



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

Jim Justice, Governor
Austin Caperton, Cabinet Secretary
www.dep.wv.gov

PERMIT MODIFICATION APPROVAL
Horizontal 6A / New Drill

EQT PRODUCTION COMPANY
120 PROFESSIONAL PLACE
BUILDING II
BRIDGEPORT, WV 26330

Re: Permit Modification Approval for GLO76H5
47-049-02451-00-00

Change the conductor casing from 20" to 26".

EQT PRODUCTION COMPANY

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: GLO76H5
Farm Name: TONKERY, TOBERT E. & MAXINE P.
U.S. WELL NUMBER: 47-049-02451-00-00
Horizontal 6A / New Drill
Date Issued: 5/30/2017

Promoting a healthy environment.

06/02/2017

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

1) Well Operator: EQT Production Company 306686 Marion Mannington Glover Gap
Operator ID County District Quadrangle

2) Operator's Well Number: GLO76H5 Well Pad Name: GLO76

3) Farm Name/Surface Owner: Robert E & Maxine P Tonkery Public Road Access: Co. Rt. 64/4

4) Elevation, current ground: 1424 Elevation, proposed post-construction: 1424

5) Well Type (a) Gas X Oil _____ Underground Storage _____

Other _____

(b) If Gas Shallow X Deep _____

Horizontal X

SDW
5/23/2017

6) Existing Pad: Yes or No yes

7) Proposed Target Formation(s), Depth(s), Anticipated Thickness and Expected Pressure(s):
Marcellus, 7708', 56', 2593 PSI

8) Proposed Total Vertical Depth: 7708

9) Formation at Total Vertical Depth: Marcellus

10) Proposed Total Measured Depth: 12041

11) Proposed Horizontal Leg Length: 3885

12) Approximate Fresh Water Strata Depths: 263

13) Method to Determine Fresh Water Depths: From offset wells

14) Approximate Saltwater Depths: None reported

15) Approximate Coal Seam Depths: 652,808,1067,1166

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

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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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	26	New	A-500	85.6	40	40	60 ft ³ / CTS
Fresh Water	13 3/8	New	J-55	54.5	413	413	387 ft ³ / CTS
Coal							
Intermediate	9 5/8	New	A-500	40	3051	3051	1211 ft ³ / CTS
Production	5 1/2	New	P-110	20	12041	12041	500' above top producing zone
Tubing	2 3/8		J-55	4.7		May not be run, if run set 40' above top perf or 80° inclination.	
Liners							

*SPW
5/23/2017*

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	26	30	.375	1378	1102	Class A	1.18
Fresh Water	13 3/8	17 1/2	.38	2700	2160	See Variance	1.19
Coal							
Intermediate	9 5/8	12 3/8	.395	3950	3160	See Variance	1.19
Production	5 1/2	8 1/2	.361	12640	10112	Class A/H	1.123/2.098
Tubing	2 3/8	NA	.19	7700			
Liners							

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Kind:				WV Department of Environmental Protection
Sizes:				
Depths Set:				

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

Drill and complete a new horizontal well in the Marcellus Formation. Drill the vertical to an approximate depth of 6250'. Kick off and drill curve. Drill the lateral in the Marcellus. Cement casing.

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Environmental Protection

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

Hydraulic fracturing is completed in accordance with state regulations using water recycled from previously fractured wells and obtained from freshwater sources. This water is mixed with sand and a small percentage (less than 0.3%) of chemicals (including 15% Hydrochloric acid, friction reducer, biocide, and scale inhibitor), referred to in the industry as a "slickwater" completion. Maximum anticipated internal casing pressure is expected to be approximately 10000 psi, maximum anticipated treating rates are expected to average approximately 100 bpm. Stage lengths vary from 150 to 300 feet. Average approximately 350,000 gallons of water per stage. Sand sizes vary from 100 mesh to 20/40 mesh. Average approximately 400,000 pounds of sand per stage.

21) Total Area to be disturbed, including roads, stockpile area, pits, etc., (acres): no additional disturbance

22) Area to be disturbed for well pad only, less access road (acres): no additional disturbance

23) Describe centralizer placement for each casing string:

- Surface: Bow spring centralizers – One centralizer at the shoe and one spaced every 500'.
- Intermediate: Bow spring centralizers– One centralizer at the shoe and one spaced every 500'.
- Production: One solid body centralizer spaced every joint from production casing shoe to KOP

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

Conductor: Class A no additives
Surface (Type 1 Cement): 0-3% Calcium Chloride. Used to speed the setting of cement slurries
Intermediate (Type 1 Cement): 0-3% Calcium Chloride. Used to speed the setting of cement slurries.
Production:
Lead (Class A Cement): 0.2% CD-20 (dispersant makes cement easier to mix). .15% SuperFL-300 (fluid loss/lengthens thickening time) .15% SEC-10 (fluid loss) 50:50 POZ (extender)
Tail (Class H Cement): 0.2% Super CR-1 (Retarder). Lengthens thickening time. .3% Super FL-200 (fluid loss) .2% SEC-10 (Fluid loss). .2% SuperFL-350 (fluid loss) Reduces amount of water lost to formation. 60 % Calcium Carbonate. Acid solubility.

