NV

September 30, 2021

Ms. Emily Hernandez
Bureau Chief, Environmental
New Mexico Oil Conservation Division
New Mexico Energy, Minerals, and Natural Resources Department
1220 South St. Francis Drive
Santa Fe, New Mexico 87505

Subject: **Update Report and Updated Remediation Workplan**
Hilcorp Energy Company
Lambe 2C
API # 30-045-30747
Incident # NVF1836050592
San Juan County, New Mexico

To Whom It May Concern:

WSP USA Inc. (WSP), on behalf of Hilcorp Lower 48 (Hilcorp), presents this *Update Report and Updated Remediation Work Plan* associated with subsurface impacts encountered at the Lambe 2C natural gas production well (Site), incident number NVF1836050592. Information about the release, release response, subsequent soil investigations and groundwater sampling, initial remediation, and proposed remediation were included in the *Soil Delineation and Proposed Remediation Work Plan* submitted by WSP to the New Mexico Oil Conservation Division (NMOCD) on August 30, 2019, (submitted directly to Mr. Cory Smith via email) and approved with conditions on September 9, 2019. Following completion of remediation activities as proposed, the *Venturi SVE Remediation Update and Proposed Workplan* (PO#: HDK7K-190830-C-1410) was submitted to NMOCD by WSP on March 5, 2020. NMOCD did not comment on the second report and did not approve or deny newly proposed activities. Hilcorp was issued a notice of violation (NOV) on September 1, 2021, for failing to meet the operational and reporting requirements conditioned by the NMOCD. The NOV requires submittal of any delinquent reports (to be submitted under separate cover), an update on site remediation, a plan for bringing the Site into compliance, and an updated remediation work plan. This report provides the update on existing site activities, a plan to bring the existing remediation system into compliance, and an updated remediation work plan that is compliant with 19.15.29.11 and 19.15.29.12 of the New Mexico Administrative Code (NMAC).

SITE DESCRIPTION

The Site is on a mesa between Arch Rock Canyon and Hart Canyon, south of Cedar Hill, New Mexico, in Unit H of Section 20 of Township 31 North and Range 10 West in San Juan County (Figure 1). On December 17, 2018, Hilcorp personnel discovered a pinhole leak due to corrosion in the bottom of a condensate tank. The leak resulted in approximately 97 barrels (bbls) of condensate draining onto the ground and infiltrating the subsurface. The release was contained within the earthen berm, but no liquids were recovered. The defective tank was immediately shut-in, drained of remaining liquids, and taken out of service. The release was reported to the New Mexico Oil Conservation Division (NMOCD) by Hilcorp on a Form C-141 Release Notification and Corrective Action Form dated December 21, 2018. The NMOCD received the release report on December 24, 2018, and assigned incident number NVF1836050592 to the release.

BACKGROUND

As presented in the previously submitted *Soil Delineation and Proposed Remediation Work Plan*, site characterization was conducted and the following NMOCD Closure Criteria apply at the Site: 100 milligrams per kilogram (mg/kg) total petroleum hydrocarbons (TPH), 10 mg/kg benzene, 50 mg/kg total for the sum of benzene, toluene, ethylbenzene,

WSP USA
848 EAST 2ND AVENUE
DURANGO CO 81301

Tel.: 303-433-9788
wsp.com

and total xylenes (BTEX), and 600 mg/kg chloride. Excavation of surface soil occurred, and the release was delineated to the site-specific standards, Details of the subsurface investigation were provided in the report referenced above and preliminary remediation was proposed to address residual impacts in the center of the impacted footprint.

The NMOCD approved the initial workplan and provided the following conditions:

- *Hilcorp must begin SVE remediation no later than October 1, 2019;*
- *Hilcorp must maintain 90 percent runtime or better per eight hours;*
- *Hilcorp must collect an initial gas sample and subsequent annual gas samples;*
- *Hilcorp will collect gas samples during an initial four-week testing period and submit an updated SVE plan based on test results.*
- *Hilcorp must submit quarterly reports.*

Following approval, Hilcorp conducted four limited soil vapor extraction (SVE) events between September 24, 2019 and October 14, 2019 using an air compressor and Venturi T to test SVE feasibility. During the Venturi events, 100 percent runtime was achieved. An initial air sample was collected on September 25, 2019, and a final air sample was collected on October 14, 2019. All these activities were documented in the *Venturi SVE Remediation Update and Proposed Workplan* dated March 5, 2020. Based on the information collected, this document proposed a subsequent remediation workplan to construct and install an SVE system to remediate hydrocarbon impacted soil at the Site. The NMOCD did not respond to the March 5, 2020 Workplan and with no long-term SVE system installed, quarterly reports would lack data.

UPDATE

Hilcorp has installed an SVE system as originally planned and conducted SVE pilot testing to confirm system design.

SVE SYSTEM INSTALLATION

In September of 2021, Hilcorp constructed and installed a SVE system at the Site to address the residual hydrocarbon impacted soil surrounding MW01. Operation began on September 24, 2021. Vacuum is applied at one location through a previously installed SVE well at the MW01 location. The well is screened across the impacted depths from 20 feet to 35 feet below ground surface (bgs) to allow for recovery of hydrocarbon vapors. Figure 2 presents an as-built of the location of the SVE well, SVE skid and aboveground piping in relation to the residual impacted area and previously installed delineation points.

The SVE well is connected via aboveground piping to a 1 horsepower (HP) Atlantic Blower AB-202/1 double stage regenerative blower capable of producing 50 standard cubic feet per minute (scfm) at 30 inches of water column (IWC) vacuum. The blower is powered by a single-phase electrical drop connected to the onsite transformer. The blower has a 24-hour runtime unless experiencing maintenance related downtime. A system configuration diagram detailing the components within the SVE system, and a blower specification sheet, including a vacuum performance curve, are included in Enclosure A.

SVE PILOT TEST

On September 17, 2021, WSP conducted SVE pilot testing activities at the Site to evaluate the effectiveness of the remedial technology to achieve site remediation cleanup goals by evaluating the flow rate and applied vacuum required to influence the subsurface and cause volatilization of the petroleum hydrocarbons entrained in the soil and to determine specific site design radius of influence (ROI) and radius of effect (ROE). The pilot testing program was designed based on previously observed geologic conditions, surface conditions, current locations of petroleum hydrocarbon impacts, and other site-specific factors. One SVE test was conducted on MW01/SVE01 with a screen depth of 20 feet to 35 feet bgs.

SVE TEST PROCEDURES

A vacuum truck was used to apply a negative pressure to the only existing SVE well (MW01/SVE01) through a manifold designed and built by WSP to control the vacuum and measure flow, vacuum, and photo-ionization detector

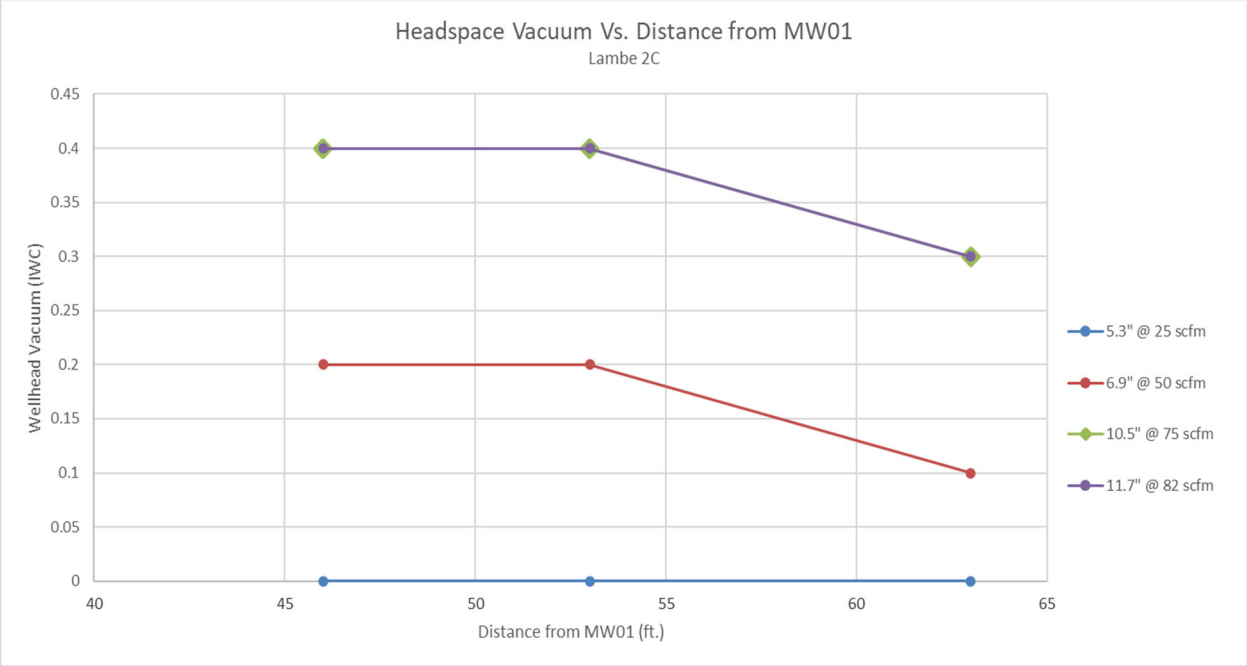
(PID) values at the extraction well. Observation wells (MW02, MW03, and MW07), having the same screened interval from 20 feet to 35 feet bgs, were used to collect SVE pilot test monitoring data. The SVE well locations are presented on Figure 2. The following list summarizes the procedure of the SVE pilot test:

- Measured the distances from the extraction well to each observation well.
- Collected background volatile organic compounds (VOCs) measurements using a PID at the SVE and observation wells.
- Connected the vacuum truck to the extraction well via a flexible hose and manifold. Slowly opened the valve and monitored the vacuum and flow.
- Applied a low vacuum at approximately 5 inches of water column (IWC). Then increased the vacuum/flow rate until influence was observed.
- Tested several vacuums in increasing magnitude based on site response observed. Tested at least three different vacuums for the pilot test.
- Collected at least two rounds of stabilized measurements per vacuum/flow rate. Measured the vacuum and the PID headspace at the observation wells. Documented readings approximately 15 minutes apart.
- Collected air samples from MW01/SVE01 in 1-Liter Tedlar bags using a high-vacuum air sampler and delivered to Hall Environmental Analysis Laboratory (Hall) for analysis of BTEX and total volatile petroleum hydrocarbons (TVPH).

All test forms and graphs are provided as Enclosure B. The air laboratory analytical reports are provided in Enclosure C and summarized in Table 1.

SVE TEST RESULTS AND CONCLUSIONS

Pilot test data indicates that SVE is a viable technology to remediate the Site. The vacuum response from the pilot test on MW01 and observations wells MW02, MW03, and MW07 is shown on the graph below. Observation wells ranged in distance from 46 feet to 63 feet from the SVE test well (MW01/SVE01). SVE pilot testing data is summarized in Table 2. Vacuum influence was observed at all the three observation wells as shown on the figure below.



The graph illustrates that no measurable vacuum influence was observed at 5.3 inches IWC and 25 scfm. At 6.9 IWC and 50 scfm influence was observed in all observation wells, and at progressively higher vacuums (10.5 IWC and 11.7 IWC) influence was measured. Based on the vacuum observations a ROI of at least 46 feet to 63 feet can be assumed.

Additional calculations were performed to determine the ROE. These calculations are included as Enclosure B. To determine a ROE, the annual pore volume exchange was calculated for 46 feet at two different flow rates of 40 standard

cubic feet per minute (scfm) and 50 scfm. Both calculations indicated an annual pore volume exchange of 703 and 879 times, respectively. The pore volume exchange conforms to values referenced in literature of at least 500 pore volume exchanges annually. To further verify the ROE corresponds with the ROI, the pore velocity was calculated at the ROI of 43 feet for both flow rates. The pore velocity calculated was 44 feet per day (ft/day) and 55 ft/day, which is above a recommended velocity of 3 ft/day. Current SVE research indicates that is desirable to achieve pore-gas velocities throughout the treatment zone in excess of 0.001 cm/sec or ~3 ft/day (DiGiulo and Ravi 1999).

The current system onsite is capable of producing 60 scfm at 10 IWC, which at the site elevation of 5,750 feet above mean sea level (AMSL) is 48.6 cfm. At the elevation corrected flow rate, a ROE of 46 feet will achieve the required pore volume exchange and velocity at 854 annual exchanges and 54 ft/day, respectively. The area of estimated remaining impact is approximately 2,064 square feet and is localized beneath the former tank area and appears limited to less than 46 feet laterally from MW01/SVE01. The pilot test results, expected blower performance, and calculated operational criteria indicate the current system and single SVE well (MW01/SVE01) are capable of affecting and volatilizing the observed area of hydrocarbon impact. The estimated remaining impact and calculated ROE of 46 feet and observed ROI of 63 feet are depicted on Figure 3.

WSP collected an air sample from the pilot test manifold, on the influent side attached to the wellhead, via high vacuum air sampler. The air sample was collected in a 1-Liter Tedlar bag and submitted to Hall for analysis of VOCs via United States Environmental Protection Agency (EPA) Method 8260, fixed gas analysis of oxygen and carbon dioxide, and TVPH via EPA Method 8015. Prior to collection, the air from the influent side was field screened with a PID for organic vapor monitoring (OVM). The pilot test air sample results indicate 1,2,4-trimethylbenzene concentration of 0.30 micrograms per liter (µg/L), a 1,3,5-trimethylbenzene concentration of 1.2 µg/L, total xylene concentration of 1.1 micrograms per liter (µg/L) and a TVPH concentration 660 µg/L. No other VOCs were detected in the pilot test air sample. Air sample laboratory analytical results are summarized in Table 1. Laboratory analytical reports and included as Enclosure C.

Estimated air emissions were calculated using air sample data collected to-date (Table 3). The impacted mass source removal via the SVE system to-date is an estimated 0.2 pounds (lbs) per hour of TVPH. More data will be collected in order to calculate mass removal over system runtime, as the only air emissions data collected thus far are from the pilot testing and system start up.

Pilot test data, additional graphs, and calculations are included as Enclosure B.

