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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](http://www.dep.wv.gov)

## PERMIT MODIFICATION APPROVAL

July 02, 2014

EQT PRODUCTION COMPANY  
POST OFFICE BOX 280  
BRIDGEPORT, WV 26330

Re: Permit Modification Approval for API Number 8510095 , Well #: 515277

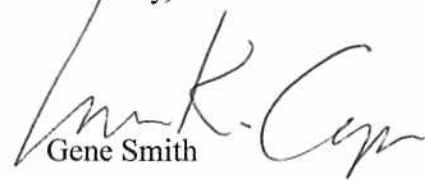
**Extended freshwater casing**

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

Promoting a healthy environment.



July 1, 2014

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

Re: Modification of 47-08510093, 08510094, 08510095, 08510096, 08510097

Dear Mr. Smith,

EQT would like to modify the depth of the fresh water casing (13 3/8") from 973' to 1075'. This will be below the current elevation of 1119' due to the potential show of red rock. I have enclosed a new WW-2B, well schematics, and rec plan for your review.

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

Sincerely,

A handwritten signature in black ink, appearing to read 'Vicki Roark'.

Vicki Roark  
Permitting Supervisor-WV

Enc.



WW - 6B  
(3/13)

**CASING AND TUBING PROGRAM**

18)

| 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 C.T.S.  |
| Fresh Water  | 13 3/8 | New         | MC-50 | 54             | 1,075                 | 1,075                   | 931 C.T.S.   |
| Coal         |        |             |       |                |                       |                         |  |
| Intermediate | 9 5/8  | New         | MC-50 | 40             | 5,330                 | 5,330                   | 2,092 C.T.S.   |
| Production   | 5 1/2  | New         | P-110 | 20             | 13,550                | 13,550                  | 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 (cu. ft./k) |
|--------------|--------|-------------------|----------------|----------------|--------------|--------------------------|
| 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.

*David Wilson*  
7-1-14

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 4251'.

Then kick off the horizontal leg into the Marcellus 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): No additional disturbance

22) Area to be disturbed for well pad only, less access road (acres): .3 ± ac

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 % Calcuim 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

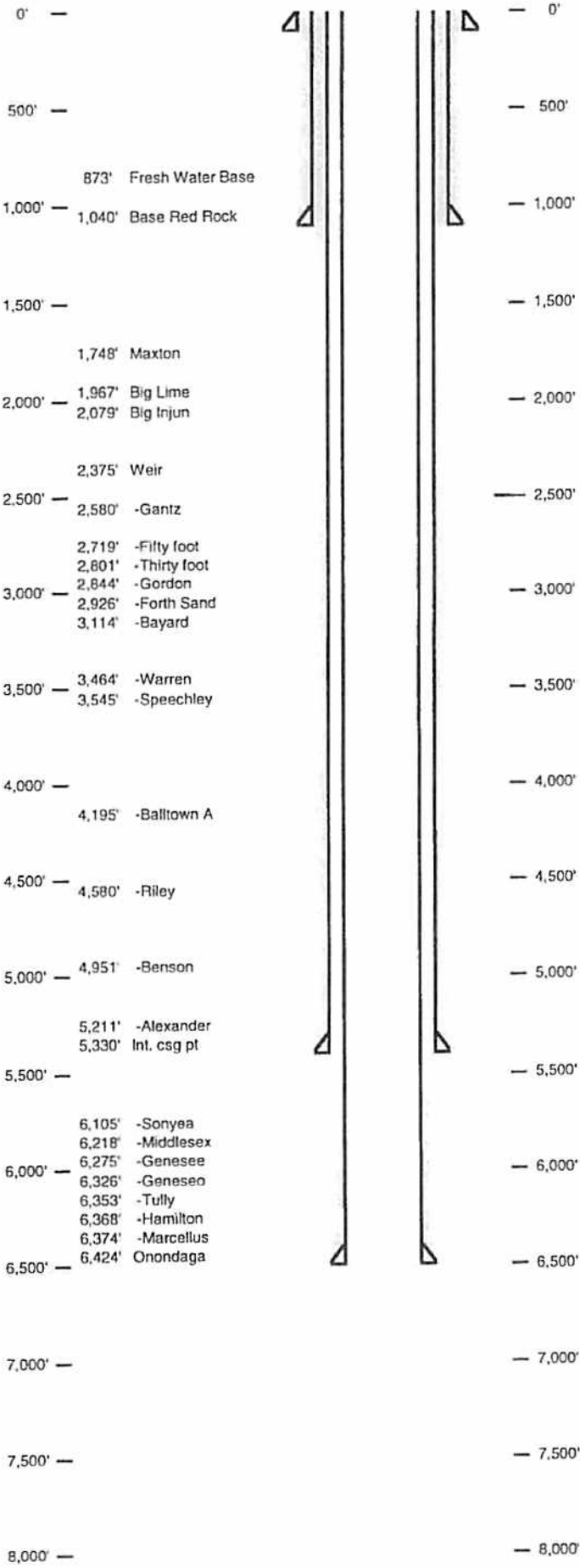
the shakers every 15 minutes.

