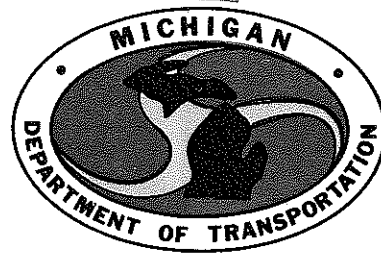


**MICHIGAN DEPARTMENT OF TRANSPORTATION
M•DOT**

**EFFECTS OF DEICING SALTS ON THE CHLORIDE
LEVELS IN WATER AND SOIL ADJACENT TO ROADWAYS**
Interim Progress Report



MATERIALS and TECHNOLOGY DIVISION

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**EFFECTS OF DEICING SALTS ON THE CHLORIDE
LEVELS IN WATER AND SOIL ADJACENT TO ROADWAYS
Interim Progress Report**

R. W. Muethel

Research Laboratory Section
Materials and Technology Division
Research Project 71 G-180
Research Report No. R-1322

Michigan Transportation Commission
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Lansing, March 1993

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ACTION PLAN

1. Materials and Technology Division

- A. Research and Technology Section is to install the new monitoring wells along I 69 at Lansing as proposed and continue to monitor the chloride content of the adjacent ground water in all the wells of this project.

ABSTRACT

Results of statewide chloride monitoring conducted under this project from 1976 through 1984 were reported in an interim progress report, Research Report No. R-1279 issued in 1986. The report indicated that the levels of chlorides in the roadside environment at the sampling sites were found to be generally low and within acceptable limits. The report recommended continued monitoring of the chloride levels in the ground water to measure the effects of improvements in winter maintenance ice control practices.

Following the recommendations, sampling of ground water from the monitor wells was resumed in 1986. Sampling from 25 ground water wells at three locations established for this investigation has continued through 1992. Water samples are obtained twice each year, in the spring after frost melt, and in the fall before resumption of winter maintenance deicing. Samples are also obtained from a roadside subgrade drain located near one of the monitor well sites.

The results of the samplings indicate that chlorides in the roadside environment at the monitor locations have remained at the previously measured levels.

Additional ground water monitor wells along a newly constructed roadway east and west of Lansing have been requested. The wells will provide information on the chloride levels in a new roadway environment. Also, the wells will be readily accessible for special samplings to measure the short term ground water chloride levels after ice control salt applications to the adjacent roadway.

INTRODUCTION

The intensive monitoring phase of this investigation involved the biweekly sampling of ground water, streams, and ponds adjacent to roadways, and biweekly sampling of shoulder gravels from statewide monitor sites along I 69, US 27, US 10, and I 75 on a year round basis from 1976 through 1984. The results of the monitoring were included in an interim progress report in 1986 (1).

Results of the intensive monitoring phase indicated that the levels of chlorides in the roadside environment at the sampling sites were found to be generally low and within acceptable limits. The results indicated that the deicing salt was being adequately dissipated by the annual precipitation, and that there was no evidence of salt accumulation in the roadside environment at the monitor sites. The report recommended continued monitoring of the chloride levels in the ground water to measure the effects of improvements in winter maintenance ice control practices.

In 1986, the monitoring of chlorides in roadside ground water was resumed based upon the interim progress report recommendation.

SAMPLING AND ANALYSIS

The sampling format for this investigation was structured to monitor the migration of roadway deicing salt into the roadside environment. Shallow ground water wells were established in areas of permeable soils that furnish direct ground water recharge. Monitoring from the ground water wells was resumed in 1986 with a sampling frequency of twice per year, in the spring after frost melt, and in the fall before resumption of winter maintenance deicing.

Samples are obtained from 25 ground water wells at three of four statewide locations originally established for the project (Fig. 1). Monitoring from one well array along I 75 south of Grayling was discontinued due to the deep ground water elevation close to 30 feet below ground surface. Chlorides from roadway deicing were not evident in the ground water at this location.

In addition to the ground water wells, one roadside subgrade drain near the US 10 monitor site is sampled for information. The drain has recorded chloride fluctuations that increase as a result of winter maintenance applications of deicing salt to the roadway, and decrease after termination of salt applications.

Location plans of the well arrays are indicated in Figures 2 through 5. Detailed descriptions of the ground water monitor sites and techniques used in sampling and analysis are included in the interim progress report issued in 1986 (1).

