west virginia department of environmental protection

Office of Oil and Gas
601 57th Street, S.E.
Charleston, WV 25304
(304) 926-0450
fax: (304) 926-0452

Austin Caperton, Cabinet Secretary
www.dep.wv.gov

Monday, April 1, 2019
PERMIT MODIFICATION APPROVAL
Horizontal 6A / New Drill

HG ENERGY II APPALACHIA, LLC
5260 DUPONT ROAD
PARKERSBURG, WV 26101

Re: Permit Modification Approval for NAYS 1209 N-4H
47-033-05937-00-00

Extend intermediate string, 17.5", by 150' through storage field.

HG ENERGY II APPALACHIA, LLC

The Office of Oil and Gas has reviewed the attached permit modification for the above referenced permit. The attached modification has been approved and well work may begin. Please be reminded that the oil and gas inspector is to be notified twenty-four (24) hours before permitted well work is commenced.

If there are any questions, please feel free to contact me at (304) 926- 0450.

James A. Martin
Chief

Operator's Well Number: NAYS 1209 N-4H
Farm Name: HG ENERY II APPALACHIA, LLC
U.S. WELL NUMBER: 47-033-05937-00-00
Horizontal 6A New Drill
Date Modification Issued: 04/01/2019

04/05/2019

WW-6B
(04/15)

API NO. 47- 033 - 05937
OPERATOR WELL NO. Nays 1209 N-4H
Well Pad Name: Nays 1209

STATE OF WEST VIRGINIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION, OFFICE OF OIL AND GAS
WELL WORK PERMIT APPLICATION

| 1) Well Operator: HG Energy II Appalachia, | 494519932 | Harrison | Union | West Milford 7.5' |
|---|---|---|---|---|
| | Operator ID | County | District | Quadrangle |

2) Operator's Well Number: Nays 1209 N-4H Well Pad Name: Nays 1209

3) Farm Name/Surface Owner: Nays / HG Energy II Appalachia Public Road Access: Kincheloe Run Rd/SLS 35

4) Elevation, current ground: 1002' Elevation, proposed post-construction: 1007'

5) Well Type (a) Gas x Oil _____ Underground Storage _____
Other _____
(b)If Gas Shallow x Deep _____
Horizontal x

SDW
2/7/2019

6) Existing Pad: Yes or No No

7) Proposed Target Formation(s), Depth(s), Anticipated Thickness and Expected Pressure(s):
Marcellus at 6863'/6914' and 51' in thickness. Anticipated pressure at 4314#.

8) Proposed Total Vertical Depth: 6900'

9) Formation at Total Vertical Depth: Marcellus

10) Proposed Total Measured Depth: 23,646'

11) Proposed Horizontal Leg Length: 16,306'

12) Approximate Fresh Water Strata Depths: 135', 500'

13) Method to Determine Fresh Water Depths: Nearest offset well data

14) Approximate Saltwater Depths: None noted in offsets

15) Approximate Coal Seam Depths: 660' to 665'

16) Approximate Depth to Possible Void (coal mine, karst, other): None

17) Does Proposed well location contain coal seams directly overlying or adjacent to an active mine? Yes _____ No X

(a) If Yes, provide Mine Info: Name: _____
Depth: _____
Seam: _____
Owner: _____

RECEIVED
Office of Oil and Gas
FEB 12 2019
WV Department of
Environmental Protection

04/05/2019

WW-6B
(04/15)

API NO. 47-_____-_____
OPERATOR WELL NO. Nays 1209 N-4H
Well Pad Name: Nays 1209

18) **CASING AND TUBING PROGRAM**

| TYPE | Size (in) | New or Used | Grade | Weight per ft. (lb/ft) | FOOTAGE: For Drilling (ft) | INTERVALS: Left in Well (ft) | CEMENT: Fill-up (Cu. Ft.)/CTS |
|---|---|---|---|---|---|---|---|
| Conductor | 30" | New | LS | 157.5 | 100' | 100' | Drilled In |
| Fresh Water | 20" | NEW | J-55 | 94 | 600' | 600' | 40% excess,yield =1.20,CTS |
| Coal | 13 3/8" | NEW | J-55 | 68 | 1735' | 1735' | 40% excess yield = 1.20,CTS |
| Intermediate | 9 5/8" | NEW | J-55 | 40 | 2500' | 2500' | 40% excess yield Lead/ 0% Excess T |
| Production | 5 1/2" | NEW | P-110 | 23 | 23646' | 23646' | 20% excess yield = 1.19, tail yield = 1.94 |
| Tubing | | | | | | | |
| Liners | | | | | | | |

