

# BLACK HILLS PLATEAU PRODUCTION COMPANY

## DRILLING PROGRAM

### Homer Deep Unit 9-11CH

SHL: 300' FNL, 200' FWL, NWNW Sect. 9 T8S R98W

BHL: 1350' FSL, 2100' FEL NWSE Sect. 15 T8S R98W

Garfield & Mesa Counties, Colorado

*NOTE:* This drilling program is as of February 26, 2014. Well is being proposed as a horizontal in the Mancos/Niobrara formation.

#### 1) Estimated Formation Tops of Important Geological Markers:

Location            GL: 5,521.2' (Graded),      KB: 5,545.2' (Estimated)

Formation	MD	TVD	Subsea TVD	Lithology	Oil/Gas/Water
Wasatch	Surface	Surface	Surface	Shale w/ SS Stringers	Possible Gas
Mesaverde	1013	1013	4523	Sandstone & Shale	Gas or Water
Cameo Coal	2956	2956	2580	Coal, Silt & Sandstone	Oil, Gas or Water
Rollins	3285	3285	2251	Sandstone	Oil, Gas or Water
Cozette	3466	3466	2070	Sandstone & Silt	Oil, Gas or Water
Corcoran	3685	3685	1851	Sandstone & Silt	Oil, Gas or Water
Mancos	3967	3967	1569	Shale & Silt	Oil, Gas or Water
Mancos 'A'*	4352	4352	1184	Shale & Silt	Oil, Gas or Water
Moab	5106	5106	430	Bentonite Marker	Bentonite
Mancos 'B'*	5536	5536	0	Shale & Silt	Oil, Gas or Water
Niobrara*	6618	6567	-1031	Calcareous Shale & Silt	Oil, Gas or Water
Target*	8203	7221	-1685	Calcareous Shale & Silt	Oil, Gas or Water
Permit TD	18,724	7041	-1505		

\* Projected completion intervals.

#### 2) Proposed Casing and Cementing Program

Hole Size (in)	Casing Size (in)	Depth Set MD	Wt./Ft., Grade, & Joint	Cement
30	20	120	Line Pipe	To surface w/ Class 3; 320 sx
14-3/4	10-3/4	1000	40.5#, J55, ST&C	Cemented to surface w/ Lead: 198 sx Class G (12.5 ppg) Tail: 271 sx Class G (14 ppg)
9-7/8	7-5/8	6,410	29.7#, N-80, LTC	Cemented 200' above TOG w/ Lead: 735 sx TXI (12 ppg) Tail: 170 sx Class G (15.8 ppg)
6-3/4	4-1/2 x 5-1/2 Tapered String (x-over @ 6,200')	18,724	4-1/2: 11.6#, P-110, LTC 5-1/2: 17#, P-110, LTC	Cemented 200' into intermediate shoe w/ Lead: 85 sx ExpandaCem (12.6 ppg) Tail: 1418 sx ExpandaCem (13.5 ppg)

Yields: Surface Lead	Class G	Yield = 2.11 ft3/sk (12.5 ppg)
Surface Tail	Class G	Yield = 1.54 ft3/sk (14.0 ppg)
Intermediate Lead	TXI	Yield = 2.88 ft3/sk (12.0 ppg)
Intermediate Tail	Class G	Yield = 1.16 ft3/sk (15.8 ppg)
Longstring Lead	ExpandaCem	Yield = 1.60 ft3/sk (12.6 ppg)
Longstring Tail	ExpandaCem	Yield = 1.36 ft3/sk (13.5 ppg)

- The proposed casing and cementing program has been designed to protect and/or isolate all usable water zones, potentially productive zones, lost circulation zones, abnormally pressures zones, and any prospectively valuable deposits of minerals. Any isolating medium other than cement shall receive approval prior to use.
- The surface casing shall be set at 1,000' and cemented back to surface either during the primary cement job or by remedial cementing. Cementing to surface will isolate all potential fresh water zones. Slurry designed for full coverage with 50% excess.
- Intermediate casing is designed to have cement lifted at least 200' above TOG. Actual cement volumes will be determined by caliper log plus 10% excess. If caliper logs are not available, volume will be assumed hole size to TD plus 25% excess.
- Production casing is designed to have cement lifted at least 200' into the intermediate shoe. Actual cement volumes will be determined by caliper log plus 10% excess. If caliper logs are not available cement volumes will be calculated at 25% excess.
- Centralizers will be installed per approved centralizer program from cement vendor.
- All waiting on cement times will be adequate to achieve a minimum of 500 psi compressive strength at the casing shoe prior to drilling out. 2,500 psi compressive strength in 72 hours.

