SHALE GAS
IN THE SOUTHERN CENTRAL AREA
OF NEW YORK STATE

Volume III

Experience of Drilling
Five Shale-Gas Wells
in New York State

Prepared for

NEW YORK STATE
ENERGY RESEARCH AND DEVELOPMENT AUTHORITY

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399/ET-FUC/81

ERDA Report 81-18

March 1983

NOTICE

First Printing: March 1983

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LIST OF ABBREVIATIONS

bbls . . . . . barrels
BPM . . . . . .barrels per minute
FWHP . . . . . flowing wellhead pressure
jts . . . . . .joints
ISIP . . . . . instantaneous shut-in pressure
MCF . . . . . .thousand cubic feet
psi . . . . . .pounds per square inch
SIP . . . . . .shut-in pressure
WHP . . . . . .wellhead pressure
WHSIP . . . . . .wellhead shut-in pressure

PREFACE

The United States Department of Energy, the United States Geological Survey, and others have estimated that trillions of cubic feet of natural gas lie unexploited in the Devonian shales and other formations of the eastern basins (particularly the Appalachian Basin) of the United States. The Department of Energy has conducted an extensive program to assess this potential resource, and to establish methods by which the gas can be economically recovered. ERDA has joined the Department of Energy in pursuing this goal within New York State.

Three major barriers face the economic development of Devonian Shale gas in New York State:

- The exploration rationale. Exploration measures have shown historically that gas can be produced from the Devonian shales only when the shale is extensively fractured. Therefore, shale-gas wells should be drilled (a) where there is known to be a substantial thickness of gas-rich shale, and (b) where the shale is naturally fractured. Department of Energy research has established that gas-rich shale deposits exist in the south-central counties of New York. The remaining issue in the exploration rationale is, therefore, to develop techniques for finding zones of natural fracture in the shale.

- The stimulation technique. Even in a zone of natural fracture, it is usually desirable to intensify the fracturing near the well by artificial means. Several methods exist for stimulation.

- The economics. The issue here concerns the true role of shale gas in the energy context of the State. If practical exploration and and stimulation techniques can be found, are the economics of shale gas such that commercial exploration companies will invest in targets of opportunity, and make the gas generally available through the existing pipeline system? To what extent does commercialization depend on the shale thickness, on the degree of fracturing, and on the depth of the shale? Conversely, are the economics such that the proper role of shale gas is in local low-volume supply for institutional and corporate users, without the involvement of a gas utility?

The Department of Energy has engaged in a high level of activity in stimulation research, and has emerged with positive (if provisional) procedures and techniques.
Accordingly, projects in New York State have concentrated on the exploration rationale and the economics of shale gas in the context of the local conditions.

ERDA has sponsored three Devonian Shale exploration programs since 1979:

1. The first program primarily addressed the exploration rationale. The effort was undertaken by Donohue Anstey & Morrill during 1979 and 1980. Four shale gas wells were sited, drilled and completed during the program as follows:

Valley Vista View no. 1, in Rathbone township, Steuben county,

Meter, Kennedy & Howe no. 1, in West Sparta township, Livingston county,

Scudder no. 1, in Hornby township, Steuben county, and

Dann no. 1, in Erwin township, Steuben county.

A full report on this program is available as ERDA Report 81-18, Shale Gas in the Southern Central Area of New York State, Volumes I and II. Volume I is a "how-to" manual summarizing current knowledge of shale-gas exploration in New York State; Volume II is a specific report on the four wells.

2. The second program was designated to determine the economics of shale gas recovery for institutional users. It involved the drilling of five shale gas wells -- one each at Houghton College, St. Bonaventure University, Alfred University, Allegany County BOCES, and Portville Central Schools. The program is described in this report and is a companion volume to Volumes I and II noted above.

3. The third program, currently in progress, addresses both the exploration rationale and the economics of recovery. The third program will involve siting and drilling of another four shale gas wells. Two of the wells (one in Broome county, one in Chemung county) will explore deep and thick shales in locations likely to exhibit fracturing; the two remaining wells (in Ontario county) will assess the economic potential remaining in known shale-gas fields at very shallow depth.

The three programs, taken together, represent a coordinated and continuous effort to determine the potential benefit of shale gas development to New York State residents.

SUMMARY

Five shale-gas wells have been located and drilled in the South-Central areas of New York State as part of this program. The program was undertaken by Arlington Exploration Company (AEC) during 1981 and 1982. The wells were drilled on educational properties in an attempt to demonstrate the economic prospect of natural gas for institutional and small commercial consumers to develop their own source of energy. All five wells were completed in the Marcellus section of the Devonian shale. Each of the five wells was connected to an appropriate heat load for the purpose of production testing.

The five wells that were drilled are:
The Alfred University #1 well, in Allegany County, which had an initial production of 40 MCF per day and is capable of a sustained production of 15 MCF per day.

The St. Bonaventure University #1 well, in Cattaraugus County, which had an initial production of 14 MCF per day and is capable of a sustained production of 7 MCF per day.

The Allegany County Board of Cooperative Educational Services #1 well, in Allegany County, which had an initial production of 72 MCF per day and is capable of a sustained production of 25 MCF per day.

The Portville Central School #1 well, in Cattaraugus County, had an initial production of 18 MCF per day and is capable of a sustained production of 9 MCF per day.

The Houghton College #2 well, in Allegany County, which had an initial production of 23 MCF per day and is capable of a sustained production of 9 MCF per day.

The project supports the theory that a well drilled anywhere in South-Central New York and completed in the Marcellus Shale using modern fracturing techniques (i.e. nitrogen foam) is likely to produce some gas. Important factors not yet predictable are the decline rate of Marcellus production and the volume of recoverable reserves.

Depths to the Marcellus Shale generally increase from north (i.e. Houghton College) to south (i.e. Portville Central School). A full discussion of the shales of south-Central New York State is contained in Section 1.2 of Volume I.

SECTION 3.1

SUMMARY
OF
ALFRED UNIVERSITY WELL NO. 1

Depth of well	3997 feet
Total Project Cost*	$172,000
Initial Production Rate	40 MCF/day
Estimated Sustained Production	15 MCF/day
Percent Methane	90 +
Formation	Marcellus Shale
Start of Project	May 30, 1981
In-Service Date	March 17, 1982

* Includes drilling, casing, wireline logs, stimulation (foam fracture), completion, testing, wellhead equipment, hook-up, site restoration, and consulting services.

The highlights of the well drilling and completion activities are described in the Compilation of Monthly Reports on pages 3-2 and 3-3; diagrams of the drilling location and well construction are illustrated on pages 3-4 and 3-5; and a summary of the initial test data appears on page 3-6. The Daily Drilling Reports, Daily Completion Reports, and the Hydrocarbon Analysis of the Gas Sample are contained in Appendix A.1.

The well is currently providing natural gas to boilers for dining hall and dormitory heat loads.

ALFRED UNIVERSITY #1 WELL
COMPILATION OF MONTHLY REPORTS
(MAY 1981 - APRIL 1982)

May 1981

The AEC/NYSERDA contract was signed on the 14th, and work began. AEC obtained the location plat and the drilling permit. AEC contracted with H. L. Murry Drilling Co. (Murry) to drill the well. Murry moved in a rotary rig and began drilling on the 30th.

June 1981

Murry drilled to a total depth of 3987'. Schlumberger ran a full suite of wireline logs. Production casing was run and cemented. The well was shut in.

July 1981

Schlumberger ran a cement bond log (satisfactory) and perforated the casing in the Marcellus shale. Halliburton acidized the well.

August 1981

Halliburton stimulated the well. The well was swabbed and sand pumped and then shut in for a pressure build up test. A 24 hour flow test was conducted. Two gas samples were collected and analyzed. The well was shut-in.

September 1981

AEC submitted a completion report and copies of all logs to N.Y.S. Department of Environmental Conservation on behalf of NYSERDA. The gas sample analysis was completed, and copies forwarded to NYSERDA. AEC and NYSERDA modified the original agreement to include construction of production facilities and piping from the well to a natural gas fired boiler at the university.

October 1981

AEC commenced installation of the necessary meters, separator, valves, pipelines, and other equipment.

November 1981

The wellhead equipment was installed.

December 1981

Hook up operations were hampered by the weather.

January 1982

The pipeline construction was 90% complete.

February 1982

A valve critical to hook up was back-ordered.

March 1982

The Alfred University #1 Well was turned on 3/17. AEC contracted with Van Tyne Consulting to conduct a study of drilling samples taken from the Marcellus shale, and the study included samples collected from this well. Site reclamation commenced.

April 1982

Well was on production.

Note: Further detail is included in the Drilling Report and Completion Report sections.

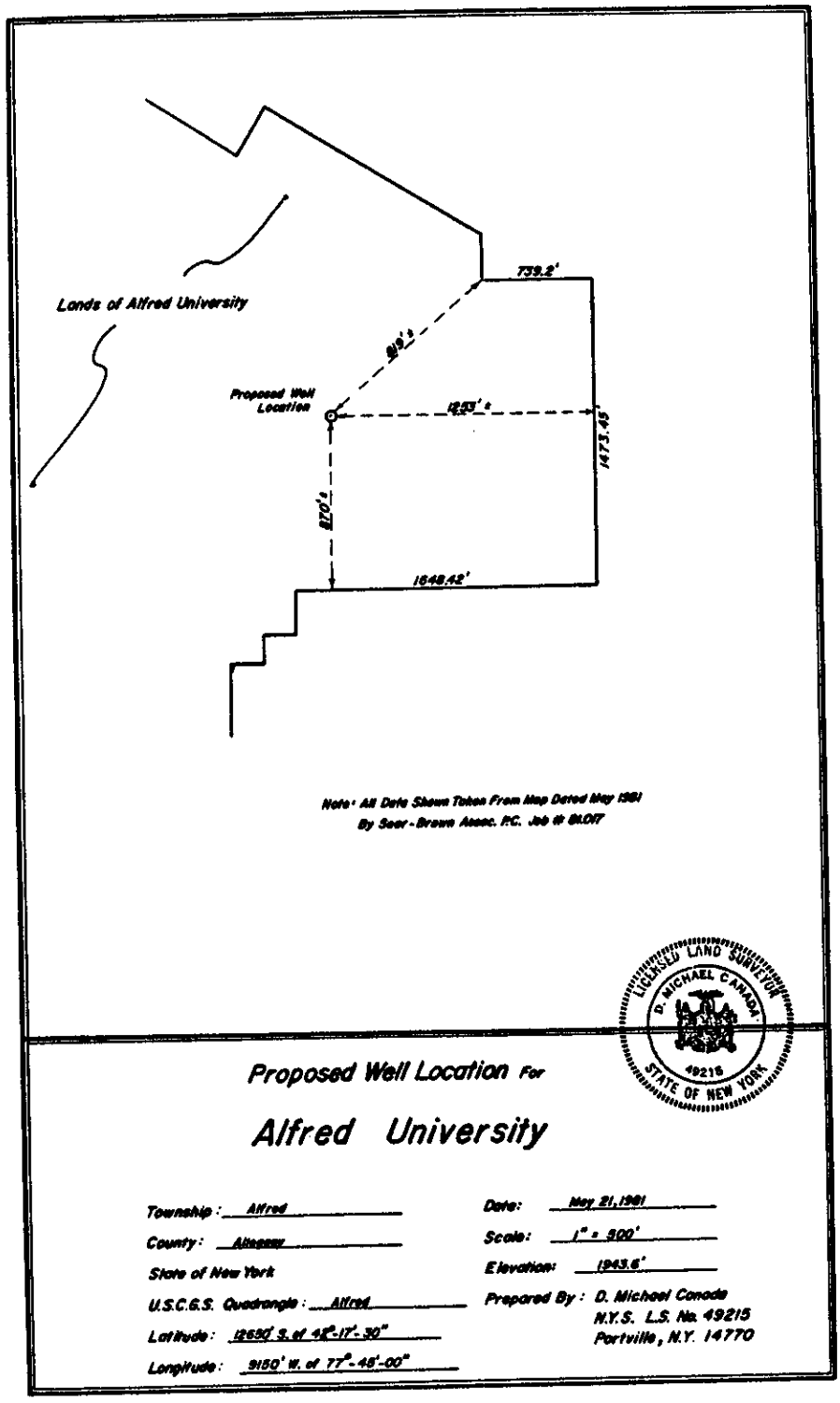
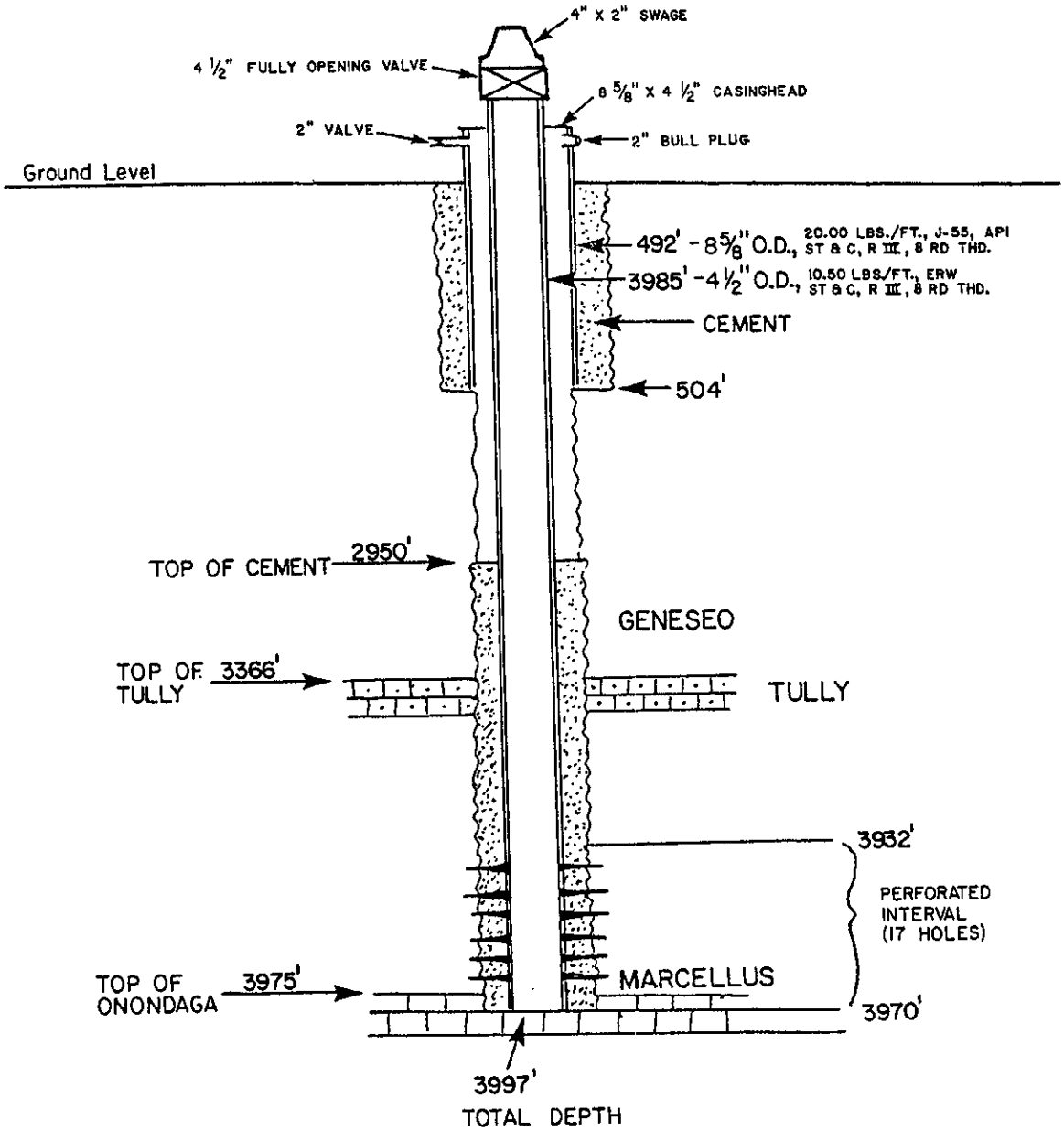

Lands of Alfred University
739.2'
Proposed Well Location
1473.48'
870'±
1648.42'
Note: All Data Shown Taken From Map Dated May 1981
By Sear-Brown Assoc. P.C. Job # 81.017
LICENSED LAND SURVEYOR
D. MICHAEL CANADA
49215
STATE OF NEW YORK
Proposed Well Location For
Alfred University
Township: Alfred
County: Allegany
State of New York
U.S.C.G.S. Quadrangle: Alfred
Latitude: 12690' S. of 42°-17'-30"
Longitude: 9150' W. of 77°-45'-00"
Date: May 21, 1981
Scale: 1" = 900'
Elevation: 1943.6'
Prepared By: D. Michael Canada
N.Y.S. L.S. No. 49215
Portville, N.Y. 14770

FIGURE 3.1-1

ALFRED UNIVERSITY #1 WELL



NOTE: All depths are measured from the Kelly Bushing, 10 feet above the Ground Level Elevation.

FIGURE 3.I-2

ALFRED UNIVERSITY #1 WELL
SUMMARY OF TEST DATA

Perforation Interval - 3932-3970 feet		7/31/81
Hydraulic gradient pressure	1704 psi	
Acid breakdown	3150 psi	7/31/81
Frac ISIP	3800 psi	8/4/81
15 min SIP	3400 psi	

	SIP	Shut in Time (hrs)	Water Recovery (bbls)	Flow Rate MCF/day	Open Time (hrs)	% Natural Gas by Analyzer
8/4/81			57			
8/5/81			92	15 est.	24	
8/6/81			110	50 est.	48	16%
8/7/81	230	1	133	180	72	26%
				160	76	26%
8/8/81			142	83	98	36%
8/10/81	1720	45				
8/11/81				35	25½	46%
8/13/81	1190	48				
8/19/81	1560	189	146			
8/20/81				40	22	52%

SECTION 3.2

SUMMARY

OF

ST. BONAVENTURE UNIVERSITY WELL NO. 1

Depth of Well	3698 feet
Total Project Cost*	$175,000
Initial Production Rate	14 MCF/day
Estimated Sustained Production	7 MCF/day
Percent Methane	90 +
Formation	Marcellus Shale
Start of Project	June 2, 1981
In-Service Date	December 9, 1981

* Includes drilling, casing, wireline logs, stimulation (foam fracture), completion, testing, wellhead equipment, hook-up, site restoration, and consulting services.

The highlights of the well drilling and completion activities are described in the Compilation of Monthly Reports on pages 3-8 and 3-9; diagrams of the drilling location and well construction are illustrated on pages 3-10 and 3-11; and a summary of the initial test data appears on page 3-12. The Daily Drilling Reports, Daily Completion Reports and the Hydrocarbon Analysis of the Gas Sample are contained in Appendix A.2.

The well is currently providing natural gas to boilers in the Administrative Building.

ST. BONAVENTURE UNIVERSITY #1 WELL
COMPILATION OF MONTHLY REPORTS
(MAY 1981 - APRIL 1982)

May 1981

The AEC/NYSERDA contract was signed on the 14th, and work began. AEC obtained the location plat and the drilling permit. AEC contracted with F. R. Root, Inc. (Root) to set conductor pipe through the surface gravel, and H. L. Murry Drilling Co. (Murry) to drill the well to total depth (TD).

June 1981

Root drilled to 145' with cable tools. Murry moved in a rotary rig and drilled to a total depth of 3696'. Schlumberger and Birdwell ran a suite of wireline logs. Production casing was run and cemented. The well was shut in.

July 1981

Schlumberger ran a cement bond log (satisfactory) and perforated the casing in the Marcellus shale. Halliburton acidized and stimulated the well. The well was swabbed and sand pumped then shut in for a pressure build up test.

