

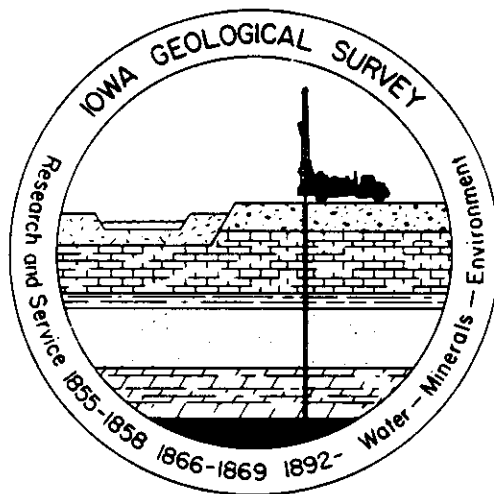
STRIPPABLE COAL RESERVE STUDY
IN SEVEN IOWA COUNTIES

Prepared for

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

By

IOWA GEOLOGICAL SURVEY



Final Report

on

Contract No. G0264013

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September, 1976

Note: This report was retyped and reprinted in 1985. No attempt was made to reevaluate the reserve calculations as originally reported.

Title

Strippable Coal Reserve Study
in Seven Iowa Counties

August 1976

Authors

P.L. Garvin, O.J Van Eck

Report No. 2

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Iowa Geological Survey
123 N. Capitol Street
Iowa City, Iowa 52242

Sponsoring Organization

U.S. Department of the Interior
Denver Federal Center
Denver, Colorado 80225

Abstract

Reserves of coal considered to be strippable by present mining methods have been determined for Appanoose, Wayne, Jasper, Jefferson, Polk, Van Buren, and Warren Counties, Iowa. The study identified remaining reserves for the seven counties of 654.15 million tons in beds no less than 28 inches thick with overburden thicknesses no greater than 150 feet. Of that total 327.07 million tons are considered recoverable by present day surface mining techniques.

Keywords

Iowa, coal, strippable, Appanoose, Wayne
Jasper, Jefferson, Polk, Van Buren, Warren

INTRODUCTION

The following report was prepared by the Iowa Geological Survey for the U.S. Department of Interior, Bureau of Mines under Grant No. G0264013.

The counties included in the study (Appanoose, Wayne, Jasper, Jefferson, Polk, Van Buren, and Warren, Fig. 1) were selected because it was considered sufficient information was available to make reasonably accurate reserve estimates. Nevertheless, the amount of available information was not extensive.

It was the intent at the outset of the study to establish criteria for determining estimates that would impose constraints so as to produce conservative reserve estimates. It is believed that intent was fulfilled.

Work under the grant was performed by Professor Paul L. Garvin, Cornell College, Mt. Vernon, Iowa assisted by graduate students. The project was coordinated by Orville J Van Eck, Associate State Geologist, Iowa Geological Survey.

SOURCES OF INFORMATION

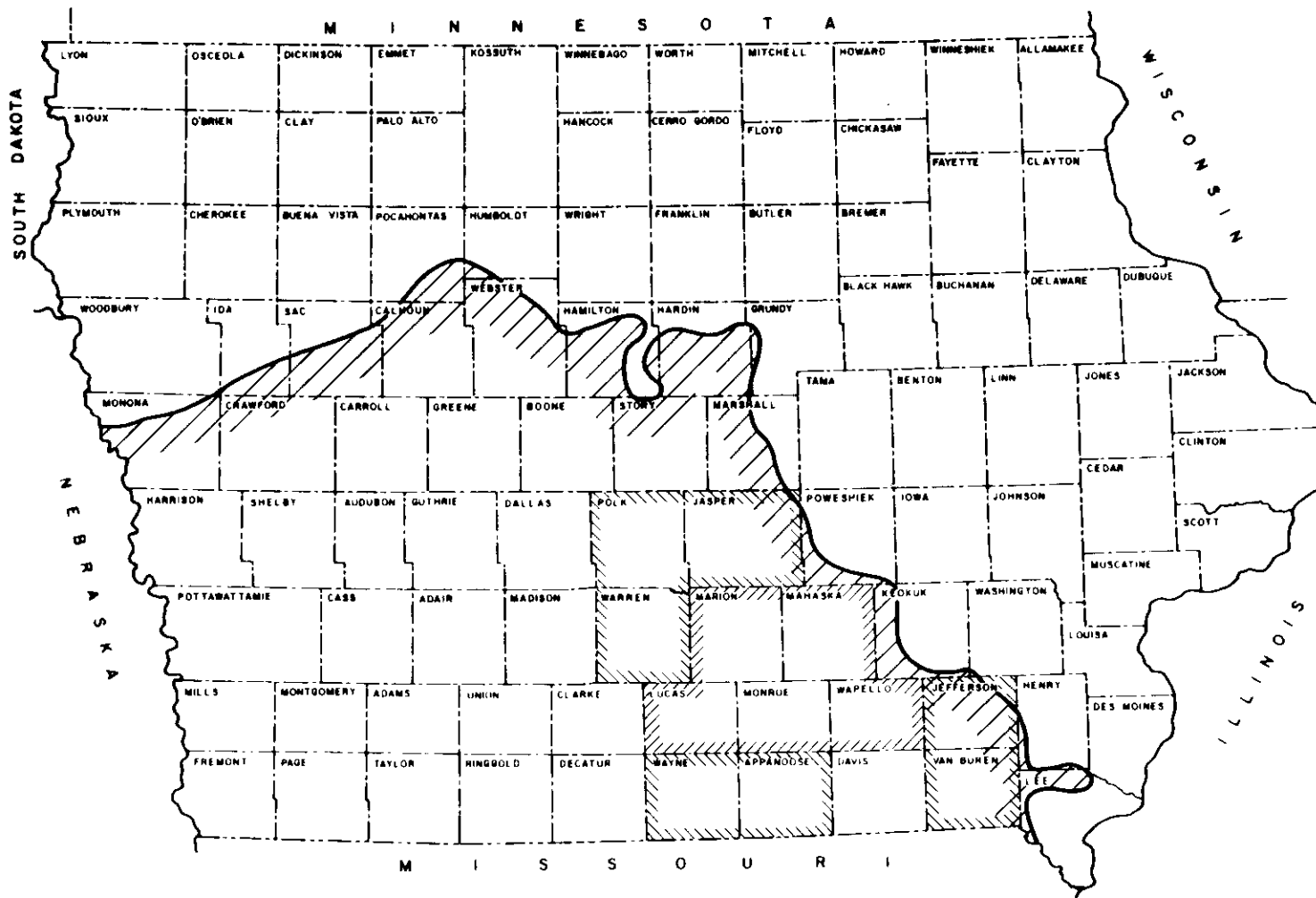
Data used in defining areas underlain by coal were taken from records of underground mine shafts, coal prospect drill holes, water wells, coal outcrops, and strip mines. Information was gathered chiefly from Annual Reports of the Iowa Geological Survey, Biennial Reports of the Iowa State Mine Inspectors, Iowa Geological Survey Technical Paper No. 4, Coal Resources of Iowa, and geologic logs of water wells, and geologic maps of the seven counties investigated. Also utilized was information from the Survey Coal Division's active core drilling program. Additional data were obtained from miscellaneous information on file at the Survey, which included maps showing locations of abandoned coal mines, and non-confidential information concerning the activities of specific coal-mining companies. Owing to the short period of time allowed for the research, field checks of the data were not made.