25) Proposed borehole conditioning procedures:

Surface: Circulate hole clean while rotating & reciprocating the drill string until cuttings diminish at surface.
Intermediate: Circulate hole clean while rotating & reciprocating the drill string until cuttings diminish at surface.
Production: Pump marker sweep with nut plug to determine actual hole washout. Calculate a gauge holes bottoms up volume. Perform a cleanup cycle by pumping 3-5 bottoms up or until the shakers are clean. Check volume of cuttings coming across the shakers every 15 minutes.

*Note: Attach additional sheets as needed.

47-049-02451
MD

Well
EOT Production
Glover Gap Quad
Marion County, WV

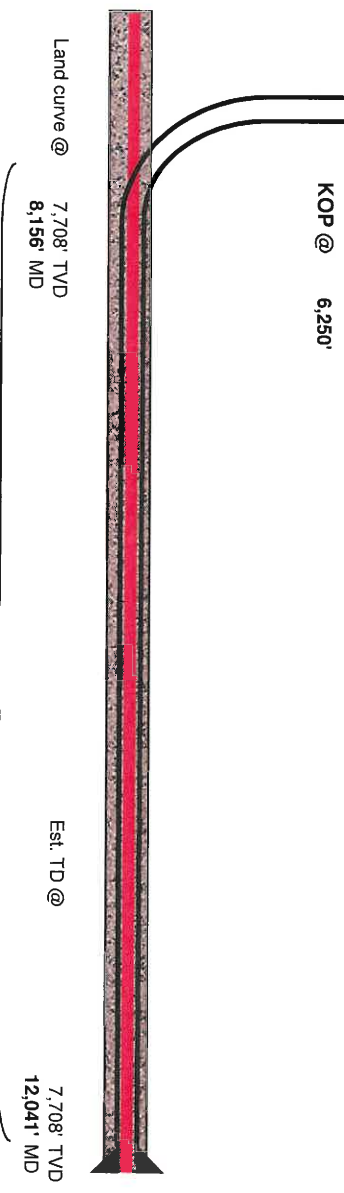
Vertical Section
Azimuth 337
4099

515495(GLO76H5)

Note: Diagram is not to scale

Formations	Top TVD	Base TVD
Conductor	40	
Base Fresh Water	263	
Surface Casing	413	
Maxton	2136 - 2173	
Big Lime	2283 - 2352	
Big Injun	2447 - 2602	
Base Red Rock	2593	
Weir	2720 - 2740	
Gantz	2928 - 2981	
Intermediate Casing	3051	
Fifty foot	3088 - 3101	
Thirty foot	3178 - 3211	
Gordon	3242 - 3291	
Forth Sand	3311 - 3343	
Bayard	3372 - 3389	
Warren	3854 - 3892	
Speechley	4075 - 4112	
Baltimore A	4436 - 4834	
Riley	4959 - 5060	
Benson	5518 - 5542	
Alexander	5904 - 6000	
Sonyea	7209 - 7370	
Middlesex	7370 - 7424	
Genesee	7424 - 7516	
Genesee	7516 - 7549	
Tully	7549 - 7575	
Hamilton	7575 - 7676	
Marcellus	7676 - 7732	
Production Casing	12041	MD
Onondaga	7732	

Casing and Cementing		Deepest Fresh Water: 263'		
Type	Conductor	Surface	Intermediate	Production
Hole Size, In.	30	17 1/2	12 3/8	8 1/2
Casing Size, OD In.	26	13 3/8	9 5/8	5 1/2
Casing Wall Thickness, In.	0.312	0.380	0.395	0.361
Depth, MD	40'	413'	3,051'	12,041'
Weight	85.6#	54.5#	40#	20#
Grade	A-500	J-55	A-500	P-110
New or Used	New	New	New	New
Burst (psi)	1378	2,700	3,950	12,640
Cement Class	A	A / Type 1	A / Type 1	A / H
Cement Yield	1.18	1.19	1.19	1.123 / 2.098
Top of Cement (Planned)	Surface	Surface	Surface	500' above top Producing Zone
Method	Displacement	Displacement	Displacement	Displacement
Est. Volume (cu ft)	49	447	1,211	2,338
Possible Additives	N/A	Calcium Chloride	Calcium Chloride	Calcium Carbonate, Fluid Loss, Extender, Dispersant, Viscosifier, Defoamer, POZ, Bonding Agent, Retarder, Anti-Settling/Suspension Agent



Proposed Well Work:
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Drill the vertical to an approximate depth of 6250'.
Kick off and drill curve. Drill lateral in the Marcellus. Cement casing.

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06/02/2017



May 22, 2017

Laura Adkins
Office of Oil and Gas
West Virginia Department of Environmental Protection
601 57th Street SE
Charleston, WV 25304

Re: Modification of 47-049-02451, 02452

Dear Ms. Adkins,

Enclosed is a modification for the above API numbers. The conductor casing has been changed from 20 inch to 26 inch. No other changes have been made.

If you have any questions, please do not hesitate to contact me at (304) 848-0076.

Sincerely,

Vicki Roark
Permitting Supervisor-WV

SDew
5/23/2017

Enc.

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