



---

west virginia department of environmental protection

---

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

Earl Ray Tomblin, Governor  
Randy C. Huffman, Cabinet Secretary  
[www.dep.wv.gov](http://www.dep.wv.gov)

## PERMIT MODIFICATION APPROVAL

August 05, 2013

EQT PRODUCTION COMPANY  
POST OFFICE BOX 280  
BRIDGEPORT, WV 26330

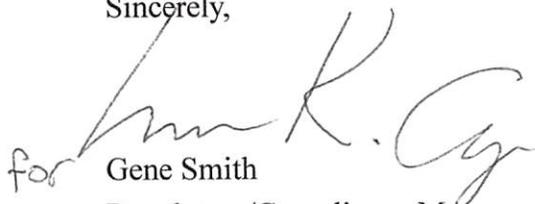
Re: Permit Modification Approval for API Number 1706062 , Well #: 514210 - CARR  
**increased TVD, extended lateral**

Oil and Gas Operator:

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.

Please call James Martin at 304-926-0499, extension 1654 if you have any questions.

Sincerely,

for   
Gene Smith  
Regulatory/Compliance Manager  
Office of Oil and Gas

STATE OF WEST VIRGINIA  
DEPARTMENT OF ENVIRONMENTAL PROTECTION, OFFICE OF OIL AND GAS  
W.VA. CODE §22-6A - WELL WORK PERMIT APPLICATION

1) Well Operator: EQT Production Company  
Operator ID 017 County 3 District 611 Quadrangle

2) Operator's Well Number: 514210 Well Pad Name SMI27

3 Elevation, current ground: 1,194.0 Elevation, proposed post-construction: 1,179.0

4) Well Type: (a) Gas  Oil

Other \_\_\_\_\_

(b) If Gas: Shallow  Deep

Horizontal

5) Existing Pad? Yes or No: yes

6) Proposed Target Formation(s), Depth(s), Anticipated Thicknesses and Associated Pressure(s):  
Target formation is Marcellus at a depth of 7024 with the anticipated thickness to be 46 feet and anticipated target pressure of 4723 PSI

7) Proposed Total Vertical Depth: 7,149

8) Formation at Total Vertical Depth: Onondaga

9) Proposed Total Measured Depth: 15,660

10) Approximate Fresh Water Strata Depths: 25, 344, 444, 654, 849, 919

11) Method to Determine Fresh Water Depth: By offset wells

12) Approximate Saltwater Depths: 1,187

13) Approximate Coal Seam Depths: N/A

14) Approximate Depth to Possible Void (coal mine, karst, other): none reported

15) Does land contain coal seams tributary or adjacent to, active mine? none reported

16) Describe proposed well work: Drill and complete a new horizontal well. The vertical drill to go down to approximately depth of 7149 Tagging the Onondaga not more than 100' then plug back to approximately 4877 and kick off the horizontal leg into the marcellus using a slick water frac.

17) Describe fracturing/stimulating methods in detail:  
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, gelling agent, gel breaker, friction reducer, biocide, and scale inhibitor). Stage lengths vary from 150 to 450 feet. Average approximately 400,000 gallons of water per stage. Sand sizes vary from 100 mesh to 20/40 mesh. Average approximately 400,000 pounds of sand per stage.

18) Total area to be disturbed, including roads, stockpile area, pits, etc, (acres): 41.9

19) Area to be disturbed for well pad only, less access road (acres): 19.7

*Darryl Newell*  
4-1-2013  
JML  
4-1-13

RECEIVED  
Office of Oil and Gas  
Apr 10 2013  
Department of Environmental Protection

API# 47-017-06062 MOD

**CASING AND TUBING PROGRAM**

20)

TYPE	Size	New or Used	Grade	Weight per ft.	FOOTAGE: for Drilling	INTERVALS: Left in Well	CEMENT: Fill- up (Cu.Ft.)
Conductor	20	New	MC-50	81#	40	40	38
Fresh Water	13 3/8	New	MC-50	54#	1,019	1,019	884
Coal	—	—	—	—	—	—	—
Intermediate	9 5/8	New	MC-50	40#	3,249	3,249	1,269
Production	5 1/2	New	P-110	20#	15,660	15,660	See Note 1
Tubing	2 3/8	—	J-55	4.6	—	—	May not be run, if run will be set 100' less than TD
Liners							

