

Introduction

Nimrod Lake is located in Yell and Perry Counties in west-central Arkansas (fig. 1). Nimrod Dam is located 9 miles southeast of Plainview, Arkansas, on Fourche LaFave River at mile 62.6. Drainage area upstream of the dam is 680 square miles. The primary land use within the basin is forested vegetation with small row crop and ranching operations nested within the Arkansas Valley and Ouachita Mountains. Nimrod Lake is used for a variety of recreational purposes such as boating, fishing, swimming, skiing and other water sports.

The U.S. Geological Survey (USGS) in cooperation with the U.S. Army Corps of Engineers, Little Rock District, initiated a bacterial study of Lake Nimrod during the spring and summer 1992. Samples were collected weekly at nine locations on the lake (table 1 and fig. 2) from May through September 1992. These of the sampling sites were located at swim beaches around the lake, the remaining sites were located on tributaries to the lake (fig. 2). One of the tributary sites was located below the sewage treatment plant outfall of the city of Plainview (fig. 2).

Samples were collected weekly for analysis by the USGS. Additional samples were collected on alternate weeks at swim beaches for analysis by the Arkansas Department of Health (ADH) to meet their requirements for swim beach monitoring as part of their regulatory duties. These data are included in this report.

Water-quality standards have been established for three of the four bacterial analyses performed during this study. The State standard established by the Arkansas Department of Pollution Control and Ecology (1991) states "for primary contact waters, between April 1 and September 30, fecal coliform content shall not exceed a geometric mean of 200/100 milliliters (mL) nor shall more than 10 percent of the total samples during any 30-day period exceed 400/100 mL." The State standard established by ADH for total coliforms at a swimming beach is not to exceed 1,000 colonies per 100 milliliters (cols./100 mL), while the State standard established for fecal coliforms is not to exceed 100 cols./100 mL (Cathy Moore, Arkansas Department of Health, oral commun., 1992).

Collection and Analyses

Samples were collected by two methods. The swim beach samples were collected by wading into the lake to approximately knee deep and dipping a sterile bottle below the surface. Samples to be analyzed by the USGS were collected weekly at the center of the swim beach. Samples to be analyzed by ADH were collected on alternate weeks at the left and right sides of each swim beach, also by wading. Tributary samples were collected weekly by either hand dipping or lowering a sample bottle to the water using a rope and a weighted bottle holder. USGS samples were chilled after collection and were analyzed within 6 hours. ADH samples were not chilled and were transported to ADH offices in Little Rock, Arkansas, for analysis on the same day of collection (Cathy Moore, Arkansas Department of Health, oral commun., 1992).

The USGS samples were analyzed for fecal coliform bacteria and fecal streptococcal bacteria following methods described in Britton and Greeson (1987). Fecal coliform bacteria were analyzed following method B-0050-85. These results are reported in tables 2-10. Fecal streptococcal bacteria were analyzed following method B-0055-85. These results are reported in tables 2-10.

Samples collected for ADH were analyzed following methods described by the American Public Health Association and others (1985) (Cathy Moore, Arkansas Department of Health, oral commun., 1992). Colonies testing positive for total coliform were then verified by lactose confirmation. Positives were then reported as confirmed total coliforms by lactose confirmation (cols./100 mL). These results are reported in tables 8-10. Using the same total coliform analysis, colonies testing positive for fecal coliforms were tested to determine if these colonies were of fecal origin; total coliform by membrane filter or fecal coliform by use of EC broth. Positives were then reported as fecal coliforms present in total coliform test by EC broth confirmation (cols./100 mL). These results are reported in tables 8-10.

References Cited

American Public Health Association, American Water Works Association, and Water Pollution Control Federation, 1985, Standard methods for the examination of water and wastewater (16th ed.): Washington, D.C., American Public Health Association, 1,268 p.

Arkansas Department of Pollution Control and Ecology, 1991, Regulation no. 2, as amended, regulations establishing water quality standards for surface waters of the State of Arkansas: Arkansas Department of Pollution Control and Ecology, 73 p.

