

State of West Virginia
Department of Environmental Protection - Office of Oil and Gas
Well Operator's Report of Well Work

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Office of Oil and Gas

OCT 23 2019

WV Department of
Environmental Protection

API 47-085-10358 County Ritchie District Clay
Quad Middlebourne 7.5' Pad Name Lettie Pad Field/Pool Name -----
Farm name Daniel M. Haymond IV et al Well Number Christopher Unit 2H
Operator (as registered with the OOG) Antero Resources Corporation
Address 1615 Wynkoop Street City Denver State CO Zip 80202

As Drilled location NAD 83/UTM Attach an as-drilled plat, profile view, and deviation survey
Top hole Northing 4357277m Easting 507737m
Landing Point of Curve Northing 4357583.96m Easting 508413.80m
Bottom Hole Northing 4360595m Easting 507354m

Elevation (ft) 970' GL Type of Well New Existing Type of Report Interim Final
Permit Type Deviated Horizontal Horizontal 6A Vertical Depth Type Deep Shallow
Type of Operation Convert Deepen Drill Plug Back Redrilling Rework Stimulate
Well Type Brine Disposal CBM Gas Oil Secondary Recovery Solution Mining Storage Other _____
Type of Completion Single Multiple Fluids Produced Brine Gas NGL Oil Other _____
Drilled with Cable Rotary

Drilling Media Surface hole Air Mud Fresh Water Intermediate hole Air Mud Fresh Water Brine
Production hole Air Mud Fresh Water Brine

Mud Type(s) and Additive(s)
Air - Foam & 4% KCL
Mud - Polymer

Date permit issued 10/24/2018 Date drilling commenced 7/5/2018 Date drilling ceased 1/15/2019
Date completion activities began 4/1/2019 Date completion activities ceased 7/4/2019
Verbal plugging (Y/N) N/A Date permission granted N/A Granted by N/A

Please note: Operator is required to submit a plugging application within 5 days of verbal permission to plug

Freshwater depth(s) ft 85, 156, 408 Open mine(s) (Y/N) depths No
Salt water depth(s) ft 1158, 1760, 1840 Void(s) encountered (Y/N) depths No
Coal depth(s) ft 320, 348, 390, 500 Cavern(s) encountered (Y/N) depths No
Is coal being mined in area (Y/N) No

Reviewed by: _____

Reviewed

API 47- 085 - 10358 Farm name Daniel M. Haymond IV et al Well number Christopher Unit 2H

CASING STRINGS	Hole Size	Casing Size	Depth	New or Used	Grade wt/ft	Basket Depth(s)	Did cement circulate (Y/ N) * Provide details below*
Conductor	24"	20"	95'	New	94#, H-40	N/A	Y
Surface	17-1/2"	13-3/8"	506'	New	48#, H-40	N/A	Y
Coal							
Intermediate 1	12-1/4"	9-5/8"	2701'	New	36#, J-55	N/A	Y
Intermediate 2							
Intermediate 3							
Production	8-3/4"/8-1/2"	5-1/2"	17807'	New	23#, P-110	N/A	Y
Tubing		2-3/8"	6752'		4.7#, N-80		
Packer type and depth set		N/A					

Comment Details _____

CEMENT DATA	Class/Type of Cement	Number of Sacks	Slurry wt (ppg)	Yield (ft ³ /sks)	Volume (ft ²)	Cement Top (MD)	WOC (hrs)
Conductor	Class A	204 sx	15.6	1.18	120	0'	8 Hrs.
Surface	Class A	430 sx	15.6	1.18	826	0'	8 Hrs.
Coal							
Intermediate 1	Class A	970 sx	15.6	1.18	1181	0'	8 Hrs.
Intermediate 2							
Intermediate 3							
Production	Class H	730 sx (Lead) 1625 sx (Tail)	14.0 (Lead), 15.2 (Tail)	1.47 (Lead), 1.83 (Tail)		-500' into Intermediate Casing	8 Hrs.
Tubing							

Drillers TD (ft) 17827 MD, 6358' TVD (BHL), 6378' (Deepest Point Drilled) Loggers TD (ft) 17827' MD

