ARCADIS
Infrastructure · Water · Environment · Buildings

Imagine the result

Chevron Environmental Management Company

Final Engineering Design Report

Former Unocal Edmonds Bulk Fuel Terminal
Edmonds, Washington

March 8, 2016

ARCADIS

Peter Campbell
Senior Engineer

Scott Zorn
Project Manager

Final Engineering Design Report

Former Unocal Edmonds Bulk Fuel Terminal
Edmonds, Washington

Prepared for:
Chevron Environmental Management Company

Prepared by:
Arcadis U.S., Inc.
1100 Olive Way
Suite 800
Seattle
Washington 98101
Tel 206.325.5254
Fax 206.325.8218

Our Ref.:
B0045362.0005

Date:
March 8, 2016

Table [1]

Figures[2]

Appendices

[1] Table numbers refer to the corresponding section.

[2] Figure numbers refer to the corresponding section.

Acronyms and Abbreviations

2016 IAWP	Final Interim Action Work Plan
AO	Agreed Order
Arcadis	Arcadis U.S., Inc.
bgs	below ground surface
CAP	Cleanup Action Plan
CATOx	catalytic oxidizer
CFR	Code of Federal Regulations
Chevron	Chevron Environmental Management Company
CMP	Compliance Monitoring Plan
COC	constituent of concern
cPAH	carcinogenic polycyclic aromatic hydrocarbon
CUL	cleanup level
DB-1	Detention Basin 1
DB-2	Detention Basin 2
DPE	dual-phase extraction
DOT	Department of Transportation
DRO	diesel range organics
Ecology	Washington State Department of Ecology
EDR	Engineering Design Report
EPH	extractable petroleum hydrocarbon
Final CSM	Final Conceptual Site Model
FS	Feasibility Study
GAC	granular activated carbon
gpm	gallons per minute
GRO	gasoline range organics
HDPE	high density polyethylene

HO	heavy oil range organics
IHS	indicator hazardous substance
LNAPL	light non-aqueous phase liquid
MFA	Maul, Foster, and Alongi
MNA	monitored natural attenuation
MTCA	Model Toxics Control Act
NPDES	National Pollutant Discharge Elimination System
O&M	operation and maintenance
OMM	Operation and Maintenance Manual
PAH	polycyclic aromatic hydrocarbon
PLC	programmable logic controller
PSCAA	Puget Sound Clean Air Agency
psi	pounds per square inch
PUD	Snohomish County Public Utility District
PVC	polyvinyl chloride
QA	quality assurance
QC	quality control
REL	remediation level
SAP	Sampling and Analysis Plan
sch.	Schedule
SDR	standard design ratio
site	former Unocal Edmonds Bulk Fuel Terminal, located at 11720 Unoco Road, Edmonds, Washington
SOOW	service cord, oil-resistant jacket, oil-resistant insulation, and weather/water resistant
TCP	traffic control plan
TPH	total petroleum hydrocarbons
Unocal	Union Oil Company of California

USEPA	United States Environmental Protection Agency
VFD	variable frequency drive
VOC	volatile organic compound
VPH	volatile petroleum hydrocarbon
WAC	Washington Administrative Code
WSDOT	Washington State Department of Transportation

1. Introduction

On behalf of Chevron Environmental Management Company (Chevron), Arcadis U.S., Inc. (Arcadis) prepared this Engineering Design Report (EDR) for the former Union Oil Company of California (Unocal) Edmonds Bulk Fuel Terminal, located at 11720 Unoco Road, Edmonds, Washington (site; Figure 1-1). This EDR was prepared to comply with Agreed Order (AO) No. DE 4460, under which Unocal, a wholly owned indirect subsidiary of Chevron Corporation, has agreed to conduct a feasibility study (FS) and interim actions at the site, monitor groundwater in the former Lower Yard, and prepare a draft Cleanup Action Plan (CAP).

1.1 Background

On August 11, 2014, Chevron submitted an Addendum to the 2014 Draft FS Report (Arcadis 2014) to the Washington State Department of Ecology (Ecology), proposing Remedial Alternative 6 (combination of excavation and dual-phase extraction [DPE] treatment) as a preferred remedy. Ecology asked Chevron to implement this alternative as a continuation of the interim actions required by AO No. DE 4460. This will allow Ecology to observe the effectiveness of the DPE system before proceeding with a CAP that includes continued operation of the system as the final remedy (Ecology 2014b). The Final Action Work Plan (2016 IAWP, Arcadis 2016), which was submitted on January 26, 2016, describes the excavation at Detention Basin 2 (DB-2) and DPE in the vicinity of the Washington State Department of Transportation (WSDOT) stormwater line in broad terms. This EDR is being submitted in accordance with Model Toxics Control Act (MTCA) regulations, per Washington Administrative Code (WAC) 173-340-400(4)(a), and at Ecology's request to provide the specific engineering details of the selected remedial alternative. For discussions regarding site background (including site description, site history, environmental setting, historical and recent site investigations and current site conditions), and cleanup standards (including indicator hazardous substances (IHSs), sediment cleanup standard, surface water cleanup standards, groundwater cleanup standards and soil cleanup standards) please refer to the 2016 IAWP (Arcadis 2016). The general site layout of the lower yard and surrounding areas is shown on Figure 1-2.

1.2 Objectives

This EDR presents design specifications and plans for the implementation of remedial actions as described in the 2016 IAWP (Arcadis 2016). This EDR discusses specific plans and specifications related to the following:

- Remove recoverable free product beneath DB-2 vicinity in the former Lower Yard. Free product is defined as light non-aqueous phase liquid (LNAPL). This will be implemented through excavation of DB-2.

- Remediate soil and groundwater in the former Lower Yard that contains petroleum hydrocarbon concentrations above the soil remediation levels (RELs) and cleanup levels (CULs) in two areas: DB-2 and the WSDOT stormwater line. This will be implemented through operation of a DPE system near the WSDOT stormwater line and excavation of DB-2.

1.3 Previous Submittals and Historical Data

Remedial actions conducted between 2001 and 2008 addressed potential impacts in the former Upper Yard, former Lower Yard, and sediment of Willow Creek. Arcadis evaluated the location, concentrations, and distributions of remaining hydrocarbon impacts in the former Lower Yard at the site using the 2012 investigation results and historical data. Few areas with remaining impacts to soil and groundwater exist in the former Lower Yard; these areas are described in the 2016 IAWP (Arcadis 2016).

Specific data and documents referred to in this EDR include:

- Draft FS Addendum (Arcadis 2014), which evaluates Remedial Alternative 6 (excavation with monitored natural attenuation [MNA]) to address contamination near DB-2, and soil and groundwater treatment using DPE to address contamination near the WSDOT stormwater line.

- Final Conceptual Site Model (Final CSM; Arcadis 2013a), which evaluates remaining impacts, potential fate and transport of the remaining impacts, and potential receptors and exposure pathways.

- Cleanup Levels and Remediation Levels Report (Arcadis 2013b), which evaluates and confirms the CULs and RELs for soil, groundwater, and surface water.

- The final compliance soil samples collected in 2007 and 2008 during remedial excavation activities and documented in the Phase I Remedial Implementation As-Built Report (Arcadis 2009).

- Final Phase II Remedial Implementation As-Built Report (Arcadis 2010a).

- The 2008 site investigation work that was conducted near the WSDOT stormwater line and the former asphalt warehouse (Arcadis 2010b).

- The 2011 site investigation work, which incorporated a tidal study, pumping tests, and investigation of soil conditions near DB-2 (Arcadis 2012a).

- Investigation activities conducted as part of the 2012 Revised Feasibility Study Work Plan (Arcadis 2012b) in August 2012, which included additional groundwater monitoring well installation, additional groundwater sampling, and sediment sampling.

- The 2016 IAWP (Arcadis 2016), which proposed additional remedial activities, additional groundwater monitoring well installation, and additional soil vapor sampling.

- Dual-Phase Extraction Pilot Test Summary (Appendix A), which summarizes the results of the 2015 DPE pilot test planned in the Public Review Draft Interim Action Work Plan (Arcadis 2015a).

Historical data, tables, figures, and laboratory reports are provided in the documents listed above and are referenced in this EDR.

1.4 Engineering Design Report Organization

The remaining sections of this EDR are summarized below:

- *Section 2 – Detention Basin 2 Excavation.* Describes the plans and specifications for interim action soil removal in the vicinity of DB-2.

- *Section 3 – Dual-Phase Extraction*. Describes the plans and specification for installation and operation of DPE near the WSDOT stormwater line.

- *Section 4 – Performance and Compliance Monitoring.* Describes performance and compliance sampling to be conducted at the site.

- *Section 5 –Reporting.* Describes documents to be submitted during and after remedial action construction (excavation and DPE).

- *Section 6 – Schedule of Deliverables*. Propose the schedule of delivery of the documents to be submitted during and after excavation construction.

- *Section 7 – References*. Lists the references cited throughout this EDR.

2. Interim Action: Excavation of Detention Basin 2

Excavation is an effective way to meet CULs because contaminants are physically removed from the site. This technology has been used extensively in the former Lower Yard, in areas unencumbered by facility infrastructure. It has been both implementable and effective at removing impacted soil within these areas. Excavation has also reduced dissolved-phase petroleum hydrocarbon concentrations in groundwater to below CULs or within one order of magnitude of CULs across the site. Full details, including construction plans and a scope of work for the DB-2 excavation, are included in the Project Manual (Appendix B).

2.1 Description of Work

Excavation of the DB-2 vicinity will remove petroleum hydrocarbon-impacted soil above CULs, thus removing the direct contact exposure pathway. In addition to closing the direct contact exposure pathway, LNAPL will be removed from the excavation and disposed of offsite. During excavation, dissolved-phase petroleum hydrocarbon impacts to groundwater will be remediated through extraction and physical, chemical, and biological processes which, following source removal, will act to reduce the mass, toxicity, mobility, volume, and concentration of constituents of concern (COCs).

2.2 Proposed Excavation Boundary

The proposed area of excavation was delineated during the 2011 soil assessment (Arcadis 2012a) and includes soil near MW-510. The proposed excavation will extend to approximately 10 to 12 feet below ground surface (bgs) and the excavation boundary is limited by the following areas:

- To the northwest by the berm separating DB-2 from Willow Creek and extending approximately 200 feet to the southeast to the point where clean soil was observed during the 2011 soil assessment.

- To the northeast by the berm separating DB-1 and DB-2 and extending approximately 100 feet to the southwest to the edge of previous excavation work.

To safely remove petroleum hydrocarbon impacted soil in DB-2 and to allow adequate room to maintain excavation sidewall stability, a temporary earthen berm will be offset from the existing DB-1/DB-2 berm as shown on Figure 2-1. Water will be removed from the northwest portion of DB-1 and the proposed area of excavation. Soil above CULs in the DB-2 vicinity will be excavated.

As mentioned above, LNAPL will be removed from the excavation and disposed of offsite at a licensed waste management facility. Water recovered from the excavation will be collected and stored in a holding tank. From the holding tank, water will be treated with an engineered treatment system that will include filter beds and activated carbon vessels and will then be discharged to DB-1. The temporary water treatment system flow diagram is shown on Figure 2-2. A National Pollutant Discharge Elimination System (NPDES) construction permit is required to discharge treated wastewater from the excavation activities to DB-1 and will be obtained prior to initiating the excavation activities.

The berm separating DB-2 from Willow Creek will also be excavated. To protect Willow Creek, two coffer dams will be placed in Willow Creek approximately 200 feet apart along the northwest excavation boundary. Water from Willow Creek will flow through the coffer dams using temporary culverts. Following excavation, the coffer dams and culverts will be removed and Willow Creek will be restored to its original stream bed.

In the area of DB-2, impacted soil will be excavated and recoverable LNAPL will be removed using vacuum dewatering trucks. Waste material will be direct loaded into trucks and trailers for offsite disposal, or stockpiled in a central location for loading into trucks and trailers for transportation to an appropriate waste disposal facility. Following completion of the DB-2 excavation, the temporary berm will be removed and DB-1 will be returned to its original boundary. As part of site restoration, DB-2 will not be re-installed, rather the DB-2 excavation will be backfilled to surrounding grade. The proposed excavation boundaries, including the temporary berm location, are shown on Figure 2-1.

2.3 Confirmation Sampling – Soil

Confirmation samples will be collected from the base and sidewalls of the excavation on an approximately 25-foot grid to meet performance monitoring requirements. Performance monitoring is described in the Sampling and Analysis Plan (SAP) in the Appendix F of the 2016 IAWP (Arcadis 2016). Samples will be submitted to an Ecology-approved laboratory for immediate analysis. Once analytical data indicate that applicable CULs are met throughout the area of excavation, the area will be backfilled with clean fill material.

2.4 Light Non-Aqueous Phase Liquid and Groundwater Remediation through Excavation

It is anticipated that excavation of impacted soil and removal of recoverable LNAPL will mitigate the soil leaching to groundwater pathway. Previous excavation work at the site

demonstrated that removal of impacted soil resulted in a decrease in dissolved-phase concentrations downgradient and in the excavation area. Monitoring well MW-529, which is installed downgradient of the proposed excavation area, has demonstrated compliance with its respective groundwater CULs since installation in 2012. Groundwater modeling data indicate that groundwater flux at perimeter well MW-510 stems from upgradient soil and groundwater conditions observed near DB-2. With source removal through excavation, and if DPE near the WSDOT stormwater line is successful, dissolved-phase groundwater concentrations may meet applicable CULs throughout the site. If dissolved-phase petroleum hydrocarbon concentrations remain above CULs after a 6-year restoration timeframe, DPE may continue, a MNA program may be implemented, or other cleanup actions may be undertaken, depending upon site conditions at the time.

As described below, wells and piezometers near the DB-2 excavation will be decommissioned during site preparation. Following the completion of excavation activities, three monitoring wells (MW-533, MW-534, and MW-535) will be installed in the area of DB-2. These wells will be included in the groundwater Compliance Monitoring Plan (CMP) for the DPE system and in the long-term groundwater monitoring program to assess whether applicable CULs are met. The performance and compliance sampling plan for the site is described in Section 4; additional information is included in the SAP in the 2016 IAWP (Arcadis 2016).

2.5 Site Preparation

Prior to excavation of DB-2, initial site preparations and protective measures will include:

- Development of an appropriate traffic control plan (TCP) with decontamination procedures for equipment and workers at the site.
- Preparation of a stormwater management plan, including removal and reinstallation of existing stormwater conveyance piping that currently intersects the planned excavation area.
- Decommissioning of monitoring well MW-510 and piezometers P-10, P-11, P-12, P-14, P-15, and P-16.
- Relocation of the existing stormwater detention pump control system and associated buried electrical lines.
- Installation of coffer dams in Willow Creek.

- Construction of a temporary berm in DB-1.

A TCP will include procedures detailing the proposed traffic flow pattern to minimize traffic-related incidents at the site, minimize excavation downtime, and verify that vehicles traveling offsite are adequately decontaminated. A truck wash will be installed and used to decontaminate vehicles exiting the exclusion zone. Prior to leaving the site, routine truck inspections will take place to verify that loads are secured.

Existing piping used to collect on-site stormwater intersects the excavation area and discharges into DB-2. Under the NPDES construction permit, prior to excavation the stormwater collection system will be rerouted around the proposed excavation area and will discharge directly into DB-1. Existing piping will be initially capped and then removed during excavation activities.

Existing monitoring wells and piezometers located in the excavation area will be decommissioned prior to excavation. Monitoring well MW-510 and piezometers P-10, P-11, P-12, P-14, P-15, and P-16 will be decommissioned according to the requirements of WAC 173-160-310.

The existing stormwater detention pond pumping system will be relocated to the berm northeast of DB-1. Pumps will be removed from DB-2 and existing pumps within DB-1 will be relocated to allow for installation of the temporary berm. Electrical lines will be removed from the DB-1/DB-2 berm and temporary aboveground wiring will control the pumping system in DB-1.

As discussed above, coffer dams and a temporary berm will be constructed in Willow Creek and DB-1, respectively. Installation of the coffer dams and temporary berm will allow for appropriate sloping of the excavation sidewalls to remove petroleum hydrocarbon impacted soil from the excavation area and along the excavation boundaries.

The remaining objectives under AO No. DE 4460 will be addressed through compliance monitoring. Detailed construction drawings and specifications are included in the Project Manual (Appendix B).

3. Interim Action: Dual-Phase Extraction near the Washington State Department of Transportation Stormwater Line

A soil and groundwater treatment system using DPE will be installed to address impacts remaining near the WSDOT stormwater line. This section describes the system design, construction plans, and implementation of DPE near the WSDOT stormwater line as part of the interim remedial action. DPE is a remedial technology that relies on mass transfer and subsequent extraction to reduce the mass of residual LNAPL in vadose and smear zone soils in the subsurface. Residual LNAPL is defined as LNAPL that is occluded by the aqueous phase, occurring as immobile ganglia surrounded by aqueous phase in the pore space or as immobile, non-water-entrapped LNAPL that does not drain from the pore spaces (White et al. 2004).

The DPE system will remediate soil impacts surrounding the WSDOT stormwater line and act as a groundwater extraction system, maintaining on-site control of dissolved-phase COCs and LNAPL. It is anticipated that reducing soil impacts to below soil RELs and CULs will result in groundwater meeting COC CULs near the WSDOT stormwater line and also address the vapor intrusion pathway.

3.1 Treatment System Operational Specifications

The treatment system design and specifications described herein are based on pilot testing performed from February 17 through 21, 2015 and March 30 through April 1, 2015 and are summarized in the DPE Pilot Test Summary (Appendix A).

The treatment design consists of an array of 14 groundwater extraction wells spaced approximately 30 to 40 feet apart, oriented along the alignment of the WSDOT stormwater line and targeting impacted soil. Figure 3-1 shows the designed treatment wellfield and piping layout.

Extraction wells will be designed to be 24 feet deep (screened from 4 to 19 feet bgs with a 5-foot sump). Each DPE well will be equipped with an electric submersible pump and groundwater elevation will be controlled through a variable frequency drive (VFD) and groundwater level transducer. Typical well construction details are shown on Figures 3-2 and 3-3. Treatment wells will be grouped into subsets from three to seven wells. The subset of wells will be established to focus treatment to specific areas of the treatment zone. For each subset of wells under vacuum, the designed pumping rate is between 8 and 10 gallons per minute (gpm); wells in operation under normal conditions are estimated to yield approximately 1 to 3 gpm. The top of the well casing will be fitted with a connection to vapor extraction conveyance piping leading to a

manifold at the system compound. The manifold will be connected to three rotary claw vacuum blowers within the system building.

The treatment system will be operated to focus treatment on a subset of the well array, pulling vacuum on three to five wells at a time while pumping groundwater from each of the wells in the network. The subset of wells where vacuum is induced will change over time based on vapor phase mass removal rates. When vapor phase mass removal rates are asymptotic from a certain well that well will be turned off and vacuum will be induced on a different well. Vacuum will be applied to the wells using three high-vacuum rotary claw blowers that will pull approximately 330 standard cubic feet per minute at 20 inches of mercury. Vapors will be treated through an electric catalytic oxidizer (CATOx), as described in Section 3.1.2.

Overall pumping rates for the system will be approximately 75 gpm and will be designed to handle approximately 150 percent (110 gpm) of the overall design flow rates to account for site heterogeneities and to meet discharge permit requirements. Groundwater will be treated through four granular activated carbon (GAC) units in series, as described in Section 3.1.3.

Extracted vapor and groundwater conveyance piping will be installed above grade and connected to the treatment system compound located in the southern portion of the former Lower Yard, as shown on Figure 3-1. The location of the equipment compound was selected based on the preliminary layout of the Edmonds Crossing Project and accepted by representatives from the WSDOT during a site visit on October 14, 2014. Treatment equipment will be housed inside a prefabricated building and delivered to the site with internal components pre-wired and tested. The system compound will consist of a system enclosure to house the groundwater and the extracted vapor treatment equipment. The main components and specifications for DPE system equipment are included in Table 3-1.

3.1.1 Hydraulic Capture Zone

The well spacing is designed to create a hydraulic capture zone of a minimum of 25 feet from the pumped wells. Groundwater will be pumped through vacuum enhanced dewatering using a downhole pump. The pump intake level will be controlled by a level transducer coupled with a VFD to control pump speed. The pumps can be adjusted to optimize the capture radius of influence. The pump depth and well spacing will create an inward gradient towards the groundwater extraction wells. The measurement of groundwater elevation during system operation in existing monitoring wells and piezometers, as well as, newly installed piezometers will be used to confirm the capture radius of influence. Pilot test data indicate that at designed pumping rates a

groundwater drawdown approximately 1 foot below static groundwater elevation was observed greater than 45 feet away from the treatment well. Pilot test groundwater drawdown data are included in Table 1C and Figure 4 in the DPE Pilot Test Summary (Appendix A).

3.1.2 Vapor Extraction

Extracted vapor will flow from each well via a 3-inch high density polyethylene (HDPE) standard design ratio (SDR) 11 pipe to a 14-leg manifold within the system building. Each leg of the manifold will consist of an air flow meter, flow control valve, vacuum gauge, and sampling port. A main header will connect the manifold to an air-water separator prior to the three blowers in series. Vapor from the blower will discharge into a CATOx for treatment prior to discharge to the atmosphere. Accumulated water from the separator will be transferred using a Moyno progressive cavity pump, to an equalization tank that is part of the groundwater treatment process equipment.

3.1.3 Groundwater Extraction

A 4-inch Grundfos or similar electric submersible pump will be installed in each extraction well. Above grade Service cord, Oil-resistant jacket, Oil-resistant insulation, and Weather/Water resistant (SOOW) cord wiring will connect the pump lead wires through a junction box located within the well vault at each extraction wellhead. The control wires will lead to individual VFDs within the system control room. To maintain a constant drawdown elevation within each extraction well, a pressure transducer will be installed above the pump. Lead wires for the transducer will connect to above grade SOOW cord through the junction box within the well vault and then to a programmable logic controller (PLC) located in the main control panel within the control room at the treatment compound. The PLC will send information to the VFDs to change the pump speed based on groundwater elevation. A mechanical level switch will be placed within the well vault and connected through above grade wiring back to the system control panel to shut off the corresponding pump if a leak of extracted groundwater occurs at the wellhead. Groundwater conveyance piping will be constructed of 1-inch diameter HDPE SDR 11 pipe prefabricated inside a 3-inch diameter HDPE SDR 11 secondary containment hose. A DPE well connection detail is shown on Figure 3-3 and piping cross section detail is included on Figure 3-4.

3.1.4 Groundwater Treatment

Groundwater will be pumped through the conveyance lines to a groundwater extraction manifold. The manifold will contain 14 individual legs, each with a flowmeter totalizer, gate valve, pressure gauge, sampling port, and check valve (Figure 3-5). The manifold

will connect to a main header pipe leading to a conical bottom settling tank. Groundwater will flow from the settling tank to an equalization tank under gravity feed. The equalization tank will have a high-high alarm that will shut off the system, as well as high- and low-level switches controlling a Gould 5-horsepower transfer pump. The pump will transfer water to four inline 2,000-pound liquid GAC vessels through two Pentair bag filters in parallel with #2 filtration bags. Treated water will be discharged to DB-1 under a NPDES permit. The discharge location and constructed outfall at DB-1 is shown on Figure 3-6. A process and instrumentation diagram for the treatment system is shown on Figure 3-7. The main system components and operational specifications are listed in Table 3-1.

3.1.5 Electrical

The system will be supplied with 120/208-230 volt three-phase power from an upgraded 600-ampere service by Snohomish County Public Utility District (PUD). Power for the building and equipment will be connected to the power service drop located between DB-1 and former DB-2, near the north side of the former Lower Yard. Electrical conduit will be placed above grade, as shown on Figure 3-6.

3.1.6 System Installation

As part of pilot test activities, three treatment wells, DPE-1 to DPE-3, and three piezometers, PZ-1 to PZ-3, were advanced with a hollow stem auger. The treatment wells will be used in the full-scale treatment design as well as PZ-3 that will be converted in treatment well DPE-4. Extraction wells DPE-1 and DPE-2 were installed to a depth of 30 feet with 5 feet of solid casing to act as sump. DPE-1 and DPE-2 were screened from 5 to 25 feet bgs with 0.02-inch slotted screen. Extraction wells DPE-3 and DPE-4 (PZ-3) were installed to a total depth of 23 feet, with 5 feet of solid polyvinyl chloride (PVC) casing to act as a sump. DPE-3 and DPE-4 (PZ-3) were screened from 5 to 18 feet bgs with 4-inch-diameter 0.02-inch slotted screen (Appendix A).

Ten additional treatment wells will be installed to a depth of 24 feet with 5 feet of solid PVC casing as a sump. The wells will be pre-cleared for subsurface utilities to 8 feet bgs with an air knife and vacuum truck to protect any potential underground improvements. Number 10-20 Colorado Silica sand will be used as filter pack around the well casing, followed by 1-foot of hydrated bentonite and then neat cement to 1 foot bgs. Wells will be constructed of 4-inch sch. 40 PVC with 0.02-inch slotted screen from 4 to 19 feet bgs with a 5-foot sump. Well construction details may change based on field observations during drilling. Well construction details are shown on Figure 3-2.

Additionally, in order to monitor the system, seven piezometers (PZ-4 to PZ-10) will be installed to a depth of 19 feet and screened from 4 to 19 feet bgs with 1-inch-diameter 0.02-inch slotted screen. DPE system monitoring well locations are shown on Figure 3-8. Piezometer construction details are shown on Figure 3-9.

During treatment well and piezometer installation, soil will be field screened for lithologic description and headspace volatile organic compound (VOC) concentrations. A sample will be obtained every 5 feet using 2.5-foot split spoon samplers. Soil will be disposed of in 55-gallon Department of Transportation (DOT) approved steel drums for offsite disposal under an existing waste profile.

The treatment well and piezometer will be developed using standard surge and purge techniques with a surge block and well pump, according to Arcadis' Standard Operating Procedure. Purge water will be disposed of offsite at an approved disposal facility.

3.1.7 Construction Plans

Construction plans are included in Appendix C and described below. Construction plans will be used for the full-scale system installation and will be provided to the system installation subcontractor. Construction drawings will be field verified and any changes will be discussed and approved by the engineer prior to implementation. A final revised set of as-built construction drawings will be kept on site and submitted with a final construction implementation and system startup report.

3.1.7.1 Treatment Well Installation

As described in Section 3.1.6, the wells will be advanced using a hollow stem auger rig. The wells will be completed with an above grade weatherproof fiberglass vault, with the base of the vault set approximately 6 inches bgs. The vault will be set in a concrete skirt, with the base of the vault in gravel backfill for drainage. Conveyance piping and control wires will enter the side of the vault and will be sealed to contain any potential leaks. A wellhead connection and vault detail is shown on Figure 3-3.

3.1.7.2 Piezometer Installation

As described in Section 3.1.6, the piezometers will be advanced using a hollow stem auger rig. The screen interval will be set from 4 to 19 feet bgs, however, the screen interval may be altered based on observations during drilling. Sand packs will be constructed of Number 10-20 Colorado Silica sand and extend from one foot above the screened interval to the total depth of the well Each of the monitoring wells will be

completed with hydrated bentonite chips to one foot bgs, with flush-mount well monuments set in concrete at the ground surface.

3.1.7.3 Piping Installation

Piping will be installed above grade to avoid trenching and soil disposal and handling issues. Piping size and materials are as follows:

- Vapor conveyance – 3-inch HDPE SDR 11.
- Water conveyance – Pre-fabricated dual contained pipe with 1-inch HDPE SDR 11 conveyance pipe constructed within 3-inch HDPE SDR 11 containment pipe.
- Treated discharge – 2-inch sch. 40 PVC with ⅜-inch insulating wrap.

Piping will be delivered to the site in 20-foot sections, cut to size by the on-site contractor, and secured to the ground with Unistrut® and U bolt clamps approximately every 25 to 50 feet. Piping connections will be made using either low-VOC PVC glue and slip couplings or HDPE fusion welds based on pipe materials used. Piping will connect to prefabricated terminations with weatherproof seals through the treatment compound sidewall. Piping locations and cross-section details are shown on Figures 3-1 and 3-4, respectively.

3.1.7.4 Electrical Installation

Power will be installed above grade in a conduit from an existing panel upgraded to 600-amp service, or from a newly installed transformer and overhead lines with a temporary power pole and new disconnect located at the system compound. The PUD will perform a site walk prior to construction to determine the appropriate location of the new or upgraded power service. Electrical work will be completed by a licensed electrician. System components will be prewired, and panels will be tested prior to shipment and certified by Underwriters Laboratory. An electrical conduit cross-section detail is included on Figure 3-4.

3.1.7.5 Pad Construction

A concrete pad will be constructed as the foundation for the DPE treatment system building. The pad will be approximately 50 feet long by 20 feet wide and 6 inches thick. It will be reinforced with welded wire mesh. The pad will have a minimum 1-foot 10-inch turndown footer with reinforced #5 rebar. The concrete pad will be constructed of normal weight concrete with a design strength of 3,000 pounds per square inch (psi) at

28 days curing time. The reinforced mesh will have a minimum cover of 3 inches and a minimum overlap of 25 inches. The reinforcing steel will be Grade 60. System pad construction details are presented on page C-8 of the construction drawing set (Appendix C).

3.1.7.6 Waste Handling

The above grade construction design will limit the amount of trenching, soil handling, and soil disposal required. Soil generated from DPE well installation will be handled in accordance with state requirements and containerized in DOT-approved 55-gallon steel drums. Soil will be labeled and staged in designated areas prior to disposal under an existing site waste profile. Soil will be transported offsite to a Chevron approved landfill.

3.1.7.7 Construction Quality Assurance/Quality Control and Health and Safety Oversight

To ensure the DPE system is installed according to construction specifications, Arcadis will provide oversight during installation as well as quality assurance (QA) and quality control (QC) for all aspects of the project. A Professional Engineer, licensed in Washington, or a technician under the direct supervision of a Professional Engineer licensed in Washington, will provide oversight for all aspects of construction as required by WAC 173-340-400(6)(b). Specialty contractors (general contractor, waste hauler, and electrical contractor) will install equipment and start up the system. Site workers will complete the hazardous waste operation and emergency response 40-hour training.

The contractor will record work performed during construction activities. Records will include construction techniques and the materials used. The contractor will also complete the following records:

- *Daily Activity Log*. This log will be completed daily and will document activities and personnel working at the site. Daily Activity Logs will be provided weekly to the designated Chevron representative.

- *Onsite Transfer Log*. This log details soil generated and transferred within the site boundaries (e.g., excavation area to stockpile area), as well as the approximate quantity and source of the soil (e.g., Excavation Area A).

- *Offsite Tracking Log.* This will be a continuous log of all offsite shipments. This log will include the type and source of material, day shipped, receiver, and weight of

the material. A copy of the Offsite Tracking Log will be provided weekly to the designated Chevron representative.

- *Health and Safety Log.* Health and safety monitoring results will be recorded daily on the Health and Safety Log. The information recorded will include the personnel working at or visiting the site and the levels of personal protection used.

The following items will be completed by Chevron or a designated representative:

- *Bills of lading for shipment*. The contractor will provide the designated Chevron representative with bill of lading information. The designated Chevron representative will be responsible for reviewing and signing all bills of lading for waste shipment.

- *Compliance monitoring documentation.* All analytical data will be uploaded to Ecology's Electronic Information Management Database.

Routine checks will be completed by the engineer and subcontractor representatives. If site conditions require a change in design, a written procedure will be approved by the engineer and recorded in the final as-built design and construction report.

The contractor will be responsible for DPE system conveyance piping pressure testing in accordance with American Society of Mechanical Engineers pressure piping code B31.2. The contractor will ensure that pressure tests are conducted by blinding off pipe ends. The pipes will be pressurized with a minimum of 5 psi and held for a minimum of 30 minutes. Site construction QA/QC personnel will provide oversight during the pressure tests.

3.1.8 System Startup Operation and Maintenance

During startup activities, field operating conditions will be monitored and adjusted to verify that design criteria are being met and are within permit requirements. Periodic site visits will be conducted to monitor and record readings from the DPE system. Initially, site visits may occur more than once a week, reducing to bimonthly visits following system optimization. Parameters such as pressure, flow, and temperature will be recorded and adjustments will be made to confirm that the system is operating at optimal conditions and within permit limits. As required, maintenance will also be performed during site visits. An operation and maintenance manual will be kept at the site for reference and to verify proper operation of the system. Compliance monitoring will be conducted based on the appropriate permit requirements and schedule. Post-

treatment VOC effluent concentrations will be monitored for compliance with Puget Sound Clean Air Agency (PSCAA) permit conditions

Groundwater will be treated and discharged under a NPDES permit. A totalizer and flow meter will monitor discharge flow rates; routine sampling will monitor discharge compliance according to NPDES permit conditions.

3.1.8.1 Hydraulic Capture Zone Confirmation

Initial system operation will focus groundwater extraction on all treatment wells in order to lower the water table approximately 3 feet within 15 feet of the remediation wells. Transducers will be set in each well to ensure the groundwater is lowered to pump intakes. The groundwater drawdown and capture zone will be verified during operation of the treatment system. The capture radius of influence will be confirmed showing an inward gradient towards the treatment wells through the measurement of groundwater elevation during system operation in monitoring wells MW-525, MW-526, MW-531 and MW-532, as well as, piezometers PZ-1, PZ-2 and PZ-4 to PZ-10 newly installed.

3.1.8.2 Vapor Extraction Optimization

Vapor extraction will be focused on four to five treatment wells at a time to maximize induced vacuum and flow rates to each well. Vapor extraction flow rates and VOC concentrations from individual wells will be used to calculate vapor phase mass removal rates. Based on these vapor phase mass removal rates, vapor extraction from the treatment wells will be adjusted to other wells. Vapor extraction from new wells will be brought online and wells that have reached asymptotic vapor phase removal will be shut off.

3.1.8.3 Remote System Monitoring

The treatment system will have remote access and emergency notification capabilities. When an alarm condition exists the system will immediately notify Arcadis operation and maintenance (O&M) personnel. Alarm notification will occur for all critical alarm conditions noted as required control devices on Figure 3-7. O&M personnel will be able to remotely access the system interface to determine the root cause of alarm conditions or check on operational status and system parameters.

3.1.9 Shutdown Criteria

Following asymptotic mass removal in the vapor phase (indicating low vapor phase mass removal rates), confirmation soil samples will be collected and laboratory testing

for fractionated hydrocarbon analysis, including volatile petroleum hydrocarbon (VPH) and extractable petroleum hydrocarbon (EPH) will be performed. The EPH/VPH data will be used to confirm the site-specific CUL for total petroleum hydrocarbons (TPH) in soil, which was calculated from soil samples collected prior to interim actions at the site, is still appropriate. If confirmation soil samples are less than the confirmed CUL for soil, and no single sample is twice the CUL, the vapor extraction portion of the treatment system will be shut down.

Following vapor extraction shutdown, groundwater extraction may continue to ensure that an inward gradient near these wells is observed, until groundwater concentrations in MW-525 and MW-526 are less than CULs, or will be less than CULs in a reasonable restoration timeframe. The pumping system will be turned off when groundwater concentrations are below CULs.

3.1.10 Applicable or Relevant and Appropriate Requirements

MTCA requires that cleanup actions comply with applicable state and federal laws (WAC 173-340-710). MTCA defines applicable state and federal laws to include "legally applicable requirements" and "relevant and appropriate requirements." Chevron has a continuing obligation to review whether additional permits or approvals addressed in RCW 70.105D.090 (1) would otherwise be required for these interim actions. If Ecology or Chevron determines that additional permits or approvals are needed, the determining party will promptly notify the other party. The laws and regulations cited in Appendix D of the 2016 IAWP pertain to nonhazardous waste because hazardous waste does not exist at the site, and the generation, handling, and treatment/disposal of hazardous waste is not anticipated as part of the remedial action (Arcadis 2016). Appendix D of the 2016 IAWP does not refer to State Dangerous Waste regulations (WAC 173-304) or Resource Conservation and Recovery Act Subtitle C regulations (40 Code of Federal Regulations [CFR] 260-268), which control the management and disposal of hazardous waste.

4. Performance and Compliance Monitoring

As part of the remedial strategy discussed in this EDR, compliance monitoring will be implemented as required by WAC 173-340-410 and 173-340-720 through 173-340-760. This section describes the components of compliance monitoring, including protection, performance, and confirmation monitoring during and following excavation activities near DB-2 and DPE operation to meet the following requirements:

- Protection monitoring will verify that human health and the environment are adequately protected during construction, operation, and maintenance periods.
- Performance monitoring will confirm that the cleanup action is performing in a manner that will allow for cleanup standards to be attained.
- Confirmation monitoring will verify the long-term effectiveness of the remediation efforts following completion of the remedial activities required in a CAP.

General components of performance monitoring for the DB-2 vicinity excavation activities and DPE operation conducted in accordance with the 2016 IAWP (Arcadis 2016) are described below.

General components of compliance monitoring for the long-term effectiveness of the remediation efforts following completion of remedial activities (confirmation monitoring) also are discussed below. Details will be provided in a separate CMP and in an Operation and Maintenance Manual (OMM) for the DPE system.

4.1 Long-Term Groundwater Compliance Monitoring

Periodic groundwater monitoring of compliance wells will be conducted to measure long-term COC trends during DPE implementation and to verify the long-term effectiveness of remediation efforts. Similar to the existing groundwater compliance monitoring, sampling events will be conducted quarterly and semiannually for interior and perimeter compliance wells. Wells in which COC concentrations exceed cleanup levels will be monitored quarterly. Compliance groundwater monitoring will continue at the site until COC concentrations in site wells meet CULs for a minimum of eight consecutive quarters. The compliance groundwater monitoring activities will be further discussed in the CMP.

4.1.1 Groundwater Sample Collection and Analysis

Groundwater compliance monitoring will include gauging and sampling of interior and perimeter compliance wells. Wells will be gauged quarterly to measure water levels, identify the presence of recoverable LNAPL, and calculate hydraulic gradient across the site.

Groundwater samples will be collected using low-flow methods to monitor dissolved-phase COC concentrations in compliance wells and to assess MNA parameters. During purging, water quality parameters (dissolved oxygen, oxidation-reduction potential, pH, conductivity, and temperature) will be monitored. Samples will be collected once parameters stabilize.

Analytes will include:

- Benzene by United States Environmental Protection Agency (USEPA) Method 8021B
- Gasoline range organics (GRO) by Ecology Method NWTPH-Gx
- Diesel range organics (DRO) and heavy oil range organics (HO) by Ecology Method NWTPH-Dx (after silica gel cleanup)
- Polycyclic aromatic hydrocarbons (PAHs) by USEPA Method 8270 selected ion monitoring
- Sulfate and nitrate by USEPA Method 300.0
- Dissolved methane by USEPA Method RSK 175
- Dissolved manganese by USEPA Method 200.8 (field filtered)
- Ferrous iron (Hach field kit)

The sampling schedule and methodology will be described in the CMP.

4.2 Dual-Phase Extraction Compliance Monitoring

Compliance monitoring during and following DPE operation will include the following components:

- DPE system monitoring (including NPDES monitoring of discharged water, PSCAA compliance monitoring of discharged air, and groundwater capture zone assessment).

- Periodic groundwater monitoring of compliance wells to assess COC concentrations with respect to CULs.

- Soil sampling in known areas of impact to assess compliance with RELs and CULs.

4.2.1 Dual-Phase Extraction System Monitoring

Routine operation, maintenance, and monitoring of the treatment system will be performed to verify that the requirements for performance monitoring per WAC 173-340-410 are met. Periodic site visits will be conducted to collect data and perform tasks that will be used to track remedial progress, verify operational compliance, and (if necessary) schedule maintenance and/or replacement work. The system will be capable of automatic system call out for alarm notification, as well as, a remote interface that will notify Arcadis OMM personnel of any abnormal operating condition. OMM personnel will be able to access the system remotely to determine the root cause of alarm conditions and respond automatic system shutdown. System performance monitoring requirements and maintenance activities will be described in the OMM, which will be prepared prior to system operation. The OMM will be updated periodically.

Quarterly groundwater gauging will be performed to assess whether the DPE system is effectively capturing groundwater and mitigating offsite migration of impacted groundwater (Figure 3-8). Potentiometric surface maps will be created.

A PSCAA permit is required for the discharge of treated effluent air to the atmosphere and a NPDES permit is required to discharge treated groundwater to DB-1. Arcadis will submit applications for PSCAA and NPDES permits prior to DPE implementation so that permits are issued prior to system operation.

4.2.1.1 Puget Sound Clean Air Agency Compliance Monitoring

Post-treatment effluent air monitoring will occur monthly to comply with the requirements of the PSCAA permit. Extracted vapor from the DPE wells will flow through a condensation knockout tank before treatment by either a CATOx or GAC, and will be vented to ambient air. Air samples will be collected monthly from the post-treatment effluent stack and may be analyzed for the following constituents:

- Benzene by USEPA Method 18
- GRO by USEPA Method 25

The list of required analytes and respective methodologies will be included in the PSCAA permit at the time of issue. Additional information regarding PSCAA compliance monitoring will be provided in the OMM following receipt of the final permit conditions.

4.2.1.2 National Pollutant Discharge Elimination System Compliance Monitoring

Post-treatment DPE effluent groundwater sampling will occur as required by the NPDES permit. Extracted groundwater will be pumped by the DPE system through an oil-water separator, followed by a particulate filter, air stripper, and GAC beds. Treated water will be discharged to DB-1 under a NPDES industrial stormwater permit. The NPDES permit will be a revised version of the NPDES construction permit used during excavation activities conducted at the site in 2007 and 2008. The proposed wastewater discharge will be characterized for the following parameters:

- Benzene, toluene, ethylbenzene, and total xylenes
- GRO, DRO, and HO
- Lead and arsenic
- 1-Methlynapthalene, 2-methylnapthalene, and naphthalene
- pH, turbidity, and total suspended solids
- PAHs

The list of required analytes and respective methodologies will be specified in the NPDES permit at the time of issue. Samples will be collected using procedures described in the 2016 IAWP (Arcadis 2016).

4.2.2 Groundwater Compliance Monitoring

Groundwater monitoring will include gauging and sampling of perimeter and interior monitoring wells. Compliance wells will be gauged to monitor water levels, identify the presence of recoverable LNAPL, and measure the hydraulic gradient across the site. Samples will be collected from the compliance wells to monitor dissolved-phase COC concentrations and to assess MNA. The sampling schedule and methodology will be described in the CMP for the DPE system and for long-term groundwater monitoring.

4.2.3 Washington State Department of Transportation Stormwater Line Soil Sampling

Soil sampling will be conducted after the DPE system mass removal rates have reached asymptotic levels. Soil samples will be collected in areas of known impact near the WSDOT stormwater line to assess whether applicable direct contact soil CULs have been met and to assess the long-term effectiveness of the remediation efforts. Sampling will be conducted when operational data indicate that the system has treated vadose and smear zone soils, as evidenced by decreases in vapor-phase concentrations in the effluent air stream or in COC concentrations in monitoring wells MW-525 and MW-526. The sampling schedule and methodology will be described in the CMP for the DPE system and for long-term groundwater monitoring.

5. Reporting

An Interim Action As-Built Report will be completed by the engineer responsible for oversight of the interim action. In accordance with WAC 173-340-400(6)(b)(ii), the Interim Action As-Built Report will be prepared at the completion of construction, document all aspects of facility construction, and include as-built drawings. The Interim Action As-Built Report will also contain an opinion from the engineer, based on testing results and inspections, as to whether the cleanup action has been constructed in substantial compliance with the plans, specifications, and related documents.

The following information will be provided in the Interim Action As-Built Report:

- Field activity descriptions, including any unusual or unexpected events or conditions.
- Daily field documentation and reports.
- Copies of chain of custody forms and laboratory reports.
- Copies of bills of lading.
- Electronic database on CD containing sampling data. Sampling data will be submitted to Ecology's Environmental Information Management System as required by AO DE No. 4460.
- Routine system operation and maintenance startup report.

The Interim Action As-Built Report will be submitted in both paper copy and as an Adobe Acrobat file (.pdf format). The number of paper copies will be specified by Ecology. A disk with the Adobe Acrobat file will be bound into the paper copies. Voluminous appendices may be included in the Adobe Acrobat file only, with the approval of Ecology.

A groundwater sampling report will be prepared after each year of sampling and will include the following:

- Descriptions of field activities, to include any unusual or unexpected events or conditions.
- Figures displaying TPH, benzene, and total carcinogenic polycyclic aromatic hydrocarbon (cPAH) concentrations in the groundwater samples.
- Tables containing groundwater monitoring data, as well as groundwater sample analytical results (geochemical indicators and IHSs).

- Copies of laboratory reports and chain of custody documentation.
- Electronic database containing all sampling data.

Groundwater sampling reports will be submitted in both paper copy and as an Adobe Acrobat file (.pdf format). The number of paper copies will be specified by Ecology. A disk with the Adobe Acrobat file will be bound into the paper copies. Voluminous appendices may be included in the Adobe Acrobat file only, with the approval of Ecology.

6. Schedule of Deliverables

It is expected that Ecology will endeavor to return comments by the dates in the Schedule of Deliverables in the IAWP dated 2016, January 27. If Ecology does not return comments by these dates, there will be a day-for-day extension of the schedule. If Chevron does not submit deliverables by the date in the Schedule of Deliverables there will be a day-for-day extension of Ecology review time.

Under the 2016 IAWP (Arcadis 2016), the DB-2 excavation will be conducted and a DPE system adjacent to the stormwater line will be installed. The DPE system will be operated in accordance with the OMM. After 12 months of operation, or upon obtaining asymptotic DPE system mass removal rates from the pretreatment effluent vapor stream (whichever comes earlier), the ability of the DPE system to achieve treatment objectives within the calculated restoration time frame will be evaluated. The evaluation will also assess whether the system's hydraulic capture zone of a minimum of 25 feet is confirmed by field measurements to be at least as large as the zone described in this EDR, and will verify whether discharge from the DPE system meets NPDES permit requirements. The CMP will establish the soil and groundwater sampling requirements that will be needed to confirm that remediation has met the calculated CULs throughout the site.

Upon completion of the interim action (excavation of DB-2 and installation of the DPE system) and the DPE system evaluation described above, the 2014 draft FS Report for the site will be finalized.

A draft CAP will then be prepared and submitted to Ecology for review as required by AO No. DE 4460. If soil and groundwater meet the cleanup standards upon completion of the interim action, the draft CAP will document that cleanup standards have been met. If soil and groundwater cleanup standards have not been met, the draft CAP will develop alternative cleanup actions to achieve cleanup standards and may present a preferred cleanup action.

Ecology will review the draft CAP and use it as the basis for preparing Ecology's draft CAP. Ecology's draft CAP will be an exhibit to a new draft Consent Decree. The new draft Consent Decree will be issued for public comment and revisions will be made as necessary. Upon entry into Snohomish County Superior Court, the new Consent Decree will take effect and govern further actions at the site.

7. References

Arcadis. 2009. Phase I Remedial Implementation As-Built Report, Unocal Edmonds Bulk Fuel Terminal Lower Yard. July 31.

Arcadis. 2010a. Final Phase II Remedial Implementation As-Built Report, Unocal Edmonds Bulk Fuel Terminal Lower Yard. January 18.

Arcadis. 2010b. 2008 Additional Site Investigation and Groundwater Monitoring Report, Former Unocal Edmonds Bulk Fuel Terminal (Lower Yard). January 18.

Arcadis. 2012a. Final 2011 Site Investigation Completion Report, Former Unocal Edmonds Bulk Fuel Terminal. May 11.

Arcadis. 2012b. Final Feasibility Study Work Plan, Former Unocal Edmonds Bulk Fuel Terminal. October 5.

Arcadis. 2013a. Final Conceptual Site Model, Former Unocal Edmonds Bulk Fuel Terminal. June 7.

Arcadis. 2013b. Cleanup Levels and Remediation Levels Report, Former Unocal Edmonds Bulk Fuel Terminal. September 17.

Arcadis. 2014. Proposed Addendum to the Draft Feasibility Study Report, Former Unocal Edmonds Bulk Fuel Terminal. August 11.

Arcadis. 2015a. Public Review Draft Interim Action Work Plan. Former Unocal Edmonds Bulk Fuel Terminal. July 6.

Arcadis. 2015b. Request to Temporally Cease Groundwater Sampling Former Unocal Edmonds Bulk Fuel Terminal. August 25.

Arcadis. 2016. Final Interim Action Work Plan. Former Unocal Edmonds Bulk Fuel Terminal. January 27.

Devlin, J.F. 2003. A Spreadsheet Method of Estimating Best-Fit Hydraulic Gradients Using Head Data from Multiple Wells. *Groundwater*. Vol. 41. No. 3: 316-320.

Ecology. 2003. Letter RE: Edmonds Bulk Fuel Terminal, Upper Yard: Completion of Cleanup per Interim Action Report. October 9.

Ecology. 2007. MTCPATPH11.1 Workbook Tool. Revised December.

Ecology. 2014a. Letter Re: Unocal Edmonds Bulk Fuel Terminal – Review of Draft Feasibility Study. May 21.

Ecology. 2014b. Letter Re: Unocal Edmonds Bulk Fuel Terminal – Review of Proposed Addendum to the Draft Feasibility Study Report. September 23.

MFA. 2002. Lower Yard Interim Action As-Built Report, Unocal Edmonds Terminal, Edmonds, WA. November 30.

MFA. 2004a. 2003 Lower Yard Interim Action As-Built Report, Unocal Edmonds Terminal, Edmonds, WA. SIT5.5. February 26.

MFA. 2004b. Draft Feasibility Study Report, Unocal Edmonds Bulk Fuel Terminal, Edmonds, Washington. March 18.

SLR. 2007a. Interim Action Report - Work Plan for 2007 Lower Yard Interim Action, Unocal Edmonds Bulk Fuel Terminal. June 25.

SLR. 2007b. Agreed Order for Remedial Action, Lower Yard of Unocal Edmonds Bulk Fuel Terminal, Edmonds, Washington. June 25.

White, M.D., Oostrom, M., and Lenhard, R.J. 2004. A practical model for mobile, residual, and entrapped NAPL in water-wet porous media. Ground Water 42:734-746.

ARCADIS

Table

Table 3-1
Components and Specifications of the DPE System
Chevron Environmental Management Company
Engineering Design Report
Former Unocal Edmonds Bulk Fuel Terminal
Edmonds, Washington

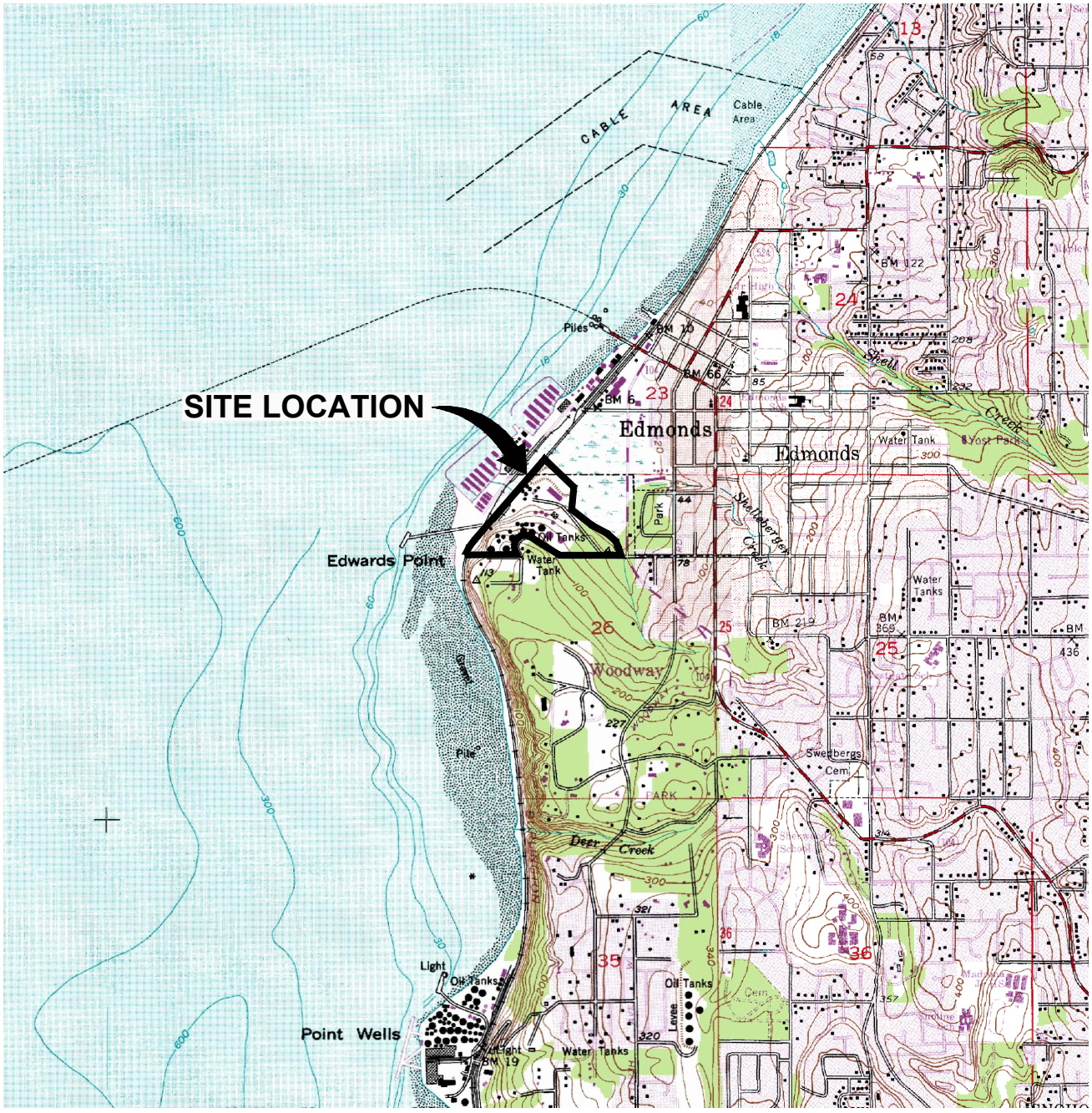
Item	Manufacturer / Model	Size/Characteristic
Vacuum Extraction Manifold:		6-inch vacuum extraction manifold with two 4-inch branches, each branch constructed with (7) 3-inch legs (with ¼-inch plug for flow measurement device)
Vapor Liquid Separator: with progressive cavity transfer pump	Newterra - Model VLW-140 Moyno - Model 34401	140 Gallons with a 1 HP 208-230/460V/3Ph motor 12 GPM at 25 PSI Motor: TEFC Suitable for CL 1 DIV 2
Soil Vapor Extraction Blower: 3 rotary claw vacuum pumps Combined inlet/discharge piping mass flow transmitter	Busch - Model MM 1502 AV Rosemount - Model 3051SMV with Rosemount 485 Annubar primary flow element	 with 20 HP 208-230/460V/3Ph motor: Motor: TEFC (Suitable for CL 1 DIV 2) 300 ACFM at 20-inch Hg at inlet of blower 250 SCFM (754 ACFM) at 20-inch Hg inlet pressure losses 15-inch WC discharge pressure losses: 1.5 PSI Discharge temperature: 275 ^{o}F at an inlet of 68 ^{o}F Noise rating: 82 dBA
Catalytic Oxidizer:	Falco - Model 600 Flameless Electric Catalytic Oxidizer	Capacity: 250-700 SCFM Max Input Loading: 500 lb/day petroleum hydrocarbons at 700 SCFM Catalyst Temperature Range: 626-1148 ^{o}F Heat exchanger: 71% efficiency at 600 SCFM Heater (electric): 27 KW Weight: 1,400 lbs Foot Print: W=40-inch, L=78-inch, H=87-inch Power Input: 208/3/60, 120V for controls Full Load Amps at 208/3/60: 75 Factory Mutual Approval (US and Canada) for use in Class 1, Division 2, Group D, T2C hazardous locations extending up to 30" above the ground. Enclosure heater (150 watt) for cold weather operation Heaters wired for 3-phase 208-240 volts or optional 480 volts Ten feet of gas vent pipe, 90° elbow and rain hat
Groundwater Extraction Manifold: 3-inch groundwater extraction manifold constructed with fourteen 1.5 - inch legs		
Two Equalization Tanks: with centrifugal transfer pump	Goulds - NPE model 2ST	500 Gallons Dimensions: 48-inch diameter x 72-inch high with a 5 HP 208-230/460V/3Ph motor 110 GPM at 80-foot TDH Motor: TEFC (Suitable for CL 1 DIV 2)
Bag Filtration: two bag filter	Pentair - Model L88302NAC10 number two	 7-inch x 36-inch carbon steel construction inlet and outlet pressure gauges (0 – 60 PSI) PVC piping with unions: 1-foot section of clear PVC
Liquid Phase Carbon Filtration: 4 contactor vessels	Newterra - Model LPC-3000	 Dimensions – 5-feet (D) x 7-feet 8-inch (H) Pressure rating – 40 PSI 3000 lbs of regenerated, granular liquid phase carbon per vessel
System Enclosures: 2 used high cube modified shipping containers		 Size: 8 feet x 40 feet built to NEC Class 1 Div 2 standards
Control System: PLC based control panel	 Allen Bradley	
Remote Control and Telemetry Hardware:	Newterra	

Notes:

HP: horse power
V: volt
Ph: Phase
GPM: gallon per minute
PSI: pound per square inch
TEFC: Totally Enclosed, Fan Cooled
D: diameter
ACFM: Actual Cubic feet per minute
inch Hg: inches of mercury
SCFM: standard cubic feet per minute
inch WC: inches of water column
°F: Fahrenheit
dBA: Decibels
lb/day: pound per day
KW: kilowatt
lbs: pounds
W: width
L: length
H: height
Amps: Amperes
TDH: Total Discharge Head
PVC: Polyvinyl Chloride
CL 1 DIV 2: Class 1 Division 2 NEC location classification
NEC: National Electric Code

ARCADIS

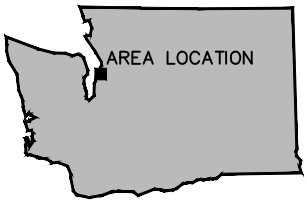
Figures



REFERENCE: USGS QUADS., 7.5 MIN. SERIES (TOPOGRAPHIC) - EDMONDS EAST, WASH. AND EDMONDS WEST, WASH.

0 0.5 1.0

Approximate Scale: 1"=0.5 Miles



WASHINGTON

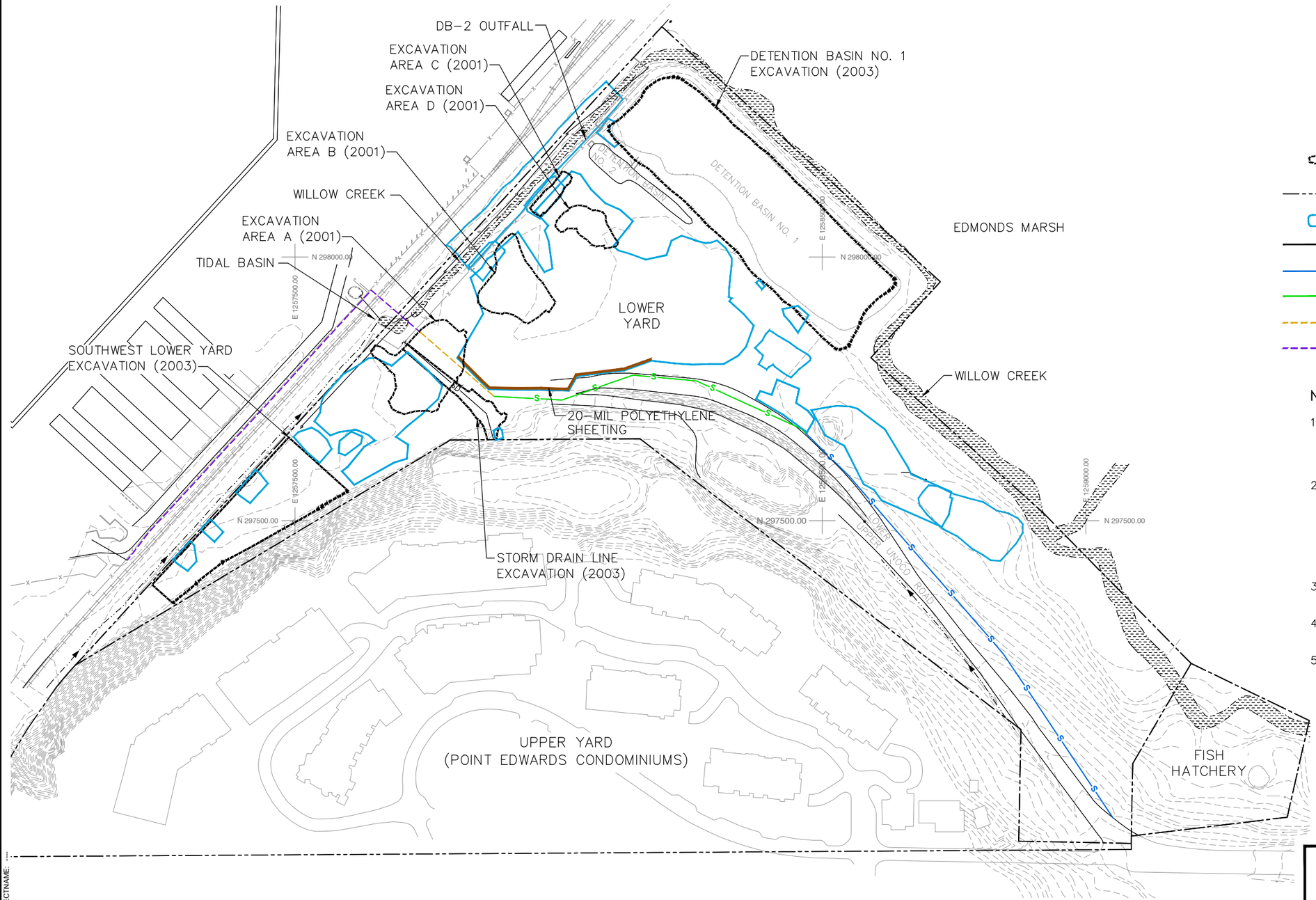
CHEVRON ENVIRONMENTAL MANAGEMENT COMPANY
FORMER UNOCAL BULK FUEL TERMINAL
EDMONDS, WASHINGTON
ENGINEERING DESIGN REPORT

SITE LOCATION MAP

ARCADIS Design & Consultancy for natural and built assets

FIGURE
1-1

CITY: MINNEAPOLIS, MN DIV/GROUP: ENV/CAD DB: R. OBERLANDER LD: R. OBERLANDER PIC:(Opt) PM:(Reqd) TM:(Opt) LYR:(Opt)ON=*;OFF=*REF*
G:\ENVCAD\Minneapolis-MNVACT\B0045362\0006\00012\EDR REPORT\DWG\45362_1-1.dwg LAYOUT: 1-1 SAVED: 2/26/2016 8:34 AM ACADVER: 19.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ---- PLOTTED: 2/26/2016 8:35 AM BY: OBERLANDER, ROSEANNE
XREFS: IMAGES: PROJECTNAME: ---
45362X0A EDMOND-E.TIF
EDMOND-W.TIF



LEGEND:

- 2001 AND 2003 SOIL EXCAVATIONS BELOW GROUNDWATER TABLE
- PROPERTY BOUNDARY
- 2007/2008 EXCAVATION BOUNDARIES
- SD — POINT EDWARDS STORM DRAIN LINE
- S — 48" DIA. WSDOT STORMWATER LINE
- S — 54" DIA. WSDOT STORMWATER LINE
- 60" DIA. WSDOT STORMWATER LINE
- 72" DIA. WSDOT STORMWATER LINE

NOTES:

1. 20-MIL POLYETHYLENE SHEETING INSTALLED UPON COMPLETION OF PHASE I OF THE 2007/2008 EXCAVATION. SHEETING REACHES TO APPROXIMATELY 7.5 FEET ABOVE MEAN SEA LEVEL.
2. HORIZONTAL DATUM: WASHINGTON STATE COORDINATE SYSTEM NORTH ZONE (NAD 83/98).
   VERTICAL DATUM: N.A.V.D. 88
   UNITS: U.S. SURVEY FEET
   HORIZONTAL AND VERTICAL CONTROL ESTABLISHED BY GPS VIA VERTICAL REFERENCE STATION NETWORK (VRSN).
3. SOUTHEAST PORTION OF WSDOT STORMWATER LINE HAS NOT BEEN SURVEYED.
4. THE LOCATION OF THE CHANGES IN DIAMETER OF THE WSDOT STORMWATER LINE ARE APPROXIMATE.
5. PORTION OF POINT EDWARDS STORM DRAIN LINE EXTENDING IN THE UPPER YARD AND POINT EDWARDS RETENTION POND HAVE NOT BEEN SURVEYED.

0 200' 400'

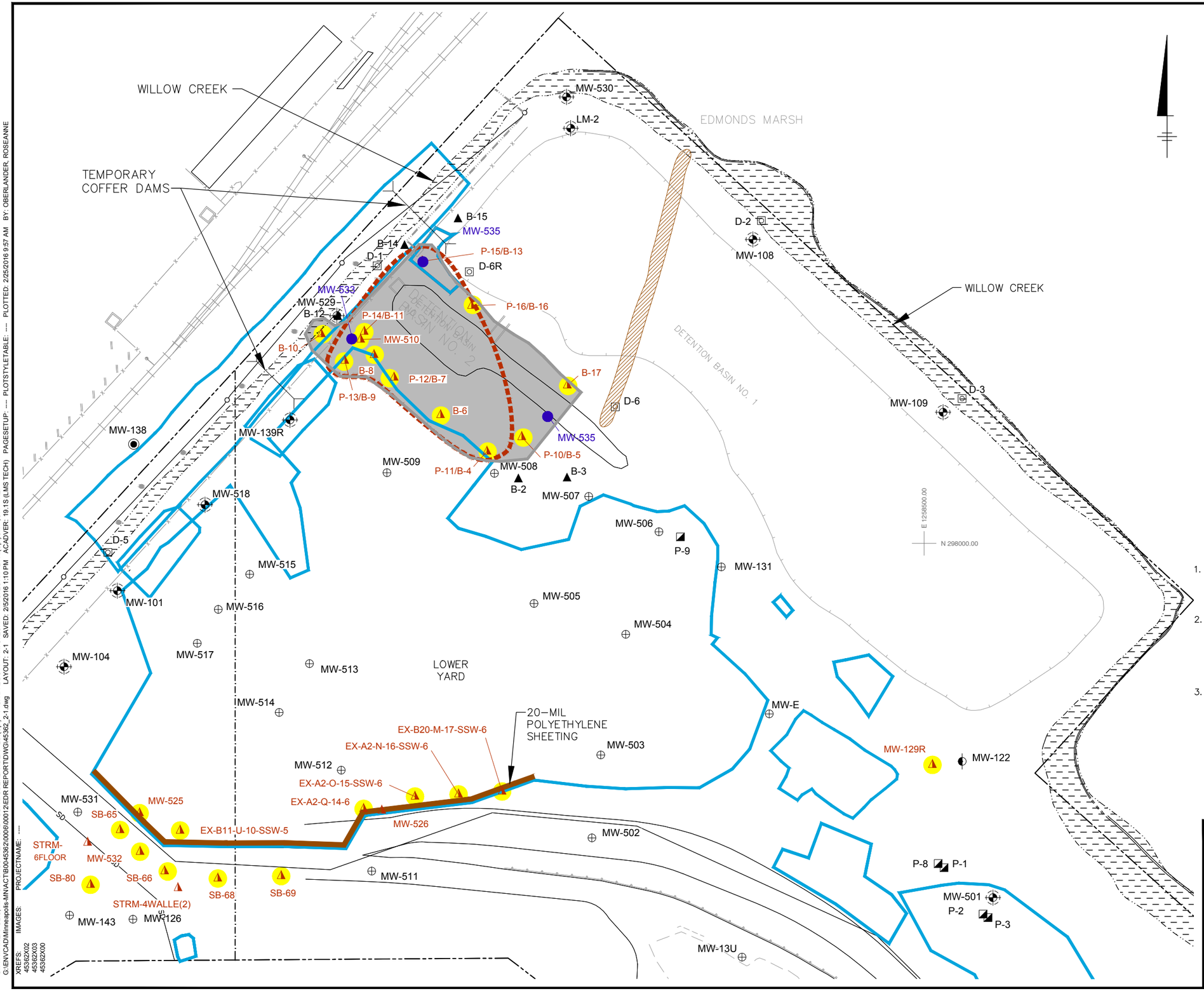
GRAPHIC SCALE

CHEVRON ENVIRONMENTAL MANAGEMENT COMPANY
FORMER UNOCAL BULK FUEL TERMINAL
EDMONDS, WASHINGTON
ENGINEERING DESIGN REPORT

SITE LAYOUT

ARCADIS

FIGURE
1-2



LEGEND:

- ESTIMATED RECOVERABLE LNAPL BOUNDARY
- SOIL SAMPLE COLLECTION LOCATION WITH CONCENTRATIONS OF TOTAL TPH AND/OR CPAHS EXCEEDING APPLICABLE SITE CULs AND/OR RELs.
- MW-203 — INTERIOR MONITORING WELL LOCATION AND DESIGNATION
- MW-122 — DEEP MONITORING WELL LOCATION AND DESIGNATION
- MW-109 — PERIMETER MONITORING WELL LOCATION
- MW-301 — BNSF WELLS
- MW-533 — PROPOSED MONITORING WELL LOCATION
- P-11 — PIEZOMETER
- D-1 — STAFF GAUGE
- DPE-12 — PROPOSED DUAL PHASE EXTRACTION WELL (DPE)
- 2007/2008 EXCAVATION BOUNDARIES
- PROPERTY BOUNDARY
- S — WSDOT STORMWATER LINE
- SD — POINT EDWARDS STORM DRAIN LINE
- SOIL BORING
- EXCAVATION BOUNDARY
- TEMPORARY EARTHEN BERM

NOTES:

1. 20-MIL POLYETHYLENE SHEETING INSTALLED UPON COMPLETION OF PHASE I EXCAVATION. SHEETING REACHES TO APPROXIMATELY 7.5 FEET ABOVE MEAN SEA LEVEL.
2. HORIZONTAL DATUM: WASHINGTON STATE COORDINATE SYSTEM NORTH ZONE (NAD 83/98).
   VERTICAL DATUM: N.A.V.D. 88
   UNITS: U.S. SURVEY FEET
   HORIZONTAL AND VERTICAL CONTROL ESTABLISHED BY GPS VIA VERTICAL REFERENCE STATION NETWORK (VRSN).
3. SOUTHEAST PORTION OF WSDOT STORMWATER LINE HAS NOT BEEN SURVEYED.

