Document Receipt Information

☐ Hard Copy ☒ CD ☐ Email

Date Received 9-27-18

Permit Number 18693

Project Manager Bobbi Coleman

Name of Contractor Jacobs

UST Certification Number 2nd Qtr 2018 Monitoring report

Docket Number ~~[illegible]~~ 27le URP

Scanned _____

3120 Highwoods Boulevard, Suite 214
Raleigh, North Carolina 27604
United States
T +1.919.875.4311
F +1.919.875.8491
www.jacobs.com

September 26, 2018

Delivered via FedEx Overnight

Ms. Bobbi Coleman
South Carolina Department of Health and Environmental Control (SCDHEC)
Assessment Section, UST Management Division
Bureau of Land and Waste Management
2600 Bull Street
Columbia, South Carolina 29201

Subject: **2018 Second Quarter Monitoring Report**
Plantation Pipe Line Company
Lewis Drive Remediation Site
Belton, South Carolina
Site ID #18693, "Kinder Morgan Belton Pipeline Release"

Dear Ms. Coleman,

On behalf of Plantation Pipe Line Company (Plantation), CH2M HILL Engineers, Inc. (CH2M is now a wholly owned subsidiary of Jacobs) is submitting the attached 2018 Second Quarter Monitoring Report for the Lewis Drive Remediation Site in Belton, South Carolina. This report summarizes the work performed at the site between April 1, 2018, and June 30, 2018. If you have any questions or concerns, please call me at 919-760-1777 or Mr. Jerry Aycock/Plantation at 770-751-4165.

Regards,

Jacobs Engineering Group Inc.

William M. Waldron, P.E.
Program Manager

c: Jerry Aycock, Plantation (Digital, Jerry_Aycock@kindermorgan.com)
Mary Clair Lyons, Esq., Plantation (Digital, Mary_Lyons@kindermorgan.com)
Richard Morton, Esq., Womble Bond Dickinson, LLP (Digital, ric.morton@wbd-us.com)
File

Plantation Pipe Line Company
Lewis Drive Remediation Site
Belton, South Carolina
Site ID Number 18693
“Kinder Morgan Belton Pipeline Release”

2018 Second Quarter Monitoring Report

Final

September 26, 2018

Plantation Pipe Line Company

Lewis Drive Remediation Site, Belton, South Carolina

Project No:	699858
Document Title:	2018 Second Quarter Monitoring Report
Revision:	Final
Date:	September 26, 2018
Client Name:	Plantation Pipe Line Company
Project Manager:	William Waldron
Author:	Bethany Garvey

CH2M HILL Engineers, Inc., a wholly owned subsidiary of Jacobs Engineering Group Inc.

3120 Highwoods Boulevard, Suite 214
Raleigh, North Carolina 27604
United States
T +1.919.875.4311
F +1.919.875.8491
www.jacobs.com

JACOBS

The material and data presented in this report were prepared consistent with current and generally accepted consulting principles and practices. This work was supervised by the following Jacobs licensed professional.

Jonathan Grimes, P.G.
South Carolina Registered Professional Geologist No. 2235

September 26, 2018
Date

Contents

Tables

Figures

Acronyms and Abbreviations

µg/L	microgram(s) per liter
1,2-DCA	1,2-dichloroethane
BCPZ	Brown's Creek Protection Zone
BTEX	benzene, toluene, ethylbenzene, and xylenes
CAP	Corrective Action Plan
CCPZ	Cupboard Creek Protection Zone
CH2M	CH2M HILL Engineers, Inc.
COC	chain-of-custody
CSA	Comprehensive Site Assessment
DO	dissolved oxygen
EPA	U.S. Environmental Protection Agency
ID	identification
Jacobs	Jacobs Engineering Group Inc.
LNAPL	light non-aqueous phase liquid
mg/L	milligram(s) per liter
MTBE	methyl tertiary butyl ether
O&M	operation and maintenance
PID	photoionization detector
Plantation	Plantation Pipe Line Company
QAPP	Quality Assurance Project Plan
SCDHEC	South Carolina Department of Health and Environmental Control
scfm	standard cubic feet per minute
scfm/ft	standard cubic feet per minute per foot
UST	underground storage tank

1. Introduction

On behalf of Plantation Pipe Line Company (Plantation), CH2M HILL Engineers, Inc. (CH2M is now a wholly owned subsidiary of Jacobs Engineering Group Inc. [Jacobs]), is submitting this 2018 Second Quarter Monitoring Report for the Lewis Drive Remediation Site in Belton, South Carolina. This report summarizes the work performed at the site between April 1, 2018, and June 30, 2018.

On December 8, 2014, a release of an estimated 8,800 barrels (369,600 gallons) of gasoline and a small amount of diesel fuel (Plantation, 2015) was discovered on Plantation's 26-inch product pipeline near Lewis Drive, Belton, South Carolina (Figure 1). The site is located on the pipeline right-of-way between Lewis Drive, a rural two-lane undivided asphalt road, to the east and a hayfield to the west. The release location and site features (including the location of monitoring wells, recovery sumps, temporary wells [piezometers], recovery trenches, recovery wells, and vertical and horizontal air sparging wells) are shown on Figure 1.

