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west virginia department of environmental protection

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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

## PERMIT MODIFICATION APPROVAL

May 29, 2014

EQT PRODUCTION COMPANY  
POST OFFICE BOX 280  
BRIDGEPORT, WV 26330

Re: Permit Modification Approval for API Number 1706383 , Well #: 514665

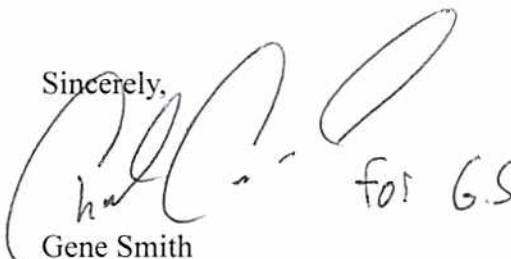
### Extend Surface Casing

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 G.S

Gene Smith  
Regulatory/Compliance Manager  
Office of Oil and Gas



4701706383  
mod 1

May 21, 2014

Mr. Gene Smith  
West Virginia Department of Environmental Protection  
Office of Oil and Gas  
601 57th Street SE  
Charleston, WV 25304

Re: Casing change on WEU51 (47-017-06381, 06386, 06385, 06384, 06383)

Dear Mr. Smith,

EQT is requesting the 13 3/8" surface casing to be set 7' below the deepest red rock show to cover potential red rock issues. The proposed casing set depth is above ground elevation. The reason for this is the red rock swells during drilling of the intermediate section causing many drilling problems such as, but not limited to, lost drilling assemblies and casing running issues.

EQT is reviewing the OXF157, we would like to request to set the surface casing deeper on each well. The 13 3/8" casing will be set at a depth of approximately 1171" KB (7' below the anticipated red rock show).

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

Sincerely,

Vicki Roark  
Permitting Supervisor-WV

Enc.

Cc: Douglas Newlon  
4060 Dutchman Road  
Macfarlan, WV 26148

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CASING AND TUBING PROGRAM

18)

<u>TYPE</u>	<u>Size</u>	<u>New or Used</u>	<u>Grade</u>	<u>Weight per ft.</u>	<u>FOOTAGE: for Drilling</u>	<u>INTERVALS: Left in Well</u>	<u>CEMENT: Fill-up (Cu.Ft.)</u>
Conductor	20	New	MC-50	81	40	40	38 C.T.S.
Fresh Water	13 3/8	New	MC-50	54	1,171	1,171	1,011 C.T.S.
Coal							
Intermediate	9 5/8	New	MC-50	40	5,322	5,322	2,085 C.T.S.
Production	5 1/2	New	P-110	20	13,289	13,289	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							

DCW  
5-23-14

<u>TYPE</u>	<u>Size</u>	<u>Wellbore Diameter</u>	<u>Wall Thickness</u>	<u>Burst Pressure</u>	<u>Cement Type</u>	<u>Cement Yield (cu. ft./k)</u>
Conductor	20	24	0.375	-	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.

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(3/13)

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. The vertical drill to go down to an approximate depth of 5510'. Then  
kick off the horizontal leg using a slick water frac.

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,  
gelling agent, gel breaker, friction reducer, biocide, and scale inhibitor), referred to in the industry as a "slickwater" completion. Maximum  
anticipated treating pressures are expected to average approximately 8500 psi, maximum anticipated treating rates are expected to average  
approximately 100 bpm. Stage lengths vary from 150 to 300 feet. Average approximately 200,000 barrels of water per stage. Sand sizes  
vary from 100 mesh to 20/40 mesh. Average approximately 200,000 pounds of sand per stage.

21) Total area to be disturbed, including roads, stockpile area, pits, etc, (acres): 51.8

22) Area to be disturbed for well pad only, less access road (acres): 11.5

23) 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

24) 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.

25) 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.

