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March 1, 2017

Delivered via FedEx Overnight Delivery

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



Subject: Response to Comments in SCDHEC Letter titled "Corrective Action Plan Review," dated January 27, 2017 (with errata dated January 31, 2017)
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) has prepared this response to comments received from the South Carolina Department of Health and Environmental Control (SCDHEC) in their letter date-stamped January 27, 2017 (with a subsequent errata letter date-stamped January 31, 2017), requesting that an addendum to the *Corrective Action Plan, Lewis Drive Release Site, Belton, South Carolina* (CAP) submitted on September 1, 2016 (CH2M, 2016c), be provided within 30 days. Questions and comments received by SCDHEC during a 47-day public comment period were also included in their letter.

Each of the comments provided in the SCDHEC correspondence are listed below, followed by Plantation's response to the comment. The CAP Addendum is also being submitted at this time under separate cover.

A) Comments from SCDHEC

Comment 1: *Case studies or information demonstrating that the proposed biosparging approach is appropriate for plumes where free product is present that is comparable to the referenced site.*

Response: A variety of remediation alternatives were screened and evaluated for this site. Section 2 of the CAP Addendum describes the evaluation and rationale for selection of the proposed remedy. Appendix A of the CAP Addendum provides a variety of case studies in which sparging was used to address free product. The Selma 3 project at a terminal in Selma, North Carolina, in particular, illustrates that sparging without soil vapor extraction was an effective remediation technology to reduce a considerable amount of free product. On this project, product thicknesses were reduced from 4 feet to zero in 12 months of air sparging

operation without accompanying soil vapor extraction. The sparging did not result in the growth of a dissolved plume or pushing of the free product offsite. A paper summarizing the Selma 3 project has been provided.

Comment 2: *A larger map of the proposed biosparging layout than was provided (Figure 9). The revised map will need to clearly illustrate the layout, all wells, trenches, sumps, and the creeks.*

Response: Figure 9 has been reprinted on 22- by 34-inch paper. See Figure 9a included in Attachment 1. Five copies have been provided.

Comment 3: *A strategy for biosparging technology in each remediation area in regard to duration, air injection rate, and interim remediation goals.*

Response: The *Startup Plan for Surface Water Protection Measures* submitted to SCDHEC on February 23, 2017 (CH2M, 2017c), provides details on the operational strategy for the surface water protection zones in the first month of startup, including air injection rates and pulsing sequences. As discussed in the referenced document, the proposed initial flow rates are very low (1 standard cubic foot per minute [scfm] per well) to slowly establish aerobic conditions and to limit volatilization of hydrocarbons. Air injection rates are planned to be gradually increased over time to optimize system performance until initially reaching 4 scfm per well. Monitoring will be conducted to evaluate system performance, and will take various forms including visual observations, field measurements, and analytical results. The CAP Addendum provides the detailed operational strategy for each of the other two remediation areas of the site, including a discussion of pulsing vs. continuous airflow per area, pulsing sequencing, air injection rates, and monitoring aspects.

At this time, we propose the following interim remediation goal: no surface water quality exceedances within 6 months following startup of the sparging system in the surface water protection zones. Once the system has reached a steady state of operation and some performance data have been collected, other interim goals may be established in consultation with SCDHEC. Until system performance can be established, it is premature, or speculative, to try to establish additional performance measures for the proposed system.

Comment 4: *Section 7.2 (Initial System Operational Concepts). Provide more detailed information regarding what observations will be made and what measurements will be collected to determine if pulsing mode is used in the shallow bedrock zone, identifying specific wells and or points from which data will be collected.*

Response: As detailed in the Startup Plan and CAP Addendum, performance monitoring will consist of a combination of dissolved oxygen (DO) measurements, water level measurements, and groundwater sampling (including both contaminants and geochemical/biodegradation parameters). The determination to pulse or continuously inject in the shallow bedrock zone will be made based on an evaluation of these parameters in the three bedrock sparging wells installed in January 2017 to evaluate final spacing and design of the shallow bedrock sparging system. Based on our extensive experience with vertical sparging wells, we anticipate that pulsing will likely be pursued for this area. Once testing is completed in this area of the site, a specific operating plan will be submitted for SCDHEC approval.

Comment 5: *Section 7.2 (Initial System Operational Concepts). Provide what specific data will be collected and the criteria that will be followed to determine changes to flow rates.*

Response: As detailed in the Startup Plan and CAP Addendum, the overall operational goal for the system is to initiate at low flow rates and increase the rate periodically while monitoring throughout the startup phase. Generally, decisions to increase the air injection rates will be

based on the degree and time of mounding, the containment of the plume, and the degree of volatilization occurring. Much of this depends on establishing aerobic conditions in the vadose zone and the ability of the vadose zone to assimilate vapors coming from the sparging operations.

Comment 6: *A tabulation of monitoring wells that will be used to monitor the effectiveness of the remedial strategy categorized by each of the five treatment areas. This should include wells outside the plume and wells within the plume, proposed parameters, and a proposed monitoring schedule.*

Response: Please see the Startup Plan and CAP Addendum for a detailed monitoring plan, which includes a tabulation of monitoring wells, subdivided by treatment area of the site, that will be used to monitor the effectiveness of the remedial actions. Table 2 of the CAP Addendum includes parameter selection, monitoring frequency, etc. The selected wells include points both within and outside the plume.

Comment 7: *A detailed effectiveness monitoring schedule. The Agency will consider a variable monitoring schedule; however, the plan should propose the specific criteria that will be used as a basis for determining the frequency of monitoring.*

Response: Please see the Startup Plan and CAP Addendum for a detailed effectiveness monitoring plan, which includes a tabulation of monitoring wells subdivided by treatment area of the site, parameter selection, monitoring frequency, etc.

Comment 8: *Continuation of free product and groundwater elevation gauging. Recharge rates for each recovery well, recovery sump, and recovery trench will need to be determined so that site-specific data supports an appropriate product recovery schedule. As site conditions change, recharge rates will need to be evaluated to determine the most effective recovery rate.*

Response: Plantation will continue to gauge free product and groundwater elevations on a regular basis as described in the most recent revision of the *Product Recovery Plan, Revision 2* (CH2M, 2016b). We further concur that transmissivity values (which are the best indicator of recoverability) calculated from baildown testing will be instrumental in determining recoverability and the frequency of recovery. Plantation proposes to conduct baildown testing in accordance with ASTM International E2856-13 at the following locations: RW-02, RW-04, RW-06, RW-09, RW-12, RW-13, and RW-14. These locations were selected to be representative of each area of the main product body. We anticipate that these locations will be sufficient to assess the variability of recovery at the site and to identify a recovery frequency that will change with time.

Based on the results of the baildown tests and subsequent product recovery measurements, it is anticipated that long-term recovery efforts will focus only on certain areas of the site or wells, or ultimately discontinuing recovery altogether when the practical product recovery limit is achieved. Conservatively, this limit is achieved in a given well once its transmissivity value decreases to less than 0.1 square foot per day (ft²/day) (ITRC, 2009).

Comment 9: *Continuation of free product recovery as long as measureable levels of product exists.*

Response: Although removal of free product using vacuum trucks is one of the least effective methods to reduce product, Plantation will continue to do so even after starting the biosparging system. Plantation will work with SCDHEC as remediation progresses to evaluate the efficiency and focus of recovery efforts using the best evaluation means available.

