

Reviewed

11/09/2018

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WR-35
Rev. 8/23/13

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

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WV Department of
Environmental Protection

API 47 - 017 - 06777 County Doddridge District Central
Quad West Union 7.5' Pad Name Long Run Pad Field/Pool Name -----
Farm name Richard F. McCullough, et al Well Number Mossor Unit 1H
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 4350125m Easting 511741m
Landing Point of Curve Northing 4350379.75m Easting 512089.52m
Bottom Hole Northing 4352522m Easting 511393m

Elevation (ft) 1021' 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 10/25/2016 Date drilling commenced 12/16/2016 Date drilling ceased 5/6/2017
Date completion activities began 6/17/2017 Date completion activities ceased 7/1/2016
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 53' Open mine(s) (Y/N) depths No
Salt water depth(s) ft 884' Void(s) encountered (Y/N) depths No
Coal depth(s) ft N/A Cavern(s) encountered (Y/N) depths No
Is coal being mined in area (Y/N) No

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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"	65'	New	94#, H-40	N/A	Y
Surface	17-1/2"	13-3/8"	529'	New	48#, H-40	N/A	Y
Coal							
Intermediate 1	12-1/4"	9-5/8"	2578'	New	36#, J-55	N/A	Y
Intermediate 2							
Intermediate 3							
Production	8-3/4"/8-1/2"	5-1/2"	14480'	New	23#, P-110	N/A	Y
Tubing		2-3/8"	N/A		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 ³)	Cement Top (MD)	WOC (hrs)
Conductor	Class A	102 sx	15.6	1.18	120	0'	8 Hrs.
Surface	Class A	620 sx	15.6	1.19	738	0'	8 Hrs.
Coal							
Intermediate 1	Class A	892 sx	15.6	1.18	1053	0'	8 Hrs.
Intermediate 2							
Intermediate 3							
Production	Class H	742 sx (Lead) 1124 sx (Tail)	13.50 (Lead), 15.20 (Tail)	1.56 (Lead), 1.83 (Tail)	3214	-500' into Intermediate Casing	8 Hrs.
Tubing							

Drillers TD (ft) 14480' MD, 6465' TVD (BHL), 6480' (Deepest Point Drilled) Loggers TD (ft) 14480' MD

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

Plug back procedure N/A

Kick off depth (ft) 6051'

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

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WAS WELL COMPLETED AS SHOT HOLE Yes No DETAILS APR 30 2018

WAS WELL COMPLETED OPEN HOLE? Yes No DETAILS WV Department of Environmental Protection

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

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<u>PRODUCING FORMATION(S)</u>	<u>DEPTHS</u>		
<u>Marcellus</u>	<u>6425' (TOP)</u>	<u>TVD</u>	<u>6775' (TOP)</u> <u>MD</u>
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

Please insert additional pages as applicable.

GAS TEST Build up Drawdown Open Flow OIL TEST Flow Pump

SHUT-IN PRESSURE Surface 3100 psi Bottom Hole --- psi DURATION OF TEST --- hrs

OPEN FLOW Gas 12036 mcfpd Oil 57 bpd NGL --- bpd Water 1 bpd GAS MEASURED BY Estimated Orifice Pilot

LITHOLOGY/ FORMATION	TOP DEPTH IN FT	BOTTOM DEPTH IN FT	TOP DEPTH IN FT	BOTTOM DEPTH IN FT	DESCRIBE ROCK TYPE AND RECORD QUANTITY AND TYPE OF FLUID (FRESHWATER, BRINE, OIL, GAS, H ₂ S, ETC)
NAME	TVD	TVD	MD	MD	

***PLEASE SEE ATTACHED EXHIBIT 3**

Please insert additional pages as applicable.

Drilling Contractor Frontier Drilling LLC
Address 562 Spring Run Road City Pennsboro State WV Zip 26415

Logging Company Pro Oil & Gas Services LLC
Address 3035 Lynnwood Drive City Hermitage State PA Zip 16148

Cementing Company C&J Energy Services
Address 1650 Hackers Creek City Jane Lew State WV Zip 26378

Stimulating Company Baker Hughes
Address 837 Philippi Pike City Clarksburg State WV Zip 26301

Please insert additional pages as applicable.

