SHALE GAS
IN THE SOUTHERN CENTRAL AREA
OF NEW YORK STATE

Volume IV

Experience of Drilling
Four Additional Shale-Gas Wells
in New York State

Prepared for

NEW YORK STATE
ENERGY RESEARCH AND DEVELOPMENT AUTHORITY

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LIST OF ABBREVIATIONS

AOF . . . . Absolute open flow
bbl . . . . barrel
jts . . . . joints
KB . . . . Kelly bushing
Mcf . . . . 1000 cubic feet
psi . . . . pounds per square inch
TD . . . . Total depth

PREFACE

S

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. The New York State Energy Research and Development Authority (NYSERDA) has joined the Department of Energy in pursuing thi~ goal within 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 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 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. NYSERDA 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 NYSERDA 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 Volume III, which is a companion volume to Volumes I and II noted above.

3. The third program, described in this Volume IV, addresses both the exploration rationale and the economics of recovery. The program involved siting and drilling of another four shale gas wells. Two of the wells (one in Broome County, and one in Chemung County) explored deep and thick shales in locations likely to exhibit fracturing; the two remaining wells (in Yates and Ontario Counties) assessed 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

Since 1979, the New York State Energy Research and Development Authority (NYSERDA) and the US Department of Energy (DOE) have been assessing the potential of shale gas as an indigenous source of energy in New York State. The work is reported in the first three volumes of this series, and now in this Volume IV: Experience of Drilling Four Additional Shale-Gas Wells in New York State.

Four additional wells have been drilled. These are at Endicott, Elmira, Rushville, and Naples.

The well at Endicott was located to test a local thickening of the Marcellus shale. Thick shale was encountered, but not in a fractured condition. The standard hydraulic stimulation in the Marcellus failed to yield significant gas, and the well has been sold to the landowner.

The well at Elmira was located to test the hypothesis of fracturing caused by salt uplift. The well has a calculated open flow of 545 Mcf/day, and appears to be the best well of the 13 reported in this series. It is presently shut-in, awaiting a production test involving conversion to electricity.

The well at Rushville was located in an old shale-gas field, to test the degree to which shale-gas economics could be improved where the shale is shallow. It encountered multiple fractures in the shale, but these produced water; apparently the early production had depleted this field and allowed water invasion. The well was plugged and abandoned, without stimulation.

The well at Naples was also located in an old shale-gas field. It was drilled and stimulated at minimum cost; the object this time was not the research-type data obtained in previous wells, but a demonstration of the improved economics available when commercial conditions were simulated. In particular, the well was drilled with a cable tool, and stimulated with explosives. After stimulation it yielded about 40 Mcf/day open flow, but on final testing had a calculated AOF of 12 Mcf/day. The well will be connected to an appropriate heat load at the Widmer Wine Cellars winery.

Nineteen shale-gas wells have now been drilled in New York State in recent years, by both the public and private sectors. Fourteen of these have been in the nature of research wells drilled and tested under the sponsorship of NYSERDA and US DOE.

The first (Houghton College No. 1) appears to be by far the best. Four, though useful in a research sense, have not produced gas. The five "school" wells reported in Volume III seem to suggest that one can drill anywhere (in the general area of Allegany and Cattaraugus Counties) and obtain modest production of perhaps 5 Mcf/day. Two wells (Rathbone and Dansville) suggest that specifically favorable locations can improve productivity somewhat; the well at Elmira, where the favorable circumstance is a salt swell, suggests further considerable improvement (though a sustained test is not yet available). The well at Naples suggests that the best economics may be obtained in the north of the area, using inexpensive drilling, explosive fracturing, and no frills.

More detailed results, conclusions and research directions are set out in the text.

Section 1

Background

Since 1979, the New York State Energy Research and Development Authority (NYSERDA), with the cooperation of the US Department of Energy (DOE) has been assessing the potential of shale-gas as an indigenous source of energy in New York State. To date, this work has been reported in three volumes entitled "Shale-Gas in the Southern Central Area of New York State." The three volumes are:

- Volume I: How to Find and Develop Shale-Gas in New York State
- Volume II: Experience of Locating and Drilling Four Shale-Gas Wells in New York State
- Volume III: Experience in Drilling Five Shale-Gas Wells in New York State

The present volume, Volume IV, recounts the experience of locating and drilling an additional four shale-gas wells in the State. The reader is assumed to be familiar with the previous work (in particular with Volume I, which constitutes a how-to manual for shale-gas drilling in the State).

INTRODUCTION

As described in detail in Volume I, the production of shale-gas requires two fundamentals: a good thickness of organic-rich shale (to generate the gas), and a system of natural or induced fractures in the shale (to provide paths by which the gas may flow to the borehole). In addition to these fundamentals, without which a shale-gas well cannot succeed at all, the degree of commercial success hinges on the cost of drilling a well, and on the actual gas production obtained. The four wells reported herein were designed to augment existing knowledge in these respects. The four wells were quite widely spaced geographically, to yield more information on the distribution, thickness and organic richness of the shale. One of the wells was located to test an area in which the shale was known to be particularly thick. Another well was located to test an area where there was a reasonable geological expectation of much natural fracturing in the shale. And two wells were located to explore the economics of revitalizing old shale-gas fields; this has previously been done at large and medium depths, and the present wells were designed to test the economics at shallow and very shallow depths.

The designations and locations of the four wells are as follows:

	Prospect	Well Name	Township	County
1.	Endicott	Tiffany No. 1	Owego	Tioga
2.	Elmira	Hulsebosch No. 1	Elmira	Chemung
3.	Rushville	Elliot No. 1	Middlesex	Yates
4.	Naples	Widmer No. 1	Naples	Ontario

Section 2

THE WELLS

THE ENDICOTT PROSPECT

One of the tentative conclusions from previous work is that the shale most likely to yield commercial gas in New York State is the Marcellus. Over most of the area previously explored, the thickness of the Marcellus is of the order of 50 feet. Other things being equal, a thicker shale should hold promise of more gas. One of the reasons for selecting the Endicott prospect, therefore, was to make a test of a thicker shale.

The lower part of Figure 2-1 shows the thickness of the Marcellus shale in Pennsylvania, as mapped by the Pennsylvania Geologic Survey in work funded by the DOE[1/]. The 125-foot contour has been extended up into New York (as shown) by the New York Geological Survey, again in work funded by the DOE[2/]. It is reasonable to extend the intermediate contours up into New York as shown by the dashed line. The conclusion is that Marcellus thicknesses in the order of 200 feet can be expected at the southern end of the county line between Tioga and Broome counties. This expectation is supported by Figure 2-2, which is an excerpt from the gamma-ray log of the Shell Klossner well in Tioga county; it shows some 180 feet of Marcellus shale. The sonic log, also shown, has clear evidence of cycle-skipping (apparent very low velocities), which may be interpreted as indication of the presence of gas. Interest is added to this local thickening of the Marcellus by the presence of the Genegantslet shale-gas field in Chenango County to the northeast, on trend with the thickening. This field was discovered some years ago; it is believed that an absence of suitable pipeline connections has prevented production of the field.

The thickening of the shale would not be a sufficient inducement, of course, if the thickness brought with it some reduction of organic richness. It is known that the Marcellus becomes more calcareous to the east. However, some increase of the

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1/Pennsylvania Department of Environmental Resources, Bureau of Topographic and Geological Survey (Harper and Pietrowski), Contract No. EY-76-S-05-5198, 1979.

2/New York State Museum and Science Service, Geological Survey - Alfred Oil and Gas Office (Van Tyne, Kamakaris and Corbo), Contract No. DE-AS21-76MC05206, 1980.

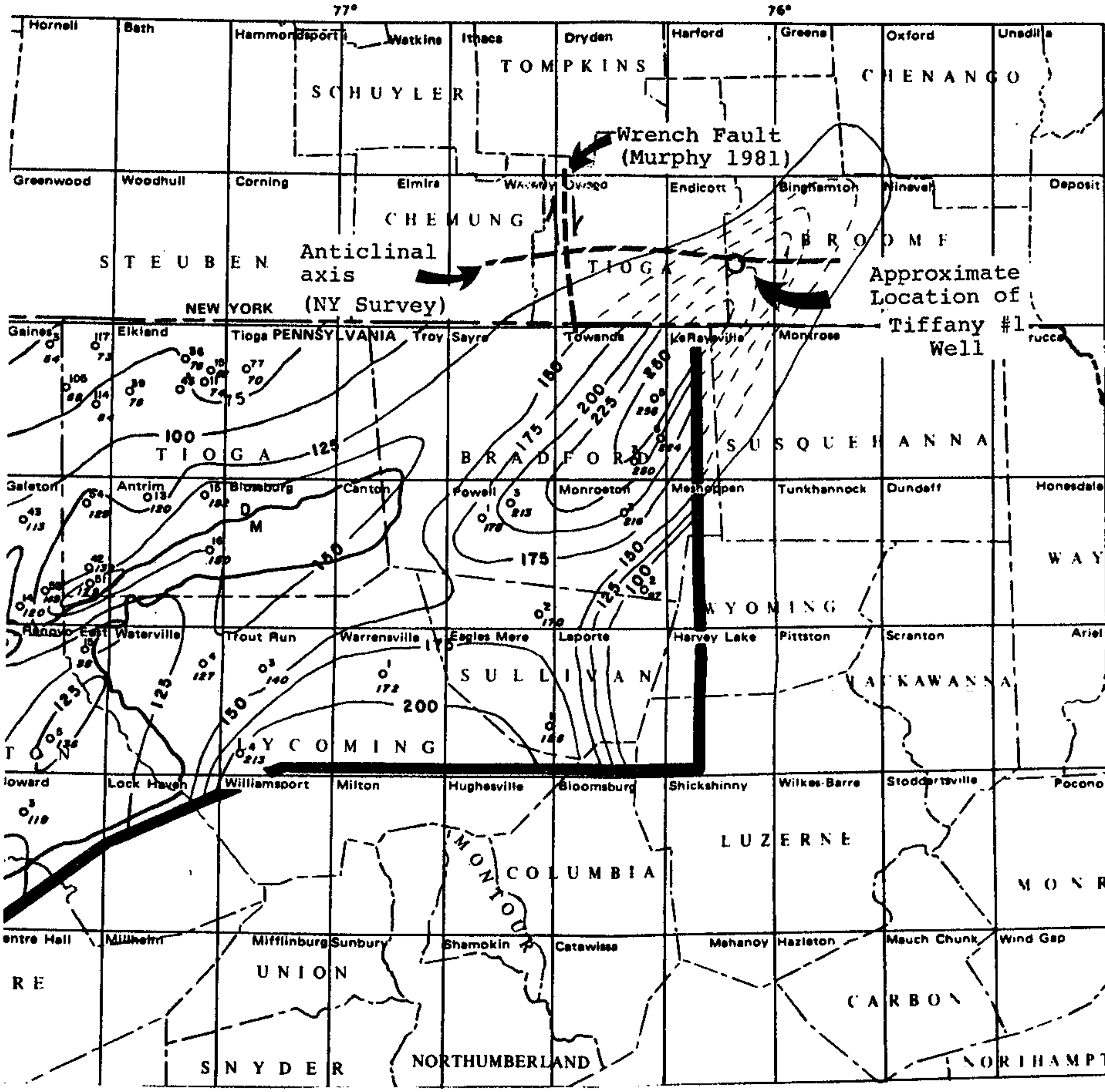


FIGURE 2-1

Marcellus Isopach Map

From Harper and Pietrowski, 1979; for further data see text section 2.1

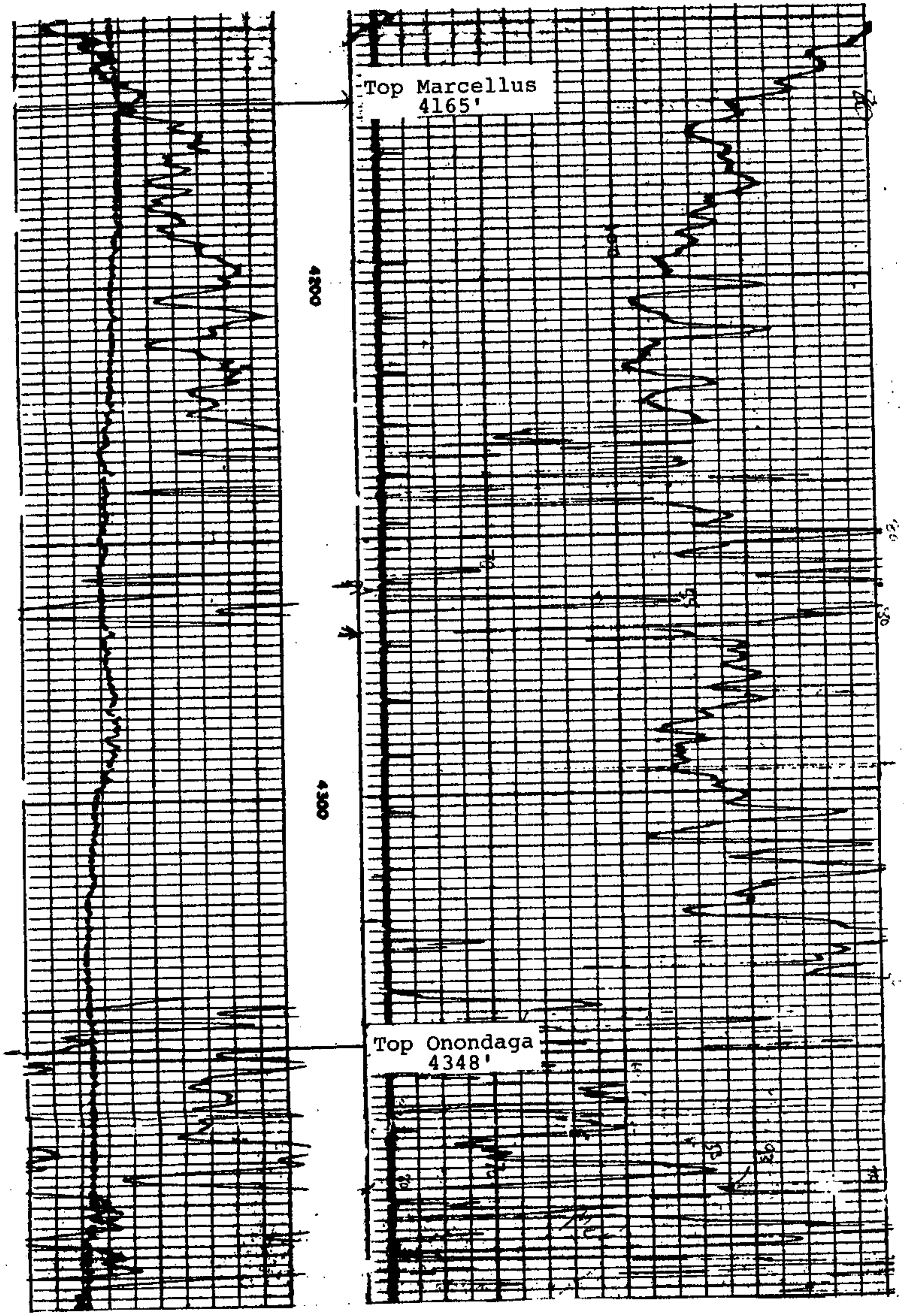


FIGURE 2-2

Marcellus Portion of Sonic Log/Shell #1 Klossner lime content might be beneficial, on balance, if it made the Marcellus more brittle and more likely to fracture when stressed. Therefore, it was considered appropriate to test this local thickening of the Marcellus.

It remained to find a fracturing mechanism likely to have affected this thick shale. Regional tectonic maps of New York State show an anticlinal axis trending south of east through Tioga County; recent work reported by Murphy[1/] (again supported by funds from DOE) suggests that this unexpected direction is a consequence of a major north-south wrench fault in western Tioga County. The anticlinal axis and the postulated fault are sketched in Figure 2-1.

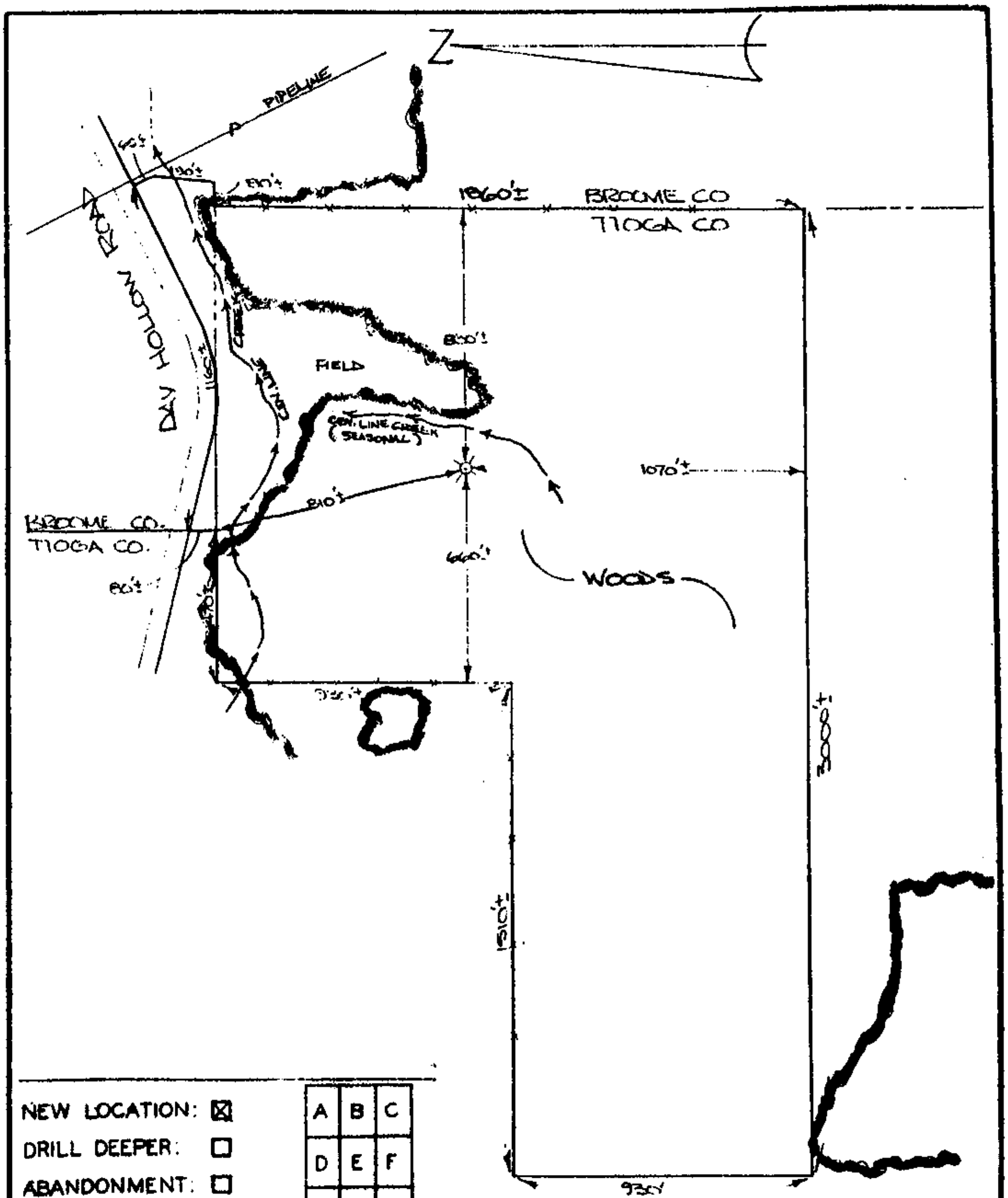
Many of the anticlines in the Southern Tier of New York have extensional grabens along their spines. It would be exceptionally favorable, therefore, if such a graben could be found intersecting the locally thick Marcellus. Accordingly the attempt was made to buy some existing seismic data in the area of the possible intersection. Unfortunately this failed; the oil company owning the data would not release them. However, the built-up nature of the area of possible intersection (which is in the western suburbs of the village of Endicott) restricted the possible drill sites in such a way that the final location had to be decided on lease considerations. This location is shown in Figure 2-3.

The well, the Tiffany No. 1, was drilled in August 1982, to a total depth of 4457 feet. Gas shows were encountered above the Tully, culminating in a show from the Geneseo at 1073 feet, estimated at 50 Mcf/d. A 124-foot section of Marcellus, which contained a show of gas, was encountered at 4284 feet (Figure 2-4). Production casing was cemented to a depth of 4448 feet, and completion and testing operations were undertaken in the Marcellus.

The well was fraced with nitrogen foam, and on four-point test was calculated to have an AOF of 9.4 Mcf/day. The well was deemed non-commercial, and subsequently sold to the landowner for a source of domestic household gas. A profile sketch of the well is shown in Figure 2-5; drilling, completion and test reports are included in Appendix A.

Of the possible explanations for this disappointment, the most likely seems to be that the hoped-for natural fracturing was not present. Only the release of the seismic data could resolve this.

1/Murphy, P.J., 1981, "Detachment Structures in South-Central New York", Northeastern Geology, vol. 3 No. 2, p. 105.



NEW LOCATION: ☒
DRILL DEEPER: ☐
ABANDONMENT: ☐
REDRILLING: ☐
CONVERSION: ☐

A	B	C
D	E	F
G	H	I

SECTION KEY

COMPANY: ARLINGTON EXPLORATION COMPANY
ADDRESS: [illegible]
LANDOWNER: GLENN O. & VALA L. TIFFANY
TRACT ______ ACRES: 98 LEASE NO. ______
WELL (FARM) NO. 1 SERIAL NO. ______
ANGLE OF DEVIATION, IF ANY ______
ELEVATION: 1138'
LATITUDE: 42°06'36" N
LONGITUDE: 76°06'40" W
DISTANCE SOUTH OF NORTH: 5,490' AND
WEST OF EAST: 7,560' IN SECTION: A
(SEE KEY ABOVE) OF ENDICOTT, N.Y. GUADRANGLE
☒ 7.5 MIN. ☐ 15 MIN. MAP DATE: 1969
TOWN: UNION & OWEGO COUNTY: BROOME & TIOGA
SIGNED: Rodrick E. McConnell L.S. 49158
DATE: 7/9/82 SCALE: 1 in = 400 ft

NEW YORK STATE
DEPARTMENT OF
ENVIRONMENTAL CONSERVATION
BUREAU OF MINERALS

WELL LOCATION MAP

D.E.C. FILE NO. ______

McCONNELL and MULLER
LAND SURVEYORS

Rodrick E. McConnell
License No 49158

Michael G. Muller
License No. 49402

Bath, New York

Job No. 1149

FIGURE 2-3

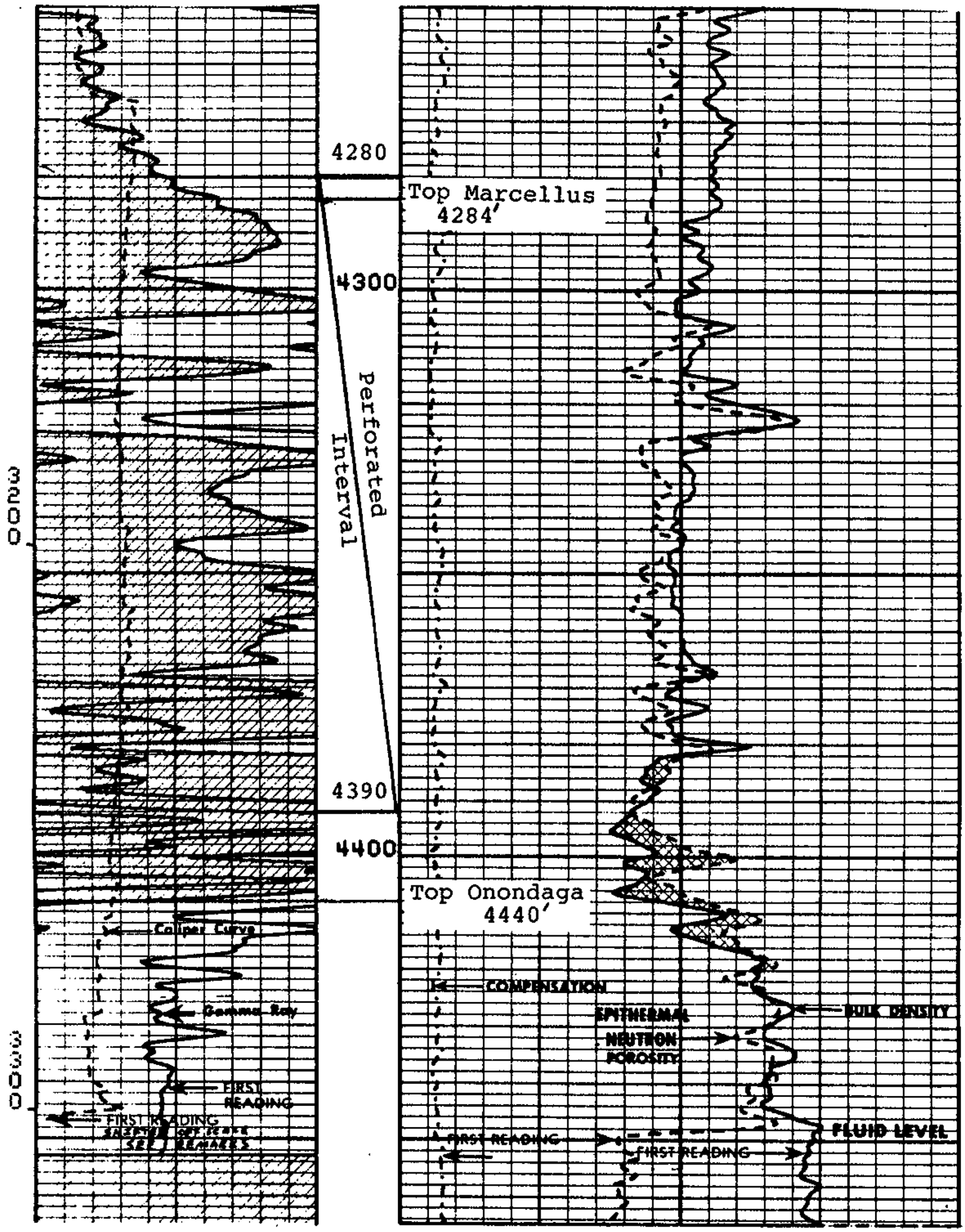
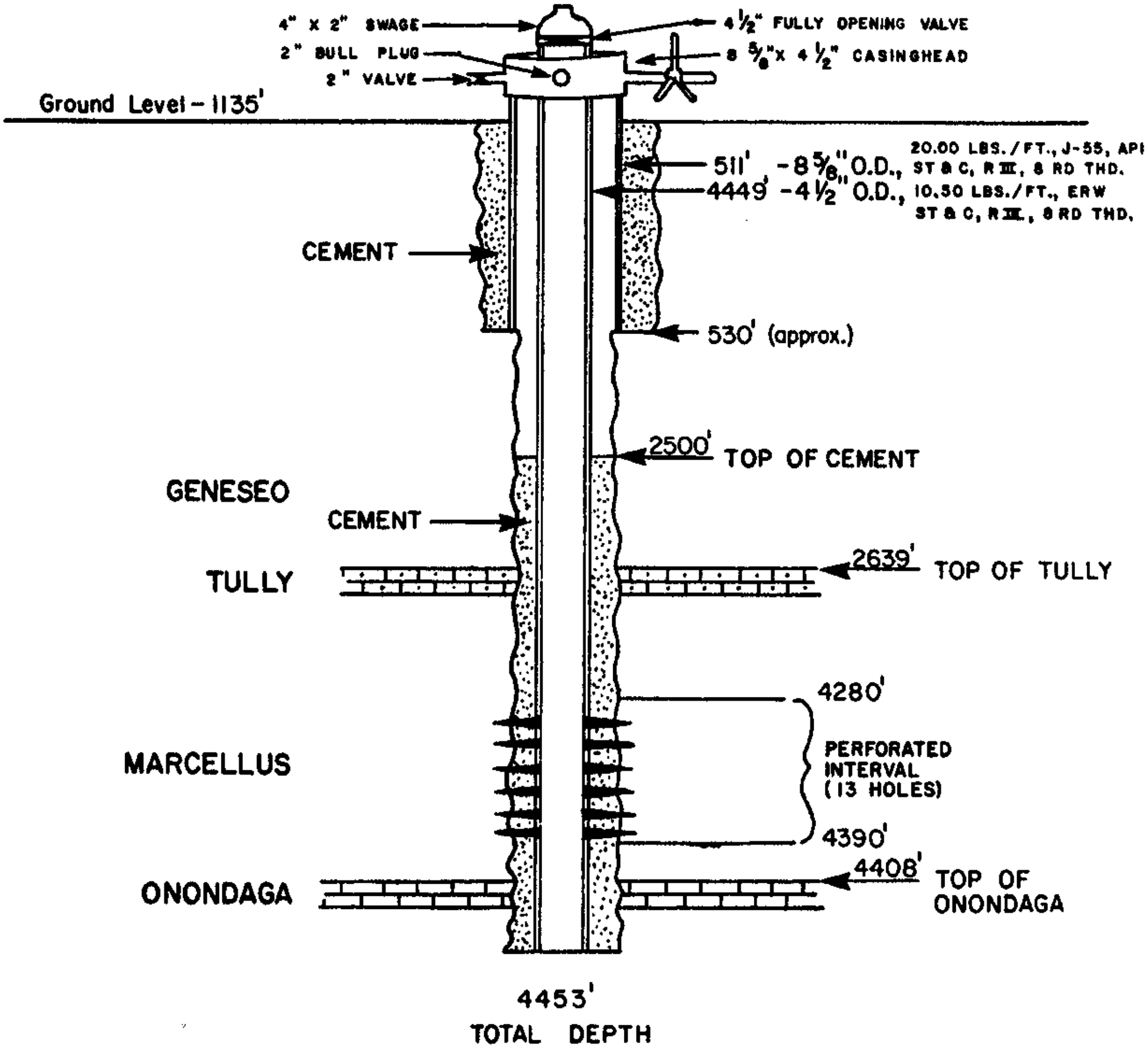


FIGURE 2-4

Marcellus Portion of #1 Tiffany Log

G.O. TIFFANY #1 WELL



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

FIGURE 2-5

THE ELMIRA PROSPECT

The City of Elmira is believed to overlie a salt dome. The salt occurs in the Salina beds, and is widespread in this part of New York State; it is mined extensively at Watkins Glen and elsewhere. The salt dome is believed to have been formed by pillowing of the salt in response to some local (but unknown) instability. Its relevance, in the context of shale-gas, is that the uplift of the shale beds by the salt is likely to have generated extensive local fracturing.