This site has been designated by the South Carolina Department of Health and Environmental Control (SCDHEC) as Site Number 18693 "Kinder Morgan Belton Pipeline Release." This Second Quarter Monitoring Report was prepared in accordance with the Corrective Action Plan (CAP) (CH2M, 2016b), CAP Addendum, Revision 1 (CH2M, 2017a), CAP Addendum, Revision 2 (CH2M, 2017d), Comprehensive Site Assessment (CSA) Report (CH2M, 2016a), and project Quality Assurance Project Plan (QAPP), Revision 4 (CH2M, 2018b). Correspondence between Plantation and SCDHEC during this reporting period is summarized below:

- Monthly status reports March 2018 through May 2018 (CH2M, 2018e, 2018i, 2018k).
- April 27, 2018 – *Request to Pump Select Monitoring Wells* (CH2M, 2018f).
- May 4, 2018 – *Request for Well Permit to Install Additional Vertical Sparging Wells for Biosparging System Expansion* (CH2M, 2018g).
- May 16, 2018 – Submittal of *UIC Permit Revision for Expansion of Biosparging Remediation System* (CH2M, 2018h).
- June 6, 2018 – *Response to Comments in SCDHEC Letter titled "Reviews of Misc. Reports, Response to Comments Document, Free Product Recovery Plan, Product Recovery Skimmer Results and Request for Well Permit" dated May 8, 2018* (CH2M, 2018j).
- June 27, 2018 – *2018 Annual Monitoring Report, Lewis Drive Remediation Site, Plantation Pipe Line Company, Belton, South Carolina. Site ID Number 18693, "Kinder Morgan Belton Pipeline Release."* (CH2M, 2018l).

2. Work Activities

The following remedial activities were performed during the second quarter 2018 in accordance with the CAP (CH2M, 2016b), CAP Addendum, Revision 1 (CH2M, 2017a), CAP Addendum, Revision 2 (CH2M, 2017d), and project QAPP, Revision 4 (CH2M, 2018b):

- Conducted three monthly groundwater sampling events and three monthly surface water sampling events.
- Operated vertical air sparging wells in the areas of Brown's Creek and Cupboard Creek (Figure 1).
- Operated stream aerators in Brown's Creek.
- Operated three horizontal air sparging wells in the Hayfield Zone (Figure 1).
- Performed routine operation and maintenance (O&M) on the air sparging system.
- Recorded changes in groundwater levels and barometric pressures in eight monitor wells using In Situ Rugged Troll 100 data loggers. Six monitoring well locations contained water level data loggers and two monitoring well locations contained barometric pressure loggers.
- Performed continuous free-product recovery (canisters and adsorbent socks) in 22 wells monthly in the Brown's Creek Protection Zone (BCPZ) and Cupboard Creek Protection Zone (CCPZ).
- Relocated a product skimmer from RW-08 to RW-10.
- Removed product skimmers from monitoring wells MW-08, MW-11, MW-15, and MW-20 per SCDHEC's request on May 8, 2018 (SCDHEC, 2018).
- Performed monthly inspections of surface water features at Brown's Creek and Cupboard Creek.

3. Work Procedures

3.1 Gauging Events

Monitoring wells, surface water locations, piezometers, and product recovery features (recovery sumps, trenches, and wells) were gauged monthly. During gauging events, DO measurements were recorded for select wells using a YSI ProODO meter. Field forms for gauging during this reporting period can be found in Appendix A. Observations made during this reporting period are summarized in Table 1 and discussed in Section 3.2. Field notes for this reporting period can be found in Appendix A.

3.2 Product Recovery

As agreed upon with the SCDHEC (CH2M, 2017c), free-product recovery was focused on the BCPZ and CCPZ during this reporting period. Product recovery was performed continuously in these two zones in recovery wells, sumps, and trenches, and monitoring wells (Table 7). In February 2018, in accordance with the Free-Product Recovery Plan – Revision 4 (CH2M, 2018a), skimmers and absorbent socks were placed in wells containing product to allow for improved product recovery and quantification on a well-by-well basis. During each monthly monitoring event, the field team recorded the product recovered from each recovery feature or monitoring well (Table 7). The quantity of recovered product was tracked by measuring these fluid levels from the skimmers in a stainless-steel measuring cup and placed in a metal 5-gallon bucket and weighing the absorbent socks before and after deployment into the well or recovery feature. The recovered fluids from the skimmers were then placed into the onsite poly tanks for temporary storage, separation, and eventual offsite disposal. Used absorbent socks were placed in a drum for offsite disposal.

3.3 Surface Water

Inspections of surface water features were performed monthly. The inspection route used is illustrated on Figures 1, 2A, and 2B.

Surface water samples were collected in accordance with the CAP Addendum, Revision 2 (CH2M, 2017d). Surface water samples were collected monthly during this reporting period.

Surface water samples were scheduled to be collected from 17 locations. During this reporting period, location SW-06 in Cupboard Creek was not sampled due to insufficient surface water, and location SW-05 in Cupboard Creek was not sampled two of the three times it was scheduled to be sampled due to insufficient surface water.

Samples were collected in accordance with the project QAPP, Revision 4 (CH2M, 2018b), and were analyzed for benzene, toluene, ethylbenzene, and xylenes (BTEX) and naphthalene using U.S. Environmental Protection Agency (EPA) Method 8260B (see Table 2). Methyl tertiary butyl ether (MTBE) was added to the analyte list in February 2018 using EPA Method 8260B. The samples were packed in wet ice and transported by FedEx under standard chain-of-custody (COC) procedures to ESC Lab Sciences in Mount Juliet, Tennessee. Laboratory reports for surface water samples and COC records for April through June 2018 are included in Appendix B. Laboratory results are summarized in Table 2. Field notes for this reporting period can be found in Appendix A.

3.4 Groundwater Sampling Events

Three groundwater sampling events were performed during the reporting period on April 6, 2018 (Event 1), May 3, 2018 (Event 2), and June 4 through 7, 2018 (Event 3). Prior to each sampling event, a comprehensive round of groundwater gauging was conducted using an oil-water interface probe to measure the depth to water and test for the presence and thickness (if present) of product. The oil-water interface probe was decontaminated before each measurement. Decontamination was performed in accordance with the SCDHEC *Programmatic Quality Assurance Program Plan, Revision 3.1*

(Programmatic QAPP) or project QAPP, Revision 4 (CH2M, 2018b) as applicable. Groundwater elevation and product thickness data are summarized in Table 3. Gauging sheets and field notes for this reporting period can be found in Appendix A. Figures 2A and 2B show groundwater elevations in the residuum and bedrock aquifers, respectively. Figure 3 presents product thickness data for the site.