Deepest formation penetrated Marcellus Plug back to (ft) N/A

Plug back procedure N/A

Kick off depth (ft) 6435'

Check all wireline logs run caliper density deviated/directional induction
 neutron resistivity gamma ray temperature sonic

Well cored Yes No Conventional Sidewall Were cuttings collected Yes No

DESCRIBE THE CENTRALIZER PLACEMENT USED FOR EACH CASING STRING _____

Conductor - 0
 Surface - 1 above guide shoe, 1 above insert float, 1 every 4th joint to surface
 Intermediate - 1 above float joint, 1 above float collar, 1 every 4th joint to surface
 Production - 1 above float joint, 1 below float collar, 1 every 3rd joint to top of cement

WAS WELL COMPLETED AS SHOT HOLE Yes No DETAILS _____

WAS WELL COMPLETED OPEN HOLE? Yes No DETAILS _____

WERE TRACERS USED Yes No TYPE OF TRACER(S) USED N/A

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EXHIBIT 1

Stage No.	Perforation Date	Perforated from MD ft.	Perforated to MD ft.	Number of Perforations	Formations
1	4/1/2019	17697	17603	60	Marcellus
2	4/1/2019	17564.088	17399.028	60	Marcellus
3	4/2/2019	17363.616	17198.556	60	Marcellus
4	4/2/2019	17163.144	16998.084	60	Marcellus
5	4/2/2019	16962.672	16797.612	60	Marcellus
6	4/3/2019	16762.2	16597.14	60	Marcellus
7	4/3/2019	16561.728	16396.668	60	Marcellus
8	4/3/2019	16361.256	16196.196	60	Marcellus
9	4/3/2019	16160.784	15995.724	60	Marcellus
10	4/4/2019	15960.312	15795.252	60	Marcellus
11	4/4/2019	15759.84	15594.78	60	Marcellus
12	4/4/2019	15559.368	15394.308	60	Marcellus
13	4/4/2019	15358.896	15193.836	60	Marcellus
14	4/5/2019	15158.424	14993.364	60	Marcellus
15	4/5/2019	14957.952	14792.892	60	Marcellus
16	4/5/2019	14757.48	14592.42	60	Marcellus
17	4/6/2019	14557.008	14391.948	60	Marcellus
18	4/6/2019	14356.536	14191.476	60	Marcellus
19	4/6/2019	14156.064	13991.004	60	Marcellus
20	4/6/2019	13955.592	13790.532	60	Marcellus
21	4/7/2019	13755.12	13590.06	60	Marcellus
22	4/7/2019	13554.648	13389.588	60	Marcellus
23	4/7/2019	13354.176	13189.116	60	Marcellus
24	4/8/2019	13153.704	12988.644	60	Marcellus
25	4/8/2019	12953.232	12788.172	60	Marcellus
26	4/8/2019	12752.76	12587.7	60	Marcellus
27	4/8/2019	12552.288	12387.228	60	Marcellus
28	4/9/2019	12351.816	12186.756	60	Marcellus
29	4/9/2019	12151.344	11986.284	60	Marcellus
30	4/9/2019	11950.872	11785.812	60	Marcellus
31	4/10/2019	11750.4	11585.34	60	Marcellus
32	4/10/2019	11549.928	11384.868	60	Marcellus
33	4/10/2019	11349.456	11184.396	60	Marcellus
34	4/11/2019	11148.984	10983.924	60	Marcellus
35	4/11/2019	10948.512	10783.452	60	Marcellus
36	4/11/2019	10748.04	10582.98	60	Marcellus
37	4/12/2019	10547.568	10382.508	60	Marcellus
38	4/12/2019	10347.096	10182.036	60	Marcellus
39	4/12/2019	10146.624	9981.564	60	Marcellus
40	4/12/2019	9946.152	9781.092	60	Marcellus
41	4/13/2019	9745.68	9580.62	60	Marcellus
42	4/13/2019	9545.208	9380.148	60	Marcellus
43	4/13/2019	9344.736	9179.676	60	Marcellus
44	4/14/2019	9144.264	8979.204	60	Marcellus
45	4/14/2019	8943.792	8778.732	60	Marcellus
46	4/14/2019	8743.32	8578.26	60	Marcellus
47	4/15/2019	8542.848	8377.788	60	Marcellus
48	4/15/2019	8342.376	8177.316	60	Marcellus
49	4/15/2019	8141.904	7976.844	60	Marcellus
50	4/15/2019	7941.432	7776.372	60	Marcellus
51	4/16/2019	7740.96	7575.9	60	Marcellus
52	4/16/2019	7540.488	7375.428	60	Marcellus
53	4/16/2019	7340.016	7174.956	60	Marcellus

