

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 #002H

API# 30-045-35563 Section 11, Township 23 N/S, Range 9 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.

Charles  
NMOCD Approved by Signature

10-3-2014  
Date KO

UNITED STATES  
DEPARTMENT OF THE INTERIOR  
BUREAU OF LAND MANAGEMENT

**RECEIVED**

FORM APPROVED  
OMB No. 1004-0137  
Expires October 31, 2014

JUN 26 2014

**APPLICATION FOR PERMIT TO DRILL OR REENTER**

1a. Type of work: <input checked="" type="checkbox"/> DRILL <input type="checkbox"/> REENTER		5. Lease Serial No. NM 109397	
1b. Type of Well: <input checked="" type="checkbox"/> Oil Well <input type="checkbox"/> Gas Well <input type="checkbox"/> Other <input checked="" type="checkbox"/> Single Zone <input type="checkbox"/> Multiple Zone		6. If Indian, Allottee, or Tribe Name Farmington Field Office Bureau of Land Management	
2. Name of Operator Logos Operating, LLC		7. Unit or CA Agreement, Name and No. OIL CONS. DIV.	
3a. Address 4001 North Butler Ave, Building 7101 Farmington, NM 87401	3b. Phone No. (include area code) 505-330-9333	8. Lease Name and Well No. SARAH B 002H	
4. Location of Well (Report location clearly and in accordance with any State requirements.) At surface 385' FNL & 1062' FEL (NE/NE) At proposed prod. zone 1655' FNL & 330' FEL (SE/NE)		9. API Well No. <b>DIST. 3</b> 30-045-35563	
14. Distance in miles and direction from nearest town or post office* 5 miles east of Nageezi		10. Field and Pool, or Exploratory Basin Mancos	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
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 <del>640.00 acres</del> 800.48	17. Spacing Unit dedicated to this well Sec 12 S2/N2 = 160 acres	
18. Distance from proposed location* to nearest well, drilling, completed, applied for, on this lease, ft. Sarah B 1H - 50'	19. Proposed Depth 10814' 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* 09/01/2014	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:

- |  |   |
|--|---|
| 1. Well plat certified by a registered surveyor.   | 4. Bond to cover the operations unless covered by an existing bond on file (see Item 20 above). |
| 2. A Drilling Plan.  | 5. Operator certification   |
| 3. A Surface Use Plan (if the location is on National Forest System Lands, the SUPO must be filed with the appropriate Forest Service Office). | 6. Such other site specific information and/or plans as may be required by the BLM.             |

25. Signature <i>Tamra Sessions</i>	Name (Printed/Typed) Tamra Sessions	Date 06/25/2014
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Title  
Operations Technician

Approved by (Signature) <i>[Signature]</i>	Name (Printed/Typed)	Date 9/29/14
---	----------------------	-----------------

Title  
AFM  
Office  
FFO

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.

**BLM'S APPROVAL OR ACCEPTANCE OF THIS**

(Continued 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

**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)

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

**NMOCDAV**

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  
OIL CONSERVATION DIVISION

Form C-102  
Revised August 1, 2011  
Submit one copy to appropriate District Office

RECEIVED

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

JUN 26 2014

AMENDED REPORT

WELL LOCATION AND ACREAGE DEDICATION PLAT

<sup>1</sup> API Number 30-045-35563		<sup>2</sup> Pool Code 97232		<sup>3</sup> Pool Name BASIN MANCOS	
<sup>4</sup> Property Code 313750		<sup>5</sup> Property Name SARAH B			<sup>6</sup> Well Number 2H
<sup>7</sup> GRID No. 289408		<sup>8</sup> Operator Name LOGOS OPERATING, LLC			<sup>9</sup> Elevation 7011'

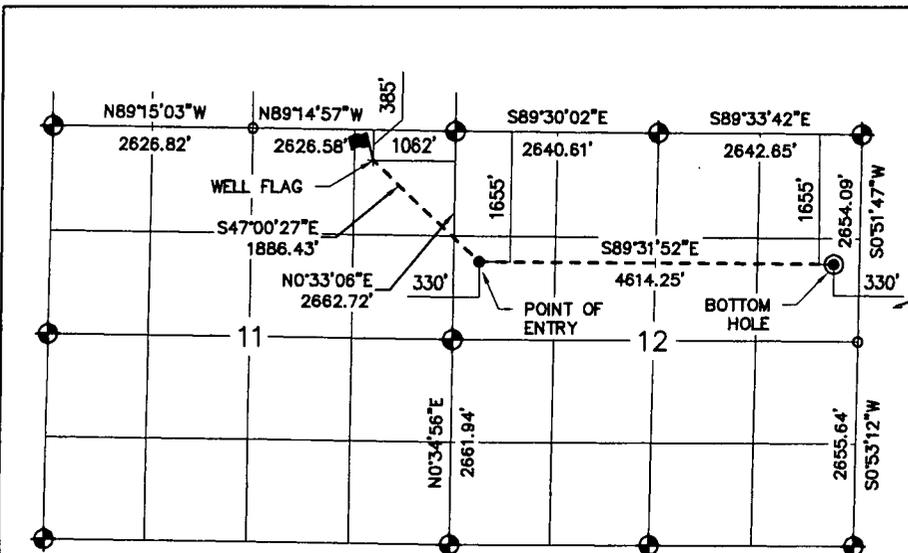
<sup>10</sup> Surface Location									
UL or lot no.	Section	Township	Range	Lot Idn	Feet from the	North/South line	Feet from the	East/West line	County
A	11	23N	8W		385'	NORTH	1062'	EAST	SAN JUAN

