

## DRILLING PLAN

### Gallo Canyon #307H

### Sandoval County, New Mexico

**Surface Location**

464-ft FWL & 871-ft FSL  
 Sec 26 T23N R06W  
 Graded Elevation 6954' MSL  
 RKB Elevation 6968' (14' KB)

**SHL Geographical Coordinates (NAD-83)**

Latitude 36.1913930° N  
 Longitude 107.4450970° W

**Kick Off Point for Horizontal Build Curve**

4619-ft MD  
 4529-ft TVD

**Local Coordinates (from SHL)**

835-ft North  
 120-ft East

**Heel Location (Pay zone entry)**

217-ft FWL & 2218-ft FSL  
 Sec 26 T23N R06W

**Heel Geographical Coordinates (NAD-83)**

Latitude 36.1951016° N  
 Longitude 107.44593860° W

**Bottom Hole Location (TD)**

360-ft FWL & 2283-ft FSL  
 Sec 22 T23N R06W

**BHL Geographical Coordinates (NAD-83)**

Latitude 36.209645° N  
 Longitude 107.4633780° W

**Well objectives**

This well is planned as a 7380-ft lateral in the Mancos Silt sand.

**Bottom Hole temperature and pressure**

The temperature in the Mancos Silt horizontal objective is 139°F. Bottom hole pressure in the Mancos Silt is forecast to be 1985 psi.

**Formation Tops** (Sd = Sand; Sh = Shale; Siltstone = Slt, Coal = C; W = water; O = oil; G = gas; NP = no penetration)

Name	MD (ft)	TVD (ft)	Lithology	Pore fluid	Expected Pore Pressure (ppg)	Planned Mud Weight (ppg)
Ojo Alamo	1423	1409	Sd	W	8.3	8.4 – 8.8
Kirtland	1531	1514	Sh	-	8.3	8.4 – 8.8
Fruitland	1747	1725	C	G	8.3	9.0 - 9.5
Pictured Cliffs	1974	1947	Sd	W	8.3	9.0 - 9.5
Lewis	2080	2050	Sh	-		9.0 - 9.5
Chacra	2861	2813	Sd	-	8.3	9.0 - 9.5
Menefee	3545	3481	Sd, C	G	8.3	9.0 - 9.5
Point Lookout	4265	4184	Sd	-	8.3	9.0 - 9.5
Mancos	4465	4379	Sh	-		9.0 - 9.5
Mancos Silt	4849	4744	Slt	O/G	6.6	9.0 - 9.5
Gallup A	NP	NP	Slt	O/G	6.6	9.0 - 9.5
Gallup B	NP	NP	Sd	O/G	6.6	8.8 - 9.0
Gallup C	NP	NP	Sd	O/G	6.6	8.8 - 9.0
Target	5530	5074	Sd	O/G	6.6	8.8 - 9.0

**Casing Program**

Casing OD	Hole Size	Weight (#/ft)	Grade	Coupling	MD Top	MD Bottom	TVD Top	TVD Bottom	Top of Cement
9-5/8"	12-1/4"	36	K-55	STC	surf	350	surf	350	surface
7"	8-3/4"	26	K-55	LTC	surf	5479	surf	5072	surface
4-1/2"	6-1/8"	11.6	P-110	BTC	5196	12913	4987	5128	5196

Note: all casing will be new

**Casing Design Load Cases**

Description		Casing String		
		9-5/8" Surface	7" Intermediate	4-1/2" Production Liner
Collapse	Full internal evacuation <sup>1</sup>	✓	✓	✓
	Cementing	✓	✓	✓
Burst	Pressure test	✓ <sup>2</sup>	✓ <sup>2</sup>	✓
	Gas kick		✓ <sup>3</sup>	
	Fracture at shoe, 1/3 BHP at surface		✓ <sup>4</sup>	
	Injection down casing			✓ <sup>5</sup>
Axial	Dynamic load on casing coupling <sup>6</sup>	✓	✓	✓
Axial	Overpull <sup>7</sup>	✓	✓	✓