CRITERIA USED IN RESERVE ESTIMATES

Coal reserves are tabulated according to coal bed thickness, thickness of overburden, stratigraphic position, and reliability of the estimate.

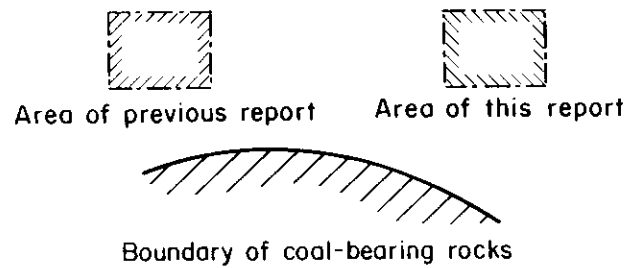
Coal Bed Thickness

Information regarding the thickness of coal beds is not abundant. Much of it is taken from reports of the Iowa State Mine Inspectors and from Annual Reports of the Iowa Geological Survey, where only an average coal thickness for the mine or mining district is reported. Coal thicknesses reported penetrated in drilling water wells in Iowa often have proven unreliable, therefore this source was considered with reserve. The complex geologic history of Iowa coal and lack of subsurface data complicates correlation of bed thickness and construction of isopach maps. Reserve estimates are given for intermediate



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Figure 1. Location of study area



coals (28 to 42 inches) and thick coals (greater than 42 inches). Reserves of thin coals (14 to 28 inches) were not estimated. For purposes of constructing thickness isopach maps, it was assumed that coal at the outer edges of all defined coal bodies is 28 inches thick.

Thickness of Overburden

Estimated reserves are reported for three categories of overburden thickness: 0-50 feet, 50-100 feet, and 100-150 feet.

Stratigraphic Position

Owing to the complex geologic history of Iowa coal beds and the extreme difficulty with lateral correlations, assignment of coals to individual beds was judged impractical. Instead, the coals were assigned to one of three broad stratigraphic units within the Pennsylvanian Des Moines Series: 1) Marmaton Group, 2) upper Cherokee Group, and 3) lower Cherokee Group. All strippable coal belonging to the Marmaton Group has been assigned to the Mystic bed, unique because of its persistence over large areas. Coal bed assignment to these three groups was based on general knowledge of Pennsylvanian stratigraphic relations, comparison with coal bed assignments made in Iowa Geological Survey Technical Paper No. 4, Coal Resources of Iowa, and observation of coal bed elevation in relation to broad stratigraphic relations.

Weight of Coal

The generally accepted weight of 1800 tons per acre-foot for Iowa coal was used in calculating the tonnage.

Reliability of Estimates

Coal reserves are reported as measured-indicated and inferred. No attempt was made to distinguish between measured and indicated reserves because of the complex character of Iowa coal beds.

Measured-Indicated Reserves

Measured-indicated reserve calculations are based on groups of closely spaced data points for which the average thickness of the coal bed is known and for which the uncertainty in determining the thickness of overburden is ± 20 feet or less. Included in these reserves are all bodies of coal at a distance no greater than one-half mile outward from such data points.

