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OPEN-FILE REPORT 80-UR - NO. 22: VERMILLION CITY

STATEWIDE LANDFILL STUDY:

VERMILLION CITY LANDFILL SITE CHARACTERISTICS

by

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1996

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INTRODUCTION

Purpose and Scope

The purpose of this report is to summarize the geologic data, hydrologic data, and other site characteristics of the Vermillion City landfill. This information was compiled as a part of the Statewide Landfill Study.

In 1984, the state of South Dakota had 38 permitted solid waste landfills, both private and public, that accepted waste other than ordinary household waste. A study was undertaken in an effort to evaluate selected landfills in South Dakota and identify those that may be best suited for the disposal of these special wastes.

This study was conducted by the South Dakota Geological Survey and the Office of Air Quality and Solid Waste of the Department of Water and Natural Resources, now known as the Department of Environment and Natural Resources. The Office of Air Quality and Solid Waste contracted with the South Dakota Geological Survey for certain geological services. The South Dakota Geological Survey contribution to this study was three-fold. First, available geologic and hydrologic data from landfills in South Dakota were reviewed and evaluated. Second, monitoring well systems were designed and installed at four landfills which were selected by the Office of Air Quality and Solid Waste. Finally, the geology was evaluated in more detail at these four landfills.

Selection of Sites

Existing information concerning 38 permitted and 2 proposed landfill sites was reviewed by the Office of Air Quality and Solid Waste in order to prioritize the sites. The Office of Air Quality and Solid Waste used this preliminary screening to reduce the number of potential sites from 40 to 26 (table 1 and fig. 1).

TABLE 1. List of sites considered for further evaluation

1. Belle Fourche City
2. Brookings City - Proposed
3. Brown County
4. Brule County
5. Byre (Private)
6. Davison County
7. De Smet City
8. Gregory County
9. Haarstad (Private)
10. Huron City
11. John Clements (Private)
12. Kadoka City
13. Marshall County
14. Miedema City
15. Milbank City
16. Miller City
17. Pierre City - Proposed
18. Pierre City - Old Site
19. Ralph Dawson (Private)
20. Rapid City
21. Sioux Falls (Runge) City
22. Vermillion City
23. Walworth County
24. Watertown City
25. Winner City
26. Yankton County

Subsequently, the South Dakota Geological Survey evaluated these 26 sites and prepared a draft report describing each site. No field checking was done. Topics such as topography, drainage, climate, soils, geology, hydrology, water quality, adjacent land use, hazardous waste records, and operational practices were addressed. These reports included copies of available maps, lithologic logs, and water quality analyses. Draft copies of these unpublished reports are on file at the Department of Environment and Natural Resources in Pierre and the South Dakota Geological Survey in Vermillion. The individual report on the Vermillion City landfill is the basis for this report.

After the initial assessment of the 26 sites, the Office of Air Quality and Solid Waste established criteria for further prioritizing the sites. Four sites were selected for the installation of monitoring wells. The South Dakota Geological Survey conducted detailed investigations at the Brown County, Watertown City, Yankton County, and Rapid City landfills (fig. 1). A draft copy of the unpublished summary report is on file at the Department of Environment and Natural Resources in Pierre and the South Dakota Geological Survey in Vermillion. The following information was available regarding the Vermillion City landfill in 1986.

VERMILLION CITY LANDFILL

Location

The Vermillion City landfill is located 2½ miles north and 1¼ miles west of Vermillion in Clay County. Its legal location is the North 890 feet of the East 660 feet of the SW¼ NW¼ sec. 34, T. 93 N., R. 52 W. (fig. 2).

Topography, Drainage, and Climate

The information on topography and drainage was taken from the Vermillion Quadrangle (United States Geological Survey, 1994). The present landfill surface may be significantly different because of activities at the landfill.

The topography near the Vermillion City landfill is dominated by a bluff (fig. 2). The landfill is located on a relatively flat area above the bluff. Below the bluff is a relatively flat floodplain. The landfill contains one small depression in the center of the site. The elevation ranges from 1,230 to 1,247 feet for a maximum relief of 17 feet at the site.

