NORTH DAKOTA STATE AGENCY
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PUBLIC DOCUMENT NO. 21

FIFTH BIENNIAL REPORT

OF THE

STATE ENGINEER

TO THE

GOVERNOR OF NORTH DAKOTA

For the Years 1911-1912

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FIFTH BIENNIAL REPORT

OF THE

STATE ENGINEER

TO THE

GOVERNOR OF NORTH DAKOTA

For the Years 1911-1912

LETTER OF TRANSMITTAL.

Bismarck, North Dakota, Sept. 30, 1912.

Honorable John Burke, Governor,

Sir: As provided by our statutes I have the honor to transmit herewith report of the transactions of the department of the State Engineer, from September 30, 1910 to September 30, 1912.

Very respectfully yours,

T. R. ATKINSON

State Engineer.

LIST OF OFFICERS AND EMPLOYEES IN THE STATE ENGINEER'S OFFICE.

T. R. Atkinson	State Engineer
J. W. Bliss	Assistant State Engineer
J. M. Hansen	Draughtsman
Thorn Dickinson	Instrument Man
Howard Flint	Instrument Man
Donald MacDonald	Rodman
Ruby Schumann	Stenographer

FINANCIAL STATEMENT.

WARRANT ACCOUNT

FOR PROMOTION OF IRRIGATION AND DRAINAGE FROM NOVEMBER 1, 1910 TO NOVEMBER 1, 1912.

No.	Date	TO WHOM ISSUED	AMOUNT
	1910		
91342	11 -1	T. R. Atkinson	$ 208.33
91343	11 -1	J. W. Bliss	41.67
91344	11 -1	Ruby Schumann	75.00
91389	11 -5	A. G. Patterson, P. M.	9.00
91399	11 -5	Western Union Telegraph Co.	.60
91402	11 -5	Northern Express Co.	1.90
91600	11-21	T. R. Atkinson	16.75
91862	12 -1	T. R. Atkinson	208.33
91863	12 -1	J. W. Bliss	125.00
91864	12 -1	Ruby Schumann	75.00
91865	12 -1	J. M. Hansen	3.50
92098	12- 5	Keuffel & Esser	2.50
92099	12- 5	Eugene Dietzgen Co.	10.29
92199	12-20	T. R. Atkinson	208.49
92200	12-20	J. W. Bliss	125.00
92201	12-20	Ruby Schumann	75.00
92202	12-20	J. M. Hansen	24.50
92289	12-22	A. G. Patterson, P. M.	7.00
92428	12-23	J. W. Bliss	2.25
92525	12-23	Northern Express Co.	.95
92538	12-23	N. D. Independent Telephone Co.	.15
	1911		
92781	1-16	Northern Express Co.	2.10
93394	2- 1	T. R. Atkinson	208.33
93395	2- 1	J. W. Bliss	125.00
93396	2- 1	Ruby Schumann	75.00
93397	2- 1	J. M. Hansen	35.00
93495	2- 3	Eugene Dietzgen Co.	9.98
93642	2- 4	Democrat Printing Co.	1.68
93975	2-15	Northern Express Co.	3.20
94116	3- 1	T. R. Atkinson	208.33
94117	3- 1	J. W. Bliss	125.00
94118	3- 1	J. M. Hansen	63.00
94119	3- 1	Ruby Schumann	75.00
94615	3-10	News Printing Co.	8.25
94643	3-15	Northern Express Co.	2.85
94691	3-16	J. W. Bliss	8.10
94692	3-16	Eugene Dietzgen Co.	26.90
94693	3-16	Eugene Dietzgen Co.	4.00
94694	3-16	Eugene Dietzgen Co.	14.29
94805	4- 1	T. R. Atkinson	208.33
94806	4- 1	J. W. Bliss	125.00
94807	4- 1	Ruby Schumann	75.00
94808	4- 1	J. M. Hansen	17.50
95012	4- 4	J. W. Bliss	13.50
95977	4-14	Northern Express Co.	1.85
96442	4-22	Eugene Dietzgen Co.	12.33
96494	4-26	Western Union Telegraph Co.	.75
96654	5- 1	T. R. Atkinson	208.33
96655	5- 1	Ruby Schumann	75.00
96657	5- 1	J. M. Hansen	17.50
96690	5- 1	J. W. Bliss	60.00
96984	5-10	M. St. P. and S. S. M. Ry Co.	3.55
	1911		
97141	5-12	Northern Express Co.	1.15
97145	5-12	Western Union Telegraph Co.	1.63
97784	6- 1	T. R. Atkinson	208.33
97785	6- 1	Ruby Schumann	75.00

WARRANT ACCOUNT—Continued.

No.	Date	TO WHOM ISSUED	AMOUNT
97786	6- 1	J. M. Hansen	12.25
97787	6- 1	J. W. Bliss	62.90
98058	6- 9	J. W. Bliss	27.50
98087	6-12	T. R. Atkinson	35.55
98088	6-12	W. R. Drummond	28.00
98089	6-12	Carl Johnson	50.00
98297	6-19	Northern Express Co.	.55
98302	6-19	Western Union Telegraph Co.	.25
98566	7- 1	T. R. Atkinson	208.33
98567	7- 1	J. W. Bliss	150.00
98568	7- 1	J. M. Hansen	7.00
98569	7- 1	Ruby Schumann	75.00
98666	7- 3	Eugene Dietzgen Co.	5.48
98921	7- 8	M. St. P. & S. S. M. Ry. Co.	1.77
98940	7- 8	Western Union Telegraph Co.	2.46
98944	7- 8	Northern Express Co.	2.35
99080	8- 1	T. R. Atkinson	208.33
99081	8- 1	J. W. Bliss	125.00
99082	8- 1	Howard Flint	35.00
99083	8- 1	J. M. Hansen	10.50
99084	8- 1	A. B. Falconer	5.70
99085	8- 1	Ruby Schumann	75.00
99215	8- 4	T. R. Atkinson	43.75
99216	8- 4	N. D. Independent Telephone Co.	.70
99217	8- 4	Eugene Dietzgen Co.	5.80
99218	8- 4	J. W. Bliss	25.70
99219	8- 4	N. D. Independent Telephone Co.	2.00
99220	8- 4	Howard Flint	13.70
99583	8-16	Western Union Telegraph Co.	1.37
99663	8-20	T. R. Atkinson	34.40
99768	8-28	Eugene Dietzgen Co.	11.02
99881	9- 1	J. W. Bliss	175.00
99931	9- 1	Bismarck Tribune Co.	8.50
99932	9- 1	Bismarck Tribune Co.	16.50
99952	9- 2	Ruby Schumann	75.00
99953	9- 2	A. B. Falconer	13.33
99954	9- 2	T. R. Atkinson	208.33
100025	9- 5	Howard Flint	67.50
100149	9-11	Times Publishing Co.	11.00
100174	9-13	Northern Express Co.	2.90
100323	9-18	N. D. Independent Telephone Co.	1.00
100381	9-20	Western Union Telegraph Co.	2.78
100406	9-26	M. St. P. & S. S. M. Ry. Co.	1.55
100487	10- 2	T. R. Atkinson	208.33
100488	10- 2	J. W. Bliss	150.00
100489	10- 2	Ruby Schumann	75.00
100490	10- 2	Howard Flint	45.60
100491	10- 2	J. M. Hansen	29.75
100492	10- 2	B. F. Tillotson	15.00
100493	10- 2	Thorn Dickinson	3.85
101040	10-12	Eugene Deitzgen Co.	10.38
101163	10-14	J. W. Bliss	51.00
101164	10-14	Howard Flint	23.75
101165	10-14	T. R. Atkinson	13.75
101166	10-14	Geo. Hoover	21.00
101167	10-14	Eugene Dietzgen Co.	10.48
101168	10-14	Eugene Dietzgen Co.	3.05
101198	10-16	Western Express Co.	2.35
101239	10-16	Northern Express Co.	4.25
101521	10-21	N. D. Independent Telephone Co.	.60
101547	10-23	Western Union Telegraph Co.	2.38
101578	10-31	M. S. P. & S. S. M. Ry. Co.	.86
101686	11- 1	T. R. Atkinson	208.33
101687	11- 1	J. M. Hansen	38.50
101688	11- 1	Howard Flint	37.50
101689	11- 1	Ruby Schumann	75.00
101690	11- 1	J. W. Bliss	50.00
101691	11- 1	Thorn Dickinson	64.48
101752	11- 9	Western Union Telegraph Co.	.95
101762	11- 9	Northern Express Co.	1.60
102227	12- 1	T. R. Atkinson	208.33

WARRANT ACCOUNT—Continued.

No.	Date	TO WHOM ISSUED	AMOUNT
102228	12- 1	J. W. Bliss	100.00
102229	12- 1	Ruby Schumann	75.00
102230	12- 1	J. M. Hansen	56.00
102232	12- 1	Thorn Dickinson	35.00
102231	12- 1	Howard Flint	12.50
102479	12- 4	Thorn Dickinson	19.90
102481	12- 4	Eugene Dietzgen Co.	14.07
102696	12- 9	T. R. Atkinson	19.65
102697	12- 9	Thorn Dickinson	19.25
102750	12-11	Northern Express Co.	2.80
102759	12-11	Western Union Telegraph Co.	1.00
102914	12-15	Eugene Dietzgen Co.	23.94
102915	12-15	Eugene Dietzgen	14.45
103109	12-23	J. W. Bliss	150.00
103110	12-23	J. M. Hansen	24.50
103111	12-23	Howard Flint	42.50
103112	12-23	Ruby Schumann	75.00
	1912		
103228	1- 2	T. R. Atkinson	208.33
103453	1-15	T. R. Atkinson	13.35
103546	1-20	Times Publishing Co.	4.50
103562	1-20	Northern Express Co.	3.25
103593	1-22	N. D. Independent Telephone Co.	.45
103606	1-22	Western Union Telegraph Co.	2.24
103984	2- 1	T. R. Atkinson	208.33
103985	2- 1	J. W. Bliss	125.00
103986	2- 1	Thorn Dickinson	57.74
103987	2- 1	H. R. Flint	20.00
103988	2- 1	J. M. Hansen	31.50
103989	2- 1	Ruby Schumann	75.00
104216	2-16	Buff & Buff Mfg. Co.	18.45
104217	2-16	Eugene Dietzgen Co.	3.95
104218	2-16	Eugene Dietzgen Co.	26.97
104278	2-17	J. W. Bliss	21.05
104294	2-19	Northern Express Co.	6.70
104381	2-20	Western Union Telegraph Co.	1.61
104521	2-23	Eugene Dietzgen Co.	20.50
104522	2-23	Eugene Dietzgen Co.	2.86
104734	3- 1	T. R. Atkinson	208.33
104735	3- 1	J. M. Hansen	17.50
104736	3- 1	Howard Flint	35.00
104737	3- 1	Thorn Dickinson	112.07
104738	3- 1	Ruby Schumann	75.00
104818	3- 2	J. W. Bliss	150.00
104901	3-11	T. R. Atkinson	38.55
104999	3-14	J. W. Bliss	174.00
105486	4- 1	T. R. Atkinson	208.33
105487	4- 1	J. W. Bliss	150.00
105488	4- 1	Thorn Dickinson	104.85
105489	4- 1	Ruby Schumann	75.00
105490	4- 1	Howard Flint	57.50
105491	4- 1	J. M. Hansen	10.50
105492	4- 1	Ed. Higbee	44.00
106043	4-11	J. W. Bliss	76.50
106087	4-12	Democrat Printing Co.	3.36
106088	4-12	Thorn Dickinson	30.25
106089	4-12	Eugene Dietzgen Co.	22.99
106162	4-13	Northern Express Co.	3.38
106293	4-24	Western Express Co.	1.00
106469	5- 1	T. R. Atkinson	208.33
106470	5- 1	J. W. Bliss	150.00
106471	5- 1	Thorn Dickinson	125.00
106472	5- 1	R. Schumann	75.00
106473	5- 1	E. F. Higbee	60.00
106474	5- 1	H. Flint	53.75
106475	5- 1	J. M. Hansen	5.25
106570	5- 3	Western Union Telegraph Co.	.25
106671	5- 9	T. R. Atkinson	18.05
107091	5-21	Northern Express Co.	2.00
107304	5-27	Eugene Dietzgen Co.	11.40
107305	5-27	Eugene Dietzgen Co.	14.58

WARRANT ACCOUNT—Continued.

No.	Date	TO WHOM ISSUED	AMOUNT
	1912		
107501	6- 1	T. R. Atkinson	208.33
107502	6- 1	J. W. Bliss	150.00
107503	6- 1	J. M. Hansen	7.00
107504	6- 1	H. Flint	10.00
107505	6- 1	Ruby Schumann	75.00
107662	6- 4	E. F. Higbee	56.00
107667	6- 4	Western Union Telegraph Co.	.75
108140	6-17	Thorn Dickinson	62.50
108176	6-18	N. D. Independent Telephone Co.	1.45
108177	6-18	N. D. Independent Telephone Co.	1.50
108199	6-19	Western Union Telegraph Co.	2.69
108212	6-19	Northern Pacific Ry. Co.	.62
108233	6-21	Eugene Dietzgen Co.	39.91
108306	6-24	Bismarck Tribune	19.20
108307	6-24	Bismarck Tribune	36.00
108389	7- 1	Thorn Dickinson	125.00
108390	7- 1	Ruby Schumann	75.00
108391	7- 1	J. W. Bliss	150.00
108392	7- 1	Sidney Dickinson	56.25
108393	7- 1	T. R. Atkinson	208.33
108500	7- 9	Ruby Schumann	75.00
108724	7-17	Eugene Dietzgen Co.	185.00
108725	7-17	Eugene Dietzgen Co.	21.92
108726	7-17	S. E. Dickinson	1.60
108915	7-23	Western Union Telegraph Co.	1.33
108922	7-23	Northern Express Co.	1.60
108951	7-27	Knight Printing Co.	97.05
109064	8- 1	T. R. Atkinson	208.33
109065	8- 1	J. W. Bliss	150.00
109066	8- 1	Thorn Dickinson	125.00
109067	8- 1	J. M. Hansen	10.50
109068	8- 1	D. McDonald	4.50
109094	8- 1	S. E. Dickinson	45.00
109287	8- 7	Bismarck Tribune	18.75
109315	8-10	Western Express Co.	5.05
109550	8-22	Northern Express Co.	2.70
109714	9- 3	T. R. Atkinson	208.33
109715	9- 3	J. W. Bliss	150.00
109716	9- 3	Ruby Schumann	75.00
109717	9- 3	D. McDonald	13.50
109718	9- 3	J. M. Hansen	7.00
109748	9- 3	Western Union Telegraph Co.	.88
109910	9- 4	M. St. P. & S. S. M. Ry. Co.	.47
110121	9-19	Eugene Dietzgen Co.	21.78
110122	9-19	Thorn Dickinson	21.10
110123	9-19	Thorn Dickinson	19.45
110124	9-19	T. R. Atkinson	9.75
110125	9-19	J. W. Bliss	12.20
110126	9-19	Democrat Printing Co.	2.40
110534	9-25	Knight Printing Co.	16.00
110577	9-28	T. R. Atkinson	208.33
110651	10- 1	J. W. Bliss	150.00
110652	10- 1	Ruby Schumann	75.00
110653	10- 1	M. Atkinson	4.50
110654	10- 1	Don McDonald	6.00
110709	10- 1	Western Express Co.	1.30
110719	10- 1	Western Union Telegraph Co.	.75
110730	10- 1	Northern Express Co.	.40
110923	10-10	T. R. Atkinson	12.40
110924	10-10	T. R. Atkinson	2.65
111023	10-14	Eugene Dietzgen Co.	10.96
111024	10-14	Eugene Dietzgen Co.	29.23
111025	10-14	Eugene Dietzgen Co.	13.08
111026	10-14	Eugene Dietzgen Co.	10.96
111027	10-14	Eugene Dietzgen Co.	.34
111160	10-21	N. D. Independent Telephone Co.	.45
111295	10-23	Western Express Co.	2.80
		Total	$ 13,713.72
		Balance in fund November 1, 1912	$ 679.27

RECEIPTS OF STATE ENGINEER'S OFFICE

FROM NOVEMBER 1, 1910 TO NOVEMBER 1, 1912.

No.	ITEMS	AMOUNT
1910		
11- 9	Recording permit No. 37	$ 1.75
11-16	Field notes	10.00
12-15	Recording permits Nos. 15 and 16	3.50
12-15	Application for permit No. 38	5.00
12-15	Proof of Publication No. 38	1.00
12-15	Recording permit No. 36	1.75
12-21	Application for permit No. 41	5.00
12-29	Proof of publication No. 42	1.00
12-29	Recording permit No. 42	1.75
12-29	Application for permit No. 44	5.00
12-29	Proof of publication No. 44	1.00
12-29	Field Notes	1.50
1911		
1- 3	Field Notes	1.50
1 -3	Application for permit No. 47	5.00
1- 5	Application for permit No. 45	5.00
1- 6	Proof of Publication No. 39	1.00
1- 6	Recording permit No. 39	1.75
1-11	Field Notes	1.50
1-11	Field Notes	50.00
1-12	Proof of publication No. 43	1.00
1-12	Recording permit No. 43	1.75
1-12	Application for permit No. 40	5.00
1-12	Proof of Publication No. 40	1.00
1-12	Recording permit No. 40	1.75
1-13	Application for permit No. 48	5.00
1-19	Application for permit No. 49	5.00
1-26	Recording permit No. 38	1.75
1-26	Field Notes	3.00
1-27	Application for permit No. 50	5.00
2- 2	Proof of publication No. 41	1.00
2- 6	Field Notes	1.50
2-11	Field Notes	3.00
2-24	Field Notes	1.50
2-24	Field Notes	24.00
2-27	Mowbray Lake Drain	127.65
31-	Field Notes	2.00
3-13	Proof of publication No. 45	1.00
3-13	Recording permit No. 45	1.75
3-17	Recording permit No. 41	1.75
3-29	Recording permit No. 44	1.75
4-14	Field Notes	2.00
4-17	Surveys	23.00
4-17	Surveys	15.00
4-17	Surveys	10.00
4-17	Surveys	23.00
5- 2	Field Notes	1.50
5-11	Application for permit No. 52	5.00
5-11	Application for permit No. 51	5.00
5-11	Proof of publication No. 51	1.00
5-11	Recording permit No. 51	1.75
5-29	Surveys	35.00
6- 5	Field Notes	2.00
6- 5	Field Notes	2.50
6- 9	Field Notes	2.00
6-12	Field Notes	5.00
6-30	Field Notes	.75
6-30	Field Notes	1.00
7- 6	Application for permit No. 53	5.00
1911		
7-15	Field Notes	1.00
7-27	Application for permit No. 55	5.00
8- 7	Application for permit No. 56	5.00
8- 7	Application for permit No. 57	5.00
8- 7	Application for permit No. 58	5.00
8- 7	Application for permit No. 60	5.00
8-23	Proof of publication No. 53	1.00

RECEIPTS OF STATE ENGINEER'S OFFICE—Continued

No.	ITEMS	AMOUNT
8-23	Application for permit No. 61	5.00
8-28	Field Notes	1.00
9- 4	Field notes	1.00
9- 4	Blue prints	6.60
9-11	Field Notes	.50
9-12	Field Notes	3.00
10-11	Application for permit No. 62	5.00
10-12	Proof of publication No. 56	1.00
10-13	Proof of publication No. 58	1.00
10-13	Recording permit No. 58	1.75
10-16	Application for permit No. 64	5.00
10-21	Recording permit No. 53	1.75
10-21	Application ofr permit No. 65	5.00
10-21	Application for permit No. 66	5.00
10-24	Surveys	20.00
10-24	Field notes	3.00
10-27	Recording permit No. 56	1.75
10-27	Proof of publication No. 60	1.00
10-28	Copies of applications Nos. 65 and 66	3.00
10-28	Field notes	1.00
10-30	Surveys	18.00
11- 4	Application for permit No. 67	5.00
11-17	Field Notes	14.00
12- 1	Field Notes	3.00
12-11	Field Notes	31.50
12-11	Field Notes	.50
12-11	Surveys	30.00
12-15	Field notes	1.50
12-22	Field Notes	3.00
12-23	Application for permit No. 69	5.00
12-29	Proof of publication No. 67	1.00
1912		
1- 2	Application for permit No. 71	5.00
1- 5	Application for permit No. 70	5.00
1-15	Field Notes	.50
1-18	Field Notes	1.00
1-20	Proof of publication No. 66	1.00
1-20	Recording permit No. 66	1.75
1-20	Proof of publication No. 62	1.00
1-20	Recording permit No. 62	1.75
1-20	Application for permit No. 54	5.00
1-20	Proof of publication No. 54	1.00
1-20	Recording permit No. 54	1.75
1-20	Recording permit No. 65	1.75
1-20	Proof of publication No. 65	1.00
1-20	Application for permit No. 72	5.00
1-20	Issuing and recording papers License No. 1	4.60
1-20	Issuing and recording papers License No. 2	6.35
1-20	Issuing and recording papers License No. 3	6.35
1-20	Issuing and recording papers License No. 4	6.35
1-20	Issuing and recording papers License No. 5	6.35
1-26	Recording permit No. 60	1.75
1-26	Recording permit No. 52	1.75
1-26	Proof of Publication No. 52	1.00
1-26	Field Notes	1.50
1-30	Application for permit No. 68	5.00
1-30	Recording permit No. 64	1.75
1-30	Proof of publication No. 64	1.00
2-10	Field Notes	3.00
2-17	Field Notes	3.00
2-17	Proof of publication No. 69	1.00
2-20	Field Notes	1.00
2-20	Field Notes	2.50
2-20	Field Notes	4.32
2-21	Proof of publication No. 71	1.00
3-12	Application for Permit No. 73	5.00
3-19	Application for permit No. 59	5.00
3-22	Application for permit No. 74	5.00
3-27	Application for permit No. 75	5.00
4- 1	Field Notes	1.00
4- 4	Field Notes	1.50

RECEIPTS OF STATE ENGINEER'S OFFICE—Continued

No.	ITEMS	AMOUNT
4- 4	Field Notes	17.00
4- 7	Field Notes	1.00
5-23	Field Notes	.50
5-27	Field Notes	1.50
6- 3	Field Notes	272.00
6- 7	Field Notes	63.00
6-14	Field Notes	1.00
6-14	Proof of publication No. 68	1.00
6-14	Recording permit No. 68	1.75
6-15	Mouse River Drain	785.95
7-10	Mouse River Drain	409.50
7-10	Recording permit No. 69	1.75
7-10	Recording permit No. 71	1.75
7-12	Field Notes	1.50
7-18	Field Notes	30.00
7-19	Application for permit No. 76	5.00
7-19	Proof of publication No. 76	1.00
7-19	Recording permit No. 76	1.75
7-20	Proof of publication No. 73	1.00
7-20	Recording permit No. 73	1.75
8- 1	Field Notes	1.00
8-10	Mouse River Drain	60.00
8-12	Field Notes	1.00
8-12	Field Notes	1.25
8-15	Field Notes	1.00
8-16	Proof of publication No. 74	1.00
8-16	Recording permit No. 74	1.75
8-17	Field Notes	130.50
8-19	Field Notes	9.00
8-22	Field Notes	1.00
8-30	Field Notes	2.00
9- 6	Mouse River Drain	40.00
9-28	Field Notes	1.25
10- 7	Mouse River Drain	30.00
10- 9	Surveys	30.20
10- 9	Surveys	11.90
10-10	Surveys	66.90
10-14	Blue prints	1.00
10-24	Field Notes	1.25
	Deposited with state treasurer	$ 2,759.77

WARRANTS ON HAND.

Pembina County Drainage No. 94 Dated Nov. 18, 1910	176.50
Cavalier County Drainage No. 60 Dated Dec. 2, 1910	256.95
Billings County General Fund No. 9311 Dated Oct. 8, 1912	150.00
	$ 583.45

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INTRODUCTION.

While the office of State Engineer was created primarily for the promotion of irrigation in the state, and while a large amount of work has been done in this direction, yet time has been found to make the office of additional value to the state in other lines of work, notably in drainage work, coal mine inspection, designing bridges for counties, laying out highways for counties and townships, designing water works and sewers for state institutions.

In addition the state engineer has done considerable work in promoting interest in better roads, by addressing conventions, visiting counties and assisting in the organizaton of good roads associations.

As in the past, the state engineer has acted as city engineer of the city of Bismarck and this has enabled him to employ more competent assistants, as good assistants can be employed continuously and their services utilized by the city or the state as the occasion arose. The utilizing of their services in this manner has made it more economical for the state as well as the city.

This office has also co-operated with the United States Geological Survey, the State Geological Survey, the United States Office of Public Roads and the United States Reclamation Service.

The thanks of this office are especially due to Prof. E. F. Chandler of the State University, in charge of the hydrographic work in the state for the United States Geological Survey, and to Dr. A. G. Leonard, State Geologist, for assistance rendered.

FILLINGS MADE IN ACCORDANCE WITH THE IRRIGATION CODE DURING THE BIENNIAL PERIOD ENDING SEPT. 30, 1912.

No.	Name of Applicant	Lands to be Irrigated	Source of Supply	Amount of water Claimed	Date of Claim
44	James M. Uhlman	35 acres in section 11, T. 152 N. R. 100 W.	Springs on SW¼ of NW¼ of Sec. 13, T. 152 N., R. 100W.	0.5	12- 5-1910
45	C. O. Hanson	280 acres in section 21, T. 143 N., R. 81 W.	Duck Creek	3.5	1- 4-1911
46	Gertrude E. Stevens	80 acres in sections 27 and 34, T. 149 N., R. 100 W.	*Rain and snow flooding		
47	Western Dakota Ry. Co.	For railway purposes	North Fork Cannon Ball River	2.0	1- 2-1911
48	Western Dakota Ry. Co.	For railway purposes	Louse Creek	2.0	1-14-1911
49	Western Dakota Ry. Co.	For railway purposes	Cannon Ball River	2.0	1-19-1911
50	Western Dakota Ry. Co.	For railway purposes	North Fork of Cannon Ball River	2.0	1-27-1911
51	E. B. Decker	157 acres in section 17, T. 143 N., R 81 W.	Painted Woods Creek	2.0	4-10-1911
52	Ole Syverson	77 acres in section 7, T. 162 N., R. 86 W.	Mouse River	1.0	5-11-1911
53	Peter Johnson	90 acres in sections 8 and 17 T. 162 N., R. 86 W.	Mouse River	1.1	8- 9-1911
54	George Gussner	156 acres in section 2, T. 139 N., Range 81 W.	Burnt Creek	1.95	7-25-1911
56	Farwell Bros.	517 acres in sections 25, 26, and 35, T. 148 N., R. 105 W.	Sage Creek	6.5	8- 7-1911
57	Scott L. Smith	150 acres in sections 17, 20 and 21, T. 155 N., R., 96 W.	Beaver Creek	1.9	8-11-1911
58	C. P. Fredendoll	880 acres in sections 7, 8 and 17, T., 147 N., R. 85 W.	Douglas Creek	2.0	8-26-1911
59	Graham Bros.	241 acres in sections 9 and 10, T., 156 N., R. 84 W.	Mouse River	3.0	3-19-1912
60	J. P. Beisel	77.5 acres in sections 1 and 12, T. 152 N., R. 104 W.	Drainage-Coulee in section 1, T. 152 N., R. 104 W.	1.0	9- 5-1911
61	G. D. Boscha	640 acres in section 10, T. 147 W., R 85 W.	Douglas Creek	8.0	9-23-1911
62	F. L. Mackey	160 acres in section 17, T. 147 N., R. 85 W.	Douglass Creek	2.0	10-11-1911
64	H. T. Burns	165 acres in sections 1, 2 and 11, T., 147 N., R. 85 W.	Garrison Creek	2.07	10-16-1911
65	J. W. Stimson	93 acres in sections 1 and 12, T. 143 N., R. 96 W.	Knife River	1.2	10-21-1911
66	Geo. Metcalf	42 acres in section 2, T. 143 N., R. 96 W.	Knife River	0.5	10-25-1911
68	J. R. Burns	762 acres in sections 1 and 12, T. 147 N., R. 85 W and sections 6 and 7 T. 147 N. R. 84 W.	Garrison Creek	9.5	1-30-1912

69	Shields Land Co.	1248 acres in sections 19, 29, 30 and 31, T. 132 N., R. 83 W., and sections 22, 23, 24 and 25, T. 132 N., R. 84 W	Deep Creek and Shields Creek	15.6	12-23-1911
70	Julia D. Austill	320 acres in sections 30 and 31, T. 151 N., R. 102 W.	Charbonneau Creek and its tributaries	4.0	12-26-1911
71	D. N. McPhee	240 acres in sections 21, 28 and 29, T. 130 N., R. 101 W.	Spring Creek	3.0	1- 2-1912
72	Northern Pacific Ry. Co.	For railway purposes	Little Muddy Creek	0.5	1-17-1912
73	Theodore A. Doughty	157.98 acres in sections 31 and 32, T. 130 N., R. 88 W.	Cedar Creek	2.0	3-12-1912
74	C. B. Heitzman	160 acres in sections 21 and 22, T. 153 N., R. 89 W.	Shell Creek	2.0	3-22-1912
75	J. C. Beaton	80 acres in section 29, T. 130 N., R. 91 W.	Cedar Creek	1.0	3-27-1912
76	John Yegen	100 acres in section 4, T. 138 N., R. 79 W.	Apple Creek	1.3	4- 1-1912
			*160 acre feet		12-29-1910

*160 acre feet.

IRRIGATION.

The practice of irrigation has increased during the past biennial period, 34 permits for the appropriation of water having been issued from this office during the past two years, as compared with 43 for the previous five years that this office has been in existence.

The benefits derived from the judicious use of irrigation water in western North Dakota have exceeded the expectations of the most sanguine.

MOUSE RIVER.

Irrigation along the bottoms of the Mouse River north of Minot produced very beneficial results during the seasons of 1910 and 1911. During 1912, owing to the rainfall being much above normal, but little attention was paid to irrigation, but where irrigation water was applied this season it was found that much larger yields were given than where rainfall alone was depended upon. Alfalfa has proved to be such a well paying crop under irrigation that the acreage in the Mouse River Valley has increased rapidly.

SHIELDS CREEK.

One of the most promising private irrigation projects surveyed during the past year is the Shields Project, near the town of Shields on the Chicago, Milwaukee and Puget Sound Railway, in southern Morton County. Preliminary surveys were made in December, 1911, and the location of the main ditches were made in June, 1912. The land proposed to be irrigated is owned by the Shields Land Company, and amounts to nearly 1250 acres, and is situated in sections 19, 29, 30 and 31, in Township 132, Range 83, and in sections 22, 23, 24 and 25 in Township 132, Range 84.

For the water supply it is proposed to divert Deep Creek into Shields Creek near the southwest corner of Section 28, Township 132, Range 84, and to create a reservoir on Shields Creek in the southwest quarter of Section 22 and the northwest quarter of section 27, Township 132, Range 84. This reservoir with a dam 22 feet high at the highest part will store 400 acre feet of water. A diversion dam will also be constructed near the southwest corner of the southwest quarter of section 23, Township 132, Range 84. The water can then be turned onto the land to be irrigated with but very little work.

The drainage area of Shields Creek above the point of diversion is 13,600 acres and the drainage area of Deep Creek above the point of diversion is 14,200 acres. Estimating the average annual run-off on this area to be one inch, the total

average run-off will amount to 2,300 acre feet. The lands for the most part lie well for irrigation and will require but a small amount of leveling. It is expected that the work on this project will go ahead next season.

DOUGLAS CREEK.

Another private project started within the past two years is the Douglas Creek Project on the old Fort Stevenson Military Reservation. The land under this project is owned by C. P. Fredendoll of Ida Grove, Iowa, and comprises approximately 1,000 acres, lying in sections 7, 8, 9, 17, and 18 in Township 147, Range 85. The most of it will be irrigated by gravity from the Koppenhaver dam in the northwest quarter of section 8, Township 147, Range 85. Some of the main ditches have already been constructed on this project. The irrigated land produced 35 bushels of wheat and 20 bushels of flax per acre in the season of 1911. Mr. Fredendoll proposes to continue the construction work next season.

