Souder, Miller & Associates♦201 S. Halagueno St.♦Carlsbad, NM 88220
(575) 689-8801

April 10, 2019

#5E27962-BG3

NMOCD District 2
811 S. First St.
Artesia, NM 88210

SUBJECT: Remediation Closure Report for the Wolfman 5/4 WOLI Fed Com #1H Release (2RP-5250), Eddy County, New Mexico

To Whom It May Concern:

On behalf of Mewbourne Oil , Souder, Miller & Associates (SMA) has prepared this Remediation Closure Report that describes the remediation of a release of liquids related to oil and gas production activities at the Wolfman 5/4 WOLI Fed Com #1H site. The site is in Unit L, Section 5, Township 23S, Range 27E, Eddy County, New Mexico, on state land. Figure 1 illustrates the vicinity and site location on an USGS 7.5-minute quadrangle map.

Table 1 summarizes release information and Closure Criteria.

Table 1: Release Information and Closure Criteria			
Name	Wolfman 5/4 WOLI Fed Com #1H	Company	Mewbourne Oil Company
API Number	30-015-44544	Location	32.310447, -104.212380
Incident Number	2RP-5250		
Estimated Date of Release	February 12, 2019	Date Reported to NMOCD	February 18, 2019
Land Owner	State	Reported To	NMOCD District 2
Source of Release	Punctured 4” poly line		
Released Volume	10 bbls	Released Material	Produced Water
Recovered Volume	N/A	Net Release	10 bbls
NMOCD Closure Criteria	>100 feet to groundwater		
SMA Response Dates	February 24, 2019, March 18 & 26, 2019		

1.0 Background

On February 12, 2019, a release was discovered in the pasture, due to a 4" poly line being punctured that ties into the Wolfman 5/4 WOLI Fed Com #1H site. Initial response activities were conducted by the operator, and included source elimination and site stabilization activities, which led to the excavation of the release area to 2-3 feet bgs. Figures 1 and 2 illustrates the vicinity and site location. Figure 3 illustrates the site and sample locations. The C-141 form is included in Appendix A.

2.0 Site Information and Closure Criteria

The Wolfman 5/4 WOLI Fed Com #1H is located approximately 5.53 miles southeast of Carlsbad, New Mexico on state land at an elevation of approximately 3,176 feet above mean sea level (amsl).

Based upon New Mexico Office of State Engineer (NMOSE) online water well database (Appendix B), depth to groundwater in the area is estimated to be 161 feet below grade surface (bgs). There is 1 known water sources within ½-mile of the location, according to the NMOSE (https://gis.ose.state.nm.us/gisapps/ose_pod_locations/; accessed 4/10/2019) The nearest significant watercourse is the Pecos River, located approximately 6.2 miles to the northeast. Figure 2 illustrates the site with 100, 200 and 300-foot radii to indicate that it does not lie within a sensitive area as described in 19.15.29.12.C(4) NMAC.

Based on the information presented herein, the applicable NMOCD Closure Criteria for this site is for a groundwater depth of greater than 100 feet bgs. The site has been restored to meet the standards of Table I of 19.15.29.12 NMAC.

Table 2 demonstrates the Closure Criteria applicable to this location. Pertinent well data is attached in Appendix B.

3.0 Release Characterization and Remediation Activities

On February 24, 2019, SMA personnel arrived on site in response to the release associated with the Wolfman 5/4 WOLI Fed Com #1H. SMA performed site delineation activities by collecting soil samples in the excavated release area.

A total of five sample locations (BH1-BH5) were investigated using a hand-auger at the various depths of the excavation (2-3 ft bgs.). A total of 5 samples were collected for laboratory analysis for total chloride using EPA Method 300.0; benzene, toluene, ethylbenzene and total xylenes (BTEX) using EPA Method 8021B; and motor, diesel and gasoline range organics (MRO, DRO, and GRO) by EPA Method 8015D.

As summarized in Table 3 and Figure 3, results indicated that the approximately 2,100 square-foot area remained impacted with hydrocarbons and further excavation was recommended.

On March 18, 2019, SMA returned to the site to oversee the excavation of remaining contaminated soil. SMA guided the excavation activities by collecting soil samples for total chloride using EPA Method 300.0. The entire release area was excavated to the depth of 4 feet bgs. The walls and base were excavated until field screening results indicated that the NMOCD Closure Criteria would be met. NMOCD was notified on March 21, 2019 that closure samples were expected to be collected in two (2) business days.

On March 26, 2019, SMA conducted confirmation sampling of the walls and base of the excavation. The confirmation samples were collected from within the excavation in accordance with a systematic sampling approach as defined by SW846 using Gilbert, 1987 equation 5.2.3 for Stratified Random Sampling which

is detailed in Appendix C. This systematic method meets the EPAs data quality assessment standards (DQA) for composite sampling as defined by (Myers 1997) using confirmation samples were comprised of five-point composites of the base (BH6-BH9) and walls (SW C1-SW C4).

A total of eight samples were collected for laboratory analysis for total chloride using EPA Method 300.0; benzene, toluene, ethylbenzene and total xylenes (BTEX) using EPA Method 8021B; and motor, diesel and gasoline range organics (MRO, DRO, and GRO) by EPA Method 8015D. Samples were placed into laboratory supplied glassware, labeled, and maintained on ice until delivery to Hall Environmental Analysis Laboratory in Albuquerque, New Mexico (Appendix D).

Figure 3 shows the extent of the excavation and sample locations. All laboratory results are summarized in Table 3. Laboratory reports are included in Appendix D.

In addition to meeting the Closure Criteria, the top four (4) feet of impacted areas meet the Reclamation requirement of 19.15.29.13(D)(1). A total of 538 yards of contaminated soils were removed and replaced with clean backfill material to return the surface to previous contours. The contaminated soil was transported and disposed of at R360, an NMOCD permitted disposal facility.

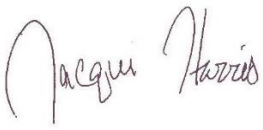
4.0 Scope and Limitations

The scope of our services included: assessment sampling; verifying release stabilization; regulatory liaison; remediation; and preparing this closure report. All work has been performed in accordance with generally accepted professional environmental consulting practices for oil and gas releases in the Permian Basin in New Mexico.

If there are any questions regarding this report, please contact either Jacqui Harris at 575-496-0780 or Shawna Chubbuck at 505-325-7535.

Submitted by:
SOUDER, MILLER & ASSOCIATES

Reviewed by:



Jacqui Harris
Project Manager

Shawna Chubbuck
Senior Scientist

ATTACHMENTS:

Figures:

Figure 1: Vicinity and Well Head Protection Map
Figure 2: Surface Water Radius Map
Figure 3: Site and Sample Location Map

