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NITRATE CONTAMINATION IN WEST-CENTRAL WISCONSIN

WITH EMPHASIS ON

MILL RUN FIRST EDITION SUBDIVISION

Location: Section 10, T27N, R10W, Town of Union, Eau Claire County, Wisconsin

WI. D.N.R. # WR04 GWM WR005 S

Requisition No. F1084

Submitted by:

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INTRODUCTION

Previous state and county laboratory analyses for nitrate-nitrogen for private wells in the Town of Union, Eau Claire County, Wisconsin (Sections 3, 4, 9, and 10, T27N, R10W) have indicated nitrate-nitrogen levels in excess of the drinking water standard of 10.0 mg/l (Lulloff, Paul, Tinker, and Degen, 1985). To determine the cause of the high nitrates, a nitrate mass balance model was applied to the Mill Run First Edition subdivision in NW 1/4, Section 10, T27N, R10W. The methods of study include the sampling of private wells, the development of a ground-water flow map, the application of a nitrate mass balance model, and an earth-resistivity survey.

The status and some results of the investigation of fracture patterns in St. Croix County, Wisconsin and the mapping of nitrate data for the West Central District of the Department of Natural Resources are also included.

This report fulfills a contract agreement between the Wisconsin Department of Natural Resources and Dr. John R. Tinker, Jr., of the Geology Department of the University of Wisconsin - Eau Claire.

CONCLUSIONS

1. The mean value of nitrate-nitrogen for many of the wells in the Mill Run First Edition subdivision exceeds the drinking water standard of 10.0 mg/l.

2. The nitrate-nitrogen values for the wells sampled showed little monthly variation for the period of study.

3. The septic systems in Mill Run First Edition subdivision are the main source of the nitrate-nitrogen in the wells in the subdivision.

4. Dilution of nitrate-nitrogen from the septic systems by groundwater beneath Mill Run First Edition subdivision is not a sufficient mechanism of attenuation to meet the drinking water standard of 10.0 mg/l.

5. The nitrate mass balance model applied to Mill Run First Edition subdivision predicted reasonable nitrate-nitrogen values when compared to the mean nitrate-nitrogen values for the wells immediately downgradient of the subdivision.

RECOMMENDATIONS

1. All present and future residents of Mill Run First Edition subdivision should be notified of the past and present nitrate-nitrogen levels for the well water in the subdivision. This is important because many families with children and infants reside in the subdivision.

2. A drinking water supply which meets the drinking water standards of NR 140 should be found for the Mill Run First Edition subdivision. Alternatives that should be considered include bottled water, deeper wells with the wells adequately cased and grouted through the contaminated groundwater, and connection to the municipal water supply of the City of Eau Claire.

3. Methods to reduce the loading of nitrate-nitrogen to the ground-water flow system should be implemented. The following methods should be studied: the extension of sewer lines from the City of Eau Claire to Mill Run First Edition (eliminate the septic systems) and the construction of a central wastewater treatment facility for the subdivision to include both aerobic and anaerobic digestion processes.

4. Research to design a septic system which includes the process of denitrification should be encouraged.

DESCRIPTION OF WORK

A contract between the State of Wisconsin Department of Natural Resources and the University of Wisconsin - Eau Claire was signed for the purpose of studying the hydrogeological factors influencing nitrates in groundwater in west-central Wisconsin with emphasis on the Mill Run First Edition subdivision in the Town of Union, Eau Claire County. The specific description of the study includes the following.

1. To determine the distribution of nitrate in groundwater for Mill Run First Edition subdivision by taking monthly water samples and conducting earth-resistivity measurements.

2. To determine the groundwater flow system for Mill Run First Edition subdivision.

3. To apply a mass balance model for nitrate for Mill Run First Edition subdivision.

4. If applicable, to recommend best management practices for nitrate reduction for Mill Run First Edition subdivision.

5. To map nitrate data for the West Central District of the DNR to a scale of 1:250,000 and "hot spots" mapped to a scale of 1:24,000.

6. To relate the nitrate distribution to the hydrogeology of the study area.

CONDITIONS OF WORK

Permission for access to the private wells serving the rental property in Mill Run First Edition was denied by the property owners, the Menard Profit Sharing Corporation, Bezanson Realty, Eau Claire, Wisconsin and a Mr. Jeff Smith, 3624 Flynn Place, Eau Claire, Wisconsin. This seriously restricted the study of the elevation of the ground-water table and the ground-water flow directions. The Department of Natural Resources was notified at the beginning of this study of this lack of permission for access to these wells.

Several owners of single family homes did not wish to participate in the nitrate sampling or to have their wells opened for the measurement of depth to water table.

Water samples were obtained from the taps of the rental property by knocking on doors and requesting a sample from the renters. Excellent cooperation was obtained from all of the renters.

All water analyses for nitrate-nitrogen were conducted at the State Laboratory of Hygiene in Madison, Wisconsin. Sample bottles were provided by the Laboratory of Hygiene and samples were collected from water taps in the homes. Two single family homes in Mill Run First Edition have a home water treatment facility or water softener. At these homes, water was collected from a faucet prior to treatment.

Blank and duplicate samples were sent to the Laboratory of Hygiene. For duplicate samples, nitrate-nitrogen values did not vary by more than 0.1 mg/l. Blank samples of distilled water had 0.5 mg/l or undetectable levels of nitrate-nitrogen.

All earth-resistivity arrays were placed in the right-of-way of public roads because cooperation was not obtained from Menards Profit Sharing Corporation. Earth resistivity measurements were obtained with an ABEM terrameter earth resistivity meter.

The budget constraints are detailed in the original grant proposal and contract for this study.

DESCRIPTION OF STUDY AREA

Location

The West-Central District of the Department of Natural Resources includes the Wisconsin counties of St. Croix, Dunn, Chippewa, Eau Claire, Pepin, Clark, Buffalo, Trempealeau, Jackson, LaCrosse, Monroe, Vernon, and Crawford. The Mill Run First Edition subdivision is located in the Town of Union, Eau Claire County in Section 10, T27N, R10W (Figure 1).

Housing - Mill Run First Edition

The subdivision consists of 69 ~~40~~ duplexes and 18 single family homes (Figure 2). Figure 3 shows the lot numbers from the subdivision plat and Figure 4 presents the street addresses for each home.

Septic Systems - Mill Run First Edition

Each duplex and single family home were originally served by their own septic tank soil absorption system. Figure 5 illustrates the location, size, and date of filing for the EH 115 forms for these initial systems (Source: EH 115 forms on file at the Eau Claire County Courthouse). Figure 6 shows the location, size, and date of filing of the EH 115 forms of 30 replacement systems for some of the original systems. Two replacement systems consist of mound systems (lots 34 and 65) with one system now serving six duplexes (lot 34). One holding tank exists in lot 53.

Soils - Mill Run First Edition

The subdivision is situated on soils of the Elk Mound-Eleva Association which are well drained and somewhat excessively drained loams and sandy loams (U.S. Soil Conservation Service, 1977). The specific soil series include the

Chetek sandy loam (CkC2), 6 to 12 percent slopes; Chetek sandy loam (CkB), 1 to 6 percent slopes; and the Billett sandy loam (BlB), 1 to 6 percent slopes (Figure 7). Also in the subdivision are smaller areas of Meridian loam (MmA), 0 to 3 percent slopes and Plainfield loamy sand (PlB), 1 to 6 percent slopes.

Geology - Mill Run First Edition

The soils within the subdivision are developed on glacial sediment mapped by Goebel et al (1983) as pre-Wisconsin loamy till. Field investigation of the topography and available outcrops of sediment in Section 3, T27N, R10W indicates the glacial sediment is outwash sand and gravel. Till units may be present at depth.

Beneath the glacial sediment is the Mt. Simon Formation of Cambrian age. The Mt. Simon Formation is a part of the quartzarenite lithotope as described by Ostrom (1970). This lithotope consists mainly of well-sorted, clean, friable, medium and fine-grained sandstone with local areas of coarse and very coarse mineralogy; cross bedding is common. Private wells in the subdivision terminate in either the glacial sediment or Mt. Simon Formation and do not penetrate to the Precambrian igneous and metamorphic rocks which underlie the Mt. Simon Formation.

Private Water Wells - Mill Run First Edition

There are 33 private wells for the ~~49~~ 69 duplexes and 18 wells for the single family homes (Figure 8). Of the 51 private wells, 34 have a known well construction report. Thirteen wells terminate in sandstone and 21 wells in glacial sediment. The glacial wells are from 68 to 93 feet deep; the sandstone wells from 87 to 174 feet deep. Static water level is from approximately 35 to 60 feet beneath the surface.

Six stratigraphic profiles (Figures 9, 10, 11, 12, 13, 14, and 15) illustrate the depth of the well, the driller's well log, depth to static water, and depth of casing. Sandstone wells are located in the south and southeastern part of the subdivision. Only one well log seems questionable (lot 42, 168 feet of glacial sediment).

Private Water Wells Adjacent to Mill Run First Edition

Seventeen private wells surrounding the subdivision were sampled for nitrate (Figures 1 and 16). Three are known glacial wells, eight are probably glacial wells, three are known sandstone wells, and two are unknown wells. Well depths for these wells are comparable to depths in the subdivision.

Ground-Water Flow System

The regional ground-water flow system was determined by an in-office method based on the well drillers report for 34 wells in the Mill Run First subdivision and 47 selected wells outside of the subdivision (Figure 17). To determine the elevation of the groundwater table, the depth to static water level as reported by the well driller was subtracted from the estimate of the ground elevation from 7-1/2 minute maps. Uncertainties with this method do exist such as wells drilled during different years and time of year and the accuracy of measurements, but Blanchard and Bradbury (1986) report that similiarly constructed maps of the groundwater system flow for the Central Sands of Wisconsin are relatively accurate when compared to flow maps constructed from detailed measurements of piezometers.

A field investigation of the ground-water flow system in Section 3, T27N, R10W was conducted by John Grump of the Wisconsin Department of Natural Resources (June 1981). This investigation involved the measuring of static water level in nine private wells on and around the Menard's wood treatment plant. Elevations of the static water level were referenced to a fixed point with the resulting ground-water flow shown in Figure 18. A comparison of Figures 17 and 18 shows that the ground-water divide is east of the Mill Run First Edition with ground-water flow in a southwesterly direction beneath the subdivision. It is possible that the ground-water divide near Mill Run First Edition shifts east-west with time.

During this study a field investigation of the ground-water flow system was conducted in the southern end of the Mill Run First Edition. The static water level in six private wells was referenced to a point with the resulting water table elevations shown in Figure 19. The water table elevations indicate a northwesterly flow direction toward the center of the subdivision. One possible explanation is the existence of a cone of depression beneath the subdivision caused by the pumping of the wells in the subdivision. The computer program of Walton (1985) was applied to check the possibility of this explanation. The program is an analytical solution of the Theis (1935) equation for well drawdown in a confined aquifer. The program may be applied to a maximum of 24 pumping wells. Reasonable values for transmissivity, storativity, and well pumpage were entered into the model for each of the 24 wells. The model predicted a negligible drawdown of the water table beneath the subdivision and does not support the water table measurements of this study. Additional study of this computer application is required.

From the ground-water investigation, it is concluded that Mill Run First Edition subdivision is situated on or near a groundwater divide with ground-water flow from northest to southwest (Grump, 1981). A cone of depression may exist beneath the subdivision which modifies the regional flow. To further clarify the ground-water flow, access is needed to the private wells of the rental property or ground-water monitoring wells should be installed in and adjacent to the subdivision

NITRATE-NITROGEN SAMPLING DATA

Water samples for nitrate-nitrogen analyses were collected monthly from December 1985 to June 1986. A summary of the number, location, and results of the samples follows.

1. December 7, 1985 - Eight samples within the subdivision and 11 outside the subdivision (Figure 20).

2. January 16, 1986 - Seven samples within the subdivision and 11 outside the subdivision (Figure 21).

3. February 15, 1986 - Twenty samples within the subdivision and no samples from outside the subdivision (Figure 22). Mean and standard deviation for all samples is 13.87 ± 3.92. Known glacial wells range from 11.1 to 20.0 mg/l nitrate-nitrogen. No known sandstone wells were sampled.

4. March 22, 1986 - Twenty two samples within the subdivision and eight samples from outside the subdivision (Figures 23 and 24). Mean and standard deviation for all samples within the subdivision is 13.63 ± 4.22. Known

glacial wells within the subdivision range from 6.7 to 19.6 mg/l and known sandstone wells range from 1.8 to 3.0 mg/l nitrate-nitrogen.

Outside of the subdivision samples ranged from 0.1 to 14.8 mg/l nitrate-nitrogen (Figure 24).

5. April 26, 1986 - Eighteen samples within the subdivision and 9 samples from outside the subdivision (Figures 25 and 26). Mean and standard deviation for samples within the subdivision except the known sandstone well in lot 85 are 13.12 ± 4.34. Known glacial wells within the subdivision range from 6.8 to 19.8 mg/l nitrate-nitrogen. No known sandstone wells were sampled except the well in lot 85 on the extreme southeast end of the subdivision.

Outside of the subdivision samples ranged from 3.8 to 14.6 mg/l nitrate-nitrogen (Figure 26).

6. June 2, 1986 - Thirty-one samples within the subdivision and 13 samples from outside the subdivision (Figures 27 and 28). Mean and standard deviation for samples within the subdivision are 12.15 ± 5.04. Known glacial wells in the subdivision range from 1.7 to 20.1 mg/l and known sandstone wells range from 2.2 to 14.2 mg/l nitrate-nitrogen.

Outside of the subdivision samples ranged from 0.5 to 14.1 mg/l nitrate-nitrogen (Figure 28).

7. June 29, 1986 - Thirty samples within the subdivision and ten samples from outside the subdivision. The laboratory results were not available at the time of the writing of this report.

The mean and standard deviations for wells within the subdivision for which more than one measurement exists are shown in Figure 29. The mean and standard deviation for known glacial wells range from 6.7 ± 0.13 to 19.9 ± 0.22 mg/l and known sandstone wells range from 2.9 ± 0.04 to 10.3 ± 0.49 mg/l nitrate-nitrogen.

The mean and standard deviations for wells outside the subdivision for which more than one measurement exists are shown in Figure 30. The values range from 0.5 ± 0.0 to 15.2 ± 1.02.

The variation in monthly nitrate values is small. This indicates a constant source of nitrate-nitrogen with time.

The location, description of well log, and all nitrate-nitrogen analyses are summarized in the attached diskette, filename MENARD and in Appendix A. Copies of the individual laboratory slips for the nitrate-nitrogen analyses are available from the writer or from the State Laboratory of Hygiene.

Most of the known glacial wells in Mill Run First Edition have an average nitrate-nitrogen level in excess of 10.0 mg/l. Some sandstone wells in Mill Run First Edition exceed 10.0 mg/l nitrate-nitrogen (lots 68 and 70) but others do not (lots 50, 71, and 85). It is noted that lot 41 is a glacial well with 1.7 mg/l nitrate-nitrogen (only one sample). Most of the nitrate-nitrogen levels in excess of 10.0 mg/l are for duplexes in the area of the highest concentration of septic systems. Most of the nitrate-nitrogen levels below 10.0 mg/l are for single family homes with sandstone or glacial wells and are located in the southeastern part of the subdivision.

Some of the wells outside of Mill Run First Edition have an average nitrate-nitrogen level in excess of 10.0 mg/l. These include the wells of M. Welch, J. Geissler, Gas Food Grocery, G. Smith, First Wisconsin Bank, and H. Gilbert (Figures 1 and 30). In respect to the ground-water flow direction (Figure 18), wells upgradient of the subdivision have nitrate-nitrogen levels well below 10.0 mg/l nitrate-nitrogen (Menards, N. King, and L. Lee, see Figures 1 and 30). Wells downgradient of the subdivision (Figure 18) have average nitrate-nitrogen levels in excess of 10.0 mg/l. (J. Geissler and M. Welch, see Figures 1 and 30). Wells in excess of 10.0 mg/l nitrate-nitrogen but not up- or downgradient of the subdivision are H. Gilbert, Gas Food Grocery, G. Smith, and First Wisconsin Bank.

NITRATE MASS BALANCE MODEL

The mass balance model described by Wehrmann (1983) was applied to the Mill Run First Edition subdivision. The model is derived from the concept that if two solutions of different concentrations are combined, the final concentration of the combined solutions can be found as follows:

$$V1C1 + V2C2 = (V1 + V2)C3$$

$$C3 = (V1C1 + V2C2)/(V1 + V2)$$

where V1 and V2 equal the original volume to be mixed and C3 equals the concentration of the combined volumes.

