



NOVO OIL & GAS NORTHERN DELAWARE, LLC

Rana Salada Fed Com 0504 133H
SHL: 1443' FSL & 607' FEL Section 06-23S-29E
BHL: 2510' FWL & 2178' FSL Section 04-23S-29E
Eddy County, New Mexico

DRILLING OPERATIONS PLAN
Standard Wolfcamp 4-STRING CASING DESIGN (R-111-P)

Estimated Drilling Conditions

Target Formation	Wolfcamp B
Target Depth - TVD (ft)	10596
Anticipated Bottom-Hole Pressure (psi)	7417.2
Anticipated Maximum Surface Pressure (psi)	5086.08
Abnormal Pressure (Yes/No)	No
Anticipated Bottom-Hole Temperature (deg F)	165 deg F
H2S Contingency Plan Required (Yes/No)	Yes

Geologic Formations

	GR	KB (25')	
Elevation	3,041	3,066	
Formation Tops	TVDss	TVD - KB	Mineral Resources
Rustler	2700	366	Water
Bell Canyon (base of salt)	0	3,066	Water
Cherry Canyon	-863	3,929	Water
Brushy Canyon	-2325	5,391	Oil, Gas, Water
Bone Spring Lime	-3430	6,496	Oil, Gas, Water
Lower Avalon		3,066	Oil, Gas, Water
1st Bone Spring Sand	-4492	7,558	Oil, Gas, Water
2nd Bone Spring Carbonate	-4745	7,811	Oil, Gas, Water
2nd Bone Spring Sand	-5235	8,301	Oil, Gas, Water
3rd Bone Spring Carbonate	-5592	8,658	Oil, Gas, Water
3rd Bone Spring Sand	-6445	9,511	Oil, Gas, Water
Wolfcamp XY	-6748	9,814	Oil, Gas, Water
Wolfcamp A	-6900	9,966	Oil, Gas, Water
Wolfcamp B	-7147	10,213	Oil, Gas, Water
Wolfcamp B Flow Unit		3,066	Oil, Gas, Water
Wolfcamp C	-7825	10,891	Water

Pressure Control Equipment and Pressure Testing Procedure

A 13-5/8" 10M Blowout Preventer system will be installed on a multi-bowl (speed head) wellhead with a 13-5/8 flanged casing spool. The top flange of casing spool will be set in a cellar below ground level. The blowout preventor system will consist of a single pipe ram on bottom, mud cross, double pipe ram with blind rams on bottom and pipe rams on top and annular preventer. The blowout preventer will be installed on top of the 13-3/8" surface casing and will remain installed to total depth of the well. Wellhead, blowout preventer and choke manifold diagrams have been included. A co-flex line will be used between the BOP system and the choke manifold. A pressure test certification form for the co-flex hose will be available on the location at the time of the BOP testing.

The BOP system will be isolated with a test plug and tested by an independent tester to 250 psi low and 10,000 psi high for 10 minutes.

The Surface Casing will be pressure tested to 250 psi low and 1500 psi high. Intermediate Casing will be pressure tested to 250 psi low and (.22 psi x Shoe TVD, which is equivalent to 652.476 psi) high for 30 minutes

Drilling Fluid Program

Depth Interval (ft)	Hole Size (in.)	Fluid Type	Mud Weight (ppg)	Funnel Viscosity (sec/qt)	API Fluid Loss (ml/30min)	Total Solids (%)
0 - 381	17-1/2	Water Based Spud Mud	8.3	30-60	N/C	2.0-8.0
381 - 2,966	12-1/4	Brine	9.8-10.2	35-45	N/C	1.0-4.0
2,966 - 9,996	9-7/8	Cut Brine	9-9.5	35-45	N/C	1.0-4.0
9,996 - 18,996	7-7/8	Oil Based Mud	8.5-12.5	35-65	4-6 cc's	1.0-8.0
Drilling Fluid System		A closed loop drilling system will be used.				