August 1981

A 24 hour flow test was conducted. Two gas samples were collected and analyzed. The well was shut in.

September 1981

AEC submitted a completion report and copies of all logs to the N.Y.S. Department of Environmental Conservation on behalf of NYSERDA. The gas sample analysis was completed and copies forwarded to NYSERDA. AEC and NYSERDA modified the original agreement to include construction of the production facilities and piping from the well to a natural gas fired boiler at the university.

October 1981

AEC commenced installation of the necessary meters, separator, valves, pipelines and other equipment.

November 1981

The wellhead equipment and pipeline were installed.

December 1981

On the 9th, the St. Bonaventure University #1 Well was turned on.

January 1982

Well was on production.

February 1982

Well was on production.

March 1982

Well was on production. AEC contracted with Van Tyne Consulting to conduct a study of drilling samples taken from the Marcellus shale, and the study included samples collected from this well. Site reclamation commenced.

April 1982

Well was on production.

Note: Further detail is included in the Drilling Report and Completion Report sections.

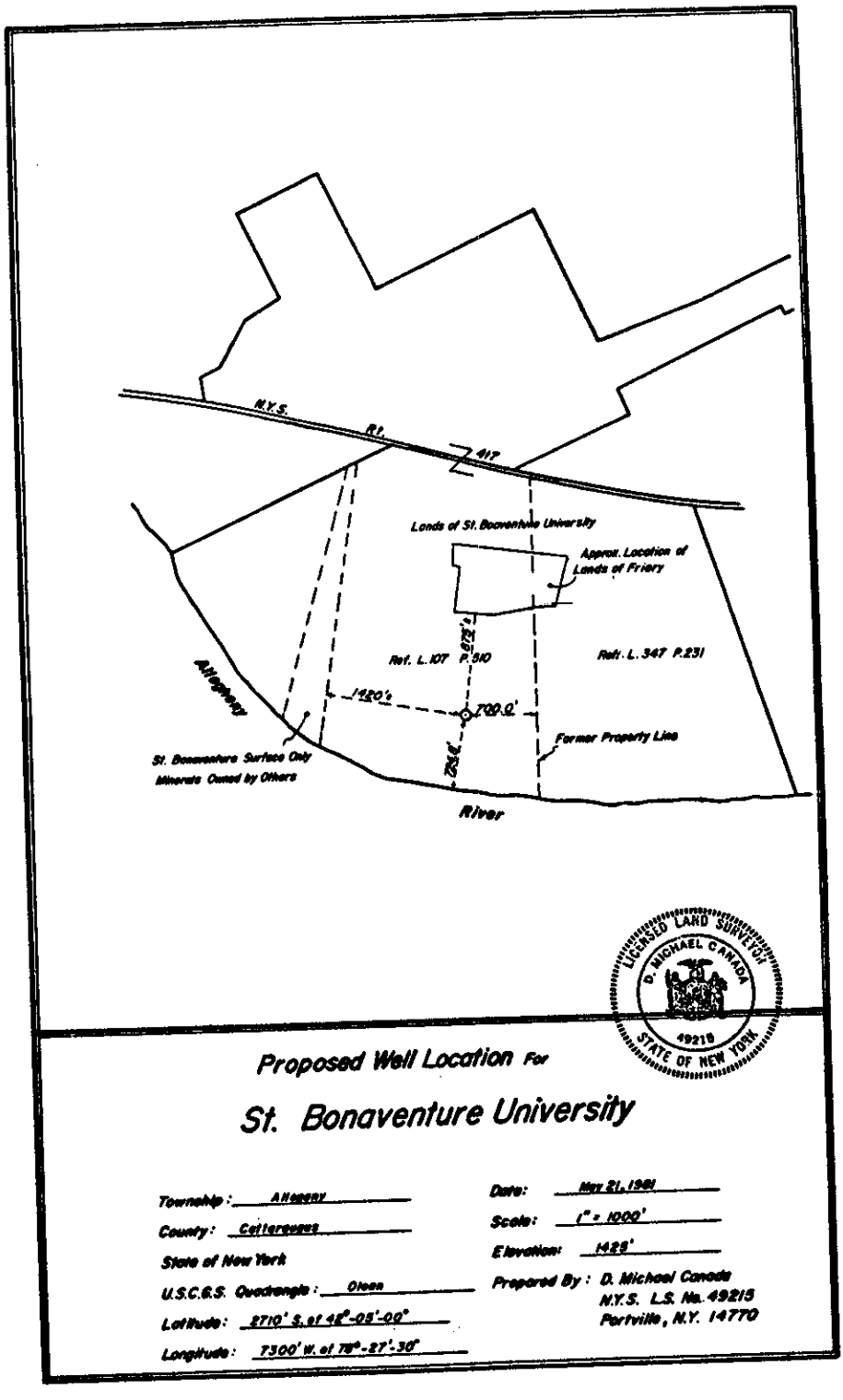
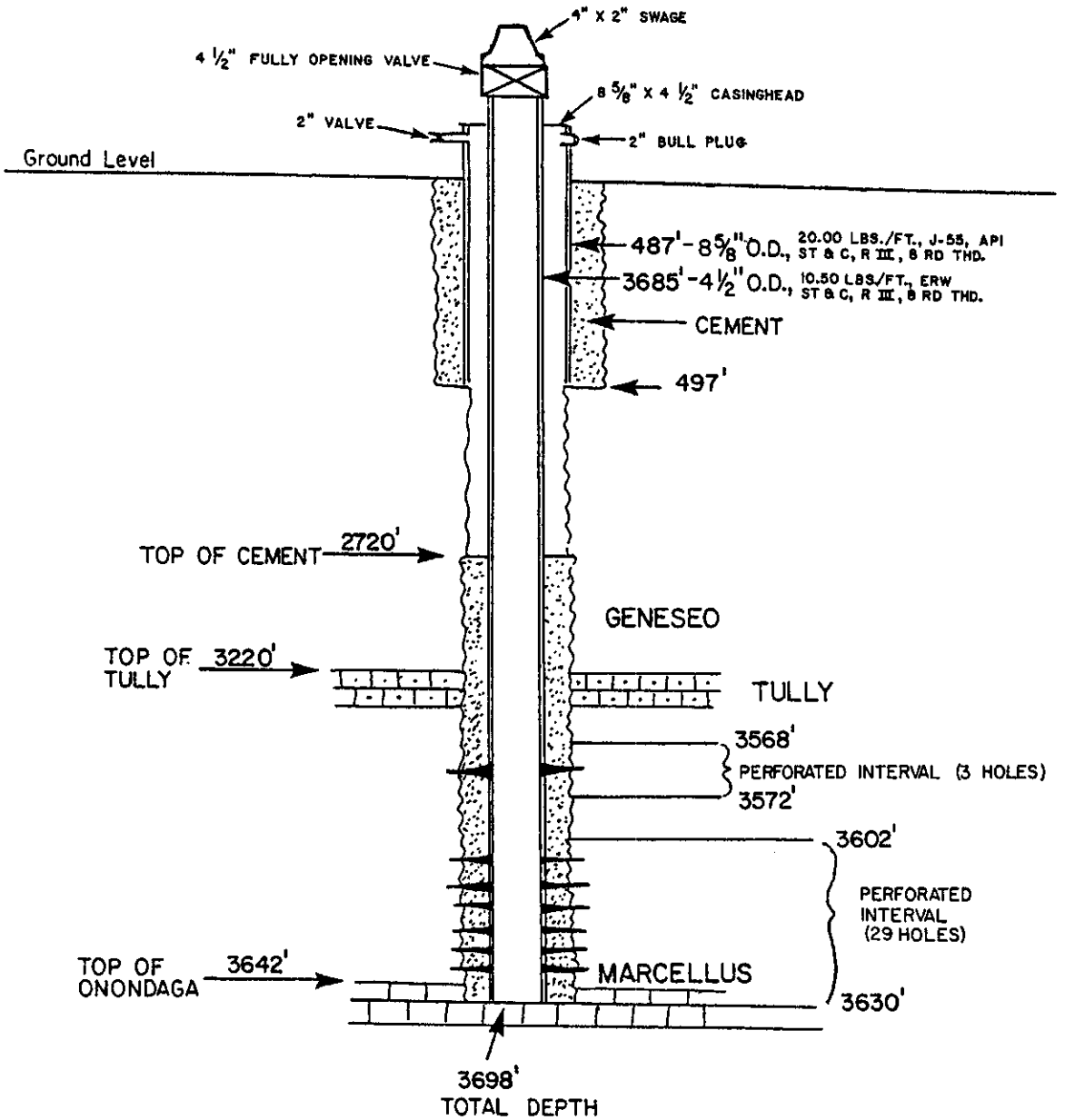

N.Y.S.
Rt.
417
Lands of St. Bonaventure University
Approx. Location of Lands of Friary
Ref. L. 107 P. 510
Ref. L. 347 P. 231
1450'
700.0'
678'
Allegheny
St. Bonaventure Surface Only
Minerals Owned by Others
Former Property Line
River
LICENSED LAND SURVEYOR
D. MICHAEL CANADA
49215
STATE OF NEW YORK
Proposed Well Location For
St. Bonaventure University
Township: Allegany
County: Cattaraugus
State of New York
U.S.C.&S. Quadrangle: Olean
Latitude: 2710' S. of 42°-05'-00"
Longitude: 7300' W. of 78°-27'-30"
Date: May 21, 1981
Scale: 1" = 1000'
Elevation: 1429'
Prepared By: D. Michael Canada
N.Y.S. L.S. No. 49215
Portville, N.Y. 14770

FIGURE 3.2-1

ST. BONAVENTURE UNIVERSITY #1 WELL



NOTE: All depths are measured from the Kelly Bushing, 10 feet above the Ground Level Elevation.

FIGURE 3.2-2

ST. BONAVENTURE UNIVERSITY #1 WELL
SUMMARY OF TEST DATA

Perforation Interval - 3568 - 3630 feet		7/22/81
Hydraulic Gradient Pressure	1546 psi	
Acid breakdown	3100 psi	7/23/81
Frac ISIP	4050 psi	7/28/81
15 min SIP	3400 psi	

	SIP	Shut in Time (hrs.)	Water Recovery (bbls)	Flow Rate (MCF/day)	Open Time (hrs)	% Natural Gas by Analyzer
7/28/81			129 est.			
7/29/81			160 est.			
7/30/81	2180	12		40 est.	12	
7/31/81	700	11		30 est.	2	30%
8/3/81	1240	73				
8/5/81	1520	142				
8/6/81				18.8	24	52%
8/14/81	1080	183				
8/21/81	1480	354	164 est.			
8/22/81				14	23	65%

SECTION 3.3

SUMMARY
OF
ALLEGANY COUNTY BOCES WELL NO. 1

Depth of Well	3344 feet
Total Project Cost*	$159,000
Initial Production Rate	72.5 MCF/day
Estimated Sustained Production	25 MCF/day
Percent Methane	90 +
Formation	Marcellus Shale
Start of Project	June 9, 1981
In-Service Date	December 8, 1981

* Includes drilling, casing, wireline logs, stimulation (foam fracture), completion, testing, wellhead equipment, hook-up, site restoration, and consulting services.

The highlights of the well drilling and completion activities are described in the Compilation of Monthly Reports on pages 3-14 and 3-15; diagrams of the drilling location and well construction are illustrated on pages 3-16 and 3-17; and a summary of the initial test data appears on page 3-18. The Daily Drilling Reports, Daily Completion Reports and the Hydrocarbon Analysis of the Gas Sample are contained in Appendix A.3.

The well is currently providing natural gas to boilers at the BOCES Occupational Center.

ALLEGANY COUNTY BOCES #1 WELL
COMPILATION OF MONTHLY REPORTS
(MAY 1981 - APRIL 1982)

May 1981

The AEC/NYSERDA contract was signed on the 14th, and work began. AEC obtained the location plat and the drilling permit. AEC contracted with Francis R. Root, Inc. (Root) to drill the well.

June 1981

Root moved in a cable rig and drilled to 187'. A rotary rig moved onto location. By the end of the month, the rig was drilling at 504'.

July 1981

The drillers reached total depth (3341') on the 2nd. Birdwell ran a full suite of wireline logs. Production casing was run and cemented and the well was shut in.

August 1981

Schlumberger ran a cement bond log (satisfactory) and perforated the casing in the Marcellus shale. Halliburton acidized and stimulated the well. The well was swabbed and sand pumped, and then shut in for a pressure build-up test. A 24 hour flow test was conducted. Two gas samples were collected and analyzed.

September 1981

AEC submitted a completion report and copies of all logs to the N.Y.S. Department of Environmental Conservation on behalf of NYSERDA. The gas sample analysis was completed, and copies forwarded to NYSERDA. AEC and NYSERDA modified the original agreement to include construction of the production facilities and piping from the well to a natural gas fired boiler at BOCES.

October 1981

AEC commenced installation of the necessary meters, separator, valves, pipelines and other equipment. The wellhead equipment was installed. Pipeline work was delayed by bad weather.

ALLEGANY COUNTY BOCES #1 WELL
COMPILATION OF MONTHLY REPORTS
(MAY 1981 - APRIL 1982)

May 1981

The AEC/NYSERDA contract was signed on the 14th, and work began. AEC obtained the location plat and the drilling permit. AEC contracted with Francis R. Root, Inc. (Root) to drill the well.

June 1981

Root moved in a cable rig and drilled to 187'. A rotary rig moved onto location. By the end of the month, the rig was drilling at 504'.

July 1981

The drillers reached total depth (3341') on the 2nd. Birdwell ran a full suite of wireline logs. Production casing was run and cemented and the well was shut in.

August 1981

Schlumberger ran a cement bond log (satisfactory) and perforated the casing in the Marcellus shale. Halliburton acidized and stimulated the well. The well was swabbed and sand pumped, and then shut in for a pressure build-up test. A 24 hour flow test was conducted. Two gas samples were collected and analyzed.

September 1981

AEC submitted a completion report and copies of all logs to the N.Y.S. Department of Environmental Conservation on behalf of NYSERDA. The gas sample analysis was completed, and copies forwarded to NYSERDA. AEC and NYSERDA modified the original agreement to include construction of the production facilities and piping from the well to a natural gas fired boiler at BOCES.

October 1981

AEC commenced installation of the necessary meters, separator, valves, pipelines and other equipment. The wellhead equipment was installed. Pipeline work was delayed by bad weather.

November 1981

The pipeline and production facilities were completed.

December 1981

On the 8th, the Allegany County BOCES #1 well was turned on.

January 1982

Well was on production.

February 1982

Well was on production.

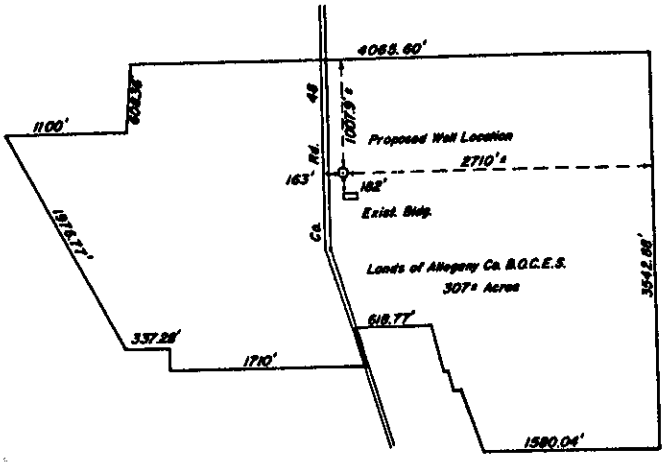
March 1982

Well was on production. AEC contracted with Van Tyne Consulting to conduct a study of drilling samples taken from the Marcellus shale, and the study included samples collected from this well. Site reclamation commenced.

April 1982

Well was on production.

Note: Further detail is included in the Drilling Report and Completion Report sections.



Note: All Data Shown Taken From Map Dated May 1981
By Saar - Brown Assoc. P.C. Job # 81.020

LICENSED LAND SURVEYOR
D. MICHAEL CANADA
49215
STATE OF NEW YORK

Proposed Well Location For

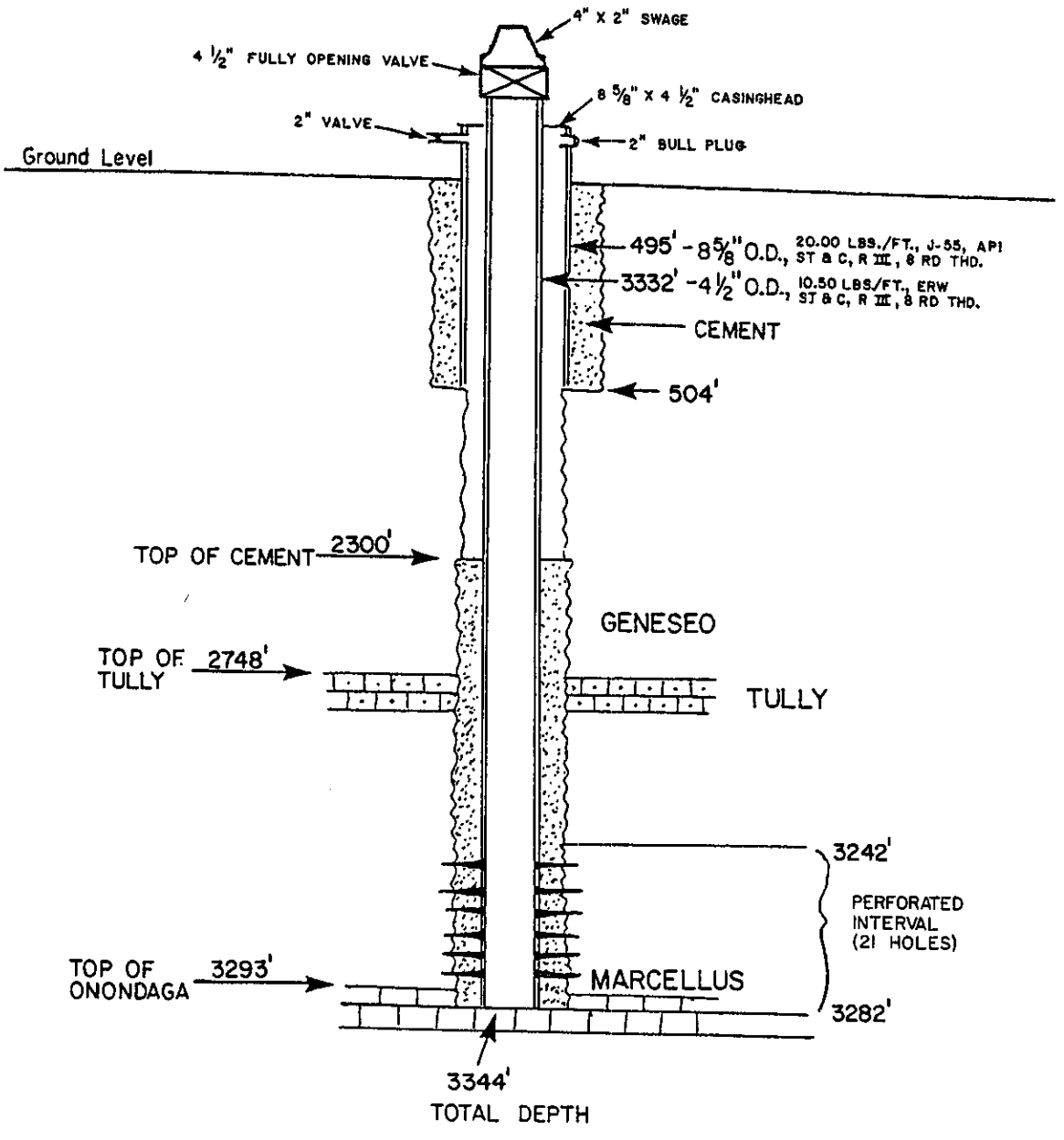
Allegany County B.O.C.E.S.

