



west virginia department of environmental protection

Office of Oil and Gas
601 57th Street, S.E.
Charleston, WV 25304
(304) 926-0450
fax: (304) 926-0452

Austin Caperton, Cabinet Secretary
www.dep.wv.gov

Monday, June 22, 2020
WELL WORK PERMIT
Horizontal 6A / New Drill

TUG HILL OPERATING, LLC
380 SOUTHPOINTE BLVD

CANONSBURG, PA 15317

Re: Permit approval for FITZGERALD S-17HU
47-051-02324-00-00

This well work permit is evidence of permission granted to perform the specified well work at the location described on the attached pages and located on the attached plat, subject to the provisions of Chapter 22 of the West Virginia Code of 1931, as amended, and all rules and regulations promulgated thereunder, and to any additional specific conditions and provisions outlined in the pages attached hereto. Notification shall be given by the operator to the Oil and Gas Inspector at least 24 hours prior to the construction of roads, locations, and/or pits for any permitted work. In addition, the well operator shall notify the same inspector 24 hours before any actual well work is commenced and prior to running and cementing casing. Spills or emergency discharges must be promptly reported by the operator to 1-800-642-3074 and to the Oil and Gas Inspector.

Please be advised that form WR-35, Well Operators Report of Well Work is to be submitted to this office within 90 days of completion of permitted well work, as should form WR-34 Discharge Monitoring Report within 30 days of discharge of pits, if applicable. Failure to abide by all statutory and regulatory provisions governing all duties and operations hereunder may result in suspension or revocation of this permit and, in addition, may result in civil and/or criminal penalties being imposed upon the operators.

Per 35 CSR 4-5.2.g this permit will expire in two (2) years from the issue date unless permitted well work is commenced. If there are any questions, please feel free to contact me at (304) 926- 0450.

James A. Martin
Chief

Operator's Well Number: FITZGERALD S-17HU
Farm Name: DANNY AND FRANCES KER+
U.S. WELL NUMBER: 47-051-02324-00-00
Horizontal 6A New Drill
Date Issued: 6/22/2020

PERMIT CONDITIONS

West Virginia Code § 22-6A-8(d) allows the Office of Oil and Gas to place specific conditions upon this permit. Permit conditions have the same effect as law. Failure to adhere to the specified permit conditions may result in enforcement action.

CONDITIONS

1. This proposed activity may require permit coverage from the United States Army Corps of Engineers (USACE). Through this permit, you are hereby being advised to consult with USACE regarding this proposed activity.
2. If the operator encounters an unanticipated void, or an anticipated void at an unanticipated depth, the operator shall notify the inspector within 24 hours. Modifications to the casing program may be necessary to comply with W. Va. Code § 22-6A-5a (12), which requires drilling to a minimum depth of thirty feet below the bottom of the void, and installing a minimum of twenty (20) feet of casing. Under no circumstance should the operator drill more than one hundred (100) feet below the bottom of the void or install less than twenty (20) feet of casing below the bottom of the void.
3. When compacting fills, each lift before compaction shall not be more than 12 inches in height, and the moisture content of the fill material shall be within limits as determined by the Standard Proctor Density test of the actual soils used in specific engineered fill, ASTM D698, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort, to achieve 95 % compaction of the optimum density. Each lift shall be tested for compaction, with a minimum of two tests per lift per acre of fill. All test results shall be maintained on site and available for review.
4. Operator shall install signage per § 22-6A-8g (6) (B) at all source water locations included in their approved water management plan within 24 hours of water management plan activation.
5. Oil and gas water supply wells will be registered with the Office of Oil and Gas and all such wells will be constructed and plugged in accordance with the standards of the Bureau for Public Health set forth in its Legislative rule entitled *Water Well Regulations*, 64 C.S.R. 19. Operator is to contact the Bureau of Public Health regarding permit requirements. In lieu of plugging, the operator may transfer the well to the surface owner upon agreement of the parties. All drinking water wells within fifteen hundred feet of the water supply well shall be flow tested by the operator upon request of the drinking well owner prior to operating the water supply well.
6. Pursuant to the requirements pertaining to the sampling of domestic water supply wells/springs the operator shall, no later than thirty (30) days after receipt of analytical data provide a written copy to the Chief and any of the users who may have requested such analyses.
7. 24 hours prior to the initiation of the completion process the operator shall notify the Chief or his designee.
8. During the completion process the operator shall monitor annular pressures and report any anomaly noticed to the chief or his designee immediately.
9. If any explosion or other accident causing loss of life or serious personal injury occurs in or about a well or well work on a well, the well operator or its contractor shall give notice, stating the particulars of the explosion or accident, to the oil and gas inspector and the Chief, within 24 hours of said accident.
10. During the casing and cementing process, in the event cement does not return to the surface, the oil and gas inspector shall be notified within 24 hours.

PERMIT CONDITIONS

11. The operator shall provide to the Office of Oil and Gas the dates of each of the following within 30 days of their occurrence: completion of construction of the well pad, commencement of drilling, cessation of drilling, completion of any other permitted well work, and completion of the well. Such notice shall be provided by sending an email to DEPOOGNotify@wv.gov.



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Oil and Gas Conservation Commission
601 57th Street SE, Charleston, WV 25304
304-926-0499 Ext 41239

Randall M. Albert, Chairman
dep.wv.gov

June 11, 2020

Department of Environmental Protection
Office of Oil and Gas
Charleston, WV 25304

RE: Application for Deep Well Permit – API #47-051-02324

COMPANY: Tug Hill Operating, LLC

FARM: Danny and Frances Kerns Estate Fitzgerald S-17HU

COUNTY: Marshall DISTRICT: Liberty QUAD: Glen Easton

The deep well review of the application for the above company is **Approved to drill to Trenton for Point Pleasant completion. Pooling Docket No. 294-298.**

The applicant has complied with the provision of Chapter 22C-9, of the Code of West Virginia, nineteen hundred and thirty-one (1931), as amended, Oil and Gas Conservation Commission as follows:

1. Comments to Notice of Deviation filed? Yes
2. Provided a certified copy of duly acknowledged and recorded consent and easement form from all surface owners? Yes
3. Provided a tabulation of all deep wells within one mile of the proposed location, including the API number of all deep wells: **yes; Docket 294-298 Exception Location Hearing
4. Provided a plat showing that the proposed location is a distance of 400+ feet from the nearest lease line or unit boundary and showing the following wells drilled to or capable of producing from the objective formation within 3,000 feet of the proposed location.

Sincerely,

A handwritten signature in blue ink that reads "Susan Rose".

Susan Rose
Administrator

** Hudson S-13HU 47-051-02293; Hudson S-12HU 47-051-02292; Hudson S-11HU 47-051-02296, Ten High 1N-20HU 47-051-02021, Ten High 1N-13HU 47-051-01965; Ten High 1S-17HU 47-051-02033; Ten High 1S-16HU 47-051-02028; Ten High 1S-15HU 47-051-02027; Ten High 1S-14HU 47-051-01966; Fitzgerald S-18HU 47-051-02325; Fitzgerald S-19HU 47-051-02326

WW-6B
(04/15)

API NO. 47-051 -
OPERATOR WELL NO. Fitzgerald S-17HU
Well Pad Name: Fitzgerald

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

1) Well Operator: Tug Hill Operating, LLC 494510851 Marshall Liberty Glen Easton 7.5'
Operator ID County District Quadrangle

2) Operator's Well Number: Fitzgerald S-17HU Well Pad Name: Fitzgerald

3) Farm Name/Surface Owner: Danny R. Kerns Public Road Access: County Route 90

4) Elevation, current ground: 1316.5' Elevation, proposed post-construction: 1293.30'

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

(b) If Gas Shallow _____ Deep _____
Horizontal _____

6) Existing Pad: Yes or No No

Ju
3/4/2020

7) Proposed Target Formation(s), Depth(s), Anticipated Thickness and Expected Pressure(s):
Point Pleasant is the target formation at a depth of 11,914' - 11,781' - thickness of 133' and anticipated pressure of approx. 9500 psi.

8) Proposed Total Vertical Depth: 12,064'

9) Formation at Total Vertical Depth: Trenton, plug back to Reedsville

10) Proposed Total Measured Depth: 23,833'

11) Proposed Horizontal Leg Length: 8861.46'

12) Approximate Fresh Water Strata Depths: 70' ; 927'

13) Method to Determine Fresh Water Depths: Offset well reports or noticeable flow at the flowline or when need to start soaping

14) Approximate Saltwater Depths: 2,167'

15) Approximate Coal Seam Depths: Sewickley Coal - 835' ; Pittsburgh Coal - 921'

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

17) Does Proposed well location contain coal seams directly overlying or adjacent to an active mine? Yes No _____

(a) If Yes, provide Mine Info: Name: Marshall County Coal Co./Marshall County Mine
Depth: 1059' TVD and 291' subsea level
Seam: Pittsburgh #8
Owner: Murray Energy / Consolidated Coal Co.

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18) **CASING AND TUBING PROGRAM**

TYPE	<u>Size (in)</u>	<u>New or Used</u>	<u>Grade</u>	<u>Weight per ft. (lb/ft)</u>	<u>FOOTAGE: For Drilling (ft)</u>	<u>INTERVALS: Left in Well (ft)</u>	<u>CEMENT: Fill-up (Cu. Ft.)/CTS</u>
Conductor	30"	NEW	BW	BW	120'	120'	259FT^3(CTS)
Fresh Water	20"	NEW	J55	106.5#	1020'	1020'	1,644FT^3(CTS)
Coal	13 3/8"	NEW	J55	54.5#	2900'	2900'	2,044FT^3(CTS)
Intermediate	9 5/8"	NEW	HPP110	47#	11,400'	11,400'	3,714FT^3(CTS)
Production	5 1/2"	NEW	P110	23#	23,833'	23,833'	5,653FT^3(CTS)
Tubing	2 7/8"	NEW	P110	6.5#		13,954'	
Liners							

TYPE	<u>Size (in)</u>	<u>Wellbore Diameter (in)</u>	<u>Wall Thickness (in)</u>	<u>Burst Pressure (psi)</u>	<u>Anticipated Max. Internal Pressure (psi)</u>	<u>Cement Type</u>	<u>Cement Yield (cu. ft./k)</u>
Conductor	30"	36"	1.0	2,333	1,866	CLASS A	1.2
Fresh Water	20"	26"	.5	2,410	1,928	SEE # 24	1.2
Coal	13 3/8"	17 1/2"	.38	2,740	2,192	SEE #24	1.2
Intermediate	9 5/8"	12 1/4"	.472	10,730	6,968	SEE #24	1.99
Production	5 1/2"	8 1/2"	.415	16,510	10,864	SEE #24	1.18
Tubing	2 7/8"			11,385	9,108		
Liners							

PACKERS

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

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APR 30 REC'D

WW-6B
(10/14)

API NO. 47- 051 - _____
OPERATOR WELL NO. Fitzgerald S-17HU
Well Pad Name: Fitzgerald

JW
3/14/2020

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

Drill through the Point Pleasant and TD Pilot Hole 150' into the Trenton. Log vertical section and run a solid cement plug back to proposed KOP (13,454'). Drill curve and lateral per proposed well plan, run and cement production casing. Perform CBL from 60 deg to surface, make cleanout run, and stimulate.

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

Well to be completed with approximately 22,150,000 lb proppant and 342,455 bbl of water. Max rate = 80 bpm; max psi = 12,000#.

21) Total Area to be disturbed, including roads, stockpile area, pits, etc., (acres): 21.21 acres

22) Area to be disturbed for well pad only, less access road (acres): 7.44 acres

23) Describe centralizer placement for each casing string:

Will run 3 centralizers on surface casing at equal distance. Intermediate will have 1 centralizer every third joint. Production casing will have one centralizer every third joint in lateral, one centralizer every joint through curve, one centralizer every third joint to surface.

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

*See Attachment

25) Proposed borehole conditioning procedures:

Will circulate a minimum of 3 hours at TD, short trip to curve, circulate bottoms up, check for flow;
POOH

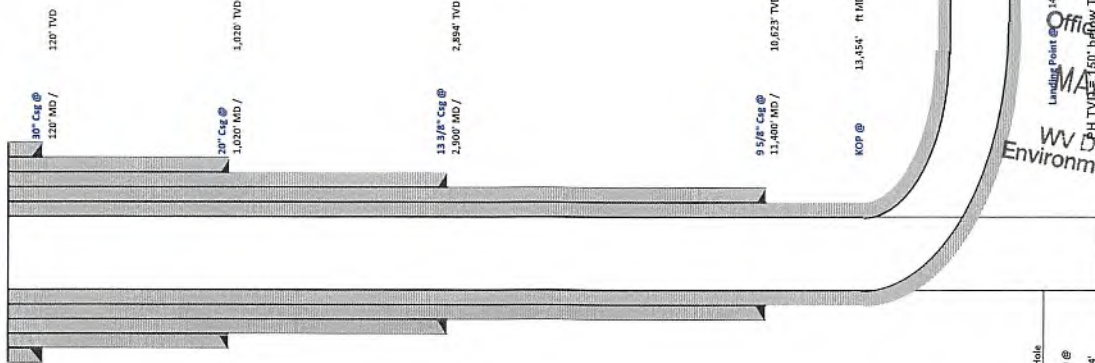
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*Note: Attach additional sheets as needed.

4705102324



WELL NAME: Fitzgerald S-17HU
STATE: WV COUNTY: Marshall
DISTRICT: Meade
DF Elev: 1,293' **GL Elev:** 1,293'
TD: 23,833'
TH Latitude: 39.801145
TH Longitude: -80.641103
BH Latitude: 39.7778644
BH Longitude: -80.64385981



Formation	Depth TVD
Deepest Fresh Water	92'
Sewidley Coal	885'
Pittsburgh Coal	921'
Big Lime	2,230'
Berea	2,848'
Tully	6,794'
Marcellus	6,907'
Onondaga	6,559'
Salina	7,682'
Lockport	8,691'
Ulica	11,513'
Point Pleasant	11,741'
Landing Depth	11,831'
Trenton	11,914'
Plot Hole TD	12,064'

Type	Hole Size [in]	Csg Size [in]	Depth [MD]	Depth [TVD]	Weight [lb/ft]	Grade	Top of Cement
Conductor	36	30	120'	120'	BW	BW	Surface
Surface	26	20	1,020'	1,020'	106.5	J55	Surface
Intermediate 1	17 1/2	13 3/8	2,900'	2,894'	54.5	J55	Surface
Intermediate 2	12 1/4	9 5/8	11,400'	10,623'	47	HPP110	Surface
Production	8 1/2	5 1/2	23,833'	11,986'	23	HCP110	Surface

CEMENT SUMMARY		DRILLING DETAILS	
Sacks	Class	Fluid Type	Centralizer Notes
338	A	Air	None
1,772	A	Air	3 Centralizers at equal distance
2,215	A	Air	1 Centralizer every other ft
3,056	A	Air	1 Centralizer every other ft
4,994	A	Air / SOBIM	1 every other joint in lateral; 1 per joint in curve; 1 every other ft to etc

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Lateral TD @ 23,833' ft MD
 11,986' ft TVD

Plot Hole PH TD @ 12,064'

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Tug Hill Operating, LLC Casing and Cement Program

Fitzgerald S-17HU

Casing

	String	Grade	Bit Size	Depth (Measured)	Cement Fill Up
Conductor	30"	BW	36"	120'	CTS
Surface	20"	J55	26"	1,020'	CTS
Intermediate 1	13 3/8"	J55	17 1/2"	2,900'	CTS
Intermediate 2	9 5/8"	HPP110	12 1/4"	11,400'	CTS
Production	5 1/2"	HCP110	8 1/2"	23,833'	CTS

Cement

Surface: Premium NE-1 + 2% bwoc CaC12 + 46.5% Fresh Water – Surface Cement mixed at 15.6 ppg, Y=1.2

Intermediate 1: Premium NE-1 + 1% bwoc CaC12 + 46.5% Fresh Water – Intermediate Cement mixed at 15.6 ppg, Y=1.2

Intermediate 2: Premium NE-1 + 1% bwoc CaC12 + 46.5% Fresh Water – Intermediate Cement mixed at 15.6 ppg, Y=1.99

Production: 50:50 Poz: Premium NE-1 + .1% bwoc ASA-301 + 60lb/sk ASCA-1 + .35% bwoc BA-10A + .25% bwoc MPA-170, 44 lb sack + .5% bwoc R-3 + .75 gals/100sk FP-13L – Production Cement mixed at 15.2ppg, Y = 1.18

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Well Site Safety Plan
Tug Hill Operating, LLC

JW
3/4/2020

Well Name: Fitzgerald S-17HU

Location: Fitzgerald Pad

Marshall County, West Virginia

UTM (meters), NAD83, Zone 17:

Northing: 4,405,748.20

Easting: 530,724.07

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Area of Review**Sources of information to Support 35CSR8 - 5.11: 9.3 et seq.**

Description of process to identify potential pathways for well communication during hydraulic fracturing activities.

Data Sources Reviewed:

1. IHS Well Data service: Public nationwide data service that pulls directly from State agency Oil and Gas databases
2. Farm Maps
3. Topo Maps: Recent and older (contact WVGES)
4. Check with DPS

Contacted Devin Ducoeur 724-705-0444, dducoeur@dpslandservices.com DPS GIS (02/27/2020) to have him make maps of the wellbores with his information. DPS utilizes WVGES maps for their mapping seems it as the best publicly available. See attached map he provided.

Request maps for:

1. Wellbore with IHS All Wells Layer
2. Map with Farm lines overlain and any well spots identified on Farm Maps
3. More recent (1970s vintage) topos and older topos

Discussion with Phil Dinterman WVGES GIS Department (7/15/2016)

- WVGES has plotted every well spot they have access to and are aware of with that contains a coordinate. 30000, 70000, and 90000 series wells are available via the WVGES online map. Some locations aren't great due to vintage and manipulation of maps through time
- 30000 series – any well drilled prior to 1929 – APIs were not assigned to original wells
- 70000 series – Well spots pulled from old Farm line maps that the WVGES has access to
- 90000 series – Any sources that the WVGES has access that shows a well spot but has no additional supporting information. DEP does not have 90000 series on their maps.
- There can be duplication between wells in the 3 series
- Phil indicated that other Operators are providing a screenshot of the WVGES map with the planned well and using that for permits

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Permit well - Fitzgerald S-17HU

Wells within 500' Buffer

Note: Well spots depicted on Area of Review map (page 3) are derived from State held coordinates. The spots may differ from those depicted on the Well Plat because the Plat locations represent actual field surveyed locations. Please refer to the Plat for surveyed well spots.

API Number	Operator Name	Total Depth	Perforated Fms	Producing zones not perforated	Is this well "known or reasonably expected to penetrate a depth that could be within the range of Fracture propagation"? 1000' is max limit I would assign to wells that might be within in range of fracture propagation	Comments
4705170625	Unknown	Unknown	Unknown	Unknown	Unknown but unlikely. The well likely represents an old shallow well that is too shallow to be effected by fracturing in the planned Point Pleasant well.	State records are incomplete
4705170626	Unknown	Unknown	Unknown	Unknown	Unknown but unlikely. The well likely represents an old shallow well that is too shallow to be effected by fracturing in the planned Point Pleasant well.	State records are incomplete
4705100632	CNX Gas Co. LLC (North)	2727' TVD	Gordon	Unknown	No, the well is not deep enough to be within the expected fracture propagation from a Point Pleasant stimulation.	Well is not reported to be plugged. Production data either not reported or 0 as of 2017
4705100945	Consolidation Coal Co.	Unknown	Unknown	Unknown	Unknown but unlikely. The well likely represents an old shallow well that is too shallow to be effected by fracturing in the planned Point Pleasant well. Well was plugged in 2004.	Well plugged in 2004
4705101013	Consolidation Coal Co.	Unknown	Unknown	Unknown	Unknown but unlikely. The well likely represents an old shallow well that is too shallow to be effected by fracturing in the planned Point Pleasant well. Well was plugged in 2006.	Well plugged in 2006
4705170593	Hope Natural Gas Company	Unknown	Unknown	Unknown	Unknown but unlikely. The well likely represents an old shallow well that is too shallow to be effected by fracturing in the planned Point Pleasant well.	State records are incomplete
4705101011	Consolidation Coal Co.	Unknown	Unknown	Unknown	Unknown but unlikely. The well likely represents an old shallow well that is too shallow to be effected by fracturing in the planned Point Pleasant well. Well was plugged in 2006.	Well plugged in 2006
4705170589	Unknown	Unknown	Unknown	Unknown	Unknown but unlikely. The well likely represents an old shallow well that is too shallow to be effected by fracturing in the planned Point Pleasant well.	State records are incomplete
4705170591	Unknown	Unknown	Unknown	Unknown	Unknown but unlikely. The well likely represents an old shallow well that is too shallow to be effected by fracturing in the planned Point Pleasant well.	State records are incomplete
4705130266	Randall-Zoerg Supply Co.	2998' TVD	Gordon	Unknown	No, the well is not deep enough to be within the expected fracture propagation from a Point Pleasant stimulation. Well was plugged in 1947.	Well plugged in 1947
4705170590	Unknown	Unknown	Unknown	Unknown	Unknown but unlikely. The well likely represents an old shallow well that is too shallow to be effected by fracturing in the planned Point Pleasant well.	State records are incomplete
4705170580	Unknown	Unknown	Unknown	Unknown	Unknown but unlikely. The well likely represents an old shallow well that is too shallow to be effected by fracturing in the planned Point Pleasant well.	State records are incomplete

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4705102324

Well: County = 61 Permit = 01091

Report Date: Thursday, February 27, 2020 1:11:13 PM

Location Information: Well Name: ...

There is no Bottom Hole Location data for this well.

Completions Information: ...

There is no Pay data for this well.

There is no Production Oil data for this well.

There is no Production Water data for this well.

There is no Stratigraphy data for this well.

There is no Wellbore (E-Log) data for this well.

There is no Plugging data for this well.

There is no Sample data for this well.

Well: County = 61 Permit = 70589

Report Date: Thursday, February 27, 2020 1:11:21 PM

Location Information: Well Name: ...

There is no Bottom Hole Location data for this well.

Completions Information: ...

There is no Pay data for this well.

There is no Production Oil data for this well.

There is no Production Water data for this well.

There is no Stratigraphy data for this well.

There is no Wellbore (E-Log) data for this well.

There is no Plugging data for this well.

There is no Sample data for this well.

Well: County = 61 Permit = 70591

Report Date: Thursday, February 27, 2020 1:11:27 PM

Location Information: Well Name: ...

There is no Bottom Hole Location data for this well.

Completions Information: ...

There is no Pay data for this well.

There is no Production Oil data for this well.

There is no Production Water data for this well.

There is no Stratigraphy data for this well.

There is no Wellbore (E-Log) data for this well.

There is no Plugging data for this well.

There is no Sample data for this well.

Well: County = 61 Permit = 30256

Report Date: Thursday, February 27, 2020 1:11:47 PM

Location Information: Well Name: ...

There is no Bottom Hole Location data for this well.

Completions Information: ...

There is no Pay data for this well.

There is no Production Oil data for this well.

There is no Production Water data for this well.

There is no Stratigraphy data for this well.

There is no Wellbore (E-Log) data for this well.

There is no Plugging data for this well.

There is no Sample data for this well.

There is no Stratigraphy data for this well.

There is no Wellbore (E-Log) data for this well.

There is no Plugging data for this well.

There is no Sample data for this well.

Well: County = 61 Permit = 70580

Report Date: Thursday, February 27, 2020 1:12:03 PM

Location Information: Well Name: ...

There is no Bottom Hole Location data for this well.

Completions Information: ...

There is no Pay data for this well.

There is no Production Oil data for this well.

There is no Production Water data for this well.

There is no Stratigraphy data for this well.

There is no Wellbore (E-Log) data for this well.

There is no Plugging data for this well.

There is no Sample data for this well.

Well: County = 61 Permit = 70580

Report Date: Thursday, February 27, 2020 1:12:40 PM

Location Information: Well Name: ...

There is no Bottom Hole Location data for this well.

Completions Information: ...

There is no Pay data for this well.

There is no Production Oil data for this well.

There is no Production Water data for this well.

There is no Stratigraphy data for this well.