Britton, L.J., and Greeson, P.E., editors, 1987, Methods for collection and analysis of aquatic biological and microbiological samples: Techniques of Water-Resources Investigations of the U.S. Geological Survey, Book 5, Chapter A4, p. 37-50.

Conversion Factors

| Multiply | By | To obtain |
|-------------|-------|------------------|
| mile | 1.609 | kilometer |
| square mile | 2.59 | square kilometer |

Table 1.-- Sampling site descriptions

| [Station number corresponds to national downstream order number assigned by the U.S. Geological Survey] | | | | |
|---|----------------|--|----------|-----------|
| Site number | Station number | Station name | Latitude | Longitude |
| N-5 | 07261910 | Nimrod Lake near Wards Crossing, Arkansas | 345703 | 0931923 |
| N-6 | 07261820 | Nimrod Lake at Highway 27 Bridge, Arkansas | 345536 | 0932436 |
| N-7 | 07261880 | Nimrod Lake at Plainview, Arkansas | 345905 | 0931837 |
| N-8 | 07261835 | Nimrod Lake at Wards Crossing, Arkansas | 345640 | 0931939 |
| N-9 | 07261920 | Prairie Creek at Plainview, Arkansas | 345904 | 0931812 |
| N-10 | 07261845 | Browns Creek near Plainview, Arkansas | 345839 | 0931952 |
| N-11 | 07261953 | Carter Cove Swim Beach near Fourche Junction, Arkansas | 345738 | 0931423 |
| N-12 | 07261970 | County Line Swim Beach near Fourche Junction, Arkansas | 345745 | 0931115 |
| N-13 | 07261995 | Quarry Cove Swim Beach near Fourche Junction, Arkansas | 345722 | 0930959 |

Table 2.--Water-quality data for Nimrod Lake near Wards Crossing, Arkansas (site N-5)

[cols./100 mL, number of colonies per 100 milliliters of sample; K, non-ideal count; >, greater than; --, no data; five digit numbers in parentheses are STORET parameter codes used for computer storage of data]

| Date of sample | Time of sample | Coliform fecal, 0.7 micron membrane filter (cols./100 mL) ¹ | Streptococci fecal, KF agar (cols./100 mL) ¹ | Weather conditions | Remarks |
|----------------|----------------|--|---|--------------------|-------------------|
| 05-08-92 | 1040 | K1 | K11 | Cloudy | -- |
| 05-12-92 | 1055 | K5 | K6 | Cloudy | Water was brown |
| 05-18-92 | 0935 | K5 | K14 | Cloudy | Water was brown |
| 05-27-92 | 0830 | K9 | 26 | -- | -- |
| 06-04-92 | 1120 | K6 | K9 | Cloudy | Water was brown |
| 06-09-92 | 0955 | K2 | K7 | Light rain | Water was brown |
| 06-15-92 | 1030 | 35 | 48 | Cloudy | No flow |
| 06-25-92 | 0946 | 21 | 33 | Cloudy | Considerable flow |
| 06-30-92 | 1140 | K1,100 | 95 | Cloudy | Average flow |
| 07-07-92 | 0955 | K5 | K16 | Sunny | No flow |
| 07-14-92 | 0955 | K5 | 25 | Sunny | No flow |
| 07-21-92 | 1030 | <1 | K2 | Sunny | No flow |
| 07-30-92 | 0830 | K1 | 51 | Cloudy | Very little flow |
| 08-05-92 | 0950 | K9 | 33 | Cloudy | Very little flow |
| 08-11-92 | 1025 | K3 | K21 | Sunny | Very little flow |
| 08-20-92 | 0935 | K6 | K57 | -- | Very little flow |
| 08-24-92 | 0910 | K2 | K150 | -- | Very little flow |
| 09-02-92 | 1040 | K12 | 47 | Rainy | -- |
| 09-11-92 | 1000 | K36 | K18 | Clear | Very little flow |
| 09-15-92 | 0955 | K2 | 23 | Cloudy | -- |
| 09-22-92 | 1100 | 26 | 78 | Cloudy | -- |
| 09-29-92 | 1005 | K6 | K8 | Clear | -- |

Table 4.--Water-quality data for Nimrod Lake at Plainview, Arkansas (site N-7)