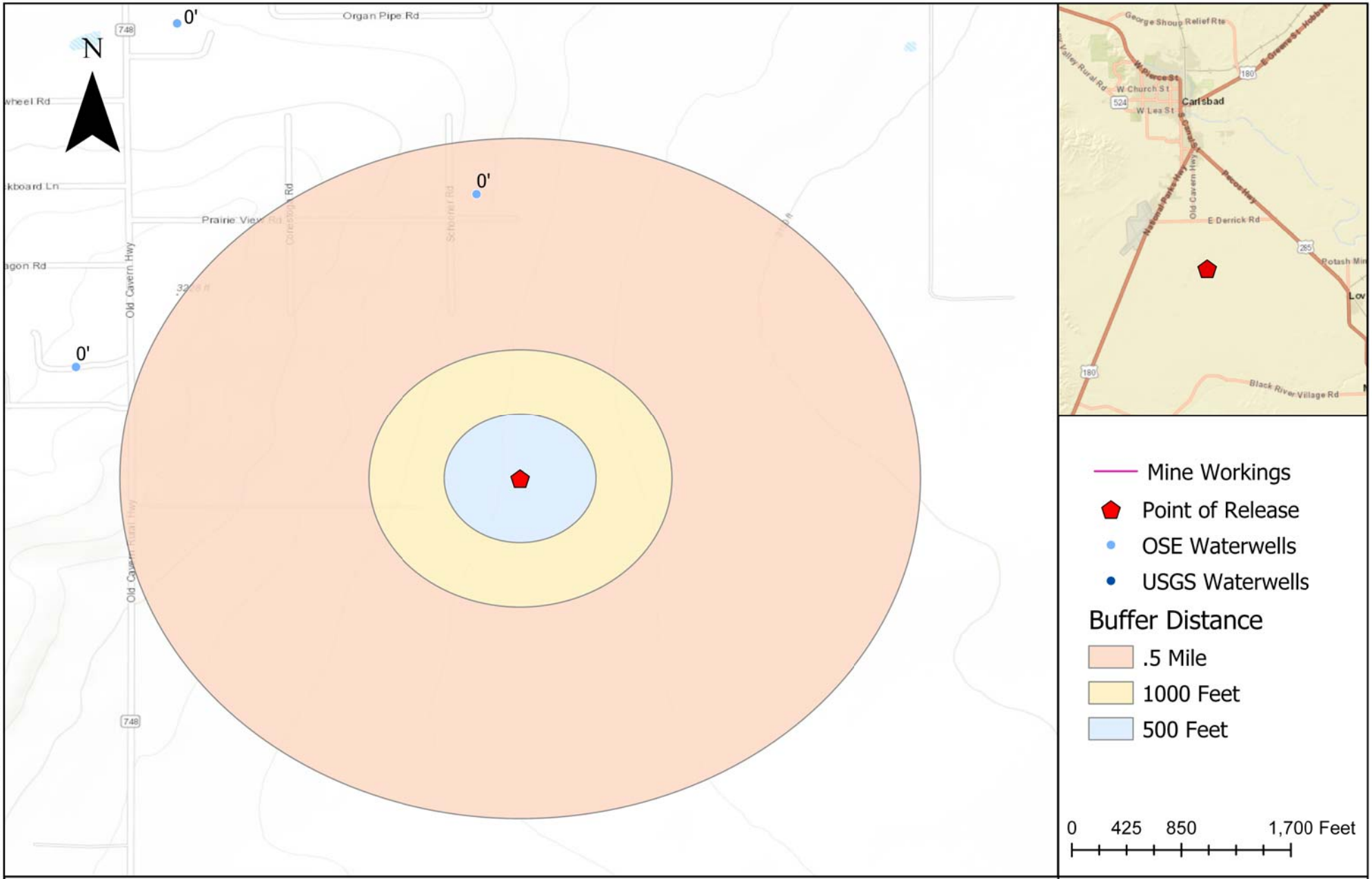
Tables:

Table 2: NMOCD Closure Criteria Justification
Table 3: Summary of Sample Results

Appendices:

Appendix A: Initial and Final C141
Appendix B: NMOSE Wells Report
Appendix C: VSP Sampling Procedure
Appendix D: Laboratory Analytical Reports
Appendix E: Open Excavation Photo

FIGURES



Regional Vicinity & Wellhead Protection Map
Wolfman 54 WOLI Fed Com #1H-Mewbourne

Figure 1

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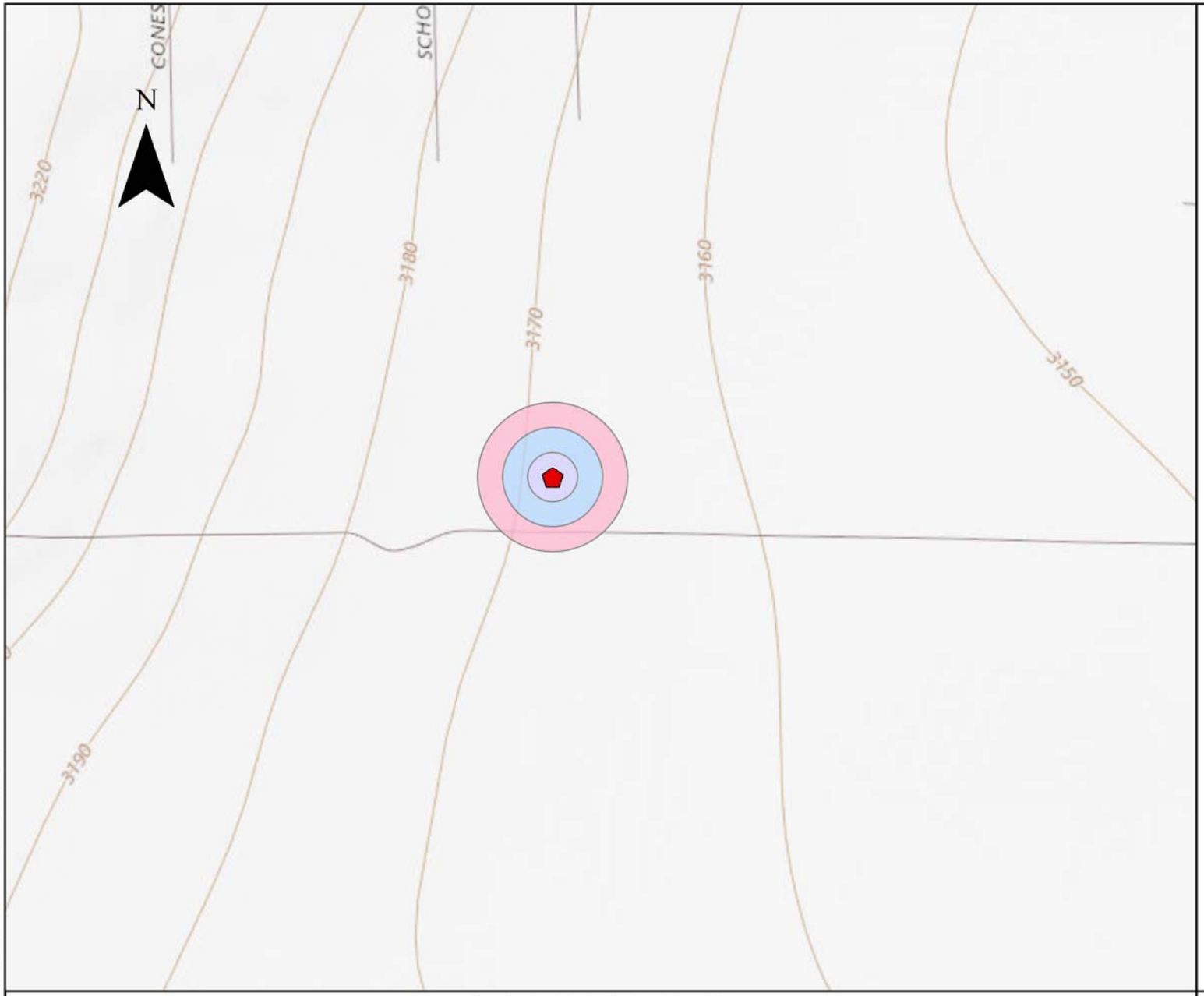
Date Saved: 2/26/2019

Revisions
By: _____ Date: _____ Descr: _____
By: _____ Date: _____ Descr: _____

Drawn	JVH
Date	2/26/2019
Checked	
Approved	

SMA

201 South Halaguena Street
Carlsbad, New Mexico 88221
(575) 689-7040
Serving the Southwest & Rocky Mountains



Point of Release
Springs Seeps
Streams Canals
Rivers
NM Wetlands
Lakes Playas
FEMA Flood Zones 2011

Buffer Distance
100 Feet
200 Feet
300 Feet

0 425 850 1,700 Feet

Surface Water Protection Map
Wolfman 54 WOLI Fed Com #1H-Mewbourne
Eddy County, NM

Figure 2

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Date Saved: 2/26/2019

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By: Date: Descr:

Drawn JVH
Date 2/26/2019
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Site and Sample location Map

Mewbourne-Wolfman 5/4 WOLI Fed Com #1H
Unit L, Sec. 5, T23S, R27E, Eddy County

Figure 3

P:\5-Mewbourne 2019 MSA (5E27962)\GIS\ARCGIS\MEWBOURNE_MIT.aprx

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Drawn LRB
Date 4/4/2019
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TABLES

Site Information (19.15.29.11.A(2, 3, and 4) NMAC)		Source/Notes
Depth to Groundwater (feet bgs)	122	
Hortizontal Distance From All Water Sources Within 1/2 Mile (ft)	2,243	OSE well
Hortizontal Distance to Nearest Significant Watercourse (ft)	6,348	Pecos River

Closure Criteria (19.15.29.12.B(4) and Table 1 NMAC)						
Depth to Groundwater		**Closure Criteria (units in mg/kg)**				
		Chloride *numerical limit or background, whichever is greater	**TPH**	**GRO + DRO**	**BTEX**	**Benzene**
< 50' BGS		600	100		50	10
51' to 100'		10000	2500	1000	50	10
>100'	X	20000	2500	1000	50	10
Surface Water	**yes or no**	**if yes, then**				
<300' from continuously flowing watercourse or other significant watercourse?	NO	600	100		50	10
<200' from lakebed, sinkhole or playa lake?	NO					
Water Well or Water Source						
<500 feet from spring or a private, domestic fresh water well used by less than 5 households for domestic or stock watering purposes?	NO					
<1000' from fresh water well or spring?	NO					
Human and Other Areas						
<300' from an occupied permanent residence, school, hospital, institution or church?	NO					
within incorporated municipal boundaries or within a defined municipal fresh water well field?	NO					
<100' from wetland?	NO					
within area overlying a subsurface mine	NO					
within an unstable area?	NO					
within a 100-year floodplain?	NO					