Comment 10: *Section 8.1.1 (Visual Observations) must state that visual inspections will be performed for evidence of petroleum sheen on surface waters, odors in the area, and/or distressed vegetation or biota on all areas of the site: including along Brown's Creek and Cupboard Creek. Provide a strategy to address any detected sheen, seeps, dead and/or distressed vegetation, distressed and /or dead biota, or out of the ordinary odors.*

Response: This has been revised accordingly in Section 3.6 of the CAP Addendum. If any of the following are observed and have not been previously reported, the observer will immediately notify the CH2M project manager by phone: petroleum sheen, seeps, dead and/or distressed vegetation, dead and/or distressed biota, or out-of-the-ordinary odors. Due to the low flow of Brown's Creek and Cupboard Creek, there is a prevalence of biological sheen, which can be confused with a petroleum sheen. Before being reported, a petroleum sheen will first be distinguished from a biological sheen by the methods described in Section 3.6 of the CAP Addendum. In general, those methods include using a stick to try to break up the sheen (a bacterial sheen will typically break into small platelets, whereas a petroleum sheen will quickly try to reform after any disturbance), and/or placing a petroleum-absorbent pad on the sheen to see if it absorbs any petroleum constituents.

Comment 11: *Installation of an additional permanent bedrock well down-gradient of MW-17B, located between the area of MW-17B and MW-21 along the pipeline. This well should be as close in proximity to the pipeline as is MW-17B.*

Response: Installation of permanent shallow and bedrock well pair MW-45/45B was completed on January 27, 2017, in close proximity to the pipeline and downgradient of MW-17B. Combination boring logs/well construction diagrams for MW-45 and MW-45B are included in Attachment 2.

Comment 12: *Installation of permanent wells (shallow & bedrock) in the area between MW-1 and MW-22.*

Response: Installation of permanent shallow and bedrock well pair MW-44/44B was completed on January 25, 2017, in the area between MW-01 and MW-22. Combination boring logs/well construction diagrams for MW-44 and MW-44B are included in Attachment 2.

Comment 13: *Installation of permanent wells (shallow & bedrock) in the area on the opposite side of Brown's Creek, across the creek from the location of SW-12.*

Response: Due to extremely wet site conditions, wells were not able to be installed at this location in January 2017. As discussed with SCDHEC, installation will be attempted again during a drier time of year. The timing for this work will be coordinated with SCDHEC during regular update meetings.

Comment 14: *A proposal to remediate the seep areas immediately up-gradient of Brown's Creek. In the November 4, 2016 meeting, Plantation Pipeline informed the Agency that the use of oxygen release compound or sodium persulfate would be evaluated.*

Response: Reactive core mat consisting of granular activated carbon will be installed at the two identified seep locations immediately upgradient of Brown's Creek in accordance with the *Surface Water Protection Plan Addendum*, submitted to SCDHEC on January 20, 2017 (CH2M, 2017a), and SCDHEC's approval dated February 10, 2017. This action is also described in Section 4, Focused Seep Abatement, of the CAP Addendum.

Comment 15: *A proposal to remediate all areas of bedrock with exceedances to risk based corrective action or details regarding how bedrock contamination will be addressed.*

Response: Groundwater in the Shallow Bedrock Zone will be remediated through an estimated 13 vertical sparging wells installed into bedrock, as outlined in Section 5.1.3 of the CAP (CH2M, 2016). In the other areas of the dissolved plume, Plantation will monitor the quality of the bedrock aquifer and will adjust remediation activities as needed to address effective cleanup of the site.

Adjustments to the system and the remedial approach will be discussed during regular meeting updates with SCDHEC.

Comment 16: *A proposal to install an additional well on the bank immediately opposite to the location of SW-1, as discussed in the November 4, 2016 meeting. It was noted during the December 6, 2016 site visit, that the well that was to be installed in the referenced area was relocated further to the southeast. When discussed during the December 6, 2016 site visit, Patrick Ferringer with CH2M stated that the drill rig was not able to reach the proposed area. This possibility was discussed during the November 4, 2016 meeting and the Agency stated that if a drill rig was not able to access the discussed location, installation of a hand augured well would be acceptable as long as the well was installed in compliance with the South Carolina Well Standards (R. 61-71).*

Response: Plantation submitted a *Request for Well Permit to Install Additional Monitoring Well (MW-34)* to SCDHEC on February 7, 2017 (CH2M, 2017b) and it was approved by SCDHEC on February 10, 2017. The well is scheduled to be installed by hand auger during the first 2 weeks of March 2017.

Comment 17: *A routine petroleum absorbent boom inspection and replacement strategy, as discussed during the December 6, 2016 site visit.*

Response: As described in Section 3.8 of the CAP Addendum, petroleum-absorbent booms are currently in place at different points along Brown's Creek as a contingency measure in case additional seep(s) manifest at the site. These booms will be inspected on a monthly basis and replaced quarterly, at a minimum, or sooner if any boom(s) show evidence of deterioration, yellowing, or vegetative growth. Removal of the booms will be discussed with SCDHEC during regular update meetings based on monitoring data being collected at the site.

Comment 18: *Clarification regarding the use of diffusion aerators in Brown's Creek. It is the Agency's understanding, based upon information shared during the November 4, 2016 meeting and author's conversation with Scott Powell January 4, 2017, that the diffusion aerators in Brown's Creek will be used to treat the contamination already present in the creek. Further, the diffusion aerators are not proposed as a continuing remediation measure as the vertical sparging wells and the remediation method discussed in item 14 are intended to treat the contamination prior to reaching the creek.*

Response: The diffusion aerators in Brown's Creek are only intended to abate existing impacts in the creek and to improve overall natural water quality of this relatively stagnant body of water. Other protective measures are designed to intercept product and reduce dissolved concentrations in groundwater before reaching the creek. These other protective measures include product evacuation from recovery wells and recovery trench RT-2, biosparging through the vertical sparging curtain upgradient of Brown's Creek, and the reactive core mat mentioned in Comment 14.

Comment 19: *In the event contamination continues to impact Brown's Creek after implementation of the biosparging system, a plan to implement immediate measures that will prevent discharge of petroleum constituents (free phase and dissolved phase) from reaching Brown's Creek should be proposed. The plan should include a monitoring system to monitor the effectiveness of proposed method. Data collected from the monitoring wells located closest to Brown's Creek will assist with this evaluation.*

Response: Because of the distance between Brown's Creek and the closest vertical sparging curtain (which varies around 70 to 100 feet), the effects of sparging near Brown's Creek will not be immediately noticeable in surface water samples or in the monitoring wells closest to Brown's Creek (monitoring wells MW-37 through MW-42). If, however, after a sufficient period of sparging (likely 180 days or more), hydrocarbon levels in these monitoring wells are not decreasing, additional measures will be discussed with SCDHEC. Potential contingency measures will be discussed during the first progress update meeting with SCDHEC.

In the meantime, reactive core mat is being installed at the location of the two known seeps (see CAP Addendum Section 4). If additional seeps are identified, reactive core mat also may be installed in those areas as approved by SCDHEC. In addition, the diffusion aerators operating in Brown's Creek will abate existing hydrocarbons in Brown's Creek while the sparging is allowed to take full effect.

B) Public Comments

Comment 1: *Surface water is returned to its natural state prior to the pipeline release.*

Response: Plantation will comply with federal and state laws regarding surface water quality. Although Plantation plans to comply with applicable cleanup criteria, we believe that remedial measures being implemented will return the creek to its natural state prior to the pipeline release.

Comment 2: *Free phase product is evacuated from existing recovery wells as long as product is measured and additional recovery wells are installed so that as much product as possible can be recovered.*

Response: The ground can be thought of as a sponge. Even when you wring it out, it still retains some moisture. Recovering product through recovery wells is analogous to inserting a straw into the sponge to suck it dry. It is one of the least effective methods to remove and/or treat product in the subsurface. Because the release was identified early, and because Plantation installed a dense network of over 37 recovery wells, sumps, and trenches to intercept and recover product, Plantation has been very successful in recovering product at the site. Ongoing recovery efforts will become increasingly less effective.