[cols./100 mL, number of colonies per 100 milliliters of sample; K, non-ideal count; >, greater than; --, no data; five digit numbers in parentheses are STORET parameter codes used for computer storage of data]

| Date of sample | Time of sample | Coliform fecal, 0.7 micron membrane filter (cols./100 mL) ¹ | Streptococci fecal, KF agar (cols./100 mL) ¹ | Weather conditions | Remarks |
|----------------|----------------|--|---|--------------------|-------------------|
| 05-08-92 | 0915 | K97 | 78 | Cloudy | -- |
| 05-12-92 | 0935 | K220 | 470 | Cloudy | No flow |
| 05-18-92 | 0830 | >60,000 | >100,000 | Cloudy | Water was brown |
| 05-27-92 | 0945 | 240 | 280 | -- | Very little flow |
| 06-04-92 | 1000 | K830 | 1,300 | Cloudy | Water was brown |
| 06-09-92 | 0840 | K250 | 290 | Cloudy | Very little flow |
| 06-15-92 | 0930 | 320 | 6,000 | Cloudy | Very little flow |
| 06-25-92 | 0855 | K390 | K760 | Cloudy | Considerable flow |
| 06-30-92 | 1035 | 950 | 3,300 | Rainy | Considerable flow |
| 07-07-92 | 0850 | 420 | 550 | Sunny | Very little flow |
| 07-14-92 | 0855 | 240 | 550 | Sunny | Very little flow |
| 07-21-92 | 0925 | 420 | 430 | Sunny | Very little flow |
| 07-30-92 | 0745 | K2,100 | 2,400 | Cloudy | No flow |
| 08-05-92 | 0900 | 330 | K1,100 | Cloudy | Very little flow |
| 08-11-92 | 0935 | K1,800 | 7,300 | Sunny | Very little flow |
| 08-20-92 | 0835 | 290 | 470 | -- | No flow |
| 08-24-92 | 0815 | 43 | 550 | -- | No flow |
| 09-02-92 | 1000 | 3,500 | 2,500 | Rainy | No flow |
| 09-11-92 | 0840 | 210 | 360 | Foggy | Very little flow |
| 09-15-92 | 0905 | K9 | 44 | Cloudy | No flow |
| 09-22-92 | 1015 | 4,100 | 41,000 | Cloudy | -- |
| 09-29-92 | 0915 | K94 | K800 | Clear | No flow |

Table 3.--Water-quality data for Nimrod Lake at Highway 27 bridge, Arkansas (site N-6)

[cols./100 mL, number of colonies per 100 milliliters of sample; K, non-ideal count; >, greater than; --, no data; five digit numbers in parentheses are STORET parameter codes used for computer storage of data]

| Date of sample | Time of sample | Coliform fecal, 0.7 micron membrane filter (cols./100 mL) ¹ | Streptococci fecal, KF agar (cols./100 mL) ¹ | Weather conditions | Remarks |
|----------------|----------------|--|---|--------------------|-------------------|
| 05-08-92 | 0950 | 23 | 65 | Cloudy | -- |
| 05-12-92 | 1000 | 32 | 30 | Cloudy | Water was green |
| 05-18-92 | 0900 | 29 | 53 | Cloudy | Water was green |
| 05-27-92 | 0730 | K8 | 62 | -- | Very little flow |
| 06-04-92 | 1040 | 230 | 510 | Cloudy | Water was muddy |
| 06-09-92 | 0915 | 21 | >1,000 | Light rain | Water was muddy |
| 06-15-92 | 0955 | 610 | 7,000 | Cloudy | No flow |
| 06-25-92 | 0920 | 30 | 34 | Cloudy | Considerable flow |
| 06-30-92 | 1105 | 20 | 53 | Cloudy | Average flow |
| 07-07-92 | 0915 | 31 | 200 | Sunny | Water was muddy |
| 07-14-92 | 0925 | K15 | 270 | Cloudy | Water was muddy |
| 07-21-92 | 0955 | K13 | K16 | Sunny | Very little flow |
| 07-30-92 | 0805 | 24 | K1,300 | Cloudy | No flow |
| 08-05-92 | 0925 | 31 | 600 | Cloudy | Very little flow |
| 08-11-92 | 1000 | 100 | 20 | Sunny | Very little flow |
| 08-20-92 | 0900 | 47 | 370 | -- | Very little flow |
| 08-24-92 | 0835 | 62 | 490 | -- | Very little flow |
| 09-02-92 | 1020 | K170 | 250 | Rainy | -- |
| 09-11-92 | 0910 | K96 | 2,000 | Foggy | No flow |
| 09-15-92 | 0925 | 34 | K410 | Cloudy | -- |
| 09-22-92 | 1030 | 280 | 3,900 | Cloudy | -- |
| 09-29-92 | 0935 | 42 | 260 | Clear | Very little flow |