GARRISON CREEK PROJECT.

This is a private project of about 750 acres lying within the old Fort Stevenson Military Reservation in sections 6 and 7, in Township 147, Range 85. A storage reservoir is to be created by the construction of a dam across Garrison Creek near the southwest corner of lot 1, section 1, Township 147, Range 85. The land under this project is owned or controlled by H. T. Burns of Garrison, N. D., and work on the construction will be pushed next year.

DRAINAGE.

MOUSE RIVER IMPROVEMENT.

The Mouse River Improvement, to which reference was made in the third and fourth biennial reports of this office, is now under actual construction. This improvement work consists of the widening, cleaning and straightening the channel of the Mouse river from the north line of McHenry county to the mouth of North Antler Creek, 14 miles north of the International Boundary line.

The original preliminary surveys were made in September and October 1907, and soundings along the river were completed in March 1909. Owing to litigation brought about by some of the McHenry County land owners, assessed for the work, the letting of the contract did not take place until July, 1911. The contract was let to the France Dredging and Construction Company, of Toledo, Ohio, at a price of 10 cents per cubic yard.

A channel 80 feet wide on the bottom with side slopes 1½ to 1 is being excavated by a 2½ cubic yard dipper dredge. Work with this dredge was started on May 15th, and about 300,000 cubic yards will have been handled this year, and the work completed to the crossing of the Minneapolis, St. Paul and Sault Ste. Marie Railroad.

HUNTER'S LAKE DRAIN.

Contract for Hunter's Lake Drain, in Cavalier County, was completed in August, 1912. The work of construction was done by A. T. Le Visconte of Langdon, with a steam dredge. This drain reclaims 481 acres of fine agricultural land.

OTTIFY LAKE DRAIN.

Ottify Lake Drain is located in Township 149, Range 60, Nelson County. Surveys for this drain were made in 1911. It is 3.37 miles long and will reclaim about 500 acres of land at an estimated cost of $10 per acre. The assessment of benefits and cost have been made, but the hearing on this has not been held. It is probable that the contract for construction will be let this winter, and the work of dredging done during next season.

NELSON COUNTY DRAIN NO. 2.

Nelson County Drain No. 2 is situated in Townships 151 and 152, Ranges 57, 58 and 59. Surveys for this drain were made in 1911 and report made to the Board of Drain Commissioners of Nelson County. This drain if constructed will reclaim 2,079 acres at an estimated cost of eight dollars per acre.

LOST RIVER DRAIN.

The Lost River Drain is located in Township 159, Range 55, Pembina County. Surveys were made for this drain in October, 1912, and plans and specifications made. This drain will prevent the flooding of 2,072 acres of first class agricultural land, at an estimated cost of $2.56 per acre.

PROPOSED DIVERSION OF MOUSE RIVER TO DEVILS LAKE.

The Hyland bill passed by the last legislative assembly, carried an appropriation of $650 for a survey by the state engineer from Devils Lake to Mouse River, to determine the feasibility of diverting the flood waters of this river to the lake. In compliance with the provisions of this bill, survey was made by this office during April and May, 1911, and detailed report as follows submitted to the Governor:

Devils Lake is situated in the Northeastern portion of North Dakota and forms a large part of the boundary between Benson and Ramsey Counties. This entire region is covered with glacial drift and many small lakes and ponds dot the landscape. Having no outlet, the waters of the lake are saline, and the water level depends wholly upon the evaporation, rainfall and the run-off into the lake from the surrounding drainage area.

The lake has steadily been decreasing in size for many years and it has caused considerable concern as to how small it may become before a stationary water level is found. Fear has often been expressed that this once beautiful lake may become an alkali flat and an unhealthy marsh. There has been much agitation relative to draining the flood waters of the Mouse river into the lake in order to prevent further shrinkage, but no definite idea of the feasibility of the proposition has heretofore been secured. Preserving to the state the only lake of any size within its borders has been deemed of sufficient importance to attract the attention of the legislature, and as a result the 1911 session adopted House Bill No. 274, which reads as follows:

"Sec. 1. As soon as practicable after the taking effect of this act it shall be the duty of the state engineer to run a survey or surveys between the Mouse River and Devils Lake for the purpose of determining the feasibility of draining the flood waters of the Mouse River into Devils Lake.

Sec. 2. There is hereby appropriated out of any moneys in the state treasury, not otherwise appropriated, the sum of six hundred fifty dollars, or so much thereof as may be necessary to carry out the provisions of this act."

Complying with the provisions of this act, the state engineer placed a party in the field in charge of J. W. Bliss, Assistant State Engineer, on April 24th, 1911, and the surveys were completed on May 25th, the cost of which, not including office work, was $638.-86. In addition to the time spent in the field nearly a month of office work was required in the preparation of the report. The list of warrants issued and charged to the Devils Lake-Mouse River survey was as follows:

No.	Date Issued to, Purpose	AMUNOT
96689	May 1st J. W. Bliss, Salary	$ 90.00
96694	May 1st Carl Johnson, Salary	27.00
97002	May 11th T. R. Atkinson, Expense	80.05
97003	May 11th Eugene Dietzgen Co., Aneroid	25.56
97004	May 11th J. W. Bliss, Expense	60.50
97005	May 11th Carl Johnson, Expense	8.50
97788	June 1st Robert McCarthy, Hire of team and driver	119.70
98090	June 12th J. W. Bliss, Expense	77.25
98091	June 12th A. J. Smeby, Hier of team	63.00
	Total to date	$ 638.86

The state engineer wishes to express his appreciation of the valuable assistance of Prof. E. F. Chandler of the State University, Assistant Engineer, U. S. Geological Survey, to whom he is indebted for most of the statistics regarding rainfall, run-off and evaporation.

SURVEYS

The field work consisted of running a total of 195 miles of levels, cross sectioning the valleys of the Mouse, Sheyenne and Wintering rivers at different points, taking numerous aneroid observations for elevation, and the locating of several dam sites.

The appropriation was not sufficiently large to include making a detailed survey of the present water surface of the lake, but the estimate made in this report is considered sufficiently accurate to enable an estimate of the cost of the undertaking to be made, although detailed surveys would probably show some variations of the cost figures, either more or less. The present size of the lake is estimated as having a water surface of about sixty square miles.

Referring to the plat it will be observed that a line of levels was run from Lake Ibsen through Leeds and north to Hurricane Lake. This was done in order to determine the feasibility of a route for a ditch running northwest from Hurricane Lake across the divide between the Mouse River and the Devils Lake drainage, and then to the Mouse River, following along the valleys of Dead Ox Creek and Willow Creek. This line was abandoned at Hurricane Lake as not being feasible when the elevation of the Lake was found to be 1551. Furthermore, the elevation of the water surface of the Mouse River at the mouth of Willow Creek is about the same as the water surface of Devils Lake.

Aneroid observations were taken over the territory from Rolette south to the Sheyenne River and from the elevations thus obtained it was found that north of the Sheyenne a ditch between the Mouse River and Devils Lake would be out of the question. The lowest point on the summit between the drainage into Willow Creek and the drainage into Devils Lake was found to be 1600 and as this elevation is 175 feet above Devils Lake it was not considered worth while to run a line of levels over this route. Part of the elevations observed with the aneroid are shown on the plat, as well as the elevations of the various towns and other points, all elevations being referred to sea level datum.

The route as finally chosen was first located by numerous aneroid observations, after which levels were run its entire length, as indicated on the profiles.

While all of the surveys are necessarily of a preliminary character, they have been carefully checked and the estimates of yardage and depth of cut are considered accurate.

DAMS AND RESERVOIR SITES.

The surveys established the fact that the difference of elevation between the water surface of the Mouse River at the mouth of Wintering Creek and of Devils Lake is 30 feet, and that the water surface of the Mouse River at this point is four feet lower than the water surface of the Sheyenne River at the lower terminal of the Mouse-Sheyenne ditch, while the water surface of the Sheyenne River in Section 29, Township 151, Range 65 is 12 feet lower than that of the lake. Therefore, if the waters of the Mouse River are to be diverted, in order to give a fall to the ditch an artificial difference of elevation will have to be created by the construction of dams. The most feasible location for a dam on the Mouse River is in Section 5, Township 154, Range 77, just above the mouth of Wintering Creek, which creek will then have to be dammed near the north line of Section 4, Township 154, Range 77, creating a small reservoir in the lower portion of the Wintering Valley.

The site for the proposed dam on the Sheyenne River is in Section 29, Township 151, Range 65. Careful computations show that the most economical construction will be obtained by raising the water surfaces of the reservoirs created by the dams as high as possible and thus lessening the depth of cut for the ditch. the route of which runs over much high and rolling prairie, the cost of additional land for the reservoir site being less than the cost of extra excavation. In raising the water surface of the Mouse River from an elevation of 1455 to 1493, the highest feasible elevation, a reservoir of 8300 acres area and which will extend nearly to the city of Velva, will be created. A large portion of this proposed reservoir is bottom land and the land damages will be heavy. The Wintering Creek reservoir will flood about 200 acres of land, while the reservoir in the Sheyenne will cover 6300 acres when the water surface is raised from 1413 to an elevation of 1455. In addition to this the Sheyenne reservoir will cover about a mile of the Northern Pacific railroad where it crosses the valley.

WATER SUPPLY—EVAPORATION.

The water level of any lake possessing no outlet depends on the amount of evaporation, seepage, rainfall and the run-off into the Lake from the drainage area tributary to it. The drainage area of Devils Lake is nearly two thousand square miles, but the land lies so nearly level and there are so many marshes, meadows, small ponds and lakes which arrest the flow of the water and from which it evaporates, that it is not likely that the run-off from more than seven hundred to eight hundred square miles of the total area ever reaches the lake.

The greater part of the drainage area lies to the north and northwest of the lake. High hills on the south side define the drainage of the lake and the Sheyenne River. Within very recent geologic times Devils Lake had an overflow either into Stump Lake to the southeast and from there into the Sheyenne River, or through one of the two very marked spillways leading from the south side of the lake to the river. From the time these spillways became dry because of the lowered water surface down to the present day the lake has gradually become more saline and the water level varied according to the proportion of evaporation, rainfall and run-off, but with a steadily increasing water surface. Old beaches are quite evident at considerable heights above the present water level, and it is known that the lake surface has fallen eighteen feet since 1867, fourteen feet since 1879, seven feet since 1887, five feet since 1902 and three feet since 1907. The fact that the lake has rapidly decreased in size during recent years is attributed in part to the fact that the greater portion of the drainage area is under cultivation. Run-off from cultivated land is greatly retarded and at times wholly prevented, since such lands absorb and retain a greater portion of the rainfall than does the unbroken sod.

Evaporation in this part of the state is practically twice the amount of the mean annual rainfall. The gross amount of evaporation has been closely estimated as averaging between thirty-three and thirty-six inches. The mean average rainfall in the vicinity of Devils Lake is seventeen inches, and the net annual evaporation is about eighteen inches, and provided there was no inflow the level of the lake would be lowered a foot and a half annually. The amount of inflow to any lake is dependent on the run-off for that locality, and the drainage area tributary. However, the run-off in central North Dakota is very small, and errors due to lack of definite date concerning it are so easily made that the computations as to the amount of inflow will be based upon the known fact that the average annual shortage of supply has been approximately 19,200 acre-feet for the past ten years, an acre foot of water being the amount required to cover an acre one foot deep. However, it has been estimated that the annual run-off in this region is not likely to exceed 0.3 inches, and in all probability is no greater than 0.2 inches. Inasmuch as the net evaporation in the locality of Devils Lake is 18 inches and the lake only falls six inches, the remaining 12 inches represents the amount of inflow. Thus it may be assumed that the total water supply is 29 inches and the total evaporation 35 inches, leaving a shortage of six inches.

Computations are given below—first, showing the annual amount of additional water supply required to maintain the lake

at its present water level and second, the amount required to restore it to an elevation 14 feet higher than at present and maintain it at that level.

TO MAINTAIN THE PRESENT LAKE LEVEL.

The amount of additional water supply to maintain the lake at its present elevation of 1425 is represented by the six inches of excess evaporation above the total water suply. The estimated area of the lake being 38,400 acres, this makes the annual additional supply required approximately 19,200 acre-feet. To supply this 19,200 acre-feet of water to the lake will require a flow of 47 cubic feet per second for a period of seven months.

The amount of water needed for the purpose of maintaing the elevation of the water surface of the lake having been determined, it becomes evident from a study of the topography of this portion of the state and the flow record for the various streams, that the Mouse River is the only source of sufficient supply. The records given below show the average flow of the Mouse River at Minot for the years 1902 to 1911, inclusive:

	1903	1904	1905	1906	1907	1908	1909	1910	1911
Jan.	.....	150**	35**	27*	14*	8*	10*	2	5*
Feb.	.....	140**	30**	25*	12*	6*	8*	15	4*
Mar.	.....	160**	92	30*	15*	20	156	127	77
Apr.	.....	4880	63	420	170	311	726	171	387
May	250	4840	67	160	1820	136	289	110	246
June	320	800	85	370	930	239	322	47	186
July	270	270	83	200	440	125	82	20	65
Aug.	190	130	71	62	100	94	37	21	37
Sept.	700	80	31	26	36	63	13	0.4	20
Oct.	290	66	16	16	20*	23	1	0.5	7
Nov.	170**	54*	27	16*	16*	30	2	0.6	11
Dec.	160**	40**	27*	15*	10*	15*	2	0.5	5*
Average	260**	970	52	110	300	89	137	40	83

* Estimated **Roughly Estimated.

	Mean 1903-1911	Mean for 7 Mo.
January	31	
February	28	
March	85	881
April	881	880
May	880	366
June	366	173
July	173	80
August	80	108
September	108	49
October	36	
November	30	
December		
Average	229	373

Referring to this table it will be seen that the average annual rate of flow of the Mouse River is 229 cubic feet per second, or

a quantity of water amounting to 166,000 acre-feet, and of this amount the greater portion flows during the months of April, May, June, July, August, September and October, the average rate of flow for that period being 373 second feet, giving a volume of 155,000 acre-feet. As shown on the plat, it is proposed to divert the surplus flow of the Mouse River at a point in Section 5, Township 154, Range 77, conducting it through a ditch into the valley of Wintering Creek, and from the Wintering Creek valley, at a point in the Northwest quarter of Section 10, Township 154, Range 77, by a ditch to the Sheyenne River. The route of the ditch from this point of diversion on the Winteirng Creek to the Sheyenne leads in an easterly direction to Smoky Lake through a succession of smaller lakes to Section 14, Township 154, Range 74, thence southeasterly through Girard and Buffalo lakes, which are situated in a very well defined valley, to the Sheyenne, at a point in Section 25, Township 151, Range 72. From this point it is proposed to let the water follow the valley of the Sheyenne River to the proposed Sheyenne reservoir, and from this reservoir to construct a ditch leading in a northwesterly direction through a very well defined valley and a succession of small lakes to Devils Lake at a point in Section 9, Township 152, Range 66. From Section 19, Township 154, Range 73 to the Sheyenne River the valley which is taken advantage of in the location of the ditch route is very marked. Hills on either side form the banks and are from twenty-five to seventy-five feet high, the bottom of the valley being from three hundred to two thousand feet in width. It is the opinion of the state engineer that in the glacial period the water of Lake Souris, which comprised the territory included in the Mouse River Loop and some of the territory to the east, found its outlet to the Sheyenne by this valley.

The valley leading from Devils Lake to the Sheyenne River has banks from twenty to fifty feet in height, and is continuous from Section 28, Township 153, Range 66 to the Sheyenne River. From that point north to the lake its continuity has been destroyed, presumably by glacial action, and is marked by small, deep lakes. The entire length of the route will be approximately 103 miles long, 65 miles of which has to be excavated, the remaining 38 miles lying along the valley of the Sheyenne River.

DITCH.

The size of a ditch required to deliver a given volume of water depends on the fall per mile, the character of the material through which it is cut, the design of the ditch, and the losses along the ditch by evaporation and seepage. It has been shown that 19,200 acre-feet or an additional water supply of a 47 cubic foot flow per second for seven months, delivered at the lake will

be sufficient to prevent further shrinkage, but a greater amount will have to be diverted from the Mouse River to allow for seepage and evaporation losses on the ditch and the reservoirs, I estimate that about 10 per cent of the water leaving the Sheyenne reservoir will be lost by seepage and evaporation before reaching Devils Lake, and that the loss due to the same causes between the Mouse River and the Sheyenne River reservoir will be about 25 per cent. In addition to this loss, the Mouse-Sheyenne River ditch will have to carry an additional amount of water to take care of the excess evaporation on the Sheyenne reservoir, part of it being taken care of by the flow of the Sheyenne itself.

The estimated average flow of the Sheyenne River at Sheyenne station, based on its 1,300 square miles of drainage area, is about 20 cubic feet per second, which amounts in seven months to 8,328 acre-feet. The net evaporation from a water surface of 6,500 acres will be 18 inches, amounting to 9,750 acre-feet. The net loss will then be the difference between 9,750 acre-feet and 8,328, which amounts to 1,422 acre-feet. Since it is assumed that 10 per cent of the water leaving the Sheyenne reservoir will be lost prior to reaching the lake, it will be necessary that 21,110 acre feet enter the head of the ditch in order to deliver 19,200 acre feet at the lake.

The Mouse-Sheyenne River ditch will have to be of sufficient size to deliver at the Sheyenne reservoir 21,120 acre-feet plus 1,422 acre-feet, the net loss by evaporation on the Sheyenne reservoir. Considering the ditch losses as being 25 per cent, the amount of water which will have to be diverted from the Mouse River reservoir is 28,177 acre-feet annually, or an average flow of 68 cubic feet per second for seven months. The total amount of water diverted from the Mouse River then, is this amount plus the amount of evaporation taking place on the Mouse River reservoir which will be 12,450 acre-feet, making a total of 40,-627 acre-feet.

The proper size of a ditch to guarantee an average flow of 68 cubic feet per second for a period of seven months is one having a maximum capacity of 130 cubic feet per second. Some years there may be a shortage of water supply, ice and snow may block the ditch for some time after the spring run-off has begun, and it may be necessary that a greater flow be accomplished for a shorter time. A ditch with a 14 foot bottom, one to one side slopes, running six feet deep will furnish 130 cubic feet per second, and a ditch of these dimensions must be used between the Mouse River and the Sheyenne. The ditch between the Sheyenne reservoir and Devils Lake, having to deliver but 21,-120 acre-feet, or a flow of 51.5 cubic feet per second would not require these dimensions, but should be used in order that greater advantage may be taken of the spring floods, furnished by that portion of the Sheyenne River above the dam.

The following estimate of the cost shows approximately the expense of the different portions of the proposed project:

To divert a sufficient amount of water to maintain the present level of the Lake.

Right of way for reservoirs and ditch, 15,405 acres,..	$ 425,000
Dam Construction:	
Mouse River Dam including Wintering Creek Dam....	248,000
Sheyenne River Dam	154,000
Ditch Construction:	
Mouse-Sheyenne River ditch	449,000
Sheyenne River-Devils Lake ditch	287,000
Engineering, legal expenses and contingencies	100,000
Total estimated cost of Project	$ 1,663,000

TO RESTORE DEVILS LAKE TO ELEVATION 1,439, (THE ELEVATION IN THE YEAR 1879), AND TO MAINTAIN IT AT THAT ELEVATION.

Government surveys made in the early eighties indicate that the lake at that time had 72,000 acres of water surface, and an elevation of about 1439. Under present conditions the net evaporation from a body of water of this extent would amount to 108,000 acre-feet. The run-off into the lake if restored to this level would be approximately the same as it is at the present time, and is used in the previous computations, 38,400 acre-feet, leaving a deficiency of 60,600 acre-feet. In other words, if the area of the lake is increased to 72,000 acres, the run-off, which is equivalent at the present time to one foot of water over 38,400 acres, will be spread over the 72,000 acres and have the effect of raising the lake a trifle over six inches, and the effect of the 18 inches evaporation will be a lowering of the lake by a trifle less than 12 inches. The annual amount of water then that must be delivered at the lake is 69,600 acre-feet, which is equivalent to a stream of water having a flow of 167 cubic feet per second for a period of seven months.

Since this amount of water maintains a constant level when the lake is 72,000 acres in extent, it is evident that until this area is obtained, that the total water supply will be in excess of the gross evaporation, and the result will be a gradual increase of the lake until a balance is reached. It will be seen that this increase in the size of the lake will be more rapid at first, gradually becoming less and less perceptible until a constant level is found, which will be at about the elevation of 1,439. The following table shows the rate of increase approximately:

Increase in Depth	Approx. Number of years required
1 foot	1
2 feet	2
3 feet	3
4 feet	4
5 feet	6
6 feet	8
7 feet	10
8 feet	13
9 feet	16
10 feet	20
11 feet	26
12 feet	34
13 feet	53
14 feet	95

The amount of water required to maintain the lake at an elevation of 1439 being 69,600 acre-feet and the percentage of losses assumed to be the same as would take place when only enough water is being diverted to maintain the present level, the amount of water that must be delivered to the head of the ditch at the Sheyenne reservoir to allow for a ten per cent loss will be 76,560 acre-feet annually. The excess of evaporation on the Sheyenne reservoir over the water supply of the Sheyenne will be the same as previously computed, 1,422 acre-feet. The amount of water which must be delivered at the Sheyenne reservoir will then be 77,982 acre-feet and the amount that must be annually diverted from Mouse River to make allowances for 25 per cent ditch losses will be 94,477 acre-feet or 235 cubic feet per second for a period of seven months.

Referring again to the table of flow of the Mouse River, it is seen that an average flow of 235 cubic feet per second for seven months is not possible except by so constructing the ditch that a greater amount of water may be diverted during the months when it is available. It will be seen that a ditch having a capacity of 500 cubic feet per second could be kept running full during the three months of April, May and June, and for the remainder of the season such an amount allowed to flow as will make the required annual amount. A flow of 500 cubic feet per second for three months will supply 89,500 acre-feet, leaving only 7,977 acre-feet to be supplied during the remainder of the season. The capacity of the ditch as calculated is obtained when the water is running eight feet deep, i. e., when that depth of water is reached it will mark the high water level of the reservoir, and waste gates will be so adjusted that the water level will then remain constant.

Assuming that the least depth of water advisable to be allowed to flow through the ditch is three feet, there will be a depth

of water stored in the reservoir 8,300 acres in extent, having an approximate average depth of four feet, amounting to 33,200 acre-feet. Assuming that half of this is allowed to go down the Mouse River and half, or 16,600 acre-feet diverted to the ditch, an excess of 8,623 acre-feet over the amount actually required is obtained from the surplus flood waters. The proposed ditch should have a 26 foot bottom, one to one side slopes and when running full have eight feet of water. This size ditch with a grade of six inches to the mile will be of the required capacity.

A ditch of this capacity furthermore allows an excess of water to be diverted when water is available, and so maintain a general average, since seasons such as 1910 occur when there is a great shortage of water supply. Also, if for successive seasons the water available permits, as much water as can be diverted may be taken, and thus hasten the restoring of the former water surface. The total amount of water diverted from the Mouse River flow will be 110,927 acre-feet which is found by adding evaporation of the Mouse River reservoir to the amount delivered to the head of the Mouse-Sheyenne River ditch. The evaporation that may take place on the reservoir of the Wintering Creek, it is assumed will be off-set by the flow of the creek.

The same size of dams and reservoirs will be used as in the first instance. The grade line of the ditch, however, will have to be two feet lower, since the largest ditch is to be two feet deeper than the smaller.

The estimated cost of the project when designed to restore the former water surface becomes as follows:

Right of way for reservoirs and ditch, 15,650 acres	$ 437,000
Dam Construction	402,000
Ditch Construction	
Mouse-Sheyenne River ditch	706,000
Sheyenne River-Devils Lake ditch	397,000
Engineeering, legal expense and contingencies	105,000
Total estimated cost of project	$2,042,000

POSSIBILITIES FOR IRRIGATION.

It has been shown that the average flow of Mouse River is 166,000 acre-feet and that the total diversion necessary to supply Devils Lake with sufficient water to maintain its present level is 40,627 acre-feet, thus we have an annual surplus in Mouse River of practically 125,000 acre-feet. This amount of water could be very advantageously used for irrigation in the territory north and east of the mouth of Wintering Creek and on the lands adjacent to the Oberon-Esmond branch of the Northern Pacific railroad, by the construction of pumping plants at the Mouse

and Sheyenne reservoirs . It is safe to assume that 100,000 acres of land could be irrigated one foot in depth, which in that locality would be sufficient in addition to the rainfall to assure bountiful crops.

The irrigation of this land could probably be accomplished at a cost of not to exceed $25 per acre, and the annual cost to supply the irrigation water to the land would be approximately $1.50 per acre. With the irrigation of these lands, considered together with the diversion of water to Devils Lake, the cost to divert the water to the lake would be very greatly reduced and at once come within the range of a possibility.

LOWER MOUSE RIVER DRAINAGE.

The diversion of the greater part of the Mouse River flow would simplify the drainage problem on the lower Mouse River, from the mouth of Willow Creek to the International boundary and would undoubtedly result in all this bottom land becoming sufficiently dry for cultivation.

SUMMARY

Although the funds provided for a survey from Devils Lake to Mouse River were not sufficient for a detailed study of all the problems in connection with the proposition to divert the flood waters of this river to the lake, yet it is thought that enough data has been obtained to enable those interested in the project to determine whether or not the problem should be given more study and a larger amount expended in detailed surveys and in devising ways and means to enable funds to be raised for the purpose of carrying the project through. From the surveys already made the following data has been obtained, conclusions reached and estimates made:

The lowest point in the divide between the drainage to Willow Creek and to Devils Lake has an elevation of 1600, which elevation is 175 feet above the present surface of Devils Lake and the elevation of Mouse River at the mouth of Willow Creek being practically the same elevation as the surface of Devils Lake; the possibility of diverting the river at the mouth of Willow Creek should not be considered.

The elevation of the Mouse River at the mouth of Wintering Creek is 30 feet higher than the present surface of Devils Lake. The elevation of the Sheyenne River at a point five miles east of the town of Sheyenne is 12 feet higher than the present surface of Devils Lake. The diversion works designed consist of the creation of a reservoir in Mouse River by the construction of an earth dam near the mouth of Wintering Creek, a ditch from this

reservoir to the Sheyenne River, the creation of reservoir on this River by the costruction of an earth dam six miles east from the town of Sheyenne and a ditch from this reservoir to Devils Lake.

The distance from Mouse River dam to Devils Lake via the surveyed route is 103 miles.

The amount of water necessary to divert from Mouse River to maintain the present level of Devils Lake is 40,627 acre-feet annually.

The estimated cost for this diversion would be $1,663,000.

The amount of water necessary to divert from Mouse River to restore the lake to its elevation in the year 1879, and to maintain it at that elevation would be 110,927 acre-feet annually.

The diversion works would be the same costruction as is necessary to divert sufficient water to maintain the lake at its present level, with the exception that the ditches would have to be 26 feet wide on the bottom instead of 14 feet and the grade line of the ditch would be two feet lower.

The cost to divert the larger amount of water would be $2,042,000.

The Mouse River reservoir is designed to be as high as possible without endangering the city of Velva.

The Sheyenne River reservoir is designed to be as high as the minimum gradeline from Mouse River reservoir will allow.

The average annual flow of Mouse River is 166,000 acre-feet.

After diverting the necessary amount required to maintain Devils Lake at its present elevation there would still remain sufficient flow to annually irrigate 100,000 acres one foot deep and to further allow of sufficient flow to furnish all the water required for stock and domestic purposes along the river north of the dam.

It is thought that 100,000 acres of irrigable land can be found within a reasonable distance of the Mouse and Sheyenne reservoirs.

The irrigation of the greater part of this land would require pumping plants to be located at each of the above named reservoirs.

The construction of these irrigation projects would be approximately $25,000 per acre. The maintenance and operating cost to deliver one acre-foot of water to the land would be approximately $1.50 per acre annually.

The development of irrigation projects in conjunction with diversion works for the diversion of sufficient water to maintain the lake at its present level, would bring the latter proposition within the bounds of a possibility.

The diversion of sufficient water to maintain the lake at its present level and to irrigate 100,000 acres would greatly simplify the drainage problem on the lower Mouse River.

CAPITOL WATER SUPPLY

Chapter 38 of the session laws of 1911, provided for the sinking of wells and the erection of a stand-pipe and system of water supply for the Capitol grounds. On June 17th, 1911, the Board of Trustees of Public Property requested the state engineer to examine and report on the best plan for the purpose. Original plans and report were made July 11, 1911. The work was constructed according to these plans and report, and final report on the same was made March 1, 1912, as follows:

The Hon. Board of Trustees of Pubic Property.
Bismarck, North Dakota.

Gentlemen:-

In compliance with your resolution of June 7th, 1911, as follows:

"WHEREAS, Chapter 38, of the Laws of 1911 makes a provision for the sinking of well or wells, the erection of a stand-pipe and other improvements to the grounds, therefore

BE IT RESOLVED, That the State Engineer be and is hereby requested to make an examination of the Capitol grounds for the purpose of ascertaining the best location for the sinking of well or wells and the location of a stand-pipe. Also to ascertain the size of equipment and the materials best suited for this purpose and to report to the Trustees of Public Property at the earliest possible day."

I beg to advise that on July 11th, 1911, I reported to you as follows:

"Pursuant to your resolution of June 7th, requesting that I make an examination of the capitol grounds for the purpose of ascertaining the best location for the sinking of well or wells and the location of a stand-pipe, and also to ascertain the size of equipment and materials best suited for this purpose, I take pleasure in handing you herewith plans, specifications and estimate of cost for the system which I have designed for the purpose of fire protection to the capitol building, and for the use of water on the lawn of the capitol grounds.

The system which I have designed provides for the sinking of two three inch wells, the construction of a cistern of 10,000 gallons capacity at these wells, water to be pumped from the wells to the cistern by an air lift system, providing the height of the lift does not exceed eighty feet. In case it should be found that this lift exceeds eighty feet, deep well pumps will be necessary. From this cistern the water is to be delivered through a six inch force main by a pump with a capacity of three hundred gallons per minute, to a 50,000 gallon steel water tank on a sixty foot steel tower, located five hundred feet north of the capitol building. I have also designed six inch mains to run parallel

with the north, east and west sides of the capitol building with a hydrant at each corner, and at such a distance from the building that two lines of hose can be used from each hydrant for the purpose of fighting fire in the capitol building. I would also recommended that the force pump be connected with the supply main of the Bismarck Water Supply Co., in order that water could be taken from their main in case that at any time our wells or the pumping machinery connected therewith should be out of commission.

The maximum pressure which will be created in these hydrants will be fifty pounds per square inch, which will give sufficient pressure to throw a stream of water over the highest part of the capitol building. The highest part will be six feet below the lowest point of the water tank. Th amount of water used through a two and one-half inch hose with a one inch nozzle at the indicated pressure is two hundred gallons per minute, so that should occasion arise that it became necessary to use four lines of two hundred feet each of hose to fight fire in the capitol building, we would be using eight hundred gallons of water per minute, and the amount of water in the tank would last sixty-two minutes. At the same time the three hundred gallon per minute pump in the power house would deliver ten thousand gallons from the cistern at the wells, so that the extreme length of time during which we could use four lines of two and one-half inch hose with one inch nozzle fighting fire in the capitol building would be seventy-five minutes. It is probable that this amount of water during this length of time would place under control any fire that might be started unless the fire was entirely beyond control before the water was applied.

The following estimate which I have made on the cost of this system does not include one thousand feet of two and one-half inch hose with nozzles, which I recommend should be purchased, the approximate cost being one dollar per lineal foot.

In figuring the cost of this work I have provided that convict labor and capitol employees should be used in the laying of the six inch mains, the construction of the foundations and the frost proof case for the water tank and for the construction of the ten thousand gallon cistern and the installation of the pump and air lift system. I have provided in the specifications that the price bid on the water tank and tower should include its erection, and that the bond of the contractor should guarantee the stability of the structure for one year after its completion, and that the price bid on the six inch water mains and on the pump and air lift system should be the price f. o. b. Bismarck.

ESTIMATE OF COST.

