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Mr. Paul Cho Regional Water Quality Control Board Los Angeles Region 320 West 4th Street, Suite 200 Los Angeles, California 90013

July 12, 2018

Subject: Southeastern Horizontal Biosparge Well (BS-02) Completion Report SFPP Norwalk Pump Station, 15306 Norwalk Boulevard, Norwalk, California

Dear Mr. Cho,

On behalf of SFPP, L.P. (SFPP), an operating partner of Kinder Morgan Energy Partners, L.P. (Kinder Morgan), CH2M HILL Engineers, Inc. (CH2M), now a wholly owned subsidiary of Jacobs Engineering Group Inc. (Jacobs), has prepared this report detailing the drilling and installation of southeastern horizontal biosparge well BS-02 at the SFPP Norwalk Pump Station, Norwalk, California. Figure 1 shows the location of the project site, Figure 2 depicts the biosparge system layout, and Figure 3 displays the location of the new well.

This work was performed by CH2M in accordance with the *Horizontal Biosparge System Construction Work Plan* (CH2M, 2017a). In the work plan, Kinder Morgan proposed to install one biosparge well (BS-02) in the southeastern area. This work follows the successful installation of the south-central biosparge well (BS-01) and results of a 1-year pilot test conducted in 2017 (CH2M, 2017b). The southeastern biosparge equipment installation and shakedown testing is scheduled to occur in September 2018. The new system will not be operational until upgrades to the southeastern soil vapor extraction (SVE) system have been completed, likely in the first quarter of 2019. System monitoring and data analysis will commence upon startup. After sufficient data have been collected, the data will be compiled into an evaluation report including tabulated summaries of biosparge system results, along with supporting groundwater and soil vapor analytical data. The evaluation report will be submitted to the Regional Water Quality Control Board, Los Angeles Region (RWQCB) and Norwalk Tank Farm Restoration Advisory Board (RAB) members for review and concurrence.

Background Information

This section presents a summary of background information including site description, hydrogeologic conditions, and references to documents in the administrative record that describe the existing remediation systems, effectiveness of the existing remediation systems, and selection of biosparge as an alternate interim remedy to the existing remediation systems.

Site Description

The entire facility on which Kinder Morgan operates is owned by DLA Energy (formerly Defense Energy Support Center) and was formerly occupied by 12 aboveground fuel storage tanks and associated piping and facilities. The facility was decommissioned in 2001 and is no longer used to handle fuel. The aboveground tanks and the main infrastructure were demolished in 2011; demolition of the subsurface piping was completed in 2012.

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Due to historical site operations, subsurface environmental assessments have been performed at the site since 1986. Groundwater monitoring and remediation wells have been installed at the site for monitoring and as components of groundwater remediation systems (Figure 2). The investigations have evaluated and defined subsurface soil and groundwater within the uppermost groundwater zone that has been impacted by fuel-related hydrocarbons from historical releases from Kinder Morgan's pipelines at the site. Separate-phase floating product, or light non-aqueous phase liquid (LNAPL), as well as sorbed-phase and dissolved-phase fuel hydrocarbons, have been delineated in areas beneath the site and at offsite properties to the south, west, and east. The screened interval of BS-02 was placed beneath the LNAPL zone in the southeastern area of the site.

Site assessments indicate that the chemicals of potential concern are total petroleum hydrocarbons (TPH), including TPH quantified as gasoline (TPH-g), diesel (TPH-d), and jet propulsion fuel Grades 4, 5, and 8 (JP-4, JP-5, and JP-8); benzene, toluene, ethylbenzene, and total xylenes (BTEX); 1,2-dichloroethane (1,2-DCA); methyl tertiary butyl ether (MTBE); and tertiary butyl alcohol (TBA). A groundwater Monitoring and Reporting Program has been in effect at the site since 1995, and the current program is described in the *Revised Groundwater Sampling and Analysis Plan, SFPP Norwalk Pump Station, 15306 Norwalk Boulevard, Norwalk, California* (CH2M, 2013a).

Hydrogeologic Conditions

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

- Semiperched groundwater zone between depths of approximately 25 and 50 feet below ground surface (bgs). Groundwater flow within this uppermost zone is generally north to northwestward with a horizontal gradient of approximately 0.001 foot per foot.
- Bellflower aquitard of the Lakewood Formation between depths of approximately 50 and 80 feet bgs beneath the site. The Bellflower aquitard consists of predominantly 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 had a magnitude of approximately 0.001 foot per foot and a generally southeastward direction.

Additional information about subsurface conditions is available in the *Conceptual Site Model and Proposed Alternate Interim Remedy for Soil, Groundwater, and LNAPL, Defense Fuel Support Point Norwalk, California* (CH2M, 2013b).

Overview of Existing Remediation Systems and Biosparge Technology

The following documents in the administrative record provide a description of the existing remediation systems process and effectiveness, and selection of biosparge as an alternate interim remedy to the existing remediation systems:

- CH2M. 2013c. Horizontal Biosparge System Construction and Pilot Test Work Plan, SFPP Norwalk Pump Station, 15306 Norwalk Boulevard, Norwalk, California. November 13.
- CH2M. 2017a. Horizontal Biosparge System Construction Work Plan, SFPP Norwalk Pump Station, 15306 Norwalk Boulevard, Norwalk, California. October 30.
- CH2M. 2017b. Evaluation Report for the South-Central Area Horizontal Biosparge Pilot Test, SFPP Norwalk Pump Station, 15306 Norwalk Boulevard, Norwalk, California. August 3.
- CH2M. 2017c. Fourth Quarter 2017 Remediation Progress Report for the SFPP Norwalk Pump Station, 15306 Norwalk Boulevard, Norwalk, California. October 13.



Field Activities and Well Construction Summary

This section presents a synopsis of field activities and well construction details. All field activities were performed between November 10 and November 21, 2017.

Preparatory Activities

The following tasks were completed prior to initiating drilling:

- Updated the existing site-specific health and safety plan to incorporate the planned fieldwork.
- Surveyed and staked the proposed bore path of the biosparge well along the ground surface.
- Notified Underground Service Alert (USA). As required by USA, the boring was called-in and marked-out in white paint the week prior to mobilizing. The Dig Alert ticket number was A173070966-00A.
- Obtained the required well permit from the Los Angeles County Department of Public Health (Attachment A).
- Performed an underground utility check using a private utility-locating subcontractor. CH2M and the subcontractor met with Kinder Morgan operations staff, marked-out the boring locations, and cleared the boring locations of potential underground utilities and other infrastructure.
- To supplement the underground utility clearance, potholing using a hand auger was performed down to 10 feet bgs every 3 feet from the borehole entry point to approximately 50 feet downrange, for a total of 17 locations. The purpose of potholing along this section of the bore path was to re-confirm that no shallow subsurface obstructions were present along the interval from the borehole entry point to the water table.
- Coordinated with Kinder Morgan personnel to arrange for a project inspector to be present while advancing the borehole beneath the active product pipeline that is perpendicular to the borehole.
- Coordinated with the Kinder Morgan Corrosion Supervisor to de-energize the cathodic protection well, located at the distal end of the bore path, due to potential electromagnetic interference with horizontal drilling guidance equipment. The cathodic protection well was re-energized after the well was installed.
- In accordance with Kinder Morgan's *Liquids O&M Procedure, Construction Near Company Facilities, Directional Drilling*, Section 3.14, part d (Kinder Morgan, 2017), prior to initiating directional drilling, another drilling contractor (Cascade Environmental) air-knifed a viewing window to help determine that the drilling tool would miss the abovementioned product pipeline. The viewing window, located approximately 550 feet downrange of the borehole point of entry and 65 feet west of the product pipeline, measured approximately 3 feet long by 2 feet wide by 10 feet deep.
- The ground surface along the planned bore path of the well was surveyed by Calvada Surveying, Inc. (Calvada), and the results were provided to Directed Technologies Drilling, Inc. (DTD). Sharewell HDD, LLC (Sharewell), of Spring, Texas, the subcontracted directional drilling navigation technician, used the survey data to aid in the deployment of the magnetic coils used for the wireline navigation system, as discussed below. A copy of the Surveyor Report is provided in Attachment B.