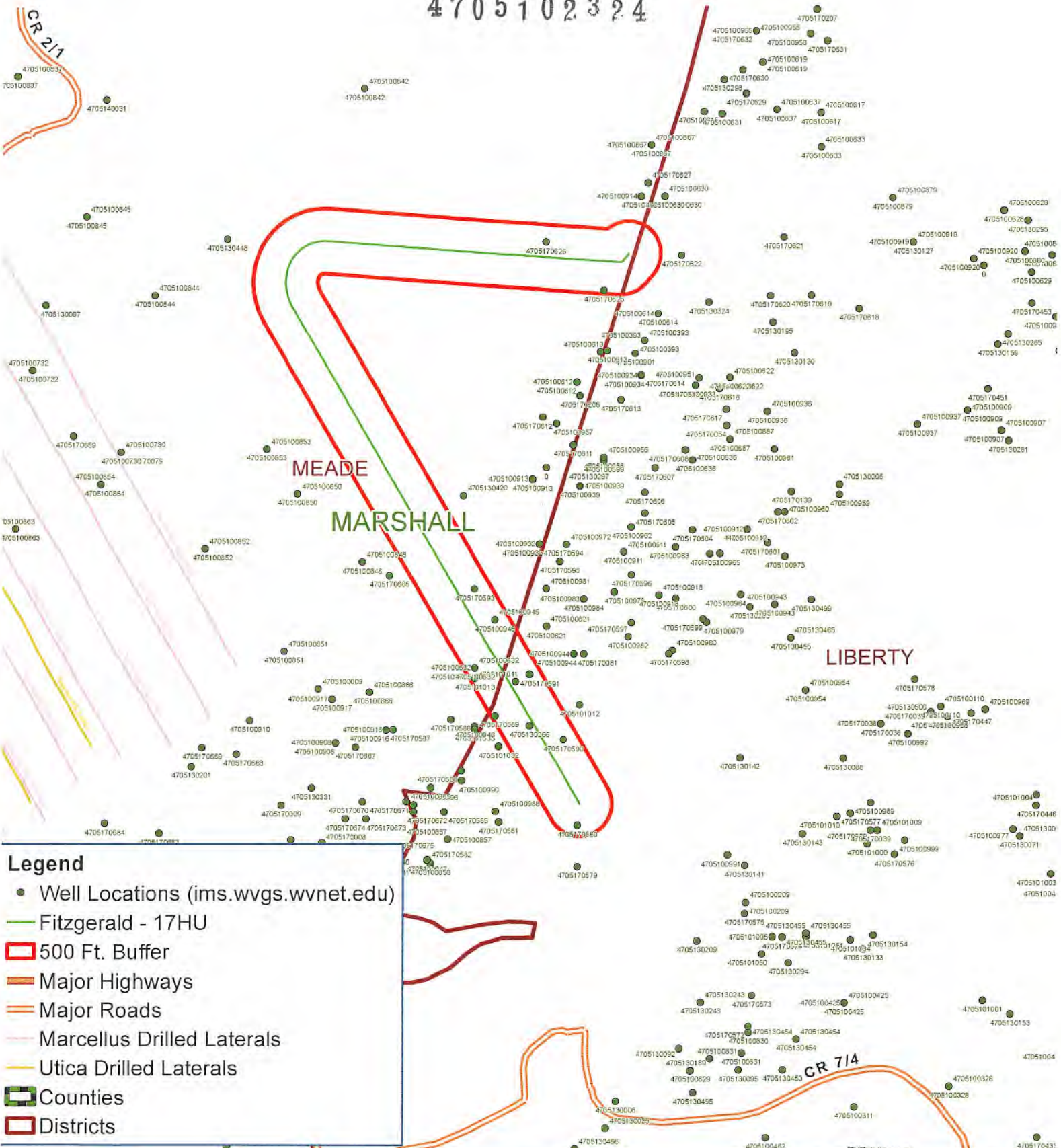
There is no Wellbore (E-Log) data for this well.

There is no Plugging data for this well.

There is no Sample data for this well.

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- Legend**
- Well Locations (ims.wvgs.wvnet.edu)
 - Fitzgerald - 17HU
 - ▭ 500 Ft. Buffer
 - ▬ Major Highways
 - ▬ Major Roads
 - ▬ Marcellus Drilled Laterals
 - ▬ Utica Drilled Laterals
 - ▭ Counties
 - ▭ Districts



Fitzgerald - 17HU
Franklin District
Marshall County, WV



Notes:

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Map Prepared by:



Well: Fitzgerald 17 HU (slot M)
Site: Fitzgerald
Project: Marshall County, West Virginia
Design: rev6
Rig:

Geocentric System: Universal Transverse Mercator (US Survey Feet)
 Datum: NAD83 West Virginia - HARN
 Ellipsoid: GRS 1980
 Zone: Zone 17N (84 W to 78 W)

System Datum: Mean Sea Level
 Depth Reference: GL @ 1292.94ft

Northing 14454525.67 Easting 1741217.18 Longitude -80.64110300 Latitude 39.90114500

Total Corr (M->G): To convert a Magnetic Direction to a Grid Direction, Subtract 9.010°



Azimuths to Grid North
 True North: -0.23°
 Magnetic North: -9.01°
 Magnetic Field
 Strength: 52004.25mT
 Dip Angle: 66.84°
 Date: 12/4/2018
 Model: IGRF2015

FORMATION TOP DETAILS

TVDPath	Formation	MD
6902.00	Top Marcellus	1000.00
6954.00	Top Onondaga	2900.00
7187.00	Base Onondaga	10282.65
7677.00	Top Salina	
8686.00	Base Salina	
9576.00	Top Clinton	
9686.00	Base Clinton	

CASING DETAILS

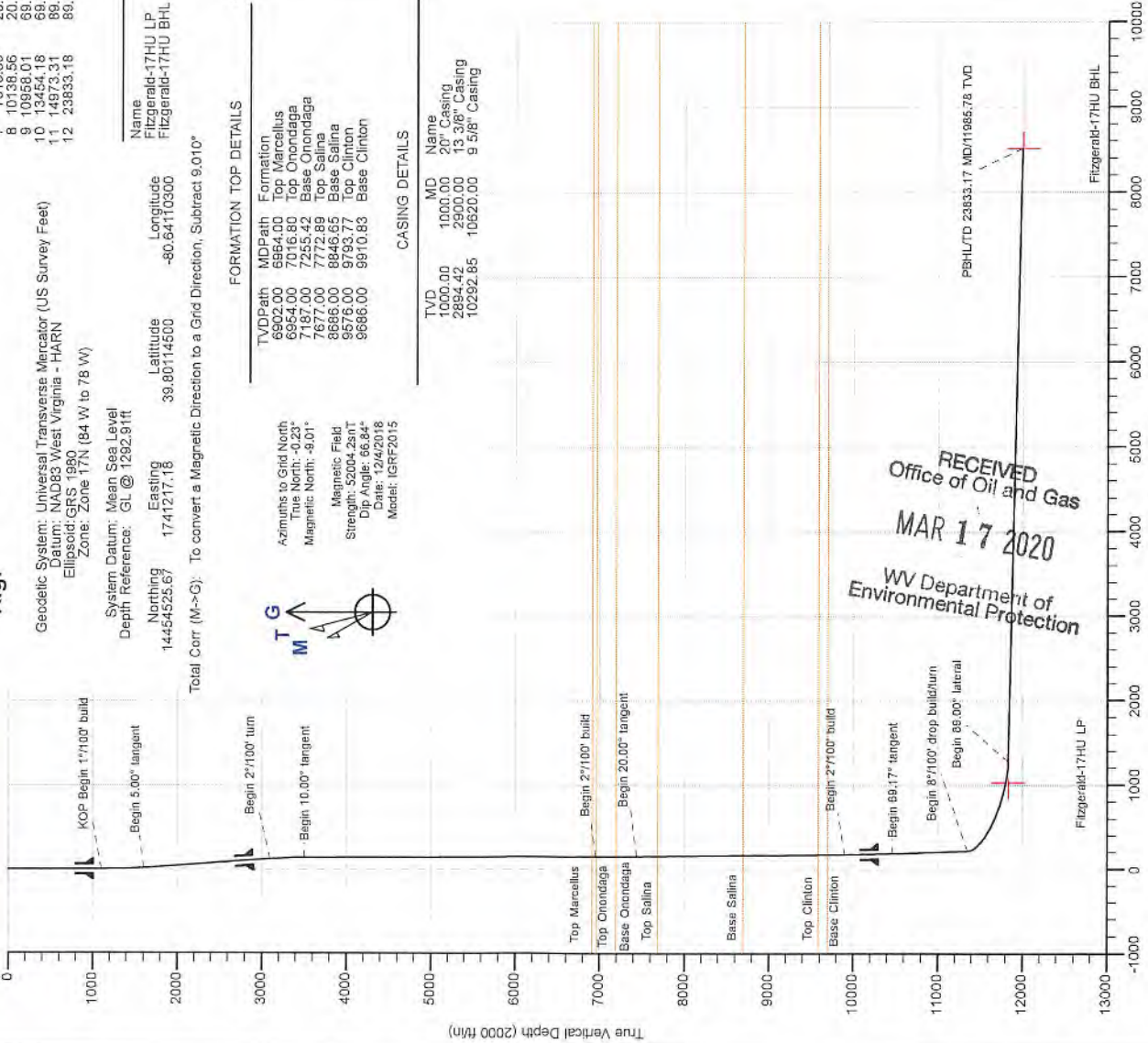
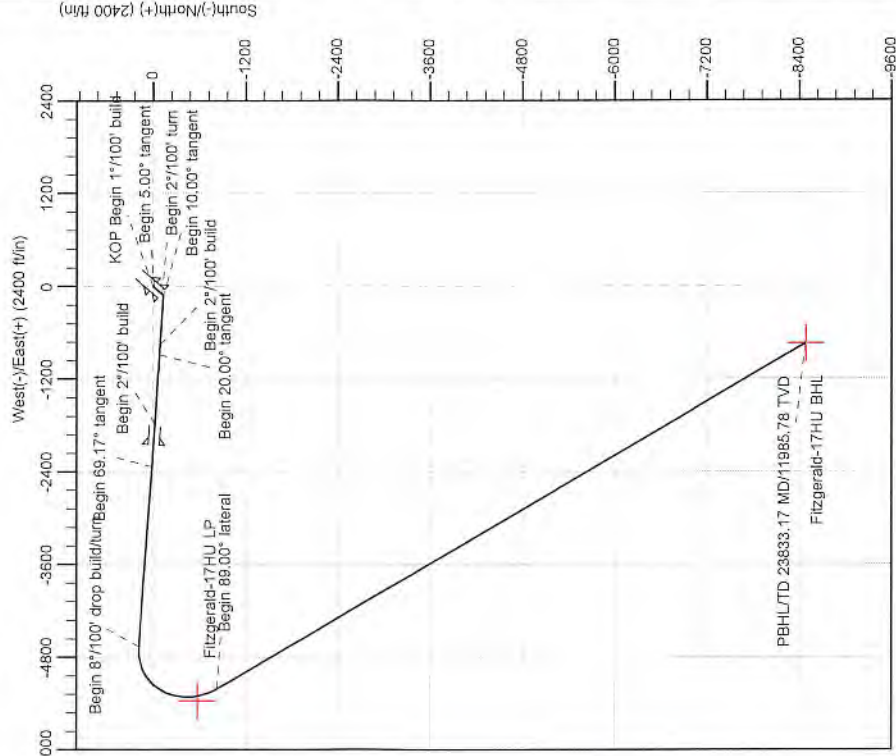
TVD	MD	Name
1000.00	1000.00	20" Casing
2894.42	2900.00	13.56" Casing
10282.65	10620.00	9.5/8" Casing

SECTION DETAILS

Sec	MD	Inc	Azi	TVD	+N+S	+E+W	DlBrg	VSect	Annotation
1	0.00	0.00	0.000	0.00	0.00	0.00	0.00	0.00	
2	1100.00	0.00	0.000	1100.00	0.00	0.00	0.00	0.00	KOP Begin 1°/100' build
3	1600.00	5.00	220.000	1593.37	-16.70	-14.01	0.00	0.00	Begin 5.00° tangent
4	3106.37	5.00	220.000	3100.00	-117.27	-98.41	1.00	220.000	Begin 2°/100' turn
5	3611.31	10.00	273.670	3501.77	-128.56	-144.91	2.00	0.000	Begin 10.00° tangent
6	7016.80	10.00	273.670	6954.00	-89.60	-752.39	0.00	0.000	Begin 2°/100' build
7	7516.80	20.00	273.670	7436.35	-81.32	-681.37	2.00	0.000	Begin 20.00° tangent
8	10138.56	20.00	273.670	9500.00	-23.93	-1776.22	0.00	0.000	Begin 2°/100' build
9	10958.01	69.17	274.213	10465.90	15.64	-2332.54	6.00	0.671	Begin 69.17° tangent
10	13454.18	69.17	274.213	11353.69	187.04	-4659.18	0.00	0.000	Begin 8°/100' drop build/turn
11	14973.31	89.00	149.723	11831.15	-830.04	-5205.85	8.00	104.796	Begin 89.00° lateral
12	23833.18	89.00	149.723	11985.78	-8490.24	-740.55	0.00	0.000	PBHL/JD 23833.17 MD/11985.78 TVD

DESIGN TARGET DETAILS

Name	+N+S	+E+W	Northing	Easting	Latitude	Longitude
Fitzgerald-17HU LP	11825.91	-536.09	14453954.67	1735859.10	39.76953434	-80.65018766
Fitzgerald-17HU BHL	11986.00	-8480.24	-740.55	1740476.53	39.77788440	-80.64365977



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Planning Report - Geographic

Database:	DB_Aug1919_v14	Local Co-ordinate Reference:	Well Fitzgerald 17 HU (slot M)
Company:	Tug Hill Operating LLC	TVD Reference:	GL @ 1292.91ft
Project:	Marshall County, West Virginia	MD Reference:	GL @ 1292.91ft
Site:	Fitzgerald	North Reference:	Grid
Well:	Fitzgerald 17 HU (slot M)	Survey Calculation Method:	Minimum Curvature
Wellbore:	Original Hole		
Design:	rev6		

Project	Marshall County, West Virginia		
Map System:	Universal Transverse Mercator (US Survey Feet)	System Datum:	Mean Sea Level
Geo Datum:	NAD83 West Virginia - HARN		
Map Zone:	Zone 17N (84 W to 78 W)		

Site	Fitzgerald				
Site Position:		Northing:	14,454,567.73 usft	Latitude:	39.80126184
From:	Lat/Long	Easting:	1,741,096.26 usft	Longitude:	-80.64153292
Position Uncertainty:	0.00 ft	Slot Radius:	13-3/16 "	Grid Convergence:	0.229 °

Well	Fitzgerald 17 HU (slot M)					
Well Position	+N-S	0.00 ft	Northing:	14,454,525.67 usft	Latitude:	39.80114500
	+E-W	0.00 ft	Easting:	1,741,217.18 usft	Longitude:	-80.64110300
Position Uncertainty		0.00 ft	Wellhead Elevation:		Ground Level:	1,292.91 ft

Wellbore	Original Hole				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	IGRF2015	12/4/2018	-8.780	66.836	52,004.22522526

Design	rev6			
Audit Notes:				
Version:	Phase:	PLAN	Tie On Depth:	0.00
Vertical Section:	Depth From (TVD) (ft)	+N/-S (ft)	+E/-W (ft)	Direction (°)
	0.00	0.00	0.00	184.991

Plan Survey Tool Program	Date	2/24/2020		
Depth From (ft)	Depth To (ft)	Survey (Wellbore)	Tool Name	Remarks
1	0.00	23,833.18 rev6 (Original Hole)	MWD	
			MWD - Standard	

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Project:	Marshall County, West Virginia	MD Reference:	GL @ 1292.91ft
Site:	Fitzgerald	North Reference:	Grid
Well:	Fitzgerald 17 HU (slot M)	Survey Calculation Method:	Minimum Curvature
Wellbore:	Original Hole		
Design:	rev6		

Plan Sections										
Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Dogleg Rate (°/100ft)	Build Rate (°/100ft)	Turn Rate (°/100ft)	TFO (°)	Target
0.00	0.00	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.000	
1,100.00	0.00	0.000	1,100.00	0.00	0.00	0.00	0.00	0.00	0.000	
1,600.00	5.00	220.000	1,599.37	-16.70	-14.01	1.00	1.00	0.00	220.000	
3,106.37	5.00	220.000	3,100.00	-117.27	-98.41	0.00	0.00	0.00	0.000	
3,511.31	10.00	273.670	3,501.77	-128.56	-144.91	2.00	1.23	13.25	83.212	
7,016.80	10.00	273.670	6,954.00	-89.60	-752.39	0.00	0.00	0.00	0.000	
7,516.80	20.00	273.670	7,436.35	-81.32	-881.37	2.00	2.00	0.00	0.000	
10,138.56	20.00	273.670	9,900.00	-23.93	-1,776.22	0.00	0.00	0.00	0.000	
10,958.01	69.17	274.213	10,465.90	15.64	-2,332.54	6.00	6.00	0.07	0.671	
13,454.18	69.17	274.213	11,353.69	187.04	-4,659.18	0.00	0.00	0.00	0.000	
14,973.31	89.00	149.723	11,831.15	-830.04	-5,206.86	8.00	1.31	-8.19	-104.796	
23,833.18	89.00	149.723	11,985.78	-8,480.24	-740.56	0.00	0.00	0.00	0.000	Fitzgerald-17HU BHL

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Planning Report - Geographic

Database: DB_Aug1919_v14
 Company: Tug Hill Operating LLC
 Project: Marshall County, West Virginia
 Site: Fitzgerald
 Well: Fitzgerald 17 HU (slot M)
 Wellbore: Original Hole
 Design: rev6

Local Co-ordinate Reference: Well Fitzgerald 17 HU (slot M)
 TVD Reference: GL @ 1292.91ft
 MD Reference: GL @ 1292.91ft
 North Reference: Grid
 Survey Calculation Method: Minimum Curvature

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Planned Survey

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
0.00	0.00	0.000	0.00	0.00	0.00	14,454,525.67	1,741,217.18	39.80114500	-80.64110300
100.00	0.00	0.000	100.00	0.00	0.00	14,454,525.67	1,741,217.18	39.80114500	-80.64110300
200.00	0.00	0.000	200.00	0.00	0.00	14,454,525.67	1,741,217.18	39.80114500	-80.64110300
300.00	0.00	0.000	300.00	0.00	0.00	14,454,525.67	1,741,217.18	39.80114500	-80.64110300
400.00	0.00	0.000	400.00	0.00	0.00	14,454,525.67	1,741,217.18	39.80114500	-80.64110300
500.00	0.00	0.000	500.00	0.00	0.00	14,454,525.67	1,741,217.18	39.80114500	-80.64110300
600.00	0.00	0.000	600.00	0.00	0.00	14,454,525.67	1,741,217.18	39.80114500	-80.64110300
700.00	0.00	0.000	700.00	0.00	0.00	14,454,525.67	1,741,217.18	39.80114500	-80.64110300
800.00	0.00	0.000	800.00	0.00	0.00	14,454,525.67	1,741,217.18	39.80114500	-80.64110300
900.00	0.00	0.000	900.00	0.00	0.00	14,454,525.67	1,741,217.18	39.80114500	-80.64110300
1,000.00	0.00	0.000	1,000.00	0.00	0.00	14,454,525.67	1,741,217.18	39.80114500	-80.64110300
20" Casing									
1,100.00	0.00	0.000	1,100.00	0.00	0.00	14,454,525.67	1,741,217.18	39.80114500	-80.64110300
KOP Begin 1°/100' build									
1,200.00	1.00	220.000	1,200.00	-0.67	-0.56	14,454,525.01	1,741,216.62	39.80114317	-80.64110501
1,300.00	2.00	220.000	1,299.96	-2.67	-2.24	14,454,523.00	1,741,214.93	39.80113768	-80.64111103
1,400.00	3.00	220.000	1,399.87	-6.02	-5.05	14,454,519.66	1,741,212.13	39.80112854	-80.64112106
1,500.00	4.00	220.000	1,499.68	-10.69	-8.97	14,454,514.98	1,741,208.21	39.80111574	-80.64113509
1,600.00	5.00	220.000	1,599.37	-16.70	-14.01	14,454,508.97	1,741,203.16	39.80109929	-80.64115314
Begin 5.00° tangent									
1,700.00	5.00	220.000	1,698.99	-23.38	-19.62	14,454,502.30	1,741,197.56	39.80108101	-80.64117318
1,800.00	5.00	220.000	1,798.61	-30.06	-25.22	14,454,495.62	1,741,191.96	39.80106274	-80.64119322
1,900.00	5.00	220.000	1,898.23	-36.73	-30.82	14,454,488.94	1,741,186.36	39.80104447	-80.64121326
2,000.00	5.00	220.000	1,997.85	-43.41	-36.42	14,454,482.27	1,741,180.75	39.80102619	-80.64123330
2,100.00	5.00	220.000	2,097.47	-50.08	-42.03	14,454,475.59	1,741,175.15	39.80100792	-80.64125334
2,200.00	5.00	220.000	2,197.09	-56.76	-47.63	14,454,468.91	1,741,169.55	39.80098965	-80.64127339
2,300.00	5.00	220.000	2,296.71	-63.44	-53.23	14,454,462.24	1,741,163.95	39.80097137	-80.64129343
2,400.00	5.00	220.000	2,396.33	-70.11	-58.83	14,454,455.56	1,741,158.34	39.80095310	-80.64131347
2,500.01	5.00	220.000	2,495.95	-76.79	-64.44	14,454,448.88	1,741,152.74	39.80093483	-80.64133351
2,600.01	5.00	220.000	2,595.57	-83.47	-70.04	14,454,442.21	1,741,147.14	39.80091655	-80.64135355
2,700.01	5.00	220.000	2,695.19	-90.14	-75.64	14,454,435.53	1,741,141.54	39.80089828	-80.64137359
2,800.01	5.00	220.000	2,794.80	-96.82	-81.24	14,454,428.85	1,741,135.94	39.80088000	-80.64139363
2,900.00	5.00	220.000	2,894.42	-103.50	-86.84	14,454,422.18	1,741,130.33	39.80086173	-80.64141368
13 3/8" Casing									
2,900.01	5.00	220.000	2,894.42	-103.50	-86.84	14,454,422.18	1,741,130.33	39.80086173	-80.64141368
3,000.01	5.00	220.000	2,994.04	-110.17	-92.45	14,454,415.50	1,741,124.73	39.80084346	-80.64143372
3,100.01	5.00	220.000	3,093.66	-116.85	-98.05	14,454,408.82	1,741,119.13	39.80082518	-80.64145376
3,106.37	5.00	220.000	3,100.00	-117.27	-98.41	14,454,408.40	1,741,118.77	39.80082402	-80.64145503
Begin 2°/100' turn									
3,200.01	5.54	239.634	3,193.25	-122.69	-104.93	14,454,402.99	1,741,112.25	39.80080923	-80.64147834
3,300.01	6.67	255.246	3,292.69	-126.61	-114.72	14,454,399.07	1,741,102.46	39.80079857	-80.64151324
3,400.01	8.15	265.816	3,391.86	-128.60	-127.40	14,454,397.07	1,741,089.77	39.80079323	-80.64155844
3,500.01	9.80	273.008	3,490.63	-128.67	-142.97	14,454,397.00	1,741,074.21	39.80079321	-80.64161387
3,511.31	10.00	273.670	3,501.77	-128.56	-144.91	14,454,397.11	1,741,072.26	39.80079354	-80.64162078
Begin 10.00° tangent									
3,600.01	10.00	273.670	3,589.12	-127.58	-160.28	14,454,398.10	1,741,056.89	39.80079641	-80.64167549
3,700.01	10.00	273.670	3,687.60	-126.46	-177.61	14,454,399.21	1,741,039.57	39.80079966	-80.64173717
3,800.01	10.00	273.670	3,786.08	-125.35	-194.94	14,454,400.32	1,741,022.24	39.80080290	-80.64179885
3,900.01	10.00	273.670	3,884.56	-124.24	-212.27	14,454,401.43	1,741,004.91	39.80080614	-80.64186054
4,000.01	10.00	273.670	3,983.04	-123.13	-229.60	14,454,402.54	1,740,987.58	39.80080939	-80.64192222
4,100.01	10.00	273.670	4,081.52	-122.02	-246.93	14,454,403.66	1,740,970.25	39.80081263	-80.64198390
4,200.01	10.00	273.670	4,180.00	-120.91	-264.26	14,454,404.77	1,740,952.92	39.80081587	-80.64204559
4,300.01	10.00	273.670	4,278.48	-119.79	-281.59	14,454,405.88	1,740,935.59	39.80081912	-80.64210727
4,400.01	10.00	273.670	4,376.96	-118.68	-298.92	14,454,406.99	1,740,918.26	39.80082236	-80.64216895



