

State of New Mexico
Energy, Minerals and Natural Resources Department

Susana Martinez
Governor

David Martin
Cabinet Secretary-Designate

Brett F. Woods, Ph.D.
Deputy Cabinet Secretary

Jami Bailey, Division Director
Oil Conservation Division



New Mexico Oil Conservation Division approval and conditions listed below are made in accordance with OCD Rule 19.15.7.11 and are in addition to the actions approved by BLM on the following 3160-3 APD form.

Operator Signature Date: 6-25-14

Well information;

Operator Logos, Well Name and Number Sarah B # 001H

API# 30-045-35564, Section 11, Township 23 (N/S), Range 8 E/W

Conditions of Approval:

(See the below checked and handwritten conditions)

- Notify Aztec OCD 24hrs prior to casing & cement.
- Hold C-104 for directional survey & "As Drilled" Plat
- Hold C-104 for NSL, NSP, DHC
- Spacing rule violation. Operator must follow up with change of status notification on other well to be shut in or abandoned
- Regarding the use of a pit, closed loop system or below grade tank, the operator must comply with the following as applicable:
 - A pit requires a complete C-144 be submitted and approved prior to the construction or use of the pit, pursuant to 19.15.17.8.A
 - A closed loop system requires notification prior to use, pursuant to 19.15.17.9.A
 - A below grade tank requires a registration be filed prior to the construction or use of the below grade tank, pursuant to 19.15.17.8.C
- Once the well is spud, to prevent ground water contamination through whole or partial conduits from the surface, the operator shall drill without interruption through the fresh water zone or zones and shall immediately set in cement the water protection string
- Regarding Hydraulic Fracturing, review EPA Underground Injection Control Guidance 84
- Oil base muds are not to be used until fresh water zones are cased and cemented providing isolation from the oil or diesel. This includes synthetic oils. Oil based mud, drilling fluids and solids must be contained in a steel closed loop system.
- Well-bore communication is regulated under 19.15.29 NMAC. This requires well-bore Communication to be reported in accordance with 19.15.29.8.

Cheryl Herro
NMOCD Approved by Signature

10-3-2014
Date JK

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

RECEIVED

APPLICATION FOR PERMIT TO DRILL OR REENTER

Lease Serial No.
NM#109397

6. If Indian, Allottee or Tribe Name

ROYD SEP 30 '14

7. If Unit or CA Agreement, Name and No.
OIL CONS. DIV.

1a. Type of work: DRILL REENTER

Farmington Field Office
Bureau of Land Management

1b. Type of Well: Oil Well Gas Well Other Single Zone Multiple Zone

8. Lease Name and Well No.
SARAH B 001H DIST. 3

2. Name of Operator Logos Operating, LLC

9. API Well No.
30-045-35564

3a. Address 4001 North Butler Ave, Building 7101
Farmington, NM 87401

3b. Phone No. (include area code)
505-330-9333

10. Field and Pool, or Exploratory
Basin Mancos

4. Location of Well (Report location clearly and in accordance with any State requirements.)*

At surface 335' FNL & 1047' FEL (NE/NE)

At proposed prod. zone 335' FNL & 330' FEL (NE/NE)

11. Sec., T. R. M. or Blk. and Survey or Area

SHL: Sec 11, T23N R08W, UL A
BHL: Sec 12, T23N R08W, UL A

14. Distance in miles and direction from nearest town or post office*
5 miles east of Nageezi

12. County or Parish
San Juan

13. State
NM

15. Distance from proposed* location to nearest property or lease line, ft. (Also to nearest drig. unit line, if any)
335' from south edge of Sec 2

16. No. of acres in lease
~~640.00~~ acres -
800.48

17. Spacing Unit dedicated to this well
N2/N2 = 160 acres

18. Distance from proposed location* to nearest well, drilling, completed, applied for, on this lease, ft.
Sarah B 2H - 50'

19. Proposed Depth
10586' MD, 5400' VD

20. BLM/BIA Bond No. on file
BLM NMB000917

21. Elevations (Show whether DF, KDB, RT, GL, etc.)
7011' GL

22. Approximate date work will start*
08/15/2014

23. Estimated duration
45 days

24. Attachments

The following, completed in accordance with the requirements of Onshore Oil and Gas Order No.1, must be attached to this form:

- Well plat certified by a registered surveyor.
- A Drilling Plan.
- A Surface Use Plan (if the location is on National Forest System Lands, the SUPO must be filed with the appropriate Forest Service Office).
- Bond to cover the operations unless covered by an existing bond on file (see Item 20 above).
- Operator certification
- Such other site specific information and/or plans as may be required by the BLM.

25. Signature *Tamra Sessions* Name (Printed/Typed) Tamra Sessions Date 06/25/2014

Title Operations Technician

Approved by (Signature) *[Signature]* Name (Printed/Typed) Date 9/29/14

Title AFM Office PFD

Application approval does not warrant or certify that the applicant holds legal or equitable title to those rights in the subject lease which would entitle the applicant to conduct operations thereon. Conditions of approval, if any, are attached.

Title 18 U.S.C. Section 1001 and Title 43 U.S.C. Section 1212, make it a crime for any person knowingly and willfully to make to any department or agency of the United States any false, fictitious or fraudulent statements or representations as to any matter within its jurisdiction.

(Continued on page 2)

**DRILLING OPERATIONS
AUTHORIZED ARE SUBJECT TO
COMPLIANCE WITH ATTACHED
"GENERAL REQUIREMENTS"**

THIS APPROVAL OR ACCEPTANCE OF THIS
ACTION DOES NOT RELIEVE THE LESSEE AND
OPERATOR FROM OBTAINING ANY OTHER
AUTHORIZATION REQUIRED FOR OPERATIONS
ON FEDERAL AND INDIAN LANDS

*(Instructions on page 2)

This action is subject to technical
and procedural review pursuant to
43 CFR 3165.3 and appeal
pursuant to 43 CFR 3165.4

NMOCDA

District I
1625 N. French Dr., Hobbs, NM 88240
Phone: (575) 393-6161 Fax: (575) 393-0720
District II
811 S. First St., Artesia, NM 88210
Phone: (575) 748-1283 Fax: (575) 748-9720
District III
1000 Rio Brazos Road, Aztec, NM 87410
Phone: (505) 334-6178 Fax: (505) 334-6170
District IV
1220 S. St. Francis Dr., Santa Fe, NM 87505
Phone: (505) 476-3460 Fax: (505) 476-3462

State of New Mexico
Energy, Minerals & Natural Resources Department
Form C-102
Revised August 1, 2011
Submit one copy to appropriate District Office

OIL CONSERVATION DIVISION
1220 South St. Francis Dr.
Santa Fe, NM 87505
JUN 26 2014

AMENDED REPORT
Farmington Field Office
Bureau of Land Management

¹ API Number 30-045-35564	² Pool Code 97232	³ Pool Name BASIN MANCOS
⁴ Property Code 313750	⁵ Property Name SARAH B	
⁷ OGRID No. 289408	⁸ Operator Name LOGOS OPERATING, LLC	⁶ Well Number 1H ⁹ Elevation 7011'