In earlier years, some dozen wells were drilled on the Elmira salt dome in the search for gas in the Oriskany sandstone. Although only one was a significant producer from the Oriskany, all of these wells had gas shows in the shale. Figure 2-6 shows the location of the previous wells, and a set of possible contours on top of the Oriskany. The suggestion is of a fairly flat-topped high, with a pronounced dipping flank to the south. In fact, this flank may be faulted; no seismic data are available to resolve this possibility.

The rationale for the location of a shale-gas well, then, was the expectation of significant fracturing at or near the abrupt change of dip off the top of the dome. A location was sought somewhere near the minus 1950-foot contour, and preferable on the south side of the dome. Of such locations, most are in the City of Elmira, and as such out of the question. A suitable position was finally found on the slope of Jerusalem Hill, east of the city. The location is shown in Figure 2-7.

The well, the Hulsebosch No. 1, was drilled in August 1982, to a total depth of 3016 feet. Minor gas shows were encountered above the Tully in the interval from 1180 feet to 1612 feet. A 74-foot interval of Marcellus was encountered at 2886 feet, as shown in Figure 2-8, but no shows of gas were observed during drilling. However, casing was set and the Marcellus formation was perforated and tested. The well was fraced with nitrogen foam and on four-point test was calculated to have an AOF of 545 Mcf/day. A profile sketch of the well is shown on Figure 2-9; the drilling, completion and test reports are included in Appendix B. The well is presently shut-in.

Conditional plans call for the well to be connected to a generator which will supply electricity to New York State Electric and Gas Corporation. A local commercial establishment has agreed to utilize the waste heat from the generator.

THE RUSHVILLE PROSPECT

The four wells drilled in Phase I of the overall program, and the Endicott and Elmira wells drilled in this project, formed part of a larger national program to

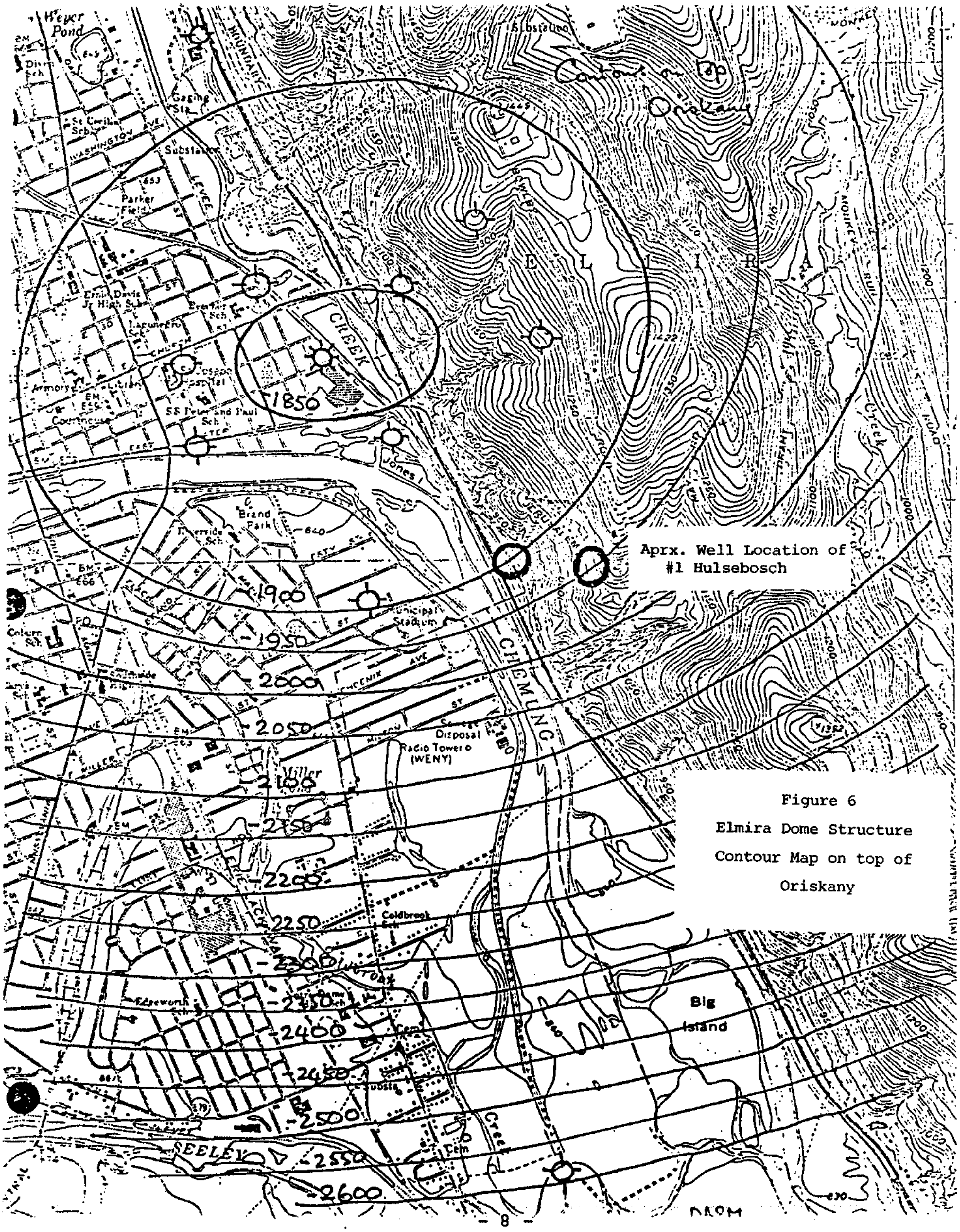
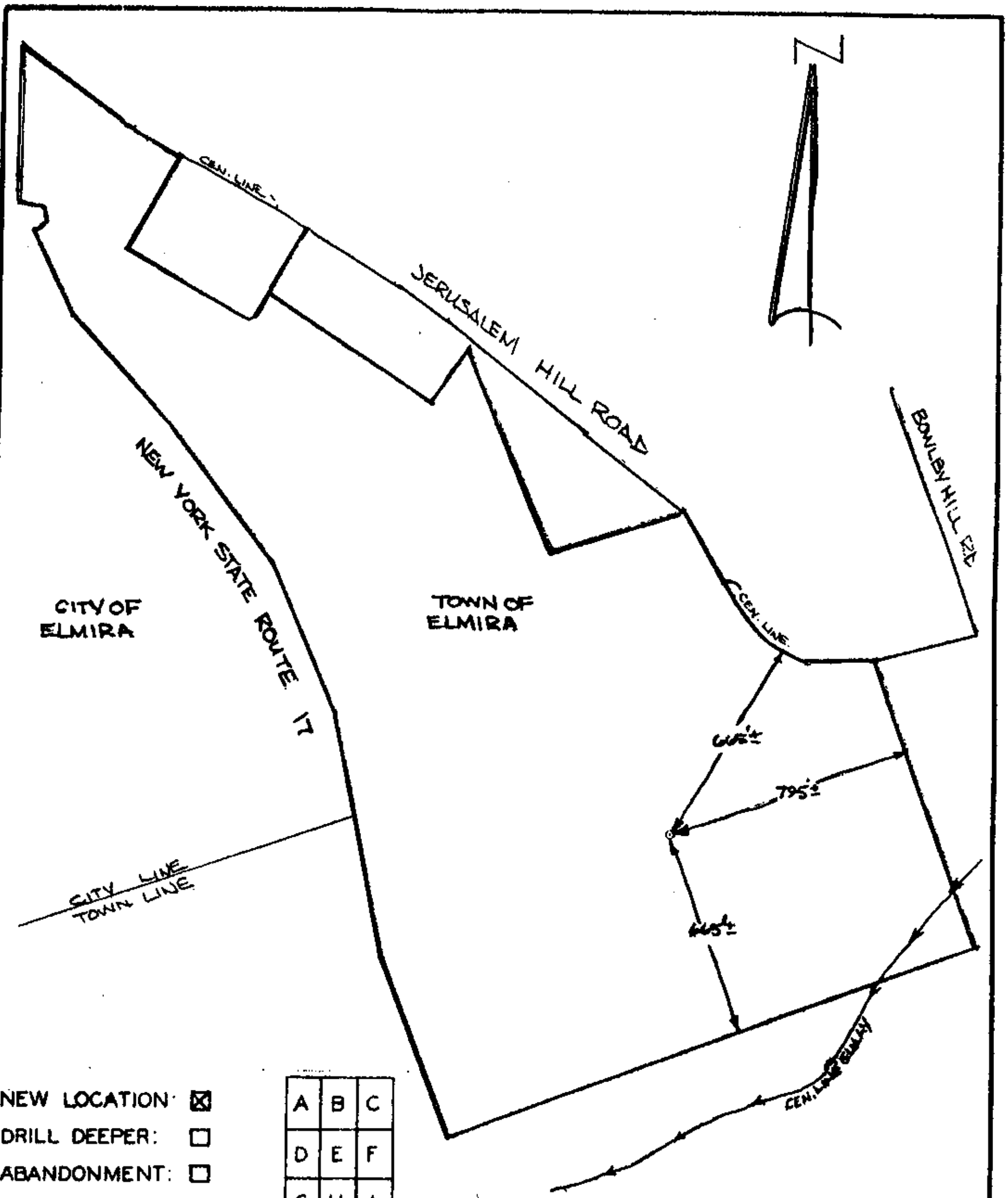


Figure 6
Elmira Dome Structure
Contour Map on top of
Oriskany



NEW LOCATION: ☒
DRILL DEEPER: ☐
ABANDONMENT: ☐
REDRILLING: ☐
CONVERSION: ☐

A	B	C
D	E	F
G	H	I

SECTION KEY

COMPANY: ARLINGTON EXPLORATION COMPANY
ADDRESS: 137 NEWBERRY ST. BOSTON MA. 02116
LANDOWNER: ADRIAN P. & JESSICA D. [illegible]
TRACT: ______ ACRES: 85 LEASE NO. ______
WELL (FARM) NO. 1 SERIAL NO. ______
ANGLE OF DEVIATION, IF ANY: ______
ELEVATION: 1068'
LATITUDE: N 42°04'56"
LONGITUDE: W 76°46'22"
DISTANCE SOUTH OF NORTH: 15,690' AND
WEST OF EAST: 6,130 IN SECTION: F
(SEE KEY ABOVE) OF ELMIRA, N.Y. QUADRANGLE
☒ 7.5 MIN. ☐ 15 MIN. MAP DATE: 1969
TOWN: ELMIRA COUNTY: CHEMUNG
SIGNED: [illegible] LS 49158
DATE: 5/21/82 SCALE: 1 IN = 400 FT

NEW YORK STATE
DEPARTMENT OF
ENVIRONMENTAL CONSERVATION
BUREAU OF MINERALS

WELL LOCATION MAP

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Rodrick E. McConnell
License No. 49158

Michael G. Muller
License No. 49402

Bath, New York Job No. 1143

FIGURE 2-7

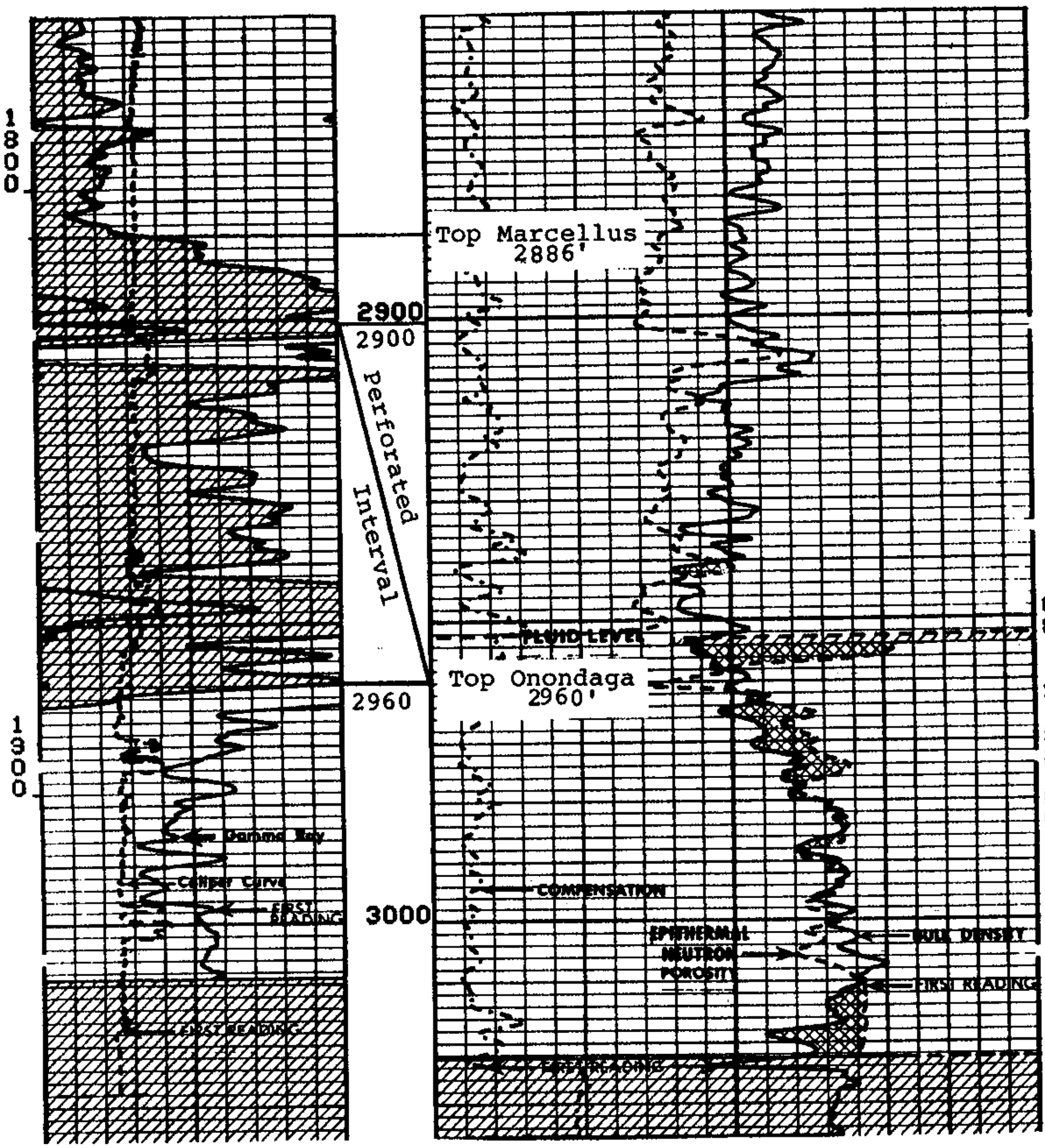
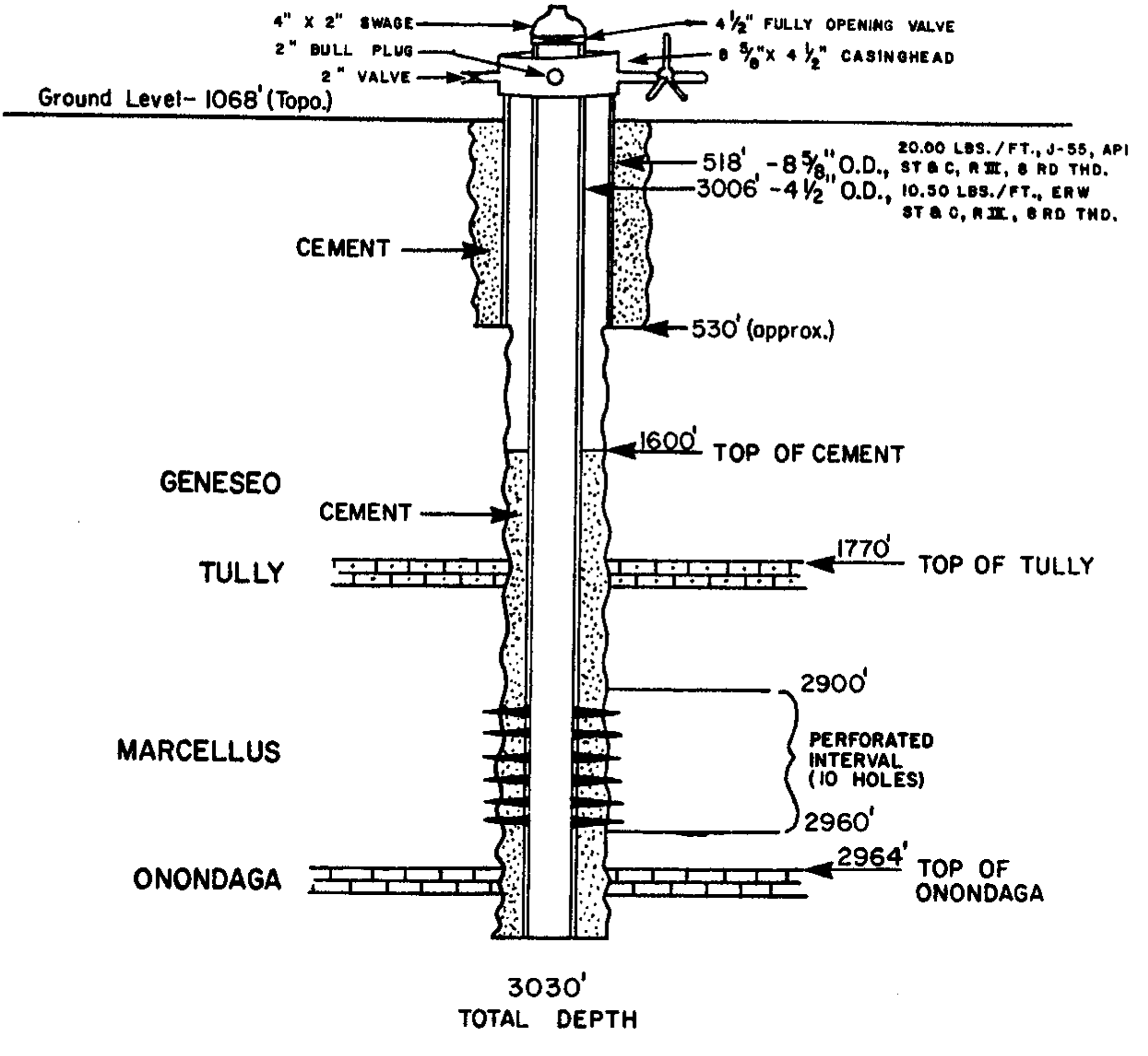


FIGURE 2-8

Marcellus Portion of #1 Hulsebosch Log

A.P. & J.O. HULSEBOSCH #1 WELL



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

FIGURE 2-9

characterize the shales (and to assess their general potential for shale-gas) in the Appalachian Basin. As such they were part of a controlled scientific observation (insofar as the vagaries of the earth allow "control"). In particular, the drilling, logging and stimulation techniques were held substantially constant in these wells, and in other wells in the national program.

Further, these techniques were designed to extract the maximum scientific knowledge, and so involved methods and tests more detailed (and more costly) than would have been used in the course of normal gas exploration.

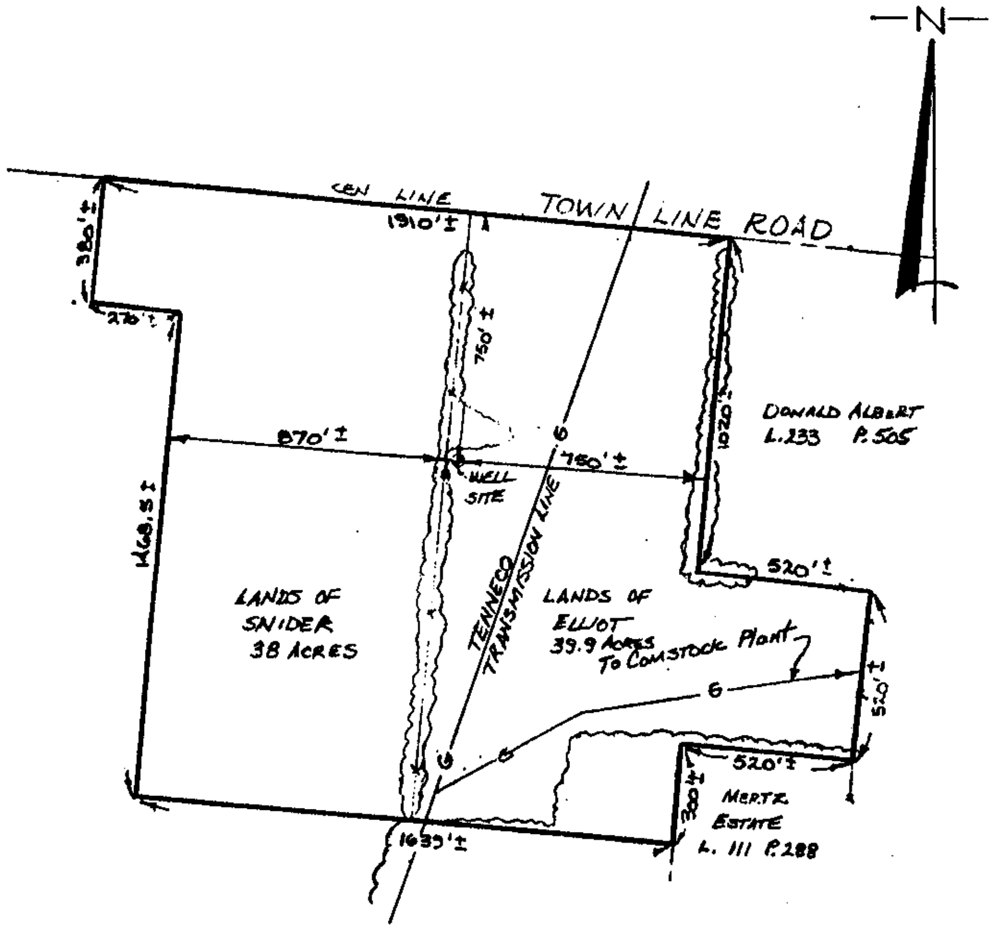
This, of course, was the correct scientific approach. However, all the parties involved are concerned not only with the understanding and assessment of the shale-gas resource, but also with its economics. Already it is known that the resource exists, and already there is some feeling for how and where to tap it, but the resource will not become of value to the nation and the state until the price is right.

Accordingly, the decision was made that the last two wells of this project should explore what can be done to improve the economics of shale-gas.

In Phase I, two wells had been drilled in old shale-gas fields: the Valley Vista View well in the old Rathbone field, and the Meter well in the old Dansville field. The initial tests on these wells suggested that the Meter well was the better. It was also the more shallow, and hence the cheaper well. Therefore, the search for a location to test better shale-gas economics narrowed to the region where the shales are more shallow, in particular, to the area north and east of Dansville.

This area includes two more old shale-gas fields, at Rushville and at Naples. By drilling a well in each of these fields, the project could explore the way in which the economics change with well depth; the four prospects (Rathbone, Dansville, Naples, and Rushville) represent a depth range for the base Marcellus from 3844 to 1600 to 1190 to 890 feet. Of course, there are other variables, but at least it can be said that all four locations represent areas where the existence of producible shale gas has been proven.

The Rushville prospect, then, was selected within the known confines of the old Rushville field; the actual location was again dictated by lease considerations. Figure 2-10 shows the location in detail. No seismic data are available in this region.



NEW LOCATION: ☒
DRILL DEEPER: ☐
ABANDONMENT: ☐
REDRILLING: ☐
CONVERSION: ☐

A	B	C
D	E	F
☒ G	H	I

SECTION KEY

COMPANY: Arlington Exploration Company
ADDRESS: 157 Newberry St. Boston Ma. 02116
LANDOWNER: Elliot & Snider
TRACT: ______ ACRES: 77.9± LEASE NO. ______
WELL (FARM) NO. 1 SERIAL NO. ______
ANGLE OF DEVIATION, IF ANY: ______
ELEVATION: 960
LATITUDE: 42°45'31"
LONGITUDE: 77°14'49"
DISTANCE SOUTH OF NORTH: 11,750 AND
WEST OF EAST: 10,550 IN SECTION: G
(SEE KEY ABOVE) OF Rushville QUADRANGLE
☐ 7.5 MIN. ■ 15 MIN. MAP DATE: 1978
TOWN: Middlesex COUNTY: Yates
SIGNED: Michael G. Muller L.S. 49402
DATE: 9/21/82 SCALE: 1" = 400'

NEW YORK STATE
DEPARTMENT OF
ENVIRONMENTAL CONSERVATION
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WELL LOCATION MAP

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License No 49158

Michael G. Muller
License No. 49402

Bath, New York
Job No 1155

FIGURE 2-10

To reflect the emphasis on economics, the previous requirement of uniformity of drilling and stimulation techniques was relaxed. Instead, the requirement adopted was that the techniques should be those which would be used by a local operator trying to find gas at an economic price. The Rushville and Naples wells, therefore, became known as the "poor-boy" wells; to minimize the cost, they were planned to be drilled with cable tools, to be sampled but not logged, and to be stimulated with explosives (rather than hydraulically). Costs of drilling and stimulation were reduced to less than $50,000, compared with more than $100,000 for the full research techniques.

The Rushville well was drilled in July-August 1983 to a total depth of 900 feet. The location is shown in Figure 2-10. The detailed drilling report is given in Appendix C. From the outset, this well was beset by the problem of water entering the well bore. Fresh water encountered at 75 feet was sealed by the surface casing, but further fresh water was encountered below 500 feet. Since this fresh water could not be allowed to come into contact with the target shale, cement was squeezed in hopes of sealing it. Further fresh water encountered at about 700 feet finally required the setting of casing. Although these occurrences represented an unwelcome increase of cost, they did suggest extensive fracturing in the upper rocks. Therefore, the presence of fractures was a positive factor, provided some sort of seal remained above the Marcellus.

Below the casing, salt water was encountered. Perhaps this change indicated the presence of the desired seal; therefore, the drilling effort was continued, again with attempts to shut off the water with cement. Figure 2-11 shows the configuration of the cement and casing. Finally, the hole penetrated the Marcellus and bottomed in the Onondaga - still making salt water, with no gas. The judgement was therefore made that the shale (which was undoubtedly well fractured) had been depleted by previous production, that the fractures had become full of salt water (possibly from a deeper aquifer), and that the water had probably removed all hopes of extracting further gas from the shale. Therefore, no attempt was made to stimulate the well; it was plugged and abandoned as a dry hole.

THE NAPLES PROSPECT

Much more is known about the old Naples field than about Rushville. Many of the wells were drilled in the early years of this century; they were drilled, of course, with cable-tool rigs, and were not stimulated. Some of the wells are still on production, yielding one or two Mcf/day.

L.W. ELLIOT #1 WELL

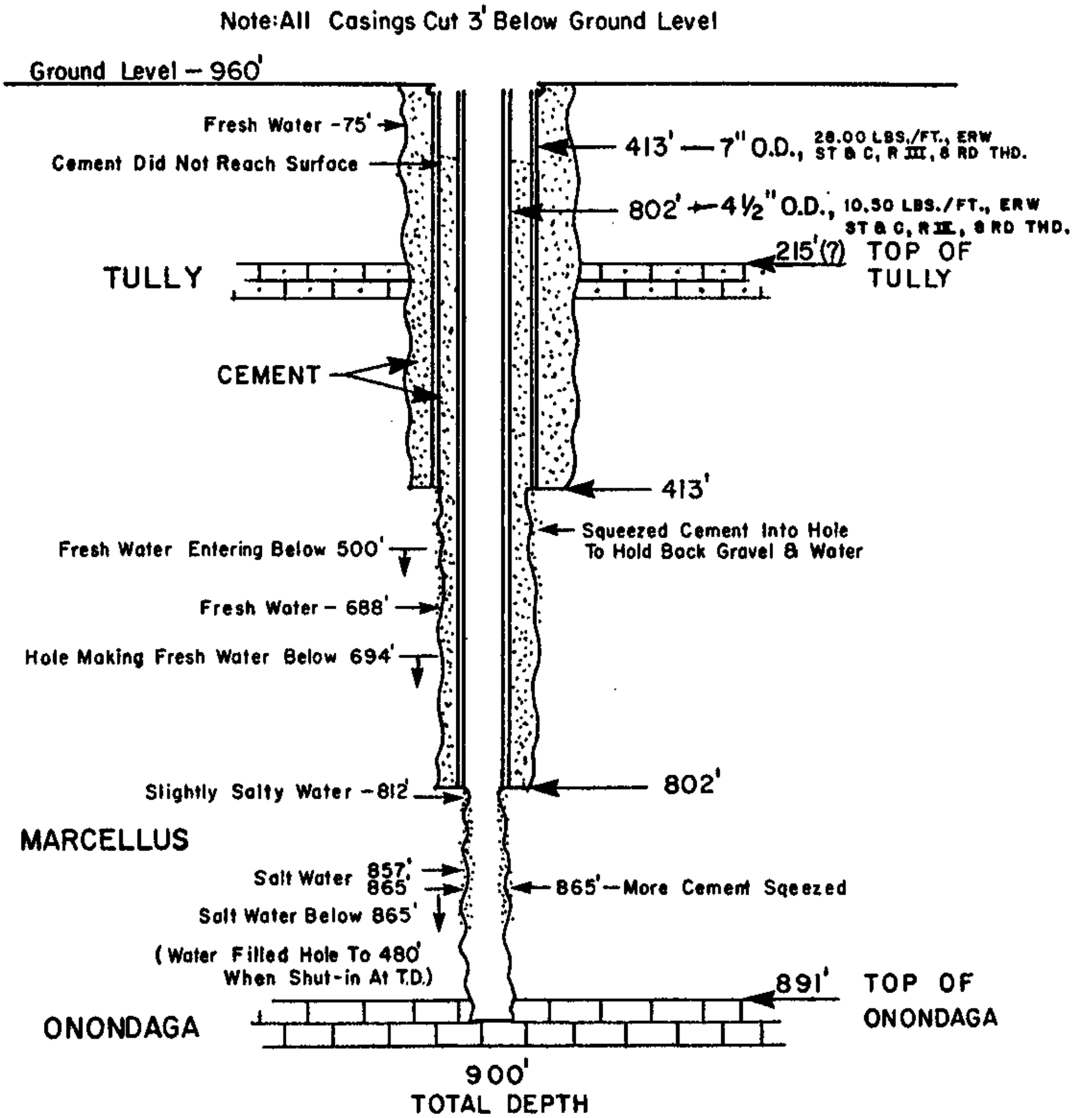


FIGURE 2-11

The mapping of the recorded well depths suggest some sort of Onondaga high trending through Naples in an east-northeast direction. It may even be a horst associated with a pronounced fracture system.