Completed by Mallory Stanton Telephone 303-357-7182 WV Department of
Signature _____ Title Permitting Supervisor Date 4/27/2018 Environmental Protection

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API 47-017-06777 Farm Name Richard F. McCullough et al Well Number Mossor Unit 1H					
EXHIBIT 1					
Stage No.	Perforation Date	Perforated from MD ft.	Perforated to MD ft.	Number of Perforations	Formations
1	9/29/2017	14209	14377	60	Marcellus
2	9/30/2017	14009	14178	60	Marcellus
3	9/30/2017	13809	13978	60	Marcellus
4	10/1/2017	13610	13778	60	Marcellus
5	10/2/2017	13410	13578	60	Marcellus
6	10/2/2017	13210	13379	60	Marcellus
7	10/2/2017	13011	13179	60	Marcellus
8	10/3/2017	12811	12979	60	Marcellus
9	10/4/2017	12611	12779	60	Marcellus
10	10/4/2017	12411	12580	60	Marcellus
11	10/5/2017	12212	12380	60	Marcellus
12	10/5/2017	12012	12180	60	Marcellus
13	10/6/2017	11812	11981	60	Marcellus
14	10/6/2017	11612	11781	60	Marcellus
15	10/7/2017	11413	11581	60	Marcellus
16	10/7/2017	11213	11381	60	Marcellus
17	10/8/2017	11013	11182	60	Marcellus
18	10/9/2017	10813	10982	60	Marcellus
19	10/9/2017	10614	10782	60	Marcellus
20	10/10/2017	10414	10582	60	Marcellus
21	10/11/2017	10214	10383	60	Marcellus
22	10/12/2017	10014	10183	60	Marcellus
23	10/12/2017	9815	9983	60	Marcellus
24	10/12/2017	9615	9783	60	Marcellus
25	10/13/2017	9415	9584	60	Marcellus
26	10/13/2017	9215	9384	60	Marcellus
27	10/14/2017	9016	9184	60	Marcellus
28	10/14/2017	8816	8984	60	Marcellus
29	10/15/2017	8616	8785	60	Marcellus
30	10/15/2017	8416	8585	60	Marcellus
31	10/16/2017	8217	8385	60	Marcellus
32	10/16/2017	8017	8185	60	Marcellus
33	10/17/2017	7817	7986	60	Marcellus
34	10/17/2017	7618	7786	60	Marcellus
35	10/18/2017	7418	7586	60	Marcellus
36	10/18/2017	7218	7386	60	Marcellus
37	10/18/2017	7018	7187	60	Marcellus
38	10/19/2017	6819	6987	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 (bbbls)	Amount of Nitrogen/ other (units)
1	9/29/2017	71.7	7529	5749	4419	407250	10199	N/A
2	9/30/2017	75.1	7049	6104	3471	407250	8621	N/A
3	9/30/2017	75.4	6801	6486	3608	410480	8956	N/A
4	10/1/2017	76.2	6969	6119	3546	408450	8479	N/A
5	10/2/2017	76.6	6893	5690	3989	406550	8557	N/A
6	10/2/2017	76.3	6967	5720	3644	408100	8393	N/A
7	10/2/2017	76.6	6831	5867	3991	407850	8902	N/A
8	10/3/2017	75.9	7031	5939	3555	408050	8438	N/A
9	10/4/2017	72.3	6838	5938	3720	408400	8599	N/A
10	10/4/2017	77.2	7045	5446	3889	408400	8778	N/A
11	10/5/2017	72.4	7067	5957	3860	407700	9882	N/A
12	10/5/2017	74	7057	5933	3701	407500	9416	N/A