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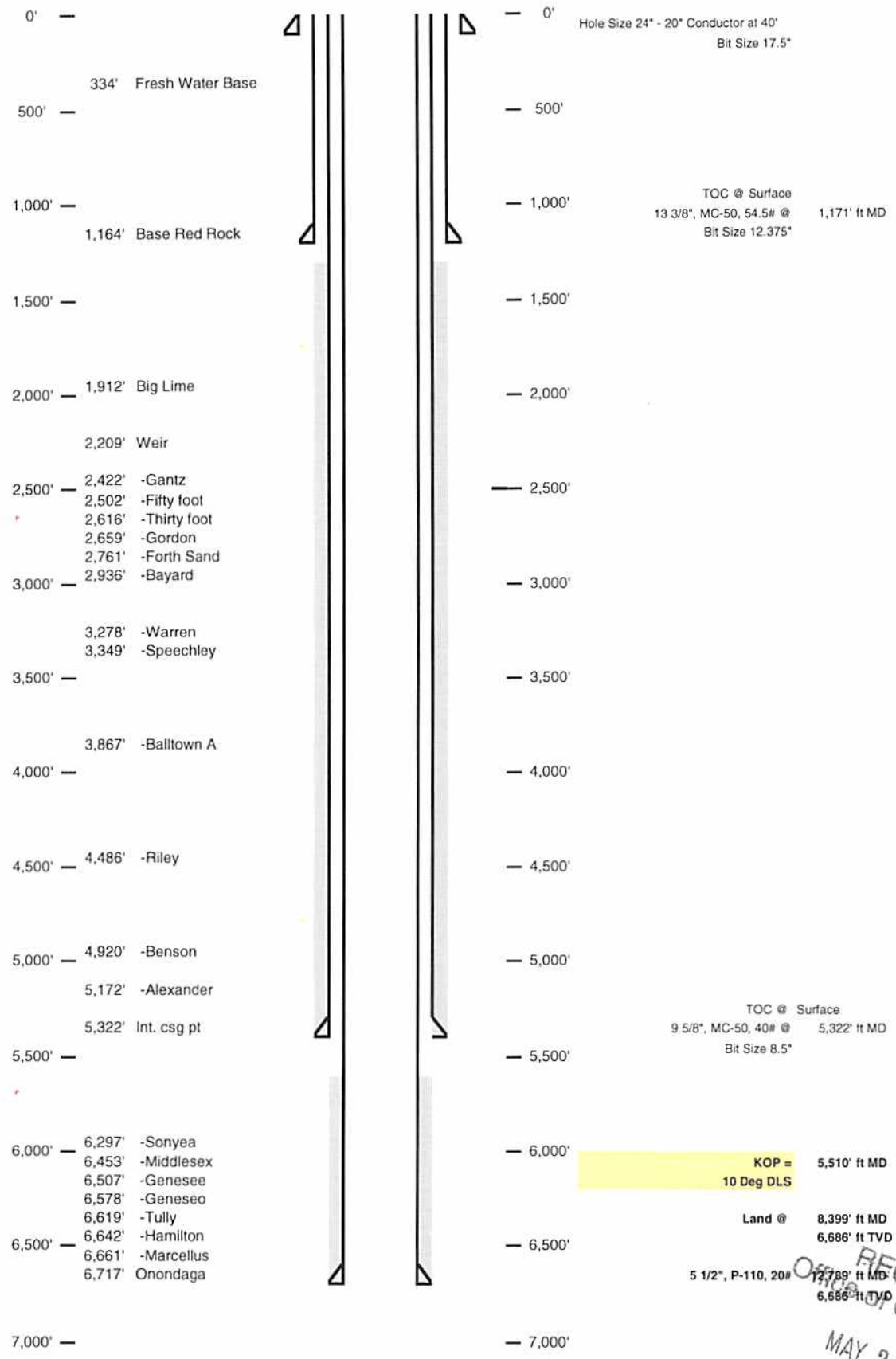
4701706383 *Mod 1*

