



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

PERMIT MODIFICATION APPROVAL

September 17, 2015

ANTERO RESOURCES CORPORATION
1615 WYNKOOP STREET
DENVER, CO 80202

Re: Permit Modification Approval for API Number 8510215, Well #: KAREN UNIT 1H

Extending lateral with changes to mineral owners

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,

Gene Smith
Assistant Chief of Permitting
Office of Oil and Gas



August 24, 2015

Antero Resources
1615 Wynkoop Street
Denver, CO 80202
Office 303.357.7310
Fax 303.357.7315

West Virginia Department of Environmental Protection
Office of Oil and Gas
Attn: Ms. Melanie Hankins
601 57th Street
Charleston, WV 25304

Ms. Hankins:

Antero Resources Corporation (Antero) would like to submit the following permit modifications for two approved wells on the Ireland North Pad. We are requesting to extend the horizontal lateral lengths which will change the bottom hole locations of the Karen Unit 1H (API# 47-085-10215) and Karen Unit 3H (API# 47-085-10216).

Attached you will find the following documents:

- REVISED Form WW-6B, which shows the revised BHL, Measured Depth and Production Casing/Cement program
- REVISED Form WW-6A1, which shows the new leases we will be drilling into (Karen Unit 1H only)
- REVISED Mylar Plat, which shows the new Lateral Length, Estimated Measured Depth and Bottom Hole Location

If you have any questions please feel free to contact me at (303) 357-7323.

Thank you in advance for your consideration.

Sincerely,

A handwritten signature in blue ink that reads "Ashlie Steele". The signature is written in a cursive, flowing style.

Ashlie Steele
Permitting Supervisor
Antero Resources Corporation

Enclosures

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

1) Well Operator: Antero Resources Corporation 494488557 085 -Ritchie Union Pullman 7.5'
Operator ID County District Quadrangle

2) Operator's Well Number: Karen Unit 1H Well Pad Name: Ireland North Pad

3) Farm Name/Surface Owner: Ireland, Lynwood et al Public Road Access: CR 9

4) Elevation, current ground: ~957' Elevation, proposed post-construction: 947'

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

Other _____

(b)If Gas Shallow X Deep _____

Horizontal X

6) Existing Pad: Yes or No No

7) Proposed Target Formation(s), Depth(s), Anticipated Thickness and Expected Pressure(s):
Marcellus Shale: 6500' TVD, Anticipated Thickness 50 feet, Associated Pressure 3,000#

8) Proposed Total Vertical Depth: 6500' TVD

9) Formation at Total Vertical Depth: Marcellus Shale

10) Proposed Total Measured Depth: 20700' MD

11) Proposed Horizontal Leg Length: 13363'

12) Approximate Fresh Water Strata Depths: 69', 279', 359'

13) Method to Determine Fresh Water Depths: Offset well records. Depths have been adjusted according to surface elevations.

14) Approximate Saltwater Depths: 1451', 1807'

15) Approximate Coal Seam Depths: 343'

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

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: _____

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	20"	New	H-40	94#	40'	40'	CTS, 38 Cu. Ft.
Fresh Water	13-3/8"	New	J-55/H-40	54.5#/48#	410'	410' *See #19	CTS, 570 Cu. Ft
Coal	9-5/8"	New	J-55	36#	2500'	2500'	CTS, 1018 Cu. Ft.
Intermediate							
Production	5-1/2"	New	P-110	20#	20700'	20700'	5284 Cu. Ft.
Tubing	2-3/8"	New	N-80	4.7#		7100'	
Liners							

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"	24"	0.438"	1530	50	Class A	1.18
Fresh Water	13-3/8"	17-1/2"	0.38"/0.33"	2730/1730	1000	Class A	1.18
Coal	9-5/8"	12-1/4"	0.352"	3520	1500	Class A	1.18
Intermediate							
Production	5-1/2"	8-3/4" & 8-1/2"	0.361"	12,630	2500	Lead-HIPOZ & Tail - H	H/POZ-1.44 & H-1.8
Tubing	2-3/8"	4.778"	0.19"	11,200			
Liners							

PACKERS

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

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

Drill, perforate, fracture a new horizontal shallow well and complete Marcellus Shale.

