STATE OF SOUTH DAKOTA
Richard Kneip, Governor

DEPARTMENT OF NATURAL RESOURCE DEVELOPMENT
Vern W. Butler, Secretary

GEOLOGICAL SURVEY
Duncan J. McGregor, State Geologist

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GROUND-WATER STUDY FOR THE CITY OF LETCHER

by

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GROUND-WATER STUDY FOR THE CITY OF LETCHER

Preliminary Report

In July and August, 1976, the South Dakota Geological Survey conducted a ground-water study for the City of Letcher. The study included a review and compilation of existing data, the drilling of 49 auger and 11 rotary test holes, the installation of 10 observation wells, and taking a well inventory in areas not covered in previous reports. In addition, 24 water samples were obtained from local residences and observation wells. These samples were analyzed in the Geological Survey's laboratories in Vermillion. The study was financed by the City of Letcher and the South Dakota Geological Survey.

This report is a summary of the Survey's field work and recommendations. A complete report including the bulk of the basic data will be available for distribution at a later date.

The City presently obtains its water from a lower sandstone in the Dakota Group from a depth of 870 feet. This water exceeds the recommended limits for total solids, sulfate, total iron, manganese, and magnesium in addition to being extremely hard. As a result of this poor quality, the City's water system is being affected by corrosion and both mineral and organic encrustation.

There are several other potential sources of ground water in the area, including shallower Dakota Sandstones, the Greenhorn Limestone, the Niobrara Marl - Codell Sandstone, and outwash deposits within surficial material. Unfortunately, the quality of water in these units is also poor, exceeding the recommended limits for total solids in every case.

A buried outwash unit overlies the Niobrara-Codell bedrock surface in most test holes. These units are hydraulically coupled to semi-coupled and contain the best water in the area.

Table 1 summarizes the quality of ground water in aquifers encountered in this study. Locations of rotary test holes drilled as part of the present investigation are shown in figure 1. Appendix A contains the logs of these holes.

Drilling a new well into the outwash - Niobrara Codell units at this time is not recommended. Although the water in these units is better than the present supply, it is still in excess of the recommended limits for total solids, sulfate, iron, and manganese. The economic benefit of using this water should be evaluated with the assistance of a professional engineering firm, but it is probably much smaller than the cost of a new well. Also, there are several abandoned wells in the area drilled into the Dakota Group which yields, under an artesian pressure, some of the poorest quality water in the area. The casings of some of these wells are undoubtedly corroded, and there is considerable potential for contamination of an upper aquifer by this water. This is probably occurring to a small degree presently and pumping water from an upper aquifer would accelerate the process. Thus, it would be impossible to guarantee water of a constant quality in the outwash-Niobrara-Codell unit.

It is recommended that the City fully explore other alternatives to drilling a new well. The most prudent solution may be the installation of a chemical treatment facility to remove some or all of the offending constituents. Recent developments in facilities of this type have reduced their cost substantially.