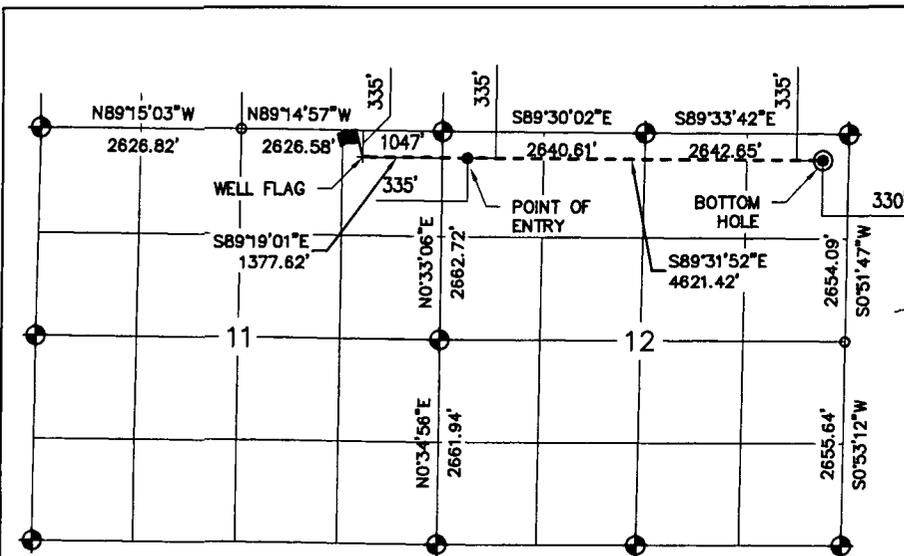
UL or lot no.	Section	Township	Range	Lot Idn	Feet from the	North/South line	Feet from the	East/West line	County
A	11	23N	8W		335'	NORTH	1047'	EAST	SAN JUAN

UL or lot no.	Section	Township	Range	Lot Idn	Feet from the	North/South line	Feet from the	East/West line	County
A	12	23N	8W		335'	NORTH	330'	EAST	SAN JUAN

¹² Dedicated Acres 160 Acres N ² /W ² sec. 12	¹³ Joint of Infill	¹⁴ Consolidation Code	¹⁵ Order No.
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RCVD SEP 30 14
OIL CONS. DIV.

No allowable will be assigned to this completion until all interests have been consolidated or a non-standard unit has been approved by the division. DIST. 3



WELL FLAG
LAT 36.24790 N (NAD 1983)
LONG 107.64570 W (NAD 1983)
LAT 36°14'52.39" N (NAD 1927)
LONG 107°38'42.32" W (NAD 1927)

POINT OF ENTRY
LAT 36.24798N (NAD 1983)
LONG 107.64103 W (NAD 1983)
LAT 36°14'52.61" N (NAD 1927)
LONG 107°38'25.51" W (NAD 1927)

BOTTOM HOLE
LAT 36.24804 N (NAD 1983)
LONG 107.62536 W (NAD 1983)
LAT 36°14'52.90" N (NAD 1927)
LONG 107°37'29.10" W (NAD 1927)

LEGEND

- ◆ FOUND 2" BRASS CAP USGLO 1947
- FOUND REBAR

¹⁷OPERATOR CERTIFICATION
I hereby certify that the information contained herein is true and complete to the best of my knowledge and belief, and that this organization either owns a working interest or unleased mineral interest in the land including the proposed bottom-hole location or has a right to drill this well at this location pursuant to a contract with an owner of such a mineral or working interest, or to a voluntary pooling agreement or a compulsory pooling order heretofore entered by the division.

Tamra Sessions 6/24/14
Signature Date

Tamra Sessions

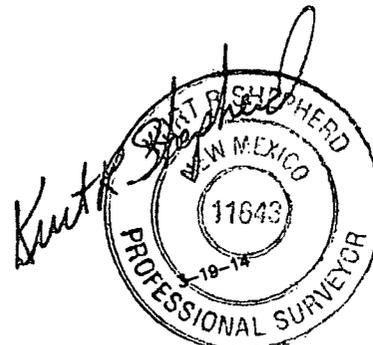
Printed Name
tsessions@logosresourcesllc.com

E-mail Address

¹⁸SURVEYOR CERTIFICATION
I hereby certify that the well location shown on this plat was plotted from field notes of actual surveys made by me or under my supervision, and that the same is true and correct to the best of my belief.

Survey Date: FEBRUARY, 2013

Signature and Seal of Professional Surveyor



Certificate Number 11643

**Attachment To Application For Permit To Drill.
Drilling program**

LOGOS OPERATING, LLC
4001 N. Butler, Bldg. 7101
Farmington, NM 87401
U.S.A

SARAH B #1H

Horizontal Gallup Oil and Gas Well
Surface Location: 335' FNL – 1047' FEL
Section 11, T23N, R8W
Ungraded GL Elev = 7011'
Estimate KB Elev = 7026'
Lat. = 36.247900 deg N
Long. = 107.645700 deg W
NAD83
San Juan County, New Mexico

Proposed Bottom Hole Location: 335' FNL – 330' FEL
Section 12, T23N, R8W
San Juan County, New Mexico

Drilling program written in compliance with onshore Oil and Gas Order No. 1
(III.D.3, effective May 2007) and Onshore Order No. 2 Dated November 18, 1988

1. ESTIMATED TOPS FOR IMPORTANT GEOLOGICAL FORMATIONS

<u>Formation Tops</u>	<u>Surface (TVD)</u>
Ojo Alamo	1145
Kirtland	1344
Fruitland	1622
Pictured Cliffs	1834
Chacra	2239
Cliffs House	3326
Menefee	3365
Point Lookout	4224
Mancos	4373
Gallup	5226
Landing Point	5443

Drilling Plan

Drill 12 ¼" hole to 500' then set 9 5/8" casing. Drill 8 3/4" hole with fresh water mud from 500' MD to kick off point #1 3072' MD and build 2 degrees per 100' to 40 degrees, 88.87 degrees azimuth and hold to approximately 4963' MD.

Trip out of hole and pick up 8 ¾" kick off assembly at 4963' MD. Build angle at 10 deg/100' to 85 degrees inclination and 269.68 degrees azimuth in the Gallup formation at 5501' MD / 5226' TVD where 7" intermediate casing will be set at 5965' MD / 5438' TVD.

7" casing will be set in a legal position 335' FNL & 335' FWL in Section 12.

The 7" casing will be drilled out with a 6 1/8" drilling assembly building angle at 5 deg/100' to 90.55 degrees inclination and 89.52 degree azimuth to 6076' MD / 5443' TVD. Hold 90.55 degrees, 89.52 degrees azimuth and drill to a total depth at 10586' MD / 5400' TVD. Adjustments may be made to the directional program based on geology. Total depth will be 10586' MD / 5400' TVD - 90.55 degrees, 89.52 degrees Azimuth.

The Bottom hole location will be in a legal location at 10586' MD at 335' FNL & 330' FEL of section 12.

A total of 4621' of horizontal hole will be drilled.

2. ANTICIPATED DEPTHS OF PROSPECTIVE OIL GAS AND OTHER HYDROCARBONS

Primary objective is the Gallup formation encountered first at 5226' TVD

See formation listings in #1 above for additional zones of interest.

3. MINIMUM SPECIFICATIONS FOR PRESSURE CONTROL EQUIPMENT

Wellhead Equipment 2,000 PSI System (See Exhibit 1)

- 9 5/8" slip-on / welded x 11" 2,000 psi casing head.
- One 11" 2,000 psi WP double-ram preventer with one (1) set of blind rams on top & one (1) set of pipe rams on bottom complete with hand wheels and extension arms.
- The choke and kill lines will be connected to outlets between the bottom and top rams, utilizing either the ram body outlet or a drilling spool with side outlets for 2" kill line and minimum 3" choke line
- One 11" x 2,000 psi WP Hydril GK (or equivalent) annular preventer.
- Accumulator - Four Station Koomey (or equivalent) 120 gallon closing unit with remote, backup. The accumulator shall have sufficient capacity to open the hydraulically-controlled gate valve and close all rams plus the annular preventer, with a 50% safety factor and retain a minimum of 200 psi above the precharge on the closing manifold without the use of the closing unit pumps. The reservoir capacity shall be double the usable accumulator capacity, and the fluid level shall be maintained at the manufacturer's recommendations.
- The BOP system shall have two (2) independent power sources (electric and air) available for powering the closing unit pumps. Sufficient nitrogen bottles are suitable as a backup power source only, and shall be recharged when the pressure falls below manufacturer's specification.
- A valve shall be installed in the closing line as close as possible to the annular preventer to act as a locking device. This valve shall be maintained in the open position and shall be closed only when the power source for the accumulator system is inoperative.