*Antero air drills the fresh water string which makes it difficult to determine when freshwater is encountered, therefore we have built in a buffer for the casing setting depth which helps to ensure that all fresh water zones are covered.

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

Antero plans to pump Slickwater into the Marcellus Shale formation in order to ready the well for production. The fluid will be comprised of approximately 99 percent water and sand, with less than 1 percent special-purpose additives as shown in the attached "List of Anticipated Additives Used for Fracturing or Stimulating Well."

Anticipated Max Pressure - 9300 lbs

Anticipated Max Rate - 80 bpm

21) Total Area to be disturbed, including roads, stockpile area, pits, etc., (acres): 28.25 acres

22) Area to be disturbed for well pad only, less access road (acres): 3.56 acres

23) Describe centralizer placement for each casing string:

Conductor: no centralizers

Surface Casing: one centralizer 10' above the float shoe, one on the insert float collar and one every 4th joint spaced up the hole to surface.

Intermediate Casing: one centralizer above float joint, one centralizer 5' above float collar and one every 4th collar to surface.

Production Casing: one centralizer at shoe joint and one every 3 joints to top of cement in intermediate casing.

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

Conductor: no additives, Class A cement.

Surface: Class A cement with 2-3% calcium chloride

Intermediate: Class A cement with 1/4 lb of flake, 5 gallons of clay treat

Production: Lead cement- 50/50 Class H/Poz + 1.5% salt + 1% C-45 + 0.5% C-16a + 0.2% C-12 + 0.45% C-20 + 0.05% C-51

Production: Tail cement- Class H + 45 PPS Calcium Carbonate + 1.0% FL-160 + 0.2% ACGB-47 + 0.05% ACSA-51 + 0.2% ACR-20

25) Proposed borehole conditioning procedures:

Conductor: blowhole clean with air, run casing, 10 bbls fresh water.

Surface: blowhole clean with air, trip to conductor shoe, trip to bottom, blowhole clean with air, trip out, run casing, circulate pipe capacity + 40 bbls fresh water followed by 25 bbls bentonite mud, 10 bbls fresh water spacer.

Intermediate: blowhole clean with air, trip to surface casing shoe, trip to bottom, blowhole clean with air, trip out, run casing, circulate 40 bbls brine water followed by 10 bbls fresh water and 25 bbls bentonite mud, pump 10 bbls fresh water.

Production: circulate with 14 lb/gal NaCl mud, trip to middle of lateral, circulate, pump high viscosity sweep, trip to base of curve, pump high viscosity sweep, trip to top of curve, trip to bottom, circulate, pump high viscosity sweep, trip out, run casing, circulate 10 bbls fresh water, pump 48 bbls barite pill, pump 10 bbls fresh water followed by 48 bbls mud flush and 10 bbls water.

*Note: Attach additional sheets as needed.

WW-6A1

Operator's Well Number Karen Unit 1H

INFORMATION SUPPLIED UNDER WEST VIRGINIA CODE
Chapter 22, Article 6A, Section 5(a)(5)
IN LIEU OF FILING LEASE(S) AND OTHER CONTINUING CONTRACT(S)

Under the oath required to make the verification on page 1 of this Notice and Application, I depose and say that I am the person who signed the Notice and Application for the Applicant, and that –

- (1) the tract of land is the same tract described in this Application, partly or wholly depicted in the accompanying plat, and described in the Construction and Reclamation Plan;
- (2) the parties and recordation data (if recorded) for lease(s) or other continuing contract(s) by which the Applicant claims the right to extract, produce or market the oil or gas are as follows:

Grantor, lessor, etc.	Grantee, lessee, etc.	Royalty	Book/Page
<u>Belle Pritchard Lease</u>			
Belle Pritchard	Ritchie A. Ireland	1/8	0077/0019
Ritchie A. Ireland	S.M.Vokel, H.R. Jackson, Sam T. Mallison, & Charles E. Young	Assignment	0080/0386
S.M. Vokel, H.R. Jackson, Sam T. Mallison, & Charles E. Young	Warren Associates, Inc.	Assignment	0126/0464
Warren Associates, Inc.	Haught, Inc.	Assignment	0170/0461
Haught, Inc.	Haught Oil Producing Corporation	Merger	Exhibit 2
Haught Oil Producing Corporation	710 Corporation	Assignment	0180/0791
710 Corporation	Lynwood K. Ireland	Assignment	0204/0553
Lynwood K. Ireland	Antero Resources Appalachian Corporation	Partial Assignment of Oil & Gas Leases	0255/0652
Antero Resources Appalachian Corporation	Antero Resources Corporation	Name Change	Exhibit 1
<u>W. P. Ireland, et ux Lease</u>			
W.P. Ireland & L.M. Ireland	M.G. Taylor	1/8	0032/0016
M.G. Taylor	Carnegie Natural Gas Company	Assignment	Recited in 0068/0188
Carnegie Natural Gas Company	Coffman Oil & Gas Company	Assignment	0068/0188
Coffman Oil & Gas Company	United Operating Company, Inc.	Assignment	0117/0660
United Operating Company, Inc.	Buttes Resources Company	Assignment	0117/0738
Buttes Resources Company	Earl Stewart	Assignment	0128/0286
Earl Stewart	JCC	Assignment	0205/0483
JCC	Key Oil Company	Assignment	0229/0019
Key Oil Company	Antero Resources Appalachian Corporation	Partial Assignment of Oil & Gas Leases	0253/0747
Antero Resources Appalachian Corporation	Antero Resources Corporation	Name Change	Exhibit 1
<u>Joyce E. Webber Lease</u>			
Joyce E. Webber	Antero Resources Appalachian Corporation	1/8+	0254/0999
Antero Resources Appalachian Corporation	Antero Resources Corporation	Name Change	Exhibit 1
<u>Earl E. Flesher, et al Lease</u>			
Earl E. Flesher, et al	Antero Resources Appalachian Corporation	1/8+	0254/0385
Antero Resources Appalachian Corporation	Antero Resources Corporation	Name Change	Exhibit 1
<u>Earl E. Flesher Lease</u>			
Earl E. Flesher	Antero Resources Appalachian Corporation	1/8+	0254/0383
Antero Resources Appalachian Corporation	Antero Resources Corporation	Name Change	Exhibit 1
<u>Carolyn Ercanbrack Lease</u>			
Carolyn Ercanbrack	Antero Resources Appalachian Corporation	1/8+	0255/0170
Antero Resources Appalachian Corporation	Antero Resources Corporation	Name Change	Exhibit 1
<u>Lewis A. Adams, et ux Lease</u>			
Lewis A. Adams, et ux	Antero Resources Corporation	1/8	0271/0671

*Partial Assignments to Antero Resources Corporation include 100% rights to extract, produce and market the oil and gas from the Marcellus and any other formations completed with this well.

****CONTINUED ON NEXT PAGE****

WW-6A1
(5/13)

Operator's Well No. Karen Unit 1H

**INFORMATION SUPPLIED UNDER WEST VIRGINIA CODE
Chapter 22, Article 6A, Section 5(a)(5)
IN LIEU OF FILING LEASE(S) AND OTHER CONTINUING CONTRACT(S)**

Under the oath required to make the verification on page 1 of this Notice and Application, I depose and say that I am the person who signed the Notice and Application for the Applicant, and that –

- (1) the tract of land is the same tract described in this Application, partly or wholly depicted in the accompanying plat, and described in the Construction and Reclamation Plan;
- (2) the parties and recordation data (if recorded) for lease(s) or other continuing contract(s) by which the Applicant claims the right to extract, produce or market the oil or gas are as follows:

Lease Name or Number	Grantor, Lessor, etc.	Grantee, Lessee, etc.	Royalty	Book/Page
<u>Tycart Resources, Inc Lease</u>	Tycart Resources, Inc.	Antero Resources Corporation	1/8+	0272/0846

*Partial Assignments to Antero Resources Corporation include 100% rights to extract, produce and market the oil and gas from the Marcellus and any other formations completed with this well.