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Planned Survey

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
4,500.01	10.00	273.670	4,475.44	-117.57	-316.25	14,454,408.10	1,740,900.93	39.80082560	-80.64223063
4,600.01	10.00	273.670	4,573.93	-116.46	-333.58	14,454,409.21	1,740,883.60	39.80082884	-80.64229232
4,700.01	10.00	273.670	4,672.41	-115.35	-350.90	14,454,410.33	1,740,866.27	39.80083209	-80.64235400
4,800.01	10.00	273.670	4,770.89	-114.24	-368.23	14,454,411.44	1,740,848.94	39.80083533	-80.64241568
4,900.01	10.00	273.670	4,869.37	-113.13	-385.56	14,454,412.55	1,740,831.61	39.80083857	-80.64247737
5,000.01	10.00	273.670	4,967.85	-112.01	-402.89	14,454,413.66	1,740,814.29	39.80084181	-80.64253905
5,100.01	10.00	273.670	5,066.33	-110.90	-420.22	14,454,414.77	1,740,796.96	39.80084506	-80.64260073
5,200.01	10.00	273.670	5,164.81	-109.79	-437.55	14,454,415.88	1,740,779.63	39.80084830	-80.64266241
5,300.01	10.00	273.670	5,263.29	-108.68	-454.88	14,454,416.99	1,740,762.30	39.80085154	-80.64272410
5,400.01	10.00	273.670	5,361.77	-107.57	-472.21	14,454,418.11	1,740,744.97	39.80085478	-80.64278578
5,500.01	10.00	273.670	5,460.25	-106.46	-489.54	14,454,419.22	1,740,727.64	39.80085803	-80.64284746
5,600.01	10.00	273.670	5,558.74	-105.34	-506.87	14,454,420.33	1,740,710.31	39.80086127	-80.64290915
5,700.01	10.00	273.670	5,657.22	-104.23	-524.20	14,454,421.44	1,740,692.98	39.80086451	-80.64297083
5,800.01	10.00	273.670	5,755.70	-103.12	-541.53	14,454,422.55	1,740,675.65	39.80086775	-80.64303251
5,900.01	10.00	273.670	5,854.18	-102.01	-558.86	14,454,423.66	1,740,658.32	39.80087100	-80.64309419
6,000.01	10.00	273.670	5,952.66	-100.90	-576.18	14,454,424.78	1,740,640.99	39.80087424	-80.64315588
6,100.01	10.00	273.670	6,051.14	-99.79	-593.51	14,454,425.89	1,740,623.66	39.80087748	-80.64321756
6,200.01	10.00	273.670	6,149.62	-98.68	-610.84	14,454,427.00	1,740,606.34	39.80088072	-80.64327924
6,300.01	10.00	273.670	6,248.10	-97.56	-628.17	14,454,428.11	1,740,589.01	39.80088396	-80.64334093
6,400.01	10.00	273.670	6,346.58	-96.45	-645.50	14,454,429.22	1,740,571.68	39.80088721	-80.64340261
6,500.01	10.00	273.670	6,445.06	-95.34	-662.83	14,454,430.33	1,740,554.35	39.80089045	-80.64346429
6,600.01	10.00	273.670	6,543.55	-94.23	-680.16	14,454,431.44	1,740,537.02	39.80089369	-80.64352598
6,700.01	10.00	273.670	6,642.03	-93.12	-697.49	14,454,432.56	1,740,519.69	39.80089693	-80.64358766
6,800.01	10.00	273.670	6,740.51	-92.01	-714.82	14,454,433.67	1,740,502.36	39.80090017	-80.64364934
6,900.01	10.00	273.670	6,838.99	-90.90	-732.15	14,454,434.78	1,740,485.03	39.80090342	-80.64371102
6,964.00	10.00	273.670	6,902.00	-90.18	-743.24	14,454,435.49	1,740,473.94	39.80090549	-80.64375049
Top Marcellus									
7,000.01	10.00	273.670	6,937.47	-89.78	-749.48	14,454,435.89	1,740,467.70	39.80090666	-80.64377271
7,016.80	10.00	273.670	6,954.00	-89.60	-752.39	14,454,436.08	1,740,464.79	39.80090720	-80.64378306
Begin 2°/100' build - Top Onondaga									
7,100.01	11.66	273.670	7,035.73	-88.60	-767.99	14,454,437.08	1,740,449.19	39.80091012	-80.64383861
7,200.01	13.66	273.670	7,133.29	-87.19	-789.87	14,454,438.48	1,740,427.31	39.80091421	-80.64391648
7,255.42	14.77	273.670	7,187.00	-86.32	-803.45	14,454,439.35	1,740,413.73	39.80091676	-80.64396483
Base Onondaga									
7,300.01	15.66	273.670	7,230.03	-85.57	-815.13	14,454,440.10	1,740,402.05	39.80091894	-80.64400641
7,400.01	17.66	273.670	7,325.82	-83.74	-843.75	14,454,441.94	1,740,373.43	39.80092429	-80.64410826
7,500.02	19.66	273.670	7,420.56	-81.69	-875.68	14,454,443.99	1,740,341.50	39.80093027	-80.64422194
7,516.80	20.00	273.670	7,436.35	-81.32	-881.37	14,454,444.35	1,740,335.81	39.80093133	-80.64424216
Begin 20.00° tangent									
7,600.02	20.00	273.670	7,514.55	-79.50	-909.77	14,454,446.17	1,740,307.41	39.80093664	-80.64434326
7,700.02	20.00	273.670	7,608.52	-77.31	-943.90	14,454,448.36	1,740,273.28	39.80094303	-80.64446476
7,772.89	20.00	273.670	7,677.00	-75.72	-968.78	14,454,449.96	1,740,248.40	39.80094768	-80.64455330
Top Salina									
7,800.02	20.00	273.670	7,702.49	-75.12	-978.03	14,454,450.55	1,740,239.15	39.80094941	-80.64458625
7,900.02	20.00	273.670	7,796.46	-72.93	-1,012.17	14,454,452.74	1,740,205.01	39.80095580	-80.64470774
8,000.02	20.00	273.670	7,890.42	-70.75	-1,046.30	14,454,454.93	1,740,170.88	39.80096218	-80.64482923
8,100.02	20.00	273.670	7,984.39	-68.56	-1,080.43	14,454,457.12	1,740,136.75	39.80096857	-80.64495072
8,200.02	20.00	273.670	8,078.36	-66.37	-1,114.56	14,454,459.31	1,740,102.62	39.80097495	-80.64507222
8,300.02	20.00	273.670	8,172.33	-64.18	-1,148.69	14,454,461.50	1,740,068.49	39.80098133	-80.64519371
8,400.02	20.00	273.670	8,266.30	-61.99	-1,182.82	14,454,463.69	1,740,034.35	39.80098772	-80.64531520
8,500.02	20.00	273.670	8,360.27	-59.80	-1,216.96	14,454,465.88	1,740,000.22	39.80099410	-80.64543669
8,600.02	20.00	273.670	8,454.24	-57.61	-1,251.09	14,454,468.06	1,739,966.09	39.80100048	-80.64555818
8,700.02	20.00	273.670	8,548.21	-55.42	-1,285.22	14,454,470.25	1,739,931.96	39.80100687	-80.64567968
8,800.02	20.00	273.670	8,642.18	-53.23	-1,319.35	14,454,472.44	1,739,897.83	39.80101325	-80.64580117



Planning Report - Geographic

Database: DB_Aug1919_v14
 Company: Tug Hill Operating LLC
 Project: Marshall County, West Virginia
 Site: Fitzgerald
 Well: Fitzgerald 17 HU (slot M)
 Wellbore: Original Hole
 Design: rev6

Local Co-ordinate Reference: Well Fitzgerald 17 HU (slot M)
 TVD Reference: GL @ 1292.91ft
 MD Reference: GL @ 1292.91ft
 North Reference: Grid
 Survey Calculation Method: Minimum Curvature

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Planned Survey

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
8,846.65	20.00	273.670	8,686.00	-52.21	-1,335.27	14,454,473.46	1,739,881.91	39.80101623	-80.64585782
Base Salina									
8,900.02	20.00	273.670	8,736.15	-51.04	-1,353.48	14,454,474.63	1,739,863.70	39.80101963	-80.64592266
9,000.02	20.00	273.670	8,830.12	-48.85	-1,387.62	14,454,476.82	1,739,829.56	39.80102602	-80.64604415
9,100.02	20.00	273.670	8,924.09	-46.66	-1,421.75	14,454,479.01	1,739,795.43	39.80103240	-80.64616564
9,200.02	20.00	273.670	9,018.06	-44.47	-1,455.88	14,454,481.20	1,739,761.30	39.80103878	-80.64628714
9,300.02	20.00	273.670	9,112.03	-42.28	-1,490.01	14,454,483.39	1,739,727.17	39.80104517	-80.64640863
9,400.02	20.00	273.670	9,206.00	-40.10	-1,524.14	14,454,485.58	1,739,693.04	39.80105155	-80.64653012
9,500.02	20.00	273.670	9,299.97	-37.91	-1,558.28	14,454,487.77	1,739,658.90	39.80105793	-80.64665161
9,600.02	20.00	273.670	9,393.94	-35.72	-1,592.41	14,454,489.96	1,739,624.77	39.80106431	-80.64677311
9,700.02	20.00	273.670	9,487.91	-33.53	-1,626.54	14,454,492.15	1,739,590.64	39.80107069	-80.64689460
9,793.77	20.00	273.670	9,576.00	-31.48	-1,658.54	14,454,494.20	1,739,558.64	39.80107668	-80.64700850
Top Clinton									
9,800.02	20.00	273.670	9,581.87	-31.34	-1,660.67	14,454,494.34	1,739,556.51	39.80107708	-80.64701609
9,900.02	20.00	273.670	9,675.84	-29.15	-1,694.80	14,454,496.52	1,739,522.38	39.80108346	-80.64713758
9,910.83	20.00	273.670	9,686.00	-28.91	-1,698.49	14,454,496.76	1,739,518.69	39.80108415	-80.64715071
Base Clinton									
10,000.02	20.00	273.670	9,769.81	-26.96	-1,728.94	14,454,498.71	1,739,488.24	39.80108984	-80.64725908
10,100.02	20.00	273.670	9,863.78	-24.77	-1,763.07	14,454,500.90	1,739,454.11	39.80109622	-80.64738057
10,138.56	20.00	273.670	9,900.00	-23.93	-1,776.22	14,454,501.75	1,739,440.96	39.80109868	-80.64742739
Begin 2°/100' build									
10,200.02	23.69	273.777	9,957.04	-22.44	-1,799.04	14,454,503.23	1,739,418.14	39.80110301	-80.64750860
10,300.02	29.69	273.898	10,046.34	-19.43	-1,843.83	14,454,506.24	1,739,373.35	39.80111176	-80.64766803
10,400.02	35.69	273.981	10,130.47	-15.72	-1,897.68	14,454,509.96	1,739,319.50	39.80112253	-80.64785972
10,500.02	41.69	274.043	10,208.49	-11.35	-1,960.01	14,454,514.33	1,739,257.18	39.80113522	-80.64808156
10,600.02	47.69	274.092	10,279.55	-6.36	-2,030.12	14,454,519.32	1,739,187.06	39.80114967	-80.64833112
10,620.00	48.89	274.100	10,292.85	-5.29	-2,044.99	14,454,520.38	1,739,172.19	39.80115276	-80.64838407
9 5/8" Casing									
10,700.02	53.69	274.132	10,342.88	-0.81	-2,107.25	14,454,524.86	1,739,109.93	39.80116573	-80.64880567
10,800.02	59.69	274.166	10,397.78	5.23	-2,190.57	14,454,530.91	1,739,026.62	39.80118323	-80.64890221
10,900.02	65.69	274.197	10,443.64	11.71	-2,279.14	14,454,537.38	1,738,938.04	39.80120197	-80.64921748
10,958.01	69.17	274.213	10,465.90	15.64	-2,332.53	14,454,541.31	1,738,884.65	39.80121333	-80.64940752
Begin 69.17° tangent									
11,000.02	69.17	274.213	10,480.84	18.52	-2,371.69	14,454,544.19	1,738,845.49	39.80122167	-80.64954691
11,100.02	69.17	274.213	10,516.41	25.39	-2,464.90	14,454,551.06	1,738,752.28	39.80124153	-80.64987867
11,200.02	69.17	274.213	10,551.97	32.25	-2,558.11	14,454,557.93	1,738,659.07	39.80126139	-80.65021044
11,300.02	69.17	274.213	10,587.54	39.12	-2,651.32	14,454,564.79	1,738,565.86	39.80128125	-80.65054221
11,400.02	69.17	274.213	10,623.11	45.99	-2,744.53	14,454,571.66	1,738,472.65	39.80130110	-80.65087397
11,500.02	69.17	274.213	10,658.67	52.85	-2,837.74	14,454,578.53	1,738,379.45	39.80132096	-80.65120574
11,600.02	69.17	274.213	10,694.24	59.72	-2,930.95	14,454,585.39	1,738,286.24	39.80134081	-80.65153751
11,700.02	69.17	274.213	10,729.81	66.59	-3,024.16	14,454,592.26	1,738,193.03	39.80136066	-80.65186927
11,800.02	69.17	274.213	10,765.37	73.45	-3,117.36	14,454,599.13	1,738,099.82	39.80138052	-80.65220104
11,900.02	69.17	274.213	10,800.94	80.32	-3,210.57	14,454,605.99	1,738,006.61	39.80140037	-80.65253281
12,000.02	69.17	274.213	10,836.50	87.19	-3,303.78	14,454,612.86	1,737,913.40	39.80142022	-80.65286458
12,100.02	69.17	274.213	10,872.07	94.05	-3,396.99	14,454,619.73	1,737,820.19	39.80144007	-80.65319635
12,200.02	69.17	274.213	10,907.64	100.92	-3,490.20	14,454,626.59	1,737,726.98	39.80145992	-80.65352811
12,300.02	69.17	274.213	10,943.20	107.79	-3,583.41	14,454,633.46	1,737,633.77	39.80147977	-80.65385988
12,400.03	69.17	274.213	10,978.77	114.65	-3,676.62	14,454,640.33	1,737,540.57	39.80149961	-80.65419165
12,500.03	69.17	274.213	11,014.33	121.52	-3,769.83	14,454,647.19	1,737,447.36	39.80151946	-80.65452342
12,600.03	69.17	274.213	11,049.90	128.39	-3,863.04	14,454,654.06	1,737,354.15	39.80153930	-80.65485519
12,700.03	69.17	274.213	11,085.47	135.25	-3,956.25	14,454,660.93	1,737,260.94	39.80155915	-80.65518696
12,800.03	69.17	274.213	11,121.03	142.12	-4,049.46	14,454,667.79	1,737,167.73	39.80157899	-80.65551873
12,900.03	69.17	274.213	11,156.60	148.99	-4,142.66	14,454,674.66	1,737,074.52	39.80159883	-80.65585050
13,000.03	69.17	274.213	11,192.17	155.85	-4,235.87	14,454,681.53	1,736,981.31	39.80161867	-80.65618227



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Planned Survey

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
13,100.03	69.17	274.213	11,227.73	162.72	-4,329.08	14,454,688.39	1,736,888.10	39.80163851	-80.65651404
13,200.03	69.17	274.213	11,263.30	169.59	-4,422.29	14,454,695.26	1,736,794.89	39.80165835	-80.65684581
13,300.03	69.17	274.213	11,298.86	176.45	-4,515.50	14,454,702.13	1,736,701.69	39.80167819	-80.65717758
13,400.03	69.17	274.213	11,334.43	183.32	-4,608.71	14,454,708.99	1,736,608.48	39.80169803	-80.65750935
13,454.18	69.17	274.213	11,353.69	187.04	-4,659.19	14,454,712.71	1,736,558.00	39.80170877	-80.65768901
Begin 8°/100' drop build/turn									
13,500.03	68.27	270.398	11,370.34	188.76	-4,701.86	14,454,714.43	1,736,515.33	39.80171395	-80.65784094
13,600.03	66.64	261.917	11,408.74	182.61	-4,793.90	14,454,708.29	1,736,423.29	39.80169804	-80.65816872
13,700.03	65.47	253.256	11,449.40	163.02	-4,883.05	14,454,688.69	1,736,334.14	39.80164516	-80.65848638
13,800.03	64.80	244.468	11,491.52	130.36	-4,967.56	14,454,656.03	1,736,249.63	39.80155636	-80.65878774
13,900.03	64.65	235.621	11,534.28	85.27	-5,045.80	14,454,610.94	1,736,171.38	39.80143335	-80.65906692
14,000.03	65.03	226.791	11,576.86	28.63	-5,116.25	14,454,554.30	1,736,100.94	39.80127852	-80.65931849
14,100.03	65.93	218.052	11,618.43	-38.47	-5,177.52	14,454,487.20	1,736,039.67	39.80109490	-80.65953756
14,200.03	67.32	209.467	11,658.16	-114.71	-5,228.43	14,454,410.96	1,735,988.76	39.80088606	-80.65971986
14,300.03	69.15	201.080	11,695.30	-198.61	-5,267.99	14,454,327.06	1,735,949.19	39.80065606	-80.65986185
14,400.03	71.38	192.916	11,729.12	-288.54	-5,295.43	14,454,237.13	1,735,921.76	39.80040938	-80.65996076
14,500.03	73.95	184.979	11,758.95	-382.75	-5,310.21	14,454,142.92	1,735,906.98	39.80015081	-80.66001466
14,600.03	76.81	177.254	11,784.23	-479.40	-5,312.05	14,454,046.27	1,735,905.14	39.79988540	-80.66002251
14,700.03	79.89	169.715	11,804.45	-576.62	-5,300.91	14,453,949.06	1,735,916.28	39.79961831	-80.65998415
14,800.03	83.14	162.322	11,819.23	-672.50	-5,277.00	14,453,853.17	1,735,940.19	39.79935474	-80.65990034
14,900.03	86.50	155.032	11,828.27	-765.19	-5,240.80	14,453,760.48	1,735,976.39	39.79909981	-80.65977270
14,973.31	89.00	149.723	11,831.15	-830.04	-5,206.86	14,453,695.64	1,736,010.33	39.79892137	-80.65965274
Begin 89.00° lateral									
15,000.03	89.00	149.723	11,831.62	-853.11	-5,193.39	14,453,672.56	1,736,023.80	39.79885787	-80.65960510
15,100.03	89.00	149.723	11,833.36	-939.46	-5,142.98	14,453,586.22	1,736,074.21	39.79862022	-80.65942679
15,200.03	89.00	149.723	11,835.11	-1,025.81	-5,092.57	14,453,499.87	1,736,124.62	39.79838256	-80.65924849
15,300.03	89.00	149.723	11,836.85	-1,112.15	-5,042.16	14,453,413.52	1,736,175.03	39.79814491	-80.65907019
15,400.03	89.00	149.723	11,838.60	-1,198.50	-4,991.75	14,453,327.18	1,736,225.44	39.79790725	-80.65889188
15,500.03	89.00	149.723	11,840.34	-1,284.85	-4,941.34	14,453,240.83	1,736,275.85	39.79766959	-80.65871358
15,600.03	89.00	149.723	11,842.09	-1,371.19	-4,890.93	14,453,154.48	1,736,326.26	39.79743194	-80.65853528
15,700.03	89.00	149.723	11,843.83	-1,457.54	-4,840.52	14,453,068.14	1,736,376.67	39.79719428	-80.65835698
15,800.03	89.00	149.723	11,845.58	-1,543.89	-4,790.11	14,452,981.79	1,736,427.08	39.79695662	-80.65817869
15,900.03	89.00	149.723	11,847.32	-1,630.23	-4,739.70	14,452,895.44	1,736,477.49	39.79671897	-80.65800039
16,000.03	89.00	149.723	11,849.07	-1,716.58	-4,689.29	14,452,809.10	1,736,527.90	39.79648131	-80.65782209
16,100.03	89.00	149.723	11,850.81	-1,802.93	-4,638.87	14,452,722.75	1,736,578.31	39.79624365	-80.65764380
16,200.03	89.00	149.723	11,852.56	-1,889.27	-4,588.46	14,452,636.40	1,736,628.72	39.79600599	-80.65746551
16,300.03	89.00	149.723	11,854.30	-1,975.62	-4,538.05	14,452,550.06	1,736,679.13	39.79576833	-80.65728722
16,400.03	89.00	149.723	11,856.05	-2,061.97	-4,487.64	14,452,463.71	1,736,729.54	39.79553067	-80.65710893
16,500.03	89.00	149.723	11,857.80	-2,148.31	-4,437.23	14,452,377.36	1,736,779.95	39.79529301	-80.65693064
16,600.03	89.00	149.723	11,859.54	-2,234.66	-4,386.82	14,452,291.02	1,736,830.36	39.79505536	-80.65675235
16,700.03	89.00	149.723	11,861.29	-2,321.01	-4,336.41	14,452,204.67	1,736,880.77	39.79481770	-80.65657406
16,800.03	89.00	149.723	11,863.03	-2,407.35	-4,286.00	14,452,118.32	1,736,931.18	39.79458004	-80.65639578
16,900.03	89.00	149.723	11,864.78	-2,493.70	-4,235.59	14,452,031.98	1,736,981.59	39.79434238	-80.65621749
17,000.03	89.00	149.723	11,866.52	-2,580.05	-4,185.18	14,451,945.63	1,737,032.01	39.79410471	-80.65603921
17,100.03	89.00	149.723	11,868.27	-2,666.39	-4,134.77	14,451,859.28	1,737,082.42	39.79386705	-80.65586093
17,200.03	89.00	149.723	11,870.01	-2,752.74	-4,084.36	14,451,772.94	1,737,132.83	39.79362939	-80.65568265
17,300.03	89.00	149.723	11,871.76	-2,839.09	-4,033.95	14,451,686.59	1,737,183.24	39.79339173	-80.65550437
17,400.04	89.00	149.723	11,873.50	-2,925.44	-3,983.54	14,451,600.24	1,737,233.65	39.79315407	-80.65532609
17,500.04	89.00	149.723	11,875.25	-3,011.78	-3,933.13	14,451,513.90	1,737,284.06	39.79291641	-80.65514781
17,600.04	89.00	149.723	11,876.99	-3,098.13	-3,882.72	14,451,427.55	1,737,334.47	39.79267875	-80.65496954
17,700.04	89.00	149.723	11,878.74	-3,184.48	-3,832.31	14,451,341.20	1,737,384.88	39.79244108	-80.65479126
17,800.04	89.00	149.723	11,880.48	-3,270.82	-3,781.90	14,451,254.86	1,737,435.29	39.79220342	-80.65461299
17,900.04	89.00	149.723	11,882.23	-3,357.17	-3,731.49	14,451,168.51	1,737,485.70	39.79196576	-80.65443472
18,000.04	89.00	149.723	11,883.97	-3,443.52	-3,681.08	14,451,082.16	1,737,536.11	39.79172809	-80.65425645