0 80' 160'
GRAPHIC SCALE

CHEVRON ENVIRONMENTAL MANAGEMENT COMPANY
FORMER UNOCAL BULK FUEL TERMINAL
EDMONDS, WASHINGTON
ENGINEERING DESIGN REPORT

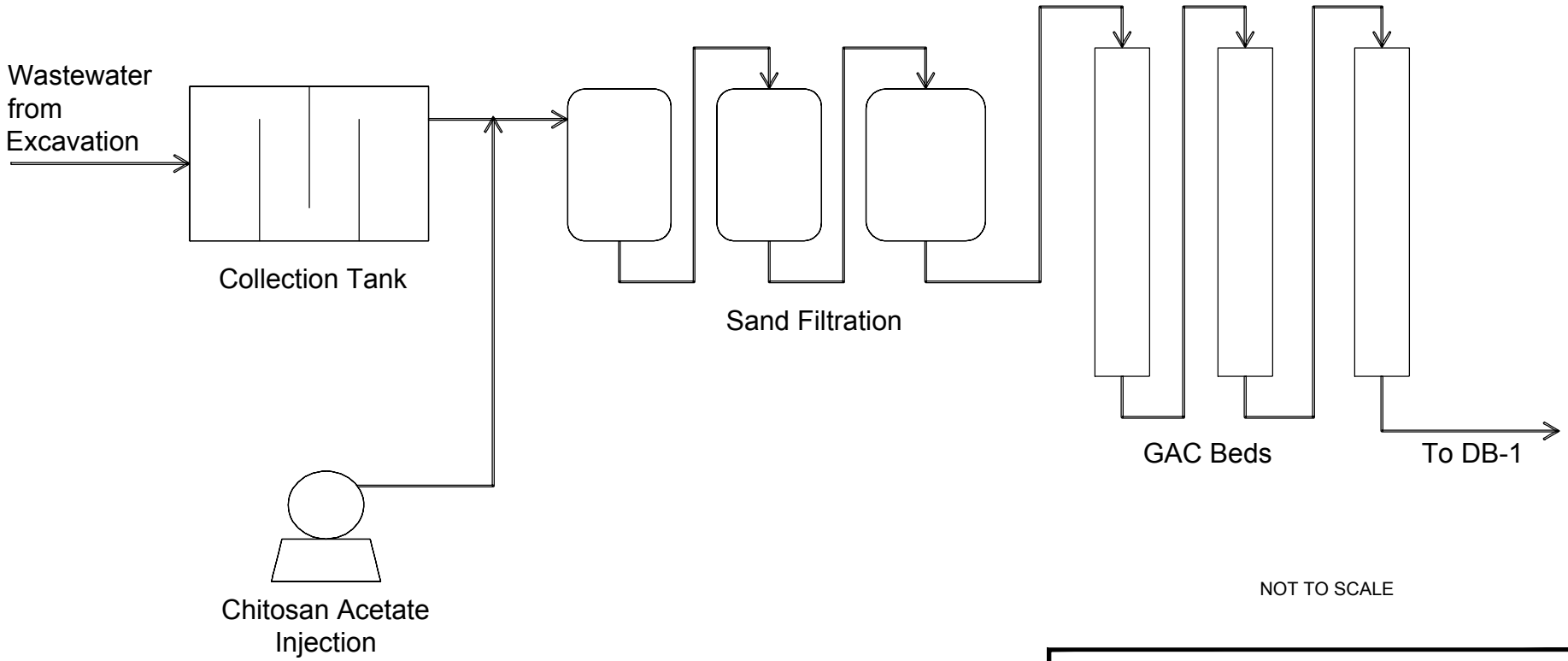
LOWER YARD REMAINING SOIL IMPACTS MAP

ARCADIS

FIGURE **2-1**

CITY: MINNEAPOLIS, MN DIV/GROUP: ENV/CAD DB: R. OBERLANDER LD:(Opt) PIC: K. ABBOTT PM: S. ZORN TM: S. ZORN LYR:(Opt)ON=*;OFF=*REF*
G:\ENVCAD\Minneapolis-MNACTIB\045362\000\6\000112\EDR REPORT\DWG\45362_2-1.dwg LAYOUT: 2-1 SAVED: 2/5/2016 1:10 PM ACADVER: 19.1S (LMS TECH) PAGESETUP: --- PLOTSTYLETABLE: --- PLOTTED: 2/25/2016 9:57 AM BY: OBERLANDER, ROSEANNE
XREFS: 45362X02 45362X03 45362X00 IMAGES: PROJECTNAME: ---

CITY: MINNEAPOLIS, MN DIV/GROUP: ENV/CAD DB: R. OBERLANDER LD: R. OBERLANDER PIC:(Opt) PM:(Reqd) TM:(Opt) LYR:(Opt)ON=*;OFF=*REF*
G:\ENVCAD\Minneapolis-MN\ACT\B0045362\0006\00012\EDR REPORT\DWG\45362_2-2.dwg LAYOUT: 2-2 SAVED: 2/5/2016 11:19 AM ACADVER: 19.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: PLTFULL.CTB PLOTTED: 2/25/2016 9:58 AM BY: OBERLANDER, ROSEANNE
XREFS: IMAGES: PROJECTNAME: ----



NOT TO SCALE

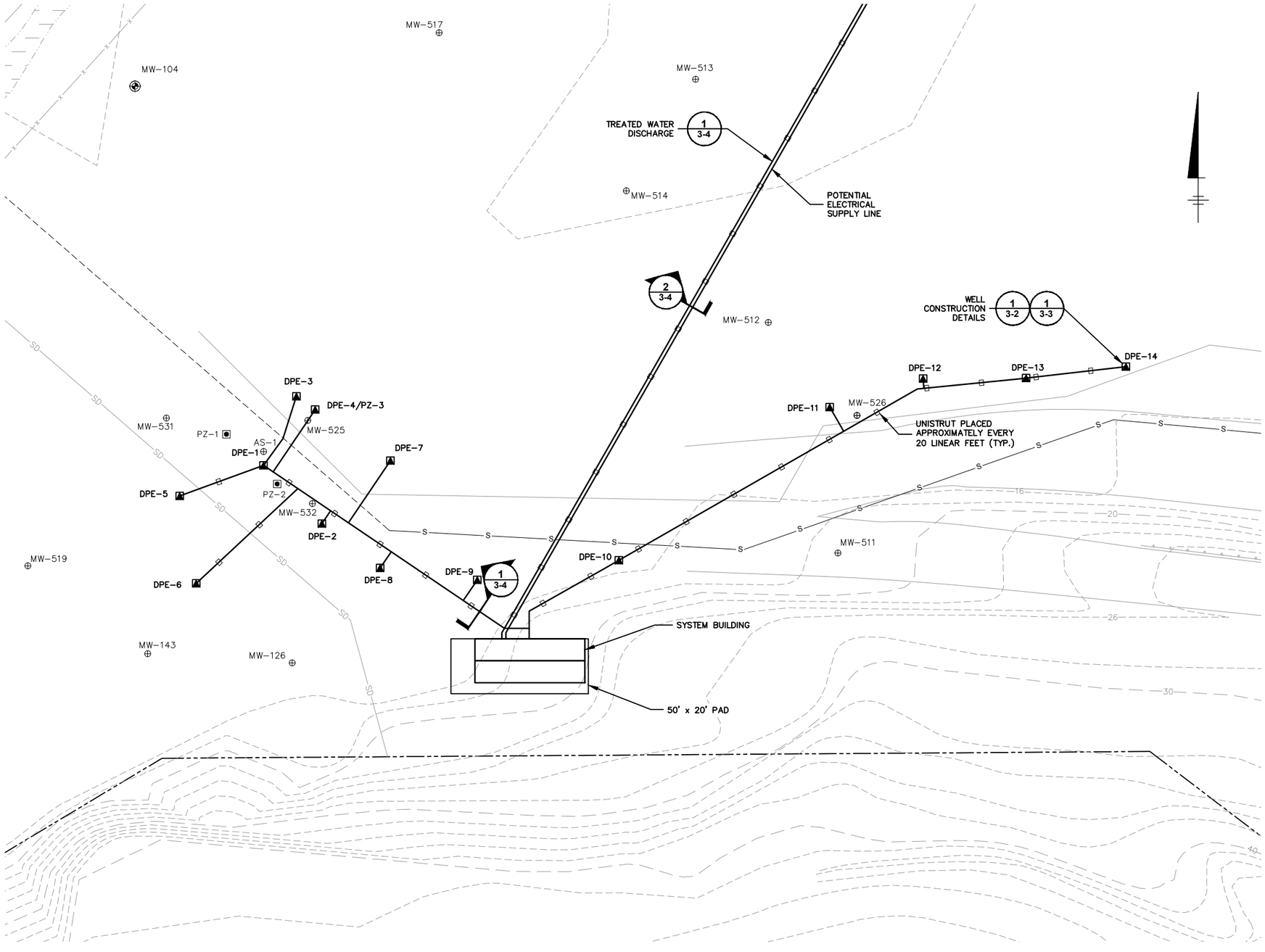
GAC = Granular Activated Carbon

CHEVRON ENVIRONMENTAL MANAGEMENT COMPANY
FORMER UNOCAL BULK FUEL TERMINAL
EDMONDS, WASHINGTON
DRAFT ENGINEERING DESIGN REPORT

TEMPORARY WATER TREATMENT SYSTEM FLOW DIAGRAM

ARCADIS

FIGURE
2-2



LEGEND:

- PROPOSED ABOVE GRADE PIPE OR CONDUIT
- PROPOSED UNISTRUT LOCATIONS
- DPE-10 — PROPOSED DUAL PHASE EXTRACTION (DPE) WELL LOCATION
- MW-203 — INTERIOR MONITORING WELL LOCATION AND DESIGNATION
- MW-108 — PERIMETER MONITORING WELL LOCATION
- PROPERTY BOUNDARY
- S — WSDOT STORMWATER LINE
- SD — POINT EDWARDS STORM DRAIN LINE

NOTES:

1. BUILDING AND ROAD INFORMATION DIGITIZED FROM GOOGLE EARTH AERIAL PHOTO. TOPOGRAPHIC CONTOURS WERE OBTAINED FROM AN UNKNOWN SOURCE. ALL LOCATIONS ARE APPROXIMATE AND SHALL BE VERIFIED IN THE FIELD BY CONTRACTOR PRIOR TO CONSTRUCTION.
2. HORIZONTAL DATUM: WASHINGTON STATE COORDINATE SYSTEM NORTH ZONE (NAD 83/98).
   VERTICAL DATUM: N.A.V.D. 88
   UNITS: U.S. SURVEY FEET
   HORIZONTAL AND VERTICAL CONTROL ESTABLISHED BY GPS VIA VERTICAL REFERENCE STATION NETWORK (VRSN).
3. SOUTHEAST PORTION OF WSDOT STORMWATER LINE HAS NOT BEEN SURVEYED.
4. LOCATION OF EXISTING POWER SUPPLY PANEL HAS NOT BEEN SURVEYED.

0 20' 40'
GRAPHIC SCALE

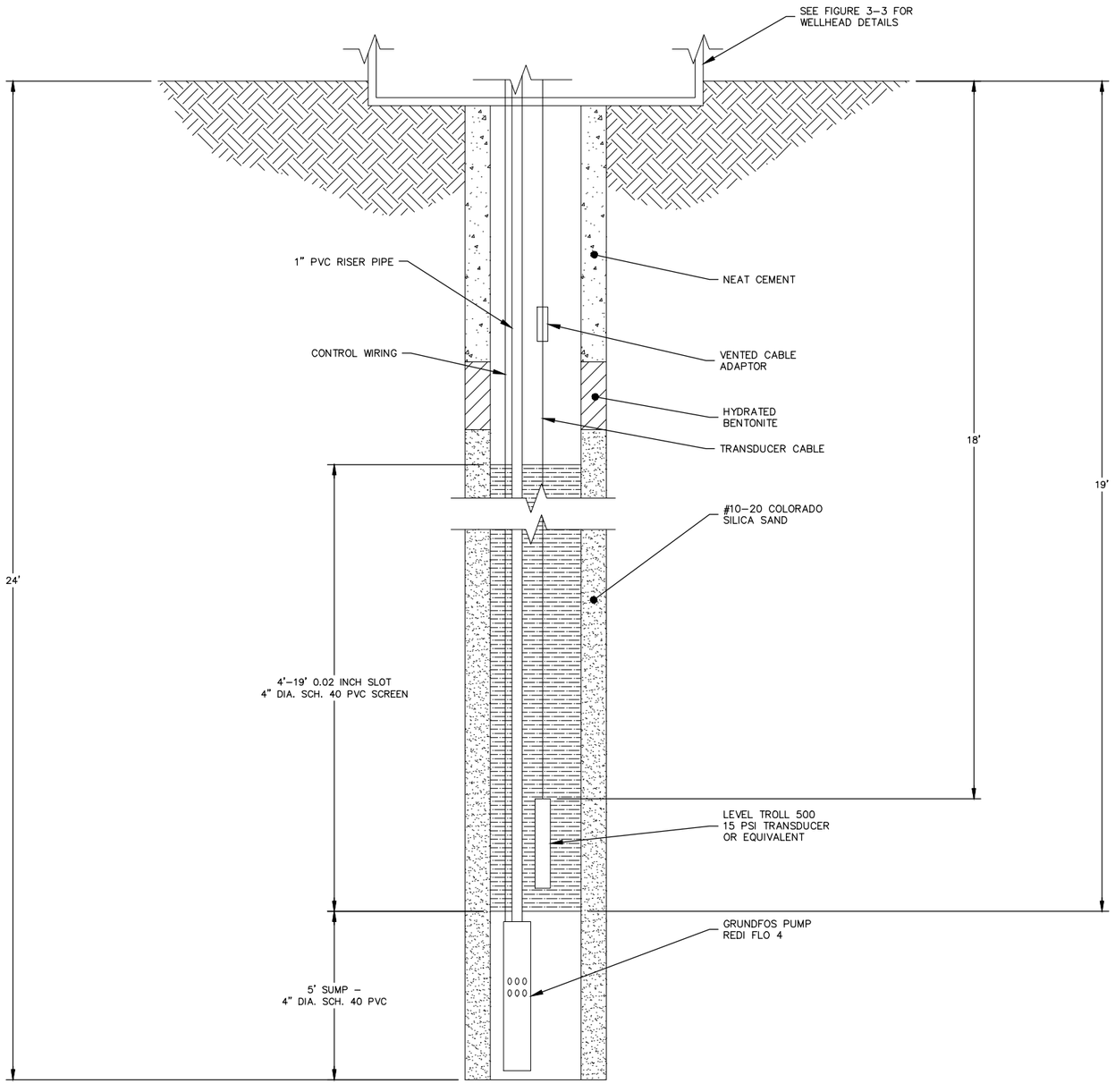
CHEVRON ENVIRONMENTAL MANAGEMENT COMPANY
FORMER UNOCAL BULK FUEL TERMINAL
EDMONDS, WASHINGTON
ENGINEERING DESIGN REPORT

DPE SYSTEM PIPING LAYOUT

ARCADIS

FIGURE
3-1

CITY: MINNEAPOLIS, MN DIV/GROUP: ENV/CAD DB: R. OBERLANDER LD:(Opt) PIC: K. ABBOTT PM: S. ZORN TM: S. ZORN LYR:(Opt)ON=*;OFF=*REF*
G:\ENVCAD\Minneapolis-MNVACT\B0045362\0006\0001\2EDR REPORT\DWG\45362_3-1.dwg LAYOUT: 3-1 SAVED: 2/25/2016 9:58 AM ACADVER: 19.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ---- PLOTTED: 2/25/2016 9:58 AM BY: OBERLANDER, ROSEANNE
XREFS: IMAGES: PROJECTNAME: ----
45362X00
45362X02
45362X03



WELL CONSTRUCTION DETAIL (1)

NOT TO SCALE

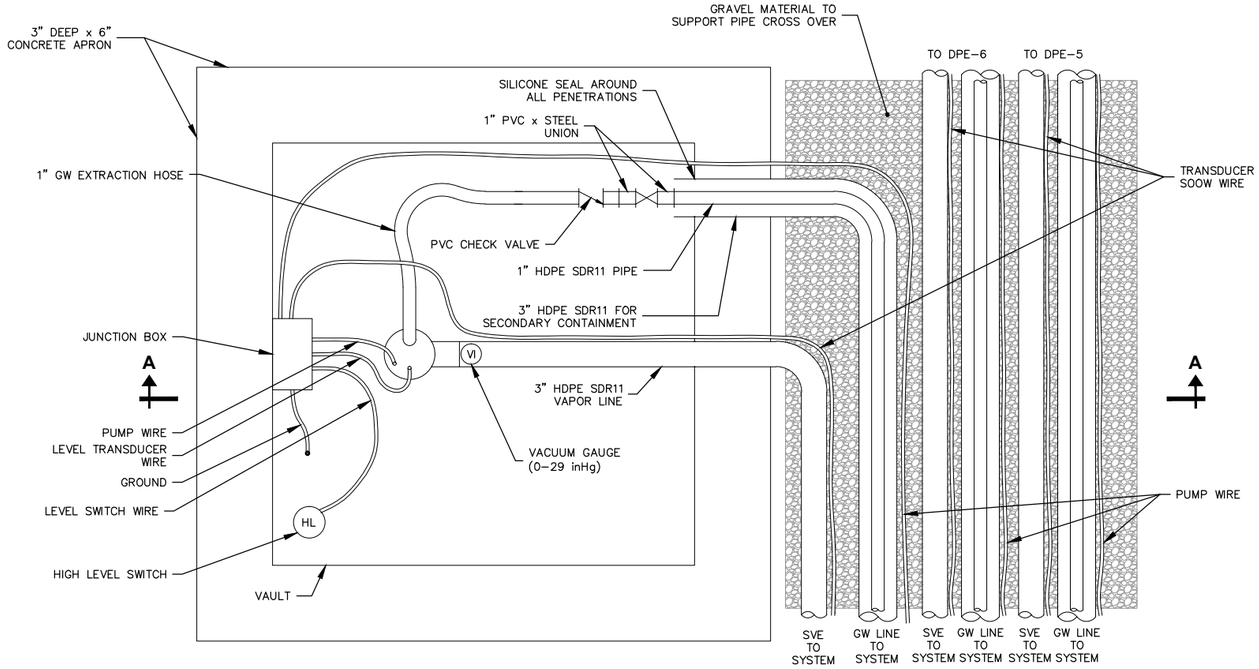
CHEVRON ENVIRONMENTAL MANAGEMENT COMPANY
FORMER UNOCAL BULK FUEL TERMINAL
EDMONDS, WASHINGTON
ENGINEERING DESIGN REPORT

DPE WELL CONSTRUCTION DETAILS

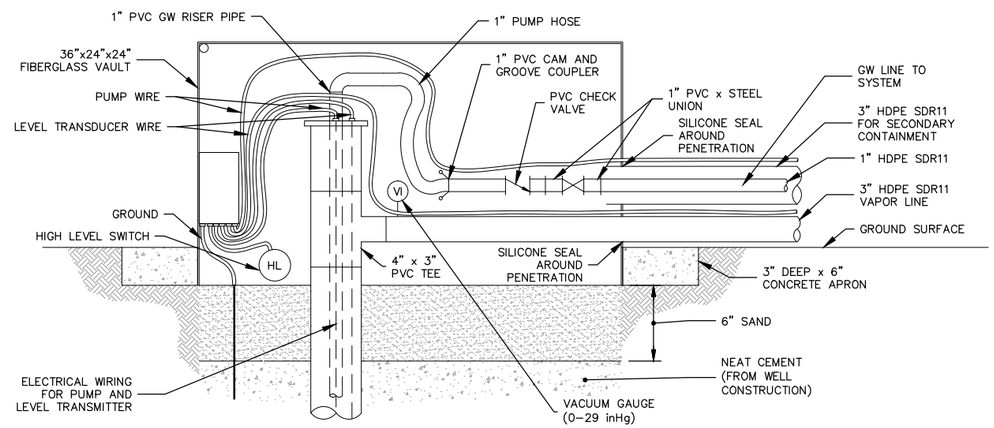
ARCADIS

FIGURE
3-2

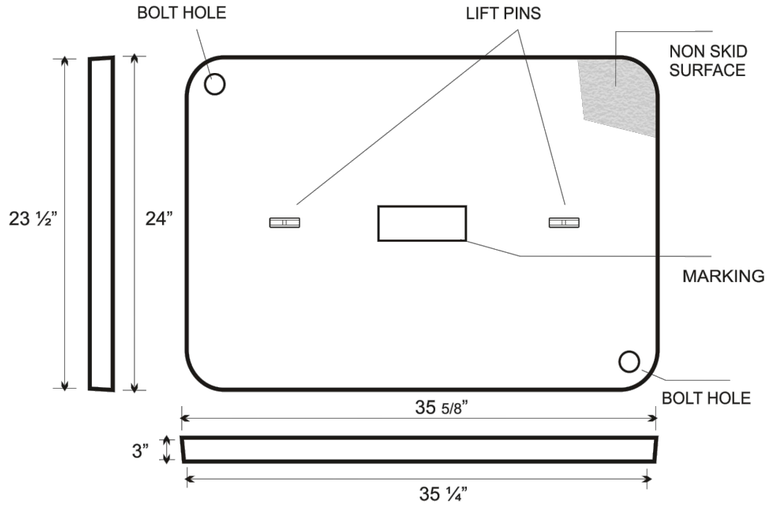
CITY: MINNEAPOLIS, MN DIV/GROUP: ENV/CAD DB: R. OBERLANDER LD:(Opt) PIC: K. ABBOTT PM: S. ZORN TM: S. ZORN LYR:(Opt)ON=*;OFF=*REF*
G:\ENVCAD\Minneapolis-MNVACTB\0045362\0006\000112\EDR REPORT\DWG\45362_3-2_3-3_3-4.dwg LAYOUT: 3-2 SAVED: 2/22/2016 9:55 AM ACADVER: 19.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ---- PLOTTED: 2/25/2016 9:58 AM BY: OBERLANDER, ROSEANNE
XREFS: IMAGES: PROJECTNAME: ---
45362X00



PLAN



SECTION A-A



WELL VAULT DETAIL

DPE WELLHEAD DETAIL 1

NOT TO SCALE

DEFINITIONS:

PVC	POLYVINYL CHLORIDE
SCH	SCHEDULE
DPE	DUAL PHASE EXTRACTION
GW	GROUNDWATER CONVEYANCE LINE
SVE	SOIL VAPOR EXTRACTION LINE
inHg	INCHES OF MERCURY
SOOW WIRE	SERVICE COLD, OIL RESISTANT JACKET, OIL RESISTANT INSULATION AND WEATHER/WATER RESISTANT
HDPE	HIGH DENSITY POLYETHYLENE
SDR	STANDARD DESIGN RATIO

LEGEND:

- CHECK VALVE
- (VI) VACUUM GAUGE 0-29 inHg
- 1" STEEL GATE VALVE
- (HL) HIGH LEVEL SWITCH

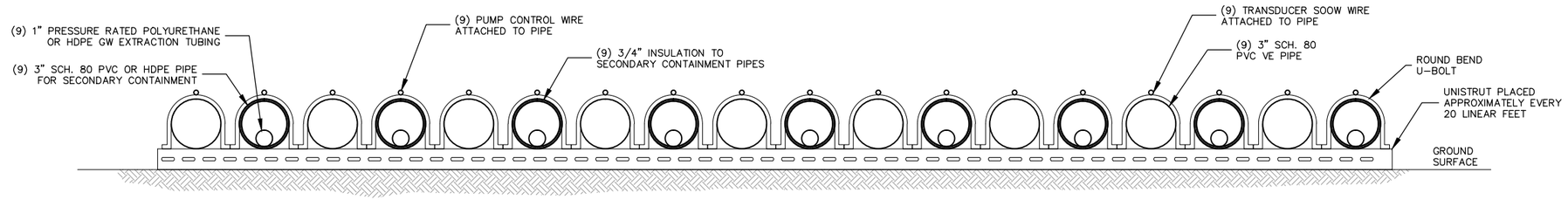
CHEVRON ENVIRONMENTAL MANAGEMENT COMPANY
FORMER UNOCAL BULK FUEL TERMINAL
EDMONDS, WASHINGTON
ENGINEERING DESIGN REPORT

DPE WELLHEAD CONNECTION DETAILS

ARCADIS

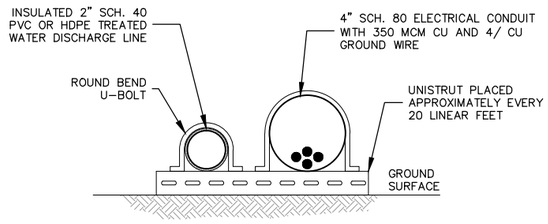
FIGURE
3-3

CITY: MINNEAPOLIS, MN DIV/GROUP: ENV/CAD DB: R. OBERLANDER LD:(Opt) PIC: K. ABBOTT PM: S. ZORN TM: S. ZORN LYR:(Opt)ON=*;OFF=*REF*
G:\ENV\CAD\Minneapolis-MN\ACTIVE\60045362\006\600172\EDR REPORT\DWG\45362_3-2_3-3_3-4.dwg LAYOUT: 3-3 SAVED: 2/22/2016 9:55 AM ACADVER: 19.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ---- PLOTTED: 2/25/2016 9:59 AM BY: OBERLANDER, ROSEANNE
XREFS: IMAGES: PROJECTNAME: ----
45362X00



PIPING CROSS-SECTION 1

0 3" 6"
SCALE: 3"=1'-0"



PIPING CROSS-SECTION 2

0 3" 6"
SCALE: 3"=1'-0"

NOTES:

1. GROUNDWATER CONVEYANCE SECONDARY CONTAINMENT LINE INSULATED WITH 3/4 INCH CLOSED CELL FOAM JACKETED INSULATION.
2. PIPE WILL BE EITHER SCH. 80 PVC OR SDR 11 HDPE DEPENDING ON PRODUCT AVAILABILITY.

DEFINITIONS:

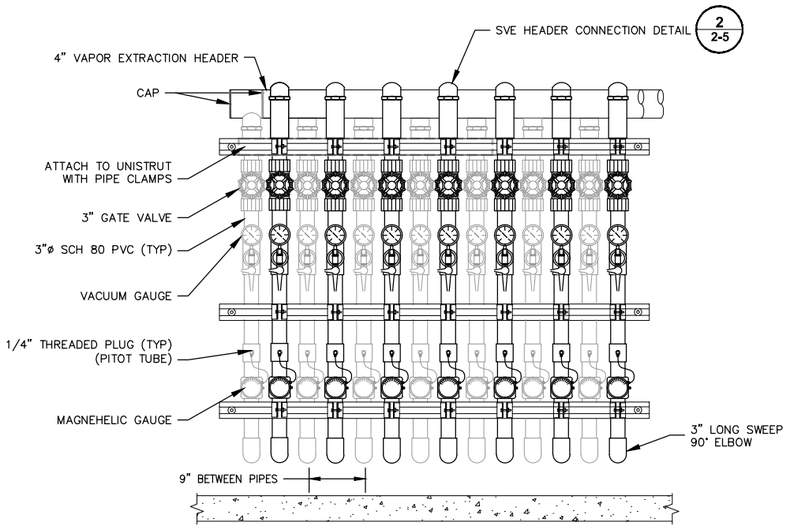
PVC	POLYVINYL CHLORIDE
SCH	SCHEDULE
inHg	INCHES OF MERCURY
SOOW WIRE	SERVICE COLD, OIL RESISTANT JACKET, OIL RESISTANT INSULATION AND WEATHER/WATER RESISTANT

CHEVRON ENVIRONMENTAL MANAGEMENT COMPANY
FORMER UNOCAL BULK FUEL TERMINAL
EDMONDS, WASHINGTON
ENGINEERING DESIGN REPORT

DPE PIPING CROSS SECTIONS

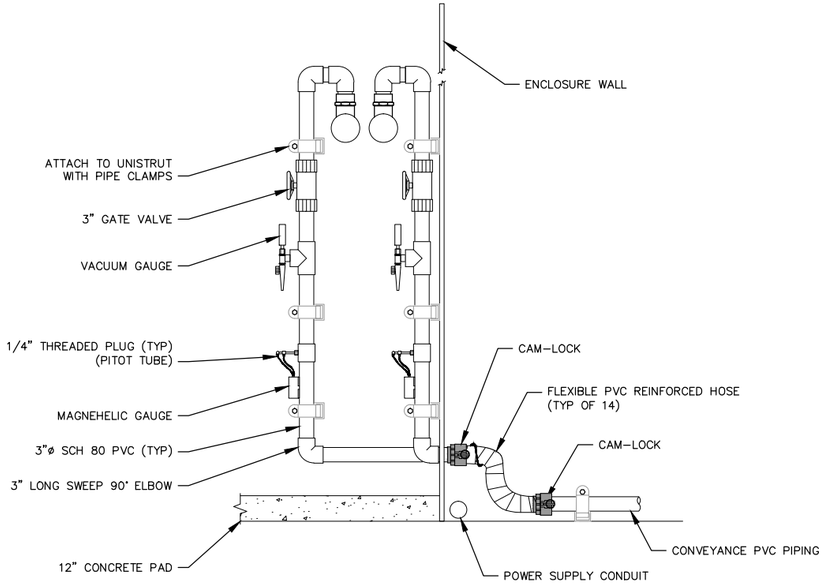
ARCADIS

FIGURE
3-4



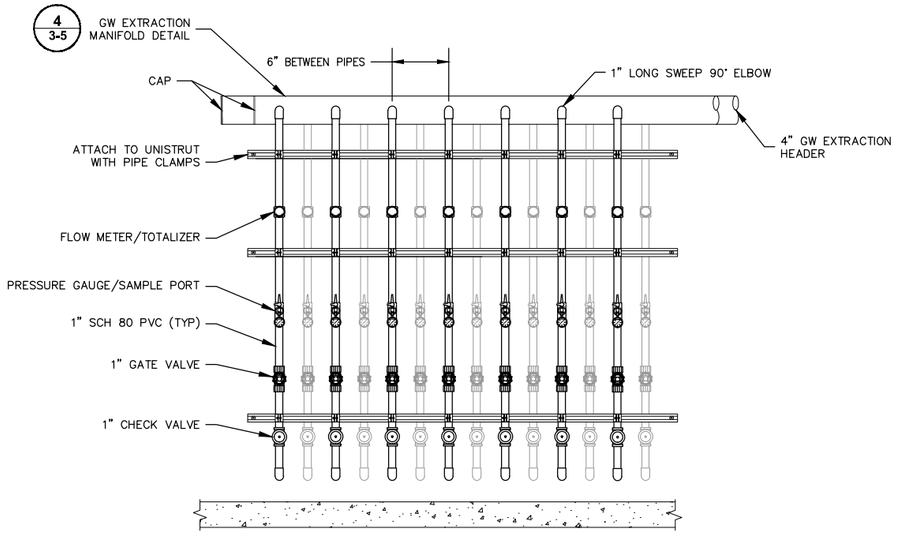
SVE PIPE MANIFOLD 1

NOT TO SCALE



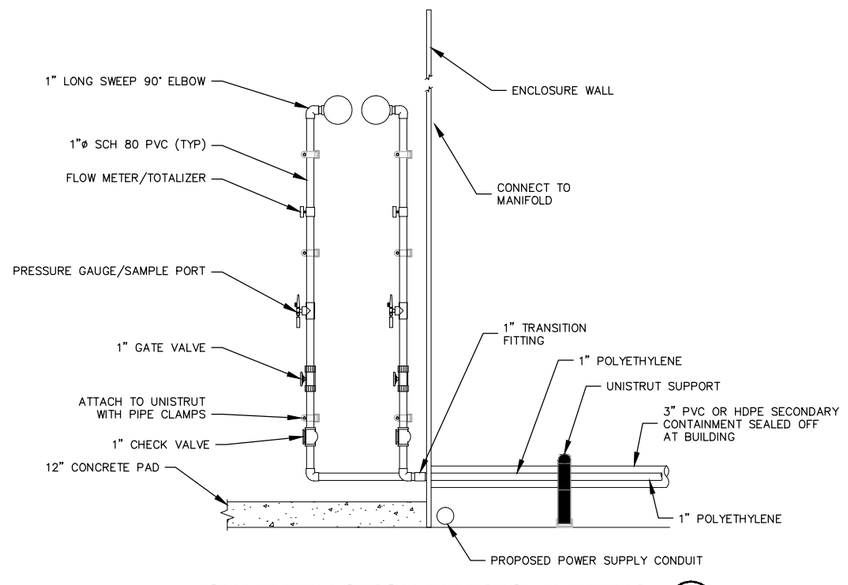
SVE MANIFOLD CONNECTION DETAIL 2

NOT TO SCALE



GW EXTRACTION PIPE MANIFOLD 3

NOT TO SCALE



GW EXTRACTION MANIFOLD DETAIL 4

NOT TO SCALE

NOTES:

1. GW AND SVE PIPE MANIFOLDS WILL BE CONSTRUCTED AT THE EQUIPMENT VENDORS FACILITY PRIOR TO SHIPMENT OF EQUIPMENT TO THE SITE.
2. POWER SUPPLY CONDUIT LOCATION MAY CHANGE BASED ON PUBLIC UTILITY SUPPLY LOCATION.

DEFINITIONS:

PVC	POLYVINYL CHLORIDE
SCH	SCHEDULE
GW	GROUNDWATER CONVEYANCE LINE
SVE	SOIL VAPOR EXTRACTION LINE

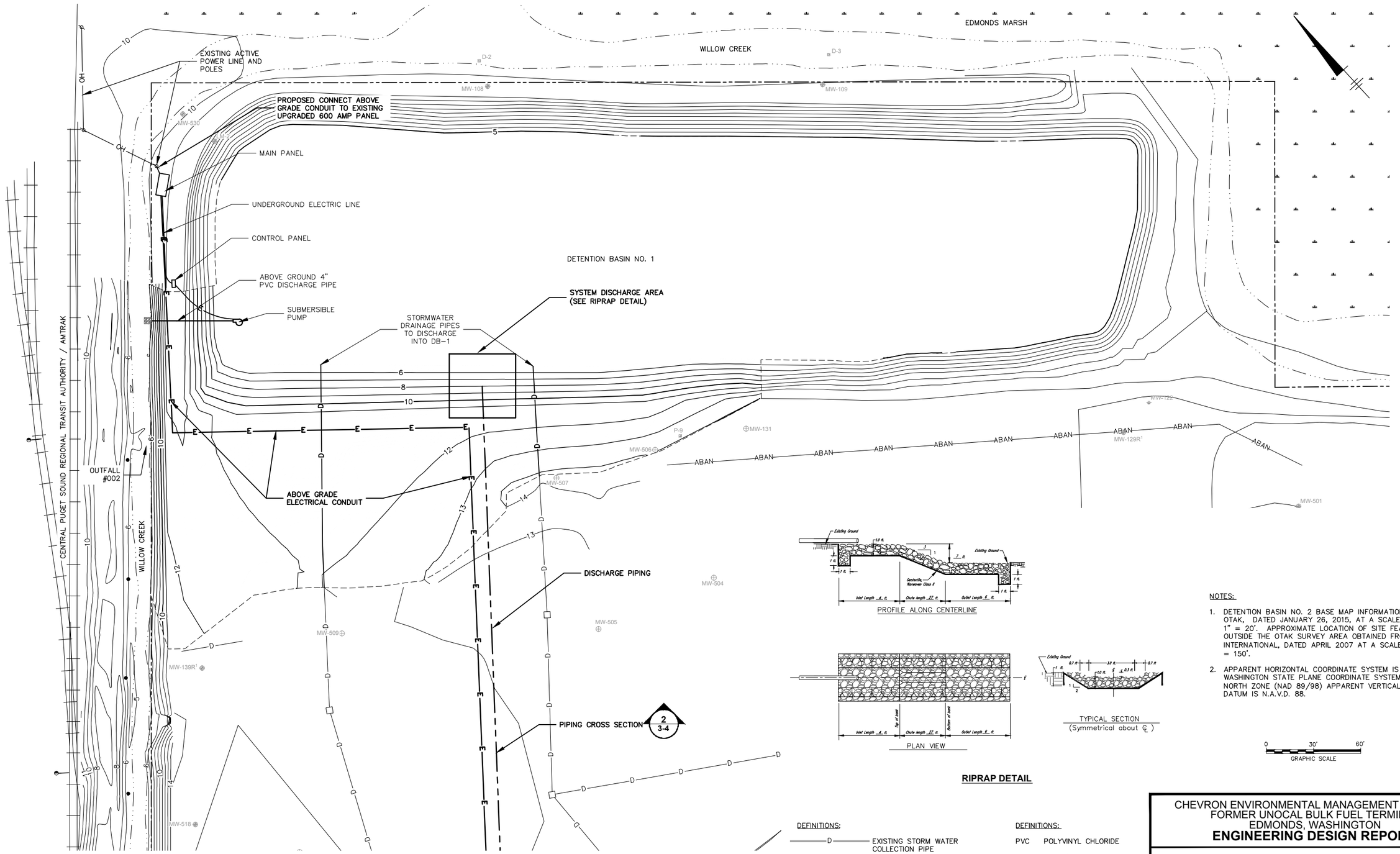
CHEVRON ENVIRONMENTAL MANAGEMENT COMPANY
FORMER UNOCAL BULK FUEL TERMINAL
EDMONDS, WASHINGTON
ENGINEERING DESIGN REPORT

DPE MANIFOLD CONNECTION DETAILS

ARCADIS

FIGURE
3-5

CITY: MINNEAPOLIS, MN DIV/GROUP: ENV/CAD DB: R. OBERLANDER LD:(Opt) PIC: K. ABBOTT PM: S. ZORN TM: S. ZORN LYR:(Opt)ON=*;OFF=*REF*
G:\ENV\CAD\Minneapolis-MN\ACTIVE\60045362\000\6000112\EDR REPORT\DWG\45362_3-5.dwg LAYOUT: 3-5 SAVED: 2/5/2016 11:16 AM ACADVER: 19.1S (LMS TECH)
XREFS: IMAGES: PROJECTNAME: ----
45362X00



RIPRAP DETAIL

NOTES:

1. DETENTION BASIN NO. 2 BASE MAP INFORMATION FROM OTAK, DATED JANUARY 26, 2015, AT A SCALE OF 1" = 20'. APPROXIMATE LOCATION OF SITE FEATURES OUTSIDE THE OTAK SURVEY AREA OBTAINED FROM SLR INTERNATIONAL, DATED APRIL 2007 AT A SCALE OF 1" = 150'.
2. APPARENT HORIZONTAL COORDINATE SYSTEM IS WASHINGTON STATE PLANE COORDINATE SYSTEM, NORTH ZONE (NAD 89/98) APPARENT VERTICAL DATUM IS N.A.V.D. 88.

0 30' 60'
GRAPHIC SCALE

DEFINITIONS:

D	EXISTING STORM WATER COLLECTION PIPE
E	ELECTRICAL CONDUIT
OH	OVERHEAD LINE
ABAN	ABANDONED LINE
MW-518	GROUNDWATER MONITORING WELL

DEFINITIONS:

PVC	POLYVINYL CHLORIDE
AMP	AMPERE

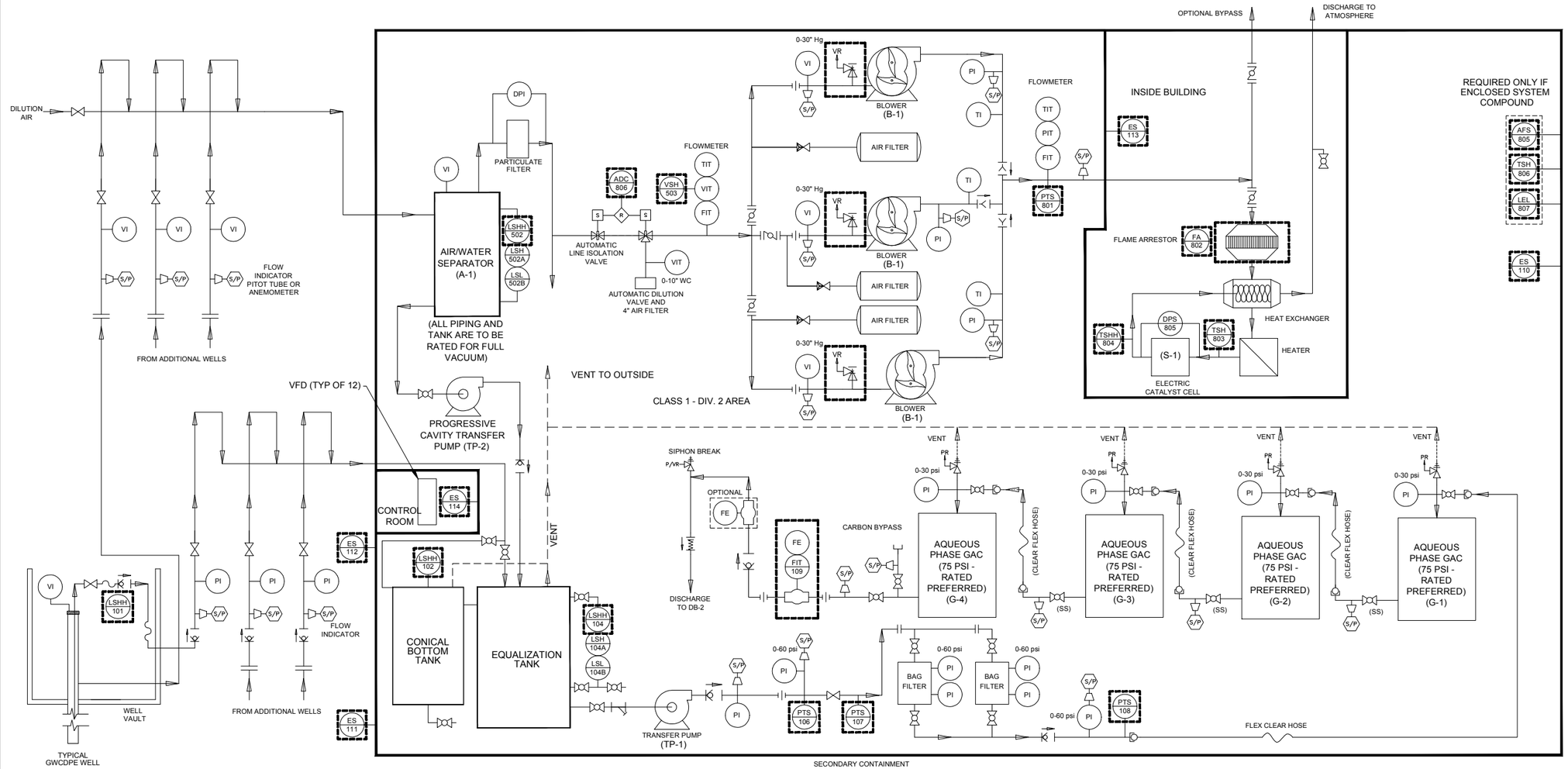
CHEVRON ENVIRONMENTAL MANAGEMENT COMPANY
FORMER UNOCAL BULK FUEL TERMINAL
EDMONDS, WASHINGTON
ENGINEERING DESIGN REPORT

RIPRAP DESIGN AT DETENTION BASIN 1

ARCADIS

FIGURE
3-6

CITY: MINNEAPOLIS, MN DIV/GROUP: ENV/CAD DB: R. OBERLANDER LD:(Opt) PIC: K. ABBOTT PM: S. ZORN TM: S. ZORN LYR:(Opt)ON=*;OFF=*REF*
G:\ENVCAD\Minneapolis-MN\ACTIB00\45362\000\612\EDR REPORT\DWG\45362_3-6.dwg LAYOUT: 3-6 SAVED: 2/5/2016 1:11 PM ACADVER: 19.1S (LMS TECH) PAGESETUP: --- PLOTSTYLETABLE: --- PLOTTED: 2/25/2016 10:00 AM BY: OBERLANDER, ROSEANNE
XREFS: IMAGES: PROJECTNAME: ---
45362X00
45362X01
45362X05



PRIMARY EQUIPMENT SYMBOLS

- VACUUM BLOWER
- METERING PUMP
- LIQUID-RING BLOWER
- COALESCING FILTER
- OIL-LESS COMPRESSOR
- DISCHARGE SILENCER

FITTINGS SYMBOLS

- CAP (THREADED)
- UNION
- PLUG (THREADED)
- FLANGED JOINT
- REDUCER
- ORIFICE-PLATE FLOWMETER
- RAIN CAP
- CAM LOCK
- WYE STRAINER
- FLEXIBLE HOSE OR CONNECTOR
- SPRAY NOZZLE
- P-TRAP

VALVE SYMBOLS

- GATE (NORMALLY OPEN)
- SOLENOID (NORMALLY CLOSED: FAIL CLOSED)
- SAMPLE PORT
- GATE (NORMALLY CLOSED)
- BALL (NORMALLY OPEN)
- PRESSURE REGULATOR
- BALL (NORMALLY CLOSED)
- VACUUM RELIEF
- BUTTERFLY (NORM. OPEN)
- PRESSURE RELIEF
- BUTTERFLY (NORM. CLOSED)
- BALL CHECK
- PRESSURE/ VACUUM RELIEF
- SPRING CHECK
- QUICK DISCONNECT
- SEATLESS CHECK
- QUICK DISCONNECT
- AUTOMATIC DRAIN
- BOSS POSITIVE METAL-TO-POLYMER COUPLER
- NEEDLE VALVE

REQUIRED CONTROL DEVICES ARE OUTLINED BOLD

ABBREVIATIONS:

DPI	DIFFERENTIAL PRESSURE INDICATOR
ES	EMERGENCY STOP
FA	FLAME ARRESTOR
FE	FLOW INDICATOR
FIT	FLOW INDICATOR AND TOTALIZER
LEL	LOWER EXPOSURE LIMIT
LSL	LEVEL SWITCH LOW
LSH	LEVEL SWITCH HIGH
LSHH	LEVEL SWITCH HIGH HIGH
PI	PRESSURE INDICATOR
PIT	PRESSURE INDICATOR TRANSMITTER
PSI	POUNDS PER SQUARE INCH
PTS	PRESSURE TRANSMITTING SWITCH
SS	STAINLESS STEEL
TI	TEMPERATURE INDICATOR
TIT	TEMPERATURE INDICATOR TRANSMITTER
TS	TEMPERATURE SWITCH
VFD	VARIABLE FREQUENCE DRIVE
VI	VACUUM INDICATOR
VIT	VACUUM INDICATOR TRANSMITTER

CONTROL UNIT	FUNCTION
LSHH 101	LEVEL SWITCH/ALARM HIGH HIGH: TURNS OFF ALL SYSTEMS
LSHH 102	LEVEL SWITCH/ALARM HIGH HIGH: TURNS OFF ALL SYSTEMS
LSHH 104	LEVEL SWITCH/ALARM HIGH HIGH: TURNS OFF ALL SYSTEMS
LSH 104A	LEVEL SWITCH HIGH: TURNS ON AS TRANSFER PUMP (TP-1)
LSL 104B	LEVEL SWITCH LOW: TURNS OFF TRANSFER PUMP (TP-1)

ALL HIGH HIGH OR LEL LEVEL SWITCHES ARE MANUAL RESET

CONTROL UNIT	FUNCTION
PTS 106	PRESSURE TRANSMITER SWITCH/ALARM HIGH: TURNS OFF ALL SYSTEMS
PTS 107	PRESSURE TRANSMITER SWITCH/ALARM HIGH: TURNS OFF ALL SYSTEMS
PTS 108	PRESSURE TRANSMITER SWITCH/ALARM HIGH: TURNS OFF ALL SYSTEMS

CONTROL UNIT	FUNCTION
ES 110	EMERGENCY STOP SWITCH (INTERNAL #1): TURNS OFF ALLSYSTEMS
ES 111	EMERGENCY STOP SWITCH (EXTERNAL #1): TURNS OFF ALLSYSTEMS
FIT 109	FLOW INDICATOR AND TOTALIZER

CONTROL UNIT	FUNCTION
LSHH 502	LEVEL SWITCH/ALARM HIGH HIGH: TURNS OFF ALL SYSTEMS
LSH 502A	LEVEL SWITCH HIGH: TURNS ON AS TRANSFER PUMP (TP-2)
LSL 502B	LEVEL SWITCH HIGH: TURNS ON AS TRANSFER PUMP (TP-2)
VSH 503	VACUUM SWITCH/ALARM HIGH HIGH: TURNS OFF ALL SYSTEMS
PTS 801	AIR PROVING SWITCH (PRESSURE SWITCH/ALARM LOW): TURNS OFF ALL SYSTEMS
FA 802	FLAME ARRESTOR: PREVENTS FLAMES FROM PROPOGATING UPSTREAM IN EVENT OF EXPLOSION

CONTROL UNIT	FUNCTION
TSH 803	TEMPERATURE SWITCH/ALARM LOW: CLOSES AUTOMATIC DILUTION VALVE (ADC) WHEN SYSTEM REACHES OPERATING TEMPERATURE RANGE
TSHH 804	TEMPERATURE SWITCH/ALARM HIGH HIGH: TURNS OFF ALL SYSTEMS
DPS 805	DIFFERENTIAL PRESSURE SWITCH/ALARM HIGH HIGH: TURNS OFF ALL SYSTEMS
AFS 805	AIR-FLOW SENSOR/ALARM HIGH HIGH: TURNS OFF ALL SYSTEMS
TSH 806	TEMPERATURE SWITCH/ALARM HIGH HIGH: TURNS OFF ALL SYSTEMS
LEL 807	LOWER EXPLOSIVE LIMIT /ALARM HIGH HIGH: TURNS OFF ALL SYSTEMS
ADC 806	AIR DILUTION CONTROL VALVE: OPENS AT HIGH TEMP TO COOL OXIDIZER CLOSES AT OPERATING TEMP

CONTROL UNIT	FUNCTION
ES 112	EMERGENCY STOP SWITCH INTERNAL #2 TURNS OFF ALL SYSTEMS
ES 113	EMERGENCY STOP SWITCH EXTERNAL #2 TURNS OFF ALL SYSTEMS
ES 114	EMERGENCY STOP SWITCH CONTROL ROOM TURNS OFF ALL SYSTEMS

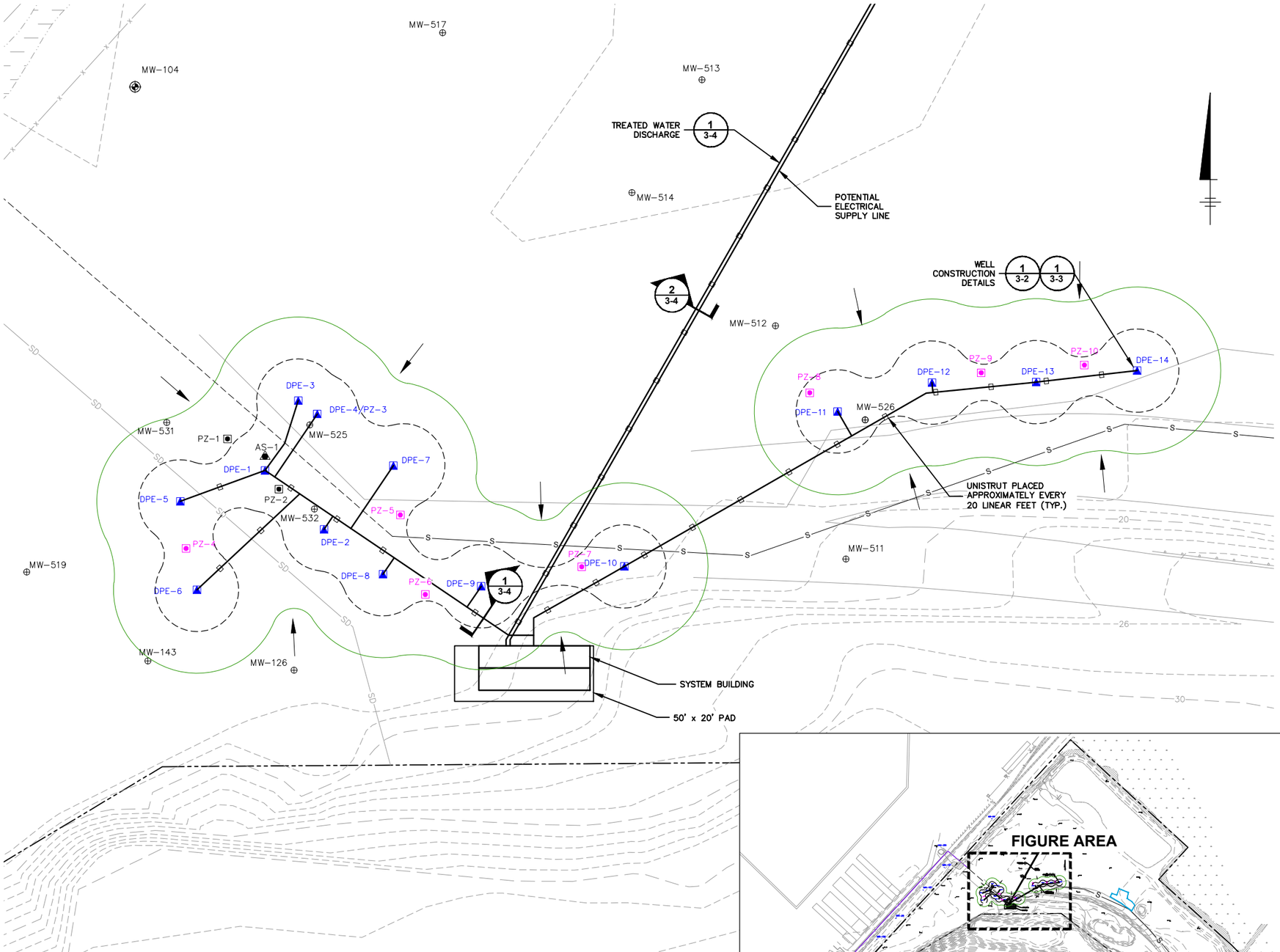
CHEVRON ENVIRONMENTAL MANAGEMENT COMPANY
FORMER UNOCAL BULK FUEL TERMINAL
EDMONDS, WASHINGTON
ENGINEERING DESIGN REPORT

PROCESS AND INSTRUMENTATION DIAGRAM

ARCADIS

FIGURE
3-7

CITY: MINNEAPOLIS, MN DIV/GROUP: ENV/CAD DB: R. OBERLANDER LD:(Opt) PIC: K. ABBOTT PM: S. ZORN TM: S. ZORN LYR:(Opt)ON=*;OFF=*REF*
G:\ENVCAD\Minneapolis-NNAC\TB0045362\0006\0001\2\EDR REPORT\DWG\45362_3-7.dwg LAYOUT: 3-7 SAVED: 2/5/2016 1:08 PM ACADVER: 19.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ---- PLOTTED: 2/5/2016 10:01 AM BY: OBERLANDER, ROSEANNE
XREFS: IMAGES: PROJECTNAME: ----
45362X00



LEGEND:

- PROPOSED ABOVE GRADE PIPE OR CONDUIT
- PROPOSED UNISTRUT LOCATIONS
- DPE-10 — PROPOSED DUAL PHASE EXTRACTION (DPE) WELL LOCATION
- MW-203 — INTERIOR MONITORING WELL LOCATION AND DESIGNATION
- MW-108 — PERIMETER MONITORING WELL LOCATION
- AS-1 — AIR SPARGE WELL LOCATION
- PROPERTY BOUNDARY
- S — WSDOT STORMWATER LINE
- SD — POINT EDWARDS STORM DRAIN LINE
- ESTIMATED DPE ROI – 30 FOOT RADIUS OF INFLUENCE
- PZ-9 — PROPOSED DPE MONITORING PIEZOMETERS
- PZ-1 — EXISTING DPE MONITORING PIEZOMETERS
- ESTIMATED 3 FOOT DRAWDOWN INFLUENCE– 15 FOOT RADIUS OF INFLUENCE
- ANTICIPATED INWARD GRADIENT

NOTES:

1. HORIZONTAL DATUM: WASHINGTON STATE COORDINATE SYSTEM NORTH ZONE (NAD 83/98).
   VERTICAL DATUM: N.A.V.D. 88
   UNITS: U.S. SURVEY FEET
   HORIZONTAL AND VERTICAL CONTROL ESTABLISHED BY GPS VIA VERTICAL REFERENCE STATION NETWORK (VRSN).
2. SOUTHEAST PORTION OF WSDOT STORMWATER LINE HAS NOT BEEN SURVEYED.
3. LOCATION OF EXISTING POWER SUPPLY PANEL HAS NOT BEEN SURVEYED.

0 20' 40'
GRAPHIC SCALE

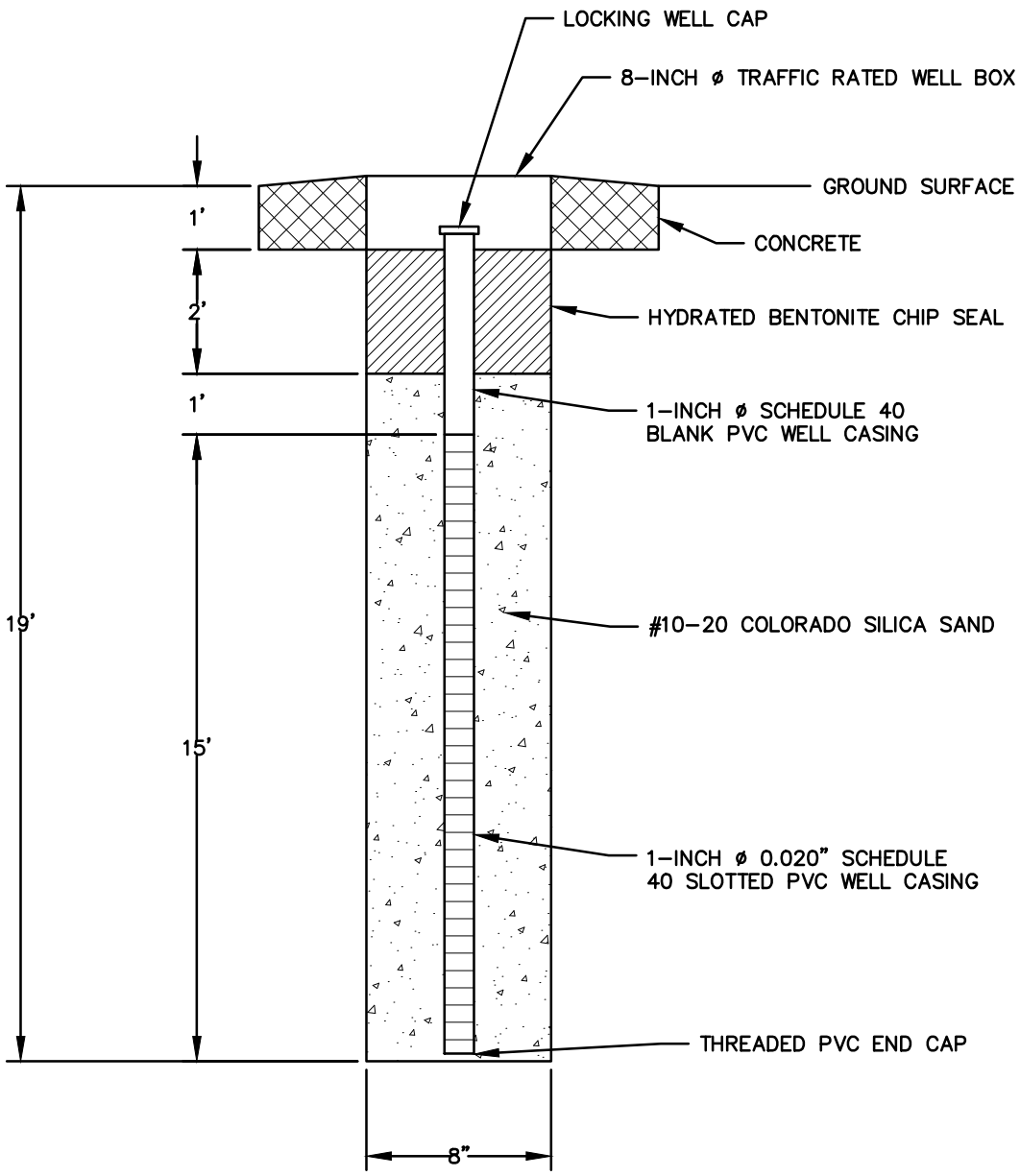
CHEVRON ENVIRONMENTAL MANAGEMENT COMPANY
FORMER UNOCAL BULK FUEL TERMINAL
EDMONDS, WASHINGTON
ENGINEERING DESIGN REPORT

PROPOSED DPE SYSTEM MONITORING LOCATIONS

ARCADIS

FIGURE
3-8

CITY: MINNEAPOLIS, MN DIV/GROUP: ENV/CAD DB: R. OBERLANDER LD:(Opt) PIC: K. ABBOTT PM: S. ZORN TM: S. ZORN LYR:(Opt)ON=*;OFF=*REF*
G:\ENVCAD\Minneapolis-MNACTIB\00\45362\00\00012\EDR REPORT\DWG\45362_3-8.dwg LAYOUT: 3-8 SAVED: 3/3/2016 4:44 PM BY: OBERLANDER, ROSEANNE
XREFS: IMAGES: PROJECTNAME: ---
45362X00
45362X02
45362X03



NOT TO SCALE

CHEVRON ENVIRONMENTAL MANAGEMENT COMPANY
FORMER UNOCAL BULK FUEL TERMINAL
EDMONDS, WASHINGTON
ENGINEERING DESIGN REPORT

PROPOSED PIEZOMETER CONSTRUCTION DETAILS

ARCADIS Design & Consultancy for natural and built assets

FIGURE
3-9

CITY: MINNEAPOLIS, MN DIV/GROUP: ENV/CAD DB: R. OBERLANDER LD: R. OBERLANDER PIC:(Opt) PM:(Reqd) TM:(Opt) LYR:(Opt)ON=*;OFF=*REF*
G:\ENVCAD\Minneapolis-MNVACT\B0045362\0006\00012\EDR REPORT\DWG\45362_3-9.dwg LAYOUT: 3-9 SAVED: 2/26/2016 9:18 AM ACADVER: 19.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ---- PLOTTED: 2/26/2016 9:18 AM BY: OBERLANDER, ROSEANNE
XREFS: IMAGES: PROJECTNAME: ----
45362X0A

ARCADIS

Appendix A

Dual-Phase Extraction Pilot Test Summary

ARCADIS U.S., Inc.
1100 Olive Way
Suite 800
Seattle
Washington
Tel 206.325.5254
Fax 206.325.8218
www.arcadis-us.com

ENVIRONMENT

David L. South
Senior Engineer
Washington State Department of Ecology
Toxics Cleanup Program, NWRO
3190 160th Avenue Southeast
Bellevue, Washington 98008-5452

Dual-Phase Extraction Pilot Test Summary
Former Unocal Edmonds Bulk Fuel Terminal
11720 Unoco Road
Edmonds, Washington

Date:
March 8, 2016

Contact:
Scott Zorn

Phone:
206.726.4709

Email:
Scott.Zorn@arcadis-us.com

Our ref:
B0045362.0006

Dear Mr. South:

On behalf of Chevron Environmental Management Company (Chevron), ARCADIS U.S., Inc. (ARCADIS) prepared this letter to summarize the Dual-Phase Extraction Pilot Test (DPE Summary) for the former Union Oil Company of California (Unocal) Edmonds Bulk Fuel Terminal, located at 11720 Unoco Road, Edmonds, Washington (Site; Figure 1). This DPE Summary is being submitted to present the results of DPE pilot testing to confirm the implementability of the technology as described in the Public Review Draft Interim Action Work Plan (IAWP; ARCADIS 2015).

Two pilot tests were performed during the first quarter of 2015. The first mobilization was completed from February 17 through 21, 2015. Based on the result of the first mobilization, a second pumping test was conducted from March 30 through April 1 in order to determine more specifically the appropriate extraction well depth and screen interval, as well as, improve overall pumping rate estimates and account for observed subsurface heterogeneity.

Dual-Phase Extraction Pilot Test

The pilot test plan was described in the IAWP (ARCADIS 2015) and proposed the installation of two DPE wells (DPE-1 and DPE-2) and two piezometers (PZ-1 and PZ-2) near the Washington State Department of Transportation (WSDOT) stormwater line. The initial plan was to perform extraction on well DPE-1 while monitoring water levels and induced vacuum in piezometers PZ-1 and PZ-2, extraction well DPE-2, and several existing monitoring wells (AS-1, MW-525, MW-531, and MW-532). During the initial pilot testing of DPE-1, the project team observed a groundwater yield of less than 1 gallon per minute (gpm) under vacuum conditions. This observed

pumping rate was lower than pumping rates from historical pumping tests (2 to 3 gpm) that were performed under normal non-vacuum-enhanced conditions. After reviewing the results of the DPE-1 pilot test, pilot test was moved from DPE-1 to DPE-2.

Data collected from pilot testing on DPE-1 and DPE-2 indicated a variation in pumping rates from less than 1 gpm to more than 8 gpm. Due to this variation, the project team remobilized to the site and installed one additional DPE well (DPE-3) and one additional observation well (PZ-3). A second round of pilot testing of well DPE-3 was performed from March 30 through April 1, 2015. DPE and pilot test wells were installed using Schedule 40 polyvinyl chloride (PVC) and advanced using a hollow stem auger (HSA), as described below. The pilot test well layout is shown on Figures 2 and 3.