**Acknowledgement of Possible Permitting/Approval
In Addition to the Office of Oil and Gas**

The permit applicant for the proposed well work addressed in this application hereby acknowledges the possibility of the need for permits and/or approvals from local, state, or federal entities in addition to the DEP, Office of Oil and Gas, including but not limited to the following:

- WV Division of Water and Waste Management
- WV Division of Natural Resources WV Division of Highways
- U.S. Army Corps of Engineers
- U.S. Fish and Wildlife Service
- County Floodplain Coordinator

The applicant further acknowledges that any Office of Oil and Gas permit in no way overrides, replaces, or nullifies the need for other permits/approvals that may be necessary and further affirms that all needed permits/approvals should be acquired from the appropriate authority before the affected activity is initiated.

Well Operator: Antero Resources Corporation
 By: Ward McNeilly 
 Its: VP, Reserves Planning & Midstream



*J. Ken Heckler, Secretary of State of the
State of West Virginia, hereby certify that*
THE FOLLOWING IS A TRUE AND CORRECT COPY OF THE ARTICLES OF MERGER
OF:

HAUGHT, INC., A WEST VIRGINIA CORPORATION AND HAUGHT OIL
PRODUCING CORP., A UTAH CORPORATION DULY SIGNED AND VERIFIED
PURSUANT TO THE PROVISIONS OF SECTION 38, ARTICLE 1, CHAPTER
31 OF THE CODE OF WEST VIRGINIA, 1931, AS AMENDED, HAVE
BEEN RECEIVED AND ARE FOUND TO CONFORM TO LAW.

ACCORDINGLY, I HEREBY ISSUE THIS CERTIFICATE OF MERGER, MERGING
HAUGHT, INC., WITH AND INTO HAUGHT OIL PRODUCING CORP., THE
SURVIVOR AND ATTACH A DUPLICATE ORIGINAL OF SAID ARTICLES
OF MERGER AS APPEARS FROM THE RECORDS OF MY SAID OFFICE.

*Given under my hand and the
Great Seal of the State of
West Virginia, on this*

TWELFTH day of

JANUARY 19 87



Ken Heckler

Secretary of State.

LATITUDE 39°12'30"

6,908'

LATITUDE 39°10'00"

4,602' TO BOTTOM HOLE

LONGITUDE 80°52'30"

11,299' TO BOTTOM HOLE

12,963'

LONGITUDE 80°52'30"