FINDINGS

Ground Water

Results of the ground water monitoring conducted from 1976 through 1984 indicated that the roadside ground water chlorides increase for a few years after the start of winter maintenance deicing treatment on a newly-opened roadway as evidenced by the samplings from the monitor well array on the US 10 roadway northwest of Clare completed shortly before the start of sampling for this investigation.

The initial sampling from the monitor site on the US 10 roadway showed chlorides of less than 10 ppm cl⁻ (parts per million chloride ion concentration), increasing during the following two years to levels fluctuating between approximately 30 to 70 ppm cl⁻ during the sampling period between 1976 and 1984.

The results of the biannual samplings obtained from the three ground water monitoring locations from 1986 through 1992 indicate a continuation of the low chlorides in the roadside environment. The chloride levels at the ground water monitor sites and subgrade drain location are shown in Figure 6.

As referenced in the 1984 interim progress report, the U. S. Public Health Service drinking water standards issued in Public Health Service Publication 956 set the recommended maximum chloride level at 250 ppm for potable water (2). Although the water from these shallow wells would probably be unfit to drink due to other contaminants, the water would meet the U. S. Public Health Service requirement for chloride content.

Field Observations

As with the sampling for the earlier phase of the investigation, visual appearance of the condition of roadside vegetation was noted. The roadside grass cover at the monitor well locations appears to be continuous, with no evidence of denudation that would indicate possible excessive chlorides in the soil.

New Monitor Sites

Additional ground water monitor wells have been requested along the new I 69 roadway east and west of Lansing. The new wells will provide additional information on the chloride levels in the ground water adjacent to a new roadway. The wells will also be readily accessible for special samplings to measure the short term ground water chloride levels after ice control salt applications to the adjacent roadway. The new wells are tentatively scheduled to be established in 1993. The general locations of the new wells are indicated in Figure 1.

CONCLUSIONS AND RECOMMENDATIONS

The results of continued monitoring of the ground water chlorides at the monitor locations indicate that the amount of salt applied to the roadways for winter maintenance deicing appears to be balanced by the amount of precipitation necessary to prevent accumulation in the roadside environment. Also, the chloride levels in the ground water were found to be acceptably low at present rates of infiltration.

Continued monitoring of the chloride levels in the ground water is recommended to determine the effectiveness of improved ice control practices in reducing the amount of chloride in the roadside environment.

REFERENCES

1. Muethel, R. W., "Effects of Deicing Salts on the Chloride Levels in Water and Soil Adjacent to Roadways," Michigan Department of Transportation, Research Report No. R-1279, 1986.
2. U. S. Public Health Service, "Public Health Service Drinking Water Standards (Revised)," Public Health Service Publication No. 956, U. S. Government Printing Office, Washington, D.C., 1962.