Groundwater wells without free product were sampled using either HydraSleeves or a peristaltic pump using low-flow purge and sampling methods. The height of the water column determined if a well was sampled using a HydraSleeve or peristaltic pump according to the following:

- Water column greater than 3 feet — A HydraSleeve was used to sample the well.
- Water column less than 3 feet but greater than 0.5 foot — A peristaltic pump was used to purge the well, and field parameters, including DO concentrations, were measured using a YSI 6920 V2-2 Multi-Parameter Water Quality Sonde meter to confirm stabilization of field parameters, in accordance with the SCDHEC *Programmatic Quality Assurance Program Plan, Revision 3.1* (Programmatic QAPP) (South Carolina Underground Storage Tank [UST] Management Division, 2016). After the water quality parameters stabilized, a sample was collected from the well using the straw method in accordance with the Programmatic QAPP. Upon stabilization, the field parameters were recorded on a separate purge log. DO measurements are summarized in Table 4.
- Water column less than 0.5 foot — The well was reported and documented in the field logbook as dry, not sampled, and DO measurements were not collected.

Samples were labeled, packed with wet ice, and transported by FedEx under standard COC procedures to ESC Lab Sciences in Mount Juliet, Tennessee. Samples were analyzed for BTEX, 1,2-dichloroethane (1,2-DCA), MTBE, and naphthalene using EPA Method 8260B. Laboratory data sheets for groundwater samples and COC records for April through June 2018 are included in Appendix C. Laboratory results are summarized in Table 5. Field notes and purge logs for this reporting period can be found in Appendix A.

3.5 Air Sparging System Operation and Maintenance

Air sparging was initiated on March 6, 2017, according to Appendix B of the Corrective Action Plan Addendum, Revision 2 (CH2M, 2017d), with routine O&M activities performed during this reporting period. O&M logs for April through June 2018 are provided in Appendix D. Air sparging activities are summarized by remediation area below. When air sparging rates were increased in any of the wells, air monitoring was performed with a photoionization detector (PID) and visual observations were made near the air sparging wells.

- BCPZ: Air sparging in the BCPZ was performed using a curtain of 26 vertical air sparging wells screened from 13 to 71.5 feet below ground surface (bgs). The flow rates in these wells averaged 8.3 standard cubic feet per minute (scfm) each during the reporting period. Additionally, air was injected into two submersible diffusion aerators installed in Brown's Creek. The flow rates in these aerators averaged 14.7 scfm each during this reporting period.
- CCPZ: Air sparging in the CCPZ was performed using a curtain of 19 vertical air sparging wells screened from 9.5 to 31.20 feet bgs. The flow rates in these wells averaged 8.1 scfm each during this reporting period.
- Shallow Bedrock Zone: No air sparging has been performed in the Shallow Bedrock Zone to date. A pilot plan for air sparging in the Shallow Bedrock Zone was approved on December 14, 2017. However, based on a meeting with SCDHEC on March 7, 2018, Plantation is deferring the bedrock sparging pilot study and installation of these wells at this time. Plantation is planning to expand the existing BCPZ and the CCPZ air sparging systems in the fourth quarter of 2018, which should address key areas of impact within the Shallow Bedrock Zone.
- Hayfield Zone: Air sparging in the Hayfield Zone was performed using three horizontal wells, HAS-01, HAS-02, and HAS-03, screened approximately 752, 715, and 377 feet, respectively. The flow rates in in each of the three horizontal wells (HAS-1, HAS-2, and HAS-3) were maintained at approximately 0.70 scfm per foot of screen (scfm/ft) during this reporting period.

Water levels were measured in the BCPZ, CCPZ, and Hayfield Zone to document the influence of the air sparging system on the residuum aquifer. During this reporting period, water level data loggers (In Situ Rugged Troll 100) have measured groundwater elevations continuously at various locations around the site. Data loggers were positioned in MW-02, MW-12, MW-25, MW-29, MW-39, and MW-40, and two barometric pressure loggers in MW-01 and MW-10.

3.6 Additional Activities

Additional activities for April 2018 through June 2018 include the product skimmer in RW-08 being relocated to RW-10 since no product has been recovered from RW-08 in the four months since it was installed in February 13, 2018 and no product thickness greater than 0.01 foot has been gauged in the recovery well since January 2018. Also, the product skimmers were removed from monitoring wells MW-08, MW-11, MW-15, and MW-20 in accordance with SCDHEC's request in their letter date-stamped May 8, 2018 (SCDHEC, 2018).

4. Discussion of Results

4.1 Product Recovery

Since the beginning of free-product recovery through June 30, 2018, approximately 222,983 gallons (5,309 barrels) of product have been recovered. During this reporting period, 2.98 gallons of product were recovered at the site using skimmers and socks.

Table 6 shows the dates and quantities of product that were shipped offsite for disposal. Table 7 shows the dates and quantities of product that were recovered while using skimmers and socks. Field notes for this reporting period are located in Appendix A.

4.2 Surface Water

Observations made during this reporting period are summarized in Table 1. Field notes for this reporting period are located in Appendix A. No new signs of distressed vegetation, hydrocarbon sheens, or odors were observed during the inspections for this reporting period.

During this reporting period, dissolved hydrocarbons were detected in surface water at SW-01, SW-02, SW-04, SW-12, SW-13, and SW-14 (Table 2). Benzene was the only constituent that exceeded the surface water standard for protection of human health for consumption of water and organisms of 2.2 micrograms per liter (µg/L) (SCDHEC, 2014) as summarized below.

- On April 6, 2018:
  - 2.23 µg/L benzene at SW-02
- On June 7, 2018:
  - 2.99 µg/L benzene at SW-13

The only exceedance of benzene at SW-02 occurred during the April event and was subsequently non-detect at 1 µg/L in May and June 2018 at SW-02. Surface water samples collected from SW-02 exceeded benzene screening criteria between December 2017 and March 2018. Plantation contracted Environmental Standards, Inc. to perform a forensic review of the detections at SW-02 (Environmental Standards, Inc., 2018). SW-12 is upgradient of SW-02 and located where product associated with the 2014 release was observed in Brown's Creek. The chemical profile of SW-02 was compared to the chemical profile of SW-12 and these data differed significantly, and therefore the impacts at SW-02 cannot be attributed to the release at the site. A summary of this data review was transmitted on March 13, 2018 to SCDHEC under a separate cover.

