Kennedy Jenks

32001 32nd Avenue South, Suite 100
Federal Way, Washington 98001
253-835-6400

Draft Operations and Maintenance Manual Environmental Remediation System

Circle K 1461
Seattle, Washington

30 March 2023

Prepared for

DEPARTMENT OF ECOLOGY
State of Washington

Toxics Cleanup Program
3190 160th Avenue SE
Bellevue, Washington 98008-5452

KJ Project No. 2196008*00

Table of Contents

Table of Contents (cont'd)

Table of Contents (cont'd)

List of Tables

List of Figures

Table of Contents (cont'd)

List of Appendices

Change Log

Revision Date	Summary of Changes Made
13 October 2022	Original draft submission
30 March 2023	Updates based on RFQQ

Section 1: Introduction

Kennedy/Jenks Consultants, Inc. (Kennedy Jenks) has prepared this Operations and Maintenance Manual (O&M Manual) to document procedures for the operation, monitoring, and maintenance activities associated with the environmental remediation system installed at the Circle K Station #1461 (site) under construction permit XXXX (Appendix A). The site is generally located at 2350 24th Avenue East in Seattle, King County, Washington (see Figure 1). This site is listed on the Washington State Department of Ecology (Ecology) Site Information System and Hazardous Sites List as Circle K 1461, under cleanup site ID 5086 and facility/site ID 2322.

In April 1992, Ecology entered into Consent Decree No. 82-2-08095-8 (CD) with Mr. Kuk Jin Choung and Ms. Kathy-Kyung D. Choung, owners of the property, to conduct a remedial investigation and feasibility study (RI/FS) and develop a cleanup action plan (CAP) for the site. After completion of the RI/FS and CAP, the CD requires performance of the cleanup action to protect human health and the environment in accordance with Model Toxics Control Act (MTCA) regulations. The RI/FS and CAP were finalized in December 2017. Implementation of the CAP is continuing under the CD with Ecology oversight, under Ecology contract number C2100069.

1.1 System Objectives

The CAP is intended to address petroleum hydrocarbon-affected soil and groundwater at the site. Hydrocarbons detected in soil and groundwater have been attributed to a leaking underground storage tank (UST) that was discovered in August 1989. A groundwater recirculation system consisting of a Multi-Phase Extraction (MPE) system and surfactant / nutrient / oxygen injection system will be used to reduce concentrations of Gasoline Range Organics (GRO) and benzene, toluene, ethylbenzene, and xylene (BTEX) in the soil and groundwater below the site. Groundwater, soil, and vapor samples will be collected periodically to monitor treatment progress.

The project goal with respect to GRO and BTEX is to remove contaminant mass to attain MTCA Method A groundwater and soil clean up levels (CULs). Reducing contaminant concentrations to the extent practicable will require:

- Systematic optimization of mass removal and remedial chemical injections through adjustments to operating wells and airflow based on monitoring results.
- Documentation of progress towards the removal of GRO and BTEX from the site.
- Compliance with the requirements of all applicable federal, state, and local permits for construction and industrial activities, underground injection, air discharge, and sewer discharge.

To support these goals, monitoring techniques will be used to demonstrate MPE system operational success.

1.2 MPE System Description

The MPE system is designed to incorporate three (3) new vertical wells and three (3) new slant wells along with seven (7) existing wells into a single extraction/injection system for a total of 13 remediation wells. Each well within the network of remediation wells is individually connected to both the extraction and injection manifolds in the treatment system enclosure (Treatment Shed) located on site. The wells are organized into four (4) groups of either three (3) or four (4) remediation wells (see Table 1). The vapor and water extracted from the wells is piped to the treatment system. The treatment train splits at a knock-out tank to a water treatment train and a vapor treatment train.

The water treatment train consists of a bag filter, two pairs of granular activated carbon (GAC) vessels plumbed in series, a mixing tank in which surfactants, bacteria, and/or nutrients can be added, and an oxygen generator. Water can be discharged to the City of Seattle (City) sanitary sewer system before the mixing tank or reinjected to the wells through the injection manifold.

The vapor treatment train consists of a temporary catalytic oxidizer to be used at system startup and a pair of vapor GAC vessels piped in series to be used once vapor contaminant concentrations are low enough for their use. Treated air is discharged through an exhaust pipe.

The system is designed to operate continuously, except for shutdowns for maintenance, replacement of media, or as-needed monitoring.

1.2.1 Air Permit Compliance Criteria

As a remediation project under a Consent Decree, the project is required to comply with the substantial requirements of the Puget Sound Clean Air Agency (PSCAA), however obtaining a PSCAA permit is not required. The MPE system will be operated to substantially meet the PSCAA operation and monitoring requirements (included in Appendix B) for remediation systems that use catalytic oxidizers and GAC for treatment of extracted soil vapors prior to discharge. Operation and monitoring requirements include moderating influent flow rate to the treatment system, and collection of vapor samples from the influent to and effluent from treatment devices (i.e., the catalytic oxidizer and GAC vessels) to demonstrate compliance with control efficiency requirements for the treatment devices. [Details to be added once PSCAA provides final guidance on substantial requirements.]

The control efficiency requirements are as follows:

- ≥ 97% if inlet TPH ≥ 200 parts per million by volume (ppmv), measured as hexane or its equivalent
- ≥ 90% if inlet TPH < 200 ppmv, measured as hexane or its equivalent; or
- ≤ 10 ppmv at the outlet of the control device, measured as hexane or its equivalent.

The system shall be operated such that the effluent of the vapor treatment system meets the Washington Administrative Code (WAC) 173-460-150 Small Quantity Emission Rate (SQER) limits for the following constituents in pounds per day (lbs/day) or pounds per hour (lbs/hour) as applicable:

Constituent	SQER (lbs/day)	SQER (lbs/hour)
Benzene	0.058	21
Toluene	370	135,050
Ethylbenzene	0.178	65
Total Xylenes	16	5,840

Compliance will be verified through vapor samples collected at the influent and effluent of the vapor treatment system (see Section 5.1 for details).

1.2.2 Discharge Permit Compliance Criteria

Due to the discharge of treated groundwater to the sanitary sewer as part of the system design, the project is required to comply with the requirements of a King County Industrial Waste Program Wastewater Discharge Authorization (KCIW WDA). Effluent limits for the constituents to be self-monitored as part of permit compliance are included in Section 4.2.8 of the SAP/QAPP. Compliance will be verified through samples collected from the water treatment system (see Section 5.1 for details). [Details to be added once KCIW provides final guidance on substantial requirements.]

1.3 Site Contacts

Personnel associated with the treatment system include Ecology personnel, Kennedy Jenks personnel, the property owner, and contractors. The Ecology Site Manager is Dale Myers, the Kennedy Jenks' project manager is Ryan Hultgren, and the property owners are Mr. Kuk Jin Choung and Kathy-Kyung D. Choung. The contact information for each is included below:

- Dale Myers, Ecology Site Manager
  - Phone: 425-649-4426
  - Email: damy461@ecy.wa.gov
- Ryan Hultgren, Kennedy Jenks project manager
  - Phone: 253-549-9725
  - Email: RyanHultgren@KennedyJenks.com
- The Choung Family:
  - Phone: 206-769-9853
  - Email: Ydc2415@hotmail.com

All field personnel must be HAZWOPER certified. A site-specific Health and Safety Plan (HASP) with Job Hazard Analyses for individual tasks has been developed for the site, and is incorporated into the O&M Manual as Appendix C.

The property is owned and managed by Mr. Kuk Jin Choung and Kathy-Kyung D. Choung who operate Jay's Dry Cleaning on the site and lease the space used for Mont's Market convenience store.

Ecology is the primary regulatory agency for the site and treatment system.

1.4 Contents

This O&M Manual provides a detailed description of each of the system components, the recommended maintenance schedule for the system, the proper operation of the remediation system, and the monitoring plan. This O&M Manual will be updated as needed based on changes to the system, including changes to installed equipment, information from vendors, permit requirement updates, and/or the O&M activities.

Section 2: System Components

This section provides detailed descriptions of each component of the MPE system, including the following:

- General Conveyance and Monitoring Infrastructure
  - Extraction/Injection Wells
  - Sub-slab Depressurization Wells
  - Vapor Pins
  - Extraction and Injection Manifold and Piping
- Water Treatment System
  - Vapor Liquid Separator
  - Transfer Pumps
  - 400 Gallon Storage Tank
  - Bag Filter
  - Liquid GAC Vessels
  - 300 Gallon Storage Tank
  - 300 Gallon Mixing Tank
  - Bacteria and Nutrients Feed
  - Surfactant Feed
  - Oxygen Generator
- Vapor Treatment System
  - Liquid Ring Vacuum Pump
  - Heat Exchanger
  - Temporary Catalytic Oxidizer
  - Vapor-Phase GAC Vessels
- System Components and Control
  - Control Panel and Programmable Logic Controller (PLC)
  - Ancillary piping, controls, and gauges that connect, control, and monitor the primary components.

The aboveground piping manifold and treatment system are housed in a fenced area on site. Construction drawings are included in Appendix D. Drawing I-05 includes the process flow diagram; Drawing C-01 shows the locations of the wells, manifolds, and treatment system; and Drawing C-03 shows the layout of the treatment system. Appendix E includes vendor-supplied documentation for the components of the treatment system including transfer pumps, tank mixer, liquid ring pump, and GAC vessels after system installation has been completed.

2.1 General Conveyance and Monitoring Infrastructure

2.1.1 Extraction/Injection Wells

The Extraction/Injection Wells (EIWs) consist of 13 remediation wells including one existing monitoring well (MW-4), six existing remediation wells (RW-2, RW-3, RW-4, RW-5, RW-6,

RW-7), three new remediation wells (RW-8, RW-9, and RW-10) and 3 new slanted remediation wells (SW-1, SW-2, and SW-3). Existing monitoring well MW-4 will not be used for injection since injection will be focused on the areas of highest petroleum hydrocarbon concentration and MW-4 is upgradient of these areas. Well locations are shown on Drawing C-01 in Appendix D. Well construction details are included in Table 1.

EIWs have a ¼-inch sampling port and ⅜-inch threaded plug at the manifolds for monitoring purposes. The EIWs are plumbed into four (4) groups of 3 to 4 wells (see Section 2.1.4 and Table 1).

2.1.2 Sub-slab Depressurization Wells

Three 4-foot-long Sub-Slab Depressurization (SSD) horizontal wells constructed of 3-inch diameter polyvinyl chloride (PVC) slotted pipes are installed below grade in gravel. The SSD wells are located on the north and west sides of the on-site building as shown on Drawing C-01 in Appendix D. The SSD wells are connected via Manifold A to allow for a negative vacuum to be applied beneath the on-site building to mitigate potential vapor intrusion into the on-site building during system operations.

2.1.3 Vapor Pins

Four (4) Vapor Pin monitoring points are installed through the floor slab inside of the on-site building. These devices are designed to be used for gas sampling to monitor sub-slab soil vapor.

2.1.4 Manifold and Piping

Extracted soil gas from three SSDs are manually controlled at manifold A as discussed above. Manifold A includes pressure gauges, isolation ball valve, flow control gate valve, ¼-inch sampling ball valve, and ⅜-inch threaded plug (for pitot tube) to each SSD well.

Extracted vapor/water from each well group is controlled at Manifold B located within the Treatment Shed at the southwest corner of the on-site building. The manifold consists of the individual pipes from each of the EIWs with associated valves and gauges (one ball valve, one gate valve, and one pressure indicator). The individual well pipes are grouped into three or four lines connected to a single extraction main per well group. There are four (4) electronic solenoid valves on the four extraction mains in Manifold B that control if the well group will be used for extraction. These valves are connected to the PLC. There is also a ball valve and globe valve on each well group's extraction main.

Treated water for recirculation back into the individual EIWs is controlled at Manifold C, also located within the Treatment Shed. The manifold consists of four injection main lines connected to individual pipes for each of the EIWs within that group. The individual EIW pipes have associated valves and gauges (one gate valve, one ball valve, one pressure gauge, and one flow meter). There are four (4) electronic solenoid valves on the four injection mains in Manifold C that control if the well group will be used for injection. These valves are connected to the PLC. There is also a ball valve and globe valve on each well group's injection main.

The extraction and injection flow rate for each EIW is controlled individually by the hand-operated gate valves located at Manifold B and Manifold C within the Treatment Shed. These hand-operated gate valves are used to balance the groundwater flow to and from individual wells within each group. The electric solenoid valves on Manifold B are interlocked with those on Manifold C via the PLC so that when one valve is open on Manifold B to a group of wells, the corresponding electric solenoid valve on Manifold C to the same group of wells is closed. This is done to avoid simultaneous extraction and injection to the same group of wells. Each piping manifold leg is labeled, and diagrams of the piping manifolds are provided in the construction drawings (Appendix D, Drawing I-05).

2.2 Water Treatment System

2.2.1 Vapor Liquid Separator T-300

The 40-gallon, steel Vapor/Liquid Separator tank (T-300 on Drawing I-02 in Appendix D) is located in the shed upstream of the liquid ring pump. Moisture is collected at the tank bottom and is pumped to the water treatment system. Vapor exits the top of the tank and continues to the blower inlet. When the high-level float switch (LSH 300) in T-300 is activated, the PLC switches on the transfer pump (P-300) and the water collected in T-300 is pumped into a 400-gallon storage tank (T-301). Once the low-level switch (LSL 300) in T-300 is activated, the PLC switches P-300 off, allowing T-300 to begin filling. If the high-high level switch (LSHH) in T-300 is activated, the PLC shall turn off the Liquid Ring Vacuum Pump (B-301) and Catalytic Oxidizer (TO-400, if installed) and the remote telemetry alarms the designated contact person that the system has been turned off for a high-high level in T-300.

The web and local human-machine interface (HMI) will show the run status and alarm conditions for T-300.

2.2.2 Transfer Pump P-300

Transfer Pump P-300 is located on the east side of T-300. When LSH 300 in T-300 is activated, P-300 pumps water out of T-300 to T-301 at a minimum rate of 3 gallons per minute (gpm) and maximum rate of 10 gpm. Maximum discharge pressure is 50 psig or less.

The web and local HMI will show the run status for P-300.

2.2.3 Storage Tank T-301

A 400-Gallon Storage Tank (T-301 is located downstream of Transfer Pump P-300 in the Water Treatment System. Untreated groundwater accumulates here until LSH 301 is activated at which point the PLC switches on Transfer Pump P-400 to pump the water collected in T-301 to the bag filter (BF-400) and GAC Vessels (LG-400, LG-401, LG-402, and LG-403). Once the low-level switch (LSL 301) in T-301 is activated, the PLC switches P-400 off, allowing T-301 to begin filling.

If the LSHH in T-301 is activated, the PLC shall turn off the Liquid Ring Vacuum Pump (B-301) and Catalytic Oxidizer (TO-400, if installed) and the remote telemetry alarms the designated contact person that the system has been turned off for a high-high level in T-301.

The web and local HMI will show the run status and alarm conditions for T-301.

2.2.4 Transfer Pump P-400

Transfer Pump P-400 is located on the north side of T-301. When LSH 301 in T-301 is activated, P-400 pumps water out of T-301 to the bag filter (BF-400) and GAC Vessels (LG-400, LG-401, LG-402, and LG-403) at a minimum rate of 3 gpm and maximum rate of 10 gpm. Maximum discharge pressure is 50 psig or less.

The web and local HMI will show the run status for P-400.

2.2.5 Bag Filter BF-400

An in-line bag filter (filter) is located downstream of P-400 and T-301. Fouling of the filter is monitored via a pressure gauge and pressure transducer installed on each side of the bag filter. The transducers are connected to the PLC and will register high pressure alarms at the PLC. PIT-400 will alarm at 20 psig and PIT-401 will alarm at 6 psig, and the remote telemetry will alarm the designated contact person. A pressure reducing valve is located downstream of BF-400 to reduce pressures to below 6 psig. A flow meter is also located downstream of BF-400 to manually monitor flow rate through the GAC vessels.

The web and local HMI will show the pressure reading and alarm conditions for PIT-400 and PIT-401.

2.2.6 Liquid GAC Vessels LG-400/401/402/403

Four (4) 55-gallon Liquid GAC Vessels are plumbed for operation in a lead-lag arrangement downstream of the filter after a pressure regulation valve. The Liquid GAC Vessels each contain approximately 200 lbs of GAC. They are piped to be operated in two parallel trains of two vessels each. Water is accumulated in T-301 to ensure flow through each GAC vessel is greater than the minimum flow of 2 gpm to avoid channeling in the GAC vessels. The pressure inside of the Liquid GAC Vessels should not exceed 6 psig and is controlled by the upstream pressure regulation valve. Each treatment train has pressure gauges before and after each GAC vessel that are not connected to the PLC. Each parallel system is capable of complete treatment, so the other system can standby or be maintained without disrupting system operation. None of the valves controlling GAC vessel flow rates are connected to the PLC.

2.2.7 300-Gallon Storage Tank T-400

A 300-gallon Storage Tank (T-400) is connected downstream of the Liquid GAC Vessels to collect treated groundwater. Treated groundwater will initially be discharged by gravity to sanitary sewer from this tank. Once treated groundwater contaminant concentrations are amenable to bioremediation via reinjection, treated water from this tank will be pumped to the 300-gallon mixing tank (T-500) where dry amendments are added by hand and mechanically

mixed. Some of the water may be discharged to sanitary sewer during injection activities if injection rates are not sufficient to allow all the treated groundwater to be used for bioremediation.

GAC-treated groundwater accumulates here until LSH 400 is activated at which point the PLC switches on Transfer Pump P-401 to pump the water to T-500. LSH 400 is positioned below the outlet to the sanitary sewer and positioned to allow for switch engagement prior to discharge to the sanitary sewer. Once the low-level switch (LSL 400) in T-400 is activated, the PLC switches P-400 off, allowing T-400 to begin filling.

The web and local HMI will show the run status and alarm conditions for T-400.

2.2.8 Transfer Pump P-401

Transfer Pump P-401 is located on the west side of Storage Tank T-400. When LSH 400 in T-400 is activated, P-401 pumps water out of T-400 to Mixing Tank T-500 at a rate of approximately 3 gpm.

The web and local HMI will show the run status for P-401.

2.2.9 300-Gallon Mixing Tank T-500

Water is transferred to the 300-Gallon Mixing Tank (T-500) from the 300-Gallon Storage Tank (T-400) by transfer pump P-401. An access port is located on top of T-500 for manual filling of dry amendments including surfactants, bacteria, and nutrients into the processed water in preparation for reinjection. T-500 is powered by an electric motor. T-500 is only operated during the addition of dry amendments. When the high-level switch for T-500 is activated, the PLC turns on the injection pump (P-500) delivering mixed flows from T-500 through the Oxygen Generator (OG-500) and into the injection well manifold. Once the low-level switch (LSL 500) in T-500 is activated, the PLC switches P-500 off, allowing T-500 to begin filling.

If the LSHH in T-500 is activated, the PLC shall turn off the Liquid Ring Vacuum Pump (B-301) and Catalytic Oxidizer (TO-400, if installed) and the remote telemetry alarms the designated contact person that the system has been turned off for a high-high level in T-500.

The web and local HMI will show the run status and alarm conditions for T-500.

2.2.10 Transfer Pump P-500

Transfer Pump P-500 is located on the west side of Mixing Tank T-500. When the additives are fully mixed in T-500 and the high level switch is activated, the PLC turns on P-500. P-500 will then pump water out of T-500 to the Oxygen Generator (OG-500) and injection well manifold.

The web and local HMI will show the run status for P-500.

2.2.11 Oxygen Generator OG-500

The in-line Oxygen Generator (OG-500) is connected to the injection piping downstream of Transfer Pump P-500. OG-500 is supplied by an air compressor with a pressure gauge (PIT-500) connected to the PLC. PIT-500 will alarm at vendor-defined high and low pressure setpoints. The compressor turns on automatically when there is no pressure in OG-500. OG-500 will be used after surfactant injection has reduced the concentrations to those conducive to bioremediation, when the injection will transition to injection of bacteria and nutrients.

The web and local human-machine interface (HMI) will show the run status for the oxygen generator via a hand/off/auto switch. The HMI will also relay vendor-defined alarm conditions.

2.3 Vapor Treatment System

2.3.1 Liquid Ring Vacuum Pump B-301

The Liquid Ring Vacuum Pump (B-301) installed downstream of the Vapor Liquid Separator (T-300), is connected to piping from the top of T-300 to pull vapor from the T-300 into the Vapor Treatment System. This pump operates at a maximum vacuum of 29 inches mercury (in Hg) and is controlled at the PLC. B-301 exerts a vacuum on the wells to extract groundwater and soil vapor into T-300. The pumping capacity is approximately 300 cubic feet per minute (CFM). The pump will be operated at an extraction flow rate based on meeting PSCAA treatment limits for TPH and BTEX constituents (see Appendix B).

B-301 will be equipment with a high pressure discharge switch (set to 1 psig) and a high temperature switch per vendor package. B-301 will also have a motor high temperature thermocouple shutdown switch per vendor package.

A pressure indicator and transmitter (PIT-300) is located upstream of B-301. Normal operating pressures for B-301 will be established during system startup, with a high and low vacuum alarm set at PIT-300 to activate when pressure is +/- 2 in Hg above or below normal operating pressures. If PIT-300 measures vacuum at 4 in Hg above normal operating pressures (or a maximum of 29 in Hg), the PLC shall turn off the Liquid Ring Vacuum Pump (B-301) and Catalytic Oxidizer (TO-400, if installed) and the remote telemetry alarms the designated contact person that the system has been turned off for a high vacuum level in PIT-300.

The web and local HMI will display the run status of B-301, the pressure reading for PIT-300, and any associated alarm conditions.

2.3.2 Heat Exchanger HEX-302

A heat exchanger will reduce the exit temperature on the discharge side of the liquid ring pump to within 15 degrees Fahrenheit (°F) of the ambient average annual maximum temperature. Vapor will be directed from the vacuum pump through the heat exchanger prior to entering TO-400 or the vapor GAC vessels.

The heat exchanger is equipment with a temperature transmitter (TIT-302), a pressure transmitter (PIT-302), and a downstream flow indicating transducer (FIT-302). The web and local HMI will display the temperature at TIT-302, the pressure at PIT-302, and the flow at FIT-302, along with any alarm conditions.

Normal operating pressures for HEX-302 will be established during system startup, with a low vacuum alarm set to activate at PIT-302 when pressure more than 15 in Hg below normal operating pressures. If PIT-300 measures vacuum at 100 inches water column, the PLC shall turn off the Liquid Ring Vacuum Pump (B-301) and Catalytic Oxidizer (TO-400, if installed) and the remote telemetry alarms the designated contact person that the system has been turned off for a high vacuum level in PIT-302.

When flow is 10 scfm or lower, FIT-302 will trigger a low flow alarm at the PLC and the remote telemetry alarms the designated contact person that the system has a low flow level in FIT-302.

2.3.3 Temporary Catalytic Oxidizer TO-400

The Temporary Catalytic Oxidizer (TO-400) is installed downstream of the Vacuum Pump B-301. Vapor will be directed through TO-400 for the first several months of operation (approximately 6 months) until concentrations of the contaminants of concern have decreased to a level suitable for treatment via the Vapor GAC vessels (LG-400/401/402/403). TO-400 will then be permanently removed, returned to the vendor, and vapor will be directed through the Vapor GAC vessels prior to discharge. TO-400 is controlled at the PLC.

The web and local HMI shall show the run status of TO-400. Any temperature or pressure alarm conditions from the vendor-defined controls at TO-400 will be related to the PLC and the web and local HMI.

2.3.4 Vapor GAC Vessels GAC-400/401

Two Vapor GAC Vessels are connected downstream of Vacuum Pump B-301 parallel to Temporary Catalytic Oxidizer TO-400. Once vapor concentrations are reduced to a level suitable for treatment via the Vapor GAC vessels (below approximately 500 parts per million (ppm) as isobutylene), TO-400 will be removed from the treatment train and the vapor will be routed through GAC-400 and GAC-401. GAC-400 and GAC-401 contain 2,000-pounds of GAC each. The vessels are plumbed in series with only a primary and secondary vessel; when concentrations leaving the primary vessel indicate that the vessel capacity is exhausted, the GAC will be replaced in the primary vessel and the vessel order reversed. Valves controlling GAC vessel treatment flows are manually operated and are not connected to the PLC. After treatment through GAC-400 and GAC-401, vapor will be discharged via a vertical discharge stack along the southwest corner of the on-site building.

2.4 System Components and Control

2.4.1 Control Panel and Programmable Logic Control (PLC)

The PLC panel is located on the outside of the Treatment Shed and has manual controls and indicators for the following processes:

- Selecting the mode (injection / extraction) for each group of wells (solenoid control).
- Hand/off/auto options for the Vacuum Pump B-301, Catalytic Oxidizer TO-400, and Oxygen Generator OG-500.
- Run time meter for B-301
- Status of level switches in tanks T-300, T-301, T-400, and T-500.
- Hand/off/auto options via the HMI for transfer pumps and the air compressor
- Emergency shut off switch
- Manual reset button for each starter
- Four faults with red alarm lights:
  - High vacuum (system shutdown)
  - High-high water level in T-300 (system shutdown)
  - High-high water level in T-301 (system shutdown)
  - High pressure (system shutdown)

Automatic equipment controls based on level switches are also controlled through the PLC.

2.4.2 Alarms

The treatment system has been configured with alarms and system shutdown triggers, which are detailed in Table 2. The piping and instrumentation diagram (P&ID) showing the alarms and associated switches or triggers is included in Appendix D (Drawings I-02 to I-05).

Alarm conditions include:

- T-300 Vapor Liquid Separator high-high level, high level, and low level
- T-301 Storage Tank high-high level, high level, and low level
- BF-400 Bag Filter high pressure alarms (PIT-400 and PIT-401)
- T-400 Storage Tank high-high level, high level, and low level
- T-500 Mixing Tank high-high level, high level, and low level
- B-301 Liquid Ring Vacuum Pump high-high pressure, high pressure, and low pressure (PIT-300)
- B-301 Liquid Ring Vacuum Pump Shutdown Alarm
- HEX-302 Heat Exchanger low vacuum and high vacuum (PIT-302)
- HEX-302 Heat Exchanger downstream low flow (FIT-302)
- TO-400 Catalytic Oxidizer Shutdown Alarm and any other vendor-defined alarm conditions
- OG-500 Oxygen Generator vendor-defined alarm conditions
- C-500 Air Compressor high pressure, low pressure

2.4.3 Autodialer

The system is equipped with a remote telemetry system (autodialer) and web server device to provide the following functions:

- Accept hardwired digital and analog signals and output hardwired digital and analog signals to devices in the system.
- Dial the alarms described above accordingly to multiple priority lists of people to be notified using voice messages, text messages, or emails.
- Provide status data as described above to authorized users via a web server.

2.4.4 Meters, Gauges, and Valves

The treatment system includes flow meters, pressure and temperature gauges, and a variety of valves. The meters, gauges, and valves are shown in the Construction Drawings I-02 through I-05.

2.4.5 Treatment Shed

The Treatment Shed houses components of the treatment system and the extraction/injection piping manifold. The PLC with HMI panel is located on the outside of the Treatment Shed.

Section 3: Component Inspection and Maintenance

This section lists each of the components in the system that require periodic maintenance and describes the type and frequency of that maintenance.

Only qualified and experienced personnel with the appropriate credentials and health and safety training should perform maintenance on the system, and power should be disconnected prior to performing maintenance activities.

Table 2 includes a list of alarm causes and simple responses. If alarm conditions persist after following these measures, the applicable system component(s) may need to be checked and/or repaired by a qualified technician.

Table 3 summarizes the type and frequency of the required maintenance and Appendix E includes the vendor-supplied documentation for each item. Table 4 summarizes the expected number of visits based on the required maintenance activities.

3.1 General Conveyance and Monitoring Infrastructure

3.1.1 Extraction/Injection Wells

The construction contractor will have inspected each wellhead when the system is first operational to check for air leakage at the piping-well connection. Thereafter, wellheads will be inspected by the operator annually. Damage to the wellheads or conditions requiring correction will be noted on the monitoring form (Appendix F or electronic equivalent). There is no regular maintenance required for the wells. Regular maintenance of the well vaults consists of replacement of bolts and gaskets as needed to keep vault lids secure and in-place. If well plugging or fouling is noted during inspection, the well will be physically surged to remove any material from the well screen or sand pack to eliminate plugging or fouling.

3.1.2 Sub-slab Depressurization Wells

The construction contractor will have inspected each wellhead before covering them when the system is first constructed to check for air leakage at the piping-well connection. Thereafter, well extraction flow and vacuum will be monitored to detect changes to well performance. There is no regular maintenance required for the wells. If changes to well performance are noted for 3 consecutive months, the well will be evaluated and repaired, as needed. The functionality of the wells will be evaluated at least annually.

3.1.3 Vapor Pins

Vapor Pins will be inspected monthly to check that covers and valves are sound. Vapor pin condition and functionality will be evaluated during each inspection. Fasteners, valves, and gaskets are to be replaced as needed.

3.1.4 Manifold and Piping

Piping manifolds will be inspected monthly, at minimum, to check that piping connections are sound, valves are in the correct positions, and the moisture level in the sumps do not require draining. Damage will be noted on the monitoring form (Appendix F or electronic equivalent) and corrective action will be taken. If monitoring indicates possible airflow problems at individual wells, the individual manifold legs will be checked for condensate accumulation will be pumped out if needed through the wye fitting in each manifold leg.

Care will be taken during monitoring and maintenance to protect against debris entering the system. If manifold piping becomes plugged, the debris or plug will be removed. Caution will be exercised when plugs are removed from the manifold piping during flow measurement.

Piping between equipment will be inspected monthly, at minimum, for leaks or for accumulation of water at low spots in header lines. Gas lines and electric lines will be inspected for leaks and damage.

3.2 Water Treatment System

3.2.1 Vapor Liquid Separator T-300

The water level in T-300 will be checked monthly and when LSHH 300 is activated. If the high-high alarm is activated routinely, the schedule for inspection and water removal will be changed to weekly and transfer pump P-300 will be evaluated for functionality until alarm is no longer activated routinely.

The level switch in the tank will be tested and the mist eliminator will be cleaned annually. T-300 will be drained and cleaned at least annually. Additional regular maintenance may also be required according to the manufacturer recommendations.

3.2.2 Transfer Pumps P-300/400/401/500

Transfer pumps will be inspected monthly. Oil and hydraulic fluids will be maintained at necessary levels during system operation. If any of the tanks are regularly reaching high-high alarm level, the corresponding transfer pump will be inspected for proper function. The transfer pumps shall meet the following criteria:

- Minimum Flow rate: 5 gpm
- Power: Approximately 1 horsepower (hp)

3.2.3 Storage Tank T-301

The water level in T-301 is checked monthly and when the high-high level alarm is activated. If the high-high alarm is activated routinely, the schedule for inspection and water removal will be updated and transfer pump P-400 will be evaluated for functionality.

T-301 will be drained and cleaned at least annually. Additional regular maintenance may also be required according to the manufacturer recommendations.

3.2.4 Bag Filter BF-400

Bag filter BF-400 is inspected monthly for damage to the filter or housing components. If damage is noted, the filter or housing components will be replaced. The pressure difference across BF-400 is monitored using the upstream and downstream pressure gauges. If pressure upstream of the bag filter increases by 10 psi compared to system startup or since the last bag filter replacement, the bag filter will be replaced. The bag filter will be replaced at least semiannually, if no pressure buildup occurs. Filter and other replacement parts are purchased from the original manufacturer to match the original system unless otherwise determined.

3.2.5 Liquid GAC Vessels LG-400/401/402/403

Liquid GAC vessel maintenance includes inspecting the physical condition of the vessels for damage or corrosion, checking for accumulated sediment or increased differential pressure, checking for channeling, and monitoring for breakthrough of the media. If the vessels are damaged or corroded, repair damage and remove corrosion or replace vessels. If sediment has been accumulated, sediment will be removed; if channeling is noted, the carbon will be replaced. If leakage is noted or if the differential pressure across a vessel increases by 10 psi, the carbon or vessel will be replaced. The Liquid GAC media is monitored for breakthrough by analyzing water samples taken monthly for the first two quarters, then quarterly until one year into Phase 3, then semiannually. The system will be shut down and the lead GAC vessels' media changed out when the lead GAC vessel control efficiency drops to 90% or below.

3.2.6 300-Gallon Storage Tank T-400

The water level in T-400 is checked monthly and when the high-high level alarm is activated. If the high-high alarm is activated routinely, the schedule for inspection will be updated and transfer pump P-401 will be evaluated for functionality.

T-400 shall be drained and cleaned at least annually.

3.2.7 300-Gallon Mixing Tank T-500

The water level in T-500 is checked monthly and when the high-high level alarm is activated. If the high-high alarm is activated routinely, the schedule for inspection and water removal will be updated and transfer pump P-500 will be evaluated for functionality.

T-500 will be drained and cleaned at least annually to remove accumulation of non-soluble amendment components. T-500 will be inspected monthly to ensure there is no accumulation of amendments. T-500 will be drained and cleaned as needed if excessive accumulation of non-soluble amendment components is noted prior to scheduled draining and cleaning. The tank mixer in T-500 is serviced per manufacturer's recommended schedule.

3.2.8 Oxygen Generator OG-500

OG-500 and associated air compressor will be inspected monthly and maintained per the manufacturer's recommendations. OG-500 must be inspected periodically for proper cycling pressures per the manufacturer's recommendations. Hinges and other appurtenances will be

lubricated as needed, at least annually to ensure that the proper functioning of the oxygen generator and air compressor are not inhibited.

3.3 Vapor Treatment System

3.3.1 Liquid Ring Vacuum Pump B-301

B-301 will be inspected monthly for oil level and potential leakage. Inspection will include checking for oil in the scavenger tubing. If oil is present in the scavenger tubing, seals will be inspected and replaced as needed.

The back pressure on the separator element will also be checked. The separator element shall be replaced if the back pressure exceeds 4 psig. The discharge pipe shall be checked for blockage. The inlet filter (if installed) shall be cleaned or replaced. Any noted debris will be removed from the pump housing and motor fan guard. Any greased bearings shall be re-greased as needed.

After 500 hours of operation, the inlet filter (if installed) will be checked, the strainers will be cleaned, and the temporary inlet screen removed. The inlet filter will be cleaned or replaced if needed.

Annually, the seal fluid will be replaced and couplings will be checked for wear and replaced as needed. Gear-end oil will be drained and replaced if the gear-end oil level is low.

3.3.2 Heat Exchanger HEX-302

The heat exchanger will be inspected monthly for damage. Any debris present will be removed.

3.3.3 Temporary Catalytic Oxidizer TO-400

The Catalytic Oxidizer is inspected weekly until treatment is transitioned to GAC treatment based on sampling results. TO-400 will be inspected weekly for damage to any parts. The temperature will be measured weekly to check that proper temperature increase is maintained. If a temperature drop is noted, the catalytic oxidizer shall be inspected for accumulated carbon and organic matter. Any accumulated matter shall be removed through burn-out or air lancing.

The catalytic oxidizer will be operated pursuant to the vendor operating instructions (to be provided by the construction contractor and included in Appendix E) and consistent with the substantial requirements of a PSCAA permit including meeting control efficiency and operating requirements. Appendix B includes PSCAA operation and monitoring requirements for the catalytic oxidizer.

3.3.4 Vapor GAC Vessels GAC-400/401

Vapor GAC vessel maintenance includes monthly inspection of the physical condition of the vessels for damage or corrosion and removal of accumulated water. Any corrosion or damage will be repaired as needed.

The Vapor GAC vessels will also be monitored for breakthrough of the media in accordance with PSCAA requirements (Appendix B). The Vapor GAC media is monitored for breakthrough by analyzing vapor samples collected using a handheld instrument [e.g., photoionization detector (PID)] at the inlet to the lead vapor GAC vessel, at the inlet of the second vapor GAC vessel (mid-point of the treatment system), and at the outlet of the second GAC vessel, as discussed in Section 5. The system will be shut down and the lead GAC vessels' media changed out with unspent carbon when the volatile organic carbon (VOC) concentration at the mid-point of the treatment system reaches any limits established in substantial requirements of the PSCAA permit. As shown in Appendix B, breakthrough is defined as the detection at the outlet from the lead GAC vessel of the higher of the following:

- 10% of the inlet stream concentration to the lead vessel (90% or less control efficiency)
- 10 ppmv, measured as hexane or its equivalent

Monitoring for breakthrough of the media will occur monthly during the first two quarters of operation, and then, depending on actual changeout frequency during operation, transition to quarterly during Phase 2 and through the first year of Phase 3, and then semiannually.

3.4 System Control

3.4.1 Control Panel and Programmable Logic Controller (PLC)

The control panel is checked monthly for proper operation and system status. Individual light bulbs and fuses are replaced as needed. These parts will be accessed by opening the front door of the control panel. Electrical power must be disconnected before any repairs are made inside the control panel. Lock out/tag out procedures, as outlined in the standard operating guidelines (SOGs) in Appendix G, will be followed as appropriate. Any other repairs will be completed by a qualified electrical contractor.

3.4.2 Alarms

Alarms shall be tested semiannually to confirm proper functionality. If alarms are not functioning properly, they shall be replaced.

3.4.3 Meters, Gauges, and Valves

Flow meters shall be inspected monthly for damage, corrosion, or water accumulation. Flow meters shall be inspected annually while the system is not operational to verify zero calibration.

Temperature and pressure gauges shall be inspected monthly for damage, corrosion, or improper functioning. Malfunctioning gauges shall be replaced, as necessary.

Inspect valves monthly for corrosion, silt buildup, and damage. Exercise the valves monthly through the full range of motion to verify proper functioning.

Meters, gauges, and valves shall also be inspected monthly and maintained in accordance with manufacturer recommendations.

3.4.4 Treatment Shed

The treatment shed will be checked during each site visit or at least monthly for evidence of external or internal damage, leaks, loss of weatherproofing or insulation, loss of soundproofing (see details in Section 5), and any other change in condition detrimental to system operation. Changes to the condition will be noted and appropriate corrective actions will be performed.

3.5 Spare Parts

Extra plugs, sample ports, bolts, and gauges will be kept on-site in the Treatment Shed in case of damage or loss of existing parts to the system components. The spare parts that should be kept in stock at all times, as space allows, include:

- Bag filters
- Fittings, such as PVC elbows, T's, and unions
- Manual valves
- Flow meters

3.6 Troubleshooting

Troubleshooting procedures will vary depending on the circumstances and are summarized in Table 5 which will be updated as needed during system operation.

3.7 Waste Management

Waste generated by the operation of the MPE system includes condensate and spent carbon.

Condensate from the Vapor Liquid Separator T-300 is pumped into drums for characterization and disposal at an approved facility. Condensate is expected to be characterized as non-hazardous waste.

Spent granular activated carbon generated during operation of the MPE system will be removed using a vacuum extraction device and placed in DOT-approved 55-gallon drums or supersacks, characterized, sealed and hauled from the site under a waste manifest. The carbon will be analyzed using the Toxicity Characteristic Leaching Procedure (TCLP) and disposed of at an approved facility. The carbon will be analyzed annually to update the disposal profile.

Upon waste profile determination, the condensate and carbon will be transported to a treatment, storage and disposal (TSD) facility approved as a Hazardous Waste Management Vendor or Non-Hazardous Waste Management Vendor. A maximum of one drum or supersack is allowed to be kept on site at a time if space allows for storage of the drum or supersack in a safe location. Containers for both media will be identified with an appropriate waste classification label placed on each container indicating the generators name, site address, contact number, general waste description, and generation date.

Section 4: System Operation

The MPE and groundwater recirculation system operation includes both startup and long-term operation. The startup phase includes operation and well performance testing.

4.1 Well Performance Testing

Performance testing of the EIWs will be conducted upon startup of continuous MPE system operation. Performance testing will be completed by the construction contractor. The objective of the performance testing is to determine the vacuum/flow relationship for each well screen. The well performance testing may use the GAC treatment in lieu of the catalytic oxidizer if necessary. Performing testing consists of the following activities:

1. Install a DS-300 pitot tube and differential pressure gauge at the location noted on the P&ID Drawing I-02 for startup testing. (Refer to Note 3 on P&ID Drawing I-02).

2. Add water to the vapor/liquid separator (T-300) until the level is visible in the level glass. Measure the liquid level and record the result.

3. Open the dilution air inlet to 100 percent.

4. Close all screens at the piping manifolds, except the first screen to be tested.

5. Start the blower at the lowest manufacturer-recommended speed.

6. Monitor the vacuum and vapor flow rate at the manifold leg for the active well screen and allow it to operate for a minimum of 10 minutes.

7. Measure the liquid level every 5 minutes in T-300, recording the elapsed test time for each measurement.

8. After each 10-minute interval, increase the extraction rate by closing the dilution valve and/or increasing the blower variable frequency drive (VFD) speed up to a maximum vacuum of 22 inches of mercury (in. Hg) measured at the inlet to the blower.

9. Continue to record time, flow, vacuum, and T-300 liquid levels through a minimum of 3 flow increments until the maximum vacuum of 22 in. Hg is reached.

10. Open the dilution air back to 100% and repeat for each well to be tested.

11. At the conclusion of the startup testing, remove the DS-300 pitot tube and differential pressure gauge from the location noted on the P&ID drawing I-02 for startup testing.

4.2 Continuous Operation

After completion of the startup testing, continuous operation will begin. It is planned that the system will operate in three phases over the life of the system:

1. **Phase 1 – Multiphase extraction**. The EIWs will be operated to extract groundwater and soil vapor from the subsurface for treatment. Extraction will occur from all wells and all sub-slab depressurization locations. Vapors will be treated with the catalytic oxidizer until extraction vapor concentrations are reduced to 500 ppm; when this concentration is reached, the catalytic oxidizer will be removed and GAC will be employed. The use of the catalytic oxidizer is estimated to last from 1 to 3 months. GAC will be employed until groundwater concentrations stabilize and approach asymptotic levels, approximately 6 to 12 months, after which Phase 2 will commence.

2. **Phase 2 – Surfactant reinjection**. When groundwater concentrations stabilize and approach asymptotic levels, the system will begin reinjection with surfactant addition. Surfactants in the reinjected water will act to liberate hydrocarbons adsorbed to soils. Reinjection will occur until the liquid phase concentrations have dropped to a level indicative of asymptotic performance of the surfactant reinjection. Phase 2 duration is estimated to be 6 months.

3. **Phase 3 – Enhanced bioremediation.** Once Phase 2 is complete the surfactant reinjection will be replaced with oxygen/nutrient addition to the reinjected water. Operation will be rotated between the four sets of wells monthly to quarterly based on the monitoring results. Enhanced bioremediation will be conducted until the site constituents of concern have been reduced significantly in the wells or site cleanup levels have been reached. Phase 3 duration is estimated to last for 24 to 48 months.

Flow rates for active EIWs will be adjusted as needed throughout MPE system operation. The estimated operational durations described above are anticipated to change and will be modified as necessary to accommodate reinjection of treated groundwater and the use of GAC vessels for treatment.

At the conclusion of active remediation system operation, the site will transition to a period of monitored natural attenuation and confirmation monitoring. Compliance monitoring activities, including performance monitoring during system operation and confirmation monitoring to demonstrate attainment of site cleanup levels, are described in the Compliance Monitoring Plan (CMP) and in the Sampling and Analysis Plan / Quality Assurance Project Plan (SAP/QAPP) included in Appendix H.

4.2.1 Phase 1 – Multiphase Extraction

The MPE system will commence operation, removing 1 to 3 pore volumes of impacted groundwater from the site until asymptotic concentrations are reached in the extracted groundwater. Pore volume information will be provided by Kennedy Jenks. The total volume extracted will be calculated by summing the volume on the flow totalizer for each well since startup. Extracted groundwater will be treated with GAC and discharged to the City sanitary sewer system that drains to the Publicly Owner Treatment Works (POTW) operated by King

County. Soil from the surface to the depth of the exposed saturated zone will be remedied by the extraction of vapor from the unsaturated soils. The vapor will be treated with a catalytic oxidizer.

Multiphase extraction operation consists of the following tasks:

1. Open the dilution air inlet to 100 percent.
2. Set all wells to extraction mode.
3. Start the blower at low speed.
4. Balance the extraction rates for each well screen in each Well Group by closing the dilution valve, increasing the blower VFD speed, and adjusting the individual valves at the piping manifolds and well heads.
5. Extraction will be applied to all wells with the limitation that the number of wells and applied vacuum will be limited to maintain groundwater extraction rates within the limits of the groundwater treatment system from 1 to 3 gpm.
6. Operation will continue until 1 to 3 pore volumes are removed from the area of impacted groundwater or groundwater concentrations stabilize.
7. Recovered groundwater will be treated and discharged to the City sanitary sewer with no reinjection during initial MPE operation.

4.2.2 Phase 2 – Surfactant Reinjection

Extraction will be performed from one of the four sets of EIWs while reinjection of treated water amended with surfactant will occur in two sets of wells. A fourth set of wells will be allowed to rest. Operation will be cycled between the four sets of wells monthly until liquid phase concentrations have dropped to a level indicative of asymptotic performance of the surfactant reinjection. At that point surfactant injection will be discontinued and Phase 3 will begin.

Surfactant reinjection will employ injection in two (2) out of four (4) well groups while extracting from one (1) well group. The fourth well group will be allowed to rest idle. See Section 4.3 for details on the injection and extraction schedule and well group cycling.

Surfactants will be added to the 300-gal mixing tank biweekly (every two weeks) by the operator. Surfactants are added to the 300-gal mixing tank, dissolved by the extracted/treated groundwater, and reinjected. Extracted/treated groundwater is added to the 300-gal mixing tank and reinjected with no amendments until the next round of amendments is added.

Surfactant Reinjection operation consists of the following tasks:

1. Open the dilution air inlet to 100 percent.

2. At start of reinjection, set Well Group 1 to extraction and Well Groups 2 and 4 to injection mode at the PLC. Group 3 will be idle initially; close individual valves at the piping manifolds and well heads for Well Group 3 so extraction/injection does not occur.

3. Start the blower at low speed.

4. Balance the injection rates for each well screen in Well Groups 2 and 4 by adjusting the individual valves at the piping manifolds. Well head valves should be completely open so balancing adjustments can be made inside the remediation shed. Balance the extraction rates for each well screen in Group 1 by closing the dilution valve, increasing the blower VFD speed, and adjusting the individual valves at the piping manifolds and well heads.

5. Injection will be applied to the two active Well Groups (Groups 2 and 4 to start) with the limitation that the number of wells and applied pressure will be limited to maintain groundwater injections rates of 1 to 3 gpm.

6. Extraction will be applied to the active Well Group (Group 1 to start) wells with the limitation that the number of wells and applied vacuum will be limited to maintain groundwater extraction rates within the limits of the groundwater treatment system from 1 to 3 gpm.

7. Extracted water will be treated via the liquid GAC system and transferred to storage tank T-400. From Tank T-400, liquids will be transferred to mixing tank T-500 to prepare the next batch of surfactant for injection.

8. If injection rates are not fast enough to keep up with extraction rates, some of the treated extracted water may be discharged directly to the City sanitary sewer based on a timer controlled on the PLC.

9. Allow mixing tank (T-400) to complete one cycle of injections with recovered groundwater only before adding liquid surfactants. Manually start the tank mixer and add surfactants into the top of the tank. Continue mixing until all dry amendments are dissolved (typically 30 minutes) before turning off the mixer.

4.2.3 Phase 3 – Enhanced Bioremediation

Once liquid phase concentrations have dropped to a level indicative of asymptotic performance of the surfactant reinjection, the surfactant injection will be discontinued, and replaced with oxygen/nutrient addition to the reinjected water. Operation will be rotated between the four well groups monthly to quarterly based on the monitoring results. Operating methods are otherwise the same as for Phase 2, with the replacement of surfactant with the amendments. It is expected that the operator will need to add amendments to the batch tank approximately biweekly (every two weeks).

4.3 Injection and Extraction Schedule

The 13 EIWs have been plumbed into four groups of wells: Group 1, Group 2, Group 3, and Group 4 (see Table 1). During surfactant reinjection and enhanced bioremediation, two (2) well groups shall be operated in injection mode while one (1) well group is simultaneously operated in extraction mode and the fourth group is idle. Well group modes are selectable on the PLC panel. If injection rates are not fast enough to keep up with extraction rates, some of the treated extracted water may be discharged directly to the City sanitary sewer.

The well groups set to extraction and injection modes will be changed periodically during system operation. Initially, Well Group 1 shall be set to extraction mode and Well Groups 2 and 4 will be set to injection mode at the PLC. Group 3 will be idle during the first month. To reduce the amount of electron acceptors and nutrients extracted from the groundwater and discharged to the City sanitary sewer, the Extraction Group will always be scheduled to follow the previous month's idle group. The operating schedule is as follows:

Month 1: Group 1 Extraction, Group 2 Injection, Group 3 Idle, and Group 4 Injection

Month 2: Group 1 Injection, Group 2 Idle, Group 3 Extraction, Group 4 Injection

Month 3: Group 1 Injection, Group 2 Extraction, Group 3 Injection, Group 4 Idle

Month 4: Group 1 Idle, Group 2 Injection, Group 3 Injection, Group 4 Extraction

The well groups used for injection and extraction are changed every month for the first 6 months of Phase 2 or Phase 3. After 6 months in the current phase, the total volumes injected into each area will be reviewed and the injection times increased for critical areas. Likewise, if monitoring the discharge to the City sanitary sewer reveals excessive nitrate (greater than 10 milligrams per liter (mg/L)) or orthophosphate (greater than 5 mg/L), the Idle Group timing should be increased. This increase in Idle Group time will give microbes more time to consume the amendments before the wells begin extraction again. This will reduce wasting treatment amendments that would otherwise be discharged to the City sanitary sewer.

4.4 Well Performance Refinement

Flow adjustments can be made to individual wells within each group if the pressures exceed those of the other wells within the group by more than 20 percent. This is necessary to reduce the potential for injected groundwater and amendments to short circuit to the surface or follow preferential flow paths to other areas of the site. Likewise, a well that is less than 50 percent below the average pressure should be investigated for an injection line break or the material being injected into utility backfill material.

If an individual well has pressures exceeding those of the other wells in the group by more than 20 percent, the flow into this well should be decreased. If an individual well has pressures less than those of the other wells in the group by more than 20 percent, the flow into this well can be increased to reduce the amount of water discharged to the sanitary sewer.

If concentrations of VOCs or GRO/BTEX are consistently noted to be higher in specific wells or during extraction from a specific well group, amended groundwater injection should be increased for these wells (or well group) to further enhance the biodegradation and removal of petroleum hydrocarbons.

4.5 Shutdown and Startup Procedures

Mid-operation shutdown and startup procedures, such as shutdown for media replacement, emergency stops and restarts, are graphically outlined in Appendix I. Some equipment must be shut down according to manufacturer's instructions before maintenance is performed. If the system is shutdown, the operator shall restart the system following the original start up procedures, then proceed with the current phase of operation prior to shutdown. The system will be shut down as part of maintenance activities outlined in Table 3, including oil changes for the liquid ring pump, bag filter replacement, tank cleanouts, and other activities where the manufacturer’s instructions call for system shutdown prior to maintenance.

Section 5: Monitoring and Reporting

System performance data will be collected from the three points of compliance (soil, water and air) where cleanup levels established for the site must be achieved. Sample data sheets for these monitoring points of compliance are included in Appendix F or an electronic equivalent. These sample data sheets are living documents that are updated as needed.

A monitoring schedule was generated describing the process for data collection and monitoring of the MPE and groundwater recirculation system and is included as Table 6.

The operator is responsible for performing operation, maintenance and monitoring of the remediation system as described in the EDR, CMP, and SAP/QAPP. The operator is anticipated to conduct the following compliance monitoring sampling activities during remediation system operation and following shutdown:

- Collection of treatment train water samples from the treatment system for laboratory analysis.
- Collection of influent, mid-point, and/or effluent vapor samples from the treatment system and from individual extraction wells for field and laboratory analysis.
- Collection of vapor samples from SSD wells and vapor monitoring pins for field analysis.
- Collection of groundwater samples from monitoring wells for performance monitoring (at startup, and then at varying frequencies including monthly, quarterly, and/or semiannually, depending on system operating phase, well location, and required laboratory analyses) and confirmation monitoring (quarterly until results from four consecutive quarters are below Site cleanup levels).
- Collection of confirmation soil samples to demonstrate Site cleanup levels have been achieved in soil.
- Collection of soil and/or water samples for waste disposal characterization.

Additional details on operator's responsibilities for monitoring are included in the CMP and SAP/QAPP included in Appendix H.

Monitoring locations, methods, frequency, data management, and reporting are described in the following subsections.

5.1 Measurement Parameters

Parameters monitored during operation of the MPE system and following shutdown include the following:

- Vacuum/Pressure
- Airflow

- Groundwater flow
- Noise level
- Temperature
- VOC Concentrations
- Oxygen, Carbon dioxide and combustible gas
- GRO/BTEX/Selected Chlorinated VOCs (Selected CVOCs)/Fats, Oils, and Grease (FOG) Concentrations
- Nitrate and Orthophosphate Concentrations
- pH and Turbidity

Table 6 is a summary of the monitoring schedule and includes the frequency of collection of each measurement parameter.

5.1.1 Vacuum/Pressure

When vacuum measurements at wells or the treatment system are measured, the local barometric pressure is also recorded.

Individual Wells

Vacuum is measured for individual wells, including the SSD wells, in operation using a hand-held manometer at the corresponding manifold legs during extraction. Vacuum is also measured at each of the vapor pins. Vacuum can be measured with any of the following handheld instruments (or similar):

- Dwyer 477AV-3 Digital Manometer:
  - Pressure differential sensor with ± 0.5% accuracy
  - Display of negative, positive, and differential pressure

- Dwyer Magnehelic vacuum gauges (various ranges and models):
  - Accuracy of ± 2%

Groundwater injection pressure is measured for each well at Manifold C via pressure indicators installed for each well. Injection flow and injection pressures will be monitored during system operation to detect well plugging or fouling. Groundwater injection pressure is only measured during Phases 2 and 3.

Treatment System

Vacuum or pressure gauges are located at the following points along the treatment train:

- After the well manifold (PI-200)
- Before vapor/liquid separator (PI-210)
- After vapor/liquid separator, before vacuum relief valve (PI-300)
- At heat exchanger (PIT-302)
- After heat exchanger (PI-301)
- Before storage tank T-301 (PI-310)
- Before bag filter (PI-400)
- After bag filter (PI-401)

- Before and after liquid GAC vessels (PI-402 through PI-407)
- Before vapor GAC vessels (PI-410, PI-411, PI-412)
- Before mixing tank T-500 (PI-408)
- Before oxygen injection (PI-500)

5.1.2 Airflow

Individual Wells

Airflow can be measured for individual wells, including the SSD wells, in operation at the corresponding manifold legs. Due to the multi-phase nature of the extraction system, a small vapor-liquid separator system will need to be employed at each well leg to separator the liquid from the air. Airflow can then be measured using any of the following instruments (or similar):

- Dwyer 471B Thermo-Anemometer:
  - ± 1.6 feet per minute accuracy
  - Air velocity range of 45-6,000 feet per minute

- TSI TA430 Airflow Velocity Meter:
  - ± 3 feet per minute accuracy
  - Air velocity range of 0 to 6,000 feet per minute

Treatment System

A flow indicator and transmitter (FE/FIT 302) is located after the heat exchanger. Airflow can be measured at the sampling ports before, after, and between the vapor GAC vessels, but this flow should be equivalent to the flow at FE/FIT 302 since there is no significant airflow losses along the treatment train.

5.1.3 Groundwater Flow

Individual Wells

Groundwater injection flow rate is measured for each well at Manifold C via flow indicators installed for each well. Injection flow and injection pressures will be monitored during system operation to detect well plugging or fouling. Groundwater injection flow rate is only measured during Phases 2 and 3.

Treatment System

A flow indicator is installed at the following locations to measure flow through the treatment system:

- After the bag filter (FI 400)
- After the liquid GAC vessels (FI 404, FI 407)
- Before discharge to the sanitary sewer (FI 500)
- Before transfer to mixing tank T-500 (FI 401)

5.1.4 Noise Level

The noise emitted by the system will be measured quarterly to confirm compliance with the City of Seattle's noise ordinance (limit of 60 dBA Leq). Noise level shall be measured outside of the treatment shed using a hand-held dBA noise level meter. If the noise level of the system is noted to be above the limit, Kennedy Jenks personnel will be notified, the source of the excessive noise will be determined, and noise reducing measures will be implemented until the noise level of the system is within the limit.

5.1.5 Temperature

A temperature indicator is located at the heat exchanger (TIT-302) and the temporary catalytic oxidizer (TIT-400). The temperature of the heat exchanger and catalytic oxidizer will be recorded during monitoring events. The ambient temperature will be measured and recorded during each monitoring event.

5.1.6 VOC Concentrations

Total VOC concentrations are measured for individual wells and the treatment system using both field methods and laboratory analysis. Total VOC concentrations are measured in the field using a PID.

5.1.6.1 VOC Concentrations - Field

Individual Wells:

Total VOC concentrations are measured for individual wells in operation using a PID at the corresponding manifold legs. Sample collection will be performed as indicated in the SAP/QAPP. VOC concentrations can be measured using any of the following instruments (or similar):

- MiniRAE 2000 or 3000, Photoionization detector
- RAE Model 8000, Photoionization detector

VOC concentrations will also be measured at each of the vapor pins and the SSD wells. VOC concentrations will be measured with low-detection PIDs (ppbRAE 3000 or equal) and Four Gas Analyzers (RKI Eagle 2 or equal). In the event that total VOC concentrations measured at the SSD or vapor pins exceed 425 ppb and/or if combustible gas is measured above 20% lower explosive limit (LEL), then vapor samples will be collected for laboratory analysis using standard soil gas sample collection procedures in Summa canisters analyzed for appropriate EPA methods for fixed gases (ASTM D1945) and hydrocarbon species.

Treatment System

Total VOC concentrations are measured at several sampling ports located throughout the treatment train using a PID or an engineer-approved substitute. Sampling ports are located as follows:

- Prior to the catalytic oxidizer (when installed)
- Prior to, at the midpoint of, and after vapor GAC vessels
- Prior to air discharge

The above sampling locations are subject to change after the final substantial requirements set by PSCAA are received.

5.1.6.2 VOC Concentrations - Laboratory

Samples of vapor for laboratory analysis are collected using Summa canisters and submitted for analysis by Environmental Protection Agency (EPA) Method TO-15.

Individual Wells

Samples are collected at the manifold legs corresponding to individual wells in operation for analysis of VOC concentrations at each well.

Treatment System

Samples are collected at the combined inflow sample port after the vapor/liquid separator, and at the combined effluent sample port prior to air discharge. The sample ports are shown on the construction drawings (Appendix D).

5.1.7 GRO/BTEX/Selected CVOCs/FOG Concentrations - Laboratory

Treatment System

Samples are collected at the following locations:

- Influent to the liquid GAC vessel trains
- Midpoint of each train
- Effluent of each train
- Point of discharge to the sanitary sewer (Phase 3 only)

The samples will be analyzed for GRO, BTEX, Selected CVOCs (tetrachloroethylene, trichloroethylene, cis-1,2-dichloroethylene, trans-1,2-dichloroethylene, vinyl chloride), and FOG.

If effluent limits established by the discharge permit are exceeded, additional water treatment system samples will be collected from sampling ports or holding tanks. These samples will be analyzed for GRO, BTEX, Selected CVOCs, FOG, and nitrate and total orthophosphate.

5.1.8 Nitrate and Orthophosphate – Laboratory

Samples for laboratory analysis will be collected at the point of discharge to the sanitary sewer during Phase 3 of operations. The samples will be analyzed for nitrate as nitrogen and total orthophosphate. As noted in Section 4, if the sample results reveal excessive nitrate (greater than 10 mg/L as Nitrogen) or excessive orthophosphate (greater than 5 mg/L), the well group timing shall be adjusted.

5.1.9 pH and Turbidity

pH and turbidity will be measured during any water sampling event (both treatment train and point of discharge to sanitary sewer samples) using a calibrated field meter.

5.2 Additional Monitoring

Individual Wells

Samples will be collected at the wellhead of individual wells (as identified in the SAP/QAPP, Appendix H) for analysis of GRO, BTEX, and monitored natural attenuation parameters. See details in the SAP/QAPP regarding sampling frequency, monitoring well locations, and sampling methodology.

Soil Borings

Confirmation soil samples will be collected after remedial system operation has ended. Up to eight (8) soil boring will be advanced to approximately twenty (20) feet below ground surface. See details in the SAP/QAPP regarding soil boring locations and sampling methodology.

5.3 Data Handling, Evaluation, and Reporting

Data is collected on paper field forms, or equivalent electronic field forms, and transcribed into spreadsheets for analysis. Laboratory data and associated field parameter data is obtained in electronic format and stored in a database. Draft monitoring form templates are included in Appendix F.

To meet the objectives of the performance monitoring program the data will be used as described in the following sections to:

- Comply with applicable permits.
- Optimize mass removal.
- Document progress toward asymptotic removal.

The operator will communicate with Kennedy Jenks and Ecology prior to site visits and coordinate if specific equipment should be inspected or if specific maintenance activities have been identified that need to be performed.

5.3.1 Inspection and Maintenance Documentation

Field forms will be completed and submitted for the system component inspection and maintenance activities identified in Section 3 and Table 3. The operator will submit electronic copies of these field forms to Ecology by the following Monday during system monitoring and inspection activities. Field forms will also be submitted by the following Monday for site visits for the Phase 2 surfactant addition and mixing and Phase 2 nutrients/bacteria amendment addition activities. The operator will submit to Ecology documentation of minor repairs conducted as part of the inspection and maintenance activities (if any).

The operator will provide documentation demonstrating removal of the catalytic oxidizer and connection of the vapor GAC vessels on the air treatment train, once completed. Documentation for this event includes:

- Documentation indicating that requirements are suitable for removal of the catalytic oxidizer. This documentation will be provided to Ecology a minimum of two (2) weeks prior to operator performing the removal.

- Documentation of removal of catalytic oxidizer and connection of vapor GAC vessels will be provided to Ecology a maximum of four (4) weeks after completion.

Any other major repairs will be documented via a written progress report and photographs, provided to Ecology within two (2) weeks of completion.

Further details on reporting requirements are included in the SAP/QAPP.

5.3.2 Reporting

The operator will provide Ecology with monthly updates on the project schedule, budget, scope of work, and deliverables. This will include preparation of a brief monthly progress update and attendance of routine progress update calls (approximately 30-minutes in duration).

The operator will also provide Ecology with Remedial Progress Evaluation reports, on a monthly, quarterly, and/or annual basis, as identified in the SAP/QAPP. Additional details on the update and report requirements are included in Section 8 of the SAP/QAPP.

5.3.3 Permit Compliance

The efficacy of the vapor treatment system will be confirmed via sampling and analysis of the influent and effluent vapor streams, in accordance with requirements from the PSCAA (see Section 1.2 and Appendix B). The vapor GAC vessels will also be monitored for breakthrough of the media by analyzing with a handheld PID vapor samples collected at the inlet to the lead vapor GAC vessel, mid-point of the two vapor GAC vessels, and at the outlet of the second GAC vessel. Additional details on compliance monitoring will be provided once PSCAA provides final comments on substantial requirements to be met for operation of the MPE system.

The efficacy of the liquid treatment system will be confirmed via sampling and analysis of the influent and effluent liquid streams, in accordance with the recommendations of the discharge permit for the City sanitary sewer. Additional details on compliance monitoring will be provided once a KCIW WDA has been issued for the site.

If parameters exceed one of the limits listed in Section 1.2.1 or Section 1.2.2, the system is adjusted, or the GAC is replaced to return the system to compliant operation.

5.3.4 Document Asymptotic Removal

System operation will be documented through reports provided to Ecology and Kennedy Jenks by the operator. The responsibilities, content, and frequency for data reporting and remedial

progress reporting to Ecology during operation and maintenance of the MPE system and compliance monitoring will be as provided in Section 8.4 of the SAP/QAPP.

During system operation, progress towards the objective of asymptotic removal of VOCs from the site will be visualized using time-series graphs prepared by Kennedy Jenks of the calculated mass removal rate and cumulative mass removed. The mass removal rate will generally decline over time, with fluctuations, as changes are made to the MPE system operation. As the mass removal rate decreases, the cumulative mass removed graph will gradually approach a horizontal line, which is indicative of asymptotic removal when additional operation yields little change in the mass removed.

References

Kennedy Jenks. 2017a. Remedial Investigation/Feasibility Study Report, Former Circle K Site. 14 December 2017.

Kennedy Jenks. 2017b. Cleanup Action Plan, Former Circle K Site. 18 December 2017.

Kennedy Jenks. 2017c. Pilot Study Work Plan, Former Circle K Site. 1 February 2017.

Kennedy Jenks. 2021. Technical Memorandum Re: Existing Project Data Review and Design Data Gap Analysis, Contract C2100069. 16 June 2021.

Kennedy Jenks. 2021. Engineering Design Report: Former Circle K Site 1461, Seattle, Washington. Prepared for Department of Ecology, State of Washington. 10 December 2021.

Tables

Table 1: Multi-Phase Extraction System Well Details

	Well Group #	Screened Interval (ft bgs)	Sand Interval (ft bgs)	Applied Vacuum (in.w.c.)	Casing Diameter (in)	Pipe Diameter (in)	Pipe Run[(a)] (ft)
Existing Monitoring/Remediation Wells							
MW-4	1	4-18.8	5-22	28	2	1	160
RW-2	4	5-20	5-22	28	4	1	110
RW-3	1	5-20	5-22	28	4	1	100
RW-4	2	5-20	5-22	28	4	1	90
RW-5	3	5-20	5-22	28	4	1	70
RW-6	1	5-20	5-22	28	4	1	130
RW-7	4	5-20	5-22	28	4	1	70
New Remediation Wells							
SW-1	2	5-17	5-19	28	4	1	110
SW-2	3	5-17	5-19	28	4	1	80
SW-3	4	5-17	5-19	28	4	1	80
RW-8	2	5-20	5-22	28	4	1	100
RW-9	1	5-20	5-22	28	4	1	50
RW-10	3	23-28	5-22	28	4	1	80

Note and Abbreviations:

(a) Pipe run approximated from Construction Drawings. Pipe run lengths will be updated after system installation is complete.

ft bgs = feet below ground surface.
in.w.c. = vacuum or pressure in inches water column.
in = inches

Table 2: Alarms and Responses

Alarm or Indicator	Cause	System Response	Alarm Type	Operator Response
High water level (LAH-300, LAH-301, LAH-400, LAH-500)	High water level in VLS/storage/mixing tank	Turn on transfer pump to pump out tank (P-300/301/400/500)	PLC Indicator	None required.
High/high water level (LAHH-300, LAHH-301, LAHH-400, LAHH-500)	Excessive accumulated water in VLS/storage/mixing tank	Generate alarm and notify operators. Shut down system.	System alerts designated contact person via remote telemetry	Pump out tank. Inspect associated pump for functionality. Restart system.
Low water level (LAL-300, LAL-301, LAL-400, LAL-500)	Low water level in VLS/storage/mixing tank	Turn off transfer pumps to allow tank to fill (P-300/301/400/500)	PLC Indicator	None required.
Bag Filter High Pressure Alarm (PIT-400, PIT-401)	High pressure before (PIT-400) or after (PIT-401) bag filter	Generate alarm and notify operators.	System alerts designated contact person via remote telemetry	Replace bag filter. Restart system.
Liquid Ring Vacuum Pump Inlet Low or High Pressure Alarm (PAL-300)	Vacuum 2 in Hg above or below normal operating pressures on blower inlet piping	Generate alarm and notify operators.	System alerts designated contact person via remote telemetry	Inspect VLS to determine and conduct necessary repairs. Restart system.
Liquid Ring Vacuum Pump Inlet High-High Pressure Alarm (PAL-300)	Excessive vacuum (4 in Hg above normal operating pressures or 29 in Hg maximum) on blower inlet piping due to pluggage or valve closure in VLS	Generate alarm and notify operators. Shut down system.	System alerts designated contact person via remote telemetry	Inspect VLS to determine and conduct necessary repairs. Verify well valves are not blocked or accidentally closed. Restart system.
Heat Exchanger Outlet Low Pressure Alarm (PAL-302)	Excessive vacuum on heat exchanger outlet piping due to issues within heat exchanger or liquid ring pump	Generate alarm and notify operators. Shut down system (if pressure at 100 inches water column).	System alerts designated contact person via remote telemetry	Inspect liquid ring vacuum pump and heat exchanger to determine issue and conduct necessary repairs. Reduce blower vacuum loading as needed. Restart system.
Heat Exchanger Outlet Low Flow Alarm (FAL-302)	Low flow at heat exchanger outlet piping due to issues within heat exchanger or liquid ring pump.	Generate alarm and notify operators.	System alerts designated contact person via remote telemetry	Inspect liquid ring vacuum pump and heat exchanger to determine issue and conduct necessary repairs. Reduce blower vacuum loading as needed. Restart system.

Table 2: Alarms and Responses

Alarm or Indicator	Cause	System Response	Alarm Type	Operator Response
Liquid Ring Vacuum Pump Shutdown Alarm	Shutdown of Liquid Ring Pump	Generate alarm and notify operators. Shut down system.	System alerts designated contact person via remote telemetry	Inspect liquid ring vacuum pump to determine issue and conduct necessary repairs. Restart system.
Catalytic Oxidizer vendor-defined alarm conditions	Vendor-defined alarm conditions	Generate alarm and notify operators. Shut down system.	System alerts designated contact person via remote telemetry	Inspect oxidizer to determine issue. Check thermal oxidizer temperature. Restart system.
Catalytic Oxidizer Shutdown Alarm	Shutdown of catalytic oxidizer.	Generate alarm and notify operators. Shut down system.	System alerts designated contact person via remote telemetry	Inspect oxidizer to determine issue. Check thermal oxidizer temperature. Restart system.
Oxygen Generator vendor-defined alarm conditions	Vendor-defined alarm conditions	Generate alarm, shut down compressor and oxygen generator.	System alerts designated contact person via remote telemetry	Inspect oxygen generator to determine issue and conduct necessary repairs. Restart system.
Air Compressor High Pressure Alarm (PAH-500)	Excessive high pressure in air compressor	Generate alarm, shut down compressor and oxygen generator.	System alerts designated contact person via remote telemetry	Inspect air compressor to determine issue and conduct necessary repairs. Restart system.
Air Compressor Low Pressure Alarm (PAL-500)	Excessive low pressure in air compressor	Generate alarm, shut down compressor and oxygen generator.	System alerts designated contact person via remote telemetry	Inspect air compressor to determine issue and conduct necessary repairs. Restart system.
Emergency Stop (E-STOP) button manually engaged	Manual engagement of emergency stop button.	Shut down system.	System alerts designated contact person via remote telemetry	Determine why E-STOP activated and correct problem. Reset (pull out) E-STOP button. Restart system. Notify Ecology and Kennedy Jenks.