\*Note: Attach additional sheets as needed.

Well Schematic  
EQT Production

Well Name 515277 (PEN15HB)  
County Ritchie  
State West Virginia

Elevation KB: 1132  
Target Marcellus  
Prospect  
Azimuth 335  
Vertical Section 5795



Hole Size 24" - 20" Conductor at 40'  
Bit Size 17.5"

TOC @ Surface  
13 3/8", MC-50, 54.5# @ 1,075' It MD  
Bit Size 12.375"

TOC @ Surface  
9 5/8", MC-50, 40# @ 5,330' It MD  
Bit Size 8.5"

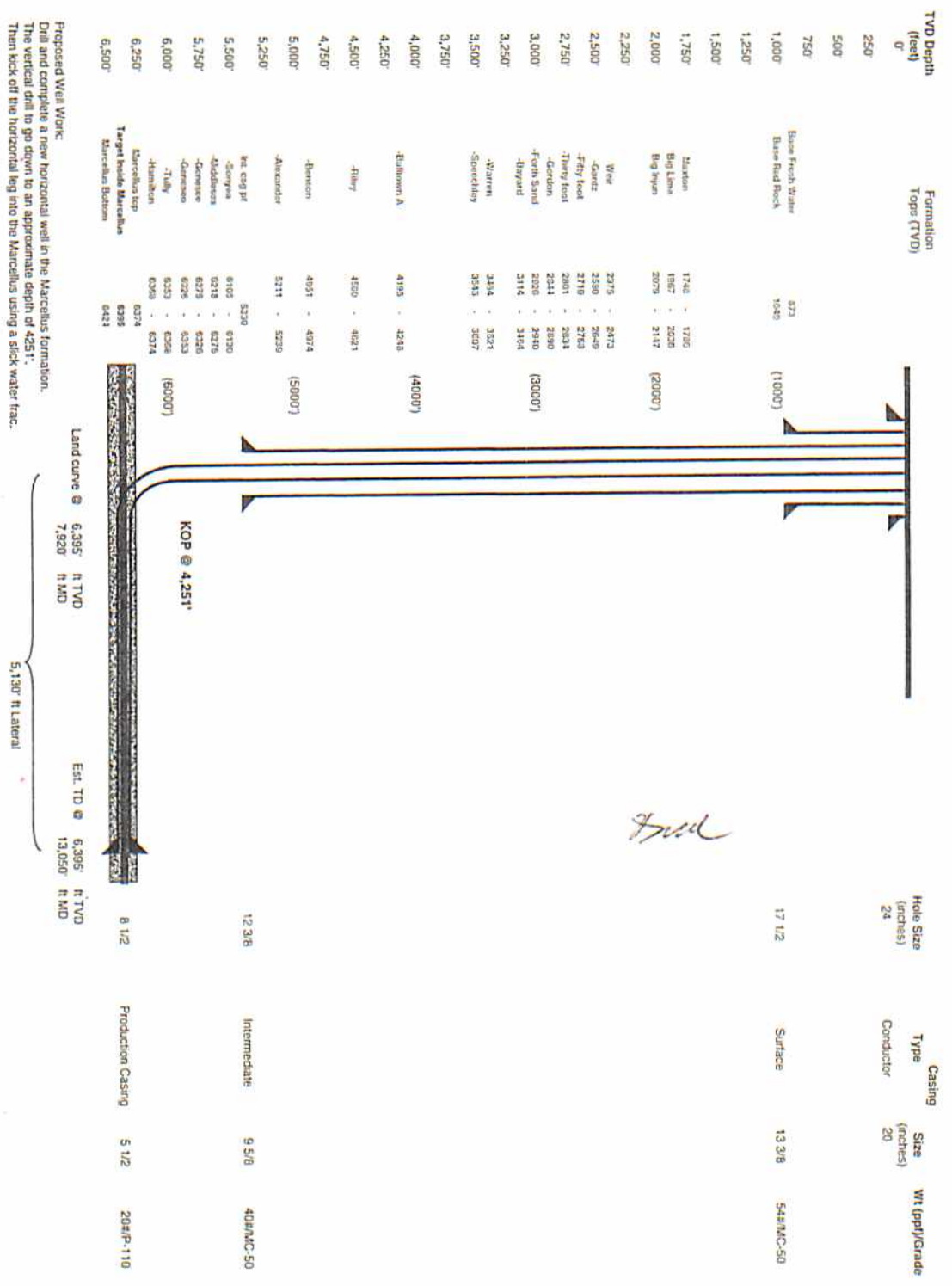
KOP = 4,251' ft MD  
10 Deg DLS

Land @ 7,920' ft MD  
