Souder, Miller & Associates ♦ 201 S. Halagueno ♦ Carlsbad, NM 88221
(575) 689-7040

March 21, 2016

NMOCD District II
Attn. Heather Patterson
1301 W Grand Ave
Artesia, NM 88210

SUBJECT: FINAL CLOSURE REPORT FOR INCIDENT 2RP-1184 Empire J Federal #3, API# 30-015-00169 EDDY COUNTY, NEW MEXICO

Dear Ms. Patterson:

On behalf of Alamo Permian Resources, Souder Miller & Associates (SMA) is pleased to submit the attached Final Closure Report summarizing the soil remediation activities performed for the produced water and crude oil release at the Empire J Federal #3 in Eddy County, New Mexico. The purpose of the closure report is to obtain approval from the New Mexico Oil Conservation Division for remediation of the release that occurred on June 14, 2012.

At the request of Alamo Permian Resources, SMA assessed, delineated and remediated soil affected by production water release associated with the Empire J Federal #3 well location. The release was initially reported to NMOCD by COG Operating on June 14, 2013 and was a result of human error. The table below summarizes information regarding the produced water release. Results of the assessment and delineation follow in the attached report.

Table 1: Release information and Site Ranking

Name	Empire J Federal #3				
Location	Incident Number	API Number	Section, Township, Range		
	2RP-1184	30-015-00169	SE/NE (UL H)	Section 1	T 18S, R 26E NMPM
Estimated Date of Release	June 14, 2012				
Date Reported to NMOCD	June 14, 2012				
Reported by	Carie Stoker, Alamo Permian Resources				
Land Owner	Bureau of Land Management (BLM)				
Reported To	NM Oil Conservation Division (NMOCD)				
Source of Release	Equipment error				
Released Material	Crude Oil				
Released Volume	3 bbls Crude Oil and 11 bbls Produce Water				
Recovered Volume	2 bbls Crude Oil and 0 bbls Produce Water				
Net Release	1 bbl Crude Oil and 11 bbls Produce Water				
Nearest Waterway	580 feet West of the location.				
Depth to Groundwater	Estimated to be 70 feet				

Nearest Domestic Water Source	Greater than 1000 feet
NMOCD Ranking	20
SMA Response Dates	Initial: 1/27/16 Mitigation Activities: 02/01/16
Subcontractors	MSI
Disposal Facility	Lea Land, LLC
Estimated Yd^3 Contaminated Soil Excavated and Disposed	$80Yd^3$

A copy of the C-141 Initial is located in Appendix B. For questions or comments pertaining to the release or the attached Work Plan, please feel free to contact either of us.

Submitted by:

SOUDER, MILLER & ASSOCIATES

Austin Weyant
Project Scientist

Reviewed by:

Cynthia Gray, CHMM
Senior Scientist

Souder, Miller & Associates ♦ 201 S. Halagueno ♦ Carlsbad, NM 88221
(575) 689-7040

SOIL REMEDIATION FINAL CLOSURE FOR INCIDENT 2RP-1184

ALAMO PERMIAN RESOURCES

EMPIRE J FEDERAL #3
API# 30-015-00169
UL H SECTION 1, T18S, R26E, NMPM
EDDY COUNTY, NM

Prepared for:
Alamo Permian Resources
415 West Wall St
Midland, TX 79701

Prepared by:
Souder, Miller & Associates
201 S. Halagueno
Carlsbad, NM 88221
575-689-7040

March 21, 2015
SMA Reference
5B24270 BG6

Table of Contents

Figures:

Tables:

Appendices:

1.0 Introduction

On behalf of Alamo Permian Resources, SMA has prepared this report that describes the assessment and mitigation of a release associated with the Empire J Federal #3 release site. The site is located in Section 1, T 18S, R 26 E NMPM, Eddy County, New Mexico, on BLM land. Figure 1 shows the vicinity and location of the site.

2.0 Site Ranking and Land Jurisdiction

The release site is located approximately 580 feet (< 1,000 feet) east of Pecos River, in an area administered by Bureau of Land Management (BLM) with an elevation of approximately 3,366 feet above sea level. SMA searched the New Mexico State Engineer's Office online water well database for water wells in the vicinity of the release. No well is located within a 1000 foot radius of the site. After evaluation of the site using aerial photography and topographic maps, depth to groundwater is estimated greater than 50 feet below ground surface (bgs) but less than 100 feet bgs. Figure 2 depicts the site details and sample locations. The physical location of this release is within the jurisdiction of NMOCD.

This release location has been assigned a NMOCD ranking of 20 under "Guidelines Remediation" which requires a soil remediation standard of 10 parts per million (ppm) benzene, 50 ppm combined benzene, toluene, ethyl-benzene, and total xylenes (BTEX), and 100 ppm total petroleum hydrocarbons (TPH). Table 1 illustrates site ranking rationale.

3.0 Assessment and Initial Results

On February 11, 2013, Tetra Tech submitted a work plan to NMOCD *"Work Plan for the Alamo Permian Resources, LLC. Empire J Federal #3 wellsite, Unit H, Section 1, Township 18 South, Range 26 East, Eddy County, New Mexico.*" According to Tetra Tech Work Plan the affected area was found to be 50 feet long and 50 feet wide. Excavation was planned by Tetra Tech to go 2-3' below surface on the south side of on the spill area and 1-2" below surface in north area of the spill.

4.0 Soil Remediation Summary

On February 1, 2016 SMA began the excavation of affected soils, with approval from area utilities owners via 811 and NMOCD. SMA continuously guided the excavation activities by collecting composite soil samples for field screening with a mobile titration unit (EPA 4500) and a calibrated PID. Excavation depth was to approximately one feet bgs in the spill area. Excavation could not occur deeper than one foot bgs due to the shallow bedrock. According to NRCS Soil Report (Appendix C) the spill area is within the Gs- Gypsum land- Cottonwood Complex. Where the bedrock is 9 to 60 inches. One delineation sample was taken to three feet bgs but was no easily accessible. Closure samples were collected at the final depth of excavation. All samples were collected and processed according to NMOCD soil sampling procedures. The samples were sent under chain-of-custody protocols to Hall Environmental Analysis Laboratory for analysis for Benzene and Total BTEX using EPA Method 8021B, DRO and GRO by EPA Method 8015D, and total Chlorides using EPA Method 300. After excavation, backfilling of caliche was spread and packed on within the excavation area on the well pad. Approximately 80 cubic yards of contaminated soil was removed and was transported to for proper disposal at Lea Land facility in New Mexico. The excavation backfilled with clean caliche material from Lea Land to bring the contours to surface grade.