Table 3: Maintenance Schedule

Component	ID	Maintenance Task	Trigger/ Threshold	Frequency[(a)]	Maintenance Activities	Expected Results	Type of Work
General Conveyance and Monitoring Infrastructure							
EIWs and Well Vaults	MW-4; RW-2, 3, 4, 5, 6, 7, 8, 9, 10; SW-1, 2, 3	Inspect	See Frequency	Once per well when first actively used, and annually thereafter	Check for air leakage when system first operational. Inspect well vault for damage. Check wellhead cap is airtight.	Well vault is in good condition. Wellhead cap is airtight.	General Inspection
		Inspect	If other monitoring indicates abnormal system performance	As needed, at least annually	Inspect well vault for damage. Check wellhead cap is airtight. Inspect well for plugging/fouling.	Well vault is in good condition. Wellhead cap is airtight. Well does not indicate plugging/fouling.	Response to abnormal system performance
		Replacement of bolts and gaskets	If inspection indicates damage to well	As needed	Repair or replace well vault, well cap, or other components.	Well vault lids are secure and in-place.	Parts replacement
		Well surging	If well plugging/fouling is noted	As needed	Remove trash/debris. Physically surge well to eliminate plugging/fouling.	Well does not indicate plugging/fouling	System repair
Sub-Slab Depressurization Wells	SSD-1, 2, 3	Inspect	See Frequency	Once per well, prior to backfill	Check for air leakage before covering. If air leakage noted, repair or replace well prior to backfill.	Well does not indicate air leakage.	Prior to system completion
		Evaluate Functionality	If well is not operating properly for 3 consecutive months	As needed, at least annually	Evaluate repair or replacement options.	Decide the approach for the malfunctioning well.	System repair
Vapor Pins	VP-1, 2, 3, 4	Inspect	See Frequency	Monthly	Check that covers and valves are sound; that vapor pins are functional. Replace components as needed.	Vapor pins are in good working condition.	General Inspection
		Replacement of fasteners, valves, gaskets	If inspection indicates replacement is needed	As needed	Replace fasteners, valves, or gaskets.	Vapor pins are in good working condition.	Parts replacement
		Replace vapor pin	If vapor pin is not operating properly	As needed	Evaluate repair or replacement options.	Replace vapor pin.	System repair

Table 3: Maintenance Schedule

Component	ID	Maintenance Task	Trigger/ Threshold	Frequency[(a)]	Maintenance Activities	Expected Results	Type of Work
Extraction and Injection Manifold	Manifold A, B, and C	Inspect	See Frequency	Monthly	Check that piping connections are sound; valves in correct position. Check moisture levels in sumps. Inspect manifold for damage.	Manifold is in good working condition and allows for extraction and injection.	General Inspection
		Remove Trash and Debris	Manifold is damaged or plugged based on inspection.	As needed, at least annually	Remove trash/debris. Repair or replace any damaged portion of the manifold.	Trash/debris has been removed. Manifold has been repaired or replaced.	Trash and Debris
Piping	–	Inspect	See Frequency	Monthly	Inspect manifold piping for damage or plugging/fouling.	Piping is in good working condition and allows for extraction and injection.	General Inspection
		Inspect	See Frequency	Monthly	Inspect piping between equipment for leaks or accumulation of water at low spots in header lines. Inspect gas and electric lines for leaks and damage. Drain any accumulated water. Repair or replace piping/lines as needed.	Piping is in good working condition with no leaks or accumulated water.	General Inspection
		Check condensate accumulation in individual manifold legs	If other monitoring indicates abnormal system performance	As needed, at least quarterly	If condensate accumulation is present, pump out condensate through wye fitting.	Condensate has been removed from piping.	System repair
Gas and Electric Lines	–	Inspect	See Frequency	Monthly	Inspect gas and electric lines for leaks or damage.	Gas and electric lines are in good working condition with no leaks or damage.	General Inspection

Table 3: Maintenance Schedule

Component	ID	Maintenance Task	Trigger/ Threshold	Frequency[(a)]	Maintenance Activities	Expected Results	Type of Work
Water Treatment System							
Vapor Liquid Separator	T-300	Inspect	See Frequency	Monthly	Check for level and potential need for pumpout. If pumpout is needed, turn on pump P-300. Record differential pressure.	Vapor liquid separator is in good condition, no pumpout required.	General Inspection
		Inspect	When high-high level alarm is activated	When triggered	Check for level and potential need for pumpout. If pumpout is needed, turn on pump P-300. Record differential pressure. Inspect pump P-300 and tank level switches to determine why automatic pumpout did not occur.	Pump P-300 is turned on to lower water level in T-300 or extraction is stopped. Pump or level switch issue is fixed.	Alarm response
		Update inspection frequency	If high-high level alarm is activated routinely	When triggered	Update inspection frequency to weekly.	More frequent inspection. Identification and repair of any system issues.	Alarm response
		Clean mist eliminator	See Frequency	Semiannually	Clean mist eliminator.	Mist eliminator in good condition.	General Maintenance
		Test level switch	See Frequency	Annually	Open and inspect interior of vessel. Test level controls.	Vapor liquid separator and alarms are in good condition.	General Maintenance
Transfer Pumps	P-300/ 400/ 401/ 500	Inspect	See Frequency	Monthly	Inspect for damage.	Pump is in good working condition.	General Inspection
		Evaluate Functionality	When high-high level alarm for associated tank is activated	When triggered, at least annually	Evaluate functionality of pump and level switch to determine why pumpout did not occur. Repair or replace as needed.	Pump is operating properly in response to high-level indicator.	Alarm response
		Evaluate Functionality	If high-high level alarm for associated tank is activated routinely	When triggered, at least annually	Evaluate functionality of pump. Repair or replace as needed.	Pump is operating properly, high-high level alarm is no longer triggered routinely.	Alarm response
		Oil and Fluids	See Frequency	Monthly	Maintain oil and hydraulic fluids at necessary levels during operation.	Pumps function properly and have sufficient oil and hydraulic fluids.	General Maintenance

Table 3: Maintenance Schedule

Component	ID	Maintenance Task	Trigger/ Threshold	Frequency[(a)]	Maintenance Activities	Expected Results	Type of Work
Storage Tanks	T-301/ 400/ 500	Inspect	See Frequency	Monthly	Check for level and potential need for pumpout. If pumpout is needed, turn on transfer pump.	Tank is in good condition, no pumpout required.	General Inspection
		Inspect	See Frequency	Monthly	Check mixing tank for accumulated amendments. If amendments have accumulated, drain and clean tank.	Tank is in good condition, no pumpout required.	General Inspection
		Inspect	When high-high level alarm is activated	When triggered	Check for level and potential need for pumpout. If pumpout is needed, turn on transfer pump. Inspect pump and tank level switches to determine why automatic pumpout did not occur.	Pump is turned on to lower water level in tank. Pump or level switch issue is fixed.	Alarm response
		Update inspection frequency	If high-high level alarm is activated routinely	When triggered	Update inspection frequency to weekly.	More frequent inspection. Identification and repair of any system issues.	Alarm response
		Drain and Clean	See Frequency	Annually	Drain and clean tanks.	Tanks are in good working condition.	General Maintenance
Bag Filter	BF-400	Inspect	See Frequency	Monthly	Inspect filter and housing components. Record pressure differential across the filter.	Filter is in good working condition with minimal pressure drop across the filter.	General Inspection
		Replace bag filter	If pressure upstream of the bag filter increases by 10 psi compared to system startup or since last bag filter replacement.	As needed, at least semiannually	Replace bag filter. Record new upstream pressure	Filter is in good working condition. Pressure upstream of bag filter has been reduced.	System repair

Table 3: Maintenance Schedule

Component	ID	Maintenance Task	Trigger/ Threshold	Frequency[(a)]	Maintenance Activities	Expected Results	Type of Work
Liquid GAC Vessels	LG-400/ 401/ 402/ 403	Inspect	See Frequency	Monthly	Inspect for corrosion, damage, leakage indicating sediment accumulation. Check differential pressure across vessels. Inspect for evidence of channelling.	GAC vessels are in good working condition.	General Inspection
		Repair damage, remove corrosion	If inspection indicates corrosion or damage	As needed	Replace GAC vessel housing if corrosion and damage is extensive. Repair damage and remove corrosion if not extensive.	GAC vessels are in good working condition.	System repair
		Replace GAC vessel	If inspection indicates leakage, or differential pressure across the vessel increases 10 psi.	As needed	Replace GAC vessel.	GAC vessel has been replaced.	System repair
		Check for breakthrough of media	See Frequency	Monthly during first two quarters of operation, then quarterly until one year into Phase 3, then semiannually	Analyze influent and effluent of water treatment system for GRO/BTEX. Check for concentrations above permit limit or treatment efficiency drops to 90%.	If breakthrough of media is noted, switch GAC	Parts replacement
		Replace media	When breakthrough of media or channeling is noted.	As needed	Replace carbon in GAC vessel.	GAC vessel carbon is replaced.	Parts replacement
Oxygen Generator and Air Compressor	OG-500 and C-500	Inspect	See Frequency	Monthly	Inspect for proper cycling pressures. Check for damage	Oxygen generator in good working condition with proper cycling pressures.	General Inspection
		Clean out filter	See Frequency	Monthly	Clean out filter. Replace if needed.	Filter is in good working condition.	General Maintenance
		Lubricate hinges or other appurtenances	See Frequency	As needed, at least annually	Lubricate door hinges or other appurtenances periodically.	No rust or other damage is present on components that may inhibit proper functioning of oxygenator.	General Maintenance

Table 3: Maintenance Schedule

Component	ID	Maintenance Task	Trigger/ Threshold	Frequency[(a)]	Maintenance Activities	Expected Results	Type of Work
Vapor Treatment System							
Liquid Ring Vacuum Pump	B-301	Inspect	See Frequency	Monthly	Check oil level and for presence of oil in scavenger tubing. Check for potential leakage. Check back pressure on separator element. Check discharge pipe for blockage.	Oil level is sufficient. No oil in scavenger tubing. No leaks are identified. Back pressure is less than 4 psig. No blockages in discharge pipe.	General Inspection
		Maintenance	See Frequency	Monthly	Clean or replace inlet filter. Remove debris from pump housing and motor fan guard. Re-grease bearings using manufacturer approved grease.	Inlet filter clean. Debris removed. Bearings re-greased.	General Maintenance
		Check Inlet Filter	See Frequency	After 500 hours of operation	Clean or replace inlet filter if needed. Remove temporary inlet screen.	Inlet filter is clean.	General Maintenance
		Clean Strainers	See Frequency	After 500 hours of operation	Clean or replace strainers.	Strainers are clean.	General Maintenance
		Replace Seal Fluid	See Frequency	Annually	Replace seal fluid.	Seal fluid replaced.	General Maintenance
		Check couplings wearing surfaces	See Frequency	Annually	Check couplings and wearing surfaces for wear. Replace as needed.	Couplings and wearing surfaces in good condition.	General Maintenance
		Oil	If oil level is low	As needed, at least per manufacturer's recommendations	Replace gear-end oil if level is low.	Gear-end oil level sufficient.	Parts replacement
		Inspect Seals	If oil is present in scavenger tubing	As needed, at least per manufacturer's recommendations	Check seals. Replace seals if needed.	Seals inspected and replaced.	Parts replacement
		Replace Separator Element	If back pressure exceeds 4 psig	As needed, at least per manufacturer's recommendations	Replace separator element.	Back pressure is less than 4 psig.	System repair

Table 3: Maintenance Schedule

Component	ID	Maintenance Task	Trigger/ Threshold	Frequency[(a)]	Maintenance Activities	Expected Results	Type of Work
Heat Exchanger	HEX-302	Inspect	See Frequency	Monthly	Inspect for damage. Remove any debris present.	Heat exchanger in good working condition.	General Inspection
Temporary Catalytic Oxidizer	TO-400	Inspect	See Frequency	Weekly	Inspect for damage. Check temperature.	Oxidizer in good working condition with sufficiently high temperature.	General Inspection
		Remove accumulated matter	If temperature drops below setpoint	As needed, at least per manufacturer's recommendations	Remove accumulated carbon and organic matter through burn-out or air lancing.	Temperature increases to sufficiently high value	System repair
Vapor GAC Vessels	GAC-400/ 401	Inspect	See Frequency	Monthly	Inspect for corrosion, damage, water accumulation.	GAC vessels are in good working condition. No corrosion, damage, or water accumulation noted.	General Inspection
		Repair damage, remove corrosion	If inspection indicates corrosion or damage	As needed	Replace GAC vessel housing if corrosion and damage is extensive. Repair damage and remove corrosion if not extensive.	GAC vessels are in good working condition. No corrosion, damage, or water accumulation noted.	System repair
		Remove accumulated water	See Frequency	Monthly	Drain any moisture from vessel. Investigation issues with vapor liquid separator system.	Vapor liquid separator system has been repaired.	System repair
		Check for breakthrough of media	See Frequency	Monthly during first two quarters of operation, then quarterly for two years, then semiannually	Analyze influent and effluent of water treatment system for VOCs. Check for concentrations above permit limit or treatment efficiency drops to 90%.	If breakthrough of media is noted, switch GAC	Parts replacement
		Replace media	When breakthrough of media is noted.	As needed	Replace carbon in GAC vessel	GAC vessel carbon is replaced.	Parts replacement

Table 3: Maintenance Schedule

Component	ID	Maintenance Task	Trigger/ Threshold	Frequency[(a)]	Maintenance Activities	Expected Results	Type of Work
System Components and Control							
Control Panel and PLC	–	Inspect	See Frequency	Monthly	Check for proper operation and system status. Replace light bulbs and fuses as needed.	System is operating properly and in good working condition.	General Inspection
Alarms	–	Inspect	See Frequency	Semiannually	Test alarms for proper operation. Replace alarms as needed.	Alarms are operating properly.	General Inspection
Flow Meters	–	Inspect	See Frequency	Monthly	Inspect for damage, corrosion, and water accumulation. Repair or replace as needed.	No damage, corrosion, or water accumulation noted.	General Inspection
			See Frequency	Annually	Verify zero calibration.	Flow meters have been verified for zero calibration.	General Inspection
Temperature and Pressure Gauges	–	Inspect	See Frequency	Monthly	Inspect for damage, corrosion, or improper functioning. Repair or replace as needed.	Temperature and pressure gauges are in good working condition.	General Inspection
Exercising Valves	–	Inspect	See Frequency	Monthly	Inspect valves for corrosion, silt buildup, and damage. Operate through full range of motion to verify proper functioning.	Valves are in good working condition.	General Inspection
Treatment Shed	–	Inspect	See Frequency	Monthly	Check general condition. Check for external or internal damage, leaks, loss of weatherproofing or insulation, loss of soundproofing, or other detrimental changes. Take corrective actions as needed. Remove trash and debris from inside and outside of compound enclosure.	Treatment shed is in good, clean condition.	General Inspection

Note:
(a) Frequency may be adjusted over the life of the system.

Kennedy Jenks

Table 4: Summary of MPE System Routine Operations and Maintenance Visits

General Operations by Phase				Number of Visits[a]						
Phase	Duration (Months)	Elapsed Time At Completion (Years)	Event	One Time	Weekly	Bi-Weekly[b]	Monthly	Semi-Annually	Annually	Total
Phase 1	-	0.5	Removal of Catalytic Oxidizer, Switch to vapor GAC vessels	1	-	-	-	-	-	**1**
Phase 1	6	0.5	Catalytic Oxidizer - Inspection, Temperature Check, Removal of Accumulated Debris	-	24	-	-	-	-	**24**
Phase 2	6	1.5	Surfactant Addition and Mixing	-	-	12	-	-	-	**12**
Phase 3	48	5.5	Amendment/Nutrient Addition and Mixing	-	-	96	-	-	-	**96**
All	66	5.5	Liquid and Vapor GAC Vessel & Media Changeout	-	-	-	34	-	-	**34**
All	66	5.5	Bag Filter Replacement	-	-	-	-	11	-	**11**
All	66	5.5	Liquid Ring Pump - Inspect Inlet Filter, Clean Strainers, Every 500 hours	-	-	-	-	-	-	**100**
			TOTAL	**1**	**24**	**108**	**34**	**11**	**0**	**278**

Regular Inspections and Maintenance by Phase				One Time	Weekly	Bi-Weekly[b]	Monthly	Semi-Annually	Annually	Total
Phase 1	12	1	Regular Inspections and Minor Repairs	-	-	-	12	2	1	**15**
Phase 2	6	1.5	Regular Inspections and Minor Repairs	-	-	-	6	1	-	**7**
Phase 3	48	5.5	Regular Inspections and Minor Repairs	-	-	-	48	8	4	**60**
			TOTAL	**0**	**0**	**0**	**66**	**11**	**5**	**82**

Notes:

(a) Some events may be combined into one visit. These combinations are not reflected here for clarity.

(b) Bi-weekly indicates one visit every two weeks.

Table 5: Troubleshooting Procedures

Problem	Procedures
Liquid ring pump will not start.	Check that E-STOP button is reset (pulled out). Check the water level in the VLS tank and pump out accumulated water. Check that all alarms have been cleared at the PLC. Open dilution air to 100% and attempt to restart.
Liquid ring pump shuts down.	Check operating temperature. Check overload setting on starter and fuses. Check for loose electrical connections. Check oil level. Drain or add oil as needed. Clean oil strainer. Check back pressure. If higher than 4 psig, replace oil separator element.
Low pressure alarm shuts down air compressor.	Re-prime discharge pump.
Other equipment issues.	See troubleshooting documentation provided by relevant equipment vendor.

Table 6: Monitoring Schedule

Parameter	Type	Media	Location	Frequency[a]	Equipment	Notes
Vacuum	Field	Air	Individual Wells (13) SSD Wells (3) Vapor Pins (4)	Quarterly	Dwyer 477AV-3 Digital, Dwyer Magnehelic vacuum gauge, or equal.	See O&M Manual.
			Treatment System	Monthly	None, use system gauges	See O&M Manual Section 5.1.1 for exact pressure gauges.
Barometric Pressure	Field	Air	Ambient	Monthly	Dwyer 477AV-3 Digital, Dwyer Magnehelic vacuum gauge, or equal.	With measurement of vacuum at individual wells and treatment system locations. See O&M Manual.
Pressure	Field	Water	Individual Wells (13)	Monthly	None, use system gauges	Injection flowrate during Phase 2: Surfactant Reinjection and Phase 3: Enhanced Bioremediation.
Airflow	Field	Air	Individual Wells (13) SSD Wells (3)	Quarterly for first year of operation, then as needed	Dwyer 471B Thermo-Anemometer, TSI TA430 Airflow Velocity meter, or equal.	See O&M Manual.
			Treatment System	Monthly	None, use system flowmeter	Air permit compliance, see O&M Manual. System flowmeter: FE/FIT 302.
Groundwater Flow	Field	Water	Individual Wells (13)	Monthly	None, use system flowmeters	Injection flowrate during Phase 2: Surfactant Reinjection and Phase 3: Enhanced Bioremediation.
			Treatment System	Monthly	None, use system flowmeters	See O&M Manual Section 5.1.3 for exact flow meters.
Noise	Field	Air	Outside Treatment Shed	Quarterly	Hand-held dBA noise level meter	Limit of 60 dBA Leq, City of Seattle noise ordinance[b]
Temperature	Field	Air	Treatment System	Monthly	None, use system gauges	See O&M Manual Section 5.1.5. System guages: TIT-302, TIT-400
			Ambient	Monthly	Dwyer 471B Thermo-Anemometer, TSI TA430 Airflow Velocity meter, or equal.	See O&M Manual.

Table 6: Monitoring Schedule

Parameter	Type	Media	Location	Frequency[a]	Equipment	Notes
VOC and Soil Gas Concentrations	Field	Air	Individual Wells (13)	Quarterly for first year of operation, then as needed	PID (MiniRAE 2000 or 3000 series, or equal)[c]	See O&M Manual.
			Vapor Pins (4)	Quarterly	Low-Detection PID (ppbRAE 3000 or equal) and Four-Gas Meter (RKI Eagle 2 or equal)[c]	Protection Monitoring - see SAP/QAPP
			SSD Wells (3)	Semiannually	Low-Detection PID (ppbRAE 3000 or equal) and Four-Gas Meter (RKI Eagle 2 or equal)[c]	Protection Monitoring - see SAP/QAPP
			Treatment System	Monthly, Quarterly, and/or Semiannually, as needed during system operation	PID (MiniRAE 2000 or 3000 series, or equal)[c]	Air permit compliance, see O&M manual
VOC Concentration	Lab	Air	Individual Wells (13)	At startup, then as needed	Summa Canister	As needed samples collected if field VOC measurements are elevated compared to startup concentrations
			SSD Wells (3)	As needed	Summa Canister	If field measurement of total VOCs or combustible gas is elevated[d]
			Vapor Pins	As needed	Summa Canister	If field measurement of total VOCs or combustible gas is elevated[d]
			Treatment System	Varies[e]	Summa Canister	Air permit compliance, see O&M manual
GRO, BTEX, Selected CVOCs, and FOG[f]	Lab	Water	Treatment System	Varies[e], As needed	Glass sample jars	Discharge permit compliance. As needed samples collected if effluent limits are exceeded.
			Discharge to Sanitary Sewer	Quarterly for first year of Phase 3, then semiannually; As needed		
pH, Turbidity	Field	Water	Treatment System	Varies[e], As needed	Portable field meter	Discharge permit compliance. As needed samples collected if effluent limits are exceeded.
			Discharge to Sanitary Sewer	Quarterly for first year of Phase 3, then semiannually; As needed	Portable field meter	
Nitrate/Ortho-phosphate	Lab	Water	Treatment System	As needed	Glass sample jars	Discharge permit compliance. As needed samples collected if effluent limits are exceeded.
			Discharge to Sanitary Sewer	Quarterly for first year of Phase 3, then semiannually		Injection/extraction schedule[g]

Table 6: Monitoring Schedule

Parameter	Type	Media	Location	Frequency[(a)]	Equipment	Notes
Field Parameters and Laboratory Analyses[(h)]	Field & Lab	Water	Off-Property Monitoring Wells (4)	At startup	Pump, tubing, and glass sample jars	Off-property monitoring wells, see SAP/QAPP
			Individual Wells at Wellhead (5)	At startup, then varies[(i)]	Pump, tubing, and glass sample jars	Performance monitoring wells, see SAP/QAPP
			Individual Wells at Wellhead (8)	See SAP/QAPP for frequency	Glass sample jars	Subset of Performance monitoring wells, see SAP/QAPP
			Individual Wells at Wellhead (13)	Quarterly after system operation has ended	Pump, tubing, and glass sample jars	Confirmation monitoring at select wells, see SAP/QAPP
Field Screening Parameters[(j)]	Field	Soil	Soil Borings (8)	After system operation has ended	PID (MiniRAE 2000 or 3000 series, or equal)[(c)]	Confirmation soil sampling, see SAP/QAPP
GRO, BTEX, and percent moisture	Lab	Soil	Soil Borings (8)	After system operation has ended	Soil boring and sample collection equipment	Confirmation soil sampling, see SAP/QAPP

Notes:

(a) Frequency may be adjusted over the life of the system.

(b) If the result is greater than 60 dBA, notify Kennedy Jenks personnel, determine the source of excessive noise, and implement sound reducing measures.

(c) A portable four-gas meter will be used to measure concentrations of total volatile organic compounds (VOCs), oxygen, carbon dioxide, and combustible gas [(reported as percent lower explosive limit (%LEL)]. Total VOCs will also be measured using a portable photoionization detector (PID) (e.g., MiniRAE 2000 or 3000 series, or equal) and/or a low-detection PID (e.g. ppbRAE 3000, or equal).

(d) If field measurement of total VOCs concentration is above 425 ppb and/or if combustible gas is measured above 20% LEL, a soil gas sample for VOC laboratory analysis will be collected.

(e) Monthly for 6 months, then quarterly for two years, then semiannual for the remainder of remedial system operation.

(f) Samples will be analyzed for GRO (gasoline range organics), BTEX (benzene, toluene, ethylbenzene, and total xylenes), Selected chlorinated VOCs (Selected VOCs: tetrachloroethylene, trichloroethylene, cis-1,2-dichloroethylene, trans-1,2-dichloroethylene, vinyl chloride), and FOG (nonpolar fat, oil, and grease)

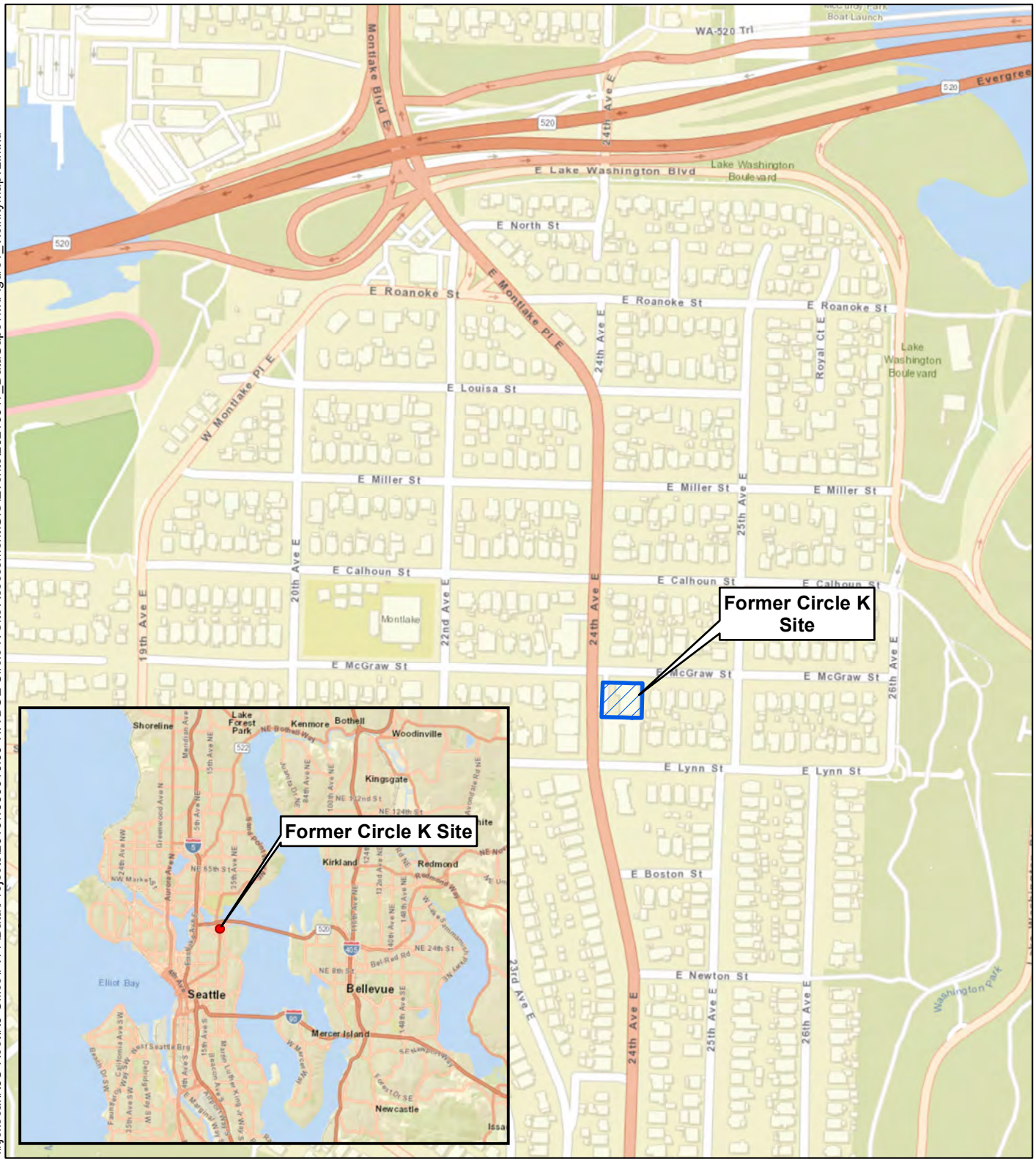
(g) If nitrate result is greater than 5 milligrams per liter (mg/L) or orthophosphate result is greater than 10 mg/L, the Idle Well Group timing should be increased.

(h) Samples will be submitted for analysis of one or more of the following: GRO, BTEX, nitrate and total orthophosphate, monitored natural attenuation parameters. See SAP/QAPP. Field parameters will be collected during groundwater purging prior to sample collection. Field parameters include: depth to groundwater, temperature, pH, specific conductivit, oxidation-reduction potential, dissolved oxygen, and turbidity.

(i) At startup, then monthly for 6 months, then quarterly until one year into Phase 3, then semiannual.

(j) Field screening parameters include physical observation, sheen tests, and measurement of headspace vapor using a PID.

Figures



\\kjc.local\KJC-Root\KJ-Office\FWY\Data\Projects\2016\1696010.00 WA DOE Circle K Site Assessment\GIS\Events\20210517_DataGapsTM\Figure1_VicinityMapv2.mxd

Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors,

Legend

Site Location

N

0 200 400

Scale: Feet

Note:
1. All locations are approximate.

Kennedy Jenks

Former Circle K Site
Seattle, Washington

Site Location and Vicinity Map

K/J 2196008*00

Figure 1

Appendix A

Permit to Construct/Operate

[To be added once permit is complete]

Appendix B

PSCAA Operation and Monitoring Requirements

Puget Sound Clean Air Agency – Soil Remediation Operation and Monitoring Requirements – Catalytic Oxidizers

1. The operator shall vent all vapors from the multi-phase extraction (MPE) system to a catalytic oxidizer prior to discharge to the atmosphere. The MPE system shall not be used to process halogenated compounds or Resources Conservation Recovery Act (RCRA) hazardous waste.

2. The control efficiency of the MPE system abatement device shall meet the following requirements, as applicable:
    a. ≥97% if inlet TPH ≥ 200 ppmv, measured as hexane or its equivalent; or
    b. ≥90% if inlet TPH < 200 ppmv, measured as hexane or its equivalent; or
    c. ≤10 ppmv at the outlet of the control device, measured as hexane or its equivalent.

3. The operator shall meet the following operating requirements:
    a. The maximum influent flow rate to the abatement system shall not exceed 300 cubic feet per minute (cfm). The influent flow rate shall be based on meeting the effluent limits for TPH/BTEX.
    b. The operator shall only use electric power to operate the catalytic oxidizer.
    c. The MPE system shall be operated with a minimum catalytic oxidizer temperature of at least 650 degrees Fahrenheit.
    d. The MPE system shall be equipped with an alarm that shuts the system off when the actual temperature readings fall below the minimum operating temperature in Condition No. 3.c.

4. The catalytic oxidizer shall be equipped with continuous temperature measuring and recording instrumentation to demonstrate compliance with the minimum inlet temperature requirements of Condition No. 3.c.

5. To demonstrate compliance with Condition No. 2 of this order, the owner or operator shall measure the inlet and exhaust gas streams by use of a hand held instrument capable of detecting concentrations at the levels expected, EPA Reference Method 8260B, EPA Method 8021, EPA Method TO-15, EPA Method 8015, or other equivalent method approved by the agency at least once per month after initial start-up as follows:
    a. Analyze inlet gas stream to determine the flow rate and the concentration of TPH/BTEX present.
    b. Analyze exhaust gas to determine the flow rate, and the concentration of TPH/BTEX present.
    c. Calculate the control efficiency based on the inlet and exhaust concentrations.

    The MPE system shall not contain a valve or any other device which will either dilute or restrict the flow of the soil gases unless the position of the device can be measured and controlled. If a device is installed, its position must be measured and recorded any time a test sample is taken which will be used to calculate either the mass flow rate of VOCs into the atmosphere or the destruction efficiency of the control device.

6. The owner or operator may operate the soil vapor extraction system without any controls when inlet sampling data from two or more consecutive months shows all of the following:
    a. Pre-control TPH emission rate is equal to or less than 2.74 lbs/day.
    b. Pre-control Benzene emission rate is equal to or less than 0.018 lbs/day.

7. The owner or operator shall maintain records of the following information:
    a. Hours and time of operation of the extraction system and control devices.
    b. The results of analysis or monitoring performed as required by condition 5.
    c. The control efficiency calculation results.

d. A summary of the temperature readings data on a monthly basis.

8. The owner or operator shall report any non-compliance with any condition of this order to the Agency no later than 30 days in which it is first discovered. The owner or operator shall detail the corrective action taken and include the data showing the exceedance as well as the time of occurrence in the submittal.

9. Records required to be maintained by this Order of Approval shall be kept for at least two years from the date of generation and made available to Puget Sound Clean Air Agency personnel upon request.

Puget Sound Clean Air Agency – Soil Remediation Operation and Monitoring Requirements – Activated Carbon System

1. The operator shall vent all vapors from the multi-phase vapor extraction (MPE) system to a minimum of two (2) granular activated carbon (GAC) canisters arranged in series prior to discharge to the atmosphere. The MPE system shall not be used to process halogenated compounds or Resources Conservation Recovery Act (RCRA) hazardous waste.

2. The control efficiency of the MPE system abatement device shall meet the following requirements, as applicable:
    a. ≥97% if inlet TPH ≥ 200 ppmv, measured as hexane or its equivalent; or
    b. ≥90% if inlet TPH < 200 ppmv, measured as hexane or its equivalent; or
    c. ≤10 ppmv at the outlet of the control device, measured as hexane or its equivalent.

3. The operator shall ensure the maximum influent flow rate to the abatement system shall not exceed 300 standard cubic feet per minute (scfm).

4. To demonstrate compliance with Condition No. 2 of this order, the owner or operator shall measure the inlet and exhaust gas streams by use of a hand held instrument capable of detecting concentrations at the levels expected, EPA Reference Method 8260B, EPA Method 8021, EPA Method TO-15, EPA Method 8015, or other equivalent method approved by the agency at least once per month after initial start-up as follows:
    a. Analyze inlet gas stream to determine the flow rate and the concentration of TPH/BTEX present.
    b. Analyze exhaust gas to determine the flow rate, and the concentration of TPH/BTEX present.
    c. Calculate the control efficiency based on the inlet and exhaust gas analysis.

    The MPE shall not contain a valve or any other device which will either dilute or restrict the flow of the soil gases unless the position of the device can be measured and controlled. If a device is installed, its position must be measured and recorded any time a test sample is taken which will be used to calculate either the mass flow rate of VOCs into the atmosphere or the destruction efficiency of the control device.
    If using a PID or FID, TPH shall be measured as hexane or its equivalent using the applicable response factors.

5. Breakthrough: During operation of the activated carbon vessels, the owner or operator shall contemporaneously monitor the gas stream by use of a hand held instrument capable of detecting concentrations at the levels expected to prevent breakthrough at least twice per week at the following locations:
    a. At the lead carbon vessel inlet;
    b. At the inlet to the last carbon vessel in series (outlet of lead carbon vessel);
    c. Outlet of the last carbon vessel prior to venting to the atmosphere.

    The owner/operator of this source may propose for Agency approval, based on actual measurements taken at the site during operation of the source, that the monitoring schedule be changed based on the decline in organic emissions and/or the demonstrated breakthrough rate of the carbon vessels.
    TPH shall be measured as hexane or its equivalent using the applicable response factors.

6. The operator shall immediately change out the first carbon bed with unspent carbon upon breakthrough defined as the detection at its outlet of the higher of the following:
    a. 10 % of the inlet stream concentration to the carbon vessel.
    b. 10 ppmv (measured as hexane or its equivalent).

7. Spent carbon removed from the MPE system shall be stored in closed containers prior to removal from the site.

8. The owner or operator may operate the MPE system without any controls when all the sampling data from two or more consecutive months shows the following:
    a. Pre-control TPH emission rate is equal to or less than 2.74 lbs/day.
    b. Pre-control Benzene emission rate is equal to or less than 0.018 lbs/day.

9. The owner or operator shall maintain records of the following information:
    a. Hours and time of operation.
    b. The results of analysis or monitoring performed as required by condition 5.
    c. The control efficiency calculation results.
    d. When operating the activated carbon vessels, the date change out occurred and the number of carbon vessel(s) changed.

10. The owner or operator shall report any non-compliance with any condition of this order to the Agency no later than 30 days in which it is first discovered. The owner or operator shall detail the corrective action taken and include the data showing the exceedance as well as the time of occurrence in the submittal.

11. Records required to be maintained by this Order of Approval shall be kept for at least two years from the date of generation and made available to Puget Sound Clean Air Agency personnel upon request.

Appendix C

Health and Safety Plan

Kennedy Jenks

32001 32nd Avenue South
Federal Way, Washington 98001
253-835-6400
FAX: 253-952-3435

Site-Specific Health and Safety Plan (HASP)

Former Circle K Site
2350 24th Avenue East
Seattle, Washington

[*9 December 2021*]

Prepared for

Washington State Department of Ecology
3190 160th Avenue Southeast
Bellevue, Washington 98008

Project No. 2196008*00

Table of Contents

© 2021 Kennedy/Jenks Consultants, Inc

List of Tables

List of Attachments

List of Appendices

Health and Safety Plan (HASP) Summary

Project Name	Circle K 1461 Environmental Design & Cleanup	**Project No.**	2196008*00
Prepared by	Ryan Hultgren	**Date**	9 December 2021
Project Manager	Ryan Hultgren	**Office**	Federal Way

Field Services Description

Field Services Date(s)	2021 - 2026		
Site Name	Former Circle K		
Location	2350 24th Avenue East, Seattle, WA		
Client Site Contact	Dale Myers	**Client Site Telephone**	425-649-4446

Type of Investigation:

Sampling Investigation:

- ☐ Hand Auger
- ☐ Drilling
- ☒ Trenching
- ☐ Well Installation
- ☐ Soil Sampling
- ☐ Groundwater Sampling
- ☐ Other:

Site Remediation:

- ☒ Excavation
- ☒ Treatment System Installation/O&M
- ☐ Underground Storage Tank (UST) Removal

- ☒ Site Walk-through
- ☐ Other: _____

© 2021 Kennedy/Jenks Consultants, Inc

Section 1: Introduction

This Site-Specific Health and Safety Plan (SSHSP), also referred to as a Health and Safety Plan (HASP), developed in accordance with Occupational Safety and Health Administration (OSHA) standards for hazardous waste operations (29 CFR 1910.120), and CAL/OSHA Standards (8 CCR 5192), establishes general health and safety protocols for Kennedy Jenks personnel at Washington State Department of Ecology's Former Circle K site (Site) located at 2350 24th Avenue East in Seattle, Washington. As needed, addenda containing activity-specific health and safety protocols will be prepared and attached to this HASP prior to the initiation of each additional field activity. The HASP and activity-specific addenda, as a minimum, contain the following information:

- Names of key personnel and alternates responsible for site health and safety and appointment of a Site Safety Officer (SSO).
- A job hazard analysis (JHA) for each site task and operation (see Appendix A for example).
- Personal protective equipment (PPE) to be used by employees for each site task and operations being conducted.
- Medical surveillance requirements.
- Frequency and types of air monitoring, personal monitoring, and environmental sampling techniques and instrumentation to be used. Methods of maintenance and calibration of monitoring and sampling equipment to be used.
- Site control measures.
- Decontamination procedures.
- An Emergency Response Plan that addresses effective site response to emergencies.
- Procedures to report injuries or illness, property damage, or near miss incidents.

For informational purposes only, this plan may be provided to subcontractors of Kennedy Jenks involved in activities at the site, interested regulatory agencies, or others. However, entities and personnel other than Kennedy Jenks shall be solely responsible for their own health and safety and shall independently assess onsite conditions and develop their own health and safety protocols to meet the minimum health and safety requirements.

Kennedy Jenks has developed a Health & Safety Operations Manual (Kennedy Jenks, Corporate Health and Safety Program, June 2020). Kennedy Jenks' Health & Safety Program, upon which the manual is based, complies with current health and safety regulations, including OSHA 29 CFR 1910.120 and Hazardous Waste Operations and Emergency Response. Many of the protocols of the corporate program are conducted on a routine basis (general training, respirator fit testing, general medical record keeping, etc.) and are not repeated herein. The Health and Safety Operations Manual is available to Kennedy Jenks employees upon request during normal business hours. Questions regarding the program should be referred to the

© 2021 Kennedy/Jenks Consultants, Inc

Kennedy Jenks Health & Safety Manager (H&S Manager) John Jindra, or the Director of Health, Safety, and Environment (Director of HS&E) Bert Drews.

A copy of this HASP, along with any addenda containing activity-specific health and safety information, will be kept in a conspicuous location at all times while work is being conducted at the site.

© 2021 Kennedy/Jenks Consultants, Inc

Section 2: Key Health and Safety Personnel

Kennedy Jenks' SSO will be designated by the Project Manager, as appropriate. The current SSO for the project is Ryan Hultgren. In the absence of the SSO during field activities, a member of the field investigation team will be designated as Kennedy Jenks SSO. The SSO is responsible for the following.

- Conducting daily tailgate safety briefings (TSBs) for Kennedy Jenks personnel at the beginning of each workday and documenting that subcontractors are also conducting TSBs. Kennedy Jenks staff may combine TSBs with the subcontractor in lieu of conducting separate safety meetings. Combined TSB meetings will be led by the subcontractor and must include emphasis provided by the subcontractor relative to the subcontractor's work. Other participants, including Kennedy Jenks and any regulatory personnel in attendance, should also discuss their respective health and safety issues and oversight specific to their activities. The TSB Record is attached to this HASP as Appendix B, and a copy of each day's executed form for Kennedy Jenks' TSB must be obtained for the project files, signed by all Kennedy Jenks employees attending the TSB meeting. Any subcontractors must provide the SSO with a daily copy of the subcontractor's own safety briefing form for the project file.

- Observing field activities for compliance with this HASP, applicable addenda, and Kennedy Jenks Health and Safety Operations Manual.

- Maintaining onsite medical surveillance, if required, and emergency medical treatment programs, and assisting in onsite emergencies.

- Modifying health and safety protocols or terminating field work when unsafe work conditions exist.

- Assuring all project team members participating in field activities have read and signed this HASP and have had the opportunity to ask safety-related questions regarding this project.

- Familiarizing personnel with health and safety protocols.

- Observing field personnel wear appropriate PPE.

- Recording data from direct reading instruments on field logs (as appropriate) and evaluating potential hazards.

- Monitoring decontamination procedures.

- Recording occurrence of any site injury, illness, property damage or near miss incident.

If unsafe conditions are encountered, if illness or injury occurs, or if the level of protection needs to be changed, the SSO will consult, in a timely manner, with the Project Manager, Ryan Hultgren; the H&S Manager, John Jindra, or the Director of HS&E, Bert Drews.

© 2021 Kennedy/Jenks Consultants, Inc

Section 3: Site Description and History

The Site is associated with a former gasoline service station property located at 2350 24th Avenue East in Seattle, Washington. In 1989, approximately 4,000 to 6,000 gallons of gasoline from a leaking underground storage tank (UST) was released to the subsurface at the Site. Based on available information, the related contaminant plume has extended off-property beneath adjacent streets and residential properties.

The property is approximately 0.26 acre in size and is located in the Montlake neighborhood southeast of the intersection between 24th Avenue East and East McGraw Street, approximately 1,800 feet south of Lake Washington. The area surrounding this Site consists mainly of residential houses and buildings, with some small commercial business located west of the Site along the 24th Avenue East. The property consists of a one-story building and a newer addition to it, which are presently being utilized as a retail dry cleaning store and a convenience store, known as Jay's Cleaners and Mont Market.

The property was operated as a gasoline station and convenience store from 1968 to 1981, owned by Mr. George Renale. Prior to 1968, it is believed the property was residential. From 1981 to July 1990, the property was leased by Mr. Renale to Circle K Corporation, who also operated the facility as a gasoline station and convenience store. In November 1990, Mr. Kuk Jin Choung, the current owner, purchased the property from Mr. Renale and has operated it as a retail dry cleaning retail store since then. In February 1992, Mr. Choung entered into a Consent Decree with Ecology to begin investigation and remediation of contamination at the Site.

© 2021 Kennedy/Jenks Consultants, Inc

Section 4: Planned Site Activities

Type of Investigation:

Sampling Investigation:
- ☐ Hand Auger
- ☐ Drilling
- ☒ Trenching
- ☐ Well Installation
- ☐ Soil Sampling
- ☐ Groundwater Sampling
- ☐ Other: Soil Gas/Indoor Air Sampling

Site Remediation:
- ☒ Excavation
- ☒ Treatment System Installation/O&M
- ☐ UST Removal

☒ Site Walk-through ☐ Other: _____

☒ Onsite Inspection or Construction-Related Services

☐ Entry into a Confined Space or Excavation[1]

☐ Work Along a Leading Edge Requiring Fall Protection

☐ Entry into an Excavation or Trench with a Depth of 5 feet or Greater (4 feet in Oregon and Washington)

☐ Field Investigation Requiring
- ☐ a. Entry into (potentially) hazardous area
- ☐ b. Interruption of vehicular traffic
- ☐ c. Interruption of plant processes
- ☐ d. Operation of pilot plant

☐ Chemical Use[2]

☐ Other - *specify*

[1] Completion of Kennedy Jenks Confined Space Pre-Entry Checklist and Entry Authorization is required or review of Client's Confined Space Procedures.

[2] A Field Chemical Use Plan must be completed.

Potential Hazards:

☒ Organics	☒ Solvents	☐ Bases
☐ Inorganics	☐ Pesticides	☐ Fire/Explosion
☒ Metals ☐ Acids	☒ Other: Traffic	

Personal Protective Equipment:

- ☐ Level C
- ☒ Level D

The Site is currently operated as a retail mini-mart and dry cleaners with limited parking onsite. Field investigation activities will include utility locate, oversight of subcontractors (e.g. surveying) and resident engineering for a contractor hired by Ecology to install a remediation system. Work will require coordination with the current property owner/operator to consider appropriate means to protect facility operations and workers/customers. In addition, traffic control services may be needed for work in City of Seattle right-of-way areas.

© 2021 Kennedy/Jenks Consultants, Inc

Section 5: Hazard Assessment

5.1 Potential Physical & Environmental Hazards

Every job must be scrutinized for potential hazards, which may cause an injury, illness, property damage, or an near miss incident. The preferred method of assessing a job for hazards is to break down each job into smaller tasks. Each task may then be scrutinized by performing a JHA.

Kennedy Jenks JHA form provides examples to assist employees in performing their own JHA. The JHA process is intended to provide a brief, consistent means of identifying and addressing hazards, which may injure employees.

Potential hazards may include, but are not limited to, the following:

- Heavy equipment
- Excavations and Trench work
- Tripping and falling hazards
- Heat stress
- Cold exposure
- Underground/overhead utilities
- Motor vehicle hazards
- Biological exposure
- Equipment hazards
- Working over or near open water
- Chemical exposure
- Fire/explosion hazard.

5.1.1 Heavy Equipment

Field personnel should be cognizant of potential physical hazards associated with use of heavy equipment and electrical equipment during field operations. Appropriate precautions include the following:

- American National Standards Institute (ANSI)-approved hardhats, Class II reflective safety vests (when outside), safety glasses or goggles, and safety-toe boots will be worn.

© 2021 Kennedy/Jenks Consultants, Inc

- Loose clothing that may catch in moving parts will not be worn.
- Hearing protection will be worn if a preliminary noise survey or past experience indicates maximum noise levels will exceed 85 decibels at any time during site operations or if sound levels become uncomfortable or prevent conversation at normal levels.
- Maintain visual contact with the equipment operator at all times within or near the equipment operating radius.

Prior to conducting drilling, a survey shall be conducted and discussed in the TSB to identify overhead electrical hazards and potential ground hazards, such as hazardous agents in the soil or underground utilities. Kennedy Jenks' staff will stay at least 25 feet from active drilling rig when possible. Coordinate collection of samples with equipment operator. Wear hearing protection when equipment is operating.

5.1.2 Excavation and Trench Work

Field personnel should enter an excavation or trench only as a last resort. Any excavation or trench exceeding 5 feet (4 feet in Washington and Oregon) in depth must be properly shored, braced, or sloped, and a safety ladder must be provided for ready access or egress.

5.1.3 Tripping and Falling Hazards

Other potential physical hazards include falling and tripping on slippery, uneven, or unpaved surfaces.

Extra care should be taken in the event of frozen ground, sleet, or snow. Modify walking activities accordingly, paying close attention to exposed bare surfaces, such as stairs, platforms, concrete walkways, truck beds, etc.

5.1.4 Heat Stress

Adverse climate conditions, primarily heat, are important considerations in planning and conducting site operations. Maximum daytime temperature may exceed 75 degrees Fahrenheit (°F) at the site, and heat stress is an associated concern. Provisions of Kennedy Jenks Heat Illness Prevention Program, Appendix C, will be applied to all projects when Kennedy Jenks employees are subjected to sustained temperatures of 85 °F or greater.

Preventive measures include the following:

- Water and/or commercial electrolyte solutions will be available, and drinking these fluids will be encouraged. When temperatures exceed 85 °F, sufficient water will be provided to accommodate each employee with 1 quart of water per hour. Water will be kept cool by means of a portable cooler with ice or similar means.
- Suitable acclimation periods will be provided for workers to gradually establish their resistance to heat stress.

Personnel exhibiting symptoms of heat stress (nausea, cramps, dizziness, clammy skin) will be removed from the work area, cooled, and provided with water, and the personnel will be

© 2021 Kennedy/Jenks Consultants, Inc

observed (see Appendix C, Heat Stress Card). Personnel exhibiting symptoms of heat stroke (hot dry skin, mental confusion, unconsciousness) will be immediately cooled and taken to the hospital. A map and written directions to the local medical facility are included as Attachment 1.

5.1.5 Cold Exposure

Cold injury (e.g., frostbite and hypothermia) and impaired ability to work are dangers encountered at low temperatures and high wind-chill factors. To guard against these conditions, if cold weather is an important consideration at this site, field personnel should wear appropriate clothing, have access to readily available warm shelter, take carefully scheduled work and rest periods, and monitor physical conditions of other workers. See Appendix D, Cold Stress Fact Sheet.

5.1.6 Underground/Overhead Utilities

The site may contain underground and aboveground utilities, including buried electrical, natural gas, water, sewer and fuel lines, and aboveground utilities, such as high-voltage transmission lines. These utilities present a potential hazard if they are struck or can arc if equipment is located too close to them. Kennedy Jenks will use the following notification, documentation and clearance procedures to clear all boring or excavation locations of utilities prior to subsurface invasive activities. Subsurface invasive work includes excavations, borings, surface grading, and hand augering soil samples when depths penetrate more than 6 inches below ground surface (bgs). Work is not to proceed where there is doubt regarding the location of underground utilities or obstructions. Invasive Activities – Utility Location Standard Operating Procedures are included as Appendix E.

Notification Procedures: Notification is made through the One-Call Center (811) for all subsurface invasive work located on public property. Kennedy Jenks or its designated subcontractor will call for a universal underground notice at least 2 business days before drilling or subsurface invasive activities are to begin.

Document time of the call, names of utilities to be contacted, and obtain a ticket number for the call on Kennedy Jenks Utility Location and Acknowledgement Form included as Appendix E. On private property not covered by the Utilities Underground Location Center, Kennedy Jenks may be required to contact and receive utility clearance approval from a combination of other public and private entities, as well as private landowners, City officials, and State of ******* entities to obtain clearance approval who may have underground utilities in the work area.

Documentation: All proposed subsurface excavations, boring, and well locations are to be marked on the ground surface using **white** paint in accordance with American Public Works as shown on the American Public Works Association (APWA) Uniform Color Code. A Kennedy Jenks Utility Location and Acknowledgement Form must be filled out for each proposed well, boring, or excavation location. Obtain signatures from each private or public utility owner to document clearance on the each form, as required.

At all locations where drilling, probing, or well installation will be performed, an air knife or similar form of suction potholing will be performed to assess possible underground utilities in the upper 6 to 8 feet of soils (depending on local conditions and expected depth of utilities). Potholing is required at **all drilling locations**, except in remote areas where the likelihood of encountering underground utilities is very low and only as approved by a Risk Manager,

© 2021 Kennedy/Jenks Consultants, Inc

Resource/Operations Manager or Officer of the company familiar with underground utilities. (Note: Use of an air knife will be appropriate for most invasive drilling and probing work, but may not be appropriate for certain activities like very shallow borings (less than 1-foot deep), certain hand-auger borings, remedial injections using probe equipment, and test pitting.) Case-by-case exceptions for activities may be provided.

Should an underground line or pipe or other obstruction be encountered unexpectedly or disturbed (broken, damaged, or undermined) immediately discontinue invasive activities and contact the Project Manager. If the Project Manager cannot be reached, contact an officer of Kennedy Jenks. Secure the area to prevent further disturbance/damage.

When clearing the site for utilities, **ALWAYS REMEMBER TO LOOK UP for overhead utilities**. Kennedy Jenks will direct its subcontractors to limit the proximity of equipment to overhead power transmission lines according to the following schedule:

Power Line	Distance from Power Line
50 kilovolts (kV) or below	10 feet
50 KV - 200 kV	15 feet
200 KV - 350 kV	20 feet
350 KV - 500 kV	25 feet
500 kV - 750 kV	35 feet
750 kV – 1,000 kV	45 feet

If the voltage of a power line is unknown, assume it is 1,000 kV

5.1.7 Motor Vehicle Hazards

When working at the site, personnel should be aware of the following situations or activities:

- Vehicle, truck, and equipment traffic on residential streets and nearby service roads. Use barricades, signage, and/or a traffic control plan, where appropriate. Kennedy Jenks personnel are NOT trained in and are NOT authorized to set up traffic control or work as a highway flagger.

- When driving, personnel should be aware of the potential for wildlife to be on the road or run into the road. Driving after dark should be limited as much as possible.

- When driving, personnel should be aware of the potential of falling asleep at the wheel and take rest stops and breaks, at regular intervals or as needed. Do not drive to and from the site if weather conditions make road travel unsafe.

- Unpaved, uneven, or soft roadways. Personnel should only consider driving sport utility vehicles (SUVs) or pickup trucks into the site with 4x4 or all-wheel drive to prevent tires from getting stuck in soft or loose sand/mud.

5.1.8 Biological Hazards

Personnel should be aware of the potential presence of insects such as spiders and wasp/hornets, or snakes in wellheads or other enclosures.

© 2021 Kennedy/Jenks Consultants, Inc

The site may have some vegetative areas that may contain poisonous plants or tress such as sumac and/or poison ivy. Contact with such plants should be avoided. If contact is suspected, wash the area immediately with soap and water.

Ticks are prevalent at the site. To prevent exposure, staff should wear long sleeves, light colors, and consider tucking pant legs into boot cuffs and/or duct taping pant legs to boots. Regular "tick checks" should be conducted throughout the day. Field clothes should be removed immediately after work is complete and washed.

Insect repellent with DEET should also be used to prevent exposure to biting insects such as ticks and mosquitoes.

Mosquitoes may pose a hazard because they are potentially infected with Eastern Equine Encephalitis (EEE) which may be transmitted through their bite. Personnel should have awareness of the severity of EEE warnings currently in the area. Field work should not be conducted during times of day when mosquitoes are known to be most active (i.e., dawn and dusk). Long-sleeve shirts, pants, gloves, and mosquito netting (over head and neck) should be worn to prevent exposure.

5.1.9 Equipment Hazards

Working with hand and small power tools, personnel should be aware of the following:

- Utilize tools only for the purpose for which they were designed.
- Inspect all tools and equipment before they are used.
- Immediately remove from service any tool or piece of equipment that is damaged.
- Be aware of potential of a burning hazard should equipment get hot during use.
- Do not wear any jewelry (including finger rings) or loose-fitting clothes that may get caught in equipment while conducting field activities.
- Use caution when lifting and carrying backpack containing bladder pump. The backpack weighs approximately 25 pounds. If walking long distances between monitoring wells, take intermittent rest breaks as needed to prevent fatigue.

5.1.10 Working Over or Near Water

Employees working over or near water shall consider the following recommended safety procedures:

- Employees must evaluate water conditions such as temperature or water current to select proper PPE. Example: dry suit and/or fall protection equipment. In addition, employees working within 4 feet of the water edge must wear properly sized U.S. Coast Guard personal floatation device (PFD).
- Perform visual inspections of area noting potential overhead and other hazards that are not in the normal field of vision.

© 2021 Kennedy/Jenks Consultants, Inc

- For work to be performed near water and more than 4 feet from the water's edge, erect sufficient barricades 4 feet away from the water's edge using traffic cones, plastic fencing, or caution tape to serve as a warning system when a worker unintentionally approaches the water's edge.

- For work to be performed above water and/or within 4 feet of the water's edge, another worker who can immediately summon emergency rescue must stand guard.

- Employees must know how to use rescue equipment such as "pole & life hook or ring buoy." (Ring buoys with at least 90 feet of line shall be provided and readily available for emergency rescue operations.)

- Proper footwear with adequate traction must be utilized when working or walking on wet faces.

5.1.11 Weather Hazard

There is a potential for snow and/or ice in the area of the proposed investigation. Personnel should layer clothing to lessen impact of the cold stress on the body (see Cold Stress Fact Sheet in Appendix D). Snow and ice can also cause roads and ground to be slick; therefore, extra precaution should be taken while driving, and moving around the work site. If personnel become too cold, they should take a break to warm up or add extra layers that do not impact PPE. If personnel experience symptoms of cold stress, they should stop work, and seek medical attention.

5.1.12 Other Safety Considerations

When working at the site, personnel should be aware of the following situations or activities:

- Vehicle, truck, and equipment traffic on residential streets and nearby service roads. Use barricades, signage, and/or a traffic control plan, where appropriate. Kennedy Jenks personnel are NOT trained in and are NOT authorized to set up traffic control or work as a highway flagger.

- Working with hand and small power tools. Utilize tools only for the purpose for which they were designed. Inspect all tools and equipment before they are used. Immediately remove from service any tool or piece of equipment that is damaged. Be aware of the potential of a burning hazard should equipment get hot during use.

- Do not wear any jewelry (including finger rings) or loose fitting clothes that may get caught in equipment while conducting field activities.

- Personnel should be aware of the potential presence of black widow spiders, wasp/hornets, or snakes in wellhead or other enclosures.

- When driving, personnel should be aware of the potential for wildlife to be on the road, or run into the road. Driving after dark should be limited as much as possible.

© 2021 Kennedy/Jenks Consultants, Inc

- When driving, personnel should be aware of the potential of falling asleep at the wheel and take rest stops and breaks, at regular intervals or as needed. Do not drive to and from the site if weather conditions make road travel unsafe.

5.2 Potential Chemical Hazards

Contaminants of concern (COC) identified for this site include gasoline-range organics (GRO), and benzene, toluene, ethylbenzene, and xylenes (BTEX). Other possible related COCs include gasoline additives such as methyl-tert-butyl-ether (MTBE), 1,2-dichloroethane (EDC), 1,2-dibromoethane (EDB), and total lead. Although not previously detected at the site, a dry-cleaning business is present on the site indicating a potential for the presence of chlorinated solvents such as tetrachloroethylene (PCE).

Field personnel could potentially be exposed to COCs at the site by direct contact with soil or groundwater, through inhalation of dusts containing organic chemicals or through inhalation of organic chemical vapors. Field personnel will minimize potential chemical hazards by 1) avoiding direct contact with groundwater and soil, 2) performing air monitoring to determine necessary level of personal protective equipment, and 3) avoiding generation of dust. Ingestion of particulate matter containing chemicals is another general exposure route. However, for site personnel, the potential for this type of exposure is minimal. Safe work practices, including restriction of eating, drinking, or smoking to certain times and places, will be enforced at the work site.

5.2.1 Groundwater Samples

Chemicals detected in groundwater from the site and the highest detected concentrations are listed in Table 1. The highest COC concentrations in groundwater are typically for samples collected from wells in which free-phase product [i.e., non-aqueous phase liquid, (NAPL)] has been present historically.

5.2.2 Soil Samples

COCs have been detected in subsurface soil samples collected at the site. The highest reported concentrations are listed in Table 2.

Available Threshold Limit Values (TLV) or Permissible Exposure Limits (PEL) published for potential chemicals that may be detected in soil and groundwater are listed in Table 1.

5.2.3 Chemical Use Plan and Safety Data Sheets (SDS)/Hazard Communication

In addition to site-related chemicals, Kennedy Jenks field personnel may work with compressed gasses, decontamination materials, and other materials that present potential health and safety issues. Typical chemicals that may be brought to the site are listed below.

- Aerosol marking paint for utility locating
- Simple Green for equipment decontamination

© 2021 Kennedy/Jenks Consultants, Inc

Kennedy Jenks has a "cradle to grave" policy regarding the purchase, storage, use, transportation, and disposal of chemicals used in the field. The Chemical Use Policy and Procedures are attached as Appendix F to provide guidance on the proper protocols for chemical use in the field. The Chemical Use Plan (see Appendix G) must be completed by Kennedy Jenks field staff using the chemicals and approved by the H&S Manager.

Kennedy Jenks has a Hazard Communication Written Program (see Appendix F) and training programs that cover these materials. Personnel conducting field activities must complete a review of the Hazard Communication Written Program and site-related chemical hazards prior to starting field activities.

The Hazard Communication Written Program is part of Kennedy Jenks Health and Safety Operations Manual.

Copies of the SDS for chemicals listed in Table 1 or listed in this section are provided in Appendix G.

© 2021 Kennedy/Jenks Consultants, Inc

Section 6: Community Hazard Analysis

Generally, insignificant particulate and vapor emissions are generated during routine soil and groundwater sampling activities. During construction-related activities, particulate and vapor emissions may increase above concentrations generated during routine soil and groundwater sampling activities. Therefore, activity-specific health and safety addenda will be developed for activities where elevated particulate and vapor emissions may develop. Onsite worker exposure to chemicals at concentrations of concern is not expected. Potential exposures to the surrounding community will likely be much less than potential onsite worker exposure and is, therefore, also not expected to be of concern.

However, a potential for onsite worker exposure to chemicals exists during drilling and sampling activities. If, based on the action levels provided in Section 7, it becomes necessary for site personnel to don Level C PPE, Kennedy Jenks along with its subcontractors, will establish three work zones: Exclusion Zone, Contaminant Reduction Zone, and Support Zone as described in Section 7.2. Exclusion and Contaminant Reduction Zones will control entrance and exit from potential exposure areas. Continuous air monitoring will be performed during activities performed within the Exclusion Zone to ensure that the appropriate level of PPE is selected and within the Support Zone to ensure that support workers are not exposed to chemicals. Potential exposures to the surrounding community are unlikely based on the size of the property. If air monitoring indicates that there is the potential for the surrounding community to be exposed, Kennedy Jenks will stop work and evaluate the need for alternative controls.

Use of barricades, caution tape, or signage to keep the general public away from working areas should be used where and when appropriate. At a minimum, keep public and non-essential personnel at least 50 feet away from an active drilling area. This can be accomplished using barricades, cones, vehicles, and caution tape.

© 2021 Kennedy/Jenks Consultants, Inc

Section 7: Protective Actions

7.1 PPE

Field personnel will wear equipment to protect against potential physical and chemical hazards, which have been identified herein and those that become apparent in the field. Guidelines for Contaminants Commonly Encountered at Kennedy Jenks Sites provide guidance in assessing potential hazards and selecting the appropriate protection. Level D protection will be required at a minimum for field activities at the site. Level D personal protective equipment to be used may include all items on the following list that are denoted by an asterisk (*).

The level of protection employed may be upgraded, as deemed necessary by the SSO. If non-routine field activities are initiated, the level of protection will be specified in the activity-specific health and safety addenda.

Personal Protective Equipment (PPE) and Monitoring Equipment

Eyes: ☒ Safety Glasses ☐ Face Shield
Boots: ☒ Safety-Toe ☐ Work ☐ Rubber ☐ Other
☒ Class II High-Visibility Reflective Safety Vest
☒ Hard hat
☒ Earmuffs/Plugs (as needed)
☒ Work Gloves ☐ *Neoprene* ☐ *Rubber* ☒ *Nitrile*
☐ Suits: ☐ *Cotton* ☐ *Tyvek* ☐ *Nylon* ☐ *Other*

☐ Respirator: (Type/Cartridge: *specify)*
☒ Emergency Eyewash ☐ Emergency Shower
☐ Spill Kit
☒ Fire Extinguisher
☒ First Aid Kit
☐ Life Jackets ☐ Rescue Life Ring
☐ Safety Belt/Harness/Tripod
☐ Lights *(type: Flashlight)*
☒ Camera/Video
☒ Cell Phone

☐ Lockout Tags and Locks
☐ Ventilator/Fan
☐ Volt/Ampere Meter
☐ PID *(calibration date: specify)*
☐ OVA *(calibration date: specify)*
☐ OVM *(calibration date: specify)*
☐ Hydrogen Sulfide Meter *(calibration date: specify)*

☐ Draeger Detection Tubes
☐ Soil Sampling Kit
☐ pH Meter/Paper
☐ Conductivity/Temperature Meter
☐ Metal Detector
☒ Air Sampling Equipment
☐ Peristaltic Pump
☐ Face covering
☐ Other: specify

7.2 Work Zones

Work zones, including designation of an Exclusion Zone, a Contamination Reduction Zone, and a Support Zone, will be established for any field activity that requires Level C protection or greater. Work zones will be clearly marked in the field. Work zones may vary depending on the proposed field activity and will be established in the activity-specific health and safety addenda.

© 2021 Kennedy/Jenks Consultants, Inc

7.3 Monitoring

7.3.1 Hazardous Substances

As appropriate, field personnel will perform air monitoring at least twice daily with a direct reading organic vapor analyzer (OVA, OVM, or HNU) in the breathing zone at each work location. All readings shall be recorded in field logs. All direct reading instruments shall be calibrated according to the manufacturer's specifications. The following action levels will be used.

- If OVA readings for a particular work area consistently exceed 5 parts per million (ppm) above background, then sampling will cease and personnel will withdraw from the work area.
- If concentrations persist above 5 ppm, then Level C protection will be required if work is to continue.
- If OVA readings exceed 10 ppm in the breathing zone while workers are in Level C protection, then work will cease, and the source of the emission will be determined and eliminated before work continues.
- Periodic measurements of the area will be taken before re-entry to ensure lower exposure limit (LEL) has been reduced to safe working levels.

7.3.2 Explosive Limits

If conditions encountered during drilling or sampling suggest potentially explosive conditions may exist, the SSO will direct explosimeter monitoring be conducted. The following explosimeter monitoring action levels will be used:

- If gas or vapor concentration is less than 10 percent of its LEL, continue investigation.
- If concentrations are between 10 and 25 percent of its LEL, continuously monitor site and continue investigation with extreme caution.
- If concentrations are greater than 25 percent of LEL, withdraw from area immediately.

7.3.3 Noise

Field personnel will initially monitor noise levels associated with equipment and machinery with a direct reading portable noise level monitor unless based on experience, it is known that hearing protection is not necessary. Readings will be taken within the normal worker hearing zone. If maximum noise levels exceed 85 decibels at any time during site operations, hearing protection will be worn.

The OSHA permissible noise exposure limit is 90 decibels as an average exposure over an 8-hour work period. If an employee's 8-hour time-weighted average noise exposure for any day is in excess of 85 decibels, the employee must participate in a hearing conservation program. For most field activities, it is unlikely the employee exposure in excess of 85 decibels for 8 hours will occur. Although a written hearing conservation program is not required, Kennedy Jenks will

© 2021 Kennedy/Jenks Consultants, Inc

provide field personnel with appropriate hearing protection (i.e., earmuffs or plugs) whenever noise levels have the potential to exceed 85 decibels.

All contractors are responsible to ensure whether a hearing conservation program is warranted per site conditions and are to ensure compliance with applicable OSHA regulations.

7.4 Site Control

Work zones will not be established for Level D activities. Individuals not directly involved in ongoing work will be requested to stay at least 50 feet away from Level D activities. For work inside a building, access will be controlled using building access control.

7.5 Decontamination

For activities requiring Level D protection and modified Level C protection without established work zones, it is unlikely major decontamination will be necessary. At the conclusion of each day or work period, disposable gloves and coveralls will be removed and disposed of in onsite containers.

If full Level C protection is required, minimum decontamination procedures associated with Level C protection will be followed and established within the Contamination Reduction Zone. These procedures are presented in Table 2.

7.6 Training

Kennedy Jenks personnel participating in field activities will have completed the Hazardous Waste Operations and Emergency Response 40-hour health and safety training course (29 CFR 1910.120), or have equivalent training, and have undergone annual 8-hour refresher training. Training requirements are discussed in Kennedy Jenks Health and Safety Operation Manual. Prior to each work day, a TSB meeting will be held at the site to familiarize personnel with health and safety issues, protective equipment, emergency information, and supplies and to discuss special topics.

7.7 Medical Monitoring

Kennedy Jenks personnel participating in field activities will be included in a medical monitoring program. The program includes a baseline physical examination, pulmonary function test, and blood and urine tests. Periodic (annual) examinations will be provided to employees who are exposed to hazardous substances or health hazards at or above the established PEL, above the published exposure levels for these substances, without regard to the use of respirators, for 30 days or more a year. Annual examinations will also be provided to Kennedy Jenks employees who wear a respirator for 30 days or more a year or as required by 1910.134. Details of the medical program are included in the Kennedy Jenks Health and Safety Operations Manual.

© 2021 Kennedy/Jenks Consultants, Inc

7.8 Sanitation and Illumination

The site may have drinking water, washing water, and restroom facilities available. If drinking water is not available at the site, a sufficient amount of water will be provided to accommodate each employee with 1 quart of water per hour. The water will be kept cool by means of a portable cooler with ice or similar means.

No eating, drinking, smoking, or gum or tobacco chewing is allowed in restricted areas.

Activities will take place during daylight hours. Because natural illumination (approximately 50- to 200-foot candles) will be sufficient to meet the 5-foot candle requirement for general site areas, no additional illumination will be required.

7.9 COVID-19 Procedures and Processes

The following information summarizes hazards, risks, and mitigation/minimization strategies for COVID-19 exposure and transmission in anticipation of field activities in the coming months. The procedures established herein provide a framework, with the expectation that site personnel will work together to optimize and refine these procedures to most effectively achieve the objective of minimizing COVID-19 exposure and transmission risks and safely completing their field assignments.

7.9.1 COVID-19 Background

COVID-19 is a new strain of coronavirus which originated in Wuhan, China, and has since been detected worldwide and now in the United States. COVID-19 is a respiratory virus and symptoms of infection include fever, dry cough, shortness of breath, and breathing difficulties. In severe cases, infection can cause pneumonia, acute respiratory syndrome, organ failure, and death . Treatment of COVID-19 is typically with medication to reduce fever and to support and improve respiratory function.

COVID-19 is thought to spread mainly from person-to-person between people who are in close contact with one another (within about 6 feet), or through respiratory droplets produced when an infected person coughs or sneezes. These droplets can land in the mouths or noses of people who are nearby or possibly be inhaled into the lungs. It may be possible that a person can get COVID-19 by touching a surface or object that has the virus on it and then touching their own mouth, nose, or possibly their eyes, but this is not thought to be the main way the virus spreads.

7.9.2 Prevention and Treatment

The best way to prevent illness is to avoid being exposed to this virus. COVID-19 vaccines are becoming available and being distributed to communities throughout the U.S. when available. Based on the information that is currently available, the vaccine is not expected to have wide-spread distribution until mid to late 2021. Centers for Disease Control and Prevention (CDC) recommends everyday preventive actions to help prevent the spread of respiratory diseases.

CDC Fact Sheets specific to COVID-19 are included in Appendix H.

© 2021 Kennedy/Jenks Consultants, Inc

7.9.3 Site-Specific Procedures and Guidelines

The following presents guidelines to be followed by all personnel onsite in conjunction with those already set in place. Other contractors/consultants working onsite should be provided this document and commit to abiding by these procedures (or more stringent firm-specific procedures). These procedures supplement those established in each firm's site-specific health and safety plan.

7.9.3.1 Transportation and Parking

Employees are encouraged to drive separately to/from the site, unless their vehicle provides adequate interior space for social distancing. Parking will be situated such that staff traveling between their designated workspace and vehicle should not encounter members of other field teams.

Travel around the site will occur on foot with appropriate social distancing and/or in separate vehicles.

7.9.3.2 Interactions Within Field Teams

All site personnel should limit physical interactions as much as practicable while still allowing for a safe and efficient workspace. Social distancing is the primary means of avoiding physical interactions. The means by which a field team establishes and maintains social distance is task- and location-specific and will be assessed and refined in the field. Those routine elements of the field program are addressed below and associated procedures ensure the CDC suggested 6-foot buffer during physical interactions.

7.9.3.3 Social Distancing – Non-Work Hours

Procedures established herein effectively limit interactions while onsite. To supplement these onsite procedures, all personnel who will be returning to site the following day should practice social distancing during non-work hours away from the facility. In the event that a questionable encounter occurs during non-working hours, Kennedy Jenks recommends that the employee mention the interaction at the next safety briefing to make others aware and refine onsite procedures if needed.

7.9.3.4 Meals

All personnel should pack and bring their meals (and snacks/drinks) onsite with them. Employees are discouraged from leaving the site during the workday.

7.9.3.5 Daily Safety Tailgate

Field teams conduct daily safety tailgate briefings at the beginning of every workday. These meetings will be conducted outside in the parking area onsite each morning. The meetings include daily scope of work and hazards that are present onsite. Recognizing the everchanging stream of information and decisions related to COVID-19, safety briefings will include an overview of pertinent updates. At the end of each meeting (and anytime during the day), all personnel present will have a chance to voice concerns. All personnel onsite have stop work authority, and COVID-19 comfort concerns are a valid reason to stop work and revisit the procedures outlined herein and/or make a go/no-go decision regarding additional field activities.

© 2021 Kennedy/Jenks Consultants, Inc

Field teams will record the meeting attendees in a field book in lieu of passing the tailgate sheet for signatures.

7.9.3.6 Sanitation

All personnel will be required to sanitize their field equipment at the end of the workday before leaving the site to help decrease spread or migration of the virus using sanitation wipes provided by their company. Similarly, once arriving onsite, all personnel should immediately thoroughly wash their hands in the designated restroom.

7.9.4 Communication and Updates

Kennedy Jenks will provide updates as more information on COVID-19 exposure and transmission risks becomes available.

While onsite, all personnel should practice safe prevention techniques as outlined in the Introduction and follow the guidelines hereinto. As the COVID-19 pandemic continues to unfold across the U.S. and in Washington, Kennedy Jenks will maintain constant communication with personnel onsite. Daily updates will be provided to verify that work can continue safely and address emerging situations.

IF YOU FEEL ILL, CONTACT YOUR H&S REPRESENTATIVE - DO NOT COME TO THE SITE.

© 2021 Kennedy/Jenks Consultants, Inc

Section 8: Emergency Response Plan

Hazard recognition is an essential part of the Emergency Response Plan. Initiation of the contingency plan relies on the employee's ability to recognize an emergency or potential for an emergency. The following is a list of events that will immediately initiate emergency procedures:

- Explosion
- Fire
- Release of organic vapors or particulate above the action levels
- Personal injury
- Failure or expected failure of runon/runoff control measures
- Natural occurrences (i.e., lightning, tornado, high winds, etc.)
- Spills.

8.1 Emergency Communications

Emergency communications will consist of two methods.

8.1.1 Verbal Communication

Verbal communication will be the primary method of emergency communication between onsite personnel, distance permitting.

8.1.2 Telephones

Telephones are used for routine communication and to notify offsite agencies of incidents and request assistance. Emergency telephone numbers are given in Section 9.

8.2 Emergency Protocol

When an event recognized as an emergency occurs, the alarm system will be used to notify personnel. As soon as the alarm system is activated, the SSO will be notified.

The SSO will take into account the following information:

- Nature of emergency
- Wind direction
- Location of personnel
- Monitoring results

© 2021 Kennedy/Jenks Consultants, Inc

- Emergency equipment available
- Offsite population.

Based on this information, the SSO will direct appropriate emergency action and agency notification. After the emergency has been controlled and the site is considered safe to re-enter, the SSO, in coordination with the Project Manager, will direct remedial action to restore the site to full operating condition.

The SSO will investigate the nature and cause of the incident so work procedures can be modified to minimize the likelihood of the incident's recurrence.

All incidents must be reported in a timely, appropriate manner to the Director of HS&E or H&S Manager. An incident is any unplanned event resulting in injury, damage, loss of assets, adverse publicity, or which requires notification of a regulatory agency, regardless of severity. All Kennedy Jenks personnel should report an incident to the SSO. The SSO will report to the Project Manager, who is responsible for notifying the Director of HS&E or H&S Manager.

Each incident will be investigated and a Root Cause Analysis Report will be generated and forwarded to the Project Manager and the H&S Manager.

If work zones are established, the Exclusion Zone will have several emergency exits, which will allow safe egress in multiple directions from any point onsite. The exit selection will be based on the emergency location, type of emergency, and wind direction. Upon hearing the evacuation signal or otherwise being notified of an evacuation, employees will immediately travel to the assembly area located at the decontamination station.

Employees will follow a route that avoids locations downwind from the emergency. If emergency exits are used, employees will proceed to the assembly area by the quickest route possible. When the assembly area is reached, employees will immediately check in with the SSO. The site will remain evacuated until the all clear signal has been given.

8.3 Emergency Supplies

The following is a list of emergency equipment available to take to the site:

- Portable emergency eye wash
- First aid supplies
- Cooler for water and ice (when temperatures are predicted to be above 85°F)
- Shade cover to protect from sun exposure.

All personnel will have a thorough understanding of the HASP before starting work. It will be reviewed periodically to keep it current with new or changing site conditions or information.

© 2021 Kennedy/Jenks Consultants, Inc

8.4 Injury Response

In the event of an employee injury in a contaminated area, consideration must be given before moving the injured and contaminated employee to outside the restricted contamination area. The nature of the injury, hazards posing an immediate danger, and other factors must all be weighed before moving an injured employee who is wearing contaminated PPE. Initial responders should follow directions from 9-1-1 personnel or the Director of HS&E or H&S Manager.

© 2021 Kennedy/Jenks Consultants, Inc

Section 9: Reporting (Injury/Illness, Property Damage, or Near Miss)

9.1 Injury/Illness Care and Notification Procedures

9.1.1 Emergency Services (9-1-1)

Call 9-1-1 for critical injuries or illnesses (i.e., head injuries, uncontrolled bleeding, difficulty breathing, chest pain, or altered level of consciousness) or if an employee or his/her supervisor has immediate concerns about an injury or illness.

9.1.2 Injury/Illness Intervention

Kennedy Jenks has retained WorkCare, a team of occupational physicians, to provide our employees with effective treatment of non-critical work-related injuries and illnesses. WorkCare provides on the spot, 24/7 employee consultations at the time an on-the-job incident occurs, as well as post-accident follow-up and consultation.

9.1.3 When to Call WorkCare

In the instance of a non-critical workplace injury or illness, an employee should call WorkCare at (888) 449-7787 to receive instruction on how to contact one of its clinicians and contact their immediate supervisor as soon as possible. Common non-critical workplace injuries/illnesses include:

- Back sprains
- Slips, trips, falls
- Shoulder strains
- Contact with a harmful substance.

9.1.4 Employee Role

The injured employee, if able, must do the following:

- Report any non-critical injuries/illness to WorkCare at (888) 449-7787 and, as soon as possible, to their immediate supervisor. WorkCare will notify the Director of HS&E and the H&S Manager of the injury or illness. The Director of HS&E will immediately notify the appropriate Business Unit President and Director of Operations of the injury or illness.

© 2021 Kennedy/Jenks Consultants, Inc

- If WorkCare determines medical attention is required, transportation must be provided for the injured employee. An injured employee must not transport himself/herself to a facility for medical treatment. If a co-worker is not available to transport the injured employee, an ambulance, a taxi, or other means of transportation must be provided, unless the employee is working in a remote area and no other form of transportation is available. WorkCare will send the employee to an approved local facility and inform the treating physician the injury is work related.

9.1.5 Project Manager Role

The Project Manager must do the following:

- Make sure the injured employee contacts WorkCare and is provided transportation to immediately obtain any required medical care from an approved doctor or hospital, if required.
- Provide emergency ambulance service if needed for critical injuries or illnesses, if required.
- Notify the Director of HS&E and H&S Manager of the injury or illness.

9.1.6 Injured Subcontractor or Other Non-Kennedy Jenks Employee

In the case of injuries or illness to non-employees, the appropriate staff member should ensure they receive proper medical attention, and their supervisor and the Director of HS&E are notified immediately. The Director of HS&E will notify Senior Leadership Team.

9.2 Property Damage and Near Miss Incident Investigation

All work-related property damage and near miss incidents will be investigated by Kennedy Jenks in a timely manner. Minor incidents and "near misses" will also be investigated so the risk of serious occurrences can be reduced in the future. All serious incidents and serious "near misses" will be investigated by the Director of HS&E or the H&S Manager.

- Near Miss. Incidents where no property was damaged and no personal injury sustained, but where, given a slight shift in time or position, damage and/or injury easily could have occurred.
- Rule of Thumb. If you need to ask yourself if the incident was a near miss or not, you have answered the question, and it is a near miss.

Forms

The Injury/Illness, Property Damage Incident, and Near Miss Reporting Forms are included as Appendix I.

© 2021 Kennedy/Jenks Consultants, Inc

Section 10: Emergency/Team Contacts & Approvals

Emergency Telephone Numbers

	Name	Phone
Site Contact	Dale Myers (DOE)	425-649-4446
WorkCare (Non-Critical Injuries)	WorkCare	888-449-7787
Fire Department[1]		9-1-1
Hospital: UW Medical Center 1959 NE Pacific Street, Suite 207 Seattle, WA 98195		206-598-3300
Directions to hospital[2]: See attached map		
Ambulance		9-1-1
Police		9-1-1
Kennedy Jenks:		
Project Manager	Ryan Hultgren	253-835-6432
Site Safety Officer (SSO)	Ryan Hultgren	253-835-6432
Health and Safety Manager	John Jindra	253-835-6466 (Office) 253-254-1079 (Cell)
Director of Health, Safety and Environment	Bert Drews	415-710-0002 (Cell)

[1] The local fire department prefers the public use 911 to assure the proper assistance in case of accident or injury.
[2] Attach written directions and map showing route to hospital.

