west virginia department of environmental protection

Office of Oil and Gas
601 57th Street, S.E.
Charleston, WV 25304
(304) 926-0450
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Austin Caperton, Cabinet Secretary
www.dep.wv.gov

Wednesday, August 22, 2018
PERMIT MODIFICATION APPROVAL
Horizontal 6A / New Drill

CNX GAS COMPANY LLC
POST OFFICE BOX 1248

JANE LEW, WV 263786506

Re: Permit Modification Approval for MAJ6HHSU
47-051-02010-00-00

Modified casing program - combines coal & freshwater casing strings

CNX GAS COMPANY 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:	MAJ6HHSU
Farm Name:	CNX LAND, LLC
U.S. WELL NUMBER:	47-051-02010-00-00
Horizontal 6A	New Drill
Date Modification Issued:	August 22, 2018

WW-6B
(04/15)

API NO. 47-_____-_____
OPERATOR WELL NO. MAJ6HHSU
Well Pad Name: MAJ6HSU

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

1) Well Operator:	CNX Gas Company, LLC	494458046	Marshall	Webster	Majorsville
		Operator ID	County	District	Quadrangle

2) Operator's Well Number: MAJ6HHSU Well Pad Name: MAJ6HSU

3) Farm Name/Surface Owner: Majorsville Public Road Access: Lone Oak Road

4) Elevation, current ground: 1370.14 Elevation, proposed post-construction: 1345.4

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

6) Existing Pad: Yes or No yes JW 8/16/18

7) Proposed Target Formation(s), Depth(s), Anticipated Thickness and Expected Pressure(s):
Point Pleasant, 11,850' TVDGL, 78', 10,757psi (0.9 psi/ft. pressure gradient)

8) Proposed Total Vertical Depth: 11,850'

9) Formation at Total Vertical Depth: Point Pleasant

10) Proposed Total Measured Depth: 18,223

11) Proposed Horizontal Leg Length: 5,968

12) Approximate Fresh Water Strata Depths: 378'

13) Method to Determine Fresh Water Depths: 2,500' radius search

14) Approximate Saltwater Depths: N/A

15) Approximate Coal Seam Depths: 772' (Pittsburgh)

16) Approximate Depth to Possible Void (coal mine, karst, other): 769'

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: _____

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Office of Oil and Gas
AUG 17 2018
WV Department of
Environmental Protection

API NO. 47-_____-_____
OPERATOR WELL NO. MAJ6HHSU
Well Pad Name: MAJ6HSU

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	N	A-252	99	129	100	188/CTS
Fresh Water							
Coal	18.625	N	J-55	87.5	867	817	667/CTS
Intermediate	13.375	N	NT-80LHE	68	3356	3306	2235/CTS
Production	5.5	N	Q-125VAXP	23	18223	18173	2763/TOC@5000'
Tubing							
Liners	9.625	N	P-110HP	43.5	11100	11050	1653/TOC@5000'

JW 8/16/18

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	36	0.312		50	A	1.18
Fresh Water							
Coal	18.625	22	0.435	2250	1400	A	1.18
Intermediate	13.375	17.5	0.480	4930	3250	A	1.18
Production	5.5	8.5	0.415	19040	9000	A	1.56
Tubing							
Liners	6.25	12.25	0.435	9900	6700	A	2.28

PACKERS

Kind:	NONE			
Sizes:				
Depths Set:				

WW-6B
(10/14)

API NO. 47-_____-_____
OPERATOR WELL NO. MAJ6HHSU
Well Pad Name: MAJ6HSU

JW 8/16/18

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

The general well work will be conducted in a fashion to efficiently place a production string of casing to total depth of the subject well bore. The vertical portion of the wellbore will be drilled with a combination of air percussion hammers, roller cone drill bits, and bent housing motors. Air/mist will be utilized to drill this interval. The horizontal portion of the wellbore will be drilled utilizing a synthetic based mud system with a density capable of suppressing bottom hole pressure at depth. All strings of casing will be permanently cemented in place in accordance with all guidelines and restrictions. No pilot hole will be drilled on this well.