SDW
2/7/2019

| TYPE | Size (in) | Wellbore Diameter (in) | Wall Thickness (in) | Burst Pressure (psi) | Anticipated Max. Internal Pressure (psi) | Cement Type | Cement Yield (cu. ft./k) |
|---|---|---|---|---|---|---|---|
| Conductor | 30" | 30" | .500 | | | | CTS |
| Fresh Water | 20" | 24" | .438 | 2110 | 1200 | Type 1, Class A | 30 % excess yield = 1.20, CTS |
| Coal | 13 3/8" | 17 1/2" | .480 | 3450 | | Type 1/Class A | 40% excess yield = 1.20, CTS |
| Intermediate | 9 5/8" | 12 1/4" | .395 | 3950 | | Type 1/Class A | 40% excess yield = 0% Excess Lead |
| Production | 5 1/2" | 8 1/2" | .415 | 14520 | 12500 | Type 1/ClassA | 20% excess yield = 1.19, tail yield 1.94 |
| Tubing | | | | | | | |
| Liners | | | | | | | |

**PACKERS**

| | | | | |
|---|---|---|---|---|
| Kind: | | | | |
| Sizes: | | | | |
| Depths Set: | | | | |

RECEIVED
Office of Oil and Gas

FEB 12 2019

WV Department of
Environmental Protection

04/05/2019

API NO. 47-_____-_____
OPERATOR WELL NO. Nays 1209 N-4H
Well Pad Name: Nays 1209

19) Describe proposed well work, including the drilling and plugging back of any pilot hole:

Drill the vertical depth to the Marcellus at an estimated total vertical depth of approximately 6900 feet. Drill horizontal leg to estimated 16306 TMD, stimulate and be capable of producing from the Marcellus Formation. Should we encounter an unanticipated void in the coal, we will install a minimum of 20' of casing below the void but not more than 100' below the void, set a basket and grout to surface.

20) Describe fracturing/stimulating methods in detail, including anticipated max pressure and max rate:

The stimulation will be completed with multiple stages divided over the lateral length of the well. Stage spacing is dependent upon engineering design. Slickwater fracturing technique will be utilized on each stage using sand, water, and chemicals. See attached list. Maximum pressure not to exceed 12,500 psi.

21) Total Area to be disturbed, including roads, stockpile area, pits, etc., (acres): 16.148 acres

22) Area to be disturbed for well pad only, less access road (acres): 10.834 acres

23) Describe centralizer placement for each casing string:

No centralizers will be used with conductor casing.
Freshwater - centralized every 3 joints to surface.
Coal - Bow Spring on every joint
Intermediate - Bow Spring on first 2 joints then every third joint to 100' from surface.
Production - Run 1 spiral centralizer every 5 joints from the top of the curve to surface. Run 1 spiral centralizer every 3 joints from the 1st 5.5" long joint to the top of the curve.

24) Describe all cement additives associated with each cement type:

Conductor -N/A, Casing to be drilled in w/ Dual Rotary Rig.
Fresh Water - 15.6 ppg PNE-1 + 3% bwoc CaCl, 40% Excess Yield = 1.20, CTS
Coal - Lead: 15.4 ppg PNE-1 + 2.5% bwoc CaCl, 40% Excess / Tail: 15.9 ppg PNE-1 + 2.5% bwoc CaCl zero% Excess. CTS
Intermediate - Lead: 15.4 ppg PNE-1 + 2.5% bwoc CaCl, 40% Excess, Tail: 15.9 ppg, PNE-1 + 2.5% bwoc CaCl, zero% Excess, CTS
Production - Lead: 14.5 ppg POZ:PNE-1 + 0.3% bwoc R3 + 1% bwoc EC1 + 0.75 gal/sk FP13L + 0.3% bwoc MPA170, Tail: 14.8 ppg PNE-1 + 0.35% bwoc R3 + 0.75 gal/sk FP13L + 50% bwoc ASCA1 + 0.5% bwoc MPA17020% ExcessLead Yield=1.19Tail Yield=1.94, CTS

25) Proposed borehole conditioning procedures:

Conductor - Ensure the hole is clean at TD.
Fresh Water - Once casing is at setting depth, circulate a minimum of one hole volume with Fresh Water prior to pumping cement.
Coal - Once casing is at setting depth, Circulate and condition at TD. Circulate a minimum of one hole volume prior to pumping cement.
Intermediate - Once casing is at setting depth, Circulate and condition mud at TD. Circulate a minimum of one hole volume prior to pumping cement.
Production - Once on bottom/TD with casing, circulate at max allowable pump rate for at least 2x bottoms up, or until returns and pump pressures indicate the hole is clean. Circulate a minimum of one hole volume prior to pumping cement.

