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Mr. Paul Cho
California Regional Water Quality Control Board
Los Angeles Region
320 West 4th Street, Suite 200
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November 4, 2019

Subject: **Work Plan for Drilling and Installation of a Stacked Horizontal Biosparge and Soil Vapor Extraction Remediation Well System in the Offsite South-Central Area of SFPP Norwalk Pump Station, Norwalk, California**

Dear Mr. Cho,

This work plan was prepared on behalf of Kinder Morgan, Inc. (Kinder Morgan) for the drilling and installation of one horizontal biosparge well and one horizontal soil vapor extraction (SVE) well (a "stacked" horizontal remediation well system) in the offsite south-central area of the SFPP, L.P. (SFPP) Norwalk Pump Station, located at 15306 Norwalk Boulevard, Norwalk, California (the site; see Figure 1).

The stacked horizontal remediation well system will be installed to enhance treatment of the hydrocarbon plume in the offsite south-central area and expand the overall footprint of the horizontal biosparge system at the site to reduce hydrocarbon constituents in groundwater and soil vapor including benzene, toluene, ethylbenzene, and xylenes (BTEX), methyl tertiary butyl ether (MTBE), and tertiary butyl alcohol (TBA).

Introduction

This work plan presents detail on the following:

- Installation of one 4-inch-diameter, approximately 800-foot-long horizontal biosparge well to treat the offsite south-central area hydrocarbon plume (BS-03; see Figure 2),
- Installation of one 6-inch-diameter, approximately 800-foot-long horizontal SVE well to control vapor migration during biosparge system operation (HSVE-01; see Figure 2).

The proposed scope of work is based on information and recommendations included in the *Evaluation Report for the South-Central Area Horizontal Biosparge Pilot Test* (CH2M[1], 2017a), *Biosparging Effectiveness Evaluation and Recommendations – South-Central Area* (CH2M, 2017b), and *Southeastern Horizontal Biosparge Well (BS-02) Completion Report* (Jacobs, 2018).

The following sections summarize relevant background information, present the objectives of the planned work, describe the proposed scope of work and methods, and provide a general schedule for implementation of this scope of work. Following project completion, a construction completion report will

[1] CH2M HILL (CH2M) is now part of Jacobs Engineering Group Inc. (Jacobs).

be prepared and submitted to the Regional Water Quality Control Board (RWQCB) describing the results of this work.

Background Information

The entire facility on which Kinder Morgan operates is overseen by the Defense Logistics Agency (DLA) Energy (formerly Defense Energy Support Center) and was formerly occupied by 12 aboveground fuel storage tanks and associated piping used to store and distribute refined petroleum products (Figure 1). Kinder Morgan maintained equipment, including a pump station, within 2 acres of the site, and easements for pipelines along the southern and eastern boundaries of the facility. The pump station was decommissioned in 2001, but three pipelines remain in service to convey refined petroleum fuels including gasoline, diesel, and jet fuel.

The three pipelines include two 16-inch-diameter and one 24-inch-diameter line, which extend along the southern boundary of the site (one of the 16-inch pipelines bends at the southeastern corner of the facility and continues northward within the eastern easement). The pipelines were fitted with block valves and motor-operated valves. The block valve located in the south-central area of the site was historically referred to as the "intermediate 24-inch block valve." The intermediate 24-inch block valve and other motor-operated valves were removed between the third quarter 2016 and second quarter 2017. Another block valve located offsite near the southeastern area is still in use and referred to as the "southeastern 24-inch block valve" or "offsite 24-inch block valve."

Because of a historical release at the south-central intermediate 24-inch block valve, the subsurface soil and groundwater within the uppermost semiperched groundwater zone (approximately 25 to 50 feet below ground surface [bgs]) in the south-central area and in the residential area to the south of the site is impacted with light nonaqueous phase liquid (LNAPL) and fuel-related hydrocarbons. Therefore, a myriad of total fluids extraction (TFE) wells and dual-phase extraction wells (SVE coupled with TFE) are operated in the south-central and offsite areas to remove LNAPL, impacted groundwater, and soil vapor from the area, and are treated by an onsite groundwater treatment system (GWTS) and an SVE treatment system (a regenerative thermal oxidizer [RTO]) (Figures 2 and 3). A description and effectiveness of the sitewide GWTS and SVE system are included in the quarterly remediation progress reports submitted for the site. Figure 2 shows the existing remediation system layout.

Hydrogeologic Conditions

The site is underlain by the following hydrogeologic units (shallow to deep):

- **Semiperched groundwater zone between depths of approximately 20 and 50 feet bgs.** Groundwater flow within this uppermost zone is generally north to northwestward with a horizontal gradient of approximately 0.001 foot per foot (ft/ft).
- **Bellflower aquitard of the Lakewood Formation between depths of approximately 50 and 80 feet bgs beneath the site**. The Bellflower aquitard consists predominantly of clay, silty clay, and sandy clay with some interbedded sand with silt.
- **Exposition aquifer between depths of approximately 80 and 220 feet bgs.** The potentiometric surface in the Exposition aquifer is approximately 20 feet lower than that in the semiperched uppermost groundwater zone. This relatively consistent difference in hydraulic heads between the semiperched upper groundwater zone and the Exposition aquifer indicates that the Bellflower aquitard inhibits the vertical movement of groundwater in the site area. The horizontal hydraulic gradient in the Exposition aquifer beneath the site area has a magnitude of approximately 0.001 ft/ft and a generally southeastward direction.

Overview of Existing Remediation Systems

Kinder Morgan operates remediation systems consisting of biosparging, SVE, TFE (extraction of free product and/or groundwater using a top-loading pump), and groundwater extraction (GWE; extraction of groundwater using a bottom-loading pump) within the following areas:

- **South-Central Area.** LNAPL and dissolved-phase hydrocarbons occur in the south-central area beneath the site and offsite beneath the residential area to the south. These impacts occurred from a historical release from the intermediate 24-inch block valve and potentially other unidentified sources at the former pump station.
- **Southeastern Area.** LNAPL and dissolved-phase hydrocarbons occur in the southeast area beneath the facility and offsite in the Holifield Park area. These impacts occurred from a historical release from the southeastern 24-inch block valve in this area.

Figure 2 shows the existing remediation system layout in the south-central and southeastern areas, including SVE and TFE operations (GWE is also performed at one location in the southeastern area). At several locations, SVE is coupled with TFE (or GWE) in a process referred to as dual-phase extraction. The effectiveness of the current remediation system and a list of SVE, TFE, and GWE wells are included in the most recent quarterly remediation progress report (Jacobs, 2019).

In December 2015, Kinder Morgan completed installation of a horizontal biosparge well, BS-01, in the south-central area as shown on Figure 2. BS-01 is constructed of 4-inch-diameter Schedule (Sch) 80 polyvinyl chloride (PVC) casing, with approximately 600 feet of screen installed 45 feet bgs. Additional details regarding the construction of the biosparge well are documented in the *Horizontal Biosparge Well and Soil Vapor Monitoring Probe Completion Report* (CH2M, 2015).

Pilot testing of BS-01 began in early January 2016 and continued through October 2016. Soil vapor and groundwater data were submitted to the RWQCB in August 2017 as detailed in the *Evaluation Report for the South-Central Area Horizontal Biosparge Pilot Test* (CH2M, 2017a). As a result of biosparge operations, LNAPL thickness was significantly reduced in 21 monitoring and remediation wells. When comparing the effectiveness of the biosparge pilot program pre- and post-initiation, the average reduction in LNAPL thickness in all wells was 1.94 feet during the 10-month pilot study, from an average of 2.15 feet in the fourth quarter 2015 to 0.21 foot in the second quarter 2018. In addition, dissolved-phase total petroleum hydrocarbons as gasoline (TPH-g), TPH as diesel (TPH-d), benzene, and MTBE concentrations also exhibited significant reductions during the test period. Based on these results, it was determined that operation of the south-central system would continue with the expansion of the system to the southeastern area using a second horizontal biosparge well, BS-02.