5.0 Conclusions and Recommendations

NMOCD "Guidelines for Remediation of Leaks, Spills, and Releases" have established the following action levels for contaminants of concern with a site ranking of 20: 10 ppm (mg/kg) Benzene, 50 ppm total BTEX, and 100 ppm TPH. The release consisted of produced and associated petroleum found during the initial assessment and delineation.

Soil sample location are illustrated in Figure 2. A summary of the laboratory analyses is included in Table 2. Laboratory reports are included in Appendix A.

6.0 Closure and Limitations

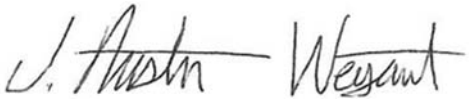
The closure samples laboratory analysis results are all below the targeted remediation standards of a site ranking of 20: 10 ppm (mg/kg) Benzene, 50 ppm total BTEX, and 100 ppm TPH.

The scope of our services consisted of the performance of a preliminary spill assessment, verification of release stabilization, regulatory liaison, and preparation of a Remediation Work Plan and a 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 Austin Weyant at 575-689-7040 or Cindy Gray at 505-325-7535.

Submitted by: Reviewed by:

SOUDER, MILLER & ASSOCIATES



Austin Weyant
Project Scientist

Cynthia Gray, CHMM
Senior Scientist

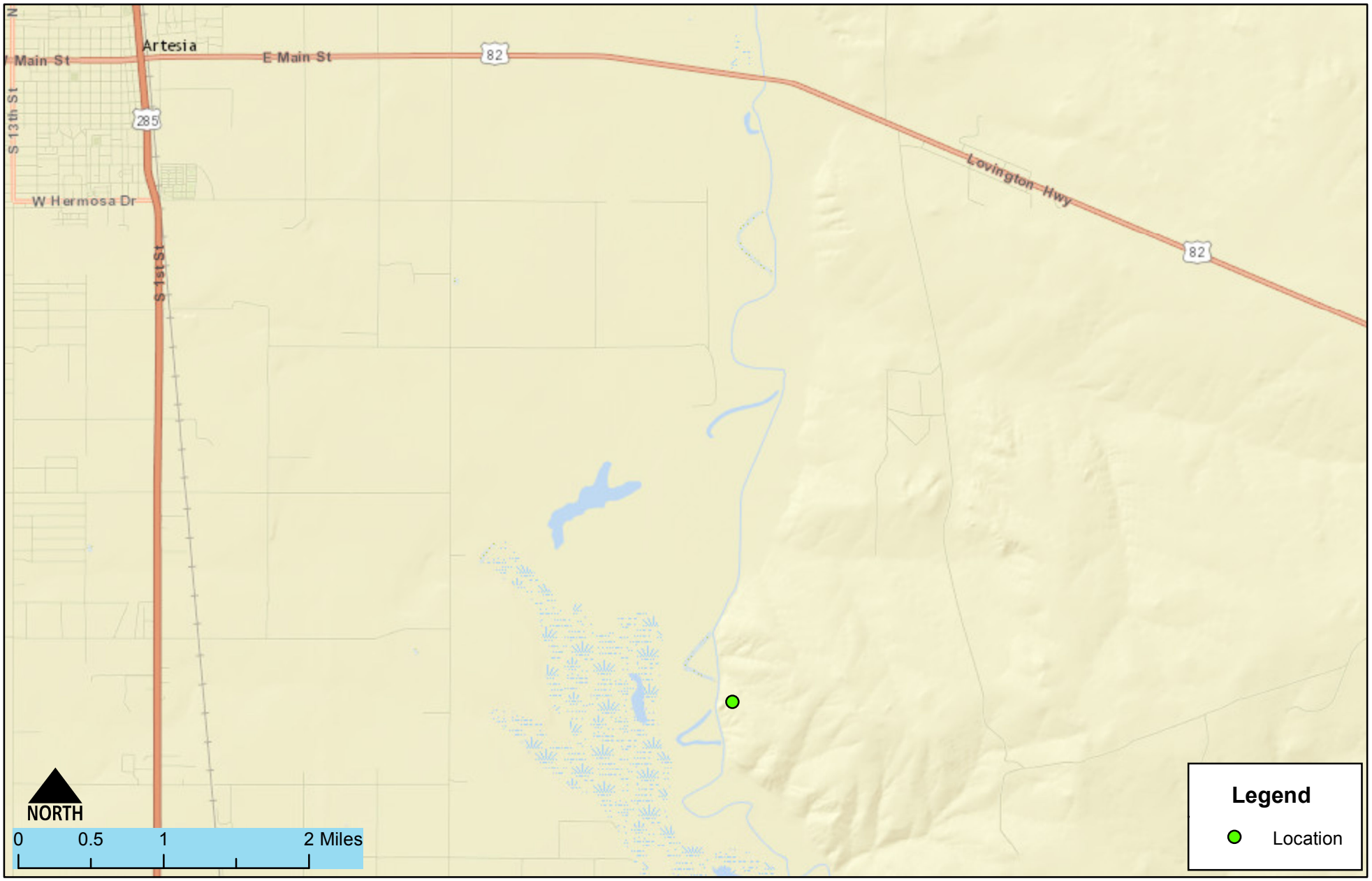
Figures:

Tables:

Appendices:

FIGURE 1

VICINITY MAP



Vicinity Map
Alamo Permian Resources- Empire J Federal #3
Riverside, New Mexico

Figure 1

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

Drawn Lucas Middleton
Checked
Approved

201 South Halaguena Street
Carlsbad, New Mexico 88221
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www.soudermiller.com
Serving the Southwest & Rocky Mountains

Date Saved: 2/9/2016

Document: C:\Users\lcm\Documents\GIS DATA\MAPS\Figure 1 Empire J Federal #3.mxd

FIGURE 2

SITE DETAILS AND SAMPLE LOCATIONS MAP

Site Detail and Sample Locations
Alamo Permain Resources- Empire J Federal #3
Riverside, New Mexico