There is no obvious drainage within the landfill site. However, the west and south borders flank the bluff slope. Clay Creek Ditch, located 1,000 feet west of the site, is the nearest body of surface water.

The average annual temperature in Clay County is 48 degrees Fahrenheit. Precipitation averages 25 inches per year. The average annual class A pan evaporation is 52 inches. Climatological data are from Spuhler and others (1971).

Geology

Surficial sediments at the landfill are comprised of till and colluvium (fig. 3). Above the bluff and to the east of the landfill, the area is underlain by loess covered till deposits to an average depth of approximately 100 feet (Christensen, 1967; Stephens, 1967). Outwash deposits are present beneath

the till. Below the bluff, the flat area is comprised of Vermillion and Missouri River floodplain deposits overlying outwash deposits (Christensen, 1967; Stephens, 1967).

Although no test holes were drilled within the landfill site, two test holes were drilled near the bluff area three-fourths of a mile northeast of this site (fig. 4; app. A). They indicate the presence of approximately 100 feet of clay till overlying 10 to 60 feet of sand or sand and gravel.

Some data have not been included because they do not meet the South Dakota Geological Survey criteria used in this study. Lithologic logs were utilized if the legal locations were known to four quarter sections (2.5 acres), and if they were located within the landfill site or 1 mile of the site boundaries. Also, the source of a log must have been known or the log was not utilized; for example, all logs of test holes drilled by the South Dakota Geological Survey identify the drilling company as "SDGS."

Hydrology

According to records from the Office of Air Quality and Solid Waste, the material at the base of the landfill consists primarily of clay (till). The permeability of till is difficult to characterize due to the highly variable nature of its physical composition and texture (i.e., grain size) in both the vertical and horizontal directions. Fractures, if any, in the upper weathered portion of the till can also contribute to significant spatial changes in permeability. Till, as a unit, generally has much lower permeability than sand. No site specific permeability data are available.

Available Office of Air Quality and Solid Waste records indicate that seven monitoring wells may be present at the site; however, no legal locations are given. Without the presence of adequately constructed monitoring wells (a minimum of three) in the proper locations and at the proper depths, the lateral hydraulic gradient and direction of potential ground water movement cannot be estimated for the landfill area. The Lower Vermillion-Missouri aquifer underlies the entire area at a depth of approximately 100 to 130 feet (Christensen, 1967, pl. 3).

Water Quality

Although many water quality data were available, the legal locations and/or well depths were not known. Only data meeting the South Dakota Geological Survey criteria were used in this study. Water quality analyses were utilized if the legal locations were known to four quarter sections (2.5 acres), and if they were located within the landfill or 1 mile of the site boundaries. Only wells with recorded depths less than 100 feet and with corresponding lithologic logs have been considered. This limit of 100 feet was arbitrarily chosen. Any major changes in water quality would probably be detected within this 100-foot depth limit because of the relatively low permeability of the underlying till. Also, the analytical laboratory that produced a water quality analysis must have been known or the analysis was not utilized.

Adjacent Land Features

Information in this section was taken from the Vermillion Quadrangle (United States Geological Survey, 1994) and the General Highway Map – Clay County (South Dakota Department of Transportation, 1975).

* The surface water nearest the site is the Clay Creek Ditch located 1,000 feet west of the site. There are two ponds located approximately half a mile south and three-quarters of a mile southeast of the site.

Operational and Siting Criteria - Summary from the Office of Air Quality and Solid Waste Records

The most common responses found on the Office of Air Quality and Solid Waste site inspection reports prior to 1986 are given in this section. Copies of the microfiche data are available from the Department of Environment and Natural Resources in Pierre.

1. Site: Vermillion City

2. Population served: 13,000

3. Method of disposal: Cut and fill (trench)

4. Estimated amount of waste received per unit time: 5,616 tons/year

5. Access to site:

   * Fenced: _X_ Yes ___ No Lockable gate: _X_ Yes ___ No
   * Litter fences present: _X_ Yes ___ No
   * All weather access road to site: _X_ Yes ___ No

6. List industry present: University of South Dakota, Vermillion Fertilizer.

7. Land Use:

   * Preoperational land use: Agriculture
   * Proposed post-operational land use: Agriculture
   * Current land use within a quarter of a mile radial area: Agriculture

SUMMARY

* Clay Creek Ditch is located west of the site.