Inferred Reserves

Inferred reserve calculations are based on isolated data points for which coal thickness and depth are not accurately known, and on groups of data points for which bed thickness or thickness of overburden could not be determined accurately. Areas of inferred coal often are represented as halos surrounding areas of measured-indicated coal, and they extend no more than one-half mile beyond the outer measured-indicated boundary. Areas of inferred coal defined by isolated data points extend to distances not greater than one mile from the nearest data point. Inferred reserves were also extended to include areas of abandoned underground coal mines and strip pits adjacent to defined areas, for which information on coal depth and thickness was not available. Small abandoned mines remote from data points for which coal depth and thickness information were lacking were not included in the reserve estimate.

GENERAL PROCEDURES IN RESERVE CALCULATION

In order to determine the original reserves for each township, data points from all available sources were first plotted on topographic base maps, each point recording coal elevation and thickness where known. Using the criteria for reliability of estimates previously discussed, the areas of measured-indicated and inferred coal were outlined on working overlay maps. Thickness of overburden for each data point was determined by the difference between the surface elevation shown on the topographic base map and the elevation of the coal bed. Boundaries between the three thickness-of-overburden categories were contoured and each category was color coded on the overlay for ease in recognition. Using known coal thickness and assuming minimum thickness at the outer edge of inferred coal (28 inches), average thickness values were assigned to each coal basin. Where known thickness exceeds 42 inches, a single 42-inch isopach line was added in order to distinguish the two thickness categories. Defined areas were then measured by means of a polar planimeter. The planimeter measurements were converted to acre-feet and then to tonnage by computer. Within each county the calculations were tabulated according to coal bed thickness, thickness of overburden, stratigraphic position, and reliability of estimate. Original reserves in each county are tabulated according to the various reserve and thickness categories in Table 1. Table 2 presents the remaining and recoverable reserves for each county. Coal reserves are reported by county and township in Table 3.

LIMITATION OF METHODS

Estimation of coal reserves in Iowa is a difficult undertaking. Subsurface information is sparse to absent in many areas. Records of early mining were poorly kept, if at all. One can demonstrate the existence of a great many underground mines and strip pits, the accurate locations and/or descriptions of which are unknown. This is particularly true in the Mystic area of Appanoose County, where numerous closely-spaced large mines are known to exist, but for which the character of the coal simply cannot be determined. Because of the general lack of stratigraphic control and because of the great lateral variation in coal character, coal bed correlation is at present virtually impossible. The only criterion for correlation which was employed in this

study was elevation of the coal bed. Much additional drilling information is needed to define the limits of coal to any reasonable degree of accuracy.

Good topographic control is lacking in parts of Jasper, Van Buren, and Jefferson Counties. In Jefferson County coal was identified in areas where topographic information was available only from United States Army Map Service NK-series maps. Because of the inadequacy of this series for determining accurate surface elevations, all coal in Jefferson County has been classed inferred.

POTENTIAL FOR FUTURE EXPLORATION

Initial discoveries of coal in Iowa were made along major drainage networks such as the Des Moines River and its tributaries. In some areas subsurface exploration at interstream divides later revealed the presence of additional coal, notably in Polk County, where several large coal basins were discovered north and east of the city of Des Moines. Since interstream-divide coals are generally too deep to be strippable at present, the most favorable areas for exploration are along the drainages.

The most promising target areas for strippable coal in the counties studied in this report appear to be adjacent to areas of former mining activity. In Polk County, regrettably, many such targets now lie within the municipal boundaries of the city of Des Moines and its suburbs, and are therefore not recoverable. Historically, Polk County produced coal from at least three seams, the lowermost of which was most extensively mined. Except immediately adjacent to the major drainages the "lower coal" is too deep to be strippable. The so-called upper seam, being shallower, appears to be the most likely prospect within the county. However, this seam is highly variable in character, and therefore quite unpredictable.

The coals of Jasper and Warren Counties are generally shallower than those in Polk County. Many of the coals, particularly in Warren County, belong to the upper Cherokee Group of the Des Moines Series. While upper Cherokee coal horizons are generally more persistent than those of the lower Cherokee, they are often thin or interrupted by pre-Pleistocene erosion. Nevertheless, there appear to be numerous areas along major drainage systems in both counties for which no record of mining exists. Such areas should be investigated.

The strippable coals of Jefferson and Van Buren Counties belong exclusively to the lower Cherokee Group. These coals occur typically in small isolated basins, some of which represent erosional Pennsylvanian remnants. In some cases the coal itself rests almost directly upon underlying Mississippian carbonates. Extensive outcropping of Mississippian strata severely limits the potential occurrence of coals in both counties. The most likely target areas for coal in Jefferson County lie in the southwestern one-third of the county.

All strippable coal reported from Wayne and Appanoose Counties appears to be assignable to the Mystic coal bed of the Marmaton Group. This bed is remarkably persistent over large areas of southern Iowa and northern Missouri; however, in many places it is too thin to be strippable. Mining activity has

been most extensive near the towns of Centerville and Mystic in Appanoose County and the town of Confidence in eastern Wayne County. Best targets for exploration probably border formerly active mines in these areas.

In most of the counties considered in this report, strip log information from scattered water wells indicates the presence of strippable coal. The question of reliability of this kind of data was previously discussed. However, these areas probably are worthy of investigation.