Township: Amity
County: Allegany
State of New York
U.S.C.&S. Quadrangle Belmont
Latitude: 42°-14'-30"
Longitude: 78°-02'-25"

Date: May 21, 1981
Scale: 1" = 1000'
Elevation: 1369.2'
Prepared By: D. Michael Canada
N.Y.S. L.S. No. 49215
Portville, N.Y. 14770

FIGURE 3.3-1

ALLEGANY COUNTY BOCES #1 WELL



NOTE: All depths are measured from the Kelly Bushing, 10 feet above the Ground Level Elevation.

FIGURE 3.3-2

ALLEGANY COUNTY BOCES #1 WELL
SUMMARY OF TEST DATA

Perforation Interval - 3242 - 3283 feet		8/10/81
Hydraulic Gradient Pressure	1405 psi	
Acid breakdown	2500 psi	8/11/81
Frac ISIP	3400 psi	8/15/81
15 min SIP	3200 psi	8/15/81

	SIP	Shut in Time (hrs)	Recovery (bbls)	Flow Rate MCF/day	Open Time (hrs)	% Natural Gas by Analyzer
8/15/81			128			
8/16/81			137	215	29	40%
8/16/81				311		34%
8/17/81				105	53	56%
8/18/81			159	72.5	75	64%
8/23/81	1600	115				

SECTION 3.4

SUMMARY

OF

PORTVILLE CENTRAL SCHOOL WELL NO. 1

Depth of Well	4237 feet
Total Cost of Project*	$178,000
Initial Production Rate	18 MCF/day
Estimated Sustained Production	9 MCF/day
Percent Methane	90 +
Formation	Marcellus Shale
Start of Project	June 11, 1981
In-Service Data	January 13, 1982

* Includes drilling, casing, wireline logs, stimulation (foam fracture), completion, testing, wellhead equipment, hook-up, site restoration, and consulting services.

The highlights of the well drilling and completion activities are described in the Compilation of Monthly Reports on pages 3-20 and 3-21; diagrams of the drilling location and well construction are illustrated on pages 3-22 and 3-23; and a summary of the initial test data appears on page 3-24. The Daily Drilling Reports, Daily Completion Reports, and the Hydrocarbon Analysis of the Gas Sample are contained in Appendix A.4.

The well is currently providing natural gas to boilers and water heaters in the Portville High School.

PORTVILLE CENTRAL SCHOOL #1 WELL
COMPILATION OF MONTHLY REPORTS
(MAY 1981 - APRIL 1982)

May 1981

The AEC/NYSERDA contract was signed on the 14th, and work began. AEC obtained the location plat and the drilling permit. AEC contracted with F. R. Root, Inc. (Root) to set conductor pipe through the surface gravel, and H. L. Murry Drilling Co. (Murry) to drill the well to total depth (TD).

June 1981

Root moved in a cable rig and drilled to 48'. Murry moved in a rotary rig and drilled to a total depth of 4227'. Birdwell ran a suite of wireline logs. Production casing was run and cemented. The well was shut in.

July 1981

Schlumberger ran a cement bond log (satisfactory) and perforated the casing in the Marcellus shale. Halliburton acidized and stimulated the well. The well was swabbed and sand pumped and then shut in for a pressure build up test.

August 1981

A 24 hour flow test was conducted. Two gas samples were collected and analyzed. The well was shut in.

September 1981

AEC submitted a completion report and copies of all logs to the N.Y.S. Department of Environmental Conservation on behalf of NYSERDA. The gas sample analysis was completed, and copies forwarded to NYSERDA. AEC and NYSERDA modified the original agreement to include construction of production facilities and piping from the well to a natural gas fired boiler at the school.

October 1981

AEC commenced installation of the necessary meters, separator, valves, pipelines and other equipment.

November 1981

The wellhead equipment was installed.

December 1981

The pipeline work was completed.

January 1982

The Portville Central School #1 Well was turned on 1/13.

February 1982

Well was on production.

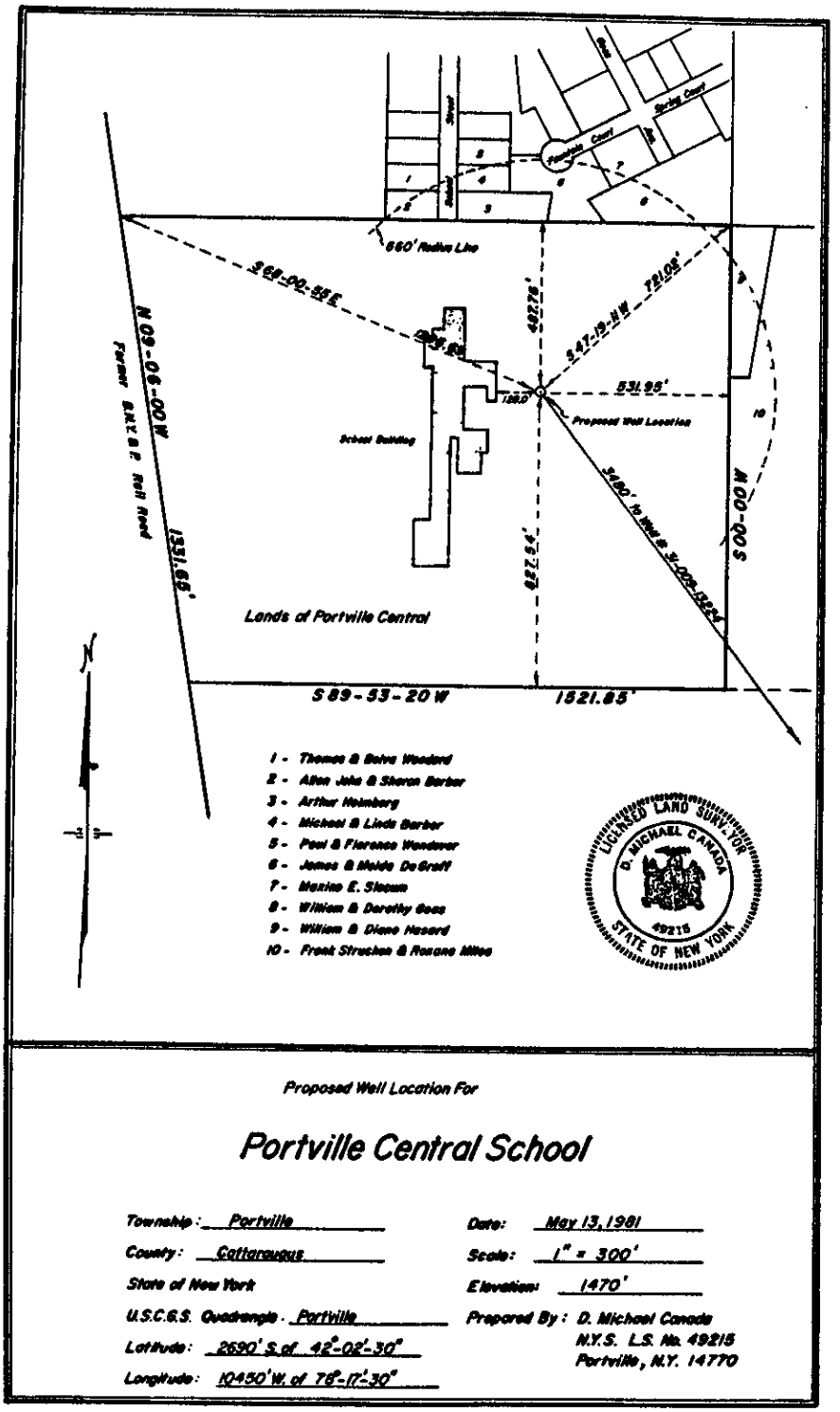
March 1982

Well was on production. AEC contracted with Van Tyne Consulting to conduct a study of drilling samples taken from the Marcellus shale, and the study included samples taken from this well. Site reclamation commenced.

April 1982

Well was on production.

Note: Further detail is included in the Drilling Report and Completion Report sections.



Proposed Well Location For

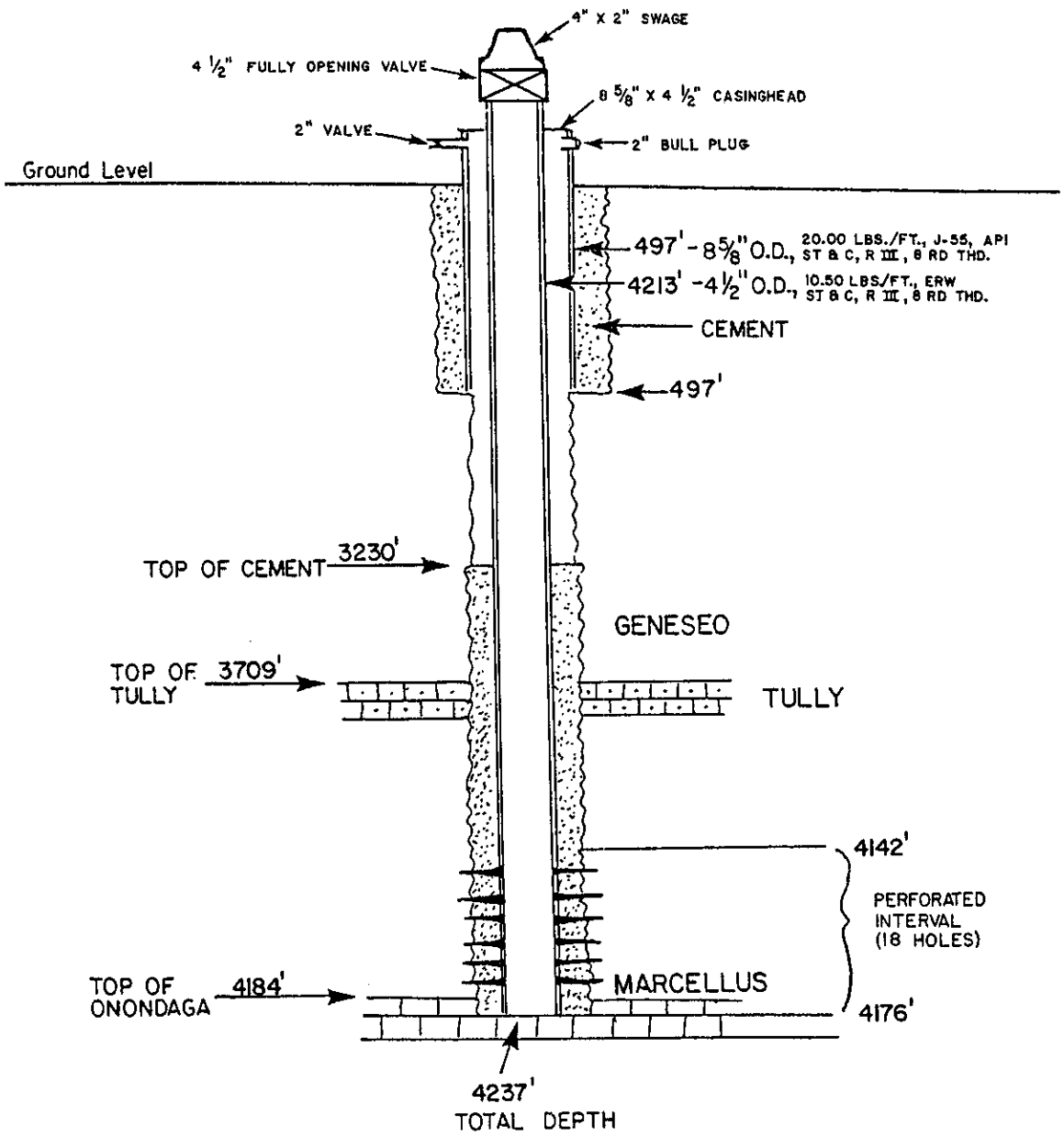
Portville Central School

Township: Portville
County: Cattaraugus
State of New York
U.S.C.G.S. Quadrangle: Portville
Latitude: 2690' S of 42°-02'-30"
Longitude: 10450' W of 78°-17'-30"

Date: May 13, 1981
Scale: 1" = 300'
Elevation: 1470'
Prepared By: D. Michael Canada
N.Y.S. L.S. No. 49215
Portville, N.Y. 14770

FIGURE 3.4-1

PORTVILLE CENTRAL SCHOOL #1 WELL



NOTE: All depths are measured from the Kelly Bushing, 10 feet above the Ground Level Elevation.

FIGURE 3.4-2

PORTVILLE CENTRAL SCHOOL #1 WELL
SUMMARY OF TEST DATA

Perforation Interval - 4142 - 4176 feet			7/18/81
Hydraulic gradient pressure		1795 psi	
Acid breakdown		2800 psi	7/20/81
Frac	ISIP	4000 psi	7/21/81
15 min	SIP	3550 psi	

	SIP	Shut in Time (hrs.)	Water Recovery (bbls)	Flow Rate (MCF/day)	Open Time (hrs)	% Natural Gas by Analyzer
7/22/81				40 est.	12	flared gas
7/23/81	700	6				
	1480	13¼				
7/24/81	820	12		20 est.	12	
7/25/81	700	14		55.5	2	
7/25/81				48.3	8	
7/26/81	300(?)	24				
7/27/81	1000	39	126			
7/28/81				31.4	24	70%
7/29/81			140	21.7	24	
8/14/81	1680	312				
8/21/81	1820	481				
8/22/81				18	26	74%

SECTION 3.5

SUMMARY
OF
HOUGHTON COLLEGE WELL NO. 2

Depth of Well	2471 feet
Total Cost of Project*	$151,000
Initial Production Rate	21 MCF/day
Estimated Sustained Production	9 MCF/day
Percent Methane	90 +
Formation	Marcellus Shale
Start of Project	June 22, 1981
In-Service Date	December 10, 1981

* Includes drilling, casing, wireline logs, stimulation (foam fracture), completion, testing, wellhead equipment, hook-up, site restoration, and consulting services.

The highlights of the well drilling and completion activities are described in the Compilation of Monthly Reports on pages 3-26 and 3-27; diagrams of the drilling location and well construction are illustrated on pages 3-28 and 3-29; and a summary of the initial test data appears on page 3-30. The Daily Drilling Reports, Daily Completion Reports, and the Hydrocarbon Analysis of the Gas Sample are contained in Appendix A.5.

The well is currently providing natural gas to boilers for space heating on campus.

HOUGHTON COLLEGE #2 WELL
COMPILATION OF MONTHLY REPORTS
(MAY 1981 - APRIL 1982)

May 1981

The AEC/NYSERDA contract was signed on the 14th, and work began. AEC obtained the location plat and the drilling permit. AEC contracted with Francis R. Root, Inc. (Root) to drill the well.

June 1981

Root moved in a rotary rig and ran into severe problems with gravel. The rotary rig was moved off and a cable rig moved on.

July 1981

The cable rig drove conductor pipe through the gravel. The rotary rig moved back on location and drilled to a total depth of 2460'. Schlumberger ran a suite of wireline logs. Production casing was run and cemented. The well was shut in.

August 1981

Schlumberger ran a cement bond log (satisfactory) and perforated the casing in the Marcellus shale. Halliburton acidized and stimulated the well. The well was swabbed and sand pumped, and then shut in for a pressure build up test. A 24 hr. flow test was conducted. Two gas samples were collected and analyzed. The well was shut in.

September 1981

AEC submitted a completion report, and copies of all logs to the N.Y.S. Department of Environmental Conservation on behalf of NYSERDA. The gas sample analysis was completed, and copies forwarded to NYSERDA. AEC and NYSERDA modified the original agreement to include construction of the production facilities and piping from the well to a natural gas fired boiler at the college.

October 1981

AEC commenced installation of the necessary meters, separator, valves, pipelines, and other equipment.

November 1981

The well head equipment and a portion of the pipeline were installed.

December 1981

The pipeline work was completed. On the 10th, Houghton College #2 Well was turned on.

January 1982

Well was on production.

February 1982

Well was on production.

March 1982

Well was on production. AEC contracted Van Tyne Consulting to conduct a study of drilling samples taken from the Marcellus shale and the study included samples collected from this well. Site reclamation commenced.

April 1982

Well was on production.

Note: Further detail is included in the Drilling Report and Completion Report sections.