Figure 2

Document: C:\Users\lcm\Documents\GIS DATA\MAPS\Figure 2 Empire J Federal #3.mxd

Date Saved: 2/9/2016

Revisions
By: Date: Descr:
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SMA
201 South Halagueno Street
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TABLE 1

RELEASE INFORMATION AND SITE RANKING

Table 1: Release information and Site Ranking					
Name	Empire J Federal #3				
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Reported To	NM Oil Conservation Division (NMOCD)				
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Released Material	Crude Oil				
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Nearest Domestic Water Source	Greater than 1000 feet				
NMOCD Ranking	20				
SMA Response Dates	Initial: 1/27/16 Mitigation Activities: 02/01/16				
Subcontractors	MSI				
Disposal Facility	Lea Land, LLC				
Estimated Yd^3 Contaminated Soil Excavated and Disposed	80 Yd^3				

TABLE 2

SUMMARY OF LABORATORY ANALYSES

Table 2: Summary of Laboratory Analyses

Analytical Report- 1602A03	Sample Number on Figure 2 Map	Sample Date	Depth	BTEX ppm	Benzene mg/Kg	GRO mg/Kg	DRO mg/Kg	Cl- mg/Kg
1602A03-001	L1-3	2/16/2016	3'	BDL	BDL	BDL	BDL	13
1602A03-002	L2-1	2/16/2016	1'	N/A	N/A	N/A	N/A	1900
1602A03-003	L3-1	2/16/2016	1'	BDL	BDL	BDL	BDL	1500
1602A03-004	L4-1	2/16/2016	1'	N/A	N/A	N/A	N/A	2500

APPENDIX A

LABORATORY ANALYTICAL REPORTS

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

March 01, 2016

Austin Weyant
Souder, Miller & Associates
201 S Halagueno
Carlsbad, NM 88221
TEL: (575) 689-7040
FAX

RE: Empire J Federal #3 OrderNo.: 1602A03

Dear Austin Weyant:

Hall Environmental Analysis Laboratory received 4 sample(s) on 2/24/2016 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 qualifers 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 #NM0190

Sincerely,

Andy Freeman
Laboratory Manager
4901 Hawkins NE
Albuquerque, NM 87109

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Souder, Miller & Associates
Client Sample ID: L1-3
Project: Empire J Federal #3
Collection Date: 2/16/2016 11:00:00 AM
Lab ID: 1602A03-001
Matrix: SOIL
Received Date: 2/24/2016 10:05:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 300.0: ANIONS						Analyst: **LGT**	
Chloride	13	1.5		mg/Kg	1	2/25/2016 1:39:11 PM	23953
EPA METHOD 8015M/D: DIESEL RANGE ORGANICS						Analyst: **KJH**	
Diesel Range Organics (DRO)	ND	9.8		mg/Kg	1	2/26/2016 3:02:05 PM	23916
Motor Oil Range Organics (MRO)	ND	49		mg/Kg	1	2/26/2016 3:02:05 PM	23916
Surr: DNOP	70.2	70-130		%Rec	1	2/26/2016 3:02:05 PM	23916
EPA METHOD 8015D: GASOLINE RANGE						Analyst: **NSB**	
Gasoline Range Organics (GRO)	ND	4.8		mg/Kg	1	2/25/2016 7:23:55 PM	23925
Surr: BFB	90.5	66.2-112		%Rec	1	2/25/2016 7:23:55 PM	23925
EPA METHOD 8021B: VOLATILES						Analyst: **NSB**	
Benzene	ND	0.048		mg/Kg	1	2/25/2016 7:23:55 PM	23925
Toluene	ND	0.048		mg/Kg	1	2/25/2016 7:23:55 PM	23925
Ethylbenzene	ND	0.048		mg/Kg	1	2/25/2016 7:23:55 PM	23925
Xylenes, Total	ND	0.097		mg/Kg	1	2/25/2016 7:23:55 PM	23925
Surr: 4-Bromofluorobenzene	108	80-120		%Rec	1	2/25/2016 7:23:55 PM	23925

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
R	RPD outside accepted recovery limits	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: L2-1
Project: Empire J Federal #3
Collection Date: 2/16/2016 11:00:00 AM
Lab ID: 1602A03-002 **Matrix:** SOIL **Received Date:** 2/24/2016 10:05:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 300.0: ANIONS						Analyst: **LGT**	
Chloride	1900	75		mg/Kg	50	2/27/2016 3:15:37 AM	23953

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
R	RPD outside accepted recovery limits	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: L3-1
Project: Empire J Federal #3
Collection Date: 2/16/2016 11:00:00 AM
Lab ID: 1602A03-003
Matrix: SOIL
Received Date: 2/24/2016 10:05:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 300.0: ANIONS						Analyst: **LGT**	
Chloride	1500	75		mg/Kg	50	2/27/2016 3:28:02 AM	23953
EPA METHOD 8015M/D: DIESEL RANGE ORGANICS						Analyst: **KJH**	
Diesel Range Organics (DRO)	ND	9.7		mg/Kg	1	2/26/2016 3:23:57 PM	23916
Motor Oil Range Organics (MRO)	ND	48		mg/Kg	1	2/26/2016 3:23:57 PM	23916
Surr: DNOP	79.5	70-130		%Rec	1	2/26/2016 3:23:57 PM	23916
EPA METHOD 8015D: GASOLINE RANGE						Analyst: **NSB**	
Gasoline Range Organics (GRO)	ND	4.8		mg/Kg	1	2/25/2016 7:47:28 PM	23925
Surr: BFB	93.2	66.2-112		%Rec	1	2/25/2016 7:47:28 PM	23925
EPA METHOD 8021B: VOLATILES						Analyst: **NSB**	
Benzene	ND	0.048		mg/Kg	1	2/25/2016 7:47:28 PM	23925
Toluene	ND	0.048		mg/Kg	1	2/25/2016 7:47:28 PM	23925
Ethylbenzene	ND	0.048		mg/Kg	1	2/25/2016 7:47:28 PM	23925
Xylenes, Total	ND	0.096		mg/Kg	1	2/25/2016 7:47:28 PM	23925
Surr: 4-Bromofluorobenzene	113	80-120		%Rec	1	2/25/2016 7:47:28 PM	23925