In order to address the remaining hydrocarbons at the site, the project team designed an innovative sparging system. Sparging is an environmental remediation technology that involves injecting atmospheric air into the groundwater and saturated soils. This stimulates the native microbial community to biodegrade residual hydrocarbons. Sparging is a proven remediation technology that has been shown to reliably reduce both free-phase product and dissolved hydrocarbons in groundwater much more rapidly and over a much broader area than direct removal.

Plantation will continue to evacuate product from the existing recovery features even after the sparging system has been initiated. However, product recovery by conventional vacuum means will prove less and less effective as the "sponge" dries up. Plantation will continue to monitor and test the characteristics of the aquifer and the body of free product to determine the most effective and efficient product recovery strategy. Plantation will continue to work closely with SCDHEC to evaluate the current strategy and adjust as necessary to meet the remediation goals.

Comment 3: *Additional biosparging is conducted.*

Response: As the system is initiated, the area of influence of the horizontal and vertical sparging wells will be monitored and evaluated. The sparging system can and will be adjusted based on those observations. Adjustments might include increasing or decreasing flow rates to particular features, or adding additional sparging wells. The sparging manifold has been specifically designed for potential expansion with 12 spare connection points for additional sparging wells if necessary. If monitoring results indicate that additional sparging wells would be effective, then Plantation will propose their locations and depths to SCDHEC to obtain permits to construct them.

Comment 4: *A pore water study is conducted.*

Response: As stated in a letter to SCDHEC dated April 21, 2016, "Response to Request for Pore Water Sampling Plan," (CH2M, 2016a) existing data indicate that a pore water study would not significantly broaden the current understanding of the site conceptual model, nor would it provide useful information for the design or implementation of the proposed biosparging remedy. SCDHEC affirmed this response in a letter dated June 13, 2016. In that letter, SCDHEC stated,

"In regard to the Response to Request for Pore Water Sampling Plan, it was agreed during the May 2, 2016 meeting that [a] Pore Water Investigation would not be conducted. However, it was also agreed that 6 additional permanent shallow monitoring points would be installed immediately beside Brown's Creek as permanent sampling locations and as pore water sampling points."

These monitoring wells (MW-37, MW-38, MW-39, MW-40, MW-41, and MW-42) have all been installed, and a seventh monitoring well is scheduled to be installed between MW-38 and MW-39 in February 2017.

Comment 5: *Clear deadlines / goals are provided in regard to the remediation and frequent monitoring is conducted to ensure deadlines / goals are met.*

Response: We agree that clearly defined goals are necessary for proper environmental remediation. We refer the reader to the corrective action objectives as stated in the CAP (CH2M, 2016c). Achieving these objectives necessarily requires time, and Plantation is committed to achieving these objectives. From the outset, Plantation has taken full responsibility for the release and expressed their commitment to a thorough and complete investigation and remediation of the site in accordance with all applicable laws and regulations. Their commitment and comprehensive approach to the full remediation and restoration of this area has been well received by the State and we will continue these efforts. Deadlines and goals will be discussed at regular update meetings with SCDHEC as site performance data become available.

C) Comments on BIOSCREEN Modeling

Comment: *For the results from the Bioscreen Model to be considered valid, the plume being modeled must be stable or decreasing. Since the referenced plume is neither stable nor decreasing, any site specific target levels (SSTLs) that were calculated would be invalid. However, the following questions and/or comments did arise from the initial review of the provided modeling effort:*

a) There is an order of magnitude variation between the hydraulic conductivity reported from the falling head and rising head slug tests at MW-2 and MW-15 used in the model. Due to the large variation;

rather than use the average of the two tests, additional tests to produce a more accurate estimate must be conducted and provided.

b) There appears to be a conversion calculation error for the hydraulic conductivity used for the "South to Cupboard Creek" estimate.

c) Simulation time should be increased until steady state is reached.

d) Upon validation that the referenced plume is stable or concentrations of petroleum constituents are decreasing, SSTs will need to be re-evaluated. Reassessment will need to continue with time, as site conditions change.

Response: We agree with SCDHEC that the dissolved plume is neither stable nor decreasing. However, the intent of BIOSCREEN modeling was to propose a quantifiable endpoint to active remediation. Once the plume is shown to be stable or decreasing (in the future, after biosparging has been allowed to take effect), then the BIOSCREEN model results can indicate whether the extents and concentrations of the plume are sufficiently reduced as to no longer require active remediation to prevent further impacts to receptors.

Since we agree that the dissolved plume is not yet stable or decreasing, Plantation proposes to defer evaluation of natural attenuation as an endpoint through the BIOSCREEN model until such time as groundwater monitoring data trends indicate that the dissolved plume is either stable or decreasing. Since we are deferring this modeling at this time, Correction Action Objective Number 3 (CAP Section 4) that uses BIOSCREEN modeling to recommend endpoints for active remediation will be deferred.

D) Comments from Southern Environmental Law Center

Below is a series of comments provided by the Southern Environmental Law Center (SELC) regarding the CAP, which SCDHEC provided for public comment. It is our understanding that SCDHEC considered SELC's comments in developing the specific comments that Plantation has responded to above. Plantation has carefully reviewed SELC's comments and believes its responses contained in this letter to SCDHEC and the public comments adequately address SELC's comments. Plantation has taken full responsibility for the release and expressed their commitment to a thorough and complete investigation and remediation of the site in accordance with all applicable laws and regulations.

Comment 1: *The Corrective Action Plan objectives must be revised.*

Response: Plantation does not anticipate revising corrective action objectives, except regarding deferral of the BIOSCREEN modeling component as discussed above in Plantation's response to SCDHEC Comment C.

Comment 2: *The Site must be adequately surveyed and sampled.*

Response: The assessment of the site has been discussed at length with SCDHEC. Ongoing monitoring will continue and be adjusted as necessary based on performance of the system.

Comment 3: *The Corrective Action Plan must include a discussion of other feasible remedial technologies.*

Response: See Plantation's response to SCDHEC Comment 1.

Comment 4: *Gasoline recovery efforts must continue.*

Response: See Plantation's response to SCDHEC Comments 8 and 9.

Comment 5: *More biosparging wells must be installed.*

Response: See Plantation's response to SCDHEC Comments 3 and 15 and Public Comments 2 and 3.

Comment 6: *Measures must be developed to protect surface waters in rain events.*

Response: See Plantation's response to SCDHEC Comments 14 and 19.

Comment 7: *The Corrective Action Plan must include adequate monitoring and reporting, as well as a more detailed schedule.*

Response: See Plantation's response to SCDHEC Comments 4, 5, 6, 7, 10, and 17.

Comment 8: *Continued transparency and public participation is essential.*

Response: From the beginning, Plantation has worked with SCDHEC in a transparent manner and welcomes public participation.

If you have any further questions or concerns, please call me at (919) 760-1777, Mr. Scott Powell/CH2M at (678) 530-4457, or Mr. Jerry Aycock/Plantation at (770) 751-4165.

Regards,
CH2M HILL Engineers, Inc.



