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OPEN-FILE REPORT 80-UR - NO. 26: YANKTON COUNTY

STATEWIDE LANDFILL STUDY:

YANKTON COUNTY 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 Yankton County 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.

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 Yankton County landfill in 1986. This report is a compilation of the preliminary report on the Yankton County landfill and the detailed investigation of the Yankton County landfill.

YANKTON COUNTY LANDFILL

Location

The Yankton County landfill is located 1 mile west of Yankton. Its legal location is SW¼ SW¼ sec. 1, T. 93 N., R. 56 W. (fig. 2).

Topography, Drainage, and Climate

The information on topography and drainage was taken from the Yankton Quadrangle (United States Geological Survey, 1978). The present landfill surface may be significantly different because of activities at the landfill.

The Yankton County landfill is located on top of a large hill trending northwest-southeast (fig. 2). The elevation ranges from 1,240 to 1,273 feet, for a maximum relief of 33 feet at the site.

Surface drainage is in all directions from the crest of the hill and is controlled by intermittent streams tributary to the Missouri River. To the northeast of the site is Marne Creek, and to the southwest is a smaller, unnamed intermittent stream. Marne Creek empties into the Missouri River approximately 1½ miles southeast of the landfill.

The average annual temperature in Yankton County is 48 degrees Fahrenheit. Precipitation averages 25 inches per year. The average annual class A pan evaporation is 53 inches. Climatological data are from Spuhler and others (1971).

Method of Investigation

In general, the plan for the detailed investigation was to determine the lithologies present and to install 16 nested sets of monitoring wells at the landfill. Nested wells are individual wells installed

at various depths at roughly the same location. This plan was selected to allow for the determination of:

1. lithologic variations with depth,

2. the vertical distribution of hydraulic head, and

3. vertical distribution of water quality.

Modifications concerning the number, arrangement, depth, and design of wells were made based on local hydrogeology and financial considerations. No holes or wells were drilled or constructed in refuse. At localities exhibiting more than one lithology, the well depths were determined after the contact between the differing lithologies had been established (for example, between oxidized till and shale). Field work was conducted at the Yankton County landfill during June 1986.

The drilling of test holes and installation of wells were accomplished using two types of drilling rigs. These included a Parmanco F-86-B rig with 4-inch outside diameter flight auger and a Mobile B-61XD rig with 4-inch inside diameter hollow-stem auger. The geology was described from flight-auger cuttings, selected 1.5 inch diameter core samples, and some 3-inch diameter core samples.

Two types of wells were constructed. Screened wells were designed to be used primarily for measuring water levels (the shallowest water level). Cored-intake wells were designed to be used primarily for water sampling at a given depth. Both well installation methods are outlined below. In order to prevent organic contamination, no glue or lubricant was used on the polyvinyl chloride casing or in the drilling process.

1. Screened wells (fig. 3) were installed using the method outlined below:

   a. auger 4-inch or 10.75-inch diameter hole

   b. insert 2-inch diameter, schedule 80, polyvinyl chloride casing with slotted screen on bottom

   c. add filter pack to approximately 1 foot above the screen

   d. add granular bentonite and/or bentonite slurry to 1 to 2 feet below the ground surface

   e. cement the upper 1 to 2 feet of borehole to stabilize the casing approximately 6 inches above the ground surface

   f. protect with steel fence posts and/or fence

2. Cored-intake wells (fig. 4) were installed using the method outlined below:

   a. auger 4-inch or 10.75-inch diameter hole

   b. insert 2-inch diameter, schedule 80, polyvinyl chloride casing sealed on the bottom by using electrical tape to attach a thin plastic cap over the end of the casing

   c. press casing through the thin plastic cap to approximately 6 inches below bottom of the auger hole into undisturbed sediment, creating a seal with the outside of the casing and the surrounding sediment

d. insert 1.5-inch diameter shelby tube into casing, core an additional 6 to 12 inches beyond the end of the casing

e. add bentonite slurry between casing and borehole wall to 1 to 2 feet below the ground surface

f. cement the upper 1 to 2 feet of borehole to stabilize casing approximately 6 inches above the ground surface

g. protect with steel posts and/or fence

Several continuous cores were collected from the landfill. At the drill site, these cores were temporarily wrapped and stored in plastic bags. Subsequently, in October and November 1986, they were sealed in clear plastic wrap, placed in boxes, and permanently stored at the South Dakota Geological Survey core repository.

Geology

The surficial lithology present at the Yankton County landfill is composed of end moraine and ground moraine deposits consisting of clay-rich till (fig. 5) overlying sand or chalk and marl. The till in this area is part of a late Wisconsin end moraine complex (G. Johnson, South Dakota Geological Survey, personal communication, 1986). The till lies unconformably on western-derived sand or the Niobrara Formation. Missouri River floodplain alluvium (an aquifer) occurs approximately 1½ miles south of the site. Tributary alluvium, colluvium, and alluvium nearly encircle the site and are directly connected to the floodplain alluvium.