Project Team Members Participating in Field Activities

Name	Affiliation	Responsibility	Signature/Date
Cayla Whiteside	KJ	Field Engineer/SSO	12/14/21
Gloria Gonzalez	KJ	Field Geologist/SSO	12/15/21
Matthew Grzegorzewski	KJ	Field Engineer/SSO	12/15/21
Bobby Ardissono	KJ	Field Engineer/SSO	12/15/21

Approvals

	Name	Signature/Date
Project Manager	Ryan Hultgren	12/9/21
Health and Safety Manager	Jay Knight (for John Jindra)	12/9/21

CC: Project File
PM Portal

© 2021 Kennedy/Jenks Consultants, Inc

Tables

Table 1: Chemicals Detected In Groundwater Monitoring Samples

Chemical	Maximum Concentrations (mg/L)	Sample Location
TPH[a] (GRO)[b]	historical: 464 recent: 109	MW-8[c] (2001) MW-13[c] (2006)
Benzene	historical: 54 recent: 7.26	MW-13 (1990) MW-13 (2006)
Toluene	historical: 28 recent: 14.7	MW-4[c] (2001) MW-13 (2006)
Ethylbenzene	historical: 50 recent: 27.7	MW-13 (1990) MW-8 (2006)
Total Xylenes	historical: 17.1 recent: 15.5	MW-4 (2001) MW-13 (2006)
MTBE	15.5 ug/L	MW-15 (2003)

Note:
(a) Total petroleum hydrocarbon
(b) Gasoline-range organics
(c) Non-aqueous phase liquid (NAPL) has been present historically in wells MW-4, -8, -9, and -13.
mg/L = milligrams per liter
ug/L = micrograms per liter

© 2021 Kennedy/Jenks Consultants, Inc

Table 2: Chemicals Detected in Soil Samples

Chemical	Maximum Concentrations (mg/kg)	Sample Location
TPH[a] (GRO)[b]	1700	NW-1 (north side of former UST excavation area) at 13 feet bgs[c] (1990)
Benzene	31	NW-1 (north side of former UST excavation area) at 13 feet bgs (1990)
Toluene	55	NW-1 (north side of former UST excavation area) at 13 feet bgs (1990)
Ethylbenzene	140	NW-1 (north side of former UST excavation area) at 13 feet bgs (1990)
Total Xylenes	300	NW-1 (north side of former UST excavation area) at 13 feet bgs (1990)

Note:
(a) Total petroleum hydrocarbon
(b) Gasoline-range organics
(c) Below ground surface
mg/kg = milligrams per kilogram

© 2021 Kennedy/Jenks Consultants, Inc

Table 3: Chemical Allowable Exposure Values and Exposure Symptoms

Chemical	TLV TWA[a]	CalOSHA STEL[b]	CalOSHA PEL[b]	Acute Exposure Symptoms[c]	Target Organs[d]
Benzene	0.5 ppm	5 ppm	1 ppm	Irritant to eyes, nose respiratory system nausea.	Skin[d], liver, kidneys, respiratory system, cardiovascular system, central nervous system.
Ethylbenzene	100 ppm	125 ppm	100 ppm	Irritant to eyes, mucous membranes, dermatitis, narcosis coma.	Skin, liver, kidneys, respiratory system, cardiovascular system, central nervous system.
Toluene	50 ppm	300 ppm ceiling	100 ppm	Fatigue, weakness, confusion, euphoria, dizziness, headache, dilated pupils.	Central nervous system, liver, kidneys, skin.
Xylene	100 ppm	150 ppm	100 ppm	Dizziness, excitement, vomiting.	Central nervous system, eyes, gastrointestinal (GI) tract, blood, liver, kidneys, skin.
Methanol (preservative)	100 ppm	250 ppm	200 ppm IDLH 6,000 ppm	Eye, skin and mucus irritant, dizziness, nausea.	Optic nerve, liver, and other organ damage.
Lead	0.05 mg/m^3	----	0.05 mg/m^3 IDLH 100 mg/m^3	Weakness, lassitude, insomnia, facial pallor, abdominal pain, anemia, tremor, eye irritation, liver and kidney disease.	Eyes, GI tract, CNS, kidneys, blood, gingival tissue.
Gasoline	None Developed	----	None Developed	Irritant to eyes, skin, mucous membranes, dermatitis, lassitude, blurred vision, dizziness, slurred speech, confusion, convulsions.	Eyes, skin, respiratory system, CNS, liver, kidneys.
Ethylene dichloride (1,2-DCE; EDC)	1 ppm (Ca TWA[c])	2 ppm (ST REL[c])	50 ppm TWA	Irritant to eyes, corneal opacity, CNS depression, nausea, vomiting, dermatitis.	Eyes, skin kidneys, liver, CNS, cardiovascular system.
Ethylene dibromide (1,2-DBE; EDB)	0.045 ppm (Ca TWA[c])	----	20 ppm TWA	Irritant to eyes, skin, respiratory system, dermatitis with vesiculation..	Eyes, skin, respiratory system, liver, kidneys, reproductive system.

Notes:

(a) TLV TWA = threshold limit value – 8-hour time-weighted average.
STEL = short-term exposure limit.
American Conference of Governmental Industrial Hygienists. TLV and Biological Exposure Indices for 1997.
TLV TWA reported in ppm represents parts of vapor per million parts of air by volume at 25 degrees Celsius (°C) and 760 torr. TLV - TWA reported in milligrams per cubic meter (mg/m^3) represents milligrams of substance per cubic meter of air.

(b) PEL = Federal Occupational Safety and Health Administration (OSHA) (29 CFR 1910 Subpart Z) Permissible Exposure Level based on 8-hour time weighted average.

(c) Source: U.S. Department of Health and Human Services. National Institute for Occupational Safety and Health (NIOSH) Pocket Guide to Chemical Hazards. June 1994. Sittig, Marshall. 1985. Handbook of Toxic and Hazardous Chemicals and Carcinogens. Park Ridge, New Jersey. Noyes Publications.

(d) Skin notation indicates route of exposure through cutaneous absorption.

ppm = parts per million
IDLH = immediately dangerous to life and health

© 2021 Kennedy/Jenks Consultants, Inc

Table 4: Measures for Level C Decontamination

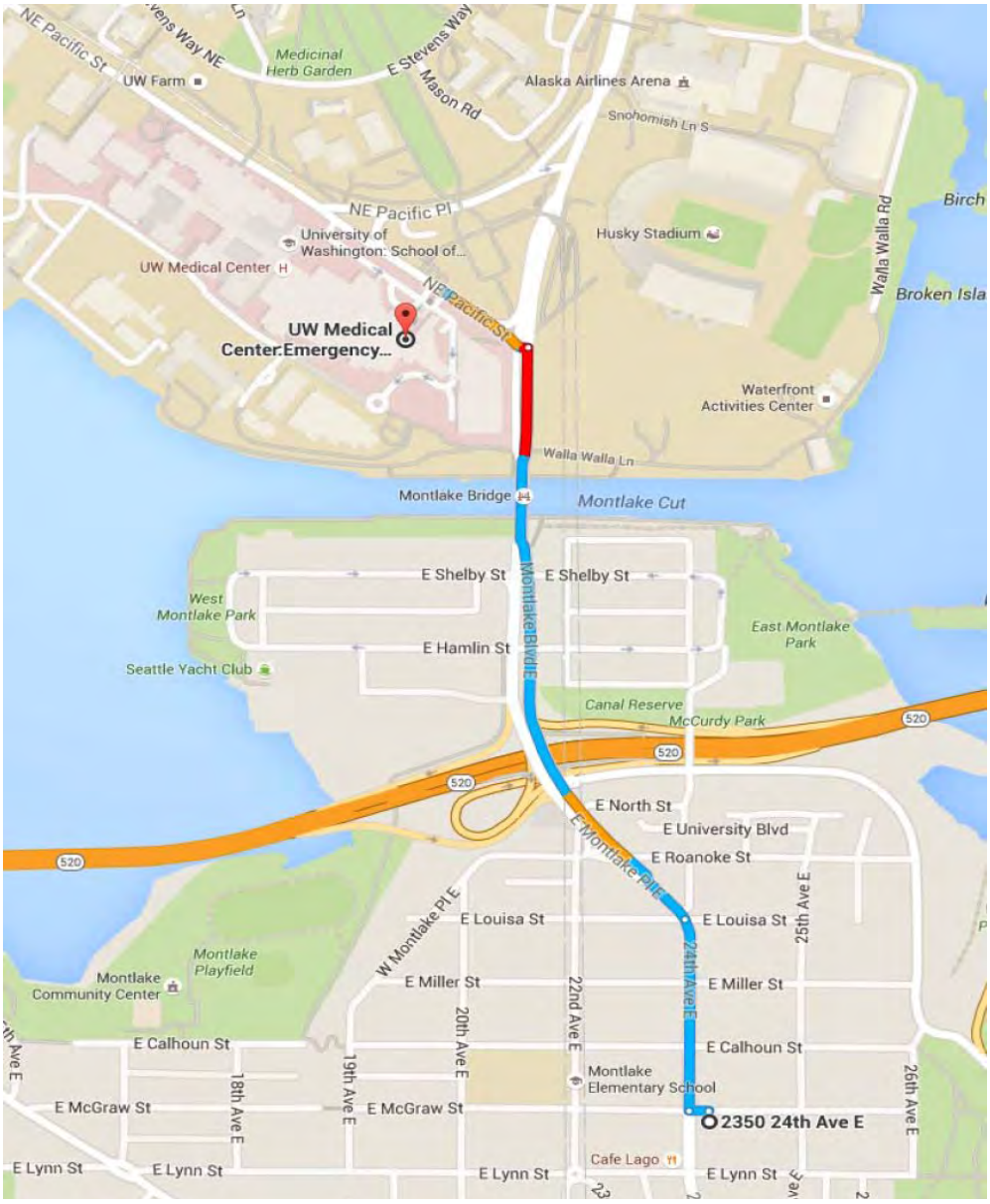
Station	Description
1	**Equipment Drop** Deposit equipment used onsite (tools, sampling devices and containers, monitoring instruments, radios, clipboards, etc.) on plastic drop cloths. Segregation at the drop reduces the probability of cross contamination. During hot weather operations, a cool down station may be set up within this area.
2	**Outer Garment, Boots, and Gloves Wash and Rinse** Scrub outer boots, outer gloves, and splash suit with decon solution or detergent water. Rinse off using copious amounts of water.
3	**Outer Boot and Glove Removal** Remove outer boots and gloves. Deposit in container with plastic liner.
4	**Canister or Mask Change** If worker leaves Exclusion Zone to change canister (or mask), this is the last step in the decontamination procedure. Worker's canister is exchanged, new outer gloves and boot covers donned, joints taped, and worker returns to duty.
5	**Boot, Gloves and Outer Garment Removal** Boots, chemical-resistant splash suit, inner gloves removed and deposited in separate containers lined with plastic.
6	**Face Piece Removal** Face piece is removed. Avoid touching face with fingers. Face piece is deposited on plastic sheet.
7	**Field Wash** Hands and face are thoroughly washed. Shower as soon as possible.

© 2021 Kennedy/Jenks Consultants, Inc

Attachment 1

Site Map

Map and Written Directions to Local Hospital



- From the Site, turn north onto 24th Avenue East.
- Follow 24th Avenue northbound; 24th Avenue becomes East Montlake Place E and then Montlake Blvd East (north of SR 520).
- Follow Montlake Blvd northbound to NE Pacific Street.
- Turn left (westbound) onto NE Pacific Street.
- Turn left from NE Pacific Street to UW Medical Center.

Appendix A

Job Hazard Analysis

Appendix B

Tailgate Safety Briefing Record

Kennedy Jenks

Kennedy Jenks
DAILY TAILGATE SAFETY BREIFING

Project Name: _____ Date: _____

Project No.: _____ Conducted By: _____ Contractor(s): _____

Check the Topics/Information Reviewed:

- O emergency procedures & evacuation route
- O site-specific safety plan, review and location
- O fire prevention/safety/fire extinguishers
- O training/certification
- O COVID-19
- O sharp objects, rebar, and scrap metals
- O slips, trips, and falls
- O vehicle safety and driving/road conditions
- O overhead utility locations and clearances
- O open pits and excavations
- O drinking water and restroom locations
- O smoking in designated areas only
- O eye wash station locations
- O Hazard Communication//SDS locations
- O site control/security
- O heat and cold stress
- O confined spaces
- O fall protection
- O insects/snakes/biological hazards
- O daily scope of work
- O directions to hospital
- O stop work authority
- O pinch points
- O lifting techniques
- O site housekeeping
- O parking and lay down areas
- O backing-up hazards
- O location of utilities
- O noise hazards
- O equipment movement
- O decontamination procedures
- O first aid
- O no horseplay
- O visitors / media / passers-by
- O lockout/tagout
- O ladders safety
- O scaffolding
- O cell phone usage / prohibitions
- O personal protective equipment
- O hard hats, safety vest, steel-toe boots
- O strains and sprains
- O buddy system
- O tool safety
- O public safety
- O traffic safety
- O hearing & eyewear protection
- O flying debris hazards
- O fire extinguisher locations
- O heavy equipment hazards
- O dust and/or vapor control
- O drug and alcohol policy
- O weather hazards
- O electrical hazards
- O other _____

***Discussion/Comments/Questions/Near Misses/Follow-up Actions*:**

List Any Special Site Conditions / H&S Precautions Reviewed

By signing below, I acknowledge that I have participated in this safety briefing. I am aware that a site-specific safety plan exists for this project and that it is available to me upon request.

NAME	***SIGNATURE***	***COMPANY***

© 2021 Kennedy/Jenks Consultants, Inc

Appendix C

Heat Stress Fact Sheet

HEAT EXHAUSTION

What happens to the body:

Headaches, dizziness, or light-headedness, weakness, mood changes, irritability or confusion, feeling sick to your stomach, vomiting, fainting, decreased and dark-colored urine, and pale, clammy skin.

What should be done:

- Move the person to a cool, shaded area. Don't leave the person alone. If the person is dizzy or light-headed, lay him on his back and raise his legs about 6-8 inches. If the person is sick to his stomach, lay him on his side.
- Loosen and remove heavy clothing.
- Have the person drink some cool water (a small cup every 15 minutes) if he is not feeling sick to his stomach.
- Try to cool the person by fanning him. Cool the skin with a cool spray mist of water or wet cloth.
- If the person does not feel better in a few minutes call for emergency help (ambulance or 911.)

If heat exhaustion is not treated, the illness may advance to heat stroke.

PUBLICATION F417-218-909 [05-2008]

HEAT STROKE - A Medical Emergency

What happens to the body:

Dry, pale skin, sweating may still be present; hot, red skin (looks like a sunburn); mood changes; irritability, confusion, and not making any sense; seizures or fits, and collapse (will not respond).

What should be done:

- Call for emergency help (ambulance or 911.)
- Move the person to a cool, shaded area. Don't leave the person alone. Lay him on his back and if the person is having seizures; remove objects close to him so he won't hit them. If the person
  is sick to his stomach, lay him on his side.
- Remove heavy and outer clothing.
- Have the person drink small amounts of cool water if he is alert enough to drink anything and not feeling sick to his stomach.
- Try to cool the person by fanning him or her. Cool the skin with a cool spray mist of water, wet cloth, or wet sheet.
- If ice is available, place ice packs in armpits and groin area.

PREVENTING HEAT-RELATED ILLNESS

- Drink a lot of water, about 1 cup every 15 minutes.
- Know the signs/symptoms of heat-related illness; monitor yourself and co-workers.
- Block out direct sun or other heat sources.
- Use cooling fans/air-conditioning; rest regularly.
- Wear lightweight, light colored, loose-fitting clothes.
- Avoid alcohol, caffeinated drinks, or heavy meals.

Washington State Department of
Labor & Industries
Division of Occupational Safety and Health

HEAT EXHAUSTION

What happens to the body:

Headaches, dizziness, or light-headedness, weakness, mood changes, irritability or confusion, feeling sick to your stomach, vomiting, fainting, decreased and dark-colored urine, and pale, clammy skin.

What should be done:

- Move the person to a cool, shaded area. Don't leave the person alone. If the person is dizzy or light-headed, lay him on his back and raise his legs about 6-8 inches. If the person is sick to his stomach, lay him on his side.
- Loosen and remove heavy clothing.
- Have the person drink some cool water (a small cup every 15 minutes) if he is not feeling sick to his stomach.
- Try to cool the person by fanning him. Cool the skin with a cool spray mist of water or wet cloth.
- If the person does not feel better in a few minutes call for emergency help (ambulance or 911.)

If heat exhaustion is not treated, the illness may advance to heat stroke.

PUBLICATION F417-218-909 [05-2008]

HEAT STROKE - A Medical Emergency

What happens to the body:

Dry, pale skin, sweating may still be present; hot, red skin (looks like a sunburn); mood changes; irritability, confusion, and not making any sense; seizures or fits, and collapse (will not respond).

What should be done:

- Call for emergency help (ambulance or 911.)
- Move the person to a cool, shaded area. Don't leave the person alone. Lay him on his back and if the person is having seizures; remove objects close to him so he won't hit them. If the person
  is sick to his stomach, lay him on his side.
- Remove heavy and outer clothing.
- Have the person drink small amounts of cool water if he is alert enough to drink anything and not feeling sick to his stomach.
- Try to cool the person by fanning him or her. Cool the skin with a cool spray mist of water, wet cloth, or wet sheet.
- If ice is available, place ice packs in armpits and groin area.

PREVENTING HEAT-RELATED ILLNESS

- Drink a lot of water, about 1 cup every 15 minutes.
- Know the signs/symptoms of heat-related illness; monitor yourself and co-workers.
- Block out direct sun or other heat sources.
- Use cooling fans/air-conditioning; rest regularly.
- Wear lightweight, light colored, loose-fitting clothes.
- Avoid alcohol, caffeinated drinks, or heavy meals.

Washington State Department of
Labor & Industries
Division of Occupational Safety and Health

© 2021 Kennedy/Jenks Consultants, Inc

Appendix D

Cold Stress Fact Sheet

COLD STRESS PREVENTION

OSHA® QUICK CARD™

Protecting Workers from Cold Stress

Cold temperatures and increased wind speed (wind chill) cause heat to leave the body more quickly, putting workers at risk of cold stress. Anyone working in the cold may be at risk, e.g., workers in freezers, outdoor agriculture and construction.

Common Types of Cold Stress

Hypothermia

- Normal body temperature (98.6°F) drops to 95°F or less.
- **Mild Symptoms**: alert but shivering.
- **Moderate to Severe Symptoms**: shivering stops; confusion; slurred speech; heart rate/breathing slow; loss of consciousness; death.

Frostbite

- Body tissues freeze, e.g., hands and feet. Can occur at temperatures above freezing, due to wind chill. May result in amputation.
- **Symptoms**: numbness, reddened skin develops gray/white patches, feels firm/hard, and may blister.

Trench Foot (also known as Immersion Foot)

- Non-freezing injury to the foot, caused by lengthy exposure to wet and cold environment. Can occur at air temperature as high as 60°F, if feet are constantly wet.
- **Symptoms**: redness, swelling, numbness, and blisters.

Risk Factors

- Dressing improperly, wet clothing/skin, and exhaustion.

For Prevention, Your Employer Should:

- Train you on cold stress hazards and prevention.
- Provide engineering controls, e.g., radiant heaters.
- Gradually introduce workers to the cold; monitor workers; schedule breaks in warm areas.

How to Protect Yourself and Others

- Know the symptoms; monitor yourself and co-workers.
- Drink warm, sweetened fluids (no alcohol).
- Dress properly:
  - Layers of loose-fitting, insulating clothes
  - Insulated jacket, gloves, and a hat (waterproof, if necessary)
  - Insulated and waterproof boots

What to Do When a Worker Suffers from Cold Stress

For Hypothermia:

- Call 911 immediately in an emergency.
- To prevent further heat loss:
  - Move the worker to a warm place.
  - Change to dry clothes.
  - Cover the body (including the head and neck) with blankets, and with something to block the cold (e.g., tarp, garbage bag). Do **not** cover the face.
- If medical help is more than 30 minutes away:
  - Give warm, sweetened drinks if alert (no alcohol).
  - Apply heat packs to the armpits, sides of chest, neck, and groin. Call 911 for additional rewarming instructions.

For Frostbite:

- Follow the recommendations "**For Hypothermia**".
- Do not rub the frostbitten area.
- Avoid walking on frostbitten feet.
- Do not apply snow/water. Do not break blisters.
- Loosely cover and protect the area from contact.
- Do not try to rewarm the area unless directed by medical personnel.

For Trench (Immersion) Foot:

- Remove wet shoes/socks; air dry (in warm area); keep affected feet elevated and avoid walking. Get medical attention.

© 2021 Kennedy/Jenks Consultants, Inc

Appendix E

Utility Location Standard Operations Procedures

Utility Location and Acknowledgement Form

KENNEDY JENKS

STANDARD OPERATING PROCEDURES

INVASIVE ACTIVITIES - UTILITY LOCATION PROCEDURES

Below is a summary of the minimum requirements for location of potential underground utilities where invasive activities are planned. Invasive activities include, but are not limited to, drilling soil borings, installing wells, hand-auger borings, excavating test pits, remedial injections, and other similar activities which penetrate the ground surface.

Minimum Procedures

1. Contact the client or property owner where invasive activities will be performed to inquire about possible underground utilities and request maps or drawings documenting the location of the utilities. Document your request for information (e.g., written email request for information).

2. Contact the local/regional underground utility location center to document planned activities and request all underground utilities be located. In most (if not all) of the United States, this can be initiated by dialing "811". Contacting the local underground utility center is also required by state law. Contacting the local utility location center is required for each episode (event) of invasive work. It is preferred to arrange a field meeting with utility representatives to confirm the absence of utilities at each drilling location. Maintain a written record for each boring/invasive location and get signatures from the locators documenting the locations are clear of utilities. This can be performed on a site map or KJ's *Utility Locate Form & Acknowledgment Form* (provided in the KJ Safety Zone). The goal is to have written acknowledgement that all final drilling locations are free of underground utilities.

3. At all locations where drilling, probing or well installation will be performed, an air-knife or similar form of suction pot-holing will be performed to assess possible underground utilities in the upper 6 to 8 feet of soils (depending on local conditions and expected depth of utilities). Potholing is required at **all drilling locations**, except in remote areas where the likelihood of encountering underground utilities is very low and only as approved by a Risk Manager, Resource Manager or Officer of the company familiar with underground utilities. (Note: Use of an air knife will be appropriate for most invasive drilling and probing work, but may not be appropriate for certain activities like very shallow borings (less than 1 foot deep), certain hand-auger borings, remedial injections using probe equipment and test pitting.) Case by case exceptions for activities may be provided.

Optional Step – While it is recommended under most conditions, an optional additional step includes coordinating (including establishing a written contract) with a private utility locator to perform an independent utility evaluation to locate "all underground utilities" at the proposed locations of invasive work. Maintain written record for each boring/invasive location and get signatures from the locators. *[Note: This step is typically not too expensive and can save costs incurred during suction pot-holing by focusing the areas of the borings (i.e., provides prior knowledge of possible utilities).]*

© 2021 Kennedy/Jenks Consultants, Inc

KENNEDY JENKS
UTILITY LOCATION & ACKNOWLEDGEMENT FORM
Call 811 for Utility Locate at Least 48 Hours Prior to Work

Project Location: _____

Project Number: _____

Project Name: _____

Planned Start Date of Field Activities: _____

Kennedy Jenks Personnel: _____

Private Utility Locator Name: _____

811 Contact Date and Time (48 hours before work begins): _____

KJ One-Call Contractor ID# (varies by state) _____

Ticket Number: _____

Utility Clearance Information

How Were Boring/Excavation Locations Cleared:

Utilities Contacted by 811	Utility Contact Number	Utility Contacted by Telephone	Marked in Field	Other (Describe)

Contact information verified by (KJ Staff):_____

Scheduled On-Site Meeting Location (if applicable):

Public Utility_____

Private Utility Locator_____

Use back of sheet to sketch of identified utilities and proposed boring/excavation locations **OR** attach figure. Include north arrow and structures if applicable.

Notes:

Mark all proposed borings and excavations with WHITE paint per APWA Utility Color Codes.

Request locator to mark utilities as required by their standard operating procedures or at least within 25 feet of boring/excavation, whichever is greater, with paint/flags.

Utility marks are valid for 14 calendar days and must be remarked if work continues beyond 14 days.

© 2021 Kennedy/Jenks Consultants, Inc

Appendix F

Field Chemical Use Policy and Procedures

Field Chemical Use Form

Hazard Communications Written Program

Field Chemical Use Policy & Procedures

Policy: Kennedy Jenks will follow appropriate chemical handling protocol, implement proper health and safety measures, and follow appropriate waste regulations when using chemicals in the field. Examples of field chemical use include, but are not limited to:

- Test kits with chemical reagents
- Chemical preservatives for samples
- Chemicals for field investigations, bench tests, and pilot studies
- Special chemicals for cleaning equipment.

Procedures: Business Unit Health & Safety Managers must review and approve field chemical use before chemicals can be purchased or taken into the field. A site-specific project Health and Safety Plan (HASP) that addresses field chemical use must be prepared by the Project Manager, then reviewed and approved by the Business Unit Health & Safety Manager. The portion of a project HASP that addresses field use of chemicals should include the following information:

- Chemical use justification. Include evaluation of alternatives, such as, less hazardous chemicals, alternative means of measuring (direct measurements without chemical reagents), and testing by a commercial laboratory or mobile laboratory.
- List of chemicals to be used, including quantities on hand.
- Safety Data Sheets (SDS) for the chemicals.
- Names of staff members that will be using the chemicals.
- Personal protective equipment (PPE) required.
- Description of how the materials will be transported, where the materials will be received and how the materials will be stored (note that our office leases prohibit handling or storage of hazardous materials or non-hazardous materials in quantities considered hazardous).
- Description of how the waste residuals will be disposed. Hazardous wastes generated from field testing, pilot studies, or equipment decontamination must be disposed in accordance with state and federal hazardous waste regulations. Project Managers should include provisions and budget for assisting clients with residual waste disposal. As the generator, the client should sign the hazardous waste manifest. Consider:
    - Coordinating with a local analytical laboratory to accept the waste. Some laboratories will accept small quantities of reagent waste along with samples for disposal for a small fee. This typically involves collecting the wastes in an appropriate container, placing wastes into a sealed container inside of a cooler, and including safety data sheets for the materials with the shipment.

© 2021 Kennedy/Jenks Consultants, Inc

- Using client's existing hazardous waste generator process to dispose of waste. Provide client with information on the type of waste generated to assure compatibility with existing waste streams.

- Returning excess chemicals to the vendor for recycling or reuse. Wherever possible, purchase reagents from a vendor that will accept return of unused product. Have the vendor provide appropriate packaging materials for the return shipment.

- Disposing of non-hazardous residuals as solid waste or in a sanitary sewer. Some wastes, with review and approval by the Business Unit Health & Safety Manager, can be disposed of in the local municipal solid waste or wastewater systems.

This information on the field use of chemicals can be provided by incorporating the example form provided at the end of this document into the HASP. An SDS for each chemical or product must be attached to the HASP. The Business Unit Health & Safety Manager will review the HASP and conduct appropriate Hazard Communication update training for the staff that will be using the chemicals.

© 2021 Kennedy/Jenks Consultants, Inc

Project Task: _____

Name of Preparer: _____

Describe Evaluation of Alternatives to Chemical Use:

Chemicals to be Used for Project:

Chemical Name	Quantity (indicate units)

Names of Staff Using Chemicals During Project:

Describe Personal Protection to be Used When Using or Handling Chemicals:

- ☐ Safety Goggles
- ☐ Nitrile Gloves
- ☐ Respirator with _____ cartridges
- ☐ Other: _____
- ☐ Portable Eye Wash
- ☐ Splash Apron/Coveralls
- ☐ Face Shield

Describe how Chemicals will be Transported and Stored at Project Site:

Describe How Used or Leftover Chemicals will be Disposed:

_____ _____

Health and Safety Manager Approval Signature **Date Approved**

© 2021 Kennedy/Jenks Consultants, Inc

Appendix G

Safety Data Sheets (SDSs)

Appendix H

CDC Fact Sheets

SHARE FACTS ABOUT COVID-19

Know the facts about coronavirus disease 2019 (COVID-19) and help stop the spread of rumors.

FACT 1

Diseases can make anyone sick regardless of their race or ethnicity.

Fear and anxiety about COVID-19 can cause people to avoid or reject others even though they are not at risk for spreading the virus.

FACT 2

For most people, the immediate risk of becoming seriously ill from the virus that causes COVID-19 is thought to be low.

Older adults and people of any age who have serious underlying medical conditions may be at higher risk for more serious complications from COVID-19.

FACT 3

Someone who has completed quarantine or has been released from isolation does not pose a risk of infection to other people.

For up-to-date information, visit CDC's coronavirus disease 2019 web page.

FACT 4

There are simple things you can do to help keep yourself and others healthy.

- Wash your hands often with soap and water for at least 20 seconds, especially after blowing your nose, coughing, or sneezing; going to the bathroom; and before eating or preparing food.
- Avoid touching your eyes, nose, and mouth with unwashed hands.
- Stay home when you are sick.
- Cover your cough or sneeze with a tissue, then throw the tissue in the trash.

FACT 5

You can help stop COVID-19 by knowing the signs and symptoms:

- Fever
- Cough
- Shortness of breath

Seek medical advice if you

- Develop symptoms

AND

- Have been in close contact with a person known to have COVID-19 or if you live in or have recently been in an area with ongoing spready of COVIID-19.

cdc.gov/COVID-19

Appendix I

Injury/Illness, Property Damage Incident, Near Miss Reporting Forms, and Motor Vehicle Accident Report

Injury/Illness Report Form

This form should only be used for reporting an incident resulting in employee injury/illness. Prior to completing this form, verify that the appropriate notifications have been made as identified below. Use the Property Damage/Incident Report Form to document property damage or other incident. Use the Near-Miss Report Form to document Near-Misses.

Name and job title of injured/illness employee:

Employee's address and telephone number:

Time, Date, and Location where the injury/illness occurred:

Address of KJ site contact:

Check the appropriate nature of injury/illness(s):

___ Sprain	___ Laceration	___ Impact/Compression Injury	___ Nausea
___ Fracture	___ Puncture	___ Allergic Reaction	___ Chemical/Substance Exposure
___ Abrasion	___ Avulsion (amputation)	___ Eye Injury	___ Heat/Cold Exposure
___ Bruise	___ Burn	___ Hearing-Related Injury	
___ Altered Level of Consciousness		___ Respiratory/Cardiac-Related Event	

Identify the body part affected:

What was the employee doing when the injury/illness occurred?

© 2021 Kennedy/Jenks Consultants, Inc

What action, mechanism, or piece of equipment directly contributed to the injury/illness?

What other processes or items may have indirectly contributed to the employee injury/illness?

Description of accident, accident scene and if accident scene has been instrumentally altered by employees, bystanders and/or emergency personnel and equipment:

How might have this injury/illness been avoided?

Was the injury/illness immediate or did it gradually evolve over time?

If this event occurred at a job site, was a site-specific safety plan prepared and approved? If so, please attach to this form.

If this event occurred at a job site, was a job hazard analysis completed for the task which the employee was performing at the time of injury/illness? If so, please attach.

What were weather conditions at the time of the injury/illness?

Was the employee's supervisor notified? When?

© 2021 Kennedy/Jenks Consultants, Inc

Did the employee contact WorkCare for medical direction? When?

List emergency medical services, fire, or law enforcement agencies summoned for the injured employee:

Provide names and phone numbers of witnesses:

Injured employee was transported to:

Name of person preparing this report: _____

Title: _____ Date: _____

© 2021 Kennedy/Jenks Consultants, Inc

Property Damage Incident Report Form

This form should be used only for an incident resulting in property damage without injury to employees involved. Use the Injury/Illness Report Form to document employee injuries. Use the Near-Miss Report Form to document Near-Misses.

Name(s) of employee(s) involved:

Time, Date, and Location where the incident occurred:

Description of the incident:

What was the employee doing when the incident occurred?

What action, mechanism, or piece of equipment may have directly contributed to the incident?

What other processes or items may have indirectly contributed to this incident?

If this incident occurred at a job site, was a site-specific safety plan prepared and approved? If so, please attach to this form.

Detail any corrective actions taken.

© 2021 Kennedy/Jenks Consultants, Inc

Provide names and phone numbers of witnesses:

Name of person preparing this report: _____

Title: _____ Date: _____

Signature of H&S Manager: _____ Date:_____

Signature of Project Manager: _____ Date:_____

© 2021 Kennedy/Jenks Consultants, Inc

Near-Miss Report Form

This form should only be used for Near-Miss events which did NOT result in injury or property damage. Use the Injury/Illness Report Form to record injuries or illness. Use the Property Damage Incident Report Form to record property damage.

Date: _____ Location: _____

Time: _____ ☐a.m. ☐p.m.

Weather Conditions: _____

Please check all that apply:

☐Unsafe Act ☐Unsafe Condition ☐Unsafe Equipment ☐Unsafe Use of Equipment

Description of Near-Miss in detail:

Employee Name _____ Date: _____

This section to be completed by Health & Safety Manager or Representative.

Cause of Near-Miss:

Corrective action(s) taken:

H&S Manager _____ Date: _____

© 2021 Kennedy/Jenks Consultants, Inc

Kennedy Jenks
Motor Vehicle Accident Report

Directions: Employee, Project Manager or Supervisor must gather the detailed information below and submit to the Health and Safety Manager (John Jindra) and the Chief Risk Officer (Jerry Cavaluzzi) for review as soon as possible or safe to do so.
After review and approval by the Health and Safety Manager and the Chief Risk Officer, Employee, Project Manager or Supervisor must contact Zurich noting Policy Number BAP9326879 and E-mail Accident Report to: USZ_CareCenter@Zurichna.com Phone: 1-800-987-3373
Copy Katie Haun at Khaun@lockton.com and Jerry Cavaluzzi at JerryCavaluzzi@KennedyJenks.com on initial report.

Employee Information

Employee Name: _____

Address: _____ City: _____ State: _____ Zip: _____

Home Phone (_____) _____-_____ Employee's preferred language: _____

Driver's License: _____ State Issued _____ Injured? ☐ Yes ☐ No

Company Vehicle

Was the vehicle Company/Personal/Rental? _____ Rental Agency: _____

Year: _____ Make: _____ Model: _____ License Plate Number: _____

VIN: _____ Area of Damage to Vehicle: _____

Vehicle Drivable? ☐ Yes ☐ No Phone number of garage taken to: _____

Accident Information

Date of Accident: _____/_____/_____ Time of Accident: _____:_____A.M./P.M.
Location of Accident: _____ City: _____ State: _____ Zip: _____

Were Police Called? ☐ Yes ☐ No Department: _____

Officer Name/Badge # _____ Phone (_____)_____-_____

Police Report Number: _____ Was a citation/ticket issued to any driver? ☐ Yes ☐ No

Reason: _____

How did accident occur? (please be specific) _____

Other Vehicle (use additional sheet if necessary, for additional vehicles)

Was another person/vehicle involved in accident? ☐ Yes ☐ No Were they issued a citation? ☐ Yes ☐ No

Year: _____ Make: _____ Model: _____ License Plate Number: _____ Driver's License #: _____

Owner's Name: _____ Address: _____ City: _____ State: _____ Zip: _____

Driver's Name: _____ Address: _____ City: _____ State: _____ Zip: _____

Home Phone (_____)_____-_____ Work Phone (_____) _____-_____ Damage to Vehicle: _____

Insurance Carrier: _____ Policy #: _____ Agent's Name: _____ Phone (_____)_____-_____

Were there passengers in the other vehicle? ☐ Yes ☐ No

Name: _____ Phone (_____)_____-_____ Injured ☐ Yes ☒ No

Name: _____ Phone (_____)_____-_____ ☐ Yes ☒ No

Name: _____ Phone (_____)_____-_____ ☐ Yes ☐ No

Witness Information

Were there any witnesses to this accident? Yes No

Name: _____ Phone (_____)_____-_____

Name: _____ Phone (_____)_____-_____

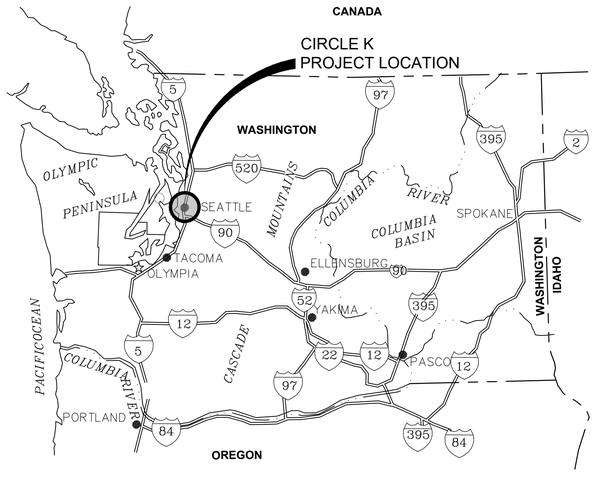
Revised: 08/20/2020

Appendix D

Design Drawings

[To be replaced with as-builts
once system installation is complete]

LOCATION MAP
SCALE: NTS



VICINITY MAP
SCALE: NTS

DEPARTMENT OF ECOLOGY
State of Washington

SITE: CIRCLE K 1461, CSID #5089

PROJECT: ENVIRONMENTAL REMEDIATION SYSTEM INSTALLATION

LOCATION: 2350 24TH AVE E,
SEATTLE, KING COUNTY, WASHINGTON 98112

DRAWING INDEX

ISSUED FOR BID

ANY PRINTS NOT BEARING THIS STAMP MAY HAVE BEEN PRINTED PRIOR TO ADVERTISING AND CANNOT BE CONSIDERED AS BID DOCUMENTS. USERS OF THIS DOCUMENT IN EDITABLE ELECTRONIC FORMATS ARE CAUTIONED AGAINST USE WITHOUT FIRST DETERMINING WHETHER CHANGES MAY HAVE BEEN MADE SUBSEQUENT TO ITS PREPARATION.

NO	REVISION	DATE	BY

SCALES
0 ——— 1"
0 ——— 25mm
IF THIS BAR IS NOT DIMENSION SHOWN, ADJUST SCALES ACCORDINGLY.

BENJAMIN EDWARD FUENTES — STATE OF WASHINGTON — 88495 — REGISTERED PROFESSIONAL ENGINEER

DESIGNED CMW
DRAWN RLH
CHECKED BEF

DEPARTMENT OF ECOLOGY State of Washington

WASHINGTON STATE DEPARTMENT OF ECOLOGY
BELLEVUE, WASHINGTON
CIRCLE K SITE 1461 ENVIRONMENTAL REMEDIATION SYSTEM INSTALLATION
SEATTLE, WASHINGTON

Kennedy Jenks

TITLE SHEET, VICINITY AND LOCATION MAPS, AND DRAWING INDEX

SCALE: AS SHOWN
JOB NO: 2196008.00
DATE: OCTOBER 2022
SHEET 1 OF 19
G-01

Plot Date: 10/11/2022 7:23 AM
User: RICHARD HILLS
File: C:\bms\kjpe-pw\d0181581\2\19600800-G-01.DWG

Plot Date: 10/11/2022 7:25 AM
User: RICHARD HILLS

ABBREVIATIONS

'	FOOT, FEET
"	INCH, INCHES
&	AND
AC	ASPHALTIC CONCRETE, ALTERNATING CURRENT
ACFM	ACTUAL CUBIC FEET PER MINUTE
AW	ASPHALT WALK
BGS	BELOW GROUND SURFACE
BLRD	BOLLARD
CB	CATCH BASIN, CIRCUIT BREAKER
CFM	CUBIC FEET PER MINUTE
CLR	CLEARANCE
CONC	CONCRETE
CSBC	CRUSHED SURFACING BASE COURSE
CW	CONCRETE WALK
DO	DISSOLVED OXYGEN
DRWY	DRIVEWAY
DS	DOWN SPOUT
ECAB	ELECTRICAL CABINET
EHH	ELECTRIC HANDHOLE
EM	ELECTRIC METER
EXIST	EXISTING
FF	FINISHED FLOOR
FFE	FINISHED FLOOR ELEVATION
FLT	FILTER
FT	FEET
G	GAS
GAC	GRANULAR ACTIVATED CARBON
GAL	GALLON(-S)
GPM	GALLONS PER MINUTE
HDPE	HIGH DENSITY POLYETHYLENE
HG	MERCURY
HYD	HYDRANT
IBC	INTERNATIONAL BUILDING CODE
IE	INVERT ELEVATION
LB(-S)	POUND(-S)
MAX	MAXIMUM
MIC	MONUMENT IN CASE
MIL(-S)	ONE-THOUSANDTH OF AN INCH
MIN	MINIMUM
MPT	MALE PIPE THREAD
MW	MONITORING WELL
(N)	NEW
NFPA	NATIONAL FIRE PROTECTION ASSOCIATION
NTS	NOT TO SCALE
OP	OVERHEAD POWER
O2	OXYGEN
OX	OXIDIZER
P	UNDERGROUND POWER
PED SIG	PEDESTRIAN SIGNAL
PLC	PROGRAMMABLE LOGIC CONTROLLER
PPLT	POWER POLE WITH LUMINAIRE
PVC	POLYVINYL CHLORIDE
RW	REMEDIATION WELL
SCADA	SUPERVISORY CONTROL AND DATE ACQUISITION
SCFM	STANDARD CUBIC FEET PER MINUTE
SD	STORM DRAIN
SDMH	STORM DRAIN MANHOLE
SS	SANITARY SEWER
SSD	SUB-SLAB DEPRESSURIZATION
SW	SLANT WELL
TYP	TYPICAL
VFD	VARIABLE FREQUENCY DRIVE (AC)
VP	VAPOR PIN
W	WATER, WIDE, WIDTH, WIRE
WM	WATER METER
WV	WATER VALVE
YD	YARD DRAIN

NOTES

GENERAL

1. PORTIONS OF THIS PROJECT ARE WITHIN CITY OF SEATTLE RIGHT OF WAY. CONTRACTOR SHALL CONFORM TO CITY OF SEATTLE ENCROACHMENT PERMIT REQUIREMENTS.
2. ALL WORK SHALL BE PERFORMED IN ACCORDANCE WITH WSDOT STANDARDS.
3. THE CONTRACTOR SHALL TAKE ALL PRECAUTIONARY MEASURES NECESSARY TO PROTECT EXISTING IMPROVEMENTS WHICH ARE TO REMAIN IN PLACE FROM DAMAGE. ALL IMPROVEMENTS DAMAGED BY THE CONTRACTOR'S OPERATIONS SHALL BE EXPEDITIOUSLY REPAIRED OR RECONSTRUCTED AT THE CONTRACTOR'S EXPENSE WITHOUT ADDITIONAL COMPENSATION.
4. ALL BUILDING COORDINATES ARE TO OUTSIDE CORNER OF COLUMN OR BUILDING.
5. CONTRACTOR SHALL RESTORE ALL SURVEY MONUMENTS THAT ARE DAMAGED OR DESTROYED DURING CONSTRUCTION.
6. PROJECT WORK OCCURS IN A STORE PARKING LOT AND ADJACENT SIDEWALK. CONTRACTOR SHALL PROVIDE SPACE FOR PUBLIC PARKING AND MAINTAIN PEDESTRIAN ACCESS TO THE STORES AT ALL TIMES DURING CONSTRUCTION. SEE SHEET C-02 FOR FURTHER DETAIL.

UTILITIES

1. LOCATIONS OF UNDERGROUND UTILITIES SHOWN ON THE DRAWINGS WERE OBTAINED FROM AVAILABLE RECORDS AND ARE SHOWN IN THEIR APPROXIMATE LOCATION. THERE IS NO GUARANTEE THAT ALL EXISTING PIPELINES AND OBSTRUCTIONS ARE SHOWN OR THAT LOCATIONS INDICATED ARE ACCURATE. PRIOR TO THE START OF CONSTRUCTION, THE CONTRACTOR SHALL POTHOLE TO DETERMINE ACTUAL LOCATION AND ELEVATION OF ALL EXISTING UTILITIES IN AND AROUND THE AREAS OF NEW CONSTRUCTION.
2. THE CONTRACTOR SHALL TAKE ALL PRECAUTIONARY MEASURES NECESSARY TO PROTECT ALL REMAINING EXISTING UTILITIES WHETHER SHOWN OR NOT SHOWN.
3. PRIOR TO ANY CONNECTION TO AN EXISTING UTILITY, THE CONTRACTOR SHALL COORDINATE WITH THE UTILITY OWNER.
4. PRIOR TO ANY EXCAVATION IN THE VICINITY OF ANY EXISTING UNDERGROUND FACILITIES, INCLUDING ALL WATER, SEWER, STORM DRAIN, GAS, PETROLEUM PRODUCTS, OR OTHER PIPELINES; ALL BURIED ELECTRIC POWER, COMMUNICATIONS, OR TELEVISION CABLES; ALL TRAFFIC SIGNAL AND STREET LIGHTING FACILITIES; AND ALL ROADWAY, STATE HIGHWAY, AND RAILROAD RIGHTS-OF-WAY, THE CONTRACTOR SHALL NOTIFY THE RESPECTIVE AUTHORITIES REPRESENTING THE OWNERS OR AGENCIES RESPONSIBLE FOR SUCH FACILITIES TO FACILITATE A TIMELY MANNER OF WORK SO THAT A REPRESENTATIVE OF SAID OWNERS OR AGENCIES CAN BE PRESENT DURING SUCH WORK IF THEY SO DESIRE. IN THE CASE OF THE UNDERGROUND UTILITY SERVICE ALERT CENTER, THIS NOTICE WILL GIVE THEM TIME TO MARK THE LOCATION OF THE UTILITIES. THE CONTRACTOR SHALL ALSO NOTIFY UNDERGROUND SERVICES ALERT (USA) AT (811) IN ACCORDANCE WITH THE SPECIFICATIONS TO FACILITATE A TIMELY MANNER OF WORK, PRIOR TO SUCH EXCAVATION.

PERMITTING

1. CONTRACTOR SHALL BE RESPONSIBLE FOR COMPLYING WITH THE REQUIREMENTS OF ALL PERMITS OBTAINED FOR THE PROJECT.
2. THE FOLLOWING PERMITS HAVE BEEN OBTAINED BY ECOLOGY AND ARE INCORPORATED INTO THE CONTRACT:
   A. UNDERGROUND INJECTION CONTROL PERMIT.
   B. STATE ENVIRONMENTAL POLICY ACT REVIEW.
3. THE FOLLOWING PERMITS HAVE BEEN OBTAINED BY ECOLOGY AND WILL BE TRANSFERRED OVER TO THE CONTRACTOR:
   A. CITY OF SEATTLE DEPARTMENT OF TRANSPORTATION STREET-USE PERMIT.
   B. KING COUNTY METRO TRANSIT OVERHEAD BUS POWER SHUTDOWN.
4. THIS PROJECT IS EXEMPT FROM THE AIR DISCHARGE PERMIT FROM THE PUGET SOUND CLEAN AIR AGENCY. THE CONTRACTOR DOES NOT HAVE TO APPLY FOR THIS PERMIT BUT MUST COMPLY WITH THE SUBSTANTIVE REQUIREMENTS OF THE PERMIT.
5. THE FOLLOWING PERMITS SHALL BE OBTAINED DIRECTLY BY THE CONTRACTOR. THIS LIST IS NOT ALL-INCLUSIVE. CONTRACTOR IS RESPONSIBLE FOR CONFIRMING WHAT PERMITS APPLY TO THE WORK AND OBTAINING THEM IN A TIMELY MANNER TO SUPPORT THE OVERALL PROJECT SCHEDULE.
   A. NOTIFICATION OW WELL CONSTRUCTION.
   B. DISCHARGE PERMITS.
   C. CITY OF SEATTLE BUILDING PERMITS.
   D. NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM CONSTRUCTION STORMWATER GENERAL PERMIT.
   E. CITY OF SEATTLE DEPARTMENT OF TRANSPORTATION PARKING PERMITS.

NOISE CONTROL

1. SEE SPECIFICATION 01 57 19.12 NOISE CONTROL FOR NOISE LIMITATIONS DETAILS. CONTRACTOR SHALL BE RESPONSIBLE FOR COMPLYING WITH THE NOISE LIMITATIONS INCLUDED IN THIS SPECIFICATION.
2. CONSTRUCTION NOISE SHALL BE LIMITED TO THE FOLLOWING TIMES:
   7:00 AM TO 10:00PM, WEEKDAYS
   9:00 AM TO 10:00PM, WEEKENDS AND HOLIDAYS.
3. CONTRACTOR SHALL SUBMIT A NOISE CONTROL WORK PLAN MEETING THE REQUIREMENTS SPECIFIED IN SPECIFICATIONS 01 57 19.12.

ISSUED FOR BID

ANY PRINTS NOT BEARING THIS STAMP MAY HAVE BEEN PRINTED PRIOR TO ADVERTISING AND CANNOT BE CONSIDERED AS BID DOCUMENTS. USERS OF THIS DOCUMENT IN EDITABLE ELECTRONIC FORMATS ARE CAUTIONED AGAINST USE WITHOUT FIRST DETERMINING WHETHER CHANGES MAY HAVE BEEN MADE SUBSEQUENT TO ITS PREPARATION.

NO	REVISION	DATE	BY

SCALES
0 1"
0 25mm
IF THIS BAR IS NOT DIMENSION SHOWN, ADJUST SCALES ACCORDINGLY.

BENJAMIN EDWARD FUENTES — STATE OF WASHINGTON — 98495 — REGISTERED PROFESSIONAL ENGINEER

DESIGNED CMW
DRAWN RLH
CHECKED BEF

DEPARTMENT OF ECOLOGY State of Washington

WASHINGTON STATE DEPARTMENT OF ECOLOGY
BELLEVUE, WASHINGTON
CIRCLE K SITE 1461 ENVIRONMENTAL REMEDIATION SYSTEM INSTALLATION
SEATTLE, WASHINGTON

Kennedy Jenks

NOTES AND ABBREVIATIONS

SCALE AS SHOWN
JOB NO 2196008.00
DATE OCTOBER 2022
SHEET 2 OF 19
G-02

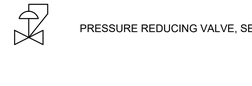
File: C:\bms\kjce-pw\d0181581219600800-G-02.DWG

Plot Date: 10/11/2022 7:26 AM
User: RICHARD HILLS

CALLOUTS AND SHORTHAND SYMBOLS

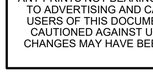
- A — SHEET KEYNOTE
- ℄ — CENTERLINE
- ∅ — DIAMETER
- ± — APPROXIMATELY
- ∠ — ANGLE
- 1 — BUILDING GRID LABEL OR ACCESSORY NUMBER
- ##-## — DOOR
- XXX — ROOM
- ## — WALL
- ##-## — WINDOW

REVISION SYMBOLS



CLOUDED AREA INDICATES CHANGED INFORMATION; NUMBER IN TRIANGLE INDICATES THE DRAWING VERSION AND MATCHES WITH REVISION INFORMATION IN THE REVISION BLOCK WITHIN THE DRAWING BORDER

PIPING - SINGLE LINE



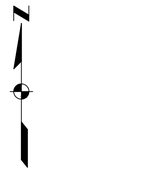
CONNECTED

NOT CONNECTED

VALVES AND GATES

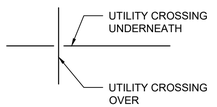
- GATE VALVE (NORMALLY OPEN, NORMALLY CLOSED)
- GLOBE VALVE (NORMALLY OPEN, NORMALLY CLOSED)
- CHECK VALVE
- BUTTERFLY VALVE
- BALL VALVE (NORMALLY OPEN, NORMALLY CLOSED)
- VACUUM RELIEF/AIR INLET VALVE (AV)
- PRESSURE RELIEF VALVE (PREL)
- 3-WAY VALVE
- PNEUMATIC ACTUATOR
- PRESSURE REDUCING VALVE, SELF-CONTAINED

SYMBOLOGY



NORTH ARROW

- NEW
- EXISTING
- FUTURE
- EXISTING LINEAR ELEMENTS TO BE REMOVED OR DEMOLISHED
- EXISTING NON-LINEAR ELEMENTS TO BE REMOVED OR DEMOLISHED
- BREAK LINE
- NATIVE EARTH (IN SECTION)
- ENGINEERED FILL (IN SECTION)
- SAND OR GROUT (IN PLAN AND SECTION)
- GRAVEL (IN PLAN AND SECTION)
- AGGREGATE BASE (IN PLAN AND SECTION)
- CRUSHED ROCK (IN PLAN AND SECTION)
- CONCRETE (IN PLAN AND SECTION)



CROSSING UTILITIES

EQUIPMENT

CENTRIFUGAL PUMPS

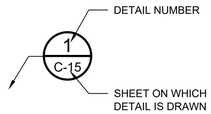
HORIZONTAL

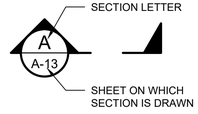
MIXERS

VERTICAL

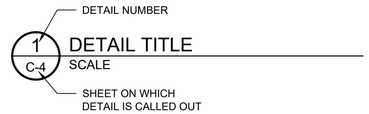
CROSS-REFERENCING SYMBOLS

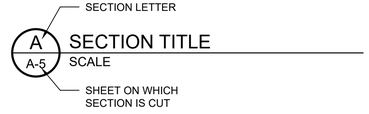
FOUND ON DRAWING WHERE DETAIL, SECTION, OR ELEVATION IS CALLED OUT





FOUND ON DRAWING WHERE DETAIL, SECTION, OR ELEVATION IS DRAWN





PIPING ACCESSORIES AND FITTINGS

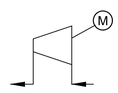
- FLANGE
- Y STRAINER
- CHEMICAL PIPING FLEXIBLE CONNECTION/ FLEXIBLE HOSE
- DRAIN

VALVE AND GATE OPERATORS

- S — SOLENOID
- M — MOTOR
- DIAPHRAGM

MISCELLANEOUS

PLATE AND FRAME HEAT EXCHANGER



ISSUED FOR BID

ANY PRINTS NOT BEARING THIS STAMP MAY HAVE BEEN PRINTED PRIOR TO ADVERTISING AND CANNOT BE CONSIDERED AS BID DOCUMENTS. USERS OF THIS DOCUMENT IN EDITABLE ELECTRONIC FORMATS ARE CAUTIONED AGAINST USE WITHOUT FIRST DETERMINING WHETHER CHANGES MAY HAVE BEEN MADE SUBSEQUENT TO ITS PREPARATION.

NO	REVISION	DATE	BY

SCALES
0 1"
0 25mm
IF THIS BAR IS NOT DIMENSION SHOWN, ADJUST SCALES ACCORDINGLY.

BENJAMIN EDWARD CUATES — STATE OF WASHINGTON — 98495 — REGISTERED PROFESSIONAL ENGINEER

DESIGNED CMW
DRAWN RLH
CHECKED BEF

DEPARTMENT OF ECOLOGY State of Washington

WASHINGTON STATE DEPARTMENT OF ECOLOGY
BELLEVUE, WASHINGTON
CIRCLE K SITE 1461 ENVIRONMENTAL REMEDIATION SYSTEM INSTALLATION
SEATTLE, WASHINGTON

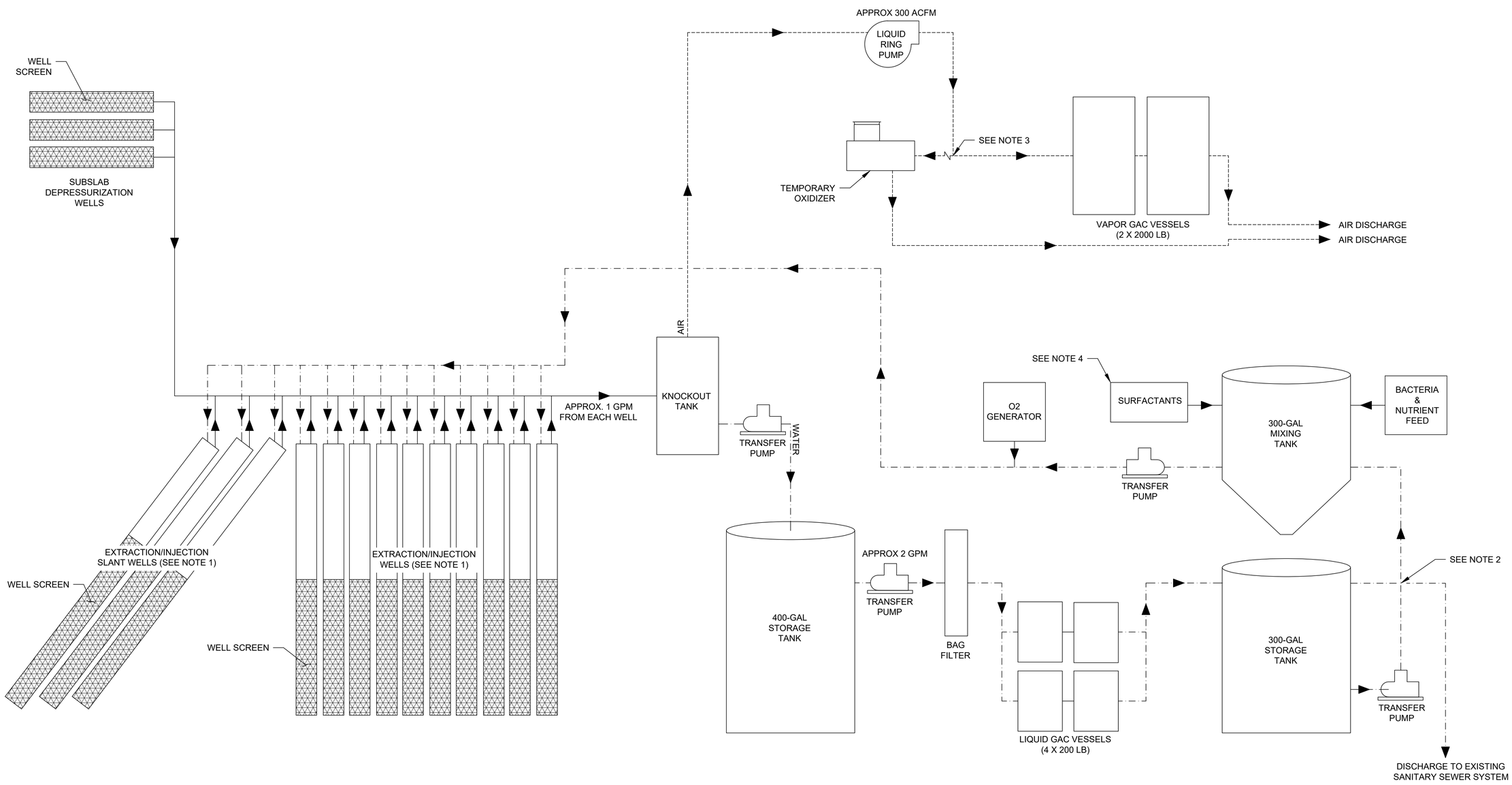
Kennedy Jenks

LEGEND AND SYMBOLS

SCALE AS SHOWN
JOB NO 2196008.00
DATE OCTOBER 2022
SHEET 3 OF 19
G-03

File: C:\bms\kjce-pw\d0181581219600800-G-03.DWG

Plot Date: 10/11/2022 7:27 AM
User: RICHARD HILLS
pw:\\kjce-pw.bentley.com:kjce-pw\Documents\Clients\WA Department of Ecology\Projects\Circle K Cleanup_2196008.00\10-Design\10.06-Drawings\General\2196008



REMEDIATION SYSTEM OPERATION NOTES:

THE FOLLOWING NOTES DESCRIBE SYSTEM OPERATIONS AFTER CONSTRUCTION, AND ARE INTENTED SOLELY TO INFORM THE CONTRACTOR OF DESIGN INTENTIONS AND GUIDE CONSTRUCTION EFFORTS.

1. SYSTEM WILL BE OPERATED TO ALLOW WELLS USED FOR EXTRACTION TO ALSO BE USED FOR REINJECTION AND VICE VERSA. OPERATION OF WELLS FOR EXTRACTION OR REINJECTION WILL BE BASED ON SITE CONDITIONS, WELL LOCATIONS, CONCENTRATIONS OF THE CONTAMINANTS OF CONCERN, AND THE OVERALL REMEDIATION PROGRESS.
2. GROUNDWATER INITIALLY EXTRACTED FROM THE SYSTEM IS EXPECTED TO BE DISCHARGED TO THE SANITARY SEWER VIA GRAVITY. ONCE GROUNDWATER CONCENTRATIONS ARE AMENABLE TO BIOREMEDIATION VIA REINJECTION, WATER WILL BE TRANSFERRED TO MIXING TANK FOR AMENDMENT PRIOR TO REINJECTION. EXCESS WATER WILL GRAVITY FLOW TO THE SANITARY SEWER. VOLUMES AND FLOW RATES WILL BE DETERMINED DURING OPERATION.
3. VAPOR WILL BE DIRECTED THROUGH THE TEMPORARY OXIDIZER FOR THE FIRST SEVERAL MONTHS OF OPERATION UNTIL CONCENTRATIONS OF THE CONTAMINANTS OF CONCERN HAVE DECREASED TO A LEVEL SUITABLE FOR TREATMENT VIA THE VAPOR GAC VESSELS. THE OXIDIZER WILL THEN BE REMOVED AND VAPOR WILL BE DIRECTED THROUGH THE GAC VESSELS PRIOR TO DISCHARGE.
4. SURFACTANTS WILL BE ADDED FIRST TO THE WATER PRIOR TO REINJECTION TO RELEASE ADDITIONAL HYDROCARBONS FROM THE SOIL. THEN BACTERIA AND NUTRIENT FEED WILL BE ADDED TO THE WATER PRIOR TO REINJECTION TO CREATE A MICROBIAL POPULATION TO DEGRADE THE HYDROCARBONS IN SITU.

ISSUED FOR BID

ANY PRINTS NOT BEARING THIS STAMP MAY HAVE BEEN PRINTED PRIOR TO ADVERTISING AND CANNOT BE CONSIDERED AS BID DOCUMENTS. USERS OF THIS DOCUMENT IN EDITABLE ELECTRONIC FORMATS ARE CAUTIONED AGAINST USE WITHOUT FIRST DETERMINING WHETHER CHANGES MAY HAVE BEEN MADE SUBSEQUENT TO ITS PREPARATION.

NO	REVISION	DATE	BY

SCALES
0 1"
0 25mm
IF THIS BAR IS NOT DIMENSION SHOWN, ADJUST SCALES ACCORDINGLY.

BENJAMIN EDWARD FUENTES — STATE OF WASHINGTON — 98405 — REGISTERED PROFESSIONAL ENGINEER

DESIGNED	CMW
DRAWN	CMW
CHECKED	BEF

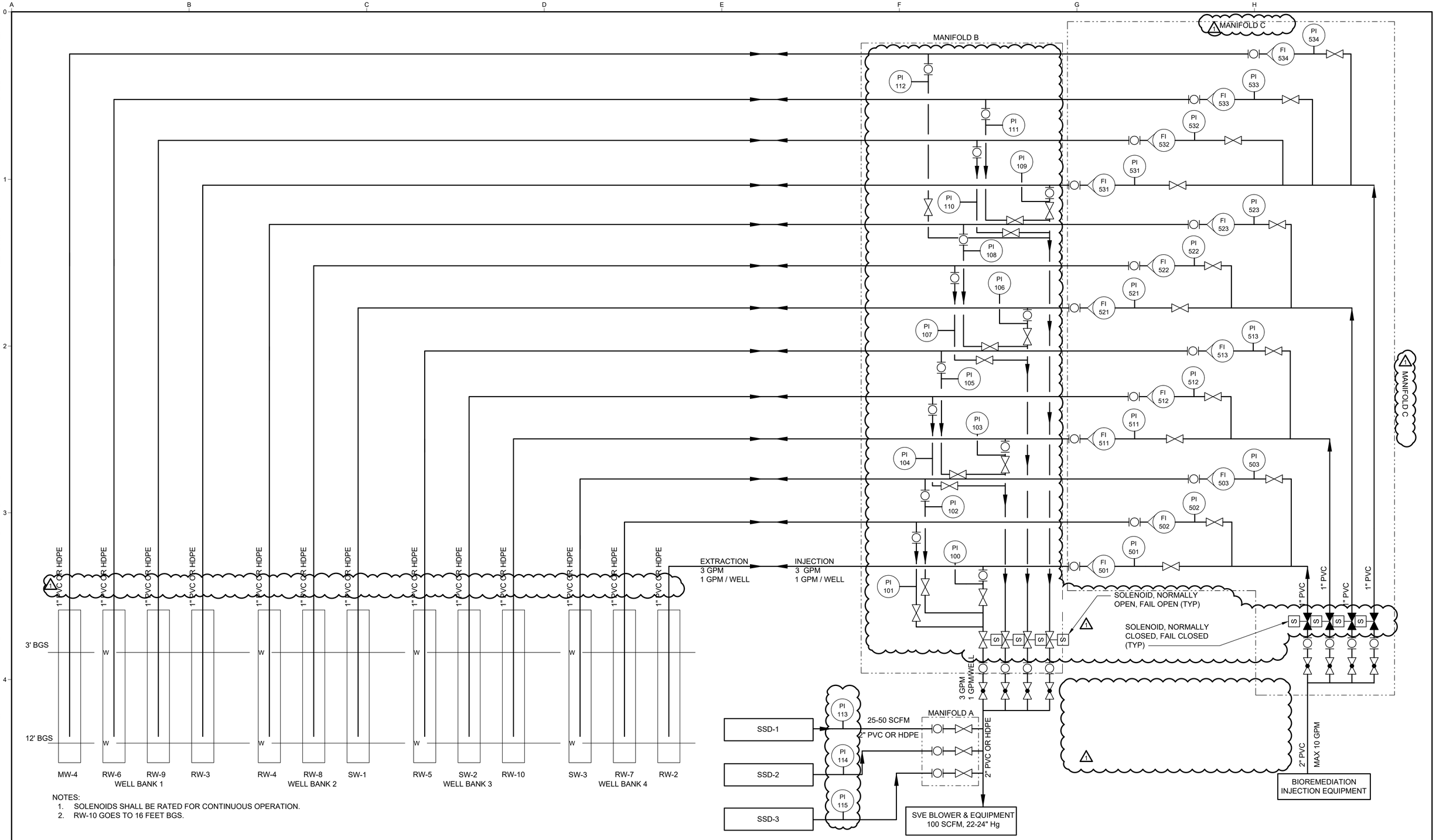
WASHINGTON STATE DEPARTMENT OF ECOLOGY
BELLEVUE, WASHINGTON
CIRCLE K SITE 1461 ENVIRONMENTAL REMEDIATION SYSTEM INSTALLATION
SEATTLE, WASHINGTON

Kennedy Jenks

TREATMENT SYSTEM SCHEMATIC

SCALE	AS SHOWN
JOB NO	2196008.00
DATE	OCTOBER 2022
SHEET	4 OF 19
	G-04

Plot Date: 1/21/2023 12:36 PM
User: JAROD FISHER
pw:\\kje-pw.bentley.com:kje-pw\Documents\Clients\WA Department of Ecology\Projects\Circle K Cleanup_2196008.00\10-Design\10.06-Drawings\Civil\KJ_Site.Civil_SHEET.DWG



NOTES:
1. SOLENOIDS SHALL BE RATED FOR CONTINUOUS OPERATION.
2. RW-10 GOES TO 16 FEET BGS.

ISSUED FOR BID

ANY PRINTS NOT BEARING THIS STAMP MAY HAVE BEEN PRINTED PRIOR TO ADVERTISING AND CANNOT BE CONSIDERED AS BID DOCUMENTS. USERS OF THIS DOCUMENT IN EDITABLE ELECTRONIC FORMATS ARE CAUTIONED AGAINST USE WITHOUT FIRST DETERMINING WHETHER CHANGES MAY HAVE BEEN MADE SUBSEQUENT TO ITS PREPARATION.

NO	REVISION	DATE	BY
1	BID SET REVISION ADDENDUM 1	1/20/23	CMW

SCALES
0 — 1"
0 — 25mm
IF THIS BAR IS NOT DIMENSION SHOWN, ADJUST SCALES ACCORDINGLY.

LAWRENCE G. REISINGER, STATE OF WASHINGTON, 22583, REGISTERED PROFESSIONAL ENGINEER

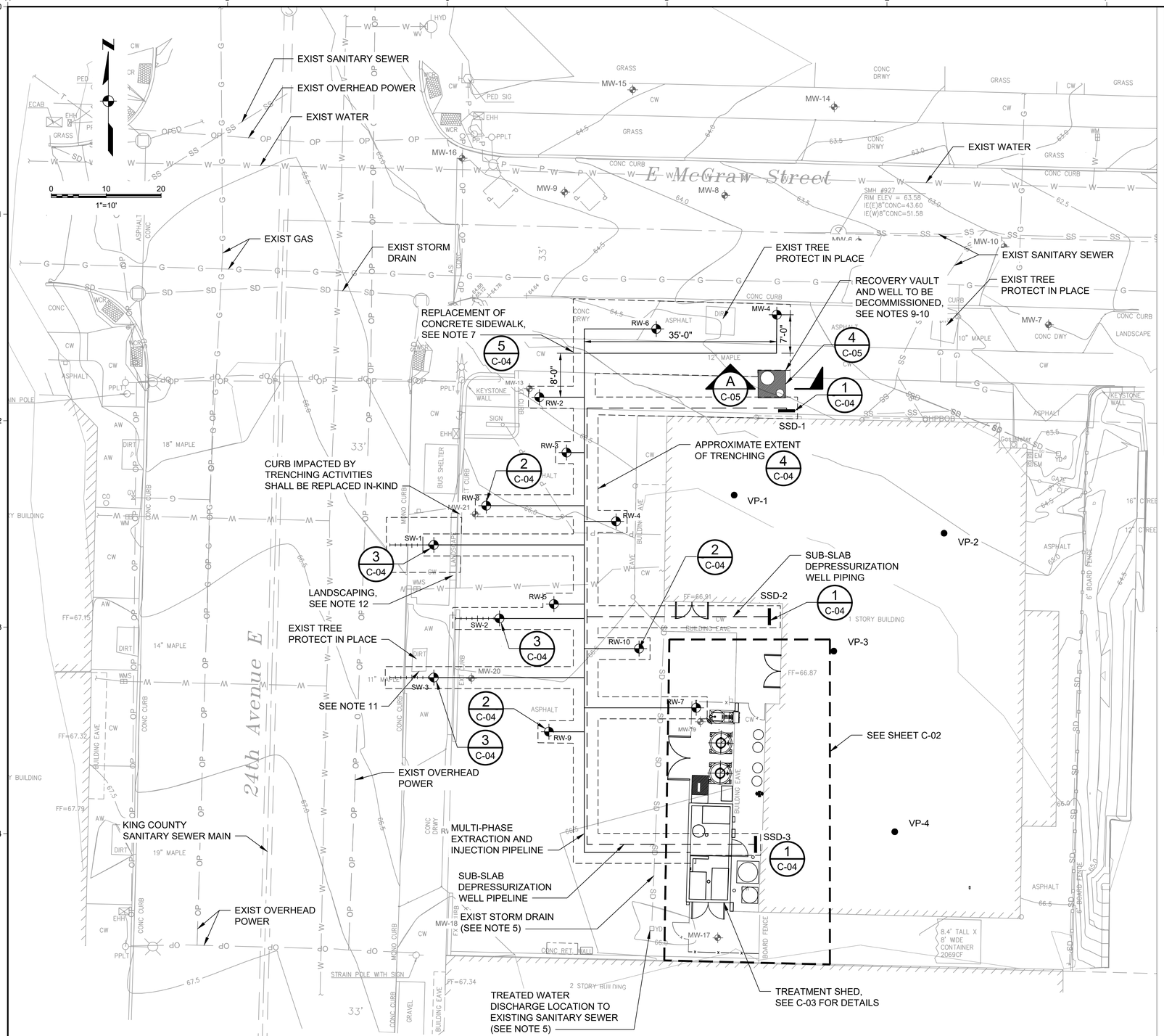
DESIGNED JMF
DRAWN JMF
CHECKED LGR

WASHINGTON STATE DEPARTMENT OF ECOLOGY
BELLEVUE, WASHINGTON
CIRCLE K SITE 1461 ENVIRONMENTAL REMEDIATION SYSTEM INSTALLATION
SEATTLE, WASHINGTON
Kennedy Jenks

PROCESS FLOW DIAGRAM

SCALE AS SHOWN
JOB NO 2196008.00
DATE OCTOBER 2022
SHEET 5 OF 19
G-05

Plot Date: 10/11/2022 7:29 AM
User: RICHARD HILLS



GENERAL SHEET NOTES

1. WELL TERMINOLOGY:
   1A. MW = EXISTING MONITORING WELL
   1B. RW = REMEDIATION WELL (EITHER EXISTING OR TO BE INSTALLED
   1C. VP = VAPOR MONITORING PIN TO BE INSTALLED
   1D. SW = SLANT WELL TO BE INSTALLED
2. SLANT WELLS SHALL BE INSTALLED AT 30 DEGREES TO A DEPTH OF 20 FEET. HORIZONTAL EXTENT (APPROXIMATELY 10 FEET) SHOWN ON PLAN VIEW. RADIUS OF INFLUENCE OF SLANT WELLS CENTERED OVER MIDPOINT OF WELL CASING SHOWN.
3. VAPOR PINS ARE SHOWN AT APPROXIMATE LOCATIONS. EXACT LOCATIONS SHALL BE COORDINATED WITH ENGINEER AND OWNER.
4. ABOVEGROUND REMEDIATION SYSTEM PIPING IS SHOWN ON SHEET C-02.
5. STORM DRAIN IS CONNECTED TO SANITARY SEWER.
6. CONTRACTOR SHALL RELOCATE ALL EXISTING SIGNAGE TO CHAIN LINK FENCE, OR TO POSTS WEST OF THE FENCE.
7. TRENCHING LIMITS THAT IMPACT CONCRETE SIDEWALK SHALL REQUIRE FULL WIDTH PANEL REMOVAL AND REPLACEMENT IN ACCORDANCE WITH SPECIFICATION SECTION 31 12 16.13.
8. TRENCHING LIMITS SHOWN HEREON ARE APPROXIMATIONS ONLY. EXACT TRENCHING LIMITS SHALL BE AT THE DISCRETION OF THE CONTRACTOR AND MINIMIZED TO THE EXTENT NECESSARY TO COMPLETE THE WORK. TRENCHING SHALL ONLY OCCUR WITHIN THE CIRCLE K PARKING LOT AND SURROUNDING SIDEWALK. TRENCHING SHALL NOT EXTEND INTO THE PAVED ROADWAYS.
9. WELL SHALL BE DECOMMISSIONED IN ACCORDANCE WITH ECOLOGY WAC 173-160-381 BY A DRILLER LICENSED IN THE STATE OF WASHINGTON. DRILLER SHALL FILE A NOTICE OF INTENT TO ECOLOGY TO DECOMMISSION THE WELL AND SUBMIT A DECOMMISSIONING REPORT TO ECOLOGY WITHIN 30 DAYS OF COMPLETION, PER WAC 173-160-141.
10. WITHIN THE VAULT, NEATLY CUT AND REMOVE ANY EQUIPMENT AND PLUG ALL CONNECTIONS (INLETS, OUTLETS, OPENINGS, ETC.) PER DETAIL 4 ON SHEET C-05. FILL VAULT TO GRADE WITH BACKFILL PER DETAIL 4 ON SHEET C-04 ON SHEET C-04 AND SPECIFICATION SECTION 31 00 00. RESURFACE AND PAVE VAULT FOOTPRINT AND IMPACT SURROUNDING AREA IN ACCORDANCE WITH SPECIFICATION SECTION 32 12 16.13.
11. CONTRACTOR SHALL NOT IMPACT TREE ROOTS WHEN DRILLING AND TRENCHING. FIELD ADJUSTMENTS MAY BE ALLOWED TO MODIFY TRENCH LIMITS AND/OR DRILLING LOCATIONS IF NECESSARY TO PROTECT TREE ROOTS IN PLACE. PROPOSED FIELD ADJUSTMENTS SHALL BE SUBMITTED TO THE ENGINEER FOR REVIEW AND APPROVAL.
12. ANY LANDSCAPING (PLANTS, SOIL, MULCH, ETC.) IMPACTED BY CONTRACTOR ACTIVITIES SHALL BE REPLACED IN-KIND. REPLACEMENT LANDSCAPING AND ANY SUPPORTING TOPSOIL, MULCH, ETC. SHALL MATCH EXISTING CONDITIONS AND BE SUBMITTED TO THE ENGINEER FOR REVIEW AND APPROVAL.

NEW REMEDIATION WELLS TO BE INSTALLED

RW-8	N:236950.38	E:1278394.71
RW-9	N:236909.25	E:1278406.10
RW-10	N:236924.38	E:1278422.51

NEW SLANT WELLS TO BE INSTALLED

SW-1	N:236943.24	E:1278385.16
SW-2	N:236929.86	E:1278397.11
SW-3	N:236919.10	E:1278385.16

EXISTING MONITORING AND REMEDIATION WELLS

MW-4	N:236985.00	E:1278447.91
RW-2	N:236970.10	E:1278404.38
RW-3	N:236960.04	E:1278409.31
RW-4	N:236947.52	E:1278418.32
RW-5	N:236932.47	E:1278407.00
RW-6	N:236982.51	E:1278425.63
RW-7	N:236913.61	E:1278432.90

LEGEND

- WELL TO BE USED FOR EXTRACTION/INJECTION (NEW AND EXISTING, SEE NOTE 1 AND WELL TABLES BELOW)
- EXISTING WELL NOT USED FOR EXTRACTION/INJECTION
- NEW SLANT WELL (SEE NOTE 2)
- EXTRACTION AND INJECTION PIPING
- SUB-SLAB DEPRESSURIZATION PIPING
- SUB-SLAB DEPRESSURIZATION WELL
- APPROXIMATE EXTENT OF TRENCH, (SEE NOTE 7 AND 8)
- CHAIN LINK FENCE
- VAPOR MONITORING PIN (SEE NOTE 3)
- G — EXISTING GAS LINE
- W — EXISTING WATER LINE
- OP — EXISTING OVERHEAD POWER LINE
- SS — EXISTING SANITARY SEWER LINE
- P — EXISTING UNDERGROUND ELECTRICAL LINE
- SD — EXISTING STORM DRAIN

ISSUED FOR BID

ANY PRINTS NOT BEARING THIS STAMP MAY HAVE BEEN PRINTED PRIOR TO ADVERTISING AND CANNOT BE CONSIDERED AS BID DOCUMENTS. USERS OF THIS DOCUMENT IN EDITABLE ELECTRONIC FORMATS ARE CAUTIONED AGAINST USE WITHOUT FIRST DETERMINING WHETHER CHANGES MAY HAVE BEEN MADE SUBSEQUENT TO ITS PREPARATION.

NO	REVISION	DATE	BY

SCALES
0 1"
0 25mm
IF THIS BAR IS NOT DIMENSION SHOWN, ADJUST SCALES ACCORDINGLY.