2-3 inch wells	$1,000.00
10,000 gallon cistern	200.00
300 gallon pump	350.00
Air lift system	300.00
1319 lineal ft. of 6 inch water pipe (22½ tons at $36 delivered to capitol)	810.00
4 Hydrants at $30	120.00
1045 lbs. specials at 3c	31.35
Lead and oakum	40.00
1 Gate valve	25.00
50,000 gallon water tower and tank	3,300.00
Concrete foundations for water tower	310.00
Frost case	85.00
Convict labor	75.00
Contingencies 10%	664.63
Total	$7,310.98

After an examination of the ground and surveys, it was decided to locate the elevated tank on lots 20 and 21 of Block 12, Capitol Park Addition, which lots are located 280 feet north of the north line of the capitol grounds, and to sink two three-inch wells at the southeast corner of the power house.

After tentative plans were drawn they were submitted to Walter I. Fisher, Manager of the General Inspection Company of Minneapolis, and he suggested some changes, which were adopted, all the plans of the system as now constructed being on file in this office.

The plant as completed consists of an elevated steel tank of 50,000 gallon capacity, which when full gives a pressure on the ground floor of the capitol building of practically fifty pounds per square inch, and a pressure on the top of the capitol building of twelve pounds per square inch, which pressure is considered ample for the purpose of fighting fire in the capitol building.

Two three-inch wells were sunk as planned, one well being 206 feet deep and one being 196 feet deep, and after testing were found to be able to deliver 1,000 gallons per hour, each.

After the wells were thoroughly tested out, a sample was taken by Mr. Larson of the Public Health Laboratory and forwarded to Dr. Ruediger, Director of the State Public Health Laboratory at the State University for analysis. His report on the water is as follows:

"The following is the result of the analysis of the sample of water submitted by you from the Capitol well:

	Parts per million
Total alkalinity	890
Alkalinity after boiling and filtering	750
Total mineral residue	3500
Total hardness	191½
Temporary hardness	140
Permanent hardness	51½
Calcium carbonate	68½
Magnesium carbonate	123
Boiler incrustants	0
Sulphates (as SO4)	1824
Chlorine	15
Nitrogen (as free ammonia)	.10
Nitrogen (as albuminoid ammonia)	.074
Nitrates	0
Nitrites	0

This water contains a large amount of mineral matter which seems to be composed very largely of sulphate of soda and bicarbonate of soda. It does not contain boiler incrustants but it is barely possible that the sulphates of soda would have a somewhat corrosive action upon the boiler. I believe, however, that the water would be fairly satisfactory for a boiler water if the boiler were frequently emptied to guard against too great a concentration of the solution. Another point must, however, be considered in this connection and that is the fact that the water contains sufficient sodium bicarbonate to froth at times when it is heated. Of course, this is very objectionable in a boiler water.

In regard to its use upon the lawn, will say that I do not consider it harmful although it no doubt would leave a whitish deposit upon the lawn if large quantities were allowed to evaporate there. I do not believe, however, that the sulphate of soda would injure the grass in any way.

Very truly yours,
G. F. RUEDIGER
Director."

Two steam heads for pumping were placed on these wells and connected direct from the boiler at the power house for steam supply. It became necessary to construct an addition to the power house to enclose these wells, which addition was constructed of brick. A reinforced concrete cistern with a capacity of 20,000 gallons was constructed, which is south of the power house. The water from the cistern is lifted to the tank by a pump which has for some time been in use in the power house for lifting water into the wooden tanks formerly located

in the attic of the capitol building. This pump is connected to the tank by a six-inch cast iron main which also runs through into the capitol building.

The original plan was amended at the suggestion of Mr. Fisher, above referred to, so that only one hydrant is used and this is located about seventy-five feet from the northeast corner of the capitol building. All of the common labor used on the construction of this system was convict labor from the Penitentiary.

The appropriation for the construction of this system was $7,500. The total expenditures were $7,339.38 as shown in the itemized account below:

1911		
100540	Oct. 2, Anthony Mairley	$ 70.00
100720	Oct. 9, Grambs & Peet Co.	728.10
100721	Oct. 9, Grambs & Peet Co.	2,000.00
101206	Oct. 16, French & Welch Hdw. Co.	6.25
101207	Oct. 16, Fairbanks, Morse & Co.	62.14
101230	Oct. 17, B. M. Beers & Son	540.00
101331	Oct. 18, Improvement Bulletin	8.40
101332	Oct. 18, Bismarck Hardware Co.	7.59
101698	Nov. 1, Jay W. Bliss	100.00
101699	Nov. 1, Henry Hartley	19.13
102225	Dec. 1, Henry Hartley	7.00
102226	Dec. 1, J. W. Bliss	50.00
102942	Dec. 15, J. C. Rhud Lumber Co.	9.30
102943	Dec. 15, Grambs & Peet	1,597.00
102944	Dec. 15, French & Welch Hdw. Co.	49.65
102945	Dec. 15, French & Welch Hdw. Co.	4.10
102946	Dec. 15, North Star Lumber Co.	109.90
102947	Dec. 15, Bismarck Hardware Co.	11.50
102948	Dec. 15, North Star Lumber Co.	1.45
102949	Dec. 15, Goodrich-Call Lumber Co.	4.15
102950	Dec. 15, French & Welch Hdw. Co.	3.71
1912		
104007	Feb. 1, J. W. Bliss	25.00
104245	Feb. 17, H. C. Rhud Lumber Co.	74.28
104247	Feb. 17, H. C. Rhud Lumber Co.	22.45
104249	Feb. 17, F. O. Hellstrom, Warden	152.30
104250	Feb. 17, Grambs & Peet Co.	771.02
104251	Feb. 17, F. O. Hellstrom	10.33
104252	Feb. 17, F. O. Hellstrom	100.84
104307	Feb. 19, French & Welch Hdw. Co.	5.15
104308	Feb. 19, F. O. Hellstrom	10.50
104309	Feb. 19, F. O. Hellstrom	7.75
104310	Feb. 19, F. O. Hellstrom	94.76
104499	Feb. 23, Bismarck Implement Co.	13.60
104500	Feb. 23, French & Welch Hdw. Co.	32.05
104501	Feb. 23, Henry Hartley	2.00
104939	Mch. 12, French & Welch Hrw. Co.	6.30
104940	Mch. 12, Ed. G. Smith	23.75
104943	Mch. 12, Grambs & Peet	336.29
104972	Mar. 13, F. O. Hellstrom	145.90
106110	Apr. 13, No. Star Lumber Co.	115.74
	Total	$ 7,339.38

I would suggest that two hundred feet of two and one-half inch standard fire hose be purchased and housed over the hydrant, and if it is intended to use water from the Bismarck Water Supply Company, a four-inch meter should be purchased and in-

stalled in order that water from this Company may be metered, and in this case some arrangement should be made with the Water Company for the price to be paid for metered water.

Respectfully submitted,
T. R. ATKINSON,
State Engineer.

ROCK ISLAND MILITARY RESERVATION.

Brigadier General, R. D. Potts, Commanding the central division of the U. S. Army, in October, 1911, requested the Governor to have a topographic survey made of Rock Island Military Reservation at Devils Lake. The execution of this work was turned over to the state engineer's office, the field work being done in October and November, 1911, and final report transmitting map was made January 2, 1912. The original map was forwarded to the Brigadier General and by him sent to the Army War College, at Washington, to be preserved among the permanent maps of the War Department. Prints have been made for the use of the North Dakota National Guard.

BUXTON GRAVEL PIT.

At the request of the Attorney General's office, survey was made of the Buxton Gravel Pit of the Great Northern Railway Co. and report made to that office showing the amount of land taken and the amount of gravel removed.

ROCK ISLAND GRAVEL PIT.

At the request of the Adjutant General, survey was made of the gravel pit of the Great Northern Railway Company on the Rock Island Military Reservation, and report made to him showing the amount of land and gravel taken.

HEART RIVER DAM.

At the request of the State Board of Control, survey and plans were made for the construction of a concrete dam over the Heart River at Mandan, the purpose of the dam being to create a reservoir for storing water for irrigation on the Reform School farm.

It was proposed that the cost of construction be paid for by the State of North Dakota from the Reform School fund, by the Russell-Miller Milling Co., and the Mandan Chautauqua Association.

Bids for the construction were opened at Mandan on September 6th, 1912. The Attorney General's office gave an opinion that the Board of Control had not authority to appropriate

money for this purpose, and therefore the contract for the construction could not be let. It will be necessary for an appropriation to be obtained from the legislature before the work can be carried on.

My report to the Board of Control on complete plans and specifications was as follows:

"August 21, 1912.

Hon. State Board of Control, Bismarck, North Dakota.

Gentlemen: I hand you herewith complete plans and specifications for the proposed Heart River dam located at Mandan, for the use of the State Reform School, The Mandan Chautauqua Association and the Russell-Miller Milling Company.

You will note that this plan has been somewhat changed from the original plan handed you on July 23rd. These changes were made owing to the fact that the material which we found in making test borings is much better than we at first anticipated. I believe that a dam constructed after these plans and specifications, if properly constructed, will be sufficiently stable to withstand any flood that may occur. Of course it is highly important that thorough inspection of the work be carried on with the construction, to see that the specifications are carried out in detail.

As you will note, the plan provides for a spillway eighty feet long and three feet deep and an apron twelve feet wide, constructed after the best engineering practice in damms built on this material. I have also provided for good sheet piling on the upstream side of the dam and sufficient rip-rap to make everything safe. The plans also provide for a sluice gate three feet in diameter, to be used for the purpose of emptying and cleaning the reservoir at any time.

In the specifications I have shown the approximate amount of material required in the construction of this dam, and have estimated the cost to be approximately $5,000.

The Mandan Commercial Club will receive tentative bids on this proposition on September 5th, at which time I anticipate being present, and trust that it will be convenient for one of your members to be there also.

I am transmitting a copy of this letter to Mr. W. A. Lanterman of the Mandan Chautauqua Association.

Very truly yours,

T. R. ATKINSON,

State Engineer."

WATER SOFTENING AND PURIFICATION PLANT FOR MAYVILLE NORMAL SCHOOL.

At the request of Mr. Thos. Hillyer, President of the Mayville Normal School, a study was made by the State Engineer of the water supply of this institution and the following report was made on October 25th, 1912:

"Report on the water supply of the Mayville Normal School, Mayville, North Dakota, for Thos. A. Hillyer, President.

The water supply for the Mayville Normal School is obtained from the City of Mayville, which city obtains its supply from the Goose River. The Goose River has a drainage area west of Mayville of approximately 500,000 acres. This drainage area is agricultural land, which is well settled, and it is customary for the farmers to use the stream for the disposal of barn manures, dead animals and refuse of all kinds, while many out houses are constructed on its banks, so that the use of this water for drinking purposes is very dangerous. In support of the above statement I quote below report of Dr. G. F. Ruediger, Director of the State Public Health Laboratory, under date of August 26th, 1912, upon two samples of the Goose River water, one sample taken near the intake pipe and one taken from the faucet at the Normal School:

'Mr. T. R. Atkinson, State Engineer, Bismarck, N. D.

Dear Sir: Following are the results of the analyses of the samples of water submitted by Mr. Hillyer of Mayville:

SAMPLE NO 1, GOOSE RIVER NEAR THE INTAKE PIPE.

Bacteriological analysis	
Total number of bacteria per cubic centimeter	1320
B. Coli per cubic centimeter	20
Cemical Analysis	Parts per million
Total alkalinity	260
Total mineral residue	700
Total hardness	475
Temporary hardness (representing carbonates of lime and magnesia)	205
Permanent hardness (representing sulpates of lime and magnesia)	270
Calcium	103
Magnesium	52
Chlorine	16.5
Sulphates	307
Free ammonia (representing decomposed organic matter)	.07
Albuminoid ammonia (representing undecomposed organic matter)	.22
Nitrates (calculated as nitrate of potash)	1.05
Nitrates	.05

SAMPLE NO. 2, FROM FAUSET AT NORMAL SCHOOL.

Bacteriological analysis.	
Total number of bacteria per cubic centimeter	680
B. Coli per cubic centimeter	1
Cemical Analysis	Parts per million
Total alkalinity	255
Total mineral residue	680
Total hardness	470

Temporary hardness (representing carbonates of lime and magnesia)	200
Permanent hardness (representing sulphates of lime and magnesia)	270
Calcium	100
Magnesium	52
Chlorine	17
Sulphates	305
Free Ammonia (representing decomposed organic matter	.08
Albuminoid ammonia (representing undecomposed organic matter	.215
Nitrates (calculated as nitrate of potash	1.5
Nitrates	.05

The chemical composition of these samples of water is almost alike. There seems, however, to be a very decided difference in the bacterial content. I doubt very much whether the number of B. coli in the river water would be quite as high as indicated if the sample were analyzed immediately after being taken from the river. I believe this water could be purified to make it entirely satisfactory for drinking purposes. The chemical analysis shows that it is well suited for softening.

Very truly yours,
G. F. RUEDIGER
Director.'

This report shows the bacteriological count to be large and also shows the presence of B. coli. This colon bacillus is what causes intestinal diseases and may carry the typhoid germ. This water, you will note from the report, also shows the presence of large amounts of sulphates of lime and magnesia, which are scale forming, and make the expense of operating your boilers and engines greatly increased, by the formation of scale in your boilers, and thus reduces the life of the flues and fire boxes and increases the cost of maintenance, the cost of coal consumption, and in general reduces greatly the efficiency of the boilers. I would therefore recommend a water softening plant for the institution on account of the economical results to be obtained, as follows: First, loss of service of boilers due to the impossibility of satisfactory continuous operation with hard water; second, possibility of substantial saving in fuel and repair bills, and the checking of rapid deterioration of boilers, together with the decrease of the cost of soap used in the laundry.

The cost of operating a water softening plant is very small, no extra attendance being necessary, as your engineer can handle this plant in connection with your power plant without extra help. With this softening plant you will have fuel saving, repair saving and depreciation saving, together with increased service obtainable from your engines. The chemicals required for this softening will be lime and soda ash, and the total cost of the treatment will not exceed four and one-half cents per thousand gallons.

Your records show that during the year of 1911 you used 596,910 cubic feet of water, or 4,476,825 gallons. Assuming that one half of this water used was used by your boilers, the total cost, for chemicals would be about $100 per year, and it is easy to see that there is a large saving to be made in the operating expenses and depreciation account of your boilers by using this softening plant.

DRINKING WATER

I understand that you are now using melted ice for drinking water, and the cost to the institution must be quite large. In preference to this I would recommend the installation of a coagulation and sedimentation tank, together with a mechanical filter for your drinking water. This will purify the water and make it perfectly safe for drinking purposes. For your softening plant I would recommend a mechanical softening plant having a capacity of 2,000 gallons per hour. As an approximate estimate of the cost of the installation of a softening plant I would submit the following:

1-2,000 gallon per hour mechanical softener installed....	$1600.00
For treatment of your drinking water, approximate cost installed, would be	1500.00
Total cost for softening and purifying	$3100.00

If your board decides to install this plant, as above outlined, I would be very glad to offer my services as state engineer, and the only expense in connection therewith would be the traveling expense and expenses outside of the office that might be incurred. It will be necessary for me to send a man to Mayville to make a plat of your buildings, and plan of the boiler house and design the softening and filtration plants in detail.

Respectfully submitted,

T. R. ATKINSON,

State Engineer."

MINOT NORMAL SCHOOL.

At the request of the State Normal Board, a topographical survey was made of the site for the new normal school at Minot and plat made in August, 1912.

CREAMERY SEPTIC TANK.

Repeated complaints to the state dairy commissioner concerning the foul odors arising from the decaying creamery waste led this officer to call upon this office to design a septic tank that would dispose of this waste and prevent the unsanitary condition surrounding many of the creameries in the state.

Creamery waste has proven to be one of the hardest wastes to satisfactorily treat by the septic tank method. After much research work by Mr. J. W. Bliss, Assistant State Engineer, plans and specifications were finally drawn for tanks of different sizes, corresponding to the output of the creamery. Several of these tanks have been constructed and have proved very satisfactory.

HIGHWAYS.

The annual levy for roads and bridges in North Dakota is not far from $1,000,000. A large amount of this, expended under the statute labor system called "working out the road taxes", sometimes makes far worse roads than if not expended at all.

During our last legislature a bill was introduced providing that the county commissioners should appoint a county superintendent of highways, and that the county superintendent should appoint deputy superintendents. The house of representatives saw fit to amend this bill so that the appointment of a county superintendent of highways is optional with the county commissioners, and the appointment of the deputy superintendents is practically given into the hands of the township supervisors. However, this law has been placed in effect in five counties and has proved very satisfactory. The following are the counties having county superintendents of highways, and the names of the superintendents:

Billings County: Thor G. Plomasen, Beach,
Burleigh County: John Ecklund, Wilton
Griggs County: Martin A. Ueland, Cooperstown
Dickey County: Sol Hunter, Oakes,
Stark County: W. R. Veigel, Dickinson

At the present time more than one-half of the states of the Union provide state aid for the construction and maintenance of roads. This aid is sometimes given to those counties or townships which expend a like amount. Some states require that the petitioners for an improved highway pay a small percentage of its cost. Whatever method of disbursing the state aid fund, it is significant that no state grants aid unless it supervises the expenditure of the road.

The constitution of North Dakota prohibits the granting of state aid in highway construction, but a concurrent resolution passed the last legislature for an amendment to the constitution which provides that the state may appropriate money for aid in the construction and improvement of highways. This resolution must come before the 1913 legislature and if concurred in by that legislature will be submitted to a vote of the people

in 1914, and if it carries by the vote of the people, laws making appropriations for this purpose may be enacted by the legislature of 1915.

HIGHWAY LAWS.

A joint resolution passed by the last legislative assembly named the Governor, the Attorney General and the State Engineer as a commission on highway laws, and appropriated the sum of two hundred dollars for the printing and distribution of the highway laws of the state among our road officials. In compliance with the terms of the resolution the highway laws of the state were codified by this office and after being reviewed by the Governor and Attorney General, 1500 copies were printed and distributed to county and township highway officials.

AUTOMOBILE LAW.

The so called automobile registration law passed by the 1911 session of the legislature has proved of great assistance in aiding in the forwarding of the good roads movement. This act provides that a registration fee of three dollars shall be paid annually on every automobile and motor cycle in the state. This registration fee is paid to the Secretary of State and after the cost of the tags and books of registration are paid for from this sum the balance, at the end of each month, is paid in to the county treasurer of each county in proportion to the number of automobiles and motor cycles registered. The money so received is expended for maintenance and repairs only on the main traveled roads of the county, under the direction of the Board of County Commissioners or county superintendent of highways, provided, that all money so expended for repairs and maintenance shall be expended from April first to December first annually. Provided, further, that none of this money shall be expended within the limits of any incorporated city or village, nor shall it be expended on any road within any township that does not levy at least a tax of six mills for road purposes. 7,220 automobiles and 265 motor cycles were registered during the year 1911 and the net revenues returned to the counties amounted to $17,761.05. Approximately 9,000 automobiles and 468 motor cycles will be registered during 1912 and the amount returned to the counties will be approximately $22,800. In general the automobile owners have taken kindly to the payment of the fee, knowing that the money would be used on the roads.

MERIDIAN ROAD.

The Meridian road is a proposed international highway from Winnipeg to the Gulf of Mexico and was promoted by John C. Nicholson of Newton, Kansas. The expense of the construct-

ion is to be maintained by the states, counties and various municipalities through which it passes. This road has been widely advertised and has greatly assisted in the good roads movement in this state. During the season of 1912, much interest was shown in its improvement and construction in our Red River Valley counties, and the results show that excellent earth roads can be constructed and maintained in this state when proper methods of working them are adopted.

LITTLE MISSOURI RIVER BRIDGE.

During the winter of 1912, the county commissioners of Billings County requested this office to prepare plans and specifications for the construction of a steel bridge over the Little Missouri River at Marmarth. An assistant was sent from this office to make the necessary surveys and soundings and complete plans and specifications for a steel bridge and for a reinforced concrete bridge were made and submitted to the commissioners. It was found that the estimated cost of this bridge was more than could be appropriated for this purpose, and the questions of bonding the county for its construction has been submitted to the voters.

RIVER RECORDS.

By E. F. Chandler.

By the permission of the United States Geological Survey, the following tables of flow of the more important or typical streams in North Dakota and the Red River valley have been selected and compiled from the records obtained under the direction of or by cooperation with the Geological Survey.

The methods followed in this work were described in the First Report of the North Dakota State Engineer, (1905), pages 49 to 62, and also in the Second Report (1907) pages 47 to 49. In the Water Supply and Irrigation Papers Series published by the Geological Survey, all these river records are published in complete form, and in the introduction to each such volume the methods are fully discussed. The essential facts are stated below.

At each "river station" or "gaging station" a gage is established at which the height of the water surface in feet and tenths is read and recorded daily or several times daily. The zero of the gage is usually below the lowest known low-water, and sometimes is many feet below the bottom of the channel, but the height of floods is easily seen by comparing the maximum flood-height readings with the minimum gage readings recorded for low water.

At suitable times, an engineer (called in this work a "hydrographer") makes instrumental measurements of the discharge, i. e., of the actual quantity of water flowing by the gage, and reads the gage-height. It is thus known how much water flows whenever the river is at that same gage-height again (provided the channel does not change.) When enough such measurements have been secured, it thus becomes possible to compute from the record of daily gage-heights an accurate record of daily quantity that flowed by the station, and to tabulate these quantities in the most convenient form for reference.

In the following pages, these results have been arranged as tables of "monthly discharge", showing for each month the flow for that day of the month when the flow was the greatest or maximum, the flow for the minimum day, and the mean flow or average for the whole month. The figures of discharge are all in "second-feet", one second-foot being a flow that carries one cubic foot of water past the observer each second; a rapid current in a small channel, or a slow current in a large channel, can carry the same amount of water past the observer in a second.

One second-foot amounts to 646,272 gallons per day, and will cover almost two acres one foot deep in twenty four hours.

As successive years vary considerably, an absolutely exact record of the flow of the river through one year would not tell how much might flow the next year; and as no two rivers are altogether alike in their conditions, records of as many as possible are needed if well-considered use is to be made of the river records. Therefore, rather than to spend a large appropriation in making a precise record of a single stream for a single year, it is much more advantageous to extend the work to as many streams through as long a period of years as funds will permit, provided the care taken in the work is not so much reduced thereby as to result in disproportionate loss of accuracy.

The column headed "accuracy" in the tables of monthly discharge applies to the mean flow for the month, but not always to the maximum or to the minimum. It depends upon the reliability of the daily observer, upon the permanency of the stream channel and the gage and other such conditions, and upon the number of discharge measurements; more discharge measurements ordinarily bring much greater accuracy to the computed results for the season.

The mean for any month marked A in these tables may safely be assumed as accurate within 5 per cent; of any month marked B, within 10 per cent; C, within 15 per cent; D, within 25 per cent; E indicates a rough estimate which is hoped to be within 50 per cent of the truth.

In ordinary winters, the flow of most of the streams in this region is too small to justify much expense in measurements; hence the accuracy of the monthly means at most of the stations is poor in winter, and at some (chiefly those of the smallest flow) not enough information is available to justify any estimates in winter.

The summaries from November 1, 1910, to November 1, 1912, of the records of these streams are included here.

Red River at Grand Forks, N. D.
Red River at Fargo, N. D.
Ottertail River at Fergus Falls, Minn.
Pembina River at Neche, N. D.
Red Lake River at Crookston, Minn.
Thief River near Thief River Falls, Minn.
Mouse River at Minot, N. D.
Grand River, (North Branch), at Haley, N. D.
Cannon Ball River at Stevenson, N. D.
Heart River near Richardton, N. D.
Knife River near Broncho, N. D.

The portions of these summaries for the year 1912 have been extracted from the official records in advance of the completion of the computations of the season's work as made for official publication and therefore are still subject to minor revision, and some other portions of the tables here included are also from the preliminary computations. But in no case will the final revision introduce any large changes in the figures here given, and in most cases there will be no change whatsoever.

Similar summaries of the river records in this region for previous years may be found in the following reports:

1903-1904, in Third Report of North Dakota State Geological Survey.
1905-1906, in Second Report of North Dakota State Engineer.
1907-1908, in Third Report of North Dakota State Engineer.
1909-1910, in Fourth Report of North Dakota State Engineer.

More detailed figures are given in the Water Supply and Irrigation Papers series as mentioned above, published by the United States from time to time through each year.

All the data of every kind on which these summaries and other less important unpublished ones rest are kept on file in the Washington office of the U. S. Geological Survey; copies of all the data are also kept in the office of the resident hydrographer of the Survey, E. F. Chandler, whose post-office address is University, N. D. On request to either office full information can be obtained if desired by any one who has reason for interest in any of these records or investigations.

RED RIVER AT GRAND FORKS, N. D.

Gagings of the flow of the Red River at Grand Forks were begun by the United States Geological Survey in 1901, but a gage height record was kept at the direction of the U. S. Corps of Engineers (War Department) for about twenty years previously. The gaging station is located below the confluence of the Red and Red Lake Rivers. The total drainage area is 25,000 square miles, of which 13,400 is in Minnesota.

The tables of discharge are based on the measurements in the list below and on fifty-seven measurements made during the ten preceding years, and are fairly accurate through the entire year.

MEASUREMENTS OF DISCHARGE.

Date	Name of Hydrographer	Gage-height.	Discharge
12-13-1910	Chandler and Ebner	3.74*	312
2-14-1911	Chandler and Monley	4.10*	198
2-18-1911	G. Monley	4.11*	177
2-25-1911	G. Monley	4.33*	235
5-13-1911	Chandler and Monley	7.13	1740
7-18-1911	E. F. Chandler	3.81	542
1- 9-1912	G. Monley	3.50*	175
2-12-1912	G. Monley	3.00*	115
5-14-1912	Chandler and Budge	8.72	2370
10-12-1912	Chandler and Stevenson	6.30	1110
11- 8-1912	Stevenson	5.12	930

*Frozen; mean thickness of ice from 0.89 to 1.63 ft.

MONTHLY DISCHARGE OF RED RIVER AT GRAND FORKS, N. D.

	Accuracy.	Maximum.	Minimum.	Mean.
1910—November,	B	470	282	395
December,	B	410	250	316
1911—January	C	260	185	212
February,	B	245	160	183
March,	C	2,100	250	760
April,	B	2.720	1,530	2,030
May	A	2,380	1,120	1,500
June,	A	3,500	1,050	1,760
July	A	1,060	318	579
August,	B	455	330	393
September	B	425	346	392
October	B	640	271	469
November	B	496	330	383
December	D	.....	230	303
1912—January	C	.....	.....	139
February	C	.....	.....	111
March	D	.....	.....	189
April	C	3,200	550	1,780
May	B	2,370	1,020	1,730
June	B	1,600	674	1,150
July	B	890	640	744
August	B	823	470	605
September	B	2,670	439	801
October	B	2,590	883	1,330

River closed Nov. 5, 1910; opened April 8, 1911; closed Nov. 5, 1911; opened April 10, 1912.

Maximum gage-heights, 9.45 ft. March 31, 1911, 10.7 ft. June 12, 1911; 12.7 ft. April 9, 1912; 9.2 ft. Sept. 30, 1912.

Minimum gage-heights, 2.7 ft. Nov. 7, 1910; 2.6 ft. July 30, 1911; 3.0 ft. Nov. 25, 1911; 2.6 ft. Feb. 10, 1912; 3.6 ft. Sept. 4, 1912.

RED RIVER AT FARGO, N. D.

The gaging station on the Red River at Fargo was established May 27, 1901. The drainage area above this point is 6,020 square miles, of which 1,750 square miles is in North Dakota, 500 square miles in South Dakota, and 3,770 square miles in Minnesota.

The tables of discharge are based on the measurements in the list below and forty-eight measurements made during the ten preceding years, due allowance being made for the gradual slight changes in the channel.

DISCHARGE MEASUREMENTS.

Date	Name of Hydrographer	Gage-height.	Discharge
6-24-1911	E. F. Chandler	6.70	143
8-21-1911	E. F. Chandler	6.73	161
5-25-1912	E. F. Chandler	8.78	576
8-30-1912	E. F. Chandler	7.11	178
10-30-1912	W. B. Stevenson	7.53	218

MONTHLY DISCHARGE OF RED RIVER AT FARGO, N. D.

	Accuracy.	Maximum.	Minimum.	Mean.
1910—November	C	.....	.....	45
1911—March	C	556	.....	235
April	A	608	286	371
May	A	309	242	283
June	A	428	116	241
July	B	131	79	102
August	A	251	116	172
September	A	221	116	160
October	A	356	147	245
November	D	.....	.....	135
December	E	.....	.....	120
1912—January	E	.....	.....	90
February	E	.....	.....	80
March	E	.....	.....	90
April	C	1,070	378	560
May	B	1,130	405	740
June	B	640	461	523
July	B	670	328	471
August	C	580	194	314
September	C	328	178	237
October	C	352	246	273

Maximum gage-heights. 8.7 ft. April 11, 1911; 10. 4 ft. Apr. 8, 1912; 10.6 ft. May 14, 1912.

Minimum gage-heights. 5.3 ft. Dec. 2, 1910; 6.2 ft. July 15, 1911; 7.1 ft. Sept. 17, 1912.

OTTERTAIL RIVER NEAR FERGUS FALLS, MINN.

The gaging station on the Ottertail (or Red) River near Fergus Falls, Minn., was established May 6, 1904, and is located about three miles northeast of Fergus Falls. The drainage area above this point is 1,310 square miles.

The tables of discharge are based on the measurements in the list below and on previous measurements, and are unusually accurate through the whole of each open season.

DISCHARGE MEASUREMENTS.

Date	Name of Hydrographer	Gage-height.	Discharge
12-16-1911	Hoyt and Soule	3.44*	119
1-25-1912	S. B. Soule	3.75*	60
2-29-1912	S. B. Soule	3.69*	72
5- 7-1912	W. G. Hoyt	2.95	301
8-11-1912	E. G. Hoyt	2.78	221

*Frozen. Mean ice thickness 0.9 to 2.2 ft.

MONTHLY DISCHARGE OF OTTERTAIL RIVER NEAR FERGUS FALLS MINN.

	Accuracy.	Maximum.	Minimum.	Mean.
1911—January	B	.....	.....	80
February	B	.....	.....	85
March	C	.....	.....	124
April	A	274	184	229
May	A	236	201	221
June	A	218	124	169
July	A	124	98	108
August	A	153	98	126
September	A	153	98	128
October	A	184	138	164
November	B	168	.....	128
December	B	.....	.....	110
1912—January	C	.....	.....	80
February	B	.....	.....	70
March	C	.....	.....	70
April	B	236	138	181
May	A	336	236	284
June	A	336	274	325
July	A	402	201	212
August	A	274	184	216
September	A	236	153	204

Maximum gage-heights. 2.9 ft. Apr. 19, 1911; 3.1 ft. July 9, 1912.
Minimum gage-heights, 2.3 ft. July 16, 1911; 2.5 ft. April 10, 1912.

PEMBINA RIVER AT NECHE, N. D.

The gaging station on the Pembina River was established April 29, 1903, and is located at Neche, sixteen miles from the mouth of the river. The drainage area above this point is 2,940 square miles of which 920 square miles is in North Dakota and 2,020 square miles in Manitoba.

The tables of discharge are based on the measurements in the list below and thirty-six previous measurements, necessary allowances being made for changes that have several times occurred in the channel conditions determining the gage-height at season of lowest flow.

DISCHARGE MEASUREMENTS.

Date	Name of Hydrographer	Gage-height.	Discharge
5-30-1911	E. F. Chandler	2.79	148
7-31-1911	E. F. Chandler	1.77	15.7
10- 1-1911	G. Monley	1.70	9.4
4-16-1912	G. Monley	3.68	184
7-23-1912	E. F. Chandler	2.35	31
9-12-1912	E. F. Chandler	3.65	145

MONTHLY DISCHARGE OF PEMBINA RIVER AT NECHE, N. D.