RECEIVED
Office of Oil and Gas
FEB 12 2019
WV Department of
Environmental Protection

*Note: Attach additional sheets as needed.

## Diane White

**From:** James H Moore Iii <James.H.Moore.Iii@dominionenergy.com>
**Sent:** Wednesday, February 06, 2019 11:55 AM
**To:** Diane White; Ronald L. Walden
**Cc:** Josh Hinton
**Subject:** RE: Revisions to the Nays 1209 N Lateral Permits for the Dominion Energy Natural Gas Storage Field

Diane,

DETI agrees/approves of HG Energy setting the 13-3/8" casing shoe 150' below the base of the Gantz Sand (Storage Zone) for the NAYS 1209 wells 1H,2H,3H,4H,5H,6H.

Thanks,

Jamie.

**Jamie Moore**
**Geologist II**
**Gas Storage Department**
**Dominion Energy Transmission, Inc.**
**925 White Oaks Boulevard**
**Bridgeport, WV 26330**
**Office-681-842-3372**
**Work Cell-304-859-1561**
**Personal Cell 540-641-4044**

Dominion Energy

---

**From:** Diane White [mailto:dwhite@hgenergyllc.com]
**Sent:** Tuesday, February 05, 2019 4:32 PM
**To:** James H Moore Iii (GasInfrastructure - 2); Ronald L. Walden (GasInfrastructure - 2)
**Cc:** Josh Hinton
**Subject:** [External] Revisions to the Nays 1209 N Lateral Permits for the Dominion Energy Natural Gas Storage Field

Jamie and Ron,
Attached are the well schematics for the Nays 1209 N laterals. The revisions which will be requested are to allow for the 150 feet additional casing through the storage field as per your conversations with Josh Hinton.
If you can send back approval via email I'll include that with my request to the DEP for the permit revisions.
Thank You,
Diane

# 1209 N-4H
## Marcellus Shale Horizontal
## Harrison County, WV

| | | | |
|---|---|---|---|
| | 1209 N-4H SHL | 237424.74N 1732370.84E |
| Ground Elevation | 1007' | 1209 N-4H LP | 237900.25N 1732486.21E |
| Azm | 342.65° | 1209 N-4H BHL | 253463.68N 1727623.91E |