Sample ID	Sample Date	Depth (feet bgs)	Action Taken	BTEX mg/Kg	Benzene mg/Kg	GRO mg/Kg	DRO mg/Kg	MRO mg/Kg	**Total TPH** mg/Kg	Cl- mg/Kg
NMOCD Closure Criteria				50	10	1000			2500	20000
BH 1	2/24/2019	3'	Excavated	<0.222	<0.025	21	760	310	1091	8400
BH 2	2/24/2019	2'	Excavated	<0.215	<0.024	16	1300	590	1906	13000
BH 3	2/24/2019	3'	Excavated	<0.217	<0.024	30	1900	760	2690	9400
BH 4	2/24/2019	2.5'	Excavated	<0.208	<0.023	27	900	370	1297	9300
BH 5	2/24/2019	2.5'	Excavated	<0.219	<0.024	<4.9	<9.8	<49	<63.7	13000
BH 6	3/26/2019	4	Excavated	<0.208	<0.023	<4.6	<9.5	<48	<62.1	2100
BH 7	3/26/2019	4	Excavated	<0.208	<0.023	<4.6	<9.8	<49	<63.4	3100
BH 8	3/26/2019	4	Excavated	<0.215	<0.024	<4.8	<9.8	<49	<63.6	12000
BH 9	3/26/2019	4	Excavated	<0.211	<0.023	<4.7	<10	<50	<64.7	14000
SW C-1	3/26/2019	0-4	Excavated	<0.221	<0.025	<4.9	<10	<50	<64.9	240
SW C-2	3/26/2019	0-4	Excavated	<0.224	<0.025	<5.0	<9.7	<49	<63.7	<60
SW C-3	3/26/2019	0-4	Excavated	<0.216	<0.024	<4.8	<9.9	<49	<63.7	<60
SW C-4	3/26/2019	0-4	Excavated	<0.221	<0.025	<4.9	<10	<50	<64.9	160

"--" = Not Analyzed
* = per Reclamation Standard (19.15.29.13.D(1) NMAC)

APPENDIX A
INITIAL AND FINAL C141

District I
1625 N. French Dr., Hobbs, NM 88240
District II
811 S. First St., Artesia, NM 88210
District III
1000 Rio Brazos Road, Aztec, NM 87410
District IV
1220 S. St. Francis Dr., Santa Fe, NM 87505

State of New Mexico
Energy Minerals and Natural Resources Department

Oil Conservation Division
1220 South St. Francis Dr.
Santa Fe, NM 87505

Form C-141
Revised August 24, 2018
Submit to appropriate OCD District office

Incident ID	NAB1905044037
District RP	2RP-5250
Facility ID	
Application ID	pAB1905043603

Release Notification

Responsible Party

Responsible Party: Mewbourne Oil Company	OGRID: 14744
Contact Name: Zack Thomas	Contact Telephone: 575-602-2188
Contact email: zthomas@mewbourne.com	Incident # *(assigned by OCD)* NAB1905044037
Contact mailing address: P.O. Box 5270, Hobbs, NM 88240	

Location of Release Source

Latitude 32.310447 Longitude -104.212380
(NAD 83 in decimal degrees to 5 decimal places)

Site Name: Wolfman 5/4 W0LI Fed Com #1H	Site Type: Oil Well
Date Release Discovered: 2-12-19	API# *(if applicable): 30-015-44544*

Unit Letter	Section	Township	Range	County
L	5	23S	27E	Eddy

Surface Owner: ☒ State ☐ Federal ☐ Tribal ☐ Private (*Name:* _____)
x FEDERAL WELL
AB

Nature and Volume of Release

Material(s) Released (Select all that apply and attach calculations or specific justification for the volumes provided below)

☐ Crude Oil	Volume Released (bbls)	Volume Recovered (bbls)
☒ Produced Water	Volume Released (bbls) 10 bbls	Volume Recovered (bbls) N/A
	Is the concentration of dissolved chloride in the produced water >10,000 mg/l?	☒ Yes ☐ No
☐ Condensate	Volume Released (bbls)	Volume Recovered (bbls)
☐ Natural Gas	Volume Released (Mcf)	Volume Recovered (Mcf)
☐ Other (describe)	Volume/Weight Released (provide units)	Volume/Weight Recovered (provide units)

Cause of Release
A 4" poly line used to transfer produced water from the Wolfman to the Top Gun SWD was punctured by an unknown source causing the release.

State of New Mexico
Oil Conservation Division

Incident ID	NAB1905044037
District RP	2RP-5250
Facility ID	
Application ID	pAB1905043603

Was this a major release as defined by 19.15.29.7(A) NMAC? ☐ Yes ☒ No	If YES, for what reason(s) does the responsible party consider this a major release?
If YES, was immediate notice given to the OCD? By whom? To whom? When and by what means (phone, email, etc)?	

Initial Response

The responsible party must undertake the following actions immediately unless they could create a safety hazard that would result in injury

☒ The source of the release has been stopped.
☒ The impacted area has been secured to protect human health and the environment.
☒ Released materials have been contained via the use of berms or dikes, absorbent pads, or other containment devices.
☒ All free liquids and recoverable materials have been removed and managed appropriately.

If all the actions described above have not been undertaken, explain why:

Per 19.15.29.8 B. (4) NMAC the responsible party may commence remediation immediately after discovery of a release. If remediation has begun, please attach a narrative of actions to date. If remedial efforts have been successfully completed or if the release occurred within a lined containment area (see 19.15.29.11(A)(5)(a) NMAC), please attach all information needed for closure evaluation.

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: Zack Thomas Title: Environmental Representative

Signature: Z. Thomas Date: 2-18-19

email: zthomas@mewbourne.com Telephone: 575-602-2188

OCD Only

Received by: Amalia Barrameda Date: 2/19/2019

State of New Mexico
Oil Conservation Division

Incident ID	
District RP	(2RP-5250)
Facility ID	
Application ID	

Closure

The responsible party must attach information demonstrating they have complied with all applicable closure requirements and any conditions or directives of the OCD. This demonstration should be in the form of a comprehensive report (electronic submittals in .pdf format are preferred) including a scaled site map, sampling diagrams, relevant field notes, photographs of any excavation prior to backfilling, laboratory data including chain of custody documents of final sampling, and a narrative of the remedial activities. Refer to 19.15.29.12 NMAC.

Closure Report Attachment Checklist: ***Each of the following items must be included in the closure report.***

☒ A scaled site and sampling diagram as described in 19.15.29.11 NMAC

☒ Photographs of the remediated site prior to backfill or photos of the liner integrity if applicable (Note: appropriate OCD District office must be notified 2 days prior to liner inspection)-

☒ Laboratory analyses of final sampling (Note: appropriate ODC District office must be notified 2 days prior to final sampling)

☒ Description of remediation activities

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. The responsible party acknowledges they must substantially restore, reclaim, and re-vegetate the impacted surface area to the conditions that existed prior to the release or their final land use in accordance with 19.15.29.13 NMAC including notification to the OCD when reclamation and re-vegetation are complete.

Printed Name: Zack Thomas Title: Environmental Representative

Signature: Z. Thomas Date: 4-5-19

email: zthomas@mewbourne.com Telephone: 575-393-5905

OCD Only

Received by: _____ Date: _____

Closure approval by the OCD does not relieve the responsible party of liability should their operations have failed to adequately investigate and remediate contamination that poses a threat to groundwater, surface water, human health, or the environment nor does not relieve the responsible party of compliance with any other federal, state, or local laws and/or regulations.

Closure Approved by: _____ Date: _____

Printed Name: _____ Title: _____

APPENDIX B
NMOSE WELLS REPORT

New Mexico Office of the State Engineer
Water Column/Average Depth to Water

(A CLW##### in the POD suffix indicates the POD has been replaced & no longer serves a water right file.)