An extension of the above equation was used to simulate the natural interactions between septic system discharge (Vs), rainfall infiltration (Vi), groundwater pumped (Vp), volume of groundwater from "background" (Vb), and volume of groundwater leaving the elemental volume (Vo) (Figure 31). The mass balance model for Mill Run First Edition is presented in Table 1 and is in spreadsheet form on the enclosed diskette under filename MASSBAL.

The input values for the mass balance model for Mill Run First Edition subdivision are summarized in Table 2. The input values of Table 2 and the spreadsheet (Filename MASSBAL) assume the concentration of nitrate-nitrogen contained in the pumped groundwater, Cp, is equal to the average of the background ground-water concentration and the diluted ground-water concentration, Cp = (Cb + Co)/2. Inserting the values presented in Table 2 into the mass balance model (MASSBAL), the predicted value of Co (the diluted concentration of nitrate-nitrogen leaving Mill Run First Edition subdivision) is 11.71 mg/l. Another prediction of Co is obtained by using the values presented in Table 2 but with the nitrate-nitrogen concentration of the pumped groundwater, Cp, equal to 12.26 which is the mean of the mean values of nitrate-nitrogen for the wells (Figure 29). With Cp = 12.26 mg/l, Co is 10.74 mg/l (Table 3). The two wells immediately downgradient of Mill Run First Edition subdivision (Figures 1 and 18) have a mean nitrate-nitrogen level of 11.9 $\pm$ 0.32 mg/l (J. Geissler's well - Figures 1 and 30) and 10.2 + 0.23 mg/l (M. Welch's well - Figures 1 and 30). It is concluded that the model does predict a reasonable value for the concentration of nitrate-nitrogen leaving Mill Run First Edition for both values of Cp. The main source of the nitrate-nitrogen is septic system effluent.

The critical housing density, H, to achieve a Co concentration of 10.0 mg/l nitrate-nitrogen is 1.84 homes per acre (Table 1).

The existing housing density for the subdivision is 2.35 homes per acre. It is concluded that the existing density for Mill Run First Edition is too large to achieve by dilution a nitrate-nitrogen of 10.0 mg/l for the groundwater beneath the subdivision.

Table 1

Menard's Mill Run Subdivision Nitrate Study
Nitrate Mass Balance

VbCb + ViCi + VsCs - VpCp = (Vb + Vi + Vs - Vp)Co where

Vb = volume of flow of groundwater entering the elemental volume from an upgradient of "background" area	
Cb = concentration of nitrate-nitrogen contained in the groundwater entering the elemental volume	4.43
Vi = volume of infiltrating precipitation entering the volume	
Ci = concentration of nitrate-nitrogen contained in the infiltrating water	0.50
Vs = volume of septic effluent entering the elemental volume	
Cs = concentration of nitrate-nitrogen contained in the septic effluent	45.00
Vp = volume of groundwater pumped by wells within the elemental volume	
Cp = concentration of nitrate-nitrogen contained in the pumped groundwater	
Co = diluted concentration of nitrate-nitrogen coming out of the elemental volume.	

The volumes from each nitrate source can be further defined as:

Vb = TIL where

T = aquifer transmissivity, in gpd/ft	83,924.00
I = hydraulic gradient, in ft/ft	0.00033
L = width of the elemental volume perpendicular to ground-water flow, in ft	1.00
Vb =	27.69

Vi = (74.39)RiA where

Ri = rate of infiltrating precipitation in in/yr	6.00
A = surface area of the elemental volume in acres where A = Le(Fl/43569)	
Le = width of the elemental flow perpendicular to ground-water flow in ft	1.00
Fl = length of the elemental flow volume parallel to ground-water flow or flow path length, in ft	1,400.00
43,560 = factor to convert square feet to acres	43,560.00
A =	0.03
74.39 = factor to convert in-ac/yr to gpd	74.39
Vi =	13.39

Vs = PHQpA where

P = number of people per household	3.00
H = lot density, in homes/acre	2.35
Qp = wastewater flow per person in gpcd	45.00
A = surface area of the elemental volume, in acres	
Vs =	9.52
PQpA =	4.05

Assumptions
1. The amount of groundwater pumped by wells within the elemental volume is equal to the volume of septic effluent entering the elemental volume, or Vp = Vs. This assumption is reasonable because most residential water use is non-consumptive, except lawn use.
2. The concentration of nitrate-nitrogen contained in the pumped groundwater, Cp, is equal to the average of the background ground-water concentration and the diluted ground-water concentration, or Cp = (Cb + Co)/2.

Combining these terms,

(TIL)Cb + (74.39)ARiCi + PHQpACs - (PHQpA)(Cb + Co/2) =
(TIL + (74.39)ARi)Co

Two terms are of particular concern:
1. the concentration leaving the elemental volume, Co; and
2. the critical housing density, H, based on setting Co equal to the drinking water standard of 10.0 mg/l NO_3-N.

Co = ((74.39)RiACi + PHQpACs + (TIL - PHQpA)/2)Cb)/
(TIL) + (74.39)RiA + (PHQpA)/2

H = (TIL(10 - Cb) + (74.39)RiA (10-Ci))/PQpA(Cs-(Cb + 10)/2)

Co = 10.0 drinking water standard	10.00
Constant 2	2.00

Numerator 74.39 ARiCi + PHQpACs + (TIL - (PHQpA)/2)Cb of Co

Numerator =	536.67
Denominator =	45.84
Co =	11.71

With Co = 10 mg/l

Numerator =	281.44
Denominator =	153.03
H =	1.84

Table 2

Summary of Input Values for Nitrate Mass Balance Model for Mill Run First Edition Subdivision

Variable Name	Input Value and Source of Information
Transmissivity, T	T = 83,924 gallons per day per foot From specific capacity data of 21 glacial wells in subdivision as determined by the computerized method of Bradbury and Rothschild (1985).
Hydraulic Gradient, I	I = 0.00033 ft/ft From the ground-water flow map of Figure 18. Data for map from John Grump (1981), DNR files, Area Office, Eau Claire, Wisconsin.
Flow Path Length, Fl	Fl = 1400 feet From aerial photos of subdivision, scale 1 inch = 200 feet.
Housing Density, H	H = 2.35 Calculated from plat map of subdivision and field checked.
Residents per Home, P	P = 3.0 average number of people per dwelling for Town of Union, Eau Claire County From Planning Office, County of Eau Claire, Eau Claire, Wisconsin.
Wastewater Discharge per person, Qp	Qp = 45 gallons/person/day From E.P.A. Design Manual by Otis et al (1980)
Nitrate-N and Nitrite Concentration of Septic Effluent, Cs	Cs = 45 mg/l From Dudley and Stephenson (1973)
Recharge from Precipitation, Ri	Ri = 6 inches per year From Thornthwaite and Mathers Climatic Water Budget Method by Snowdon et al (1985) and results compared to E.P.A. 1975 Water Balance Method by Peter Kmet (1982). The 6 inches per year assumes no runoff and thus increases the dilution capability of the infiltrating groundwater.
Nitrate-Nitrogen in ground-water entering the subdivision, Cb	Cb = 4.43 An average of nitrate-nitrogen for upgradient wells (Menards, Coop, and King)

Table 3

Calculation of concentration of nitrate-nitrogen leaving Mill Run First Edition, Co, assuming input values of Table 2 and the concentration of nitrate-nitrogen pumped from the wells, Cp, is equal to 12.26. See Tables 1 and 2 for variable names.

Given,

$$VbCb + ViCi + VsCs - VpCp = (Vb + Vi + Vs - Vp)\ Co$$

Assume Vs = Vp, therefore

$$VbCb + ViCi + VsCs - VpCp = (Vb + Vi)Co$$

Substituting variables of Table 1 and 2

$$(TIL)Cb + (74.39)ARiCi + PHQpACs - PHQpCp = Co(TIL + 74.39ARi)$$

Substituting values of Tables 1 and 2

$$27.69(4.43) + 13.39(0.5) + 9.52(45) - 9.52(13.63) = Co(27.69 + 13.39)$$

After multiplication, addition, and subtraction

$$441.05 = Co(41.08)$$

Finally,

$$Co = 10.74 \text{ mg/l}$$

Sensitivity analyses for different values of Transmissivity (T), Hydraulic Gradient (I), Housing Density (H), Residents per Home (H), Nitrate-Nitrogen Concentration of Septic Effluent (Cs), Recharge from Precipitation (Ri), and Nitrate-Nitrogen Concentration of Groundwater Entering Mill Run (Cb) were conducted and are presented in Figures 32 and 47. Spreadsheet MASSBAL assumes Cp = (Cb + Co)/2.

A summary of the sensitivity analyses follows:

1. Input values as stated in Table 2, but vary Ci from 0.0 to 2.0 mg/l (Figures 32 and 33). The flow length for Mill Run First Edition is 1400 feet or 0.27 miles, thus Co ranges from 11.56 to 12.15 mg/l nitrate-nitrogen with a Ci change from 0.0 to 2.0 mg/l; H (Critical Housing Density) ranges from 1.71 to 1.88 homes per acre. It is concluded that changes in Co and H are not very sensitive to changes in Ci. With Ci equal to 0.0 mg/l, Co is still above 10.0 mg/l and H is below 2.35 homes/acre.

2. Input values as stated in Table 2, but vary Ri from 4 to 8 inches per year (Figures 34 and 35). For a flow length of 0.27 miles, Co ranges from 10.71 to 12.92 mg/l; H ranges from 1.56 to 2.12 homes/acre. It is concluded that changes in Co and H are somewhat sensitive to changes in Ri. However, the model still predicts a Co greater than 10.0 mg/l and a H less than 2.35 homes/acre with an Ri equal to 8 inches/year.

3. Input values as stated in Table 2, but vary P from 2.0 to 5.0 persons per home (Figures 36 and 37). For a flow length of 0.27 miles, Co ranges from 9.06 to 16.49 mg/l, H ranges from 1.10 to 2.76 homes/acre. It is concluded that changes in Co and H are very sensitive to changes in P. To obtain a Co value below 10.0 mg/l and an H above 2.35 homes per acre, P must be equal to 2.0 persons/home. Although population data was not collected for the subdivision, observations made during the collecting of the nitrate samples indicate that a P equal to 2.0 persons/home is unreasonable.

4. Input values as stated in Table 2, but vary Cb from 0 to 8 mg/l (Figures 38 and 39). For a flow length of 0.27 miles, Co ranges from 9.49 to 13.49 mg/l, H ranges from 1.25 to 2.49 homes/acre. It is concluded that changes in Co and H are very sensitive to changes in Cb. The nitrate sampling indicates that upgradient wells have an average nitrate-nitrogen concentration of 4.43. To obtain a Co value below 10.0 mg/l and an H above 2.35 homes per acre, Cb must be equal to 0.0 mg/l. A Cb value of 0.0 mg/l for glacial wells upgradient of the subdivision is an unreasonable assumption.

5. Input values as stated in Table 2, but vary I from 0.0001 to 0.0005 ft/ft (figures 40 and 41). For a flow length of 0.27 miles, Co ranges from 9.98 to 17.0 mg/l, H ranges from 1.14 to 2.36 homes/acre. It is concluded that changes in Co and H are very sensitive to changes in I. This conclusion stresses the importance of an accurate ground-water map for an area for which the nitrate model is applied.

6. Input values as stated in Table 2, but vary T from 40,000 to 140,000 g/d/ft (Figures 42 and 43). For a flow length of 0.27 miles, Co ranges from 9.61 to 15.07 mg/l; H ranges from 1.31 to 2.51 homes/acre. It is concluded

that changes in Co and H are very sensitive to changes in T. With T = 83,924 g/d/ft, the model does predict values close to the field measured nitrate-nitrogen values. The reader is referred to Bradbury and Rothschild (1985) for a review of the method used to obtain a T = 83,924 g/d/ft. To obtain a Co value below 10.0 mg/l and an H above 2.35 homes/acre, T must be equal to 140,000 g/d/ft. It is concluded that a T = 83,924 g/d/ft is reasonable for the rock and sediment beneath the subdivision.

7. Input values as stated in Table 2, but change Cs from 45 mg/l to 33.75 mg/l (a 25 percent reduction by denitrification) and vary T from 40,000 to 140,000 g/d/ft (Figures 44 and 45). For a flow length of 0.27 miles, Co ranges from 7.95 to 11.65 mg/l; H ranges from 1.87 to 3.58 homes/acre. It is concluded Co and H are very sensitive to changes in T with Cs equal to 33.75 mg/l. A Co value just below 10.0 mg/l is obtained with T = 83,924 and a Cs = 33.75. Noting that soil absorption systems are not designed to promote anaerobic conditions (denitrification), the question is does denitrification occur in and beneath absorption fields? An additional question is should land disposal systems just meet the enforcement standards of NR 140?

8. Input values as stated in Table 2, but change Cs from 45 mg/l to 22.5 mg/l (a 50 percent reduction by denitrification) and vary T from 40,000 to 140,000 g/d/ft (Figures 46 and 47). For a flow length of 0.27 miles, Co ranges from 6.29 to 8.24 mg/l; H ranges from 3.24 to 6.21 homes/acre. It is concluded Co and H are very sensitive to changes in T with Cs equal to 22.5 mg/l. A Co value below 10.0 mg/l is obtained with a T =83,924 g/d/ft. Again noting that soil absorption systems are not designed to promote anaerobic conditions (denitrification), the question is does denitrification occur in and beneath absorption fields to the extent of a 50 percent nitrate-nitrogen reduction?

EARTH RESISTIVITY DATA

An earth resistivity survey is a geophysical technique which induces an electrical current into geological material to provide data on the presence and extent of a contaminant plume. The method assumes a low resistivity to an electrical current with a high dissolved solids content in groundwater. Interpretation of resistivity data is complicated by the fact that resistivity is also influenced by changes in geologic material and water content. The goal of an earth resistivity survey is to determine changes in resistivity that are solely in response to changes in water quality. Sometimes this is very difficult or impossible to achieve especially when the variation in resistivity due to changes in rock material is greater than the variation in resistivity caused by changes in water quality.

Figure 48 presents the location of the earth resistivity sites. At each site, a Schlumberger electrode array was used with an a-spacing increasing at a 5-foot increment from 30 to 90 feet. Figures 49, 50, 51 and 52 present the results of four horizontal soundings. An interpretation of each sounding follows.

1. Compare the earth resistivity data of sites 18 to 21, 26 and 27 (Figure 49) to the well log data of Profiles J-K, H-I, and L-M (Figures 14, 13 and 15). The resistivity values vary from greater than 700 ohm-feet to less than 200 ohm-feet from site 18 to site 29. One interpretation is that well log J-K

(Figure 14) shows mostly sand or sand/gravel with little clay. Higher resistivities would be expected with lower clay content. Well log H-I (Figure 13) shows an increase in clay with the sand and gravel. The increase in clay content may explain the decrease in resistivities of sites 26, 27, 28 and 29 when compared to sites 19, 20, and 21. Well log L-M (Figure 15) also shows the presence of soft and firm sandstone in the southeastern part of the subdivision. This lithologic change may also influence the resistivity data.

2. Compare earth resistivity data of sites 9, 10, 11, 12, 13, 14, 15, and 16 (Figure 50) to well log data of Profile C-D (Figure 11). The lowest resistivity values (less than 300 ohm-feet) occur in one of the areas of highest nitrate-nitrogen (See Figure 29). An increase in total dissolved solids in the groundwater from the effluent of the septic systems may be one explanation of this data. However, another interpretation is that sand/clay is also present in well logs 16, 14 and 11 and sand, sand/gravel, and fine sand in well log 18.

3. Compare earth resistivity data of Figure 51 to well log data of Profile A-B (Figure 10). Site 3 with the lowest resistivity readings is immediately downgradient of a large 30 by 100 foot mound system which serves 6 duplexes. Dissolved solids from the mound may be influencing site 3 measurements as is the same situation for measurements of site 37 just downgradient of the smaller mound system in lot 65.

The resistivity data of sites 32, 33, 34, 39, 40, and 41 may be influenced by the presence of sand/clay and gravel/clay as indicated in well logs 2, 4, 5, and 7 (Figure 10).

4. Note the decrease in resistivity values from site 36, 38, 8 to site 7 (Figure 52). This decrease in resistivity would be expected as a contaminant plume develops and moves downgradient of the central part of the subdivision. Another interpretation is that the resistivity values change in response to a change in geologic material.