Also relevant in the context of fractures is the position of Naples with respect to the final position of the ice sheet which covered northern New York. Figure 2-12 shows a synthesized "space photograph" of the Finger Lakes region, covering the same area shown as a normal USGS map in Figure 2-13. The synthetic space photograph of Figure 2-12 was prepared from the contours on Figure 2-13, assuming an artificial sun 30^{o} above the horizon, in the southeast. Rather dramatically, it divides the region into three parts, which are suggested by the superimposed dashed lines: a northerly part, showing the region scoured almost flat by the ice sheet; a southerly part, showing intense fluvial erosion; and an intermediate part, perhaps representing the melt zone of the ice sheet and its individual glaciers. It is postulated, then, that the ice sheet represented a heavy burden, producing some additional elastic compression of the rocks below, and that this compression relaxed when the ice melted; the effect might well be to produce some fracturing around the edge of the ice sheet.

As shown on Figure 2-12, Naples shares with Dansville a position on the edge of the ice sheet. It may therefore have both a regional reason to have fractures (the glacial unloading) and a local reason (a minor structural uplift trending east-northeast).

The detailed location of the test well was again decided primarily by lease considerations; it lies in a void between old producing wells, at the position indicated in Figure 2-14. No seismic data are available in this area.

The well was drilled in September 1983 to a total depth of 1220 feet. The detailed drilling and completion reports are given in Appendix D. Fresh water encountered at 470 feet was successfully sealed with a short length of 8-inch casing below the 10-inch surface casing. A show of gas estimated at 50 Mcf/day was encountered in the Geneseo, at 500-505 feet. There was no significant flow from the Marcellus.

Figure 2-15 shows the configuration of the well, and the explosive used in stimulating it. The explosive used was Judymite; the total charge was 3200 lb, from about 800 to 1200 feet. The rational for stimulating so much of the Hamilton Shale, in addition to the Marcellus itself, was a hope that the more-brittle Hamilton might develop fractures extending down into the Marcellus over a wider area than that contacting the borehole.

FIGURE 2-12

Geospectra Plat

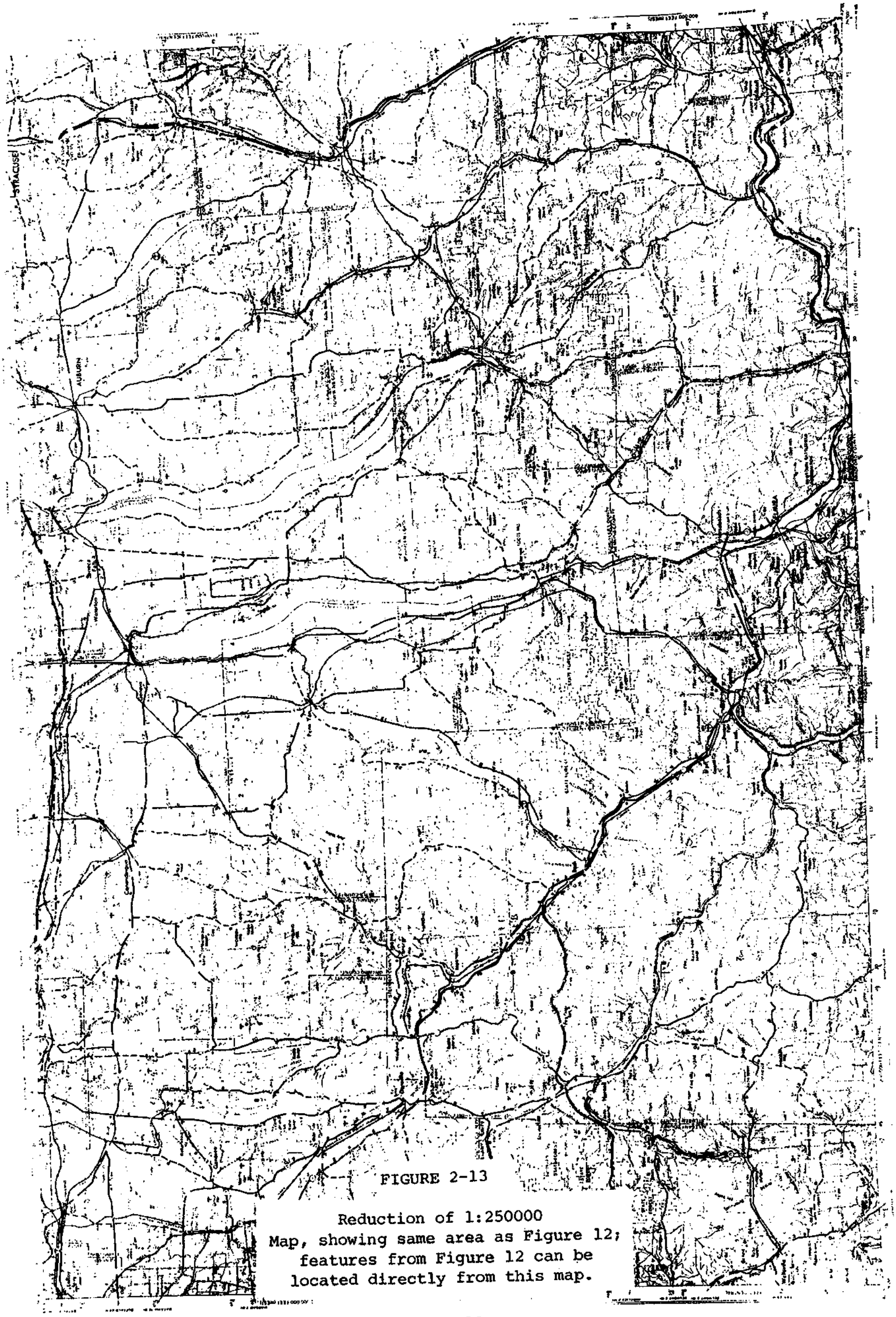
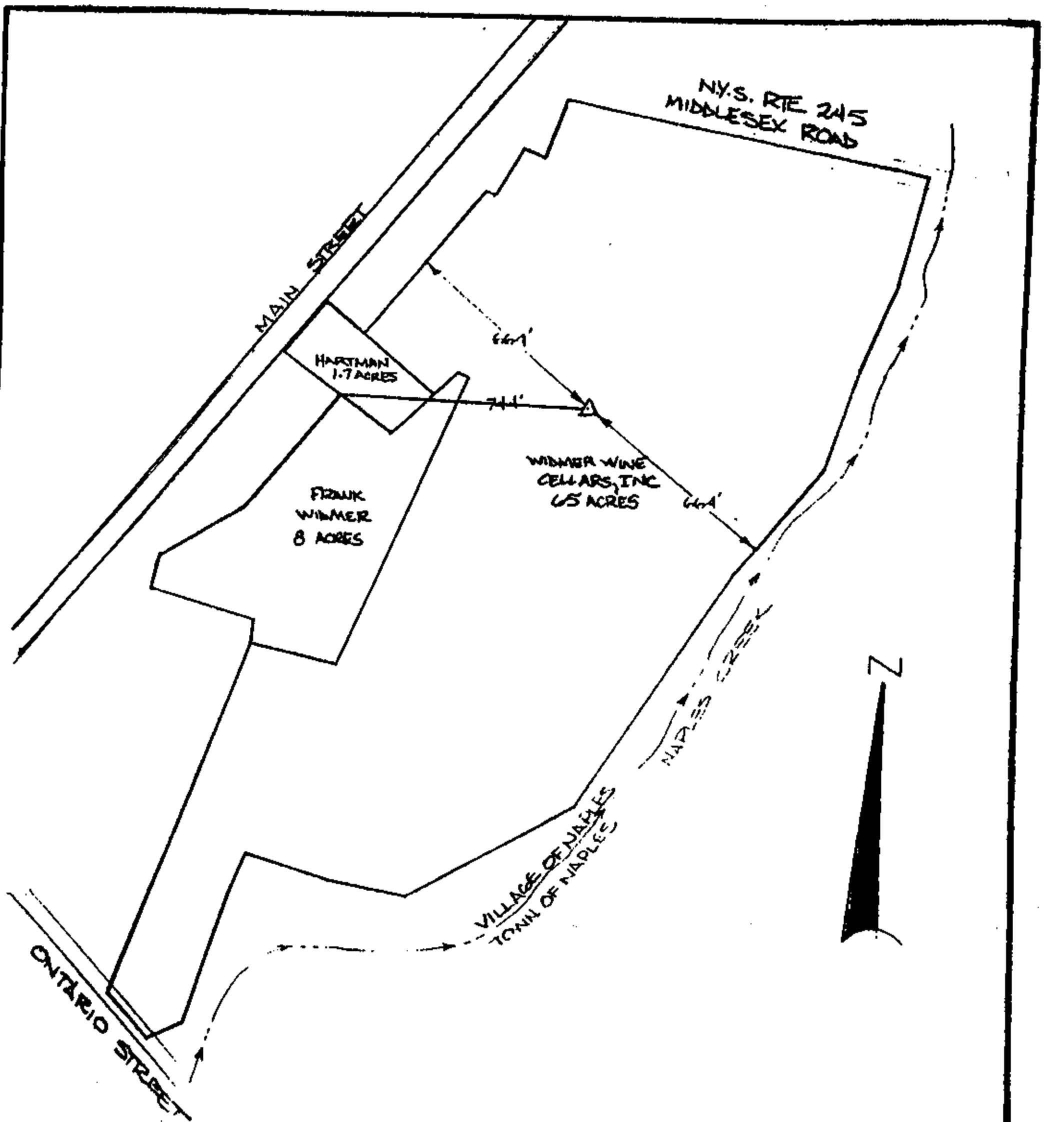


FIGURE 2-13

Reduction of 1:250000
Map, showing same area as Figure 12;
features from Figure 12 can be
located directly from this map.



NEW LOCATION: ☒
DRILL DEEPER: ☐
ABANDONMENT: ☐
REDRILLING: ☐
CONVERSION: ☐

A	B	C
D	E	F
G	H	I

SECTION KEY

COMPANY: Arlington Exploration Company
ADDRESS: 127 Newberry St. Boston MA. 02116
LANDOWNER: Widmer Wine Cellars, Inc.
TRACT ______ ACRES: 74.7 LEASE NO. ______
WELL (FARM) NO. 1 SERIAL NO. ______
ANGLE OF DEVIATION, IF ANY ______
ELEVATION: 723'
LATITUDE: 42°37'25" N
LONGITUDE: 77°23'37" W
DISTANCE SOUTH OF NORTH: 525'± AND
WEST OF EAST: 4950'± IN SECTION: C
(SEE KEY ABOVE) OF NAPLES, N.Y. QUADRANGLE
☒ 7.5 MIN. ☐ 15 MIN. MAP DATE: 1976
TOWN: NAPLES COUNTY: ONTARIO
SIGNED [signature] LS 49158
DATE: 11/12/82 SCALE: 1 in = 400 FT

NEW YORK STATE
DEPARTMENT OF
ENVIRONMENTAL CONSERVATION
BUREAU OF MINERALS

WELL LOCATION MAP

D.E.C. FILE NO. ______

McCONNELL and MULLER
LAND SURVEYORS

Rodrick E. McConnell
License No. 49158

Michael G. Muller
License No. 49402

Bath, New York Job No 1173

FIGURE 2-14

WIDMER WINE CELLARS #1 WELL

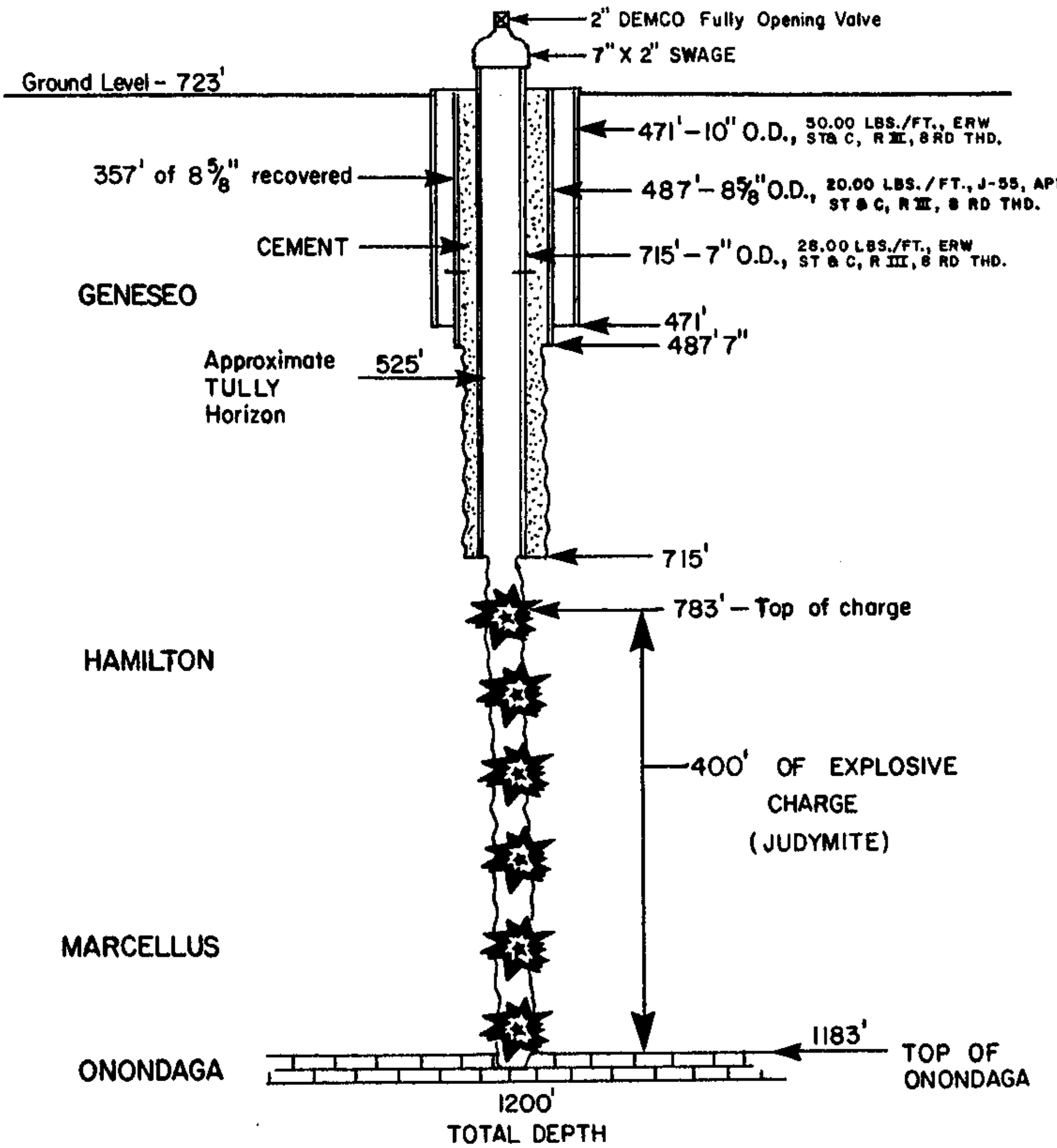


FIGURE 2-15

After stimulation, the well flowed at an estimated rate of 40 Mcf/day. On four-point test, the well was calculated to have an AOF of 12 Mcf/day. The well is currently being connected to the premises of the Widmer Wine Cellars winery, where the gas will be used for space heating.

Section 3

THE PERFORMANCE OF THE SHALE-GAS WELLS DRILLED IN PHASE I AND PHASE II

NYSERDA commissioned an independent study of the performance of all the shale-gas wells it has drilled in New York State. At the time of writing, this study was not yet available. The results presented here, therefore, are estimates which shortly may be improved.

Table 3-1 lists, for each well, the estimated initial flow of gas (after clean-up), the calculated absolute open flow (from the modified isochronal tests), and the cumulative production through September 1983.

Of the four wells with significant gas, the best (on isochronal test) is clearly the Elmira well. However, as noted earlier, any measure of sustained production for this well must await the connection of the electric generator set.

None of the wells approaches Houghton College No. 1, the well which initially gave impetus to shale-gas research in New York State; this well had an initial flow of about 1300 Mcf/day, and has yielded a cumulative production of over 20 million cubic feet in about 2 1/2 years.
At the gas prices existing in the present gas glut, and with the drilling and stimulation costs associated with research-type wells, it is probable that none of these wells is economic.

Even the Houghton College No. 1 is marginal. Therefore, some interest will attach to the "poor-boy" Naples well when it is placed on production.

Table 3-1

WELL PERFORMANCE

Well	Initial open flow Mcf/day	Calculated open flow Mcf/day	Cumulative Production after (months) Mcf
Scudder No. 1 (N. Corning)	Dry		0
Dann No. 1 (Erwin)		10	74 (2)
Valley Vista View No. 1 (Rathbone)	200	110, 142	2,935 (9)
Meter No. 1 (Dansville)	411	95	3,687 (20)
Tiffany No. 1 (Endicott)	17	9	0
Hulsebosch No. 1 (Elmira)	86	545	2,500 (10)
Elliott No. 1 (Rushville)	Dry		0
Widmer No. 1 (Naples)	40	12	200 (9)
Alfred University	40	35	1,230 (34)
Allegany County BOCES	73	105	2,440 (34)
Houghton College No. 2	77	23	630 (33)
Portville Central School	22	18	930 (34)
St. Bonaventure	14	19	720 (33)

Section 4

CONCLUSIONS AND DIRECTIONS

- The primary concern of the NYSERDA program was research: first to characterize the shale, as part of a national program, and second to test several rationales for the location of shale-gas wells.

- Considerable progress has been made on the national program to characterize the shale. One major report[1] describes these results

NOTE: Due to error, continued on p. 4-2

[1] Resource and Exploration Assessment of the Oil and Gas Potential in the Devonian Gas Shales of the Appalachian Basin, by R.E. Zielinski and R.D. McIver (Mound Facility); U.S. Department of Energy, Morgantown Technology Center; Report DOE/DP/0053-1125, 1983.

for the whole Appalachian Basin; another specifically describes results obtained in New York State[2/].

- The effort to find a consistent exploration rationale for shale gas has made progress, but cannot be claimed to have succeeded. From the outset it has been clear that some locations were better than others; initially it was also hoped that the better locations would not prove to be highly local, but that extensive zones of good shale-gas production would be discovered. This hope has dimmed somewhat; possibly, it may be found that shale-gas production is at least as site-specific as production from conventional reservoirs. It may even be found that our means for finding such site-specific locations are less effective than they are for conventional reservoirs.

- The Mound report confirms earlier opinions that the amount of gas locked in the shales of the Appalachian Basin is vast. To unlock it all would require tens of thousands of wells, probably drilled in a 10-acre spacing. This cannot possibly be contemplated at present. Unless there is some breakthrough in stimulation techniques, the average production per well is likely to be only a few Mcf/day; this can be attractive only if there is a major increase in the price of gas, and/or a major decrease in the cost of drilling and stimulating a well, or if considerations such as security of supply are paramount over economics. In the near term, hopes of economic return must continue to be restricted to good site-specific locations.

- Nothing has happened to change the established view that the search for good shale-gas locations is the search for zones of fracture in the shale; further, the preference is for shales which contain some silt stringers to act as conduits (and/or small gas-storage reservoirs) between the fracture system and the body of the shale.

- The only known way to establish the existence of silt stringers within the shale is to drill a hole. Further, since silt stringers are not likely to be extensive, or to interconnect, no feasible degree of well control would allow the areal mapping of such stringers; thus it is not likely that the presence or absence of stringers can be predicted at a new well location. If a good stringer has been encountered in one well (and other things are equal), the only guidance would be to drill the step-out well in the direction of depositional strike.

- The only known ways to establish the existence of fractures are the study of lineaments, subsurface mapping from well control, surface geochemistry, and seismics. Lineaments have the disadvantage of indicating only fractures which extend to the surface, and up which all the shale-gas is likely to have been lost; their study has not yielded conspicuous success. Subsurface mapping from well control can certainly establish faults and flexures likely to generate fractures, but in New York State the density of well control is seldom sufficient to do this with the precision of location which is probably necessary for a good shale-gas well. Geochemistry has not been tested in New York State; again, it is most likely to detect

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[2/] Study of Cuttings Samples from NYSERDA Shal-gas Wells in Western New York, by A.M. Van Tyne; NYSERDA Report, 1983.

fractures which have been leaking, rather than those which are vertically sealed. Seismic remains the clear preference for finding significant faults and flexures in the shale; however, it remains very expensive, and seldom justified by the economics of shale-gas wells.

- Nineteen shale-gas wells have been drilled in New York State in recent years. Of these, nine (Houghton College No. 1, and the eight wells of Phase I and Phase II) were drilled primarily for research. Five (the "school wells" described in Volume III of this series of reports) were drilled to establish the value of the shale-gas resource to colleges, hospitals and other institutions. The remaining five wells were drilled by municipal and business organizations searching for commercial gas; these were at Bath (3) and Avoca (2).

- Of these wells, the first (Houghton College No. 1) is the best. It appears to have been an anomaly. Another well (Houghton College No. 2), drilled at a later date one-fourth mile away, is clearly not as good. Possible explanations for this disparity include a greater content of silt in the No. 1 well (the No. 2 well was <u>not</u> on Depositional strike), and the presence of a fracture/joint system (perhaps indicated by the present course of the Genesee River) close to the No. 1 well. Be that as it may, there could not be a better example of the site-specificity of good shale-gas locations.

- The next best well appears to be the Hulsebosch No. 1 at Elmira, though proof of this judgement must await the extended production test. For this well, the favorable circumstance is believed to be known: the existence of a salt swell, uplifting and probably fracturing the prospective shale beds. This raises the interesting possibility that fracturing produced by the comparatively slow movement of salt may be more favorable to shale-gas production than fracturing produced during faulting. Perhaps fracturing produced by salt movement is more smoothly and generally distributed, over a wider area.

- Previous work (Volumes I and II) has established that, of the several shales present in the study area, the most obviously prospective is the Marcellus. This shale is typically 40-50 feet thick over most of the area, thickening -- and probably becoming more limey -- to the east. Locally, extending northeastwards from Pennsylvania, a region of anomalously thick Marcellus is found near the village of Endicott. This has been tested; it yielded a dry hole. There is some minor possibility that the shale was damaged by fresh water during a drilling mishap (drilling report for 23 September 1982); however, it is probably safe to accept the message that a thick Marcellus is no guarantee of plentiful shale gas. For the present, continued shale-gas exploration is unlikely in this region, unless seismic data showing a zone of intense natural fracturing can be obtained.

- Of the other shales present in the study area, the Rhinestreet proved discouraging in the previous work reported in Volumes I and II. There remains the Geneseo. This shale is generally less organically-rich than the Marcellus, but it is more shallow, and similarly widespread. No tests of the Geneseo have been made in any of the 19 shale-gas wells drilled in New York State, although significant shows have been encountered in several of the wells. One problem is that water is often encountered in the upper part of this formation. Had the Hulsebosch (Elmira) well been dry in the Marcellus, it would have been a good well in which to test the Geneseo; hydrofracturing over the black-shale range of 1490-1640 feet could probably have been done without significant risk of trouble from the water at 1365 feet. However, this option is not likely until the present completion depletes the Marcellus.

- The wells drilled in Phase II have confirmed an observation of Phase I: that the absence of natural flow from the Marcellus is not to be interpreted negatively. Neither the Elmira well nor the Naples well yielded any measurable natural flow before stimulation.

- The Elmira and Endicott wells in Phase II, like the producing wells in Phase I, were fractured hydraulically; the technique was kept substantially the same as that used in other wells throughout the DOE's Eastern Gas Shales Project. In particular, the fracturing fluid was directed, through perforations, into the black shale itself. Although this has expert support, the view is also expressed in the industry that it might be worth trying to develop a fracture system in the more brittle shale above the black shale. The argument heard is that the high organic content of the black shale makes it compressible, and that much of the energy of the fracturing fluid is used merely to compress the black shale without fracturing it. Perhaps fractures generated in the more brittle shale above the black shale would contact the black shale over at least the same area as that achieved by fracturing the black shale itself. This contention has not been tested specifically in either Phase I or Phase II; it remains a good subject for a controlled experiment. However, the well at Naples is interesting in one respect; although two variables were introduced (explosive fracturing rather than hydraulic, as well as the fracturing of the entire shale column rather than just the black shale), the fracturing does appear at present to have been successful.

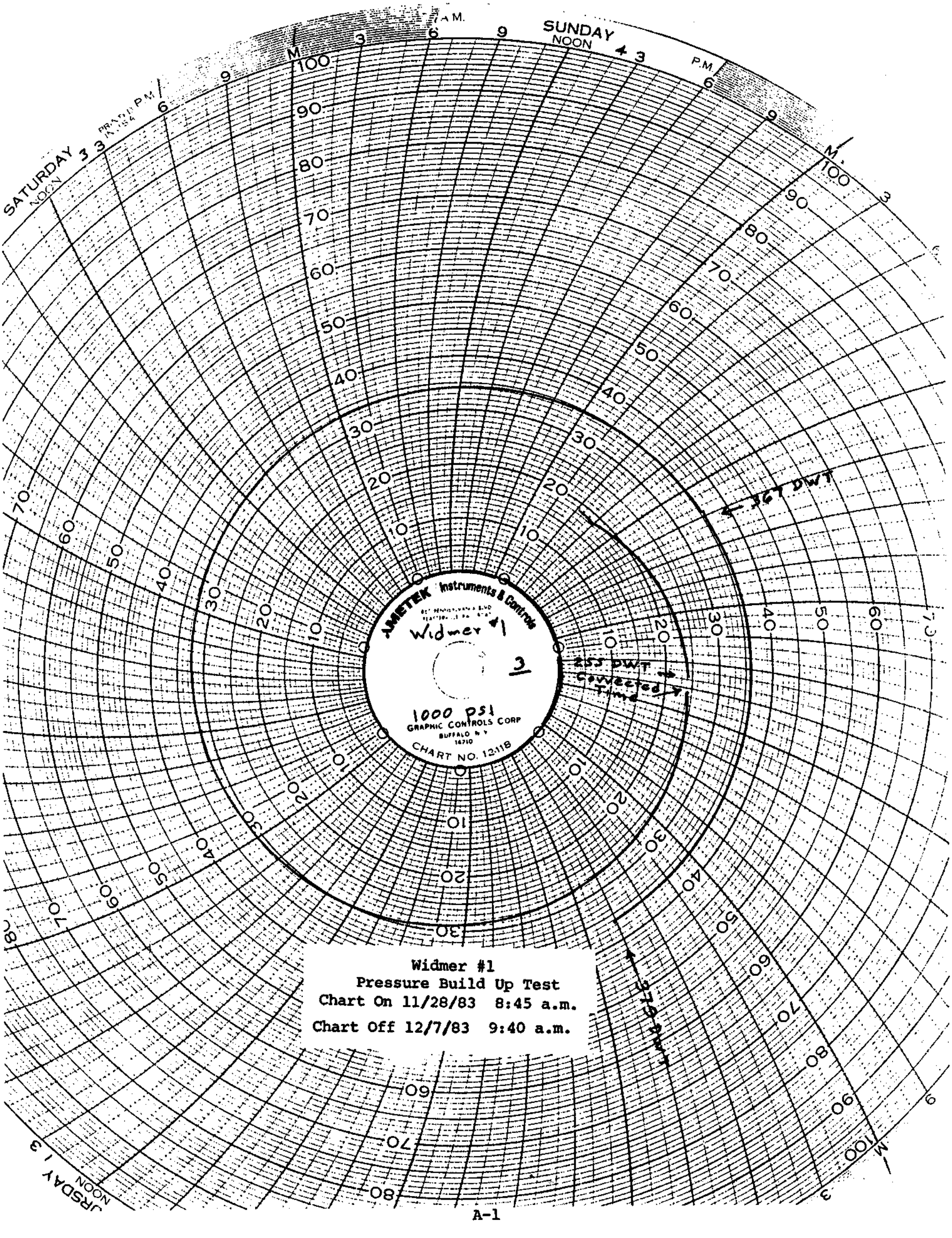
- Although budget considerations have not allowed it, and the opportunity has now passed, the explosive fracturing of more of the shale column in the Endicott (Tiffany) well -- which was previously and unsuccessfully fractured hydraulically in the black shale -- would have made an interesting experiment.

- The work to date clearly indicates some avenues for future research. Among these are the stimulation and testing of the Geneseo (possibly at Elmira), a controlled experiment using explosive stimulation in a well where hydraulic stimulation had failed, a controlled experiment to determine the effect of fracturing the gray shale above the black shale, a seismic line connecting the two wells at Houghton College (in hopes that it would explain the difference between them), an appraisal of the new Spectralogs in characterizing the shale, and the systematic mapping of salt movement over the area.