The isolated benzene exceedance at SW-13 of 2.99 µg/L appears to be anomalous and will continue to be monitored.

Construction details for the stream gauges are presented in Table 8. Surface water sample results are summarized in Table 2. Field notes for this reporting period are located in Appendix A. Trends for surface water sampling locations SW-01, SW-02, SW-04, SW-12, and SW-13 are presented in Appendix E. Analytical data sheets and COC records are included in Appendix B.

4.3 Groundwater Flow and Product Distribution

Water levels from the June 2018 gauging event were used to create potentiometric surface maps for the site (Figures 2A and 2B). Groundwater in both the residuum (Figure 2A) and bedrock (Figure 2B) aquifers mimics the topography of the site and generally flows from topographic highs to topographic lows. Cupboard Creek flows intermittently, indicating the primary direction of groundwater flow is northeast toward Brown's Creek. The June 2018 water table configurations and direction of groundwater flow are consistent with previous findings.

Product thicknesses decreased across the site from April 2018 through June 2018 and are presented alongside well gauging data in Table 3. This decrease in product thickness is directly attributable to the continued operation of the air sparging system. Gauging sheets for this reporting period are located in Appendix A. Hydrographs for nonrecovery (monitoring wells and piezometers) and recovery (recovery sumps, recovery trenches, and recovery wells) features representative of general product thickness trends are presented in Appendix F. Results are summarized as follows:

- Nonrecovery Features:
  - Decreasing product thickness trends were noted in groundwater monitoring wells MW-09, MW-16, and MW-18.
  - Stable product thickness trends are noted in groundwater monitoring wells MW-08 and MW-20.
  - Measurable product thickness has not been detected in a year in monitoring well MW-12 and in four months in monitoring well MW-11.
- Recovery Features:
  - Decreasing product thickness trends were noted in recovery sump RS-01, and in recovery wells RW-02, RW-04, RW-05, RW-10, and RW-15.
  - Increasing product thickness trends were noted in temporary well TW-42 from May to June and recovery sump RS-05 in May and then decreasing in June.
  - Stable product thickness trends are noted in recovery sumps RS-02, RS-07, RS-10, and RS-14.
  - Measurable product thickness has not been detected in over a year in recovery sump RS-11 and recovery well RW-13, ten months in recovery sumps RS-12 and RS-18 and recovery well RW-11, nine months in recovery sumps RS-09 and RS-15 and recovery well RW-12, eight months in recovery sumps RS-06, recovery well RW-09, four months in recovery sump RS-17 and recovery wells RW-03, RW-06, and RW-07, and at least four months in all recovery trenches

The product extent in June 2016 is compared to that in June 2018 on Figure 3, demonstrating the decrease of product thickness and extent over the last 24 months. The extent of product has decreased since product is no longer measurable in MW-09, MW-11, MW-12, MW-16, MW-19, RS-02, RS-05, RS-06, RS-07, RS-08, RS-09, RS-11, RS-12, RS-13, RS-18, RT-1A, RT-1B, RT-1C, RT-2K, RT-2L, RW-02, RW-03, RW-05, RW-06, RW-07, RW-08, RW-10, RW-11, RW-13, RW-14, TW-28, TW-84, and TW-94.

Stream elevations are tabulated in Table 3 and are presented with groundwater elevations on Figure 2A. Construction details for recovery and nonrecovery features are presented in Table 9.

4.4 Dissolved Oxygen Distribution

DO measurements in groundwater are provided in Table 4. Field notes for this reporting period can be found in Appendix A. The average DO concentration has stabilized in the residuum wells and increased in the bedrock wells. In residuum wells, the average DO concentration ranged from 7.12 milligrams per liter (mg/L) in April 2018 to 7.93 mg/L in June 2018. In bedrock wells, the average DO concentration increased from 1.66 mg/L in April 2018 to 3.28 mg/L in June 2018.

4.4.1 Brown's Creek Protection Zone

The average DO concentrations in the BCPZ increased from 3.10 mg/L in April 2018 to 5.88 mg/L in June 2018.

4.4.2 Cupboard Creek Protection Zone

The average DO concentrations in the CCPZ decreased from 5.04 mg/L in April 2018 to 2.90 mg/L in June 2018.

4.4.3 Hayfield Zone

The average DO concentration in the Hayfield Zone have increased from 8.38 mg/L in April 2018 to 9.41 mg/L in June 2018.

4.4.4 Shallow Bedrock Zone

DO levels in this zone were stable with 1.58 mg/L in April 2018 and 1.21 mg/L in June 2018.

4.5 Groundwater Monitoring Results

Groundwater monitoring results for this reporting period indicate that there are significant decreases in dissolved concentrations of hydrocarbons in the BCPZ, CCPZ, and Hayfield Zone, and stable trends in the Shallow Bedrock Zone, in bedrock wells, and in other locations outside the influence of the air sparging systems. Table 5 presents analytical results for all groundwater samples that have been collected at the site since July 2015. Field notes and purge logs for this reporting period are located in Appendix A. The laboratory analytical reports for the sampling events for this reporting period are provided in Appendix C. Groundwater analytical results are screened against the risk-based screening levels listed in the South Carolina Programmatic QAPP, Table D1 (South Carolina UST Management Division, 2016), which are provided at the top of Table 5. The June 2018 results are shown on Figures 4A and 4B, and summarized in the following sections. Trends for select groundwater monitoring wells are shown in Appendix G. If the monitoring well is influenced by the air sparging system, there will be a gray shaded area on the trend charts. Trends were not created for monitoring wells that have been nondetect since sampling began.

