THE LIGNITE RESOURCES OF NORTH DAKOTA

by

Edward C. Murphy, Ned W. Kruger, Gerard E. Goven,
Quentin L. Vandal, Kimberly C. Jacobs, and Michele L. Gutenkunst

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Edward C. Murphy, State Geologist
Lynn D. Helms, Director Dept. of Mineral Resources
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On the cover: An old mine tipple near Larson in Burke County, North Dakota.

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ACKNOWLEDGEMENTS

Ned W. Kruger, Gerard E. Goven, Quentin L. Vandal, Kimberly C. Jacobs, and Michele L. Gutenkunst were temporary Survey geologists. These geologists interpreted the stratigraphy from approximately 20,000 electric logs and entered that data into the ND Geological Survey coal database. A copy of this information was incorporated into the National Coal Resource Database (NCRDS). That work was supported by the U.S. Geological Survey, Department of Interior, under assistance award numbers 1434-HQ-97-AG-01822, 99HQAG0001, and 02ERAG0016.

INTRODUCTION

For those unfamiliar with the term lignite resource, the lignite resources of North Dakota encompasses all of the lignite within the borders of North Dakota. For the purposes of this study, only strata within the Fort Union Group (Paleocene) and the upper member of the Golden Valley Formation (Eocene) were considered (Figure 1). Coal-bearing strata of the Fort Union Group are restricted to the western half of North Dakota (Figure 2). There are a few thin coals known to occur in older strata within the Williston Basin, the Hell Creek and Newcastle Formations (Cretaceous). A thin coal (less than three feet thick) occurs within the upper part of the Hell Creek Formation in central and south-cental North Dakota (Morton, Emmons, and Sheridan counties). The Fort Union/Hell Creek contact is difficult to pick in the subsurface and is typically placed at the base of the lowest occurring coal in the section. As a result of this traditional practice, we may have inadvertently placed the Fort Union/Hell Creek contact at the base of this upper Hell Creek coal in the area mentioned, thus incorporating the Hell Creek coal into our database.

The upper member of the Golden Valley Formation (Camels Butte Member) and the Fort Union Group contain alternating beds of sandstone, siltstone, mudstone, claystone, and lignite. The maximum depth to the base of the Fort Union Group, or to the deepest coal in western North Dakota, is about 1,800 feet. The maximum depth of Fort Union coal occurs in northwestern Dunn and eastern McKenzie counties near the center of the Williston Basin. All of the coal within the Fort Union Group in North Dakota is identified as lignite. Because there is little data available on the BTU content of deeper coals in the Fort Union, it may be possible that deeper burial near the center of the Williston Basin may have transformed some of the older coals (Ludlow Formation) into subbitumious (Figure 1). In 2003, subbitumious coal was reported from oil well cuttings in Wells County, approximately 30 miles east of the known limit of coal-bearing rocks in North Dakota (Figure 2). Additional drilling at the well site determined that the coal had been incorporated into glacial outwash sands and gravels.

A typical or average lignite in the Fort Union Group is about two feet thick and has an areal extent of less than a few thousand acres (Murphy, 2006). In contrast, the thickest coal in the state (the Harmon bed) is 53 feet thick and is in excess of 50 feet over an area of about 50,000 acres. The Harmon bed is the most laterally extensive coald in the state, extending over an area of approximately 13,000 square miles (Murphy et al., 2002). There is only one other coal in North Dakota (T Cross bed) that is known to be more than 30 feet thick. Although, a third (Alkabo bed) comes close with a maximum thickness of 29 feet (Murphy, 2006). There are eight lignites in North Dakota that are 20 or more feet thick.

There is little information on coal quality in North Dakota outside of the existing mine sites. We do know that the quality of the lignite mined in North Dakota is variable, but generally falls within the following ranges:

Moisture	33.5 - 43.8 %
Volatile Matter	24.1 - 30.2 %
Fixed Carbon	25.2 - 32.9 %
Ash	4.4 - 8.0 %
Sulfur	0.2 - 1.4%
Btu	5,960 - 7,487 lb

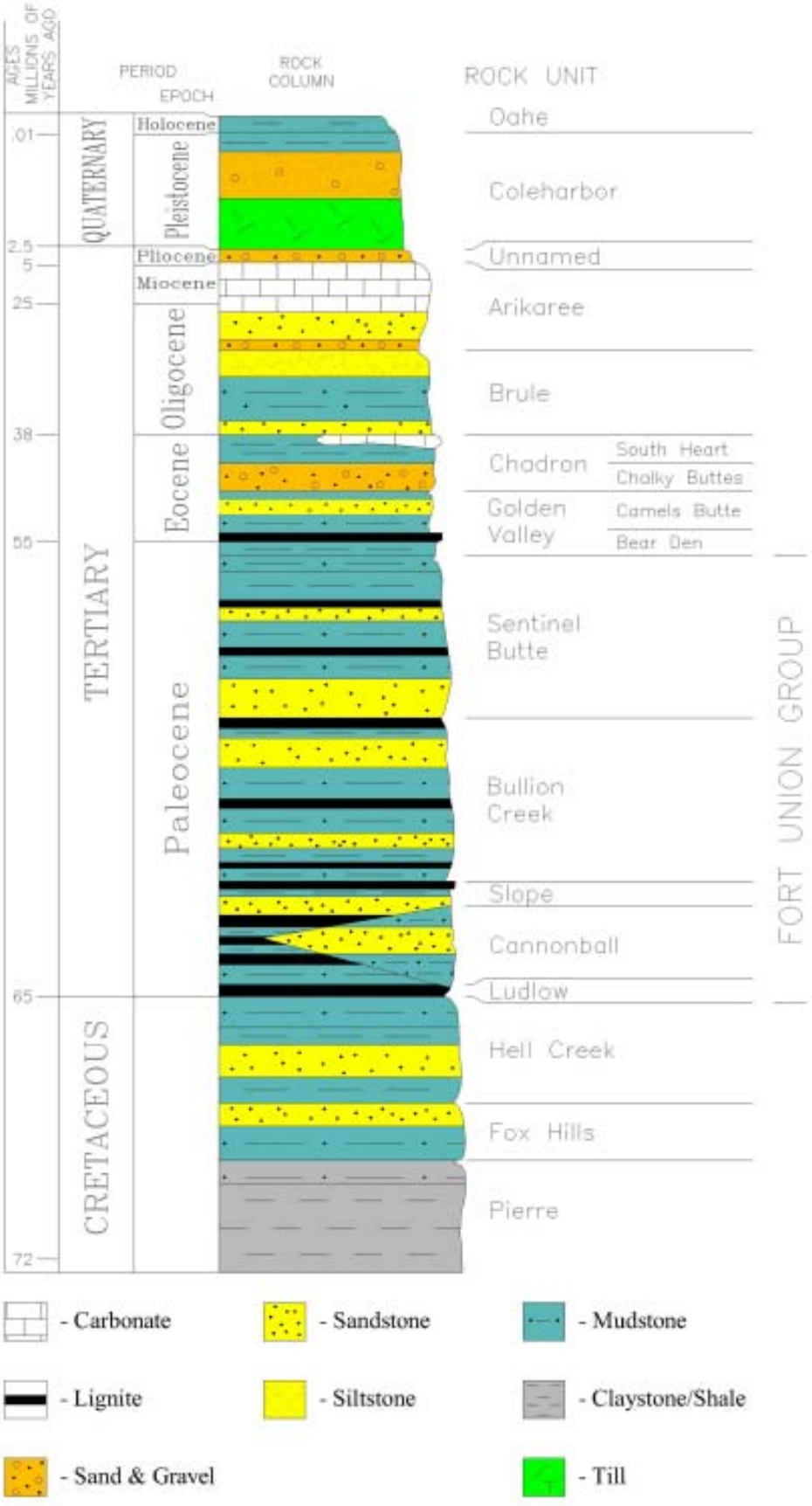

Figure 1. Stratigraphic column of the rocks and sediments present at the surface in western and central North Dakota (Murphy, 2006).

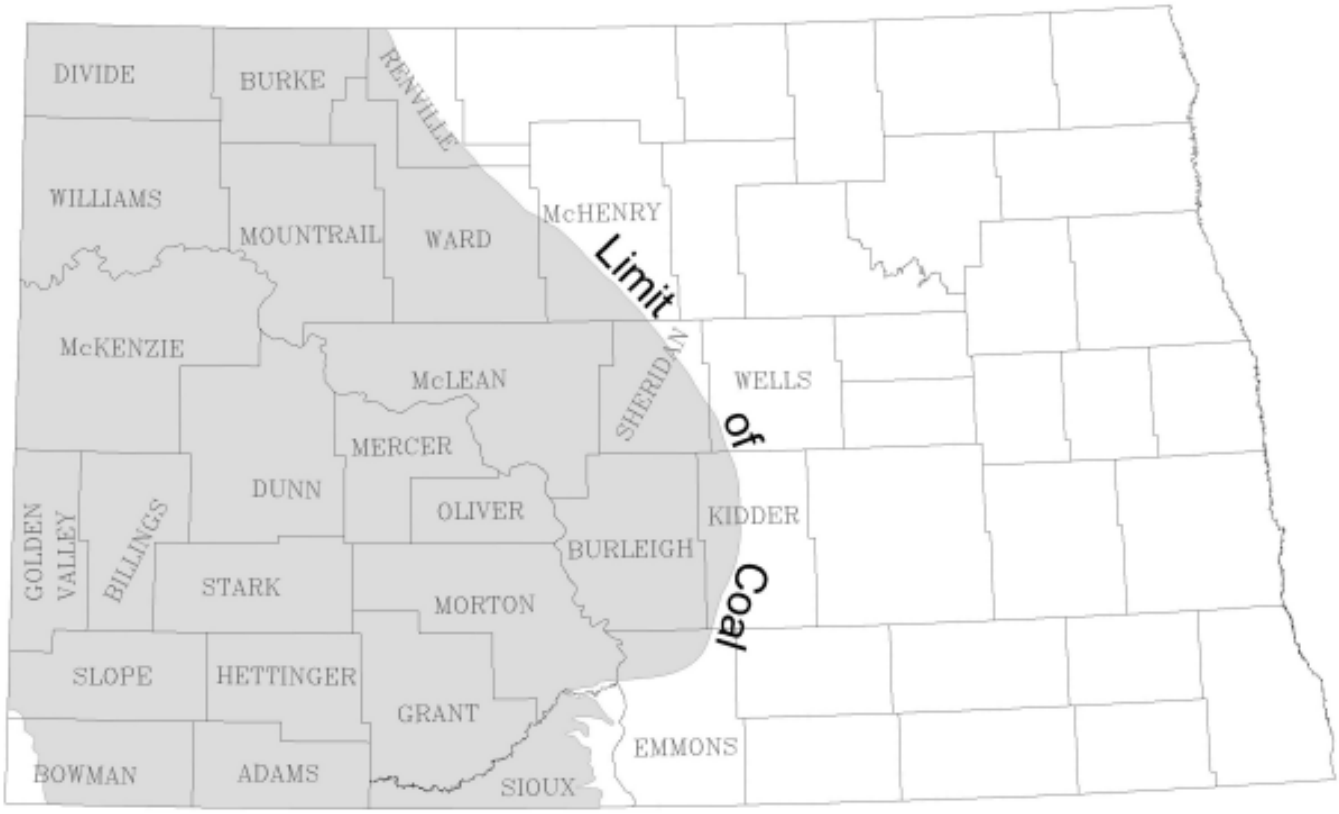

Figure 2. The extent of coal-bearing rocks of the Fort Union Group in North Dakota.

