THE CARR #5-B:
A MEDIUM RADIUS HORIZONTAL WELL
DRILLED IN THE BASS ISLAND TREND

Final Report

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NOTICE

ABSTRACT

The Bass Island trend in western New York is a series of fields that produce oil and gas from fractured carbonate reservoirs. Resource Energy, Inc. with financial assistance from the New York State Energy Research and Development Authority (NYSERDA) drilled a medium radius horizontal well in the Bass Island trend in the fall of 2001 attempting to intersect and produce oil and gas from two fault zones in one well bore. Conventional methods were used for drilling a vertical 7 7/8” hole down to a kick off point. At the kick off point, an adjustable down hole motor and MWD equipment were used to drill a 300 foot radius and a horizontal lateral. Horizontal drilling works well in other basins and has application in the Bass Island trend. The well was successfully drilled. Both fault zones were encountered with a total of approximately 210 feet of fractured limestone penetrated. Two completion attempts were made, both unsuccessful. The well cost approximately $339,058. Subtracting costs for non-directional drilling problems a successful completed well would have cost $306,292 or about 1.2 times the cost of drilling two standard vertical wells.

ACKNOWLEDGEMENTS

Resource Energy, Inc. (REI) acknowledges the help of many people in the completion of this project. Most important was the financial assistance from NYSERDA. Their help turned this project from a wish into an accomplishment. REI also thanks Ryan for their expert directional drilling services, Union Drilling for the drill rig and crew and Schlumberger for the help with the completion.

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Section 1
INTRODUCTION

Medium Radius Horizontal (MRH) drilling technology is currently being used in many petroleum basins with great success. Applications include drilling in fractured carbonate, reef, shale and coal bed methane reservoirs. The common reservoir characteristics in most of these applications are the presence of high angle fracturing and/or lateral compartmentalized porosity. Horizontal well bores intersect a greater number of high angle fractures and/or lateral compartments than do vertical well bores, resulting in the potential of greater production and recovery rates.

The Bass Island trend in western New York is a classic fractured carbonate reservoir. Low angle faults cutting through the Onondaga Limestone have created surrounding high angle fracture envelopes. Before the drilling of the Carr #5-B MRH well, the Bass Island was drilled using conventional vertical drilling techniques targeting one fault zone. This project involves the drilling of a conventional diameter medium radius horizontal well that will cut laterally through two faults and their surrounding fracture envelopes.

Section 2
GEOLOGY AND RESERVOIR CHARACTERISTICS OF THE BASS ISLAND TREND

The Bass Island Trend is located in western Pennsylvania and New York (see Figure 1). It is approximately 1-½ miles wide and trends NE – SW as shown. Wells in the trend produce oil and gas from faulted and fractured rock ranging in age from Silurian (Salina Group) to Devonian (Hamilton Group) at depths of 2000 to 3000 feet.

Reverse faults and associated fractures define the limits and trend of the production. The reverse faults trend NE – SW, is parallel to sub-parallel, sole in the Salina "B" salt and flatten into the bedding planes of shale units in the Marcellus and Hamilton Group. The majority of the faults dip to the SE at low angles (15 to 25 degrees) with antithetic faults dipping to the NW at higher angles (35 to 70 degrees). Throw on the faults ranges from a few feet to 150 feet. Occasionally back thrusts develop on the NW side of the trend and dip to the NW. The faults are moderately sinuous and can be discontinuous along strike. Tear or strike slip faults may cause offset in the main faults in some areas.

The fault geometry and depth to the oil/water contact limit the oil and gas accumulation in any specific fault and its surrounding fracture envelope. The reservoir rapidly degrades along the fault above the point where the Marcellus Shale intersects the fault plane in the footwall. Similarly, the reservoir rapidly degrades along the fault below the point where the Salina Formation intersects the fault plane in the hanging wall.

Three rock units are generally recognized between the Marcellus and the Salina. These are the primary "Bass Island" reservoirs. Below the Marcellus is the Onondaga Limestone. In Chautauqua Co. the Onondaga is a tan to gray, fine to medium crystalline limestone, approximately 175 to 200 feet thick. It contains abundant chert both bedded and nodular. Under the Onondaga is the Bois Blanc/Oriskany unit. This rock is a bluish to greenish white chert with some sand grains present and is 20 to 50 feet thick. Below is the Akron Dolomite. This rock is brown, sucrosic dolomite and is 30 to 50 feet thick. The best wells in the trend occur primarily in fault repeated sections of Onondaga Limestone.

Porosity in the reservoir rock is primarily fracture porosity. There are generally two types of fractures, fault plane and antithetic. Fault plane fractures dip to the SE and make up the gouge zone of the reverse faults. Antithetic fractures make up the fracture envelope surrounding the SE dipping faults. These fractures dip into (NW) the main fault plane at higher angles. Antithetic reverse faults are actually large relatives of these fractures. The extent of the antithetic fracture envelope has been measured in open hole well logs and commonly extends 40 feet (vertically) on either side of where the fault intersects the vertical well bore. Depending on the specific location, the fracture porosity can be in various stages of degradation. Secondary calcite growths in the fractures commonly reduce porosity and permeability. Hydrocarbons appear to have migrated into the fracture network, during to after porosity degradation.

Bass Island wells are often difficult to produce. The oil is paraffin based. Some wells start out producing gas, and then rapidly change to oil production. Some wells never make any oil while some other ones produce emulsions of oil and water. Some start out making substantial amounts of oil and/or gas then rapidly water out. It is well known that the bubble point of the crude is very close to reservoir temperature. Producing the well at high rates tends to deposit paraffin in the production tubulars, and very likely in the formation.

Section 3
RESERVOIR TARGET AND PROPOSED COMPLETION

The Carr #5-B (API permit # 31-013-21988) well is located in central North Harmony Township, Chautauqua Co., New York (see Figure 1). The well is situated between the Carr #4-B approximately 1100 feet to the west, and the Carr #2 well approximately 650 feet to the northeast.

The target reservoir was the fracture envelope surrounding a pair of reverse faults that parallel each other and can be traced for approximately 2 miles along the Bass Island trend (see Figure 2). Wells that intersect this pair of faults include the following:

1. Gleason #4 (31-013-12280) – The faults intersect the well bore in the Lower Salina.
2. Carr #4-B (31-013-20037) – The faults intersect the well bore in the Marcellus and Upper Onondaga.
3. Gleason #9-B (31-013-20039) – The faults intersect the well bore in the Lower Salina.
4. Carr #2 (31-013-17671) – The faults intersect the well bore in the Bois Blanc and the Akron.
5. Hudson #1 (31-013-17978) – The faults intersect the well bore in the Lower Hamilton and the Upper Onondaga.
6. Cook #2 (31-013-18815) – The faults intersect the well bore in the Lower Salina.
7. Cook #1 (31-013-18993) – The faults intersect the well bore in the Middle to Lower Onondaga.