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18,100.04	89.00	149.723	11,885.72	-3,529.86	-3,630.66	14,450,995.82	1,737,586.52	39.79149043	-80.65407818
18,200.04	89.00	149.723	11,887.46	-3,616.21	-3,580.25	14,450,909.47	1,737,636.93	39.79125277	-80.65389991
18,300.04	89.00	149.723	11,889.21	-3,702.56	-3,529.84	14,450,823.12	1,737,687.34	39.79101510	-80.65372164
18,400.04	89.00	149.723	11,890.95	-3,788.90	-3,479.43	14,450,736.78	1,737,737.75	39.79077744	-80.65354338
18,500.04	89.00	149.723	11,892.70	-3,875.25	-3,429.02	14,450,650.43	1,737,788.16	39.79053977	-80.65336511
18,600.04	89.00	149.723	11,894.45	-3,961.60	-3,378.61	14,450,564.08	1,737,838.57	39.79030211	-80.65318685
18,700.04	89.00	149.723	11,896.19	-4,047.94	-3,328.20	14,450,477.74	1,737,888.98	39.79006444	-80.65300859
18,800.04	89.00	149.723	11,897.94	-4,134.29	-3,277.79	14,450,391.39	1,737,939.39	39.78982678	-80.65283033
18,900.04	89.00	149.723	11,899.68	-4,220.64	-3,227.38	14,450,305.04	1,737,989.80	39.78958911	-80.65265207
19,000.04	89.00	149.723	11,901.43	-4,306.98	-3,176.97	14,450,218.70	1,738,040.21	39.78935145	-80.65247381
19,100.04	89.00	149.723	11,903.17	-4,393.33	-3,126.56	14,450,132.35	1,738,090.62	39.78911378	-80.65229555
19,200.04	89.00	149.723	11,904.92	-4,479.68	-3,076.15	14,450,046.00	1,738,141.03	39.78887611	-80.65211730
19,300.04	89.00	149.723	11,906.66	-4,566.02	-3,025.74	14,449,959.66	1,738,191.44	39.78863845	-80.65193904
19,400.04	89.00	149.723	11,908.41	-4,652.37	-2,975.33	14,449,873.31	1,738,241.86	39.78840078	-80.65176079
19,500.04	89.00	149.723	11,910.15	-4,738.72	-2,924.92	14,449,786.96	1,738,292.27	39.78816311	-80.65158254
19,600.04	89.00	149.723	11,911.90	-4,825.07	-2,874.51	14,449,700.62	1,738,342.68	39.78792544	-80.65140429
19,700.04	89.00	149.723	11,913.64	-4,911.41	-2,824.10	14,449,614.27	1,738,393.09	39.78768777	-80.65122604
19,800.04	89.00	149.723	11,915.39	-4,997.76	-2,773.69	14,449,527.92	1,738,443.50	39.78745011	-80.65104779
19,900.04	89.00	149.723	11,917.13	-5,084.11	-2,723.28	14,449,441.58	1,738,493.91	39.78721244	-80.65086954
20,000.04	89.00	149.723	11,918.88	-5,170.45	-2,672.86	14,449,355.23	1,738,544.32	39.78697477	-80.65069129
20,100.04	89.00	149.723	11,920.62	-5,256.80	-2,622.45	14,449,268.88	1,738,594.73	39.78673710	-80.65051305
20,200.04	89.00	149.723	11,922.37	-5,343.15	-2,572.04	14,449,182.54	1,738,645.14	39.78649943	-80.65033480
20,300.04	89.00	149.723	11,924.11	-5,429.49	-2,521.63	14,449,096.19	1,738,695.55	39.78626176	-80.65015656
20,400.04	89.00	149.723	11,925.86	-5,515.84	-2,471.22	14,449,009.84	1,738,745.96	39.78602409	-80.64997832
20,500.04	89.00	149.723	11,927.61	-5,602.19	-2,420.81	14,448,923.50	1,738,796.37	39.78578642	-80.64980008
20,600.04	89.00	149.723	11,929.35	-5,688.53	-2,370.40	14,448,837.15	1,738,846.78	39.78554875	-80.64962184
20,700.04	89.00	149.723	11,931.10	-5,774.88	-2,319.99	14,448,750.80	1,738,897.19	39.78531108	-80.64944360
20,800.04	89.00	149.723	11,932.84	-5,861.23	-2,269.58	14,448,664.46	1,738,947.60	39.78507341	-80.64926537
20,900.04	89.00	149.723	11,934.59	-5,947.57	-2,219.17	14,448,578.11	1,738,998.01	39.78483574	-80.64908713
21,000.04	89.00	149.723	11,936.33	-6,033.92	-2,168.76	14,448,491.77	1,739,048.42	39.78459806	-80.64890890
21,100.04	89.00	149.723	11,938.08	-6,120.27	-2,118.35	14,448,405.42	1,739,098.83	39.78436039	-80.64873067
21,200.04	89.00	149.723	11,939.82	-6,206.61	-2,067.94	14,448,319.07	1,739,149.24	39.78412272	-80.64855243
21,300.04	89.00	149.723	11,941.57	-6,292.96	-2,017.53	14,448,232.73	1,739,199.65	39.78388505	-80.64837420
21,400.04	89.00	149.723	11,943.31	-6,379.31	-1,967.12	14,448,146.38	1,739,250.06	39.78364738	-80.64819598
21,500.04	89.00	149.723	11,945.06	-6,465.65	-1,916.71	14,448,060.03	1,739,300.47	39.78340970	-80.64801775
21,600.04	89.00	149.723	11,946.80	-6,552.00	-1,866.30	14,447,973.69	1,739,350.88	39.78317203	-80.64783952
21,700.04	89.00	149.723	11,948.55	-6,638.35	-1,815.89	14,447,887.34	1,739,401.29	39.78293436	-80.64766130
21,800.04	89.00	149.723	11,950.29	-6,724.70	-1,765.48	14,447,800.99	1,739,451.71	39.78269668	-80.64748307
21,900.04	89.00	149.723	11,952.04	-6,811.04	-1,715.06	14,447,714.65	1,739,502.12	39.78245901	-80.64730485
22,000.04	89.00	149.723	11,953.78	-6,897.39	-1,664.65	14,447,628.30	1,739,552.53	39.78222133	-80.64712663
22,100.04	89.00	149.723	11,955.53	-6,983.74	-1,614.24	14,447,541.95	1,739,602.94	39.78198366	-80.64694841
22,200.04	89.00	149.723	11,957.27	-7,070.08	-1,563.83	14,447,455.61	1,739,653.35	39.78174598	-80.64677019
22,300.05	89.00	149.723	11,959.02	-7,156.43	-1,513.42	14,447,369.26	1,739,703.76	39.78150831	-80.64659197
22,400.05	89.00	149.723	11,960.76	-7,242.78	-1,463.01	14,447,282.91	1,739,754.17	39.78127063	-80.64641375
22,500.05	89.00	149.723	11,962.51	-7,329.12	-1,412.60	14,447,196.57	1,739,804.58	39.78103296	-80.64623554
22,600.05	89.00	149.723	11,964.26	-7,415.47	-1,362.19	14,447,110.22	1,739,854.99	39.78079528	-80.64605732
22,700.05	89.00	149.723	11,966.00	-7,501.82	-1,311.78	14,447,023.87	1,739,905.40	39.78055760	-80.64587911
22,800.05	89.00	149.723	11,967.75	-7,588.16	-1,261.37	14,446,937.53	1,739,955.81	39.78031993	-80.64570090
22,900.05	89.00	149.723	11,969.49	-7,674.51	-1,210.96	14,446,851.18	1,740,006.22	39.78008225	-80.64552269
23,000.05	89.00	149.723	11,971.24	-7,760.86	-1,160.55	14,446,764.83	1,740,056.63	39.77984457	-80.64534448
23,100.05	89.00	149.723	11,972.98	-7,847.20	-1,110.14	14,446,678.49	1,740,107.04	39.77960690	-80.64516627
23,200.05	89.00	149.723	11,974.73	-7,933.55	-1,059.73	14,446,592.14	1,740,157.45	39.77936922	-80.64498806
23,300.05	89.00	149.723	11,976.47	-8,019.90	-1,009.32	14,446,505.79	1,740,207.86	39.77913154	-80.64480986
23,400.05	89.00	149.723	11,978.22	-8,106.24	-958.91	14,446,419.45	1,740,258.27	39.77889386	-80.64463165
23,500.05	89.00	149.723	11,979.96	-8,192.59	-908.50	14,446,333.10	1,740,308.68	39.77865618	-80.64445345



Planning Report - Geographic

Database:	DB_Aug1919_v14	Local Co-ordinate Reference:	Well Fitzgerald 17 HU (slot M)
Company:	Tug Hill Operating LLC	TVD Reference:	GL @ 1292.91ft
Project:	Marshall County, West Virginia	MD Reference:	GL @ 1292.91ft
Site:	Fitzgerald	North Reference:	Grid
Well:	Fitzgerald 17 HU (slot M)	Survey Calculation Method:	Minimum Curvature
Wellbore:	Original Hole		
Design:	rev6		

Planned Survey									
Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
23,600.05	89.00	149.723	11,981.71	-8,278.94	-858.09	14,446,246.75	1,740,359.09	39.77841850	-80.64427525
23,700.05	89.00	149.723	11,983.45	-8,365.28	-807.68	14,446,160.41	1,740,409.50	39.77818082	-80.64409704
23,800.05	89.00	149.723	11,985.20	-8,451.63	-757.26	14,446,074.06	1,740,459.91	39.77794314	-80.64391884
23,833.17	89.00	149.723	11,985.78	-8,480.23	-740.57	14,446,045.46	1,740,476.61	39.77786442	-80.64385982
PBHL/TD 23833.17 MD/11985.78 TVD									
23,833.18	89.00	149.723	11,985.78	-8,480.24	-740.56	14,446,045.45	1,740,476.61	39.77786440	-80.64385981

Design Targets											
Target Name	- hit/miss target	- Shape	Dip Angle (°)	Dip Dir. (°)	TVD (ft)	+N/-S (ft)	+E/-W (ft)	Northing (usft)	Easting (usft)	Latitude	Longitude
Fitzgerald-17HU LP			0.00	0.000	11,825.91	-571.00	-5,358.09	14,453,954.68	1,735,859.10	39.79963434	-80.66018766
- plan misses target center by 60.38ft at 14692.52ft MD (11803.12 TVD, -569.34 N, -5302.19 E)											
- Point											
Fitzgerald-17HU BHL			0.00	0.000	11,986.00	-8,480.24	-740.55	14,446,045.45	1,740,476.63	39.77786440	-80.64385977
- plan misses target center by 0.22ft at 23833.18ft MD (11985.78 TVD, -8480.24 N, -740.56 E)											
- Point											

Casing Points					
Measured Depth (ft)	Vertical Depth (ft)	Name	Casing Diameter (")	Hole Diameter (")	
1,000.00	1,000.00	20" Casing	20	26	
2,900.00	2,894.42	13 3/8" Casing	13-3/8	17-1/2	
10,620.00	10,292.85	9 5/8" Casing	9-5/8	12-1/4	

Formations					
Measured Depth (ft)	Vertical Depth (ft)	Name	Lithology	Dip (°)	Dip Direction (°)
6,964.00	6,902.00	Top Marcellus		0.000	
7,016.80	6,954.00	Top Onondaga		0.000	
7,255.42	7,187.00	Base Onondaga		0.000	
7,772.89	7,677.00	Top Salina		0.000	
8,846.65	8,686.00	Base Salina		0.000	
9,793.77	9,576.00	Top Clinton		0.000	
9,910.83	9,686.00	Base Clinton		0.000	

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Planning Report - Geographic

Database:	DB_Aug1919_v14	Local Co-ordinate Reference:	Well Fitzgerald 17 HU (slot M)
Company:	Tug Hill Operating LLC	TVD Reference:	GL @ 1292.91ft
Project:	Marshall County, West Virginia	MD Reference:	GL @ 1292.91ft
Site:	Fitzgerald	North Reference:	Grid
Well:	Fitzgerald 17 HU (slot M)	Survey Calculation Method:	Minimum Curvature
Wellbore:	Original Hole		
Design:	rev6		

Plan Annotations

Measured Depth (ft)	Vertical Depth (ft)	Local Coordinates		Comment
		+N/-S (ft)	+E/-W (ft)	
1,100.00	1,100.00	0.00	0.00	KOP Begin 1°/100' build
1,600.00	1,599.37	-16.70	-14.01	Begin 5.00° tangent
3,106.37	3,100.00	-117.27	-98.41	Begin 2°/100' turn
3,511.31	3,501.77	-128.56	-144.91	Begin 10.00° tangent
7,016.80	6,954.00	-89.60	-752.39	Begin 2°/100' build
7,516.80	7,436.35	-81.32	-881.37	Begin 20.00° tangent
10,138.56	9,900.00	-23.93	-1,776.22	Begin 2°/100' build
10,958.01	10,465.90	15.64	-2,332.53	Begin 69.17° tangent
13,454.18	11,353.69	187.04	-4,659.19	Begin 8°/100' drop build/turn
14,973.31	11,831.15	-830.04	-5,206.86	Begin 89.00° lateral
23,833.17	11,985.78	-8,480.23	-740.57	PBHL/TD 23833.17 MD/11985.78 TVD

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WW-9
(4/16)

API Number 47 - 051 - _____
Operator's Well No. Fitzgerald S-17HU

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

FLUIDS/ CUTTINGS DISPOSAL & RECLAMATION PLAN

Operator Name Tug Hill Operating, LLC OP Code 494510851

Watershed (HUC 10) Upper Fish Creek Quadrangle Glen Easton 7.5'

Do you anticipate using more than 5,000 bbls of water to complete the proposed well work? Yes No

Will a pit be used? Yes No

If so, please describe anticipated pit waste: AST Tanks with proper containment will be used for staging fresh water for frac and flow back water

Will a synthetic liner be used in the pit? Yes No If so, what ml.? AST Tanks will be used with proper contain +

Proposed Disposal Method For Treated Pit Wastes:

- Land Application
- Underground Injection (UIC Permit Number UIC 2459, UIC 965, UIC 359, UIC 2D0732540, UIC 2D0732523)
- Reuse (at API Number _____)
- Off Site Disposal (Supply form WW-9 for disposal location)
- Other (Explain _____)

Will closed loop system be used? If so, describe: Yes - For Vertical and Horizontal Drilling

Drilling medium anticipated for this well (vertical and horizontal)? Air, freshwater, oil based, etc. Air for vertical / Oil for Horizontal

-If oil based, what type? Synthetic, petroleum, etc. Synthetic Oil Base

Additives to be used in drilling medium? Barite for weight

Drill cuttings disposal method? Leave in pit, landfill, removed offsite, etc. All drill cuttings to be disposed of in a Landfill

-If left in pit and plan to solidify what medium will be used? (cement, lime, sawdust) N/A

-Landfill or offsite name/permit number? Wetzel County Sanitary Landfill (SWF-1021 / WV0109185) and Westmoreland Sanitary Landfill, LLC (SAN1405 / PA DEP EC#1386426)

Permittee shall provide written notice to the Office of Oil and Gas of any load of drill cuttings or associated waste rejected at any West Virginia solid waste facility. The notice shall be provided within 24 hours of rejection and the permittee shall also disclose where it was properly disposed.

I certify that I understand and agree to the terms and conditions of the GENERAL WATER POLLUTION PERMIT issued on August 1, 2005, by the Office of Oil and Gas of the West Virginia Department of Environmental Protection. I understand that the provisions of the permit are enforceable by law. Violations of any term or condition of the general permit and/or other applicable law or regulation can lead to enforcement action.

I certify under penalty of law that I have personally examined and am familiar with the information submitted on this application form and all attachments thereto and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine or imprisonment.

Company Official Signature James A. Pancake
Company Official (Typed Name) Jim Pancake
Company Official Title Vice President - Geosciences

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Environmental Protection

Subscribed and sworn before me this 25th day of February, 2020

[Signature] Notary Public
My commission expires 2-10-2024

Commonwealth of Pennsylvania - Notary Seal
Chester Arthur West IV, Notary Public
Washington County
My commission expires February 10, 2024
Commission number 1267179
Member, Pennsylvania Association of Notaries

Tug Hill Operating, LLC

Proposed Revegetation Treatment: Acres Disturbed 7.44 Prevegetation pH 6.0

Lime 3 Tons/acre or to correct to pH 6.5

Fertilizer type 10-20-20

Fertilizer amount 500 lbs/acre

Mulch 2.5 Tons/acre

Seed Mixtures

Temporary		Permanent	
Seed Type	lbs/acre	Seed Type	lbs/acre
Annual Ryegrass	40	Orchard Grass	12
Spring Oats	96	Ladino	3
		White Clover	2

Attach:

Maps(s) of road, location, pit and proposed area for land application (unless engineered plans including this info have been provided). If water from the pit will be land applied, include dimensions (L x W x D) of the pit, and dimensions (L x W), and area in acreage, of the land application area.

Photocopied section of involved 7.5' topographic sheet.

Plan Approved by: *Jeanie Wehler*

Comments: _____

Title: Oil and Gas Inspector

Date: 3/4/2020

Field Reviewed? Yes No

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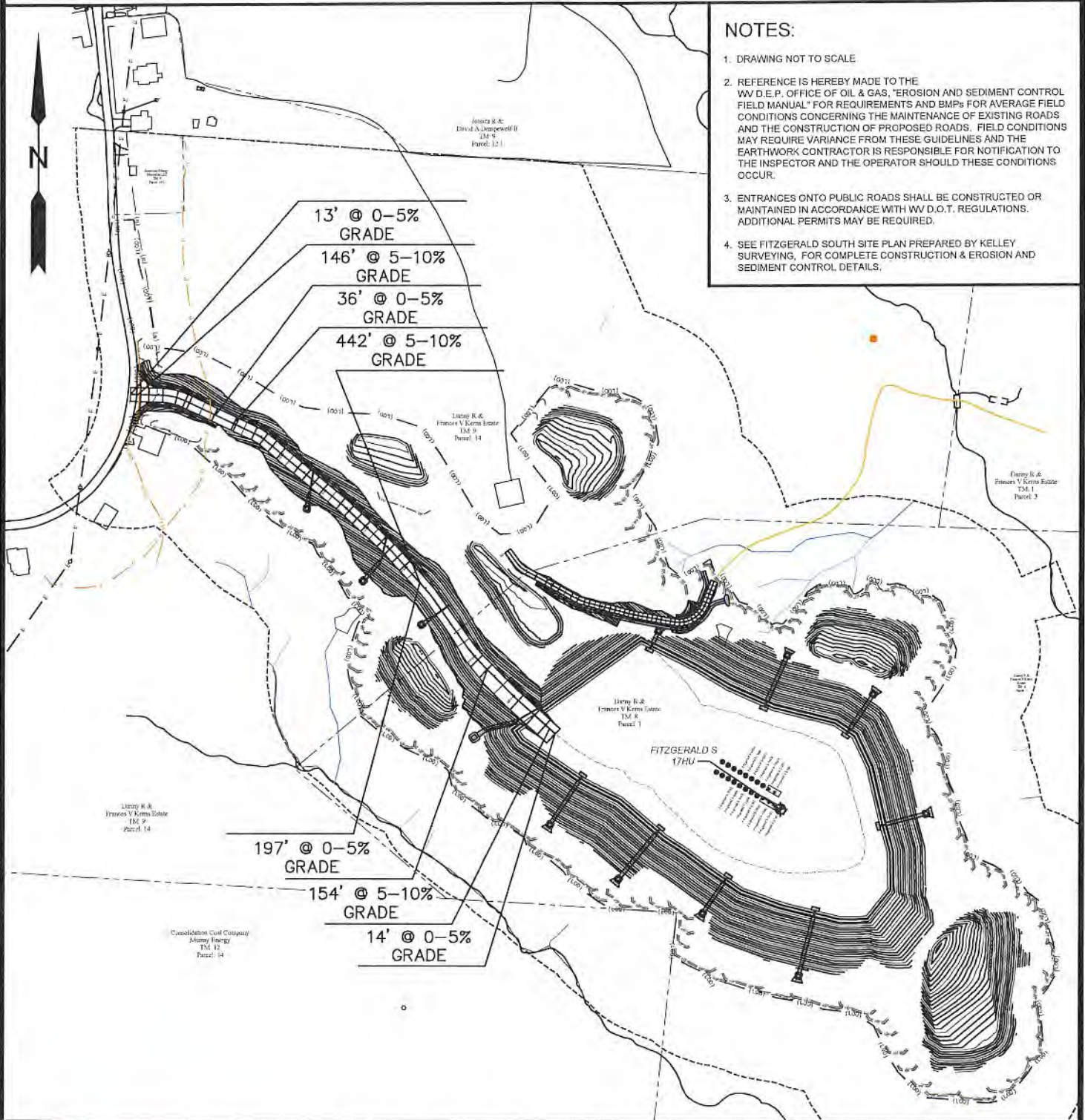
WW-9

PROPOSED FITZGERALD S - 17HU

SUPPLEMENT PG. 1

NOTES:

1. DRAWING NOT TO SCALE
2. REFERENCE IS HEREBY MADE TO THE WV D.E.P. OFFICE OF OIL & GAS, "EROSION AND SEDIMENT CONTROL FIELD MANUAL" FOR REQUIREMENTS AND BMPs FOR AVERAGE FIELD CONDITIONS CONCERNING THE MAINTENANCE OF EXISTING ROADS AND THE CONSTRUCTION OF PROPOSED ROADS. FIELD CONDITIONS MAY REQUIRE VARIANCE FROM THESE GUIDELINES AND THE EARTHWORK CONTRACTOR IS RESPONSIBLE FOR NOTIFICATION TO THE INSPECTOR AND THE OPERATOR SHOULD THESE CONDITIONS OCCUR.
3. ENTRANCES ONTO PUBLIC ROADS SHALL BE CONSTRUCTED OR MAINTAINED IN ACCORDANCE WITH WV D.O.T. REGULATIONS. ADDITIONAL PERMITS MAY BE REQUIRED.
4. SEE FITZGERALD SOUTH SITE PLAN PREPARED BY KELLEY SURVEYING, FOR COMPLETE CONSTRUCTION & EROSION AND SEDIMENT CONTROL DETAILS.



12 Vanhorn Drive | P.O. Box 150 | Glenville, WV 26351 | 304.462.5634
 1412 Kanawha Boulevard, East | Charleston, WV 25301 | 304.346.3952
 254 East Beckley Bypass | Beckley, WV 25801 | 304.255.5296
 slswv.com

TOPO SECTION:		OPERATOR:	
GLEN EASTON 7.5'		PREPARED FOR: TUG HILL OPERATING, LLC 380 SOUTHPOINTE BLVD SUITE 200 CANONSBURG, PA 15317	
COUNTY	DISTRICT		
MARSHALL	LIBERTY		
DRAWN BY	JOB NO.	DATE	SCALE
K.G.M.	8910	03/03/20	NONE

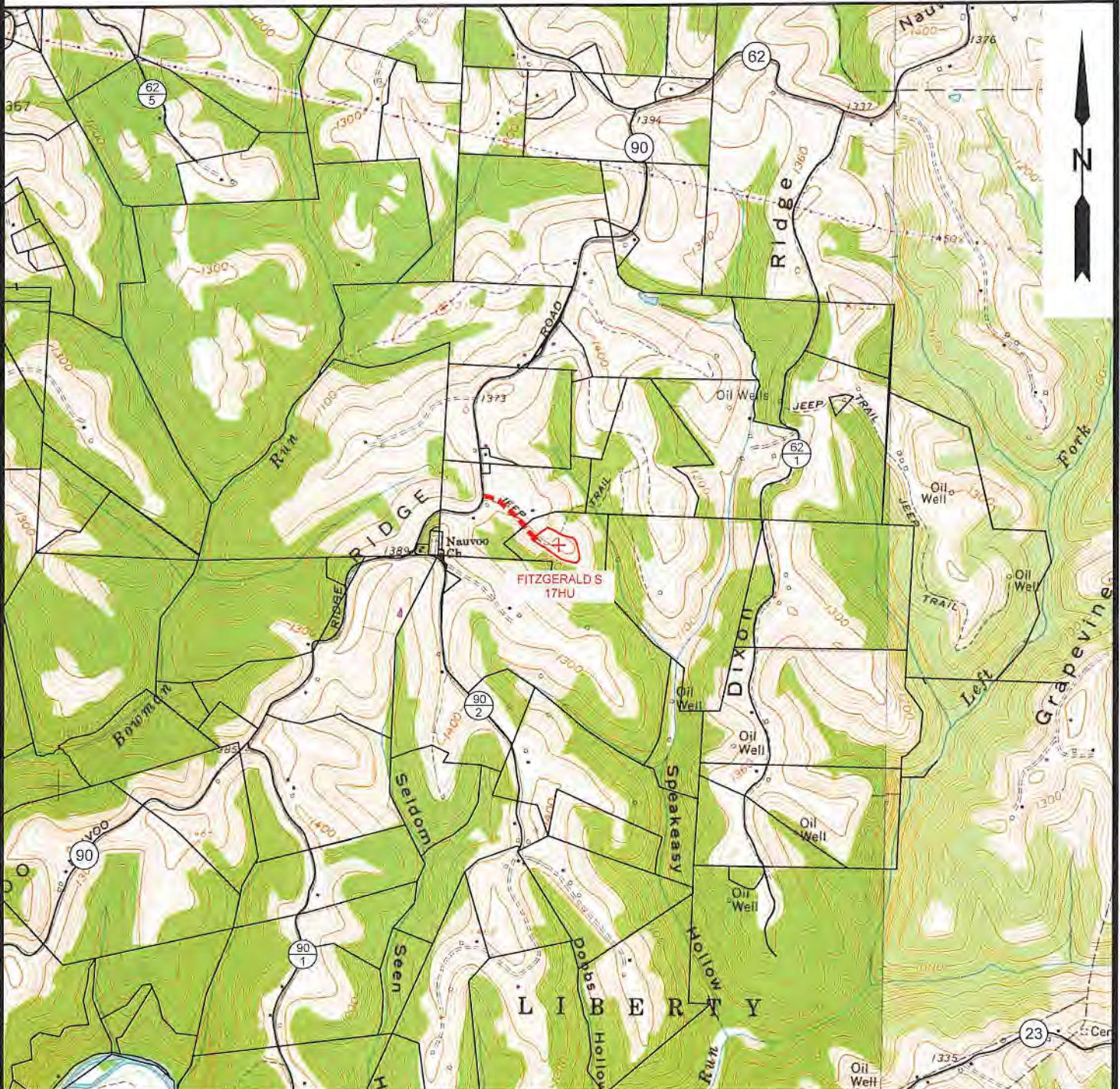


**TUG HILL
OPERATING**

WW-9

PROPOSED FITZGERALD S - 17HU

SUPPLEMENT PG. 2



NOTE: CLOSEST WATER PURVEYOR
CITY OF CAMERON - FRANK WALKER RESERVOIR
CAMDEN, WV

LAT: 39.829865
LON: -80.573724
LOCATED: N 62°00'46" E AT 21,684.26' FROM THE CENTER OF FITZGERALD S WELL PAD LOCATION.