BENJAMIN EDWARD FLENTES — STATE OF WASHINGTON — 68495 — REGISTERED PROFESSIONAL ENGINEER

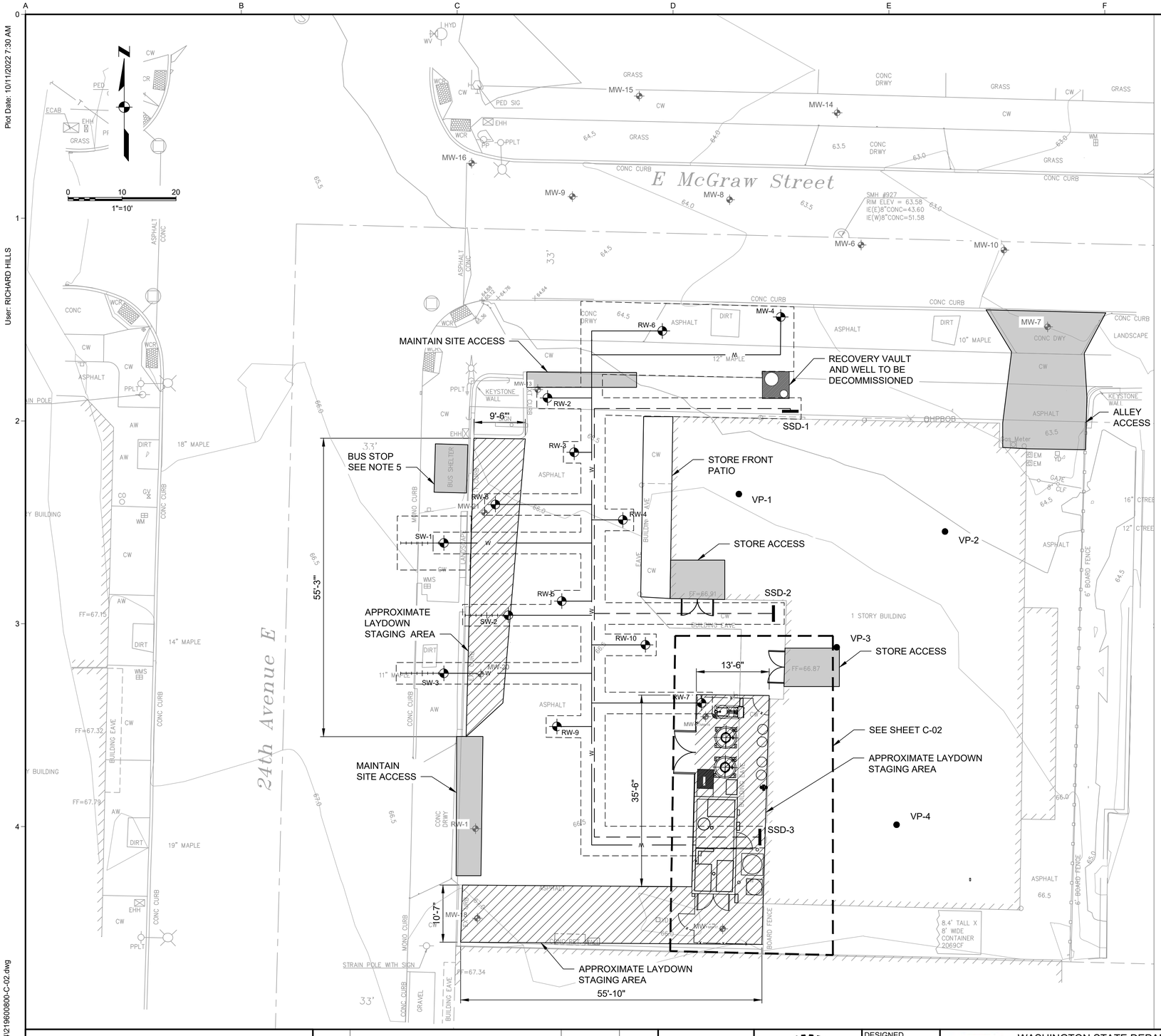
DESIGNED CMW
DRAWN CMW
CHECKED BEF

WASHINGTON STATE DEPARTMENT OF ECOLOGY
BELLEVUE, WASHINGTON
CIRCLE K SITE 1461 ENVIRONMENTAL REMEDIATION SYSTEM INSTALLATION
SEATTLE, WASHINGTON
Kennedy Jenks

OVERALL SITE PLAN AND SYSTEM LAYOUT

SCALE 1" = 10'
JOB NO 2196008.00
DATE OCTOBER 2022
SHEET 6 OF 19
C-01

File: C:\bms\kjce-pwd\018157421\9600800-C-01.dwg



GENERAL SHEET NOTES

1. DIMENSIONS SHOWN ARE THE MAXIMUM ALLOWABLE FOR LAYDOWN STAGING AREAS. AREAS MAY NEED TO BE REDUCED TO ALIGN WITH EXISTING FEATURES SUCH AS CURBS OR ALLOW FOR VEHICLE AND PEDESTRIAN TRAFFIC AND SHALL BE SECURED BY TEMPORARY FENCING.
2. CONTRACTOR SHALL PROVIDE TRAFFIC CONTROL USING CONTRACTOR MEANS AND METHODS SUCH AS PHASED CONSTRUCTION, TRAFFIC RATED TRENCH LIDS, SIGNAGE, TEMPORARY FENCING, AND OTHER, AS NEEDED TO MAINTAIN VEHICLE AND PEDESTRIAN ACCESS TO THE STORES.
3. CONTRACTOR WORK AREA SHALL BE CLEARLY DELINEATED AND FENCED OFF TO PREVENT PUBLIC ENTRANCE, WHILE STILL MAINTAINING STORE ACCESS AT ALL TIMES DURING CONSTRUCTION.
4. CONTRACTOR SHALL SECURE ANY CITY PERMITTING RELATED TO TRAFFIC CONTROL INCLUDING PROVIDING TRAFFIC CONTROL PLANS, CITY RIGHT OF WAY WORK, AND KING METRO FOR WORK NEAR THE BUS STOP WHICH MAY REQUIRE WEEKEND WORK.
5. CONTRACTOR SHALL OBTAIN ALL PERMITS NECESSARY FOR CONSTRUCTION WITHIN THE RIGHT-OF-WAY AND MAINTAIN FULL ACCESS TO THE BUS STOP AT ALL TIMES DURING CONSTRUCTION.
6. PIPE ROUTING IS APPROXIMATE. CONTRACTOR SHALL PROVIDE INDIVIDUAL LINES TO EACH WELL PER P&ID DRAWINGS.
7. CONTRACTOR SHALL SUBMIT A WORK SEQUENCING PLAN DESCRIBING THE METHOD IN WHICH ALL REQUIRED ACCESS POINTS SHALL BE PROPERLY MAINTAINED. DETAILS ON THE WORK SEQUENCING PLAN REQUIREMENTS ARE INCLUDED IN SPECIFICATION SECTION 01 33 00.

LEGEND

- WELL TO BE USED FOR EXTRACTION/INJECTION (NEW AND EXISTING, SEE NOTE 1 AND WELL TABLES ON SHEET C-01)
- EXISTING WELL NOT USED FOR EXTRACTION/INJECTION
- NEW SLANT WELL (SEE NOTE 2)
- EXTRACTION AND INJECTION PIPING
- SUB-SLAB DEPRESSURIZATION PIPING
- SUB-SLAB DEPRESSURIZATION WELL
- APPROXIMATE EXTENT OF TRENCH
- CHAIN LINK FENCE
- VAPOR MONITORING PIN (SEE NOTE 3)
- SITE AND STORE ACCESS AREAS
- APPROXIMATE LOCATION OF STAGING AREA

ISSUED FOR BID

ANY PRINTS NOT BEARING THIS STAMP MAY HAVE BEEN PRINTED PRIOR TO ADVERTISING AND CANNOT BE CONSIDERED AS BID DOCUMENTS. USERS OF THIS DOCUMENT IN EDITABLE ELECTRONIC FORMATS ARE CAUTIONED AGAINST USE WITHOUT FIRST DETERMINING WHETHER CHANGES MAY HAVE BEEN MADE SUBSEQUENT TO ITS PREPARATION.

NO	REVISION	DATE	BY

SCALES
0 1"
0 25mm
IF THIS BAR IS NOT DIMENSION SHOWN, ADJUST SCALES ACCORDINGLY.

BENJAMIN EDWARD FUENTES, STATE OF WASHINGTON, 98495, REGISTERED PROFESSIONAL ENGINEER

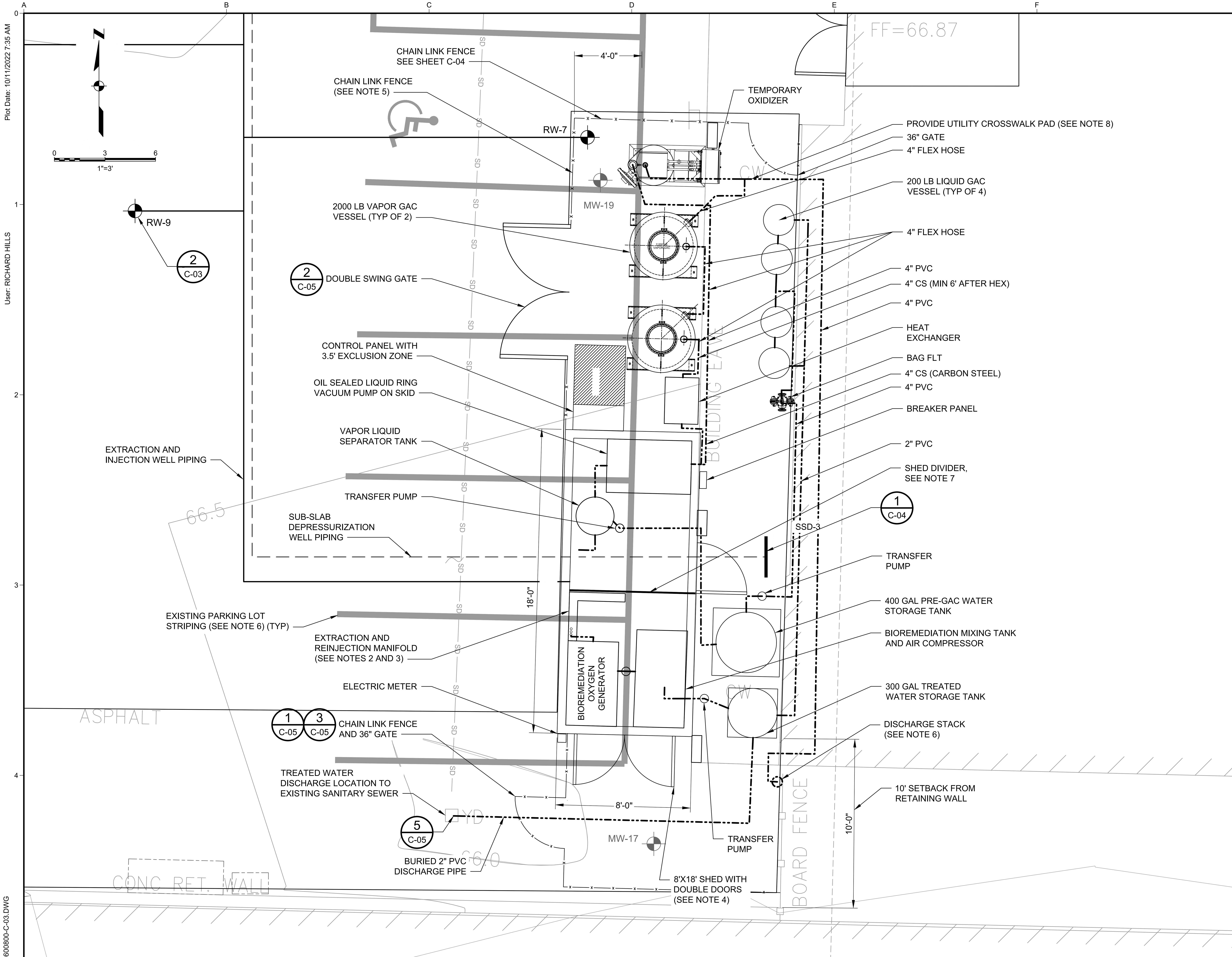
DESIGNED CMW
DRAWN CMW
CHECKED BEF

WASHINGTON STATE DEPARTMENT OF ECOLOGY
BELLEVUE, WASHINGTON
CIRCLE K SITE 1461 ENVIRONMENTAL REMEDIATION SYSTEM INSTALLATION
SEATTLE, WASHINGTON
Kennedy Jenks

SITE PLAN STAGING AREAS

SCALE 1" = 10'
JOB NO 2196008.00
DATE OCTOBER 2022
SHEET 7 OF 19
C-02

Plot Date: 10/11/2022 7:30 AM
User: RICHARD HILLS
File: C:\bms\kjce-pwd\18157412\19600800-C-02.dwg



GENERAL SHEET NOTES

1. WELL TERMINOLOGY:
   1A. MW = EXISTING MONITORING WELL
   1B. RW = REMEDIATION WELL (EITHER EXISTING OR TO BE INSTALLED
2. ALL MANIFOLDS SHALL BE EQUIPPED WITH GATE VALVE, SAMPLE PORTS, AND 1/4" TAP FOR FLOW INSERTION.
3. EXTRACTION AND REINJECTION MANIFOLDS SHALL BE EQUIPPED WITH CONTROL VALVES AND FLOW METER FOR EACH WELL.
4. PIPING AND VALVES SHALL BE STACKED VERTICALLY ALONG EQUIPMENT ENCLOSURE WALL FOR ACCESS TO FLOW PATH AND MEASUREMENTS.
5. CONTRACTOR SHALL RECREATE ALL PARKING SPACES AFFECTED BY THE REMEDIATION SYSTEM INCLUDING REPAINTING PARKING LOT STRIPING AND HANDICAP SYMBOLS, AND REPLACING EXITING CURBS WITH NEW CURBS.
6. INSTALL ANY NECESSARY PIPE SUPPORTS TO DISCHARGE STACK TO EXTEND TOP OF STACK TO 3 FEET ABOVE THE ROOF. DISCHARGE STACK PIPE SUPPORTS SHALL BE CONTRACTOR DESIGNED AND SUBMITTED TO THE ENGINEER FOR APPROVAL.
7. DIVIDER AND SHED CONSTRUCTION SHALL MEET IBC AND NFPA REQUIREMENTS TO SEPARATE ZONES. SHED CONSTRUCTION SHALL INCLUDE DIVIDER TO SEPARATE UNCLASSIFIED AND CLASS 1, DIVISION 2 RATED EQUIPMENT OR CONTRACTOR SHALL PROVIDE TWO SEPARATE SHEDS INSTALLED ADJACENT TO EACH OTHER.
8. PIPE ROUTING IS APPROXIMATE. FIELD ROUTE AS NEEDED TO MAINTAIN PATHWAYS AND ACCESS TO EQUIPMENT AND VALVES. PROVIDE STEP OVERS/RAMPS WHERE REQUIRED OR ELEVATE TO MINIMUM 7 FEET ABOVE GROUND TO MAINTAIN ACCESS PER SPECIFICATIONS. PROVIDE LOW POINT DRAINS AND HIGH POINT VENTS AS NEEDED. CONTRACTOR DESIGNED SUPPORTS SHALL BE FAVORABLY APPROVED BY ENGINEER. EXCEPT AS MAY BE REQUIRED FOR THE DISCHARGE STACK, SUPPORTS SHALL NOT BE ANCHORED TO THE BUILDING WALL, AWNING, ROOF, OR COLUMNS.
9. TREATMENT SYSTEM SHALL BE COMMISSIONED IN ACCORDANCE WITH SPECIFICATION SECTION 01 77 00.

LEGEND

- EXTRACTION AND INJECTION PIPING
- SUB-SLAB DEPRESSURIZATION WELL PIPING
- REMEDIATION SYSTEM PROCESS PIPING (SEE NOTE 4)
- CHAIN LINK FENCE (SEE NOTE 5)
- SUB-SLAB DEPRESSURIZATION WELL
- VAPOR MONITORING PIN
- WELL TO BE USED FOR EXTRACTION/INJECTION (NEW AND EXISTING, SEE NOTE 1 AND WELL TABLES ON SHEET C-01)
- EXISTING WELL NOT USED FOR EXTRACTION/INJECTION

Plot Date: 10/11/2022 7:35 AM
User: RICHARD HILLS
File: C:\bms\kjce-pw\d0181574\219600800-C-03.DWG

ISSUED FOR BID

ANY PRINTS NOT BEARING THIS STAMP MAY HAVE BEEN PRINTED PRIOR TO ADVERTISING AND CANNOT BE CONSIDERED AS BID DOCUMENTS. USERS OF THIS DOCUMENT IN EDITABLE ELECTRONIC FORMATS ARE CAUTIONED AGAINST USE WITHOUT FIRST DETERMINING WHETHER CHANGES MAY HAVE BEEN MADE SUBSEQUENT TO ITS PREPARATION.

NO	REVISION	DATE	BY

SCALES
0 1"
0 25mm
IF THIS BAR IS NOT DIMENSION SHOWN, ADJUST SCALES ACCORDINGLY.

BENJAMIN EDWARD FUENTES
STATE OF WASHINGTON
88495
REGISTERED
PROFESSIONAL ENGINEER

DESIGNED	CMW
DRAWN	CMW
CHECKED	BEF

DEPARTMENT OF ECOLOGY
State of Washington

WASHINGTON STATE DEPARTMENT OF ECOLOGY
BELLEVUE, WASHINGTON

CIRCLE K SITE 1461 ENVIRONMENTAL
REMEDIATION SYSTEM INSTALLATION
SEATTLE, WASHINGTON

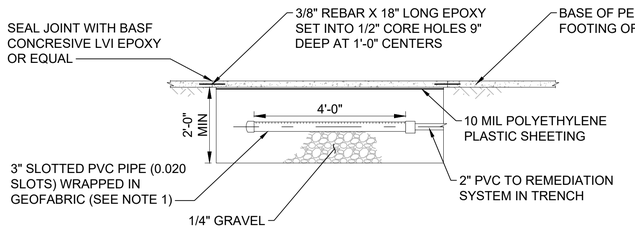
Kennedy Jenks

REMEDIATION SYSTEM LAYOUT

SCALE	1" = 10'
JOB NO	2196008.00
DATE	OCTOBER 2022
SHEET	8 OF 19

C-03

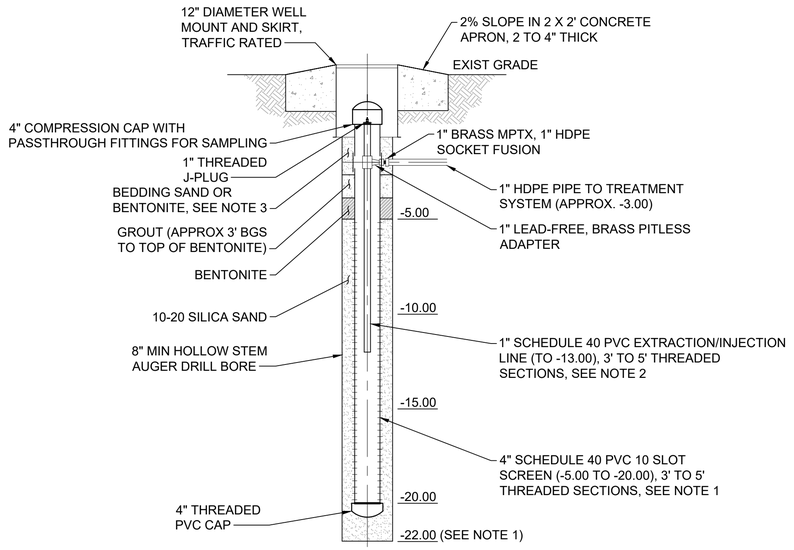
Plot Date: 10/11/2022 7:36 AM
User: RICHARD HILLS
File:\\Cdpw\work\projects\WA Department of Ecology\Projects\Circle K Cleanup_2196008.00\10-Design\10.00-Drawings\Civil\2196008C-04



NOTES:

1. GEOFABRIC SHALL BE NONWOVEN POLYPROPYLENE GEOTEXTILE, SUCH AS MIRAFI 140N, OR EQUAL.
2. SUB-SLAB DEPRESSURIZATION (SSD) WELL SHALL BE INSTALLED AT LEAST 1 FOOT BELOW THE BOTTOM OF ANY PERIMETER FOOTING OF THE BUILDING.

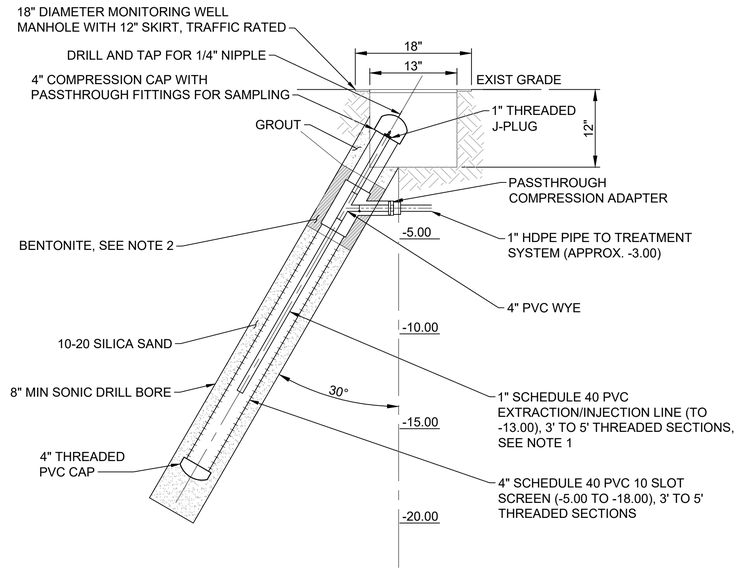
1 C-01 SUB-SLAB DEPRESSURIZATION WELL
SCALE: 1/2" = 1'



NOTES:

1. WELL RW-10 SHALL BE DRILLED TO 30 FT BGS WITH A SCREEN INTERVAL FROM 23 TO 28 FT BGS. IN RW-10 THE EXTRACTION/INJECTION LINE SHALL EXTEND TO - 16 FT BGS.
2. PIPING SHALL EXTEND TO LOW GROUND WATER ELEVATION OR A MINIMUM OF 13' BGS.
3. AFTER INSTALLATION OF COUPLING AND PITLESS ADAPTER, CONTRACTOR SHALL BACKFILL WITH MINIMUM 3" BENTONITE AND THEN COMPACT PER SPECIFICATIONS.

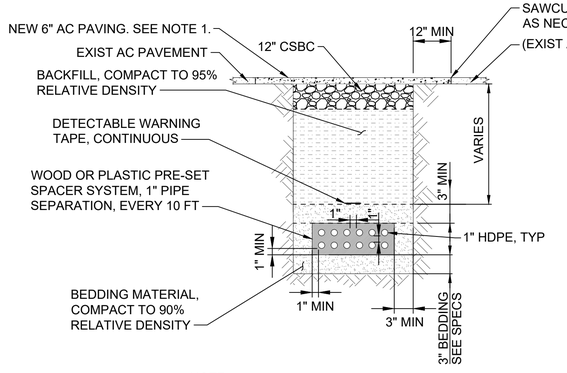
2 C-01 VERTICAL WELL
SCALE: NTS



NOTES:

1. PIPING SHALL EXTEND TO LOW GROUND WATER ELEVATION OR A MINIMUM OF 13' BGS.
2. AFTER INSTALLATION OF WYE, CONTRACTOR SHALL BACKFILL WITH MINIMUM 3" BENTONITE AND THEN COMPACT PER SPECIFICATIONS.

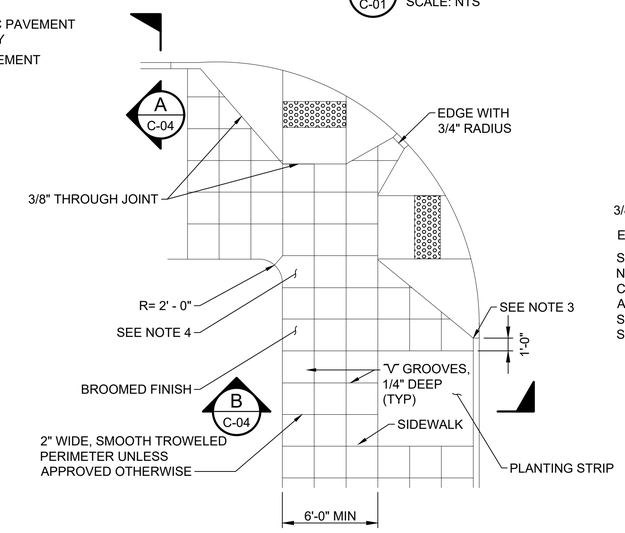
3 C-01 SLANT WELL
SCALE: NTS



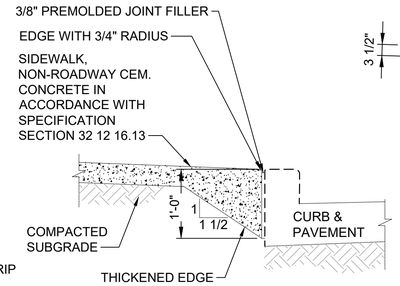
NOTE:

1. NEW AC PAVING OVER CRUSHED SURFACING BASE COURSE COMPACTED TO 95% RELATIVE DENSITY. AC PAVING SHALL BE MINIMUM OF 6" THICK. REMOVE EXISTING PAVEMENT AND BASE FOR THE FULL WIDTH OF THE TRENCH.

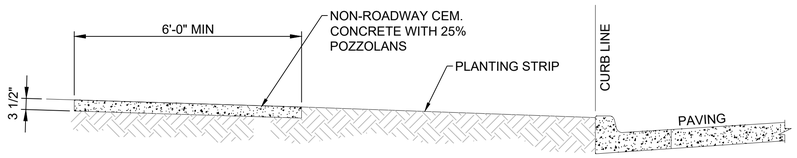
4 C-01 TRENCH SECTION
SCALE: NTS



5 C-01 TYPICAL SIDEWALK & CURB RAMP
SCALE: NTS



A C-04 THROUGH JOINT AT SECTION
SCALE: NTS UNLESS CURB IS MONOLITHIC WITH SIDEWALK



NOTES:

1. 3/8" THROUGH AND CONTRACTION JOINTS MUST BE LOCATED AS REQUIRED BY SPECIFICATION 32 12 16.13.
2. SAWCUT SCORING MUST MATCH PATTERN IN ADJACENT EXISTING SIDEWALK OR MUST BE A 2' SQUARE SCORING PATTERN UNLESS OTHERWISE APPROVED BY THE ENGINEER.
3. 12" MINIMUM BETWEEN EDGE OF RAMP WING AND PLANTING STRIP IS DESIRABLE.
4. 6'-0" MINIMUM CONTINUOUS SIDEWALK MUST BE MAINTAINED AROUND CORNERS.

B C-04 SECTION
SCALE: NTS

ISSUED FOR BID

ANY PRINTS NOT BEARING THIS STAMP MAY HAVE BEEN PRINTED PRIOR TO ADVERTISING AND CANNOT BE CONSIDERED AS BID DOCUMENTS. USERS OF THIS DOCUMENT IN EDITABLE ELECTRONIC FORMATS ARE CAUTIONED AGAINST USE WITHOUT FIRST DETERMINING WHETHER CHANGES MAY HAVE BEEN MADE SUBSEQUENT TO ITS PREPARATION.

NO	REVISION	DATE	BY

SCALES
0 1"
0 25mm
IF THIS BAR IS NOT DIMENSION SHOWN, ADJUST SCALES ACCORDINGLY.

BENJAMIN EDWARD FUENTES — STATE OF WASHINGTON — 68495 — REGISTERED PROFESSIONAL ENGINEER

DESIGNED RJA
DRAWN RJA
CHECKED BEF

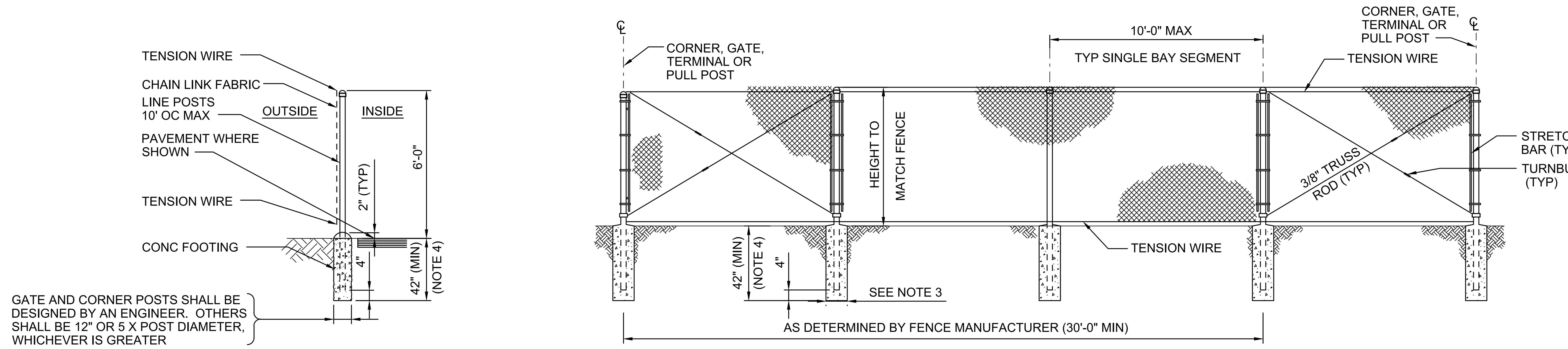
WASHINGTON STATE DEPARTMENT OF ECOLOGY
BELLEVUE, WASHINGTON
CIRCLE K SITE 1461 ENVIRONMENTAL REMEDIATION SYSTEM INSTALLATION
SEATTLE, WASHINGTON

Kennedy Jenks

CIVIL SECTIONS AND DETAILS - I

SCALE AS SHOWN
JOB NO 2196008.00
DATE OCTOBER 2022
SHEET 9 OF 19
C-04

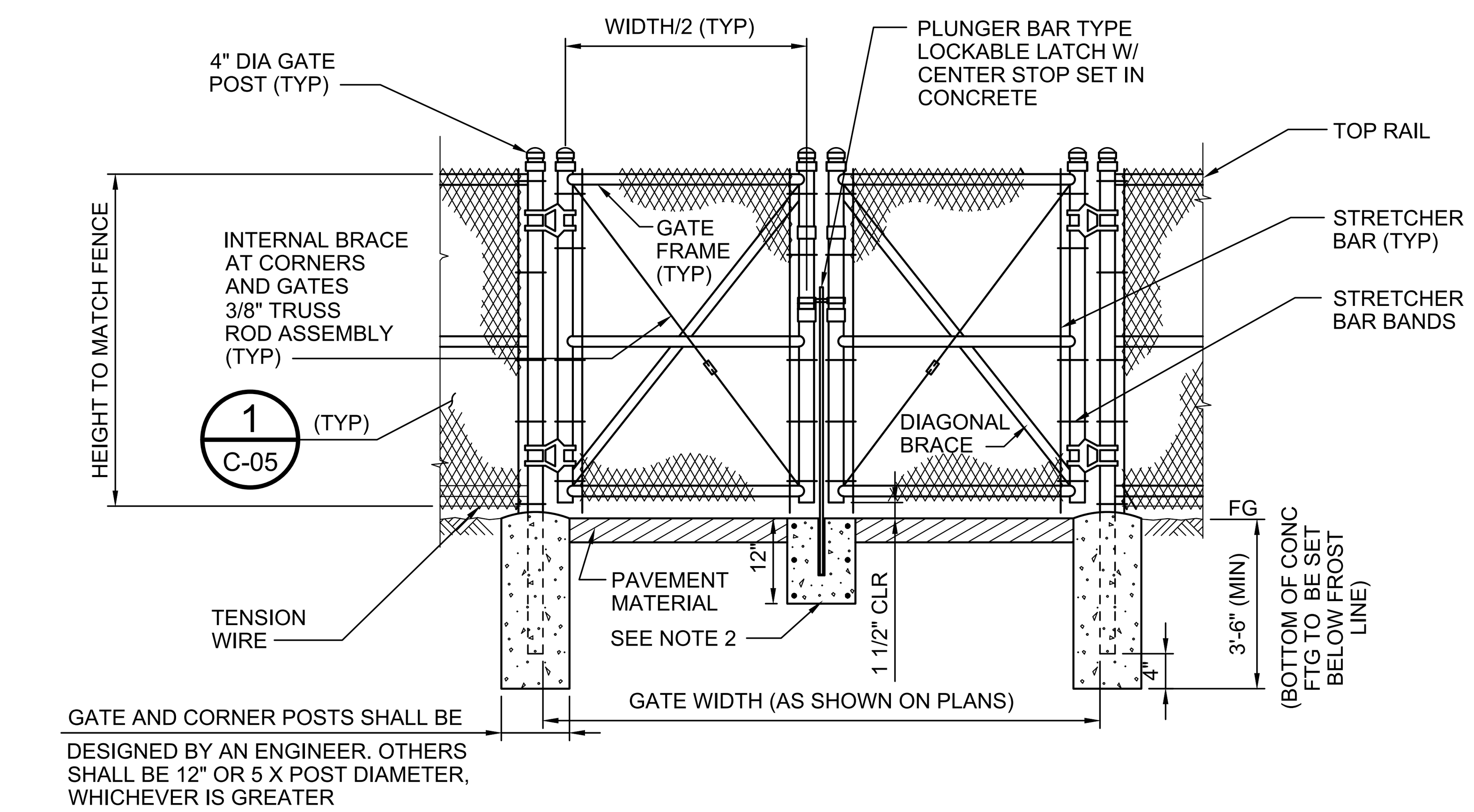
Plot Date: 10/11/2022 7:37 AM
User: RICHARD HILLS
File: ...\WA Department of Ecology\Projects\Circle K Cleanup_2196008.00\10-Design\10.06-Drawings\Civil\219600800-C-05



NOTES:

1. SEE SPECIFICATIONS FOR FENCE MATERIAL, COATINGS, AND INSTALLATION REQUIREMENTS.
2. EXTENSION ARM MAY BE TURNED IN AT OPTION OF OWNER.
3. LINE POSTS FOOTINGS SHALL BE 12" OR 5 X POST DIAMETER, WHICHEVER IS GREATER.
4. BOTTOM OF CONC FTG TO BE SET BELOW FROST LINE.
5. FENCE SHALL INCLUDE PRIVACY SCREEN MATERIAL WOVEN INTO CHAIN LINK FENCE. PRIVACY SCREEN MATERIAL SHALL BE DARK GREY COLOR OR OTHER COLOR AGREED UPON WITH THE OWNER.
6. CONCRETE SHALL HAVE A MINIMUM 28 DAY COMPRESSIVE STRENGTH OF 4,000 PSI AS MEASURED IN ACCORDANCE WITH ASTM C39.
7. MIX DESIGN
   7.1 FIELD TEST RECORDS: SUBMIT IN ACCORDANCE WITH ACI 318 CHAPTER 5.3
   7.2 WATER/CEMENT RATIO: 0.5 MAX
   7.3 AIR CONTENT: 4% +/- 1% IN ACCORDANCE WITH ASTM C231
8. CEMENTITIOUS MATERIALS
   8.1 MINIMUM CONTENT: 570 LBS/CU YD
   8.2 PORTLAND CEMENT: ASTM C150, TYPE II LOW ALKALI
   8.3 FLYASH: ASTM C618, CLASS F, NOT TO EXCEED 20% OF TOTAL CEMENTITIOUS MATERIALS.
9. AGGREGATE
   9.1 COARSE: CONFORM TO ASTM C33, 1-INCH MAX AGGREGATE
   9.2 FINE: CONFORM TO TABLE 1 OF ASTM C33
10. ADMIXTURES
   10.1 AIR ENTRAINING: ASTM C260
   10.2 WATER REDUCING: ASTM C494, TYPE A
11. CONCRETE CONSTRUCTION SHALL CONFORM TO ACI 301-10, 318-11, AND ACI 347.
12. CONCRETE SHALL BE PLACED AND CURED BETWEEN 50 AND 90 DEGREES F.
13. PROVIDE SF-2.0 FINISH AT FORMED SURFACES IN ACCORDANCE WITH ACI 301.
14. PROVIDE TROWEL FINISH AT HORIZONTAL SURFACES IN ACCORDANCE WITH ACI 301.
15. UNLESS OTHERWISE NOTED, ALL EXPOSED EDGES AND CORNERS SHALL BE CHAMFERED 3/4-INCH.
16. REINFORCING BARS SHALL BE ASTM A615-GRADE 60.
17. WELDED WIRE FABRIC SHALL CONFORM TO ASTM A185.
18. ARRANGEMENT AND DETAINING OF REINFORCING STEEL, INCLUDING BAR SUPPORTS AND SPACERS, SHALL BE IN ACCORDANCE WITH THE LATEST ACI 315 DETAILING MANUAL.
19. REINFORCING SHALL LAP IN ACCORDANCE WITH ACI 318-11.
20. DIMENSIONS TO REINFORCING ARE TO BAR CENTERLINES, UNLESS NOTED OTHERWISE BAR COVER IS CLEAR DISTANCE BETWEEN THE BAR AND THE CONCRETE SURFACE. UNLESS SHOWN OTHERWISE, BAR COVER SHALL NOT BE LESS THE 1 1/2 INCH.

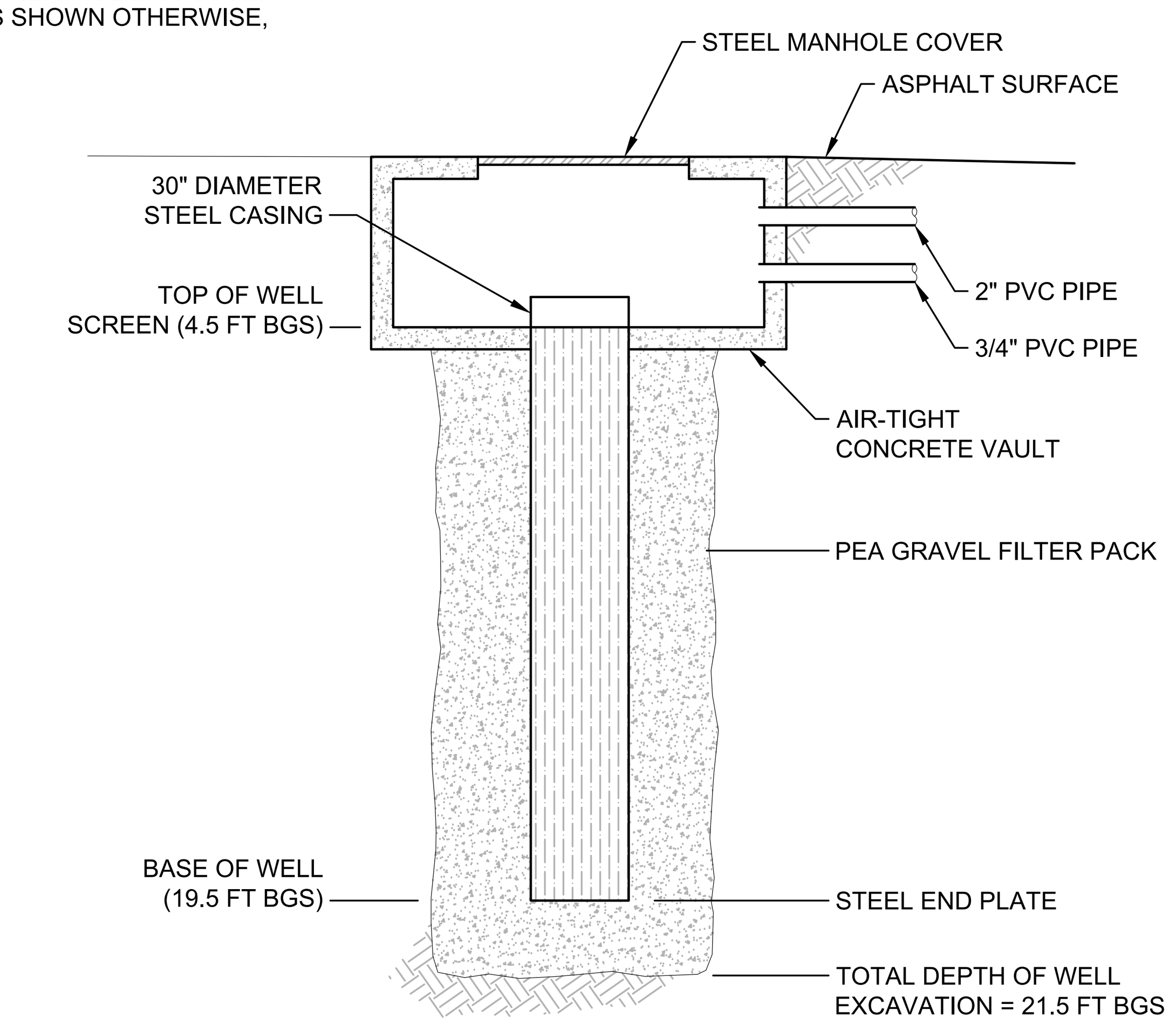
1 (C-03) CHAIN LINK FENCE
SCALE: NTS



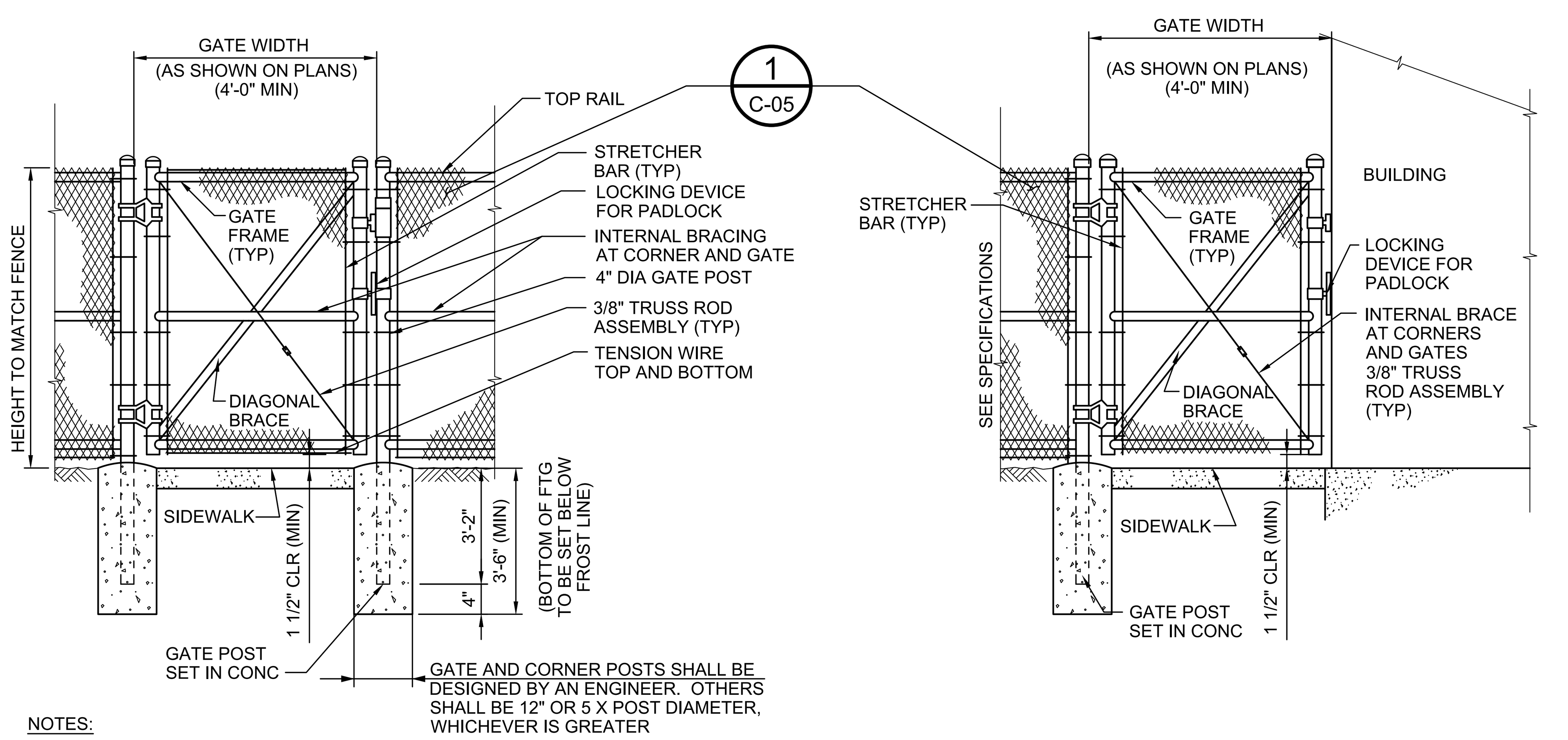
NOTES:

1. SEE SPECIFICATIONS FOR FENCE MATERIAL, COATINGS, AND INSTALLATION REQUIREMENTS.
2. 12" DIAMETER X 18" DEEP CONCRETE STOP W/ 20 GA STEEL PLUNGER SLEEVE, DIA = ROD OD +1/2".

2 (C-03) DOUBLE LEAF SWING GATE
SCALE: NTS



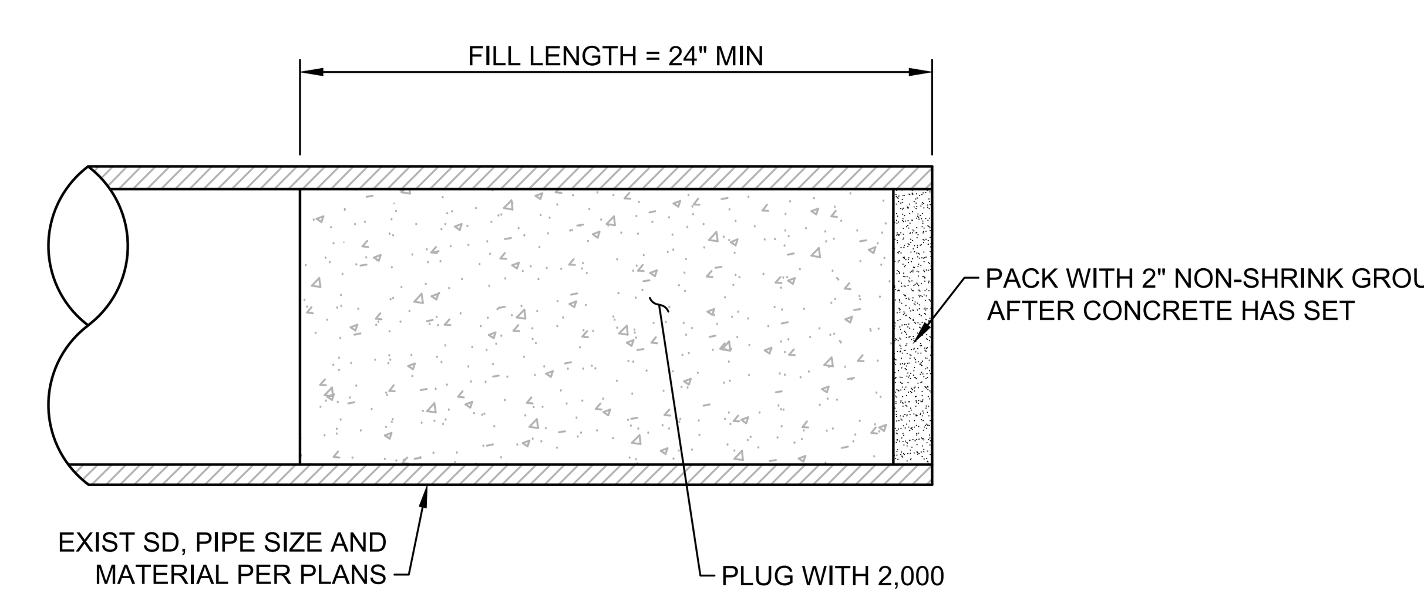
A (C-01) RECOVERY WELL AND VAULT
SCALE: NTS



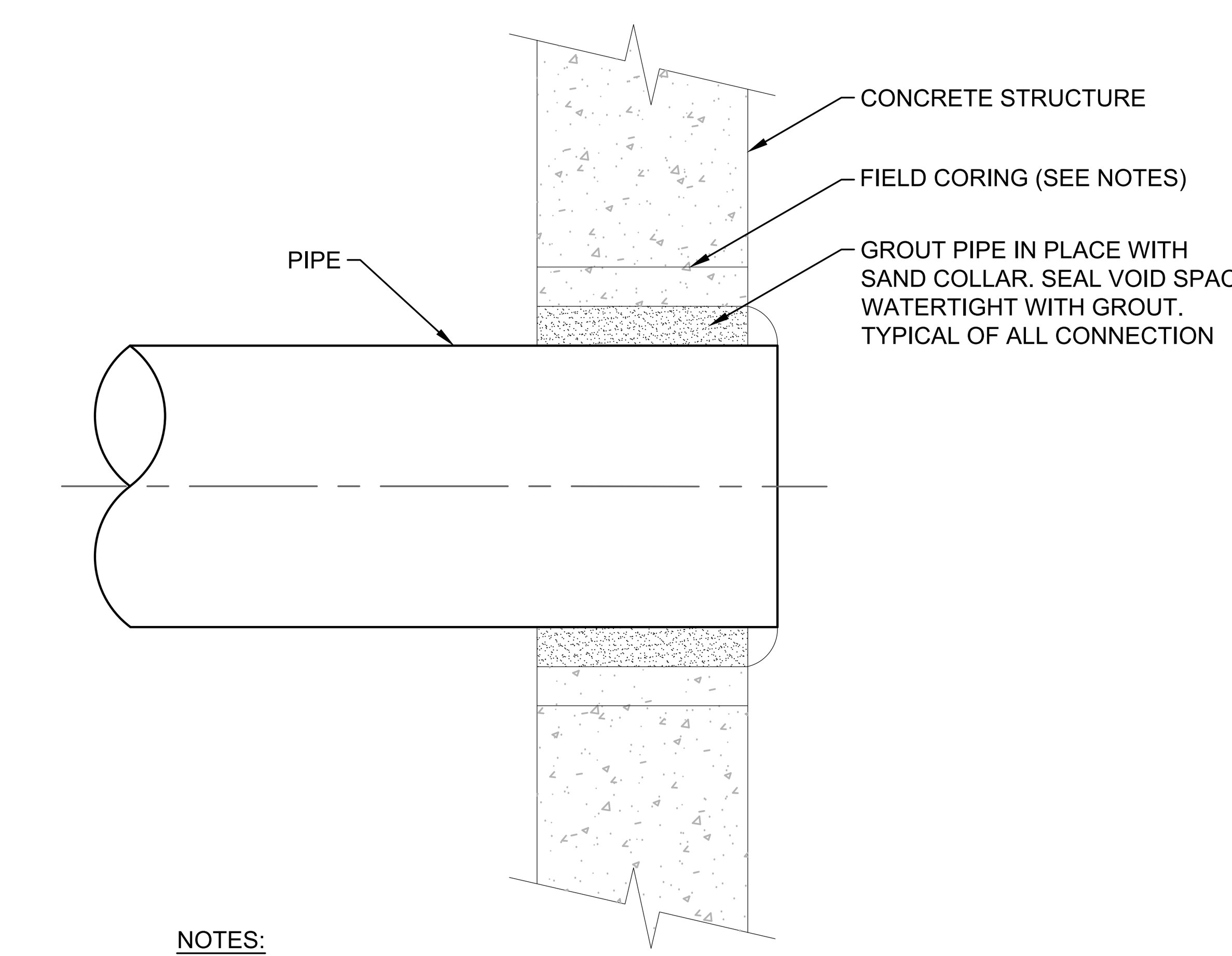
NOTES:

1. SEE SPECS FOR FENCE MATERIAL, COATINGS, AND INSTALLATION REQUIREMENTS.
2. GATE TO BE INSTALLED WITH KEEPER TO SECURE IN OPEN POSITION.
3. GATES LESS THAN 8'-0" IN WIDTH SHALL BE SINGLE LEAF.

3 (C-03) SINGLE LEAF SWING GATE
SCALE: NTS



4 (C-01) PIPE PLUG
SCALE: NTS



NOTES:

1. CONTRACTOR SHALL NEATLY CORE DRILL OPENINGS FOR THESE UTILITY CONNECTION IN THE FIELD BASED ON SPECIFIC UTILITY SIZE AND LOCATION. CORE DRILL OPENING SIZES SHALL BE MINIMIZED AS NECESSARY TO MAKE THE UTILITY CONNECTION.
2. CONTRACTOR SHALL MAKE ALL CORE DRILLED OPENINGS WATERTIGHT WITH NON-SHRINK GROUT.
3. GROUT SHALL MEET THE REQUIREMENTS OF ASTM C 1107 FOR HYDRAULIC-CEMENT NON-SHRINK GROUT, HAVE A 25 TO 30 SECOND FLUID CONSISTENCY ACCORDING TO ASTM C 939, HAVE A MINIMUM WORKING TIME OF 30 MINUTES, HAVE MINIMUM COMPRESSIVE STRENGTH OF 7,500 PSI @ 28 DAYS WHEN PREPARED IN FLUID CONSISTENCY, AND NOT CONTAIN POWDERED ALUMINUM.

5 (C-03) PIPE TO CATCH BASIN CONNECTOR
SCALE: NTS

ISSUED FOR BID

ANY PRINTS NOT BEARING THIS STAMP MAY HAVE BEEN PRINTED PRIOR TO ADVERTISING AND CANNOT BE CONSIDERED AS BID DOCUMENTS. USERS OF THIS DOCUMENT IN EDITABLE ELECTRONIC FORMATS ARE CAUTIONED AGAINST USE WITHOUT FIRST DETERMINING WHETHER CHANGES MAY HAVE BEEN MADE SUBSEQUENT TO ITS PREPARATION.

NO	REVISION	DATE	BY

SCALES
0 — 1"
0 — 25mm
IF THIS BAR IS NOT DIMENSION SHOWN, ADJUST SCALES ACCORDINGLY.

BENJAMIN EDWARD FUENTES — STATE OF WASHINGTON — 88495 REGISTERED PROFESSIONAL ENGINEER

DESIGNED	RJA
DRAWN	RJA
CHECKED	BEF

DEPARTMENT OF ECOLOGY State of Washington

WASHINGTON STATE DEPARTMENT OF ECOLOGY
BELLEVUE, WASHINGTON
CIRCLE K SITE 1461 ENVIRONMENTAL REMEDIATION SYSTEM INSTALLATION
SEATTLE, WASHINGTON

Kennedy Jenks

CIVIL SECTIONS AND DETAILS - II

SCALE	AS SHOWN
JOB NO	2196008.00
DATE	OCTOBER 2022
SHEET	10 OF 19
	C-05

Plot Date: 10/11/2022 7:38 AM
User: RICHARD HILLS
pw:\\kjce-pw.bentley.com:kjce-pw\Documents\Clients\WA Department of Ecology\Projects\Circle K Cleanup_2196008.0010-Design\10.06-Design\Electrical\2196008.0-E-01

ABBREVIATIONS

'	FOOT, FEET
"	INCH, INCHES
#	NUMBER
%	PERCENT
&	AND
@	AT
±	APPROXIMATELY
<	LESS THAN
=	EQUALS
>	GREATER THAN
A	AMPERE(-S)
A/C	AIR CONDITIONING
A/D	ANALOG TO DIGITAL
A/M	AUTO/MANUAL
ABAN(-D)	ABANDON(-ED)
AC	ALTERNATING CURRENT
AF	AMPERE FRAME
AFCI	ARC-FAULT CIRCUIT INTERRUPTER
AFF	ABOVE FINISHED FLOOR
AFG	ABOVE FINISHED GRADE
AI	ANALOG INPUT
AIC	AMPERES INTERRUPTING CAPACITY
ANN	ANNUNCIATOR
ANT	ANTENNA
AO	ANALOG OUTPUT
APPROX	APPROXIMATE(-LY)
ARCH	ARCHITECT(-URAL)
AS	AMMETER SWITCH
ASD	ADJUSTABLE SPEED DRIVE (DC)
AT	AMPERE TRIP
ATS	AUTOMATIC TRANSFER SWITCH
AUTO	AUTOMATIC
AUX	AUXILIARY
AWG	AMERICAN WIRE GAGE
BATT	BATTERY
BC	BARE COPPER
BKR	BREAKER
C	CONDUCTOR, CONTACT
C/S	CONSTANT SPEED
CAB	CABINET
CALC(S)	CALCULATION(S)
CAT	CATEGORY
CB	CATCH BASIN
CCTV	CLOSED-CIRCUIT TELEVISION
CHEM	CHEMI(-CAL, -STRY)
CID1	CLASSIFICATION I, DIVISION 1
CID2	CLASSIFICATION I, DIVISION 2
CKT	CIRCUIT
CLR	CLEAR(-ANCE)
CLSM	CONTROLLED LOW STRENGTH MATERIAL
CO	CONDUIT ONLY
COAX	COAXIAL
COM	COMMON
COMM	COMMUNICATION
COND	CONDUIT
CPT	CONTROL POWER TRANSFORMER
CR	CONTROL RELAY
CT	CURRENT TRANSFORMER
CTRL	CONTROL
CU IN	CUBIC INCH(-ES)
DC	DIRECT CURRENT
DCS	DISTRIBUTED CONTROL SYSTEM
DEG	DEGREE(-S)
DEG C	DEGREES CELSIUS
DEG F	DEGREES FARENHEIT
DEMO	DEMOLISH
DI	DISCRETE INPUT
DIA	DIAMETER
DIAG	DIAGRAM
DISC	DISCONNECT
DISTR	DISTRIBUTION
DO	DISCRETE OUTPUT
DPDT	DOUBLE POLE, DOUBLE THROW
DPST	DOUBLE POLE, SINGLE THROW
DR	DOOR
DTL(-S)	DETAIL(-S)
DUP	DUPLEX
EFFIC	EFFICIENCY
EFFL	EFFLUENT
ELEC	ELECTRIC(-AL)
ELEM	ELEMENTARY
EMERG	EMERGENCY
ENCL	ENCLOSURE
ENET	ETHERNET
ENGR	ENGINEER
EPA	ENVIRONMENTAL PROTECTION AGENCY
EQPM	EQUIPMENT
EST	ESTIMATE(-D)
E-STOP	EMERGENCY STOP
ETC	ET CETERA
ETM	ELAPSED TIME METER
EUSERC	ELECTRIC UTILITY SERVICE EQUIPMENT REQUIREMENTS COMMITTEE
EXIST	EXISTING
EXP	EXPANSION
EXT	EXTERNAL
FA	FIRE ALARM
FACIL	FACILIT(-Y, -IES)
FC	FAIL CLOSED
FDR	FEEDER
FIG	FIGURE
FLA	FULL LOAD AMPERES
FLEX	FLEXIBLE
FO	FIBER OPTIC, FAIL OPEN
FREQ	FREQUENCY
FT	FOOT, FEET
FU	FUSE
FUT	FUTURE
FVNR	FULL VOLTAGE, NON REVERSING
FVR	FULL VOLTAGE, REVERSING
FWD	FORWARD
G	GROUND (ELECTRICAL)
GAC	GRANULAR ACTIVATED CARBON
GAL	GALLON(-S)
GFCI	GROUND-FAULT CIRCUIT INTERRUPTER
GND	GROUND
GRS	GALVANIZED RIGID STEEL
H	HIGH, HEIGHT
HD	HEAT DETECTOR
HDPE	HIGH DENSITY POLYETHYLENE
HGR	HANGER
HH	HANDHOLE
HMI	HUMAN MACHINE INTERFACE
HOA	HAND-OFF-AUTOMATIC
HOR	HAND-OFF-REMOTE
HP	HORSEPOWER
HR(S)	HOUR(-S)
HTR	HEATER
HVAC	HEATING, VENTILATING, AND AIR CONDITIONING
HZ	HERTZ (CYCLES PER SECOND)
I&C	INSTRUMENTATION AND CONTROL
I/O	INPUT/OUTPUT
IEEE	INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS
IL	INDICATING LIGHT
IN	INCH(-ES)
INST	INSTANTANEOUS
INSTR	INSTRUMENT(-ATION)
IP	INTERNET PROTOCOL
IR	INFRARED
IS	INTRINSICALLY SAFE
ISA	INTERNATIONAL SOCIETY OF AUTOMATION
ISO	ISOLAT(-E, -ION)
ISR	INTRINSICALLY SAFE RELAY
JB	JUNCTION BOX
KA	KILOAMPERE(-S)
KCMIL	THOUSANDS OF CIRCULAR MILS
KHZ	KILOHERTZ
KV	KILOVOLT(-S)
KVA	KILOVOLT-AMPERE(-S)
KVAR	KILOVOLT-AMPERE(-S) REACTIVE
KVARH	KILOVOLT-AMPERE REACTIVE HOUR(-S)
KW	KILOWATT(-S)
KWH	KILOWATT HOUR(-S)
L	LENGTH, LINE
LA	LIGHTNING ARRESTER
LAN	LOCAL AREA NETWORK
LB(-S)	POUND(-S)
LCP	LOCAL CONTROL PANEL
LCS	LOCAL CONTROL STATION
LEL	LOWER EXPLOSIVE LIMIT
LOC	LOCATION
LOR	LOCAL-OFF-REMOTE
LOTO	LOCK-OUT, TAG-OUT
LP	LIGHTING PANELBOARD
L-R	LOCAL-REMOTE
LS	LIMIT SWITCH
LT	LIGHT
LTG	LIGHTING
LV	LOW VOLTAGE
mA	MILLIAMPERE(-S)
MAX	MAXIMUM
MCB	MAIN CIRCUIT BREAKER
MCC	MOTOR CONTROL CENTER
MCP	MOTOR CIRCUIT PROTECTOR
MECH	MECHANICAL
MFR	MANUFACTURER
MH	MANHOLE
MHZ	MEGAHERTZ
MIL(-S)	ONE-THOUSANDTH OF AN INCH
MIN	MINIMUM, MINUTE(-S)
MISC	MISCELLANEOUS
MLO	MAIN LUGS ONLY
MM	MULTIMODE
MOCP	MAXIMUM OVERCURRENT PROTECTION
MOD(-S)	MODIFI(-Y, -ICATIONS)
MOV	MOTOR OPERATED VALVE
MT(-D, -G)	MOUNT(-ED, -ING)
MTR	MOTOR
MTS	MANUAL TRANSFER SWITCH
MV	MEDIUM VOLTAGE
N	NORTH, NEUTRAL
N/A	NOT APPLICABLE
NAOCL	SODIUM HYPOCHLORITE
NAOH	SODIUM HYDROXIDE
NC	NORMALLY CLOSED
NEC	NATIONAL ELECTRICAL CODE (NFPA 70)
NECA	NATIONAL ELECTRICAL CONTRACTORS ASSOCIATION
NEMA	NATIONAL ELECTRICAL MANUFACTURER'S ASSOCIATION
NETA	INTERNATIONAL ELECTRICAL TESTING ASSOCIATION
NFC	NOT FOR CONSTRUCTION
NFPA	NATIONAL FIRE PROTECTION ASSOCIATION
NH3	AMMONIA
NIC	NOT IN CONTRACT
NO	NORMALLY OPEN, NUMBER
NORM	NORMAL
NTS	NOT TO SCALE
O/C	OPEN/CLOSE
O3	OZONE
ODP	OPEN DRIP PROOF
OFCI	OWNER FURNISHED, CONTRACTOR INSTALLED
OIT	OPERATOR INTERFACE TERMINAL
OL	THERMAL OVERLOAD RELAY
ORIG	ORIGINAL
OSC	OPEN/STOP/CLOSE
OT	OVER TEMPERATURE
P	POLE
PA	PUBLIC ADDRESS
PB	PULLBOX, PUSHBUTTON
PC(-S)	PIECE(-S), PHOTOCELL
PCC	POINT OF COMMON COUPLING
PE	PHOTOELECTRIC
PF	POWER FACTOR
PFR	POWER FACTOR RELAY
PH	PHASE
PLC	PROGRAMMABLE LOGIC CONTROLLER
PM	POWER MONITOR
PNL	PANEL
PNLBD	PANELBOARD
POE	POWER OVER ETHERNET
PP	POWER POLE
PRI	PRIMARY
PRV	PRESSURE RELIEF VALVE, PRESSURE REDUCING VALVE
PS	POWER SUPPLY
PT(-S)	POTENTIAL TRANSFORMER
PVC	POLYVINYL CHLORIDE
PWR	POWER
R, RAD	RADIUS
RCPT	RECEPTACLE
RCT	REPEAT CYCLE TIMER
RIO	REMOTE INPUT/OUTPUT
RM	ROOM
RMT	REMOTE
RPM	REVOLUTIONS PER MINUTE
RST	RESET
RT	RESET TIMER
RTU	REMOTE TELEMETRY UNIT
RVSS	REDUCED VOLTAGE, SOLID STATE
S/S	START/STOP
SCADA	SUPERVISORY CONTROL AND DATA ACQUISITION
SCR	SILICON CONTROLLED RECTIFIER
SD	SMOKE DETECTOR
SEC	SECONDARY
SER	SERVICE ENTRANCE RATED
SGNL	SIGNAL
(SH)	SHIELDED
SHT	SHEET
SM	SINGLEMODE
SP	SET POINT
SPD	SURGE PROTECTIVE DEVICE
SPDT	SINGLE POLE, DOUBLE THROW
SPEC(-S)	SPECIFICATION(-S)
SS	STAINLESS STEEL, SOLID STATE
STB	SHORTING TERMINAL BLOCK
STD(-S)	STANDARD(-S)
STL	STEEL
STP	SHIELDED TWISTED PAIR
STRC	STRUCTUR(-E, -AL)
SWBD	SWITCHBOARD
SWGR	SWITCHGEAR
SYNC	SYNCHRONIZING
T	TIME(-R)
TB	TERMINAL BLOCK
TC	TRAY CABLE
TCP	TRANSMISSION CONTROL PROTOCOL
TEFC	TOTALLY ENCLOSED FAN COOLED
TEL	TELEPHONE
TEMP	TEMPERATURE, TEMPORARY
TENV	TOTALLY ENCLOSED NON-VENTILATED
THRU	THROUGH
TOT	TOTAL, TOTALIZE(R)
TSTAT	THERMOSTAT
TYP	TYPICAL
UG	UNDERGROUND
UL	UNDERWRITERS LABORATORIES
UNKN	UNKNOWN
UPS	UNINTERRUPTIBLE POWER SUPPLY
UTP	UNSHIELDED TWISTED PAIR
UV	ULTRAVIOLET
V	VOLTS
V/S	VARIABLE SPEED
VA	VOLT-AMPERES
VAR	VARIES, VARIABLE, VOLT-AMPERES REACTIVE
VCP	VENDOR CONTROL PANEL
VFD	VARIABLE FREQUENCY DRIVE (AC)
VFI	VACUUM FAULT INTERRUPTER
VS	VOLTMETER SWITCH
W	WIDE, WIDTH, WIRE, WATTS, WEST
W/	WITH
W/O	WITHOUT
WAN	WIDE AREA NETWORK
WHDM	WATT-HOUR DEMAND METER
WHM	WATT-HOUR METER
WP	WEATHERPROOF, WEATHER PROTECTED
WR	WEATHER RESISTANT
WTP	WATER TREATMENT PLANT
WTR	WATER
WW	WASTEWATER
WWTP	WASTEWATER TREATMENT PLANT
XFMR	TRANSFORMER
XP	EXPLOSION PROOF

ELECTRICAL NOTES

1. THIS IS A GENERALIZED LEGEND SHEET. THIS CONTRACT MAY NOT USE ALL INFORMATION SHOWN.
2. THE INSTALLATION OF ALL EQUIPMENT, RACEWAYS, CONDUCTORS, AND CABLES SHOWN ON THESE DRAWINGS OR DESCRIBED IN THE SPECIFICATIONS SHALL CONFORM TO THE REQUIREMENTS SET FORTH IN THE LATEST EDITIONS OF THE NATIONAL ELECTRICAL CODE AND ALL APPLICABLE LOCAL CODES AND UTILITY COMPANY STANDARDS. IT IS THE CONTRACTOR'S RESPONSIBILITY TO CONTACT THE UTILITY COMPANY AND VERIFY THEIR REQUIREMENTS.
3. ELECTRICAL CONTRACTOR SHALL VISIT THE SITE PRIOR TO BIDDING THE PROJECT TO VERIFY THE SCOPE OF WORK WITH FIELD CONDITIONS. PARTICULAR ATTENTION SHOULD BE GIVEN TO NEW CONDUIT RUNS IN EXISTING BUILDINGS.
4. NOTIFY THE ENGINEER IMMEDIATELY IN WRITING IF CONFLICTS IN EQUIPMENT LOCATIONS ARE DISCOVERED OR IF PROBLEMS ARISE DUE TO FIELD CONDITIONS, LACK OF INFORMATION OR ANY OTHER REASON. NO PAYMENT WILL BE MADE FOR CHANGES WHICH HAVE NOT BEEN FAVORABLY REVIEWED BY THE ENGINEER.
5. CONDUIT ROUTING SHOWN ON PLAN DRAWINGS IS DIAGRAMMATIC ONLY. RACEWAYS SHALL BE INSTALLED IN A MANNER TO PREVENT CONFLICTS WITH EQUIPMENT OR STRUCTURAL CONDITIONS. EXPOSED RACEWAYS SHALL BE INSTALLED PARALLEL OR PERPENDICULAR TO BEAMS AND WALLS. REFER ALSO TO THE CONTRACT SPECIFICATIONS.
6. VERIFY THE EXACT LOCATION OF TERMINAL BOXES AND CONDUIT ENTRANCES TO ALL EQUIPMENT AGAINST APPROVED SHOP DRAWINGS BEFORE STUBBING UP CONDUITS. CONDUIT STUB-UPS SHALL NOT BE MORE THAN 6 INCHES FROM THE CENTERLINE OF TERMINAL BOXES.
7. CONNECTIONS BETWEEN RIGID CONDUIT AND MOTOR TERMINAL BOXES OR SIMILAR EQUIPMENT SUBJECT TO VIBRATION SHALL BE FLEXIBLE LIQUID-TIGHT CONDUIT.
8. CONDUITS SHALL BE TERMINATED SO AS TO PERMIT NEAT CONNECTION TO MOTORS AND OTHER EQUIPMENT.
9. CONDUITS FOR FUTURE EQUIPMENT OR EXTENSIONS SHALL BE TERMINATED AS SHOWN IN THE DETAILS OR AS SPECIFIED.
10. LOCATIONS OF PULLBOXES ARE APPROXIMATE. COORDINATE EXACT LOCATION IN THE FIELD TO ENSURE 6 INCHES (MINIMUM) CLEARANCE FROM MECHANICAL PIPING FLOW LINES.
11. ONLY MAJOR PULLBOXES ARE SHOWN. PROVIDE ADDITIONAL PULLBOXES WHERE REQUIRED TO MAKE A WORKABLE INSTALLATION.
12. PERFORM WORK IN ACCORDANCE WITH THE DETAILS WHETHER OR NOT THEY ARE REFERENCED ON THE DRAWINGS.
13. VERIFY ALL COLOR REQUIREMENTS BEFORE ORDERING MATERIALS.
14. THE WIRING DIAGRAMS, QUANTITY AND SIZE OF WIRES AND CONDUIT REPRESENT A SUGGESTED ARRANGEMENT BASED UPON SELECTED STANDARD COMPONENTS OF ELECTRICAL EQUIPMENT. MODIFICATIONS ACCEPTABLE TO THE ENGINEER MAY BE MADE BY THE CONTRACTOR TO ACCOMMODATE EQUIPMENT ACTUALLY PURCHASED. THE BASIC SEQUENCE AND METHOD OF CONTROL MUST BE MAINTAINED AS INDICATED ON THE DRAWINGS AND/OR SPECIFICATIONS.
15. REFER TO THE MECHANICAL DRAWINGS FOR CERTAIN CONTROL DIAGRAMS, EXACT LOCATIONS OF MECHANICAL EQUIPMENT, AND FOR CERTAIN CONNECTIONS TO BE MADE TO ELECTRICAL CIRCUITS.
16. CONDUIT SIZE AND FILL SHALL BE AS INDICATED ON THE CONDUIT AND CABLE SCHEDULES. WHERE NO SIZE IS SHOWN, THE CONDUIT SHALL BE SIZED IN ACCORDANCE WITH THE LATEST EDITION OF THE NATIONAL ELECTRICAL CODE ADOPTED BY THE AUTHORITY HAVING JURISDICTION. MINIMUM CONDUIT SIZE IS 3/4 INCH, EXCEPT WHERE ENCASED OR BURIED. MINIMUM ENCASED OR BURIED CONDUIT SIZE IS 1 INCH.
17. PROVIDE EXPANSION OR EXPANSION AND DEFLECTION FITTINGS FOR ALL CONDUIT RUNS CROSSING EXPANSION JOINTS. REFER TO THE STRUCTURAL DRAWINGS FOR LOCATIONS OF EXPANSION JOINTS.
18. PROVIDE 3/16 INCH NYLON PULL ROPE IN EACH EMPTY CONDUIT.
19. FOR LIGHTING AND RECEPTACLE SYSTEMS, ONLY CIRCUIT NUMBERS ARE SHOWN. PROVIDE ALL NECESSARY CONDUITS, WIRES, FITTINGS, JUNCTION BOXES AND NECESSARY COMPONENTS SHOWN OR NOT SHOWN ON THE DRAWINGS, TO MAKE THE ELECTRICAL INSTALLATION COMPLETE AND OPERATIONAL. SIZE CONDUITS AND WIRING IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE. ALL CONDUIT RUNS SHALL BE CONCEALED UNLESS INDICATED OTHERWISE. CIRCUIT LOADING SHALL BE AS INDICATED IN THE PANEL SCHEDULES. ALL LIGHTING AND RECEPTACLE CIRCUITS SHALL INCLUDE GROUND WIRE.
20. MOUNT LUMINAIRES ACCORDING TO THE MOUNTING HEIGHT GIVEN ON THE DRAWINGS, WITH THE DISTANCE BEING MEASURED FROM THE BOTTOM OF THE LUMINAIRE TO THE FINISHED FLOOR. PROVIDE APPROPRIATE BRACKETS AND HARDWARE FOR MOUNTING.
21. ALL RECEPTACLES IN OUTDOOR AND ANTICIPATED WET AREAS SHALL BE GROUND FAULT CIRCUIT INTERRUPTER RECEPTACLES WITH WEATHERPROOF WHILE IN-USE COVERS.
22. ALL FREE STANDING ELECTRICAL EQUIPMENT AND CONTROL PANELS SHALL BE SET ON CONCRETE HOUSEKEEPING PADS WITH LEVELING CHANNELS EMBEDDED IN THE PAD.
23. ALL PANELBOARDS SHALL BE MOUNTED SO THAT THE DISTANCE FROM THE CENTERLINE OF THE TOP CIRCUIT BREAKER OPERATING HANDLE IN THE UPPERMOST POSITION TO THE FINISHED FLOOR SHALL NOT EXCEED 6'-7".
24. ALL SURFACE MOUNTED PANELS AND PANELBOARDS ON THE INTERIOR OF EXTERIOR WALLS ABOVE GRADE OR IN OTHER LOCATIONS CONSIDERED DAMP OR WET SHALL BE MOUNTED SO AS TO MAINTAIN A 1/4 INCH (MINIMUM) AIR SPACE BETWEEN THE ENCLOSURE AND THE WALL.
25. PROVIDE LOCKOUTS IN STRICT ACCORDANCE WITH OWNER'S REQUIREMENTS.
26. REFER TO THE SINGLE LINE DIAGRAMS, EQUIPMENT ELEVATIONS, PANELBOARD SCHEDULES, AND COMPONENT/DEVICE LABELS IN THE CONTROL SCHEMATICS FOR NAMEPLATE INFORMATION. SEE THE CONTRACT SPECIFICATIONS FOR NAMEPLATE SIZE, COLOR, MATERIAL, AND PLACEMENT REQUIREMENTS.
27. "NORMAL" STATUS OF SWITCHES OR CONTACTS SHOWN IN CONTROL SCHEMATICS IS THE SHELF POSITION.

ELECTRICAL DEMOLITION NOTES

1. BIDDING CONTRACTORS SHALL VISIT THE SITE TO ASSESS THE SCOPE OF DEMOLITION, REMOVAL AND MODIFICATION WORK.
2. ELECTRICAL CONTRACTOR AND THE OWNER SHALL DE-ENERGIZE ALL WIRING PRIOR TO REMOVAL OF EQUIPMENT, DEVICES, MOTORS INSTRUMENTATION, CONTROL PANELS, ETC. CONTRACTOR SHALL OBTAIN PRIOR APPROVAL FROM THE OWNER.
3. EXPOSED RACEWAYS: REMOVE CONDUIT, WIRES, AND BOXES. PATCH TO MATCH EXISTING. FINISH ALL OPENINGS LEFT IN WALLS AND FLOORS.
4. CONCEALED CONDUITS IN THE SLAB: REMOVE EXISTING WIRES TO THE EXTENT POSSIBLE AND ABANDON CONDUITS IN THE SLAB. CUT CONDUIT FLUSH AND PATCH THE FLOOR TO MATCH EXISTING.
5. CONTROL PANELS: ELECTRICAL CONTRACTOR SHALL DE-ENERGIZE AND REMOVE ALL CONDUIT AND WIRE AS DESCRIBED IN NOTES 3 AND 4. CONTRACTOR SHALL REMOVE PANELS AS NOTED ON THE CONTRACT DRAWINGS.
6. MOTOR CONTROL CENTERS: DISCONNECT AND REMOVE ALL CONDUITS AND WIRING TO EXISTING STARTERS AND/OR BREAKERS, PANELBOARDS, BRANCH CIRCUITS, INTERLOCKS AND STATUS WIRING WITHIN MCC.
7. REFER TO THE CONTRACT SPECIFICATIONS FOR ADDITIONAL ELECTRICAL DEMOLITION AND REMOVAL REQUIREMENTS.

ISSUED FOR BID

ANY PRINTS NOT BEARING THIS STAMP MAY HAVE BEEN PRINTED PRIOR TO ADVERTISING AND CANNOT BE CONSIDERED AS BID DOCUMENTS. USERS OF THIS DOCUMENT IN EDITABLE ELECTRONIC FORMATS ARE CAUTIONED AGAINST USE WITHOUT FIRST DETERMINING WHETHER CHANGES MAY HAVE BEEN MADE SUBSEQUENT TO ITS PREPARATION.

NO	REVISION	DATE	BY

SCALES
0 1"
0 25mm
IF THIS BAR IS NOT DIMENSION SHOWN, ADJUST SCALES ACCORDINGLY.