All BOP equipment will be hydraulically operated with controls accessible both on the rig floor.

The wellhead BOP equipment will be nipped-up on the 9-5/8" x 11" 2,000 psi WP casing head prior to drilling out from under surface casing. All ram preventers and related equipment will be tested to 2,000 psi for 10 minutes. Annular preventers will be tested to 50% of rated working pressure for 10 minutes. Surface casing will be tested to 70% of internal yield pressure. All preventers and surface casing will be tested before drilling out of surface casing. BOP equipment will be tested every 14 days, after any repairs are made to the BOP equipment, and after the BOP equipment is subjected to pressure. Annular preventers will be functionally operated at least once per week. Pipe rams will be activated daily and blind rams shall be activated each trip or at least weekly. The New Mexico Oil & Gas Conservation Commission and the BLM will be notified 24 hours in advance of testing of BOPE.

4. PROPOSED BIT AND CASING PROGRAM

A. Bit Program

12-1/4" Surface Hole = Surface to 500'
 8-3/4" = 500' to 5965' = 7" Casing point
 6-1/8" Lateral = 5965' MD to 10586' MD = Gallup Pay Zone Horizontal

B. Casing Program – all casing strings are new casing

Casing & Hole Size	Weight	Grade	Coupling	Setting Depth (MD)	Comments
9-5/8" (12 1/4")	36 ppf	K-55	LT&C	0' - 500'	New casing. Cement to surface.
7" (8 3/4")	23 ppf	J-55	LT&C	0' - 5965' MD	New Casing. Cement to surface with cement.
4 1/2" (6 1/8")	11.6 ppf	P-110	LT&C	5300' - 10586' MD	New Casing - Horizontal Hole Cemented full length with foam cement - TOL at 40 degrees.

Casing strings below the conductor casing will be tested to .22 psi per foot of casing string length or 1500 psi, whichever is greater, but not to exceed 70% of the minimum internal yield.

Minimum casing design factors used:

Collapse -	1.125
Burst -	1.0
Jt. Strength -	1.60

Surface casing shall have a minimum of 1 centralizer per joint on the bottom three (3) joints, starting with the shoe joint for a total of (4) minimum centralizers. Centralizers will be placed 10' above the shoe on the shoe joint, on the 1st, 2nd and 3rd casing collars.

The intermediate casing will be centralized using 1 centralizer the first 6 jts and spaced appropriately through the curve section of the well-bore and then spaced +/- 1 centralizer / 4 jts through the remainder of the cement column, using approximately 40 centralizers.

5. PROPOSED CEMENTING PROGRAM

The proposed cementing program has been designed to protect and/or isolate all usable water zones, potentially productive zones, lost circulation zones, abnormally pressured zones, and any prospectively valuable deposits of minerals. Any isolating medium other than cement shall receive approval prior to use. The casing setting depth shall be calculated to position the casing seat opposite a competent formation which will contain the maximum pressure to which it will be exposed during normal drilling operations. All indications of useable water shall be reported.

- The proposed cementing program is as follows:

Top plugs shall be used to reduce contamination of cement by displacement fluid. A bottom plug or other acceptable technique, such as a pre-flush fluid, inner string cement method, etc. shall be utilized to help isolate the cement from contamination by the mud fluid being displaced ahead of the cement slurry.

Surface Casing Single Stage Job – (0-500’):

Excess – 100% over gauge hole – 12-1/4” hole and 9-5/8” casing (0.3132ft3/ft)

Top of Cement - Surface

Primary Cement
HALCEM (TM) SYSTEM
0.125 lbm/sk Poly-E-Flake (Lost Circulation Additive)
0.4 % Halad(R)-344 (Low Fluid Loss Control)

Fluid Weight 15.80 lbm/gal
Slurry Yield: 1.15 ft³/sk
Total Mixing Fluid: 4.94 Gal/sk
Top of Fluid: 0 ft
Calculated Fill: 500 ft
Volume: 55.8 bbl 313.2
Calculated Sacks: 273 sks

Intermediate Casing – Two Stage Job (0-5965’ MD):

Excess – 50% over gauge hole – 8-3/4” hole and 7” casing (0.1503 ft3/ft)

Top of Cement – Surface.

Foamed Lead Cement
ELASTISEAL (TM) SYSTEM
0.2 % Versaset (Thixotropic Additive)
0.15 % HALAD-766 (Low Fluid Loss Control)
1.5 % CHEM - FOAMER 760, TOTETANK (Foamer)

Fluid Weight 13 lbm/gal
Slurry Yield: 1.43 ft³/sk
Total Mixing Fluid: 6.74 Gal/sk
Top of Fluid: 0 ft
Calculated Fill: 5760 ft
Volume: 231 bbl
Calculated Sacks: 908 sks

Tail Cement
HALCEM (TM) SYSTEM
0.2 % Versaset (Thixotropic Additive)
0.15 % HALAD-766 (Low Fluid Loss Control)

Fluid Weight 13.50 lbm/gal
Slurry Yield: 1.29 ft³/sk
Total Mixing Fluid: 5.70 Gal/sk
Top of Fluid: 5760 ft
Calculated Fill: 500 ft
Volume: 20
Calculated Sacks: 90 sks

Primary Cement – Cap Cement
HALCEM (TM) SYSTEM
2 % Calcium Chloride (Accelerator)

Fluid Weight 15.80 lbm/gal
Slurry Yield: 1.17 ft³/sk
Total Mixing Fluid: 5.02 Gal/sk
Calculated Fill: 500 ft
Volume: 20.77 bbl
Calculated Sacks: 100 sks

Detailed Pumping Schedule

Fluid #	Fluid Type	Fluid Name	Surface Density lbm/gal	Estimated Avg Rate bbl/min	Downhole Volume
1	Spacer	Fresh Water Spacer	8.3		10 bbl
2	Spacer	CHEMICAL WASH	8.4		40 bbl
3	Spacer	Fresh Water Spacer	8.3		10 bbl
4	Cement	Foamed Lead Cement	13.0		908 sks
5	Cement	Tail Cement	13.5		90 sks
6	Spacer	Displacement	8.3		
7	Cement	Cap Cement	15.8		100 sks

Foam Output Parameter Summary:

Fluid #	Fluid Name	Unfoamed Liquid Volume	Beginning Density lbm/gal	Ending Density lbm/gal	Beginning Rate scf/bbl	Ending Rate scf/bbl
Stage 1						
4	Foamed Lead Cement	200bbl	9.5	9.5	4.2	372.9

Foam Design Specifications:

Foam Calculation Method: Constant Density	Calculated Gas = 23129.9 scf
Backpressure: 14 psig	Additional Gas = 50000 scf
Bottom Hole Circulating Temp: 105 degF	Total Gas = 73129.9 scf
Mud Outlet Temperature: 85 degF	

Cement volumes are minimums and may be adjusted based on caliper log results.

Production Casing – Single Stage Job (5300' - 10586' MD):

Excess – 50% over gauge hole – 6-1/8" hole and 4-1/2" casing (0.0942 ft³/ft)

Top of Cement – Top of Liner.