| WELLBORE DIAGRAM | HOLE | CASING | GEOLOGY | TOP | BASE | MUD | CEMENT | CENTRALIZERS | CONDITIONING | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|---|
| | 30" | 30" 157.5# LS | **Conductor** | **0** | **100** | AIR | N/A, Casing to be drilled in w/ Dual Rotary Rig | N/A | Ensure the hole is clean at TD. | Conductor casing = 0.5" wall thickness |
| | 24" | 20" 94# J-55 | Fresh Water | 0 | 135 | AIR | 15.6 ppg PNE-1 + 3% bwoc CaCl 40% Excess Yield=1.20 / CTS | Centralized every 3 joints to surface | Once casing is at setting depth, circulate a minimum of one hole volume with Fresh Water prior to pumping cement. | Surface casing = 0.438" wall thickness Burst=2110 psi |
| | | | **Fresh Water** | **0** | **600** | | | | | |
| | 17.5" | 13-3/8" 68# J-55 BTC | Kittaning Coal | 660 | 665 | AIR / KCL Salt Polymer | Lead: 15.4 ppg PNE-1 + 2.5% bwoc CaCl 40% Excess / Tail: 15.9 ppg PNE-1 + 2.5% bwoc CaCl zero% Excess. CTS | Bow Spring on every joint **will also be running ECP for isolating storage zone** | Once casing is at setting depth, Circulate and condition at TD. Circulate a minimum of one hole volume prior to pumping cement. | Intermediate casing = 0.480" wall thickness Burst=3450 psi |
| | | | Little/Big Lime | 1126 / 1167 | 1151 / 1243 | | | | | |
| | | | Injun / Gantz (Storage) | 1243 / 1535 | 1349 / 1585 | | | | | |
| | | | ***Intermediate 1*** | ***0*** | ***1735*** | | | | | |
| | 12.25" | 9-5/8" 40# J-55 BTC | Fifty / Thirty Foot | 1650 / 1730 | 1697 / 1742 | AIR / KCL Salt Polymer | Lead: 15.4 ppg PNE-1 + 2.5% bwoc CaCl 40% Excess / Tail: 15.9 ppg PNE-1 + 2.5% bwoc CaCl zero% Excess. CTS | Bow Spring on first 2 joints then every third joint to 100' form surface | Once casing is at setting depth, Circulate and condition mud at TD. Circulate a minimum of one hole volume prior to pumping cement. | Intermediate casing = 0.395" wall thickness Burst=3950 psi |
| | | | Gordon Stray / Gordon | 1785 / 1850 | 1850 / 1940 | | | | | |
| | | | 5th Sand | 2035 | 2070 | | | | | |
| | | | Bayard Sand | 2125 | 2160 | | | | | |
| | | | **Intermediate 2** | **0** | **2500** | | | | | |
| | 8.5" Vertical | 5-1/2" 23# P-110 HC CDC HTQ | Speechley | 2745 | 2763 | 9.0ppg SOBM | **Lead**: 14.5 ppg POZ:PNE-1 + 0.3% bwoc R3 + 1% bwoc EC1 + 0.75 gal/sk FP13L + 0.3% bwoc MPA170 **Tail**: 14.8 ppg PNE-1 + 0.35% bwoc R3 + 0.75 gal/sk FP13L + 50% bwoc ASCA1 + 0.5% bwoc MPA170 20% Excess Lead Yield=1.19 Tail Yield=1.94 CTS | Run 1 spiral centralizer every 5 joints from the top of the curve to surface. | Once on bottom/TD with casing, circulate at max allowable pump rate for at least 2x bottoms up, or until returns and pump pressures indicate the hole is clean. Circulate a minimum of one hole volume prior to pumping cement | Production casing = 0.415" wall thickness Burst=14520 psi Note:Actual centralizer schedules may be changed due to hole conditions |
| | | | Balltown | 2965 | 3005 | | | | | |
| | | | Benson | 4050 | 4083 | | | | | |
| | | | West Falls | 4620 | 5865 | | | | | |
| | 8.5" Curve | | Rhinestreet | 5865 | 6140 | 11.5ppg-12.5ppg SOBM | | Run 1 spiral centralizer every 3 joints from the 1st 5.5" long joint to the top of the curve. | | |
| | | | Cashaqua | 6140 | 6341 | | | | | |
| | | | Middlesex | 6341 | 6421 | | | | | |
| | | | West River | 6421 | 6514 | | | | | |
| | | | Burkett | 6514 | 6540 | | | | | |
| | | | Tully Limestone | 6540 | 6644 | | | | | |
| | | | Hamilton | 6644 | 6863 | | | | | |
| | 8.5" Lateral | | Marcellus | 6863 | 6914 | 11.5ppg-12.5ppg SOBM | | | | |
| | | | **TMD / TVD (Production)** | **23646** | **6900** | | | | | |
| | | | Onondaga | 6914 | | | | | | |

LP @ 6900' TVD / 7340' MD

8.5" Hole - Cemented Long String
5-1/2" 23# P-110 HC CDC HTQ

+/-16306' ft Lateral

TD @ +/-6900' TVD
+/-23646' MD

Previous Permit

WW-6B
(04/15)

API NO. 47- 47 033 05937
OPERATOR WELL NO. Nays 1209 N-4H
Well Pad Name: Nays 1209

04/05/2019

NIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION, OFFICE OF OIL AND GAS
WELL WORK PERMIT APPLICATION

| 1) Well Operator: HG Energy II Appalachia, L | 494519932 | Harrison | Union | West Milford 7.5' |
|---|---|---|---|---|
| | Operator ID | County | District | Quadrangle |

2) Operator's Well Number: Nays 1209 N-4H Well Pad Name: Nays 1209

3) Farm Name/Surface Owner: Nays / HG Energy II Appalachia Public Road Access: Kincheloe Run Rd/SLS 35

4) Elevation, current ground: 1002' Elevation, proposed post-construction: 1007'

5) Well Type (a) Gas x Oil _____ Underground Storage _____
Other _____
(b)If Gas Shallow x Deep _____
Horizontal x

SDW
12/22/2018

6) Existing Pad: Yes or No No

7) Proposed Target Formation(s), Depth(s), Anticipated Thickness and Expected Pressure(s):
Marcellus at 6863'/6914' and 51' in thickness. Anticipated pressure at 4314#.