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MAR 17 2020



12 Vanhorn Drive | P.O. Box 150 | Glenville, WV 26351 | 304.462.5534
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254 East Beckley Bypass | Beckley, WV 25801 | 304.255.5295
slswv.com

TOPO SECTION:		OPERATOR:	
GLEN EASTON 7.5' & CAMERON 7.5'		PREPARED FOR: TUG HILL OPERATING, LLC 380 SOUTHPOINTE BLVD SUITE 200 CANONSBURG, PA 15317	
COUNTY	DISTRICT		
MARSHALL	LIBERTY & MEADE		
DRAWN BY	JOB NO.	DATE	SCALE
K.G.M.	8910	03/03/2020	1" = 2000'



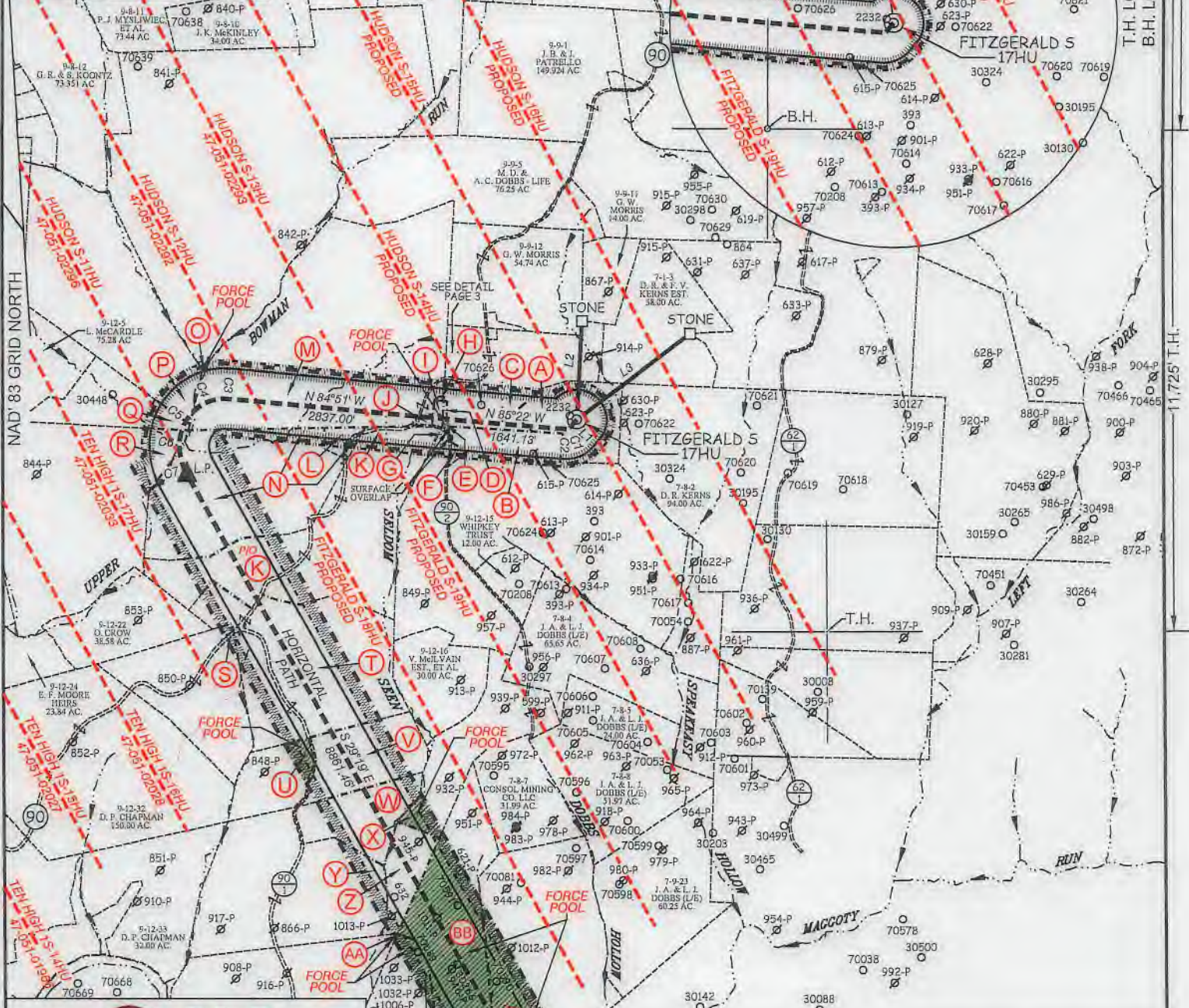
WV Department of Environmental Protection
TUG HILL OPERATING

**FITZGERALD S LEASE
UTICA UNIT - 412.02 AC±
WELL 17HU
TUG HILL OPERATING**

T.H. LATITUDE 39°50'00"
B.H. LATITUDE 39°47'30"

LINE TABLE

LINE	BEARING	DISTANCE
L1	S 40°58' W	153.14'
L2	N 03°07' E	1310.39'
L3	N 52°50' E	1905.72'



T.H. LONGITUDE 80°37'30"
B.H. LONGITUDE 80°37'30"

5,301' B.H.
4,524' T.H.

11,725' T.H.
5,028' B.H.

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CURVE TABLE

CURVE	ARC LENGTH	RADIUS	CHORD BEARING	CHORD LENGTH
C1	19.05'	33.83'	S 61°10' W	18.80'
C2	28.43'	102.99'	S 86°47' W	28.34'
C3	139.64'	989.05'	N 87°22' W	139.53'
C4	408.91'	599.07'	S 67°38' W	401.02'
C5	322.40'	631.18'	S 32°33' W	318.91'
C6	337.71'	681.85'	S 03°59' W	334.27'
C7	271.73'	801.26'	S 19°24' E	270.43'

P.S. 849 *C. Victor Moyers*

(S.P.C. NORTH ZONE) (UTM(M) ZONE 17 NORTH)

NAD'83 S.P.C.(FT)	N. 475,953.93	E. 1,647,905.85
NAD'83 GEO.	LAT-(N) 39.801145	LONG-(W) 80.641103
NAD'83 UTM (M)	N. 4,405,748.24	E. 530,724.06

LANDING POINT

NAD'83 S.P.C.(FT)	N. 475,210.8	E. 1,642,684.1
NAD'83 GEO.	LAT-(N) 39.798921	LONG-(W) 80.659653
NAD'83 UTM (M)	N. 4,405,495.2	E. 529,137.0

BOTTOM HOLE

NAD'83 S.P.C.(FT)	N. 467,484.4	E. 1,647,023.4
NAD'83 GEO.	LAT-(N) 39.777864	LONG-(W) 80.643860
NAD'83 UTM (M)	N. 4,403,163.5	E. 530,498.3



(+) DENOTES LOCATION OF WELL ON UNITED STATES TOPOGRAPHIC MAPS.

LEGEND

- UNIT BOUNDARY
- LEASED TRACTS INSIDE
- UNIT BOUNDARY
- SURFACE LINE
- PROPOSED UTICA
- WELL LATERAL
- 400' OFFSET LINE
- 500' OFFSET LINE
- TIE LINE
- CREEK
- ROAD
- FORCE POOL TRACT
- COUNTY ROUTE
- PROPOSED WELL
- EXISTING WELL
- PERMITTED WELL
- SURFACE OWNER (SEE TABLE)
- LEASE # (SEE ADDITIONAL SHEETS)

SCALE 1" = 2000' FILE NO. 8910P17HUR2.dwg
FITZGERALD S-17HU REV6
DATE MARCH 11 20 20
REVISED APRIL 13, MAY 6 20 20
OPERATORS WELL NO. FITZGERALD S-17HU
API WELL NO. 47 - 051 - 02324 H6A
STATE COUNTY PERMIT

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

WELL OPERATOR TUG HILL OPERATING, LLC ADDRESS 1320 SOUTH UNIVERSITY DRIVE, SUITE 500 FORT WORTH, TX 76107
DESIGNATED AGENT DIANNA STAMPER CT CORPORATION SYSTEM ADDRESS 5400 D BIG TYLER ROAD CHARLESTON, WV 25313

**FITZGERALD S LEASE
UTICA UNIT - 412.02 AC±
WELL 17HU
TUG HILL OPERATING**

T.H. LATITUDE 39°50'00"
B.H. LATITUDE 39°47'30"

(S.P.C. NORTH ZONE) (UTM(M) ZONE 17 NORTH)

NAD'83 S.P.C.(FT)	N. 475,953.93	E. 1,647,905.85
NAD'83 GEO.	LAT-(N) 39.801145	LONG-(W) 80.641103
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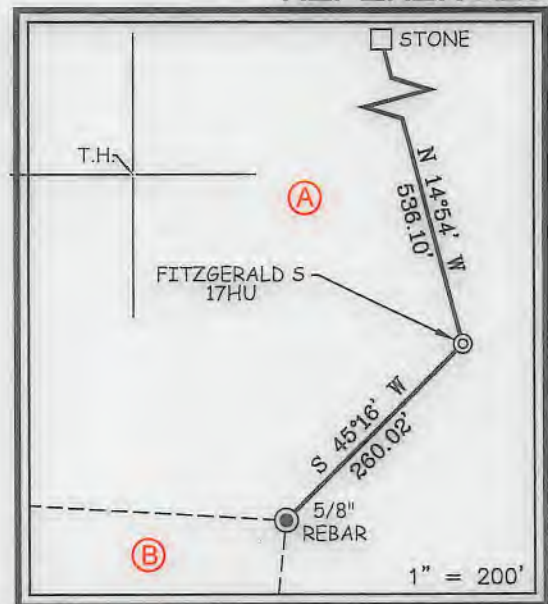
T.H. LONGITUDE 80°37'30"
B.H. LONGITUDE 80°37'30"
5,028' B.H.
11,725' T.H.

TAG	SURFACE OWNER	PARCEL	ACRES
A	DANNY R. & FRANCES V. KERNS ESTATE	7-8-1	27.00
B	CONSOL MINING CO., LLC	9-12-14	127.61
C	DANNY R. & FRANCES V. KERNS ESTATE	9-9-14	48.308
D	NAUVOO CEMETERY ASSOC. INC.	9-9-14.2	0.292
E	TRUSTEES OF THE REORGANIZED CHURCH OF LATTER DAY SAINTS	9-9-15	LOT
F	VIRGINIA MCILVAIN ESTATE & THE WHIPKEY TRUST	9-9-18	LOT
G	WHIPKEY TRUST	9-12-12	61.00
H	NAUVOO CEMETERY ASSOC. INC.	9-9-16.1	0.126
I	NAUVOO CEMETERY ASSOC. INC.	9-9-17	1.00
J	GARY W. MORRIS	9-9-22	0.15
K	WARREN BERYLE & ELEANOR LOU CHAMBERS - LIFE	9-12-11	91.00
L	ROBERT W. KNIGHT	9-12-10	3.00
M	TODD L. SCHERICH, ET AL	9-9-16	168.204
N	CHARLES WILLIAM DOBBS, ET AL	9-12-9	82.26
O	MARY LOU RUBINI, DAVID & ERIC KATZMEYER	9-9-4	268.39
P	CONSOL MINING CO., LLC	9-9-3	84.50
Q	LUCY MCCARDLE	9-9-1	20.89
R	LUCY MCCARDLE	9-12-8	117.85
S	DAVID PAUL CHAPMAN	9-12-21	50.00
T	RONALD EUGENE & MARY LEE DOBBS	9-12-20	91.00
U	RAYMOND D. DOBBS, ET UX	9-12-34	17.5
V	RAYMOND D. DOBBS, ET UX	9-12-19	30.00
W	ROY ROGERS WOODS, SR.	9-12-18	30.00
X	VIRGINIA MCILVAIN ESTATE & THE WHIPKEY TRUST	9-12-17	37.27
Y	ANNA E. MEYER ESTATE	9-12-35	93.64
Z	CONSOL MINING CO., LLC	9-12-36	15.30
AA	CONSOL MINING CO., LLC	9-15-6	59.00
BB	CONSOL MINING CO., LLC	7-9-1	59.00
CC	PAUL & SUSAN ASTON	7-9-2	98.95
DD	CONSOL MINING CO., LLC	7-9-22	101.36

NOTES ON SURVEY

- NO WATER WELLS WERE FOUND WITHIN 250' OF PROPOSED GAS WELL. NO AGRICULTURAL BUILDINGS ≥ 2500 SQ. FT. OR DWELLINGS WERE FOUND WITHIN 625' OF THE CENTER OF PROPOSED WELL PAD.
- WELL SPOT CIRCLE & TOPO MARK SCALE ARE 1"=2000'
- PROPOSED LATERAL OR TOP HOLE OF FITZGERALD S-17HU IS WITHIN 3000' OF THE TOP HOLES OR LATERALS OF PROPOSED FITZGERALD S-18HU, PROPOSED FITZGERALD S-19HU, HUDSON S-11HU (47-051-02296), HUDSON S-12HU (47-051-02292), HUDSON S-13HU (47-051-02293), PROPOSED HUDSON S-14HU, PROPOSED HUDSON S-15HU, PROPOSED HUDSON S-16HU, TEN HIGH 1S-16HU (47-051-02028) & TEN HIGH 1S-17HU (47-051-02033).

REFERENCES

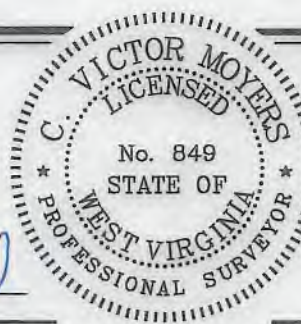


12 Vanlorn Drive | P.O. Box 150 | Glenville, WV 26351 | 304.462.5634
1412 Kanawha Boulevard, East | Charleston, WV 25301 | 304.346.3952
254 East Beckley Bypass | Beckley, WV 25801 | 304.255.5296
slswv.com

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. 849

C. Victor Moyers



(+) DENOTES LOCATION OF WELL ON UNITED STATES TOPOGRAPHIC MAPS.

DATE MARCH 11, 20 20
REVISED _____, 20 _____
OPERATORS WELL NO. FITZGERALD S-17HU
API WELL NO. 47 - 051 - 02324 ^{H&A} _{PC&P}
STATE COUNTY PERMIT

MINIMUM DEGREE OF ACCURACY 1 / 2500 FILE NO. 8910P17HU.dwg
FITZGERALD S-17HU REV6
HORIZONTAL & VERTICAL CONTROL DETERMINED BY DGPS (SURVEY GRADE TIE TO CORS NETWORK) SCALE 1" = 2000'

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



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

LOCATION: GROUND = 1,318.40' ELEVATION PROPOSED = 1,344.81' WATERSHED SPEAKEASY HOLLOW OF MAGGOTY RUN
DISTRICT LIBERTY COUNTY MARSHALL QUADRANGLE GLEN EASTON 7.5'

SURFACE OWNER DANNY AND FRANCES KERNS ESTATE ACREAGE 27.00±
ROYALTY OWNER DANNY S. KERNS, ET AL ACREAGE 27.00±

PROPOSED WORK: LEASE NO. SEE WW-6A1
DRILL X CONVERT _____ DRILL DEEPER _____ REDRILL _____ FRACTURE OR STIMULATE X PLUG OFF OLD FORMATION _____ PERFORATE NEW FORMATION _____ PLUG AND ABANDON _____ CLEAN OUT AND REPLUG _____ OTHER _____
PHYSICAL CHANGE IN WELL (SPECIFY) _____ TARGET FORMATION POINT PLEASANT ESTIMATED DEPTH TVD: 12,064' / TMD: 23,833'

WELL OPERATOR TUG HILL OPERATING, LLC
ADDRESS 1320 SOUTH UNIVERSITY DRIVE, SUITE 500 FORT WORTH, TX 76107

DESIGNATED AGENT DIANNA STAMPER CT CORPORATION SYSTEM
ADDRESS 5400 D BIG TYLER ROAD CHARLESTON, WV 25313

COUNTY NAME
PERMIT

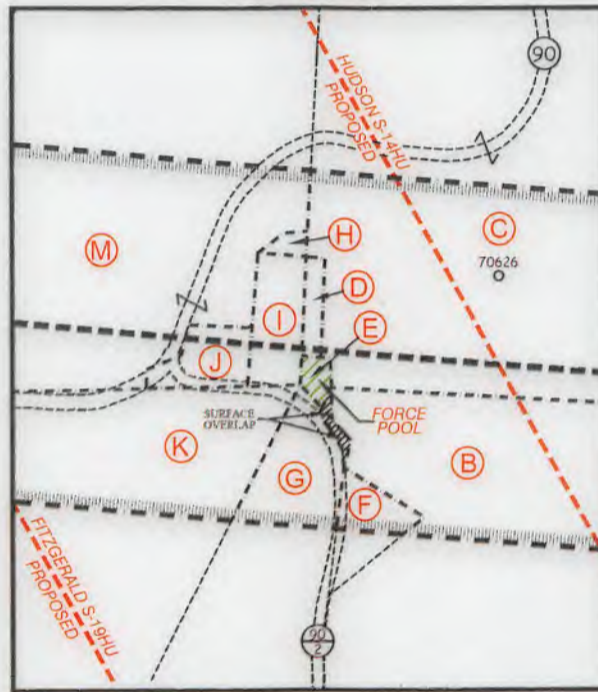
**FITZGERALD S LEASE
UTICA UNIT - 412.02 AC±
WELL 17HU
TUG HILL OPERATING**



12 Ventham Drive | P.O. Box 150 | Glenville, WV 26031 | 304.462.5434
1412 Kanawha Boulevard, East | Charleston, WV 25301 | 304.346.1052
254 East Beckley Bypass | Beckley, WV 26001 | 304.255.5296
slswv.com

NO.	Lease ID	Tags	Parcel	Grantor, Lessor, Etc.	Deed Book/Page
1	10*25518	A	7-8-1	DANNY S KERNS, MARRIED MAN DFALING WITH HIS SOLE AND SEPARATE PROPERTY et al	1010 532
2	10*18339	B	9-12-14	RESOURCE MINERALS HEADWATER I LP et al	940 448
3	PENDING	C	9-9-14	REGINA DANETTE FIGUEROA et al	1075 137
4	10*27299	D	9-9-14.2	NAUVOO CEMETERY ASSOCIATION	1057 357
5	**	E	9-9-15	REORGANIZED CHURCH OF LATER DAY SAINTS	UNRELEASED
6	10*22524	F	9-9-18	ALYCE LYNN MCGUFFIE et al	1027 233
7	10*19557	G	9-12-12	TERRY L BLAKE et al	944 649
8	10*19987	H	9-9-16.1	LESLEY D BALLA et al	955 103
9	10*27299	I	9-9-17	NAUVOO CEMETERY ASSOCIATION	1057 357
10	10*24535	J	9-9-22	BOARD OF EDUCATION OF MARSHALL COUNTY	1026 64
11	10*15494	K	9-12-11	CHRISTOPHER SINGER AND SHEREA SINGER et al	898 433
12	10*23656	L	9-12-10	ROBERT W KNIGHT AND BARBARA J KNIGHT	1011 504
13	10*19987	M	9-9-16	LESLEY D BALLA et al	955 103
14	10*15999	N	9-12-9	CHARLES W DOBBS AND JUDITH M DOBBS et al	702 171
15	**	O	9-9-4	MARY LOU RUBINI AKA MARY LOU MILLER et al	793 287
16	10*47051.304.0	P	9-9-3	UNITED BANK INC	905 5
17	10*23386	Q	9-9-1	EDITH CARMICHAEL HEIRS BY HERMAN IANTZ, ESQ AS SPEC COMMISSIONER et al	1008 68
18	10*47051.289.1	R	9-12-8	JANICE M HIXSON AND HARRY C HIXSON et al	898 461
19	10*47051.140.1	S	9-12-21	DAVID P CHAPMAN & DEBORAH BORCK CHAPMAN et al	806 318
20	10*24579	T	9-12-20	PIKEWOOD ENERGY CORPORATION AN OHIO CORPORATION et al	1026 149
21	10*21449	U	9-12-34	GARY WAYNE MORRIS et al	957 262
22	10*19748	V	9-12-19	ELIZABETH JANE KELLEY et al	957 335
23	10*18073	W	9-12-18	ROY R WOODS	927 22
24	10*21532	X	9-12-17	CHARLES F RICHARDSON AND SHIRLEY S RICHARDSON et al	957 327
25	10*19706	Y	9-12-35	BARBARA JO BEVERIDGE et al	944 627
26	PENDING	Z	9-12-36	OCTO OIL COMPANY LLC	1076 17
27	PENDING	AA	9-15-6	OCTO OIL COMPANY LLC et al	1076 17
28	10*22631	BB	7-9-1	FREDA ELIZABETH BLAKE et al	966 632
29	**	CC	7-9-2	AUSTIE CARNEY ET AL	363 15
30	10*17930	DD	7-9-22	BOUNTY MINERALS LLC et al	928 396

DETAIL
SCALE: 1" = 500'



FILE NO. 8910P17HUR.dwg
FITZGERALD S-17HU REV6

DATE MARCH 11, 2020

REVISED MARCH 25, 2020


OPERATORS WELL NO. FITZGERALD S-17HU

API WELL NO. 47 — 051 — 02324 ^{HGA} _{Deep}

NO. STATE COUNTY PERMIT



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



P.S. 849 *C. Victor Moyers*

WELL OPERATOR TUG HILL OPERATING, LLC ADDRESS 1320 SOUTH UNIVERSITY DRIVE, SUITE 500 FORT WORTH, TX 76107

DESIGNATED AGENT DIANNA STAMPER CT CORPORATION SYSTEM ADDRESS 5400 D BIG TYLER ROAD CHARLESTON, WV 25313

COUNTY NAME
PERMIT

WW-6A1
(5/13)

Operator's Well No. Fitzgerald S-17HU

**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
*See attached pages				

***Co-tenancy utilization – At least 7 mineral owners in tract. At least 75% of the royalty owners have executed a lease on the tract. The interests of the remaining co-tenants were acquired pursuant to the Co-tenancy Modernization and Majority Protection Act.**