Lead Cement - Cap Cement	Fluid Weight	13 lbm/gal
ELASTISEAL (TM) SYSTEM	Slurry Yield:	1.43 ft ³ /sk
0.2 % Versaset (Thixotropic Additive)	Total Mixing Fluid:	6.75 Gal/sk
0.15 % HALAD-766 (Low Fluid Loss Control)	Top of Fluid:	5300 ft
0.2 % Halad(R)-344 (Low Fluid Loss Control)	Calculated Fill:	300 ft
	Volume:	7.15 bbl
	Calculated Sacks:	30 sks

Foamed Lead Cement	Fluid Weight	13 lbm/gal
ELASTISEAL (TM) SYSTEM	Slurry Yield:	1.43 ft ³ /sk
0.2 % Versaset (Thixotropic Additive)	Total Mixing Fluid:	6.75 Gal/sk
0.15 % HALAD-766 (Low Fluid Loss Control)	Top of Fluid:	5600 ft
2.5 % CHEM - FOAMER 760, TOTETANK (Foamer)	Calculated Fill:	3914 ft
0.2 % Halad(R)-344 (Low Fluid Loss Control)	Volume:	99 bbl
	Calculated Sacks:	387 sks

Tail Cement	Fluid Weight	13.50 lbm/gal
ELASTISEAL (TM) SYSTEM	Slurry Yield:	1.28 ft ³ /sk
0.2 % Versaset (Thixotropic Additive)	Total Mixing Fluid:	5.64 Gal/sk
0.15 % HALAD-766 (Low Fluid Loss Control)	Top of Fluid:	9514 ft
0.05 % SA-1015 (Suspension Agent)	Calculated Fill:	1069 ft
	Volume:	20.85 bbl
	Calculated Sacks:	100 sks

Detailed Pumping Schedule

Fluid #	Fluid Type	Fluid Name	Surface Density lbm/gal	Estimated Avg Rate bbl/min	Downhole Volume
1	Spacer	Fresh Water Spacer	8.3		10 bbl
2	Spacer	CHEMICAL WASH	8.4		40 bbl
3	Spacer	Fresh Water Spacer	8.3		10 bbl
4	Cement	Cap Cement	13.0		30 sks
5	Cement	Foamed Lead Cement	13.0		387 sks
6	Cement	Tail Cement	13.5		100 sks
7	Spacer	MMCR Spacer	8.3		20 bbl
8	Spacer	Fresh Water Displacement	8.3		

Foam Output Parameter Summary:

Fluid #	Fluid Name	Unfoamed Liquid Volume	Beginning Density lbm/gal	Ending Density lbm/gal	Beginning Rate scf/bbl	Ending Rate scf/bbl
Stage 1						
5	Foamed Lead Cement	50.98bbl	10.0	10.0	303.8	509.4

Foam Design Specifications:

Foam Calculation Method:	Constant Density	Calculated Gas =	20792.1 scf
Backpressure:	14 psig	Additional Gas =	50000 scf
Bottom Hole Circulating Temp:	158 degF	Total Gas =	70792.1 scf
Mud Outlet Temperature:	100 degF		

Production liner clarification: Utilizing foam cement for zonal isolation in the production liner.

Actual volumes will be calculated and determined by conditions onsite. All cement slurries will meet or exceed minimum BLM and New Mexico Oil Conservation Division requirements. Slurries used will be the slurries listed above or equivalent slurries depending on service provider selected. Cement yields may change depending on slurries selected.

All waiting on cement times shall be a minimum of 8 hours or adequate to achieve a minimum of 500 psi compressive strength at the casing shoe prior to drilling out.

6. PROPOSED DRILLING FLUIDS PROGRAM

A. Vertical Portion

Hole Size (in)	TVD (ft)	Mud Type	Density (lb/gal)	Viscosity (sec/qt)	Fluid Loss (cc)
12 1/4"	0-500'	Fresh Water	8.4-8.6	60-70	NC
8 3/4"	500'-5236'	Fresh Water LSND	8.5-8.8	40-50	8-10

B. Kick off to Horizontal Lateral

Hole Size (in)	TVD/MD (ft)	Mud Type	Density (lb/gal)	Viscosity (sec/qt)	Fluid Loss (CC)
8 3/4"	5515' MD (KOP)- 6000' MD	Fresh Water LSND	8.5-8.8	40-50	8-10
6 1/8"	6000' MD - 10586' MD	Synthetic Oil Based Mud	7.0-9.0	15-25	<1

- There will be sufficient mud on location to control a blowout should one occur. Mud flow and volume will be monitored both visually and with electronic pit volume totalizers. Mud tests shall be performed every 24 hours after mudding up to determine, as applicable: density, viscosity, gel strength, filtration, and pH.
- A closed-loop system will be used to recover drilling fluid and dry cuttings in both phases of the well and on all hole intervals, including fresh water and oil-based operations. Above-ground tanks will be utilized to hold cuttings and fluids for rig operations. A frac tank will be on location to store fresh water. Waste will be disposed of properly at an EPA-approved hazardous waste facility. Fresh water cuttings will be disposed of at Basin Disposal, Inc. and/or Industrial Ecosystems, Inc. The location will be lined in accordance with the Surface Use Plan of Operations.

7. TESTING, CORING and LOGGING

- Drill Stem Testing - None anticipated
- Coring - None anticipated.
- Mud Logging - Mud loggers will be on location from intermediate casing point to TD.
- Logging - See Below
- Gamma Ray from surface casing point to TD

Cased Hole:

CBL/CCL/GRNDL will be run as needed for perforating control

8. ABNORMAL PRESSURES & HYDROGEN SULFIDE

The anticipated bottom hole pressure is +/- 2547 psi based on a 9.0 ppg at 5443' TVD of the landing point of the horizontal. No abnormal pressure or temperatures are anticipated.

No hydrogen sulfide gas is anticipated, however, if H₂S is encountered, the guidelines in Onshore Order No. 6 will be followed.

9. ANTICIPATED START DATE AND DURATION OF OPERATIONS

Drilling is estimated to commence on August 15, 2014. It is anticipated that completion operations will begin within 30 days after the well has been drilled depending on fracture treatment schedules with various pumping service companies.

It is anticipated that the drilling of this well will take approximately 45 days.

Based on the following rulings we are going to TD the well at 250' from the FEL, but due to the length of the RSI sleeve the first perf will be greater than 330' FEL. Although this horizontal well will be drilled past the applicable setbacks, an unorthodox location application is not required because the completed interval in this well, as defined by 19.15.16.7 B(1) NMAC, will be entirely within the applicable setbacks. This approach complies with all applicable rules, including 19.15.16.14 A(3) NMAC, 19.15.16.14 B(2) NMAC, 19.15.16.15 B(2) NMAC, and 19.15.16.15 B(4) NMAC.

✓ **CLOSED-LOOP SYSTEM DESIGN PLAN**

The closed-loop system will consist of a series of temporary above-ground storage tanks and/or haul-off bins suitable for holding the cuttings and fluids from drilling operations. The closed loop system will not entail temporary pits, below-grade storage tanks, below-grade sumps, or drying pads.

Design considerations include:

- The closed-loop system will be signed in accordance with 19.15.17.11 NMAC.
- The closed-loop system storage tanks will be of adequate volume to ensure confinement of all fluids and provide sufficient freeboard to prevent uncontrolled releases.
- Topsoil will be salvaged and stored for use in reclamation activities.
- The closed-loop system storage tanks will be placed in bermed secondary containment sized to contain a minimum of 110 percent of the volume of the largest storage tank.

CLOSED-LOOP SYSTEM OPERATING & MAINTENANCE PLAN

The closed-loop system will be operated and maintained to contain liquids and solids; minimize the amount of drilling fluids and cuttings that require disposal; maximize the amount of drilling fluid recycled and reused in the drilling process; isolate drilling wastes from the environment; prevent contamination of fresh water; and protect public health and the environment.

Operation and maintenance considerations include:

- Fluid levels will be maintained to provide sufficient freeboard to prevent over-topping.
- Visual inspections will be conducted on a daily basis to identify any potential leaks and to ensure that the closed-loop system storage tanks have sufficient freeboard to prevent over-topping.
- Only drilling fluids or cuttings intrinsic to, used by, or generated from, drilling operations will be stored in the closed-loop system storage tanks. Hazardous waste, miscellaneous solid waste, and/or debris will not be stored in the storage tanks.
- The OCD District Office will be notified within 48 hours of discovery of a leak in the closed-loop drilling system. If a leak is discovered, all liquid will be removed within 48 hours and the damage repaired.