Previous Studies

In 1925, A.G. Leonard, L.P. Dove, and H.N. Eaton attempted the first statewide assessment of coal beds in western North Dakota. Their work drew heavily upon information from numerous lignite mines as well as coal outcrops that they and others had previously mapped in western North Dakota. One year later, Leonard (1926) estimated North Dakota's lignite resource (total amount of coal) at 516 billion tons. Leonard based this figure on an average cumulative coal thickness of 16 feet that he estimated occurred within 300 to 400 feet of the surface in western North Dakota. His thickness estimate was based on fieldwork he had done in Billings, Golden Valley, McKenzie, Bowman, and Slope counties. Leonard knew that his estimate was low because it did not take into account the deeper coal beds. In 1939, M.R. Campbell reportedly estimated the resource at 600 billion tons in a mimeographed press release by the United States Geological Survey (Brant, 1953).

In 1953, R.A. Brant estimated there were 351 billion tons of lignite in North Dakota. For more than 50 years, Brant's report has been the definitive resource estimate for North Dakota's coal deposits. Brant calculated the resource based on lignite beds that were more than 2.5 feet thick. His database consisted of a few thousand data points, primarily outcrop information that was supplemented with sparse drillhole data. Brant plotted this information on 1:125,000 scale base maps. His resource estimates were spilt into three categories; measured, indicated, and inferred. Brant's inferred estimates were extremely speculative based "*largely on broad knowledge of the geologic characteristics of the bed or region, supported by few or no measurements*" (Brant, 1953, p. 8). The inferred estimates (291 billion tons) represented 83 % of his total resource.

Methods Used to Calculate Lignite Resources for This Study

Lignite resources were calculated using geophysical logs from over 19,000 holes (Figure 3). This database includes industry test holes (coal, uranium, clay) on file with the North Dakota Geological Survey, test holes drilled by the North Dakota State Water Commission, coal exploration holes drilled by the North Dakota Geological Survey and the United States Geological Survey, and oil wells where the gamma log was recorded to the surface. Geologist's or driller's logs from water wells and mineral programs were not entered into the coal database unless there were accompanying electric logs to verify lithologies. Most of the coal exploration and subsurface mineral holes are less than 300 feet deep. Stratigraphic data on the middle to lower portions of the Fort Union Group was generally only obtainable from deep test holes drilled by the ND State Water Commission and oil and gas gamma logs run to surface.

The lignite resource was determined on a township by township basis, similar in scope to the Brant (1953) study. Unlike Brant however, the average coal thickness and the average number of coals was reported for each of the roughly 900 coal-bearing townships in North Dakota. In addition, all measurable coals were included in the database, we did not set a thickness minimum at 2.5 feet as Brant had done. For most townships, the database we compiled consists primarily of holes that are less than 400 feet deep. That is, most townships (outside of the oil-producing areas) contain dozens of logs for holes that are 200 to 400 feet deep, but only a handful of logs that span the entire Fort Union Group. To compensate for this inherent bias, the logs were subdivided into two categories; shallow (less than 400 feet deep) and deep (more than 400 feet). The deep logs generally consisted of gamma logs from oil wells that had been run inside surface casing. The shallow electric logs were typically complete log suites (gamma, resistivity, density, and occasionally spontaneous potential) that had been run open-hole (through uncased holes). In addition, the shallow logs had generally been run at an expanded scale (50 feet to the inch) which made it easier to identify thin beds of coal. The larger, better-quality database of shallow logs resulted in more accurate estimates of the shallow lignite resource than were possible with the smaller, lower-quality deep-coal database. Occasionally, several logs would be available to depths of 600 to 800 feet for a given township. In those cases, averages were determined for a shallow, medium, and deep interval and then those numbers were added together to obtain an average for the entire township. Typically, 36 or more shallow holes would be utilized (at least one test hole per section) to determine the number of beds and cumulative thicknesses of lignite in the shallow zone of a township. Those numbers were then added to the averages of a dozen or so deep holes to determine the average cumulative coal thickness and number of coal beds in a township. Although not grouped as such in the tables, this method and the character of the database resulted in a mixture of measured (data points no greater than ½ mile apart), indicated (data points ½ to 1 ½ -miles apart), and inferred (data points are 1 ½ to 6 miles apart) resources. In most areas there was sufficient near-surface data (coals within 400 feet of the surface) that the resulting resource estimates could be classified as either measured or indicated. This could also be said for the deeper coals (coals below 400 feet) where estimates were made within oil producing areas. Outside of the oil producing areas, the number of available deep logs often dropped to less than a dozen per township resulting in resource estimates that were largely inferred.

It was possible to identify and measure coal thicknesses of less than one foot on the expanded-scale logs that were typically run for coal exploration. However, coals less than two feet thick were often difficult to identify on oil and gas gamma logs. As a result, thin coals on theses logs were likely not identified or their thicknesses were under reported (Figures 4 and 5). In addition to scale problems, oil and gas surface casing appeared to dampen the trace of the gamma log because they were generally not as sharp and defined as the gamma logs run in open-hole suites of logs. Open-hole log suites generally contain both a gamma and density log which enables a low-gamma count to be verified or rejected on the density log as a coal.

Once the average cumulative feet of coal was determined for each township in a county, that number (feet) was multiplied by the number of acres in that township. The typical township in North Dakota contains 23,040 acres. However, for various reasons (including surveying corrections and international, state, and county boundaries) there are a number of townships in western North Dakota that contain fewer acres. The acre-feet of lignite for each township in a given county were added together and converted to tons by multiplying by 1,750, the number of tons in one acre-foot of lignite, to determine the coal resource for that county.

Our means of resource estimation are likely, at best, unconventional. We used this method because we did not have the expertise or access to a software program that would compute these calculations. What we did have was one or two orders of magnitude more data than was available to R.A. Brant in 1953. We knew that whatever method we employed would generate a more realistic estimation than Brant's badly outdated study.

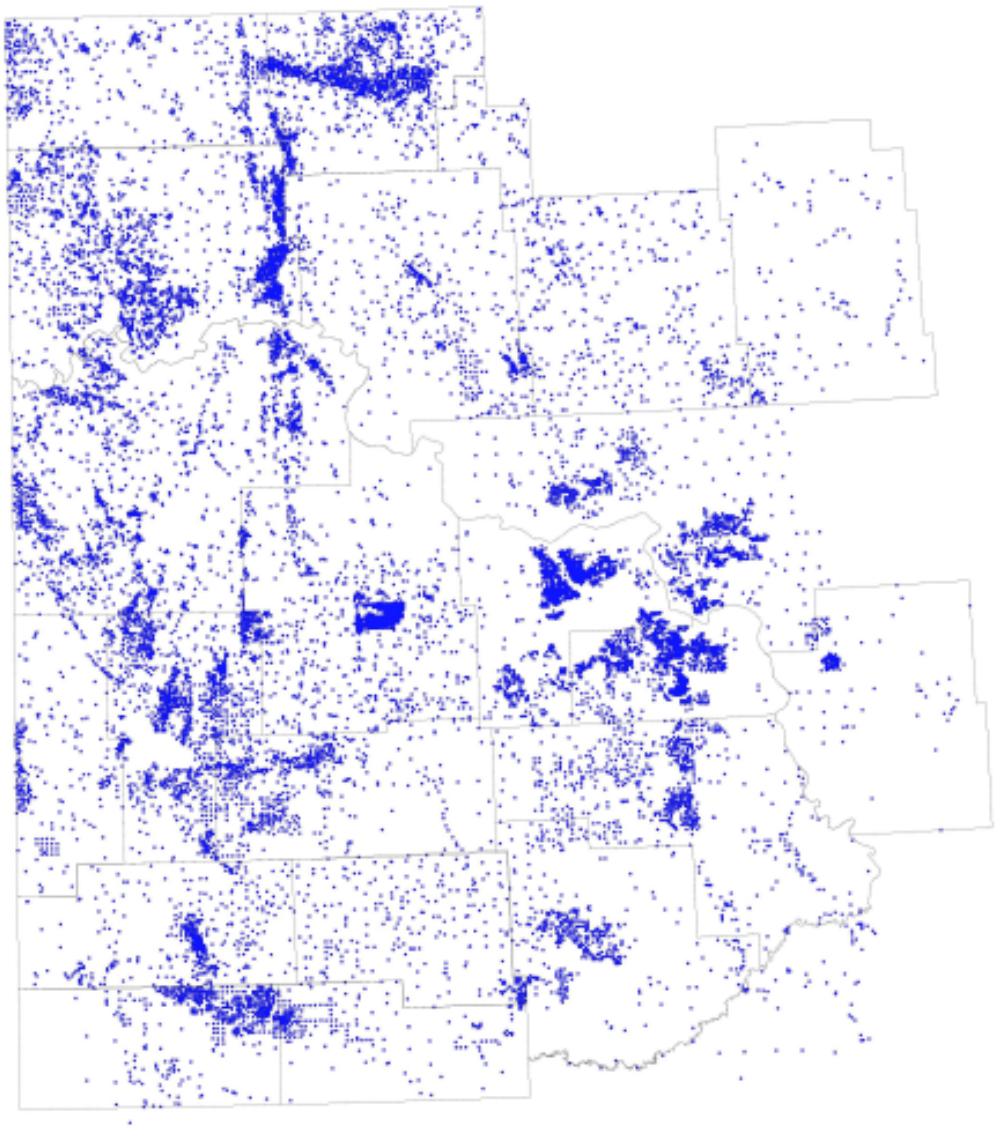

Figure 3. Data points in western and central North Dakota used to calculate the lignite resource in North Dakota (Murphy, 2006). The database contains 19,163 points. This data was transferred by the North Dakota Geological Survey into the National Coal Resources Database (NCRDS). Map courtesy of Jon Haacke, United States Geological Survey.