Pilot Test Well Construction Details

Six new monitoring wells were installed prior to pilot testing. The new wells included three DPE wells (DPE-1, DPE-2, and DPE-3) and three piezometers (PZ-1, PZ-2, and PZ-3). Piezometers PZ-1 and PZ-2 were advanced as 2-inch-diameter wells to 25 feet below ground surface (bgs), with 20 feet of 2-inch-diameter, 0.02-inch slotted screen. Wells DPE-1 and DPE-2 were installed to a total depth of 30 feet bgs, with 5 feet of 4-inch-diameter solid casing from 25 to 30 feet bgs to act as a sump, followed by 20 feet of 4-inch-diameter, 0.02-inch slotted screen from 25 to 5 feet bgs and 4-inch-diameter solid casing to surface. Wells DPE-3 and PZ-3, both 4-inch-diameter wells, were installed to a total depth of 22 feet bgs with a 4-foot sump from 22 to 18 feet bgs, followed by 14 feet of 0.02-inch slotted screen from 18 to 4 feet bgs and solid casing from 4 feet bgs to the surface. Well PZ-3 was installed as a dual-purpose well with the potential to be converted to a DPE well. Well construction details are provided in Table 1a and boring logs are included as Attachment A. Tables 1b and 1c presents the general setup of the pilot test, including the well pumped and the wells monitored, during the first mobilization and the second mobilization respectively.

Pilot Test Implementation

DPE pilot test equipment included a mobile DPE trailer with a rotary claw blower and a portable compressor connected to a downhole submersible pump.

An above grade hose was used to connect the vapor extraction portion of the DPE trailer to a manifold and then to the DPE well through a wellhead adaptor. The DPE trailer housed the rotary claw blower, an air/water separator tank, and the flow and vacuum gauges. The DPE blower effluent was treated using a Falco 300 electric catalytic oxidizer before being discharged to the air. Prior to implementing the DPE pilot testing, ARCADIS verified with the Puget Sound Clean Air Agency, a Notice of Construction application and Order of Approval were not required for short-term pilot testing.

The groundwater extraction portion of the DPE pilot test system included a portable electric compressor that powered a downwell top-loading pneumatic pump (QED AP4 long). The pneumatic pump discharged groundwater through a flow meter, into aboveground piping, and then into an aboveground tank.

Following a review of DPE-1 pumping data, additional pilot testing was conducted at wells DPE-2 and DPE-3 using a downhole electric submersible pump (Grundfos SQE 15) to handle the higher flow rates observed during pilot testing on DPE-2 and DPE-3. The electric submersible pump was powered by an on-site generator and discharged to a double-walled groundwater storage tanks. The water in these tanks was then analyzed and compared to the applicable constituents of concerns (COCs). Based on these results, the stored groundwater was either discharged to detention basin 2 (DB-2) or properly disposed of by Emerald Services. Analytical results are show in Table 2.

Pilot Test Results

Pilot test data were collected from the mobile remediation system gauges, extraction well gauges, and surrounding monitoring wells. System and pumping well data included groundwater pumping rate, system and wellhead vacuum, extraction well depth to water, vapor flow rates, vapor temperature, and vapor concentrations. Monitoring well data included depth to water, induced vacuum, and monitoring well volatile organic compound (VOC) headspace concentrations.

Monitoring well data collected during the DPE-1 and DPE-2 pilot tests are summarized in Table 3; monitoring well data collected during the DPE-3 pilot test are summarized in Table 4. Extraction well and system data collected from DPE-1 and DPE-2 are summarized in Table 5; extraction well and system data collected during the DPE-3 pilot test are summarized in Table 6.

Induced vacuum radius of influence (ROI) and distance versus groundwater drawdown graphs for each pilot test are included in Attachment B. To calculate the induced vacuum ROI, the normalized vacuum (vacuum observed at the monitoring wells, divided by the vacuum applied to the extraction well) was plotted on an arithmetic scale (y-axis) and radial distance from the extraction well on a logarithmic scale (x-axis) for all observation points. This distance (on the x-axis) represents the observed vacuum ROI equal to 1 percent of the applied vacuum using the spatially averaged vacuum data. The ROI based on 1 percent of normalized vacuum is the Chevron standard used to conservatively account for site heterogeneities as described in the 2010 Soil Vapor Extraction Guidance Document (Chevron 2010).

VOC concentrations were collected from wellheads, the vapor extraction manifold, and the pre- and post-treatment effluent stack using a handheld VOC meter. VOC concentration and vapor flow rates from the extraction manifold were used to calculate an estimated hourly mass removal rate. Pilot test results are presented in Tables 3 through 6.

DPE-1 Pilot Test Results

A downhole pneumatic pump was used in DPE-1 pilot test, along with the mobile DPE trailer, to extract both groundwater and vapor. Pilot test data were collected approximately every hour for the first 20 hours of the pilot test and every 2 hours thereafter, for a total operational time of approximately 40 hours. Wells DPE-2, PZ-1, PZ-2, AS-1, MW-525, MW-531, and MW-532 were monitored for depth to water, headspace VOC concentrations, and induced vacuum. DPE-1 pilot test data is provided in Tables 3 and 5.

DPE-1 pilot test data are summarized below:

- Groundwater pumping rates ranged from 0.65 to 1.05 gpm.
- Extraction well casing vacuum ranged from 271 to approximately 300 inches of water.
- Extraction well groundwater drawdown ranged from approximately 14.5 to 18.77 feet below static groundwater elevation.
- Vapor flow rates ranged from 36.58 to 128.16 standard cubic feet per minute (scfm) during the test.

- Mass removal estimates increased throughout the test, starting at approximately 0.7 pound per day (lb/day) to a high of 28 lbs/day (17 hours into the test), with an estimated 16.5 lbs/day at the end of DPE-1 pilot test.

- The induced vacuum influence observed was greater than 1 percent of normalized vacuum at a horizontal distance of 23 feet (MW-525) from the extraction well.

- Minimal drawdown was observed in wells surrounding the extraction well during the DPE-1 pilot test, with approximately 0.53 foot of drawdown observed at PZ-1, which is located approximately 7 feet from the extraction well.

The DPE-1 pilot test results show that elevated mass removal rates and reasonable vacuum ROI can be achieved; however, pumping rates and drawdown were lower than expected. Heaving sands were noted during installation of DPE-1 and may have compromised the well screen, resulting in the observed lower yield and drawdown. Based on these results, the project team performed a second pilot test using well DPE-2.

DPE-2 Pilot Test Results

The project team began the DPE-2 pilot test using the downhole pneumatic pump; however, the pneumatic pump could not sustain the desired drawdown under vacuum while pumping at approximately 5.5 to 6 gpm. After approximately 1.5 hours of pumping, the pneumatic pump was exchanged for an electric submersible pump. Pilot test data were collected approximately every hour for the first 16 hours and then every 2 hours thereafter, for a total operational time of approximately 44 hours. Wells DPE-1, PZ-1, PZ-2, AS-1, MW-525, MW-531, and MW-532 were monitored for depth to water, headspace VOC concentrations, and induced vacuum. DPE-2 pilot test data is provided in Tables 3 and 5. Additionally, a cross-section showing the drawdown at 80 hours after the beginning of the pilot test (after 34 hours of pumping at DPE-2) is presented on Figure 4. The location of the cross-section is showed on Figure 3.

DPE-2 pilot test data are summarized below:

- Groundwater pumping rates ranged from approximately 7 to 9 gpm.

- Extraction well casing vacuum ranged from approximately 183 to 268 inches of water.
- Extraction well groundwater drawdown ranged from approximately 12.5 to 16.2 feet below static water elevation.
- Vapor flow rates ranged from 38 to 117 scfm, averaging approximately 78 scfm during the test.
- Mass removal estimates increased from approximately 0.9 lb/day to 12.7 lbs/day approximately 14 hours into the test. Mass removal rates then decreased to 3.7 lbs/day at the end of the test.
- The induced vacuum influence observed was greater than 1 percent of normalized vacuum at a horizontal distance of 38 feet (MW-525) from the extraction well.
- Drawdown of approximately 1.4 feet was observed in monitoring well PZ-2, approximately 23 feet horizontally from extraction well DPE-2; drawdown of approximately 1 foot was observed in DPE-1, 30 feet horizontally from extraction well DPE-3.
- After 34 hours of pumping activities at extraction well DPE-2, groundwater elevations were drawn down to a level that would allow access to all know soil impacts above site cleanup levels (CULs) in the impacted area. Cross-Section A-A' showing draw down in extraction well DPE-2 is presented on Figure 4.

The DPE-2 pilot test results show that mass removal rates, reasonable vacuum ROI, and the target groundwater drawdown depth can be achieved. Groundwater yield was similar to expected conditions, with an average pumping rate of 7.5 gpm while under vacuum. Additional pumping wells should adequately dewater the target smear zone.

Based on the variation between pumping rates in wells DPE-1 and DPE-2, the project team performed an additional pilot test on well DPE-3. Well DPE-3 was installed to target groundwater extraction within the finer grained 1929 fill surrounding the WSDOT stormwater line, which was observed from approximately 4 to 22 feet bgs. Pilot test results from DPE-3 are discussed below.

DPE-3 Pilot Test Results

The DPE-3 pilot test was performed using an electric submersible pump. Pilot test data were collected approximately every hour for the first 10 hours, then every 2 hours for the next 20 hours and every hour thereafter. The total operational time of the DPE-3 pilot test was approximately 34 hours. Wells DPE-1, DPE-2, PZ-1, PZ-2, PZ-3, AS-1, MW-525, MW-531, and MW-532 were monitored for depth to water, headspace VOC concentrations, and induced vacuum. DPE-3 pilot test data is provided in Tables 4 and 6.

DPE-3 pilot test data are summarized below:

- Groundwater pumping rates ranged from approximately 8.7 to 13.3 gpm.
- Extraction well casing vacuum ranged from approximately 129 to 163 inches of water.
- Extraction well groundwater drawdown ranged from approximately 3.5 to 12.5 feet below static groundwater elevation.
- Vapor flow rates ranged from 95 to 112 scfm, averaging approximately 78 scfm during the test.
- Mass removal estimates increased from approximately 1.1 to 5 lbs/day at the end of the test.
- The induced vacuum influence observed was greater than 1 percent of normalized vacuum at a horizontal distance of 10 feet (PZ-3) from the extraction well.
- Drawdown of approximately 3.6 feet was observed in monitoring well PZ-3, approximately 10 feet horizontally from extraction well DPE-2; drawdown of approximately 2.2 feet was observed in DPE-1, 29 feet horizontally from extraction well DPE-3.

The DPE-3 pilot test results show that mass removal rates, reasonable vacuum ROI, and the target drawdown depth can be achieved. Induced vacuum greater than 1 percent of normalized vacuum was observed at approximately 10 feet horizontally from the extraction well. This induced vacuum ROI was lower than expected compared to results observed during DPE-1 and DPE-2 pilot testing.

Groundwater yield was greater than the rate observed during DPE-2 pilot testing, with an average pumping rate of 9.8 gpm while under vacuum. The greatest extent of groundwater drawdown was observed during the DPE-3 pilot test, with 3.6 feet of drawdown below static groundwater observed 10 feet horizontally from the extraction well.

Summary

The DPE pilot test was performed to aid in the full-scale design of the DPE system proposed in the IAWP (ARCADIS 2015). The full-scale design will focus remediation on the remaining COCs in shallow soil that exceed the Model Toxics Control Act Method B CULs near the WSDOT stormwater line. Pilot test results indicate that groundwater drawdown to below target soil is feasible. Pilot test data indicate that wells installed within the 1929 fill, similar to DPE-2 and DPE-3 construction, can create a drawdown of greater than 2.2 feet at a distance of 30 feet horizontally from the pumping wells after approximately 34 hours of pumping.

Average vapor mass VOC removal rates using PID readings and system air flow ranged from 3.1 lbs/day during DPE-3 pilot testing to 13.8 lbs/day observed during DPE-1 pilot testing, indicating that mass can be removed through DPE implementation.

Based on pilot test data, extraction wells will be installed on a maximum of 50 foot centers targeting a design ROI of 30 feet. Wells will be spaced closer in areas of highest soil impacts. Remediation wells will be installed to approximately 19 feet with 15 feet of screen allowing for pump intakes to be adjusted to target shallow soil impacts. The treatment system will be designed to operate at a pumping rate of 3 gpm on all remediation wells, with a target pumping rate of up to 13 gpm on wells with vacuum enhanced dewatering. Due to the high air flow rates observed ranging from 36 to 128 scfm, vacuum enhance dewatering will be applied to a subset of 4 to 6 wells. Focusing vacuum enhanced dewatering on a subset of wells will increase the overall operational efficiency of the proposed remediation system and improve maintenance and optimization downtime. A full-scale remediation system design and operation and maintenance plan will be submitted to Ecology prior to system construction.

If you have any questions regarding the information presented in this DPE Summary, please contact Scott Zorn at 206.713.8292.

Sincerely,

Peter Campbell
Senior Engineer

Scott Zorn
Project Manager

Copies:
Kim Jolitz, Chevron

Tables

Table 1a	Well Construction Details
Table 1b	Pilot Test DPE-1 and DPE-2 Setup
Table 1c	Pilot Test DPE-3 Setup
Table 2	Groundwater Storage Tank Analytical Results
Table 3	Monitoring Well Network Data – Pilot Test DPE-1 and DPE-2
Table 4	Monitoring Well Network Data – Pilot Test DPE-3
Table 5	System and Extraction Well Data – Pilot Test DPE-1 and DPE-2
Table 6	System and Extraction Well Data – Pilot Test DPE-3

Figures

Figure 1	Site Location Map
Figure 2	Site Map
Figure 3	Pilot Test Layout
Figure 4	DPE Cross Section A-A’

Attachments

Attachment A	Boring Logs
Attachment B	Pilot Test Data

References

ARCADIS. 2015. Public Review Draft Interim Action Work Plan, Former Unocal Edmonds Bulk Fuel Terminal. July 6.

Chevron. 2010. Chevron 2010 Sol Vapor Extraction Guidance Document. August 2010.

Ecology. 2007. Agreed Order No. DE 4460, between Ecology and the Union Oil Company of California. June 25.

White, M.D., M. Oostom, and R.J. Lenhard. 2004. A Practical Model for Mobile, Residual and Entrapped LNAPL in Water-Wet Porous Media. *Ground Water*. Vol. 42 No. 5 pp 734-746.

ARCADIS

Tables

TABLE 1a
Well Construction Details
Chevron Environmental Management Company
Pilot Test Summary Memorandum
Former Unocal Edmonds Bulk Fuel Terminal
Edmonds, Washington

Well Name	**Completion Date**	**Well Diameter (inches)**	**Total Depth of Boring (feet)**	**Total Depth of Well (feet)**	**Riser Length - *well box to screen* (feet)**	**Screen Length - *riser to sump* (feet)**	**Sump Lenth - *screen to bottom* (feet)**
DPE-1	2/10/2015	4	30	30	5	20	5
DPE-2	2/11/2015	4	30	30	5	20	5
DPE-3	3/24/2015	4	22	22	5	13	4
PZ-1	2/11/2015	2	25	25	5	20	NA
PZ-2	2/10/2015	2	25	25	5	20	NA
PZ-3	3/23/2015	4	22	22	5	13	4

Notes:
NA = not applicable

TABLE 1b
Pilot Test DPE-1 and DPE-2 Setup
Chevron Environmental Management Company
Pilot Test Summary Memorandum
Former Unocal Edmonds Bulk Fuel Terminal
Edmonds, Washington

	Baseline Data			
	Well ID	Date	DTW (ft BTOC)	DTB (ft BTOC)
Pumped wells / monitoring wells	DPE-1	02.16.15	6.19	28.80
	DPE-2	02.16.15	5.8	29.35
Monitoring wells	PZ-1	02.16.15	6.31	25.01
	PZ-2	02.16.15	6.04	23.89
	AS-1	02.16.15	6.2	18.32
	MW-525	02.16.15	5.6	12.45
	MW-531	02.16.15	7.07	12.84
	MW-532	02.16.15	6.25	12.55
Witness wells (tide)	MW-20R	02.16.15	6.01	14.23
	MW-512	02.16.15	5.76	12.73
	MW-514	02.16.15	3.96	12.60
	MW-518	02.16.15	7.8	13.36
	MW-526	02.16.15	4.35	13.03
	MW-20R	02.21.15	6.22	14.23
	MW-512	02.21.15	5.99	12.73
	MW-514	02.21.15	4.21	12.60
	MW-518	02.21.15	7.96	13.36
	MW-526	02.21.15	4.55	13.03

	DPE-1 Pumping test				
	Well ID	Distance from pumped well (ft)	DTW- beginning of test[1] (ft BTOC)	DTW- end of test[1] (ft BTOC)	Maximum Drawdown (ft BTOC)
Pumped well	DPE-1	0	20.76	24.94	18.77
Monitoring wells	DPE-2	30	5.85	5.95	0.23
	PZ-1	7	6.54	6.59	0.53
	PZ-2	15	6.2	6.30	0.59
	AS-1	5	6.61	6.61	0.64
	MW-525	23	5.63	5.58	0.45
	MW-531	40	7.03	7.17	0.25
	MW-532	23	6.53	6.54	0.44

	DPE-2 Pumping test				
	Well ID	Distance from pumped well (ft)	DTW- beginning of test[2] (ft BTOC)	DTW- end of test[2] (ft BTOC)	Maximum Drawdown (ft BTOC)
Pumped well	DPE-2	0	11	18.90	16.2
Monitoring wells	DPE-1	30	6.72	7.10	1.21
	PZ-1	45	6.62	6.94	0.78
	PZ-2	23	6.73	7.36	1.49
	AS-1	35	6.61	7.02	1
	MW-525	38	5.82	6.30	0.9
	MW-531	68	7.23	7.32	0.35
	MW-532	10	6.52	7.21	1.3

Note:
hh:mm = hour:minute DTW = depth to water BTOC = below top of casing
min = minute ft = feet DTB = depth to bottom
[1] = DPE-1 Pumping test was implemented from 2.17.15 16:30 to 2.19.15 8:30
[2] = DPE-2 Pumping test was implemented from 2.19.15 14:00 to 2.21.15 10:00

TABLE 1c
Pilot Test DPE-3 Setup
Chevron Environmental Management Company
Pilot Test Summary Memorandum
Former Unocal Edmonds Bulk Fuel Terminal
Edmonds, Washington

	Baseline Data			
	Well ID	Date	DTW (ft BTOC)	DTB (ft BTOC)
Pumped well	DPE-3	03.30.15	4.63	25.01
Monitoring wells	DPE-1	03.30.15	6.26	28.80
	DPE-2	03.30.15	5.92	29.35
	PZ-1	03.30.15	6.41	23.89
	PZ-2	03.30.15	6.2	18.32
	PZ-3	03.30.15	5.54	18.32
	AS-1	03.30.15	6.35	25.00
	MW-525	03.30.15	5.73	12.45
	MW-531	03.30.15	7.18	12.84
	MW-532	03.30.15	6.38	12.84

	DPE-3 Pumping test				
	Well ID	Distance from pumped well (ft)	DTW- beginning of test[1] (ft BTOC)	DTW- end of test[1] (ft BTOC)	Maximum Drawdown (ft BTOC)
Pumped well	DPE-3	0	16.04	16.50	12.47
Monitoring wells	DPE-1	29	8.17	8.40	2.73
	DPE-2	48	6.54	6.75	0.9
	PZ-1	31.5	7.80	8.09	1.89
	PZ-2	31	7.39	7.95	1.8
	PZ-3	10	9.02	9.02	3.82
	AS-1	25	7.84	8.21	2.02
	MW-525	5	10.13	9.56	4.49
	MW-531	57	7.23	7.31	0.22
	MW-532	40	6.95	7.65	1.32

Note:

hh:mm = hour:minute
DTW = depth to water
BTOC = below top of casing
min = minute
ft = feet
DTB = depth to bottom

[1] = DPE-3 Pumping test was implemented from 3.30.15 10:30 to 3.31.15 20:00

TABLE 2
Groundwater Storage Tank Analytical Results
Chevron Environmental Management Company
Pilot Test Summary Memorandum
Former Unocal Edmonds Bulk Fuel Terminal
Edmonds, Washington

Sample ID	Date	Time	Gasoline Range Organics by NWTPH-Gx C7 - C12 (µg/L)	Benzene by 8021B (µg/L)	Diesel Range Organics by NWTPH-Dx (µg/L)	Heavy Range Organics by NWTPH-Dx (µg/L)	Zinc by EPA 200.7 (µg/L)	Copper by EPA 200.8 (µg/L)	Lead by EPA 200.8 (µg/L)	Turbidity by EPA 180.1 (NTU)	Total Alkalinity by SM 2320 (µg/L as CaC03)	Total Hardness by SM 2340 (µg/L as CaC03)	pH	Total cPAHs Adjusted for Toxicity (µg/L)	Comments
			GC Volatiles		GC Petroleum		Metals			Wet Chemistry					
B-TANK-1	2/20/2015	14:30	<50	<0.2	<29	<67	4.3	3.4	0.72	22.2	118,000	90,300	6.78	<0.0151	
BAKER-DPE-3-PILOT2	3/30/2015	14:30	830	170	110	<68	7.1	2.3	0.47	48.4	201,000	194,000	NA	<0.0151	Observed LNAPL on surface of water

Notes:
< = The compound was analyzed for but not detected. The associated value is the compound method detection limit.
cPAHs = Carcinogenic Polynuclear Aromatic Hydrocarbons, by EPA Method 8270C-HVI. cPAHs adjusted for toxicity according to WAC 173-340-708(8) and Air Toxics Hot Spots Program Risk Assessment
(µg/L) = micrograms per liter.
EPA = Environmental Protection Agency.
NWTPH = Northwest Total Petroleum Hydrocarbons
LNAPL = Light non-aqueous phase liquid.
NTU = nephelometric turbidity units
NA = Not Analyzed.

TABLE 3
Monitoring Well Network Data – Pilot Test DPE-1 DPE-2
Chevron Environmental Management Company
Pilot Test Summary Memorandum
Former Unocal Edmonds Bulk Fuel Terminal
Edmonds, Washington

Well ID	Date	Time (hh:mm)	Elapsed Time (hr)	Distance from pumped well (ft)	Headspace VOCs (ppmv)	Vacuum ("H2O)	DTW (ft BTOC)	DTB (ft BTOC)	Static DTW (ft BTOC)	Drawdown (ft BTOC)	Note
DPE-1	02.16.15	10:10	--	--	306.7	--	6.19	28.8	6.19	--	
	02.17.15	16:29	0.00	0	509.0	271.8	20.76	28.8	6.19	14.57	Beginning of DPE-1 test
		17:30	1.02		390.0	271.8	20.72	28.8	6.19	14.53	
		18:30	2.02			271.8	20.75	28.8	6.19	14.56	
		19:30	3.02		352.5	278.6	20.78	28.8	6.19	14.59	
		21:00	4.52		377.3	285.4	20.77	28.8	6.19	14.58	
		21:45	5.27		376.4	278.6	20.75	28.8	6.19	14.56	
		22:30	6.02		349.7	278.6	20.80	28.8	6.19	14.61	
		23:30	7.02		631.0	278.6	20.75	28.8	6.19	14.56	
	02.18.15	0:30	8.02		422.9	278.6	20.80	28.8	6.19	14.61	
		1:30	9.02		381.3	275.9	20.77	28.8	6.19	14.58	
		2:30	10.02		682.6	278.6	20.76	28.8	6.19	14.57	
		3:30	11.02		621.4	278.6	20.80	28.8	6.19	14.61	
		4:30	12.02		681.5	278.6	20.78	28.8	6.19	14.59	
		5:30	13.02		704.1	278.6	20.80	28.8	6.19	14.61	
		6:30	14.02		355.2	278.6	20.78	28.8	6.19	14.59	
		7:35	15.10		346.7	278.6	20.75	28.8	6.19	14.56	
		8:30	16.02		426.1	339.8	20.77	28.8	6.19	14.58	
		10:30	18.02		465.0	278.6	20.72	28.8	6.19	14.53	
		12:30	20.02		418.0	292.2	24.93	28.8	6.19	18.74	Lowered pump
		14:30	22.02		405	285.4	24.95	28.8	6.19	18.76	
		16:30	24.02		384	299.0	24.96	28.8	6.19	18.77	
		18:30	26.02		424	299.0	24.95	28.8	6.19	18.76	
		20:30	28.02		426.4	292.2	24.93	28.8	6.19	18.74	
		22:30	30.02		473.5	292.2	24.78	28.8	6.19	18.59	
	02.19.15	0:30	32.02		416.7	299.0	24.81	28.8	6.19	18.62	
		2:30	34.02		459.1	299.0	24.80	28.8	6.19	18.61	
		4:30	36.02		476.2	292.2	24.88	28.8	6.19	18.69	
		6:30	38.02		483.6	292.2	24.85	28.8	6.19	18.66	
		8:30	40.02		384	292.2	24.94	28.8	6.19	18.75	End of DPE-1 test
	02.19.15	14:01	45.53	30	1.50	1.1	6.72	28.8	6.19	0.53	Beginning of DPE-2 test
		15:34	47.08		0.00	1.0	6.69	28.8	6.19	0.5	
		17:27	48.97		0.00	1.2	6.60	28.8	6.19	0.41	
		19:14	50.75		0.00	2.1	7.03	28.8	6.19	0.84	Use of Grundfoss
		20:18	51.82		0.10	1.7	7.17	28.8	6.19	0.98	
		21:26	52.95		0.00	1.8	7.25	28.8	6.19	1.06	
		22:25	53.93		0.10	2.1	7.28	28.8	6.19	1.09	
		23:33	55.07		0.00	2.1	7.30	28.8	6.19	1.11	
	02.20.15	0:37	56.13		0.00	1.5	7.33	28.8	6.19	1.14	
		1:39	57.17		0.00	1.8	7.31	28.8	6.19	1.12	
		2:35	58.10		0.00	1.7	7.30	28.8	6.19	1.11	
		3:23	58.90		0.00	1.9	7.29	28.8	6.19	1.1	
		4:34	60.08		0.00	2.0	7.25	28.8	6.19	1.06	
		5:48	61.32		0.00	1.9	7.23	28.8	6.19	1.04	
		6:31	62.03		0.10	1.6	7.23	28.8	6.19	1.04	

TABLE 3
Monitoring Well Network Data – Pilot Test DPE-1 DPE-2
Chevron Environmental Management Company
Pilot Test Summary Memorandum
Former Unocal Edmonds Bulk Fuel Terminal
Edmonds, Washington

Well ID	Date	Time (hh:mm)	Elapsed Time (hr)	Distance from pumped well (ft)	Headspace VOCs (ppmv)	Vacuum ("H2O)	DTW (ft BTOC)	DTB (ft BTOC)	Static DTW (ft BTOC)	Drawdown (ft BTOC)	Note
DPE-1	02.20.15	7:32	63.05	30	0.00	3.7	7.35	28.8	6.19	1.16	
		8:04	63.58		0.00	1.4	7.11	28.8	6.19	0.92	
		9:15	64.77		0.00	1.4	7.10	28.8	6.19	0.91	
		10:35	66.10		0.00	0.9	7.21	28.8	6.19	1.02	
		12:06	67.62		0.00	1.4	7.20	28.8	6.19	1.01	
		14:11	69.70		0.00	1.4	7.22	28.8	6.19	1.03	
		16:10	71.68		0.00	1.2	7.27	28.8	6.19	1.08	
		17:56	73.45		0.00	1.0	7.18	28.8	6.19	0.99	
		20:05	75.60		0.00	1.8	7.25	28.8	6.19	1.06	
		22:05	77.60		0.00	0.8	7.28	28.8	6.19	1.09	
		23:53	79.40		0.10	0.7	7.20	28.8	6.19	1.01	
	02.21.15	1:54	81.42		0.10	1.0	7.31	28.8	6.19	1.12	
		4:03	83.57		0.30	1.5	7.40	28.8	6.19	1.21	
		6:14	85.75		0.10	1.4	7.20	28.8	6.19	1.01	
		8:05	87.60		0.00	1.0	7.22	28.8	6.19	1.03	
		10:06	89.62		0.00	1.0	7.10	28.8	6.19	0.91	
DPE-2	02.16.15	10:10	--	--	30.0	--	5.80	29.35	5.80	--	Time recorded is approximate
	02.17.15	16:22	0	30	0.0	1.8	5.85	29.35	5.80	0.05	Beginning of DPE-1 test
		17:26	1.07		0.0	1.8	5.85	29.35	5.80	0.05	
		18:37	2.25		0.2	1.5	5.90	29.35	5.80	0.10	
		19:28	3.10		0.2	1.7	5.93	29.35	5.80	0.13	
		20:31	4.15		0.1	1.4	5.95	29.35	5.80	0.15	
		21:38	5.27		0.1	1.5	5.95	29.35	5.80	0.15	
		22:25	6.05		0.2	1.4	5.99	29.35	5.80	0.19	
		23:31	7.15		0.1	1.4	6.00	29.35	5.80	0.20	
	02.18.15	0:36	8.23		0.1	1.5	5.96	29.35	5.80	0.16	
		1:22	9.00		0.1	1.4	5.99	29.35	5.80	0.19	
		2:15	9.88		0.2	1.2	5.95	29.35	5.80	0.15	
		3:41	11.32		0.1	1.4	5.93	29.35	5.80	0.13	
		4:15	11.88		0.1	1.0	5.97	29.35	5.80	0.17	
		5:12	12.83		0.1	1.5	5.90	29.35	5.80	0.10	
		6:24	14.03		0.0	1.2	5.90	29.35	5.80	0.10	
		7:22	15.00		0.2	1.1	5.92	29.35	5.80	0.12	
		8:38	16.27		0.1	1.4	5.94	29.35	5.80	0.14	
		10:25	18.05		0.3	1.0	5.97	29.35	5.80	0.17	
		12:36	20.23		0.1	1.7	5.93	29.35	5.80	0.13	
		14:45	22.38		0.1	2.0	5.90	29.35	5.80	0.10	
		16:34	24.20		0.0	1.6	5.90	29.35	5.80	0.10	
		18:23	26.02		0.2	1.5	5.90	29.35	5.80	0.10	
		20:23	28.02		0.0	1.5	6.00	29.35	5.80	0.20	
		22:28	30.10		0.0	1.4	6.00	29.35	5.80	0.20	
	02.19.15	0:41	32.32		0.0	1.4	6.03	29.35	5.80	0.23	
		2:40	34.30		0.0	1.4	6.00	29.35	5.80	0.20	
		4:23	36.02		0.1	1.4	6.03	29.35	5.80	0.23	
		6:22	38.00		0.0	1.2	5.98	29.35	5.80	0.18	
		8:49	40.45		0.0	1.4	5.95	29.35	5.80	0.15	End of DPE-1 test

TABLE 3
Monitoring Well Network Data – Pilot Test DPE-1 DPE-2
Chevron Environmental Management Company
Pilot Test Summary Memorandum
Former Unocal Edmonds Bulk Fuel Terminal
Edmonds, Washington

Well ID	Date	Time (hh:mm)	Elapsed Time (hr)	Distance from pumped well (ft)	Headspace VOCs (ppmv)	Vacuum ("H2O)	DTW (ft BTOC)	DTB (ft BTOC)	Static DTW (ft BTOC)	Drawdown (ft BTOC)	Note
DPE-2	02.19.15	14:00	45.63	0	70.0	81.5	11.00	29.35	5.80	5.20	Beginning of test in DPE-2, VOCs reading was post-dilution
		15:30	47.13		90.1	81.5	11.20	29.35	5.80	5.40	VOCs reading was post-dilution
		17:20	48.97		--	--	10.55	29.35	5.80	4.75	
		19:30	51.13		74.9	183.5	18.85	29.35	5.80	13.05	Use Grundfoss, VOCs reading was post-dilution
		20:30	52.13		399.4	183.5	18.75	29.35	5.80	12.95	
		21:30	53.13		426.8	197.1	18.60	29.35	5.80	12.80	
		22:30	54.13		380.7	190.3	18.40	29.35	5.80	12.60	
		23:30	55.13		--	190.3	18.40	29.35	5.80	12.60	
	02.20.15	0:30	56.13		356.0	190.3	18.40	29.35	5.80	12.60	
		1:30	57.13		371.8	190.3	18.80	29.35	5.80	13.00	
		2:30	58.13		490.1	190.3	18.80	29.35	5.80	13.00	
		3:30	59.13		--	190.3	18.30	29.35	5.80	12.50	
		4:30	60.13		411.9	190.3	18.50	29.35	5.80	12.70	
		5:30	61.13		426.5	190.3	18.40	29.35	5.80	12.60	
		6:30	62.13		426.8	190.3	18.55	29.35	5.80	12.75	
		7:30	63.13		--	190.3	18.35	29.35	5.80	12.55	
		8:00	63.63		--	190.3	19.25	29.35	5.80	13.45	
		9:00	64.63		390.0	190.3	19.63	29.35	5.80	13.83	
		10:00	65.63		--	203.9	19.35	29.35	5.80	13.55	
		12:00	67.63		359.0	190.3	21.45	29.35	5.80	15.65	
		14:00	69.63		370.0	197.1	21.92	29.35	5.80	16.12	
		16:00	71.63		245.0	244.6	19.00	29.35	5.80	13.20	
		18:00	73.63		316.0	244.6	20.93	29.35	5.80	15.13	
		20:00	75.63		310.0	255.5	22.00	29.35	5.80	16.20	
		22:00	77.63		296.0	247.3	22.00	29.35	5.80	16.20	
	02.21.15	0:00	79.63		156.0	222.9	22.00	29.35	5.80	16.20	
		2:00	81.63		396.0	244.6	22.00	29.35	5.80	16.20	
		4:00	83.63		313.0	244.6	22.00	29.35	5.80	16.20	
		6:00	85.63		374.3	271.8	17.72	29.35	5.80	11.92	
		8:00	87.63		175.5	265.0	19.18	29.35	5.80	13.38	
		10:00	89.63		216.7	268.4	18.90	29.35	5.80	13.10	End of DPE-2 test
PZ-1	02.16.15	10:10	--	--	223.1	--	6.31	25.01	6.31	--	Time recorded is approximate
	02.17.15	16:31	0	7	6.6	0.0	6.54	25.01	6.31	0.23	Beginning of DPE-1 test
		17:31	1.00		3.6	0.0	6.53	25.01	6.31	0.22	
		18:43	2.20		3.2	0.0	6.57	25.01	6.31	0.26	
		19:33	3.03		2.5	0.0	6.63	25.01	6.31	0.32	
		20:44	4.22		2.6	0.0	6.70	25.01	6.31	0.39	
		21:35	5.07		1.9	0.0	6.76	25.01	6.31	0.45	
		22:29	5.97		1.9	0.3	6.80	25.01	6.31	0.49	
		23:37	7.10		4.2	0.0	6.82	25.01	6.31	0.51	
	02.18.15	0:47	8.27		1.6	0.0	6.84	25.01	6.31	0.53	
		1:34	9.05		1.3	0.0	6.80	25.01	6.31	0.49	
		2:26	9.92		0.8	0.0	6.80	25.01	6.31	0.49	
		3:48	11.28		4.5	2.4	6.70	25.01	6.31	0.39	
		4:21	11.83		3.5	2.0	6.60	25.01	6.31	0.29	

TABLE 3
Monitoring Well Network Data – Pilot Test DPE-1 DPE-2
Chevron Environmental Management Company
Pilot Test Summary Memorandum
Former Unocal Edmonds Bulk Fuel Terminal
Edmonds, Washington

Well ID	Date	Time (hh:mm)	Elapsed Time (hr)	Distance from pumped well (ft)	Headspace VOCs (ppmv)	Vacuum ("H2O)	DTW (ft BTOC)	DTB (ft BTOC)	Static DTW (ft BTOC)	Drawdown (ft BTOC)	Note
PZ-1	02.18.15	5:51	13.33	7	6.0	1.8	6.62	25.01	6.31	0.31	
		6:37	14.10		2.0	1.2	6.53	25.01	6.31	0.22	
		7:27	14.93		0.6	1.4	6.59	25.01	6.31	0.28	
		8:44	16.22		3.0	2.0	6.61	25.01	6.31	0.30	
		10:32	18.02		4.9	1.4	6.66	25.01	6.31	0.35	
		12:43	20.20		10.4	2.8	6.63	25.01	6.31	0.32	
		14:52	22.35		18.5	3.0	6.53	25.01	6.31	0.22	
		16:42	24.18		12.1	2.4	6.51	25.01	6.31	0.20	
		18:31	26.00		7.2	2.3	6.52	25.01	6.31	0.21	
		20:27	27.93		9.5	2.5	6.56	25.01	6.31	0.25	
		22:35	30.07		9.7	2.4	6.72	25.01	6.31	0.41	
	02.19.15	0:46	32.25		0.7	0.8	6.82	25.01	6.31	0.51	
		2:49	34.30		0.4	1.4	6.82	25.01	6.31	0.51	
		4:27	35.93		0.3	1.0	6.72	25.01	6.31	0.41	
		6:29	37.97		4.6	2.4	6.54	25.01	6.31	0.23	
		8:59	40.47		0.6	1.5	6.59	25.01	6.31	0.28	End of DPE-1 test
	02.19.15	14:03	45.53	45	7.8	0.7	6.62	25.01	6.31	0.31	Beginning of DPE-2 test
		15:39	47.13		0.8	0.6	6.62	25.01	6.31	0.31	
		17:30	48.98		0.7	0.5	6.55	25.01	6.31	0.24	
		19:15	50.73		0.5	0.9	6.72	25.01	6.31	0.41	Use of Grundfoss
		20:20	51.82		0.1	0.7	6.79	25.01	6.31	0.48	
		21:31	53.00		0.1	0.7	6.92	25.01	6.31	0.61	
		22:27	53.93		1.0	0.7	6.93	25.01	6.31	0.62	
		23:36	55.08		1.8	0.7	6.98	25.01	6.31	0.67	
	02.20.15	0:38	56.12		4.3	0.9	7.03	25.01	6.31	0.72	
		1:42	57.18		4.3	0.8	7.05	25.01	6.31	0.74	
		2:40	58.15		6.3	0.6	7.02	25.01	6.31	0.71	
		3:26	58.92		0.6	0.7	7.01	25.01	6.31	0.70	
		4:40	60.15		4.8	0.6	7.00	25.01	6.31	0.69	
		5:50	61.32		3.7	0.6	6.95	25.01	6.31	0.64	
		6:34	62.05		6.8	0.7	6.87	25.01	6.31	0.56	
		7:35	63.07		2.0	0.5	6.85	25.01	6.31	0.54	
		8:08	63.62		1.7	0.8	6.83	25.01	6.31	0.52	
		9:17	64.77		1.1	0.7	6.83	25.01	6.31	0.52	
		10:37	66.10		0.4	0.6	6.87	25.01	6.31	0.56	
		12:10	67.65		2.1	1.0	6.95	25.01	6.31	0.64	
		14:15	69.73		0.7	1.0	6.96	25.01	6.31	0.65	
		16:10	71.65		1.1	0.0	6.95	25.01	6.31	0.64	
		17:58	73.45		0.6	0.1	6.90	25.01	6.31	0.59	
		19:51	75.33		2.3	0.9	6.86	25.01	6.31	0.55	
		22:04	77.55		4.2	0.7	6.95	25.01	6.31	0.64	
		23:56	79.42		0.8	0.3	6.95	25.01	6.31	0.64	
	02.21.15	1:56	81.42		4.4	0.7	7.09	25.01	6.31	0.78	
		4:07	83.60		2.9	0.7	7.03	25.01	6.31	0.72	
		6:15	85.73		1.6	0.7	6.92	25.01	6.31	0.61	
		8:10	87.65		1.3	0.9	6.93	25.01	6.31	0.62	
		10:10	89.65		0.1	0.0	6.94	25.01	6.31	0.63	End of DPE-2 test

TABLE 3
Monitoring Well Network Data – Pilot Test DPE-1 DPE-2
Chevron Environmental Management Company
Pilot Test Summary Memorandum
Former Unocal Edmonds Bulk Fuel Terminal
Edmonds, Washington

Well ID	Date	Time (hh:mm)	Elapsed Time (hr)	Distance from pumped well (ft)	Headspace VOCs (ppmv)	Vacuum ("H2O)	DTW (ft BTOC)	DTB (ft BTOC)	Static DTW (ft BTOC)	Drawdown (ft BTOC)	Note
PZ-2	02.16.15	10:10	--	--	101.6	--	6.04	23.89	6.04	--	Time recorded is approximate
	02.17.15	16:28	0	15	0.0	9.5	6.20	23.89	6.04	0.16	Beginning of DPE-1 test
		17:28	1.00		0.0	9.4	6.14	23.89	6.04	0.1	
		18:39	2.18		0.2	9.4	6.21	23.89	6.04	0.17	
		19:30	3.03		0.2	9.1	6.25	23.89	6.04	0.21	
		20:39	4.18		0.1	8.8	6.29	23.89	6.04	0.25	
		21:32	5.07		0.2	8.7	6.38	23.89	6.04	0.34	
		22:27	5.98		0.0	8.0	6.38	23.89	6.04	0.34	
		23:34	7.10		0.1	8.7	6.35	23.89	6.04	0.31	
	02.18.15	0:42	8.23		0.1	8.9	6.26	23.89	6.04	0.22	
		1:30	9.03		0.1	8.4	6.45	23.89	6.04	0.41	
		2:21	9.88		0.1	7.7	6.35	23.89	6.04	0.31	
		3:45	11.28		0.0	8.1	6.32	23.89	6.04	0.28	
		4:21	11.88		0.1	7.4	6.31	23.89	6.04	0.27	
		4:57	12.48		0.1	8.0	6.40	23.89	6.04	0.36	
		6:29	14.02		0.0	7.4	6.21	23.89	6.04	0.17	
		7:24	14.93		0.1	8.0	6.32	23.89	6.04	0.28	
		8:41	16.22		0.1	7.5	6.36	23.89	6.04	0.32	
		10:29	18.02		0.1	5.2	6.43	23.89	6.04	0.39	
		12:39	20.18		0.1	9.1	6.30	23.89	6.04	0.26	
		14:49	22.35		0.1	10.2	6.20	23.89	6.04	0.16	
		16:37	24.15		0.1	8.7	6.23	23.89	6.04	0.19	
		18:27	25.98		0.0	8.7	6.31	23.89	6.04	0.27	
		20:25	27.95		0.0	8.0	6.23	23.89	6.04	0.19	
		22:31	30.05		0.0	8.0	6.36	23.89	6.04	0.32	
	02.19.15	0:43	32.25		0.0	7.2	6.38	23.89	6.04	0.34	
		2:46	34.30		0.0	7.9	6.32	23.89	6.04	0.28	
		4:25	35.95		0.0	8.1	6.63	23.89	6.04	0.59	
		6:25	37.95		0.0	8.0	6.25	23.89	6.04	0.21	
		8:54	40.43		0.0	7.9	6.30	23.89	6.04	0.26	End of DPE-1 test
	02.19.15	13:58	45.50	23.00	0.0	3.7	6.73	23.89	6.04	0.69	Beginning of DPE-2 test
		15:31	47.05		0.0	3.7	6.80	23.89	6.04	0.76	
		17:25	48.95		0.0	3.5	6.65	23.89	6.04	0.61	
		19:13	50.75		0.0	6.0	7.15	23.89	6.04	1.11	Use of Grundfoss
		20:16	51.80		0.0	4.9	7.23	23.89	6.04	1.19	
		21:24	52.93		0.0	4.8	7.30	23.89	6.04	1.26	
		22:24	53.93		0.1	5.1	7.30	23.89	6.04	1.26	
		23:32	55.07		0.0	4.7	7.33	23.89	6.04	1.29	
	02.20.15	0:37	56.15		0.0	4.5	7.40	23.89	6.04	1.36	
		1:34	57.10		0.0	4.5	7.35	23.89	6.04	1.31	
		2:34	58.10		0.0	4.5	7.32	23.89	6.04	1.28	
		3:21	58.88		0.0	4.1	7.32	23.89	6.04	1.28	
		4:26	59.97		0.0	4.4	7.32	23.89	6.04	1.28	
		5:46	61.30		0.0	4.2	7.32	23.89	6.04	1.28	
		6:31	62.05		0.1	4.1	7.40	23.89	6.04	1.36	

TABLE 3
Monitoring Well Network Data – Pilot Test DPE-1 DPE-2
Chevron Environmental Management Company
Pilot Test Summary Memorandum
Former Unocal Edmonds Bulk Fuel Terminal
Edmonds, Washington

Well ID	Date	Time (hh:mm)	Elapsed Time (hr)	Distance from pumped well (ft)	Headspace VOCs (ppmv)	Vacuum ("H2O)	DTW (ft BTOC)	DTB (ft BTOC)	Static DTW (ft BTOC)	Drawdown (ft BTOC)	Note
PZ-2	02.20.15	7:33	63.08	23.00	0.3	1.4	7.19	23.89	6.04	1.15	
		8:03	63.58		0.0	4.0	7.25	23.89	6.04	1.21	
		9:15	64.78		0.0	3.8	7.22	23.89	6.04	1.18	
		10:34	66.10		0.0	4.1	7.36	23.89	6.04	1.32	
		12:04	67.60		0.0	4.4	7.35	23.89	6.04	1.31	
		14:10	69.70		0.0	4.1	7.22	23.89	6.04	1.18	
		16:09	71.68		0.0	4.7	7.47	23.89	6.04	1.43	
		17:57	73.48		0.0	4.1	7.36	23.89	6.04	1.32	
		19:50	75.37		0.0	4.7	7.40	23.89	6.04	1.36	
		22:06	77.63		0.0	3.9	7.43	23.89	6.04	1.39	
		23:51	79.38		0.0	2.7	7.29	23.89	6.04	1.25	
	02.21.15	1:54	81.43		0.0	4.0	7.53	23.89	6.04	1.49	
		4:02	83.57		0.0	4.1	7.32	23.89	6.04	1.28	
		6:12	85.73		0.0	3.1	7.34	23.89	6.04	1.3	
		8:05	87.62		0.0	4.2	7.34	23.89	6.04	1.3	
		10:05	89.62		0.0	3.8	7.36	23.89	6.04	1.32	End of DPE-2 test
AS-1	02.16.15	10:10	--	--	14.7	--	6.20	18.32	6.20	--	Time recorded is approximate
	02.17.15	16:30	0	5	1.2	0.0	6.61	18.32	6.20	0.41	Beginning of DPE-1 test
		17:30	1.00		1.1	0.0	6.59	18.32	6.20	0.39	
		18:42	2.20		1.2	0.0	6.62	18.32	6.20	0.42	
		19:32	3.03		1.4	0.0	6.66	18.32	6.20	0.46	
		20:42	4.20		1.0	0.0	6.72	18.32	6.20	0.52	
		21:34	5.07		1.1	0.0	6.75	18.32	6.20	0.55	
		22:28	5.97		0.7	0.0	6.80	18.32	6.20	0.6	
		23:35	7.08		1.2	0.0	6.84	18.32	6.20	0.64	
	02.18.15	0:45	8.25		1.4	0.5	6.83	18.32	6.20	0.63	
		1:32	9.03		1.0	0.0	6.80	18.32	6.20	0.6	
		2:24	9.90		1.1	0.0	6.80	18.32	6.20	0.6	
		3:46	11.27		1.5	0.1	6.80	18.32	6.20	0.6	
		4:25	11.92		1.9	0.0	6.60	18.32	6.20	0.4	
		5:54	13.40		2.5	0.2	6.70	18.32	6.20	0.5	
		6:33	14.05		2.0	0.0	6.67	18.32	6.20	0.47	
		7:26	14.93		2.5	0.0	6.63	18.32	6.20	0.43	
		8:43	16.22		34.6	0.0	6.69	18.32	6.20	0.49	
		10:31	18.02		8.1	0.0	6.69	18.32	6.20	0.49	
		12:42	20.20		8.5	0.0	6.71	18.32	6.20	0.51	
		14:51	22.35		9.7	0.0	6.63	18.32	6.20	0.43	
		16:40	24.17		7.4	0.0	6.60	18.32	6.20	0.4	
		18:30	26.00		4.9	0.0	6.60	18.32	6.20	0.4	
		20:26	27.93		2.7	0.0	6.64	18.32	6.20	0.44	
		22:39	30.15		3.2	0.0	6.74	18.32	6.20	0.54	
	02.19.15	0:45	32.25		15.4	0.0	6.78	18.32	6.20	0.58	
		2:55	34.42		9.9	0.0	6.80	18.32	6.20	0.6	
		4:26	35.93		25.7	0.5	6.70	18.32	6.20	0.5	
		6:26	37.93		17.2	0.0	6.62	18.32	6.20	0.42	
		8:55	40.42		8.7	0.0	6.61	18.32	6.20	0.41	End of DPE-1 test

TABLE 3
Monitoring Well Network Data – Pilot Test DPE-1 DPE-2
Chevron Environmental Management Company
Pilot Test Summary Memorandum
Former Unocal Edmonds Bulk Fuel Terminal
Edmonds, Washington

Well ID	Date	Time (hh:mm)	Elapsed Time (hr)	Distance from pumped well (ft)	Headspace VOCs (ppmv)	Vacuum ("H2O)	DTW (ft BTOC)	DTB (ft BTOC)	Static DTW (ft BTOC)	Drawdown (ft BTOC)	Note
AS-1	02.19.15	14:05	45.58	35	11.7	0.0	6.61	18.32	6.20	0.41	Beginning of DPE-2 test
		15:37	47.12		6.1	0.0	6.62	18.32	6.20	0.42	
		17:28	48.97		7.4	0.0	6.57	18.32	6.20	0.37	
		19:15	50.75		6.3	0.0	6.81	18.32	6.20	0.61	Use of Grundfoss
		20:17	51.78		6.6	0.0	6.89	18.32	6.20	0.69	
		21:27	52.95		3.0	0.0	6.97	18.32	6.20	0.77	
		22:36	54.10		2.8	0.0	7.00	18.32	6.20	0.8	
		23:35	55.08		8.9	0.0	7.08	18.32	6.20	0.88	
	02.20.15	0:42	56.20		5.8	0.0	7.10	18.32	6.20	0.9	
		1:44	57.23		4.9	0.0	7.10	18.32	6.20	0.9	
		2:38	58.13		8.8	0.0	7.08	18.32	6.20	0.88	
		3:25	58.92		7.5	0.0	7.10	18.32	6.20	0.9	
		4:39	60.15		7.1	0.0	7.05	18.32	6.20	0.85	
		5:55	61.42		9.9	0.0	7.00	18.32	6.20	0.8	
		6:33	62.05		27.8	0.0	6.93	18.32	6.20	0.73	
		7:34	63.07		12.8	0.0	6.92	18.32	6.20	0.72	
		8:07	63.62		3.8	0.0	6.91	18.32	6.20	0.71	
		9:16	64.77		7.5	0.0	6.92	18.32	6.20	0.72	
		10:36	66.10		8.7	0.0	6.93	18.32	6.20	0.73	
		12:08	67.63		14.1	0.0	6.92	18.32	6.20	0.72	
		14:12	69.70		4.5	0.0	7.02	18.32	6.20	0.82	
		16:10	71.67		7.6	0.0	7.04	18.32	6.20	0.84	
		18:00	73.50		3.6	0.0	6.98	18.32	6.20	0.78	
		19:55	75.42		3.6	0.0	6.96	18.32	6.20	0.76	
		22:09	77.65		3.0	0.0	7.00	18.32	6.20	0.8	
		23:54	79.40		5.2	0.0	7.20	18.32	6.20	1	
	02.21.15	1:55	81.42		3.0	0.0	7.13	18.32	6.20	0.93	
		4:05	83.58		4.0	0.0	7.15	18.32	6.20	0.95	
		6:13	85.72		4.8	0.0	7.01	18.32	6.20	0.81	
		8:07	87.62		3.9	0.0	7.01	18.32	6.20	0.81	
		10:08	89.63		3.5	0.0	7.02	18.32	6.20	0.82	End of DPE-2 test
MW-20R	02.16.15	10:22	--	--	0.0	--	6.01	14.23	--	--	
	02.21.15	10:21	--	--	0.0	--	6.22	14.23	--	--	
MW-512	02.16.15	10:24	--	--	0.7	--	5.76	12.73	--	--	
	02.21.15	10:33	--	--	0.6	--	5.99		--	--	
MW-514	02.16.15		--	--	0.1	--	3.96	12.60	--	--	
	02.21.15	10:29	--	--	0.0	--	4.21		--	--	
MW-518	02.16.15	10:26	--	--	0.3	--	7.80	13.36	--	--	
	02.21.15	10:26	--	--	0.1	--	7.96		--	--	
MW-525	02.16.15	10:10	--	--	69.0	--	5.60	12.45	5.6	--	Time recorded is approximate
	02.17.15	16:34	0	23	5.8	4.4	5.63	12.45	5.6	0.03	Beginning of DPE-1 test
		17:35	1.02		2.2	5.1	5.55	12.45	5.6	-0.05	
		18:45	2.18		106.6	5.0	5.50	12.45	5.6	-0.10	
		19:30	2.93		3.6	4.2	5.74	12.45	5.6	0.14	
		20:48	4.23		202.2	4.5	5.61	12.45	5.6	0.01	
		21:38	5.07		8.0	3.3	5.82	12.45	5.6	0.22	

TABLE 3
Monitoring Well Network Data – Pilot Test DPE-1 DPE-2
Chevron Environmental Management Company
Pilot Test Summary Memorandum
Former Unocal Edmonds Bulk Fuel Terminal
Edmonds, Washington

Well ID	Date	Time (hh:mm)	Elapsed Time (hr)	Distance from pumped well (ft)	Headspace VOCs (ppmv)	Vacuum ("H2O)	DTW (ft BTOC)	DTB (ft BTOC)	Static DTW (ft BTOC)	Drawdown (ft BTOC)	Note
MW-525	02.17.15	22:31	5.95	23	318.7	4.7	5.65	12.45	5.6	0.05	
		23:39	7.08		6.8	4.0	5.97	12.45	5.6	0.37	
	02.18.15	0:50	8.27		356.1	5.0	5.70	12.45	5.6	0.10	
		1:38	9.07		268.4	3.4	5.70	12.45	5.6	0.10	
		2:33	9.98		292.8	4.2	5.67	12.45	5.6	0.07	
		3:51	11.28		248.1	4.3	5.65	12.45	5.6	0.05	
		4:29	11.92		203.4	3.8	5.58	12.45	5.6	-0.02	
		5:55	13.35		279.6	4.1	5.65	12.45	5.6	0.05	
		6:40	14.10		276.8	3.9	5.54	12.45	5.6	-0.06	
		7:29	14.92		202.6	4.1	5.60	12.45	5.6	0.00	
		8:50	16.27		5.4	2.9	5.79	12.45	5.6	0.19	
		10:36	18.03		205.0	3.4	5.69	12.45	5.6	0.09	
		12:47	20.22		145.7	4.7	5.57	12.45	5.6	-0.03	
		14:54	22.33		174.4	5.2	5.50	12.45	5.6	-0.10	
		16:45	24.18		208.70	4.3	5.55	12.45	5.6	-0.05	
		18:34	26.00		116.4	4.5	5.55	12.45	5.6	-0.05	
		20:29	27.92		80.7	4.3	5.77	12.45	5.6	0.17	
		22:37	30.05		76.3	4.0	5.65	12.45	5.6	0.05	
	02.19.15	0:49	32.25		103.8	3.8	5.95	12.45	5.6	0.35	
		2:51	34.28		55.7	4.0	6.05	12.45	5.6	0.45	
		4:29	35.92		6.1	3.7	5.83	12.45	5.6	0.23	
		6:34	38.00		90.9	4.1	5.80	12.45	5.6	0.20	
		9:03	40.48		126.8	4.2	5.58	12.45	5.6	-0.02	End of DPE-1 test
	02.19.15	14:09	45.58	38	81.0	2.7	5.82	12.45	5.6	0.22	Beginning of DPE-2 test
		15:38	47.07		70.4	2.6	5.89	12.45	5.6	0.29	
		17:33	48.98		107.7	2.5	5.83	12.45	5.6	0.23	
		19:18	50.73		93.4	4.0	5.96	12.45	5.6	0.36	Use of Grundfoss
		20:24	51.83		134.4	3.6	6.08	12.45	5.6	0.48	
		21:33	52.98		161.40	3.5	6.17	12.45	5.6	0.57	
		22:29	53.92		171.6	3.6	6.17	12.45	5.6	0.57	
		23:39	55.08		57.7	3.2	6.23	12.45	5.6	0.63	
	02.20.15	0:45	56.18		129.4	3.0	6.35	12.45	5.6	0.75	
		1:31	56.95		164.2	3.4	6.40	12.45	5.6	0.8	
		2:45	58.18		93.1	3.1	6.25	12.45	5.6	0.65	
		3:28	58.90		67.2	3.3	6.23	12.45	5.6	0.63	
		4:44	60.17		121.6	3.2	6.20	12.45	5.6	0.6	
		5:52	61.30		64.2	2.6	6.25	12.45	5.6	0.65	
		6:36	62.03		5.6	2.1	6.31	12.45	5.6	0.71	
		7:37	63.05		7.7	2.9	6.28	12.45	5.6	0.68	
		8:11	63.62		23.3	3.0	6.13	12.45	5.6	0.53	
		9:20	64.77		5.6	2.7	6.15	12.45	5.6	0.55	
		10:39	66.08		38.6	2.3	6.30	12.45	5.6	0.7	
		12:14	67.67		12.1	3.4	6.20	12.45	5.6	0.6	
		14:16	69.70		54.3	3.1	6.41	12.45	5.6	0.81	
		16:14	71.67		8.4	2.9	6.35	12.45	5.6	0.75	
		18:01	73.45		27.3	2.5	6.28	12.45	5.6	0.68	
		19:59	75.42		30.4	2.5	6.33	12.45	5.6	0.73	

TABLE 3
Monitoring Well Network Data – Pilot Test DPE-1 DPE-2
Chevron Environmental Management Company
Pilot Test Summary Memorandum
Former Unocal Edmonds Bulk Fuel Terminal
Edmonds, Washington

Well ID	Date	Time (hh:mm)	Elapsed Time (hr)	Distance from pumped well (ft)	Headspace VOCs (ppmv)	Vacuum ("H2O)	DTW (ft BTOC)	DTB (ft BTOC)	Static DTW (ft BTOC)	Drawdown (ft BTOC)	Note
MW-525	02.20.15	21:10	76.60	38	20.7	2.0	6.35	12.45	5.6	0.75	
		23:58	79.40		20.7	1.7	6.35	12.45	5.6	0.75	
	02.21.15	1:58	81.40		5.0	2.2	6.47	12.45	5.6	0.87	
		4:10	83.60		19.4	2.5	6.50	12.45	5.6	0.9	
		6:20	85.77		0.6	2.4	6.31	12.45	5.6	0.71	
		8:14	87.67		19.9	3.1	6.26	12.45	5.6	0.66	
		10:14	89.67		5.7	3.1	6.30	12.45	5.6	0.7	End of DPE-2 test
MW-526	02.16.15	10:30	--	--	119.5	--	4.35	13.03	--	--	
	02.21.15	10:42	--	--	88.14	--	4.55		--	--	
MW-531	02.16.15	10:10	--	--	0.6	--	7.07	12.84	7.07	--	Time recorded is approximate
	02.17.15	16:32	0	40	3.9	0.0	7.03	12.84	7.07	-0.04	Beginning of DPE-1 test
		17:33	1.02		0.5	0.0	7.03	12.84	7.07	-0.04	
		18:47	2.25		0.7	0.0	7.02	12.84	7.07	-0.05	
		19:34	3.03		0.3	0.0	7.04	12.84	7.07	-0.03	
		20:46	4.23		0.2	0.0	7.11	12.84	7.07	0.04	
		21:36	5.07		1.2	0.0	7.18	12.84	7.07	0.11	
		22:30	5.97		0.4	0.0	7.20	12.84	7.07	0.13	
		23:38	7.10		0.5	0.0	7.25	12.84	7.07	0.18	
	02.18.15	0:49	8.28		0.9	0.0	--	12.84	7.07	--	
		1:36	9.07		0.9	0.0	7.29	12.84	7.07	0.22	
		2:29	9.95		0.2	0.0	7.32	12.84	7.07	0.25	
		3:50	11.30		0.5	0.0	7.30	12.84	7.07	0.23	
		4:28	11.93		0.7	0.0	7.26	12.84	7.07	0.19	
		5:52	13.33		0.0	0.0	7.23	12.84	7.07	0.16	
		6:39	14.12		0.0	0.0	7.30	12.84	7.07	0.23	
		7:28	14.93		0.1	0.0	7.19	12.84	7.07	0.12	
		8:46	16.23		0.1	0.0	7.17	12.84	7.07	0.1	
		10:34	18.03		0.1	0.3	7.19	12.84	7.07	0.12	
		12:45	20.22		0.1	0.3	7.21	12.84	7.07	0.14	
		14:45	22.22		0.1	0.4	7.17	12.84	7.07	0.1	
		16:04	23.53		0.1	0.0	7.12	12.84	7.07	0.05	
		18:32	26.00		0.0	0.3	7.05	12.84	7.07	-0.02	
		20:28	27.93		1.4	0.0	7.08	12.84	7.07	0.01	
		22:41	30.15		0.0	0.0	7.20	12.84	7.07	0.13	
	02.19.15	0:48	32.27		0.0	0.0	7.29	12.84	7.07	0.22	
		2:52	34.33		0.0	0.0	7.31	12.84	7.07	0.24	
		4:28	35.93		0.0	0.0	7.29	12.84	7.07	0.22	
		6:31	37.98		0.00	0.0	7.22	12.84	7.07	0.15	
		9:01	40.48		0.0	0.0	7.17	12.84	7.07	0.1	End of DPE-1 test
	02.19.15	14:07	45.58	68	0.0	0.0	7.23	12.84	7.07	0.16	Beginning of DPE-2 test
		15:42	47.17		0.0	0.0	7.21	12.84	7.07	0.14	
		17:31	48.98		0.0	0.0	7.15	12.84	7.07	0.08	
		19:17	50.75		0.0	0.0	7.04	12.84	7.07	-0.03	Use of Grundfoss
		20:22	51.83		0.0	0.0	7.12	12.84	7.07	0.05	
		21:32	53.00		0.0	0.0	7.17	12.84	7.07	0.1	
		22:28	53.93		0.0	0.0	7.20	12.84	7.07	0.13	

TABLE 3
Monitoring Well Network Data – Pilot Test DPE-1 DPE-2
Chevron Environmental Management Company
Pilot Test Summary Memorandum
Former Unocal Edmonds Bulk Fuel Terminal
Edmonds, Washington

Well ID	Date	Time (hh:mm)	Elapsed Time (hr)	Distance from pumped well (ft)	Headspace VOCs (ppmv)	Vacuum ("H2O)	DTW (ft BTOC)	DTB (ft BTOC)	Static DTW (ft BTOC)	Drawdown (ft BTOC)	Note
MW-531	02.19.15	23:37	55.08	68	0.0	0.0	7.25	12.84	7.07	0.18	
	02.20.15	0:41	56.15		0.0	0.0	7.30	12.84	7.07	0.23	
		1:41	57.15		0.0	0.0	7.31	12.84	7.07	0.24	
		2:43	58.18		0.40	0.0	7.36	12.84	7.07	0.29	
		3:27	58.92		0.2	0.0	7.34	12.84	7.07	0.27	
		4:42	60.17		0.00	0.0	7.32	12.84	7.07	0.25	
		5:45	61.22		0.0	0.0	7.30	12.84	7.07	0.23	
		6:35	62.05		0.4	0.0	7.30	12.84	7.07	0.23	
		7:36	63.07		0.0	0.0	7.27	12.84	7.07	0.2	
		8:10	63.63		0.3	0.0	7.25	12.84	7.07	0.18	
		9:18	64.77		0.1	0.0	7.25	12.84	7.07	0.18	
		10:28	65.93		0.1	0.0	7.25	12.84	7.07	0.18	
		12:11	67.65		0.0	0.0	7.28	12.84	7.07	0.21	
		14:14	69.70		0.0	0.0	7.32	12.84	7.07	0.25	
		16:12	71.67		0.0	0.0	7.30	12.84	7.07	0.23	
		18:00	73.47		0.0	0.0	7.27	12.84	7.07	0.2	
		19:57	75.42		0.0	0.0	7.25	12.84	7.07	0.18	
		22:09	77.62		0.0	0.0	7.28	12.84	7.07	0.21	
		23:57	79.42		0.1	0.0	7.35	12.84	7.07	0.28	
	02.21.15	1:57	81.42		0.0	0.0	7.40	12.84	7.07	0.33	
		4:09	83.62		0.0	0.0	7.42	12.84	7.07	0.35	
		6:16	85.73		0.0	0.0	7.38	12.84	7.07	0.31	
		8:12	87.67		0.0	0.0	7.32	12.84	7.07	0.25	
		10:12	89.67		0.0	0.0	7.32	12.84	7.07	0.25	End of DPE-2 test
MW-532	02.16.15	10:10	--	--	36.0	--	6.25	12.55	6.25	--	Time recorded is approximate
	02.17.15	16:26	0.00	23	0.0	0.0	6.53	12.55	6.25	0.28	Beginning of DPE-1 test
		17:27	1.02		0.3	0.4	6.52	12.55	6.25	0.27	
		18:38	2.20		0.3	0.3	6.53	12.55	6.25	0.28	
		19:29	3.05		0.0	0.3	6.54	12.55	6.25	0.29	
		20:37	4.18		0.3	0.4	6.54	12.55	6.25	0.29	
		21:30	5.07		0.3	0.4	6.59	12.55	6.25	0.34	
		22:26	6.00		0.3	0.3	6.60	12.55	6.25	0.35	
		23:33	7.12		0.1	0.1	6.65	12.55	6.25	0.4	
	02.18.15	0:39	8.22		0.1	0.2	6.69	12.55	6.25	0.44	
		1:28	9.03		0.6	0.3	6.61	12.55	6.25	0.36	
		2:18	9.87		3.9	0.3	6.64	12.55	6.25	0.39	
		3:43	11.28		0.1	0.5	6.60	12.55	6.25	0.35	
		4:18	11.87		2.0	0.4	6.59	12.55	6.25	0.34	
		5:45	13.32		0.5	0.5	6.57	12.55	6.25	0.32	
		6:26	14.00		1.4	0.5	6.53	12.55	6.25	0.28	
		7:23	14.95		0.6	0.5	6.54	12.55	6.25	0.29	
		8:39	16.22		0.9	0.5	6.55	12.55	6.25	0.3	
		10:27	18.02		4.0	0.4	6.55	12.55	6.25	0.3	
		12:38	20.20		1.4	0.6	6.59	12.55	6.25	0.34	
		14:47	22.35		1.4	0.7	6.50	12.55	6.25	0.25	
		16:36	24.17		2.2	0.5	6.53	12.55	6.25	0.28	
		18:25	25.98		0.3	0.5	6.55	12.55	6.25	0.3	

TABLE 3
Monitoring Well Network Data – Pilot Test DPE-1 DPE-2
Chevron Environmental Management Company
Pilot Test Summary Memorandum
Former Unocal Edmonds Bulk Fuel Terminal
Edmonds, Washington