CLOSED-LOOP SYSTEM CLOSURE PLAN

The closed-loop system will be closed in accordance with 19.15.17.13 NMAC. Closure considerations include:

- Drilling fluids will be recycled and transferred to other permitted closed-loop systems or returned to the vendor for reuse, as practical.
- Residual fluids will be pulled from the storage tanks, mixed with saw dust or similar absorbent material, and disposed of at Industrial Ecosystem, Inc. waste disposal facilities.
- Remaining cuttings or sludges will be vacuumed from the storage tanks and disposed of at the Envirotech, Inc and/or Industrial Ecosystem, Inc. waste disposal facilities.
- Storage tanks will be removed from the well location during the rig move.
- The well pad will be reclaimed and seeded in accordance with subsections G, Hand I of 19.15.17.13 NMAC.



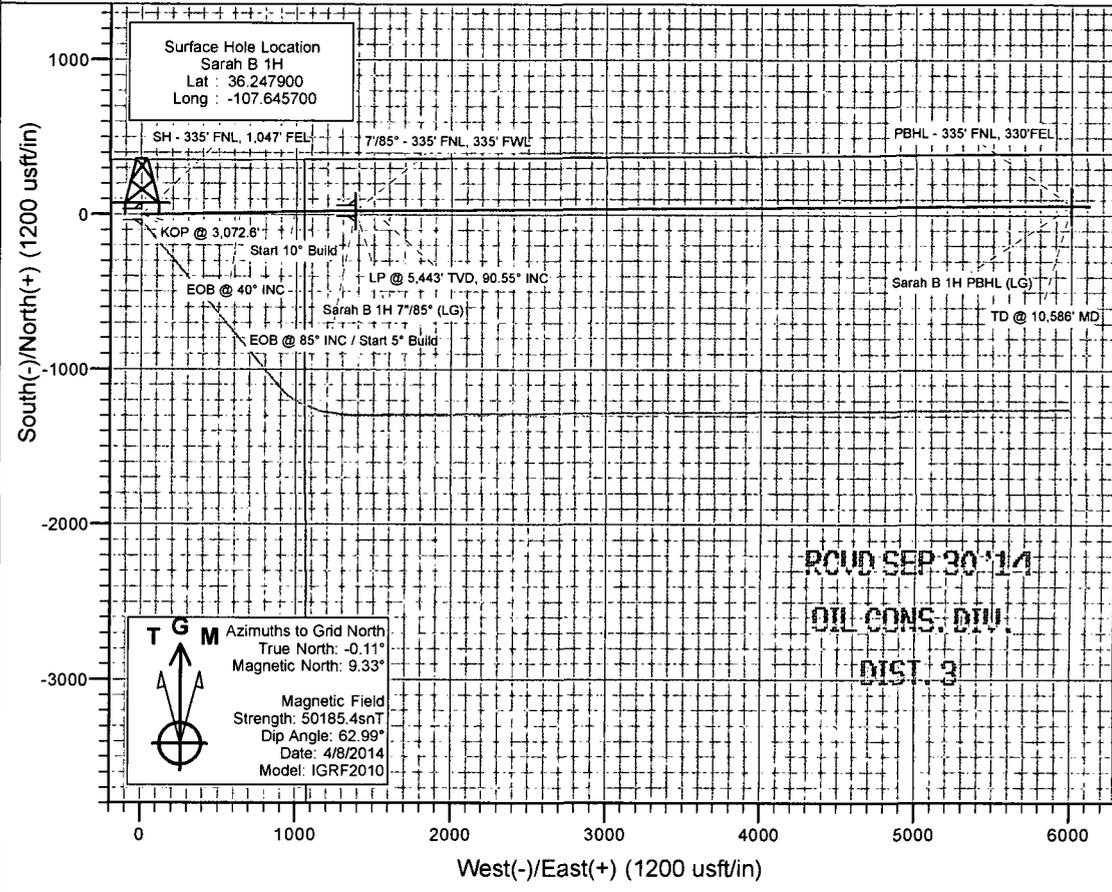
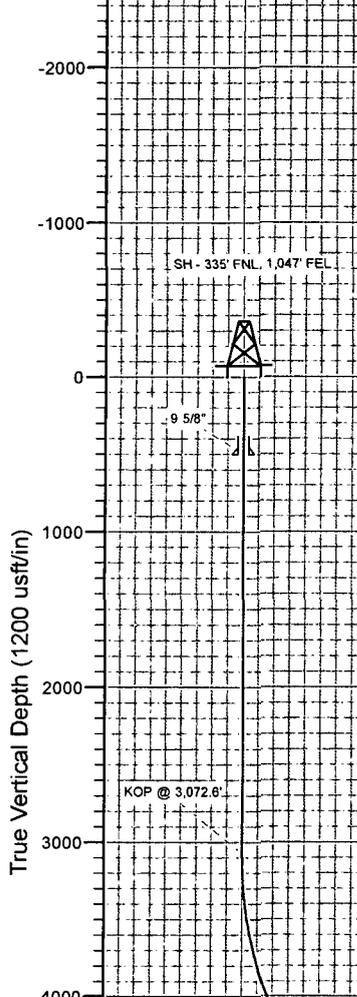
Project: San Juan County, NM
 Site: S11-T23N-R8W (Sarah Pad)
 Well: Sarah B 1H
 Wellbore: HZ
 Design: Plan #2 Lower Gallup



Plan #2 Lower Gallup
 Sarah B 1H
 145XXX, SC
 KB=15' @ 7026.Dustf (Original Well Elev)
 Ground Elevation @ 7011.0
 North American Datum 1983
 Well Sarah B 1H, Grid North

SECTION DETAILS

Sec	MD	Inc	Azi	TVD	+N/-S	+E/-W	Dleg	TFace	Vsect	Target
1	0.0	0.00	0.00	0.0	0.0	0.0	0.00	0.00	0.0	
2	3072.6	0.00	0.00	3072.6	0.0	0.0	0.00	0.00	0.0	
3	4963.7	40.00	88.87	4813.8	12.5	633.6	2.12	88.87	633.7	
4	5515.1	40.00	88.87	5236.2	19.5	988.0	0.00	0.00	988.1	
5	5965.1	85.00	89.52	5438.7	24.5	1376.9	10.00	0.92	1377.1	Sarah B 1H 7°/85° (LG)
6	6076.1	90.55	89.52	5443.0	25.5	1487.7	5.00	0.00	1487.9	
7	10586.0	90.55	89.52	5400.0	63.2	5997.3	0.00	0.00	5997.7	Sarah B 1H PBHL (LG)



TGM Azimuths to Grid North
 True North: -0.11°
 Magnetic North: 9.33°
 Magnetic Field
 Strength: 50185.4nT
 Dip Angle: 62.99°
 Date: 4/8/2014
 Model: IGRF2010

ROAD SEP 30'14
 OIL CONS. DIV.
 DIST. 3

DESIGN TARGET DETAILS

Name	+N/-S	+E/-W	Northing	Easting	Latitude	Longitude
Sarah B 1H PBHL (LG)	63.2	5997.3	1909850.84	2784414.38	36.248040	-107.625360
Sarah B 1H 7°/85° (LG)	24.5	1376.9	1909812.17	2779794.00	36.247960	-107.641030

FORMATION TOP DETAILS

TVDPath	MDPath	Formation
1145.0	1145.0	Ojo Alamo
1344.0	1344.0	Kirtland
1622.0	1622.0	Fruitland
1834.0	1834.0	Pictured Cliffs
2239.0	2239.0	Chacra
3326.0	3326.4	Cliff House
3365.0	3365.6	Meneffes
4224.0	4261.8	Point Lookout
4373.0	4429.0	Mancos
5226.0	5501.8	Gallup
5433.0	5920.0	Top Lower Gallup