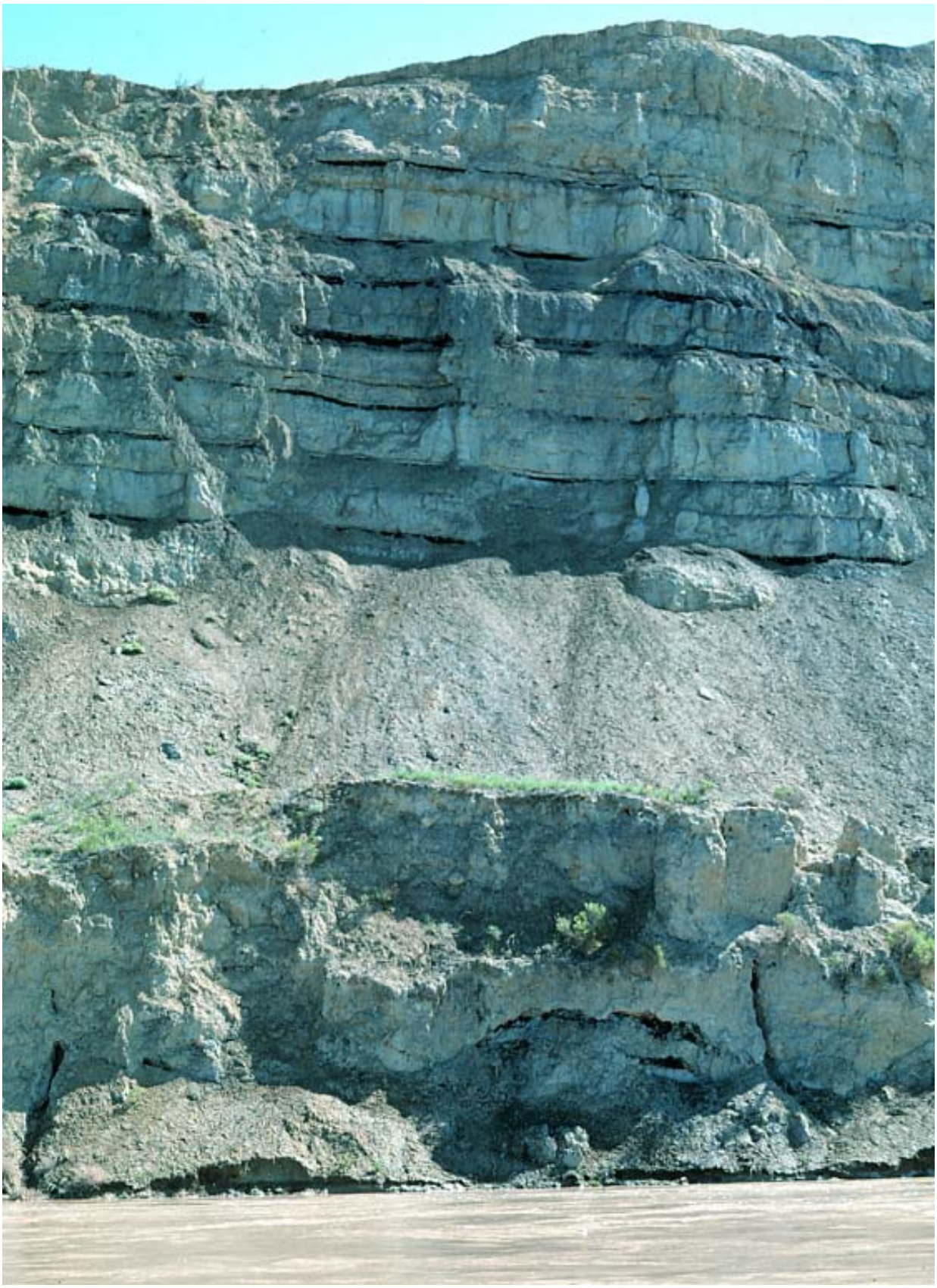

Figure 4. Nine, thin lignites are exposed above a talus slope in a 70-foot cliff face of Bullion Creek strata adjacent to the Little Missouri River north of Medora. It is likely that most, if not all, of these thin coals would be difficult to identify on gamma logs run through oil and gas casing.

Figure 5. The Hegel bed is exposed in a highwall at the Center Mine. Approximately eight feet of coal is exposed in this cut.

Results

We determined that North Dakota contains approximately 1.3 trillion tons of lignite (Table 1, Appendix A). Not surprisingly, this is twice the resource estimate of Leonard (1926) and Campbell (1929) and three times the estimate of Brant, 1953 (Figure 6). In 1973, E.R. Landis presented lignite resource estimates for 34 townships in Grant, Morton, Stark, and Hettinger counties. We were unable to make meaningful comparisons of our township estimates with 26 of Landis's estimates because they were for partial townships. We were, however, able to compare our results to eight of his "entire" townships. We estimated that two billion tons of lignite were present in three townships in Stark County that Landis had estimated contained 585 million tons, we estimated 3.4 billion tons to Landis's 512 million tons for three townships in Hettinger County, and 766 million tons to Landis's 746 million tons in Grant County. Our resource estimates were higher for seven of the eight townships, two by an order of magnitude. Even with some of the inherent limitations of our database, we had significantly more information to work with than Landis and the other previous workers. The resource estimates for North Dakota lignite will likely continue to rise as more subsurface information becomes available in the future.

We determined that there are, on average, nine coal seams beneath the surface at any given locality in western North Dakota with an average cumulative thickness of 36.7 feet (Table 1, Appendix A). Ten counties average a dozen or more lignite seams. Townships in Bowman, Burke, Billings, Dunn, McKenzie, Mountrail, and Williams counties averaged more than 20 coal seams. Two townships in McKenzie County averaged more than 26 coals. The majority of these coal beds are thin, less than five feet thick. The average thickness of a coal bed in western North Dakota is 3.7 feet (Table 1). Several counties contain an average cumulative coal thickness of more than 50 feet (Billings, Burke, Dunn, Golden Valley, McKenzie, Mercer, Mountrail, Stark, and Williams). Cumulative coal thicknesses approached or exceeded 100 feet in townships within Billings, McKenzie, and Williams counties.

Experience gained through years of measuring geologic sections and participating in drilling programs in Fort Union strata suggests that the calculated averages for the number of coal seams in a given township are likely too low and calculated bed thicknesses are likely too high. As noted, these numbers were generated from a database compiled from lithologic interpretation of electric logs, many of which were gamma logs run through oil and gas surface casing. As previously stated, thin coals (less than 2 feet thick) are generally difficult to identify on these logs. As a result, thin coals were likely under-reported which led to an under-reporting of the total number of coal seams which, in turn, led to an excessive estimation of the average bed thickness.

There is little direct correlation between a county's coal resources and its coal reserves (Table 1). Slope County has the most coal reserves, but ranks 11th in coal resources, Bowman County is 6th in reserves and 14th in resources, etc. On the other hand, counties that have little in the way of resource (eg., Grant, Burleigh, Renville, McHenry, Sheridan) tend to plot very low on the reserves side (Figure 7).

From the results of this study, it appears that both the number of coals and the coal thickness is greater in the upper Fort Union Group (Bullion Creek and Sentinel Butte formations) than it is in the lower portion of that group (Ludlow, Cannonball, and Slope formations – the Cannonball Formation is marine and contains no coal). Although this is consistent with the findings of previous studies of the Fort Union, it should be noted that biases within this dataset may have amplified the results (Figure 8).

Given current technologies, 25 billion tons, or 2% of North Dakota's 1.3 trillion ton lignite resource, is classified as reserve because it can be economically mined by surface methods (Murphy, 2006). Emerging technologies, such as insitu gasification, may significantly increase in the future the amount of this resource that can be converted to a reserve.

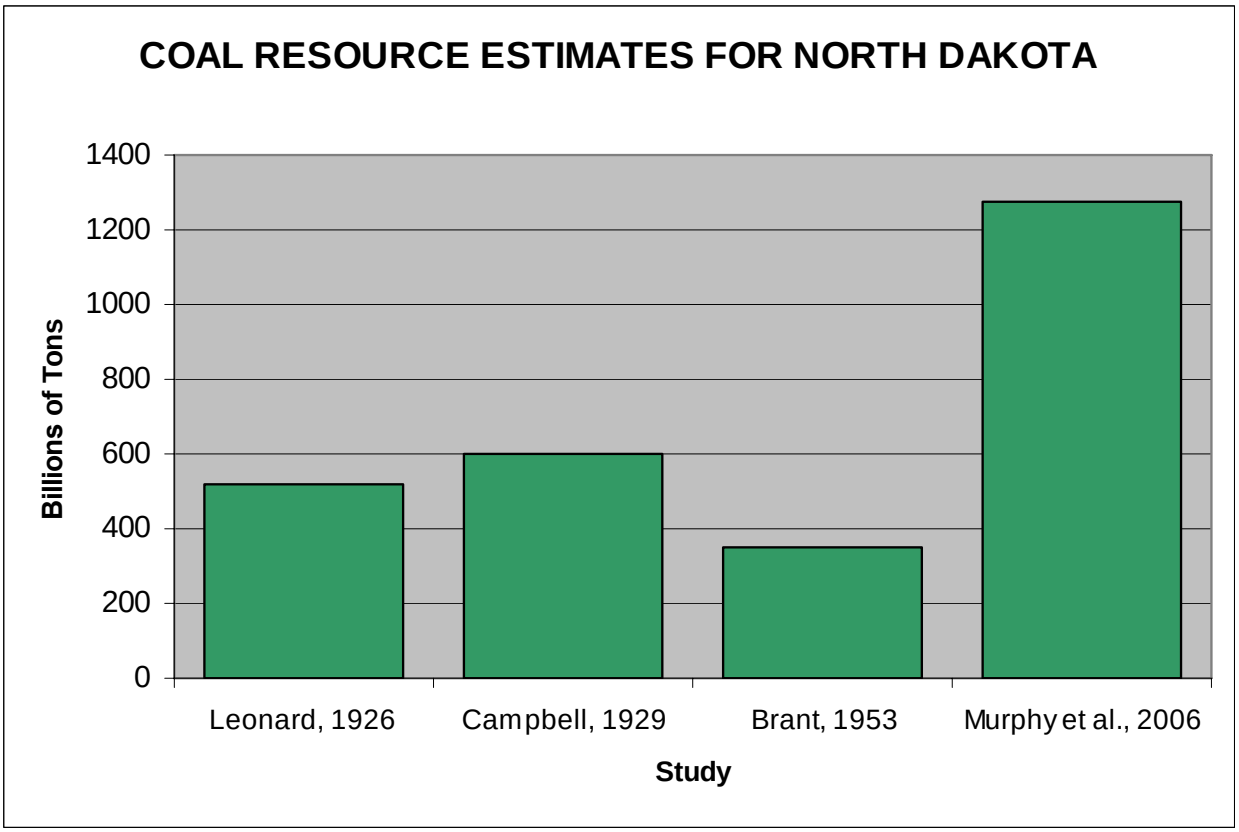

Figure 6. Comparison of four coal resource estimates for North Dakota.

Table 1. North Dakota Lignite Resources and Reserves by County

County	Average Number of Beds	Average Thickness (ft.)	Resources (tons)	Reserves (tons)	Resource Ranking	Reserve Ranking
Adams	4	3.7	15,946,560,000	149,800,000	17	19
Billings	13	4.7	75,680,640,000	2,771,743,750	5	3
Bowman	9	3.8	32,397,008,000	1,648,080,000	14	6
Burke	13	3.9	62,969,760,000	535,111,500	8	14
Burleigh	2	2.5	7,775,278,000	30,800,000	20	20
Divide	11	4.1	61,347,720,000	395,692,500	9	16
Dunn	14	4	124,388,320,000	1,720,960,500	3	5
Golden Valley	12	4.8	59,321,346,000	1,433,001,500	10	9
Grant	3	3.2	12,258,610,000	172,952,500	19	18
Hettinger	10	3.6	46,179,840,000	729,872,500	13	12
McHenry	1	3.7	867,440,000	5,250,000	22	21
McKenzie	16	4.3	205,226,070,000	1,760,727,500	1	4
McLean	4	2.7	22,695,127,000	1,500,000,000	16	8
Mercer	13	4.2	63,903,623,000	1,267,497,000	7	10
Morton	5	3.2	30,635,920,000	594,291,250	15	13
Mountrail	16	3.4	111,379,520,000	218,198,750	4	17
Oliver	6	3.3	15,880,928,000	1,066,441,250	18	11
Renville	1	2.3	2,842,560,000	0	21	none
Sheridan	1*	4.0*	560,000	0	23	none
Slope	8	5.9	57,797,600,000	4,032,871,500	11	1
Stark	12	4.2	73,303,104,000	3,051,664,000	6	2
Ward	8	2.6	49,230,720,000	416,752,000	12	15
Williams	17	3.6	143,352,720,000	1,554,206,500	2	7
AVERAGE	9	3.7				
TOTAL			**1,275,380,974,000**	**25,055,914,500**		