(R=POD has been replaced, O=orphaned, C=the file is closed)

(quarters are 1=NW 2=NE 3=SW 4=SE)
(quarters are smallest to largest) (NAD83 UTM in meters) (In feet)

POD Number	POD Sub-basin Code	County	Q 64	Q 16	Q 4	Sec	Tws	Rng	X	Y	Distance	Depth Well	Depth Water	Water Column
C 01618	C	ED	4	4	4	07	23S	27E	573252	3575384*	930	250		

Average Depth to Water: --

Minimum Depth: --

Maximum Depth: --

Record Count: 1

UTMNAD83 Radius Search (in meters):

Easting (X): 574144.17 **Northing (Y):** 3575119.65 **Radius:** 1000

***UTM location was derived from PLSS - see Help**

New Mexico Office of the State Engineer
Water Column/Average Depth to Water

(A CLW##### in the POD suffix indicates the POD has been replaced & no longer serves a water right file.)

(R=POD has been replaced, O=orphaned, C=the file is closed)

(quarters are 1=NW 2=NE 3=SW 4=SE)
(quarters are smallest to largest) (NAD83 UTM in meters) (In feet)

POD Number	Code	POD Sub-basin	County	Q 64	Q 16	Q 4	Sec	Tws	Rng	X	Y	Distance	Depth Well	Depth Water	Water Column
C 01618		C	ED	4	4	4	07	23S	27E	573252	3575384*	929	250		
C 03005		C	ED	3	4	4	07	23S	27E	573052	3575384*	1123	140	100	40
C 01632		C	ED	3	2	4	07	23S	27E	573050	3575789*	1280	162	100	62
C 01632 CLW197648	O	C	ED	3	2	4	07	23S	27E	573050	3575789*	1280	162	100	62
C 01632 POD2		C	ED	3	2	4	07	23S	27E	573050	3575789*	1280	173	100	73
C 01071		C	ED			1	08	23S	27E	573751	3576499*	1427	279	95	184
C 02191		C	ED			1	08	23S	27E	573751	3576499*	1427	252	75	177
C 03301		C	ED	3	3	4	07	23S	27E	572597	3575268	1554	375		
C 04044 POD1		CUB	ED	3	2	3	09	23S	27E	575504	3575907	1566	290	150	140
C 03892 POD1		C	ED	1	2	1	08	23S	27E	573846	3576764	1665	148	54	94
C 02510		C	ED	1	2	1	08	23S	27E	573848	3576806*	1705	350	350	0
C 02326		C	ED			2	07	23S	27E	572948	3576491*	1815	140	99	41

Average Depth to Water: **122 feet**

Minimum Depth: **54 feet**

Maximum Depth: **350 feet**

Record Count: 12

UTMNAD83 Radius Search (in meters):

Easting (X): 574145.3407053011 **Northing (Y):** 3575126.6733355266 **Radius:** 2000

***UTM location was derived from PLSS - see Help**

APPENDIX C
VSP SAMPLING PROCEDURE

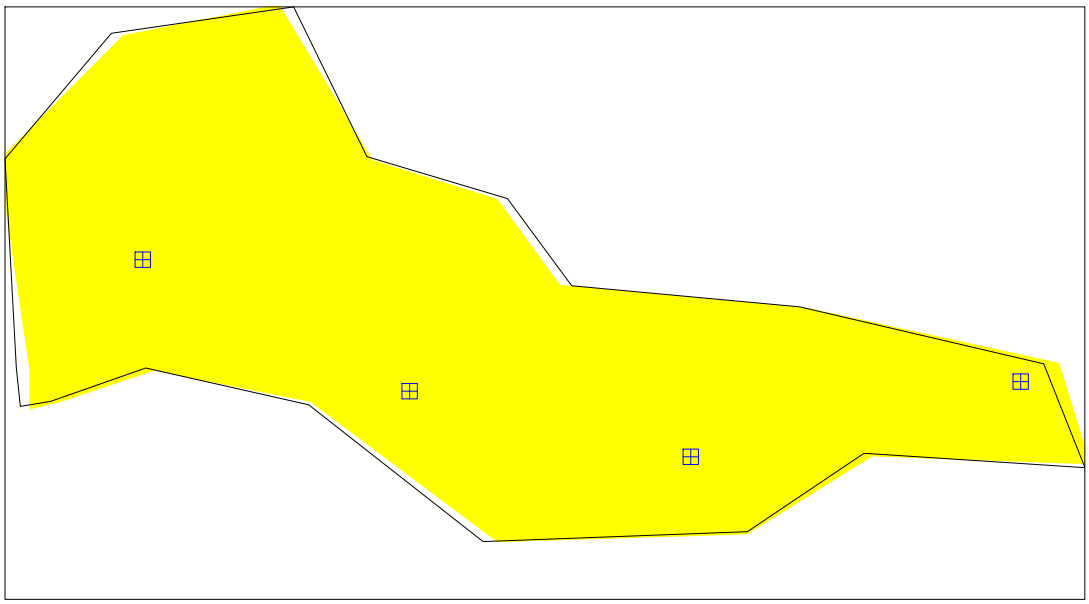
VSP Sample Design Report for Using Stratified Sampling to Estimate the Population Proportion

Summary

This report summarizes the stratified sampling design used, associated statistical assumptions, as well as general guidelines for conducting post-sampling data analysis. Sampling plan components presented here include how many sampling locations to choose and where within the sampling area to collect those samples. The type of medium to sample (i.e., soil, groundwater, etc.) and how to analyze the samples (in-situ, fixed laboratory, etc.) are addressed in other sections of the sampling plan. It is important to note that the decision for sample size calculation is determined for the combined strata, rather than any individual strata.

The following table summarizes the proportion stratified sampling design developed. A figure that shows sampling locations in the field and a table that lists sampling location coordinates are also provided below.

SUMMARY OF SAMPLING DESIGN	
Primary Objective of Design	Estimate the population proportion of all strata combined
Criteria for Determining Total Number of Samples	Achieve pre-specified precision of the estimated proportion for specified stratum costs, but no restriction on total costs
Sample Placement (Location) in the Field	Random sampling within grids within each stratum
Formula for calculating number of sampling locations	From Gilbert (1987, page 51)
Method for calculating number of sampling locations in each stratum	Optimal Allocation
Calculated total number of samples	4
Stratum 1	4
Total area of all strata	280.30 ft^2



Area: Area 1

X Coord	Y Coord	Label	Value	Type	Historical	Sample Area
-11600857.8193	3804133.5919			Random in Grid		
-11600848.8073	3804131.4881			Random in Grid		
-11600838.2326	3804133.9011			Random in Grid		
-11600866.3715	3804137.8076			Random in Grid		

Primary Sampling Objective
The primary purpose of sampling at this site is to estimate the proportion for the entire site, i.e., for all strata combined, such that the estimated proportion has the minimum possible standard deviation under the condition that the sampling and measurement costs cannot exceed a specified amount. Preexisting information was used to divide the site into 1 non-overlapping strata that were expected to be more homogeneous internally than for the entire site (all strata combined). The expected variability of values within each stratum was estimated or approximated, and the stratum weights, W_h, were determined so that the total number of samples could be allocated appropriately among the strata.

Number of Total Samples: Calculation Equation and Inputs
The total number of samples is computed to achieve the pre-specified precision of the estimated population proportion for specified stratum costs, but no restriction on total costs. *Note that the calculation is for the total number of samples, i.e., for combined strata, rather than individual strata.*

The formula used to calculate the total number of samples is:

$$n = \frac{\left(\sum_{h=1}^{L} W_h \sqrt{P_h(1-P_h)}\sqrt{c_h}\right)\sum_{h=1}^{L} \frac{W_h \sqrt{P_h(1-P_h)}}{\sqrt{c_h}}}{V + \frac{1}{N}\sum_{h=1}^{L} W_h P_h (1-P_h)}$$

where
L is the number of strata, $h=1,2,...,L$,
P_h is the estimated proportion of measurements in stratum h,
$W_h = N_h / N$ is the weight associated with stratum h,
N_h is the total number of possible sampling locations (units) in stratum h,
N is the total number of possible units in all strata combined, $N = \sum_{h=1}^{L} N_h$
V is the pre-specified variance or precision, and
c_h is the cost of collecting and measuring a sample in stratum h.