8) Proposed Total Vertical Depth: 6900'

9) Formation at Total Vertical Depth: Marcellus

10) Proposed Total Measured Depth: 23,646'

11) Proposed Horizontal Leg Length: 16,306'

12) Approximate Fresh Water Strata Depths: 135', 500'

13) Method to Determine Fresh Water Depths: Nearest offset well data

14) Approximate Saltwater Depths: None noted in offsets

15) Approximate Coal Seam Depths: 660' to 665'

16) Approximate Depth to Possible Void (coal mine, karst, other): None

17) Does Proposed well location contain coal seams directly overlying or adjacent to an active mine? Yes _____ No X

(a) If Yes, provide Mine Info: Name: _____
Depth: _____
Seam: _____
Owner: _____

RECEIVED
Office of Oil and Gas
NOV 14 2018
WV Department of
Environmental Protection

WW-6B
(04/15)

API NO. 47-_____-_____
OPERATOR WELL NO. Nays 1209 N-4H
Well Pad Name: Nays 1209

18) **CASING AND TUBING PROGRAM**

| TYPE | Size (in) | New or Used | Grade | Weight per ft. (lb/ft) | FOOTAGE: For Drilling (ft) | INTERVALS: Left in Well (ft) | CEMENT: Fill-up (Cu. Ft.)/CTS |
|---|---|---|---|---|---|---|---|
| Conductor | 30" | New | LS | 157.5 | 100' | 100' | Drilled In |
| Fresh Water | 20" | NEW | J-55 | 94 | 600' | 600' | 40% excess,yield =1.20,CTS |
| Coal | 13 3/8" | NEW | J-55 | 54.5 | 1635' | 1635' | 40% excess yield = 1.20,CTS |
| Intermediate | 9 5/8" | NEW | J-55 | 40 | 2500' | 2500' | 40% excess yield Lead/ 0% Excess Tail CTS |
| Production | 5 1/2" | NEW | P-110 | 23 | 23646' | 23646' | 20% excess yield = 1.19, tail yield = 1.94 |
| Tubing | | | | | | | |
| Liners | | | | | | | |

SPW
10/22/2018

| TYPE | Size (in) | Wellbore Diameter (in) | Wall Thickness (in) | Burst Pressure (psi) | Anticipated Max. Internal Pressure (psi) | Cement Type | Cement Yield (cu. ft./k) |
|---|---|---|---|---|---|---|---|
| Conductor | 30" | 30" | .500 | | | | CTS |
| Fresh Water | 20" | 24" | .438 | 2110 | 1200 | Type 1, Class A | 30 % excess yield = 1.20, CTS |
| Coal | 13 3/8" | 17 1/2" | .380 | 2730 | | Type 1/Class A | 40% excess yield = 1.20, CTS |
| Intermediate | 9 5/8" | 12 1/4" | .395 | 3950 | | Type 1/Class A | 40% excess yield = 0% Excess Lead/ Tail |
| Production | 5 1/2" | 8 1/2" | .415 | 14520 | 12500 | Type 1/ClassA | 20% excess yield = 1.19, tail yield 1.94 |
| Tubing | | | | | | | |
| Liners | | | | | | | |

RECEIVED
Office of Oil and Gas
NOV 14 2018
WV Department of
Environmental Protection

**PACKERS**

| | | | | |
|---|---|---|---|---|
| Kind: | | | | |
| Sizes: | | | | |
| Depths Set: | | | | |

04/05/2019

WW-6B
(10/14)

API NO. 47-_____-_____
OPERATOR WELL NO. Nays 1209 N-4H
Well Pad Name: Nays 1209

19) Describe proposed well work, including the drilling and plugging back of any pilot hole:

Drill the vertical depth to the Marcellus at an estimated total vertical depth of approximately 6900 feet. Drill horizontal leg to estimated 16306 TMD, stimulate and be capable of producing from the Marcellus Formation. Should we encounter an unanticipated void in the coal, we will install a minimum of 20' of casing below the void but not more than 100' below the void, set a basket and grout to surface.