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
R	RPD outside accepted recovery limits	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: L4-1
Project: Empire J Federal #3
Collection Date: 2/16/2016 11:00:00 AM
Lab ID: 1602A03-004
Matrix: SOIL
Received Date: 2/24/2016 10:05:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 300.0: ANIONS						Analyst: **LGT**	
Chloride	2500	75		mg/Kg	50	2/27/2016 3:40:27 AM	23953

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
R	RPD outside accepted recovery limits	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#: **1602A03**

01-Mar-16

Client: Souder, Miller & Associates

Project: Empire J Federal #3

Sample ID	**MB-23953**	SampType:	**MBLK**		TestCode:	**EPA Method 300.0: Anions**				
Client ID:	**PBS**	Batch ID:	**23953**		RunNo:	**32430**				
Prep Date:	**2/25/2016**	Analysis Date:	**2/25/2016**		SeqNo:	**991759**	Units:	**mg/Kg**		
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Chloride	ND	1.5								

Sample ID	**LCS-23953**	SampType:	**LCS**		TestCode:	**EPA Method 300.0: Anions**				
Client ID:	**LCSS**	Batch ID:	**23953**		RunNo:	**32430**				
Prep Date:	**2/25/2016**	Analysis Date:	**2/25/2016**		SeqNo:	**991760**	Units:	**mg/Kg**		
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Chloride	14	1.5	15.00	0	95.3	90	110			

Sample ID	**1602981-001AMS**	SampType:	**MS**		TestCode:	**EPA Method 300.0: Anions**				
Client ID:	**BatchQC**	Batch ID:	**23953**		RunNo:	**32430**				
Prep Date:	**2/25/2016**	Analysis Date:	**2/25/2016**		SeqNo:	**991763**	Units:	**mg/Kg**		
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Chloride	15	1.5	15.00	1.028	95.3	64.2	131			

Sample ID	**1602981-001AMSD**	SampType:	**MSD**		TestCode:	**EPA Method 300.0: Anions**				
Client ID:	**BatchQC**	Batch ID:	**23953**		RunNo:	**32430**				
Prep Date:	**2/25/2016**	Analysis Date:	**2/25/2016**		SeqNo:	**991764**	Units:	**mg/Kg**		
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Chloride	15	1.5	15.00	1.028	92.0	64.2	131	3.28	20	

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
R	RPD outside accepted recovery limits	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#: **1602A03**

01-Mar-16

Client: Souder, Miller & Associates

Project: Empire J Federal #3

Sample ID **LCS-23916**	SampType: **LCS**	TestCode: **EPA Method 8015M/D: Diesel Range Organics**
Client ID: **LCSS**	Batch ID: **23916**	RunNo: **32421**
Prep Date: **2/24/2016**	Analysis Date: **2/26/2016**	SeqNo: **991462** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Diesel Range Organics (DRO)	42	10	50.00	0	84.3	65.8	136			
Surr: DNOP	4.6		5.000		91.1	70	130			

Sample ID **LCS-23931**	SampType: **LCS**	TestCode: **EPA Method 8015M/D: Diesel Range Organics**
Client ID: **LCSS**	Batch ID: **23931**	RunNo: **32421**
Prep Date: **2/25/2016**	Analysis Date: **2/26/2016**	SeqNo: **991463** Units: **%Rec**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Surr: DNOP	4.0		5.000		79.5	70	130			

Sample ID **MB-23916**	SampType: **MBLK**	TestCode: **EPA Method 8015M/D: Diesel Range Organics**
Client ID: **PBS**	Batch ID: **23916**	RunNo: **32421**
Prep Date: **2/24/2016**	Analysis Date: **2/26/2016**	SeqNo: **991464** 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	9.3		10.00		92.6	70	130			

Sample ID **MB-23931**	SampType: **MBLK**	TestCode: **EPA Method 8015M/D: Diesel Range Organics**
Client ID: **PBS**	Batch ID: **23931**	RunNo: **32421**
Prep Date: **2/25/2016**	Analysis Date: **2/26/2016**	SeqNo: **991465** Units: **%Rec**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Surr: DNOP	7.7		10.00		77.3	70	130			

Sample ID **1602996-001AMS**	SampType: **MS**	TestCode: **EPA Method 8015M/D: Diesel Range Organics**
Client ID: **BatchQC**	Batch ID: **23916**	RunNo: **32422**
Prep Date: **2/24/2016**	Analysis Date: **2/26/2016**	SeqNo: **991875** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Diesel Range Organics (DRO)	70	9.6	47.80	0	146	31.2	162			
Surr: DNOP	6.1		4.780		127	70	130			

Sample ID **1602996-001AMSD**	SampType: **MSD**	TestCode: **EPA Method 8015M/D: Diesel Range Organics**
Client ID: **BatchQC**	Batch ID: **23916**	RunNo: **32422**
Prep Date: **2/24/2016**	Analysis Date: **2/26/2016**	SeqNo: **991951** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Diesel Range Organics (DRO)	73	9.9	49.65	0	147	31.2	162	4.79	31.7	

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QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1602A03**

01-Mar-16

Client: Souder, Miller & Associates

Project: Empire J Federal #3

Sample ID	**1602996-001AMSD**	SampType: **MSD**			TestCode: **EPA Method 8015M/D: Diesel Range Organics**					
Client ID:	**BatchQC**	Batch ID: **23916**			RunNo: **32422**					
Prep Date:	**2/24/2016**	Analysis Date: **2/26/2016**			SeqNo: **991951**		Units: **mg/Kg**			
Analyte		Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Surr: DNOP		5.9		4.965		119	70	130	0	0	

Sample ID	**1602A15-001AMS**	SampType: **MS**			TestCode: **EPA Method 8015M/D: Diesel Range Organics**					
Client ID:	**BatchQC**	Batch ID: **23931**			RunNo: **32421**					
Prep Date:	**2/25/2016**	Analysis Date: **2/26/2016**			SeqNo: **992471**		Units: **%Rec**			
Analyte		Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Surr: DNOP		4.1		4.735		86.5	70	130			

Sample ID	**1602A15-001AMSD**	SampType: **MSD**			TestCode: **EPA Method 8015M/D: Diesel Range Organics**					
Client ID:	**BatchQC**	Batch ID: **23931**			RunNo: **32421**					
Prep Date:	**2/25/2016**	Analysis Date: **2/26/2016**			SeqNo: **992549**		Units: **%Rec**			
Analyte		Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Surr: DNOP		4.2		5.010		84.4	70	130	0	0	