William M. Waldron, P.E.
Senior Project Manager

Attachments:

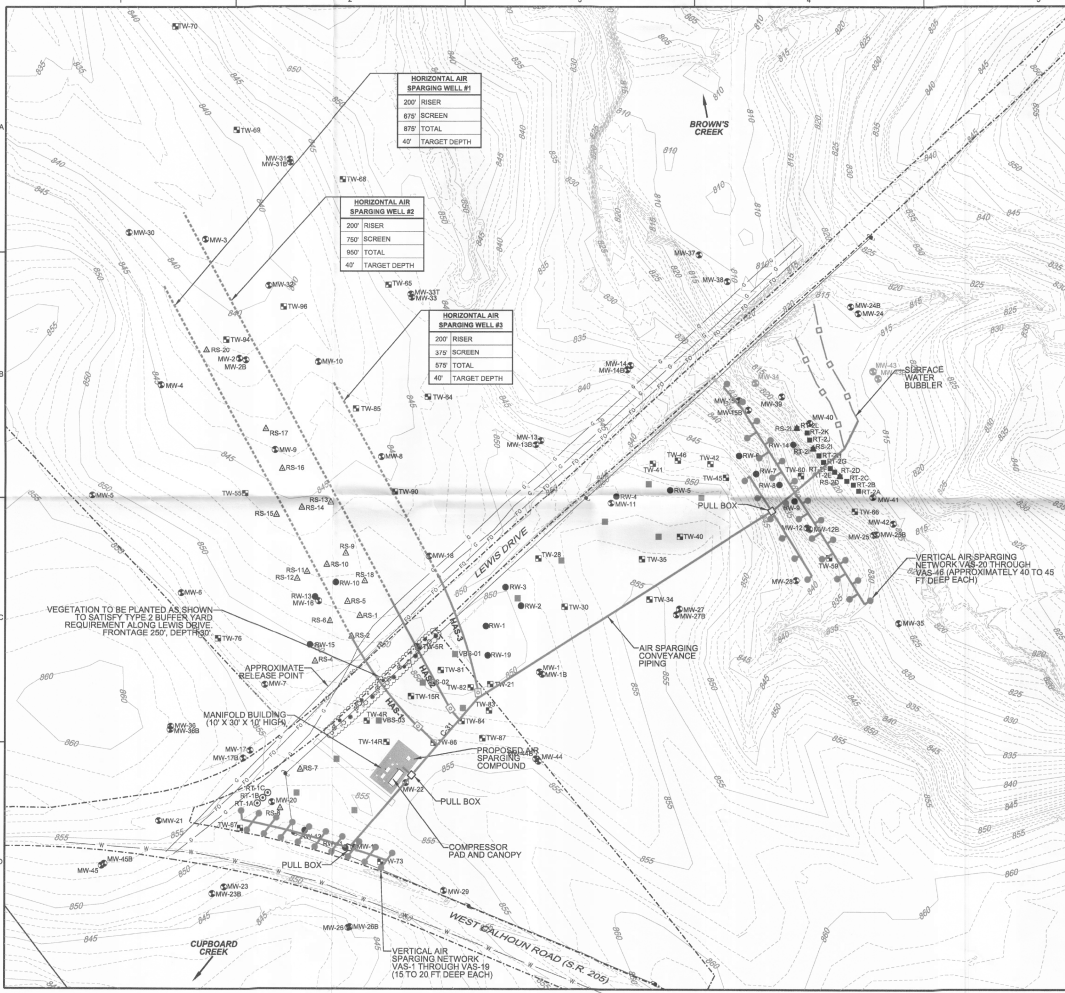
- Attachment 1 – Figure 9a, Proposed Sparging Layout (Large Format); 5 copies
- Attachment 2 – Well Construction Diagrams for MW-44, MW-44B, MW-45, and MW-45B

c: Jerry Aycock, Plantation (Digital, Jerry_Aycock@kindermorgan.com)
Mary Clair Lyons, Esq., Plantation (Digital, Mary_Lyons@kindermorgan.com)
Richard Morton, Esq., Womble Carlyle Sandridge & Rice, PLLC (Digital, rmorton@wcsr.com)
File

References

- CH2M HILL Engineers, Inc. (CH2M). 2016a. "Response to Request for Pore Water Sampling Plan." Letter to South Carolina Department of Health and Environmental Control. April 21.
- CH2M HILL Engineers, Inc. (CH2M). 2016b. *Product Recovery Plan, Revision 2*. June 23.
- CH2M HILL Engineers, Inc. (CH2M). 2016c. *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. *Surface Water Protection Plan Addendum, Lewis Drive Release, Plantation Pipe Line Company, Belton, South Carolina, Site ID #18693, "Kinder Morgan Belton Pipeline Release."* Submitted to South Carolina Department of Health and Environmental Control. January 20.
- CH2M HILL Engineers, Inc. (CH2M). 2017b. *Request for Well Permit to Install Additional Monitoring Well (MW-34)*. Submitted to South Carolina Department of Health and Environmental Control. February 7.
- CH2M HILL Engineers, Inc. (CH2M). 2017c. *Startup Plan for Surface Water Protection Measures – Revision 2, Lewis Drive Remediation, Plantation Pipe Line Company, Belton, South Carolina, Site ID #18693, "Kinder Morgan Belton Pipeline Release."* Submitted to South Carolina Department of Health and Environmental Control. February 23.
- Interstate Technology & Regulatory Council (ITRC). 2009. *Evaluating LNAPL Remedial Technologies for Achieving Project Goals. LNAPL-2*. Washington, D.C. Prepared by the Interstate Technology & Regulatory Council LNAPLs Team. December. www.itrcweb.org.
- South Carolina Department of Health and Environmental Control (SCDHEC). 2017. "Corrective Action Plan Review." Letter to Plantation Pipeline Company. January 27 (with errata dated January 31, 2017).

Attachment 1
Figure 9a, Proposed Sparging Layout
(Large Format)



- LEGEND**
- ⊕ MONITORING WELL
 - ⊕ MONITORING WELL PROPOSED
 - ⊕ PIEZOMETER
 - ⊕ RECOVERY SUMP
 - ⊕ RECOVERY WELL
 - ⊕ RECOVERY TRENCH POINT
 - ⊕ HORIZONTAL BIOSPARGING ENTRY POINT
 - ⊕ VERTICAL SAPROLITE BIOSPARGING WELL
 - ⊕ VERTICAL BEDROCK BIOSPARGING WELL
 - ⊕ PULL BOX
 - ⊕ CANOPY
 - ⊕ UNDERSTORY
 - ⊕ EVERGREEN
 - ⊕ SHRUB
 - ⊕ SURFACE WATER BUBBLER
 - ⊕ HORIZONTAL SPARGE WELL
 - ⊕ HORIZONTAL SPARGE WELL (SCREENED)
 - ⊕ PROPOSED FENCE
 - ⊕ POWER LINE
 - ⊕ EXISTING FENCE
 - ⊕ PIPE LINE
 - ⊕ FIBER OPTIC LINE
 - ⊕ PROPERTY BOUNDARY
 - ⊕ WATER LINE



NOTES
 1. BASEMAP SURVEY PERFORMED BY TAYLOR, WISEMAN & TAYLOR, FEBRUARY 4, 2016.

ch2m:

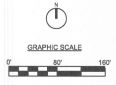
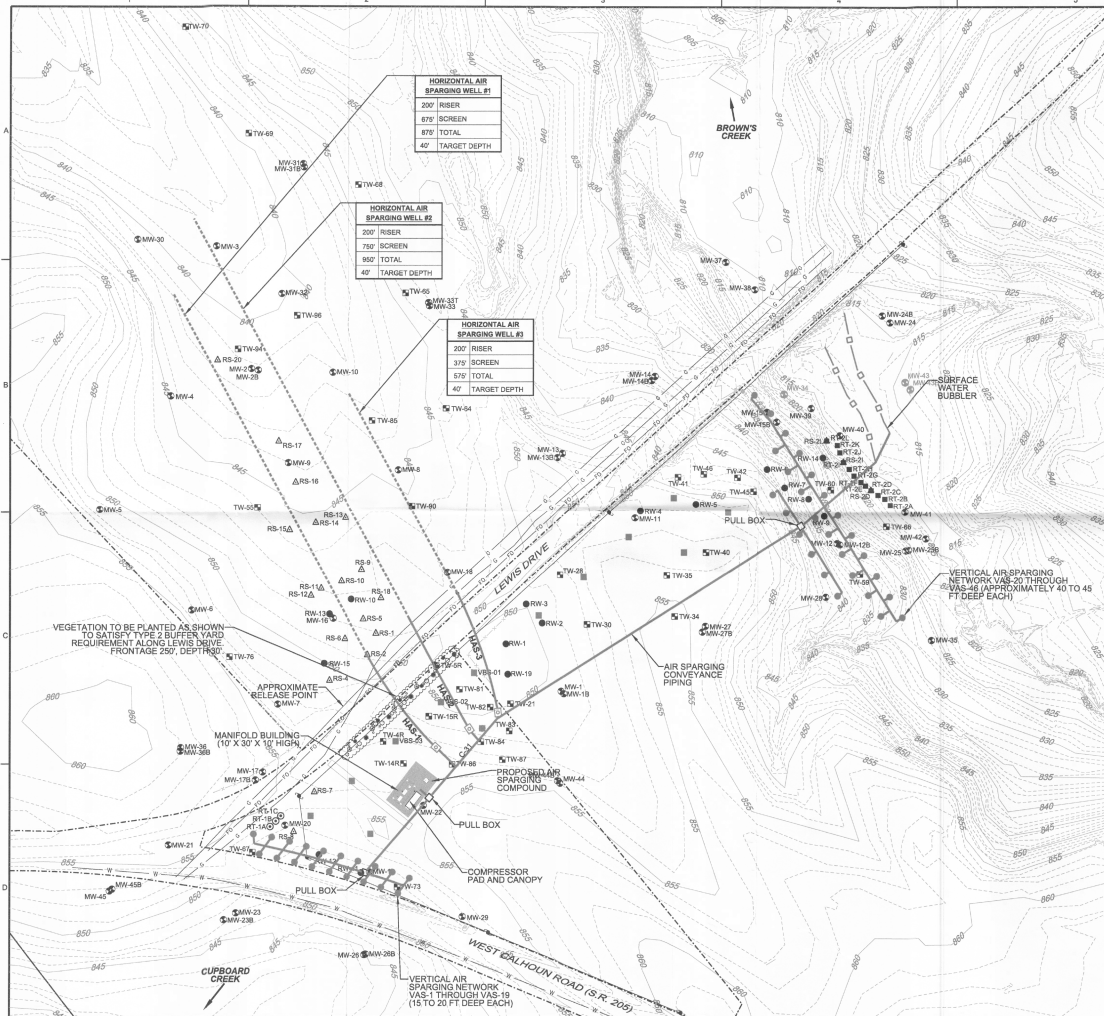
Figure 9a Proposed Sparging Layout
 Lewis Drive Corrective Action Plan
 Site ID #18563 "Nuclear Airgun Station Sparging Release"

DATE	MARCH 2017
PROJ	856407
DWG	
SHEET	

PLANTATION PIPE LINE COMPANY
 BELTON, SOUTH CAROLINA
 AND/OR MONITORING RELEASE
 DATE: _____ BY: JAWD
 REVISION: _____ BY: JAWD
 DRAWN BY: _____

REGISTERED PROFESSIONAL ENGINEER
 STATE OF NORTH CAROLINA
 LICENSE NO. 10887
 ROBERT F. POWELL

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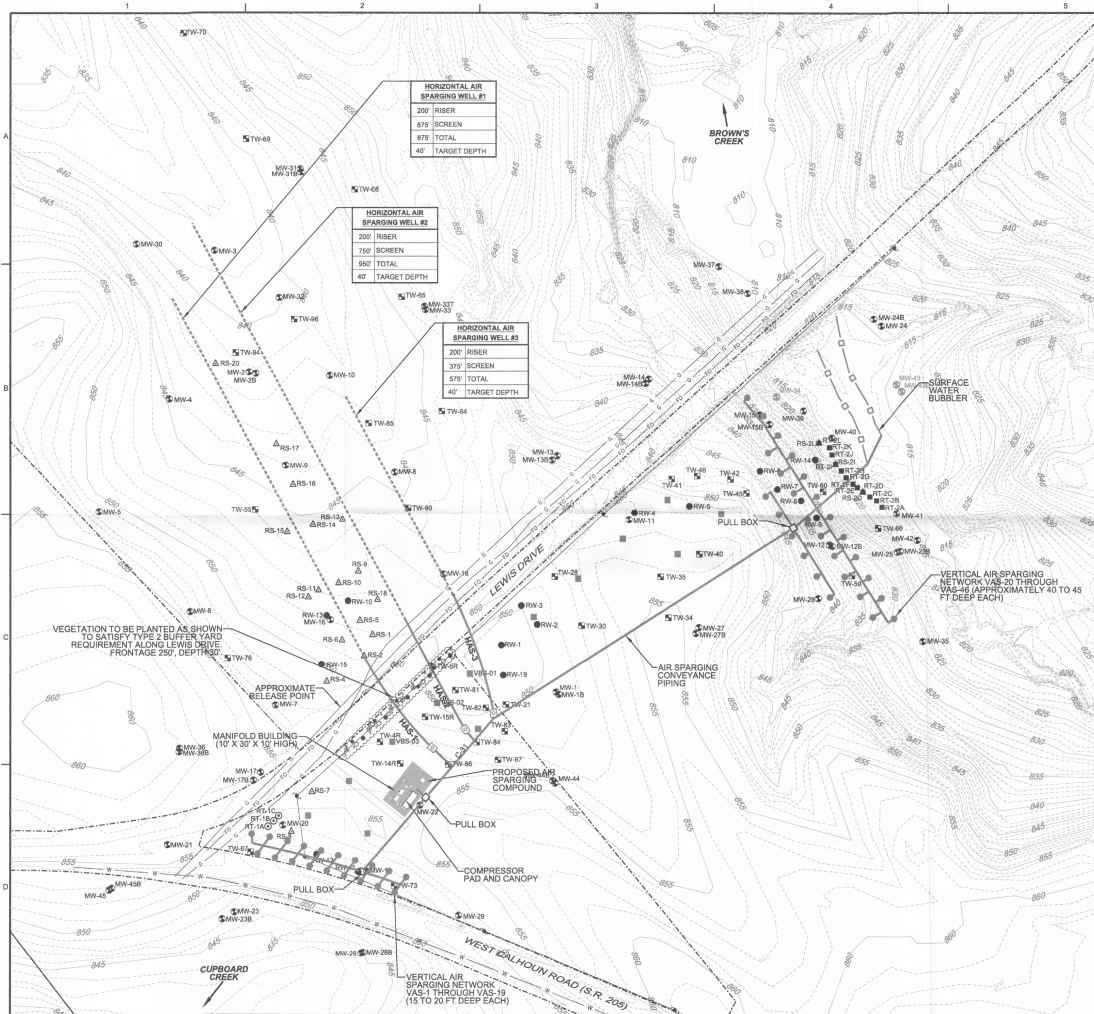


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 - ⊕ SURFACE WATER BUBBLER
 - ⊕ HORIZONTAL SPARGE WELL
 - ⊕ HORIZONTAL SPARGE WELL (SCREENED)
 - ⊕ PROPOSED FENCE
 - ⊕ POWER LINE
 - ⊕ EXISTING FENCE
 - ⊕ PIPE LINE
 - ⊕ FIBER OPTIC LINE
 - ⊕ PROPERTY BOUNDARY
 - ⊕ WATER LINE

NOTES

1. BASEMAP SURVEY PERFORMED BY TAYLOR, WISEMAN & TAYLOR; FEBRUARY 4, 2016.

<p>Figure 9a Proposed Sparging Layout Lewis Drive Corrective Action Plan Belton, South Carolina Site ID #18693 "Kovach Magnum Estuary Population Release"</p>	
<p>PLANTATION PIPELINE COMPANY BELTON, SOUTH CAROLINA PROJECT MANAGER: JEFFREY RELEASE</p>	<p>REVISION DATE DRAWN BY CHECKED BY APPROVED BY</p>
<p>DATE: MARCH 2017 PROJ: 656401 DWG SHEET</p>	



- LEGEND**
- MONITORING WELL
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 - HORIZONTAL SPARGE WELL
 - HORIZONTAL SPARGE WELL (SCREENED)
 - PROPOSED FENCE
 - POWER LINE
 - - - - EXISTING FENCE
 - PIPE LINE
 - FIBER OPTIC LINE
 - - - - PROPERTY BOUNDARY
 - - - - WATER LINE

NOTES
1. BASEMAP SURVEY PERFORMED BY TAYLOR, WISEMAN & TAYLOR, FEBRUARY 4, 2016.