**Note #**

- 1 Fluid level at shoe, air column to surface, pore pressure outside
- 2 Tested to 80% of minimum internal yield with freshwater inside, pore pressure outside
- 3 50 bbl kick at TD, 0.50 ppg intensity, 4" drill pipe, 9.0 ppg mud, fracture gradient at shoe
- 4 2060 psi BHP, 687 psi surface pressure, 12.5 ppg EMW shoe integrity
- 5 Surface stimulation pressure of 8000 psi on 8.3 ppg fluid column. Stimulation will be down frac string, so load does not apply to 7" intermediate casing.
- 6 Shock load from abrupt pipe deceleration, evaluated against coupling rating
- 7 Overpull values as follows: Surface casing 20,000 lbs, Intermediate & Production 100,000 lbs

**Casing Design Factors**

Casing string	Casing OD	Design Factors			
		Burst	Collapse	Axial	Triaxial
Surface	9-5/8"	1.25	13.38	8.16	1.56
Intermediate	7"	1.25	1.50	1.68	1.34
Production liner	4-1/2"	1.37	3.68	1.88	1.69

**Cement Design**

9-5/8" Surface Casing

	<u>Lead</u>
Name	Redi-Mix
Type	I-II
Planned top	Surface
Density (ppg)	14.50
Yield (cf/sx)	1.61
Mix water (gal/sx)	7.41
Volume (sx)	114
Volume (bbls)	33
Volume (cu. ft.)	185
Excess %	50

7" Intermediate Casing

	<u>Lead</u>	<u>Tail</u>
	BJ Services	BJ Services
Type	III	Poz/G
Planned top	Surface	4119-ft
Density (ppg)	12.30	13.50
Yield (cf/sx)	2.34	1.50
Mix water (gal/sx)	13.26	7.20
Volume (sx)	400	218
Volume (bbls)	167	58
Volume (cu.ft.)	937	326
Excess %	55	55

#### 4-1/2" Production Liner

Type	BJ Services
Planned top	Poz/G 5196-ft
Density (ppg)	13.3
Yield (cf/sx)	1.56
Mix water (gal/sx)	7.71
Volume (sx)	648
Volume (bbls)	180
Volume (cu.ft)	1013
Excess %	40

#### Wellhead & Pressure Control

The well head will be an 11" 5M multi-bowl system. A 3M BOPE conforming to Onshore Order #2 will be installed on the surface casing. The BOP and accumulator will meet API 16D and 16E respectively.

A PVT mud monitoring system and a trip tank will be rigged up and operational for all hole intervals. An electronic geolograph will be employed to monitor and record drilling data (ROP, WOB, SPM, Pressure, RPM and torque).

#### Mud Program

Surface hole will be drilled with a fresh water, native mud system. In intermediate hole, a low weight 7% KCl LSND drilling fluid will be used, with KCl providing chemical stability for the young shales and clays present in the interval. In production hole a LSND system with polymer and lubricant additives is programmed. Sufficient drill water and mud additives will be on hand to maintain adequate pit volumes and maintain well control.

Hole Section	Fluid type	Interval (MD)	Density (ppg)	Funnel Viscosity	Yield Point	Fluid Loss (cc/30 min)
Surface	Fresh water spud mud	0 – 350	8.4 – 8.8	32 – 44	2 – 12	NC
Intermediate	7% KCl Low solids, non-dispersed	350 – 5479	9.0 – 9.5	38 – 45	8 – 14	<20
Production	Low solids, non-dispersed	5479 – 12913	8.8 – 9.2	34 – 38	6 – 8	6 – 8

#### Cores, tests and logs

Wellbore surveying: Drift (inclination only) surveys will be obtained in surface hole. MWD directional surveys will be taken in intermediate and production hole.

Logging while drilling: None in surface hole. MWD GR in intermediate and production hole.

Mud logging: a two-person mud logging unit with C1 – C4 gas analysis will be operational in intermediate and production hole.

Electric logging: No open hole electric logs are programmed. A cased hole GR/CCL will be run during completions for perforating depth control.