6,395' ft TVD

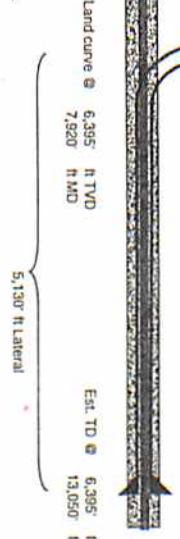
5 1/2", P-110, 20# 13,050' ft MD  
6,395' ft TVD

4708510095

Well 515277 (PEN15H8)  
 EOT Production  
 Pennsylvania  
 Ritchie West Virginia  
 Asmuth 335  
 Vertical Section 5795



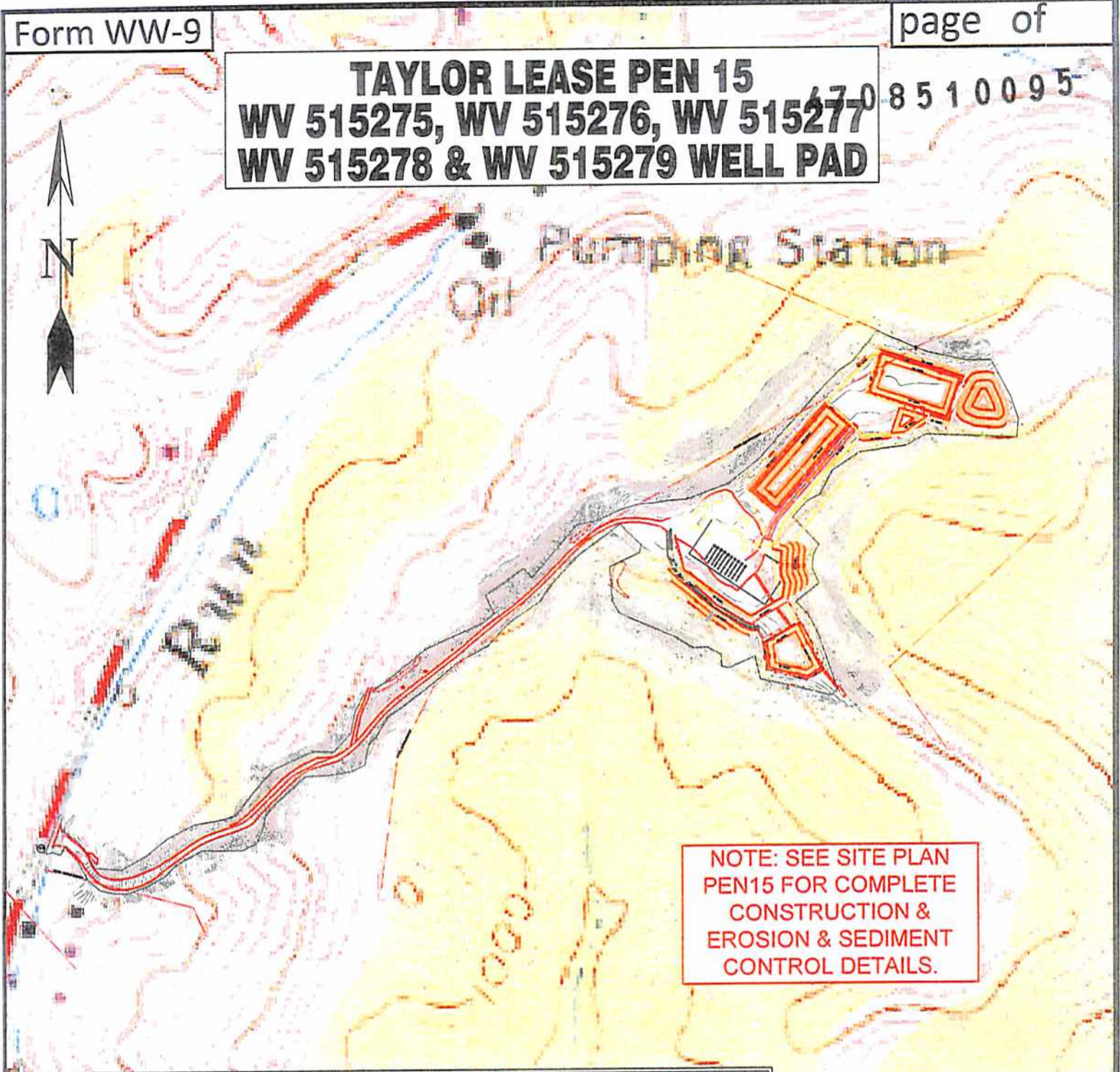
Proposed Well Work:  
 Drill and complete a new horizontal well in the Marcellus formation.  
 The vertical drill to go down to an approximate depth of 4251'.  
 Then kick off the horizontal leg into the Marcellus using a slick water frac.