CASING DETAILS

TVD	MD	Name
500.0	500.0	9 5/8"
5438.7	5965.1	7"

Vertical Section at 89.40° (1200 usft/in)

Cathedral Energy Services

Planning Report

Database:	USA EDM 5000.Multi Users DB	Local Co-ordinate Reference:	Well Sarah B 1H
Company:	LOGOS Operating LLC	TVD Reference:	KB=15' @ 7026.0usft (Original Well Elev)
Project:	San Juan County, NM	MD Reference:	KB=15' @ 7026.0usft (Original Well Elev)
Site:	S11-T23N-R8W (Sarah Pad)	North Reference:	Grid
Well:	Sarah B 1H	Survey Calculation Method:	Minimum Curvature
Wellbore:	HZ		
Design:	Plan #2 Lower Gallup		

Project	San Juan County, NM		
Map System:	US State Plane 1983	System Datum:	Mean Sea Level
Geo Datum:	North American Datum 1983		
Map Zone:	New Mexico Western Zone		

Site	S11-T23N-R8W (Sarah Pad)				
Site Position:		Northing:	1,909,587.63 usft	Latitude:	36.247900
From:	Lat/Long	Easting:	2,778,417.05 usft	Longitude:	-107.645700
Position Uncertainty:	0.0 usft	Slot Radius:	13-3/16"	Grid Convergence:	0.11 °

Well	Sarah B 1H					
Well Position	+N-S	0.0 usft	Northing:	1,909,587.63 usft	Latitude:	36.247900
	+E-W	0.0 usft	Easting:	2,778,417.05 usft	Longitude:	-107.645700
Position Uncertainty		0.0 usft	Wellhead Elevation:	usft	Ground Level:	7,011.0 usft

Wellbore	HZ				
Magnetics	Model Name	Sample Date	Declination	Dip Angle	Field Strength
			(°)	(°)	(nT)
	IGRF2010	4/8/2014	9.44	62.99	50,185

Design	Plan #2 Lower Gallup				
Audit Notes:					
Version:	Phase:	PROTOTYPE	Tie On Depth:	0.0	
Vertical Section:	Depth From (TVD)	+N-S	+E-W	Direction	
	(usft)	(usft)	(usft)	(°)	
	0.0	0.0	0.0	89.40	

Plan Sections										
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N-S (usft)	+E-W (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)	TFO (°)	Target
0.0	0.00	0.00	0.0	0.0	0.0	0.00	0.00	0.00	0.00	
3,072.6	0.00	0.00	3,072.6	0.0	0.0	0.00	0.00	0.00	0.00	
4,963.7	40.00	88.87	4,813.8	12.5	633.6	2.12	2.12	0.00	88.87	
5,515.1	40.00	88.87	5,236.2	19.5	988.0	0.00	0.00	0.00	0.00	
5,965.1	85.00	89.52	5,438.7	24.5	1,376.9	10.00	10.00	0.15	0.92	Sarah B 1H 7"/85° (LC)
6,076.1	90.55	89.52	5,443.0	25.5	1,487.7	5.00	5.00	0.00	0.00	
10,586.0	90.55	89.52	5,400.0	63.2	5,997.3	0.00	0.00	0.00	0.00	Sarah B 1H PBHL (LC)

Cathedral Energy Services

Planning Report

Database:	USA EDM 5000 Multi Users DB	Local Co-ordinate Reference:	Well Sarah B 1H
Company:	LOGOS Operating LLC	TVD Reference:	KB=15' @ 7026.0usft (Original Well Elev)
Project:	San Juan County, NM	MD Reference:	KB=15' @ 7026.0usft (Original Well Elev)
Site:	S11-T23N-R8W (Sarah Pad)	North Reference:	Grid
Well:	Sarah B 1H	Survey Calculation Method:	Minimum Curvature
Wellbore:	HZ		
Design:	Plan #2 Lower Gallup		

Planned Survey

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100u)	Comments / Formations
0.0	0.00	0.00	0.0	0.0	0.0	0.0	0.00	0.00	
0.5	0.00	0.00	0.5	0.0	0.0	0.0	0.00	0.00	SH - 335' FNL, 1,047' FEL
100.0	0.00	0.00	100.0	0.0	0.0	0.0	0.00	0.00	
200.0	0.00	0.00	200.0	0.0	0.0	0.0	0.00	0.00	
300.0	0.00	0.00	300.0	0.0	0.0	0.0	0.00	0.00	
400.0	0.00	0.00	400.0	0.0	0.0	0.0	0.00	0.00	
500.0	0.00	0.00	500.0	0.0	0.0	0.0	0.00	0.00	9 5/8"
600.0	0.00	0.00	600.0	0.0	0.0	0.0	0.00	0.00	
700.0	0.00	0.00	700.0	0.0	0.0	0.0	0.00	0.00	
800.0	0.00	0.00	800.0	0.0	0.0	0.0	0.00	0.00	
900.0	0.00	0.00	900.0	0.0	0.0	0.0	0.00	0.00	
1,000.0	0.00	0.00	1,000.0	0.0	0.0	0.0	0.00	0.00	
1,100.0	0.00	0.00	1,100.0	0.0	0.0	0.0	0.00	0.00	
1,145.0	0.00	0.00	1,145.0	0.0	0.0	0.0	0.00	0.00	Ojo Alamo
1,200.0	0.00	0.00	1,200.0	0.0	0.0	0.0	0.00	0.00	
1,300.0	0.00	0.00	1,300.0	0.0	0.0	0.0	0.00	0.00	
1,344.0	0.00	0.00	1,344.0	0.0	0.0	0.0	0.00	0.00	Kirtland
1,400.0	0.00	0.00	1,400.0	0.0	0.0	0.0	0.00	0.00	
1,500.0	0.00	0.00	1,500.0	0.0	0.0	0.0	0.00	0.00	
1,600.0	0.00	0.00	1,600.0	0.0	0.0	0.0	0.00	0.00	
1,622.0	0.00	0.00	1,622.0	0.0	0.0	0.0	0.00	0.00	Fruitland
1,700.0	0.00	0.00	1,700.0	0.0	0.0	0.0	0.00	0.00	
1,800.0	0.00	0.00	1,800.0	0.0	0.0	0.0	0.00	0.00	
1,834.0	0.00	0.00	1,834.0	0.0	0.0	0.0	0.00	0.00	Pictured Cliffs
1,900.0	0.00	0.00	1,900.0	0.0	0.0	0.0	0.00	0.00	
2,000.0	0.00	0.00	2,000.0	0.0	0.0	0.0	0.00	0.00	
2,100.0	0.00	0.00	2,100.0	0.0	0.0	0.0	0.00	0.00	
2,200.0	0.00	0.00	2,200.0	0.0	0.0	0.0	0.00	0.00	
2,239.0	0.00	0.00	2,239.0	0.0	0.0	0.0	0.00	0.00	Chacra
2,300.0	0.00	0.00	2,300.0	0.0	0.0	0.0	0.00	0.00	
2,400.0	0.00	0.00	2,400.0	0.0	0.0	0.0	0.00	0.00	
2,500.0	0.00	0.00	2,500.0	0.0	0.0	0.0	0.00	0.00	
2,600.0	0.00	0.00	2,600.0	0.0	0.0	0.0	0.00	0.00	
2,700.0	0.00	0.00	2,700.0	0.0	0.0	0.0	0.00	0.00	
2,800.0	0.00	0.00	2,800.0	0.0	0.0	0.0	0.00	0.00	
2,900.0	0.00	0.00	2,900.0	0.0	0.0	0.0	0.00	0.00	
3,000.0	0.00	0.00	3,000.0	0.0	0.0	0.0	0.00	0.00	
3,072.6	0.00	0.00	3,072.6	0.0	0.0	0.0	0.00	0.00	KOP @ 3,072.6'
3,100.0	0.58	88.87	3,100.0	0.0	0.1	0.1	2.12	2.12	
3,200.0	2.69	88.87	3,200.0	0.1	3.0	3.0	2.12	2.12	
3,300.0	4.81	88.87	3,299.7	0.2	9.5	9.5	2.12	2.12	
3,326.4	5.37	88.87	3,326.0	0.2	11.9	11.9	2.12	2.12	Cliff House
3,365.6	6.20	88.87	3,365.0	0.3	15.8	15.8	2.12	2.12	Menefee
3,400.0	6.92	88.87	3,399.2	0.4	19.8	19.8	2.12	2.12	
3,500.0	9.04	88.87	3,498.2	0.7	33.6	33.6	2.12	2.12	
3,600.0	11.16	88.87	3,596.7	1.0	51.2	51.2	2.12	2.12	
3,700.0	13.27	88.87	3,694.4	1.4	72.3	72.3	2.12	2.12	
3,800.0	15.39	88.87	3,791.3	1.9	97.1	97.1	2.12	2.12	
3,900.0	17.50	88.87	3,887.2	2.5	125.4	125.4	2.12	2.12	
4,000.0	19.62	88.87	3,982.0	3.1	157.2	157.2	2.12	2.12	
4,100.0	21.73	88.87	4,075.5	3.8	192.5	192.5	2.12	2.12	
4,200.0	23.85	88.87	4,167.7	4.6	231.2	231.2	2.12	2.12	