4.5.1 Brown's Creek Protection Zone

Dissolved concentrations show an overall decreasing trend in the residuum aquifer of the BCPZ. For example, in monitoring wells MW-28, MW-34, MW-40, and MW-42, benzene concentrations have decreased by one to three orders of magnitude. Concentrations of BTEX constituents were stable in MW-12 between September 2017 and March 2018, but have shown a decrease in June 2018. Concentrations of BTEX constituents in MW-15, MW-38, and MW-39, remain stable; MW-41 being non-detect since February 2018.

Benzene concentrations appear to be stable in bedrock wells (968 µg/L in MW-15B in June 2018, and nondetect in all other bedrock monitoring wells). MW-12B is the only exception, showing a decreasing trend in benzene concentration (126 µg/L in September 2017 to 3.06 µg/L in March 2018); however, the benzene at this well showed an increase of 275 µg/L in June 2018.

Benzene was detected above its screening level in five of fifteen residuum monitoring wells in the BCPZ (MW-12, MW-15, MW-34, MW-38, and MW-40), ranging from 16.3 µg/L (MW-12) to 472 µg/L (MW-40). MTBE was detected above its screening level in MW-15, MW-34, MW-38, MW-39, and MW-40, ranging from 63.8 µg/L (MW-15) to 322 µg/L (MW-39). Constituents in cross-gradient monitoring wells MW-37 (to the north) and MW-35 (to the south) have been below screening levels since system startup. Constituent concentrations in monitoring well MW-24 were below screening levels since September 2017. MW-25 were below screening levels since March 2018, and MW-43 and MW-49 were below screening levels since the fourth quarter 2017.

Benzene was detected above its screening level in two of five bedrock monitoring wells within the BCPZ, at the concentration of 275 µg/L in MW-12B and 968 µg/L in MW-15B. Toluene and MTBE were also detected above their screening levels in MW-15B at 1,990 µg/L and 109 µg/L, respectively. Constituents have been nondetect in MW-25B since March 2017, in MW-24B since September 2017, and in MW-43B since December 2017.

4.5.2 Cupboard Creek Protection Zone

Dissolved concentrations in the CCPZ were increasing but have stabilized since initiating air sparging. Benzene concentrations in MW-23 have remained nondetect since March 2018. MW-19 has not been able

to be sampled on a regular frequency due to insufficient water however it was sampled during the June event. MW-20 has not been able to be sampled due to the presence of free product. Since MW-46 was installed in September 2017, BTEX concentrations have been increasing and will continue to be evaluated.

Benzene and MTBE were detected above their screening levels in one residuum monitoring well in the CCPZ (294 µg/L and 184 µg/L, respectively, in MW-46). Benzene was also detected above its screening level in residuum monitoring well MW-19 at a concentration of 8.15 µg/L. MW-20 was not sampled because it contained free product. Downgradient monitoring wells MW-26 and MW-29 were nondetect for all constituents.

No constituents were detected above screening levels in bedrock monitoring wells in the CCPZ.

4.5.3 Hayfield Zone

A decreasing trend is very evident in the residuum aquifer in the Hayfield Zone, with the reductions in concentrations in constituents detected and the constituents exceeding the screening criteria. For example, in MW-02, MW-09, and MW-30, benzene concentrations have decreased by one to three orders of magnitude and all other constituents are below screening levels for these locations. Concentrations at locations outside the influence of the air sparging system remain stable, notably near residuum well northwest of MW-07 and bedrock wells north of MW-13B and southeast of MW-17B. However, concentrations have increased for MW-13B with BTEX, increasing by an order of magnitude. Constituents analyzed in monitoring wells MW-04, MW-05, MW-06, MW-08, MW-10, MW-14, MW-21, MW-31, MW-32, MW-33T, and MW-47 were nondetect.

Constituent concentrations in MW-09B, MW-14B, and MW-17B have remained stable. Constituents in monitoring wells MW-02B, MW-06B, MW-36B, MW-45B, MW-48B, and MW-50B were below screening levels. All bedrock monitoring wells in the Hayfield Zone were sampled.

Benzene was detected above its screening level in 2 of 22 residuum monitoring wells in the Hayfield Zone ranging from 44.2 µg/L (MW-13) to 184 µg/L (MW-36). All other constituents were not detected above their respective screening levels. Four residuum monitoring wells in the Hayfield Zone were not sampled because of insufficient water (MW-17) and presence of product (MW-07, MW-16, and MW-18).

Benzene was detected above its screening level in four of ten bedrock monitoring wells ranging in concentrations from 8.63 µg/L in MW-14B to 8,910 µg/L in MW-17B. Concentrations of ethylbenzene, toluene, MTBE, and naphthalene exceeded their screen levels at MW-17B. MTBE also exceeded its screening level in MW-13B.

4.5.4 Shallow Bedrock Zone

In the residuum of the Shallow Bedrock Zone, one well contained product (MW-11). Benzene was the only constituent detected above its screening level in groundwater (MW-27) at a concentration of 5.74 µg/L.

Benzene was detected above its screening level in one of three bedrock monitoring wells in the Shallow Bedrock Zone, at the concentration of 8.96 µg/L in MW-01B.

4.6 Air Sparging System Operating Efficiency and Performance Data

Between April 1, 2018, and June 30, 2018, the air sparging system operated a total of approximately 4,159 hours, with an operating uptime of 97.7 percent. Since two compressors were operating during this timeframe, system maintenance activities could be conducted with minimal system downtime. During this reporting period, the only downtime was due to power grid fluctuations caused by local area storms and Subtropical Storm Alberto. The air sparging system was not operating for a total of 22 hours in May and 11 hours in June. In June 2018, air sparging flow rates in the stream aerators, horizontal wells, and vertical wells were at 98 percent, 91 percent, and 55 percent of design flow capacity, respectively.