In the before mentioned wells, the faults are separated by 50 to 100 vertical feet and dip at approximately 24° to the SE. The upper most fault in these wells has 10 to 30 feet of throw and the lower fault has 30 to 50 feet of throw. Drilling shows were reported in the Carr #4-B, Hudson #1 and the Cook #1. The closest production from these faults is from the Cook #1 well. It is approximately 4,800 feet to the NE and produced a significant amount of oil probably out of the upper fault. To the SW along the fault trend approximately 8,400 feet, where only one of the faults is present, the Saulsgiver #1-B well (31-013-18351) produced 10,780 barrels of oil and 104,970 mcf gas from November 1985 through June 1998.

West of the Carr #5-B is the Carr# 4-B. In this well the upper fault is in the Marcellus with 10 feet of throw and the lower fault is at the very top of the Onondaga and has 30 feet of throw. An attempt was made to complete this well in the lower fault zone. Some oil and gas was produced however the zone was abandoned and the well completed in the Medina. In my opinion, the position of the fault in this well bore was less than ideal. It was right in the top of the Onondaga and the porosity at the fault plane is probably filled with shaley fault gouge from the Marcellus.

Conventional vertical wells drilled in the Bass Island Trend typically target the fracture envelope of a fault occurring in the upper to middle Onondaga where limestone is repeated in the adjacent hanging wall and foot wall. When two faults are present, typically only one fault zone produces. The other is usually too high, repeating shale units or too low where the fault zone is wet.

In 1999 Resource Energy, Inc. proposed to NYSERDA to drill a medium radius horizontal well in between the Carr #4-B and the Carr #2 well in an attempt to intersect both faults in an optimal structural position and produce both reservoirs from the same well bore. The plan consisted of drilling a conventional (7 7/8") vertical well to a kick off point (KOP) at approximately –790 feet sub sea level. At the KOP, the well would be drilled directionally with a 300 foot radius of curvature to the horizontal using conventional sized down hole motors with MWD tools for steering. After drilling the radius the well would be drilled horizontal until both faults were encountered (an additional 400 – 500 feet). After drilling, casing would be run in the vertical part of the well bore and the well completed open hole with an acid stimulation.

Section 4
DRILLING AND COMPLETION PROCEDURE

Initial operations on the Carr #5-B MRH well were begun on October 6th, 2001 (see Table 1 for daily drilling reports). The drilling method used consisted of a drill string conveyed, fluid driven, down-hole motor assembly. A conventional drill rig was employed. Mud pulse MWD equipment was used to orient the motors while drilling.

VERTICAL HOLE

The well was spud on October 6th. Problems were encountered on the second day when the surface casing would not hold pressure after the cement job. A squeeze job failed and the rig was skidded and a new surface hole was spud on October 11th. The well was drilled to a TVD of 2403 (-790 sub sea level) on October 15th, the drill pipe was tripped and preparations were made for the drilling of the curved part of the hole

DRILLING THE CURVED HOLE

On October 16th, drilling of the curved part of the hole began using an adjustable, mud driven down hole motor. A mud pulse, MWD system was used to the orient the face of the drill bit in the proper direction. After drilling 63 feet it was determined that the hole was going in the wrong direction. Drill pipe was tripped and a cement plug was set on the bottom of the hole to facilitate the kick off of the well bore in the proper direction. The curve was kicked in the right direction and was drilled to 2837 feet (see appendix I for direction and depth surveys). Drill pipe was tripped to prepare for horizontal drilling.

HORIZONTAL HOLE

On October 20th the horizontal drilling assembly was tripped in the hole and horizontal drilling commenced. On October 22nd the well reached its total measured depth of 3274 feet (TVD 2703', -1090 sub sea)

WELL COMPLETION AND STIMULATION

Following the completion of drilling, 4 ½" production casing with a DV tool on bottom was run in the hole and set at 2836'. It was cemented with 180 sxs of 50/50 poz. The cement and plug in the DV tool was drilled out and the open hole prepared for completion. 1000 gallons of 15% HCl was spotted and displaced into the formation using a coiled tubing completion unit. The formation took the acid immediately with out any pressure build up. The casing was unloaded with N2 and no flow was detected. Another 1000 gallons of 15%HCl was spotted and displaced into the formation. Again the hole was unloaded with no flow or show of oil and gas present. The well was shut in and the casing pressure was monitored for several days. The highest the pressure built up to was 100 psi. After a week the casing was opened. The well blew down in a couple of minutes. No trace of oil or gas was noticed. The well was shut in again and after a week the casing pressure was measured at 24 psi.

Section 5
RESULTS

DRILLING AND COSTS

No mechanical problems were encountered while using the medium radius horizontal drilling equipment. The technology used seems to work perfectly for this application. Two problems occurred while drilling that was unrelated to the horizontal drilling technology. The first was a problem with the original surface hole. It had to be abandoned because the casing would not hold pressure. This was probably a result of local fracturing near the well bore and shale gas production into the annulus while the casing was being cemented. This cost 5 days of drilling time and associated expenses (see Table 1 & 2). The second problem occurred when the kick off point was reached. The drill face of the down hole motor was oriented 180° off of the intended direction. It was quickly discovered, however it was necessary to set a cement plug and kick off the well again. This problem cost two days of drill time and associated expenses (see Table 1 & 2).

As with the previous horizontal well that Resource drilled (Maring #3-B), penetration rates while directional drilling on fluid were very slow. The average drill rate with the down hole motor, whether sliding or rotating was approximately 9 feet per hour. It was thought prior to the drilling of this well that the conventional size of the bore hole would help increase penetration rates. This was not the case. It is believed that the lithology of the Onondaga is the determining factor in penetration rates when drilling with a down hole motor. The limestone is dense and contains 20% chert by volume making for difficult drilling.

Table 2 shows the drilling costs associated with the Carr #5-B as compared with the costs of drilling a standard vertical well into one fault zone. It would cost approximately $306,292 to drill, complete and produce the medium radius horizontal well (without the surface hole and kick off problems, see Table 2). This cost is approximately 1.2 times the cost of drilling two faults with two vertical wells.

GEOLOGY

The Top of the Onondaga Limestone was drilled at approximately 2660'. The well bore stayed in the Onondaga all the way to TD. Numerous sample shows and fracture zones were encountered (see Figure 3 and Appendix A).

At 2750 feet the well bore encountered fractured limestone with sample shows. At 3027' to 3030' the bit experienced rough drilling and the drill motor stalled several times. This was interpreted as the first or upper fault. The fault plane was surrounded by fractured limestone with good sample shows from 2980' to 3090'. The drilling prognosis predicted the first fault at 3020.

From 3150 to 3230 another fracture zone was encountered with good sample shows. At 3207 the drill rate tripled briefly and circulation was lost for a short time. This was interpreted as the second fault. The drilling prognosis called for the second fault at 3220. No drilling shows were noticed however circulation was lost when drilling into the second fault zone.