**numbers generated from only one locality in T149N, R74W*

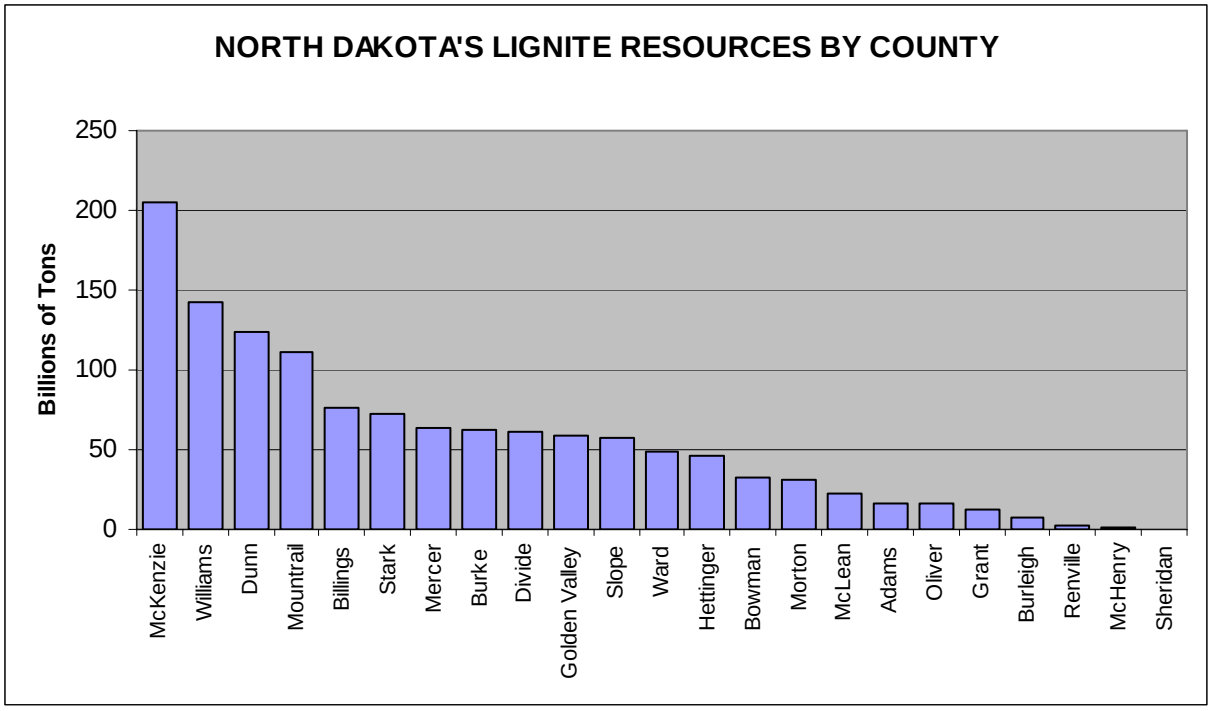

Figure 7. Half of North Dakota's lignite resources are located in five counties; McKenzie, Williams, Dunn, Mountrail, and Billings. Billings and McKenzie are also amongst the counties with the largest lignite reserves.

Figure 8. Sixteen hundred feet of Fort Union Group core laid out from a hole in south-central Williams County. Coal frequency and thickness generally decreased downhole at this location.

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APPENDIX A. NORTH DAKOTA LIGNITE RESOURCE BY COUNTY

ADAMS COUNTY

TOWNSHIP	COAL BEDS	CUMMULATIVE COAL THICKNESS	TOWNSHIP ACRES	ACRE-FEET OF COAL
T129N, R91W	2	8	23,040	184,320
T129N, R92W	2	8	23,040	184,320
T129N, R93W	1	7	23,040	161,280
T129N, R94W	2	13	23,040	299,520
T129N, R95W	2	7	23,040	161,280
T129N, R96W	1	3	23,040	69,120
T129N, R97W	1	4	23,040	92,160
T129N, R98W	1	6	23,040	138,240
T130N, R91W	2	8	23,040	184,320
T130N, R92W	2	8	23,040	184,320
T130N, R93W	1	7	23,040	161,280
T130N, R94W	2	11.5	23,040	264,960
T130N, R95W	3	6	23,040	138,240
T130N, R96W	6	15	23,040	345,600
T130N, R97W	9	28	23,040	645,120
T130N, R98W	12	37	23,040	852,480
T131N, R91W	3	15	23,040	345,600
T131N, R92W	5	24	23,040	552,960
T131N, R93W	3	21	23,040	483,840
T131N, R94W	1	7	23,040	161,280
T131N, R95W	3	6	23,040	138,240
T131N, R96W	5	13.5	23,040	311,040
T131N, R97W	8	30	23,040	691,200
T131N, R98W	12	43	23,040	990,720
T132N, R95W	3	10.5	20,160	211,680
T132N, R96W	4	11.5	20,160	231,840
T132N, R97W	7	21	20,160	423,360
T132N, R98W	5	25	20,160	504,000
TOTAL	108	404	633,600	9,112,320
AVERAGE	4	14.9		
LIGNITE RESOURCE (tons)				15,946,560,000

BILLINGS COUNTY

TOWNSHIP	COAL BEDS	CUMMULATIVE COAL THICKNESS	TOWNSHIP ACRES	ACRE-FEET OF COAL
T137N, R100W	17	90.8	23,040	2,092,032
T137N, R101W	11	45	23,040	1,036,800
T137N, R102W	10	45	23,040	1,036,800
T138N, R100W	10	46	23,040	1,059,840
T138N, R101W	10	45	23,040	1,036,800
T138N, R102W	9	46	23,040	1,059,840
T139N, R100W	12	52.4	23,040	1,207,296
T139N, R101W	9	46.1	23,040	1,062,144
T139N, R102W	7	32.9	23,040	758,016
T140N, R100W	13	50.4	23,040	1,161,216
T140N, R101W	9	45.6	23,040	1,050,624
T140N, R102W	9	38.1	23,040	877,824
T141N, R98W	17	67.3	23,040	1,550,592
T141N, R99W	14	58.3	23,040	1,343,232
T141N, R100W	13	61.7	23,040	1,421,568
T141N, R101W	10	53.9	23,040	1,241,856
T141N, R102W	8	40.1	23,040	923,904

T142N, R98W	17	89.6	23,040	2,064,384
T142N, R99W	15	69.4	23,040	1,598,976
T142N, R100W	14	69.9	23,040	1,610,496
T142N, R101W	11	59.6	23,040	1,373,184
T142N, R102W	12	96.5	23,040	2,223,360
T143N, R98W	22	89.5	23,040	2,062,080
T143N, R99W	19	83	23,040	1,912,320
T143N, R100W	15	70.3	23,040	1,619,712
T143N, R101W	12	54.4	23,040	1,253,376
T143N, R102W	15	50.2	23,040	1,156,608
T144N, R98W	15	64.4	23,040	1,483,776
T144N, R99W	17	74.2	23,040	1,709,568
T144N, R100W	12	55.5	23,040	1,278,720
T144N, R101W	11	43	23,040	990,720
T144N, R102W	12	42.9	23,040	988,416
TOTAL	407	1877	737,280	43,246,080
AVERAGE	13	60.5		
LIGNITE RESOURCE (tons)				75,680,640,000

BOWMAN COUNTY

TOWNSHIP	COAL BEDS	CUMMULATIVE COAL THICKNESS	TOWNSHIP ACRES	ACRE-FEET OF COAL
T132N, R99W	12	32.5	19,200	624,000
T132N, R100W	13	55	19,200	1,056,000
T132N, R101W	18	87.5	19,200	1,680,000
T132N, R102W	10	39.5	19,200	758,400
T132N, R103W	10	41	19,200	787,200
T132N, R104W	11	46	19,200	883,200
T131N, R99W	22	52.5	23,040	1,209,600
T131N, R100W	20	75	23,040	1,728,000
T131N, R101W	17	60.7	23,040	1,398,528
T131N, R102W	6	27	23,040	622,080
T131N, R103W	11	45.5	23,040	1,048,320
T131N, R104W	11	36	23,040	829,440
T130N, R99W	13	34.8	23,040	801,792
T130N, R100W	8	27.3	23,040	628,992
T130N, R101W	4	14.5	23,040	334,080
T130N, R102W	6	29	23,040	668,160
T130N, R103W	5	26.3	23,040	605,952
T130N, R104W	5	26.3	23,040	605,952
T129N, R99W	8	32	23,040	737,280
T129N, R100W	6	26.4	23,040	608,256
T129N, R101W	4	19.7	23,040	453,888
T129N, R102W	2	9.4	23,040	216,576
T129N, R103W	2	11.5	18,560	213,440
T129N, R104W	1	1	13,440	13,440
TOTAL	225	856.4	515,840	18,512,576
AVERAGE	9.4	35.7		
LIGNITE RESOURCE (tons)				32,397,008,000

BURKE COUNTY

TOWNSHIP	COAL BEDS	CUMMULATIVE COAL THICKNESS	TOWNSHIP ACRES	ACRE-FEET OF COAL
T159N, R90W	17	56	23,040	1,290,240
T159N, R91W	20	73	23,040	1,681,920
T159N, R92W	18	78	23,040	1,797,120
T159N, R93W	14	69	23,040	1,589,760

T159N, R94W	10	37	23,040	852,480
T160N, R90W	16	62	23,040	1,428,480
T160N, R91W	16	60	23,040	1,382,400
T160N, R92W	19	81	23,040	1,866,240
T160N, R93W	17	57	23,040	1,313,280
T160N, R94W	12	52	23,040	1,198,080
T161N, R89W	11	53	23,040	1,221,120
T161N, R90W	16	67	23,040	1,543,680
T161N, R91W	17	65	23,040	1,497,600
T161N, R92W	16	69	23,040	1,589,760
T161N, R93W	14	61	23,040	1,405,440
T161N, R94W	13	53	23,040	1,221,120
T162N, R88W	10	25	23,040	576,000
T162N, R89W	11	40	23,040	921,600
T162N, R90W	14	49	23,040	1,128,960
T162N, R91W	12	43	23,040	990,720
T162N, R92W	15	53	23,040	1,221,120
T162N, R93W	14	52	23,040	1,198,080
T162N, R94W	13	53	23,040	1,221,120
Ts162 & 163N, R88W	8	32	27,840	890,880
Ts162 & 163N, R89W	7	25	27,840	696,000
Ts162 & 163N, R90W	10	34	27,840	946,560
Ts162 & 163N, R91W	9	27	27,840	751,680
Ts162 & 163N, R92W	8	26	27,840	723,840
Ts162 & 163N, R93W	8	32	27,840	890,880
Ts162 & 163N, R94W	13	34	27,840	946,560
TOTAL	398	1518		35,982,720
AVERAGE	13	50.6		
LIGNITE RESOURCE (tons)				62,969,760,000

BURLEIGH COUNTY

TOWNSHIP	COAL BEDS	CUMMULATIVE COAL THICKNESS	TOWNSHIP ACRES	ACRE-FEET OF COAL
T137N, R75W	0	0	0	0
T137N, R76W	0	0	0	0
T137N, R77W	0	0	0	0
T137N, R78W	0	0	0	0
T137N, R79W	0	0	0	0
T137N, R80W	0	0	0	0
T138N, R75W	0	0	0	0
T138N, R76W	0	0	0	0
T138N, R77W	0	0	0	0
T138N, R78W	1	6	23,040	138,240
T138N, R79W	1	2	23,040	46,080
T138N, R80W	1	2	19,200	38,400
T139N, R75W	0	0	0	0
T139N, R76W	0	0	0	0
T139N, R77W	0	0	0	0
T139N, R78W	1	1	23,040	23,040
T139N, R79W	1	1	23,040	23,040
T139N, R80W	2	2	22,980	45,960
T139N, R81W	2	2	5,760	11,520
T140N, R75W	1	3	23,040	69,120
T140N, R76W	2	6	23,040	138,240
T140N, R77W	1	1	23,040	23,040
T140N, R78W	1	1	23,040	23,040
T140N, R79W	1	1	23,040	23,040