TABLE 1 ORIGINAL RESERVES OF BITUMINOUS COAL IN
 JASPER, POLK, WARREN, WAYNE, APPANOOSE, VAN BUREN, AND JEFFERSON COUNTIES, IOWA
 (values in millions of tons)

COUNTIES	STRAT. POSITION*	Measured-Indicated Reserves						Inferred Reserves						TOTAL ORIGINAL RESERVES
		Coal Bed Thickness						Coal Bed Thickness						
		28-42 Inches			more than 42 Inches			28-42 Inches			more than 42 Inches			
		Overburden Thickness (ft)						Overburden Thickness (ft)						
		0-50	50-100	100-150	0-50	50-100	100-150	0-50	50-100	100-150	0-50	50-100	100-150	
Jasper	U	0.48	0.25	0.00	0.07	0.03	0.00	0.68	2.12	0.00	0.00	0.00	0.00	3.63
	L	1.09	2.89	1.50	2.50	4.78	4.27	13.67	26.82	23.51	7.79	10.23	7.36	106.41
Polk	U	0.00	0.00	0.00	0.00	0.00	0.00	0.60	1.50	0.32	0.00	0.12	0.76	3.30
	L	0.92	15.47	11.63	0.62	8.14	25.26	8.31	34.55	46.24	0.00	10.80	20.86	182.80
Warren	U	5.52	4.21	2.57	0.04	0.00	0.24	16.95	15.54	11.35	2.59	0.00	0.00	59.01
	L	0.58	2.67	3.67	0.23	1.87	0.44	8.48	13.85	7.77	1.48	1.34	0.59	42.97
Wayne	M	2.12	3.55	4.21	0.00	0.00	0.00	10.41	12.88	16.72	0.00	0.00	0.00	49.89
Appanoose	M	6.91	9.10	24.27	0.00	0.00	0.00	26.98	67.29	86.80	0.00	0.00	0.00	221.35
Van Buren	L	4.64	4.23	0.03	0.00	0.00	0.00	23.22	21.17	6.92	1.31	1.31	0.55	63.38
Jefferson	L	1.62	2.50	0.15	0.29	3.94	0.00	48.33	67.45	15.60	6.49	3.86	0.00	150.23
Totals		23.88	44.87	48.03	3.75	18.76	30.21	157.63	263.17	215.23	19.66	27.66	30.12	882.97

* M = Mystic

U = Upper Cherokee

L = Lower Cherokee

TABLE 2 REMAINING AND RECOVERABLE RESERVES IN
 JASPER, POLK, WARREN, WAYNE, APPANOOSE, VAN BUREN, AND JEFFERSON COUNTIES, IOWA
 (Millions of tons)

COUNTY	ORIGINAL RESERVES (O) (Measured-Indicated + Inferred) ¹	TOTAL COAL MINED 1880-1973 (M) (Underground + Stripping) ²	REMAINING RESERVES (R) R = O - 2M	RECOVERABLE RESERVES (C) C = 1/2R
Jasper	110.04	10.20	89.69	44.82
Polk	186.10	50.97	84.16	42.08
Warren	101.98	2.46	97.06	48.53
Wayne	49.89	2.67	44.55	22.28
Appanoose	221.35	46.29	128.77	64.38
Van Buren	63.38	1.57	60.24	30.12
Jefferson	150.23	0.25	149.73	74.86
Totals	882.97	114.41	654.15	327.07

¹ Includes only coal whose thickness is no less than 28 inches and whose overburden thickness is no greater than 150 feet.

² Includes all coal mined regardless of thickness or depth.

APPANOOSE COUNTY
ORIGINAL
MEASURED-INDICATED RESERVES

MYSTIC

MILLIONS OF TONS

TOWNSHIP & RANGE	THICKNESS IN	0-50 FT	50-100 FT	100-150 FT	TOTALS
T67N R16W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T67N R17W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T67N R18W	28-42	0.76	0.62	1.60	2.97
	>42	0.00	0.00	0.00	0.00
T67N R19W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T68N R16W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T68N R17W	28-42	0.00	0.20	3.59	3.78
	>42	0.00	0.00	0.00	0.00
T68N R18W	28-42	1.51	1.40	10.48	13.40
	>42	0.00	0.00	0.00	0.00
T68N R19W	28-42	0.00	0.08	1.37	1.46
	>42	0.00	0.00	0.00	0.00
T69N R16W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T69N R17W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T69N R18W	28-42	4.64	5.69	3.25	13.58
	>42	0.00	0.00	0.00	0.00
T69N R19W	28-42	0.00	1.11	2.65	3.76
	>42	0.00	0.00	0.00	0.00
T70N R16W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T70N R17W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T70N R18W	28-42	0.00	0.00	0.22	0.22
	>42	0.00	0.00	0.00	0.00
T70N R19W	28-42	0.00	0.00	1.11	1.11
	>42	0.00	0.00	0.00	0.00
	TOTALS	6.91	9.10	24.27	