PRODUCTION

No production resulted from drilling the Carr #5-B. It was a dry hole. Two 1000 gallon acid treatments were performed with no results. No breakdown pressure was recorded indicating the treatments probably went into the same zone. It is thought that only one of the fault zones was effectively treated, namely; the fault zone at 3207' where circulation was lost. It was the same zone that fluid was lost into while drilling. It is also the zone that was tested in the Carr #4-B and produced some oil and gas. It is possible that this zone was depleted.

In order to have treated the upper fault zone effectively it would have been necessary to isolate it from the lower fault zone. This would have been done using a tubing conveyed packer placed in the well bore between the fault zones. The upper zone could then be acidized without communicating with the first two treatments. Because of the high cost of this procedure, the cost overruns in the well due to the problems mentioned before while drilling and the absence of shows in the first two completion attempts, the decision was made not to attempt this. The well was plugged and abandoned.

Section 6
CONCLUSIONS

The following is a list of conclusions regarding the drilling of the Carr #5-B MRH well:

1. The well was drilled essentially as planned with two problems.
2. The technology used in drilling the well worked perfectly.
3. More research is needed to identify methods that would result in better penetration rates while drilling with down hole motors in the Onondaga.
4. The cost of drilling a MRH well is 1.2 times that of the cost of drilling two conventional vertical wells.
5. It is unclear whether the horizontal completion, in this instance, was effective in treating both faults. One fault may have received the majority of the stimulation.

DRILL CUTTINGS ANALYSIS FOR THE CARR #5-B

GENERAL LITHOLOGY*
*Lithology is described as a percentage of the total sample

SH 1	Shale: Gray to Gray-Black, limey, blocky, hard
SH 2	Shale: Black, limey, blocky, hard
SH 3	Shale: Black, slabby, soft, carbonaceous
LM 1	Limestone: White to Light Gray, fine to medium crystaline, blocky, some fossils, some pyrite, some stylolites, some shale laminations
LM 2	Limestone: Tan to Gray-Brown, fine to medium crystaline, blocky, some fossils, some pyrite, some stylolites, some shale laminations
CH	Chert: Light to Dark Gray, Tan to Gray-Brown, concoidal fracture, sharp edges, black inclusions

OIL FLUORESCENCE (FLUOR)**
** All observed fluorescence occurrs in calcite lined fractures or on calcite lined fracture surfaces

FLU	Presence of drill cuttings with oil fluorescence	
	SPS	Sparse
	MOD	Moderate
	ABD	Abundant
TYPE	Brightness of the oil fluorescence	
	DLL	Dull: light coating of oil on fracture filling, calcite crystal surfaces
	BRT	Bright: light coating of oil on fracture filling, calcite crystal surfaces with oil droplets in the pore spaces
	MXD	Mixed dull and bright

SAMPLE CUT* (OIL CUT)**
***Oil extracted from drill cuttings using clear lighter fluid as a solvent

MKY	Milky cut: lighter fluid becomes milky in color, good sample show indicating some porosity and permeability in the fractures
M/A	Milky cut with acid: lighter fluid becomes milky in color when 10% HCL is added, poor sample show indicating minor porosity and permeability in fractures
STR	Streaming cut: oil streams out of cuttings and colors the lighter fluid milky, excellent sample show indicating good porosity and permeability in fractures

FRACTURE DESCRIPTION (FRAC DESC)

CFF	Calcite filled, micro fractures crossing the drill cutting indicating moderate to poor porosity and permeability in the fracture
HCF	Half (one side) of a calcite filled fracture: drill cuttings with one flat side, encrusted with calcite often exhibiting euhedral crystal faces; a fracture filled with calcite that has broken open indicating the presence of good porosity and permeability

POSSIBLE PRODUCTIVE RESERVOIR** (PROD RES)**
****Productive reservoir is defined by the presence of moderate to abundant, bright fluorescence in the drill cuttings; many exhibiting broken open fractures with euhedral calcite crystals indicative of good reservoir porosity and permeability

XXX	Fault plane fracturing, primary producing reservoir, fractures dip SE
XX	Fault fracture envelope, primary producing reservoir, fractures antithetic and connect to fault, fractures dip NW
X	Outer edge of fault fracture envelope, fractures probably connected to fault, fractures dip NW

Table 3

DRILL CUTTINGS ANALYSIS FOR THE CARR #5-B

DRILLED	LITHOLOGY						FLUOR		OIL	FRAC	PROD	
DEPTH	SH 1	SH 2	SH 3	LM 1	LM 2	CH	FLU	TYPE	CUT	DESC	RES	COMMENTS
2530'	100%											
2540'		100%										
2550'			100%									
2560'	100%											
2570'				10%	80%	10%						Top Stafford Limestone
2580'		90%			10%							
2590'		100%										
2600'		100%										
2610'		100%										
2620'		100%										
2630'		100%										
2640'			100%									Top Marcellus Shale
2650'			60%		40%							Transition Zone
2660'				45%	40%	15%						Top Onondaga Limestone
2670'				40%	25%	35%						
2680'				40%	40%	20%	SPS	DLL		CFF		
2690'				20%	70%	10%	SPS	DLL		CFF		
2700'				40%	45%	15%						
2710'				40%	40%	20%						
2720'				30%	30%	40%	SPS	DLL		CFF		
2730'				20%	60%	20%						
2740'				20%	60%	20%	SPS	DLL		CFF		
2750'				20%	65%	15%	SPS	MXD	M/A	CFF		Flexure and fold fractures with porosity
2760'				40%	45%	15%	SPS	MXD	M/A	CFF		Flexure and fold fractures with porosity
2770'				15%	70%	15%	SPS	MXD	M/A	CFF		Flexure and fold fractures with porosity
2780'				25%	40%	35%	SPS	MXD	M/A	CFF		Flexure and fold fractures with porosity
2790'				35%	30%	35%	SPS	DLL		CFF		
2800'				10%	70%	20%	SPS	BRT	STR	CFF & HCF		Flexure and fold fractures with porosity
2810'				10%	40%	50%	SPS	BRT	MKY	CFF & HCF		Flexure and fold fractures with porosity
2820'				20%	65%	15%	SPS	BRT	MKY	CFF & HCF		Flexure and fold fractures with porosity
2830'				30%	60%	10%	ABD	BRT	MKY	CFF & HCF		Flexure and fold fractures with porosity, maybe productive
2840'				20%	65%	15%	MOD	BRT	M/A	CFF & HCF		Flexure and fold fractures with porosity, maybe productive
2850'				30%	60%	10%	SPS	DLL		CFF		
2860'				20%	70%	10%	SPS	BRT	M/A	CFF & HCF		Flexure and fold fractures with porosity
2870'				30%	60%	10%	SPS	DLL		CFF		
2880'				30%	60%	10%	SPS	BRT	M/A	CFF & HCF		Flexure and fold fractures with porosity
2890'				20%	65%	15%	SPS	BRT	M/A	CFF & HCF		Flexure and fold fractures with porosity