Cathedral Energy Services

Planning Report

Database:	USA EDM 5000 Multi Users DB	Local Co-ordinate Reference:	Well Sarah B 1H
Company:	LOGOS Operating LLC	TVD Reference:	KB=15' @ 7026.0usft (Original Well Elev)
Project:	San Juan County, NM	MD Reference:	KB=15' @ 7026.0usft (Original Well Elev)
Site:	S11-T23N-R8W (Sarah Pad)	North Reference:	Grid
Well:	Sarah B 1H	Survey Calculation Method:	Minimum Curvature
Wellbore:	HZ		
Design:	Plan #2 Lower Gallup		

Planned Survey

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100u)	Comments / Formations
4,261.8	25.15	88.87	4,224.0	5.1	256.8	256.9	2.12	2.12	Point Lookout
4,300.0	25.96	88.87	4,258.4	5.4	273.3	273.3	2.12	2.12	
4,400.0	28.08	88.87	4,347.5	6.3	318.7	318.8	2.12	2.12	
4,429.0	28.69	88.87	4,373.0	6.6	332.5	332.5	2.12	2.12	Mancos
4,500.0	30.19	88.87	4,434.9	7.3	367.4	367.4	2.12	2.12	
4,600.0	32.31	88.87	4,520.3	8.3	419.2	419.3	2.12	2.12	
4,700.0	34.42	88.87	4,603.9	9.4	474.2	474.3	2.12	2.12	
4,800.0	36.54	88.87	4,685.3	10.5	532.3	532.3	2.12	2.12	
4,900.0	38.65	88.87	4,764.5	11.7	593.2	593.3	2.12	2.12	
4,963.7	40.00	88.87	4,813.8	12.5	633.6	633.7	2.12	2.12	EOB @ 40° INC
5,000.0	40.00	88.87	4,841.6	13.0	656.9	657.0	0.00	0.00	
5,100.0	40.00	88.87	4,918.2	14.3	721.2	721.3	0.00	0.00	
5,200.0	40.00	88.87	4,994.8	15.5	785.5	785.6	0.00	0.00	
5,300.0	40.00	88.87	5,071.4	16.8	849.7	849.9	0.00	0.00	
5,400.0	40.00	88.87	5,148.0	18.1	914.0	914.1	0.00	0.00	
5,500.0	40.00	88.87	5,224.6	19.4	978.3	978.4	0.00	0.00	
5,501.8	40.00	88.87	5,226.0	19.4	979.4	979.6	0.00	0.00	Gallup
5,515.1	40.00	88.87	5,236.2	19.5	988.0	988.1	0.00	0.00	Start 10° Build
5,550.0	43.49	88.95	5,262.2	20.0	1,011.2	1,011.4	10.00	9.99	
5,600.0	48.49	89.05	5,297.0	20.6	1,047.1	1,047.3	10.00	10.00	
5,650.0	53.49	89.13	5,328.4	21.2	1,086.0	1,086.1	10.00	10.00	
5,700.0	58.49	89.21	5,356.4	21.8	1,127.4	1,127.6	10.00	10.00	
5,750.0	63.49	89.28	5,380.6	22.4	1,171.1	1,171.3	10.00	10.00	
5,800.0	68.49	89.34	5,401.0	23.0	1,216.8	1,216.9	10.00	10.00	
5,850.0	73.49	89.40	5,417.2	23.5	1,264.0	1,264.2	10.00	10.00	
5,900.0	78.49	89.45	5,429.3	24.0	1,312.5	1,312.7	10.00	10.00	
5,920.0	80.49	89.47	5,433.0	24.1	1,332.2	1,332.4	10.00	10.00	Top Lower Gallup
5,950.0	83.49	89.50	5,437.2	24.4	1,361.9	1,362.1	10.00	10.00	
5,965.1	85.00	89.52	5,438.7	24.5	1,376.9	1,377.1	10.00	10.00	EOB @ 85° INC / Start 5° Build - 7/85° - 335' F
6,000.0	86.74	89.52	5,441.2	24.8	1,411.7	1,411.9	5.01	5.01	
6,076.1	90.55	89.52	5,443.0	25.5	1,487.8	1,488.0	5.00	5.00	LP @ 5,443' TVD, 90.55° INC
6,100.0	90.55	89.52	5,442.8	25.7	1,511.7	1,511.9	0.00	0.00	
6,200.0	90.55	89.52	5,441.8	26.5	1,611.7	1,611.9	0.00	0.00	
6,300.0	90.55	89.52	5,440.9	27.3	1,711.7	1,711.8	0.00	0.00	
6,400.0	90.55	89.52	5,439.9	28.2	1,811.6	1,811.8	0.00	0.00	
6,500.0	90.55	89.52	5,439.0	29.0	1,911.6	1,911.8	0.00	0.00	
6,600.0	90.55	89.52	5,438.0	29.9	2,011.6	2,011.8	0.00	0.00	
6,700.0	90.55	89.52	5,437.1	30.7	2,111.6	2,111.8	0.00	0.00	
6,800.0	90.55	89.52	5,436.1	31.5	2,211.6	2,211.8	0.00	0.00	
6,900.0	90.55	89.52	5,435.2	32.4	2,311.6	2,311.8	0.00	0.00	
7,000.0	90.55	89.52	5,434.2	33.2	2,411.6	2,411.8	0.00	0.00	
7,100.0	90.55	89.52	5,433.2	34.0	2,511.6	2,511.8	0.00	0.00	
7,200.0	90.55	89.52	5,432.3	34.9	2,611.6	2,611.8	0.00	0.00	
7,300.0	90.55	89.52	5,431.3	35.7	2,711.6	2,711.8	0.00	0.00	
7,400.0	90.55	89.52	5,430.4	36.5	2,811.6	2,811.8	0.00	0.00	
7,500.0	90.55	89.52	5,429.4	37.4	2,911.6	2,911.8	0.00	0.00	
7,600.0	90.55	89.52	5,428.5	38.2	3,011.5	3,011.8	0.00	0.00	
7,700.0	90.55	89.52	5,427.5	39.1	3,111.5	3,111.8	0.00	0.00	
7,800.0	90.55	89.52	5,426.6	39.9	3,211.5	3,211.8	0.00	0.00	
7,900.0	90.55	89.52	5,425.6	40.7	3,311.5	3,311.8	0.00	0.00	
8,000.0	90.55	89.52	5,424.7	41.6	3,411.5	3,411.8	0.00	0.00	
8,100.0	90.55	89.52	5,423.7	42.4	3,511.5	3,511.8	0.00	0.00	