T140N, R80W	1	1	23,040	23,040
T140N, R81W	1	1	14,080	14,080
T141N, R75W	2	6	23,040	138,240
T141N, R76W	1	4.7	23,040	108,288
T141N, R77W	2	4	23,040	92,160
T141N, R78W	1	1	23,040	23,040
T141N, R79W	1	1	23,040	23,040
T141N, R80W	2	6	23,040	138,240
T141N, R81W	6	15	2,560	38,400
T142N, R75W	1	5	23,040	115,200
T142N, R76W	2	8	23,040	184,320
T142N, R77W	2	4	23,040	92,160
T142N, R78W	4	15	23,040	345,600
T142N, R79W	9	27.6	23,040	635,904
T142N, R80W	9	21	23,040	483,840
T142N, R81W	5	17	11,520	195,840
T143N, R75W	1	4	23,040	92,160
T143N, R76W	2	5	23,040	115,200
T143N, R77W	1	1	23,040	23,040
T143N, R78W	1	1	23,040	23,040
T143N, R79W	5	15.6	23,040	359,424
T144N, R75W	0	0	23,040	0
T144N, R76W	0	0	23,040	0
T144N, R77W	1	1	23,040	23,040
T144N, R78W	3	5	23,040	115,200
T144N, R79W	6	19	23,040	437,760
TOTAL	84	216.9		4,443,016
AVERAGE	1.7	4.2		
LIGNITE RESOURCE (tons)				7,775,278,000

DIVIDE COUNTY

TOWNSHIP	COAL BEDS	CUMMULATIVE COAL THICKNESS	TOWNSHIP ACRES	ACRE-FEET OF COAL
T160N, R95W	14	44	23,040	1,013,760
T160N, R96W	16	60	23,040	1,382,400
T160N, R97W	17	71	23,040	1,635,840
T160N, R98W	14	51	23,040	1,175,040
T160N, R99W	12	34	23,040	783,360
T160N, R100W	11	54	23,040	1,244,160
T160N, R101W	19	86	23,040	1,981,440
T160N, R102W	14	69	23,040	1,589,760
T160N, R103W	14	58	21,120	1,224,960
T161N, R95W	11	40	23,040	921,600
T161N, R96W	13	34	23,040	783,360
T161N, R97W	8	26	23,040	599,040
T161N, R98W	6	34	23,040	783,360
T161N, R99W	10	51	23,040	1,175,040
T161N, R100W	12	72	23,040	1,658,880
T161N, R101W	9	41	23,040	944,640
T161N, R102W	11	50	23,040	1,152,000
T161N, R103W	10	48	9,600	460,800
T162N, R95W	15	54	23,040	1,244,160
T162N, R96W	10	31	23,040	714,240
T162N, R97W	9	37	23,040	852,480
T162N, R98W	8	27	23,040	622,080
T162N, R99W	5	22	23,040	506,880
T162N, R100W	10	45	23,040	1,036,800

T162N, R101W	8	35	23,040	806,400
T162N, R102W	6	61	23,040	1,405,440
T162N, R103W	8	40	9,600	384,000
Ts163 & 164N, R95W	8	28	27,840	779,520
Ts163 & 164N, R96W	9	28	27,840	779,520
Ts163 & 164N, R97W	7	20	27,840	556,800
Ts163 & 164N, R98W	8	28	27,840	779,520
Ts163 & 164N, R99W	10	36	27,840	1,002,240
Ts163 & 164N, R100W	8	27	27,840	751,680
Ts163 & 164N, R101W	9	28	27,840	779,520
T163 & 164N, R102W	8	38	27,840	1,057,920
T163 & 164N, R103W	8	42	11,600	487,200
TOTAL	375	1550	827,600	35,055,840
AVERAGE	10.7	44.3		
LIGNITE RESOURCE (tons)				61,347,720,000

DUNN COUNTY

TOWNSHIP	COAL BEDS	CUMMULATIVE COAL THICKNESS	TOWNSHIP ACRES	ACRE-FEET OF COAL
T141N, R91W	13	54	15,360	829,440
T141N, R92W	12	45	15,360	691,200
T141N, R93W	12	48	15,360	737,280
T141N, R94W	9	34	23,040	783,360
T141N, R95W	15	46	23,040	1,059,840
T141N, R96W	16	67	23,040	1,543,680
T141N, R97W	16	75	23,040	1,728,000
T142N, R91W	10	53	23,040	1,221,120
T142N, R92W	9	43	23,040	990,720
T142N, R93W	14	71	23,040	1,635,840
T142N, R94W	11	47	23,040	1,082,880
T142N, R95W	13	51	23,040	1,175,040
T142N, R96W	15	80	23,040	1,843,200
T143N, R91W	15	60	23,040	1,382,400
T143N, R92W	15	56	23,040	1,290,240
T143N, R93W	8	46	23,040	1,059,840
T143N, R94W	12	57	23,040	1,313,280
T143N, R95W	10	47	23,040	1,082,880
T143N, R96W	14	63	23,040	1,451,520
T143N, R97W	17	66	23,040	1,520,640
T144N, R91W	10	40	23,040	921,600
T144N, R92W	12	43	23,040	990,720
T144N, R93W	14	71	23,040	1,635,840
T144N, R94W	9	57	23,040	1,313,280
T144N, R95W	18	62	23,040	1,428,480
T144N, R96W	21	79	23,040	1,820,160
T144N, R97W	18	65	23,040	1,497,600
T145N, R91W	10	34	23,040	783,360
T145N, R92W	10	33	23,040	760,320
T145N, R93W	13	64	15,360	983,040
T145N, R94W	12	58	15,360	890,880
T145N, R95W	12	51	15,360	783,360
T145N, R96W	18	78	23,040	1,797,120
T145N, R97W	18	75	23,040	1,728,000
T146N, R91W	14	44	23,040	1,013,760
T146N, R92W	14	56	23,040	1,290,240
T146N, R93W	15	65	23,040	1,497,600
T146N, R94W	15	68	23,040	1,566,720

T146N, R95W	12	53	23,040	1,221,120
T146N, R96W	17	74	23,040	1,704,960
T146N, R97W	17	81	23,040	1,866,240
T147N, R91W	16	52	22,800	1,185,600
T147N, R92W	16	51	23,040	1,175,040
T147N, R93W	18	53	23,040	1,221,120
T147N, R94W	16	52	23,040	1,198,080
T147N, R95W	17	59	23,040	1,359,360
T147N, R96W	14	56	23,040	1,290,240
T147N, R97W	13	54	23,040	1,244,160
T148N, R91W	16	47	13,760	646,720
T148N, R92W	18	44	23,040	1,013,760
T148N, R93W	12	34	23,040	783,360
T148N, R94W	20	52	23,040	1,198,080
T148N, R95W	17	47	23,040	1,082,880
T148N, R96W	14	42	23,040	967,680
T148N, R97W	15	48	23,040	1,105,920
T149 & 150N, R91W	13	45	26,880	1,209,600
T149 & 150N, R92W	13	45	23,040	1,036,800
T149 & 150N, R93W	9	47	30,720	1,443,840
TOTAL	812	3188	1,292,240	71,079,040
AVERAGE	14	56		
LIGNITE RESOURCE (tons)				124,388,320,000

GOLDEN VALLEY COUNTY

TOWNSHIP	COAL BEDS	CUMMULATIVE COAL THICKNESS	TOWNSHIP ACRES	ACRE-FEET OF COAL
T136N, R105W	7	31	23,040	714,240
T136N, R106W	8	35	22,440	785,400
T137N, R103W	9	35.8	23,040	824,832
T137N, R104W	8	32	23,040	737,280
T137N, R105W	12	33	23,040	760,320
T137N, R106W	5	13	10,560	137,280
T138N, R103W	11	39	23,040	898,560
T138N, R104W	10	40	23,040	921,600
T138N, R105W	12	46	23,040	1,059,840
T138N, R106W	8	30	10,560	316,800
T139N, R103W	11	59	23,040	1,359,360
T139N, R104W	11	54	23,040	1,244,160
T139N, R105W	12	63	23,040	1,451,520
T139N, R106W	11	57	10,560	601,920
T140N, R103W	8	41	23,040	944,640
T140N, R104W	17	75	23,040	1,728,000
T140N, R105W	12	74	23,040	1,704,960
T140N, R106W	7	47	10,560	496,320
T141N, R103W	14	63	23,040	1,451,520
T141N, R104W	18	82	23,040	1,889,280
T141N, R105W	15	66	23,040	1,520,640
T142N, R103W	12	50	23,040	1,152,000
T142N, R104W	17	69	23,040	1,589,760
T142N, R105W	16	64	23,040	1,474,560
T143N, R103W	13	47	23,040	1,082,880
T143N, R104W	15	63	23,040	1,451,520
T143N, R105W	15	70	23,040	1,612,800
T144N, R103W	11	50	23,040	1,152,000
T144N, R104W	14	55	23,040	1,267,200
T144N, R105W	15	68	23,040	1,566,720

TOTAL	354	1551.8		33,897,912
AVERAGE	12	57.5		
LIGNITE RESOURCE (tons)				59,321,346,000

GRANT COUNTY

TOWNSHIP	COAL BEDS	CUMMULATIVE COAL THICKNESS	TOWNSHIP ACRES	ACRE-FEET OF COAL
T130N, Rs85 - 90W	no data	0	0	0
T131N, R84W	0	0	0	0
T131N, R85W	0	0	0	0
T131N, R86W	0	0	0	0
T131N, R87W	1	2.5	22,960	57,400
T131N, R88W	2	9	23,040	207,360
T131N, R89W	2	12	23,040	276,480
T131N, R90W	7	33	23,040	760,320
T132N, R85W	3	7	21,120	147,840
T132N, R86W	1	3	21,120	63,360
T132N, R87W	1	2.5	21,120	52,800
T132N, R88W	1	4	21,120	84,480
T132N, R89W	1	4	21,120	84,480
T132N, R90W	2	11	21,120	232,320
T133N, R83W	0	0	23,040	0
T133N, R84W	3	6	14,080	84,480
T133N, R85W	3	6	23,040	138,240
T133N, R86W	2	5	23,040	115,200
T133N, R87W	1	2	23,040	46,080
T133N, R88W	2	5	23,040	115,200
T133N, R89W	2	5	23,040	115,200
T133N, R90W	3	10	23,040	230,400
T134N, R85W	1	2	23,040	46,080
T134N, R86W	1	2	23,040	46,080
T134N, R87W	2	5	23,040	115,200
T134N, R88W	3	8	23,040	184,320
T134N, R89W	7	19	23,040	437,760
T134N, R90W	7	24	23,040	552,960
T135N, R85W	1	3	23,040	69,120
T135N, R86W	1	5	23,040	115,200
T135N, R87W	2	5	23,040	115,200
T135N, R88W	3	7	23,040	161,280
T135N, R89W	2	5	23,040	115,200
T135N, R90W	4	11	23,040	253,440
T136N, R85W	1	2	23,040	46,080
T136N, R86W	1	2	23,040	46,080
T136N, R87W	3	10	23,040	230,400
T136N, R88W	2	7	23,040	161,280
T136N, R89W	2	3	23,040	69,120
T136N, R90W	4	9	23,040	207,360
T137N, R88W	9	34	23,040	783,360
T137N, R89W	5	15	23,040	345,600
T137N, R90W	2	4	23,040	92,160
TOTAL	100	309		7,004,920
AVERAGE	2.5	7.9		
LIGNITE RESOURCE (tons)				12,258,610,000