Table 5.--Water-quality data for Nimrod Lake at Wards Crossing, Arkansas (site N-8)

[cols./100 mL, number of colonies per 100 milliliters of sample; K, non-ideal count; >, greater than; --, no data; five digit numbers in parentheses are STORET parameter codes used for computer storage of data]

| Date of sample | Time of sample | Coliform fecal, 0.7 micron membrane filter (cols./100 mL) ¹ | Streptococci fecal, KF agar (cols./100 mL) ¹ | Weather conditions | Remarks |
|----------------|----------------|--|---|--------------------|------------------|
| 05-08-92 | 1030 | K2 | K5 | Cloudy | -- |
| 05-12-92 | 1040 | K7 | K14 | Cloudy | Very little flow |
| 05-18-92 | 0930 | 20 | 73 | Cloudy | Water was brown |
| 05-27-92 | 0815 | K9 | K18 | -- | Very little flow |
| 06-04-92 | 1105 | K12 | 21 | Cloudy | Water was brown |
| 06-09-92 | 0945 | K14 | 22 | Light rain | No flow |
| 06-15-92 | 1020 | 54 | 92 | Clear | Very little flow |
| 06-25-92 | 0941 | 20 | 91 | Cloudy | Water was brown |
| 06-30-92 | 1130 | K10 | K13 | Cloudy | Water was brown |
| 07-07-92 | 0940 | 34 | 29 | Sunny | No flow |
| 07-14-92 | 0945 | K2 | K10 | Sunny | Water was brown |
| 07-21-92 | 1015 | K4 | K1 | Sunny | Water was brown |
| 07-30-92 | 0820 | K14 | 91 | Cloudy | No flow |
| 08-05-92 | 0945 | 26 | 9 | Cloudy | No flow |
| 08-11-92 | 1020 | K6 | K13 | Cloudy | No flow |
| 08-20-92 | 0925 | K6 | K33 | -- | Very little flow |
| 08-24-92 | 0900 | K2 | 52 | -- | No flow |
| 09-02-92 | 1035 | K9 | 22 | Rainy | -- |
| 09-11-92 | 0945 | K7 | K10 | Clear | Very little flow |
| 09-15-92 | 0945 | K5 | K8 | Cloudy | -- |
| 09-22-92 | 1050 | 60 | 240 | Cloudy | -- |
| 09-29-92 | 0955 | K7 | K8 | Clear | Very little flow |

Table 9.--Water-quality data for County Line Swim Beach near Fourche Junction, Arkansas (site N-12)

[cols./100 mL, number of colonies per 100 milliliters of sample; K, non-ideal count; <, less than; --, no data; five digit numbers in parentheses are STORET parameter codes used for computer storage of data]