Drill Rig Mobilization

The directional drilling subcontractor, DTD, mobilized a "Range 2" CMS 9030 drill rig rated for 90,000 pounds thrust and 30,000 pounds pullback force, with approximately 25,000 foot-pounds of torque. This rig has the capacity to run oversize drill rods (5.5-inch ID) needed for blind-end installations where the 4-inch well materials are installed inside the drill rods.

The drill rig was supplied with recycled drilling fluid from an American Augers system, which mixes and cleans the drill mud. This mud system includes multiple mud tanks, mixing jets, scalper screens/shakers,

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desilting and de-sanding hydrocyclones, pumps, and associated fluid conveyance lines. Drilling cuttings from the shakers were accumulated in 30-yard roll-off containers positioned adjacent to the mud system. Photographs of the drill rig and mud system are provided in Attachment C as Photographs 1 and 2.

Borehole Navigation

With the aid of the survey data provided by Calvada, DTD used a wireline navigation system known as a Tru-Tracker magnetic guidance system, supplied and operated by Sharewell, to determine the precise location of the drilling bit during borehole advancement. This system generated an electromagnetic field by laying a temporary coil on the ground surface with a loop of insulated wire that encircles the bore path, extending on either side approximately 40 feet away (Attachment C, Photograph 3). The coil was surveyed by Sharewell prior to boring advancement. The electric field allowed precise location of the sensor (located behind the drill head) to be tracked in three dimensions while drilling. Continuous communication between the driller and Sharewell technician enabled precise navigation, within +/-0.5-foot deviation from the target path. Sharewell survey results, including plan and profile views of the bore path/well and navigation data collected from each drill rod, are provided in Attachment B. DTD's Well Completion Report (Attachment D) provides additional well installation details.

Drilling and Construction

The drill bit diameter used to advance the BS-02 borehole for biosparge well installation was 10.25 inches. The borehole diameter ranged from 100 to 125 percent of the drill bit size, due to asymmetrical enlargement of the horizontal borehole by gravitational effects during drilling. A photograph of the drill bit is provided as Photograph 4 in Attachment C. Biodegradable guar-based drilling fluid (Baroid BioBore biodegradable biopolymer) was used to facilitate advancement of the drill bit and circulation of the drill cuttings from the borehole.

The entry point for BS-02 is located along the access road immediately south of the southeastern corner of the former truck fill stand. The borehole was drilled 733.92 lateral feet bgs, with a surficial bore path extending 717.82 feet from the entry point. Soil cutting returns at the drilling rig mud system were logged by a CH2M geologist for color, grain size, and other pertinent soil characteristics. Soil also was screened in the field using a photoionization detector for the potential presence of volatile organic compounds. A copy of the Boring Log is provided in Attachment E.

After the borehole was advanced to the target distance, all rods were tripped out of the bore, the drill bit and navigation system housing (containing the sensor) were removed, and the drill rods with an open "blunt nose" fitting were returned to "chase" the boring and prepare for well installation. Drilling fluid was pumped continuously during this process to keep the borehole open and drill rods clear. Upon achieving target distance, the drill rig mast/carrier was used to gradually push the polyvinyl chloride (PVC) well materials into place in 20-foot (flush-threaded) sections. A total of 493 feet of Schedule 80 PVC riser pipe (blank casing) were installed from the entry point to the beginning of the screened interval, with 240 feet of Schedule 80 PVC slotted pipe ("screen") from 493 feet to 733 feet. Photograph 5 in Attachment C shows project staff inspecting the well materials prior to installation. The screen has a maximum slot width of 0.012 inches, a slot length of 1.6 inches, and 4 rows at 20 slots per foot (4 rows x 5 slots per row; approximately 0.27 percent open area). A filter pack was not required for this well because horizontal wells with this configuration are typically allowed to develop naturally. The well construction diagram is included in Attachment F.

Well Development

Well development was conducted to ensure effective communication between the well and the surrounding geologic formation. A combination of jetting and flushing clean water and a drilling-fluid-breaking enzyme through the well screen was employed for development. The total development water flushed and jetted into the well was approximately 11,200 gallons, with a total of 18 jetting passes through the well screen section. Approximately 10,900 gallons of development fluid (development water and drilling mud) was discharged and containerized during the development event. Field water quality

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parameters (pH, temperature, conductivity, turbidity, sand and mud content) were collected during development activities and are included in the Well Development Log (Attachment G).

Well Grouting

Installation of a well seal was completed after well development. A grout plug was emplaced by pumping approximately 150 gallons of thick cement-bentonite through a tremie to a depth of 20 feet bgs (about 100 feet measured laterally). The grout plug settled for several hours followed by the emplacement of 650 to 700 gallons of cement-bentonite grout. Grouting was continued until grout material was identified at the borehole entry point.

Wellhead Completion

The wellhead includes a 4-inch clean-out (Y-pipe) and 4-inch isolation valve, set inside a 3-foot by 5-foot steel access manway with an 18-inch-wide (6-inch-thick) concrete apron and washed gravel base. The manway includes a spring assist H-20 traffic-rated, bolted cover.

The vault was set and leveled to prevent ponding or entrapment of rainwater on the wellhead. Openings were drilled through the vault walls to provide entry for the well riser and access for the air supply stubout. The 4-inch Schedule 80 PVC "Y" wellhead assembly consists of a 4-inch ball valve, 3-inch reducer, and 3-inch stubout, which composes the angled portion of the "Y." The stubout terminates approximately 2 to 3 feet beyond the concrete apron surrounding the vault, and is closed with a flush-threaded 3-inch cap. The terminated stubout is demarcated at the surface with a wooden, orange-painted stake to identify the subsurface location. The straight segment of the "Y" was completed with a flush-threaded, 4-inch cap with an O-ring and pipe dope to form an air-tight seal and provide access for future downhole activities.