* The geology at this site generally consists of loess-covered till (approximately 100 feet thick) adjacent to colluvium. Both the till and the colluvium overlie outwash deposits.

* Two reliable test hole logs were available for this site.

* No reliable monitoring wells were present near this site.

* No reliable water level data were available near this site.

* No reliable water quality analyses were available near this site.

REFERENCES CITED

Christensen, C.M., 1967, Geology and hydrology of Clay County, South Dakota; Part I: Geology: South Dakota Geological Survey Bulletin 19, 84 p.

South Dakota Department of Transportation, 1975, General Highway Map Clay County, South Dakota: South Dakota Department of Transportation in cooperation with the United States Department of Transportation, (revisions as of March 31, 1981).

Spuhler, W., Lytle, W.F., and Moe, D., 1971, Climate of South Dakota: Brookings, South Dakota, South Dakota State University Agricultural Experiment Station Bulletin 582, 30 p.

Stephens, J.C., 1967, Geology and hydrology of Clay County, South Dakota; Part II: Water resources: South Dakota Geological Survey Bulletin 19, 62 p.

United States Geological Survey, 1994, Vermillion quadrangle, South Dakota-Nebraska: 7.5 minute series (topographic), scale 1:24,000.

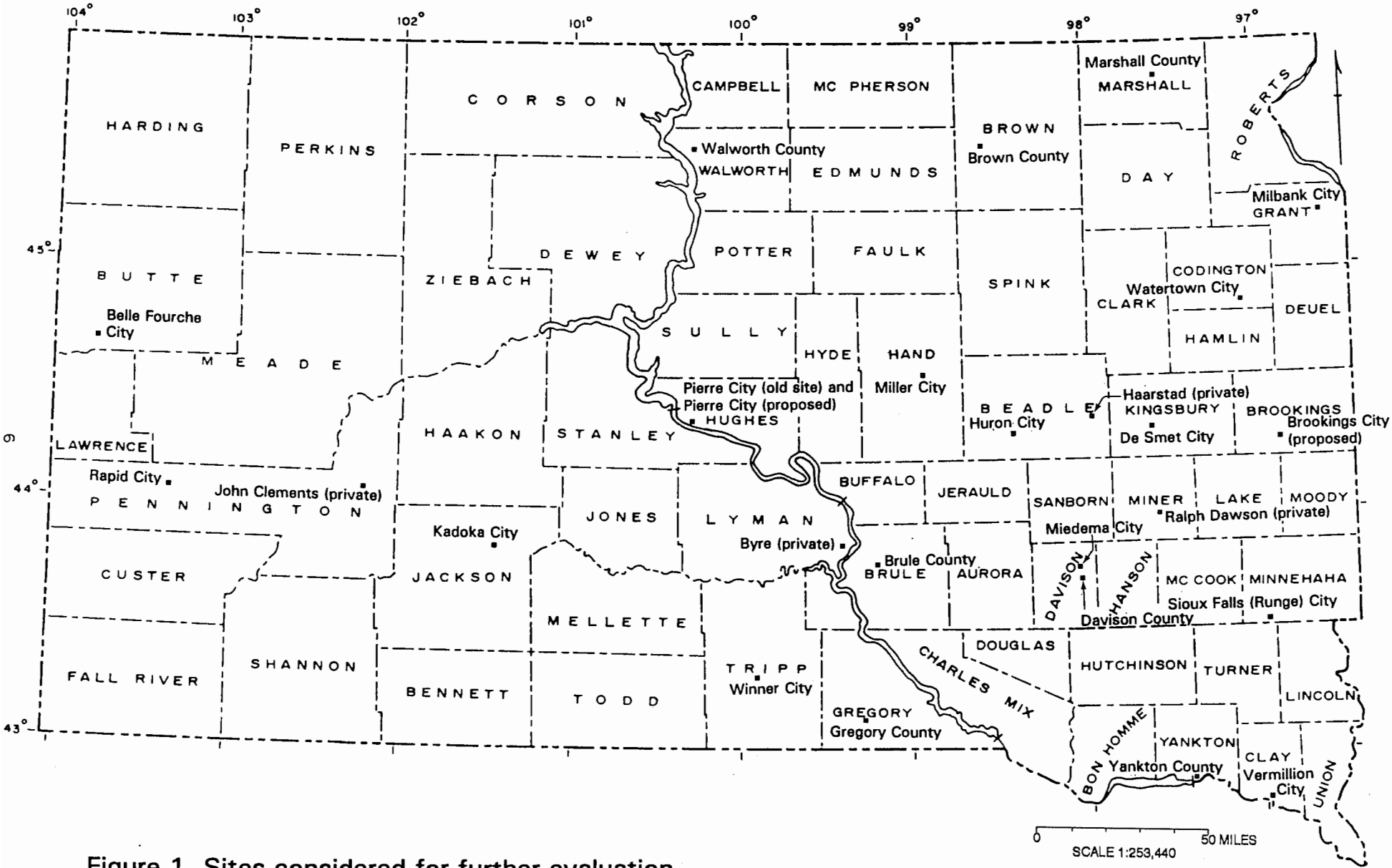


Figure 1. Sites considered for further evaluation.