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
R	RPD outside accepted recovery limits	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#: **1602A03**

01-Mar-16

Client: Souder, Miller & Associates

Project: Empire J Federal #3

Sample ID	**MB-23925**	SampType:	**MBLK**		TestCode:	**EPA Method 8015D: Gasoline Range**				
Client ID:	**PBS**	Batch ID:	**23925**		RunNo:	**32403**				
Prep Date:	**2/24/2016**	Analysis Date:	**2/25/2016**		SeqNo:	**991237**	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		92.8	66.2	112			

Sample ID	**LCS-23925**	SampType:	**LCS**		TestCode:	**EPA Method 8015D: Gasoline Range**				
Client ID:	**LCSS**	Batch ID:	**23925**		RunNo:	**32403**				
Prep Date:	**2/24/2016**	Analysis Date:	**2/25/2016**		SeqNo:	**991238**	Units:	**mg/Kg**		
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Gasoline Range Organics (GRO)	26	5.0	25.00	0	105	79.6	122			
Surr: BFB	970		1000		97.3	66.2	112			

Sample ID	**1602A03-003AMS**	SampType:	**MS**		TestCode:	**EPA Method 8015D: Gasoline Range**				
Client ID:	**L3-1**	Batch ID:	**23925**		RunNo:	**32403**				
Prep Date:	**2/24/2016**	Analysis Date:	**2/25/2016**		SeqNo:	**991245**	Units:	**mg/Kg**		
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Gasoline Range Organics (GRO)	28	4.8	23.99	0	118	59.3	143			
Surr: BFB	980		959.7		102	66.2	112			

Sample ID	**1602A03-003AMSD**	SampType:	**MSD**		TestCode:	**EPA Method 8015D: Gasoline Range**				
Client ID:	**L3-1**	Batch ID:	**23925**		RunNo:	**32403**				
Prep Date:	**2/24/2016**	Analysis Date:	**2/25/2016**		SeqNo:	**991246**	Units:	**mg/Kg**		
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Gasoline Range Organics (GRO)	29	4.8	24.04	0	119	59.3	143	1.28	20	
Surr: BFB	980		961.5		102	66.2	112	0	0	

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
R	RPD outside accepted recovery limits	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#: **1602A03**

01-Mar-16

Client: Souder, Miller & Associates

Project: Empire J Federal #3

Sample ID	**MB-23925**	SampType: **MBLK**		TestCode: **EPA Method 8021B: Volatiles**					
Client ID:	**PBS**	Batch ID: **23925**		RunNo: **32403**					
Prep Date:	**2/24/2016**	Analysis Date: **2/25/2016**		SeqNo: **991270**		Units: **mg/Kg**			

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	ND	0.050								
Toluene	ND	0.050								
Ethylbenzene	ND	0.050								
Xylenes, Total	ND	0.10								
Surr: 4-Bromofluorobenzene	1.1		1.000		111	80	120			

Sample ID	**LCS-23925**	SampType: **LCS**		TestCode: **EPA Method 8021B: Volatiles**					
Client ID:	**LCSS**	Batch ID: **23925**		RunNo: **32403**					
Prep Date:	**2/24/2016**	Analysis Date: **2/25/2016**		SeqNo: **991271**		Units: **mg/Kg**			

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	1.0	0.050	1.000	0	100	80	120			
Toluene	1.0	0.050	1.000	0	104	80	120			
Ethylbenzene	1.0	0.050	1.000	0	104	80	120			
Xylenes, Total	3.2	0.10	3.000	0	105	80	120			
Surr: 4-Bromofluorobenzene	1.2		1.000		116	80	120			

Sample ID	**1602A03-001AMS**	SampType: **MS**		TestCode: **EPA Method 8021B: Volatiles**					
Client ID:	**L1-3**	Batch ID: **23925**		RunNo: **32403**					
Prep Date:	**2/24/2016**	Analysis Date: **2/25/2016**		SeqNo: **991274**		Units: **mg/Kg**			

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	0.86	0.048	0.9634	0	89.3	71.5	122			
Toluene	0.95	0.048	0.9634	0	98.3	71.2	123			
Ethylbenzene	1.0	0.048	0.9634	0	105	75.2	130			
Xylenes, Total	3.1	0.096	2.890	0	108	72.4	131			
Surr: 4-Bromofluorobenzene	1.1		0.9634		116	80	120			

Sample ID	**1602A03-001AMSD**	SampType: **MSD**		TestCode: **EPA Method 8021B: Volatiles**					
Client ID:	**L1-3**	Batch ID: **23925**		RunNo: **32403**					
Prep Date:	**2/24/2016**	Analysis Date: **2/25/2016**		SeqNo: **991275**		Units: **mg/Kg**			

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	0.84	0.048	0.9643	0	87.3	71.5	122	2.23	20	
Toluene	0.92	0.048	0.9643	0	95.5	71.2	123	2.78	20	
Ethylbenzene	0.95	0.048	0.9643	0	98.3	75.2	130	6.56	20	
Xylenes, Total	3.0	0.096	2.893	0	102	72.4	131	5.14	20	
Surr: 4-Bromofluorobenzene	1.1		0.9643		118	80	120	0	0	

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
R	RPD outside accepted recovery limits	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

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

Sample Log-In Check List

Client Name: **SMA-CARLSBAD** Work Order Number: **1602A03** RcptNo: 1

Received by/date: 02/24/16

Logged By: **Joe Archuleta** **2/24/2016 10:05:00 AM**

Completed By: **Joe Archuleta** **2/24/2016 10:21:09 AM**

Reviewed By: 02/24/16

Chain of Custody

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

Log In

4. Was an attempt made to cool the samples? Yes ☑ No ☐ NA ☐
5. Were all samples received at a temperature of >0° C to 6.0°C Yes ☑ No ☐ NA ☐
6. Sample(s) in proper container(s)? Yes ☑ No ☐
7. Sufficient sample volume for indicated test(s)? Yes ☑ No ☐
8. Are samples (except VOA and ONG) properly preserved? Yes ☑ No ☐
9. Was preservative added to bottles? Yes ☐ No ☑ NA ☐
10. VOA vials have zero headspace? Yes ☐ No ☐ No VOA Vials ☑
11. Were any sample containers received broken? Yes ☐ No ☑
12. Does paperwork match bottle labels? (Note discrepancies on chain of custody) Yes ☑ No ☐
13. Are matrices correctly identified on Chain of Custody? Yes ☑ No ☐
14. Is it clear what analyses were requested? Yes ☑ No ☐
15. 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: _____