The western-derived sand, as little as 12 to 14 feet under this site, has been observed at many localities in southeastern South Dakota. This sand is easily distinguished from glacial outwash because of its mineralogic composition which consists almost entirely of quartz, feldspar, and granite fragments. Western-derived sand is fluvial in origin and the sediments range in size from moderately well sorted, medium sand, to poorly-sorted coarse sand (Johnson and Milburn, 1984). At the present time no landfill refuse cells are in the western-derived sand.

The Niobrara Formation is Cretaceous in age and it is composed of chalk, calcareous marl, and calcareous shale. At this site it ranges from 20 to 40 feet below land surface. It has been defined as an aquifer in the Yankton area by Bugliosi (1983). At the present time no landfill refuse cells are in the Niobrara Formation.

Prior to the detailed South Dakota Geological Survey investigations in June 1986, eight test holes had been drilled within 1 mile of the site (fig. 6, app. A). No logs were available within the landfill. Test holes YA-299-80, YA-279-80, and YA-233-80 encountered clay (till) to the bottom of the holes at 28 feet. With the exception of test hole YN-70-80, the remaining test holes encountered gravel, sand, or sand and gravel between 2 and 37 feet thick. The thickest gravel layer observed was in test hole YA-289-80, from 11 to 48 feet below the surface. Test holes YA-309-80 and YA-300-80 encountered the Niobrara Formation at 14 and 16 feet, respectively. Test holes YN-70-80 and R1-83-168 encountered the Niobrara Formation at 60 and 92 feet, respectively.

Only data meeting the South Dakota Geological Survey criteria were 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 within 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."

During June 1986, 40 test holes were drilled at this site and 39 were completed as wells. Well depths ranged between 19 and 65 feet. The locations of the test holes and wells are indicated on figure 7 (app. B). Continuous core was obtained from test holes R20-86-32, R20-86-33, and R20-86-34.

At the landfill site, the till ranged from 9 to 48 feet thick averaging 22 feet thick. It consists primarily of unstratified, oxidized, tan-brown, silty, clay containing clasts of sand and gravel. In the western part of the site, till overlies the Niobrara Formation at a depth of between approximately 12 feet in the north (test hole R20-96-32) to 40 feet in the south (test hole R20-86-35). In the south-central part of the site, only till was observed to a depth of 50 feet (test hole R20-86-31). Along the eastern portion of the site, western-derived sand was encountered beneath the till, overlying the Niobrara Formation. To the north, the western-derived sand was first observed at shallow depths (12 to 14 feet) and it was generally less than 10 feet thick. Progressing along the eastern side of the site toward the south, the western-derived sand was encountered deeper in the test holes (15 to 25 feet) and it was generally thicker. Only a few of the deeper test holes in the eastern portion of the site completely penetrated the western-derived sand layer (test hole R20-86-34). Test hole R20-86-36 was drilled specifically to estimate the thickness of the western-derived sand; sand was observed from 24 to 56 feet before the Niobrara Formation was encountered.

Western-derived sand samples from test holes R20-86-33 and R20-86-36 primarily contained the minerals quartz, feldspar, and rock fragments of granite. The particle sizes ranged from fine to coarse sand with a few pebbles also being present. The mineralogy and texture of these samples confirmed that this sand is composed of western-derived sand.

Nine test holes were completed in the Niobrara Formation. The chalk was white to brown in color and had a silty, calcareous composition.

A minor amount of buried loess is present along the western boundary of the site. This wind blown deposit is generally light yellow-brown in color and ranges in size from silt to fine sand. Test holes A1-86-53 and A2-86-95 contained 8 and 16 feet of loess, respectively.

Hydrology

The clay material at the base of the landfill consists primarily of till (Office of Air Quality and Solid Waste records). This was confirmed by observations made during drilling. 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. In South Dakota, till generally has much lower permeability than sand. No site specific permeability data are available.

Prior to the 1985 South Dakota Geological Survey investigation, no monitoring wells were present within 1 mile of the site. 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 ground water movement could not be estimated for the landfill area.

Project plans called for the Office of Air Quality and Solid Waste to collect water level data from the wells that were installed for this project. No data are available in the Office of Air Quality and Solid Waste files for this project, but information may be available in records postdating 1986.

The nearest ground water supply (aquifer), according to Bugliosi (1983), is the Lower James-Missouri aquifer which underlies the landfill site. The top of the aquifer is within 10 to 20 feet of the land surface in the Missouri River valley and the average thickness of the aquifer is 150 feet (Bugliosi, 1983).

Water Quality

No water quality data were available within the landfill or within 1 mile of the landfill boundaries.

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 within 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. It was assumed that 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.

Project plans called for the Office of Air Quality and Solid Waste to collect water quality data from the wells that were installed for this project. No data are available in the Office of Air Quality and Solid Waste files for this project, but information may be available in records postdating 1986.

Adjacent Land Use and Features

Information about adjacent land use and features was taken from the Yankton Quadrangle (United States Geological Survey, 1978) and the General Highway Map - Yankton County (South Dakota Department of Transportation, 1975).