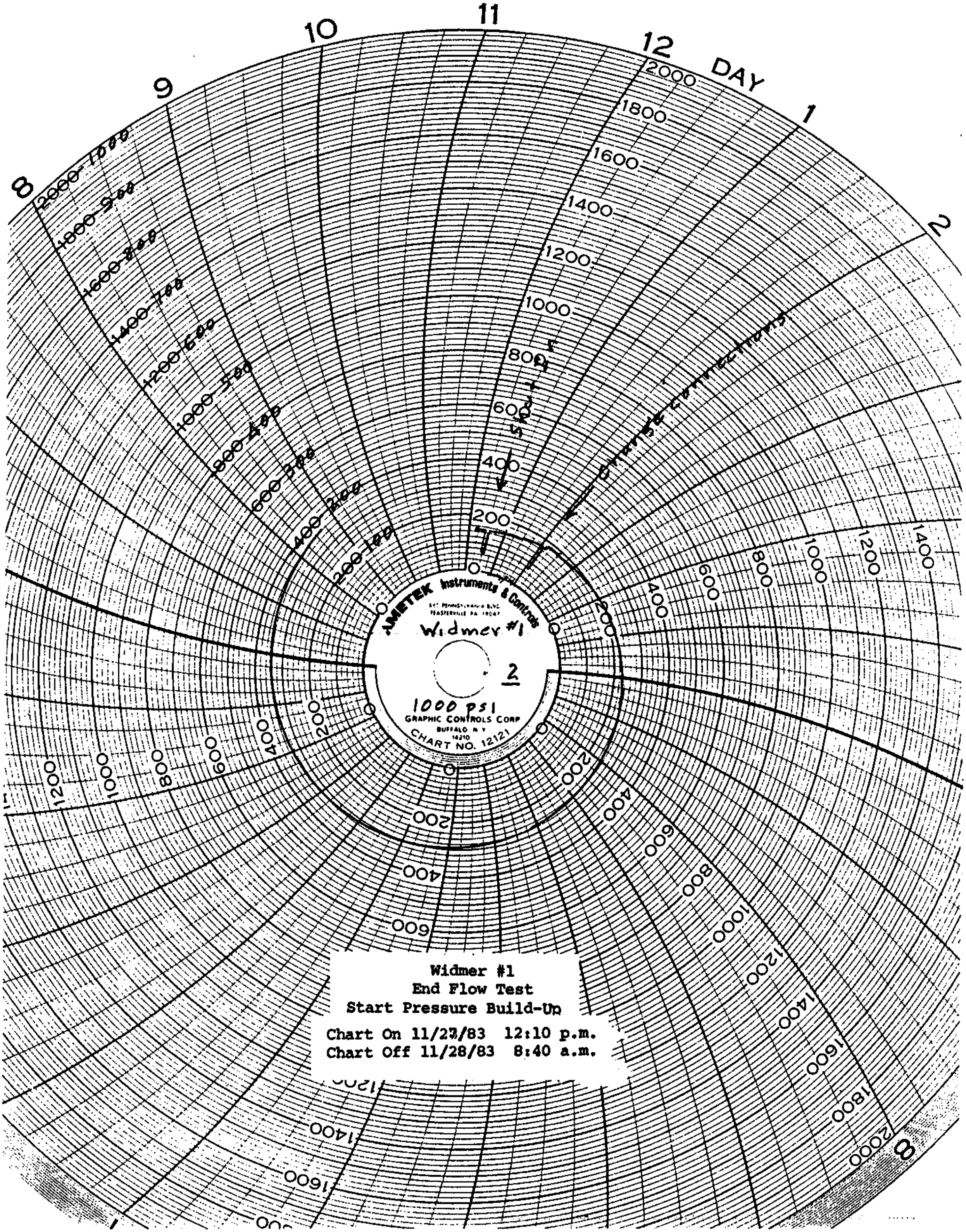
- The work to date also indicates some directions for exploiting what is already known. First, future activity should continue to concentrate on the provision of shale-gas to schools, colleges, institutions and local industry -- not to pipeline companies. Second, the uncertainties remain such that it still makes sense, whenever possible, to work outward from known favorable locations. Of the known shale-gas fields which merit further investigations, Naples appears to be the most promising. Third, good possibilities exist for institutional wells in and near the town of Elmira. One interesting possibility at Elmira would be to drill a "poor-boy" well to the Geneseo, and to stimulate and test the Geneseo, before proceeding on to the major target in the Marcellus. Finally, a test well would be desirable at any location for which glacial unloading and salt movement might combine their fracturing effects; such a location may well exist near Watkins Glen.

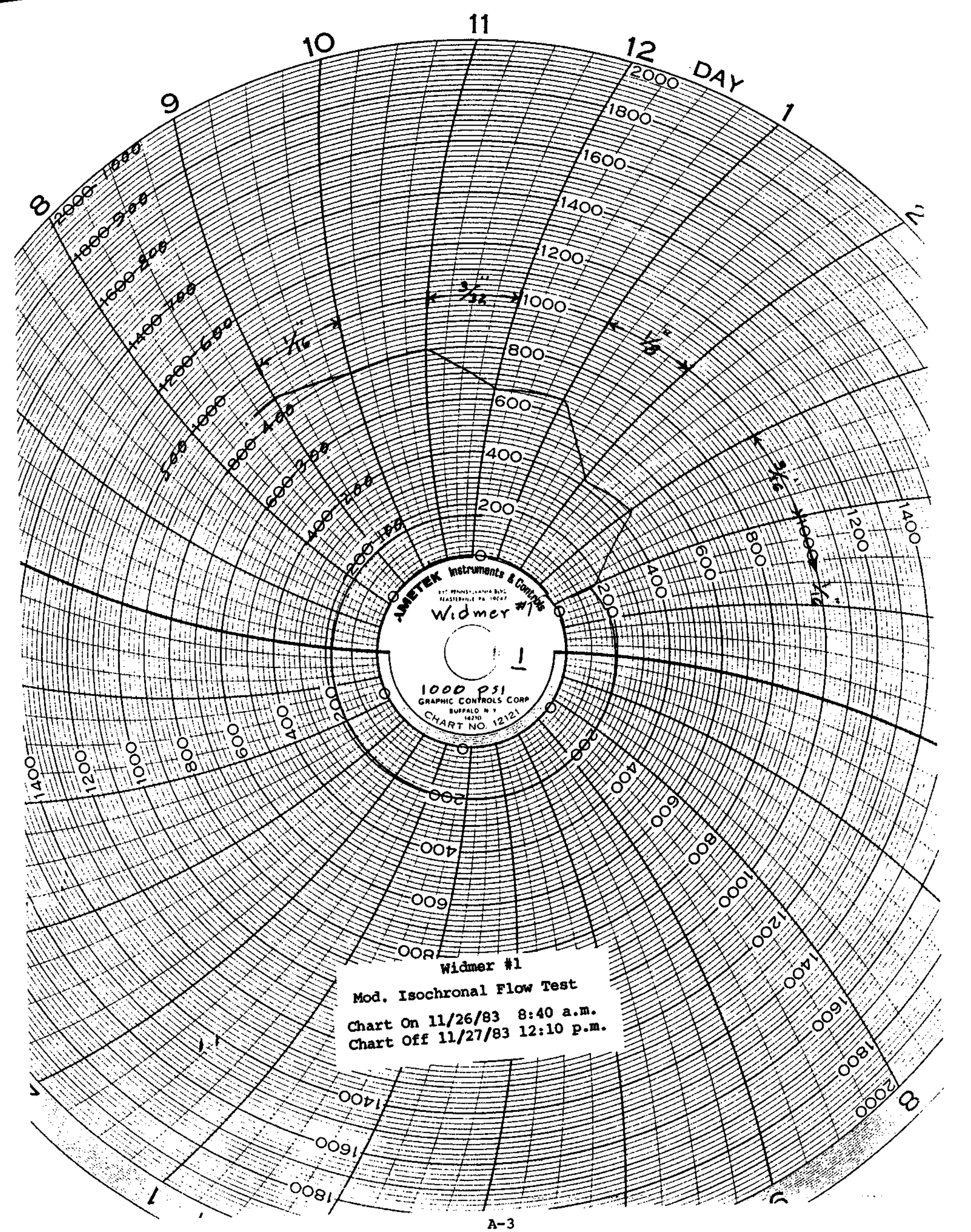
Appendix A:

Drilling, completion and test reports for the Endicott (Tiffany) well

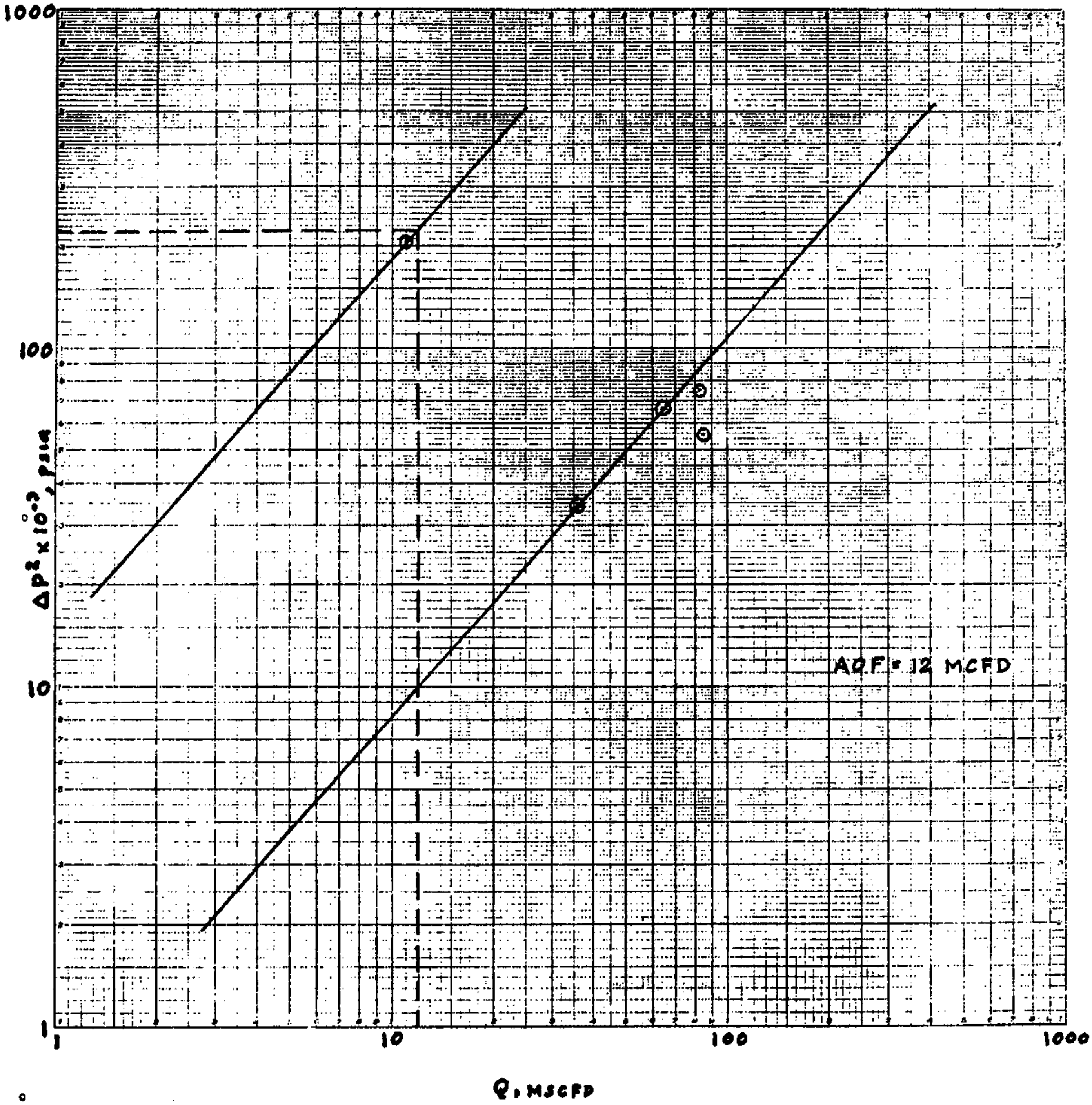


Widmer #1
Pressure Build Up Test
Chart On 11/28/83 8:45 a.m.
Chart Off 12/7/83 9:40 a.m.


Widmer #1
End Flow Test
Start Pressure Build-Up
Chart On 11/27/83 12:10 p.m.
Chart Off 11/28/83 8:40 a.m.
DAY
AMETEK Instruments & Controls
Widmer #1
1000 psi
GRAPHIC CONTROLS CORP
BUFFALO N.Y.
CHART NO. 12121


Widmer #1
Mod. Isochronal Flow Test
Chart On 11/26/83 8:40 a.m.
Chart Off 11/27/83 12:10 p.m.
AMETEK Instruments & Controls
Widmer #1
1000 PSI
GRAPHIC CONTROLS CORP
BUFFALO N.Y.
CHART NO. 12121
DAY

Widmer No. 1


1000
100
10
1
$\Delta P^2 \times 10^{-3}$, psia
AOF = 12 MCFD
1
10
100
1000
Q, MSCFD

GAS WELL DELIVERABILITY TEST CALCULATIONS - FLOW RATES

(BASE CONDITIONS = 14.65 psia and 60°F)

Widmer #1

CRITICAL FLOW PROVER

$q = 10^{-3}\ C\ P\ F_{tf}\ F_g\ F_{pv}$

RATE NO.	PROVER SIZE inches	ORIFICE DIAMETER inches	BASIC ORIFICE COEFFICIENT (C) Mscfd/lb.	STATIC PRESSURE (P) psia	FLOW. TEMP. FACTOR F_{tf}	SPECIFIC GRAVITY FACTOR F_g	SUPERCOMP. FACTOR F_{pv}	FLOW RATE q MMscfd
1	2	1/16	0.0846	429	1	1	1	36
2	2	3/32	0.1863	350	1	1	1	65
3	2	1/8	0.3499	237	1	1	1	83
4	2	3/16	0.8035	106	1	1	1	85
5	2	1/16	0.0846	129	1	1	1	11

ORIFICE METER

$q = 24 \times 10^{-6}\ C' \sqrt{h_w\ P_f}$

$C' = F_b\ F_{pb}\ F_{tb}\ F_g\ F_{tf}\ F_r\ Y\ F_{pv}\ F_m$

$F_{pb} = 1.0055$

$F_{tb} = 1.0000$

RATE NO.	STAGE	METER RUN OR LINE SIZE inches	ORIFICE DIAMETER inches	STATIC PRESSURE P_f psia	DIFFERENTIAL INCHES H_2O h_w	BASIC ORIFICE FACTOR F_b	SPECIFIC GRAVITY FACTOR F_g	FLOW. TEMP. FACTOR F_{tf}
1	H							
	L							
2	H							
	L							
3	H							
	L							
4	H							
	L							
5	H							
	L							

ORIFICE METER CALCULATIONS (CONTINUED)

RATE NO.	STAGE	REYNOLDS FACTOR F_r	EXPANSION FACTOR Y	SUPERCOMP. FACTOR F_{pv}	MANOMETER FACTOR F_m	C' ft^3/hr	$\sqrt{h_w\ P_f}$	FLOW RATE q MMscfd	TOTAL GAS PRODUCTION RATE MMscfd
1	H								
	L								
2	H								
	L								
3	H								
	L								
4	H								
	L								
5	H								
	L								

EG-34-10-75

FLANGE TAPS ☐ PIPE TAPS ☐

CONTINUATION OF FLOW NO. 5 TO STABILIZATION

Date	Time	Cum. Hrs.	Chart			Prover DWT		Temp.
11-26-83	9:00 P.	5.0	101					
	9:30	5.5	101					
	10:00	6.0	101					
	10:30	6.5	101					
	11:00	7.0	100					
	Midnite	8.0	99					
11-27	2:00A	10.0	97					
	4:00	12.0	92					
	6:00	14.0	88					
	8:00	16.0	84					
	10:00	18.0	82					
	Noon	20.0	78					
	12:10 P.		78 +10			88		54
			Change	charts				
	12:30 P	20.5	Shut	In		87		52
	Well	stabilized	@	101 psig	in 4.5	hours.		
			Corr =	+13				
				114 psig				

METER RUN OR PROVER SIZE 2 inches ORIFICE SIZE 1/16 inches

SEPARATOR CONDITIONS: HP SEP. ______ psig, ______ °F LP SEP. ______ psig, ______ °F

CONDENSATE PRODUCTION RATE ______ Bbl per hour TOTAL ______ Bbl

WATER PRODUCTION RATE ______ Bbl per hour TOTAL ______ Bbl

FINAL FLOWING WELLHEAD PRESSURE: TUBING ______ CASING 87 psig

WELL SHUT-IN AT 12:30 ~~AM~~/PM 11-27 19 83 TOTAL FLOW TIME 20.5 hours

FINAL SHUT-IN WELLHEAD PRESSURE: TUBING N/A CASING 470 psig 12/13/83

DURATION OF FINAL SHUT-IN 384 hours TESTED BY (CO.) [illegible]

Widmer #1

SHUT-IN NO. ____ (INTERMEDIATE)

DATE	TIME	CUMULATIVE SHUT-IN TIME hours	WELLHEAD PRESSURE psig TUBING	WELLHEAD PRESSURE psig CASING	WELLHEAD TEMPERATURE °F

REMARKS

FLOW NO. 5 WELL OPENED AT 4:00 ~~AM~~/PM ____ 19 ____

DATE	TIME	CUMULATIVE FLOW TIME hours	WELLHEAD PRESSURE psig ~~TUBING~~	WELLHEAD PRESSURE psig CASING	WELLHEAD TEMPERATURE °F	METER OR PROVER DATA STATIC PRESSURE psig	METER OR PROVER DATA DIFFERENTIAL inches H_2O	METER OR PROVER DATA TEMPERATURE °F
11-26-83	4:00 P.	-0-		91	48	Opened on	1/16" choke.	
	4:15	0.25				97		47
	4:30	0.5				100		46
	4:45	0.75	Chart			103		46
	5:00	1.0	93 +13			105		46
	5:30	1.5	94					
	6:00	2.0	97					
	6:30	2.5	98					
	7:00	3.0	99					
	7:30	3.5	100					
	8:00	4.0	100					
	8:30	4.5	101					

METER RUN OR PROVER SIZE 2 inches ORIFICE SIZE 1/16 inches

SEPARATOR CONDITIONS: HP SEP. ____ psig, ____ °F LP SEP. ____ psig, ____ °F

CONDENSATE PRODUCTION RATE ____ Bbl per hour TOTAL ____ Bbl

WATER PRODUCTION RATE ____ Bbl per hour TOTAL ____ Bbl

FINAL FLOWING WELLHEAD PRESSURE: TUBING ____ CASING ____ psig

WELL SHUT-IN AT ____ AM/PM ____ 19 ____ TOTAL FLOW TIME ____

GAS WELL DELIVERABILITY TEST - FIELD NOTES

Widmer #1

SHUT-IN NO. 4 (INTERMEDIATE)

DATE	TIME	CUMULATIVE SHUT-IN TIME hours	WELLHEAD PRESSURE psig		WELLHEAD TEMPERATURE °F
			TUBING	CASING	
11-26-83	2:00 P.	-0-		222	50
	2:15	0.25		228	52
	2:30	0.5		233	54
	2:45	0.75		238	53
	3:00	1.0		241	52

REMARKS

FLOW NO. 4 WELL OPENED AT 3:00 ~~AM~~/PM ______ 19 ____

DATE	TIME	CUMULATIVE FLOW TIME hours	WELLHEAD PRESSURE psig		WELLHEAD TEMPERATURE °F	METER OR PROVER DATA		
			TUBING	CASING		STATIC PRESSURE psig	DIFFERENTIAL inches H_2O	TEMPERATURE °F
11-26	3:00 P.	-0-		241	52	Opened on	3/16" choke.	
	3:15	0.25				184		48
	3:30	0.5				144		48
	3:45	0.75				114		48
	4:00	1.0				91		48

METER RUN OR PROVER SIZE 2 inches ORIFICE SIZE 3/16 inches

SEPARATOR CONDITIONS: HP SEP. ______ psig, ______ °F LP SEP. ______ psig, ______ °F

CONDENSATE PRODUCTION RATE ______ Bbl per hour TOTAL ______ Bbl

WATER PRODUCTION RATE ______ Bbl per hour TOTAL ______ Bbl

FINAL FLOWING WELLHEAD PRESSURE: TUBING ______ CASING 91 psig

WELL SHUT-IN AT ______ AM/PM ______

Widmer #1

SHUT-IN NO. 3 (INTERMEDIATE)

DATE	TIME	CUMULATIVE SHUT-IN TIME hours	WELLHEAD PRESSURE psig		WELLHEAD TEMPERATURE °F
			TUBING	CASING	
11-26-83	Noon	-0-		335	49
	12:15 P.	0.25		339	50
	12:30	0.5		342	50
	12:45	0.75		344	50
	1:00	1.0		346	52

REMARKS

FLOW NO. 3 WELL OPENED AT 1:00 ~~AM~~/PM ______ 19 ____

DATE	TIME	CUMULATIVE FLOW TIME hours	WELLHEAD PRESSURE psig		WELLHEAD TEMPERATURE °F	METER OR PROVER DATA		
			TUBING	CASING		STATIC PRESSURE psig	DIFFERENTIAL inches H_2O	TEMPERATURE °F
11-26	1:00 P.	-0-		346	52	Opened on	1/8" choke.	
	1:15	0.25		~~307~~		307		52
	1:30	0.5				274		50
	1:45	0.75				246		50
	2:00	1.0				222		50

METER RUN OR PROVER SIZE 2 inches ORIFICE SIZE 1/8 inches

SEPARATOR CONDITIONS: HP SEP. ______ psig, ______ °F LP SEP. ______ psig, ______ °F

CONDENSATE PRODUCTION RATE ______ Bbl per hour TOTAL ______ Bbl

WATER PRODUCTION RATE ______ Bbl per hour TOTAL ______ Bbl

FINAL FLOWING WELLHEAD PRESSURE: TUBING ______ CASING 222 psig

WELL SHUT-IN AT 2:00 ~~AM~~/PM ______ 19 ____ TOTAL FLOW TIME 1 hours

GAS WELL DELIVERABILITY TEST - FIELD NOTES

Widmer #1

SHUT-IN NO. 2 (INTERMEDIATE)

DATE	TIME	CUMULATIVE SHUT-IN TIME hours	WELLHEAD PRESSURE psig		WELLHEAD TEMPERATURE °F
			TUBING	CASING	
11-26-83	10:00 A	-0-		414	45
	10:15 A	0.25		415	46
	10:30 A	0.50		416	47
	10:45 A	0.75		417	47
	11:00 A	1.0		417	48

REMARKS

FLOW NO. 2 WELL OPENED AT 11:00 AM/~~PM~~ 19

DATE	TIME	CUMULATIVE FLOW TIME hours	WELLHEAD PRESSURE psig		WELLHEAD TEMPERATURE °F	METER OR PROVER DATA		
			TUBING	CASING		STATIC PRESSURE psig	DIFFERENTIAL inches H_2O	TEMPERATURE °F
11-26	11:00 A	-0-		417	48	Opened on	3/32" choke.	
	11:15 A	0.25				393		48
	11:30 A	0.5				372		48
	11:45 A	0.75				353		49
	Noon	1.0				335		49
			Found trace of hydrates on back of plate.					

METER RUN OR PROVER SIZE 2 inches ORIFICE SIZE 3/32 inches

SEPARATOR CONDITIONS: HP SEP. ______ psig, ______ °F LP SEP. ______ psig, ______ °F

CONDENSATE PRODUCTION RATE ______ Bbl per hour TOTAL ______ Bbl

WATER PRODUCTION RATE ______ Bbl per hour TOTAL ______ Bbl

FINAL FLOWING WELLHEAD PRESSURE: TUBING ______ CASING 335 psig

WELL SHUT-IN AT Noon AM/PM

GAS WELL DELIVERABILITY TEST – FIELD NOTES

WELL NAME Widmer #1 LOCATION ______ W___

FIELD OR AREA Naples POOL OR ZONE ______

PERF./OPEN HOLE INTERVAL ______ PRODUCING THROUGH: ~~TUBING~~ Casing ☑ ANNULUS ☐

WELL BLOWN FOR 5 hours – dry ~~minutes~~ SPRAY: WATER/CONDENSATE CLEAR IN ______ minutes

DATE SHUT-IN 10-24 1983 TIME 7:00 P.M. TOTAL SHUT-IN TIME 782 hours

SHUT-IN NO. 1 (INITIAL)

DATE	TIME	CUMULATIVE SHUT-IN TIME hours	WELLHEAD PRESSURE psig TUBING	WELLHEAD PRESSURE psig CASING	WELLHEAD TEMPERATURE °F
10-25-83	10:00 A	15		145	
11-8	10:00 A	351		418	
11-16	9:00 A	542		437	
11-19	11:30 A	616 ½		440	
11-26	9:00 A	782		449	41

REMARKS

FLOW NO. 1 WELL OPENED AT 9:00 AM ~~PM~~ 11-26 1983

DATE	TIME	CUMULATIVE FLOW TIME hours	WELLHEAD PRESSURE psig TUBING	WELLHEAD PRESSURE psig CASING	WELLHEAD TEMPERATURE °F	METER OR PROVER DATA STATIC PRESSURE psig	DIFFERENTIAL inches H_2O	TEMPERATURE °F
11-26-83	9:00 A	-0-		449	41	Opened on	1/16" choke.	
	9:15 A	0.25				437		43
	9:30 A	0.50				429		44
	9:45 A	0.75				420		44
	10:00 A	1.00				414		45
			Found little hydrates on back of plate.					

METER RUN OR PROVER SIZE 2 inches ORIFICE SIZE 1/16 inches

SEPARATOR CONDITIONS: HP SEP. ______ psig, ______ °F LP SEP. ______ psig, ______ °F

CONDENSATE PRODUCTION RATE ______ Bbl per hour TOTAL ______ Bbl

WATER PRODUCTION RATE ______ Bbl per hour TOTAL ______ Bbl

FINAL FLOWING WELLHEAD PRESSURE: TUBING ______ CASING 414 psig

WELL SHUT-IN AT 10:00 AM ~~PM~~ ______

GAS WELL DELIVERABILITY TEST CALCULATIONS

(BASE CONDITIONS = 14.65 psia and 60°F)

WELL NAME Widmer #1 LOCATION Naples W__

POOL OR ZONE Devonian Shale FINAL DATE OF TEST Nov. 26 1983

SIMPLIFIED ANALYSIS

	DURATION hours	SANDFACE PRESSURE psia	CALC.	MEAS.	$p^2 \times 10^{-3}$ psia^2	$\Delta p^2 \times 10^{-3}$ psia^2	FLOW RATE (q) Mscfd
INITIAL SHUT-IN	782	472	x		222.8		
FLOW 1	1	434	x		188.4	34.4	36
SHUT-IN	1	437	x		191.0		
FLOW 2	1	353	x		124.6	66.4	65
SHUT-IN	1	364	x		132.5		
FLOW 3	1	239	x		57.1	75.4	83
SHUT-IN	1	258	x		66.6		
FLOW 4	1	107	x		11.4	55.2	85
EXTENDED FLOW	4.5	130	x		16.9	205.9	11
FINAL SHUT-IN							

RESULTS

$q = C(\bar{p}_R^2 - p_{wf}^2)^n$

slope n = 0.89

$\bar{p}_R$ = 472 psia

$C = \dfrac{q}{(\bar{p}_R^2 - p_{wf}^2)^n}$

= 0.000205

AOF (Mscfd)

= 12

LIT (ψ) ANALYSIS (SEE NOTE ON REVERSE)

	DURATION hours	SANDFACE PRESSURE psia	ψ MM psia^2/cp	Δψ MM psia^2/cp	FLOW RATE (q) MMscfd	Δψ/q	q^2	Δψ - bq^2
INITIAL SHUT-IN								
FLOW 1								
SHUT-IN								
FLOW 2								
SHUT-IN								
FLOW 3								
SHUT-IN								
FLOW 4								
TOTAL = Σ								
EXTENDED FLOW								
FINAL SHUT-IN								

PRE-COMPLETION TESTS	TYPE TEST (dst, bail, etc.)	DURATION OF TEST	ZONES TESTED	AMOUNTS AND KINDS OF FLUIDS PRODUCED DURING TEST
	N/A	hrs.	ft. to ft.	
		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.)
	Bedrock	
0-487	Sand, silt & gravel w/shale pebbles	water @265', 425' - Artesian fresh
487-525	shale	Black, Artesian fresh water @ 478-491, Gas show at 505" - 50 MCF est., nearly exhausted by TD
525	Aprox. Tully Horizon	No Limestone present
525-1148	Shale	Dark gray and black. @796-825-slight gas odor when chips are immersed in HCL
1148-1183	Shale - Marcellus	Black
1183	Onondaga top (apprx)	
1183-1220	Limestone	Brownish gray to light gray to white, crystalline
1220	TD Driller	No gas flow or odor observed at TD
		Well not logged

INSTRUCTIONS

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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.

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
BUREAU OF MINERALS

17-366

WELL DRILLING AND COMPLETION REPORT

DO NOT WRITE IN SHADED AREA

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: Arlington Exploration Company

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

COUNTY: Ontario

TOWN: Naples

LEASE: Widmer Wine Cellars

WELL NO.: #1

LOCATION DESCRIPTION: N of S 525' W of E 4950' Naples 7.5 minute Quad
Lat. N42°37'25" Lon W77°23'37" Section C

ELEVATION: 723' ground level ft. 1 [ ] Derrick Floor 2 [ ] Kelly Bushing

FIELD NAME:

POOL NAME: Naples Prospect

FORMATIONS COMPLETED: Devonian Shale

DRILLING CONTRACTOR: Otis Eastern Services Inc.

