

78=00
7-2



RECEIVED

JAN 18 1973

OIL & GAS DIVISION
DEPT. OF MINES

STATE OF WEST VIRGINIA
DEPARTMENT OF MINES
OIL AND GAS DIVISION

- Rotary
- Spudder
- Cable Tools
- Storage

Quadrangle Holden

Permit No. MINGO-813

WELL RECORD

Oil or Gas Well Gas (KIND)

Company <u>Columbia Gas Transmission Corporation</u>	Casing and Tubing	Used in Drilling	Left in Well	Packers
Address <u>Charleston, West Virginia</u>				
Farm <u>Cotiga Development Company</u> Acres <u>11,151.31</u>	Size			
Location (waters) <u>Laurel Fork</u>	<u>20"</u>	<u>20'</u>	<u>20'</u>	Kind of Packer
Well No. <u>9675</u> Elev. <u>715.96</u>	<u>13-3/8"</u>	<u>93'</u>	<u>93'</u>	Size of
District <u>Harvey</u> County <u>Mingo</u>	<u>9-5/8"</u>	<u>2012'</u>	<u>2012'</u>	Depth set
The surface of tract is owned in fee by <u>Cotiga Development Co., Paoli, Pa.</u>	8 1/4			
Mineral rights are owned by <u>Cotiga Development Company</u>	6%			
Address <u>Paoli, Pa.</u>	5 3/16			
Drilling commenced <u>September 14, 1972</u>	4 1/2			
Drilling completed <u>October 10, 1972</u>	3			Perf. top
Date Shot <u>10-12-72</u> From <u>2900'</u> To <u>4678'</u>	2			Perf. bottom
With <u>18,700# of DuPont Gelatin</u>	Liners Used			Perf. top
Open Flow <u>6</u> /10ths Water in <u>2</u> Inch				Perf. bottom
<u>103,000 Mcf</u> /10ths Merc. in <u>48</u> Cu. Ft.	Attach copy of cementing record			
Rock Pressure <u>310</u> lbs. <u>48</u> hrs.	<u>13-3/8"</u> <u>93'</u> <u>9-18-72</u>			
Oil <u>Not Acidized</u> bbls., 1st 24 hrs.	CASING CEMENTED <u>9-5/8"</u> SIZE <u>2012'</u> No. Ft. <u>9-26-72</u> Date			
WELL ACIDIZED (DETAILS) <u>Not Acidized</u>	Amount of cement used (bags) <u>520</u> bags			
WELL FRACTURED (DETAILS) <u>Not fractured</u>	Name of Service Co. <u>Dowell</u>			
	COAL WAS ENCOUNTERED AT			
	FEEET			
	INCHES			
	FEEET			
	INCHES			

RESULT AFTER TREATMENT (Initial open Flow or bbls.)

ROCK PRESSURE AFTER TREATMENT _____ HOURS

Fresh Water 10' Feet Salt Water _____ Feet

Producing Sand Brown Shale Depth 4678' T.D. in Onond.

Formation	Color	Hard or Soft	Top	Bottom	Oil, Gas or Water	Depth	Remarks
Soil			0	10	Water at 10'		
Sand			10	105			
Shale			105	175			
Sand			175	225			
Sand & Shale			225	318			
Sand			318	380			
Shale			380	410			
Sand			410	440			
Sand & Shale			440	500			
Sand			500	580			
Sand & Shale			580	685			
Sand			685	725			
Shale			725	735			
Sand			735	1000			
Shale			1000	1050			
Sand			1050	1535	Bottom of Salt Sand		
Shale			1535	1605			
Sand & Shale			1605	1773			
Little Lime			1773	1807			
Pencil Cave Shale			1807	1813			
Big Line			1813	1995			
Red Injun			1995	2061			
Sand & Shale			2061	2234			
Shale			2234	2315			
Shale			2315	2788			
Sand			2788	2892			
Grey Shale			2892	3740	Show of Gas 3346' to 3600'		
Grey & Brown Shale			3740	3880			
Brown Shale			3880	4172			

Formation	Color	Hard or Soft	Top δ	Bottom	Oil, Gas or Water	Depth Found	Remarks
Grey Shale			4172	4528		LOGGED 10-10-72	
Brown Shale			4528	4673			
Ironiferous			4673	4678		Gamma Ray	
TOTAL DEPTH			4678			Temperature	
						Caliper	
						Sidewall Photographs	

Note: hole was directionally drilled at $\sim 45^\circ$!