LAWRENCE G. REISINGER — STATE OF WASHINGTON — 22589 — REGISTERED PROFESSIONAL ENGINEER

DESIGNED	LGR
DRAWN	RM
CHECKED	LGR

WASHINGTON STATE DEPARTMENT OF ECOLOGY
BELLEVUE, WASHINGTON
CIRCLE K SITE 1461 ENVIRONMENTAL REMEDIATION SYSTEM INSTALLATION
SEATTLE, WASHINGTON
Kennedy Jenks

GENERAL ELECTRICAL ABBREVIATIONS AND NOTES

SCALE	AS SHOWN
JOB NO	2196008.00
DATE	OCTOBER 2022
SHEET	11 OF 19
	E-01

Plot Date: 10/11/2022 7:40 AM
User: RICHARD HILLS
pw:\\kjce-pw.bentley.com:kjce-pw\Documents\Clients\WA Department of Ecology\Projects\Circle K Cleanup_2196008.00\10-Design\10.06-Drawings\Electrical\219600800-E-02

SINGLE LINE DIAGRAM SYMBOLS

BUS

BUS (EXISTING)

FEEDER

FEEDER (EXISTING)

X — AMPS FRAME — 100A / 70A — AMPS TRIP
LOW VOLTAGE THERMAL-MAGNETIC CIRCUIT BREAKER
3-POLE EXCEPT WHERE NOTED
X = CIRCUIT NUMBER OR LOCATION (SEE ELEVATION)

X — AMPS CONTINUOUS — 100A / MCP
LOW VOLTAGE MOTOR CIRCUIT PROTECTOR
3-POLE EXCEPT WHERE NOTED
X = CIRCUIT NUMBER OR LOCATION (SEE ELEVATION)

400AF / 200AT
LOW VOLTAGE DRAWOUT CIRCUIT BREAKER
INCLUDING L-S-I-G SETTINGS UNLESS NOTED OTHERWISE
L = LONG TIME
S = SHORT TIME
I = INSTANTANEOUS
G = GROUND FAULT

52 — MEDIUM VOLTAGE DRAWOUT CIRCUIT BREAKER

FVNR # — FULL VOLTAGE COMBINATION STARTER
WITH CONTROL POWER TRANSFORMER
# = NEMA SIZE
FVR = REVERSING TYPE
FVNR = NON-REVERSING TYPE

RVSS __A — REDUCED VOLTAGE STARTER
WITH CONTROL POWER TRANSFORMER
RATING IN AMPERES AS INDICATED
RVSS = SOLID STATE TYPE
RVAT = AUTO-TRANSFORMER TYPE

VFD __A — VARIABLE FREQUENCY DRIVE
WITH CONTROL POWER TRANSFORMER
RATING IN AMPERES AS INDICATED

30A — DISCONNECT SWITCH
3 POLE EXCEPT WHERE NOTED
RATING IN AMPERES AS INDICATED

30A / 25A — FUSED DISCONNECT SWITCH
3 POLE EXCEPT WHERE NOTED
RATINGS IN AMPERES AS INDICATED

480:120 (3) — POTENTIAL TRANSFORMER
RATIO AND NUMBER OF PT'S AS INDICATED

(3) — CURRENT TRANSFORMER
RATIO AND NUMBER OF CT'S AS INDICATED

* — METERING DEVICE
* = METER TYPE
WHM = WATT HOUR METER
WM = WATT METER
AM = AMMETER
VM = VOLTMETER
PFM = POWER FACTOR METER
SSM = SOLID STATE METER

— RELAY DEVICE FUNCTION
PER ANSI NUMBER C37.2

15/25	AUTO SYNCHRONIZER RELAY
25	SYNCHRONISM CHECK RELAY
27	UNDERVOLTAGE RELAY
27/59	UNDER/OVERVOLTAGE RELAY
32	DIRECTIONAL POWER RELAY
37	UNDERCURRENT RELAY
38	HIGH TEMP (BEARING)
39	VIBRATION RELAY
40	LOSS OF FIELD/UNDER EXCITATION RELAY
41	FIELD CONTACTOR
43	SELECTOR SWITCH
46	CURRENT IMBALANCE RELAY
47	PHASE SEQUENCE/FAILURE RELAY
48	GROUND FAULT INCOMPLETE SEQUENCE RELAY
49	HIGH TEMP (OIL OR STATOR)
50/51	INST/TIME OVERCURRENT RELAY
50/51G	INST/TIME DIRECTLY CONNECTED GND OVERCURRENT RELAY
50/51N	INST/TIME RESIDUALLY CONNECTED GND OVERCURRENT
51G	GND FAULT RELAY
52	POWER CIRCUIT BREAKER
55	POWER FACTOR TRIP RELAY
60	VOLTAGE BALANCE
62	TIME DELAY
65	GOVERNOR LOAD SHARING/SOFT LANDING CONTROL
66	TIME BETWEEN STARTS RELAY
67	DIRECTIONAL REVERSE VAR/KW RELAY
71L	LOW OIL LEVEL RELAY
81O/U	OVER/UNDER FREQUENCY RELAY
83	CONTROL POWER TRANSFORMER
86	UTILITY LOCKOUT RELAY
87TL	TRANSFORMER DIFFERENTIAL RELAY
87M	MOTOR DIFFERENTIAL RELAY
90	VAR/PF AND CROSS CURRENT COMPENSATION CONTROLLER

K — KEY INTERLOCK

ST — SHUNT TRIP

SSMP — SOLID STATE MOTOR PROTECTIVE DEVICE

SPD — SURGE PROTECTIVE DEVICE

EARTH GROUND CONNECTION

LIGHTNING ARRESTOR AND SURGE CAPACITOR

HP, FLA — MOTOR
HORSEPOWER AND FULL LOAD AMPERES AS INDICATED

KW, __A — PACKAGED EQUIPMENT
LOAD (IN KW OR KVA) AND AMPERES AS INDICATED

MOV — ELECTRICAL MOTOR OPERATED VALVE
WITH INTEGRAL REVERSING STARTER

TERMINATOR / POTHEAD

POWER OR DISTRIBUTION TRANSFORMER
CONFIGURATION AND RATING AS INDICATED

DELTA-WYE

DELTA-WYE GROUNDED

DELTA-DELTA

GEN — GENERATOR
RATINGS AS INDICATED

AUTOMATIC OR MANUAL TRANSFER SWITCH
RATING AND CONFIGURATION AS INDICATED

5 — CAPACITOR
RATING IN KVAR AS INDICATED

__A __SEC — NEUTRAL GROUNDING RESISTOR
CURRENT RATING IN AMPERES AS NOTED
TIME RATING IN SECONDS AS NOTED

— CONTACTOR
NUMBER INDICATES NEMA SIZE

OVERLOAD (THERMAL OR SOLID STATE)

5A — FUSE
SIZE AS INDICATED

AS — AMMETER SWITCH

VS — VOLTMETER SWITCH

RECEPTACLE, 120V

SPECIAL RECEPTACLE, 208V OR 240V, 1-PHASE

SPECIAL/WELDING RECEPTACLE, 208V OR 240V, 3-PHASE

SPECIAL RECEPTACLE, 480V, 3-PHASE

CONTROL SCHEMATIC SYMBOLS

CONDUCTORS - NOT CONNECTED

CONDUCTORS - CONNECTED

TERMINAL

** # — CONTROL DEVICE COIL
** = TYPE
CR = CONTROL RELAY
TD = TIME DELAY RELAY
ISR = INTRINSICALLY SAFE RELAY
PC = PHOTOCELL

CR 1 — XXXX, XXXX
NORMALLY OPEN CONTACT LINE REFERENCE
NORMALLY CLOSED CONTACT LINE REFERENCE

SV-# — SOLENOID COIL

CR# CR# — CONTACT
NORMALLY OPEN / CLOSED

MCP, 5A — CIRCUIT BREAKER OR MCP AS NOTED
1-POLE / 3-POLE

OL — OVERLOAD (THERMAL OR SOLID STATE)

DISCONNECT SWITCH
1-POLE / 3-POLE

M — MOTOR

CONTROL POWER TRANSFORMER

BATTERY

5A — FUSE
RATING IN AMPERES

EARTH GROUND CONNECTION

CHASSIS GROUND CONNECTION
(NOT NECESSARILY EARTH GROUNDED)

DI — DIGITAL INPUT TO PLC/RTU/DCS

DIGITAL OUTPUT FROM PLC/RTU/DCS
NORMALLY OPEN

DIGITAL OUTPUT FROM PLC/RTU/DCS
NORMALLY CLOSED

AI — ANALOG INPUT TO PLC/RTU/DCS
4-20 mA (UNLESS INDICATED OTHERWISE)

AO — ANALOG OUTPUT FROM PLC/RTU/DCS
4-20 mA (UNLESS INDICATED OTHERWISE)

SINGLE POLE SWITCH
NORMALLY OPEN / CLOSED

H O A, XOO, OOX — THREE-POSITION SELECTOR SWITCH
X: INDICATES CONTACTS CLOSED
H-O-A: HAND-OFF-AUTO
L-O-R: LOCAL-OFF-REMOTE
O-S-C: OPEN-STOP-CLOSE

L R, XOO, OOX — TWO-POSITION SELECTOR SWITCH
X: INDICATES CONTACTS CLOSED
L-R: LOCAL-REMOTE
O-C: OPEN-CLOSE
A-M: AUTO-MANUAL

O S C, XOO, OOX — THREE-POSITION SELECTOR SWITCH
WITH SPRING-RETURN MOMENTARY
CONTACT

E-STOP E-STOP — EMERGENCY PUSHBUTTON
NORMALLY OPEN / CLOSED

PUSHBUTTON
NORMALLY OPEN / CLOSED

MULTI-POSITION
SELECTOR SWITCH

X — PUSH-TO-TEST INDICATING LIGHT
X = COLOR
A = AMBER
B = BLUE
G = GREEN
R = RED
W = WHITE

X — INDICATING LIGHT

ETM — ELAPSED TIME METER

BUZZER

BELL

HORN

RESISTANCE TEMPERATURE DETECTOR (RTD)

HEATER

COMMUNICATION JACK
(ETHERNET UNLESS INDICATED OTHERWISE)

RECEPTACLE, 120V

NGR — NEUTRAL GROUNDING RESISTOR

1 — LOCATION SYMBOL
LEGEND SHOWN ON SCHEMATIC DRAWINGS
ALL DEVICES ARE LOCATED IN THE MCC
UNLESS INDICATED OTHERWISE

POTENTIOMETER

REACTOR (LINE OR LOAD
DEPENDING ON PLACEMENT)

SENSING SWITCHES		
CLOSE ON		SENSED VARIABLE
RISING	FALLING	
FS	FS	FLOW
LS	LS	LEVEL
PS	PS	PRESSURE
TS	TS	TEMPERATURE

LIMIT SWITCHES	
ZS	NORMALLY OPEN,CLOSE ON REACHING LIMIT
ZS	NORMALLY CLOSED, OPEN ON REACHING LIMIT

TORQUE SWITCH	
	NORMALLY CLOSED, OPEN ON INCREASING TORQUE

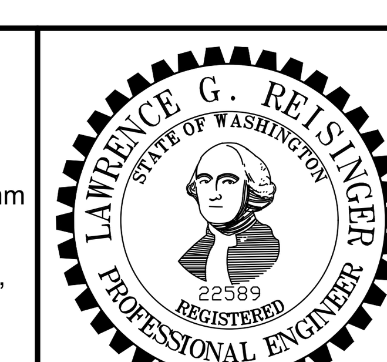
TIMED CONTACTS			
SYMBOL	NORMAL	OPEN TO CLOSED	CLOSED TO OPEN
TR	OPEN	DELAYED	INSTANTANEOUS
TR	CLOSED	INSTANTANEOUS	DELAYED
TR	OPEN	INSTANTANEOUS	DELAYED
TR	CLOSED	DELAYED	INSTANTANEOUS

ISSUED FOR BID

ANY PRINTS NOT BEARING THIS STAMP MAY HAVE BEEN PRINTED PRIOR TO ADVERTISING AND CANNOT BE CONSIDERED AS BID DOCUMENTS. USERS OF THIS DOCUMENT IN EDITABLE ELECTRONIC FORMATS ARE CAUTIONED AGAINST USE WITHOUT FIRST DETERMINING WHETHER CHANGES MAY HAVE BEEN MADE SUBSEQUENT TO ITS PREPARATION.

NO	REVISION	DATE	BY

SCALES
0 — 1"
0 — 25mm
IF THIS BAR IS NOT DIMENSION SHOWN, ADJUST SCALES ACCORDINGLY.



DESIGNED LGR
DRAWN RM
CHECKED LGR

WASHINGTON STATE DEPARTMENT OF ECOLOGY
BELLEVUE, WASHINGTON
CIRCLE K SITE 1461 ENVIRONMENTAL REMEDIATION SYSTEM INSTALLATION
SEATTLE, WASHINGTON

Kennedy Jenks

GENERAL ELECTRICAL
LEGEND - I

SCALE AS SHOWN
JOB NO 2196008.00
DATE OCTOBER 2022
SHEET 12 OF 19
E-02

PLAN SYMBOLS

CONDUIT AND RACEWAYS

- CONDUIT - MULTIPLE IN DUCT BANK
- MULTIPLE CONDUIT RUN
- CONDUIT - ENCASED OR UNDERGROUND
- CONDUIT - EXPOSED OR CONCEALED
- CALLOUT INDICATING CONDUIT PER SCHEDULE (P-135)
- HOME RUN TO PANELBOARD OR AS INDICATED (3/4 " CONDUIT, 2 #12, 1 #12 GND UNLESS INDICATED OTHERWISE)
- FLEXIBLE CONDUIT
- CONDUIT RUN, CONTINUES ON SAME SHEET OR AS NOTED
- CONDUIT - CAPPED OR SEALED
- OPEN CIRCLE DENOTES UPWARD CONDUIT RISER
- SEMI CIRCLE DENOTES DOWNWARD CONDUIT RISER
- (J) JUNCTION BOX
- HH-# UNDERGROUND RACEWAY HANDHOLE DIMENSIONS AS NOTED
- MH-# UNDERGROUND RACEWAY MANHOLE DIMENSIONS AS NOTED

EQUIPMENT

- (M) MOTOR
- PANEL OR CABINET - AS LABELED SWBD, SWGR, MCC, LP, PNLBD, PLC, ETC

GROUNDING

- BARE COPPER GROUND TO GROUND WIRE IN SLAB, OR UNDERGROUND GROUND GRID, SIZE AS NOTED
- GROUND CONNECTION - BOLTED
- GROUND CONNECTION - EXOTHERMICALLY WELDED
- GROUND ROD - IN WELL WITH BOX
- GROUND ROD - BURIED

FIRE PROTECTION

- F FIRE ALARM PULL STATION
- F FIRE ALARM STROBE
- F FIRE ALARM HORN
- F FIRE ALARM HORN/STROBE
- SD SMOKE DETECTOR
- HD HEAT DETECTOR

LIGHTING

- A / * LUMINAIRE CALLOUT
  A = LUMINAIRE TYPE
  * = APPROXIMATE MOUNTING HEIGHT AFF
  CLG = CEILING MOUNT
  (SEE LUMINAIRE SCHEDULE FOR MORE DETAILS)
- X-#a LUMINAIRE - STRIP OR TROFFER TYPE (SWITCHED/UNSWITCHED)
  X = LIGHTING PANEL DESIGNATION
  # = CIRCUIT NUMBER
  a = SWITCH DESIGNATION
- WALL MOUNTED LUMINAIRE (SWITCHED/UNSWITCHED)
- PENDANT/CEILING MOUNTED LUMINAIRE (SWITCHED/UNSWITCHED)
- POLE, BRACKET, ARM, AND MOUNTED LUMINAIRE
- RECESSED CAN LUMINAIRE (SWITCHED/UNSWITCHED)
- EMERGENCY LUMINAIRE WITH SELF CONTAINED BATTERY
- WALL/CEILING MOUNTED EXIT LIGHT DIRECTIONAL ARROW WHERE INDICATED, SHADED AREA INDICATES ILLUMINATED FACE
- $ X-#a / * LIGHT SWITCH
  X = LIGHTING PANEL DESIGNATION
  # = CIRCUIT NUMBER
  a = SWITCH DESIGNATION
  * = SWITCH TYPE
  1 1 WAY
  3 3 WAY
  4 4 WAY
  D DIMMER
- M MOTION SENSOR
- O OCCUPANCY SENSOR
- PC PHOTOCELL
- TC TIME CLOCK

RECEPTACLES

- X-# / * DUPLEX RECEPTACLE, 120V, WALL MOUNT
  NEMA 5-20R CONFIGURATION
  X = LIGHTING PANEL DESIGNATION
  # = CIRCUIT NUMBER
  * = RECEPTACLE TYPE
  WP WEATHERPROOF
  XP EXPLOSION PROOF
  GFCI GROUND FAULT CIRCUIT INTERRUPTER
- X-# / * DUPLEX RECEPTACLE, 120V, FLOOR MOUNT
  NEMA 5-20R CONFIGURATION
- X-# / A SINGLE SPECIAL RECEPTACLE, 208V OR 240V, 1-PHASE
  X = PANEL DESIGNATION
  # = CIRCUIT NUMBER
  A = AMPERAGE
- X-# / A SINGLE SPECIAL/WELDING RECEPTACLE, 208V OR 240V, 3-PHASE
  X = PANEL DESIGNATION
  # = CIRCUIT NUMBER
  A = AMPERAGE
- X-# / A SINGLE SPECIAL RECEPTACLE, 480V, 3-PHASE
  X = PANEL DESIGNATION
  # = CIRCUIT NUMBER
  A = AMPERAGE

SECURITY AND COMMUNICATION

- ANTENNA
- * VC VIDEO CAMERA
  * = TYPE
  F FIXED
  PTZ PAN-TILT-ZOOM
  360 360 DEGREE FIXED
- * SECURITY ACCESS DEVICE
  * = TYPE
  CR CARD READER
  KS KEY SWITCH
  KP KEYPAD
  RF RADIO FREQUENCY ID
- TELEPHONE OUTLET WALL MOUNTED/FLOOR MOUNTED
- DATA OUTLET WALL MOUNTED/FLOOR MOUNTED
- TELEPHONE/DATA COMBINATION OUTLET WALL MOUNTED/FLOOR MOUNTED
- TV TELEVISION ANTENNA/CABLE OUTLET

MISCELLANEOUS

- DISCONNECT SAFETY SWITCH
- INSTRUMENT
- $ X-# / * SWITCH - SPECIAL PURPOSE
  X = LIGHTING PANEL DESIGNATION
  # = CIRCUIT NUMBER
  * = SWITCH TYPE
  M MOTOR RATED
  K KEY OPERATED
  T TIMER
- (T) THERMOSTAT

ISSUED FOR BID

ANY PRINTS NOT BEARING THIS STAMP MAY HAVE BEEN PRINTED PRIOR TO ADVERTISING AND CANNOT BE CONSIDERED AS BID DOCUMENTS. USERS OF THIS DOCUMENT IN EDITABLE ELECTRONIC FORMATS ARE CAUTIONED AGAINST USE WITHOUT FIRST DETERMINING WHETHER CHANGES MAY HAVE BEEN MADE SUBSEQUENT TO ITS PREPARATION.

NO	REVISION	DATE	BY

SCALES
0 1"
0 25mm
IF THIS BAR IS NOT DIMENSION SHOWN, ADJUST SCALES ACCORDINGLY.

LAWRENCE G. REISINGER — STATE OF WASHINGTON — 22389 — REGISTERED PROFESSIONAL ENGINEER

DESIGNED LGR
DRAWN RM
CHECKED LGR

DEPARTMENT OF ECOLOGY State of Washington

WASHINGTON STATE DEPARTMENT OF ECOLOGY
BELLEVUE, WASHINGTON
CIRCLE K SITE 1461 ENVIRONMENTAL REMEDIATION SYSTEM INSTALLATION
SEATTLE, WASHINGTON

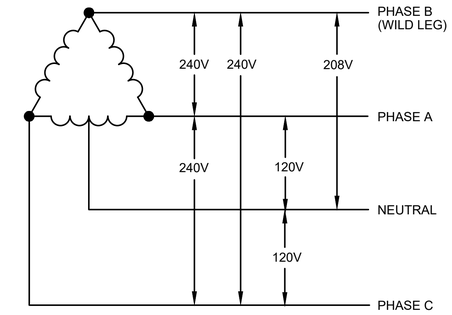
Kennedy Jenks

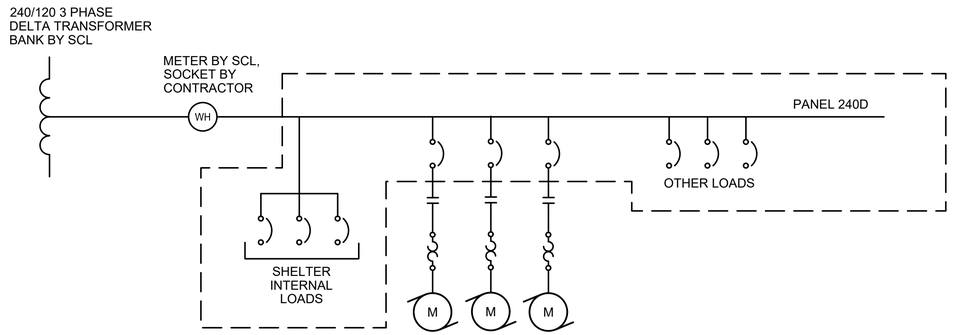
GENERAL ELECTRICAL
LEGEND - II

SCALE AS SHOWN
JOB NO 2196008.00
DATE OCTOBER 2022
SHEET 13 OF 19
E-03

Plot Date: 10/11/2022 7:41 AM
User: RICHARD HILLS
pw:\\kjce-pw.bentley.com:kjce-pw\Documents\Clients\WA Department of Ecology\Projects\Circle K Cleanup_2196008.00\10-Design\10.06-Drawings\Electrical\219600800-E-03

PNL-240D						FED FROM: METER					
240	/120 VOLTS, THREE PHASE, 4 WIRE DELTA		BUS:	200	AIC: 10KA		MAIN: 200A/3P	MOUNTING: SURFACE			
CKT. NO.	DESCRIPTION	CONNECTED KVA			TRIP AMPS/ POLES	CKT. NO.	DESCRIPTION	CONNECTED KVA			TRIP AMPS/ POLES
		A	B	C				A	B	C	
1	BLOWER	7.5			100/3	2	TRANSFER PUMP P-400 STARTER	0.6			30/3
3			7.5			4			0.6		
5				7.5		6				0.6	
7	HEAT EXCHANGER	0.9			30/3	8	THERMAL OX	9.0			125/3
9			0.9			10			9.0		
11				0.9		12				9.0	
13	TRANSFER PUMP P-300	0.6			30/3	14	RECEPTACLES	0.4			20/1
15			0.6			16	**MARK "DO NOT USE FOR 120V"**		**WILD**		
17				0.6		18	DO-IT UNIT			3.0	40/1
19	LIGHTS	0.4			20/1	20	SPACE HEAT	1.0			20/2
21	**MARK "DO NOT USE FOR 120V"**		**WILD**			22			1.0		
23	HEAT TRACE			1.0	20/1	24	SPACE				
25	SPACE				20/1	26	TRANSFER PUMP P-401 STARTER	0.6			
27	**MARK "DO NOT USE FOR 120V"**		**WILD**			28			0.6		
29	SPACE					30				0.6	30/3
31	TRANSFER PUMP P-500 STARTER	0.6				32	CONTROL PANEL				
33			0.6			34	**MARK "DO NOT USE FOR 120V"**		**WILD**		
35				0.6	30/3	36	SPACE				
37	SPACE					38	SPACE				
39	**MARK "DO NOT USE FOR 120V"**		**WILD**			40	**MARK "DO NOT USE FOR 120V"**		**WILD**		
41	SPACE					42	SPACE				
PHASE SUBTOTALS (KVA):		10.0	9.6	10.6				11.5	11.2	13.2	
PHASE TOTALS (KVA):								**21.5**	**20.7**	**23.7**	
PHASE TOTALS (AMPS):								**155.2**	**149.7**	**171.3**	
TOTAL (KVA):										**66.0**	**KVA**
MAX PHASE AMPS										**171.3**	**A**
PERCENT LOAD MAX PHASE:										**85.7**	**%**
TOTAL (AMPERES):										**159**	**A**





PUMPS P-400, 401, 500

ONE LINE DIAGRAM

ISSUED FOR BID

ANY PRINTS NOT BEARING THIS STAMP MAY HAVE BEEN PRINTED PRIOR TO ADVERTISING AND CANNOT BE CONSIDERED AS BID DOCUMENTS. USERS OF THIS DOCUMENT IN EDITABLE ELECTRONIC FORMATS ARE CAUTIONED AGAINST USE WITHOUT FIRST DETERMINING WHETHER CHANGES MAY HAVE BEEN MADE SUBSEQUENT TO ITS PREPARATION.

NO	REVISION	DATE	BY

SCALES
0 1"
0 25mm
IF THIS BAR IS NOT DIMENSION SHOWN, ADJUST SCALES ACCORDINGLY.

LAWRENCE G. REISINGER STATE OF WASHINGTON 22589 REGISTERED PROFESSIONAL ENGINEER

DESIGNED LGR
DRAWN RM
CHECKED LGR

DEPARTMENT OF ECOLOGY State of Washington

WASHINGTON STATE DEPARTMENT OF ECOLOGY
BELLEVUE, WASHINGTON
CIRCLE K SITE 1461 ENVIRONMENTAL REMEDIATION SYSTEM INSTALLATION
SEATTLE, WASHINGTON

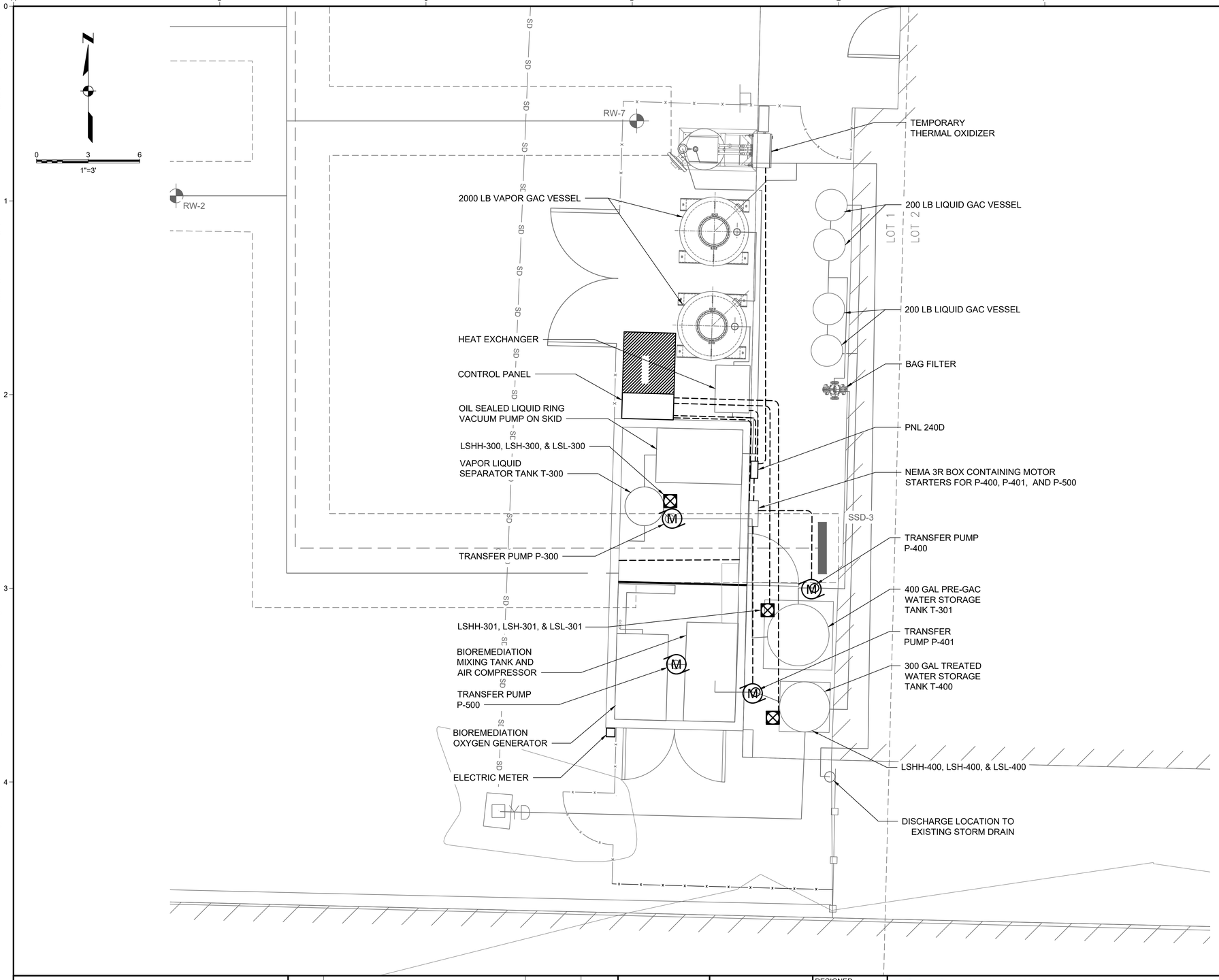
Kennedy Jenks

ELECTRICAL
PANEL SCHEDULE AND THREE LINE DIAGRAM

SCALE AS SHOWN
JOB NO 2196008.00
DATE OCTOBER 2022
SHEET 14 OF 19
E-04

Plot Date: 10/11/2022 7:41 AM
User: RICHARD HILLS
pw:\\kjce-pw.bentley.com:kjce-pw\Documents\Clients\WA Department of Ecology\Projects\Circle K Cleanup_2196008.0010-Design\10.06-Drawings\Electrical\2196008-E-04

Plot Date: 1/20/2023 4:40 PM
User: CAYLA WHITESIDE
pw:\\kjce-pw.bentley.com:kjce-pw\Documents\Clients\WA Department of Ecology\Projects\Circle K Cleanup_2196008.00\10-Design\10.06-Drawings\Electrical\219600800-E-05



GENERAL SHEET NOTES

1. ALL CONDUITS SHOWN ARE SCHEMATIC, AND NOT THE ACTUAL PATH FROM ONE END TO THE OTHER. ROUTE ALL CONDUITS UNDER PAVEMENT OR OVERHEAD AS NECESSARY TO AVOID TRIPPING OR OTHER HAZARDS. UNDER PAVEMENT CONDUIT MAY BE PVC SCHEDULE 80. ABOVE GROUND AND TRANSITIONAL PIECES SHALL BE RIGID GALVANIZED STEEL CONDUIT. SIZE IN COMPLIANCE WITH CONDUIT FILL REQUIREMENTS OF THE NATIONAL ELECTRICAL CODE.
2. PROVIDE EQUIPMENT AS SHOWN IN PREFABRICATED SHELTER STRUCTURE. PREWIRED TO ALL INTERNAL ELECTRICAL COMPONENTS, AND WIRED TO EXTERNAL ABUTTING PANELS FOR CONTROL AND POWER. THE "VACUUM BLOWER" UNIT AND ASSOCIATED EQUIPMENT HAVE BEEN EVALUATED AS MAKING THE ENCLOSED SPACE CLASS 1, GROUP D, DIVISION 2 PER NEC ARTICLE 501, AND MUST BE INSTALLED IN COMPLIANCE WITH INSTALLATIONS IN SUCH A SPACE. THE "DO-IT" UNIT AND ASSOCIATED EQUIPMENT ARE UNCLASSIFIED IN AN ENCLOSED SPACE. THE CONTRACTOR MAY MITIGATE THE CLASSIFIED SPACE BY MAKING ALL EQUIPMENT IN A SINGLE SPACE SUITABLE FOR DIVISION 2 OR MAY SEPARATE THE EQUIPMENT INTO TWO SPACES. PROVIDE ALL SEALS AND OTHER APPURTENANCES REQUIRED BY NEC AT THE BOUNDARY BETWEEN THE CLASSIFIED SPACE AND THE EXTERIOR OF THE SHELTER.
3. PROVIDE CONTROL PANEL WITH PROGRAMMABLE LOGIC CONTROLLER (PLC) FOR ALL EQUIPMENT AT THE SITE. CONTRACTOR SHALL COORDINATE INTERNAL SHELTER WIRING AND EXTERNAL WIRING AS SHOWN. PROVIDE LOCAL HMI FUNCTIONALITY AND AUTODIALING OF ALARM CONDITIONS. SEE SPECIFICATION 02 71 00 (GROUNDWATER TREATMENT) FOR DETAILS REGARDING FUNCTION OF CONTROL AND COMMUNICATION SYSTEM. ⚠1
4. PANEL PNL-240D IS SHOWN WITH ALL CIRCUITS FOR THE SITE ANTICIPATED, BOTH INTERNAL AND EXTERNAL TO THE SHELTER. CONNECT ALL INTERNAL LOADS FROM THE SHELTER AND ALL EXTERNAL LOADS AS SHOWN. IF ACTUAL LOADS DEVIATE FROM INDICATED LOADS, OR ADDITIONAL LOADS ARE ADDED OR INDICATED LOADS ARE DELETED, CONTRACTOR SHALL PREPARE REVISED PANEL SCHEDULE AND LOAD SUMMARY TO SUBMIT TO AHJ FOR APPROVAL.

ISSUED FOR BID

ANY PRINTS NOT BEARING THIS STAMP MAY HAVE BEEN PRINTED PRIOR TO ADVERTISING AND CANNOT BE CONSIDERED AS BID DOCUMENTS. USERS OF THIS DOCUMENT IN EDITABLE ELECTRONIC FORMATS ARE CAUTIONED AGAINST USE WITHOUT FIRST DETERMINING WHETHER CHANGES MAY HAVE BEEN MADE SUBSEQUENT TO ITS PREPARATION.

NO	REVISION	DATE	BY
1	BID SET REVISION ADDENDUM 1	1/20/23	CMW

SCALES
0 1"
0 25mm
IF THIS BAR IS NOT DIMENSION SHOWN, ADJUST SCALES ACCORDINGLY.

LAWRENCE G. REISINGER — STATE OF WASHINGTON — 22589 — REGISTERED PROFESSIONAL ENGINEER

DESIGNED LGR
DRAWN RM
CHECKED LGR

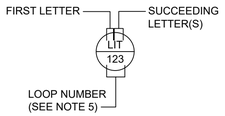
WASHINGTON STATE DEPARTMENT OF ECOLOGY
BELLEVUE, WASHINGTON
CIRCLE K SITE 1461 ENVIRONMENTAL REMEDIATION SYSTEM INSTALLATION
SEATTLE, WASHINGTON
Kennedy Jenks

ELECTRICAL
SITE PLAN

SCALE 1" = 3'
JOB NO 2196008.00
DATE OCTOBER 2022
SHEET 15 OF 19
E-05

Plot Date: 10/11/2022 7:44 AM
User: RICHARD HILLS
pw:\\kjce-pw.bentley.com:kjce-pw\Documents\Clients\WA Department of Ecology\Projects\Circle K Cleanup_2196008.00\10-Design\10.06-Drawings\Instrumentation\2196008-I-01

INSTRUMENT CALLOUTS AND TAG SCHEMA



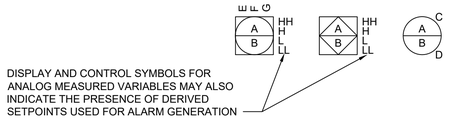
TYPICAL TAG FORMAT	
LIT-123	INSTRUMENT TAG NUMBER
LIT	FUNCTIONAL IDENTIFICATION
L	FIRST LETTER
IT	SUCCEEDING LETTER(S)
123	LOOP NUMBER

EXPANDED TAG FORMAT	
20LIT-123A	INSTRUMENT TAG NUMBER
20	AREA NUMBER
LIT	FUNCTIONAL IDENTIFICATION
L	FIRST LETTER
IT	SUCCEEDING LETTER(S)
123	LOOP NUMBER
A	OPTIONAL SUFFIX

	FIRST LETTER (1)		SUCCEEDING LETTERS (15)		
	MEASURED OR INITIATING VARIABLE	MODIFIER	READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION	MODIFIER
A	ANALYSIS (2)(3)(4)		ALARM		
B	BURNER, COMBUSTION (2)		USER'S CHOICE (5)	USER'S CHOICE (5)	USER'S CHOICE (5)
C	USER'S CHOICE (3a)(5)			CONTROL (23a)(23e)	CLOSED (27b)
D	DENSITY	DIFFERENTIAL	DAMPER		
E	VOLTAGE (2)		SENSOR (PRIMARY ELEMENT)		
F	FLOW, FLOW RATE (2)	RATIO (FRACTION) (2b)			
G	USER'S CHOICE		GLASS, VIEWING DEVICE (16)		
H	HAND (2)				HIGH (27A)(28A)(29)
I	CURRENT (ELECTRICAL)(2)		INDICATE (17)		
J	POWER (2)		SCAN (18)		
K	TIME, TIME SCHEDULE (2)	TIME RATE OF CHANGE (12c)(13)		CONTROL STATION (24)	
L	LEVEL (2)		LIGHT (19)		LOW (27b)(28)(29)
M	MOISTURE	MOMENTARY			MIDDLE, INTERMEDIATE
N	USER'S CHOICE (5)		USER'S CHOICE (5)	USER'S CHOICE (5)	USER'S CHOICE (5)
O	USER'S CHOICE (5)		ORIFICE, RESTRICTION		OPEN (27a)
P	PRESSURE, VACUUM (2)		POINT (TEST) CONNECTION		
Q	QUANTITY (2)	INTEGRATE, TOTALIZE	INTEGRATE, TOTALIZE		
R	RADIATION (2)		RECORD (20)		RUN
S	SPEED, FREQUENCY (2)	SAFETY (14)		SWITCH (23b)	STOP
T	TEMPERATURE (2)			TRANSMIT	
U	MULTI VARIABLE (2)(6)		MULTIFUNCTION (21)	MULTIFUNCTION (21)	MULTIFUNCTION (21)
V	VIBRATION, MECHANICAL ANALYSIS (2)(4)(7)			VALVE, DAMPER, OR LOUVER (23c)(23e)	
W	WEIGHT, FORCE (2)		WELL, PROBE		
X	UNCLASSIFIED (8)	X AXIS (11c)	ACCESSORY DEVICES (22) UNCLASSIFIED (8)	UNCLASSIFIED (8)	UNCLASSIFIED (8)
Y	EVENT, STATE, PRESENCE (2)(9)	Y AXIS (11c)		RELAY, COMPUTE, CONVERT	
Z	POSITION, DIMENSION (2)	Z AXIS (11c), SAFETY INSTRUMENTED SYSTEM (30)		DRIVER, ACTUATOR, UNCLASSIFIED FINAL CONTROL ELEMENT	

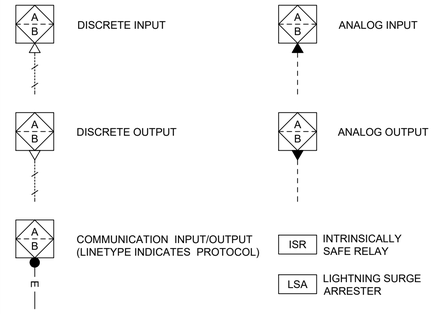
NOTE: NUMBERS IN PARANTHESES REFER TO EXPLANATORY NOTES IN ANSI/ISA-5.1-2009, SECTION 4.2

	LOCATED IN FIELD VISIBLE AT LOCATION OPERATOR ACCESSIBLE	LOCATED ON MAIN PANEL VISIBLE ON PANEL FRONT OPERATOR ACCESSIBLE	LOCATED IN MAIN PANEL CABINET NOT VISIBLE ON PANEL FRONT NOT OPERATOR ACCESSIBLE	LOCATED ON SECONDARY PANEL VISIBLE ON PANEL FRONT OPERATOR ACCESSIBLE	LOCATED IN SECONDARY PANEL CABINET NOT VISIBLE ON PANEL FRONT NOT OPERATOR ACCESSIBLE
SHARED DISPLAY SHARED CONTROL	A B	A B	A B	A B	A B
PROGRAMMABLE LOGIC CONTROL	A B	A B	A B	A B	A B
COMPUTER FUNCTION	A B C D	A B C D	A B C D	A B C D	A B C D
INSTRUMENT	A B C D	A B C D	A B C D	A B C D	A B C D
PILOT LIGHT	A B C D	A B C D		A B C D	



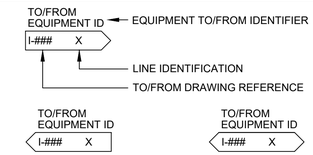
LETTER MAPPING:
- A: IDENTIFICATION LETTERS (SEE TABLE OR REFER TO ANSI/ISA-5.1-2009; TABLE 4.1)
- B: LOOP NUMBER
- C: USER DESCRIPTOR/FUNCTION DESIGNATION (SEE LIST THIS SHEET)
- D: MEASUREMENT (REFER TO ANSI/ISA-5.1-2009; TABLE 5.2.2)
- E: PROCESS CONTROL DESCRIPTOR LINE 1
- F: PROCESS CONTROL DESCRIPTOR LINE 2
- G: PROCESS CONTROL DESCRIPTOR LINE 3

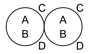
PLC I/O



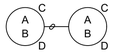
MISCELLANEOUS

OFF-SHEET CONNECTORS (ARROW IN DIRECTION OF PROCESS OR CONTROL)





TOUCHING BUBBLES INDICATE A SINGLE INSTRUMENT OR COMPONENT PERFORMING MULTIPLE FUNCTIONS, OR AN INSTRUMENT WITH INTEGRAL TRANSMITTER



INSTRUMENT WITH REMOTE TRANSMITTER

RELAY INTERLOCK
REFER TO CONTROL SCHEMATICS AND/OR PROCESS CONTROL NARRATIVES FOR BEHAVIOR

FUNCTION DESIGNATIONS

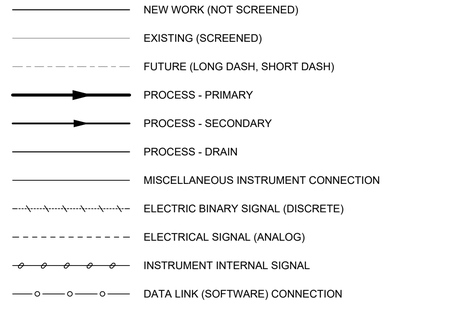
SWITCHES	
A/M	AUTO-MANUAL
ESTOP	EMERGENCY STOP
F-R	FORWARD-REVERSE
HOA	HAND-OFF-AUTO
HOR	HAND-OFF-REMOTE
L/R	LOCAL-REMOTE
LOR	LOCAL-OFF-REMOTE
O/C	OPEN-CLOSE
OCA	OPEN-CLOSE-AUTO
O-O	ON-OFF
OSC	OPEN-STOP-CLOSE
POT	POTENTIOMETER
RST	RESET
S-S	START-STOP

ANALYTICAL INSTRUMENTS	
ALK	ALKALINITY
CL2*	CHLORINE CONCENTRATION
COMB	COMBUSTIBLE GAS
COND	CONDUCTIVITY
DO	DISSOLVED OXYGEN
H2S	HYDROGEN SULFIDE
LEL	LOWER EXPLOSIVE LIMIT
NO3	NITRATE
O2	OXYGEN CONCENTRATION
O3	OZONE
ORP	OXIDATION REDUCTION POTENTIAL
PH	HYDROGEN ION CONCENTRATION
SO2	SULFUR DIOXIDE
TH	TOTAL HARDNESS
TURB	TURBIDITY
UV	ULTRAVIOLET TRANSMITTANCE OR INTENSITY
*	NOTED AS TOTAL OR FREE

INSTRUMENT AND EQUIPMENT SERVICES

- IA — INSTRUMENT AIR SUPPLY (SEE NOTE 4)
- ES — ELECTRICAL SERVICE (DIFFERENT VOLTAGES ARE SPECIFICALLY NOTED)
- POE — POWER OVER ETHERNET

LINE SYMBOLOGY

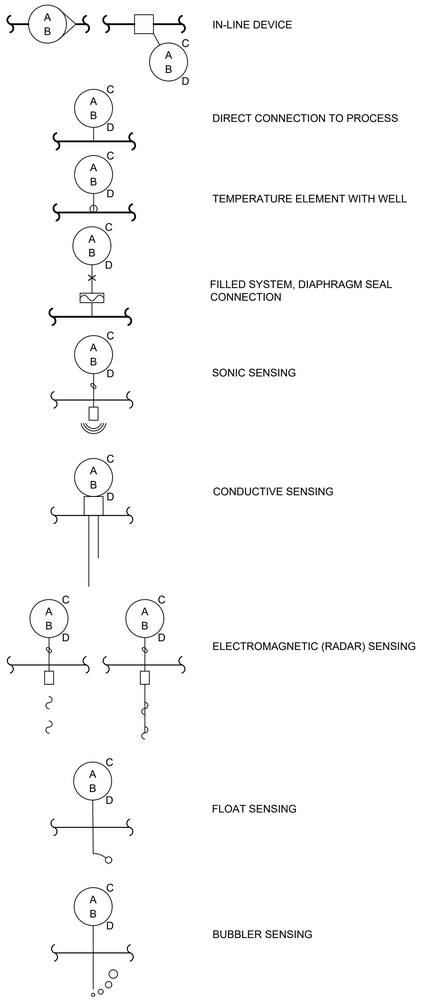


- NEW WORK (NOT SCREENED)
- EXISTING (SCREENED)
- FUTURE (LONG DASH, SHORT DASH)
- PROCESS - PRIMARY
- PROCESS - SECONDARY
- PROCESS - DRAIN
- MISCELLANEOUS INSTRUMENT CONNECTION
- ELECTRIC BINARY SIGNAL (DISCRETE)
- ELECTRICAL SIGNAL (ANALOG)
- INSTRUMENT INTERNAL SIGNAL
- DATA LINK (SOFTWARE) CONNECTION
- CAPILLARY SIGNAL
- ELECTROMAGNETIC (RADAR) GUIDED SIGNAL
- ELECTROMAGNETIC (RADAR) UNGUIDED/FREE AIR SIGNAL
- HYDRAULIC LINK OR CONNECTION
- MECHANICAL LINK OR CONNECTION
- PNEUMATIC BINARY SIGNAL
- PNEUMATIC SIGNAL
- PROPRIETARY SIGNAL
- CONTROLNET SIGNAL
- DEVICENET SIGNAL
- ETHERNET (TCP/IP) SIGNAL
- MODBUS (2-WIRE) SIGNAL
- PROFIBUS SIGNAL
- FIBER OPTIC SIGNAL
- LINE BREAK OR GAP
- SIGNAL LINE ARROW
- SIGNAL LINES - CONNECTED
- SIGNAL LINES - NOT CONNECTED

SIGNAL PROCESSING FUNCTIONS

- SUMMING
- DIFFERENCE
- INTEGRAL
- DERIVATIVE
- MULTIPLYING
- DIVIDING
- ROOT EXTRACTION
- SQUARE ROOT
- EXPONENTIAL
- HIGH SELECTING
- LOW SELECTING
- BIAS
- NONLINEAR OR UNSPECIFIED FUNCTION
- CONVERT:
  - E - VOLTAGE
  - I - CURRENT
  - P - PNEUMATIC
  - A - ANALOG
  - B - BINARY
  - H - HYDRAULIC
  - O - ELECTROMAGNETIC/SONIC
  - R - RESISTANCE (ELECTRICAL)
  - D - DIGITAL

TYPICAL CONNECTIONS



NOTES

1. SEE THE GENERAL AND ELECTRICAL DISCIPLINE DRAWINGS FOR ADDITIONAL SYMBOLS AND ABBREVIATIONS.
2. SEE THE GENERAL DISCIPLINE DRAWINGS FOR EQUIPMENT DESIGNATIONS AND PROCESS IDENTIFICATION CODES.
3. THIS IS A GENERALIZED LEGEND SHEET. SEE ALSO ISA S5.1, S5.3 AND S7.3.
4. FOR INSTRUMENT AIR QUALITY STANDARDS, REFER TO ISA RP7.7.
5. WHERE LOOP NUMBERS EXCEED THE LENGTH AVAILABLE WITHIN A BUBBLE, THE LOWER HALF OF THE BUBBLE MAY APPEAR BROKEN TO ALLOW SPACE FOR THE LOOP NUMBER.
6. SEE SPECIFICATION 17010 FOR COMPLETE DETAILS OF LOOP DRAWING AND INTERCONNECTION DRAWING SUBMITTAL REQUIREMENTS.
7. POWER SUPPLIES FOR INSTRUMENT LOOPS OR SYSTEMS SHALL BE PROVIDED BY THE INSTRUMENTATION SUPPLIER TO MEET THE VOLTAGE AND CURRENT REQUIREMENTS OF THE COMPONENTS IN EACH LOOP OR SYSTEM.
8. FIELD SWITCHES FOR ELECTRICAL MOTOR OPERATION SHALL BE SUPPLIED BY THE ELECTRICAL CONTRACTOR UNLESS THEY ARE PART OF A VENDOR PACKAGE.

ISSUED FOR BID

ANY PRINTS NOT BEARING THIS STAMP MAY HAVE BEEN PRINTED PRIOR TO ADVERTISING AND CANNOT BE CONSIDERED AS BID DOCUMENTS. USERS OF THIS DOCUMENT IN EDITABLE ELECTRONIC FORMATS ARE CAUTIONED AGAINST USE WITHOUT FIRST DETERMINING WHETHER CHANGES MAY HAVE BEEN MADE SUBSEQUENT TO ITS PREPARATION.

NO	REVISION	DATE	BY

SCALES
0 — 1"
0 — 25mm
IF THIS BAR IS NOT DIMENSION SHOWN, ADJUST SCALES ACCORDINGLY.

LAWRENCE G. REISINGER — STATE OF WASHINGTON — 22599 — REGISTERED PROFESSIONAL ENGINEER

DESIGNED	LGR
DRAWN	RM
CHECKED	LGR

DEPARTMENT OF ECOLOGY State of Washington

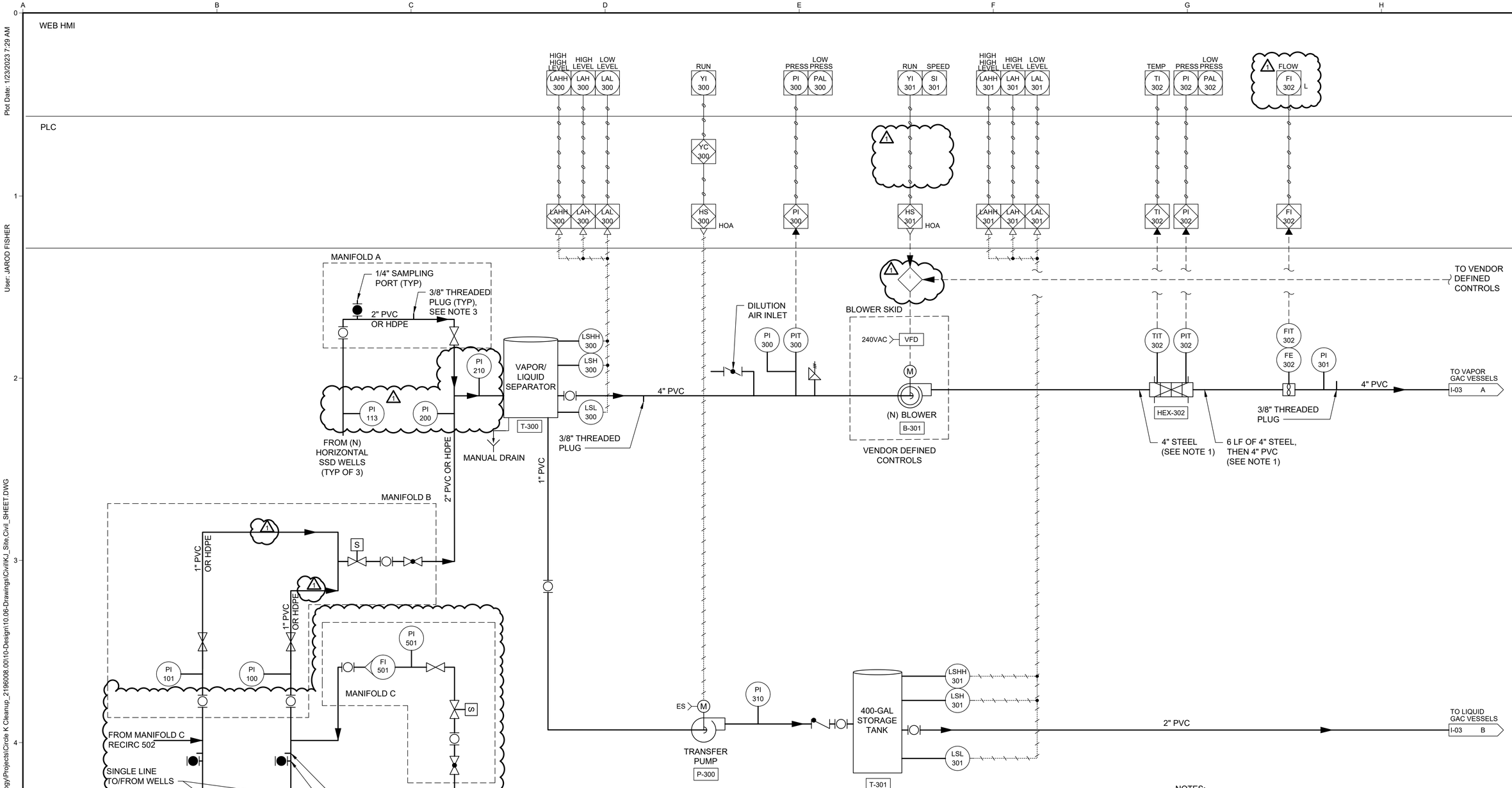
WASHINGTON STATE DEPARTMENT OF ECOLOGY
BELLEVUE, WASHINGTON
CIRCLE K SITE 1461 ENVIRONMENTAL REMEDIATION SYSTEM INSTALLATION
SEATTLE, WASHINGTON

Kennedy Jenks

P&ID LEGEND

SCALE	AS SHOWN
JOB NO	2196008.00
DATE	OCTOBER 2022
SHEET	16 OF 19
	I-01

Plot Date: 1/23/2023 7:29 AM
User: JAROD FISHER
pw:\\kjce-pw.bentley.com:kjce-pw\Documents\Clients\WA Department of Ecology\Projects\Circle K Cleanup_2196008.00\10-Design\10.06-Drawings\Civil\KJ_Site_Civil_SHEET.DWG



NOTES:

1. STEEL OR METAL FITTINGS AND VALVES SHALL BE USED WHERE STEEL PIPING IS LOCATED.
2. TREATMENT SYSTEM SHALL BE COMMISSIONED IN ACCORDANCE WITH SPECIFICATION SECTION 01 77 00.
3. LOCATION FOR INSTALLATION OF TEMPORARY DS 300 PITOT TUBE AND DIFFERENTIAL PRESSURE GAUGE FOR STARTUP TESTING.

ISSUED FOR BID

ANY PRINTS NOT BEARING THIS STAMP MAY HAVE BEEN PRINTED PRIOR TO ADVERTISING AND CANNOT BE CONSIDERED AS BID DOCUMENTS. USERS OF THIS DOCUMENT IN EDITABLE ELECTRONIC FORMATS ARE CAUTIONED AGAINST USE WITHOUT FIRST DETERMINING WHETHER CHANGES MAY HAVE BEEN MADE SUBSEQUENT TO ITS PREPARATION.

NO	REVISION	DATE	BY
1	BID SET REVISION ADDENDUM 1	1/26/23	CMW

SCALES
0 1"
0 25mm
IF THIS BAR IS NOT DIMENSION SHOWN, ADJUST SCALES ACCORDINGLY.

LAWRENCE G. REISINGER STATE OF WASHINGTON 32599 REGISTERED PROFESSIONAL ENGINEER

DESIGNED CMW
DRAWN RM
CHECKED LGR

DEPARTMENT OF ECOLOGY State of Washington

WASHINGTON STATE DEPARTMENT OF ECOLOGY
BELLEVUE, WASHINGTON
CIRCLE K SITE 1461 ENVIRONMENTAL REMEDIATION SYSTEM INSTALLATION
SEATTLE, WASHINGTON

Kennedy Jenks

P&ID - I

SCALE AS SHOWN
JOB NO 2196008.00
DATE OCTOBER 2022
SHEET 17 OF 19
I-02

Plot Date: 1/20/2023 5:36 PM
User: CAYLA WHITESIDE
pw:\\kjpe-pw.bentley.com:kjpe-pw\Documents\Clients\WA Department of Ecology\Projects\Circle K Cleanup_2196008.00\10-Design\10.06-Drawings\Civil\KJ_Site,Civil_SHEET.DWG

WEB HMI

PLC

RUN YI 400 — YC 400 — HS 400 HOA

HIGH PRESS PAH 400 — PI 400

HIGH PRESS PAH 401 — PI 401

RUN YI 402 — YC 402 — HS 402 HOA

TEMP TI 400 H — TI 400

HIGH HIGH LEVEL LAHH 400

HIGH LEVEL LAH 400

LOW LEVEL LAL 400

RUN YI 401 — HS 401 HOA

TO BLOWER SKID

FROM BLOWER SKID I-02 A

4" PVC

TIT 400

OXIDIZER

TO-400

VENDOR DEFINED CONTROLS

PI 411

PI 412

PI 410

1/4" SAMPLING PORT

1/4"

(N) VAPOR GAC VESSEL 2000 LB

GAC-400

GAC-401

TO AIR DISCHARGE

FROM STORAGE TANK I-02 B

2" PVC

ES M

TRANSFER PUMP P-400

PI 400 — PIT 400

BAG FILTER BF-400

PI 401 — PIT 401

6 PSIG

FI 400

SEE NOTE 2

3/8" THREADED PLUG (TYP)

PI 402 — LG-400

PI 403 — LG-401

PI 404

FI 404

PI 405 — LG-402

PI 406 — LG-403

PI 407

FI 407

(N) 200 LB LIQUID GAC VESSELS

300 GAL STORAGE TANK T-400

LSHH 400

LSH 400

LSL 400

FI 500

TO EXISTING SANITARY SEWER

PI 408

FI 401

TO GROUNDWATER RECIRCULATION I-04 A

TRANSFER PUMP P-401

NOTE:

1. STEEL OR METAL FITTINGS AND VALVES SHALL BE USED WHERE STEEL PIPING IS LOCATED. CONNECTIONS USING DISSIMILAR MATERIALS SHALL BE PROHIBITED.
2. FLOW AT FI 400 SHALL BE BETWEEN 4-20 GPM TO ENSURE THAT FLOW THROUGH LIQUID GAC VESSELS IS AT LEAST 2 GPM AND AT MOST 10 GPM.

ISSUED FOR BID

ANY PRINTS NOT BEARING THIS STAMP MAY HAVE BEEN PRINTED PRIOR TO ADVERTISING AND CANNOT BE CONSIDERED AS BID DOCUMENTS. USERS OF THIS DOCUMENT IN EDITABLE ELECTRONIC FORMATS ARE CAUTIONED AGAINST USE WITHOUT FIRST DETERMINING WHETHER CHANGES MAY HAVE BEEN MADE SUBSEQUENT TO ITS PREPARATION.

NO	REVISION	DATE	BY
1	BID SET REVISION ADDENDUM 1	1/20/23	CMW

SCALES
0 1"
0 25mm
IF THIS BAR IS NOT DIMENSION SHOWN, ADJUST SCALES ACCORDINGLY.

LAWRENCE G. REISINGER — STATE OF WASHINGTON — 22589 — REGISTERED PROFESSIONAL ENGINEER

DESIGNED CMW
DRAWN RM
CHECKED LGR

DEPARTMENT OF ECOLOGY State of Washington

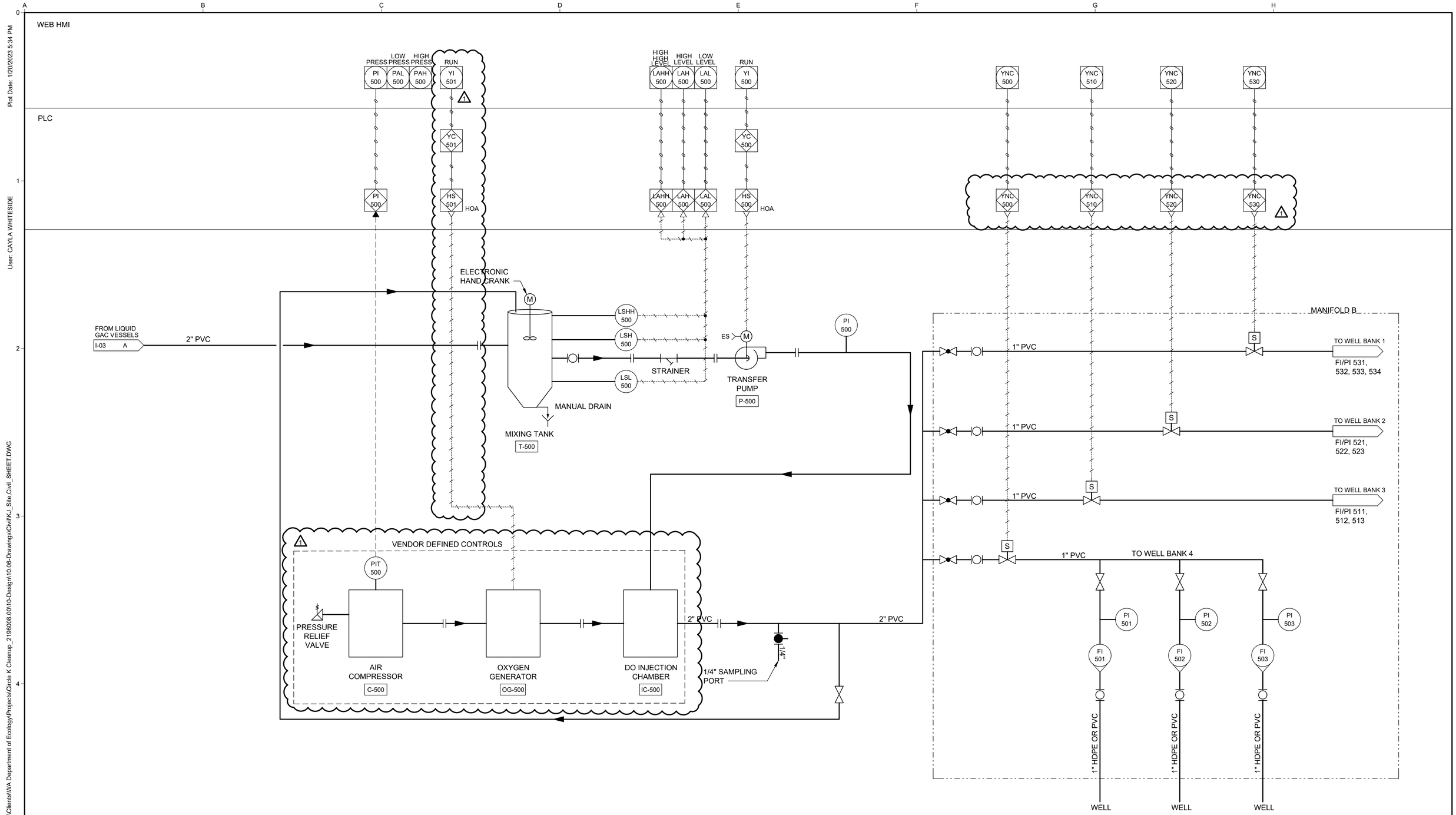
WASHINGTON STATE DEPARTMENT OF ECOLOGY
BELLEVUE, WASHINGTON
CIRCLE K SITE 1461 ENVIRONMENTAL REMEDIATION SYSTEM INSTALLATION
SEATTLE, WASHINGTON

Kennedy Jenks

P&ID - II

SCALE AS SHOWN
JOB NO 2196008.00
DATE OCTOBER 2022
SHEET 18 OF 19
I-03

Plot Date: 1/20/2023 5:34 PM
User: CAYLA WHITESIDE
pw:\\kjce-pw.bentley.com:kjce-pw\Documents\Clients\WA Department of Ecology\Projects\Circle K Cleanup_2196008.00\10-Design\10.06-Drawings\Civil\KJ_Site.Civil_SHEET.DWG



ISSUED FOR BID

ANY PRINTS NOT BEARING THIS STAMP MAY HAVE BEEN PRINTED PRIOR TO ADVERTISING AND CANNOT BE CONSIDERED AS BID DOCUMENTS. USERS OF THIS DOCUMENT IN EDITABLE ELECTRONIC FORMATS ARE CAUTIONED AGAINST USE WITHOUT FIRST DETERMINING WHETHER CHANGES MAY HAVE BEEN MADE SUBSEQUENT TO ITS PREPARATION.

NO	REVISION	DATE	BY
1	BID ISSUE REVISION ADDENDUM 1	1/20/23	CMW

SCALES
0 1"
0 25mm
IF THIS BAR IS NOT DIMENSION SHOWN, ADJUST SCALES ACCORDINGLY.

LAWRENCE G. REISINGER — STATE OF WASHINGTON — 32589 — REGISTERED PROFESSIONAL ENGINEER

DESIGNED CMW
DRAWN RM
CHECKED LGR

DEPARTMENT OF ECOLOGY State of Washington

WASHINGTON STATE DEPARTMENT OF ECOLOGY
BELLEVUE, WASHINGTON
CIRCLE K SITE 1461 ENVIRONMENTAL REMEDIATION SYSTEM INSTALLATION
SEATTLE, WASHINGTON

Kennedy Jenks

P&ID - III

SCALE AS SHOWN
JOB NO 2196008.00
DATE OCTOBER 2022
SHEET 19 OF 19
I-04

Appendix E

Vendor-Supplied Documentation

[To be added after system installation is complete]

Appendix F

Monitoring Form Templates

SYSTEM MONITORING FORM
CIRCLE K - PHASE 1: MULTI-PHASE EXTRACTION

Name:

Date/time of data collection:

Weather:

System On on Arrival? (circle): yes no

System Hours:

Phase 1: Multiphase Extraction, all wells in extraction mode.

Barometric pressure (psi):	Barometric Pressure source:
Ambient Temperature (°F):	Ambient Temperature source:
Noise (dBA): *If above 60 dBA, notify KJ personnel	Noise measurement source:

Moisture Separator Drained? (circle) Yes No

Approximate volume (gal):

Thermal Oxidizer Installed? (circle) Yes No

Effluent Vapor VOC Conc (ppm):

*if < 500 ppm isobutylene, replace Thermal Oxidizer with Vapor GAC.

PID Calibration Performed? (circle) Yes No

PID Calibration	Zero Gas	Span Gas
Calibration Value (ppm):		
Instrument Reading (ppm):		

Active Alarm Conditions (circle, note affected equipment):

1. No Alarm
2. High Water Level Tank(s):
3. Low Water Level Tank(s):
4. High Pressure Equipment:
5. Low Pressure Equipment:
6. System Shutdown Equipment:
7. Temperature Equipment:

Wells - Injection/Extraction (At Manifold)

Well ID	Pres/Vac* (psi)	Flow* (cfm)	PID* (ppm)	Valve (open, closed, 1/2)
RW-2				
RW-3				
RW-4				
RW-5				
RW-6				
RW-7				
RW-8				
RW-9				
RW-10				
SW-1				
SW-2				
SW-3				
MW-4				

Well ID	Pres/Vac* (psi)	Flow* (cfm)	PID* (ppm)	Valve (open, closed, 1/2)
SSD-1				
SSD-2				
SSD-3				
VP-1				
VP-2				
VP-3				
VP-4				

*only measured quarterly

Treatment System

Location	ID	Temp (°F)	Pres/Vac (psi)	Flow (cfm/gpm)	PID (ppm)
After Manifold	PI 211				
Before KO	PI 220				
After KO**	PI 300				
At Heat Exchanger	PIT/TIT 302				
After Heat Exchanger	FE 302/PI 301				
Catalytic Oxidizer	TI 400				
Before Vapor GAC	PI 411				
Vapor GAC Midpoint	PI 412				
After Vapor GAC	PI 410				
Air Discharge Point**	-				
Before 400-gal Tank	PI 310				
Before Bag Filter	PI 400				
After Bag Filter**	FI 400/PI 401				
Before Liquid GAC 1	PI 402				
Midpoint Liquid GAC 1**	PI 403				
Before Liquid GAC 2	PI 405				
Midpoint Liquid GAC 2**	PI 406				
After Liquid GAC 1**	FI/PI 404				
After Liquid GAC 2**	FI/PI 407				
Liquid Discharge Pt.	FI 500				

** Location for collection of air or water sample for laboratory analysis.

Comments/Maintenance Activities:

Permit Discharge Limits:	
Air:	Water:

*If exceeded, notify Kennedy Jenks personnel.

Notes: psi = pounds/square inch; cfm = cubic feet per minute; ppm = parts per million; gal = gallons; KO = knock-out/vapor liquid separator; GAC = granular activated carbon

SYSTEM MONITORING FORM
CIRCLE K - PHASE 2: SURFACTANT REINJECTION

Name:
Date/time of data collection:
Weather:

System On on Arrival? (circle): yes no
System Hours:
Phase 2: Surfactant Reinjection, note mode for well groups.

Barometric pressure (psi):	Barometric Pressure source:
Ambient Temperature (°F):	Ambient Temperature source:
Noise (dBA): *If above 60 dBA, notify KJ personnel	Noise measurement source:

Moisture Separator Drained? (circle) Yes No
Approximate volume (gal):

Well Group Modes (Extraction, Injection, Rest):				
	Group 1		Group 3	
	Group 2		Group 4	

PID Calibration Performed? (circle) Yes No

PID Calibration	Zero Gas	Span Gas
Calibration Value (ppm):		
Instrument Reading (ppm):		

Active Alarm Conditions (circle, indicate affected equipment):
1. No Alarm
2. High Water Level Tank(s):
3. Low Water Level Tank(s):
4. High Pressure Equipment:
5. Low Pressure Equipment:
6. System Shutdown Equipment:
7. Temperature Equipment:

Surfactant Added? (circle) Yes No Volume (lbs):

Wells - Injection/Extraction (At Manifold)

Well ID	Well Group #	Pres/Vac (Inj only, psi)	Flow (cfm/gpm)	PID* (ppm)	Valve (open, closed, 1/2)
RW-2	4				
RW-3	1				
RW-4	2				
RW-5	3				
RW-6	1				
RW-7	4				
RW-8	2				
RW-9	1				
RW-10	3				
SW-1	2				
SW-2	3				
SW-3	4				
MW-4+	1				

Well ID	Mode	Pres/Vac* (psi)	Flow* (cfm)	PID* (ppm)	Valve (open, closed, 1/2)
SSD-1	Ext.				
SSD-2	Ext.				
SSD-3	Ext.				
VP-1					
VP-2					
VP-3					
VP-4					

*only measured quarterly

Treatment System

Location	ID	Temp (°F)	Pres/Vac (psi)	Flow (cfm/gpm)	PID (ppm)
After Manifold	PI 211				
Before KO	PI 220				
After KO**	PI 300				
At Heat Exchanger	PIT/TIT 302				
After Heat Exchanger	FE 302/PI 301				
Before Vapor GAC	PI 411				
Vapor GAC Midpoint	PI 412				
After Vapor GAC	PI 410				
Air Discharge Point**	-				
Before 400-gal Tank	PI 310				
Before Bag Filter	PI 400				
After Bag Filter	FI 400/PI 401				
Before Liquid GAC 1	PI 402				
Midpoint Liquid GAC 1	PI 403				
Before Liquid GAC 2	PI 405				
Midpoint Liquid GAC 2	PI 406				
After Liquid GAC 1	FI/PI 404				
After Liquid GAC 2	FI/PI 407				
Liquid Discharge Pt.	FI 500				
To GW Recirc.	FI 401/PI 408				
After Mixing Tank	PI 500				
At Air Compressor	PIT 500				

** Location for collection of air or water sample for laboratory analysis.

+MW-4 not used for reinjection

Comments/Maintenance Activities:

Permit Discharge Limits:
Air: Water:
*If exceeded, notify Kennedy Jenks personnel.

Notes: psi = pounds/square inch; cfm = cubic feet per minute; ppm = parts per million; gal = gallons; KO = knock-out/vapor liquid separator; GAC = granular activated carbon; gpm = gallons per minute; lb = pounds

SYSTEM MONITORING FORM
CIRCLE K - PHASE 3: ENHANCED BIOREMEDIATION

Name:
Date/time of data collection:
Weather:

System On on Arrival? (circle): yes no
System Hours:
Phase 3: Enhanced Bioremediation, note mode for well groups.

Barometric pressure (psi):	Barometric Pressure source:
Ambient Temperature (°F):	Ambient Temperature source:
Noise (dBA): *If above 60 dBA, notify KJ personnel	Noise measurement source:

Moisture Separator Drained? (circle) Yes No
Approximate volume (gal):

Well Group Modes (Extraction, Injection, Rest):				
	Group 1		Group 3	
	Group 2		Group 4	

PID Calibration Performed? (circle) Yes No

PID Calibration	Zero Gas	Span Gas
Calibration Value (ppm):		
Instrument Reading (ppm):		

Active Alarm Conditions (circle, indicate affected equipment):
1. No Alarm
2. High Water Level Tank(s):
3. Low Water Level Tank(s):
4. High Pressure Equipment:
5. Low Pressure Equipment:
6. System Shutdown Equipment:
7. Temperature Equipment:

Amendments Added? (circle) Yes No Volume (lbs):

Wells - Injection/Extraction (At Manifold)

Well ID	Well Group #	Pres/Vac (Inj only, psi)	Flow (cfm/gpm)	PID* (ppm)	Valve (open, closed, 1/2)
RW-2	4				
RW-3	1				
RW-4	2				
RW-5	3				
RW-6	1				
RW-7	4				
RW-8	2				
RW-9	1				
RW-10	3				
SW-1	2				
SW-2	3				
SW-3	4				
MW-4+	1				

Well ID	Mode	Pres/Vac* (psi)	Flow* (cfm)	PID* (ppm)	Valve (open, closed, 1/2)
SSD-1	Ext.				
SSD-2	Ext.				
SSD-3	Ext.				
VP-1					
VP-2					
VP-3					
VP-4					

*only measured quarterly

Treatment System

Location	ID	Temp (°F)	Pres/Vac (psi)	Flow (cfm/gpm)	PID (ppm)
After Manifold	PI 211				
Before KO	PI 220				
After KO**	PI 300				
At Heat Exchanger	PIT/TIT 302				
After Heat Exchanger	FE 302/PI 301				
Before Vapor GAC	PI 411				
Vapor GAC Midpoint	PI 412				
After Vapor GAC	PI 410				
Air Discharge Point**	-				
Before 400-gal Tank	PI 310				
Before Bag Filter	PI 400				
After Bag Filter**	FI 400/PI 401				
Before Liquid GAC 1	PI 402				
Midpoint Liquid GAC 1**	PI 403				
Before Liquid GAC 2	PI 405				
Midpoint Liquid GAC 2**	PI 406				
After Liquid GAC 1**	FI/PI 404				
After Liquid GAC 2**	FI/PI 407				
Liquid Discharge Pt.**	FI 500				
To GW Recirc.	FI 401/PI 408				
After Mixing Tank	PI 500				
At Air Compressor	PIT 500				

** Location for collection of air or water sample for laboratory analysis.

+MW-4 not used for reinjection

Comments/Maintenance Activities:

Permit Discharge Limits:
Air: Water:
*If exceeded, notify Kennedy Jenks personnel.

Notes: psi = pounds/square inch; cfm = cubic feet per minute; ppm = parts per million; gal = gallons; KO = knock-out/vapor liquid separator; GAC = granular activated carbon; gpm = gallons per minute; lb = pounds

SYSTEM MAINTENANCE FORM
CIRCLE K REMEDIATION SYSTEM

Name:

Date/time of data collection:

Weather:

Equipment	Inspected?	Condition	Notes on Maintenance Activities Performed
RW-2			
RW-3			
RW-4			
RW-5			
RW-6			
RW-7			
RW-8			
RW-9			
RW-10			
SW-1			
SW-2			
SW-3			
MW-4			
SSD-1, 2, 3			
Vapor Pins 1-4			
Manifold			
Piping			
KO Tank (T-300)			
P-300			
P-400			
P-401			
P-500			
Tank T-301			
Tank T-400			
Mixing Tank (T-500)			
Bag Filter (BF-400)			
Liquid GAC LG-400			
Liquid GAC LG-401			
Liquid GAC LG-402			
Liquid GAC LG-403			
Liquid Ring Pump			
Heat Exchanger			
TO-400			
Vapor GAC-400			
Vapor GAC-401			
Control Panel			
Alarms			
Flow Meters			
Temp/Pres. Gauges			
Valves			

Comments

Appendix G

Standard Operating Guidelines

[To be provided by O&M contractor for review and approval by Ecology and Kennedy Jenks]

Appendix H

Compliance Monitoring Plan (CMP) and Sampling and Analysis Plan / Quality Assurance Project Plan (SAP/QAPP)

Kennedy Jenks

32001 32nd Avenue South, Suite 100
Federal Way, Washington 98001
253-835-6400

Compliance Monitoring Plan

Circle K 1461
Seattle, Washington 98112

22 November 2022

Prepared for

DEPARTMENT OF ECOLOGY
State of Washington

3190 160th Avenue SE
Bellevue, Washington 98008-5452

KJ Project No. 2196008*00

Compliance Monitoring Plan
Signature Page

Site: Circle K 1461

Facility Site Identification Number (FSID):

Cleanup Site Identification Number (CSID): #5089

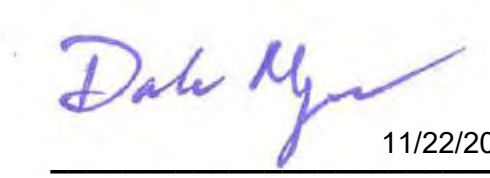
Address: 2350 24th Avenue East, Seattle, Washington

Document Name: Circle K 1461 – Compliance Monitoring Plan (CMP)

Document Date: November 2022

Signature below indicates review and approval of the Compliance Monitoring Plan and agreement that the anticipated sampling and analytical methods are sufficient to meet the quality objectives of the Circle K Environmental Remediation System Monitoring Program.