* The city of Yankton is within 1 mile of the southern and eastern sides of the site.
* The nearest surface water is Marne Creek, an intermittent stream located approximately 400 feet from the northeast corner of the site.
* Two intermittent streams flank the hill on which the landfill is located.
* The site is approximately 1 mile west of Highway 81.
* Two cemeteries and one drive-in theater are also located approximately 1 mile east of the site.
* Railroads run approximately northwest to southeast through sec. 1, T. 93 N., R. 56 W., east of the site.

* A power station is located a quarter of a mile southeast of the site.

* A shopping center is located half a mile southeast of the site.

* Stewart School is located approximately 1 mile southeast of the site.

* A radio tower (KYNT) is located a quarter of a mile southwest 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: Yankton County

2. Population served: 20,000

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

4. Estimated amount of waste received per unit time: 18,121 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: TCI, Kolberg Mfg., Alumax Extrusions, M-Tron, Dale Electronics, Hastings Filter Mfg., Morgan Mfg., Stuelpnagel Egg Breaking, South Dakota Human Services Center, United States Army Corps of Engineers (Lewis and Clark Lake)

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

* This landfill is located in close proximity to intermittent streams and the Missouri River.

* The geology at this site generally consists of 20 to 40 feet of till overlying a western-derived sand or the Niobrara Formation. Loess is present between the till and the Niobrara Formation on the western side of the site. A western-derived sand layer up to 32 feet thick is present between the till and the Niobrara Formation on the north and east sides of the site. Surficial alluvium is adjacent to the site.

* Forty test hole logs were available for this site.

* Eight other test hole logs were available within 1 mile of the site.

* Thirty-nine monitoring wells were present near this site.

* No water level data were available near this site.

* No water quality data were available near this site.

REFERENCES CITED

Bugliosi, E.F., 1983, Major aquifers in Yankton County, South Dakota: South Dakota Geological Survey Information Pamphlet 28, 7 p.

Johnson, G.D., and Milburn, S.E., 1984, Pathological evidence of an injured equid, and associated fossils of Late Blancan(?) age from the Bon Homme gravel, Yankton County, South Dakota: Proceedings of the South Dakota Academy of Science, v. 63, p. 77-84.

Simpson, Howard E., 1960, Geology of the Yankton area, South Dakota and Nebraska: United States Geological Survey Professional Paper 328, 124 p.

South Dakota Department of Transportation, 1975, General Highway Map, Yankton County, South Dakota: South Dakota Department of Transportation in cooperation with the United States Department of Transportation, (revisions as of March 31, 1977).

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.

United States Geological Survey, 1978, Yankton quadrangle, South Dakota: 7.5 minute series (topographic), scale 1:24,000.

Figure 1. Sites considered for further evaluation.