Special Handling (if applicable)

16. 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: _____

17. Additional remarks:

18. **Cooler Information**

Cooler No	Temp °C	Condition	Seal Intact	Seal No	Seal Date	Signed By
1	4.1	Good	Yes			

Chain-of-Custody Record

ent: SMA Carlsbad

ailing Address:

hone #:

nail or Fax#:

A/QC Package:
Standard ☐ Level 4 (Full Validation)

ccreditation
NELAP ☐ Other
EDD (Type)

Turn-Around Time:
☑ Standard ☐ Rush

Project Name: Empire J Federal #3

Project #:

Project Manager: Ashley Weyant

Sampler: LGM

On Ice: ☒ Yes ☐ No

Sample Temperature: 9.1

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 Request ID	Container Type and #	Preservative Type	HEAL No. 1602A03	BTEX + MTBE + TMB's (8021)	BTEX + MTBE + TPH (Gas only)	TPH 8015B (GRO / DRO / MRO)	TPH (Method 418.1)	EDB (Method 504.1)	PAH's (8310 or 8270 SIMS)	RCRA 8 Metals	Anions ($F, Cl, NO_3, NO_2, PO_4, SO_4$)	8081 Pesticides / 8082 PCB's	8260B (VOA)	8270 (Semi-VOA)	Air Bubbles (Y or N)
6/16	1100	Soil	L1-3	A02		-001	X		X					X				
			L2-1			-002								X				
			L3-1			-003	X		X					X				
			L4-1			-004								X				
			~~L5-1~~															

Date: Time: Relinquished by:

Date: Time: Relinquished by:

Received by: Date Time
02/24/16 1005

Received by: Date Time

Remarks:

APPENDIX B

FORM C141 FINAL

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

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

Form C-141
Revised August 8, 2011

Submit 1 Copy to appropriate District Office in accordance with 19.15.29 NMAC.

Release Notification and Corrective Action

nML B1129352724 2RP-928

OPERATOR ☐ Initial Report ☒ Final Report

Name of Company ALAMO PERMIAN RESOUCES, LLC	Contact CARIE STOKER
Address 415 W. WALL ST. SUITE 500	Telephone No. 432 664 7659
Facility Name EMPIRE J FEDERAL #3	Facility Type

Surface Owner FEDERAL	Mineral Owner FEDERAL	API No. 30-015-00169

LOCATION OF RELEASE

Unit Letter	Section	Township	Range	Feet from the	North/South Line	Feet from the	East/West Line	County
H	1	18S	26E	2304	N	330	E	EDDY

Latitude 32.7723 **Longitude** -104.32915

NATURE OF RELEASE

Type of Release: Water	Volume of Release: **EST** 10 bbls	Volume Recovered: 0 bbls
Source of Release: 500 bbl Frac Tank	Date and Hour of Occurrence: Unknown	Date and Hour of Discovery 5/09/11
Was Immediate Notice Given? ☐ Yes ☒ No ☐ Not Required	If YES, To Whom?	
By Whom?	Date and Hour	
Was a Watercourse Reached? ☐ Yes ☒ No	If YES, Volume Impacting the Watercourse.	

If a Watercourse was Impacted, Describe Fully.*

Describe Cause of Problem and Remedial Action Taken.*

Cause of problem: Release of produced water from frac tank
Remedial Action Taken: Clean up per SMA's environmental assessment and agreement with current BLM procedures and regulations; To prevent future discharges, frac tank will be removed-all fluids will be produced to a berm contained tank battery

Describe Area Affected and Cleanup Action Taken.*

Approximately 80 cubic yards of contaminated soil was removed and was transported to for proper disposal at Lea Land facility in New Mexico. The excavation backfilled with clean caliche material from Lea Land to bring the contours to surface grade. (see closure report for full details)

I hereby certify that the information given above is true and complete to the best of my knowledge and understand that pursuant to NMOCD 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 NMOCD marked as "Final Report" does not relieve the operator of liability should their operations have failed to adequately investigate and remediate contamination that pose a threat to ground water, surface water, human health or the environment. In addition, NMOCD 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.

Signature: Carie Stoker	OIL CONSERVATION DIVISION
Printed Name: CARIE STOKER	Approved by Environmental Specialist:
Title: REGULATORY/ PRODUCTION TECH	Approval Date: / Expiration Date:
E-mail Address: cstoker@helmsoil.com	Conditions of Approval: / Attached ☐
Date: 03/23/2016 Phone: 432 664 7659	

* Attach Additional Sheets If Necessary

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
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1220 S. St. Francis Dr., Santa Fe, NM 87505

State of New Mexico
Energy Minerals and Natural Resources

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

Form C-141
Revised August 8, 2011

Submit 1 Copy to appropriate District Office in accordance with 19.15.29 NMAC.

Release Notification and Corrective Action

nJMW1217347760 2RP-1184

OPERATOR ☐ Initial Report ☒ Final Report

Name of Company ALAMO PERMIAN RESOUCES, LLC	Contact CARIE STOKER
Address 415 W. WALL ST. SUITE 500	Telephone No. 432 664 7659
Facility Name EMPIRE J FEDERAL #3	Facility Type

Surface Owner FEDERAL	Mineral Owner FEDERAL	API No. 30-015-00169

LOCATION OF RELEASE

Unit Letter	Section	Township	Range	Feet from the	North/South Line	Feet from the	East/West Line	County
H	1	18S	26E	2304	N	330	E	EDDY

Latitude 32.7723 **Longitude** -104.32915

NATURE OF RELEASE

Type of Release: Oil & Water	Volume of Release: **EST** 3 bbls oil; 11 bbls wtr	Volume Recovered: 2 bbls oil
Source of Release: Backside Casing Valve	Date and Hour of Occurrence: Unknown	Date and Hour of Discovery 6/14/12
Was Immediate Notice Given? ☒ Yes ☐ No ☐ Not Required	If YES, To Whom? Mike Stewart	
By Whom? Jennifer Van Curen	Date and Hour 6/14/12	
Was a Watercourse Reached? ☐ Yes ☒ No	If YES, Volume Impacting the Watercourse.	