BS-02 was installed in the southeastern area of the site in November 2017. Similar to BS-01, BS-02 is constructed of a 4-inch-diameter Sch 80 PVC casing with 240 feet of screen installed 45 feet bgs. The construction completion report was submitted to the RWQCB in July 2018 (Jacobs, 2018). A 175-horse-power (hp) rotary screw air compressor, enclosed in a 12-foot by 25-foot container, supplying approximately 882 standard cubic feet per minute (scfm) of air at 125 pounds per square inch gauge (psig) to BS-01 and BS-02 was installed in October 2018. BS-02 is not yet operational but is anticipated to go online in the first quarter of 2020.

A third horizontal biosparge well (BS-03) is planned for the offsite south-central area, as shown on Figure 3. In addition, a horizontal SVE well (HSVE-01) is proposed to be co-installed, off-set approximately 10 feet north and residing 25 feet above BS-03, to control vapor migration during biosparge system operation (Figure 3). The existing SVE system has been in operation since 1992. Connecting a series of SVE wells via aboveground and belowground air conveyance lines, the system currently uses a blower to remove soil vapor from the south-central and southeastern areas. The extracted vapor is conveyed to a knock-out tank that separates entrained moisture from the soil vapor. Accumulated moisture in the knock-out tank is treated by the main GWTS. The soil vapor is then treated in an RTO (installed in the second quarter 2017) where volatile organic compounds (VOCs) are converted

to carbon dioxide and water prior to being discharged to the atmosphere. The RTO blower currently operates at a flow of approximately 1,500 scfm and a vacuum-pressure of 50 inches of water.

These two new horizontal wells will constitute a vertically stacked horizontal well system. The purpose of the horizontal remediation well system is to treat the most upgradient portion of the offsite plume and will supplement the existing SVE and TFE wells in that area. A conceptual diagram of the completed horizontal biosparge and SVE well is presented as Figure 4.

Objectives and Approach

This work plan describes activities for the installation and evaluation of a third horizontal biosparge well (BS-03) and a horizontal SVE well (HSVE-01) in the offsite south-central area. Project objectives are as follows:

- Utilize the groundwater monitoring network in the offsite south-central area to evaluate BS-03 performance in terms of LNAPL removal and remediation of dissolved petroleum hydrocarbons.
- Verify HSVE-01 is effectively capturing vapor associated with operation of BS-03. This objective will be accomplished by performing routine sampling and monitoring of the soil vapor monitoring network in the offsite south-central area.

Scope of Work

The proposed scope of work to accomplish the objectives of this work plan includes drilling, system infrastructure connection, biosparge and SVE system startup, and monitoring. Major activities associated with the scope of work are as follows:

- Pre-mobilization activities
- Field activities
  - Preliminary land survey
  - Underground utility location and mark-out, potholing and air knife excavation activities
  - BS-03 and HSVE-01 drilling and installation
  - Equipment decontamination
  - Waste management
  - System Connection
- System startup, monitoring, data analysis, and reporting

Pre-Mobilization Activities

Jacobs will perform the following permitting and field preparation tasks prior to commencement of field construction activities:

- Update the existing site-specific Health and Safety Plan to incorporate the planned fieldwork.
- Notify the RWQCB, DLA Energy, and the City of Norwalk a minimum of 1 week in advance of the planned field activities.
- Notify Underground Service Alert (USA). As required by USA, the borings will be called-in and marked-out in white paint at least 2 business days prior to drilling.
- Obtain the required boring/well permits from the Los Angeles County Department of Public Health.
- Register BS-03 with the U.S. Environmental Protection Agency (EPA) as an injection well.
- Coordinate with Kinder Morgan personnel to arrange for a Kinder Morgan field inspector to be present during field activities within 10 feet of Kinder Morgan pipelines.

- Coordinate with Kinder Morgan personnel to arrange for a third-party pipeline inspector to be present during digging and drilling activities.
- Obtain access agreements for all affected offsite residences and provide notice and schedule of proposed work.

Field Activities

Preliminary Land Survey

Prior to construction activities, the borehole entry points will be marked on the ground surface with white spray paint and/or pin flags and surveyed by Jacobs personnel. The survey coordinates will be in the required format to upload to the RWQCB's GeoTracker website.

Underground Utility Location, Mark-out, Potholing and Air Knife Excavation

Following the preliminary survey, an underground utility check will be performed using a private utility-locating subcontractor. Jacobs and the subcontractor will coordinate with Kinder Morgan operations staff to clear the borehole path of potential underground utilities and other infrastructure.

Prior to drilling, a subcontractor will pothole using a hand auger to 10 feet bgs, every 3 feet from the entry point to 50 feet downrange of each bore path to check for the presence of underground utilities. It is anticipated that up to 20 pothole locations will be augered. Since BS-03 and HSVE-01 boreholes will be advanced initially at an approximately 13-degree slope below horizontal, the drill rig will be set back approximately 130 feet to the northeast of the site boundary. The three active fuel pipelines run parallel to, and within, 15 feet of the site boundary, demarcated by a block wall. These pipelines range in depth from approximately 4 to 6 feet bgs. It is expected that the boreholes will have reached an approximate depth of 18 feet bgs at the point in which they cross below the pipelines. However, as an added safety measure, an air knife subcontractor will excavate an approximate 2-foot by 6-foot "window" down to 10 feet bgs on the up-range side of the pipelines to visibly confirm the new wells have safely passed below the pipelines.

The proposed location of BS-03 and HSVE-01 will be finalized in the field based on the results of the surveys conducted by the private utility-locating subcontractor and USA mark-outs.

BS-03 and HSVE-01 Drilling and Installation

A horizontal directional drilling (HDD) subcontractor will use blind-end horizontal drilling to install one nominal 4-inch horizontal biosparge well (BS-03) and one nominal 6-inch-diameter horizontal SVE well (HSVE-01) to depths of approximately 45 feet bgs and 19 feet bgs, respectively. The target depth of BS-03 will be as close as practicable to the bottom of the uppermost groundwater zone to maximize the zone of influence (ZOI). HSVE-01 will overlay BS-03 by 26 feet, off-set 10 feet to the north, to capture any migrating vapor from biosparging activities

The borehole diameter for BS-03 will be approximately 8 inches (at least 2 inches minimum annular space on either side of the 4-inch well casing), and the borehole diameter for HSVE-01 will be at least 10 inches (at least 2 inches minimum annular space on either side of the 6-inch well casing) as required by the Los Angeles County Department of Public Health. Biodegradable guar-based drilling fluid will be used to facilitate advancement of the drill bit and circulation of the drill cuttings from the two boreholes.

The screened interval of BS-03 will be installed beneath the LNAPL smear zone, as shown on Figure 3. The entry point for BS-03 and HSVE-01 will be located on the southeastern portion of SFPP, adjacent to the southern access road (Figure 2). The estimated length of casing (i.e., riser pipe) required for BS-03 and HSVE-01 is 300 feet, with 500 feet of slotted pipe (i.e., well screen), for a total length of approximately 800 feet for both wells (Figure 4).

BS-03 will be constructed of 4-inch-diameter, flush threaded, PVC Sch 80 casing and slotted pipe. HSVE-01 will be constructed of 6-inch diameter stainless-steel Sch 10 casing and slotted pipe, with welded Sch 10 threaded ends. BS-03 and HSVE-01 will have a maximum slot width of 0.012 inch or less. The slotted section of the well will be installed as flat as practicably possible. The tolerance of the screen section for both will be ±1 foot vertically and ±3 feet horizontally, verified using a gyroscopic steering tool. At BS-03, 5 percent bentonite cement will be pumped via a tremie pipe from approximately 20 feet bgs to ground surface to create a surface seal. At HSVE-01, 5 percent bentonite cement will be pumped via a tremie pipe from approximately 15 feet bgs to ground surface to create a surface seal.

Immediately following installation of the well casing, screen, and cement seal, BS-03 and HSVE-01 will be flushed with clean water to remove mud from the annulus and subsequently with a pH-adjusting, drill fluid breaking enzyme solution to accelerate degradation of drill fluid residuals. Most of the drilling fluid degradation occurs within the first 12 to 24 hours. The remaining well development steps, which include jetting and pumping, will be accomplished after a delay of hours up to a few days, as determined by the drilling subcontractor.