	Accuracy.	Maximum.	Minimum.	Mean.
1911—March 23-31	D	890	440	635
April	B	404	181	286
May	B	494	133	227
June	B	197	118	154
July	D	110	16	49
August	C	35	11	24
September	D	17	1	6
October	D	35	2	20
1912—April	C	371	124	192
May	C	380	124	182
June	C	344	64	151
July	C	920	48	129
August	C	308	12	82
September	C	380	12	196
October	C	239	148	200

Maximum gage heights. 8.9 ft. March 24, 1911; 5.0 ft. May 30, 1912; 8.0 ft. July 29, 1912.

Minimum gage-height. 1.3 ft. Sept. 15, 1911; 2.0 ft. Sept. 14, 1912.

RED LAKE RIVER AT CROOKSTON, MINN.

The gaging station at Crookston, Minn., was established May 19, 1901. In September, 1911, an automatic gage was installed there, which keeps a continuous record of the hourly fluctuations of flow, thus securing unusually good records. The drainage area above Crookston is 5,400 square miles, and almost the entire discharge of the Red Lake River is included at this station, as there are no considerable tributaries between this point and the mouth of the river at Grand Forks.

The tables of discharge are based on the measurements in the list below and fifty previous measurements. On account of the operation of the power-plant above the gage, under some

conditions for a single hour the gage-height does not indicate the true amount of flow, hence the occasional discrepancies appearing among the results of measurements.

DISCHARGE MEASUREMENTS.

Date	Name of Hydrographer	Gage-height.	Discharge
11- 7-1910	Chandler and Ebner	3.18	275
11- 7-1910	Chandler and Ebner	2.42	67
12-21-1910	G. Monley	3.80*	185
3- 1-1911	G. Ebner	3.46*	57
3- 1-1911	G. Ebner	4.09*	142
4-30-1911	E. F. Chandler	3.73	466
5- 6-1911	E. F. Chandler	3.59	387
7-19-1911	E. F. Chandler	2.46	92
9-15-1911	E. F. Chandler	2.13	22
9-15-1911	E. F. Chandler	2.13	21
11- 6-1911	E. F. Chandler	2.10	14
12-18-1911	G. Monley	2.07	22
1-27-1912	Monley and Ebner	2.59*	10
1-27-1912	Monley and Ebner	4.06*	18
3- 2-1912	Chandler & Monley	2.72*	14
3- 2-1912	Chandler & Monley	4.92*	182
3-17-1912	G. Ebner	2.87*	18
7-22-1912	E. F. Chandler	2.52	136
9-19-1912	E. F. Chandler	2.42	55
9-27-1912	E. F. Chandler	6.24	1610
10- 1-1912	W. B. Stevenson	6.18	1650

*Gage height affect by ice partially closing channel.

MONTHLY DISCHARGE OF RED LAKE RIVER AT CROOKSTON, MINN.

	Accuracy.	Maximum.	Minimum.	Mean.
1910—November	B	266	69	204
December	C	310	80	192
1911—January	D	184	50	125
February	D	266	50	98
March	D	687	90	308
April	A	801	469	635
May	A	629	281	448
June	A	3,160	170	935
July	A	311	72	147
August	B	197	61	113
September	B	296	41	81
October	A	186	8	96
November	B	157	29	63
December	B	122	55	70
1912—January	D	70	15	31
February	D	59	15	37
March	D	116	25	43
April	C	1,210	100	394
May	A	451	192	320
June	A	542	121	242
July	A	577	88	305
August	B	601	157	306
September	A	2,120	129	644
October	A	1,710	404	705

Maximum gage heights, 5.4 ft. March 18, 1911; 8.4 ft. June 10, 1911; 7.1 ft. Apr. 8, 1912; 6.8 ft. Sept. 29, 1912.

Minimum gage heights, 2.4 ft. Nov. 3, 1910; 2.0 ft. Oct. 2, 1911; 2.4 ft. July 15, 1912.

THIEF RIVER NEAR THIEF RIVER FALLS, MINN.

The gaging station on the Thief River was established July 1, 1909. It is located about six miles above the confluence of the Thief River with the Red Lake River at Thief River Falls, this being the most important tributary of the Red Lake River. The drainage area above the station is 1,010 square miles.

The tables of discharge are based on the measurements in the list below and thirteen measurements made in preceding years.

DISCHARGE MEASUREMENTS.

6-29-1911	E. F. Chandler	3.82	3
9-18-1912	E. F. Chandler	3.77	4

MONTHLY DISCHARGE OF THIEF RIVER NEAR THIEF RIVER FALLS, MINN.

	Accuracy.	Maximum.	Minimum.	Mean.
1910—November	D	.....	.....	0
December	D	.....	.....	0
1911—January	D	.....	.....	0
February	D	.....	.....	0
March	B	74	0	12
April	A	112	11	45
May	B	77	0	7
June	B	30	0.1	11
July	B	8	0	1
August	C	0	0	0
September	C	0	0	0
October	C	0	0	0
November	C	.....	.....	0.1
December	B	.....	.....	0
1912—January	B	.....	.....	0
February	B	.....	.....	0
March	E	.....	.....	0.5
April	A	48	1.5	15
May	A	17	0.1	5
June	B	13	0	1.9
July	B	8	0	1.2
August	B	0.5	0	0.2
September	A	116	0	24
October	A	80	12	40

Maximum gage heights, 5.3 ft. April 26, 1911; 5.2 ft. April 5, 1912; 5.0 ft. Sept. 30, 1912.

Minimum gage heights, 3.2 ft. Nov. 15, 1910; 3.2 ft. Aug. 6, 1911; 3.4 ft. June 27, 1912.

MOUSE RIVER AT MINOT, N. D.

The gaging station on the Mouse River at Minot was established May 5, 1903. The drainage area above this point is 8,400 square miles, of which three-fourths is in Canada and one-fourth in North Dakota.

The tables of discharge are based on the measurements in the list below and forty-two measurements made in previous years.

DISCHARGE MEASUREMENTS.

Date	Name of Hydrographer	Gage-height.	Discharge
8- 3-1911	E. F. Chandler	4.49	18
8-17-1911	E. F. Chandler	4.54	22
4- 9-1912	Geo. Ebner	7.10	613
4-10-1912	Geo. Ebner	7.12	580
9-13-1912	E. F. Chandler	4.41	16

MONTHLY DISCHARGE OF MOUSE RIVER AT MINOT, N. D.

	Accuracy.	Maximum.	Minimum.	Mean.
1910—November	C	.....	.....	0.6
December	E	.....	.....	0.5
1911—March	D	14	.....	4
April	B	745	14	339
May	B	723	146	440
June	B	202	55	137
July	D	63	14	34
August	D	24	4	15
September	D	4	1	2
October	D	7	1	2
November	D	.....	.....	11
December	E	.....	.....	2
1912—January	E	.....	.....	1
February	E	.....	.....	1
March	E	.....	.....	46
April	B	1,150	306	690
May	B	946	235	510
June	B	504	69	240
July	C	69	60	67
August	C	60	30	43
September	C	52	16	33
October	C	69	24	48

Maximum gage heights, 7.6 ft. April 30, 1911; 10.4 ft. April 20, 1912.

Minimum gage heights, 2.9 ft. Dec. 31, 1910; 3.4 ft. Oct. 1, 1911; 2.0 ft. Feb. 14, 1012; 4.4 ft. Sept. 13, 1912.

GRAND RIVER (NORTH BRANCH) AT HALEY, N. D.

The gaging station on the North Branch of the Grand River at Haley was established May 11, 1908. The drainage area above this point is 500 square miles. The tables of discharge are based on the measurements in the list below and on five measurements made in previous years. The discharge found at the first twelve of the measurements listed below was not the normal discharge for that gage-height on account of the presence of ice in the channel, and the conditions were abnormal at a few of the other measurements.

DISCHARGE MEASUREMENTS.

Date	Name of Hydrographer	Gage-height.	Discharge
4- 6-1911	J. W. Bliss	1.00	2.3
8-13-1911	E. F. Chandler	0.66	0.2
3-28-1912	H. N. Lungwitz	5.42	261
3-28-1912	H. N. Lungwitz	5.85	460
3-28-1912	H. N. Lungwitz	6.10	545
3-29-1912	H. N. Lungwitz	4.94	670
3-29-1912	H. N. Lungwitz	6.94	1,250
3-30-1912	H. N. Lungwitz	5.77	554
3-30-1912	H. N. Lungwitz	5.63	503
3-31-1912	H. N. Lungwitz	5.08	370
4- 1-1912	H. N. Lungwitz	3.82	189
4- 1-1912	H. N. Lungwitz	3.77	155
4- 2-1912	H. N. Lungwitz	4.73	210
4- 3-1912	H. N. Lungwitz	4.15	157
4-15-1912	H. N. Lungwitz	4.65	150
4-16-1912	H. N. Lungwitz	3.90	163
4-17-1912	H. N. Lungwitz	3.57	121
4-18-1912	H. N. Lungwitz	4.07	134
7- 2-1912	E. F. Chandler	0.60	0.3
7- 4-1912	H. N. Lungwitz	3.72	90
7- 5-1912	H. N. Lungwitz	5.11	531
7- 5-1912	H. N. Lungwitz	4.82	460
7- 5-1912	H. N. Lungwitz	4.10	363
7- 6-1912	H. N. Lungwitz	2.98	203
7- 6-1912	H. N. Lungwitz	2.52	156
7- 7-1912	H. N. Lungwitz	3.48	101
7- 7-1912	H. N. Lungwitz	2.97	128
7- 8-1912	H. N. Lungwitz	1.82	128
7- 9-1912	H. N. Lungwitz	1.61	90
7-13-1912	H. N. Lungwitz	3.72	301
7-13-1912	H. N. Lungwitz	3.57	294
7-13-1912	H. N. Lungwitz	3.15	234

GRAND RIVER (NORTH BRANCH) AT HALEY, N. D.—Continued.

MONTHLY DISCHARGE OF GRAND RIVER (NORTH BRANCH) AT HALEY, N. D.

	Accuracy.	Maximum.	Minimum.	Mean.
1910—November	D	.....	.....	0.5
December	E	.....	.....	0.3
1911—March	D	.....	.....	2.5
April	D	.....	.....	3.3
May	D	.....	.....	3
June	D	.....	.....	3
July	D	.....	.....	0.6
August	C	.....	.....	0.2
September	C	.....	.....	0.2
October	C	.....	.....	0.2
November	D	.....	.....	0.2
1912—March	C	1,000	0	82
April	C	212	70	145
May	C	520	153	201
June	C	172	6	121
July	B	444	1	64
August	C	1	0.1	0.2
September	C	0.2	0.1	0.1
October	C	.....	.....	0.4

Maximum gage heights, 1.2 ft. April 1, 1911; 7.3 ft. March 29, 1912; 5.1 ft. May 8, 1912; 5.2 ft. July 5, 1912.

Minimum gage heights, 0.9 ft. Nov. 15, 1910; 0.6 ft. Sept. 1, 1911; 0.5 ft. Sept. 15, 1912.

CANNON BALL RIVER, NEAR STEVENSON, N. D.

The gaging station on the Cannon Ball river was first established June 10, 1903, near the post-office of Stevenson, which was at that time about thirty miles from the mouth of the river at a point four miles south of the present postoffice Timmer. The drainage area above this point is 3,650 square miles.

After having been discontinued for about two years, the station was re-established August 9, 1911, about a mile upstream from its original location. The datum of the new gage is so related to the datum of the original gage as to add approximately 10 feet to all gage readings. Thus a reading of 15 feet on the present gage indicates about the same height of water as a reading of five feet on the original gage.

The tables of discharge are based upon the measurements in the list below and thirty-three measurements made in previous years.

DISCHARGE MEASUREMENTS.

Date	Name of Hydrographer	Gage-height.	Discharge
3-23-1911	J. W. Bliss (old gage)	3.48	94
8- 9-1911	E. F. Chandler (old gage)	3.32	74
9- 5-1911	E. F. Chandler (new gage)	12.63	2
11- 3-1911	Geo. Ebner	12.71	2
4- 4-1912	Geo. Ebner	18.77	3,860
5- 4-1912	Geo. Ebner	13.85	126
7- 4-1912	E. F. Chandler	13.33	51
9- 2-1912	E. F. Chandler	13.06	21

MONTHLY DISCHARGE OF CANNON BALL RIVER NEAR STEVENSON, N. D.

	Accuracy.	Maximum.	Minimum.	Mean.
1911—August 9-31	B	137	3	25
September	B	09	1	10
October	B	34	2	5
November	D	3	1	2
December	E	.....	.....	2
1912—January	E	.....	.....	10
February	E	.....	.....	523
March	E	3,800	7	1,230
April	B	6,390	215	159
May	B	502	83	109
June	B	247	56	498
July	B	3,720	45	44
August	B	76	21	28
September	B	45	3	29
October	B	29	9	

Maximum gage-heights, 23.0 ft. March 28, 1912; 18.7 ft. July 9, 1912.
Minimum gage heights, 12.6 ft. Oct. 1, 1911; 12.9 ft. Sept. 10, 1912.

HEART RIVER NEAR RICHARDTON, N. D.

The gaging station on the Heart River was established May 18, 1903, and was located at the steel highway bridge ten miles south of Richardton. On September 4, 1911, it was transferred one mile down-stream, and the gage-datum was changed so as to add approximately 20 feet to all gage readings. Thus a reading of 25 feet on the present gage indicates about the same height of water as a reading of 5 feet at the original station. The drainage area above this point is 1250 square miles.

The tables of discharge are based on the measurements in the following list and on twenty-six measurements obtained in previous years.

HEART RIVER NEAR RICHARDTON, N. D.

DISCHARGE MEASUREMENTS.

Date	Name of Hydrographer	Gage-height	Discharge
4- 9-1911	J. W. Bliss Original	3.90	29
8-14-1911	E. F. Chandler Original	3.49	29
9- 4-1911	E. F. Chandler new	23.27	0.05
4- 6-1912	Geo. Ebner original	14.70	2,400
4- 8-1912	Geo. Ebner new	28.06	645
5- 5-1912	Geo. Ebner	25.45	74
5- 6-1912	Geo. Ebner	28.71	827
7- 7-19[illegible]	E. F. Chandler	24.32	33
8-31-1912	E. F. Chandler	24.22	23

MONTHLY DISCHARGE OF HEART RIVER NEAR RICHARDTON, N. D.

	Accuracy	Maximum	Minimum	Mean
1910—November	D	.....	.....	2.9
1911—March	D	210	.....	66
April	C	45	21	32
May	C	37	13	20
June	C	174	2	36
July	C	21	0	3
August	C	37	0	6
September	C	53	0	10
October	D	.....	3	7
November	E	.....	.....	4
December	E	.....	.....	3
1912—January	E	.....	.....	0.1
February	E	24	.....	4
March	D	4,560	2	503
April	C	4,050	125	1,170
May	B	2,650	42	377
June	B	424	26	127
July	B	2,360	24	263
August	A	210	19	35
September	A	29	19	20
October	B	22	15	19

Maximum gage-heights, 5.7 ft. March 19, 1911; 42.0 ft. (new gage) March 30, 1912; 34.5 ft. May 7, 1912; 33.4 ft. July 11, 1912.

Minimum gage-heights, 4.0 ft. Nov. 5, 1910; 3.3 ft. July 25, 1911; 24.1 ft. (new gage) August 12, 1912.

KNIFE RIVER NEAR BRONCHO, N. D.

The gaging station on the Knife River is north of Hebron, in section 4, Township 142 North, Range 90 West, being near Broncho post-office. A station was first established on the river in this immediate vicinity May 29, 1903. The drainage area above this point is 1,260 square miles.

The tables of discharge are based on the measurements in the following list and twenty-seven measurements made in previous years at the same point or nearby.

DISCHARGE MEASUREMENTS.

Date	Name of Hydrographer	Gage-height.	Discharge
4- 8-1912	J. W. Bliss	3.76	21
8-16-1911	E. F. Chandler	3.90	26
4- 7-1912	Geo. Ebner	11.10	1,050
7- 6-1912	E. F. Chandler	3.90	20

MONTHLY DISCHARGE OF KNIFE RIVER NEAR BRONCHO, N. D.

	Accuracy.	Maximum	Minimum.	Mean.
1910—November	D	.....	.....	12
1911—March	D	400	.....	80
April	C	70	18	35
May	B	32	4	12
June	B	641	10	92
July	B	82	2	10
August	C	166	4	46
September	B	282	7	61
October	B	32	7	12
November	D	.....	.....	8
December	E	.....	.....	5
1912—January	E	.....	.....	4
February	E	.....	.....	5
March	E	5,000	.....	397
April	C	3,560	40	1,160
May	B	2,920	40	571
June	B	298	27	70
July	B	356	4	69
August	B	78	13	30
September	B	40	13	19
October	B	57	22	28

Maximum gage-heights, 6.4 ft. March 22, 1911; 7.6 ft. June 5, 1911; 22.0 ft. March 30, 1912; 14.9 ft. May 6, 1912.

Minimum gage-heights, 3.6 ft. Nov. 6, 1910; 3.3 ft. July 21, 1911; 3.4 ft. July 2, 1912.

NORTH DAKOTA LIGNITE COAL MINES.

BY J. W. BLISS, Assistant.

Report for 1910—1912.

Since the legislature of 1907 enacted into law a provision making the state engineer ex-officio coal mine inspector, three biennial trips of inspection have been made, the first during the spring of 1908, the second during December 1909 and January 1910, and the third during February and March, 1912. In 1908 there were 65 coal mines in operation, in 1909, 103, in 1910, 84 and in 1911, 100. The annual production of lignite coal has been steadily increasing, as shown by the following comparative table, the data having been compiled under the direction of the state engineer.

In 1908 320,742 tons were mined.
In 1909 372,570 tons were mined
In 1910 416,580 tons were mined
In 1911 486,842 tons were mined

The rate of increase of each year over the previous one being respectively 14 per cent. 12 per cent and 17 per cent.

1910.

During the year 84 mines sent reports to this office. Of these 84 mines, two were in operation on state lands, one on government land, the remaining 81 being owned or leased by the operators. Eight were surface mines, the remaining 76 being underground mines.

Through the winter of 1910 an average of 865 men were employed, while 292 were kept on during the summer, the average being approximately 578. The average annual output per man employed was 721 tons. The average number of days worked was 182, making the average daily output per man employed practically four tons.

There were five non-fatal accidents during 1910, which makes the rate 0.86 per cent with reference to the average number employed, or one non-fatal accident to every 83,316 tons of coal mined. One miner was killed, making the rate 0.17 per cent, or one fatal accident per 416,580 tons of coal mined.

1911.

During 1911, 95 mines were inspected and five reported to the office. The mines reporting were the Government Mine at Williston, the Peerless Mine near Palermo, and the Anstadt, Flint and Nelson mines in Oliver County. The Government Mine was closed down at the time of inspection and the Peerless Mine was flooded with water. Of the 100 mines operating through 1911, 20 were surface and 80 underground mines. Two mines were open on State Land and four on Government land. the remaining 94 being owned or leased by the operator.

1098 men were employed during the winter, 323 through the summer, making the average number employed during the year 710. The average annual output per man employed was 680 tons . The average number of days worked being 179, the daily average output per man employed is 3.8 tons.

There were 18 non-fatal accidents, making the rate 2.53 per cent based on the average number employed, or one accident to every 27,053 tons of coal mined. One fatality occurred, the rate for 1911 being .14 per cent or one death to each 486,842 tons of coal produced.

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DIRECTORY OF NORTH DAKOTA COAL MINES

ADAMS COUNTY

	Name of Mine and Name of Owner	Lessee	Postoffice and Location
1.	Clermont Coal Mine, State Land	James Thies	Haynes, SW¼ NE¼ Sec. 16, T. 129, R. 94
2.	Farmers Coal Mine, Farmers' Cooperative Coal Mining Company	F. H. Due	Haynes, NW¼ SW¼ Sec. 9, T. 129, R. 94
3.	Haynes Coal Mine, Haynes Coal Mining Co.	J. W. Robinson	Haynes, NE¼ SE¼ Sec. 8, T. 129, R. 94
4.	Monroe & Knepper Coal Mine State Land	Erickson & Waggoner	Haynes, SE¼ SE¼ Sec. 16, T. 129, R. 94
5.	Stevenson & Gunderson Coal Mine, L. Stevenson, G. K. Gunderson	J. J. Redington	Haynes, NW¼ of Sec. 15, T 129, R. 94

BILLINGS COUNTY

6.	De Mores Coal Mine, De Mores Estate	H. C. Kinmarck 1910 J. Brady 1911	Medora, Lot 1, Sec. 26, T. 140, R. 102
7.	Jackson Coal Mine, Frisch Land Co.	O. Jackson	Bowman, NW¼ of Sec. 19, T. 133, R. 102

BOWMAN COUNTY

8.	Scranton Coal Mine, Consolidated Coal Co.		Scranton, SW¼ SW¼ Sec. 24, T. 131, R. 100

BURKE COUNTY

9.	Anderson Coal Mine, Nels Anderson		Stampede, NW¼ NW¼ Sec. 26, T. 162, R. 94
10.	Domrese Coal Mine, H. J. Demrese		Columbus, NW¼ NW¼ Sec. 24, T. 162, R. 94
11.	Fenster Coal Mine, Fenster Bros.		Larson, SE¼ NE¼ Sec. 7, T. 162, R. 94
12.	Gille Coal Mine, E. C. Gille		Columbus, E½ SE¼ Sec. 20, T. 162, R. 93
13.	Greenup Coal Mine, J. S. Greenup		Columbus, SE¼ SW¼ Sec. 7, T. 162, R. 93
14.	Hagen Coal Mine, E. L. Hagen		Larson, NW¼ of Sec. 7, T. 162, R. 94.
15.	Mackee Coal Mine, G. G. Kuffcorn		Columbus, NW¼ of Sec. 30, T. 162, R. 94
16.	Olson Coal Mine, Anders Olson		Larson, SW¼ of Sec. 14, T. 162, R. 94
17.	Vick Coal Mine, Herman Vick		Columbus, NE¼ SW¼ Sec. 19, T. 162, R. 93

BURLEIGH COUNTY

18.	Bachman Coal Mine, E. Bachman	Emil Bachman 1910 Victor Engstrom 1911	Wilton, SW¼ of Sec. 8, T. 142, R. 79.
19.	Coleman Coal Mine, Victor Coleman		Wilton, NW¼ of Sec. 18, T. 142, R. 78

20.	Eckman Coal Mine, Oscar Eckman	Oscar Eckman 1910 J. H. Daniels 1911	Wilton, SE¼ of Sec. 8, T. 142, R. 79
21.	Lind Coal Mine, Annie C. Lind		Wilton, NE¼ of Sec. 6, T. 142, R. 79
22.	Peterson Coal Mine, Chas. L. Peterson		Wilton, SW¼ of Sec. 9, T. 142, R. 79
23.	Johnson Coal Mine, A. M. Johnson		Wilton, SE¼ of Sec. 1, T. 142, R. 78
24.	Washburn Coal Mine, Washburn Lignite Coal Co.		Wilton, NE¼ of Sec. 1, T. 142, R. 80
	DIVIDE COUNTY		
25.	Evanson Coal Mine, Ed. Evanson		Noonan, NE¼ SE¼ Sec. 3, T. 162, R. 95
26.	Dougherty Coal Mine, C. Dougherty		Noonan, NE¼ NW¼ Sec. 10, T. 162, R. 95
27.	Noonan Coal Mine, P. F. Noonan		Noonan, SE¼ SE¼ Sec. 4, T. 162, R. 95
28.	Truax Coal Mine, E. W. Truax		Noonan, E. ½ NE¼ Sec. 10, T. 162, R. 95.
	GOLDEN VALLEY COUNTY		
29.	Corliss Coal Mine, I. J. Corliss		Beach, SW¼ of Sec. 25, T. 139, R. 105
30.	Porter Coal Mine, Wm. Porter		Beach, SW¼ of Sec. 22, T. 139, R. 105
31.	Rohl Coal Mine, Allen Rohr	Franzen & Brown	Sentinel Butte, Sec. 8, T. 139, R. 104
	McLEAN COUNTY		
32.	Bitumina Coal Mine, John Satterlund	Ed. Kugler	Washburn, SW¼ NW¼ Sec. 6, T. 144, R. 82
33.	Borchardt Coal Mine, E. G. Borchardt		Underwood, NE¼ of Sec. 5, T. 145, R. 82
34.	Hansen Coal Mine, P. I. Hansen	J. T. Hansen	Underwood, E½ W½ Sec. 18, T. 146, R. 81
35.	H. H. Hansen Coal Mine, H. H. Hansen	C. Mintz & J. Mintz	Turtle Lake, SE¼ of Sec. 34, T. 147, R. 81
36.	Quisel Coal Mine, C. K. Quisel	G. Burns	Underwood, NE¼ of Sec. 34, T. 146, R. 82
37.	Youngquist Coal Mine, Youngquist Estate	Youngquist & Phister	Washburn, SE¼ of Sec. 10, T. 144, R. 83
	MORTON COUNTY		
38.	Feland Coal Mine, Theodore Feland		Sims, SW¼ of Sec. 13, T. 138, R. 86
39.	Hebron Brick Co. Coal Mine, Hebron Fire and Pressed Brick Co.		Hebron, Sec. 11, T. 140, R. 90
40.	New Salem Coal Mine, Dakota Coal Products Co.	H. T. Wadeson 1910	New Salem,
41.	North Star Coal Mine, Haven & Murray	Joe Bellage 1911	Hebron, SW¼ of Sec. 3, T. 140, R. 90.

DIRECTORY OF NORTH DAKOTA COAL MINES

MOUNTRAIL COUNTY

Name of Mine Owner	Lesee	Postoffce Location
42. Blickre Coal Mine, Government	A. B. Blickre	White Earth SW¼ NW¼ Sec. 30, T. 158, R. 93
43. Bowman Coal Mine, C. H. Bowman		Epworth, SW¼ of Sec. 18, T. 153, R. 89
44. Common Coal Mine, Government		White Earth, NW¼ SE¼ Sec. 23, T. 156, R. 94
45. Elgers Coal Mine, Fred Elgers	B. A. Blake	Stanley, Sec. 13, T. 151, R. 92
46. Hardman Coal Mine, W. F. Hardman		Stanley, NE¼ NE¼ Sec. 13, T. 155, R. 92
47. Hefte Coal Mine, Ole Hefte		White Earth, SW¼ of Sec. 8, T. 157, R. 93
48. Hoeppe Coal Mine, Henry Hoeppe		Epworth, SE¼ of Sec. 21, T. 153, R. 90
49. Moore Coal Mine, Government	Tom Moore	White Earth, SW¼ NE¼ Sec. 12, T. 157, R. 94.
50. North Star Coal Mine, Albert Roseno		Epworth NE¼ of Sec. 26, T. 155, R. 90
51. Palda Coal Mine, G. S. Rogers		Palermo, SE¼ SW¼ Sec. 5, T. 131, R. 89
52. Peerless Coal Mine, Government	Fred Zamer	Palermo, NW¼ NE¼ Sec. 4, T. 154, R. 89
53. Sellar Coal Mine, W. L. Sellars		Epworth, NE¼ SE¼ Sec. 17, T. 153, R. 89
54. Setra Coal Mine, C. A. Setra		Epworth, SW¼ of Sec. 17, T. 153, R. 89
55. White Earth Coal Mine, Corkhill Fergeson Co. Rochester, N. Y.		White Earth, NW¼ NW¼ Sec. 15, T. 156, R. 94

OLIVER COUNTY

56. Anstadt Coal Mine, N. D. Ganten	John Anstadt	Center,
57. Flint Coal Mine, Henregetta Flint		Hannover, SE¼ of Sec. 9, T, 142, R. 85
58. Nelson Coal Mine, N. O. Nelson		Center, SW¼ of Sec. 12, T. 141, R. 84

RENVILLE COUNTY

59. Jewell Coal Mine, Gus Wahr	St. John & Bailey	Donnybrook, NW¼ SW¼ Sec. 29, T. 158, R. 86
60. Tehelka Coal Mine, Peter Tehelka		Carpio, SW¼ NE¼ Sec. 33, T. 155, R. 86

STARK COUNTY

61. Lehigh Coal Mine, Consolidated Coal Co.		Dickinson, SW¼ of Sec. 8, T. 139, R. 95
62. Pelton Coal Mine, Mrs. M. McGilory	A. H. Pelton	Dickinson, NW¼ of Sec. 8, T. 139, R. 95
63. Zenith Coal Mine, Zenith Coal Co.		Zenith, SW¼ of Sec. 6, T. 139, R. 98

WARD COUNTY

64.	Baden Coal Mine, Alfred Christianson, Chris Hansen		Baden, NW¼ SE¼ Sec. 26, T. 159, R. 88
65.	Bertelson Coal Mine, J. H. Mott		Kenmare, SE¼ of Sec. 29, T. 161, R. 88
66.	Colton Coal Mine, L. D. Colton		Burlington, SE¼ of Sec. 12, T. 155, R. 84
67.	Conan Coal Mine, D. Conan	Thomas Hill	Burlington, Sec. 18, T. 155, R. 83
68.	Crosby Coal Mine John Crosby		Kenmare, NW¼ SE¼ Sec. 30, T. 161, R. 88
69.	Davis Coal Mine, Davis Coal Co.		Burlington, NE¼ SW¼ Sec. 12, T. 155, R. 84
70.	Des Lacs Coal Mine, Joe Allen		Foxholm, SE¼ of Sec. 2, T. 156, R. 85
71.	Diamond Coal Mine, H. N. Creck	Mellow & Gunderson	Kenmare, Lot 1, Sec. 9, T. 160, R. 88
72.	Farmers Lignite Coal Mine, Farmers' Lignite Coal and Transportation Co.		Bowbells, SW¼ SE¼ Sec. 20, T. 161, R. 88
73.	Forsythe Coal Mine, P. N. Forsythe	Stewart & Peterson Bros.	Burlington, Lots 3 and 4, Sec. 5, T. 155, R. 84
74.	Hart Coal Mine, Harry Hart Estate	H. W. Jebb	Kenmare, Lot 3, Sec. 20, T. 160, R. 88
75.	Hodson Coal Mine, Steve Hodson		Baden,
76.	Hunewell Coal Mine, R. J. Hunewell		Burlington, NW¼ Sec. 13, T. 155, R. 83
77.	Ingeson Coal Mine, J. W. Ingeson		Kenmare, Lot 3, Sec. 30, T. 161, R. 88
78.	Kenmare Brick & Coal Company Mine, Kenmare Brick & Coal Company	R. J. Lewis, Mgr.	Kenmare, Sec. 8, T. 159, R. 88
79.	Knorr Coal Mine, G. J. Knorr		Sawyer, NE¼ Sec. 30, T. 152, R. 88
80.	Leeson Coal Mine No. 1, J. J. Leeson		Velva, SE ¼ SW¼ Sec. 28, T. 152, R. 81
81.	Leeson Coal Mine No. 2, J. J. Leeson		Velva, NE¼ NW¼ Sec. 19, T. 152, R. 81
82.	Lloyd Coal Mine, D. J. Lloyd Coal Co.		Burlington, SE¼ SE¼ Sec. 31, T. 156, R. 84
83.	McClure Coal Mine, McClure Coal Co.		Tasker, NE¼ SE¼ Sec. 19, T. 156, R. 84
84.	Murray Coal Mine, W. D. Coflisch		Sawyer, NE¼ SE¼ Sec. 29, T. 152, R. 81
85.	Scotty Coal Mine, Andrew Barrie		Burlington, SE¼ SE¼ Sec. 1, T. 155, R. 84
86.	Smith Dry Coal Co., National Briquetting	M. E. Williams	Kenmare, Lot 1, Sec. 7, T. 160, R. 83
87.	Spencer Coal Mine, Wm. Spencer		Donnybrook, Sec. 31, T. 159, R. 87.
88.	Strong Coal Mine, A. W. Ditmer	Joe Strong	Velva, NW¼ of Sec. 27, T. 152, R. 81
89.	Tree-Bosch Coal Mine, Tree & Bosch	Geo. Tuman	Velva, SE¼ of Sec. 30, T. 152, R. 81
90.	Vadneis Coal Mine, Wm. Vadneis	Tom Reynolds	Kenmare, SE¼ SE¼ Sec. 29, T. 160, R. 88
91.	Wallace Coal Mine, Davis Coal Co.	J. S. Wallace	Burlington, SE¼ SE¼ Sec. 2, T. 155, R. 84
92.	Westergaard Coal Mine, O. K. Westergaard		Kenmare, NE¼ NW¼ Sec. 32, T. 161, R. 88