DRILLING AND CORING

DATE DRILLING COMMENCED: Month 8 Day 24 Year 83

DATE DRILLING COMPLETED: Month 10 Day 13 Year 83

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

WELL DRILLED WITH CABLE TOOLS: From N/A ft. to N/A ft.

WELL DRILLED WITH ROTARY TOOLS: From Surface ft. to 1220 ft.

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

TLS

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

CORE RECOVERY: N/A ft.

CORES WERE: 1 [ ] Lab Analyzed N/A 2 [ ] Described

DRILLERS TOTAL DEPTH: 1220' ✓ ft.

PLUG BACK TOTAL DEPTH: N/A ft.

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

LOGS

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

CHECK OTHER LOGS RUN: 1 [ ] Gamma Ray-Neutron 2 [ ] Temperature 3 [ ] Caliper [ ] Others (Specify)

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. / 8 5/8" in.	471 ft. / 487.7 ft.	-- ft. / 357.7 ft.	145 sk. / sk.	ft. / ft.	
INTERMEDIATE OR WATER STRINGS	7 in.	714.5 ft.	-- ft.	sk.	surface ft.	circulated
PRODUCING	in.	ft.	ft.	sk.	ft.	
LINERS	in.	ft.	ft.	sk.	ft.	

FINAL COMPLETION

DATE FINAL COMPLETION: Month 10 Day 18 Year 83

WELL COMPLETED OPEN HOLE: From 783 ft. to ft.

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

TREATMENT OR STIMULATION

ZONES TREATED	SHOT, ACID, FRAC, ETC.	DETAILS OF TREATMENT (Kinds and Amounts of Materials, Rates, Pressures, Dates, Etc.)
783 ft. to 1183 ft.	Explosive Charge	400' of Judymite, 24' strings of explosive and primer joined by 6' primacord.
ft. to ft.		
ft. to ft.		
ft. to ft.		RECEIVED
ft. to ft.		FEB 02 1984
ft. to ft.		MINERAL RESOURCES
ft. to ft.		D.E.C. REGION 8

TYPE

INITIAL PRODUCTION

TYPE OF TEST: [ ] Pumping [X] Flowing

FLOWING TEST DATA: Choke Size ½ in. Flow.T.P. N/A psi Flow. C.P. 360 psi S.I.T.P. N/A psi S.I.C.P. 374 psi S.I. Time 125 Hrs.

DATE OF TEST: 10/24/83

DURATION OF TEST: 15 Hrs.

OIL PRODUCTION: N/A Bbls/Day

WATER PRODUCTION: N/A Bbls/Day

GAS PRODUCTION: 12 est 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: Vice President

DATE: 2/21/84

85-15-7 (1/75)

— SEE REVERSE SIDE FOR INSTRUCTIONS —

Widmer Sample Study P. 2

530- 540 Shale, dark gray, moderately calcareous as above, scattered pyrite
540- 567 as above, slightly calcareous, 20% black shale
567- 574 Shale, gray, calcareous, sandstone cavings?
574- 702 Shales, dark gray samples misplaced if taken
702- 714 Shale,dark gray, slightly calcareous
714- 747 as above, calcareous, tr. pyrite
747- 786 Shale very dark gray, slightly calcareous 30% dark gray
786- 796 as above, all very dark gray
796- 825 Shale, black, calcareous, slight gas odor when cips are immersed in HCl
825- 855 Shale, dark gray, slightly calcareous, 30% as above
855- 865 Shale, very dark gray to black, calcareous 20% light gray
865- 885 Shale,dark gray, calcareous, 20% black shale
885- 898 as above, 40% black shale
898- 960 Shale, very dark gray to black, calcareous
960- 980 Shale,dark gray, slightly calcareous
980- 990 Shale, very dark gray, calcareous
990-1148 Shale,dark gray to black, calcareous probably interbed of light & dark shales no limestones noted, darker? approximately 1126'
1148-1183 Shale, Marcellus black, moderately calcareous, tr. pyrite, 1 calcite vein filling noted as a caving in the next sample
1183 Approximate Onondaga Top
1183-1198 Limestone, Brownish gray to light gray mudstone no fossils or slickensides noted
1198-1204 Limestone, medium gray, crystalline, either black shale interbeds or lots of cavings
1204-1220 Limestone, gray to white, crystalline,(wackstone) fossiliferous(only coral fragments recognized)
1220TD driller

No gas flow or odor observed at TD

Well not logged

Widmer Wine Cellars #1 Naples Twp. Ontario Co. #17366

Sample Study During Drilling

0- 30	Gravel, sandy fresh water 12'
30- 40	Sand, 10% small pebbles
40- 60	Sand, finer - few crystalline pebbles
60- 90	Silt, brown sandy(clay content not determined)
90- 98	Sand,fine
98-105	Silt, brown sandy
105-145	as above with shale pebbles(dark gray)
145-165	as above, increase in sand content
165-185	Sand, fine silty, 10% shale pebbles
185-203	as above with larger well rounded shale pebbles
203-240	as above, 30% shale pebbles
240-250	Silt, 30% pebbles
250-265	Sand,fine brown, no pebbles
265-295	Silt and clay, few pebbles
295-315	Sand, coarse & pea gravel, pebbles well rounded
315-325	Gravel, coarse, dark gray siltstones and shales
325-332	as above, sandy
332-334	Sand, with large rounded shale pebbles
334-345	as above, no pebbles
345-350	as above, 20% pebbles
350-360	Gravel, sandy, coarse dark gray pebbles
360-375	as above, finer
375-387	as above, becoming coarser, no sand, looks more like bedrock cuttings-shales
387-397	Gravels,as above, 20% black shale & dark gray limestone
397-417	Silt, gray, scattered shale pebbles
417-447	Gravel, gray, silt,and shale pebbles
447-455	as above, sandy
455-465	as above, silty
465-472	Gravel- all dark shale pebbles
472-478	Shale, black calcareous, 10% nonshale gravel
478-491	Shale, black noncalcareous, 30% calcareous as above 5% nonshale gravel ARTESIAN FRESH WATER
491-498	Gravel, well rounded small pebbles(probably cavings)

487' approximate top of bedrock 8 5/8" casing seat

498-510 Shale,black, slightly calcareous, scattered limestone

505 Gas show 50MCF/d estimated nearly exhausted by TD

510-519 Shale, black, slightly calcareous, Tr. brachipod shell 1 calcite vein filling

519-530 as above, 40% gray shale(moderately calcareous) Tr pyrite

525' approximate Tully horizon, no limestone present

Page 2 Widmer #1 Daily drilling Report

10/10	Drill shale to 938'
10/11	" 1037'
10/12	" 1188' Top Onondaga Limestone approx 1183'
10/13	Drill Onondaga limestone to TD 1220' SD, WOshot
10/18	Otto Torpedo Co. set bridge @ 1198' fill back with gravel to 1183', loaded shot, top of shot @783' Shot fired 12:05PM Tag bottom @ 1210' after shot Well shutin 1:30PM well making 50MCF/d estimated just prior to shutin

Well pressures

	10 min.	10psi.	on guage
	90 min.	70psi.	"
10/19	18hr.	235psi.	"
10/24	144hr.	360psi	" Dead weight tester measured 374psi.

AM NOT SURE IF WELL WAS blown DOWN IN AM ON Weds (10/19) IF SO, 144hr TIME IS INCORRECT

Widmer Wine Cellars #1 Naples Twp, Ontario Co. #17366

Daily Drilling Report

8/24	Otis Eastern Services Rig spud well drill to 12'		
8/25	Drill & drive 10" conductor to	65'	
8/26	"	95'	
8/29	"	135'	
8/30	"	160'	
8/31	"	200'	
9/1	"	238'	
9/2	"	265'	flowed some water
9/6	"	294'	
	Hole filled up 100' of sand over weekend		
9/7	Drill & drive 10" conductor to	308'	
9/8	"	328'	Hard driving
9/9	"	337'	Gravel & quick sand
9/12	"	346'	Quick sand
9/13	"	377'	
9/14	"	397'	
9/15	"	407'	
9/16	"	425'	Artesian fresh water
9/19	"	465'	
9/20	"	471'	casing at refusal
9/21	Drill ahead to 478' sand & gravel coming in		
9/22	Drill to 498' cannot keep hole open - gravel caving in		
9/23	Spot cement to seal gravel		
9/26	Drill cement in pipe to 420'		
9/27	Drill cement to 470'		
9/28	Try to drill ahead gravel coming in		
9/29	Run 487'7" 8 5/8" casing(16 jts.) drove last 20'		
9/30	Drill to 519' SG 505'-50MCF/d estimated.		
10/1	Drill to 574' Annulus flowing fresh water-capped		
10/3	Drill to 635'		
10/4	" 695'		
10/5	Drill to 720' Run and cement 714.5' 7"(22jts.) Recovered 12jts. 8 5/8" casing(130' left in) Cement wiper plug only went 270' then pressured up to 500psi with no movement		
10/6	Drill cement 270' to 620'		
10/7	Drill cement and rock to 770'		

3sks.

145 sk [illegible]
40#
1/2 salt
1/4 flocele

Appendix B:

Drilling, completion and test reports for the Elmira (Hulsebosch) well

779-801	Shale, dark gray, moderately calcareous
801-811	Shale, very dark gray, calcareous, trace pyrite
811-826	Limestone, dark gray, shaly, trace fossils, trace calcite vein filling
826-828	as above, 30% black shale
828-846	Shale, dark gray to black, calcareous
846-857	Shale, black, moderately calcareous
857-860	as above, 40% light gray limestone(fossiliferous) trace pyrite
860-865	Shale, black, slightly calcareous, 30% dark gray calcareous shale, 5% limestone as above
865-871	Shale, black, noncalcareous, 20% dark gray calcareous
871-886	as above, 30% light gray crystalline limestone trace fossils, trace pyrite
886-894	Limestone, light gray mudstone, no fossils, trace pyrite, 10% crystalline limestone and 30% black shale as above
891	Top Onondaga limestone - driller
894-897	Limestone, medium gray to white(opaque), scattered rust stained pyrite, 20% shale cavings
897-900	Limestone, as above, hard drilling, sample very fine

900TD

1983

Sample Study during drilling

0- 30	Till & shale
30- 50	Shale, dark gray, calcareous, silty
50- 70	Limestone, gray brown, shaly with thin brown siltstone interbeds, trace pyrite
70- 80	Siltstone, medium gray, shaly, calcareous
80-110	as above, slightly calcareous, trace pyrite
110-128	Shale, dark gray, slightly calcareous, silty
128-135	gap
135-155	Shale dark gray to black, slightly calcareous
155-165	as above, moderately calcareous
165-215	Shale,black, moderately calcareous, trace pyrite
215-235	Shale,dark gray, slightly calcareous, 10% brown fine grained limestone(Tully ?)
235-260	Shale, medium gray, calcareous, trace brachiopod, trace pyrite, trace white calcite(vein filling ?)
260-266	Shale, as above, moderately calcareous
266-330	Shale, darker gray, calcareous
330-350	as above, very calcareous, trace calcite(white) vein filling, trace shell fragments
350-355	Limestone, medium gray, shaly
355-391	Shale, medium gray,calcareous
391-410	Shale, darker gray, calcareous
410-418	as above, 10% dark gray shaly limestone, Tr. fossils
418-446	Shale, medium gray, very calcareous
446-464	as above, slightly to moderately calcareous
464-472	as above, 40% dark gray moderately calcareous shale
472-482	Shale, medium gray, moderately calcareous, fracture surface coated with calcaite and pyrite
482-488	Shale, medium gray, calcareous, trace pyrite
488-494	Shale, dark gray, slightly calcareous, trace shell and pyrite
494-512	as above, moderately calcareous
512-520	as above, slightly calcareous
520-544	as above, slightly lighter gray
544-552	as above, darker gray
552-562	Shale, medium gray, extremely calcareous
562-572	Limestone, very dark gray, shaly, fossiliferous
572-582	Shale, dark gray, moderately calcareous
582-640	as above, calcareous
640-675	as above, 20% black shale
675-688	Shale, very dark gray to black, moderately calcareous
688-712	as above, extremely calcareous
712-724	Shale, black, slightly calcareous
724-779	as above, calcareous

Elliot #1 Daily Drilling Report page 2.

8/15 Drill to 897', Top Onondaga Limestone 891'
Water level @ 480' over weekend-did not change during drilling, rate still same-¼gal/min on swab test

16 Drill to 900'TD water level @ 480'
Swab hole dry for 45 min. - no gas flow detected
Water flow recovered @ ½gal/min.

17 Shut in well, release rig.

1983

Elliot #1 Middlesex Twp. Yates Co. N.Y.

Daily Drilling Report

7/6 Spud, set 27' conductor, drill to 40'
7 Drill 8" hole to 100', Fresh water @ 75'- fill hole to 10'
8 Drill to 165'

7/11 Drill to 260'
12 Drill to 350'
13 Drill to 413' TD 8" hole
14 Set 413' 7" casing and cement with good returns
15 Drill to 472'

7/18 Drill to 530', Slight gas odor during bailer runs
Fresh water entering below 500'
19 Drill to 600'
20 Drill to 675', water level @ 275'
21 Squeeze cement in open hole below casing
22 Drill out cement
cement 385'-500'
water 500'-550'
cement 550'-620'
water 620'-675' appears dry
drill to 688' hole making water
drill to 694' SD for weekend

7/25 Squeeze 150 sacks cement in open hole below casing
Cement level would not fall - left hole full of cement
Water level at 440' over weekend before squeeze
26 Drill cement to 525'
27 Drill cement and shale to 724'- cement solid to 694'TD
Fresh water entering hole below 694'
28 Drill to 779', water level @400'
29 Drill to 801', SD to run casing

8/1 Set 802' 4½" casing, 10.5# E.R.W. cement with 80 sacks, no cement return
Wait on cement
4 Drill plug, cement, float shoe and shale to 810', 4" hole
5 Drill to 812', Broke pin on bit,
6 Fish out bit, water level in hole @ 300'
Water slightly salty, Slight H_2S odor

8/8 Drill to 826', water level @ 300'
9 Drill to 857', hole makes ½gal/min on swab test
10 Drill to 865', Halliburton pressured up casing to 800psi.
hole taking little or no fluid.
Dump 12 sacks of cement followed by 5bbl water in hole
to seal water zone
11 Wait on cement
12 Drill cement and shale to 880', salty water entering
below 865', 120' water in hole

PRE-COMPLETION TESTS	TYPE TEST (dst, bail, etc.)	DURATION OF TEST	ZONES TESTED	AMOUNTS AND KINDS OF FLUIDS PRODUCED DURING TEST
	N/A	hrs.	ft. to ft.	
		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.)
	Bedrock	
0-30	Till & Shale	
30-50	Shale	
50-70	Limestone	Gray brown, shaly fresh water @75'
70-215	Shale	Dark gray to black, slightly to moderately calcareous
215-235	Shale-Limestone 10%	Limestone-brown, fine grained (Tully?)
235-562	Shale	Medium gray, darker gray with depth, calcareous -Limestone @350-355, medium gray shaly below 500' fresh water entering @530' - slight gas odor during bailer runs
562-572	Limestone	Very dark gray, shaly fossiliferous
572-811	Shale	Dark gray, shaly trace fossils, some black shales @688' hole making water, below 694' fresh water entering
811-828	Limestone	Dark gray, shaly, trace fossils, some black shales, @812-water in hole slightly salty, H_2S odor
828-891	Shale	Black, moderately calcareous t. calcareous 5% to 40% Limestone, light gray, 857-865' hole makes 1/4 gal/min. on swab test, below 865' salty water entering - first salt entrance
891	Top Onondaga - driller	
891-900	Limestone	medium gray to white
900	TD	at TD, water flow recovered @ ½ gal/min.
		Well not logged

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   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.

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
BUREAU OF MINERALS

WELL DRILLING AND COMPLETION REPORT

DO NOT WRITE IN SHADED AREA

GENERAL WELL INFORMATION

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

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

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

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

OPERATOR: Arlington Exploration Company

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

COUNTY: Yates

TOWN: Middlesex

LEASE: Lee W. Elliot

WELL NO.:

LOCATION DESCRIPTION: Lat. 42°45'31" Lon 77°14'49" Middlesex 7.5'quad, Sec. G

ELEVATION: 960 ft. Ground level 1 [ ] Derrick Floor 2 [ ] Kelly Bushing

FIELD NAME / POOL NAME: Rushville Prospect

FORMATIONS COMPLETED: None

DRILLING CONTRACTOR: Otis Eastern Service Inc.

DRILLING AND CORING

DATE DRILLING COMMENCED: Month 7 Day 6 Year 83

DATE DRILLING COMPLETED: Month 8 Day 17 Year 83

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

WELL DRILLED WITH CABLE TOOLS: From surface ft. to 900 ft.

WELL DRILLED WITH ROTARY TOOLS: From N/A ft. to N/A ft.

ROTARY DRILLING FLUID: 1 [ ] Mud 2 [ ] Air N/A TLS

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

CORE RECOVERY: N/A ft.

CORES WERE: 1 [ ] Lab Analyzed N/A 2 [ ] Described

DRILLERS TOTAL DEPTH: 900 ft.

PLUG BACK TOTAL DEPTH: N/A ft.

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

LOGS

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

CHECK OTHER LOGS RUN: 1 [ ] Gamma Ray-Neutron 2 [ ] Temperature 3 [ ] Caliper [ ] Others (Specify) None

CASING

TYPE	SIZE (O D)	DEPTH SET	CASING PULLED	AMOUNT CEMENT	EST. TOP CEMENT	CEMENT PUMPED, DUMPED OR CIRCULATED
DRIVE, SURFACE OR CONDUCTOR	7 in.	413 ft.	-- ft.	-- sk.	surface ft.	circulated
INTERMEDIATE OR WATER STRINGS	in.	ft.	ft.	sk.	ft.	
PRODUCING	4½ in.	802 ft.	-- ft.	80 sk.	100 ft.	~~complete circu-~~ ~~lation during~~ cementation ~~(no cement~~ returns)
LINERS	in.	ft.	ft.	sk.	ft.	

FINAL COMPLETION

DATE FINAL COMPLETION: Month N/A Day Year

WELL COMPLETED OPEN HOLE: From N/A ft. to ft.

PERFORATED INTERVALS	NO. OF SHOTS	PERFORATED INTERVALS (Cont'd.)	NO. OF SHOTS
N/A ft. to ft.		ft. to ft.	
ft. to ft.		ft. to ft.	
ft. to ft.		ft. to ft.	

TREATMENT OR STIMULATION

ZONES TREATED	SHOT, ACID, FRAC, ETC.	DETAILS OF TREATMENT Kinds and Amounts of Materials, Rates, Pressures, Dates, Etc.
ft. to ft.		
ft. to ft.		
ft. to ft.		
ft. to ft.		
ft. to ft.		
ft. to ft.		
ft. to ft.		

INITIAL PRODUCTION

TYPE OF TEST: [ ] Pumping [ ] Flowing

FLOWING TEST DATA: N/A Choke Size ___ in. Flow.T.P. ___ psi Flow. C.P. ___ psi S.I.T.P. ___ psi S.I.C.P. ___ psi S.I. Time ___ Hrs.

DATE OF TEST:

DURATION OF TEST: Hrs.

OIL PRODUCTION: N/A Bbls/Day

WATER PRODUCTION: N/A Bbls/Day

GAS PRODUCTION: N/A Mcf/Day

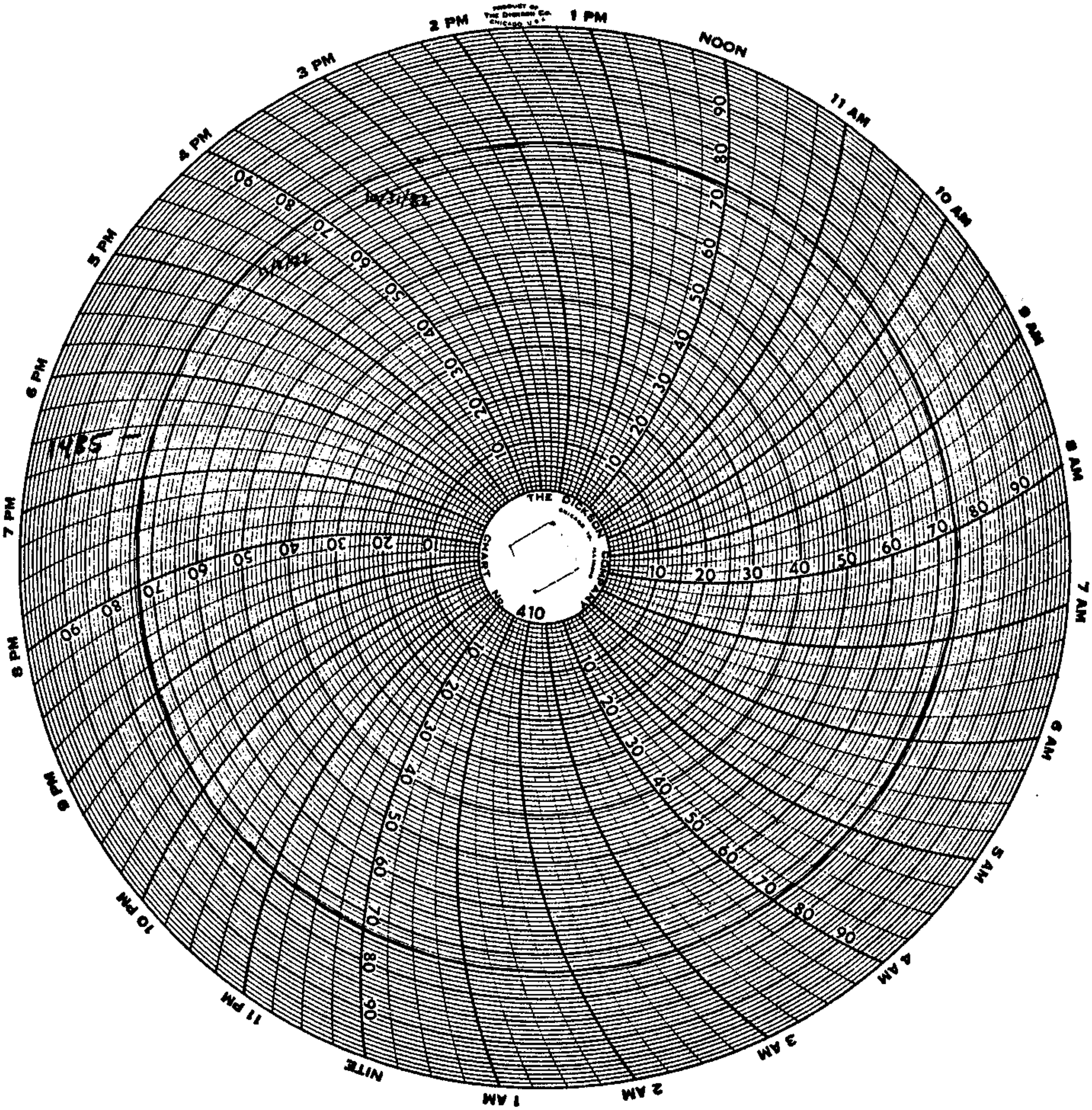
METHOD USED TO MEASURE GAS PRODUCTION: 1 [ ] Orifice Meter 2 [ ] Pitot Tube 3 [ ] Estimated

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 | TITLE | DATE

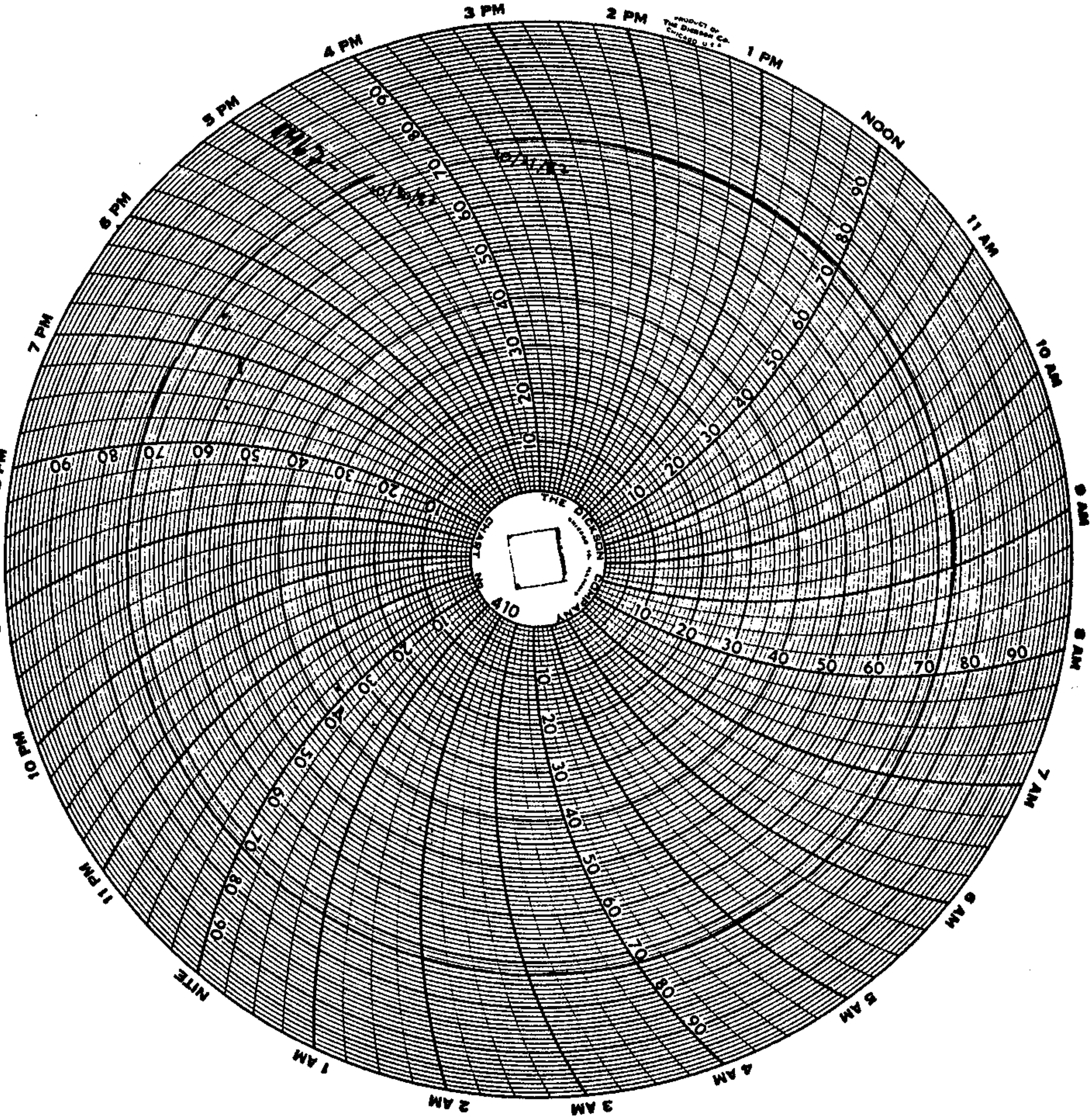
85-15-7 (1/75)

— SEE REVERSE SIDE FOR INSTRUCTIONS —



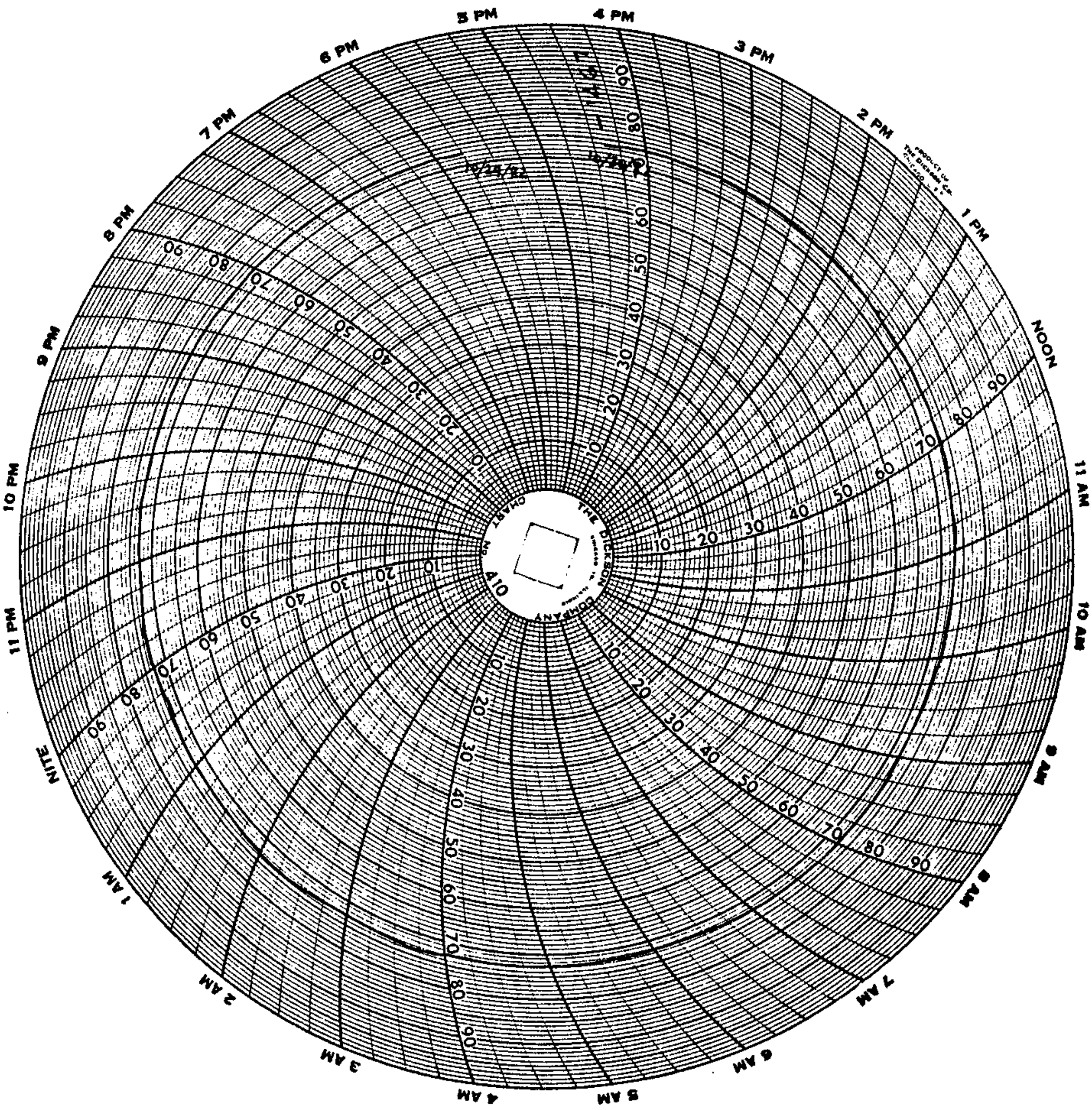
#1 Hulsebosch Pressure Build Up Test

On 10/31/82 3:30 p.m.
Off 11/2/82 4:45 p.m.