If a Watercourse was Impacted, Describe Fully.*

Describe Cause of Problem and Remedial Action Taken.*

Cause of problem: Discharge from backside casing valve
Remedial Action Taken: Vacuum trucks dispatched to suck up standing fluid

Describe Area Affected and Cleanup Action Taken.*

Approximately 80 cubic yards of contaminated soil was removed and was transported to for proper disposal at Lea Land facility in New Mexico. The excavation backfilled with clean caliche material from Lea Land to bring the contours to surface grade. (see closure report for full details)

I hereby certify that the information given above is true and complete to the best of my knowledge and understand that pursuant to NMOCD 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 NMOCD marked as "Final Report" does not relieve the operator of liability should their operations have failed to adequately investigate and remediate contamination that pose a threat to ground water, surface water, human health or the environment. In addition, NMOCD 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.

Signature: Carie Stoker	OIL CONSERVATION DIVISION	
Printed Name: CARIE STOKER	Approved by Environmental Specialist:	
Title: REGULATORY/ PRODUCTION TECH	Approval Date:	Expiration Date:
E-mail Address: cstoker@helmsoil.com	Conditions of Approval:	Attached ☐
Date: 03/23/2016 Phone: 432 664 7659		

* Attach Additional Sheets If Necessary

APPENDIX C

NATURAL RESOURCES CONSERVATION SERVICE – SOIL RESOURCE REPORT FOR EDDY AREA, NEW MEXICO

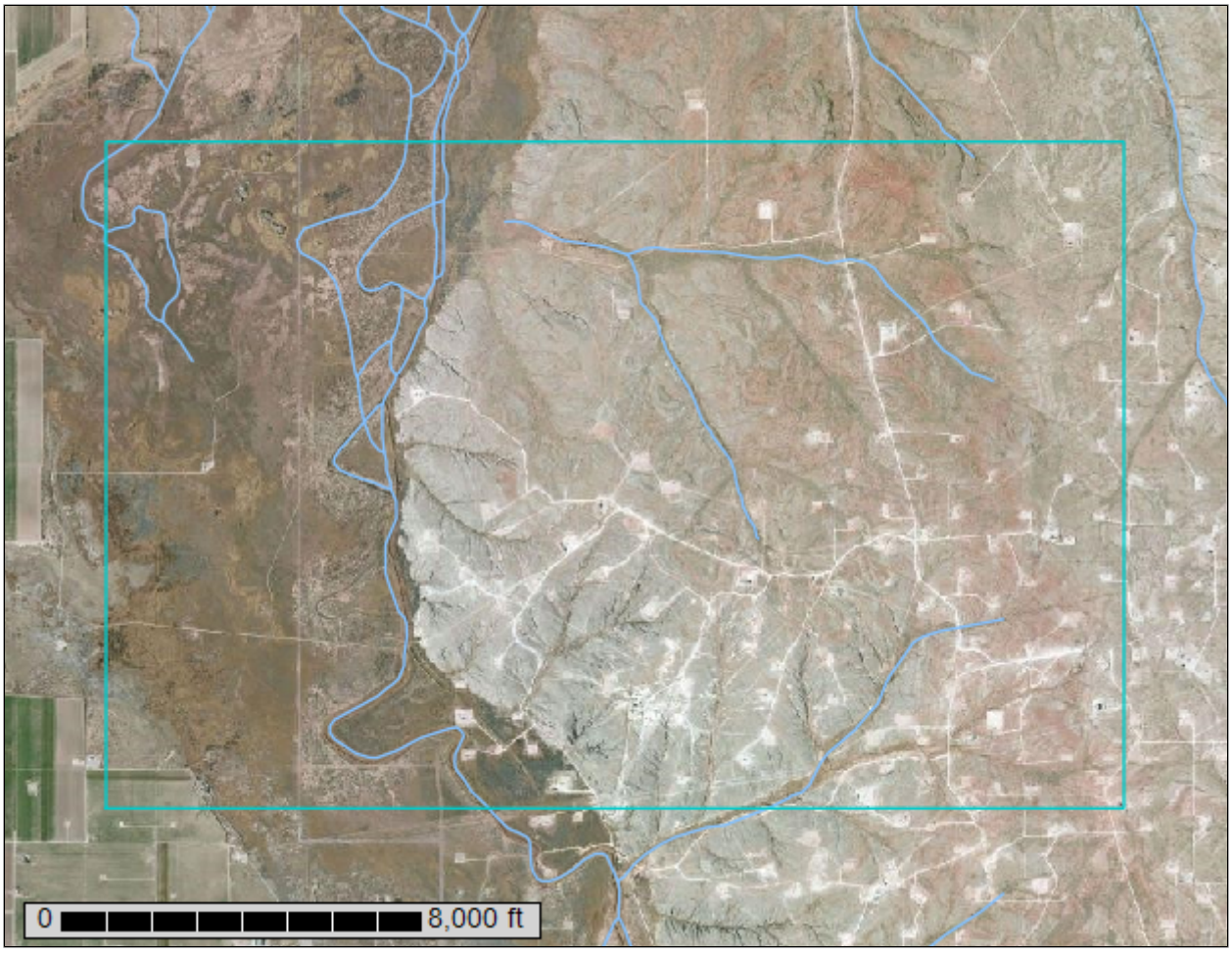
United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Eddy Area, New Mexico



February 10, 2016

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (http://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means