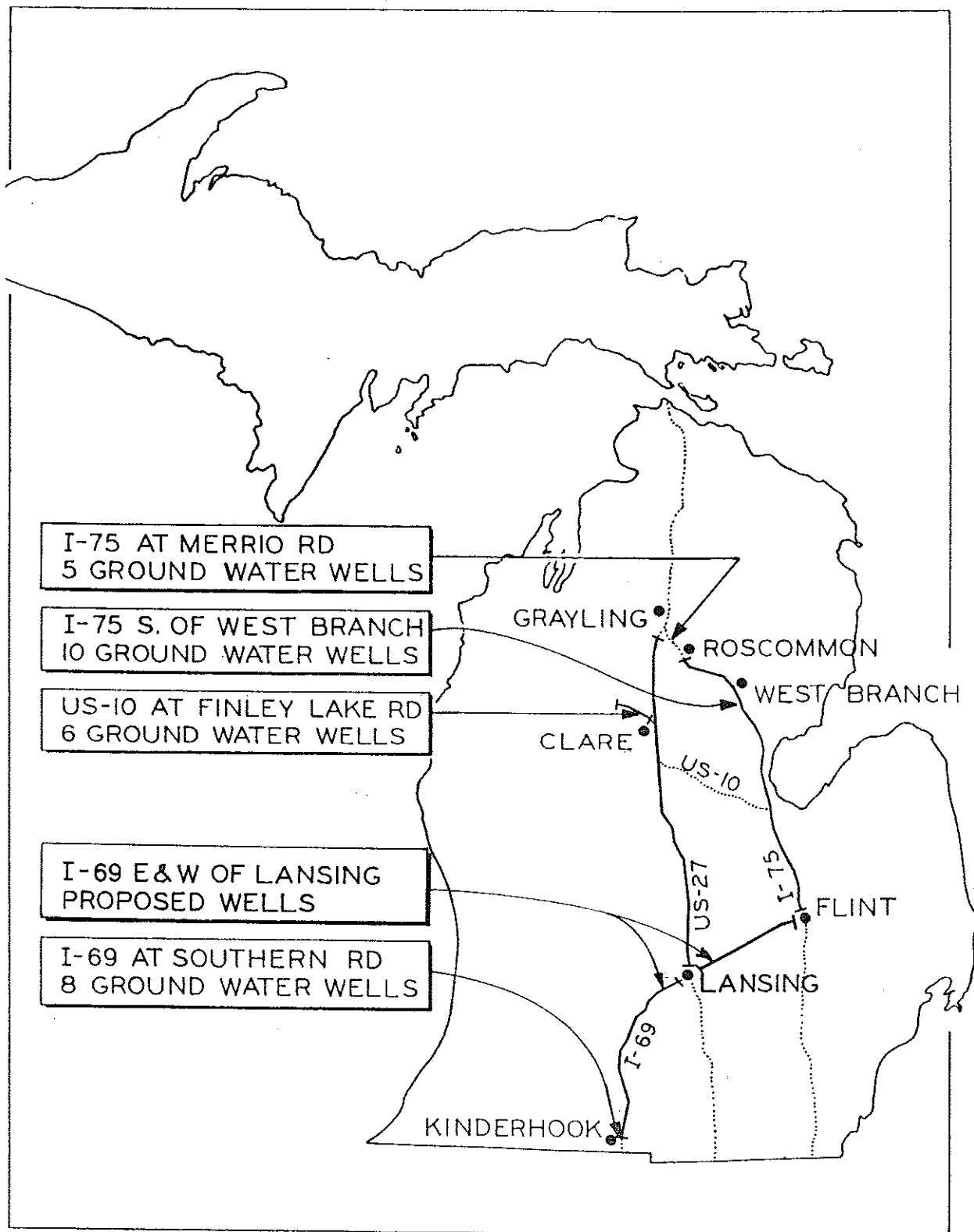


Figure 1. Locations of ground water wells and state trunkline segments monitored.