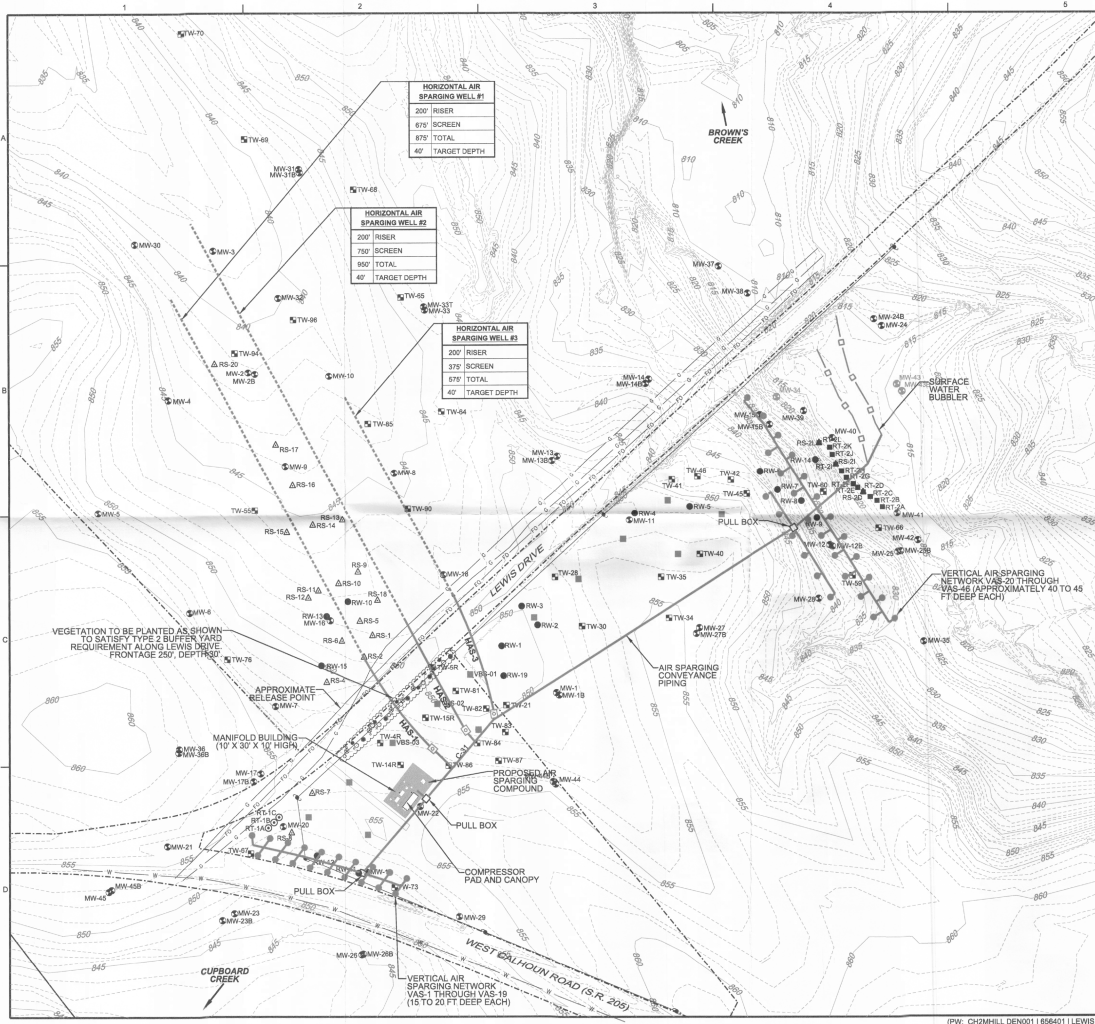


NO.	DATE	BY	REVISION

PLANTATION PIPE LINE COMPANY
LEWIS DRIVE RELEASE
SITE ID #18803
KROGER MORGAN BOSTON PIPELINE RELEASE
SITE ID #18803

Figure 9a Proposed Sparging Layout
Corrective Action Plan
Site ID #18803
KROGER MORGAN BOSTON PIPELINE RELEASE
SITE ID #18803

DATE	MARCH 2017
PROJ	656401
DWG	
SHEET	



- LEGEND**
- ⊕ MONITORING WELL
 - ⊕ MONITORING WELL PROPOSED
 - ⊕ PIEZOMETER
 - ▲ RECOVERY SUMP
 - RECOVERY WELL
 - RECOVERY TRENCH POINT
 - ⊞ HORIZONTAL AIR SPARGING ENTRY POINT
 - VERTICAL SAPROLITE BIOSPARGING WELL
 - VERTICAL BEDROCK BIOSPARGING WELL
 - PULL BOX
 - CANOPY
 - UNDERSTORY
 - EVERGREEN
 - SHRUB
 - SURFACE WATER BUBBLER
 - HORIZONTAL SPARGE WELL
 - - - HORIZONTAL SPARGE WELL (SCREENED)
 - - - PROPOSED FENCE
 - POWER LINE
 - - - EXISTING FENCE
 - PIPE LINE
 - - - FIBER OPTIC LINE
 - - - PROPERTY BOUNDARY
 - - - WATER LINE

