

**Evaluation of the Potential for  
Natural Gas Development  
Eisenhower Middle & High School  
Farmington Township  
Warren County, Pennsylvania**

**Prepared For the Warren County School District**

**Date of This Evaluation: September 25, 2006**



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## **1.0 Executive Summary**

- At the request of The Warren County School District, Mactech Mineral Management, Inc. independently determined and appraised certain natural gas wells within the vicinity of the Eisenhower Middle & High School located in Farmington Township, Warren County.
- Natural gas has been produced in northwestern Pennsylvania and neighboring western New York, for many decades. The most significant gas reservoir in the area is the Silurian Age Medina Group of sediments, particularly the Whirlpool Sandstone Formation And the overlying Grimsby Formation. In the study area, the Medina Group is found at drilling depth depths of 4,900 to 5,100 feet.
- Typical natural gas production performance is characterized by steep initial declines followed by flattening and hyperbolic decline. Medina Group gas wells are characterized by a high drilling success ratio but low production rate, low ultimate recovery and a long producing life at marginal economic conditions.
- Production decline curve analysis was utilized to predict future production estimates. This type of analysis is the most frequently used method for estimating developed producing reserves.

Based on our assessment of the wells currently producing in vicinity of the Eisenhower School, in our opinion:

- The average 20-year natural gas production is estimated to be 114,105 Mcf. The recoveries ranged from a low of 48,336 Mcf/well to a high of 442,378 Mcf/well
- The estimated cost to drill and complete a Medina well is \$233,920
- Based upon an estimated 20-year recovery of 105,595 Mcf/well, the net Present Value discounted @ 10% before tax is \$233,410 over a 20-year period. Payout on initial capital investment is projected to be 4.5 years.
- The estimated Royalty Income (12.5%) is \$79,196/per well.

Neither Mactech Mineral Management, Inc. nor any of its employees own any interest in the subject properties, and neither the employment to do this review nor compensation for the review is contingent on our estimates of reserves and future income for the subject properties and/or wells reviewed herein.

Reserve estimates and performance predictions are professional opinions dependent upon available data, reservoir and economical conditions, production procedures, interpretation and judgment. Methods that are incorporated in this report are accepted as proper geological and engineering methods. Subsequent data and/or reservoir performance may justify their revision.

Prepared by:

*James J Macfarlane*  
James J. Macfarlane, P.G.  
President

## **2.0 Geologic Summary**

Natural gas has been produced in northwestern Pennsylvania and neighboring western New York, for many decades. The most significant gas reservoir in the area is the Silurian Age Medina Group of sediments, particularly the Whirlpool Sandstone Formation And the overlying Grimsby Formation. These two formations are separated by the intervening Cabot Head Shale Formation. In the study area, the Medina Group is found at drilling depth depths of 4,900 to 5,100 feet. Generally speaking, the quality of the Whirlpool and Grimsby reservoirs is poor. Permeability and porosity are low. Continuity of individual sand saturations are variable in the Grimsby. However, natural gas is prevalent on a nearly continuous accumulation in the area, which is controlled more by stratigraphic than structural trapping mechanisms. Thus, Medina Group gas wells are characterized by a high drilling success ratio but low production rate, low ultimate recovery and a long producing life at marginal economic conditions.

### **THE MEDIA GROUP**

The group is part of the Silurian Niagaran Provincial Series deposited along the northern rim of the Appalachian foreland basin. The Medina Group sediments were deposited in deltaic and shallow marine environments. The sequence from the Whirlpool Sandstone through the Grimsby Formation records an early Silurian marine transgression over the eroded Queenston deposits, followed by regression resulting from active progradation of the Medina fringe delta. The Medina Group is the primary gas producing interval of western New York and northwestern Pennsylvania.

### **3.0 Summary of Decline Curve Analysis:**

Most of the oil and gas in the Appalachian Basin is produced from tight sandstone reservoirs such as the lower Silurian age Medina Group sandstone which is developed for natural gas production in northwestern Pennsylvania and western New York

Typical production performance is characterized by steep initial declines followed by flattening and hyperbolic decline. In many of these reservoirs, the initial producing rates are high but decline very rapidly to very low sustained rates of 5 to 20 MCFPD. In many cases, performance data indicate similar reserves for wells, whereas reserves estimated on the basis of logs and core data would differ significantly for these wells. Low per well operating costs and generally favorable product prices in a good market area combine to provide low economic limit production rates, which leads to long life. Usually 30 to 90 days of daily capacity production will establish useful decline patterns. Such data may yield reliable reserve estimates when combined with analogy.

All the wells in the study were originally hydraulically fractured. Typically, the Upper Grimsby was perforated and stimulated. Hydraulically fractured wells during their producing life can pass through several flow regimes such as an initial clean up period, bilinear flow, linear flow, pseudo-radial flow and boundary affected flow.

Production data was submitted to Mactech by the Warren County School District via a mineral rights owner with fractional royalty ownership in four (4) wells operated by Nornew, Inc. From the data submitted, the subject wells commenced in February 2001 and information ended after November 2005. There was monthly production data omitted for various periods, though we were able to extrapolate this missing data utilizing decline curve models. Actual production from these wells experienced the typical performance of high flush production rates and steep initial declines followed by flattening and hyperbolic decline.

In addition to the above (4) wells, Mactech was able to obtain annual production data for an additional (8) wells via PADCNR IRIS system. The wells are also operated by Nornew and are adjacent to the aforementioned (4) wells. Unfortunately the data acquired via the PADCNR is only posted through the year 2000. Production decline analysis also showed that these wells also experienced the typical hyperbolic decline production rate.

Figure 1 is a table that summarizes the production from the wells analyzed. Summarized is actual production, projected remaining reserves and the 20 year estimated ultimate recovery (EUR) of natural gas. The range of the 20-year estimated production recovery was from a low of 48,336 Mcf to a high of 444,378 Mcf per well. The average of the 12 wells was 114,105 Mcf. Figures 2 through 13 are individual decline curve models of the subject 12 wells analyzed.

Figure 16 locates all wells within the vicinity of the Eisenhower Middle Senior High School in Farmington Township, Warren County, PA.

#### **4.0 Summary of Economical Analysis:**

Based upon the results of the decline curve analysis, Mactech was able to perform a 20 year economic projection. The following parameters were used for a projected cash flow;

1. Estimated Ultimate Recovery (EUR) for the typical is 105,595 Mcf.
2. Natural Gas Price of \$6.00/Mcf was used and this product price was held constant for the 20-year period.
3. Net Working Interest was assumed to be 87.5%.
4. Annual well operating cost was estimated to be \$6,800
5. The estimated completed well cost is \$233,920. This includes well head, gas production equipment, pipeline and sales meter.

Based upon the above parameters, the income results are as follows:

1. The 20-year cumulative net income after operating expenses was estimated to be \$335,218
2. Estimated pay-out on capital investment (\$233,920) before-tax was approximately 4.5 years.
3. 20-year Net Present Value (NPV) using a discount rate of 10% was 233,410
4. The 12.5% royalty interest was valued to be \$79,196 over a 20-year period.

Please refer to Figure 14 for the estimated cash flow details and Figure 15 for the estimated wells costs.