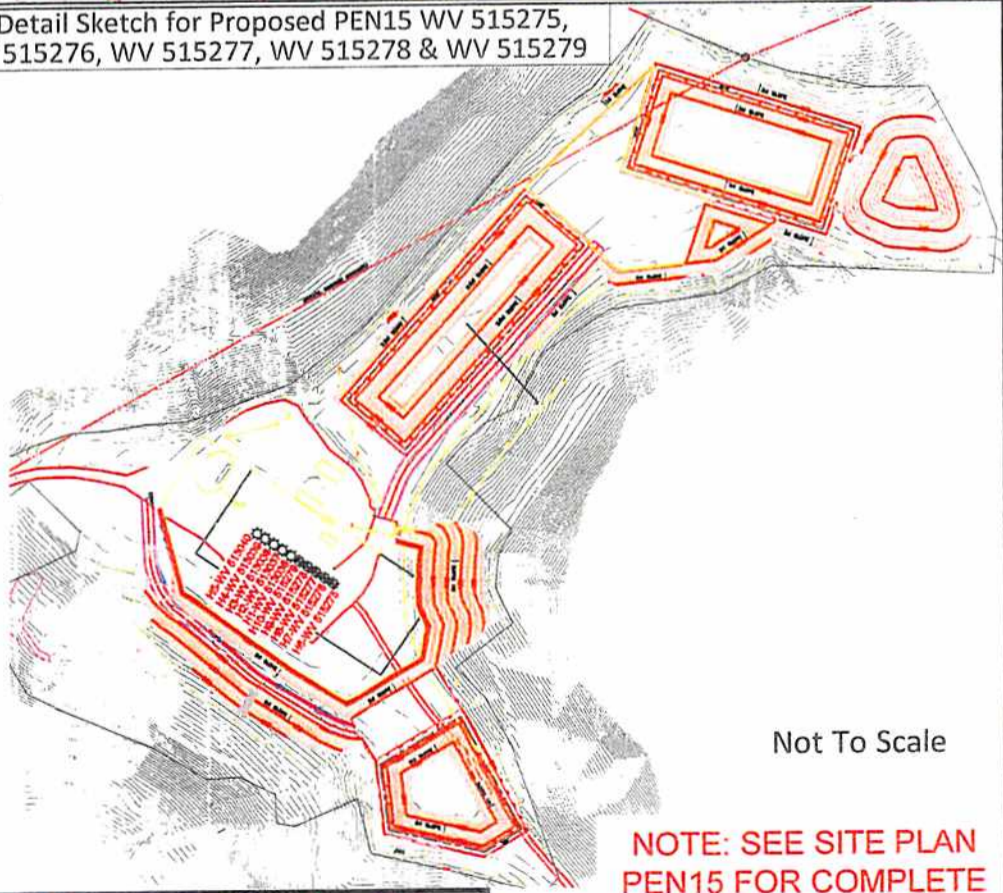
# TAYLOR LEASE PEN 15

WV 515275, WV 515276, WV 515277  
WV 515278 & WV 515279 WELL PAD

670 851 0095



Detail Sketch for Proposed PEN15 WV 515275, WV 515276, WV 515277, WV 515278 & WV 515279