**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: Tug Hill Operating, LLC

By: Amy L. Miller 

Its: Permitting Specialist - Appalachia Region

**	BB	7-9-1	HARLAND LEE SNYDER	CHESAPEAKE APPALACHIA LLC	1/8*	747	264	27/50 Chesapeake Appalachia LLC to Statoil USA Onshore Properties Inc	39/110 Chesapeake Appalachia LLC to SWN Production Company LLC	39/424 Statoil USA Onshore Exchange Titledholder LLC	19/624 SWN Exchange Titledholder LLC and SWN Production Company LLC	** FORCE POOL
**	BB	7-9-1	KATHLEEN D BAKER AND JOHN A BAKER	CHESAPEAKE APPALACHIA LLC	1/8*	761	31	33/246 Chesapeake Appalachia LLC to Statoil USA Onshore Properties Inc	39/110 Chesapeake Appalachia LLC to SWN Production Company LLC	39/424 Statoil USA Onshore Exchange Titledholder LLC	19/624 SWN Exchange Titledholder LLC and SWN Production Company LLC	** FORCE POOL
**	BB	7-9-1	JOHNNY RAY MORRIS AND ROSE A MORRIS	CHESAPEAKE APPALACHIA LLC	1/8*	742	419	32/750 Chesapeake Appalachia LLC to Statoil USA Onshore Properties Inc	39/110 Chesapeake Appalachia LLC to SWN Production Company LLC	39/424 Statoil USA Onshore Exchange Titledholder LLC	19/624 SWN Exchange Titledholder LLC and SWN Production Company LLC	** FORCE POOL
**	BB	7-9-1	JOHN MALCOLM HINOS AND MARY L HINOS	CHESAPEAKE APPALACHIA LLC	1/8*	761	37	33/246 Chesapeake Appalachia LLC to Statoil USA Onshore Properties Inc	39/110 Chesapeake Appalachia LLC to SWN Production Company LLC	39/424 Statoil USA Onshore Exchange Titledholder LLC	19/624 SWN Exchange Titledholder LLC and SWN Production Company LLC	** FORCE POOL
**	BB	7-9-1	JAMES RICHARD BLAKE	CHESAPEAKE APPALACHIA LLC	1/8*	759	7	31/125 Chesapeake Appalachia LLC to Statoil USA Onshore Properties Inc	39/110 Chesapeake Appalachia LLC to SWN Production Company LLC	39/424 Statoil USA Onshore Exchange Titledholder LLC	19/624 SWN Exchange Titledholder LLC and SWN Production Company LLC	** FORCE POOL
**	BB	7-9-1	HUBERT EARL MORRIS	CHESAPEAKE APPALACHIA LLC	1/8*	742	591	27/50 Chesapeake Appalachia LLC to Statoil USA Onshore Properties Inc	39/110 Chesapeake Appalachia LLC to SWN Production Company LLC	39/424 Statoil USA Onshore Exchange Titledholder LLC	19/624 SWN Exchange Titledholder LLC and SWN Production Company LLC	** FORCE POOL
**	BB	7-9-1	HERMAN WALKER BLAKE AND EVELYN BLAKE	CHESAPEAKE APPALACHIA LLC	1/8*	747	322	27/50 Chesapeake Appalachia LLC to Statoil USA Onshore Properties Inc	39/110 Chesapeake Appalachia LLC to SWN Production Company LLC	39/424 Statoil USA Onshore Exchange Titledholder LLC	19/624 SWN Exchange Titledholder LLC and SWN Production Company LLC	** FORCE POOL
**	BB	7-9-1	GARY W MORRIS AKA GARY WAYNE MORRIS	CHESAPEAKE APPALACHIA LLC	1/8*	745	230	32/750 Chesapeake Appalachia LLC to Statoil USA Onshore Properties Inc	39/110 Chesapeake Appalachia LLC to SWN Production Company LLC	39/424 Statoil USA Onshore Exchange Titledholder LLC	19/624 SWN Exchange Titledholder LLC and SWN Production Company LLC	** FORCE POOL
**	BB	7-9-1	SAMUEL NELSON RICHMOND ESTATE AND DONNA LEE STEWART	CHESAPEAKE APPALACHIA LLC	1/8*	754	564	31/125 Chesapeake Appalachia LLC to Statoil USA Onshore Properties Inc	39/110 Chesapeake Appalachia LLC to SWN Production Company LLC	39/424 Statoil USA Onshore Exchange Titledholder LLC	19/624 SWN Exchange Titledholder LLC and SWN Production Company LLC	** FORCE POOL
**	BB	7-9-1	DELORES L BLAKE	CHESAPEAKE APPALACHIA LLC	1/8*	746	289	27/50 Chesapeake Appalachia LLC to Statoil USA Onshore Properties Inc	39/110 Chesapeake Appalachia LLC to SWN Production Company LLC	39/424 Statoil USA Onshore Exchange Titledholder LLC	19/624 SWN Exchange Titledholder LLC and SWN Production Company LLC	** FORCE POOL
**	BB	7-9-1	DAVID RANDALL MORRIS	CHESAPEAKE APPALACHIA LLC	1/8*	742	629	31/25 Chesapeake Appalachia LLC to Statoil USA Onshore Properties Inc	39/110 Chesapeake Appalachia LLC to SWN Production Company LLC	39/424 Statoil USA Onshore Exchange Titledholder LLC	19/624 SWN Exchange Titledholder LLC and SWN Production Company LLC	** FORCE POOL
**	BB	7-9-1	DAVID BLAKE	CHESAPEAKE APPALACHIA LLC	1/8*	747	316	27/50 Chesapeake Appalachia LLC to Statoil USA Onshore Properties Inc	39/110 Chesapeake Appalachia LLC to SWN Production Company LLC	39/424 Statoil USA Onshore Exchange Titledholder LLC	19/624 SWN Exchange Titledholder LLC and SWN Production Company LLC	** FORCE POOL
**	BB	7-9-1	DANN GORDON MORRIS	CHESAPEAKE APPALACHIA LLC	1/8*	742	401	27/50 Chesapeake Appalachia LLC to Statoil USA Onshore Properties Inc	39/110 Chesapeake Appalachia LLC to SWN Production Company LLC	39/424 Statoil USA Onshore Exchange Titledholder LLC	19/624 SWN Exchange Titledholder LLC and SWN Production Company LLC	** FORCE POOL
**	BB	7-9-1	NINA TAYLOR FAMILY TRUST, GEORGE R TAYLOR TRUSTEE	SWN PRODUCTION COMPANY LLC	1/8*	933	3					** FORCE POOL
**	BB	7-9-1	GEORGE R TAYLOR	SWN PRODUCTION COMPANY LLC	1/8*	931	644					** FORCE POOL
**	BB	7-9-1	LARENCE TODD TAYLOR	SWN PRODUCTION COMPANY LLC	1/8*	932	25					** FORCE POOL
**	BB	7-9-1	APPALACHIAN ROYALTIES INC	NA	NA	UNLEASD						** FORCE POOL
**	BB	7-9-1	GARY A HINDS JR	NA	NA	UNLEASD						** FORCE POOL
**	BB	7-9-1	HOWARD PATTERSON HENS	NA	NA	UNLEASD						** FORCE POOL
**	BB	7-9-1	ELIA M STEPHENS HENS	NA	NA	UNLEASD						** FORCE POOL
**	BB	7-9-1	USA BRAYTON	NA	NA	UNLEASD						** FORCE POOL
**	BB	7-9-1	MARIE E BOWERS	NA	NA	UNLEASD						** FORCE POOL
**	BB	7-9-1	THE ESTATE OF MARIE L SNYDER	NA	NA	UNLEASD						** FORCE POOL
**	BB	7-9-1	WILLIAM TAYLOR BERSBERG	NA	NA	UNLEASD						** FORCE POOL
**	BB	7-9-1	TIMOTHY E BOWERS	NA	NA	UNLEASD						** FORCE POOL
**	BB	7-9-1	CAUDINE STEELE HENS	NA	NA	UNLEASD						** FORCE POOL
**	BB	7-9-1	BERNICE WISE HENS	NA	NA	UNLEASD						** FORCE POOL
**	BB	7-9-1	SUELLA LUCILLE	NA	NA	UNLEASD						** FORCE POOL
**	BB	7-9-1	SHIRLEY ANN DAVIS	NA	NA	UNLEASD						** FORCE POOL
**	BB	7-9-1	FREDA ELIZABETH BLAKE	TH EXPLORATION, LLC	1/8*	965	632	NA	NA	NA	NA	NA
**	BB	7-9-1	VICKI LORDAN	TH EXPLORATION, LLC	1/8*	974	138	NA	NA	NA	NA	NA
**	BB	7-9-1	CHARLES W DOBBS AND LUDITH M DOBBS	TH EXPLORATION, LLC	1/8*	974	190	NA	NA	NA	NA	NA
**	BB	7-9-1	JEFFRY L PORTER AND DOITY PORTER	TH EXPLORATION, LLC	1/8*	974	188	NA	NA	NA	NA	NA
**	BB	7-9-1	SHARON BOWERS WALTER	TH EXPLORATION, LLC	1/8*	974	148	NA	NA	NA	NA	NA
**	BB	7-9-1	JAY H PRICE	TH EXPLORATION, LLC	1/8*	974	272	NA	NA	NA	NA	NA
**	BB	7-9-1	KAREN L REBL	TH EXPLORATION, LLC	1/8*	988	509	NA	NA	NA	NA	NA

**	CC	7-9-22	ALISTE CARMY ET AL	THE MANUFACTURERS LIGHT AND HEAT COMPANY SWN PRODUCTION	1/8*	363	15	422/204 The Manufacturers Light and Heat Company to Columbia Gas Transmission Corporation	agreement between Columbia Gas Transmission Corporation and Columbia Natural Resources LLC	650/ 63 Columbia Natural Resources LLC and Chesapeake Appalachia LLC merger	agreement between Columbia Gas Transmission Corporation and Chesapeake Appalachia LLC	675/279 Chesapeake Appalachia LLC to Statoilhydro USA Onshore Properties Inc	On 11/20/2009, Statoilhydro USA Onshore Properties Inc changed name to Statoil USA Onshore Properties Inc	22/14 Columbia Gas Transmission LLC to Nisource Energy Ventures LLC	Effective 12/16/2014, Nisource Energy Ventures LLC changed name to Columbia Energy Ventures LLC	33/110 Chesapeake Appalachia LLC to SWN Production Company LLC	33/424 Statoil USA Onshore Properties Inc to SWN Exchange	19/624 SWN Exchange Titholder LLC and SWN Production Company LLC merger	** FORTCE POOL	
**	CC	7-9-22	BETTY BROWN GORDON	COMPANY LLC	1/8*	1067	80	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PENDING	DD	7-9-22	CHERILYN CAPSTAN *	THE EXPLORATION, LLC	1/8*	1075	512	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PENDING	DD	7-9-22	PAIGE FRANCIS *	THE EXPLORATION, LLC	1/8*	1076	314	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
10*24685	DD	7-9-22	BOULTRY MINERALS LLC	THE EXPLORATION, LLC	1/8*	928	396	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
10*24680	DD	7-9-22	LARRY D FROST AND LOHANE L FROST	THE EXPLORATION, LLC	1/8*	1026	217	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
10*24661	DD	7-9-22	HAROLD M GARNER AND SUSAN B GARNER	THE EXPLORATION, LLC	1/8*	1026	202	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
10*24662	DD	7-9-22	RICHARD D SPRINGER AND SHERYL SPRINGER AND JAMES C SPRINGER	THE EXPLORATION, LLC	1/8*	1026	220	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
10*24664	DD	7-9-22	JOHN J GARNER	THE EXPLORATION, LLC	1/8*	1026	226	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
10*24685	DD	7-9-22	SEIZANNE FROST	THE EXPLORATION, LLC	1/8*	1026	229	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
10*24670	DD	7-9-22	KENDRA S BETTS AND RICHARD A BETTS	THE EXPLORATION, LLC	1/8*	1026	223	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
10*24730	DD	7-9-22	DOLORES A MAUR	THE EXPLORATION, LLC	1/8*	1027	302	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
10*24816	DD	7-9-22	BETTY G TREWELING	THE EXPLORATION, LLC	1/8*	1028	133	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
10*24916	DD	7-9-22	BRENDA L WEINHART	THE EXPLORATION, LLC	1/8*	1028	594	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
10*25003	DD	7-9-22	LINDA L POTTS AND DONALD D POTTS	THE EXPLORATION, LLC	1/8*	1028	621	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
10*25491	DD	7-9-22	GARY M SMITH AND VICKIE L SMITH	THE EXPLORATION, LLC	1/8*	1033	126	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
10*25512	DD	7-9-22	MATTHEW J OWEN	THE EXPLORATION, LLC	1/8*	1033	111	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
10*26662	DD	7-9-22	MARTHA SUE FORBES	THE EXPLORATION, LLC	1/8*	1033	510	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
10*26653	DD	7-9-22	SCOTT SHOTT JR OF A	THE EXPLORATION, LLC	1/8*	1038	513	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
10*26657	DD	7-9-22	ERIC J MARTIN	THE EXPLORATION, LLC	1/8*	1038	506	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
10*26658	DD	7-9-22	BRENDA R PARSON AND LARRY A PARSON	THE EXPLORATION, LLC	1/8*	1038	504	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
10*26689	DD	7-9-22	MORGAN GIBSON	THE EXPLORATION, LLC	1/8*	1039	319	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
10*26682	DD	7-9-22	THOMAS SHOTT	THE EXPLORATION, LLC	1/8*	1041	316	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
10*26691	DD	7-9-22	DANIEL C SHOTT	THE EXPLORATION, LLC	1/8*	1041	218	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
10*26970	DD	7-9-22	THE ESTATE OF JOHN C SHOTT	THE EXPLORATION, LLC	1/8*	1046	190	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
10*26971	DD	7-9-22	GRACE R SHOTT-CLARBY	THE EXPLORATION, LLC	1/8*	1046	194	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
10*27090	DD	7-9-22	HUGH I SHOTT II AF BETTY SHOTT	THE EXPLORATION, LLC	1/8*	1053	9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
10*27091	DD	7-9-22	BRIDGETTE BLAVNE JONES	THE EXPLORATION, LLC	1/8*	1050	204	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
10*27092	DD	7-9-22	JAMES H SHOTT III	THE EXPLORATION, LLC	1/8*	1050	201	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
10*27096	DD	7-9-22	JOSEPH H SMITH	THE EXPLORATION, LLC	1/8*	1050	250	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
10*28264	DD	7-9-22	THE FIRMANT G HULSE AND CATHERINE D HULSE TRUST	THE EXPLORATION, LLC	1/8*	1067	516	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
10*28329	DD	7-9-22	JOSEPH BILLES ET AL *	THE EXPLORATION, LLC	1/8*	1068	135	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
10*28590	DD	7-9-22	NANCY B HERBERND REVOCABLE TRUST *	THE EXPLORATION, LLC	1/8*	1072	408	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

* Co-tenancy Utilization - At least 75% of the royalty owners have executed a lease on the tract. The interests of the remaining co-tenants were acquired pursuant to the Co-tenancy Modernization and Majority Protection Act.

ASSIGNMENT OF OIL AND GAS LEASES

This **ASSIGNMENT OF OIL AND GAS LEASES** (the "**Assignment**") is made and entered into this 8th day of March, 2018 (the "**Effective Date**"), from **Blue Roan Resources, LLC**, a West Virginia limited liability company, having an address at 3437 University Avenue, Morgantown, WV, 26505 (hereinafter "**Assignor**"), and **TH Exploration, LLC**, a Texas limited liability company, having an address at 1320 S. University Drive, Suite 500, Fort Worth, TX 76107 (hereinafter "**Assignee**").

WITNESSETH:

WHEREAS, Assignor is the owner of the right, title, and interest in those certain Oil and Gas Leases situated in Marshall County, West Virginia, which are described in Exhibit "A" attached hereto and made a part hereof (hereinafter the "**Leases**"); and

WHEREAS, subject to the exceptions and reservations herein contained, Assignor desires to assign, set over, and transfer to Assignee all of Assignor's right, title, and interest in and to the Leases.

NOW, THEREFORE, for and in consideration of the sum of Ten Dollars (\$10.00), cash in hand paid, and other good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, and subject to the limited warranties, restrictions and conditions hereinafter mentioned, the parties hereto, intending to be legally bound, do covenant and agree as follows:

1. **Assignment.** Assignor does hereby grant, bargain, sell, convey, deliver, assign, set over and transfer, as of the Effective Date, to Assignee, its respective successors and assigns, forever, subject to the terms, reservations, waivers and provisions as hereinafter set forth, an undivided interest of all of Assignor's right, title and interest in and to the Leases and all oil, natural gas, natural gas liquids, condensate, casinghead gas and other liquefied or gaseous hydrocarbons or products ("**Hydrocarbons**") thereby held, in any and all depths and formations ("**Assigned Formations**"), together with any and all other rights that are reasonably necessary or convenient to explore for and produce Hydrocarbons from the Assigned Formations, including, but not limited to, the right of surface access, use and occupancy, the right of ingress and egress, the right to conduct geophysical and other exploratory activities, the right to lay pipeline, the right to drill through, but not perforate or stimulate, all other depths and formations necessary for the purpose of reaching the Assigned Formations and to conduct operations therein.

TO HAVE AND TO HOLD such right, title and interest in and to the Leases unto Assignees or their designee, and their respective successors and assigns, forever, in accordance with the provisions of this Assignment.

2. **Representations and Warranties.** Assignor represents and warrants that such Assignor has not conveyed or otherwise encumbered its interest in the Leases since the time that Assignor obtained its interests in the Leases.

Assignor represents and warrants that, as to its interests in the Leases, Assignor has paid all royalties, overriding royalties, and other payments required by the Leases which were due for the period in which Assignor held its interests in the Leases, including, but not limited to, the interests assigned hereunder, and that Assignor has fully performed all conditions necessary to maintain the Leases in full force and effect during such period.

3. **Successors and Assigns.** The terms of this Assignment shall be binding upon and inure to the benefit of the parties hereto and each of their respective successors and assigns, and such terms shall be covenants running with the land, and with each subsequent transfer or assignment thereof.

4. **Further Assurances.** Assignor and Assignee hereby agree to take all actions and execute, acknowledge, and deliver all such instruments as are necessary or advisable to effectuate the purposes of this Assignment.

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STATE OF WEST VIRGINIA §
 §
COUNTY OF MARSHALL §

ASSIGNMENT AND CONVEYANCE

THIS ASSIGNMENT AND CONVEYANCE (the "**Assignment**") is made and entered into this 23rd day of April, 2019 (the "**Effective Date**"), by and between **AMERICAN PETROLEUM PARTNERS OPERATING, LLC**, (hereinafter "**Assignor**") and **TH EXPLORATION, LLC** (hereinafter "**Assignee**") pursuant to the terms of that certain Acreage Trade Agreement between the Assignor and the Assignee dated November 15, 2018 (the "**Acreage Trade Agreement**"). Capitalized terms used but not defined herein and defined in the Acreage Trade Agreement shall have the meanings given to such terms in the Acreage Trade Agreement.

WITNESSETH:

WHEREAS, Assignor desires to assign, set over, and transfer to Assignee all of Assignor's right, title, and interest in and to those certain Oil and Gas Leases situated in Marshall County, West Virginia, as described in **Exhibit A-2**, attached hereto and made a part hereof (hereinafter the "**Leases**"); and

WHEREAS, Assignor desires to assign, set over, and transfer to Assignee all of Assignor's right, title, and interest in and to the Leases as described below.

NOW, THEREFORE, for good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, and subject to the limited warranties, restrictions and conditions hereinafter mentioned, the parties hereto, intending to be legally bound, do covenant and agree as follows:

1. **Assignment.** Assignor does hereby grant, bargain, sell, convey, deliver, assign, set over and transfer, as of the Effective Date, to Assignee, its respective successors and assigns, forever, all of Assignor's right, title and interest in and to the Leases, and the lands covered thereby, together with all rights incident thereto and appurtenances thereon.

TO HAVE AND TO HOLD such right, title and interest in and to the Leases unto Assignee or its designee, and their respective successors and assigns, forever, in accordance with the provisions of this Assignment.

2. **Special Warranty.** Assignor represents and warrants that Assignor has not conveyed or otherwise encumbered (other than Permitted Encumbrances) its interest in the Leases since the time that Assignor obtained its interests in the Leases. Assignor does covenant, promise and agree, to and with the Assignee, its respective successors and assigns, to forever specially warrant and defend the title to the Leases or portions thereof included under this Assignment, unto the Assignee and its respective successors and assigns, against the lawful claims of Assignor, and all persons claiming, or to claim, the same or any part thereof, by, through or under Assignor.

Assignor represents and warrants that Assignor has paid any and all bonuses, rentals, royalties, overriding royalties, and other payments required by the Leases which were due for the period in which Assignor held its interests in the Leases, and that Assignor has fully performed all conditions necessary to maintain the Leases in full force and effect during such period, free and clear of all Encumbrances, except for and subject only to Permitted Encumbrances.

3. **Successors and Assigns.** The terms of this Assignment shall be binding upon and inure to the benefit of the parties hereto and each of their respective successors

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ASSIGNMENT AND CONVEYANCE

This Assignment and Conveyance (this "**Assignment**") is from **EQUINOR USA ONSHORE PROPERTIES INC.**, a Delaware corporation ("**Assignor**"), to **TH Exploration, LLC**, a Texas limited liability company ("**Assignee**"), and is executed on December 9, 2019 (the "**Effective Date**"). Assignor and Assignee may be referred to herein collectively as the "**Parties**," or individually as a "**Party**." Capitalized terms used herein but not otherwise defined herein (including in Section 3.7) shall have the meanings given such terms in that certain Acreage Trade Agreement between the Assignor and the Assignee dated November 1, 2019 (the "**Acreage Trade Agreement**").

ARTICLE 1
ASSIGNMENT OF ASSETS

Section 1.1 **Assignment.** For good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, Assignor hereby **GRANTS, BARGAINS, ASSIGNS, CONVEYS AND TRANSFERS** unto Assignee all of Assignor's right, title and interest in and to (i) the oil and gas leases described in more detail on Exhibit A attached hereto (the "**Leases**") INsofar AND ONLY INsofar as they cover those lands described on Exhibit A (the "**Leasehold Rights**") and (ii) any surface use agreements that relate to such Leasehold Rights (collectively with the Leasehold Rights, the "**Conveyed Assets**").

TO HAVE AND TO HOLD the Conveyed Assets, together with all and singular the rights, privileges, contracts and appurtenances, in any way appertaining or belonging thereto, unto Assignee, its successors and assigns, forever, subject, to the terms and conditions of this Assignment.

Section 1.2 **Assignment Subject to Acreage Trade Agreement.** This Assignment is made in accordance with and is subject to the terms, covenants and conditions contained in that certain Acreage Trade Agreement. In the event of a conflict between the provisions of the Acreage Trade Agreement and this Assignment, the provisions of the Acreage Trade Agreement shall control. The execution and delivery of this Assignment by Assignor, and the execution and acceptance of this Assignment by Assignee, shall not operate to release or impair any surviving rights or obligations of either Party with respect to the other under the Acreage Trade Agreement.

ARTICLE 2
SPECIAL WARRANTY OF TITLE AND DISCLAIMERS

Section 2.1 **Special Warranty of Title.** Assignor hereby agrees to warrant and defend Defensible Title to the Leases unto Assignee, its successors and assigns, against every Person whomsoever lawfully claiming or to claim the same or any part thereof by, through or under Assignor or any of its Affiliates, but not otherwise.

Section 2.2 **Disclaimers of Warranties and Representations.**

(a) EXCEPT AS EXPRESSLY REPRESENTED OTHERWISE IN SECTION VI OF THE ACREAGE TRADE AGREEMENT OR THIS ASSIGNMENT, ASSIGNOR MAKES NO, AND HEREBY EXPRESSLY DISCLAIMS, ANY REPRESENTATION OR WARRANTY, EXPRESS, IMPLIED OR STATUTORY, INCLUDING AS TO (I) TITLE TO THE LEASEHOLD RIGHTS, (II) THE CONTENTS, CHARACTER OR NATURE OF ANY DESCRIPTIVE MEMORANDUM, OR ANY REPORT OF ANY OF ITS PETROLEUM ENGINEERING CONSULTANTS, OR ANY GEOLOGICAL OR SEISMIC DATA OR INTERPRETATION, RELATING TO THE LEASEHOLD RIGHTS, (III) THE QUANTITY, QUALITY OR RECOVERABILITY OF PETROLEUM SUBSTANCES IN OR FROM THE LEASEHOLD RIGHTS, (IV) THE EXISTENCE OF ANY PROSPECT, OR ANY RECOMPLETION, INFILL OR STEP-OUT DRILLING OPPORTUNITIES, (V) ANY ESTIMATES OF THE VALUE OF THE LEASEHOLD RIGHTS, (VI) THE PRODUCTION OF PETROLEUM SUBSTANCES FROM THE LEASEHOLD RIGHTS, OR ANY PRODUCTION OR DECLINE RATES, (VII) THE MAINTENANCE, REPAIR, CONDITION, QUALITY, SUITABILITY, DESIGN OR MARKETABILITY OF THE LEASEHOLD RIGHTS, (VIII) INFRINGEMENT OF ANY INTELLECTUAL PROPERTY RIGHT, AND (IX) ANY OTHER MATERIALS OR INFORMATION THAT MAY HAVE BEEN MADE AVAILABLE OR COMMUNICATED TO ASSIGNEE OR ITS AFFILIATES, OR ITS OR THEIR RESPECTIVE

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ASSIGNMENT AND CONVEYANCE

This Assignment and Conveyance (this "*Assignment*") is from STATOIL USA ONSHORE PROPERTIES INC., a Delaware corporation ("*Assignor*"), to TH Exploration, LLC, a Texas limited liability company ("*Assignee*"), and is executed on August 22, 2016 (the "*Effective Date*"). Assignor and Assignee may be referred to herein collectively as the "*Parties*," or individually as a "*Party*." Capitalized terms used herein but not otherwise defined herein (including in Section 3.7) shall have the meanings given such terms in that certain Acreage Trade Agreement between the Assignor and the Assignee dated June 19, 2016 (the "*Acreage Trade Agreement*").