5. Conclusions

The following conclusions are based upon data analysis from the site work performed between April 1, 2018, and June 30, 2018:

- Since starting the site air sparging system on March 6th, 2017 for the vertical sparging systems in the BCPZ and CCPZ areas and in May 2017 for the horizontal sparging system in the hayfield zone, product thickness values have declined in both recovery and nonrecovery features across the site. The number of locations with product thicknesses greater than 0.5 foot has decreased from seven locations in March 2018, three locations in April, two locations in May, and one location in June 2018. The locations that have measurable product thickness are not adjacent to any surface water bodies at the site.
- The volume of product recovered between April 2018 and June 2018 was 2.98 gallons which is less than what was collected in March 2018 alone (3.43 gallons).
- Three surface water sampling events were performed during this quarter. Based on a review of historical detections at SW-02 that determined that they were not related to the release, it is unlikely that the exceedance of benzene at SW-02 during this period of record can be attributed to the release at the site. Benzene has not been detected at SW-02 since April 2018. The benzene exceedance at SW-13 appears to be anomalous and will continue to be monitored.
- The average DO concentration in residuum and bedrock wells has remained stable for this reporting period. This shows the effectiveness of the air sparging system at introducing oxygen into the subsurface. Air sparging will continue to be increased at the vertical wells to design flow rates during the next quarter to meet the increasing biomass oxygen demand. The design flow rates have been met and sustained at the horizontal and stream aerators locations.
- Groundwater monitoring results for this reporting period indicate that due to operation of the air sparging system there are continued decreases in dissolved concentrations of hydrocarbons in the BCPZ, CCPZ, and Hayfield Zone, and stable trends in the Shallow Bedrock Zone, in bedrock wells, and in other locations outside the influence of the air sparging system. Concentrations in MW-40 dropped significantly during the June 2018 event.
- During this reporting period, the air sparging system had an operating uptime of 97.7 percent. Operating flows in the stream aerators, horizontal wells, and vertical wells were at 98 percent, 91 percent, and 55 percent of design flow capacity, respectively.

6. Future Activities

This section describes future activities planned for the site.

6.1 Groundwater and Surface Water Monitoring

- Continue gauging of monitoring wells and surface water sampling locations in accordance with the CAP Addendum, Revision 2 (CH2M, 2017d) submitted to SCDHEC on October 12, 2017.
- Sample monitoring wells and surface water sampling locations on a quarterly basis starting in July 2018 per Section 3 and Table 2 of the CAP Addendum, Revision 2 (CH2M, 2017d).
- Collect DO concentration measurements on a quarterly basis, starting in July 2018 per Section 3 and Table 2 of the CAP Addendum, Revision 2 (CH2M, 2017d).
- Submit quarterly reports starting in July 2018 per Section 3 and Table 2 of the CAP Addendum, Revision 2 (CH2M, 2017d).
- Continue routine visual inspection of Brown's Creek and Cupboard Creek as outlined in the CAP Addendum, Revision 2 (CH2M, 2017d).
- Install additional monitoring wells to expand the monitoring network north of MW-30, west of MW-30, and upgradient of MW-38 in accordance with the Request for Well Permit to Install Additional Monitoring Wells (CH2M, 2018d).
- Abandon 1-inch-diameter wells (piezometers) because their narrow diameter exaggerates product thickness measurements and because the existing 2-inch monitoring well network is now sufficient for groundwater elevation and product thickness measurements.
- Abandon monitoring wells MW-17 and MW-19 without replacement. These wells have consistently experienced insufficient water for sampling, and additional downgradient and cross-gradient wells have since been installed in their vicinity that have had sufficient water to sample.
- Analyze concentration trends in the monitoring well network to identify areas for additional remediation, if necessary, and to optimize the monitoring well network.

6.2 Product Recovery

Continue monthly product recovery evaluations using skimmers and socks in accordance with the Product Recovery Skimmer Results report (CH2M, 2018c). This will allow more accurate tracking of free product recovered at each feature.

6.3 System Operation and Maintenance

- Continue routine O&M activities for the air sparging system as described in the CAP Addendum, Revision 2 (CH2M, 2017d).
- Continue air sparging in the BCPZ and CCPZ. Persistent free product in MW-20 will be addressed by maximizing air flow in the vertical air sparging wells in the vicinity of this feature up to the maximum design flow rate of 15 scfm per well.
- Continue air sparging in the horizontal wells in the Hayfield Zone up to the maximum design flow rate of 0.75 scfm/ft.
- Continue operating the stream diffusion aerators at the design flow rate of 15 scfm in each, according to the Sparging Operating Limits letter (CH2M, 2017b).

6.4 Remediation System Expansion

In order to address persistent concentrations in the vicinity of MW-11 and MW-17, Plantation proposed expanding the existing air sparging system in correspondence dated May 4, 2018 (CH2M, 2018g). The

plan proposed installing 13 new vertical air sparging wells to the top of bedrock. Five of these wells would be installed to extend the remedial zone of influence of the CCPZ air sparging curtain to the northwest across Lewis Drive beyond monitoring well MW-17 (Figure 1). The remaining eight wells would be installed to extend the remedial zone of influence of the BCPZ air sparging curtain southwest toward monitoring well MW-11 (Figure 1).

7. References

CH2M HILL Engineers, Inc. (CH2M). 2016a. *Comprehensive Site Assessment Report, Lewis Drive Release Site, Belton, South Carolina. Site ID Number 18693 ("Kinder Morgan Belton Pipeline Release").* July.

CH2M HILL Engineers, Inc. (CH2M). 2016b. *Corrective Action Plan, Lewis Drive Release Site, Belton, South Carolina. Site ID Number 18693 ("Kinder Morgan Belton Pipeline Release").* September 1.

CH2M HILL Engineers, Inc. (CH2M). 2017a. *Corrective Action Plan Addendum, Revision 1, Plantation Pipe Line, Lewis Drive Remediation Site, Belton, South Carolina. Site ID Number 18693, "Kinder Morgan Belton Pipeline Release."* May 25.