<sup>11</sup> Bottom Hole Location If Different From Surface									
UL or lot no.	Section	Township	Range	Lot Idn	Feet from the	North/South line	Feet from the	East/West line	County
H	12	23N	8W		1655'	NORTH	330'	EAST	SAN JUAN

<sup>12</sup> Dedicated Acres 160 acres S2/N2 Sec. 12				<sup>13</sup> Joint of Infill		<sup>14</sup> Consolidation Code		<sup>15</sup> Order No. ROVD SEP 30 '14 OIL CON. DIV.	
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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



<sup>17</sup>OPERATOR 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

<sup>18</sup>SURVEYOR 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 4, 2013  
Signature and Seal of Professional Surveyor

WELL FLAG  
LAT 36.24782 N (NAD 1983)  
LONG 107.64575 W (NAD 1983)  
LAT 36°14'52.11" N (NAD 1927)  
LONG 107°38'42.50" W (NAD 1927)

POINT OF ENTRY  
LAT 36.24434 N (NAD 1983)  
LONG 107.64101 W (NAD 1983)  
LAT 36°14'39.58" N (NAD 1927)  
LONG 107°38'25.44" W (NAD 1927)

BOTTOM HOLE  
LAT 36.24442 N (NAD 1983)  
LONG 107.62536 W (NAD 1983)  
LAT 36°14'39.87" N (NAD 1927)  
LONG 107°37'29.10" W (NAD 1927)

LEGEND  
 FOUND 2" BRASS CAP USGLO 1947  
 FOUND REBAR



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 #2H**

Horizontal Gallup Oil and Gas Well  
Surface Location: 385' FNL – 1062' FEL  
Section 11, T23N, R8W  
Ungraded GL Elev = 7011'  
Estimate KB Elev = 7026'  
Lat. = 36.247820 deg N  
Long. = 107.645750 deg W  
NAD83  
San Juan County, New Mexico

Proposed Bottom Hole Location: 1655' 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 2398' MD and build 2 degrees per 100' to 40 degrees, 140.11 degrees azimuth and hold to approximately 4398' MD.

Trip out of hole and pick up 8 ¾" kick off assembly at 4398' MD. Build angle at 10 deg/100' to 85 degrees inclination and 89.52 degrees azimuth in the Gallup formation at 5501' MD / 5226' TVD where 7" intermediate casing will be set at 6199' MD / 5438' TVD.

7" casing will be set in a legal position 1655' FNL & 330' 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 6310' MD / 5443' TVD. Hold 90.55 degrees, 89.52 degrees azimuth and drill to a total depth at 10814' MD / 5400' TVD. Adjustments may be made to the directional program based on geology. Total depth will be 10814' MD / 5400' TVD - 90.55 degrees, 89.52 degrees Azimuth.

The Bottom hole location will be in a legal location at 10814' MD at 1655' FNL & 330' FEL of Section 12.

A total of 4615' 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 A)

- 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 6199' = 7" Casing point  
 6-1/8" Lateral = 6199' MD to 10814' 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' - 6199' MD	New Casing. Cement to surface with cement.
4 1/2" (6 1/8")	11.6 ppf	P-110	LT&C	5300' - 10814' 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 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> 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	Fluid Weight	15.80 lbm/gal
HALCEM (TM) SYSTEM	Slurry Yield:	1.15 ft <sup>3</sup> /sk
0.125 lbm/sk Poly-E-Flake (Lost Circulation Additive)	Total Mixing Fluid:	4.94 Gal/sk
0.4 % Halad(R)-344 (Low Fluid Loss Control)	Top of Fluid:	0 ft
	Calculated Fill:	500 ft
	Volume:	55.8 bbl 313.2
	Calculated Sacks:	273 sks

**Intermediate Casing – Two Stage Stage Job (0-6199’ MD):**

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

**Top of Cement – Surface.**

Foamed Lead Cement	Fluid Weight	13 lbm/gal
ELASTISEAL (TM) SYSTEM	Slurry Yield:	1.43 ft <sup>3</sup> /sk
0.2 % Versaset (Thixotropic Additive)	Total Mixing Fluid:	6.74 Gal/sk
0.15 % HALAD-766 (Low Fluid Loss Control)	Top of Fluid:	0 ft
1.5 % CHEM - FOAMER 760, TOTETANK (Foamer)	Calculated Fill:	5760 ft
	Volume:	231 bbl
	Calculated Sacks:	908 sks

**Tail Cement**

HALCEM (TM) SYSTEM	Fluid Weight	13.50 lbm/gal
0.2 % Versaset (Thixotropic Additive)	Slurry Yield:	1.29 ft <sup>3</sup> /sk
0.15 % HALAD-766 (Low Fluid Loss Control)	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	Fluid Weight	15.80 lbm/gal
2 % Calcium Chloride (Accelerator)	Slurry Yield:	1.17 ft <sup>3</sup> /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
<b>Stage 1</b>						
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’ - 10814’ MD):**