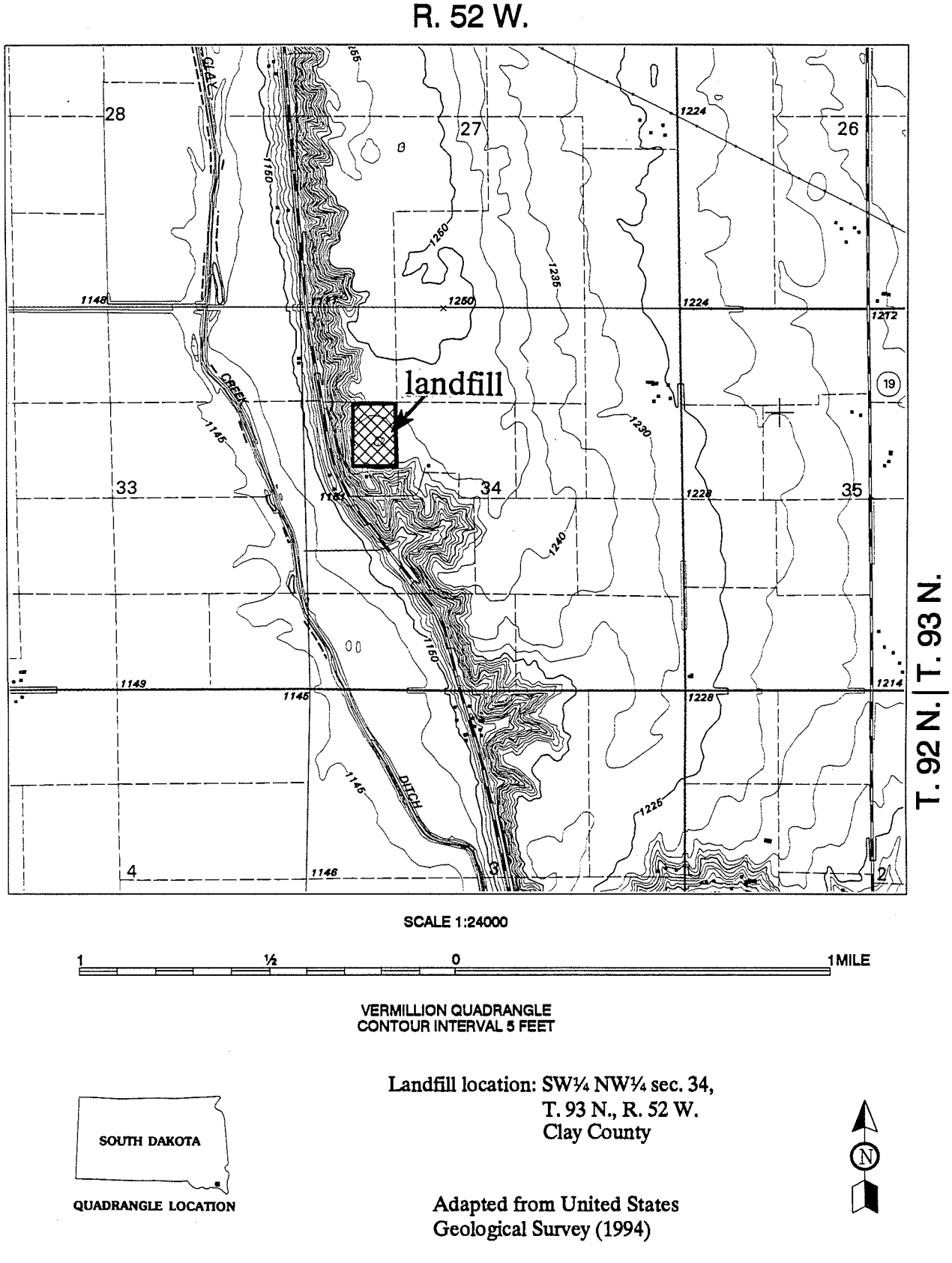
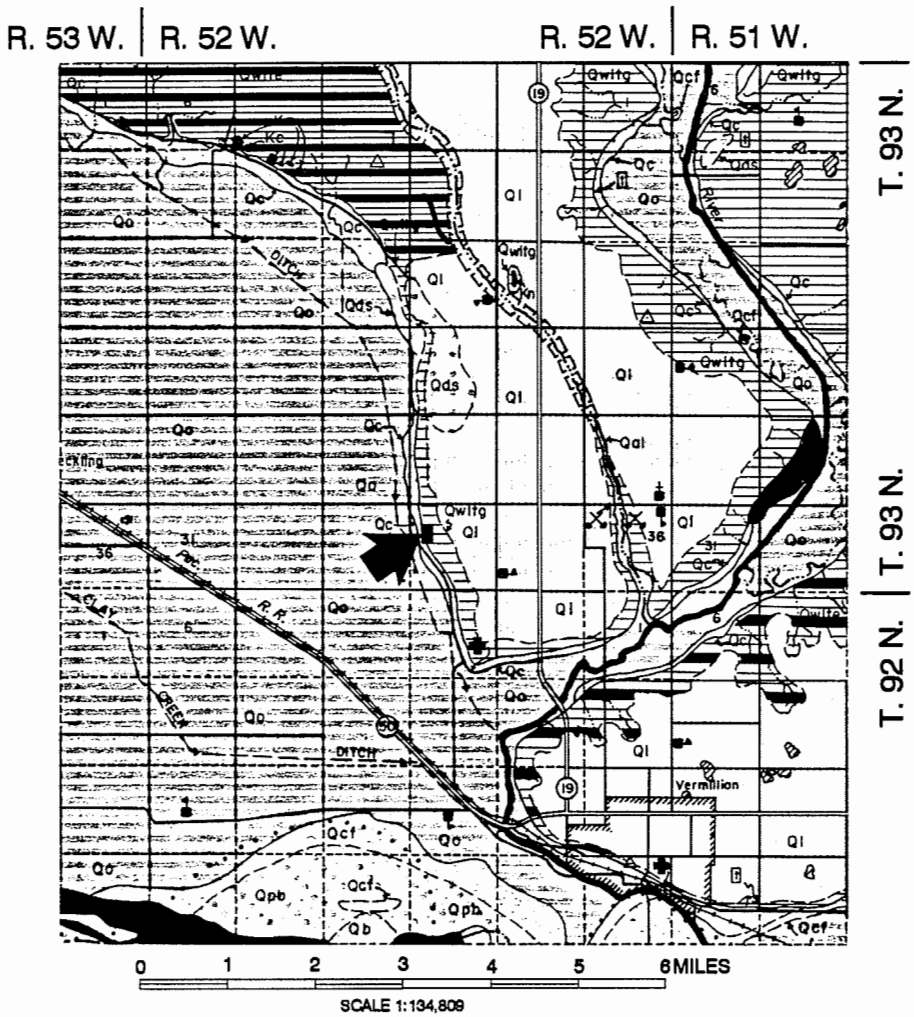


Figure 2. Location of the Vermillion City landfill.