At the proximal end of the biosparge and SVE wells, a cleanout will be installed in a steel frame access manway (one manway for both wellheads), the dimensions of which will be approximately 36 inches by 60 inches, with a spring-assist H-20 rated cover. The termination of the biosparge well will include one 4-inch-diameter Sch 80 PVC “Y” pipe. The termination of the SVE well will include one 6-inch-diameter stainless steel “Y” pipe. For both biosparge and SVE wells, the straight end of the “Y” will terminate inside the vault with a 4-inch and 6-inch National Pipe Tapered (NPT) thread plug (PVC and stainless steel, respectively). For each well, the 45-degree elbow of the “Y” will connect to 3-inch and 6-inch high-density polyethylene (HDPE) transition fittings and HDPE conveyance pipe that will stub outside of the vault at approximately 3 feet below grade, for connection by others. The stubs should be covered with slip caps (secured with duct tape), and its location indicated at the surface with a marking flag. The manway will be set in a concrete pad that measures at least 18 inches wide on all sides of the vault, and 6 inches thick.

Equipment Decontamination

Drilling equipment will be steam-cleaned using potable water prior to use. Sampling equipment will be cleaned before each use by washing with an Alconox-water solution and double-rinsing with potable water.

Waste Management

Waste generated during field activities will include the following:

- Equipment wash and rinse water
- Drilling fluid
- Soil cuttings
- Municipal waste (gloves, rags, paper towels)

Drilling fluid or soil cuttings generated from drilling and installation of BS-03 and HSVE-01 will be contained in lined roll-off bins and temporarily staged onsite. Municipal waste that may include gloves, rags, and paper towels will be separately contained in Department of Transportation (DOT)-approved 55-gallon steel drums.

A composite sample of the soil cuttings will be collected and sent to a certified laboratory for waste disposal profiling purposes. The drummed solids (gloves, rags, paper towels) will be disposed of as municipal trash. Jacobs will coordinate with Kinder Morgan personnel and the waste hauler to verify the laboratory parameters that need to be analyzed to meet waste profiling requirements.

Jacobs will properly label each container as the waste is generated. The following label will be filled out and placed on the containers: “Non-Classified Waste Material, Laboratory Analyses in Progress.”

System Connection

The biosparge equipment includes the following equipment installed in October 2018:

- 175-hp rotary screw air compressor, supplying approximately 882 scfm and 125 psig.
- 8-foot by 30-foot system enclosure with ventilation, noise suppression, ducting, and lights.
- 240-gallon air receiver.
- Electrical and controls using programmable logic controller/operator interface terminal, and cellular network for alarm-dialer and remote monitoring.

The SVE equipment includes the following equipment installed May 2017:

- RTO rated for 3,000 scfm. Current operating flow is approximately 1,500 scfm. With the addition of vertical SVE wells (estimated to be 600 scfm) and HSVE-01 (estimated to be 700 to 900 scfm), the expected operating flow will be in the range of 2,600 to 2,800 scfm. Permitted maximum flow is 3,000 scfm.

Conceptual process flow diagrams for the biosparge and SVE systems are provided as Figures 5 and 6, respectively.

The biosparge equipment is located along the access road just south of the southeastern corner of the former truck fill stand. The RTO equipment is located approximately 600 feet to the west in the primary remediation treatment system compound. Conveyance lines will be installed to tie-in BS-03 and HSVE-01 as part of a separate mobilization.

System Startup, Monitoring, Data Analysis, and Reporting

This section provides a high-level summary of the methods and processes that will be followed during system startup, short-term and long-term monitoring, data evaluation and reporting. A Work Plan Addendum will be submitted prior to system startup that expands on the following sections by providing a detailed description of the work that will occur after this new system is installed.

System Startup

Biosparging at BS-03 will not be initiated until the capture zone of HSVE-01 is tested and confirmed to be sufficient for managing potential vapor migration. Startup will be initiated at a flow rate of approximately 0.1 scfm per foot of screen interval (cfm/ft), and will be increased gradually in steps over a period of approximately 3 to 5 days to a target flow rate of 0.8 cfm/ft. The lateral extent of the ZOI in the saturated zone will be evaluated, and the SVE vacuum capture zone will also be reassessed, based on field measurements at nearby groundwater monitoring wells and soil vapor monitoring probes.

The baseline flow rate for HSVE-01 will be 1 cfm/ft or 500 cfm, and will be increased gradually to a maximum of 1.8 cfm/ft, depending on vacuum and water table elevation measurements in surrounding soil vapor monitoring probes and groundwater monitoring wells.

Monitoring and evaluation of the new system will be conducted in three phases:

- Phase 1: Baseline Sampling
- Phase 2: Short-Term ZOI Evaluation and Soil Vapor Monitoring (Week 1)
- Phase 3: Long-Term Monitoring

Table 1 presents the proposed sampling and analysis program for the offsite area. The soil vapor monitoring probes and groundwater monitoring wells listed below are relevant due to their proximity to residential structures, the biosparge ZOI, and LNAPL smear zone. Existing monitoring wells are shown on Figure 2.

- **Soil Vapor Monitoring Probes.** SVM-3, SVM-4, SVM-7, SVM-8, SVM-10, SVM-16, GMW-O-12, and GMW-O-21. In addition, the existing monitoring network will be expanded to include five new soil vapor probes (SVM-26 through SVM-30) proposed to be installed prior to system startup in the first quarter of 2020. The proposed soil vapor probes are shown on Figure 3. Additional soil vapor probe installations will be detailed in a work plan addendum.
- **Groundwater Monitoring Wells.** GMW-O-12, GMW-O-14, and GMW-O-21. Figures 3 shows these wells in relation to BS-03 and HSVE-01. Additional groundwater wells may be installed in a separate mobilization, if necessary. Additional groundwater monitoring well installations will be detailed in a work plan addendum.

As noted in Table 1, if measurable LNAPL is encountered during gauging of selected wells, groundwater samples will not be collected and alternate sampling locations will be considered. Groundwater sampling included in this work plan will be conducted generally in accordance with Kinder Morgan's current Groundwater Sampling and Analysis Plan (CH2M, 2013). The soil vapor samples will be collected in accordance with the recommended guidelines in the Department of Toxic Substances Control (DTSC) *Advisory for Active Soil Gas Investigations* (DTSC, 2015).

Phase 1: Baseline Sampling

Prior to BS-03 and HSVE-01 system startup, a baseline set of groundwater and soil vapor samples will be collected from selected wells during the normal operation of the TFE and SVE. Groundwater samples will be analyzed for VOCs including fuel oxygenates using EPA Method 8260B, TPH-g and TPH-d using EPA Method 8015M, and field water quality parameters (pH, dissolved oxygen [DO], oxidation-reduction potential, temperature, and conductivity). Soil vapor samples will be analyzed for VOCs using EPA Method TO-15, TPH-g using EPA Method TO-3, and fixed gases (oxygen, carbon dioxide, and methane) using ASTM International (ASTM) D1946.

Phase 2: Short-Term ZOI Evaluation and Soil Vapor Monitoring (Week 1)

Short-Term ZOI Evaluation

The ZOI evaluation will be conducted after the 3-day startup period and will require approximately 2 days to complete. The lateral and vertical extent of the ZOI will be based on the following observations and/or field analytical data from nearby groundwater monitoring wells and/or soil vapor monitoring probes: (1) changes in DO concentrations; (2) vadose zone pressure; (3) changes in water level; and (4) changes in vadose zone VOCs, oxygen, and carbon dioxide vapor concentrations.

Specific aspects of the ZOI evaluation are as follows:

- Three groundwater monitoring/observation wells nearest the screened section of BS-03 and HSVE-01 (GMW-O-12, GMW-O-14, GMW-O-21) will have groundwater levels and DO concentrations measured manually before, during, and after both BS-03 and HSVE-01 are operational. Additional wells may be added to this list in a work plan addendum.
- VOCs, oxygen, and carbon dioxide field readings using a 5-gas meter will be collected at regular intervals from the list of soil vapor monitoring probes in Table 1. Additional probes may be added to this list in a work plan addendum.
- Vadose zone pressure in the soil vapor monitoring probes will be measured at regular intervals.