PLAN FOR COMPLIANCE AND UPDATED REMEDIATION WORKPLAN

The following information is provided to document a plan for compliance with the conditions of approval applied to the initial workplan. No comment or conditions were ever received from the NMOCD for the second workplan submitted by Hilcorp on March 5, 2020. In addition, details are provided for this document to serve as the updated remediation workplan. The updated remediation start date, as-built diagrams, explanation of ROI and ROE, and initial gas sampling results are provided above. The initial four-week testing period was previously conducted and those results were provided in the updated March 2020 SVE plan that was not acknowledged by NMOCD. The only condition of approval remaining to be completed from the original approval is quarterly reporting.

SVE RUN TIME

The SVE system is powered by a single-phase electrical drop connected to the onsite transformer. Based on 24 hours of available run time, to maintain a 90% runtime, the system will have to operate a minimum of 7,884 hours per year. Using the installed run-time meter on the SVE unit, Hilcorp will report system run time quarterly. Downtime outside of Hilcorp's control, including local and regional power outages, will be accounted for and the total available annual run-time hours will be adjusted. This information will be reported in quarterly reports.

UPDATED SVE START DATE

On September 24, 2021 (at the time of system start-up), WSP collected an air sample from the SVE system influent side, prior to the knockout tank, in a 1-Liter Tedlar bag via a high-vacuum air sampler and submitted to Hall for analysis of BTEX via EPA Method 8021 and TVPH via EPA Method 8015. Prior to collection, the air from the

influent side was field screened with a PID for OVM. The initial air sample results indicate a toluene concentration of 0.94 µg/L, total xylenes concentration of 4.3 µg/L, and a TVPH concentration of 880 µg/L.

Laboratory analytical results from these sampling events are included in Enclosure C and summarized in Table 1.

OPERATIONS AND MAINTENANCE

During the upcoming operations, visits to the Site will be completed monthly by WSP personnel and monthly by Hilcorp so that the SVE system is inspected bi-weekly. This will ensure 90% runtime efficiency continues, mass removal is monitored, and any maintenance issues are addressed. In addition to routine operation and maintenance (O&M) visits, the SVE system will be tied into Hilcorp's telemetry network. If the system experiences downtime, the Hilcorp environmental group will be notified via email immediately. Immediate notification will allow for quick response to system down time and further help to ensure 90% runtime. During O&M visits, personnel will ensure that the SVE system is operating within normal working temperature, pressure, and vacuum range. System runtime will be recorded, and vapor concentrations will be measured from a sampling port on the influent side of the blower using a PID. Vacuum, temperature, and flow measurements indicated on the SVE system gauges will also be recorded. Any deviations from normal operating parameters will be recorded and corrected by onsite personnel, if possible. An O&M form to be used during semi-monthly visits is attached as Enclosure D. An *Operations and Maintenance Manual* is also attached in Enclosure D, to be used as guidance for performing O&M.

An air sample will be collected quarterly and analyzed for BTEX by EPA Method 8021 and TVPH by EPA Method 8015. Quarterly reports with sample results, runtime, and mass source removal will be submitted each quarter, starting with the 4th quarter of 2021.

Quarterly air sampling and reporting will continue until air concentrations of TVPH collected from the system become asymptotic. At that time soil samples will be collected from the impacted area to assess soil concentrations. Proposed performance and/or confirmation soil sampling locations are shown on Figure 3.

If soil samples indicate hydrocarbon impact has been reduced to below Table 1 Closure Criteria, WSP will present the confirmation laboratory analytical data in a report and request closure of the release. Should the results indicate that analytes in the soil exceed Table 1 Closure Criteria, Hilcorp will continue to operate the system and make operational adjustments based on results of the investigation.

REMEDIATION TIMELINE

The United States Army Corps of Engineers, *Soil Vapor Extraction and Bioventing – Engineer Manual,* dated June 3, 2002, states 'Unless target cleanup goals are low or initial concentrations are very high, 1,000 to 1,500 pore volumes would be a good estimate of the required air exchanges. The current system installed on site will achieve 1,500 pore volume exchanges at 641 days of operation. With a startup date of September 24, 2021, and a run time of 90% the estimated remediation end date is currently August 30, 2023. Based on pore volume exchanges, WSP anticipates that system will operate between 1.17 and 1.75 years. WSP will also assess air concentrations of TVPH from the system and if these become asymptotic before the anticipated closure date then sampling will commence per the schedule below. The SVE system will remain at the Site full time until remediation is complete.

The following timeline is proposed following submittal of this report;

- 4th Quarter 2021 through 3rd Quarter 2022: Collect air samples quarterly. Once air concentrations of TVPH collected from the system become asymptotic, soil samples will be collected from the impacted area to collect soil performance samples and assess soil concentrations.
- 4th Quarter 2022: If air concentrations of TVPH have not become asymptotic, collect soil samples for performance monitoring. Evaluate soil samples and make potential SVE system adjustments;
- 1st Quarter 2023 to 2nd Quarter, 2023: Collect air samples quarterly. Once air concentrations of TVPH collected from the system become asymptotic, soil samples will be collected from the impacted area to collect soil performance samples and assess soil concentrations for closure.
- 3rd Quarter 2023: Final site closure

Air emissions data, mass removal calculations, and system runtime will be reported quarterly. The first quarterly report (starting with the fourth quarter of 2021) will be submitted to the NMOCD within 45 days after final laboratory analytical reports are received.

WSP appreciates the opportunity to provide this report to the NMOCD. If you have any questions or comments regarding this work plan, do not hesitate to contact Danny Burns at (970) 385-1096 or via email at danny.burns@wsp.com or Mitch Killough at (713)-757-5247 or at mkillough@hilcorp.com.

Kind regards,

Danny Burns
Project Consultant, Geologist

Ashley Ager, M.S., P.G.
Assistant Vice President, Geologist

Robert Rebel, P.E.
Environmental Engineer, Technical Principal

Encl.

Figure 1 – Site Location Map
Figure 2 – As-Built Diagram
Figure 3 – Estimated Radius of Influence and Effect
Table 1 – Laboratory Analytical Results
Table 2 – Pilot Testing Data
Table 3 - Air Emissions
Enclosure A – Existing SVE Blower Performance Chart
Enclosure B – Additional Pilot Testing Data and Graphs
Enclosure C –Laboratory Analytical Reports
Enclosure D – O&M Form and Manual

REFERENCES

DiGiulio, D., Ravi, V., & Brusseau, M. (1999). Evaluation of mass flux to and from ground water using a vertical flux model (VFLUX): application to the soil vacuum extraction closure problem. *Ground water monitoring & remediation*, 19, 96-104.

The US Army Corps of Engineers, *Soil Vapor Extraction and Bioventing – Engineer Manual,* dated June 3, 2002

Incident ID	NVF1836050592
District RP	
Facility ID	
Application ID	

Remediation Plan

Remediation Plan Checklist: ***Each of the following items must be included in the plan.***

- ☒ Detailed description of proposed remediation technique
- ☒ Scaled sitemap with GPS coordinates showing delineation points
- ☒ Estimated volume of material to be remediated
- ☒ Closure criteria is to Table 1 specifications subject to 19.15.29.12(C)(4) NMAC
- ☒ Proposed schedule for remediation (note if remediation plan timeline is more than 90 days OCD approval is required)

Deferral Requests Only: ***Each of the following items must be confirmed as part of any request for deferral of remediation.***

- ☐ Contamination must be in areas immediately under or around production equipment where remediation could cause a major facility deconstruction.
- ☐ Extents of contamination must be fully delineated.
- ☐ Contamination does not cause an imminent risk to human health, the environment, or groundwater.

I hereby certify that the information given above is true and complete to the best of my knowledge and understand that pursuant to OCD rules and regulations all operators are required to report and/or file certain release notifications and perform corrective actions for releases which may endanger public health or the environment. The acceptance of a C-141 report by the OCD does not relieve the operator of liability should their operations have failed to adequately investigate and remediate contamination that pose a threat to groundwater, surface water, human health or the environment. In addition, OCD acceptance of a C-141 report does not relieve the operator of responsibility for compliance with any other federal, state, or local laws and/or regulations.

Printed Name: Mitch Killough Title: Environmental Specialist

Signature: _____ Date: 10-6-2021

email: mkillough@hilcorp.com Telephone: 713-757-5247

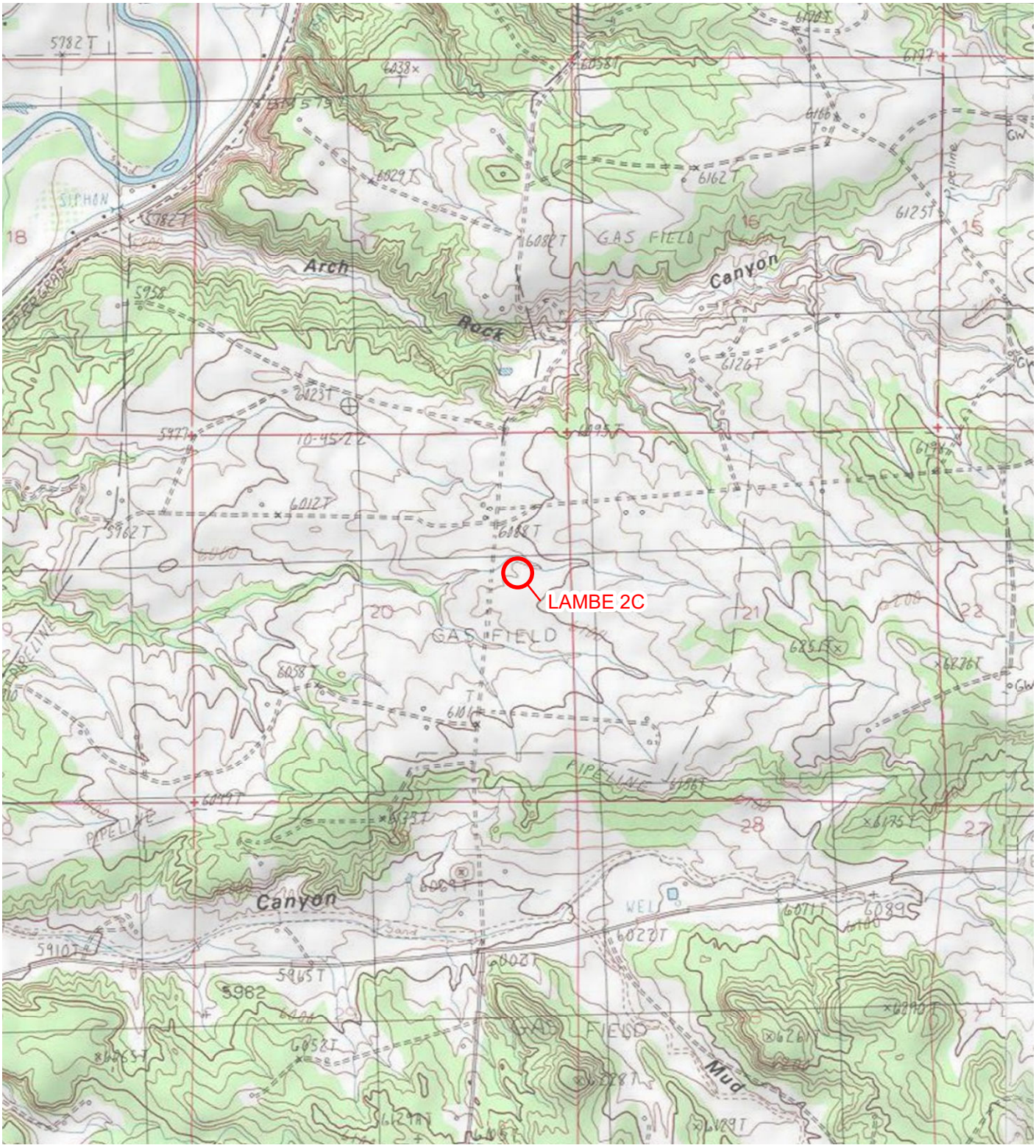
OCD Only

Received by: _____ Date: _____

☐ Approved ☐ Approved with Attached Conditions of Approval ☐ Denied ☐ Deferral Approved

Signature: _____ Date: _____

FIGURES



LEGEND

SITE LOCATION

IMAGE COURTESY OF ESRI/USGS

0 2,000 4,000

Feet

N

NEW MEXICO

FIGURE 1
SITE LOCATION MAP
LAMBE 2C
SENE SEC 20 T31N R10W
SAN JUAN COUNTY, NEW MEXICO
HILCORP ENERGY COMPANY

C:\Users\USTJ689650\OneDrive - WSP O365\HILCORP\TE017818055_LAMBE 2C\MXD\TE017818055_FIG01_SL.mxd