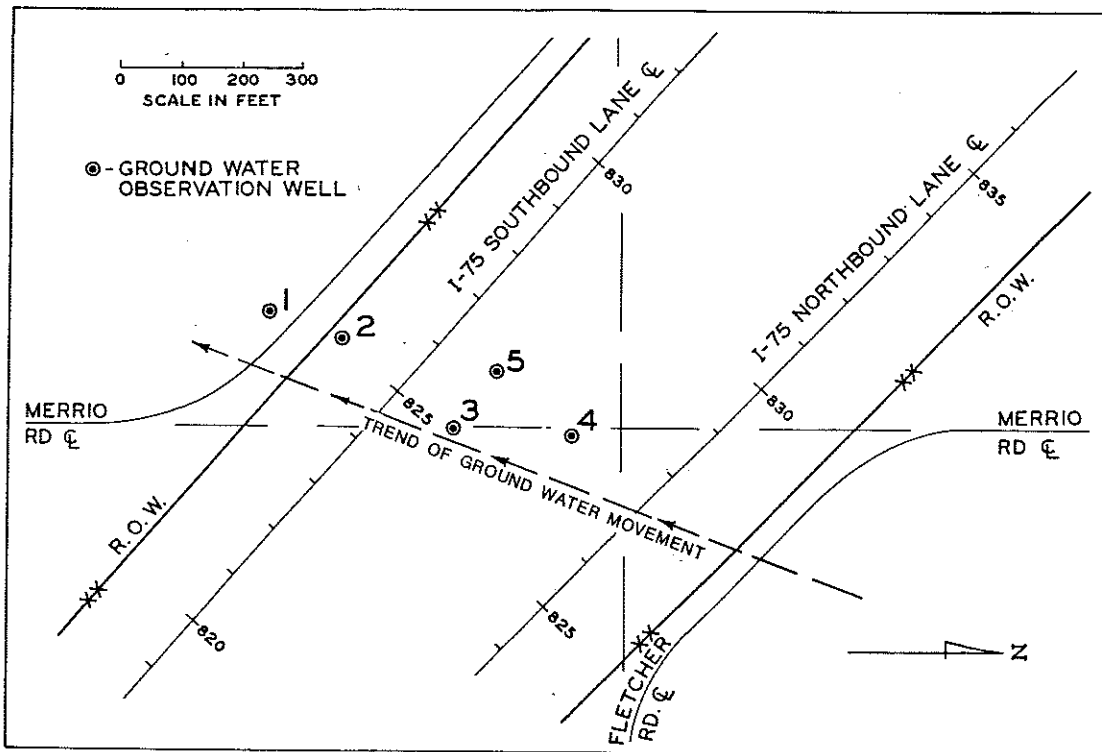


Figure 2. I 75 well locations: I 75 south of Grayling (Sections 20, 21, 28, 29, T25N-R3W, Beaver Creek Twp, Crawford Co.). Roadway opened to traffic in 1971.

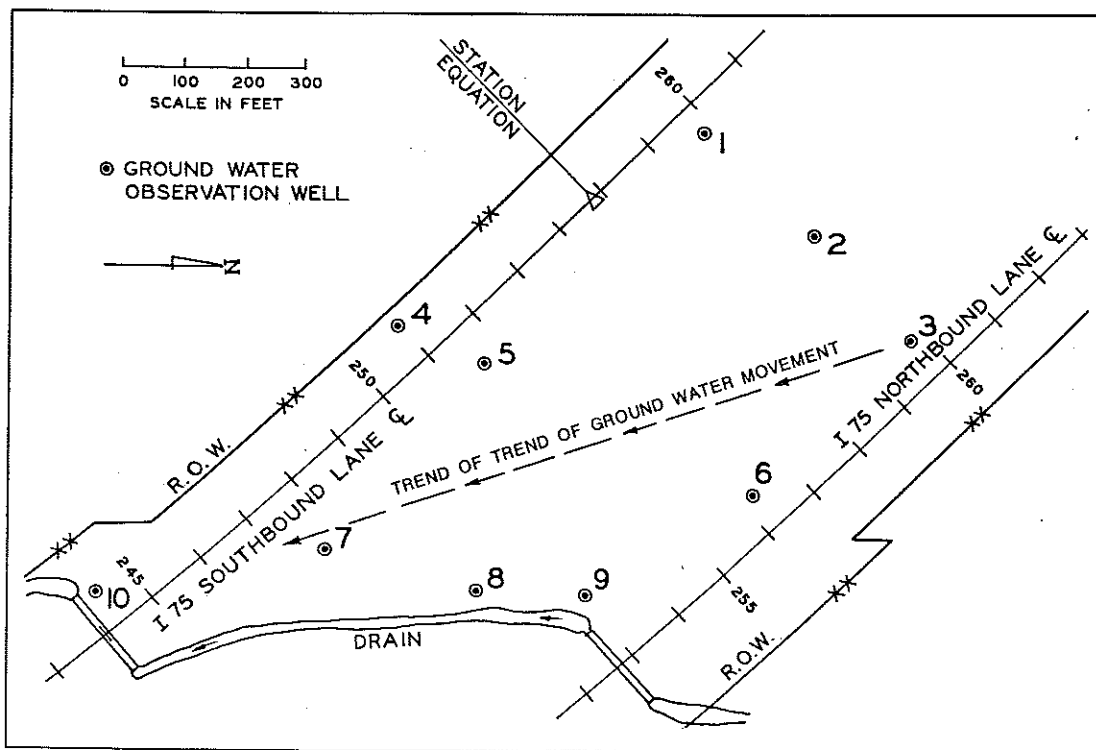


Figure 3. I 75 well locations: I 75 south of West Branch (Section 16, T21N-R2E, Horton Twp, Ogemaw Co.). Roadway opened to traffic in 1971.