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EXHIBIT 2

Stage No.	Stimulations Date	Avg Pump Rate	Avg Treatment Pressure (PSI)	Max Breakdown Pressure (PSI)	ISIP (PSI)	Amount of Proppant (lbs)	Amount of Water (bbls)	Amount of Nitrogen/ other (units)
1	4/1/2019	74.7	7803		3454	266750	7429.1	N/A
2	4/1/2019	70.71	8009	6381	4309	415220	9032.8	N/A
3	4/2/2019	72.51	7976	6164	4304	408560	8862.9	N/A
4	4/2/2019	72.2	8398	5952	3419	398360	9161.5	N/A
5	4/2/2019	71.9	8249	5797	3518	404420	10236.9	N/A
6	4/3/2019	69.85	8069	6156	3308	403000	8814	N/A
7	4/3/2019	72.8	7954	6519	3492	402360	8875	N/A
8	4/3/2019	57.7	8113	4610	4178	403940	11928	N/A
9	4/3/2019	66.31	7770	6179	3263	409020	9269	N/A
10	4/4/2019	67.68	7734	6140	3374	408960	8781	N/A
11	4/4/2019	74.2	8186	5682	3458	417020	8819	N/A
12	4/4/2019	75.6	8176	6113	3272	415440	9046	N/A
13	4/4/2019	74.25	7842	6458	3351	418140	8854	N/A
14	4/5/2019	77.08	7943	5982	3461	413260	8699	N/A
15	4/5/2019	77.18	7902	4677	3398	415960	8952	N/A
16	4/5/2019	76.77	8015	5913	3287	420740	9051	N/A
17	4/6/2019	75.16	7908	6579	3415	413360	8929	N/A
18	4/6/2019	72.93	7909	6633	3321	416400	8971	N/A
19	4/6/2019	74.63	8161	9828	3393	418360	8971	N/A
20	4/6/2019	76.02	7906	6728	3130	410320	8856	N/A
21	4/7/2019	74.33	7959	6418	3520	416900	8910	N/A
22	4/7/2019	77.04	8012	6421	3628	394740	9629	N/A
23	4/7/2019	73.51	7896	6691	3609	395020	8622	N/A
24	4/8/2019	76.76	7726	6056	3778	401800	8800	N/A
25	4/8/2019	77.67	7969	5894	3845	400860	8862	N/A
26	4/8/2019	71.07	8063	5584	3667	398200	9118	N/A
27	4/8/2019	76.45	7710	6113	3763	402480	8687	N/A
28	4/9/2019	70.6	7562	6128	3775	399960	8550	N/A
29	4/9/2019	79.2	7920	5794	3850	400200	8828	N/A
30	4/9/2019	78.05	8019	6436	3663	399240	8732	N/A
31	4/10/2019	77.62	7919	6350	3747	399720	8634	N/A
32	4/10/2019	77.14	7996	5575	3714	400080	8550	N/A
33	4/10/2019	78.53	7723	5890	3752	400100	8639	N/A
34	4/11/2019	75.39	7532	6655	3882	399820	8508	N/A
35	4/11/2019	72.12	7260	6488	3636	400080	9123	N/A
36	4/11/2019	74.55	7645	6081	3735	399520	8476	N/A
37	4/12/2019	78.29	7463	6185	3720	399960	8515	N/A
38	4/12/2019	76.26	7867	6050	3840	400940	8532	N/A
39	4/12/2019	80.07	7695	5844	3707	399820	8646	N/A
40	4/12/2019	75.4	7586	5962	3755	399640	8710	N/A
41	4/13/2019	74.61	7874	5019	3784	400160	8665	N/A
42	4/13/2019	78.08	7422	5688	3767	400260	8530	N/A
43	4/13/2019	77.39	7365	5866	3650	400240	8515	N/A
44	4/14/2019	78.54	7395	6419	3629	400300	8310	N/A
45	4/14/2019	75.13	7266	6172	3688	400060	8461	N/A
46	4/14/2019	76.61	7118	6190	3626	400220	8515	N/A
47	4/15/2019	78.68	7235	6037	3634	400400	8347	N/A
48	4/15/2019	79.3	7297	7151	3914	400160	8454	N/A
49	4/15/2019	78.28	7194	6765	3570	400320	8504	N/A
50	4/15/2019	79.16	7111	6266	3524	400280	8606	N/A
51	4/16/2019	78.23	7306	6359	4099	400080	8567	
52	4/16/2019	79.56	7074	5963	3611	400180	8398	N/A
53	4/16/2019	80.34	6840	5503	3564	398480	8384	N/A
	AVG	74.5	7,841	6,143	3,627	18,089,690	399,090	TOTAL