## **5.0 Figures:**

Warren County School District-Eisenhower Middle Senior High School  
Farmington Township, Pennsylvania  
Medina Sandstone Reservoir Production Analysis of Certain Gas Wells

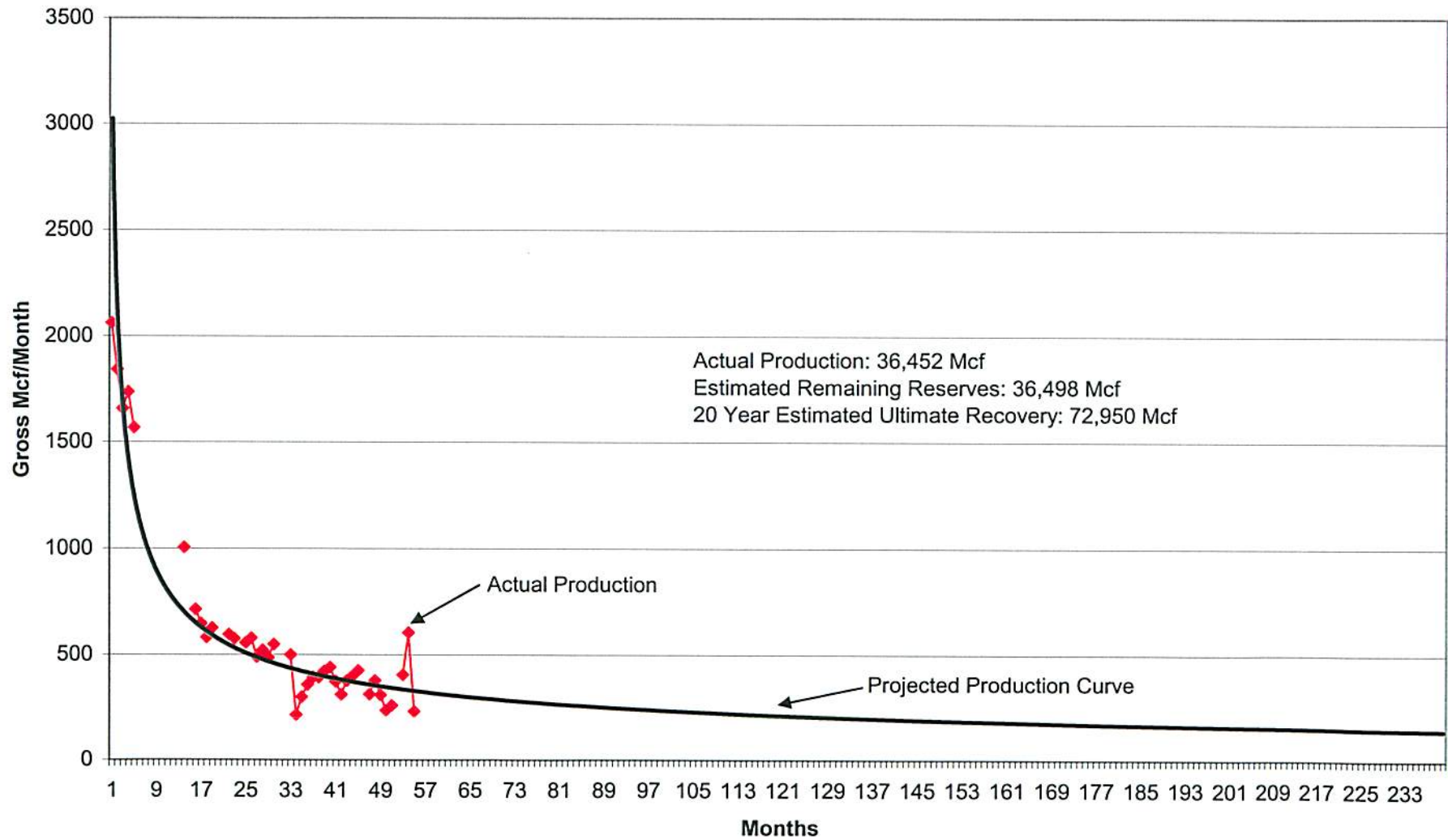
FIGURE 1

Well Name	Actual Production (Mcf)	Projected Remaining Reserves (Mcf)	Estimated Recovery (Mcf)
T. Lindell #1*	36,452	36,498	72,950
S.R. Vanord #1*	26,463	49,490	75,953
L.H. Enos #3*	38,666	73,020	111,686
T.W. Jones #1*	48,607	122,499	171,106
D.R. Lindell #2	26,571	36,643	63,214
D.A. Wilcox #1	22,669	31,567	54,236
Reasor & Wo	31,644	36,327	67,971
J.L. Swanson #1	99,516	342,862	442,378
R.C. Gilkinson #1	32,576	42,429	75,005
Reasor	44,197	61,253	105,450
Hirsh#1	36,317	44,662	80,979
R.U. Schaffer #1	14,202	34,134	48,336
TOTAL (*4 wells)	101,581	281,507	431,695
TOTAL (All wells)	457,880	911,384	1,369,264
AVERAGE/WELL (*4 wells)	37,547	70,377	107,924
AVERAGE/WELL (All wells)	38,157	75,949	114,105

\*Various months data was omitted as supplied to Mactech.