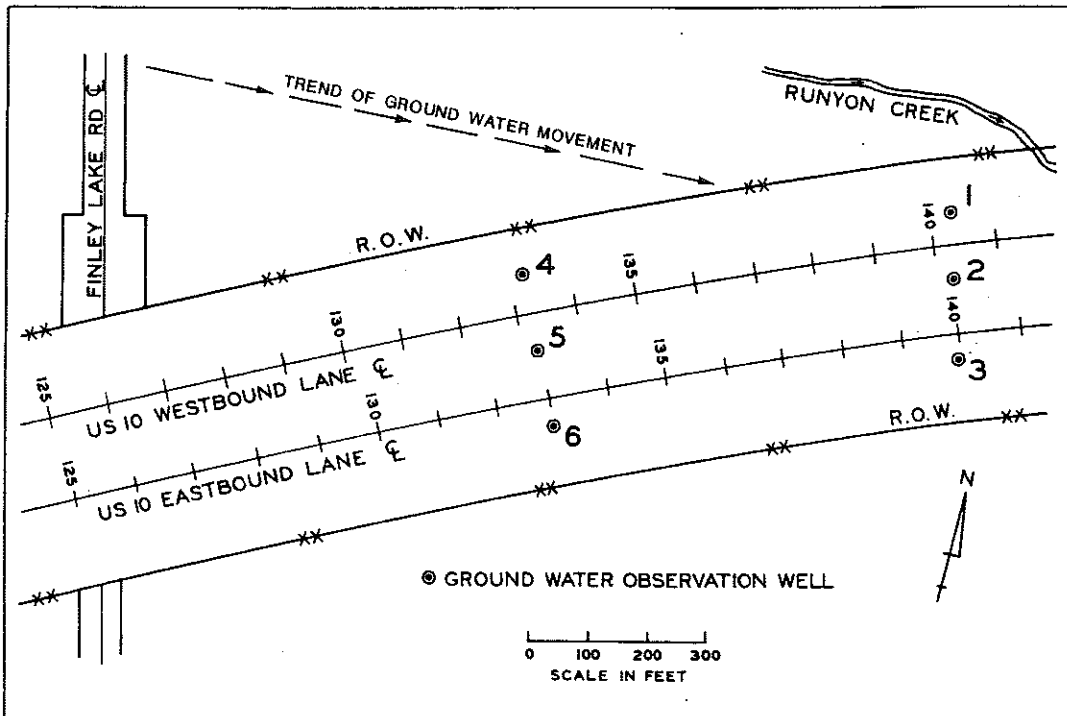


Figure 4. US 10 well locations: US 10, Finley Lake Rd Area (Section 14, T17N-R5W, Surrey Twp, Clare Co.). Roadway opened to traffic in 1975.

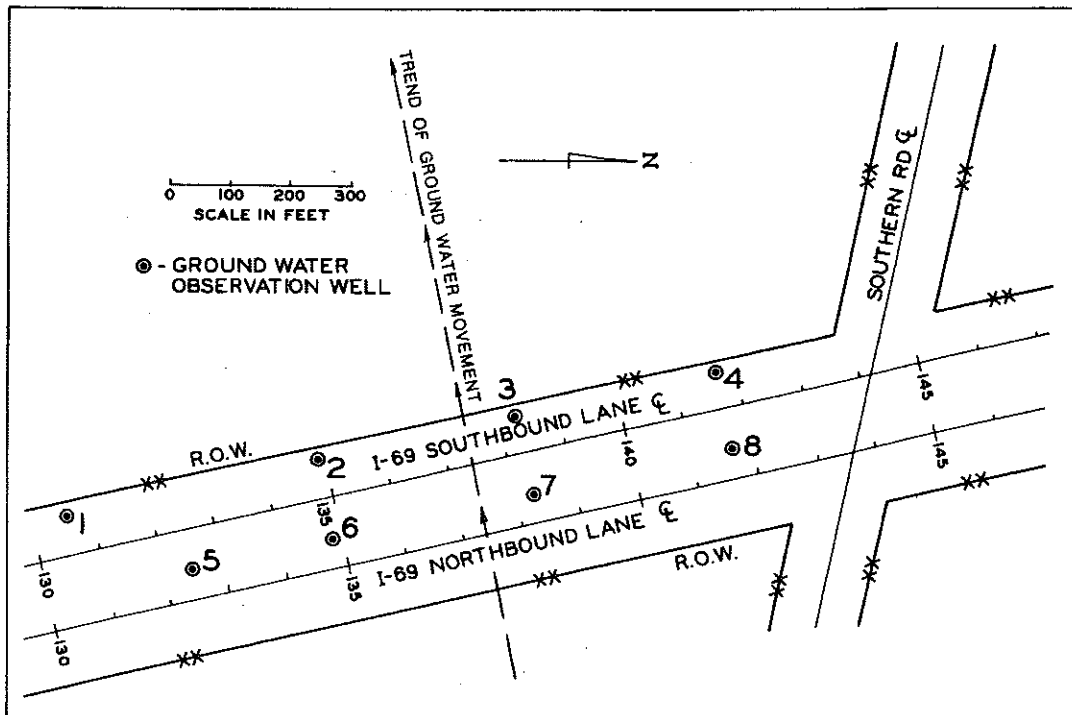


Figure 5. I 69 well locations: I 69, Southern Rd area (Sections 10 and 15, T8S-R6W, Kinderhook Twp, Branch Co.). Roadway opened to traffic in 1967.