A concrete slab was poured around the vault installation area, using (50) 60-pound bags of pre-mixed Sakcrete. The concrete slab is 6 inches thick, 6 feet wide, 8 feet long, and exceeds 1.5 feet in all cardinal directions from the rim of the vault. The slab was troweled to finish the surface. Photographs of the well vault are provided as Photographs 6 and 7 in Attachment C.

Waste Management

Waste generated during field activities included soil cuttings/drilling fluids, decontamination water, purged groundwater, disposable sampling supplies and personal protective equipment (for example, nitrile gloves), and general refuse (construction debris). Soil cuttings and drilling fluids were containerized in two 20-cubic-yard roll-off bins. Rinse water and purged groundwater were containerized in two 4,000-gallon polyethylene holding tanks with secondary containment. Used personal protective equipment and general refuse were containerized in one 20-yard roll-off bins. Drilling fluids were removed from the roll-off bins via vac-truck nearly daily when generated. Roll-off bins holding solid waste (drill cuttings) were labeled and temporarily stored at the drilling site pending analytical results for waste classification and eventual disposal by Kinder Morgan's waste hauling contractor (Patriot Environmental Services [Patriot]).

The following sections summarize estimated volumes of liquid and solid waste removed from the site during the investigation.

Liquids

- Approximately 3,900 gallons of nonhazardous waste liquids (biosparge well drilling fluids, decontamination water, and well development water) were removed from the site on November 15, 2017, by Patriot and transported to Crosby and Overton at 1630 West 17th Street, Long Beach, California 90813.
- Approximately 2,900 gallons of nonhazardous waste liquids (biosparge well drilling fluids, decontamination water, and well development water) were removed from the site on November 16, 2017, by Patriot and transported to Crosby and Overton.

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- Approximately 4,700 gallons of nonhazardous waste liquids (biosparge well drilling fluids, decontamination water, and well development water) were removed from the site on November 17, 2017, by Patriot and transported to Crosby and Overton.
- Approximately 9,600 gallons of nonhazardous waste liquids (biosparge well drilling fluids, decontamination water, and well development water) were removed from the site on November 21, 2017.

Solids

Solid waste (biosparge well drill cutting) samples were collected for profiling purposes on November 29, 2017.

- Approximately 8 cubic yards of nonhazardous waste solids (biosparge well drill cuttings) were removed from the site on December 22, 2017.
- General refuse, such as disposable sampling supplies and spent personal protective equipment, was containerized in a separate dumpster and hauled offsite by Patriot for disposal as municipal trash at the end of the project.

Copies of the waste manifests are provided in Attachment H.

System Startup Schedule

It is anticipated that the southeastern biosparge equipment installation and shakedown testing will occur in September 2018. The new system will not be operational until upgrades to the southeastern SVE system have been completed, which will likely occur in the first quarter of 2019. Upgrades to the southeastern SVE system will be detailed in a forthcoming addendum to the Horizontal Biosparge System Construction Work Plan, which was submitted to the RWQCB on October 30, 2017 (CH2M, 2017a). As mentioned above, an evaluation report will be prepared following system startup and provided to the RWQCB and RAB for review. The report will include analytical and operational data, as well as a brief discussion of system performance.

References

AMEC Geomatrix, Inc. 2009. Preliminary Conceptual Site Model. February 13.

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

CH2M HILL (CH2M). 2013b. Conceptual Site Model and Proposed Alternate Interim Remedy for Soil, Groundwater, and LNAPL, Defense Fuel Support Point, 15306 Norwalk Boulevard, Norwalk, California. September 3.

CH2M HILL (CH2M). 2013c. Horizontal Biosparge System Construction and Pilot Test Work Plan, SFPP Norwalk Pump Station, 15306 Norwalk Boulevard, Norwalk, California. November 13.

CH2M HILL (CH2M). 2017a. Horizontal Biosparge System Construction Work Plan, SFPP Norwalk Pump Station, 15306 Norwalk Boulevard, Norwalk, California. October 30.

CH2M HILL (CH2M). 2017b. Evaluation Report for the South-Central Area Horizontal Biosparge Pilot Test, SFPP Norwalk Pump Station, 15306 Norwalk Boulevard, Norwalk, California. August 3.

CH2M HILL (CH2M). 2017c. Fourth Quarter 2017 Remediation Progress Report SFPP Norwalk Pump Station, 15306 Norwalk Boulevard, Norwalk, California. October 13.

Interstate Technology Regulatory Council (ITRC). 2009. Evaluating LNAPL Remedial Technologies for Achieving Project Goals. December.

Kinder Morgan Energy Partners (Kinder Morgan). 2017. *Liquids O&M Procedure, Construction Near Company Facilities. Number L-O&M 204.* Revised July 12, 2017.

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If you have any additional questions regarding this investigation, please contact Eric Davis/Jacobs at (404) 323-1600, or Mr. Stephen Defibaugh, Kinder Morgan's Remediation Project Manager, at (714) 560-4802.

Sincerely,

Jacobs Engineering Group Inc.

Sie Da

Eric Davis, P.G. Project Manager

Mas they

Mark Strong Environmental Engineer

Copies to: Steve Defibaugh, Kinder Morgan Energy Partners, L.P. Norwalk Tank Farm Restoration Advisory Board (RAB) Reference Librarian, Norwalk Public Library

Attachments:

- Figure 1 Site Location Map
- Figure 2 Remediation System Layout
- Figure 3 Southeastern Area Biosparge Well Location Map
- Figure 4 Conceptual Horizontal Biosparge Well Completion Diagram
- Attachment A Los Angeles County Department of Public Health Well Permit
- Attachment B Surveyor Reports
- Attachment C Photo Documentation
- Attachment D DTD Well Completion Report
- Attachment E Well Boring Log
- Attachment F Well Construction Diagram
- Attachment G Well Development Log
- Attachment H Waste Manifests

Figures





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

JACOBS

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.

EN1014151027SCO Figure1.pdf 10/15



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LEGEND

\bigcirc	Soil Vapor Probe/Soil Vapor Monitoring Probe
	Horizontal Biosparge Well Entry Point
•	Existing Groundwater Monitoring Well
4	Existing Remediation Well
	Kinder Morgan Combined Soil Vapor and Total Fluids Extraction Wells
1	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 Vapor Extraction Well Piping
	Horizontal Biosparge Well (Dashed Line Depicts Approximate
	Lateral Extent of Well Screen)

Air Compressor System

Imagery Source: Google Earth October 18, 2016.



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





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LEGEND

	Horizontal Biosparge Well Entry Point
\bigcirc	Eastern Soil Vapor Monitoring Probe Location
	Estimated Location of Cathodic Protection Well
+	Existing Groundwater Monitoring Well
+	Existing Remediation Well
	KMEP Remediation Piping Layout (Above Ground and Below Ground)
	Proposed Eastern 15-Acre Property Boundary
	Horizontal Biosparge Well (Dashed Line Depicts Approximate Lateral Extent of Well Screen)
	Approximate Extent of Dissolved Phase in Groundwater Inferred Historical Extent of LNAPL Zone (Smear Zone) from LNAPL Characterization Work Plan (AMEC Geomatrix, 2010)
	Estimated Location of Kinder Morgan Active Fuel Line Air Compressor System

Imagery Source: Google Earth October 18, 2016.