Do not use tops or thicknesses in computer mapping.

true vertical depth total depth $\rightarrow 3928\text{ft.}$

Date December 12, 1972
 APPROVED Columbia Gas Transmission Owner
 By E. H. Foster Supt.
 (Title)



STATE OF WEST VIRGINIA
DEPARTMENT OF MINES

RECEIVED

AUG 18 1972

OIL & GAS DIVISION
DEPT. OF MINES

Oil and Gas Division

OIL AND GAS WELL PERMIT APPLICATION

TO THE DEPARTMENT OF MINES,
Charleston, W. Va.

DATE August 15, 1972

Surface Owner Susie Thompson

Company Columbia Gas Transmission Corp.

Address _____

Address P.O. Box 1273 Charleston, W.Va. 25325

Mineral Owner Cotiga Development Co.

Farm Cotiga Development Co. Acres 11,151.31

Address 25 Darby Road Paoli, Pa. 19301

Location (waters) Laurel Fork of Pigeon Creek

Coal Owner Cotiga Development Co.

Well No. 9675 Elevation 715.96'

Address _____

District Harvey County Mingo

Coal Operator Not Operated

Quadrangle Holden

Address _____

THIS PERMIT MUST BE POSTED AT THE WELL SITE

All provisions being in accordance with Chapter 22, of the W. Va. Code, the location is hereby approved for drilling. This permit shall expire if operations have not commenced by 12-18-72

Deputy Director - Oil & Gas Division

Kenneth
Butcher

INSPECTOR TO BE NOTIFIED
Barboursville, W.Va. PH: 736-4885

GENTLEMEN:

The undersigned well operator is entitled to drill upon the above named farm or tract of land for oil and gas, having fee title thereto, (or as the case may be) under grant or lease dated December 5, 1929 by Cotiga Development Company made to Woods Oil & Gas Co. and recorded on the 18th day of December 1929, in Mingo County, Book 24 Page 339

NEW WELL DRILL DEEPER REDRILL FRACTURE OR STIMULATE
 OIL AND GAS WELL ORIGINALLY DRILLED BEFORE JUNE 5, 1969.

The enclosed plat was prepared by a registered engineer or licensed land surveyor and all coal owners and/or operators have been notified as of the above date.

The above named coal owners and/or operator are hereby notified that any objection they wish to make, or are required to make by Section 3 of the Code, must be received by, or filed with the Department of Mines within ten (10) days. *

Copies of this notice and the enclosed plat were mailed by registered mail, or delivered to the above named coal operators or coal owners at their above shown respective address _____ day _____ before, or on the same day with the mailing or delivery of this copy to the Department of Mines at Charleston, West Virginia.

Very truly yours, COLUMBIA GAS TRANSMISSION CORP.

(Sign Name) By Adrian E. Kaidman
Supt., Well Operator Civil Eng. Dept.

P. O. Box 1273

Street

Address
of
Well Operator

Charleston

City or Town

West Virginia 25325

State

*SECTION 3 If no objections are filed or found by the Department of mines, within said period of ten days from the receipt of notice and plat by the department of mines, to said proposed location, the department shall forthwith issue to the well operator a permit reciting the filing of such plat, that no objections have been made by the coal operators or found thereto by the department and that the same is approved and the well operator authorized to proceed.