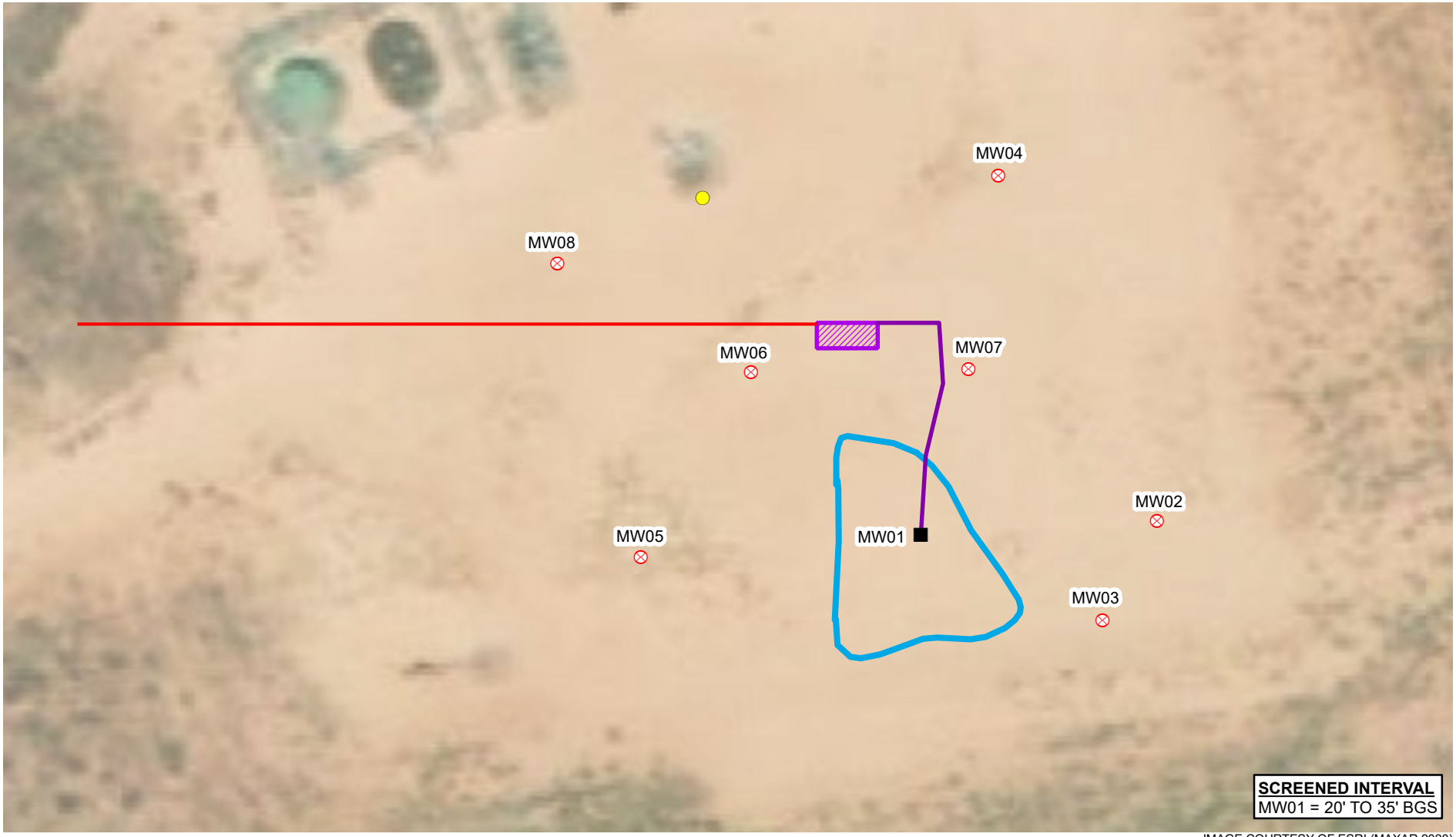


IMAGE COURTESY OF ESRI (MAXAR 2020)

LEGEND

- SVE WELL / MONITORING WELL
- MONITORING WELL
- WELLHEAD
- SVE PIPING
- ELECTRICAL SERVICE LINE
- SVE SKID LOCATION
- REMAINING IMPACTED SOIL

0 40 80
Feet

N

BGS: BELOW GROUND SURFACE
SVE: SOIL VAPOR EXTRACTION

FIGURE 2
AS-BUILT DIAGRAM
LAMBE 2C
SENE SEC 20 T31N R10W
SAN JUAN COUNTY, NEW MEXICO
HILCORP ENERGY COMPANY

P:\Hilcorp\GIS\TE017818055_LAMBE 2C\MXD\TE017818055_FIG02_AS_DIAGRAM_2021.mxd

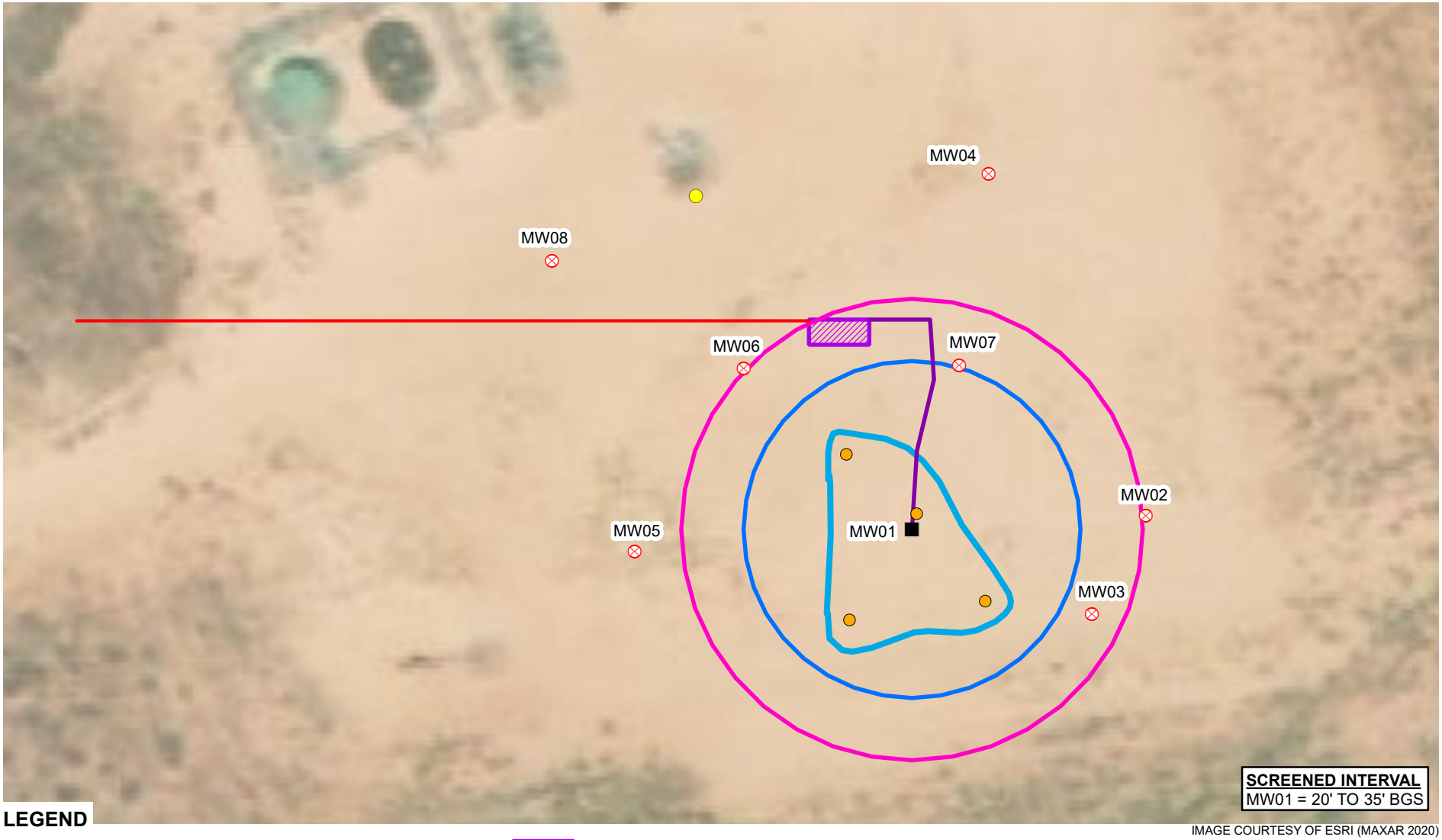


IMAGE COURTESY OF ESRI (MAXAR 2020)

LEGEND

- SVE WELL / MONITORING WELL
- MONITORING WELL
- PROPOSED SOIL CONFIRMATION BORING LOCATIONS
- WELLHEAD
- SVE PIPING
- ELECTRICAL SERVICE LINE
- SVE SKID LOCATION
- REMAINING IMPACTED SOIL
- RADIUS OF EFFECT (46')
- RADIUS OF INFLUENCE (63')

BGS: BELOW GROUND SURFACE
SVE: SOIL VAPOR EXTRACTION

0 40 80
Feet

N

FIGURE 3
ESTIMATED ROI AND ROE
LAMBE 2C
SENE SEC 20 T31N R10W
SAN JUAN COUNTY, NEW MEXICO
HILCORP ENERGY COMPANY

P:\Hilcorp\GIS\TE017818055_LAMBE 2C\MXD\TE017818055_FIG03_ESTIMATED_ROI_2021.mxd

TABLES

TABLE 1
AIR SAMPLE LABORATORY ANALYTICAL RESULTS

LAMBE 2C
SAN JUAN COUNTY, NEW MEXICO
HILCORP ENERGY COMPANY

Sample ID	Sample Date	PID Reading (ppm)	Benzene (µg/L)	Toluene (µg/L)	Ethyl-benzene (µg/L)	Total Xylenes (µg/L)	TVPH (µg/L)
Influent 9/25	9/25/2019	782	6.1	42	<5.0	56	NA
Influent-MW01	10/14/2019	431	7.3	26	2.6	36	3,600
Influent - Pilot Test	9/17/2021	78	<0.10	<0.10	<0.10	1.1	660
Influent-MW01	9/24/2021	97	<0.20	0.94	<0.20	4.3	880

NOTES:
µg/L - micrograms per liter
NA - not analyzed
PID - photo-ionization detector
ppm - parts per million
TVPH- total volatile petroleum hydrocarbons

TABLE 2
PILOT TESTING DATA

LAMBE 2C
SAN JUAN COUNTY, NEW MEXICO
HILCORP ENERGY COMPANY

Date : 9/17/2021 SVE well dia - 2"

Extraction Test Well
MW01

Pilot Test Extraction Well					Observation Wells			Observation Wells		
Time	Wellhead Vacuum (in. wc)	Well Velocity (fpm)	Well Flow (scfm)	PID at Stack (ppm)	**MW07**	**MW02**	**MW03**	**MW07**	**MW02**	**MW03**
					Distance From Test Well (feet)			Distance From Test Well (feet)		
					46	**63**	**53**	**46**	**63**	**53**
					Vacuum (in. wc)			PID Measurement (ppm)		
11:50	0.0	0	0	0.0	0.0	0.00	0.00	0.0	0.0	0.0
12:00	3.5	690	14	76	0.0	0.0	0.0	0.0	0.0	0.0
12:20	5.3	2,780	25	107	0.0	0.0	0.0	0.0	0.0	0.0
12:32	6.1	3,570	40	116	0.1	0.0	0.1	0.0	0.0	0.0
12:43	6.0	3,350	42	140	0.1	0.0	0.1	0.0	0.0	0.0
12:51	7.0	4,450	50	149	0.1	0.1	0.1	0.0	0.0	0.0
13:08	6.9	4,013	50	131	0.2	0.1	0.2	0.0	0.0	0.0
13:20	10.4	6,950	75	122	0.3	0.3	0.4	5.2	2.3	2.1
13:28	10.5	6,690	75	102	0.4	0.3	0.4	4.6	2.1	2.0
13:40	10.5	5,800	75	98	0.3	0.3	0.3	5.4	1.8	1.4
13:48	11.7	6,960	82	94	0.4	0.2	0.3	6.8	0.9	0.7
14:02	11.7	7,010	82	89	0.4	0.3	0.4	10.8	4.1	2.0
14:20	11.7	7,980	82	77	0.3	0.3	0.4	3.3	0.8	0.9
14:40	7.2	4,200	50	79	0.2	0.2	0.3	6.5	1.7	1.8
14:50	7.2	4,250	50	78	0.2	0.2	0.3	7.0	1.2	1.3

Notes:
fpm - feet per minute
in. wc - inches of water column
ppm - parts per million
PID - photoionization detector
scfm - standard cubic feet per minute

TABLE 3
SOIL VAPOR EXTRACTION SYSTEM RECOVERY & EMISSIONS SUMMARY

LAMBE 2C
SAN JUAN COUNTY, NEW MEXICO
HILCORP ENERGY COMPANY

Sample Information and Lab Analysis

Date	Total Flow (cf)	Delta Flow (cf)	Benzene (µg/L)	Toluene (µg/L)	Ethyl-benzene (µg/L)	Xylenes (µg/L)	TVPH (µg/L)	PID (ppm)
9/24/2021	4,590	4,590	*0.20*	0.94	*0.20*	4.3	880	97
		Average	0.20	0.94	0.20	4.3	880	97

Vapor Extraction Calculations

Date	Flow Rate (cfm)	Benzene (lb/hr)	Toluene (lb/hr)	Ethyl-benzene (lb/hr)	Xylenes (lb/hr)	TVPH (lb/hr)
9/24/2021	51	0.00004	0.0002	0.00004	0.001	0.2
Average	51	0.00004	0.0002	0.00004	0.001	0.2

Pounds Extracted Over Operating Time

Date	Total Operational Hours	Delta Hours	Benzene (lbs)	Toluene (lbs)	Ethyl-benzene (lbs)	Xylenes (lbs)	TVPH (lbs)	TVPH (tons)
9/24/2021	Startup							
9/24/2021	1.5	1.5	0.0001	0.0003	0.0001	0.001	0.3	0.0001
	Total Extracted to Date		0.0001	0.0003	0.0001	0.001	0.3	0.0001

Notes:

cf - cubic feet
cfm - cubic feet per minute
lbs - pounds
lb/hr - pounds per hour
µg/L - micrograms per hour
NA - not analyzed
PID - photoionization detector
ppm - parts per million
TVPH - total volatile petroleum hydrocarbons
Italics and gray indicate laboratory result was less than reporting limit. Reporting limit utilized in calculations.