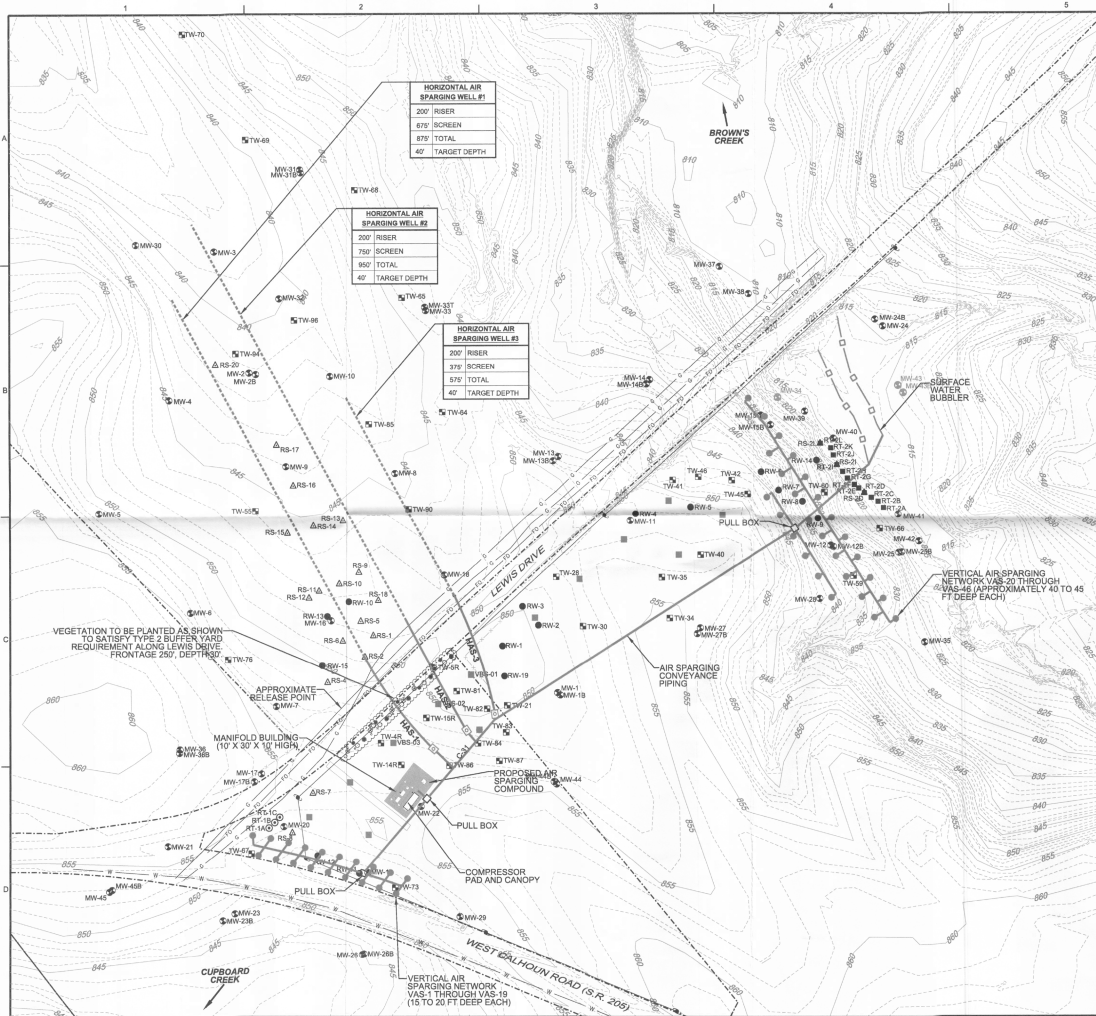
NOTES

1. BASEMAP SURVEY PERFORMED BY TAYLOR, WISEMAN & TAYLOR, FEBRUARY 4, 2016.

NO.	DATE	BY	CHKD.	REVISION

PLANTATION PIPE LINE COMPANY
 LEWIS DRIVE RELEASE
 SHELTON, SOUTH CAROLINA
 PINDER MORGAN BELTON PIPELINE RELEASE
 SHELTON, SOUTH CAROLINA
 PROJECT NO. 150503 "PINDER MORGAN BELTON PIPELINE RELEASE"
 SHEET NO. 150503-01
 DATE: MARCH 2017
 PROJ: 656401
 DWG:
 SHEET:
 FILENAME: SFILENAME
 PLOT DATE: \$PLOTDATE
 PLOT TIME: \$PLOTTIME

CH2M
Figure 0a Proposed Sparging Layout
 Lewis Drive Remediation Site, Shelton, South Carolina
 Site ID # 150503 "Pinder Morgan Belton Pipeline Release"
 SHEET NO. 150503-01
 DATE: MARCH 2017
 PROJ: 656401
 DWG:
 SHEET:
 FILENAME: SFILENAME
 PLOT DATE: \$PLOTDATE
 PLOT TIME: \$PLOTTIME



- LEGEND**
- ⊕ MONITORING WELL
 - ⊕ MONITORING WELL PROPOSED
 - △ PIEZOMETER
 - ▲ RECOVERY SUMP
 - RECOVERY WELL
 - ⊖ RECOVERY TRENCH POINT
 - HORIZONTAL AIR SPARGING ENTRY POINT
 - VERTICAL SAPROLITE BIOSPARGING WELL
 - HORIZONTAL BEDROCK BIOSPARGING WELL
 - PULL BOX
 - CANOPY
 - UNDERSTORY
 - EVERGREEN
 - SHRUB
 - SURFACE WATER BUBBLER
 - HORIZONTAL SPARGE WELL
 - ⋯ HORIZONTAL SPARGE WELL (SCREENED)
 - ⋯ PROPOSED FENCE
 - POWER LINE
 - - - EXISTING FENCE
 - PIPE LINE
 - - - FIBER OPTIC LINE
 - - - PROPERTY BOUNDARY
 - WATER LINE



NOTES
1. BASEMAP SURVEY PERFORMED BY TAYLOR, WISEMAN & TAYLOR; FEBRUARY 4, 2016.

NO.	DATE	DESIGN	BY	APPROVED

PLANTATION PIPE LINE COMPANY
LEWIS DRIVE RELEASE
BENTON COUNTY, MISSISSIPPI
KORNER MORGAN BELTON PIPELINE RELEASE
CROSSING UNDER THE BRIDGE OVER LEWIS DRIVE, BENTON COUNTY, MISSISSIPPI
CH2M HILL, 2017. ALL RIGHTS RESERVED.

ch2m.

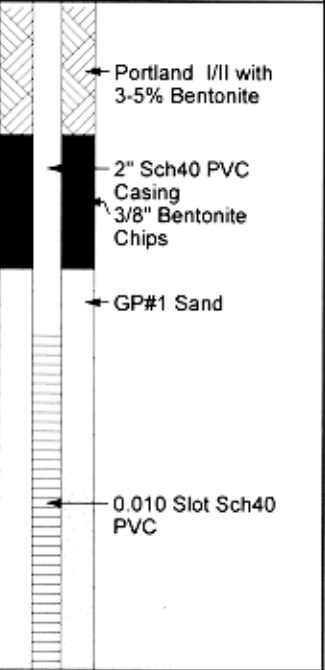
Figure 04 Proposed Sparging Layout
Lewis Drive Remediation Site, Benton, South Carolina
Site ID #178893 "Korner Morgan Belton Pipeline Release"

DATE: MARCH 2017
PROJ: 656401
DWG:
SHEET

(PW: CH2MHILLDEN001 | 656401 | LEWIS DRIVE | BOD) FILENAME: \$FILENAME PLOT DATE: \$PLOTDATE PLOT TIME: \$PLOTTIME

Attachment 2
Well Construction Diagrams for
MW-44, MW-44B, MW-45, and
MW-45B

CLIENT Plantation Pipe Line Company PROJECT NAME Lewis Drive Remediation
 PROJECT NUMBER 684910 PROJECT LOCATION Belton, South Carolina
 DATE STARTED 1/23/17 COMPLETED 1/23/17 GROUND ELEVATION _____ HOLE SIZE 6.25" inches
 DRILLING CONTRACTOR AE Drilling GROUND WATER LEVELS:
 DRILLING METHOD Hollow Stem Auger AT TIME OF DRILLING ---
 LOGGED BY P. Ferringer/CLT CHECKED BY _____ AT END OF DRILLING ---
 NOTES _____ AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE), RQD LENGTH	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0						
0.5					(SM) TOPSOIL, SILTY SAND; brown, moist, organic rich.	
					(CL) CLAY with SAND; yellowish brown, moist, medium plasticity, trace coarse sand, <10% very fine to fine sand, no odor.	 <ul style="list-style-type: none"> Portland I/II with 3-5% Bentonite 2" Sch40 PVC Casing 3/8" Bentonite Chips GP#1 Sand 0.010 Slot Sch40 PVC
5	SPT 1	1-2-2-2 (4)			Reddish brown, dry, non-cohesive, non-plastic, less sand.	
					Some mica.	
9.0	SPT 2	25-50/2"			(SW) WEATHERED ROCK with SAPROLITE, WELL GRADED SAND with CLAY; dry, very dense, very fine to medium sand, micaceous, no odor.	
10						

11.0
Bottom of borehole at 10.0 feet.

ENVIRONMENTAL_BH - GINT STD US_LAB_GDT - 2/28/17 22:12 - Z:\KINDERMORGAN\654558\LEWISDRIVE\GINT\PROJECT FILES\LEWIS DRIVE ISA BORING LOGS.GPJ



CLIENT Plantation Pipe Line Company PROJECT NAME Lewis Drive Remediation
 PROJECT NUMBER 684910 PROJECT LOCATION Belton, South Carolina
 DATE STARTED 1/23/17 COMPLETED 1/25/17 GROUND ELEVATION _____ HOLE SIZE 8/4 inches
 DRILLING CONTRACTOR AE Drilling GROUND WATER LEVELS:
 DRILLING METHOD Hollow Stem Auger/Wire Line/Air Rotary AT TIME OF DRILLING ---
 LOGGED BY P. Ferringer/CLT CHECKED BY _____ AT END OF DRILLING ---
 NOTES Core logged wet. AFTER DRILLING ---