Qal..... Alluvium
Qb..... Bar
Qc..... Colluvium
Qpb..... Point bar
Qcf..... Channel fill
Qo..... Overbank
Qds..... Dune sand
Ql..... Loess
Qwlvo..... Valley outwash
Qwlte..... Till (end moraine)
Qwltg..... Till (ground moraine)
Kn..... Niobrara Marl
Kc..... Carlile Shale
End moraine crest
Geologic contact. Dashed where approximately located.

Adapted from Christensen (1967, pl. 1)

Figure 3. Geology near the Vermillion City landfill.

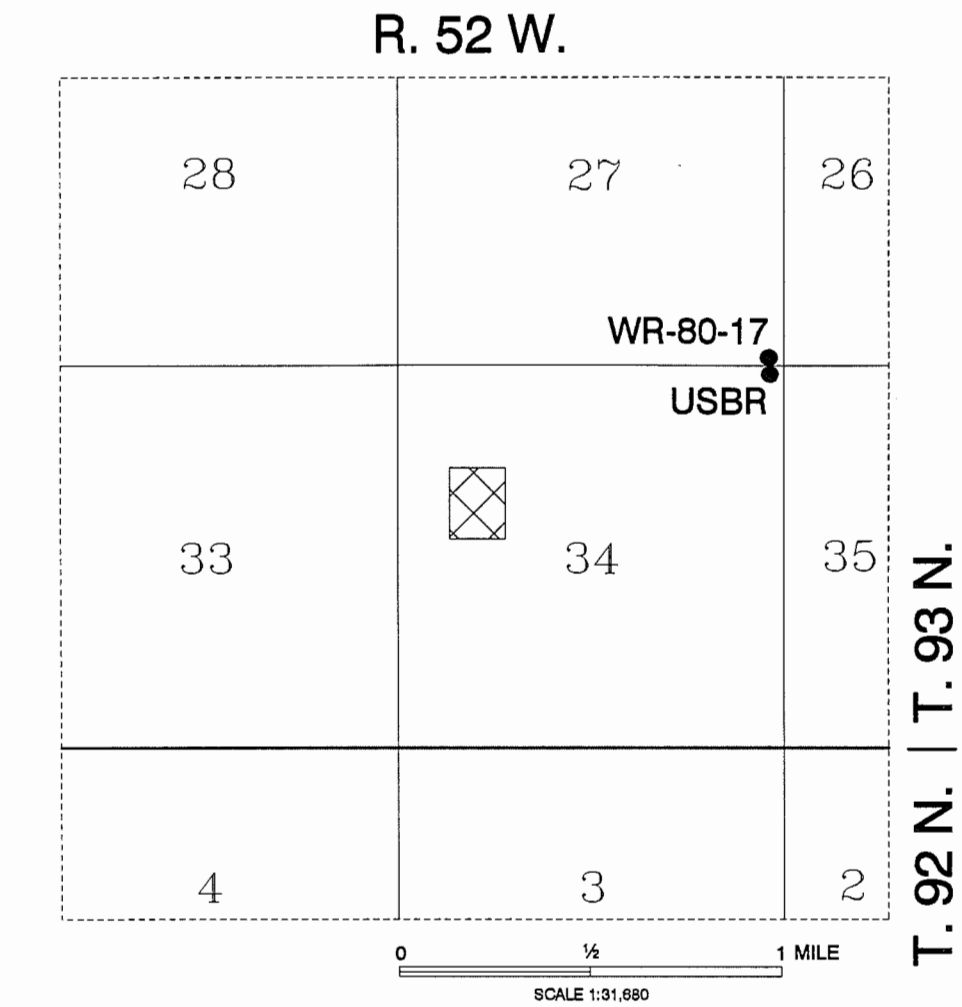


Figure 4. Locations of test holes drilled within 1 mile of the Vermillion City landfill.

APPENDIX A

Legal locations of Vermillion City landfill area logs of test holes

Listed below are the legal locations of those test holes cited in this report. Please contact the South Dakota Geological Survey if a copy of a lithologic log is needed.

SE SE SE SE sec. 27, T. 093 N., R. 52 W.

NE NE NE NE sec. 34, T. 093 N., R. 52 W.