TYPE	Size	Wellbore Diameter	Wall Thickness	Burst Pressure	Cement Type	Cement Yield
Conductor	20	24	0.635	—	Construction	1.18
Fresh Water	13 3/8	17 1/2	0.38	2,480	1	1.21
Coal	—	—	—	—	—	—
Intermediate	9 5/8	12 3/8	0.395	3,590	1	1.21
Production	5 1/2	8 1/2	0.361	12,640	—	1.27/1.86
Tubing						
Liners						

**Packers**

Kind:	N/A		
Sizes:	N/A		
Depths Set:	N/A		

Note 1: EQT plans to bring the TOC on the production casing cement job 1,000' above kick off point, which is at least 500' above the shallowest production zone, to avoid communication.

*Doug Newlin*  
4-1-2013  
*Duc*  
4-1-13

RECEIVED  
Office of Oil and Gas  
Apr 10 2013  
The Department of  
Environmental Protection

21) Describe centralizer placement for each casing string.

- Surface: Bow spring centralizers – One at the shoe and one spaced every 500'.
- Intermediate: Bow spring centralizers– One cent at the shoe and one spaced every 500'.
- Production: One spaced every 1000' from KOP to Int csg shoe

22) Describe all cement additives associated with each cement type.

**Surface (Type 1 Cement):** 0-3% Calcium Chloride

Used to speed the setting of cement slurries.

0.4% flake. Loss Circulation Material (LCM) is used to combat the loss of the cement slurry to a thief zone.

**Intermediate (Type 1 Cement):** 0-3% Calcium Chloride. Salt is used in shallow, low temperature formations to speed the setting of cement slurries. 0.4% flake. Loss Circulation Material (LCM) is used to combat the loss of whole drilling fluid or cement slurry (not filtrate) to a thief zone.

**Production:**

**Lead (Type 1 Cement):** 0.2-0.7% Lignosulfonate (Retarder). Lengthens thickening time.

0.3% CFR (dispersant). Makes cement easier to mix.

**Tail (Type H Cement):** 0.25-0.40% Lignosulfonate (Retarder). Lengthens thickening time.

0.2-0.3% CFR (dispersant). This is to make the cement easier to mix.

60 % Calcium Carbonate. Acid solubility.

0.4-0.6% Halad (fluid loss). Reduces amount of water lost to formation.

23) Proposed borehole conditioning procedures. **Surface:** Circulate hole clean (Approximately 30-45 minutes) rotating & reciprocating one full joint until cuttings diminish at surface. When cuttings returning to surface diminish, continue to circulate an additional 5 minutes. To ensure that there is no fill, short trip two stands with no circulation. If there is fill, bring compressors back on and circulate hole clean. A constant rate of higher than expected cuttings volume likely indicates washouts that will not clean up.

**Intermediate:** Circulate hole clean (Approximately 30-45 minutes) rotating & reciprocating one full joint until cuttings diminish at surface. When cuttings returning to surface diminish, continue to circulate an additional 5 minutes. If foam drilling, to enhance hole cleaning use a soap sweep or increase injection rate & foam concentration.