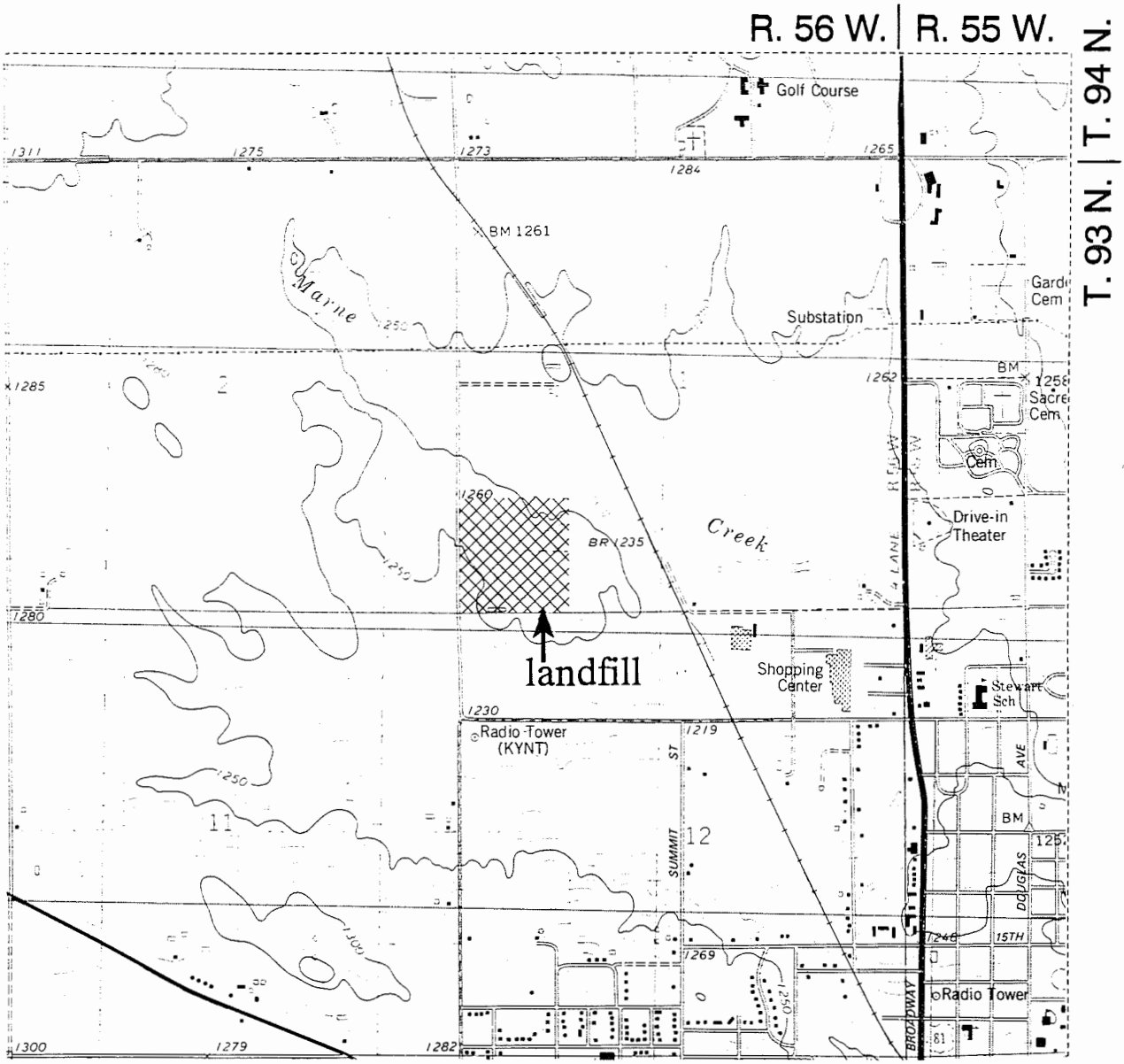


Figure 2. Location of the Yankton County landfill.

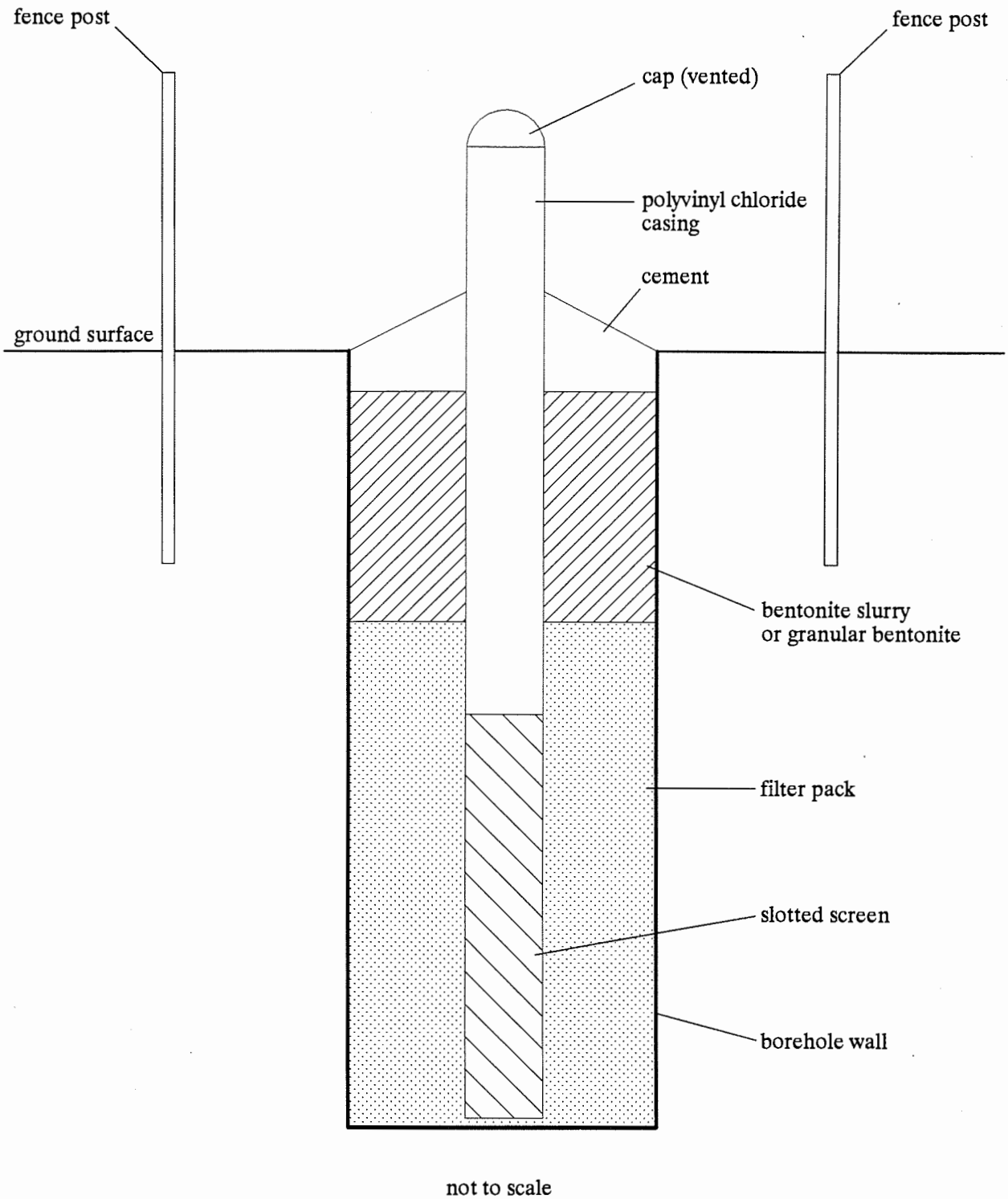


Figure 3. Generalized construction of a screened well.