**Casing Design** (All casing will be new or reconditioned and tested to meet or exceed API standards):

Casing String				Casing Strength Properties			Minimum Design Factors		
Size (in)	Weight (lb/ft)	Grade	Connection	Collapse (psi)	Burst (psi)	Tensile (1000 lb)	Collapse	Burst	Tension
10-3/4	40.5	J/K-55	STC	1,580	3,130	420	1.10	1.10	1.80
7-5/8	29.7	N-80	LTC	4,790	6,890	575	1.10	1.10	1.80
5-1/2	17.0	P-110	LTC	7,460	10,640	546	1.10	1.10	1.80
4-1/2	11.6	P-110	LTC	7,560	10,690	367	1.10	1.10	1.80

**Casing Design Considerations/Safety Factors:**

**A. Surface Casing @ 1,000' MD; 10-3/4" 40.5# J/K-55 STC**

Purpose: Protect shallow fresh water and contain MASP to TD  
 Maximum anticipated mud weight at surface casing depth: 9.0 ppg  
 Maximum anticipated mud weight at intermediate TD: 9.8 ppg  
 Maximum anticipated equivalent formation pressure at TD: 11.0 ppg  
 TVD at intermediate casing point: 6,398 ft  
 Surface setting depth: 1,000 ft  
 Max pore pressure: 0.572 psi/ft

**Collapse Design:**

Evacuated casing with 9.0 ppg drilling fluid density  
 Load = 9.0 ppg \* 0.052 \* 1000 ft 468 psig  
 Rating 1,580 psig  
 Safety Factor 3.38

**Burst Design:**

Assume kick with partially evacuated hole and influx gradient of 0.22 psi/ft  
 (Calculations assume shoe will not break down)  
 MASP (Load) 6,398 ft \* (0.572-0.22) psi/ft 2,252 psig  
 Rating 3,130 psig  
 Safety Factor 1.39

**Tensile Design:**

Designed on Air Weight \* Buoyancy + OverPull Margin  
 Load = 1000 ft \* 40.5 lb/ft \* 0.862 + 100,000 lbs (OPM) 134,911 lbs  
 Rating 420,000 lbs  
 Safety Factor 3.11  
 OverPull with S.F. = 420,000 lbs / 1.8 – 34,911 lbs 198,422 lbs

**B. Intermediate Casing @ 6,410' MD; 7-5/8" 29.7# N-80 LTC**

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Maximum anticipated mud weight at Total Depth:	9.8 ppg
Maximum anticipated equivalent formation pressure at TD:	11.0 ppg
TVD at intermediate casing point:	6,398 ft
Assumed Gas Gradient for Production Operations:	0.22 psi/ft

**Collapse Design:**

Designed on evacuated casing properties with 9.8 ppg drilling fluid density with no internal back-up

Load = 9.8 ppg * 0.052 * 6,398 ft	3,260 psig
Rating	4,790 psig
Safety Factor	1.47

**Burst Design:**

Maximum Surface Shut-In Pressure

MASSIP (Load) = 6,398 ft * (0.572-0.22) psi/ft	2,252 psig
Rating	6,890 psig
Safety Factor	3.06

**Tensile Design:**

Designed on Air Weight \* Buoyancy + OverPull Margin

Load = (6,410 ft * 29.7 lb/ft * 0.850) + 100,000 lbs (OPM)	216,820 lbs
Rating	575,000 lbs
Safety Factor	2.65
OverPull with S.F. = 575,000 lbs / 1.8 – 116,820 lbs	202,625 lbs

**C. Production Casing @ 18,724' MD; 5-1/2" 17# P-110 x 4-1/2" 11.6# P-110**

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Maximum anticipated mud weight at Total Depth:	11.5 ppg
Maximum anticipated equivalent formation pressure at TD:	11.0 ppg
TVD at production casing point:	7,206 ft
Cross-Over Location	6,200 ft
Maximum Surface Treating Pressure for Fracture Operations	7,000 psig
Assumed Gas Gradient for Production Operations:	0.22 psi/ft

**Collapse Design:**

Designed on evacuated casing properties with 11.5 ppg drilling fluid density with no internal back-up

Load = 11.5 ppg * 0.052 * 7,206 ft	4,309 psig
Rating	7,460 psig
Safety Factor	1.73

**Burst Design:**

**Design Consideration #1: Maximum Surface Shut-In Pressure**

MASSIP (Load) = 7,206 ft * (0.572-0.22) psi/ft	2,536 psig
Rating	10,640 psig
Safety Factor	4.20

**Design Consideration #2: Maximum Surface Treating Pressure During Frac Operations**

MSTP	6,500 psig
Rating	10,640 psig
Safety Factor	1.64

**Tensile Design:**

Designed on Air Weight \* Buoyancy + OverPull Margin

Load = (6,410 ft * 17.0 lb/ft + 1,790 ft * 11.6 lb/ft) * 0.824 + 100,000 lbs (OPM)	206,900 lbs
Rating	546,000 lbs
Safety Factor	2.64
OverPull with S.F. = 546,000 lbs / 1.8 – 106,900 lbs	196,400 lbs

**3) Operator's Minimum Specifications for Pressure Control:**

Please reference enclosed BOP Diagram.