**Excess – 50% over gauge hole – 6-1/8” hole and 4-1/2” casing (0.0942 ft<sup>3</sup>/ft)**

**Top of Cement – Top of Liner.**

**Lead Cement - Cap Cement**

ELASTISEAL (TM) SYSTEM

0.2 % Versaset (Thixotropic Additive)

0.15 % HALAD-766 (Low Fluid Loss Control)

0.2 % Halad(R)-344 (Low Fluid Loss Control)

Fluid Weight	13 lbm/gal
Slurry Yield:	1.43 ft <sup>3</sup> /sk
Total Mixing Fluid:	6.75 Gal/sk
Top of Fluid:	5300 ft
Calculated Fill:	300 ft
Volume:	7.15 bbl
Calculated Sacks:	30 sks

**Foamed Lead Cement**

ELASTISEAL (TM) SYSTEM

0.2 % Versaset (Thixotropic Additive)

0.15 % HALAD-766 (Low Fluid Loss Control)

2.5 % CHEM - FOAMER 760, TOTETANK (Foamer)

0.2 % Halad(R)-344 (Low Fluid Loss Control)

Fluid Weight	13 lbm/gal
Slurry Yield:	1.43 ft <sup>3</sup> /sk
Total Mixing Fluid:	6.75 Gal/sk
Top of Fluid:	5600 ft
Calculated Fill:	3914 ft
Volume:	99 bbl
Calculated Sacks:	387 sks

**Tail Cement**

ELASTISEAL (TM) SYSTEM

0.2 % Versaset (Thixotropic Additive)

0.15 % HALAD-766 (Low Fluid Loss Control)

0.05 % SA-1015 (Suspension Agent)

Fluid Weight	13.50 lbm/gal
Slurry Yield:	1.28 ft <sup>3</sup> /sk
Total Mixing Fluid:	5.64 Gal/sk
Top of Fluid:	9514 ft
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
<b>Stage 1</b>						
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'-5146'	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"	5582' MD (KOP)- 6300' MD	Fresh Water LSND	8.5-8.8	40-50	8-10
6 1/8"	6300' MD - 10814' 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 H<sub>2</sub>S 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 September 1, 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.



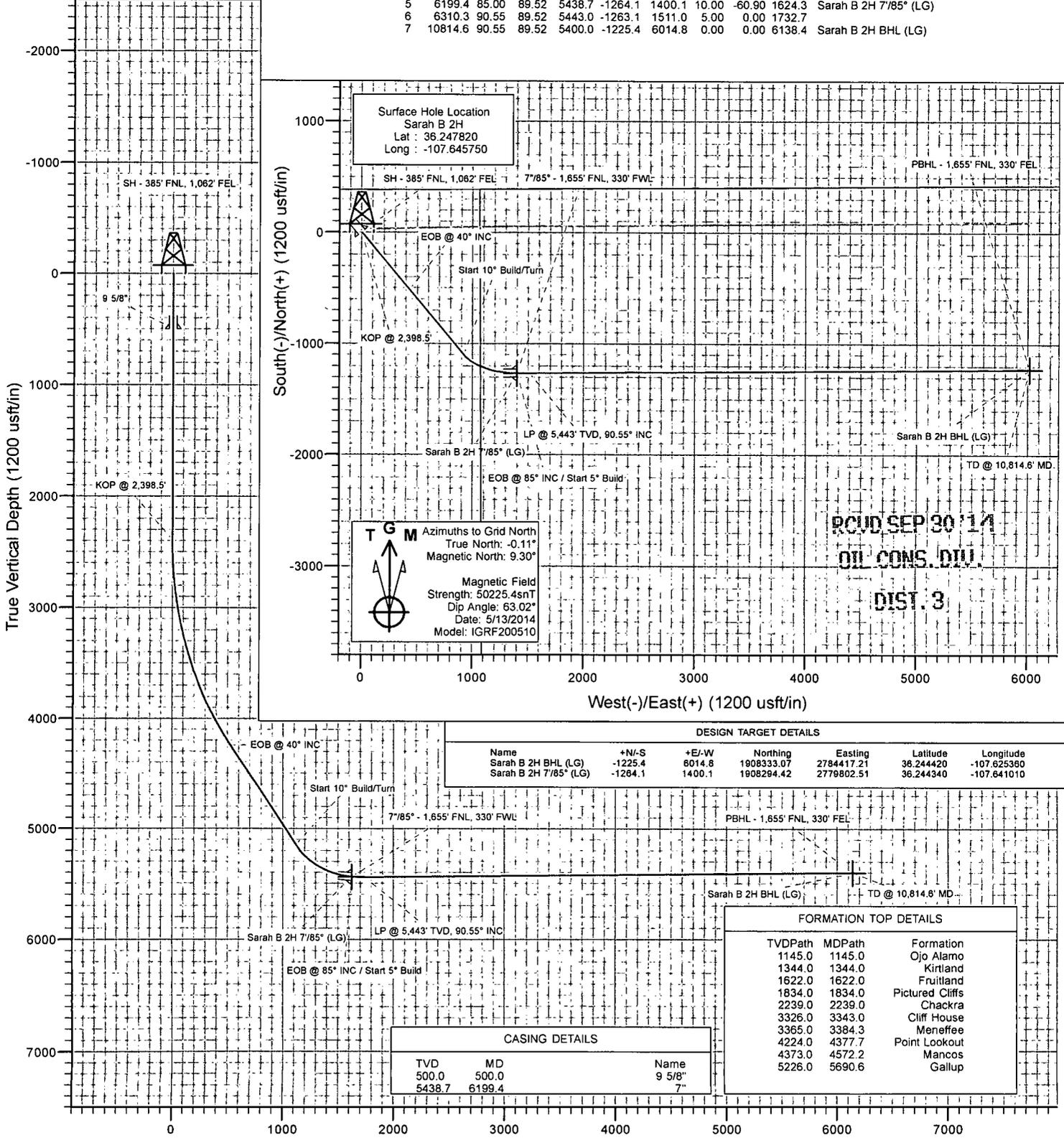
Project: San Juan County, NM  
 Site: S11-T23N-R8W (Sarah Pad)  
 Well: Sarah B 2H  
 Wellbore: HZ  
 Design: Plan #1 Lower Gallup