The values of these inputs that result in the calculated number of sampling locations are:

Parameter	Stratum
	1
P_h	0.2
C_h	
W_h	280.301

Parameter	Input Value
V	1

Allocation of Samples to Strata
The total number of samples is allocated to the individual strata on an optimal basis using the formula:

$$n_h = n \frac{N_h \sqrt{P_h(1-P_h)} / \sqrt{c_h}}{\sum_{h=1}^{L} N_h \sqrt{P_h(1-P_h)} / \sqrt{c_h}}$$

where

n_h is the number of samples allocated to stratum h,
L is the number of strata,
N_h is the total number of units in stratum h,
P_h is the proportion in stratum h,
c_h is the cost per population unit in stratum h.

n is the total number of units sampled in all strata, $n = \sum_{h=1}^{L} n_h$

Using this formula, the number of samples allocated to each stratum is:

Stratum	Number of Samples
1	4
Total Samples	4

Method for Determining Sampling Locations

Five methods for determining sample locations are provided in VSP: 1) simple random sampling, 2) random sampling within grids, 3) systematic sampling with a random start, 4) systematic sampling with a fixed start and 5) adaptive grid sampling. One may use a different method for each stratum, based on the conceptual site model and decision to be made for a given stratum. For this site, sample locations were chosen using random sampling within grids in each stratum.

Locating the sample points using a random sampling within grids method combines appealing aspects of both the random and the systematic grid methods. It provides data that are separated by many distances, providing information about the spatial structure of the potential contamination. It also ensures good coverage of the entire site, although not as completely as if systematic grid sampling were performed.

Statistical Assumptions

The assumptions associated with the formulas for computing the number of samples are:

1. The estimated stratum proportions, P_h, are reasonable and representative of the stratum populations being sampled.
2. The sampling locations are selected using simple random sampling.
3. The stratum costs, C_h, and the fixed cost C_0, are accurate.

The first and third assumptions will be assessed in a post data collection analysis. The second assumption, although not strictly valid for strata where systematic grid sampling was used rather than simple random sampling, is not expected to significantly affect conclusions of the study because (1) the gridded sample locations were selected based on a random start and (2) any patterns of contamination in the field that may exist are not expected to coincide with the regularity of the grid sampling pattern.

Recommended Data Analysis Activities

Post data collection activities generally follow those outlined in EPA's Guidance for Data Quality Assessment (EPA, 2000). The data analysts will become familiar with the context of the problem and goals for data collection and assessment. The data will be verified and validated before being subjected to statistical or other analyses. Graphical and analytical tools will be used to verify to the extent possible the assumptions of any statistical analyses that are performed as well as to achieve a general understanding of the data. The data will be assessed to determine whether they are adequate in both quality and quantity to support the primary objective of sampling.

Estimates for the proportion of the population values will be calculated using the formulas appropriate for stratified sampling; these formulas are found in EPA QA/G-5S (EPA, 2001). Results of the exploratory and quantitative assessments of the data will be reported, along with conclusions that may be supported by them.

APPENDIX D

LABORATORY ANALYTICAL REPORTS

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Souder, Miller & Associates
Client Sample ID: SWC-1
Project: Wolfman
Collection Date: 3/26/2019 9:20:00 AM
Lab ID: 1903D67-001 **Matrix:** SOIL
Received Date: 3/28/2019 8:50:00 AM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 300.0: ANIONS						Analyst: **MRA**	
Chloride	240	60		mg/Kg	20	4/3/2019 1:46:22 PM	44059
EPA METHOD 8015M/D: DIESEL RANGE ORGANICS						Analyst: **lrm**	
Diesel Range Organics (DRO)	ND	10		mg/Kg	1	3/30/2019 5:36:28 PM	43966
Motor Oil Range Organics (MRO)	ND	50		mg/Kg	1	3/30/2019 5:36:28 PM	43966
Surr: DNOP	99.7	70-130		%Rec	1	3/30/2019 5:36:28 PM	43966
EPA METHOD 8015D: GASOLINE RANGE						Analyst: **RAA**	
Gasoline Range Organics (GRO)	ND	4.9		mg/Kg	1	3/30/2019 8:19:27 PM	43937
Surr: BFB	91.2	73.8-119		%Rec	1	3/30/2019 8:19:27 PM	43937
EPA METHOD 8021B: VOLATILES						Analyst: **RAA**	
Benzene	ND	0.025		mg/Kg	1	3/30/2019 8:19:27 PM	43937
Toluene	ND	0.049		mg/Kg	1	3/30/2019 8:19:27 PM	43937
Ethylbenzene	ND	0.049		mg/Kg	1	3/30/2019 8:19:27 PM	43937
Xylenes, Total	ND	0.098		mg/Kg	1	3/30/2019 8:19:27 PM	43937
Surr: 4-Bromofluorobenzene	94.4	80-120		%Rec	1	3/30/2019 8:19:27 PM	43937

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

Qualifiers:

H	Holding times for preparation or analysis exceeded
PQL	Practical Quanitative Limit
S	% Recovery outside of range due to dilution or matrix
ND	Not Detected at the Reporting Limit
RL	Reporting Detection Limit
W	Sample container temperature is out of limit as specified at testcode

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Souder, Miller & Associates
Client Sample ID: SWC-2
Project: Wolfman
Collection Date: 3/26/2019 9:25:00 AM
Lab ID: 1903D67-002 **Matrix:** SOIL
Received Date: 3/28/2019 8:50:00 AM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 300.0: ANIONS						Analyst: **MRA**	
Chloride	ND	60		mg/Kg	20	4/3/2019 2:23:37 PM	44059
EPA METHOD 8015M/D: DIESEL RANGE ORGANICS						Analyst: **lrm**	
Diesel Range Organics (DRO)	ND	9.7		mg/Kg	1	3/30/2019 5:58:27 PM	43966
Motor Oil Range Organics (MRO)	ND	49		mg/Kg	1	3/30/2019 5:58:27 PM	43966
Surr: DNOP	95.3	70-130		%Rec	1	3/30/2019 5:58:27 PM	43966
EPA METHOD 8015D: GASOLINE RANGE						Analyst: **RAA**	
Gasoline Range Organics (GRO)	ND	5.0		mg/Kg	1	3/30/2019 8:42:46 PM	43937
Surr: BFB	90.3	73.8-119		%Rec	1	3/30/2019 8:42:46 PM	43937
EPA METHOD 8021B: VOLATILES						Analyst: **RAA**	
Benzene	ND	0.025		mg/Kg	1	3/30/2019 8:42:46 PM	43937
Toluene	ND	0.050		mg/Kg	1	3/30/2019 8:42:46 PM	43937
Ethylbenzene	ND	0.050		mg/Kg	1	3/30/2019 8:42:46 PM	43937
Xylenes, Total	ND	0.099		mg/Kg	1	3/30/2019 8:42:46 PM	43937
Surr: 4-Bromofluorobenzene	92.7	80-120		%Rec	1	3/30/2019 8:42:46 PM	43937

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

Qualifiers:

H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
PQL	Practical Quanitative Limit	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified at testcode

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Souder, Miller & Associates
Client Sample ID: SWC-3
Project: Wolfman
Collection Date: 3/26/2019 9:30:00 AM
Lab ID: 1903D67-003
Matrix: SOIL
Received Date: 3/28/2019 8:50:00 AM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 300.0: ANIONS						Analyst: **MRA**	
Chloride	ND	60		mg/Kg	20	4/3/2019 3:00:50 PM	44059
EPA METHOD 8015D MOD: GASOLINE RANGE						Analyst: **RAA**	
Gasoline Range Organics (GRO)	ND	4.8		mg/Kg	1	3/30/2019 6:21:52 AM	43946
Surr: BFB	111	70-130		%Rec	1	3/30/2019 6:21:52 AM	43946
EPA METHOD 8015M/D: DIESEL RANGE ORGANICS						Analyst: **lrm**	
Diesel Range Organics (DRO)	ND	9.9		mg/Kg	1	3/30/2019 6:20:30 PM	43966
Motor Oil Range Organics (MRO)	ND	49		mg/Kg	1	3/30/2019 6:20:30 PM	43966
Surr: DNOP	92.4	70-130		%Rec	1	3/30/2019 6:20:30 PM	43966
EPA METHOD 8260B: VOLATILES SHORT LIST						Analyst: **RAA**	
Benzene	ND	0.024		mg/Kg	1	3/30/2019 6:21:52 AM	43946
Toluene	ND	0.048		mg/Kg	1	3/30/2019 6:21:52 AM	43946
Ethylbenzene	ND	0.048		mg/Kg	1	3/30/2019 6:21:52 AM	43946
Xylenes, Total	ND	0.096		mg/Kg	1	3/30/2019 6:21:52 AM	43946
Surr: 1,2-Dichloroethane-d4	85.7	70-130		%Rec	1	3/30/2019 6:21:52 AM	43946
Surr: 4-Bromofluorobenzene	104	70-130		%Rec	1	3/30/2019 6:21:52 AM	43946
Surr: Dibromofluoromethane	88.9	70-130		%Rec	1	3/30/2019 6:21:52 AM	43946
Surr: Toluene-d8	89.9	70-130		%Rec	1	3/30/2019 6:21:52 AM	43946