The lower resistivity values of site 22 may be caused by the failing septic system located directly across the street which was actively discharging septic effluent to the lawn surface and nearby ditch.

It is concluded that several interpretations exist for the earth resistivity data. Several sites do show the influence of discharge from septic systems but, at this time, the data is inconclusive in defining one large contaminant plume for the subdivision.

MAPPING OF FRACTURE PATTERNS
ST. CROIX COUNTY, WISCONSIN

The fracture patterns in the dolomite have been mapped for several 7-1/2 minute quadrangles of St. Croix County, Wisconsin. More time is needed to complete this mapping project.

MAPPING OF NITRATE-NITROGEN DATA FOR THE WEST-CENTRAL DISTRICT OF DNR

Nitrate data for 1985 has been obtained from the District Office of the West-Central District of the Department of Natural Resources. In the past, nitrate data was mapped to a scale of 1:250,000. This process was time consuming and did not produce results that were easily copied. Therefore, a different approach has been implemented which consists of mapping the nitrate data by Township and Range using the Golden Software Graphics package. A file is created for the nitrate data and then plotted with the graphics package. See Figure 53 for an example of a township in Eau Claire County. The contours are somewhat misleading because areas of sparse or no data do receive a contour line. However, data management is much easier and the results do indicate high nitrate areas for additional study. Since this was the objective of this data management, the process is an improvement over the previous method.

Files for the nitrate data for Eau Claire County have been created. Files for other counties will be created when time permits.

The problem of obtaining mappable data still exists. Many nitrate values can not be mapped because of unavailable data on well location.

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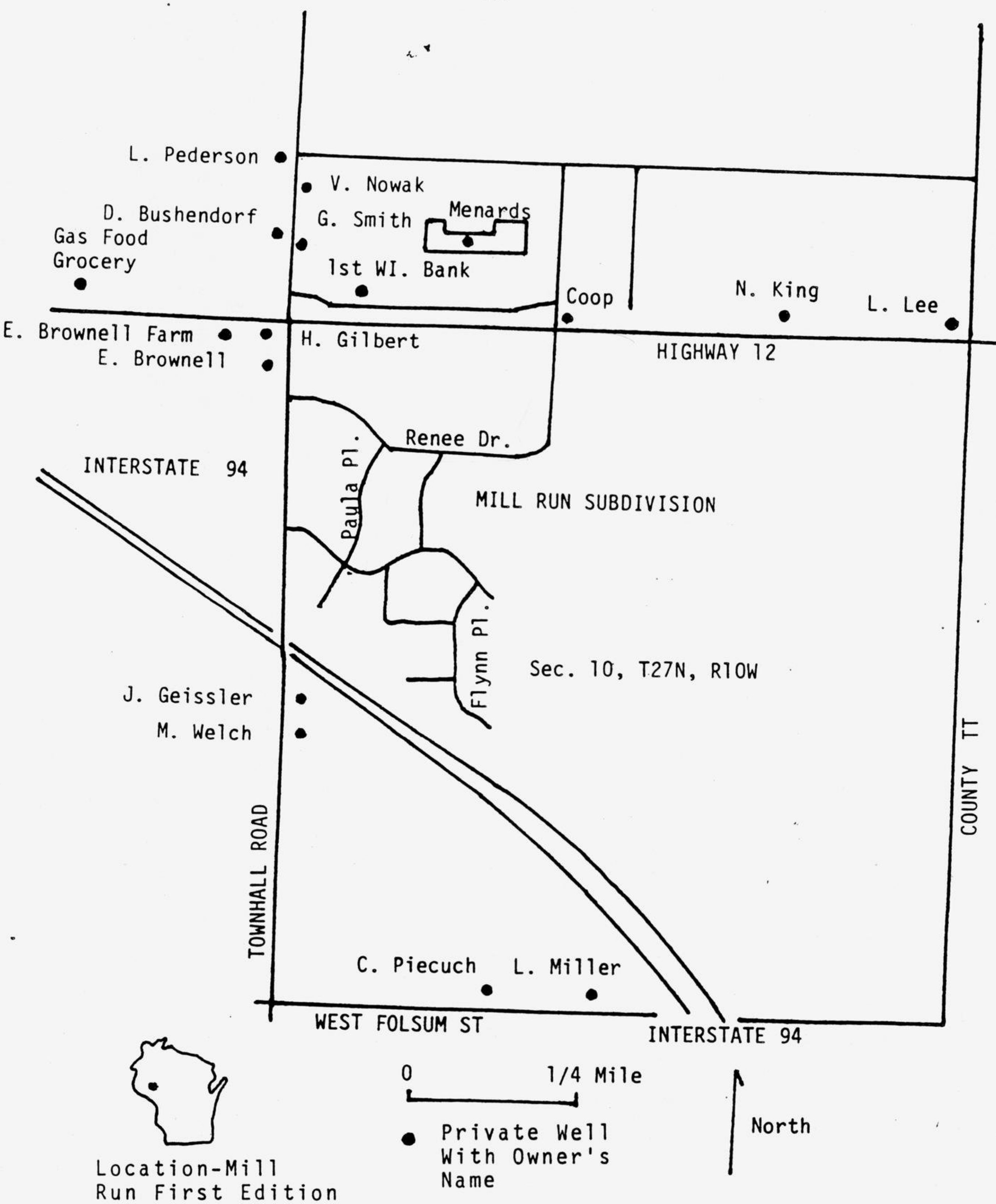


Figure 1. Mill Run First Edition subdivision is located in Section 10, T27N, R10W, Town of Union of Eau Claire County, WI. Solid circles locate private wells surrounding the subdivision that were sampled for nitrate-nitrogen.

Figure 2. Mill Run First Edition subdivision consists of ~~4~~69 duplexes and 18 single family homes.

Figure 3. Eighty-nine numbered lots and two unnumbered lots comprise the Mill Run First Edition subdivision (Source:Mill Run First Edition Plat, 1976)

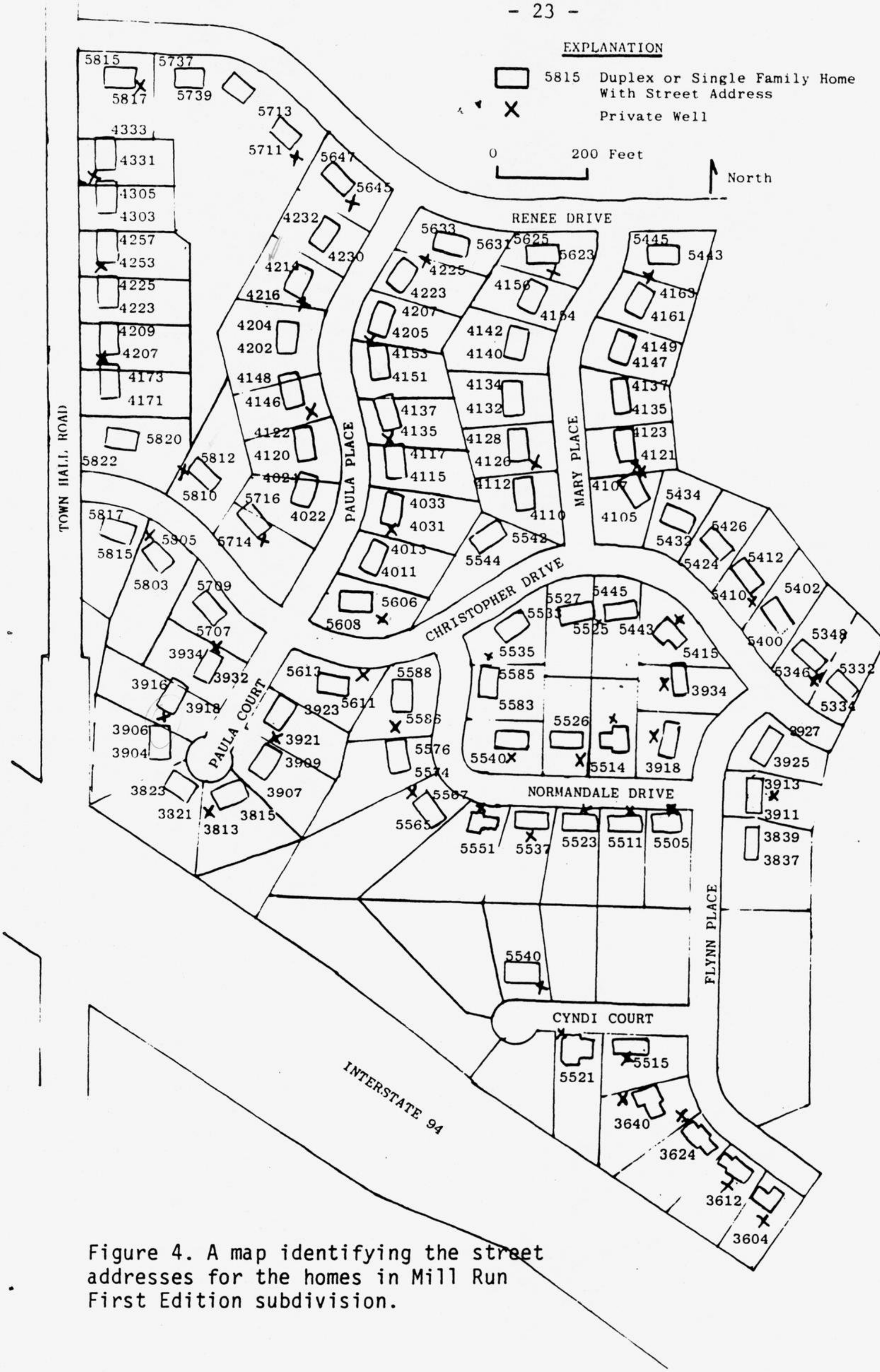


Figure 4. A map identifying the street addresses for the homes in Mill Run First Edition subdivision.

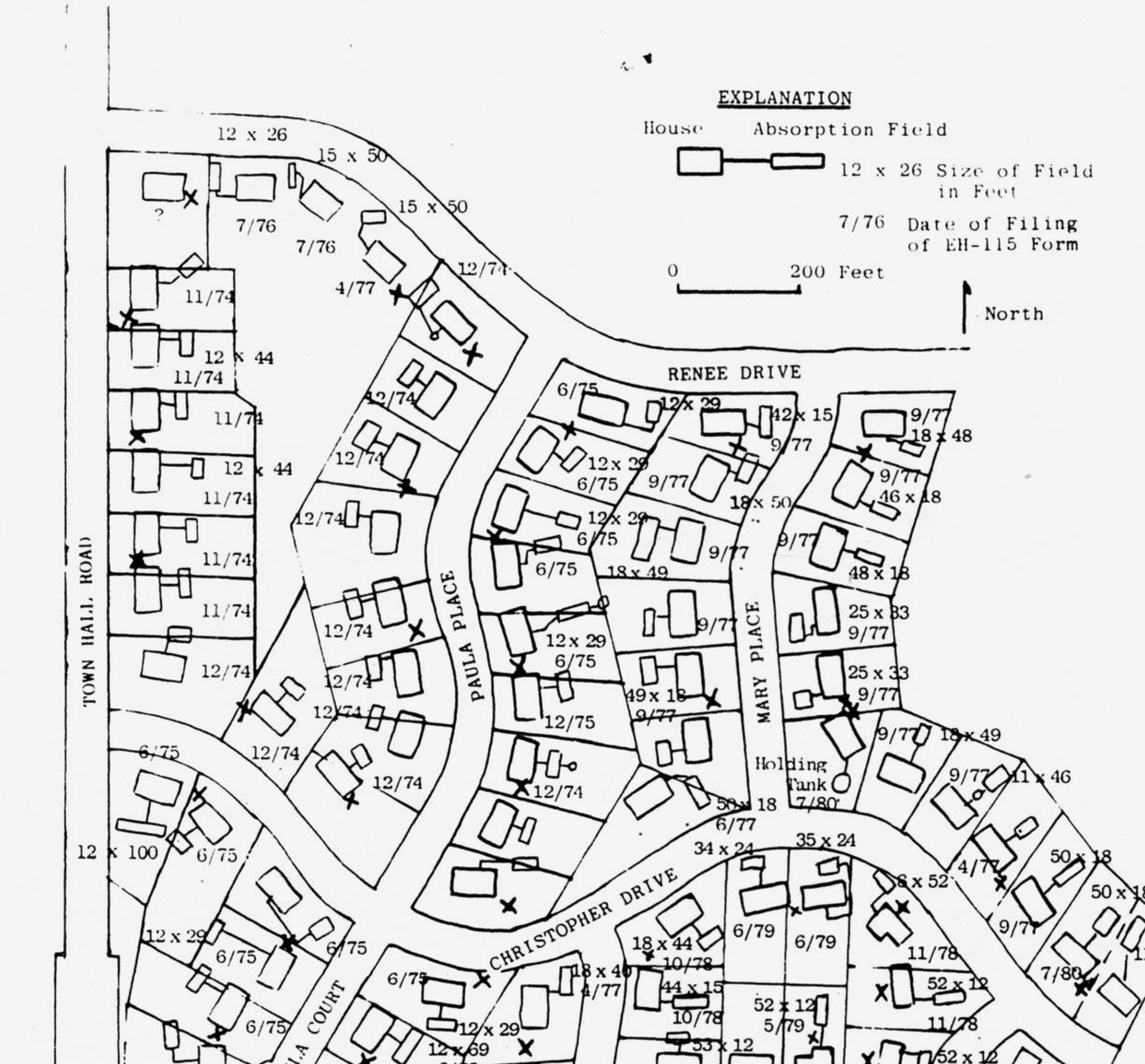


Figure 5. The location, size, and date of EH-115 form for the initial septic tank soil absorption systems in Mill Run First Edition (Source: EH 115 Forms-Eau Claire County Courthouse).

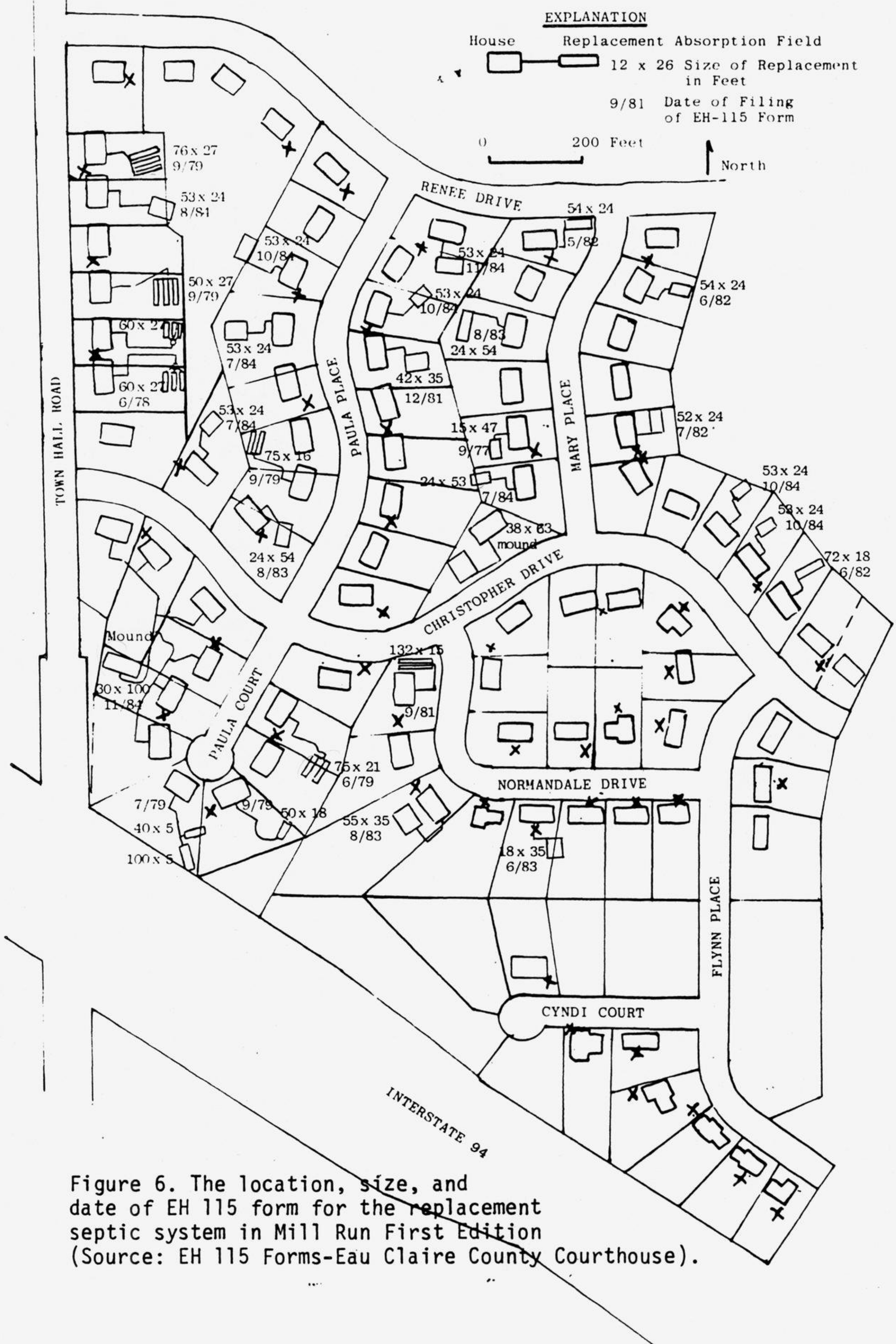


Figure 6. The location, size, and date of EH 115 form for the replacement septic system in Mill Run First Edition (Source: EH 115 Forms-Eau Claire County Courthouse).