Well ID	Date	Time (hh:mm)	Elapsed Time (hr)	Distance from pumped well (ft)	Headspace VOCs (ppmv)	Vacuum ("H2O)	DTW (ft BTOC)	DTB (ft BTOC)	Static DTW (ft BTOC)	Drawdown (ft BTOC)	Note
MW-532	02.18.15	20:24	27.97	23	0.40	0.5	6.55	12.55	6.25	0.3	
		22:24	29.97		0.5	0.5	6.58	12.55	6.25	0.33	
	02.19.15	0:42	32.27		0.1	0.4	6.65	12.55	6.25	0.4	
		2:43	34.28		0.20	0.4	6.63	12.55	6.25	0.38	
		4:24	35.97		0.6	0.5	6.61	12.55	6.25	0.36	
		6:23	37.95		0.0	0.4	6.58	12.55	6.25	0.33	
		8:51	40.42		0.1	0.5	6.54	12.55	6.25	0.29	End of DPE-1 test
	02.19.05	13:57	45.52	10	0.0	5.1	6.52	12.55	6.25	0.27	Beginning of DPE-2 test
		15:30	47.07		1.3	5.8	6.55	12.55	6.25	0.3	
		17:23	48.95		0.0	5.4	6.65	12.55	6.25	0.4	
		19:12	50.77		0.0	11.4	7.55	12.55	6.25	1.3	Use of Grundfoss
		20:15	51.82		0.00	9.3	6.73	12.55	6.25	0.48	
		21:20	52.90		0.1	9.6	6.82	12.55	6.25	0.57	
		22:23	53.95		0.1	6.1	7.05	12.55	6.25	0.8	
		23:31	55.08		0.0	7.8	6.90	12.55	6.25	0.65	
	02.20.15	0:35	56.15		0.0	7.9	7.00	12.55	6.25	0.75	
		1:32	57.10		0.0	7.7	6.93	12.55	6.25	0.68	
		2:32	58.10		0.1	7.2	7.41	12.55	6.25	1.16	
		3:20	58.90		0.0	7.3	7.31	12.55	6.25	1.06	
		4:25	59.98		0.0	7.0	7.20	12.55	6.25	0.95	
		5:44	61.30		0.0	6.9	7.09	12.55	6.25	0.84	
		6:30	62.07		0.1	6.2	7.29	12.55	6.25	1.04	
		7:30	63.07		0.1	6.9	7.21	12.55	6.25	0.96	
		8:30	64.07		0.0	6.7	6.98	12.55	6.25	0.73	
		9:12	64.77		0.0	6.2	6.97	12.55	6.25	0.72	
		10:31	66.08		0.0	7.2	7.27	12.55	6.25	1.02	
		12:03	67.62		0.0	7.0	7.25	12.55	6.25	1.00	
		14:09	69.72		0.0	6.8	7.09	12.55	6.25	0.84	
		16:08	71.70		0.0	7.2	7.26	12.55	6.25	1.01	
		17:58	73.53		0.0	7.4	7.12	12.55	6.25	0.87	
		20:01	75.58		0.1	7.8	7.35	12.55	6.25	1.10	
		22:01	77.58		0.0	6.5	7.34	12.55	6.25	1.09	
		23:50	79.40		0.0	2.3	7.25	12.55	6.25	1.00	
	02.21.15	1:53	81.45		0.1	6.5	7.50	12.55	6.25	1.25	
		4:00	83.57		0.0	6.2	7.50	12.55	6.25	1.25	
		6:10	85.73		0.0	3.8	7.34	12.55	6.25	1.09	
		8:03	87.62		0.0	6.8	7.17	12.55	6.25	0.92	
		10:02	89.60		0.0	6.7	7.21	12.55	6.25	0.96	End of DPE-2 test

Note:

hh:mm = hour:minute
min = minute
gal = gallon
gpm = gallon per minute
°F = Fahrenheit
ft = feet

DTW = depth to water
DPE = dual phase extraction
"Hg = inches of mercury
"H2O= inches of water
ES = Electric Submersible
scfm = standard cubic feet per minute

ppmv = parts per million by volume
lb = pound
VOCs = Volatile organic compounds

[a]Mass removal rate calculated using average VOCs concentrations between time period for instances following post-dilution concentrations readings
Mass Removal Rate Equation: ((Average VOCs)/1000000)*(Average Volumetric Air Flow Rate))*(1440 min/day)*(1/379 ft3 air/mole)*(86.2lb/lb mole)
with: VOCs in ppmv Air flow rate in scfm Mass Removal Rate in lb/day
Vacuum Equation: Vacuum = DPE Vacuum*13.59 with: Vacuum in "H2O DPE Vacuum in "Hg

TABLE 4
Monitoring Well Network Data – Pilot Test DPE-3
Chevron Environmental Management Company
Pilot Test Summary Memorandum
Former Unocal Edmonds Bulk Fuel Terminal
Edmonds, Washington

Well ID	Date	Time (hh:mm)	Elapsed Time (hr)	Distance from pumped well (ft)	Headspace VOCs (ppmv)	Vacuum ("H2O)	DTW (ft BTOC)	DTB (ft BTOC)	Static DTW (ft BTOC)	Drawdown (ft below Static DTW)	Note
DPE-1	03.30.15	8:21	--	29	30.9	--	6.26	28.8	6.26	--	
	03.30.15	10:53	0.00	29	1.3	0.0	8.17	28.8	6.26	1.91	Beginning of DPE-3 test
		11:51	0.97		6.6	0.0	8.32	28.8	6.26	2.06	Pulling full vacuum at DPE-3
		12:50	1.95		2.0	0.0	8.35	28.8	6.26	2.09	
		13:49	2.93		--	0.3	8.35	28.8	6.26	2.09	
		15:38	4.75		--	0.3	8.37	28.8	6.26	2.11	
		16:50	5.95		--	0.3	8.38	28.8	6.26	2.12	
		17:51	6.97		--	0.0	7.88	28.8	6.26	1.62	Blower Stopped
		18:53	8.00		--	0.7	8.34	28.8	6.26	2.08	
		20:24	9.52		170.6	0.6	8.48	28.8	6.26	2.22	
		21:25	10.53		8.9	0.9	8.65	28.8	6.26	2.39	
		23:18	12.42		8.6	0.6	8.59	28.8	6.26	2.33	
	03.31.15	1:15	14.37		130.5	0.5	8.54	28.8	6.26	2.28	
		3:28	16.58		36.7	0.6	8.53	28.8	6.26	2.27	
		5:24	18.52		82.2	0.6	8.45	28.8	6.26	2.19	
		7:20	20.45		2.4	0.7	8.47	28.8	6.26	2.21	
		8:41	21.80		51.7	0.9	8.45	28.8	6.26	2.19	
		10:48	23.92		39.5	1.3	8.49	28.8	6.26	2.23	
		12:43	25.83		61.3	1.3	8.48	28.8	6.26	2.22	
		14:46	27.88		53.5	1.3	8.47	28.8	6.26	2.21	
		16:50	29.95		34.1	0.9	8.43	28.8	6.26	2.17	
		17:46	30.88		2.7	0.8	8.40	28.8	6.26	2.14	
		18:51	31.97		24.8	0.9	8.40	28.8	6.26	2.14	
		20:02	33.15		25.1	0.9	8.99	28.8	6.26	2.73	End of DPE-3 test
		21:15	34.37		27.7	--	6.50	28.8	6.26	0.24	
		22:15	35.37		20.0	--	6.85	28.8	6.26	0.59	
		23:11	36.30		40.2	--	6.70	28.8	6.26	0.44	
	04.01.15	0:12	37.32		26.9	--	6.65	28.8	6.26	0.39	

TABLE 4
Monitoring Well Network Data – Pilot Test DPE-3
Chevron Environmental Management Company
Pilot Test Summary Memorandum
Former Unocal Edmonds Bulk Fuel Terminal
Edmonds, Washington

Well ID	Date	Time (hh:mm)	Elapsed Time (hr)	Distance from pumped well (ft)	Headspace VOCs (ppmv)	Vacuum ("H2O)	DTW (ft BTOC)	DTB (ft BTOC)	Static DTW (ft BTOC)	Drawdown (ft below Static DTW)	Note
DPE-2	03.30.15	8:30	--	48	10.0	--	5.92	29.35	5.92	--	
		10:50	0	48	1.5	0.0	6.54	29.35	5.92	0.62	Beginning of DPE-3 test
		11:58	1.13		0.2	0.0	6.61	29.35	5.92	0.69	Pulling full vacuum at DPE-3
		12:59	2.15		0.2	0.0	6.65	29.35	5.92	0.73	
		13:55	3.08		--	0.0	6.65	29.35	5.92	0.73	
		15:35	4.75		--	0.0	6.67	29.35	5.92	0.75	
		16:56	6.10		--	0.0	6.68	29.35	5.92	0.76	
		18:00	7.17		--	0.0	6.51	29.35	5.92	0.59	Blower Stopped
		19:02	8.20		--	0.7	6.70	29.35	5.92	0.78	
		20:01	9.18		0.0	0.4	6.73	29.35	5.92	0.81	
		21:00	10.17		1.6	0.3	6.78	29.35	5.92	0.86	
		23:00	12.17		3.5	0.3	6.75	29.35	5.92	0.83	
	03.31.15	1:07	14.28		7.7	0.0	6.75	29.35	5.92	0.83	
		3:23	16.55		4.0	0.3	6.74	29.35	5.92	0.82	
		5:20	18.50		4.4	4.0	6.77	29.35	5.92	0.85	
		7:17	20.45		3.2	0.3	6.81	29.35	5.92	0.89	
		8:47	21.95		14.0	0.4	6.77	29.35	5.92	0.85	
		10:56	24.10		25.0	0.7	6.80	29.35	5.92	0.88	
		12:50	26.00		30.3	0.6	6.77	29.35	5.92	0.85	
		14:52	28.03		33.0	0.7	6.78	29.35	5.92	0.86	
		16:56	30.10		24.7	0.5	6.76	29.35	5.92	0.84	
		17:53	31.05		26.0	0.4	6.75	29.35	5.92	0.83	
		18:57	32.12		9.3	0.4	6.75	29.35	5.92	0.83	
		20:10	33.33		3.5	0.4	6.82	29.35	5.92	0.90	End of DPE-3 test
		21:20	34.50		13.6	--	6.25	29.35	5.92	0.33	
		22:20	35.50		18.0	--	6.15	29.35	5.92	0.23	
		23:16	36.43		25.3	--	6.15	29.35	5.92	0.23	
	04.01.15	0:19	37.48		8.6	--	6.12	29.35	5.92	0.20	

TABLE 4
Monitoring Well Network Data – Pilot Test DPE-3
Chevron Environmental Management Company
Pilot Test Summary Memorandum
Former Unocal Edmonds Bulk Fuel Terminal
Edmonds, Washington

Well ID	Date	Time (hh:mm)	Elapsed Time (hr)	Distance from pumped well (ft)	Headspace VOCs (ppmv)	Vacuum ("H2O)	DTW (ft BTOC)	DTB (ft BTOC)	Static DTW (ft BTOC)	Drawdown (ft below Static DTW)	Note
DPE-3	03.30.15	8:03	--	0	375.1	--	4.63	25.01	4.63	--	
	03.30.15	10:37	0	0	35.1	142.7	16.04	25.01	4.63	11.41	Beginning of DPE-3 test
		12:05	1.47		53.0	142.7	7.60	25.01	4.63	2.97	Pulling full vacuum at DPE-3
		13:05	2.47		62.1	142.7	8.20	25.01	4.63	3.57	
		14:01	3.40		72.2	142.7	8.70	25.01	4.63	4.07	
		15:50	5.22		67.2	163.1	9.45	25.01	4.63	4.82	
		17:02	6.42		71.0	163.1	10.15	25.01	4.63	5.52	
		18:09	7.53		--	0.0	15.70	25.01	4.63	11.07	Blower Stopped
		19:10	8.55		90.0	135.9	10.30	25.01	4.63	5.67	
		20:00	9.38		84.2	135.9	10.80	25.01	4.63	6.17	
		23:30	12.88		97.0	135.9	12.00	25.01	4.63	7.37	
	03.31.15	1:00	14.38		95.6	129.1	12.50	25.01	4.63	7.87	
		3:33	16.93		107.9	129.1	13.09	25.01	4.63	8.46	
		5:32	18.92		112.0	129.1	13.40	25.01	4.63	8.77	
		7:25	20.80		115.0	122.3	13.75	25.01	4.63	9.12	
		8:53	22.27		116.0	135.9	14.00	25.01	4.63	9.37	
		11:01	24.40		132.0	135.9	13.92	25.01	4.63	9.29	
		12:59	26.37		140.0	145.4	13.80	25.01	4.63	9.17	
		14:58	28.35		130.0	149.5	14.28	25.01	4.63	9.65	
		17:02	30.42		130.0	148.0	17.10	25.01	4.63	12.47	
		18:00	31.38		131.0	106.0	16.72	25.01	4.63	12.09	
		19:03	32.43		132.0	108.0	16.80	25.01	4.63	12.17	
		20:13	33.60		130.0	108.0	16.50	25.01	4.63	11.87	
		21:25	34.80		389.1	--	7.10	25.01	4.63	2.47	End of DPE-3 test
		22:24	35.78		433.6	--	6.90	25.01	4.63	2.27	
		23:20	36.72		381.2	--	6.84	25.01	4.63	2.21	
	04.01.15	0:21	37.73		488.9	--	6.80	25.01	4.63	2.17	

TABLE 4
Monitoring Well Network Data – Pilot Test DPE-3
Chevron Environmental Management Company
Pilot Test Summary Memorandum
Former Unocal Edmonds Bulk Fuel Terminal
Edmonds, Washington

Well ID	Date	Time (hh:mm)	Elapsed Time (hr)	Distance from pumped well (ft)	Headspace VOCs (ppmv)	Vacuum ("H2O)	DTW (ft BTOC)	DTB (ft BTOC)	Static DTW (ft BTOC)	Drawdown (ft below Static DTW)	Note
PZ-1	03.30.15	8:15	--	31.5	80.3	--	6.41	23.89	6.41	--	
		10:44	0	31.5	2.0	0.0	7.80	23.89	6.41	1.39	Beginning of DPE-3 test
		11:47	1.05		1.4	0.0	8.01	23.89	6.41	1.6	Pulling full vacuum at DPE-3
		12:46	2.03		0.8	0.0	8.05	23.89	6.41	1.64	
		13:44	3.00		--	0.0	8.05	23.89	6.41	1.64	
		15:40	4.93		--	0.0	8.03	23.89	6.41	1.62	
		16:46	6.03		--	0.0	8.03	23.89	6.41	1.62	
		17:45	7.02		--	0.0	7.69	23.89	6.41	1.28	Blower Stopped
		18:48	8.07		--	0.4	8.00	23.89	6.41	1.59	
		20:30	9.77		91.6	0.0	8.14	23.89	6.41	1.73	
		21:29	10.75		282.1	0.4	8.30	23.89	6.41	1.89	
		23:24	12.67		43.5	0.0	8.27	23.89	6.41	1.86	
	03.31.15	1:17	14.55		12.7	0.0	8.24	23.89	6.41	1.83	
		3:30	16.77		33.2	0.0	8.20	23.89	6.41	1.79	
		5:28	18.73		7.1	0.0	8.15	23.89	6.41	1.74	
		7:22	20.63		14.9	0.4	8.10	23.89	6.41	1.69	
		8:37	21.88		15.4	0.3	8.11	23.89	6.41	1.7	
		10:42	23.97		6.5	0.5	8.19	23.89	6.41	1.78	
		13:05	26.35		149.2	0.8	8.14	23.89	6.41	1.73	
		14:42	27.97		5.7	0.0	8.18	23.89	6.41	1.77	
		16:46	30.03		4.5	0.0	8.09	23.89	6.41	1.68	
		17:42	30.97		1.3	0.0	8.08	23.89	6.41	1.67	
		18:47	32.05		0.7	0.0	8.09	23.89	6.41	1.68	
		19:57	33.22		--	--	--	23.89	6.41		End of DPE-3 test

TABLE 4
Monitoring Well Network Data – Pilot Test DPE-3
Chevron Environmental Management Company
Pilot Test Summary Memorandum
Former Unocal Edmonds Bulk Fuel Terminal
Edmonds, Washington

Well ID	Date	Time (hh:mm)	Elapsed Time (hr)	Distance from pumped well (ft)	Headspace VOCs (ppmv)	Vacuum ("H2O)	DTW (ft BTOC)	DTB (ft BTOC)	Static DTW (ft BTOC)	Drawdown (ft below Static DTW)	Note
PZ-2	03.30.15	8:24	--	31	367.2	--	6.20	18.32	6.20	--	
	03.30.15	10:56	0	31	21.0	0.0	7.39	18.32	6.20	1.19	Beginning of DPE-3 test
		11:53	0.95		0.4	0.3	7.54	18.32	6.20	1.34	Pulling full vacuum at DPE-3
		12:52	1.93		0.3	0.4	7.61	18.32	6.20	1.41	
		13:51	2.92		0.5	0.4	7.63	18.32	6.20	1.43	
		15:37	4.68		0.5	0.5	7.70	18.32	6.20	1.5	
		16:52	5.93		0.4	0.4	7.72	18.32	6.20	1.52	
		17:54	6.97		1.7	0.0	7.44	18.32	6.20	1.24	Blower Stopped
		18:56	8.00		0.5	0.8	7.74	18.32	6.20	1.54	
		20:21	9.42		0.0	0.7	7.82	18.32	6.20	1.62	
		21:24	10.47		0.0	0.8	7.92	18.32	6.20	1.72	
		23:16	12.33		0.0	0.8	7.95	18.32	6.20	1.75	
	03.31.15	1:12	14.27		0.0	0.6	7.96	18.32	6.20	1.76	
		3:28	16.53		0.0	0.9	8.00	18.32	6.20	1.8	
		5:22	18.43		0.0	0.9	7.92	18.32	6.20	1.72	
		7:20	20.40		0.0	0.9	7.95	18.32	6.20	1.75	
		8:43	21.78		0.0	1.1	7.95	18.32	6.20	1.75	
		10:50	23.90		0.0	1.4	8.00	18.32	6.20	1.8	
		12:45	25.82		0.0	1.4	7.97	18.32	6.20	1.77	
		14:48	27.87		0.0	1.4	7.98	18.32	6.20	1.78	
		16:52	29.93		0.1	1.3	7.95	18.32	6.20	1.75	
		17:48	30.87		0.0	1.1	7.93	18.32	6.20	1.73	
		18:53	31.95		0.0	1.1	7.95	18.32	6.20	1.75	
		20:05	33.15		0.0	1.1	7.96	18.32	6.20	1.76	End of DPE-3 test
		21:16	34.33		0.2	--	7.00	18.32	6.20	0.8	
		22:16	35.33		1.5	--	6.85	18.32	6.20	0.65	
		23:12	36.27		8.6	--	6.78	18.32	6.20	0.58	
	04.01.15	0:13	37.28		19.5	--	6.74	18.32	6.20	0.54	

TABLE 4
Monitoring Well Network Data – Pilot Test DPE-3
Chevron Environmental Management Company
Pilot Test Summary Memorandum
Former Unocal Edmonds Bulk Fuel Terminal
Edmonds, Washington

Well ID	Date	Time (hh:mm)	Elapsed Time (hr)	Distance from pumped well (ft)	Headspace VOCs (ppmv)	Vacuum ("H2O)	DTW (ft BTOC)	DTB (ft BTOC)	Static DTW (ft BTOC)	Drawdown (ft below Static DTW)	Note
PZ-3	03.30.15	8:33	--	10	737.5	--	5.54	18.32	5.54	--	
	03.30.15	11:02	0	10	16.9	0.4	9.02	18.32	5.54	3.48	Beginning of DPE-3 test
		12:00	0.97		0.9	1.0	9.18	18.32	5.54	3.64	Pulling full vacuum at DPE-3
		13:01	1.98		0.6	1.0	9.18	18.32	5.54	3.64	
		13:57	2.92		0.5	1.0	9.19	18.32	5.54	3.65	
		15:33	4.52		0.6	1.0	9.18	18.32	5.54	3.64	
		16:58	5.93		0.7	1.1	9.18	18.32	5.54	3.64	
		18:03	7.02		1.7	0.0	8.07	18.32	5.54	2.53	Blower Stopped
		19:05	8.05		0.5	1.3	9.13	18.32	5.54	3.59	
		20:33	9.52		0.5	1.3	9.25	18.32	5.54	3.71	
		21:35	10.55		0.0	0.9	9.36	18.32	5.54	3.82	
		23:28	12.43		0.0	1.1	9.28	18.32	5.54	3.74	
	03.31.15	1:21	14.32		0.0	0.9	9.31	18.32	5.54	3.77	
		3:35	16.55		0.0	1.3	9.30	18.32	5.54	3.76	
		5:31	18.48		0.0	0.9	9.20	18.32	5.54	3.66	
		7:24	20.37		0.1	1.3	9.16	18.32	5.54	3.62	
		8:49	21.78		0.0	1.4	9.19	18.32	5.54	3.65	
		10:58	23.93		0.0	1.9	9.21	18.32	5.54	3.67	
		12:53	25.85		0.0	2.0	9.16	18.32	5.54	3.62	
		14:54	27.87		0.1	2.1	9.15	18.32	5.54	3.61	
		16:58	29.93		0.1	1.4	9.12	18.32	5.54	3.58	
		17:56	30.90		0.1	1.3	9.03	18.32	5.54	3.49	
		18:59	31.95		0.0	0.6	9.02	18.32	5.54	3.48	
		20:11	33.15		0.0	0.7	9.02	18.32	5.54	3.48	End of DPE-3 test
		21:22	34.33		2.7	--	6.10	18.32	5.54	0.56	
		22:22	35.33		12.9	--	5.95	18.32	5.54	0.41	
		23:18	36.27		23.7	--	6.16	18.32	5.54	0.62	
	04.01.15	0:19	37.28		24.9	--	6.93	18.32	5.54	1.39	

TABLE 4
Monitoring Well Network Data – Pilot Test DPE-3
Chevron Environmental Management Company
Pilot Test Summary Memorandum
Former Unocal Edmonds Bulk Fuel Terminal
Edmonds, Washington

Well ID	Date	Time (hh:mm)	Elapsed Time (hr)	Distance from pumped well (ft)	Headspace VOCs (ppmv)	Vacuum ("H2O)	DTW (ft BTOC)	DTB (ft BTOC)	Static DTW (ft BTOC)	Drawdown (ft below Static DTW)	Note
AS-1	03.30.15	8:18	--	25	4.7	--	6.35	25	6.35	--	
	03.30.15	10:47	0	25	0.4	0.0	7.84	25	6.35	1.49	Beginning of DPE-3 test
		11:49	1.03		0.7	0.0	8.05	25	6.35	1.7	Pulling full vacuum at DPE-3
		12:48	2.02		0.7	0.0	8.11	25	6.35	1.76	
		13:46	2.98		1.4	0.0	8.11	25	6.35	1.76	
		15:39	4.87		2.2	0.0	8.17	25	6.35	1.82	
		16:48	6.02		1.3	0.0	8.13	25	6.35	1.78	
		17:48	7.02		0.9	0.0	7.72	25	6.35	1.37	Blower Stopped
		18:50	8.05		1.9	0.0	8.14	25	6.35	1.79	
		20:26	9.65		2.1	0.0	8.28	25	6.35	1.93	
		21:26	10.65		0.8	0.3	8.33	25	6.35	1.98	
		23:20	12.55		0.8	0.0	8.37	25	6.35	2.02	
	03.31.15	1:15	14.47		1.2	0.0	8.35	25	6.35	2	
		3:29	16.70		0.8	0.0	8.32	25	6.35	1.97	
		5:27	18.67		1.0	0.0	8.29	25	6.35	1.94	
		7:21	20.57		0.7	0.0	8.25	25	6.35	1.9	
		8:39	21.87		0.0	0.0	8.29	25	6.35	1.94	
		10:45	23.97		0.2	0.0	8.32	25	6.35	1.97	
		12:41	25.90		0.2	0.0	8.37	25	6.35	2.02	
		14:44	27.95		0.4	0.0	8.32	25	6.35	1.97	
		16:48	30.02		0.2	0.0	8.23	25	6.35	1.88	
		17:44	30.95		0.1	0.0	8.20	25	6.35	1.85	
		18:49	32.03		0.0	0.0	8.21	25	6.35	1.86	
		20:00	33.22		0.4	1.2	8.25	25	6.35	1.9	End of DPE-3 test
		21:13	34.43		1.2	--	7.01	25	6.35	0.66	
		22:13	35.43		0.5	--	6.99	25	6.35	0.64	
		23:09	36.37		1.3	--	6.80	25	6.35	0.45	
	04.01.15	0:10	37.38		0.1	--	6.95	25	6.35	0.6	

TABLE 4
Monitoring Well Network Data – Pilot Test DPE-3
Chevron Environmental Management Company
Pilot Test Summary Memorandum
Former Unocal Edmonds Bulk Fuel Terminal
Edmonds, Washington

Well ID	Date	Time (hh:mm)	Elapsed Time (hr)	Distance from pumped well (ft)	Headspace VOCs (ppmv)	Vacuum ("H2O)	DTW (ft BTOC)	DTB (ft BTOC)	Static DTW (ft BTOC)	Drawdown (ft below Static DTW)	Note
MW-525	03.30.15	8:36	--	5	117.4	--	5.73	12.45	5.73	--	
	03.30.15	11:05	0	5	242.5	1.5	10.13	12.45	5.73	4.40	Beginning of DPE-3 test
		12:03	0.97		0.4	3.7	10.22	12.45	5.73	4.49	Pulling full vacuum at DPE-3
		13:03	1.97		0.3	5.7	10.05	12.45	5.73	4.32	
		13:59	2.90		0.3	6.0	9.94	12.45	5.73	4.21	
		15:32	4.45		0.3	6.2	9.95	12.45	5.73	4.22	
		17:00	5.92		0.3	4.0	9.97	12.45	5.73	4.24	
		18:06	7.02		2.4	0.0	8.55	12.45	5.73	2.82	Blower Stopped
		19:08	8.05		0.3	6.3	9.78	12.45	5.73	4.05	
		20:31	9.43		0.5	3.9	10.00	12.45	5.73	4.27	
		21:32	10.45		0.1	5.5	9.98	12.45	5.73	4.25	
		23:26	12.35		0.0	5.6	9.91	12.45	5.73	4.18	
	03.31.15	1:20	14.25		0.0	3.2	10.10	12.45	5.73	4.37	
		3:32	16.45		0.0	5.7	9.85	12.45	5.73	4.12	
		5:30	18.42		12.1	3.9	9.89	12.45	5.73	4.16	
		7:24	20.32		0.0	4.9	9.83	12.45	5.73	4.10	
		8:51	21.77		0.0	5.2	9.75	12.45	5.73	4.02	
		11:00	23.92		0.0	8.2	9.74	12.45	5.73	4.01	
		12:56	25.85		0.0	8.4	9.59	12.45	5.73	3.86	
		14:56	27.85		0.0	8.2	9.68	12.45	5.73	3.95	
		17:00	29.92		0.0	6.6	9.62	12.45	5.73	3.89	
		17:58	30.88		0.0	6.2	9.58	12.45	5.73	3.85	
		19:01	31.93		0.0	6.1	9.56	12.45	5.73	3.83	
		20:12	33.12		0.0	6.1	9.54	12.45	5.73	3.81	End of DPE-3 test
		21:23	34.30		3.8	--	6.25	12.45	5.73	0.52	
		22:23	35.30		385.5	--	6.25	12.45	5.73	0.52	
		23:19	36.23		294.1	--	6.80	12.45	5.73	1.07	
	04.01.15	0:20	37.25		196.6	--	6.10	12.45	5.73	0.37	

TABLE 4
Monitoring Well Network Data – Pilot Test DPE-3
Chevron Environmental Management Company
Pilot Test Summary Memorandum
Former Unocal Edmonds Bulk Fuel Terminal
Edmonds, Washington

Well ID	Date	Time (hh:mm)	Elapsed Time (hr)	Distance from pumped well (ft)	Headspace VOCs (ppmv)	Vacuum ("H2O)	DTW (ft BTOC)	DTB (ft BTOC)	Static DTW (ft BTOC)	Drawdown (ft below Static DTW)	Note
MW-531	03.30.15	8:12	--	57	0.2	--	7.18	12.84	7.18	--	
	03.30.15	10:41	0	57	0.3	0.0	7.23	12.84	7.18	0.05	Beginning of DPE-3 test
		11:45	1.07		0.2	0.0	7.23	12.84	7.18	0.05	Pulling full vacuum at DPE-3
		12:45	2.07		0.2	0.0	7.23	12.84	7.18	0.05	
		13:42	3.02		0.2	0.0	7.24	12.84	7.18	0.06	
		15:43	5.03		0.2	0.0	7.22	12.84	7.18	0.04	
		16:44	6.05		0.4	0.0	7.21	12.84	7.18	0.03	
		17:42	7.02		1.0	0.0	7.21	12.84	7.18	0.03	Blower Stopped
		18:45	8.07		0.2	0.0	7.24	12.84	7.18	0.06	
		20:31	9.83		0.3	0.0	7.26	12.84	7.18	0.08	
		21:37	10.93		0.4	0.0	7.29	12.84	7.18	0.11	
		23:30	12.82		0.2	0.0	7.33	12.84	7.18	0.15	
	03.31.15	1:24	14.72		0.3	0.0	7.34	12.84	7.18	0.16	
		3:40	16.98		0.0	0.0	7.35	12.84	7.18	0.17	
		5:29	18.80		0.5	0.0	7.33	12.84	7.18	0.15	
		7:24	20.72		0.1	0.0	7.29	12.84	7.18	0.11	
		8:35	21.90		0.0	0.0	7.29	12.84	7.18	0.11	
		10:40	23.98		0.0	0.0	7.32	12.84	7.18	0.14	
		12:38	25.95		0.0	0.0	7.33	12.84	7.18	0.15	
		14:40	27.98		0.1	0.0	7.34	12.84	7.18	0.16	
		16:44	30.05		0.0	0.0	7.33	12.84	7.18	0.15	
		17:39	30.97		0.0	0.0	7.30	12.84	7.18	0.12	
		18:45	32.07		0.0	0.0	7.31	12.84	7.18	0.13	
		19:55	33.23		0.0	0.0	7.34	12.84	7.18	0.16	End of DPE-3 test
		21:14	34.55		0.0	--	7.35	12.84	7.18	0.17	
		22:14	35.55		0.0	--	7.35	12.84	7.18	0.17	
		23:10	36.48		0.0	--	7.40	12.84	7.18	0.22	
	04.01.15	0:11	37.50		0.0	--	7.40	12.84	7.18	0.22	

TABLE 4
Monitoring Well Network Data – Pilot Test DPE-3
Chevron Environmental Management Company
Pilot Test Summary Memorandum
Former Unocal Edmonds Bulk Fuel Terminal
Edmonds, Washington

Well ID	Date	Time (hh:mm)	Elapsed Time (hr)	Distance from pumped well (ft)	Headspace VOCs (ppmv)	Vacuum ("H2O)	DTW (ft BTOC)	DTB (ft BTOC)	Static DTW (ft BTOC)	Drawdown (ft below Static DTW)	Note
MW-532	03.30.15	8:27	--	40	6.3	--	6.38	12.84	6.38	--	
	03.30.15	10:59	0	40	2.7	0.0	6.95	12.84	6.38	0.57	Beginning of DPE-3 test
		11:56	0.95		2.0	0.0	7.12	12.84	6.38	0.74	Pulling full vacuum at DPE-3
		12:55	1.93		0.9	0.0	7.21	12.84	6.38	0.83	
		13:53	2.90		1.2	0.0	7.28	12.84	6.38	0.9	
		15:36	4.62		3.2	0.0	7.32	12.84	6.38	0.94	
		16:54	5.92		3.1	0.0	7.36	12.84	6.38	0.98	
		17:57	6.97		2.7	0.0	7.29	12.84	6.38	0.91	Blower Stopped
		18:59	8.00		1.4	0.0	7.36	12.84	6.38	0.98	
		20:15	9.27		3.2	0.0	7.43	12.84	6.38	1.05	
		21:22	10.38		1.5	0.0	7.53	12.84	6.38	1.15	
		23:14	12.25		0.9	0.0	7.57	12.84	6.38	1.19	
	03.31.15	1:11	14.20		1.4	0.0	7.60	12.84	6.38	1.22	
		3:25	16.43		0.7	0.0	7.70	12.84	6.38	1.32	
		5:22	18.38		0.8	0.0	7.65	12.84	6.38	1.27	
		7:18	20.32		0.8	0.0	7.63	12.84	6.38	1.25	
		8:45	21.77		0.4	0.0	7.64	12.84	6.38	1.26	
		10:53	23.90		0.1	0.4	7.68	12.84	6.38	1.3	
		12:48	25.82		0.2	0.4	7.67	12.84	6.38	1.29	
		14:50	27.85		1.4	0.4	7.69	12.84	6.38	1.31	
		16:54	29.92		0.3	0.0	7.66	12.84	6.38	1.28	
		17:51	30.87		0.2	0.0	7.62	12.84	6.38	1.24	
		18:55	31.93		0.2	0.0	7.65	12.84	6.38	1.27	
		20:08	33.15		0.3	0.0	7.67	12.84	6.38	1.29	End of DPE-3 test
		21:18	34.32		0.1	--	7.26	12.84	6.38	0.88	
		22:18	35.32		0.6	--	7.10	12.84	6.38	0.72	
		23:14	36.25		1.1	--	6.99	12.84	6.38	0.61	
	04.01.15	0:15	37.27		0.2	--	6.93	12.84	6.38	0.55	

Note:

hh:mm = hour:minute
min = minute
gal = gallon
gpm = gallon per minute
°F = Fahrenheit
ft = feet

DTW = depth to water
DPE = dual phase extraction
"Hg = inches of mercury
"H2O= inches of water
ES = Electric Submersible
scfm = standard cubic feet per minute

ppmv = parts per million by volume
lb = pound
VOCs = Volatile organic compounds

[a]Mass removal rate calculated using average VOCs concentrations between time period for instances following post-dilution concentrations readings

Mass Removal Rate Equation:
((Average VOCs)/1000000)*(Average Volumetric Air Flow Rate))*(1440 min/day)*(1/379 ft3
with: VOCs in ppmv Air flow rate in scfm Mass Removal Rate in lb/day
Vacuum Equation: Vacuum = DPE Vacuum*13.59 with: Vacuum in "H2O DPE Vacuum in "Hg

TABLE 5
System and Extraction Well Data – Pilot Test DPE-1 DPE-2
Chevron Environmental Management Company
Pilot Test Summary Memorandum
Former Unocal Edmonds Bulk Fuel Terminal
Edmonds, Washington

Date	Time (hh:mm)	Elapsed Time Since Last Measurement (min)	Operating Period (cumulative mins)	Cumulative Gallons (totalizer, gal)	Calculated pumping rate (gpm)	Cycle counter (0.65 gallons per cycle)	Manifold Bleed Valve Open	DTW Interface probe (ft)	DPE Vacuum ("Hg)	Blower Inlet Vacuum ("Hg)	Temperature at Measurment point (°F)	Air Flow Meter (scfm)	VOCs (ppmv)	Mass Removal Rate[a] (lb/day)	Cumulative Mass Removed (lb)	Note
DPE-1 test																
02.17.15	12:05	--	--	3513.68	--	263	yes	21.86	23.10	--	--	--	--	--	--	Beginning of test in DPE-1
	13:15	70.00	70	3625.77	1.60	347	50%	21.43	6.00	6.00	64.5	12.46	163.3	0.7	--	
	14:20	65.00	135	3676.12	0.77	435	no	21.23	20.00	20.00	65.7	16.92	191.0	0.9	0.038	
	14:57	37.00	172	--	--	477	no	20.72	20.00	20.00	68.2	17.50	227.0	1.2	0.069	
	16:30	93.00	265	3789.35	1.22	641	no	20.76	20.00	20.00	69.1	26.03	509.0	2.6	0.238	
	17:30	60.00	325	3828.32	0.65	749	no	20.72	20.00	20.00	61.2	36.58	390.0	4.6	0.430	
	18:30	60.00	385	3995.47	2.79	826	no	20.75	20.00	20.00	61.1	82.42	--	8.9	0.800	
	19:30	60.00	445	4035.07	0.66	919	no	20.78	20.50	20.50	58.4	100.11	352.5	8.9	1.170	
	21:00	90.00	535	4087.82	0.59	1001	no	20.77	21.00	20.30	49.0	85.10	377.3	11.1	1.862	
	21:45	45.00	580	4129.01	0.92	1066	no	20.75	20.50	20.10	55.0	102.65	376.4	11.6	2.224	
	22:30	45.00	625	4166.05	0.82	1124	no	20.80	20.50	20.50	52.8	104.20	349.7	12.3	2.608	
	23:30	60.00	685	4215.95	0.83	1198	no	20.75	20.50	20.10	61.2	102.40	631.0	16.6	3.300	
02.18.15	0:30	60.00	745	4279.59	1.06	1277	no	20.80	20.50	20.10	57.2	100.86	422.9	17.5	4.030	
	1:30	60.00	805	4313.62	0.57	1350	no	20.77	20.30	20.00	57.4	123.26	381.3	14.8	4.645	
	2:30	60.00	865	4363.01	0.82	1426	no	20.76	20.50	20.10	60.9	111.58	682.6	20.5	5.498	
	3:30	60.00	925	4426.53	1.06	1504	no	20.80	20.50	20.10	61.3	113.42	621.4	24.0	6.499	
	4:30	60.00	985	4468.11	0.69	1573	no	20.78	20.50	20.10	54.7	122.47	681.5	25.2	7.547	
	5:30	60.00	1045	4518.10	0.83	1650	no	20.80	20.50	20.10	56.9	125.10	704.1	28.1	8.717	
	6:30	60.00	1105	4554.40	0.60	1722	no	20.78	20.50	20.10	59.1	118.86	355.2	21.2	9.599	
	7:35	65.00	1170	4605.99	0.79	1800	no	20.75	20.50	20.10	58.4	127.52	346.7	14.2	10.238	
	8:30	55.00	1225	4682.17	1.39	1919	no	20.72	25.00	25.00	67.8	83.72	426.1	13.4	10.749	
	10:30	120.00	1345	4756.50	0.62	2033	no	20.72	20.50	20.00	73.6	112.45	465.0	14.3	11.941	
	12:30	120.00	1465	4762.81	0.05	2215	no	24.93	21.50	21.00	72.6	106.60	418.0	15.8	13.261	
	14:30	120.00	1585	4823.06	0.50	2314	no	24.95	21.00	20.30	74.7	115.16	405.0	14.9	14.507	
	16:30	120.00	1705	4929.53	0.89	2470	no	24.96	22.00	21.50	68.6	116.02	384.0	14.9	15.751	
	18:30	120.00	1825	5011.34	0.68	2617	no	24.95	22.00	21.00	67.4	118.43	424.0	15.5	17.044	
	20:30	120.00	1945	5104.55	0.78	2767	no	24.93	21.50	21.00	69.8	116.59	426.4	16.4	18.407	
	22:30	120.00	2065	5201.95	0.81	2924	no	24.78	21.50	21.00	66.5	113.74	473.5	17.0	19.822	
02.19.15	0:30	120.00	2185	5393.92	1.60	3070	no	24.81	22.00	20.50	65.8	128.16	416.7	17.6	21.291	
	2:30	120.00	2305	5499.91	0.88	3224	no	24.80	22.00	21.00	64.0	121.40	459.1	17.9	22.782	
	4:30	120.00	2425	5576.27	0.64	3365	no	24.88	21.50	21.00	65.4	102.75	476.2	17.2	24.213	
	6:30	120.00	2545	5665.65	0.74	3507	no	24.85	21.50	20.60	64.2	113.90	483.6	17.0	25.632	
	8:30	120.00	2665	5783.17	0.98	3698	no	24.94	21.50	21.00	65.7	118.33	384.0	16.5	27.006	End of test in DPE-1
DPE-2 test																
02.19.15	14:00	330.00	2995	6042.22	--	4190	no	11.00	6.00	6.00	53.9	38.11	70.0	0.9	27.207	Beginning of test in DPE-2
	15:30	90.00	3085	6603.76	6.24	5096	no	11.20	6.00	6.00	54.8	43.80	90.1	1.1	27.274	VOCs reading was post-dilution
	19:30	240.00	3325	7917.00	5.47	Switch to ES	yes	18.50	13.50	12.60	54.8	86.58	74.9	1.8	27.567	Use Grundfoss, VOCs reading was post-dilution
	20:30	60.00	3385	8432.00	8.58	--	50%	18.75	13.50	12.90	69.0	92.13	399.4	12.1	28.069	
	21:30	60.00	3445	8942.00	8.50	--	50%	18.60	14.50	13.50	57.4	82.69	426.8	11.8	28.562	
	22:30	60.00	3505	9451.00	8.48	--	50%	18.40	14.00	13.20	56.5	81.71	380.7	10.9	29.015	
	23:30	60.00	3565	9933.00	8.03	--	50%	18.40	14.00	12.90	59.8	81.34	--	10.1	29.435	
02.20.15	0:30	60.00	3625	10439.00	8.43	--	50%	18.50	14.00	13.20	60.4	87.57	356.0	10.1	29.855	
	1:30	60.00	3685	10800.00	6.02	--	50%	18.80	14.00	13.00	61.1	89.40	371.8	10.5	30.294	
	2:30	60.00	3745	11325.00	8.75	--	50%	18.80	14.00	13.10	62.9	82.31	490.1	12.1	30.799	
	3:30	60.00	3805	11778.00	7.55	--	50%	18.30	14.00	13.10	63.9	86.52	--	12.7	31.327	
	4:30	60.00	3865	12221.00	7.38	--	50%	18.50	14.00	13.00	64.1	88.41	411.9	12.7	31.855	
	5:30	60.00	3925	12677.00	7.60	--	50%	18.40	14.00	13.10	63.8	91.43	426.5	12.3	32.369	
	6:30	60.00	3985	13000.00	5.38	--	50%	18.55	14.00	13.10	64.5	89.40	426.8	12.6	32.895	
	7:30	60.00	4045	13548.00	9.13	--	50%	18.35	14.00	13.00	65.2	83.59	--	11.6	33.379	
	8:00	30.00	4075	13895.00	11.57	--	50%	19.25	14.00	13.00	62.7	84.63	--	11.6	33.621	
	9:00	60.00	4135	14250.40	5.92	--	50%	19.63	14.00	13.20	58.4	89.60	390.0	11.6	34.105	
	10:00	60.00	4195	14883.00	10.54	--	50%	19.35	15.00	15.00	52.8	85.48	--	10.6	34.547	
	12:00	120.00	4315	15472.00	4.91	--	50%	21.45	14.00	14.50	53.3	84.55	359.0	10.0	35.380	
	14:00	120.00	4435	16367.00	7.46	--	50%	21.92	14.50	15.00	54.7	87.70	370.0	10.3	36.237	
	16:00	120.00	4555	17392.00	8.54	--	50%	19.00	18.00	18.00	52.1	105.08	245.0	9.7	37.046	
	18:00	120.00	4675	18287.00	7.46	--	50%	20.93	18.00	18.00	50.9	117.36	316.0	10.2	37.897	
	20:00	120.00	4795	19123.00	6.97	--	30%	22.00	18.80	18.80	62.4	62.14	310.0	9.2	38.664	
	22:00	120.00	4915	19925.00	6.68	--	30%	22.00	18.20	18.20	61.8	64.50	296.0	6.3	39.188	
02.21.15	0:00	120.00	5035	20762.00	6.98	--	30%	22.00	16.40	15.50	62.7	73.46	156.0	5.1	39.613	
	2:00	120.00	5155	21621.00	7.16	--	30%	22.00	18.00	17.20	61.0	62.42	369.0	5.8	40.100	
	4:00	120.00	5275	22411.00	6.58	--	30%	22.00	18.00	17.70	63.4	66.21	313.0	7.2	40.699	
	6:00	120.00	5395	23325.00	7.62	--	20%	17.72	20.00	20.00	60.0	51.26	374.3	6.6	41.249	
	8:00	120.00	5515	24253.00	7.73	--	20%	19.18	19.50	20.00	58.5	52.05	175.5	4.7	41.637	
	10:00	120.00	5635	25163.00	7.58	--	20%	18.90	19.75	20.00	51.6	62.90	216.7	3.7	41.945	End of test in DPE-2

Note:

hh:mm = hour:minute
min = minute
gal = gallon
gpm = gallon per minute
°F = Fahrenheit
ft = feet
DTW = depth to water
DPE = dual phase extraction
"Hg = inches of mercury
ES = Electric Submersible
scfm = standard cubic feet per minute
ppmv = parts per million by volume
lb = pound
VOCs = Volatile organic compounds

[a]Mass removal rate calculated using average VOCs concentrations between time period for instances following post-dilution concentrations readings
Mass Removal Rate Equation:
((Average VOCs)/1000000)*(Average Volumetric Air Flow Rate))*(1440 min/day)*(1/379 ft3 air/mole)*(86.2lb/lb mole)
with: VOCs in ppmv Air flow rate in scfm Mass Removal Rate in lb/day

TABLE 6
System and Extraction Well Data – Pilot Test DPE-3
Chevron Environmental Management Company
Pilot Test Summary Memorandum
Former Unocal Edmonds Bulk Fuel Terminal
Edmonds, Washington

Date	Time (hh:mm)	Elapsed Time Since Last Measurement (min)	Operating Period (cumulative hrs)	Cumulative Gallons (totalizer, gal)	Calculated pumping rate (gpm)	Manifold Bleed Valve Open	DTW Interface probe (ft)	DPE Vacuum ("Hg)	Blower Inlet Vacuum ("Hg)	Temperature at Measurment point (°F)	Air Flow Meter (scfm)	VOCs (ppmv)	Mass Removal Rate[a] (lb/day)	Cumulative Mass Removed (lb)	Note
DPE-3 test															
03.30.15	9:00	--	--	25808.11			4.63								
	11:00	120	0	27049.11	225.41	no	8.50	10.5	13.50	61.2	100	35	1.1	0.096	Beginning of test
	12:00	60	1	27594.11	9.08	no	7.60	10.5	14.00	58.9	95	51	1.4	0.153	
	13:00	60	2	28001.11	6.78	no	8.20	10.5	14.00	57.5	95	60	1.7	0.225	
	14:00	60	3	28802.11	13.35	no	8.85	10.5	14.00	59.8	95	68	2.0	0.308	
	16:00	120	5	29806.11	8.37	no	9.65	12.0	14.00	61.9	97	69	2.2	0.487	
	17:00	60	6	30471.11	11.08	no	10.10	12.0	13.80	63.5	97	78	2.3	0.584	
	18:00	60	7	31075.11	10.07	no	14.00	0.0	0.00	--	--	--	2.8	0.702	SVE System restarting but pumping continued
	19:00	60	8	31696.94	10.36	no	10.30	10.0	13.50	63.1	97	100	2.8	0.820	
	20:00	60	9	32219.00	8.70	no	10.80	10.0	13.80	57.6	97	100	3.2	0.952	
	21:00	60	10	32982.00	12.72	no	11.30	10.0	13.80	55.5	97	90	3.0	1.078	
	23:00	120	12	34168.00	9.88	no	11.90	9.5	13.80	55.4	97	111	3.2	1.344	
03.31.15	1:00	120	14	35359.00	9.93	no	12.50	9.5	13.80	55.9	97	109	3.5	1.636	
	3:00	120	16	36582.00	10.19	no	--	9.5	13.80	54.2	97	115	3.6	1.932	
	5:00	120	18	37767.11	9.88	no	13.40	9.5	13.80	55.1	97	112	3.6	2.233	
	7:00	120	20	38826.11	8.83	no	13.75	9.0	13.80	53.4	97	115	3.6	2.533	
	9:00	120	22	39907.11	9.01	no	13.95	9.0	13.80	56.1	99	116	3.7	2.842	
	11:00	120	24	41200.11	10.78	no	13.95	10.0	14.20	55.2	99	132	4.0	3.177	
	13:00	120	26	42366.11	9.72	no	13.80	10.7	14.50	55.9	81	140	4.0	3.511	
	15:00	120	28	43508.11	9.52	no	14.20	11.0	14.40	61.7	77	130	3.5	3.802	
	17:00	120	30	44694.11	9.88	no	17.12	8.00	10.70	56.7	45	130	2.6	4.019	Reduced well head vacuum
	18:00	60	31	45266.11	9.53	no	16.72	8.00	10.90	56.0	46	131	1.9	4.100	
	19:00	60	32	45820.00	9.23	no	16.40	8.00	10.80	54.2	45	132	2.0	4.181	
	20:00	60	33	46460.00	10.67	no	16.50	8.00	10.90	54.7	45	130	1.9	4.262	

Note:

hh:mm = hour:minute
gal = gallon
gpm = gallon per minute
°F = Fahrenheit

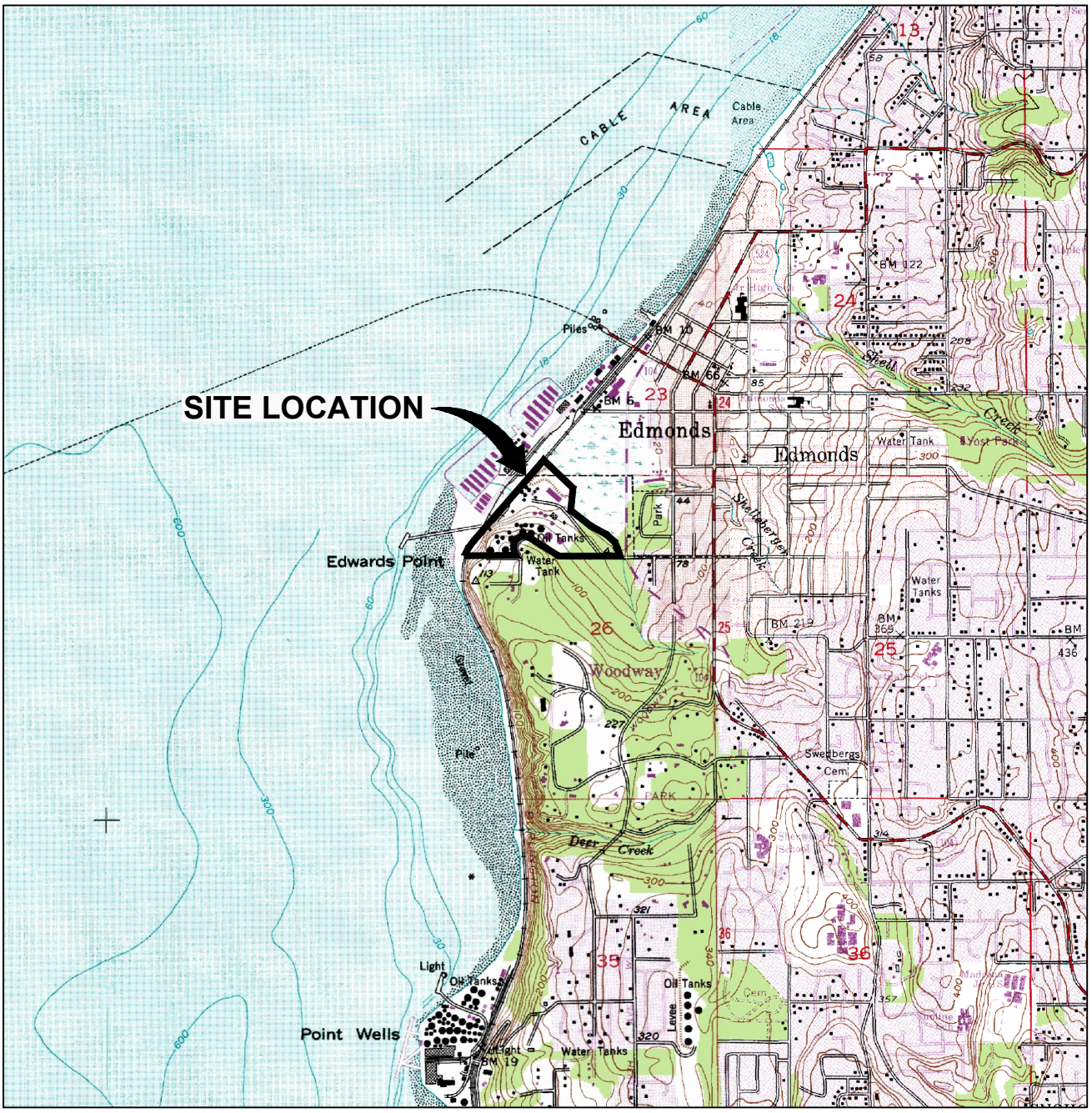
ft = feet
DTW = depth to water
"Hg = inches of mercury
ES = Electric Submersible

scfm = standard cubic feet per minute
ppmv = parts per million by volume
VOCs = Volatile organic compounds
SVE = Soil Vapor Extraction

[a]Mass removal rate calculated using average VOCs concentrations between time period for instances following post-dilution concentrations readings
Mass Removal Rate Equation:
((Average VOCs)/1000000)*(Average Volumetric Air Flow Rate))*(1440 min/day)*(1/379 ft3 air/mole)*(86.2lb/lb mole)
with: VOCs in ppmv Air flow rate in scfm Mass Removal Rate in lb/day

ARCADIS

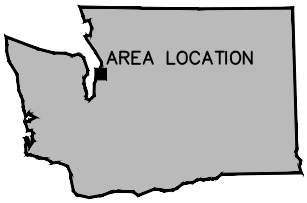
Figures



REFERENCE: USGS QUADS., 7.5 MIN. SERIES (TOPOGRAPHIC) - EDMONDS EAST, WASH. AND EDMONDS WEST, WASH.

0 0.5 1.0

Approximate Scale: 1"=0.5 Miles



WASHINGTON

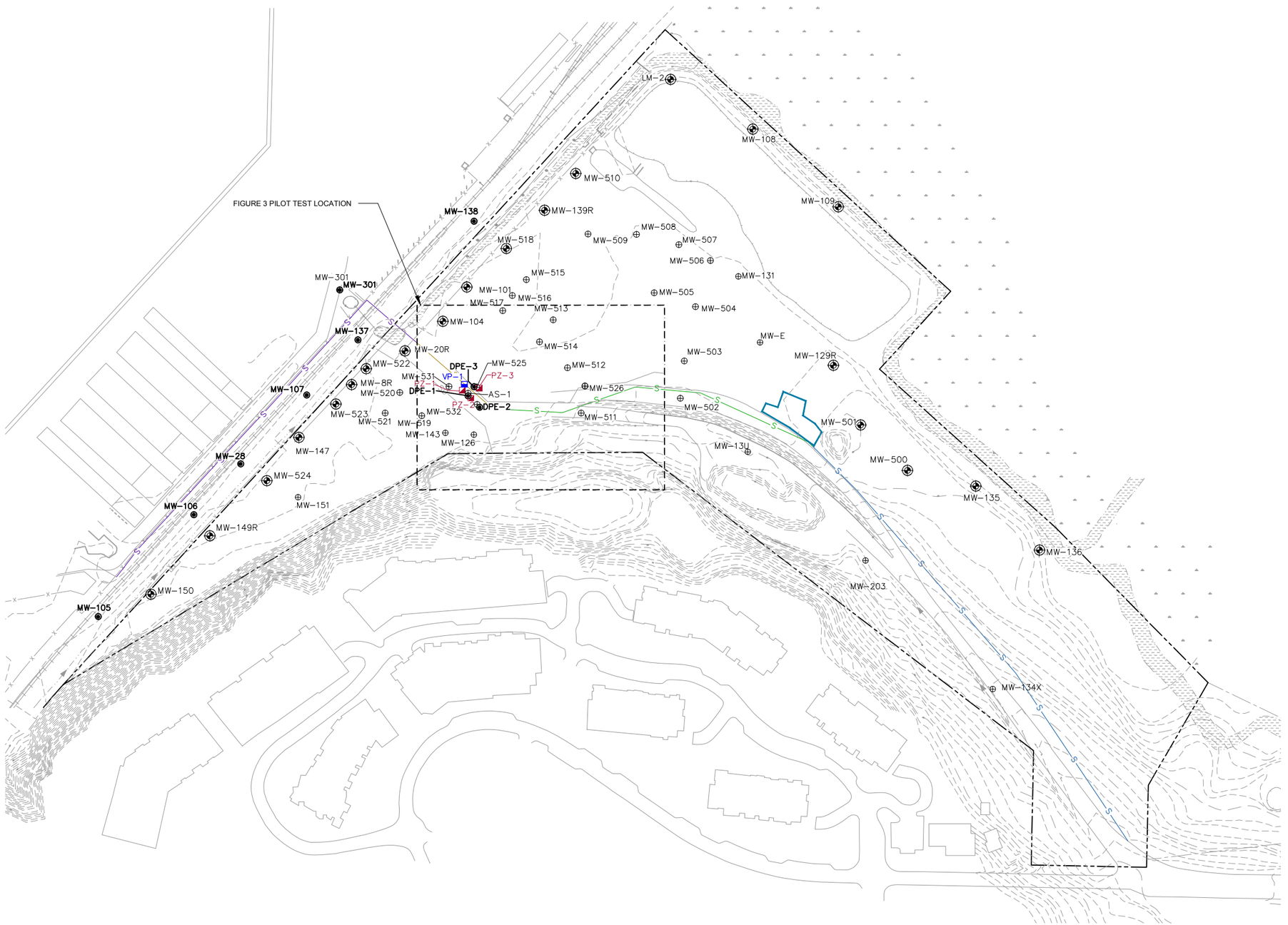
CHEVRON ENVIRONMENTAL MANAGEMENT COMPANY
FORMER UNOCAL BULK FUEL TERMINAL
EDMONDS, WASHINGTON

PILOT TEST SUMMARY MEMORANDUM

SITE LOCATION MAP

ARCADIS

FIGURE 1



LEGEND:

DPE-1 ⊕	DPE WELL LOCATION
MW-203 ⊕	INTERIOR MONITORING WELL LOCATION AND DESIGNATION
MW-108 ⊕	PERIMETER MONITORING WELL LOCATION
PZ-1	PIEZOMETER WELL LOCATION
VP-1	SOIL VAPOR PROBE / SAMPLING LOCATION
———	PROPERTY BOUNDARY
——S———	WSDOT STORMWATER LINE
——SD———	POINT EDWARDS STORM DRAIN LINE

NOTES:

1. BUILDING AND ROAD INFORMATION DIGITIZED FROM GOOGLE EARTH AERIAL PHOTO. TOPOGRAPHIC CONTOURS WERE OBTAINED FROM AN UNKNOWN SOURCE. ALL LOCATIONS ARE APPROXIMATE AND SHALL BE VERIFIED IN THE FIELD BY CONTRACTOR PRIOR TO CONSTRUCTION.
2. HORIZONTAL DATUM: WASHINGTON STATE COORDINATE SYSTEM NORTH ZONE (NAD 83/98).
   VERTICAL DATUM: N.A.V.D. 88
   UNITS: U.S. SURVEY FEET
   HORIZONTAL AND VERTICAL CONTROL ESTABLISHED BY GPS VIA VERTICAL REFERENCE STATION NETWORK (VRSN).
3. SOUTHEAST PORTION OF WSDOT STORMWATER LINE HAS NOT BEEN SURVEYED.
4. LOCATION OF EXISTING POWER SUPPLY PANEL HAS NOT BEEN SURVEYED.

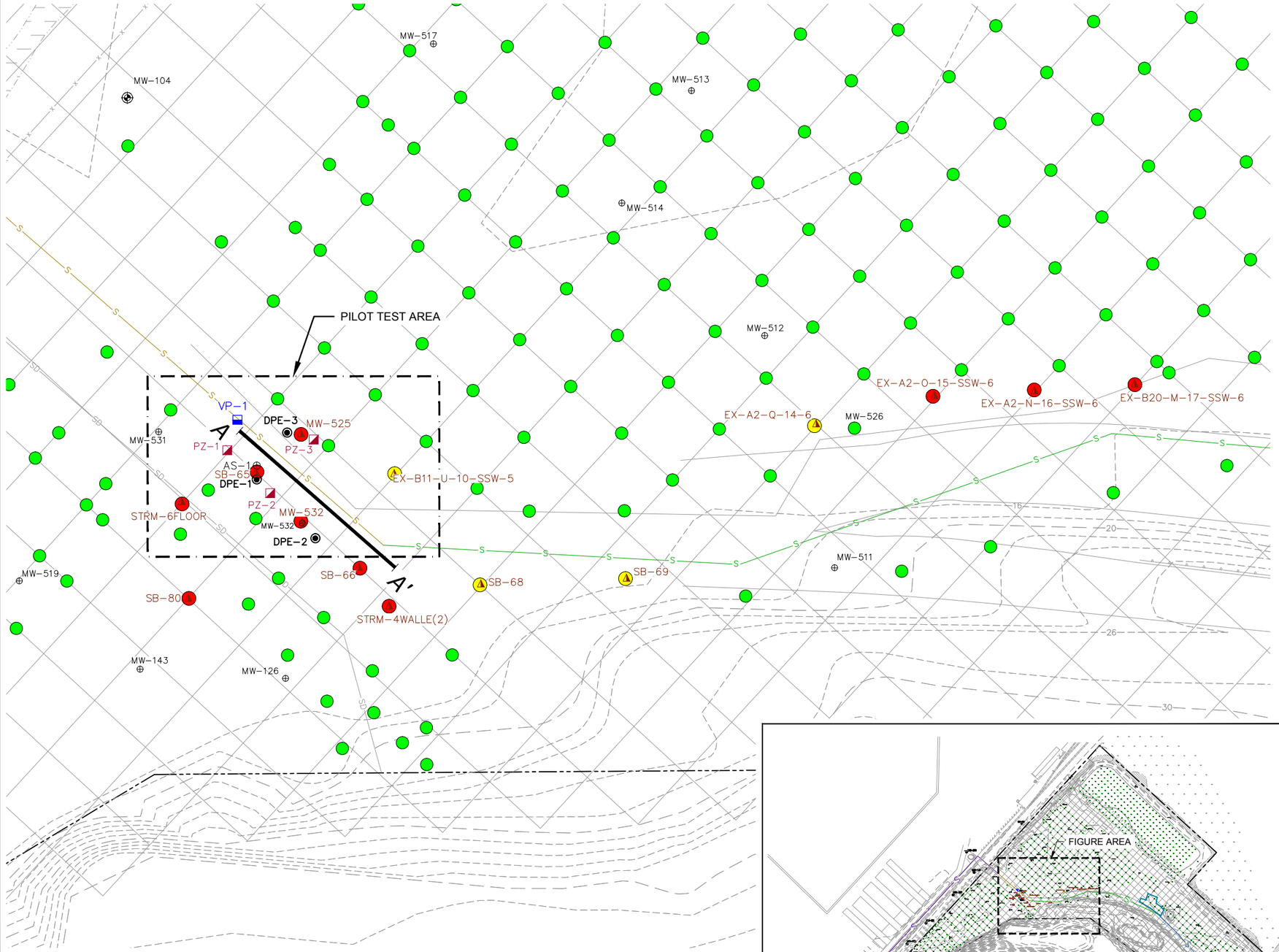
0 100' 200'
GRAPHIC SCALE

CHEVRON ENVIRONMENTAL MANAGEMENT COMPANY
FORMER UNOCAL BULK FUEL TERMINAL
EDMONDS, WASHINGTON
PILOT TEST SUMMARY MEMORANDUM

SITE MAP

ARCADIS

FIGURE
2



LEGEND:

- DPE-1 ◉ — DPE WELL LOCATION
- MW-203 ⊕ — INTERIOR MONITORING WELL LOCATION AND DESIGNATION
- MW-108 ⊕ — PERIMETER MONITORING WELL LOCATION
- PZ-1 — PIEZOMETER WELL LOCATION
- VP-1 — SOIL VAPOR PROBE / SAMPLING LOCATION
- PROPERTY BOUNDARY
- S — WSDOT STORMWATER LINE
- SD — POINT EDWARDS STORM DRAIN LINE
- A' — A — CROSS SECTION A-A'
- SOIL SAMPLE LOCATION WITH ANALYTE CONCENTRATIONS EXCEEDING SITE CULs OR RELs
- SOIL SAMPLE LOCATION WITH ANALYTE CONCENTRATIONS EXCEEDING TWICE THE CUL
- SOIL SAMPLE LOCATION WITH ANALYTE CONCENTRATIONS LESS THAN SOIL CULs/RELs

NOTES:

1. BUILDING AND ROAD INFORMATION DIGITIZED FROM GOOGLE EARTH AERIAL PHOTO. TOPOGRAPHIC CONTOURS WERE OBTAINED FROM AN UNKNOWN SOURCE. ALL LOCATIONS ARE APPROXIMATE AND SHALL BE VERIFIED IN THE FIELD BY CONTRACTOR PRIOR TO CONSTRUCTION.
2. HORIZONTAL DATUM: WASHINGTON STATE COORDINATE SYSTEM NORTH ZONE (NAD 83/98).
   VERTICAL DATUM: N.A.V.D. 88
   UNITS: U.S. SURVEY FEET
   HORIZONTAL AND VERTICAL CONTROL ESTABLISHED BY GPS VIA VERTICAL REFERENCE STATION NETWORK (VRSN).
3. SOUTHEAST PORTION OF WSDOT STORMWATER LINE HAS NOT BEEN SURVEYED.
4. LOCATION OF EXISTING POWER SUPPLY PANEL HAS NOT BEEN SURVEYED.