Table 3

DRILL CUTTINGS ANALYSIS FOR THE CARR #5-B

DRILLED DEPTH	**LITHOLOGY SH 1**	**SH 2**	**SH 3**	**LM 1**	**LM 2**	**CH**	**FLUOR FLU**	**TYPE**	**CUT**	**FRAC DESC**	**PROD RES**	**COMMENTS**
2900'				20%	65%	15%	SPS	BRT	M/A	CFF & HCF		Flexure and fold fractures with porosity
2910'				20%	55%	25%						
2920'				20%	45%	35%	SPS	DLL		CFF		
2930'				20%	45%	35%	SPS	DLL		CFF		
2940'				25%	15%	60%	MOD	DLL		CFF		
2950'				35%	35%	30%	SPS	MXD	M/A	CFF & HCF	X	Fault related fracture envelope
2960'				35%	35%	30%	MOD	DLL		CFF		
2970'				35%	35%	30%	MOD	DLL		CFF		
2980'				35%	35%	30%	ABT	BRT	M/A	CFF & HCF	XX	Fault related fracture envelope
2990'				35%	35%	30%	ABT	BRT	M/A	CFF & HCF	XX	Fault related fracture envelope
3000'				35%	35%	30%	ABT	BRT	M/A	CFF & HCF	XX	Fault related fracture envelope
3010'				35%	50%	15%	ABT	BRT	M/A	CFF & HCF	XX	Fault related fracture envelope
3020'				40%	45%	15%	ABT	BRT	MKY	CFF & HCF	XX	Fault related fracture envelope
3030'				40%	45%	15%	ABT	BRT	MKY	CFF & HCF	**XXX**	**Bit stalls, rough hole 3027' - 3030', FAULT ZONE**
3040'				40%	45%	15%	ABT	BRT	M/A	CFF & HCF	XX	Fault related fracture envelope
3050'				20%	45%	35%	ABT	BRT	MKY	CFF & HCF	XX	Fault related fracture envelope
3060'				40%	40%	20%	SPS	BRT	M/A	CFF & HCF	X	Fault related fracture envelope
3070'				40%	40%	20%	SPS	BRT	M/A	CFF & HCF	X	Fault related fracture envelope
3080'				40%	40%	20%	SPS	BRT	STR	CFF & HCF	X	Fault related fracture envelope
3090'				35%	55%	10%	SPS	BRT	M/A	CFF & HCF	X	Fault related fracture envelope
3100'				45%	45%	10%	SPS	DLL		CFF		
3110'				50%	40%	10%	SPS	DLL		CFF		
3120'				50%	40%	10%	SPS	DLL		CFF		
3130'				45%	45%	10%	SPS	DLL		CFF		
3140'				45%	45%	10%	SPS	DLL		CFF		
3150'				40%	45%	15%	SPS	BRT	M/A	CFF & HCF	X	Fault related fracture envelope
3160'				40%	45%	15%	SPS	BRT	M/A	CFF & HCF	X	Fault related fracture envelope
3170'				40%	45%	15%	SPS	BRT	M/A	CFF & HCF	X	Fault related fracture envelope
3180'				40%	45%	15%	SPS	BRT	M/A	CFF & HCF	X	Fault related fracture envelope
3190'				40%	45%	15%	ABT	BRT	MKY	CFF & HCF	XX	Fault related fracture envelope
3200'				40%	45%	15%	ABT	BRT	MKY	CFF & HCF	XX	Fault related fracture envelope
3210'				55%	30%	15%	ABT	BRT	M/A	CFF & HCF	**XXX**	**Drilling break @ 3207', trippled in speed, FAULT ZONE**
3220'				55%	30%	15%	ABT	BRT	MKY	CFF & HCF	XX	Fault related fracture envelope
3230'				55%	30%	15%	ABT	BRT	M/A	CFF & HCF	XX	Fault related fracture envelope
3240'				35%	35%	30%	MOD	DLL		CFF		
3250'				35%	35%	30%	SPS	DLL		CFF		
3260'				35%	35%	30%	SPS	DLL		CFF		

Table 3

Ryan *The leader in UNDERGROUND INTELLIGENCE™*

REPORT OF DOWNHOLE SURVEY

November 8, 2001

COMPANY: Resource America

WELL NAME: Carr 5B

LOCATION: North Harmony Township

Chautauqua County, OH

MAGNETIC DECLINATION: 9.98° West, True

P.O. Box 504, Traverse City, MI 49685
Phone: (231) 947-2977 Toll free: (877) 452-2203 Fax: (231) 947-2978

Ryan Energy
Report of Downhole Survey

Company:	RESOURCE AMERICA	**Date:** 11/8/2001 **Time:** 11:17:48	**Page:** 1
Field:	CHAUTAUQUA	**Co-ordinate(NE) Reference:**	Site: CARR, Grid North
Site:	CARR	**Vertical (TVD) Reference:**	System: Mean Sea Level
Well:	#5-B	**Section (VS) Reference:**	Well (0.00N,0.00E,315.00Azi)
Wellpath:	AS DRILLED	**Survey Calculation Method:**	Radius of Curvature **Db:** Sybase

Survey:	AS DRILLED	**Start Date:**	10/18/2001
Company:	Ryan Energy	**Engineer:**	Stephanie Gierucki
Tool:		**Tied-to:**	From Surface