WILLIAMS COUNTY

93.	Black Diamond Coal Mine, J. W. Jackson		Williston, SW NE Sec. 33, T. 152, R. 100
94.	Brown Coal Mine, J. T. Brown		Williston, NW¼ SE¼ Sec. 7, T. 154, R. 100
95.	Government Coal Mine, Williston Irrigation Project		Williston, SE¼ NE¼ Sec. 7, T. 154, R. 100
96.	Head Coal Mine, P. G. Head		Williston, NE¼ SE¼ Sec. 7, T. 154, R. 101
97.	Low Level Coal Mine, John Kruegger		Avoca, SW¼ of Sec. 3, T. 154, R. 100
98.	Miller Coal Mine, O. C. Miller		Williston, E½ NW¼ Sec. 24, T. 156, R. 101
99.	Moorman Coal Mine, J. Moorman		Williston, SW¼ NW¼ Sec. 29, T. 155, R. 97
100.	Sharpe Coal Mine, E. A. Sharpe		Williston, Sec. 16, T. 154, R. 100
101.	Williston Lignite Coal Mine, Ray Powell		Williston, NE¼ SE¼ Sec. 33, T. 154, R. 100

TABLE No. 1

Name of Mine and Superintendent	Kind of Opening	Method of Ventilation	Date of Inspection
ADAMS COUNTY			
1. Clermont Coal Mine, Lessee	Slope	Air Shaft	3-24-1912
2. Farmers Coal Mine, Lessee	Slope	Air Shaft	3-24-1912
3. Haynes Coal Mine, Lessee	Slope	Air Shaft	3-24-1912
4. Monroe & Knepper Coal Mine, Lessee	Slope	Air Shaft	3-24-1912
5. Stevenson & Gunderson Coal Mine, Lessee	Slope	Air Shaft	3-24-1912
BILLINGS COUNTY			
6. De Mores Coal Mine, Lessee	Drift		3-28-1912
7. Jackson Coal Mine, Lessee	Strip pit		3-26-1912
BOWMAN COUNTY			
8. Scranton Coal Mine, A. J. Gray	Slope	Air Shaft	3-25-1912
BURKE COUNTY			
9. Anderson Coal Mine, Owner	Strip pit		Reported
10. Domrese Coal Mine, Owner	Strip pit		3- 2-1912
11. Fenster Coal Mine, Owner	Slope	Air Shaft	3- 1-1912
12. Gille Coal Mine, Owner	Strip pit		3- 2-1912
13. Greenup Coal Mine, Owner	Strip pit		3- 2-1912
14. Hagen Coal Mine, Owner	Drift	None	3- 1-1912
15. Mackee Coal Mine, Owner	Drift	Air Shaft	3- 2-1912
16. Olson Coal Mine, Owner	Strip pit		3- 2-1912
17. Vick Coal Mine, Owner	Strip pit		3- 2-1912
BURLEIGH COUNTY			
18. Bachman Coal Mine, Lessee	Slope	Air Shaft	3-11-1912
19. Coleman Coal Mine, Owner	Slope	Air Shaft	3-11-1912
20. Eckman Coal Mine, Lessee	Slope	Air Shaft	3-11-1912
21. Lind Coal Mine, Owner	Slope	Air Shaft	3-12-1912

22. Peterson Coal Mine, Owner	Slope	Air Shaft & Furnace	3-12-1912
23. Johnson Coal Mine, Owner	Slope	Air Shaft	3-11-1912
24. Washburn Coal Mine, P. J. Cahill	Shaft	Air Shaft and Fan	3-12-1912
DIVIDE COUNTY			
25. Evanson Coal Mine, Owner	Slope	Air Shaft	3- 1-1912
26. Dougherty Coal Mine, H. Curley	Slope	Air Shaft	3- 1-1912
27. Noonan Coal Mine, L. H. Buckland	Shaft and Drift	Air Shaft	3- 1-1912
28. Truax Coal Mine, Geo. Aiken	Slope	Air Shaft	3- 1-1912
GOLDEN VALLEY COUNTY			
29. Corliss Coal Mine, Owner	Strip pit		3-23-1912
30. Porter Coal Mine, Owner	Strip pit		3-23-1912
31. Rohl Coal Mine, Lessee	Drift	None	3-23-1912
McLEAN COUNTY			
32. Bitumina Coal Mine, Lessee	Drift	Air Shaft	3-10-1912
33. Borchardt Coal Mine, Owner	Shaft	Air Shaft and Furnace	3-10-1912
34. Hansen Coal Mine, Lessee	Drift	Air Shaft	3- 8-1912
35. H. H. Hansen Coal Mine, Lessee	Shaft	Air Shaft	3- 8-1912
36. Quisel Coal Mine, Lessee	Shaft	Air Shaft	3-10-1912
37. Youngquist Coal Mine, Lessee	Drift	Air Shaft	3-10-1912
MORTON COUNTY			
38. Feland Coal Mine, Owner	Drift	Air Shaft	3-30-1912
39. Hebron Brick Co. Coal Mine, Frank Bimeck	Drift	Air Shaft	3-29-1912
40. New Salem Coal Mine, Alfred Alffleck	Shaft and Slope	Air Shaft and Fan	3-30-1912
41. North Star Coal Mine, Lessee	Drift	Air Shaft	3-29-1912
MOUNTRAIL COUNTY			
42. Blickre Coal Mine, Lessee	Strip pit		2-26-1912
43. Bowman Coal Mine, L. S. Landacre	Shaft	Air Shaft	2-28-1912
44. Common Coal Mine, J. Altenthaler	Strip pit		2-26-1912
45. Elgers Coal Mine, Lessee	Drift	None	2-27-1912

TABLE NO. 1

MOUNTRAIL COUNTY

Name of Mine and Superintendent	Kind of Opening	Method of Ventilation	Date of Inspection
46. Hardman Coal Mine, Owner	Drift	None	2-27-1912
47. Hefte Coal Mine, Owner	Strip pit		2-26-1912
48. Hoeppe Coal Mine, Owner	Strip pit		2-27-1912
49. Moore Coal Mine, Lessee	Drift	None	2-26-1912
50. North Star Coal Mine, Owner	Strip pit		2-27-1912
51. Palda Coal Mine, Owner	Drift	Air Shaft	2-28-1912
52. Peerless Coal Mine, Lessee	Drift	Air Shaft	Reported 2-28-1912
53. Sellar Coal Mine, Owner	Drift	Air Shaft	2-28-1912
54. Setra Coal Mine, Owner	Strip pit		2-28-1912
55. White Earth Coal Mine, Sam Kay	Drift	Air Shaft	2-26-1912
OLIVER COUNTY			
56. Anstedt Coal Mine, Owner	Strip pit		Reported 4-16-1912
57. Flint Coal Mine, Owner	Strip pit		Reported 4-16-1912
58. Nelson Coal Mine, Owner	Strip pit		Reported 4-16-1912
RENVILLE COUNTY			
59. Jewell Coal Mine, Lessee	Slope	Air Shaft	3-5 -1912
60. Tehelka Coal Mine, Owner	Slope	Air Shaft	3-5 -1912
STARK COUNTY			
61. Lehigh Coal Mine, Jim Brady 1910, Ed. Ebough 1911	Drift	Air Shaft and Fan	3-28-1912
62. Pelton Coal Mine, Lessee	Slope	Air Shaft	3-28-1912
63. Zenith Coal Mine, Henry Truelson	Slope	Air Shaft	3-28-1912
WARD COUNTY			
64. Baden Coal Mine, Owners	Drift	Air Shaft	3- 4-1912
65. Bertelson Coal Mine, Owner	Drift and Shaft	Air Shaft	3- 3-1912
66. Colton Coal Mine, Owner	Shaft	Air Shaft	3- 6-1912
67. Conan Coal Mine, Lessee	Drift	Air Shaft	3- 6-1912
68. Crosby Coal Mine, Owner	Drift	Air Shaft	3- 3-1912

69.	Davis Coal Mine, W. A. Wiesnoff	Slope	Air Shaft & Furnace		3- 6-1912
70.	Des Lacs Coal Mine, Owner	Slope	Air Shaft		3- 5-1912
71.	Diamond Coal Mine, Lessee	Drift	Air Shaft		3- 4-1912
72.	Farmers Lignite Coal Mine, O. r. Hansen	Drift	Air Shaft	Reported	5-18-1912
73.	Forsythe Coal Mine, Lessee	Slope	Air Shaft	Inspected	3-3- 1912
74.	Hart Coal Mine, Lessee	Drift	Air Shaft		3- 6-1912
75.	Hodson Coal Mine, Owner	Slope	Air Shaft		3- 4-1912
76.	Hunewell Coal Mine, Owner	Drift	Air Shaft		3- 4-1912
77.	Ingeson Coal Mine, Owner	Drift	Air Shaft		3- 6-1912
78.	Kenmare Brick & Coal Co. Mine, J. B. Foster	Drift	Air Shaft		3- 3-1912
79.	Knorr Coal Mine, Owner	Drift	Air Shaft		3- 4-1912
80.	Leeson Coal Mine No. 1, N. R. Nichols	Strip pit			3- 7-1912
81.	Leeson Coal Mine No. 2, Owner	Drift			3- 7-1912
82.	Lloyd Coal Mine, Hadley Gray	Slope	Air Shaft		3- 7-1912
83.	McClure Coal Mine, Mark Hendrick	Drift	Air Shaft		3- 6-1912
84.	Murray Coal Mine, Owner	Drift	Air Shaft		3- 6-1912
85.	Scotty Coal Mine, Owner	Shaft	Air Shaft		3- 7-1912
86.	Smith Dry Coal Mine, John Smith	Slope	Air Shaft		3- 6-1912
87.	Spencer Coal Mine, Owner	Drift	Air Shaft		3- 3-1912
88.	Strong Coal Mine, Lessee	Strip pit			3- 4-1912
89.	Tree-Bosch Coal Mine, Lessee	Strip pit			3- 7-1912
90.	Vandeis Coal Mine, Lessee	Drift	Air Shaft		3- 7-1912
91.	Wallace Coal Mine, Lessee	Drift	Air Shaft		3- 4-1912
92.	Westergaard Coal Mine, Owner	Shaft	Air Shart		3- 3-1912

WILLIAMS COUNTY

93.	Black Diamond Coal Mine, Aleck Thompson	Drift	Air Shaft		2-22-1912
94.	Brown Coal Mine, Eric Larson	Drift	Air Shaft		2-24-1912
95.	Government Coal Mine, Project Engineer	Drift	Air Shaft	Reported	4-10-1912
96.	Head Coal Mine, Owner	Drift	Air Shaft		2-23-1912
97.	Low Level Coal Mine, George Cox	Slope	Air Shaft		2-23-1912
98.	Miller Coal Mine, Owner	Drift	None		2-24-1912
99.	Moorman Coal Mine, Owner	Drift	None		2-25-1912
100.	Sharpe Coal Mine, Pete Anderson	Slope	None		2-23-1912
101.	Williston Lignite Coal Mine, Matt Grev	Drift	Air Shaft		2-22-1912

TABLE NO. 2

Name of Mine	1910 No. of days operated	1910 No. of men in winter	1910 No. of men in summer	1911 No. of days operated	1911 No. of men in winter	1911 No. of men in summer	Wages for 1910 and 1911 Day Wages	Price paid per ton in entry	Price paid per ton in room
ADAMS COUNTY									
1. Clermont Coal Mine	150	4	1	150	6	1	.....	$ .75	$ .55
2. Farmers Coal Mine	220	3	1	250	3	1	.....	.75	.50
3. Haynes Coal Mine	250	4	2	250	4	1	.....	.50	.50
4. Monroe & Knepper Coal Mine	250	4	.....	280	4	.....	.....	.50	.50
5. Stevenson & Gunderson Coal Mine	.....	.....	.....	280	4	1	.....	.60	.60
BILLINGS COUNTY									
6. DeMores Coal Mine	120	2	.....	120	2	.....	.....	.60	.60
7. Jackson Coal Mine	120	2	.....	120	2	.....	1.50	.....	.....
BOWMAN COUNTY									
8. Scranton Coal Mine	300	30	8	300	32	6	1.50	.50	.50
BURKE COUNTY									
9. Anderson Coal Mine	200	3	2	.....	.....	.....	1.50	.....	.....
10. Domrese Coal Mine	250	4	2	250	4	2	1.50	.....	.....
11. Fenster Coal Mine	150	3	1	150	3	.....	1.50	.....	.....
12. Gille Coal Mine	150	6	1	150	6	2	1.50	.....	.....
13. Greenup Coal Mine	280	4	1	200	4	1	1.50	.....	.....
14. Hagen Coal Mine	.....	.....	.....	100	2	.....	.....	.80	.80
15. Mackee Coal Mine	150	6	1	100	3	1	.....	1.00	.75
16. Olson Coal Mine	.....	.....	.....	80	3—4	2	1.75	.....	.....
17. Vick Coal Mine	150	3	.....	150	3	.....	1.50	.....	.....

BURLEIGH COUNTY									
18. Bachman Coal Mine	120	2	.....	120	2	.....	.....	1.00	.75
19. Coleman Coal Mine	100	2	.....	100	2	.....	.....	1.00	.75
20. Eckman Coal Mine	250	4	2	250	4	2	.....	1.00	.75
21. Lind Coal Mine	300	6	1	300	6	1	.....	1.00	.75
22. Peterson Coal Mine	250	4	1	250	4	1	1.50	1.00	.80
23. Johnson Coal Mine	75	2	.....	75	2	.....	.....	1.00	.75
24. Washburn Mine	313	250	100	313	300	100	.....	*	.....
DIVIDE COUNTY									
25. Evanson Coal Mine	120	12	2	250	15	2	1.25	1.15	.70
26. Dougherty Coal Mine	300	10	4	300	32	4	1.25	1.00	.70
27. Noonan Coal Mine	280	16	.....	280	19	.....	.....	1.00	.70
28. Truax Coal Mine	300	25	3—4	300	50	7—8	1.35	1.00	.70
GOLDEN VALLEY COUNTY									
29. Corliss Coal Mine	120	2	.....	150	3	.....	1.50	.....	.....
30. Porter Coal Mine	.....	.....	.....	100	2	.....	1.50	.....	.....
31. Rohl Coal Mine	.....	.....	.....	60	2	.....	1.50	.....	.....
McLEAN COUNTY									
32. Bitumina Coal Mine	300	4	2	300	6	2	.....	.60	.50
33. Borchardt Coal Mine	.....	.....	.....	150	2	.....	.....	.75	.50
34. Hansen Coal Mine	.....	.....	.....	100	7	.....	.....	.60	.60
35. H. H. Hansen Coal Mine	.....	.....	.....	100	4	.....	.....	.80	.60
36. Quisel Coal Mine	90	2	1	130	3	1	1.50	.75	.60
37. Youngquist Coal Mine	100	3	.....	120	3	.....	.....	.75	.50
MORTON COUNTY									
38. Feland Coal Mine	150	4	.....	150	4	.....	.....	.90	.75
39. Hebron Brick Co. Coal Mine	250	8	6	250	8	6	3.50	.....	.75
40. New Salem Coal Mine	90	20	7	250	55	17	.....	1.00	.75
41. North Star Coal Mine	120	3	.....	150	3	2	.....	1.00	.60

*See Individual Description.

TABLE NO. 3—Continued.

Name of Mine	1910 No. of days operated.	1910 No. of men in winter	1910 No. of men in summer	1911 No. of days operated	1911 No. of men in winter	1911 No. of men in summer	Wages for 1910 and 1911 Day Wages	Price paid per ton in entry	Price paid per ton in room
MOUNTRAIL COUNTY									
42. Blickre Coal Mine	150	3	.....	150	3	.....	.....	1.50	.....
43. Bowman Coal Mine	200	3	.....	200	3	.....	1.00	.90	.80
44. Common Coal Mine	.....	.....	.....	50	1	.....	1.50	.....	.....
45. Elgers Coal Mine	.....	.....	.....	100	3	.....	.....	1.00	.75
46. Hardman Coal Mine	150	2	.....	150	2	.....	2.00	.....	.....
47. Hefte Coal Mine	.....	.....	.....	60	4	.....	1.50	.....	.....
48. Hoeppe Coal Mine	100	1	.....	80	1	.....	1.00	.....	.....
49. Moore Coal Mine	.....	.....	.....	60	2	.....	.....	1.00	.80
50. North Star Coal Mine	300	5	.....	100	1	.....	1.50	.....	.....
51. Paida Coal Mine	300	5	1	300	5	1	1.50	1.00	.80
52. Peerless Coal Mine	150	4	.....	150	4	.....	1.50	1.00	.80
53. Sellar Coal Mine	30	2	.....	60	2	.....	.....	1.00	1.00
54. Setra Coal Mine	50	2	.....	50	2	.....	1.00	.....	.....
55. White Earth Coal Mine	150	6	3	150	7	.....	1.50	.90	.70
OLIVER COUNTY									
56. Anstadt Coal Mine	30	1	.....	30	1	.....	1.50	.....	.....
57. Flint Coal Mine	50	1	.....	50	1	.....	1.50	.....	.....
58. Nelson Coal Mine	200	2	2	200	2	2	2.00	.....	.....
RENVILLE COUNTY									
59. Jewell Coal Mine	90	3	.....	90	4	.....	.....	1.00	1.00
60. Tehelka Coal Mine	150	2	.....	280	2	.....	.....	1.00	1.00
STARK COUNTY									
61. Lehigh Coal Mine	300	60	20	300	60	20	.....	.47	.42
62. Pelton Coal Mine	.....	.....	.....	100	8	2	.....	**3.75	.60
63. Zenith Coal Mine	280	15	10	280	15	10	.....	.70	.60

**per day.

WARD COUNTY

64. Baden Coal Mine	150	6	.....	150	6	.....	.....	1.00	.75
65. Bertelson Coal Mine	300	8	3	240	11	2	1.75	1.00	.80
66. Colton Coal Mine	125	5	.....	125	5	.....	2.50	.95	.75
67. Conan Coal Mine	100	2	1	150	3	1	.....	1.00	.70
68. Crosby Coal Mine	200	6	2	180	6	2	.....	1.10	.70
69. Davis Coal Mine	250	20	6	250	12	6	2.50	.90	.70
70. Des Lacs Coal Mine	150	10	3	280	27	5	2.25	1.00	.80
71. Diamond Coal Mine	300	17	4	300	17	5	2.50	1.10	.90
72. Farmers Lignite Coal Mine	270	12	2	270	10	2	2.25	.90	.90
73. Forsythe Coal Mine	.....	.....	.....	250	6	2	2.50	1.00	.70
74. Hart Coal Mine	300	12	3	300	6	3	1.50	†1.30	.90
75. Hodson Coal Mine	.....	.....	.....	50	2	.....	1.50	.....	.90
76. Hunewell Coal Mine	250	4	1	250	4	1	2.50	1.00	.80
77. Ingeson Coal Mine	250	4	.....	200	2	.....	.....	1.00	1.00
78. Kenmare Brick & Coal Co. Mine	120	10	3	161	20	4	2.50	†1.25	.90
79. Knorr Coal Mine	150	2	.....	100	2	.....	.....	1.00	.75
80. Leeson Coal Mine No. 1	150	5	1	150	5	1	1.50	1.00	.70
81. Leeson Coal Mine No. 2	300	4	1	300	4	1	.....	.75	.75
82. Lloyd Coal Mine	250	20	5	250	20	5	3.00	.90	.70
83. McClure Coal Mine	300	39	15	300	41	19	.....	.70 †.40	.70
84. Murray Coal Mine	300	6	1—2	150	6	.....	1.50	1.00	.70
85. Scotty Coal Mine	150	2	.....	150	2	.....	.....	.....	.80
86. Smith Dry Coal Mine	300	24	10	300	30	12	.....	†1.25	.90
87. Spencer Coal Mine	100	3	.....	100	3	.....	1.50	1.00	.80
88. Strong Coal Mine	90	2	.....	90	2	.....	.....	.....	.70
89. Tree-Bosrh Coal Mine	.....	.....	.....	100	2	.....	1.50	.....	.....
90. Vadneis Coal Mine	100	3	.....	100	3	.....	1.25	†1.40	.90
91. Wallace Coal Mine	280	18	6	280	18	4	.....	.90	.70
92. Westergaard Coal Mine	50	1	.....	50	2	.....	1.50	.....	.....

WILLIAMS COUNTY

93. Black Diamond Coal Mine	250	7—8	4—5	250	6—7	3—4	.....	.90	.70
94. Brown Coal Mine	.....	.....	.....	10	4	1	2.25	1.00	.70
95. Government Coal Mine	100	1	20—35	100	1	20—40	.....	.70—.80	.60
96. Head Coal Mine	200	3—4	.....	200	5—6	.....	2.25	.90	.80
97. Low Level Coal Mine	300	25	4	300	24	6—10	3.00	.90	.70
98. Miller Coal Mine	90	3	.....	90	3	.....	1.50	.....	.....
99. Moorman Coal Mine	50	2	.....	40	2	.....	.....	1.00	1.00
100. Sharpe Coal Mine	150	3—5	.....	60	5—6	.....	.....	.....	1.00
101. Williston Lignite Coal Mine	300	6	2	300	12	3	1.75	.90	.70

*per foot.

TABLE NO. 3—ADAMS COUNTY

Name of Mine	Depth of Coal	Thickness of coal bed	Thickness of coal mined	System and Method of Mining	Explosive Used and Means of Ignition
1. Clermont Coal Mine	30	12	9	Single entry—Blast off solid	FFF—Squibs
2. Farmers Coal Mine	30	12	9	Single entry—Blast off solid	FFF—Squibs
3. Haynes Coal Mine	30	12	9	Single entry—Blast off solid	FFF—Fuse
4. Monroe & Knepper Coal Mine	40	12	9	Single entry—Blast off solid	FFF—Fuse
5. Stevenson & Gunderson Coal Mine	130	10—11	8	Single entry—Blast off solid	FFF—Squibs
BILLINGS COUNTY					
6. De Mores Coal Mine	300	10	8	Single entry—Blast off solid	Dynamite—Fuse
7. Jackson Coal Mine	4	7	7	Surface—Blast off solid	Dynamite—Fuse
BOWMAN COUNTY					
8. Scranton Coal Mine	40	19	10	Double entry—Blast off solid	Dynamite—Fuse
BURKE COUNTY					
9. Anderson Coal Mine	20	8	8	Surface—Blast off solid	Dynamite—Fuse
10. Domrese Coal Mine	8	9	9	Surface—Blast off solid	Dynamite—Fuse
11. Fenster Coal Mine	6	6	6	Surface & slope—Blast off solid	FFF—Fuse
12. Gille Coal Mine	8—25	9—11	9—11	Surface—Blast off solid	Dynamite—Fuse
13. Greenup Coal Mine	5—15	8	8	Surface—Blast off solid	Dynamite—Fuse
14. Hagen Coal Mine	20	5	5	Single entry—Hand mining	
15. Mackee Coal Mine	30	7—8	6	Double entry—Blast off solid	FFF—Fuse
16. Olson Coal Mine	10	8	8	Surface—Blast off solid	Dynamite—Fuse
17. Vien Coal Mine	6	6	6	Surface—Blast off solid	Dynamite—Fuse

BURLEIGH COUNTY					
18. Bachman Coal Mine	60	10	8	Single entry—Blast off solid	FFF—Fuse
19. Coleman Coal Mine	43	5	4	Single entry—Blast off solid	FFF—Fuse
20. Eckman Coal Mine	60	8—10	8	Single entry—Blast off solid	FFF—Squibs
21. Lind Coal Mine	45	13	8	Single entry—Blast off solid	FFF—Squibs
22. Peterson Coal Mine	50	10—11	8	Single entry—Blast off solid	FFF—Squibs
23. Johnson Coal Mine	40	4	4	Single entry—Blast off solid	FFF—Squibs
24. Washburn Coal Mine	50	11—16	7	Double entry—Under cutting	FFF—Squibs
DIVIDE COUNTY					
25. Evanson Coal Mine	25—30	7	5	Single entry—Blast off solid	FFF—Squibs
26. Dougherty Coal Mine	65	6—9	5	Single entry—Blast off solid	FFF—Squibs
27. Noonan Coal Mine	40	7½	5½	Single entry—Blast off solid	FFF—Squibs
28. Truax Coal Mine	40	7½	5½	Double entry—Blast off solid	FFF—Squibs
GOLDEN VALLEY COUNTY					
29. Corliss Coal Mine	14	12	8	Surface—Pick mining	
30. Porter Coal Mine	4	12	8	Surface—Blast off solid	FFF—Fuse
31. Rohl Coal Mine	200	12	8	Single entry—Blast off solid	FFF—Fuse
McLEAN COUNTY					
32. Bitumina Coal Mine	66	10	8	Double entry—Blast off solid	Dynamite—Fuse
33. Borchardt Coal Mine	37	12	8	Single entry—Blast off solid	Dynamite—Fuse
34. Hansen Coal Mine	100	10	7—8	Double entry—Blast off solid	Dynamite—Fuse
35. H. H. Hansen Coal Mine	40	7—8	6	Single entry—Pick mining	
36. Quisel Coal Mine	50	13	8	Single entry—Blast off solid	Dynamite—Fuse
37. Youngquist Coal Mine	70	11	7	Single entry—Blast off solid	FFF and Dynamite—Fuse
MORTON COUNTY					
38. Feland Coal Mine	35	6—7	6	Double entry—Blast off solid	FFF—Squibs
39. Hebron Brick Co., Coal Mine	80	6	6	Double entry—Blast off solid	FFF—Squibs
40. New Salem Coal Mine	40	5—6	5—6	Double entry—Blast off solid	Dynamite—Fuse
41. North Star Coal Mine	80	10	7	Single entry—Blast off solid	FFF—Fuse

MOUNTRAIL COUNTY

Name of Mine	Depth of Coal	Thickness of coal bed	Thickness of coal mined	System and Method of Mining	Explosive Used and Means of Ignition
42. Blickre Coal Mine	15	5	5	Surface—Pick mining	
43. Bowman Coal Mine	50	8	6	Single entry—Blast off solid	FFF—Squibs
44. Common Coal Mine	10	5	5	Surface—Pick mining	
45. Elgers Coal Mine	75	4	4	Single entry—Pick mining	
46. Hardman Coal Mine	75	3	3	Single entry—Pick mining	
47. Hefte Coal Mine	8	5	5	Surface—Pick mining	
48. Hoeppe Coal Mine	6—8	6	6	Surface—Pick mining	
49. Moore Coal Mine	120	5	5	Single entry—Blast off solid	FFF—Squibs
50. North Star Coal Mine	3—6	6	6	Surface—Pick mining	
51. Palda Coal Mine	35	7—8	5	Single entry—Blast off solid	FFF—Squibs
52. Peerless Coal Mine	35—40	7—8	5	Single entry—Blast off solid	FFF—Fuse
53. Sellar Coal Mine	40	4	4	Single entry—Blast off solid	FFF—Fuse
54. Setra Coal Mine	12	3	3	Surface—Pick mining	
55. White Earth Coal Mine	200	6—7	6—7	Double entry—Blast off solid	FFF—Squibs

OLIVER COUNTY

56. Anstadt Coal Mine	8—12	3—6	3—6	Surface—Pick mining	
57. Flint Coal Mine	10	3	3	Surface—Pick mining	
58. Nelson Coal Mine	8	3—7	3—7	Surface—Pick mining	

RENVILLE COUNTY

59. Jewell Coal Mine	100	3	3	Single entry—Pick mining	
60. Tehelka Coal Mine	90	2—3	2—3	Single entry—Pick mining	

STARK COUNTY

61. Lehigh Coal Mine	60—100	14	7—10	Double entry—Blast off solid	FFF—Squibs
62. Pelton Coal Mine	30	12	7—9	Single entry—Blast off solid	FFF—Squibs
63. Zenith Coal Mine	100	18	8—10	Double entry—Blast off solid	Dynamite—Fuse

WARD COUNTY

64.	Baden Coal Mine	100	2—3	2—3	Single entry—Pick mining	
65.	Bertelson Coal Mine	147	5—6	5—6	Double entry—Under mining	FFF—Squibs
66.	Colton Coal Mine	112	10—11	7—8	Double entry—Blast off solid	FFF—Squibs
67.	Conan Coal Mine	120	11	7—8	Single entry—Blast off solid	FFF—Squibs
68.	Crosby Coal Mine	120	5—6	5—6	Double entry—Min. seam at top	FFF—Squibs
69.	Davis Coal Mine	160	8—6	6	Double entry—Blast off solid	FFF—Squibs
70.	Des Lacs Coal Mine	200	10	7	Double entry—Blast off solid	FFF—Squibs
71.	Diamond Coal Mine	170	5	5	Double entry—Blast off solid	FFF—Squibs
72.	Farmers Lignite Coal Mine	125	5—6	5—6	Single entry—Pick mining	
73.	Forsythe Coal Mine	150	8	6—7	Double entry—Blast off solid	FFF—Squibs
74.	Hart Coal Mine	170	5—6	5—6	Double entry—Top mining	FFF—Squibs
75.	Hodson Coal Mine	100	3	3	Single entry—Pick mining	FFF—Squibs
76.	Hunewell Coal Mine	120	9	7	Double entry—Blast off solid	FFF—Squibs
77.	Ingeson Coal Mine	120	6	6	Double entry—Blast off solid	FFF—Squibs
78.	Kenmare Brick & Coal Co. Mine	125	3—5	3—5	Double entry—Under mining	FFF—Squibs
79.	Knorr Coal Mine	40—53	11	7	Single entry—Blast off solid	Dynamite—Fuse
80.	Leeson Coal Mine No. 1	44	10	7—8	Single entry—Blast off solid	Dynamite—Fuse
81.	Leeson Coal Mine No. 2	52	14	8	Single entry—Blast off solid	Dynamite—Fuse
82.	Lloyd Coal Mine	120	8	7	Double entry—Blast off solid	FFF—Squibs
83.	McClure Coal Mine	150	7—8	5—7	Double entry—Blast off solid	FFF—Squibs
84.	Murray Coal Mine	43	13	7	Single entry—Blast off solid	Dynamite—Fuse
85.	Scotty Coal Mine	32	10	7—8	Double entry—Blast off solid	Dynamite—Fuse
86.	Smith Dry Coal Mine	175	4—5	4—5	Double entry—Blast off solid	FFF—Squibs
87.	Spencer Coal Mine	120	3	3	Single entry—Pick mining	
88.	Strong Coal Mine	12—13	8	8	Surface—Pick mining	
89.	Treo-Bosch Coal Mine	10	12	6	Surface—Blast off solid	Dynamite—Fuse
90.	Vadneis Coal Mine	180	3	3	Single entry—Top mining	FFF—Squibs
91.	Wallace Coal Mine	80	10	7—8	Double entry—Blast off solid	FFF—Squibs
92.	Westergaard Coal Mine	100	5	5	Single entry—Top mining	FFF—Squibs

WILLIAMS COUNTY

93.	Black Diamond Coal Mine	110	10	7	Double entry—Blast off solid	FFF—Squibs
94.	Brown Coal Mine	100	9—10	7	Double entry—Blast off solid	FFF—Squibs
95.	Government Coal Mine	100	9	6	Double entry—Blast off solid	
96.	Head Coal Mine	35	9	7	Single entry—Blast off solid	FFF—Squibs
97.	Low Level Coal Mine	150	10	8	Double entry—Under cutting	Dynamite—Fuse
98.	Miller Coal Mine	125	9	7	Single entry—Pick mining	
99.	Moorman Coal Mine	200	10—11	6—7	Double entry—Blast off solid	FFF—Fuse
100.	Sharpe Coal Mine	100	8—9	8—9	Single entry—Blast off solid	FFF—Fuse
101.	Williston Lignite Coal Mine	80	9—10	6—7	Single entry—Blast off solid	FFF—Squibs

TABLE NO. 4—ADAMS COUNTY

Name of Mine	Main Entry				Rooms			
	Length	Width of top	Width at bottom	Depth	Length	Width	Depth	Width of pillar
1. Clermont Coal Mine	400	10	10	8	200	20	9	12
2. Farmers Coal Mine	350	8	8	8	150	20	9	14
3. Haynes Coal Mine	180	5	5	7	100	18	9	10
4. Monroe & Knepper Coal Mine	250	10	10	8	100	18	9	18
5. Stevenson & Gunderson Coal Mine	400	6	6	8	100	14	8	12
BILLINGS COUNTY								
6. De Mores Coal Mine	100	8	8	8	100	18	8	14
7. Jackson Coal Mine	.....	.....	.....	.....	.....	.....	.....	.....
BOWMAN COUNTY								
8. Scranton Coal Mine	500	8	8	10	300	30	10	10
BURKE COUNTY								
9. Anderson Coal Mine	.....	.....	.....	.....	.....	.....	.....	.....
10. Domrese Coal Mine	.....	.....	.....	.....	.....	.....	.....	.....
11. Fenster Coal Mine	100	6	7	5	100	14	5	8
12. Gille Coal Mine	.....	.....	.....	.....	100	18	8	10
13. Greenup Coal Mine	100	6	7	6	100	14	6	10
14. Hagen Coal Mine	50	3	5	4	100	12	5	20
15. Mackee Coal Mine	600	4	6	6	100	14	5	14
16. Olson Coal Mine	.....	.....	.....	.....	.....	.....	.....	.....
17. Vick Coal Mine	.....	.....	.....	.....	.....	.....	.....	.....