TOTAL VOLUME MEASURED-INDICATED 40.28 MILLIONS OF TONS

APPANOOSE COUNTY

ORIGINAL
INFERRED RESERVES

MYSTIC

MILLIONS OF TONS

TOWNSHIP & RANGE	THICKNESS IN	0-50 FT	50-100 FT	100-150 FT	TOTALS
T67N R16W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T67N R17W	28-42	0.00	0.06	0.28	0.34
	>42	0.00	0.00	0.00	0.00
T67N R18W	28-42	0.98	4.82	11.52	17.32
	>42	0.00	0.00	0.00	0.00
T67N R19W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T68N R16W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T68N R17W	28-42	0.14	1.88	9.36	11.38
	>42	0.00	0.00	0.00	0.00
T68N R18W	28-42	3.28	7.99	22.22	33.49
	>42	0.00	0.00	0.00	0.00
T68N R19W	28-42	0.06	2.44	4.96	7.45
	>42	0.00	0.00	0.00	0.00
T69N R16W	28-42	0.00	0.00	1.39	1.39
	>42	0.00	0.00	0.00	0.00
T69N R17W	28-42	5.39	8.35	5.32	19.06
	>42	0.00	0.00	0.00	0.00
T69N R18W	28-42	7.94	26.61	17.32	51.86
	>42	0.00	0.00	0.00	0.00
T69N R19W	28-42	3.12	9.04	11.03	23.19
	>42	0.00	0.00	0.00	0.00
T70N R16W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T70N R17W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T70N R18W	28-42	1.15	1.48	1.45	4.08
	>42	0.00	0.00	0.00	0.00
T70N R19W	28-42	4.93	4.63	1.95	11.52
	>42	0.00	0.00	0.00	0.00
	TOTALS	26.98	67.29	86.80	

TOTAL VOLUME INFERRED 181.06 MILLIONS OF TONS

JASPER COUNTY
ORIGINAL
MEASURED-INDICATED RESERVES
UPPER CHEROKEE
MILLIONS OF TONS

TOWNSHIP & RANGE	THICKNESS IN	0-50 FT	50-100 FT	100-150 FT	TOTALS
T78N R17W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T78N R18W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T78N R19W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T78N R20W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T78N R21W	28-42	0.48	0.25	0.00	0.73
	>42	0.07	0.03	0.00	0.10
T79N R17W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T79N R18W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T79N R19W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T79N R20W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T79N R21W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T80N R17W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T80N R18W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T80N R19W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T80N R20W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T80N R21W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T81N R17W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T81N R18W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T81N R19W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T81N R20W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T81N R21W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
	TOTALS	0.55	0.28	0.00	

TOTAL VOLUME MEASURED-INDICATED 0.83 MILLIONS OF TONS

JASPER COUNTY
ORIGINAL
INFERRED RESERVES
UPPER CHEROKEE

MILLIONS OF TONS

TOWNSHIP & RANGE	THICKNESS IN	0-50 FT	50-100 FT	100-150 FT	TOTALS
T78N R17W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T78N R18W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T78N R19W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T78N R20W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T78N R21W	28-42	0.68	2.12	0.00	2.79
	>42	0.00	0.00	0.00	0.00
T79N R17W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T79N R18W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T79N R19W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T79N R20W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T79N R21W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T80N R17W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T80N R18W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T80N R19W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T80N R20W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T80N R21W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T81N R17W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T81N R18W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T81N R19W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T81N R20W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T81N R21W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
	TOTALS	0.68	2.12	0.00	

TOTAL VOLUME INFERRED

2.79 MILLIONS OF TONS

JASPER COUNTY
ORIGINAL
MEASURED-INDICATED RESERVES
LOWER CHEROKEE

MILLIONS OF TONS

TOWNSHIP & RANGE	THICKNESS IN	0-50 FT	50-100 FT	100-150 FT	TOTALS
T78N R17W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T78N R18W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T78N R19W	28-42	0.35	0.85	0.00	1.20
	>42	0.93	0.80	0.00	1.73
T78N R20W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T78N R21W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T79N R17W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T79N R18W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T79N R19W	28-42	0.20	0.96	0.45	1.61
	>42	0.00	0.00	0.00	0.00
T79N R20W	28-42	0.52	1.06	0.99	2.57
	>42	0.04	1.47	2.81	4.32
T79N R21W	28-42	0.00	0.00	0.00	0.00
	>42	0.40	0.36	0.18	0.94
T80N R17W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T80N R18W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T80N R19W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T80N R20W	28-42	0.02	0.02	0.06	0.11
	>42	0.35	0.60	0.00	0.95
T80N R21W	28-42	0.00	0.00	0.00	0.00
	>42	0.78	1.55	1.28	3.61
T81N R17W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T81N R18W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T81N R19W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T81N R20W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T81N R21W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
	TOTALS	3.58	7.68	5.77	

TOTAL VOLUME MEASURED-INDICATED 17.04 MILLIONS OF TONS

JASPER COUNTY
ORIGINAL
INFERRED RESERVES
LOWER CHEROKEE

MILLIONS OF TONS

TOWNSHIP & RANGE	THICKNESS IN	0-50 FT	50-100 FT	100-150 FT	TOTALS
T78N R17W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T78N R18W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T78N R19W	28-42	2.69	5.22	1.55	9.46
	>42	2.54	1.98	0.14	4.66
T78N R20W	28-42	1.60	3.37	1.00	5.97
	>42	0.00	0.00	0.00	0.00
T78N R21W	28-42	0.03	1.57	1.59	3.19
	>42	0.00	0.03	0.15	0.18
T79N R17W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T79N R18W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T79N R19W	28-42	6.60	9.44	7.25	23.29
	>42	3.84	5.01	2.11	10.96
T79N R20W	28-42	1.38	4.97	7.43	13.78
	>42	0.00	0.64	2.70	3.34
T79N R21W	28-42	0.17	1.41	2.35	3.92
	>42	0.23	1.07	0.51	1.81
T80N R17W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T80N R18W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T80N R19W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T80N R20W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T80N R21W	28-42	1.20	0.84	2.34	4.38
	>42	1.18	1.50	1.75	4.43
T81N R17W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T81N R18W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T81N R19W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T81N R20W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T81N R21W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
	TOTALS	21.48	37.06	30.86	