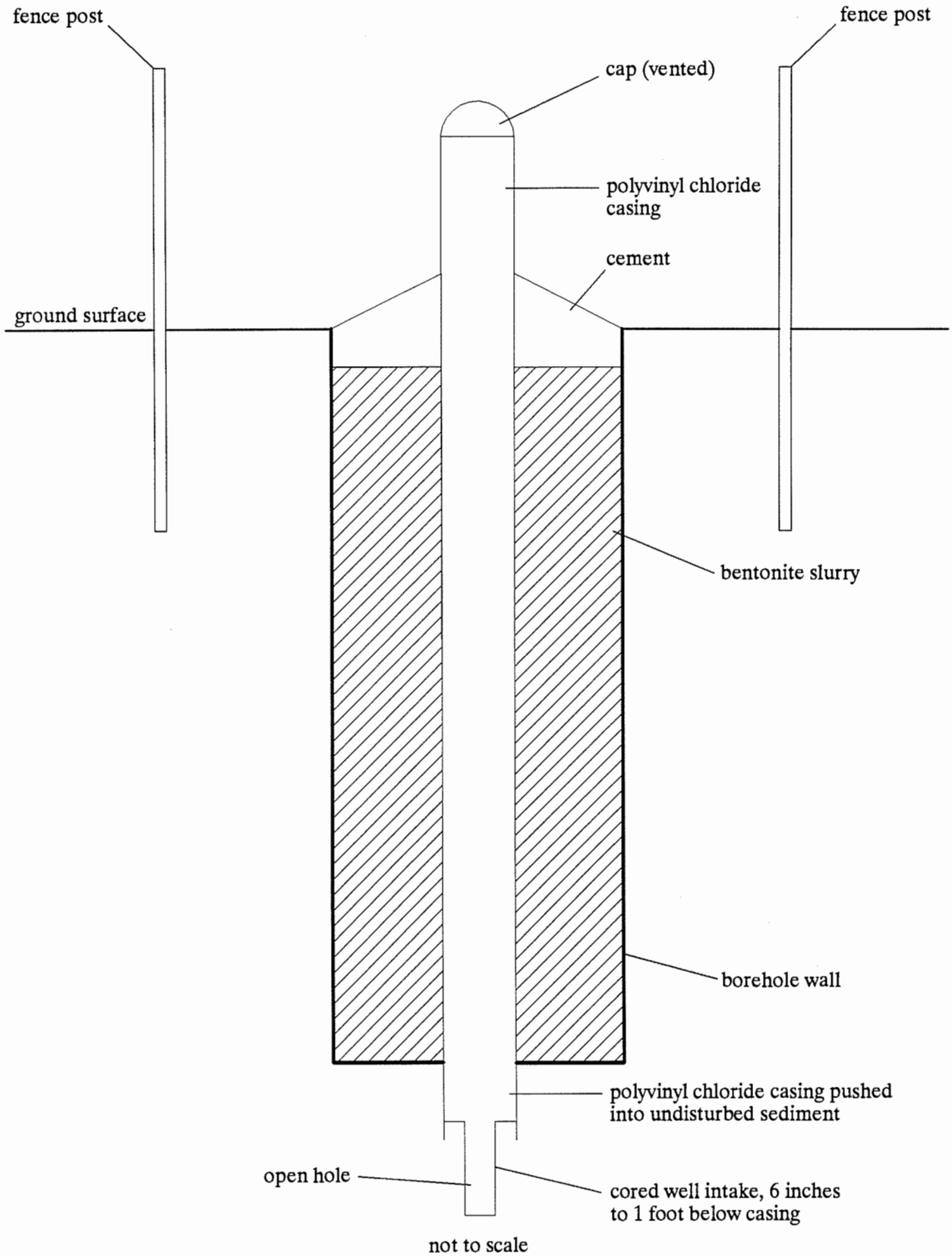
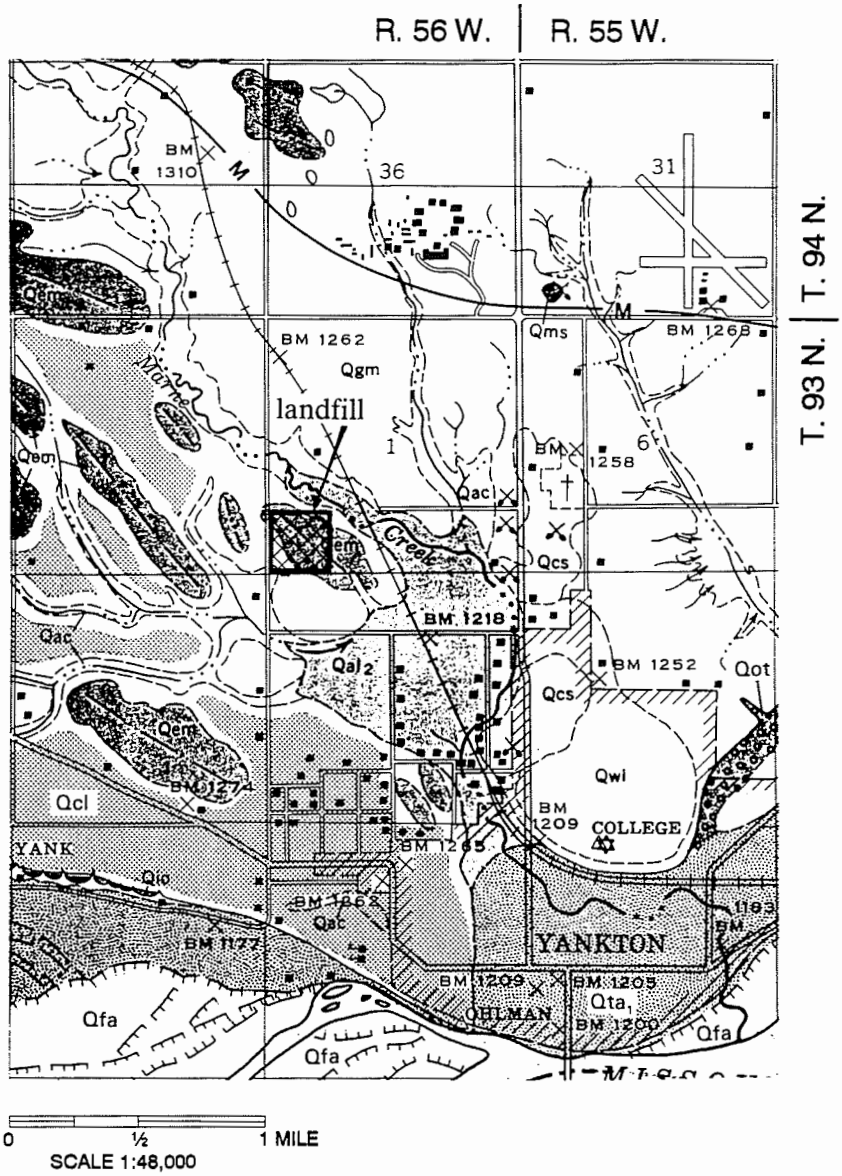