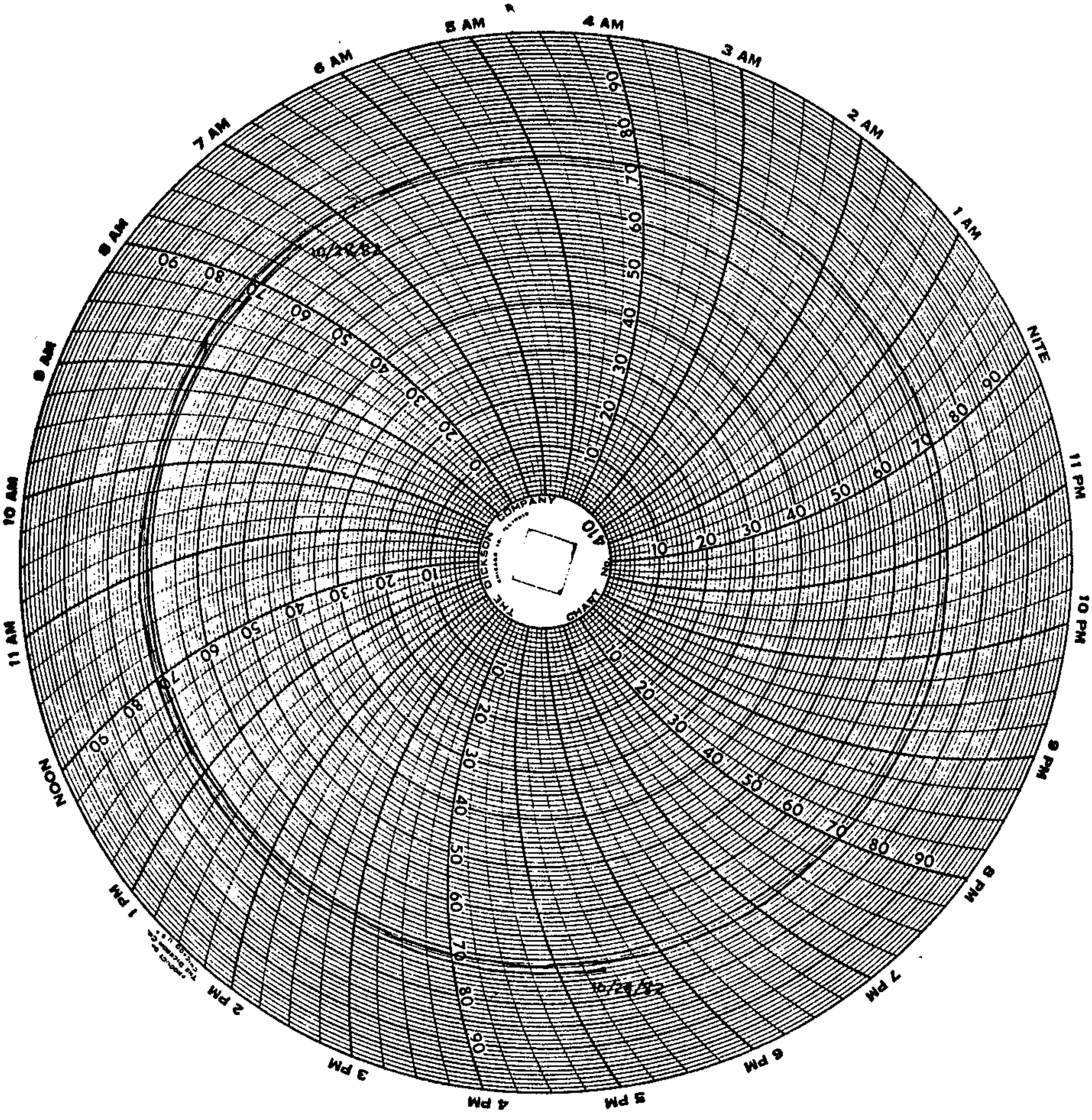
#1 Hulsebosch Pressure Build Up Test

On 10/30/82 4:20 p.m.
Off 10/31/82 3:30 p.m.



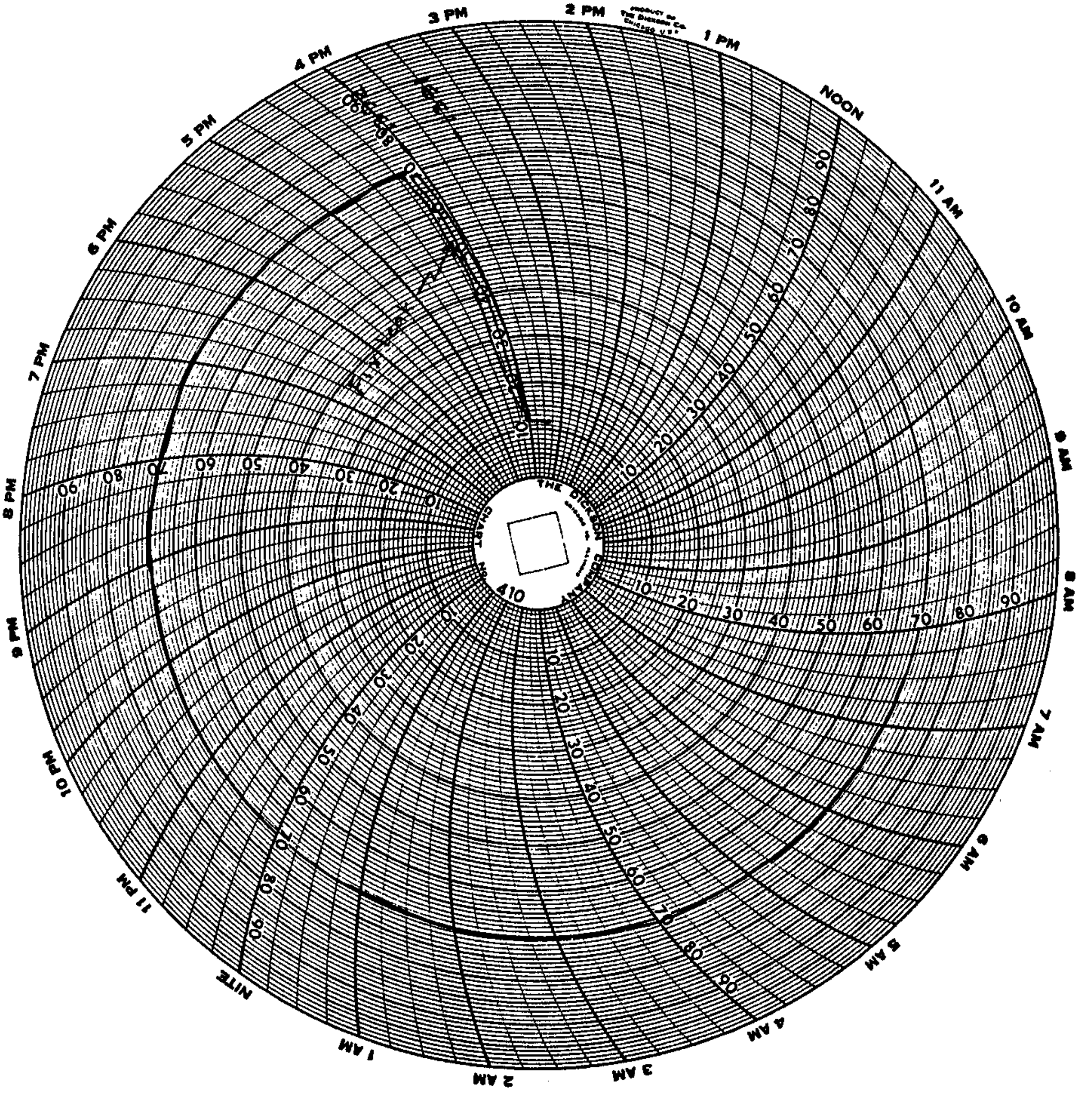
#1 Hulsebosch Pressure Build Up Test

On 10/29/82 5:45 p.m.
Off 10/30/82 4:20 p.m.



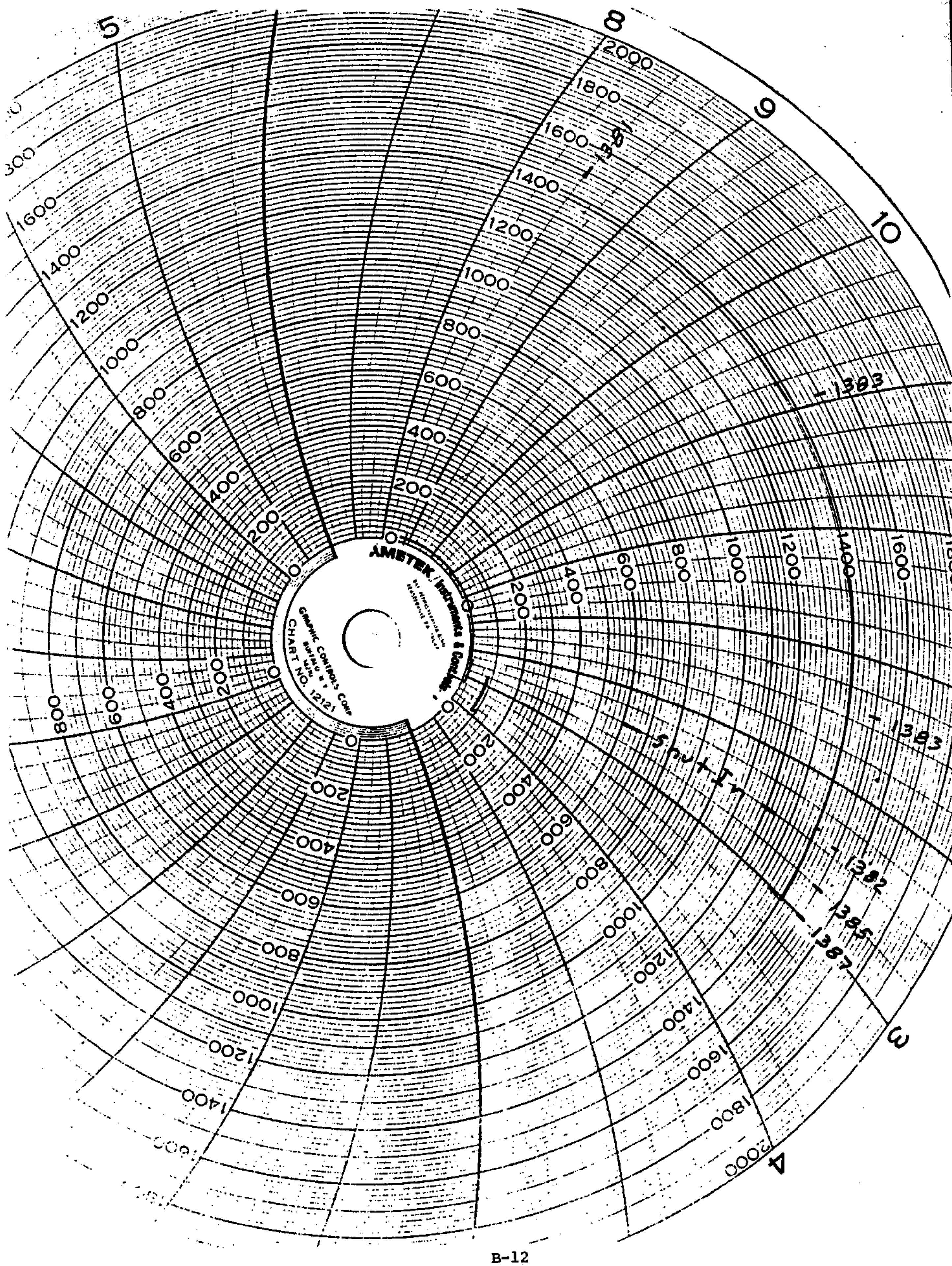
#1 Hulsebosch Pressure Build Up Test

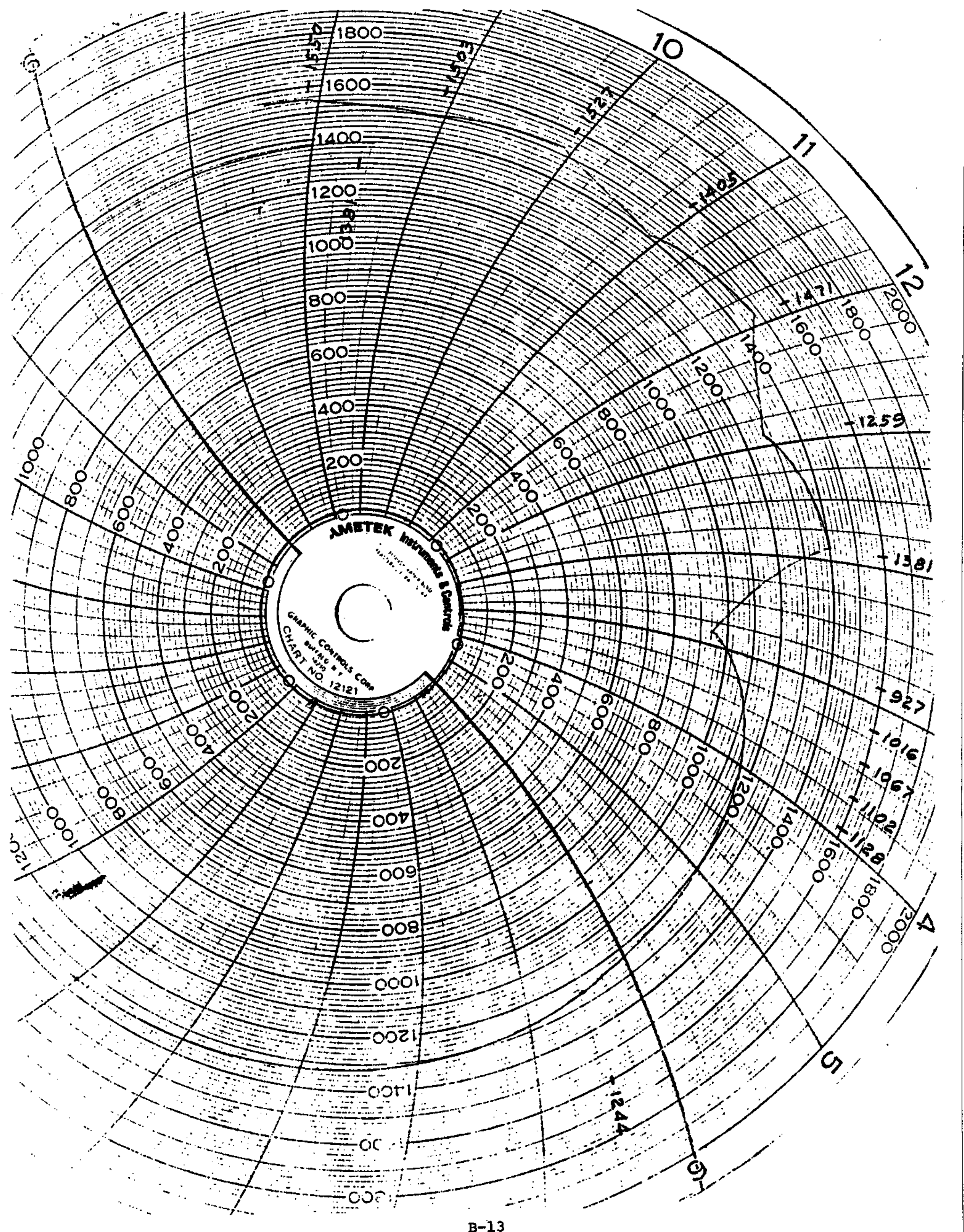
On 10/28/82 7:30 a.m.
Off 10/29/82 5:45 p.m.



#1 Hulsebosch Pressure Build Up Test

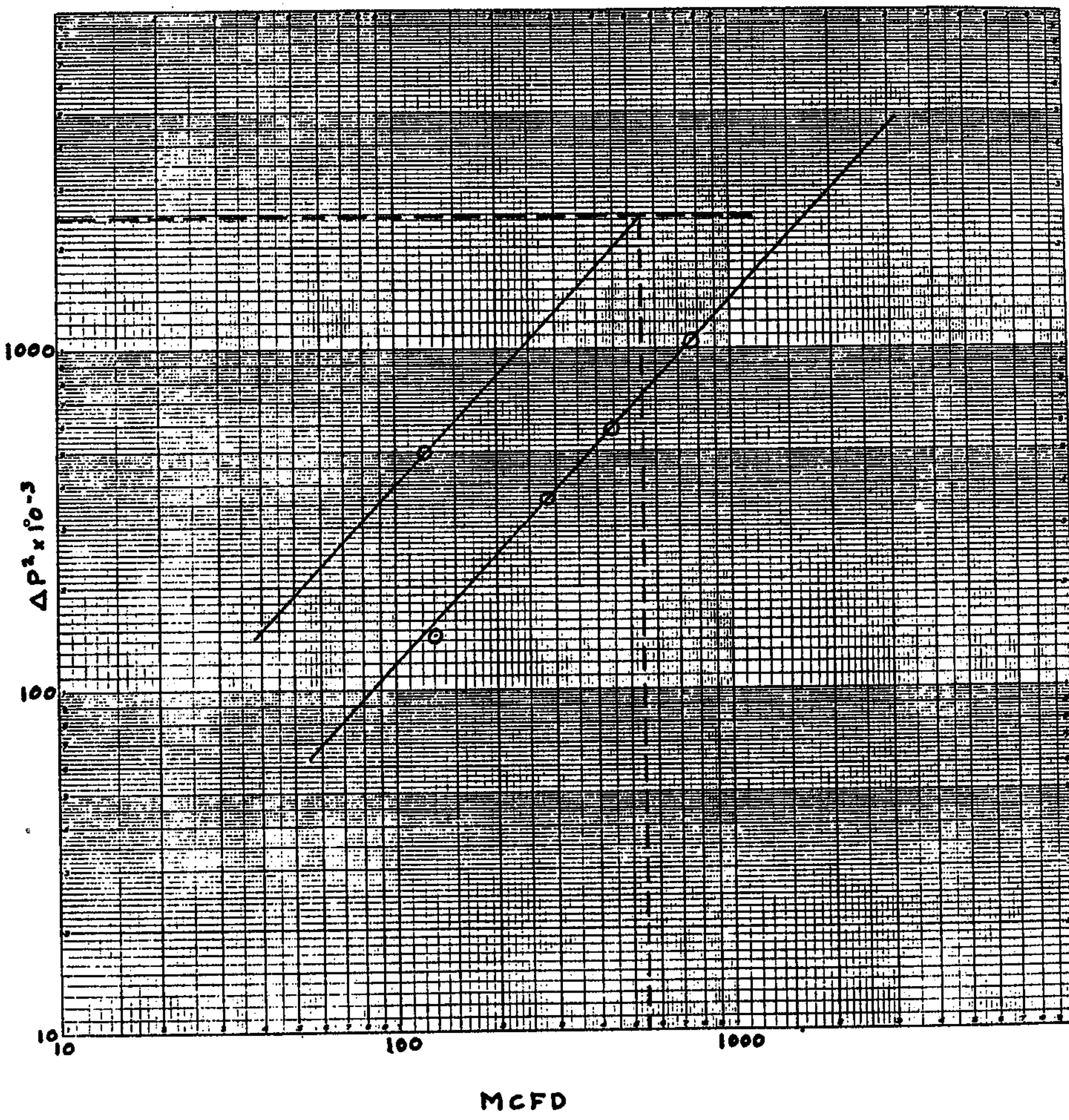
On 10/27/82 3:25 p.m.
Off 10/28/82 7:30 a.m.


AMETEK Instruments & Controls
GRAPHIC CONTROLS CORP
CHART NO. 12121
5
8
9
10
3
4
1383
1383
1382
1385
1387


AMETEK Instruments & Controls
GRAPHIC CONTROLS CORP
CHART NO. 12121
10
11
12
4
5
1405
1471
1259
1381
927
1016
1067
1102
1128
1244
1527

Hulsebosch

AOF = 545 MCFD



GAS WELL DELIVERABILITY TEST CALCULATIONS - FLOW RATES

(BASE CONDITIONS = 14.65 psia and 60°F)

CRITICAL FLOW PROVER

$q = 10^{-3} \; C \; P \; F_{tf} \; F_g \; F_{pv}$

RATE NO.	PROVER SIZE inches	ORIFICE DIAMETER inches	BASIC ORIFICE COEFFICIENT (C) Mcfd/lb.	STATIC PRESSURE (P) psia	FLOW. TEMP. FACTOR F_{tf}	SPECIFIC GRAVITY FACTOR F_g	SUPERCOMP. FACTOR F_{pv}	FLOW RATE Q MMscfd
1	2	1/16	.0848	1518	1.0178	1	1	131
2	2	3/32	.1975	1420	1.0127	1	1	284
3	2	1/8	.3506	1247	1.0088	1	1	441
4	2	3/16	.8052	942	1.0078	1	1	764
5	2	1/16	.0848	1397	1.0281	1	1	122

ORIFICE METER

$q = 24 \times 10^{-6} \; C' \sqrt{h_w \; P_f}$

$C' = F_b \; F_{pb} \; F_{tb} \; F_g \; F_{tf} \; F_r \; Y \; F_{pv} \; F_m$

$F_{pb} = 1.0055$

$F_{tb} = 1.0000$

RATE NO.	STAGE	METER RUN OR LINE SIZE inches	ORIFICE DIAMETER inches	STATIC PRESSURE P_f psia	DIFFERENTIAL INCHES H_2O h_w	BASIC ORIFICE FACTOR F_b	SPECIFIC GRAVITY FACTOR F_g	FLOW. TEMP. FACTOR F_{tf}
1	H							
	L							
2	H							
	L							
3	H							
	L							
4	H							
	L							
5	H							
	L							

ORIFICE METER CALCULATIONS (CONTINUED)

RATE NO.	STAGE	REYNOLDS FACTOR F_r	EXPANSION FACTOR Y	SUPERCOMP. FACTOR F_{pv}	MANOMETER FACTOR F_m	C' ft^3/hr	$\sqrt{h_w \; P_f}$	FLOW RATE Q MMscfd	TOTAL GAS PRODUCTION RATE MMscfd
1	H								
	L								
2	H								
	L								
3	H								
	L								
4	H								
	L								
5	H								
	L								

EG-34-10-75

FLANGE TAPS ☐ PIPE TAPS ☐

XXXXXXXXXXXX OF FLOW NO. 5 TO STABILIZATION

Date	Time	Cum. Time hrs	Static Pressure	Temp., F°		Remarks
10-26-82	2:55		927	52°		
	3:10	1/4	1016	58°		
	3:25	1/2	1067	58°		
	3:40	3/4	1102	58°		
	3:55	1	1228	57°		
	6:25	3 1/2	1244	48°		
10-27	8:25A	17 1/2	1381	8°		
	10:55	20	1383	12°		
	1:25P	22 1/2	1383	28°		
	2:25	23 1/2	1382	32°		Anulus - 200 psig
	2:30	Shut-In			*	(Gauge)
Pressure Build-Up:						
10-27	2:45P	1/4	1385			
	3:00	1/2	1387			Chart on @ 3:25 P.M.
	3:30	1	1391			small press. recorder
	3:45					Got gas sample
	4:00	1 1/2	1392			Reconn. Recorder
10-28	7:30A		1410 (Chart pressure)			
10-30	4:45P	74 1/2	1467 (Chart = 1470)	64°		
11-2	5:00P	146 1/2	1485	66°		(Chart = 1475; Gauge = 1500)

METER RUN OR PROVER SIZE 2 inches ORIFICE SIZE 1/16 inches

SEPARATOR CONDITIONS: HP SEP. ____ psig, ____ °F LP SEP. ____ psig, ____ °F

*Found some hydrates in choke nipple.

CONDENSATE PRODUCTION RATE ____ Bbl per hour TOTAL ____ Bbl

WATER PRODUCTION RATE ____ Bbl per hour TOTAL ____ Bbl

FINAL FLOWING WELLHEAD PRESSURE: TUBING ____ CASING 1382 psig

WELL SHUT-IN AT 2:30 XX/PM 10-27 19 82 TOTAL FLOW TIME 23 1/2 hours

FINAL SHUT-IN WELLHEAD PRESSURE: TUBING ____ CASING 1485 psig

Estimated Stabilization 122 hours TESTED BY (CO.) J. Keltz

GAS WELL DELIVERABILITY TEST - FIELD NOTES

SHUT-IN NO. 4 (INTERMEDIATE)

DATE	TIME	CUMULATIVE SHUT-IN TIME hours	WELLHEAD PRESSURE psig TUBING	WELLHEAD PRESSURE psig CASING	WELLHEAD TEMPERATURE °F
10-26	12:55			1259	
	1:10	1/4		1314	61°
	1:25	1/2		1344	67°
	1:40	3/4		1365	70°
	1:55	1		1381	72°

REMARKS

FLOW NO. 4 WELL OPENED AT 1:55 ~~AM~~ / PM 10-26 19 82

DATE	TIME	CUMULATIVE FLOW TIME hours	WELLHEAD PRESSURE psig TUBING	WELLHEAD PRESSURE psig CASING	WELLHEAD TEMPERATURE °F	METER OR PROVER DATA STATIC PRESSURE psig	DIFFERENTIAL inches H_2O	TEMPERATURE °F
10-26	1:55			1381	72°			
	2:10	1/4				1191		51°
	2:25	1/2				1075		51°
	2:40	3/4				991		52°
	2:55	1				927		52°
		Little hydrates on back of plate.						

METER RUN OR PROVER SIZE 2 inches ORIFICE SIZE 3/16 inches

SEPARATOR CONDITIONS: HP SEP. ______ psig, ______ °F LP SEP. ______ psig, ______ °F

CONDENSATE PRODUCTION RATE ______ Bbl per hour TOTAL ______ Bbl

WATER PRODUCTION RATE ______ Bbl per hour TOTAL ______ Bbl

FINAL FLOWING WELLHEAD PRESSURE: TUBING ______ CASING 927 psig

GAS WELL DELIVERABILITY TEST - FIELD NOTES

SHUT-IN NO. 3 (INTERMEDIATE)

DATE	TIME	CUMULATIVE SHUT-IN TIME hours	WELLHEAD PRESSURE psig TUBING	WELLHEAD PRESSURE psig CASING	WELLHEAD TEMPERATURE °F
10-26	10:55			1405	
	11:10	1/4		1434	45°
	11:25	1/2		1451	50°
	11:40	3/4		1462	56°
	11:55	1		1471	60°

REMARKS

FLOW NO. 3 WELL OPENED AT 11:55 AM / PM 10-26 19 82

DATE	TIME	CUMULATIVE FLOW TIME hours	WELLHEAD PRESSURE psig TUBING	WELLHEAD PRESSURE psig CASING	WELLHEAD TEMPERATURE °F	METER OR PROVER DATA STATIC PRESSURE psig	DIFFERENTIAL inches H_2O	TEMPERATURE °F
10-26	11:55			1471	60°			
	12:10	1/4				1390		50°
	12:25	1/2				1337		50°
	12:40	3/4				1296		50°
	12:55	1				1259		51°

Little condensation on back of plate.

METER RUN OR PROVER SIZE 2 inches ORIFICE SIZE 1/8 inches

SEPARATOR CONDITIONS: HP SEP. ______ psig, ______ °F LP SEP. ______ psig, ______ °F

CONDENSATE PRODUCTION RATE ______ Bbl per hour TOTAL ______ Bbl

WATER PRODUCTION RATE ______ Bbl per hour TOTAL ______ Bbl

FINAL FLOWING WELLHEAD PRESSURE: TUBING ______ CASING 1259 psig

SHUT-IN NO. 2 (INTERMEDIATE)

DATE	TIME	CUMULATIVE SHUT-IN TIME hours	WELLHEAD PRESSURE psig		WELLHEAD TEMPERATURE °F
			TUBING	CASING	
10-26	8:55			1503	
	9:10	1/4		1514	38°
	9:25	1/2		1520	37°
	9:40	3/4		1524	37°
	9:55	1		1527	37°

REMARKS

FLOW NO. 2 WELL OPENED AT 9:55 AM/~~PM~~ 10-26 19 82

DATE	TIME	CUMULATIVE FLOW TIME hours	WELLHEAD PRESSURE psig		WELLHEAD TEMPERATURE °F	METER OR PROVER DATA		
			TUBING	CASING		STATIC PRESSURE psig	DIFFERENTIAL inches H_2O	TEMPERATURE °F
10-26	9:55			1527	37°			
	10:10	1/4				1478		45°
	10:25	1/2				1448		46°
	10:40	3/4				1424		46°
	10:55	1				1405		47°

Little condensation on back of plate.