Cathedral Energy Services

Planning Report

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Company:	LOGOS Operating LLC	TVD Reference:	KB=15' @ 7026.0usft (Original Well Elev)
Project:	San Juan County, NM	MD Reference:	KB=15' @ 7026.0usft (Original Well Elev)
Site:	S11-T23N-R8W (Sarah Pad)	North Reference:	Grid
Well:	Sarah B 1H	Survey Calculation Method:	Minimum Curvature
Wellbore:	HZ		
Design:	Plan #2 Lower Gallup		

Planned Survey									
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100u)	Comments / Formations
8,200.0	90.55	89.52	5,422.8	43.2	3,611.5	3,611.8	0.00	0.00	
8,300.0	90.55	89.52	5,421.8	44.1	3,711.5	3,711.7	0.00	0.00	
8,400.0	90.55	89.52	5,420.8	44.9	3,811.5	3,811.7	0.00	0.00	
8,500.0	90.55	89.52	5,419.9	45.8	3,911.5	3,911.7	0.00	0.00	
8,600.0	90.55	89.52	5,418.9	46.6	4,011.5	4,011.7	0.00	0.00	
8,700.0	90.55	89.52	5,418.0	47.4	4,111.5	4,111.7	0.00	0.00	
8,800.0	90.55	89.52	5,417.0	48.3	4,211.5	4,211.7	0.00	0.00	
8,900.0	90.55	89.52	5,416.1	49.1	4,311.4	4,311.7	0.00	0.00	
9,000.0	90.55	89.52	5,415.1	49.9	4,411.4	4,411.7	0.00	0.00	
9,100.0	90.55	89.52	5,414.2	50.8	4,511.4	4,511.7	0.00	0.00	
9,200.0	90.55	89.52	5,413.2	51.6	4,611.4	4,611.7	0.00	0.00	
9,300.0	90.55	89.52	5,412.3	52.4	4,711.4	4,711.7	0.00	0.00	
9,400.0	90.55	89.52	5,411.3	53.3	4,811.4	4,811.7	0.00	0.00	
9,500.0	90.55	89.52	5,410.4	54.1	4,911.4	4,911.7	0.00	0.00	
9,600.0	90.55	89.52	5,409.4	55.0	5,011.4	5,011.7	0.00	0.00	
9,700.0	90.55	89.52	5,408.4	55.8	5,111.4	5,111.7	0.00	0.00	
9,800.0	90.55	89.52	5,407.5	56.6	5,211.4	5,211.7	0.00	0.00	
9,900.0	90.55	89.52	5,406.5	57.5	5,311.4	5,311.7	0.00	0.00	
10,000.0	90.55	89.52	5,405.6	58.3	5,411.4	5,411.7	0.00	0.00	
10,100.0	90.55	89.52	5,404.6	59.1	5,511.3	5,511.7	0.00	0.00	
10,200.0	90.55	89.52	5,403.7	60.0	5,611.3	5,611.7	0.00	0.00	
10,300.0	90.55	89.52	5,402.7	60.8	5,711.3	5,711.7	0.00	0.00	
10,400.0	90.55	89.52	5,401.8	61.6	5,811.3	5,811.6	0.00	0.00	
10,500.0	90.55	89.52	5,400.8	62.5	5,911.3	5,911.6	0.00	0.00	
10,586.0	90.55	89.52	5,400.0	63.2	5,997.3	5,997.6	0.00	0.00	PBHL - 335' FNL, 330' FEL - TD @ 10,586' MD

Targets										
Target Name	Dip Angle (°)	Dip Dir. (°)	TVD (usft)	+N/-S (usft)	+E/-W (usft)	Northing (usft)	Easting (usft)	Latitude	Longitude	
Sarah B 1H PBHL (LG) - hit/miss target - Shape - Point	0.00	2.16	5,400.0	63.2	5,997.3	1,909,650.84	2,784,414.38	36.248040	-107.625360	
Sarah B 1H 7°/85° (LG) - plan hits target center - Point	0.00	2.16	5,438.7	24.5	1,376.9	1,909,612.17	2,779,794.00	36.247960	-107.641030	
Sarah B 1H 7°/85° (2BG) - plan misses target center by 73.7usft at 5957.7usft MD (5438.0 TVD, 24.5 N, 1369.6 E) - Point	0.00	2.16	5,364.7	24.5	1,376.9	1,909,612.17	2,779,794.00	36.247960	-107.641030	
Sarah B 1H PBHL (2BG) - plan misses target center by 6.0usft at 10586.0usft MD (5400.0 TVD, 63.2 N, 5997.3 E) - Point	0.00	2.16	5,406.0	63.2	5,997.3	1,909,650.84	2,784,414.38	36.248040	-107.625360	

Cathedral Energy Services Planning Report

Database:	USA EDM 5000 Multi Users DB	Local Co-ordinate Reference:	Well Sarah B 1H
Company:	LOGOS Operating LLC	TVD Reference:	KB=15' @ 7026.0usft (Original Well Elev)
Project:	San Juan County, NM	MD Reference:	KB=15' @ 7026.0usft (Original Well Elev)
Site:	S11-T23N-R8W (Sarah Pad)	North Reference:	Grid
Well:	Sarah B 1H	Survey Calculation Method:	Minimum Curvature
Wellbore:	HZ		
Design:	Plan #2 Lower Gallup		

Casing Points						
Measured Depth (usft)	Vertical Depth (usft)		Name	Casing Diameter (")	Hole Diameter (")	
500.0	500.0	9 5/8"		0	0	
5,965.1	5,438.7	7"		0	0	

Formations						
Measured Depth (usft)	Vertical Depth (usft)	Name	Lithology	Dip (°)	Dip Direction (°)	
1,145.0	1,145.0	Ojo Alamo		0.00	0.00	
1,344.0	1,344.0	Kirtland		0.00	0.00	
1,622.0	1,622.0	Fruitland		0.00	0.00	
1,834.0	1,834.0	Pictured Cliffs		0.00	0.00	
2,239.0	2,239.0	Chacra		0.00	0.00	
3,326.4	3,326.0	Cliff House		0.00	0.00	
3,365.6	3,365.0	Meneffee		0.00	0.00	
4,261.8	4,224.0	Point Lookout		0.00	0.00	
4,429.0	4,373.0	Mancos		0.00	0.00	
5,501.8	5,226.0	Gallup		0.00	0.00	
5,920.0	5,433.0	Top Lower Gallup		0.00	0.00	

Plan Annotations					
Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment	
		+N-S (usft)	+E-W (usft)		
0.5	0.5	0.0	0.0	SH - 335' FNL, 1,047' FEL	
3,072.6	3,072.6	0.0	0.0	KOP @ 3,072.6'	
4,963.7	4,813.8	12.5	633.6	EOB @ 40° INC	
5,515.1	5,236.2	19.5	988.0	Start 10° Build	
5,965.1	5,438.7	24.5	1,376.9	EOB @ 85° INC / Start 5° Build	
5,965.1	5,438.7	24.5	1,376.9	7/85° - 335' FNL, 335' FWL	
6,076.1	5,443.0	25.5	1,487.8	LP @ 5,443' TVD, 90.55° INC	
10,586.0	5,400.0	63.2	5,997.3	PBHL - 335' FNL, 330' FEL	
10,586.0	5,400.0	63.2	5,997.3	TD @ 10,586' MD	

Well Control Equipment Schematic for 2M Service

Attachment to Drilling Technical Program

Exhibit #1 Typical BOP setup

Location: San Juan Basin, New Mexico

Date: August 24, 2004

By: John Thompson (Walch E&P)