COUNTY NAME

PERMIT

Antero Resources Corporation
Well No. Karen Unit 1H

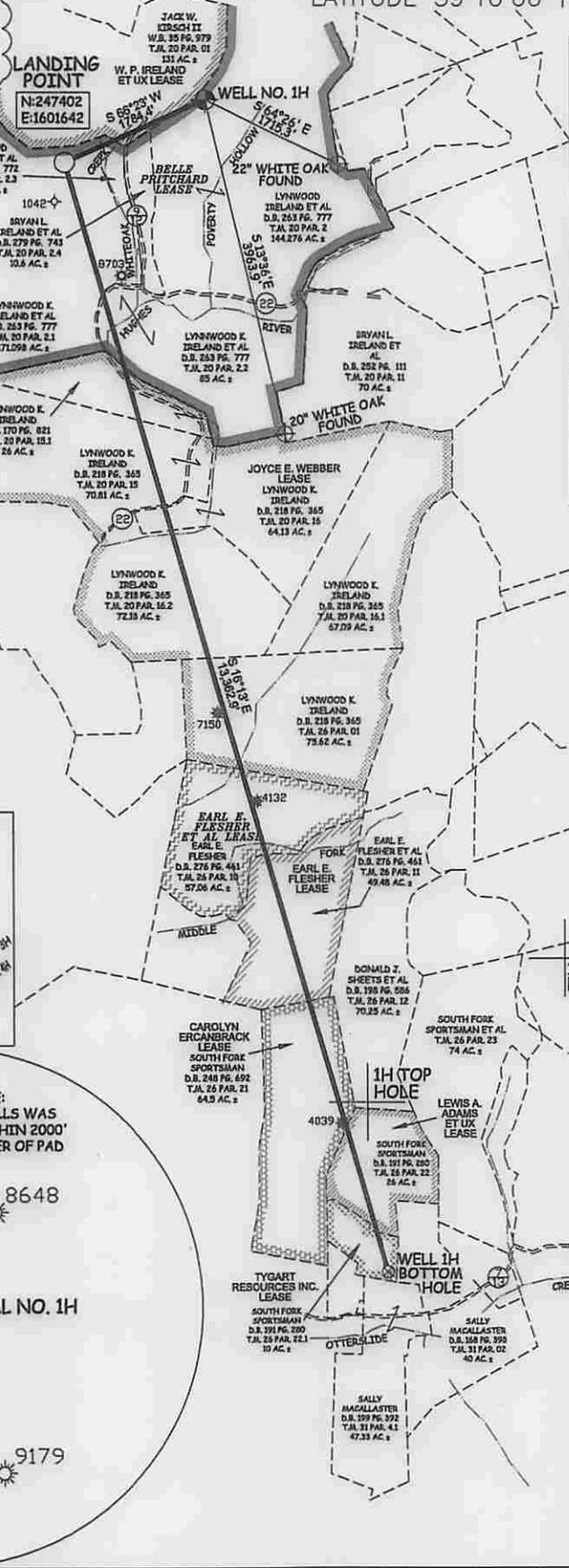
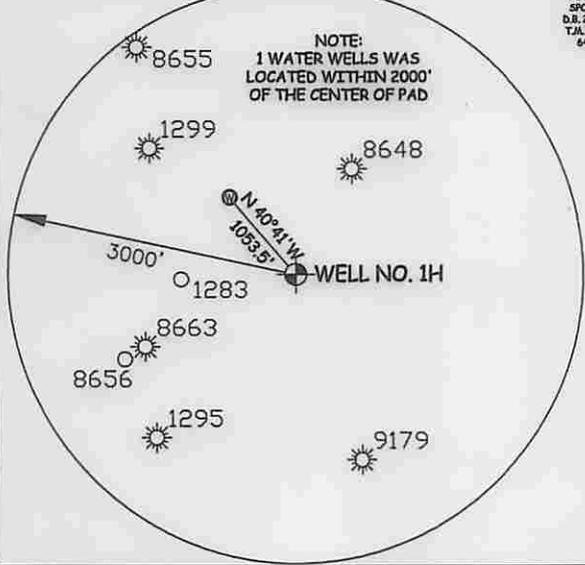
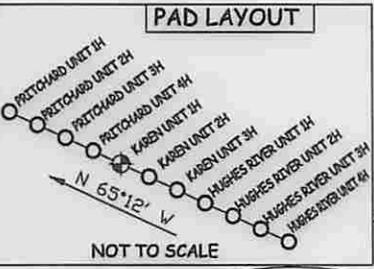
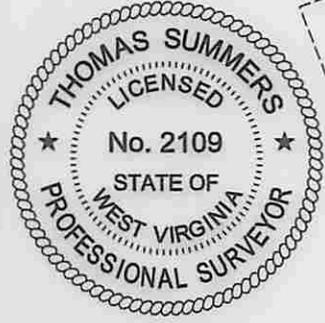
LANDING POINT
N:247402
E:1601642

WELL NO. 1H

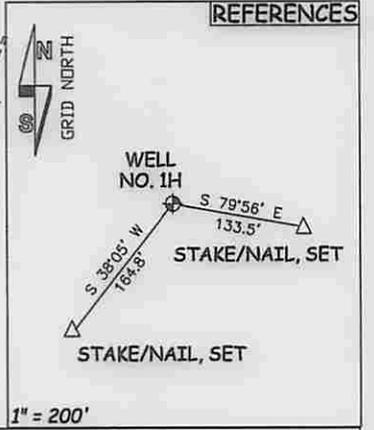
NOTES:
 WELL 1H TOP HOLE INFORMATION:
 N: 248,117ft E: 1,603,277ft
 LAT: 39°10'21.88" LON: 80°53'57.72"
 BOTTOM HOLE INFORMATION:
 N: 234,571ft E: 1,605,375ft
 LAT: 39°08'08.33" LON: 80°53'28.41"
 WEST VIRGINIA COORDINATE SYSTEM OF 1927 NORTH ZONE. ZONE WAS DERIVED FROM MEASUREMENTS TAKEN WITH TRIMBLE GEOXT SUBMETER MAPPING GRADE GPS UNIT. PLAT ORIENTATION, CORNER, AND WELL REFERENCE TIE LINES ARE BASED ON GRID NORTH.