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

The stimulation will be multiple stages divided over the lateral length of the well. Stage spacing is dependent upon engineering design. Slickwater fracturing technique will also be utilized on each stage using sand, water, and chemicals.
Max Pressure - 14,500 psi. Max Rate - 100 bbl/min.

21) Total Area to be disturbed, including roads, stockpile area, pits, etc., (acres): 13.0

22) Area to be disturbed for well pad only, less access road (acres): 5.4

23) Describe centralizer placement for each casing string:

Centralizers will placed per CNX sop of casing running. Typical surface/intermediate casings will be 1:3 from shoe to surface. Isolation strings will be 1:2 to planned TOC. Production strings will be 1:1 from the shoe to KOP, and 1:2 through the planned TOC.

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

See attached.

25) Proposed borehole conditioning procedures:

Conditioning will be conducted as needed. All factors will be adjusted per hole conditions. All returns from the well bore must be consistent with a stable hole, returning minimal cuttings, while exhibiting a non-existent gas flow prior to tripping out.

*Note: Attach additional sheets as needed.

DRILLING WELL PLAN

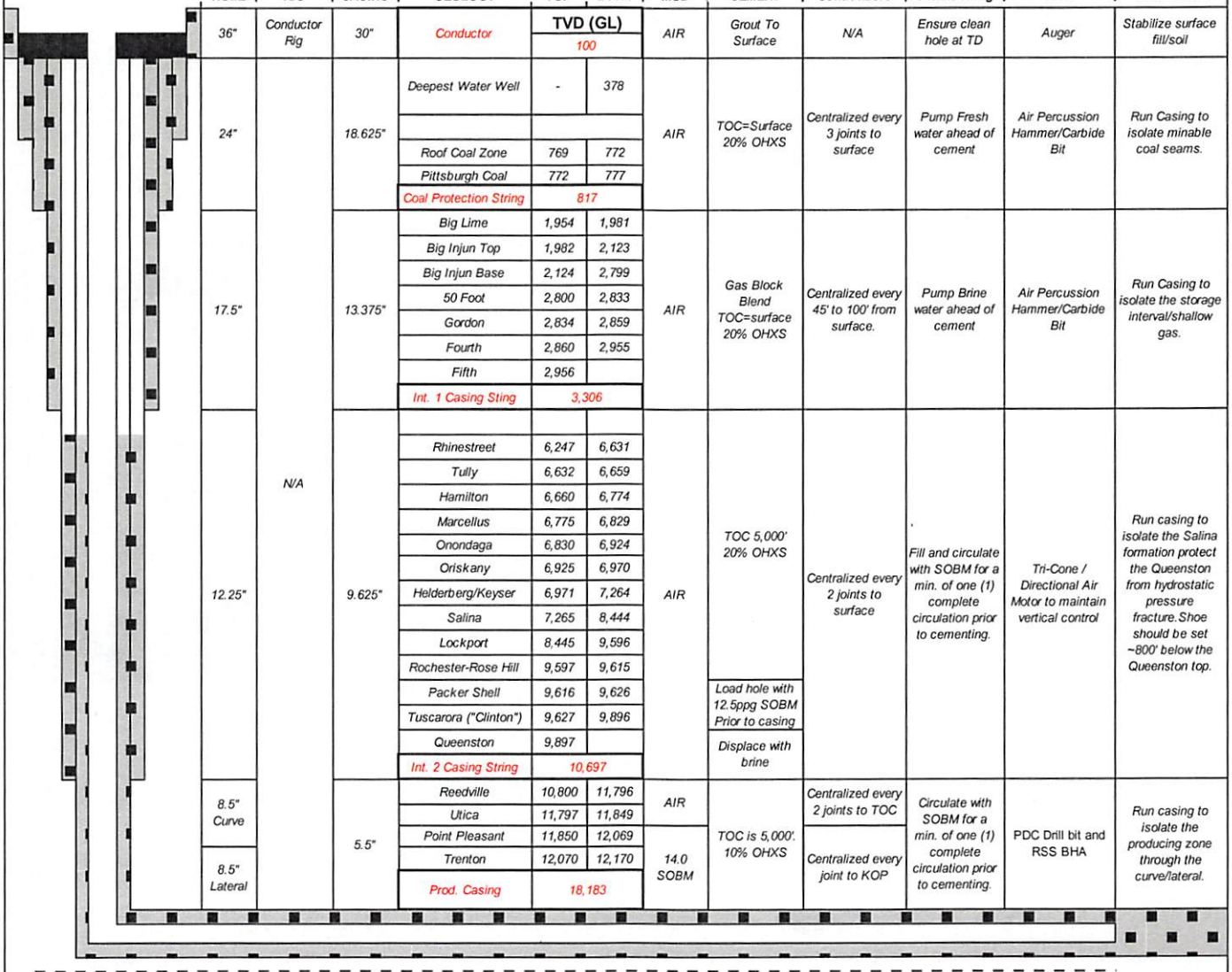
MAJ-6H

Utica HZ

MAJ-6H

Ground Elevation	1343	SHL (NAD27)	N: 524252.813 E:1705926.955
SHL (NAD83)	N: 524290.027 E: 1674492.151	BHL (NAD 27)	N:520297.58 E: 1711906.531

HOLE	RIG	CASING	GEOLOGY	TOP	BTTM	MUD	CEMENT	Centralizers	Conditioning	BITS	COMMENTS
36"	Conductor Rig	30"	Conductor	TVD (GL) 100		AIR	Grout To Surface	N/A	Ensure clean hole at TD	Auger	Stabilize surface fill/soil
24"	N/A	18.625"	Deepest Water Well	-	378	AIR	TOC=Surface 20% OHXS	Centralized every 3 joints to surface	Pump Fresh water ahead of cement	Air Percussion Hammer/Carbide Bit	Run Casing to isolate minable coal seams.
			Roof Coal Zone	769	772						
			Pittsburgh Coal	772	777						