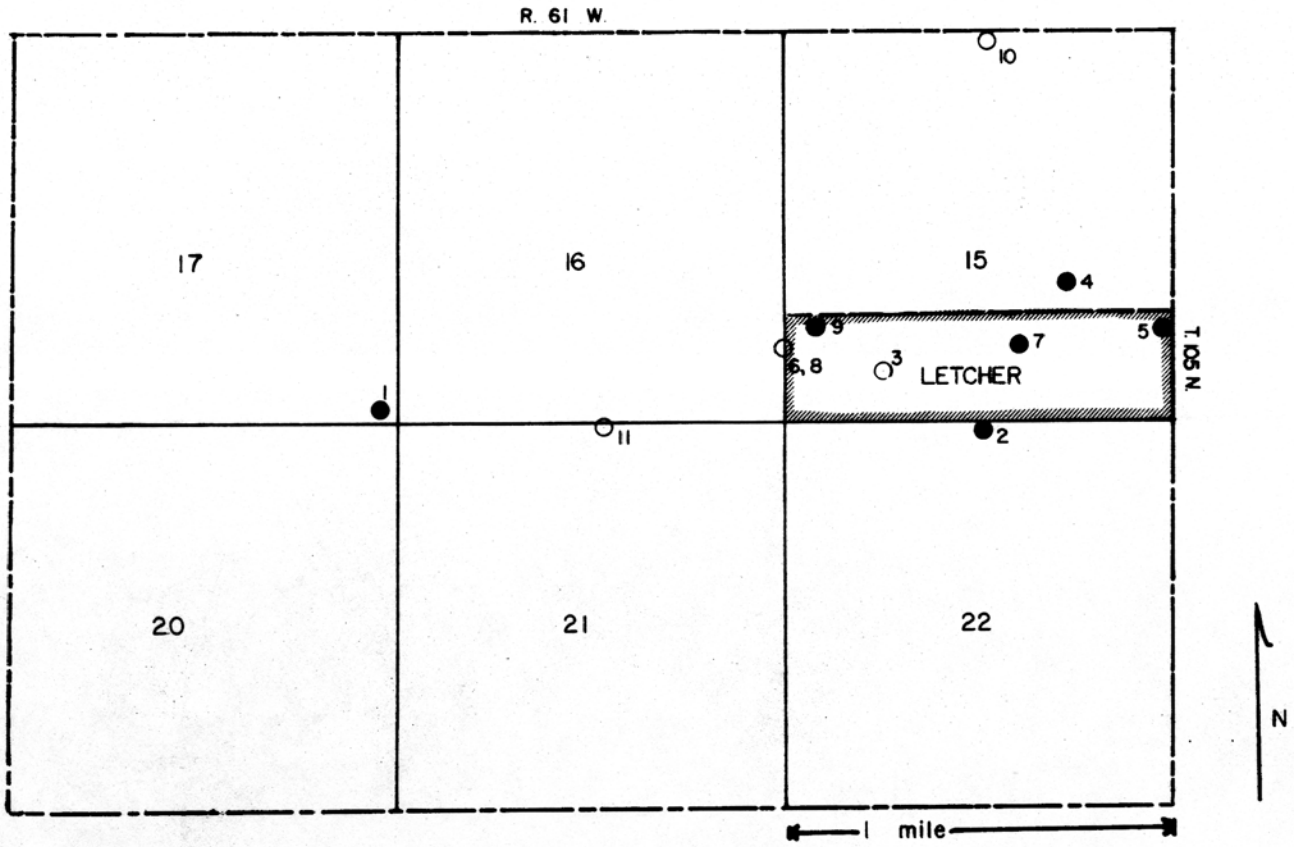

FIGURE 1-- Location of rotary test holes in the Letcher area.

○ test hole

● test hole with observation well

Table 1. QUALITY OF GROUND WATER IN THE LETCHER AREA*

GEOLOGIC SOURCE	SOURCE OF SAMPLE	LOCATIONS	TOTAL SOLIDS	HARDNESS	SULFATE	TOTAL IRON	MANGANESE	SODIUM	CALCIUM	MAGNESIUM	CHLORIDE	NITRATE NITROGEN
Shallow Meltwater Channels	SDGS Observation Well	SE¼SE¼SE¼SE¼ Sec 6 T105N R61W	>6000	---	---	---	-----	---	---	---	---	---
	SDGS Observation Well	NW¼SW¼SW¼SW¼ Sec 8 T105N R60W	>3000	---	---	---	-----	---	---	---	---	---
Basal Outwash-Niobrara Chalk	Avg. of 4 Observation Wells & 2 Domestic Wells	Sec 15 T105N R61W	1580	243	637	1.4	0.4	381	49	29	98	<.5
Greenhorn Limestone	SDGS Observation Well	NE¼NE¼NE¼NW¼ Sec 22 T105N R61W	1930	140	710	.1	0.05	500	30	15	85	<.5
Dakota 1	Domestic Well	SW¼SW¼SW¼SW¼ Sec 15 T105N R61W	2168	736	1510	5.8	0.1	180	195	61	69	<.5
Dakota 2	Swimming Pool Supply Well	NE¼NE¼SW¼SE¼ Sec 15 T105N R61W	2020	389	1510	0.8	0.05	330	95	37	67	<.5
Dakota 3	City Well	NW¼NE¼SW¼SE¼ Sec 15 T105N R61W	2143	1086	1228	3.7	0.2	186	377	34	62	0.
RECOMMENDED LIMITS[1]			1000[2]	---	500[2]	0.3	0.05	---	---	50	250	10.0