Figure 3. Southeastern Area Biosparge Well Location Map SFPP Norwalk Pump Station Norwalk, California







LEGEND

West



Approximate Groundwater Elevation in Uppermost Groundwater Zone (October 2017)

SCO698197.HD.01 norwalk_conceptual_horizontal_biosparge_rev5.ai 2/18

Note:

Top of the Bellfower Aquitard was interpreted based on (1) review of the lithological descriptions provided on the select well and boring logs (Preliminary Conceptual Site Model, AMEC Geomatrix, Inc., 2009) and (2) Conceptual Site Model and Proposed Alternate Interim Remedy for Soil, Groundwater, and LNAPL (CH2M, 2013b)

Figure 4. Conceptual Horizontal Biosparge Well Completion Diagram SFPP Norwalk Pump Station Norwalk, California



East

Attachment A Los Angeles County Department of Public Health Well Permit



ENVIRONMENTAL HEALTH

Drinking Water Program



5050 Commerce Drive, Baldwin Park, CA 91706

Telephone: (626) 430-5420 • Facsimile: (626) 813-3013 • Email: waterquality@ph.lacounty.gov

http://publichealth.lacounty.gov/eh/ep/dw/dw_main.htm

Well Permit Approval

TO BE COMPLETED BY APPLICANT:							
WORK SITE ADDRESS	CITY	ZIP	EMAIL ADDRESS FOR WELL PERMIT APPROVAL				
15306 Norwalk Blvd.	Norwalk	90650	Eric.Davis@CH2M.com				

NOTICE:

- WORK PLAN APPROVALS ARE VALID FOR 180 DAYS. 30 DAY EXTENSIONS OF WORK PLAN APPROVALS ARE CONSIDERED ON AN INDIVIDUAL (CASE-BY-CASE) BASIS AND MAY BE SUBJECT TO ADDITIONAL PLAN REVIEW FEES (HOURLY RATE AS APPLICABLE).
- WORK PLAN MODIFICATIONS MAY BE REQUIRED IF WELL AND GEOLOGIC CONDITIONS ENCOUNTERED AT THE SITE INSPECTION ARE FOUND TO DIFFER
 FROM THE SCOPE OF WORK PRESENTED TO THE DEPARTMENT OF PUBLIC HEALTH—DRINKING WATER PROGRAM.
- THIS WELL PERMIT APPROVAL IS LIMITED TO COMPLIANCE WITH THE CALIFORNIA WELL STANDARDS AND THE LOS ANGELES COUNTY CODE AND DOES NOT GRANT ANY RIGHTS TO CONSTRUCT, RENOVATE, OR DECOMMISSION ANY WELL. THE APPLICANT IS RESPONSIBLE FOR SECURING ALL OTHER NECESSARY PERMITS SUCH AS WATER RIGHTS, PROPERTY RIGHTS, COASTAL COMMISSION APPROVALS, USE COVENANTS, ENCROACHMENT PERMISSIONS, UTILITY LINE SETBACKS, CITY/COUNTY PUBLIC WORKS RIGHTS OF WAY, ETC.
- ALL FIELD WORK MUST BE CONDUCTED UNDER THE DIRECT SUPERVISION OF A PROFESSIONAL GEOLOGIST LICENSED IN THE STATE OF CALIFORNIA.
 THIS PERMIT IS NOT COMPLETE UNTIL ALL OF THE FOLLOWING REQUIREMENTS ARE SIGNED BY THE DEPUTY HEALTH OFFICER. WORK SHALL NOT BE INITIATED WITHOUT A WORK PLAN APPROVAL STAMPED BY THE DEPARTMENT OF PUBLIC HEALTH—DRINKING WATER PROGRAM.
- · NOTIFY THE DRINKING WATER PROGRAM BY EMAIL 3 BUSINESS DAYS BEFORE WORK IS SCHEDULED TO BEGIN. Jugur Nochigur 626-430-5386 au Juran gul z Och acounter

TOBEC	OMPLETED BY DEPARTMENT OF PUBLIC HE	ALTH-DRINKING WATER PROGRAM:
U WORK PLAN INCOMPLETE;	WORK PLAN APPROVED	DATE: 10/24/17
SUBMIT THE FOLLOWING:		
	Los Angeles County Drinking Water stamp	ADDITIONAL APPROVAL CONDITIONS:
	A CONTRACTOR	on 10/20/17 \$ 519.00 was baid
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ANNULAR SEAL FINAL IN	SPECTION REQUIRED		WELL COMPLETION LOG REQUIRED			
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DATE ACCEPTED:	REHS signature	DATE ACCEPTED:	REHS signature			
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WATER SUPPLY YIELD RE	EQUIRED	OTHER REQUIREMENT	•			
DATE ACCEPTED:	REHS signature	DATE ACCEPTED:	REHS signature			
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Attachment B Surveyor Reports







SVM-15

SURVEYED NOVEMBER 8, 2017

STAKING LOCATIONS							
POINT NO.	NORTHING	EASTING	LATITUDE (DD)	LONGITUDE (DD)	DESCRIPTION		
	(FEET)	(FEET)	(22)	2011011022(22)			
3109	1782920.28	6540671.37	33.8915452	-118.0691786	0+00.047 -0.009		
3110	1782917.67	6540721.27	33.8915381	-118.0690142	0+50.018 0.007		
3111	1782915.07	6540771.19	33.8915311	-118.0688497	1+00.004 0.010		
3112	1782912.48	6540821.14	33.8915241	-118.0686851	1+50.020 0.010		
3113	1782909.90	6540871.05	33.8915171	-118.0685207	1+99.995 -0.009		
3114	1782907.29	6540920.98	33.8915100	-118.0683562	2+49.994 0.007		
3115	1782904.70	6540970.92	33.8915030	-118.0681916	2+99.997 0.008		
3116	1782902.11	6541020.85	33.8914959	-118.0680271	3+50.000 0.002		
3117	1782899.51	6541070.79	33.8914889	-118.0678625	4+00.002 0.000		
3118	1782896.91	6541120.71	33.8914818	-118.0676980	4+49.997 0.009		
3119	1782895.63	6541145.68	33.8914784	-118.0676157	4+75.001 0.003		
3120	1782894.34	6541170.62	33.8914749	-118.0675336	4+99.969 -0.009		
3121	1782891.72	6541220.58	33.8914678	-118.0673689	5+49.998 0.010		
3122	1782889.38	6541265.50	33.8914614	-118.0672209	5+94.979 0.019		
3123	1782886.82	6541315.47	33.8914545	-118.0670563	6+45.013 -0.017		
3124	1782883.17	6541385.36	33.8914446	-118.0668260	7+14.996 0.001		





DD: DECIMAL DEGREES

DATES OF SURVEY

MAY 2, 2014 OCTOBER 2, 2014 MARCH 9, 2017 NOVEMBER 8, 2017

BENCH MARK

THE ELEVATIONS SHOWN HEREON ARE BASED UPON STATIC GPS OBSERVATION, HOLDING THE CSRC DATA POINT "CRHS"; ELEVATION = 42.80 FEET (NAVD 88)