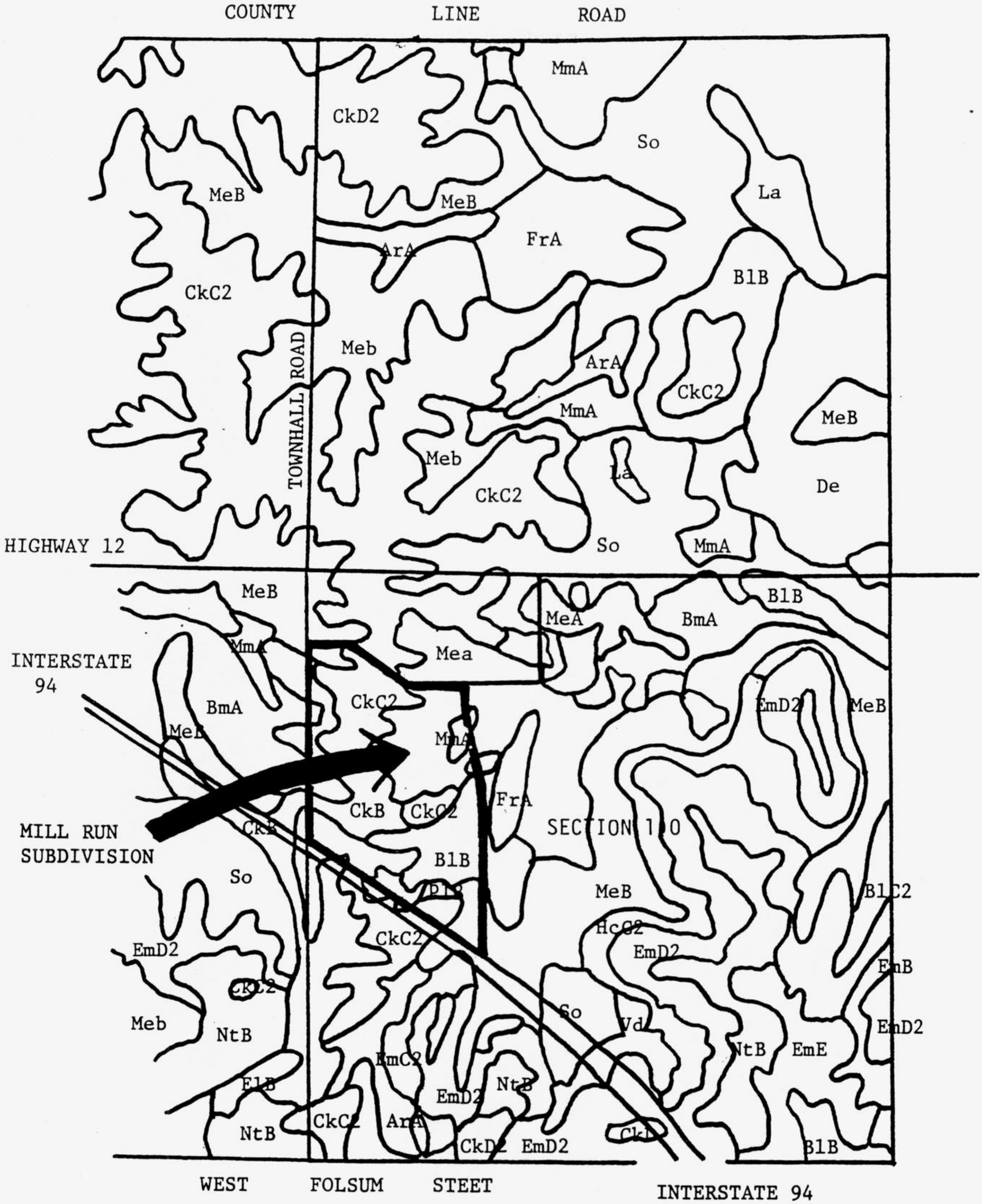


Figure 7. Soils map of Mill Run First Edition Subdivision (Comprehensive Soils Report of Eau Claire County, 1977). Section 10, T27N, R10W is one square mile.

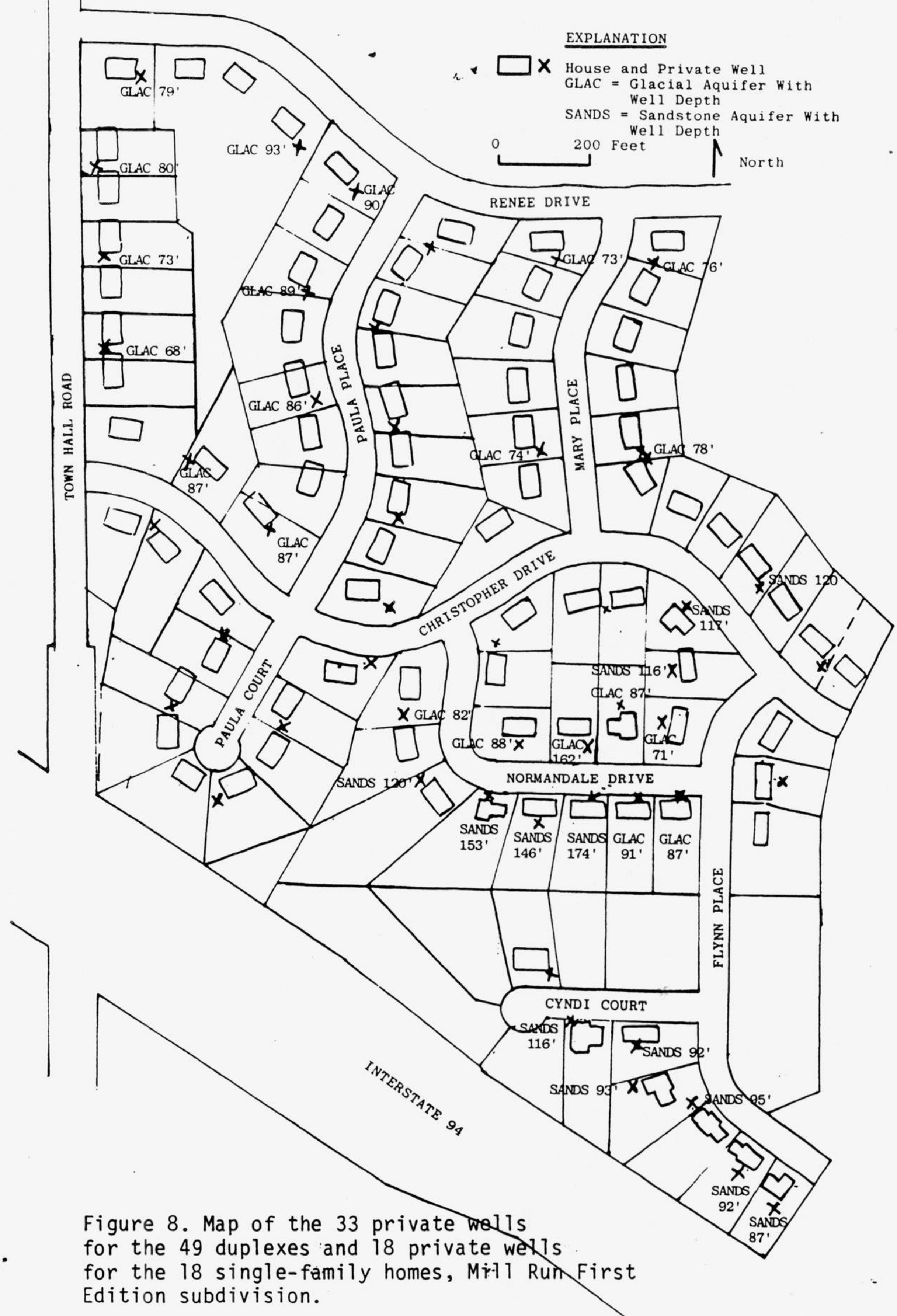


Figure 8. Map of the 33 private wells for the 49 duplexes and 18 private wells for the 18 single-family homes, Mill Run First Edition subdivision.

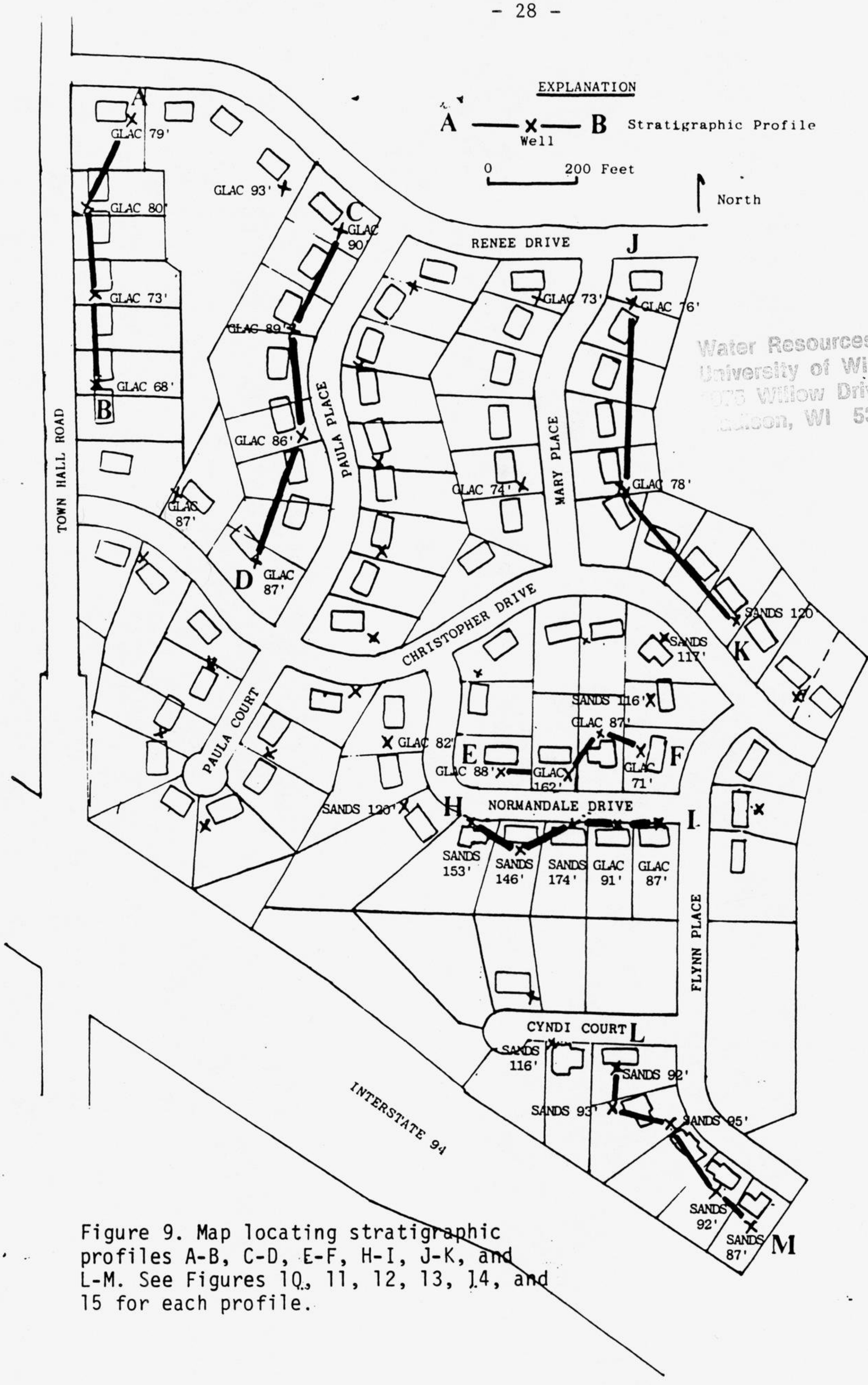


Figure 9. Map locating stratigraphic profiles A-B, C-D, E-F, H-I, J-K, and L-M. See Figures 10, 11, 12, 13, 14, and 15 for each profile.

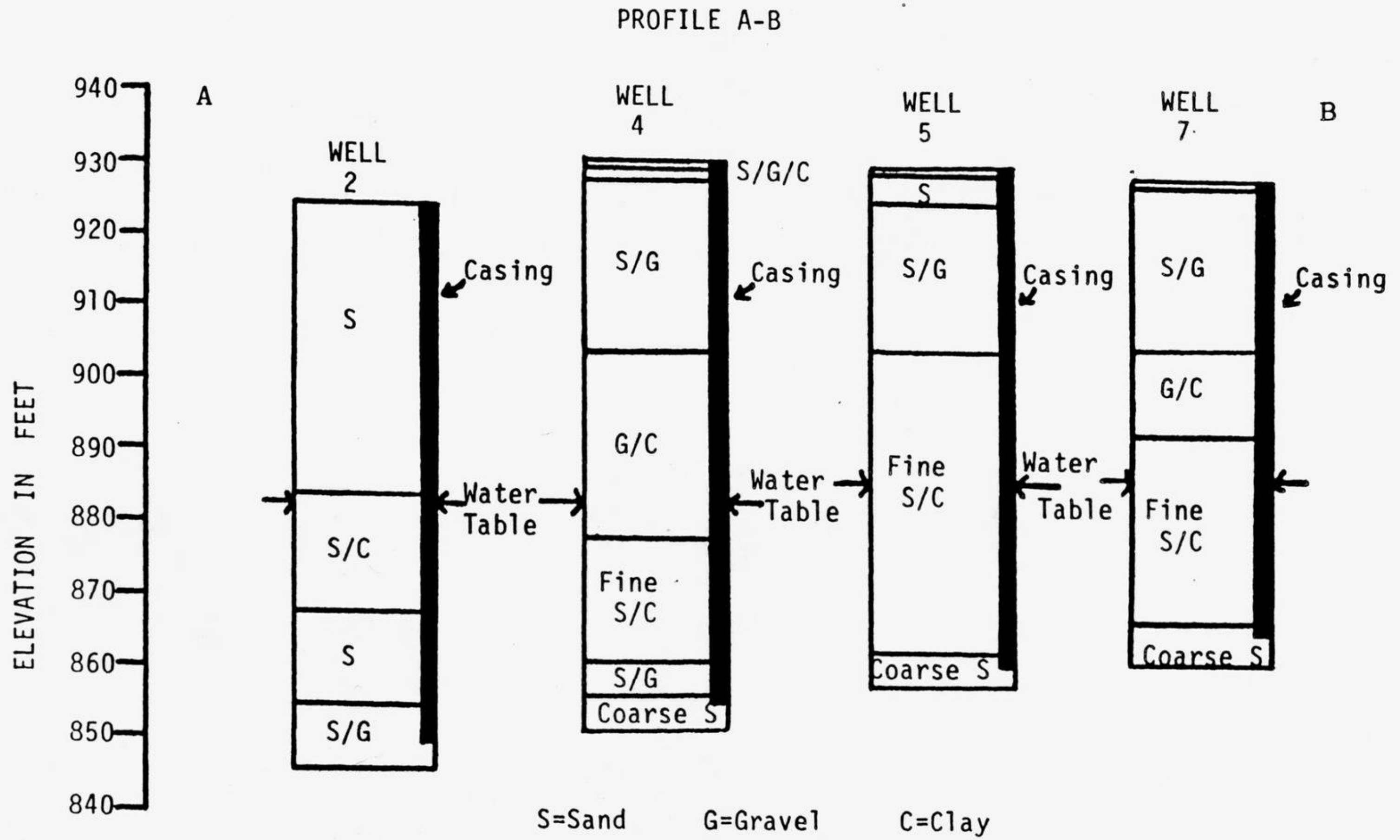


Figure 10. Stratigraphic profile A-B as constructed from well drillers log. See Figure 9 for exact location of profile.