Short-Term Soil Vapor Monitoring

Soil vapor monitoring will be conducted during the first week of operation. Selected soil vapor monitoring probes closest to BS-03 and HSVE-01 (Table 1) will be sampled once per day to monitor VOC concentrations at depths of 5 and 10 feet bgs; samples will be analyzed using EPA Method TO-15.

Phase 3: Long-Term Monitoring

Groundwater

After the first week of operation, the groundwater wells indicated in Table 1 will be monitored quarterly for a period of 1 year. After 1 year of quarterly sampling, these wells will be sampled on a semiannual basis under the routine groundwater Monitoring and Reporting Program. Groundwater samples will be analyzed for VOCs including fuel oxygenates using EPA Method 8260B, and TPH-g and TPH-d using EPA Method 8015M. A summary of selected wells and laboratory analyses for long-term monitoring is included in Table 1. Additional wells may be added to this list in a work plan addendum.

Soil Vapor

After the first week of operation, the nested soil vapor monitoring probes indicated in Table 1 will be monitored for VOCs, oxygen, and carbon dioxide with a 5-gas meter as follows: weekly during the first month, monthly for the next 6 months, and on a quarterly basis thereafter. Concurrently, vadose zone pressure will be measured using a digital manometer.

Soil vapor samples will be collected quarterly from the same set of soil vapor monitoring probes (Table 1) for a period of 1 year to evaluate subsurface soil vapor concentrations near the site boundary. After 1 year of quarterly sampling, these soil vapor monitoring probes will be sampled on a semiannual basis. Soil vapor samples will be analyzed for VOCs using EPA Method TO-15, TPH-g using EPA Method TO-3, and fixed gases (carbon dioxide, oxygen, and methane) using ASTM D1946. Additional probes may be added to this list in a work plan addendum.

Data Analysis and Reporting

Jacobs will prepare a construction completion report for submittal to the RWQCB that provides a record of the well installation activities conducted under this work plan. The report will include the following:

- Background, purpose, scope of work, field and laboratory methods, and results
- Site location map, soil vapor probe and well location map, BS-03 and HSVE-01 as-built cross-sectional diagram
- Table summarizing well completion details and laboratory analytical results
- Appendices with the county and city permits, boring logs, and laboratory reports

After sufficient data have been collected, the data will be compiled into an evaluation report that will include tabulated summaries of groundwater and soil vapor analytical data, and evaluation of results; the report will be submitted to the RWQCB for approval.

In addition, collected data will be included in quarterly remediation progress reports that are submitted to the RWQCB on April 15, July 15, October 15, and January 15 of each year.

Schedule

Jacobs anticipates installation of BS-03 and HSVE-01 in December 2019. Connection to existing, aboveground remediation equipment will occur in the first quarter of 2020, system monitoring and data analysis commencing upon startup. A construction completion report summarizing the results of the field

activities will be prepared and submitted to the RWQCB within 60 days of well installation. Evaluation reports will be prepared and submitted to the RWQCB according to the schedule indicated above.

References

CH2M HILL (CH2M). 2013. *Revised Groundwater Sampling and Analysis Plan, SFPP Norwalk Pump Station, 15306 Norwalk Boulevard, Norwalk, California*. May 30.

CH2M HILL (CH2M). 2015. *Horizontal Biosparge Well and Soil Vapor Monitoring Probe Completion Report, SFPP Norwalk Pump Station, 15306 Norwalk Boulevard, Norwalk, California*. February 18.

CH2M HILL (CH2M). 2017a. *Evaluation Report for the South-Central Area Horizontal Biosparge Pilot Test SFPP Norwalk Pump Station, Norwalk, California*. August 3.

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Jacobs Engineering Group, Inc. (Jacobs). 2018. *Southeastern Horizontal Biosparge Well (BS-02) Completion Report – SFPP Norwalk Pump Station, 15306 Norwalk Boulevard, Norwalk, California.* July.

Jacobs Engineering Group, Inc. (Jacobs). 2019. *Third Quarter 2019 Remediation Progress Report SFPP Norwalk Pump Station Norwalk, California*. October.

If you have any questions regarding this work plan, please contact Eric Davis/Jacobs at 404.323.1600, or Alan Van Antwerp, Kinder Morgan's Remediation Project Manager, at 619.922.1960.

Regards,

Eric Davis, P.G.
Senior Project Manager

Mark Strong
Senior Technical Consultant

Copy to: Alan Van Antwerp, Kinder Morgan, Inc.

Attachments:

Table 1 – Groundwater and Vapor Sampling and Analysis Plan for the Offsite South-Central Area

Figure 1 – Site Location Map
Figure 2 – Remediation System Layout
Figure 3 – Offsite South-Central Area Horizontal Biosparge and SVE Well Location Map
Figure 4 – Conceptual Horizontal Biosparge and Soil Vapor Extraction Well Completion Diagram
Figure 5 – Biosparge System Piping and Instrumentation Diagram
Figure 6 – Soil Vapor Extraction System Piping and Instrumentation Diagram

Table

Table 1. Groundwater and Vapor Sampling and Analysis Plan for the Offsite South-Central Area
SFPP Norwalk Pump Station, Norwalk, California

Parameter	Analytical Method	Sampling Method/Container	South-Central Sample Locations
GROUNDWATER SAMPLING PLAN			
Baseline Groundwater Sampling [a, b]			
VOCs	EPA 8260B	3 x 40-ml VOA vials (preserved)	GMW-O-12, GMW-O-14, and GMW-O-21
TPH-g and TPH-d	EPA 8015M	3 x 40-ml VOA vials (preserved), 1-L Amber	
Water Parameters (pH, DO, ORP, temperature, conductivity, and water level)	Field Measurement	Flow-through cell	
Short-Term Monitoring (during first week)			
Water level	Transducer	Down-well transducer	GMW-O-12, GMW-O-14, and GMW-O-21
DO	DO Sensor	Down-well DO Sensor	
Long-Term Groundwater Monitoring (quarterly for 1 year and semiannual thereafter) [a, b]			
VOCs	EPA 8260B	3 x 40-ml VOA vials (preserved)	GMW-O-12, GMW-O-14, and GMW-O-21
TPH-g and TPH-d	EPA 8015M	3 x 40-ml VOA vials (preserved), 1-L Amber	
Water Parameters (pH, DO, ORP, temperature, conductivity, and water level)	Field Measurement	Flow-through cell	

Table 1. Groundwater and Vapor Sampling and Analysis Plan for the Offsite South-Central Area
SFPP Norwalk Pump Station, Norwalk, California

Parameter	Analytical Method	Sampling Method/Container	South-Central Sample Locations
VAPOR SAMPLING PLAN			
Baseline Vapor Sampling			
VOCs	EPA TO-15	1-L Summa	SVM-3, SVM-4, SVM-8, SVM-10 and SVM-16
VOCs, O_2, CO_2	5 Gas Meter	Tedlar bag	
TPH-g	EPA TO-3	1-L Summa	
Fixed Gases (CO_2, O_2, and Methane)	ASTM-1946	1-L Summa	
Vadose zone pressure	Manometer	--	
Short-Term Monitoring (during first week)			
VOCs (once per day)	EPA TO-15	1-L Summa	SVM-3, SVM-4, SVM-8, SVM-10 and SVM-16
VOCs, O_2, CO_2	5 Gas Meter	Tedlar bag	
Vadose zone pressure	Manometer	--	
Long-Term Vapor Monitoring (quarterly for 1 year and semiannual thereafter)			
VOCs	EPA TO-15	1-L Summa	SVM-3, SVM-4, SVM-8, SVM-10 and SVM-16 and proposed probes SVM-26 through SVM-30
VOCs, O_2, CO_2 [c]	5 Gas Meter	Tedlar bag	
TPH-g	EPA TO-3	1-L Summa	
Fixed Gases (CO_2, Oxygen, and Methane)	ASTM-1946	1-L Summa	
Vadose zone pressure [c]	Manometer	--	

Notes:

[a] Groundwater samples and water level measurements will be collected per Kinder Morgan's Groundwater Sampling and Analysis Plan (CH2M, 2013).

[b] Groundwater samples will not be collected at locations with measurable free product.