Not To Scale

**NOTE: SEE SITE PLAN PEN15 FOR COMPLETE CONSTRUCTION & EROSION & SEDIMENT CONTROL DETAILS.**

RECEIVED  
Office of Oil and Gas  
MAR 28 2014

**SCALE: 1"=500'**



**Professional Energy Consultants**  
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(304) 462-6634      WWW.SLSURVEYS.COM

|                    |                  |                  |                                 |
|--------------------|------------------|------------------|---------------------------------|
| DRAWN BY<br>K.D.W. | FILE NO.<br>7496 | DATE<br>01-31-14 | CADD FILE:<br>7496REC-PEN15.dwg |
|--------------------|------------------|------------------|---------------------------------|

TOPO SECTION OF PENNSBORO 7.5' USGS TOPO QUADRANGLE



**EQT PRODUCTION COMPANY  
TAYLOR LEASE  
1,600 ACRES±**

LATITUDE 39° 17' 30"

NOTES ON SURVEY

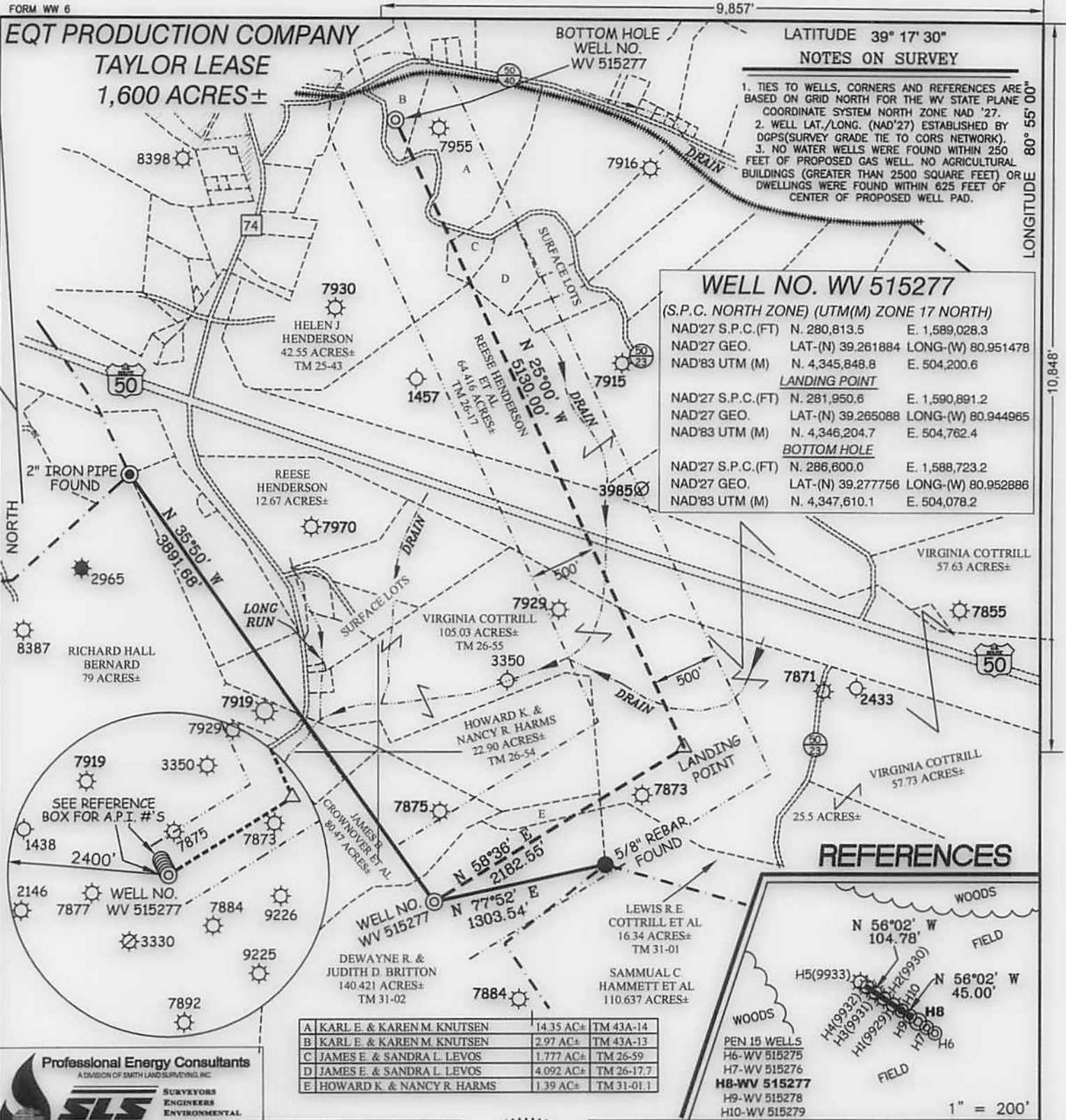
1. TIES TO WELLS, CORNERS AND REFERENCES ARE BASED ON GRID NORTH FOR THE WV STATE PLANE COORDINATE SYSTEM NORTH ZONE NAD '27.
2. WELL LAT./LONG. (NAD'27) ESTABLISHED BY DGPS(SURVEY GRADE TIE TO CORS NETWORK).
3. NO WATER WELLS WERE FOUND WITHIN 250 FEET OF PROPOSED GAS WELL. NO AGRICULTURAL BUILDINGS (GREATER THAN 2500 SQUARE FEET) OR DWELLINGS WERE FOUND WITHIN 625 FEET OF CENTER OF PROPOSED WELL PAD.