ENVIRONMENTAL BH - GINT STD US LAB GDT - 2/28/17 22.13 - Z:\KINDERMORGAN\654568LEWISDRER\GINT\ISA\GINT PROJECT FILES\LEWIS DRIVE ISA BORING LOGS.GPJ

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE), ROD LENGTH	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0						
0.5					(SM) TOPSOIL, SILTY SAND; brown, moist, organic rich.	
					(CL) CLAY with SAND; yellowish brown, moist, medium stiff, medium plasticity, trace coarse sand, <10% very fine to fine sand, no odor.	
5						
6.0					(CL) CLAY with trace SAND; reddish brown, dry, stiff, non-plastic, noncohesive	
9.0						
10.0					(SW) WEATHERED ROCK with SAPROLITE, WELL GRADED SAND with CLAY; brown, dry, very dense, very fine to medium sand, micaceous, no odor.	
	RC NQ1	66.6			BEDROCK, BIOTITE GNEISS; moderate, grey and black with orange oxidation, gneissic, foliated, moderate decomposition, slightly disintegrated, moderately fractured. 10.1: FRACTURE; joint, <5 degrees, very narrow, not healed, oxidized, undulating, wet with minor seepage. 10.2: FRACTURE; joint, <5 degrees, very narrow, not healed, oxidized, undulating, wet with minor seepage. 10.3: FRACTURE; joint, <5 degrees, very narrow, not healed, oxidized, undulating, wet with minor seepage. 10.5: FRACTURE; joint, <5 degrees, very narrow, not healed, oxidized, undulating, wet with minor seepage. 10.6: FRACTURE; joint, <5 degrees, very narrow, not healed, oxidized, undulating, wet with minor seepage. 10.9: Slight decomposition, competent, intensely foliated, quartz, plagioclase, biotite, amphibole. 11: FRACTURE; joint, <5 degrees, extremely narrow, not healed, oxidized, smooth, damp. 11.1: FRACTURE; joint, <5 degrees, extremely narrow, not healed, oxidized, smooth, damp. 11.2: FRACTURE; joint, <5 degrees, extremely narrow, not healed, oxidized, smooth, damp. 11.3: FRACTURE; joint, <5 degrees, extremely narrow, not healed, oxidized, smooth, damp. 11.45: Fresh, competent, unfractured, trace pegmatitic quartz, ~30 degree foliation. 14.25: No pegmatitic quartz. 16.45: Increasing quartz and plagioclase. Large pegmatitic quartz and plagioclase crystals.	Portland I/II with 3-5% Bentonite 4" Steel Casing
15						
20						

(Continued Next Page)



CLIENT Plantation Pipe Line Company PROJECT NAME Lewis Drive Remediation
 PROJECT NUMBER 684910 PROJECT LOCATION Belton, South Carolina
 DATE STARTED 1/26/17 COMPLETED 1/26/17 GROUND ELEVATION _____ HOLE SIZE 6.25 inches
 DRILLING CONTRACTOR AE Drilling GROUND WATER LEVELS:
 DRILLING METHOD Hollow Stem Auger AT TIME OF DRILLING ---
 LOGGED BY P. Ferringer/CLT CHECKED BY _____ AT END OF DRILLING ---
 NOTES _____ AFTER DRILLING ---

ENVIRONMENTAL BH - GINT STD US LAB GDT - 2/28/17 22-13 - Z:\KINDERMORGAN\654558\LEWIS\DRILLING\GINT\ISA\GINT PROJECT FILES\LEWIS DRIVE ISA BORING LOGS.GPJ

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE), ROD LENGTH	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0					(SC) TOPSOIL, CLAYEY SAND; olive brown, moist, loose, non-cohesive, very fine to coarse sand, trace organics, no odor.	<ul style="list-style-type: none"> Portland I/II with 3-5% Bentonite 3/8" Bentonite Chips 2" Sch40 PVC Casing GP#1 Sand 0.010 Slot Sch40 PVC
1.5				(CL) CLAY; reddish brown, dry to moist, stiff, cohesive, low plasticity, <10% very fine to medium sand, trace manganese nodules and veinlettes.		
5	SPT 1	4-5-4-6 (9)		Trace mica, less manganese. Red, non-cohesive, >15% sand, micaceous, tan clay veins.		
10	SPT 2	4-4-5-5 (9)		Moist, trace thin lamination, increasing silt, micaceous.		
10.5				(SM) SAPROLITE, SANDY SILT with CLAY; reddish brown, dry to moist, stiff, non-cohesive, very fine to fine sand, micaceous.		
14.0				Trace weathered rock fragments.		
15	SPT 3	10-50/4"		(SW) WEATHERED ROCK, WELL GRADED SAND; biotite gneiss, moist, dense to very dense, trace rock fragments, very fine to coarse sand, trace oxidation, no odor.		

Bottom of borehole at 15.0 feet.



CLIENT Plantation Pipe Line Company PROJECT NAME Lewis Drive Remediation
 PROJECT NUMBER 684910 PROJECT LOCATION Belton, South Carolina
 DATE STARTED 1/25/17 COMPLETED 1/27/17 GROUND ELEVATION _____ HOLE SIZE 8/4 inches
 DRILLING CONTRACTOR AE Drilling GROUND WATER LEVELS:
 DRILLING METHOD Hollow Stem Auger/Wire Line/Air Rotary AT TIME OF DRILLING ---
 LOGGED BY P. Ferringer/CLT CHECKED BY _____ AT END OF DRILLING ---
 NOTES Core logged wet. AFTER DRILLING ---

ENVIRONMENTAL BH - GINT STD US LAB GDT - 2/28/17 22.13 - Z:\KINDERMORGAN\654568LEWISDRIVE\GINT\PROJECT FILES\LEWIS DRIVE ISA BORING LOGS.GPJ

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE), ROD LENGTH	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0					(SC) TOPSOIL, CLAYEY SAND; olive brown, moist, loose, non-cohesive, very fine to coarse sand, trace organics, no odor.	
1.5					(CL) CLAY; reddish brown to red, dry to moist, stiff, cohesive, low plasticity, <10% very fine to medium sand, trace manganese nodules.	
5	SPT 1	4-5-5-6 (10)	PID = 0		Trace mica.	
10	SPT 2	4-5-4-5 (9)	PID = 0		Less clay, increasing mica.	
10.5					(SM) SAPROLITE, SANDY SILT with CLAY; reddish brown, dry, stiff, non-cohesive, very fine to fine sand, micaceous. 10.7' Intensely banded, trace weathered rock lenses.	
14.0					(SW) WEATHERED ROCK, WELL GRADED SAND; biotite gneiss, moist, dense to very dense, trace rock fragments, very fine to coarse sand, trace oxidation, no odor.	
15	SPT 3	7-50	PID = 0		BEDROCK, BIOTITE GNEISS; strong, grey and black, intensely foliated, slight decomposition, competent, trace disintegration, slightly fractured, trace large quartz crystals.	
15.6					16.4: FRACTURE; joint, <5 degrees, extremely narrow, oxidized, undulating, dry with staining. 16.6: FRACTURE; joint, 20 degrees, extremely narrow, oxidized, smooth, damp. 17: 5mm thick biotite band. 17.7: Fresh, no discoloration or disintegration, increasing plagioclase and biotite bands.	
20	RC NQ1	60.5			Strong, fresh, competent, unfractured, increasing amphibole and biotite, intensely foliated, <2 degree foliation.	
25	RC HQ1	52.8				

4" Steel Casing
 Portland I/II with 3-5% Bentonite