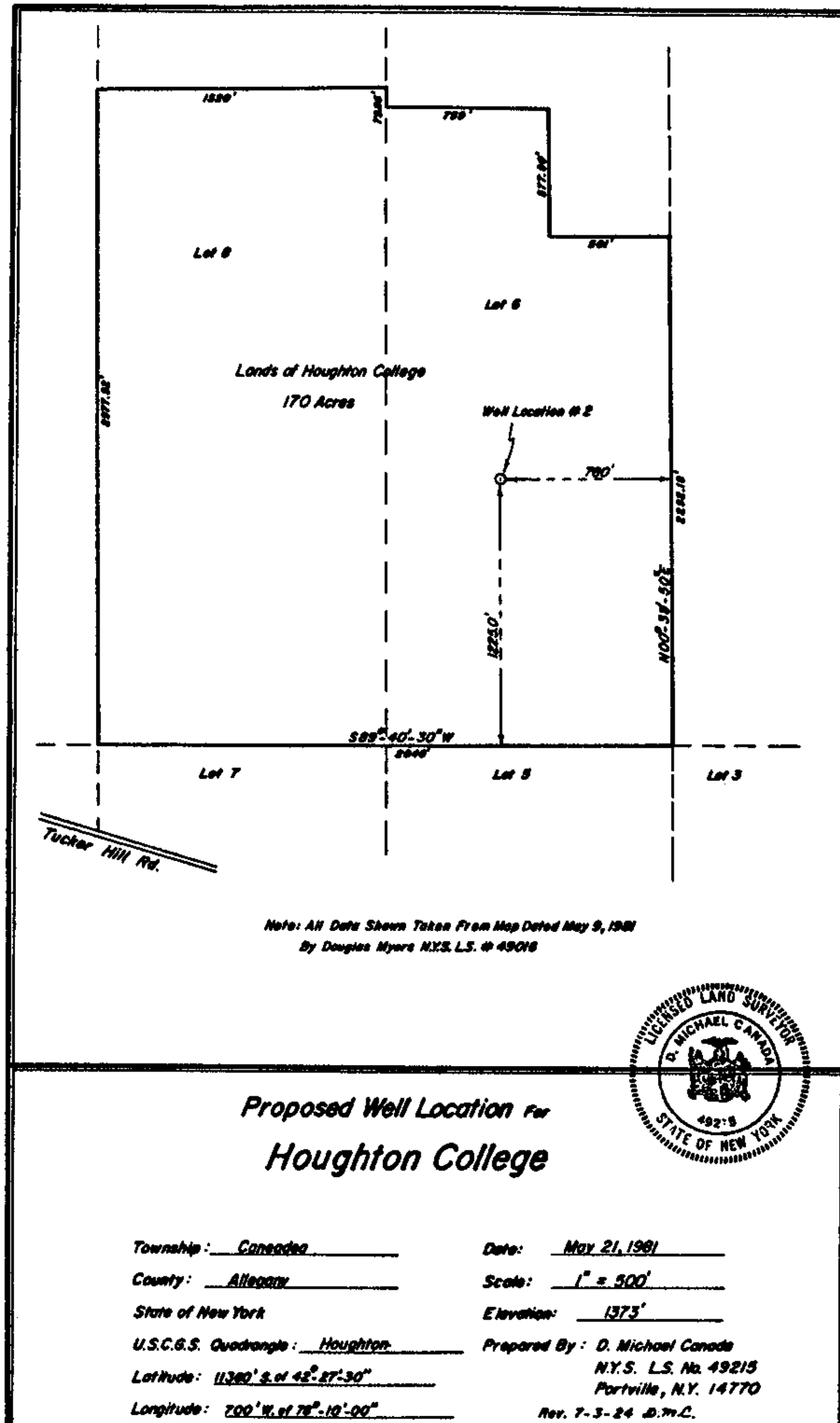
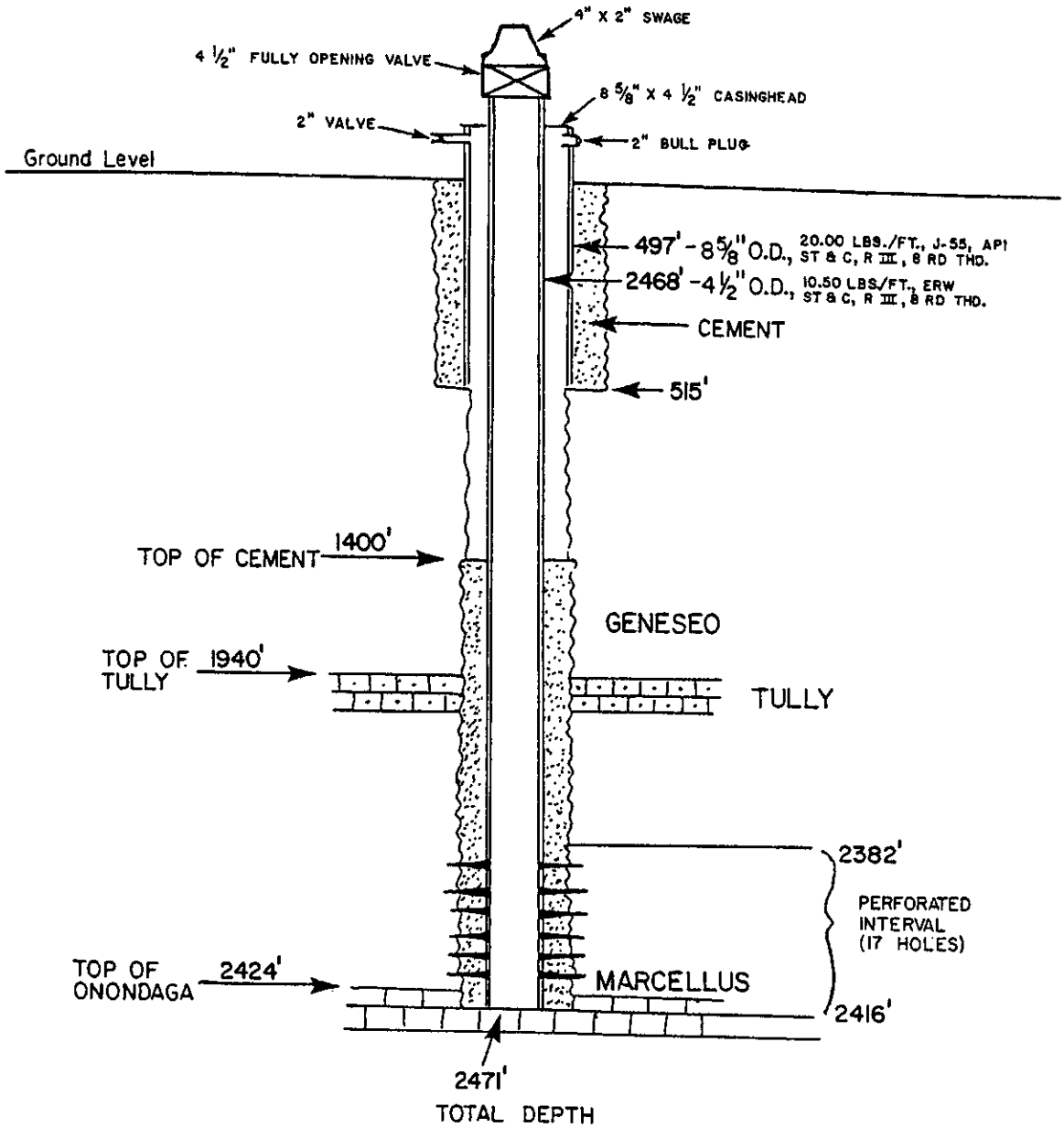

Lot 8
Lot 6
Lands of Houghton College
170 Acres
Well Location # 2
700'
1225.0'
S89°-40'-30"W
Lot 7
Lot 5
Lot 3
Tucker Hill Rd.
Note: All Data Shown Taken From Map Dated May 9, 1981
By Douglas Myers N.Y.S. L.S. # 49016
LICENSED LAND SURVEYOR
D. MICHAEL CANADA
STATE OF NEW YORK
Proposed Well Location For
Houghton College
Township: Caneadea
County: Allegany
State of New York
U.S.C.G.S. Quadrangle: Houghton
Latitude: 11360' S. of 42°-27'-30"
Longitude: 700' W. of 78°-10'-00"
Date: May 21, 1981
Scale: 1" = 500'
Elevation: 1373'
Prepared By: D. Michael Canada
N.Y.S. L.S. No. 49215
Portville, N.Y. 14770
Rev. 7-3-24 D.M.C.

FIGURE 3.5-1

HOUGHTON COLLEGE #2 WELL



NOTE: All depths are measured from the Kelly Bushing, 4 feet above the Ground Level Elevation.

FIGURE 3.5-2

HOUGHTON COLLEGE #2 WELL
SUMMARY OF TEST DATA

Perforation Interval - 2382 - 2416 feet			8/3/81
Hydraulic gradient pressure		1032 psi	
Acid breakdown		2250 psi	8/5/81
Frac	ISIP	2800 psi	8/8/81
15 min	SIP	2500 psi	

	SIP	Shut in Time (hrs.)	Water Recovery (bbls)	Flow Rate (MCF/day)	Open Time (hrs)	% Natural Gas by Analyzer
8/8/81			158			
8/9/81			168	290	24	9%
8/10/81				137	38	19%
8/11/81				77	52	29%
8/13/81	860	47				
8/19/81	1220	184				
8/20/81				23	21	64%

APPENDIX A.1

ALFRED UNIVERSITY WELL NO. 1

Daily Drilling Report

Daily Completion Report

Well Drilling and Completion Report

Hydrocarbon Analysis of Gas Sample

ALFRED UNIVERSITY #1 WELL
DRILLING REPORT

ALFRED TOWNSHIP, ALLEGANY COUNTY, NEW YORK

Daily Drilling Report

Elevations: 1943.6' ground 1953' Kelly Bushing (KB)

5/30/81 Rig up H.L. Murry Drilling, Inc. Rig #2 (rotary). Spud well at 2:20 pm.

5/31/81 Set 11' of conductor pipe. Repairing rig @ 244'.

6/1/81 Drilling @ 409' (8 am).

6/2/81 Drilled to 504'. Ran 492' of 8 5/8", J-55 casing, set @ 502', and cemented to surface.

6/3/81 Drilling @ 1627' (8 am).

6/4/81 Drilling @ 2674' (8 am). Down at 10 am to repair traveling block.

6/5/81 Repairing traveling block @ 2797'. Resumed drilling at 9:50 pm.

6/6/81 Drilling @ 3323' (8 am). Down for bit trip (3731').

6/7/81 Drilled to a total depth (TD) of 3987'. Schlumberger logging, logger's TD 3997'.

6/8/81 Schlumberger logged until 5 am, running Gamma Ray, Density, Caliper, Neutron Porosity, Temperature and Audio logs. Ran 3984.91' of 4½" production casing, casing shoe @ 3993' from KB. Halliburton on site to cement, plug (latch down) 3986' from KB. (See below for more detail.) Rig released.

No measurable gas flows encountered during drilling. Gas odor noted during drilling on June 3 & 4 (above Tully Limestone). No gas noted below the Tully limestone during drilling and no odor was present during logging. Gas odor

present when production casing was run.

Formation Tops - Log Picks

Tully	3366-3416 feet
Marcellus	3942 feet
Onondaga	3975 feet
Tioga Bentonite	3987 feet

Sample Study During Drilling

Hamilton shales above 3900' - gray to dark gray calcareous shales.

3900-3910' As above with 1% fibrous calcite veinlet filling.

3910-3930' Dark gray to black slightly calcareous shale.

3930-3935' Black very slightly calcareous shale.

3935-3965' As above with scattered pyrite.

3965-3970' Brown limestone.

3968' Tioga Bentonite by drill time (reddish brown, micaceous).

3970-3975' Gray limestone.

3975-3987' Gray limestone with scattered pyrite, fine grained lime mudstone, no fossils.

3987' Driller's TD.

Production Casing Tally

95 joints	3947.50'
bottom pup & shoe	7.18' baffle 5.68' above shoe
2nd pup	20.10'
1st pup (on top)	10.13'
	3984.91'

6 centralizers on collars #1, 2, 3, 4, 6 & 8.

Cement basket on collar #11.

Cemented with 200 sacks 50/50 Pozmix, 10% salt, ¼# flocele.

75 bbl gel above cement.

70 bbl 2% KCL water in annulus.

Estimated cement top @ 2950'.

ALFRED UNIVERSITY #1 WELL
COMPLETION REPORT

7/30/81

7:00 am Rig on location and rigging up.

7:30 am Schlumberger on location. Trouble with generator on logging unit could not be repaired.

9:00 am Schlumberger called replacement unit from Bradford, PA, station.

11:30 am Second Schlumberger logging truck on location.

12:10 pm Started cement bond log.

4:40 pm Completed logging. Cement bond appears satisfactory.

4:50 pm Started swabbing.

8:00 pm Completed swabbing.

7/31/81

7:00 am Schlumberger on location to perforate.

11:30 am Perforating completed. 17 shots, 3932-3970'. Top shot didn't fire.

12:00 pm Halliburton on location.

12:45 pm Start acid placement.

1:50 pm Breakdown 3150 psi. Perf. balls hit. 4750 psi.

1:53 pm Stop pumping for 10 min., drop perf. balls.

2:02 pm Pumping, pressure @ 2100 psi., pressure to 4500 psi., Stop pumping for 10 min.

2:10 pm Resume pumping to 4500 psi. Open line & bleed off approximately 1 bbl. Begin pumping @ 2500 psi.

2:15 pm Final treating pressure 2500 psi. ISIP 2000 psi.

2:45 pm Start swabbing.

6:00 pm Swabbed and bailed to 3970'. Released rig.

8/4/81

7:30 am Halliburton on location to frac.

9:05 am Test lines to 5000 psi.

9:25 am Start treating at 4000 psi, 20 BPM.

9:35 am Pressure to 4400 psi, rate 20 BPM.

9:45 am Pressure to 4300 psi, rate 20 BPM.

9:55 am Pressure to 4400 psi, rate 20 BPM.

10:05 am Pressure to 4400 psi, rate 20 BPM.

10:15 am Pressure to 4400 psi, rate 20 BPM.

10:24 am Frac completed, ISIP 3800 psi.

10:39 am WHSIP 3400 psi, (15 min.).

11:15 am WHSIP 3100 psi. Opened well to flow back to tank through a 1/8" choke.

11:30 am 3000 psi FWHP.

12:00 pm 2900 psi FWHP.

12:20 pm 10 bbl water recovered.

12:30 pm 2800 psi FWHP.

12:50 pm 2700 psi FWHP. Very little sand returns. Changed to ¼" choke.

1:00 pm FWHP 2800 psi.

1:30 pm FWHP 1800 psi.

2:00 pm FWHP 1400 psi. 26 bbl water recovered.

2:30 pm FWHP 1100 psi. Very little sand returns.

2:45 pm FWHP 1000 psi. Changed to 3/8" choke.

3:25 pm FWHP 400 psi. Changed to 3/4" choke.

3:45 pm FWHP 90 psi.

4:00 pm FWHP 50 psi.

4:30 pm Removed choke to flow open thru a 2" line to tank. Flowing gas and water by heads. FWHP - 30 psi. 54 bbl. total water recovered.

6:00 pm FWHP 30 psi. 57 bbl total water recovered. Crew released. Well flowing gas & some water into tank.

8/5/81

10:00 am Rig (bailing) moved on location. Total water in flowback tank 85 bbls. Estimated gas flow 15,000 CF/day. No water coming back.

11:30 am Started swabbing and swabbed 250' of water to top perforation (3.9 bbls.). No frac sand in well.

12:00 pm Swabbed est. 150' of water
4:00 pm Swabbed est. 50' of water } 3 bbls. water

5:00 pm Crew released. Well left flowing open with almost negligible gas flow.

8/6/81

7:00 am Started swabbing 1000' of water in hole. (15.5 bbls). Gas flow estimated at 50 MCF/day. Total water recovery 107 bbls. Gas stream tests approximately 15% natural gas.

3:00 pm Gas stream tests approximately 16% natural gas.

4:00 pm Swabbed throughout day in one hour intervals, recovering approximately ½ bbl. each time. Total water recovered 110 bbls. Crew released. Well left flowing open.

8/7/81

7:00 am 1000' solid water and 500' foam in well overnight.

9:00 am Swabbed to top perforation & recovered est. 19 bbls. water.

9:15 am Measured gas stream as 26% natural gas. Flared gas from well. Estimate 40% nat. gas. Measured open flow at 180,000 CF/day with well being open since frac. Gas flow and water recovery seem to be improving steadily on well after a very poor initial flow and rate of water recovery.

11:15 am SIWHP 230 psi in 1 hr. Blew well down and appeared to have much gas. Started swabbing.

2:00 pm Flow stream tested 26% natural gas. Gauged flow at 160,000. CF/day.

8/7/81 (Cont'd)

4:00 pm Continued swabbing hourly, recovering 1/3-1/2 bbl. water. Total water recovery now 133 bbls. Released crew. Left well flowing open.

8/8/81

7:00 am 400' solid water and 200' foam in hole. Estimate 8 bbls. water swabbed by 8 am.

8:00 am Alternate wait one hr. and swab recovering approx. ¼ bbl. each swab.

12:00 pm Flow rate gauged @ 83,000 CF/day.

12:30 pm Gas stream measures 36% natural gas, (by analyzer).

3:00 pm Swabbed 50' after waiting 3 hrs. (3/4 bbl.) Total water recovery from well 142 bbls.

3:30 pm Released rig. Well shut in for pressure buildup.

8/10/81

1:15 pm WHSIP 1720 psi after 45 hr. shut in.

1:30 pm Blew well down for 24 hr. open flow. No water or mist with gas flow on blowdown.

8/11/81

3:00 pm Gas stream measures 46% nat. gas by analyzer. Flow rate: flowing by heads from 20,000 CF/day to 79,000 CF/day. Best estimate of true flow rate 35,000 CF/day after open 24½ hrs.

3:30 pm Well closed in and locked.

8/13/81

3:00 pm WHSIP 1190 psi after 48 hr. shut in.

8/19/81

12:00 pm WHSIP 1560 psi after 189 hrs.

8/19/81 (Cont'd)

12:30 pm Opened well to blow down. Blew down and went dead.

12:45 pm Well started to flow gas and water and carried much water cleaning itself. Gas flow restored. Left well open for sample tomorrow. Est. water returns 4 bbls.

8/20/81

10:00 am Open flow 104 MCF/day after flowing open 22 hrs. Flow surging by heads thru fluid in the well. Variation from 17 to maximum 120 MCF/day. Best estimate 40 MCF/day.

10:15 am Measured gas stream 52% natural gas.

10:23 am Well shut in for pressure buildup for gas sample.

10:35 am Gas sample #1 at 40 psi., wellhead.

10:38 am Gas sample #2 at 50 psi., wellhead.

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
BUREAU OF MINERALS

WELL DRILLING AND COMPLETION REPORT

DO NOT WRITE IN SHADED AREA

PERMIT NO. (This Operation): 31-
ORIGINAL PERMIT OR FILE NO.: 31-

GENERAL WELL INFORMATION

OPERATION TYPE: [X] New Well [ ] Deepening [ ] Plug Back [ ] Conversion
TYPE WELL COMPLETED: [X] Producing [ ] Observation [ ] Input [ ] Dry Hole
FLUIDS PRODUCED OR INJECTED: [ ] Oil [ ] Brine [ ] Waste [X] Gas [ ] Fresh Water
SPECIAL WELL USE: [ ] Secondary Recovery [ ] Storage [ ] Water Supply [ ] Disposal
COMPLETION TYPE: 1 [X] Single Reservoir 2 [ ] Multiple Reservoirs

OPERATOR: New York State Energy Research and Development Authority
Lahee Initial: | Lahee Final:
Operator: | Status:

COUNTY: Allegany
TOWN: Alfred
Town: | GR Elev.: | Type:

LEASE: Alfred University
WELL NO.: 1
Latitude: | Footage: | S
Longitude: | Footage: | E

LOCATION DESCRIPTION: 12650'S 42°-17'-30", 9150'W 77°-45'-00" 7½' Alfred I

ELEVATION: 1953 ft. 1 [ ] Derrick Floor 2 [X] Kelly Bushing
FIELD NAME / POOL NAME: Devonian Shale
Pool: | Field:

FORMATIONS COMPLETED: Marcellus shale
DRILLING CONTRACTOR: H.L. Murray Dirlling
UNITS:

DRILLING AND CORING

DATE DRILLING COMMENCED: Month May Day 30 Year 81
DATE DRILLING COMPLETED: Month June Day 7 Year '81
DRILLING SAMPLES WERE COLLECTED FOR THE STATE: [ ] Yes 2 [X] No

WELL DRILLED WITH CABLE TOOLS: From ft. to ft.
WELL DRILLED WITH ROTARY TOOLS: From 0 ft. to 3997 (log) ft.
ROTARY DRILLING FLUID: 1 [ ] Mud 2 [X] Air
TY

WELL CORED: From ft. to ft. From ft. to ft.
CORE RECOVERY: ft. ft.
CORES WERE: 1 [ ] Lab Analyzed 2 [ ] Described

DRILLERS TOTAL DEPTH: 3987 ft.
PLUG BACK TOTAL DEPTH: 3986 ft.
SIDEWALL CORES: From ft. to From ft. to

LOGS

CHECK DRILLING LOGS COMPILED: 1 [ ] Drillers Log 2 [ ] Sample Log 3 [X] Drilling Time [ ] Others (Specify)
LOCS
CHECK OTHER LOGS RUN: 1 [X] Gamma Ray-Neutron 2 [X] Temperature 3 [X] Caliper [X] Others (Specify) CBL, VDL, CCL, FDC, SNP, MSG, Audio, FTG
LOCS
LOCS

CASING

TYPE	SIZE (O.D)	DEPTH SET	CASING PULLED	AMOUNT CEMENT	EST. TOP CEMENT	CEMENT PUMPED, DUMPED OR CIRCULATI
DRIVE, SURFACE OR CONDUCTOR	12 in.	11 ft.	ft.	sk.	ft.	
	in.	ft.	ft.	sk.	ft.	
INTERMEDIATE OR WATER STRINGS	8 5/8 in.	492 ft.	ft.	sk.	ft.	Pumped to surface and away.
	in.	ft.	ft.	sk.	ft.	
	in.	ft.	ft.	sk.	ft.	
PRODUCING	4½ in.	3993 ft.	ft.	200 sk.	2950 ft.	Pumped
LINERS	in.	ft.	ft.	sk.	ft.	

FINAL COMPLETION

DATE FINAL COMPLETION: Month August Day 4 Year 1981
WELL COMPLETED OPEN HOLE: From ft. to

PERFORATED INTERVALS: 3932 ft. to 3970 ft.; ft. to ft.; ft. to ft.
NO. OF SHOTS: 17
PERFORATED INTERVALS (Cont'd.): ft. to ft.; ft. to ft.; ft. to ft.
NO. OF SH:

TREATMENT OR STIMULATION

ZONES TREATED	SHOT, ACID, FRAC, ETC.	DETAILS OF TREATMENT Kinds and Amounts of Materials, Rates, Pressures, Dates, Etc.
3932 ft. to 3970 ft.	HF Acid	Displace 1500 gal into form. Breakdown
ft. to ft.		surface press. 3150 psi. 30 perf balls.
3932 ft. to 3970 ft.	Foam Frac	75% quality foam. Treat 20 BPM @4400 psi. 50,000 gal foam; 12,500 gal water;
ft. to ft.		1,580,000 SCF N_2, 10,000 lbs 80/100 sd, 50,000 lbs 20/40 sd.
ft. to ft.		
ft. to ft.		
ft. to ft.		