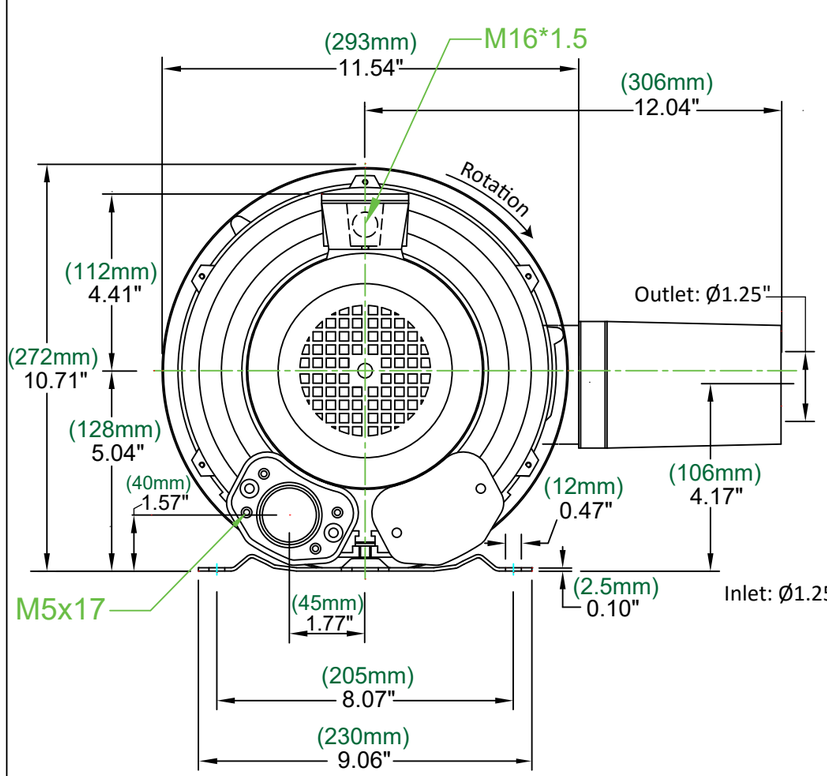
ENCLOSURE A – EXISTING SVE BLOWER PERFORMANCE CHART

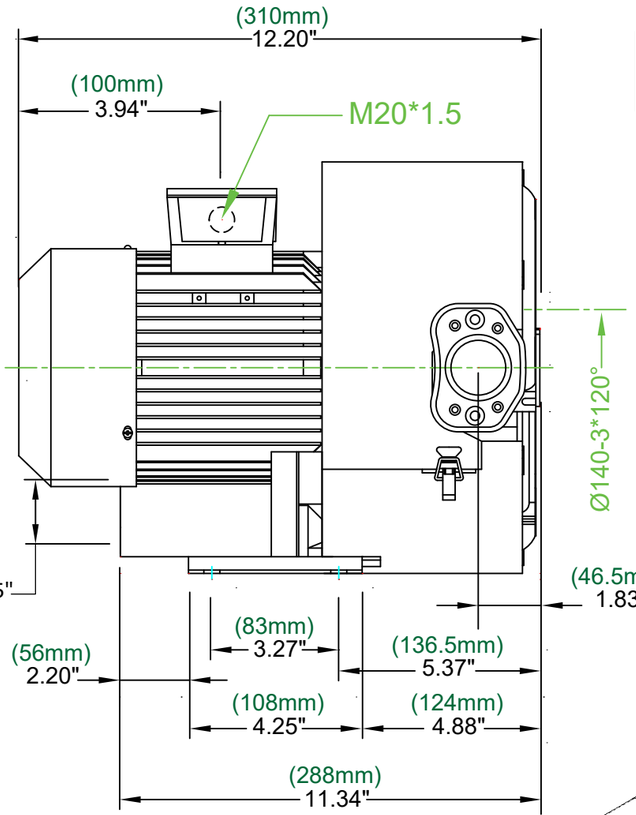
atlantic blowers

Phase	Model Number	Curve Number	Frequency (Hz)	KW	HP	Max Flow (SCFM)	Max Pressure ("H_2O)	Max Vacuum ("H_2O)	Sound Level (dB)	Inlet/Outlet Diameter (Inches)	Voltage	Current (A)	Weight (lbs)
1	AB-202/1	A101	60Hz	0.75	1.00	64	101	101	68	1.25"	110-120/220-240	11.0Δ/5.4Y	37
			50Hz	0.63	1.83	53	70	70	64		100-120/200-240	9.2Δ/4.5Y	

**Sound db measured at 3ft.

MODEL NO. : AB-202/1 DOUBLE STAGE



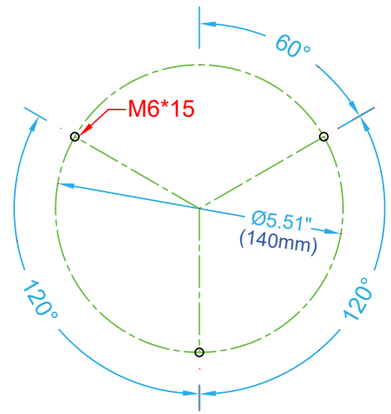


Key

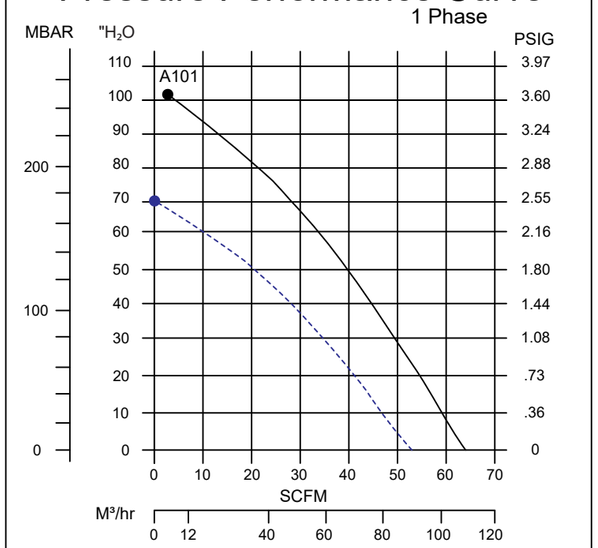
60Hz

50Hz

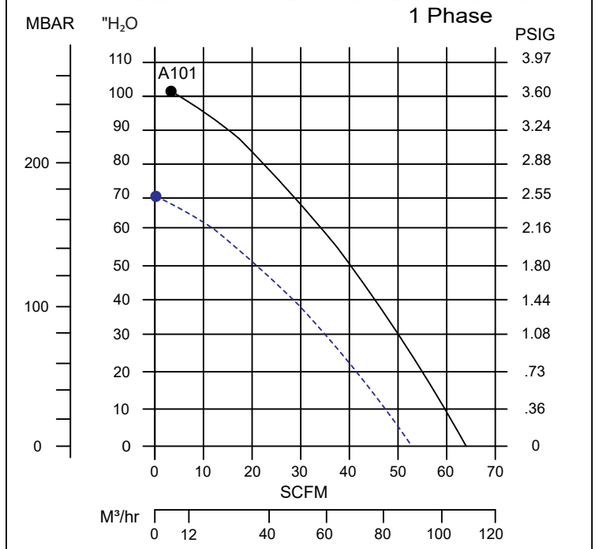
Standard Conditions
-Sea Level (14.69 PSI)
-60°F (15°C)
-0% Relative Humidity