13	10/6/2017	69.3	6534	5597	3683	407450	8728	N/A
14	10/6/2017	73.8	6697	5980	3927	407400	8602	N/A
15	10/7/2017	72.4	6748	5825	3893	407950	8846	N/A
16	10/7/2017	76.7	6522	5862	3904	408100	8441	N/A
17	10/8/2017	73.4	6659	5941	3875	407300	8770	N/A
18	10/9/2017	70.5	6314	5659	3813	412650	8668	N/A
19	10/9/2017	74.8	6650	5974	3920	411300	8505	N/A
20	10/10/2017	75.8	6509	6570	3889	408850	8245	N/A
21	10/11/2017	72.8	6761	5973	3778	408500	8334	N/A
22	10/12/2017	75.4	6683	5754	3934	407850	8422	N/A
23	10/12/2017	75.6	6576	5555	3822	410050	8360	N/A
24	10/12/2017	78.8	6648	5605	4165	409250	8135	N/A
25	10/13/2017	74.7	6802	5709	4409	408450	8379	N/A
26	10/13/2017	78.8	6761	5446	4976	410550	8751	N/A
27	10/14/2017	76	6591	5248	4995	407750	8270	N/A
28	10/14/2017	79	6732	5697	4193	409350	8246	N/A
29	10/15/2017	78.3	6793	5267	5191	408800	8421	N/A
30	10/15/2017	76.4	6355	5125	4434	410350	8201	N/A
31	10/16/2017	73.3	6588	5555	4017	407950	8204	N/A
32	10/16/2017	78.3	6454	5500	4238	408400	8220	N/A
33	10/17/2017	79	6261	5139	4356	408650	8218	N/A
34	10/17/2017	77.4	6267	5887	4705	408150	8276	N/A
35	10/18/2017	79.1	6315	5255	4836	408100	8139	N/A
36	10/18/2017	78	6247	5920	5137	408450	8195	N/A
37	10/18/2017	79.1	6155	5031	5007	410500	8428	N/A
38	10/19/2017	79.5	6240	5704	4988	408900	8205	N/A
	AVG=	75.1	6,764	5,775	4,014	13,074,230	275,968	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
Fresh Water	66'	N/A	N/A	N/A
Sandy siltstone	0	67	0	80
Silty sandstone	67	107	67	120
Sandy siltstone	107	387	107	400
Silty sandstone (tr coal)	387	587	387	600
Sandy shale	587	627	587	640
Silty limestone	627	707	627	720
Silty shale	707	787	707	800
Siltstone	787	867	787	880
Sandstone	867	947	867	960
Shaly sandstone	947	1,067	947	1,080
Silty sandstone (tr coal)	1,067	1,267	1,067	1,280
Silty shale	1,267	1,507	1,267	1,520
Sandy shale (tr coal)	1,507	1,677	1,507	1,690
Shaly sandstone	1,677	1,727	1,677	1,740
Silty shale	1,727	1,881	1,727	1,895
Big Lime	1,881	2,585	1,895	2,623
Fifty Foot Sandstone	2,585	2,686	2,623	2,727
Gordon	2,686	3,184	2,727	3,242
Fifth Sandstone	3,184	3,233	3,242	3,294
Bayard	3,233	3,704	3,294	3,780
Speechley	3,704	4,000	3,780	4,086
Baltown	4,000	4,515	4,086	4,618
Bradford	4,515	4,918	4,618	5,031
Benson	4,918	5,153	5,031	5,273
Alexander	5,153	5,800	5,273	5,939
Rhinestreet	5,800	6,077	5,939	6,256
Sycamore	6,077	6,244	6,232	6,454
Middlesex	6,244	6,364	6,430	6,644
Burkett	6,364	6,394	6,620	6,707
Tully	6,394	6,425	6,683	6,799
Marcellus	6,425	NA	6,775	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