[c] Vadose zone pressure and VOC, O_2, and CO_2 will be collected weekly for the first month, monthly for the first 6 months, quarterly for 1 year, and semiannual thereafter

CO_2 = carbon dioxide
DO = dissolved oxygen
EPA = U.S. Environmental Protection Agency
L = liter(s)
ml = milliliter(s)
O_2 = oxygen
ORP = oxidation-reduction potential
TPH-d = total petroleum hydrocarbons as diesel
TPH-g = total petroleum hydrocarbons as gasoline
VOA = volatile organic analysis - glass vials with Teflon-lined septa
VOC = volatile organic compound

Figures

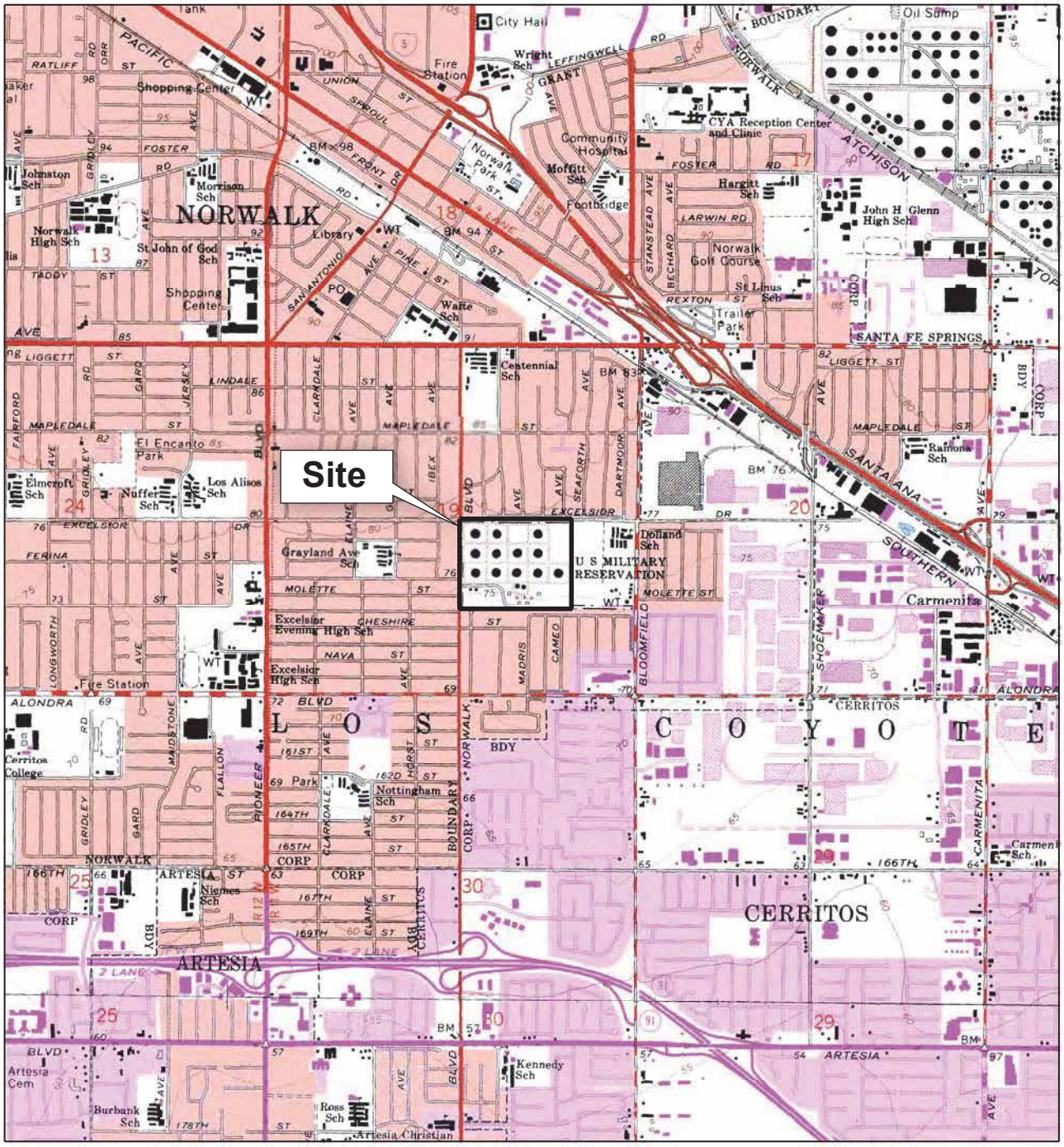

Figure 1. Site Location Map
SFPP Norwalk Pump Station
Norwalk, California

BASEMAP MODIFIED FROM U.S.G.S. 7.5 MINUTE QUADRANGLE MAP
LOS ALAMITOS 1964, CALIFORNIA. PHOTO-REVISED 1981.
WHITTIER 1965, CALIFORNIA. PHOTO-REVISED 1981.

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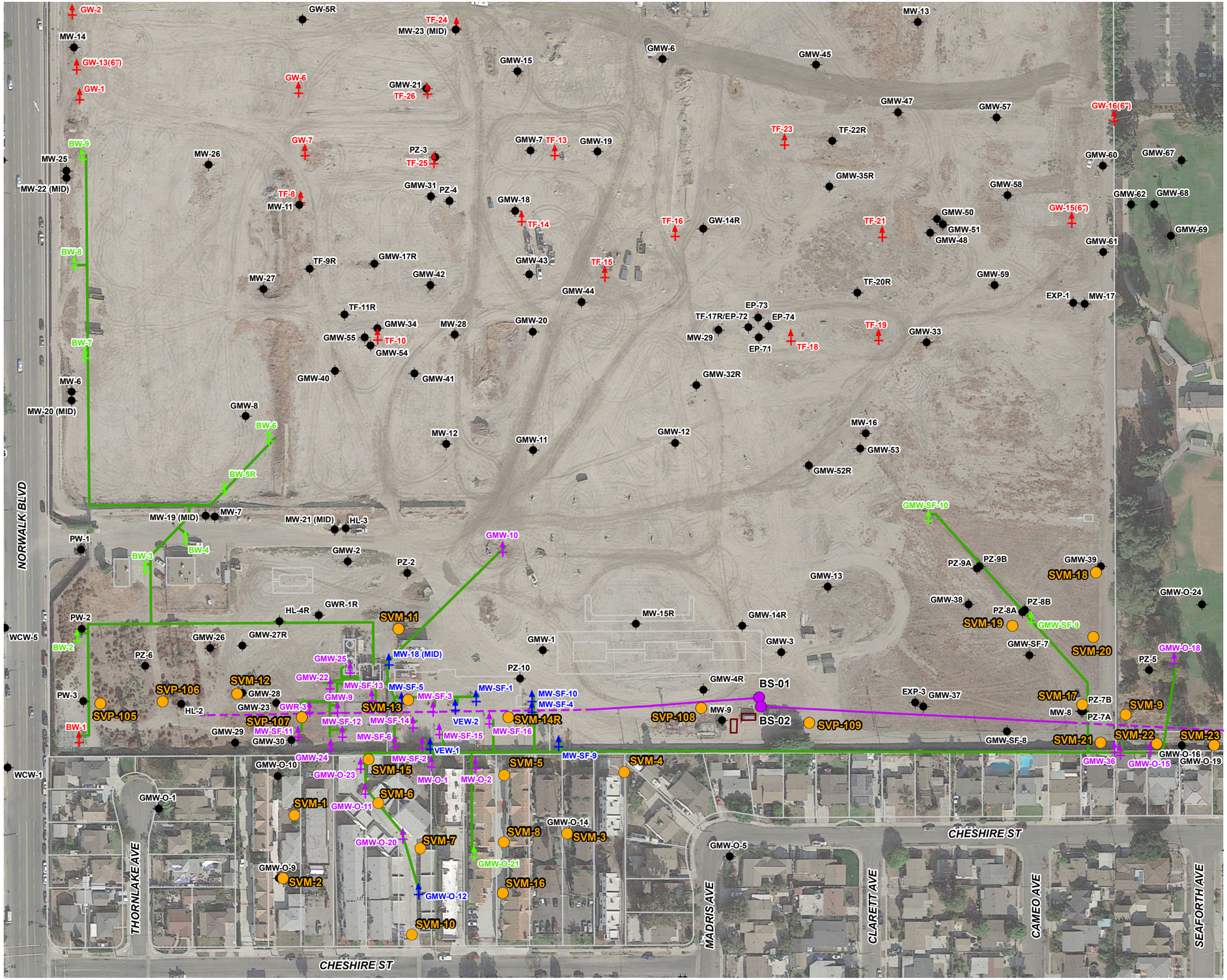