Well Schematic  
EQT Production

Well Name 514665 (WEU51H5)  
County Doddridge  
State West Virginia

Elevation KB:  
Target  
Prospect  
Azimuth  
Vertical Section

1221
Marcellus
155
5235

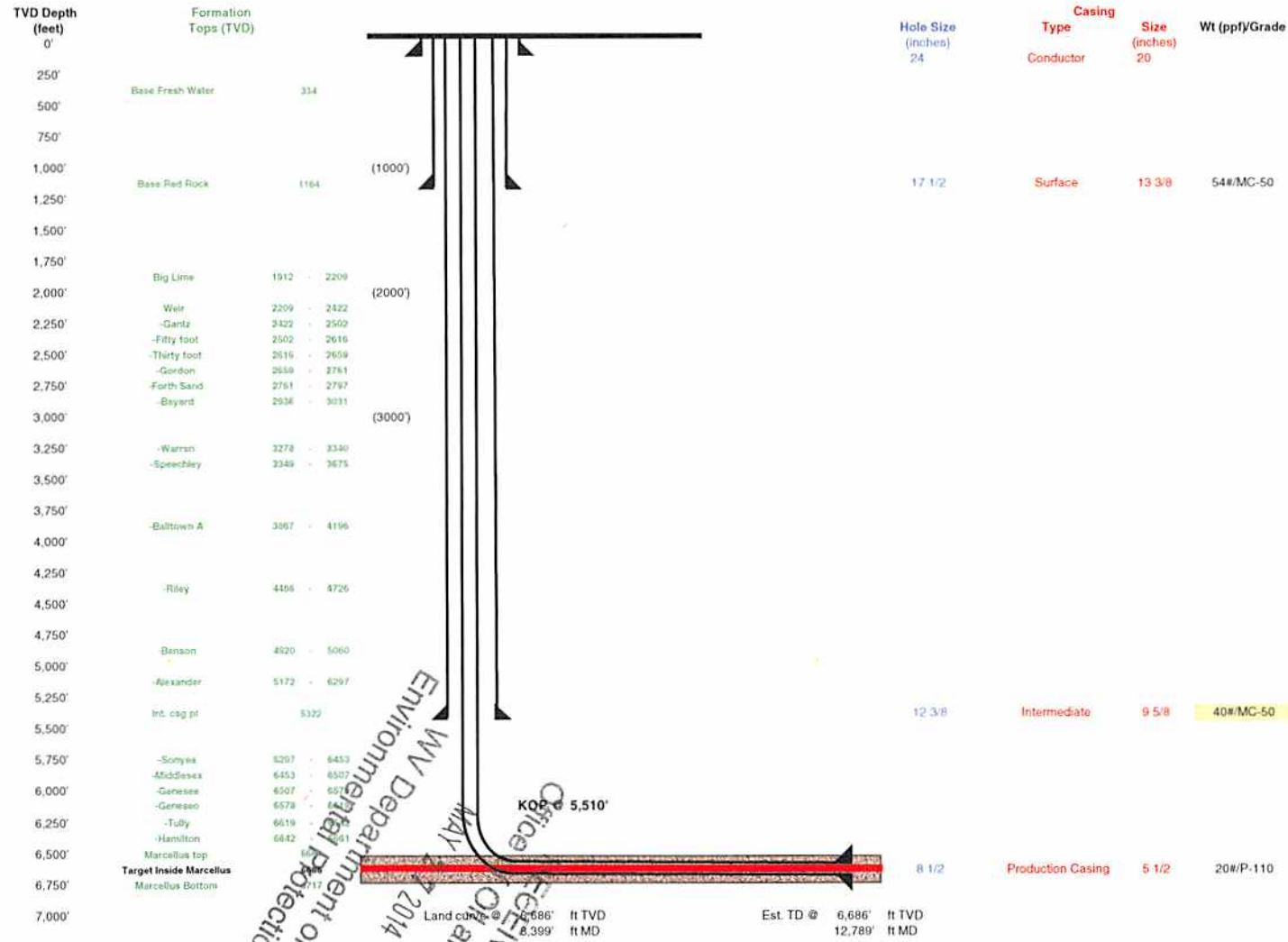


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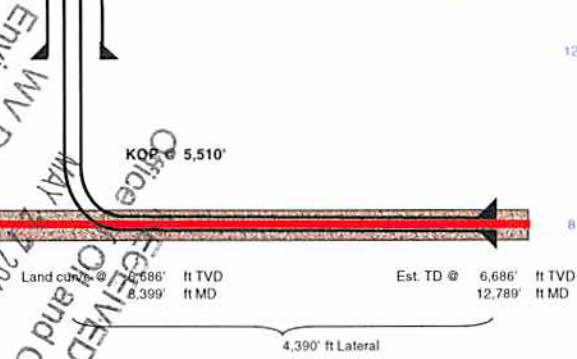
05/30/2014