Figure 4. Generalized construction of a cored-intake well.



Qfa ..... Floodplain alluvium

Qta_1 ..... Terrace alluvium

Qal_2 ..... Tributary alluvium

Qac ..... Alluvium and colluvium

Qms ..... Ice-contact stratified drift

Qgm ..... Ground moraine of Mankato, Cary, Iowan, and Illinoian ages

Qot ..... Outwash

Qem ..... End moraines of Mankato and of Cary age

Qcs ..... Ice-contact stratified drift

Qwl ..... Loess of Wisconsin age

Qcl ..... Cary loess

Qio ..... Outwash

Gradational contact

End moraine crest

M — Outer Mankato drift border

Abandoned river channel

Landfill

Adapted from Simpson (1960)

Figure 5. Geology near the Yankton County landfill.

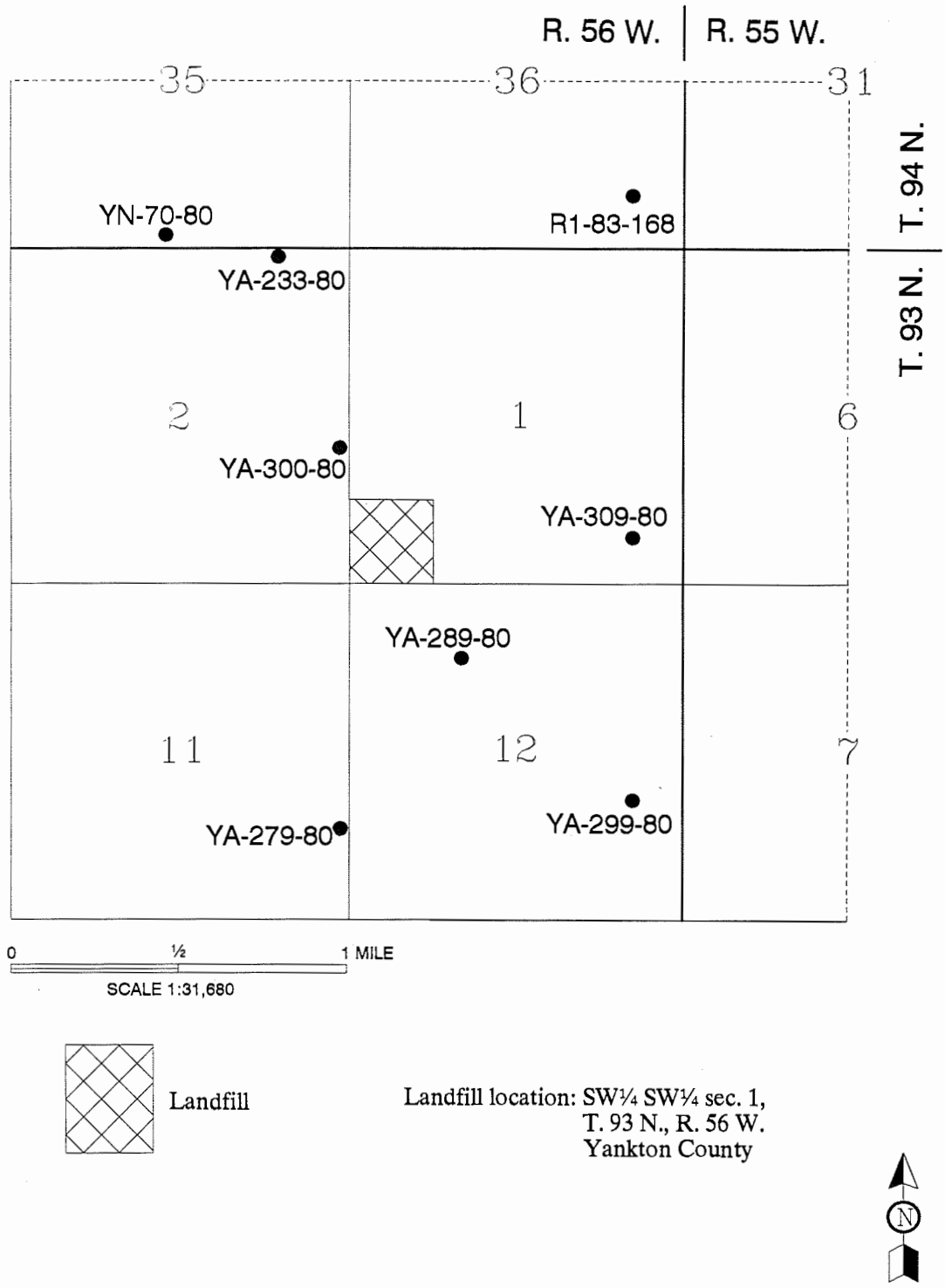


Figure 6. Locations of test holes drilled prior to June 1986 within 1 mile of the Yankton County landfill.