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

Qualifiers:

H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
PQL	Practical Quanitative Limit	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified at testcode

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Souder, Miller & Associates
Client Sample ID: SWC-4
Project: Wolfman
Collection Date: 3/26/2019 9:35:00 AM
Lab ID: 1903D67-004 **Matrix:** SOIL
Received Date: 3/28/2019 8:50:00 AM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 300.0: ANIONS						Analyst: **MRA**	
Chloride	160	61		mg/Kg	20	4/3/2019 3:13:15 PM	44059
EPA METHOD 8015D MOD: GASOLINE RANGE						Analyst: **RAA**	
Gasoline Range Organics (GRO)	ND	4.9		mg/Kg	1	3/30/2019 7:47:28 AM	43946
Surr: BFB	109	70-130		%Rec	1	3/30/2019 7:47:28 AM	43946
EPA METHOD 8015M/D: DIESEL RANGE ORGANICS						Analyst: **lrm**	
Diesel Range Organics (DRO)	ND	10		mg/Kg	1	3/30/2019 6:42:28 PM	43966
Motor Oil Range Organics (MRO)	ND	50		mg/Kg	1	3/30/2019 6:42:28 PM	43966
Surr: DNOP	77.8	70-130		%Rec	1	3/30/2019 6:42:28 PM	43966
EPA METHOD 8260B: VOLATILES SHORT LIST						Analyst: **RAA**	
Benzene	ND	0.025		mg/Kg	1	3/30/2019 7:47:28 AM	43946
Toluene	ND	0.049		mg/Kg	1	3/30/2019 7:47:28 AM	43946
Ethylbenzene	ND	0.049		mg/Kg	1	3/30/2019 7:47:28 AM	43946
Xylenes, Total	ND	0.098		mg/Kg	1	3/30/2019 7:47:28 AM	43946
Surr: 1,2-Dichloroethane-d4	85.2	70-130		%Rec	1	3/30/2019 7:47:28 AM	43946
Surr: 4-Bromofluorobenzene	105	70-130		%Rec	1	3/30/2019 7:47:28 AM	43946
Surr: Dibromofluoromethane	87.8	70-130		%Rec	1	3/30/2019 7:47:28 AM	43946
Surr: Toluene-d8	88.0	70-130		%Rec	1	3/30/2019 7:47:28 AM	43946

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

Qualifiers:

H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
PQL	Practical Quanitative Limit	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified at testcode

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Souder, Miller & Associates
Client Sample ID: BH-6
Project: Wolfman
Collection Date: 3/26/2019 9:00:00 AM
Lab ID: 1903D67-005 **Matrix:** SOIL
Received Date: 3/28/2019 8:50:00 AM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 300.0: ANIONS						Analyst: **MRA**	
Chloride	2100	150		mg/Kg	50	4/4/2019 9:42:00 AM	44059
EPA METHOD 8015D MOD: GASOLINE RANGE						Analyst: **RAA**	
Gasoline Range Organics (GRO)	ND	4.6		mg/Kg	1	3/30/2019 9:13:04 AM	43946
Surr: BFB	108	70-130		%Rec	1	3/30/2019 9:13:04 AM	43946
EPA METHOD 8015M/D: DIESEL RANGE ORGANICS						Analyst: **lrm**	
Diesel Range Organics (DRO)	ND	9.5		mg/Kg	1	3/30/2019 7:04:36 PM	43966
Motor Oil Range Organics (MRO)	ND	48		mg/Kg	1	3/30/2019 7:04:36 PM	43966
Surr: DNOP	97.4	70-130		%Rec	1	3/30/2019 7:04:36 PM	43966
EPA METHOD 8260B: VOLATILES SHORT LIST						Analyst: **RAA**	
Benzene	ND	0.023		mg/Kg	1	3/30/2019 9:13:04 AM	43946
Toluene	ND	0.046		mg/Kg	1	3/30/2019 9:13:04 AM	43946
Ethylbenzene	ND	0.046		mg/Kg	1	3/30/2019 9:13:04 AM	43946
Xylenes, Total	ND	0.093		mg/Kg	1	3/30/2019 9:13:04 AM	43946
Surr: 1,2-Dichloroethane-d4	82.4	70-130		%Rec	1	3/30/2019 9:13:04 AM	43946
Surr: 4-Bromofluorobenzene	103	70-130		%Rec	1	3/30/2019 9:13:04 AM	43946
Surr: Dibromofluoromethane	84.6	70-130		%Rec	1	3/30/2019 9:13:04 AM	43946
Surr: Toluene-d8	86.7	70-130		%Rec	1	3/30/2019 9:13:04 AM	43946

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

Qualifiers:

H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
PQL	Practical Quanitative Limit	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified at testcode

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Souder, Miller & Associates
Client Sample ID: BH-7
Project: Wolfman
Collection Date: 3/26/2019 9:05:00 AM
Lab ID: 1903D67-006 **Matrix:** SOIL
Received Date: 3/28/2019 8:50:00 AM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 300.0: ANIONS						Analyst: **MRA**	
Chloride	3100	150		mg/Kg	50	4/4/2019 9:55:00 AM	44059
EPA METHOD 8015D MOD: GASOLINE RANGE						Analyst: **RAA**	
Gasoline Range Organics (GRO)	ND	4.6		mg/Kg	1	3/30/2019 9:41:35 AM	43946
Surr: BFB	109	70-130		%Rec	1	3/30/2019 9:41:35 AM	43946
EPA METHOD 8015M/D: DIESEL RANGE ORGANICS						Analyst: **lrm**	
Diesel Range Organics (DRO)	39	9.8		mg/Kg	1	3/30/2019 7:26:33 PM	43966
Motor Oil Range Organics (MRO)	ND	49		mg/Kg	1	3/30/2019 7:26:33 PM	43966
Surr: DNOP	84.8	70-130		%Rec	1	3/30/2019 7:26:33 PM	43966
EPA METHOD 8260B: VOLATILES SHORT LIST						Analyst: **RAA**	
Benzene	ND	0.023		mg/Kg	1	3/30/2019 9:41:35 AM	43946
Toluene	ND	0.046		mg/Kg	1	3/30/2019 9:41:35 AM	43946
Ethylbenzene	ND	0.046		mg/Kg	1	3/30/2019 9:41:35 AM	43946
Xylenes, Total	ND	0.093		mg/Kg	1	3/30/2019 9:41:35 AM	43946
Surr: 1,2-Dichloroethane-d4	85.2	70-130		%Rec	1	3/30/2019 9:41:35 AM	43946
Surr: 4-Bromofluorobenzene	104	70-130		%Rec	1	3/30/2019 9:41:35 AM	43946
Surr: Dibromofluoromethane	86.3	70-130		%Rec	1	3/30/2019 9:41:35 AM	43946
Surr: Toluene-d8	89.6	70-130		%Rec	1	3/30/2019 9:41:35 AM	43946

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

Qualifiers:

H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
PQL	Practical Quanitative Limit	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified at testcode

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Souder, Miller & Associates
Client Sample ID: BH-8
Project: Wolfman
Collection Date: 3/26/2019 9:10:00 AM
Lab ID: 1903D67-007
Matrix: SOIL
Received Date: 3/28/2019 8:50:00 AM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 300.0: ANIONS						Analyst: **MRA**	
Chloride	12000	600		mg/Kg	200	4/4/2019 10:07:00 AM	44059
EPA METHOD 8015D MOD: GASOLINE RANGE						Analyst: **RAA**	
Gasoline Range Organics (GRO)	ND	4.8		mg/Kg	1	3/30/2019 10:09:57 AM	43946
Surr: BFB	107	70-130		%Rec	1	3/30/2019 10:09:57 AM	43946
EPA METHOD 8015M/D: DIESEL RANGE ORGANICS						Analyst: **lrm**	
Diesel Range Organics (DRO)	ND	9.8		mg/Kg	1	3/30/2019 7:48:34 PM	43966
Motor Oil Range Organics (MRO)	ND	49		mg/Kg	1	3/30/2019 7:48:34 PM	43966
Surr: DNOP	89.6	70-130		%Rec	1	3/30/2019 7:48:34 PM	43966
EPA METHOD 8260B: VOLATILES SHORT LIST						Analyst: **RAA**	
Benzene	ND	0.024		mg/Kg	1	3/30/2019 10:09:57 AM	43946
Toluene	ND	0.048		mg/Kg	1	3/30/2019 10:09:57 AM	43946
Ethylbenzene	ND	0.048		mg/Kg	1	3/30/2019 10:09:57 AM	43946
Xylenes, Total	ND	0.095		mg/Kg	1	3/30/2019 10:09:57 AM	43946
Surr: 1,2-Dichloroethane-d4	84.9	70-130		%Rec	1	3/30/2019 10:09:57 AM	43946
Surr: 4-Bromofluorobenzene	104	70-130		%Rec	1	3/30/2019 10:09:57 AM	43946
Surr: Dibromofluoromethane	88.9	70-130		%Rec	1	3/30/2019 10:09:57 AM	43946
Surr: Toluene-d8	88.1	70-130		%Rec	1	3/30/2019 10:09:57 AM	43946