1. Drinking water standards, U.S. Public Health Service (1962).

2. Modified for South Dakota by the Department of Health (written communication, Water Sanitation Section, September 24, 1963).

* All analyses in parts per million (to convert to grains per gallon, divide by 17.12).

Information regarding the economic feasibility can be obtained from the Farmer's Home Administration in Huron.

Another alternative may be to join with local farmers and neighboring communities in sharing the development and operating costs of a rural water system. An adequate supply of water of acceptable quality may be found outside the economic range of the town which would become economically available under a cost-sharing scheme.

Finally, it is imperative that the City follow through evaluating the present status of its system with the assistance of a professional engineering firm.

This report was prepared by: David Stonestrom and Assad Barari, October, 1976.

APPENDIX A

LOGS OF ROTARY TEST HOLES IN THE LETCHER AREA

SOUTH DAKOTA GEOLOGICAL SURVEY

Location SE¼SE¼SE¼SE¼ Section: 17 T. 105 N. S. R. 61 E. W

Well: _____ Test Hole: LR 1 Land Owner: _____

County: Sanborn Date: 7-21-76 Elevation: A 1300 (A, I, T)

E-Log: _____ Samples: _____ Drilling Company: SDGS

Source of Data: _____

Geologic Unit	Thickness	Lithologic Description	From - to Feet
	2	Topsoil: silt and fine to medium sand; black.	0-2
Qwlo	10	Sand, fine to medium; light brown.	2-12
Qwlg	3	Till: silt and clay; medium brown; pebbly	12-15
Qwlg	15	Till: silt and clay; light gray; pebbly.	15-30
Qwlg	12	Till: silt and clay; light gray; very pebbly & sandy	30-42
Qo	3	Gravel, granule to pebble sizes; gray; intermittent	
		layers of fine to medium sand.	42-45
Qt	30	Till: silt and clay; gray; slightly gravelly; some	
		small beds of sand and gravel.	45-75
Qo	20	Sand, medium to coarse.	75-95
Qo	13	Gravel, granule to pebble sizes.	95-108
Qt	12	Till: silt and clay; gray; slightly gravelly.	108-120
		TD - 120	

SOUTH DAKOTA GEOLOGICAL SURVEY

Location NE¼NE¼NE¼NW¼ Section: 22 T. 105 N. S. R. 61 E W.

Well: _____ Test Hole: LR 2 Land Owner: _____

County: Sanborn Date: 7-21-76 Elevation: 1300 (A, I, T)

E-Log: (W.S.) Samples: _____ Drilling Company: SDGS

Source of Data: _____

Geologic Unit	Thickness	Lithologic Description	From - to Feet
	1	Topsoil: silt; brown	0-1
Qwlg	29	Till: Silt and clay; light brown; Sandy and	1-30
		slightly gravelly.	
Qwlg	25	Till: silt and clay; gray; slightly sandy.	30-55
Qo	5	Gravel, fine to medium; very sandy and clayey	55-60
Qt	165	Till: silt and clay; gray; slightly to very sandy	
		and slightly to very gravelly.	60-225
Qo	1	Gravel; mainly pebble sizes	225-226
Qt	22	Till: clay and silt; gray; sandy and slightly	
		gravelly.	226-248
Qt	2	Till: Silt and clay; gray; sandy and gravelly	248-250
Kc	56	Shale; dark gray; fissile	250-306
Kg	14	Limestone; gray; fragmental; fossiliferous	306-320
Kgs	17	Shale; gray	320-337
		TD - 337	

SOUTH DAKOTA GEOLOGICAL SURVEY

Location SE¼SE¼NE¼SW¼SW¼ Section: 15 T. 105 N. ~~X~~. R. 61 ~~X~~. W.