INITIAL PRODUCTION

TYPE OF TEST: [ ] Pumping [X] Flowing
FLOWING TEST DATA: Choke Size none in. Flow.T.P. psi Flow. C.P. 0 psi S.I.T.P. psi S.I.C.P. 1220 psi S.I. Time 45 Hrs.
DATE OF TEST: 8/20/81
DURATION OF TEST: 22 Hr.

OIL PRODUCTION: 0 Bbls/Day
WATER PRODUCTION: 0 Bbls/Day
GAS PRODUCTION: 40 Mcf/Day
METHOD USED TO MEASURE GAS PRODUCTION: 1 [X] Orifice Meter 2 [ ] Pitot Tube 3 [ ] Estimated

I hereby affirm under penalty of perjury that information provided on this form is true to the best of my knowledge and belief. False statements made herein are punishable as a Class A misdemeanor pursuant to Section 210.45 of the Penal Law.

SIGNATURE: [signature] TITLE: V.P. Operations Director for RESEARCH DATE: 9/17/81

85-15-7 (1/75) — SEE REVERSE SIDE FOR INSTRUCTIONS —

PRE-COMPLETION TESTS	TYPE TEST (dst, ball, etc.)	DURATION OF TEST	ZONES TESTED	AMOUNTS AND KINDS OF FLUIDS PRODUCED DURING TEST
	Open flow	25½ hrs.	3932 ft. to 3970 ft.	35 MCF/day, 56% formation gas.
		hrs.	ft. to ft.	
		hrs.	ft. to ft.	

RECORD OF FORMATIONS PENETRATED

DEPTHS	FORMATION TOPS OR ROCK TYPE	REMARKS (Gas and Oil Shows, Water Type and Quantity, etc.)
11	Bedrock	
3366	Tully ls.	Gas odor above Tully ls. Depleted later.
3942	Marcellus sh.	
3975	Onondaga ls.	
3978	Tioga bentonite	Gas odor when production casing was run.

INSTRUCTIONS

A. One (1) copy of Form 85-15-7 shall be filed with the Bureau of Minerals, New York State Department of Environmental Conservation, Regional Office, 128 South Street, Olean, New York 14760. It shall be filed within 30 days after the completion of the operation by any owner or operator who has received a permit from the Bureau of Minerals to drill, deepen, plug back or convert a well for production, input, storage or disposal.

B. Fill out Form 85-15-7 for each well in the following manner:

1. General Well Information. Fill out this section for each well reported.
2. Drilling and Coring.
   a. For new wells give complete details of drilling and coring.
   b. For old wells give only the details of deepening, plugging back and coring.
3. Logs, Casing, Pre-Completion Tests, Treatment or Stimulation. Give only details of work done during this operation.
4. Final Completion and Initial Production. Detail all zones open and initial production from all zones open after the well is completed or recompleted.
5. Record of Formations Penetrated. Please report the tops of formations; if not available, describe the rock type. Also report the depths at which:
   a. any shows of gas or oil were found and any measurements or estimates of volumes;
   b. any quantities of fresh or salt water (including black or sulphur water) were found and, if possible, an estimate of the producing capacity of these zones.

C. Form 85-15-7 may be either hand printed or typewritten and shall be signed by a responsible individual who has full and correct knowledge of the facts stated and the authority to make such statements.

CORE LABORATORIES, INC.
Reservoir Fluid Analysis

September 14, 1981

File RFL 81727

Company Arlington Exploration Company Formation Marcellus Shale

Well Alfred University No. 1 County

Field Wildcat State New York

HYDROCARBON ANALYSIS OF GAS SAMPLE

Component	Mol Percent	GPM
Hydrogen Sulfide	0.00	
Carbon Dioxide	0.11	
Nitrogen	45.14	
Methane	46.83	
Ethane	5.48	1.457
Propane	1.43	0.391
iso-Butane	0.20	0.065
n-Butane	0.37	0.116
iso-Pentane	0.13	0.047
n-Pentane	0.09	0.032
Hexanes	0.11	0.045
Heptanes plus	0.11	0.050
	100.00	2.203

Calculated gas gravity (air = 1.000) = 0.800

Calculated gross heating value = 643 BTU per cubic foot of dry gas at 14.65 psia and 60°F.

Collected at 40 psig and 60°F. on August 20, 1981.
Sample contained 11.38 percent air.

APPENDIX A.2

ST. BONAVENTURE UNIVERSITY WELL NO. 1

Daily Drilling Report

Daily Completion Report

Well Drilling and Completion Report

Hydrocarbon Analysis of Gas Sample

ST. BONAVENTURE UNIVERSITY #1 WELL
DRILLING REPORT

ALLEGANY TOWNSHIP, CATTARAUGUS COUNTY NEW YORK

Daily Drilling Report

Elevations: 1425' ground 1435' Kelly Bushing (KB)

6/2/81 Spud hole with Francis R. Root Inc.'s cable tool rig.

6/5/81 Drilled to total depth (TD) 145'. Set 120' of 12" welded conductor pipe. Rig released.

6/8/81 Move in H.L. Murry Drilling, Inc.'s Rig #2.

6/9/81 Rig up, and commenced drilling at 4 PM (152')

6/10/81 Ran 487' of 8 5/8", J-55 casing,set at 497' from KB and cemented to the surface.

6/11/81 Drilling at 1058' (8 am).

6/12/81 Drilling at 2128' (8 am).

6/13/81 Drilling to a TD of 3696'.
Schlumberger logging, logger's TD 3698'.

6/14/81 Schlumberger ran Gamma Ray, Density, Caliper, Neutron Porosity, Audio logs; Temperature log not operable.
Birdwell moved in to run Gamma Ray-Temperature log.
Ran 3685.08' of 4½" production casing, casing shoe at 3696' from KB (pipe tally TD 3694'). Halliburton on site to cement, cement plug (latch down) at 3686' from KB at 6:45 pm. Casing shoe momentarily plugged during cement plug displacement; casing pressured up to 3000 psi, released and repressured to 2650 psi before circulation restored. Plug landed but float did not hold - well left shut in with Halliburton cementing head on well over night.

44' of pocket below Marcellus inside casing.

Formation Tops - Log Picks

Bradford Third 973 (Production in old well 150' south of this well and believed to have produced the oil show noted by the driller at 1243'. No free oil recovered although the strong oil odor persisted during drilling, and logging tools came out of hole coated with oil film.)

Tully	3220'
Marcellus	3600'
Onondaga	3642'

Sample Study During Drilling

3100-3120' Slightly calcareous dark gray shale.

3120-3140' Very slightly calcareous shale as above.

3140-3180' Slightly calcareous dark gray shale.

3180-3200' Black shale, noncalcareous.

3200-3240' Gray shale, slightly calcareous

3240-3250' Gray-brown limestone.

3250-3280' Dark gray calcareous shale.

3280-3290' Light gray limestone, mudstone, no fossils.

3290-3300' Medium gray limestone.

3300-3560' Dark gray to black calcareous shales.

3560-3600' As above with pyrite.

3600-3620' Black shale, very slightly calcareous.

3620-3630' Black shale, noncalcareous.

3630-3646' Black shale, slightly calcareous, scattered pyrite.

3646-3650' Light gray limestone, mudstone, trace stylolite.

3650-3660' As above, trace shell fragments.

3660-3680' Gray & dark gray shaly limestone.

3680-3690' As above with traces of green shale and white limestone fragments both set in limestone matrix (reef nearby).

3690-3696' Gray shaly limestone.

3696' Driller's TD.

Production Casing Tally

88 joints	3651.88'	
Bottom pump & shoe	7.57'	baffle 6.12' above shoe
2nd pup	20.05'	
1st pup (on top)	5.58'	
	3685.08'	

6 centralizers on collars #1, 2, 3, 4, 6, 8; basket on #10.

Hole loaded with 254 bbl of 2% KCL water ahead of gel & cement.

Cemented with 200 sacks 50/50 Pozmix, 10% salt, ¼# flocele.

75 bbl of gel above cement.

ST. BONAVENTURE UNIVERSITY #1 WELL
COMPLETION REPORT

7/14/81

11:30 am Frac tanks on location. 3-350 bbl.

7/15/81

5:00 pm GFS rig moving in on St. Bonaventure #1.

7/17/81

7:00 am GFS moved in and rigged up on location. 2-350 bbl frac tanks filled, from hydrant at St. Bonaventure University.

8:00 am Schlumberger on location.

9:45 am Start logging run. When wellhead valve opened, well went on slight vacuum instantaneously. Water level in well ± 100' from ground level.

2:00 pm Logging completed. Bond in section to be perforated appears poor. Uncertain whether bond very poor or Schlumberger tool not performing correctly. Schlumberger took log to Bradford for review by district engineer. (TD by this log 24' higher than original TD.) Dist. Engineer (Schlumberger) agrees that bond in Marcellus and directly below not good. All agree to not proceed further on well at 3 pm. Asked rig & log truck to move to Portville location. There is some evidence that Schlumberger bond log tool was not calibrated correctly when the run was made on the St. Bonaventure's well. Even though the relative bond in the Marcellus section did not look good and the bond directly below it not quite as bad, the absolute bond might be O.K. At least the cement directly below the Marcellus might be sufficient to retain a frac.

Schlumberger has agreed to rerun the log (without charge) with a correctly calibrated tool.

7/18/81

7:00 pm Loggers on location. Rigging up.

8:00 pm Started logging.

10:00 pm Completed logging. This cement bond log now looks satisfactory. Plan to schedule frac for this well now August 4, 1981.

12:00 am Schlumberger off location.

7/20/81

5:00 pm Rigging up.

7:00 pm Swabbed to 1800'. Left rig on location.

7/22/81

9:30 am Started swabbing @ 1800'.

10:00 am Schlumberger on location.

11:15 am Completed swabbing to 3630' (bottom perforation).

11:15 am Moving in frac tanks and flow back tanks. Perforated one shot every 2' from 3568'-3572' and 3602'-3630'.

4:00 pm Schlumberger off location.

7/23/81

8:00 am Halliburton on location to acidize.

8:30 am 2-350 bbl water frac tanks filled from hydrant on University. Total water taken from University hydrant is 700 bbls.

8:55 am Test lines for acid spot & breakdown. Operator went to 5100 psi.

9:15 am Start pumping acid. Breakdown at 3100 psi. Final displacement 3800 psi.

9:40 am Acidizing completed. Well shut in.

10:15 am Blowback to pit. Start swabbing.

3:30 pm Finished swabbing to running sand pump to bottom perforation.

7/28/81

8:00 am Halliburton on location for frac.

9:05 am Test lines.

9:10 am Treat at 4500 psi. (Est. 4300 psi wellhead). Rate 12 BPM.

9:20 am Treating at 4400 psi. Rate 12 BPM.

9:35 am Treating at 4400 psi. Rate 12 BPM.

9:45 am Treating at 4300 psi. Rate 12 BPM.

9:55 am Treating at 4300 psi. Rate 12 BPM.

10:20 am Treating at 4200 psi. Rate 12 BPM.

10:35 am Treating at 4300 psi. Rate 12 BPM.

10:50 am Broke off. 4050 psi SIWHP, frac complete.

3:40 pm FWHP = 1650 psi.

4:00 pm Elbow at top of tank cut open losing flow into tank, continuing to let well flow back thru ¼" choke. Some sand in samples.

4:20 pm FWHP = 1020 psi.

5:05 pm FWHP = 1075 psi. Very small amount of sand.

5:45 pm FWHP = 900 psi. Very small amount of sand. Shut well in to repair elbow on flow line. Changed to 3/8" choke. Measured water in tank as 80 bbls total. Estimated amount flowed to atmosphere during line break is 30 bbls for total of 110 bbls.

6:15 pm Welded and repaired flow line and piped into flowback tank. WHSIP 1650 psi, changed to new 3/8" choke.

7:00 pm FWHP 500 psi.

7:30 pm FWHP 390 psi.

8:00 pm FWHP 325 psi. Measured water in tank at 85 bbls.

8:30 pm FWHP 290 psi. Very small amount of sand.

8:40 pm Changed to 3/4 choke. Elbow on tank entry broke. 93 bbls water in tank. Total estimated water 123 bbls.

7/28/81 (Cont'd)

9:00 pm Flow line failed at another elbow on tank. Repiped flow line directly to pit. Changed to 3/4" choke.

9:40 pm Changed to full line flow. FWHP = 80 psi. Left well open, flowing into pit and carrying water. Estimated water flowed to atmosphere and into pit from 8:40 pm to 9:40 pm (when most water stopped flowing) is 6 bbls.

7/29/81

7:00 am Well flowing open with alternate gas & nitrogen and intermittent slugs of water.

8:00 am Closing well in 15 min. with buildup to approximately 250 psi and blowing, recovering slugs of water and repeating each 15 min. Very little sand returns. (Overnight water recovery estimated @ 30 bbls.)

9:00 am Analyzed gas flow stream as 90% Nitrogen, 10% natural gas. Measured water in flowback tank as 93 bbls. Est. total water now recovered = 93 + 30 + 6 + 30 = 159 bbls.

11:00 am Continued intermittent flowback until 11:10 am but bringing no water at end. Left well flowing open and water volume in stream increasing continuously after 20 min. on gas only, then decreasing.

12:00 pm Rig on location.

4:00 pm Sand pumped to 3655' (25' below bottom perforation.

5:00 pm Well swabbed dry to top perforation. Approximately 50' of water in hole (.8 bbls) swabbed and well cleaned itself. Estimated water 1 bbl. Total water recovered - 160 bbls. est.

7/30/81

7:15 am SIWHP 2180 psi, after 12 hr. shut in. Fluid level 3550'. Approx. 80' fluid over bottom perforation.

7:30 am Started bailing. Bailed to TD. Water coming in at ½ bailer volume every hr. by 3 pm.

7/30/81 (Cont'd)

4:00 pm Left well flowing open. Crew released.

5:00 pm Well shut in. 40 MCF/day estimated.

7/31/81

7:00 am SIWHP 700 psi after 11 hr. shut in. Started bailing approximately 40' of water in hole.

9:00 am Checked gas stream as 30% natural gas. Estimated gas flow rate, 30 MCF/day. Water coming in at rate at which it can be bailed with a small bailer.

8/3/81

7:00 pm SIWHP = 1240 psi after 73 hr. shut in (from 6 pm, 7/31/81).

8/5/81

4:00 pm WHSIP 1520 psi after 118 hr. shut in.

5:00 pm Opened well, blew down, and left flowing open.

8/6/81

5:00 pm Gas stream measured 52% natural gas and flow rate 18,800 CF/day, both after well flowing open 24 hrs. Use 18,800 as the designated 24 hrs. open flow. Well shut in.

8/14/81

8:30 am WHSIP 1080 psi after 183 hrs. shut in.

8/21/81

11:15 am WHSIP 1480 psi after 354 hrs. shut in.

11:30 am Blew well down to take gas sample later. Well unloaded with strong flow of water. Estimated water returns; 4 bbls.

8/22/81

10:40 am Open flow varying from 13 to 15 MCF/day. Est. avg. value 14 MCF/day after being open 23 hrs.

8/22/81 (Cont'd)

11:00 am Gas sample 65% natural gas by analyzer. Shut well in for pressure. buildup for gas samples.

11:45 am WHP 20 psi. Took sample #1 @ 20 psi.

11:50 am WHP 22 psi. Took sample #2 @ 22 psi.

12:00 pm Well left shut in with cover over 2" valve. Slight leak at swage (tightened & shut off). Annulus not opened or pressure checked.

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
BUREAU OF MINERALS

WELL DRILLING AND COMPLETION REPORT

DO NOT WRITE IN SHADED AREA: PERMIT NO. (This Operation) 31- ; ORIGINAL PERMIT OR FILE NO. 31- ; Lahee Initial; Lahee Final; Operator; Status; Town; GR Elev.; Type; Latitude; Footage N S; Longitude; Footage E W; Pool; Field; UNITS

GENERAL WELL INFORMATION

OPERATION TYPE: [X] New Well [ ] Deepening [ ] Plug Back [ ] Conversion

TYPE WELL COMPLETED: [X] Producing [ ] Observation [ ] Input [ ] Dry Hole

FLUIDS PRODUCED OR INJECTED: [ ] Oil [ ] Brine [ ] Waste [X] Gas [ ] Fresh Water

SPECIAL WELL USE: [ ] Secondary Recovery [ ] Storage [ ] Water Supply [ ] Disposal

OPERATOR: New York State Energy Research and Development Authority

COMPLETION TYPE: 1 [X] Single Reservoir 2 [ ] Multiple Reservoirs

COUNTY: Cattaraugus

TOWN: Allegany

LEASE: St. Bonaventure University

WELL NO.: 1

LOCATION DESCRIPTION: 2710'S 42°-05'-00", 7300'W 78°-27'-30" 7½" Olean D

ELEVATION: 1435 ft. 1 [ ] Derrick Floor 2 [X] Kelly Bushing

FIELD NAME:

POOL NAME: Devonian Shale

DRILLING CONTRACTOR: Root (surface) H.L. Murray Drilling Co.

FORMATIONS COMPLETED: Marcellus Shale

DRILLING AND CORING

DATE DRILLING COMMENCED: Month June Day 2 Year 81

DATE DRILLING COMPLETED: Month June Day 13 Year 81

DRILLING SAMPLES WERE COLLECTED FOR THE STATE: 1 [ ] Yes 2 [X] No

WELL DRILLED WITH CABLE TOOLS: From 0 ft. to 145 ft.

WELL DRILLED WITH ROTARY TOOLS: From 145 ft. to 3698 ft.

ROTARY DRILLING FLUID: 1 [ ] Mud 2 [X] Air

WELL CORED: From ft. to ft. From ft. to ft.

CORE RECOVERY: ft. ft.

CORES WERE: 1 [ ] Lab Analyzed 2 [ ] Described

DRILLERS TOTAL DEPTH: 3672 ft.

PLUG BACK TOTAL DEPTH: 3686 ft.

SIDEWALL CORES: From ft. to; From ft. to

LOGS

CHECK DRILLING LOGS COMPILED: 1 [ ] Drillers Log 2 [ ] Sample Log 3 [X] Drilling Time [ ] Others (Specify)

CHECK OTHER LOGS RUN: 1 [X] Gamma Ray-Neutron 2 [X] Temperature 3 [X] Caliper [X] Others (Specify) CBL, VDL, CCL FDC, SNP, AUDIO

CASING

TYPE	SIZE (O D)	DEPTH SET	CASING PULLED	AMOUNT CEMENT	EST. TOP CEMENT	CEMENT PUMPED, DUMPED OR CIRCULATED
DRIVE, SURFACE OR CONDUCTOR	12 in.	120 ft.	ft.	sk.	ft.	
INTERMEDIATE OR WATER STRINGS	8 5/8 in.	497 ft.	ft.	sk.	ft.	Pumped. Circulate to surface.
PRODUCING	4½ in.	3693 ft.	ft.	200 sk.	2720 ft.	Pumped
LINERS	in.	ft.	ft.	sk.	ft.	

FINAL COMPLETION

DATE FINAL COMPLETION: Month July Day 28 Year '81

WELL COMPLETED OPEN HOLE: From ft. to ft.

PERFORATED INTERVALS		NO. OF SHOTS
3568 ft. to	3572 ft.	3
3602 ft. to	3630 ft.	29

PERFORATED INTERVALS (Cont'd.): ft. to ft.