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

Qualifiers:

H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
PQL	Practical Quanitative Limit	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified at testcode

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Souder, Miller & Associates
Client Sample ID: BH-9
Project: Wolfman
Collection Date: 3/26/2019 9:15:00 AM
Lab ID: 1903D67-008
Matrix: SOIL
Received Date: 3/28/2019 8:50:00 AM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 300.0: ANIONS						Analyst: **MRA**	
Chloride	14000	600		mg/Kg	200	4/4/2019 10:19:00 AM	44059
EPA METHOD 8015D MOD: GASOLINE RANGE						Analyst: **RAA**	
Gasoline Range Organics (GRO)	ND	4.7		mg/Kg	1	3/30/2019 10:38:31 AM	43946
Surr: BFB	111	70-130		%Rec	1	3/30/2019 10:38:31 AM	43946
EPA METHOD 8015M/D: DIESEL RANGE ORGANICS						Analyst: **lrm**	
Diesel Range Organics (DRO)	ND	10		mg/Kg	1	3/30/2019 8:10:21 PM	43966
Motor Oil Range Organics (MRO)	ND	50		mg/Kg	1	3/30/2019 8:10:21 PM	43966
Surr: DNOP	92.2	70-130		%Rec	1	3/30/2019 8:10:21 PM	43966
EPA METHOD 8260B: VOLATILES SHORT LIST						Analyst: **RAA**	
Benzene	ND	0.023		mg/Kg	1	3/30/2019 10:38:31 AM	43946
Toluene	ND	0.047		mg/Kg	1	3/30/2019 10:38:31 AM	43946
Ethylbenzene	ND	0.047		mg/Kg	1	3/30/2019 10:38:31 AM	43946
Xylenes, Total	ND	0.094		mg/Kg	1	3/30/2019 10:38:31 AM	43946
Surr: 1,2-Dichloroethane-d4	82.8	70-130		%Rec	1	3/30/2019 10:38:31 AM	43946
Surr: 4-Bromofluorobenzene	97.8	70-130		%Rec	1	3/30/2019 10:38:31 AM	43946
Surr: Dibromofluoromethane	88.2	70-130		%Rec	1	3/30/2019 10:38:31 AM	43946
Surr: Toluene-d8	91.2	70-130		%Rec	1	3/30/2019 10:38:31 AM	43946

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

Qualifiers:

H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
PQL	Practical Quanitative Limit	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified at testcode

Hall Environmental Analysis Laboratory, Inc.

Analytical Report
Lab Order **1902B87**
Date Reported: **3/7/2019**

CLIENT: Souder, Miller & Associates
Project: Wolfman 5-4
Lab ID: 1902B87-001 **Matrix:** SOIL

Client Sample ID: BH 1
Collection Date: 2/24/2019 10:00:00 AM
Received Date: 2/28/2019 8:55:00 AM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 300.0: ANIONS						Analyst:	**MRA**
Chloride	8400	300		mg/Kg	100	3/6/2019 5:04:49 AM	43423
EPA METHOD 8015M/D: DIESEL RANGE ORGANICS						Analyst:	**lrm**
Diesel Range Organics (DRO)	760	9.9		mg/Kg	1	3/1/2019 10:34:38 AM	43405
Motor Oil Range Organics (MRO)	310	49		mg/Kg	1	3/1/2019 10:34:38 AM	43405
Surr: DNOP	114	70-130		%Rec	1	3/1/2019 10:34:38 AM	43405
EPA METHOD 8015D: GASOLINE RANGE						Analyst:	**NSB**
Gasoline Range Organics (GRO)	21	4.9		mg/Kg	1	3/2/2019 2:21:45 AM	43403
Surr: BFB	234	73.8-119	S	%Rec	1	3/2/2019 2:21:45 AM	43403
EPA METHOD 8021B: VOLATILES						Analyst:	**NSB**
Benzene	ND	0.025		mg/Kg	1	3/2/2019 2:21:45 AM	43403
Toluene	ND	0.049		mg/Kg	1	3/2/2019 2:21:45 AM	43403
Ethylbenzene	ND	0.049		mg/Kg	1	3/2/2019 2:21:45 AM	43403
Xylenes, Total	ND	0.099		mg/Kg	1	3/2/2019 2:21:45 AM	43403
Surr: 4-Bromofluorobenzene	109	80-120		%Rec	1	3/2/2019 2:21:45 AM	43403

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 Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Souder, Miller & Associates
Client Sample ID: BH 2
Project: Wolfman 5-4
Collection Date: 2/24/2019 10:05:00 AM
Lab ID: 1902B87-002
Matrix: SOIL
Received Date: 2/28/2019 8:55:00 AM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 300.0: ANIONS						Analyst:	**MRA**
Chloride	13000	600		mg/Kg	200	3/6/2019 5:17:13 AM	43423
EPA METHOD 8015M/D: DIESEL RANGE ORGANICS						Analyst:	**lrm**
Diesel Range Organics (DRO)	1300	98		mg/Kg	10	3/1/2019 1:49:20 PM	43405
Motor Oil Range Organics (MRO)	590	490		mg/Kg	10	3/1/2019 1:49:20 PM	43405
Surr: DNOP	0	70-130	S	%Rec	10	3/1/2019 1:49:20 PM	43405
EPA METHOD 8015D: GASOLINE RANGE						Analyst:	**NSB**
Gasoline Range Organics (GRO)	16	4.8		mg/Kg	1	3/2/2019 2:44:29 AM	43403
Surr: BFB	198	73.8-119	S	%Rec	1	3/2/2019 2:44:29 AM	43403
EPA METHOD 8021B: VOLATILES						Analyst:	**NSB**
Benzene	ND	0.024		mg/Kg	1	3/2/2019 2:44:29 AM	43403
Toluene	ND	0.048		mg/Kg	1	3/2/2019 2:44:29 AM	43403
Ethylbenzene	ND	0.048		mg/Kg	1	3/2/2019 2:44:29 AM	43403
Xylenes, Total	ND	0.095		mg/Kg	1	3/2/2019 2:44:29 AM	43403
Surr: 4-Bromofluorobenzene	112	80-120		%Rec	1	3/2/2019 2:44:29 AM	43403

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 Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Souder, Miller & Associates
Client Sample ID: BH 3
Project: Wolfman 5-4
Collection Date: 2/24/2019 10:10:00 AM
Lab ID: 1902B87-003
Matrix: SOIL
Received Date: 2/28/2019 8:55:00 AM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 300.0: ANIONS						Analyst:	**MRA**
Chloride	9400	600		mg/Kg	200	3/6/2019 5:29:38 AM	43423
EPA METHOD 8015M/D: DIESEL RANGE ORGANICS						Analyst:	**lrm**
Diesel Range Organics (DRO)	1900	97		mg/Kg	10	3/1/2019 2:13:33 PM	43405
Motor Oil Range Organics (MRO)	760	480		mg/Kg	10	3/1/2019 2:13:33 PM	43405
Surr: DNOP	0	70-130	S	%Rec	10	3/1/2019 2:13:33 PM	43405
EPA METHOD 8015D: GASOLINE RANGE						Analyst:	**NSB**
Gasoline Range Organics (GRO)	30	4.8		mg/Kg	1	3/2/2019 3:07:19 AM	43403
Surr: BFB	313	73.8-119	S	%Rec	1	3/2/2019 3:07:19 AM	43403
EPA METHOD 8021B: VOLATILES						Analyst:	**NSB**
Benzene	ND	0.024		mg/Kg	1	3/2/2019 3:07:19 AM	43403
Toluene	ND	0.048		mg/Kg	1	3/2/2019 3:07:19 AM	43403
Ethylbenzene	ND	0.048		mg/Kg	1	3/2/2019 3:07:19 AM	43403
Xylenes, Total	0.11	0.097		mg/Kg	1	3/2/2019 3:07:19 AM	43403
Surr: 4-Bromofluorobenzene	118	80-120		%Rec	1	3/2/2019 3:07:19 AM	43403