Survey

Stn	MD ft	Incl deg	Azim deg	TVD ft	N/S ft	E/W ft	VS ft	DLS deg/100ft	CluD ft	CluA deg
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	2400.00	0.00	0.00	2400.00	0.00	0.00	0.00	0.00	0.00	0.00
3	2403.00	0.57	306.00	2403.00	0.01	-0.01	0.01	18.92	0.01	306.00
4	2437.00	7.00	306.00	2436.91	1.33	-1.83	2.23	18.92	2.26	306.00
5	2468.00	12.20	308.10	2467.46	4.44	-5.95	7.35	16.81	7.42	306.73
6	2500.00	17.30	312.00	2498.40	9.68	-12.18	15.46	16.23	15.56	308.47
7	2530.00	22.40	312.20	2526.61	16.51	-19.74	25.63	17.00	25.73	309.90
8	2562.00	27.10	311.60	2555.66	25.45	-29.71	39.00	14.71	39.12	310.59
9	2593.00	31.30	310.90	2582.71	35.42	-41.08	54.09	13.59	54.24	310.77
10	2624.00	37.20	312.00	2608.33	46.97	-54.15	71.50	19.14	71.68	310.94
11	2655.00	44.00	312.30	2631.85	60.50	-69.10	91.63	21.94	91.84	311.20
12	2687.00	51.40	313.00	2653.37	76.52	-86.49	115.27	23.18	115.48	311.50
13	2719.00	59.00	314.10	2671.62	94.61	-105.52	141.52	23.92	141.73	311.88
14	2750.00	66.90	314.80	2685.71	113.93	-125.22	169.10	25.56	169.29	312.30
15	2781.00	74.60	314.80	2695.92	134.54	-145.97	198.35	24.84	198.51	312.67
16	2812.00	82.00	314.80	2702.20	155.91	-167.49	228.68	23.87	228.83	312.95
17	2843.00	88.70	315.50	2704.71	177.80	-189.27	259.56	21.73	259.69	313.21
18	2874.00	90.30	315.80	2704.98	199.97	-210.94	290.56	5.25	290.66	313.47
19	2874.20	90.29	315.80	2704.98	200.11	-211.08	290.76	3.23	290.86	313.47
20	2905.00	89.30	315.80	2705.09	222.19	-232.55	321.55	3.23	321.64	313.70
21	2935.00	88.70	316.20	2705.62	243.77	-253.39	351.54	2.40	351.61	313.89
22	2967.00	91.10	315.80	2705.67	266.79	-275.61	383.54	7.60	383.59	314.07
23	2997.00	92.70	315.50	2704.68	288.23	-296.57	413.52	5.43	413.56	314.18
24	3028.00	90.90	315.80	2703.70	310.38	-318.23	444.50	5.89	444.53	314.28
25	3059.00	89.00	316.20	2703.73	332.68	-339.76	475.49	6.26	475.52	314.40
26	3091.00	89.70	315.80	2704.09	355.70	-361.99	507.48	2.52	507.50	314.50
27	3122.00	89.30	315.80	2704.36	377.92	-383.60	538.48	1.29	538.49	314.57
28	3154.00	89.50	316.20	2704.70	400.94	-405.83	570.47	1.40	570.48	314.65
29	3185.00	89.40	315.80	2705.00	423.24	-427.36	601.47	1.33	601.47	314.72
30	3214.00	89.60	316.20	2705.25	444.10	-447.51	630.46	1.54	630.47	314.78
31	3260.00	89.92	316.20	2705.44	477.30	-479.35	676.45	0.70	676.45	314.88

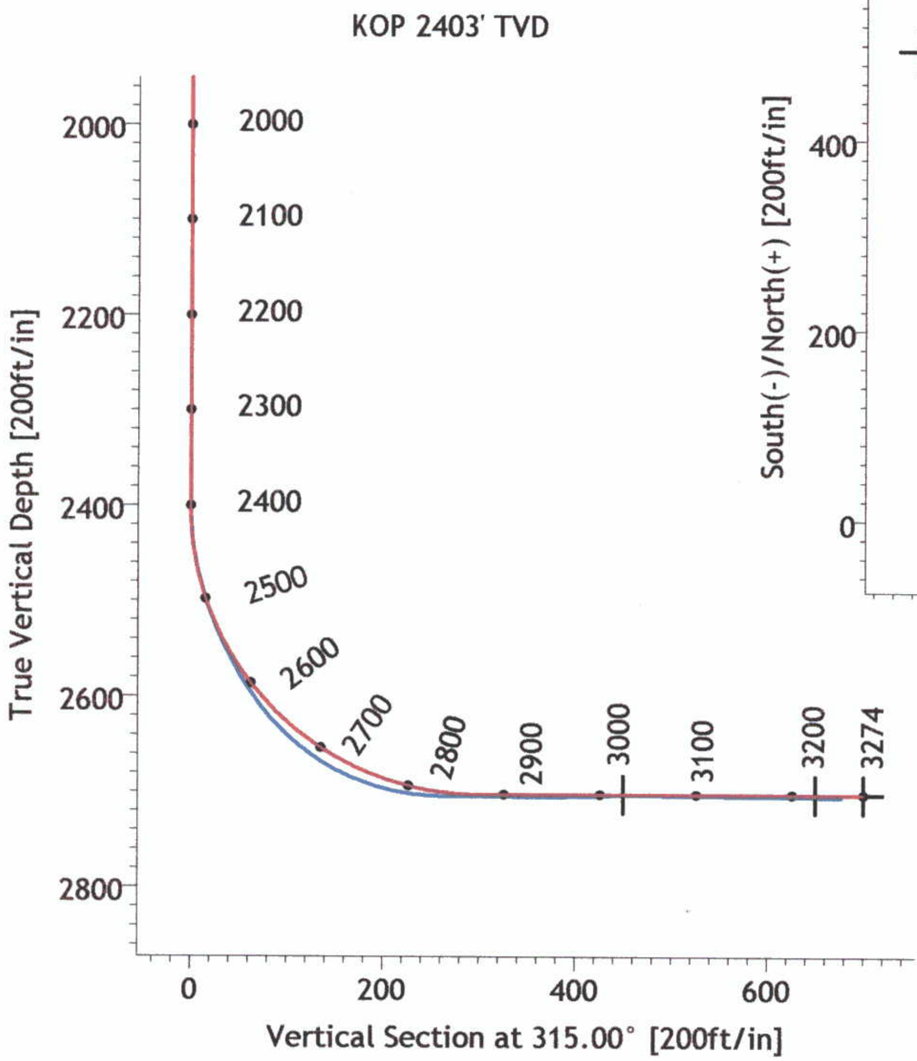
Annotation

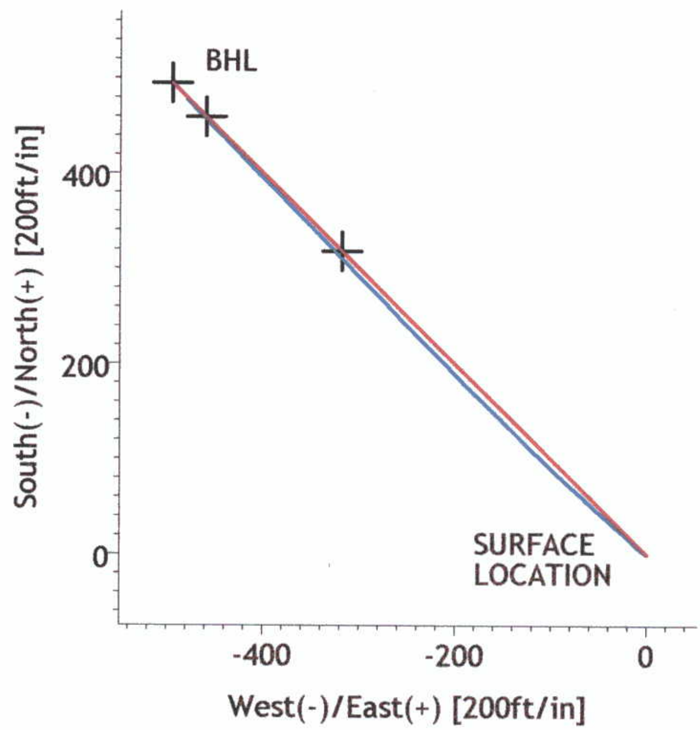
MD ft	TVD ft	
2403.00	2403.00	KOP 2403' TVD
2403.00	2403.00	BUILD @ 19.1`/100' MD
3274.20	0.00	TD @ 3274' MD/ 2703' TVD
2874.20	2704.98	90` @ 2874' MD/ 2703' TVD