TOTAL VOLUME INFERRED 89.40 MILLIONS OF TONS

JEFFERSON COUNTY
ORIGINAL
MEASURED-INDICATED RESERVES
LOWER CHEROKEE

MILLIONS OF TONS

TOWNSHIP & RANGE	THICKNESS IN	0-50 FT	50-100 FT	100-150 FT	TOTALS
T71N R08W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T71N R09W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T71N R10W	28-42	0.98	1.22	0.15	2.34
	>42	0.03	3.57	0.00	3.60
T71N R11W	28-42	0.64	1.28	0.00	1.92
	>42	0.26	0.37	0.00	0.63
T72N R08W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T72N R09W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T72N R10W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T72N R11W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T73N R08W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T73N R09W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T73N R10W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T73N R11W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
	TOTALS	1.91	6.44	0.15	

TOTAL VOLUME MEASURED-INDICATED 8.50 MILLIONS OF TONS

JEFFERSON COUNTY

ORIGINAL
INFERRED RESERVES

LOWER CHEROKEE

MILLIONS OF TONS

TOWNSHIP & RANGE	THICKNESS IN	0-50 FT	50-100 FT	100-150 FT	TOTALS
T71N R08W	28-42	1.07	4.46	1.04	6.57
	>42	0.00	0.00	0.00	0.00
T71N R09W	28-42	2.35	1.94	0.00	4.29
	>42	0.00	0.00	0.00	0.00
T71N R10W	28-42	14.40	23.72	3.99	42.11
	>42	1.66	1.66	0.00	3.32
T71N R11W	28-42	4.46	7.99	0.29	12.74
	>42	0.28	0.27	0.00	0.55
T72N R08W	28-42	9.85	11.20	1.18	22.22
	>42	1.84	0.54	0.00	2.38
T72N R09W	28-42	0.33	2.67	1.27	4.28
	>42	0.00	0.00	0.00	0.00
T72N R10W	28-42	2.34	3.61	5.13	11.08
	>42	0.00	0.00	0.00	0.00
T72N R11W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T73N R08W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T73N R09W	28-42	13.53	11.86	2.71	28.10
	>42	2.71	1.39	0.00	4.11
T73N R10W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T73N R11W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
	TOTALS	54.83	71.32	15.60	

TOTAL VOLUME INFERRED 141.75 MILLIONS OF TONS

POLK COUNTY
ORIGINAL
INFERRED RESERVES
UPPER CHEROKEE

MILLIONS OF TONS

TOWNSHIP & RANGE	THICKNESS IN	0-50 FT	50-100 FT	100-150 FT	TOTALS
T78N R22W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T78N R23W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T78N R24W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T78N R25W	28-42	0.28	0.12	0.00	0.40
	>42	0.00	0.00	0.00	0.00
T79N R22W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T79N R23W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T79N R24W	28-42	0.32	1.38	0.32	2.02
	>42	0.00	0.12	0.76	0.88
T79N R25W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T80N R22W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T80N R23W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T80N R24W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T80N R25W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T81N R22W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T81N R23W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T81N R24W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T81N R25W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
TOTALS		0.60	1.62	1.08	

TOTAL VOLUME INFERRED 3.29 MILLIONS OF TONS

POLK COUNTY
ORIGINAL
MEASURED-INDICATED RESERVES

LOWER CHEROKEE

MILLIONS OF TONS

TOWNSHIP & RANGE	THICKNESS IN	0-50 FT	50-100 FT	100-150 FT	TOTALS
T78N R22W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T78N R23W	28-42	0.15	1.74	1.85	3.74
	>42	0.00	2.54	3.09	5.63
T78N R24W	28-42	0.62	2.28	1.03	3.94
	>42	0.30	6.47	6.90	13.67
T78N R25W	28-42	0.00	1.22	6.01	7.23
	>42	0.00	0.14	5.52	5.66
T79N R22W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T79N R23W	28-42	0.00	0.00	1.25	1.25
	>42	0.00	0.99	2.45	3.44
T79N R24W	28-42	0.15	2.90	1.49	4.54
	>42	0.32	5.33	7.30	12.95
T79N R25W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T80N R22W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T80N R23W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T80N R24W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T80N R25W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T81N R22W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T81N R23W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T81N R24W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T81N R25W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
	TOTALS	1.54	23.61	36.89	