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 Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Souder, Miller & Associates
Client Sample ID: BH 4
Project: Wolfman 5-4
Collection Date: 2/24/2019 10:15:00 AM
Lab ID: 1902B87-004
Matrix: SOIL
Received Date: 2/28/2019 8:55:00 AM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 300.0: ANIONS						Analyst:	**MRA**
Chloride	9300	590		mg/Kg	200	3/6/2019 5:42:03 AM	43423
EPA METHOD 8015M/D: DIESEL RANGE ORGANICS						Analyst:	**lrm**
Diesel Range Organics (DRO)	900	9.7		mg/Kg	1	3/1/2019 12:36:03 PM	43405
Motor Oil Range Organics (MRO)	370	49		mg/Kg	1	3/1/2019 12:36:03 PM	43405
Surr: DNOP	95.6	70-130		%Rec	1	3/1/2019 12:36:03 PM	43405
EPA METHOD 8015D: GASOLINE RANGE						Analyst:	**NSB**
Gasoline Range Organics (GRO)	27	4.6		mg/Kg	1	3/2/2019 3:30:11 AM	43403
Surr: BFB	222	73.8-119	S	%Rec	1	3/2/2019 3:30:11 AM	43403
EPA METHOD 8021B: VOLATILES						Analyst:	**NSB**
Benzene	ND	0.023		mg/Kg	1	3/2/2019 3:30:11 AM	43403
Toluene	ND	0.046		mg/Kg	1	3/2/2019 3:30:11 AM	43403
Ethylbenzene	ND	0.046		mg/Kg	1	3/2/2019 3:30:11 AM	43403
Xylenes, Total	0.096	0.093		mg/Kg	1	3/2/2019 3:30:11 AM	43403
Surr: 4-Bromofluorobenzene	113	80-120		%Rec	1	3/2/2019 3:30:11 AM	43403

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 Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Souder, Miller & Associates
Client Sample ID: BH 5
Project: Wolfman 5-4
Collection Date: 2/24/2019 10:20:00 AM
Lab ID: 1902B87-005
Matrix: SOIL
Received Date: 2/28/2019 8:55:00 AM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 300.0: ANIONS						Analyst:	**MRA**
Chloride	13000	600		mg/Kg	200	3/6/2019 5:54:28 AM	43423
EPA METHOD 8015M/D: DIESEL RANGE ORGANICS						Analyst:	**lrm**
Diesel Range Organics (DRO)	ND	9.8		mg/Kg	1	3/1/2019 1:24:54 PM	43405
Motor Oil Range Organics (MRO)	ND	49		mg/Kg	1	3/1/2019 1:24:54 PM	43405
Surr: DNOP	95.6	70-130		%Rec	1	3/1/2019 1:24:54 PM	43405
EPA METHOD 8015D: GASOLINE RANGE						Analyst:	**NSB**
Gasoline Range Organics (GRO)	ND	4.9		mg/Kg	1	3/2/2019 3:52:55 AM	43403
Surr: BFB	99.3	73.8-119		%Rec	1	3/2/2019 3:52:55 AM	43403
EPA METHOD 8021B: VOLATILES						Analyst:	**NSB**
Benzene	ND	0.024		mg/Kg	1	3/2/2019 3:52:55 AM	43403
Toluene	ND	0.049		mg/Kg	1	3/2/2019 3:52:55 AM	43403
Ethylbenzene	ND	0.049		mg/Kg	1	3/2/2019 3:52:55 AM	43403
Xylenes, Total	ND	0.097		mg/Kg	1	3/2/2019 3:52:55 AM	43403
Surr: 4-Bromofluorobenzene	107	80-120		%Rec	1	3/2/2019 3:52:55 AM	43403

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

Qualifiers:

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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 Detection Limit
S	% Recovery outside of range due to dilution or matrix
W	Sample container temperature is out of limit as specified

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1902B87**

07-Mar-19

Client: Souder, Miller & Associates

Project: Wolfman 5-4

Sample ID: **MB-43423**	SampType: **MBLK**	TestCode: **EPA Method 300.0: Anions**
Client ID: **PBS**	Batch ID: **43423**	RunNo: **58059**
Prep Date: **2/28/2019**	Analysis Date: **3/1/2019**	SeqNo: **1945478** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Chloride	ND	1.5								

Sample ID: **LCS-43423**	SampType: **LCS**	TestCode: **EPA Method 300.0: Anions**
Client ID: **LCSS**	Batch ID: **43423**	RunNo: **58059**
Prep Date: **2/28/2019**	Analysis Date: **3/1/2019**	SeqNo: **1945479** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Chloride	15	1.5	15.00	0	96.9	90	110			

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 Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1902B87**

07-Mar-19

Client: Souder, Miller & Associates

Project: Wolfman 5-4

Sample ID: **LCS-43405**	SampType: **LCS**	TestCode: **EPA Method 8015M/D: Diesel Range Organics**
Client ID: **LCSS**	Batch ID: **43405**	RunNo: **58030**
Prep Date: **2/28/2019**	Analysis Date: **3/1/2019**	SeqNo: **1945112** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Diesel Range Organics (DRO)	46	10	50.00	0	92.0	63.9	124			
Surr: DNOP	4.9		5.000		97.4	70	130			

Sample ID: **MB-43405**	SampType: **MBLK**	TestCode: **EPA Method 8015M/D: Diesel Range Organics**
Client ID: **PBS**	Batch ID: **43405**	RunNo: **58030**
Prep Date: **2/28/2019**	Analysis Date: **3/1/2019**	SeqNo: **1945113** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Diesel Range Organics (DRO)	ND	10								
Motor Oil Range Organics (MRO)	ND	50								
Surr: DNOP	11		10.00		113	70	130			

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 Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1902B87**

07-Mar-19

Client: Souder, Miller & Associates

Project: Wolfman 5-4

Sample ID: **MB-43403**	SampType: **MBLK**	TestCode: **EPA Method 8015D: Gasoline Range**
Client ID: **PBS**	Batch ID: **43403**	RunNo: **58044**
Prep Date: **2/28/2019**	Analysis Date: **3/1/2019**	SeqNo: **1945345** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Gasoline Range Organics (GRO)	ND	5.0								
Surr: BFB	930		1000		92.6	73.8	119			

Sample ID: **LCS-43403**	SampType: **LCS**	TestCode: **EPA Method 8015D: Gasoline Range**
Client ID: **LCSS**	Batch ID: **43403**	RunNo: **58044**
Prep Date: **2/28/2019**	Analysis Date: **3/1/2019**	SeqNo: **1945346** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Gasoline Range Organics (GRO)	25	5.0	25.00	0	100	80.1	123			
Surr: BFB	1100		1000		112	73.8	119			

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 Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1902B87**

07-Mar-19

Client: Souder, Miller & Associates

Project: Wolfman 5-4

Sample ID: **MB-43403**	SampType: **MBLK**	TestCode: **EPA Method 8021B: Volatiles**
Client ID: **PBS**	Batch ID: **43403**	RunNo: **58044**
Prep Date: **2/28/2019**	Analysis Date: **3/1/2019**	SeqNo: **1945376** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	ND	0.025								
Toluene	ND	0.050								
Ethylbenzene	ND	0.050								
Xylenes, Total	ND	0.10								
Surr: 4-Bromofluorobenzene	0.99		1.000		99.1	80	120			

Sample ID: **LCS-43403**	SampType: **LCS**	TestCode: **EPA Method 8021B: Volatiles**
Client ID: **LCSS**	Batch ID: **43403**	RunNo: **58044**
Prep Date: **2/28/2019**	Analysis Date: **3/1/2019**	SeqNo: **1945377** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	0.85	0.025	1.000	0	84.6	80	120			
Toluene	0.98	0.050	1.000	0	97.9	80	120			
Ethylbenzene	1.0	0.050	1.000	0	101	80	120			
Xylenes, Total	3.1	0.10	3.000	0	102	80	120			
Surr: 4-Bromofluorobenzene	1.1		1.000		110	80	120			

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 Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

APPENDIX E
OPEN EXCAVATION PHOTO

Near SW C-3 Facing West

Near SW C-1 Facing East