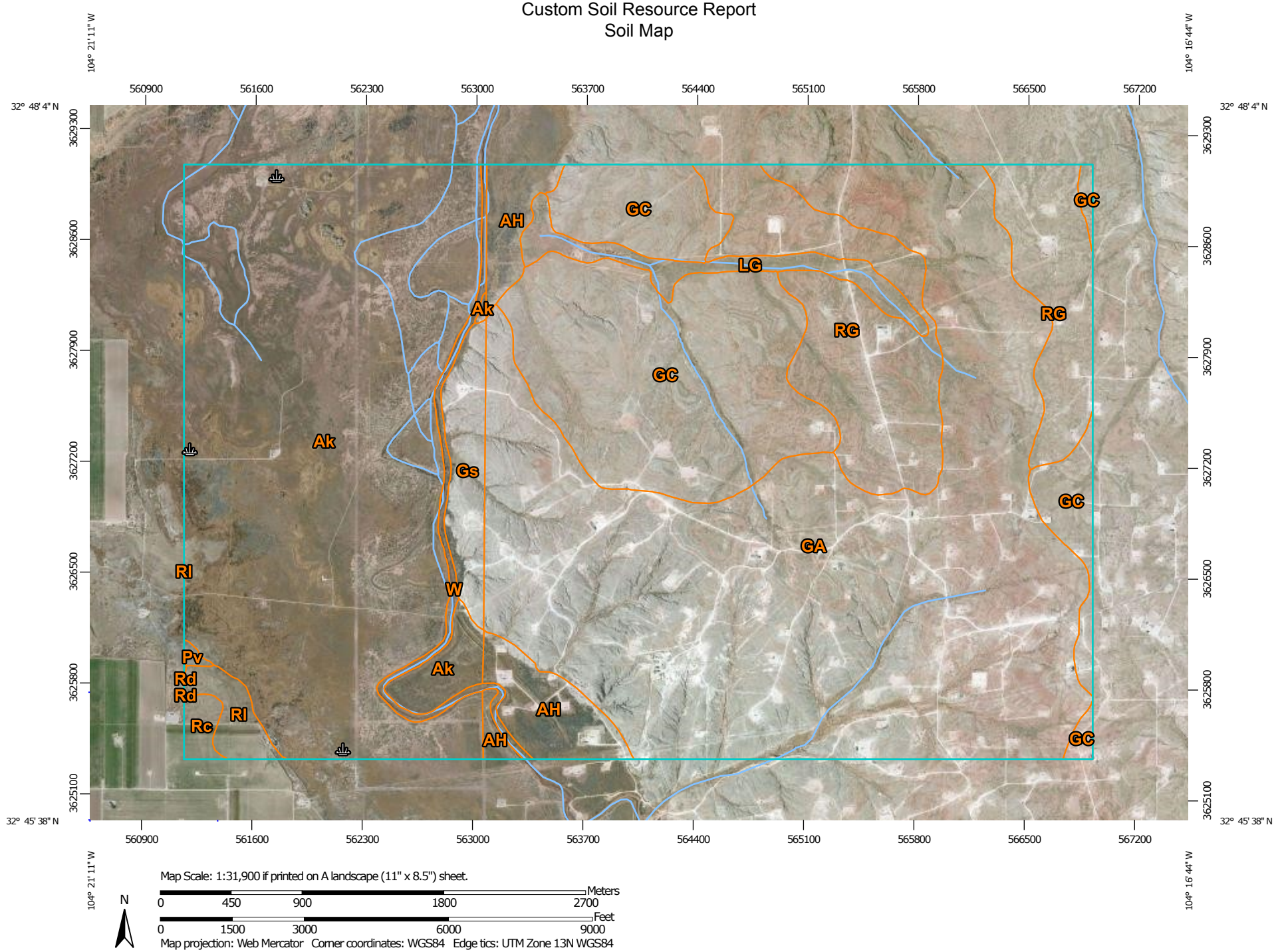
for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

Contents

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Eddy Area, New Mexico
Survey Area Data: Version 11, Sep 26, 2014

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Mar 17, 2011—Mar 20, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Eddy Area, New Mexico (NM614)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
AH	Arno-Harkey complex, saline, 0 to 1 percent slopes	171.3	3.2%
Ak	Arno-Harkey complex, saline, 0 to 1 percent slopes	1,565.5	29.2%
GA	Gypsum land	1,959.0	36.5%
GC	Gypsum land-Cottonwood complex, 0 to 3 percent slopes	808.7	15.1%
Gs	Gypsum land-Cottonwood complex, 0 to 3 percent slopes	99.7	1.9%
LG	Largo silt loam, overflow, 0 to 1 percent slopes	89.6	1.7%
Pv	Pima clay loam, gray variant, 0 to 1 percent slopes	4.1	0.1%
Rc	Reagan loam, 0 to 1 percent slopes	21.5	0.4%
Rd	Reagan loam, 1 to 3 percent slopes	0.3	0.0%
RG	Reeves-Gypsum land complex, 0 to 3 percent slopes	556.3	10.4%
Rl	Reeves loam, 0 to 1 percent slopes	44.3	0.8%
W	Water	49.2	0.9%
Totals for Area of Interest		**5,369.5**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be

made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Gs—Gypsum land-Cottonwood complex, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 1w4j
Elevation: 3,000 to 5,000 feet
Mean annual precipitation: 10 to 14 inches
Mean annual air temperature: 60 to 64 degrees F
Frost-free period: 190 to 220 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Gypsum land: 60 percent
Cottonwood and similar soils: 30 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Gypsum Land

Setting

Landform: Plains, ridges, hills
Landform position (two-dimensional): Backslope, footslope, shoulder, toeslope
Landform position (three-dimensional): Side slope, crest, nose slope, head slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Residuum weathered from gypsum

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s

Description of Cottonwood

Setting

Landform: Hills, ridges
Landform position (two-dimensional): Backslope, footslope, shoulder, toeslope
Landform position (three-dimensional): Crest, nose slope, side slope, head slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Residuum weathered from gypsum

Typical profile

H1 - 0 to 9 inches: loam
H2 - 9 to 60 inches: bedrock

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: 3 to 12 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 2.00 in/hr)

Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Gypsum, maximum in profile: 5 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 1.0
Available water storage in profile: Very low (about 1.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: D
Ecological site: Gyp Upland (R042XC006NM)

LG—Largo silt loam, overflow, 0 to 1 percent slopes

Map Unit Setting

National map unit symbol: 1w4z
Elevation: 3,000 to 4,200 feet
Mean annual precipitation: 10 to 14 inches
Mean annual air temperature: 60 to 64 degrees F
Frost-free period: 200 to 217 days
Farmland classification: Not prime farmland

Map Unit Composition

Largo and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Largo

Setting

Landform: Alluvial fans, plains
Landform position (three-dimensional): Rise, talf
Down-slope shape: Linear, convex
Across-slope shape: Linear
Parent material: Calcareous alluvium

Typical profile

H1 - 0 to 6 inches: silt loam
H2 - 6 to 60 inches: stratified silt loam to silty clay loam

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Occasional

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