(NAD) 83 (UTM) ZONE 17 COORDS:
 WELL 1H TOP HOLE INFORMATION:
 N: 4,335,961m E: 508,708m
 BOTTOM HOLE INFORMATION:
 N: 4,331,845m E: 509,416m

WW NORTH ZONE GRID NORTH



NOTE:
NO OCCUPIED DWELLINGS OR BUILDINGS TWO THOUSAND FIVE HUNDRED (2,500) SQUARE FEET OR LARGER USED TO HOUSE OR SHELTER DAIRY CATTLE OR POULTRY HUSBANDRY ARE LOCATED WITHIN SIX HUNDRED TWENTY-FIVE (625) FEET OF THE CENTER OF THE WELL PAD.



JOB # 14-127WA
 DRAWING # KAREN1H
 SCALE 1" = 2000'
 MINIMUM DEGREE OF ACCURACY SUBMETER
 PROVEN SOURCE OF ELEV. SUBMETER MAPPING GRADE GPS
 STATE OF WEST VIRGINIA DEPARTMENT OF ENERGY DIVISION OF OIL AND GAS

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 RULES ISSUED AND PERSCRIBED BY THE DEPARTMENT OF ENVIRONMENTAL PROTECTION.

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

WILLOW LAND SURVEYING PLLC
 220 MASONIC AVE. PENNSBORO WEST VIRGINIA 26415



LEGEND

- Surface Owner Boundary Lines +/-
- - - Interior Surface Tracts +/-
- x - x - Existing Fence
- ⊕ Found monument, as noted

THOMAS SUMMERS P.S. 2109
 DATE 08/12/15
 OPERATOR'S WELL# KAREN UNIT #1H

WELL TYPE: OIL ___ GAS LIQUID INJECTION ___ WASTE DISPOSAL ___
 (IF "GAS") PRODUCTION STORAGE ___ DEEP ___ SHALLOW
 LOCATION: ORIGINAL GROUND ELEV. 957' PROPOSED ELEV. 947' WATERSHED SOUTH FORK HUGHES RIVER
 QUADRANGLE PULLMAN 7.5' DISTRICT UNION
 SURFACE OWNER LYNWOOD IRELAND ET AL
 OIL & GAS ROYALTY OWNER BELLE PRITCHARD; W. P. IRELAND ET UX;
 JOYCE E. WEBBER; EARL E. FLESHER ET AL.; EARL E. FLESHER;
 CAROLYN ERCANBRACK; LEWIS A. ADAMS ET UX; TYGART RESOURCES INC.
 PROPOSED WORK: DRILL CONVERT ___ DRILL DEEPER ___ REDRILL ___ FRACTURE OR STIMULATE
 PLUG OFF OLD FORMATION ___ PERFORATE NEW FORMATION OTHER PHYSICAL CHANGE IN WELL
 (SPECIFY) BHL Permit MOD PLUG & ABANDON CLEAN OUT & REPLUG
 TARGET FORMATION MARCELLUS ESTIMATED DEPTH 6,500' TVD 20,700' MD
 WELL OPERATOR ANTERO RESOURCES CORP. DESIGNATED AGENT DIANNA STAMPER
 ADDRESS 1615 WYNKOOP STREET ADDRESS CT CORPORATION SYSTEM
 DENVER, CO 80202 CHARLESTON, WV 25313

API WELL # 47 - 085 - 10215 MOD
 STATE COUNTY PERMIT
 COUNTY RITCHIE
 ACREAGE 144.276 ACRES +/-
 LEASE ACREAGE 415 AC±; 222 AC±;
 445.67 AC±; 57 AC±; 82 AC±;
 64.5 AC±; 26 AC±; 10 AC±