LEGEND

- Soil Vapor Probe/Soil Vapor Monitoring Probe
- Horizontal Biosparge Well Entry Point
- Existing Groundwater Monitoring Well
- Existing Remediation Well
- Kinder Morgan Combined Soil Vapor and Total Fluids Extraction Wells
- Kinder Morgan Soil Vapor Extraction Wells
- Kinder Morgan Total Fluids and/or Groundwater Extraction Wells
- Kinder Morgan Remediation Piping Layout (Above Ground and Below Ground)
- Horizontal Biosparge Well (Dashed Line Depicts Approximate Lateral Extent of Well Screen)
- Air Compressor System

BS-01 250 ft. of riser pipe and 800 ft. of slotted casing

BS-02 493 ft. of riser pipe and 240 ft. of slotted casing

Imagery Source:
Google Earth December 3, 2017.

N

0 75 150 300
Feet

1 inch = 150 feet

Figure 2. Remediation System Layout
SFPP Norwalk Pump Station
Norwalk, California

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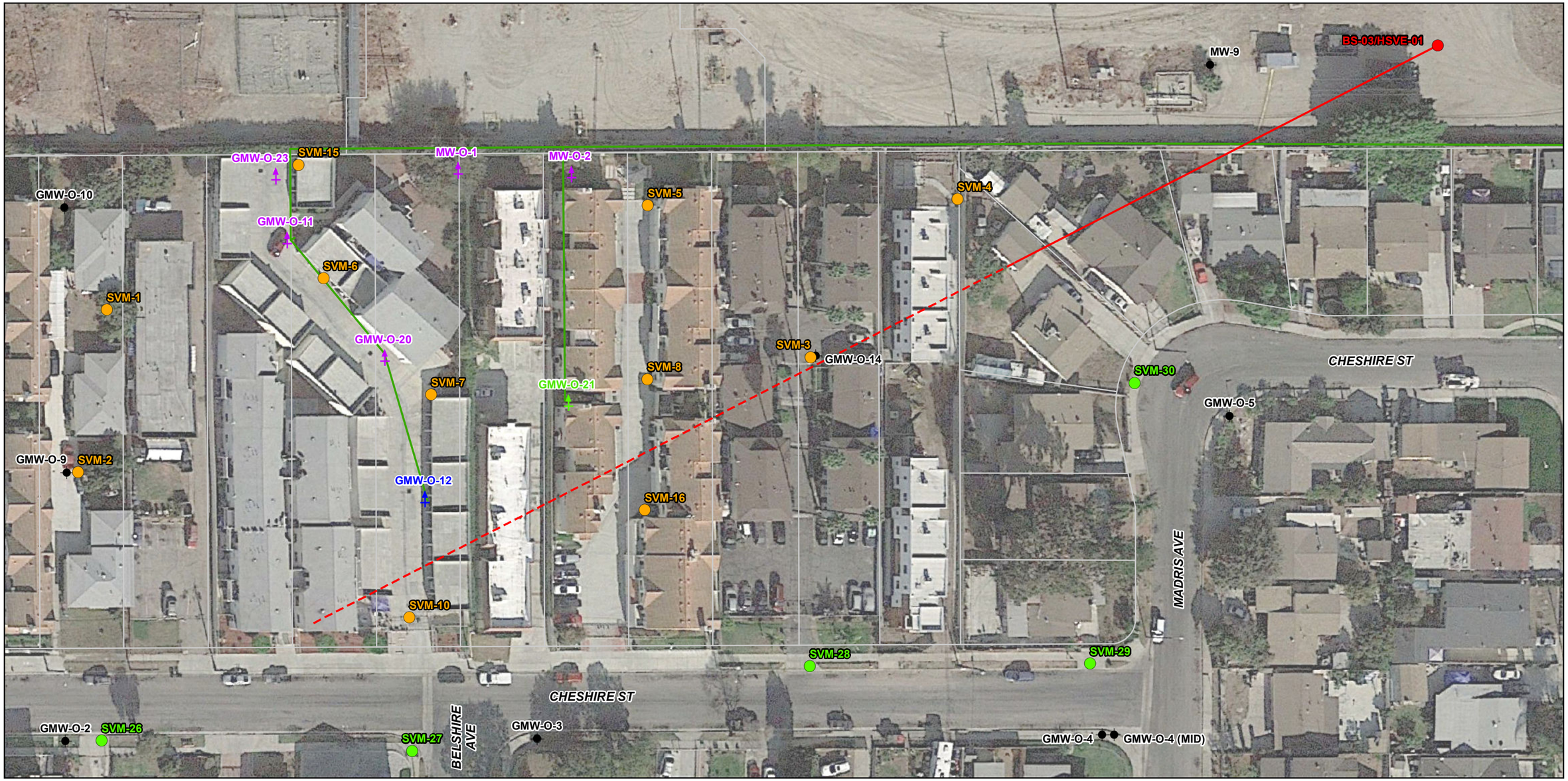
\\BROOKSIDEFILES\GIS_SHARE\ENBG\00_PROJ\K\KINDERMORGAN\NORWALK\MAPFILES\2019\FIGURE_2_REMEDIATION_SYSTEM_LAYOUT.MXD AESPEJO 10/9/2019



LEGEND

- Proposed Soil Vapor Monitoring Probe Location
- BS-03/HSVE-01 (300 Feet of Riser Pipe, 500 Feet of Slotted Casing)
- Soil Vapor Probe/Soil Vapor Monitoring Probe
- Existing Groundwater Monitoring Well
- Existing Kinder Morgan Combined Soil Vapor and Total Fluids Extraction Wells
- Existing Kinder Morgan Soil Vapor Extraction Wells
- Existing Kinder Morgan Total Fluids and/or Groundwater Extraction Wells
- Existing Kinder Morgan Remediation Piping Layout (Above Ground and Below Ground)
- New Remediation Well

Imagery Source:
Google Earth December 3, 2017.

N

0 60 120
Feet

1 inch = 60 feet

Figure 3
Offsite South Central Area Horizontal Biosparge and SVE Well Location Map
SFPP Norwalk Pump Station
Norwalk, California