HETTINGER COUNTY

TOWNSHIP	COAL BEDS	CUMMULATIVE COAL THICKNESS	TOWNSHIP ACRES	ACRE-FEET OF COAL
T132N, R91W	11	49	19,200	940,800
T132N, R92W	6	29	19,200	556,800
T132N, R93W	10	42	19,200	806,400
T132N, R94W	8	34	19,200	652,800
T133N, R91W	14	34	23,040	783,360
T133N, R92W	8	18	23,040	414,720
T133N, R93W	4	16	23,040	368,640
T133N, R94W	10	40	23,040	921,600
T133N, R95W	12	40	23,040	921,600
T133N, R96W	13	31	23,040	714,240
T133N, R97W	12	29	23,040	668,160
T134N, R91W	14	31	23,040	714,240
T134N, R92W	10	27	23,040	622,080
T134N, R93W	8	22	23,040	506,880
T134N, R94W	14	59	23,040	1,359,360
T134N, R95W	8	42	23,040	967,680
T134N, R96W	8	42	23,040	967,680
T134N, R97W	11	37	23,040	852,480
T135N, R91W	5	12	23,040	276,480
T135N, R92W	10	32	23,040	737,280
T135N, R93W	10	26	23,040	599,040
T135N, R94W	16	55	23,040	1,267,200
T135N, R95W	11	45	23,040	1,036,800
T135N, R96W	9	42	23,040	967,680
T135N, R97W	12	48	23,040	1,105,920
T136N, R91W	7	29	23,040	668,160
T136N, R92W	9	33	23,040	760,320
T136N, R93W	9	23	23,040	529,920
T136N, R94W	13	48	23,040	1,105,920
T136N, R95W	15	52	23,040	1,198,080
T136N, R96W	13	56	23,040	1,290,240
T136N, R97W	10	48	23,040	1,105,920
TOTAL	330	1171	721,920	26,388,480
AVERAGE	10.3	36.6		
LIGNITE RESOURCE (tons)				46,179,840,000

MCHENRY COUNTY

TOWNSHIP	COAL BEDS	CUMMULATIVE COAL THICKNESS	TOWNSHIP ACRES	ACRE-FEET OF COALL
T151N, R79W	1	5	23,040	115,200
T151N, R80W	3	12	23,040	276,480
T152N, R78W	1	1	23,040	23,040
T152N, R79W	1	3	17,920	53,760
T152N, R80W	1	5	5,440	27,200
TOTAL	7	26		495,680
AVERAGE	1.4	5.2		
LIGNITE RESOURCE (tons)				867,440,000

MCKENZIE COUNTY

TOWNSHIP	COAL BEDS	CUMMULATIVE COAL THICKNESS	TOWNSHIP ACRES	ACRE-FEET OF COAL
T145N, R98W	24	99	23,040	2,280,960
T145N, R99W	24	82	23,040	1,889,280
T145N, R100W	13	55	23,040	1,267,200

T145N, R101W	14	53	23,040	1,221,120
T145N, R102W	11	54	23,040	1,244,160
T145N, R103W	14	64	23,040	1,474,560
T145N, R104W	16	82	23,040	1,889,280
T145N, R105W	15	65	9,600	624,000
T146N, R98W	26	101	23,040	2,327,040
T146N, R99W	26	99	23,040	2,280,960
T146N, R100W	19	77	23,040	1,774,080
T146N, R101W	17	83	23,040	1,912,320
T146N, R102W	16	77	23,040	1,774,080
T146N, R103W	15	70	23,040	1,612,800
T146N, R104W	16	63	23,040	1,451,520
T146N, R105W	13	53	9,600	508,800
T147N, R98W	18	72	23,040	1,658,880
T147N, R99W	24	84	23,040	1,935,360
T147N, R100W	20	80	23,040	1,843,200
T147N, R101W	12	79	23,040	1,820,160
T147N, R102W	13	76	23,040	1,751,040
T147N, R103W	15	70	23,040	1,612,800
T147N, R104W	11	53	23,040	1,221,120
T147N, R105W	15	59	9,600	566,400
T148N, R98W	15	60	23,040	1,382,400
T148N, R99W	23	86	23,040	1,981,440
T148N, R100W	20	80	23,040	1,843,200
T148N, R101W	17	101	23,040	2,327,040
T148N, R102W	16	72	23,040	1,658,880
T148N, R103W	17	71	23,040	1,635,840
T148N, R104W	15	63	23,040	1,451,520
T148N, R105W	14	56	9,600	537,600
T149N, R94W	19	60	23,040	1,382,400
T149N, R95W	14	54	23,040	1,244,160
T149N, R96W	16	59	23,040	1,359,360
T149N, R97W	8	33	23,040	760,320
T149N, R98W	7	24	23,040	552,960
T149N, R99W	11	37	23,040	852,480
T149N, R100W	12	45	23,040	1,036,800
T149N, R101W	16	65	23,040	1,497,600
T149N, R102W	13	52	23,040	1,198,080
T149N, R103W	14	67	23,040	1,543,680
T149N, R104W	12	58	21,120	1,224,960
T150N, R94W	15	53	23,040	1,221,120
T150N, R95W	15	65	23,040	1,497,600
T150N, R96W	15	65	23,040	1,497,600
T150N, R97W	13	59	23,040	1,359,360
T150N, R98W	10	56	23,040	1,290,240
T150N, R99W	22	71	23,040	1,635,840
T150N, R100W	13	56	23,040	1,290,240
T150N, R101W	14	62	23,040	1,428,480
T150N, R102W	14	61	23,040	1,405,440
T150N, R103W	16	82	23,040	1,889,280
T150N, R104W	13	78	21,120	1,647,360
T151N, R94W	15	65	22,240	1,445,600
T151N, R95W	14	67	23,040	1,543,680
T151N, R96W	13	54	23,040	1,244,160
T151N, R97W	11	52	23,040	1,198,080
T151N, R98W	16	63	23,040	1,451,520
T151N, R99W	13	66	23,040	1,520,640

T151N, R100W	11	56	23,040	1,290,240
T151N, R101W	11	49	23,040	1,128,960
T151N, R102W	12	56	23,040	1,290,240
T151N, R103W	13	72	23,040	1,658,880
T151N, R104W	15	84	21,120	1,774,080
T152N, R93W	17	78	4,480	349,440
T152N, R94W	19	90	23,040	2,073,600
T152N, R95W	17	78	23,040	1,797,120
T152N, R96W	12	62	23,040	1,428,480
T152N, R97W	11	71	23,040	1,635,840
T152N, R98W	19	96	23,040	2,211,840
T152N, R99W	13	58	23,040	1,336,320
T152N, R100W	15	71	14,720	1,045,120
T152N, R101W	11	42	22,400	940,800
T152N, R102W	12	56	23,040	1,290,240
T152N, R103W	12	59	10,880	641,920
T152N, R104W	8	50	10,240	512,000
T153N, R93	17	72	1,920	138,240
T153N, R94W	18	70	17,280	1,209,600
T153N, R95W	13	45	23,040	1,036,800
T153N, R96W	14	57	23,040	1,313,280
T153N, R97W	19	85	23,040	1,958,400
T153N, R98W	19	90	2,880	259,200
T153N, R99W	19	55	3,840	211,200
T153N, R100W	19	55	22,400	1,232,000
T153N, R101W	19	56	2,240	125,440
T154N, R94W	18	70	300	21,000
T154N, R95W	13	45	1,728	77,760
T154N, R96W	14	57	2,560	145,920
T154N, R97W	19	85	1,280	108,800
T154N, R98W	19	55	1,600	88,000
TOTAL	1396	5993		118,308,840
AVERAGE	15.5	66.6		
LIGNITE RESOURCE (tons)				205,226,070,000

MCLEAN COUNTY

TOWNSHIP	COAL BEDS	CUMMULATIVE COAL THICKNESS	TOWNSHIP ACRES	ACRE-FEET OF COAL
T143N, R80W	3	6	23,040	138,240
T143N, R81W	1	3	18,560	55,680
T144N, R80W	1	1	22,980	22,980
T144N, R81W	1	1	21,760	21,760
T144N, R82W	1	3	10,240	30,720
T144N, R83W	1.4	7.8	14,720	114,816
T144N, R84W	3	14.8	7,520	111,296
T145N, R79W	1	1	23,040	23,040
T145N, R80W	2.2	3.3	23,040	76,032
T145N, R81W	3	5.8	23,040	133,632
T145N, R82W	3	12	23,040	276,480
T145N, R83W	4	16	23,040	368,640
T145N, R84W	5	19	10,240	194,560
T146N, R79W	2	2.3	23,040	52,992
T146N, R80W	1	0.5	23,040	11,520
T146N, R81W	2	8	23,040	184,320
T146N, R82W	8	23	23,040	529,920
T146N, R83W	4	16	23,040	368,640
T146N, R84W	5	18	18,560	334,080

T147N, R79W	2	2	23,040	46,080
T147N, R80W	1	1	23,040	23,040
T147N, R81W	4	9	23,040	207,360
T147N, R82W	5	14	23,040	322,560
T147N, R83W	7	18	23,040	414,720
T147N, R84W	2	2.3	5,760	13,248
T147N, R85W	0	0	0	0
T147N, R86W	5	9	7,040	63,360
T147N, R87W	7	18	8,320	149,760
T147N, R88W	5	24	10,240	245,760
T147N, R89W	4	18	4,480	80,640
T147N, R90W	0	0	0	0
T148N, R79W	1	1	23,040	23,040
T148N, R80W	1	1	23,040	23,040
T148N, R81W	1	2.5	23,040	57,600
T148N, R82W	2	3	23,040	69,120
T148N, R83W	8	13	23,040	299,520
T148N, R84W	5	16	23,040	368,640
T148N, R85W	4	15	23,040	345,600
T148N, R86W	5	17	23,040	391,680
T148N, R87W	5	18	23,040	414,720
T148N, R88W	5	20.4	23,040	470,016
T148N, R89W	3	12	23,040	276,480
T148N, R90W	3	10	16,000	160,000
T148N, R91W	3	10	1,920	19,200
T149N, R78W	1	1	23,040	23,040
T149N, R79W	1	1	23,040	23,040
T149N, R80W	3	3	23,040	69,120
T149N, R81W	2	3	23,040	69,120
T149N, R82W	3	6	23,040	138,240
T149N, R83W	3	5.7	23,040	131,328
T149N, R84W	5	15	23,040	345,600
T149N, R85W	5	17	23,040	391,680
T149N, R86W	3	11	23,040	253,440
T149N, R87W	4	8	23,040	184,320
T149N, R88W	3	6	23,040	138,240
T149N, R89W	3	8	23,040	184,320
T149N, R90W	3	9	15,360	138,240
T150N, R78W	1	1	23,040	23,040
T150N, R79W	2	3	23,040	69,120
T150N, R80W	2	4	23,040	92,160
T150N, R81W	4	8	23,040	184,320
T150N, R82W	5	11	23,040	253,440
T150N, R83W	4	8	23,040	184,320
T150N, R84W	3	8.3	23,040	191,232
T150N, R85W	4	14	23,040	322,560
T150N, R86W	3	8.3	23,040	191,232
T150N, R87W	3	7	23,040	161,280
T150N, R88W	14	25	23,040	576,000
T150N, R89W	10	23	23,040	529,920
T150N, R90W	9	24	23,040	552,960
T150N, R91W	3	8	1,600	12,800
TOTAL	245.6	662		12,968,644
AVERAGE	3.5	9.5		
LIGNITE RESOURCE (tons)				22,695,127,000