0 20' 40'
GRAPHIC SCALE

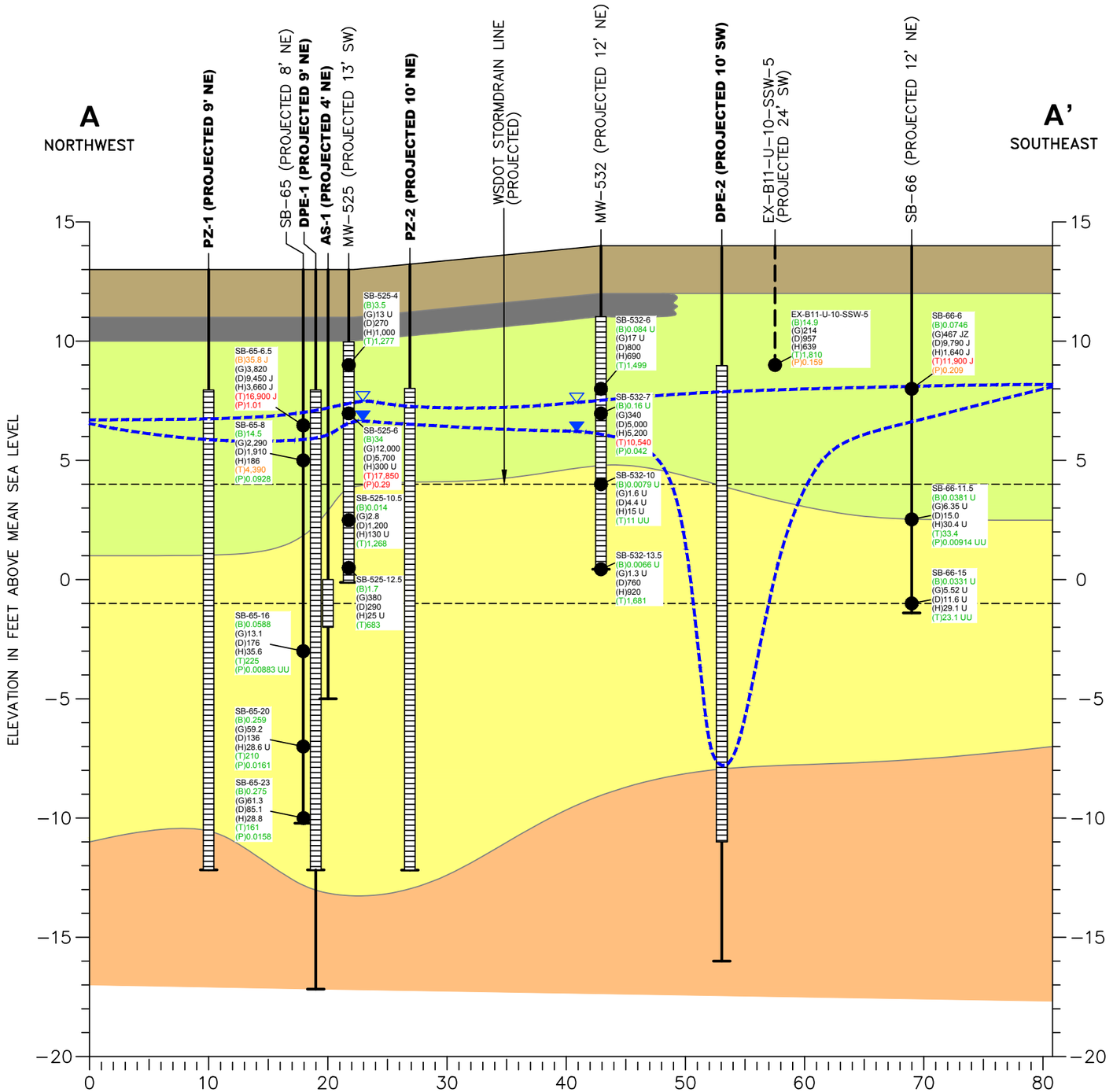
CHEVRON ENVIRONMENTAL MANAGEMENT COMPANY
FORMER UNOCAL BULK FUEL TERMINAL
EDMONDS, WASHINGTON
PILOT TEST SUMMARY MEMORANDUM

PILOT TEST LAYOUT

ARCADIS

FIGURE
3

CITY:SYRACUSE-NY DIV/GROUP:ENVCAD DB:G.STEINBERGER LD: PIC:M.FLEISCHNER PM:S.ZORN TM:P.CAMPBELL LYR:(Opt)ON=*;OFF=*REF*
C:\Users\jharris\Desktop\ENVCAD\B00453620006\00003\Pilot Test Summary Memo\DWG\45362G03.dwg LAYOUT: 3 SAVED: 2/29/2016 10:57 AM ACADVER: 19.1S (LMS TECH) PAGESETUP: C-LD2B-PDF-CONV PLOTSTYLETABLE: PLTFULL.CTB PLOTTED: 3/3/2016 2:15 PM BY: HARRIS, JESSICA
XREFS:
45362X00
45362X02
45362X03
IMAGES:



MW-532 (PROJECTED 12' NE)

SB-532-7
(B)0.16 U
(G)340
(D)5,000
(H)5,200
(T)10,540
(P)0.042

LEGEND:

WELL OR BORING ID, PROJECTED DISTANCE AND DIRECTION **(BOLD REPRESENTS AS/DPE WELLS)**

GROUND SURFACE

HISTORICAL HIGH WATER LEVEL

DPE PILOT TEST STATIC WATER LEVEL AND DRAW DOWN AT ~80 HOURS OF PUMPING

HISTORICAL LOW WATER LEVEL

LITHOLOGIC CONTACT (DASHED WHERE INFERRED)

SAMPLE ID AND DEPTH
B = BENZENE (mg/kg)
G = GASOLINE RANGE ORGANICS (mg/kg)
D = DIESEL RANGE ORGANICS (mg/kg)
H = HEAVY RANGE ORGANICS (mg/kg)
T = TOTAL HYDROCARBONS (mg/kg)
P = TOTAL PAHs (mg/kg)

SCREENED INTERVAL

BOTTOM OF BORING

- ASPHALT
- SAND/GRAVEL BACKFILL
- SILTY SAND WITH GRAVEL (1929 FILL) MEDIUM TO FINE, LOW PLASTIC FINES
- SILTY SAND, FINE TO VERY FINE
- FINE TO VERY FINE SAND

(12' NE)= OFFSET DISTANCE FROM CROSS SECTION
PAH POLYNUCLEAR AROMATIC HYDROCARBONS
mg/kg MILLIGRAMS PER KILOGRAM
NE NORTHEAST
SW SOUTHWEST
CUL CLEANUP LEVEL

SOIL CLEANUP LEVELS	
BENZENE = 18 mg/kg	GREEN = BELOW CUL
TPH = 2,775 mg/kg	ORANGE = ABOVE CUL
TOTAL CPAHs = 0.14 mg/kg	RED = >2x CUL

VERTICAL EXAGGERATION: 2x

0 5' 10'
VERTICAL SCALE

0 10' 20'
HORIZONTAL SCALE

CHEVRON ENVIRONMENTAL MANAGEMENT COMPANY
FORMER UNOCAL BULK FUEL TERMINAL
EDMONDS, WASHINGTON
PILOT TEST SUMMARY MEMORANDUM

DPE CROSS SECTION A-A'

ARCADIS

FIGURE
4

CITY: PHOENIX, AZ DIV/GROUP: ENVCAD DB: A. REYES, T. HUTCHINS-WASS, J. HARRIS
G:\ENVCAD\Minneapolis-MNNACT\B00453620006\00003\DWG\453622G04.dwg LAYOUT: 4 SAVED: 3/32016 4:19 PM ACADVER: 19.1S (LMS TECH) PAGESETUP: --- PLOTSTYLETABLE: ARCADIS.CTB PLOTTED: 3/32016 4:21 PM BY: OBERLANDER, ROSEANNE

Attachment A

Boring Logs

Date Start/Finish: 2/10/2015
Drilling Company: Cascade Drilling
Driller's Name: Curtis A.
Drilling Method: Hollow Stem Auger
Auger Size: 10" Outer Diameter
Rig Type: Truck Mounted
Sampling Method: Split Spoon

Northing: NE
Easting: NE
Casing Elevation: NE

Borehole Depth: 30' bgs
Surface Elevation: NE

Descriptions By: SLM

Well/Boring ID: **DPE-1**

Client: Chevron EMC

Location: Edmonds Terminal, 11720 Unoco Rd, Edmonds, WA

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	Blow Counts	N-Value	PID Headspace (ppm)	Analytical Sample	USCS Code	Geologic Column	Stratigraphic Description	Well/Boring Construction
0	0										Topsoil	18 inch well box
											Fill	J-Plug
												Concrete
			2-2.5	0	NA	NA	NA				No recovery, 12 inches of asphalt	
												Riser Sch. 40 PVC - 4 inch diameter
												Bentonite
		HA	4.5 - 5	.5	NA	NA	162.9		SM		Silty Sand, medium to fine sand, trace small gravel, well graded, dark brown, wet, HCLO	Water first encountered
5	-5											
		HA	7-7.5	0	NA	NA	NA				No recovery, too wet for hand auger	
		1	8.5 -10	1.0	1 1 1	2	730.1				Sand, medium grain, poorly graded, dark brown, wet, HCLO	
10	-10											
		2	11-12.5	0	NA	NA	NA				Sample interval missed by driller	
									SP			
		3	13.5 -15	1.5	1 2 1	3	296				Same As Above at the 10 foot interval	
15	-15											0.020 Slot Screen Sch. 40 PVC

ARCADIS
Infrastructure · Water · Environment · Buildings

Remarks: bgs = below ground surface
NA = Not Available
ppm = parts per million
NE = Not Established
HA = Hand Auger
HCLO = Hydrocarbon like odor

Date Start/Finish: 2/10/2015
Drilling Company: Cascade Drilling
Driller's Name: Curtis A.
Drilling Method: Hollow Stem Auger
Auger Size: 10" Outer Diameter
Rig Type: Truck Mounted
Sampling Method: Split Spoon

Northing: NE
Easting: NE
Casing Elevation: NE

Borehole Depth: 30' bgs
Surface Elevation: NE

Descriptions By: SLM

Well/Boring ID: **DPE-1**

Client: Chevron EMC

Location: Edmonds Terminal, 11720 Unoco Rd, Edmonds, WA

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	Blow Counts	N-Value	PID Headspace (ppm)	Analytical Sample	USCS Code	Geologic Column	Stratigraphic Description	Well/Boring Construction
		4	16-17.5	1.5	1 1 1	2	463				Same As Above	
		5	18.5 -20	1.5	1 2 2	4	343		SP		Sand, medium to fine grain, poorly graded, silt seam at 19 feet, dark brown, wet, HCLO	#2/12 Sand
20	-20											
		6	21-22.5	1.5	2 2 1	3	421		SP		Sand, medium to fine grain, poorly graded, dark brown, wet, HCLO, noticible sheen	
		7	23.5 -25	1.5	1 1 1	2	359				Same As Above	
25	-25											
		8	26-27.5	0	NA	NA	NA				No recovery due to well heaving - the driller inserted a well plug	
		9	27.5 -29	1.5	NA	NA	582		CM		Clay and Silt, dense, woody debris, dark brown, wet, no odor	Sump Sch. 40 PVC
		10	29-30	1.0	NA	NA	582				Same as Above, the bottom two intervals were combined and screened	
30	-30											

ARCADIS
Infrastructure · Water · Environment · Buildings

Remarks: bgs = below ground surface
NA = Not Available
ppm = parts per million
NE = Not Established
HA = Hand Auger
HCLO = Hydrocarbon like odor

Date Start/Finish: 2/10/2015
Drilling Company: Cascade Drilling
Driller's Name: Curtis A.
Drilling Method: Hollow Stem Auger
Auger Size: 10" Outer Diameter
Rig Type: Truck Mounted
Sampling Method: Split Spoon

Northing: NE
Easting: NE
Casing Elevation: NE

Borehole Depth: 30' bgs
Surface Elevation: NE

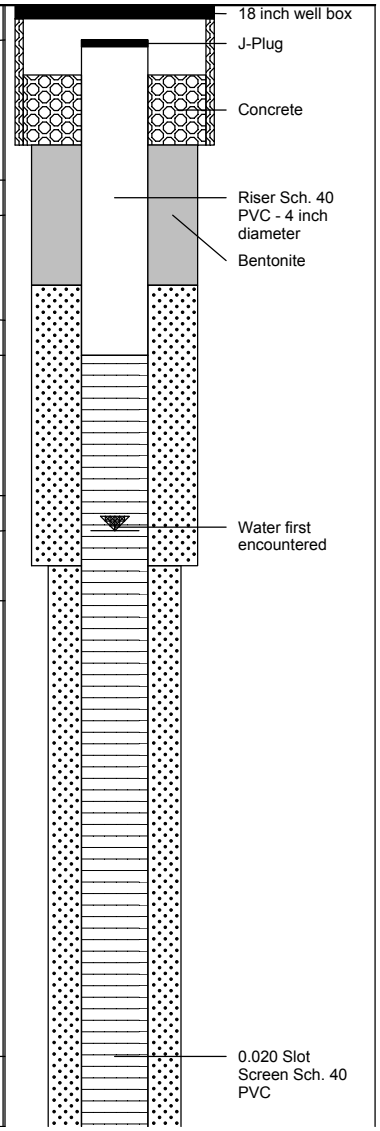
Descriptions By: SLM

Well/Boring ID: **DPE-2**

Client: Chevron EMC

Location: Edmonds Terminal, 11720 Unoco Rd, Edmonds, WA

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	Blow Counts	N-Value	PID Headspace (ppm)	Analytical Sample	USCS Code	Geologic Column	Stratigraphic Description
0	0										Topsoil
		HA	2.5-3	.5	NA	NA	0.7		SG		Sand, small Gravel, fine to course grain size, well graded, brown, no HCLO
		HA	4.5 - 5	.5	NA	NA	77.7		SP		Sand, medium to fine grain, poorly graded, grey, no HCLO
5	-5										
		HA	7-7.5	.5	NA	NA	20.5		SG		Sand, coarse to medium grain, trace small gravel, grey, wet
		1	8.5 -10	1.5	1 2 1	3	4.3				Sand, medium grain, poorly graded, grey, wet, no HCLO
10	-10										
		2	11-12.5	1.5	2 5 4	9	1.4		SP		Same As Above
		3	13.5 -15	1.5	4 7 2	9	13.4				Same As Above
15	-15										



ARCADIS
Infrastructure · Water · Environment · Buildings

Remarks: bgs = below ground surface
NA = Not Available
ppm = parts per million
NE = Not Established
HA = Hand Auger
HCLO = Hydrocarbon like odor

Project Number:B0045362
Data File:

Date: 5/20/2015 Created/Edited by:RwL

Date Start/Finish: 2/10/2015
Drilling Company: Cascade Drilling
Driller's Name: Curtis A.
Drilling Method: Hollow Stem Auger
Auger Size: 10'' Outer Diameter
Rig Type: Truck Mounted
Sampling Method: Split Spoon

Northing: NE
Easting: NE
Casing Elevation: NE

Borehole Depth: 30' bgs
Surface Elevation: NE

Descriptions By: SLM

Well/Boring ID: **DPE-2**

Client: Chevron EMC

Location: Edmonds Terminal, 11720 Unoco Rd, Edmonds, WA

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	Blow Counts	N-Value	PID Headspace (ppm)	Analytical Sample	USCS Code	Geologic Column	Stratigraphic Description	Well/Boring Construction
		4	16-17.5	1.5	7 9 10	19	12.7				Sand, medium grain, porrly graded, brown, no HCLO, wet	
		5	18.5 -20	1.5	6 8 9	17	7.1		SP		Same As Above	#2/12 Sand
20	-20											
		6	21-22.5	1.5	7 9 10	19	3.5				Same As Above	
		7	23.5 -25	1.5	16 20 20	40	7.4		SP		Sand, medium to fine grain, poorly graded, dark grey, no HCLO, wet	
25	-25											
		8	26-27.5	1.5	11 16 25	41	5.6		SM		Silty Sand, medium to fine grain, poorly graded, brown, no HCLO, wet	Sump Sch. 40 PVC
		9	28.5 -30	1.5	6 10 15	25	4.5		SM		Silty Sand, medium grain, poorly graded, brown, No HCLO, wet	
30	-30											

ARCADIS
Infrastructure · Water · Environment · Buildings

Remarks:
bgs = below ground surface
NA = Not Available
ppm = parts per million
NE = Not Established
HA = Hand Auger
HCLO = Hydrocarbon like odor

Date Start/Finish: 3/23/15 - 3/24/15 **Drilling Company:** Cascade Drilling **Driller's Name:** James G. **Drilling Method:** Hollow Stem Auger **Auger Size:** 10'' Outer Diameter **Rig Type:** Truck Mounted **Sampling Method:** Split Spoon	**Northing:** NE **Easting:** NE **Casing Elevation:** NE **Borehole Depth:** 22' bgs **Surface Elevation:** NE **Descriptions By:** RL/RB	**Well/Boring ID:** **DPE-3** **Client:** Chevron EMC **Location:** Edmonds Terminal, 11720 Unoco Rd, Edmonds, WA

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	Blow Counts	N-Value	PID Headspace (ppm)	Analytical Sample	USCS Code	Geologic Column	Stratigraphic Description	Well/Boring Construction
0	0										Topsoil and gravel/cobbles	18 inch well box
											Fill	J-Plug
												Concrete
		HA	2.5-3	.5	NA	NA	132.8		SP		Sand fill - poorly graded medium sand, loose, brown, dry, HCLO	Riser Sch. 40 PVC - 4 inch diameter
											Cleared past 20-Mil Polyethylene sheeting at 4.5 feet bgs, which delineates Phase I 2007/2008 excavation and un-excavated soils around the WSDOT Stormwater Line	Bentonite
5	-5	HA	5-5.5	.5	NA	NA	807		CH		Clay with trace Organics - clay has medium to high plasticity, organics are woody debris, thick black substance with sheen, dark brown to grey and black color, moist, HCLO	
		HA	7.5-8	.5	NA	NA	1,035		SC		Sand with Clay and Organics - Sand fine to coarse, well graded, clay has low plasticity, organics are roots, grey, wet, HCLO	
											cleared hole with air knife and vacuum to 8.5 feet bgs	Water first encountered
10	-10	1	10-11.5	1.5	6 6 9	15	1,267				Sand with little Gravel and trace Silt - well graded, sand is fine to coarse, gravel is small to medium and subrounded, grey, wet, HCLO	
									SG			0.020 Slot Screen Sch. 40 PVC

ARCADIS
Infrastructure · Water · Environment · Buildings

Remarks:
bgs = below ground surface
NA = Not Available
ppm = parts per million
NE = Not Established
HA = Hand Auger
HCLO = Hydrocarbon like odor

Date Start/Finish: 3/23/15 - 3/24/15 **Drilling Company:** Cascade Drilling **Driller's Name:** James G. **Drilling Method:** Hollow Stem Auger **Auger Size:** 10" Outer Diameter **Rig Type:** Truck Mounted **Sampling Method:** Split Spoon	**Northing:** NE **Easting:** NE **Casing Elevation:** NE **Borehole Depth:** 22' bgs **Surface Elevation:** NE **Descriptions By:** RL/RB	**Well/Boring ID: DPE-3** **Client:** Chevron EMC **Location:** Edmonds Terminal, 11720 Unoco Rd, Edmonds, WA

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	Blow Counts	N-Value	PID Headspace (ppm)	Analytical Sample	USCS Code	Geologic Column	Stratigraphic Description	Well/Boring Construction
		2	12.5 -14	1.5	9 12 14	26	981				Same as Above - Chunck of wood found at 14 feet bgs	#2/12 Sand
15	-15	3	15- 16.5	1.5	10 11 11	22	563		SW		Sand with trace Gravel - sand is fine to coarse, gravel is very small and subrounded, wood chunck found at 16 feet bgs, grey, wet, HCLO	
		4	17.5 -19	1.5	12 16 18	34	594				Same as Above - small lenses of woody debris, decreasing gravel content	
20	-20	5	20- 21.5	1.5	6 12 10	22	346				Same as Above - woody debris throughout with a large chunck at 21.5 feet bgs	Sump Sch. 40 PVC

ARCADIS
Infrastructure · Water · Environment · Buildings

Remarks: bgs = below ground surface
NA = Not Available
ppm = parts per million
NE = Not Established
HA = Hand Auger
HCLO = Hydrocarbon like odor

Date Start/Finish: 2/10/2015
Drilling Company: Cascade Drilling
Driller's Name: Curtis A.
Drilling Method: Hollow Stem Auger
Auger Size: 10" Outer Diameter
Rig Type: Truck Mounted HSA
Sampling Method: Split Spoon

Northing: NE
Easting: NE
Casing Elevation: NE

Borehole Depth: 25 feet bgs
Surface Elevation: NE

Descriptions By: SLM

Well/Boring ID: **PZ-1**

Client: Chevron EMC

Location: Edmonds Terminal, 11720 Unoco Rd, Edmonds, WA

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	Blow Counts	N-Value	PID Headspace (ppm)	Analytical Sample	USCS Code	Geologic Column	Stratigraphic Description	Well/Boring Construction
0	0										Topsoil	10 inch well box J-Plug
		HA	2-2.5	.5	NA	NA	NA				No Recovery, Asphalt removed	Concrete
		HA	4.5 - 5	.5	NA	NA	377		SP		Sand, medium, poorly graded, brown, HCLO, dry	Riser Sch. 40 PVC - 2 inch diameter Bentonite
5	-5	HA	7-7.5	.5	NA	NA	740		SP		Sand, medium grain, trace small gravel, poorly graded, wet	
		1	8.5 -10	1.5	1 1 2	3	721				Sand, medium grain, poorly graded, dark grey, wet, HCLO	Water first encountered
10	-10	2	11-12.5	1.5	1 2 2	4	136.4				Same As Above	

Remarks:
bgs = below ground surface
NA = Not Available
ppm = parts per million
NE = Not Established
HA = Hand Auger
HCLO = Hydrocarbon like odor

ARCADIS
Infrastructure · Water · Environment · Buildings

Project Number:B0045362
Data File:

Date: 5/20/2015 Created/Edited by:RwL

Date Start/Finish: 2/10/2015
Drilling Company: Cascade Drilling
Driller's Name: Curtis A.
Drilling Method: Hollow Stem Auger
Auger Size: 10" Outer Diameter
Rig Type: Truck Mounted HSA
Sampling Method: Split Spoon

Northing: NE
Easting: NE
Casing Elevation: NE

Borehole Depth: 25 feet bgs
Surface Elevation: NE

Descriptions By: SLM

Well/Boring ID: **PZ-1**

Client: Chevron EMC

Location: Edmonds Terminal, 11720 Unoco Rd, Edmonds, WA

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	Blow Counts	N-Value	PID Headspace (ppm)	Analytical Sample	USCS Code	Geologic Column	Stratigraphic Description	Well/Boring Construction
		3	13.5 -15	1.5	2 2 4	6	347.0		SP		Same As Above	
15	-15											0.020 Slot Screen Sch. 40 PVC
		4	16- 17.5	1.5	5 4 3	7	374.6				Same As Above	#2/12 Sand
		5	18.5 -20	1.5	5 4 4	8	327				Same As Above	
20	-20											
		6	21- 22.5	1.5	5 10 9	19	165.1		SW		Sand, medium to fine grain, small gravel, well graded, dark grey, HCLO	
		7	23.5 -25	1.5	10 14 11	25	10.5		SM		Silty Sand, very fine to fine grain, poorly graded, no HCLO, wet	
25	-25											

ARCADIS
Infrastructure · Water · Environment · Buildings

Remarks: bgs = below ground surface
NA = Not Available
ppm = parts per million
NE = Not Established
HA = Hand Auger
HCLO = Hydrocarbon like odor

Date Start/Finish: 2/10/2015
Drilling Company: Cascade Drilling
Driller's Name: Curtis A.
Drilling Method: Hollow Stem Auger
Auger Size: 10" Outer Diameter
Rig Type: Truck Mounted HSA
Sampling Method: Split Spoon

Northing: NE
Easting: NE
Casing Elevation: NE

Borehole Depth: 25 feet bgs
Surface Elevation: NE

Descriptions By: SLM

Well/Boring ID: **PZ-2**

Client: Chevron EMC

Location: Edmonds Terminal, 11720 Unoco Rd, Edmonds, WA

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	Blow Counts	N-Value	PID Headspace (ppm)	Analytical Sample	USCS Code	Geologic Column	Stratigraphic Description	Well/Boring Construction
0	0										Topsoil	10 inch well box J-Plug Concrete
		HA	2-2.5	.5	NA	NA	NA				No Recovery, Asphalt removed	
		HA	4.5 - 5	.5	NA	NA	98.1		SP		Sand, medium to fine grain, poorly graded, brown, no HCLO, wet	Riser Sch. 40 PVC - 2 inch diameter Bentonite
5	-5											Water first encountered
		HA	7-7.5	.5	NA	NA	583		SP		Sand, fine grain, poorly graded, brown, HCLO, wet	
		1	8.5 -10	1.5	0 1 1	2	419				Sand, medium grain, poorly graded, dark grey, HCLO, wet	
10	-10								SP			
		2	11-12.5	1.5	4 5 6	11	122				Same As Above	

ARCADIS
Infrastructure · Water · Environment · Buildings

Remarks:
bgs = below ground surface
NA = Not Available
ppm = parts per million
NE = Not Established
HA = Hand Auger
HCLO = Hydrocarbon like odor

Project Number:B0045362
Data File:

Date: 5/20/2015 Created/Edited by:RwL

Date Start/Finish: 2/10/2015
Drilling Company: Cascade Drilling
Driller's Name: Curtis A.
Drilling Method: Hollow Stem Auger
Auger Size: 10" Outer Diameter
Rig Type: Truck Mounted HSA
Sampling Method: Split Spoon

Northing: NE
Easting: NE
Casing Elevation: NE

Borehole Depth: 25 feet bgs
Surface Elevation: NE

Descriptions By: SLM

Well/Boring ID: **PZ-2**

Client: Chevron EMC

Location: Edmonds Terminal, 11720 Unoco Rd, Edmonds, WA

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	Blow Counts	N-Value	PID Headspace (ppm)	Analytical Sample	USCS Code	Geologic Column	Stratigraphic Description	Well/Boring Construction
		3	13.5 -15	1.5	2 2 2	4	34.8		SP		Sand, medium to coarse grain, poorly graded, dark grey to brown, HCLO, wet	
15	-15											0.020 Slot Screen Sch. 40 PVC
		4	16- 17.5	1.5	5 4 5	9	69.1				Same As Above	#2/12 Sand
									SP			
		5	18.5 -20	1.5	5 5 5	10	44.8				Same As Above	
20	-20											
		6	21- 22.5	1.5	7 9 40	49	34.7		SM		Silty Sand, medium grain, poorly graded, brown, HCLO, wet	
		7	23.5 -25	0	50/5	100	NA		OP		Recovery limited to wood chuncks seen in split spoon	
25	-25											

ARCADIS
Infrastructure · Water · Environment · Buildings

Remarks: bgs = below ground surface
NA = Not Available
ppm = parts per million
NE = Not Established
HA = Hand Auger
HCLO = Hydrocarbon like odor

Date Start/Finish: 3/23/15
Drilling Company: Cascade Drilling
Driller's Name: James G.
Drilling Method: Hollow Stem Auger
Auger Size: 10'' Outer Diameter
Rig Type: Truck Mounted
Sampling Method: Split Spoon

Northing: NE
Easting: NE
Casing Elevation: NE

Borehole Depth: 22' bgs
Surface Elevation: NE

Descriptions By: RL/RB

Well/Boring ID: **PZ-3**

Client: Chevron EMC

Location: Edmonds Terminal, 11720 Unoco Rd, Edmonds, WA

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	Blow Counts	N-Value	PID Headspace (ppm)	Analytical Sample	USCS Code	Geologic Column	Stratigraphic Description	Well/Boring Construction
0	0										Topsoil and sand/gravel/cobbles	18 inch well box
											Fill - Sand/gravel/cobbles	J-Plug
												Concrete
											Cleared past 20-Mil Polyethylene sheeting at 3.5 feet bgs, which delineates Phase I 2007/2008 excavation and un-excavated soils around the WSDOT Stormwater Line	Riser Sch. 40 PVC - 4 inch diameter
		HA	3.5 -4	.5	NA	NA	98.3		SG		Sand with Gravel - sand is medium to very coarse grain, gravel is small to large with trace cobbles, angular to subrounded, well graded, brown, moist, HCLO	Bentonite
5	-5	HA	5-5.5	.5	NA	NA	322.6		CH		Clay with trace Gravel and Organic material - clay has high plasticity, gravel is medium and sub angular, organic material comprised of woody debris, grey, moist, HCLO	
											At 5.5 feet bgs, encountered plastic fabric debris - brittle and weak	
		HA	7.5 -8	.5	NA	NA	919.2				Sand with little Silt and Organics - sand is well graded, silt has low plasticity, woody debris comprised of small roots and sticks, grey, very moist, strong HCLO	
												Water first encountered
											cleared hole with air knife and vacuum to 9.5 feet bgs	
10	-10	1	10-11.5	1.5	5 7 7	14	889				Sand with little Silt, trace Gravel and Organics, sand well graded, silt low plasticity, gravel subangualr, organics comprised of bark pieces, grey, wet, HCLO	
									SW			0.020 Slot Screen Sch. 40 PVC

ARCADIS
Infrastructure · Water · Environment · Buildings

Remarks:
bgs = below ground surface
NA = Not Available
ppm = parts per million
NE = Not Established
HA = Hand Auger
HCLO = Hydrocarbon like odor

Project Number:B0045362
Data File:

Date: 5/20/2015 Created/Edited by:RwL

Date Start/Finish: 3/23/15 **Drilling Company:** Cascade Drilling **Driller's Name:** James G. **Drilling Method:** Hollow Stem Auger **Auger Size:** 10" Outer Diameter **Rig Type:** Truck Mounted **Sampling Method:** Split Spoon	**Northing:** NE **Easting:** NE **Casing Elevation:** NE **Borehole Depth:** 22' bgs **Surface Elevation:** NE **Descriptions By:** RL/RB	**Well/Boring ID:** **PZ-3** **Client:** Chevron EMC **Location:** Edmonds Terminal, 11720 Unoco Rd, Edmonds, WA

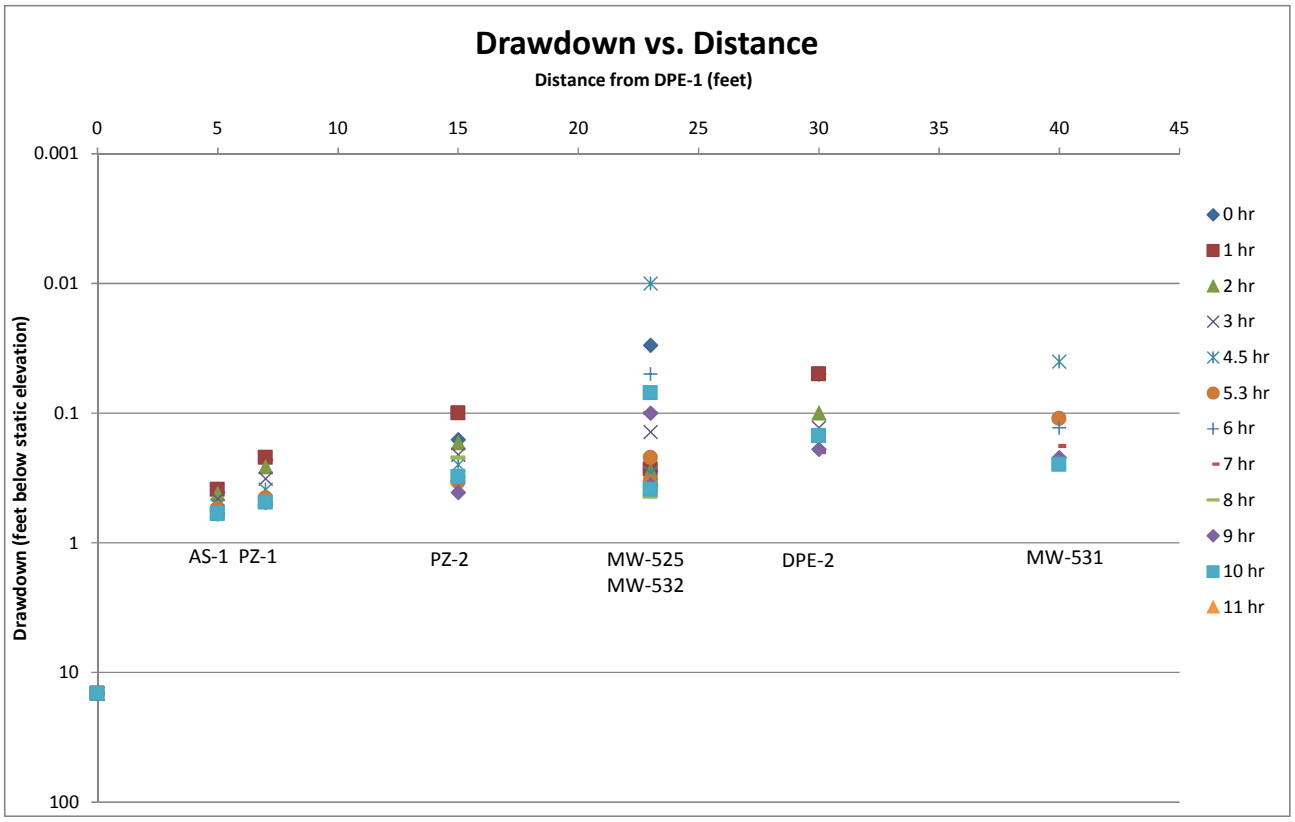
DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	Blow Counts	N-Value	PID Headspace (ppm)	Analytical Sample	USCS Code	Geologic Column	Stratigraphic Description	Well/Boring Construction
		2	12.5 -14	1.5	6 6 6	12	391				Same as above	#2/12 Sand
15	-15	3	15- 16.5	1.5	9 10 10	20	469				Same as above with a lense of brown high plasticity clay at 16 feet bgs, lense less than one inch thick. Decreasing amount of woody debris and silt	
		4	17.5 -19	1.5	9 12 10	22	432		SP		Sand - medium to coarse grain, little woody debris that appears to be a chunck of a larger piece of wood, wet, grey, HCLO	
20	-20	5	20- 21.5	1.5	8 10 9	19	160				Same as above - thin high plasticity, borwn clay lense at 21 feet bgs, lense is less than one quarter inch thick with consistent lithology on either side, grey, HCLO	Sump Sch. 40 PVC

ARCADIS
Infrastructure · Water · Environment · Buildings

Remarks: bgs = below ground surface
NA = Not Available
ppm = parts per million
NE = Not Established
HA = Hand Auger
HCLO = Hydrocarbon like odor

Attachment B

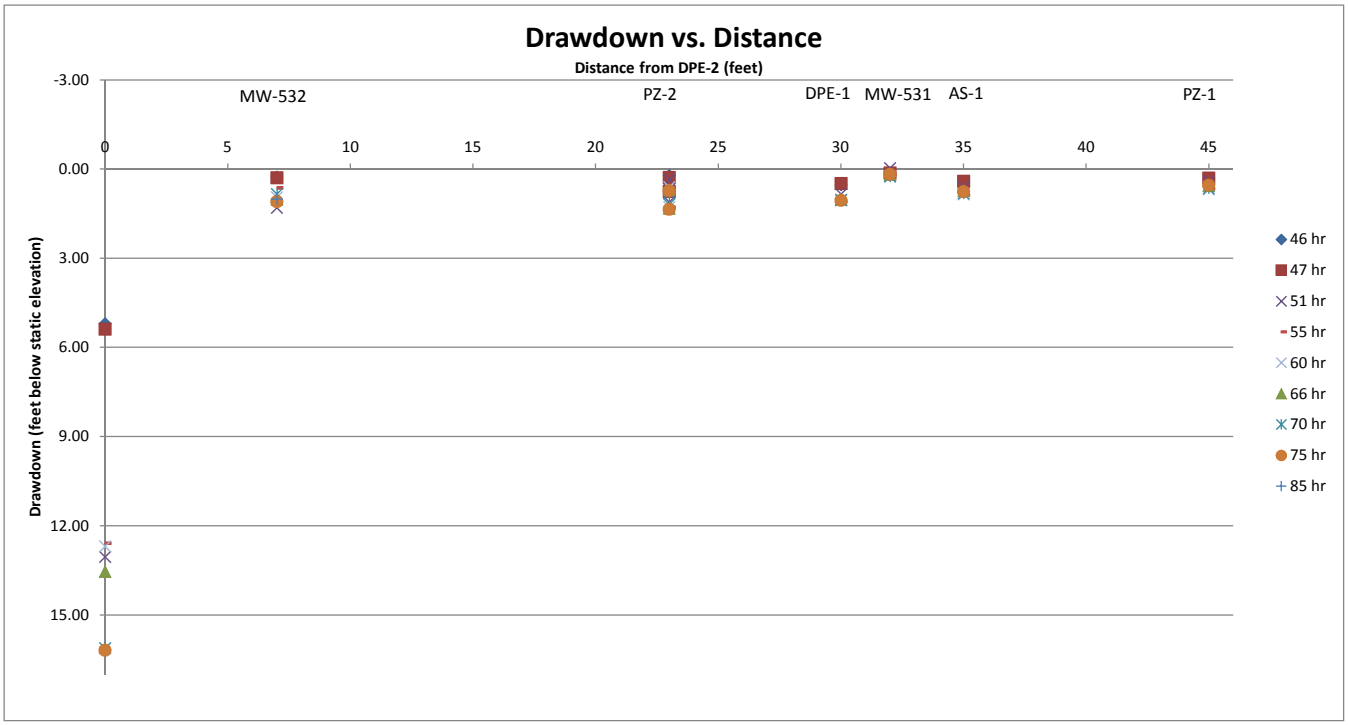
Pilot Test Data



DPE-1 Test

	Time elapsed (hr)	0	1	2	3	4	5	6	7	8	9	10	11
Well	Distance (feet)	Drawdown (feet below static groundwater elevation)											
DPE-1	0	14.57	14.53	14.56	14.59	14.58	14.56	14.61	14.56	14.61	14.58	14.57	14.61
AS-1	5	0.41	0.39	0.42	0.46	0.52	0.55	0.6	0.64	0.63	0.6	0.6	0.6
PZ-1	7	0.23	0.22	0.26	0.32	0.39	0.45	0.49	0.51	0.53	0.49	0.49	0.39
PZ-2	15	0.16	0.1	0.17	0.21	0.25	0.34	0.34	0.31	0.22	0.41	0.31	0.28
MW-525	23	0.03	-0.05	-0.1	0.14	0.01	0.22	0.05	0.37	0.1	0.1	0.07	0.05
MW-532	23	0.28	0.27	0.28	0.29	0.29	0.34	0.35	0.4	0.44	0.36	0.39	0.35
DPE-2	30	0.05	0.05	0.1	0.13	0.15	0.15	0.19	0.2	0.16	0.19	0.15	0.13
MW-531	40	-0.04	-0.04	-0.05	-0.03	0.04	0.11	0.13	0.18	--	0.22	0.25	0.23

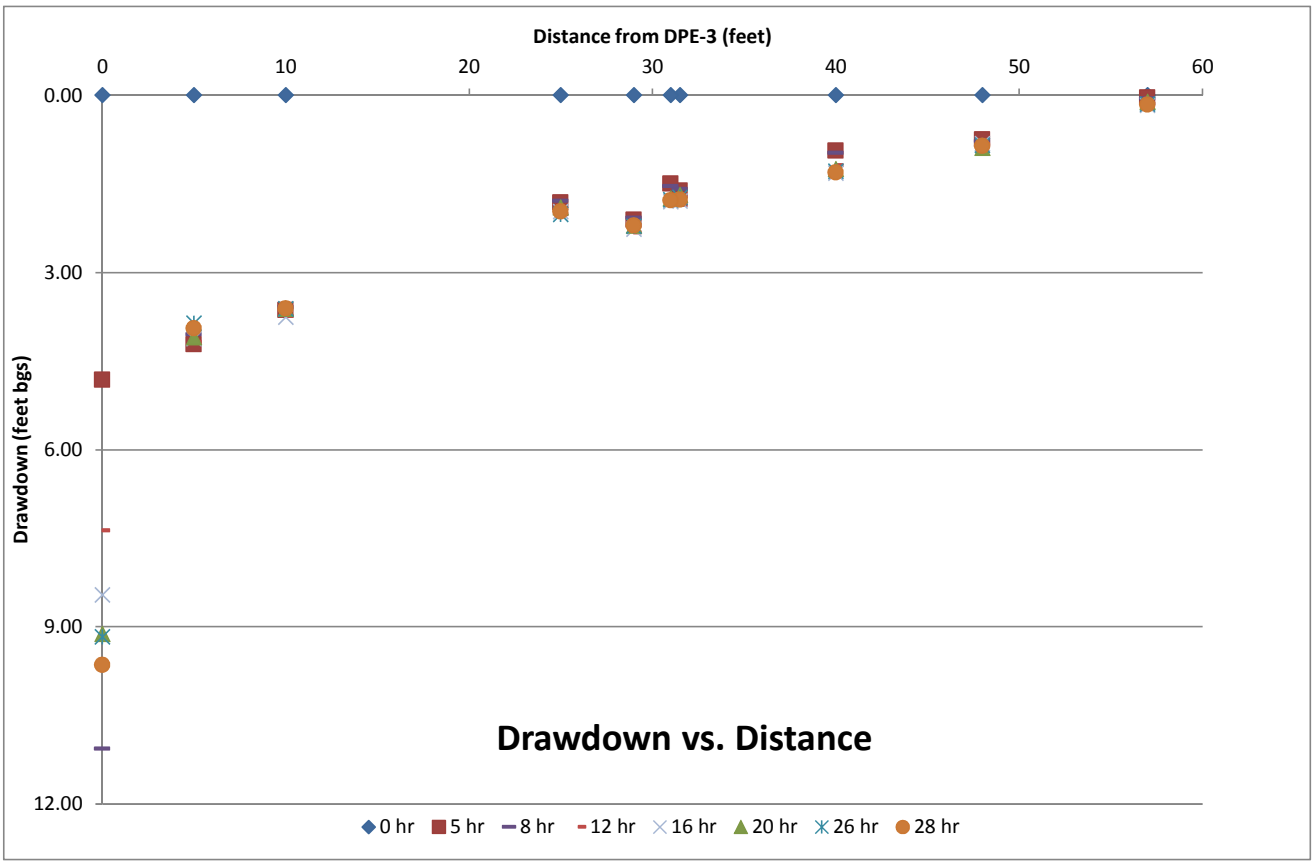
Note:
hr = hour
bgs = below ground surface
DPE = dual phase extraction



DPE-2 Test

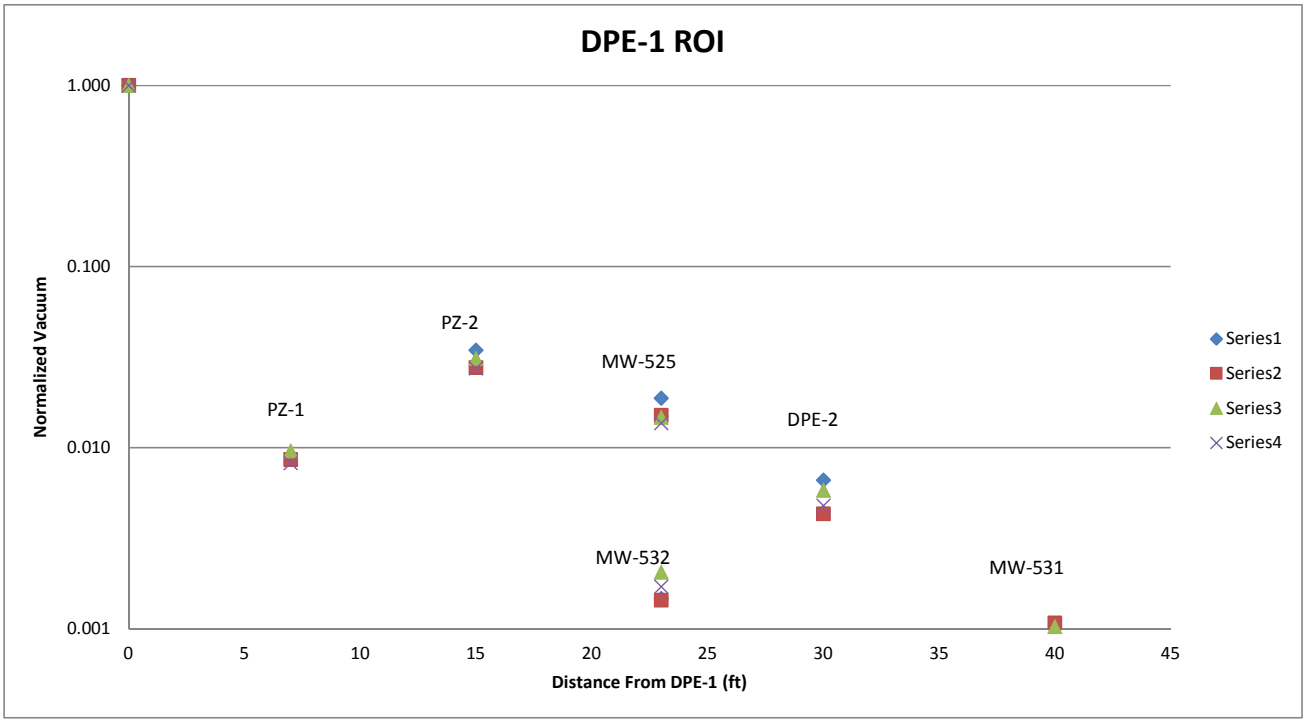
	Time elapsed (hr)	46 hr	47 hr	49 hr	51 hr	52 hr	53 hr	54 hr	55 hr	56 hr	57 hr	58 hr	59 hr	60 hr	61 hr	62 hr	66 hr	70 hr	75 hr	85 hr
Well	Distance (feet)	Drawdown (feet below static groundwater elevation)																		
DPE-1	30	0.53	0.50	0.41	0.84	0.98	1.06	1.09	1.11	1.14	1.12	1.11	Measu	1.06	1.04	1.04	1.02	1.03	1.06	1.01
DPE-2	0	5.20	5.40	4.75	13.05	12.95	12.80	12.60	12.60	12.60	13.00	13.00	12.50	12.70	12.60	12.75	13.55	16.12	16.20	11.92
PZ-1	45	0.31	0.31	0.24	0.41	0.48	0.61	0.62	0.67	0.72	0.74	0.71	0.70	0.69	0.64	0.56	0.56	0.65	0.55	0.61
PZ-2	23	0.69	0.76	0.61	1.11	1.19	1.26	1.26	1.29	1.36	1.31	1.28	1.28	1.28	1.28	1.36	1.32	1.18	1.36	1.30
AS-1	35	0.41	0.42	0.37	0.61	0.69	0.77	0.80	0.88	0.90	0.90	0.88	0.90	0.85	0.80	0.73	0.73	0.82	0.76	0.81
MW-525	23	0.22	0.29	0.23	0.36	0.48	0.57	0.57	0.63	0.75	0.80	0.65	0.63	0.60	0.65	0.71	0.70	0.81	0.73	0.71
MW-531	32	0.16	0.14	0.08	-0.03	0.05	0.10	0.13	0.18	0.23	0.24	0.29	0.27	0.25	0.23	0.23	0.18	0.25	0.18	0.31
MW-532	7	0.27	0.30	0.40	1.30	0.48	0.57	0.80	0.65	0.75	0.68	1.16	1.06	0.95	0.84	1.04	1.02	0.84	1.10	1.09

Note:
hr = hour
bgs = below ground surface
DPE = dual phase extraction



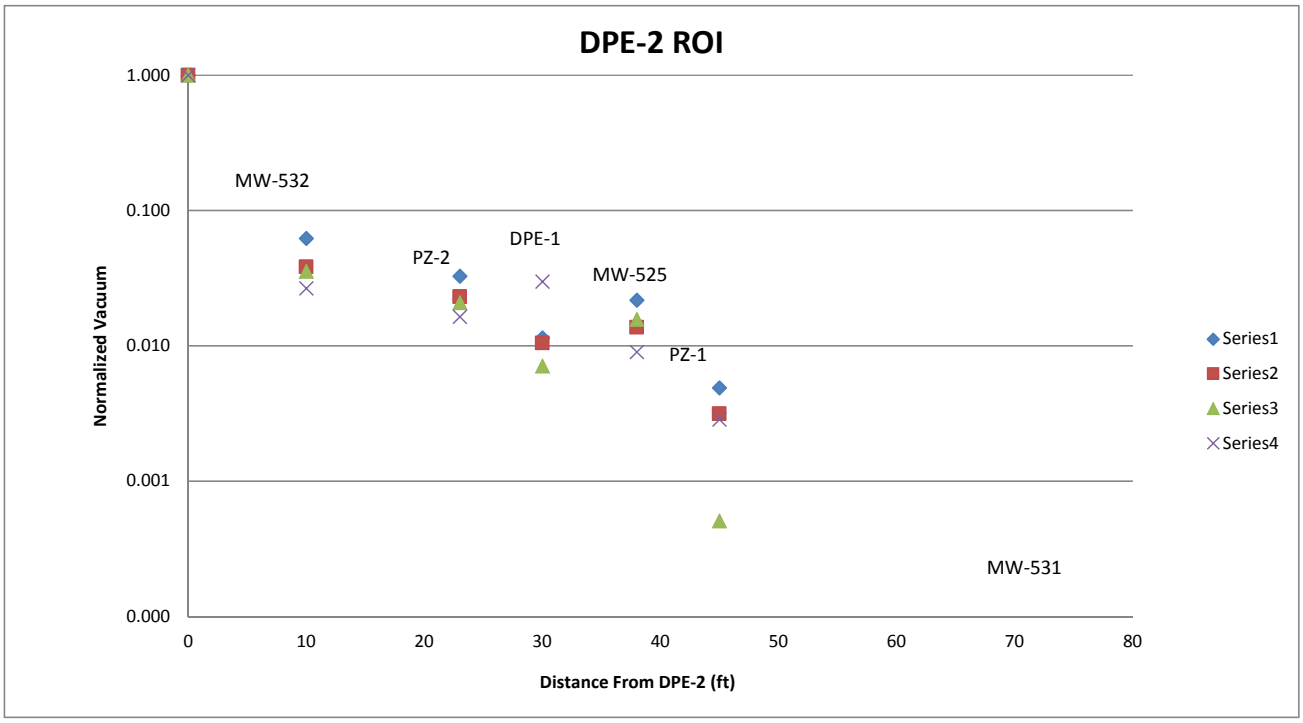
	Time elapsed (hr)	0 hr	5 hr	8 hr	12 hr	16 hr	20 hr	26 hr	28 hr
Well	Distance (feet)	Drawdown (feet bgs)							
DPE-1	29	0.00	2.11	2.08	2.33	2.27	2.21	2.22	2.21
DPE-2	48	0.00	0.75	0.78	0.83	0.82	0.89	0.85	0.86
DPE-3	0	0.00	4.82	11.07	7.37	8.46	9.12	9.17	9.65
PZ-1	31.5	0.00	1.62	1.59	1.86	1.79	1.69	1.73	1.77
PZ-2	31	0.00	1.50	1.54	1.75	1.80	1.75	1.77	1.78
PZ-3	10	0.00	3.64	3.59	3.74	3.76	3.62	3.62	3.61
AS-1	25	0.00	1.82	1.79	2.02	1.97	1.90	2.02	1.97
MW-525	5	0.00	4.22	4.05	4.18	4.12	4.10	3.86	3.95
MW-531	57	0.00	0.04	0.06	0.15	0.17	0.11	0.15	0.16
MW-532	40	0.00	0.94	0.98	1.19	1.32	1.25	1.29	1.31

Note:
hr = hour
bgs = below ground surface
DPE = dual phase extraction



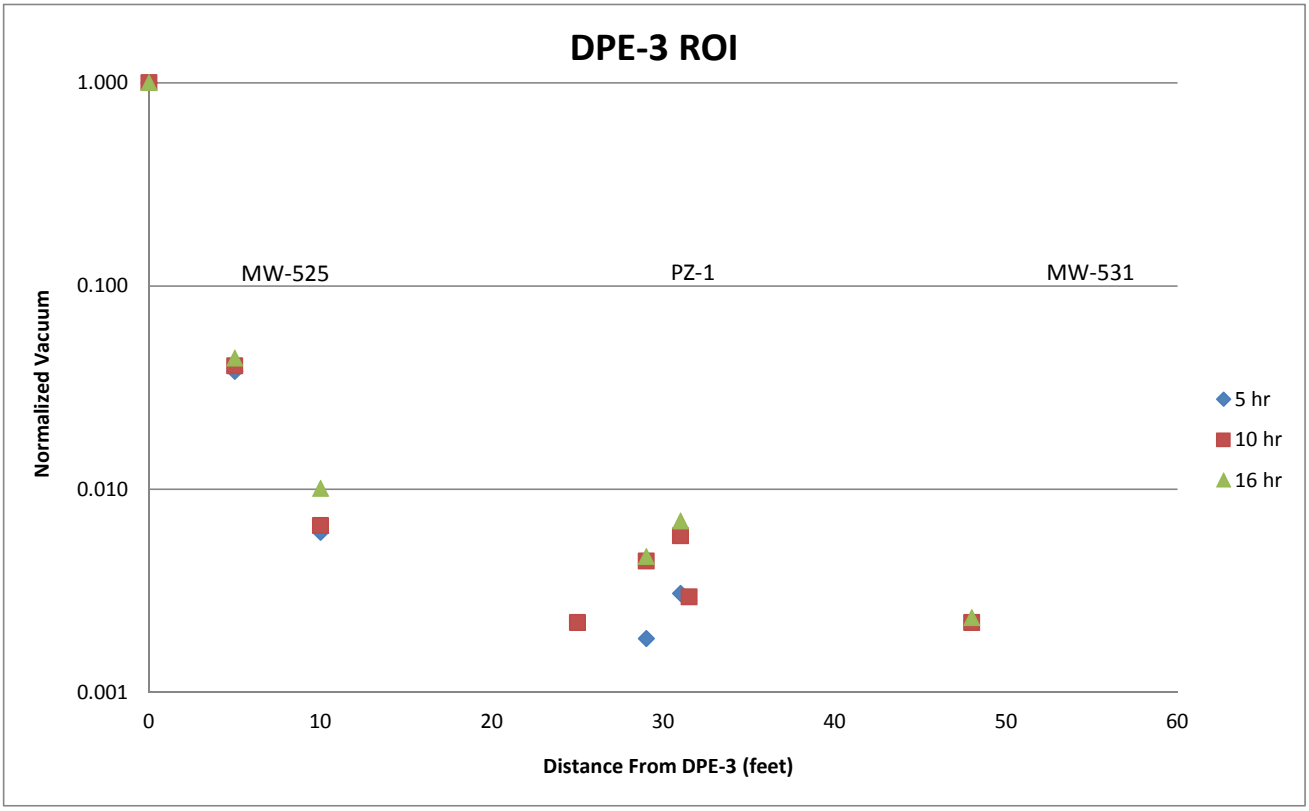
Time elapsed (hr)		1 hr		10 hr		20 hr		30 hr	
Vacuum ("H2O)		Vacuum	Normalized Vacuum	Vacuum	Normalized Vacuum	Vacuum	Normalized Vacuum	Vacuum	Normalized Vacuum
Well	Distance (feet)								
DPE-1	0	271.800	1.000	278.595	1.000	292.185	1.000	292.185	1.000
DPE-2	30	1.800	0.007	1.200	0.004	1.700	0.006	1.4	0.005
PZ-1	7	0.000	0.000	2.400	0.009	2.800	0.010	2.4	0.008
PZ-2	15	9.400	0.035	7.700	0.028	9.100	0.031	8	0.027
MW-525	23	5.100	0.019	4.200	0.015	4.300	0.015	4	0.014
MW-531	40	0.000	0.000	0.300	0.001	0.300	0.001	0	0.000
MW-532	23	0.400	0.001	0.400	0.001	0.600	0.002	0.5	0.002

Note:
hr = hour
DPE = dual phase extraction
"H2O = inches of water



Time elapsed (hr)		50 hr		60 hr		70 hr		80 hr	
Vacuum ("H2O)		Vacuum	Normalized Vacuum	Vacuum	Normalized Vacuum	Vacuum	Normalized Vacuum	Vacuum	Normalized Vacuum
Well	Distance (feet)								
DPE-2	0	183.465	1.000	190.260	1.000	197.055	1.000	244.62	1.000
MW-532	10	11.400	0.062	7.300	0.038	7.000	0.036	6.5	0.027
PZ-2	23	6.000	0.033	4.400	0.023	4.100	0.021	4	0.016
DPE-1	30	2.100	0.011	2.000	0.011	1.400	0.007	7.31	0.030
MW-525	38	4.000	0.022	2.600	0.014	3.100	0.016	2.2	0.009
PZ-1	45	0.900	0.005	0.600	0.003	0.100	0.001	0.7	0.003
MW-531	68	0.000	0.000	0.000	0.000	0.000	0.000	0	0.000

Note:
hr = hour
DPE = dual phase extraction
"H2O = inches of water



Time elapsed (hr)		5 hr		10 hr		16 hr	
Vacuum ("H2O)		Vacuum	Normalized Vacuum	Vacuum	Normalized Vacuum	Vacuum	Normalized Vacuum
Well	Distance (feet)						
DPE-3	0	163.080	1.000	135.900	1.000	129.105	1.000
MW-525	5	6.200	0.038	5.500	0.040	5.700	0.044
PZ-3	10	1.000	0.006	0.900	0.007	1.300	0.010
AS-1	25	0.000	0.000	0.300	0.002	0.000	0.000
DPE-1	29	0.300	0.002	0.600	0.004	0.600	0.005
PZ-2	31	0.500	0.003	0.800	0.006	0.900	0.007
PZ-1	31.5	0.000	0.000	0.400	0.003	0.000	0.000
DPE-2	48	0.000	0.000	0.300	0.002	0.300	0.002
MW-532	40	0.000	0.000	0.000	0.000	0.000	0.000
MW-531	57	0.000	0.000	0.000	0.000	0.000	0.000

Note:
hr = hour
DPE = dual phase extraction
"H2O = inches of water

Appendix B

Project Manual

ARCADIS
Infrastructure, environment, facilities

Imagine the result

Chevron Environmental Management Company

Project Manual

Unocal Edmonds Bulk Fuel Terminal

11720 Unoco Road

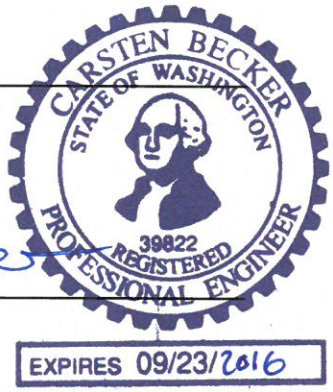
Edmonds, Washington 98020

March 8, 2016

ARCADIS

Scott Zorn
Project Manager

Carsten Becker, P.E.
Principal Engineer



Rory Kilkenny, P.E.
Staff Engineer

Project Manual

Unocal Edmonds Bulk Fuel Terminal

Prepared for:
Chevron Environmental Management Company

Prepared by:
ARCADIS
2300 Eastlake Avenue East
Suite 200
Seattle
Washington 98102
Tel 206.325.5254
Fax 206.325.8218

Our Ref.:
B0045362

Date:
March 8, 2016

SECTION 01010

PART I – GENERAL

1.0 General Description of Work and Site Conditions
1.1 Basis of Design
1.2 Summary of Work
1.3 Job Conditions
1.4 Work by Others
1.5 Material Handling
1.6 Erosion and Sediment Control
1.7 Health and Safety
1.8 Submittals
1.9 Limitations

PART II - PRODUCT

2.0 Imported Soils – Hydraulic Isolation Barriers (Berm Import Fill)
2.1 Imported Soils – Bank Import Backfill
2.2 Imported Soils – Quarry Spalls, Crushed Stone
2.3 Bypass Erosion Control
2.4 Bypass Piping
2.5 Geosynthetics
2.6 Restoration Plants

PART III - EXECUTION

3.0 Construction Sequence
3.1 Hydraulic Isolation of DB-2 Excavation Area
3.2 DB-2 Excavation and Backfill
3.3 Construction Observation
3.4 Design Support
3.5 Reporting

PART IV - REFERENCES

ATTACHMENT A: CONTRACT DRAWINGS
ATTACHMENT B: NPDES PERMIT

PART I – GENERAL

1.0 General Description of Work and Site Conditions

This Project Manual details proposed construction activities at Chevron Environmental Management Company's (Chevron) Former Unocal Edmonds Bulk Fuel Terminal located in Edmonds, Washington (Terminal). This document has been prepared based upon (Arcadis U.S., Inc. [Arcadis]) findings and suggested designs in the *Final Interim Action Work Plan* (2016 IAWP) (Arcadis, 2016).

As with all projects performed for Chevron (Owner), health and safety will be a driving factor in all efforts. Activities discussed within this Project Manual shall be included in the 2016 Interim Action Site Health and Safety Plan (HASP) that shall be prepared by the Contractor and reviewed by the Owner and Engineer (Arcadis). All personnel working on this project shall be trained in behavior-based safety protocols and in Chevron's Short Service Employee Program prior to arriving onsite. All personnel working on this project shall have Stop Work Authority.

The Terminal comprises two major parcels, former Upper and Lower Yards, with a total combined area of approximately 47 acres. It is located east-southeast of BNSF Railway (BNSF) Property, south of the Union Oil Marsh (also known as the Edmonds Marsh) and Willow Creek Extension, and northwest of the Deer Creek Salmon Hatchery (fish hatchery).

The approximately 22-acre former Lower Yard surrounds the former Upper Yard to the north, east and west. It is currently owned by Unocal. Unocal and Washington State Department of Transportation (WSDOT) have entered into a purchase and sale agreement for WSDOT to assume ownership of the property after Capital Remediation Work has been completed. WSDOT currently plans to move the Edmonds Ferry Dock to the Site as part of the Edmonds Crossing Project.

The western boundary of the former Lower Yard is the BNSF Property, and the northwestern boundary is Willow Creek and BNSF Property. Further west of the former Lower Yard is the Port of Edmonds Marina and Puget Sound. North and northeast of the former Lower Yard are Willow Creek and Edmonds Marsh. Southeast is the fish hatchery. At its nearest point (the southwest corner of the former Lower Yard), the former Lower Yard boundary is approximately 160 feet from the Puget Sound shoreline.

Two stormwater detention basins (DB-1 and DB-2) are present within the former Lower Yard. 12 storm drains collect surface-water runoff from the former Lower Yard and convey the collected stormwater directly into DB-2 via gravity flow. DB-1 and DB-2 form depressions approximately 6 and 4 feet deep, respectively, and can be described as followed:

- DB-1 is located in the east/northeast former Lower Yard and west/northwest former Lower Yard. DB-1 is bounded to the northwest, northeast, and southeast by a manmade berm. The berm runs along the eastern property boundary, adjacent to Willow Creek. DB-1 acts as a retention pond for

overflow from DB-2 during storm events. DB-1 is an unlined pond with one aboveground pump and a piping system to the DB-2 outfall on the bank of Willow Creek.

- DB-2 is located between the west/northwest former Lower Yard and central former Lower Yard, south of DB-1. DB-2 serves as a stormwater collection area from which former Lower Yard stormwater is discharged into Willow Creek under Industrial Stormwater General Permit No. SO3-002953C. DB-2 has a flexible membrane liner, two submersible pumps, and a piping system to the DB-2 outfall.

The objective of the work described in this Project Manual is the removal and replacement of soils surrounding and beneath DB-2 which contains petroleum hydrocarbon concentrations above the soil remediation levels (RELs) and cleanup levels (CULs).

The work area around DB-2 that is the subject of this Project Manual shall be subsequently referred to as the "Site". All utilities referred to in this Project Manual or Attachment A shall be verified by the Contractor prior to start of the Work.

Total petroleum hydrocarbons (TPH), carcinogenic polynuclear aromatic hydrocarbons (cPAHs), and benzene are the primary constituents of concern (COCs) for the remedial activities at the Site. During the Site investigations conducted by Arcadis in 2008, 2011 and 2012; soil samples were analyzed for TPH, benzene and cPAHs and compared to soil remediation level (REL) concentration of 2,775 mg/kg, and cleanup action level (CUL) concentrations for cPAHs adjusted for toxicity (cPAHs TEQ) of 0.14 mg/kg and benzene of 18 mg/kg. Exceedances were measured within the saturated and unsaturated (vadose) zones.

The groundwater elevation for the Site has been measured historically from 6.45 to 12.11 feet North American Vertical Datum of 1988 (ft NAVD88) which is typically 3 to 7 feet below the ground surface (ft-bgs). The groundwater flows from the highest groundwater elevations, located in the central and eastern portions of the former Lower Yard, radially towards the northwest and northeast portions of the Site.

This Project Manual describes the proposed Interim Actions as shown on the Contract Drawings of Attachment A.

1.1 Basis of Design

The Basis of Design (BOD) serves as means to communicate technical guidance and design intent to all parties. The main purpose of the design is to remove the impacted soil within the vicinity of DB-2 and fill the excavation to match the surrounding topography to grade into DB-1 with clean imported soils.

The specific objectives of this interim action are presented below:

- Remediate soil in the former Lower Yard that contains petroleum hydrocarbon concentrations above the soil RELs and CULs in DB-2.

- Remove recoverable free product beneath DB-2 vicinity in the former Lower Yard. Free product is defined as “Light nonaqueous phase liquids (LNAPL).

Indicator Hazardous Substance	**Soil CUL or REL (mg/kg)**
TPH (REL)	2,775
Benzene (REL)	18
Total cPAHs (CUL)	0.14

The excavated soils exceeding these limits shall be exported offsite for recycling/treatment. The excavated soils below these limits shall be considered “clean” and available for use as backfill above the groundwater table; however, it is not anticipated that excavated soil will be reused onsite.

Water shall be treated to the effluent standards provided for outfalls under the current National Pollutant Discharge Elimination System (NPDES) permit for the site. The table below includes part of the maximum daily effluent limitations at the outfall, but does not provide all requirements of the permit applicable to discharges and hydraulic isolation barrier operation – the Contractor shall comply with the details provided in the NPDES permit in Attachment B.

EFFLUENT LIMITATIONS[b]	
Parameter	**Maximum Daily[a]**
Flow	35,600 gallons per day (gpd)
Chitosan Acetate	0.1 milligram per liter (mg/L)
pH	Between 6.5 and 8.5 standard units
Dissolved Oxygen	minimum 8 mg/L
Oily Sheen	No visible sheen
Turbidity	5 Nephelometric Turbidity Unit (NTU) above background (or as noted below)[c]
Benzene	51 microgram per liter (μg/L)
Sum of Benzene, Toluene, Ethylbenzene, and total Xylenes	100 μg/L
TPH	506 μg/L
Total Recoverable Lead	17.5 μg/L
Total Recoverable Arsenic	360 μg/L
[a]The maximum daily effluent limitation is defined as the highest allowable daily discharge. The daily discharge means the discharge of a pollutant measured during a calendar day.	
[b]The point of compliance is at any bypass point or outfall where a discharge enters surface waters outside of the hydraulic isolation barriers.	
[c]Turbidity shall not exceed 5 NTU over background turbidity when the background turbidity is 50 NTU or less, or have more than a 10 percent increase in turbidity when the background turbidity is more than 50 NTU.	

1.2 Summary of Work

The proposed Work is shown on the Contract Drawings provided in Attachment A. The Work performed by the Contractor shall consist of the following activities:

A. Mobilization:

1. Mobilization shall include: verifying existing work zones; provide the following: site office, surveying, project management, permit compliance, materials delivery and preconstruction submittals.
2. Install temporary erosion and sedimentation controls, as required by the Contract Drawings and the Storm Water Pollution Prevention Plan (SWPPP) developed as part of the general construction permit of NPDES permit included in Attachment B.

B. Site Preparation and Clearing:

1. The Contractor shall independently determine the location and depth of all utilities within the work area using Chevron approved utility locating procedures.
2. Protect adjacent works and structures during the entire project. Any facilities damaged by the Contractor's operations shall be repaired to their original condition at the Contractor's expense.
3. The Contractor shall cut and grub any remaining trees, shrubs and other vegetation to within two inches above existing grade from DB-2 and as approved by the Owner for access along banks to conduct soil removal and hydraulic isolation construction activities. The cleared and/or grubbed material shall be temporarily stored in an onsite stockpile. Upon completion of regrading activities, the stockpiled material shall be shredded and distributed across the vegetated area of the Site as mulch. Disturbed areas outside of the restoration limits shown in Attachment A shall be restored with suitable vegetation including replanted trees, shrubs, and grasses as on Drawing 10 of Attachment A.
4. Clearing limits shall be all areas requiring excavation, stockpiling, groundwater treatment setup, and areas as necessary for access to the Work.

C. Hydraulic Isolation of DB-2

1. The Contractor shall construct hydraulic isolation barriers both up and downstream of the DB-2 area within Willow Creek and cross DB-1 as shown on Drawing 3 in Attachment A. A piping system shall be used to convey flows upstream and downstream of the Willow Creek hydraulic isolation barriers as shown on Drawings 3 in Attachment A.
2. Standing water within the hydraulically isolated area of Willow Creek shall be dewatered, and discharged downstream of the downstream hydraulic isolation barrier. Surface water inside the hydraulic isolation barriers shall be continuously pumped and discharged downstream. Standing water within the hydraulically isolated area of DB-1

shall be continuously pumped and discharged into the remaining active section of DB-1.
3. Stormwater utilities that currently discharge into DB-2 will be capped outside of the remedial boundary as shown on Drawing 3 of Attachment A. Stormwater collected in this system will be pumped into DB-1 as needed during storm events. The Contractor shall verify stormwater utilities by independent survey.

D. Soil Excavation for Petroleum Hydrocarbon Impacted DB-2 Area

1. Prior to any excavation activities, the Contractor shall locate utilities at the Site that will be affected by the excavation activities. Utilities known to the Engineer are shown on the drawings in Attachment A. Additional utilities may exist and shall be located by the Contractor as well.
2. The Contractor shall properly abandon or temporarily re-route all active utilities within the excavation area as approved by the Engineer.
3. DB-2 Area shall be excavated to an initial target elevation of +1 ft NAVD88.
4. Excavated soil shall be managed at the contaminated soil staging area and the soil shall be mixed with dry material as needed to reduce moisture content of the composite mass to the value accepted by the appropriate disposal facility.
5. The water table within the excavation shall be managed to stay at or below the target elevation of +4.
6. Hydraulic isolation barrier dewatering fluids, water pumped from the excavation and gravity dewatering decant water from soil staging area shall be directed to an onsite treatment system provided and operated by the Contractor. This treated water shall be managed onsite and discharged in accordance with the NPDES permit in Attachment B.
7. Arcadis shall determine if additional excavation is required both vertically and horizontally following initial excavation based on confirmatory sampling.
8. The Contractor shall conduct additional excavation if needed as determined by Arcadis.
9. Backfill the excavation area to re-establish the boundaries of DB-1 and Willow Creek and grade excavation to gently slope into DB-1.
10. Connect the stormwater drainage system into DB-1.
11. Re-establish the Willow Creek Extension surface to the original grade and restore area as indicated on Drawings 10 of Attachment A following construction.

1.3 Job Conditions

A. Known Existing Utilities: As depicted on the General Site Plan in Attachment A, the Site has existing utilities, both active and abandoned. Stormwater utilities to re-establish the stormwater conveyance at the Site are shown in Attachment A. The Contractor shall verify stormwater utilities by independent survey.

B. Contractor shall notify Engineer immediately if additional utilities are discovered within the work area.

C. Other structures include: BNSF embankment at the western boundary of Willow Creek; concrete outfall structures associated with Outfall 2. Any existing structures damaged by the Contractor's operations shall be repaired to their original condition as approved by Engineer and at the Contractor's sole expense.