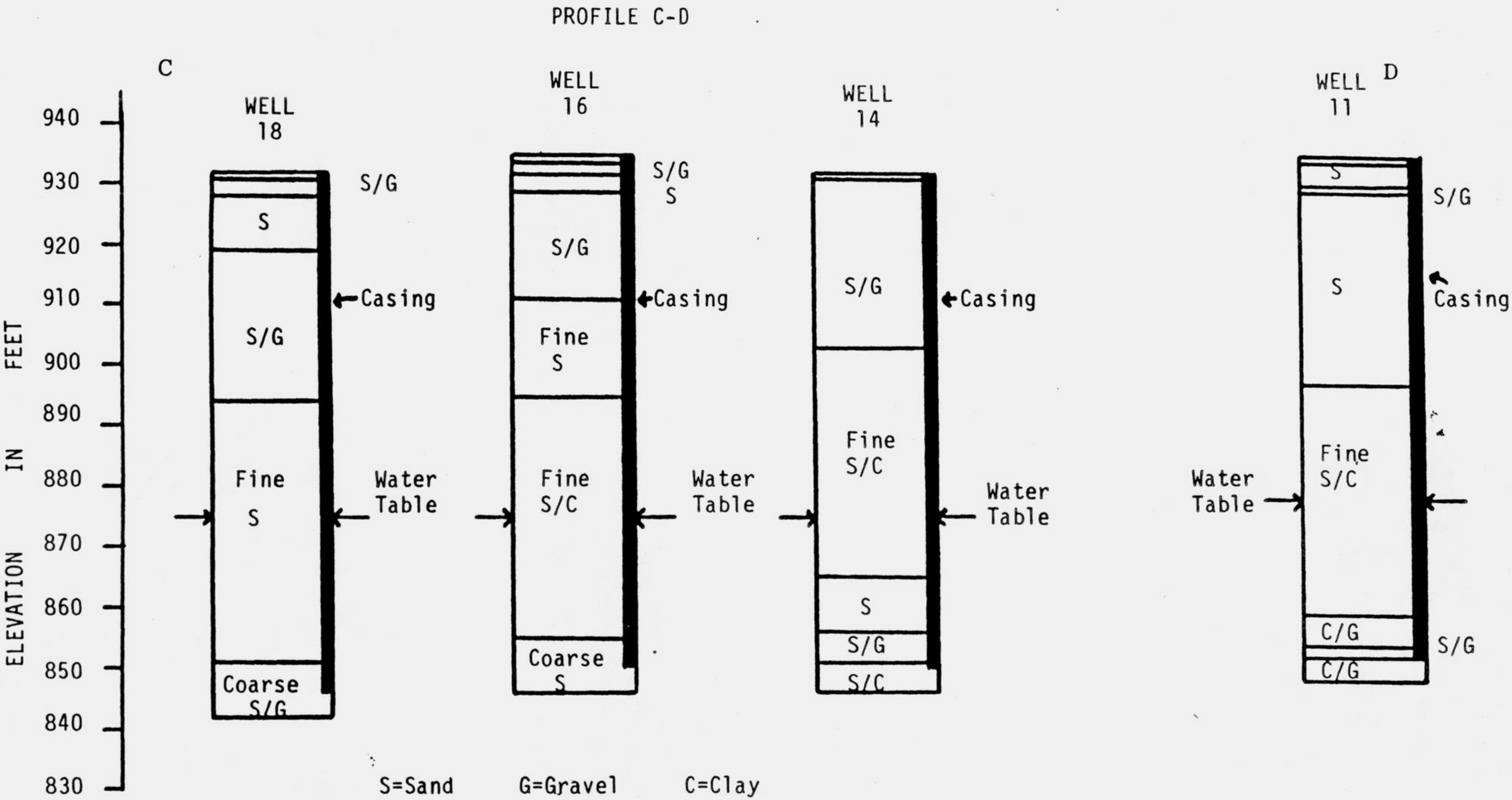


Figure 11. Stratigraphic profile C-D as constructed from well drillers log. See Figure 9 for exact location of profile.

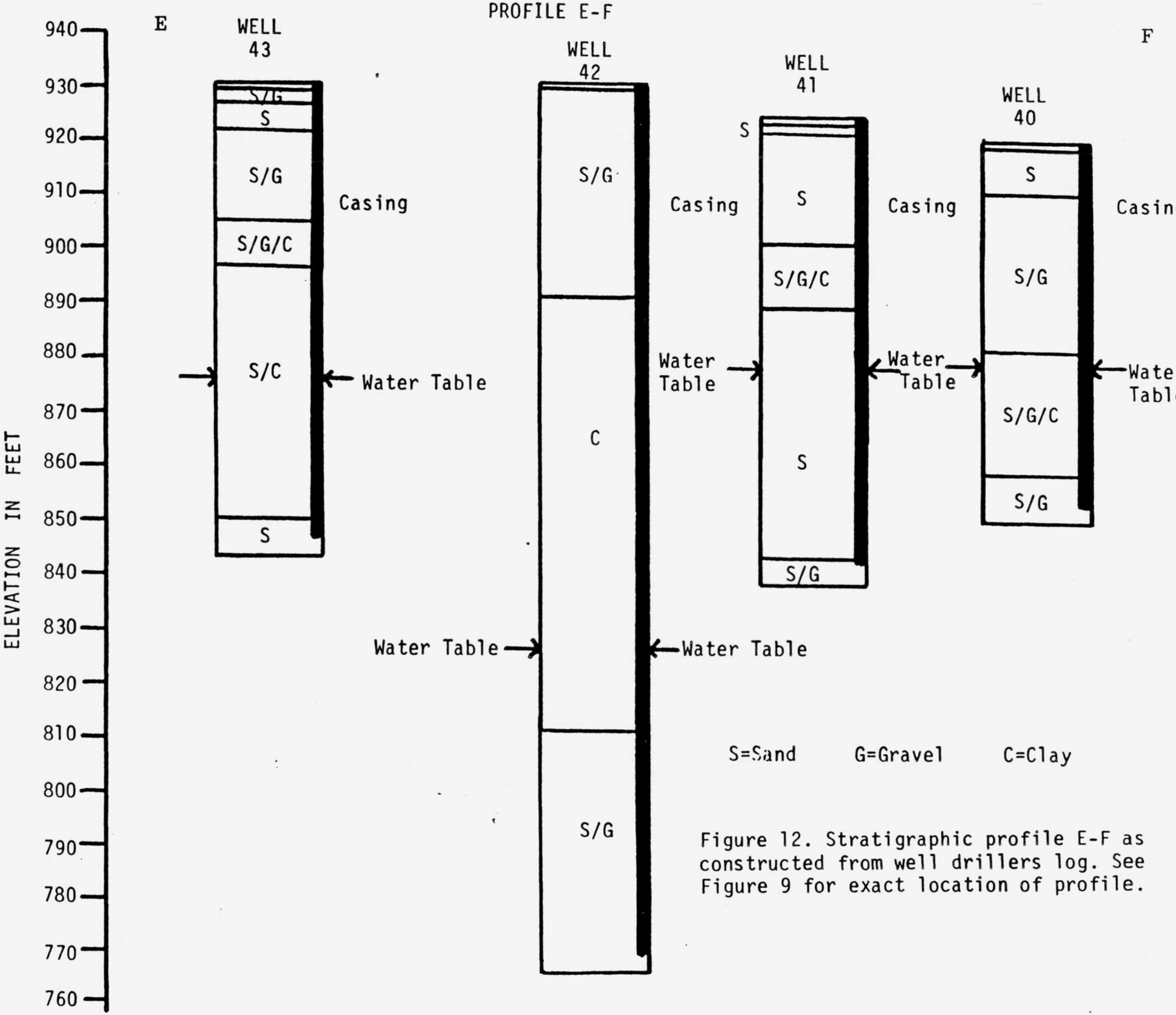


Figure 12. Stratigraphic profile E-F as constructed from well drillers log. See Figure 9 for exact location of profile.

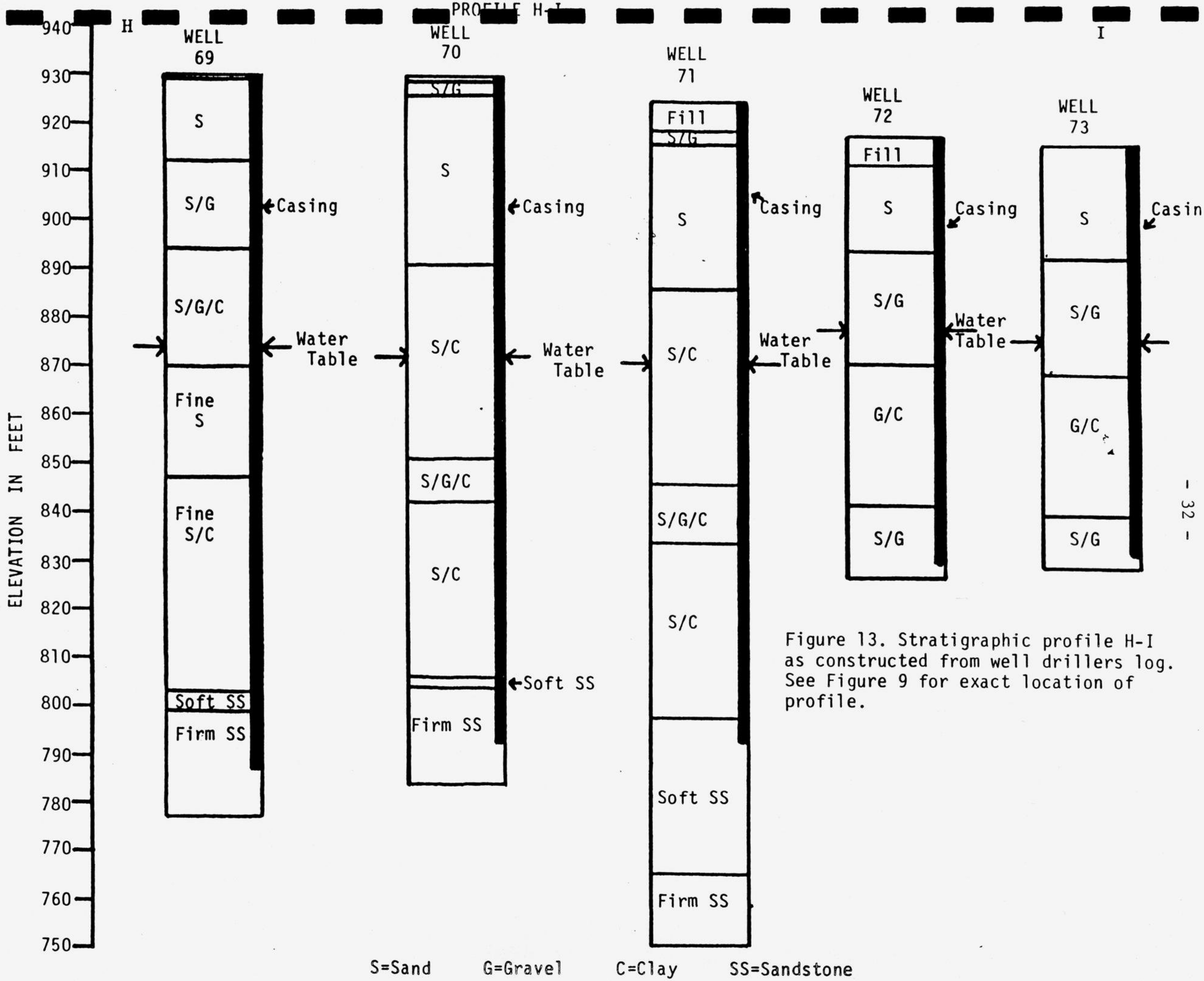


Figure 13. Stratigraphic profile H-I as constructed from well drillers log. See Figure 9 for exact location of profile.

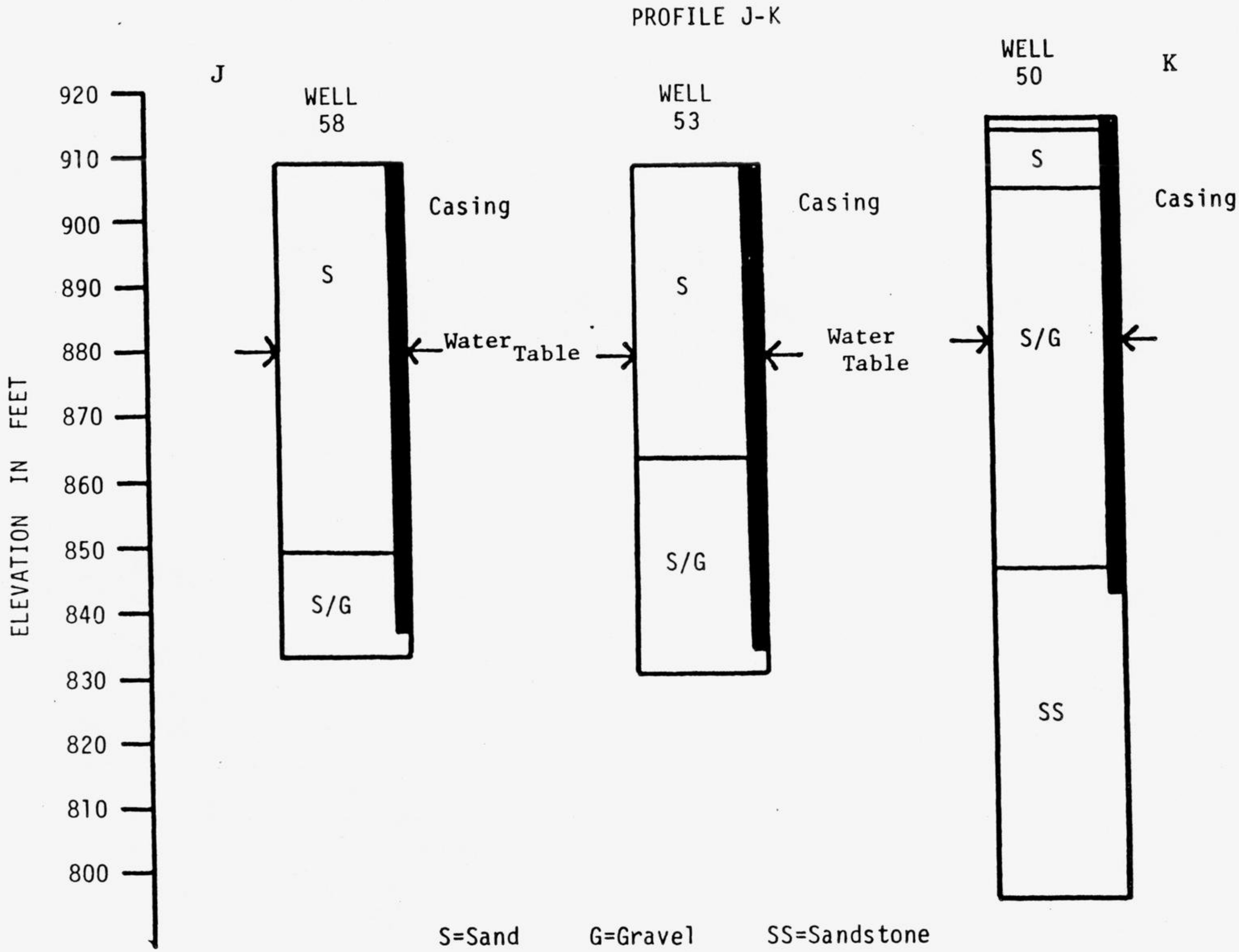


Figure 14. Stratigraphic profile J-K as constructed from well drillers log. See Figure 9 for exact location of profile.