CH2M HILL Engineers, Inc. (CH2M). 2017b. *Sparging Operating Limits, Plantation Pipe Line Company, Lewis Drive Remediation Site, Belton, South Carolina. Site ID Number 18693, "Kinder Morgan Belton Pipeline Release."* July 26.

CH2M HILL Engineers, Inc. (CH2M). 2017c. *Interim Free Product Recovery Plan – Revision 3, Plantation Pipe Line Company, Lewis Drive Remediation Site, Belton, South Carolina. Site ID Number 18693, "Kinder Morgan Belton Pipeline Release."* August 4.

CH2M HILL Engineers, Inc. (CH2M). 2017d. *Corrective Action Plan Addendum, Revision 2, Lewis Drive Remediation Site, Belton, South Carolina. Site ID Number 18693 ("Kinder Morgan Belton Pipeline Release").* October 12.

CH2M HILL Engineers, Inc. (CH2M). 2018a. *Free-Product Recovery Plan – Revision 4, Lewis Drive Remediation, Plantation Pipe Line Company, Belton, South Carolina. Site ID Number 18693, "Kinder Morgan Belton Pipeline Release."* February 6.

CH2M HILL Engineers, Inc. (CH2M). 2018b. *Quality Assurance Project Plan, Revision 4.* Addendum to the SCDHEC UST Programmatic Quality Assurance Program Plan for Plantation Pipe Line Company/Site ID No. 18693. February 9.

CH2M HILL Engineers, Inc. (CH2M). 2018c. *Product Recovery Skimmer Results, Lewis Drive Remediation Site, Plantation Pipe Line Company, Belton, South Carolina. Site ID Number 18693, "Kinder Morgan Belton Pipeline Release."* March 22.

CH2M HILL Engineers, Inc. (CH2M). 2018d. *Request for Well Permit to Install Additional Monitoring Wells, Lewis Drive Release, Plantation Pipe Line Company, Belton, South Carolina. Site ID Number 18693, "Kinder Morgan Belton Pipeline Release."* March 26.

CH2M HILL Engineers, Inc. (CH2M). 2018e. *Lewis Drive – March 2018 Monthly Status Update, Plantation Pipe Line Company, Belton, South Carolina. Site ID Number 18693, "Kinder Morgan Belton Pipeline Release."* April 18.

CH2M HILL Engineers, Inc. (CH2M). 2018f. *Request to Pump Select Monitoring Wells, Lewis Drive Release, Plantation Pipe Line Company, Belton, South Carolina. Site ID Number 18693, "Kinder Morgan Belton Pipeline Release."* April 27.

CH2M HILL Engineers, Inc. (CH2M). 2018g. *Request for Well Permit to Install Additional Vertical Sparging Wells for Biosparging System Expansion, Lewis Drive Release, Plantation Pipe Line Company, Belton, South Carolina. Site ID Number 18693, "Kinder Morgan Belton Pipeline Release."* May 4.

CH2M HILL Engineers, Inc. (CH2M). 2018h. *Submittal of UIC Permit Revision for Expansion of Bio/Air Sparging Remediation System* May 4.

CH2M HILL Engineers, Inc. (CH2M). 2018i. *Lewis Drive – April 2018 Monthly Status Update, Plantation Pipe Line Company, Belton, South Carolina. Site ID Number 18693, "Kinder Morgan Belton Pipeline Release."* May 29.

CH2M HILL Engineers, Inc. (CH2M). 2018j. *Response to Comments in SCDHEC Letter titled "Reviews of Misc. Reports, Response to Comments Document, Free Product Recovery Plan, Product Recovery Skimmer Results and Request for Well Permit" dated May 8, 2018.* June 6.

CH2M HILL Engineers, Inc. (CH2M). 2018k. *Lewis Drive – May 2018 Monthly Status Update, Plantation Pipe Line Company, Belton, South Carolina. Site ID Number 18693, "Kinder Morgan Belton Pipeline Release."* June 27.

CH2M HILL Engineers, Inc. (CH2M). 2018l. *2018 Annual Monitoring Report, Lewis Drive Remediation Site, Plantation Pipe Line Company, Belton, South Carolina. Site ID Number 18693, "Kinder Morgan Belton Pipeline Release."* (CH2M, 2018k). June 27.

Environmental Standards, Inc. 2018. *Technical Memorandum – Review of Surface Water Data*. January 17.

Plantation Pipe Line Company. 2015. Department of Transportation (DOT) Form 7000.1 Accident Report - Hazardous Liquid Pipeline Systems. Submitted to the DOT Pipeline and Hazardous Materials Safety Administration (PHMSA). January 7.

South Carolina Department of Health and Environmental Control (SCDHEC). 2014. *R. 61-68, Water Classifications & Standards*. June 27.

SCDHEC. 2018. Reviews of Miscellaneous Reports, Response to Comments Document - Free Product Recovery Plan, Product Recovery Skimmer Results, and Request for Well Permit. May 8.

South Carolina Underground Storage Tank Management Division. 2016. *Programmatic Quality Assurance Program Plan, Revision 3.1.* February.

Tables

Table 1. Field Observation Log

Plantation Pipe Line Company

Lewis Drive Remediation Site, Belton, South Carolina

Site ID #18693 "Kinder Morgan Belton Pipeline Release"

Date	**Inspect Wetlands South of Calhoun Road** (Any odor, sheen or distressed vegetation? Describe.)	**Inspect Brown's Creek Upstream and Downstream of the Culvert Under Lewis Drive** (Any odor, sheen or distressed vegetation? Describe.)
4/6/2018	No odors, sheens, or distressed vegetation observed in wetlands South of Calhoun Road.	No odors, sheens or distressed vegetation observed in wetlands either upstream or downstream of Culvert under Lewis Drive.
5/3/2018	No odors, sheens, or distressed vegetation observed in wetlands South of Calhoun Road.	No odors, sheens or distressed vegetation observed in wetlands either upstream or downstream of Culvert under Lewis Drive.
6/7/2018	No odors, sheens, or distressed vegetation observed in wetlands South of Calhoun Road.	No odors, sheens or distressed vegetation observed in wetlands either upstream or downstream of Culvert under Lewis Drive.