ARTICLE 1 ASSIGNMENT OF ASSETS

Section 1.1 Assignment. For good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, Assignor hereby GRANTS, BARGAINS, ASSIGNS, CONVEYS AND TRANSFERS unto Assignee all of Assignor's right, title and interest in and to (i) the oil and gas leases described in more detail on Exhibit A attached hereto (the "*Leases*") INsofar AND ONLY INsofar as they cover the Target Formations and INsofar AND ONLY INsofar as they cover those lands described on Exhibit A (the "*Leasehold Rights*") and (ii) any surface use agreements that relate to such Leasehold Rights (collectively with the Leasehold Rights, the "*Conveyed Assets*"). Assignor does hereby reserve unto itself the right and subsurface easement to drill through the Leasehold Rights to access the those depths and formations in the Leases other than the Target Formations and (y) to shoot seismic, sonic, or other energy or waves through the Leasehold Rights and to receive, record and evaluate such energy or waves, including those reflected from or in any way pertaining to the reserved depths, and to utilize any and all other exploration technologies that image the subsurface of the leasehold including the reserved depths and to receive, record and evaluate all images resulting therefrom.

TO HAVE AND TO HOLD the Conveyed Assets, together with all and singular the rights, privileges, contracts and appurtenances, in any way appertaining or belonging thereto, unto Assignee, its successors and assigns, forever, subject, to the terms and conditions of this Assignment.

Section 1.4 Assignment Subject to Acreage Trade Agreement. This Assignment is made in accordance with and is subject to the terms, covenants and conditions contained in that certain Acreage Trade Agreement. In the event of a conflict between the provisions of the Acreage Trade Agreement and this Assignment, the provisions of the Acreage Trade Agreement shall control. The execution and delivery of this Assignment by Assignor, and the execution and acceptance of this Assignment by Assignee, shall not operate to release or impair any surviving rights or obligations of either Party with respect to the other under the Acreage Trade Agreement.

ARTICLE 2 SPECIAL WARRANTY OF TITLE AND DISCLAIMERS

Section 2.1 Special Warranty of Title. Assignor hereby agrees to warrant and defend Defensible Title to the Leases unto Assignee, its successors and assigns, against every Person whomsoever lawfully claiming or to claim the same or any part thereof by, through or under Assignor or any of its Affiliates, but not otherwise.

Section 2.2 Disclaimers of Warranties and Representations.

(a) EXCEPT AS EXPRESSLY REPRESENTED OTHERWISE IN SECTION VI OF THE ACREAGE TRADE AGREEMENT OR THIS ASSIGNMENT, ASSIGNOR MAKES NO, AND HEREBY EXPRESSLY DISCLAIMS, ANY REPRESENTATION OR WARRANTY, EXPRESS, IMPLIED OR STATUTORY, INCLUDING AS TO (I) TITLE TO THE LEASEHOLD RIGHTS, (II) THE CONTENTS, CHARACTER OR NATURE OF ANY

COPY

STATE OF WEST VIRGINIA §
 §
COUNTY OF MARSHALL §

Marshall County
Jan Pest, Clerk
Instrument 1453305
04/24/2019 @ 11:51:22 AM
ASSIGNMENTS
Book 43 @ Page 503
Pages Recorded 10
Recording Cost \$ 17.00

ASSIGNMENT AND CONVEYANCE

THIS ASSIGNMENT AND CONVEYANCE (the "Assignment") is made and entered into this 23rd day of April, 2019 (the "Effective Date"), by and between AMERICAN PETROLEUM PARTNERS OPERATING, LLC, (hereinafter "Assignor") and TH EXPLORATION, LLC (hereinafter "Assignee") pursuant to the terms of that certain Acreage Trade Agreement between the Assignor and the Assignee dated November 15, 2018 (the "Acreage Trade Agreement"). Capitalized terms used but not defined herein and defined in the Acreage Trade Agreement shall have the meanings given to such terms in the Acreage Trade Agreement.

WITNESSETH:

WHEREAS, Assignor desires to assign, set over, and transfer to Assignee all of Assignor's right, title, and interest in and to those certain Oil and Gas Leases situated in Marshall County, West Virginia, as described in Exhibit A-2, attached hereto and made a part hereof (hereinafter the "Leases"); and

WHEREAS, Assignor desires to assign, set over, and transfer to Assignee all of Assignor's right, title, and interest in and to the Leases as described below.

NOW, THEREFORE, for good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, and subject to the limited warranties, restrictions and conditions hereinafter mentioned, the parties hereto, intending to be legally bound, do covenant and agree as follows:

1. Assignment. Assignor does hereby grant, bargain, sell, convey, deliver, assign, set over and transfer, as of the Effective Date, to Assignee, its respective successors and assigns, forever, all of Assignor's right, title and interest in and to the Leases, and the lands covered thereby, together with all rights incident thereto and appurtenances thereon.

TO HAVE AND TO HOLD such right, title and interest in and to the Leases unto Assignee or its designee, and their respective successors and assigns, forever, in accordance with the provisions of this Assignment.

2. Special Warranty. Assignor represents and warrants that Assignor has not conveyed or otherwise encumbered (other than Permitted Encumbrances) its interest in the Leases since the time that Assignor obtained its interests in the Leases. Assignor does covenant, promise and agree, to and with the Assignee, its respective successors and assigns, to forever specially warrant and defend the title to the Leases or portions thereof included under this Assignment, unto the Assignee and its respective successors and assigns, against the lawful claims of Assignor, and all persons claiming, or to claim, the same or any part thereof, by, through or under Assignor.

Assignor represents and warrants that Assignor has paid any and all bonuses, rentals, royalties, overriding royalties, and other payments required by the Leases which were due for the period in which Assignor held its interests in the Leases, and that Assignor has fully performed all conditions necessary to maintain the Leases in full force and effect during such period, free and clear of all Encumbrances, except for and subject only to Permitted Encumbrances.

3. Successors and Assigns. The terms of this Assignment shall be binding upon and inure to the benefit of the parties hereto and each of their respective successors

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March 10, 2020

WV Department of Environmental Protection
Office of Oil & Gas
601 57th Street, SE
Charleston, WV 25304
Attention: Laura Adkins

RE: Fitzgerald S-17HU

Subject: Marshall County Route 90 Road Crossing Letter

Dear Laura:

Tug Hill Operating, LLC (THO) hereby submits this letter as confirmation that THO has obtained the right to drill, extract and produce the minerals under Marshall County Route 90 in the area reflected on the Fitzgerald S-17HU well plat. THO has conducted a full title search in the relevant Court House to confirm its ownership under said County Routes and is not currently aware of any recorded document that would suggest an ownership other than THO.

If your office has any questions or concerns regarding the contents of this letter, please do not hesitate to contact me directly at 304-376-0111, or by email at amiller@tug-hilop.com.

Sincerely,

A handwritten signature in blue ink that reads "Amy L. Miller".

Amy L. Miller
Permitting Specialist
Appalachia Region

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(1/12)

**STATE OF WEST VIRGINIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION, OFFICE OF OIL AND GAS
NOTICE CERTIFICATION**

Date of Notice Certification: 05/23/2019

API No. 47- 051 -

Operator's Well No. Fitzgerald S-17HU

Well Pad Name: Fitzgerald

Notice has been given:

Pursuant to the provisions in West Virginia Code § 22-6A, the Operator has provided the required parties with the Notice Forms listed below for the tract of land as follows:

State:	<u>West Virginia</u>	UTM NAD 83	Easting:	<u>530,724.06</u>
County:	<u>Marshall</u>		Northing:	<u>4,405,748.24</u>
District:	<u>Liberty</u>	Public Road Access:	<u>Rines Ridge Road (County Route 76)</u>	
Quadrangle:	<u>Glen Easton 7.5'</u>	Generally used farm name:	<u>Danny S. Kerns, et al</u>	
Watershed:	<u>Upper Fish Creek</u>			

Pursuant to West Virginia Code § 22-6A-7(b), every permit application filed under this section shall be on a form as may be prescribed by the secretary, shall be verified and shall contain the following information: (14) A certification from the operator that (i) it has provided the owners of the surface described in subdivisions (1), (2) and (4), subsection (b), section ten of this article, the information required by subsections (b) and (c), section sixteen of this article; (ii) that the requirement was deemed satisfied as a result of giving the surface owner notice of entry to survey pursuant to subsection (a), section ten of this article six-a; or (iii) the notice requirements of subsection (b), section sixteen of this article were waived in writing by the surface owner; and Pursuant to West Virginia Code § 22-6A-11(b), the applicant shall tender proof of and certify to the secretary that the notice requirements of section ten of this article have been completed by the applicant.

<p>Pursuant to West Virginia Code § 22-6A, the Operator has attached proof to this Notice Certification that the Operator has properly served the required parties with the following:</p> <p>*PLEASE CHECK ALL THAT APPLY</p> <p><input type="checkbox"/> 1. NOTICE OF SEISMIC ACTIVITY or <input checked="" type="checkbox"/> NOTICE NOT REQUIRED BECAUSE NO SEISMIC ACTIVITY WAS CONDUCTED</p> <p><input checked="" type="checkbox"/> 2. NOTICE OF ENTRY FOR PLAT SURVEY or <input type="checkbox"/> NO PLAT SURVEY WAS CONDUCTED</p> <p><input type="checkbox"/> 3. NOTICE OF INTENT TO DRILL or <input checked="" type="checkbox"/> NOTICE NOT REQUIRED BECAUSE NOTICE OF ENTRY FOR PLAT SURVEY WAS CONDUCTED or</p> <p style="padding-left: 40px;"><input type="checkbox"/> WRITTEN WAIVER BY SURFACE OWNER (PLEASE ATTACH)</p> <p><input checked="" type="checkbox"/> 4. NOTICE OF PLANNED OPERATION</p> <p><input checked="" type="checkbox"/> 5. PUBLIC NOTICE</p> <p><input checked="" type="checkbox"/> 6. NOTICE OF APPLICATION</p>	<p>OOG OFFICE USE ONLY</p> <p><input type="checkbox"/> RECEIVED/ NOT REQUIRED</p> <p><input type="checkbox"/> RECEIVED</p> <p><input type="checkbox"/> RECEIVED/ NOT REQUIRED</p> <p><input type="checkbox"/> RECEIVED</p> <p><input type="checkbox"/> RECEIVED</p>
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Office of Oil and Gas
MAR 17 2020
DEPARTMENT OF ENVIRONMENTAL PROTECTION

Required Attachments:

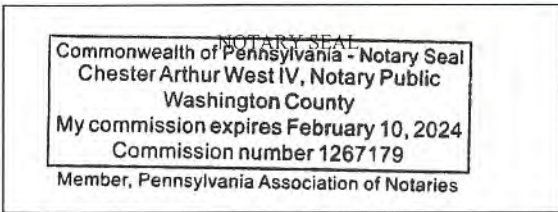
The Operator shall attach to this Notice Certification Form all Notice Forms and Certifications of Notice that have been provided to the required parties and/or any associated written waivers. For the Public Notice, the operator shall attach a copy of the Class II Legal Advertisement with publication date verification or the associated Affidavit of Publication. The attached Notice Forms and Certifications of Notice shall serve as proof that the required parties have been noticed as required under West Virginia Code § 22-6A. Pursuant to West Virginia Code § 22-6A-11(b), the Certification of Notice to the person may be made by affidavit of personal service, the return receipt card or other postal receipt for certified mailing.

WW-6AC
(1/12)

Certification of Notice is hereby given:

THEREFORE, I Amy L. Miller, have read and understand the notice requirements within West Virginia Code § 22-6A. I certify that as required under West Virginia Code § 22-6A, I have served the attached copies of the Notice Forms, identified above, to the required parties through personal service, by registered mail or by any method of delivery that requires a receipt or signature confirmation. I certify under penalty of law that I have personally examined and am familiar with the information submitted in this Notice Certification and all attachments, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

Well Operator:	<u>Tug Hill Operating, LLC</u>	Address:	<u>380 Southpointe Boulevard, Plaza II, Suite 200</u>
By:	<u>Amy L. Miller <i>Amy Miller</i></u>		<u>Canonsburg, PA 15317</u>
Its:	<u>Permitting Specialist - Appalachia Region</u>	Facsimile:	<u>724-338-2030</u>
Telephone:	<u>724-749-8388</u>	Email:	<u>amiller@tug-hillop.com</u>



Subscribed and sworn before me this 13th day of March 2020.

[Signature] Notary Public

My Commission Expires 2-10-2024

Oil and Gas Privacy Notice:

The Office of Oil and Gas processes your personal information, such as name, address and telephone number, as part of our regulatory duties. Your personal information may be disclosed to other State agencies or third parties in the normal course of business or as needed to comply with statutory or regulatory requirements, including Freedom of Information Act requests. Our office will appropriately secure your personal information. If you have any questions about our use or your personal information, please contact DEP's Chief Privacy Officer at deprivacyofficer@wv.gov.

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Environmental Protection

**STATE OF WEST VIRGINIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION, OFFICE OF OIL AND GAS
NOTICE OF APPLICATION**

Notice Time Requirement: notice shall be provided no later than the **filing date of permit application.**

Date of Notice: 3/10/2020 **Date Permit Application Filed:** 3/12/2020

Notice of:

- PERMIT FOR ANY WELL WORK CERTIFICATE OF APPROVAL FOR THE CONSTRUCTION OF AN IMPOUNDMENT OR PIT

Delivery method pursuant to West Virginia Code § 22-6A-10(b)

- PERSONAL SERVICE REGISTERED MAIL METHOD OF DELIVERY THAT REQUIRES A RECEIPT OR SIGNATURE CONFIRMATION

Pursuant to W. Va. Code § 22-6A-10(b) no later than the filing date of the application, the applicant for a permit for any well work or for a certificate of approval for the construction of an impoundment or pit as required by this article shall deliver, by personal service or by registered mail or by any method of delivery that requires a receipt or signature confirmation, copies of the application, the erosion and sediment control plan required by section seven of this article, and the well plat to each of the following persons: (1) The owners of record of the surface of the tract on which the well is or is proposed to be located; (2) The owners of record of the surface tract or tracts overlying the oil and gas leasehold being developed by the proposed well work, if the surface tract is to be used for roads or other land disturbance as described in the erosion and sediment control plan submitted pursuant to subsection (c), section seven of this article; (3) The coal owner, operator or lessee, in the event the tract of land on which the well proposed to be drilled is located [sic] is known to be underlain by one or more coal seams; (4) The owners of record of the surface tract or tracts overlying the oil and gas leasehold being developed by the proposed well work, if the surface tract is to be used for the placement, construction, enlargement, alteration, repair, removal or abandonment of any impoundment or pit as described in section nine of this article; (5) Any surface owner or water purveyor who is known to the applicant to have a water well, spring or water supply source located within one thousand five hundred feet of the center of the well pad which is used to provide water for consumption by humans or domestic animals; and (6) The operator of any natural gas storage field within which the proposed well work activity is to take place. (c)(1) If more than three tenants in common or other co-owners of interests described in subsection (b) of this section hold interests in the lands, the applicant may serve the documents required upon the person described in the records of the sheriff required to be maintained pursuant to section eight, article one, chapter eleven-a of this code. (2) Notwithstanding any provision of this article to the contrary, notice to a lien holder is not notice to a landowner, unless the lien holder is the landowner. W. Va. Code R. § 35-8-5.7.a requires, in part, that the operator shall also provide the Well Site Safety Plan ("WSSP") to the surface owner and any water purveyor or surface owner subject to notice and water testing as provided in section 15 of this rule.

Application Notice WSSP Notice E&S Plan Notice Well Plat Notice is hereby provided to:

SURFACE OWNER(s)

Name: Regina D. Figueroa
Address: 94 E. 700 N
Valparaiso, IN 46383
Name: Danny S. Kerns *See attached list
Address: 3500 West 80th Place
Merrillville, IN 46410

SURFACE OWNER(s) (Road and/or Other Disturbance)

Name: Regina D. Figueroa
Address: 94 E. 700 N
Valparaiso, IN 46383
Name: Danny S. Kerns *See attached list
Address: 3500 West 80th Place
Merrillville, IN 46410

SURFACE OWNER(s) (Impoundments or Pits)

Name: _____
Address: _____

COAL OWNER OR LESSEE

Name: Consol Energy
Address: 1000 Consol Energy Drive
Canonsburg, PA 15317

COAL OPERATOR

Name: Murray American Energy, Inc. attn: Mason Smith
Address: 46226 National Road
St. Clairsville, OH 43905

SURFACE OWNER OF WATER WELL AND/OR WATER PURVEYOR(s)

Name: Danny R. Kerns *See attached list
Address: 3500 West 80th Place
Merrillville, IN 64610

OPERATOR OF ANY NATURAL GAS STORAGE FIELD

Name: _____
Address: _____

*Please attach additional forms if necessary

Notice is hereby given:

Pursuant to West Virginia Code § 22-6A-10(b), notice is hereby given that the undersigned well operator has applied for a permit for well work or for a certificate of approval for the construction of an impoundment or pit.

This Notice Shall Include:

Pursuant to W. Va. Code § 22-6A-10(b), this notice shall include: (1) copies of the application; (2) the erosion and sediment control plan required by section seven of this article; and (3) the well plat.

Pursuant to W. Va. Code § 22-6A-10(f), this notice shall include: (1) a statement of the time limits for filing written comments; (2) who may file written comments; (3) the name and address of the secretary for the purpose of filing the comments and obtaining additional information; and (4) a statement that the persons may request, at the time of submitting written comments, notice of the permit decision and a list of persons qualified to test water.

Pursuant to W. Va. Code R. § 35-8-5.7.a, the operator shall provide the Well Site Safety Plan to the surface owner and any water purveyor or surface owner subject to notice and water testing as provided in section 15 of this rule.

Pursuant to W. Va. Code R. § 35-8-15.2.c, this notice shall: (1) contain a statement of the surface owner's and water purveyor's right to request sampling and analysis; (2) advise the surface owner and water purveyor of the rebuttable presumption for contamination or deprivation of a fresh water source or supply; advise the surface owner and water purveyor that refusal to allow the operator to conduct a pre-drilling water well test constitutes a method to rebut the presumption of liability; (3) advise the surface owner and water purveyor of his or her independent right to sample and analyze any water supply at his or her own expense; advise the surface owner and water purveyor whether or not the operator will utilize an independent laboratory to analyze any sample; and (4) advise the surface owner and or water purveyor that he or she can obtain from the Chief a list of water testing laboratories in the subject area capable of and qualified to test water supplies in accordance with standard acceptable methods.

Additional information related to horizontal drilling may be obtained from the Secretary, at the WV Department of Environmental Protection headquarters, located at 601 57th Street, SE, Charleston, WV 25304 (304-926-0450) or by visiting www.dep.wv.gov/oil-and-gas/pages/default.aspx.

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Well Location Restrictions

Pursuant to W. Va. Code § 22-6A-12, Wells may not be drilled within two hundred fifty feet measured horizontally from any water well or developed spring used for human or domestic animal consumption. The center of well pads may not be located within six hundred twenty-five feet of an occupied dwelling structure, or a building two thousand five hundred square feet or larger used to house or shelter dairy cattle or poultry husbandry. This limitation is applicable to those wells, developed springs, dwellings or agricultural buildings that existed on the date a notice to the surface owner of planned entry for surveying or staking as provided in section ten of this article or a notice of intent to drill a horizontal well as provided in subsection (b), section sixteen of this article was provided, whichever occurs first, and to any dwelling under construction prior to that date. This limitation may be waived by written consent of the surface owner transmitted to the department and recorded in the real property records maintained by the clerk of the county commission for the county in which such property is located. Furthermore, the well operator may be granted a variance by the secretary from these distance restrictions upon submission of a plan which identifies the sufficient measures, facilities or practices to be employed during well site construction, drilling and operations. The variance, if granted, shall include terms and conditions the department requires to ensure the safety and protection of affected persons and property. The terms and conditions may include insurance, bonding and indemnification, as well as technical requirements. (b) No well pad may be prepared or well drilled within one hundred feet measured horizontally from any perennial stream, natural or artificial lake, pond or reservoir, or a wetland, or within three hundred feet of a naturally reproducing trout stream. No well pad may be located within one thousand feet of a surface or ground water intake of a public water supply. The distance from the public water supply as identified by the department shall be measured as follows: (1) For a surface water intake on a lake or reservoir, the distance shall be measured from the boundary of the lake or reservoir. (2) For a surface water intake on a flowing stream, the distance shall be measured from a semicircular radius extending upstream of the surface water intake. (3) For a groundwater source, the distance shall be measured from the wellhead or spring. The department may, in its discretion, waive these distance restrictions upon submission of a plan identifying sufficient measures, facilities or practices to be employed during well site construction, drilling and operations to protect the waters of the state. A waiver, if granted, shall impose any permit conditions as the secretary considers necessary. (c) Notwithstanding the foregoing provisions of this section, nothing contained in this section prevents an operator from conducting the activities permitted or authorized by a Clean Water Act Section 404 permit or other approval from the United States Army Corps of Engineers within any waters of the state or within the restricted areas referenced in this section. (d) The well location restrictions set forth in this section shall not apply to any well on a multiple well pad if at least one of the wells was permitted prior to the effective date of this article. (e) The secretary shall, by December 31, 2012, report to the Legislature on the noise, light, dust and volatile organic compounds generated by the drilling of horizontal wells as they relate to the well location restrictions regarding occupied dwelling structures pursuant to this section. Upon a finding, if any, by the secretary that the well location restrictions regarding occupied dwelling structures are inadequate or otherwise require alteration to address the items

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(8-13)

API NO. 47-051 -
OPERATOR WELL NO. Fitzgerald S-17HU
Well Pad Name: Fitzgerald

examined in the study required by this subsection, the secretary shall have the authority to propose for promulgation legislative rules establishing guidelines and procedures regarding reasonable levels of noise, light, dust and volatile organic compounds relating to drilling horizontal wells, including reasonable means of mitigating such factors, if necessary.

Water Well Testing:

Pursuant to West Virginia Code § 22-6A-10(d), notification shall be made, with respect to surface landowners identified in subsection (b) or water purveyors identified in subdivision (5), subsection (b) of this section, of the opportunity for testing their water well. The operator shall provide an analysis to such surface landowner or water purveyor at their request.

Water Testing Laboratories:

Pursuant to West Virginia Code § 22-6A-10(i), persons entitled to notice pursuant to subsection (b) of this section may contact the department to ascertain the names and locations of water testing laboratories in the subject area capable and qualified to test water supplies in accordance with standard accepted methods. In compiling that list of names the department shall consult with the state Bureau for Public Health and local health departments. A surface owner and water purveyor has an independent right to sample and analyze any water supply at his or her own expense. The laboratory utilized by the operator shall be approved by the agency as being certified and capable of performing sample analyses in accordance with this section.