COORDINATES

THE COORDINATES SHOWN HEREON ARE BASED UPON THE CALIFORNIA COORDINATE SYSTEM (CCS 83), ZONE 5, 1983 DATUM, DEFINED BY SECTIONS 8801 TO 8819 OF THE CALIFORNIA PUBLIC RESOURCES CODE, BASED UPON STATIC GPS OBSERVATION, HOLDING THE CSRC DATA POINT "CRHS"



6 HUTTON CENTER DRIVE, SUITE 700 SANTA ANA, CA 92707 PHONE: (714) 435–6131 OFFICE (714) 424–2033 FAX

NO.	DAT
1	11-10

SITE PLAN SFPP GROUNDWATER AND SOIL REMEDIATION SYSTEM DEFENSE FUEL SUPPORT POINT 15306 NORWALK BOULEVARD, NORWALK, CA



The Sharewell survey drawing is provided in the electronic version available on GeoTracker.

Attachment C Photo Documentation

Attachment C Photo Documentation

Horizontal Biosparge Well Installation Photographs

Photograph 1: View of drill rig (CMS 9030), looking south.
Photograph 2: View of mud system (MP-400), looking south.
Photograph 3: View of wireline coil navigation system at ground surface, looking east.
Photograph 4: View of tri-cone stainless-steel drill bit.
Photograph 5: View of well screen and blank casing, looking southwest.
Photograph 6: View of well vault installation.
Photograph 7: View of completed well vault surface.



Photograph 1: View of drill rig (CMS 9030), looking south.



Photograph 2: View of mud system (MP-400), looking south.



Photograph 3: View of wireline coil navigation system at ground surface, looking east.



Photograph 4: View of tri-cone stainless-steel drill bit.



Photograph 5: View of well screen and blank casing inspection, looking southwest.



Photograph 6: View of well vault installation.



Photograph 7: View of completed well vault surface.

Attachment D DTD Well Completion Report



Eric Davis CH2M 1000 Wilshire Boulevard Suite 2100 Los Angeles, CA 90017 Eric.Davis@CH2M.com

RE: Final Well Completion Report - Well BS-02, Norwalk DFSP, Norwalk, CA

Dear Eric:

Thank you for selecting DTD to install the second biosparge well (BS-02) at the Norwalk DFSP site in Norwalk, CA. We are pleased that the installation was concluded successfully. This letter is to document various aspects of the well completion for your project records.

I have documented construction details in the table below. The as-built information, including bore profile, 3D coordinates of the locating plots of the Sharewell MGS and Tru-Tracker tools, and X-Y coordinates of the as-built well location are all provided as attachments. These were generated by our navigation subcontractor, Sharewell HD, and reviewed by DTD.

Well Construction Details - Biosparge Well BS-02

Well Length: 733 feet

Screened Length: 240 feet

Riser Length: 493 feet to ground vault entry

End Cap: Flush Threaded, with O-ring. Installed length ~ 0.75 feet

Screen Depth (Average - center of borehole): 45 feet

Screen and Riser Material: 4-inch Schedule 80 PVC [white], flush threaded with 4 TPI threads

Slot Specifications (as installed) (0.012x1.6" [nominal] slots, 20 slots per foot (4 rows x 5 slots/row) ~0.27% Open Area

Wellhead Components: 4" "Y" connection. 4" flush threaded with cap for cleanout. 4" to 3" reducer, connected to 3" PVC ball valve to 3" PVC to HDPE transition. Short 3" HDPE stub out outside vault for future connection.

Drilling Fluid: Baroid BioBore biodegradable biopolymer

Well Development additives: CETCO LEB-CD enzyme breaker

DTD mobilized a forward crew on Friday, November 10, 2017 to receive equipment and supplies and do preliminary staging of equipment at the site. Full mobilization of crew and equipment was completed on Monday, November 13. Sharewell HD supplied a Tru-Tracker magnetic guidance system and technician to

Directed Technologies Drilling Inc. 3476-B W. Belfair Valley Rd 100 Rolling Ridge Dr. Bremerton, WA 98312 Bellefonte, PA 16823 Voice: 800-239-5950 Fax: 800-574-8046 Web: www.horizontaldrill.com operate the drillhead locating system. The drilling equipment was set up and the magnetic coil was laid out and surveyed.

Drilling commenced on the morning of Tuesday, November 14 and continued through Thursday, November 16. Drilling proceeded continuously during day shifts through this period, with short breaks for waste transfer, mixing of drilling fluid, and other routine tasks. Constant contact was maintained between the driller and Sharewell HD technician to maintain the borepath typically within < 0.5 feet from designed path. A record as-built of the bore path is provided as an attachment.

While drilling near the Kinder Morgan pipelines, the cathodic protection system was shut down to prevent possible interference with the locating system. The system was restarted automatically by Kinder Morgan on the afternoon of November 16.

Prior to crossing beneath the Kinder Morgan pipelines, a small diameter shaft (1.5-2 feet diameter) was excavated using an air knife to a depth of 10 feet. This was situated on the projected bore path, and between the pipeline and the approaching drill bit. The pit was required by Kinder Morgan to visually confirm that there was no danger of collision between the drill and the pipeline. As the drilling progressed, it was visually confirmed that the bit did not enter the inspection pit, and Tru-Tracker data verified the depth at approximately 37 feet below the pipeline invert. The air knifing was completed under DTD subcontract to Cascade Environmental, through a change order approved by CH2M.

The pilot bore was completed on November 16, to a total length of 733 feet. The as-built data and drawings for the completed bore were completed by Sharewell HD and submitted to DTD. These were reviewed and are attached with this submittal, as listed in the table:

Item #	Title	Description
1	17-348_Display.pdf	PDF file of CAD plot, showing as-built coordinates of pilot bore
2	17-348_Display.dxf	AutoCAD DWG file of above
3	17-348_DirectionalData.csv	CSV file of Magnetic Azimuth Data
4	17-348_TrackingData.csv	CSV file of Tru-Tracker Data

During drilling, the tooling advanced through relatively continuous, heterogenous dense, silty sand. The bore was ended at 733 feet, upon approval by CH2M.

After removing the drill rods and bottom hole assembly, including the navigating tools, drill rods were advanced, without a drill bit, to the end of the open bore. All well materials were then installed through the center of the open drill rod on November 17. The drill rods were then withdrawn from the bore, leaving the well materials in place in the open borehole.

The well assembly included:

1pc. - Pointed, Flush-threaded Sch. 80 PVC end cap. Approximate length 0.75 feet.

12 pcs. – Flush-threaded, White, Schedule 80 PVC well screen, 20 ft. lengths. Slotting as described in table above. Total 240 feet in 20 foot (make-up length) sticks. Threaded joints made up with factory O-Rings and PTFE tape.