20) Describe fracturing/stimulating methods in detail, including anticipated max pressure and max rate:

The stimulation will be completed with multiple stages divided over the lateral length of the well. Stage spacing is dependent upon engineering design. Slickwater fracturing technique will be utilized on each stage using sand, water, and chemicals. See attached list. Maximum pressure not to exceed 12,500 psi.

21) Total Area to be disturbed, including roads, stockpile area, pits, etc., (acres): 16.148 acres

22) Area to be disturbed for well pad only, less access road (acres): 10.834 acres

23) Describe centralizer placement for each casing string:

No centralizers will be used with conductor casing.
Freshwater - centralized every 3 joints to surface.
Coal - Bow spring on every joint
Intermediate - Bow Spring on first 2 joints then every third joint to 100' from surface.
Production - Run 1 spiral centralizer every 5 joints from the top of the curve to surface. Run 1 spiral centralizer every 3 joints from the 1st 6.5° tang joint to the top of the curve.

24) Describe all cement additives associated with each cement type:

RECEIVED
Office of Oil and Gas
NOV 14 2018
WV Department of
Environmental Protection

Conductor -N/A, Casing to be drilled in w/ Dual Rotary Rig.
Fresh Water - 15.6 ppg PNE-1 + 2% bwoc CaCl, 40% Excess Yield = 1.20, CTS
Coal - Lead: 16.4 ppg PNE-1 +(2.5% bwoc CaCl, 40% Excess / Tail: 15.9 ppg PNE-1 + 2.5% bwoc CaCl zero% Excess. CTS
Intermediate - Lead: 15.4 ppg PNE-1 + 2.5% bwoc CaCl, 40% Excess, Tail: 15.9 ppg, PNE-1 + 2.5% bwoc CaCl, zero% Excess, CTS
Production - Lead: 14.5 ppg POZ-PNE-1 + 0.3% bwoc R3 + 1% bwoc EC1 + 0.75 gal/sk FP13L + 0.3% bwoc MPA170, Tail: 14.8 ppg PNE-1 + 0.35% bwoc R3 + 0.75 gal/sk FP13L + 50% bwoc ASCA1 + 0.5% bwoc MPA17020% ExcessLead Yield=1.19Tail Yield=1.94, CTS

25) Proposed borehole conditioning procedures:

Conductor - Ensure the hole is clean at TD.
Fresh Water - Once casing is at setting depth, circulate a minimum of one hole volume with Fresh Water prior to pumping cement.
Coal - Once casing is at setting depth, Circulate and condition at TD. Circulate a minimum of one hole volume prior to pumping cement.
Intermediate - Once casing is at setting depth, Circulate and condition mud at TD. Circulate a minimum of one hole volume prior to pumping cement.
Production - Once on bottom/TD with casing, circulate at max allowable pump rate for at least 2x bottoms up, or until returns and pump pressures indicate the hole is clean. Circulate a minimum of one hole volume prior to pumping cement.

*Note: Attach additional sheets as needed.

# 1209 N-4H
## Marcellus Shale Horizontal
## Harrison County, WV

| | | | |
|---|---|---|---|
| | | 1209 N-4H SHL | 237424.74N 1732370.84E |
| Ground Elevation | 1007' | 1209 N-4H LP | 237900.25N 1732486.21E |
| Azm | 342.65° | 1209 N-4H BHL | 253463.68N 1727623.91E |