Casing Program

Depth Interval	Length (ft)	Hole Size	Casing Size	Weight (ppf)	Grade	Coupling	Notes
0' - 381' 280	381	17-1/2	13-3/8"	54.50	J-55	BTC	
0' - 2,966' 2850	2,966	12-1/4"	10-3/4"	40.50	J-55	BTC	SC-BTC (11.25" OD)
0' - 9,996'	9,996	9-7/8"	8-5/8"	32.00	P110 HSCY	TLW	Semi-Flush Joint
0' - 18,996'	18,996	7-7/8"	5-1/2"	20.00	P-110EC	DWC/C-IS+	Potential to upgrade to 23# coupling OD must meet 0.422" clearance.

Note: **DGX, GBCD, CDC, DWC/C, TXP-BTC** could be substituted on 5-1/2" casing due to availability of coupling.

If substituted and not upgraded, submit sundry for approval.

Casing Centralizers

Surface Casing: Centralizers will be run on the bottom 3 joints of casing and then 1 centralizer per joint to surface.

Intermediate Casing: Centralizers will be run on the bottom 3 joints of casing and then 1 centralizer every 4th joint to surface.

Casing Performance Properties and Design Criteria

Depth Interval	Collapse (psi)	Burst (psi)	Joint Strength (1000 lbs)	Actual Design Safety Factors			Notes
				Collapse	Burst	Tension	
0' - 381'	1,130	2,740	853	6.85	1.83	8.53	
0' - 2,966'	1,580	3,130	629	1.42	2.09	3.12	Collapse: 1/3 fluid filled at all times
0' - 9,996'	4,230	8,930	1144	1.24	4.06	3.09	Collapse: 1/3 fluid filled at all times
0' - 18,996'	12,090	14,360	729	2.15	1.25	2.61	
Design Safety Factors		Design safety factors will meet or exceed as shown.					

Surface Casing

Collapse: $DF_C = 1.125$

- Full Internal Evacuation: Collapse force is equal to mud gradient (0.433 psi/ft) in which the casing will be run and internal evacuation of casing.
- Cementing: Collapse force is equal net force of the planned cement slurry gradient (0.718 psi/ft) in which the casing will be run and internal force equivalent to fresh water displacement gradient (0.433 psi/ft).

Burst: $DF_B = 1.125$

- Casing Pressure Test: According to BLM Onshore Order No. 2 with 0.22 psi/ft or 1500 psi, whichever is greater but not to exceed 70 percent of the minimum internal yield.

Tensile: $DF_T = 1.60$

- Overpull: A tensile force of 100,000 lbs over string weight with a bouyancy factor of 0.8727 in water (8.33 ppg).

Intermediate Casing

Collapse: $DF_C = 1.125$

- Full Internal Evacuation: Collapse force is equal to mud gradient (0.531 psi/ft) in which the casing will be run and internal evacuation of casing.
- Cementing: Collapse force is equal net force of the planned cement slurry gradient (0.626 psi/ft) in which the casing will be run and internal force equivalent to the displacement fluid gradient.

Burst: $DF_B = 1.125$

- Casing Pressure Test: According to BLM Onshore Order No. 2 with 0.22 psi/ft or 1500 psi, whichever is greater but not to exceed 70 percent of the minimum internal yield.
- Gas Kick: Internal burst load of a 50 bbl gas kick at the casing with drillpipe in the hole. External force will be 10.2 ppg brine water gradient (0.531 psi/ft) and internal force will be with 10.0 ppg brine water gradient (0.521 psi/ft) with gas kick.

Tensile: $DF_T = 1.60$

- Overpull: A tensile force of 100,000 lbs over string weight with a bouyancy factor of 0.8441 in brine water (10.2 ppg).

Production CasingCollapse: $DF_C = 1.125$

- Full Internal Evacuation: Collapse force is equal to mud gradient (0.531 psi/ft) in which the casing will be run and internal evacuation of casing.
- Cementing: Collapse force is equal net force of the planned cement slurry gradient (0.688 psi/ft) in which the casing will be run and internal force equivalent to fresh water displacement gradient (0.433 psi/ft).