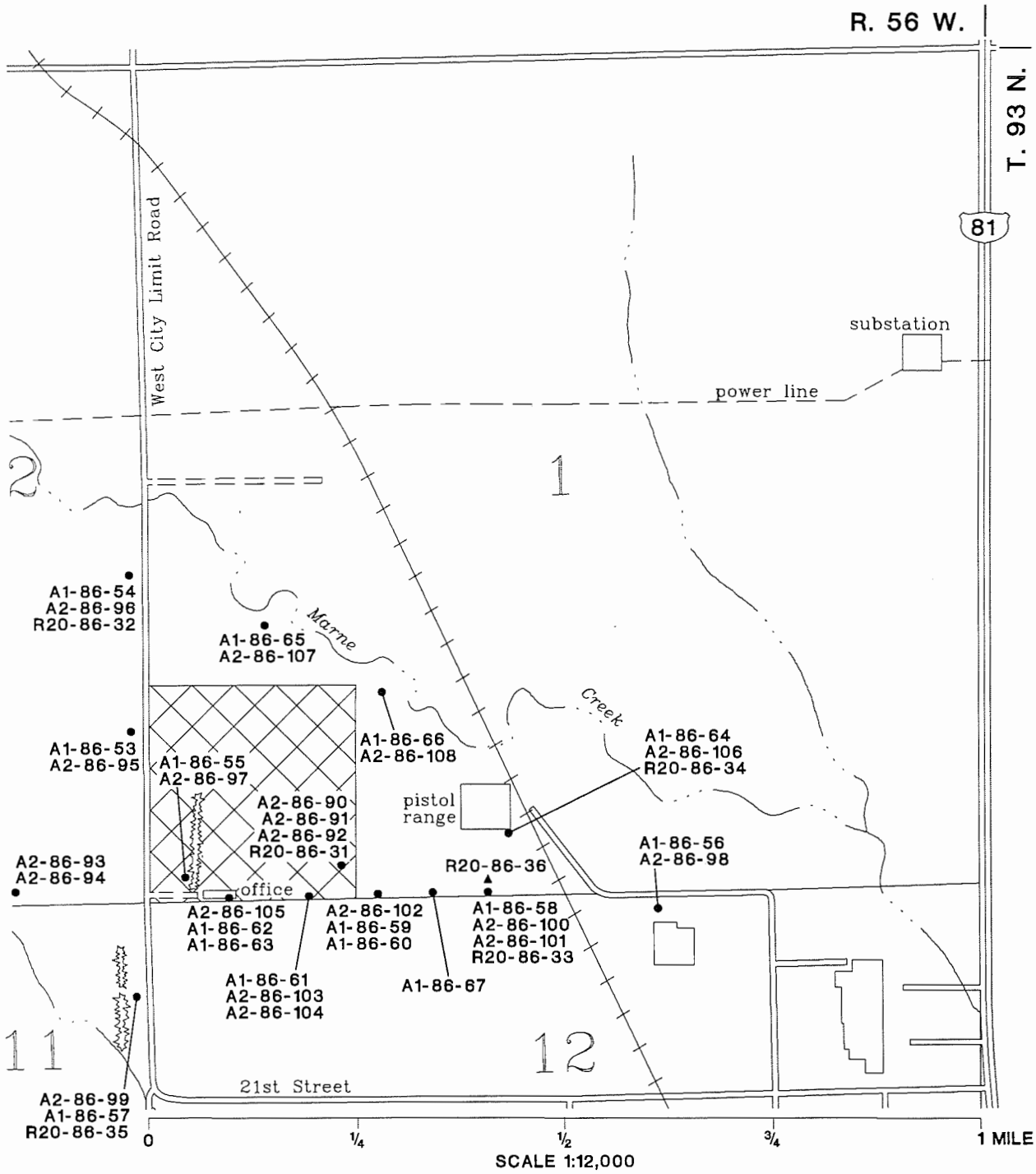


Figure 7. Locations of test holes drilled and wells installed in June 1986 near the Yankton County landfill.

APPENDIX A

Legal locations of Yankton County landfill area logs of test holes drilled prior to June 1986

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

NE NW SE SE sec. 01, T. 93 N., R. 56 W.
NW NE NW NE sec. 02, T. 93 N., R. 56 W.
NE NE NE SE sec. 02, T. 93 N., R. 56 W.
SE SE NE SE sec. 11, T. 93 N., R. 56 W.

SW SE NE NW sec. 12, T. 93 N., R. 56 W.
SE NW NE SE sec. 12, T. 93 N., R. 56 W.
SE SE SE SW sec. 35, T. 94 N., R. 56 W.
NW NW SE SE sec. 36, T. 94 N., R. 56 W.

APPENDIX B

Legal locations of Yankton County landfill area logs of test holes drilled in June 1986

Listed below are the legal locations of the test holes cited in this report. Please contact the South Dakota Geological Survey if a copy of a lithologic log is needed. If a legal location is duplicated, that means more than one test hole has been drilled at that location.

NW SE NW SW sec. 01, T. 93 N., R. 56 W.
NW SE NW SW sec. 01, T. 93 N., R. 56 W.
SW SW SW SW sec. 01, T. 93 N., R. 56 W.
SW SW SW SW sec. 01, T. 93 N., R. 56 W.

SE SW SW SW sec. 01, T. 93 N., R. 56 W.
SE SW SW SW sec. 01, T. 93 N., R. 56 W.
SE SW SW SW sec. 01, T. 93 N., R. 56 W.
SW SE SW SW sec. 01, T. 93 N., R. 56 W.