| WELLBORE DIAGRAM | HOLE | CASING | GEOLOGY | TOP | BASE | MUD | CEMENT | CENTRALIZERS | CONDITIONING | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|---|
| | 30" | 30" 157.5# LS | Conductor | 0 | 100 ✓ | AIR | N/A, Casing to be drilled in w/ Dual Rotary Rig | N/A | Ensure the hole is clean at TD. | Conductor casing = 0.5" wall thickness |
| | 24" | 20" 94# J-55 | Fresh Water | 0 | 135, 500 ✓ | AIR | 15.6 ppg PNE-1 + 3% bwoc CaCl 40% Excess Yield=1.20 / CTS | Centralized every 3 joints to surface | Once casing is at setting depth, circulate a minimum of one hole volume with Fresh Water prior to pumping cement. | Surface casing = 0.438" wall thickness Burst=2110 psi |
| | | | Fresh Water | 0 | 600 ✓ | | | | | |
| | 17.5" | 13-3/8" 68# J-55 BTC | Kittaning Coal | 660 ✓ | 665 ✓ | AIR / KCL Salt Polymer | Lead: 15.4 ppg PNE-1 + 2.5% bwoc CaCl 40% Excess / Tail: 15.9 ppg PNE-1 + 2.5% bwoc CaCl zero% Excess. CTS | Bow Spring on every joint | Once casing is at setting depth, Circulate and condition at TD. Circulate a minimum of one hole volume prior to pumping cement. | Intermediate casing = 0.480" wall thickness Burst=3450 psi |
| | | | Little/Big Lime | 1126 / 1167 | 1151 / 1243 | | | | | |
| | | | Injun / Gantz (Storage) | 1243 / 1535 | 1349 / 1585 | | | | | |
| | | | *Intermediate 1 (Shoe 50' below storage)* | *0* | *1635* ✓ | | | | | |
| | 12.25" | 9-5/8" 40# J-55 BTC | Fifty / Thirty Foot | 1650 / 1730 | 1697 / 1742 | AIR / KCL Salt Polymer | Lead: 15.4 ppg PNE-1 + 2.5% bwoc CaCl 40% Excess / Tail: 15.9 ppg PNE-1 + 2.5% bwoc CaCl zero% Excess. CTS | Bow Spring on first 2 joints then every third joint to 100' form surface | Once casing is at setting depth, Circulate and condition mud at TD. Circulate a minimum of one hole volume prior to pumping cement. | Intermediate casing = 0.395" wall thickness Burst=3950 psi |
| | | | Gordon Stray / Gordon | 1785 / 1850 | 1850 / 1940 | | | | | |
| | | | 5th Sand | 2035 | 2070 | | | | | |
| | | | Bayard Sand | 2125 | 2160 | | | | | |
| | | | Intermediate 2 | 0 | 2500 ✓ | | | | | |
| | 8.5" Vertical | 5-1/2" 23# P-110 HC CDC HTQ | Speechley | 2745 | 2763 | 9.0ppg SOBM | **Lead**: 14.5 ppg POZ:PNE-1 + 0.3% bwoc R3 + 1% bwoc EC1 + 0.75 gal/sk FP13L + 0.3% bwoc MPA170 **Tail**: 14.8 ppg PNE-1 + 0.35% bwoc R3 + 0.75 gal/sk FP13L + 50% bwoc ASCA1 + 0.5% bwoc MPA170 20% Excess Lead Yield=1.19 Tail Yield=1.94 CTS | Run 1 spiral centralizer every 5 joints from the top of the curve to surface. | Once on bottom/TD with casing, circulate at max allowable pump rate for at least 2x bottoms up, or until returns and pump pressures indicate the hole is clean. Circulate a minimum of one hole volume prior to pumping cement. | Production casing = 0.415" wall thickness Burst=14520 psi Note:Actual centralizer schedules may be changed due to hole conditions |
| | | | Balltown | 2965 | 3005 | | | | | |
| | | | Benson | 4050 | 4083 | | | | | |
| | | | West Falls | 4620 | 5865 | | | | | |
| | 8.5" Curve | | Rhinestreet | 5865 | 6140 | 11.5ppg-12.5ppg SOBM | | Run 1 spiral centralizer every 3 joints from the 1st 5.5" long joint to the top of the curve. | | |
| | | | Cashaqua | 6140 | 6341 | | | | | |
| | | | Middlesex | 6341 | 6421 | | | | | |
| | | | West River | 6421 | 6514 | | | | | |
| | | | Burkett | 6514 | 6540 | | | | | |
| | | | Tully Limestone | 6540 | 6644 | | | | | |
| | | | Hamilton | 6644 | 6863 | | | | | |
| | 8.5" Lateral | | Marcellus | 6863 | 6914 | 11.5ppg-12.5ppg SOBM | | | | |
| | | | TMD / TVD (Production) | 23646 ✓ | 6900 | | | | | |
| | | | Onondaga | 6914 | | | | | | |

LP @ 6900' TVD / 7340' MD

8.5" Hole - Cemented Long String
5-1/2" 23# P-110 HC CDC HTQ

+/-16306' ft Lateral

TD @ +/-6900' TVD
+/-23646' MD

X=centralizers