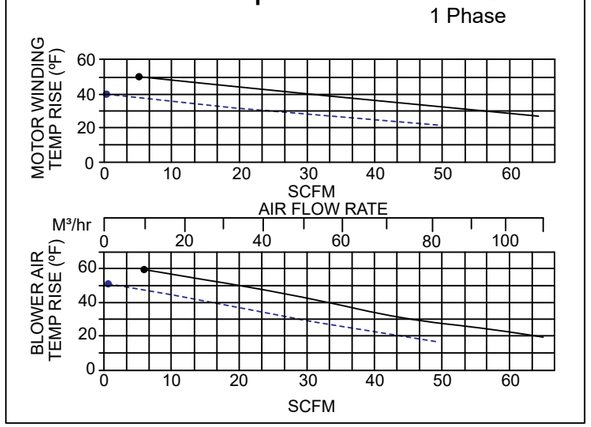
Pressure Performance Curve



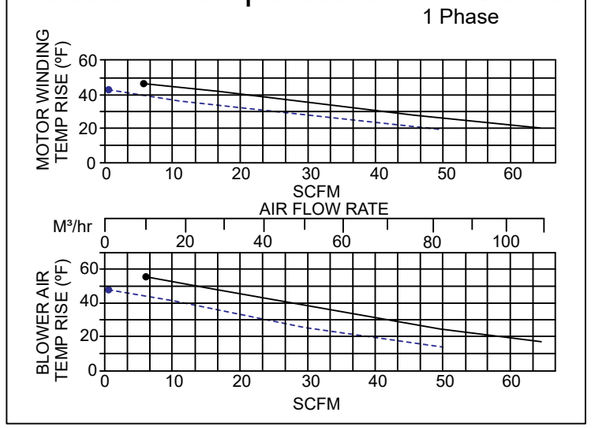
Vacuum Performance Curve

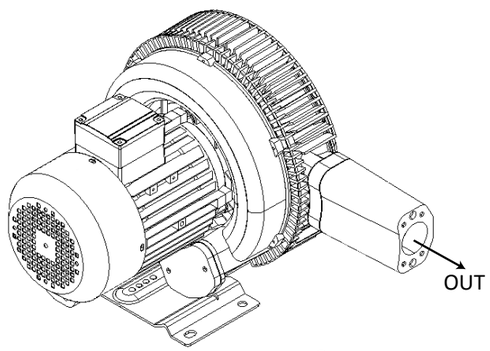


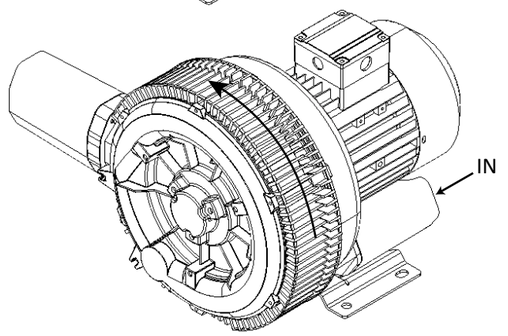
Pressure -Temperature Rise Curve



Vacuum -Temperature Rise Curve



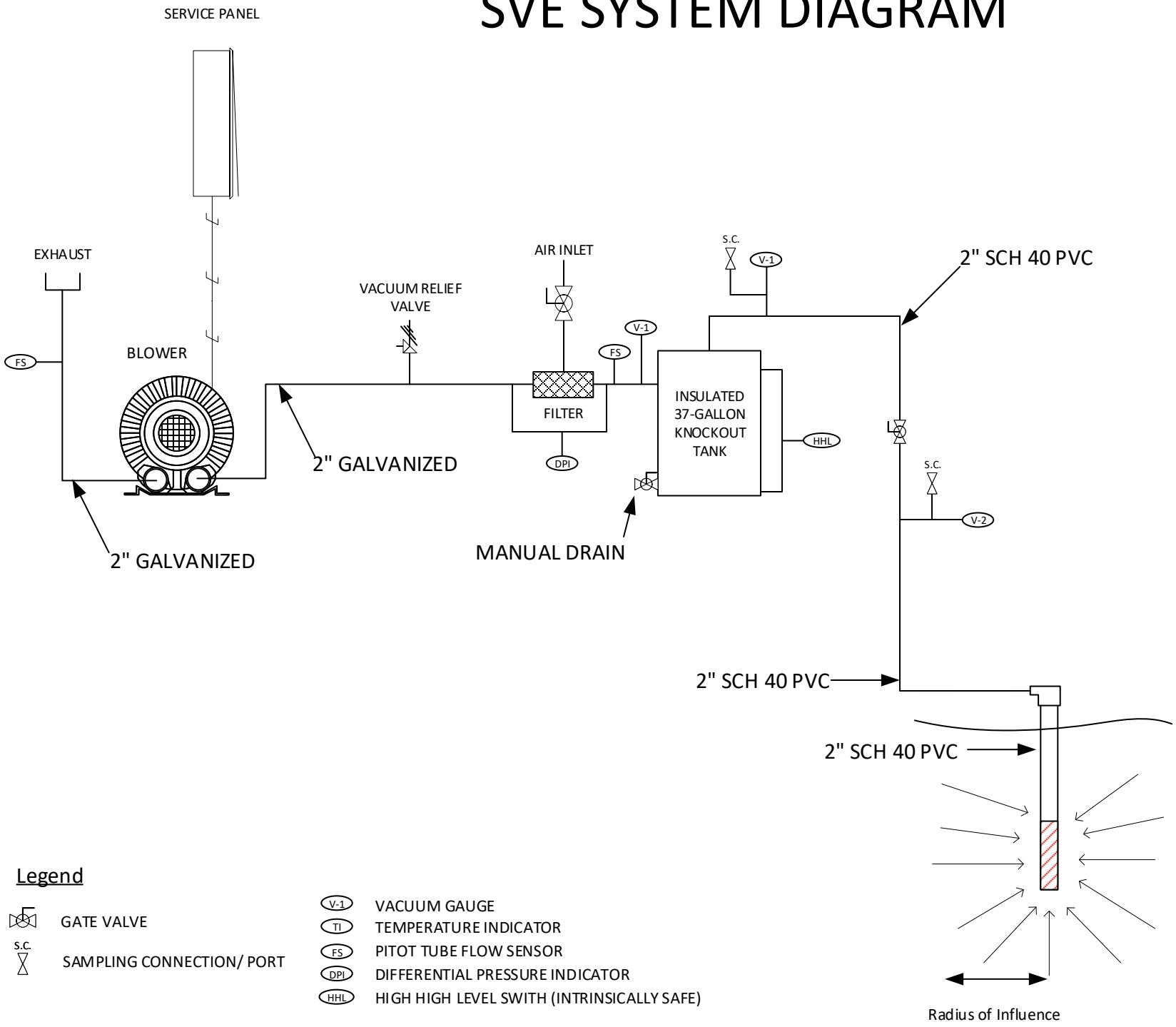




Disclaimer

(214) 233-0280
www.atlanticblowers.com

SVE SYSTEM DIAGRAM



Legend

GATE VALVE

S.C. SAMPLING CONNECTION/ PORT

V-1 VACUUM GAUGE

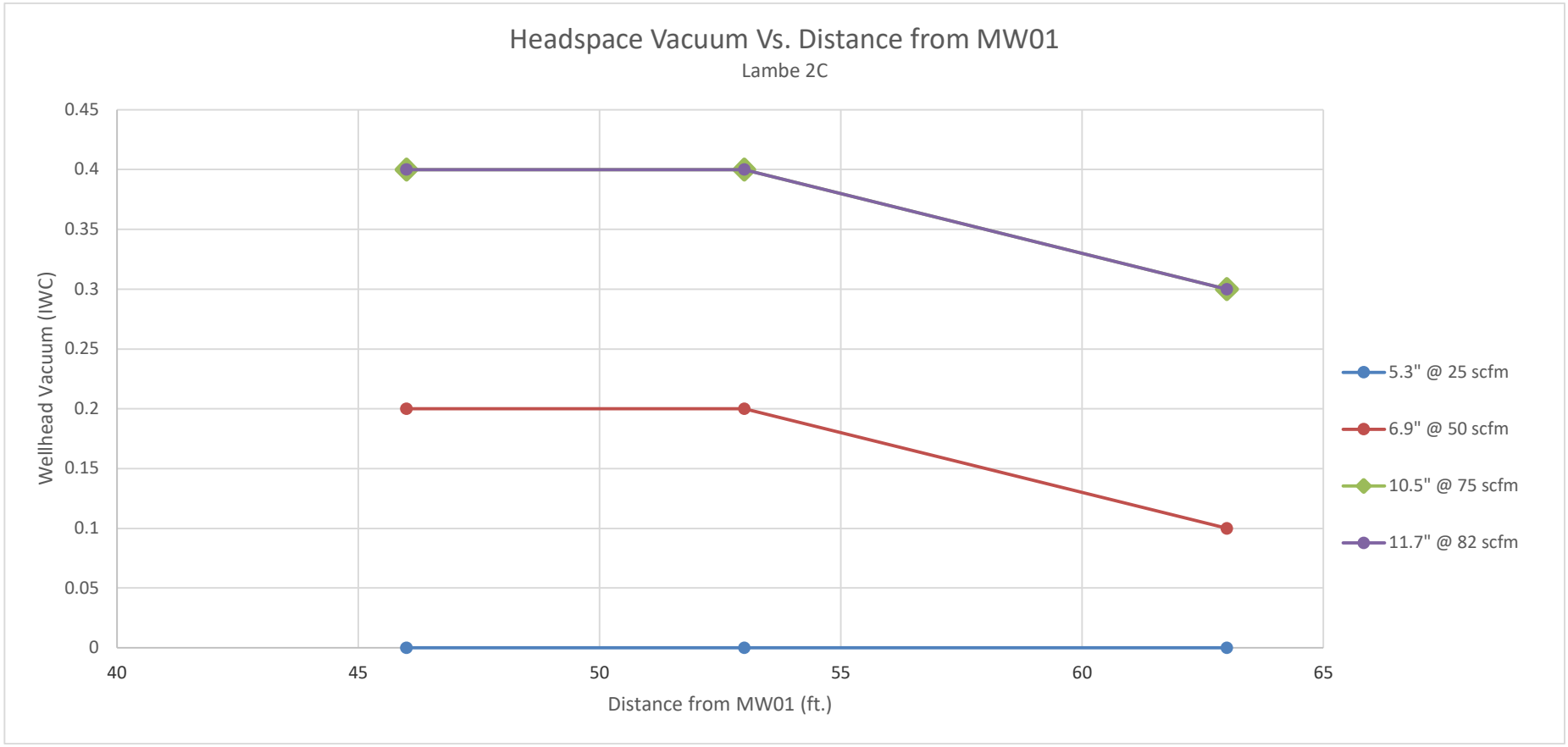
TI TEMPERATURE INDICATOR

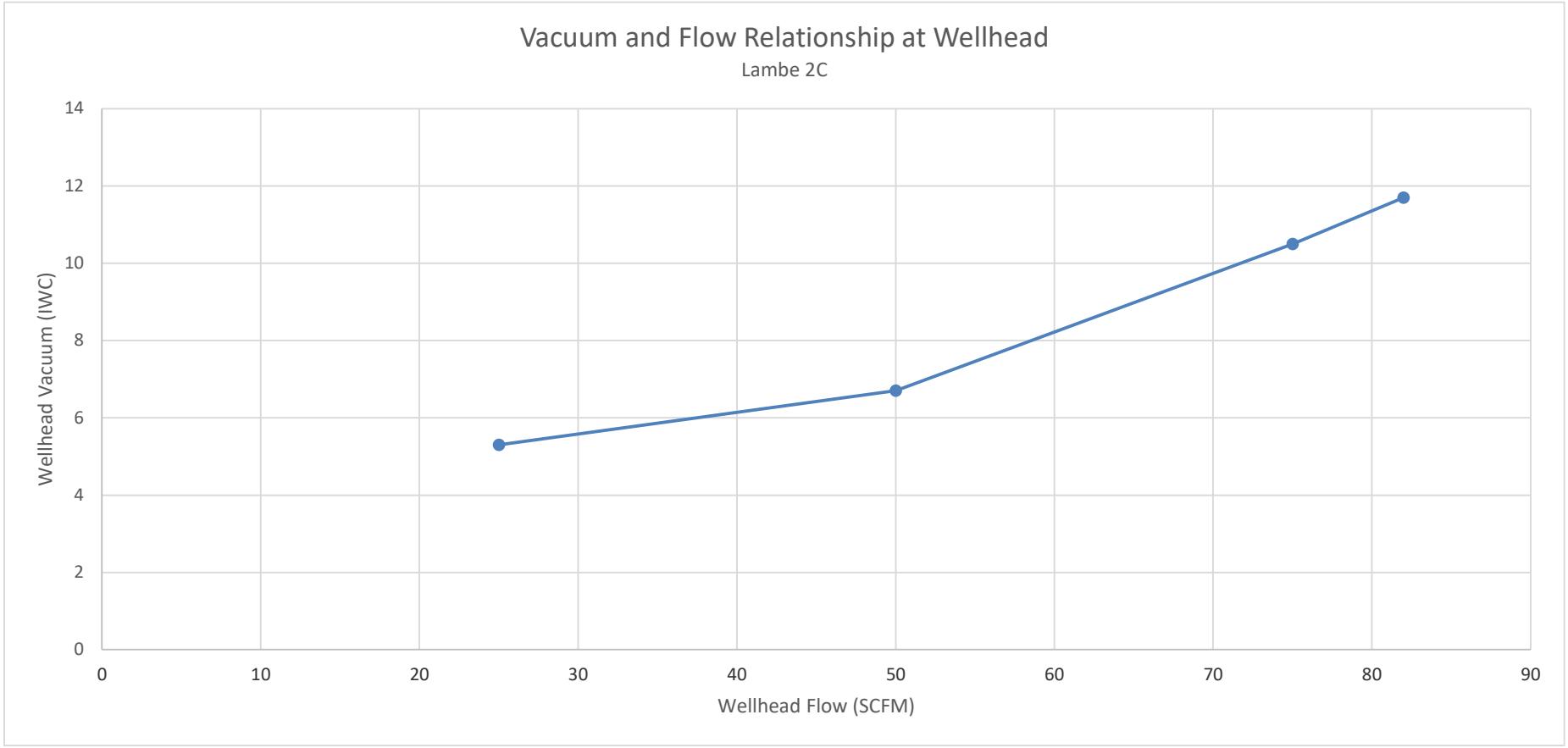
FS PITOT TUBE FLOW SENSOR

DPI DIFFERENTIAL PRESSURE INDICATOR

HHL HIGH HIGH LEVEL SWITH (INTRINSICALLY SAFE)

ENCLOSURE B – PILOT TESTING DATA





RADIUS OF EFFECT CALCULATIONS

SOIL VAPOR EXTRACTION PILOT TEST
LAMBE 2C
HILCORP ENERGY COMPANY

Site Specific Information		
Test Well	MW01	
SVE Screen Length (H)	15	ft
Soil Type	silty sand	
Porosity (n)	30%	percent
Test Specific Information		
Radius of Influence (ROI)	46	feet - 0.1 to 0.2 IWC observed in MW07 at distance of 46 feet
Flow Rate (1)	40	SCFM
Wellhead Vacuum (1)	6.1	IWC
Flow Rate (2)	50	SCFM
Wellhead Vacuum (2)	6.9	IWC
Calculations (Flowrate 1 - 40 SCFM)		
Total Volume (ft^3)	99,714	= PI * ROI * ROI * H
Volume Pore Space (ft^3)	29,914	= Total Volume * n
Pore Volume Exchange Rate	0.52	days
Annual Pore Volume Exchanges	703	>500 Required
Velocity at ROI (ft/min)	0.031	= Flowrate/(PI * ROI * ROI * H * n)
Velocity at ROI (ft/day)	44.3	~ 3 ft/day recommended
Calculations (Flowrate 2 - 50 SCFM)		
Total Volume (ft^3)	99,714	= PI * ROI * ROI * H
Volume Pore Space (ft^3)	29,914	= Total Volume * n
Pore Volume Exchange Rate	0.42	days
Annual Pore Volume Exchanges	879	>500 Required
Velocity at ROI (ft/min)	0.038	= Flowrate/(2*PI*ROI*H*n)
Velocity at ROI (ft/day)	55.4	~ 3 ft/day recommended*
Calculations of existing system capable of - 60 SCFM and 48.6 CFM at 5,750 feet (site elevation)		
Assumed ROE	46	ft
Volume Pore Space (ft^3)	29,914	
Pore Volume Exchange rate	0.43	days
Annual Pore Volume Exchanges	854	>500 Required
Velocity at ROE (ft/day)	53.8	~ 3 ft/day recommended*

Conclusions

Vacuum influence was observed at 46 feet (closest observation well) at wellhead flowrates of 40 SCFM and 50 SCFM. Assuming a radius of influence (ROI) of 46 feet, the radius of effect (ROE) was evaluated using annual pore volume exchange rate and subsurface air velocity. Two air flows were evaluated 40 SCFM and 50 SCFM. Both had acceptable annual pore volume exchanges >500 and were close for acceptable pore space velocities > 3 ft/day.

The existing system onsite is capable of 60 scfm (48.6 cfm accounting for site elevation of 5,750 feet). Calculations with the existing onsite system show a ROE of 46 feet is achievable with 854 annual pore volume exchanges and a pore space velocity of 53 ft/day.

Notes:

*Current SVE Research indicates that is it desirable to achieve pore-gas velocities throughout the treatment zone in excess of 0.001 cm/sec or ~3 ft/day (DiGiulo and Ravi 1999)
ft - feet
ROI - radius of influence
IWC - inches water column
min - minute
s - second
SCFM - standard cubic feet per minute

ENCLOSURE C – LABORATORY ANALYTICAL REPORTS

HALL ENVIRONMENTAL ANALYSIS LABORATORY

Hall Environmental Analysis Laboratory
4901 Hawkins NE
Albuquerque, NM 87109
TEL: 505-345-3975 FAX: 505-345-4107
Website: clients.hallenvironmental.com

September 27, 2021

Mitch Killough
HILCORP ENERGY
PO Box 4700
Farmington, NM 87499
TEL: (505) 564-0733
FAX:

RE: Lambe 2C OrderNo.: 2109998

Dear Mitch Killough:

Hall Environmental Analysis Laboratory received 1 sample(s) on 9/18/2021 for the analyses presented in the following report.

These were analyzed according to EPA procedures or equivalent. To access our accredited tests please go to www.hallenvironmental.com or the state specific web sites. In order to properly interpret your results, it is imperative that you review this report in its entirety. See the sample checklist and/or the Chain of Custody for information regarding the sample receipt temperature and preservation. Data qualifiers or a narrative will be provided if the sample analysis or analytical quality control parameters require a flag. When necessary, data qualifiers are provided on both the sample analysis report and the QC summary report, both sections should be reviewed. All samples are reported, as received, unless otherwise indicated. Lab measurement of analytes considered field parameters that require analysis within 15 minutes of sampling such as pH and residual chlorine are qualified as being analyzed outside of the recommended holding time.

Please don't hesitate to contact HEAL for any additional information or clarifications.

ADHS Cert #AZ0682 -- NMED-DWB Cert #NM9425 -- NMED-Micro Cert #NM0901

Sincerely,

Andy Freeman
Laboratory Manager
4901 Hawkins NE
Albuquerque, NM 87109

Analytical Report
Lab Order **2109998**
Date Reported: **9/27/2021**

Hall Environmental Analysis Laboratory, Inc.

CLIENT: HILCORP ENERGY
Client Sample ID: Influent Pilot Test
Project: Lambe 2C
Collection Date: 9/17/2021 2:50:00 PM
Lab ID: 2109998-001 **Matrix:** AIR
Received Date: 9/18/2021 9:00:00 AM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
EPA METHOD 8015D: GASOLINE RANGE						Analyst: **NSB**
Gasoline Range Organics (GRO)	660	5.0		µg/L	1	9/21/2021 11:11:29 AM
Surr: BFB	685	37.3-213	S	%Rec	1	9/21/2021 11:11:29 AM
EPA METHOD 8260B: VOLATILES						Analyst: **CCM**
Benzene	ND	0.10		µg/L	1	9/21/2021 2:45:00 PM
Toluene	ND	0.10		µg/L	1	9/21/2021 2:45:00 PM
Ethylbenzene	ND	0.10		µg/L	1	9/21/2021 2:45:00 PM
Methyl tert-butyl ether (MTBE)	ND	0.10		µg/L	1	9/21/2021 2:45:00 PM
1,2,4-Trimethylbenzene	0.30	0.10		µg/L	1	9/21/2021 2:45:00 PM
1,3,5-Trimethylbenzene	1.2	0.10		µg/L	1	9/21/2021 2:45:00 PM
1,2-Dichloroethane (EDC)	ND	0.10		µg/L	1	9/21/2021 2:45:00 PM
1,2-Dibromoethane (EDB)	ND	0.10		µg/L	1	9/21/2021 2:45:00 PM
Naphthalene	ND	0.20		µg/L	1	9/21/2021 2:45:00 PM
1-Methylnaphthalene	ND	0.40		µg/L	1	9/21/2021 2:45:00 PM
2-Methylnaphthalene	ND	0.40		µg/L	1	9/21/2021 2:45:00 PM
Acetone	ND	1.0		µg/L	1	9/21/2021 2:45:00 PM
Bromobenzene	ND	0.10		µg/L	1	9/21/2021 2:45:00 PM
Bromodichloromethane	ND	0.10		µg/L	1	9/21/2021 2:45:00 PM
Bromoform	ND	0.10		µg/L	1	9/21/2021 2:45:00 PM
Bromomethane	ND	0.20		µg/L	1	9/21/2021 2:45:00 PM
2-Butanone	ND	1.0		µg/L	1	9/21/2021 2:45:00 PM
Carbon disulfide	ND	1.0		µg/L	1	9/21/2021 2:45:00 PM
Carbon tetrachloride	ND	0.10		µg/L	1	9/21/2021 2:45:00 PM
Chlorobenzene	ND	0.10		µg/L	1	9/21/2021 2:45:00 PM
Chloroethane	ND	0.20		µg/L	1	9/21/2021 2:45:00 PM
Chloroform	ND	0.10		µg/L	1	9/21/2021 2:45:00 PM
Chloromethane	ND	0.10		µg/L	1	9/21/2021 2:45:00 PM
2-Chlorotoluene	ND	0.10		µg/L	1	9/21/2021 2:45:00 PM
4-Chlorotoluene	ND	0.10		µg/L	1	9/21/2021 2:45:00 PM
cis-1,2-DCE	ND	0.10		µg/L	1	9/21/2021 2:45:00 PM
cis-1,3-Dichloropropene	ND	0.10		µg/L	1	9/21/2021 2:45:00 PM
1,2-Dibromo-3-chloropropane	ND	0.20		µg/L	1	9/21/2021 2:45:00 PM
Dibromochloromethane	ND	0.10		µg/L	1	9/21/2021 2:45:00 PM
Dibromomethane	ND	0.20		µg/L	1	9/21/2021 2:45:00 PM
1,2-Dichlorobenzene	ND	0.10		µg/L	1	9/21/2021 2:45:00 PM
1,3-Dichlorobenzene	ND	0.10		µg/L	1	9/21/2021 2:45:00 PM
1,4-Dichlorobenzene	ND	0.10		µg/L	1	9/21/2021 2:45:00 PM
Dichlorodifluoromethane	ND	0.10		µg/L	1	9/21/2021 2:45:00 PM
1,1-Dichloroethane	ND	0.10		µg/L	1	9/21/2021 2:45:00 PM
1,1-Dichloroethene	ND	0.10		µg/L	1	9/21/2021 2:45:00 PM

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Limit
S	% Recovery outside of range due to dilution or matrix		

Analytical Report
Lab Order **2109998**
Date Reported: **9/27/2021**

Hall Environmental Analysis Laboratory, Inc.