Rebuttable Presumption for Contamination or Deprivation of a Fresh Water Source or Supply:

W. Va. Code § 22-6A-18 requires that (b) unless rebutted by one of the defenses established in subsection (c) of this section, in any action for contamination or deprivation of a fresh water source or supply within one thousand five hundred feet of the center of the well pad for horizontal well, there is a rebuttable presumption that the drilling and the oil or gas well or either was the proximate cause of the contamination or deprivation of the fresh water source or supply. (c) In order to rebut the presumption of liability established in subsection (b) of this section, the operator must prove by a preponderance of the evidence one of the following defenses: (1) The pollution existed prior to the drilling or alteration activity as determined by a predrilling or prealteration water well test. (2) The landowner or water purveyor refused to allow the operator access to the property to conduct a predrilling or prealteration water well test. (3) The water supply is not within one thousand five hundred feet of the well. (4) The pollution occurred more than six months after completion of drilling or alteration activities. (5) The pollution occurred as the result of some cause other than the drilling or alteration activity. (d) Any operator electing to preserve its defenses under subdivision (1), subsection (c) of this section shall retain the services of an independent certified laboratory to conduct the predrilling or prealteration water well test. A copy of the results of the test shall be submitted to the department and the surface owner or water purveyor in a manner prescribed by the secretary. (e) Any operator shall replace the water supply of an owner of interest in real property who obtains all or part of that owner's supply of water for domestic, agricultural, industrial or other legitimate use from an underground or surface source with a comparable water supply where the secretary determines that the water supply has been affected by contamination, diminution or interruption proximately caused by the oil or gas operation, unless waived in writing by that owner. (f) The secretary may order the operator conducting the oil or gas operation to: (1) Provide an emergency drinking water supply within twenty-four hours; (2) Provide temporary water supply within seventy-two hours; (3) Within thirty days begin activities to establish a permanent water supply or submit a proposal to the secretary outlining the measures and timetables to be used in establishing a permanent supply. The total time in providing a permanent water supply may not exceed two years. If the operator demonstrates that providing a permanent replacement water supply cannot be completed within two years, the secretary may extend the time frame on case-by-case basis; and (4) Pay all reasonable costs incurred by the real property owner in securing a water supply. (g) A person as described in subsection (b) of this section aggrieved under the provisions of subsections (b), (e) or (f) of this section may seek relief in court... (i) Notwithstanding the denial of the operator of responsibility for the damage to the real property owner's water supply or the status of any appeal on determination of liability for the damage to the real property owner's water supply, the operator may not discontinue providing the required water service until authorized to do so by the secretary or a court of competent jurisdiction.

Written Comment:

Pursuant to West Virginia Code § 22-6A-11(a), all persons described in subsection (b), section ten of this article may file written comments with the secretary as to the location or construction of the applicant's proposed well work within thirty days after the application is filed with the secretary. All persons described in West Virginia Code § 22-6A-10(b) may file written comments as to the location or construction of the applicant's proposed well work to the Secretary at:

Chief, Office of Oil and Gas
Department of Environmental Protection
601 57th St. SE
Charleston, WV 25304
(304) 926-0450

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Such persons may request, at the time of submitting written comments, notice of the permit decision and a list of persons qualified to test water. **NOTE: YOU ARE NOT REQUIRED TO FILE ANY COMMENT.**

Time Limits and Methods for Filing Comments.

The law requires these materials to be served on or before the date the operator files its Application. You have **THIRTY (30) DAYS** after the filing date to file your comments. Comments must be filed in person or received in the mail by the Chief's office by the time stated above. You may call the Chief's office to be sure of the date. Check with your postmaster to ensure adequate delivery time or to arrange special expedited handling. If you have been contacted by the well operator and you have signed a "voluntary statement of no objection" to the planned work described in these materials, then the permit may be issued at any time.

Pursuant to West Virginia Code § 22-6A-11(c)(2), Any objections of the affected coal operators and coal seam owners and lessees shall be addressed through the processes and procedures that exist under sections fifteen, seventeen and forty, article six of this chapter, as applicable and as incorporated into this article by section five of this article. The written comments filed by the parties entitled to notice under subdivisions (1), (2), (4), (5) and (6), subsection (b), section ten of this article shall be considered by the secretary in the permit issuance process, but the parties are not entitled to participate in the processes and proceedings that exist under sections fifteen, seventeen or forty, article six of this chapter, as applicable and as incorporated into this article by section five of this article.

Comment Requirements

Your comments must be in writing and include your name, address and telephone number, the well operator's name and well number and the approximate location of the proposed well site including district and county from the application. You may add other documents, such as sketches, maps or photographs to support your comments.

Disclaimer: All comments received will be placed on our web site <http://www.dep.wv.gov/oil-and-gas/Horizontal-Permits/Pages/default.aspx> and the applicant will automatically be forwarded an email notice that such comments have been submitted. The applicant will be expected to provide a response to comments submitted by any surface owner, water purveyor or natural gas storage operator noticed within the application.

Permit Denial or Condition

The Chief has the power to deny or condition a well work permit. Pursuant to West Virginia Code § 22-6A-8(d), the permit may not be issued or be conditioned, including conditions with respect to the location of the well and access roads prior to issuance if the director determines that:

- (1) The proposed well work will constitute a hazard to the safety of persons;
- (2) The plan for soil erosion and sediment control is not adequate or effective;
- (3) Damage would occur to publicly owned lands or resources; or
- (4) The proposed well work fails to protect fresh water sources or supplies.

A permit may also be denied under West Virginia Code § 22-6A-7(k), the secretary shall deny the issuance of a permit if the secretary determines that the applicant has committed a substantial violation of a previously issued permit for a horizontal well, including the applicable erosion and sediment control plan associated with the previously issued permit, or a substantial violation of one or more of the rules promulgated under this article, and in each instance has failed to abate or seek review of the violation within the time prescribed by the secretary pursuant to the provisions of subdivisions (1) and (2), subsection (a), section five of this article and the rules promulgated hereunder, which time may not be unreasonable.

Pursuant to West Virginia Code § 22-6A-10(g), any person entitled to submit written comments to the secretary pursuant to subsection (a), section eleven of this article, shall also be entitled to receive from the secretary a copy of the permit as issued or a copy of the order modifying or denying the permit if the person requests receipt of them as a part of the written comments submitted concerning the permit application. Such persons may request, at the time of submitting written comments, notice of the permit decision and a list of persons qualified to test water.

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API NO. 47-051 **4705102324**
OPERATOR WELL NO. Fitzgerald S-17HU
Well Pad Name: Fitzgerald

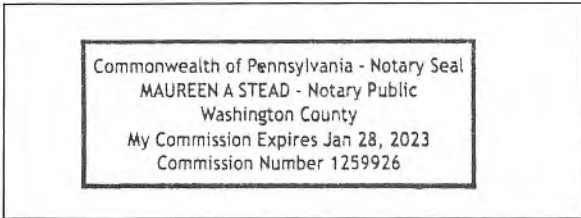
Notice is hereby given by:

Well Operator: Tug Hill Operating, LLC
Telephone: 724-749-8388
Email: amiller@tug-hilltop.com *amy stiller*

Address: 380 Southpointe Boulevard, Plaza II, Suite 200
Canonsburg, PA 15317
Facsimile: 724-338-2030

Oil and Gas Privacy Notice:

The Office of Oil and Gas processes your personal information, such as name, address and telephone number, as part of our regulatory duties. Your personal information may be disclosed to other State agencies or third parties in the normal course of business or as needed to comply with statutory or regulatory requirements, including Freedom of Information Act requests. Our office will appropriately secure your personal information. If you have any questions about our use or your personal information, please contact DEP's Chief Privacy Officer at deprivacyofficer@wv.gov.



Subscribed and sworn before me this 6 day of MARCH 2020.
Maureen Stead Notary Public
My Commission Expires 1/28/23

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WW-6A NOTICE OF APPLICATION

FITZGERALD S-17HU

ADDITIONAL PARTIES TO NOTICE

Surface Owner (Pad and Access Road)

Deena J. Palomo
20 Maxwell St.
Apt. 4
Hebron, IN 46341

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Exhibit WW-6A**Supplement Pg. 1A**

Tug Hill Operating, LLC
 380 Southpointe Blvd, Suite 200
 Cannonsburg, PA 15137

Residences within Two-Thousand Feet (2,000')

Well: Fitzgerald S – 17HU
 District: Liberty
 State: WV

There are four (4) residences, one (1) business or commercial site, one (1) church, no schools or no emergency facilities within two-thousand feet (2,000') of the above referenced well location.

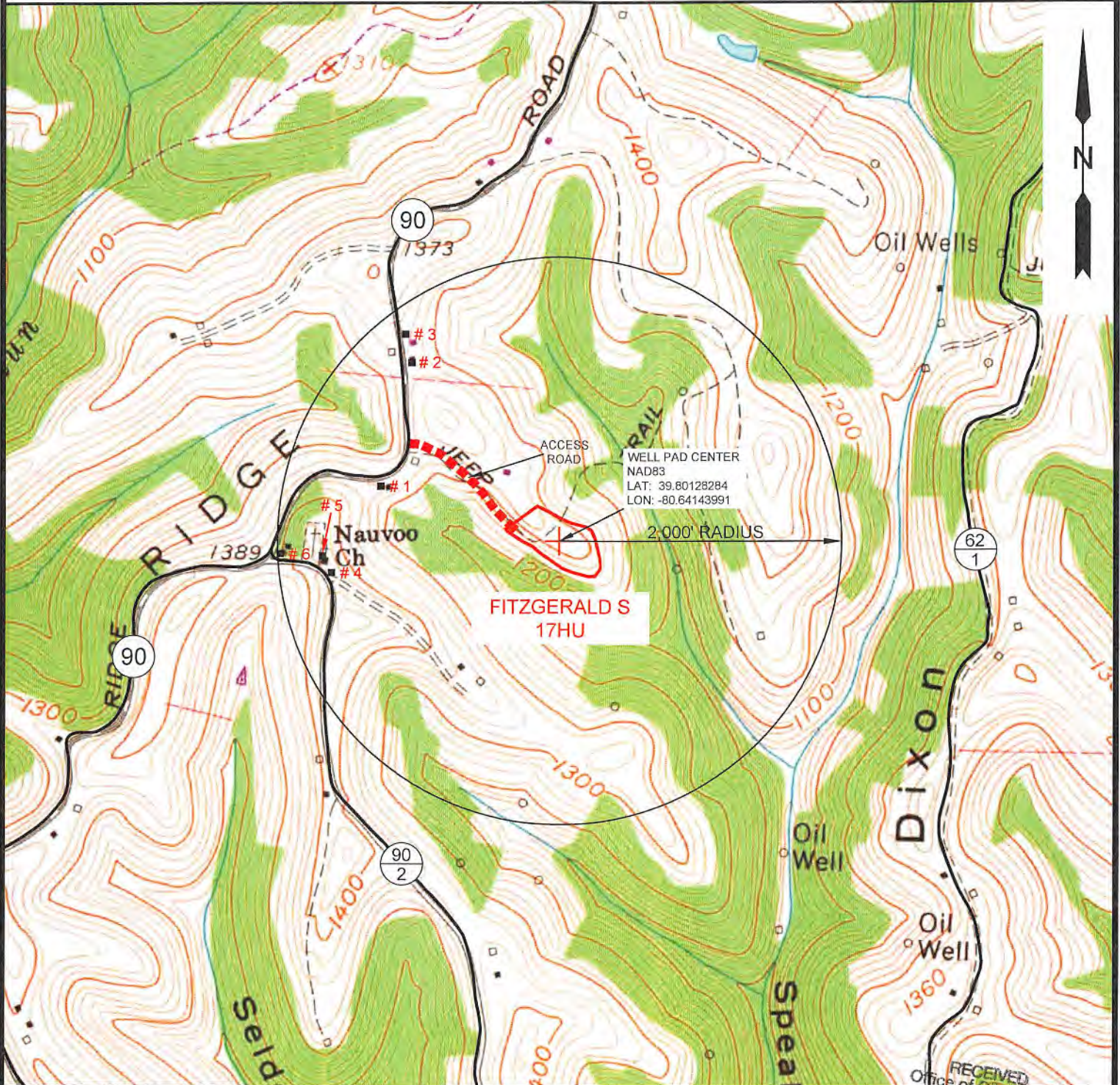
<p>Residence (#1) TM 9 Pcl. 14 Danny R. Kerns, Et Al Phone: 219-887-6761 (Reverse Address – David A. & Regina D. Figueroa) Physical Address: 1352 Nauvoo Ridge Rd. Cameron, WV 26033 Tax Address: 94 E 700 N Valparaiso, IN 46383</p>	<p>Residence (#2) TM 9 Pcl. 12.1 Jessica R. & David A. II Dempewolf Phone: 304-810-0500 (Reverse Address – Jolene Morris) Physical Address: 1180 Nauvoo Ridge Rd. Cameron, WV 26033 Tax Address: Same</p>	<p>Residence (#3) TM 9 Pcl. 12 Gary W. Morris c/o Gary Morris & Cynthia Patrello Phone: None Found Physical Address: 1156 Nauvoo Ridge Rd. Cameron, WV 26033 Tax Address: Same</p>
<p>Business/Commercial Site (#4) TM 12 Pcl. 14 Consol Mining Co. LLC Consolidation Coal Company c/o Murray Energy c/o Land Dept. Physical Address: 90 The Corner Ln. Glen Easton, WV 26039 (Appears to be an underground mine vent or fan site or other related infrastructure) Tax Address: 46226 National Rd. Saint Clairsville, OH 43950</p>	<p>Church (#5) TM 9 Pcl. 15 Trustees of the Reorganized Church of Latter Day Saints Phone: None Physical Address: 88 The Corner Ln. Glen Easton, WV 26039 Tax Address: Exempt/None</p>	<p>Residence (#6) TM 9 Pcl. 22 Gary W. Morris Phone: None Found Physical Address: 1556 Nauvoo Ridge Rd. Cameron, WV 26033 Tax Address: 1156 Nauvoo RDG Glen Easton, WV 26039</p>

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PROPOSED FITZGERALD S - 17HU



NOTE: THERE APPEARS TO BE FIVE (5) POSSIBLE WATER SOURCES WITHIN 2,000'.

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 <p>12 Vanhorn Drive P.O. Box 150 Glenville, WV 26351 304.462.5634 1412 Kanawha Boulevard, East Charleston, WV 25301 304.346.3952 254 East Beckley Bypass Beckley, WV 25801 304.255.5296 sllswv.com</p>	TOPO SECTION: GLEN EASTON 7.5' & CAMERON 7.5'		OPERATOR: PREPARED FOR: TUG HILL OPERATING, LLC 380 SOUTHPOINTE BLVD SUITE 200 CANONSBURG, PA 15317		 <p>WV Department of Environmental Protection TUG HILL OPERATING</p>		
	COUNTY MARSHALL	DISTRICT LIBERTY & MEADE	DRAWN BY K.G.M.	JOB NO. 8910		DATE 03/03/2020	SCALE 1" = 1000'

STATE OF WEST VIRGINIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION, OFFICE OF OIL AND GAS
NOTICE OF ENTRY FOR PLAT SURVEY

Notice Time Requirement: Notice shall be provided at least SEVEN (7) days but no more than FORTY-FIVE (45) days prior to entry

Date of Notice: 4/24/2019 Date of Planned Entry: 5/3/2019

Delivery method pursuant to West Virginia Code § 22-6A-10a

- PERSONAL SERVICE
- REGISTERED MAIL
- METHOD OF DELIVERY THAT REQUIRES A RECEIPT OR SIGNATURE CONFIRMATION

Pursuant to West Virginia Code § 22-6A-10(a), Prior to filing a permit application, the operator shall provide notice of planned entry on to the surface tract to conduct any plat surveys required pursuant to this article. Such notice shall be provided at least seven days but no more than forty-five days prior to such entry to: (1) The surface owner of such tract; (2) to any owner or lessee of coal seams beneath such tract that has filed a declaration pursuant to section thirty-six, article six, chapter twenty-two of this code; and (3) any owner of minerals underlying such tract in the county tax records. The notice shall include a statement that copies of the state Erosion and Sediment Control Manual and the statutes and rules related to oil and gas exploration and production may be obtained from the Secretary, which statement shall include contact information, including the address for a web page on the Secretary's web site, to enable the surface owner to obtain copies from the secretary.

Notice is hereby provided to:

SURFACE OWNER(s)
Name: Regina D. Figueroa
Address: 94 E 700 N
Valparaiso, IN 46383
Name: Danny S. Kerns
Address: 3500 West 80th Pl.
Merrillville, IN 46410
Name: Deena J. Palomo
Address: 20 Maxwell St., Apt. 4
Hebron, IN 46341

COAL OWNER OR LESSEE
Name: Consol Energy Attn: Casey Saunders
Address: 1000 Consol Energy Drive
Canonsburg, PA 15317

MINERAL OWNER(s)
Name: Regina D. Figueroa
Address: 94 E 700 N
Valparaiso, IN 46383 *See attached list
*please attach additional forms if necessary

Notice is hereby given:

Pursuant to West Virginia Code § 22-6A-10(a), notice is hereby given that the undersigned well operator is planning entry to conduct a plat survey on the tract of land as follows:

State: West Virginia Approx. Latitude & Longitude: 39.80128284; -80.64143991
County: Marshall Public Road Access: County Route 80
District: Liberty Watershed: Upper Fish Creek
Quadrangle: Glen Easton 7.5' Generally used farm name: Danny & Frances Kerns Estate

Copies of the state Erosion and Sediment Control Manual and the statutes and rules related to oil and gas exploration and production may be obtained from the Secretary, at the WV Department of Environmental Protection headquarters, located at 601 57th Street, SE, Charleston, WV 25304 (304-926-0450). Copies of such documents or additional information related to horizontal drilling may be obtained from the Secretary by visiting www.dep.wv.gov/oil-and-gas/pages/default.aspx.

Notice is hereby given by:

Well Operator: Tug Hill Operating, LLC
Telephone: 724-749-8388
Email: amiller@tug-hillcop.com

Address: 380 Southpointe Boulevard, Plaza II, Suite 200
Canonsburg, PA 15317
Facsimile: 724-338-2030

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Office of Oil and Gas
MAR 17 2020
W.V. Department of
Environmental Protection

Oil and Gas Privacy Notice:

The Office of Oil and Gas processes your personal information, such as name, address and telephone number, as part of our regulatory duties. Your personal information may be disclosed to other State agencies or third parties in the normal course of business or as needed to comply with statutory or regulatory requirements, including Freedom of Information Act requests. Our office will appropriately secure your personal information. If you have any questions about our use or your personal information, please contact DEP's Chief Privacy Officer at depprivacyofficer@wv.gov.

WW-6A3 NOTICE OF ENTRY FOR PLAT SURVEY
FITZGERALD PAD

MINERAL OWNERS

Danny S. Kerns
3500 West 80th Pl.
Merrillville, IN 46410

Deena J. Palomo
20 Maxwell Street, Apt. 4
Hebron, IN 46341

WW-6A5
(1/12)

Operator Well No. Fitzgerald S-17HU

**STATE OF WEST VIRGINIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION, OFFICE OF OIL AND GAS
NOTICE OF PLANNED OPERATION**

Notice Time Requirement: notice shall be provided no later than the **filing date of permit application.**

Date of Notice: 03/12/2020 **Date Permit Application Filed:** 03/13/2020

Delivery method pursuant to West Virginia Code § 22-6A-16(c)

CERTIFIED MAIL HAND
RETURN RECEIPT REQUESTED DELIVERY

Pursuant to W. Va. Code § 22-6A-16(c), no later than the date for filing the permit application, an operator shall, by certified mail return receipt requested or hand delivery, give the surface owner whose land will be used for the drilling of a horizontal well notice of the planned operation. The notice required by this subsection shall include: (1) A copy of this code section; (2) The information required to be provided by subsection (b), section ten of this article to a surface owner whose land will be used in conjunction with the drilling of a horizontal well; and (3) A proposed surface use and compensation agreement containing an offer of compensation for damages to the surface affected by oil and gas operations to the extent the damages are compensable under article six-b of this chapter. (d) The notices required by this section shall be given to the surface owner at the address listed in the records of the sheriff at the time of notice.

Notice is hereby provided to the SURFACE OWNER(s)
(at the address listed in the records of the sheriff at the time of notice):

Name: Regina D. Figueroa
Address: 94 E 700 N
Valparaiso, IN 46383

Name: Danny S. Kerns
Address: 3500 West 80th Pl
Merrillville, IN 46410

Notice is hereby given:

Pursuant to West Virginia Code § 22-6A-16(c), notice is hereby given that the undersigned well operator has developed a planned operation on the surface owner's land for the purpose of drilling a horizontal well on the tract of land as follows:

State:	<u>West Virginia</u>	UTM NAD 83	Easting:	<u>530,724.06</u>
County:	<u>Marshall</u>		Northing:	<u>4,405,748.24</u>
District:	<u>Liberty</u>	Public Road Access:	<u>Rines Ridge Road (County Route 76)</u>	
Quadrangle:	<u>Glen Easton 7.5'</u>	Generally used farm name:	<u>Danny R. Kerns, et al</u>	
Watershed:	<u>Upper Fish Creek (HUC 10)</u>			

This Notice Shall Include:

Pursuant to West Virginia Code § 22-6A-16(c), this notice shall include: (1) A copy of this code section; (2) The information required to be provided by **W. Va. Code § 22-6A-10(b)** to a surface owner whose land will be used in conjunction with the drilling of a horizontal well; and (3) A proposed surface use and compensation agreement containing an offer of compensation for damages to the surface affected by oil and gas operations to the extent the damages are compensable under article six-b of this chapter. Additional information related to horizontal drilling may be obtained from the Secretary, at the WV Department of Environmental Protection headquarters, located at 601 57th Street, SE, Charleston, WV 25304 (304-926-0450) or by visiting www.dep.wv.gov/oil-and-gas/pages/default.aspx.

Well Operator: Tug Hill Operating, LLC
Telephone: 724-749-8388
Email: amiller@tug-hillop.com

Address: 380 Southpointe Boulevard, Plaza II, Suite 200
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Additional Party to Notice
WW-6A5
Fitzgerald Pad

Deana J. Palomo
20 Maxwell Street, Apt. 4
Hebron, IN 46341

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WEST VIRGINIA DEPARTMENT OF TRANSPORTATION

Division of Highways

1900 Kanawha Boulevard East • Building Five • Room 110
Charleston, West Virginia 25305-0430 • (304) 558-3505

Byrd E. White, III
Secretary of Transportation/
Commissioner of Highways

February 27, 2020

Jimmy Wriston, P. E.
Deputy Secretary/
Deputy Commissioner

James A. Martin, Chief
Office of Oil and Gas
Department of Environmental Protection
601 57th Street, SE
Charleston, WV 25304

Subject: DOH Permit for the Fitzgerald Pad, Marshall County
Fitzgerald S-17HU Well Site

Dear Mr. Martin,

This well site will be accessed from a DOH permit #06-2019-0351 which has been issued to Tug Hill Operating, LLC for access to the State Road for a well site located off Marshall County Route 90 SLS.

This operator is in compliance with §22-6A-20 of the WV Code. Operator has signed a STATEWIDE OIL AND GAS ROAD MAINTENANCE BONDING AGREEMENT and provided the required Bond. This operator is currently in compliance with the DOH OIL AND GAS POLICY dated October 1, 2018.

Very Truly Yours,

Gary K. Clayton, P.E.
Regional Maintenance Engineer
Central Office O&G Coordinator

Cc: Amy Miller
Tug Hill Operating, LLC
CH, OM, D-6
File

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PLANNED ADDITIVES TO BE USED IN FRACTURING OR STIMULATION

Well No. Fitzgerald S-17HU

PRODUCT NAME:	CHEMICAL DESCRIPTION:	PRODUCT USE:	HAZARDOUS COMPONENT:
GBW-20C	Hemicellulase Breaker	Breaker - Water	None
ALPHA 1427		Biocide	Glutaraldehyde – CAS#000111-30-8 Quaternary ammonium chloride CAS# 007173-51-5 Alky dimethyl benzyl ammonium Chloride (C12-16) – CAS#068424-85-1 Ethanol – CAS# 000064-17-5 Water – CAS# 007732-18-5
FRAC SAND	Silica Sand (various Mesh sizes)	Proppant	Crystalline silica (quartz) CAS# 14808-60-7
S-8C, Sand	Silica Sand (100 mesh)	Sand	Silica – CAS# 14808-60-7
GW-3LDF		Gellant - Water	Petroleum Distillate Blend – Proprietary, (Not Associated with Diesel Fuel) Guar gum – CAS# 009000-30-0
FRW-18		Friction Reducer	Hydrotreated light distillate CAS# 064742-47-8
Scaletrol		Scale Inhibitor	Ethylene glycol – CAS# 000107-21-1 Diethylene glycol – CAS# 000111-46-6

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