Notes:

ID = identification

Table 2. Analytical Results for Surface Water

Plantation Pipe Line Company

Lewis Drive Remediation Site, Belton, South Carolina

Site ID #18693 "Kinder Morgan Belton Pipeline Release"

Location	Sample ID	Date Collected	Units	Analyte: Benzene	Ethylbenzene	Toluene	m&p-Xylene	o-Xylene	Naphthalene	MTBE
		Screening Value (µg/L):		2.2 [a]	530 [a]	1,000 [a]	NA [b]	NA [b]	NA [b]	NA [b]
SW-RELEASE	SW-RELEASE	1/20/2015	µg/L	**330**	**490**	**2,400**	**2,100**	**940**	**140**	**5.7 J**
SW-01	SW01-121114	12/11/2014	µg/L	0.5 U	1 U	1 U	2 U	1 U	1 U	1 U
	SW01-022515	2/25/2015	µg/L	5 U[c]	5 U	5 U	10 U	5 U	5 U	NA
	SW01-030215	3/2/2015	µg/L	5 U[c]	5 U	5 U	10 U	5 U	5 U	NA
	SW01-031115	3/11/2015	µg/L	5 U[c]	5 U	5 U	10 U	5 U	5 U	NA
	SW01-031815	3/18/2015	µg/L	5 U[c]	5 U	5 U	10 U	5 U	5 U	NA
	SW01-033115	3/31/2015	µg/L	5 U[c]	5 U	**17.6**	10 U	5 U	5 U	NA
	SW01-042215	4/22/2015	µg/L	5 U[c]	5 U	**14.9**	10 U	5 U	5 U	NA
	SW01-050715	5/7/2015	µg/L	5 U[c]	5 U	**7.00**	10 U	5 U	5 U	NA
	SW01-051915	5/19/2015	µg/L	5 U[c]	5 U	**8.80**	**10.6**	**6.40**	5 U	NA
	SW01-060315	6/3/2015	µg/L	5 U[c]	5 U	5 U	10 U	5 U	5 U	NA
	SW01-061815	6/18/2015	µg/L	5 U[c]	5 U	5 U	10 U	5 U	5 U	NA
	SW01-071515	7/15/2015	µg/L	5 U[c]	5 U	5 U	10 U	5 U	5 U	NA
	SW01-081315	8/13/2015	µg/L	5 U[c]	5 U	5 U	10 U	5 U	5 U	NA
	SW01-092415	9/24/2015	µg/L	5 U[c]	5 U	5 U	10 U	5 U	5 U	NA
	SW01-102215	10/22/2015	µg/L	1 U	1 U	1 U	2 U	1 U	1 U	NA
	SW01-112415	11/24/2015	µg/L	**7.80**	**1.50**	**13.0**	**9.30**	**4.60**	1 U	NA
	SW01-122215	12/22/2015	µg/L	**4.60**	1 U	**8.80**	**5.50**	**3.10**	1 U	NA
	SW01-012516	1/25/2016	µg/L	**17.6**	**2.30**	**36.0**	**11.3**	**6.30**	1 U	NA
	SW01-021816	2/18/2016	µg/L	**23.4**	**3.00**	**55.6**	**15.0**	**9.10**	1 U	NA
	SW01-031616	3/16/2016	µg/L	**20.1**	**2.40**	**42.3**	**13.3**	**7.60**	1 U	NA
	SW01-042716	4/27/2016	µg/L	**20.8**	1 U	**30.6**	**2.90**	**2.00**	1 U	NA
	SW01-050916	5/9/2016	µg/L	**16.5**	**1.400**	**16.3**	**7.00**	**4.80**	1 U	NA
	SW01-062716	6/27/2016	µg/L	**9.00**	1 U	**3.30**	2 U	1 U	1 U	NA
	SW01-072816	7/28/2016	µg/L	1 U	1 U	1 U	2 U	1 U	1 U	NA
	SW01-081916	8/19/2016	µg/L	1 U	1 U	1 U	2 U	1 U	1 U	NA
	SW01-092916	9/29/2016	µg/L	1 U	1 U	1 U	2 U	1 U	1 U	NA
	SW01-103116	10/31/2016	µg/L	1 U	1 U	1 U	2 U	1 U	1 U	NA
	SW01-112816	11/28/2016	µg/L	**5.00**	1 U	**10.4**	**4.900**	**8.30**	1 U	NA
	SW01-122916	12/29/2016	µg/L	**12.6**	1 U	**22.1**	**11.2**	**13.5**	1 U	NA
	SW01-012017	1/20/2017	µg/L	**1.00**	1 U	**2.300**	2 U	**3.50**	1 U	NA
	SW01-022817	2/28/2017	µg/L	**18.5**	**1.93**	**37.0**	**13.8**	**10.2**	5 U	NA
	SW01-031517	3/15/2017	µg/L	**3.02**	1 U	**5.13**	**2.16**	**1.74**	5 U	NA
	SW01-032117	3/21/2017	µg/L	1 U	1 U	**1.57**	2 U	1 U	5 U	NA
	SW01-033017	3/30/2017	µg/L	1 U	1 U	1 U	2 U	1 U	5 U	NA
	SW01-040517	4/5/2017	µg/L	1 U	1 U	**2.25**	2 U	1 U	5 U	NA
	SW01-050417	5/4/2017	µg/L	1 U	1 U	1 U	2 U	1 U	5 U	NA
	SW01-061317	6/13/2017	µg/L	1 U	1 U	**1.90**	2 U	1 U	5 U	NA
	SW01-071817	7/18/2017	µg/L	1 U	1 U	1 U	2 U	1 U	5 U	NA
	SW01-080217	8/2/2017	µg/L	1 U	1 U	1 U	2 U	1 U	5 U	NA