BURLEIGH COUNTY								
18. Bachman Coal Mine	150	8	8	7	120	18	8	16
19. Coleman Coal Mine	100	5	5	4	100	16	4	12
20. Eckman Coal Mine	1,500	10	10	7	100	18	8	8
21. Lind Coal Mine	400	8	8	7	100	14	8	12
22. Peterson Coal Mine	200	8	8	6	200	18	8	12
23. Johnson Coal Mine	100	5	5	4	100	14	4	9
24. Washburn Coal Mine	4,000	9	9	6—7	200	18	8	12
DIVIDE COUNTY								
25. Evanson Coal Mine	1,000	4	5	5	100	14	5	8
26. Dougherty Coal Mine	600	4	6	6	120	16	6	6
27. Noonan Coal Mine	800	4	6	5	100	12	6	18
28. Truax Coal Mine	1,500	4	6	6	125	14	6	6—8
GOLDEN VALLEY COUNTY								
29. Corliss Coal Mine	.....	.....	.....	.....	.....	.....	.....	.....
30. Porter Coal Mine	.....	.....	.....	.....	.....	.....	.....	.....
31. Rohl Coal Mine	.....	.....	.....	.....	.....	.....	.....	.....
McLEAN COUNTY								
32. Bitumina Coal Mine	400	4	8	7	300	22	8	12
33. Borchardt Coal Mine	100	4	6	8	150	12	8	8
34. Hansen Coal Mine	300	6	8	8	150	12	8	20
35. H. H. Hansen Coal Mine	40	6	6	6	70	12	6	12
36. Quisel Coal Mine	180	5	8	7—8	125	20	7—8	10
37. Youngquist Coal Mine	150	7	7	5—6	125	18	7	10
38. Feland Coal Mine	3,000	4	6	6	100	16	6	20
39. Hebron Brick Co. Coal Mine	800	6	8	6	100	20	6	10
40. New Salem Coal Mine	200	8	8	5—6	125	16	5—6	14
41. North Star Coal Mine	150	6	6	6	100	14	6	14

Name of Mine	Main Entry				Rooms			
	Length	Width of top	Width at bottom	Depth	Length	Width	Depth	Width of pillar
MOUNTRAIL COUNTY								
42. Blickre Coal Mine	.....	.....	.....	.....	.....	.....	.....	.....
43. Bowman Coal Mine	100	5	7	5	100	16	6	10
44. Common Coal Mine	.....	.....	.....	.....	.....	.....	.....	.....
45. Elgers Coal Mine	80	5	5	4	80	12	4	12
46. Hardman Coal Mine	80	5	5	4	60	12	3	12
47. Hefte Coal Mine	.....	.....	.....	.....	.....	.....	.....	.....
48. Hoeppe Coal Mine	.....	.....	.....	.....	.....	.....	.....	.....
49. Moore Coal Mine	60	5	5	5	50	10	5	10
50. North Star Coal Mine	.....	.....	.....	.....	.....	.....	.....	.....
51. Palda Coal Mine	600	4	5	5	120	14	5	18
52. Peerless Coal Mine	400	4	5	5	120	14	5	8
53. Sellar Coal Mine	120	4	5	4	120	14	4	8
54. Setra Coal Mine	.....	.....	.....	.....	.....	.....	.....	.....
55. White Earth Coal Mine	650	8	8	6	200	20	6	20
OLIVER COUNTY								
56. Anstadt Coal Mine	.....	.....	.....	.....	.....	.....	.....	.....
57. Flint Coal Mine	.....	.....	.....	.....	.....	.....	.....	.....
58. Nelson Coal Mine	.....	.....	.....	.....	.....	.....	.....	.....
RENVILLE COUNTY								
59. Jewell Coal Mine	150	5	5	5	100	16	2—3	12
60. Tehelka Coal Mine	200	4—5	4—5	4—5	100	12	2—3	25
STARK COUNTY								
61. Lehigh Coal Mine	4,000	8	10	8	150	24	7—10	18
62. Pelton Coal Mine	400	6	6	8	50	20	8	20
63. Zenith Coal Mine	600	8	10	8	100	20	10	8

WARD COUNTY

64. Baden Coal Mine	300	4	6	5—6	50	6	3	6
65. Bertelson Coal Mine	700	5	5	5	110	14	5	7
66. Colton Coal Mine	540	8	8	6	115	15	8	7
67. Conan Coal Mine	500	7	7	7	100	14	7	25
68. Crosby Coal Mine	800	6	6	5—6	300	15	6	15
69. Davis Coal Mine	600	6	6	6	120	16	6	14
70. Des Lacs Coal Mine	600	7	7	6	100	20	7	14
71. Diamond Coal Mine	1,400	7	7	5	115	15	5	10
72. Farmers Lignite Coal Mine	675	4	4	5—6	100	10	5—6	6—8
73. Forsythe Coal Mine	250	5—6	5—6	6	125	12	6—7	25
74. Hart Coal Mine	3,000	7	7	5—6	125	14	5—6	12
75. Hodson Coal Mine	120	4	4	4	50	8	3	10
76. Hunewell Coal Mine	1,000	6	6	6	100	16	7	12
77. Ingeson Coal Mine	1,000	4	6	6	110	14	5	7
78. Kenmare Brick & Coal Co. Mine	1,700	6	6	6	200	14	3	14
79. Knorr Coal Mine	175	7	7	7	100	16	7	7
80. Leeson Coal Mine No. 1	200	8	8	6—7	100	15	7	12
81. Leeson Coal Mine No. 2	250	8	10	6—7	100	20	8	10
82. Lloyd Coal Mine	1,500	7	8	6	120	12	7	16
83. McClure Coal Mine	5,000	6	6	6	100	16	6	16
84. Murray Coal Mine	800	7	8	6—7	110	16	7	8
85. Scotty Coal Mine	200	8	8	7	100	16	8	12
86. Smith Dry Coal Mine	540	8	8	5	100	14	5	14
87. Spencer Coal Mine	100	4	4	3	50	8	3	10
88. Strong Coal Mine	.....	.....	.....	.....	.....	.....	.....	.....
89. Tree-Bosch Coal Mine	.....	.....	.....	.....	.....	.....	.....	.....
90. Vadneis Coal Mine	75	6	6	5	125	20	3	15
91. Wallace Coal Mine	400	7	7	6	125	20	8	14
92. Westergaard Coal Mine	100	5	5	5	100	16	5	10

WILLIAMS COUNTY

93. Black Diamond Coal Mine	1,000	5	8	6	250	20	6	16
94. Brown Coal Mine	250	7	7	7	100	12	7	18
95. Government Coal Mine	.....	.....	.....	.....	.....	.....	.....	.....
96. Head Coal Mine	350	8	8	6—8	50	16	7—8	10
97. Low Level Coal Mine	1,150	8	8	7	125	16	7	12
98. Miller Coal Mine	75	5	6	7	100	10	7	10
99. Moorman Coal Mine	200	8	8	6	100	12	6	16
100. Sharpe Coal Mine	200	8	9	8	200	16	9	16
101. Williston Lignite Coal Mine	750	8	8	6—7	300	20	6—7	15

TABLE NO. 5—ADAMS COUNTY

Name of Mine and Kind of Roof	Kind of Floor Mine Drained by	Kind of Timber Used	Size of Timber—Inches	Cost at Mine
1. Clermont Coal Mine—2 ft. of coal	Hard clay	Tamarack	6—8	.30
2. Farmrs Coal Mine—3 ft. of coal	Hard clay	Tamarack	6—8	.30
3. Haynes Coal Mine—3 ft. of coal	Hard clay	Tamarack	6—8	.30
4. Monroe & Knepper—3 ft. of coal	Hard clay	Tamarack	6—8	.30
5. Stevenson & Gunderson Coal Mine—1—2 ft. of coal	Hard clay	Tamarack	6—8	.30
BILLINGS COUNTY				
6. De Mores Coal Mine—2 ft. of coal	Hard clay	Cottonwood	6—8	.25
7. Jackson Coal Mine	2 ft. of coal—Ditch	.....	.....	.....
BOWMAN COUNTY				
8. Scranton Coal Mine—8—9 ft. of coal	Hard clay—Windmill & pump	Tamarack	8	.30
BURKE COUNTY				
9. Anderson Coal Mine	Clay—Hand pump	.....	.....	.....
10. Domrese Coal Mine	Hard clay—Windmill & pump	.....	.....	.....
11. Fenster Coal Mine—Hard clay	Hard clay	Tamarack	4—6	.22
12. Gille Coal Mine	Hard clay—Ditch	.....	.....	.....
13. Greenup Coal Mine	Hard clay	.....	.....	.....
14. Hagen Coal Mine—Clay	Hard clay	.....	.....	.....
15. Mackee Coal Mine—Clay	Clay—Hand pump	Cedar & Ash	6—8	.21
16. Olson Coal Mine	Hard Clay—Gas. eng. & pump	.....	.....	.....
17. Vick Coal Mine	Clay	.....	.....	.....
BURLEIGH COUNTY				
18. Bachman Coal Mine—2 ft. of coal	Hard clay	Tamarack	6	.22
19. Coleman Coal Mine—Hard clay	Hard clay	Tamarack	6	.20

20. Eckman Coal Mine—1—2 ft. of coal	Hard clay	Cottonwood	6—10	.25
21. Line Coal Mine—4—5 ft. of coal	Hard clay	Tamarack	6	.22
22. Peterson Coal Mine—2—3 ft. of coal	Hard clay			
23. Johnson Coal Mine—Hard clay	Hard clay	Tamarack	4	.16
24. Washburn Coal Mine—3—5 ft. of coal	Hard clay—Elec. & st'm pump	Tamarack	6—10	.30
DIVIDE COUNTY				
25. Evanson Coal Mine—2 ft. of coal	Blue clay	Cedar	5	.20
26. Dougherty Coal Mine—2 ft. of coal	Blue clay	Cedar	5	.20
27. Noonan Coal Mine—2 ft. of coal	Blue clay	Cedar	5	.20
28. Truax Coal Mine—1 ft. of coal	Blue clay	Cedar	5	.20
GOLDEN VALLEY COUNTY				
29. Corliss Coal Mine	2 ft. of coal—Ditch			
30. Porter Coal Mine				
31. Rohl Coal Mine—3 ft. of coal	Hard clay—Ditch			
McLEAN COUNTY				
32. Bitumina Coal Mine—2 ft. of coal	Clay	Cottonwood	6—8	.20
33. Borchardt Coal Mine—3—4 ft. of coal	Clay	Tamarack	6	.25
34. Hansen Coal Mine—2 ft. of coal	Clay	Cedar	6—8	.25
35. H. H. Hansen Coal Mine—1 ft. of coal	Clay—Steam pump	Cedar	8	.30
36. Quisel Coal Mine—4—5 ft. of coal	Clay—Steam pump	Cedar	6	.25
37. Youngquist Coal Mine—4 ft. of coal	Clay—Ditch	Cottonwood	6	.20
MORTON COUNTY				
38. Feland Coal Mine—Clay	Clay	Tamarack	6—8	.14
39. Hebron Brick Co., Coal Mine—Clay	Clay	Tamarack	6—8	.12
40. New Salem Coal Mine—Clay	Clay	Tamarack	6—8	.11
41. North Star Coal Mine—1 ft. of coal	Clay	Tamarack	6	.16

TABLE NO. 5—Continued.

MONUTRAIL COUNTY

Name of Mine and Kind of Roof	Kind of Floor Mine Drained by	Kind of Timber Used	Size of Timber—Inches	Cost at Mine
42. Blickre Coal Mine	Clay—Ditch			
43. Bowman Coal Mine—2 ft. of coal	Clay	Tamarack	6—8	.25
44. Common Coal Mine	Clay—Ditch			
45. Elgers Coal Mine—Clay	Clay—Ditch	Tamarack	4	.12
46. Hardman Coal Mine—Clay	Clay—Ditch	Tamarack	5	.12
47. Hefte Coal Mine	Clay—Ditch			
48. Hoeppe Coal Mine	Clay—Ditch			
49. Moore Coal Mine—Clay	Clay	Cedar	4	.12
50. North Star Coal Mine	Clay—Ditch			
51. Palda Coal Mine—1 ft. of coal	6 in. of coal—Water car	Tamarack	4	.18
52. Peerless Coal Mine—1 ft. of coal	6 in. coal—Ditch	Tamarack	4	.18
53. Sellar Coal Mine—Blue clay	Blue clay	Tamarack	4	.18
54. Setra Coal Mine	Clay—Ditch			
55. White Earth Coal Mine—Hard clay	Hard clay	Cedar	8	.33
OLIVER COUNTY				
56. Anstadt Coal Mine	Clay—Ditch			
57. Flint Coal Mine	Clay—Ditch			
58. Nelson Coal Mine—Drift	Clay—Ditch			
RENVILLE COUNTY				
59. Jewell Coal Mine—Yellow clay	Blue clay	Tamarack	4	.18
60. Tehelka Coal Mine—Blue clay	Blue clay	Tamarack	4	.18
STARK COUNTY				
61. Lehigh Coal Mine—4—5 ft. of coal	Clay—Electric pump	Tamarack	6—8	.12
62. Pelton Coal Mine—4 ft. of coal	Clay—Gas. eng. & pump	Ties		.10
63. Zenith Coal Mine—8 ft. of coal	Clay—Steam pump	Tamarack	6—8	.12

WARD COUNTY

64.	Baden Coal Mine—Sandy clay	Clay			
65.	Bertelson Coal Mine—Yellow clay	Blue clay	Tamarack	6	.19
66.	Colton Coal Mine—2—3 ft. of coal	Clay	Elm & Ash	6	.25
67.	Conan Coal Mine—1—3 ft. of coal	Clay—Water car	Ash	6	.25
68.	Crosby Coal Mine—1—3 ft. of coal	Clay—Gasoline eng. & pump	Tamarack	6	.18
69.	Davis Coal Mine—Blue clay	Clay—Steam pump	Tamarack	6—8	.14
70.	Des Lacs Coal Mine—Sandy clay	Clay—Steam pump	Tamarack	6	.18
71.	Diamond Coal Mine—Sandy clay	Clay	Tamarack	6	.20
72.	Farmers Lignite Coal Mine—Clay	Clay—Ditch	Cedar	5	.23
73.	Forsythe Coal Mine—1—2 ft. of coal	Clay—Gasoline pump	Tamarack	6	.22
74.	Hart Coal Mine—Blue clay	Clay	Tamarack	6	.20
75.	Hodson Coal Mine—Yellow clay	Clay	Ties		.16
76.	Hunewell Coal Mine—1—2 ft. of coal	Clay—Gasoline pump			
77.	Ingeson Coal Mine—Clay	Clay—Ditch	Tamarack	6	.20
78.	Kenmare Brick & Coal Co. Mine—Clay	Clay	Tamarack	6	.15
79.	Knorr Coal Mine—3 ft. of coal	Clay—Ditch	Tamarack	6	.14
80.	Leeson Coal Mine No. 1—2 ft. of coal	6 in. coal—Ditch	Elm & ash	4—8	.15
81.	Leeson Coal Mine No. 2—3 ft. of coal	Clay	Tamarack	6	.25
82.	Lloyd Coal Mine—1—2 ft. of coal	Clay—Gasoline pump	Elm	4—8	.20
83.	McClure Coal Mine—2—3 ft. of coal	Clay—Gasoline pump	Tamarack	6	.20
84.	Murray Coal Mine—4 ft. of coal	Clay—Ditch	Tamarack	6	.20
85.	Scotty Coal Mine—2 ft. of coal	Clay	Elm & ash	6—7	.30
86.	Smith Dry Coal Mine—Clay	Clay	Elm & ash	4—6	.22
87.	Spencer Coal Mine—Sandy clay	Clay	Tamarack	6	.15
88.	Strong Coal Mine—Clay	Clay—Hand pump	Cedar	4—6	.20
89.	Tree-Bosch Coal Mine	Clay—Ditch			
90.	Vadneis Coal Mine—Clay	Clay	Tamarack	6	.20
91.	Wallace Coal Mine—2 ft. of coal	Clay—Water car	Tamarack	8	.20
92.	Westergaard Coal Mine—Blue clay	Clay	Tamarack	6	.20

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93.	Black Diamond Coal Mine—3 ft. of coal	Hard Clay	Cottonwood	8—12	.20
94.	Brown Coal Mine—2—3 ft. of coal	Hard Clay	Cottonwood	8—10	.20
95.	Government Coal Mine				
96.	Head Coal Mine	Ditch	Cottonwood	8—10	.25
97.	Low Level Coal Mine—3 ft. of coal	Soft clay—Steam pump	Tamarack	6—8	.22
98.	Miller Coal Mine—2 ft. of coal	Soft clay—Ditch	Cottonwood	5	.15
99.	Moorman Coal Mine—4 ft. of coal	Hard Clay	Elm & cottonwood	4—6	.10
100.	Sharpe Coal Mine—Hard clay	Hard Clay	Tamarack	6	.18
101.	Williston Lignite Coal Mine—3 ft. of coal	Hard Clay	Elm & cottonwood	8—14	.20

TABLE NO. 6—ADAMS COUNTY

Name of Mine and Power Used to Deliver Coal at Surface	Kind of Track and Tipple used	Distance from Station—Railroad
1. Clermont Coal Mine—Horse	12 lb. Steel—Hand dump	2-3 Mi. Haynes.....C. M. & P. S.
2. Farmers Coal Mine—Horse	12 lb. Steel—Hand dump	3 Mi. Haynes .....C. M. & P. S.
3. Haynes Coal Mine—Horse	12 lb. Steel—Hand dump	2-3 Mi. Haynes.....C. M. & P. S.
4. Monroe & Knepper Coal Mine—Horse	12 lb. Steel—Hand dump	2-3 Mi. Haynes.....C. M. & P. S.
5. Stevenson & Gunderson Coal Mine—Horse	12 lb. Steel—Hand dump	3 Mi. Haynes .....C. M. & P. S.
BILLINGS COUNTY		
6. De Mores Coal Mine—Hand	12 lb. Steel—Hand dump	At Medora .....N. P.
7. Jackson Coal Mine		10 Mi. Bowman ....C. M. & P. S.
BOWMAN COUNTY		
8. Scranton Coal Mine—Horse	16 lb. Steel—Hand dump	At Scranton .....C. M. & P. S.
BURKE COUNTY		
9. Anderson Coal Mine		4 Mi. Stampede .....G. N.
10. Domrese Coal Mine		6 Mi. Columbus ..... Soo
11. Fenster Coal Mine—Horse and cable	Wood—Hand dump	5 Mi. Larson ..... G. N.
12. Gille Coal Mine		5-6 Mi. Columbus ..... Soo
13. Greenup Coal Mine		5-6 Mi. Columbus ..... Soo
14. Hagen Coal Mine—Hand	Wood	5-6 Mi. Larson .....G. N.
15. Mackee Coal Mine—Horse	8 lb. Steel—Hand dump	8 Mi. Columbus ..... Soo
16. Olson Coal Mine		2 Mi. Larson .....G. N.
17. Vick Coal Mine		6 Mi. Columbus ..... Soo
BURLEIGH COUNTY		
18. Bachman Coal Mine—Horse and cable	12 lb. Steel—Hand dump	3 Mi. Wilton .....Soo
19. Coleman Coal Mine—Horse and cable	Wood	10 Mi. Wilton .....Soo
20. Eckman Coal Mine—Horse and cable	12 lb. Steel—Hand dump	3 Mi. Wilton .....Soo
21. Lind Coal Mine—Horse and cable	12 lb. Steel—Hand dump	2 Mi. Wilton .....Soo
22. Peterson Coal Mine—Horse and cable	16 lb. Steel—Hand dump	5 Mi. Wilton .....Soo
23. Johnson Coal Mine—Horse and cable	Wood	8 Mi. Wilton .....Soo
24. Washburn Coal Mine—Steam hoist	24 lb. Steel—Automatic dump	1 Mi. Wilton .....Soo

	DIVIDE COUNTY		
25.	Evanson Coal Mine—Whim	16 lb. Steel—Hand dump	1 Mi. Noonan G. N.
26.	Dougherty Coal Mine—Horse and cable	16 lb. Steel—Hand dump	1 Mi. Noonan G. N.
27.	Noonan Coal Mine—Steam hoist	16 lb. Steel—Hand dump	1 Mi. Noonan G. N.
28.	Truax Coal Mine—Gasoline hoist	16 lb. Steel—Hand dump	1 Mi. Noonan G. N.
	GOLDEN VALLEY COUNTY		
29.	Corliss Coal Mine		11 Mi. Beach N. P.
30.	Porter Coal Mine		10 Mi. Beach N. P.
31.	Rohl Coal Mine		3 Mi. Sentinel Butte N. P.
	McLEAN COUNTY		
32.	Bitumina Coal Mine—Horse	12 lb. Steel—Hand dump	8 Mi. Washburn Soo
33.	Borchardt Coal Mine—Whim	Wood—Hand dump	7 Mi. Underwood Soo
34.	Hansen Coal Mine—Horse	16 lb. Steel—Hand dump	4 Mi. Underwood Soo
35.	H. H. Hansen Coal Mine—Steam hoist	16 lb. Steel—Hand dump	4 Mi. Turtle Lake N. P.
36.	Quisel Coal Mine—Steam hoist	Wood—Hand dump	3 Mi. Underwood Soo
37.	Youngquist Coal Mine—Horse	Wood	10 Mi. Underwood Soo
	MORTON COUNTY		
38.	Feland Coal Mine—Horse	12 lb. Steel—Hand dump	1 Mi. Sims N. P.
39.	Hebron Brick Co. Coal Mine—Horse	12 lb. Steel—and dump	5 Mi. Hebron N. P.
40.	New Salem Coal Mine—Steam hoist	16 lb. Steel—Automatic dump	1 Mi. New Salem N. P.
41.	North Star Coal Mine—Horse and cable	12 lb. Steel—Hand dump	5 Mi. Hebron N. P.
	MOUNTRAIL COUNTY		
42.	Blickre Coal Mine		9 Mi. White Earth G. N.
43.	Bowman Coal Mine—Whim	12 lb. Steel—Hand dump	18 Mi. Palermo G. N.
44.	Common Coal Mine		8 Mi. White Earth G. N.
45.	Elgers Coal Mine—Horse	Wood	7 Mi. Stanley G. N.
46.	Hardman Coal Mine—Hand	Wood	6 Mi. Stanley G. N.
47.	Hefte Coal Mine		6 Mi. White Earth G. N.
48.	Hoeppe Coal Mine		24 Mi. Stanley G. N.
49.	Moore Coal Mine—Hand	Wood	6 Mi. White Earth G. N.
50.	North Star Coal Mine		23 Mi. Stanley G. N.
51.	Palda Coal Mine—Horse	12 lb. Steel—Hand dump	16 Mi. Palermo G. N.
52.	Peerless Coal Mine—Horse	12 lb. Steel—Hand dump	16 Mi. Palermo G. N.
53.	Sellar Coal Mine—Hand	8 lb. Steel	20 Mi. Palermo G. N.
54.	Setra Coal Mine		21 Mi. Palermo G. N.
55.	White Earth Coal Mine—Horse	16 lb. Steel—Hand dump	6 Mi. White Earth G. N.

TABLE NO. 6—Continued.

Name of Mine and Power Used to Deliver Coal at Surface	Kind of Track and Tipple used	Distance from Station—Railroad
OLIVER COUNTY		
56. Anstadt Coal Mine		
57. Flint Coal Mine		24 Mi. New Salem ....N. P.
58. Nelson Coal Mine		14 Mi. Judson ....N. P.
RENVILLE COUNTY		
59. Jewell Coal Mine—Horse	12 lb. Steel—Hand dump	5 Mi. Donnybrook ....Soo
60. Tehelka Coal Mine—Horse	12 lb. Steel—Hand dump	5 Mi. Donnybrook ....Soo
STARK COUNTY		
61. Lehigh Coal Mine—Horse	20 lb. Steel—Automatic dump	At Lehigh ....N. P.
62. Pelton Coal Mine—Whim	12 lb. Steel—Hand dump	4 Mi. Dickinson ....N. P.
63. Zenith Coal Mine—Horse	20 lb. Steel—Hand dump	At Zenith ....N. P.
WARD COUNTY		
64. Baden Coal Mine—Horse	12 lb. Steel—Hand dump	1 Mi. Baden ....Soo
65. Bertelson Coal Mine—Steam hoist	Wood—Hand dump	8 Mi. Kenmare ....Soo
66. Colton Coal Mine—Steam hoist	12 lb. Rails—Hand dump	4 Mi. Burlington ....Soo
67. Conan Coal Mine—Horse	16 lb. Rails—Hand dump	2 Mi. Burlington ....Soo
68. Crosby Coal Mine—Hand	8 lb. Steel—Hand dump	8 Mi. Kenmare ....Soo
69. Davis Coal Mine—Steam hoist	20 lb. Steel—Automatic dump	1 Mi. Burlington ....Soo
70. Des Lacs Coal Mine—Steam hoist	12 lb. Steel—Hand dump	At Foxholm ....Soo
71. Diamond Coal Mine—Horse	12 lb. Steel—Hand dump	2 Mi. Kenmare ....Soo
72. Farmers Lignite Coal Mine—Hand	Wood	8 Mi. Bowbells ....Soo
73. Forsythe Coal Mine—Horse	16 lb. Steel—Hand dump	1 Mi. Paradise ....Soo
74. Hart Coal Mine—Horse	12 lb. Steel—Hand dump	1 Mi. Kenmare ....Soo
75. Hodson Coal Mine—Horse	1 in. Iron pipe—Hand dump	4 Mi. Baden ....Soo
76. Hunewell Coal Mine—Horse	12 lb. Steel—Hand dump	2 Mi. Burlington ....Soo
77. Ingeson Coal Mine—Horse	Wood—Hand dump	7 Mi. Kenmare ....Soo
78. Kenmare Brick & Coal Co. Mine—Horse	16 lb. Steel—Hand dump	3 Mi. Kenmare ....Soo
79. Knorr Coal Mine—Horse	8 lb. Steel—Hand dump	10 Mi. Velva ....Soo
80. Leeson Coal Mine No. 1—Horse	Sleds	8 Mi. Velva ....Soo

81.	Leeson Coal Mine No. 2—Horse	16 lb. Steel—Hand dump	12 Mi. Velva	Soo
82.	Lloyd Coal Mine—Horse	16 lb. Steel—Hand dump	1 Mi. Paradise	Soo
83.	McClure Coal Mine—Horse	22 lb. Steel—Automatic dump	At Tasker	Soo
84.	Murray Coal Mine—Horse	12 lb. Steel—Hand dump	10 Mi. Velva	Soo
85.	Scotty Coal Mine—Steam hoist	8 lb. Steel—Hand dump	3 Mi. Burlington	Soo
86.	Smith Dry Coal Mine—Electric motor	24 lb. Steel—Automatic dump	1 Mi. Kenmare	Soo
87.	Spencer Coal Mine—Hand	Wood—Hand dump	5 Mi. Donnybrook	Soo
88.	Strong Coal Mine		7 Mi. Velva	Soo
89.	Tree-Bosch Coal Mine		12 Mi. Velva	Soo
90.	Vadnais Coal Mine—Horse	12 lb. Steel—Hand dump	2 Mi. Kenmare	Soo
91.	Wallace Coal Mine—Horse	16 lb. Steel—Hand dump	At Burlington	Soo
92.	Westergaard Coal Mine—Steam hoist	12 lb. Steel—Hand dump	7 Mi. Kenmare	Soo

WILLIAMS COUNTY

93.	Black Diamond Coal Mine—Horse	12 lb. Steel—Hand dump	5 Mi. Williston	G. N.
94.	Brown Coal Mine—Horse	Angle iron—Hand dump	3 Mi. Williston	G. N.
95.	Government Coal Mine—Horse	12 lb. Steel—Hand dump	4 Mi. Williston	G. N.
96.	Head Coal Mine—Horse	Wood	6 Mi. Williston	G. N.
97.	Low Level Coal Mine—Steam hoist	16 lb. Steel—Hand dump	At Avoca	G. N.
98.	Miller Coal Mine—Hand	12 lb. Steel—Hand dump	12 Mi. Williston	G. N.
99.	Moorman Coal Mine—Hand	Wood—Hand dump	8 Mi. Wheelock	G. N.
100.	Sharpe Coal Mine—Horse	Wood	5 Mi. Williston	G. N.
101.	Williston Lignite Coal Mine—Horse	12 lb. Steel—Automatic dump	5 Mi. Williston	G. N.

TABLE NO. 7—ADAMS COUNTY

Name of Mine	1910 Annual Output	1910 Selling Price at Mine	1910 Value at Mine	1911 Annual Output	1911 Selling Price at Mine	1911 Value at Mine
1. Clermont Coal Mine	759	1.75	1,328.25	1,215	1.75	2,126.25
2. Farmers Coal Mine	1,416	1.75	2,478.00	824	1.75	1,442.00
3. Haynes Coal Mine	700	1.75	1,225.00	900	1.75	1,575.00
4. Monroe & Knepper Coal Mine	2,818	1.75	4,931.50	3,836	1.75	6,713.00
5. Stevenson & Gunderson Coal Mine	.....	.....	.....	1,600	1.75	2,800.00
BILLINGS COUNTY						
6. De Mores Coal Mine	300	2.00	600.00	425	2.00	850.00
7. Jackson Coal Mine	164	1.50	246.00	300	1.50	450.00
BOWMAN COUNTY						
8. Scranton Coal Mine	10,000	1.35	13,500.00	10,818	1.35	14,604.30
BURKE COUNTY						
9. Anderson Coal Mine	1,000	1.20	1,200.00	.....	.....	.....
10. Domrese Coal Mine	4,000	1.20	4,800.00	4,000	1.20	4,800.00
11. Fenster Coal Mine	700	1.20	840.00	750	1.20	900.00
12. Gille Coal Mine	1,500	1.20	1,800.00	2,000	1.20	2,400.00
13. Greenup Coal Mine	3,500	1.20	4,200.00	2,760	1.20	3,312.00
14. Hagen Coal Mine	.....	.....	.....	100	1.25	125.00
15. Mackee Coal Mine	1,200	1.80	2,160.00	370	1.80	666.00
16. Olson Coal Mine	.....	.....	.....	700	1.20	840.00
17. Vick Coal Mine	2,100	1.20	2,520.00	2,500	1.20	3,000.00

BURLEIGH COUNTY						
18. Bachman Coal Mine	1,000	1.50	1,500.00	1,000	1.50	1,500.00
19. Coleman Coal Mine	200	1.50	300.00	200	1.50	300.00
20. Eckman Coal Mine	600	1.50	900.00	600	1.50	900.00
21. Lind Coal Mine	2,700	1.50	4,050.00	2,000	1.50	3,000.00
22. Peterson Coal Mine	1,300	1.50	1,950.00	1,500	1.50	2,250.00
23. Johnson Coal Mine	200	1.50	300.00	200	1.50	300.00
24. Washburn Coal Mine	140,000	1.35	189,000.00	167,714	1.35	226,413.90
DIVIDE COUNTY						
25. Evanson Coal Mine	3,000	1.50	4,500.00	7,000	1.50	10,500.00
26. Dougherty Coal Mine	4,000	1.50	6,000.00	16,121	1.50	24,181.50
27. Noonan Coal Mine	4,000	1.50	6,000.00	5,445	1.50	8,167.50
28. Truax Coal Mine	7,000	1.50	10,500.00	16,075	1.50	24,112.50
GOLDEN VALLEY COUNTY						
29. Corliss Coal Mine	500	1.50	750.00	1,000	1.50	1,500.00
30. Porter Coal Mine	150	1.50	225.00	100	1.50	150.00
31. Rohl Coal Mine	50	1.50	75.00	100	1.50	150.00
McLEAN COUNTY						
32. Bitumina Coal Mine	4,050	1.50	6,075.00	2,455	1.50	3,682.50
33. Borchardt Coal Mine	.....	.....	.....	200	1.50	300.00
34. Hansen Coal Mine	400	1.60	640.00	1,000	1.60	1,600.00
35. H. H. Hansen Coal Mine	.....	.....	.....	700	2.00	1,400.00
36. Quisel Coal Mine	300	1.50	450.00	300	1.50	450.00
37. Youngquist Coal Mine	150	1.50	225.00	400	1.30	520.00
MORTON COUNTY						
38. Feland Coal Mine	2,000	1.50	3,000.00	2,500	1.50	3,750.00
39. Hebron Brick Co. Coal Mine	12,500	1.20	15,000.00	13,229	1.20	15,874.80
40. New Salem Coal Mine	1,000	1.50	1,500.00	4,000	1.50	6,000.00
41. North Star Coal Mine	600	1.25	750.00	900	1.25	1,125.00

TABLE NO. 7—Continued.