LEGEND
AS DRILLED
PLANNED WELL

RESOURCE AMERICA

CARR 5B
NORTH HARMONY TOWNSHIP
CHAUTAUQUA COUNTY, OH
COMPLETION PLOT





BHL AS DRILLED
477' NORTH, 479' WEST OF SURFACE
DISPL: 676' @ N 43.80` W

Ryan The leader in UNDERGROUND INTELLIGENCE™

INDEX MAP

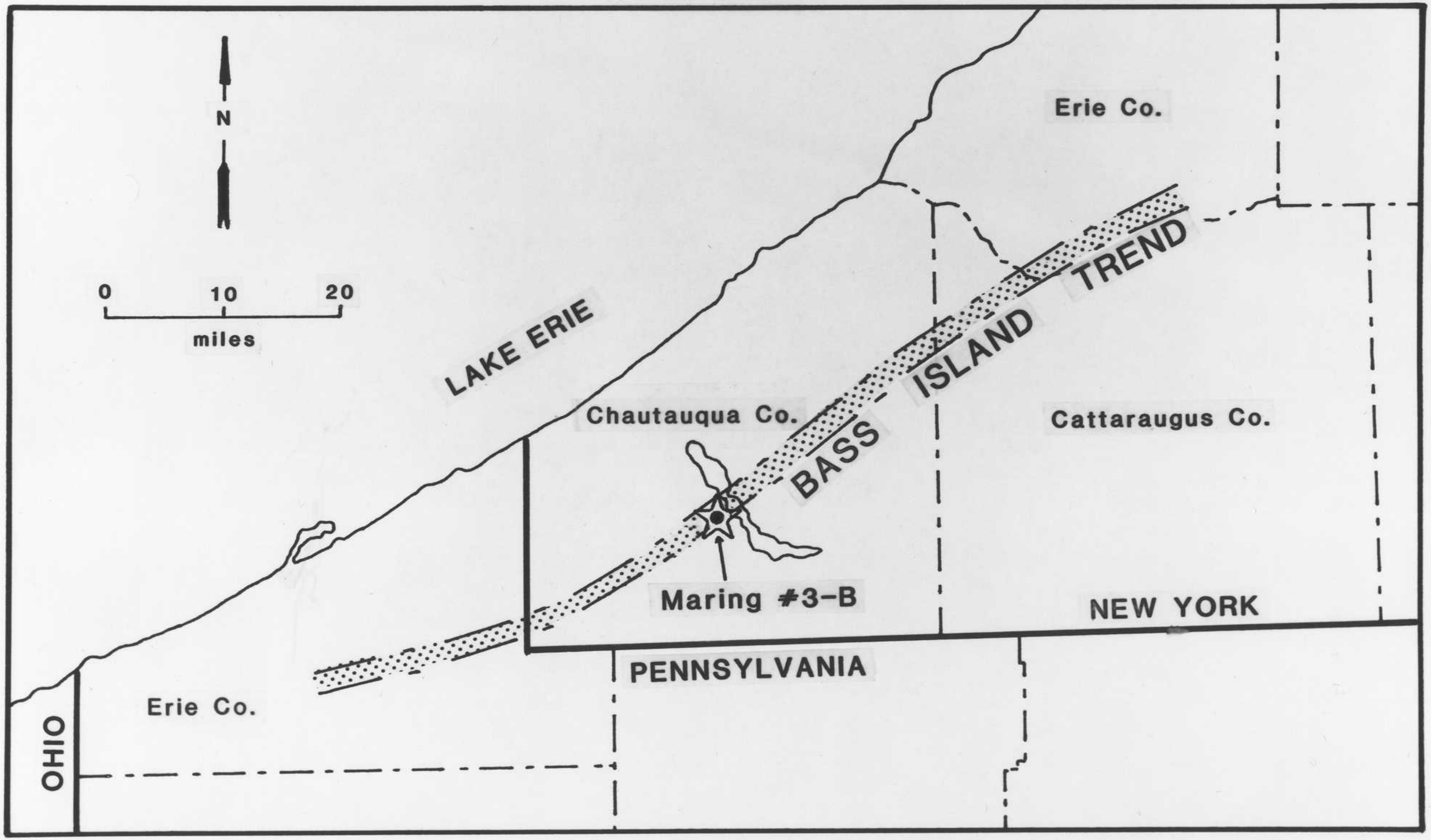


Figure 1

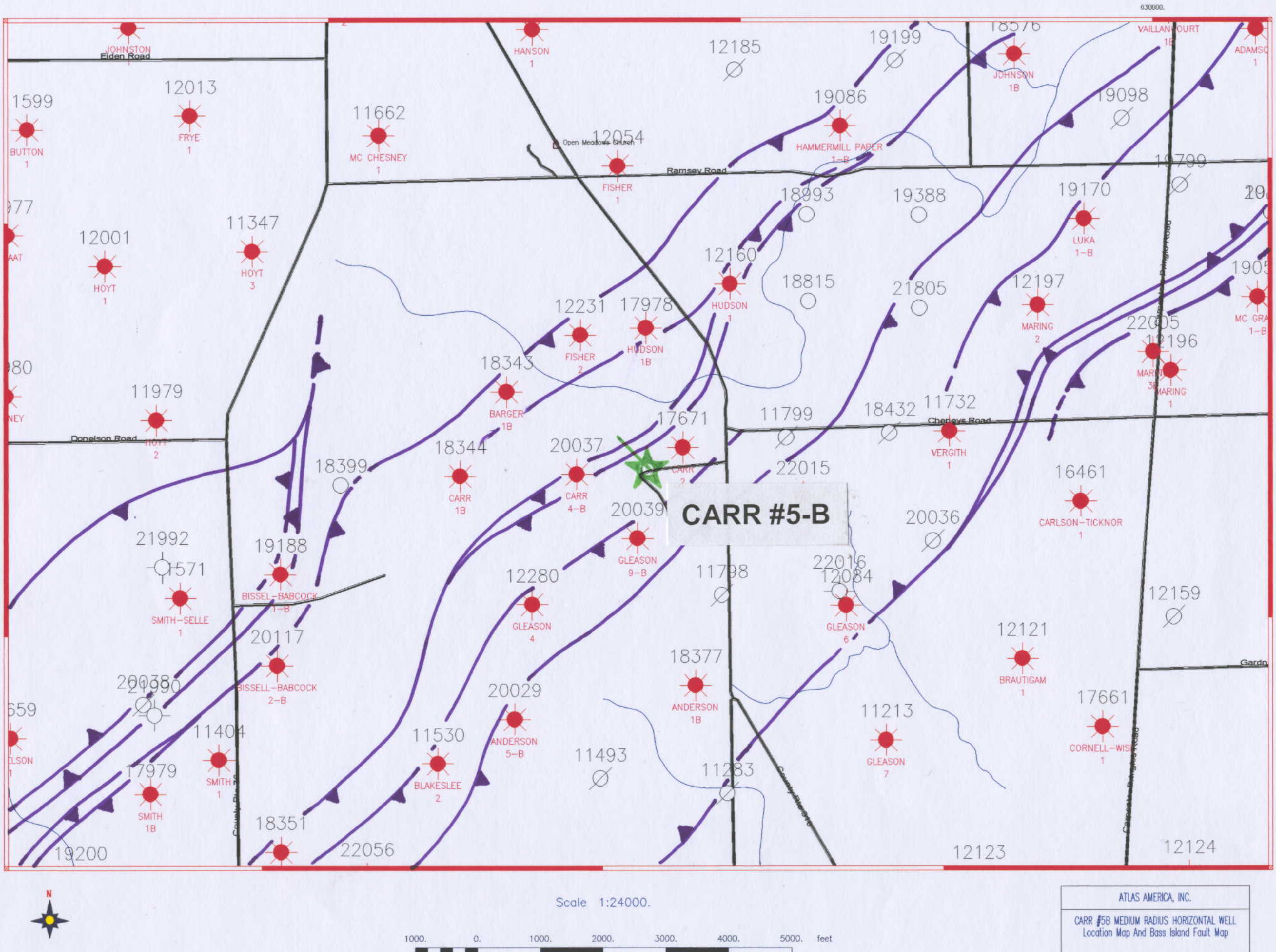
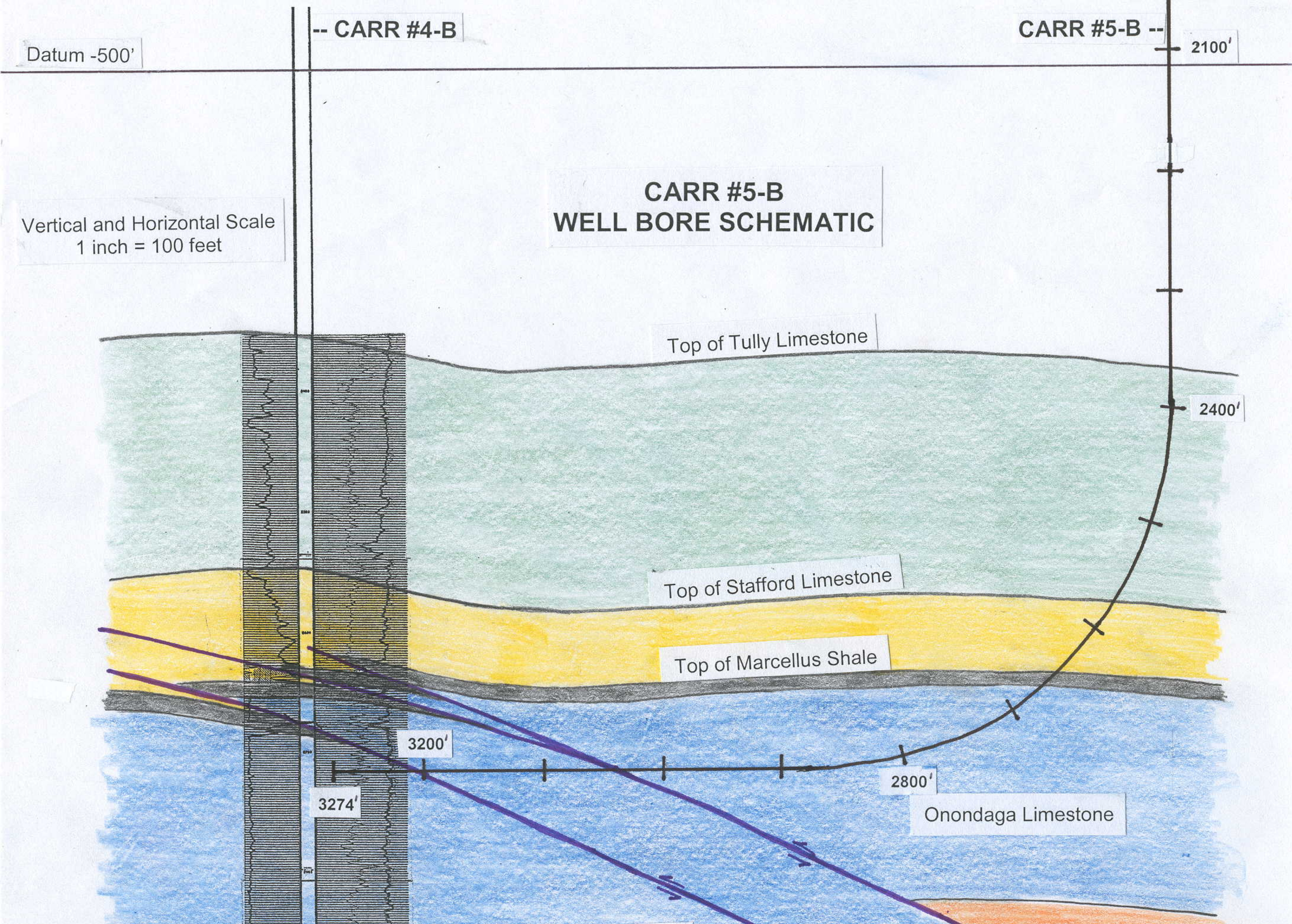

CARR #5-B
JOHNSTON
Elden Road
HANSON 1
12185
19199
18576
JOHNSON 1B
VAILLANCOURT 1B
ADAMS 1
1599
BUTTON 1
12013
FRYE 1
11662
MC CHESNEY 1
Open Meadows Church
12054
FISHER 1
19086
HAMMERMILL PAPER 1-B
19098
Ramsey Road
19799
12001
HOYT 1
11347
HOYT 3
18993
19388
19170
LUKA 1-B
12160
HUDSON 1
18815
21805
12197
MARING 2
12231
FISHER 2
17978
HUDSON 1B
22005
12196
MARING 1
MC GRA 1-B
18343
BARGER 1B
11979
HOYT 2
Donelson Road
17671
CARR 2
11799
18432
11732
Cheneys Road
VERGITH 1
18344
CARR 1B
20037
CARR 4-B
22015
16461
CARLSON-TICKNOR 1
18399
20039
GLEASON 9-B
20036
21992
1571
SMITH-SELLE 1
19188
BISSELL-BABCOCK 1-B
12280
GLEASON 4
11798
22016
12084
GLEASON 6
12159
20117
BISSELL-BABCOCK 2-B
12121
BRAUTIGAM 1
20038
21990
18377
ANDERSON 1B
20029
ANDERSON 5-B
17661
CORNELL-WISE 1
11213
GLEASON 7
11404
SMITH 1
17979
SMITH 1B
11530
BLAKESLEE 2
11493
11283
18351
22056
19200
12123
12124
Gardn
630000.
N
Scale 1:24000.
1000. 0. 1000. 2000. 3000. 4000. 5000. feet
ATLAS AMERICA, INC.
CARR #5B MEDIUM RADIUS HORIZONTAL WELL
Location Map And Bass Island Fault Map
Steven E. George
3/22/2004
1:24,000