Plan #1 Lower Gallup  
 Sarah B 2H  
 145XXX; SC  
 KB=15' @ 7026.0usft  
 Ground Elevation @ 7011.0  
 North American Datum 1983  
 Well Sarah B 2H, Grid North

SECTION DETAILS

Sec	MD	Inc	Azi	TVD	+N/-S	+E/-W	Dleg	TFace	VSec	Target
1	0.0	0.00	0.00	0.0	0.0	0.0	0.00	0.00	0.0	
2	2398.5	0.00	0.00	2398.5	0.0	0.0	0.00	0.00	0.0	
3	4398.7	40.00	140.11	4240.1	-514.3	429.9	2.00	140.11	523.9	Sarah B 2H 7/85° (LG)
4	5581.9	40.00	140.11	5146.4	-1098.0	917.7	0.00	0.00	1118.4	
5	6199.4	85.00	89.52	5438.7	-1264.1	1400.1	10.00	-60.90	1624.3	Sarah B 2H BHL (LG)
6	6310.3	90.55	89.52	5443.0	-1263.1	1511.0	5.00	0.00	1732.7	
7	10814.6	90.55	89.52	5400.0	-1225.4	6014.8	0.00	0.00	6138.4	Sarah B 2H BHL (LG)



**TGM**  
 Azimuths to Grid North  
 True North: -0.11°  
 Magnetic North: 9.30°  
 Magnetic Field  
 Strength: 50225.4snt  
 Dip Angle: 63.02°  
 Date: 5/13/2014  
 Model: IGRF200510

RCVD SEP 30 11  
 OIL CONS. DIV.  
 DIST. 3

DESIGN TARGET DETAILS

Name	+N/-S	+E/-W	Northing	Easting	Latitude	Longitude
Sarah B 2H BHL (LG)	-1225.4	6014.8	1908333.07	2784417.21	36.244420	-107.625360
Sarah B 2H 7/85° (LG)	-1264.1	1400.1	1908294.42	2779802.51	36.244340	-107.641010

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	Chackra
3326.0	3343.0	Cliff House
3365.0	3384.3	Meneffee
4224.0	4377.7	Point Lookout
4373.0	4572.2	Mancos
5226.0	5690.6	Gallup

CASING DETAILS

TVD	MD	Name
500.0	500.0	9 5/8"
5438.7	6199.4	7"

Vertical Section at 101.52° (1200 usft/in)

# Cathedral Energy Services

## Planning Report

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

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

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

<b>Well</b>	Sarah B 2H					
<b>Well Position</b>	<b>+N-S</b>	0.0 usft	<b>Northing:</b>	1,909,558.48 usft	<b>Latitude:</b>	36.247820
	<b>+E-W</b>	0.0 usft	<b>Easting:</b>	2,778,402.36 usft	<b>Longitude:</b>	-107.645750
<b>Position Uncertainty</b>	0.0 usft	<b>Wellhead Elevation:</b>	0.0 usft	<b>Ground Level:</b>	7,011.0 usft	

<b>Wellbore</b>	HZ				
<b>Magnetics</b>	<b>Model Name</b>	<b>Sample Date</b>	<b>Declination</b>	<b>Dip Angle</b>	<b>Field Strength</b>
	IGRF200510	5/13/2014	(°)	(°)	(nT)
			9.42	63.02	50,225

<b>Design</b>	Plan #1 Lower Gallup			
<b>Audit Notes:</b>				
<b>Version:</b>	<b>Phase:</b>	PROTOTYPE	<b>Tie On Depth:</b>	0.0
<b>Vertical Section:</b>	<b>Depth From (TVD)</b>	<b>+N-S</b>	<b>+E-W</b>	<b>Direction</b>
	(usft)	(usft)	(usft)	(°)
	0.0	0.0	0.0	101.52

Plan Sections										
Measured	Inclination	Azimuth	Vertical	+N-S	+E-W	Dogleg	Build	Turn	TFO	Target
Depth	(°)	(°)	Depth	(usft)	(usft)	Rate	Rate	Rate	(°)	
(usft)			(usft)			(°/100usft)	(°/100usft)	(°/100usft)		
0.0	0.00	0.00	0.0	0.0	0.0	0.00	0.00	0.00	0.00	
2,398.5	0.00	0.00	2,398.5	0.0	0.0	0.00	0.00	0.00	0.00	
4,398.7	40.00	140.11	4,240.1	-514.3	429.9	2.00	2.00	0.00	140.11	
5,581.9	40.00	140.11	5,146.4	-1,098.0	917.7	0.00	0.00	0.00	0.00	
6,199.4	85.00	89.52	5,438.7	-1,264.1	1,400.1	10.00	7.29	-8.19	-60.90	Sarah B 2H 7°/85° (LC)
6,310.3	90.55	89.52	5,443.0	-1,263.1	1,511.0	5.00	5.00	0.00	0.00	
10,814.6	90.55	89.52	5,400.0	-1,225.4	6,014.8	0.00	0.00	0.00	0.00	Sarah B 2H BHL (LG)