Name of Mine	1910 Annual Output	1910 Selling Price at Mine	1910 Value at Mine	1911 Annual Output	1911 Selling Price at Mine	1911 Value at Mine.
MOUNTRAIL COUNTY						
42. Blickre Coal Mine	500	1.50	750.00	500	1.50	750.00
43. Bowman Coal Mine	250	2.00	500.00	400	2.00	800.00
44. Common Coal Mine	.....	.....	.....	500	1.00	500.00
45. Elgers Coal Mine	.....	.....	.....	250	2.00	500.00
46. Hardman Coal Mine	300	2.00	600.00	300	2.00	600.00
47. Hefte Coal Mine	.....	.....	.....	300	1.50	450.00
48. Heoppe Coal Mine	50	2.00	100.00	150	2.00	300.00
49. Moore Coal Mine	.....	.....	.....	67	1.50	100.50
50. North Star Coal Mine	200	2.00	400.00	100	2.00	200.00
51. Palda Coal Mine	2,500	2.00	5,000.00	2,700	2.00	5,400.00
52. Peerless Coal Mine	800	2.00	1,600.00	500	2.00	1,000.00
53. Sellar Coal Mine	100	2.00	200.00	60	2.00	120.00
54. Setra Coal Mine	50	2.00	100.00	50	2.00	100.00
55. White Earth Coal Mine	600	1.75	1,050.00	2,400	1.75	4,200.00
OLIVER COUNTY						
56. Anstadt Coal Mine	125	1.25	156.25	75	1.25	93.75
57. Flint Coal Mine	200	1.25	250.00	295	1.25	368.75
58. Nelson Coal Mine	1,400	.90	1,260.00	1,600	.90	1,440.00
RENVILLE COUNTY						
59. Jewell Coal Mine	1,495	2.00	2,990.00	300	2.25	675.00
60. Tehelka Coal Mine	400	2.00	800.00	700	2.00	1,400.00
STARK COUNTY						
61. Lehigh Coal Mine	50,000	1.25	62,500.00	47,972	1.25	59,965.00
62. Pelton Coal Mine	.....	.....	.....	4,200	1.25	5,250.00
63. Zenith Coal Mine	11,575	1.35	15,626.25	10,000	1.35	13,500.00

WARD COUNTY

64.	Baden Coal Mine	650	1.75	1,137.50	2,000	1.75	3,500.00
65.	Bertelson Coal Mine	6,000	2.00	12,000.00	5,300	2.00	10,600.00
66.	Colton Coal Mine	1,000	1.50	1,500.00	1,170	1.50	1,755.00
67.	Conan Coal Mine	800	1.50	1,200.00	1,000	1.50	1,500.00
68.	Crosby Coal Mine	2,511	1.85	4,645.35	2,379	1.85	4,401.15
69.	Davis Coal Mine	18,650	1.50	27,975.00	9,283	1.50	13,924.50
70.	Des Lacs Coal Mine	.....	.....	.....	2,500	2.00	5,000.00
71.	Diamond Coal Mine	2,000	2.00	4,000.00	2,800	2.00	5,600.00
72.	Farmers Lignite Coal Mine	2,635	1.80	4,743.00	2,465	1.80	4,437.00
73.	Forsythe Coal Mine	.....	.....	.....	3,500	1.75	6,125.00
74.	Hart Coal Mine	2,000	2.00	4,000.00	3,600	1.75	6,300.00
75.	Hodson Coal Mine	.....	.....	.....	150	1.75	262.00
76.	Hunewell Coal Mine	700	1.50	1,050.00	1,130	1.50	1,695.00
77.	Ingeson Coal Mine	750	2.00	1,500.00	426	2.00	852.00
78.	Kenmare Brick & Coal Co. Mine	5,081	1.75	8,891.75	3,401	1.75	5,951.75
79.	Knorr Coal Mine	400	1.50	600.00	655	1.50	982.50
80.	Leeson Coal Mine No. 1	1,500	1.50	2,250.00	2,200	1.50	3,300.00
81.	Leeson Coal Mine No. 2	4,000	1.50	6,000.00	4,000	1.50	6,000.00
82.	Lloyd Coal Mine	15,000	1.35	20,250.00	19,550	1.35	26,392.50
83.	McClure Coal Mine	15,940	1.50	23,910.00	16,592	1.50	24,888.00
84.	Murray Coal Mine	900	1.50	1,350.00	2,200	1.50	3,300.00
85.	Scotty Coal Mine	600	1.50	900.00	600	1.50	900.00
86.	Smith Dry Coal Mine	7,000	1.50	10,500.00	3,366	1.50	5,049.00
87.	Spencer Coal Mine	100	1.50	150.00	100	1.50	150.00
88.	Strong Coal Mine	200	1.50	300.00	150	1.50	225.00
89.	Tree-Bosch Coal Mine	.....	.....	.....	500	1.00	500.00
90.	Vadneis Coal Mine	500	2.00	1,000.00	400	2.00	800.00
91.	Wallace Coal Mine	7,698	1.80	13,856.40	9,283	1.80	16,709.40
92.	Westergaard Coal Mine	100	2.00	200.00	100	2.00	200.00

WILLIAMS COUNTY

93.	Black Diamond Coal Mine	7,250	1.50	10,875.00	3,500	1.50	5,250.00
94.	Brown Coal Mine	150	1.60	240.00	300	1.60	480.00
95.	Government Coal Mine	5,671	1.50	8,506.50	6,075	1.50	9,112.50
96.	Head Coal Mine	600	1.50	900.00	1,167	1.50	1,750.50
97.	Low Level Coal Mine	12,392	1.75	21,686.00	13,774	1.75	24,104.50
98.	Miller Coal Mine	250	1.80	450.00	250	1.80	450.00
99.	Moorman Coal Mine	700	1.50	1,050.00	600	1.50	900.00
100.	Sharpe Coal Mine	450	1.50	675.00	120	1.50	180.00
101.	Williston Lignite Coal Mine	6,000	1.50	9,000.00	9,000	1.50	13,500.00

COAL PRODUCTION BY COUNTIES

County	1910 Tons	1910 Value	1911 Tons	1911 Value
Adams	5,693	$ 9,962.75	8,375	$ 14,656.25
Billings	464	846.00	725	1,300.00
Bowman	10,000	13,500.00	10,818	14,604.30
Burke	14,000	17,520.00	13,180	16,043.00
Burleigh	146,000	198,000.00	173,214	234,663.90
Divide	18,000	27,000.00	44,641	66,961.50
Golden Valley	700	1,050.00	1,200	1,800.00
McLean	4,900	7,390.00	5,055	7,952.50
Morton	16,100	20,250.00	20,629	26,749.80
Mountrail	5,350	10,300.00	8,277	15,020.50
Oliver	1,725	1,666.25	1,970	1,902.50
Renville	1,895	3,790.00	1,000	2,075.00
Stark	61,575	78,126.25	62,172	78,715.00
Ward	96,715	153,909.00	100,800	161,299.80
Williams	33,463	53,382.50	34,786	55,727.50
Total	416,580	$ 596,692.75	486,642	$ 699,471.55

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MINES OPERATING DURING 1908 AND 1909 AND CLOSED DURING 1910 AND 1911.

Name of Mine and Owner	Lessee and Postoffice	Location
BILLINGS COUNTY		
Haas Coal Mine—E. G. Haas	Bowman	NE¼ NE¼ Sec. 34, T. 133, R. 101
BURKE COUNTY		
Anderson Coal Mine—Andrew Anderson	Columbus	NW¼ NW¼ Sec. 29, T. 162, R. 94
Hall Coal Mine—Jerome Hall	Larson	NE¼ NE¼ Sec. 7, T. 162, R. 94
McLEAN COUNTY		
Duchene Black Diamond Coal Mine—State Land	J. J. Duchene—Garrison	NW¼ SE¼ Sec. 16, T. 148, R. 86
Love's Coal Mine—I. E. Love	Wiprud	NW¼ SE¼ Sec. 36, T. 149, R. 81
Long & Arvidson Coal Mine—Long & Arvidson	Goldley & Isaackson—Turtle Lake	NW¼ Sec. 13, T. 146, R. 80
MERCER COUNTY		
Haatvit Coal Mine—State Land	John Haatvit—Stanton	SW¼ Sec. 36, T. 145, R. 86
Jansen Coal Mine—State Land	B. Jansen—Stanton	NE¼ Sec. 16, T. 144, R. 85
Schmidt Coal Mine—State Land	Albert Schmidt—Aplin	Sec. 16, T. 143, R. 88
MOUNTRAIL COUNTY		
Blake Coal Mine—W. J. Blake	Stanley	NE¼ SE¼ Sec. 12, T. 155, R. 92
Porger Coal Mine—George Porger	White Earth	E½ NW¼ Sec. 16, T. 156, R. 94
RENVILLE COUNTY		
Christoferson Coal Mine—Chris Christoferson	Carpio	SE¼ SW¼ Sec. 35, T. 158, R. 86
White Ash Coal Mine—Dor Carroll	Gustafson & Reichman—Carpio	Sec. 28, T. 158, R. 86

STARK COUNTY

Missouri Slope Coal Mine	Dickinson	SE¼ Sec. 7, T. 139, R. 95
Riley Coal Mine—F. Riley	Lehigh	NE¼ Sec. 8, T. 139, R. 95

WARD COUNTY

Broughton Coal Mine—State Land	G. B. Cummings—Coulee	SE¼ SE¼ Sec. 36, T. 159, R. 88
Carpio Coal Mine—Jacob Karstenson	Adams & Lorenz—Carpio	NW¼ Sec. 12, T. 157, R. 86
Coulee Coal Mine—Herbert French	Baden	NW¼ Sec. 26, T. 159, R. 88
Hot Blast Coal Mine	Hodgson & McIntosh—Donnybrook	SW¼ NW¼ Sec. 5, T. 158, R. 87
Little Minnie Coal Mine—Foxholm Lignite Coal Co.	Foxholm	NE¼ NE¼ Sec. 11, T. 156, R. 85
Soo Coal Mine—H. L. Laughlin	C. A. Buie—Kenmare	NE¼ NW¼ Sec. 31, T. 161, R. 88
Stafford Coal Mine—Stafford Land Co.	Sawyer	NE¼ NE¼ Sec. 15, T. 152, R. 82

WILLIAMS COUNTY

Camp Creek Coal Mine—State Land	E. E. Ryall—Williston	NW¼ SE¼ Sec. 16, T. 155, R. 101
Coulter Coal Mine—Coulter Bros.	A. Thompson—Williston	SW¼ Sec. 10, T. 154, R. 101
Good Coal Mine—State Land	T. E. Good—Williston	NW¼ SW¼ Sec. 36, T. 155, R. 101
Hess Coal Mine—State Land	C. A. Hess—Squires	NE¼ Sec. 36, T. 155, R. 104
Johnson's Coal Mine—State Land	Bert Johnson—Hoffiund	NE¼ Sec. 36, T. 155, R. 96
Larsen Coal Mine—State Land	J. J. Larsen—Williston	NW¼ Sec. 36, T. 155, R. 102
Morrow Coal Mine—State Land	L. A. Morrow—Epping	NE¼ NW¼ Sec. 16, T. 155, R. 99
Old Nelson Coal Mine—State Land	Monroe Beard—Ray	NW¼ SW¼ Sec. 16, T. 155, R. 97
Parker Coal Mine—State Land	Bert Mackee—Noonan	NE¼ SE¼ Sec. 3, T. 162, R. 95
Reynolds Coal Mine—Reynolds & Gardiner	Noonan	NE¼ SE¼ Sec. 12, T. 162, R. 95

MINES THAT SHIP COAL

ADAMS COUNTY

Name of Mine	Operator	Postoffice
1. Clermont Coal Mine	James Thies	Haynes
4. Monroe & Knepper Coal Mine	Erickson & Waggoner	Haynes

BURKE COUNTY

10. Domrese Coal Mine	H. J. Domrese	Columbus
11. Fenster Coal Mine	Fenster Bros.	Larson
13. Greenup Coal Mine	J. S. Greenup	Columbus

BURLEIGH COUNTY

24. Washburn Coal Mine	Washburn Lignite Coal Company	Wilton

DIVIDE COUNTY

25. Evanson Coal Mine	Ed Evanson	Noonan
26. Dougherty Coal Mine	C. Dougherty	Noonan
27. Noonan Coal Mine	P. F. Noonan	Noonan
28. Truax Coal Mine	E. W. Truax	Noonan

McLEAN COUNTY

32. Bitumina Coal Mine	Ed Kugler	Washburn

MORTON COUNTY

38. Feland Coal Mine	Theodore Feland	Sims
40. New Salem Coal Mine	Dakota Coal Products Company	New Salem

STARK COUNTY

61. Lehigh Coal Fine	Consolidated Coal Co.,	Dickinson
63. Zenith Coal Mine	Zenith Coal Co.	Zenith

WARD COUNTY

69. Davis Coal Mine	Davis Coal Co.	Burlington
73. Forsythe Coal Mine	Stewart & Peterson	Burlington
74. Hart Coal Mine	H. W. Jebb	Kenmare
78. Kenmare Brick & Coal Company Mine	Kenmare Brick & Coal Co.	Kenmare
82. Lloyd Coal Mine	D. J. Lloyd Coal Co.,	Burlington
83. McClure Coal Mine	McClure Coal Co.	Tasker
86. Smith Dry Coal Mine	M. E. Williams	Kenmare
91. Wallace Coal Mine	J. S. Wallace	Burlington

WILLIAMS COUNTY

93. Black Diamond Coal Mine	J. W. Jackson	Williston
97. Low Level Coal Mine	John Bruegger	Avoca
101. Williston Lignite Coal Mine	Ray Powell	Williston

FATALITIES AND ACCIDENTS—1910

NON-FATAL ACCIDENTS

Name of Mine and Miner	Cause of Accident	Extent of Injury	Date of Injury
BURLEIGH COUNTY			
Washburn Coal Mine—J. V. Williams*	Drilling out missed shot	Badly bruised and cut	11-23-1910
STARK COUNTY			
Lehigh Coal Mine—Vernon Butler*	Delayed shot	Bruised and cut	11-19-1910
Lehigh Coal Mine—R. Dorsmyth	Delayed shot	Bruised and cut	11-19-1910
WARD COUNTY			
Bertelson Coal Mine—G. W. Cass	Caught between shaft and cage	Lost his right ear	9-11-1910
WILLIAMS COUNTY			
Low Level Coal Mine—Leon Alger*	Delayed shot	Face bruised and cut	11-10-1910

FATALITIES

MORTON COUNTY			
Blue Grass Coal Mine—Fritz Grittel**	Fall of roof		10-18-1910

*These were mentioned in the 1909-1909 report.
**This property was not reported by this office.

TABLE OF MEN EMPLOYED

	Average No. of Men—Winter	Average No. of Men—Summer	Average No. of days worked	Av'rage daily output per man employed—tons	Average annual output per man employed—tons
1910	865	292	182	4	721
1911	1,098	323	179	3.8	686

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FATALITIES AND ACCIDENTS—1911

NON-FATAL ACCIDENTS

BILLINGS COUNTY

Name of Mine and Miner	Cause of Accident	Extent of Injury	Date of Injury
Jackson Coal Mine—Ole Jackson	Struck by sliver from steel wedge	Lost right eye	3-18-1911
J. Ralfing	Caught by rolling block of coal	Leg broken	11-11-1911
BOWMAN COUNTY			
Scranton Coal Mine—Vinsen Kromsueck	Drilling out missed shot	Badly injured hand	11-24-1911
BURLEIGH COUNTY			
Washburn Coal Mine—Wm. Cooper	Squeezed between car and side of entry	Bruised	11-10-1911
Washburn Coal Mine—Dan Prentice	Squeezed between loader and box car	Bruised	1-10-1911
WARD COUNTY			
Bertelson Coal Mine—J. H. Mott	Caught between cage shaft at bottom	Ribs and shoulder broken	7- 3-1911
Colton Coal Mine—Ole Mourning	Delayed shot	Bruised	10-10-1911
Colton Coal Mine—Wilbur Duseth	Brake and hoist broke; cage dropped	Ankle broken	9-27-1911
Conan Coal Mine—Dan Conan	Fall of coal	Badly crushed and bruised	3- 6-1911
Crosby Coal Mine—Tom Morris	Fall of "Niggerhead"	Bruised, ankle broken	11-20-1911
Des Lacs Coal Mine—Not known	Fall of coal	Bruised	2-15-1911
Hart Coal Mine—Byron Taylor	After lighting fuse light went out. He was unable to get out of room	Badly bruised about his face	12-15-1911
Hart Coal Mine—John Vere	Squeezed by car in entry	Slightly injured	5-10-1911
Leeson Coal Mine No. 2—Harry Greenwold	Fall of coal	Bruised badly	3- 3-1911
Lloyd Coal Mine—Andrew Oland	Fall of coal	Foot bruised	11-15-1911

McClure Coal Mine—Frank Wilson	Fall of coal	Hip broken	12-15-1911
Tehelka Coal Mine—Pete Tehelka	Drove pick thru right foot	Blood poison	3- 1-1911
Government Coal Mine—Eric Larson	Fall of coal	Ankle broken	3- -1911

FATALITIES—STARK COUNTY

Hebron Brick Co. Mine—Frank Smith	Premature shot, cause not known		3-16-1911

FATAL ACCIDENTS

	Average No. of men employed	No. of fatal accidents	Rate	Production per death
1910	578	1	.17%	416,580
1911	710	1	.14%	486,842

NON-FATAL ACCIDENTS

	Average No. of men employed	No. of non-fatal accidents	Rate	Production per accident
1910	578	5	.86%	83,316
1911	710	18	2.53%	27,052

DESCRIPTIONS OF THE COAL MINES.

ADAMS COUNTY.

1. The Clermont Coal Mine.

The Clermont coal mine is situated about two miles north of Haynes and in a bed of coal 12 to 13 feet thick. No particularly well laid out system of mining has been adopted, and the present works are not of a permanent nature. On March 24th, 1912, the active operations had been discontinued, but I found the mine in fair order. The air was good, and I regarded the condition of the mine as being safe.

2. The Farmers Coal Mine.

The Farmers Coal Mine is situated about three miles north of Haynes and is operated by a cooperative company of farmers, who mine the coal very largely for their own use. On March 24th, 1912, I found no one at the mine, and it was evident that active operations had been closed down for the summer.

I consider the mine to be in a safe condition, and found the air very good. No system of mining is employed. Little timbering is required, the roof being very good, but I anticipate that future trouble will be experienced in maintaining the main haulage ways.

3. The Haynes Coal Mine.

The Haynes Coal Mine is owned by the Brown Land Company of Mandan, and it is usually leased. This mine was originally laid out in a systematic manner, but I found on March 24th, 1912, that little attention was being paid to the following system. However, in this mine as in the other mines of this district the roof is exceptionally good. No water is encountered and I found the mine to be in a fairly safe condition and that the Circulation of the air was sufficient.

4.The Monroe & Knepper Coal Mine.

This mine is situated on a school section. It was never opened up in a manner intended to be permanent. Too much dependence had been placed on the excellent character of the roof and the main entry was driven from 10 to 12 feet wide with a two foot coal top. No timbering was done, and I found on March 24th, 1912, when I visited this mine, that several falls of roof had occured, and some timbering had been done. However, the slope and main entry were not in first class shape. No water is encountered, but little timbering is required in the rooms and with the exception of the slope and entry things were found to be in a satisfactory condition.

5. Stevenson & Gunderson Coal Mine.

Active mining operations were begun at this time in January, 1911. The mine is located on the northeast side of a high hill.

The coal is found to be between 10 and 11 feet thick. No water is encountered and practically no timbering has to be done after the coal bed is reached. The slope leading to the coal bed is very well timbered, and a definite system of mining is adopted and is being carried out, although an error was made and a portion of the main entry runs parallel to an old room, with a pillar but four to ten feet thick between. I found everything about the mine to be in fair order, the air being good, and the mine in a safe condition on March 24th, 1912.

BILLINGS COUNTY.

6. De Mores Coal Mine.

This mine is situated a few hundred feet north of the town of Medora and is owned by the De Mores Estate. It was leased to H. Kinmarck of Medora for the year 1910, and to Kinmarck and Jas. Brady for the year 1911. Eight to ten feet of coal occurs here. No water is found and conditions are very favorable for economical mining, the roof being very solid. However, no system has been adopted, and either a permanent entry leading back beyond the old workings, which is well timbered, will have to be driven, or a new mine opened up to permit of safe mining another year.

On March 28th, 1912, I found the mine abandoned for the summer, and the workings were in poor condition.

7. Jackson Coal Mine.

O. Jackson leases this property from the Frisch Land Company of Minneapolis, and operates a surface mine, the coal occurring at a depth of four feet. Seven feet of coal is obtained and about two feet left in the bottom on account of water. This mine was operated by George Clark in 1909 and was reported at that time as the Clark Mine.

Ordinarily surfaces mines are opened up on the side of a sloping hill, and are only operated as surface mines until such a time as the overburden becomes too thick to be economically scraped, when underground operations are begun, but in this case the mine is opened up on the bottom of a flat valley and the dirt will not be too deep for surface operations for a distance of 500 to 800 feet in any direction.

BOWMAN COUNTY.

8. Scranton Coal Mine.

The Scranton Coal Mine is one of the mines owned and operated by the Consolidated Coal Company of Dickinson. It is situated in the side of a low range of hills lying just north of the town of Scranton. A short spur from the Milwaukee leads to the mine, and the box cars are loaded directly from the

mine cars. Working in 19 feet of solid coal, no timbering is required in the entries and only a single row of props is needed in the rooms. Eight to nine feet of coal is left in the roof and this is largely recovered in drawings the rooms back. No pillar coal is recovered. In this way props are used several times. Little water occurs, which is removed from the sump by means of a windmill pump. An air shaft furnishes the ventilation. On humid days a fire is built to maintain a good circulation. On March 25th, 1912, I found conditions in and about this mine to be first class.

BURKE COUNTY.

9. Anderson Coal Mine.

The Anderson Coal Mine did not operate in the year 1911, but was operating in 1910. It is situated four miles southwest of Stampede, and is a surface mine. The coal bed, which is eight feet thick, is overlaid by 20 feet of clay. A steam shovel has been purchased and was placed at work stripping this coal, but did not prove to be successful. The mine is owned by Nels Anderson.

10. Domrese Coal Mine.

This mine is a strip pit owned and operated by H. J. Domrese. At the point where the mine is now being worked there is nine feet of coal overlaid by eight feet of clay, which is removed with teams and scrapers. Considerable coal from this mine is shipped from Columbus, which is six miles distant.

A wind mill pump is used to remove the surface water which accumulates. The country in this section is rolling prairie, and the strip pit is situated on the southeast side of a low ridge.

11. Fenster Coal Mine.

This mine has been operated as a surface mine for a number of years, but the mine being located on the side of a shallow valley, has been worked out as surface mine, the overburden having become too thick to permit of economical removal, and in the winter of 1911 a slope was driven meeting the coal. On March 1st, 1912, I found that this slope had been driven during the winter and no timbering of any kind had been done. This mine is being operated on a very small scale, and it was the intention of the Fenster Bros. to timber the slope as soon as possible and to get the new workings in better shape. At the time I was there conditions were not satisfactory.

12. Gille Coal Mine.

This mine has formerly been operated as the Gille-Miller Mine, but in 1911 E. C. Gille operated it alone. The coal bed here is nine to eleven feet thick. An overburden varying from nine to twenty-five feet in thickness overlies the coal. All of

the coal which was stripped during the summer of 1910 was removed early in the winter, and on March 2nd, 1912, I found that several rooms had been worked into the face of the coal for a distance of 50 to 75 feet. No timbering has been done and as the rooms were from 15 to 20 feet wide they would become unsafe as soon as warm weather came. It was the practice to back sleighs coming for coal into the rooms and load them directly at the face.

13. Greenup Coal Mine.

This mine is owned and operated by J. S. Greenup. The mine is located in a shallow coulee and has been worked out as a surface mine and during the last part of the winter of 1911 underground operations were begun, a tipple having been built, up which cars coming from the mine were hauled by means of a cable, pulleys and team, the cars being dumped at the top over screens which roughly size the coal, and from the storage bins the coal is loaded into wagons or sleighs with a minimum amount of handling.

On March 2nd, 1912, I found this mine to be in good order, although the main entry had only been driven in about 100 feet.

14. Hagan Coal Mine.

This mine is a very small proposition. The coal being mined is about five feet thick. All work is done by hand. It was opened during the fall of 1911 for the purpose of supplying a little local trade. On March 1st, 1912, I found this mine in an unsafe condition. There was no ventilation and no timbering had been.

15. Mackee Coal Mine.

This mine, owned and operated by S. G. Ruffcorn, is situated eight miles north of Columbus and a few hundred feet south of the International boundary line. A small creek known locally as Short Creek, has cut a shallow valley through here and the coal outcrops along the side. This mine has been in operation for a number of years and is nearly worked out, the entry now being so long that further economical operation of the mine will require the sinking of a shaft. On March 2nd, 1912, I found conditions about the mine to be very good, the timbering especially being very satisfactory.

16. Olson Coal Mine.

This mine was opened during the summer of 1911 by Anders Olson. Eight feet of good coal covered with three feet of slack and three feet of clay occurs here. The coal dips towards the hill and it will not be operated as a surface mine for more than one or two seasons. A large quantity of water occurs and a gasoline engine and centrifugal pump are used to keep the mine dry.

17. Vick Coal Mine.

This is a surface mine situated southwest of Columbus, owned and operated by Herman Vick. The coal occurs at shallow depths and is six feet thick. There is no water and the coal is loosened with dynamite. Although the overburden is only six feet thick there is no slack on top of the coal and all conditions are favorable for economical mining. A portion of the production of this mine is also shipped.

BURLEIGH COUNTY.

18. Bachman Coal Mine.

During 1910 Emil Bachman operated this mine himself. During 1911 it was leased to Victor Engstrom. A slope leads to the coal which occurs at a depth of about 60 feet. The coal is delivered at the top by means of a long cable and a team of horses. It is loaded from the tipple directly into sleighs and wagons. On March 11th, 1912, I found conditions about this mine unsatisfactory. The timbering was insufficient and the ventilation very poor. There were but two miners working at this time.

19. Coleman Coal Mine.

This mine is located on a five foot bed of coal occurring at a depth of 43 feet. A slope leads to the coal, which is delivered at the surface by means of a cable and team. On March 11th, 1912, I found the timbering in the slope to be in a poor condition, but found conditions otherwise fairly satisfactory for a mine of this size. One miner was doing all the work at this time.

20. Eckman Coal Mine.

This mine was operated in 1910 by Oscar Eckman, owner. In 1911 it was leased to J. H. Daniels. This mine has been operated for a number of years and is pretty well worked out. The roof is exceptionally good. Unusually wide rooms and entries have been driven and no falls have occurred, although little timbering has ever been done. No system of mining has been carried out, and on March 11th, 1912, I found the mine in a run down condition.

21. Lind Coal Mine.

This mine is the property of Mrs. Annie C. Lind, who operates it herself. The coal bed is 13 feet thick, eight feet of which is mined, there being an overburden of 45 feet. Coal is delivered at the surface with a long cable and team. The roof material is very good, permitting the driving of wide entries and rooms with very little timbering. No very definite plan of mining has been adopted but on March 11th, 1912, I found the mine to be in a safe condition.

22. Peterson Coal Mine.

The Peterson Coal Mine, owned and operated by Charley Peterson, is located in an 11 foot bed of coal. From three feet

to four feet is left to support the roof and very little timbering is done. On March 11th I found the mine in a safe condition and well ventilated.

23. Johnson Coal Mine.

A. M. Johnson owns and operates a small mine in a four foot bed of coal occurring at a depth of 40 feet. He supplies a small local trade. The slope is very small and timbered. All the coal is mined and considerable timbering is required to hold the roof, which is not very good. On March 11th, 1912, I found that a new slope was being driven and all arrangements had been made to abandon the old workings, which were in a poor condition.

24. Washburn Coal Mine.

The Washburn Coal Mine, owned and operated by the Washburn Iignite Coal Company, is situated a mile east of Wilton. The coal varies from 11 to 16 feet in thickness and is overlaid with about 50 feet of earth. Coal is delivered to the tipple by a two cage steam hoist. The coal is screened and loaded into the box cars with box car loaders, one of which is driven by electric power, the other being operated by steeam. Nine Jeffries Brest Undercutting machines are used. In the entry work thirty-nine cents per ton plus nine cents per foot is paid for mining. Eight cents per ton is paid for undercutting. In room work the price paid for mining is thirty-eight cents per ton and eight cents per ton for undercutting. Mine drainage is taken care of by the use of four portable electric pumps for delivering the water to a pump not far from the shaft, where a No. 5 Cameron steam pump lifts it to the surface. Ventilation is provided by the use of a 16 foot blower fan.

In connection with the mine an electric light plant is operated which furnishes Wilton with electric light and power During 1910 A. W. Pollock was superintendent of the mine. During 1911 he was succeeded by P. J. Cahill. Dan Wilson was mine manager, T. Jones and Dand Quigley were his assistnts.

In connection with the mine a large boarding house, numerous small houses and a well equipped building at the mine called the steam "Dry", where the miners change their clothes, is provided.

This mine is the largest and most completely equipped mine in the state. On March 12th, 1912, I found conditions in and about this mine to be first class in every respect.

DIVIDE COUNTY.

25. Evanson Coal Mine.

The Evanson Coal Mine, owned and operated by Ed Evanson, is located on a seven foot bed of coal, of which five feet is mined. The coal occurs at a depth of from 25 to 30 feet. The slope is

well timbered and lagged its entire length. A whim is used to draw the cars up to the tipple. Ventilation is provided by means of an air shaft, and on March 1st, 1912, I found conditions in regard to this mine entirely satisfactory.

26. Dougherty Coal Mine.

This mine is owned and operated by the Dougherty Coal Mining Co., Charley Dougherty having active management of the mine. The coal at this point varies from six to nine feet in thickness and occurs at a depth of 65 feet. The mine is loccated in a shallow coulee and the slope leads to the coal, which is delivered at the tipple by horse power. No carefully laid out system of mining is followed. The Company has a contract for supplying a couple of mills with coal the year around. On March 1st, 1912, I found conditions about the mine quite satisfactory.