CLIENT: HILCORP ENERGY
Client Sample ID: Influent Pilot Test
Project: Lambe 2C
Collection Date: 9/17/2021 2:50:00 PM
Lab ID: 2109998-001 **Matrix:** AIR
Received Date: 9/18/2021 9:00:00 AM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
EPA METHOD 8260B: VOLATILES						Analyst: **CCM**
1,2-Dichloropropane	ND	0.10		µg/L	1	9/21/2021 2:45:00 PM
1,3-Dichloropropane	ND	0.10		µg/L	1	9/21/2021 2:45:00 PM
2,2-Dichloropropane	ND	0.10		µg/L	1	9/21/2021 2:45:00 PM
1,1-Dichloropropene	ND	0.10		µg/L	1	9/21/2021 2:45:00 PM
Hexachlorobutadiene	ND	0.10		µg/L	1	9/21/2021 2:45:00 PM
2-Hexanone	ND	1.0		µg/L	1	9/21/2021 2:45:00 PM
Isopropylbenzene	ND	0.10		µg/L	1	9/21/2021 2:45:00 PM
4-Isopropyltoluene	ND	0.10		µg/L	1	9/21/2021 2:45:00 PM
4-Methyl-2-pentanone	ND	1.0		µg/L	1	9/21/2021 2:45:00 PM
Methylene chloride	ND	0.30		µg/L	1	9/21/2021 2:45:00 PM
n-Butylbenzene	ND	0.30		µg/L	1	9/21/2021 2:45:00 PM
n-Propylbenzene	ND	0.10		µg/L	1	9/21/2021 2:45:00 PM
sec-Butylbenzene	ND	0.10		µg/L	1	9/21/2021 2:45:00 PM
Styrene	ND	0.10		µg/L	1	9/21/2021 2:45:00 PM
tert-Butylbenzene	ND	0.10		µg/L	1	9/21/2021 2:45:00 PM
1,1,1,2-Tetrachloroethane	ND	0.10		µg/L	1	9/21/2021 2:45:00 PM
1,1,2,2-Tetrachloroethane	ND	0.10		µg/L	1	9/21/2021 2:45:00 PM
Tetrachloroethene (PCE)	ND	0.10		µg/L	1	9/21/2021 2:45:00 PM
trans-1,2-DCE	ND	0.10		µg/L	1	9/21/2021 2:45:00 PM
trans-1,3-Dichloropropene	ND	0.10		µg/L	1	9/21/2021 2:45:00 PM
1,2,3-Trichlorobenzene	ND	0.10		µg/L	1	9/21/2021 2:45:00 PM
1,2,4-Trichlorobenzene	ND	0.10		µg/L	1	9/21/2021 2:45:00 PM
1,1,1-Trichloroethane	ND	0.10		µg/L	1	9/21/2021 2:45:00 PM
1,1,2-Trichloroethane	ND	0.10		µg/L	1	9/21/2021 2:45:00 PM
Trichloroethene (TCE)	ND	0.10		µg/L	1	9/21/2021 2:45:00 PM
Trichlorofluoromethane	ND	0.10		µg/L	1	9/21/2021 2:45:00 PM
1,2,3-Trichloropropane	ND	0.20		µg/L	1	9/21/2021 2:45:00 PM
Vinyl chloride	ND	0.10		µg/L	1	9/21/2021 2:45:00 PM
Xylenes, Total	1.1	0.15		µg/L	1	9/21/2021 2:45:00 PM
Surr: Dibromofluoromethane	94.1	70-130		%Rec	1	9/21/2021 2:45:00 PM
Surr: 1,2-Dichloroethane-d4	87.3	70-130		%Rec	1	9/21/2021 2:45:00 PM
Surr: Toluene-d8	123	70-130		%Rec	1	9/21/2021 2:45:00 PM
Surr: 4-Bromofluorobenzene	90.3	70-130		%Rec	1	9/21/2021 2:45:00 PM

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Limit
S	% Recovery outside of range due to dilution or matrix		

ENERGY LABORATORIES
Trust our People. Trust our Data.
www.energylab.com
Billings, MT 800.735.4489 • Casper, WY 888.235.0515
Gillette, WY 866.686.7175 • Helena, MT 877.472.0711

ANALYTICAL SUMMARY REPORT

September 23, 2021

Hall Environmental
4901 Hawkins St NE Ste D
Albuquerque, NM 87109-4372

Work Order: G21090337

Project Name: Not Indicated

Energy Laboratories Inc. Gillette WY received the following 1 sample for Hall Environmental on 9/21/2021 for analysis.

Lab ID	Client Sample ID	Collect Date	Receive Date	Matrix	Test
G21090337-001	2109998-001B; Influent Pilot Test	09/17/21 14:50	09/21/21	Air	Natural Gas Analysis - BTU Natural Gas Analysis - Compressibility Factor Natural Gas Analysis - GPM Natural Gas Analysis - Molecular Weight Natural Gas Analysis - Routine Natural Gas Analysis - Pressure Base Natural Gas Analysis - Psuedo-Critical Pressure Natural Gas Analysis - Psuedo-Critical Temperature Natural Gas Analysis - Specific Gravity Natural Gas Analysis - Temperature Base

The analyses presented in this report were performed by Energy Laboratories, Inc., 400 W. Boxelder Rd., Gillette, WY 82718, unless otherwise noted. Any exceptions or problems with the analyses are noted in the report package. Any issues encountered during sample receipt are documented in the Work Order Receipt Checklist.

The results as reported relate only to the item(s) submitted for testing. This report shall be used or copied only in its entirety. Energy Laboratories, Inc. is not responsible for the consequences arising from the use of a partial report.

If you have any questions regarding these tests results, please contact your Project Manager.

Report Approved By:

ENERGY LABORATORIES
Trust our People. Trust our Data.
www.energylab.com
Billings, MT 800.735.4489 • Casper, WY 888.235.0515
Gillette, WY 866.686.7175 • Helena, MT 877.472.0711

LABORATORY ANALYTICAL REPORT

Prepared by Gillette, WY Branch

Client: Hall Environmental
Project: Not Indicated
Client Sample ID: 2109998-001B; Influent Pilot Test
Location:
Lab ID: G21090337-001

Report Date: 09/23/21
Collection Date: 09/17/21 14:50
Date Received: 09/21/21
Sampled By: Not Provided

Analyses	Result	Units	Qualifier	Method	Analysis Date / By
NATURAL GAS CHROMATOGRAPHIC ANALYSIS REPORT					
Oxygen	12.894	Mol %		GPA 2261	09/22/21 15:50 / blb
Nitrogen	80.933	Mol %		GPA 2261	09/22/21 15:50 / blb
Carbon Dioxide	6.173	Mol %		GPA 2261	09/22/21 15:50 / blb
Hydrogen Sulfide	< 0.001	Mol %		GPA 2261	09/22/21 15:50 / blb
Methane	< 0.001	Mol %		GPA 2261	09/22/21 15:50 / blb
Ethane	< 0.001	Mol %		GPA 2261	09/22/21 15:50 / blb
Propane	< 0.001	Mol %		GPA 2261	09/22/21 15:50 / blb
Isobutane	< 0.001	Mol %		GPA 2261	09/22/21 15:50 / blb
n-Butane	< 0.001	Mol %		GPA 2261	09/22/21 15:50 / blb
Isopentane	< 0.001	Mol %		GPA 2261	09/22/21 15:50 / blb
n-Pentane	< 0.001	Mol %		GPA 2261	09/22/21 15:50 / blb
Hexanes plus	< 0.001	Mol %		GPA 2261	09/22/21 15:50 / blb
GPM @ STD COND/1000 CU.FT., MOISTURE FREE GAS					
GPM Ethane	< 0.0003	gal/MCF		GPA 2261	09/22/21 15:50 / blb
GPM Propane	< 0.0003	gal/MCF		GPA 2261	09/22/21 15:50 / blb
GPM Isobutane	< 0.0003	gal/MCF		GPA 2261	09/22/21 15:50 / blb
GPM n-Butane	< 0.0003	gal/MCF		GPA 2261	09/22/21 15:50 / blb
GPM Isopentane	< 0.0004	gal/MCF		GPA 2261	09/22/21 15:50 / blb
GPM n-Pentane	< 0.0004	gal/MCF		GPA 2261	09/22/21 15:50 / blb
GPM Hexanes plus	< 0.0004	gal/MCF		GPA 2261	09/22/21 15:50 / blb
GPM Pentanes plus	< 0.0004	gal/MCF		GPA 2261	09/22/21 15:50 / blb
GPM Total	< 0.0004	gal/MCF		GPA 2261	09/22/21 15:50 / blb
CALCULATED PROPERTIES					
Calculation Pressure Base	14.730	psia		GPA 2261	09/22/21 15:50 / blb
Calculation Temperature Base	60	°F		GPA 2261	09/22/21 15:50 / blb
Compressibility Factor, Z	1.0000	unitless		GPA 2261	09/22/21 15:50 / blb
Molecular Weight	29.51	unitless		GPA 2261	09/22/21 15:50 / blb
Pseudo-critical Pressure, psia	560	psia		GPA 2261	09/22/21 15:50 / blb
Pseudo-critical Temperature, deg R	254	deg R		GPA 2261	09/22/21 15:50 / blb
Specific Gravity (air=1.000)	1.022	unitless		GPA 2261	09/22/21 15:50 / blb
Gross BTU per cu ft @ std cond, dry	< 0.01	BTU/cu ft		GPA 2261	09/22/21 15:50 / blb
Gross BTU per cu ft @ std cond, wet	< 0.01	BTU/cu ft		GPA 2261	09/22/21 15:50 / blb

Report Definitions:
RL - Analyte Reporting Limit
QCL - Quality Control Limit
MCL - Maximum Contaminant Level
ND - Not detected at the Reporting Limit (RL)

ENERGY LABORATORIES
Trust our People. Trust our Data.
www.energylab.com
Billings, MT 800.735.4489 • Casper, WY 888.235.0515
Gillette, WY 866.686.7175 • Helena, MT 877.472.0711

QA/QC Summary Report

Prepared by Gillette, WY Branch

Client: Hall Environmental **Work Order:** G21090337 **Report Date:** 09/23/21

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **GPA 2261**									Analytical Run: R266925
Lab ID: **ICV-2109221415**	Initial Calibration Verification Standard								09/22/21 14:15
Oxygen	0.394	Mol %	0.001	98	75	110			
Nitrogen	5.131	Mol %	0.001	102	90	110			
Carbon Dioxide	4.906	Mol %	0.001	99	90	110			
Hydrogen Sulfide	0.127	Mol %	0.001	128	100	136			
Methane	73.196	Mol %	0.001	100	90	110			
Ethane	5.004	Mol %	0.001	101	90	110			
Propane	5.002	Mol %	0.001	100	90	110			
Isobutane	1.986	Mol %	0.001	99	90	110			
n-Butane	1.967	Mol %	0.001	98	90	110			
Isopentane	0.985	Mol %	0.001	98	90	110			
n-Pentane	0.995	Mol %	0.001	99	90	110			
Hexanes plus	0.307	Mol %	0.001	102	90	110			
Lab ID: **CCV-2109221435**	Continuing Calibration Verification Standard								09/22/21 14:36
Oxygen	0.615	Mol %	0.001	103	90	110			
Nitrogen	1.306	Mol %	0.001	93	85	110			
Carbon Dioxide	0.959	Mol %	0.001	96	90	110			
Hydrogen Sulfide	0.025	Mol %	0.001	100	70	130			
Methane	93.523	Mol %	0.001	100	90	110			
Ethane	1.017	Mol %	0.001	102	90	110			
Propane	1.012	Mol %	0.001	101	90	110			
Isobutane	0.495	Mol %	0.001	99	90	110			
n-Butane	0.494	Mol %	0.001	99	90	110			
Isopentane	0.200	Mol %	0.001	100	90	110			
n-Pentane	0.200	Mol %	0.001	100	90	110			
Hexanes plus	0.154	Mol %	0.001	103	90	110			
Lab ID: **CCV-2109221600**	Continuing Calibration Verification Standard								09/22/21 16:01
Oxygen	0.620	Mol %	0.001	103	90	110			
Nitrogen	1.348	Mol %	0.001	96	85	110			
Carbon Dioxide	0.962	Mol %	0.001	96	90	110			
Hydrogen Sulfide	0.024	Mol %	0.001	96	70	130			
Methane	93.484	Mol %	0.001	100	90	110			
Ethane	1.014	Mol %	0.001	101	90	110			
Propane	1.008	Mol %	0.001	101	90	110			
Isobutane	0.494	Mol %	0.001	99	90	110			
n-Butane	0.494	Mol %	0.001	99	90	110			
Isopentane	0.199	Mol %	0.001	99	90	110			
n-Pentane	0.199	Mol %	0.001	99	90	110			
Hexanes plus	0.154	Mol %	0.001	103	90	110			
Method: **GPA 2261**									Batch: R266925
Lab ID: **G21090337-001ADUP**	Sample Duplicate				Run: Varian GC_210922A				09/22/21 15:55
Oxygen	12.890	Mol %	0.001				0.0	10	