TREATMENT OR STIMULATION

ZONES TREATED	SHOT, ACID, FRAC, ETC.	DETAILS OF TREATMENT Kinds and Amounts of Materials, Rates, Pressures, Dates, Etc.
3568 ft. to 3630 ft.	HF Acid	Displace 1500 gal acid into form. Breakdown surface press 3100 psi. 30 perf balls.
3568 ft. to 3630 ft.	Foam Frac	75% quality foam, Treat 12 BPM @4300 psi; 50,000 gal foam; 12,500 gal water; 1,364,000 SCF N_2; 10,000 lbs 80/100 sd, 50,000 lbs 20/40 sd.

INITIAL PRODUCTION

TYPE OF TEST: [ ] Pumping [X] Flowing

FLOWING TEST DATA: Choke Size none in.; Flow T.P. psi; Flow C.P. 0 psi; S.I.T.P. psi; S.I.C.P. 1520 psi; S.I. Time 142 Hrs.

DATE OF TEST: 8/22/81 DURATION OF TEST: 23 Hrs.

OIL PRODUCTION: 0 Bbls/Day

WATER PRODUCTION: 0 Bbls/Day

GAS PRODUCTION: 14 Mcf/Day

METHOD USED TO MEASURE GAS PRODUCTION: 1 [X] Orifice Meter 2 [ ] Pitot Tube 3 [ ] Estimated

I hereby affirm under penalty of perjury that information provided on this form is true to the best of my knowledge and belief. False statements made herein are punishable as a Class A misdemeanor pursuant to Section 210.45 of the Penal Law.

SIGNATURE: [signature]

TITLE: V.P. Operations Arlington Expl. Co. as agent for NYSERDA

DATE: 9/12/81

85-15-7 (1/75)

— SEE REVERSE SIDE FOR INSTRUCTIONS —

PRE-COMPLETION TESTS	TYPE TEST (dst, bail, etc.)	DURATION OF TEST	ZONES TESTED	AMOUNTS AND KINDS OF FLUIDS PRODUCED DURING TEST
	Open flow	24 hrs.	3568 ft. to 3630 ft.	18.8 MCF/day. 62% formation gas.
		hrs.	ft. to ft.	
		hrs.	ft. to ft.	

RECORD OF FORMATIONS PENETRATED

DEPTHS	FORMATION TOPS OR ROCK TYPE	REMARKS (Gas and Oil Shows, Water Type and Quantity, etc.)
120	Bedrock	
923	Bradford third	Strong oil odor. Wireline tools coated when run.
3220	Tully ls.	
3600	Marcellus sh.	
3642	Onondaga ls.	

INSTRUCTIONS

A. One (1) copy of Form 85-15-7 shall be filed with the Bureau of Minerals, New York State Department of Environmental Conservation, Regional Office, 128 South Street, Olean, New York 14760. It shall be filed within 30 days after the completion of the operation by any owner or operator who has received a permit from the Bureau of Minerals to drill, deepen, plug back or convert a well for production, input, storage or disposal.

B. Fill out Form 85-15-7 for each well in the following manner:

1. General Well Information. Fill out this section for each well reported.
2. Drilling and Coring.
   a. For new wells give complete details of drilling and coring.
   b. For old wells give only the details of deepening, plugging back and coring.
3. Logs, Casing, Pre-Completion Tests, Treatment or Stimulation. Give only details of work done during this operation.
4. Final Completion and Initial Production. Detail all zones open and initial production from all zones open after the well is completed or recompleted.
5. Record of Formations Penetrated. Please report the tops of formations; if not available, describe the rock type. Also report the depths at which:
   a. any shows of gas or oil were found and any measurements or estimates of volumes;
   b. any quantities of fresh or salt water (including black or sulphur water) were found and, if possible, an estimate of the producing capacity of these zones.

C. Form 85-15-7 may be either hand printed or typewritten and shall be signed by a responsible individual who has full and correct knowledge of the facts stated and the authority to make such statements.

CORE LABORATORIES, INC.
Reservoir Fluid Analysis

September 14, 1981

File RFL 81727

Company Arlington Exploration Company Formation Marcellus Shale

Well St. Bonaventure College No. 1 County

Field Wildcat State New York

HYDROCARBON ANALYSIS OF GAS SAMPLE

Component	Mol Percent	GPM
Hydrogen Sulfide	0.00	
Carbon Dioxide	0.36	
Nitrogen	23.02	
Methane	61.89	
Ethane	9.95	2.646
Propane	3.00	0.821
iso-Butane	0.29	0.094
n-Butane	0.78	0.244
iso-Pentane	0.16	0.058
n-Pentane	0.20	0.072
Hexanes	0.18	0.073
Heptanes plus	0.17	0.077
	100.00	4.085

Calculated gas gravity (air = 1.000) = 0.762

Calculated gross heating value = 941 BTU per cubic foot of dry gas at 14.65 psia and 60°F.

Collected at 20 psig and 65°F. on August 22, 1981.
Sample contained 0.37 percent air.

CORE LABORATORIES, INC.

James R. Fortner

James R. Fortner
Assistant Manager
Reservoir Fluid Analysis

JRF:JB:la
7 cc: Arlington Exploration
137 New Berry Street
Boston, MA 02116
Attn: Mr. Bob Lynch

APPENDIX A.3

ALLEGANY COUNTY BOCES WELL NO. 1

Daily Drilling Report

Daily Completion Report

Well Drilling and Completion Report

Hydrocarbon Analysis of Gas Sample

ALLEGANY COUNTY BOCES #1 WELL
DRILLING REPORT

AMITY TOWNSHIP, ALLEGANY COUNTY, NEW YORK

Daily Drilling Report

Elevations: 1369' ground 1379' Kelly Bushing (KB)

6/9/81 Spud surface hole with Francis R. Root, Inc.'s cable tool rig.

6/15/81 Drilled to a total depth (TD) of 187', with 12" conductor pipe driven to 173'.

6/16/81 Move off cable tool rig.

6/29/81 Move in H. L. Murry Drilling, Inc.'s Rig #2 (rotary). Spud hole.

6/30/81 Drilled to 504'. Ran 494.97' of 8 5/8", J-55 casing, set at 504' and cemented to surface.

7/1/81 Drilling @ 997' (8 am).

7/2/81 Drilled to a TD of 3350'.

7/3/81 Birdwell logging (logger's TD 3344'); logs run: Gamma Ray, Neutron, Density, Temperature, Sibilation & Induction. Ran 3332.19' of 4½" production casing, casing shoe at 3341' from KB. Halliburton on site to cement, plug (latch down) 3333' from KB. (See below for more detail.) Rig released.

Halliburton blew pump pumping KCL but completed pumping with one pump. Plug landed and held OK.

Slight show of gas reported below 900' during drilling.

Very slight show of gas at TD (from 957' - sibilation log)

Formation Tops - Log Picks

Tully 2748'

Marcellus	3238'
Onondaga	3293'

Sample Study During Drilling

2759'	Top Tully limestone by drilling time, typical dark brown limestone (mudstone), trace pyrite.
3200-3250'	Dark gray calcareous shale
3250-3260'	Dark gray to black calcareous shale
3260-3270'	Slightly calcareous black shale
3270-3280'	As above, 30% dark dray limestone, trace pyrite.
3280-3290'	Noncalcareous shale and brown limestone, top Onondaga 3300 by drill time
3300-3310'	Brown bentonite and dark gray limestone, trace pyrite.
3310-3320'	Dark gray dense (mudstone) limestone
3320-3350'	Medium gray limestone (mudstone), no fossils
3350'	TD Driller

Production Casing Tally

80 joints	3324.25'	
Bottom pup & shoe	7.94'	baffle 6.14' above shoe
	3332.19'	

No pups on top; shoe 3' above bottom (tagged)

6 centralizers on collars #1, 2, 3, 4, 6, 8

Cement Basket on Collar #12

Cemented with 200 sacks 50/50 Pozmix, 10% salt, ¼# flocele

105 bbl of gel above cement

Annulus full of 2% KCL water

Circulation established before all of cement was pumped (plug not yet released)

Estimated cement top @ 2300'

8/10/81

7:00 am Schlumberger on location to log & perforate.

8:00 am Start logging.

12:30 pm Completed logging. Cement bond log satisfactory.

1:30 pm Hole swabbed to bottom perforation (3282'). Waiting on Schlumberger for equipment.

4:00 pm Started perforating run.

6:20 pm Schlumberger pulled perforating carrier. Shots did not fire.

8:40 pm Finished perforating, 3242'-3282'.

9:50 pm Schlumberger off location.

8/11/81

8:00 am Halliburton on location to acidize.

9:00 am Test lines to 4900 psi.

9:20 am Start acid and perf. balls.

9:38 am Break at 2500 psi.

9:42 am Pressure to 5600 psi. Shut down 10 min.

9:52 am Continued treating @ 2700 psi.

9:54 am Completed displacement. ISIP 2200 psi.

10:04 am SIP 2200 psi.

10:15 am Started swabbing.

10:40 am Halliburton off location.

12:00 pm Swabbed to bottom perforation.

8/15/81

7:30 am Halliburton on location to frac.

8/15/81 (Cont'd)

8:40 am Test lines to 5000 psi.

9:00 am Start frac.

9:03 am Breakdown @ 3600 psi, Start treating @ 3200 psi.

9:05 am Shut down. Repair leak on wellhead.

9:07 am Restart frac. Repair wellhead second time.

9:15 am Restart frac. Treating @3800 psi, 20 BPM.

9:30 am Treating @3600 psi, 20 BPM.

9:45 am Treating @ 3900 psi, 20 BPM.

9:55 am Treating @ 3800 psi, 20 BPM.

10:10 am Treating @3800 psi, 20 BPM.

10:15 am Frac completed, ISIP 3400 psi.

10:30 am WHSIP 3200 psi.

10:45 am WHSIP 2950 psi. Opened to flow back through a 1/8" choke.

11:00 am WHFP 2850 psi, 1/8" choke. Very little sand returns.

11:30 am WHFP 2750 psi, 1/8" choke. Very little sand returns.

12:00 pm WHFP 2650 psi, 1/8" choke. Very little sand returns. Change to ¼" choke.

1:00 pm WHFP 2500 psi, ¼" choke. 46 bbls total water recovery, moderate sand returns.

1:30 pm 2300 psi. FWHP 65 bbl total water recovery.

2:00 pm 1900 psi. FWHP.

2:30 pm 1500 psi. FWHP.

3:00 PM 1600 psi. FWHP, 128 bbls total water recovery.

3:30 pm 1350 psi. FWHP, negligible sand returns.

3:50 pm Change to 3/8" choke.

8/15/81 (Cont'd)

4:00 pm 1350 psi. FWHP, 3/8" choke. No sand.

4:30 pm 660 psi. FWHP, 3/8" choke. No sand.

5:00 pm 450 psi. FWHP, 3/8" choke. Very little sand. Changed to 3/4" choke. 150 bbls total recovery.

5:30 pm 95 psi. FWHP. 175 bbls total water recovery.

6:00 pm 45 psi. FWHP. 175 bbls total water recovery.

6:10 pm Removed choke to flow thru 2" line. Crew released. Well left flowing open.

8/16/81

9:00 am Total water measured in flowback tank is 128 bbls. (Not as noted on 8/15/81). Total recovery 130 bbls to date.

10:00 am Bailing rig on location. Rigging up.

11:30 am Checked TD at 3295' (13' below bottom perforation @ 3282'). No sand pump run. Started swabbing.

12:30 pm Swabbed est 3 bbls of water. No water found in hole. Waiting 1 hr. to swab, by intervals checked gas stream as 34% natural gas by analyzer. Measured flow rate 311 MCF/day.

2:30 pm Swabbed well after 2 hr. Recovered 2 bbls water. Flared gas and appeared to have much natural gas by flame. Analyzer shows 40% natural gas.

4:00 pm Swabbed after 1½ hr. Recovered 1 bbl water. Checked gas as 41% by analyzer. Flow rate 215,000 CF/day. Crew released. Well left flowing open. Total water recovery 137 bbls.

8/17/81

7:00 am Found 900' water plus foam in well. Swabbed dry. Est. water recovery 15.5 bbls. Bringing sand with swab. Total water recovery presently 149 bbls. Gas stream 56% natural gas by analyzer.

8/17/81 (Cont'd)

8:30 am Tagged bottom at 3252'. Rigging sand pump to clean out to approximately 3302'.

12:30 pm Recovered good amounts of sand to this point and TD measured 3276'. However, no further sand recovery to 2 pm. Sand pump hitting down hard. Actual log measurements from KB indicate the top of sand now at the lower perforation. Called yard for new sand pump. Swabbing while waiting for pump.

3:30 pm Checked flow rate @ 105 MCF/day (open 53 hr since frac) and gas analysis as 54% natural gas.

4:30 pm Ran new sand pump. Trouple with pump.

5:00 pm Pump worked O.K. No sand recovery. Crew released. Well left flowing open. Estimated total water recovery to date 151 bbls.

8/18/81

7:00 am Ran sand pump with no sand recovery. Sand apparently packed hard at bottom perf. Quit sand pumping. Started swabbing 350' of water (in hole overnight). 5½ bbls. water.

9:00 am Finished swabbing. Continued alternate waiting 1 or 2 hr. and swabbing. Checked gas stream as 64% natural gas by analyzer.

2:00 pm Open flow. 72.5 MCF/day after flowing open since 11 am, 8/15/81. 75 hrs.

3:30 pm Took two gas samples to be shipped to Core Labs for analysis. One at 50 psi and one at 60 psi. At same time measured gas steam at 65% natural gas by analyzer. Total water recovery 159 bbls.

4:30 pm Rig released.

5:00 pm Well shut in.

8/23/81

11:30 am Annulus pressure 60 psi after shut in 8/18/82 at 4 pm. (115 hrs). Left shut in.

11:45 am WHP 1600 psi after (115 hrs.) Left shut in.

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
BUREAU OF MINERALS

WELL DRILLING AND COMPLETION REPORT

DO NOT WRITE IN SHADED AREA

31-
PERMIT NO. (This Operation)
31-
ORIGINAL PERMIT OR FILE NO.

GENERAL WELL INFORMATION

OPERATION TYPE: [X] New Well [ ] Deepening [ ] Plug Back [ ] Conversion
TYPE WELL COMPLETED: [X] Producing [ ] Observation [ ] Input [ ] Dry Hole
SPECIAL WELL USE: [ ] Secondary Recovery [ ] Storage [ ] Water Supply [ ] Disposal
FLUIDS PRODUCED OR INJECTED: [ ] Oil [ ] Brine [ ] Waste [X] Gas [ ] Fresh Water
COMPLETION TYPE: 1 [X] Single Reservoir 2 [ ] Multiple Reservoirs

OPERATOR: New York State Energy Research and Development Authority
Lahee Initial / Lahee Final
Operator / Status

COUNTY: Allegany
TOWN: Amity
Town / GR Elev. / Type

LEASE: Allegany County BOCES
WELL NO.: 1
Latitude / Footage N S
Longitude / Footage E W

LOCATION DESCRIPTION: 3040'S 42°-15-00", 10875'W 78°-00-00 Belmont C 7½'
Pool / Field

ELEVATION: 1379.2 ft. 1 [ ] Derrick Floor 2 [X] Kelly Bushing
FIELD NAME / POOL NAME: Devonian Shale
UNITS

FORMATIONS COMPLETED: Marcellus Shale
DRILLING CONTRACTOR: Root (surface) Murray Drilling

DRILLING AND CORING

DATE DRILLING COMMENCED: Month June Day 9 Year '81
DATE DRILLING COMPLETED: Month July Day 2 Year 81
DRILLING SAMPLES WERE COLLECTED FOR THE STATE: 1 [ ] Yes 2 [X] No

WELL DRILLED WITH CABLE TOOLS: From 0 ft. to 187 ft.
WELL DRILLED WITH ROTARY TOOLS: From 187 ft. to 3350 ft.
ROTARY DRILLING FLUID: 1 [ ] Mud 2 [X] Air
TLS

WELL CORED: From ft. to ft. From ft. to ft.
CORE RECOVERY: ft. ft.
CORES WERE: 1 [ ] Lab Analyzed 2 [ ] Described

DRILLERS TOTAL DEPTH: 3350 ft.
PLUG BACK TOTAL DEPTH: 3333 ft.
SIDEWALL CORES: From ft. to ft. From ft. to ft.

LOGS

CHECK DRILLING LOGS COMPILED: 1 [ ] Drillers Log 2 [ ] Sample Log 3 [X] Drilling Time [ ] Others (Specify) CBL, VDL, CCL
LOGS
CHECK OTHER LOGS RUN: 1 [X] Gamma Ray-Neutron 2 [X] Temperature 3 [ ] Caliper [X] Others (Specify) DBC, ENP, IS, WSS
LOGS

CASING

TYPE	SIZE (O D)	DEPTH SET	CASING PULLED	AMOUNT CEMENT	EST. TOP CEMENT	CEMENT PUMPED, DUMPED OR CIRCULATED
DRIVE, SURFACE OR CONDUCTOR	12 in.	173 ft.	ft.	sk.	ft.	
	in.	ft.	ft.	sk.	ft.	
INTERMEDIATE OR WATER STRINGS	8 5/8 in.	504 ft.	ft.	sk.	ft.	Pumped to surface
	in.	ft.	ft.	sk.	ft.	
PRODUCING	4½ in.	3341 ft.	ft.	200 sk.	2300 ft.	Pumped
LINERS	in.	ft.	ft.	sk.	ft.	

FINAL COMPLETION

DATE FINAL COMPLETION: Month August Day 15 Year 1981
NO. OF SHOTS: 21
PERFORATED INTERVALS: 3242 ft. to 3282 ft.; ft. to ft.; ft. to ft.
WELL COMPLETED OPEN HOLE: From ft. to ft.
PERFORATED INTERVALS (Cont'd.): ft. to ft.; ft. to ft.; ft. to ft.
NO. OF SHOTS

TREATMENT OR STIMULATION

ZONES TREATED	SHOT, ACID, FRAC, ETC.	DETAILS OF TREATMENT Kinds and Amounts of Materials, Rates, Pressures, Dates, Etc.
3242 ft. to 3282 ft.	HF Acid	Displace 1500 gal acid into form. Breakdown press 2500 psi (surface) 30 perf balls.
ft. to ft.		
3242 ft. to 3282 ft.	Foam Frac	75% quality foam. Treat 20 BPM @ approx. 3800 psi. 50,000 gal foam; 12,500 gal. water; 1,580,000 SCF N_2, 10,000 lbs. 80/100 sd, 50,000 lbs 20/40 sd.
ft. to ft.		
ft. to ft.		
ft. to ft.		
ft. to ft.		

TYPE

INITIAL PRODUCTION

TYPE OF TEST: [ ] Pumping [X] Flowing
FLOWING TEST DATA: Choke Size none in. Flow.T.P. ___ psi Flow. C.P. 0 psi S.I.T.P. ___ psi S.I.C.P. 1600 psi S.I. Time 115 Hrs.
DATE OF TEST: 8/18/81
DURATION OF TEST: 75 Hrs.

OIL PRODUCTION: 0 Bbls/Day
WATER PRODUCTION: 0 Bbls/Day
GAS PRODUCTION: 72.5 Mcf/Day
METHOD USED TO MEASURE GAS PRODUCTION: 1 [X] Orifice Meter 2 [ ] Pilot Tube 3 [ ] Estimated

I hereby affirm under penalty of perjury that information provided on this form is true to the best of my knowledge and belief. False statements made herein are punishable as a Class A misdemeanor pursuant to Section 210.45 of the Penal Law.