# Cathedral Energy Services

## Planning Report

<b>Database:</b>	USA EDM 5000 Multi Users DB	<b>Local Co-ordinate Reference:</b>	Well Sarah B 2H
<b>Company:</b>	LOGOS Operating LLC	<b>TVD Reference:</b>	KB=15' @ 7026.0usft
<b>Project:</b>	San Juan County, NM	<b>MD Reference:</b>	KB=15' @ 7026.0usft
<b>Site:</b>	S11-T23N-R8W (Sarah Pad)	<b>North Reference:</b>	Grid
<b>Well:</b>	Sarah B 2H	<b>Survey Calculation Method:</b>	Minimum Curvature
<b>Wellbore:</b>	HZ		
<b>Design:</b>	Plan #1 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 - 385' FNL, 1,062' 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	Chackra
2,300.0	0.00	0.00	2,300.0	0.0	0.0	0.0	0.00	0.00	
2,398.5	0.00	0.00	2,398.5	0.0	0.0	0.0	0.00	0.00	KOP @ 2,398.5'
2,400.0	0.03	140.11	2,400.0	0.0	0.0	0.0	2.00	2.00	
2,500.0	2.03	140.11	2,500.0	-1.4	1.2	1.4	2.00	2.00	
2,600.0	4.03	140.11	2,599.8	-5.4	4.5	5.5	2.00	2.00	
2,700.0	6.03	140.11	2,699.4	-12.2	10.2	12.4	2.00	2.00	
2,800.0	8.03	140.11	2,798.7	-21.6	18.0	22.0	2.00	2.00	
2,900.0	10.03	140.11	2,897.4	-33.6	28.1	34.2	2.00	2.00	
3,000.0	12.03	140.11	2,995.6	-48.3	40.3	49.2	2.00	2.00	
3,100.0	14.03	140.11	3,093.0	-65.6	54.8	66.8	2.00	2.00	
3,200.0	16.03	140.11	3,189.6	-85.5	71.4	87.1	2.00	2.00	
3,300.0	18.03	140.11	3,285.2	-107.9	90.2	109.9	2.00	2.00	
3,343.0	18.89	140.11	3,326.0	-118.4	99.0	120.6	2.00	2.00	Cliff House
3,384.3	19.72	140.11	3,365.0	-128.9	107.7	131.3	2.00	2.00	Meneffee
3,400.0	20.03	140.11	3,379.7	-133.0	111.1	135.4	2.00	2.00	
3,500.0	22.03	140.11	3,473.1	-160.5	134.1	163.5	2.00	2.00	
3,600.0	24.03	140.11	3,565.1	-190.5	159.2	194.1	2.00	2.00	
3,700.0	26.03	140.11	3,655.7	-223.0	186.4	227.1	2.00	2.00	
3,800.0	28.03	140.11	3,744.8	-257.8	215.5	262.6	2.00	2.00	
3,900.0	30.03	140.11	3,832.2	-295.1	246.6	300.6	2.00	2.00	
4,000.0	32.03	140.11	3,917.9	-334.6	279.7	340.8	2.00	2.00	
4,100.0	34.03	140.11	4,001.7	-376.4	314.6	383.4	2.00	2.00	
4,200.0	36.03	140.11	4,083.6	-420.5	351.4	428.3	2.00	2.00	