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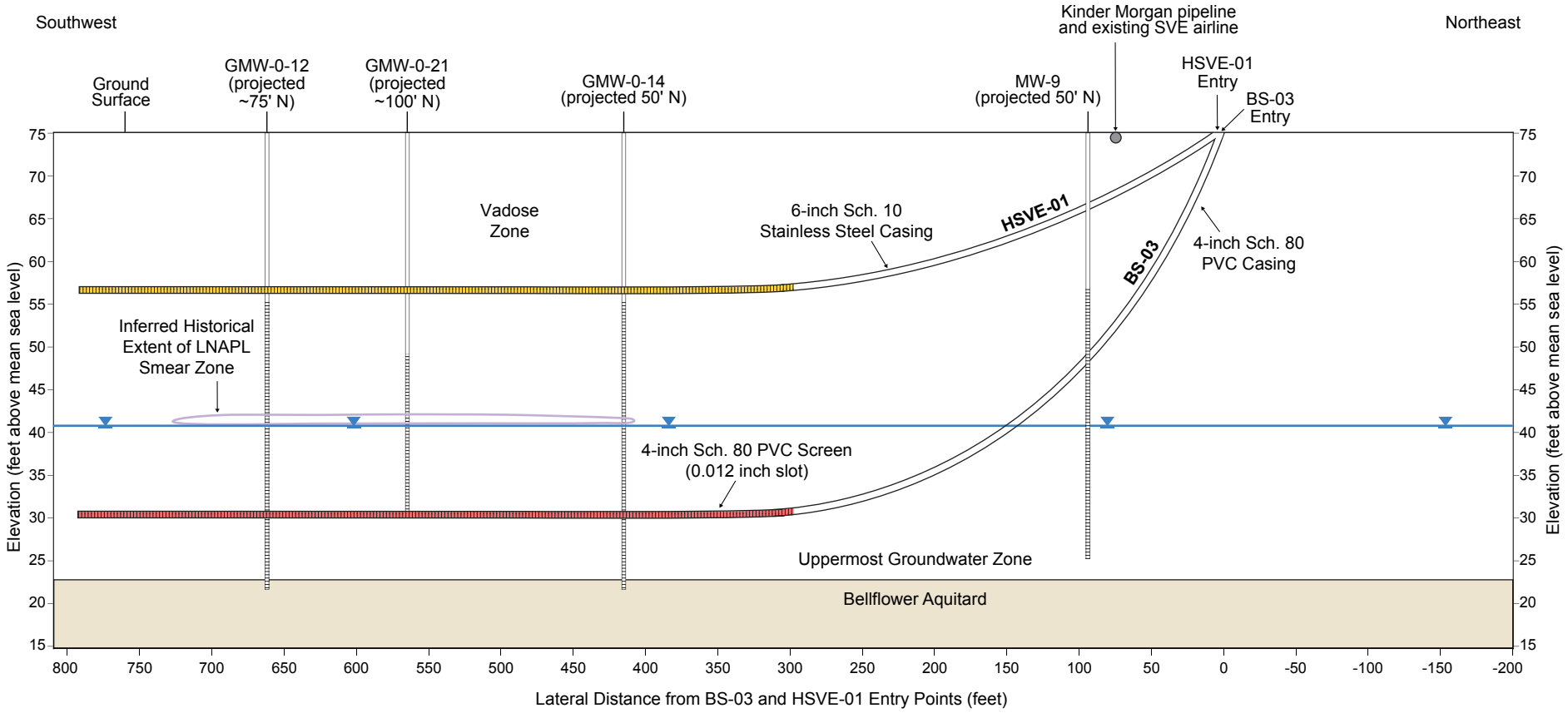
R:\ENBG\00_PROJ\K\KINDERMORGAN\NORWALK\MAPFILES\2019\FIGURE_3_OFFSITE_SC_AREA_BIOSPARGE_WELL.MXD 10/31/2019 12:05:17 AM



LEGEND

- Monitoring or TFE/SVE Well Screen
- Horizontal Biosparge Well Screen
- Horizontal Soil Vapor Extraction Well Screen
- Average 2Q19 GWE for GMW-O-12, GMW-O-14, GMW-O-21 and MW-9
- Kinder Morgan Pipeline and Existing Remediation System Piping

Note: HSV-01 boring path will reside approximately 10 feet north of the BS-03 boring path

Figure 4.Conceptual Horizontal Biosparge and Soil Vapor Extraction Well Completion Diagram
SFPP Norwalk Pump Station
Norwalk, California

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MASTER BILL OF MATERIAL

ITEM	QTY	DESCRIPTION
100	1	COMPRESSED AIR PACKAGE, KAESER DSD-175, 882 CFM @ 125 PSI, 175 HP, 3PH TEFC 460V w WYE DELTA NEMA 12 STARTER AND ENCLOSURE, SIGMA CONTROL 2 SYSTEM NOTE: 1/2" CONDENSATE DRAIN REQUIRES CONNECTION BY OTHERS
201	1	AUTO DRAIN – KAESER ECO-DRAIN 32, 120VAC, 1/2" INLET/OUTLET
205	1	COMPRESSED AIR TANK, PENWAY MODEL A21536094150 (TL DIM 62"), 240 GAL VERTICAL, 150 PSI, EPOXY LINED
207	1	PARTICULATE FILTER – KAESER F250KB, 3" NPT w/ECO-DRAIN 31, 1/4" DRAIN
208	1	COALESCED OIL FILTER – KAESER F250KE, 3" NPT w/ECO-DRAIN 31, 1/4" DRAIN
209	4	COMPRESSED AIR SILENCER, NORGREN P/N MBP04A, 1/2" MNPT
210	1	PRESSURE RELIEF VALVE, CONTROL DEVICES, BRASS, 1244 SCFM @ 150 PSIG RELIEF PRESSURE, 1" NPT

ITEM	QTY	DESCRIPTION
401	3	BALL VALVE, 1/2" NPT BRASS BODY, TFE SEAT, SS BALL, LOCKING HANDLE
402	3	CHECK VALVE, JOMAR T-521G (105-608G), 2" BRASS BODY, PTFE SEAT
403	1	BALL VALVE, WATTS G4000M1, 3" 150# FLANGED BALL VALVE FULL PORT, CI, SS BALL
404	1	BALL VALVE-STRAINER, MIDWEST CONTROL BPS-5050, 1/2" NPT BRASS BODY CHROME BALL, TFE SEAT, 50 MESH SS STRAINER
405	3	SOLENOID VALVE, STC 2W500-2, 2" BRASS BODY, BUNA-N SEAT, 110VAC (30W), NC
406	3	PRESSURE REGULATOR, ARO MODEL R37591-100, 0-125 PSI ZINC BODY 2" NPT w/GAUGE
407	3	DIAPHRAGM VALVE, GIE WTDX223B2.0, DI BODY, BUNA-N, 2" NPT, MANUAL OPERATOR
408	3	BALL VALVE, WEBSTONE 4172, 1/2" BRASS BODY, SS BALL, TFE SEAT w/ 1/4" GAUGE PO

ITEM	QTY	DESCRIPTION
801	1	FLOW TRANSMITTER, CDI 5400-30S, 0-1200 CFM, 4-20mA w/ VORTAB MODEL VIS
802	1	PRESSURE TRANSMITTER, DWYER 628-11-GH-P1-E6-S1, 0-150 PSIG, 4-20mA
803	1	TEMP GAUGE, PIC MODEL B3B6-JJ, 20-240F, SS CASE, 1/2" NPT, 3" FACE, 6" STEM
804	3	FLOW TRANSMITTER, CDI 5400-20S, 0-600 CFM, 4-20mA w/ VORTAB MODEL VIS
806	1	LEVEL SWITCH, DWYER F6-MHS2, 1/2" NPT
807	3	PRESSURE GAUGE, PIC# 201L-425C, 0-30 PSIG, 1/4" NPT, 2-1/2" DIA LF 304SS CASE
809	1	PRESSURE GAUGE, PIC# 201L-425F, 0-160 PSIG, 1/4" NPT, 2-1/2" DIA LF 304SS CASE