**WELL NO. WV 515277**

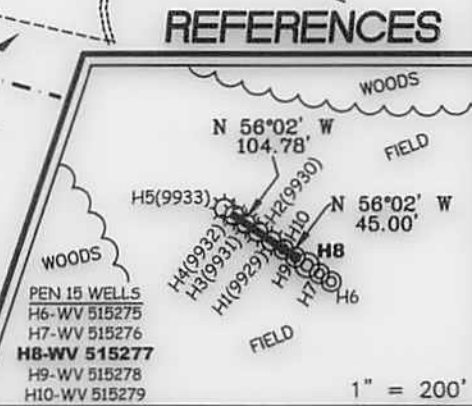
(S.P.C. NORTH ZONE) (UTM(M) ZONE 17 NORTH)  
 NAD'27 S.P.C.(FT) N. 280,813.5 E. 1,589,028.3  
 NAD'27 GEO. LAT-(N) 39.261884 LONG-(W) 80.951478  
 NAD'83 UTM (M) N. 4,345,848.8 E. 504,200.6

**LANDING POINT**  
 NAD'27 S.P.C.(FT) N. 281,950.6 E. 1,590,891.2  
 NAD'27 GEO. LAT-(N) 39.265088 LONG-(W) 80.944965  
 NAD'83 UTM (M) N. 4,346,204.7 E. 504,762.4

**BOTTOM HOLE**  
 NAD'27 S.P.C.(FT) N. 286,600.0 E. 1,588,723.2  
 NAD'27 GEO. LAT-(N) 39.277756 LONG-(W) 80.952886  
 NAD'83 UTM (M) N. 4,347,610.1 E. 504,078.2



|   |                            |           |            |
|---|----------------------------|-----------|------------|
| A | KARL E. & KAREN M. KNUTSEN | 14.35 AC± | TM 43A-14  |
| B | KARL E. & KAREN M. KNUTSEN | 2.97 AC±  | TM 43A-13  |
| C | JAMES E. & SANDRA L. LEVOS | 1.777 AC± | TM 26-59   |
| D | JAMES E. & SANDRA L. LEVOS | 4.092 AC± | TM 26-17.7 |
| E | HOWARD K. & NANCY R. HARMS | 1.39 AC±  | TM 31-01.1 |



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 WWW.SLSURVEYS.COM



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 JANUARY 10, 20 14  
 REVISED \_\_\_\_\_, 20 \_\_\_\_\_  
 OPERATORS WELL NO. WV 515277  
 API WELL NO. 47 - 85 - 10095 *H6A*  
 STATE COUNTY PERMIT

MINIMUM DEGREE OF ACCURACY 1 / 200 FILE NO. 7496P515277  
 PROVEN SOURCE OF ELEVATION DGPS (SURVEY GRADE TIE TO CORS NETWORK) SCALE 1" = 1000'

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 1,119' (PAD ELEVATION) WATERSHED LONG RUN OF NORTH FORK HUGHES RIVER  
 DISTRICT CLAY COUNTY RITCHIE QUADRANGLE PENNSBORO 7.5'  
 SURFACE OWNER DEWAYNE BRITTON ET UX ACREAGE 140.421  
 ROYALTY OWNER E. R. TAYLOR HEIRS ACREAGE 1,600±  
 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 6395 TVD

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 BRIDGEPORT, WV 26330

COUNTY NAME PERMIT