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

ENERGY LABORATORIES
Trust our People. Trust our Data.
www.energylab.com
Billings, MT 800.735.4489 • Casper, WY 888.235.0515
Gillette, WY 866.686.7175 • Helena, MT 877.472.0711

QA/QC Summary Report

Prepared by Gillette, WY Branch

Client: Hall Environmental **Work Order:** G21090337 **Report Date:** 09/23/21

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **GPA 2261**									Batch: R266925
Lab ID: **G21090337-001ADUP**	Sample Duplicate				Run: Varian GC_210922A			09/22/21 15:55	
Nitrogen	80.927	Mol %	0.001				0.0	10	
Carbon Dioxide	6.183	Mol %	0.001				0.2	10	
Hydrogen Sulfide	< 0.001	Mol %	0.001					10	
Methane	< 0.001	Mol %	0.001					10	
Ethane	< 0.001	Mol %	0.001					10	
Propane	< 0.001	Mol %	0.001					10	
Isobutane	< 0.001	Mol %	0.001					10	
n-Butane	< 0.001	Mol %	0.001					10	
Isopentane	< 0.001	Mol %	0.001					10	
n-Pentane	< 0.001	Mol %	0.001					10	
Hexanes plus	< 0.001	Mol %	0.001					10	

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

ENERGY LABORATORIES
Trust our People. Trust our Data.
www.energylab.com
Billings, MT 800.735.4489 • Casper, WY 888.235.0515
Gillette, WY 866.686.7175 • Helena, MT 877.472.0711

Work Order Receipt Checklist

Hall Environmental

G21090337

Login completed by: Chantel S. Johnson
Date Received: 9/21/2021
Reviewed by: Misty Stephens
Received by: csj
Reviewed Date: 9/23/2021
Carrier name: FedEx

Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on all shipping container(s)/cooler(s)?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on all sample bottles?	Yes ☐	No ☐	Not Present ☑
Chain of custody present?	Yes ☑	No ☐	
Chain of custody signed when relinquished and received?	Yes ☑	No ☐	
Chain of custody agrees with sample labels?	Yes ☑	No ☐	
Samples in proper container/bottle?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☑	No ☐	
All samples received within holding time? (Exclude analyses that are considered field parameters such as pH, DO, Res Cl, Sulfite, Ferrous Iron, etc.)	Yes ☑	No ☐	
Temp Blank received in all shipping container(s)/cooler(s)?	Yes ☐	No ☐	Not Applicable ☑
Container/Temp Blank temperature:	°C		
Containers requiring zero headspace have no headspace or bubble that is <6mm (1/4").	Yes ☐	No ☐	No VOA vials submitted ☑
Water - pH acceptable upon receipt?	Yes ☐	No ☐	Not Applicable ☑

Standard Reporting Procedures:

Lab measurement of analytes considered field parameters that require analysis within 15 minutes of sampling such as pH, Dissolved Oxygen and Residual Chlorine, are qualified as being analyzed outside of recommended holding time.

Solid/soil samples are reported on a wet weight basis (as received) unless specifically indicated. If moisture corrected, data units are typically noted as –dry. For agricultural and mining soil parameters/characteristics, all samples are dried and ground prior to sample analysis.

Radiochemical precision results represent a 2-sigma Total Measurement Uncertainty.

Contact and Corrective Action Comments:

None

HALL ENVIRONMENTAL ANALYSIS LABORATORY

Hall Environmental Analysis Laboratory
4901 Hawkins NE
Albuquerque, NM 87109
TEL: 505-345-3975
FAX: 505-345-4107
Website: clients.hallenvironmental.com

CHAIN OF CUSTODY RECORD 1 1

SUB CONTRATOR:	**Energy Labs-Gillette**	COMPANY: **Energy Laboratories**	PHONE: **(866) 686-7175**	FAX:	
ADDRESS:	**400 W Boxelder Rd**		ACCOUNT #:	EMAIL:	
CITY, STATE, ZIP:	**Gillette, WY 82718**				

ITEM	SAMPLE	CLIENT SAMPLE ID	BOTTLE TYPE	MATRIX	COLLECTION DATE	# CONTAINERS	ANALYTICAL COMMENTS
1	2109998-001B	Influent Pilot Test	TEDLAR	Air	9/17/2021 2:50:00 PM	1	Natural Gases (CO2, O2)

SPECIAL INSTRUCTIONS / COMMENTS:

Please include the LAB ID and the CLIENT SAMPLE ID on all final reports. Please e-mail results to lab@hallenvironmental.com. Please return all coolers and blue ice. Thank you.

Relinquished By:	Date: 9/20/2021	Time: 3:25 PM	Received By:	Date:	Time:
Relinquished By:	Date:	Time:	Received By:	Date: 9/21/2021	Time: 0900
Relinquished By:	Date:	Time:	Received By:	Date:	Time:

TAT: Standard ☑ RUSH Next BD ☐ 2nd BD ☐ 3rd BD ☐

REPORT TRANSMITTAL DESIRED:
☐ HARDCOPY (extra cost) ☐ FAX ☐ EMAIL ☐ ONLINE

FOR LAB USE ONLY
Temp of samples ____ °C Attempt to Cool ? ____
Comments: G2109033 7

HALL ENVIRONMENTAL ANALYSIS LABORATORY

Hall Environmental Analysis Laboratory
4901 Hawkins NE
Albuquerque, NM 87109
TEL: 505-345-3975 FAX: 505-345-4107
Website: clients.hallenvironmental.com

Sample Log-In Check List

Client Name: HILCORP ENERGY Work Order Number: 2109998 RcptNo: 1

Received By: Sean Livingston 9/18/2021 9:00:00 AM

Completed By: Sean Livingston 9/18/2021 10:30:53 AM

Reviewed By: 9/18/21

Chain of Custody

1. Is Chain of Custody complete?	Yes ☑	No ☐	Not Present ☐
2. How was the sample delivered?	Courier		

Log In

3. Was an attempt made to cool the samples?	Yes ☑	No ☐	NA ☐
4. Were all samples received at a temperature of >0° C to 6.0°C	Yes ☑	No ☐	NA ☐
5. Sample(s) in proper container(s)?	Yes ☑	No ☐	
6. Sufficient sample volume for indicated test(s)?	Yes ☑	No ☐	
7. Are samples (except VOA and ONG) properly preserved?	Yes ☑	No ☐	
8. Was preservative added to bottles?	Yes ☐	No ☑	NA ☐
9. Received at least 1 vial with headspace <1/4" for AQ VOA?	Yes ☐	No ☐	NA ☑
10. Were any sample containers received broken?	Yes ☐	No ☑	
11. Does paperwork match bottle labels? (Note discrepancies on chain of custody)	Yes ☑	No ☐	
12. Are matrices correctly identified on Chain of Custody?	Yes ☑	No ☐	
13. Is it clear what analyses were requested?	Yes ☑	No ☐	
14. Were all holding times able to be met? (If no, notify customer for authorization.)	Yes ☑	No ☐	

# of preserved bottles checked for pH: (<2 or >12 unless noted)

Adjusted?

Checked by: SCL 9/18/21

Special Handling (if applicable)

15. Was client notified of all discrepancies with this order? Yes ☐ No ☐ NA ☑

Person Notified: Date:

By Whom: Via: ☐ eMail ☐ Phone ☐ Fax ☐ In Person

Regarding:

Client Instructions:

16. Additional remarks:

17. **Cooler Information**

Cooler No	Temp °C	Condition	Seal Intact	Seal No	Seal Date	Signed By
1	5.8	Good				

Chain-of-Custody Record

Client: Hilcorp Energy Company
Attn: Mitch Killough
Mailing Address:
Phone #:
email or Fax#:
QA/QC Package:
☐ Standard ☐ Level 4 (Full Validation)
Accreditation: ☐ Az Compliance
☐ NELAC ☐ Other
☐ EDD (Type)

Turn-Around Time:
☒ Standard ☐ Rush
Project Name: Lambe 2C
Project #:
Project Manager: WSP - Danny Burns
Sampler: DB
On Ice: ☒ Yes ☐ No
# of Coolers: 1
Cooler Temp(including CF): 5.8 ± 0.5 = 5.8 (°C)

HALL ENVIRONMENTAL ANALYSIS LABORATORY
www.hallenvironmental.com
4901 Hawkins NE - Albuquerque, NM 87109
Tel. 505-345-3975 Fax 505-345-4107

Analysis Request

Date	Time	Matrix	Sample Name	Container Type and #	Preservative Type	HEAL No. 2109998	BTEX / MTBE / TMB's (8021)	TPH:8015D(GRO / DRO / MRO)	8081 Pesticides/8082 PCB's	EDB (Method 504.1)	PAHs by 8310 or 8270SIMS	RCRA 8 Metals	Cl, F, Br, NO_3, NO_2, PO_4, SO_4	8260 (VOA) VOCs	8270 (Semi-VOA)	Total Coliform (Present/Absent)	Fixed gas O_2 + CO_2
9-17-21	14:50	Air	Influent Pilot Test	2-Tedlar	—	001		X						X			X

Date:	Time:	Relinquished by:	Received by:	Via:	Date	Time
9-17-21	1600			Walk	9/17/21	1600
9/17/21	1749			Courier	9/18/21	9:00

Remarks:
cc: danny.burns@wsp.com
devin.hencmann@wsp.com
stuart.hyde@wsp.com

If necessary, samples submitted to Hall Environmental may be subcontracted to other accredited laboratories. This serves as notice of this possibility. Any sub-contracted data will be clearly notated on the analytical report.

HALL ENVIRONMENTAL ANALYSIS LABORATORY

Hall Environmental Analysis Laboratory
4901 Hawkins NE
Albuquerque, NM 87109
TEL: 505-345-3975 FAX: 505-345-4107
Website: clients.hallenvironmental.com

September 30, 2021

Mitch Killough
HILCORP ENERGY
PO Box 4700
Farmington, NM 87499
TEL: (505) 564-0733
FAX

RE: Lambe 2C OrderNo.: 2109E86

Dear Mitch Killough:

Hall Environmental Analysis Laboratory received 1 sample(s) on 9/25/2021 for the analyses presented in the following report.

These were analyzed according to EPA procedures or equivalent. To access our accredited tests please go to www.hallenvironmental.com or the state specific web sites. In order to properly interpret your results, it is imperative that you review this report in its entirety. See the sample checklist and/or the Chain of Custody for information regarding the sample receipt temperature and preservation. Data qualifiers or a narrative will be provided if the sample analysis or analytical quality control parameters require a flag. When necessary, data qualifiers are provided on both the sample analysis report and the QC summary report, both sections should be reviewed. All samples are reported, as received, unless otherwise indicated. Lab measurement of analytes considered field parameters that require analysis within 15 minutes of sampling such as pH and residual chlorine are qualified as being analyzed outside of the recommended holding time.

Please don't hesitate to contact HEAL for any additional information or clarifications.

ADHS Cert #AZ0682 -- NMED-DWB Cert #NM9425 -- NMED-Micro Cert #NM0901

Sincerely,

Andy Freeman
Laboratory Manager
4901 Hawkins NE
Albuquerque, NM 87109

Analytical Report
Lab Order **2109E86**
Date Reported: **9/30/2021**

Hall Environmental Analysis Laboratory, Inc.

CLIENT: HILCORP ENERGY
Client Sample ID: Influent MW01
Project: Lambe 2C
Collection Date: 9/24/2021 2:20:00 PM
Lab ID: 2109E86-001 **Matrix:** AIR
Received Date: 9/25/2021 8:48:00 AM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
EPA METHOD 8015D: GASOLINE RANGE						Analyst: **NSB**
Gasoline Range Organics (GRO)	880	10		µg/L	2	9/27/2021 10:38:36 AM
Surr: BFB	515	37.3-213	S	%Rec	2	9/27/2021 10:38:36 AM
EPA METHOD 8021B: VOLATILES						Analyst: **NSB**
Benzene	ND	0.20		µg/L	2	9/27/2021 10:38:36 AM
Toluene	0.94	0.20		µg/L	2	9/27/2021 10:38:36 AM
Ethylbenzene	ND	0.20		µg/L	2	9/27/2021 10:38:36 AM
Xylenes, Total	4.3	0.40		µg/L	2	9/27/2021 10:38:36 AM
Surr: 4-Bromofluorobenzene	93.6	70-130		%Rec	2	9/27/2021 10:38:36 AM

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.
D	Sample Diluted Due to Matrix
H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit
PQL	Practical Quanitative Limit
S	% Recovery outside of range due to dilution or matrix
B	Analyte detected in the associated Method Blank
E	Value above quantitation range
J	Analyte detected below quantitation limits
P	Sample pH Not In Range
RL	Reporting Limit

HALL ENVIRONMENTAL ANALYSIS LABORATORY

Hall Environmental Analysis Laboratory
4901 Hawkins NE
Albuquerque, NM 87109
TEL: 505-345-3975 FAX: 505-345-4107
Website: clients.hallenvironmental.com

Sample Log-In Check List

Client Name: HILCORP ENERGY Work Order Number: 2109E86 RcptNo: 1

Received By: **Tracy Casarrubias** 9/25/2021 8:48:00 AM

Completed By: **Juan Rojas** 9/25/2021 10:02:14 AM

Reviewed By: DAD 9/25/21

Chain of Custody

1. Is Chain of Custody complete?	Yes ☑	No ☐	Not Present ☐
2. How was the sample delivered?	Courier		

Log In

3. Was an attempt made to cool the samples?	Yes ☑	No ☐	NA ☐
4. Were all samples received at a temperature of >0° C to 6.0°C	Yes ☐	No ☐	NA ☑
5. Sample(s) in proper container(s)?	Yes ☑	No ☐	
6. Sufficient sample volume for indicated test(s)?	Yes ☑	No ☐	
7. Are samples (except VOA and ONG) properly preserved?	Yes ☑	No ☐	
8. Was preservative added to bottles?	Yes ☐	No ☑	NA ☐
9. Received at least 1 vial with headspace <1/4" for AQ VOA?	Yes ☐	No ☐	NA ☑
10. Were any sample containers received broken?	Yes ☐	No ☑	
11. Does paperwork match bottle labels? (Note discrepancies on chain of custody)	Yes ☑	No ☐	
12. Are matrices correctly identified on Chain of Custody?	Yes ☑	No ☐	
13. Is it clear what analyses were requested?	Yes ☑	No ☐	
14. Were all holding times able to be met? (If no, notify customer for authorization.)	Yes ☑	No ☐	