| Sample location | Date of sample | Time of sample | Coliform fecal, 0.7 micron membrane filter (cols./100 mL) ¹ | Streptococci fecal, KF agar (cols./100 mL) ¹ | Confirmed total coliforms by lactose confirmation (cols./100 mL) ² | Fecal coliforms present in total coliform test, EC broth confirmation (cols./100 mL) ² | Weather conditions | Remarks |
|-----------------|----------------|----------------|--|---|---|---|--------------------|-----------------|
| Center | 05-08-92 | 1140 | K2 | K5 | -- | -- | Cloudy | -- |
| Left side | 05-12-92 | 1140 | -- | -- | 70 | 10 | Cloudy | Water was brown |
| Center | 05-12-92 | 1145 | K9 | 39 | -- | -- | Cloudy | Water was brown |
| Right side | 05-12-92 | 1150 | -- | -- | 100 | -- | Cloudy | Water was brown |
| Left side | 05-18-92 | 1035 | -- | -- | 16,000 | <1 | Cloudy | Water was clear |
| Center | 05-18-92 | 1040 | -- | -- | -- | -- | Cloudy | Water was clear |
| Right side | 05-18-92 | 1045 | -- | -- | 300 | -- | Cloudy | Water was clear |
| Center | 05-27-92 | 1125 | K3 | K4 | -- | -- | -- | -- |
| Left side | 06-04-92 | 1235 | -- | -- | 70 | 30 | Cloudy | -- |
| Center | 06-04-92 | 1240 | K16 | K14 | -- | -- | Cloudy | -- |
| Right side | 06-04-92 | 1245 | -- | -- | 1,000 | <1 | Cloudy | -- |
| Center | 06-09-92 | 1100 | K1 | K15 | -- | -- | Cloudy | -- |
| Left side | 06-15-92 | 1120 | -- | -- | 100 | 100 | Clear | -- |
| Center | 06-15-92 | 1125 | 42 | 61 | -- | -- | Clear | -- |
| Right side | 06-15-92 | 1130 | -- | -- | 1,000 | <1 | Clear | -- |
| Center | 06-25-92 | 1040 | K18 | <10 | -- | -- | Cloudy | -- |
| Left side | 06-30-92 | 1310 | -- | -- | 100 | <1 | Cloudy | -- |
| Center | 06-30-92 | 1315 | K14 | K1,600 | -- | -- | Cloudy | -- |
| Right side | 06-30-92 | 1320 | -- | -- | 200 | <1 | Cloudy | -- |
| Center | 07-07-92 | 1050 | K3 | K18 | -- | -- | Sunny | -- |
| Center | 07-14-92 | 1105 | K45 | K150 | -- | -- | Cloudy | -- |
| Center | 07-21-92 | 1115 | K4 | K13 | -- | -- | Sunny | -- |
| Left side | 07-27-92 | 1045 | -- | -- | 10 | 10 | -- | -- |
| Right side | 07-27-92 | 1050 | -- | -- | 60 | 20 | -- | -- |
| Left side | 07-30-92 | 0925 | -- | -- | 70 | <1 | Cloudy | Water was dingy |
| Center | 07-30-92 | 0930 | K4 | K2 | -- | -- | Cloudy | Water was dingy |
| Right side | 07-30-92 | 0935 | -- | -- | 400 | 300 | Cloudy | Water was dingy |
| Center | 08-05-92 | 1035 | K8 | K13 | -- | -- | Cloudy | -- |
| Left side | 08-11-92 | 1115 | -- | -- | 1,000 | <1 | Cloudy | -- |
| Center | 08-11-92 | 1120 | K4 | 29 | -- | -- | Cloudy | -- |
| Right side | 08-11-92 | 1125 | -- | -- | 100 | <1 | Cloudy | -- |
| Center | 08-20-92 | 1025 | <1 | K1 | -- | -- | -- | -- |
| Left side | 08-24-92 | 1010 | -- | -- | 10 | 10 | -- | -- |
| Center | 08-24-92 | 1015 | K2 | 49 | -- | -- | -- | -- |
| Right side | 08-24-92 | 1020 | -- | -- | <1 | -- | -- | -- |
| Center | 09-02-92 | 1110 | K7 | 23 | -- | -- | Rain | -- |
| Left side | 09-11-92 | 1045 | -- | -- | <1 | <1 | Clear | -- |
| Center | 09-11-92 | 1050 | K73 | K18 | -- | -- | Clear | -- |
| Right side | 09-11-92 | 1055 | -- | -- | <1 | <1 | Clear | -- |
| Center | 09-15-92 | 1025 | K1 | K13 | -- | -- | Cloudy | -- |
| Left side | 09-22-92 | 0930 | -- | -- | 1,000 | <1 | Cloudy | -- |
| Center | 09-22-92 | 0935 | K17 | 41 | -- | -- | Cloudy | -- |
| Right side | 09-22-92 | 0940 | -- | -- | 30 | 20 | Cloudy | -- |
| Center | 09-29-92 | 1045 | K1 | K5 | -- | -- | Clear | -- |

¹ Analyses performed by U.S. Geological Survey.