D. Groundwater Monitoring Wells: Wells MW-508, MW-510, D-1, P10, P-11, P12, P13, P-15, and P16 within the excavation limits shall be removed and abandoned by the Contractor prior to proceeding with excavation activities. In the event that the Contractor exposes other existing monitoring wells within the excavation areas the Contractor shall immediately contact the Owner and Engineer to determine appropriate course of action before proceeding with work in that area.

1.4 Work By Others

A. Procurement of the environmental permits and payment of associated fees will be performed by the Engineer.

B. Groundwater monitoring following Interim Actions shall be conducted by the Engineer according to the 2016 IAWP.

C. Soil samples shall be submitted to an Ecology-certified laboratory for analysis of diesel-range organics (DRO) and heavy oil-range organics (HO) by Ecology Method NWTPH-Dx (after silica gel cleanup), sum of gasoline-range organics (GRO) by Ecology Method NWTPH-Gx, and benzene by United States Environmental Protection Agency (USEPA) Method 8021B. Any sample that contains detectable DRO and/or HO concentrations shall be analyzed for cPAHs by USEPA Method 8270C. All sampling shall be conducted in accordance with the 2016 IAWP.

D. The Engineer will collect water samples from the effluent of the treatment system and from ports within the system to verify the system performance.

E. The Engineer will collect water samples from the effluent of the decant discharge line during dewatering of the excavation area to confirm that the effluent meets the NPDES effluent limitations.

1.5 Material Handling

A. The Contractor shall be responsible for maintaining good housekeeping for all material (e.g. fuel and oil) and all operating equipment while working at the Site. All material generated by the Contractor during construction shall be handled and disposed of appropriately by the Contractor.

1.6 Erosion and Sediment Control

A. The Contractor shall provide and maintain appropriate methods and best management practices (BMPs), equipment and temporary construction to control stormwater runoff and erosion at the construction site and adjacent areas as necessary.

B. The methods and BMPs shall be selected in accordance with the SWPPP developed as part of the general construction permit of the NPDES permit included in Attachment B.

C. Erosion at discharge points will be mitigated with the placement of quarry spalls or other approved quarry rock as indicated in Attachment A.

1.7 Health and Safety

The Contractor shall be responsible for the following:

A. The Engineer has prepared a site-specific HASP that conforms with 29 Code of Federal Regulations (CFR) 1910 and 1926 and Owner requirements. The Contractor shall review the existing HASP and prepare amendments as required so that all site work is conducted under a single HASP.

B. Submit HASP amendments to the Owner and Engineer at least two weeks prior to mobilization. Incorporate comments into the final HASP.

C. Provide health and safety materials and equipment as required by the site-specific HASP.

D. Verify that all onsite employees and workers from scheduled and unscheduled visits have completed loss prevention systems (LPS) training and Chevron's Short Service Employee Program. The Contractor shall also maintain a log of all onsite visitors during the entire construction period. Onsite visitors must participate in a site-specific safety orientation, and pass a comprehension test before being allowed onsite. Unaccompanied visitors are not allowed within the work zone.

E. Prepare Job Safety Analyses (JSAs) for every field task as part of the LPS program.

F. Train all onsite personnel to perform the Safe Performance Self-Assessment (SPSA) prior to beginning any activity and after any near-miss or other incident to determine if it is safe to proceed.

G. Prepare Loss Prevention Observations (LPOs) at a minimum frequency of one LPO per 400 field hours. LPOs on higher-risk activities must be performed at a minimum frequency of one per 200 field hours.

H. Prepare Incident Investigation/Near-Loss Investigation (II/NLI) Reports. If a loss occurs, the Contractor shall notify the Engineer's Representative and Owner in person or by cellular phone immediately. Submit Initial II/NLI Reports to the Owner within 24 hours of an incident. Submit Final II/NLI to the Owner within 5 business days of a loss and within 10 business days for a near loss.

I. Observe and obey Tenets of Operation Excellence (OE). The OE Tenets are an extension of Chevron's values and principles. The Contractor shall not deviate from "always" in the OE Tenets. Any deviation from "always" in the OE Tenets requires a Management of Change, including a risk assessment with involvement of appropriate subject matter experts approved by the Owner and Engineer.

J. Provide a full-time Safety Officer to oversee LPS, OE and Chevron's Short Service Employee Program responsibilities. The Safety Officer shall be present at weekly progress meetings.

K. Health and safety materials and equipment required for the Owner's employees shall be provided by the Owner.

L. The Owner's and Engineer's representative shall attend site safety meetings.

1.8 Submittals

All submittals are subject to the approval of the Engineer and shall be provided two weeks prior to the start of the Work. Work cannot commence until submittals provide sufficient detail, are approved by Owner and Engineer, and are date-stamped as final by the Engineer:

A. Site-specific HASP that conforms with 29 CFR 1910 and 1926.

B. Shop drawings and manufacturer specifications showing pump types, float-based activation, manual override system, pipe alignment and anchor or support methods, intakes details, and dimension-scaled details providing configuration for all pipe, pump, and valves connections.

C. Work plan describing means and methods for controlling bypass system water flow during tidal fluctuation. Work plan shall include sufficient detail to fully describe the bypass system including operational details, pipe cleanout procedures, and contingency measures for conveyance pipe clogging.

D. Import fill compliance laboratory reports, e.g., grain size distribution, Los Angeles Abrasion, Degradation Factor, specific gravity, compaction curves, and others as required.

E. Pre-excavation, post-excavation (pre-filling) and final restoration grid survey of work areas with sufficient density to accurately determine cut and fill volumes.

F. Construction Schedule (requiring weekly update thereafter).

1.9 Clarifications

A. This Project Manual provides requirements for contaminated DB-2 soil interim action consistent with the intent of design. Where discrepancy is identified between this manual and the Contract Drawings of Attachment A or other attachments to the Project Manual, the Contractor shall bring this to the attention of the Owner and Engineer for resolution prior to implementing the Work.

PART 2 – PRODUCTS

2.0 Imported Soils – Hydraulic Isolation Barriers (Berm IMPORT FILL)

A. Imported Soils General Requirements:

1. Shall be approved by the Engineer.
2. Shall be obtained from an Ecology-approved supplier, and will be certified by the supplier(s) as clean. Samples will not be collected from any imported soil after it has been unloaded at the lower yard.
3. Shall be free of debris, rock or dirt clods, vegetative matter and other deleterious materials.
4. Shall be segregated and protected from exposure to onsite contaminated materials.
5. Shall meet the following grain size requirements; however, Contractor may propose alternate well-graded sand and gravel gradation to the Engineer for review as substitute berm import fill (any accepted substitute shall maintain consistency with the accepted alternate gradation – the Owner and/or Engineer may refuse delivery for non-compliance of backfill materials if necessary):

Berm Imported Fill	
Sieve Size	***(% Passing)***
3 inch	100
2 inch	90-100
1 inch	50-80
½ inch	30-50
3/8 inch	25-40
#4	15-30
#10	10-20
#40	0-10
#200	0-2

2.1 Imported Soils – BANK IMPORT BACKFILL

A. Imported Soils General Requirements for DB-2 excavation areas:

1. Shall have same general requirements 1 through 4 of BERM IMPORT FILL.

2. Shall include a modified proctor compaction report to identify optimum moisture content and maximum dry density values.
3. Shall meet the following grain size requirements.

	(% Passing)	
Sieve Size	***Vadose Zone Backfill***	***Saturated Zone Backfill***
2 ½ inch	--	99-100
2 inch	--	65-100
1 inch	--	50-80
3/8 inch	95-100	--
#4	90-100	26-44
#40	--	0-16
#200	3-12	0-9

2.2 Imported Soils – QUARRY SPALLS, CRUSHED STONE

A. Quarry Spalls shall meet requirements of WSDOT 2008 Standard Specifications Section 9-13 for Riprap, Quarry Spalls, Slope Protection, and Rock walls.

1. Contractor shall submit Degradation Factor, Los Angeles Abrasion, and Specific Gravity laboratory test results.
2. Quarry spalls shall be of a size range of 4 inches to 8 inches and include multiple faces.

B. Crushed stone shall meet requirements as specified in WSDOT 2008 Standard Specifications, Section 9-03.9(3) Crushed Surfacing, but with the following exceptions: 1) gradations for either top course or base course shall adjust to 1-inch-minus; 2) crushed stone shall have no more than 5 percent fines as determined by the U.S. No. 200 sieve; and 3) shall be free of wood waste and other deleterious materials.

2.3 Bypass Erosion Control

A. Shall consist of three layers below discharge pipe, including (from bottom to top) high-strength woven geotextile, 1-inch-minus crushed stone, and quarry spalls.

B. Discharge pipe shall be placed upon 1-inch-minus crushed stone overlying woven geotextile at a minimum, i.e., shall not be placed in contact with unprotected/unfiltered sediment surface.

C. Limits of erosion control area shall be adjusted as necessary to dissipate flow velocities to eliminate erosion and maintain turbidity at or below 5 NTU above background, and meet other water quality requirements to remain in accordance with NPDES discharge requirements.

2.4 Bypass Piping

A. HDPE Piping

1. High-density polyethylene (HDPE) pipe and fittings shall be manufactured from new, first quality, high density polyethylene resin conforming to American Society for Testing and Materials (ASTM) D1248 (Type III, Class C Category 5, Grade P 34) and having a Plastic Pipe Institute Rating of PE 3408.
2. All HDPE pipe and fittings shall conform to ASTM D3350 and have a minimum cell classification of PE 345434C.
3. Bypass piping shall be 24-inch-diameter dedicated pipe for upstream flow and 24-inch-diameter dedicated pipe for downstream flow. Piping shall be capable of being joined together in the field with leak-proof joints.
4. Provide access ports to low points in HDPE culvert bypass pipeline to allow complete draining or pumping of water from the line after use.
5. Provide anchors, stakes, supports, pipe stands, and any other means necessary to position and support pipelines within Willow Creek Extension and to the discharge point at appropriate elevations, which shall be done in a stable and safe configuration subject to the approval of the Engineer.

2.5 Geosythetics

A. CONTRACTOR shall provide woven geotextiles meeting the following specifications:

1. Manufactured of polypropylene slit film yarns.
2. Meet American Association of State Highway and Transportation Officials (AASHTO) Specification for Class 1 separation and stabilization.
3. Meet the minimum average roll values specified as follows for high-strength woven geotextiles, as indicated on the QC certificates:
    a. Tensile Strength: 415 lbs by ASTM D-4632
    b. Elongation at Break: 12% by ASTM D-4632
    c. Wide Width Tensile Strength: 4,800 lb/ft by ASTM D-4595
    d. Mullen Burst: 1,200 psi by ASTM D-3786
    e. Puncture Strength: 195 lbs by ASTM D-4833
    f. Trapezoidal Tear: 180 lbs by ASTM D-4533

B. CONTRACTOR shall provide geomembrane for placement around the coffer dams which meets the following specifications:

1. Meet the minimum per lot values specified as follows in accordance with PGI 1004 Specifications, as indicated on QC certifications (values for polyvinyl chloride):
    a. Thickness: 30 mil
    b. Minimum Tensile Strength: 73 lbs/inch
    c. Minimum Tear Strength: 8 lbs
    d. Average Plasticizer Molecular Weight: 400
    e. Maximum Volatile Loss: 0.7%
    f. Maximum Soil Burial Elongation: 20%
2. Use of high density polyethylene and other geomembrane equivalents are acceptable if approved by the Engineer.

2.6 Restoration Plants

A. Restoration plants shall conform to the guidelines provided on in Attachment A.

B. Any plants used for restoration purposes shall be approved by the Engineer.

Part 3 — EXECUTION

The Contractor shall furnish all labor, equipment, materials, and appurtenances to complete the Work of this Contract. Any delays resulting from Contractor's inability to maintain schedule from lack of necessary work force, equipment, or materials to proceed with the work of this Contract shall be at the Contractor's sole expense.

3.0 Construction Sequence

A. Construction sequence shall provide for a logical progression of work that is planned with an approach to avoid exceedances of NPDES discharge requirements resulting from resuspended sediment within the DB-2 excavation area.

For Contractor's information, the basis of design has assumed the following generalized sequence.

1. Install high-strength woven geotextiles below bypass erosion control mattresses and below footprint of hydraulic isolation barrier footprints.
2. Place downstream and upstream erosion controls for intakes and discharge locations.
3. Install bypass piping.
4. Place and key in geomembrane and complete South Hydraulic Isolation Barrier.
5. Place North Hydraulic Isolation Barrier.
6. Place DB-1 Hydraulic Isolation Barrier.
7. Dewater isolated portions of Willow Creek and DB-1.
8. Perform DB-2 excavation activities.
9. Backfill excavation to elevation +5 with saturated zone backfill
10. Backfill excavation with vadose zone backfill to grade excavation toward DB-1.
11. Site restoration and restoration planting.
12. Remove hydraulic isolation barriers at low tide (maintain bypass flow during berm removal).
13. Site restoration and restoration planting.

3.1 Hydraulic Isolation of DB-2 Excavation Area

A. Temporary Willow Creek Extension Flow Diversion

1. Hydraulic isolation barriers shall be installed prior to soil removal activities within DB-2 as shown in Attachment A.
2. The downstream berm shall be constructed before upstream berm and utilize sediment resuspension control system if triggered by turbidity exceedance during berm materials placement in the water column as measured immediately upstream of downstream bypass erosion control.
3. The top elevation of the berm shall be +10 feet Mean Lower Low Water (MLLW).
4. The Engineer will conduct water quality monitoring to observe that discharge meets the effluent limitations of the NPDES permit. If the discharge exceeds the effluent limitations, the discharge shall be routed to the onsite water treatment system;

however, the Contractor shall not exceed the maximum permitted daily flow of all treated site water of 35,600 gpd.

5. The Contractor shall coordinate with Owner to provide necessary access and accommodate scheduling for activities related to fish management as required under the permit for this Work.

B. Willow Creek Extension Bypass

1. The Contractor shall construct a stream flow bypass system to divert a component of the flow of the Willow Creek Extension around the hydraulic isolation barriers. The bypass system shall allow flow downstream towards Puget Sound, and upstream during periods of flow reversal caused by tidal fluctuations. Bypass details are shown in Attachment A.
5. The bypass system shall include the capability to add, at any time during drainage ditch construction activities, a 6-inch pump for increasing the downstream flow. The 6-inch pump shall be used to complement the flow that is provided by the bypass pipes if the upstream water level rises to within 1 foot of overtopping the upstream berm, or shall be used prior to this water level if required by the Engineer based on conditions in the drainage ditch at the time of construction or based on bypass system performance in general.
6. The pump intakes shall be fitted with fish screens, complying with the National Marine Fisheries Service (NMFS) Juvenile Fish Screen Criteria and the NMFS addendum NMFS Pump Intake Screen Guidelines.
7. HDPE piping used for the bypass pipeline conveying creek flow shall be joined with either thermal butt-fusion or extrusion welding techniques, in accordance with Manufacturer's recommendations and ASTM D2657. The bypass pipeline shall be firmly anchored in place along the bank using anchors or wedges provided by the Contractor. Transitions in piping shall be gradual to avoid sharp bends in the piping.
8. Field cutting of pipe shall be performed only if required and with a machine specifically designed for cutting pipe. Cuts shall be made carefully and without damaging pipe. Resulting cut edge shall be smooth and at a right angle to the axis of the pipe. Flame cutting will not be allowed.

C. Dewatering Detention Basin Pond No. 1

1. Contractor shall construct a hydraulic isolation barrier within DB-1 as shown in Attachment A. The isolated portion of DB-1 shall be dewatered with a sump pump continuously and discharged to the remaining portion of DB-1. Dewatering pumps shall be trash pumps of sufficient horsepower to facilitate required inward gradient and dewatered elevation and shall include sump and sand bags and other filtration as needed to minimize disturbance and entrainment of sediment from below the pump.

3.2 DB-2 Excavation and Backfill:

A. Soil Excavation

1. Initial target excavation depth for hydrocarbon impacted areas shall extend to +1 ft-MLLW (City of Edmonds Mean former Lower Low Water).
2. The Contractor is responsible for the stability of the side slopes during excavation. Temporary slopes shall be limited to 2H:1V or less steep. Alternative excavation techniques, including controlled excavation using sheet piles or soldier piles or by utilizing limited width excavations shall be submitted to the Engineer for review.

3. If excavations encounter conditions requiring the extraction of LNAPL and/or petroleum hydrocarbon impacted water, additional excavation along the bank both vertically and horizontally shall be conducted according to the SAP in Attachment C of the 2016 IAWP using the 25 ft by 25 ft sampling grid system to verify the REL and CUL limits are met. This shall occur only upon direction by the Engineer.
4. Excavations for petroleum hydrocarbon impacted areas shall extend laterally and vertically until the REL and CUL limits are met.
5. Upon achieving acceptable REL and CUL levels of the soils along the excavation bottoms and sidewalls, a survey of the final extent of the excavation shall be conducted.

D. Excavated Soil Management

1. Soil shall be placed in the lined staging area for gravity dewatering in order to meet the required moisture content for transport and thermal treatment or disposal at the approved facility. Amendments to be used with the soil used to achieve the required moisture content must be approved by the Engineer. Purchase of dry soil or other drying agent may be the preferred option by Owner and Engineer.
2. Contractor shall manage stockpiles of soil excavated to provide a minimum of 8 hours for gravity dewatering of decant water and excess pore water from the wet soil prior to adding amendments, unless otherwise approved by the Engineer.
3. Use odor-suppressant foams as necessary during contaminated soil gravity dewatering.
4. Excavated soil shall be transported offsite for recycling/disposal.
5. Contractor shall transport soil for treatment or disposal at a facility pre-approved by the Owner.

B. LNAPL and Water Management

1. Water generated during excavation dewatering from the sump pumps within the footprint of the DB-2 excavation area will be sent to the onsite water treatment facility.
2. Water generated in the staging area during excavation activities will be sent to the onsite water treatment facility.
3. If encountered, Contractor shall remove the LNAPL within the soil excavation areas by vacuum truck for offsite recycling/treatment.
4. If encountered, Contractor shall extract the petroleum hydrocarbon impacted groundwater and send to the onsite facility for treatment.

C. Water Treatment System

1. Extracted groundwater and/or storm water shall be treated using the onsite water treatment system prior to discharge to Detention Basin No. 2 pursuant to the conditions of a NPDES discharge permit. Impacted water shall be extracted and treated at a maximum rate of 35,600 gpd.

2. The Engineer shall collect water samples from the effluent of the treatment system and from ports within the system to verify the system performance. The sampling schedule and analytical parameters shall be in accordance with the Individual NPDES permit in Attachment B.

D. Backfill

1. Clean imported saturated zone backfill specified in Part 2 shall be placed within the saturated zone.
2. According to the Draft Preliminary Geotechnical Engineering Report prepared by Landau Associates for the WSDOT Edmonds Crossing (Landau Associates 2008), the material to be excavated as well as underlying soils will likely liquefy during the design seismic event and would require ground improvement to adequately support new structures. Backfilling activities included in this scope are intended to replace the existing contaminated soils with clean backfill material as well as grade the ground surface towards DB-1. Since liquefaction is expected to occur throughout the Site due to the design seismic event, no effort will be made to compact the new saturated zone fill to a density that would prevent liquefaction or perform another form of ground improvement. Ground improvement is not part of this scope and it is possible that newly placed saturated zone fill will liquefy during strong seismic shaking.
3. Clean imported (vadose zone) backfill specified in Part 2 shall be placed within the vadose zone.
4. Clean imported backfill shall be used within the upper 6 inches of the surface.
5. Backfill placement and compaction for vadose zone backfill shall meet a minimum 90 percent modified proctor dry density per ASTM D1557. Tests shall be performed at a frequency of one test every other lift and every lift within three feet of the final grade surface unless otherwise approved by the Engineer.
6. Contractor shall survey final grade elevations following restoration.

E. Restoration

1. Contractor shall restore disturbed areas outside of the Willow Creek Extension to pre-construction conditions. Inside the Willow Creek Extension, Contractor shall provide restoration planting as shown in Attachment A.
2. Backfill shall be placed within the footprint of the excavation along the Willow Creek surface to restore the pre-removal grade.
3. The Contractor shall cover the surface of the backfilled sediment with a BioNet or equivalent to prevent erosion and allow plant growth in a brackish water environment. The BioNet shall consist of a material capable of resisting erosional flow velocities of 5 feet/sec. Minimum overlap of BioNet is 3 feet and all positions shall be staked with flanged tops pinned flush with grade of the Willow Creek Extension (i.e., stakes shall not stickup into the water column).
4. The Contractor shall plant the re-established surface with environmentally compatible plant-life as indicated on the Planting Plan shown in Attachment A.
5. The Contractor shall remove berms during low tide minimizing water flow velocities to protect the re-established ditch surface.

3.3 Construction Observations

To properly monitor construction progress and quality, design conformance, and variable field conditions; and to maintain consistent communication between all parties, the Engineer's Representative shall provide full-time observation during construction. The primary responsibility of the Engineer's Representative shall be the appropriate and efficient resolution of technical, scheduling, coordination and constructability issues. The Engineer's Representative shall also be responsible for the following:

A. Conduct weekly progress meeting to be attended by the Owner, Engineer and Contractor.

B. Prepare Field Orders to properly track and address variable field conditions, as required and requested by the Owner. Major field order items shall be communicated with the appropriate regulatory authority, as determined by the Owner and Engineer.

C. Prepare sketches required to resolve problems due to actual field conditions encountered.

D. Serve as the liaison between the Owner, Engineer, other project team consultants, Contractor and regulatory authorities to maintain an efficient exchange of information.

E. Coordinate with adjacent property Owners (if necessary).

F. Observe the execution of the work and prepare field reports.

G. Perform construction quality assurance tasks, including regular erosion and sediment control inspections.

H. Observe and monitor construction quality control testing.

I. Work with the Contractor to prepare weekly construction status reports and schedules.

J. Review any II/NLI reports with the Contractor and monitor the appropriate measures taken by the Contractor to protect personnel from the hazard in question.

K. Observe if the Contractor deviates from any of the OE Tenets and require a Management of Change that includes a risk assessment with involvement of appropriate subject matter experts.

L. Perform the final inspection and prepare the final report at project completion.

3.4 Design Support

The Engineer, and potentially other project team consultants, will provide engineering and design support services during construction. Individuals familiar with the Site restoration objectives and design activities shall provide this support. These individuals shall assist in addressing and resolving technical issues as they arise during the construction activities. As part of design support activities, perform submittal reviews.

3.5 Reporting

The Engineer's Representative shall work with the Contractor to maintain a red-lined markup of Contract Drawings to document changes. The Contractor shall provide surveys (with elevations and positions of removal areas) to show that the work has met the construction criteria detailed in this *Project Manual*.

Part 4 – References

Landau Associates, December 4, 2008, *Draft Preliminary Geotechnical Engineering Report*, Edmonds Crossing Project, Edmonds, Washington.

Arcadis. 2016. *Final Interim Action Work Plan*. Former Unocal Edmonds Bulk Fuel Terminal. January 27.

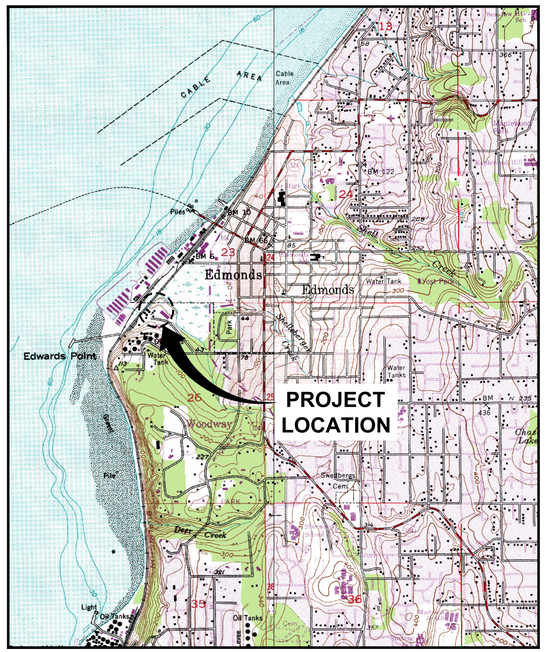
.

ATTACHMENT A

CONTRACT DRAWINGS

CONTRACT DRAWINGS

INTERIM ACTION FOR 2015 LOWER YARD FORMER UNOCAL EDMONDS BULK FUEL TERMINAL



REFERENCE: BASE MAP USGS QUADS., 7.5 MIN. SERIES (TOPOGRAPHIC) - EDMONDS EAST, WASH. AND EDMONDS WEST, WASH.

LOCATION MAP

0 2000' 4000'

GRAPHIC SCALE

WASHINGTON

DATE ISSUED

MARCH 8, 2016

CHEVRON ENVIRONMENTAL MANAGEMENT COMPANY EDMONDS, WASHINGTON

ARCADIS

ARCADIS U.S., INC.

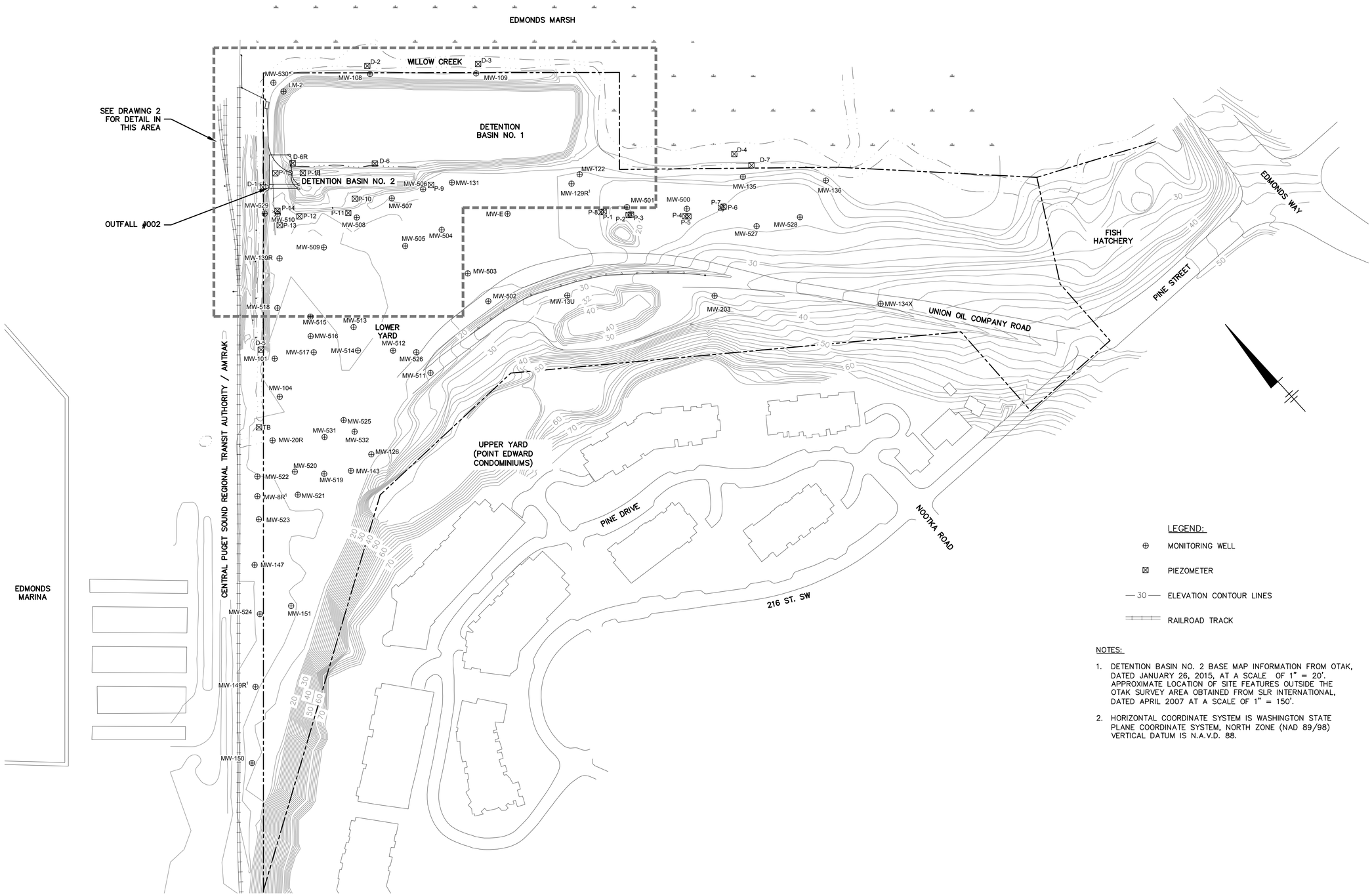
KEY CONTACTS:

PROJECT SITE:
FORMER UNOCAL EDMONDS BULK FUEL TERMINAL
11720 UNOCO ROAD
EDMONDS, WA., 98020

ENGINEER:
ARCADIS U.S., INC.
1100 OLIVE WAY, SUITE 800
SEATTLE, WA., 98101
TELEPHONE 206.726.4726
CONTACT: CARSTEN BECKER, P.E.

RESPONDENT:
CHEVRON ENVIRONMENTAL
MANAGEMENT COMPANY
6101 BOLLINGER CANYON ROAD
SAN RAMON, CA 94583
TELEPHONE: 925.790.3946
CONTACT: KIM JOLITZ, P.G., C..HG.

INDEX TO DRAWINGS



LEGEND:

- ⊕ MONITORING WELL
- ⊠ PIEZOMETER
- —30— ELEVATION CONTOUR LINES
- RAILROAD TRACK

NOTES:

1. DETENTION BASIN NO. 2 BASE MAP INFORMATION FROM OTAK, DATED JANUARY 26, 2015, AT A SCALE OF 1" = 20'. APPROXIMATE LOCATION OF SITE FEATURES OUTSIDE THE OTAK SURVEY AREA OBTAINED FROM SLR INTERNATIONAL, DATED APRIL 2007 AT A SCALE OF 1" = 150'.
2. HORIZONTAL COORDINATE SYSTEM IS WASHINGTON STATE PLANE COORDINATE SYSTEM, NORTH ZONE (NAD 89/98) VERTICAL DATUM IS N.A.V.D. 88.

1"=100' (100' 0 100' 200')

THIS BAR REPRESENTS ONE INCH ON THE ORIGINAL DRAWING: USE TO VERIFY FIGURE REPRODUCTION SCALE

No.	Date	Revisions	By	Cʼd

Professional Engineer's Name		
CARSTEN BECKER		
Professional Engineer's No.		
39822		
State	Date Signed	Project Mgr.
WA		S
Designed	Drawn	Checked
RP	GS	CB

ARCADIS

ARCADIS U.S., INC.

FORMER UNOCAL EDMONDS TERMINAL • EDMONDS, WASHINGTON

INTERIM ACTION FOR 2015 LOWER YARD

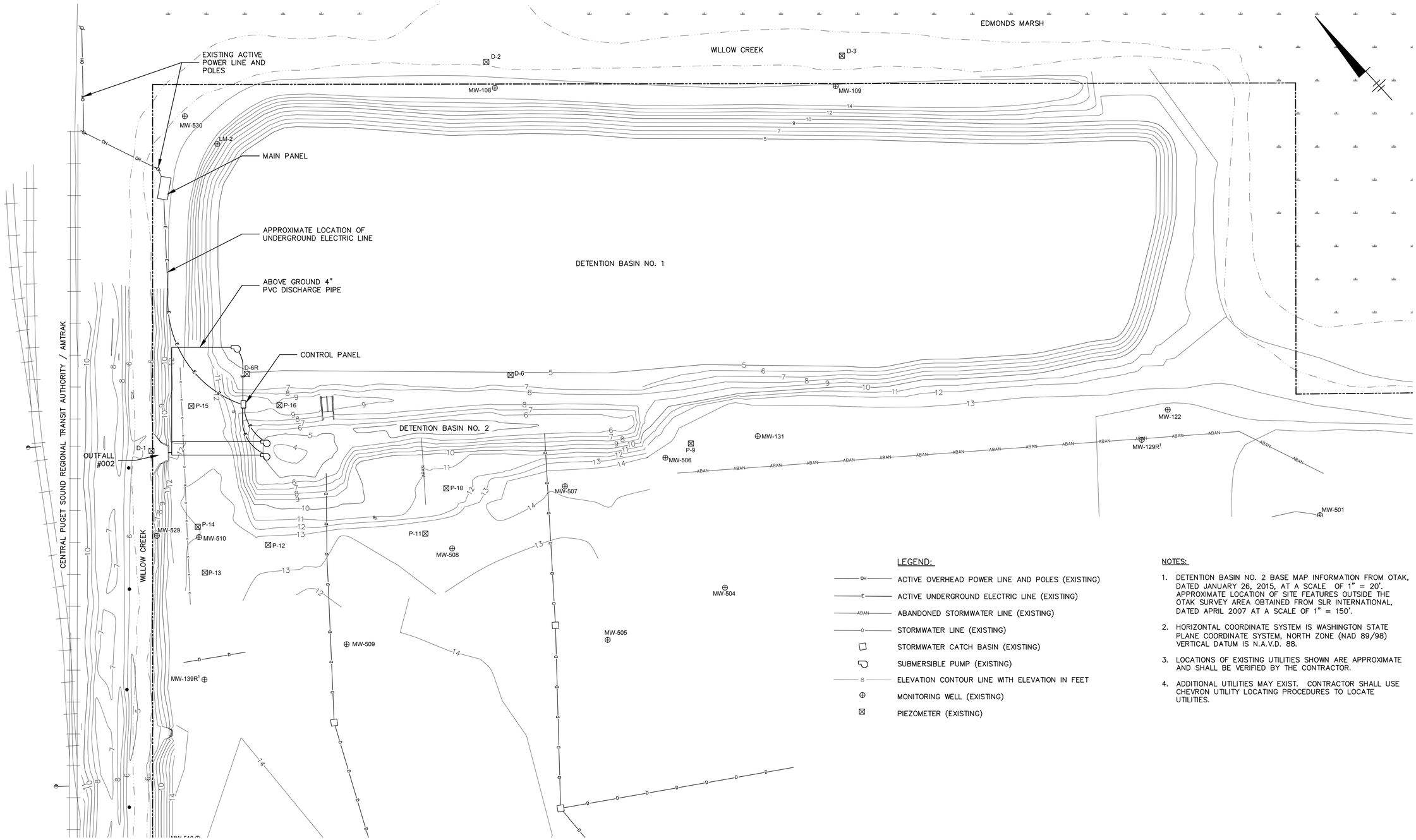
GENERAL SITE PLAN

ARCADIS Project No.
B0045362.0006.00004

Date
MARCH 2016

ARCADIS U.S., INC.
1100 OLIVE WAY, SUITE 800
SEATTLE, WA, 98101
Tel: 206.726.4726

1



LEGEND:

- ACTIVE OVERHEAD POWER LINE AND POLES (EXISTING)
- ACTIVE UNDERGROUND ELECTRIC LINE (EXISTING)
- ABANDONED STORMWATER LINE (EXISTING)
- STORMWATER LINE (EXISTING)
- STORMWATER CATCH BASIN (EXISTING)
- SUBMERSIBLE PUMP (EXISTING)
- ELEVATION CONTOUR LINE WITH ELEVATION IN FEET
- MONITORING WELL (EXISTING)
- PIEZOMETER (EXISTING)

NOTES:

1. DETENTION BASIN NO. 2 BASE MAP INFORMATION FROM OTAK, DATED JANUARY 26, 2015, AT A SCALE OF 1" = 20'. APPROXIMATE LOCATION OF SITE FEATURES OUTSIDE THE OTAK SURVEY AREA OBTAINED FROM SLR INTERNATIONAL, DATED APRIL 2007 AT A SCALE OF 1" = 150'.
2. HORIZONTAL COORDINATE SYSTEM IS WASHINGTON STATE PLANE COORDINATE SYSTEM, NORTH ZONE (NAD 89/98) VERTICAL DATUM IS N.A.V.D. 88.
3. LOCATIONS OF EXISTING UTILITIES SHOWN ARE APPROXIMATE AND SHALL BE VERIFIED BY THE CONTRACTOR.
4. ADDITIONAL UTILITIES MAY EXIST. CONTRACTOR SHALL USE CHEVRON UTILITY LOCATING PROCEDURES TO LOCATE UTILITIES.

1"=30' (30' 0 30' 60')

THIS BAR REPRESENTS ONE INCH ON THE ORIGINAL DRAWING: USE TO VERIFY FIGURE REPRODUCTION SCALE

No.	Date	Re□isions	B□	C□d

Professional Engineer's Na□e		
CARSTEN BECKER		
Professional Engineer's No.		
39822		
State	Date Signed	Pro□□t Mgr.
WA		S□
Designed □□	Drawn □□	C□e□□ed □□
RP□	GS	CB

ARCADIS

ARCADIS U.S., INC.

FORMER UNOCAL EDMONDS TERMINAL • EDMONDS, WASHINGTON

INTERIM ACTION FOR 2015 LOWER YARD

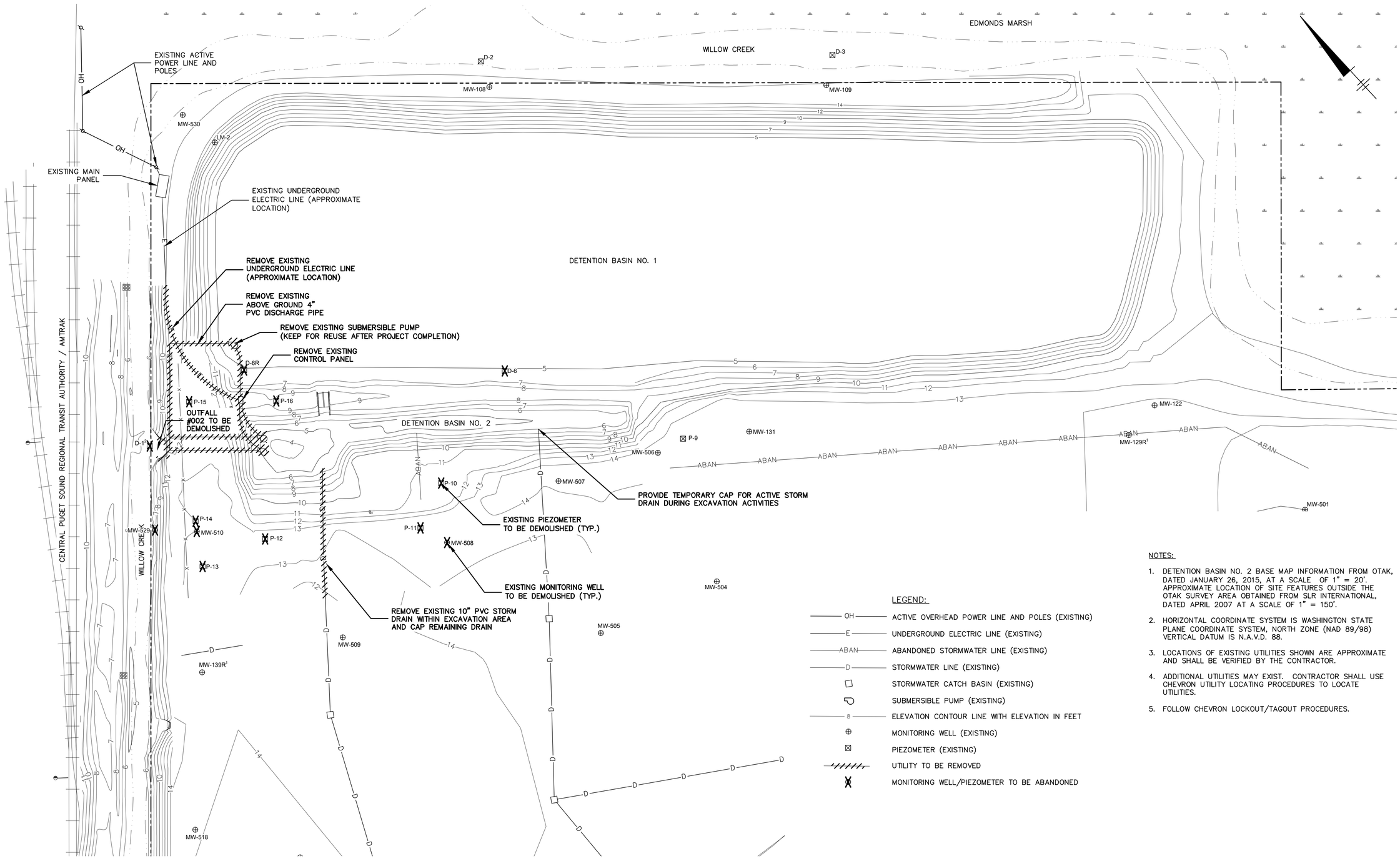
SITE PLAN - EXISTING CONDITIONS

ARCADIS Pro□□t No.
B0045362.0006.00004

Date
MARCH 2016

ARCADIS U.S., INC.
1100 OLIVE WAY, SUITE 800
SEATTLE, WA. 98101
Tel: 206.726.4726

2



NOTES:

1. DETENTION BASIN NO. 2 BASE MAP INFORMATION FROM OTAK, DATED JANUARY 26, 2015, AT A SCALE OF 1" = 20'. APPROXIMATE LOCATION OF SITE FEATURES OUTSIDE THE OTAK SURVEY AREA OBTAINED FROM SLR INTERNATIONAL, DATED APRIL 2007 AT A SCALE OF 1" = 150'.
2. HORIZONTAL COORDINATE SYSTEM IS WASHINGTON STATE PLANE COORDINATE SYSTEM, NORTH ZONE (NAD 89/98) VERTICAL DATUM IS N.A.V.D. 88.
3. LOCATIONS OF EXISTING UTILITIES SHOWN ARE APPROXIMATE AND SHALL BE VERIFIED BY THE CONTRACTOR.
4. ADDITIONAL UTILITIES MAY EXIST. CONTRACTOR SHALL USE CHEVRON UTILITY LOCATING PROCEDURES TO LOCATE UTILITIES.
5. FOLLOW CHEVRON LOCKOUT/TAGOUT PROCEDURES.

LEGEND:

- OH — ACTIVE OVERHEAD POWER LINE AND POLES (EXISTING)
- E — UNDERGROUND ELECTRIC LINE (EXISTING)
- ABAN — ABANDONED STORMWATER LINE (EXISTING)
- D — STORMWATER LINE (EXISTING)
- STORMWATER CATCH BASIN (EXISTING)
- SUBMERSIBLE PUMP (EXISTING)
- 8 — ELEVATION CONTOUR LINE WITH ELEVATION IN FEET
- MONITORING WELL (EXISTING)
- PIEZOMETER (EXISTING)
- UTILITY TO BE REMOVED
- MONITORING WELL/PIEZOMETER TO BE ABANDONED

1"=30' (30' 0 30' 60')

THIS BAR REPRESENTS ONE INCH ON THE ORIGINAL DRAWING: USE TO VERIFY FIGURE REPRODUCTION SCALE

No.	Date	Revisions	By	Ckd

Professional Engineer's Name		
CARSTEN BECKER		
Professional Engineer's No.		
39822		
State	Date Signed	Project Mgr.
WA		S
Designed RP	Drawn GS	Checked CB

ARCADIS

ARCADIS U.S., INC.

FORMER UNOCAL EDMONDS TERMINAL • EDMONDS, WASHINGTON

INTERIM ACTION FOR 2015 LOWER YARD

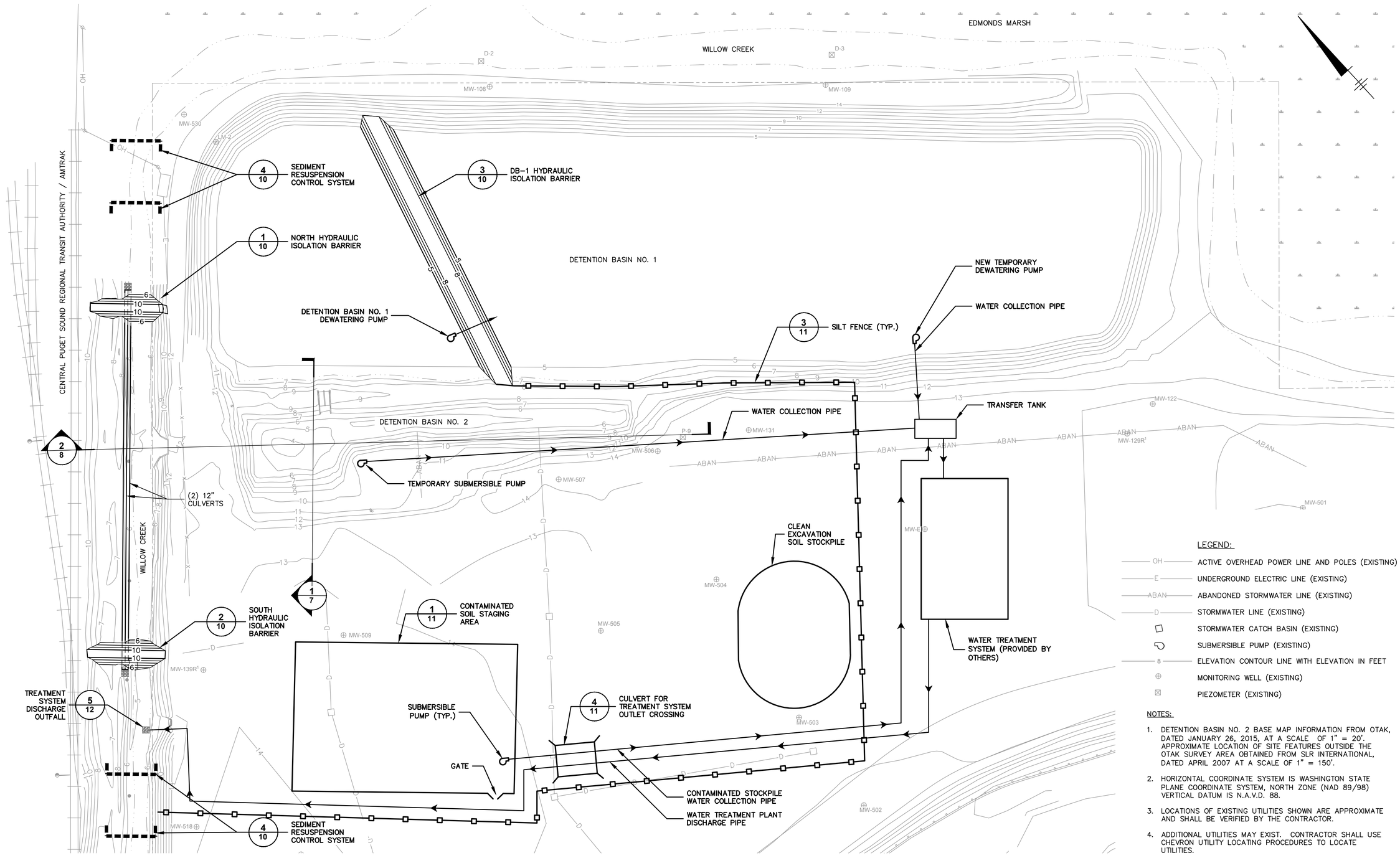
DEMOLITION PLAN

ARCADIS Project No. B0045362.0006.00004

Date MARCH 2016

ARCADIS U.S., INC.
1100 OLIVE WAY, SUITE 800
SEATTLE, WA, 98101
Tel: 206.726.4726

3



LEGEND:

- OH — ACTIVE OVERHEAD POWER LINE AND POLES (EXISTING)
- E — UNDERGROUND ELECTRIC LINE (EXISTING)
- ABAN — ABANDONED STORMWATER LINE (EXISTING)
- D — STORMWATER LINE (EXISTING)
- STORMWATER CATCH BASIN (EXISTING)
- SUBMERSIBLE PUMP (EXISTING)
- 8 — ELEVATION CONTOUR LINE WITH ELEVATION IN FEET
- MONITORING WELL (EXISTING)
- PIEZOMETER (EXISTING)

NOTES:

1. DETENTION BASIN NO. 2 BASE MAP INFORMATION FROM OTAK, DATED JANUARY 26, 2015, AT A SCALE OF 1" = 20'. APPROXIMATE LOCATION OF SITE FEATURES OUTSIDE THE OTAK SURVEY AREA OBTAINED FROM SLR INTERNATIONAL, DATED APRIL 2007 AT A SCALE OF 1" = 150'.
2. HORIZONTAL COORDINATE SYSTEM IS WASHINGTON STATE PLANE COORDINATE SYSTEM, NORTH ZONE (NAD 89/98) VERTICAL DATUM IS N.A.V.D. 88.
3. LOCATIONS OF EXISTING UTILITIES SHOWN ARE APPROXIMATE AND SHALL BE VERIFIED BY THE CONTRACTOR.
4. ADDITIONAL UTILITIES MAY EXIST. CONTRACTOR SHALL USE CHEVRON UTILITY LOCATING PROCEDURES TO LOCATE UTILITIES.

CITY:SYRACUSE-NY DIV/GROUP:ENVCAD DB:G.STEINBERGER LD: PIC:M.FLEISCHNER PM:S..ORN TM:R..IL:ENNY LYR:(Opt)ON=*;OFF=*REF*
G:\ENVCAD\SYRACUSE\ACTIB\0045362\0006\00004\DWG\CONTRACT45362C04.dwg LAYOUT: 4 SAVED: 2/8/2016 10:18 AM ACADVER: 19.1S (LMS TECH) PAGESETUP: PDF-DL PLOTSTYLETABLE: PLTCONT.CTB PLOTTED: 2/8/2016 1:26 PM BY: STEINBERGER, GEORGE
XREFS: IMAGES: PROJECTNAME: ----
45362X00
45362X01
45362X02
45362X03

1"=30' (30' 0 30' 60')

THIS BAR REPRESENTS ONE INCH ON THE ORIGINAL DRAWING: USE TO VERIFY FIGURE REPRODUCTION SCALE

No.	Date	Revisions	By	Ckd

Professional Engineer's Name
CARSTEN BECKER
Professional Engineer's No.
39822

State	Date Signed	Project Mgr.
WA		S
Designed	Drawn	Checked
RP	GS	CB

ARCADIS

ARCADIS U.S., INC.

FORMER UNOCAL EDMONDS TERMINAL • EDMONDS, WASHINGTON
INTERIM ACTION FOR 2015 LOWER YARD

SITE PREPARATION AND HYDRAULIC ISOLATION PLAN

ARCADIS Project No.
B0045362.0006.00004

Date
MARCH 2016

ARCADIS U.S., INC.
1100 OLIVE WAY, SUITE 800
SEATTLE, WA, 98101
Tel: 206.726.4726

4

EDMONDS MARSH

WILLOW CREEK

MW-530

DETENTION BASIN NO. 1

EXCLUSION ZONE

SUPPORT ZONE

AMS-7

AMS-6

ABAN

ABAN

ABAN

ABAN

EXCAVATION AREA

CLEAN EXCAVATION SOIL STOCKPILE

AMS-5

WATER TREATMENT SYSTEM

CONTAMINATION REDUCTION ZONE

CENTRAL PUGET SOUND REGIONAL TRANSIT AUTHORITY / AMTRAK

WILLOW CREEK

CONTAMINATED SOIL STAGING AREA

AMS-4

OFFICE TRAILERS

UNION OIL COMPANY ROAD

SECURITY STATION

AMS-3

CULVERT FOR TREATMENT SYSTEM OUTLET CROSSING

4
11

TRUCK WASH AREA

SITE ENTRANCE

PINE STREET

AMS-2

AMS-1

CLEAN IMPORT

AIR MONITORING STATION (TYP.)

PINE DRIVE

LEGEND:

TRAFFIC FLOW DIRECTION

AMS-5 AIR MONITORING STATION

CITY:SYRACUSE-NY DIV/GROUP:ENVCAD DB:G.STEINBERGER LD: PIC:M.FLEISCHNER PM:S□ORN TM:R□IL□ENNY LYR:(Opt)ON=*OFF=*REF*
G:\ENV\CADISYRACUSE\ACT\B0045362\0006\00004\DWG\CONTRACT\45362G05.dwg LAYOUT: 5 SAVED: 10/12/2015 3:53 PM ACADVER: 19.1S (LMS TECH) PAGESETUP: PDF-DL PLOTSTYLETABLE: PLTCONT.CTB PLOTTED: 2/8/2016 1:26 PM BY: STEINBERGER, GEORGE

XREFS: IMAGES: PROJECTNAME: ----
45362X00
45362X01
45362X02
45362X03
45362X04

60' 0 60' 120'
1"=60'

THIS BAR REPRESENTS ONE INCH ON THE ORIGINAL DRAWING:

USE TO VERIFY FIGURE REPRODUCTION SCALE

No.	Date	Re□isions	B□	C□d

Professional Engineer's Na□e
CARSTEN BECKER
Professional Engineer's No.
39822

State	Date Signed	Pro□ect Mgr.
WA		S□
Designed □□	Drawn □□	C□e□□ed □□
RP□	GS	CB

ARCADIS

ARCADIS U.S., INC.

FORMER UNOCAL EDMONDS TERMINAL • EDMONDS, WASHINGTON
INTERIM ACTION FOR 2015 LOWER YARD

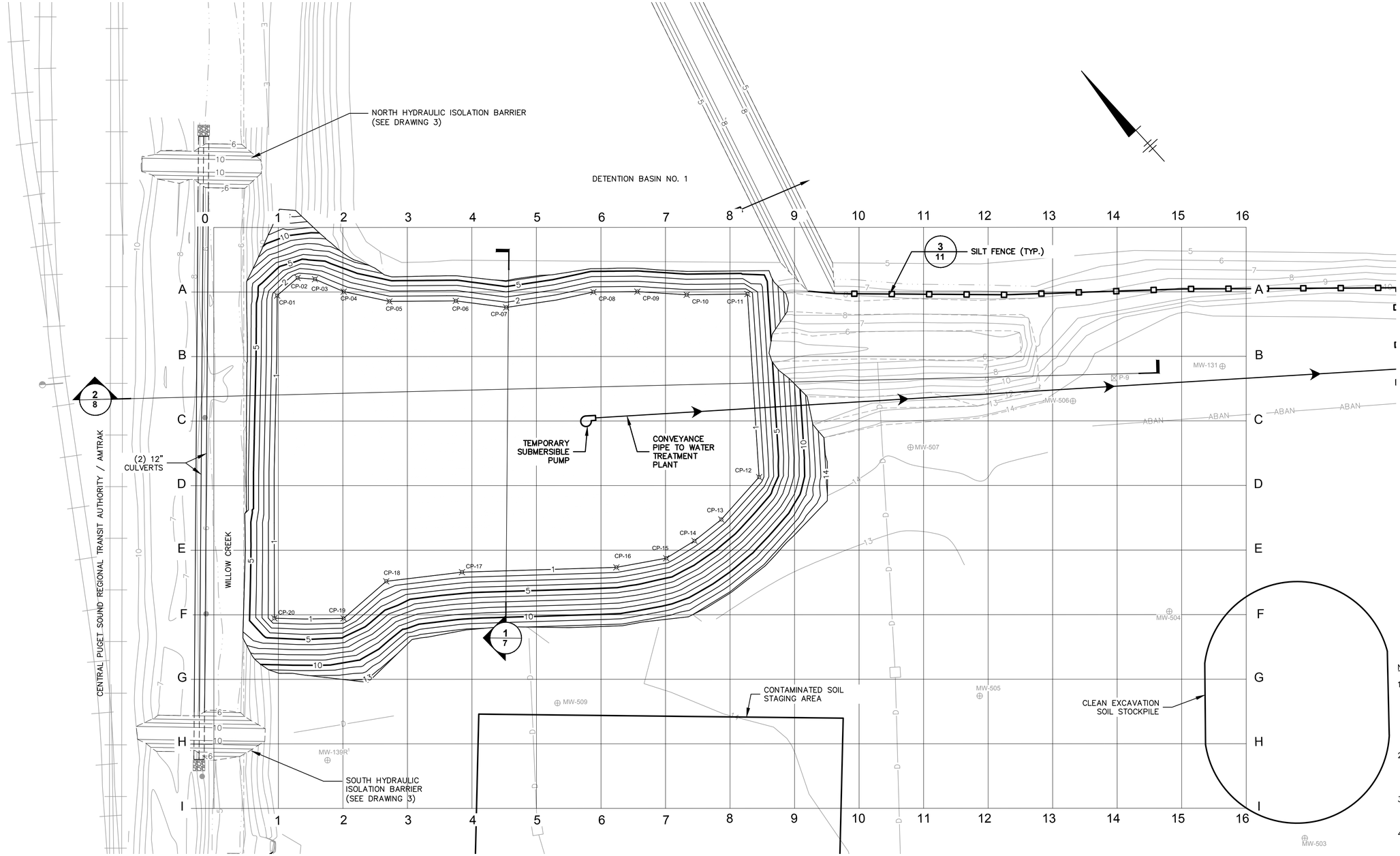
TRAFFIC CONTROL AND AIR MONITORING STATION PLAN

ARCADIS Pro□ect No.
B0045362.0006.00004

Date
MARCH 2016

ARCADIS U.S., INC.
1100 OLIVE WAY, SUITE 800
SEATTLE, WA, 98101
Tel: 206.726.4726

5



LEGEND:

- 5 — PROPOSED CONTOUR
- CP-01 — CONTROL POINT
- SILT FENCE
- D — STORMWATER LINE
- EXISTING CATCH BASIN

CONTROL POINTS			
ID	NORTHING	EASTING	ELEVATION
CP-01	298248.22	1258080.11	1.00
CP-02	298247.92	1258090.58	1.00
CP-03	298242.99	1258095.20	1.00
CP-04	298231.91	1258100.13	1.00
CP-05	298217.13	1258110.60	1.00
CP-06	298199.89	1258129.70	1.00
CP-07	298184.81	1258142.33	1.00
CP-08	298166.34	1258171.28	1.00
CP-09	298154.95	1258183.91	1.00
CP-10	298141.10	1258197.15	1.00
CP-11	298125.40	1258214.71	1.00
CP-12	298070.11	1258170.04	1.00
CP-13	298067.96	1258148.17	1.00
CP-14	298068.88	1258134.93	1.00
CP-15	298071.34	1258122.30	1.00
CP-16	298081.81	1258105.66	1.00
CP-17	298120.91	1258060.39	1.00
CP-18	298138.14	1258036.36	1.00
CP-19	298138.76	1258014.49	1.00
CP-20	298156.93	1257994.78	1.00

NOTES:

1. DETENTION BASIN NO. 2 BASE MAP INFORMATION FROM OTAK, DATED JANUARY 26, 2015, AT A SCALE OF 1" = 20'. APPROXIMATE LOCATION OF SITE FEATURES OUTSIDE THE OTAK SURVEY AREA OBTAINED FROM SLR INTERNATIONAL, DATED APRIL 2007 AT A SCALE OF 1" = 150'.
2. HORIZONTAL COORDINATE SYSTEM IS WASHINGTON STATE PLANE COORDINATE SYSTEM, NORTH ZONE (NAD 89/98) VERTICAL DATUM IS N.A.V.D. 88.
3. LOCATIONS OF EXISTING UTILITIES SHOWN ARE APPROXIMATE AND SHALL BE VERIFIED BY THE CONTRACTOR.
4. ADDITIONAL UTILITIES MAY EXIST. CONTRACTOR SHALL USE CHEVRON UTILITY LOCATING PROCEDURES TO LOCATE UTILITIES.
5. EXCAVATIONS SHALL BE SLOPED NO STEEPER THAN 2H:1V. CONTRACTOR IS RESPONSIBLE FOR SAFETY OF EXCAVATIONS AND PROPER TRENCHING, BENCHING, AND SLOPING IN ACCORDANCE WITH OSHA STANDARD 1926.

CITY:SYRACUSE-NY DIV/GROUP:ENVCAD DB:G.STEINBERGER LD: PIC:M.FLEISCHNER PM:S..ORN TM:R..ILLENNY LYR:(Opt)ON=*;OFF=*REF*
G:\ENVCAD\SYRACUSE\ACTIB0045362\0006\0004\DWG\CONTRACT45362G06.dwg LAYOUT: 6 SAVED: 2/8/2016 1:23 PM ACADVER: 19.1S (LMS TECH) PAGESETUP: PDF-DL PLOTSTYLETABLE: PLTCONT.CTB PLOTTED: 2/8/2016 1:26 PM BY: STEINBERGER, GEORGE
XREFS: IMAGES: PROJECTNAME: ---
45362X00
45362X01
45362X02
45362X04
45362X03

1"=20' (20' 0 20' 40')

THIS BAR REPRESENTS ONE INCH ON THE ORIGINAL DRAWING: USE TO VERIFY FIGURE REPRODUCTION SCALE

No.	Date	Revisions	By	Cd

Professional Engineer's Name		
CARSTEN BECKER		
Professional Engineer's No.		
39822		
State	Date Signed	Project Mgr.
WA		S
Designed	Drawn	Checked
RP	GS	CB

ARCADIS

ARCADIS U.S., INC.

FORMER UNOCAL EDMONDS TERMINAL • EDMONDS, WASHINGTON

INTERIM ACTION FOR 2015 LOWER YARD

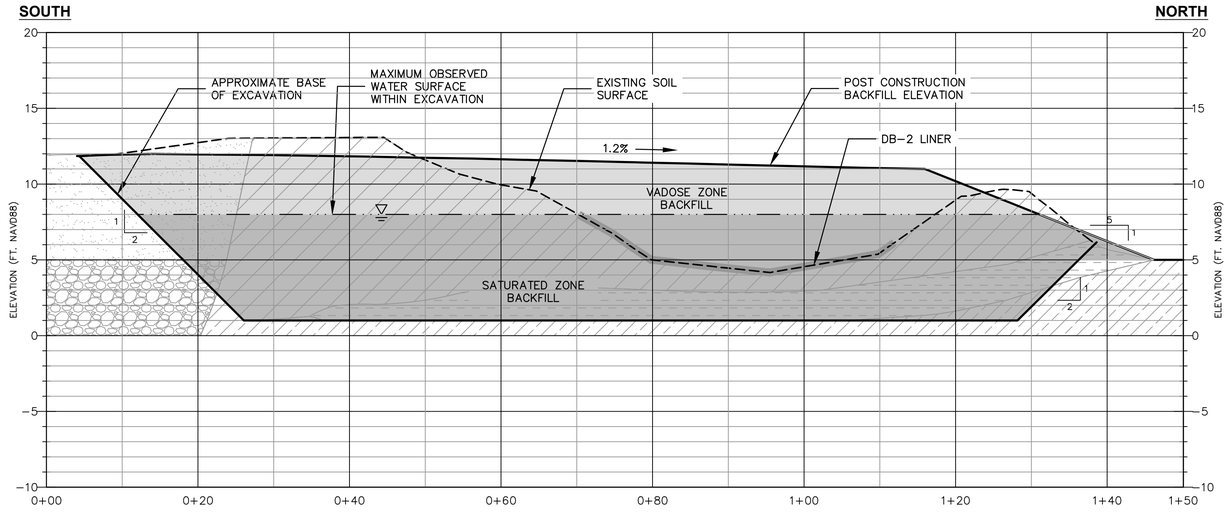
EXCAVATION PLAN

ARCADIS Project No.
B0045362.0006.00004

Date
MARCH 2016

ARCADIS U.S., INC.
1100 OLIVE WAY, SUITE 800
SEATTLE, WA, 98101
Tel: 206.726.4726

6



CROSS SECTION 1

0 10' 20'

HORIZONTAL SCALE: 1"=10'

0 5' 10'

VERTICAL SCALE: 1"=5'

LEGEND:

- GRAVEL FILL
- SILT, SAND, GRAVEL FILL
- BEACH DEPOSITS
- 1929 FILL
- MARSH DEPOSITS
- SATURATED ZONE
- VADOSE ZONE

NOTE:

1. SOIL LAYERS AND GEOLOGICAL CONTACT LOCATIONS ARE APPROXIMATE AND INFERRED BETWEEN BORING LOCATIONS. LITHOLOGICAL INFORMATION PROVIDED IS BASED ON DATA OBTAINED FROM THE SITE AND ACTUAL SUBSURFACE CONDITIONS ENCOUNTERED DURING EXCAVATIONS MAY BE DIFFERENT FROM THOSE SHOWN.

CITY:SYRACUSE-NY DIV/GROUP:ENVCAD DB:G.STEINBERGER LD: PIC:M.FLEISCHNER PM:S._ORN TM:R._IL._ENNY LYR:(Opt)ON=*;OFF=*REF*
G:\ENVCAD\SYRACUSE\ACTIB\0045362\0006\00004\DWG\CONTRACT\45362G07.dwg LAYOUT: 7 SAVED: 10/5/2015 12:22 PM ACADVER: 19.1S (LMS TECH) PAGESETUP: PDF-DL PLOTSTYLETABLE: PLTCONT.CTB PLOTTED: 2/8/2016 1:27 PM BY: STEINBERGER, GEORGE
XREFS: IMAGES: PROJECTNAME: ----
45362X00

SCALE(S) AS INDICATED

THIS BAR REPRESENTS ONE INCH ON THE ORIGINAL DRAWING: USE TO VERIFY FIGURE REPRODUCTION SCALE

No.	Date	Revisions	By	Ckd

Professional Engineer's Name
CARSTEN BECKER

Professional Engineer's No.
39822

State	Date Signed	Project Mgr.
WA		S
Designed	Drawn	Checked
RP	GS	CB

ARCADIS

ARCADIS U.S., INC.