Job Start Date:	9/29/2017
Job End Date:	10/19/2017
State:	West Virginia
County:	Doddridge
API Number:	47-017-06777-00-00
Operator Name:	Antero Resources Corporation
Well Name and Number:	Mossor Unit 1HST2
Latitude:	39.30042800
Longitude:	-80.86383300
Datum:	NAD83
Federal Well:	NO
Indian Well:	YES
True Vertical Depth:	6,466
Total Base Water Volume (gal):	14,074,037
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
Water	Supplied by Operator	Base Fluid					
			Water	7732-18-5	70.00000	87.96389	
Sand (Proppant)	CWS	Propping Agent					
				Listed Below			

DWP-641	CWS	Friction Reducer					
				Listed Below			
DWP-111	CWS	Gel Slurry					
				Listed Below			
SANIFRAC 8844	CWS	Biocide					
				Listed Below			
CI-9100G	CWS	Corrosion Inhibitor					
				Listed Below			
DAP-103	CWS	Iron Control					
				Listed Below			
Hydrochloric Acid	CWS	Clean Perforations					
				Listed Below			
DAP-902	CWS	Scale Inhibitor					
				Listed Below			
Calbreak 5501	CWS	Breaker					
				Listed Below			
Other Chemical (s)	Listed Above	See Trade Name (s) List					

				Listed Below			
Items above are Trade Names with the exception of Base Water . Items below are the individual ingredients.							
			Crystalline silica (Quartz)	14808-60-7	100.00000	11.63816	
			Calcite	471-34-1	1.00000	0.08960	
			Hydrochloric acid	7647-01-0	37.00000	0.05592	
			Guar gum	9000-30-0	60.00000	0.04658	
			Distillates (petroleum), hydrotreated middle	64742-46-7	60.00000	0.04658	
			Polymer	26100-47-0	45.00000	0.02846	
			Illite	12173-60-3	1.00000	0.02674	
			Distillates (petroleum), hydrotreated light	64742-47-8	30.00000	0.01897	
			Goethite	1310-14-1	0.10000	0.01163	
			Apatite	64476-38-6	0.10000	0.01163	
			Biotite	1302-27-8	0.10000	0.01163	
			Ammonium Persulfate	64742-47-8	100.00000	0.00943	
			Ammonium chloride	12125-02-9	11.00000	0.00696	
			Polyethylene glycol mixture	25322-68-3	54.50000	0.00619	
			2-Propenoic acid, homopolymer, sodium salt	9003-04-7	40.00000	0.00611	
			Quaternary ammonium compounds, bis (hydrogenated tallow alkyl)dimethyl, salts with bentonite	68953-58-2	5.00000	0.00388	
			Ilmenite	98072-94-7	0.10000	0.00267	
			Sorbitan monooleate	1338-43-8	4.00000	0.00253	
			2,2-Dibromo-3-Nitrilopropionamide	10222-01-2	20.00000	0.00227	
			Polyethylene glycol monooleate	9004-96-0	3.00000	0.00190	
			Vinylidene chloride-methyl acrylate copolymer	69418-26-4	20.00000	0.00189	

			1,2-Propanediol	57-55-6	10.00000	0.00153	
			Sorbitol tetraoleate	61723-83-9	2.00000	0.00126	
			Oxirane, 2-methyl-, polymer with oxirane, monodecyl ether	37251-67-5	1.50000	0.00116	
			Amines, tallow alkyl, ethoxylated	61791-26-2	1.00000	0.00063	
			Citric acid	77-92-9	60.00000	0.00051	
			Sodium bromide	7647-15-6	4.00000	0.00045	
			Dibromoacetonitrile	3252-43-5	3.00000	0.00034	
			Alkyloxypolyethyleneoxy ethanol	84133-50-6	0.50000	0.00032	
			Acrylamide	79-06-1	0.10000	0.00006	
			Ethylene glycol	107-21-1	40.00000	0.00003	
			Diethylene glycol (mono) methyl ether	34590-94-8	20.00000	0.00002	
			Diethylene glycol	111-46-6	1.00000	0.00001	
			Formic Acid	64-18-6	10.00000	0.00001	
			Tar bases, quinolone derivs, benzyl chloride- quatenized	72480-70-7	10.00000	0.00001	
			Cinnamaldehyde	104-55-2	10.00000	0.00001	
			Tar bases, quinolone derivs	68513-87-1	1.00000	0.00001	
			Isopropanol	67-63-0	5.00000	0.00001	
			Ethoxylated alcohols	Proprietary	10.00000	0.00001	Proprietary CAS

* 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)