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EXHIBIT 3

LITHOLOGY/ FORMATION	TOP DEPTH (TVD)	BOTTOM DEPTH (TVD)	TOP DEPTH (MD)	BOTTOM DEPTH (MD)
	From Surface	From Surface	From Surface	From Surface
Silty Sandstone	75	215	75	215
Silty Shale	215	255	215	255
shaly sand	255	395	255	395
Shale	395	455	395	455
Dolomitic Shale	455	735	455	735
Shaly Siltstone	735	855	735	855
Silty Sandstone	855	895	855	895
Shaly Sand	895	1,015	895	1,015
Sandstone	1,015	1,055	1,015	1,055
Silty, Shaly, Sandstone	1,055	1,095	1,055	1,095
Sandstone, Tr Shale, Tr Coal	1,095	1,495	1,095	1,495
Silty Sandstone	1,495	1,675	1,495	1,675
Shaly Siltstone	1,675	1,850	1,675	1,907
Big Lime	1,875	2,612	1,932	2,772
Fifty Foot Sandstone	2,612	2,714	2,772	2,885
Gordon	2,714	3,046	2,885	3,261
Fifth Sandstone	3,046	3,099	3,261	3,321
Bayard	3,099	3,816	3,321	4,119
Speechley	3,816	4,116	4,119	4,456
Balltown	4,116	4,512	4,456	4,901
Bradford	4,512	4,750	4,901	5,300
Benson	4,750	5,160	5,300	5,628
Alexander	5,160	6,182	5,628	6,812
Sycamore	6,050	6,157	6,643	6,787
Middlesex	6,157	6,258	6,787	6,965
Burkett	6,258	6,294	6,965	7,050
Tully	6,294	6,320	7,050	7,128
Marcellus	6,320	NA	7,128	NA

*Please note Antero determines formation tops based on mud logs that are only run on one well on a multi-well pad. The measured depth (MD) data on subsequent wells may be slightly different due to the well's unique departure.

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Hydraulic Fracturing Fluid Product Component Information Disclosure

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Frac Focus
Chemical Disclosure Registry



Job Start Date:	4/1/2019
Job End Date:	5/2/2019
State:	West Virginia
County:	Ritchie
API Number:	47-085-10358-00-00
Operator Name:	Antero Resources Corporation
Well Name and Number:	Christopher 2H
Latitude:	39.36483600
Longitude:	-80.91035300
Datum:	NAD83
Federal Well:	NO
Indian Well:	NO
True Vertical Depth:	6,377
Total Base Water Volume (gal):	20,247,958
Total Base Non Water Volume:	0

Hydraulic Fracturing Fluid Composition:

Trade Name	Supplier	Purpose	Ingredients	Chemical Abstract Service Number (CAS #)	Maximum Ingredient Concentration in Additive (% by mass)**	Maximum Ingredient Concentration in HF Fluid (% by mass)**	Comments
Fresh Water	Operator	Base Fluid					
			Water	7732-18-5	100.00000	88.59258	Density = 8.340
Ingredients	Listed Above	Listed Above					
			Water	7732-18-5	100.00000	0.20364	

				Hydrochloric acid	7647-01-0	15.00000	0.02393	
				Inorganic salt	Proprietary	30.00000	0.01448	
				Hydrotreated light petroleum distillate	64742-47-8	30.00000	0.01448	
				Acrylamide acrylate polymer	Proprietary	30.00000	0.01448	
				Guar gum	9000-30-0	100.00000	0.00823	
				Ethylene glycol	107-21-1	60.00000	0.00779	
				Glutaraldehyde	111-30-8	30.00000	0.00266	
				Telmer	Proprietary	10.00000	0.00130	
				Quaternary ammonium compounds, benzyl-C12-16-alkyldimethyl chlorides	68424-85-1	5.00000	0.00044	
				Sodium persulfate	7775-27-1	100.00000	0.00020	
				Sodium polyacrylate	9003-04-7	1.00000	0.00013	
				Methanol	67-56-1	100.00000	0.00013	
				Ethanol	64-17-5	1.00000	0.00009	
				Modified thiourea polymer	Proprietary	30.00000	0.00003	
				Phosphoric acid	7664-38-2	0.10000	0.00001	
				Ethoxylated alcohols	Proprietary	5.00000	0.00001	
				Propargyl alcohol	107-19-7	5.00000	0.00001	
				Acrylic acid	79-10-7	0.01000	0.00000	
				Sodium sulfate	7757-82-6	0.10000	0.00000	

* Total Water Volume sources may include various types of water including fresh water, produced water, and recycled water

** Information is based on the maximum potential for concentration and thus the total may be over 100%

*** If you are calculating a percentage of total ingredients do not add the water volume below the green line to the water volume above the green line

Note: For Field Development Products (products that begin with FDP), MSDS level only information has been provided. Ingredient information for chemicals subject to 29 CFR 1910.1200(i) and Appendix D are obtained from suppliers Material Safety Data Sheets (MSDS)

LATITUDE 39°22'30"

9,996'

11,237'

LATITUDE 39°25'00"

Antero Resources Corporation Well No. Christopher Unit 2H

AS DRILLED DATA: WELL 2H TOP HOLE INFORMATION: N: 318,121ft E: 1,601,260ft LAT: 39°21'53.41" LON: 80°54'37.27" BOTTOM HOLE INFORMATION: N: 329,031ft E: 1,600,186ft LAT: 39°23'41.07" LON: 80°54'53.14" 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 2H TOP HOLE INFORMATION: N: 4,357,277m E: 507,737m BOTTOM HOLE INFORMATION: N: 4,360,595m E: 507,354m