# Cathedral Energy Services

## Planning Report

<b>Database:</b>	USA EDM 5000 Multi Users DB	<b>Local Co-ordinate Reference:</b>	Well Sarah B.2H
<b>Company:</b>	LOGOS Operating LLC	<b>TVD Reference:</b>	KB=15' @ 7026.0usft
<b>Project:</b>	San Juan County, NM	<b>MD Reference:</b>	KB=15' @ 7026.0usft
<b>Site:</b>	S11-T23N-R8W (Sarah Pad)	<b>North Reference:</b>	Grid
<b>Well:</b>	Sarah B 2H	<b>Survey Calculation Method:</b>	Minimum Curvature
<b>Wellbore:</b>	HZ		
<b>Design:</b>	Plan #1 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
4,300.0	38.03	140.11	4,163.4	-466.7	390.1	475.4	2.00	2.00	
4,377.7	39.58	140.11	4,224.0	-504.1	421.3	513.4	2.00	2.00	Point Lookout
4,398.7	40.00	140.11	4,240.1	-514.3	429.9	523.9	2.00	2.00	EOB @ 40° INC
4,400.0	40.00	140.11	4,241.1	-515.0	430.4	524.6	0.00	0.00	
4,500.0	40.00	140.11	4,317.7	-564.3	471.7	574.8	0.00	0.00	
4,572.2	40.00	140.11	4,373.0	-599.9	501.4	611.1	0.00	0.00	Mancos
4,600.0	40.00	140.11	4,394.3	-613.7	512.9	625.1	0.00	0.00	
4,700.0	40.00	140.11	4,470.9	-663.0	554.1	675.3	0.00	0.00	
4,800.0	40.00	140.11	4,547.5	-712.3	595.3	725.6	0.00	0.00	
4,900.0	40.00	140.11	4,624.1	-761.6	636.6	775.8	0.00	0.00	
5,000.0	40.00	140.11	4,700.7	-810.9	677.8	826.0	0.00	0.00	
5,100.0	40.00	140.11	4,777.3	-860.3	719.0	876.3	0.00	0.00	
5,200.0	40.00	140.11	4,853.9	-909.6	760.2	926.5	0.00	0.00	
5,300.0	40.00	140.11	4,930.5	-958.9	801.5	976.8	0.00	0.00	
5,400.0	40.00	140.11	5,007.1	-1,008.2	842.7	1,027.0	0.00	0.00	
5,500.0	40.00	140.11	5,083.7	-1,057.6	883.9	1,077.2	0.00	0.00	
5,581.9	40.00	140.11	5,146.4	-1,098.0	917.7	1,118.4	0.00	0.00	Start 10° Build/Turn
5,600.0	40.91	137.69	5,160.2	-1,106.8	925.4	1,127.7	10.00	5.00	
5,650.0	43.65	131.48	5,197.2	-1,130.4	949.4	1,155.9	10.00	5.49	
5,690.6	46.11	126.89	5,226.0	-1,148.4	971.6	1,181.3	10.00	6.05	Gallup
5,700.0	46.70	125.88	5,232.5	-1,152.5	977.1	1,187.5	10.00	6.31	
5,750.0	50.00	120.85	5,265.7	-1,173.0	1,008.3	1,222.1	10.00	6.59	
5,800.0	53.49	116.29	5,296.7	-1,191.7	1,042.7	1,259.6	10.00	6.98	
5,850.0	57.14	112.13	5,325.1	-1,208.5	1,080.2	1,299.7	10.00	7.30	
5,900.0	60.91	108.30	5,350.9	-1,223.3	1,120.4	1,342.1	10.00	7.55	
5,950.0	64.79	104.75	5,373.7	-1,235.9	1,163.1	1,386.4	10.00	7.75	
6,000.0	68.75	101.43	5,393.4	-1,246.3	1,207.8	1,432.3	10.00	7.91	
6,050.0	72.76	98.27	5,409.9	-1,254.4	1,254.3	1,479.5	10.00	8.04	
6,100.0	76.83	95.26	5,423.0	-1,260.0	1,302.2	1,527.5	10.00	8.13	
6,150.0	80.93	92.34	5,432.7	-1,263.3	1,351.2	1,576.1	10.00	8.20	
6,199.4	85.00	89.52	5,438.7	-1,264.1	1,400.2	1,624.3	10.00	8.24	EOB @ 85° INC / Start 5° Build - 7"/85° - 1,655'
6,300.0	90.03	89.52	5,443.1	-1,263.2	1,500.6	1,722.6	5.00	5.00	
6,310.3	90.55	89.52	5,443.0	-1,263.1	1,511.0	1,732.7	5.00	5.00	LP @ 5,443' TVD, 90.55° INC
6,400.0	90.55	89.52	5,442.2	-1,262.4	1,600.6	1,820.4	0.00	0.00	
6,500.0	90.55	89.52	5,441.2	-1,261.5	1,700.6	1,918.2	0.00	0.00	
6,600.0	90.55	89.52	5,440.2	-1,260.7	1,800.6	2,016.0	0.00	0.00	
6,700.0	90.55	89.52	5,439.3	-1,259.9	1,900.6	2,113.9	0.00	0.00	
6,800.0	90.55	89.52	5,438.3	-1,259.0	2,000.6	2,211.7	0.00	0.00	
6,900.0	90.55	89.52	5,437.4	-1,258.2	2,100.6	2,309.5	0.00	0.00	
7,000.0	90.55	89.52	5,436.4	-1,257.4	2,200.6	2,407.3	0.00	0.00	
7,100.0	90.55	89.52	5,435.5	-1,256.5	2,300.6	2,505.1	0.00	0.00	
7,200.0	90.55	89.52	5,434.5	-1,255.7	2,400.6	2,602.9	0.00	0.00	
7,300.0	90.55	89.52	5,433.6	-1,254.8	2,500.6	2,700.7	0.00	0.00	
7,400.0	90.55	89.52	5,432.6	-1,254.0	2,600.5	2,798.5	0.00	0.00	
7,500.0	90.55	89.52	5,431.6	-1,253.2	2,700.5	2,896.3	0.00	0.00	
7,600.0	90.55	89.52	5,430.7	-1,252.3	2,800.5	2,994.2	0.00	0.00	
7,700.0	90.55	89.52	5,429.7	-1,251.5	2,900.5	3,092.0	0.00	0.00	
7,800.0	90.55	89.52	5,428.8	-1,250.7	3,000.5	3,189.8	0.00	0.00	
7,900.0	90.55	89.52	5,427.8	-1,249.8	3,100.5	3,287.6	0.00	0.00	
8,000.0	90.55	89.52	5,426.9	-1,249.0	3,200.5	3,385.4	0.00	0.00	
8,100.0	90.55	89.52	5,425.9	-1,248.1	3,300.5	3,483.2	0.00	0.00	
8,200.0	90.55	89.52	5,425.0	-1,247.3	3,400.5	3,581.0	0.00	0.00	