27. Noonan Coal Mine.

The Noonan Coal Mine is owned and operated by P. F. Noonan. There are two means of access to the mine, a drift opening into a small valley across from the Dougherty Coal Mine and a shaft. Most of the coal is delivered through the shaft, a hoist being operated by steam. A suitable tipple, having considerable storage capacity has been erected, and facilities for handling a considerable amount of coal have been installed. The mine was not in operation on March 1st, 1912, but I found conditions satisfactory.

28. Truax Coal Mine.

The Truax Coal Mine is owned and operated by E. W. Truax. This mine is located on the same bed of coal as the Evanson, Dougherty and Noonan mines. George Aiken has acted as superintendent during 1911. A slope is used, up which the mine cars are hauled by means of a steel cable to the tipple, which has provision for considerable storage capacity. A gasoline engine is used to operate the hoist. On March 1st, 1912, I found conditions generally satisfactory, and the mine in good shape.

GOLDEN VALLEY COUNTY.

29. Corliss Coal Mine.

This mine is owned and operated by I. J. Corliss, and is 11 miles southeast of Beach and is located on a side hill. The coal, which is 12 feet thick and occurs under 14 feet of overburden, is obtained by scraping. The top four feet of the coal has been partly slacked and is worthless. Water is encountered, which is ditched out. On March 23, 1912, I found the mine closed down and the pit largely filled with snow.

30. Porter Coal Mine.

The Porter Coal Mine is a small strip pit operating on the same bed of coal that occurs at the Corliss Mine. The mine is located on a side hill and cannot be operated as a surface mine for any length of time before underground operations will be have to begun. On the March 23rd, 1912, I found the pit full of snow.

31. Rohl Coal Mine.

This mine is situated on the eastern side of Sentinel Butte, and occurs well back at the head of a sharp coulee, making the mine very nearly inaccessible. The coal at this point outcrops, and a little surface mining has been attempted, but the overburden very rapidly becomes too heavy, and I found on March 23rd, 1912, that coal has merely been gouged out, several large rooms having been driven directly into the outcrop. Future operations at this point cannot be carried on except by allowing the ground undermined to cave, and to start again after clearing away to the face of the coal. Owing to its location this mine will never have other than a local trade. On March 23, 1912, I found the mine abandoned for the summer.

McLEAN COUNTY.

32. Bitumina Coal Mine.

The Bitumina Coal Mine is owned by John Satterlund and leased by Ed Kugler. The mine is located northwest from Washburn. The coal at this point is about ten feet thick, eight feet of which is mined. A large tipple has been built and a steam hoist is used to run the cars from the entrance of the drift to the tipple. They are delivered to the entrance by horses. A large portion of the output is sold in the city of Washburn, some being hauled to a spur north of Washburn and shipped. On March 10th, 1912, I found that the mine has closed down a short time before, there being some 300 tons in the tipple, but on examining the mine I found it to be quite satisfactory in most respects.

33. Borchardt Coal Mine.

E. G. Borchardt owns and operates a mine about seven miles southwest from Underwood, which is located on a 12 foot bed of coal, eight feet of which is mined. The coal occurs 37 feet underground and is reached by a shaft. A horse whim is used to lift the coal. This mine is dry, but there is a considerable amount of black damp, and a constant circulation is maintained by means of a furnace and air shaft. On March 10th, 1912 I found conditions about the mine satisfactory.

34. The Hansen Coal Mine.

J. I. Hansen leases this mine from P. I. Hansen. A drift leads to the coal bed, which is 10 feet thick, eight feet of which is recovered. A small hand dump tipple has been built, which

permits of dumping the cars into the wagon boxes. No storage is allowed for. The mine is located on the west side of a coulee. No water is encountered and the roof is very good. On March 8th, 1912, I found the mining operations satisfactory, although no particular system of mining was being followed.

35. H. H. Hansen Coal Mine.

This coal mine was leased during 1911 from Herman Hansen, by Mintz & Mintz. The coal occurs at a depth of 40 feet and is seven to eight feet thick. A steam hoist is used and the buildings are quite well planned and arranged. However, on March 8th, 1912, I found the mine in charge of Frank Allen and badly run down. The mine is very wet and the pump was not large enough to keep the mine dry. About six inches of mud and water cover the floor of the rooms and entries. Three men were employed in the mine at this time.

36. Quisel Coal Mine.

C. K. Quisel of Underwood owns coal land southeast of that city, which has been leased by George Burns. A shaft 50 feet in depth reaches the coal, which is 13 feet thick at this point. A traction engine has been turned into a hoisting engine. Another traction engine is used to run a steam pump. This mine has only been operating at this point for something less than a year and the entries have not been driven very far from the foot of the shaft. Also a couple of rooms have been turned for the purpose of getting quick coal. There is a large amount of water and the mine was very wet on March 10th, 1912, but I found the mine in safe condition.

37. Youngquist Coal Mine.

The Youngquist coal mine is located in a deep coulee not far from the Missouri River at a point about ten miles south of Underwood. It was operated in 1911 by Phister & Youngquist, who sold their output at Washburn. This mine is one of the smaller mines. The main entry only extended in about 100 feet and there were a couple of rooms. A ditch kept the mine dry, and on March 10th, 1912, I found the mine about to be closed down, but the indications were that sufficient timber had been provided to make the mine safe.

MORTON COUNTY.

38. Feland Coal Mine.

Theodore Feland operates a mine at Sims. This mine is located on a coal bed from six to seven feet thick and from five to six feet is generally mined. A spur from the Northern Pacific at Sims leads directly to the tipple of the mine and permits of easy shipment. This mine has been operated for a number of years, and the main haul way is becoming so long that a new

point of entrance will be required in order to continue profitable mining. On March 30th, 1912, I found the mine closed down and Mr. Feland not at home. However, conditions about the mine were satisfactory.

39. Hebron Brick Company Coal Mine.

This mine is situated about five miles north of the town of Hebron. A narrow gauge track has been built from the mine to the plant of the Hebron Fire and Pressed Brick Co., whose operations require the entire output of the mine. Frank Binneck operate the mine under a lease. On March 29th, 1912, I found that a new entry had been driven into the old works at a point about 500 feet west of the old entry. Conditions about the mine were very good. A carefully laid out system of mining is followed. The timbering is exceptionally well done and the entire mine kept in a first class condition.

40. New Salem Coal Mine.

The New Salem Coal mine, owned and operated by the Dakota Coal Products Company, is located a mile east of New Salem. A spur from the Northern Pacific leads to the tipple.

This mine was opened up during 1910 by F. C. Affleck, manager for the Company. The coal at this point is between five and six feet thick, all of which is mined.

A shaft was originally installed and later a slope was driven. The Company has an electric plant here and furnishes light for New Salem. A 60 inch Sturtevant fan is used for ventilation.

The largest part of the work done so far by the Company has been the driving of entries and development work. On March 29th, 1912, I found the mine shut down because of flooding by surface water. A number of wells had been driven to supply water for the boilers, but were abandoned as no water was found. Later surface water entered the mine through these wells. Surface and underground conditions were very satisfactory.

41. North Star Coal Mine.

The North Star Coal Mine is located on coal land owned by Harvey Hagen and leased during 1911 by Joe Beilage. On March 29th, 1912, I found the old workings abandoned and a crew of men were just preparing to drive another slope. The coal is about 10 feet thick, seven feet of which is mined. It is the intention of the lessee to open up the new workings along a double entry system, and to have the mine in running condition in time for 1912.

MOUNTRAIL COUNTY.

42. Blickre Coal Mine.

This mine has been operated on Government land by A. Blickre. The coal occurs at a depth of about 10 to 15 feet and

White Earth Creek. On February 26th, 1912, I found Mr. Blickre absent, but several teams loading. They load the coal themselves, paying fifty cents a ton for the coal.

43. Bowman Coal Mine.

The Bowman coal mine is located near the post office of Epworth. It is owned by C. H. Bowman and run by L. S. Landacre. The coal occurs 50 feet below the surface of the ground and a one horse whim operates a hoist at the shaft. This mine is a small one and sells only to a local trade. The coal is eight feet thick and six feet is mined, two feet being left to strengthen the roof. Entries have only been driven 100 feet from the foot of the shaft and on February 28th, 1912 I found that there was no provision made for any ventilation, and the timbering was not sufficient either for safety or to insure permanent entries.

44. Common Coal Mine.

Eight miles south of White Earth in the valley of the White Earth Creek, and is an open mine on Government land, which supplies coal to a number of people. It is understood that J. Altenthaler stripped this mine and allows others to mine the coal that he has exposed, at a given price per ton. I estimated that during 1911 500 tons must have been removed. It was difficult to get much definite information regarding this little mine, as Mr. Altenthaler had had some trouble with Government officials.

45. Elgers Coal Mine.

Fred Elgers is the owner of the land on which B. A. Black operates this coal mine. This mine is very small, only two or three miners working in it, and on February 27th, 1912, I found conditions rather unsatisfactory in the mine. The entry was of such a size that it was the custom to back the team and sleigh into the face. The mine is extremely wet.

46. Hardman Coal Mine.

W. F. Hardman operates this mine. For several years the Hardman Mine was operated as a surface mine, but the increasing depth of dirt over the coal made it necessary to undermine. The coal being but three feet thick makes this an unsatisfactory proposition. The mining is done by hand. There is considerable water, and the entries and rooms are very cramped, as none of the clay is mined. On February 27th, 1912 I found the mine in a fair condition. The timbering was being done in a satisfactory manner. There was no method of ventilation. However, the entry was but 75 feet long and there are but two miners at any one time.

47. Hefte Coal Mine.

The Hefte Coal Mine was opened up during the summer of 1911 by Ole Hefte. It was operated as a surface mine until after

the ground became frozen. Some undermining was then done. There was in the beginning eight feet of overburden and five feet of coal, but as the mine is located on a side hill the overburden rapidly becomes heavier. On February 26th, 1912, I found four men employed and conditions generally not satisfactory. However, Mr. Hefte intends to operate the mine as an underground mine and expects to have it more satisfactorily equipped before another fall.

48. Hoeppe Coal Mine.

The Hoeppe Coal Mine is located 24 miles south of Stanley. There is six feet of coal overlain with six to eight feet of earth. A little undermining is attempted while the ground is frozen. Mr. Hoeppe himself uncovers the coal during the summer months, and charges for the privilege of mining. On February 27th, 1912, I found considerable water in the pit.

49. Moore Coal Mine.

This coal mine is located on Government land in a bed of coal five and one-half feet thick, which outcrops on the side of the bluffs along the White Earth Creek. Of this coal only two and one-half feet is good. Two miners were employed during 1911, the mine being operated only through January, February and March. The mine was opened up in the first place by farmers who got their own coal here. On February 26th, 1912, I found conditions about this little mine very good.

50. North Star Coal Mine.

The North Star Coal Mine is a surface mine, three to six feet of earth lying over six feet of coal. There are a great many springs in the immediate vicinity of the mine, and the strip pit itself is very wet, a large ditch being required to keep the water down. It is owned and operated by Albert Roseno. This is a very small mine, dependent on a local trade.

51. Palda Coal Mine.

G. S. Rogers owns and operates this mine. It is operated as a single entry mine and as the coal occurs at depths varying from 35 to 40 feet, ventilation is secured by boring an air shaft at any time one is needed, several being in use at this time. The mine is practically dry. This is one of the older mines and the main entry is about 600 feet long, off from which cross entries have been turned. Very little timbering is required except at the beginning of the entry and in the rooms. The coal is from seven to eight feet thick, of which five feet is mined. On February 28th, 1912, I found conditions about this mine very satisfactory.

52. Peerless Coal Mine.

The Peerless Coal mine is on Government land and during 1911 was operated by Fred Zamer. On February 28th, 1912, I

learned that the mine had been permanently abandoned, the steel rails having been removed. An excessive amount of water rendered the operation of the mine unprofitable. The mine is located on the same bed of coal as the Palda Mine.

53. Sellar Coal Mine.

W. L. Sellar owns and operates a small mine near Epworth. The coal is about four feet thick and under a 40 foot overburden. All of the coal is removed and as the clay roof is of a poor nature considerable timbering is required. On February 28th, 1912, I found three men at work. The timbering was not sufficient considering the character of the roof, to be called safe.

54. Setra Coal Mine.

C. A. Setra owns and operates this mine, which is a very small one. Three feet of coal occurs at a depth of 12 feet. The earth is stripped. Two miners were at work on February 28th, 1912.

55. White Earth Coal Mine.

The White Earth Coal Mine is situated six miles south of White Earth in the valley of the White Earth Creek. This mine has not been owned and operated by different mining companies, and on February 26th, 1912, I found but two miners at work. When first opened up the mine was well laid out and provided with excelent buildings. An incline leading from the tipple to the top of the river bluffs was in use, and operated by a large steam hoist. The mine, however, has not been kept up and on the date mentioned I found it in a generally run down condition.

OLIVER COUNTY.

56. Anstadt Coal Mine.

A surface mine is operated by John Anstadt in Oliver County, the mine being leased from N. D. Ganten. This mine is one of the smaller workings, and the coal occurs at a depth of from eight to twelve feet, and it is from three to six feet thick. The mine is largely operated for the purpose of supplying his own fuel and supplying a very small local trade.

57. Flint Coal Mine.

Mrs. Henregetta Flint operates a small surface mine supplying local trade. At this mine there is three feet of coal under a 10 foot overburden. A ditch is used to keep the mine free from water.

58. Nelson Coal Mine.

N. O. Nelson operates a surface mine where three to seven feet of coal occur beneath an overburden of eight feet. This is one of the large mines in Oliver County. During the summer months the coal is stripped in large quantities and easily mined during the winter.

RENVILLE COUNTY.

59. Jewel Coal Mine.

The Jewel Coal Mine is owned by Gus Wahl and leased by St. John & Bailey. On March 5th, 1912, when I inspected this property, I found the miners robbing pillars and entries and preparing to abandon the mine. This mine islocated on a three foot vein of coal outcropping at the foot of bluffs along the Des Lac River, and never at any time was a very satisfactory mine.

60. Tehelka Coal Mine.

On March 5th, 1912, I found Peter Tehelka had abandoned his old mine and a short distance around the bluff from it had started a new slope. The intention is to operate this mine on a small scale in connection with his farm, as the coal is but two to three feet thick. The new slope was very well driven and should be satisfactory.

STARK COUNTY

61. Lehigh Coal Mine.

This mine is owned and operated by the Consolidated Coal Company of Dickinson. It is situated at Lehigh, about six miles east of Dickinson. The coal bed is 14 feet thick, of which seven to ten feet is mined. This leaves a very excellent roof and the rooms are driven 25 feet wide, 250 feet deep, with one row of props. The pillars are left eight feet wide. Three Jeffries Chain Brest Undercutting machines are used, and an electric Christy box car loader is used. An electric pump is used to keep the mine dry, although there is very little water. Ventilation is furnished by means of an electrically driven exhaust fan. Part of the mine is lighted by electricity. A well equipped power house furnishes power and light for the mine. The haulage, which is about a mile, is against a one per cent grade. Mules are used underground. John Brodie, President of the Company, has active charge of the mine. On March 18th, 1912, I found conditions about the mine generally satisfactory.

62. Pelton Coal Mine.

This mine is leased from Mrs. M. McGilory by A. H. Pelton. It was opened during November, 1910. The coal occurs at a depth of about 30 feet and is 12 feet thick. Seven to nine feet is mined. The mine is being developed on a single entry system, and the equipment was secured from the Dakota Pressed Brick Company, who at one time operated a mine in the neighborhood. On March 18th, 1912, I found conditions about the mine very satisfactory, although the mine was not in active operation.

63. Zenith Coal Mine.

The Zenith Coal Co., of Duluth own the Zenith Coal Mine. Henry Truelson is president and general manager of the Comp-

any and has active charge. The coal at this mine is from 18 to 24 feet thick and from eight to ten feet is mined. This mine is very wet, the water overlying the coal and seeping through vertical cracks, keeps the mine in a very muddy condition. Two large steam pumps are used night and day when the mine is in operation. A fire during the early part of 1911 destroyed all of the tipple, which was entirely enclosed. On March 28th, 1912, at the time that I inspected the mine, a cave in had occurred in the main entry and it was not possible to go through all of the underground works. The main entry was driven on a five per cent grade, and is 1000 feet long. Mules are used for haulage, and steam for pumping is furnished by two traction engine boilers.

WARD COUNTY.

64. Baden Coal Mine.

This coal mine is owned and operated by Alfred Christianson and Chris Hanson. This mine during 1908 and 1909 was operated by Jonas Johnson, but the main entry had become so unsafe that in 1910 a new entry was opened up and was driven to a depth of about 300 feet. The coal is from two to three feet thick, necessitating the removal of considerable clay in order to get a clear haulage way. It is developed on a single entry system and side entries are driven at right angles. These side entries are only as deep as the coal bed is thick and the mine cars are home made and of special design. Little timbering is done, and as the roof is of clay it will continue to scale off and increase the height of the entries. There have been several small falls of roof, and in order to insure safety the main entries at least should be well timbered. On March 4th, 1912, I found the mine satisfactorily ventilated, and in good condition other than insufficiently timbered.

65. Bertelson Coal Mine.

The Bertelson Coal Mine, formerly owned and operated by Bert Bertelson, has become the property of J. H. Mott, who now operates it. The mine is one of the larger mines of the Kenmare district. There is a drift of about 300 feet in length, driven in the southeast bank of the upper Des Lac Lake, and a shaft having a depth of 147 feet is used to deliver coal at the top of the bluff. This entry is well timbered and carefully lagged, and I found the mine throughout well timbered. There is no water in the mine. During the winter time most of the coal is delivered through the drift, loaded onto sleighs and hauled on the ice to the city of Kenmare. Coal for local trade is delivered at the top of the shaft. The hoisting apparatus consist of a traction engine blocked up, with a cable on one of the drivers. On March 3rd, 1912, I found conditions about the mine satisfactory regards ventilation and timbering. However, I found the bottom of

the shaft very poor in design. At the intersection of the shaft and entry there is not sufficient height to the entry, and there have been a couple of rather serious accidents, due to getting caught between the floor of the cage and the top of the entry as the cage ascended.

66. Colton Coal Mine.

The Colton Coal Mine is located about one and one-half miles from Burlington. The mine is back some distance from the Mouse River bluffs and the coal which outcrops along the river bank is reached by a shaft 112 feet deep. The coal is from 10 to 11 feet thick and of good quality. A tipple having considerable storage capacity has been built. The hoisting apparatus is very satisfactory, steam being used. Ventilation is provided by means of an air shaft, fitted with a large bell of galvanized iron so arranged as to be turned in the direction of the wind. The shaft is used as the up-cast. On March 6th, 1912, I found conditions about this mine satisfactory.

67. Conan Coal Mine.

The Conan Coal Mine is one of several smaller mines operating in the vicinity of Burlington. The coal bed is reached by a drift driven into the foot of the hill, a little above the level of the valley. Little timbering is done outside of the drift. A small office and wagon scales comprise the surface equipment. On March 6th, 1912, I was satisfied with the condition in which I found the property.

68. Crosby Coal Mine.

Under the management of John Crosby this mine has prospered for some time. However, on account of an illness of his, which had prevented his presence in the mine for about three months prior to date of inspection, the mine was found to be run down, the entries not being properly drained. Generally the mine was quite satisfactory in appearance on March 3rd, 1911. The timbering of entries and rooms was well done and the ventilation good.

69. Davis Coal Mine.

The Davis Coal Mine is the largest mine in the Burlington District and is well equipped with up to date mining appliances. It is well managed and kept in first class condition. An unusualy good air shaft and furnace made of brick furnishes ventilation. A large hoisting engine pulls from six to eight cars at a time up the slope to a tipple, where the coal is screened and loaded into box cars. A large brick plant is operated some seasons in connection with the mine. On March 6th, I found the mine in good condition.

70. The Des Lacs Coal Mine.

This mine, located within a few hundred feet of the town of Foxholm, was opened up in the summer of 1910, but pracically no coal was mined until the winter of 1911. The mine was started by Mr. Wilson and in the fall of 1911 was sold to Joe Allen. There is a great deal of water in the workings and the drains to the sumps were not open, and on March 5th the condition of the entries was very poor. I do not consider the system of mining good nor the work permanent, and I believe that difficulty will be experienced in holding the main entry. A traction engine is blocked up and one of the drivers replaced by a drum for hoisting. A well arranged tipple with screening device and mine scales has been constructed. A small bunk house and office with wagon scales is near the tipple.

71. The Diamond Coal Mine.

This mine was formerly owned and operated by Geo. Von Nieda. It is now owned by H. N. Peck of Kenmare. This mine is one of the old mines of the Kenmare district and the main entry is now so long and crooked and the timbering is so rotten that it should be abandoned and a new entry should be driven. The mine is Adjacent to the Soo railroad and the tipple dumps directly into the box cars. On March 4th, I found this mine to be unsatisfactory.

72. Farmers Lignite Coal Mine.

This mine is owned by a number of farmers who operate it largely to supply their own coal. The coal bed is from five to six feet thick and over laid with a sandy clay making a very poor roof. The bottom clay is soft and heaves quite rapidly so that it becomes necessary to open a new entry every two years. On March 3rd, 1912, I found the mine in poor shape, but the season's work was about over and it was expected that the present works would be abandoned during the summer of 1912.

73. Forsythe Coal Mine.

This mine is owned by P. N. Forsythe but has been leased, the old workings operated by Mr. Forsythe having been abandoned, and a new slope driven on the south side of a small coulee. On March 6th, 1912, I found that the new workings were not very extensive, but that an effort was being made to keep them in good order and in a safe condition.

74. The Hart Coal Mine.

The Hart Mine is one of the older mines near Kenmare, and the present entry is long and the timbering is very rotten. On March 4th, 1912, I found the mine in a very badly run down condition. This mine should be abandoned and a new entry driven.

75. Hodsen Coal Mine.

This mine has a neatly timbered incline, but no timbering in the entries, which are narrow. The roof is not very good and more timbering should be done. A coal shed and bunk house are handily situated. On March 4th, 1912, I found the mine in neat order and fairly satisfactory as to safeness.

76. Hunewell Coal Mine.

This is one of the small mines of the Burlington field. However R. J. Hunewell has kept the mine in good shape, and on March 6th, 1912, I found conditions about the mine satisfactory.

77. Ingeson Coal Mine.

This mine is nearly worked out. No timbering to speak of is done and generally speaking, the appearance of the entire mine was quite unsatisfactory. A system of mining is adopted and said to be suitable to the conditions. A narrow entry is driven off the main entries about 200 feet and then the work is widened out to about 20 feet and brought back. Although no injuries at this mine have been reported, and on March 3rd, 1912, I found the mine unsafe. It is intended to open a new drift another summer.

78. Kenmare Brick & Coal Co.

This mine was opened originally in connection with a brick plant, but the latter has not been operated for some years. The coal bed is not very thick, and much dead work is necessary in order to keep the entries high enough to let mine mules pas through them. The timbering was in good shape, and on March 4th, I found the mine in good condition.

79. The Knorr Coal Mine.

This mine is one of the very small mines and is in operation only during the winter months. On March 7th, 1912, I found the mine full of mater and frozen and no work being done. The mine is located in a deep coulee and a drift leads to the coal, which outcrops at the bottom of the coulee. There are numerous springs in the vicinity.

80. Leeson Coal Mine. No. 1

This mine has previously been operated as a surface mine, but on March 7th, I found that considerable underground work had been done. No system was shown in the operations, and while I considered the mine safe for temporary work, if some care in planning the work had been exercised, the same amount of coal would have been mined with the same amount of labor and a decent mine have been left for future development.

81. Leeson Coal Mine. No. 2.

This mine was also previously operated as a surface mine, but the overburden becoming too thick for this method, underground work was begun, and on March 7th, 1912, I found that a neatly laid out mine was under operation. The mine was in a safe condition, although no air shaft had been constructed.

82. Lloyd Coal Mine.

The Lloyd coal mine operates in a coulee about a mile from Paradise siding. The most of the output of the mine is handled at Minot, where the Lloyd Coal Company have offices. This mine has been worked a number of years and the workings faces are quite a ways from the entry. On March 6th, 1912, I found the mine in fair shape, with the exception of the ventilation, which was very poor.

83. The McClure Coal Mine.

This mine is located at Tasker and has been in operation for a number of years, and being one of the bigger mines of the state, and having a large annual output, the working faces are nearly a mile from the entrance of the mine. There is a long covered trestle from the entrance of the drift to the tipple, which is built beside the Soo side track. A steam box car loader is used. The Company operates a Commissary and owns a boarding house and a blacksmith shop. On March 6th, 1912, I found conditions satisfactory.

84. Murray Coal Mine.

The Murray mine was operated as a surface mine for a number of years and finally underground work was started. This mine has a remarkably good roof and wide rooms and entries have been driven, which have stood up remarkably well. On March 7th, 1912, I found the mine in a safe condition.

85. Scotty Coal Mine.

This is a small mine near Burlington. It has a shaft about 35 feet deep and a traction engine has been converted into a hoist. On March 6th, 1912, I found no one about the mine and was unable to get down.

86. Smith Dry Coal Mine.

The Smith mine has been in operation for several years, and it was found necessary during 1911 to open a new slope. This is very well timbered and in good shape. An electric plant is operated in connection with the mine, supplying light to the town of Kenmare.

The equipment of the mine is modern and up to date in every respect. On March 3rd, 1912, I found the mine in a safe condition, the timbering being especially well done.

87. Spencer Coal Mine.

This mine is located about four miles down the valley from Baden and is a very small proposition. The main entry was in very poor condition, the water accumulating along part of its length not being removed, which softened up the floor clay enough to cause the timbering to settle. On March 2nd, 1912, I found this mine in an unsatisfactory condition.

88. Strong Coal Mine.

The Strong mine is a strip pit that has on previous years had an output of 1500 to 2000 tons per year. Now it can no longer be operated as a strip pit and underground mining is done. A room large enough to back wagons into had been driven into the face of the coal, and on March 7th, 1912, I found that the mine would not be safe after the frost left the ground.

89. Tree-Bosch Coal Mine.

This is a new mine and opened as a strip pit. It occurs in a small coulee which has steep banks and can only be operated as a surface mine for a short time. On March 7th, 1912, I found two men working.

90. Vadneis Coal Mine.

The Vadneis mine is a small mine near Kenmare. The bed of lignite is about three feet thick and the rooms and entries are very low. I found little or no ventilation on March 4th, 1912—otherwise the mine was in fair shape. Three men were at work at that time.

91. Wallace Coal Mine.

This mine is situated in the town of Burlington and is one of the important mines of the Burlington group. Mr. Wallace, operator of the mine is a mining man of great experience, and this mine is one of the best arranged and ventilated in the state. On March 6, 1912, I found everything about the mine in good condition.

92. Westergaard Coal Mine.

The old workings of this mine, which were entered by a drift on the south east bank of Des Lac Lake near Kenmare, have been abandoned and a shaft 150 feet deep has been sunk on the same quarter section, but up on top of the lake banks. On March 3rd, 1912, I found the mine closed and it was not possible to go down the shaft. However, but little coal had been mined at the new workings.

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93. Black Diamond Coal Mine.

The bed of lignite in which this mine is located outcrops along the side of the bluffs east of the Missouri River. It is five miles southeast of Williston and three miles from the Great Northern shipping spur. Coal is hauled to Williston at a cost of 90 cents a ton, or to the spur for seventy cents. The surface works consists of a small blacksmith shop, a 15 ton capacity hand dump tipple, bunk house, barn and scale house. The mine scales are placed in the main entry about 250 ft. from the tipple. A 500 foot entry has been driven and from these double entries have been turned to the south. Rooms are worked off from the

west side of these entries and driven as far as possible toward old workings. At places the work is 200 feet ahead of the air. The mine was originally laid out to be worked on the stub entry plan, but this has been abandoned. The overburden is largely clay with some sand, the floor being clay. Timbering in the rooms is hardly sufficient to prove permanent, but affords temporary protection.

94. Brown Coal Mine.

An old drift worked in 1910 was abandoned and a new set of entries begun in the fall of 1911. The work on the new entries was very good, the timbering being very well done. The entries are to be driven to the property limits, and the intention is to turn cross entries from which rooms will be worked, no rooms to be turned from the main entries. A large bunk house and a set of wagon scales comprise the surface equipment. Everything about the mine was in first class shape on February 24th, 1912.

95. Government Coal Mine.

The Government mine was closed down at the time inspection was made, as the entire output is used for power purposes during the irrigation season, and all of the coal is mined during the summer months. This, however, is one of the best arranged mines in the state and is kept in a safe condition.

96. Head Coal Mine.

At the date of previous inspection two years ago this mine was just being opened, but at this time several rooms and entries were being worked. The work is not being done in such a manner as to be permanent and difficulty will be experienced in preserving the entries at the point where rooms are turned. The timbering is fairly well done in the rooms, the entry being timbered only until coal is reached. The condition of the tracks and entries was not very good, but the intention is to substitute steel rails for the 2x4 pieces now used. Surface equipment consists of office building and a small tipple. On February 23rd, 1912, I found two men at work.

97. Low Level Coal Mine.

This mine is situated within 300 feet of the sidetracks of Avoca on a bed of coal which has an approximate elevation of 1920 sea level datum. As the working face is gradually pushed north and west water becomes more troublesome, as the lignite bed dips slightly in that direction. The timbering is well done along the incline until the coal is reached, after which most of the entries are not timbered except in weak places. The rooms are supported by props, in spite of which the roof is difficult to hold and a number of falls of roof have occured. Heaving of the floors is experienced in the entries and rooms that are allowed to stand. A trestle leading from the mine to the

side track permits the dumping of the mine cars directly into the freight cars. The mine scales are located on the trestle. A sump located 385 feet from the mouth of the incline collects the water, and a 600 gallon capacity duplex pump delivers it at the surface. In the second west entry a dip occurs which necessitated installing a compressed air driven pump to lift the water to the sump. The surface equipment consists of the trestle, power house, containing compressor and hoisting engine, bunk house and boarding house. The overburden is largely clay, the first ten inches of which fall readily. The floor is clay, which heaves readily, due to the presence of the water. Two to three feet of coal is left for a roof in the entries and rooms, the roof coal and part of the pillars being recovered. Conditions were fairly good on February 23rd, 1911.

98. Miller Coal Mine.

This property is located 12 miles north of Williston. Coal outcrops at the bottom of the coulee, and a drift has been started in by Mr. Miller. The mine is a small one and is not being developed in a permanent fashion. The timbering is sufficient to afford temporary protection. The mine is run in connection with a farm, and at odd intervals. Coal overlays the coal and the floor is also clay. Conditions about the mine were fair, considering the scale of work and its temporary character, on February 24th, 1912.

99. Moorman Coal Mine.

The Moorman Coal Mine is located seven miles southeast of Wheelock in what is known as Hungry Gulch. The steep haul out of the coulee is the chief draw back to the mine. A tipple so arranged as to permit dumping the mine car into wagons has been arranged. The mine has been opened up in a new place since the previous report. Very little timbering has been done, but the appearance of the mine on February 25th, 1912, was very good.

100. The Sharp Coal Mine.

This mine is located on school land and was sub-leased by Pete Anderson and five others for a period of three years. They opened up and timbered an entry. The timber being procured from an old working on the same property. About 600 feet of entry work has been done and two rooms have been turned. The miners take turns mining coal and work in other mines parts of the time, each man receiving the price the coal he mines sells for. The work is not being done in a permanent manner and the timbering is insufficient. A small office enclosing the mine scales has been built at the tipple, which is designed to permit unloading the mine cars into wagons and sleighs. On February 23rd, I found one man at work.

101. Williston Lignite Coal Mine.

This mine is located about 1000 feet south of the Black Diamond Coal Mine and on the same bed of coal. General conditions are the same as prevail at that mine. A large automatic dump tipple of about 50 tons capacity provides storage room. Bunk house, barn and scale house are conveniently located. The mine is well timbered, both in the rooms and entries, in a permanent manner. Considerable pillar coal is recovered, together with some roof coal. Part of the track is laid with 12 pound steel and part with 16 pound.