METER RUN OR PROVER SIZE 2 inches ORIFICE SIZE 3/32 inches

SEPARATOR CONDITIONS: HP SEP. ______ psig, ______ °F LP SEP. ______ psig, ______ °F

CONDENSATE PRODUCTION RATE ______ Bbl per hour TOTAL ______ Bbl

WATER PRODUCTION RATE ______ Bbl per hour TOTAL ______ Bbl

FINAL FLOWING WELLHEAD PRESSURE: TUBING ______ CASING 1405 psig

WELL SHUT-IN AT ______ AM/PM

GAS WELL DELIVERABILITY TEST – FIELD NOTES

WELL NAME #1 Hulsebosch LOCATION Elmira W___

FIELD OR AREA ____________ POOL OR ZONE Marcellus

PERF./XXXXXXXX INTERVAL 2894'-2954.3 PRODUCING THROUGH: XXXXXX casing [X] ANNULUS [ ]

WELL BLOWN FOR ______ minutes SPRAY: WATER/CONDENSATE CLEAR IN ______ minutes

DATE SHUT-IN ______ 19___ TIME ______ TOTAL SHUT-IN TIME ______ hours

SHUT-IN NO. 1 (INITIAL)

DATE	TIME	CUMULATIVE SHUT-IN TIME hours	WELLHEAD PRESSURE psig TUBING	WELLHEAD PRESSURE psig CASING	WELLHEAD TEMPERATURE °F
10-26-82				1550	30°

REMARKS

All pressures DWT unless otherwise indicated.

FLOW NO. 1 WELL OPENED AT 7:55 AM/XX 10-26 19 82

DATE	TIME	CUMULATIVE FLOW TIME hours	WELLHEAD PRESSURE psig TUBING	WELLHEAD PRESSURE psig CASING	WELLHEAD TEMPERATURE °F	METER OR PROVER DATA: STATIC PRESSURE psig	DIFFERENTIAL inches H_2O	TEMPERATURE °F
10-26	7:55A			1550	30°			
	8:10	1/4				1532		40°
	8:25	1/2				1520		41°
	8:40	3/4				1511		41°
	8:55	1				1503		42°
		Little hydrates on back of plate.						

METER RUN OR PROVER SIZE 2" inches ORIFICE SIZE 1/16 inches

SEPARATOR CONDITIONS: HP SEP. ______ psig, ______ °F LP SEP. ______ psig, ______ °F

CONDENSATE PRODUCTION RATE ______ Bbl per hour TOTAL ______ Bbl

WATER PRODUCTION RATE ______ Bbl per hour TOTAL ______ Bbl

FINAL FLOWING WELLHEAD PRESSURE: TUBING ______ CASING 1503 psig

WELL SHUT-IN AT ______ AM/PM ______ 19___ TOTAL FLOW TIME 1 hours

* [illegible] PRESSURES MUST BE OBTAINED UPSTREAM OF ANY CHOKING DEVICE

GAS WELL DELIVERABILITY TEST CALCULATIONS

(BASE CONDITIONS = 14.65 psia and 60°F)

WELL NAME #1 Hulsebosch LOCATION Elmira W__

POOL OR ZONE Marcellus FINAL DATE OF TEST 11-2 19 82

SIMPLIFIED ANALYSIS

	DURATION hours	~~WELLHEAD~~ WH PRESSURE psia	CALC.	MEAS.	$p^2 \times 10^{-3}$ psia²	$\Delta p^2 \times 10^{-3}$ psia²	FLOW RATE (q) ~~M~~Mscfd
INITIAL SHUT-IN		1565		X	2449		
FLOW 1	1	1518		X	2304	145	131
SHUT-IN	1	1542		X	2378		
FLOW 2	1	1420		X	2016	362	284
SHUT-IN	1	1486		X	2208		
FLOW 3	1	1274		X	1623	585	441
SHUT-IN	1	1396		X	1949		
FLOW 4	1	942		X	887	1062	764
EXTENDED FLOW	20	1397		X	1952	497	122
FINAL SHUT-IN	122	1500		X	2250		

RESULTS

$q = C\left(\bar{p}_R^2 - p_{wf}^2\right)^n$

slope n = ______

$\bar{p}_R$ = ______ psia

$C = \dfrac{q}{\left(\bar{p}_R^2 - p_{wf}^2\right)^n}$

= ______

AOF (~~M~~Mscfd)

= 545

(see graph)

LIT (ψ) ANALYSIS (SEE NOTE ON REVERSE)

	DURATION hours	SANDFACE PRESSURE psia	ψ MM psia²/cp	$\Delta\psi$ MM psia²/cp	FLOW RATE (q) MMscfd	$\Delta\psi/q$	q^2	$\Delta\psi - bq^2$
INITIAL SHUT-IN		---						
FLOW 1								
SHUT-IN								
FLOW 2								
SHUT-IN								
FLOW 3								
SHUT-IN								
FLOW 4								
TOTAL = Σ								
EXTENDED FLOW								
FINAL SHUT-IN								

DISCARDED POINT ______

N = ______ $\bar{\psi}_R$ = ______ MMpsia²/cp

$$a, a_t = \frac{\Sigma \frac{\Delta\psi}{q} \Sigma q^2 - \Sigma q \Sigma \Delta\psi}{N \Sigma q^2 - \Sigma q \Sigma q} = \_\_\_\_\_\_$$

$$b = \frac{N \Sigma \Delta\psi - \Sigma q \Sigma \frac{\Delta\psi}{q}}{N \Sigma q^2 - \Sigma q \Sigma q} = \_\_\_\_\_\_$$

(EXTENDED FLOW) a = ______ b = ______

RESULTS

TRANSIENT FLOW: $\bar{\psi}_R - \psi_{wf} = a_t q + bq^2$

i.e. ______ $- \psi_{wf}$ = ______ q + ______ q^2

STABILIZED FLOW: $\bar{\psi}_R - \psi_{wf} = aq + bq^2$

i.e. ______ $- \psi_{wf}$ = ______ q + ______ q^2

DELIVERABILITY:

$$q = \frac{1}{2b}\left[-a + \sqrt{a^2 + 4b\left(\bar{\psi}_R - \psi_{wf}\right)}\right]$$

10-28-82	Changed chart @ 7:30 a.m.
	Pressure from chart - 1410 psig
10-30-82	Changed chart @ 4:20 p.m.
	Took DWT - 1467 psig
11-2-82	Found pressure stabilized @ 1485 psig - DWT. Removed recorder and installed pressure gauge on wellhead.
	Test complete.
11-20-82	3:30 p.m. Took DWT - 1507 psig (577 hrs.); Gauge pressure - 1530 psig. GFS at well site to install separator.
	Refer to Daily Activity Report of 10-25-82: The annulus gas leak referred to is coming from the 8-5/8" collar on the top joint of casing. This collar apparently was not set up properly when it was installed.

Energy Storage Ventures | John F. Keltz, Consultant, P.O. Box 376, Honeoye, NY 14471, 716 229-5161

#1 Hulsebosch - Flow Test

10-25-82 Met Dr. Hulsebosch. Checked well site. Found 4½" frac valve closed and chainlocked. Casing pressure 1600+ psig.

Gas started leaking below 8-5/8" collar while attempting to remove chain.

Opened annulus, got strong steady blow and shut in. Open estimated 20 sec. Gas stopped leaking.

Opened frac valve to check casing pressure - 1560 psig

Checked annulus pressure - 47 psig

Rigged up equipment for flow test

10-26-82 Checked annulus pressure - 170 psig

Chart on recorder @ 7:30 a.m.

DWT - 1550 psig. Start flow test @ 7:55 a.m. with 1/16" plate. Complete 4th flow rate @ 2:55 p.m., with 3/16" plate and start stabilization flow w/ 1/16" plate.

10-27-82 Well stabilized @ 1382 psig on 1/16" plate.

Shut in @ 2:30 p.m. Found some hydrates in choke nipple which may have affected flow rate.

Installed small pressure recorder to record final build-up.

Took gas sample for analysis.

Rig down flow test equipment.

PRE-COMPLETION TESTS	TYPE TEST (dst, bail, etc.)	DURATION OF TEST	ZONES TESTED	AMOUNTS AND KINDS OF FLUIDS PRODUCED DURING TEST
	N/A	hrs.	ft. to ft.	
		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.)
	Bedrock	
0-80'	Gravel	Water at 77'
80'-1770'	Silty Shale	Water at 1350', Gas Shows 1180', 1285', 1454', 1502', 1563', 1612'
1770'-1878'	Tully Limestone	
1978'-2700'	Shale	
2700'-2850'		Shale, dark gray moderately calcareous
2850'-2860'		As above 30% black shale
2860'-2900'	Marcellus Top 2875	Shale, black, slightly calcareous, 30% as above
2900'-2925'		Shale, black, calcareous, scattered pyrite, tr calcite (white) vein filling
2925'-2940'		As above, slighty calcareous
2940'-2949'		Shale, dark gray, calcareous
2949'-2990'	Onondaga 2964'	Shale, black, slightly calcareous, tr pyrite, tr calcite (white) vein filling
2990'-3014'		Limestone, dark gray, shaly, tr pyrite & coral frag
3012		Bentonite
3014'-3030'	Oriskany Top 3016'	Limestone darker gray shaly
3030'		Oriskany white sandstone fragments in circulation at TD
3030'		TD

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.

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
BUREAU OF MINERALS

WELL DRILLING AND COMPLETION REPORT

DO NOT WRITE IN SHADED AREA

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: Arlington Exploration Company

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

COUNTY: Chemung **TOWN:** Elmira

LEASE: A.P. & J.O. Hulsebosch **WELL NO.** 1

LOCATION DESCRIPTION: Elmira 7.5 minute Quad.
Lat. N. 42° 04' 52" W 76° 46' 22" Section F

ELEVATION: 1,078 ft. 1 [ ] Derrick Floor 2 [X] Kelly Bushing

FIELD NAME / POOL NAME: Elmira Prospect

FORMATIONS COMPLETED: Devonian Shale (Marcellus)

DRILLING CONTRACTOR: H.L. Murry Drilling Company

DRILLING AND CORING

DATE DRILLING COMMENCED: Month 8 Day 9 Year 82

DATE DRILLING COMPLETED: Month 8 Day 14 Year 82

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

WELL DRILLED WITH CABLE TOOLS: From N/A ft. to N/A ft.

WELL DRILLED WITH ROTARY TOOLS: From surface ft. to 3,0 ft.

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

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

CORE RECOVERY: N/A ft.

CORES WERE: N/A 1 [ ] Lab Analyzed 2 [ ] Described

DRILLERS TOTAL DEPTH: 3,030 ft.

PLUG BACK TOTAL DEPTH: N/A ft.

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

LOGS

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

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

CASING

TYPE	SIZE (O.D.)	DEPTH SET	CASING PULLED	AMOUNT CEMENT	EST. TOP CEMENT	CEMENT PUMPED, DUMPED OR CIRCULATED
DRIVE, SURFACE OR CONDUCTOR	12 1/4 in.	67 ft.	– ft.	– sk.	– ft.	–
	8 5/8 in.	518 ft.	– ft.	150 sk.	Surface ft.	Circulated
INTERMEDIATE OR WATER STRINGS	N/A in.	ft.	ft.	sk.	ft.	
PRODUCING	4 1/2 in.	3005 ft.	– ft.	300 sk.	1600 ft.	Circulated
LINERS	N/A in.	ft.	ft.	sk.	ft.	

FINAL COMPLETION

DATE FINAL COMPLETION: Month 8 Day 23 Year 82

WELL COMPLETED OPEN HOLE: From – ft. to – ft.

PERFORATED INTERVALS	NO. OF SHOTS	PERFORATED INTERVALS (Cont'd.)	NO. OF SHOTS
2900 ft. to 2960 ft.	10	– ft. to ft.	
ft. to ft.		ft. to ft.	
ft. to ft.		ft. to ft.	

TREATMENT OR STIMULATION

ZONES TREATED	SHOT, ACID, FRAC, ETC.	DETAILS OF TREATMENT Kinds and Amounts of Materials, Rates, Pressures, Dates, Etc.
2900 ft. to 2960 ft.	Foam Frac	8-19-82 BRKDN – 3000 psi; ATP – 2994 psi; Aver. Rate – 4.2 BPM; Sand 60,000 Lbs; Water 350 BBLS; Nitrogen – 1,042,000 SCF
ft. to ft.		
ft. to ft.		
ft. to ft.		
ft. to ft.		
ft. to ft.		
ft. to ft.		

INITIAL PRODUCTION

TYPE OF TEST: [ ] Pumping [X] Flowing

FLOWING TEST DATA: Choke Size 1/16 in. Flow. T.P. N/A psi Flow. C.P. 1382 psi S.I.T.P. N/A psi S.I.C.P. 1485 psi S.I. Time 122 Hrs.

DATE OF TEST: 10/26/82 **DURATION OF TEST:** 8 Hrs.

OIL PRODUCTION: N/A Bbls/Day **WATER PRODUCTION:** N/A Bbls/Day **GAS PRODUCTION:** 122 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. for Operations **DATE:** 12/15/82

85-15-7 (1/75)

– SEE REVERSE SIDE FOR INSTRUCTIONS –

Appendix C:

Daily drilling report and sample study on Rushville (Elliot) well

ARLINGTON EXPLORATION COMPANY

HULSEBOSCH #1

Sunday
8/22/82

12:00 pm Last run with sand pump recovers very little sand and traces of cement. Cement indicating well cleaned out to plug.
Let well sit.

12:50 am Run swab and recovered only a trace of water. Well cleaned to TD. No sand or water in hole andnone apparently coming in. Left well open.

1:25 pm Changed to 3000 psi Mastergate on wellhead.

3:00 pm Made final swab run. Recovered estimated 1/8 bbl water.

4:00 pm Nat. Gas 78% of stream.
Released rig.

5:00 pm Flow rate 125 MCF. 78% Nat. gas.

Monday
8/23/82

6:30 am Nat. Gas 81% of stream.

7:00 am Flow rate 106 MCF/day. Well shut in.

7:30 am Annulus pressure 140 psi.
Well chained and locked closed.

ARLINGTON EXPLORATION COMPANY

HULSEBOSCH #1

Friday
8/20/82

1:30 pm	Recovered some sand from hole but sand appears to be coming in from formation.
3:30 pm	Recovered sand from hole to 2955'. Below bottom perf. Shut in.
4:00 pm	Opened well after ½ hr shut in & recovered very little sand and no water. Tested flow rate=200 MCF/day. Open 24 hrs.
4:10 pm	Check annulus pressure @180 psi. Released crew for travel to yard at Millport.

Saturday
8/21/82

7:00 am	Flow rate 147 MCF/day. Had been open almost continuously since frac. (39 hrs)
8:00 am	Started swabbing. Approx. 970' water in hole.
9:00 am	Total fluid in blowback tank 155 bbls. (Approx. 141 bbls water). Hauled 120 bbls from tank.
12:00 pm	Swabbed, bailed and pumped sand to 2915 on sand. Sand apparently coming into hole.
1:00 pm	Sand is packed hard and sand pump will not pick. Dart bailer will not either.
1:30 pm	Running swab to recover 500' of fluid over sand. Recovered some acid on first two runs.
2:45 pm	Water swabbed. Shut well in to blow back sand.
5:30 pm	SIWHP 480 psi. Blew well down. No water, some sand.
5:45 pm	Well shut in overnite.
10:00 pm	SIWHP 550 psi.
12:00 pm	SIWHP 800 psi.

Sunday
8/22/82

7:00 am	SIWHP 1000 psi after 13 hr shut in. Blew well down. Carried some sand and no water.
8:00 am	Ran swab and picked top of sand at 2961. (7' below bottom perf).
8:45 am	Ran swab. Recovered no sand and very little amount of spent acid and water.
9:00 am	Running sand pump and recovering good amounts of sand. Sand in pocket was apparently loosened enabling sand pump to recover by blowing well down.
10:00 am	Checked open flow. 163 MCF/day. Well open 3 hrs. Continuing to pump sand.
11:30 am	Recovered 19 perf balls in one run with sand pump.

ARLINGTON EXPLORATION COMPANY

HULSEBOSCH #1

Thursday

8/19/82

8:18 am	Start acid breakdown. Test lines. Breakdown ± 3000 psi. Ppg in acid @ ± 3100 lbs, 21 BPM.
8:24 am	Stop ppg in @752 gal. ISIP drop to zero.
8:38 am	Resumed ppg.
8:45 am	Drop 20 perf balls. 19 BPM.
8:50 am	Shut down. WHP 4400, 1017 gas total. 5 min 2400 (?) error 10 min 2400
9:05 am	Well closed in to hook hook up to flow back.
10:20 am	Opened well to flow back into tank and top connection (Ell) on turn into tank blew off. Shut in.
10:30 am	Repiped with Halliburton iron and (opened partially) to flow back. Fair blow for 1 minute and well went dead. Left well open.
10:50 am	Waiting on KCl from Bradford to treat frac water.
11:20 am	Measured fluid in blowback tank as 18 bbls. Added estimated 10 bbls blown free = 28 bbls.
2:30 pm	Calcium Chloride on location & unloaded to dump in hopper with sand.
3:00 pm	Start frac. Pumping in at 5 BPM and 3100 psi.
3:15 pm	Start sand.
3:25 pm	Treating at 5.1 BPM, 3190 psi.
4:00 pm	Dump frac beads in hopper. 1042.80 gal. total. Spread out over last 12 min. of frac.
4:13 pm	Finish sand & nitrogen. Start 1500 gal water only, to displace sand to above top perf.
4:23 pm	Well closed in. Break off.
5:10 pm	2400 psi SIWHP.
5:45 pm	Started to flow back, 1/8 choke. 2200 psi WHFP.
	See attached schedule of frac flowback.

Friday

8/20/82

7: 45am	Well completed flow back from fracing. Flowing at small gas rate, 0 psi WHP, no gas odor.
8:45 am	Opened well. Check TD @2933 indicating 21' frac sand above bottom perf.
9:00 am	Start swabbing.
1200 pm	Swabbed fluid level to 2700. Started sand pump.

Arlington Exploration Company

137 NEWBURY STREET, BOSTON, MA 02116, USA, (617) 267-7600, TELEX: 940-557

HULSEBOSCH #1 WELL

Completion Report

Wednesday
8/18/82

5:45 am Birdwell on location to log.

6:30 am Commence logging.
Log difference 5' in correlating with log of 8/13/82. (Log zero top frac valve.)
Partial bonding thru Marcellus from 2900 to 2960. Bond above and below, good.

8:40 am Completed logging.
Correlated logs for perforating.

Old Log	New Log	
2900	2894	
2906.7	2900.7	
2913.3	2907.4	
2920	2914.1	(should be 2914) slight error in log pick.
2926.7	2920.8	
2933.3	2927.5	
2940	2934.2	(should be 2934) slight error in log pick.
2946.7	2940.9	
2953.3	2947.6	
2960	2940.9	
2953.3	2947.6	
2960	2954.3	

10:15 am Verified shot spacings for bottom 2 guns.

10:50 am Well swabbed dry.
Waiting on acid.

2:18 pm Haliburton on location to spot acid.

2:25 pm Haliburton spotted 200 gal HF acid and off location.

2:40 pm Birdwell start perforating run 1.

3:20 pm Complete run 1. Perforate 2934.2-2954.3, 4 shots.

4:30 pm Complete run 2. Perforate 2907.4-2927.3, 4 shots.

5:55 pm Complete run 3. Perforate 2900 & 2906.7.

5:55 pm Completed perforating.

5:55 pm Haliburton waiting to move on location.

6:25 pm Released rig. Rigged down & moved off location.

8:15 pm Haliburton on location & hooked up.

A.P. & J.O. Hulsebosch #1 Well page 2

Sample Study During Drilling

2700 - 2850 Shale, dark gray moderately calcareous
2850 - 2860 as above 30% black shale
2860 - 2900 Shale, black, slightly calcareous, 30% as above
2900 - 2925 Shale, black, calcareous, scattered pyrite, tr calcite(white) vein filling
2925 - 2940 as above, slightly calcareous
2940 - 2949 Shale, dark gray, calcareous
2949 - 2990 Shale, black, slightly calcareous, tr pyrite, tr calcite(white) vein filling
2990 - 3014 Limestone, dark gray, shaly, tr pyrite & coral frag.
3012 Bentonite
3014 - 3030 Limestone darker gray shaly
3030 Oriskany white sandstone fragments in circulation @ TD
3030 Driller TD

PRODUCTION CASING TALLY

70 jts.	2978.30'	baffle 23.02' above shoe between joints 7 & 8
Bottom shoe & pup	23.02	
Marker pup	5.03	
	3006.35	

Shoe 4' above bottom(tagged)

6 centralizers on collars: pup,2,4,6,8,30

Cemented with 300 sacks 50/50 pozmix, 10% salt, ¼# flocele

25 bbl gel(KCl) water above cement

Balance of annulus contains 2% KCl water which circulated to the surface during cement pumping

Estimated cement top at 1600'

Logging and cementing were trouble free

Arlington Exploration Company

137 NEWBURY STREET, BOSTON, MA 02116, USA, (617) 267-7600, TELEX: 940-557

A.P. & J.O. HULSEBOSCH #1 WELL

Elmira Township, Chemung County, New York

Daily Drilling Report

8/9 Spud 7:30 AM
8/10 Driving Conductor 67' 12¼" set
8/11 Waiting on Cement 8AM 10 5/8" hole TD 538'
8/12 SD @ 1808' waiting for KCl to mix soap
8/13 drilling at 2927' 8AM TD 3030 @ 1PM
8/14 Cementing 4½" casing, Plug down 8:30AM

Log TD 3025' Elevation 1078 KB, 1068 ground

Casing Shoe at 3005 from ground level, 3016 from KB

Plug(latch down) 2993 from KB

Logs(Birdwell) Gamma Ray, Neutron, Density, Temperature, Sibilation

Gas Shows from Hot Wire Gas Detector during drilling

1180	4 units	
1285	8 units	
1454	13 units	
1502	100 units	blew down to 12 units in 30 min.
1563	24 units	
1612	40 units	blew down to 20 units by TD

At TD no observable flow despite sibilation kicks on log

FORMATION TOPS(log picks)

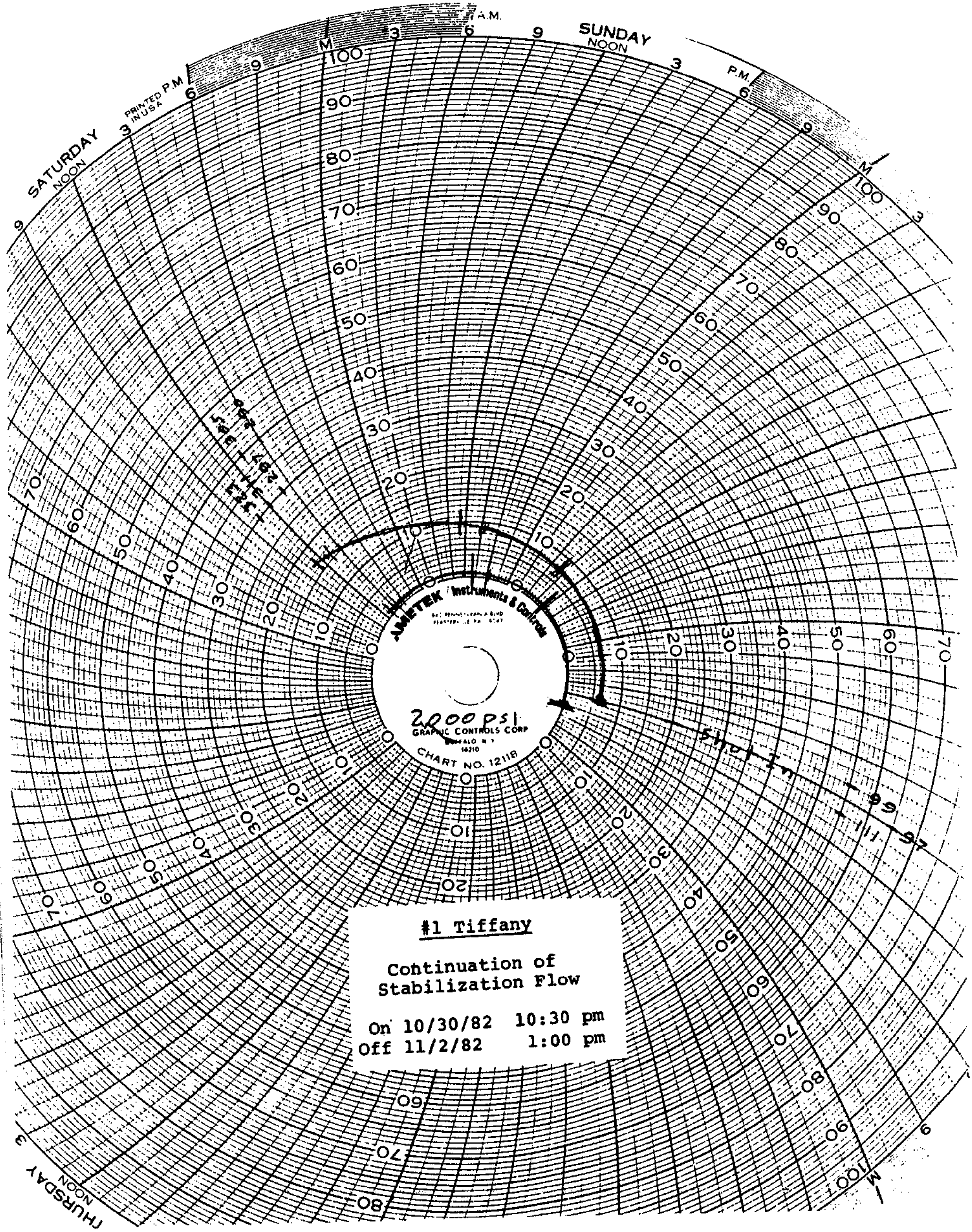
Tully	1770
Marcellus	2875
Onondaga	2964
Oriskany	3016
Log TD	3025

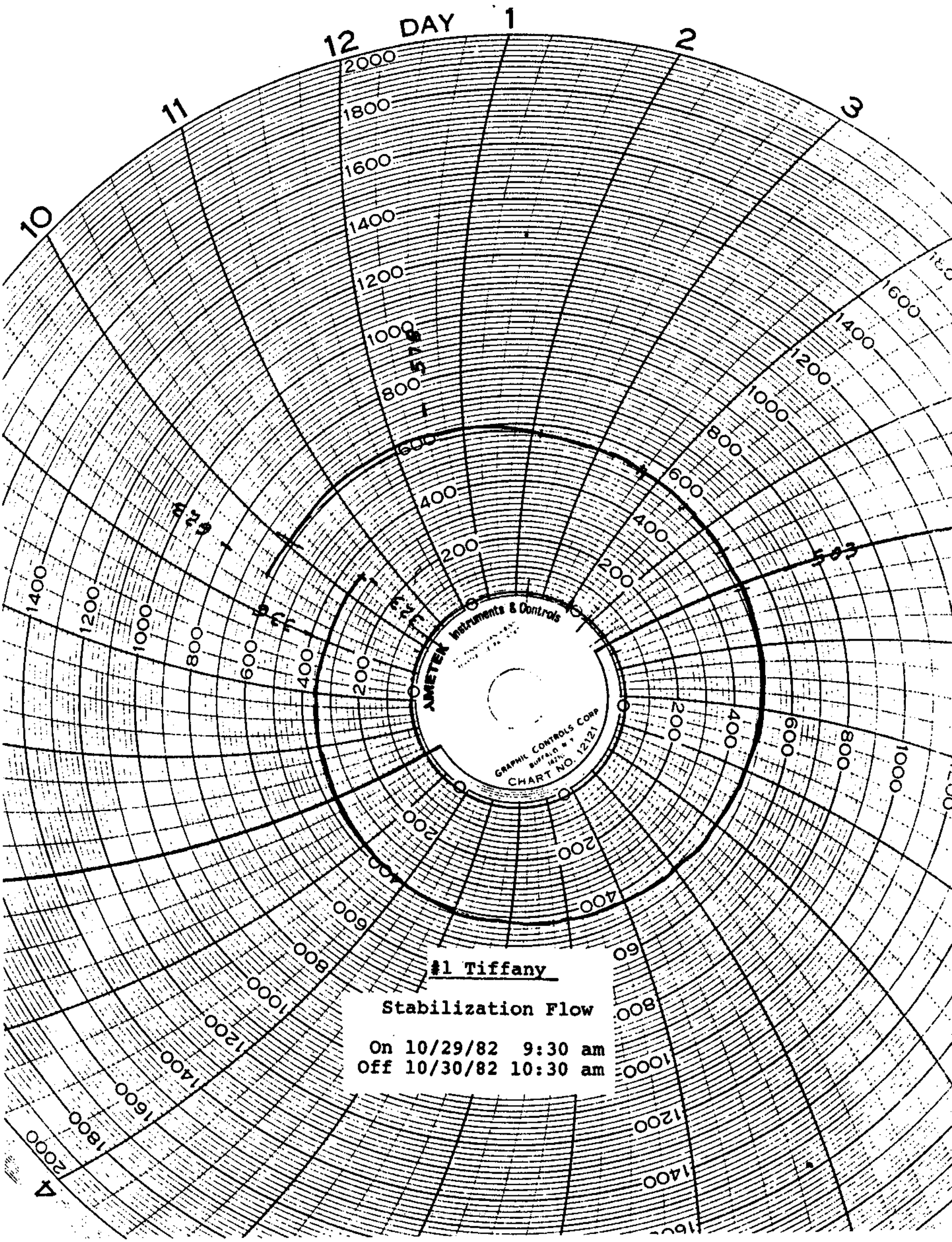
Hole drilled to 1365 with air, had slight water show and drilled balance of hole below 1365 with mist- soap with 2% KCl added to air