Well 514665 (WEU51H5)  
 EQT Production  
 West Union  
 Doddridge West Virginia

Azimuth 155  
 Vertical Section 5235



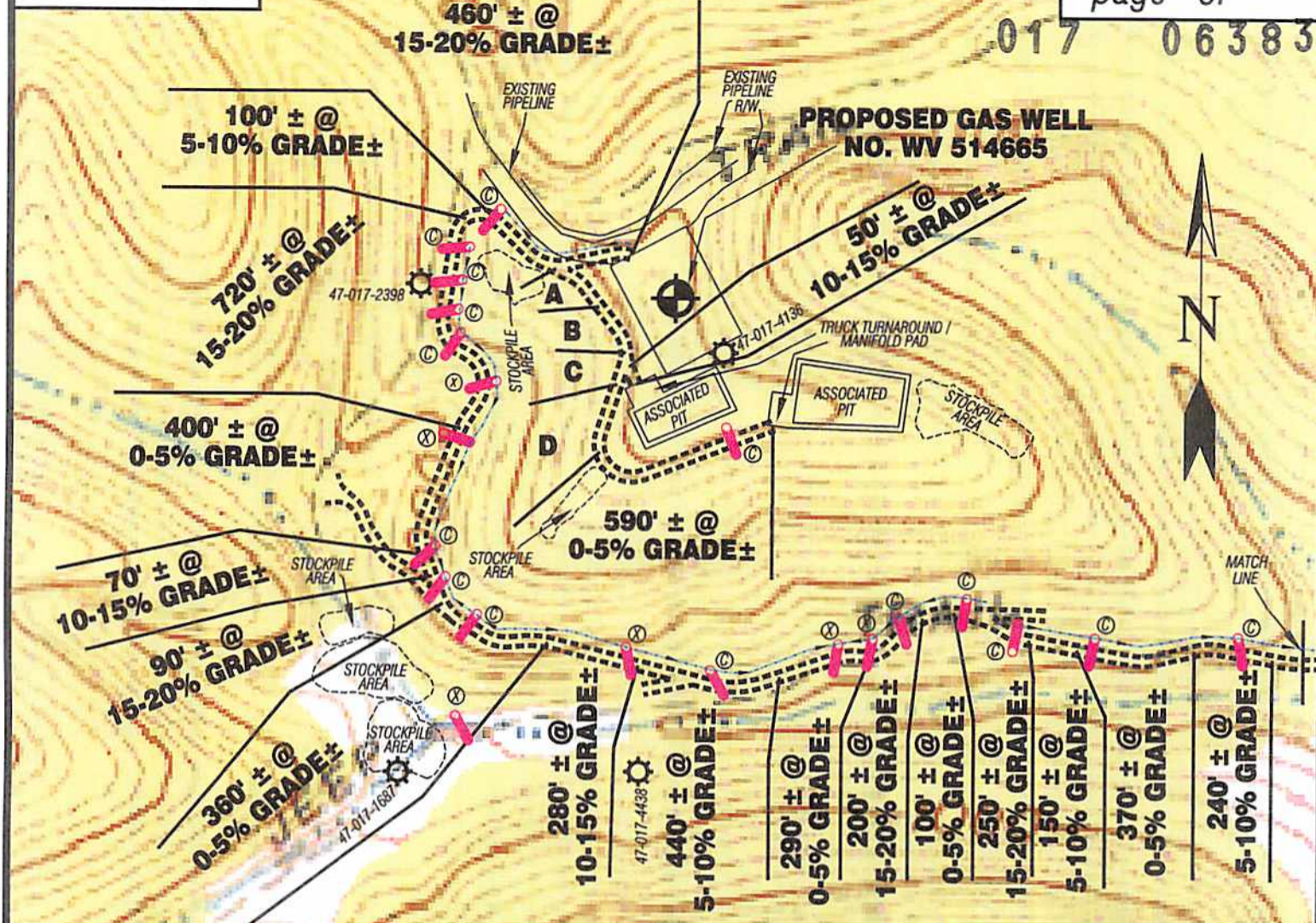
Proposed Well Work:  
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 The vertical drill to go down to an approximate depth of 5510'.