SIGNATURE: Robert A. Jacobs
TITLE: V.P. - Operations Appalachia Expl. Co. as agent for NYSERDA
DATE: 9/17/81

– SEE REVERSE SIDE FOR INSTRUCTIONS –

85-15-7 (1/75)

PRE-COMPLETION TESTS

TYPE TEST (dst, bail, etc.)	DURATION OF TEST	ZONES TESTED	AMOUNTS AND KINDS OF FLUIDS PRODUCED DURING TEST
Open flow	29 hrs.	3242 ft. to 3282 ft.	215 MCF/day (50% form. gas)
Open flow	53 hrs.	3242 ft. to 3282 ft.	105 MCF/day (66% form. gas)
	hrs.	ft. to ft.	

RECORD OF FORMATIONS PENETRATED

DEPTHS	FORMATION TOPS OR ROCK TYPE	REMARKS (Gas and Oil Shows, Water Type and Quantity, etc.)
	Bedrock	Very slight show gas.
900		
2748	Tully ls	
3238	Marcellus sh	
3293	Onondaga ls	Log
		Very slight show of gas at TD. (3344)

INSTRUCTIONS

A. One (1) copy of Form 85-15-7 shall be filed with the Bureau of Minerals, New York State Department of Environmental Conservation, Regional Office, 128 South Street, Olean, New York 14760. It shall be filed within 30 days after the completion of the operation by any owner or operator who has received a permit from the Bureau of Minerals to drill, deepen, plug back or convert a well for production, input, storage or disposal.

B. Fill out Form 85-15-7 for each well in the following manner:

1. General Well Information. Fill out this section for each well reported.
2. Drilling and Coring.
   a. For new wells give complete details of drilling and coring.
   b. For old wells give only the details of deepening, plugging back and coring.
3. Logs, Casing, Pre-Completion Tests, Treatment or Stimulation. Give only details of work done during this operation.
4. Final Completion and Initial Production. Detail all zones open and initial production from all zones open after the well is completed or recompleted.
5. Record of Formations Penetrated. Please report the tops of formations; if not available, describe the rock type. Also report the depths at which:
   a. any shows of gas or oil were found and any measurements or estimates of volumes;
   b. any quantities of fresh or salt water (including black or sulphur water) were found and, if possible, an estimate of the producing capacity of these zones.

C. Form 85-15-7 may be either hand printed or typewritten and shall be signed by a responsible individual who has full and correct knowledge of the facts stated and the authority to make such statements.

CORE LABORATORIES, INC.
Reservoir Fluid Analysis

September 14, 1981

File RFL 81727

Company Arlington Exploration Company Formation Marcellus Shale

Well Allegany Co. Boces No. 1 County

Field Wildcat State New York

HYDROCARBON ANALYSIS OF GAS SAMPLE

Component	Mol Percent	GPM
Hydrogen Sulfide	0.00	
Carbon Dioxide	0.27	
Nitrogen	30.05	
Methane	58.64	
Ethane	8.23	2.188
Propane	1.91	0.523
iso-Butane	0.19	0.062
n-Butane	0.38	0.119
iso-Pentane	0.09	0.033
n-Pentane	0.08	0.029
Hexanes	0.10	0.041
Heptanes plus	0.06	0.027
	100.00	3.022

Calculated gas gravity (air = 1.000) = 0.755

Calculated gross heating value = 817 BTU per cubic foot of dry gas at 14.65 psia and 60°F.

Collected at 60 psig and 70°F. on August 18, 1981.
Sample contained 5.77 percent air.

APPENDIX A.4

PORTVILLE CENTRAL SCHOOL WELL NO. 1

Daily Drilling Report

Daily Completion Report

Well Drilling and Completion Report

Hydrocarbon Analysis of Gas Sample

PORTVILLE CENTRAL SCHOOL #1 WELL
DRILLING REPORT

PORTVILLE TOWNSHIP, CATTARAUGUS COUNTY, NEW YORK

Daily Drilling Report

Elevations: 1470' ground 1480' Kelly Bushing (KB)

6/11/81 Spud surface hole with Francis R. Root, Inc.'s cable tool rig.

6/12/81 Drilled to a total depth (TD) of 48'. Drove 44' feet of 12" conductor pipe. Rig released.

6/15/81 Moved in H.L. Murry Drilling, Inc.'s Rig #2 (rotary). Rig up and commenced drilling at 9:15 pm.

6/16/81 Drilling at 306' (8 am).

6/17/81 Drilled to 497.19'. Ran 497' of 8 5/8", J-55 casing; set at 497.19' and cemented to surface.

6/18/81 Drilling at 1238' (8 am).

6/19/81 Fishing for drilling bit @ 1731'.

6/20/81 Drilling on fish.

6/21/81 Fishing.

6/22/81 Fishing.

6/23/81 Cemented back 100' and whipstock hole.

6/24/81 Drilling @ 1738' (8 am).

6/25/81 Drilling @ 2654' (8 am).

6/26/81 Drilled to a TD of 4227'. Birdwell began logging at 8 pm, logger's TD 4237'.

6/27/81 Birdwell logged until 1 pm, running Gamma Ray, Density, Neutron, Caliper, Sibilation, Temperature & Induction logs. Ran 4212.86' of 4½" production casing (casing tally TD 4225"),

set at 4222' from KB, Halliburton on site to cement, plug down at 7 pm, 4214' from KB. Rig released.

Formation Tops - Log Picks

Bradford Third (oil show)	1052'
Tully	3709'
Marcellus	4138'
Onondaga	4184'

No gas flow detected at TD.

Oil odor present during fishing operations from Upper Devonian sandstones.

Sample Study During Drilling

3650-3670'	Noncalcareous black shale.
3670-3690'	Calcareous dark gray shale.
3690-3700'	As above with gray-brown limestone, trace pyrite
3700-3740'	Brown limestone, dense mudstone; Tully limestone 3706 by drill time.
3740-3780'	Dark gray & black calcareous shales.
3780-3790'	Light gray limestone (Tichnor).
3790-3860'	Dark gray calcareous shales.
3860-4090'	Dark gray & black calcareous shales, trace pyrite.
4090-4118'	Black calcareous shales.
4118-4130'	Black slightly calcareous shale.
4130-4140'	Dark gray calcareous shale.
4140-4150'	Black slightly calcareous shale.
4150-4165'	Noncalcareous black shale.
4165-4177'	Black slightly calcareous shale.
4177-4180'	Dark dray limestone (mudstone).
4180-4210'	Dark gray shaly limestone, trace pyrite.

4210-4227' Medium gray limestone.

4227' Driller's TD.

Production Casing Tally

101 joints	4189.33'	
Bottom pup and shoe	7.89'	baffle 6.09' above shoe
2nd pup	10.04'	
Top pup	5.60'	
	4212.86'	

6 centralizers on collars #1, 2, 3, 4, 6, 8; basket on #11.

Hole loaded with 280 bbl of 2% KCL water ahead of gel and cement.

Cemented with 220 sacks 50/50 Pozmix, 10% salt, ¼# flocele.

75 bbl of gel above cement.

Approximately 314 bbl fluid pumped before circulation to surface.

Bradford third sandstone at 1052' should produce oil and gas after fracture treatment.

7/17/81

4:30 pm Service rig on location, rigging up.

6:00 pm Commenced logging.

9:00 pm Finished logging. Cement bond log satisfactory.

7/18/81

7:00 am Swabbing well.

10:45 am Completed swabbing to 4180'.

12:00 pm Schlumberger on location. Perforated with 18 shots, one every 2' from 4142-4176.

4:40 pm Completed perforations.

7/20/81

8:00 am Moved in 2nd frac tank and flow tank. Took 700 bbls water from hydrant.

9:00 am Halliburton on location.

10:50 am Spot 1500 gal acid and follow with displacement water to top perforation. Breakdown 2800 psi. Treating @ 4000 psi, 1 BPM rate. Shut down, wait 10 min., resumed pumping, treated remainder at 3200 psi, 10 BPM.

11:00 am Rig down Halliburton and open well to flow back.

11:10 am Started swabbing. (Filling frac tanks.)

3:00 pm Swabbed to 4140'. Some gas coming with swab from 2200' down.

4:00 pm Rig moved off location.

7/21/81

7:30 am Made up flow-back line.

7/21/81 (cont'd)

8:00 am Halliburton on location. WHSIP 30 psi.

11:17 am Started frac.

11:23 am Treating at 4400 psi.

11:35 am Wellhead line connection leaking. Repaired.

11:40 am Restart.

11:45 am Treating @ 4400 psi @ 16 BPM.

11:57 am Treat Press. 4300 psi.

12:05 pm Treat Press. 4400 psi.

12:10 pm Treat Press. 4500 psi.

12:15 pm Treat Press. 4500 psi.

12:25 pm Treat Press. 4300 psi.

12:35 pm Treat Press. 4300 psi. One Nitrogen truck down.

12:40 pm Frac finished, ISIP 4000 psi.

12:45 pm SIWHP 3700 psi.

12:50 pm SIWHP 3600 psi. Well shut in.

1:30 pm Opened well to flow thru 8/64" choke to flowback tank.

2:05 pm Flowing back some sand. FWHP = 3400 psi.

2:50 pm FWHP = 3350 psi.

3:15 pm FWHP = 3300 psi.

3:45 pm FWHP = 3200 psi.

4:00 pm Down. 1/8" choke out. Well shut in. New choke (1/8") installed.

4:45 pm Well opened to flow. 3300 psi. WHP.

5:00 pm FWHP = 3250 psi.

5:40 pm Swage broke in flow line (cut thru threads). Line disconnected from tank to save rest of line. Master gate valve would not close. Opened master as wide as possible and allowed to flow thru 1/8"

7/21/81 (cont'd)

choke to pit. Small amount of sand.

5:55 pm FWHP = 2950 psi. Very small amount of sand.

6:05 pm FWHP = 2800 psi. Very small amount of sand.

6:10 pm FWHP = 2700 psi. Very small amount of sand.

6:35 pm FWHP = 2400 psi. Very small amount of sand.

7:05 pm FWHP = 2050 psi. No sand.

7:20 pm FWHP = 1850 psi. Very small amount of sand.

7:30 pm FWHP = 1750 psi. Very small amount of sand.

8:00 pm FWHP = 1450 psi. Some water slugs.

8:30 pm FWHP = 1200 psi.

9:00 pm FWHP = 1100 psi.

9:30 pm FWHP = 1100 psi.

10:00 pm FWHP = 1100 psi.

10:30 pm FWHP = 1100 psi.

11:00 pm FWHP = 1000 psi. 1/8" choke.

11:30 pm FWHP = 1000 psi.

7/22/81

12:00 am FWHP = 950 psi.

12:30 am FWHP = 900 psi.

1:00 am FWHP = 850 psi.

1:30 am FWHP = 800 psi.

2:00 am FWHP = 800 psi.

2:30 am FWHP = 750 psi.

3:00 am FWHP = 700 psi.

3:30 am FWHP = 600 psi.

4:00 am FWHP = 550 psi.

7/22/81 (cont'd)

4:30 am FWHP = 550 psi.

5:00 am FWHP = 500 psi.

5:30 am FWHP = 450 psi.

6:00 am FWHP = 400 psi.

6:30 am FWHP = 350 psi.

7:00 am FWHP = 300 psi.

7:15 am Shut well in @ 300 psi WHP. Changed choke from 1/8" to 3/8".

7:55 am SIWHP 900 psi. Opened well to continue flowing back. Reconnected to flowback tank. No evidence of sand returning.

9:00 am FWHP 250 psi. (3/8" choke). Changed gauges. SIWHP = 90 psi. Removed 3/8" choke. Opened to flowback unrestricted. Carrying water and some gas. Natural gas odor.

1:00 pm Well flowing back gas a very little water. No foam.

4:30 pm Repiped flow line to pit for well shut in and blowdown tomorrow.

4:35 pm Shut in.

4:40 pm Reopened and lit flow line. Fairly strong gas flow and flame.

5:15 pm Shut in for pressure buildup.

7/23/81

6:30 am WHSIP 1480 psi after 13½ hrs. shut in.

7:00 am WHSIP 1500 psi.

7:30 am WHSIP 1520 psi.

7:45 am Opened well to flow back into tank. Blew down and well went dead for five minutes.

7:50 am Started flowing gas and small amounts of very salty water, by heads.

7/23/81 (cont'd)

7:50 am Volume in tank after blowdown = 42 bbls.

11:00 am Well shut in. Small gas flow rate and no water.

4:00 pm Moved rig on location.

5:00 pm WHSIP 700 psi after 6 hr. shut in. Opened well & blew down with no water. Rigged to start pumping sand. Checked water level at 3400'. Small steady gas flow.

6:00 pm Running sand pump, 71' of sand on bottom.

7:00 pm Trouble with sand pump. Repairing pump. Shut well in. Released crew. Estimated gas flow prior to shut in: 40 MCF/day.

7/24/81

7:00 am WHSIP 829 psi after 12 hr. shut in.

7:15 am Rigged up bailer. Sand is floating in agitated water. Estimated gas flow rate after blowing down is 20 MCF/day. Water level 3400' (depth).

11:00 am Running sand pump.

3:00 pm Sand cleaned out to 4191'. Start swabbing estimated 1000' of water (15.5 bbls).

5:00 pm Hole swabbed and bailed dry. Well making estimated 20 MCF/day. Shut in.

7/25/81

7:00 am SIWHP 700 psi after 14 hr, shut in. Blew well down with no water returns.

8:00 am Well clean to TD with 400' water (6.2 bbls).

8:35 am Well swabbed dry to top perf. Wait ½ hr.

9:05 am Agitated water ± 50' above top perforation. Swabbed dry. Continue

7/25/81 (cont'd)

alternated swabbing and waiting.

10:00 am Gauged well @ 55.5 MCF/day after waiting from 9:05 swab run.

10:05 am Swabbed. Water level 25' above top perforation.

1:00 pm Water now coming into well at rate of 10'-15' every half hour, after each swab run.

2:00 pm Ran swab to top perforation. No recovery. Rigged bailer.

3:00 pm Bailed well dry to TD.

3:10 pm Well shut in.

7/26/81

3:00 pm SIWHP 300 psi inaccurate gauge reading.

7/27/81

7:00 am SIWHP = 1000 psi after 39 hr. shut in. Blew well down with very little water.

7:30 am Started swabbing. Top of water 500' above TD but highly agitated. Swabbing, estimated water column in hole to be approx. 250' (3.9 bbls).

8:30 am Well swabbed dry to TD in 4 runs. Left well open to swab at noon. Estimated total recovery of water from the well to date is 126 bbls.

12:00 pm Ran swab. Well had 150' of water above TD. Swabbed dry and left well open to swab at 2:30 pm.

2:30 pm Started swabbing water level at top perforation or approximately 60' (.9 bbls) above TD. Bailed water and some acid.

3:00 pm Finished bailing to TD. Left well flowing open for 24 hr. gauge test tomorrow.

7/28/81

7:00 am 31,400 SCF/day open flow test after open 24 hrs. Probably some water in hole (some Nitrogen also?).

7:30 am Well shut in.

2:20 pm Opened well to blow down. Started swabbing agitated water in hole approx. 450' (7 bbls).

2:50 pm Swabbed dry bottom perf. Left well flowing open.

3:00 pm Sampled gas stream with gas analyzer. Reading 70% natural gas. Indicates 30% Nitrogen by difference.

7/29/81

7:30 am Gauged well at 21,300 SCF/day. (Probably some water in hole.) After flowing open 17 hrs. (also opened 24 hrs. previous to this with a 7 hr. shut in period between the two flow periods), and can be relied on as a valid 24 hr. open flow potential of the well. Left well flowing open to swab later.

10:00 am Swabbed well, 450' water in hole (7 bbls). Total estimated water recovery from well now 140 bbls.

11:00 am Completed swabbing.

4:00 pm 10' of water in hole. Bailed dry. Well shut in. Rig moved off location. Gauged well at 21,700/day.

8/1/81

7:00 am WHSIP = 880 psi after 63 hr. shut in.

8:30 am Gas analysis reading, 38% nat. gas. Flow rate 34,000 CF/day, after 25 hr. open flow.

9:00 am Well closed in.

8/14/81

9:00 am WHSIP 1680 psi after 312 hrs. shut in.

8/21/81

10:00 am Annulus flowing est. 3 MCF/day of gas.

10:15 am WHSIP 1820 psi after 481 hrs.

10:30 am Blew well down to take sample later. No water returns during blowdown.

8/22/81

12:30 pm Open flow rate surging by heads from 17 to 33 MCF/day. Best est. of steady flow rate is 18 MCF/day after being open 26 hrs.

12:35 pm Gas sample 74% natural gas by analyzer.

12:45 pm Well shut in for pressure build up for gas sample.

1:14 pm WHP 20 psi. Took gas sample #1 @ 20 psi.

1:17 pm WHP 22 psi. Took gas sample #2 @ 22 psi. Annulus left open to avoid press. buildup.

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
BUREAU OF MINERALS

WELL DRILLING AND COMPLETION REPORT

GENERAL WELL INFORMATION

OPERATION TYPE: [X] New Well [ ] Plug Back [ ] Deepening [ ] Conversion

TYPE WELL COMPLETED: [X] Producing [ ] Input [ ] Observation [ ] Dry Hole

FLUIDS PRODUCED OR INJECTED: [ ] Oil [X] Gas [ ] Brine [ ] Fresh Water [ ] Waste

SPECIAL WELL USE: [ ] Secondary Recovery [ ] Water Supply [ ] Storage [ ] Disposal

DO NOT WRITE IN SHADED AREA: 31— PERMIT NO. (This Operation); 31— ORIGINAL PERMIT OR FILE NO.; Lahee Initial; Lahee Final; Operator; Status; Town; GR Elev.; Type; Latitude; Footage N/S; Longitude; Footage E/W; Pool; Field; UNITS

OPERATOR: New York State Energy Research and Development Authroity

COMPLETION TYPE: 1 [X] Single Reservoir 2 [ ] Multiple Reservoirs

COUNTY: Cattaraugus

TOWN: Portville

LEASE: Portville Central School

WELL NO.: 1

LOCATION DESCRIPTION: 2690'S 42°-2'-30", 10450'W 78°-17'-30" Portville 7½'

ELEVATION: 1480 ft. 1 [ ] Derrick Floor 2 [X] Kelly Bushing

FIELD NAME:

POOL NAME: Devonian Shale

FORMATIONS COMPLETED: Marcellus Shale

DRILLING CONTRACTOR: Root, (surface) HL Murray Drlg, Inc.

DRILLING AND CORING

DATE DRILLING COMMENCED: Month June Day 11 Year '81

DATE DRILLING COMPLETED: Month June Day 26 Year '81

DRILLING SAMPLES WERE COLLECTED FOR THE STATE: 1 [ ] Yes 2 [X] No

WELL DRILLED WITH CABLE TOOLS: From 0 ft. to 48 ft.

WELL DRILLED WITH ROTARY TOOLS: From 48 ft. to 4237 ft.

ROTARY DRILLING FLUID: 1 [ ] Mud 2 [X] Air

WELL CORED: From ft. to ft.; From ft. to ft.

CORE RECOVERY: ft.; ft.

CORES WERE: 1 [ ] Lab Analyzed 2 [ ] Described

DRILLERS TOTAL DEPTH: 4227 ft.

PLUG BACK TOTAL DEPTH: 4214 ft.