SW SE SW SW sec. 01, T. 93 N., R. 56 W.
SW SE SW SW sec. 01, T. 93 N., R. 56 W.
SE SE SW SW sec. 01, T. 93 N., R. 56 W.
SE SE SW SW sec. 01, T. 93 N., R. 56 W.

SE SE SW SW sec. 01, T. 93 N., R. 56 W.
SE SE SW SW sec. 01, T. 93 N., R. 56 W.
NW NW SE SW sec. 01, T. 93 N., R. 56 W.
NW NW SE SW sec. 01, T. 93 N., R. 56 W.

SW SW SE SW sec. 01, T. 93 N., R. 56 W.
SW SW SE SW sec. 01, T. 93 N., R. 56 W.
SW SW SE SW sec. 01, T. 93 N., R. 56 W.
SE SW SE SW sec. 01, T. 93 N., R. 56 W.

NE SE SE SW sec. 01, T. 93 N., R. 56 W.
NE SE SE SW sec. 01, T. 93 N., R. 56 W.
NE SE SE SW sec. 01, T. 93 N., R. 56 W.
SW SE SE SW sec. 01, T. 93 N., R. 56 W.

SW SE SE SW sec. 01, T. 93 N., R. 56 W.
SW SE SE SW sec. 01, T. 93 N., R. 56 W.
SW SE SE SW sec. 01, T. 93 N., R. 56 W.
SW SE SE SW sec. 01, T. 93 N., R. 56 W.

Appendix B – continued.

SE NE NE SE sec. 02, T. 93 N., R. 56 W.
SE NE NE SE sec. 02, T. 93 N., R. 56 W.
SE NE NE SE sec. 02, T. 93 N., R. 56 W.
NE NE SE SE sec. 02, T. 93 N., R. 56 W.

NE NE SE SE sec. 02, T. 93 N., R. 56 W.
SE SW SE SE sec. 02, T. 93 N., R. 56 W.
SE SW SE SE sec. 02, T. 93 N., R. 56 W.
SE NE NE NE sec. 11, T. 93 N., R. 56 W.

SE NE NE NE sec. 11, T. 93 N., R. 56 W.
SE NE NE NE sec. 11, T. 93 N., R. 56 W.
NE NW NW NE sec. 12, T. 93 N., R. 56 W.
NE NW NW NE sec. 12, T. 93 N., R. 56 W.