Washington State Department of Ecology:



11/22/2022

Dale Myers Date
Ecology Site Manager
Phone: (425) 649-4426
e-mail: damy461@ecy.wa.gov

Kennedy/Jenks Consultants, Inc. Project Manager:

11/22/2022

Ryan Hultgren Date
Title: Project Manager
Phone: (253) 835-6432
e-mail: RyanHultgren@KennedyJenks.com

Table of Contents

List of Tables

List of Figures

List of Acronyms

bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, and xylene
CAP	cleanup action plan
CD	Consent Decree No. 82-2-08095-8, April 1992
CLARC	Cleanup Levels and Risk Calculation
CMP	Compliance Monitoring Plan
COC	contaminants of concern
CUL	cleanup level
Ecology	Washington State Department of Ecology
EDR	Engineering Design Report
EPA	U.S. Environmental Protection Agency
GRO	Gasoline Range Organics
HASP	Health and Safety Plan
IDW	investigation-derived waste
Kennedy Jenks	Kennedy/Jenks Consultants, Inc.
LEL	lower explosive limit
LNAPL	light non-aqueous phase liquid
MPE	multi-phase extraction
MTCA	Model Toxics Control Act
MW	monitoring well
O&M	operations and maintenance
PID	photoionization detector
ppbv	part per billion by volume
QAPP	Quality Assurance Project Plan
RI/FS	Remedial Investigation and Feasibility Study
RW	remediation well
SAP	Sampling and Analysis Plan
SSD	sub-slab depressurization
SW	slanted remediation well
UST	underground storage tank
VI	vapor intrusion
VOC	volatile organic compound
WAC	Washington Administrative Code

Section 1: Introduction

This Compliance Monitoring Plan (CMP) describes specific activities and requirements for compliance monitoring associated with the cleanup action planned for the Circle K 1461 Station #1461 located at 2350 24th Avenue East in Seattle, Washington in King County (Site) (see Figure 1). The Site is currently operating as a convenience store and dry cleaner.

This document is intended to be used in conjunction with other Site-specific project documents, including the following:

- Remedial Investigation and Feasibility Study (RI/FS) Report, Former Circle K Site [Kennedy/Jenks Consultants, Inc. (Kennedy Jenks) 2017]
- Engineering Design Report (EDR), Former Circle K Site 1461, Seattle, Washington (Kennedy Jenks 2021a)
- Health and Safety Plan (HASP) (Kennedy Jenks 2021b)
- Project Manual for the Circle K 1461 Environmental Remediation System Installation Seattle, Washington (Project Manual) (Kennedy Jenks 2022a)
- Operations and Maintenance Manual (O&M Manual) [Kennedy Jenks 2022b (Draft)]
- Sampling and Analysis Plan / Quality Assurance Project Plan (SAP/QAPP) [Kennedy Jenks 2022c (Draft)]

The draft O&M Manual and draft SAP/QAPP (prepared in 2022) will be finalized in conjunction with implementation of the cleanup action. This CMP has been prepared to fulfill requirements of the Model Toxics Control Act (MTCA) regulations published in Washington Administrative Code (WAC) WAC 173-340-410 and WAC 173-340-400(a)(xiv). This Site is listed on the Washington State Department of Ecology (Ecology) Site Information System and Hazardous Sites List as Circle K 1461, under cleanup site ID 5086 and facility/site ID 2322.

1.1 Project Description and Cleanup Action Overview

A remedial action is planned to address petroleum hydrocarbon-impacted soil and groundwater at the Site. Hydrocarbons detected in soil and groundwater have been attributed to a leaking underground storage tank (UST) that was discovered in August 1989. A Multi-Phase Extraction (MPE) system will be installed and operated to reduce concentrations of Gasoline Range Organics (GRO) and benzene, toluene, ethylbenzene, and xylene (BTEX) in the soil and groundwater below the Site. Groundwater, soil, and vapor samples will be collected periodically to monitor treatment progress.

In April 1992, Ecology entered into Consent Decree No. 82-2-08095-8 (CD) with Mr. Kuk Jin Choung and Ms. Kathy-Kyung D. Choung, owners of the property, to conduct a RI/FS and develop a cleanup action plan (CAP) for the Site. After completion of the RI/FS and CAP, the CD requires performance of the cleanup action to protect human health and the environment in accordance with Model Toxics Control Act (MTCA) regulations. The RI/FS and

CAP were finalized in December 2017. Implementation of the CAP is continuing under the CD with Ecology oversight, under Ecology contract number C2100069.

The Site history and planned cleanup action are described in detail in the RI/FS, CAP, and EDR. The findings presented in the RI/FS Report (Kennedy Jenks 2017) included the most current data set for the Site. A general summary overview is provided below in Section 1.2.

1.2 Previous Remedial and Investigation Activities

In 1989, a leak was discovered in one of the four onsite gasoline USTs. It was estimated that approximately 4,000 to 6,000 gallons of gasoline were released to the subsurface. Following the discovery of the release, all six onsite USTs and the pump island were removed. In addition, approximately 900 cubic yards (cy) of petroleum hydrocarbon-containing soil (PCS) were excavated and removed from the Site. The property was redeveloped in 1990 and 1991 and currently includes a single one-story building operated as a retail dry cleaning store (Jay's Cleaners) and a convenience store (Mont's Market).

Additional remedial and investigation activities were conducted between 1989 and 2006 including installation of and sampling groundwater monitoring wells, light non-aqueous phase liquid (LNAPL) recovery, groundwater extraction and treatment, soil vapor extraction (SVE), and enhanced fluid recovery (EFR). A Draft RI/FS was completed for the Site in 2009 by Ecology (Ecology 2009). Additional RI field activities were completed by Kennedy Jenks in 2016 and 2017 to address data gaps remaining after the Draft RI/FS. The locations of monitoring and remediation wells installed through the 2016/2017 investigation plus proposed remediation wells for the MPE system are presented in Figure 2. Additional details regarding the pre-2016 RI remedial systems and subsequent investigations are summarized in the RI/FS (Kennedy Jenks 2017) and the EDR (Kennedy Jenks 2021a).

1.2.1 Contaminants of Concern

The RI/FS identified GRO and BTEX constituents related to former fueling activities at the Site as the primary contaminants of concern (COCs). GRO and BTEX constituents are present in soil and groundwater at concentrations above MTCA Method A cleanup levels (CULs). Toluene, ethylbenzene, and xylenes are also COCs and are present at concentrations above MTCA Method A CULs in Site media where GRO and/or benzene are also reported. Reported concentrations of GRO and benzene are used to describe the extent of impacted media in the following sections.

1.2.2 Impacted Soil

Based on analytical results and field observations, the vertical extent of GRO concentrations exceeding the soil MTCA Method A CUL appears to be generally limited to the zone from 8 to greater than 20 feet bgs. The horizontal extent of GRO-impacted soil (approximately 5,300 square feet) is generally located beneath the onsite parking lot and may extend beneath the onsite building and into the roadways to the north and west of the property as shown in Figure 3. The lateral and vertical extents of benzene, toluene, ethylbenzene, and xylenes concentrations that exceed the soil CUL appear to coincide with the distribution of GRO; therefore, targeting the zone in which GRO concentrations exceed soil CULs for remediation will also address cleanup of the aromatic gasoline constituents.

1.2.3 Impacted Groundwater

There are currently 19 groundwater monitoring wells and nine multi-purpose wells on Site. Monitoring wells MW-1 through MW-16 were installed in 1989. Monitoring wells MW-17, MW-18, and MW-19 and nine multi-purpose wells (MW-20, MW-21, and RW-1 through RW-7) were installed on Site as part of the RI activities in 2016 and 2017. Table 1 lists existing monitoring and remediation wells and six proposed new remediation wells, along with the installation date and screen interval. Six of the wells (MW-1, MW-2, MW-3, MW-5, MW-12, and MW-13) have been abandoned and are not shown in Table 1. Locations of existing wells are shown on Figure 2. Existing wells will be utilized as part of the monitoring program and as part of the remedial system design. The planned remedial action will include the installation of three new multi-purpose remediation wells (RW-8, RW-9, and RW-10) and three new slanted remediation wells (SW-1, SW-2, and SW-3).

Petroleum hydrocarbons in groundwater at the Site are limited to dissolved-phase impacts; LNAPL was last measured in Site monitoring wells (MW-4, MW-8, MW-9, and MW-13) in October 2006 [EA Engineering, Science, and Technology, Inc. (EA) 2006] and was not observed in monitoring wells during RI groundwater monitoring events in 2016 and 2017 (Kennedy Jenks 2017). The extent of dissolved-phase petroleum hydrocarbons (approximately 10,900 square feet) and related compounds is bounded on the north side of East McGraw Street, and generally extends beneath the onsite parking lot as shown in Figure 3. Dissolved-phase impacts may also extend beneath the onsite building and to the west beneath 24th Avenue East, though groundwater impacts are bounded along the western side of the street.

1.2.4 Vapor Intrusion Assessment

Kennedy Jenks conducted an initial (Tier 1) assessment of the potential for vapor intrusion (VI) into the main Site structure and adjacent residences following the methods described in the EPA's *Technical Guide for Addressing Petroleum Vapor Intrusion at Leaking Underground Storage Tank Sites* (EPA 2015). The results of the Tier 1 assessment are presented in the RI/FS (Kennedy Jenks 2017) and are summarized as follows:

- The occupied on-property commercial structure is within the lateral VI inclusion zone based on the maximum benzene, toluene, and xylene concentrations detected in groundwater near the building.

- Although groundwater at the Site is typically encountered approximately 10 feet bgs adjacent to the building, exceeding EPA's vertical groundwater separation distance criterion of 6 feet for bio-attenuation of petroleum hydrocarbons, the presence of underground utilities could provide a preferential pathway(s) for soil vapors to enter the onsite building. Consequently, the VI pathway into the onsite structure is considered potentially complete pending further characterization of preferential vapor pathways.

- The potential for VI into nearby residential structures appears to be very low based upon the proximity of the soil and groundwater contamination to such structures; however, in the absence of additional sampling at the residential properties to confirm subsurface conditions, the VI pathway for off-property residential areas must be regarded as potentially complete.

1.3 Purpose of the CMP

The purpose of this CMP is to satisfy the requirements of WAC 173-340-410 and WAC 173-340-400(a)(xiv) and those established under the 1992 CD.

The CMP provides a description of the compliance monitoring requirements for the cleanup action, including protection monitoring, performance monitoring, and confirmational monitoring as described in WAC 173-340-410:

- Protection Monitoring. Protection monitoring is performed during the cleanup action to confirm that human health and the environment are adequately protected during the construction and operation and maintenance period of the cleanup action as described in the health and safety plan.

- Performance Monitoring. Performance monitoring is performed during the cleanup action and includes sampling and analysis of environmental media to ensure that cleanup standards have been attained during the cleanup action, and, as appropriate, demonstrating attainment of other performance standards including construction quality control and permit compliance.

- Confirmational Monitoring. Confirmational monitoring is performed following the cleanup action to confirm the long-term effectiveness of the cleanup action once cleanup standards, and if appropriate, remediation levels or other performance standards, have been attained.

The CMP is presented in Section 3 and includes a summary of the required compliance monitoring sampling during and after the cleanup action.

Section 2: Organization and Responsibilities

As previously discussed, the cleanup action at the Site is being performed under the 1992 CD and managed by Ecology. The primary parties responsible for implementation of the cleanup action and compliance monitoring include the following:

Ecology:	Project Coordinator Dale Myers Northwest Regional Office, Bellevue, Washington
Consultant:	Kennedy/Jenks Consultants, Inc. Ryan Hultgren Federal Way, Washington
Construction Contractor:	To be determined.
Operations and Maintenance (O&M) Contractor:	To be determined.

2.1 Compliance Monitoring Responsibilities

The general areas of responsibility for the primary parties involved with implementation of the cleanup action, with respect to compliance monitoring, are summarized below:

- **Ecology.** The cleanup action is being managed by Ecology under the 1992 CD. Ecology is also the primary regulatory agency providing oversight of the project. Ecology will provide review and approval of planned sampling frequency and analytical tests, and review of analytical results (during the cleanup action) for the onsite vapor and water treatment systems, soil and groundwater samples, and imported fill materials.

- **Consultant.** The consultant will perform oversight of construction activities and sampling performed by the Construction Contractor. The consultant will also work with the O&M Contractor to ensure that the needed data are collected during remediation system operation and will provide engineering services as needed to troubleshoot system issues.

- **Construction Contractor.** The Construction Contractor is responsible for performing construction-related activities at the Site as described in the EDR and Project Manual. Monitoring and sampling related activities performed by the contractor are anticipated to include:

    - Installation of four new Vapor Pin® sample devices in the property building, three new sub-slab depressurization (SSD) horizontal wells below grade in gravel located on the north and west sides of the building, and six new remediation wells.

- Soil screening and chemical sampling of soil from the soil borings for new remediation wells, excavated soil from piping trenches and drilling cuttings for waste disposal characterization, and imported fill materials.

- Collection of water samples from new remediation wells development water and decontamination water from equipment cleaning for water waste disposal characterization.

- Collection of vapor samples from SSD wells and Vapor Pin® sampling devices for field analysis. Samples may also be collected for laboratory analysis.

- **O&M Contractor.** The O&M Contractor is responsible for performing operation, maintenance and monitoring of the remediation system as described in the EDR and Operations and Maintenance Manual (O&M Manual). The O&M Contractor is anticipated to conduct the following compliance monitoring sampling activities during remediation system operation and following shutdown:

  - Collection of effluent water samples from the onsite water treatment system for laboratory analysis.

  - Collection of influent and effluent vapor samples from the onsite vapor treatment system and from individual extraction wells for field and laboratory analysis.

  - Collection of vapor samples from SSD wells and Vapor Pin® sampling devices.

  - Collection of groundwater samples from monitoring wells for performance monitoring (at startup, quarterly for two years, semiannually for remaining years of system operation) and confirmation monitoring (quarterly until results from four consecutive quarters are below Site cleanup levels).

  - Collection of confirmation soil samples to demonstrate Site cleanup levels have been achieved in soil.

  - Collection of soil and/or water samples for waste disposal characterization.

Note: This document only describes responsibilities related to sampling and analysis of soil, vapor, and water samples. Other project responsibilities for each party are discussed in greater detail in other project documents (EDR, Project Manual, O&M Manual, SAP/QAPP, etc.).

2.2 Project Schedule

A general remedial action schedule, as required in WAC 173-340-400(4)(a)(vi), is outlined below.

The design plans and construction specifications are expected to be completed in third or fourth quarter 2022. A contractor is expected to be selected by fourth quarter 2022. The installation of the system is expected to be completed in 13 to 15 weeks as outlined below. Operation of the system is expected to occur over a 3- to 10-year period.

Estimated Project Schedule

- Stage 1. Mobilization and Well Installation – 2 weeks
- Stage 2. Vapor Monitoring Equipment Installation – 1 week
- Stage 3. Excavation and Trenching, Soil Screening and Sampling – 3 weeks
- Stage 4. Treatment System Installation – 3 to 4 weeks
- Stage 5. Installation of Electrical Components – 1 Week
- Stage 6. Site Restoration – 1 week
- Stage 7. Demobilization and Final Completion – 2 to 3 weeks
- Stage 8. Operation and Compliance Monitoring – 3 to 12 years

As indicated above, each stage will be completed consecutively. The actual time required to complete the remedial action may vary depending on Site conditions, weather conditions, and the rate of decrease in the constituents in the groundwater and vapor on Site.

Groundwater and vapor monitoring will be conducted during system operation (Stage 8). Confirmation monitoring will be conducted once the remediation system is no longer actively operating and will include soil sampling to confirm soil meets Site CULs, and groundwater monitoring until four consecutive quarters of groundwater sampling results meet Site CULs. The specific wells, laboratory analytes, and sampling frequency may be modified for groundwater monitoring events as determined by Ecology.

Section 3: Compliance Monitoring

This section describes the compliance monitoring activities that will be performed at the Site as part of the remedial action. Compliance monitoring activities identified in this section will fulfill requirements for ongoing monitoring of this remedial action in accordance with MTCA (WAC 173-340-410).

Existing Site monitoring wells not included as part of the remedial action will remain onsite for possible future use during confirmation monitoring. The locations of these monitoring wells are shown on Figure 2.

3.1 Protection Monitoring

Health and safety measures are required for those individuals working at and visiting the Site. Remediation contractors working at the Site will prepare a Site-specific HASP (under separate cover) for their employees, which will describe health and safety measures, including any protection monitoring necessary during construction (Construction Contractor) and O&M (O&M Contractor) activities. In addition, the consultant will prepare a separate HASP for compliance monitoring tasks to be performed by its personnel during the remediation system construction and operation phases, and the subsequent confirmation monitoring phase.

The remediation contractors will have primary responsibility for implementation of the HASP during the construction and maintenance phases of the cleanup action, including protection monitoring for their personnel, including subcontractors, visitors, and the general public (the onsite businesses will remain open during the remedial action). Protection monitoring by the contractors will also include measures, as necessary, for protection of surrounding communities and the environment during construction and will be specified in their Site HASP.

During construction and operation and maintenance activities, contractors will confirm that human health and the environment are protected in accordance with their Site HASP and federal and local regulations. Within the contractors' Site HASPs, details will be included on procedures for vapor and air space monitoring for protection of Site workers.

Specific protection monitoring on the property will include vapor monitoring to assess the possibility of a vapor intrusion pathway into the property building. Protection vapor monitoring will be conducted via the sampling of three SSD wells on the north and west sides of the building and sampling of four Vapor Pin® sampling devices installed within the building. Vapor monitoring will also continue through site restoration activities (performance monitoring).

Approximate locations of the SSD wells are shown on Sheet C-01 of the Project Manual. The SSD wells will be monitored for total volatile organic compounds (VOCs) using a photoionization detector (PID) capable of measurements at low-detection ranges, with a resolution of 1 part per billion by volume (ppbv) or less; also known as a ppb PID. Monitoring will also be performed using a multi-gas meter (four-gas meter) to measure percent lower explosive limit (% LEL), oxygen, carbon dioxide, and total VOCs. SSD wells be monitored using a ppb PID and four-gas meter biannually, as well as between different states of remedial system operation: before

startup (baseline sampling), before changing to Granular Activated Carbon (GAC) operations, before changing to surfactant injection, and before changing to enhanced biodegradation.

Approximate locations of the vapor pins are shown in Figure 3 (as well as Sheet C-01). Vapor pins will be monitored quarterly using a ppb PID and four-gas meter, as noted in the O&M Manual.

3.2 Performance Monitoring

Performance monitoring is required in conjunction with the remedial action, to confirm that the remedial action has attained Site CULs and met remedial action objectives (RAOs). The scope of activities includes:

- Collection of soil samples for characterization (from soil borings during installation of six remediation wells) and for construction quality control (i.e., testing of imported fill materials).
- Collection of soil and water samples for waste disposal profile development (i.e., stockpiled soil, well development water, groundwater sampling purge water, vapor treatment system condensate).
- Collection of groundwater samples from a selection of monitoring wells during remedial system operation to evaluate cleanup progress, optimize treatment corridors, and attainment of cleanup levels.
- Collection of water samples from the water treatment system (effluent) to monitor compliance with permit discharge criteria and when to progress through the three phases of the remedial system operation.
- Collection of vapor samples from the SSD wells on the north and west sides of the property building and Vapor Pin® sampling devices installed in the building to assess vapor intrusion.
- Collection of vapor samples from the vapor treatment system (influent and effluent) and individual extraction remediation wells to demonstrate compliance with substantial emissions requirements.

Performance monitoring tasks associated with the cleanup action are summarized below for soil, groundwater, and vapor matrices.

3.2.1 Soil Monitoring

Performance soil monitoring to be conducted by the Construction Contractor during construction activities will include soil screening and soil sampling including the following:

- Field screening each soil boring, and collection and laboratory analysis of up to two soil samples from each of the soil borings for proposed, new vertical remediation wells (RW-8, RW-9, and RW-10) and slanted remediation wells (SW-1, SW-2, and SW-3) (Figure 1). Soil samples will be submitted for laboratory chemical analysis of GRO by

Northwest Total Petroleum Hydrocarbons in Gasoline Range (NWTPH-Gx) and BTEX by EPA Method 8260B to 1) further delineate the nature and extent of impacts to soil and groundwater and 2) for investigation derived waste (IDW) disposal characterization purposes.

- Field screening and collection and laboratory analysis of soil samples from soil stockpiles generated during system installation for waste characterization, if required (i.e., if waste cannot be profiled using existing RI data). Required chemical analyses for soil samples will be determined based on generator knowledge and the requirements of the waste disposal facility.

- Collection and laboratory analysis of representative samples of imported fill materials for chemical analysis. [Note: This is the Construction Contractor's responsibility; however, this sampling may also be performed by the Consultant for verification purposes.] Required chemical analyses for soil samples will be determined by Ecology and the Consultant.

3.2.2 Groundwater Monitoring

Performance groundwater monitoring to be conducted by the Construction Contractor during construction activities will include collection and laboratory analysis of water samples from remediation well development water and cleaning water for waste disposal characterization.

Performance groundwater monitoring to be conducted by the O&M Contractor during remediation system operation will include:

- Collection of water samples from the influent and effluent of the liquid treatment system, in accordance with recommendations from the City of Seattle and King County. [Note: This sampling is the Contractor's responsibility; however, to ensure accuracy of the results, the Consultant will also perform periodic independent monitoring.]

- Collection of groundwater samples from monitoring wells during system operation. During initial operation and transitions between treatment methods, monitoring may be conducted more often at selected wells.

3.2.3 Vapor Monitoring

Performance Vapor Monitoring to be conducted by the O&M Contractor during remediation system operation will include:

- Performance of the vapor treatment system will be confirmed via sampling and analysis of the influent and effluent vapors, in accordance with recommendations from the Puget Sound Clean Air Agency (PSCAA). The influent and effluent vapors will be sampled monthly for the first two quarters of system operation and quarterly thereafter for field and laboratory analyses of VOCs. Additional details on vapor performance monitoring are included in the O&M Manual and SAP/QAPP.

- Vapor monitoring to assess the possibility of a vapor intrusion pathway into the property building will be conducted during remediation system operation. Vapor monitoring will be

conducted via collection of vapor samples from Vapor Pin® sample devices installed in the building (Figure 3) and the SSD wells located on the north and west sides of the building (Sheet C-01 in the Project Manual). Field testing of vapor samples collected from the site will be conducted using a ppb PID for total VOCs and a 4-gas meter to measure % LEL, oxygen, carbon dioxide, and VOCs. Vapor samples may also be collected for laboratory analysis of VOCs based on field measurement results.

3.3 Confirmation Monitoring

Confirmation monitoring will be conducted to assess the long-term effectiveness of the remedial action once cleanup standards have been attained and/or once the remediation system is no longer actively operating. Confirmation monitoring at the Site will include:

- Soil sampling to confirm soil meets Site cleanup levels, and
- Four consecutive quarters of groundwater monitoring to show that groundwater concentrations meet Site cleanup levels.

Additional details on the sampling locations, sampling methods, analyses to be performed and sampling frequency for soil and groundwater confirmation monitoring activities at the Site are included in the SAP/QAPP (under separate cover). The location(s) and depth(s) for collection of confirmation soil samples will be determined in accordance with applicable Ecology guidance and will be approved by Ecology prior to collecting samples.

Confirmation groundwater monitoring events will be performed following completion of the remediation system operation. Groundwater samples will be collected from monitoring wells located on and off the properly to demonstrate attainment of Site cleanup levels. These wells are identified as “Compliance Wells” in Table 1. Groundwater monitoring will be ceased in wells after laboratory data from four consecutive quarters of monitoring indicate GRO and BTEX concentrations in groundwater samples are below the Site cleanup levels. Those wells will then be removed from the groundwater monitoring program, but not decommissioned.

The specific wells, laboratory analytes, and sampling frequency may be modified for subsequent monitoring events as determined by Ecology.

3.4 Cleanup Requirements

3.4.1 Remedial Action Objectives

The objective of the cleanup action is to reduce potential risks to human health and the environment. Because the Site is zoned as “Neighborhood-Commercial,” the proposed soil cleanup standards must be protective of unrestricted land use. Specific risk-based remedial action objectives include:

- Reduce the potential for human contact with soil and groundwater containing COCs at concentrations exceeding the selected CULs.
- Protect groundwater quality by addressing dissolved phase petroleum hydrocarbons exceeding the selected CULs.

- Reduce the potential for human exposure to vapors (primarily vapor intrusion into buildings) associated with soil and groundwater containing COCs at concentrations exceeding the selected CULs.

3.4.2 Cleanup and Screening Levels

The cleanup standards for soil and groundwater, as selected in the RI/FS and presented in the CAP, are noted below per WAC 173-340-400(4)(a)(i).

- **Soil:** MTCA Method A soil CULs for unrestricted land use based on WAC 173-340-740 and/or obtained from Ecology's Cleanup Levels and Risk Calculation (CLARC) database. For those compounds where MTCA Method A levels may not be available, soil CULs will be based on MTCA Method B values and/or leaching to groundwater values.

- **Groundwater:** MTCA Method A groundwater CULs for fuel components (GRO and BTEX constituents) based on WAC 173-340-740 and/or obtained from Ecology's CLARC database. For those compounds where MTCA Method A levels may not be available, groundwater CULs will be based on MTCA Method B values.

- **Vapor Intrusion:** Screening levels for soil gas will be based on MTCA Method B groundwater screening levels for the vapor intrusion pathway obtained from Ecology's CLARC database. If sub-slab soil gas samples are collected, they will be compared to Method B sub-slab soil gas screening levels obtained from Ecology's CLARC database.

CULs for unrestricted land uses are proposed as part of the cleanup standards for this Site. These standards are protective of human exposure via direct contact pathway and are protective of groundwater and surface water. The CULs are summarized in Table 2.

Groundwater CULs selected for the Site are based on MTCA Method A CULs for fuel components (GRO and BTEX). MTCA Method A groundwater CULs for GRO and BTEX were selected for fuel components because they are the most applicable and protective standards for gasoline-range hydrocarbon compounds (including BTEX).

3.4.3 Points of Compliance

The points of compliance, based on the potential chemical exposure routes, are those points where cleanup levels established for the Site shall be achieved.

The points of compliance for Site media were established as follows:

- **Soil:** Based on WAC 173-340-740, the point of compliance for soil is as follows:
  - Throughout the Site for protection of groundwater.
  - From the ground surface to the depth of shallow groundwater for possible VI.
  - From the ground surface to a depth of 15 feet below grade for protection of humans based on direct contact.

- **Groundwater:** In accordance with WAC 173-340-720(8), throughout the Site from the uppermost saturated zone to the lowest depth potentially affected by Site contaminants.
- **Air:** In accordance with WAC 174-340-750(6), in ambient air throughout the Site.

Section 4: Reporting

At the completion of construction, an As Built Report will be prepared in accordance with WAC 173-340-400(6)(b)(ii). The Engineer responsible for the oversight of construction will prepare as built drawings incorporating drawing markups provided by the Construction Contractor and a report documenting construction. The 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 and specifications and related documents.

The responsibilities, content, and frequency for data reporting and remedial progress reporting to Ecology during operation and maintenance of the MPE system and compliance monitoring will be as provided in Section 8.4 of the SAP/QAPP.

Deliverables will be provided to Ecology electronically in MS Word, Excel, and/or Adobe PDF formats for all documents, as appropriate.

References

EA Engineering, Science, and Technology, Inc. 2006. Circle K Station #1461, Groundwater Summary for October 2006, Recommendations for Additional Cleanup Action Tests. 21 November 2006.

Kennedy/Jenks Consultants, Inc., 2021a. Engineering Design Report, Former Circle K Site 1461, Seattle, Washington. 10 December 2021.

Kennedy/Jenks Consultants, Inc., 2021b. Site-Specific Health and Safety Plan, Former Circle K Site, 2350 24th Ave East, Seattle, Washington 98112. 12 December 2021.

Kennedy/Jenks Consultants. 2022a. 95% Project Manual for the Circle K Site 1461 Environmental Remediation System Installation Seattle, Washington. October 2022.

Kennedy/Jenks Consultants, Inc., 2022b. Draft Operations and Maintenance Manual Environmental Remediation System, Circle K 1461, Seattle, Washington. November 2022.

Kennedy/Jenks Consultants, Inc., 2022c. Draft Sampling and Analysis Plan/Quality Assurance Project Plan, Circle K 1461, Seattle, Washington. November 2022.

Washington State Department of Ecology. 1995. Guidance on Sampling and Data Analysis Methods. Publication No. 94-49.

Washington State Department of Ecology. Revised 2016. Guidance for Remediation of Petroleum Contaminated Sites. Publication No. 10-09-057. June 2016

Washington State Department of Ecology. Revised 2022. Guidance for Evaluating Vapor Intrusion in Washington State. Publication No. 09-09-047. March 2022.

Tables

Table 1: Summary of Groundwater Monitoring and Remediation Wells

FORMER CIRCLE K SITE 1461
Seattle, Washington

Monitoring Well ID	Date Installed	Well Status	Well Use	Well Diameter (inches)	Screened Interval (feet bgs)	Easting (US Survey Feet)	Northing (US Survey Feet)
MW-2	09/11/1989	Existing	Monitoring Well	2	5.5-20.9	1278287.96	236985.88
MW-6	10/02/1989	Existing	Monitoring Well	2	5-20.4	1278462.46	236998.42
MW-7	10/02/1989	Existing	Monitoring Well	2	5-20.2	1278497.04	236983.26
MW-8	10/03/1989	Existing	Compliance Well	2	5-20.3	1278438.10	237006.82
MW-9	10/03/1989	Existing	Compliance Well	2	5-21.2	1278408.96	237007.40
MW-10	10/03/1989	Existing	Compliance Well	2	5-20.4	1278488.93	236997.48
MW-11	10/04/1989	Existing	Monitoring Well	2	5-20.0	1278384.53	237065.31
MW-13	12/20/1989	Existing	Compliance Well	2	4-19.0	1278402.55	236971.66
MW-14	12/20/1989	Existing	Compliance Well	2	4-19.3	1278458.03	237022.92
MW-15	12/21/1989	Existing	Compliance Well	2	4-18.7	1278421.35	237026.01
MW-16	12/21/1989	Existing	Compliance Well	2	4-19.2	1278390.29	237013.58
MW-17	08/01/2016	Existing	Compliance Well	2	4-19	1278436.82	236871.78
MW-18	08/01/2016	Existing	Compliance Well	2	5-15	1278391.36	236873.73
MW-19	09/23/2016	Existing	Compliance Well	2	5-20	1278433.66	236911.07
MW-20	09/23/2016	Existing	Compliance Well	4	5-20	1278392.00	236918.95
MW-21	09/23/2016	Existing	Compliance Well	4	5-20	1278392.68	236948.84
RW-1	02/07/2017	Existing	Compliance Well	4	5.5-20.5	1278390.95	236890.20
MW-4	09/12/1989	Existing	Remediation Well	2	4-18.8	1278447.91	236985.00
RW-2	02/09/2017	Existing	Remediation Well	4	5-20	1278404.38	236970.10
RW-3	02/09/2017	Existing	Remediation Well	4	5-20	1278409.31	236960.04
RW-4	02/08/2017	Existing	Remediation Well	4	5-20	1278418.32	236947.51
RW-5	02/08/2017	Existing	Remediation Well	4	5-20	1278407.00	236932.47
RW-6	02/10/2017	Existing	Remediation Well	4	5-20	1278425.63	236982.51
RW-7	02/07/2017	Existing	Remediation Well	4	5.0-20.0	1278432.90	236913.61
RW-8	TBD	Proposed	Remediation Well	4	5-20	1278394.71	236950.38
RW-9	TBD	Proposed	Remediation Well	4	5-20	1278406.10	236909.25
RW-10	TBD	Proposed	Remediation Well	4	23-28	1278422.51	236924.38
SW-1	TBD	Proposed	Slant Remediation Well	4	5-18	1278385.16	236943.24
SW-2	TBD	Proposed	Slant Remediation Well	4	5-18	1278397.11	236929.86
SW-3	TBD	Proposed	Slant Remediation Well	4	5-18	1278385.16	236919.10

Notes:

Monitoring Well	Existing monitoring well for groundwater level measurements only
Compliance Well	Existing monitoring well for groundwater compliance monitoring
Remediation Well	Existing injection/extraction remediation well
Remediation Well	Proposed new remediation well; easting and northing data are approximate
Slant Remediation Well	Proposed new slanted remediation well; easting and northing data are approximate

bgs = below ground surface
TBD = to be determined
Easting and Northing data provided in horizontal datum NAD 83, Washington North State Plane Coordinates in U.S. Survey feet

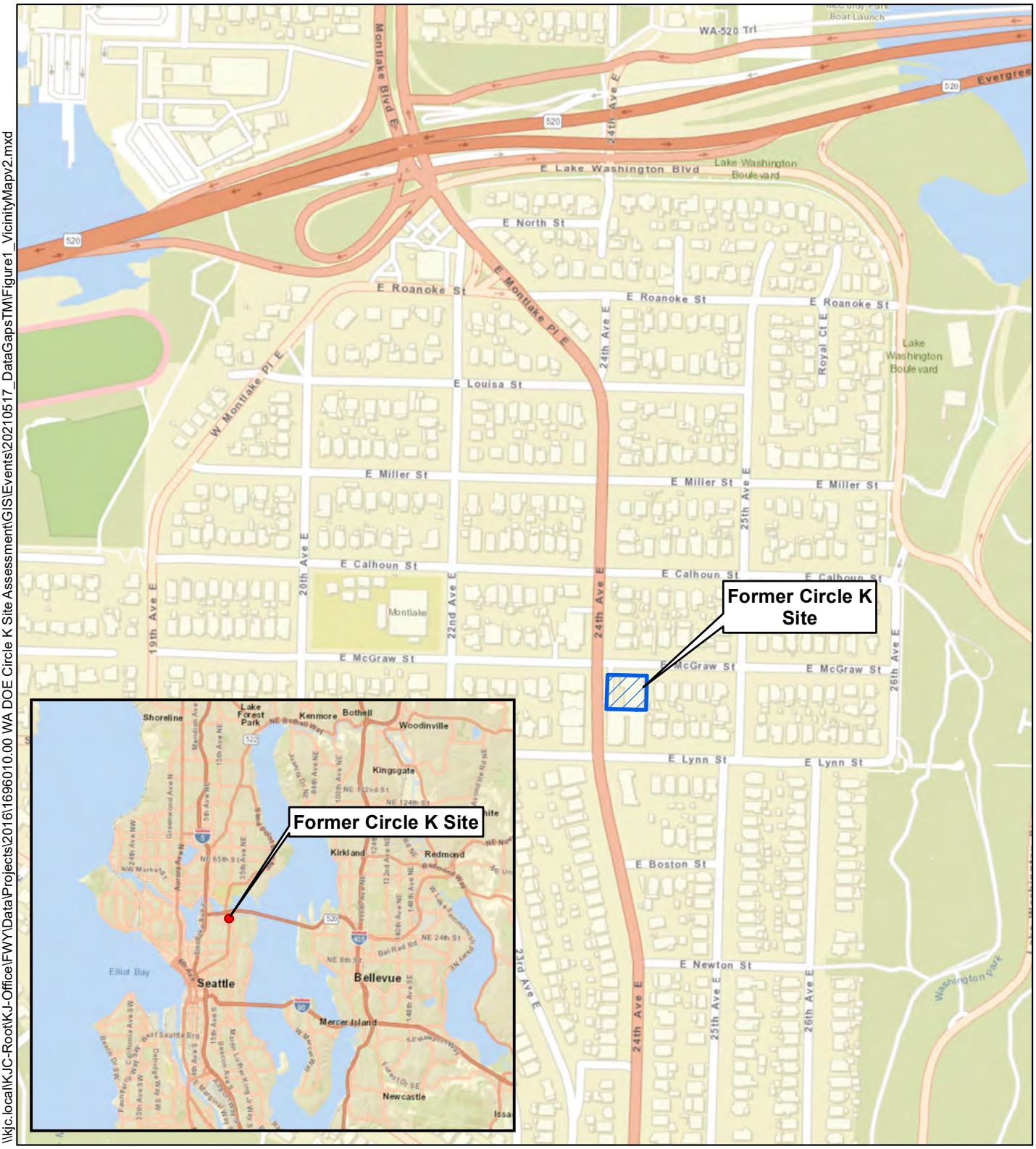
Table 2: Summary of Site Cleanup Levels and Screening Levels

FORMER CIRCLE K SITE 1461
Seattle, Washington

Media / COCs	Value and Units	Cleanup Level / Screening Level Source
Soil		
Gasoline-Range Organics (GRO)	100 mg/kg (w/o benzene)	MTCA Method A Soil Cleanup Levels (CULs) for Unrestricted Land Use - Washington State Administrative Code (WAC) 173-340-740, Table 740-1.
	30 mg/kg (with benzene)	
Benzene	0.03 mg/kg	
Toluene	7 mg/kg	
Ethylbenzene	6 mg/kg	
Xylenes	9 mg/kg	
Groundwater		
Gasoline-Range Organics (GRO)	1,000 µg/L (w/o benzene)	MTCA Method A Groundwater CULs - WAC 173-340-720, Table 720-1.
	800 µg/L (with benzene)	
Benzene	5 µg/L	
Toluene	1,000 µg/L	
Ethylbenzene	700 µg/L	
Xylenes	1,000 µg/L	
Soil Gas / Vapor		
Gasoline-Range Organics (GRO)	1,500 µg/m^3 (425 ppbv)	MTCA Method B Noncancer Sub-Slab Soil Gas Screening Level - Cleanup Levels and Risk Calculation (CLARC) Vapor Intrusion Method B Table - July 2022
Benzene	460 µg/m^3 (140 ppbv)	
Toluene	76,000 µg/m^3 (20,160 ppbv)	
Ethylbenzene	15,000 µg/m^3 (3,450 ppbv)	
Xylenes	1,500 µg/m^3 (345 ppbv)	

Notes:
COCs = contaminants of concern
mg/kg = milligrams per kilogram
µg/L = micrograms per liter
µg/m^3 = micrograms per cubic meter
ppbv = parts per billion by volume

Figures



\\kjc.local\KJC-Root\KJ-Office\FWY\Data\Projects\2016\1696010.00 WA DOE Circle K Site Assessment\GIS\Events\20210517_DataGapsTM\Figure1_VicinityMapv2.mxd

Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors,

Legend

Site Location

N

0 200 400

Scale: Feet

Note:
1. All locations are approximate.

Kennedy Jenks

Former Circle K Site
Seattle, Washington

Site Location and Vicinity Map

KJ 2196008*00

Figure 1

Path: H:\GIS_CloudProjects\WA DOE\Circle K\SAP\Figure2_SiteMap.mxd ©2022 Kennedy/Jenks Consultants

Legend

- Existing Well
- Existing Well to be Used for Extraction/Injection
- New Extraction/Injection Well
- New Slant Well
- New Vapor Monitoring Pin
- Parcel Boundary

Notes:
1. All locations are approximate.

N

0 15 30

Scale: Feet

Kennedy Jenks

Former Circle K Site
Seattle, Washington

Well Locations Map

KJ 2196008*00

Figure 2

Path: H:\GIS_CloudProjects\WA DOE\Circle K\SAP\Figure3_ExtentofImpact.mxd ©2022 Kennedy/Jenks Consultants

Legend

- Existing Well
- Existing Well to be Used for Extraction/Injection
- New Extraction/Injection Well
- New Slant Well
- New Vapor Monitoring Pin
- Parcel Boundary
- Approximate Extent of Gasoline-Range Organics and/or Benzene in Groundwater above MTCA Method A Cleanup Levels
- Approximate Extent of Gasoline-Range Organics and/or Benzene in Soil above MTCA Method A Cleanup Levels

Notes:
1. All locations are approximate.
2. GRO = gasoline range organics
3. CUL = clean up levels

N

0 15 30

Scale: Feet

Kennedy Jenks

Former Circle K Site
Seattle, Washington

Approximate Extents of GRO and Benzene Impacts to Soil and Groundwater

KJ 2196008*00

Figure 3

Kennedy Jenks

32001 32nd Avenue South, Suite 100
Federal Way, Washington 98001
253-835-6400

Draft
Sampling and Analysis Plan/ Quality Assurance Project Plan

Circle K 1461
Seattle, Washington 98112

30 March 2023

Prepared for

DEPARTMENT OF ECOLOGY
State of Washington

3190 160th Avenue SE
Bellevue, Washington 98008-5452

KJ Project No. 2196008*00

Draft Sampling and Analysis Plan/ Quality Assurance Project Plan Signature Page

Site: Circle K 1461

Facility Site Identification Number (FSID): 2322

Cleanup Site Identification Number (CSID): #5089

Address: 2350 24th Avenue East, Seattle, Washington

Document Name: Circle K 1461– Sampling and Analysis Plan/Quality Assurance Project Plan (SAP/QAPP)

Document Date: March 2023

Signature below indicates review and approval of the Quality Assurance Project Plan and agreement that the anticipated sampling and analytical methods are sufficient to meet the quality objectives of the Circle K Environmental Remediation System Monitoring Program.

Washington State Department of Ecology:

Dale Myers Date
Ecology Site Manager
Phone: (425) 649-4426
e-mail: damy461@ecy.wa.gov

Kennedy/Jenks Consultants, Inc. Project Manager:

Ryan Hultgren Date
Title: Project Manager
Phone: (253) 835-6432
e-mail: RyanHultgren@KennedyJenks.com

Data validation reviewer (QAPP review, data validation):

Rhonda Reilly Date
Title: Quality Validation Reviewer
Phone: (253) 835-6400
e-mail: RhondaReilly@kennedyjenks.com

Table of Contents

Table of Contents (cont'd)

Table of Contents (cont'd)

List of Tables

List of Figures

List of Appendices

List of Acronyms

ARAR	applicable, relevant, and appropriate requirement
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, xylenes
°C	degrees Celsius
CFR	Code of Federal Regulations
CMP	Compliance Monitoring Plan
COC	contaminant of concern
CUL	cleanup level
DI	distilled/deionized
DO	dissolved oxygen
DOT	Department of Transportation
DSARS	Document Storage and Retrieval System
Ecology	Washington State Department of Ecology
EDR	Engineering Design Report
EIM	Environmental Information Management
EIW	extraction/injection well
EPA	U.S. Environmental Protection Agency
GAC	granular activated carbon
GRO	gasoline-range organics
HASP	Health and Safety Plan
ID	identification
IDW	investigation-derived waste
ISIS	Integrated Site Information System
Kennedy Jenks	Kennedy/Jenks Consultants, Inc.
LEL	lower explosive limit
LNAPL	light non-aqueous phase liquid
MDL	method detection limit
MPE	multi-phase extraction
MQO	measurement quality objective
MRL	method reporting limit
MS	matrix spike
MSD	matrix spike duplicate
MTCA	Model Toxics Control Act
NIST	National Institute of Standards and Technology
NWTPH-Gx	Northwest Total Petroleum Hydrocarbons as Gasoline Extended
O&M	Operations and Maintenance

ORP	oxidation-reduction potential
OSHA	Occupational Safety and Health Administration
PID	photoionization detector
ppb	parts per billion
PPE	personal protective equipment
ppm	parts per million
PQL	practical quantitation limit
PSCAA	Puget Sound Clean Air Agency
PVC	polyvinyl chloride
QA	quality assurance
QAPP	Quality Assurance Project Plan
QA/QC	quality assurance and quality control
QC	quality control
R	recovery
RCRA 8	Resource Conservation and Recovery Act Eight
RI	Remedial Investigation
RI/FS	Remedial Investigation and Feasibility Study
RPD	relative percent difference
SAP	Sampling and Analysis Plan
SOG	Standard Operating Guideline
SSD	sub-slab depressurization
SVOC	semi-volatile organic compound
TPH	total petroleum hydrocarbon
UST	underground storage tank
VI	vapor intrusion
VOA	volatile organic analysis
VOC	volatile organic compound
WAC	Washington Administrative Code

Section 1: Introduction and Background

The purpose of this Sampling and Analysis Plan/Quality Assurance Project Plan (SAP/QAPP) is to document the sampling procedures and protocols for the compliance monitoring activities at the Circle K 1461 site (Site) in Seattle, Washington. This SAP/QAPP is also intended to satisfy the technical requirements of the Washington Administrative Code (WAC) 173-340-820 and other Washington State Department of Ecology (Ecology) policies and/or procedures.

The SAP/QAPP describes sample collection, handling, and analysis procedures, including quality assurance and quality control (QA/QC) requirements. The SAP/QAPP also includes a discussion of the rationale and requirements (sampling frequency and analyses) for groundwater, soil, and vapor sampling at the Site in accordance with the Compliance Monitoring Plan (CMP) prepared under separate cover [Kennedy/Jenks Consultants, Inc. (Kennedy Jenks) 2022]. The CMP provides a description of the compliance monitoring requirements for the cleanup action, including protection monitoring, performance monitoring, and confirmational monitoring as described in WAC 173-340-410.

Specific information required by WAC 173-340-820 and provided in this document includes:

- Purpose and objectives of the data collection including QA/QC.
- Organization and responsibilities for sampling and analysis activities.
- Requirements for sampling activities:
  - Project schedule
  - Rationale for location and frequency of sampling and parameters to be analyzed
  - Procedures for installation of sampling devices
  - Procedures for sample collection and handling including decontamination for equipment and personnel
  - Procedures for management of waste materials generated by sampling activities
  - Description of QA/QC samples
  - Sample labeling, packaging, and chain-of-custody protocols
  - Procedures for splitting samples.
- Procedures for sample analyses and reporting including analytical laboratory detection/reporting limits, analytical methods, QA/QC procedures, data reporting, and data validation.

This SAP/QAPP is intended to be used in conjunction with other site-specific project documents, including the following:

- Remedial Investigation and Feasibility Study (RI/FS) Report, Former Circle K Site (Kennedy Jenks 2017)
- Engineering Design Report, Former Circle K Site 1461, Seattle, Washington (EDR) (Kennedy Jenks 2021a)
- Health and Safety Plan (HASP) (Kennedy Jenks 2021b)
- Bid Set Project Manual for the Circle K 1461 Environmental Remediation System Installation Seattle, Washington (Project Manual) (Kennedy Jenks 2023a)
- Draft Operations and Maintenance (O&M) Manual Environmental Remediation System, Circle K 1461 Seattle, Washington (O&M Manual) (Kennedy Jenks 2023b)
- CMP, Circle K 1461 Seattle, Washington (Kennedy Jenks 2022)

1.1 Project Description

The Site is located at 2350 24th Avenue East in Seattle, Washington. The property currently includes a single one-story building operated as a retail dry cleaning store (Jay's Cleaners) and a convenience store (Mont's Market).

A remedial action is planned to address petroleum hydrocarbon-affected soil and groundwater at the Site. Hydrocarbons detected in soil and groundwater have been attributed to a leaking underground storage tank (UST) that was discovered in August 1989. Following the discovery of the release, all six onsite USTs and the pump island were removed. In addition, approximately 900 cubic yards (cy) of petroleum hydrocarbon-containing soil (PCS) were excavated and removed from the site. Additional remedial and investigation activities were conducted between 1989 and 2006 including installation of and sampling monitoring wells, light non-aqueous phase liquid (LNAPL) recovery, groundwater extraction and treatment, soil vapor extraction (SVE), and enhanced fluid recovery (EFR). LNAPL has not been detected in a monitoring well since October 2006 [EA Engineering, Science, and Technology, Inc. (EA) 2006].

In April 1992, Ecology entered into Consent Decree No. 82-2-08095-8 (CD) with Mr. Kuk Jin Choung and Ms. Kathy-Kyung D. Choung, owners of the property, to conduct a RI/FS and develop a cleanup action plan (CAP) for the site. After completion of the RI/FS and CAP, the CD requires performance of the cleanup action to protect human health and the environment in accordance with Model Toxic Control Act (MTCA) regulations. The RI/FS and CAP were finalized in December 2017. Implementation of the CAP is continuing under the CD with Ecology oversight, under Ecology contract number C2100069.

The site history and planned cleanup action are described in detail in the RI/FS, EDR, O&M Manual, and CMP.

1.2 Contaminants of Concern

The RI/FS identified Total Petroleum Hydrocarbons (TPH) as Gasoline-Range Organics (GRO) and benzene, toluene, ethylbenzene, and xylene (BTEX) related to former fueling activities at the site as the primary contaminants of concern (COCs). GRO and BTEX constituents are present in soil and groundwater at concentrations above MTCA Method A cleanup levels (CULs). Toluene, ethylbenzene, and xylenes are also COCs and are present at concentrations above MTCA Method A CULs in site media where GRO and/or benzene are also reported. Reported concentrations of GRO and benzene were used in the RI/FS and EDR to describe the extent of impacted media.

1.3 Cleanup Action Overview

A Multi-Phase Extraction (MPE) system will be installed and operated to reduce concentrations of GRO and BTEX in the soil and groundwater below the Site. Groundwater, soil, and vapor samples will be collected periodically to monitor treatment progress. The remedial action using the MPE System is presented in the EDR, prepared for Ecology in December 2021 (Kennedy Jenks 2021) and in the Project Manual (Kennedy Jenks 2023a).

The MPE system is designed to incorporate three (3) new vertical wells and three (3) new slant wells along with seven (7) existing wells into a single extraction/injection system for a total of 13 remediation wells. Each extraction/injection well (EIW) within the network of remediation wells is individually connected to both the extraction and injection manifolds in the treatment system enclosure (Treatment Shed) located on site. The wells are organized into four (4) groups of either three (3) or four (4) remediation wells (see Table 1). Three sub-slab depressurization (SSD) wells and four Vapor Pin® sampling devices will be installed to assess the possibility of a vapor intrusion pathway into the property building.

It is planned that the system will operate in three phases over the life of the system:

1. **Phase 1 – Multi-phase extraction**. The EIWs will be operated to extract groundwater and soil vapor from the subsurface for treatment. Extraction will occur from all wells and all sub-slab depressurization locations. The water treatment train consists of a bag filter, two pairs of granular activated carbon (GAC) vessels plumbed in series, a mixing tank in which surfactants, bacteria, and/or nutrients can be added, and an oxygen generator. Water can be discharged to the City of Seattle (City) sanitary sewer system before the mixing tank or reinjected to the wells through the injection manifold. Vapors will be treated with the catalytic oxidizer until extraction vapor concentrations are reduced to 500 parts per million (ppm); when this concentration is reached, the catalytic oxidizer will be removed, and GAC will be employed for air treatment. Treated air will be discharged through an exhaust pipe. The use of the catalytic oxidizer is estimated to last from 1 to 3 months. GAC will be employed until groundwater concentrations stabilize and approach asymptotic levels, approximately 6 to 12 months, after which Phase 2 will commence.

2. **Phase 2 – Surfactant reinjection**. When groundwater concentrations stabilize and approach asymptotic levels, the system will begin reinjection with surfactant addition. Surfactants in the reinjected water will act to liberate hydrocarbons adsorbed to soils. Reinjection and extraction will occur until the liquid phase concentrations have dropped

to a level indicative of asymptotic performance of the surfactant reinjection. Phase 2 duration is estimated to be 6 months.

3. **Phase 3 – Enhanced bioremediation.** Once Phase 2 is complete the surfactant reinjection will be replaced with oxygen/nutrient addition to the reinjected water. Operation will be rotated between the four sets of wells monthly to quarterly based on the monitoring results. Enhanced bioremediation will be conducted until the site constituents of concern have been reduced significantly in the wells or site cleanup levels have been reached. Phase 3 duration is estimated to last for 24 to 84 months.

The system is designed to operate continuously, except for shutdowns for maintenance, replacement of media, or as-needed monitoring.

1.4 Compliance Monitoring

Compliance monitoring is required in conjunction with installation and operation of the remedial system (protection and performance monitoring) and for the duration of the compliance period to confirm that the remedial action has attained site CULs and met remedial action objectives (RAOs) (confirmation monitoring). The CMP (Kennedy Jenks 2022) details the compliance monitoring that will be carried out during installation and operation of the remedial system. Site cleanup levels are presented in Table 2. Kennedy Jenks has prepared this SAP/QAPP to support this field sampling and data collection effort. Soil, groundwater, and vapor sample collection activities will include:

- Collection of soil samples for characterizing soil during installation of six remediation wells, developing waste disposal profiles for soil generated during construction activities, profiling imported soil for backfilling excavations, and confirmation soil sample collection after remedial system operation has ended.

- Collection of groundwater samples from a selection of monitoring wells for performance monitoring during remedial system operation and for confirmation monitoring to demonstrate the long-term effectiveness of the cleanup action once cleanup standards have been attained.

- Collection of discharge water samples from the water treatment system and point of discharge to the sanitary sewer (when applicable).

- Collection of vapor samples from the vapor treatment system (influent and effluent), individual extraction remediation wells, vapor monitoring pins, and SSD wells.

This SAP/QAPP will be amended if compliance monitoring indicates additional activities are necessary.

1.5 Document organization

The remainder of this document is organized as follows:

- Section 1: Introduction and Background

- Section 2: Organization and Responsibilities
- Section 3: Quality Assurance Project Plan
- Section 4: Field Sampling Activities
- Section 5: Field Documentation
- Section 6: Quality Control
- Section 7: Calibration, Testing, Inspection, and Maintenance of Equipment, Instrumentation and Supplies
- Section 8: Data Management Review and Reporting

Section 2: Organization and Responsibilities

As previously discussed, the cleanup action at the site is being performed under a Consent Decree and managed by Ecology. The primary parties responsible for implementation of the cleanup action and compliance monitoring include the following:

Ecology:	Project Coordinator Dale Myers Northwest Regional Office, Bellevue, Washington
Consultant:	Kennedy/Jenks Consultants, Inc. Ryan Hultgren Federal Way, Washington

Remediation Contractors:

Construction Contractor:	To be determined.
Operations and Maintenance (O&M) Contractor:	To be determined.

2.1 Compliance Monitoring Responsibilities

The general areas of responsibility for the primary parties involved with implementation of the cleanup action, with respect to compliance monitoring, are summarized below:

- **Ecology.** The cleanup action is being managed by Ecology under a Consent Decree. Ecology is also the primary regulatory agency providing oversight of the project. Ecology will review and approve this SAP/QAPP; ensure that the proposed work will meet the requirements of this SAP/QAPP; coordinate property access; oversee work performed by the remediation contractors; review reports evaluating and summarizing project activities, sampling results (including onsite vapor and water treatment systems, soil and groundwater samples, waste characterization, and imported fill materials), and further-action, if any; conduct site visits as needed; update Ecology's Integrated Site Information System (ISIS) database; and provide technical assistance to site owners as needed.

- **Consultant.** The consultant will perform oversight for construction activities in accordance with the Project Manual and sampling performed by the Construction Contractor. The consultant will also work with the O&M Contractor to ensure that the needed data are collected during remediation system operation and will provide engineering services as needed to troubleshoot system issues. Remediation system operation is described in the O&M Manual. The consultant will also assist Ecology to review analytical laboratory results, QC data collected, and review data summary reports prepared by the remediation contractors for submittal to Ecology. Where applicable, the consultant will report deficiencies in sample collection, preservation, handling, test

methods, or documentation; initiate and support technical audits and corrective action that may arise from deficiencies in sample collection, preservation, handling, test methods, or documentation.

- **Remediation Contractors.** There will be two primary remediation contractors, the Construction Contractor will be responsible for installation of the remediation system and the O&M Contractor will be responsible for operation, monitoring, and maintenance of the system. The remediation contractors will complete activities defined in this SAP/QAPP, following standard sampling protocols and record and document all field data as defined in this SAP/QAPP. Contractors will verify the proper functioning of all equipment before beginning field activities and ensure the proper number, type, and quantity of sample containers, including preservation requirements, are available for field activities. Other responsibilities include communicating data quality objectives to the analytical laboratories analyzing compliance monitoring samples and assembling project teams to implement field work and coordinate sample analyses.

    - **Construction Contractor.** The Construction Contractor is responsible for performing construction-related activities at the site as described in the EDR and Project Manual. Sampling performed by the contractor is anticipated to include soil screening and chemical sampling of soil from soil borings, excavated soil for waste disposal characterization, and imported fill materials, and chemical sampling of water from well development, equipment cleaning, and from excavations for water waste disposal characterization.

    - **O&M Contractor.** The O&M Contractor is responsible for performing operation, maintenance and monitoring of the remediation system as described in the EDR and O&M Manual. Sampling performed by the O&M Contractor is anticipated to include periodic (e.g., daily, weekly, monthly, quarterly) sampling of the influent and effluent of the onsite water treatment system and the effluent of the onsite vapor treatment system. The O&M Contractor will also perform vapor monitoring of individual monitoring wells and vapor monitoring pins. The O&M contractor will also conduct performance groundwater monitoring at startup and then quarterly for the first two years and twice a year thereafter during system operation.

- **Analytical Laboratory.** The analytical laboratory(ies) analyzing and reporting results for compliance monitoring samples will understand and follow sampling objectives outlined in this SAP/QAPP and perform requested analyses using appropriate test methods specified in this QAPP. The laboratories will prepare analytical laboratory reports for review by the respective Construction or O&M Contractor, as well as by the Consultant, and Ecology, including all relevant data and QC reports; communicate analytical problems, issues, or concerns to the environmental consultant in a timely manner; and initiate corrective action when deficiencies in sample collection, preservation, handling, test methods, or documentation are identified internally by the contract analytical laboratory, or by the remediation contractors and/or Consultant and Ecology.

The Consultant, Construction Contractor, and O&M Contractor will each prepare a site-specific HASP, which will describe health and safety measures to be followed by their workers while conducting site visits and compliance monitoring field activities. All subcontractors providing

support during sampling will be required to maintain their own HASP documenting their health and safety procedures.

Personnel, including subcontractors, must obtain the proper training to recognize and protect themselves from hazardous chemicals known or suspected to be present at the site. All field personnel are required to have appropriate Occupational Safety and Health Administration (OSHA) health and safety training for hazardous waste sites per 29 Code of Federal Regulations (CFR) 1910.120, supplemented by annual refresher courses. Environmental consultants are responsible for ensuring that their personnel are informed about and trained on relevant OSHA and Washington Industrial Safety and Health Act (WISHA) guidelines.

Note: This SAP/QAPP only describes responsibilities related to sampling and analysis of soil, vapor, and water samples. Other project responsibilities for each party are discussed in greater detail in other project documents (CMP, EDR, Project Manual, and O&M Manual).

2.2 Project Schedule

A general remedial action schedule, as required in WAC 173-340-400(4)(a)(vi), is outlined below.

The design plans and construction specifications were completed in the first quarter of 2023. A Construction Contractor was selected in the first quarter of 2023. The installation of the system is expected to be completed in 13 to 15 weeks during the second and third quarters of 2023 as outlined below. Operation of the system is expected to occur over a 3- to 10-year period. For the purposes of this document, system operation was estimated to have a duration of 5.5 years and confirmation monitoring was estimated to have a duration of 2.5 years, for a total of 8 years of system operation.

Estimated Project Schedule

- Stage 1. Mobilization and Well Installation – 2 weeks
- Stage 2. Vapor Monitoring Equipment Installation – 1 week
- Stage 3. Excavation and Trenching, Soil Screening and Sampling – 3 weeks
- Stage 4. Treatment System Installation – 3 to 4 weeks
- Stage 5. Installation of Electrical Components – 1 Week
- Stage 6. Site Restoration – 1 week
- Stage 7. Demobilization and Final Completion – 2 to 3 weeks
- Stage 8. Operation and Compliance Monitoring – 3 to 10 years

As indicated above, each stage will be completed consecutively. The actual time required to complete the remedial action may vary depending on site conditions, weather conditions, and the rate of decrease in the constituents in the groundwater and vapor on site.

Groundwater and vapor monitoring will be conducted during system operation. Confirmation monitoring will be conducted once the remediation system is no longer actively operating and will include soil sampling to confirm soil meets site CULs, and quarterly groundwater monitoring in compliance monitoring wells until four consecutive quarters of groundwater sampling results meet site CULs.

Section 3: Quality Assurance Project Plan

The primary goal of sampling and analysis for the Circle K 1461 monitoring is to collect groundwater, water, soil, and vapor monitoring data during cleanup activities and for the duration of the compliance period, to confirm CUL attainment and achievement of remedial action outcomes.

The purpose of the QAPP is to identify the QA/QC protocols necessary to achieve the site-specific objectives for sample collection and analysis. Data acquired must be collected in accordance with QA/QC requirements (i.e., the QAPP). Records will be maintained to document all activities performed and data generated during implementation of the site investigation.

3.1 Sampling Objectives

The objective of field sampling activities is to monitor groundwater, water, soil, and vapor during and following remedial action. The groundwater, water, soil, and vapor samples will be submitted to a Washington State-accredited laboratory for analysis of the primary COCs, GRO and BTEX, along with additional analyses for waste disposal profiling, demonstration of compliance with vapor and water treatment discharge permits, and evaluation for transitioning through the three phases of remedial system operation. The data acquired during the sampling event(s) and remedial system operation each year will be used to prepare Remedial System Progress Reports as described in Section 8.4.

3.2 Sampling Process Design

The monitoring and sampling processes associated with protection, performance, and confirmation monitoring and proposed schedule are summarized in Section 4 and in Table 3. Table 3 also includes activities associated with the operation and maintenance of the remediation system that are described in more detail in the O&M Manual, and not extensively covered in this SAP/QAPP.

The total number of groundwater, water, soil, and vapor samples expected to be collected over an assumed eight-year (8-year) operation of the system are included in Tables 4, 5, 6, and 7. These tables assume the following phase durations:

- Phase 1: One (1) year
- Phase 2: Six (6) months
- Phase 3: Four (4) years
- Confirmation Monitoring: Two (2) years and six (6) months

3.3 Measurement Quality Objectives

Measurement quality objectives (MQOs) are qualitative or quantitative statements of the precision, accuracy (or bias), representativeness, completeness, comparability, and sensitivity

necessary for the data to fulfill project objectives. Routine procedures for measuring precision and accuracy include use of quality control samples [i.e., replicate analyses, check or laboratory control samples, matrix spikes (MS), and procedural blanks]. MQOs and QC procedures identified for the groundwater monitoring program are described in the following. In addition to the MQOs discussed in this SAP/QAPP, the laboratory shall follow other QC measures for instrument calibration and laboratory performance specified in the applicable methods and according to the laboratory's Standard Operating Guidelines (SOGs).

3.3.1 Precision

Precision is an appraisal of the reproducibility of a set of measurements. Precision can be better defined as the variability of a group of measurements compared to their average value. Variability for environmental monitoring programs contains both an analytical component and a field component.

Analytical precision will be evaluated by the analyses of matrix spike duplicate (MSD) and laboratory duplicate samples, which can be mathematically expressed as the relative percent difference (RPD) between duplicate sample analyses. RPD is calculated using the following equation:

$$RPD = \frac{C_1 - C_2}{\overline{C}} \; x\,100$$

where:

C_1 = First concentration value or recovery value measured for a variable

C_2 = Second concentration value or recovery value measured for a variable

The frequency of the performance of MSD and laboratory duplicate samples, where applicable, is usually one per batch (which typically consists of up to 20 samples) for each sample matrix received.

Field duplicate samples will be submitted blind to the laboratory to determine field variability. Frequency of field duplicate samples is discussed in Section 7.1.1.

Precision quantities will be calculated for analyses with method reporting limits of the same order of magnitude and with detected concentrations greater than or equal to five times the method reporting limits. In instances where no criteria have been established (e.g., field duplicates), RPD project goals will be 50 percent for well-homogenized soil samples and 30 percent for water samples.

3.3.2 Bias and Accuracy

Bias is the systematic or persistent distortion of a measurement process that causes error in one direction. Accuracy refers to how close a measurement is to the true value. Bias and accuracy will be evaluated by the analysis of MS samples and laboratory control samples and can be mathematically expressed as the percent recovery of an analyte that has been used to fortify a field sample or clean laboratory matrix sample at a known concentration prior to analysis. The percent recovery (R) for a MS sample is calculated as follows:

$$R = \frac{(\text{SSR} - \text{SR})}{\text{SA}} * 100$$

Where:

SSR = Spiked sample result

SR = Sample result

SA = Spike added.

The following calculation is used to determine R for a laboratory control sample or reference material:

$$R = \frac{RM}{RC} * 100$$

Where:

RM = Reference material result

RC = Known reference concentration

Results of MS and laboratory control samples will be evaluated to the laboratory's control limits. Control limits are defined as the mean recovery, plus or minus three standard deviations, of the 20 data points, with the warning limits set as the mean, plus or minus two standard deviations. The laboratory will review the QC samples and surrogate standard recoveries for each analysis to ensure that internal QC data lie within the limits of acceptability. The laboratory will investigate any suspect trends and take appropriate corrective actions

Field blank samples and method blank samples will also be used to evaluate bias of the data. Results for field and method blanks can reflect systematic bias that results from contamination of samples during collection or analysis. Analytes detected in field or method blank samples will be evaluated as potential indicators of bias.

3.3.3 Representativeness

Representativeness concerns the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Where appropriate, sampling locations will be selected on both systematic and biased (judgmental) sampling bases to spatially cover the study area. Sampling locations are described in Section 3.

3.3.4 Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system. Completeness will be measured for each set of data received by dividing the number of valid measurements actually obtained by the number of valid measurements that were planned. Although 100 percent is the goal for completeness, 90 percent is the minimum acceptable level.

3.3.5 Comparability

Comparability is a qualitative QA criterion that expresses the confidence in the ability to compare one data set with another. Comparability among data sets is achieved through the use of similar sampling procedures and analytical methods. Sampling procedures will be performed as specified in Section 5. Analytical procedures will be conducted according to the methods discussed in this SAP/QAPP.

3.3.6 Sensitivity

Sensitivity is the capability of a method or instrument to discriminate between measurement responses representing different levels of the variable of interest. The method detection limit (MDL) is defined as the statistically calculated minimum amount that can be measured with 99 percent confidence that the reported value is greater than zero. MDLs are specified in the individual methods and are developed by the laboratory for each analyte of interest representing the aqueous and solid matrices within the capability of an analytical method.

The method reporting limit (MRL) or practical quantitation limit (PQL) is the lowest value to which the laboratory will report an unqualified quantitative result for an analyte. The PQL is always greater than the statistically determined MDL. The PQLs required for this project are such that data can be compared to the lowest possible applicable, relevant, and appropriate requirements (ARARs) suitable for the site. Target PQLs for sample laboratory analyses across all media in this SAP/QAPP are presented in Tables 8, 9, and 10.

Section 4: Field Sampling Activities

This section describes the objectives, locations, and methods for compliance monitoring field activities, including laboratory analyses, types of samples collected, sampling frequencies, sampling procedures, sample identification, decontamination, and waste disposal, that will be performed at the site as part of the remedial action. Sampling procedures presented in this section are generic and intended to be suitable for a variety of site conditions. The Remediation Contractors (i.e., Construction Contractor and O&M Contractor) will prepare SOGs that their staff will follow to complete applicable sampling and monitoring tasks. It is anticipated that the remediation contractors will prepare SOGs to address one or more the following tasks, depending on contractor roles:

- Environmental Data Collection
- Borehole Logging
- Surface and Shallow Soil Sampling
- Boring and Subsurface Soil Sampling
- Test Pit / Excavation Sampling
- Soil Gas and Vapor Sampling
- Photoionization Detector (PID) Vapor Analyzer Procedures
- Well Construction and Development
- Measuring Groundwater Levels
- Groundwater Sampling
- Sample Packaging and Shipping
- Equipment Decontamination
- Personnel Decontamination
- Handling and Disposal of Investigation-Derived Waste

The remediation contractors will provide their SOGs to Ecology for review and approval prior to implementation. Ecology-approved SOGs will be included in Appendix A of this SAP/QAPP. It is anticipated that the specific procedures followed to implement this SAP/QAPP will be modified in the field as needed to address site-specific conditions.

Compliance monitoring activities identified in the CMP and in this section will fulfill requirements for ongoing monitoring of this remedial action in accordance with MTCA (WAC 173-340-410) and WAC 173-340-400(a)(xiv). The CMP provides a description of the compliance monitoring

requirements for the cleanup action, including protection monitoring, performance monitoring, and confirmational monitoring as described in WAC 173-340-410. Expected soil, groundwater, and vapor sample collection activities under each monitoring phase are provided below. Sampling frequency and locations are also detailed in Table 3.

Protection Monitoring. Protection monitoring is performed during the cleanup action to confirm that human health and the environment are adequately protected during the construction and maintenance period of the cleanup action as described in the HASP.

- The remediation contractors will have primary responsibility for implementation of their HASPs during the construction and maintenance phases of the cleanup action, including protection monitoring for their personnel (e.g., vapor and air space monitoring), including subcontractors, visitors, and the general public (the onsite businesses will remain open during the remedial action). Protection monitoring by the remediation contractors will also include measures, as necessary, for protection of surrounding communities and the environment during construction and will be specified in their site HASP.

- Specific protection monitoring on the property will include vapor monitoring to assess the possibility of a vapor intrusion pathway into the property building. Protection vapor monitoring will be conducted via the sampling of three SSD wells on the north and west sides of the building and sampling of four vapor pins installed within the building. Vapor monitoring will also continue through site restoration activities (performance monitoring). Field vapor measurements and vapor samples for laboratory analysis collected at the SSD wells and vapor pins are identified in Table 5.

- In addition, the consultant will prepare a separate HASP for compliance monitoring tasks to be performed by its personnel during the remediation system construction and operation phases, and the subsequent confirmational monitoring phase.

Performance Monitoring. Performance monitoring is performed during the cleanup action and includes sampling and analysis of environmental media to ensure that cleanup standards have been attained during the cleanup action, and, as appropriate, demonstrating attainment of other performance standards including construction quality control and permit compliance. Performance monitoring will include the following:

- Collection of soil samples for characterization (from soil borings during installation of six remediation wells) and for construction quality control (i.e., testing of imported fill materials).

- Collection of vapor samples from the SSD wells on the north and west sides of the property building and vapor pins installed in the building to assess vapor intrusion. See Table 5.

- Collection of vapor samples from the vapor treatment system (influent and effluent) and individual extraction remediation wells to determine when to change vapor treatment methods and to demonstrate compliance with substantial emissions requirements. See Table 5.

- Collection of water samples from the water treatment system to monitor compliance with permit discharge criteria and when to progress through the three phases of the remedial system operation. See Table 6.

- Collection of groundwater samples from a selection of monitoring wells during remedial system operation to evaluate cleanup progress. See Table 7.

- Collection of samples for waste disposal profile development (i.e., stockpiled soil, well development water, groundwater sampling purge water, vapor treatment system condensate).

Confirmational Monitoring. Confirmational monitoring is performed following the cleanup action to confirm the long-term effectiveness of the cleanup action. Confirmation monitoring will include the following.

- Collection of soil samples from soil borings advanced within the treatment area to demonstrate compliance with site-specific soil CULs. See Table 4.

- Collection of groundwater samples quarterly from monitoring wells to demonstrate attainment of site-specific groundwater CULs for four consecutive quarters. See Table 7.

- Collection of soil and water samples (if needed) for waste disposal profiles.

4.1 Sample Analyses

This section provides a description of the anticipated field and laboratory analytical testing that will be performed during the remedial action and subsequent monitoring, and the analytical testing facilities that will be used.

4.1.1 Field and Laboratory Analytical Methods

Most of the soil and water samples collected during the construction and operation phases of the remedial system will be performed by an offsite fixed laboratory. Volatile organic compound (VOC) concentrations in vapor samples will be analyzed by a combination of field meters and offsite fixed laboratories.

All laboratories will be accredited by Ecology for the analyses being performed. Qualifications for the selected laboratories will be submitted to Ecology for review and approval prior to the start of onsite work.

The following analytical methods will be used for groundwater, water, soil, and vapor samples. Information regarding the specific analyses and sampling frequency for different media is presented in the following sections. Sample container, preservative, and holding time requirements for the analyses listed below are provided in Table 11. Additional information regarding the analytical method reporting limit requirements and laboratory QA/QC is provided in Sections 3 and 6. Field measurements will be made using portable instruments appropriate for the parameters being measured and will be calibrated daily (refer to Section 7).

Vapor samples from the vapor treatment system (influent and effluent) and individual extraction wells and sub-slab soil gas samples from the vapor pins and SSD wells will be analyzed for one or more of the following:

- Field analysis of total VOCs, oxygen, carbon dioxide, and combustible gas concentrations in influent and effluent vapor samples from the vapor treatment system and in soil gas samples from the SSD wells and vapor pins.
    - Total VOCs will be measured in the field with a photoionization detector (PID) using a 10.6 electron volt (eV) lamp and 100 ppm isobutylene gas for calibration. PIDs with different detection ranges and resolutions will be used depending on the measured vapor or soil gas source:
        - MiniRAE 2000, MiniRAE 3000, or UltraRAE 3000 (or equal), with a detection range of 0 to 9999 ppm and resolution 0.1 ppm; hereafter referred to as a "PID." For measurement of vapor treatment system influent and effluent and extracted air from wells.
        - ppbRAE 3000 (or equal), with a detection range of 0 to 9999 parts per billion (ppb) and resolution of 1 ppb; hereafter referred to as a "ppb PID." For measurement of soil gas from vapor pins and SSD wells.
    - Vapor and soil gas measurements will also be performed using a multi-gas meter (also known as a four-gas meter) to measure total VOCs, oxygen, carbon dioxide, and combustible gas [reported as percent lower explosive limit (% LEL)] concentrations. Meter option and specifications:
        - RKI Eagle 2; detection ranges – total VOCs (0 to 2000 ppm), oxygen (0 to 40% oxygen), carbon dioxide (range varies but 0 to 40% is recommended), % LEL (0 to 100%).
- Laboratory analytical measurement of VOCs using United States Environmental Protection Agency (EPA) method TO-15 in effluent vapor samples from the vapor treatment system and from individual wells operating in extraction mode.
- Soil gas samples from vapor pins and/or SSD wells may also be collected for laboratory analysis of VOCs using EPA Method TO-15 if field measurements are above screening criteria specified in Section 4.2.7.3 (vapor pins) and Section 4.2.7.4 (SSD wells) .

Field screening methods for soil samples will include headspace analysis using a PID, which is described further in Section 4.2.1.

Soil samples will be submitted for laboratory analysis for the primary COCs (Table 4):

- GRO by Ecology Method Northwest Total Petroleum Hydrocarbons as Gasoline Extended (NWTPH-Gx).
- BTEX by EPA Method 8260B.

Water treatment system samples will be submitted for laboratory analysis of the following constituents (Table 6):

- GRO by Ecology Method Northwest Total Petroleum Hydrocarbons as Gasoline by (NWTPH-Gx).
- BTEX using EPA Method 8260B.
- Selected Chlorinated Volatile Organic Compounds (Selected CVOCs) by EPA Method 8260B.
    - Tetrachloroethylene (PCE),
    - Trichloroethylene (TCE),
    - cis-1,2-dichloroethylene (cis-1,2-DCE),
    - trans-1,2-dichloroethylene (trans-1,2-DCE), and
    - Vinyl chloride.
- FOG (Nonpolar Fat, Oil, and Grease) by KCIW Free-Floating Polar Fats, Oils, and Grease (FF-FOG) sampling procedure (KCIW 2016).

Water samples collected at the point of discharge to the sanitary sewer will be analyzed for the following constituents during Phase 3 of system operation in addition to the constituents identified for the water treatment system samples above:

- Nitrate by EPA Method 353.2
- Orthophosphate by EPA Method 365.1

Field parameter monitoring for groundwater will be conducted during the monitoring well purging process prior to sample collection at each well location:

- Dissolved oxygen (DO), oxidation-reduction potential (ORP), pH, specific conductivity, and temperature measured in the field using portable meter(s) equipped with appropriate probes either down-well or with a flow-through cell.
- Turbidity using analytical method SM1230 or a portable field meter.

Groundwater samples will be submitted for laboratory analysis of GRO and BTEX and additional constituents depending on the system operation phase (Phases 1, 2, and 3) and confirmation monitoring as shown in Table 7:

- GRO by Ecology Method Northwest Total Petroleum Hydrocarbons as Gasoline Extended (NWTPH-Gx).
- BTEX by EPA Method 8260B.

- Nitrate by EPA Method 353.2 (Phases 2 and 3)
- Orthophosphate by EPA Method 365.1 (Phases 2 and 3)
- Monitored natural attenuation (MNA) Parameters (Confirmation Monitoring):
  - Nitrate by EPA Method 353.2.
  - Sulfate by EPA Method 9056A.
  - Dissolved iron and dissolved manganese by EPA Method 6020.
  - Dissolved methane by EPA Method RSK-175.

Groundwater or water samples may also be analyzed for one or more of the following parameters as listed below. The analytical protocols are subject to confirmation at the conclusion of the permitting activities:

- Oil and grease by EPA Method 1664A
- Resource Conservation and Recovery Act Eight (RCRA 8) metals by EPA Method 6020 (arsenic, barium, cadmium, chromium, lead, selenium, and silver) and by EPA Method 7470 (mercury).
- Ammonia nitrogen by EPA Method 350.1
- VOCs by EPA Method 8260

Additional analyses may be required for characterization of waste materials, imported fill materials (to confirm the O&M Contractor's results), or water samples including one or more of the following:

- VOCs using EPA Method 8260B.
- Semi-Volatile Organic Compounds (SVOCs) by EPA Method 8270E.
- Polycyclic aromatic hydrocarbons (PAHs) using EPA Method 8270E in select ion monitoring (SIM) mode.
- RCRA 8 metals using EPA Method 6010 (arsenic, barium, cadmium, chromium, lead, selenium, and silver) and by EPA Method 7471 (mercury).
- Total Petroleum Hydrocarbons (TPH) as GRO by method NWTPH-Gx.
- TPH as Diesel-Range Organics (DRO) by method NWTPH-Dx without silica gel cleanup (SGC) preparation.
- Polychlorinated biphenyls (PCBs) using EPA Method 8082B.