SIDEWALL CORES: From ft. to; From ft. to

LOGS

CHECK DRILLING LOGS COMPILED: 1 [ ] Drillers Log 2 [ ] Sample Log 3 [X] Drilling Time [ ] Others (Specify)

CHECK OTHER LOGS RUN: 1 [X] Gamma Ray-Neutron 2 [X] Temperature 3 [X] Caliper [X] Others (Specify) ~~CBL, VDL, CCL~~ DBC, ENP, IS, STS

CASING

TYPE	SIZE (O D)	DEPTH SET	CASING PULLED	AMOUNT CEMENT	EST. TOP CEMENT	CEMENT PUMPED, DUMPED OR CIRCULATED
DRIVE, SURFACE OR CONDUCTOR	12 in.	44 ft.	ft.	sk.	ft.	
INTERMEDIATE OR WATER STRINGS	8 5/8 in.	497 ft.	ft.	sk.	ft.	Pumped to surface
PRODUCING	4½ in.	4222 ft.	ft.	220 sk.	3230 ft.	Pumped
LINERS	in.	ft.	ft.	sk.	ft.	

FINAL COMPLETION

DATE FINAL COMPLETION: Month July; Day 21 Year '81

WELL COMPLETED OPEN HOLE: From ft. to ft.

PERFORATED INTERVALS: 4142 ft. to 4176 ft.; ft. to ft.; ft. to ft.

NO. OF SHOTS: 18

PERFORATED INTERVALS (Cont'd.): ft. to ft.; ft. to ft.; ft. to ft.

NO. OF SHOTS:

TREATMENT OR STIMULATION

ZONES TREATED	SHOT, ACID, FRAC, ETC.	DETAILS OF TREATMENT Kinds and Amounts of Materials, Rates, Pressures, Dates, Etc.
4142 ft. to 4176 ft.	HF Acid	Displace 1500 gal. acid into form.
ft. to ft.		Breakdown press. 2800 psi (surface). 30 perf balls.
4142 ft. to 4176 ft.	Foam Frac	75% quality foam. Treat 16 BPM @4400 psi.
ft. to ft.		50,000 ga. foam; 12,500 gal water; 1,528,000 SCF N_2; 10,000 lbs 80/100 sd;
ft. to ft.		50,000 lbs 20/40 sd.
ft. to ft.		
ft. to ft.		

INITIAL PRODUCTION

TYPE OF TEST: [ ] Pumping [X] Flowing

FLOWING TEST DATA: Choke Size none In.; Flow. T.P. 0 psi; Flow. C.P. psi; S.I.T.P. ~~XXXX~~ psi; S.I.C.P. 1820 psi; S.I. Time 481 Hrs.

DATE OF TEST: 8/22/81

DURATION OF TEST: 26 Hrs.

OIL PRODUCTION: 0 Bbls/Day

WATER PRODUCTION: 0 Bbls/Day

GAS PRODUCTION: 18 Mcf/Day

METHOD USED TO MEASURE GAS PRODUCTION: 1 [X] Orifice Meter 2 [ ] Pilot Tube 3 [ ] Estimated

I hereby affirm under penalty of perjury that information provided on this form is true to the best of my knowledge and belief. False statements made herein are punishable as a Class A misdemeanor pursuant to Section 210.45 of the Penal Law.

SIGNATURE: [signature]

TITLE: V.P. Operations Acting for Eastern Co. As Operator for NYSERDA

DATE: 9/17/81

85-15-7 (1/75)

— SEE REVERSE SIDE FOR INSTRUCTIONS —

PRE-COMPLETION TESTS	TYPE TEST (dst, ball, etc.)	DURATION OF TEST	ZONES TESTED	AMOUNTS AND KINDS OF FLUIDS PRODUCED DURING TEST
	Open flow	24 hrs.	4142 ft. to 4176 ft.	21.7 MCF/day. 80% formation gas.
		hrs.	ft. to ft.	
		hrs.	ft. to ft.	

RECORD OF FORMATIONS PENETRATED

DEPTHS	FORMATION TOPS OR ROCK TYPE	REMARKS (Gas and Oil Shows, Water Type and Quantity, etc.)
44	Bedrock	
1052	Bradford third	Show of oil.
3709	Tully ls	
4138	Marcellus sh	
4184	Onondaga ls	
		Oil odor during fishing operations from upper Devonion sandstones.

INSTRUCTIONS

A. One (1) copy of Form 85-15-7 shall be filed with the Bureau of Minerals, New York State Department of Environmental Conservation, Regional Office, 128 South Street, Olean, New York 14760. It shall be filed within 30 days after the completion of the operation by any owner or operator who has received a permit from the Bureau of Minerals to drill, deepen, plug back or convert a well for production, input, storage or disposal.

B. Fill out Form 85-15-7 for each well in the following manner:

1. General Well Information. Fill out this section for each well reported.
2. Drilling and Coring.
   a. For new wells give complete details of drilling and coring.
   b. For old wells give only the details of deepening, plugging back and coring.
3. Logs, Casing, Pre-Completion Tests, Treatment or Stimulation. Give only details of work done during this operation.
4. Final Completion and Initial Production. Detail all zones open and initial production from all zones open after the well is completed or recompleted.
5. Record of Formations Penetrated. Please report the tops of formations; if not available, describe the rock type. Also report the depths at which:
   a. any shows of gas or oil were found and any measurements or estimates of volumes;
   b. any quantities of fresh or salt water (including black or sulphur water) were found and, if possible, an estimate of the producing capacity of these zones.

C. Form 85-15-7 may be either hand printed or typewritten and shall be signed by a responsible individual who has full and correct knowledge of the facts stated and the authority to make such statements.

CORE LABORATORIES, INC.
Reservoir Fluid Analysis

September 14, 1981

File RFL 81727

Company Arlington Exploration Company Formation Marcellus Shale

Well Portville Central School No. 1 County

Field Wildcat State New York

HYDROCARBON ANALYSIS OF GAS SAMPLE

Component	Mol Percent	GPM
Hydrogen Sulfide	0.00	
Carbon Dioxide	0.23	
Nitrogen	12.73	
Methane	72.06	
Ethane	10.77	2.864
Propane	2.85	0.780
iso-Butane	0.28	0.091
n-Butane	0.63	0.197
iso-Pentane	0.13	0.047
n-Pentane	0.14	0.050
Hexanes	0.11	0.045
Heptanes plus	0.07	0.032
	100.00	4.106

Calculated gas gravity (air = 1.000) = 0.712

Calculated gross heating value = 1036 BTU per cubic foot of dry gas at 14.65 psia and 60°F.

Collected at 69°F. on August 22, 1981.
Sample contained 10.84 percent air.

APPENDIX A.5

HOUGHTON COLLEGE WELL NO. 2

Daily Drilling Report

Daily Completion Report

Well Drilling and Completion Report

Hydrocarbon Analysis of Gas Sample

HOUGHTON COLLEGE #2 WELL
DRILLING REPORT

CANEADEA TOWNSHIP, ALLEGANY COUNTY, NEW YORK

Daily Drilling Reports

Elevations: 1373' ground 1377' Kelly Bushing (KB)

6/22/81 Rig up Francis R. Root, Inc.'s rotary rig.

6/23/81 Drilled 70' and collapsed conductor. Pulled pipe.

6/24/81 Drilling at 55', 49' conductor driven.

6/25/81 Artesian water around 90'. Severe gravel problems below 100'.

6/30/81 Moving in Root's cable rig to drive conductor.

7/1/81 Set 206' conductor, drilling ahead in gravel.

7/2/81 Drove conductor to 240'. Moved off cable rig.

7/7/81 Moved rotary back on hole, drilled to 280' and drove 10" conductor pipe to 275'.

7/8/81 Drilled to a depth of 515', ran 497'of 8 5/8" J-55 casing, and cemented to surface.

7/9/81 Drilling 8" hole.

7/10/81 Drilling at 1250' (8 am).

7/11/81 Drilled to a total depth (TD) of 2460'. Schlumberger logging, logger's TD 2471'.

7/12/81 Logs run: Gamma Ray, Neutron, Density, Induction, Temperature, Noise. Ran 2468.3' of 4½" production casing, casing shoe at 2470' from KB. Halliburton on site to cement, plug (latch down) at 2462' from KB. (See below for more detail). Rig released.

Conductor parted at 146' while driving, milled briefly to get through.

No show of gas during drilling or at TD.

Top of bedrock at 275'.

Formation Tops - Log Picks

Tully	1940'
Marcellus	2378'
Onondaga	2424'

Sample Study During Drilling

1900-1933' Black noncalcareous shale.

1933' Gray-brown limestone (mudstone), scattered pyrite.

2200-2340' Dark gray & black calcareous shales.

2340-2360' Dark gray calcareous shale.

2360-2370' As above with 10% dark gray limestone.

2370-2380' Dark gray calcareous shale.

2380-2390' Black noncalcareous shale.

2390-2400' As above with 1% calcite (fibrous) veinlet filling.

2400-2410' Noncalcareous black shale.

2410-2420' Gray & dark gray limestone, 20% light gray limestone.
Trace bentonite, scattered pyrite.

2420-2460' Dark gray limestone (mudstone).

2460' Driller TD

Production Casing Tally

59 joints	2450.3'	
Bottom shoe & pup	7.9'	baffle 6.1' above shoe
Top pup	10.1'	
	2468.3'	

Shoe 2' above bottom (tagged).

6 centralizers on collars #1, 2, 3, 4, 6, 8.

Cement basket on collar #11.

Cemented with 200 sacks 50/50 Pozmix, 10% salt, ¼# flocele.

75 bbl of gel above cement.

Annulus full of 2% KCL water.

Estimated cement top 1400'.

8/3/81

7:00 am Schlumberger on location, rigging up.

9:00 am Commence logging.

10:00 am Logging completed, cement bond log O.K. Started swabbing.

12:00 pm Completed swabbing to anticipated bottom perf. at 2416'.

12:25 pm Commenced perforating.

1:40 pm Finished perforating from 2382' to 2416' with 17 shots (one every 2'). Shot at 2386' did not fire.

2:30 pm Schlumberger off location. Released rig crew.

8/5/81

6:00 am Filled frac tanks from hydrant at Houghton Nursing Home. (700 bbls.).

9:00 am Halliburton on location to acidize.

9:50 am Test lines to 5000 psi.

10:00 am Start acid.

10:15 am Breakdown 2250 psi. Treating at 2400, 1 BPM.

10:17 am Pressure to 4750 psi. Stop pumping. SIP 1700 psi.

10:27 am Commenced pumping. Treating @ 2600 psi.

10:30 am Finished pumping @ 3100 psi. ISIP 1750 psi.

10:40 am SIP 1750 psi. Well shut in.

11:30 am Halliburton off location.

11:40 am Started swabbing.

8/8/81

8:00 am Halliburton on location to frac.

9:45 am Breakdown and start treating at 3500 psi.

9:55 am Treating @ 3200 psi @ 20 BPM.

10:00 am Treating @ 3200 psi @ 20 BPM.

10:10 am Treating @ 3200 psi @ 20 BPM.

10:20 am Treating @ 3200 psi @ 20 BPM.

10:30 am Treating @ 3200 psi @ 20 BPM.

10:37 am Treating @ 3100 psi @ 20 BPM.

10:50 am Frac completed. ISIP 2800 psi.

11:05 am WHSIP 2500 psi.

11:30 am Started flowing well back to tank @ 2450 psi.

12:00 pm FWHP 2100 psi, ¼" choke.

1:00 pm FWHP 1925 psi, ¼" choke.

2:00 pm FWHP 1800 psi, ¼" choke.

2:45 pm FWHP 1700 psi, ¼" choke. Some sand returns. 46 bbls water in tank. (20 bbls in first hour.)

3:00 pm FWHP 1675 psi, ¼" choke. Some sand returning.

4:00 pm FWHP 1500 psi, ¼" choke. Some sand returning.

4:30 pm Water recovery, 84 bbls.

5:00 pm FWHP 1250 psi, ¼" choke. More sand returning.

5:30 pm Water recovery, 106 bbls. Sand returning.

6:00 pm FWHP 1100 psi, ¼" choke. Sand returning.

6:50 pm Changed choke to 3/8".

7:00 pm FWHP 800 psi, 3/8" choke. Water recovery, 120 bbls.

8/8/81 (Cont'd)

7:30 pm FWHP 510 psi, 3/8" choke.

8:00 pm FWHP 390 psi, 3/8" choke. Water recovery 128 bbls.

9:00 pm FWHP 300 psi. Changed to 3/4" choke. Water recovery 159 bbls.

9:25 pm FWHP 90 psi. Removed choke to flow open.

10:00 pm Total water recovery 158 bbls. Left well flowing open into tank.

8/9/81

7:00 am Approximately 50' foam in hole. No water. Total recovery of water. in tank 168 bbls. Started swabbing. Recovered little foam only. No sand in hole.

11:00 am Check gas stream @ 9% natural gas. Open flow 290 MCF/day.

12:00 pm Continued swabbing is recovering very little foam each run. Crew released. Well left flowing open to start swabbing 7 am tomorrow.

8/10/81

7:00 am Started swabbing. Recovered only some foam. (No water in well.)

1:00 pm Well flow rate: 137,000 CF/day. Gas stream: 19% natural gas.

4:00 pm Swabbing recovering very small amount of foam only. Rig released. Well left flowing open.

8/11/81

4:35 pm Checked gas stream as 29% natural gas by analyzer. Well is flowing by heads and has fluid in well. Occasionally carries some foam to surface after flowing open since frac 8/8/81 at 12 PM.

5:00 pm Although flowing by heads through much fluid, a flow test indicated 77,000 CF/day at a fairly steady rate. Well shut in.

8/13/81

4:00 pm WHSIP 860 psi after 47 hrs. Shut in.

8/19/81

9:30 am SIWHP 1220 psi after 184 hrs. shut in. Annulus flowing some gas. Measured at 3 MCF/day.

10:15 am Opened well to blow down. Did not carry any water. Left open for gas sample tomorrow.

8/20/81

7:17 am No evidence of any flow from annulus since well has blown down. Well apparently unloaded water after blowing down, but still flowing by heads now. Flow varying from 20 MCF to 30 MCF. Best estimate of steady value 23 MCF/day after flowing open 21 hrs.

7:45 am Natural gas by analyzer 64%.

8:00 am Well shut in for press. buildup for samples.

8:38 am Gas sample at 40 psi, wellhead (#1).

8:43 am Gas sample at 42 psi, wellhead (#2). Left annulus open to avoid pressure buildup.

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
BUREAU OF MINERALS

WELL DRILLING AND COMPLETION REPORT

GENERAL WELL INFORMATION

OPERATION TYPE: [X] New Well [ ] Deepening [ ] Plug Back [ ] Conversion

TYPE WELL COMPLETED: [X] Producing [ ] Observation [ ] Input [ ] Dry Hole

DO NOT WRITE IN SHADED AREA — 31- PERMIT NO. (This Operation); 31- ORIGINAL PERMIT OR FILE NO.; Lahee Initial; Lahee Final; Operator; Status; Town; GR Elev.; Type; Latitude; Footage N/S; Longitude; Footage E/W; Pool; Field; UNITS

FLUIDS PRODUCED OR INJECTED: [ ] Oil [ ] Brine [ ] Waste [X] Gas [ ] Fresh Water

SPECIAL WELL USE: [ ] Secondary Recovery [ ] Storage [ ] Water Supply [ ] Disposal

OPERATOR: New York State Energy Research and Development Authority

COMPLETION TYPE: 1 [X] Single Reservoir 2 [ ] Multiple Reservoirs

COUNTY: Allegany

TOWN: Caneadea

LEASE: Houghton College

WELL NO.: 2

LOCATION DESCRIPTION: 11,200S 42°-27-30", 673'W 78°-10'-00", Houghton E 7½'

ELEVATION: 1377 ft. 1 [ ] Derrick Floor 2 [X] Kelly Bushing

FIELD NAME / POOL NAME: Devonian Shale

FORMATIONS COMPLETED: Marcellus Shale

DRILLING CONTRACTOR: Francis Root, Inc.

DRILLING AND CORING

DATE DRILLING COMMENCED: Month June Day 23 Year 81

DATE DRILLING COMPLETED: Month July Day 11 Year 81

DRILLING SAMPLES WERE COLLECTED FOR THE STATE: 1 [ ] Yes 2 [X] No

WELL DRILLED WITH CABLE TOOLS: From 0 ft. to 240

WELL DRILLED WITH ROTARY TOOLS: From 240 ft. to 2471 ft.

ROTARY DRILLING FLUID: 1 [ ] Mud 2 [X] Air

TLS

WELL CORED: From ft. to ft. / From ft. to ft.

CORE RECOVERY: ft.

CORES WERE: 1 [ ] Lab Analyzed 2 [ ] Described

DRILLERS TOTAL DEPTH: 2460 (2471 Log) ft.

PLUG BACK TOTAL DEPTH: 2462 ft.

SIDEWALL CORES: From ft. to ft. / From ft. to ft.

LOGS

CHECK DRILLING LOGS COMPILED: 1 [ ] Drillers Log 2 [ ] Sample Log 3 [ ] Drilling Time [ ] Others (Specify)

CHECK OTHER LOGS RUN: 1 [X] Gamma Ray-Neutron 2 [X] Temperature 3 [X] Caliper [X] Others (Specify) CBL, VDL, CCL FDC, SNP, AUDIO, FTG

LOGS / LOGS

CASING

TYPE	SIZE (O D)	DEPTH SET	CASING PULLED	AMOUNT CEMENT	EST. TOP CEMENT	CEMENT PUMPED, DUMPED OR CIRCULATED
DRIVE, SURFACE OR CONDUCTOR	10 in.	275 ft.	ft.	sk.	ft.	
INTERMEDIATE OR WATER STRINGS	8 5/8 in.	497 ft.	ft.	sk.	ft.	Pumped. Did not circulate to surface.
PRODUCING	4½ in.	2470 ft.	ft.	200 sk.	1400 ft.	Pumped
LINERS	in.	ft.	ft.	sk.	ft.	

FINAL COMPLETION

DATE FINAL COMPLETION: Month August Day 8 Year 1981

WELL COMPLETED OPEN HOLE: From ft. to ft.

PERFORATED INTERVALS	NO. OF SHOTS
2382 ft. to 2416 ft.	17
ft. to ft.	
ft. to ft.	

PERFORATED INTERVALS (Cont'd.) ft. to ft. — NO. OF SHOTS

TREATMENT OR STIMULATION

ZONES TREATED	SHOT, ACID, FRAC, ETC.	DETAILS OF TREATMENT Kinds and Amounts of Materials, Rates, Pressures, Dates, Etc.
2382 ft. to 2416 ft.	HF Acid	Displace 1500 gal acid into form. Breakdown
ft. to ft.		surface press 2250 psi. 30 perf balls.
2382 ft. to 2416 ft.	Foam Frac	75% quality foam. Treat 20 BPM @3200 psi.
ft. to ft.		50,000 gal foam; 12,500 gal water; 1,150,000 SCF N_2, 10,000 lbs 80/100 sd. 50,000 lbs 20/40 sd.
ft. to ft.		
ft. to ft.		
ft. to ft.		

INITIAL PRODUCTION

TYPE OF TEST: [ ] Pumping [X] Flowing

FLOWING TEST DATA: Choke Size none in.; Flow. T.P. psi; Flow. C.P. 0 psi; S.I.T.P. psi; S.I.C.P. 1220 psi; S.I. Time 184 Hrs.

DATE OF TEST: 8/20/81

DURATION OF TEST: 23 Hrs.

OIL PRODUCTION: 0 Bbls/Day

WATER PRODUCTION: 0 Bbls/Day

GAS PRODUCTION: 23 Mcf/Day

METHOD USED TO MEASURE GAS PRODUCTION: 1 [X] Orifice Meter 2 [ ] Pitot Tube 3 [ ] Estimated

I hereby affirm under penalty of perjury that information provided on this form is true to the best of my knowledge and belief. False statements made herein are punishable as a Class A misdemeanor pursuant to Section 210.45 of the Penal Law.

SIGNATURE [signature] TITLE V.P. Operations Arlington Expl. Co. Agent Operator for NYSERDA DATE 9/17/81

85-15-7 (1/75)

— SEE REVERSE SIDE FOR INSTRUCTIONS —