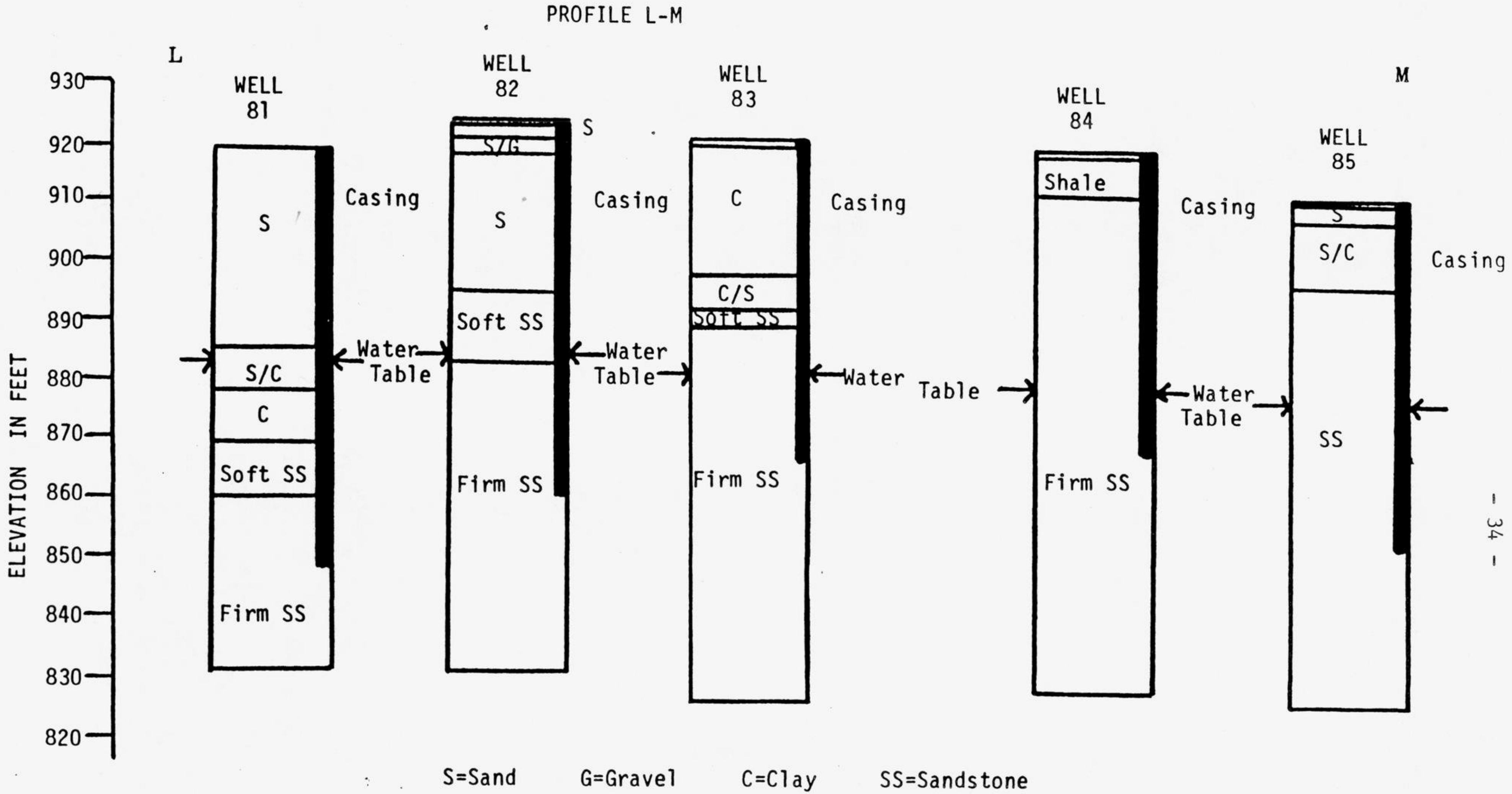


Figure 15. Stratigraphic profile L-M as constructed from well drillers log. See Figure 9 for exact location of profile.

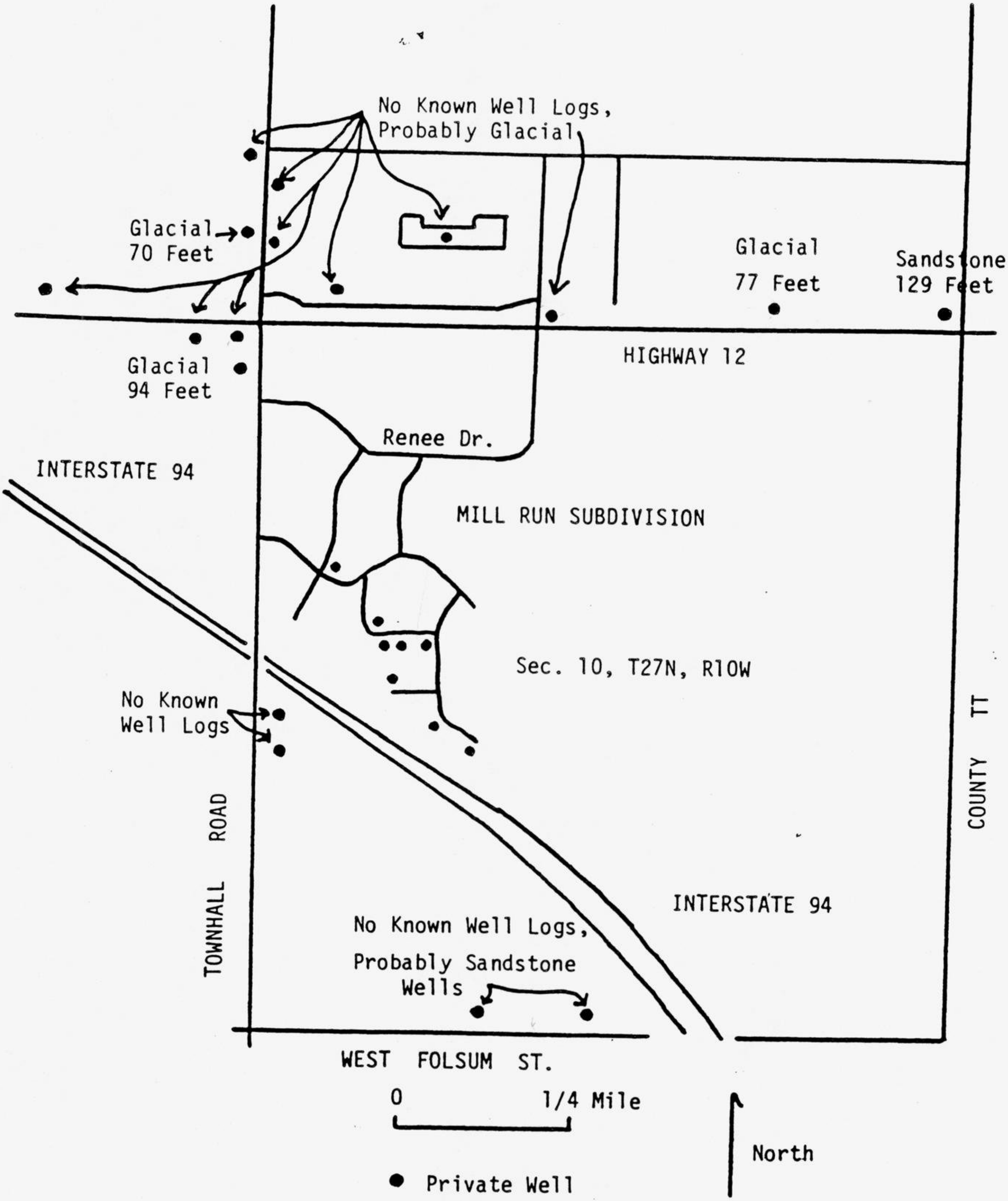


Figure 16. Location map of the sixteen private wells surrounding Mill Run First Edition that were sampled for nitrate-nitrogen. Well depth and aquifer type are indicated where known.

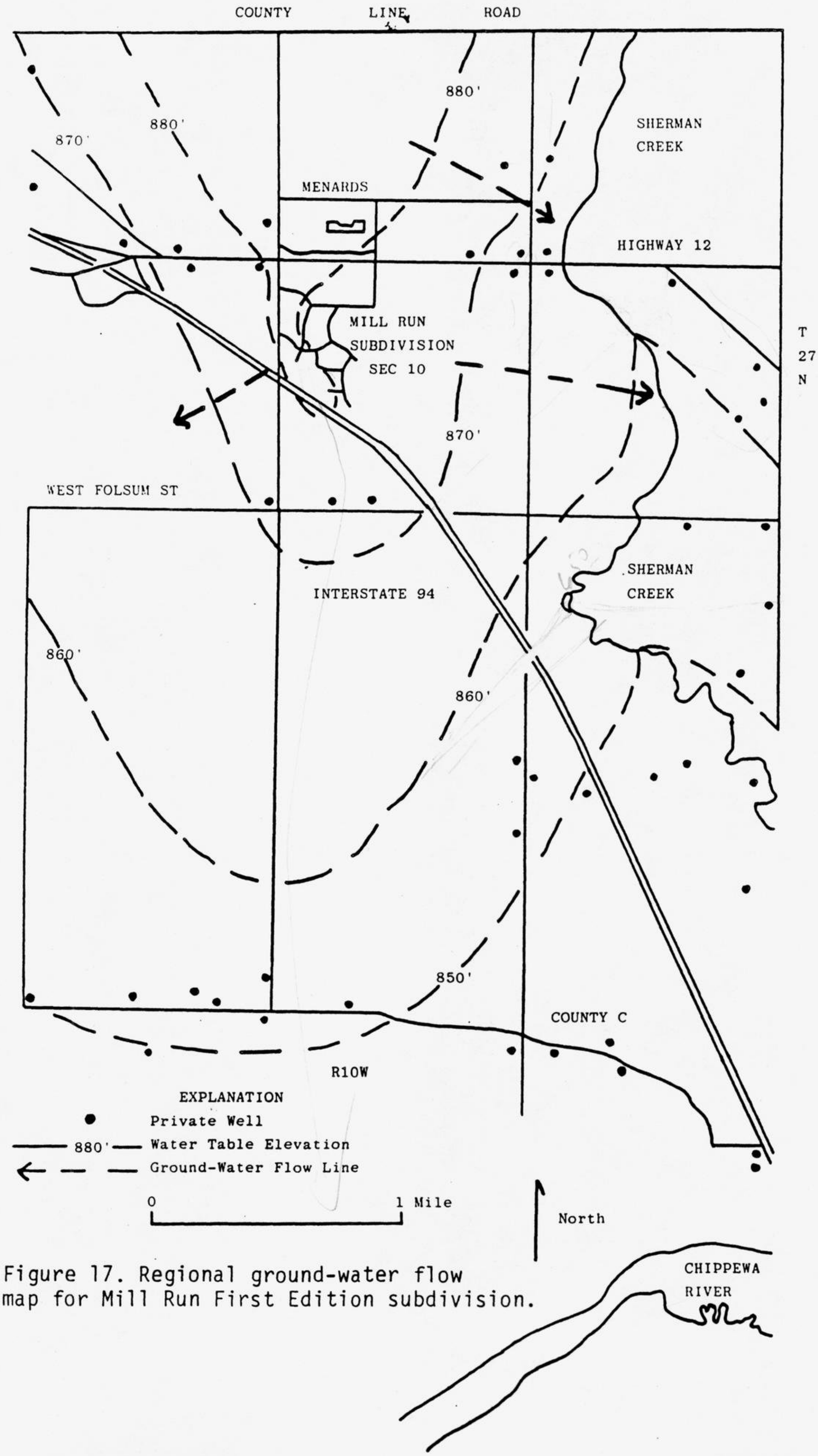


Figure 17. Regional ground-water flow map for Mill Run First Edition subdivision.

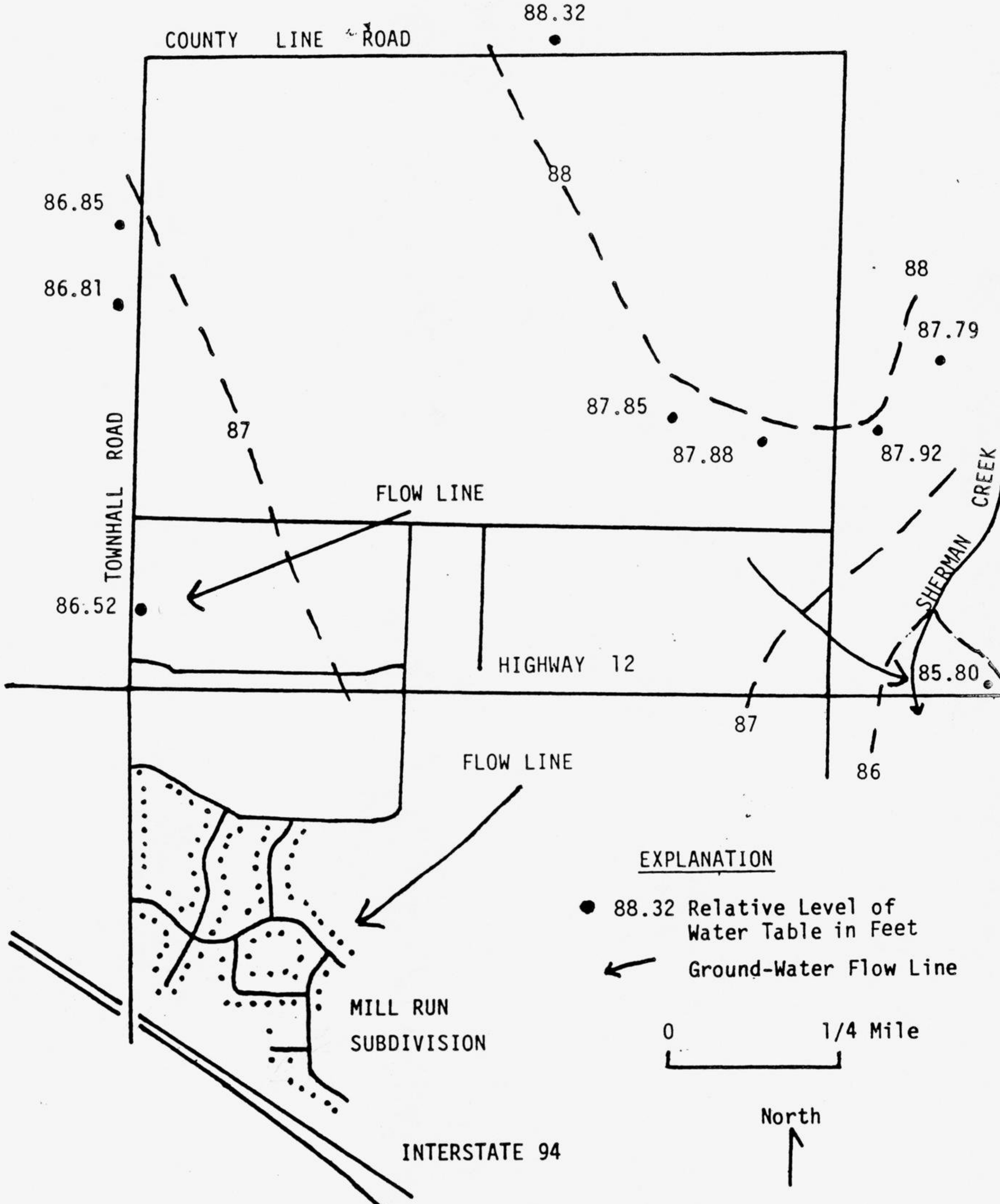


Figure 18, Ground-water flow map constructed from static water table elevations of Grump (1981) for the area of Menard's wood treatment facility in Section 3, T27N, R10W.