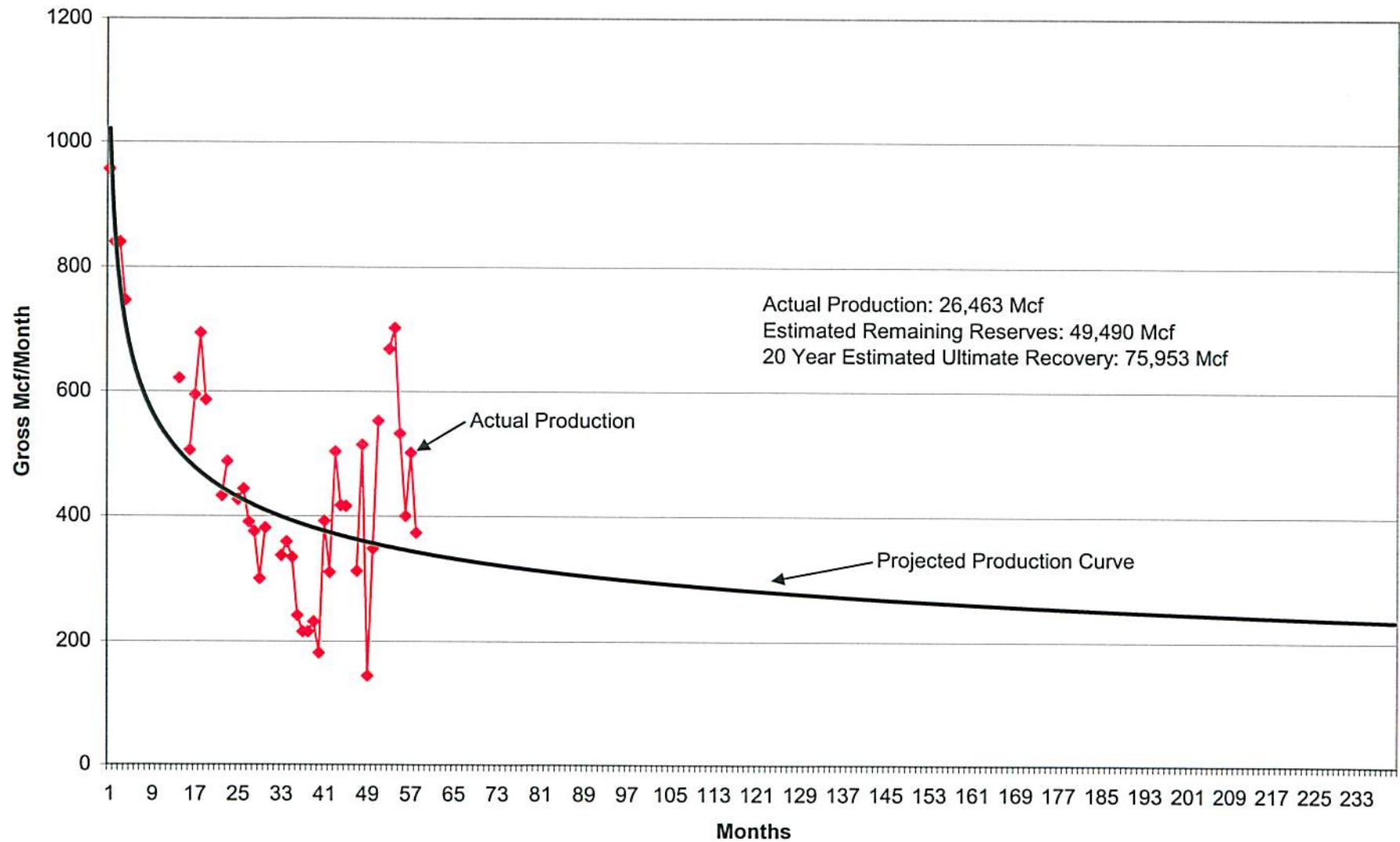
# Nornew-T. Lindell #1

Figure 2

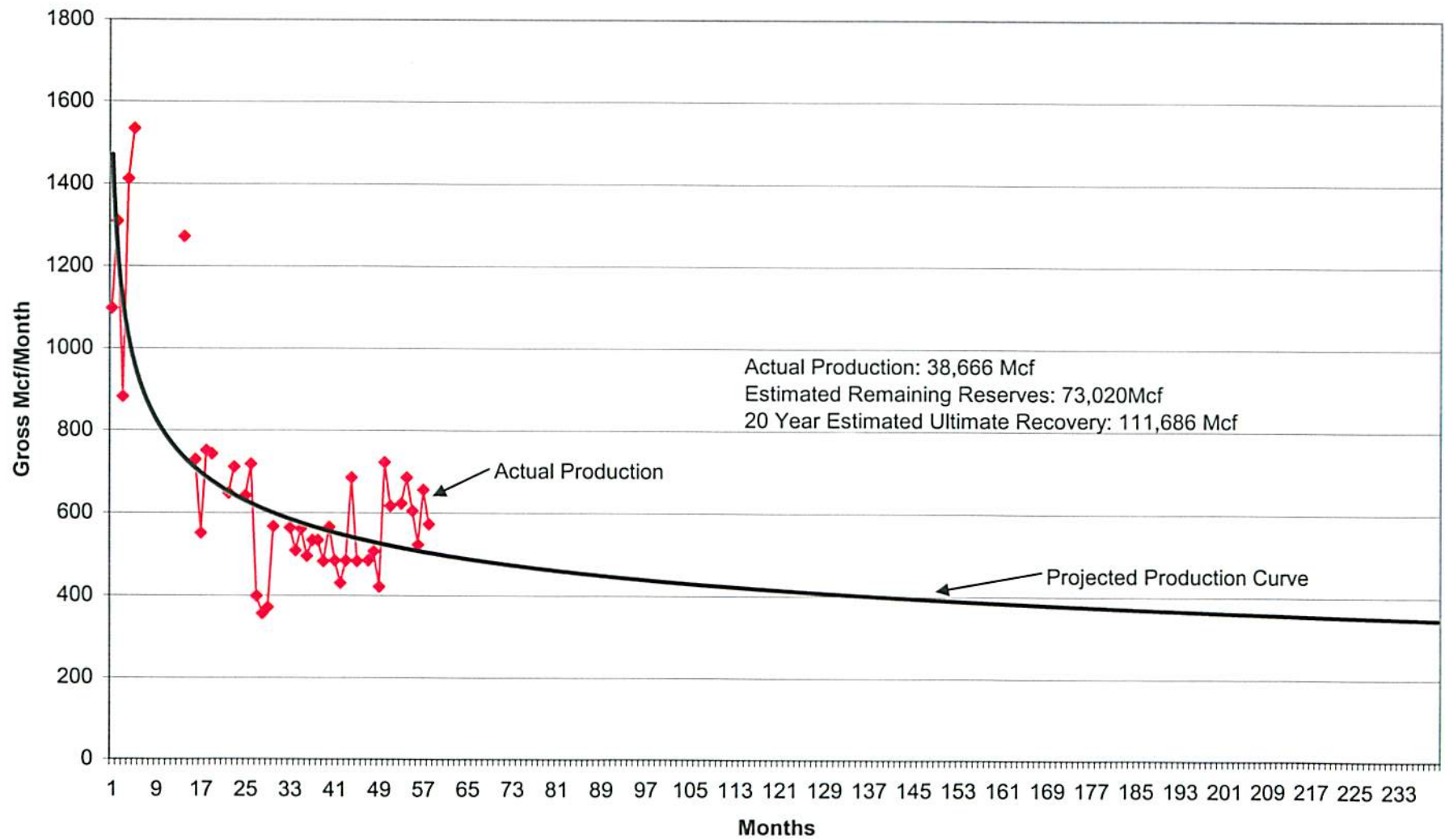


# Nornew-S.R. Vanord #1

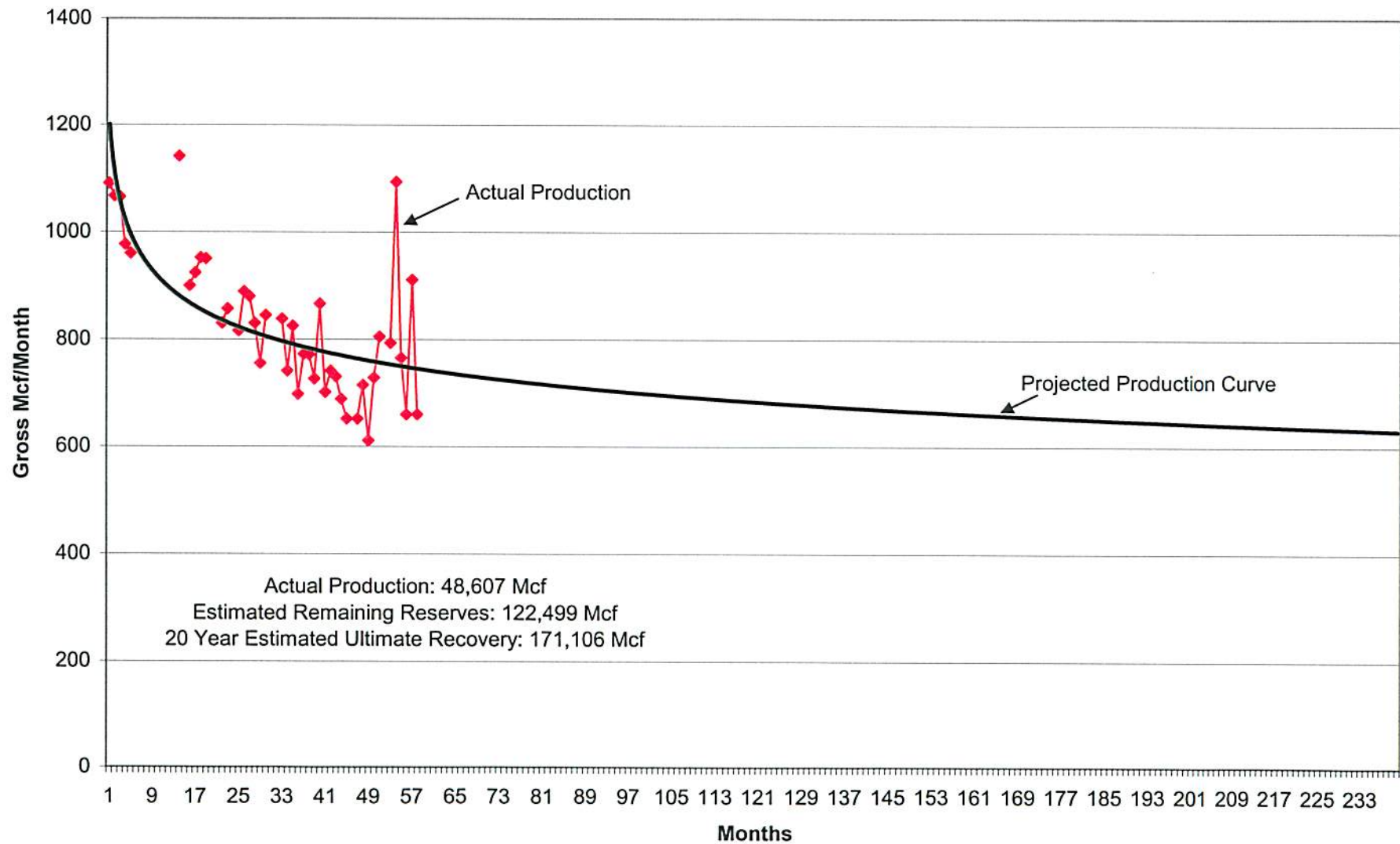
Figure 3



Nornew-L.H. Enos #3  
Figure 4

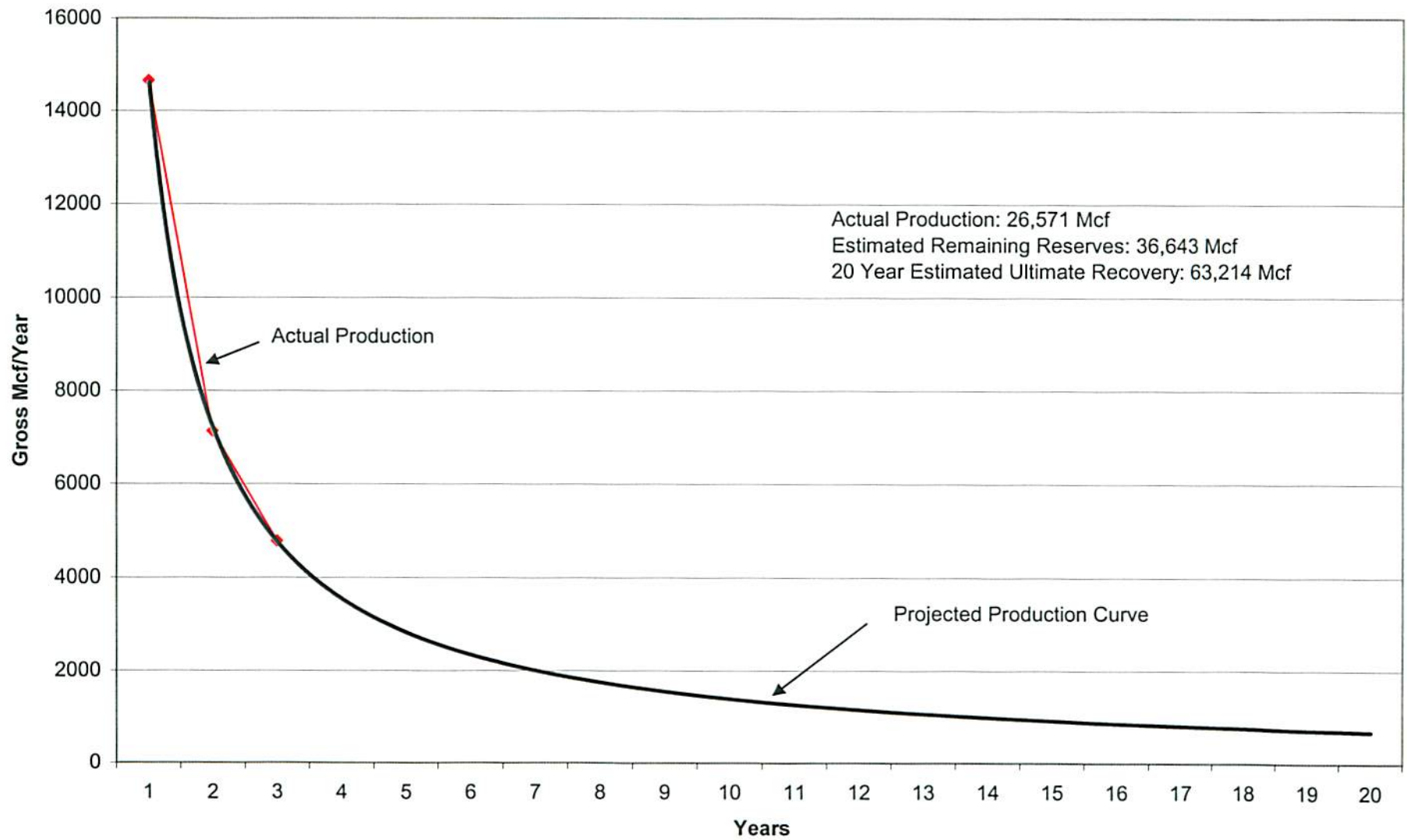


Nornew-T.W. Jones #1  
Figure 5

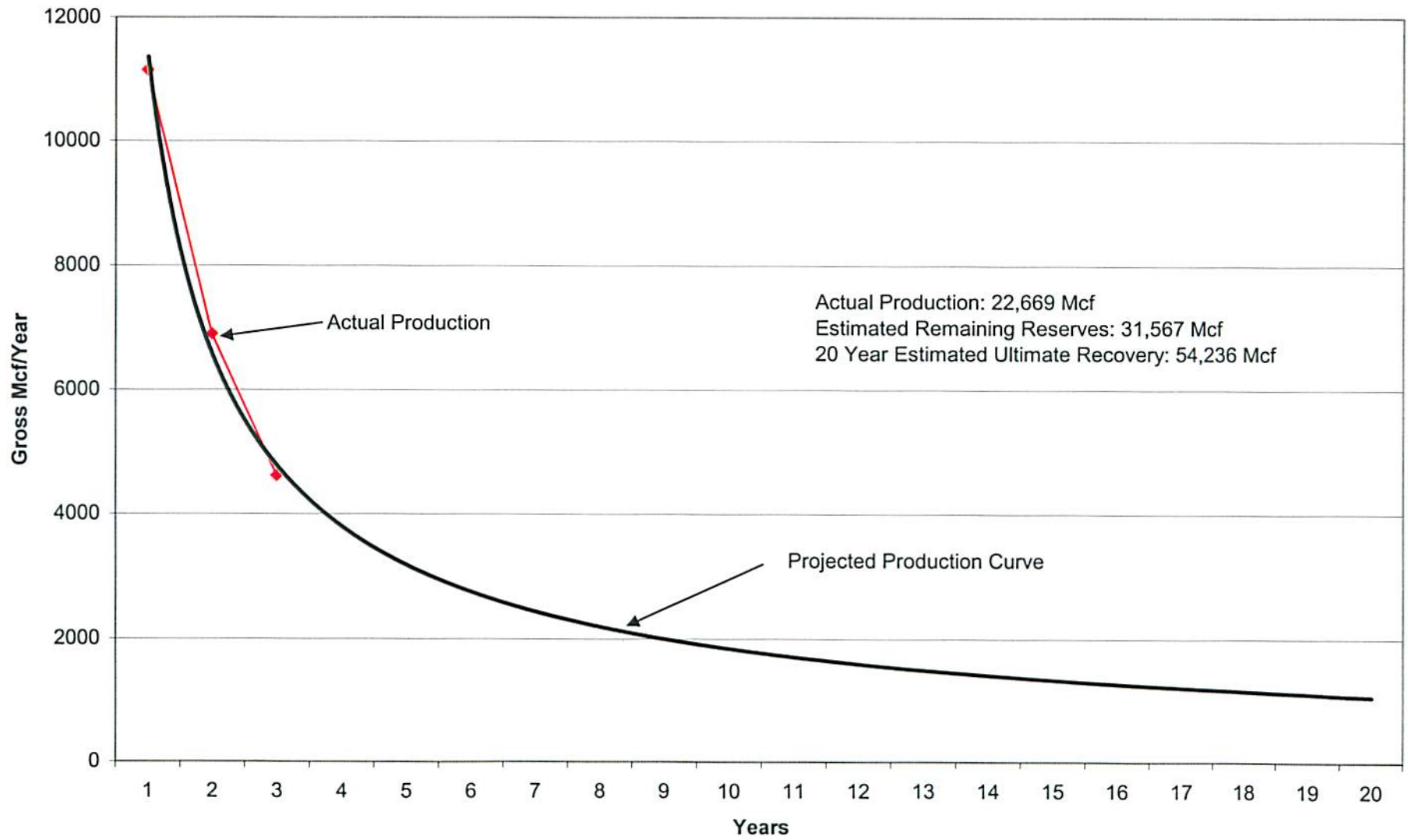




Nornew-DR Lindell 2  
Figure 6

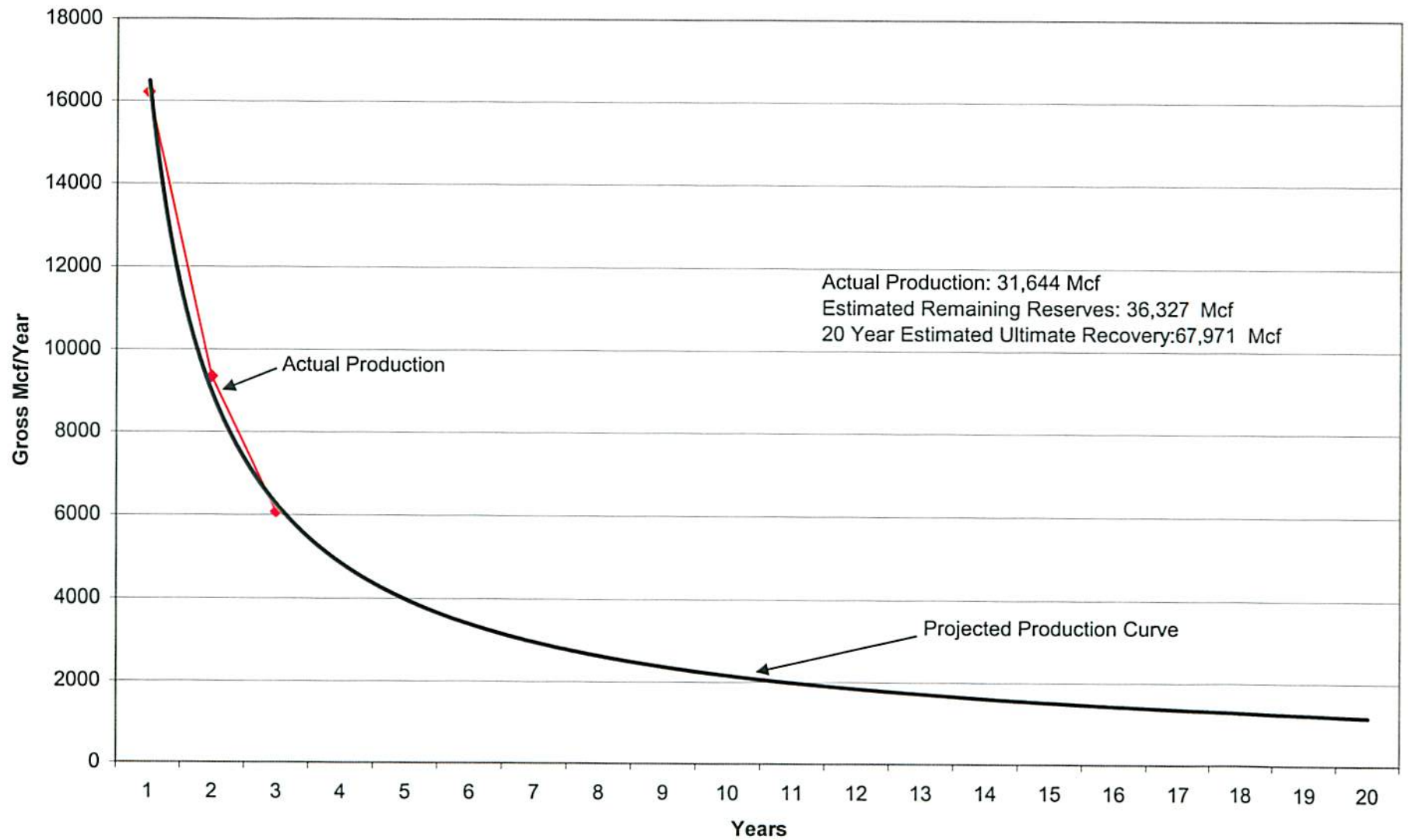


Nornew-DA Wilcox  
Figure 7



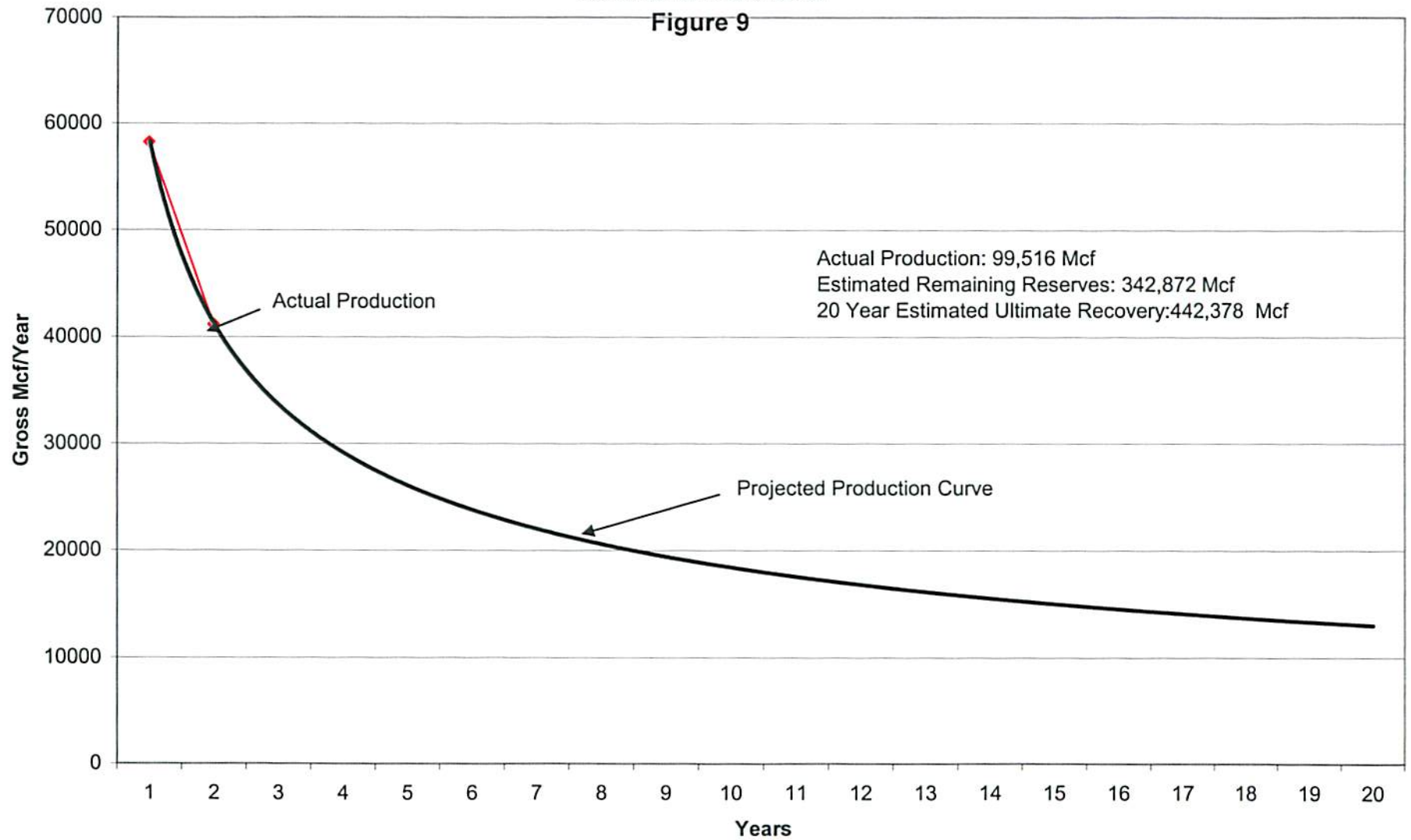


Nornew-Reasor & Wo  
Figure 8

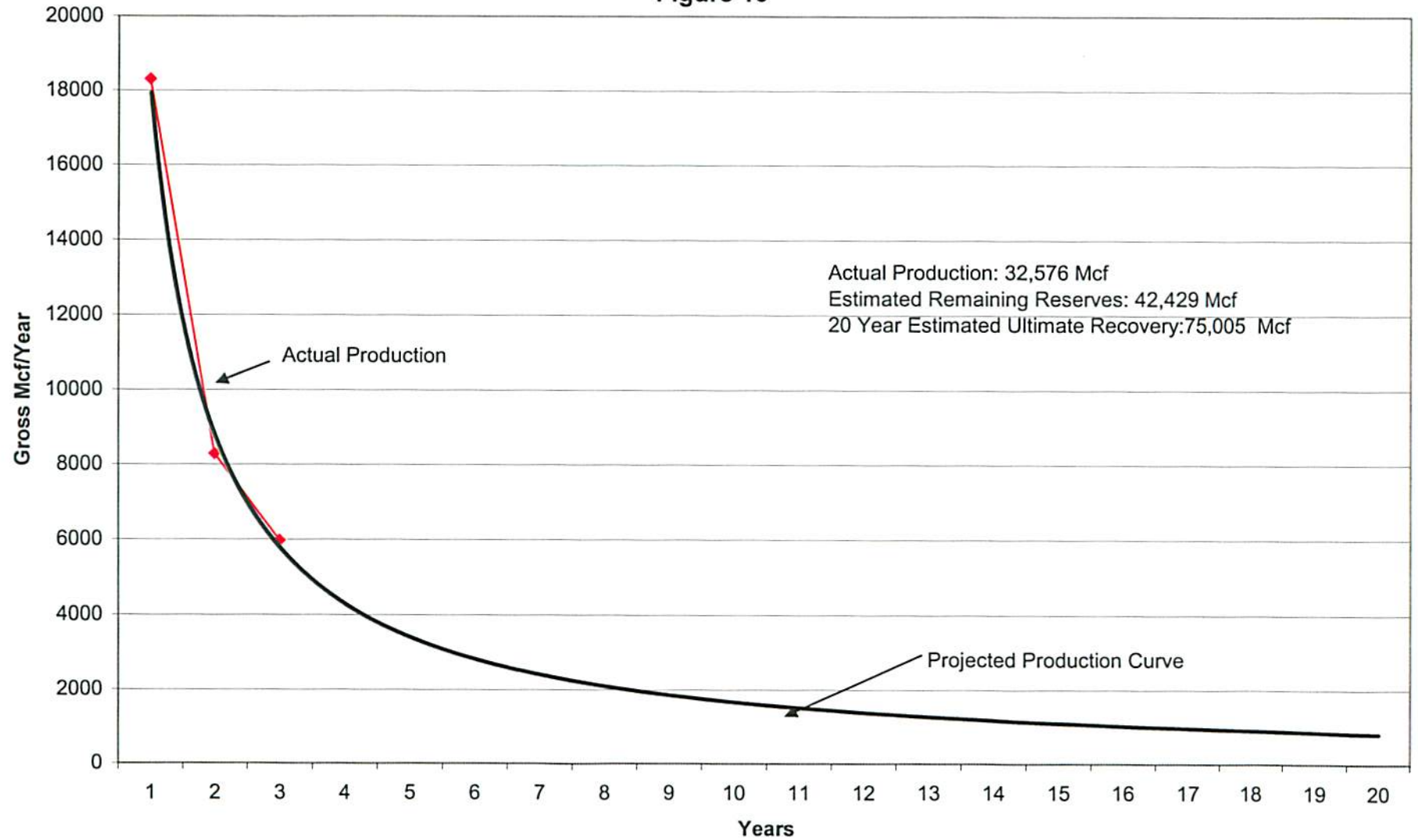


# Nornew-JL Swanson

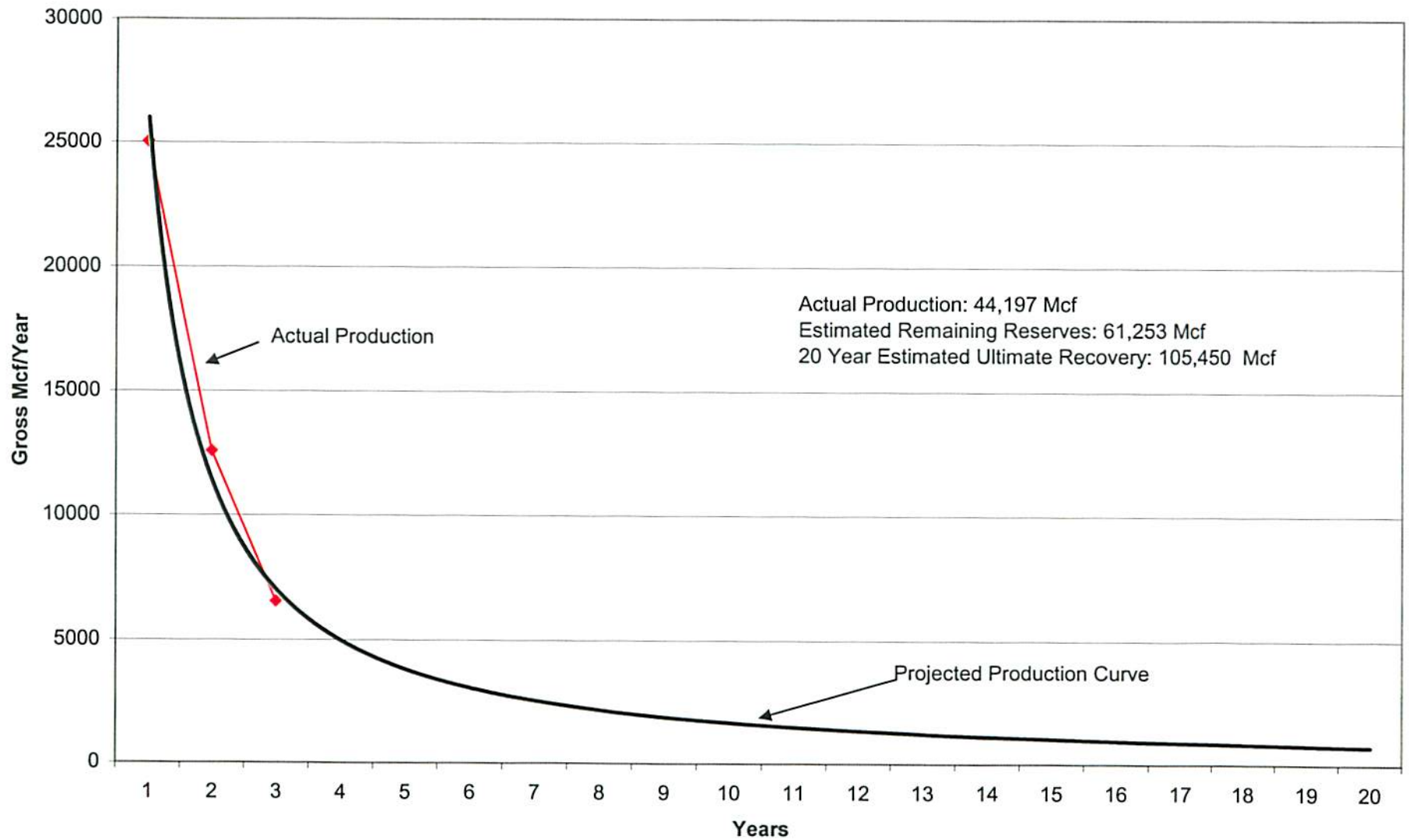
Figure 9