# Cathedral Energy Services

## Planning Report

<b>Database:</b>	USA EDM 5000 Multi Users DB	<b>Local Co-ordinate Reference:</b>	Well Sarah B 2H
<b>Company:</b>	LOGOS Operating LLC	<b>TVD Reference:</b>	KB=15' @ 7026.0usft
<b>Project:</b>	San Juan County, NM	<b>MD Reference:</b>	KB=15' @ 7026.0usft
<b>Site:</b>	S11-T23N-R8W (Sarah Pad)	<b>North Reference:</b>	Grid
<b>Well:</b>	Sarah B 2H	<b>Survey Calculation Method:</b>	Minimum Curvature
<b>Wellbore:</b>	HZ		
<b>Design:</b>	Plan #1-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
8,300.0	90.55	89.52	5,424.0	-1,246.5	3,500.5	3,678.8	0.00	0.00	
8,400.0	90.55	89.52	5,423.1	-1,245.6	3,600.5	3,776.7	0.00	0.00	
8,500.0	90.55	89.52	5,422.1	-1,244.8	3,700.5	3,874.5	0.00	0.00	
8,600.0	90.55	89.52	5,421.1	-1,244.0	3,800.4	3,972.3	0.00	0.00	
8,700.0	90.55	89.52	5,420.2	-1,243.1	3,900.4	4,070.1	0.00	0.00	
8,800.0	90.55	89.52	5,419.2	-1,242.3	4,000.4	4,167.9	0.00	0.00	
8,900.0	90.55	89.52	5,418.3	-1,241.4	4,100.4	4,265.7	0.00	0.00	
9,000.0	90.55	89.52	5,417.3	-1,240.6	4,200.4	4,363.5	0.00	0.00	
9,100.0	90.55	89.52	5,416.4	-1,239.8	4,300.4	4,461.3	0.00	0.00	
9,200.0	90.55	89.52	5,415.4	-1,238.9	4,400.4	4,559.2	0.00	0.00	
9,300.0	90.55	89.52	5,414.5	-1,238.1	4,500.4	4,657.0	0.00	0.00	
9,400.0	90.55	89.52	5,413.5	-1,237.3	4,600.4	4,754.8	0.00	0.00	
9,500.0	90.55	89.52	5,412.6	-1,236.4	4,700.4	4,852.6	0.00	0.00	
9,600.0	90.55	89.52	5,411.6	-1,235.6	4,800.4	4,950.4	0.00	0.00	
9,700.0	90.55	89.52	5,410.6	-1,234.7	4,900.4	5,048.2	0.00	0.00	
9,800.0	90.55	89.52	5,409.7	-1,233.9	5,000.4	5,146.0	0.00	0.00	
9,900.0	90.55	89.52	5,408.7	-1,233.1	5,100.3	5,243.8	0.00	0.00	
10,000.0	90.55	89.52	5,407.8	-1,232.2	5,200.3	5,341.6	0.00	0.00	
10,100.0	90.55	89.52	5,406.8	-1,231.4	5,300.3	5,439.5	0.00	0.00	
10,200.0	90.55	89.52	5,405.9	-1,230.6	5,400.3	5,537.3	0.00	0.00	
10,300.0	90.55	89.52	5,404.9	-1,229.7	5,500.3	5,635.1	0.00	0.00	
10,400.0	90.55	89.52	5,404.0	-1,228.9	5,600.3	5,732.9	0.00	0.00	
10,500.0	90.55	89.52	5,403.0	-1,228.0	5,700.3	5,830.7	0.00	0.00	
10,600.0	90.55	89.52	5,402.0	-1,227.2	5,800.3	5,928.5	0.00	0.00	
10,700.0	90.55	89.52	5,401.1	-1,226.4	5,900.3	6,026.3	0.00	0.00	
10,800.0	90.55	89.52	5,400.1	-1,225.5	6,000.3	6,124.1	0.00	0.00	
10,814.6	90.55	89.52	5,400.0	-1,225.4	6,014.8	6,138.4	0.00	0.00	TD @ 10,814.6' MD - PBHL - 1,655' FNL, 330' F

Targets									
Target Name	Dip Angle (°)	Dip Dir. (°)	TVD (usft)	+N/-S (usft)	+E/-W (usft)	Northing (usft)	Easting (usft)	Latitude	Longitude
Sarah B 2H 7/85° (2BG) - hit/miss target - Shape - plan misses target center by 73.7usft at 6190.3usft MD (5437.9 TVD, -1264.1 N, 1391.1 E) - Point	0.00	0.00	5,364.7	-1,264.1	1,400.1	1,908,294.42	2,779,802.51	36.244340	-107.641010
Sarah B 2H BHL (LG) - plan hits target center - Point	0.00	0.00	5,400.0	-1,225.4	6,014.8	1,908,333.07	2,784,417.21	36.244420	-107.625360
Sarah B 2H BHL (2BG) - plan misses target center by 6.0usft at 10814.5usft MD (5400.0 TVD, -1225.4 N, 6014.8 E) - Point	0.00	0.00	5,406.0	-1,225.4	6,014.8	1,908,333.07	2,784,417.21	36.244420	-107.625360
Sarah B 2H 7/85° (LG) - plan hits target center - Point	0.00	0.00	5,438.7	-1,264.1	1,400.1	1,908,294.42	2,779,802.51	36.244340	-107.641010