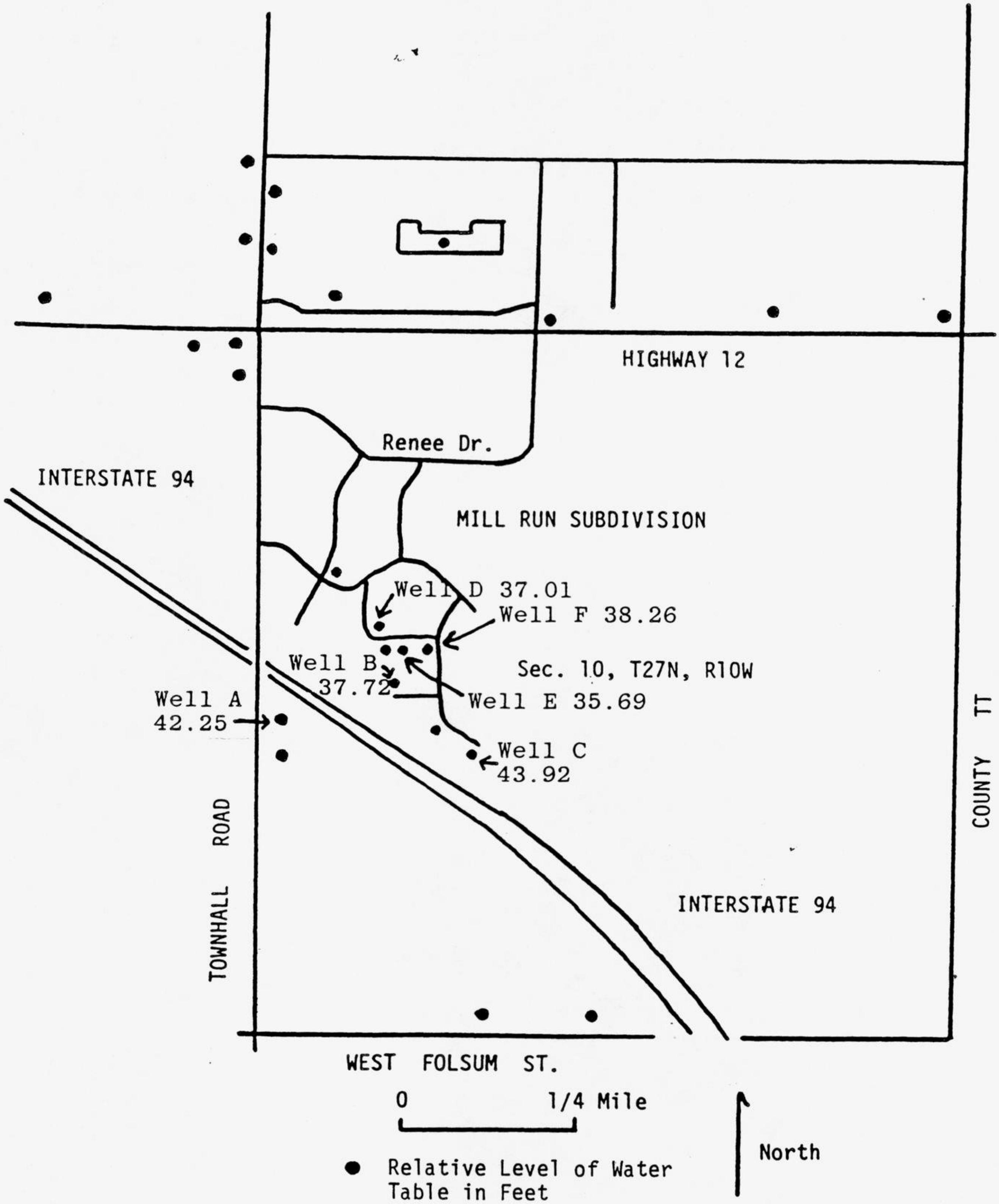


Figure 19. Static ground-water table elevations for six private wells in and adjacent to the southern end of Mill Run First Edition subdivision (Tinker, June 1986, This Report).

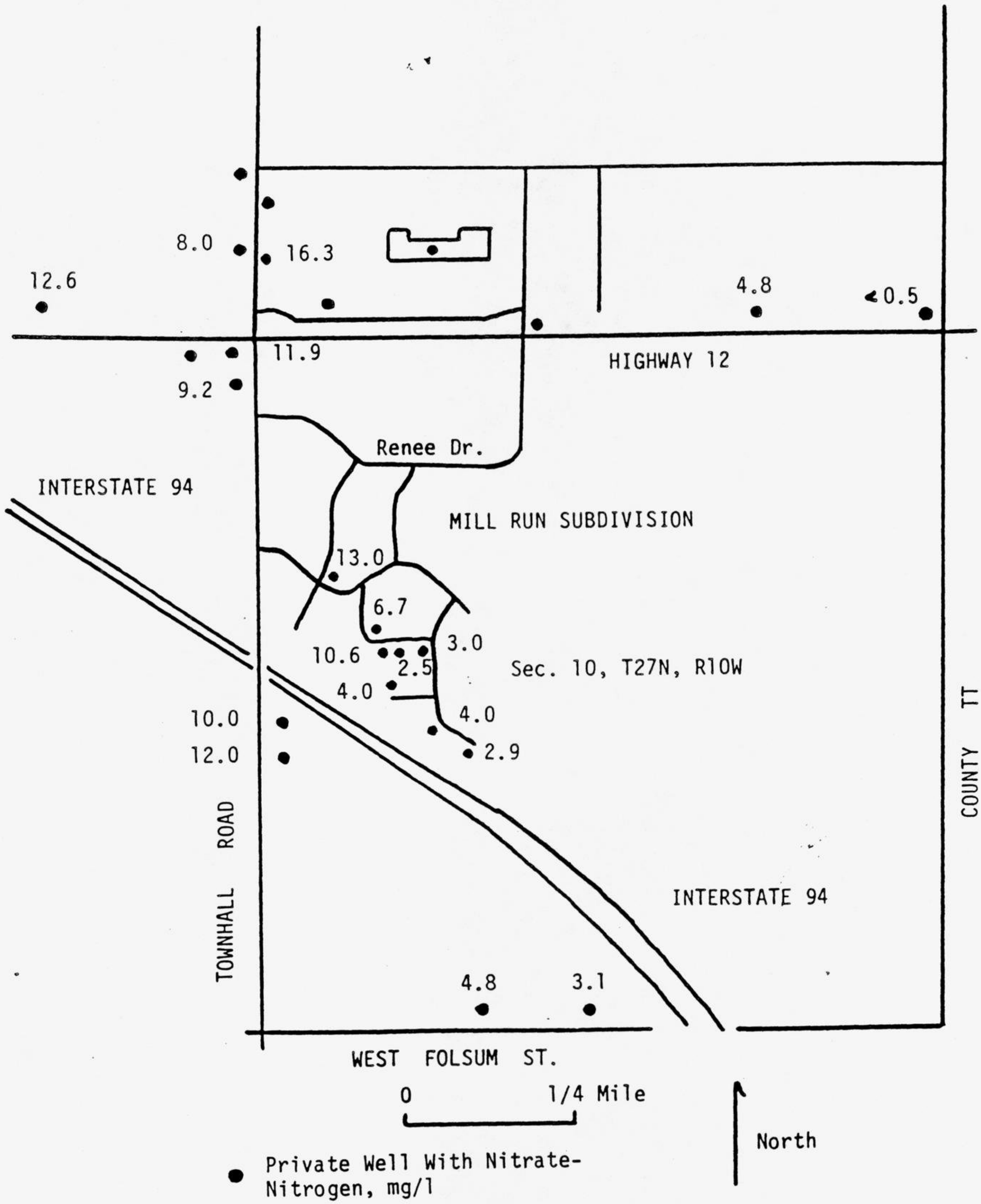


Figure 20. Nitrate-nitrogen in mg/l for eight wells in Mill Run First Edition and 11 wells outside the subdivision for December 7, 1985.

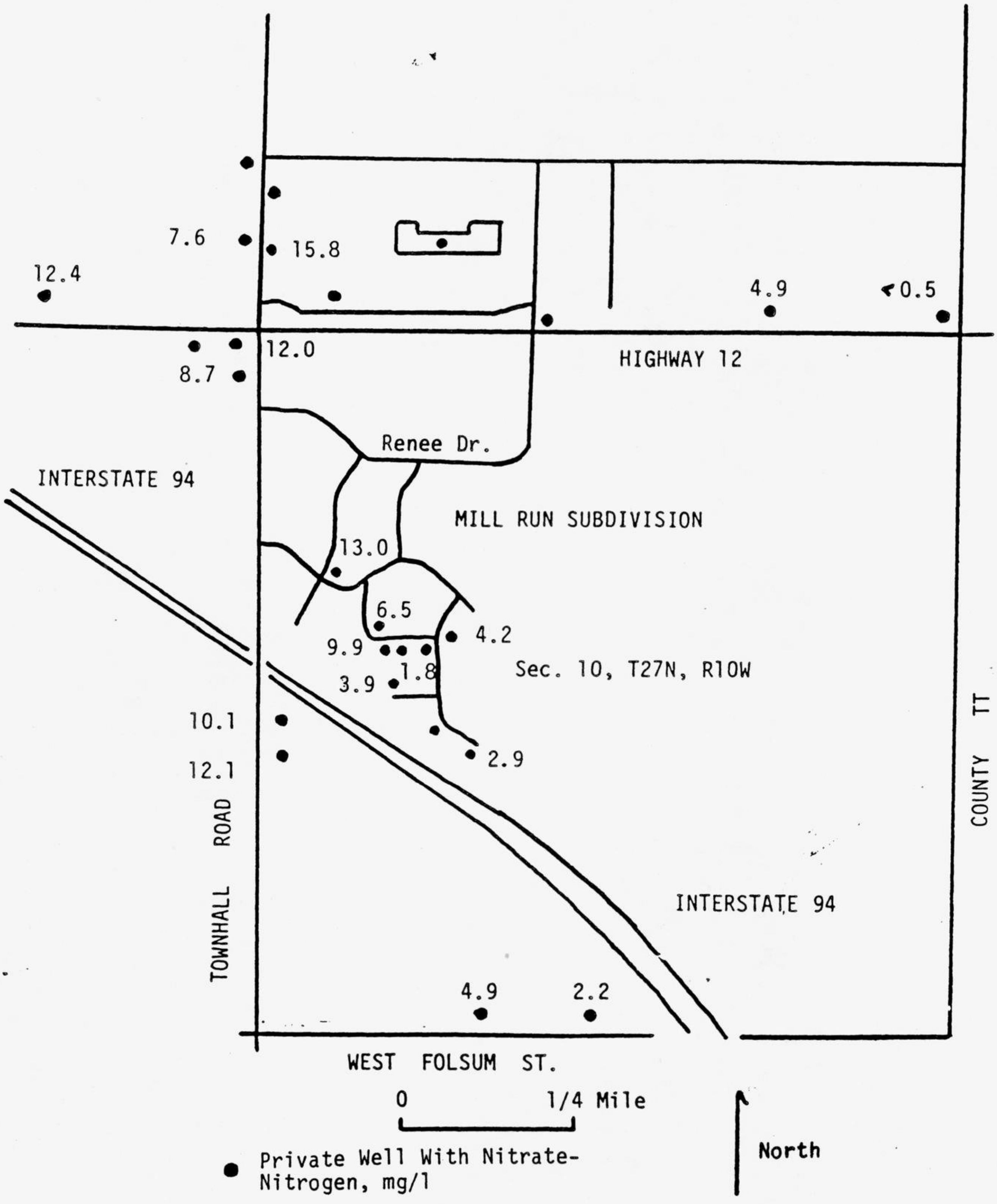


Figure 21. Nitrate-nitrogen in mg/l for seven wells in Mill Run First Edition and 11 wells outside the subdivision for January 16, 1986.

Figure 22. Nitrate-nitrogen in mg/l for 20 wells in Mill Run First Edition for February 15, 1986.

Figure 23. Nitrate-nitrogen in mg/l for 21 wells in Mill Run First Edition subdivision for March 22, 1986.

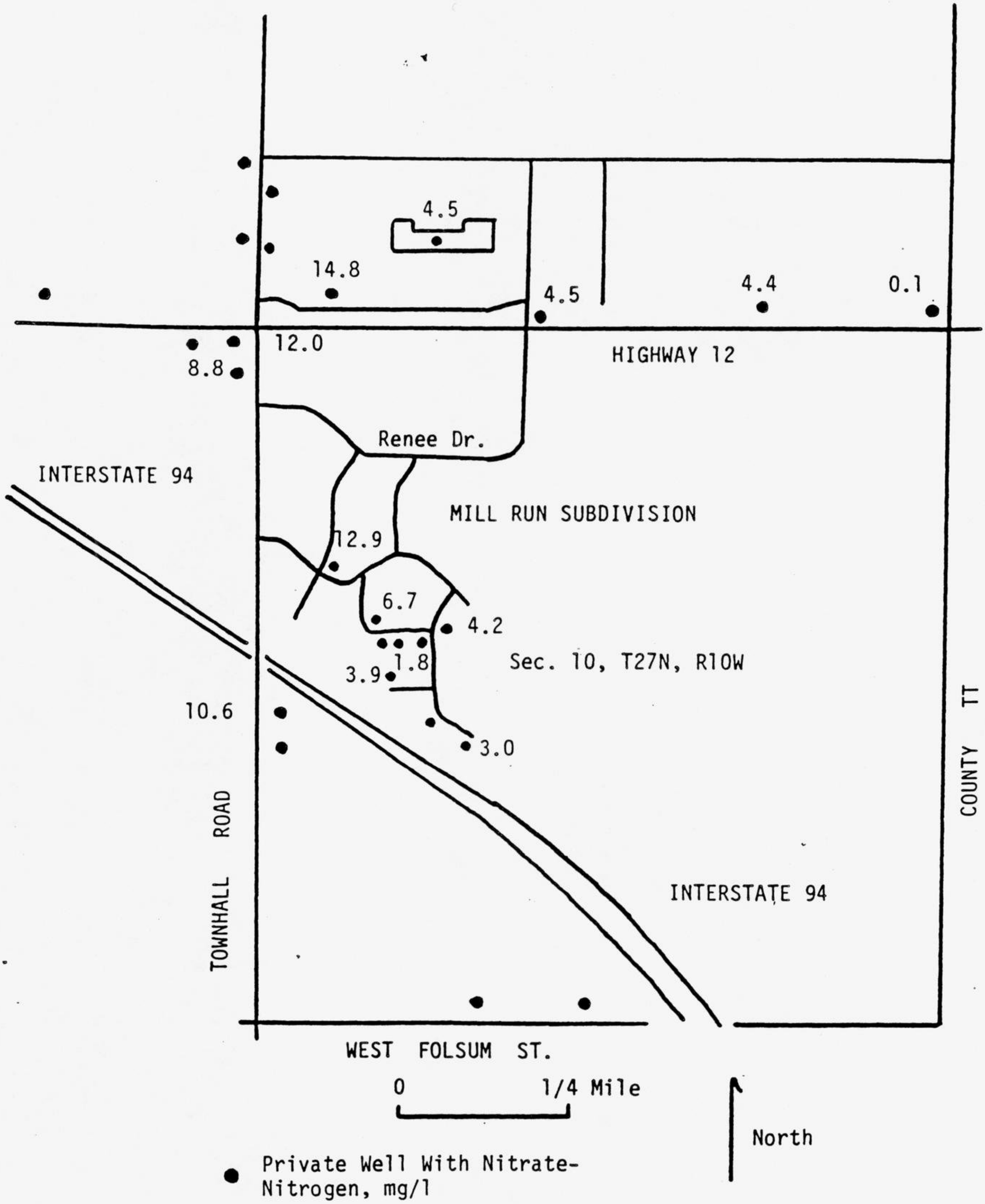


Figure 24. Nitrate-nitrogen in mg/l for eight wells outside Mill Run First Edition subdivision for March 22, 1986.

Figure 25. Nitrate-nitrogen in mg/l for 18 wells in Mill Run First Edition subdivision for April 26, 1986.