#### Cuttings and drilling fluids management

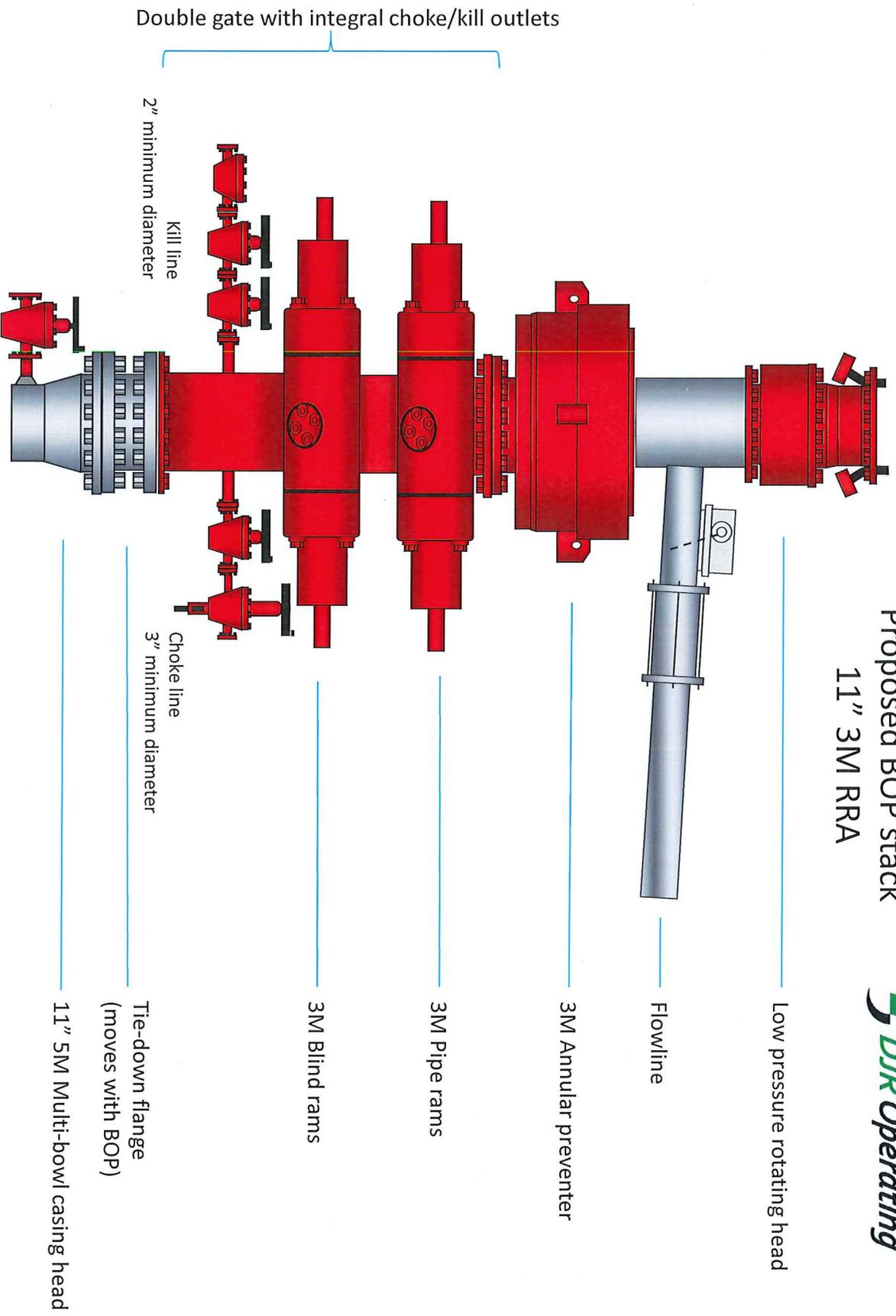
A closed loop, steel tank-based circulating system will be used. In addition to the rig solids control equipment, a dewatering centrifuge and chemical flocculation system will be operational to strip solids from the whole mud. All solids will be collected in 3-sided bins and will then be put into transports with a bucket loader. Drying agents will be used if necessary. The solids will be taken to a licensed commercial disposal facility. Whole mud will be dewatered back to drill water and used as make up for subsequent wells or hauled off for disposal. A diagram of the closed loop system is included.

#### Completion

It is envisioned that this well will be completed with a multi-stage sand frac, using the plug and perf technique. After drilling out the plugs, the current plan is to install a 2-7/8" plunger-assisted gas lift tubing string. The stimulation and completion plan will be sundried at a later date.



# Proposed BOP stack 11" 3M RRA



# Choke Manifold

Actual system to conform with Onshore Order 2