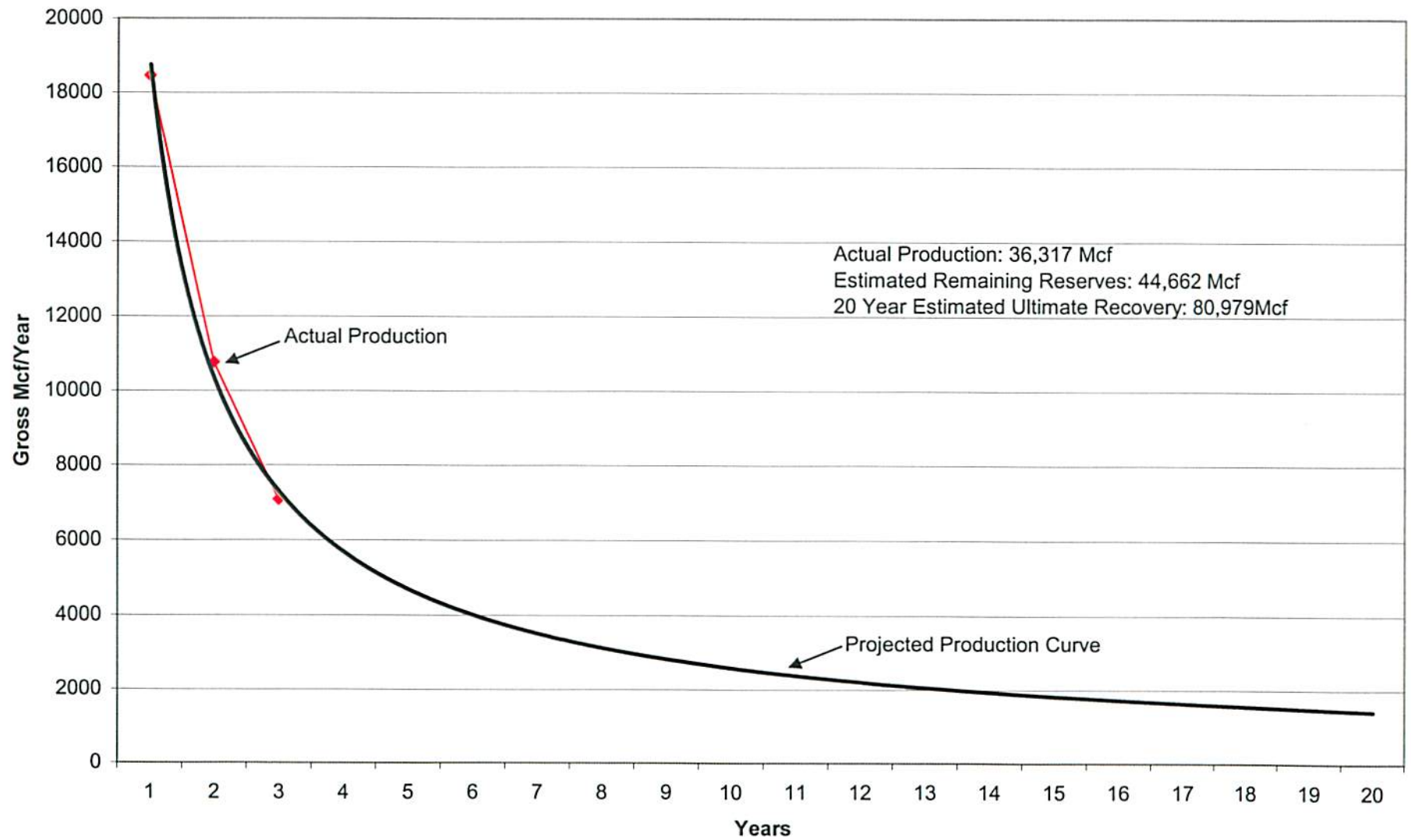
Nornew-RC Gilkinson  
Figure 10



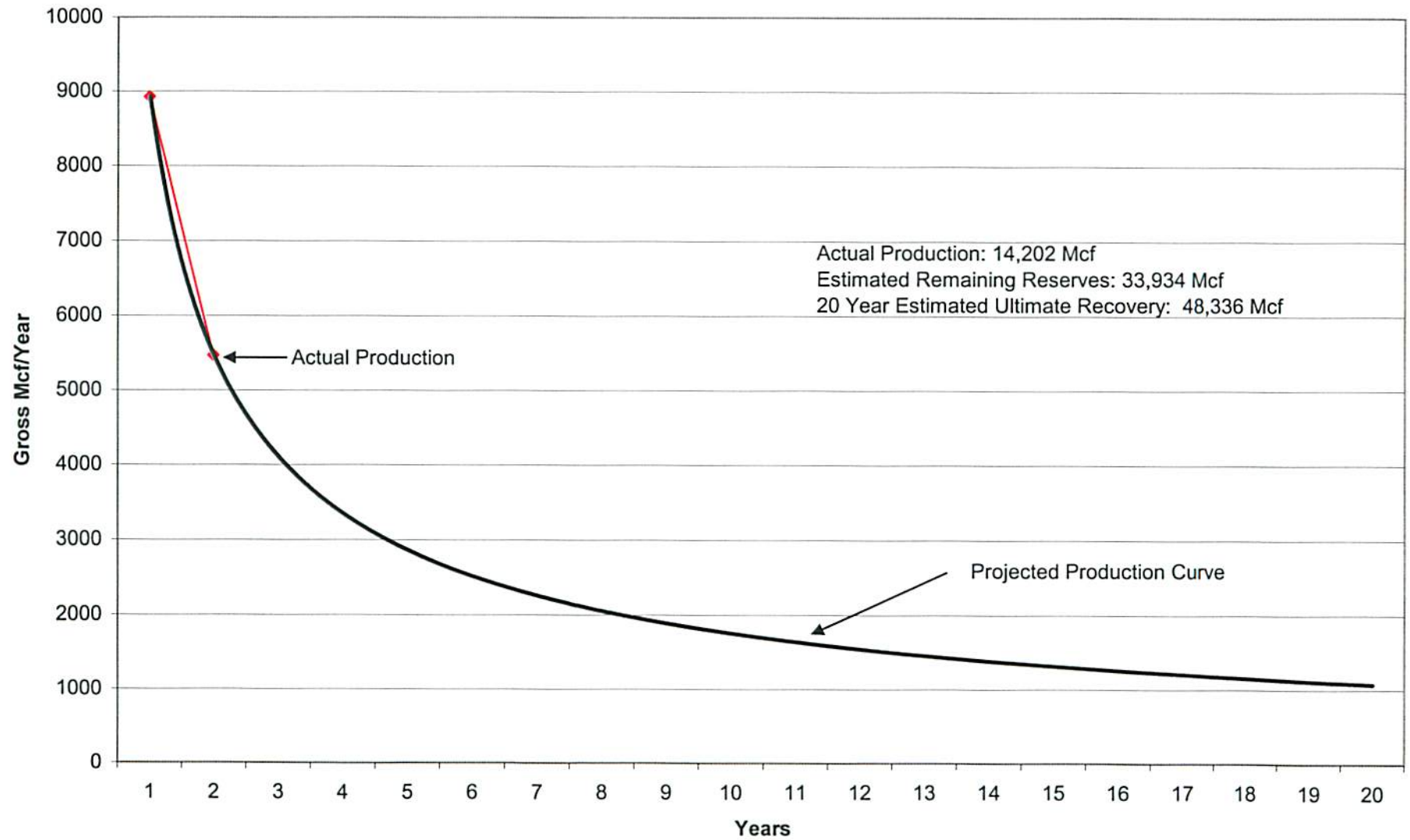
Nornew-Reasor  
Figure 11



Nornew-Hirsh #1  
Figure 12



Nornew-RU Shaffer  
Figure 13





Project Name: Type Well: Medina-Farmington Twp. Warren, Co.  
 Class/Category: Undeveloped

Figure 14

Yr	G A S P R O D U C T I O N			EXPENSES Net Well Operating Expenses (\$)	R E V E N U E S			
	100% Gross Mcf	87.50% Net Mcf	Price \$ Per Mcf		87.50% Net Cash Flow Gas	Before Tax Net Cash Flow After Opr. Expenses (\$)	Cuml. Before Tax Net Cash Flow After Opr. Expenses (\$)	12.50% Royalty Income (\$)
1	25,054	21,922	6.00	\$ 6,800.00	\$ 111,803.48	\$ 105,003	\$ 105,003	\$ 18,791