			Coal Protection String	817							
17.5"		13.375"	Big Lime	1,954	1,981	AIR	Gas Block Blend TOC=surface 20% OHXS	Centralized every 45' to 100' from surface.	Pump Brine water ahead of cement	Air Percussion Hammer/Carbide Bit	Run Casing to isolate the storage interval/shallow gas.
			Big Injun Top	1,982	2,123						
			Big Injun Base	2,124	2,799						
			50 Foot	2,800	2,833						
			Gordon	2,834	2,859						
			Fourth	2,860	2,955						
			Fifth	2,956							
			Int. 1 Casing Sting	3,306							
12.25"		9.625"	Rhinestreet	6,247	6,631	AIR	TOC 5,000' 20% OHXS	Centralized every 2 joints to surface	Fill and circulate with SOBM for a min. of one (1) complete circulation prior to cementing.	Tri-Cone / Directional Air Motor to maintain vertical control	Run casing to isolate the Salina formation protect the Queenston from hydrostatic pressure fracture.Shoe should be set ~800' below the Queenston top.
			Tully	6,632	6,659						
			Hamilton	6,660	6,774						
			Marcellus	6,775	6,829						
			Onondaga	6,830	6,924						
			Oriskany	6,925	6,970						
			Helderberg/Keyser	6,971	7,264						
			Salina	7,265	8,444						
			Lockport	8,445	9,596						
			Rochester-Rose Hill	9,597	9,615						
			Packer Shell	9,616	9,626		Load hole with 12.5ppg SOBM Prior to casing				
			Tuscarora ("Clinton")	9,627	9,896						
			Queenston	9,897			Displace with brine				
			Int. 2 Casing String	10,697							
8.5" Curve		5.5"	Reedville	10,800	11,796	AIR	TOC is 5,000', 10% OHXS	Centralized every 2 joints to TOC	Circulate with SOBM for a min. of one (1) complete circulation prior to cementing.	PDC Drill bit and RSS BHA	Run casing to isolate the producing zone through the curve/lateral.
			Utica	11,797	11,849						
			Point Pleasant	11,850	12,069	14.0 SOBM					
8.5" Lateral			Trenton	12,070	12,170			Centralized every joint to KOP			
			Prod. Casing	18,183							



5,968' Lateral

89.0° Planned Inclination
145° Planned Azimuth

BHL
11,850' TVD
18,223' MD

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