**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.

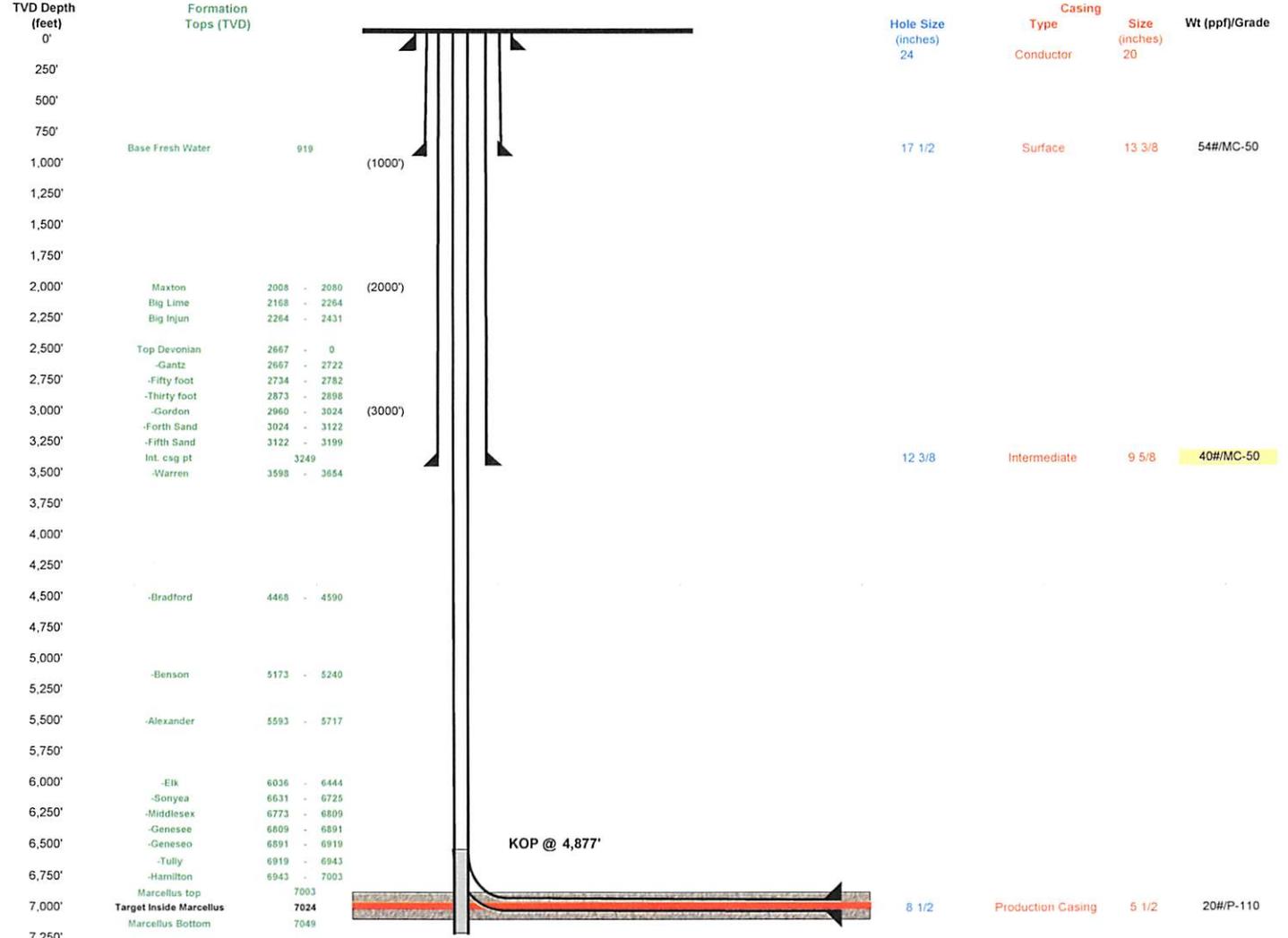
\*Note: Attach additional sheets as needed.

RECEIVED  
Office of Oil and Gas  
APR 01 2013  
WV Department of  
Environmental Protection

API 47-017-06062 MOD

Well 514210 (SMI27H12)  
 EQT Production  
 Smithburg  
 Doddridge West Virginia

Azimuth 155  
 Vertical Section 7752



7,500' TD Pilot Hole @ 7149  
 100' below top of Onondaga  
 7,750' Run Logs. Plug back to KOP at 4877  
 Kick off for horizontal well in Marcellus

Land curve @ 7,024' ft TVD  
 7,959' ft MD  
 Est. TD @ 7,009' ft TVD  
 15,160' ft MD  
 7,200' ft Lateral