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Mad 1

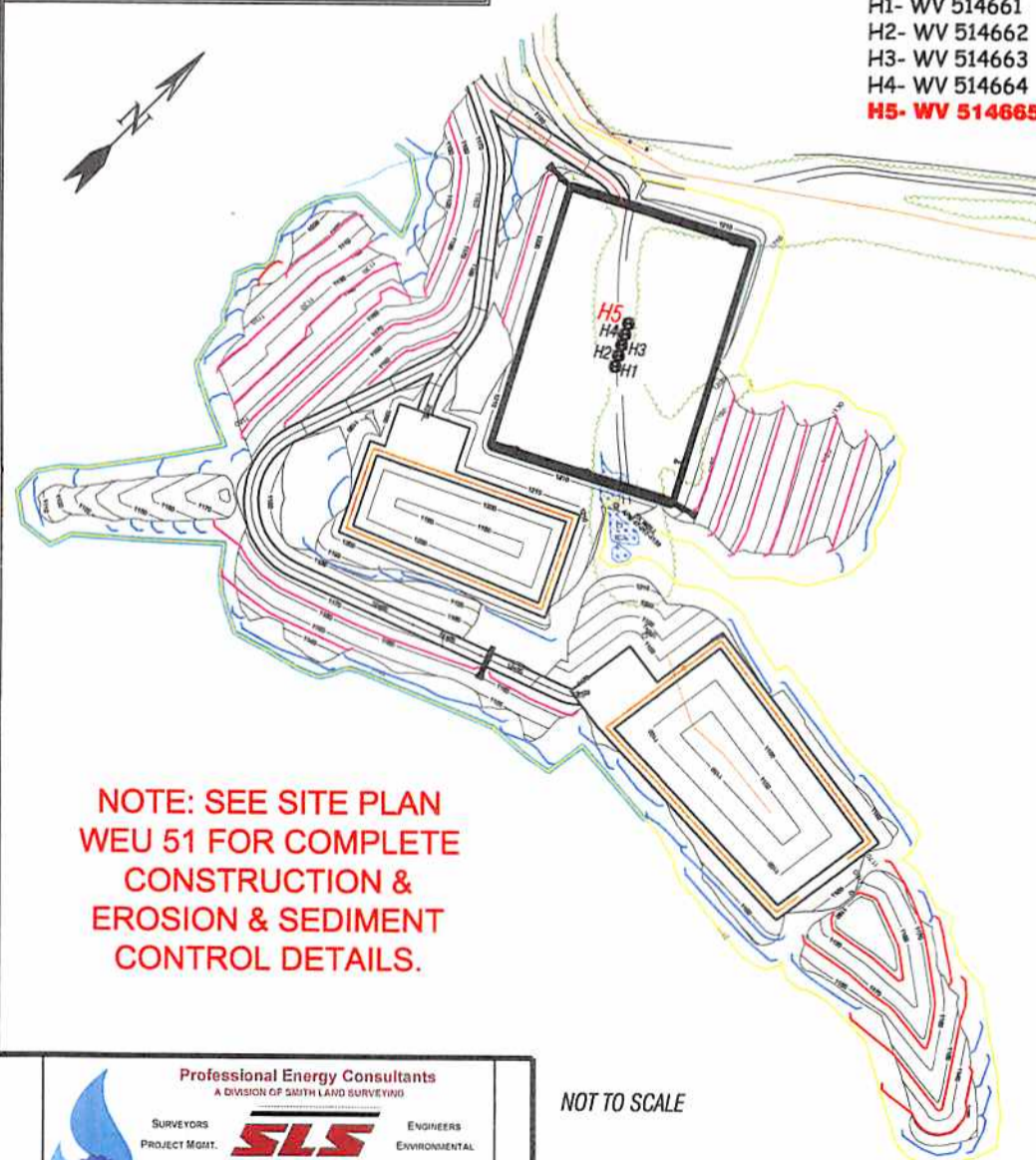




WEST UNION 7.5' QUAD  
OXFORD 7.5' QUAD

# LEEMAN MAXWELL LEASE WELL NO. WV 514665

Detail Sketch for Proposed Well WV 514665



- WEU51 WELLS**  
 H1- WV 514661  
 H2- WV 514662  
 H3- WV 514663  
 H4- WV 514664  
**H5- WV 514665**

	DISTANCE	GRADE ±
A	170' ±	0-5%
B	160' ±	15-20%
C	100' ±	0-5%
D	210' ±	15-20%

SCALE: 1"=500'



**NOTE: SEE SITE PLAN WEU 51 FOR COMPLETE CONSTRUCTION & EROSION & SEDIMENT CONTROL DETAILS.**

ALL ROADS SHOWN HEREON ARE EXISTING UNLESS OTHERWISE NOTED AND SHALL BE MAINTAINED IN ACCORDANCE WITH WV D.E.P. OIL AND GAS BMP MANUAL ENTRANCES AT COUNTY/STATE ROADS SHALL BE MAINTAINED IN ACCORDANCE WITH WV D.O.T. REGULATION SEPARATE PERMITS MAY BE REQUIRED BY THE D.O.T.