FORMER UNOCAL EDMONDS TERMINAL • EDMONDS, WASHINGTON

INTERIM ACTION FOR 2015 LOWER YARD

EXCAVATION CROSS SECTION 1

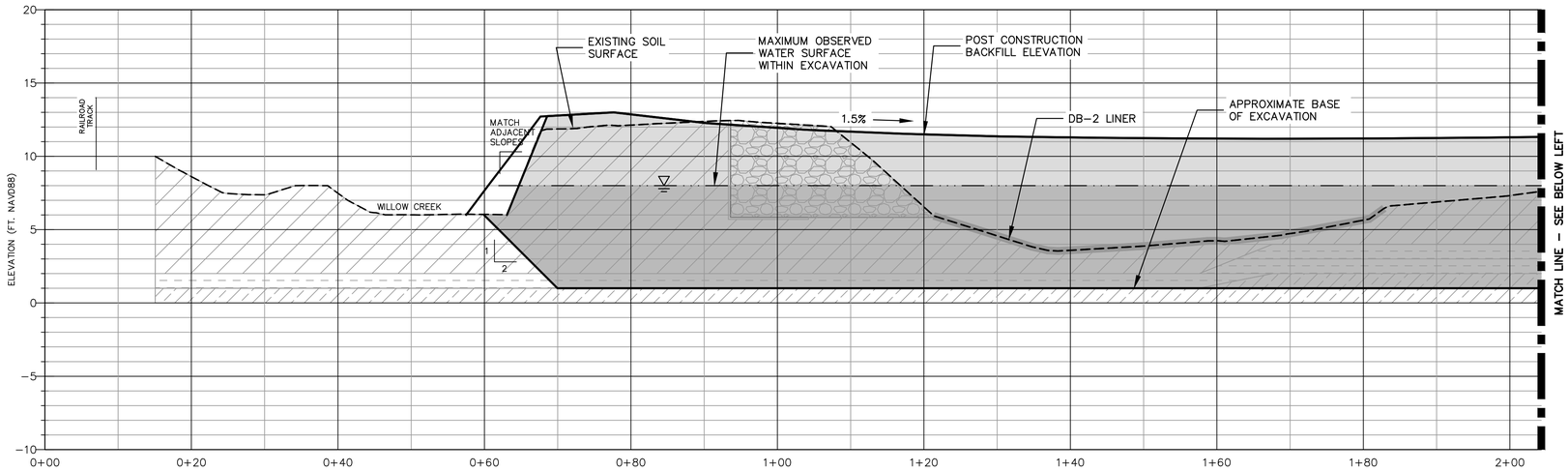
ARCADIS Project No.
B0045362.0006.00004

Date
MARCH 2016

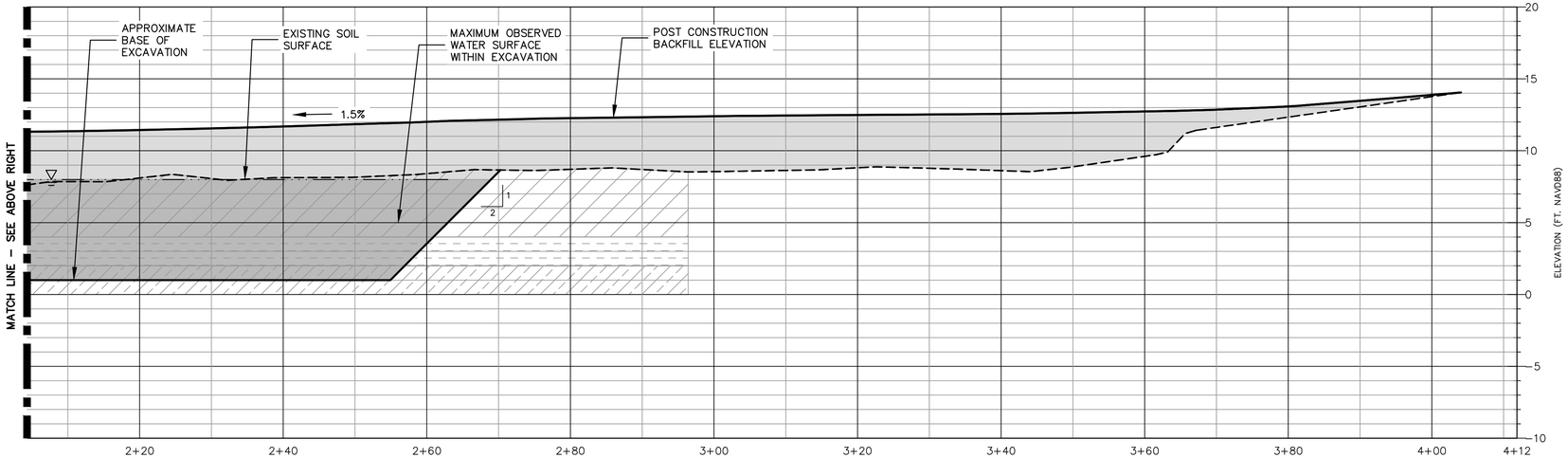
ARCADIS U.S., INC.
1100 OLIVE WAY, SUITE 800
SEATTLE, WA, 98101
Tel: 206.726.4726

7

WEST



EAST



CROSS SECTION 2

0 10' 20'
HORIZONTAL SCALE: 1"=10'

0 5' 10'
VERTICAL SCALE: 1"=5'

LEGEND:

- GRAVEL FILL
- SILT, SAND, GRAVEL FILL
- BEACH DEPOSITS
- 1929 FILL
- MARSH DEPOSITS
- SATURATED ZONE
- VADOSE ZONE

NOTE:

1. SOIL LAYERS AND GEOLOGICAL CONTACT LOCATIONS ARE APPROXIMATE AND INFERRED BETWEEN BORING LOCATIONS. LITHOLOGICAL INFORMATION PROVIDED IS BASED ON DATA OBTAINED FROM THE SITE AND ACTUAL SUBSURFACE CONDITIONS ENCOUNTERED DURING EXCAVATIONS MAY BE DIFFERENT FROM THOSE SHOWN.

SCALE(S) AS INDICATED

THIS BAR REPRESENTS ONE INCH ON THE ORIGINAL DRAWING: ____ USE TO VERIFY FIGURE REPRODUCTION SCALE

No.	Date	Re□isions	B□	C□d

Professional Engineer's Na□e: CARSTEN BECKER
Professional Engineer's No.: 39822
State: WA
Date Signed:
Pro□e□t Mgr.: S□
Designed □□: RP□
Drawn □□: GS
C□e□□ed □□: CB

ARCADIS

ARCADIS U.S., INC.

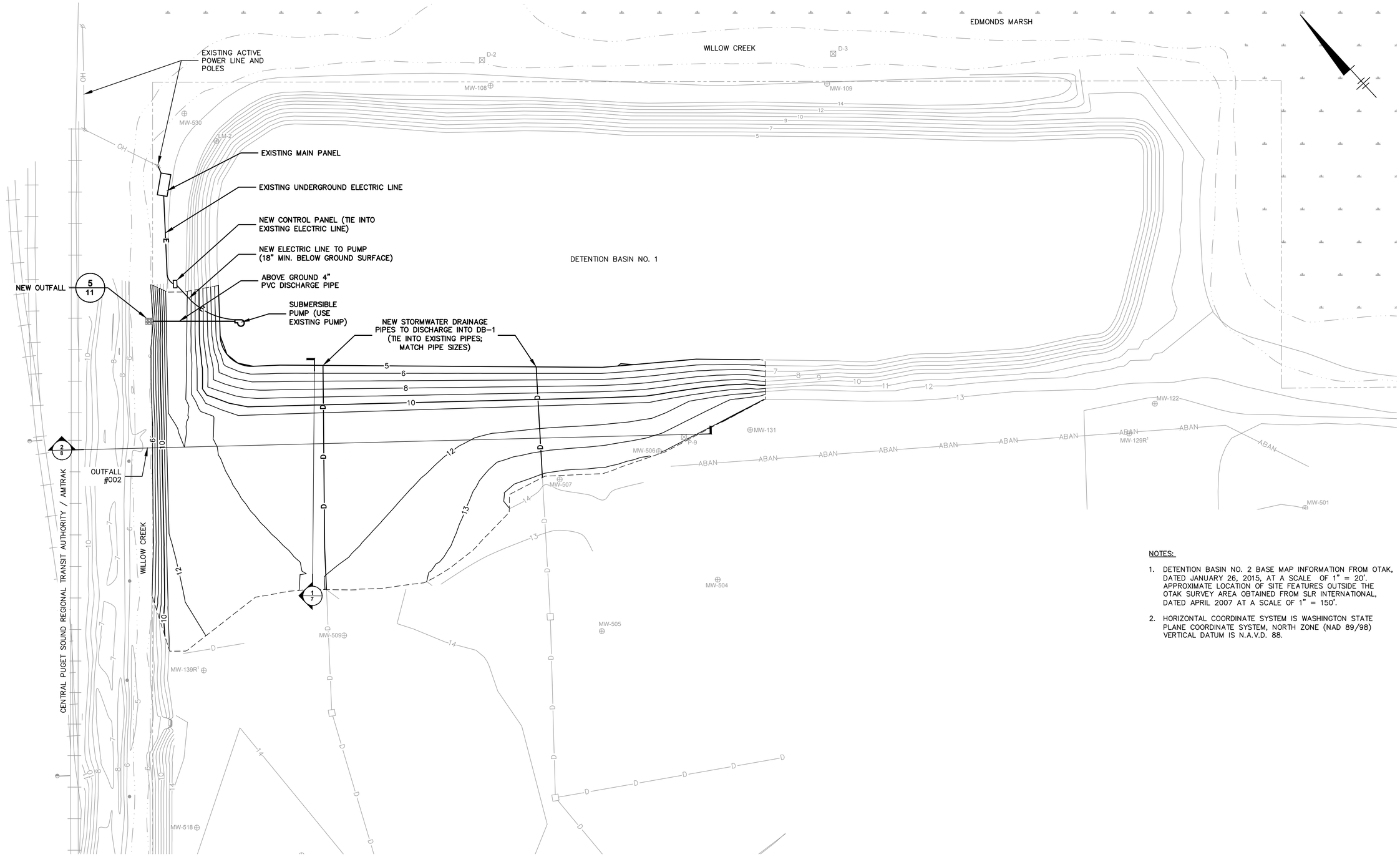
FORMER UNOCAL EDMONDS TERMINAL • EDMONDS, WASHINGTON
INTERIM ACTION FOR 2015 LOWER YARD

EXCAVATION CROSS SECTION 2

ARCADIS Pro□e□t No.
B0045362.0006.00004

Date
MARCH 2016

ARCADIS U.S., INC.
1100 OLIVE WAY, SUITE 800
SEATTLE, WA, 98101
Tel: 206.726.4726



NOTES:

1. DETENTION BASIN NO. 2 BASE MAP INFORMATION FROM OTAK, DATED JANUARY 26, 2015, AT A SCALE OF 1" = 20'. APPROXIMATE LOCATION OF SITE FEATURES OUTSIDE THE OTAK SURVEY AREA OBTAINED FROM SLR INTERNATIONAL, DATED APRIL 2007 AT A SCALE OF 1" = 150'.
2. HORIZONTAL COORDINATE SYSTEM IS WASHINGTON STATE PLANE COORDINATE SYSTEM, NORTH ZONE (NAD 89/98) VERTICAL DATUM IS N.A.V.D. 88.

CITY:SYRACUSE-NY DIV/GROUP:ENV/CAD DB:G.STEINBERGER LD: PIC:M.FLEISCHNER PM:S..ORN TM:R..IL..ENNY LYR:(Opt)ON=*;OFF=*REF*
G:\ENVCAD\SYRACUSE\ACTIB0045362\0006\00004\DWG\CONTRACT\45362G09.dwg LAYOUT: 9 SAVED: 10/21/2015 10:19 AM ACADVER: 19.1S (LMS TECH) PAGESETUP: PDF-DL PLOTSTYLETABLE: PLTCONT.CTB PLOTTED: 2/8/2016 1:27 PM BY: STEINBERGER, GEORGE
XREFS: IMAGES: PROJECTNAME: ---
45362X00
45362X01
45362X05

30' 0 30' 60'
1"=30'

THIS BAR REPRESENTS ONE INCH ON THE ORIGINAL DRAWING:

USE TO VERIFY FIGURE REPRODUCTION SCALE

No.	Date	Revisions	By	Ckd

Professional Engineer's Name
CARSTEN BECKER

Professional Engineer's No.
39822

State	Date Signed	Project Mgr.
WA		S
Designed	Drawn	Checked
RP	GS	CB

ARCADIS

ARCADIS U.S., INC.

FORMER UNOCAL EDMONDS TERMINAL • EDMONDS, WASHINGTON

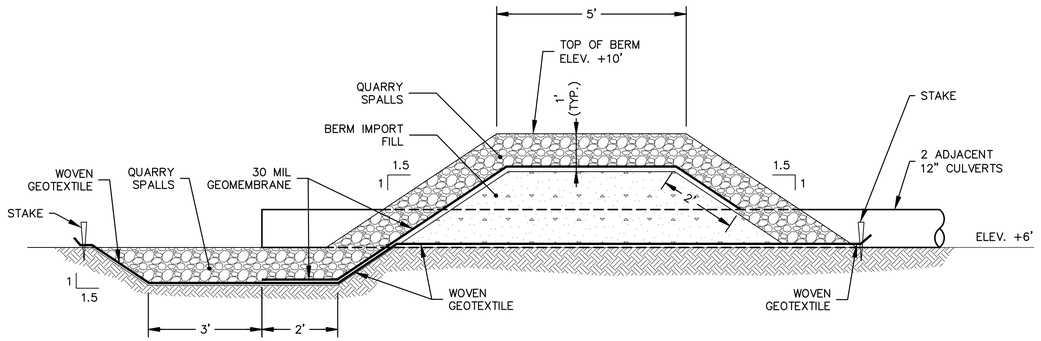
INTERIM ACTION FOR 2015 LOWER YARD

FINAL GRADING AND HYDRAULIC MANAGEMENT PLAN

ARCADIS Project No.
B0045362.0006.00004

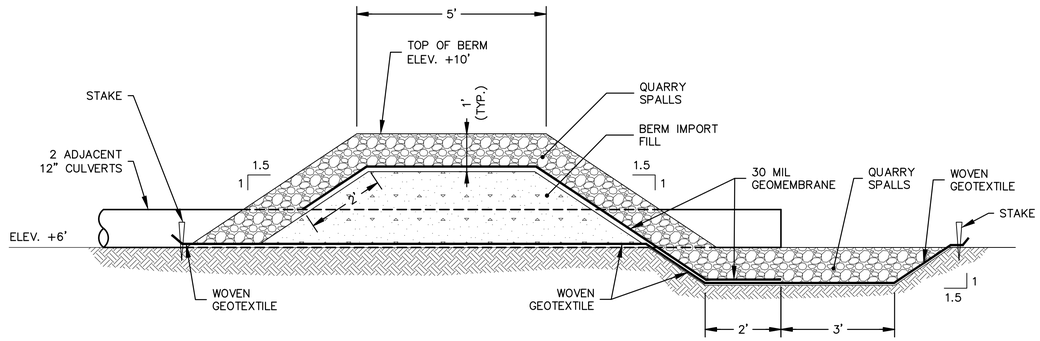
Date
MARCH 2016

ARCADIS U.S., INC.
1100 OLIVE WAY, SUITE 800
SEATTLE, WA, 98101
Tel: 206.726.4726



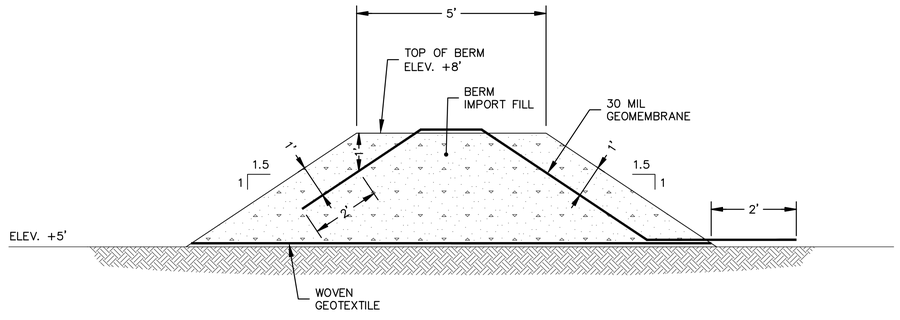
SOUTH HYDRAULIC ISOLATION BARRIER 1

NOT TO SCALE



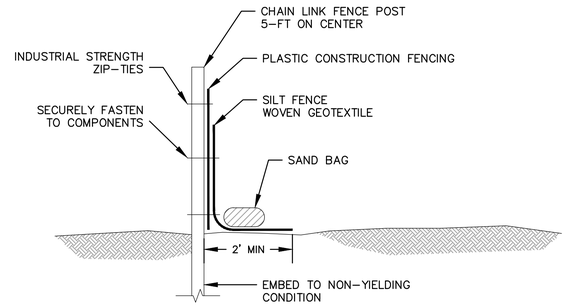
NORTH HYDRAULIC ISOLATION BARRIER 2

NOT TO SCALE



DB-1 HYDRAULIC ISOLATION BARRIER 3

NOT TO SCALE



SEDIMENT RESUSPENSION CONTROL SYSTEM 4

NOT TO SCALE

SCALE(S) AS INDICATED

THIS BAR REPRESENTS ONE INCH ON THE ORIGINAL DRAWING: USE TO VERIFY FIGURE REPRODUCTION SCALE

No.	Date	Revisions	By	Ckd

Professional Engineer's Name
CARSTEN BECKER
Professional Engineer's No.
39822

State	Date Signed	Project Mgr.
WA		S
Designed	Drawn	Checked
RP	GS	CB

ARCADIS

ARCADIS U.S., INC.

FORMER UNOCAL EDMONDS TERMINAL • EDMONDS, WASHINGTON
INTERIM ACTION FOR 2015 LOWER YARD

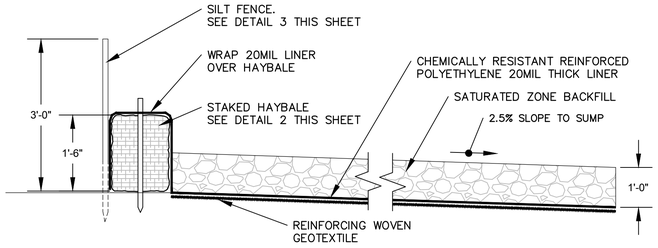
HYDRAULIC ISOLATION STRUCTURE DETAILS

ARCADIS Project No.
B0045362.0006.00004

Date
MARCH 2016

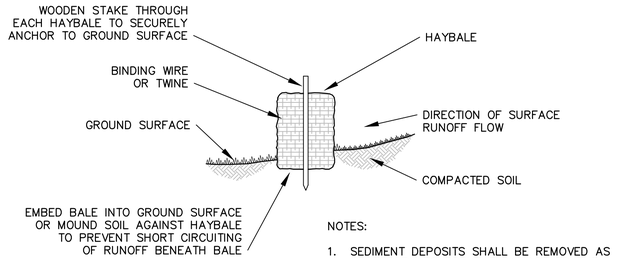
ARCADIS U.S., INC.
1100 OLIVE WAY, SUITE 800
SEATTLE, WA, 98101
Tel: 206.726.4726

10



SOIL STAGING AREA DETAIL 1

NOT TO SCALE

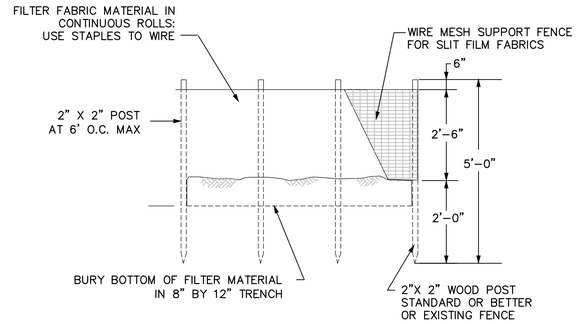


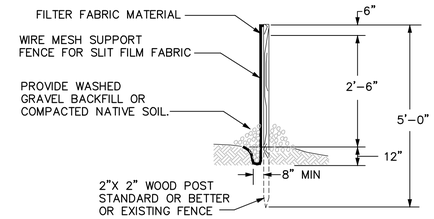
NOTES:

1. SEDIMENT DEPOSITS SHALL BE REMOVED AS NECESSARY TO PREVENT DAMAGE TO THE HAYBALE.
2. THE HAYBALES WILL REMAIN IN PLACE UNTIL ALL EXCAVATED MATERIAL HAS BEEN REMOVED FROM THE SITE.

HAYBALE DETAIL 2

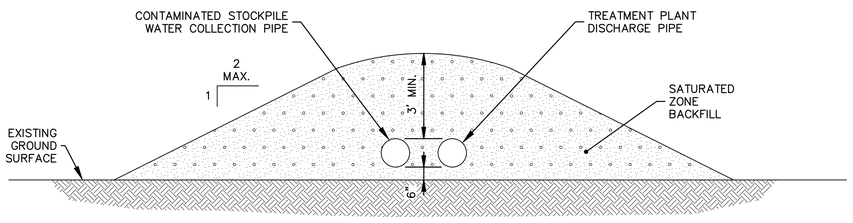
NOT TO SCALE





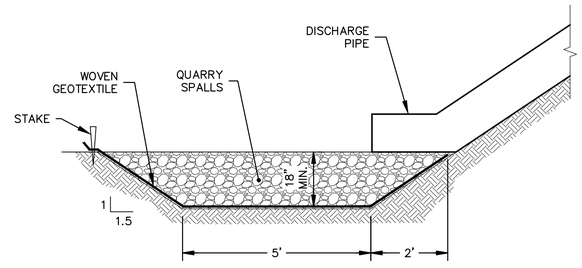
SILT FENCE DETAIL 3

NOT TO SCALE



TYPICAL CULVERT FOR TREATMENT PLANT LINE CROSSING 4

NOT TO SCALE



OUTFALL DETAIL 5

NOT TO SCALE

SCALE(S) AS INDICATED

THIS BAR REPRESENTS ONE INCH ON THE ORIGINAL DRAWING: USE TO VERIFY FIGURE REPRODUCTION SCALE

No.	Date	Revisions	By	Ckd

Professional Engineer's Name
CARSTEN BECKER
Professional Engineer's No.
39822

State	Date Signed	Project Mgr.
WA		S
Designed	Drawn	Checked
RP	GS	CB

ARCADIS

ARCADIS U.S., INC.

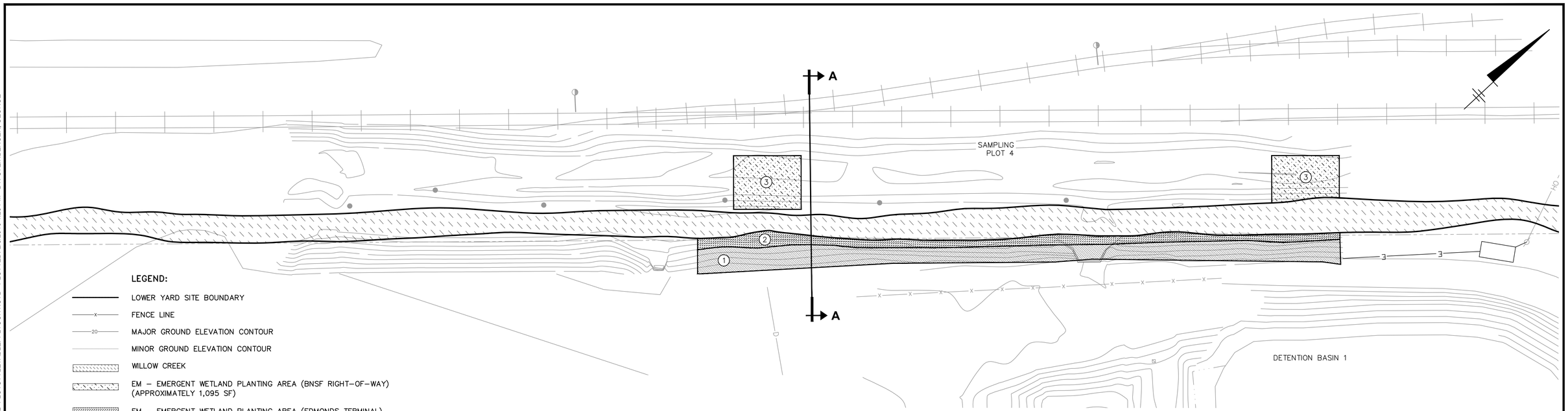
FORMER UNOCAL EDMONDS TERMINAL • EDMONDS, WASHINGTON
INTERIM ACTION FOR 2015 LOWER YARD

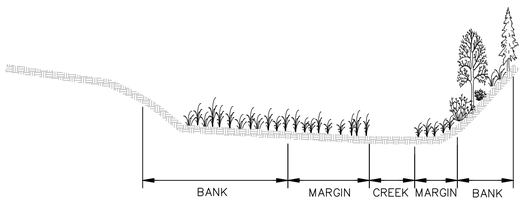
BMP DETAILS

ARCADIS Project No.
B0045362.0006.00004

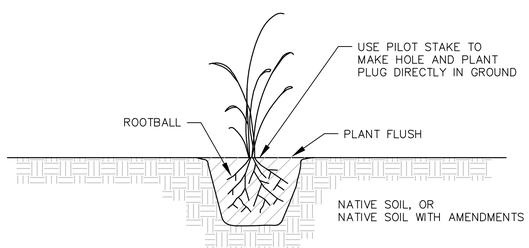
Date
MARCH 2016

ARCADIS U.S., INC.
1100 OLIVE WAY, SUITE 800
SEATTLE, WA, 98101
Tel: 206.726.4726





SECTION A



EMERGENT GRASSES PLANTING DETAIL

NTS

(1) TABLE 1 FLOOD PLAIN FOREST – WILLOW CREEK BANKS (EDMUNDS TERMINAL) PLANTING SPECIFICATIONS

SPECIES		STRATUM	CONTAINER SIZE	DENSITY PER ACRE	QUANTITY
SCIENTIFIC NAME	COMMON NAME				
ALNUS RUBRA	RED ALDER	T	1 GALLON	725.00	34
PINUS CONTORTA VAR. CONTORTA	SHORE PINE	T	1 GALLON	250.00	12
SALIX LUCIDA SSP. LASIANDRA	PACIFIC WILLOW	T/S	1 GALLON	725.00	34
SALIX SITCHENSIS	SITKA WILLOW	S	1 GALLON	725.00	34
CORNUS SERICEA SPP. SERICEA	RED OSIER DOGWOOD	S	1 GALLON	600.00	28
TWINBERRY	LONICERA INVOLUCRATA	S	1 GALLON	400.00	19
DESCHAMPSIA CESPITOSA	TUFTED HAIRGRASS	H	BAREROOT	2000.00	94

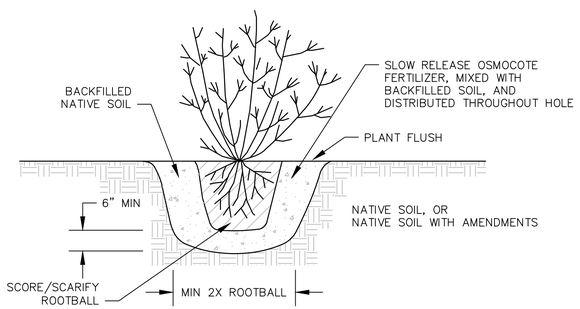
T=TREE; S=SHRUB; H=HERBACEOUS

(2) TABLE 2 EMERGENT WETLAND COMMUNITY – MARGINS OF WILLOW CREEK (EDMUNDS TERMINAL) PLANTING SPECIFICATIONS

SPECIES		CONTAINER SIZE	DENSITY PER ACRE	QUANTITY
SCIENTIFIC NAME	COMMON NAME			
CAREX ABNUPTA	SLOUGH SEDGE	BAREROOT	3000	60
CAREX LYNGBEI	LYNGBY'S SEDGE	BAREROOT	1000	20
SCHOENOPLECTUS ACTUS VAR. ACUTUS	HARDSTEM BULRUSH	BAREROOT	2000	40
SCHOENOPLECTUS MARITIMUS	BASKET BULRUSH	BAREROOT	2000	40
SPARGANIUM ANGUSTIFOLIUM	NARROWLEAF BURREED	BAREROOT	2000	40

(3) TABLE 2 EMERGENT WETLAND COMMUNITY – MARGINS OF WILLOW CREEK (BNSF RIGHT–OF WAY) PLANTING SPECIFICATIONS

SPECIES		CONTAINER SIZE	DENSITY PER ACRE	QUANTITY
SCIENTIFIC NAME	COMMON NAME			
CAREX ABNUPTA	SLOUGH SEDGE	BAREROOT	3000	75
CAREX LYNGBEI	LYNGBY'S SEDGE	BAREROOT	1000	25
SCHOENOPLECTUS ACTUS VAR. ACUTUS	HARDSTEM BULRUSH	BAREROOT	2000	50
SCHOENOPLECTUS MARITIMUS	BASKET BULRUSH	BAREROOT	2000	50
SPARGANIUM ANGUSTIFOLIUM	NARROWLEAF BURREED	BAREROOT	2000	50



SHRUB PLANTING DETAIL

NTS

SCALE(S) AS INDICATED

THIS BAR REPRESENTS ONE INCH ON THE ORIGINAL DRAWING:

USE TO VERIFY FIGURE REPRODUCTION SCALE

No.	Date	Re:isions	B::	C:d

ARCADIS

ARCADIS U.S., INC.

FORMER UNOCAL EDMONDS TERMINAL • EDMONDS, WASHINGTON
INTERIM ACTION FOR 2015 LOWER YARD

PLANTING PLAN AND DETAILS

ARCADIS Pro:8::1 No.
B0045362.0006.00004

Date
MARCH 2016

ARCADIS U.S., INC.
1100 OLIVE WAY, SUITE 800
SEATTLE, WA, 98101
Tel: 206.726.4726

12

ATTACHMENT B

NPDES PERMIT

NPDES Permit is currently being processed and completion is anticipated First Quarter 2016

Appendix C

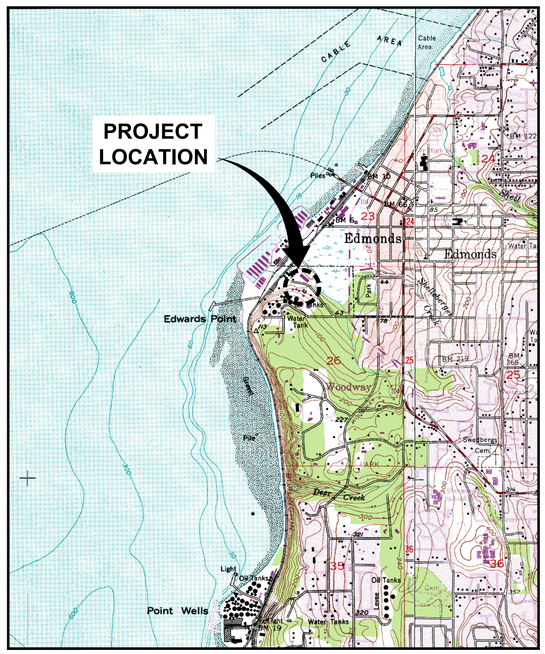
DPE System Documents

CONSTRUCTION DRAWINGS FOR

SYSTEM DESIGN SPECIFICATION

FORMER UNOCAL BULK FUEL TERMINAL

MARCH 8, 2016



REFERENCE: BASE MAP USGS 7.5 MINUTE QUADRANGLE., (QUADNAME), (ST)., (DATE)

LOCATION MAP

0 2000' 4000'
GRAPHIC SCALE

PRELIMINARY

ARCADIS

ARCADIS U.S., INC.

KEY CONTACTS:

SFSP PROJECT MANAGER:
KIM JOLITZ
CHEVRON ENVIRONMENTAL MANAGEMENT COMPANY
6101 BOLLINGER CANYON ROAD
SAN RAMON, CA 94538
TELEPHONE: 925.790.3946
EMAIL: kjolitz@chevron.com

ENGINEER:
PETER CAMPBELL
ARCADIS U.S., INC.
7 TOVEY ROAD
CHARLESTON, SC
TELEPHONE: 206.910.0217
EMAIL: peter.campbell@arcadis-us.com

PROPERTY DATA:

PROPERTY ADDRESS:
11720 UNOCO ROAD
EDMONDS, WASHINGTON

ZONED:
MP2

INDEX TO DRAWINGS

1.0 Introduction

The enclosed drawings and specifications contain information for the construction and installation of a treatment facility. The following drawings depicting the treatment facility are required for construction and installation:

Drawing No.	Revision	Title
G1A	0	Construction Notes and Specifications
G1B	0	Construction Notes and Specifications
G1C	0	Construction Notes and Specifications
G-2	0	Major Equipment and Instrument List
C-1	0	Site Details and Piping Layout
C-2	0	System Building Layout Detail
C-3	0	System Building Layout Detail
C-4	0	Piping Cross Sections
C-5	0	Wellhead Connection Construction Details
C-6	0	Well Construction Details
C-7	0	Manifold Connection Details
C-8	0	System Pad Details
C-9	0	Riprap Design at Detention Basin 1
P-1	0	Process and Instrumentation Diagram

CHEVRON: Chevron Environmental Management Company
ENGINEER: ARCADIS
CONTRACTOR: ClearCreek Contractors

2.0 General Construction Specifications

2.1 The CONTRACTOR shall review the facility design plans, and field verify all dimensions and site conditions before starting work. The ENGINEER shall be notified of any discrepancy.

2.2 All materials used for construction of the facility shall be new or documented to be suitable for reuse.

2.3 The ENGINEER will request a plan check, if applicable. The ENGINEER shall apply for and obtain all discharge permits for treated water and air, as applicable.

2.4 The CONTRACTOR shall obtain and pay for all building permits. The CONTRACTOR shall obtain all necessary inspections, including rough electrical, mechanical, civil, or other applicable inspections, and obtain a final signed off inspection card from the local authority.

2.5 The CONTRACTOR shall provide a one year warranty on all CONTRACTOR-provided materials and supplies. The CONTRACTOR shall provide a warranty on workmanship for a period of not less than one year. All defects in CONTRACTOR supplied and installed materials and supplies shall be repaired at CONTRACTOR expense.

2.6 In addition to the remediation design plans, the ENGINEER will supply the CONTRACTOR with manufacturer's equipment handling and installation procedures. The CONTRACTOR will install all equipment in accordance with the manufacturers' specifications and instructions.

2.7 The ENGINEER will clearly indicate in the remediation design plans the items to be provided by CEMC, the ENGINEER and others. All other items and equipment not clearly indicated as provided by others in the remediation design plans shall be provided by and installed by the CONTRACTOR.

2.8 The CONTRACTOR shall be responsible for keeping the site free of excessive debris and waste during construction. The CONTRACTOR is to take the necessary precautions to control dust and stormwater runoff from excavation and construction activities.

2.9 The CONTRACTOR shall be responsible for the independent location of all utilities and shall take appropriate measures to protect them from damage. The CONTRACTOR shall formally contact the regional underground utility notification service, such as the Underground Service Alert (USA), One Call, or Blue Stakes, and obtain all necessary Clearances before breaking ground. Should any utilities, including but not limited to, electrical conduits, telephone lines, water lines, sewer, or storm drain lines be damaged during construction, the CONTRACTOR shall be responsible for notifying the affected parties and completing repairs, if applicable. The CONTRACTOR shall be responsible for all repair costs.

2.10 CONTRACTOR shall also be responsible for repairing all damage made by the CONTRACTOR to monitoring wells, well seals, manhole boxes, and all above ground structures as the result of accident or neglect.

2.11 The CONTRACTOR shall restore all disturbed areas to match the pre-construction conditions and the surrounding area. This includes disturbed lawns, trees, shrubs, plantings, fences, sidewalks, and other structures.

2.12 Upon completion of the project, the CONTRACTOR shall assist the ENGINEER in preparing “as-built” drawings. The “as-built” drawings shall show the actual construction details, including final trench and well locations, compound layout, and piping details.

2.13 A final inspection will be performed by the ENGINEER and/or a CEMC representative. All items not meeting the specifications and the remediation design plans shall be promptly repaired and/or replaced by the CONTRACTOR at no expense to CEMC.

2.14 The CONTRACTOR shall provide an electrician for a minimum of two days for the startup of the equipment, unless this work can be safely accomplished in less time. The electrician shall be prepared to demonstrate proper motor rotation, proper connections of equipment to circuit breakers, and be available to troubleshoot electrical problems with the system.

3.0 Trenching and Backfill

3.1 General

3.1.1 Trenching and backfill specifications will be developed by the ENGINEER and be presented in the design plans.

3.1.2 The trenching and backfill specifications are subject to approval by the local authority during planning and building department permit reviews.

3.1.3 All mechanical equipment operation (i.e., backhoe, excavator, or other powered equipment) shall be performed by competent personnel and/or personnel licensed to perform such work. All construction shall be performed by trained personnel operating under a licensed contractor.

3.2 Pavement Cutting - NA

3.2.1 Existing pavement shall be saw cut to provide a neat vertical face for repaving. When wet cutting, best management practices (BMPs) shall be implemented to prevent cutting water from entering storm drains or migrating from the site.

3.2.2 The CONTRACTOR shall make every effort to use existing pavement edges and joints when saw cutting to reduce unnecessary cuts. Pavement removed from trenches or other excavations shall be replaced to match the existing material.

3.2.3 Concrete or asphalt trench cuts shall not exceed a nominal width of 36 inches, and shall be not less than 18 inches wide (nominal) unless specified otherwise in the design plans. Trenches shall be cut to the minimum width necessary to accommodate all piping shown in the design plans.

3.3 Trench Excavation - NA

3.3.1 Trenches shall be excavated to the specified widths and depths specified in the design plans. Any deviation from the trenching plans shall be approved by the ENGINEER before work commences. All deviations shall be documented on the “As-Built drawings.

3.3.2 CONTRACTOR shall stop work immediately if product piping or tank field is encountered during excavation. Further excavation shall not be conducted without the approval of CEMC and ENGINEER.

3.3.3 All excavation activities shall be in strict accordance with OSHA regulations and all Federal, State, and Local laws and regulations.

3.3.4 All excavated soil shall be monitored by the ENGINEER in accordance with local contaminated soil handling regulations and permits. If hydrocarbon impacted soil is detected, the soil shall be stockpiled in an area designated by the ENGINEER. The impacted soil shall be placed on 6 mil plastic sheeting and securely covered using a minimum of 6 mil thick plastic sheeting. Alternatively, impacted soil may be placed in properly labeled DOT-approved 55 gallon steel drums or roll-off bins. The ENGINEER shall be responsible for sampling and chemically analyzing the excavated soil for hydrocarbons for waste profiling. CEMC will be responsible for disposal/treatment of hydrocarbon impacted soil.

3.3.5 The CONTRACTOR shall be responsible for loading soil into trucks and off-site disposal or recycling of all hydrocarbon-free soil and construction debris.

3.3.6 The CONTRACTOR shall take all necessary precautions to avoid damaging existing underground utilities, piping, and underground structures during excavation activities.

3.3.7 The CONTRACTOR shall hand-excavate to expose all existing product, vent, electrical conduit, water, and sewer lines before excavating with mechanical equipment.

3.3.8 Once all existing lines have been located, the trenches shall be neatly cut by a backhoe,excavator, bobcat, or other approved method to provide a square cut trench.

3.3.9 The CONTRACTOR shall be responsible for the safety and integrity of trenches and trench plates placed over open trenches during working and non-working hours. If trenches must remain open after normal work hours the CONTRACTOR shall implement the following measures:

- Active traffic areas - open trenches shall be covered by steel trench plates capable of supporting vehicular traffic. Trench plates are to be placed so that there are no gaps between plates. The edges of the plates shall be secured with temporary asphalt patch to minimize displacement by vehicles crossing the plates.
- Non-traffic areas - open trenches shall be covered by steel trench plates (non-skid plates in frequently used pedestrian areas) or ¾-inch thick plywood.

3.3.10 The CONTRACTOR shall take precautions to minimize surface water entering excavations and preventing oversaturation of trenches.

3.3.11 When required by local authority, the ENGINEER will implement a Storm Water Pollution Prevention Plan (SWPPP). The CONTRACTOR shall strictly follow the requirements of the SWPPP. If no SWPPP is required, the CONTRACTOR shall implement Best Management Practices to ensure that all storm water runoff from construction debris, excavated soil, or disturbed surfaces will not to enter a storm drain or runoff the site.

3.3.12 Excavation shall not interfere with 45-degree zone of influence on any existing foundation or footing. Existing footings or foundations that may be affected by any excavation shall be underpinned adequately or otherwise protected against settlement and shall be protected against lateral movement per applicable building code.

3.3 Backfill

3.3.1 Trenches shall be backfilled as soon as practical after pressure testing the underground pipe runs, and following any required inspections. Trenches shall not remain open longer than necessary to prevent sidewall caving. If caving is anticipated, the CONTRACTOR shall use a commercial soil sealant/binder or forms to prevent caving. Chemical soil binders/sealants shall be approved by CEMC.

Prior to backfilling, the CONTRACTOR shall confirm that the underground pipe is buried to a minimum depth of 18 inches from the top of the pipe, unless otherwise noted in the design plans and local building codes.

Underground piping shall be bedded in clean sand, or the ENGINEER-approved equivalent, to a minimum depth of 2-inches below the bottom of the piping and 2-inches above the piping. The sand shall be clean, rock-free (100 percent passing No. 4 sieve), and free of silt and clay.

Trench backfill material may consist of Class II aggregate base course, CDF slurry mix, or approved “native” excavated material. Backfill materials shall not contain rubble, vegetation, trash, boulders, or other debris.

3.4.5 Native soil may be used as support material around above grade pipe with approval of CEMC and the ENGINEER. It is recommended that native soil be tested for geotechnical properties to determine if the material is suitable for backfill.

3.4.6 Backfill material (other than CDF slurry) shall be placed in 8-inch maximum lifts (unless otherwise specified in the design plans), and compacted to 95 percent of the maximum dry density at optimum moisture content (based on Modified Proctor Compaction Test ASTM D1557) or in accordance with the local codes.

3.4.7 Backfill soil shall be compacted to 95 percent of the maximum dry density at optimum moisture content (based on ASTM D1557) or in accordance with the local codes.

3.4.8 Cement sand slurry (controlled density fill [CDF]) may be used as backfill material with the approval of CEMC and the ENGINEER. The CDF shall be 1.5 to 2 sack slurry. No compaction testing is required for CDF.

3.4.9 Class 2 aggregate base shall be placed under new asphalt pavement. The aggregate base thickness should equivalent to the existing aggregate base thickness or six inches whichever is greater.

3.4.10 Prior to paving, the CONTRACTOR shall remove all vegetation, surplus soil, rubble, trash, debris and other materials and provide a flat, unyielding subgrade surface for paving. Saturated, soft or pumping soils shall be removed and replaced with suitable material in accordance these specifications.

3.4.11 The CONTRACTOR shall prepare the sub-grade elevation to match the base of the existing pavement, unless the asphalt restoration design exceeds existing in-place asphalt design.

4.0 Piping

4.1 General

4.1.1 The local authority, and building and plumbing codes, along with ASTM specifications,shall be used to design the types of piping and installation methods required for each remediation site.

4.1.2 All piping work shall be installed by trained personnel operating under a state-licensed contractor.

4.1.3 All materials shall be new or documented to be suitable for reuse.

4.1.4 All materials and work shall be in accordance with the pipe manufacturer's specifications, the design plans, and all applicable codes.

4.1.5 All piping and plumbing shall be performed by trained and competent personnel, who meet all of the requirements dictated by the local authorities. In addition, the CONTRACTOR is responsible for ensuring the installation of any equipment or materials which require specific licensing shall be performed under the direction of the individual who holds a current license for such work.

4.1.6 When connecting to existing underground piping, the CONTRACTOR shall first verify the existing piping path. If the existing underground piping is to be used for conveyance, the CONTRACTOR shall also field verify the integrity of the existing pipe prior to connecting to it.

4.1.7 The pipe for vapor lines shall be sloped towards the wellheads at a ratio of 1:100 to avoid accumulation of condensate in the pipes. If a trench depth of greater than 4 feet is needed to achieve a required slope, the CONTRACTOR shall notify the ENGINEER and implement

SCALE(S) AS INDICATED

THIS BAR REPRESENTS ONE INCH ON THE ORIGINAL DRAWING: USE TO VERIFY FIGURE REPRODUCTION SCALE

No.	Date	Revisions	By	Ckd

Professional Engineer's Name: **PETER J. CAMPBELL**
Professional Engineer's No.: WA 45051
State: WA | Date Signed: | Project Mgr.: -
Designed by: | Drawn by: - | Checked by: -

PRELIMINARY

ARCADIS U.S., INC.

CHEVRON ENVIRONMENTAL MANAGEMENT COMPANY ● FORMER UNOCAL BULK FUEL TERMINAL, EDMONDS, WASHINGTON
SYSTEM DESIGN SPECIFICATION

GENERAL NOTES

ARCADIS Project No.
B0045362.0006.00012

Date
MARCH 2016

ARCADIS
6723 Towpath Road, Box 66
Syracuse, NY 13214
Tel: 315-446-9120

G-1A

measures to address potential condensate accumulation in the pipe as directed by the ENGINEER.

4.1.8 Where piping is installed above ground, pipe supports and clamps shall be used to support the pipe at appropriate intervals to prevent sag as specified in the piping manufacturer's specifications. When Unistrut supports are used the ends of the supports shall be covered with plastic protective caps.

4.1.5 The CONTRACTOR shall paint all above ground piping as appropriate for UV protection, where required by code and to identify potential hazards (i.e.; overhead piping, potential trip hazard). When painting piping is applicable, the following schedule shall be used: “grey - soil vapor”, “blue - treated water”, “yellow - gas supply”, “air lines - not painted”.

4.1.6 The CONTRACTOR shall label all above ground piping with indelible or permanent marking indicating the contents of the pipe (i.e., “groundwater,” “vapor,” or “treated water”, compressed air, gas, electric) and the flow direction.

4.1.7 The CONTRACTOR shall make all wellhead connections as shown in the design plans.

4.1.8 The piping materials shall be specified by the ENGINEER in the design plans. Any conflicts or questions concerning pipe material compatibility, as discovered by the CONTRACTOR, shall be immediately brought to the attention of the ENGINEER.

4.1.9 The use of dissimilar metals and alloys in direct contact with each other is prohibited on all pipe lines containing liquids due to the potential for galvanic corrosion. Where dissimilar metals must be joined, di-electric unions or couplers shall be used.

4.1.10 All underground piping shall be identified using tracer wire and metallic tape placed above the piping at the top of the bedding material above the piping. Tracer wire terminals will be tagged and identified in the equipment compound, at junction boxes, and well boxes.

4.1.11 The CONTRACTOR shall ensure that all foreign materials have been removed from the underground piping following installation and before backfilling.

4.2 Polyvinyl Chloride (PVC) Pipe Specifications

4.2.1 All underground PVC process piping shall be Schedule 40 (unless noted otherwise in design drawings). All aboveground PVC process piping shall be Schedule 80 (unless noted otherwise in design drawings or required by applicable codes).

4.2.2 All pipe joints are to be glued using PVC primer and PVC solvent cement. Connections to other type of pipes are to be by flange or male/female adapters specifically designed for a transition from PVC pipe to a specific type of pipe (i.e., galvanized steel, copper).

4.2.3 PVC pipe shall not be used for above ground or underground compressed air service, or for high temperature applications, such as blower discharge piping.

4.3 Galvanized Pipe Specifications

4.3.1 Galvanized pipe shall be schedule 40 hot-dip galvanized (HDG) steel per ASTM A53.

4.3.2 Galvanized pipe shall not be used to convey soil vapor. Use of galvanized pipe prior to catalytic oxidizer abatement systems may increase risk of poisoning the catalytic cell material. Oxidizer vendors should be consulted for appropriate piping material use prior to installing the oxidizer.

4.4 ABS Compressed Air Pipe Specifications - NA

4.4.1 ABS pipe and fittings shall be DuraplusTM or equivalent and capable of withstanding continuous working pressures greater than 100 psi.

4.4.2 ABS-compressed air fittings shall be the socket type, designed for solvent welding.

- Fittings shall be designed and manufactured to withstand the continuous pressures applicable to the maximum pressure rating of the pipe.
- The solvent cement shall be ABS solvent cement and designed to withstand continuous pressures up to 185 psi at 73° F.

4.4.3 When transitioning from ABS to non-ABS piping material, the CONTRACTOR shall ensure appropriate transition fittings are used.

4.5 Stainless Steel Pipe Specifications

4.5.1 Stainless Steel pipe shall consist of Type 304 or 316 for construction unless specified in the design plans or on approval by the ENGINEER.

4.5.2 All connections shall be made using stainless steel flange connections with Buna-N gaskets and NPT threaded connections. Use of stainless steel unions shall not be used.

4.5.3 All threaded connections shall be made using pipe thread sealant tape specifically made for use with stainless steel pipe and should contain nickel.

4.6 Flexible Hoses/ Tubing

4.6.1 Flexible hoses and tubing shall be rated for chemical compatibility, and the operating pressures and temperatures at which they will be used.

4.6.2 Connections to fittings and components shall be with hose barbs and clamps, cam-locks with locking clips, or compression fittings. When applicable, the CONTRACTOR shall not use plastic cam-locks.

4.6.3 All air quick connects and safety release valves will be installed per manufacturer specifications and recommendations.

4.6.4 Underground hose shall be placed in PVC conduits and shall have no greater than 360- degrees in total turns between access points or joined in a junction box.

4.6.5 All underground splices and connections shall occur in a junction box or well box. No hose connections are to be located in conduits.

4.6.1 Hose clamps (used in conjunction with hose barb fittings) shall be roll-over, center punch (banded) or T-Bar type clamps. Worm gear hose clamps shall not be used.

4.7 Pressure Testing

4.7.1 All process piping shall be pressure tested according to local specifications and witnessed by an ENGINEER or an approved representative. No testing will be conducted through instruments or equipment

4.7.2 All PVC lines used for vacuum will be tested at 5 pounds per square inch (PSI) of pressure and held for an hour. If a pressure drop of more than 1 PSI is observed during the hour, the line will be inspected and repaired as necessary prior to retesting the line.

4.7.3 All PVC lines used for water will be tested at 5 PSI for a period of 60 minutes. If a leak is observed during the testing time or a pressure drop of more than 1 PSI is noted, the line will be inspected and repaired as necessary prior to retesting the line.

4.7.4 All ABS lines used for compressed air will be tested at 100 PSI for a period of 60 minutes. If a pressure drop of more than 1 PSI is observed during the testing time, the line will be inspected and repaired as necessary prior to retesting the line. A curing time (minimum of 24 hours or per the material manufacturer, whichever is the largest), will be followed prior to beginning any testing on the ABS lines. Only threaded fittings to be used on the ABS pipe and transition fittings are to be metal reinforced.

5.0 Asphalt Pavement NA

5.1 General

5.1.1 Hot mix Asphalt Concrete shall not be used to restore asphalt surfaces affected by construction activities. EXCEPTION: Asphalt cold patch may be used as a temporary surface for small pavement patches (not to exceed 3 feet by 3 feet) during site construction activities. Temporary asphalt patch must be removed prior to or during final site restoration activities.

5.1.2 Asphalt driveways, parking strips, or other areas designed for vehicular and pedestrian traffic shall be restored to match existing grades.

5.1.3 The CONTRACTOR shall assure that the sub-grade has been properly prepared. No asphalt shall be installed on saturated, soft or pumping soil, frozen soil, ice, snow, or standing water.

5.1.4 Finished surfaces shall be smooth with uniform texture and be free of voids, mounds, ridges, depressions, cracks, roller marks, pits, or other irregularities (1/4 inch maximum over 10 feet straight edge). Edges shall be capped over and straight. Restored pavement surfaces not meeting these requirements will be replaced at the CONTRACTOR's expense.

5.2 Asphalt Concrete Materials

5.2.1 Asphalt Concrete shall be a high-quality, controlled hot mixture of asphalt and well-graded quality aggregate, and compacted into a uniformly dense mass. The paving materials shall conform to ASTM specification D3515.

5.2.2 A tack coat bonding agent shall be applied between asphalt layers, between layers of concrete or slurry and the asphalt, and between cut edges of existing asphalt to bond to the new asphalt to the old surface. The tack coat material shall meet the specifications in ASTM D977 or D2397 and be grades SS-1, SS-1h, CSS-1, or CSS-1h. The asphalt tack coat shall be a diluted emulsified asphalt mixture of equal parts emulsion and clean water.

5.2.3 The aggregate used for the base course and surface mixture shall be crushed stone, gravel, stone or slag screenings, sand, mineral filler, or a combination of these materials. Uncrushed coarse aggregate may be used in base course mixtures only.

- Coarse and fine aggregate shall conform to ASTM D692 and ASTM D1073.
- Mineral filler shall conform to ASTM D242.
- If approved for use by Chevron, slag shall be blast furnace, air cooled slag that is not less than 70 pounds per cubic foot in mass.

5.2.4 The liquid asphalt used shall conform to ASTM D3381 and D946, and shall be the appropriate grade for the ambient mean annual temperature conditions.

5.3 Asphalt Concrete Pavement Construction

5.3.1 Prior to placing new asphalt adjacent to existing pavement, the CONTRACTOR shall saw- cut a clean, straight edge along the existing pavement, and apply tack coat to the vertical cut surface. All saw cut debris shall be removed from the trench prior to laying the new pavement.

5.3.2 The temperature of the asphalt mixture shall not exceed 325oF when discharged from the spreader. Initial compaction shall be performed when the temperature of the mixture is estimated to be less than 250oF. Final compaction shall begin with the asphalt as hot as possible, but not less than 150oF.

5.3.3 The asphalt mixture shall be placed in lifts and compacted to a maximum nominal thickness of 2 inches until the new asphalt surface match the existing surface. The asphalt shall be compacted to a minimum of 96 percent of the reference density.

5.3.4 A tack coat of 0.15 gallon per square yard of diluted emulsified asphalt shall be applied between the base coarse surface and asphalt pavement. All vertical surfaces, which will contact the new asphalt paving, shall be tack coated. The tack coat shall be allowed to cure before asphalt placement, and shall be applied on surfaces that can be covered with an asphalt mixture during the same day.

5.2.1 The asphalt mix shall be compacted immediately after placement. Initial compaction shall be accomplished using a steel wheel tandem roller, steel three-wheeled roller, or vibratory roller. As needed, intermediate rolling with a pneumatic tire roller shall be done immediately behind the initial rolling. In areas too small for the roller compactor, a vibrating plate compactor or hand tamper shall be used to achieve the required compaction. NOTE: The CONTRACTOR shall be responsible for preventing traffic loads on newly asphalted surfaces until it has sufficiently cooled to support traffic.

5.2.2 The CONTRACTOR shall return to the site after one week and apply asphalt joint sealer to all asphalt joints.

6.0 Portland Cement Concrete Pavement

6.1 General

6.1.1 Finished concrete surfaces shall be true and even with the existing grade (1/4 inch maximum over 10 feet straight edge). The surface grade and finish must match the surrounding area. The finished concrete shall be free of voids, mounds, ridges, depressions, cracks, or other irregularities . Any concrete determined to be substandard shall be removed and replaced at no cost to CEMC or the ENGINEER.

6.1.2 Concrete restoration shall only occur along vertical forms or saw cut walls. When possible, saw cuts shall follow existing joints and the layout existing concrete surface patterns. Newly placed concrete pavement shall be protected from vehicular and pedestrian traffic until it is suitably cured. The CONTRACTOR shall be responsible for replacement of the concrete pavement not meeting design documents and/or specifications.

6.1.3 Concrete shall be thoroughly mixed to assure uniform mixture of components within the mass.

6.2 Concrete Materials

6.2.1 Portland Cement shall conform to ASTM C-150 Type II.

6.2.2 Fine and Coarse Aggregates for normal weight concrete shall conform to ASTM C-33 and shall conform to the appropriate ASTM grading requirement. Aggregates shall be clean, hard and uniformly graded sand, crushed rock or gravel, free from loam, clay or organic matter. Sound aggregate shall be used and shall have a maximum diameter of 1.5-inches.

6.2.3 Water shall be potable and free of acids, alkalis, and organic materials.

6.2.4 The concrete mix shall pass a compressive strength test of 2,500 psi after 28 days. In certain localities, 3,000 psi compressive strength concrete is required by seismic code.

6.2.5 The concrete mix shall have a minimum slump of 3-inches and a maximum slump of 4- inches.

6.2.6 The CONTRACTOR shall specify the concrete mix, and provide a copy of the concrete specifications for approval from CEMC and the ENGINEER prior to placement, if requested. The number of bags of cement per yard, compressive strength, volume of water, slump, type and weight of fine and coarse aggregates, and type and amount of admixtures shall be addressed in the specification.

6.3 Reinforcing Steel

6.3.1 Transverse reinforcing steel dowels shall be a Number 4 (#4, 1/2 inch diameter) Grade 60 rebar (minimum), spaced no more than 18-inches on center along the entire length the trench. The reinforcing steel dowels shall be embedded at least 4-inches into the existing concrete at mid-height and secured in place using non-shrink epoxy to anchor the steel rebar in place

All concrete reinforcement shall be as follows:

- No. 4 bars and larger
- Welded Wire Fabric (Unless required by local authority or with the approval of the CEMC project manager, welded wire fabric (WWF) or mesh shall not be used to reinforce trenches in traffic areas.

6.3.2 All bars should be clean of rust, grease or other materials likely to impair bond.

SCALE(S) AS INDICATED

THIS BAR REPRESENTS ONE INCH ON THE ORIGINAL DRAWING: USE TO VERIFY FIGURE REPRODUCTION SCALE

No.	Date	Revisions	By	Ckd

Professional Engineer's Name: PETER J. CAMPBELL
Professional Engineer's No.: WA 45051

State	Date Signed	Project Mgr.
WA		-

Designed by	Drawn by	Checked by
-	-	-

PRELIMINARY

ARCADIS

ARCADIS U.S., INC.

CHEVRON ENVIRONMENTAL MANAGEMENT COMPANY • FORMER UNOCAL BULK FUEL TERMINAL, EDMONDS, WASHINGTON

SYSTEM DESIGN SPECIFICATION

GENERAL NOTES

ARCADIS Project No.
B0045362.0006.00012

Date
MARCH 2016

ARCADIS
6723 Towpath Road, Box 66
Syracuse, NY 13214
Tel: 315-446-9120

G-1B

6.3.3 All bends shall be made cold.

6.3.4 Splicing of bars shall have a minimum 1'6" lap of 1'-6" in all concrete cases unless dimensioned otherwise on details.

6.3.5 All reinforcing bars shall be accurately and securely placed before pouring concrete or applying grout and supported off the ground using steel or plastic cradles.

6.3.6 Spacing of bars shall be considered as maximum spacing.

6.3.7 Non-shrink epoxy materials shall be a 100 percent solids, high-modulus, non-slag gel.

6.3.8 Longitudinal reinforcing steel shall be #4 rebar (unless otherwise specified in the design plans) and securely attached to all transverse reinforcing steel dowels using wire-ties or approved equivalent.

6.4 Concrete Joints

6.4.1 Joints shall be provided in paving where they previously existed and shall blend smoothly with those existing joints. As a general rule, joint spacing shall not exceed 15 feet.

6.4.2 The CONTRACTOR shall install the same type of joint as those in existing slab.

6.4.3 Joints shall be provided along property lines, where entry ramps cross and at changes in grade or slope

6.4.4 Saw cut control joints shall be cut 4 to 12 hours after concrete is poured, otherwise use tooled or preformed joint inserts.

6.4.5 The CONTRACTOR shall use Aqua Crete® or equivalent sealant to seal the concrete joints. Joint surfaces shall be thoroughly cleaned prior to applying joint compound.

6.5 Concrete Placement

6.5.1 The CONTRACTOR shall assure that the sub-grade has been properly prepared. No concrete shall be poured on soft, saturated or pumping soil, frozen soil, ice, snow, or standing water.

6.5.2 Concrete shall be poured in accordance with commonly accepted industry practices.

- The CONTRACTOR shall prevent overworking and aggregate segregation.
- The concrete shall be adequately tamped or vibrated to prevent voids or honeycombing.
- Area between joints shall be cast as one continuous pour.
- Concrete curbs shall be monolithically poured with the adjacent concrete paving, unless prior approval from the ENGINEER is obtained.
- The maximum allowable travel time to the site in hot weather will be 1 hour and 15 minutes and cold weather will be 2 hours.

6.6 Concrete Finishing

6.6.1 The CONTRACTOR shall finish the concrete in accordance with standard industry practices.

- After all the bleed water has disappeared; the CONTRACTOR shall float the flat surface by hand using a trowel.
- After floating, a soft concrete finish broom shall be used to finish the surface to match the existing concrete finish.

6.6.2 Dry cement shall not be used to remove excess water from the surface. Finish work must be delayed until the water sheen has disappeared.

6.6.3 Water shall not be added to ease the finishing.

6.6.4 Care shall be used to not overwork the surface.

6.6.5 Construction/control joints and edges shall be hand-tooled to a ¼-inch radius.

7.0 Electrical

7.1 General

7.1.1 The local authority and building codes, including the national electric code (NEC), are used to dictate the specific type of electrical enclosures and raceways that are required for use in specific hazardous and non-hazardous locations.

7.1.2 All work will be performed in accordance with the NEC. Local codes will govern, but any differences should be pointed out to the local authority. All work shall conform to the regulations and specifications of the local power company providing the service.

7.1.3 Electrical work shall only be conducted by an electrical CONTRACTOR who is licensed in the state where the work is to be performed.

7.2 Electrical Service

7.2.1 The CONTRACTOR shall install a weather-tight main electrical breaker/disconnect panel located outside the equipment enclosure as shown on the site plans. The main panel shall have a lockable disconnect/shut-off switch. The CONTRACTOR shall install the power as required by the ENGINEER.

7.2.2 All service equipment shall be enclosed in a water-tight National Electrical Manufacturers Association [NEMA] enclosure, if exposed to the elements.

7.2.3 The power meter is typically supplied and installed by the local power utility company.

7.2.4 If three-phase power is required and only single-phase power is available, a phase converter shall be used for those components requiring such service. The equipment vendor shall ensure that all electrical motors and controls are rated for converter use, and can withstand the additional heat buildup caused by phase converter use.

7.3 Electrical Service Disconnects

7.3.1 The CONTRACTOR shall install all service disconnect switches necessary to safely shutdown and lockout the equipment.

7.3.2 At a minimum, the switches shall be contained in a water-tight NEMA 4 panel.

7.3.3 The CONTRACTOR shall install an emergency stop switch on the exterior of the compound.

7.4 Electrical Above Ground Conduits and Enclosures

7.4.1 The CONTRACTOR shall install threaded rigid galvanized metal conduit in all aboveground installations, unless otherwise specified by the ENGINEER.

7.4.2 Threaded joints shall be installed per local code with at least five threads fully engaged.

7.4.3 All couplings, unions, junction boxes, device boxes, and conduit bodies shall have tight joints.

7.4.4 In unclassified areas, liquid-tight flexible nonmetallic tubing may be used to make connections to motors and other electrical equipment. The maximum length shall not exceed 18 inches.

7.5.5 Wire nuts or twist-lock terminations shall not be used for ground, motor, or power connections.

7.7 Electrical Grounding

7.7.1 The conduit system and neutral conductors shall be grounded in accordance with local code. Ground testing shall be documented and submitted to the ENGINEER.

8.0 Construction Details

8.1 Equipment Enclosure

8.1.1 Install fencing and equipment enclosure as shown on the design plans

8.1.2 Slats for chain link fence shall match existing building color scheme or colored as determined by the local building department.

8.1.3 Fence post footings shall be concrete, minimum 1-foot diameter and 3-feet deep unless otherwise specified in the applicable permit conditions or design plans.

8.1.4 CONTRACTOR shall install the following signage on all sides of the remediation equipment room and the inside door of the remediation equipment room:

- Danger High Voltage
- No Smoking
- 24-hour contact numbers
- Others as per local code

9.0 Construction Schedule

9.1 The CONTRACTOR shall confirm a construction schedule with the ENGINEER least one week (5 business days) prior to any work at the site.

9.2 The proposed construction schedule shall be presented in a time line format showing estimated start date, duration and completion times for each activity. Any deviation from the originally proposed schedule must be communicated to the ENGINEER within 24- hours.

9.3 The CONTRACTOR shall make proper and timely notification of all work and inspections to regulatory or governing agencies as required by building and other construction permits.

10.0 CONTRACTOR Safety Requirements

10.1 The CONTRACTOR is responsible for the safety of his personnel and subcontractor personnel. The CONTRACTOR shall conform with the ENGINEER's and CEMC's Behavior Based Safety Program requirements. At a minimum the CONTRACTOR shall:

- Develop and have available site specific Health and Safety Plan (HASP) and Journey Management Plan (JMP) which conforms to the ENGINEER's and CEMC standards.
- Develop and have available on site Job Loss Analysis (JLA) forms outlining the tasks to be performed, the job steps, the hazards, and the mitigating procedures to minimize risk and maximize safety.
- Complete the CEMC Permit-to-Work processes and procedures.
- Conduct and document a tailgate safety meeting each morning and afternoon when site work is to be performed.
- Ensure compliance with all Federal and State Occupational Safety and Health Administration (OSHA) and local safety regulations.
- Meet requirements of CEMC's Short Service Employee (SSE) Process.
- Ensure the appropriate personnel have received Defensive Driving training.

10.2 Work hours shall be during daylight hours only, unless approved by the CEMC and ENGINEER prior to the work being performed. Weekend work will not be allowed, unless approved by CEMC and ENGINEER prior to the work being performed. Work hours may be dictated by the local planning department or the building permit.

10.1 The CONTRACTOR shall have sufficient quantities and quality of hard hats, goggles, safety glasses, reflective vests, and gloves on site to outfit all CONTRACTOR workers, and provide for a secure work area.

10.2 The CONTRACTOR shall secure all work areas with barricades, snow fence, or temporary chain link fence to protect the work area from intrusion by unauthorized vehicles or pedestrians. When conditions warrant, the CONTRACTOR shall provide traffic flaggers in addition to barricades to control ingress and egress from the work area. A traffic control plan shall be included in the CONTRACTOR HASP.

10.3 A pre-construction safety meeting shall be held at the site within two weeks prior to the anticipated start of construction. The pre-construction safety meeting shall be attended by CEMC, the ENGINEER, the CONTRACTOR, and other interested parties.

- If the site is an active business, the site owner/manager must be present to discuss impacts to the facility activities.
- The basis for the JMP is to be discussed during the meeting. Ingress and egress for equipment and deliveries, exclusion zones, impacts on vehicle and pedestrian traffic, and emergency response are to be discussed and documented during the meeting.

10.4 The CONTRACTOR shall have access to at least one 20-pound dry chemical type-ABC fire extinguisher at the site, with current inspection tags, during all construction activities.

10.5 The CONTRACTOR shall contain loose debris and store construction materials on a daily basis make sure that the work area is clean and orderly prior to departure from the site.

10.6 The CONTRACTOR shall contain loose debris and store construction materials on a daily basis make sure that the work area is clean and orderly prior to departure from the site.

SCALE(S) AS INDICATED

THIS BAR REPRESENTS ONE INCH ON THE ORIGINAL DRAWING: USE TO VERIFY FIGURE REPRODUCTION SCALE

No.	Date	Revisions	By	Ckd

Professional Engineer's Name
PETER J. CAMPBELL
Professional Engineer's No.
WA 45051

State	Date Signed	Project Mgr.
WA		.
Designed by	Drawn by	Checked by
.	.	.

PRELIMINARY

ARCADIS
ARCADIS U.S., INC.

CHEVRON ENVIRONMENTAL MANAGEMENT COMPANY • FORMER UNOCAL BULK FUEL TERMINAL, EDMONDS, WASHINGTON
SYSTEM DESIGN SPECIFICATION

GENERAL NOTES

ARCADIS Project No.
B0045362.0006.00012

Date
MARCH 2016

ARCADIS
6723 Towpath Road, Box 66
Syracuse, NY 13214
Tel: 315-446-9120

G-1C

Soil Vapor Extraction

Item	Equipment Description	Quantity	Detail No.	Drawing	Equipment ID
1	140 gallons Vapor Liquid Separator Newterra model VLW-140	1		P-1	A-1
2	Moyno model 34401 progressive cavity transfer pump with a 1 HP 208-230/460V/3P motor (12 gpm @ 25 psi)	1		P-1	
3	Busch model MM 1502 AV rotary claw vacuum pumps, each with a 20 HP 208-230/460V/3P	3		P-1	B-1
4	Integral discharge silencer	3		P-1	
5	Integral vacuum relief valve	3		P-1	
6	Solberg inlet filter/silencer	2		P-1	
7	4" Oxidizer dilution assembly (controlled by oxidizer) inlcudes vacuum transmitter and Solberg filter/silencer	1			
8	Rosemount model 3051SMV mass flow transmitter with Rosemount 485 Annubar primary flow element includes high vacuum alarm setpoint	1			
9	Intellishare Model ECO300 Flameless Electric Catalytic Oxidizer	1		P-1	S-1

Groundwater Extraction Pumps

Item	Equipment Description	Quantity	Detail No.	Drawing	Equipment ID
10	Grundfos model SPE electric submersible well pumps, each with ½ HP 230V/1P motor, 12 gpm at depth of 50 feet	12		C-1, P-1	P-1 through P-10
11	Grundfos VFD	12	1	C-5	
12	High level alarm switch	12		C-5	

Groundwater Treatment

Item	Equipment Description	Quantity	Detail No.	Drawing	Equipment ID
13	110 GPM oil water separator, newterra model OWS-18 with 70 gallon effluent water chamber	1		P-1	T-1
14	Goulds NPE model 2ST centrifugal transfer pump with a 3 HP 208-230/460V/3P motor, 110 GPM at 60' TDH	1		P-1	TP-1
15	Pentair model L88302NAC10 number two size bag filter housings in parallel	2		P-1	
16	QED model EZ Tray 12.4SS stainless steel air stripper	1		P-1	AS-1
17	New York Blower with a 5 HP 208-230/460/3P motor	1		P-1	B-2
18	Goulds NPE model 2ST centrifugal transfer pump with a 3 HP 208-230/460V/3P motor:	1		P-1	TP-3
19	Liquid Phase Carbon Filtration Units, newterra model HPLPC3000 contactor vessels	2		P-1	G-1, G-2

System Enclosure

Item	Equipment Description	Quantity	Detail No.	Drawing	Equipment ID
20	8' x 40' used high cube modified shipping container that will serve as process room, with double access doors to connect to additonal shipping container	1		C-2	
21	8' x 40' used high cube modified shipping container divided into two rooms - control room and process room, with double access doors to connect to additonal shipping container	1		C-2	
22	Ventilation fan with thermostat and sound attenuating hood				
23	Heater with thermostat				
24	Passive vent louvers with sound attenuating hood				
25	Sump with high level alarm switch				
26	Emergency stop switch				
27	LEL transmitter (with calibration kit)				
28	Fire extinguisher				
29	First aid kit				
30	Eye wash bottles				

Control System

Item	Equipment Description	Quantity	Detail No.	Drawing	Equipment ID
31	NEMA 1 lockable panel enclosure	1		C-2	
32	NEMA 3R Fused main disconnect	1			
33	Allan Bradley MicroLogix 1400	1			
34	Programmable 6" user display/touch screen	1			
35	Duplex 15 Amp GFI receptacle	1			
36	HOA switches (contained within touchscreen)				
37	Red alarm indicator light	1			
38	newterra Site Link Basic Wireless Service	1			

Status	Well	Total Depth (ft bgs)	Casing Diameter (inches)	Screen Interval (ft bgs)	Sump (ft bgs)
Installed	DPE-1	30	4	5 - 25	25 - 30
Installed	DPE-2	30	4	5 - 25	25 - 30
Installed	DPE-3	22	4	5 - 18	18 - 22
Installed	DPE-4	23	4	4 - 18	18 - 23
Proposed	DPE-5	24	4	4 - 19	19 - 24
Proposed	DPE-6	24	4	4 - 19	19 - 24
Proposed	DPE-7	24	4	4 - 19	19 - 24
Proposed	DPE-8	24	4	4 - 19	19 - 24
Proposed	DPE-9	24	4	4 - 19	19 - 24
Proposed	DPE-10	24	4	4 - 19	19 - 24
Proposed	DPE-11	24	4	4 - 19	19 - 24
Proposed	DPE-12	24	4	4 - 19	19 - 24
Proposed	DPE-13	24	4	4 - 19	19 - 24
Proposed	DPE-14	24	4	4 - 19	19 - 24

NOTES:

FT BGS = feet below ground surface

THE CONSTRUCTION OF PROPOSED WELLS MAY VARY BASED ON SITE CONDITIONS.