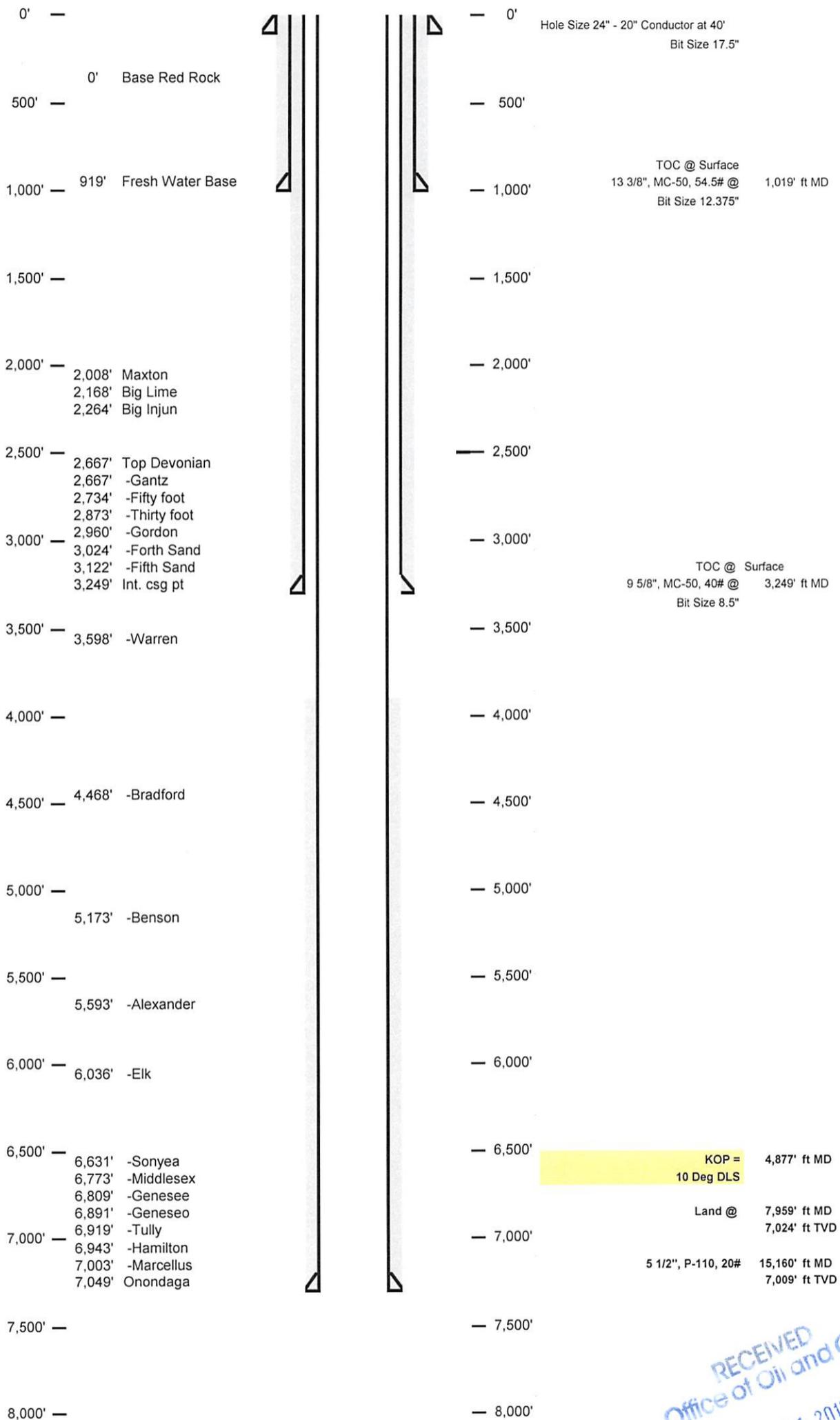
RECEIVED  
 Office of Oil and Gas  
 Mar 11 2013  
 WV Department of Environmental Protection

Well Schematic  
EQT Production

Well Name 514210 (SMI27H12)  
County Doddridge  
State West Virginia

Elevation KB:  
Target  
Prospect  
Azimuth  
Vertical Section

1189
Marcellus
155
7752



RECEIVED  
Office of Oil and Gas  
JUN 01 2013  
WV Department of  
Environmental Protection