SEDIMENT BASINS (TRAPS) AND APPROPRIATE EROSION CONTROL BARRIERS ARE TO BE CONSTRUCTED AT ALL CULVERT AND CROSS DRAIN INLETS AND OUTLETS AS REQUIRED IN THE WV D.E.P. OIL AND GAS BMP MANUAL. FIELD CONDITIONS (ROCK OUTCROPS AND BEDROCK) MAY PROHIBIT INLET TRAPS BEING INSTALLED. WHEN THESE CONDITIONS EXIST ADDITIONAL EROSION CONTROL MEASURES SHALL BE EVALUATED AND UTILIZED AS NEEDED.

EARTHWORK CONTRACTORS ARE RESPONSIBLE FOR NOTIFICATION TO THE OPERATOR AND INSPECTOR PRIOR TO ANY DEVIATION FROM THIS PLAN.

Office of Oil and Gas  
 WV Dept. of Energy  
 TEMPORARY SEED & MULCH ALL SLOPES AFTER CONSTRUCTION OF LOCATION.  
**05/30/2014**

CUT & STACK ALL MARKETABLE TIMBER.  
 STACKED BRUSH MAY BE USED FOR SEDIMENT CONTROL.  
 APPLICATIONS FOR SEPARATE PLC PERMITS ON THE ACCESS ROAD STREAM CROSSINGS HAVE BEEN PREPARED (IF APPLIES).

- = EXISTING CULVERT
- = PROPOSED CULVERT 12" MIN. UNLESS OTHERWISE NOTED
- = PROPOSED STREAM CROSSING
- = APPROXIMATE LIMITS OF DISTURBANCE