2	13,614	11,912	6.00	\$ 6,800.00	\$ 60,750.37	\$ 53,950	\$ 158,954	\$ 10,210
3	9,528	8,337	6.00	\$ 6,800.00	\$ 42,519.54	\$ 35,720	\$ 194,673	\$ 7,146
4	7,397	6,473	6.00	\$ 6,800.00	\$ 33,009.77	\$ 26,210	\$ 220,883	\$ 5,548
5	6,078	5,319	6.00	\$ 6,800.00	\$ 27,124.50	\$ 20,324	\$ 241,208	\$ 4,559
6	5,177	4,530	6.00	\$ 6,800.00	\$ 23,103.74	\$ 16,304	\$ 257,511	\$ 3,883
7	4,521	3,955	6.00	\$ 6,800.00	\$ 20,172.93	\$ 13,373	\$ 270,884	\$ 3,390
8	4,019	3,517	6.00	\$ 6,800.00	\$ 17,936.43	\$ 11,136	\$ 282,021	\$ 3,015
9	3,624	3,171	6.00	\$ 6,800.00	\$ 16,170.44	\$ 9,370	\$ 291,391	\$ 2,718
10	3,303	2,890	6.00	\$ 6,800.00	\$ 14,738.57	\$ 7,939	\$ 299,330	\$ 2,477
11	3,037	2,657	6.00	\$ 6,800.00	\$ 13,552.82	\$ 6,753	\$ 306,083	\$ 2,278
12	2,813	2,462	6.00	\$ 6,800.00	\$ 12,553.82	\$ 5,754	\$ 311,836	\$ 2,110
13	2,622	2,294	6.00	\$ 6,800.00	\$ 11,699.98	\$ 4,900	\$ 316,736	\$ 1,966
14	2,456	2,149	6.00	\$ 6,800.00	\$ 10,961.31	\$ 4,161	\$ 320,898	\$ 1,842
15	2,456	2,149	6.00	\$ 6,800.00	\$ 10,961.31	\$ 4,161	\$ 325,059	\$ 1,842
16	2,184	1,911	6.00	\$ 6,800.00	\$ 9,746.07	\$ 2,946	\$ 328,005	\$ 1,638
17	2,071	1,812	6.00	\$ 6,800.00	\$ 9,239.75	\$ 2,440	\$ 330,445	\$ 1,553
18	1,969	1,723	6.00	\$ 6,800.00	\$ 8,786.49	\$ 1,986	\$ 332,431	\$ 1,477
19	1,877	1,643	6.00	\$ 6,800.00	\$ 8,378.23	\$ 1,578	\$ 334,010	\$ 1,408
20	1,795	1,570	6.00	\$ 6,800.00	\$ 8,008.46	\$ 1,208	\$ 335,218	\$ 1,346
Total	105,595	95,699	83,737		\$ 471,218.02	\$ 427,059		\$ 79,196

Reserve & Economic Input & Results		
Gross oil reserves, bbl		0
Gross gas reserves, mcf		105,595
Net oil reserves, mcf		0
Net gas reserves, mcf		95,699
Gross wells		1.00
Projected time, years		20.00
Net initial capital cost, \$		98,500
NPV @ 10% Discount Rate		\$233,410
Net Revenue Interest		87.50%
Initial oil price, \$ per bbl	\$	-
Initial gas price, \$ per mcf	\$	6.00
Net oper. Cost/well/yr.	\$	6,800
Natural gas transport rate, per mcf	\$	-