MERCER COUNTY

TOWNSHIP	COAL BEDS	CUMMULATIVE COAL THICKNESS	TOWNSHIP ACRES	ACRE-FEET OF COAL
T144N, R88W	17	60	23,040	1,382,400
T144N, R89W	14	49	22,980	1,126,020
T144N, R90W	10	37.6	5,760	216,576
T142N, R88W	15	60	23,040	1,382,400
T142N, R89W	14	51	23,040	1,175,040
T142N, R90W	12	42	23,040	967,680
T143N, R88W	13	59	23,040	1,359,360
T143N, R89W	11	50	23,040	1,152,000
T143N, R90W	11	51	23,040	1,175,040
T144N, R84W	16	63	14,720	927,360
T144N, R85W	15	57	23,040	1,313,280
T144N, R86W	13	34	23,040	783,360
T144N, R87W	12	37	23,040	852,480
T144N, R88W	11	59	23,040	1,359,360
T144N, R89W	13	60	23,040	1,382,400
T144N, R90W	15	57	23,040	1,313,280
T145N, R84W	13	45	10,880	489,600
T145N, R85W	14	50	23,040	1,152,000
T145N, R86W	12	53	23,040	1,221,120
T145N, R87W	12	65	23,040	1,497,600
T145N, R88W	11	55	23,040	1,267,200
T145N, R89W	13	42	23,040	967,680
T145N, R90W	15	57	23,040	1,313,280
T146N, R84W	10	50	2,560	128,000
T146N, R85W	11	51	23,040	1,175,040
T146N, R86W	15	61	23,040	1,405,440
T146N, R87W	13	60	23,040	1,382,400
T146N, R88W	14	72	23,040	1,658,880
T146N, R89W	14	60	23,040	1,382,400
T146N, R90W	14	58	23,040	1,336,320
T147N, R84W	0	0	0	0
T147N, R85W	10	50	10,240	512,000
T147N, R86W	14	62	3,840	238,080
T147N, R87W	13	58	1,280	74,240
T147N, R88W	0	0	0	0
T147N, R89W	14	60	7,680	460,800
T147N, R90W	14	67	14,720	986,240
TOTAL	458	1902.6		36,516,356
AVERAGE	12.7	52.8		
LIGNITE RESOURCE (tons)				63,903,623,000

MORTON COUNTY

TOWNSHIP	COAL BEDS	CUMMULATIVE COAL THICKNESS	TOWNSHIP ACRES	ACRE-FEET OF COAL
T134N, R81W	1	1	4,480	4,480
T134N, R82W	1	1	7,680	7,680
T134N, R83W	1	1	5,120	5,120
T134N, R84W	1	1	17,920	17,920
T135N, R80W	1	1	5,440	5,440
T135N, R81W	1	1	19,840	19,840
T135N, R82W	1	1	23,040	23,040
T135N, R83W	1	1	23,040	23,040
T135N, R84W	1	1	23,040	23,040
T136N, R80W	1	1	20,480	20,480

T136N, R81W	1	1	23,040	23,040
T136N, R82W	1	1	23,040	23,040
T136N, R83W	1	1	23,040	23,040
T136N, R84W	1	1	23,040	23,040
T137N, R80W	1	2	10,240	20,480
T137N, R81W	2	5	23,040	115,200
T137N, R82W	3	9	23,040	207,360
T137N, R83W	4	12	23,040	276,480
T137N, R84W	4	15	23,040	345,600
T137N, R85W	4	12	23,040	276,480
T137N, R86W	6	33	23,040	760,320
T137N, R87W	7	28	23,040	645,120
T138N, R80W	1	2	3,200	6,400
T138N, R81W	1	4	23,040	92,160
T138N, R82W	5	15	23,040	345,600
T138N, R83W	5	16	23,040	368,640
T138N, R84W	6	22	23,040	506,880
T138N, R85W	8	27	23,040	622,080
T138N, R86W	6	25	23,040	576,000
T138N, R87W	7	27	23,040	622,080
T138N, R88W	7	28	23,040	645,120
T138N, R89W	7	27	23,040	622,080
T138N, R90W	13	42	23,040	967,680
T139N, R81W	2	4	16,640	66,560
T139N, R82W	4	11	23,040	253,440
T139N, R83W	7	16	23,040	368,640
T139N, R84W	5	18	23,040	414,720
T139N, R85W	9	31	23,040	714,240
T139N, R86W	5	11	23,040	253,440
T139N, R87W	5	13	23,040	299,520
T139N, R88W	2	6	23,040	138,240
T139N, R89W	5	15	23,040	345,600
T139N, R90W	12	38	23,040	875,520
T140N, R81W	3	8	9,600	76,800
T140N, R82W	3	13	23,040	299,520
T140N, R83W	4	13	23,040	299,520
T140N, R84W	8	20	23,040	460,800
T140N, R85W	8	30	23,040	691,200
T140N, R86W	7	18	23,040	414,720
T140N, R87W	5	18	23,040	414,720
T140N, R88W	8	28	23,040	645,120
T140N, R89W	13	51	23,040	1,175,040
T140N, R90W	14	49	21,120	1,034,880
TOTAL	240	776		17,506,240
AVERAGE	4.6	14.9		
LIGNITE RESOURCE (tons)				30,635,920,000

MOUNTRAIL COUNTY

TOWNSHIP	COAL BEDS	CUMMULATIVE COAL THICKNESS	TOWNSHIP ACRES	ACRE-FEET OF COAL
T150N, R92W	17	53	17,920	949,760
T150N, R93W	17	52	11,520	599,040
T151N, R88W	15	48	23,040	1,105,920
T151N, R89W	16	50	23,040	1,152,000
T151N, R90W	15	42	23,040	967,680
T151N, R91W	11	42	7,680	322,560

T151N, R92W	13	48	23,040	1,105,920
T151N, R93W	13	50	20,160	1,008,000
T152N, R88W	14	44	23,040	1,013,760
T152N, R89W	17	48	23,040	1,105,920
T152N, R90W	16	55	23,040	1,267,200
T152N, R91W	9	48	19,200	921,600
T152N, R92W	15	58	19,840	1,150,720
T152N, R93W	15	61	7,680	468,480
T153N, R88W	13	40	23,040	921,600
T153N, R89W	16	57	23,040	1,313,280
T153N, R90W	18	54	23,040	1,244,160
T153N, R91W	15	58	23,040	1,336,320
T153N, R92W	17	61	18,560	1,132,160
T153N, R93W	19	62	11,520	714,240
T154N, R88W	16	44	23,040	1,013,760
T154N, R89W	14	52	23,040	1,198,080
T154N, R90W	14	49	23,040	1,128,960
T154N, R91W	12	53	23,040	1,221,120
T154N, R92W	17	64	23,040	1,474,560
T154N, R93W	20	66	23,040	1,520,640
T154N, R94W	21	63	15,360	967,680
T155N, R88W	17	43	23,040	990,720
T155N, R89W	15	59	23,040	1,359,360
T155N, R90W	13	47	23,040	1,082,880
T155N, R91W	13	52	23,040	1,198,080
T155N, R92W	20	74	23,040	1,704,960
T155N, R93W	23	79	23,040	1,820,160
T155N, R94W	21	59	23,040	1,359,360
T156N, R88W	12	51	23,040	1,175,040
T156N, R89W	14	43	23,040	990,720
T156N, R90W	14	55	23,040	1,267,200
T156N, R91W	17	56	23,040	1,290,240
T156N, R92W	23	84	23,040	1,935,360
T156N, R93W	19	79	23,040	1,820,160
T156N, R94W	20	70	23,040	1,612,800
T157N, R88W	16	45	23,040	1,036,800
T157N, R89W	16	47	23,040	1,082,880
T157N, R90W	14	39	23,040	898,560
T157N, R91W	19	61	23,040	1,405,440
T157N, R92W	17	60	23,040	1,382,400
T157N, R93W	16	49	23,040	1,128,960
T157N, R94W	16	51	23,040	1,175,040
T158N, R88W	9	32	23,040	737,280
T158N, R89W	14	38	23,040	875,520
T158N, R90W	15	44	23,040	1,013,760
T158N, R91W	15	50	23,040	1,152,000
T158N, R92W	18	65	23,040	1,497,600
T158N, R93W	18	59	23,040	1,359,360
T158N, R94W	13	42	23,040	967,680
TOTAL	872	2955		63,645,440
AVERAGE	15.9	53.7		
LIGNITE RESOURCE (tons)				111,379,520,000

OLIVER COUNTY

TOWNSHIP	COAL BEDS	CUMMULATIVE COAL THICKNESS	TOWNSHIP ACRES	ACRE-FEET OF COAL
T141N, R81W	2	9	18,560	167,040
T141N, R82W	4	12	23,040	276,480
T141N, R83W	5	15.8	23,040	364,032
T141N, R84W	8	21	23,040	483,840
T141N, R85W	8	14.5	23,040	334,080
T141N, R86W	7	17	23,040	391,680
T141N, R87W	9	22	23,040	506,880
T142N, R81W	3	7	11,520	80,640
T142N, R82W	4	11	23,040	253,440
T142N, R83W	7	51	23,040	1,175,040
T142N, R84W	7	20	23,040	460,800
T142N, R85W	7	23.2	23,040	534,528
T142N, R86W	7	17.4	23,040	400,896
T142N, R87W	8	20.7	23,040	476,928
T143M, R81W	3	6.8	2,880	19,584
T143M, R82W	2.5	6.8	23,040	156,672
T143M, R83W	6	17	23,040	391,680
T143M, R84W	5	17	23,040	391,680
T143M, R85W	6	25.4	23,040	585,216
T143M, R86W	7	23	23,040	529,920
T143M, R87W	5	16	23,040	368,640
T144N, R81W	7	33	640	21,120
T144N, R82W	7	33	12,800	422,400
T144N, R83W	12	40	7,040	281,600
TOTAL	146.5	479.6		9,074,816
AVERAGE	6.1	19.9		
LIGNITE RESOURCE (tons)				15,880,928,000

RENVILLE COUNTY

TOWNSHIP	COAL BEDS	CUMMULATIVE COAL THICKNESS	TOWNSHIP ACRES	ACRE-FEET OF COAL
T158N, R81W	0	0	23,040	0
T158N, R82W	0	0	23,040	0
T158N, R83W	0	0	23,040	0
T158N, R84W	0	0	23,040	0
T158N, R85W	0	0	23,040	0
T158N, R86W	1	1.5	23,040	34,560
T159N, R84W	1	1	23,040	23,040
T159N, R85W	3	2	23,040	46,080
T159N, R86W	2	1	23,040	23,040
T160N, R84W	1	1	23,040	23,040
T160N, R85W	2	3	23,040	69,120
T160N, R86W	2	4	23,040	92,160
T161N, R84W	0	0	23,040	0
T161N, R85W	3	8	23,040	184,320
T161N, R86W	3	10	23,040	230,400
T161N, R87W	2	7	23,040	161,280
T162N, R84W	0	0	23,040	0
T162N, R85W	3	8	23,040	184,320
T162N, R86W	5	17	23,040	391,680
T162N, R87W	3	7	23,040	161,280
T163N, R84W	0	0	23,040	0
T163N, R85W	0	0	23,040	0
T163N, R86W	0	0	23,040	0