BLANKET BOND

MINGO-813

PERMIT NUMBER

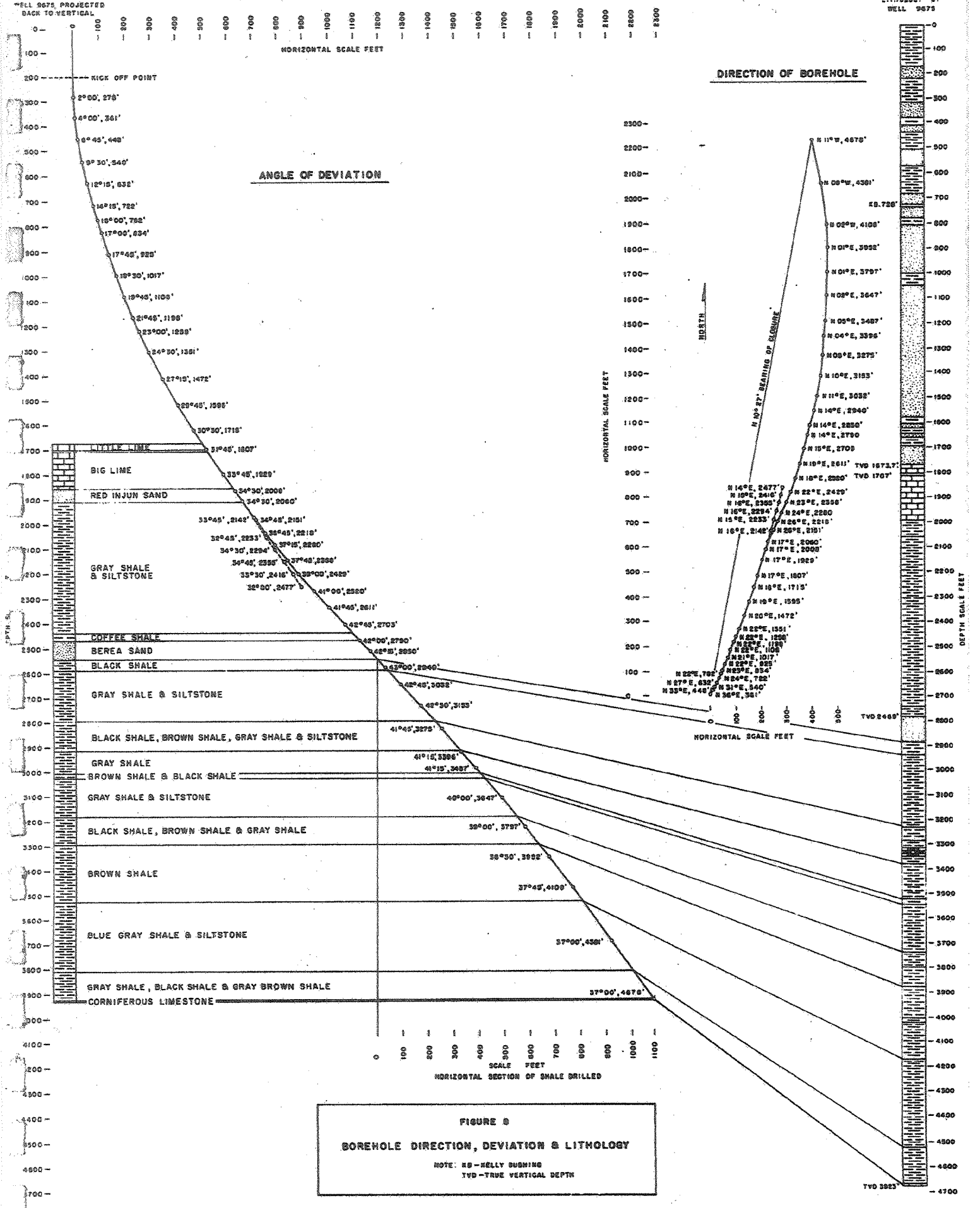
however, the borehole cut the predicted failure envelope at an angle of approximately 80° ; at T.D. we still had 70° between the borehole and the failure envelope.

The stratigraphy of this well was normal in relation to the surrounding wells. True vertical thickness of the shale section from the base of the Berea to the top of the Corniferous was 1,378' and the actual Brown Shale interval, the kerogen bearing zone and source rock, had a true vertical thickness of about 345'. In well 9675, however, the actual shale thickness drilled was 1,781' for a net increase in the Brown Shale section of 29.2%. The thickness of the good brown shale interval within the shale section (3740' - 4174' kerogen zone) was increased from 345 feet to 434 feet for a net increase of 25.8% for this interval (Figure 8).

From a study of driller's logs, electric logs and sand samples available, it is obvious that production in the Brown Shale is not restricted to any one interval within the shale section, therefore, the entire 1,781 feet that was drilled could theoretically be a fractured reservoir. Since the stratigraphy of this well does not appear to be significantly different than other wells within the area, the difference in results must be due to the fractures encountered while drilling the well.

The structure in the area is relatively simple. The Berea generally has an east-west strike with gentle southward dip and the Corniferous has a north-south strike with an eastward dip. The main structural complication in this area is the east-west trending Warfield Fault (Figure 1). It is this fault and the associated fracture system that accounts for the major amount of production in the study area

Ryan, Griffith & Foster



Ryan, Griffith & Foster

TABLE I
 WELL NO. 9675
 MINGO COUNTY, W. VA.
 Open Flow After Fracturing 103 Mcfd; R. P. 552 psi

PRODUCTION

<u>Month</u>	<u>Days on Line</u>	<u>Production/Mcf</u>	<u>Line Pressure</u>
1973 } April	30	893	94#
May	31	482	86#
June	30	426	74#

entered into WUGES OGDB 7/1/72007
 kel.