Burst: $DF_B = 1.125$

- Pressure Test: Pressure test will be to 80% of Internal Yield Pressure of casing intended for fracture stimulation.

Tensile: $DF_T = 1.60$

- Overpull: A tensile force of 100,000 lbs over string weight with a bouyancy factor of 0.8472 in oil-based mud (10.0 ppg).

Cementing Program**Surface Casing Cement:**

0' - 381'

Top of Cement: Surface

Cement	Amount (sacks)	Slurry Volume (cu. ft.)	Slurry Volume (bbls)	Weight (ppg)	Yield (cu. ft./sx)	Mix Water (gal/sx)	24hr 115deg Strength (psi)	Excess Cement (%)
Lead								
Tail	288	529.4	94.3	13.20	1.84	9.92	1,200	100.0%

Lead:

Tail: Class C Cement with Gel, Accelerator, LCM

Salt Protection Casing Cement:

Surface Shoe Depth 381

Top of Lead 0

Top of Tail 0

Intermediate Shoe Depth 2,966

Cement	Amount (sacks)	Slurry Volume (cu. ft.)	Slurry Volume (bbls)	Weight (ppg)	Yield (cu. ft./sx)	Mix Water (gal/sx)	24hr 115deg Strength (psi)	Excess Cement (%)
Lead	195	498.6	88.8	11.80	2.56	15.42	1,000	50.0%
Tail	175	231.0	41.1	14.80	1.32	6.33	900	20.0%

Lead:

Tail: Class C Cement with Gel, Retarder, LCM

Intermediate Casing Cement:

0' - 9,996'

Top of Cement: Surface

Cement	Amount (sacks)	Slurry Volume (cu. ft.)	Slurry Volume (bbls)	Weight (ppg)	Yield (cu. ft./sx)	Mix Water (gal/sx)	24hr 115deg Strength (psi)	Excess Cement (%)
Lead	739	2313.3	412.0	10.20	3.13	15.86	900	100.0%
Tail	150	208.5	37.1	13.80	1.39	6.57	1,200	50.0%

Lead: Class C or H Cement with Fluid Loss, Retarder, LCM, Possibly beaded for desired compressive strength

Tail: Class C or H Cement with Fluid Loss, Retarder, LCM

Production Casing Cement:

0' - 18,996'

Top of Cement: 0'

Cement	Amount (sacks)	Slurry Volume (cu. ft.)	Slurry Volume (bbls)	Weight (ppg)	Yield (cu. ft./sx)	Mix Water (gal/sx)	24hr 115deg Strength (psi)	Excess Cement (%)
Lead								
Tail	2484	3949.7	703.4	13.20	1.59	7.98	1,200	20.0%

Lead:

Tail: Class H Cement with Fluid Loss, Retarder, LCM

Logging, Testing & Coring Program

A 2 person mud logging program will be used from 3,000 ft to Total Depth

A gamma ray log will be acquired by directional drilling Measure While Drilling tools from the intermediate casing to Total Depth.

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 Rd., Aztec, NM 87410
Phone:(505) 334-6178 Fax:(505) 334-6170
District IV
1220 S. St Francis Dr., Santa Fe, NM 87505
Phone:(505) 476-3470 Fax:(505) 476-3462

State of New Mexico
Energy, Minerals and Natural Resources
Oil Conservation Division
1220 S. St Francis Dr.
Santa Fe, NM 87505

CONDITIONS

Action 189989

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Operator: NOVO OIL & GAS NORTHERN DELAWARE, LLC 1001 West Wilshire Blvd Oklahoma City, OK 73116	OGRID: 372920
	Action Number: 189989
	Action Type: [C-103] NOI Change of Plans (C-103A)

CONDITIONS

Created By	Condition	Condition Date
kpickford	None	2/23/2023