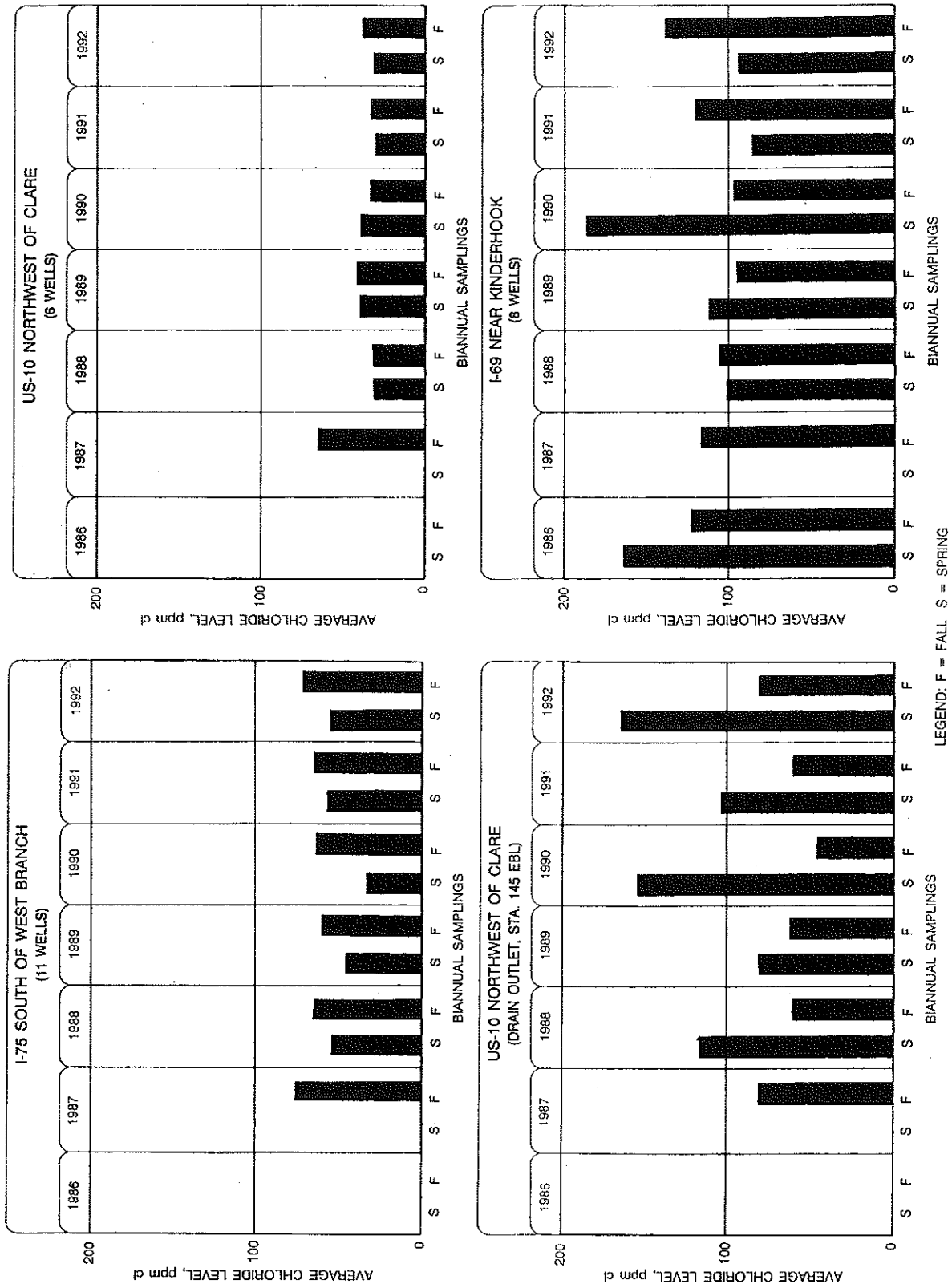


Figure 6. Biannual average chloride levels in ground water at sampling sites on trunklines.