TOTAL VOLUME MEASURED-INDICATED 62.04 MILLIONS OF TONS

POLK COUNTY
ORIGINAL
INFERRED RESERVES

LOWER CHEROKEE

MILLIONS OF TONS

TOWNSHIP & RANGE	THICKNESS IN	0-50 FT	50-100 FT	100-150 FT	TOTALS
T78N R22W	28-42	0.00	0.13	0.37	0.50
	>42	0.00	0.00	0.00	0.00
T78N R23W	28-42	5.53	13.15	3.86	22.54
	>42	0.00	1.23	4.83	6.05
T78N R24W	28-42	0.83	9.24	8.43	18.50
	>42	0.00	4.09	5.67	10.75
T78N R25W	28-42	0.17	6.39	14.88	21.43
	>42	0.00	2.74	1.55	4.28
T79N R22W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T79N R23W	28-42	0.25	0.28	8.29	8.81
	>42	0.00	0.56	4.29	4.84
T79N R24W	28-42	1.53	4.66	8.39	14.58
	>42	0.00	2.18	3.52	5.70
T79N R25W	28-42	0.00	0.70	1.81	2.51
	>42	0.00	0.00	0.00	0.00
T80N R22W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T80N R23W	28-42	0.00	0.00	0.22	0.22
	>42	0.00	0.00	0.00	0.00
T80N R24W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T80N R25W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T81N R22W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T81N R23W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T81N R24W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T81N R25W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
	TOTALS	8.31	45.33	67.11	

TOTAL VOLUME INFERRED 120.75 MILLIONS OF TONS

VAN BUREN COUNTY
ORIGINAL
MEASURED-INDICATED RESERVES

LOWER CHEROKEE

MILLIONS OF TONS

TOWNSHIP & RANGE	THICKNESS IN	0-50 FT	50-100 FT	100-150 FT	TOTALS
T67N R08W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T67N R09W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T67N R10W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T67N R11W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T68N R08W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T68N R09W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T68N R10W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T68N R11W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T69N R08W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T69N R09W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T69N R10W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T69N R11W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T70N R08W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T70N R09W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T70N R10W	28-42	0.82	1.22	0.00	2.04
	>42	0.00	0.00	0.00	0.00
T70N R11W	28-42	3.82	3.01	0.03	6.86
	>42	0.00	0.00	0.00	0.00
	TOTALS	4.64	4.23	0.03	

TOTAL VOLUME MEASURED-INDICATED

8.90 MILLIONS OF TONS

VAN BUREN COUNTY

ORIGINAL
INFERRED RESERVES

LOWER CHEROKEE

MILLIONS OF TONS

TOWNSHIP & RANGE	THICKNESS IN	0-50 FT	50-100 FT	100-150 FT	TOTALS
T67N R08W	28-42	0.98	0.55	0.00	1.53
	>42	0.00	0.00	0.00	0.00
T67N R09W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T67N R10W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T67N R11W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T68N R08W	28-42	2.60	3.71	2.59	8.90
	>42	1.06	1.08	0.55	2.69
T68N R09W	28-42	1.04	0.87	0.00	1.92
	>42	0.00	0.00	0.00	0.00
T68N R10W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T68N R11W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T69N R08W	28-42	0.69	0.64	0.21	1.54
	>42	0.00	0.00	0.00	0.00
T69N R09W	28-42	2.51	1.28	0.00	3.79
	>42	0.00	0.00	0.00	0.00
T69N R10W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T69N R11W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T70N R08W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T70N R09W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T70N R10W	28-42	5.92	8.49	0.94	15.35
	>42	0.00	0.00	0.00	0.00
T70N R11W	28-42	9.45	5.63	3.18	18.26
	>42	0.25	0.23	0.00	0.48
	TOTALS	24.53	22.48	7.47	

TOTAL VOLUME INFERRED

54.47 MILLIONS OF TONS

WARREN COUNTY
ORIGINAL
MEASURED-INDICATED RESERVES
UPPER CHEROKEE
MILLIONS OF TONS

TOWNSHIP & RANGE	THICKNESS IN	0-50 FT	50-100 FT	100-150 FT	TOTALS
T74N R22W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T74N R23W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T74N R24W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T74N R25W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T75N R22W	28-42	0.71	0.19	0.00	0.91
	>42	0.00	0.00	0.00	0.00
T75N R23W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T75N R24W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T75N R25W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T76N R22W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T76N R23W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T76N R24W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T76N R25W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T77N R22W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T77N R23W	28-42	1.18	1.82	1.24	4.23
	>42	0.00	0.00	0.00	0.00
T77N R24W	28-42	2.11	1.21	1.14	4.47
	>42	0.04	0.40	0.24	0.68
T77N R25W	28-42	1.52	0.59	0.19	2.30
	>42	0.00	0.00	0.00	0.00
TOTALS		5.56	4.21	2.81	

TOTAL VOLUME MEASURED-INDICATED 12.58 MILLIONS OF TONS

WARREN COUNTY
ORIGINAL
INFERRED RESERVES

UPPER CHEROKEE

MILLIONS OF TONS

TOWNSHIP & RANGE	THICKNESS IN	0-50 FT	50-100 FT	100-150 FT	TOTALS
T74N R22W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T74N R23W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T74N R24W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T74N R25W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T75N R22W	28-42	1.48	1.08	0.00	2.56
	>42	0.00	0.00	0.00	0.00
T75N R23W	28-42	0.69	0.42	0.49	1.59
	>42	0.00	0.00	0.00	0.00
T75N R24W	28-42	1.21	0.00	0.00	1.21
	>42	2.53	0.00	0.00	2.53
T75N R25W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T76N R22W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T76N R23W	28-42	0.00	2.33	0.14	2.47
	>42	0.00	0.00	0.00	0.00
T76N R24W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T76N R25W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T77N R22W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T77N R23W	28-42	1.44	3.53	6.69	11.66
	>42	0.00	0.00	0.00	0.00
T77N R24W	28-42	5.67	4.60	3.95	14.22
	>42	0.00	0.00	0.00	0.00
T77N R25W	28-42	5.46	3.58	0.08	10.12
	>42	0.06	0.00	0.00	0.06
TOTALS		19.53	15.54	11.35	