- Chlorinated pesticides by EPA Method 8081A.
- Toxicity Characteristic Leaching Procedure (TCLP) RCRA 8 metals extracted using EPA Method 1311 and analyzed using EPA Method 6000/7000 series (if required by the waste disposal facility).

4.1.2 Sample Location Identification

Sampling locations will be assigned unique identifiers that incorporate the media, sample type, sampling depth (if applicable), and sample location number.

Names for depth specific samples (e.g., soil from borings), will include the sample depth interval in the sample name. For example, a soil sample collected from 4 to 5 feet below ground surface (bgs) from the boring for well RW-8, would be identified as: RW-8-SO-(4.0-5.0).

- The location name is RW-8
- The media is soil (SO)
- The sample depth is from 4 to 5 feet bgs (4.0-5.0)

Names for vapor samples from vapor pins and SSD wells will include the sampling port location, well name, vapor point name; flow direction (e.g., E = extraction, I = injection); media type (V = vapor, W = water); and sampling date in “YYYYMMDD” format. For example, the sample name SSD-1-VE-(20220906) is explained below:

- The location name is SSD-1
- Media is vapor (V)
- The remediation system was operating in extraction mode (E)
- The sample date is 6 September 2022 (20220906)

Names for vapor or liquid samples from the remediation system will include the sampling port location, process identification; flow direction (e.g., E = extraction, I = injection); media type (V = vapor, W = water); and sampling date in “YYYYMMDD” format. For example, the sample name GAC-400-VE-(20220906)

- The location name is GAC-400
- Media is vapor (V)
- The remediation system was operating in extraction mode (E)
- The sample date is 6 September 2022 (20220906)

Sampling port locations and identifiers are included in the drawings in the Project Manual and in the monitoring forms in Appendix E of the O&M Manual.

Names for groundwater samples collected from individual monitoring wells at the wellheads will include the well name; media type (W = water); and sampling date in “YYYYMMDD” format. For example, MW-14-W-(20220906).

- The location name is MW-14
- Media is water (W)
- The sample date is 6 September 2022 (20220906)

4.2 Sampling Procedures

This section presents the anticipated sampling methods and frequency for sampling of environmental media (soil, vapor, and water) for compliance monitoring during the remedial action and provides an overview of sampling methodologies. Sampling procedures presented in this section are generic and intended to be suitable for a variety of site conditions. The Construction Contractor and O&M Contractor of will prepare SOGs, for Ecology’s review and approval, to conduct applicable (to each contractor) sampling and monitoring tasks.

All samples must be collected in a manner consistent with the media being sampled and the analytes of interest. Additional methods may be used with the approval of the Ecology Project Manager. Some sources for the appropriate sampling methods include, but are not limited to:

- Guidance for Remediation of Petroleum Contaminated Sites. Publication No. 10-09-057 (Petroleum Remediation Guidance) (Ecology 2016).
- Standard Operating Procedure EAP099, Version 1.0: Purging and Sampling Monitoring Wells for General Chemistry Parameters. Publication No. 18-03-214 (Standard Operating Procedure EAP099) (Ecology 2018).
- Guidance for Evaluating Vapor Intrusion (VI) in Washington State. Publication No. 09-09-047 (VI Guidance) (Ecology 2022).
- Standard Practice for Low-Flow Purging and Sampling for Wells and Devices Used for Ground-Water Quality Investigations (Low-Flow Standard Practice) (ASTM 2018).
- Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW-846), Chapter 10. (EPA 2007). Describes sampling techniques for various media, including soils, sediments, air, water, etc.

The use of proper sample containers and appropriate preservation techniques when collecting samples is important. Samples will always be collected in containers supplied by the analytical laboratory. This ensures that the container has been properly cleaned and that the analytical laboratory will have sufficient sample material to conduct the requested test. Samples must also be properly preserved, or they may be rejected.

Table 11 summarizes common sample containers, preservation techniques, and holding times for the requested analytes. Specific sampling methods for media of interest and planned sampling and monitoring activities are discussed in greater detail in the following sections. The

sections are generally organized by media – soil, vapor, water, and groundwater sampling activities.

4.2.1 Soil Field Screening

Field screening soil will be performed to characterize soil borings for remediation well installations, to monitor the progress of excavation activities including segregation of suspected contaminated versus suspected clean native soil, and to characterize confirmation monitoring soil samples prior to laboratory analysis.

Field screening of soil materials for the presence of petroleum impacts will typically include the following:

- Visual observation of staining and other discoloration.
- Olfactory observation of petroleum hydrocarbon odors.
- Water-sheen testing for the presence of hydrocarbon sheen.
- Headspace analysis for organic vapors using a PID and headspace technique.

Field screening methodologies for the above techniques as well as for logging soil borings and collecting soil samples for laboratory analysis from the new remediation wells are described in the Project Manual (Division 33 – Utilities; Section 33 11 53.13 – Remediation Wells, parts 3.02 and 3.03).

4.2.2 Soil Sample Collection

Collection of soil samples for laboratory analyses will be in accordance with the Construction and O&M Contractors' SOGs (Appendix A).

Soil samples will be collected from stockpiled soil from piping trench excavations, imported backfill, soil borings advanced for the installation of six new remediation wells and from confirmation soil borings after the active remedy (operation of MPE system) has been completed, and from drummed soil for waste characterization.

Collection of soil samples from soil borings will be dependent on the selected drilling method(s) (e.g., hollow stem auger, sonic drilling, or direct push) and sampling device (e.g., split spoon sampler or continuous sampling with disposable polyethylene liners). Soil samples for lithologic logging and chemical and physical analysis will be collected by driving the appropriate sampling device to the desired depth followed by removal of the sampling device to retrieve the sample. Soil in the sampling device will be classified in the field in general accordance with the visual-manual procedure of the Unified Soil Classification System (ASTM D-2488-90). The Munsell Color Classification may also be used.

Soil samples for volatile chemical analyses (e.g., GRO and BTEX) will be collected from the sampling device (e.g., split spoon sampler or polyethylene liner) using EPA sampling method 5035: soil samples will be collected using a handheld coring device, such as a TerraCore™ or EazyDraw Syringe® & PowerStop Handle® sampler, or other approved coring device, and the

"cored" soil will be placed directly into containers provided by the analytical laboratory with appropriate sample preservative and sealed.

Samples for non-volatile constituent analyses will be collected directly from the sampling device into clean sampling containers provided by the analytical laboratory and sealed. Soil samples will be collected using a clean stainless-steel spoon or trowel, disposable sample scoops compatible with chemical constituents, or by hand using a new pair of nitrile gloves. Reusable sampling equipment will be decontaminated prior to sample collection at each location. Decontamination and cleaning procedures are presented in Section 4.3 and will be included in Remediation Contractor SOGs.

Samples of stockpiled soil (and imported backfill if required to sample at the backfill source) for volatile chemical analyses will be collected using EPA sampling method 5035 directly from the stockpiles themselves or from excavation equipment (i.e., backhoe or excavator). Samples collected from a backhoe or excavator bucket will be collected from the center of the bucket or from an area of soil that has not been in contact with the surface of the bucket. Samples for non-volatile chemical analyses will be collected using a clean stainless-steel spoon or trowel, disposable sample scoop, or by hand using a new pair of gloves.

A sample label will be completed with the sample name, collection time and date, sample depth interval (as applicable), sampling method, and requested laboratory analyses, and affixed to the sample bottles. Sealed and labeled sample containers will be immediately placed and kept in a cooler chilled with ice until transfer to an accredited laboratory under chain-of-custody procedures and documentation. Samples will be maintained at a stable temperature of 4 ± 2 degrees Celsius.

These sample details along with a description of the physical soil conditions, sample container size, and containment and management of excess soil (e.g., drilling cuttings) will be recorded in the field book, drilling log (for soil borings), and on the laboratory chain-of-custody. Field Documentation is discussed further in Section 5.

Soil samples submitted to the analytical laboratory but not marked for initial analysis shall be archived by the analytical laboratory for possible follow-up analyses. Archived samples shall be frozen to extend hold times, if needed.

4.2.3 Remediation Well Installation Soil Samples

Three new vertical remediation wells and three new slant remediation wells will be installed by the Construction Contractor as described in the Project Manual (Division 33 – Section 33 11 53.13 – Remediation Wells).

At least two soil samples shall be collected at each soil boring location for laboratory analysis of GRO by method NWTPH-Gx and BTEX by EPA Method 8260B as follows:

- One sample from the unsaturated zone (above 5 feet bgs)
- One sample from the presumed smear zone (5 to 10 feet bgs)

Additional soil samples will be collected if potential petroleum hydrocarbon impacts in soil are identified based on field screening observations and the depth interval is not represented by other samples. Soil samples for GRO and BTEX analysis will be in accordance with SOGs and methods for collection soil samples for volatile analyses (EPA sampling method 5035) as described in Section 4.2.2.

Soil samples submitted to the analytical laboratory but not marked for initial analysis shall be archived by the analytical laboratory for possible follow-up analyses. Archived samples shall be frozen to extend hold times, if needed.

4.2.4 Excavated Soil Characterization

Prior to the start of trench excavation activities for installation of subsurface injection/extraction piping and other equipment, separate stockpile areas will be established by the Construction Contractor for onsite storage of suspected impacted and not impacted soil pending transport offsite for disposal. These stockpile areas will be constructed and maintained as described in the EDR and Project Manual for the duration of the project (i.e., until all excavated soil is transported offsite).

During trench excavation activities, native soil which does not appear to be impacted by COCs will be stockpiled separately from soil suspected to be contaminated by COCs. Soil samples will be collected from stockpiled soil and submitted for laboratory analysis to develop waste profiles for offsite disposal. Native soil shall not be reused for backfill.

Due to the small footprint of the site, it is possible that excavation of trenches for piping installation will be conducted in stages and will include multiple smaller excavation areas. The locations and sizes of the excavation areas will be determined by the Construction Contractor.

The soil excavation and evaluation process is described in greater detail in the following sections.

4.2.4.1 Native Soil Excavation and Stockpiling

The general process for assessment, excavation, stockpiling, and characterization sampling of waste soils generated during remedial system installation excavation activities is described below:

- Existing data provided in the RI/FS, EDR and Project Manual will be used as general guidance to estimate the volume of soil to be excavated for installation of system piping and other subsurface work, and the potential for the soil to be contaminated by COCs.

- Field screening of soil will be performed during excavation. Field screening may include visual and olfactory observation, water sheen testing, and PID headspace measurements.

- Excavated soil that does not exhibit field indications of COC impacts will be placed in a separate stockpile from soil suspected to be contaminated by COCs.

- Each stockpile will be numbered consecutively (i.e., SP1, SP2, etc., or similar) and the location will be documented in field notes and maps. The area of the site from which each stockpile was derived will also be documented.

- Soil samples will be collected from each stockpile as described below in Section 4.2.4.

- Stockpile soil samples will be analyzed for VOCs, RCRA 8 metals, GRO, and DRO and/or other analyses required by the disposal facility using the analytical methods described in Section 4.1. Whether sample analyses are conducted on an expedited turn-around basis will be at the discretion of the Contractor.

- Soil stockpiles will be underlain and covered with plastic sheeting pending receipt of analytical results.

4.2.4.2 Stockpile Sampling Frequency

The number of samples recommended by Ecology for stockpile characterization, based on the guidelines presented in Ecology's *Guidance for Remediation of Petroleum Contaminated Sites* dated June 2016, is summarized below:

Cubic Yards of Soil	Number of Samples for Chemical Analysis
0 – 100	3
101 – 500	5
501 – 1,000	7
1,001 – 2,000	10
>200	10 + 1 for each additional 500 cubic yards

The quantity of excavated material for the project is estimated to be approximately 300 cubic yards or less, based on the size of the trenching excavation areas and anticipated trench depth. Based on Ecology's recommended sampling frequency, a 300 cubic yard stockpile would require 5 samples for characterization. However, the number of stockpiles and sizes will be determined by the Construction Contractor based on the amount and locations of excavation areas and based on field conditions encountered. The number of characterization samples collected from each pipe will be based on the above table.

Stockpile soil samples will be collected as discrete grab samples with hand tools 6 to 12 inches beneath the surface of the pile and immediately preserved. Sample locations will be collected where field instrument readings (e.g., PID) or field observations of potential impacts (e.g., visual staining or odors) indicate contamination is most likely present. If field instruments and/or field observations do not indicate contamination, the stockpile will be divided into sections, with the number of sections equivalent to the number of samples for chemical analysis based on stockpile volume, and a sample from each section will be collected.

4.2.5 Waste Characterization Sampling

Sampling for waste characterization may be performed during the remedial action based on the requirements of the selected waste disposal facilities. Ideally, the profiles for disposal waste

materials will be established using existing data from RI sampling prior to the start of field activities.

Existing data will be submitted to the waste disposal facilities prior to the start of onsite work; however, it is possible that the facilities will require additional data (i.e., data for additional analytes or for verification of contaminant concentrations) as soil and groundwater samples were most recently collected in 2016. It is anticipated that data for VOCs, RCRA 8 metals, GRO, and DRO would be required for waste disposal profile development. However, the number of samples by media and chemical analytes would be based on the requirements of the disposal facility and could include any of the analyses listed in Section 4.1.1.

Media possibly requiring additional waste characterization sampling are anticipated to include the following:

- Petroleum-contaminated soil (PCS). PCS would initially be stockpiled onsite and soil samples would be collected from the stockpile(s). The characterization samples would be submitted for laboratory analysis (on an expedited turn-around basis) based on the requirements of the disposal facility. If the profile for PCS disposal is established using prior site data, additional sampling of PCS during the remedial action may not be necessary.

- Drilling cuttings. Soil cuttings from remediation well installation, if not included in the profile for excavated soil, would be sampled for waste characterization as required by the offsite disposal facility.

- Water treatment effluent water. If effluent from the onsite treatment system does not meet the permit standards (refer to Section 4.2.8), offsite disposal may be required. In this case, samples would be collected from onsite holding tanks for laboratory analysis as required by the disposal facility.

- Vapor liquid separator condensate. Condensate from the vapor liquid separator of the MPE system will be pumped into 55-gallon drums and sampled for laboratory analysis as required by the offsite disposal facility for waste characterization.

- Purge water. Well development, sampling purge water, and sampling equipment decontamination water may be sampled for waste characterization if analytical data from previous monitoring is insufficient to establish a waste disposal profile. Samples would be collected from purge water stored temporarily onsite in 55-gallon drums for laboratory analysis as required by the disposal facility.

- Spent GAC generated during operation of the MPE system will be removed using a vacuum extraction device and placed in U.S. Department of Transportation (DOT)-approved 55-gallon drums or supersacks, characterized, sealed and hauled from the site under a waste manifest. The carbon will be analyzed using the Toxicity Characteristic Leaching Procedure (TCLP) and disposed at an offsite facility. The carbon will be analyzed annually to update the disposal profile.

The Construction Contractor and O&M Contractor will each provide SOGs for sampling and general handing of waste materials.

4.2.6 Imported Fill Materials Sampling

The remediation Construction Contractor will request analytical data for all backfill materials being imported to the site and will submit the data, if any is provided, to Ecology for review and approval as described in the EDR and bid specifications. The Consultant will also review analytical data for backfill materials and provide an assessment of the suitability of the material for use as backfill onsite to Ecology.

If the data provided by the supplier is determined by Ecology to be inadequate, or is not available, the Construction Contractor shall collect samples of proposed backfill materials for chemical analysis. Analyses performed for each proposed backfill material source will be based on data needs identified by Ecology and including SVOCs, VOCs, PCBs, PAHs, chlorinated pesticides, RCRA 8 metals, GRO, and DRO using the analytical methods specified in Section 3.1.1. The consultant may also independently collect and analyze a limited number of samples to verity the contractor's results.

For each proposed backfill material, the sampling frequency will be one, five-point composited soil sample for each 500 yards of imported soil.

4.2.7 Vapor Sampling Activities

Protection and performance monitoring on the property will include vapor monitoring to assess the possibility of a vapor intrusion pathway into the property building. Vapor (soil gas) monitoring will be conducted via the sampling of the three SSD horizontal wells and four vapor pins.

Four (4) Vapor Pin ® monitoring points will be installed through the floor slab inside of the property building (approximate locations shown in Figure 2) in accordance with manufacturer details and as described in the Project Manual. The vapor pins are designed to be used for gas sampling to monitor sub-slab soil vapor.

Three 4-foot-long SSD horizontal wells constructed of 3-inch diameter polyvinyl chloride (PVC) slotted pipes will be installed below grade in gravel as described in the Project Manual. The SSD wells are located on the north and west sides of the on-site building as shown on Drawing C-01 in the Project Manual. The SSD wells are connected downstream of the piping manifold to allow for a negative vacuum to be applied beneath the on-site building to mitigate potential vapor intrusion into the on-site building during system operations.

Additional performance vapor monitoring will include sampling the individual wells in operation and the influent and effluent of the vapor treatment system. The vapor treatment train of the MPE system consists of a temporary catalytic oxidizer to be used at system startup and a pair of vapor GAC vessels piped in series to be used once vapor contaminant concentrations are low enough for their use. Treated air is discharged through an exhaust pipe.

As a remediation project, the project is required to comply with the substantial requirements of the Puget Sound Clean Air Agency (PSCAA), however obtaining a PSCAA permit is not required. The MPE system will be operated to meet the substantial requirements of PSCAA permits for operating this type of equipment. In accordance with recommendations from PSCAA, influent and effluent vapor samples will be collected from the system for analysis of VOCs by method TO-15, according to the frequency identified in Tables 3 and 5.

Vapor samples will be collected during the construction phase by the Construction Contractor and during system operation by the O&M Contractor. Vapor samples will be collected and analyzed in accordance with Ecology's VI Guidance (Ecology 2022).

4.2.7.1 Vapor Samples from Individual Wells

Total VOC concentrations will be measured for individual wells in operation using field (PID and/or ppb PID) and laboratory methods at the corresponding manifold legs. Samples of vapor for laboratory analysis will be collected using Summa canisters and submitted for analysis by EPA Method TO-15.

Sample collection will be performed as indicated in the Ecology-approved O&M Contractor-supplied SOGs in Appendix A. Field VOC concentrations will be measured using either a standard PID or ppb PID as defined in Section 3.1.1, depending on concentration levels.

4.2.7.2 Vapor Treatment System Samples

Field total VOC concentrations will be measured at several sampling ports located throughout the treatment train using either a standard PID or ppb PID as defined in Section 3.1.1, depending on concentration levels.

Vapor samples for laboratory analysis will be collected at the frequency identified in Table 5 using Summa canisters and submitted for analysis by EPA Method TO-15. Samples will be collected at the combined inflow sample port after the vapor/liquid separator, and at the combined effluent sample port prior to air discharge. The sample ports are shown on the construction drawings in Appendix C of the O&M Manual.

Sampling ports for field measurements are located as follows:

- Prior to the catalytic oxidizer (when installed)
- Prior to, at the midpoint of, and after vapor GAC vessels
- Prior to air discharge

4.2.7.3 Vapor Monitoring Pins

Total VOCs, oxygen, carbon dioxide, and combustible gas (% LEL) concentrations will be measured in sub-slab soil gas grab samples collected from the four Vapor Pin® sampling devices using a ppb PID and four-gas meter. Samples will be collected by purging each location with a vacuum pump to remove three (3) purge volumes at the location before collecting an air sample in a Tedlar® bag with a vacuum box sampler. The sample will then be tested with the handheld instrument, and if field measurements of total VOCs concentrations in a vapor pin soil gas sample is above 425 ppb and/or if combustible gas is measured above 20% LEL, a soil gas sample for laboratory analysis of VOCs by TO-15 will be collected from the Vapor Pin® sampling device for confirmation. Laboratory results will be compared to sub-slab soil gas screening levels provided in Table 2, to determine if modifications to the remedial system operation and/or other corrective actions may be required.

4.2.7.4 SSD Wells

Total VOCs, oxygen, carbon dioxide, and combustible gas concentrations will be measured in soil gas grab samples from the manifold sampling ports of the three SSD wells using a ppb PID and four-gas meter. Sample collection methods will be the same as for the Vapor Pin® sample devices. If field measurements of total VOCs concentrations in a SSD well soil gas sample is above 425 ppb and/or if combustible gas is measured above 20% LEL, a soil gas sample for laboratory analysis of VOCs by TO-15 will be collected from the SSD well.

The above sampling locations are subject to change after the substantial requirements set by PSCAA.

4.2.8 Water Treatment System Sampling

Samples will be collected from the onsite water treatment system during the construction phase and operation phase of the cleanup actions. The water treatment train consists of a bag filter, two pairs of GAC vessels plumbed in series, a mixing tank in which surfactants, bacteria, and/or nutrients can be added, and an oxygen generator. Water can be discharged to the City of Seattle (City) sanitary sewer system before the mixing tank or reinjected to the wells through the injection manifold. The Construction Contractor will have responsibility for compliance with the discharge permit during construction and the O&M Contractor will have responsibility for compliance during the operation of the remedial system. Design requirements for the water treatment system are included in the Project Manual.

Water samples will be collected at the influent to the liquid GAC vessel trains, at the midpoint of each train, and at the effluent of each train. Water samples will be collected at the frequency identified in Table 6. During Phase 3 – Enhanced Bioremediation of the MPE remedial action, samples of treated, extracted groundwater will be collected for laboratory analysis at the point of discharge to the sanitary sewer. Water treatment system samples will be analyzed for GRO, BTEX, Selected CVOCs, and FOG. Point of discharge samples will be analyzed for the same constituents, with the addition of nitrate and total orthophosphate.

pH and turbidity will also be measured during each sampling event using a calibrated portable field meter. Effluent limits based on the King County Industrial Waste permit include the following which are subject to update/clarification during permitting activities:

Analyte / Parameter	Indicator Level (i.e., Discharge Limit)
GRO	250 µg/L
Benzene	70 µg/L
Toluene	1,400 µg/L
Ethylbenzene	1,700 µg/L
Xylenes, Total	2,200 µg/L
PCE	240 µg/L
TCE	500 µg/L[1]
cis-1,2-DCE	1,000 µg/L[2]
trans-1,2-DCE	1,000 µg/L[2]
VC	12 µg/L
Nonpolar fats, oil, and grease (FOG)	100,000 µg/L

Analyte / Parameter	Indicator Level (i.e., Discharge Limit)
Turbidity	25 NTU
pH	5.0-12.0 (standard units)

Notes:

µg/L = micrograms per liter
NTU = Nephelometric turbidity unit
1. Chapter 173-303 WAC: Dangerous Waste Regulation
2. Based on the Permissible Exposure Limit of total 1,2-dichloroethylene divided 50% to the *cis*-isomer and 50% to the *trans*-isometer.

Additional samples may be collected from the sampling ports or holding tanks to characterize the waste water if effluent limits are exceeded. A separate binder will be maintained to document all monitoring samples and results (field measurements, laboratory analytical reports, and daily inspection reports).

Monitoring results from the liquid treatment system will be confirmed via sampling and analysis of the influent and effluent liquid streams, in accordance with the recommendations of the discharge permit for the City sanitary sewer. Additional details on compliance monitoring will be provided once a discharge permit has been issued for the site.

4.2.9 Groundwater Monitoring

Groundwater monitoring will be performed following completion of the construction phase of the remedial action, and at periodic intervals afterward to evaluate attainment of cleanup levels (performance monitoring) during remedial system operation and during confirmation monitoring after the remedial action. Each groundwater monitoring and sampling event will include measurement of groundwater levels (and LNAPL levels, if applicable) (collectively known as liquid levels) in site monitoring and remediation wells (as accessible) and collection of groundwater samples for laboratory analysis from selected monitoring wells. Though LNAPL has not been observed in a site monitoring well since October 2006 (EA 2006), its presence will be monitored during groundwater monitoring events. The number and selection of wells may vary during performance and confirmation monitoring based on remedial action progress.

4.2.9.1 Liquid Level Measurements

Liquid level measurements will be obtained prior to purging monitoring wells for groundwater sample collection. Liquid levels will be measured with an electronic water level indicator and/or electronic oil-water interface indicator if presence of LNAPL is suspected. All liquid levels will be recorded to the nearest 0.01 foot. Measurements will be referenced to the top of the well casing on the north side. The probe of the level indicator will be decontaminated between wells with a detergent wash, followed by two distilled water rinses. Groundwater table elevations will be calculated by subtracting the depth to the groundwater table from the casing rim elevations (surveyed casing rim elevations are referenced to the North American Vertical Datum of 1988).

4.2.9.2 Groundwater Sampling Method

Low-flow purging will be the default method for groundwater sampling. Other purge methods will not be used without Ecology approval. Groundwater samples will be collected in accordance with low-flow purging and sampling guidance documents including:

- Ecology's *Standard Operating Procedure EAP099, Version 1.0: Purging and Sampling Monitoring Wells for General Chemistry Parameters. Publication No. 18-03-214* (Ecology 2018) and
- ASTM's *Standard Practice for Low-Flow Purging and Sampling for Wells and Devices Used for Ground-Water Quality Investigations* (ASTM 2018).

The wells will be purged using an appropriate pump (e.g., peristaltic pump, submersible pump, dedicated pump, etc.) for groundwater level conditions. New dedicated tubing will be installed in each well prior to purging the well. The tubing inlet (or pump intake) will be placed within the screened interval of the well or a few inches off the bottom, depending on the static water level.

Field parameter monitoring for groundwater will be conducted during the purging process prior to sample collection at each well location. Field parameters will be measured using a portable meter equipped with separate probes for temperature, pH, specific conductivity, ORP, and DO. The probe will be installed down-well or in an in-line flow-through cell during the purging process. Turbidity will also be measured using a separate field meter. Meter readings will be recorded at minimum 5-minute intervals during the purging process, including a final reading taken at the completion of purging for each well location. Purging will continue until stabilization criteria (per O&M Contractor's groundwater sampling SOG) for each parameter have been met.

After purging, a grab groundwater sample is collected (using the pump) and transferred to the appropriate sample containers in accordance with the O&M Contractor's groundwater sampling SOG.

Quality control samples will be collected in accordance with Section 6. Purge methods and monitoring parameters will be documented on the purge and sample form (Example form included in Appendix C). The dedicated tubing will either be stored in each respective well for reuse or be removed after all wells are sampled and will be disposed of as Investigation-derived waste (IDW).

The O&M Contractor will provide SOGs for groundwater level measurements and low-flow groundwater sampling techniques including field parameter stabilizing criteria.

4.2.9.3 Performance Groundwater Monitoring

Performance groundwater monitoring will be conducted during system operation by the O&M Contractor to confirm that the remedial action has attained the site CULs. During initial operation and transitions between treatment methods, monitoring may be conducted more often at selected wells. The sampling frequency for performance groundwater monitoring is identified in Table 7.

Groundwater samples will be collected from up to thirteen (13) monitoring wells for groundwater performance monitoring as follows:

- Performance Monitoring (13 wells): MW-6, MW-8, MW-9, MW-13, MW-14, MW-15, MW-16, MW-17, MW-18, MW-19, MW-20, MW-21, and RW-1

- Performance Monitoring Subset (8 wells) (more frequent monitoring during system startup and during Phases 2 and 3): MW-8, MW-9, MW-13, MW-14, MW-16, MW-19, MW-20, and MW-21

These 13 wells were selected to represent elevated dissolved phase GRO and BTEX concentrations (MW-8, MW-9, MW-13, MW-17, MW-19, MW-20, and MW-21) or non-detect or reported concentrations near or below CULs (MW-6, MW-14, MW-15, MW-16, MW-18, and RW-1). The wells around the COC-impacted extents will be used to monitor potential expansion / retraction of the petroleum hydrocarbon-impacted groundwater areas.

Groundwater samples collected from the thirteen performance monitoring wells during Phase 1 of the remedial system operation will be analyzed for GRO and BTEX concentrations. During Phases 2 and 3, samples from the eight wells in the performance monitoring subset will be analyzed for GRO and BTEX plus nitrate and orthophosphate.

Off-Property wells MW-2, MW-7, MW-10, and MW-11 will be sampled for GRO and BTEX at system startup to confirm consistency with previous sampling results. For the remaining performance monitoring events, these four wells will be used for groundwater flow direction evaluations only. Previous groundwater samples from these four wells have not contained GRO or BTEX concentrations above cleanup levels.

The groundwater sampling frequency varies by well designation (e.g., performance monitoring vs. performance monitoring subset). It is anticipated that the eight wells in the subset group will be sampled as follows during Phases 1, 2, and 3 of the remedial system operation over the assumed course of five and a half (5.5) years (66 months):

- Phase 1 (1 year): At remedial system startup, then monthly for 6 months, then quarterly for two quarters; GRO and BTEX only.

- Phase 2 (0.5 year): Monthly for 3 months, then one quarterly event; GRO, BTEX, nitrate, and orthophosphate.

- Phase 3 (4 years): Monthly for 3 months, then five quarterly events, two and a half (2.5) years of semiannual sampling; GRO, BTEX, nitrate, and orthophosphate.

The other five wells would be sampled as follows:

- Phases 1, 2 and 3 combined: At remedial system startup, then monthly for 6 months, followed by quarterly events for 24 months (2 years), and then semiannual events for the remaining 36 months (3 years); 21 events over 5.5 years for GRO and BTEX.

Table 7 summarizes the frequency of performance monitoring groundwater sampling events and target laboratory analyses for the two groups of monitoring wells.

The specific wells, laboratory analytes, and sampling frequency presented above may be modified for subsequent performance monitoring events as determined by Ecology.

4.2.9.4 Confirmation Groundwater Monitoring

Confirmation monitoring will be conducted to assess the long-term effectiveness of the remedial action once cleanup standards have been attained and/or once the remediation system is no longer actively operating. Confirmation monitoring at the site will include soil sampling to confirm soil meets site cleanup levels (see Table 4) and conducting quarterly groundwater monitoring until four consecutive quarters of results demonstrate that groundwater has met site cleanup levels (Table 7).

Identification of location(s) and depth(s) for collection of confirmation soil samples will be discussed with Ecology prior to collecting samples.

Groundwater samples will be collected from monitoring wells located on and off the properly to demonstrate attainment of Site cleanup levels. These wells are identified as “Compliance Wells” in Table 1. The samples to be collected are identified in Table 7. Confirmation groundwater monitoring will include collection of samples from the following 13 monitoring wells on a quarterly basis:

- On-Property: MW-17, MW-18, MW-19, MW-20, MW-21, RW-1
- Off-Property: MW-6, MW-8, MW-9, MW-13, MW-14, MW-15, MW-16

Off-Property wells MW-2, MW-7, MW-10, and MW-11 will be used for groundwater flow direction measurements only. Previous groundwater samples from these four wells have not contained GRO or BTEX concentrations above cleanup levels.

Groundwater monitoring will be ceased in individual wells after laboratory data from four consecutive quarters of monitoring indicate GRO and BTEX concentrations in groundwater samples are less than Site cleanup levels. Those wells will then be removed from the groundwater monitoring program, but not decommissioned. A minimum of four quarterly confirmation groundwater monitoring events would be conducted to confirm attainment of groundwater site cleanup levels in each monitoring well.

The specific wells, laboratory analytes, and sampling frequency may be modified for subsequent monitoring events as determined by Ecology.

4.2.9.5 Natural Attenuation Parameters

Groundwater sampling for field and laboratory-analyzed natural attenuation parameters will be conducted during confirmation sampling in general accordance with Ecology’s *Guidance on Remediation of Petroleum-Contaminated Groundwater by Natural Attenuation,* dated July 2005 (NA Guidance) (Ecology 2005).

Primary geochemical indicators of natural attenuation including dissolved oxygen, redox potential, pH, specific conductivity, and temperature will be measured in the field during the purging process prior to sample collection at each well location.

Secondary geochemical indicators including nitrate, sulfate, dissolved iron, dissolved manganese, methane (dissolved) and alkalinity will be analyzed by the laboratory using the analytical methods described in Section 4.1.1. Samples for dissolved iron and dissolved manganese will be collected at the end of the purging process after field-filtering through a 45-micron inline filter.

Sample collection frequency for laboratory-analyzed secondary geochemical indicators will be based on attainment of site CULs during confirmation monitoring. Samples will be collected for secondary geochemical indicators during the first and third quarters of the first year of confirmation monitoring from the eight (8) performance subset wells. Depending on attainment of CULs in each well and contamination plume stability, the frequency, number and location of wells may be modified for subsequent monitoring events as determined by Ecology. Wells to be sampled for laboratory-analyzed natural attenuation parameters are identified in Table 7.

4.3 Equipment and Personnel Decontamination

To the greatest extent possible, disposable and/or dedicated personal protective and sampling equipment will be used to avoid cross-contamination. All non-disposable sampling equipment [e.g., drilling equipment, core barrels, sampling tools (i.e., stainless-steel spoons, trowels, bowls, etc.), and field meters] will be cleaned between sample locations to avoid cross-contamination in accordance with procedures described in the Construction and O&M Contractors' SOGs for equipment and personnel decontamination. To the extent possible, sampling using non-disposable sampling equipment will begin at locations suspected to be least contaminated, progressing to the most contaminated locations.

It is anticipated that all fieldwork will be conducted according to the HASP using Level "D" personal protective equipment (PPE). In accordance with the decontamination procedures described in the SOGs, disposable PPE and equipment will be placed in appropriate disposal containers.

The following cleaning procedures will be used as the minimum requirements for all non-disposable equipment used to collect routine samples undergoing organic or inorganic constituent analyses:

- Clean with tap water and non-phosphate detergent using a brush if necessary to remove particulate matter and surface films. Equipment may be steam cleaned (using high-pressure hot water) as an alternative to brushing. PVC or plastic items should not be steam cleaned.

- Rinse with tap water. Repeat cleaning and tap water rinse as needed to remove particulate matter and surface films.

  [NOTE: If tap water is suspected to be contaminated, use containerized drinking water or distilled/deionized (DI) water.]

- Final rinse with tap water.

- Additional final rinse with distilled/DI water.

[NOTE: Each rinse may be performed with distilled/DI water if desired, but only the final rinse needs to be performed with distilled/DI water.]

- Air-dry the equipment completely.
- Store the cleaned equipment in a clean container.

Decontamination will be conducted in a central location, upwind and away from suspected contaminant sources. Equipment rinsate blanks (see Section 6) will be collected as a QA/QC measure for the decontamination procedures on a daily basis when non-disposable equipment is used.

4.4 Investigation Derived Waste (IDW) Handling

IDW generated during construction, remedial system operation, and compliance monitoring activities at the site are anticipated to include excavated soil, drilling soil cuttings, well purge and development water, equipment decontamination water, vapor treatment condensation water. Because these IDW materials may be contaminated, each IDW type will be containerized separately pending characterization for disposal. These materials will be placed in DOT-approved 55-gallon drums and temporarily stored onsite pending characterization and offsite disposal. All drums will be labeled to indicate contents, name and address of the generator, and the date and origin/location of collection. IDW drums will be placed in a configuration that allows room for inspections, operations and maintenance, and handling.

The Construction and O&M Contractors will be responsible for waste management at the Site, which includes containerizing and securing the IDW, and labeling, staging, and profiling the IDW for ultimate disposal within a timely manner and in accordance with their SOGs. Final disposal of IDW will be completed by the Construction Contractor and O&M Contractor on behalf of Ecology. Handling and disposal of IDW procedures that will be followed by the remediation contractors' personnel and subcontractors will be provided in SOGs provided each contractor.

PPE (i.e., gloves, etc.) and disposable sampling materials [i.e., tubing, sampling scoops, cleaning supplies (paper towels) etc.] will be disposed of at a state-permitted, licensed, or registered municipal or industrial solid waste landfill.

IDW will be disposed of promptly after characterization is performed. The IDW characterization process is outlined in EPA's (1991) *Management of Investigation-Derived Wastes During Site Inspections* and EPA's (1992) *Guide to Management of Investigation-Derived Wastes*. Classification of IDW will also follow the regulations as published in Dangerous Waste Regulations (WAC 173-303) and/or Water Quality Regulations on the basis of the laboratory analyses. IDW will also be evaluated as required by WAC 173-303-100 State Only Dangerous Waste. Once the IDW is characterized, the Construction Contractor or O&M Contractor (as applicable) will make a determination and adequately document the proper management and/or disposal. Pending the waste disposal subcontractor's schedule, the IDW will be removed from the Site for disposal no more than 30 days from the end of its generation.

Section 5: Field Documentation

To ensure that samples are correctly identified and tracked, careful sample documentation and custody procedures will be used during the Circle K 1461 monitoring event to maintain sample integrity during collection, transport, storage, and analysis.

Field sampling personnel will be responsible for maintaining proper documentation and custody procedures from sample collection until samples are transferred to the analytical laboratory or a commercial freight carrier. The environmental consultant will review and approve all field documentation. The analytical laboratory will be responsible for maintaining sample custody and documentation from the time the analytical laboratory receives the samples until final sample disposal. Field documentation and sample chain-of-custody requirements are discussed below.

5.1 Documentation of Field Activities

A field logbook will be maintained by the sampling team. Field logbooks will be waterproof pages in bound notebooks. All entries to field logbooks, and all other field documentation, will be made using indelible ink. Any errors will be corrected by drawing a single line through the incorrect entry, entering the correct information, and dating and initialing the change. After project completion, all field logbooks will be stored in the final project file.

Daily entries into the logbook will generally include the information listed below, but information recorded on field forms (i.e., purge forms, etc.) need not be duplicated in the field logbook.

- Date
- Personnel onsite (including visitors)
- Weather conditions
- Type(s) of field equipment used
- Field equipment calibration methods (if applicable)
- Sample location
- Date and time of sample collection
- Sample identification number
- Description of sampling location
- Sample type (e.g., duplicates)
- Photographs (including general field activities, soil borings, and sample locations)
- Issues encountered and/or corrective actions

- Any deviations from the SAP/QAPP
- Any other observations that may be relevant to the specific field program or activities that may affect the resulting analytical data.

5.2 Photographs

Where practical, photographs will be taken to document field activities, including monitoring well conditions. Also, a small whiteboard may be included in the photograph to list the sample name, date, and time of collection.

In order for these photographs to be effective documentation, the accompanying information should be entered into the field logbook, or on a field map:

- Date
- Time
- Name of photographer
- Site name
- General direction faced when photograph was taken
- Any other appropriate comments (e.g., weather).

5.3 Sample Field Forms

Field sampling personnel may complete field sample forms for soil, vapor, and groundwater. As previously noted, data entered on field forms do not need to be duplicated in the field notebook.

5.4 Field Chain-of-Custody Procedures

All samples will be placed immediately in appropriate containers with appropriate preservatives per the analytical method requirements (see Table 11). The filled containers should be tightly sealed, the outer surface wiped to remove any loose particulates, and stored in a dedicated cooler with ice (or ice packs) pending transport to the analytical laboratory.

Samples will be labeled with the following information:

- Project name/location
- Sample identification number
- Date and time of sample collection
- Preservative (if applicable)
- Analyses to be performed

- Sample matrix (i.e., groundwater,)
- Sampler's name or initials.

Chain-of-custody procedures provide an accurate written record of sample possession from the time of collection through analytical laboratory analysis. A sample is considered in custody *only* when one of the following applies:

- It is in an authorized person's immediate possession.
- It is in view of an authorized person after being in that person's physical possession.
- It is in a secure area, restricted to authorized personnel only, after having been in an authorized person's physical possession.

Each chain-of-custody form will be completed properly to ensure that sample custody is documented, appropriate samples have been collected, and scheduled analyses are assigned correctly. All entries will be made using indelible ink. Any errors will be corrected by drawing a single line through the incorrect entry, entering the correct information, and then initialing and dating the change. Analytical laboratories typically provide a chain-of-custody form that they prefer. At a minimum, these forms will contain the following information:

- Sample identification
- Date and time of sample collection
- Sample matrix (i.e., groundwater)
- Number and type of containers per sample
- Preservative (if applicable)
- Analyses to be performed
- Sampler's name and initials
- Release and acceptance information, including date, location, and sampler's signature.

Custody seals must be used when samples are shipped to the analytical laboratory, or when they are delivered to the analytical laboratory after hours. The seals must be signed by the field personnel and be affixed to the sample cooler in a way that would necessitate breaking the seal in order to open the cooler. If the samples are delivered directly to the analytical laboratory by the sampler, sample seals are not necessary.

If the samples are shipped via a commercial carrier, the carrier will relinquish samples to the analytical laboratory upon arrival, and the analytical laboratory personnel will complete the chain-of-custody form. The chain-of-custody forms will be sealed in plastic zip-lock bags (or similar) and secured to the top of the lid inside the cooler with tape.

5.4.1 Analytical Laboratory Chain-of-Custody Procedures

A signed chain-of-custody form will be obtained from the analytical laboratory custodian after the samples have been received and sample condition recorded. Upon receipt by the analytical laboratory, samples will be checked carefully to ensure that sample containers are not broken or leaking, proper preservation methods have been followed [including receipt at 4 degrees Celsius (°C) ± 2°C when applicable], and labels and custody seals are intact. Each chain-of-custody form will be verified for accuracy and completeness, and any discrepancies will be brought to the attention of the environmental consultant or Ecology Project Manager. From the time of receipt, the analytical laboratory will use its standard internal chain-of-custody procedures to ensure that the samples are tracked through completion of the analytical process.

Sample custody will be maintained within the analytical laboratory's secure facility until disposal. Following sample analysis and throughout the holding time, the analytical laboratory will archive any remaining sample material for all samples (100 percent). The analytical laboratory will be responsible for sample disposal, which will be conducted in accordance with all applicable local, state, and federal regulations.

5.5 Handling/Referring Possible Violations

If, during the course of this work, questionable practices or site conditions are noted, it is incumbent upon the field personnel to suitably document these facts, without compromising the objectives of the project. A summary of these observations will be forwarded to the Ecology Project Manager following completion of onsite activities.

Section 6: Quality Control

QC is the implementation, monitoring, and documentation of the quality processes and procedures. Every procedural aspect, from project planning, sample collection, laboratory analysis, to data assessment, imparts a significant and often critical bearing on environmental decisions.

QC samples to be used to evaluate analytical data in terms of the quality criteria parameters include duplicate samples, equipment-rinsate blanks, trip blanks, temperature blanks, method blanks, and/or MS/MSD. These include QC samples prepared in the field and by the analytical laboratory. Method-specific QC procedures are detailed in the analytical laboratory's statement of qualifications (SOQs) and will be available upon request. The minimum requirements of the analytical laboratory's QA/QC plan include the frequency of QC sample analysis, acceptance criteria (control limits), and corrective actions and also describe the holding time criteria to be used to assess data quality.

6.1 Field QC Requirements Samples

For field sampling, QC samples are used to assess sample collection techniques and environmental conditions during sample collection and transport. For this project, field QC samples include equipment rinsate blanks, duplicate samples, trip blanks, and temperature blanks. QC samples and frequency of collection are discussed in the following sections and identified for each soil, groundwater, water, or vapor sampling event in Tables 4 through 7. A summary of specifications for containers, holding times, preservation, and handling for each matrix and analysis group is shown in Table 11.

6.1.1 Equipment Rinsate Blanks

Equipment rinsate blank samples will be collected at the frequency of one per day that non-disposable field equipment is used (expected for soil samples only, see Table 4). Rinsate blanks will be collected by filling appropriate sample containers in the field with laboratory prepared organic-free water that has been passed through decontaminated reusable sampling equipment. Field blanks will be used to assess variability in decontamination procedures.

6.1.2 Duplicate Samples

Duplicate samples may be used to assess variability in sampling techniques. A duplicate sample pair is typically a single grab sample that is split into two samples during collection. For each duplicate sample pair, one sample is labeled with the sample identification and the other is labeled with a blind duplicate sample identification. This sample pair is then submitted to the same analytical laboratory as two separate samples. Precision will be evaluated by calculating the RPD between the field duplicate samples, as described in Section 3.3.1. The RPD will be calculated for field duplicate pairs for each analyte whose measured values are greater than the RL. The frequency for duplicate samples shall typically be one per 20 investigative samples, with a minimum of one duplicate within each media per sampling event. Duplicate samples are identified in Tables 4 through 7.

6.1.3 Trip Blank Sample

Trip blank samples will be collected when soil, water, and/or groundwater samples for volatile organic compounds (VOCs) are collected. Volatile organic samples are susceptible to contamination by diffusion of organic contaminants through the sample vials. Therefore, trip blank samples will be submitted to monitor for possible sampling contamination during shipment if VOC analyses are performed. Trip blank samples will be prepared by the analytical laboratory by filling volatile organic analysis (VOA) vials with organic-free water and acid preservative and shipping the blank samples with the clean sample containers. Trip blank samples will accompany the sample containers through collection and shipment to the laboratory and will be stored with the samples. If samples for VOC analysis are not collected, a field blank will be collected each day. Field blanks will be collected by filling appropriate sample containers in the field with laboratory prepared organic-free water. Trip blanks samples are identified in Tables 4 through 7.

6.1.4 Temperature Blanks

A temperature blank is used to monitor temperature preservation of samples transported to the contract analytical laboratory. The temperature blank is distilled water stored in a glass/plastic vial or jar, and is typically provided by the analytical laboratory. A temperature blank should be included with each sample cooler submitted for chemical analysis. Upon receipt by the analytical laboratory, the sample custodian will measure and record the temperature of the blank sample.

Temperature blanks are commonly used to evaluate the effectiveness of preservation requirements (e.g., chilling samples on ice during shipment to the analytical laboratory) and application of appropriate data qualifiers when blank results indicate the potential for elevated temperatures to affect field samples during transport to the analytical laboratory. Typically, the temperature blank must be within the criteria of 4±2°C (2°C to 6°C).

Section 7: Calibration, Testing, Inspection, and Maintenance of Equipment, Instrumentation, and Supplies

All field analytical instruments and equipment will be tested, inspected, and maintained according to the manufacturer's guidelines and recommendations. Data collected from improperly functioning equipment will not be used. The equipment testing, inspection, and maintenance logs for all equipment must be made available to the Ecology Project Manager, and/or their representative upon request.

7.1 Calibration

Calibration refers to the process of verifying, adjusting, or fine-tuning the measurements reported by a given instrument to agree with known values. In general, the calibration process involves analyzing commercially prepared calibration standards of known concentrations or values, which span either the measurement range of the instrument or the range of values anticipated to be encountered in a given investigation. The measured value produced by the instrument is then compared to the published value for that calibration standard, and the difference is compared to project, method, or instrument acceptance criteria. If the difference between the published and measured values for the calibration standard is smaller than the acceptance criteria, then the instrument is considered to be in calibration. If the difference is greater than the applicable acceptance criteria, the instrument is considered to be out of calibration and must be recalibrated in accordance with manufacturer's recommendations before any measurements made with the device can be considered valid. Field equipment calibration procedures and requirements are described in the following sections.

7.2 Field Equipment Calibration

Field instruments and meters will be calibrated, at a minimum, on a daily basis, and as needed to maintain calibration during each field day. Instruments and meters will be calibrated using the manufacturer's recommended procedures and appropriate calibration standards. A field log will be maintained with calibration dates, times, and results (as appropriate) for each instrument and meter. For instruments and meters that are factory-calibrated (i.e., not intended for daily calibration), a reference standard will be measured daily.

Field instruments and meters anticipated to be used for compliance monitoring during the remedial action include:

- PID and ppb PID calibrated daily using 100 ppm isobutylene gas and as needed to maintain calibration.
- Four-gas multimeter calibrated daily using vendor-provided calibration gases
- Multi-parameter probe for water quality parameters including temperature, specific conductivity, pH, redox potential, and dissolved oxygen calibrated daily and as needed to maintain calibration (no calibration required for temperature).
- Turbidity meter field checked daily and as needed.

Instrument calibration procedures are described in the SOGs provided in Appendix B.

Field calibration standards will be obtained from the National Institute of Standards and Technology (NIST), EPA Cooperative Research and Development Agreement vendors, American Association of Laboratory Accreditation vendors, or other reliable commercial sources. For the purposes of field instrument calibration, vendor standards will not be diluted. Before each use, standards will be checked for signs of deterioration (e.g., discoloration, formation of precipitates, and changes in concentrations), and will be discarded if deterioration is suspected or the expiration date identified by the vendor has passed.

For corrective action, if calibration of a field instrument is outside the criteria at the beginning of the day, the instrument will be recalibrated with new standards. If recalibration is unsuccessful, the unit will be repaired or replaced.

All field analytical instruments and equipment will be tested, inspected, and maintained according to the manufacturer's guidelines and recommendations. Data collected from improperly functioning equipment will not be used. The equipment testing, inspection, and maintenance logs for all equipment must be made available to the Ecology Project Manager, and/or their representative upon request.

7.3 Equipment Testing, Inspection, and Maintenance

A preventive maintenance program is necessary to promote the timely and effective completion of a measurement effort for field programs. The preventive maintenance program will be designed to minimize the downtime of crucial sampling or analytical equipment due to unexpected component failure. Efforts will focus on establishing maintenance responsibilities, maintenance schedules for major or critical instrumentation and apparatus, and an adequate inventory of critical spare parts and equipment.

7.3.1 Field Equipment/Instruments

The field equipment used for sampling will be maintained and used according to the manufacturer's directions. The field team leader will ensure that each piece of equipment is operational and is inspected on a regular basis. Any preventive maintenance or repair conducted in the field will be recorded in the field logbook or other appropriate field forms. If equipment is determined to be damaged, in need of maintenance, or otherwise unusable, it will be immediately taken out of service until such time that it can be repaired or replaced. The field team leader will be responsible for inspecting and testing the field equipment to verify it is in acceptable condition before the item is put back into service. Backup instruments and equipment will be available onsite or within a short turnaround time to avoid delays in the field schedule. Field instruments will be checked and calibrated before they are shipped or carried to the field and will be checked and calibrated before use. Calibration checks will be performed as specified in the manufacturer's directions.

7.4 Inspection/Acceptance of Supplies and Consumables

All supplies and consumables will be examined for damage or other characteristics that would otherwise compromise data quality.

Section 8: Data Management, Review, and Reporting

8.1 Laboratory Data Reporting

The analytical laboratory is responsible for providing sufficient laboratory documentation such that the sample results are traceable to the field samples, and the analytical data can be verified and validated by an independent third-party reviewer, if applicable. All analytical laboratory data packages will contain the following information:

- Cover letter
- Chain-of-custody forms
- Summary of sample results
- Summary of QC results.

The minimum information to be presented for each sample for each parameter or parameters group:

- Client sample number and analytical laboratory sample number
- Sample matrix
- Date of extraction/preparation and date/time of analysis
- Dilution factors
- Sample weights/volumes used in sample preparation/analysis
- Identification of analytical instrument
- Analytical method
- Detection/quantitation and reporting limits
- Definitions of any data qualifiers used.

The minimum QC summary information to be presented for each sample for each parameter or parameter group will include:

- Surrogate standard recovery results
- Matrix QC results (MS/MSD, duplicate)
- Method blank results
- Laboratory duplicate results and control limits

- Analytical laboratory check standard results
- Initial and continuing calibration results and control limits.

8.2 Data Management

Field data recorded during sampling and monitoring events (e.g., depth to groundwater measurements, groundwater, soil or vapor sample identifications, dates and times, etc.), will be recorded on field data sheets, in a hardbound field book, or hand-held computers. Field data will be reported to the Ecology Project Manager and/or their representative upon request, through monthly updates, and in the Remedial Progress Evaluation Reports (Section 8.4).

Data will also be managed and stored using the following Ecology databases:

- Environmental data (including field measurements) and sample results will be uploaded by the O&M Contractor to Ecology's Environmental Information Management (EIM) System on a quarterly basis. The analytical laboratory will provide data in a format compatible with EIM, in addition to any other reporting formats.
- The O&M Contractor will provide electronic copies [e.g., laboratory-provided PDF and/or electronic data deliverable (EDD) files as applicable] of all final analytical data for compliance monitoring and sampling to Ecology via email or file sharing application.
- Maps and reports submitted to Ecology will be stored in Document Storage and Retrieval System (DSARS).
- Site photographs submitted to Ecology will be stored in Photo and Image Management System (PIMS).

8.3 Data Review and Validation

This section discusses data review and verification procedures and requirements.

Field and analytical laboratory data generated from sampling activities will be reviewed and verified. Field data entered into databases will be verified. Errors identified during the verification of data will be corrected prior to release of the final data.

The analytical laboratory is responsible for verifying analytical results prior to the submittal of the final laboratory data report. Initially, all analytical data generated by the analytical laboratory are verified by the laboratory. During the analysis process, the analyst and the laboratory QA Manager verify that the results have met various performance-based control limits (e.g., surrogate recoveries and continuing calibration). Nonconformance of various method QC requirements and control limits warrants the re-analysis and/or re-extraction of a sample.

Data validation will be conducted in accordance with applicable sections of EPA's Contract Laboratory Program National Functional Guidelines for Organic Data Review (EPA 2020). For each data package, the Kennedy Jenks' QA Officer will conduct a review of the QC results. If data do not meet required criteria, they will be flagged with data qualifiers as specified under the

action portion of each requirement of the functional guidelines (EPA 2020). Data validation procedures will entail evaluating the following:

- Holding times (check to see whether samples were analyzed within the specified holding time)
- Method blank results [check to see whether analytes were present in method blank samples and that a blank was analyzed every 20 samples (or more often) for each matrix]
- Surrogate recovery results for organic analyses (check to see whether surrogate recoveries met control limits)
- Laboratory control sample results (check to see whether laboratory control samples met control limits)
- Field duplicate results
- Laboratory duplicate results (check to see whether duplicate analyses were conducted every 20 samples for each matrix or at least for each batch of samples, where applicable, and that control limits were met)
- MS/MSD results for all relevant analyses (check to see whether MS/MSDs were analyzed every 20 samples for each matrix or at least for each batch of samples, where applicable, and that control limits were met)
- Reported detection limits for analyses (check to see whether the detection/reporting limits were adequate for comparison to appropriate regulatory criteria).

The QA Officer will prepare a QA memorandum for each data package describing the results of the data validation and describing any qualifiers that are added to the data. Limitations to the usability of the data will also be discussed in the memorandum.

8.4 Data Reporting

Reporting during remedial system operation includes:

- Monthly Updates:
    - O&M Contractor will provide Ecology with monthly tracking of project schedule, budget, scope of work, and deliverables, including but not limited to:
        - Timely notification of change to scope, schedule, or budget.
        - Timely notification to Ecology Site Manager/Contract Officer when 75% of the budget has been spent.
        - Preparation of a brief Monthly Progress Update for Ecology, due by the 15th day of each following month, through the duration of system

operations and into the confirmation monitoring phase after MPE system shutdown, including:

- Summary of operations, monitoring, and maintenance activities performed during the reporting period.
- Summary of operations, monitoring, and maintenance activities to be performed in the next month.
- Comparison of work completed to scheduled activities.
- Potential problems identified and suggested resolutions.
- Deliverables submitted during the reporting period.
- EIM field and laboratory analytical results submitted during the reporting period.

  - O&M Contractor will attend routine, Monthly Progress Update calls, approximately 30-minutes in duration, between the Ecology Site Manager and Contractor's Project Manager.

- Monthly Remedial Progress Evaluation Reports

  - O&M Contractor will prepare and submit a report to Ecology for the first month of each remedial system operating phase (Phases 1, 2, and 3) and the confirmation monitoring phase.
  - Submittal will be on or before the 28th day of the following month to allow time for data tabulation and validation of laboratory analytical results.

- Quarterly Remedial Progress Evaluation Reports

  - O&M Contractor will prepare and submit a report to Ecology for the first, second, and third quarter per year of remedial system operation and confirmation monitoring.
  - Submittal will be on or before the 28th day of the month following the end of the quarter to allow time for data tabulation and validation of laboratory analytical results.

- Annual Remedial Progress Reports

  - O&M Contractor will prepare and submit an annual report to Ecology for each year of remedial system operation and confirmation monitoring. The annual report will be prepared in place of a fourth quarterly remedial progress evaluation report.

- A draft annual report will be due to Ecology for review by February 15th of the following year. A final annual report will be updated to incorporate Ecology's comments.

The monthly and quarterly reports will include a summary of activities completed during the preceding reporting period (month or quarter) as applicable for conducted activities, including:

- Summary of operations, monitoring, sampling, and maintenance activities.
- Operational information on the MPE system performance including tables summarizing recorded field system measurements.
- Groundwater level measurement data.
- Tables summarizing field analytical results.
- Tables summarizing laboratory analytical data for vapor, discharge water, groundwater, and/or soil samples collected during the reporting period, including comparison to applicable PSCAA, KCIW, and MTCA cleanup levels.
- Concentration trend graphs for GRO and benzene in effluent samples from the air treatment system and water treatment system.
- Analytical laboratory reports and data validation reports for sample analysis results collected during the applicable reporting period.
- IDW manifests from the reporting period.
- Conclusions and recommendations for future remedial actions based on MPE system operation and compliance monitoring field and analytical data collected.

The annual report will include a summary of activities completed during the year, and tables summarizing collected data since the beginning of system operation and compliance monitoring as described in this document and listed below:

- Summary of operations, monitoring, and maintenance activities.
- Operational information on the MPE system performance including tables summarizing recorded field system measurements.
- Groundwater level measurement data.
- Tables summarizing field analytical results.
- Tables summarizing laboratory analytical data for vapor, discharge water, groundwater, and/or soil samples, including comparison to applicable PSCAA, KCIW, and/or MTCA cleanup levels.

- Concentration trend graphs for GRO and benzene in effluent samples from the air treatment system and water treatment system.
- Concentration trend graphs for GRO and benzene concentrations in groundwater for the thirteen (13) performance monitoring wells.
- Analytical reports from the laboratory and data validation reports for sample analysis results collected during the fourth quarter reporting period.
- IDW manifests from the fourth quarter reporting period.
- Conclusions and recommendations for future remedial actions based on MPE system operation and compliance monitoring field and analytical data collected.

All reports will include copies of field notebooks or field sampling data sheets, laboratory analytical data reports, and chain-of-custody documents. All final reports will be filed with the Ecology Project Manager and will be uniquely identified by the Site identification (ID) number in Ecology's ISIS database. Project records will be maintained in the site's ISIS file in accordance with Ecology's Record Retention Schedule.

Deliverables will be provided to Ecology electronically in MS Word, Excel, and/or Adobe PDF formats for all documents, as appropriate. As determined by Ecology, the preparation and submittal frequency of the Remedial Progress Evaluation Report may be modified during the three phases of system operation and compliance monitoring.

8.5 Data Usability

Laboratory data generated in accordance with this SAP/QAPP will be considered usable for site characterization and evaluation of the effectiveness of the remedial action unless the data validation process described herein results in rejection of data. Rejected data will not be used to support site characterization or any other project objective.

After environmental data have been reviewed, verified, and validated in accordance with the procedures described in this SAP/QAPP, the data must further be evaluated to determine whether project data quality objectives have been achieved. Data quality objectives may be evaluated by a review of the sampling design and methods to verify that these were implemented as planned and are adequate to support project objectives, a review of any issues brought up during data review and validation, and an evaluation of the limitations of the collected data.

Any report or technical memorandum in which data for this project is reported will discuss potential impacts of data usability and will clearly define limitations associated with the data.

References

ASTM International. 2018. Standard Practice for Low-Flow Purging and Sampling for Wells and Devices Used for Ground-Water Quality Investigations. 1 September 2018.

EA Engineering, Science, and Technology, Inc. 2006. Circle K Station #1461, Groundwater Summary for October 2006, Recommendations for Additional Cleanup Action Tests. 21 November 2006.

Kennedy/Jenks Consultants, Inc., 2021a. Engineering Design Report, Former Circle K Site 1461, Seattle, Washington. 10 December 2021.

Kennedy/Jenks Consultants, Inc. 2021b. Site-Specific Health and Safety Plan, Former Circle K Site, 2350 24th Ave East, Seattle, Washington 98112. 12 December 2021.

Kennedy/Jenks Consultants, Inc. 2022. Compliance Monitoring Plan, Circle K 1461, 2350 24th Ave East, Seattle, Washington 98112. November 2022.

Kennedy/Jenks Consultants, Inc. 2023a. Bid Set Project Manual for the Circle K 1461 Environmental Remediation System Installation, Seattle, Washington. January 2023.

Kennedy/Jenks Consultants, Inc. 2023b. Draft Operations and Maintenance Manual Environmental Remediation System, Circle K 1461, Seattle, Washington. March 2023.

King County Industrial Waste Program. 2016. Sampling Procedure of Customers Free-Floating Polar Fats, Oils, and Grease (FF-FOG). Version 001. 1 February 2016.

U.S. Environmental Protection Agency. 1991. Management of Investigation-Derived Wastes During Site Inspections. Office of Emergency and Remedial Response. EPA/540/G-91/009. May.

U.S. Environmental Protection Agency. 1992. Guide to Management of Investigation-Derived Wastes. Office of Solid Waste and Emergency Response. 9345.3-03F3. January.

U.S. Environmental Protection Agency. 1996. Ground Water Issue. Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedure. Document No. EPA/540/S-95/504. April 1996.

U.S. Environmental Protection Agency. 2007. Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW-846), Chapter 10. Revision 3. February.

U.S. Environmental Protection Agency. 2020. National Functional Guidelines for Organic Superfund Methods Data Review, United States Environmental Protection Agency Office of Superfund Remediation and Technology Innovation (OSRTI), November 2020.

Washington State Department of Ecology. 1995. Guidance on Sampling and Data Analysis Methods. Publication No. 94-49.

Washington State Department of Ecology. Revised 2016. Guidance for Remediation of Petroleum Contaminated Sites. Publication No. 10-09-057. June 2016.

Washington State Department of Ecology. 2018. Standard Operating Procedure EAP099, Version 1.0. Purging and Sampling Monitoring Wells for General Chemistry Parameters. Publication No. 18-03-214. April 2018.

Washington State Department of Ecology. Revised 2022. Guidance for Evaluating Vapor Intrusion in Washington State. Publication No. 09-09-047. March 2022.

Tables

TABLE 1
GROUNDWATER MONITORING AND REMEDIATION WELLS
FORMER CIRCLE K SITE 1461
Seattle, Washington

Monitoring Well ID	Date Installed	Well Status	MPE Well Group	Well Diameter (inches)	Screened Interval (feet bgs)	Top of Casing Elevation (feet amsl)	Well Use	Water Levels	Performance Monitoring	Performance Monitoring - Subset	Confirmation Monitoring
MW-2	09/11/1989	Existing	--	2	5.5-20.9	69.79	Monitoring Well	X	--	--	--
MW-6	10/02/1989	Existing	--	2	5-20.4	63.13	Compliance Well	X	X	--	X
MW-7	10/02/1989	Existing	--	2	5-20.2	62.66	Monitoring Well	X	--	--	--
MW-8	10/03/1989	Existing	--	2	5-20.3	63.59	Compliance Well	X	X	X	X
MW-9	10/03/1989	Existing	--	2	5-21.2	64.3	Compliance Well	X	X	X	X
MW-10	10/03/1989	Existing	--	2	5-20.4	62.86	Monitoring Well	X	--	--	--
MW-11	10/04/1989	Existing	--	2	5-20.0	63.59	Monitoring Well	X	--	--	--
MW-13	12/20/1989	Existing	--	2	4-19.0	65.08	Compliance Well	X	X	X	X
MW-14	12/20/1989	Existing	--	2	4-19.3	63.3	Compliance Well	X	X	X	X
MW-15	12/21/1989	Existing	--	2	4-18.7	64.18	Compliance Well	X	X	--	X
MW-16	12/21/1989	Existing	--	2	4-19.2	64	Compliance Well	X	X	X	X
MW-17	08/01/2016	Existing	--	2	4-19	65.98	Compliance Well	X	X	--	X
MW-18	08/01/2016	Existing	--	2	5-15	66.73	Compliance Well	X	X	--	X
MW-19	09/23/2016	Existing	--	2	5-20	66.36	Compliance Well	X	X	X	X
MW-20	09/23/2016	Existing	--	4	5-20	66.17	Compliance Well	X	X	X	X
MW-21	09/23/2016	Existing	--	4	5-20	65.89	Compliance Well	X	X	X	X
RW-1	02/07/2017	Existing	--	4	5.5-20.5	--	Compliance Well	X	X	--	X
MW-4	09/12/1989	Existing	1	2	4-18.8	63.62	Remediation Well	X	--	--	--
RW-2	02/09/2017	Existing	4	4	5-20	--	Remediation Well	X	--	--	--
RW-3	02/09/2017	Existing	1	4	5-20	--	Remediation Well	X	--	--	--
RW-4	02/08/2017	Existing	2	4	5-20	--	Remediation Well	X	--	--	--
RW-5	02/08/2017	Existing	3	4	5-20	--	Remediation Well	X	--	--	--
RW-6	02/10/2017	Existing	1	4	5-20	--	Remediation Well	X	--	--	--
RW-7	02/07/2017	Existing	4	4	5.0-20.0	--	Remediation Well	X	--	--	--
RW-8	TBD	Proposed	2	4	5-20		Remediation Well	X	--	--	--
RW-9	TBD	Proposed	1	4	5-20		Remediation Well	X	--	--	--
RW-10	TBD	Proposed	3	4	23-28		Remediation Well	X	--	--	--
SW-1	TBD	Proposed	2	4	5-18		Slant Remediation Well	--	--	--	--
SW-2	TBD	Proposed	3	4	5-18		Slant Remediation Well	--	--	--	--
SW-3	TBD	Proposed	4	4	5-18		Slant Remediation Well	--	--	--	--

Notes:

Monitoring Well	Existing monitoring well for groundwater level measurements only
Compliance Well	Existing monitoring well for groundwater compliance monitoring
Remediation Well	Existing injection/extraction remediation well
Remediation Well	Proposed new remediation well; easting and northing data are approximate
Slant Remediation Well	Proposed new slanted remediation well; easting and northing data are approximate

bgs = below ground surface
TBD = to be determined
X = Monitoring activity to be performed.
-- = not applicable

Estimated number of monitoring events (and samples from each well) do not include quality control (QC) samples such as trip blanks, duplicates, rinseate blanks, etc.
MPE = multiphase extraction

TABLE 2

SUMMARY OF SITE CLEANUP LEVELS AND SCREENING LEVELS
CIRCLE K 1461, SEATTLE, WA

Media / COCs	Value and Units	Cleanup Level / Screening Level Source
Soil		
Gasoline-Range Organics (GRO)	100 mg/kg (w/o benzene)	MTCA Method A Soil Cleanup Levels (CULs) for Unrestricted Land Use - Washington State Administrative Code (WAC) 173-340-740, Table 740-1.
	30 mg/kg (with benzene)	
Benzene	0.03 mg/kg	
Toluene	7 mg/kg	
Ethylbenzene	6 mg/kg	
Xylenes	9 mg/kg	
Groundwater		
Gasoline-Range Organics (GRO)	1,000 µg/L (w/o benzene)	MTCA Method A Groundwater CULs - WAC 173-340-720, Table 720-1.
	800 µg/L (with benzene)	
Benzene	5 µg/L	
Toluene	1,000 µg/L	
Ethylbenzene	700 µg/L	
Xylenes	1,000 µg/L	
Soil Gas / Vapor		
Gasoline-Range Organics (GRO)	1,500 µg/m^3 (425 ppbv)	MTCA Method B Noncancer Sub-Slab Soil Gas Screening Level - Cleanup Levels and Risk Calculation (CLARC) Vapor Intrusion Method B Table - July 2022
Benzene	460 µg/m^3 (140 ppbv)	
Toluene	76,000 µg/m^3 (20,160 ppbv)	
Ethylbenzene	15,000 µg/m^3 (3,450 ppbv)	
Xylenes	1,500 µg/m^3 (345 ppbv)	

Notes:

COCs = contaminants of concern

mg/kg = milligrams per kilogram

µg/L = micrograms per liter

µg/m^3 = micrograms per cubic meter

ppbv = parts per billion by volume

TABLE 3

MONITORING SCHEDULE
CIRCLE K 1461, SEATTLE, WA

Parameter	Media	Location	Frequency[(a)]	Equipment	Notes
Vacuum	Air	Individual Wells	Quarterly	Dwyer 477AV-3 Digital, Dwyer Magnehelic vacuum gauge, or equal.	See O&M Manual.
		Treatment System	Monthly	None	See O&M Manual Section 5.1.1 for exact pressure indicator numbers.
Barometric Pressure	Air	Ambient	Monthly	Dwyer 477AV-3 Digital, Dwyer Magnehelic vacuum gauge, or equal.	With measurement of vacuum at individual wells and treatment system locations. See O&M Manual.
Airflow	Air	Individual Wells	Quarterly for first year of operation, then as needed	Dwyer 471B Thermo-Anemometer, TSI TA430 Airflow Velocity meter, or equal.	See O&M Manual.
		Treatment System	Monthly	None	Air permit compliance, see O&M Manual. At FE/FIT 302.
VOC, Soil Gas Concentrations (Field, PID)[(b)]	Air	Individual Wells	Quarterly during Phase 1, then as needed	PID (MiniRAE 2000 or 3000 series, or equal)	Phase 1: Multi-phase Extraction
		Vapor Pins	Quarterly	Low-Detection PID (ppbRAE 3000 or equal) and Four-Gas Meter (RKI Eagle 2 or equal)	Protection Monitoring - see SAP/QAPP
		Sub-slab Depressurization Wells	Semiannually	Low-Detection PID (ppbRAE 3000 or equal) and Four-Gas Meter (RKI Eagle 2 or equal)	Protection Monitoring - see SAP/QAPP
		Treatment System	Quarterly	PID (MiniRAE 2000 or 3000 series, or equal)	Air permit compliance, see O&M manual
VOC Concentration (Lab)	Air	Individual Wells	At startup, then as needed	Summa Canister	
		Treatment System	Monthly for two quarters, then quarterly[(c)]	Summa Canister	Air permit compliance, see O&M manual
		Vapor Pins	As needed	Summa Canister	If elevated field soil gas results
		Sub-slab Depressurization Wells	As needed	Summa Canister	If elevated field soil gas results

TABLE 3

MONITORING SCHEDULE
CIRCLE K 1461, SEATTLE, WA

Parameter	Media	Location	Frequency[(a)]	Equipment	Notes
Groundwater Flow	Water	Individual Wells at Manifold	Monthly	None	Injection flowrate during Phase 2: Surfactant Reinjection and Phase 3: Enhanced Bioremediation.
		Treatment System	Monthly	None	See O&M Manual Section 5.1.3 for exact flow indicator numbers.
GRO/BTEX Concentration (Lab)	Water	Individual Wells at Wellhead	At startup, then quarterly and semiannual [(c)]	Pump, tubing, and glass sample jars	Performance monitoring wells, see SAP/QAPP
		Individual Wells at Wellhead	At startup, then monthly, quarterly, semiannual [(d)]	Pump, tubing, and glass sample jars	Subset of Performance monitoring wells, see SAP/QAPP
		Individual Wells at Wellhead	Quarterly after system shutdown	Pump, tubing, and glass sample jars	Confirmation monitoring at select wells, see SAP/QAPP
		Treatment System	Monthly for two quarters, then quarterly[(c)]	Glass sample jars	Discharge permit compliance
Nitrate/Orthophosphate (Lab)	Water	Individual Wells at Wellhead	Monthly at startup of Phases 2 & 3, then quarterly, semiannual	Glass sample jars	Subset of Performance monitoring wells Phases 2 & 3, see SAP/QAPP
		Discharge to Sanitary Sewer	Quarterly for first year of Phase 3, then semiannually	Glass sample jars	Injection/extraction schedule[(d)]
Noise	Air	Treatment Shed	Quarterly	Hand-held dBA noise level meter	City of Seattle noise ordinance[(e)]
Temperature	Air	Treatment System	Monthly	None	See O&M Manual.
		Ambient	Monthly	Dwyer 471B Thermo-Anemometer, TSI TA430 Airflow Velocity meter, or equal.	See O&M Manual.

Notes:

(a) Frequency will be adjusted over the life of the system. Blanks indicate no specified frequency.

(b) A portable four-gas meter will be used to measure concentrations of total volatile organic compounds (VOCs), oxygen, carbon dioxide, and combustible gas [(reported as percent lower explosive limit (%LEL)]. Total VOCs will also be measured using a portable photoionization detector (PID) (e.g., MiniRAE 2000 or 3000 series, or equal) and/or a low-detection PID (e.g. ppbRAE 3000, or equal).

(c) Monitoring at startup, monthly for 6 months, then after two years of quarterly monitoring, monitoring frequency shall be semiannual during remedial system operation.

(d) Subset of wells, monitoring at startup, monthly for 6 months, then combinations of monthly, quarterly, and semiannual monitoring during remedial system operation.

(e) If nitrate result is greater than 5 milligrams per liter (mg/L) or orthophosphate result is greater than 10 mg/L, the Idle Well Group timing should be increased.

(f) If the result is greater than 60 dBA, notify Kennedy Jenks personnel, determine the source of excessive noise, and implement sound reducing measures.

TABLE 4

SUMMARY OF CONFIRMATION SOIL SAMPLE COLLECTION
CIRCLE K 1461, SEATTLE, WA

	Count of Confirmation Soil Samples[a]					Count of Quality Control (QC) Samples			
	Confirmation Soil Borings (Minimum 2 samples per boring)				Total Soil Samples	QC Blind Field Duplicate	QC Trip Blank	QC Equipment Rinse Blank[b]	Total QC Samples
Phase	**Count of Soil Borings**	**GRO & BTEX (minimum)**	**GRO & BTEX (additional)**	**Moisture Content (1 per soil sample)**	**Per Event**	**GRO & BTEX**	**GRO & BTEX**	**GRO & BTEX**	**Per Event**
Confirmation	8	16	2	18	18	1	2	2	5
Total number of samples		16	2	18	18	1	2	2	5
Total number of events		1	1	1	1	1	1	1	1
Sample Matrix		soil	soil	soil	soil	soil	water	water	Soil & water

Notes:

(a) Minimum of two soil samples will be collected from each of eight (8) confirmation soil borings for laboratory analyses
- Total Petroleum Hydrocarbons as Gasoline Range Organics (GRO) by NWTPH-Gx
- Benzene, toluene, ethylbenzene, and xylenes (BTEX) by EPA Method 8260.
- EPA Sampling Method 5035 for GRO and BTEX samples
- Separate 8-ounce glass jar of soil will be collected for moisture content. Chemical results to be reported on dry weight basis by laboratory.

(b) QC Equipment Rinse Blank or Field Blank - To be determined if QC Field Blank samples or QC Equipment Rinse Samples required based on soil sampling tools.