24 pcs. – Flush-threaded, White, Schedule 80 PVC blank riser, 20 ft. lengths. 1 pc., 10 ft. length; 1 pc., 5 ft. length. Total 493 feet. Approximately 7 feet of stick up remaining when well materials seated in hole. Stick up subsequently shortened and removed to facilitate well development, later cut to length for vault installation.

Well materials were supplied through Sinclair Well Products of Cerritos, CA. Well materials were inspected and approved prior to installation by CH2M (Mark Strong.)

Well Development:

Upon installation of the well casing and screen, DTD undertakes a well development process to ensure effective communication between the well and the surrounding geologic formation. DTD began the well development process on November 17. A Vactor combination jetting/vacuum truck was used for the development.

The initial attempt to flush the well was not successful – most likely due to heavy mud resisting uphole movement from the low pressure flushing pump. After two jetting passes, utilizing about 2,000 gallons of water, the flushing process was restarted and successfully completed. Approximately 2,000 gallons of water were flushed into the well – the introduced water was mixed with two pints of CETCO Liquid Enzyme Breaker to accelerate the breakdown of residual biopolymer drilling fluid.

Well development continued on November 18, with an additional flush of 3,000 gallons of water, followed by 16 jetting passes, using 4,200 gallons of water. All development water was captured and conveyed to poly tanks provided by CH2M. CH2M approved the completion of the well development on November 18 at 10:55.

Well Surface Completion:

Installation of the well seal was completed after well development. A grout plug was first introduced by pumping \sim 150 gallons of thick cement-bentonite through a tremie to a depth of 20' bgs (about 100 feet measured horizontally). This was allowed to set for several hours, and was followed by the pumping of 650-700 gallons of cement-bentonite grout from the initial plug back uphole. Grout was noted at the ground surface at the conclusion of the operation.

Well Vault:

A 3 foot by 5 foot, steel walled, bottomless vault was installed. The vault assembly includes a diamond plate, H-20 traffic rated lid with spring assist and bolted down locking device. The vault has sidewalls of approximately 24 inches height.

The vault was set and leveled to prevent ponding or entrapment of rainwater on the wellhead. Openings were drilled through the vault walls to provide entry for the well riser and access for the air supply stub out. The well head assembly of a "Y", with a 4-inch ball valve, 3-inch reducer, and 3-inch stubout was made on the angled portion of the "Y". The stub out terminates approximately 2-3 feet beyond the concrete apron surrounding the vault, and is closed with a flush-threaded 3-inch cap. The straight part of the "Y" was completed with a flush-threaded, 4-inch cap with O-ring and pipe dope to form an air-tight seal and provide access for future downhole activities.

A concrete slab was constructed, using 50 bags of pre-mixed Sakcrete, 60 lb. bags. This was calculated to build a slab that exceeds 18 inches in all directions from the rim of the vault, to a slab depth of nominal 6 inches, per specifications. No slump test or other testing of the concrete was made. The slab was troweled to finish the surface. An orange-painted stake was set beside the vault to indicate the position of the stub out.

At the conclusion of the wellhead completion, DTD rough-graded the surrounding area, picked up remaining debris and/or trash, then completed demobilization of equipment from the well site.

Sincerely,

Directed Technologies Drilling, Inc.

/s/ <u>Lucas Anderson</u> <u>Field Manager</u>

Michael D. Luberdy

Michael D. Lubrecht Project Manager / Senior Geologist

Cc:

Dan Ombalski – Directed Technologies Drilling, Inc.



DTD						
Project	Scale					
KINDER MORGAN	X axis: 1 in = 10.0 ft					
NORWALK, CA	Y axis: 1 in = 10.0 ft					
Project started on	Z axis: 1 in = 10.0 ft					
Project completed on						
Proposed bore11.1 PUNCH IN	As-drilled bore - 17-348					
Bore Plan	Bore started on Nov 14, 2017					
MD of proposed bore = 730.3 ft	Bore completed on Nov 16, 2017					
Away of proposed bore = 726.1 ft	Directional data 🔲 Tracking data 🛆					
Line Az of proposed bore = 0.0°						
THIS DRAWING PROVIDED BY : SHAREWELL HDD						
OPERATOR(S) FOR THIS JOB : RENO MAYNARD						
THIS DRAWING IS BASED ON INFORMATION PROVID	ED BY : DTD					

Attachment E Well Boring Log



PROJECT NUMBER: 698197 BS-02 SHEET 1 OF 7

Well Boring Log

PROJECT : Southeastern Biosparge Well Installation ELEVATION : 75.0 ft msl (ground surface) NGVD29 LOCATION : 15306 Norwalk Blvd, Norwalk, CA

DRILLING CONTRACTOR AND DRILL RIG : Directed Technologies Drilling, Directional Drill CMS9030TMSC

WATER	LEVEL :	NA			START : 11/14/2017	END : 11/21/2017	LOGGER	: M. Thomas
DEPTH BELOW GROUND SURFACE (ft)	RECOVERY (ft)	SAMPLE TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION		WELL DETAILS
					SILTY SAND (SM) grayish brown (2.5Y 5/2), Brown, 85% fine to medium sand, subangular, 15% fines, trace coarse sand, micaceous	Geophysical utility survey performed to clear for subsurface utilities. Hand augered to 5 feet bgs at entry point and up to 10 feet bgs, 50 feet east of entry point every 3 feet or subsurface clearance along bore path. No conflicts encountered.		Portland Cement-Bentonite Grout 4-inch SCH 80 PVC well casing
30 30 40 50					as above	Samples for logging were collected from drill cuttings from the borehole drilling fluid returns. Drilling fluid viscosity averaged 50 sec/qt. Drilling fluid pressure averaged 150-175 psi. Drilling fluid borehole return averaged 160 gpm. no odor		
60 70 80					SILTY SAND (SM) dark grayish brown (2.5Y 4/2), Brown, 95% fine sand, 5% fines, trace medium sand, micaceous			thick cement-bentonite
90					SILTY SAND (SM)			grout plug
110 - - 120					sand, 40% fines, trace medium sand, micaceous			ସ୍ – ସ୍ – ସ୍ – ସ୍ – ସ୍ – ସ୍ – ସ୍ – ସ୍ –



PROJECT NUMBER:

698197

BORING NUMBER: BS-02

SHEET 2 OF 7

Well Boring Log

PROJECT : Southeastern Biosparge Well Installation ELEVATION : 75.0 ft msl (ground surface) NGVD29 LOCATION : 15306 Norwalk Blvd, Norwalk, CA

DRILLING CONTRACTOR AND DRILL RIG : Directed Technologies Drilling, Directional Drill CMS9030TMSC

WATER	LEVEL :	NA			START : 11/14/2017	END : 11/21/2017	LOGGER : M. Thomas
DEPTH BELOW BROUND SURFACE (ff)	RECOVERY (ft)	SAMPLE TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION	WELL DETAILS
					SILT WITH SAND (ML) light brownish gray (2.5Y 6/2), Brown, 40% fine to medium sand, 60% fines, micaceous		0 0 - 0 0 -
160 170 					POORLY GRADED SAND (SP) light brownish gray (2.5Y 6/2), Brown, fine to medium sand, trace silt, subangular		
					SILTY SAND (SM) Brown, 80% fine to medium sand, 20% fines, subangular	no odor, minor sheen	
220					POORLY GRADED SAND (SP) Brown, fine to medium sand, micaceous, subangular		