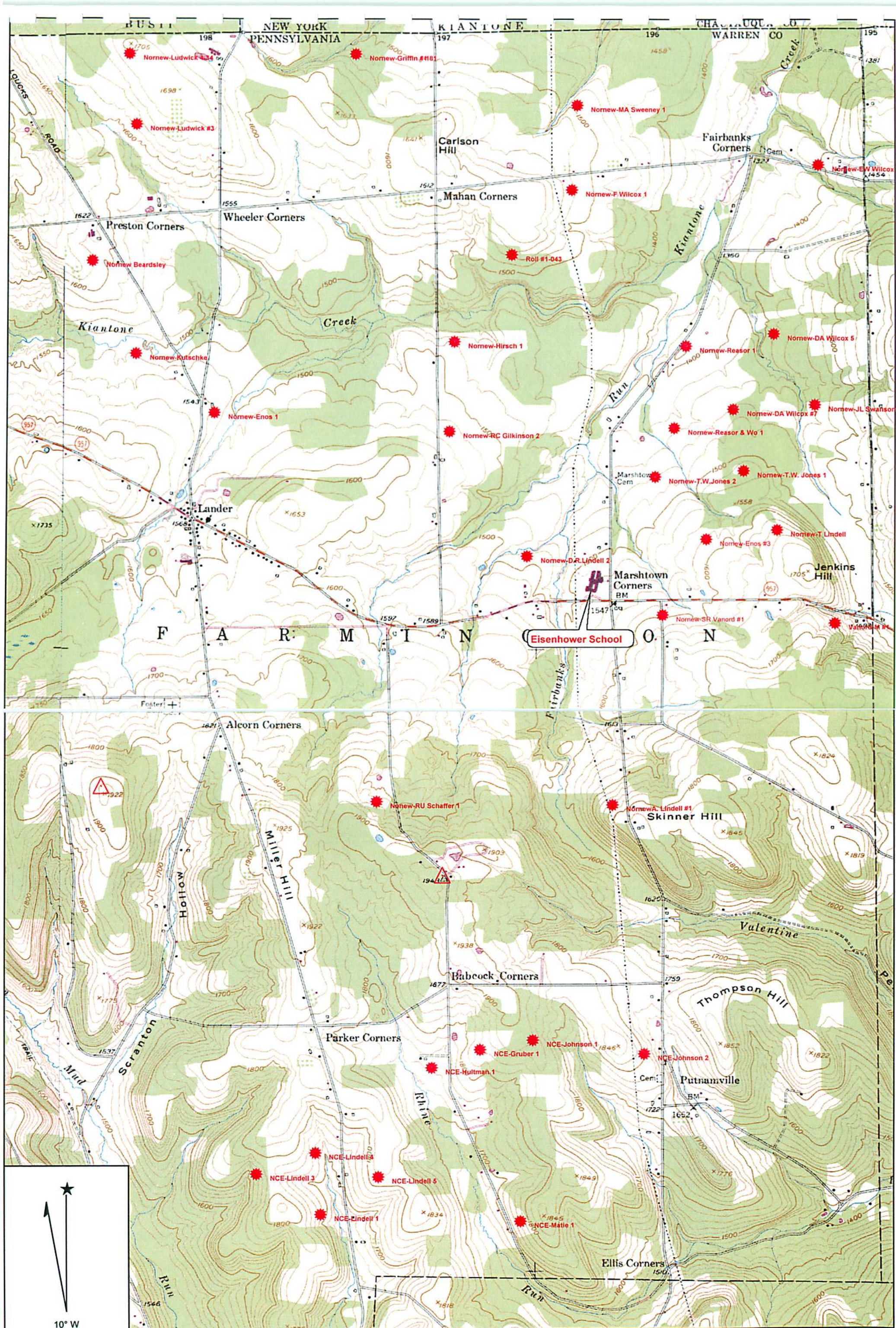
Net Present Value Profile	
Discount Rate	PW of Net Before - Tax
0.00%	\$0
5.00%	\$271,257
10.00%	\$233,410
12.00%	\$221,271
15.00%	\$205,443
20.00%	\$183,934
25.00%	\$166,846



Prospect Name:	Eishenhower School	Prospect Objective	Medina	Figure 15
Operator	N/A	Projected Total Depth	4,900	
State	Pennsylvania			
County	Warren			
Town	Farmington			

						GROSS WORKING INTEREST COST DETAIL		
						DRY	COMPLETED	
COST CATEGORIES						HOLE	HOLE	
INTANGIBLES	Land Services (Surveying, Title Opinion, Permitting, Damages, ROW's)					\$1,650	\$1,650	
	Location Construction (Labor, stone, culverts, fabric, filter fence, etc.)					\$7,000	\$7,000	
	Mobilization / Demobilization (Moving drilling unit to / from drillsite)					\$2,000	\$2,000	
	Contract Drilling : Turnkey 0 ft					\$0	\$0	
	Contract Drilling : Footage 4,900 ft @ \$19.25 \$/ft					\$94,325	\$94,325	
	Contract Drilling : DayWork 0 days @ \$0.00 \$/day					\$0	\$0	
	Directional Drilling Services days @ \$/day					\$0	\$0	
	Bits					\$0	\$0	
	Power, Fuel & Water (for drilling operations only)					\$2,000	\$2,000	
	Drilling Mud & Chemicals					\$0	\$0	
	Mudlogging Services					\$0	\$0	
	Coring, Wireline Testing, DST.					\$0	\$0	
	Equipment Rental (drilling operations only - mud pumps, BOP's, etc.)					\$0	\$0	
	Well Supplies ( Centralizers, Float Equip., DV Tools, Baffles, etc.)					\$750	\$750	
	Cementing (Conductor, Surface, Interm, & Prod)					\$3,000	\$13,500	
	Logging (including: coal logs, sidewall coring & openhole logs)					\$3,200	\$3,200	
	Perforating/Notching (Includes: CBL log & any cased hole electricline work)					\$3,100	\$3,100	
	Stimulation - Acidizing & Fracturing (incl.: tank rental & water hauling)					\$0	\$35,500	
	Completion Unit (Service Rig, Coiled Tubing, etc.)					\$0	\$3,600	
	Pit Treatment / Solidification					\$600	\$600	
	Water Disposal (Drilling & Completion Fluids)					\$750	\$750	
	Location Restoration / Reclamation					\$2,200	\$2,200	
	Supervision (wellsite, engineering & geology)					\$0	\$3,200	
	Transportation (Materials)					\$0	\$0	
	Wellhead & Tank Battery Installation (Roustabout Labor & Equipment)					\$0	\$2,400	
	Gathering pipeline Installation (Labor & Equipment)					\$0	\$3,500	
	Plug & Abandonment (cementing/Service Rig)					\$0	\$0	
	Drilling Administration Overhead (bonding & insurance)					\$0	\$0	
	Miscellaneous & Contingency					\$0	\$0	
GROSS INTANGIBLE COSTS						\$120,575	\$179,275	
TANGIBLES	Tubing/Rods 4,900 FT @ 1.55 \$/ft					\$0	\$7,595	
	Casing -Conductor 35 FT @ 15.00 \$/ft					\$525	\$525	
	-Surface 500 FT @ 8.70 \$/ft					\$4,350	\$4,350	
	-Interm. 0 FT @ 0.00 \$/ft					\$0	\$0	
	-Prod. 4900 FT @ 5.75 \$/ft					\$0	\$28,175	
	Well Equipment: -Surface						\$2,500	
	-Subsurface						\$0	
	Lease Equipment: -Artificial Lift/Pumping Unit						\$1,000	
	-Oil & Gas Flow Lines						\$1,500	
	-Electric Lines & Misc. Materials						\$0	
	-Tank Batteries, Separators & Sub-Meter						\$6,500	
	-Gas Gathering Lines w/ Sales Meter						\$2,500	
	-Other Production Equipment						\$0	
	GROSS TANGIBLE COSTS						\$4,875	\$54,645
	GROSS TOTAL COSTS						\$125,450	\$233,920





Name: RUSSELL  
Date: 9/25/2006  
Scale: 1 inch equals 2000 feet

Location: 041° 57' 22.87" N 079° 12' 57.10" W  
Caption: WELL LOCATION MAP