Figure 2



Datum -500'
-- CARR #4-B
CARR #5-B --
2100'
CARR #5-B
WELL BORE SCHEMATIC
Vertical and Horizontal Scale
1 inch = 100 feet
Top of Tully Limestone
2400'
Top of Stafford Limestone
Top of Marcellus Shale
3200'
2800'
3274'
Onondaga Limestone

Figure 3

CARR #5-B DAILY DRILLING REPORTS

CARR #5-B DAILY DRILLING REPORTS		
DAY	DEPTH	ACTIVITY
10/5/2001	0'	Move rig on location, do repairs.
10/6/2001	42'	Spud well, set 42' conductor, nipple up.
10/7/2001	474'	Drilled surface hole, ran 11 joints of 8 5/8" surface casing and set at 474'.
		Cemented with 175 sxs of standard cement with 17 BBLS returns. Currently
		waiting on cement.
10/8/2001	474'	Surface casing presssure not holding, waiting on cementers FOR squeeze
		job. Squeeze surface casing with 150 sxs cement, filled casing to top.
10/9/2001	474'	Drilling out cement.
10/10/2001	474'	Surface casing not holding pressure, skid rig to drill new surface hole.
10/11/2001	55'	Spud well, set 42' of conductor, drilling ahead.
10/12/2001	474'	Drilled surface hole, ran 11 joints of 8 5/8" surface casing and set at 474'.
		Cemented with 150 sxs of standard cement with 5 BBLS returns. Currently
		waiting on cement.
10/13/2001	474'	Repair rig.
10/14/2001	1770'	Drilling.
10/15/2001	2304'	Drilled to kick off point at 2403. Preparing to cut radius.
10/16/2001	2304'	Drilled 65' of radius and ran directional survey. Radius kicked off in wrong
		direction. Preparing to spot cement plug to kick well in the right direction.
		Spotted 80 sxs of class A cement with 3% Ca. Redrill hole to 2403'.
10/17/2001	2304'	Running in the hole with a motor for the kick.
10/18/2001	2603'	Drilling radius, 12.2° at 2468', angle good at 2603, tripping out to dress bit.
10/19/2001	2837'	Drilled radius, 45° at 2640, finished cutting radius with 88° at 2837', tripping
		out for horizontal drilling assembly.
10/20/2001	2837'	Tripping in with horizontal drilling assembly.
10/21/2001	3032'	Drilling horizontal hole.
10/22/2001	3274'	Finished drilling horizontal hole.
10/23/2001	3274'	Ran 70 joints of 4 1/2" production casing and set at 2836', cemented with
		180 sxs of 50/50 poz. Estimated annular cement top at 1835'.
11/1/2001		Drilled out cement and spotted 1000 gal. of 15% HCl, displaced into
		formation, unloaded casing with N2. No natural flow. Respotted 1000 gal. of
		15% HCl.
11/2/2001		Unload hole, no flow.
11/5/2001		Casing pressure 100 psi.
11/6/2001		Casing pressure 100 psi.
11/7/2001		Casing pressure 100 psi.
11/9/2001		Opened up well, blew dead in one minute, left well open for 30 minutes, no
		oil or gas, shut well in.
11/13/2001		Casing pressure 24 psi.

Table 1

WELL COST COMPARISON OF THE CARR #5-B MRH WELL AND STANDARD VERTICAL WELL DRILLED IN THE BASS ISLAND TREND

CARR #5-B MRH WELL (COSTS)				
WELL ACTIVITY	COMMENTS	COST $*	COST $**	COST $***
Survey and stake		500	500	500
Permits & Water Tests		1150	1150	1150
Build roads & site		3850	3850	3850
Drilling Contract Costs		91883	66359	56150
Footage rate - $12/ft.		NA	NA	NA
Rig labor - $250/hr.		NA	NA	NA
Directional drilling		80766	80766	68340
Bits, Reamers & Tools		15421	15421	15421
Mud & pit liner		18801	18801	18801
Water & tank hauling		NA	NA	NA
Surface casing		7417	3709	3709
Cementing		6115	3050	3050
Logging		NA	NA	NA
Supervision & consulting		10500	7600	6416
Reclamation		2500	2500	2500
Miscellaneous		32343	32343	32343
Drilling Costs to Casing Point		271246	236049	212230
Production casing & packer		18627	18627	18627
Cementing & Equipment		4968	4968	4968
Perforating & bond log		2509	2509	2509
Acid treatment		32915	32915	32915
Water disposal		5653	5653	5653
Trucking, Water & Tanks		3140	3140	3140
Tubing	2500 ft. @ $.75/ft.		2250	2250
Casing & tubing head			700	700
Valves & connections			1000	1000
Tank battery set up			7000	7000
GPU separator w/ meter			2300	2300
Pumping unit w/ engine			4500	4500
Rods & pump			2500	2500
Flow line & sales line			2500	2500
Labor			2500	2500
Pipe line valves & fittings			1000	1000
	Total $	339058	330111	306292

STANDARD VERTICAL WELL (ESTIMATED COSTS)		
WELL ACTIVITY	COMMENTS	COST $
Survey and stake		500
Drilling permit		850
Build roads & site		5000
Drilling Contract Costs		NA
Footage rate - $12.5/ft.	3000 ft.	37500
Rig labor - $250/hr.	24 hrs.	6000
Directional drilling		NA
Bits, Reamers & Tools		976
Mud & pit liner		645
Water & tank hauling		2000
Surface casing		3700
Cementing		3000
Logging		6000
Supervision & consulting		3000
Reclamation		2500
Miscellaneous		500
Drilling Costs to Casing Point		72171
Production casing	2900 ft. @ $3.25/ft.	9425
Cementing & Equipment		3900
Perforating & bond log		2500
Acid treatment		8000
Water disposal		4000
Trucking, Water & Tanks		1500
Tubing	2500 ft. @ $.90/ft.	2250
Casing & tubing head		700
Valves & connections		1000
Tank battery set up		7000
GPU separator w/ meter		2300
Pumping unit w/ engine		4500
Rods & pump		2500
Flow line & sales line		2500
Labor		2500
Pipe line valves & fittings		1000
	Total $	127746

*Costs for drilling the Carr #5-B.
**Costs for drilling the Carr #5-B minus the costs of the failed surface hole and plus probable completion costs.
***Costs for drilling the Carr #5-B minus the costs of the failed surface hole, minus the costs of the bad kick off and plus the probable completion costs.

Table 2