TOTAL VOLUME INFERRED 46.42 MILLIONS OF TONS

WARREN COUNTY
ORIGINAL
MEASURED-INDICATED RESERVES

LOWER CHEROKEE

MILLIONS OF TONS

TOWNSHIP & RANGE	THICKNESS IN	0-50 FT	50-100 FT	100-150 FT	TOTALS
T74N R22W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T74N R23W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T74N R24W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T74N R25W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T75N R22W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T75N R23W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T75N R24W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T75N R25W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T76N R22W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T76N R23W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T76N R24W	28-42	0.00	0.00	3.67	3.67
	>42	0.00	0.00	0.00	0.00
T76N R25W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T77N R22W	28-42	0.58	0.79	0.00	1.37
	>42	0.23	0.78	0.44	1.45
T77N R23W	28-42	0.00	1.74	0.00	1.74
	>42	0.00	1.09	0.00	1.09
T77N R24W	28-42	0.00	0.14	0.00	0.14
	>42	0.00	0.00	0.00	0.00
T77N R25W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
	TOTALS	0.81	4.54	4.11	

TOTAL VOLUME MEASURED-INDICATED

9.45 MILLIONS OF TONS

WARREN COUNTY
ORIGINAL
INFERRED RESERVES
LOWER CHEROKEE

MILLIONS OF TONS

TOWNSHIP & RANGE	THICKNESS IN	0-50 FT	50-100 FT	100-150 FT	TOTALS
T74N R22W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T74N R23W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T74N R24W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T74N R25W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T75N R22W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T75N R23W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T75N R24W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T75N R25W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T76N R22W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T76N R23W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T76N R24W	28-42	0.00	0.00	5.07	5.07
	>42	0.00	0.00	0.00	0.00
T76N R25W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T77N R22W	28-42	7.54	8.28	0.97	16.79
	>42	1.48	0.67	0.53	2.68
T77N R23W	28-42	0.94	3.33	1.56	5.83
	>42	0.00	0.67	0.06	0.73
T77N R24W	28-42	0.00	2.24	0.17	2.41
	>42	0.00	0.00	0.00	0.00
T77N R25W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
	TOTALS	9.96	15.19	8.36	

TOTAL VOLUME INFERRED 33.51 MILLIONS OF TONS

WAYNE COUNTY
ORIGINAL
MEASURED-INDICATED RESERVES

MYSTIC

MILLIONS OF TONS

TOWNSHIP & RANGE	THICKNESS IN	0-50 FT	50-100 FT	100-150 FT	TOTALS
T67N R20W	28-42	0.00	0.34	0.73	1.06
	>42	0.00	0.00	0.00	0.00
T67N R21W	28-42	0.00	0.00	0.14	0.14
	>42	0.00	0.00	0.00	0.00
T67N R22W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T67N R23W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T68N R20W	28-42	0.00	0.39	0.67	1.06
	>42	0.00	0.00	0.00	0.00
T68N R21W	28-42	0.00	0.00	0.90	0.90
	>42	0.00	0.00	0.00	0.00
T68N R22W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T68N R23W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T69N R20W	28-42	0.83	0.87	0.52	2.23
	>42	0.00	0.00	0.00	0.00
T69N R21W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T69N R22W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T69N R23W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T70N R20W	28-42	1.29	1.95	1.24	4.48
	>42	0.00	0.00	0.00	0.00
T70N R21W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T70N R22W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T70N R23W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
TOTALS		2.12	3.55	4.21	

TOTAL VOLUME MEASURED-INDICATED

9.88 MILLIONS OF TONS

WAYNE COUNTY
ORIGINAL
INFERRED RESERVES

MYSTIC

MILLIONS OF TONS

TOWNSHIP & RANGE	THICKNESS IN	0-50 FT	50-100 FT	100-150 FT	TOTALS
T67N R20W	28-42	0.00	0.62	1.54	2.16
	>42	0.00	0.00	0.00	0.00
T67N R21W	28-42	0.00	0.00	0.34	0.34
	>42	0.00	0.00	0.00	0.00
T67N R22W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T67N R23W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T68N R20W	28-42	0.00	0.36	1.74	2.10
	>42	0.00	0.00	0.00	0.00
T68N R21W	28-42	0.00	0.25	1.85	2.10
	>42	0.00	0.00	0.00	0.00
T68N R22W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T68N R23W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T69N R20W	28-42	4.05	4.68	5.47	14.20
	>42	0.00	0.00	0.00	0.00
T69N R21W	28-42	0.00	0.00	0.67	0.67
	>42	0.00	0.00	0.00	0.00
T69N R22W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T69N R23W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T70N R20W	28-42	5.23	6.71	5.12	17.05
	>42	0.00	0.00	0.00	0.00
T70N R21W	28-42	1.14	0.26	0.00	1.40
	>42	0.00	0.00	0.00	0.00
T70N R22W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
T70N R23W	28-42	0.00	0.00	0.00	0.00
	>42	0.00	0.00	0.00	0.00
	TOTALS	10.41	12.88	16.72	

TOTAL VOLUME INFERRED 40.02 MILLIONS OF TONS