NOT TO SCALE

## TOPO SECTION OF USGS WEST UNION 7.5' QUADRANGLE

Professional Energy Consultants  
 A DIVISION OF SMITH LAND SURVEYING

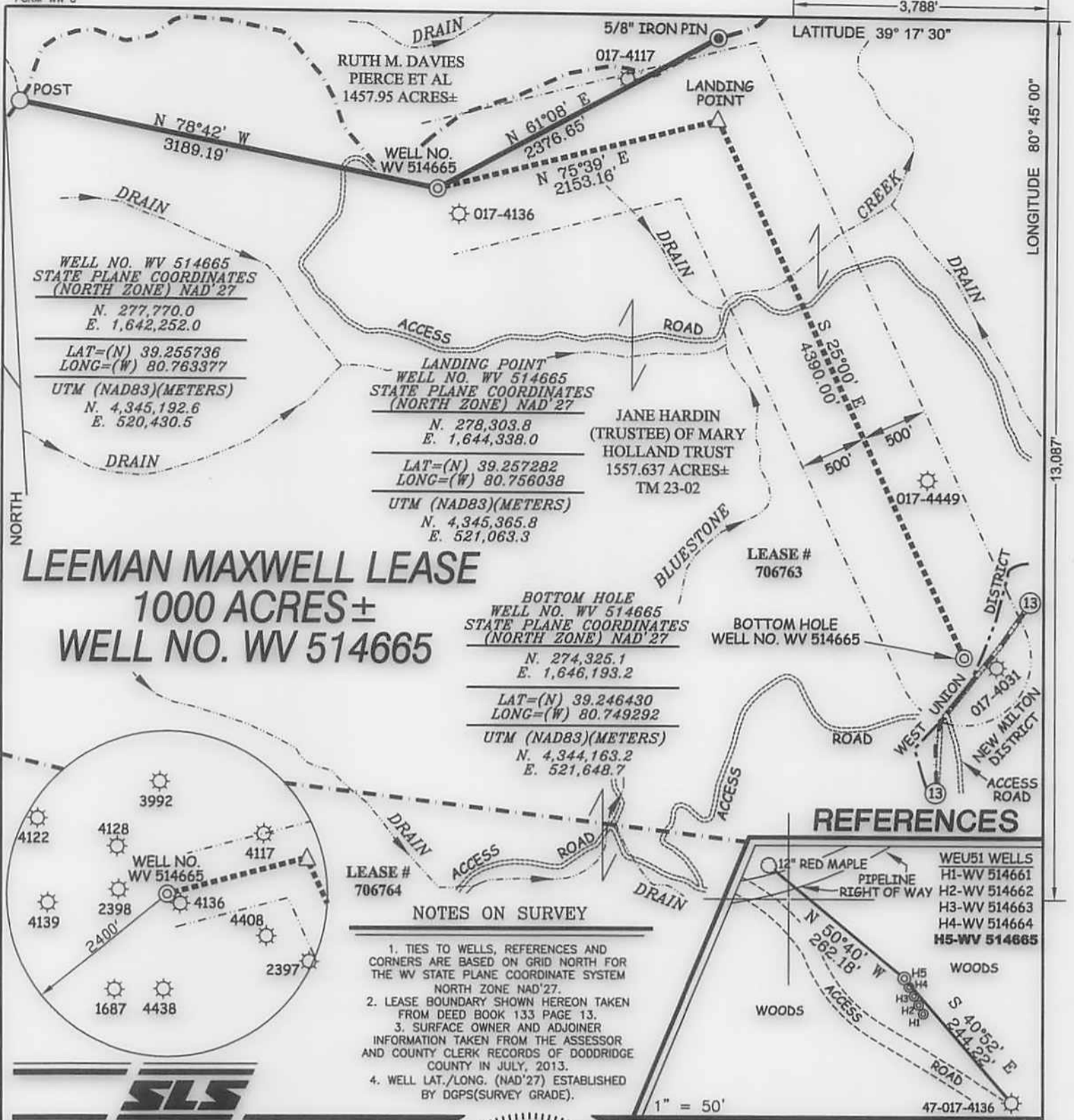
SURVEYORS PROJECT MGMT. **SLS** ENGINEERS ENVIRONMENTAL

226 West Main St. P.O. Box 1160, Glenville, WV 26031 (204) 462-6834  
 55005 Dunes Bottom Road, Shady Side, OH 43087 (740) 671-9911

HONESTY. INTEGRITY. QUALITY

DRAWN BY: K.D.W. FILE NO.: 8051 DATE: 09/12/13 CADD FILE: 8051REC/WV514665.DWG





**LEEMAN MAXWELL LEASE**  
**1000 ACRES±**  
**WELL NO. WV 514665**

WELL NO. WV 514665  
 STATE PLANE COORDINATES  
 (NORTH ZONE) NAD 27  
 N. 277,770.0  
 E. 1,642,252.0  
 LAT=(N) 39.255736  
 LONG=(W) 80.783377  
 UTM (NAD83)(METERS)  
 N. 4,345,192.6  
 E. 520,430.5

LANDING POINT  
 WELL NO. WV 514665  
 STATE PLANE COORDINATES  
 (NORTH ZONE) NAD 27  
 N. 278,303.8  
 E. 1,644,338.0  
 LAT=(N) 39.257282  
 LONG=(W) 80.756038  
 UTM (NAD83)(METERS)  
 N. 4,345,365.8  
 E. 521,063.3