PROJECT NUMBER:

698197

BORING NUMBER: BS-02

SHEET 3 OF 7

Well Boring Log

PROJECT : Southeastern Biosparge Well Installation

LOCATION : 15306 Norwalk Blvd, Norwalk, CA

ELEVATION : 75.0 ft msl (ground surface) NGVD29 DRILLING CONTRACTOR AND DRILL RIG : Directed Technologies Drilling, Directional Drill CMS9030TMSC

WATER	LEVEL :	NA			START : 11/14/2017 E	ND : 11/21/2017	LOGGER : M. Thomas
DEPTH BELOW GROUND SURFACE (ft)	RECOVERY (ft)	SAMPLE TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION	WELL DETAILS
					gray (5Y 5/1), as above		
290					POORLY GRADED SAND (SP) gray (5Y 5/1), Brown, fine to medium sand, trace silt,	no odor	
310				<u> </u>	micaceous, subangular		6.5 × 10 × 20 × 20 × 20 × 20 × 20 × 20 × 20
320 320 330					POORLY GRADED SAND (SP) Brown, fine to medium sand, micaceous, subangular		
340							
350 350 360							2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2



PROJECT NUMBER:

698197

BORING NUMBER: BS-02

SHEET 4 OF 7

Well Boring Log

PROJECT : Southeastern Biosparge Well Installation

LOCATION : 15306 Norwalk Blvd, Norwalk, CA

ELEVATION : 75.0 ft msl (ground surface) NGVD29 DRILLING CONTRACTOR AND DRILL RIG : Directed Technologies Drilling, Directional Drill CMS9030TMSC

WATER	LEVEL :	NA			START : 11/14/2017 E	ND : 11/21/2017	LOGGER : M. Thomas
DEPTH BELOW GROUND SURFACE (ft)	RECOVERY (ft)	SAMPLE TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION	WELL DETAILS
					gray (5Y 5/1), as above		
- 380 - -							
390 - - 400					as above		
- - - 410							
- 420 - -					as above	no odor, minor sheen	
430							
450							
- - 460					POORLY GRADED SAND (SP) Brown, fine to medium sand, micaceous, subangular	no odor	
- 470 - -							
480							kind kind



BORING NUMBER: BS-02

SHEET 5 OF 7

Well Boring Log

PROJECT : Southeastern Biosparge Well Installation

LOCATION : 15306 Norwalk Blvd, Norwalk, CA

ELEVATION : 75.0 ft msl (ground surface) NGVD29 DRILLING CONTRACTOR AND DRILL RIG : Directed Technologies Drilling, Directional Drill CMS9030TMSC

COORDINATES : N 1782920.28, E 6540671.37 CA State Plane NAD83 DRILLING METHOD AND EQUIPMENT : Directional Drilling, Chisel-tooth tri-cone bit with 2° bend

PROJECT NUMBER:

698197

WATER	LEVEL :	NA			START : 11/14/2017 E	END : 11/21/2017	LOGGER : M. Thomas
OW RFACE	(ft)	ΓPE	STANDARD	0G	SOIL DESCRIPTION	COMMENTS	
DEPTH BEL GROUND SUF (ft)	RECOVERN	SAMPLE TY	FENETRATION TEST RESULTS 6"-6"-6"-6" (N)	GRAPHIC L	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION	WELL DETAILS
- - - 490					as above	start of screen	4-inch SCH 80 PVC
- 500 - -							• (a), (a
510 - - 520					as above	no odor	
- - - 530							
- - 540							
					POORLY GRADED SAND (SP) dark greenish gray (10Y 4/1), Brown, fine to medium sand, trace silt, micaceous, subangular		
560							
570 - - 580							200 200 200 200 200 200 200 200 200 200
- - - 590					dark greenish gray (10Y 4/1), as above		
- - 600							



BORING NUMBER: BS-02

SHEET 6 OF 7

Well Boring Log

PROJECT : Southeastern Biosparge Well Installation ELEVATION : 75.0 ft msl (ground surface) NGVD29 LOCATION : 15306 Norwalk Blvd, Norwalk, CA

DRILLING CONTRACTOR AND DRILL RIG : Directed Technologies Drilling, Directional Drill CMS9030TMSC

COORDINATES : N 1782920.28, E 6540671.37 CA State Plane NAD83 DRILLING METHOD AND EQUIPMENT : Directional Drilling, Chisel-tooth tri-cone bit with 2° bend

PROJECT NUMBER:

698197

WATER	LEVEL :	NA			START : 11/14/2017	END : 11/21/2017	LOGGER : M. Thomas
DEPTH BELOW GROUND SURFACE (ft)	RECOVERY (ft)	SAMPLE TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION	WELL DETAILS
610	-				POORLY GRADED SAND (SP) Brown, fine to medium sand, trace silt, subangular		
630 630							
640 - - - 650 - - - -					POORLY GRADED SAND (SP) Brown, fine to medium sand, micaceous, subangular		
660 - - 670 - - -					as above		
680 - - - 690 - - -							
700					as above		

	PROJECT NUMBER:	BORING NUMBER:				
CHORA	698197	BS-02	SHEET	7	OF	7
GHZIVI						

Well Boring Log

PROJECT : Southeastern Biosparge Well Installation

LOCATION : 15306 Norwalk Blvd, Norwalk, CA

ELEVATION : 75.0 ft msl (ground surface) NGVD29 DRILLING CONTRACTOR AND DRILL RIG : Directed Technologies Drilling, Directional Drill CMS9030TMSC

WATER	LEVEL :	NA			START: 11/14/2017	END : 11/21/2017	LOGGER : M. Thomas
ACE	ft)	ш	STANDARD	U	SOIL DESCRIPTION	COMMENTS	
URF.	RY (I	ΥF		СГО	SOIL NAME LISCS GROUP SYMBOL	DEPTH OF CASING	
E CP B CP €(€)	OVE	IPLE	e" e" e" e"	DHI	COLOR, MOISTURE CONTENT, RELATIVE	DRILLING DETAILS,	WELL DETAILS
SOUP	REC	SAN	0-0-0-0 (N)	GRA	DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	INSTRUMENTATION	
ō							
-							
730							
-					as above		$-\frac{1}{2}$
					Boring terminated at 734.0 ft bgs.	End of Screen at 733	Flush threaded end-cap (0.75 ft)
						1001	
740							
							_
							-
750							
-							-
-							-
760							-
-							_
_]
770 -							-
-							-
]
780							
-							_
							-
790							
							-
-							_
800							-
-							-
-							-
810 -							_
-							-
-							-
820							—
-							-
-							-
830							
-							-
-							-
840							