# Cathedral Energy Services

## Planning Report

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

Casing Points					
Measured Depth (usft)	Vertical Depth (usft)		Name	Casing Diameter (")	Hole Diameter (")
500.0	500.0	9 5/8"		0	0
6,199.4	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		
1,344.0	1,344.0	Kirtland		0.00		
1,622.0	1,622.0	Fruitland		0.00		
1,834.0	1,834.0	Pictured Cliffs		0.00		
2,239.0	2,239.0	Chackra		0.00		
3,343.0	3,326.0	Cliff House		0.00		
3,384.3	3,365.0	Meneffee		0.00		
4,377.7	4,224.0	Point Lookout		0.00		
4,572.2	4,373.0	Mancos		0.00		
5,690.6	5,226.0	Gallup		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 - 385' FNL, 1,062' FEL	
2,398.5	2,398.5	0.0	0.0	KOP @ 2,398.5'	
4,398.7	4,240.1	-514.3	429.9	EOB @ 40° INC	
5,581.9	5,146.4	-1,098.0	917.7	Start 10° Build/Turn	
6,199.4	5,438.7	-1,264.1	1,400.1	EOB @ 85° INC / Start 5° Build	
6,199.4	5,438.7	-1,264.1	1,400.2	7"/85° - 1,655' FNL, 330' FWL	
6,310.3	5,443.0	-1,263.1	1,511.0	LP @ 5,443' TVD, 90.55° INC	
10,814.6	5,400.0	-1,225.4	6,014.8	TD @ 10,814.6' MD	
10,814.6	5,400.0	-1,225.4	6,014.8	PBHL - 1,655' FNL, 330' FEL	

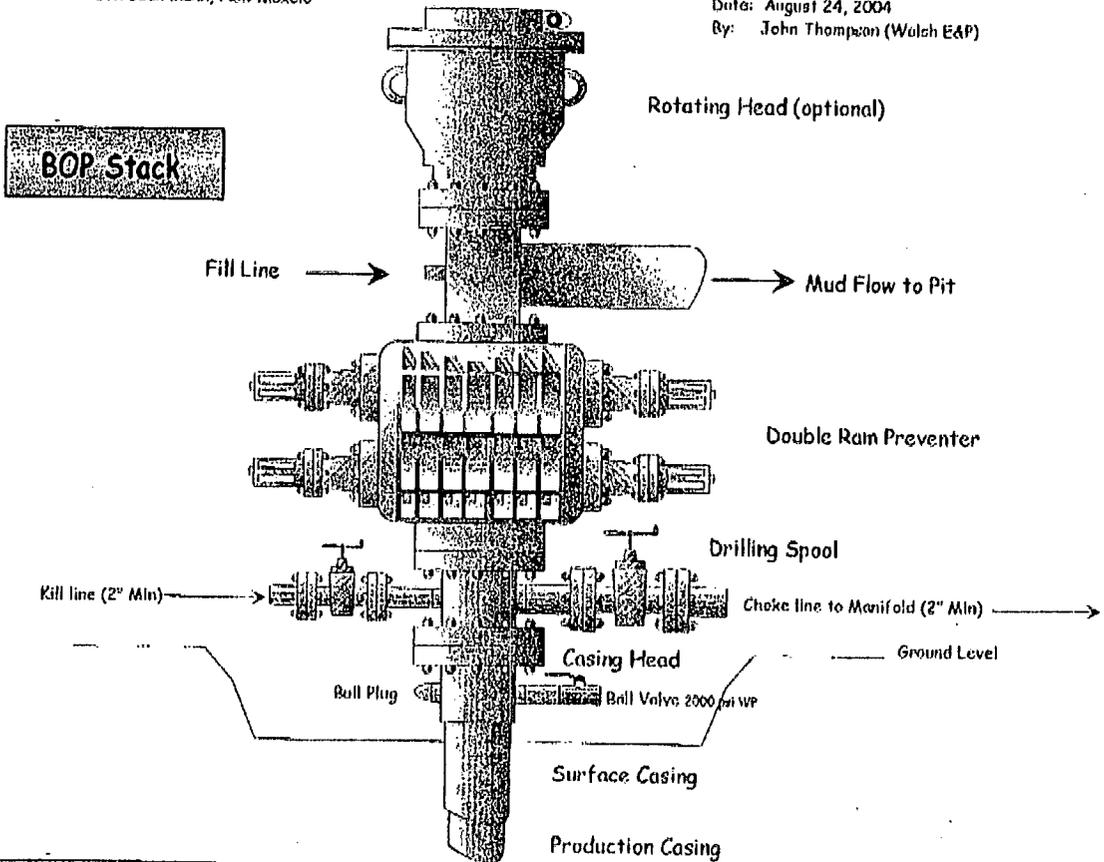
# Well Control Equipment Schematic for 2M Service

Attachment to Drilling Technical Program

## Exhibit #1 Typical BOP setup

Location: Sun Juan Basin, New Mexico

Date: August 24, 2004  
By: John Thompson (Walch E&P)



### Choke & Kill Manifold