Well: _____ Test Hole: LR 3 Land Owner: _____

County: Sanborn Date: 7-28-76 Elevation: 1304 (A, I, T)

E-Log: _____ Samples: _____ Drilling Company: SDGS

Source of Data: _____

Geologic Unit	Thickness	Lithologic Description	From - to Feet
	1	Topsoil: silt; black.	0-1
Qwlo	6	Sand, very fine to medium; light brown; silty.	1-7
Qwlg	32	Till: silt and clay; brown; sandy and gravelly.	7-39
Qwlg &/or Qt	97	Till: silt and clay; gray; sandy and slightly	
		gravelly to gravelly.	39-136
Qo	10	Gravel, granule to pebble sizes.	136-146
Kn	32	Marl; light gray; fossiliferous(mostly Foraminifers).	146-178
Kcc	32	Silt; dark gray; clayey.	178-210
		TD - 210	

SOUTH DAKOTA GEOLOGICAL SURVEY

Location NE¼SE¼NW¼SE¼ Section: 15 T. 105 N. ~~S~~. R. 61 ~~E~~. W.

Well: _____ Test Hole: LR 4 Land Owner: _____

County: Sanborn Date: 7-28-76 Elevation: 1300 (A, I, T)

E Log: _____ Samples: _____ Drilling Company: SDGS

Source of Data: _____

Geologic Unit	Thickness	Lithologic Description	From - to Feet
	1	Topsoil: silt; black.	0-1
Qwlo	4	Sand, very fine to fin; brown.	1-5
Qwlg	20	Till: silt and clay; brown; sandy and slightly	
		gravelly.	5-25
Qwlg	25	Till: silt and clay; gray; sandy and slightly	
		gravelly.	25-50
Qwlg or Qt	78	Till: Silt and clay; gray; sandy and gravelly	50-128
Qo	13	Sand, medium to coarse.	128-141
Kn	29	Marl; light gray; fossiliferous (mostly foraminifers)	141-170
		TD - 170	

SOUTH DAKOTA GEOLOGICAL SURVEY

Location NE¼NE¼NE¼SE¼SE¼ Section: 15 T. 105 N. ~~S~~. R. 61 ~~W~~ W.

Well: _____ Test Hole: LR 5 Land Owner: _____

County: Sanborn Date: 7-29-76 Elevation: 1297 (A, I, T)

E-Log: _____ Samples: _____ Drilling Company: SDGS

Source of Data: _____

Geologic Unit	Thickness	Lithologic Description	From - to Feet
	1	Topsoil: silt; sandy.	0-1
Qwlo	4	Sand, fine to medium; brown.	1-5
Qwlg	18	Till: silt and clay; brown; gravelly.	5-23
Qwlg &/or Qt	48	Till: silt and clay; gray; sandy and slightly	
		gravelly to gravelly.	23-71
Qo	14	Sand, medium to coarse.	71-85
Qo	27	Gravel, fine; gray; slightly clayey.	85-102
Qo	8	Alternating gravel and clay layers.	102-110
Qt	21	Till: silt and clay; gray; slightly gravelly	110-131
Qo	6	Gravel, pebble to granule sizes.	131-137
Qt	28	Till: silt and clay; gray; contains a few thin	
		gravel layers.	137-165
Qt?	20	Silt and very fine sand; dark gray; clayey	165-185
Qt	25	Till: silt and clay; gray; slightly gravelly	185-210
		TD - 210	

SOUTH DAKOTA GEOLOGICAL SURVEY

Location SW¼NW¼NW¼SW¼SW¼ Section: 15 T. 105 N. ~~S~~. R. 61 ~~E~~ W.