Attachment F Well Construction Diagram

	PROJECT NUMBER 698197		WELL NUMBER	SHEFT	Г 1 ОF 1
CH2M	w	ELL COMF		DIAGRAM	
PROJECT : KMEP Norwalk Biosparge Well	nstallation LC	DCATION: 15306 Nor	walk Blvd, Norwalk, C	CA	
DRILLING CONTRACTOR : Directed Techno	logies Drilling and Sharewe				
DRILLING METHOD AND EQUIPMENT USED : STEEPING METHOD AND EQUIPMENT USED :	Directional Mud Drilling. L	Jirectional Drill CMS90	301MSC with 10.25	chisel-tooth tricone bit v	with 2° bend.
WATER LEVELS : Refer to Site Data for Wate	r Levels START : 11/14/2	2017 EN	D: 11/21/2017	LOGGER : M. Tho	mas
$1. 2. 3. 9. \\ \theta -12^{\circ}$				Ground Surface	
25 ft bgs 7. 75 ft 8. 100 ft	7 <u>32.9</u> 7 <u>32.9</u> 4. 5.	2 ft		45	ft bgs 733.67 ft
1- Ground elevation at well 75 ft msl		Screen from 493 - 7 Fluid degrader	33 feet.	Vot to Scale .iquid Enzyme Breaker	
2- Top of casing elevation 74 ft msl					
3- Wellhead protection cover type H20 spri a) concrete pad dimensions 72"x96"x6"	ng-assist vault box 5'x3'x2' concrete pad		d Weter Eluphing on	d latting	
4- Dia./type of well casing 4-inch SCH	80 PVC with O-rings	Development time	~4.5 hours		
5- Type/slot/aperture of screen 4-inch SCH 0.012" nominal slots, cut in 4 rows guadra	80 slotted PVC	· Final Development I Temp: 21.23° C	Parameters		
Slot Length/Spacing 1.6 inch slo	ts, 20 slots/ft	pH: 7.56			
Field Measured? (es) No		Conductivity: 0.652	ms/cm		
6- Type screen filter Natural Filter Pack fro	m Borehole	Turbidity: 650 NTU	ml/l		
a) Quantity used N/A		Mud Content: <1.0 r	nl/L		
····		Total Water Volume	Discharged: ~10,900) gallons	
7- Type of seal Portland-Cement Ben	tonite Grout				
a) Quantity used 45 (95 lb.) bags of Po	rtland with 5% Bentonite	Comments	- Ita and a star a t		
8- Grout stop seal <u>Thick cement-bentoni</u>	te grout plug at 100 feet	Urill bit has a 10.25" vary slightly (likely 1	alameter; however, l 00% to 125% of drill l	norizontal borehole diar bit size) due to gravitati	neters onal
9- Angle at Point of Entry -12°					
a) Boring angle at screen -0.21° to	0.1°				
Drilling Fluid employed Baroid Bio-Bore bioploymer drilling fluid.	biodegradable				

Attachment G Well Development Log

		pro 698	јест <mark>и</mark> мв 3197	ER			WELL ID BS-02		Sheet 1 of 1
CH	2M				W	ELL I	DEVEL	OPM	ENT LOG
PROJECT :	KMEP Norwalk	Biosparge W	ell Installation		LC	CATION :	15306 Norwalk	Blvd, No	rwalk, CA
DEVELOPMENT CO	NTRACTOR :	Direc	ted Technolo	gies Drilli	ng				
DEVELOPMENT ME	THOD AND EQ	UIPMENT US	ED :	Flush an	d Jet, Vactor	1200 Jet/Va	acuum Unit		
START WATER LEV	ELS :	Not monitore	d START :	11/17/20)17	END :	11/18/2017	LOGGER	: M. Thomas
MAXIMUM DRAWDO	OWN DURING F	UMPING:	Not dete	rmined (N	ID)				
RANGE AND AVERA	AGE DISCHARG	GE RATE:	26 - 73 g	Ipm					
TOTAL QUANTITY (OF WATER DIS	CHARGED:	10,900 g	allons					
DISPOSITION OF D	ISCHARGE WA	TER:	Discharg	e water h	eld in rolloff bi	ns and poly	tanks for profil	ing and dis	sposal.
MONITORING EQUI	PMENT USED:	Horib	a U-52 cal'd	to 4.0 pH	, cond4.49 r	nS/cm, and	turbidity 0.0 NT	ΓU	
Date/Time	Water Volume Discharged (gal)	Water Level (ft BTOC)	Temp. (°C)	pН	Conductivity	Turbidity (NTU)	Sand (ml/L)	Mud (ml/L)	Remarks
11/17/17 15:00									Flush Annulus. Discontinued due to restricted water movement downhole. Very muddy.
16:30	2000		20.99	7.75	0.739	+1000	20.0	45	Jetted inside of casing to ease restriction. 2 screen passes. Very muddy.
16:50	2800								Annulus flushing recommenced. Very muddy.
17:08	3700								Annulus flush. Very muddy.
11/18/2017 8:08	5700		16.52	6.40	1.540	+1000	15.0	30.0	Annulus flush. Muddy and sandy.
8:45	6700		17.64	5.91	1.030	+1000	10.0	20.0	Annulus flush. Less muddy.
9:11	8000		18.25	6.38	0.956	+1000	10.0	20.0	Jetting commenced down casing, 3 passes of screen.
9:27	8600		18.66	6.58	0.886	+1000	8.0	15.0	Jetting down casing, 3 passes of screen.
9:35	9100		19.16	7.03	0.660	+1000	1.0	3.0	collected from casing.
9:44	9700		19.49	7.52	0.62	890	<1.0	<1.0	collected from casing.
9:55	10500		19.65	7.51	0.64	832	<1.0	<1.0	Jetting. 2 screen passes. Quality parameters collected from casing.
10:10	10900		21.23	7.56	0.652	650	<1.0	<1.0	Jetting. 3 screen passes. Collected quality parameters from casing.
End of development									Terminated jetting/flushing. Approx 4.5 hours of development
				1					
					+				
		ļ			<u> </u>				
					t				

Attachment H Waste Manifests

OR/	PADES NAME AND MAINING ADDRESS CONSULANCE CONSULANCE CONSULANCE 15306 D. LP (NORWALK STATION) 15306 D. TOWN AND COUNTRY RD. ATTN: KARINA HANKINS NORW ANGE CA 92868	ors Site Address 5 Norwalk Valk, CA 90	s (il dillerent i CBLVD 0650	iai mainy avico	-,	
Genera 6. Trar	ator's Phone: 714-550-4400 sporter 1 Company Name		199	U.S. EPA ID N	lumber	
PATR	IOT ENVIRONMENTAL SERVICES				100/94	
7. Trar	isporter 2 Company Name			U.S. EPA ID N	under	
8. Des CRC 163 LON	ignated Facility Name and Site Address SBY & OVERTON 0 WEST 17 TH STREET IG BEACH CA 90813		2	U.S. EPA ID N CAD0284	lumber 109019	
Facilit	/s Phone: 800-827-6729	10. Con	tainers	11. Total	12. Unit	1
	9. Waste Shipping Name and Description	No.	Туре	Quantity	Wt./Vol.	
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