² Analyses performed by the Arkansas Department of Health.

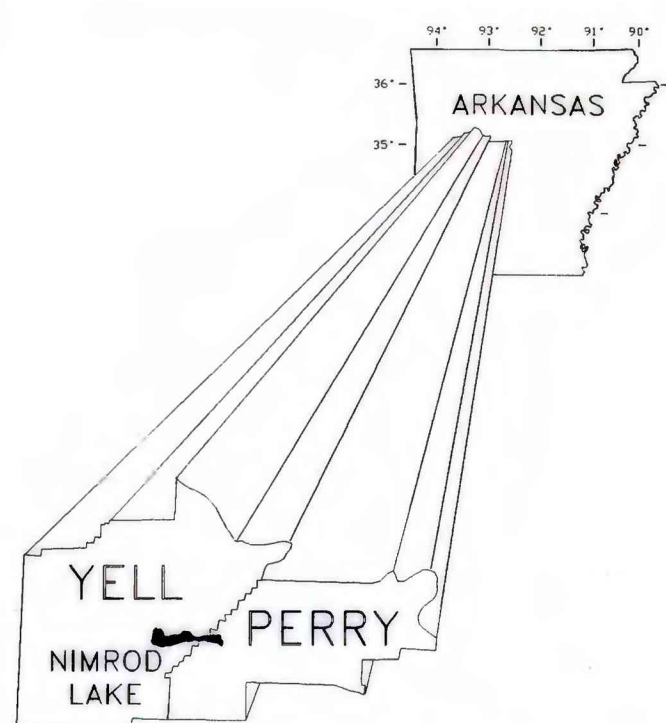


Figure 1.--Location of study area.