Well: _____ Test Hole: LR 6 Land Owner: _____

County: Sanborn Date: 7-29-76 Elevation: 1306 (A, I, T)

E-Log: _____ Samples: _____ Drilling Company: SDGS

Source of Data: _____

Geologic Unit	Thickness	Lithologic Description	From - to Feet
	1	Topsoil: silt; black.	0-1
Qwlg	24	Till: silt and clay; brown; slightly gravelly.	1-25
Qwlg	12	Till: silt and clay; gray; slightly gravelly.	25-37
Qo	6	Gravel to coarse sand	37-43
Qt	60	Till: silt and clay; gray; slightly sandy and	
		gravelly.	43-103
Qo	15	Gravel, granule to pebble sizes; slightly clayey	103-118
Qt?	24	Silt; gray; very slightly gravelly.	118-142
Kn	18	Marl; light gray; fossiliferous (mainly foraminifers)	142-150
		TD - 160	

SOUTH DAKOTA GEOLOGICAL SURVEY

Location NE¼SE¼NW¼SW¼SE¼ Section: 15 T. 105 N. XX R. 61 XX W.

Well: _____ Test Hole: LR 7 Land Owner: _____

County: Sanborn Date: 7-29-76 Elevation: 1303 (A, I, T)

E-Log: _____ Samples: _____ Drilling Company: SDGS

Source of Data: _____

Geologic Unit	Thickness	Lithologic Description	From - to Feet
	2	Topsoil: silt; black.	0-2
Qwlo	3	Sand, fine to medium; brown; silty.	2-5
Qwlg	19	Till: Silt and clay; brown; sandy and gravelly	5-24
Qwlg	18	Till: Silt and clay; gray; sandy and slightly	
		gravelly.	24-42
Qo	6	Gravel, fine to coarse sand.	42-48
Qt	116	Till: Silt and clay; gray; sandy and gravelly	48-164
Qo	1	Gravel, fine, to coarse sand.	164-165
Qt	25	Till: silt and clay; gray; sandy and very gravelly.	165-190
Qo	6	Sand, medium.	190-196
Qo	12	Gravel, granule to pebble sizes.	196-208
Kcc?	22	Silt; gray.	208-230
		TD 230	

SOUTH DAKOTA GEOLOGICAL SURVEY

Location SW¼NW¼NW¼SW¼SW¼ Section: 15 T. 105 N. ~~X~~ R. 61 ~~E~~ W.

Well: _____ Test Hole: LR 8 Land Owner: _____

County: Sanborn Date: 8-3-76 Elevation: ~~1306~~ (A, I, T)

E-Log: _____ Samples: _____ Drilling Company: ~~SDGS~~

Source of Data: _____

Geologic Unit	Thickness	Lithologic Description	From - to Feet
	2	Topsoil: silt; brown; sandy.	0-2
Qwlg	20	Till: silt and clay; light brown; gravelly	2-22
Qwlg	21	Till: silt and clay; gray; sandy and slightly gravelly	
		to gravelly.	22-43
Qo	7	Sand, medium to coarse	43-50
Qt	52	Till: Silt and clay; gray; sandy and slightly	
		gravelly to gravelly.	50-102
Qo	24	Gravel, granule to pebble sizes.	102-126
Qt	15	Till: Silt and clay; gray; gravelly and sandy	126-141
Kn	12	Marl; light gray; fossiliferous (Mainly foraminifers);	
		slightly gravelly (scattered granules)	141-153
Kcc	29	Silt; gray; slightly gravelly (scattered granules)	153-182
Qt?	43	Till (?) : silt and clay; gray; gravelly	182-225
Kcc	13	Silt; gray; clayey.	225-238
Kc	32	Shale; dark gray; fissile.	238-270
		TL - 270	

SOUTH DAKOTA GEOLOGICAL SURVEY

Location NW¼NE¼NW¼SW¼SW¼ Section: 15 T. 105 N. ~~X~~S. R. 61 ~~XX~~E. W.