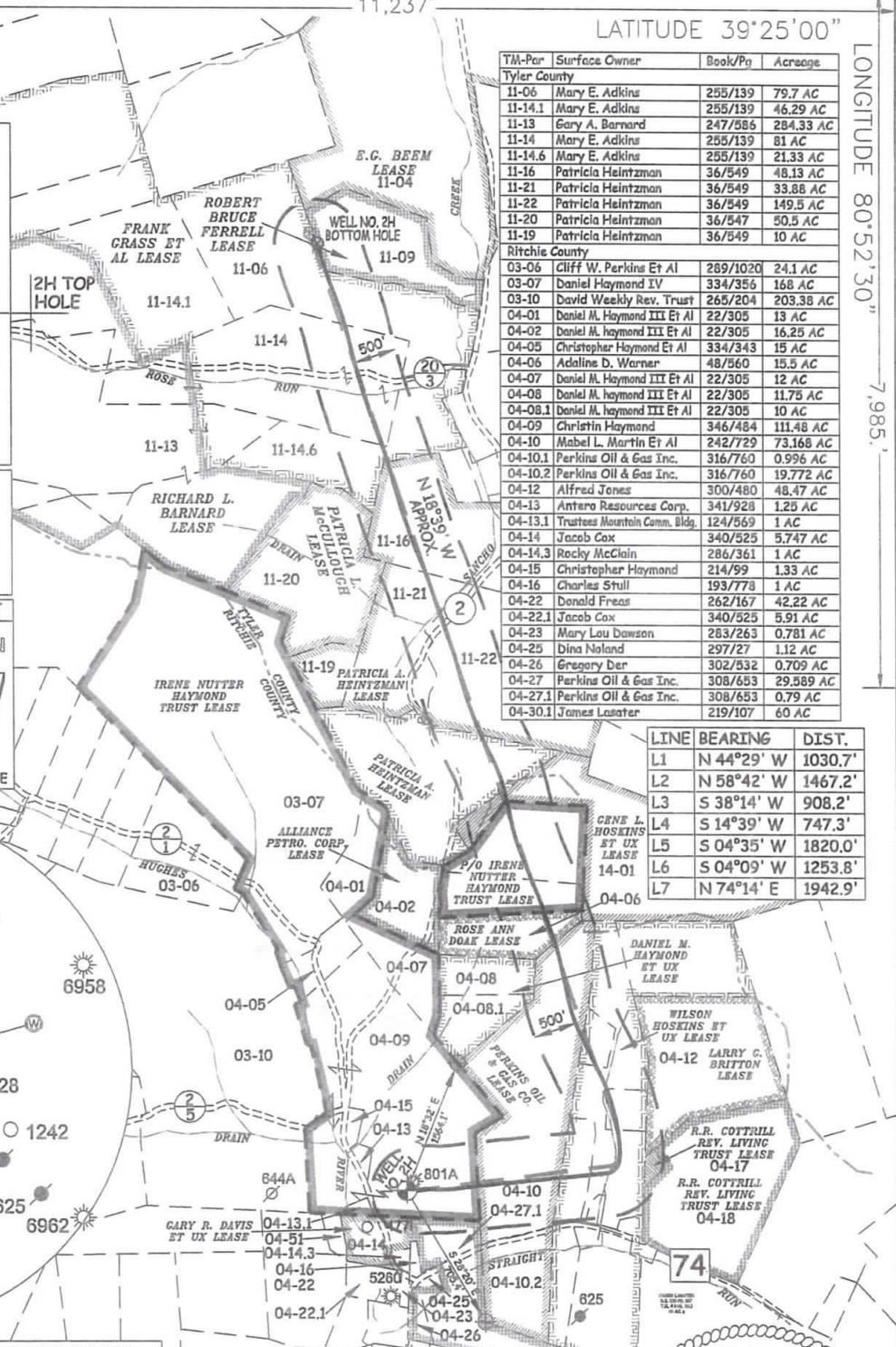
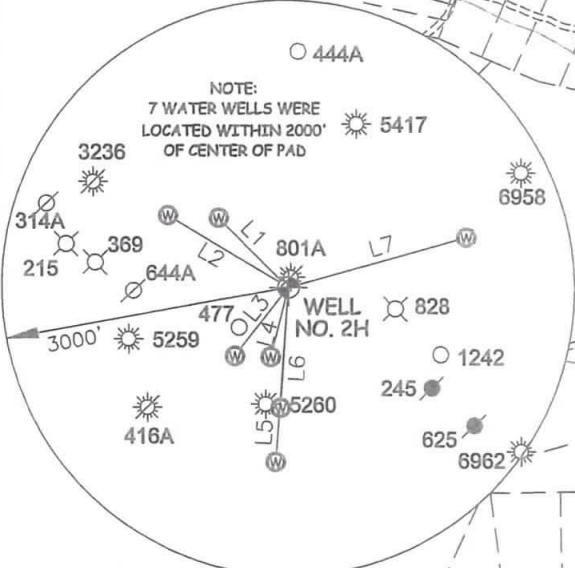
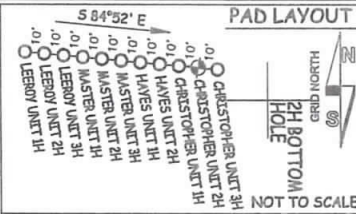