NOTES

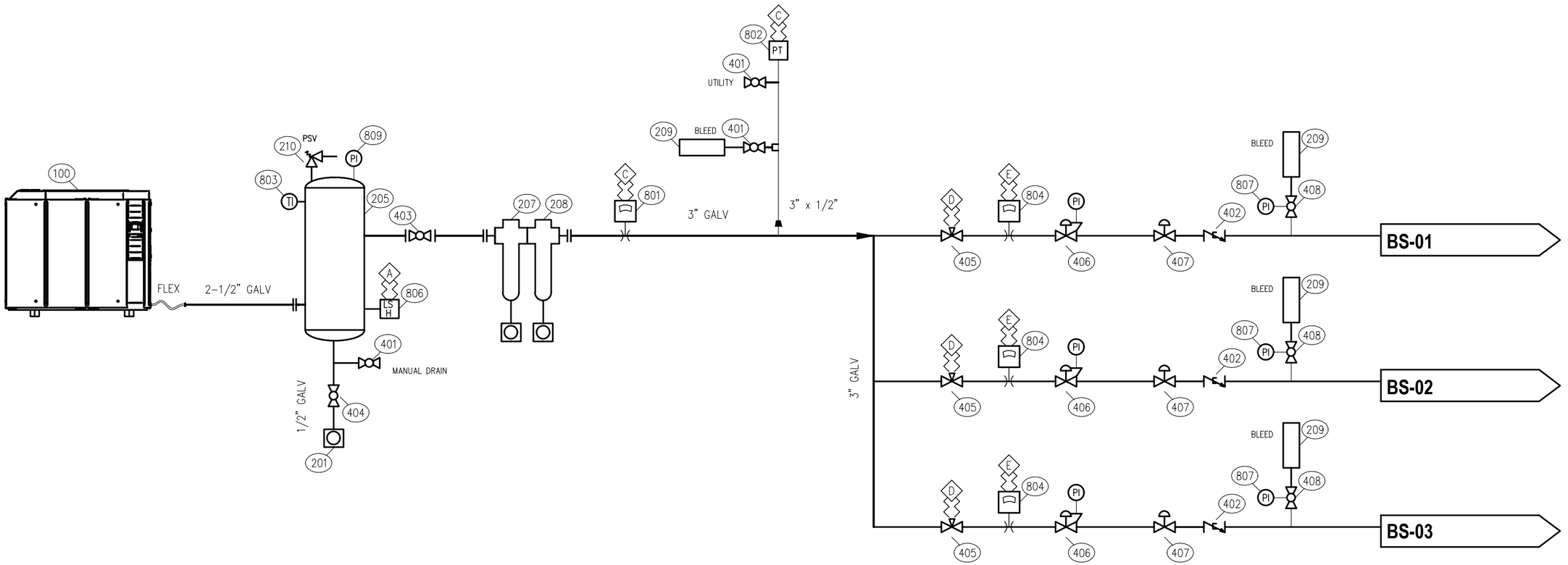
1. ALL TUBE FITTINGS BRASS PUSH LOCK FITTING
2. ALL TUBING POLYETHYLENE
3. PRIMARY SYSTEM VOLTAGE 480V 3 PHASE 60 HZ
4. ALL GASKET BUNA-N UNLESS OTHERWISE NOTED
5. –

- BILL OF MAT'L TAG
- PNEUMATIC TAG
- ELECTRICAL TAG
- PRESSURE GAUGE
- DIFF. PRESS. GAUGE
- THERMOMETER
- BUTTERFLY VALVE
- CAM FITTING OR UNION
- GATE VALVE
- BALL VALVE
- GLOBE VALVE
- SOLENOID VALVE
- RELIEF VALVE
- SWING CHECK VALVE
- PISTON CHECK VALVE
- IN-LINE CHECK VALVE
- BUTTERFLY CHECK VALVE
- DIAPHRAGM VALVE
- REGULATOR VALVE
- REGULATOR/RELIEF VALVE
- IN LINE FILTER
- "Y" – STRAINER
- FLOW METER
- ORIFICE PITOT TUBE SENSOR
- PRESSURE/VACUUM TRANSDUCER
- FLOW SWITCH
- LIQUID LEVEL SWITCH
- LEVEL SENSOR – HIGH
- LEVEL SENSOR – LOW
- PRESSURE SENSOR – DIFFERENTIAL
- PRESSURE SENSOR – LOW
- PRESSURE SENSOR – HIGH
- TEMPERATURE SENSOR – HIGH
- RESISTANT TEMPERATURE DETECTOR
- MAIN PROCESS PIPING
- UTILITY PIPING
- FUTURE PIPING / PIPING BY OTHERS
- INST. TUBING AIR, GAS, or OIL
- PROCESS HOSE

BILL OF MATERIAL TAG LEGEND

- 1XX – SPECIALIZED PROCESS EQUIPMENT
- 2XX – STANDARD PROCESS EQUIPMENT
- 3XX – CONTROL PANELS
- 4XX – VALVES
- 5XX – LIGHTING
- 6XX – HEATING AND VENTILATION
- 7XX – NOT USED
- 8XX – INSTRUMENTATION
- 9XX – OTHER
- 0XX – NOT USED

PROCESS



Source: Original drawing - Onion Equipment Company

Figure 5. Biosparge System
Piping and Instrumentation Diagram
SFPP Norwalk Pump Station
Norwalk, California

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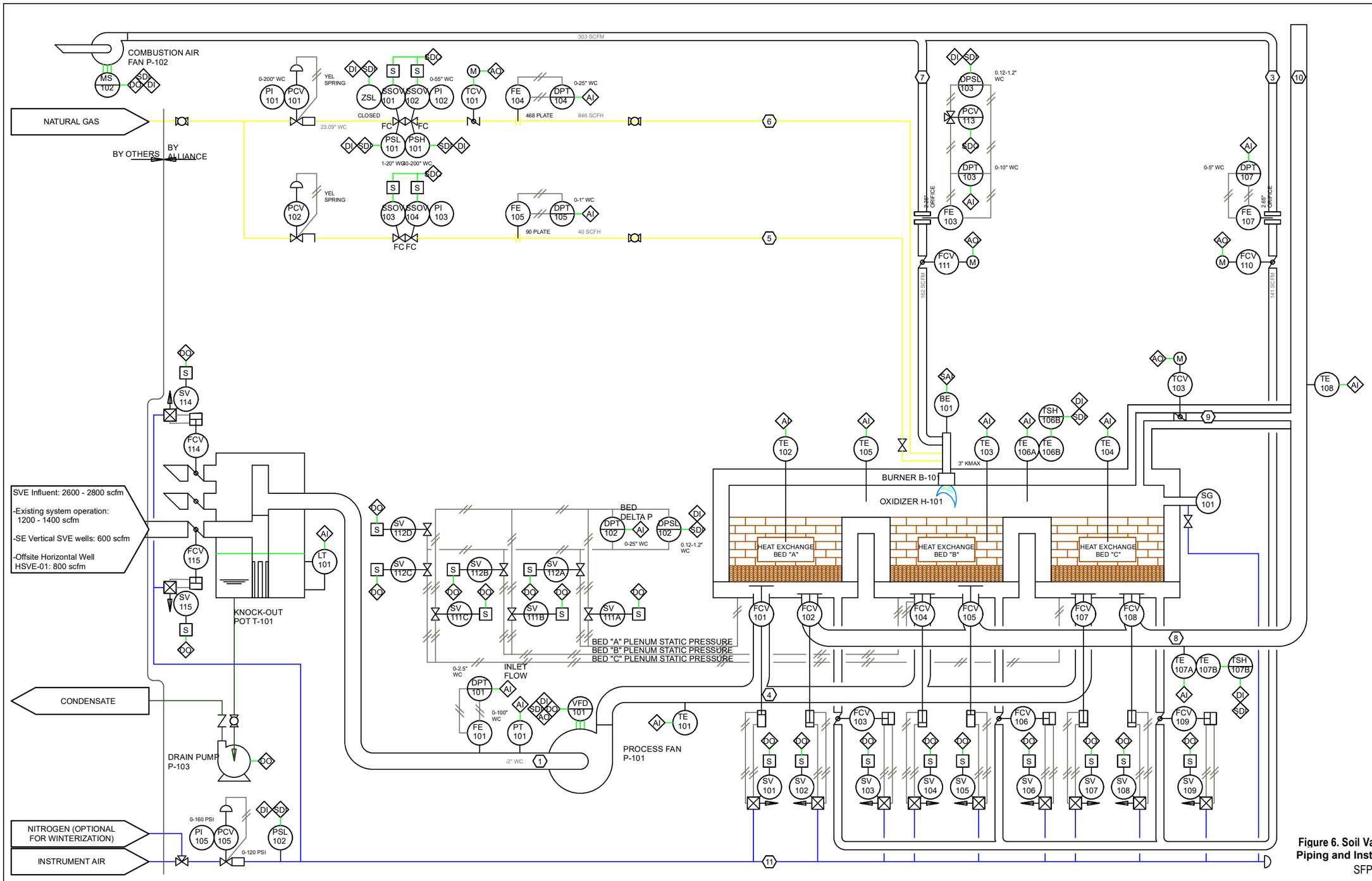

SOURCE: ALLIANCE CORPORATION, BOXIDIZER 303 REGENERATIVE THERMAL OXIDIZER PROCESS FLOW AND INSTRUMENTATION DIAGRAM, DATE: 12-MAY-2016, SCALE: NONE
DRAWING NO.: 1886-01-01, REVISION NO.: 1

Figure 6. Soil Vapor Extraction System Piping and Instrumentation Diagram
SFPP Norwalk Pump Station
Norwalk, California

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