TABLE 5

SUMMARY OF COMPLIANCE VAPOR MONITORING AND SAMPLE COLLECTION
CIRCLE K 1461, SEATTLE, WA

			Count of Field Vapor Measurements[a]					Count of Vapor Samples for Laboratory Analysis[b]						
			SSD Wells (3 wells)	Vapor Pins (4 pins)	Well Manifold (13 wells)	Treatment System (Influent, Midpoint, Effluent)	Total Samples	SSD Wells (3 wells)	Vapor Pins (4 pins)	Well Manifold (13 wells)	Treatment System (Influent, Effluent)	Total Samples	QC Blind Field Duplicate	Total QC Samples
Phase	**Sampling Event**	**Elapsed time (years)**	**Total VOCs, O_2, CO_2, Combustible Gas**	**Total VOCs, O_2, CO_2, Combustible Gas**	**Total VOCs**	**Total VOCs**	**Per Event**	**VOCs (including BTEX)[d]**	**VOCs (including BTEX)**	**VOCs (including BTEX)**	**VOCs (including BTEX)**	**Per Event**	**VOCs (including BTEX)**	**Per Event**
Phase 1	Startup	0	--	--	--	--	0	--	--	13	--	13	1	1
Phase 1	Monthly 1	--	--	4	13	5	22	--	--	--	2	2	0	0
Phase 1	Monthly 2	--	--	--	--	--	0	--	--	--	2	2	0	0
Phase 1	Monthly 3	0.25	--	--	--	--	0	--	--	--	2	2	0	0
Phase 1	Monthly 4	--	--	4	13	5	22	--	--	--	2	2	0	0
Phase 1	Monthly 5	--	--	--	--	--	0	--	--	--	2	2	0	0
Phase 1	Monthly 6	0.5	3	--	--	--	3	--	--	--	2	2	0	0
Phase 1	Quarterly 1	0.75	--	4	13	5	22	--	--	--	2	2	0	0
Phase 1	Quarterly 2	1	3	4	13	5	25	--	--	--	2	2	0	0
Phase 2	Quarterly 1	1.25	--	4	--	5	9	--	--	--	2	2	0	0
Phase 2	Quarterly 2	1.5	3	4	--	5	12	--	--	--	2	2	0	0
Phase 3	Quarterly 1	1.75	--	4	--	5	9	--	--	--	2	2	0	0
Phase 3	Quarterly 2	2	3	4	--	5	12	--	--	--	2	2	0	0
Phase 3	Quarterly 3	2.25	--	4	--	5	9	--	--	--	2	2	0	0
Phase 3	Quarterly 4	2.5	3	4	--	5	12	--	--	--	2	2	0	0
Phase 3	Semiannual 1	3	3	8	--	10	21	--	--	--	2	2	0	0
Phase 3	Semiannual 2	3.5	3	8	--	10	21	--	--	--	2	2	0	0
Phase 3	Semiannual 3	4	3	8	--	10	21	--	--	--	2	2	0	0
Phase 3	Semiannual 4	4.5	3	8	--	10	21	--	--	--	2	2	0	0
Phase 3	Semiannual 5	5	3	8	--	10	21	--	--	--	2	2	0	0
Phase 3	Semiannual 6	5.5	3	8	--	10	21	--	--	--	2	2	0	0
Phase 1 to 3	As Needed 1	--	--	--	13	--	13	3	4	13	--	Up to 20	1	1
Phase 1 to 3	As Needed 2	--	--	--	13	--	13	3	4	13	--	Up to 20	1	1
Phase 1 to 3	As Needed 3	--	--	--	13	--	13	3	4	13	--	Up to 20	1	1
Phase 1 to 3	As Needed 4	--	--	--	13	--	13	3	4	13	--	Up to 20	1	1
Phase 1 to 3	As Needed 5	--	--	--	13	--	13	3	4	--	--	Up to 7	0	0
Confirmation	Quarterly 1	5.75	--	4	--	--	4	--	--	--	--	0	--	0
Confirmation	Quarterly 2	6	3	4	--	--	7	--	--	--	--	0	--	0
Confirmation	Quarterly 3	6.25	--	4	--	--	4	--	--	--	--	0	--	0
Confirmation	Quarterly 4	6.5	3	4	--	--	7	--	--	--	--	0	--	0
Confirmation	Quarterly 5	6.75	--	4	--	--	4	--	--	--	--	0	--	0
Confirmation	Quarterly 6	7	3	4	--	--	7	--	--	--	--	0	--	0
Confirmation	Quarterly 7	7.25	--	4	--	--	4	--	--	--	--	0	--	0
Confirmation	Quarterly 8	7.5	3	4	--	--	7	--	--	--	--	0	--	0
Confirmation	Quarterly 9	7.75	--	4	--	--	4	--	--	--	--	0	--	0
Confirmation	Quarterly 10	8	3	4	--	--	7	--	--	--	--	0	--	0
First 22 Months of Operation: Total # of Field Measurements/Laboratory Samples			**12**	**32**	**52**	**40**	**136**	**0**	**0**	**13**	**24**	**37**	**1**	**1**
First 22 Months of Operation: # of Events			**4**	**8**	**4**	**8**	**9**	**0**	**0**	**1**	**12**	**13**	**1**	**1**
Total # of Field Measurements/ Laboratory Samples			**48**	**128**	**117**	**110**	**403**	**15**	**20**	**65**	**40**	**140**	**5**	**5**
Total # of Events			**16**	**32**	**9**	**16**	**32**	**5**	**5**	**5**	**20**	**26**	**5**	**5**

Notes:

(a) Collected using a standard photoionization detector (PID) or low-detection PID (ppb PID) (depending on concentration levels) for VOCs and four-gas meter for VOCs, Oxygen (O_2), Carbon Dioxide (CO_2), and Combustible Gas.

(b) Collected via summa canisters and submitted for laboratory analysis.

(c) Volatile organic compounds (VOCs) reported will include full list of VOCs compounds based on selected analytical laboratory, at a minimum including benzene, toluene, ethylbenzene, and total xylenes.

TABLE 6

SUMMARY OF COMPLIANCE WATER TREATMENT SYSTEM SAMPLE COLLECTION
CIRCLE K 1461, SEATTLE, WA

			Count of Water Samples for Laboratory Analysis				Count of Quality Control Samples		
			Treatment System (5 locations)[(a)]	Discharge to Sanitary Sewer (1 location)	Treatment System (As Needed)[(b)]	Total Samples	QC Blind Field Duplicate	QC Trip Blank	Total QC Samples
Phase	Sampling Event	Elapsed time (years)	GRO, BTEX, CVOCs, FOG, pH, Turbidity[(c)(d)]	NO3, PO4, GRO, BTEX, CVOCs, FOG, pH, Turbidity[(c)(d)]	NO3, PO4, GRO, BTEX, CVOCs, FOG, pH, Turbidity[(c)(d)]	Per Event	GRO, BTEX, CVOCs, FOG	GRO, BTEX, CVOCs	Per Event
Phase 1	Monthly 1	--	5	--	--	5	1	1	2
Phase 1	Monthly 2	--	5	--	--	5	1	1	2
Phase 1	Monthly 3	0.25	5	--	--	5	1	1	2
Phase 1	Monthly 4	--	5	--	--	5	1	1	2
Phase 1	Monthly 5	--	5	--	--	5	1	1	2
Phase 1	Monthly 6	0.5	5	--	--	5	1	1	2
Phase 1	Quarterly 1	0.75	5	--	--	5	1	1	2
Phase 1	Quarterly 2	1	5	--	--	5	1	1	2
Phase 2	Quarterly 1	1.25	5	--	--	5	1	1	2
Phase 2	Quarterly 2	1.5	5	--	--	5	1	1	2
Phase 3	Quarterly 1	1.75	5	1	--	6	1	1	2
Phase 3	Quarterly 2	2	5	1	--	6	1	1	2
Phase 3	Quarterly 3	2.25	5	1	--	6	1	1	2
Phase 3	Quarterly 4	2.5	5	1	--	6	1	1	2
Phase 3	Semiannual 1	3	5	1	--	6	1	1	2
Phase 3	Semiannual 2	3.5	5	1	--	6	1	1	2
Phase 3	Semiannual 3	4	5	1	--	6	1	1	2
Phase 3	Semiannual 4	4.5	5	1	--	6	1	1	2
Phase 3	Semiannual 5	5	5	1	--	6	1	1	2
Phase 3	Semiannual 6	5.5	5	1	--	6	1	1	2
Phase 1 to 3	As Needed 1	--	--	--	1	1	1	1	2
Phase 1 to 3	As Needed 2	--	--	--	1	1	1	1	2
Phase 1 to 3	As Needed 3	--	--	--	1	1	1	1	2
Phase 1 to 3	As Needed 4	--	--	--	1	1	1	1	2
Phase 1 to 3	As Needed 5	--	--	--	1	1	1	1	2
Phase 1 to 3	As Needed 6	--	--	--	1	1	1	1	2
Phase 1 to 3	As Needed 7	--	--	--	1	1	1	1	2
Phase 1 to 3	As Needed 8	--	--	--	1	1	1	1	2
Phase 1 to 3	As Needed 9	--	--	--	1	1	1	1	2
Phase 1 to 3	As Needed 10	--	--	--	1	1	1	1	2
22 Months of Operation: Number of samples			**60**	**2**	**0**	**62**	**12**	**12**	**24**
22 Months of Operation: Number of events			**12**	**2**	**0**	**12**	**12**	**12**	**12**
	Total number of samples		**100**	**10**	**10**	**120**	**30**	**30**	**60**
	Total number of events		**20**	**10**	**10**	**30**	**30**	**30**	**30**

Notes:
(a) Treatment System sample locations: Influent to liquid GAC vessel trains, midpoint of each train, effluent of each train.
(b) Samples collected from sampling ports or holding tanks to characterize wastewater if effluent limits are exceeded.
(c) Laboratory analyses:
GRO: Total Petroleum Hydrocarbons as Gasoline Range Organics (GRO)
BTEX: Benzene, Toluene, Ethylbenzene, and Total Xylenes
CVOCs: Selected chlorinated volatile organic compounds (CVOCs) including tetrachloroethylene (PCE), trichloroethylene (TCE),

TABLE 7

SUMMARY OF COMPLIANCE GROUNDWATER SAMPLE COLLECTION
CIRCLE K 1461, SEATTLE, WA

			Count of Monitoring Well Samples for Laboratory Analysis[(a)]							Count of Quality Control Samples for Laboratory Analysis				
			Off-Property Monitoring (4 wells)	Performance Monitoring (5 wells)	Performance Monitoring Subset (8 wells)				Total Well Samples	QC Blind Field Duplicate			QC Trip Blank	Total QC Samples
Phase	Sampling Event	Elapsed time (years)	GRO & BTEX	GRO & BTEX	Sampling Event	GRO & BTEX	Nitrate & Ortho-phosphate	MNA Parameters	Per Event	GRO & BTEX	Nitrate & Ortho-phosphate	MNA Parameters	GRO & BTEX	Per Event
Phase 1	Startup	0	4	5	Startup	8	--	--	17	1	--	--	3	4
Phase 1	Monthly 1		--	5	Monthly 1	8	--	--	13	1	--	--	2	3
Phase 1	Monthly 2		--	5	Monthly 2	8	--	--	13	1	--	--	2	3
Phase 1	Monthly 3	0.25	--	5	Monthly 3	8	--	--	13	1	--	--	2	3
Phase 1	Monthly 4		--	5	Monthly 4	8	--	--	13	1	--	--	2	3
Phase 1	Monthly 5		--	5	Monthly 5	8	--	--	13	1	--	--	2	3
Phase 1	Monthly 6	0.5	--	5	Monthly 6	8	--	--	13	1	--	--	2	3
Phase 1	Quarterly 1	0.75	--	5	Quarterly 1	8	--	--	13	1	--	--	2	3
Phase 1	Quarterly 2	1	--	5	Quarterly 2	8	--	--	13	1	--	--	2	3
Phase 2					Monthly 1	8	8	--	8	1	1	--	2	3
Phase 2					Monthly 2	8	8	--	8	1	1	--	2	3
Phase 2	Quarterly 1	1.25	--	5	Monthly 3	8	8	--	13	1	1	--	2	3
Phase 2	Quarterly 2	1.5	--	5	Quarterly 1	8	8	--	13	1	1	--	2	3
Phase 3					Monthly 1	8	8	--	8	1	1	--	2	3
Phase 3					Monthly 2	8	8	--	8	1	1	--	2	3
Phase 3	Quarterly 1	1.75	--	5	Monthly 3	8	8	--	13	1	1	--	2	3
Phase 3	Quarterly 2	2	--	5	Quarterly 1	8	8	--	13	1	1	--	2	3
Phase 3	Quarterly 3	2.25	--	5	Quarterly 2	8	8	--	13	1	1	--	2	3
Phase 3	Quarterly 4	2.5	--	5	Quarterly 3	8	8	--	13	1	1	--	2	3
Phase 3		2.75	--		Quarterly 4	8	8	--	8	1	1	--	2	3
Phase 3	Semiannual 1	3	--	5	Quarterly 5	8	8	--	13	1	1	--	2	3
Phase 3	Semiannual 2	3.5	--	5	Semiannual 1	8	8	--	13	1	1	--	2	3
Phase 3	Semiannual 3	4	--	5	Semiannual 2	8	8	--	13	1	1	--	2	3
Phase 3	Semiannual 4	4.5	--	5	Semiannual 3	8	8	--	13	1	1	--	2	3
Phase 3	Semiannual 5	5	--	5	Semiannual 4	8	8	--	13	1	1	--	2	3
Phase 3	Semiannual 6	5.5	--	5	Semiannual 5	8	8	--	13	1	1	--	2	3
Confirmation	Quarterly 1	5.75	--	5	Quarterly 1	8	--	8	13	1	--	1	2	3
Confirmation	Quarterly 2	6	--	5	Quarterly 2	8	--	--	13	1	--	--	2	3
Confirmation	Quarterly 3	6.25	--	5	Quarterly 3	8	--	8	13	1	--	1	2	3
Confirmation	Quarterly 4	6.5	--	5	Quarterly 4	8	--	--	13	1	--	--	2	3
Confirmation	Quarterly 5	6.75	--	5	Quarterly 5	8	--	--	13	1	--	--	2	3
Confirmation	Quarterly 6	7	--	5	Quarterly 6	8	--	--	13	1	--	--	2	3
Confirmation	Quarterly 7	7.25	--	5	Quarterly 7	8	--	--	13	1	--	--	2	3
Confirmation	Quarterly 8	7.5	--	5	Quarterly 8	8	--	--	13	1	--	--	2	3
Confirmation	Quarterly 9	7.75	--	5	Quarterly 9	8	--	--	13	1	--	--	2	3
Confirmation	Quarterly 10	8	--	5	Quarterly 10	8	--	--	13	1	--	--	2	3
22 Months of Operation: Number of samples			**4**	**65**		**136**	**64**	**0**	**205**	**17**	**8**	**0**	**35**	**52**
22 Months of Operation: Numberof events			**1**	**13**		**17**	**8**	**0**	**17**	**17**	**8**	**0**	**17**	**17**
	Total number of samples		**4**	**155**		**288**	**136**	**16**	**447**	**36**	**17**	**2**	**73**	**109**
	Total number of events		**1**	**31**		**36**	**17**	**2**	**36**	**36**	**17**	**2**	**36**	**36**

Notes:

(a) Groundwater samples will be collected from up to 17 monitoring wells during each event. The wells have been divided into three groups based on sampling frequency and laboratory analyses:
- Off-Property Monitoring (4 wells) sampled at startup only: MW-2, MW-7, MW-10, and MW-11.
- Performance Monitoring (5 wells): MW-6, MW-15, MW-17, MW-18, and RW-1
- Performance Monitoring Subset (8 wells) (more frequent monitoring and additional laboratory analyses during Phases 2 and 3): MW-8, MW-9, MW-13, MW-14, MW-16, MW-19, MW-20, and MW-21

(b) Groundwater and Quality Control samples will be submitted for analysis of one or more of the following. Refer to SAP/QAPP for analytical methods.
- Total Petroleum Hydrocarbons as Gasoline Range Organics (GRO) by NWTPH-Gx, and Benzene, toluene, ethylbenzene, and xylenes (BTEX) by EPA Method 8260.
- Nitrate and Total Orthophosphate - See SAPP/QAPP for laboratory analytical methods.
- Monitored natural attenuation (MNA) Parameters: nitrate, sulfate, dissolved manganese, dissolved iron, and methane - See SAPP/QAPP for laboratory analytical methods.

TABLE 8

SUMMARY OF TARGET PQLS FOR SOIL SAMPLES
CIRCLE K 1461, SEATTLE, WA

Analyte	CAS Number	Method	MDL	Target PQL	Units
NWTPH-Gx					
GASOLINE RANGE ORGANICS (C6-C12)	GROC6C12	NWTPHGX	0.0339	0.1	mg/kg
NWTPH-Dx Without Silica Gel Cleanup					
DIESEL RANGE ORGANICS	DRO2	NWTPHDX-SGT		4	mg/kg
RESIDUAL RANGE ORGANICS	RRO	NWTPHDX-SGT		10	mg/kg
Volatile Organic Compounds					
ACETONE	67-64-1	SW8260B	0.0365	0.05	mg/kg
ACRYLONITRILE	107-13-1	SW8260B	0.0036	0.0125	mg/kg
BENZENE	71-43-2	SW8260B	0.0005	0.001	mg/kg
BROMOBENZENE	108-86-1	SW8260B	0.0009	0.0125	mg/kg
BROMODICHLOROMETHANE	75-27-4	SW8260B	0.0007	0.0025	mg/kg
BROMOFORM	75-25-2	SW8260B	0.0012	0.025	mg/kg
BROMOMETHANE	74-83-9	SW8260B	0.0020	0.0125	mg/kg
N-BUTYLBENZENE	104-51-8	SW8260B	0.0053	0.0125	mg/kg
SEC-BUTYLBENZENE	135-98-8	SW8260B	0.0029	0.0125	mg/kg
TERT-BUTYLBENZENE	98-06-6	SW8260B	0.0020	0.005	mg/kg
CARBON TETRACHLORIDE	56-23-5	SW8260B	0.0009	0.005	mg/kg
CHLOROBENZENE	108-90-7	SW8260B	0.0002	0.0025	mg/kg
DIBROMOCHLOROMETHANE	124-48-1	SW8260B	0.0006	0.0025	mg/kg
CHLOROETHANE	75-00-3	SW8260B	0.0017	0.005	mg/kg
CHLOROFORM	67-66-3	SW8260B	0.0010	0.0025	mg/kg
CHLOROMETHANE	74-87-3	SW8260B	0.0044	0.0125	mg/kg
2-CHLOROTOLUENE	95-49-8	SW8260B	0.0009	0.0025	mg/kg
4-CHLOROTOLUENE	106-43-4	SW8260B	0.0005	0.005	mg/kg
1,2-DIBROMO-3-CHLOROPROPANE (DBCP)	96-12-8	SW8260B	0.0039	0.025	mg/kg
1,2-DIBROMOETHANE	106-93-4	SW8260B	0.0006	0.0025	mg/kg
DIBROMOMETHANE	74-95-3	SW8260B	0.0008	0.005	mg/kg
1,2-DICHLOROBENZENE	95-50-1	SW8260B	0.0004	0.005	mg/kg
1,3-DICHLOROBENZENE	541-73-1	SW8260B	0.0006	0.005	mg/kg
1,4-DICHLOROBENZENE	106-46-7	SW8260B	0.0007	0.005	mg/kg
DICHLORODIFLUOROMETHANE	75-71-8	SW8260B	0.0016	0.0025	mg/kg
1,1-DICHLOROETHANE	75-34-3	SW8260B	0.0005	0.0025	mg/kg
1,2-DICHLOROETHANE	107-06-2	SW8260B	0.0006	0.0025	mg/kg
1,1-DICHLOROETHENE	75-35-4	SW8260B	0.0006	0.0025	mg/kg
CIS-1,2-DICHLOROETHENE	156-59-2	SW8260B	0.0007	0.0025	mg/kg
TRANS-1,2-DICHLOROETHENE	156-60-5	SW8260B	0.0010	0.005	mg/kg
1,2-DICHLOROPROPANE	78-87-5	SW8260B	0.0014	0.005	mg/kg
1,1-DICHLOROPROPENE	563-58-6	SW8260B	0.0008	0.0025	mg/kg
1,3-DICHLOROPROPANE	142-28-9	SW8260B	0.0005	0.005	mg/kg
CIS-1,3-DICHLOROPROPENE	10061-01-5	SW8260B	0.0008	0.0025	mg/kg
TRANS-1,3-DICHLOROPROPENE	10061-02-6	SW8260B	0.0011	0.005	mg/kg
2,2-DICHLOROPROPANE	594-20-7	SW8260B	0.0014	0.0025	mg/kg
DI-ISOPROPYL ETHER (DIPE)	108-20-3	SW8260B	0.0004	0.001	mg/kg
ETHYLBENZENE	100-41-4	SW8260B	0.0007	0.0025	mg/kg
HEXACHLOROBUTADIENE	87-68-3	SW8260B	0.0060	0.025	mg/kg
ISOPROPYLBENZENE	98-82-8	SW8260B	0.0004	0.0025	mg/kg
CYMENE (P-ISOPROPYLTOLUENE)	99-87-6	SW8260B	0.0026	0.005	mg/kg
METHYL ETHYL KETONE (2-BUTANONE)	78-93-3	SW8260B	0.0635	0.1	mg/kg
METHYLENE CHLORIDE	75-09-2	SW8260B	0.0066	0.025	mg/kg
METHYL ISOBUTYL KETONE (MIBK)	108-10-1	SW8260B	0.0023	0.025	mg/kg
METHYL TERT-BUTYL ETHER	1634-04-4	SW8260B	0.0004	0.001	mg/kg
NAPHTHALENE	91-20-3	SW8260B	0.0049	0.0125	mg/kg
N-PROPYLBENZENE	103-65-1	SW8260B	0.0010	0.005	mg/kg
STYRENE	100-42-5	SW8260B	0.0002	0.0125	mg/kg
1,1,1,2-TETRACHLOROETHANE	630-20-6	SW8260B	0.0009	0.0025	mg/kg
1,1,2,2-TETRACHLOROETHANE	79-34-5	SW8260B	0.0007	0.0025	mg/kg
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE (FREON 113)	76-13-1	SW8260B	0.0008	0.0025	mg/kg
TETRACHLOROETHENE (PCE)	127-18-4	SW8260B	0.0009	0.0025	mg/kg
TOLUENE	108-88-3	SW8260B	0.0013	0.005	mg/kg
1,2,3-TRICHLOROBENZENE	87-61-6	SW8260B	0.0073	0.0125	mg/kg
1,2,4-TRICHLOROBENZENE	120-82-1	SW8260B	0.0044	0.0125	mg/kg
1,1,1-TRICHLOROETHANE	71-55-6	SW8260B	0.0009	0.0025	mg/kg

SUMMARY OF TARGET PQLS FOR SOIL SAMPLES
CIRCLE K 1461, SEATTLE, WA

Analyte	CAS Number	Method	MDL	Target PQL	Units
1,1,2-TRICHLOROETHANE	79-00-5	SW8260B	0.0006	0.0025	mg/kg
TRICHLOROETHENE (TCE)	79-01-6	SW8260B	0.0006	0.001	mg/kg
TRICHLOROFLUOROMETHANE	75-69-4	SW8260B	0.0008	0.0025	mg/kg
1,2,3-TRICHLOROPROPANE	96-18-4	SW8260B	0.0016	0.0125	mg/kg
1,2,4-TRIMETHYLBENZENE	95-63-6	SW8260B	0.0016	0.005	mg/kg
1,2,3-TRIMETHYLBENZENE	526-73-8	SW8260B	0.0016	0.005	mg/kg
1,3,5-TRIMETHYLBENZENE	108-67-8	SW8260B	0.0020	0.005	mg/kg
VINYL CHLORIDE	75-01-4	SW8260B	0.0012	0.0025	mg/kg
XYLENE, TOTAL	1330-20-7	SW8260B	0.0009	0.0065	mg/kg
Polycyclic Aromatic Hydrocarbons (PAHs) -SIM					
ANTHRACENE	120-12-7	SW8270CSIM	0.002	0.006	mg/kg
ACENAPHTHENE	83-32-9	SW8270CSIM	0.002	0.006	mg/kg
ACENAPHTHYLENE	208-96-8	SW8270CSIM	0.002	0.006	mg/kg
BENZO(A)ANTHRACENE	56-55-3	SW8270CSIM	0.002	0.006	mg/kg
BENZO(A)PYRENE	50-32-8	SW8270CSIM	0.002	0.006	mg/kg
BENZO(B)FLUORANTHENE	205-99-2	SW8270CSIM	0.002	0.006	mg/kg
BENZO(G,H,I)PERYLENE	191-24-2	SW8270CSIM	0.002	0.006	mg/kg
BENZO(K)FLUORANTHENE	207-08-9	SW8270CSIM	0.002	0.006	mg/kg
CHRYSENE	218-01-9	SW8270CSIM	0.002	0.006	mg/kg
DIBENZ(A,H)ANTHRACENE	53-70-3	SW8270CSIM	0.002	0.006	mg/kg
FLUORANTHENE	206-44-0	SW8270CSIM	0.002	0.006	mg/kg
FLUORENE	86-73-7	SW8270CSIM	0.002	0.006	mg/kg
INDENO(1,2,3-C,D)PYRENE	193-39-5	SW8270CSIM	0.002	0.006	mg/kg
NAPHTHALENE	91-20-3	SW8270CSIM	0.004	0.02	mg/kg
PHENANTHRENE	85-01-8	SW8270CSIM	0.002	0.006	mg/kg
PYRENE	129-00-0	SW8270CSIM	0.002	0.006	mg/kg
1-METHYLNAPHTHALENE	90-12-0	SW8270CSIM	0.004	0.02	mg/kg
2-METHYLNAPHTHALENE	91-57-6	SW8270CSIM	0.004	0.02	mg/kg
2-CHLORONAPHTHALENE	91-58-7	SW8270CSIM	0.005	0.02	mg/kg
Semi-Volatile Organic Compounds					
ACENAPHTHENE	83-32-9	SW8270C	0.0054	0.0333	mg/kg
ACENAPHTHYLENE	208-96-8	SW8270C	0.0047	0.0333	mg/kg
ANTHRACENE	120-12-7	SW8270C	0.0059	0.0333	mg/kg
BENZIDINE	92-87-5	SW8270C	0.0626	1.67	mg/kg
BENZO(A)ANTHRACENE	56-55-3	SW8270C	0.0059	0.0333	mg/kg
BENZO(B)FLUORANTHENE	205-99-2	SW8270C	0.0062	0.0333	mg/kg
BENZO(K)FLUORANTHENE	207-08-9	SW8270C	0.0059	0.0333	mg/kg
BENZO(G,H,I)PERYLENE	191-24-2	SW8270C	0.0061	0.0333	mg/kg
BENZO(A)PYRENE	50-32-8	SW8270C	0.0062	0.0333	mg/kg
BIS(2-CHLOROETHOXY) METHANE	111-91-1	SW8270C	0.0100	0.333	mg/kg
BIS(2-CHLOROETHYL) ETHER	111-44-4	SW8270C	0.0110	0.333	mg/kg
2,2'-OXYBIS(1-CHLORO)PROPANE	108-60-1	SW8270C	0.0144	0.333	mg/kg
4-BROMOPHENYL PHENYL ETHER	101-55-3	SW8270C	0.0117	0.333	mg/kg
2-CHLORONAPHTHALENE	91-58-7	SW8270C	0.0059	0.0333	mg/kg
4-CHLOROPHENYL PHENYL ETHER	7005-72-3	SW8270C	0.0116	0.333	mg/kg
CHRYSENE	218-01-9	SW8270C	0.0066	0.0333	mg/kg
DIBENZ(A,H)ANTHRACENE	53-70-3	SW8270C	0.0092	0.0333	mg/kg
1,2-DICHLOROBENZENE	95-50-1	SW8270C	0.0099	0.333	mg/kg
1,3-DICHLOROBENZENE	541-73-1	SW8270C	0.0101	0.333	mg/kg
1,4-DICHLOROBENZENE	106-46-7	SW8270C	0.0099	0.333	mg/kg
3,3'-DICHLOROBENZIDINE	91-94-1	SW8270C	0.0123	0.333	mg/kg
2,4-DINITROTOLUENE	121-14-2	SW8270C	0.0096	0.333	mg/kg
2,6-DINITROTOLUENE	606-20-2	SW8270C	0.0109	0.333	mg/kg
FLUORANTHENE	206-44-0	SW8270C	0.0060	0.0333	mg/kg
FLUORENE	86-73-7	SW8270C	0.0054	0.0333	mg/kg
HEXACHLOROBENZENE	118-74-1	SW8270C	0.0118	0.333	mg/kg
HEXACHLOROBUTADIENE	87-68-3	SW8270C	0.0112	0.333	mg/kg
HEXACHLOROCYCLOPENTADIENE	77-47-4	SW8270C	0.0175	0.333	mg/kg
HEXACHLOROETHANE	67-72-1	SW8270C	0.0131	0.333	mg/kg
INDENO(1,2,3-C,D)PYRENE	193-39-5	SW8270C	0.0094	0.0333	mg/kg
ISOPHORONE	78-59-1	SW8270C	0.0102	0.333	mg/kg
NAPHTHALENE	91-20-3	SW8270C	0.0084	0.0333	mg/kg
NITROBENZENE	98-95-3	SW8270C	0.0116	0.333	mg/kg

SUMMARY OF TARGET PQLS FOR SOIL SAMPLES
CIRCLE K 1461, SEATTLE, WA

Analyte	CAS Number	Method	MDL	Target PQL	Units
N-NITROSODIMETHYLAMINE	62-75-9	SW8270C	0.0494	0.333	mg/kg
N-NITROSODIPHENYLAMINE	86-30-6	SW8270C	0.0252	0.333	mg/kg
N-NITROSODI-N-PROPYLAMINE	621-64-7	SW8270C	0.0111	0.333	mg/kg
PHENANTHRENE	85-01-8	SW8270C	0.0066	0.0333	mg/kg
BENZYL BUTYL PHTHALATE	85-68-7	SW8270C	0.0104	0.333	mg/kg
BIS(2-ETHYLHEXYL) PHTHALATE	117-81-7	SW8270C	0.0422	0.333	mg/kg
DI-N-BUTYL PHTHALATE	84-74-2	SW8270C	0.0114	0.333	mg/kg
DIETHYL PHTHALATE	84-66-2	SW8270C	0.0110	0.333	mg/kg
DIMETHYL PHTHALATE	131-11-3	SW8270C	0.0706	0.333	mg/kg
DI-N-OCTYL PHTHALATE	117-84-0	SW8270C	0.0225	0.333	mg/kg
PYRENE	129-00-0	SW8270C	0.0065	0.0333	mg/kg
1,2,4-TRICHLOROBENZENE	120-82-1	SW8270C	0.0104	0.333	mg/kg
4-CHLORO-3-METHYLPHENOL (CRESOL)	59-50-7	SW8270C	0.0108	0.333	mg/kg
2-CHLOROPHENOL	95-57-8	SW8270C	0.0110	0.333	mg/kg
2,4-DICHLOROPHENOL	120-83-2	SW8270C	0.0097	0.333	mg/kg
2,4-DIMETHYLPHENOL	105-67-9	SW8270C	0.0087	0.333	mg/kg
4,6-DINITRO-2-METHYLPHENOL	534-52-1	SW8270C	0.0755	0.333	mg/kg
2,4-DINITROPHENOL	51-28-5	SW8270C	0.0779	0.333	mg/kg
2-NITROPHENOL	88-75-5	SW8270C	0.0119	0.333	mg/kg
4-NITROPHENOL	100-02-7	SW8270C	0.0104	0.333	mg/kg
PENTACHLOROPHENOL	87-86-5	SW8270C	0.0090	0.333	mg/kg
PHENOL	108-95-2	SW8270C	0.0134	0.333	mg/kg
2,4,6-TRICHLOROPHENOL	88-06-2	SW8270C	0.0107	0.333	mg/kg
Metals					
ARSENIC	7440-38-2	SW6010B	0.52	2	mg/kg
BARIUM	7440-39-3	SW6010B	0.09	0.5	mg/kg
CADMIUM	7440-43-9	SW6010B	0.05	0.5	mg/kg
CHROMIUM, TOTAL	7440-47-3	SW6010B	0.13	1	mg/kg
LEAD	7439-92-1	SW6010B	0.21	0.5	mg/kg
SELENIUM	7782-49-2	SW6010B	0.76	2	mg/kg
SILVER	7440-22-4	SW6010B	0.13	1	mg/kg
Mercury					
MERCURY	7439-97-6	SW7471A	0.02	0.04	mg/kg
Conventional Parameters					
BROMIDE	24959-67-9	SW9056A	3.55	10	mg/kg
CHLORIDE (AS CL)	16887-00-6	SW9056A	9.20	20	mg/kg
FLUORIDE	16984-48-8	SW9056A	0.86	2	mg/kg
NITROGEN, NITRATE (AS N)	N_NO3	SW9056A	0.56	10	mg/kg
NITRITE	NO2	SW9056A	0.51	10	mg/kg
NITROGEN, NITRATE-NITRITE	NO3NO2N	SW9056A	1.06	20	mg/kg
SULFATE (AS SO4)	14808-79-8	SW9056A	12.9	50	mg/kg
PHOSPHORUS, TOTAL ORTHOPHOSPHATE (AS P)	PORTHO	SW9056A	0.36	1	mg/kg
PHOSPHORUS, TOTAL	7723-14-0	SW9056A	0.79	2	mg/kg
GUANIDINE NITRATE	506-93-4	SW9056MOD	2.15	5	mg/kg
PHOSPHATE, ORTHO-	14265-44-2	SW9056A	1.19	5	mg/kg
Organochlorine Pesticides					
ALDRIN	309-00-2	SW8081	0.004	0.02	mg/kg
ALPHA BHC (ALPHA HEXACHLOROCYCLOHEXANE)	319-84-6	SW8081	0.004	0.02	mg/kg
BETA BHC (BETA HEXACHLOROCYCLOHEXANE)	319-85-7	SW8081	0.004	0.02	mg/kg
DELTA BHC (DELTA HEXACHLOROCYCLOHEXANE)	319-86-8	SW8081	0.003	0.02	mg/kg
GAMMA-BHC (LINDANE)	58-89-9	SW8081	0.003	0.02	mg/kg
CHLORDANE	12789-03-6	SW8081	0.103	0.3	mg/kg
4,4'-DDD	72-54-8	SW8081	0.004	0.02	mg/kg
4,4'-DDE	72-55-9	SW8081	0.004	0.02	mg/kg
4,4'-DDT	50-29-3	SW8081	0.006	0.02	mg/kg
DIELDRIN	60-57-1	SW8081	0.003	0.02	mg/kg
ENDOSULFAN	115-29-7	SW8081	0.004	0.02	mg/kg
BETA ENDOSULFAN (ENDOSULFAN II)	33213-65-9	SW8081	0.003	0.02	mg/kg
ENDOSULFAN SULFATE	1031-07-8	SW8081	0.004	0.02	mg/kg
ENDRIN	72-20-8	SW8081	0.004	0.02	mg/kg
ENDRIN ALDEHYDE	7421-93-4	SW8081	0.003	0.02	mg/kg
ENDRIN KETONE	53494-70-5	SW8081	0.007	0.02	mg/kg

SUMMARY OF TARGET PQLS FOR SOIL SAMPLES
CIRCLE K 1461, SEATTLE, WA

Analyte	CAS Number	Method	MDL	Target PQL	Units
HEXACHLOROBENZENE	118-74-1	SW8081	0.003	0.02	mg/kg
HEPTACHLOR	76-44-8	SW8081	0.004	0.02	mg/kg
HEPTACHLOR EPOXIDE	1024-57-3	SW8081	0.003	0.02	mg/kg
METHOXYCHLOR	72-43-5	SW8081	0.005	0.02	mg/kg
TOXAPHENE	8001-35-2	SW8081	0.124	0.4	mg/kg
Herbicides					
2,4-D (2-(2,4-DICHLOROPHENOXY)-ACETIC ACID))	94-75-7	SW8151	0.01	0.07	mg/kg
DALAPON	75-99-0	SW8151	0.01	0.07	mg/kg
2,4-DB (4-(2,4-DICHLOROPHENOXY)BUTANOIC ACID)	94-82-6	SW8151	0.03	0.07	mg/kg
DICAMBA	1918-00-9	SW8151	0.02	0.07	mg/kg
DICHLORPROP	120-36-5	SW8151	0.02	0.07	mg/kg
DINOSEB	88-85-7	SW8151	0.01	0.07	mg/kg
MCPA (2-METHYL-4-CHLOROPHENOXY ACETIC ACID)	94-74-6	SW8151	0.44	6.5	mg/kg
MCPP (2-(2-METHYL-4-CHLOROPHENOXY) PROPANOIC ACID)	93-65-2	SW8151	0.37	6.5	mg/kg
2,4,5-T (ACETIC ACID, (2,4,5-TRICHLOROPHENOXY)-)	93-76-5	SW8151	0.01	0.07	mg/kg
2,4,5-TP (SILVEX)	93-72-1	SW8151	0.01	0.07	mg/kg
Polychlorinated Biphenyls (PCBs)					
PCB-1016 (Aroclor 1016)	12674-11-2	SW8082	0.01	0.034	mg/kg
PCB-1221 (Aroclor 1221)	11104-28-2	SW8082	0.01	0.034	mg/kg
PCB-1232 (Aroclor 1232)	11141-16-5	SW8082	0.01	0.034	mg/kg
PCB-1242 (Aroclor 1242)	53469-21-9	SW8082	0.01	0.034	mg/kg
PCB-1248 (Aroclor 1248)	12672-29-6	SW8082	0.01	0.017	mg/kg
PCB-1254 (Aroclor 1254)	11097-69-1	SW8082	0.01	0.017	mg/kg
PCB-1260 (Aroclor 1260)	11096-82-5	SW8082	0.01	0.017	mg/kg
Herbicides by HPLC					
2,4-D (2-(2,4-dichlorophenoxy)-acetic acid))	94-75-7	SW8321	0.005	0.02	mg/kg
DALAPON	75-99-0	SW8321	0.003	0.02	mg/kg
2,4-DB (4-(2,4-dichlorophenoxy)butanoic acid)	94-82-6	SW8321	0.009	0.02	mg/kg
DICAMBA	1918-00-9	SW8321	0.004	0.02	mg/kg
DICHLORPROP	120-36-5	SW8321	0.003	0.02	mg/kg
DINOSEB	88-85-7	SW8321	0.002	0.02	mg/kg
MCPA (2-methyl-4-chlorophenoxy acetic acid)	94-74-6	SW8321	0.003	0.02	mg/kg
MCPP (2-(2-methyl-4-chlorophenoxy) propanoic acid)	93-65-2	SW8321	0.002	0.02	mg/kg
2,4,5-T (Acetic acid, (2,4,5-trichlorophenoxy)-)	93-76-5	SW8321	0.007	0.02	mg/kg
2,4,5-TP (SILVEX)	93-72-1	SW8321	0.002	0.02	mg/kg

Notes:

(a) Target Practical Quantitation Level (PQL) values presented in this table are based on method reporting limits (MRLs) from Pace National Analytical, Mt Juliet, Tennessee (Pace).

(b) PQLs from selected analytical laboratories to be verified prior to start of field sampling activities.

Abbreviations:

na = not applicable for matrix
µg/kg = micrograms per kilogram
µg/L = micrograms per liter
mg/kg = milligrams per kilogram
pg/g = picograms per gram
PQL = Practical Quantitation Limit
MRL = Method Reporting Limit
SIM = Select Ion Monitoring

TABLE 9

SUMMARY OF TARGET PQLS FOR VAPOR AND SOIL GAS SAMPLES
CIRCLE K 1461, SEATTLE, WA

Analyte	CAS Number	Method	MDL	PQL	Units
Volatile Organic Compounds					
ACETONE	67-64-1	TO-15	0.58	1.25	ppbv
ALLYL CHLORIDE (3-CHLOROPROPENE)	107-05-1	TO-15	0.11	0.20	ppbv
BENZENE	71-43-2	TO-15	0.07	0.20	ppbv
BENZYL CHLORIDE	100-44-7	TO-15	0.06	0.20	ppbv
BROMODICHLOROMETHANE	75-27-4	TO-15	0.07	0.20	ppbv
BROMOFORM	75-25-2	TO-15	0.07	0.60	ppbv
BROMOMETHANE	74-83-9	TO-15	0.10	0.20	ppbv
1,3-BUTADIENE	106-99-0	TO-15	0.10	2.00	ppbv
CARBON DISULFIDE	75-15-0	TO-15	0.10	0.20	ppbv
CARBON TETRACHLORIDE	56-23-5	TO-15	0.07	0.20	ppbv
CHLOROBENZENE	108-90-7	TO-15	0.08	0.20	ppbv
CHLOROETHANE	75-00-3	TO-15	0.10	0.20	ppbv
CHLOROFORM	67-66-3	TO-15	0.07	0.20	ppbv
CHLOROMETHANE	74-87-3	TO-15	0.10	0.20	ppbv
2-CHLOROTOLUENE	95-49-8	TO-15	0.08	0.20	ppbv
CYCLOHEXANE	110-82-7	TO-15	0.08	0.20	ppbv
DIBROMOCHLOROMETHANE	124-48-1	TO-15	0.07	0.20	ppbv
1,2-DIBROMOETHANE	106-93-4	TO-15	0.07	0.20	ppbv
1,2-DICHLOROBENZENE	95-50-1	TO-15	0.13	0.20	ppbv
1,3-DICHLOROBENZENE	541-73-1	TO-15	0.18	0.20	ppbv
1,4-DICHLOROBENZENE	106-46-7	TO-15	0.06	0.20	ppbv
1,2-DICHLOROETHANE	107-06-2	TO-15	0.07	0.20	ppbv
1,1-DICHLOROETHANE	75-34-3	TO-15	0.07	0.20	ppbv
1,1-DICHLOROETHENE	75-35-4	TO-15	0.08	0.20	ppbv
CIS-1,2-DICHLOROETHENE	156-59-2	TO-15	0.08	0.20	ppbv
TRANS-1,2-DICHLOROETHENE	156-60-5	TO-15	0.07	0.20	ppbv
1,2-DICHLOROPROPANE	78-87-5	TO-15	0.08	0.20	ppbv
CIS-1,3-DICHLOROPROPENE	10061-01-5	TO-15	0.07	0.20	ppbv
TRANS-1,3-DICHLOROPROPENE	10061-02-6	TO-15	0.07	0.20	ppbv
1,4-DIOXANE (P-DIOXANE)	123-91-1	TO-15	0.08	0.20	ppbv
ETHANOL	64-17-5	TO-15	0.27	1.25	ppbv
ETHYLBENZENE	100-41-4	TO-15	0.08	0.20	ppbv
4-ETHYLTOLUENE	622-96-8	TO-15	0.08	0.20	ppbv
TRICHLOROFLUOROMETHANE	75-69-4	TO-15	0.08	0.20	ppbv
DICHLORODIFLUOROMETHANE	75-71-8	TO-15	0.14	0.20	ppbv
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE (FREON 113)	76-13-1	TO-15	0.08	0.20	ppbv
1,2-DICHLOROTETRAFLUOROETHANE	76-14-2	TO-15	0.09	0.20	ppbv
N-HEPTANE	142-82-5	TO-15	0.10	0.20	ppbv
HEXACHLOROBUTADIENE	87-68-3	TO-15	0.11	0.63	ppbv
N-HEXANE	110-54-3	TO-15	0.21	0.63	ppbv
ISOPROPYLBENZENE	98-82-8	TO-15	0.08	0.20	ppbv
METHYLENE CHLORIDE	75-09-2	TO-15	0.10	0.20	ppbv
2-HEXANONE	591-78-6	TO-15	0.13	1.25	ppbv
METHYL ETHYL KETONE (2-BUTANONE)	78-93-3	TO-15	0.08	1.25	ppbv
METHYL ISOBUTYL KETONE (MIBK)	108-10-1	TO-15	0.08	1.25	ppbv
METHYL METHACRYLATE	80-62-6	TO-15	0.09	0.20	ppbv
METHYL TERT-BUTYL ETHER	1634-04-4	TO-15	0.06	0.20	ppbv
NAPHTHALENE	91-20-3	TO-15	0.35	0.63	ppbv
ISOPROPANOL	67-63-0	TO-15	0.26	1.25	ppbv
PROPYLENE	115-07-1	TO-15	0.09	1.25	ppbv

SUMMARY OF TARGET PQLS FOR VAPOR AND SOIL GAS SAMPLES
CIRCLE K 1461, SEATTLE, WA

Analyte	CAS Number	Method	MDL	PQL	Units
STYRENE	100-42-5	TO-15	0.08	0.20	ppbv
1,1,2,2-TETRACHLOROETHANE	79-34-5	TO-15	0.07	0.20	ppbv
TETRACHLOROETHENE (PCE)	127-18-4	TO-15	0.08	0.20	ppbv
TETRAHYDROFURAN	109-99-9	TO-15	0.07	0.20	ppbv
TOLUENE	108-88-3	TO-15	0.09	0.50	ppbv
1,2,4-TRICHLOROBENZENE	120-82-1	TO-15	0.15	0.63	ppbv
1,1,1-TRICHLOROETHANE	71-55-6	TO-15	0.07	0.20	ppbv
1,1,2-TRICHLOROETHANE	79-00-5	TO-15	0.08	0.20	ppbv
TRICHLOROETHENE (TCE)	79-01-6	TO-15	0.07	0.20	ppbv
1,2,4-TRIMETHYLBENZENE	95-63-6	TO-15	0.08	0.20	ppbv
1,3,5-TRIMETHYLBENZENE	108-67-8	TO-15	0.08	0.20	ppbv
2,2,4-TRIMETHYLPENTANE	540-84-1	TO-15	0.13	0.20	ppbv
VINYL CHLORIDE	75-01-4	TO-15	0.09	0.20	ppbv
BROMOETHENE (VINYL BROMIDE)	593-60-2	TO-15	0.09	0.20	ppbv
VINYL ACETATE	108-05-4	TO-15	0.12	0.20	ppbv
XYLENE, TOTAL	1330-20-7	TO-15	0.14	0.60	ppbv
XYLENE, M,P-	XYLENES1314	TO-15	0.14	0.40	ppbv
XYLENE, O-	95-47-6	TO-15	0.08	0.20	ppbv
TPH GC/MS LOW FRACTION	8006-61-9	TO-15	39.7	200	ppbv

Notes:

(a) Target Practical Quantitation Level (PQL) values presented in this table are based on method reporting limits (MRLs) from Pace National Analytical, Mt Juliet, Tennessee (Pace).

(b) PQLs from selected analytical laboratories to be verified prior to start of field sampling activities.

Abbreviations:

na = not applicable for matrix

ppbv = parts per billion by volume

PQL = Practical Quantitation Limit

MRL = Method Reporting Limit

TABLE 10

SUMMARY OF TARGET PQLS FOR WATER SAMPLES
CIRCLE K 1461, SEATTLE, WA

Analyte	CAS Number	METHOD	MDL	Target PQL	Units
NWTPH-Gx					
TOTAL PETROLEUM HYDROCARBONS (TPH) (C6-C12)	TPHC6C12	NWTPHGX	31.6	100	ug/L
NWTPH-Dx without silica gel cleanup					
DIESEL RANGE ORGANICS	DRO2	NWTPHDX-SGT		200	ug/L
RESIDUAL RANGE ORGANICS	RRO	NWTPHDX-SGT		250	ug/L
Volatile Organic Compounds					
ACETONE	67-64-1	SW8260B	11.3	50	ug/L
ACROLEIN	107-02-8	SW8260B	2.54	50	ug/L
ACRYLONITRILE	107-13-1	SW8260B	0.671	10	ug/L
BENZENE	71-43-2	SW8260B	0.0941	1	ug/L
BROMOBENZENE	108-86-1	SW8260B	0.118	1	ug/L
BROMODICHLOROMETHANE	75-27-4	SW8260B	0.136	1	ug/L
BROMOFORM	75-25-2	SW8260B	0.129	1	ug/L
BROMOMETHANE	74-83-9	SW8260B	0.605	5	ug/L
N-BUTYLBENZENE	104-51-8	SW8260B	0.157	1	ug/L
SEC-BUTYLBENZENE	135-98-8	SW8260B	0.125	1	ug/L
TERT-BUTYLBENZENE	98-06-6	SW8260B	0.127	1	ug/L
CARBON TETRACHLORIDE	56-23-5	SW8260B	0.128	1	ug/L
CHLOROBENZENE	108-90-7	SW8260B	0.116	1	ug/L
DIBROMOCHLOROMETHANE	124-48-1	SW8260B	0.14	1	ug/L
CHLOROETHANE	75-00-3	SW8260B	0.192	5	ug/L
CHLOROFORM	67-66-3	SW8260B	0.111	5	ug/L
CHLOROMETHANE	74-87-3	SW8260B	0.96	2.5	ug/L
2-CHLOROTOLUENE	95-49-8	SW8260B	0.106	1	ug/L
4-CHLOROTOLUENE	106-43-4	SW8260B	0.114	1	ug/L
1,2-DIBROMO-3-CHLOROPROPANE (DBCP)	96-12-8	SW8260B	0.276	5	ug/L
1,2-DIBROMOETHANE	106-93-4	SW8260B	0.126	1	ug/L
DIBROMOMETHANE	74-95-3	SW8260B	0.122	1	ug/L
1,2-DICHLOROBENZENE	95-50-1	SW8260B	0.107	1	ug/L
1,3-DICHLOROBENZENE	541-73-1	SW8260B	0.11	1	ug/L
1,4-DICHLOROBENZENE	106-46-7	SW8260B	0.12	1	ug/L
DICHLORODIFLUOROMETHANE	75-71-8	SW8260B	0.374	5	ug/L
1,1-DICHLOROETHANE	75-34-3	SW8260B	0.1	1	ug/L
1,2-DICHLOROETHANE	107-06-2	SW8260B	0.0819	1	ug/L
1,1-DICHLOROETHENE	75-35-4	SW8260B	0.188	1	ug/L
CIS-1,2-DICHLOROETHENE	156-59-2	SW8260B	0.126	1	ug/L
TRANS-1,2-DICHLOROETHENE	156-60-5	SW8260B	0.149	1	ug/L
1,2-DICHLOROPROPANE	78-87-5	SW8260B	0.149	1	ug/L
1,1-DICHLOROPROPENE	563-58-6	SW8260B	0.142	1	ug/L
1,3-DICHLOROPROPANE	142-28-9	SW8260B	0.11	1	ug/L
CIS-1,3-DICHLOROPROPENE	10061-01-5	SW8260B	0.111	1	ug/L
TRANS-1,3-DICHLOROPROPENE	10061-02-6	SW8260B	0.118	1	ug/L
2,2-DICHLOROPROPANE	594-20-7	SW8260B	0.161	1	ug/L
DI-ISOPROPYL ETHER (DIPE)	108-20-3	SW8260B	0.105	1	ug/L
ETHYLBENZENE	100-41-4	SW8260B	0.137	1	ug/L
HEXACHLOROBUTADIENE	87-68-3	SW8260B	0.337	1	ug/L
ISOPROPYLBENZENE	98-82-8	SW8260B	0.105	1	ug/L
CYMENE (P-ISOPROPYLTOLUENE)	99-87-6	SW8260B	0.12	1	ug/L
METHYL ETHYL KETONE (2-BUTANONE)	78-93-3	SW8260B	1.19	10	ug/L
METHYLENE CHLORIDE	75-09-2	SW8260B	0.43	5	ug/L
METHYL ISOBUTYL KETONE (MIBK)	108-10-1	SW8260B	0.478	10	ug/L
METHYL TERT-BUTYL ETHER	1634-04-4	SW8260B	0.101	1	ug/L
NAPHTHALENE	91-20-3	SW8260B	1	5	ug/L
N-PROPYLBENZENE	103-65-1	SW8260B	0.0993	1	ug/L
STYRENE	100-42-5	SW8260B	0.118	1	ug/L
1,1,1,2-TETRACHLOROETHANE	630-20-6	SW8260B	0.147	1	ug/L
1,1,2,2-TETRACHLOROETHANE	79-34-5	SW8260B	0.133	1	ug/L
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE (FREON 113)	76-13-1	SW8260B	0.18	1	ug/L
TETRACHLOROETHENE (PCE)	127-18-4	SW8260B	0.3	1	ug/L
TOLUENE	108-88-3	SW8260B	0.278	1	ug/L
1,2,3-TRICHLOROBENZENE	87-61-6	SW8260B	0.23	1	ug/L
1,2,4-TRICHLOROBENZENE	120-82-1	SW8260B	0.481	1	ug/L

SUMMARY OF TARGET PQLS FOR WATER SAMPLES
CIRCLE K 1461, SEATTLE, WA

Analyte	CAS Number	METHOD	MDL	Target PQL	Units
1,1,1-TRICHLOROETHANE	71-55-6	SW8260B	0.149	1	ug/L
1,1,2-TRICHLOROETHANE	79-00-5	SW8260B	0.158	1	ug/L
TRICHLOROETHENE (TCE)	79-01-6	SW8260B	0.19	1	ug/L
TRICHLOROFLUOROMETHANE	75-69-4	SW8260B	0.16	5	ug/L
1,2,3-TRICHLOROPROPANE	96-18-4	SW8260B	0.237	2.5	ug/L
1,2,4-TRIMETHYLBENZENE	95-63-6	SW8260B	0.322	1	ug/L
1,2,3-TRIMETHYLBENZENE	526-73-8	SW8260B	0.104	1	ug/L
1,3,5-TRIMETHYLBENZENE	108-67-8	SW8260B	0.104	1	ug/L
VINYL CHLORIDE	75-01-4	SW8260B	0.234	1	ug/L
XYLENE, TOTAL	1330-20-7	SW8260B	0.174	3	ug/L
Methane by RSK175					
Methane	74-82-8	RSK175		10	ug/L
Polycyclic Aromatic Hydrocarbons (PAHs) -SIM					
ANTHRACENE	120-12-7	SW8270CSIM	0.019	0.05	ug/L
ACENAPHTHENE	83-32-9	SW8270CSIM	0.019	0.05	ug/L
ACENAPHTHYLENE	208-96-8	SW8270CSIM	0.0171	0.05	ug/L
BENZO(A)ANTHRACENE	56-55-3	SW8270CSIM	0.0203	0.05	ug/L
BENZO(A)PYRENE	50-32-8	SW8270CSIM	0.0184	0.05	ug/L
BENZO(B)FLUORANTHENE	205-99-2	SW8270CSIM	0.0168	0.05	ug/L
BENZO(G,H,I)PERYLENE	191-24-2	SW8270CSIM	0.0184	0.05	ug/L
BENZO(K)FLUORANTHENE	207-08-9	SW8270CSIM	0.0202	0.05	ug/L
CHRYSENE	218-01-9	SW8270CSIM	0.0179	0.05	ug/L
DIBENZ(A,H)ANTHRACENE	53-70-3	SW8270CSIM	0.016	0.05	ug/L
FLUORANTHENE	206-44-0	SW8270CSIM	0.027	0.1	ug/L
FLUORENE	86-73-7	SW8270CSIM	0.0169	0.05	ug/L
INDENO(1,2,3-C,D)PYRENE	193-39-5	SW8270CSIM	0.0158	0.05	ug/L
NAPHTHALENE	91-20-3	SW8270CSIM	0.0917	0.25	ug/L
PHENANTHRENE	85-01-8	SW8270CSIM	0.018	0.05	ug/L
PYRENE	129-00-0	SW8270CSIM	0.0169	0.05	ug/L
1-METHYLNAPHTHALENE	90-12-0	SW8270CSIM	0.0687	0.25	ug/L
2-METHYLNAPHTHALENE	91-57-6	SW8270CSIM	0.0674	0.25	ug/L
2-CHLORONAPHTHALENE	91-58-7	SW8270CSIM	0.0682	0.25	ug/L
Semi-Volatile Organic Compounds					
ACENAPHTHENE	83-32-9	SW8270C	0.0886	1	ug/L
ACENAPHTHYLENE	208-96-8	SW8270C	0.0921	1	ug/L
ANTHRACENE	120-12-7	SW8270C	0.0804	1	ug/L
BENZIDINE	92-87-5	SW8270C	3.74	10	ug/L
BENZO(A)ANTHRACENE	56-55-3	SW8270C	0.199	1	ug/L
BENZO(B)FLUORANTHENE	205-99-2	SW8270C	0.13	1	ug/L
BENZO(K)FLUORANTHENE	207-08-9	SW8270C	0.12	1	ug/L
BENZO(G,H,I)PERYLENE	191-24-2	SW8270C	0.121	1	ug/L
BENZO(A)PYRENE	50-32-8	SW8270C	0.0381	1	ug/L
BIS(2-CHLOROETHOXY) METHANE	111-91-1	SW8270C	0.116	10	ug/L
BIS(2-CHLOROETHYL) ETHER	111-44-4	SW8270C	0.137	10	ug/L
2,2'-OXYBIS(1-CHLORO)PROPANE	108-60-1	SW8270C	0.21	10	ug/L
4-BROMOPHENYL PHENYL ETHER	101-55-3	SW8270C	0.0877	10	ug/L
2-CHLORONAPHTHALENE	91-58-7	SW8270C	0.0648	1	ug/L
4-CHLOROPHENYL PHENYL ETHER	7005-72-3	SW8270C	0.0926	10	ug/L
CHRYSENE	218-01-9	SW8270C	0.13	1	ug/L
DIBENZ(A,H)ANTHRACENE	53-70-3	SW8270C	0.0644	1	ug/L
1,2-DICHLOROBENZENE	95-50-1	SW8270C	0.0713	10	ug/L
1,3-DICHLOROBENZENE	541-73-1	SW8270C	0.132	10	ug/L
1,4-DICHLOROBENZENE	106-46-7	SW8270C	0.0942	10	ug/L
3,3'-DICHLOROBENZIDINE	91-94-1	SW8270C	0.212	10	ug/L
2,4-DINITROTOLUENE	121-14-2	SW8270C	0.0983	10	ug/L
2,6-DINITROTOLUENE	606-20-2	SW8270C	0.25	10	ug/L
FLUORANTHENE	206-44-0	SW8270C	0.102	1	ug/L
FLUORENE	86-73-7	SW8270C	0.0844	1	ug/L
HEXACHLOROBENZENE	118-74-1	SW8270C	0.0755	1	ug/L
HEXACHLOROBUTADIENE	87-68-3	SW8270C	0.0968	10	ug/L
HEXACHLOROCYCLOPENTADIENE	77-47-4	SW8270C	0.0598	10	ug/L

SUMMARY OF TARGET PQLS FOR WATER SAMPLES
CIRCLE K 1461, SEATTLE, WA

Analyte	CAS Number	METHOD	MDL	Target PQL	Units
HEXACHLOROETHANE	67-72-1	SW8270C	0.127	10	ug/L
INDENO(1,2,3-C,D)PYRENE	193-39-5	SW8270C	0.279	1	ug/L
ISOPHORONE	78-59-1	SW8270C	0.143	10	ug/L
NAPHTHALENE	91-20-3	SW8270C	0.159	1	ug/L
NITROBENZENE	98-95-3	SW8270C	0.297	10	ug/L
N-NITROSODIMETHYLAMINE	62-75-9	SW8270C	0.998	10	ug/L
N-NITROSODIPHENYLAMINE	86-30-6	SW8270C	2.37	10	ug/L
N-NITROSODI-N-PROPYLAMINE	621-64-7	SW8270C	0.261	10	ug/L
PHENANTHRENE	85-01-8	SW8270C	0.112	1	ug/L
BENZYL BUTYL PHTHALATE	85-68-7	SW8270C	0.765	3	ug/L
BIS(2-ETHYLHEXYL) PHTHALATE	117-81-7	SW8270C	0.895	3	ug/L
DI-N-BUTYL PHTHALATE	84-74-2	SW8270C	0.453	3	ug/L
DIETHYL PHTHALATE	84-66-2	SW8270C	0.287	3	ug/L
DIMETHYL PHTHALATE	131-11-3	SW8270C	0.26	3	ug/L
DI-N-OCTYL PHTHALATE	117-84-0	SW8270C	0.932	3	ug/L
PYRENE	129-00-0	SW8270C	0.107	1	ug/L
1,2,4-TRICHLOROBENZENE	120-82-1	SW8270C	0.0698	10	ug/L
4-CHLORO-3-METHYLPHENOL (CRESOL)	59-50-7	SW8270C	0.131	10	ug/L
2-CHLOROPHENOL	95-57-8	SW8270C	0.133	10	ug/L
2,4-DICHLOROPHENOL	120-83-2	SW8270C	0.102	10	ug/L
2,4-DIMETHYLPHENOL	105-67-9	SW8270C	0.0636	10	ug/L
4,6-DINITRO-2-METHYLPHENOL	534-52-1	SW8270C	1.12	10	ug/L
2,4-DINITROPHENOL	51-28-5	SW8270C	5.93	10	ug/L
2-NITROPHENOL	88-75-5	SW8270C	0.117	10	ug/L
4-NITROPHENOL	100-02-7	SW8270C	0.143	10	ug/L
PENTACHLOROPHENOL	87-86-5	SW8270C	0.313	10	ug/L
PHENOL	108-95-2	SW8270C	4.33	10	ug/L
2,4,6-TRICHLOROPHENOL	88-06-2	SW8270C	0.1	10	ug/L
Metals					
ARSENIC	7440-38-2	SW6020	0.25	1	ug/L
ARSENIC,DISSOLVED	7440-38-2	SW6020	0.25	1	ug/L
BARIUM	7440-39-3	SW6020	0.381	2	ug/L
BARIUM, DISSOLVED	7440-39-3	SW6020	0.381	2	ug/L
CADMIUM	7440-43-9	SW6020	0.16	0.5	ug/L
CADMIUM,DISSOLVED	7440-43-9	SW6020	0.16	0.5	ug/L
CHROMIUM, TOTAL	7440-47-3	SW6020	0.54	1	ug/L
CHROMIUM,DISSOLVED	7440-47-3	SW6020	0.54	1	ug/L
IRON	7439-89-6	SW6020	220	5000	ug/L
IRON,DISSOLVED	7439-89-6	SW6020	220	5000	ug/L
LEAD	7439-92-1	SW6020	0.24	1	ug/L
LEAD,DISSOLVED	7439-92-1	SW6020	0.24	1	ug/L
MANGANESE, DISSOLVED	7439-96-5	SW6020		25	ug/L
SELENIUM	7782-49-2	SW6020	0.38	1	ug/L
SELENIUM,DISSOLVED	7782-49-2	SW6020	0.38	1	ug/L
SILVER	7440-22-4	SW6020	0.31	0.5	ug/L
SILVER,DISSOLVED	7440-22-4	SW6020	0.31	0.5	ug/L
Mercury					
MERCURY	7439-97-6	SW7470A	0.1	0.2	ug/L
MERCURY,DISSOLVED	7439-97-6	SW7470A	0.1	0.2	ug/L
Conventional Parameters					
ALKALINITY, TOTAL (AS CACO3)	ALK	SM2320B	8450	20000	ug/L
TURBIDITY	TURBIDITY	A2130B	0.20	0.4	NTU
NITROGEN, NITRATE-NITRITE	NO3NO2N	E353.2	50	100	ug/L

SUMMARY OF TARGET PQLS FOR WATER SAMPLES
CIRCLE K 1461, SEATTLE, WA

Analyte	CAS Number	METHOD	MDL	Target PQL	Units
Anions					
BROMIDE	24959-67-9	SW9056A	353	1000	ug/L
CHLORIDE (AS CL)	16887-00-6	SW9056A	379	1000	ug/L
FLUORIDE	16984-48-8	SW9056A	64	150	ug/L
NITROGEN, NITRATE (AS N)	N_NO3	SW9056A	48	100	ug/L
NITRITE	NO2	SW9056A	42	100	ug/L
PHOSPHATE, ORTHO-	14265-44-2	SW9056A	0	100	ug/L
SULFATE (AS SO4)	14808-79-8	SW9056A	594	5000	ug/L
GUANIDINE NITRATE	506-93-4	SW9056MOD	98	500	ug/L
CHLORATE	14866-68-3	SW9056A	24	50	ug/L
Polychlorinated Biphenyls (PCBs)					
PCB-1016 (Aroclor 1016)	12674-11-2	SW8082	0.01981	0.5	ug/L
PCB-1221 (Aroclor 1221)	11104-28-2	SW8082	0.02443	0.5	ug/L
PCB-1232 (Aroclor 1232)	11141-16-5	SW8082	0.02133	0.5	ug/L
PCB-1242 (Aroclor 1242)	53469-21-9	SW8082	0.02424	0.5	ug/L
PCB-1248 (Aroclor 1248)	12672-29-6	SW8082	0.01354	0.5	ug/L
PCB-1254 (Aroclor 1254)	11097-69-1	SW8082	0.01813	0.5	ug/L
PCB-1260 (Aroclor 1260)	11096-82-5	SW8082	0.0146	0.5	ug/L
Herbicides by HPLC					
2,4-D (2-(2,4-DICHLOROPHENOXY)-ACETIC ACID))	94-75-7	SW8321	1.0026	2	ug/L
DALAPON	75-99-0	SW8321	0.6214	2	ug/L
2,4-DB (4-(2,4-DICHLOROPHENOXY)BUTANOIC ACID)	94-82-6	SW8321	1.0014	2	ug/L
DICAMBA	1918-00-9	SW8321	0.5477	2	ug/L
DICHLORPROP	120-36-5	SW8321	0.3665	2	ug/L
DINOSEB	88-85-7	SW8321	0.6385	2	ug/L
MCPA (2-METHYL-4-CHLOROPHENOXY ACETIC ACID)	94-74-6	SW8321	0.3629	2	ug/L
MCPP (2-(2-METHYL-4-CHLOROPHENOXY) PROPANOIC ACID)	93-65-2	SW8321	0.3233	2	ug/L
2,4,5-T (ACETIC ACID, (2,4,5-TRICHLOROPHENOXY)-)	93-76-5	SW8321	0.5725	2	ug/L
2,4,5-TP (SILVEX)	93-72-1	SW8321	0.8068	2	ug/L
Herbicides					
2,4-D (2-(2,4-dichlorophenoxy)-acetic acid))	94-75-7	SW8151	0.547	2	ug/L
DALAPON	75-99-0	SW8151	0.344	2	ug/L
2,4-DB (4-(2,4-dichlorophenoxy)butanoic acid)	94-82-6	SW8151	0.302	2	ug/L
DICAMBA	1918-00-9	SW8151	0.245	2	ug/L
DICHLORPROP	120-36-5	SW8151	1.04	2	ug/L
DINOSEB	88-85-7	SW8151	0.25	2	ug/L
MCPA (2-methyl-4-chlorophenoxy acetic acid)	94-74-6	SW8151	13.1	100	ug/L
MCPP (2-(2-methyl-4-chlorophenoxy) propanoic acid)	93-65-2	SW8151	66	100	ug/L
2,4,5-T (Acetic acid, (2,4,5-trichlorophenoxy)-)	93-76-5	SW8151	0.258	2	ug/L
2,4,5-TP (SILVEX)	93-72-1	SW8151	0.335	2	ug/L
Organochlorine Pesticides					
ALDRIN	309-00-2	SW8081	0.0198	0.05	ug/L
ALPHA BHC (ALPHA HEXACHLOROCYCLOHEXANE)	319-84-6	SW8081	0.0172	0.05	ug/L
BETA BHC (BETA HEXACHLOROCYCLOHEXANE)	319-85-7	SW8081	0.0208	0.05	ug/L
DELTA BHC (DELTA HEXACHLOROCYCLOHEXANE)	319-86-8	SW8081	0.015	0.05	ug/L
GAMMA-BHC (LINDANE)	58-89-9	SW8081	0.0209	0.05	ug/L
CHLORDANE	12789-03-6	SW8081	0.0198	5	ug/L
4,4'-DDD	72-54-8	SW8081	0.0177	0.05	ug/L
4,4'-DDE	72-55-9	SW8081	0.0154	0.05	ug/L
4,4'-DDT	50-29-3	SW8081	0.0198	0.05	ug/L
DIELDRIN	60-57-1	SW8081	0.0162	0.05	ug/L
ENDOSULFAN	115-29-7	SW8081	0.016	0.05	ug/L
BETA ENDOSULFAN (ENDOSULFAN II)	33213-65-9	SW8081	0.0164	0.05	ug/L
ENDOSULFAN SULFATE	1031-07-8	SW8081	0.0217	0.05	ug/L
ENDRIN	72-20-8	SW8081	0.0161	0.05	ug/L
ENDRIN ALDEHYDE	7421-93-4	SW8081	0.0237	0.05	ug/L
ENDRIN KETONE	53494-70-5	SW8081	0.0219	0.05	ug/L
HEXACHLOROBENZENE	118-74-1	SW8081	0.0176	0.05	ug/L

TABLE 10

SUMMARY OF TARGET PQLS FOR WATER SAMPLES
CIRCLE K 1461, SEATTLE, WA

Analyte	CAS Number	METHOD	MDL	Target PQL	Units
HEPTACHLOR	76-44-8	SW8081	0.0148	0.05	ug/L
HEPTACHLOR EPOXIDE	1024-57-3	SW8081	0.0183	0.05	ug/L
METHOXYCHLOR	72-43-5	SW8081	0.0193	0.05	ug/L
TOXAPHENE	8001-35-2	SW8081	0.168	0.5	ug/L

Notes:

(a) Target Practical Quantitation Level (PQL) values presented in this table are based on method reporting limits (MRLs) from Pace National Analytical, Mt Juliet, Tennessee (Pace).

(b) PQLs from selected analytical laboratories to be verified prior to start of field sampling activities.

Abbreviations:

na = not applicable for matrix
µg/L = micrograms per liter
PQL = Practical Quantitation Limit
MRL = Method Reporting Limit
SIM = Select Ion Monitoring

TABLE 11

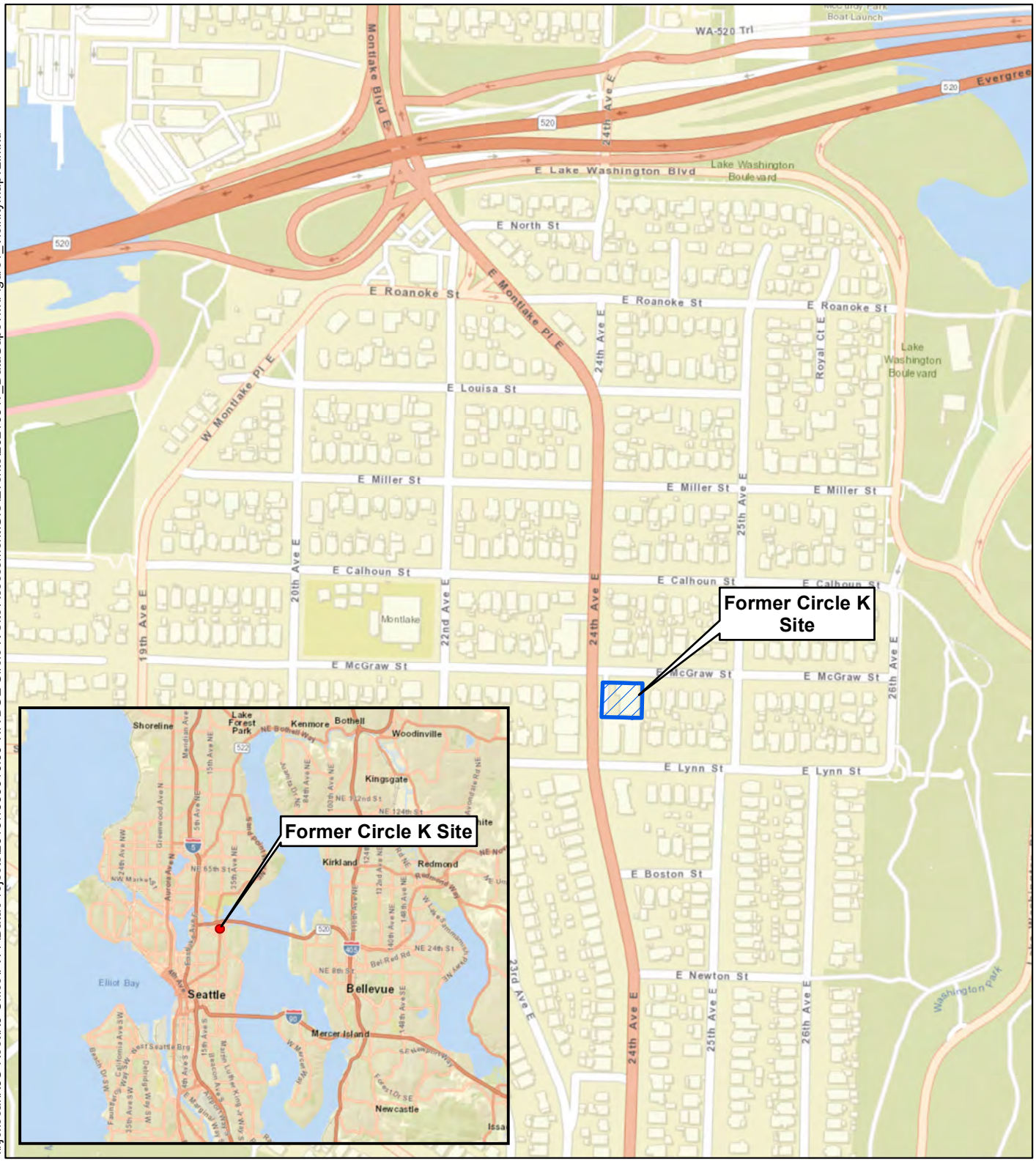
SAMPLING CONTAINERS, PRESERVATION, AND HOLDING TIMES
CIRCLE K 1461, SEATTLE, WA

Sampling Container, Preservation and Holding Times					
Matrix	**Analyte**	**Method**	**Container(s) per sample**	**Preservation**	**Holding Time**
Solid	% Moisture	SM 2540G	1 - 8oz glass jar	4 ± 2°C	14 days
Solid	Volatile Organic Compounds (VOCs)	EPA 8260B	1 - 40-mL amber jar	4 ± 2°C, Methanol	14 days
Solid	Gasoline-Range Organics (GRO)	NWTPH-Gx (gasoline extended)	1 - 40-mL amber jar	4 ± 2°C, Methanol	14 days
Solid	Semivolatile Organic Compounds (SVOCs)	EPA 8270E	1 - 8oz glass jar	4 ± 2°C	14 days extraction / 40 days analyzed
Solid	Polycyclic Aromatic Hydrocarbons (PAHs)	EPA 8270E-SIM	1 - 8oz glass jar	4 ± 2°C	14 days extraction / 40 days analyzed
Solid	Diesel- and Oil-Range Organics (DRO and ORO)	NWTPH-Dx (diesel extended) without Silica Gel Cleanup	1 - 8oz glass jar	4 ± 2°C	14 days extraction / 40 days analyzed
Solid	Metals (arsenic, barium, cadimium, chromium, lead, selenium, silver)	EPA 6010B	1 - 8oz glass jar	4 ± 2°C	6 months
Solid	Metals (mercury)	EPA 7471A	1 - 8oz glass jar	4 ± 2°C	28 days
Solid	TCLP Leachate (metals)	EPA 1311	1 - 8oz glass jar	4 ± 2°C	6 months (28 days mercury)
Solid	Polychlorinated Biphenyls (PCBs)	EPA 8082	1 - 8oz glass jar	4 ± 2°C	365 days extraction / 40 days analyzed
Solid	Organochlorine Pesticides	EPA 8081	1 - 8oz glass jar	4 ± 2°C	14 days extraction / 40 days analyzed
Solid	Chlorinated herbicides	EPA 8151	1 - 8oz glass jar	4 ± 2°C	14 days extraction / 40 days analyzed
Water	Volatile Organic Compounds (VOCs)	EPA 8260B	3 x 40 mL glass vials	4 ± 2°C, HCl	14 days
Water	Gasoline-Range Organics (GRO)	NWTPH-Gx (gasoline extended)	2 x 40 mL glass vials	4 ± 2°C, HCl	14 days
Water	Diesel- and Oil-Range Organics (DRO and ORO)	NWTPH-Dx (diesel extended) without Silica Gel Cleanup	2 x 40 mL glass vials	4 ± 2°C, HCl	14 days extraction / 40 days analyzed
Water	Nitrate	EPA 353.2	1 – 250 mL HDPE	4 ± 2°C, H2SO4	28 days
Water	Orthophosphate	EPA 365.1	1 – 100 mL glass	4 ± 2°C	48 hours
Water	Semivolatile Organic Compounds (SVOCs)	EPA 8270E	2 - 100 mL amber glass	4 ± 2°C	7 days extraction / 40 days analyzed
Water	Polycyclic Aromatic Hydrocarbons (PAHs)	EPA 8270E-SIM	2 - 40 mL vials	4 ± 2°C	7 days extraction / 40 days analyzed
Water	Total Metals (arsenic, barium, cadimium, chromium, lead, selenium, silver)	EPA 6020	1 – 250 mL HDPE	4 ± 2°C, HNO3	180 days
Water	Total Metals (mercury)	EPA 7470A	1 – 250 mL HDPE	4 ± 2°C, HNO3	28 days
Water	Polychlorinated Biphenyls (PCBs)	EPA 8082	2 - 100 mL amber glass	4 ± 2°C	365 days
Water	Organochlorine Pesticides	EPA 8081	2 - 100 mL amber glass	4 ± 2°C	7 days
Solid	Chlorinated herbicides	EPA 8151	1 - 8oz glass jar	4 ± 2°C	7 days extraction / 40 days analyzed
Air	Volatile Organic Compounds (VOCs)	TO-15	Summa Canister	Not applicable	30 days

Notes:
PAHs = polycyclic aromatic hydrocarbons
PCBs = polychlorinated biphenyls
TCLP = Toxicity Characteristic Leaching Procedure

Chemical Preservatives:
HCl = hydrochloric acid
NaOH = sodium hydroxide
ZnAc = zinc acetate
H2SO4 = sulfuric acid
HNO3 = nitric acid

Figures



\\kjc.local\KJC-Root\KJ-Office\FWY\Data\Projects\2016\1696010.00 WA DOE Circle K Site Assessment\GIS\Events\20210517_DataGapsTM\Figure1_VicinityMapv2.mxd

Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors,

Legend

Site Location

N

0 200 400

Scale: Feet

Note:
1. All locations are approximate.

Kennedy Jenks

Former Circle K Site
Seattle, Washington

Site Location and Vicinity Map

K/J 2196008*00

Figure 1

Path: H:\GIS_CloudProjects\WA DOE\Circle K\SAP\Figure2_SiteMap.mxd ©2022 Kennedy/Jenks Consultants

Legend

- Existing Well
- Existing Well to be Used for Extraction/Injection
- New Extraction/Injection Well
- New Slant Well
- New Vapor Monitoring Pin
- Parcel Boundary

Notes:
1. All locations are approximate.

N

0 15 30

Scale: Feet

Kennedy Jenks

Former Circle K Site
Seattle, Washington

Well Locations Map

K/J 2196008*00

Figure 2

Path: H:\GIS_CloudProjects\WA DOE\Circle K\SAP\Figure3_ExtentofImpact.mxd ©2022 Kennedy/Jenks Consultants

Legend

- Existing Well
- Existing Well to be Used for Extraction/Injection
- New Extraction/Injection Well
- New Slant Well
- New Vapor Monitoring Pin
- Parcel Boundary
- Approximate Extent of Gasoline-Range Organics and/or Benzene in Groundwater above MTCA Method A Cleanup Levels
- Approximate Extent of Gasoline-Range Organics and/or Benzene in Soil above MTCA Method A Cleanup Levels

Notes:
1. All locations are approximate.
2. GRO = gasoline range organics
3. CUL = clean up levels

N

0 15 30

Scale: Feet

Kennedy Jenks

Former Circle K Site
Seattle, Washington

Approximate Extents of GRO and Benzene Impacts to Soil and Groundwater

K/J 2196008*00

Figure 3

Appendix A

Standard Operating Guidelines

[To be provided by O&M Contractor and reviewed and approved by Ecology and Kennedy Jenks]

Appendix B

Monitoring and Sampling Example Field Forms

[To be provided by O&M Contractor and reviewed and approved by Ecology and Kennedy Jenks]

Appendix I

Startup and Shutdown Diagrams

[To be added after system installation is complete]