Ryan Griffith + Foster

X

GEOLOGICAL AND ENGINEERING

Report on

DEVIATED SHALE WELL #9675,

HARVEY DISTRICT, MINGO COUNTY, WEST VIRGINIA

by

William M. Ryan, Geologist

Paul R. Griffith, Assistant Superintendent, Hamlin Division

John M. Foster, Project Engineer-Wells

COLUMBIA GAS TRANSMISSION CORPORATION
EXPLORATION AND DEVELOPMENT DEPARTMENT

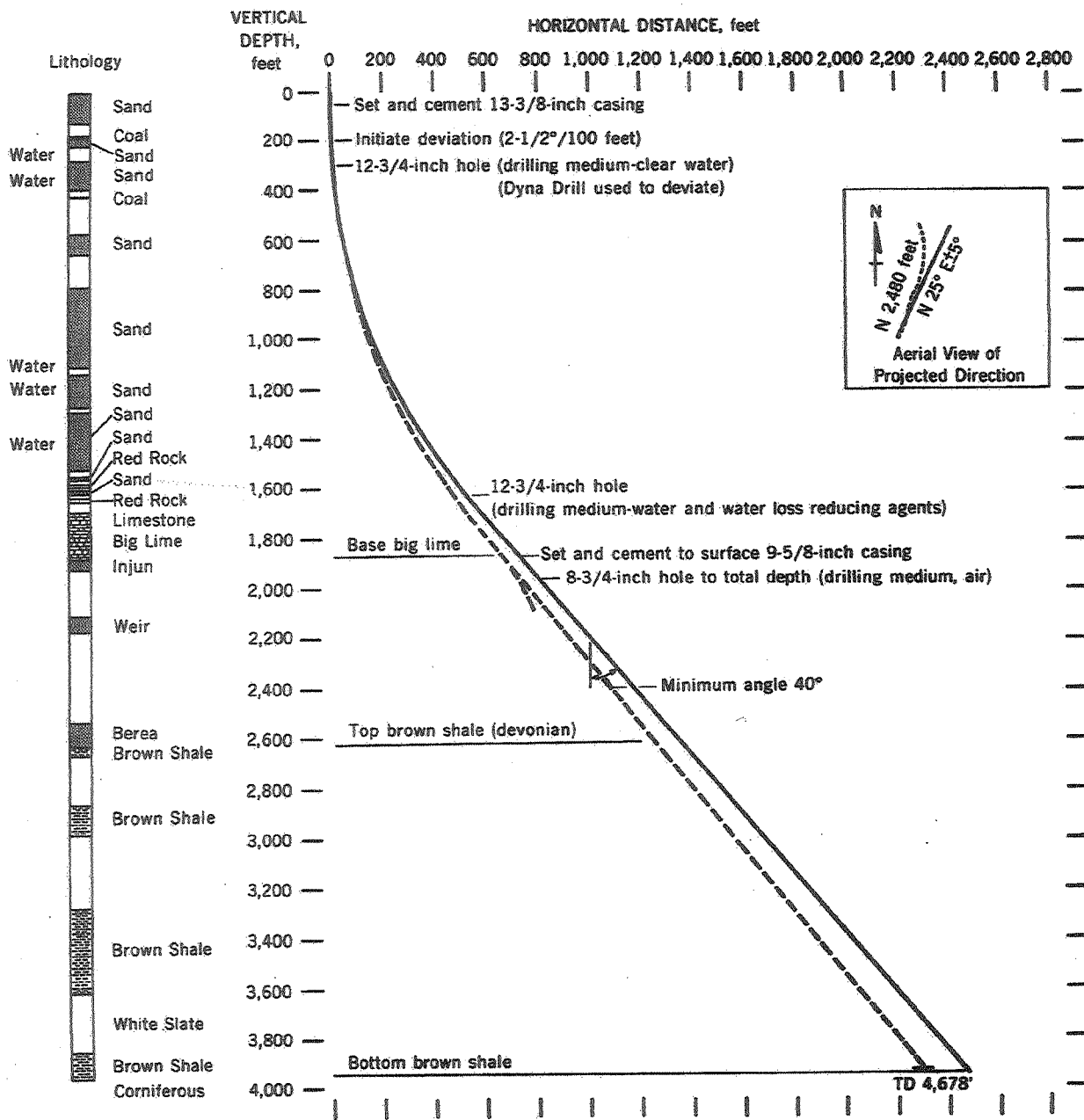


FIGURE 3. — Depth and Horizontal Scale of Deviated Well.

Overbey + Ryan

DRILLING A DIRECTIONALLY DEVIATED WELL
TO STIMULATE GAS PRODUCTION FROM A
MARGINAL RESERVOIR IN SOUTHERN WEST VIRGINIA

BY

W. K. Overbey, Jr. and W. M. Ryan

Technical Progress Report

U.S. ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION

Morgantown Energy Research Center
Morgantown, West Virginia