TOTAL	31	70.5		1,624,320
AVERAGE	1.3	3		
LIGNITE RESOURCE (tons)				2,842,560,000

SHERIDAN COUNTY

TOWNSHIP	COAL BEDS	CUMMULATIVE COAL THICKNESS	TOWNSHIP ACRES	ACRE-FEET OF COAL
T149N, R74W	1	4	80	320
LIGNITE RESOURCE (tons)				560,000

SLOPE COUNTY

TOWNSHIP	COAL BEDS	CUMMULATIVE COAL THICKNESS	TOWNSHIP ACRES	ACRE-FEET OF COAL
T133N, R98W	13	47	23,040	1,082,880
T133N, R99W	11	56	23,040	1,290,240
T133N, R100W	12	66	23,040	1,520,640
T133N, R101W	6	46	23,040	1,059,840
T133N, R102W	7	49	23,040	1,128,960
T133N, R103W	3	22	23,040	506,880
T133N, R104W	4	41	23,040	944,640
T133N, R105W	2	3	11,520	34,560
T133N, R106W	0	0	0	0
T134N, R98W	7	27	23,040	622,080
T134N, R99W	10	48	23,040	1,105,920
T134N, R100W	8	56	23,040	1,290,240
T134N, R101W	14	88	23,040	2,027,520
T134N, R102W	7	48	23,040	1,105,920
T134N, R103W	5	18	23,040	414,720
T134N, R104W	5	24	23,040	552,960
T134N, R105W	5	21	23,040	483,840
T134N, R106W	3	31	3,200	99,200
T135N, R98W	5	32	23,040	737,280
T135N, R99W	7	34	23,040	783,360
T135N, R100W	8	39	23,040	898,560
T135N, R101W	9	64	23,040	1,474,560
T135N, R102W	10	56	23,040	1,290,240
T135N, R103W	12	69	23,040	1,589,760
T135N, R104W	9	40	23,040	921,600
T135N, R105W	7	30	23,040	691,200
T135N, R106W	7	30	15,360	460,800
T136N, R98W	14	64	23,040	1,474,560
T136N, R99W	11	80	23,040	1,843,200
T136N, R100W	9	81	15,360	1,244,160
T136N, R101W	11	58	15,360	890,880
T136N, R102W	9	57	15,360	875,520
T136N, R103W	10	54	23,040	1,244,160
T136N, R104W	10	58	23,040	1,336,320
TOTAL	270	1537	698,240	33,027,200
AVERAGE	8	47		
LIGNITE RESOURCE (tons)				57,797,600,000

STARK COUNTY

TOWNSHIP	COAL BEDS	CUMMULATIVE COAL THICKNESS	TOWNSHIP ACRES	ACRE-FEET OF COAL
T137N, R91W	5	18	23,040	414,720
T137N, R92W	4	13	23,040	299,520

T137N, R93W	7	33	23,040	760,320
T137N, R94W	16	48	23,040	1,105,920
T137N, R95W	15	77	23,040	1,774,080
T137N, R96W	17	64	23,040	1,474,560
T137N, R97W	19	72	23,040	1,658,880
T137N, R98W	13	60	23,040	1,382,400
T137N, R99W	15	82	23,040	1,889,280
T138N, R91W	7	29	23,040	668,160
T138N, R92W	7	29	23,040	668,160
T138N, R93W	9	25	23,040	576,000
T138N, R94W	9	22	23,040	506,880
T138N, R95W	5	55	23,040	1,267,200
T138N, R96W	19	72	23,040	1,658,880
T138N, R97W	9	42	23,040	967,680
T138N, R98W	15	79	23,040	1,820,160
T138N, R99W	12	59	23,040	1,359,360
T139N, R91W	11	38.5	23,040	887,040
T139N, R92W	12	39	23,040	898,560
T139N, R93W	11	40	23,040	921,600
T139N, R94W	11	43	23,040	990,720
T139N, R95W	13	43	23,040	990,720
T139N, R96W	15	65	23,040	1,497,600
T139N, R97W	9	46	23,040	1,059,840
T139N, R98W	8	45	23,040	1,036,800
T139N, R99W	17	71	23,040	1,635,840
T140N, R91W	5	31.5	23,040	725,760
T140N, R92W	7	29.8	23,040	686,592
T140N, R93W	15	62	23,040	1,428,480
T140N, R94W	15	56	23,040	1,290,240
T140N, R95W	15	55	23,040	1,267,200
T140N, R96W	15	78	23,040	1,797,120
T140N, R97W	15	61	23,040	1,405,440
T140N, R98W	13	48	23,040	1,105,920
T140N, R99W	14	58	23,040	1,336,320
T141N, R91W	6	24.5	7,680	188,160
T141N, R92W	7	29	7,680	222,720
T141N, R93W	8	34.2	7,680	262,656
TOTAL	445	1876.5		41,887,488
AVERAGE	12	50.7		
LIGNITE RESOURCE (tons)				73,303,104,000

WARD COUNTY

TOWNSHIP	COAL BEDS	CUMMULATIVE COAL THICKNESS	TOWNSHIP ACRES	ACRE-FEET OF COAL
T151N, R81W	5	26	23,040	599,040
T151N, R82W	2	10	23,040	230,400
T151N, R83W	1	2	23,040	46,080
T151N, R84W	9	20	23,040	460,800
T151N, R85W	11	34	23,040	783,360
T151N, R86W	12	40	23,040	921,600
T151N, R87W	13	29	23,040	668,160
T152N, R81W	2	8	23,040	184,320
T152N, R82W	3	19	23,040	437,760
T152N, R83W	4	11	23,040	253,440
T152N, R84W	3	7	23,040	161,280
T152N, R85W	14	44	23,040	1,013,760

T152N, R86W	13	40	23,040	921,600
T152N, R87W	13	40	23,040	921,600
T153N, R81W	1	2	23,040	46,080
T153N, R82W	3	9	23,040	207,360
T153N, R83W	7	24	23,040	552,960
T153N, R84W	9	18	23,040	414,720
T153N, R85W	10	29	23,040	668,160
T153N, R86W	8	22	23,040	506,880
T153N, R87W	13	40	23,040	921,600
T154N, R81W	1	2	23,040	46,080
T154N, R82W	1	2	23,040	46,080
T154N, R83W	3	5	23,040	115,200
T154N, R84W	10	29	23,040	668,160
T154N, R85W	13	43	23,040	990,720
T154N, R86W	16	44	23,040	1,013,760
T154N, R87W	15	38	23,040	875,520
T155N, R81W	0	0	23,040	0
T155N, R82W	4	2	23,040	46,080
T155N, R83W	2	5	23,040	115,200
T155N, R84W	12	27	23,040	622,080
T155N, R85W	11	34	23,040	783,360
T155N, R86W	13	36	23,040	829,440
T155N, R87W	12	33	23,040	760,320
T156N, R81W	0	0	23,040	0
T156N, R82W	5	10	23,040	230,400
T156N, R83W	1	1	23,040	23,040
T156N, R84W	6	13	23,040	299,520
T156N, R85W	12	24	23,040	552,960
T156N, R86W	15	35	23,040	806,400
T156N, R87W	16	36	23,040	829,440
T157N, R81W	2	4	23,040	92,160
T157N, R82W	1	1	23,040	23,040
T157N, R83W	4	9	23,040	207,360
T157N, R84W	8	18	23,040	414,720
T157N, R85W	2	6	23,040	138,240
T157N, R86W	11	22	23,040	506,880
T157N, R87W	17	36	23,040	829,440
T158N, R87W	17	32	23,040	737,280
T159N, R87W	8	20	23,040	460,800
T159N, R88W	14	35	23,040	806,400
T159N, R89W	15	39	23,040	898,560
T160N, R87W	8	21	23,040	483,840
T160N, R88W	7	21	23,040	483,840
T160N, R89W	15	41	23,040	944,640
T161N, R88W	10	23	23,040	529,920
TOTAL	463	1221		28,131,840
AVERAGE	8.3	21.8		
LIGNITE RESOURCE (tons)				49,230,720,000

WILLIAMS COUNTY

TOWNSHIP	COAL BEDS	CUMMULATIVE COAL THICKNESS	TOWNSHIP ACRES	ACRE-FEET OF COAL
T152N, R103W	14	38	9,920	376,960
T152N, R104W	14	38	10,240	389,120
T153N, R98W	24	60	8,960	537,600
T153N, R99W	24	51	16,320	832,320

T153N, R100W	20	51	11,520	587,520
T153N, R101W	18	50	19,200	960,000
T153N, R102W	19	67	23,040	1,543,680
T153N, R103W	17	46	9,600	441,600
T154N, R95W	13	36	11,520	414,720
T154N, R96W	6	14	8,320	116,480
T154N, R97W	25	65	11,520	748,800
T154N, R98W	24	69	23,040	1,589,760
T154N, R99W	15	42	23,040	967,680
T154N, R100W	14	39	21,760	848,640
T154N, R101W	18	47	18,560	872,320
T154N, R102W	19	57	23,040	1,313,280
T154N, R103W	13	35	23,040	806,400
T154N, R104W	17	48	9,600	460,800
T155N, R95W	10	68	23,040	1,566,720
T155N, R96W	15	35	23,040	806,400
T155N, R97W	15	33	23,040	760,320
T155N, R98W	23	89	23,040	2,050,560
T155N, R99W	22	77	23,040	1,774,080
T155N, R100W	15	44	23,040	1,013,760
T155N, R101W	20	74	23,040	1,704,960
T155N, R102W	19	50	23,040	1,152,000
T155N, R103W	16	50	23,040	1,152,000
T155N, R104W	18	50	9,600	480,000
T156N, R95W	10	68	23,040	1,566,720
T156N, R96W	11	51	23,040	1,175,040
T156N, R97W	19	87	23,040	2,004,480
T156N, R98W	20	82	23,040	1,889,280
T156N, R99W	19	79	23,040	1,820,160
T156N, R100W	15	59	23,040	1,359,360
T156N, R101W	15	64	23,040	1,474,560
T156N, R102W	18	82	23,040	1,889,280
T156N, R103W	15	64	23,040	1,474,560
T156N, R104W	15	71	9,600	681,600
T157N, R95W	16	62	23,040	1,428,480
T157N, R96W	17	66	23,040	1,520,640
T157N, R97W	17	71	23,040	1,635,840
T157N, R98W	17	70	23,040	1,612,800
T157N, R99W	18	70	23,040	1,612,800
T157N, R100W	13	51	23,040	1,175,040
T157N, R101W	17	74	23,040	1,704,960
T157N, R102W	23	101	23,040	2,327,040
T157N, R103W	13	63	21,120	1,330,560
T158N, R95W	15	53	23,040	1,221,120
T158N, R96W	16	57	23,040	1,313,280
T158N, R97W	18	73	23,040	1,681,920
T158N, R98W	14	65	23,040	1,497,600
T158N, R99W	14	63	23,040	1,451,520
T158N, R100W	14	52	23,040	1,198,080
T158N, R101W	13	50	23,040	1,152,000
T158N, R102W	22	80	23,040	1,843,200
T158N, R103W	17	59	21,120	1,246,080
T159N, R95W	15	54	23,040	1,244,160
T159N, R96W	16	57	23,040	1,313,280
T159N, R97W	17	80	23,040	1,843,200
T159N, R98W	19	95	23,040	2,188,800
T159N, R99W	13	62	23,040	1,428,480

T159N, R100W	13	64	23,040	1,474,560
T159N, R101W	13	59	23,040	1,359,360
T159N, R102W	13	74	23,040	1,704,960
T159N, R103W	10	38	21,120	802,560
TOTAL	1067	3893		81,915,840
AVERAGE	16.7	60.8		
LIGNITE RESOURCE (tons)				143,352,720,000