# of preserved bottles checked for pH: _____ (<2 or >12 unless noted)

Adjusted? _____

Checked by: TME 9.25.21

Special Handling (if applicable)

15. Was client notified of all discrepancies with this order? Yes ☐ No ☐ NA ☑

Person Notified: _____ Date _____

By Whom: _____ Via: ☐ eMail ☐ Phone ☐ Fax ☐ In Person

Regarding: _____

Client Instructions: _____

16. Additional remarks:

17. **Cooler Information**

Cooler No	Temp °C	Condition	Seal Intact	Seal No	Seal Date	Signed By
1	5.3	Good				
2	8.4	Good				

Chain-of-Custody Record

Client: Hilcorp
Mitch Killough
Mailing Address:

Phone #:
email or Fax#:
QA/QC Package:
☐ Standard ☐ Level 4 (Full Validation)
Accreditation: ☐ Az Compliance
☐ NELAC ☐ Other
☐ EDD (Type)

Turn-Around Time:
☒ Standard ☐ Rush
Project Name: Lambe 2C
Project #:
Project Manager: WSP- Danny Burns
Sampler: DB
On Ice: ☐ Yes ☐ No
# of Coolers: 2
Cooler Temp(including CF): See Remarks (°C)

HALL ENVIRONMENTAL ANALYSIS LABORATORY
www.hallenvironmental.com
4901 Hawkins NE - Albuquerque, NM 87109
Tel. 505-345-3975 Fax 505-345-4107

Analysis Request

Date	Time	Matrix	Sample Name	Container Type and #	Preservative Type	HEAL No. 2109E86	BTEX / MTBE / TMB's (8021)	TPH:8015D(GRO / DRO / MRO)	8081 Pesticides/8082 PCB's	EDB (Method 504.1)	PAHs by 8310 or 8270SIMS	RCRA 8 Metals	Cl, F, Br, NO_3, NO_2, PO_4, SO_4	8260 (VOA)	8270 (Semi-VOA)	Total Coliform (Present/Absent)
9-24-21	1420	Air	Influent MW01	1-Tedlar	—	-001	X	X								

Date:	Time:	Relinquished by:	Received by:	Via:	Date	Time
9-24-21	1730			courier	9.25.21	8:48
Date:	Time:	Relinquished by:	Received by:	Via:	Date	Time

Remarks:
cooler 1: 5.3 -Ø = 5.3
cooler 2: 8.4 -Ø = 8.4

If necessary, samples submitted to Hall Environmental may be subcontracted to other accredited laboratories. This serves as notice of this possibility. Any sub-contracted data will be clearly notated on the analytical report.

ENCLOSURE D – O&M FORM AND MANUAL

SVE SYSTEM
BIWEEKLY O&M FORM

DATE: _____ O&M PERSONNEL: _____

TIME ONSITE: _____ TIME OFFSITE: _____

SVE SYSTEM

SVE STATUS: _____ SVE BLOWER HOURS: _____

GENERATOR HOURS: _____

SVE ALARMS: (check if applicable)		
		HIGH/LOW VACUUM
		KO TANK HIGH LEVEL
		HIGH EXHAUST TEMPERATURE

MANIFOLD INLET VACUUM: _____ KO TANK DRAIN: _____

AFTER FILTER VACUUM: _____ BYPASS STATUS: _____

EXHAUST TEMPERATURE: _____ BLOWER GREASE: _____

EXHAUST PRESSURE: _____ GENERATOR GREASE: _____

EXHAUST FLOW: _____ INLINE FILTER CLEAN: _____

SVE SYSTEM

EXHAUST PID: _____ AIR SAMPLE COLLECTION: _____

MANIFOLD	VACUUM (IWC)	PID HEADSPACE (PPM)	FLOW (CFM)	ADJUSTMENTS
INLET				

COMMENTS/OTHER MAINTENANCE:

OPERATIONS AND MAINTENANCE MANUAL

SAN JUAN BASIN, NEW MEXICO SVE SYSTEMS

OCTOBER 2021

Prepared for:

HILCORP ENERGY COMPANY
1111 TRAVIS STREET
HOUSTON, TEXAS

Prepared by:

WSP USA, INC
848 EAST 2ND AVENUE
DURANGO, COLORADO
(970) 385-1096

SECTION 1.0

INTRODUCTION

1.0 INTRODUCTION

This Operations and Maintenance (O&M) Manual has been prepared for the Hilcorp Energy Company (Hilcorp) for the purpose of successfully operating the soil vapor extraction (SVE) systems remediating subsurface hydrocarbon impacts in the San Juan Basin, New Mexico. The O&M manual is the base guide for all O&M personnel to follow at sites throughout the basin. This O&M manual is intended to serve as a guide to assist in the routine day-to-day operation and maintenance of the remediation systems. This manual also outlines the remediation system monitoring schedules to comply with regulatory agencies and to document the effectiveness of the systems. Successful operation of the systems will ensure that the environment is protected, the public welfare is promoted, and that federal/state and local laws/regulations are met.

1.2 SVE Process Equipment

A vacuum is applied to the wells and subsurface piping using a regenerative blower system electrified either by solar panels and batteries or directly connected to the power grid. Each system includes a manifold to control flow from each well or group of wells, and the SVE blower system. The manifold includes control valves, sample ports, and a tap plug for obtaining air velocity measurements in the individual lines. The initial flow and applied vacuum settings will be determined during pilot testing, system startup, and initial O&M procedures. As subsurface conditions change, adjustment of the flow rates and applied vacuum to each SVE well may be required. Typically, adjustments will be required to balance the air flowing from the various wells.

Starting from the manifold, the SVE skid generally contains:

- a control valve;
- a vacuum indicator;
- a sample port;
- an air/water separator with storage tank, fluid sight tube and fluid level switch;
- an additional vacuum indicator;
- a dilution air valve;
- a particulate filter;
- a vacuum relief valve;
- a regenerative blower driven by an electric motor;

- a high temperature switch;
- a temperature indicator;
- a pressure indicator;
- a SVE stack drain/sampling valve; and
- a flow indicator.

An SVE system diagram is attached.

SECTION 2.0

SYSTEM OPERATION

Operational procedures are summarized below. These procedures describe the adjustments needed for full system operation. Manufacturer's information for the specific system components shall be examined when seeking information regarding a particular system component. The equipment supplier provided O&M Manuals should also be consulted during operation and maintenance procedures.

2.1 ROUTINE O&M SITE VISITS

O&M site visits will occur as needed to achieve near continuous operation of the systems. Typically, system operation checks will be performed every other weekly (twice monthly). Site visits which shall include more involved tasks will be performed monthly, quarterly, semi-annually, annually, and on an as-needed basis. Specific O&M tasks have been determined for each of the above frequencies, and these tasks should be used as a reference guide for determining what actions are necessary for proper system operation. The O&M tasks are summarized on the site specific Monitoring Schedules. The monitoring schedule indicates the frequency required for each of the O&M tasks. The monitoring schedule also shows the monitoring required at individual wells.

Records kept during the O&M procedures shall be recorded in a field book and scanned onto the WSP server each day after returning to the office. WSP will review the site data and log book prior to each site visit to determine what O&M actions occurred during the last site visit and identify any special equipment or maintenance actions required for the planned site visit.

Semi-Monthly System Check

A typical system check during the weekly O&M site visit will consist of the following tasks, in sequential order beginning with arrival on site:

1. Note if the systems are running.
2. Inspect the control panel to determine if any alarms have occurred (if applicable).
3. Record any alarm conditions and the hour meter values for applicable remediation equipment onsite.
4. Note the inlet vacuum for the SVE blower.
5. Record all gauge and flow indicator values for the SVE system.
6. Record vacuum or pressure readings on the manifold assembly and perform minor valve adjustments as needed to optimize system operation.
7. Check air/water separation tank levels and transfer fluid as needed.

8. Lubricate the appropriate generators and blowers, check and add oil/grease as required.
9. Examine/check operation of building heaters and exhaust fans (if applicable).
10. Perform simple adjustments to correct any system operational problems.
11. Perform general housekeeping inside and outside of the equipment area, such as picking up trash or debris surrounding the site. Note any damage or vandalism requiring attention.
12. Collect influent samples per quarterly and annual requirements.

Monthly System Checks

Monthly site visits shall include the following additional efforts:

1. Collect any required air samples.
2. Monitor the SVE exhaust using a photoionization detector (PID).
3. Following the recording of measurements, adjustments of system operation may be made based on the measurements.
4. Perform any required equipment maintenance (See O&M Manual for specific maintenance requirements).
5. Check and clean filters.

Quarterly Site Checks

Quarterly site visits shall include:

1. Measure and record vacuum in each SVE line.
2. Measure and adjust vacuum and measure vapor concentrations using a PID at the SVE wellheads.
3. Clean and replace filters as required by manufacturer's O&M manual or as needed through visual inspection, and perform all required maintenance items, as required.
4. Clean all fluid level switches.
5. Change and check oil and oil filters, where applicable.

Semi-annual System Checks

Semi-annual site visits shall include:

1. Change generator and SVE blower oil. Replace with oil recommended by the equipment manufacturer or equivalent.

2. Tighten all wire terminals and check connections.

Annual

Annual requirements include:

1. Replace SVE blower air inlet filter elements.

Periodic

The following items will need to be conducted as remediation progresses. The timing of these activities is site dependent and cannot be predicted. These activities shall be performed as soon as possible following discovery of conditions affecting or limiting system performance.

1. Drain the SVE air/water separation or knockout (KO) tank fluid.

2. Clean sludge from the SVE air/water separation tanks.

2.2 SVE SYSTEM PERFORMANCE ADJUSTMENTS

On a routine basis, WSP will evaluate site monitoring data and may complete performance adjustments to the remediation system operation. It may be beneficial to adjust the remediation system's operation over time, and as specific areas of a site require less effort than other areas. Remediation efforts will be characterized by system monitoring information.

For example, as the concentration of contaminants in SVE wells decreases to asymptotic conditions, flow and vacuum in these areas may be adjusted in attempts to increase volatilization and contaminant removal. Additionally, as contaminant concentrations decrease to below 1 milligram per liter (mg/L), flow in individual SVE wells may be decreased and/or shut off to induce higher flow in other wells and target specific areas of the site.

2.2.1 SVE Flow Adjustment

Proper operation of the SVE systems entails applying an optimum vacuum at the screened interval of the SVE well such that the maximum air flow rate through the well is achieved. The SVE systems are designed to run at a specific vacuum and air flow rate, however, due to variable subsurface conditions, the air flow through the subsurface may need to be reduced by opening the blower inlet bypass valve and/or restricting flow from certain wells.

The air flow rate may be measured at the flow lines using a portable air velocity device, such as a thermal anemometer. The air flow rate and applied vacuum can be adjusted by opening/closing ball valves on the individual lines. Typically, these adjustments will be made quarterly. Ideal operation of the SVE system entails balancing flow rates from each well. To balance flow from all SVE wells, minor calculations may be required for sites with different sizes of SVE lines.

To balance the SVE system, follow the following procedure:

1. Measure the air velocity in each line using the thermal anemometer.

2. Calculate the total flow from the SVE wells using the equation Flowrate = Cross Sectional Area X Velocity. Area for the SVE pipes is calculated using the formula Area = π * Diameter^2 / 4.

3. Divide the total flow by the number of wells to be balanced. This number equals the average flow rate.

4. Back calculate the air velocity required to achieve the average flowrate for each pipe size using the equation: Velocity = Average Flowrate / Area.

5. Starting at the well yielding the highest flowrate, use the control valve for each line to reduce the flowrate to the average flowrate by lowering the air velocity measured with the thermal anemometer to the velocity calculated in Step #4.

6. Check lower flow wells to ensure an increase in airflow.

Note that the thermal anemometer yields a rough field estimate, and there may be a large inaccuracy inherent to the instrument. It is therefore only necessary to achieve a balance within 25% of the average flowrate. The system will also change flows as the higher flow wells are reduced and system vacuum is increased. This is another reason why it is not necessary to balance the SVE wells to closer than 25% of the calculated average flow. Also note that most SVE systems have the same sized pipes for all SVE lines, which allows for fewer calculations when balancing the SVE system.

For sites with the same size SVE lines, the average flowrate calculation and velocity back calculations are not necessary. Rather, measure the velocity from each well, calculate the average velocity, and attempt to achieve the average velocity from each well by reducing flow/velocity from the higher flow wells. As with the flowrate calculation method, velocities within 25% of the average velocity do not need adjustment.

District I
1625 N. French Dr., Hobbs, NM 88240
Phone:(575) 393-6161 Fax:(575) 393-0720
District II
811 S. First St., Artesia, NM 88210
Phone:(575) 748-1283 Fax:(575) 748-9720
District III
1000 Rio Brazos Rd., Aztec, NM 87410
Phone:(505) 334-6178 Fax:(505) 334-6170
District IV
1220 S. St Francis Dr., Santa Fe, NM 87505
Phone:(505) 476-3470 Fax:(505) 476-3462

State of New Mexico
Energy, Minerals and Natural Resources
Oil Conservation Division
1220 S. St Francis Dr.
Santa Fe, NM 87505

CONDITIONS

Action 54558

CONDITIONS

Operator: HILCORP ENERGY COMPANY 1111 Travis Street Houston, TX 77002	OGRID: 372171
	Action Number: 54558
	Action Type: [C-141] Release Corrective Action (C-141)

CONDITIONS

Created By	Condition	Condition Date
nvelez	Accepted for the record. See App ID 124692 for most updated status. Site Assessment/Characterization & Remediation Plan addressed on 09/09/2019.	9/27/2022