Well: _____ Test Hole: LR 9 Land Owner: _____

County: Sanborn Date: 8-3-76 Elevation: 1302 (A, I, T)

E-Log: _____ Samples: _____ Drilling Company: SDGS

Source of Data: _____

Geologic Unit	Thickness	Lithologic Description	From - to Feet
	1	Topsoil: silt; brown.	0-1
Qwlo	5	Sand, fine; brown; silty.	1-6
Qwlg	2	Till: Silt and clay; brown; slightly gravelly	6-8
Qwlo	11	Sand, medium to coarse.	8-19
Qwlg	3	Till: silt and clay; light brown; slightly gravelly	19-22
Qwlg or Qt	21	Till: Silt and clay; gray; slightly gravelly	22-43
Qo	5	Sand, coarse.	43-48
Qt	51	Till: Silt and clay; gray; slightly gravelly;	
		some thin layers of sand.	48-99
Qo	9	Gravel, granule to pebble sizes.	99-108
Qt	35	Till: Silt and clay; gray; slightly gravelly	108-143
Kn	37	Marl; white; fossiliferous (mainly foraminifers).	143-180
		TD - 180	

SOUTH DAKOTA GEOLOGICAL SURVEY

Location NE¼NE¼NE¼NW¼ Section: 15 T. 105 N. ~~S.~~ R. 61 ~~E.~~ W.

Well: _____ Test Hole: LR 10 Land Owner: _____

County: Sanborn Date: 8-4-76 Elevation: A 1310 (A, I, T)

E-Log: _____ Samples: _____ Drilling Company: SDGS

Source of Data: _____

Geologic Unit	Thickness	Lithologic Description	From - to Feet
	1	Topsoil: silt; black	0-1
Qwlo	9	Sand, fine to medium; brown.	1-10
Qwle	14	Till: silt and clay; brown; sandy.	10-24
Qwle &/or Qt	109	Till: Silt and clay; gray; sandy and slithgly	
		to very gravelly.	24-133
Qo	14	Gravel and sand; sorted.	133-147
Qo	5	Sand, medium to coarse.	147-152
Qt	28	Till: Silt and clay; gray; sandy, gravelly.	152-180
		TD - 180	

SOUTH DAKOTA GEOLOGICAL SURVEY

Location NE¼NE¼NE¼NW¼ Section: 21 T. 105 N. ~~S.~~ R. 61 ~~E.~~ W.

Well: _____ Test Hole: LR 11 Land Owner: _____

County: Sanborn Date: 8-4-76 Elevation: 1300 (A, I, T)

E Log: _____ Samples: _____ Drilling Company: SDGS

Source of Data: _____

Geologic Unit	Thickness	Lithologic Description	From - to Feet
	1	Topsoil: silt; brown.	0-1
Qwlo	4	Sand, very fine to fine; light brown.	1-5
Qwlg	18	Till: Silt and clay; brown; sandy.	5-23
Qwlg	19	Till: Silt and clay; gray; sandy.	23-42
Qo	1	Sand, medium to coarse.	42-43
Qt	37	Till: Silt and clay; gray; sandy and slightly	
		gravelly to gravelly.	43-80
Qo	7	Sand, fine to medium	80-87
Qo	7	Gravel, granule to pebble sizes.	87-94
Qo	19	Pebbles and fine to medium sand.	94-113
Qt	25	Till: Silt and clay; gray; sandy and gravelly	113-138
Kn	2	Marl; light gray; fossiliferous (mainly foraminifers);	
		slightly sandy and gravelly.	138-140
		TD - 140	