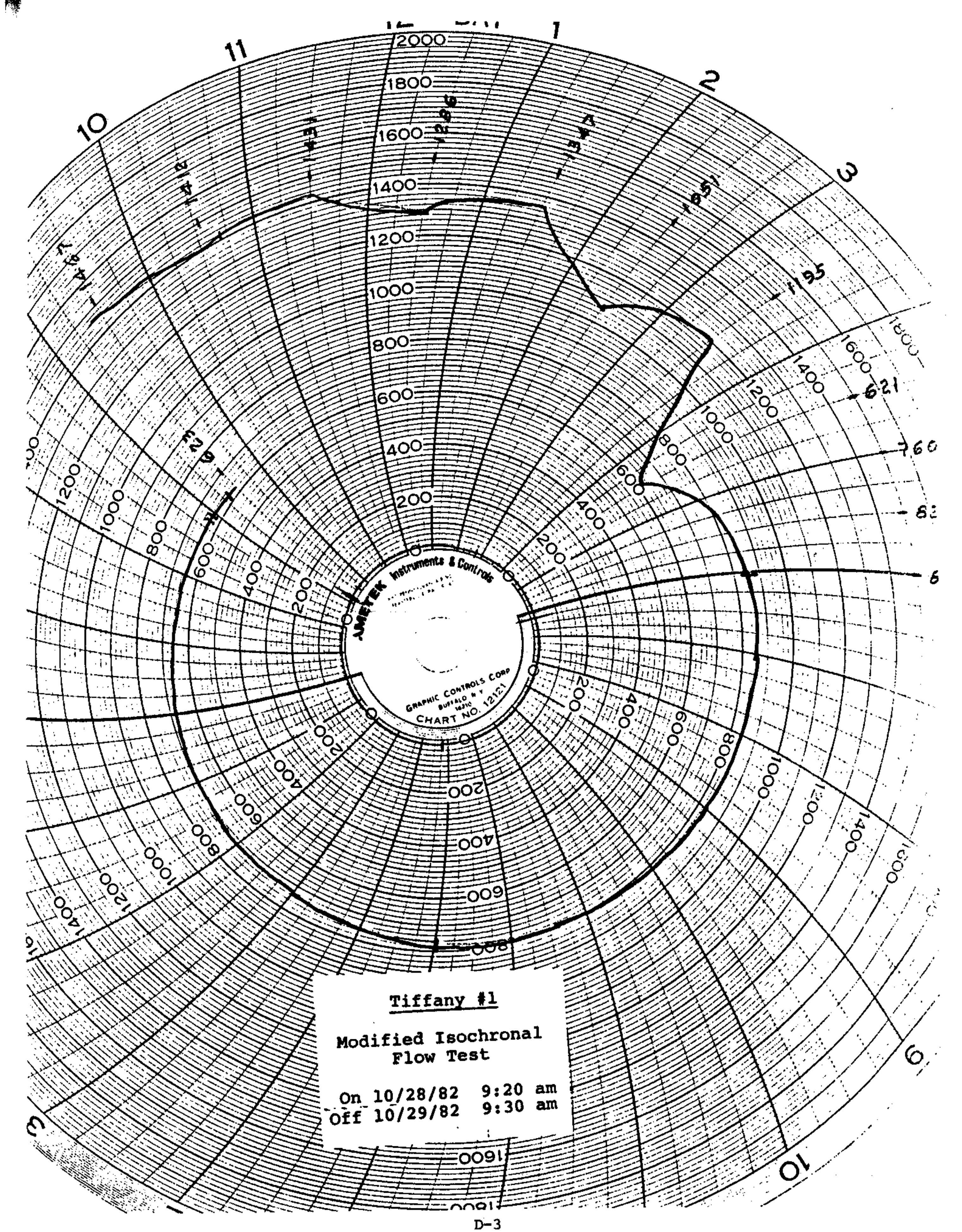
Poor circulation put sample tops about 26' low

Appendix D:

Drilling, completion and test reports for the Naples (Widmer) well

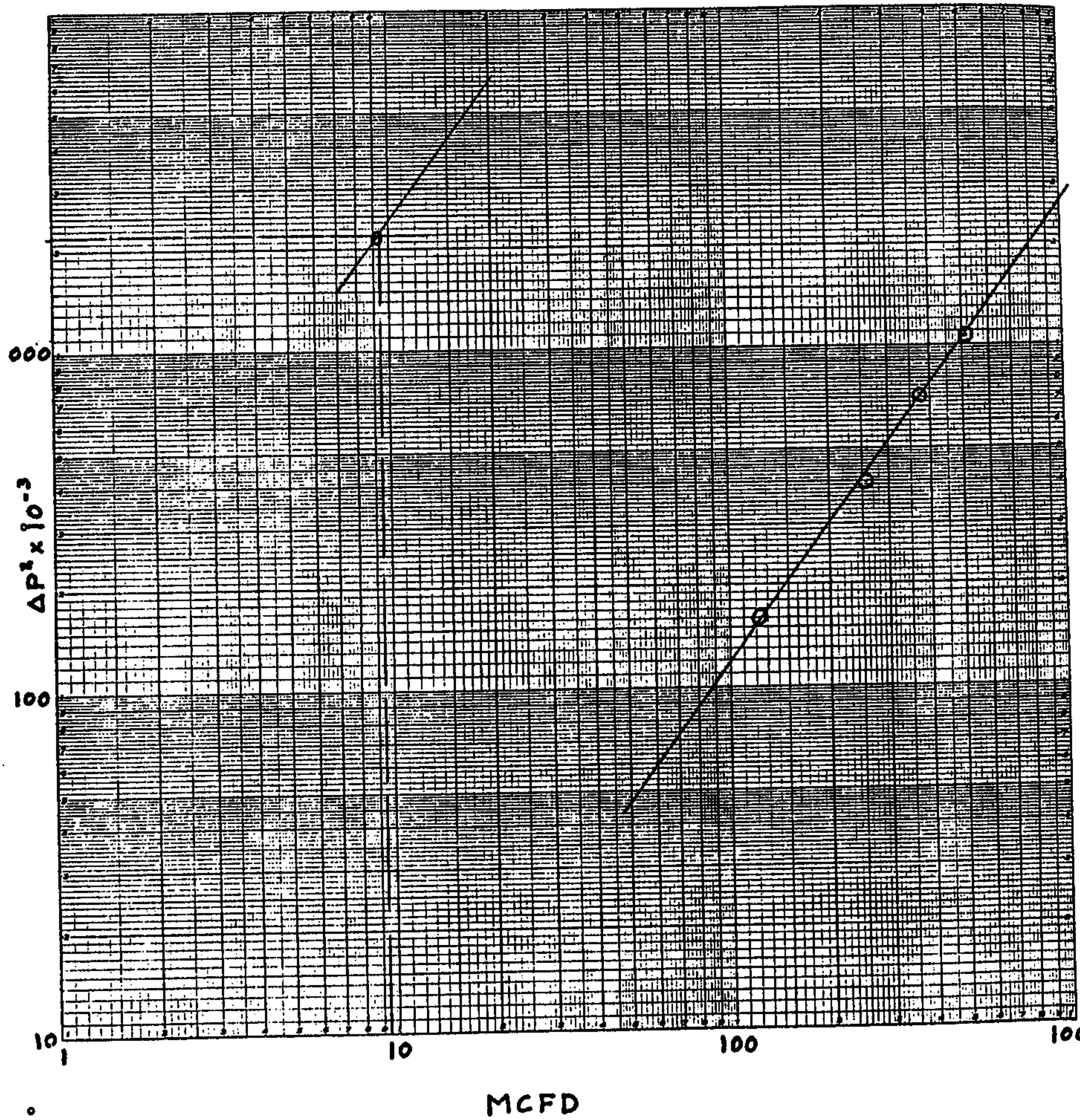

SATURDAY
NOON
SUNDAY
NOON
THURSDAY
NOON
A.M.
P.M.
PRINTED IN USA
AMETEK Instruments & Controls
2000 psi
GRAPHIC CONTROLS CORP
BUFFALO N.Y.
14210
CHART NO. 1211B
#1 Tiffany
Continuation of
Stabilization Flow
On 10/30/82 10:30 pm
Off 11/2/82 1:00 pm


DAY
AMETEK Instruments & Controls
GRAPHIC CONTROLS CORP
CHART NO. 12121
#1 Tiffany
Stabilization Flow
On 10/29/82 9:30 am
Off 10/30/82 10:30 am


AMETEK Instruments & Controls
GRAPHIC CONTROLS CORP
BUFFALO N Y
CHART NO. 12121
Tiffany #1
Modified Isochronal
Flow Test
On 10/28/82 9:20 am
Off 10/29/82 9:30 am

Tiffany.

AOF = 9.4 MCFD



GAS WELL DELIVERABILITY TEST CALCULATIONS - FLOW RATES

(BASE CONDITIONS = 14.65 psia and 60 °F)

CRITICAL FLOW PROVER

$q = 10^{-3} \; C \; P \; F_{tf} \; F_g \; F_{pv}$

RATE NO.	PROVER SIZE inches	ORIFICE DIAMETER inches	BASIC ORIFICE COEFFICIENT (C) Mscfd/lb.	STATIC PRESSURE (P) psia	FLOW. TEMP. FACTOR F_{tf}	SPECIFIC GRAVITY FACTOR F_g	SUPERCOMP. FACTOR F_{pv}	FLOW RATE Q MMscfd
1	2	1/16	..0848	1427	1.0168	1	1	123
2	2	3/32	.1975	1301	1.0098	1	1	259
3	2	1/8	.3506	1066	1.0098	1	1	377
4	2	3/16	.8052	636	1.0107	1	1	518
5	2	1/16	.0848	112	0.9777	1	1	9.3

ORIFICE METER

$q = 24 \times 10^{-6} \; C' \sqrt{h_w \; P_f}$

$C' = F_b \; F_{pb} \; F_{tb} \; F_g \; F_{tf} \; F_r \; Y \; F_{pv} \; F_m$

$F_{pb} = 1.0055$

$F_{tb} = 1.0000$

RATE NO.	STAGE	METER RUN OR LINE SIZE inches	ORIFICE DIAMETER inches	STATIC PRESSURE P_f psia	DIFFERENTIAL INCHES H_2O h_w	BASIC ORIFICE FACTOR F_b	SPECIFIC GRAVITY FACTOR F_g	FLOW. TEMP. FACTOR F_{tf}
1	H							
	L							
2	H							
	L							
3	H							
	L							
4	H							
	L							
5	H							
	L							

ORIFICE METER CALCULATIONS (CONTINUED)

RATE NO.	STAGE	REYNOLDS FACTOR F_r	EXPANSION FACTOR Y	SUPERCOMP. FACTOR F_{pv}	MANOMETER FACTOR F_m	C' ft^3/hr	$\sqrt{h_w \; P_f}$	FLOW RATE Q MMscfd	TOTAL GAS PRODUCTION RATE MMscfd
1	H								
	L								
2	H								
	L								
3	H								
	L								
4	H								
	L								
5	H								
	L								

XXXXXXXXXX OF FLOW NO. 5 TO STABILIZATION

Date	Time	Cum. Time hrs	Static Pressure	Temp. F°	Remarks
10-28-82	4:30P		621	49°	
	4:45	1/4	705	52°	
	5:00	1/2	760	52°	
	5:15	3/4	798	52°	
	5:30	1	823	51°	
	5:45	1 1/4	840	50°	
	6:00	1 1/2	849	49°	
10-29	9:30A	17	623	45°	
	12:30P	20	578	66°	
	6:00	25 1/2	503	56°	
10-30	9:00A	40 1/2	336	49°	
	10:30A	42	323	63°	Changed chart to 7 day clock
	Noon	43 1/2	311	68°	
	1:00P	44 1/2	305	70°	
	2:00	45 1/2	297	67°	
	3:00	46 1/2	290	64°	
11-2-82	11:00A	114 1/2	99	82°	Took gas sample
	Noon	115 1/2	97	84°	Shut-in
	12:15P	1/4	101	86°	
	12:30	1/2	105	86°	
	12:45	3/4	108	84°	Remove chart. Rig down test
	1:00	1	111	82°	equipment.
	1:30	1 1/2	116	82°	Connected recorder.
	2:30	2 1/2	126	84°	
	3:30	3 1/2	134	74°	
11-20-82	12:30P	432 1/2	692	54°	(690 - chart) Remove Recorder (700 - gauge)

METER RUN OR PROVER SIZE 2 inches ORIFICE SIZE 1/16 inches

SEPARATOR CONDITIONS: HP SEP. ______ psig, ______ °F LP SEP. ______ psig, ______ °F

CONDENSATE PRODUCTION RATE ______ Bbl per hour TOTAL 97 Bbl

WATER PRODUCTION RATE ______ Bbl per hour TOTAL ______ Bbl

FINAL FLOWING WELLHEAD PRESSURE: TUBING ______ CASING 97 psig

WELL SHUT-IN AT Noon xxxxxx 11-2 19 82 TOTAL FLOW TIME 115 1/2 hours

FINAL SHUT-IN WELLHEAD PRESSURE: TUBING ______ CASING ______ psig

DURATION OF FINAL SHUT-IN ______ hours TESTED BY (CO.) J. Keltz

GAS WELL DELIVERABILITY TEST - FIELD NOTES

SHUT-IN NO. 4 (INTERMEDIATE)

DATE	TIME	CUMULATIVE SHUT-IN TIME hours	WELLHEAD PRESSURE psig		WELLHEAD TEMPERATURE °F
			TUBING	CASING	
10-28	2:30			1051	
	2:45	1/4		1123	55°
	3:00	1/2		1163	58°
	3:15	3/4		1184	60°
	3:30	1		1195	61°

REMARKS

FLOW NO. 4 WELL OPENED AT 3:30 ~~AM~~ / PM 10-28 19 82

DATE	TIME	CUMULATIVE FLOW TIME hours	WELLHEAD PRESSURE psig		WELLHEAD TEMPERATURE °F	METER OR PROVER DATA		
			TUBING	CASING		STATIC PRESSURE psig	DIFFERENTIAL inches H_2O	TEMPERATURE °F
10-28	3:30			1195				
	3:45	1/4				958		49°
	4:00	1/2				802		49°
	4:15	3/4				691		49°
	4:30	1				621		49°

METER RUN OR PROVER SIZE 2 inches ORIFICE SIZE 3/16 inches

SEPARATOR CONDITIONS: HP SEP. ______ psig, ______ °F LP SEP. ______ psig, ______ °F

CONDENSATE PRODUCTION RATE ______ Bbl per hour TOTAL ______ Bbl

WATER PRODUCTION RATE ______ Bbl per hour TOTAL ______ Bbl

FINAL FLOWING WELLHEAD PRESSURE: TUBING ______ CASING 621 psig

GAS WELL DELIVERABILITY TEST – FIELD NOTES

SHUT-IN NO. 3 (INTERMEDIATE)

DATE	TIME	CUMULATIVE SHUT-IN TIME hours	WELLHEAD PRESSURE psig		WELLHEAD TEMPERATURE °F
			TUBING	CASING	
10-28	12:30			1286	
	12:45	1/4		1326	57°
	1:00	1/2		1339	64°
	1:15	3/4		1344	68°
	1:30	1		1347	69°

REMARKS

FLOW NO. 3 WELL OPENED AT 1:30 ~~AM~~ / PM 10-28 19 82

DATE	TIME	CUMULATIVE FLOW TIME hours	WELLHEAD PRESSURE psig		WELLHEAD TEMPERATURE °F	METER OR PROVER DATA		
			TUBING	CASING		STATIC PRESSURE psig	DIFFERENTIAL inches H_2O	TEMPERATURE °F
10-28	1:30			1347				
	1:45	1/4				1236		50°
	2:00	1/2				1164		50°
	2:15	3/4				1104		50°
	2:30	1				1051		50°

METER RUN OR PROVER SIZE 2 inches ORIFICE SIZE 1/8 inches

SEPARATOR CONDITIONS: HP SEP. ______ psig, ______ °F LP SEP. ______ psig, ______ °F

CONDENSATE PRODUCTION RATE ______ Bbl per hour TOTAL ______ Bbl

WATER PRODUCTION RATE ______ Bbl per hour TOTAL ______ Bbl

FINAL FLOWING WELLHEAD PRESSURE: TUBING ______ CASING 1051 psig

WELL SHUT-IN AT ______ AM/PM

GAS WELL DELIVERABILITY TEST - FIELD NOTES

SHUT-IN NO. 2 (INTERMEDIATE)

DATE	TIME	CUMULATIVE SHUT-IN TIME hours	WELLHEAD PRESSURE psig		WELLHEAD TEMPERATURE °F
			TUBING	CASING	
10-28	10:30			1412	
	10:45	1/4		1426	42°
	11:00	1/2		1429	44°
	11:15	3/4		1430	46°
	11:30	1		1431	47°

REMARKS

FLOW NO. 2 WELL OPENED AT 11:30 AM / ~~PM~~ 10-28 19 82

DATE	TIME	CUMULATIVE FLOW TIME hours	WELLHEAD PRESSURE psig		WELLHEAD TEMPERATURE °F	METER OR PROVER DATA		
			TUBING	CASING		STATIC PRESSURE psig	DIFFERENTIAL inches H_2O	TEMPERATURE °F
10-28	11:30			1431				
	11:45	1/4				1373		47°
	12:00	1/2				1340		49°
	12:15	3/4				1311		50°
	12:30	1				1286		50°

METER RUN OR PROVER SIZE 2 inches ORIFICE SIZE 3/32 inches

SEPARATOR CONDITIONS: HP SEP. ______ psig, ______ °F LP SEP. ______ psig, ______ °F

CONDENSATE PRODUCTION RATE ______ Bbl per hour TOTAL ______ Bbl

WATER PRODUCTION RATE ______ Bbl per hour TOTAL ______ Bbl

FINAL FLOWING WELLHEAD PRESSURE: TUBING ______ CASING 1286 psig

GAS WELL DELIVERABILITY TEST – FIELD NOTES

WELL NAME #1 Glen Tiffany LOCATION ______ W__

FIELD OR AREA Endicott POOL OR ZONE ______

PERF./OPEN HOLE INTERVAL 4280'-4400' PRODUCING THROUGH: ~~XXXXXX~~ casing [x] ANNULUS [ ]

WELL BLOWN FOR ______ minutes SPRAY: WATER/CONDENSATE CLEAR IN ______ minutes

DATE SHUT-IN ______ 19__ TIME ______ TOTAL SHUT-IN TIME ______ hours

SHUT-IN NO. 1 (INITIAL)

DATE	TIME	CUMULATIVE SHUT-IN TIME hours	WELLHEAD PRESSURE psig		WELLHEAD TEMPERATURE °F
			TUBING	CASING	
10-28-82	9:25A			1467	36°

REMARKS

All pressures DWT unless otherwise indicated.

FLOW NO. 1 WELL OPENED AT 9:30 AM/~~PM~~ 10-28 19 82

DATE	TIME	CUMULATIVE FLOW TIME hours	WELLHEAD PRESSURE psig		WELLHEAD TEMPERATURE °F	METER OR PROVER DATA		
			TUBING	CASING		STATIC PRESSURE psig	DIFFERENTIAL inches H_2O	TEMPERATURE °F
10-28	9:30A			1467	36°			
	9:45	1/4				1445		40°
	10:00	1/2				1432		41°
	10:15	3/4				1421		42°
	10:30	1				1412		43°

METER RUN OR PROVER SIZE 2 inches ORIFICE SIZE 1/16 inches

SEPARATOR CONDITIONS: HP SEP. ______ psig, ______ °F LP SEP. ______ psig, ______ °F

CONDENSATE PRODUCTION RATE ______ Bbl per hour TOTAL ______ Bbl

WATER PRODUCTION RATE ______ Bbl per hour TOTAL ______ Bbl

FINAL FLOWING WELLHEAD PRESSURE: TUBING ______ CASING 1412 psig

WELL SHUT-IN AT ______ AM/PM ______ 19__ TOTAL FLOW TIME 1 hours

NOTE: ... PRESSURES AND TEMPERATURES MUST BE OBTAINED UPSTREAM OF ANY CHOKING DEVICE

GAS WELL DELIVERABILITY TEST CALCULATIONS

(BASE CONDITIONS = 14.65 psia and 60°F)

WELL NAME #1 Tiffany LOCATION Endicott W___

POOL OR ZONE ___ FINAL DATE OF TEST ___ 19__

SIMPLIFIED ANALYSIS

	DURATION hours	~~XXXXXXXX~~ WH PRESSURE psia	CALC.	MEAS.	$p^2 \times 10^{-3}$ psia^2	$\Delta p^2 \times 10^{-3}$ psia^2	FLOW RATE (q) ~~M~~Mscfd
INITIAL SHUT-IN		1482		X	2196		
FLOW 1	1	1427		X	2036	160	123
SHUT-IN	1	1446		X	2091		
FLOW 2	1	1301		X	1693	398	259
SHUT-IN	1	1362		X	1855		
FLOW 3	1	1066		X	1136	719	377
SHUT-IN	1	1210		X	1464		
FLOW 4	1	636		X	404	1060	518
EXTENDED FLOW	115.5	112		X	12.5	2184	9.3
FINAL SHUT-IN							

RESULTS

$q = C\left(\bar{p}_R^2 - p_{wf}^2\right)^n$

slope n = ___

$\bar{p}_R$ = ___ psia

$C = \dfrac{q}{\left(\bar{p}_R^2 - p_{wf}^2\right)^n}$

= ___

AOF (~~M~~Mscfd) 9.4 (see graph)

LIT (ψ) ANALYSIS (SEE NOTE ON REVERSE)

	DURATION hours	SANDFACE PRESSURE psia	ψ MM psia^2/cp	Δψ MM psia^2/cp	FLOW RATE (q) MMscfd	Δψ/q	q^2	$\Delta\psi - bq^2$
INITIAL SHUT-IN		—						
FLOW 1								
SHUT-IN								
FLOW 2								
SHUT-IN								
FLOW 3								
SHUT-IN								
FLOW 4								
TOTAL = Σ								
EXTENDED FLOW								
FINAL SHUT-IN								

DISCARDED POINT ___

N = ___ $\bar{\psi}_R$ = ___ MMpsia^2/cp

$a, a_t = \dfrac{\Sigma \frac{\Delta\psi}{q} \Sigma q^2 - \Sigma q \Sigma \Delta\psi}{N \Sigma q^2 - \Sigma q \Sigma q}$ = ___

$b = \dfrac{N \Sigma \Delta\psi - \Sigma q \Sigma \frac{\Delta\psi}{q}}{N \Sigma q^2 - \Sigma q \Sigma q}$ = ___

(EXTENDED FLOW) Δψ = ___ q = ___ b = ___

$\Delta\psi - bq^2$

RESULTS

TRANSIENT FLOW: $\bar{\psi}_R - \psi_{wf} = a_t q + bq^2$

i.e. ___ $- \psi_{wf}$ = ___ q + ___ q^2

STABILIZED FLOW: $\bar{\psi}_R - \psi_{wf} = aq + bq^2$

i.e. ___ $- \psi_{wf}$ = ___ q + ___ q^2

DELIVERABILITY:

$q = \frac{1}{2b}\left[-a + \sqrt{a^2 + 4b\left(\bar{\psi}_R - \psi_{wf}\right)}\right]$

FOR ψ_{wf} = 0, q = AOF = ___ MMscfd

Energy
Storage
Ventures
John F. Keltz
Consultant
P.O. Box 376
Honeoye, NY 14471
716 229-5161

#1 Tiffany - Flow Test

10-28-82 Met Glen Tiffany. Checked well site.

Casing pressure - 1460 psig (Gauge)

Rigged up for flow test. Chart on @ 9:20 a.m.

DWT - 1467 psig @ 9:25 a.m. Start flow test at 9:30 a.m. with 1/16" plate.

Complete 4th flow rate @ 4:30 p.m. with 3/16" plate and start stabilization flow with 1/16" plate.

10-29-82 Watched pressure - well did not stabilize.

10-30-82 Watched pressure - well did not stabilize. Changed recorder to 7 - day clock.

11-2-82 Found pressure decreasing 2 psi/hr. - considered stabilized. Recording pen on chart will not go below 130 psi because of interference by second pen.

Took gas sample for analysis.

Shut well in at noon for pressure build-up. Removed flow test equipment.

Installed recorder for pressure build-up.

Watched pressure for 3½ hours.

11-20-82 Removed pressure recorder and took DWT. Left gauge with Glen Tiffany to take periodic pressures on well.

DWT - 692 psig; recorder - 690 psig; gauge - 700 psig.

PRE-COMPLETION TESTS	TYPE TEST (dst, bail, etc.)	DURATION OF TEST	ZONES TESTED	AMOUNTS AND KINDS OF FLUIDS PRODUCED DURING TEST
	N/A	hrs.	ft. to ft.	
		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.)
	Bedrock	
4100 - 4185	Shale, Dark grey,	moderately calcareous
4185 - 4200	Shale, Black, sli	ghtly calcareous, trace pyrite
4200 - 4254	as above with 2%	white calicte vein fillings (both clear and
	white opaque cal	cite)
4254 - 4280	as above; shale	noncalcareous
4280 - 4305	Shale as above no	white calcite, scattered pyrite
4305 - 4315	Shale as above sl	ightly calcareous
4315 - 4426	Shale, black as a	bove, moderately calcareous, scattered pyrite,
	occasional trace	limestone
4426 - 4457	Onandaga limetso	ne, dark gray shaly
4430	Bentonite	
4453	Limestone, light	gray
4457	Driller TD	

INSTRUCTIONS

A. One (1) copy of Form 85-15-7 shall be filed with the Bureau of Mineral Resources, 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 Mineral Resources 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.

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
BUREAU OF MINERAL RESOURCES

WELL DRILLING AND COMPLETION REPORT

DO NOT WRITE IN SHADED AREA

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: Arlington Exploration Company

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

COUNTY: Tioga **TOWN:** Owego

LEASE: Glenn O. Tiffany **WELL NO.:** 1

LOCATION DESCRIPTION: Lat: 42°06'36" Long: 76°06'04"

ELEVATION: 1145 ft. 1 [ ] Derrick Floor 2 [X] Kelly Bushing

FIELD NAME:
POOL NAME: --

FORMATIONS COMPLETED: Marcellus Shale

DRILLING CONTRACTOR: H.L. Murry Drilling Co.

DRILLING AND CORING

DATE DRILLING COMMENCED: Month 8 Day 16 Year 82

DATE DRILLING COMPLETED: Month 8 Day 21 Year 82

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

WELL DRILLED WITH CABLE TOOLS: From N/A ft. to ft.

WELL DRILLED WITH ROTARY TOOLS: From 0 ft. to 4453 ft.

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

TLS

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

CORE RECOVERY: N/A ft.

CORES WERE: N/A 1 [ ] Lab Analyzed 2 [ ] Described

DRILLERS TOTAL DEPTH: 4453 ft.

PLUG BACK TOTAL DEPTH: N/A ft.

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

LOGS

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

CHECK OTHER LOGS RUN: 1 [X] Gamma Ray-Neutron 2 [X] Temperature 3 [X] Caliper [ ] Others (Specify) Noise, Density

LOGS

CASING

TYPE	SIZE (O D)	DEPTH SET	CASING PULLED	AMOUNT CEMENT	EST. TOP CEMENT	CEMENT PUMPED, DUMPED OR CIRCULATED
DRIVE, SURFACE OR CONDUCTOR	8 5/8 in.	511 ft.	N/A ft.	150 sk.	surface ft.	circulated
	N/A in.	ft.	ft.	sk.	ft.	
INTERMEDIATE OR WATER STRINGS	N/A in.	ft.	ft.	sk.	ft.	
PRODUCING	4½ in.	4448 ft.	N/A ft.	430* sk.	2500 ft.	circulated
LINERS	in.	ft.	ft.	sk.	ft.	

*subsequently squeezed cement in annulus from 2500 ft. to surface

FINAL COMPLETION

DATE FINAL COMPLETION: Month 12 Day 19 Year 82

WELL COMPLETED OPEN HOLE: From N/A ft. to N/A ft.

PERFORATED INTERVALS	NO. OF SHOTS	PERFORATED INTERVALS (Cont'd.)	NO. OF SHOTS
4280 ft. to 4390.25 ft.	13	ft. to ft.	
ft. to ft.		ft. to ft.	
ft. to ft.		ft. to ft.	

TREATMENT OR STIMULATION

ZONES TREATED	SHOT, ACID, FRAC, ETC.	DETAILS OF TREATMENT Kinds and Amounts of Materials, Rates, Pressures, Dates, Etc.
4280 ft. to 4390.25 ft.	Frac	9/20/82 60,000 lbs. sand; 50,000 gals.
ft. to ft.		75 quality N_2 foam; average rate
ft. to ft.		12 Bbls foam; ATP 3268 psi;
ft. to ft.		ISIP 2550
ft. to ft.		
ft. to ft.		
ft. to ft.		

TYPE

INITIAL PRODUCTION

TYPE OF TEST: [ ] Pumping [X] Flowing

FLOWING TEST DATA: Choke Size 1/16 in.; Flow. T.P. N/A psi; Flow. C.P. 112 psi; S.I.T.P. ___ psi; S.I.C.P. 1467 psi; S.I. Time 720 Hrs.

DATE OF TEST: 10/20-11/2/82

DURATION OF TEST: 115.5 Hrs.

OIL PRODUCTION: N/A Bbls/Day

WATER PRODUCTION: N/A Bbls/Day

GAS PRODUCTION: 9.4 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:** Vice President **DATE:** 9/19/83

85-1-7 (5/78)

— SEE REVERSE SIDE FOR INSTRUCTIONS —

ARLINGTON EXPLORATION COMPANY

SUMMARY: PRODUCTION & PRESSURE INFORMATION

GLEN TIFFANY #1

Est. formation pressure	1900 psi.
Flowback water recovery	152 bbls.
Flowback water recovery per hr., avg.	7.9 bbls/hr.
Per cent nat. gas, last reading to date	43%
Best value of shut in pressure	1300 psi.
Pressure buildup, psi/min., avg.(9/22)	1.8 psi/min.

Flow Rates

Final open flow	39 MCFD
Per cent nat. gas	44%
Final open flow, nat. gas	17 MCFD
Estimated first yr. production, avg.	12 MCFD