BOTTOM HOLE  
 WELL NO. WV 514665  
 STATE PLANE COORDINATES  
 (NORTH ZONE) NAD 27  
 N. 274,325.1  
 E. 1,646,193.2  
 LAT=(N) 39.246430  
 LONG=(W) 80.749292  
 UTM (NAD83)(METERS)  
 N. 4,344,163.2  
 E. 521,648.7



**REFERENCES**

12" RED MAPLE PIPELINE RIGHT OF WAY	WEU51 WELLS
	H1-WV 514661
	H2-WV 514662
	H3-WV 514663
	H4-WV 514664
	H5-WV 514665

**NOTES ON SURVEY**

1. TIES TO WELLS, REFERENCES AND CORNERS ARE BASED ON GRID NORTH FOR THE WV STATE PLANE COORDINATE SYSTEM NORTH ZONE NAD 27.
2. LEASE BOUNDARY SHOWN HEREON TAKEN FROM DEED BOOK 133 PAGE 13.
3. SURFACE OWNER AND ADJOINER INFORMATION TAKEN FROM THE ASSESSOR AND COUNTY CLERK RECORDS OF DODDRIDGE COUNTY IN JULY, 2013.
4. WELL LAT./LONG. (NAD 27) ESTABLISHED BY DGPS(SURVEY GRADE).



I THE UNDERSIGNED, HEREBY CERTIFY THAT THIS PLAT IS CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF AND SHOWS ALL THE INFORMATION REQUIRED BY LAW AND THE REGULATIONS ISSUED AND PRESCRIBED BY THE DIVISION OF ENVIRONMENTAL PROTECTION.

P.S. 677 *Gregory A. Smith*

(+) DENOTES LOCATION OF WELL ON UNITED STATES TOPOGRAPHIC MAPS.  
 DATE SEPTEMBER 4, 20 13  
 OPERATORS WELL NO. WV 514665  
 API WELL NO. 47-017-06383  
 STATE COUNTY PERMIT

MINIMUM DEGREE OF ACCURACY 1/200 FILE NO. 8051P514665  
 PROVEN SOURCE OF ELEVATION DGPS (SURVEY GRADE TIE TO CORS NETWORK) SCALE 1" = 1,000'

STATE OF WEST VIRGINIA  
 DIVISION OF ENVIRONMENTAL PROTECTION  
 OFFICE OF OIL AND GAS

WELL TYPE: OIL  GAS  LIQUID INJECTION  WASTE DISPOSAL  IF "GAS" PRODUCTION  STORAGE  DEEP  SHALLOW

LOCATION: ELEVATION 1,225(GROUND) 1,208(PROPOSED) WATERSHED BLUESTONE CREEK  
 DISTRICT WEST UNION COUNTY DODDRIDGE QUADRANGLE WEST UNION 7.5'

SURFACE OWNER JANE HARDIN (TRUSTEE) OF MARY HOLLAND TRUST ACREAGE 1557.637±  
 ROYALTY OWNER LEEMAN MAXWELL HEIRS LEASE ACREAGE 1000± LEASE NO. 706763

PROPOSED WORK: DRILL  CONVERT  DRILL DEEPER  REDRILL  FRACTURE OR STIMULATE  PLUG OFF OLD   
 FORMATION  PERFORATE NEW FORMATION  PLUG AND ABANDON  CLEAN OUT AND REPLUG  OTHER   
 PHYSICAL CHANGE IN WELL (SPECIFY) \_\_\_\_\_ TARGET FORMATION MARCELLUS ESTIMATED DEPTH \_\_\_\_\_

WELL OPERATOR EQT PRODUCTION COMPANY DESIGNATED AGENT REX C. RAY  
 ADDRESS 115 PROFESSIONAL PLACE P.O. BOX 280 BRIDGEPORT, WV 26330 ADDRESS 115 PROFESSIONAL PLACE P.O. BOX 280 BRIDGEPORT, WV 26330

COUNTY NAME PERMIT

05/30/2014

H6A MOD