SCALE(S) AS INDICATED

THIS BAR REPRESENTS ONE INCH ON THE ORIGINAL DRAWING: USE TO VERIFY FIGURE REPRODUCTION SCALE

No.	Date	Revisions	By	Cko

Professional Engineer's Name: PETER J. CAMPBELL
Professional Engineer's No.: WA 45051
State: WA | Date Signed: - | Project Mgr.: -
Designed by: - | Drawn by: - | Checked by: -

PRELIMINARY

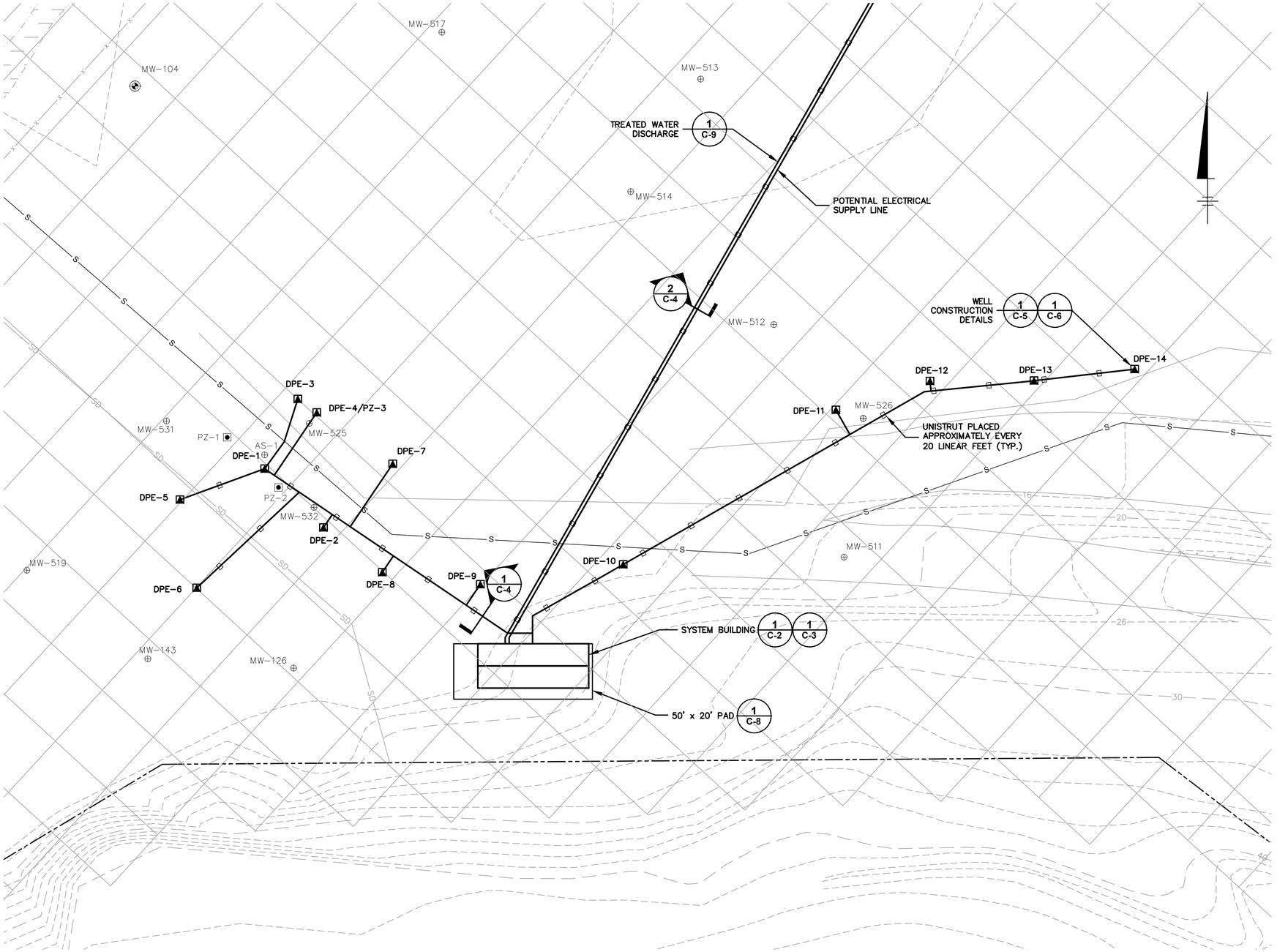
ARCADIS U.S., INC.

CHEVRON ENVIRONMENTAL MANAGEMENT COMPANY • FORMER UNOCAL BULK FUEL TERMINAL, EDMONDS, WASHINGTON
SYSTEM DESIGN SPECIFICATION

MAJOR EQUIPMENT AND INSTRUMENTATION LIST

ARCADIS Project No. B0045362.0006.00012
Date MARCH 2016
ARCADIS
6723 Towpath Road, Box 66
Syracuse, NY 13214
Tel: 315-446-9120

G-2



LEGEND:

- PROPOSED ABOVE GRADE PIPE OR CONDUIT
- PROPOSED UNISTRUT LOCATIONS
- DPE–10 — PROPOSED DUAL PHASE EXTRACTION (DPE) WELL LOCATION
- MW–203 — INTERIOR MONITORING WELL LOCATION AND DESIGNATION
- MW–108 — PERIMETER MONITORING WELL LOCATION
- PROPERTY BOUNDARY
- S — WSDOT STORMWATER LINE
- SD — POINT EDWARDS STORM DRAIN LINE

NOTES:

1. BUILDING AND ROAD INFORMATION DIGITIZED FROM GOOGLE EARTH AERIAL PHOTO. TOPOGRAPHIC CONTOURS WERE OBTAINED FROM AN UNKNOWN SOURCE. ALL LOCATIONS ARE APPROXIMATE AND SHALL BE VERIFIED IN THE FIELD BY CONTRACTOR PRIOR TO CONSTRUCTION.
2. HORIZONTAL DATUM: WASHINGTON STATE COORDINATE SYSTEM NORTH ZONE (NAD 83/98).
   VERTICAL DATUM: N.A.V.D. 88
   UNITS: U.S. SURVEY FEET
   HORIZONTAL AND VERTICAL CONTROL ESTABLISHED BY GPS VIA VERTICAL REFERENCE STATION NETWORK (VRSN).
3. SOUTHEAST PORTION OF WSDOT STORMWATER LINE HAS NOT BEEN SURVEYED.
4. LOCATION OF EXISTING POWER SUPPLY PANEL HAS NOT BEEN SURVEYED.

CITY: MINNEAPOLIS, MN DIV/GROUP: ENV/CAD DB: R. OBERLANDER LD: R. OBERLANDER PIC: P. CAMPBELL PM: TM: A. PATEL LYR:ON=*;OFF=*REF*
G:\ENVCAD\Minneapolis-MN\ACTIB\0045362\0006\00012\CONTRACTDWG\PRELIMINARY\45362C01.dwg LAYOUT: C-1 SAVED: 3/8/2016 8:31 AM ACADVER: 19.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ---- PLOTTED: 3/8/2016 8:31 AM BY: OBERLANDER, ROSEANNE
XREFS: 45362X00 45362X02 45362X03 IMAGES: PROJECTNAME: ---- PETER_CAMPBELL.tif

20' 0 20' 40'
1"=20'

THIS BAR REPRESENTS ONE INCH ON THE ORIGINAL DRAWING: USE TO VERIFY FIGURE REPRODUCTION SCALE

No.	Date	Revisions	By	Ckd

Professional Engineer's Name: PETER J. CAMPBELL
Professional Engineer's No.: WA 45051
State: WA | Date Signed: | Project Mgr.: -
Designed by: - | Drawn by: - | Checked by: -

PRELIMINARY

ARCADIS U.S., INC.

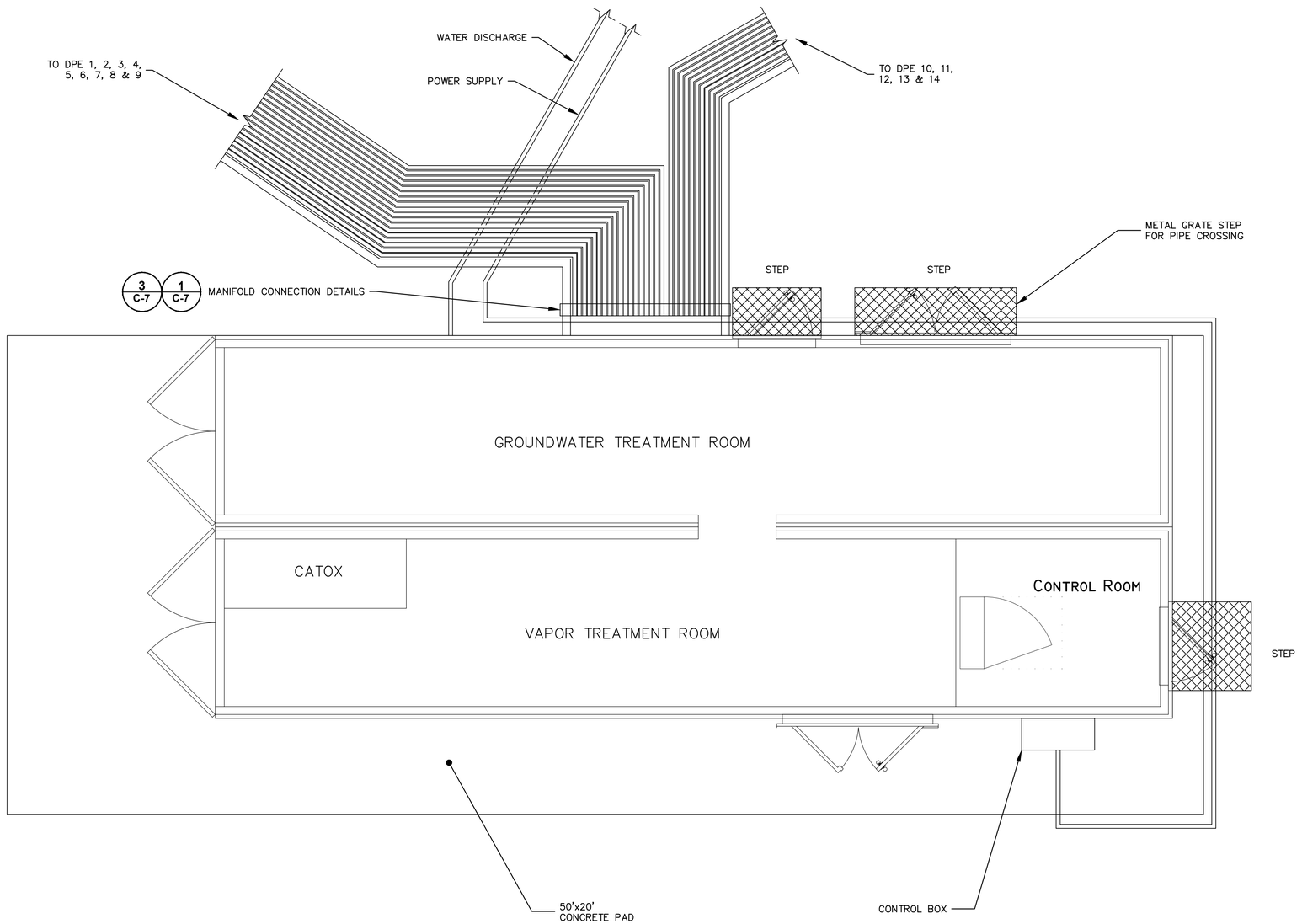
CHEVRON ENVIRONMENTAL MANAGEMENT COMPANY • FORMER UNOCAL BULK FUEL TERMINAL, EDMONDS, WASHINGTON
SYSTEM DESIGN SPECIFICATION

DPE SYSTEM PIPING LAYOUT

ARCADIS Project No. B0045362.0006.00012
Date MARCH 2016

ARCADIS
6723 Towpath Road, Box 66
Syracuse, NY 13214
Tel: 315-446-9120

C-1



SYSTEM LAYOUT (1)

0 2' 5'

SCALE: 3/8"=1'-0"

CITY: MINNEAPOLIS, MN DIV/GROUP: ENV/CAD DB: R. OBERLANDER LD: R. OBERLANDER PIC: P. CAMPBELL PM: TM: A. PATEL LYR:ON=*;OFF=*REF*
G:\ENVCAD\Minneapolis-MN\ACTIB0045362\0006\0012\CONTRACT\DWG\PRELIMINARY45362C02.dwg LAYOUT: C-2 SAVED: 3/8/2016 8:24 AM ACADVER: 19.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ---- PLOTTED: 3/8/2016 8:29 AM BY: OBERLANDER, ROSEANNE
XREFS: IMAGES: PROJECTNAME: ----
45362X00 PETER_CAMPBELL.tif

SCALE(S) AS INDICATED

THIS BAR REPRESENTS ONE INCH ON THE ORIGINAL DRAWING:

USE TO VERIFY FIGURE REPRODUCTION SCALE

No.	Date	Revisions	By	Ckd

THIS DRAWING IS THE PROPERTY OF THE ARCADIS ENTITY IDENTIFIED IN THE TITLE BLOCK AND MAY NOT BE REUSED OR ALTERED IN WHOLE OR IN PART WITHOUT THE EXPRESS WRITTEN PERMISSION OF SAME.

Professional Engineer's Name: PETER J. CAMPBELL
Professional Engineer's No.: WA 45051
State: WA | Date Signed: | Project Mgr.: .
Designed by: . | Drawn by: . | Checked by: .

PRELIMINARY

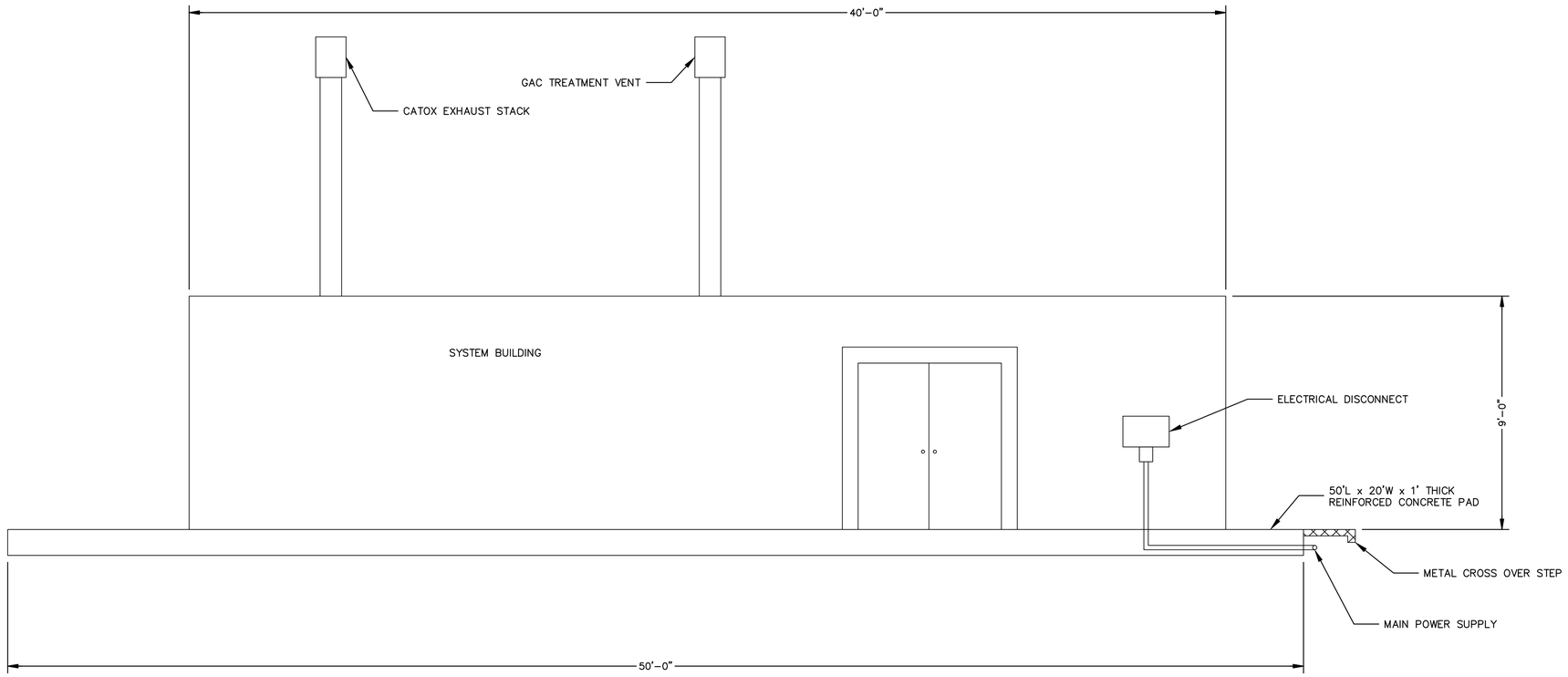
ARCADIS U.S., INC.

CHEVRON ENVIRONMENTAL MANAGEMENT COMPANY • FORMER UNOCAL BULK FUEL TERMINAL, EDMONDS, WASHINGTON
SYSTEM DESIGN SPECIFICATION

SYSTEM BUILDING LAYOUT DETAIL

ARCADIS Project No. B0045362.0006.00012
Date MARCH 2016
ARCADIS 6723 Towpath Road, Box 66 Syracuse, NY 13214 Tel: 315-446-9120

C-2



ELEVATION

TREATMENT FACILITY LAYOUT (1)

0 2' 5'

SCALE: 3/8"=1'-0"

SCALE(S) AS INDICATED

THIS BAR REPRESENTS ONE INCH ON THE ORIGINAL DRAWING: USE TO VERIFY FIGURE REPRODUCTION SCALE

No.	Date	Revisions	By	Ckd

Professional Engineer's Name
PETER J. CAMPBELL
Professional Engineer's No.
WA 45051

State	Date Signed	Project Mgr.
WA		.
Designed by	Drawn by	Checked by
.	.	.

PRELIMINARY

STATE OF WASHINGTON PETER J. CAMPBELL REGISTERED PROFESSIONAL ENGINEER
3/31/16

ARCADIS

ARCADIS U.S., INC.

CHEVRON ENVIRONMENTAL MANAGEMENT COMPANY ● FORMER UNOCAL BULK FUEL TERMINAL, EDMONDS, WASHINGTON
SYSTEM DESIGN SPECIFICATION

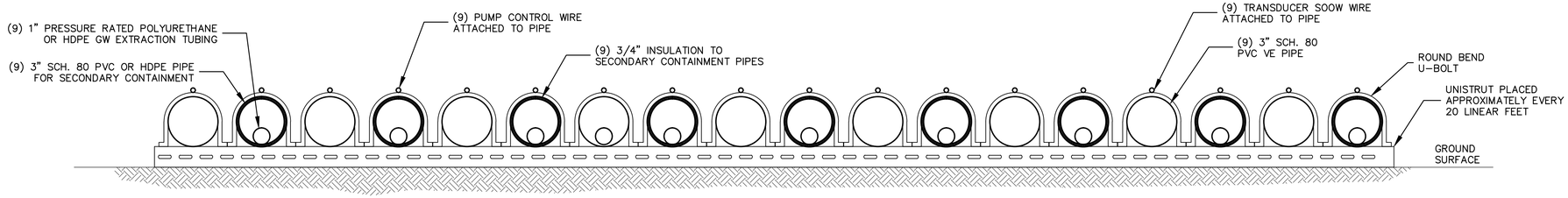
SYSTEM BUILDING LAYOUT DETAIL

ARCADIS Project No.
B0045362.0006.00012

Date
MARCH 2016

ARCADIS
6723 Towpath Road, Box 66
Syracuse, NY 13214
Tel: 315-446-9120

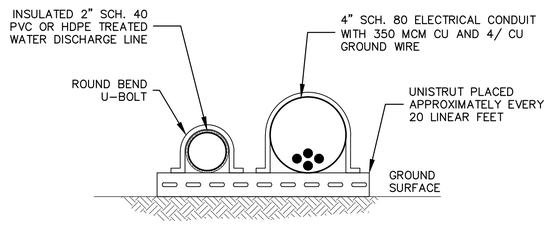
C-3



PIPING CROSS-SECTION 1

0 3" 6"

SCALE: 3"=1'-0"



PIPING CROSS-SECTION 2

0 3" 6"

SCALE: 3"=1'-0"

NOTES:

1. GROUNDWATER CONVEYANCE SECONDARY CONTAINMENT LINE INSULATED WITH 3/4 INCH CLOSED CELL FOAM JACKETED INSULATION.
2. PIPE WILL BE EITHER SCH. 80 PVC OR SDR 11 HDPE DEPENDING ON PRODUCT AVAILABILITY.

DEFINITIONS:

PVC	POLYVINYL CHLORIDE
SCH	SCHEDULE
inHg	INCHES OF MERCURY
SOOW WIRE	SERVICE COLD, OIL RESISTANT JACKET, OIL RESISTANT INSULATION AND WEATHER/WATER RESISTANT

SCALE(S) AS INDICATED

THIS BAR REPRESENTS ONE INCH ON THE ORIGINAL DRAWING:

USE TO VERIFY FIGURE REPRODUCTION SCALE

No.	Date	Revisions	By	Ckd

Professional Engineer's Name: PETER J. CAMPBELL		
Professional Engineer's No.: WA 45051		
State: WA	Date Signed:	Project Mgr.: .
Designed by: .	Drawn by: .	Checked by: .

PRELIMINARY

PETER J. CAMPBELL STATE OF WASHINGTON 45051 REGISTERED PROFESSIONAL ENGINEER

Ed 03/14/19

ARCADIS

ARCADIS U.S., INC.

CHEVRON ENVIRONMENTAL MANAGEMENT COMPANY • FORMER UNOCAL BULK FUEL TERMINAL, EDMONDS, WASHINGTON

SYSTEM DESIGN SPECIFICATION

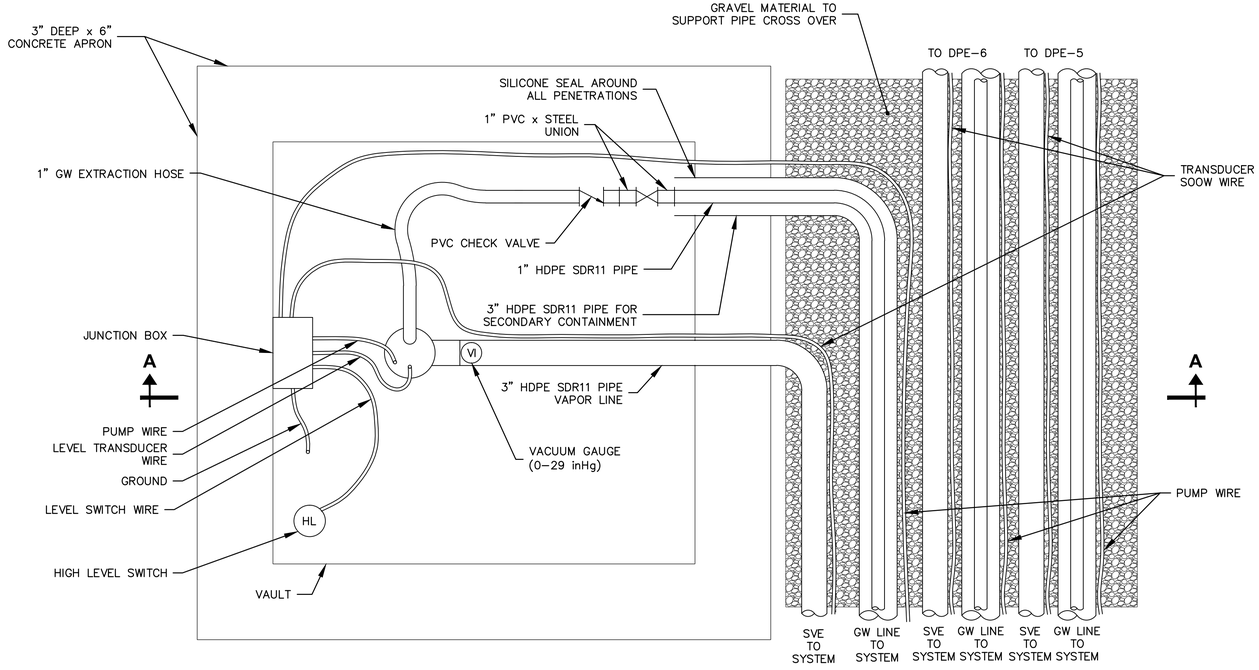
PIPING CROSS-SECTIONS

ARCADIS Project No.
B0045362.0006.00012

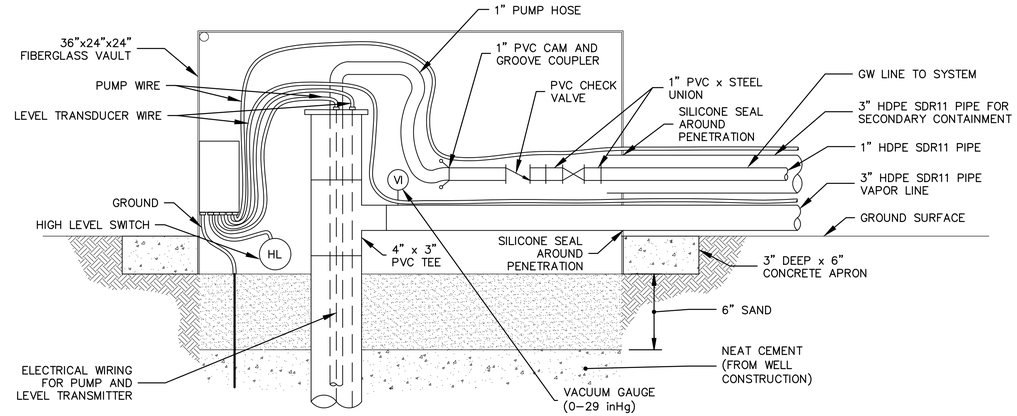
Date
MARCH 2016

ARCADIS
6723 Towpath Road, Box 66
Syracuse, NY 13214
Tel: 315-446-9120

C-4



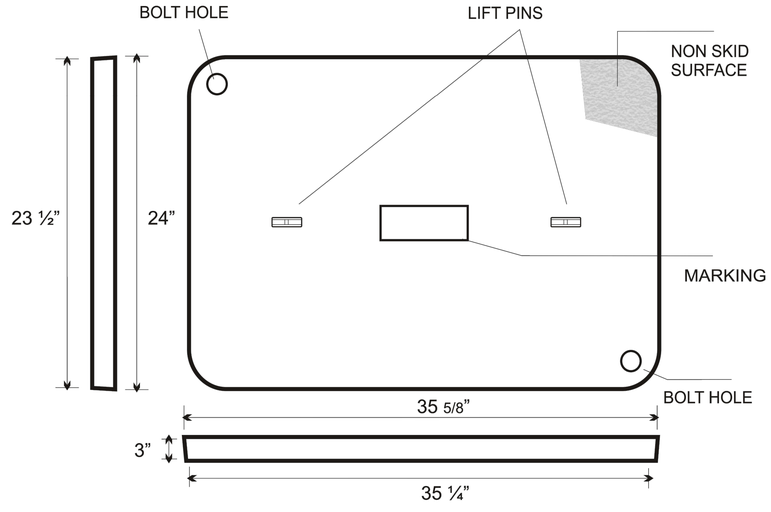
PLAN



SECTION A-A

DPE WELLHEAD DETAIL (1)

NOT TO SCALE



WELL VAULT DETAIL

LEGEND

- CHECK VALVE
- (VI) VACUUM GAUGE 0-29 inHg
- 1" STEEL GATE VALVE
- (HL) HIGH LEVEL SWITCH

DEFINITIONS:

PVC	POLYVINYL CHLORIDE
DPE	DUAL PHASE EXTRACTION
GW	GROUNDWATER CONVEYANCE LINE
SVE	SOIL VAPOR EXTRACTION LINE
inHg	INCHES OF MERCURY
SOOW WIRE	SERVICE COLD, OIL RESISTANT JACKET, OIL RESISTANT INSULATION AND WEATHER/WATER RESISTANT
HDPE	HIGH DENSITY POLYETHYLENE
SDR	STANDARD DESIGN RATIO

CITY: MINNEAPOLIS, MN DIV/GROUP: ENV/CAD DB: R. OBERLANDER LD: R. OBERLANDER PIC: P. CAMPBELL PM: TM: A. PATEL LYR:ON=*;OFF=*REF*
G:\ENVCAD\Minneapolis-MN\ACTIB\B0045362\0006\0012\CONTRACT\DWG\PRELIMINARY\45362C04.dwg LAYOUT: C-5 SAVED: 3/8/2016 8:22 AM ACADVER: 19.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ---- PLOTTED: 3/8/2016 8:23 AM BY: OBERLANDER, ROSEANNE
XREFS: IMAGES: PROJECTNAME: ----
45362X00 PETER_CAMPBELL.tif

SCALE(S) AS INDICATED

THIS BAR REPRESENTS ONE INCH ON THE ORIGINAL DRAWING: USE TO VERIFY FIGURE REPRODUCTION SCALE

No.	Date	Revisions	By	Cko

Professional Engineer's Name: PETER J. CAMPBELL
Professional Engineer's No.: WA 45051
State: WA | Date Signed: | Project Mgr.: -
Designed by: - | Drawn by: - | Checked by: -

PRELIMINARY

ARCADIS U.S., INC.

CHEVRON ENVIRONMENTAL MANAGEMENT COMPANY • FORMER UNOCAL BULK FUEL TERMINAL, EDMONDS, WASHINGTON

SYSTEM DESIGN SPECIFICATION

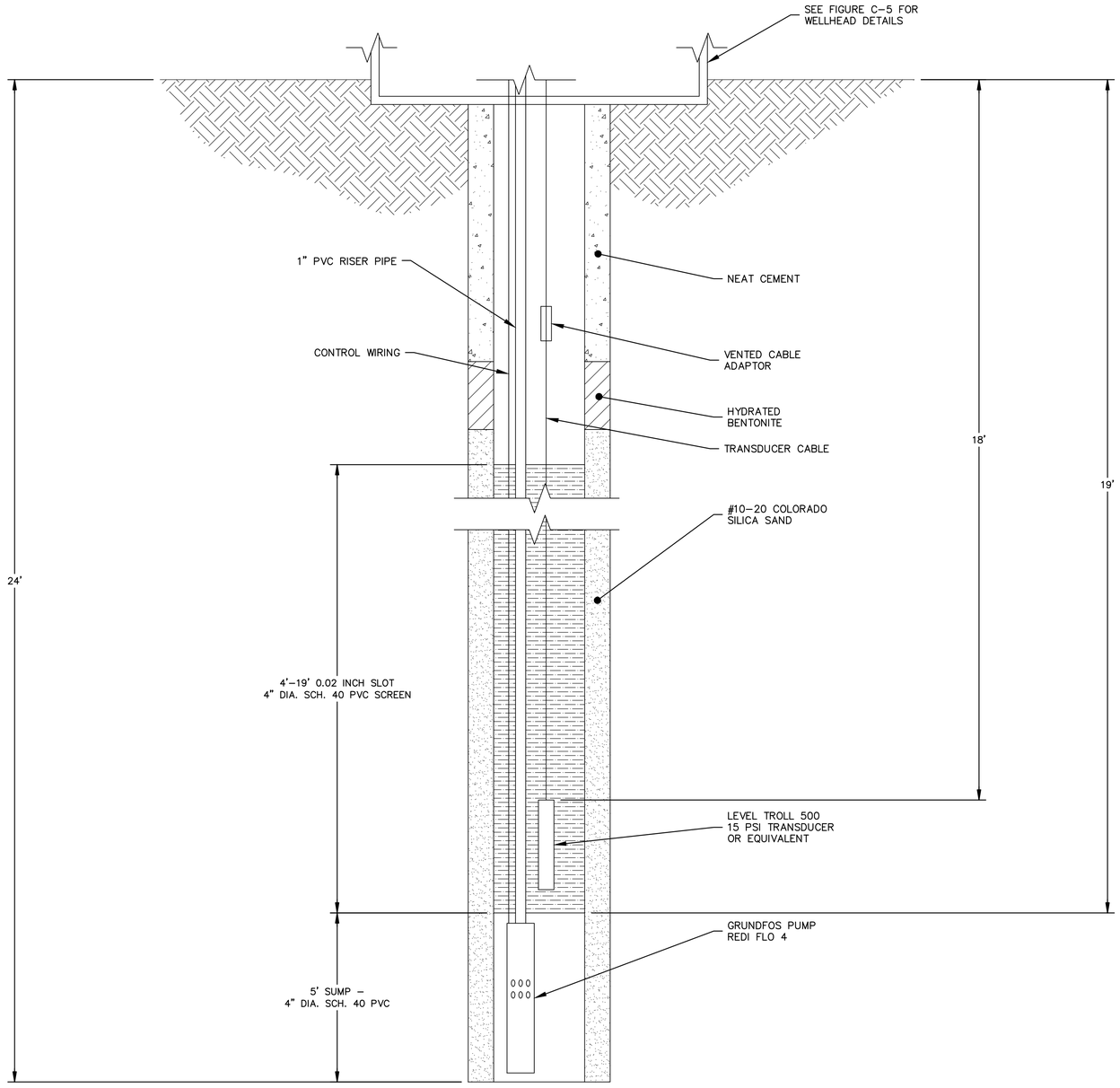
WELLHEAD CONNECTION CONSTRUCTION DETAILS

ARCADIS Project No. B0045362.0006.00012

Date MARCH 2016

ARCADIS
6723 Towpath Road, Box 66
Syracuse, NY 13214
Tel: 315-446-9120

C-5



WELL CONSTRUCTION DETAIL 1

NOT TO SCALE

SCALE(S) AS INDICATED

THIS BAR REPRESENTS ONE INCH ON THE ORIGINAL DRAWING: USE TO VERIFY FIGURE REPRODUCTION SCALE

No.	Date	Revisions	By	Ckd

Professional Engineer's Name
PETER J. CAMPBELL
Professional Engineer's No.
WA 45051

State	Date Signed	Project Mgr.
WA		.
Designed by	Drawn by	Checked by
.	.	.

PRELIMINARY

ARCADIS

ARCADIS U.S., INC.

CHEVRON ENVIRONMENTAL MANAGEMENT COMPANY • FORMER UNOCAL BULK FUEL TERMINAL, EDMONDS, WASHINGTON
SYSTEM DESIGN SPECIFICATION

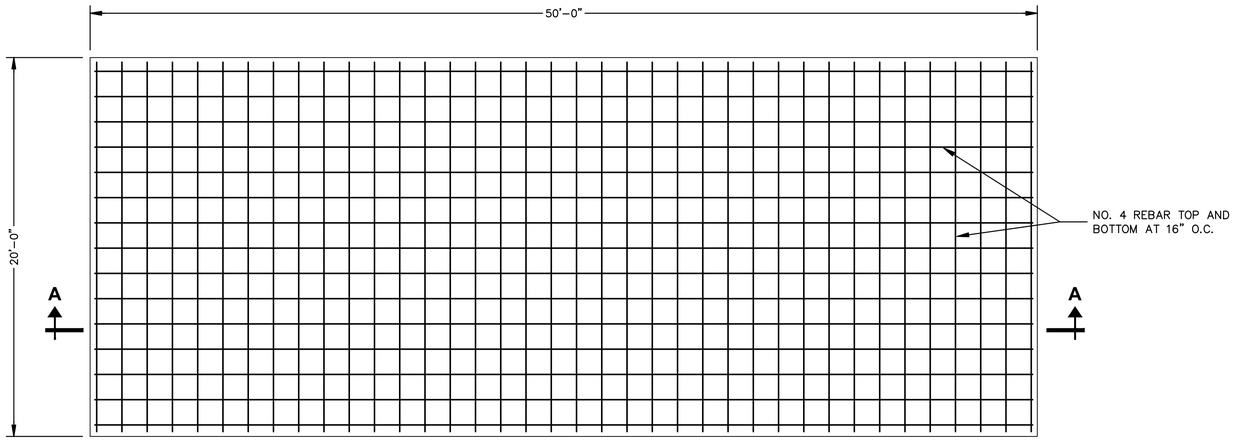
WELL CONSTRUCTION DETAILS

ARCADIS Project No.
B0045362.0006.00012

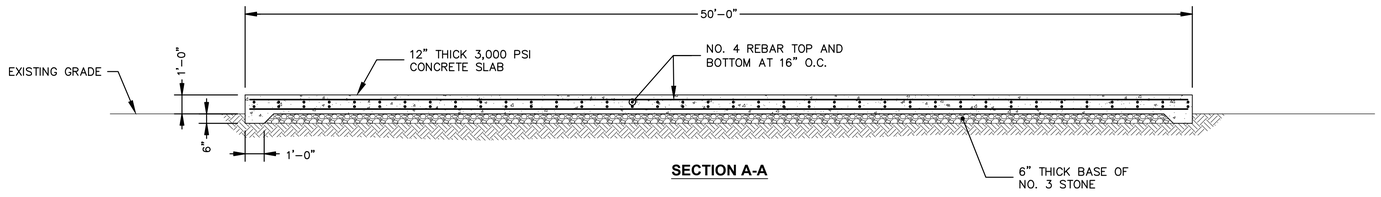
Date
MARCH 2016

ARCADIS
6723 Towpath Road, Box 66
Syracuse, NY 13214
Tel: 315-446-9120

C-6



PLAN



SECTION A-A

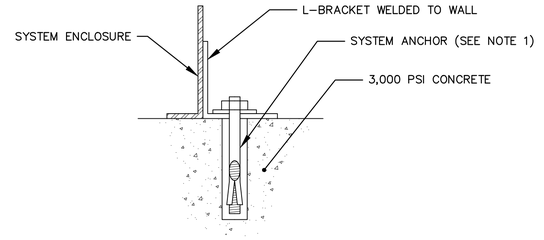
NOTES:

1. 12" THICK 3,000 PSI CONCRETE.
2. 3/4" MAXIMUM AGGREGATE SIZE.
3. #4 REBAR @ 16" O.C. TOP AND BOTTOM OF PAD, MIN. 3" COVER.

CONCRETE PAD DETAIL 1

0 4' 8'

SCALE: 1/4"=1'-0"



NOTE:

1. ANCHORS SHALL BE 3/8"ø SIMPSON STRONG-TIE WEDGE ALL ANCHORS, 3" MIN. EMBEDDED DEPTH.

SYSTEM ANCHOR DETAIL 2

NOT TO SCALE

1. CAST-IN-PLACE CONCRETE AND REINFORCING STEEL

1.1. ALL CONCRETE WORK SHALL CONFORM TO ACI 301, ACI 318, ACI 315, ACI 315R DETAILING MANUAL, AWS D1.4, AND CRSI "PLACING REINFORCING BARS."

1.2. MATERIALS SHALL CONFORM TO THE FOLLOWING STANDARDS:
- ASTM C 33 – STANDARD SPECIFICATION FOR CONCRETE AGGREGATE
- ASTM C 150 – STANDARD SPECIFICATION FOR PORTLAND CEMENT
- ASTM C 260 – STANDARD SPECIFICATION FOR AIR-ENTRAINING ADMIXTURES FOR CONCRETE
- ASTM C 309 – STANDARD SPECIFICATION FOR LIQUID MEMBRANE-FORMING COMPOUNDS FOR CURING CONCRETE
- ASTM C 494 – STANDARD SPECIFICATION FOR CHEMICAL ADMIXTURES FOR CONCRETE

1.3. ALL CONCRETE SHALL HAVE A MINIMUM 28-DAY SPECIFIED COMPRESSIVE STRENGTH F'C OF 3,000 PSI, SLUMP OF 4" TO 6". WATER TO CEMENT RATIO SHALL BE BETWEEN 0.45 AND 0.60 AND AIR ENTRAINED 6% ± 1%.

1.4. ALL CONCRETE IS NORMAL WEIGHT CONCRETE UNLESS NOTED OTHERWISE.

1.5. ALL CONCRETE SURFACES SHALL BE BROOM FINISHED UNLESS OTHERWISE NOTED.

1.6. UNLESS NOTED OTHERWISE, ALL REINFORCING STEEL SHALL BE NEW BILLET STEEL, CONFORMING TO ASTM A-615, DEFORMED. DO NOT TACK WELD REINFORCING STEEL UNLESS NOTED OTHERWISE.

1.7. REINFORCING STEEL GRADE SHALL BE GRADE 60.

1.8. ANCHOR PERGOLA PLATE TO SLAB WITH (4) 3/8" DIAMETER X 4-1/4" HILTI KWIK BOLT, 3/8"X4-1/4" DIAMETER THREADED ROD (ASTM A36) SET IN HILTI HIT-RE 500-SD EPOXY ADHESIVE OR EQUIVALENT. ALL ANCHORS SHALL BE GALVANIZED AND EMBEDDED A MINIMUM OF 3-1/2" IN TO THE CONCRETE.

2. FOUNDATIONS

2.1. FOUNDATION DESIGN IS BASED ON AN ALLOWABLE SOIL BEARING PRESSURE OF 1,500 PSF. IF QUESTIONABLE SOILS ARE PRESENT, SUCH AS, EXPANSIVE CLAY, MUD, ORGANIC SILT OR UNPREPARED FILL SOIL, THE SOIL SUBGRADES BEARING CAPACITIES SHALL BE OBSERVED, VERIFIED AND AMENDED AS RECOMMENDED BY A QUALIFIED GEOTECHNICAL AND CONSTRUCTION TESTING FIRM TO CONFIRM THE ALLOWABLE PRESUMPTIVE BEARING PRESSURE IS MET.

SCALE(S) AS INDICATED

THIS BAR REPRESENTS ONE INCH ON THE ORIGINAL DRAWING: USE TO VERIFY FIGURE REPRODUCTION SCALE

No.	Date	Revisions	By	Cko

Professional Engineer's Name
PETER J. CAMPBELL
Professional Engineer's No.
WA 45051

State	Date Signed	Project Mgr.
WA		-
Designed by -	Drawn by -	Checked by -

PRELIMINARY

ARCADIS U.S., INC.

CHEVRON ENVIRONMENTAL MANAGEMENT COMPANY • FORMER UNOCAL BULK FUEL TERMINAL, EDMONDS, WASHINGTON
SYSTEM DESIGN SPECIFICATION

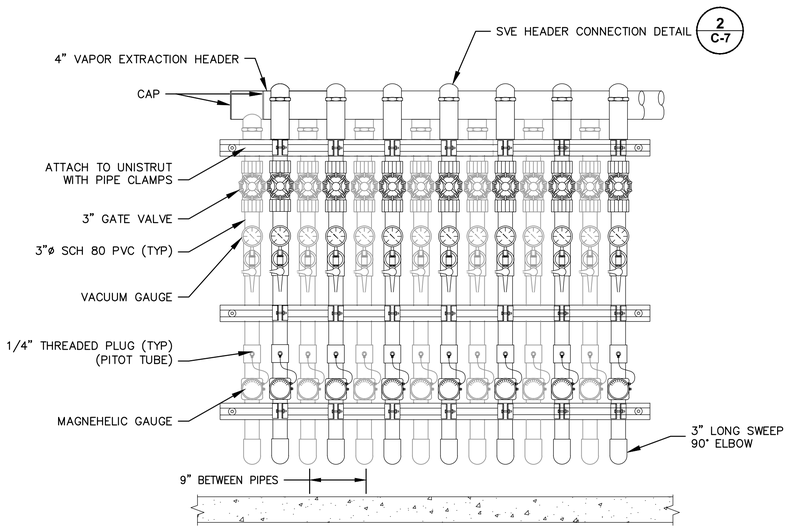
SYSTEM PAD DETAILS

ARCADIS Project No.
B0045362.0006.00012

Date
MARCH 2016

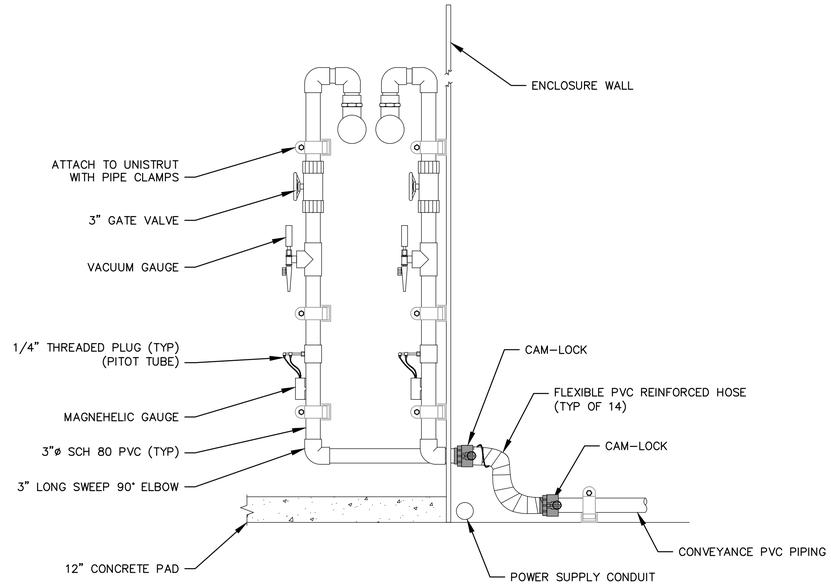
ARCADIS
6723 Towpath Road, Box 66
Syracuse, NY 13214
Tel: 315-446-9120

C-8



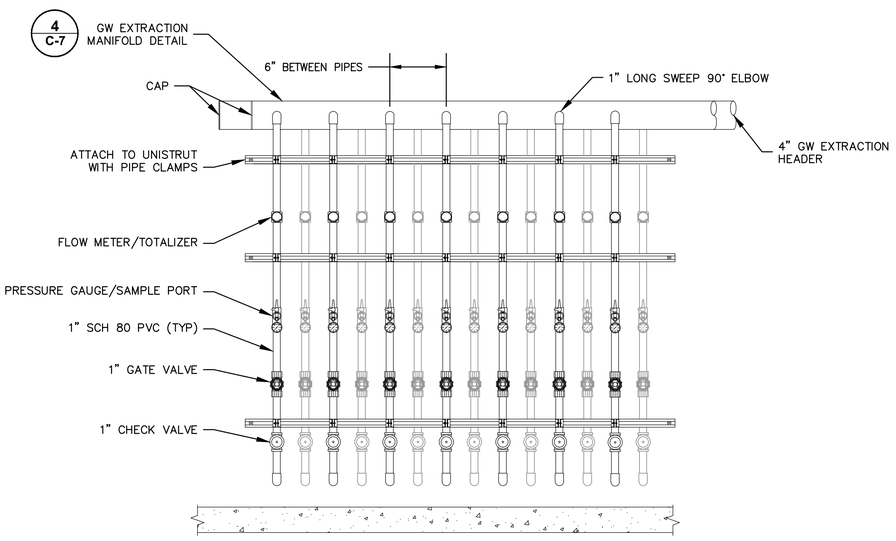
SVE PIPE MANIFOLD 1

NOT TO SCALE



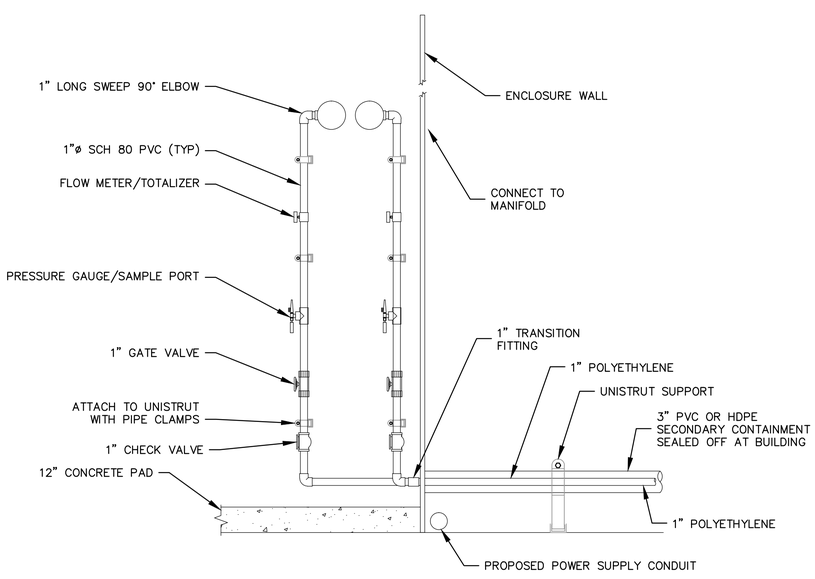
SVE MANIFOLD CONNECTION DETAIL 2

NOT TO SCALE



GW EXTRACTION PIPE MANIFOLD 3

NOT TO SCALE



GW EXTRACTION MANIFOLD DETAIL 4

NOT TO SCALE

NOTES:

1. GW AND SVE PIPE MANIFOLDS WILL BE CONSTRUCTED AT THE EQUIPMENT VENDORS FACILITY PRIOR TO SHIPMENT OF EQUIPMENT TO THE SITE.
2. POWER SUPPLY CONDUIT LOCATION MAY CHANGE BASED ON PUBLIC UTILITY SUPPLY LOCATION.

DEFINITIONS:

PVC	POLYVINYL CHLORIDE
SCH	SCHEDULE
GW	GROUNDWATER CONVEYANCE LINE
SVE	SOIL VAPOR EXTRACTION LINE

CITY: MINNEAPOLIS, MN DIV/GROUP: ENV/CAD DB: R. OBERLANDER LD: R. OBERLANDER PIC: P. CAMPBELL PM: TM: A. PATEL LYR:ON=*;OFF=*REF*
G:\ENV\CAD\Minneapolis-MN\ACTIB\0045362\0006\00012\CONTRACTDWG\PRELIMINARY\45362C07.dwg LAYOUT: C-7 SAVED: 3/8/2016 8:20 AM ACADVER: 19.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ---- PLOTTED: 3/8/2016 8:21 AM BY: OBERLANDER, ROSEANNE
XREFS: IMAGES: PROJECTNAME: ----
45362X00 PETER_CAMPBELL.tif

SCALE(S) AS INDICATED

THIS BAR REPRESENTS ONE INCH ON THE ORIGINAL DRAWING: USE TO VERIFY FIGURE REPRODUCTION SCALE

No.	Date	Revisions	By	Ckd

Professional Engineer's Name: **PETER J. CAMPBELL**
Professional Engineer's No.: WA 45051
State: WA | Date Signed: | Project Mgr.: .
Designed by: . | Drawn by: . | Checked by: .

PRELIMINARY

ARCADIS U.S., INC.

CHEVRON ENVIRONMENTAL MANAGEMENT COMPANY • FORMER UNOCAL BULK FUEL TERMINAL, EDMONDS, WASHINGTON
SYSTEM DESIGN SPECIFICATION

MANIFOLD CONNECTION DETAILS

ARCADIS Project No.
B0045362.0006.00012

Date
MARCH 2016

ARCADIS
6723 Towpath Road, Box 66
Syracuse, NY 13214
Tel: 315-446-9120

C-7

EDMONDS MARSH

WILLOW CREEK

D-2

D-3

MW-108

MW-109

MW-530

LM-3

EXISTING ACTIVE POWER LINE AND POLES

PROPOSED CONNECT ABOVE GRADE CONDUIT TO EXISTING UPGRADED 600 AMP PANEL

MAIN PANEL

UNDERGROUND ELECTRIC LINE

CONTROL PANEL

ABOVE GROUND 4" PVC DISCHARGE PIPE

SUBMERSIBLE PUMP

DETENTION BASIN NO. 1

SYSTEM DISCHARGE AREA (SEE RIPRAP DETAIL)

STORMWATER DRAINAGE PIPES TO DISCHARGE INTO DB-1

CENTRAL PUGET SOUND REGIONAL TRANSIT AUTHORITY / AMTRAK

OUTFALL #002

WILLOW CREEK

ABOVE GRADE ELECTRICAL CONDUIT

DISCHARGE PIPING

PIPING CROSS SECTION

2
C-4

MW-131

P-9

MW-506

MW-507

MW-504

MW-505

MW-509

MW-139R[1]

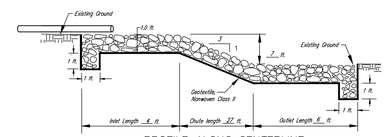
MW-518

MW-122

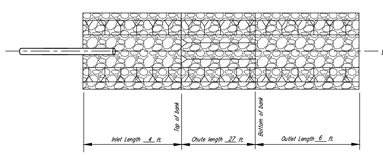
MW-129R[1]

MW-501

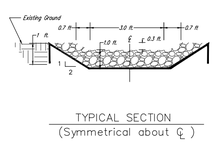
ABAN



PROFILE ALONG CENTERLINE



PLAN VIEW



TYPICAL SECTION
(Symmetrical about ℄)

RIPRAP DETAIL

NOTES:

1. DETENTION BASIN NO. 2 BASE MAP INFORMATION FROM OTAK, DATED JANUARY 26, 2015, AT A SCALE OF 1" = 20'. APPROXIMATE LOCATION OF SITE FEATURES OUTSIDE THE OTAK SURVEY AREA OBTAINED FROM SLR INTERNATIONAL, DATED APRIL 2007 AT A SCALE OF 1" = 150'.
2. APPARENT HORIZONTAL COORDINATE SYSTEM IS WASHINGTON STATE PLANE COORDINATE SYSTEM, NORTH ZONE (NAD 89/98) APPARENT VERTICAL DATUM IS N.A.V.D. 88.

DEFINITIONS:

- D — EXISTING STORM WATER COLLECTION PIPE
- E — ELECTRICAL CONDUIT
- OH — OVERHEAD LINE
- ABAN — ABANDONED LINE
- MW-518 — GROUNDWATER MONITORING WELL

DEFINITIONS:

PVC POLYVINYL CHLORIDE

AMP AMPERE

30' 0 30' 60'
1"=30'

THIS BAR REPRESENTS ONE INCH ON THE ORIGINAL DRAWING:

USE TO VERIFY FIGURE REPRODUCTION SCALE

No.	Date	Revisions	By	Ckd

Professional Engineer's Name: PETER J. CAMPBELL		
Professional Engineer's No.: WA 45051		
State: WA	Date Signed:	Project Mgr.: .
Designed by: .	Drawn by: .	Checked by: .

PRELIMINARY

PETER J. CAMPBELL — STATE OF WASHINGTON — 45051 — REGISTERED PROFESSIONAL ENGINEER — 03/14/16

ARCADIS

ARCADIS U.S., INC.

CHEVRON ENVIRONMENTAL MANAGEMENT COMPANY ● FORMER UNOCAL BULK FUEL TERMINAL, EDMONDS, WASHINGTON

SYSTEM DESIGN SPECIFICATION

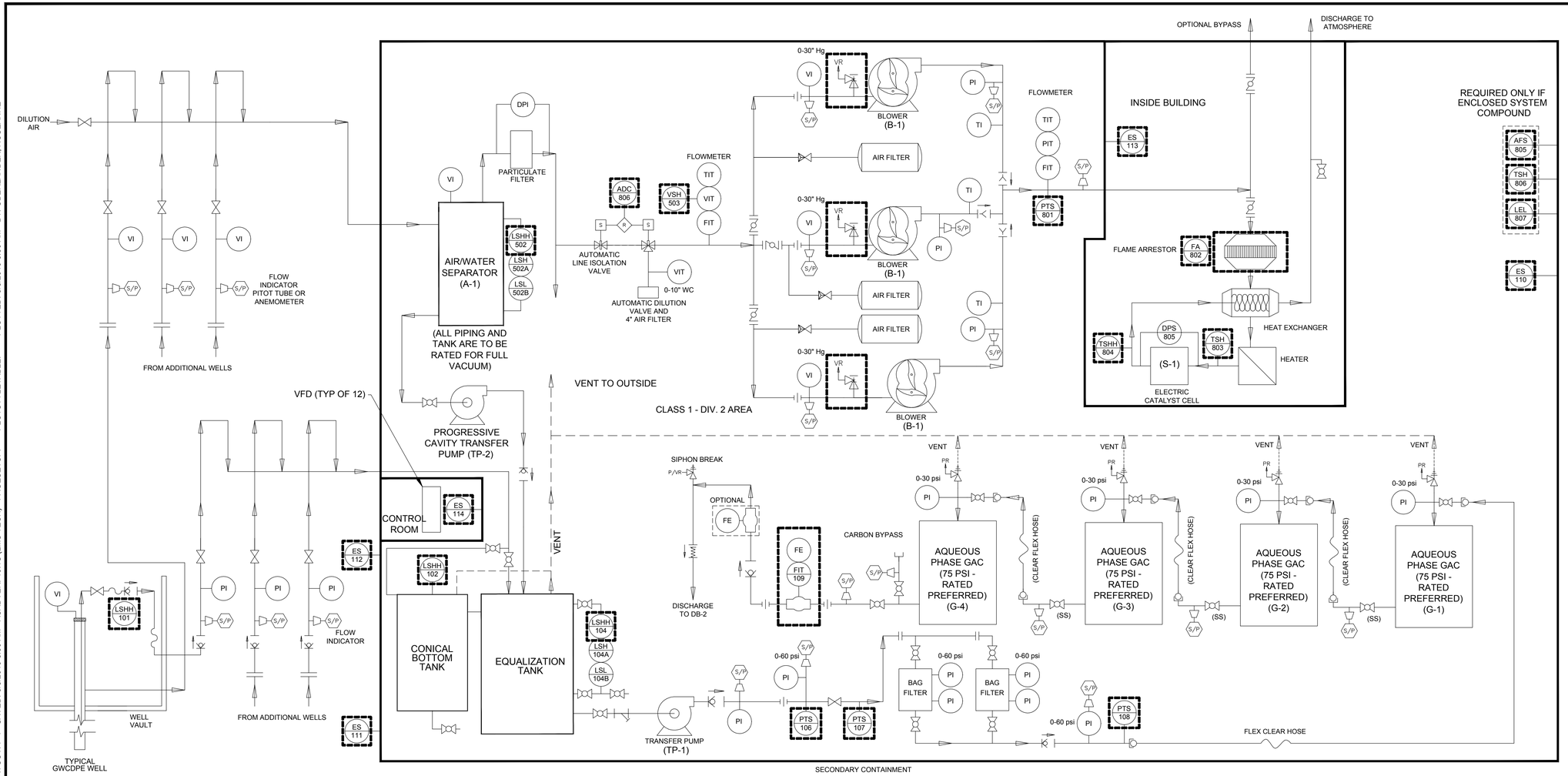
RIPRAP DESIGN AT DETENTION BASIN 1

ARCADIS Project No.
B0045362.0006.00012

Date
MARCH 2016

ARCADIS
6723 Towpath Road, Box 66
Syracuse, NY 13214
Tel: 315-446-9120

C-9



PRIMARY EQUIPMENT SYMBOLS

- VACUUM BLOWER
- LIQUID-RING BLOWER
- OIL-LESS COMPRESSOR
- METERING PUMP
- COALESCING FILTER
- DISCHARGE SILENCER

FITTINGS SYMBOLS

- CAP (THREADED)
- PLUG (THREADED)
- REDUCER
- RAIN CAP
- WYE STRAINER
- SPRAY NOZZLE
- UNION
- FLANGED JOINT
- ORIFICE-PLATE FLOWMETER
- CAM LOCK
- FLEXIBLE HOSE OR CONNECTOR
- P-TRAP

VALVE SYMBOLS

- GATE (NORMALLY OPEN)
- GATE (NORMALLY CLOSED)
- BALL (NORMALLY OPEN)
- BALL (NORMALLY CLOSED)
- BUTTERFLY (NORM. OPEN)
- BUTTERFLY (NORM. CLOSED)
- BALL CHECK
- SPRING CHECK
- SEATLESS CHECK
- AUTOMATIC DRAIN
- NEEDLE VALVE
- SOLENOID (NORMALLY CLOSED: FAIL CLOSED)
- PRESSURE REGULATOR
- VACUUM RELIEF
- PRESSURE RELIEF
- PRESSURE/ VACUUM RELIEF
- QUICK DISCONNECT
- QUICK DISCONNECT
- BOSS POSITIVE METAL-TO-POLYMER COUPLER
- SAMPLE PORT

REQUIRED CONTROL DEVICES ARE OUTLINED BOLD

ABBREVIATIONS:

DPI	DIFFERENTIAL PRESSURE INDICATOR
ES	EMERGENCY STOP
FA	FLAME ARRESTOR
FE	FLOW INDICATOR
FIT	FLOW INDICATOR AND TOTALIZER
LEL	LOWER EXPOSURE LIMIT
LSL	LEVEL SWITCH LOW
LSH	LEVEL SWITCH HIGH
LSHH	LEVEL SWITCH HIGH HIGH
PI	PRESSURE INDICATOR
PIT	PRESSURE INDICATOR TRANSMITTER
PSI	POUNDS PER SQUARE INCH
PTS	PRESSURE TRANSMITTING SWITCH
SS	STAINLESS STEEL
TI	TEMPERATURE INDICATOR
TIT	TEMPERATURE INDICATOR TRANSMITTER
TS	TEMPERATURE SWITCH
VFD	VARIABLE FREQUENCE DRIVE
VI	VACUUM INDICATOR
VIT	VACUUM INDICATOR TRANSMITTER

CONTROL UNIT	FUNCTION
LSHH 101	LEVEL SWITCH/ALARM HIGH HIGH: TURNS OFF ALL SYSTEMS
LSHH 102	LEVEL SWITCH/ALARM HIGH HIGH: TURNS OFF ALL SYSTEMS
LSHH 104	LEVEL SWITCH/ALARM HIGH HIGH: TURNS OFF ALL SYSTEMS
LSH 104A	LEVEL SWITCH HIGH: TURNS ON AS TRANSFER PUMP (TP-1)
LSL 104B	LEVEL SWITCH LOW: TURNS OFF TRANSFER PUMP (TP-1)

ALL HIGH HIGH OR LEL LEVEL SWITCHES ARE MANUAL RESET

CONTROL UNIT	FUNCTION
PTS 106	PRESSURE TRANSMITER SWITCH/ALARM HIGH: TURNS OFF ALL SYSTEMS
PTS 107	PRESSURE TRANSMITER SWITCH/ALARM HIGH: TURNS OFF ALL SYSTEMS
PTS 108	PRESSURE TRANSMITER SWITCH/ALARM HIGH: TURNS OFF ALL SYSTEMS

CONTROL UNIT	FUNCTION
ES 110	EMERGENCY STOP SWITCH (INTERNAL #1): TURNS OFF ALLSYSTEMS
ES 111	EMERGENCY STOP SWITCH (EXTERNAL #1): TURNS OFF ALLSYSTEMS
FIT 109	FLOW INDICATOR AND TOTALIZER

CONTROL UNIT	FUNCTION
LSHH 502	LEVEL SWITCH/ALARM HIGH HIGH: TURNS OFF ALL SYSTEMS
LSH 502A	LEVEL SWITCH HIGH: TURNS ON AS TRANSFER PUMP (TP-2)
LSL 502B	LEVEL SWITCH HIGH: TURNS ON AS TRANSFER PUMP (TP-2)
VSH 503	VACUUM SWITCH/ALARM HIGH HIGH: TURNS OFF ALL SYSTEMS
PTS 801	AIR PROVING SWITCH (PRESSURE SWITCH/ALARM LOW): TURNS OFF ALL SYSTEMS
FA 802	FLAME ARRESTOR: PREVENTS FLAMES FROM PROPOGATING UPSTREAM IN EVENT OF EXPLOSION

CONTROL UNIT	FUNCTION
TSH 803	TEMPERATURE SWITCH/ALARM LOW: CLOSES AUTOMATIC DILUTION VALVE (ADC) WHEN SYSTEM REACHES OPERATING TEMPERATURE RANGE
TSHH 804	TEMPERATURE SWITCH/ALARM HIGH HIGH: TURNS OFF ALL SYSTEMS
DPS 805	DIFFERENTIAL PRESSURE SWITCH/ALARM HIGH HIGH: TURNS OFF ALL SYSTEMS
AFS 805	AIR-FLOW SENSOR/ALARM HIGH HIGH: TURNS OFF ALL SYSTEMS
TSH 806	TEMPERATURE SWITCH/ALARM HIGH HIGH: TURNS OFF ALL SYSTEMS
LEL 807	LOWER EXPLOSIVE LIMIT /ALARM HIGH HIGH: TURNS OFF ALL SYSTEMS
ADC 806	AIR DILUTION CONTROL VALVE: OPENS AT HIGH TEMP TO COOL OXIDIZER CLOSES AT OPERATING TEMP

CONTROL UNIT	FUNCTION
ES 112	EMERGENCY STOP SWITCH INTERNAL #2 TURNS OFF ALL SYSTEMS
ES 113	EMERGENCY STOP SWITCH EXTERNAL #2 TURNS OFF ALL SYSTEMS
ES 114	EMERGENCY STOP SWITCH CONTROL ROOM TURNS OFF ALL SYSTEMS

CITY: MINNEAPOLIS, MN DIV/GROUP: ENV/CAD DB: R. OBERLANDER LD: R. OBERLANDER PIC: P. CAMPBELL PM: TM: A. PATEL LYR:ON=*;OFF=*REF*
G:\ENVCAD\Minneapolis-MNACTIB0045362\0006\0012\CONTRACT\DWG\PRELIMINARY45362P01.dwg LAYOUT: P-1 SAVED: 3/8/2016 8:30 AM ACADVER: 19.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ---- PLOTTED: 3/8/2016 8:30 AM BY: OBERLANDER, ROSEANNE
XREFS: IMAGES: PROJECTNAME: ----
45362X00 PETER_CAMPBELL.tif

SCALE(S) AS INDICATED

THIS BAR REPRESENTS ONE INCH ON THE ORIGINAL DRAWING: USE TO VERIFY FIGURE REPRODUCTION SCALE

No.	Date	Revisions	By	Ckd

Professional Engineer's Name: **PETER J. CAMPBELL**
Professional Engineer's No.: WA 45051

State	Date Signed	Project Mgr.
WA		-
Designed by -	Drawn by -	Checked by -

PRELIMINARY

ARCADIS U.S., INC.

CHEVRON ENVIRONMENTAL MANAGEMENT COMPANY ● FORMER UNOCAL BULK FUEL TERMINAL, EDMONDS, WASHINGTON

SYSTEM DESIGN SPECIFICATION

PROCESS AND INSTRUMENTATION DIAGRAM

ARCADIS Project No. B0045362.0006.00012

Date MARCH 2016

ARCADIS
6723 Towpath Road, Box 66
Syracuse, NY 13214
Tel: 315-446-9120

P-1