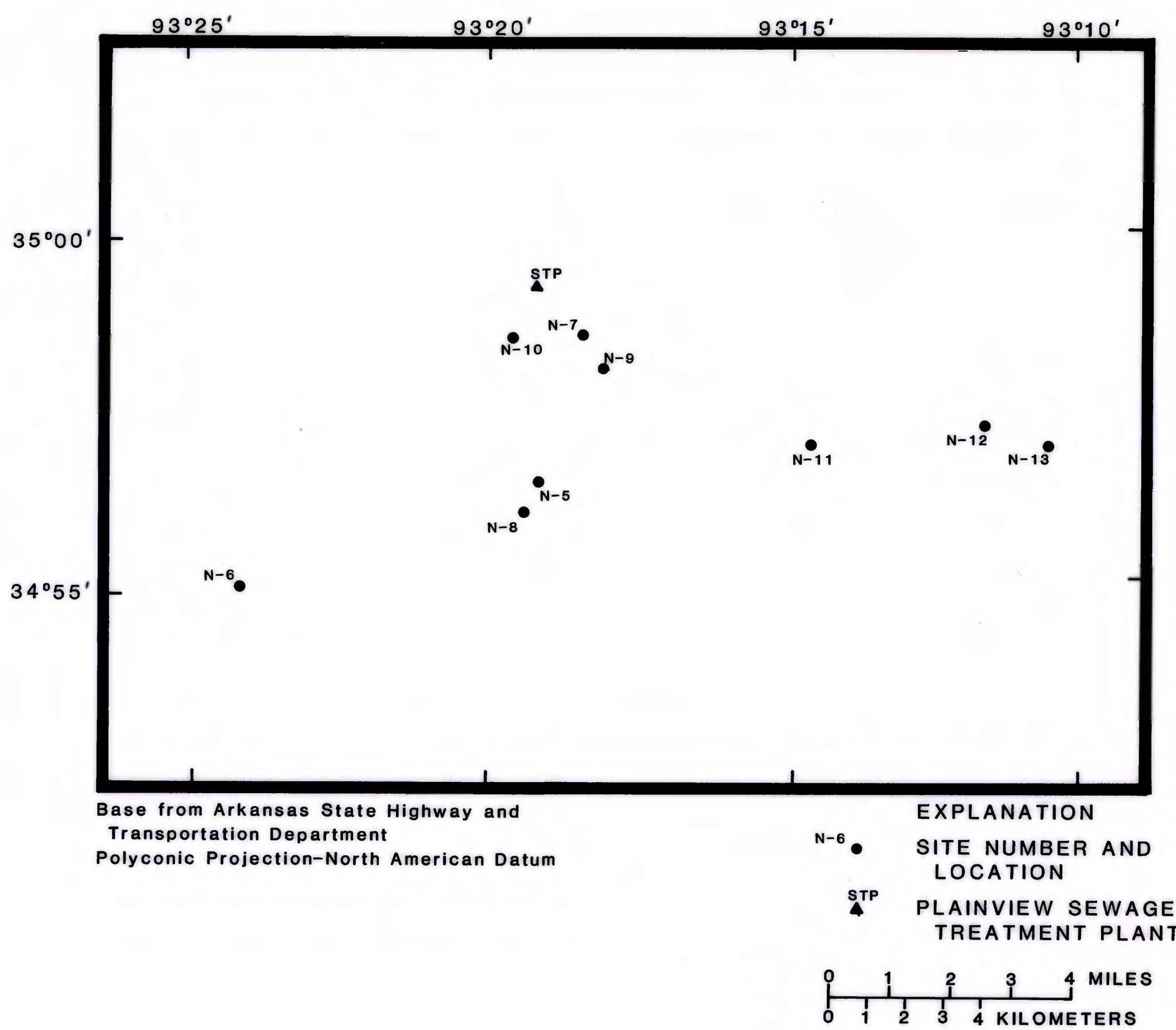


Figure 2.--Map showing locations of sampling sites.

Table 6.--Water-quality data for Prairie Creek at Plainview, Arkansas (site N-9)

[cols./100 mL, number of colonies per 100 milliliters of sample; K, non-ideal count; >, greater than; --, no data; five digit numbers in parentheses are STORET parameter codes used for computer storage of data]

| Date of sample | Time of sample | Coliform fecal, 0.7 micron membrane filter (cols/100 mL) (31625) | Streptococci fecal, KF agar (cols/100 L) (31673) | Weather conditions | Remarks |
|----------------|----------------|--|--|--------------------|-------------------|
| 05-08-92 | 1055 | K61 | 73 | Cloudy | -- |
| 05-12-92 | 1100 | 33 | 76 | Cloudy | Water was brown |
| 05-18-92 | 0950 | K14,000 | 41,000 | Cloudy | Water was brown |
| 05-27-92 | 0930 | 240 | 590 | -- | No flow |
| 06-04-92 | 1130 | 500 | 790 | Cloudy | Water was brown |
| 06-09-92 | 1100 | K150 | 600 | Cloudy | No flow |
| 06-15-92 | 1040 | 420 | 1,100 | Clear | Very little flow |
| 06-25-92 | 0957 | 230 | 530 | Cloudy | Considerable flow |
| 06-30-92 | 1150 | K720 | K1,400 | Cloudy | Very little flow |
| 07-07-92 | 1100 | 260 | 850 | Sunny | Very little flow |
| 07-14-92 | 1010 | 330 | 560 | Sunny | Water was brown |
| 07-21-92 | 1040 | 210 | 760 | Sunny | Water was brown |
| 07-30-92 | 0835 | K54 | 680 | Cloudy | No flow |
| 08-05-92 | 0905 | K1,400 | 4,900 | Cloudy | No flow |
| 08-11-92 | 1040 | K9,800 | 33,000 | Cloudy | No flow |
| 08-20-92 | 0945 | 330 | 530 | -- | No flow |
| 08-24-92 | 0920 | 27 | 530 | -- | No flow |
| 09-05-92 | 1045 | K270 | 2,700 | Rainy | No flow |
| 09-14-92 | 1015 | K12,000 | K12,000 | Clear | No flow |
| 09-15-92 | 1000 | K1,100 | K770 | Cloudy | -- |
| 09-22-92 | 1110 | 43,000 | >60,000 | Cloudy | -- |
| 09-28-92 | 1015 | K700 | 640 | Clear | No flow |