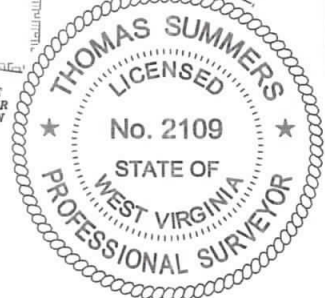
Table with columns: TM-Par, Surface Owner, Book/Pg, Acreage. Lists various land parcels and owners in Tyler and Ritchie Counties.

Table with columns: LINE, BEARING, DIST. Lists line bearings and distances for various points on the map.

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



Form containing job details: JOB # 17-017WA, DRAWING # CHRISTOPHER2HAD, 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, DATE 09/04/19, OPERATOR'S WELL# CHRISTOPHER UNIT #2H

LEGEND table with symbols for Surface Owner Boundary Lines +/-, Interior Surface Tracts +/-, Proposed Well Path, As Drilled Well Path. Includes signature of Thomas Summers and name THOMAS SUMMERS P.S. 2109.

- NOTES: 1. NO OCCUPIED DWELLINGS OR BUILDINGS TWO THOUSAND FIVE HUNDRED (2,500) SQUARE FEET OR LARGER... 2. TOP HOLE DATA SHOWN HEREON WAS PROVIDED BY ANTERO RESOURCES CORPORATION... 3. AS DRILLED DATA WAS PROVIDED BY ANTERO RESOURCES CORPORATION... 4. WLS IS NOT CERTIFYING THE DATA AND INFORMATION PROVIDED LISTED IN NOTES 2 AND 3... 5. WLS IS BY NO MEANS RESPONSIBLE FOR ANY ERRORS OR INACCURACIES WITH THE DATA AND INFORMATION THAT HAS BEEN PROVIDED.

Form containing well type and location details: WELL TYPE: OIL GAS X LIQUID INJECTION WASTE DISPOSAL 47 - 085 - 10358 (IF "GAS") PRODUCTION X STORAGE DEEP SHALLOW X STATE COUNTY PERMIT LOCATION: ELEVATION 970' - AS BUILT WATERSHED NORTH FORK HUGHES RIVER QUADRANGLE PENNSBORO 7.5' (TH) - MIDDLEBOURNE 7.5' (BH) DISTRICT CLAY COUNTY RITCHIE SURFACE OWNER DANIEL M. HAYMOND IV ET AL ACREAGE 111.48 ACRES +/- OIL & GAS ROYALTY OWNER IRENE NUTTER HAYMOND TRUST; PERKINS OIL & GAS CO.; WILSON HOSKINS ET UX; ROSE ANN DOAK; GENE L. HOSKINS ET UX; PATRICIA A. HEINTZMAN; PATRICIA A. HEINTZMAN; FRANK GRASS ET AL; ROBERT BRUCE FERRELL LEASE ACREAGE 375 AC +/-; 94 AC +/-; 120 AC +/-; 15,963 AC +/-; 87 AC +/-; 60 AC +/-; 149.5 AC +/-; 431.29 AC +/-; 29.12 AC +/- PROPOSED WORK: DRILL CONVERT DRILL DEEPER REDRILL FRACTURE OR STIMULATE PLUG OFF OLD FORMATION PERFORATE NEW FORMATION OTHER PHYSICAL CHANGE IN WELL (SPECIFY) AS DRILLED PLUG & ABANDON CLEAN OUT & REPLUG TARGET FORMATION MARCELLUS ESTIMATED DEPTH 6,358' TVD 17,827' MD WELL OPERATOR ANTERO RESOURCES CORP. DESIGNATED AGENT DIANNA STAMPER - CT CORPORATION SYSTEM ADDRESS 1615 WYNKOOP ST. ADDRESS 5400 D BIG TYLER ROAD DENVER, CO 80202 CHARLESTON, WV 25313