The blowout preventer assembly shall consist of one 11" 5,000 psi double ram preventer, and an 11" 5,000 psi annular preventer. All will be hydraulically operated. The BOP pipe and blind rams will be hydraulically tested to 100% of working pressure (if isolated from the surface casing with a test plug) or to 70% of the internal yield of the surface casing after nipping up. The annular preventer will be tested to 50% of its' working pressure rating for 10 minutes or until provisions for the test are met. The pipe rams and blind rams will be function tested on each trip out of the hole, but not more than once per day. All such checks will be noted on the daily Tour Sheets.

Accessories to the BOPE include an upper and lower kelly cock, a sub on the floor with a full opening valve to be stabbed into the drill string when the kelly is not in the drill string, a drill pipe float (except for lost circulation conditions), and a choke manifold with a pressure rating equivalent to the BOP stack. An accumulator with a minimum of 1.5 times the volume of fluid necessary to close all BOP equipment will be part of the BOP system.

Remote controls capable of both opening and closing all preventers will be readily accessible to the driller. A manual locking device (i.e., hand wheels) or automatic locking devices shall be installed as part of the system. The BOP will be kept in good mechanical working order. Checks and inspections will be recorded on daily Tour Sheets.

Primary BOP actuating control will be located either in the doghouse or on the rig floor.

Sufficient mud volume and weight material will be maintained on location to overcome any flows.

**Auxiliary Equipment:**

- a) A Kelly Cock will be kept in the drill string at all times.
- b) A float will be used at the bit at all times (except for lost circulation drilling condition).
- c) A full-opening drill pipe stabbing valve (inside BOP) with proper drill pipe connection will be on the rig floor at all times.
- d) The drilling fluids systems will be visually monitored at all times.

**4) Mud Program:**

Hole (in)	Depth (ft)	Type	Weight (ppg)	Viscosity (cps)	Fluid Loss (cc)	Solids (%)
30	120	Spud Mud	8.9-9.4	60 - 80	<10	1 - 5
14-3/4	1,000	Gel/Polymer	9.0-10.0	50 - 65	≤6	≤6
9-7/8	6,410	Gel/Polymer	9.5-11.5	45 - 55	≤5	≤5-6
6-3/4	18,724	Gel/Polymer	10.0-12.0	40 - 45	≤5	≤5-6

\* Sufficient mud material(s) to maintain mud properties, control lost circulation and contain a blowout will be available at the well site during drilling operations.

\*\* A closed loop system will be utilized during drilling operations.

**5) Auxiliary Equipment:**

- 1. A Kelly Cock will be kept in the drill string at all times.
- 2. A float will be used at the bit at all times (except for lost circulation drilling condition).
- 3. A full-opening drill pipe stabbing valve (inside BOP) with proper drill pipe connection will be on the rig floor at all times.
- 4. The drilling fluids systems will be visually monitored at all times.

**6) Testing, Logging and Core Programs:**

Deviation Surveys:

0' to 1,000'	Totco (7 <sup>º</sup> ) – survey every ±210'
1,000' to 4,000'	Totco (7 <sup>º</sup> ) – survey every ±300'
4,000' to TD	±90 ft MWD w/ INC, AZM , & GR

Mud Log:

2-Man Unit with chromatograph	3000' to TD
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Samples:

100 ft samples	3,000' to 3,500'
30 ft samples	3,500' to 6,300'
10 ft samples	7,200' to 8,200'
10-30 ft samples	8,200' to TD

M/LWD Logging Program:

MWD Gamma Ray and/or Resistivity with surveys from 3,500' – TD

Open Hole Logging Program:

Triple Combo w/Spectral GR/DIL/FDC/CNL-Sonic	1,000' to 6,410'
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Cores: Possible sidewall cores in Williams Fork and/or Mancos

DST's: None planned

**7) Anticipated Abnormal Pressures or Temperatures:**

1. No abnormal pressures or temperatures are anticipated.
2. No H<sub>2</sub>S gas has been encountered in or known to exist in the general area.
3. Pressures; Mancos pressure 0.572 psi/ft.
4. Estimated bottom-hole pressure is 3,528 psi.

**8) Anticipated Starting Dates and Approximate Duration:**

Starting Date:	May 1, 2014
Spud Date:	January 1, 2015
Drilling Days:	45 days
Completion Days:	30 days

Notes: Per OnShore Order 1, 3/7/07 the former 8 point drilling plan (also referred to as the Subsurface Use Plan)

Due to the voluminous requirements of horizontal drilling, a larger well pad and pit are being proposed. The pit will be lined with 2 synthetic liners, each having a minimum of 24 mil thickness as per COGCC regulation 904.c.(1). The pit will contain freshwater and/or recycled flowback water for makeup water during drilling and fracture stimulation during completions.