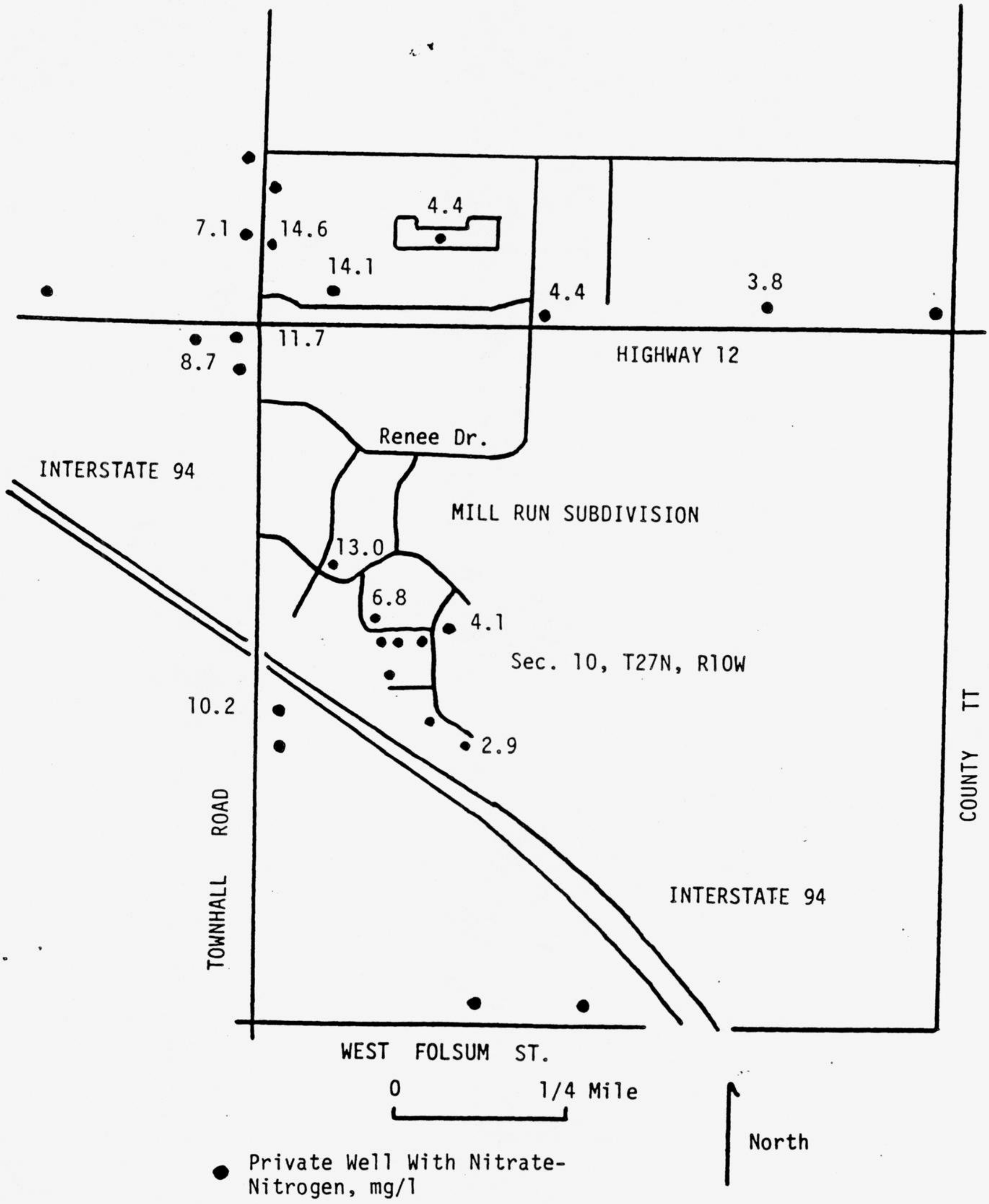


Figure 26. Nitrate-nitrogen in mg/l for nine wells outside of Mill Run First Edition subdivision for April 26, 1986.

Figure 27. Nitrate-nitrogen in mg/l for 30 wells in Mill Run First Edition subdivision for June 2, 1986.

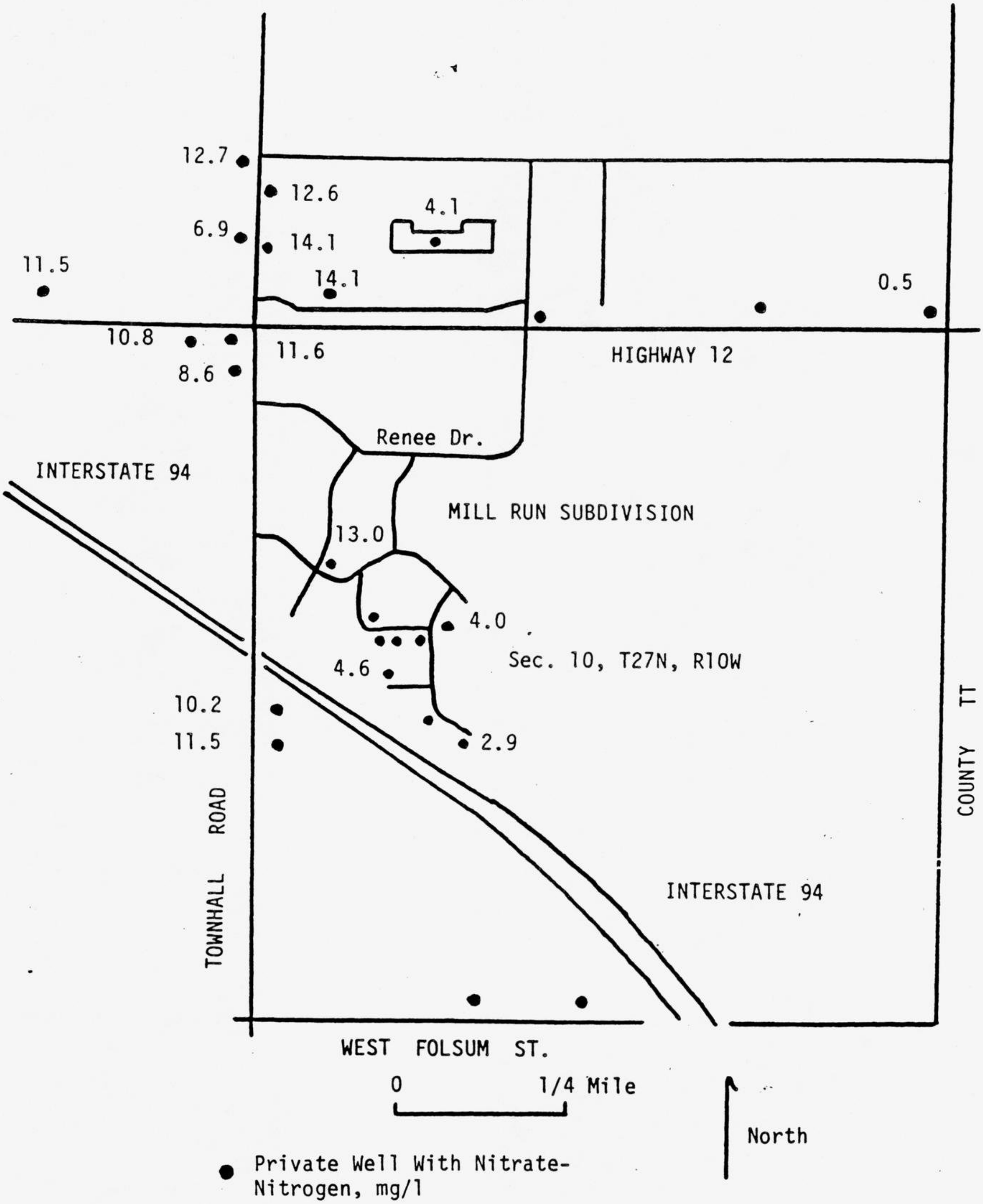


Figure 28. Nitrate-nitrogen in mg/l for 13 wells outside Mill Run First Edition subdivision for June 2, 1986

Figure 29. Mean and standard deviations for nitrate-nitrogen in mg/l for wells within Mill Run First Edition subdivision.

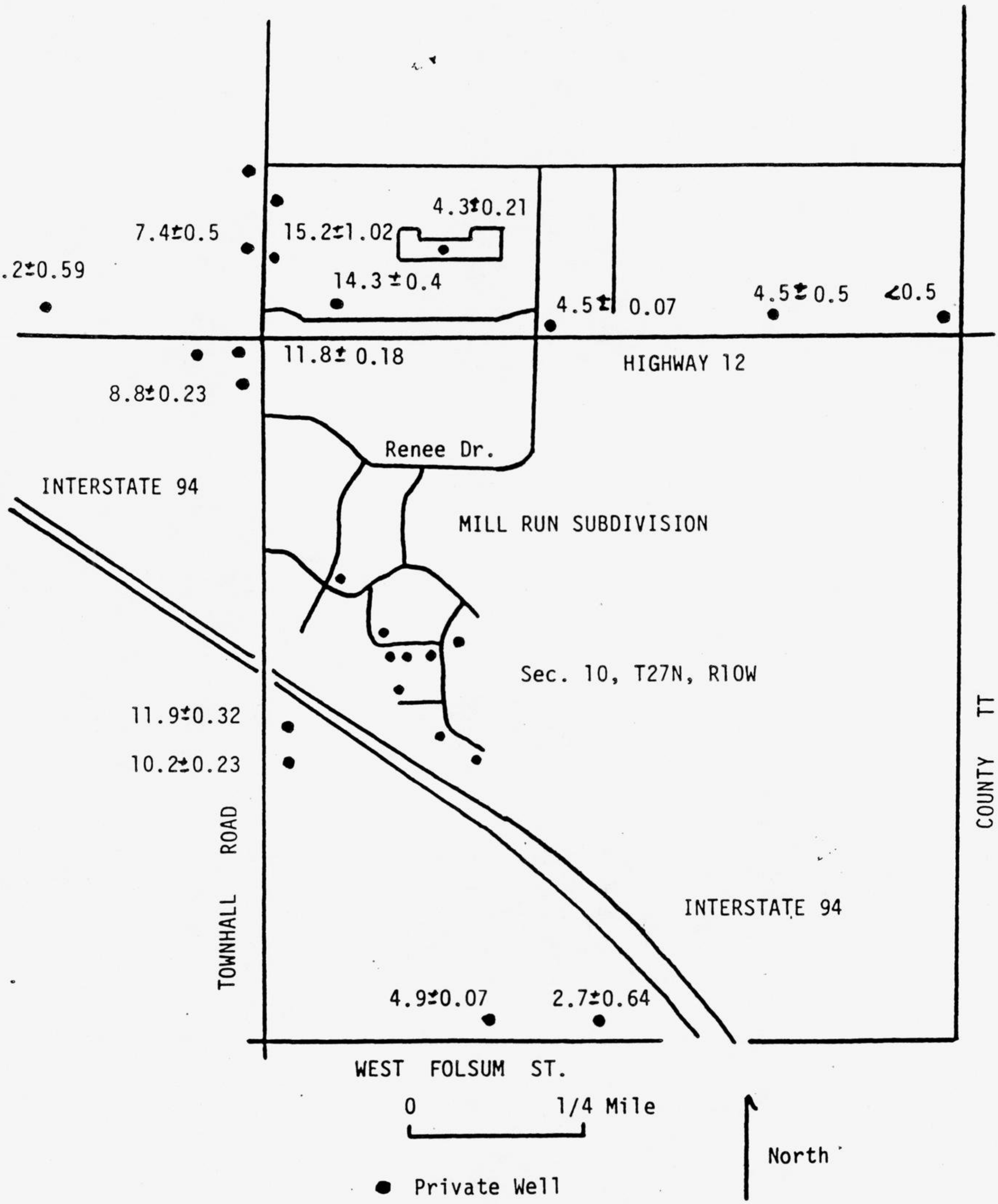


Figure 30. Mean and standard deviations for nitrate-nitrogen in mg/l for wells outside of Mill Run First Edition subdivision.

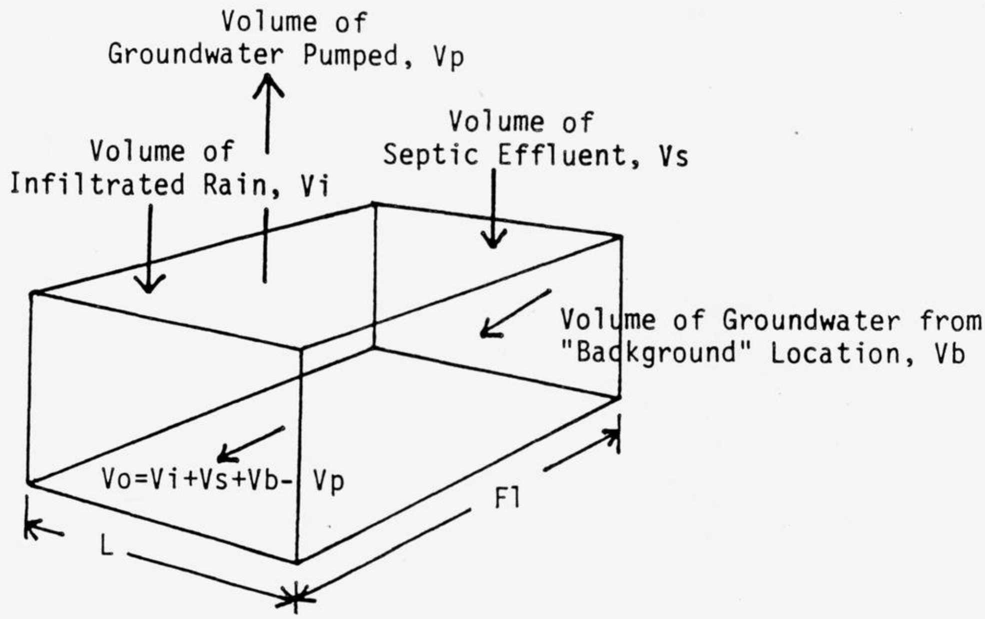


Figure 31. Elemental volume of nitrate mass balance model illustrating volume of groundwater pumped, Vp; volume of infiltrated precipitation, Vi; volume of septic effluent, Vs; volume of groundwater from "background" location, Vb; and volume of groundwater leaving elemental volume, Vo.

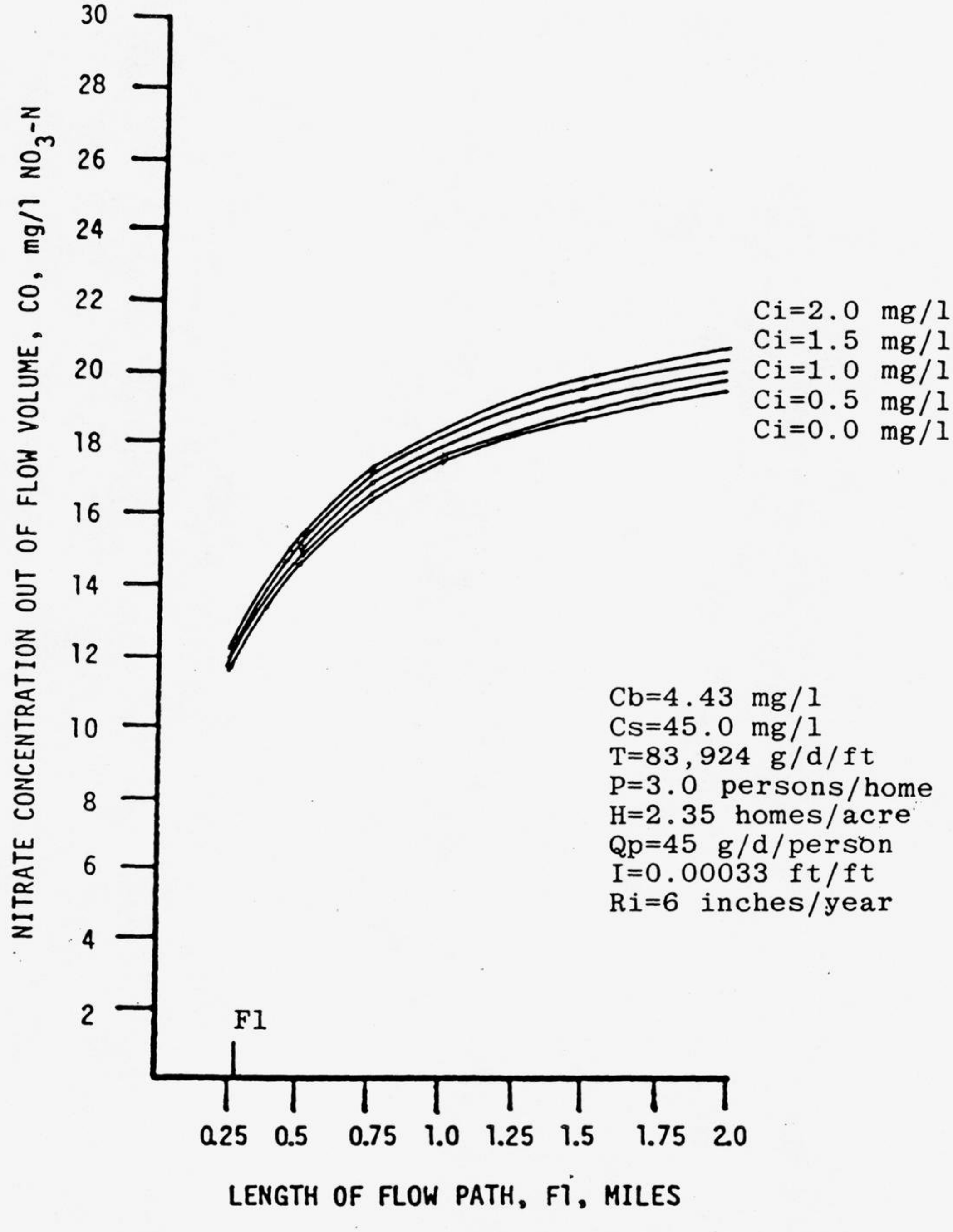


Figure 32. Nitrate concentration out of flow volume vs. length of flow path for different values of nitrate-nitrogen in recharge, Ci. Fl=0.27 miles for Mill Run First Edition subdivision.

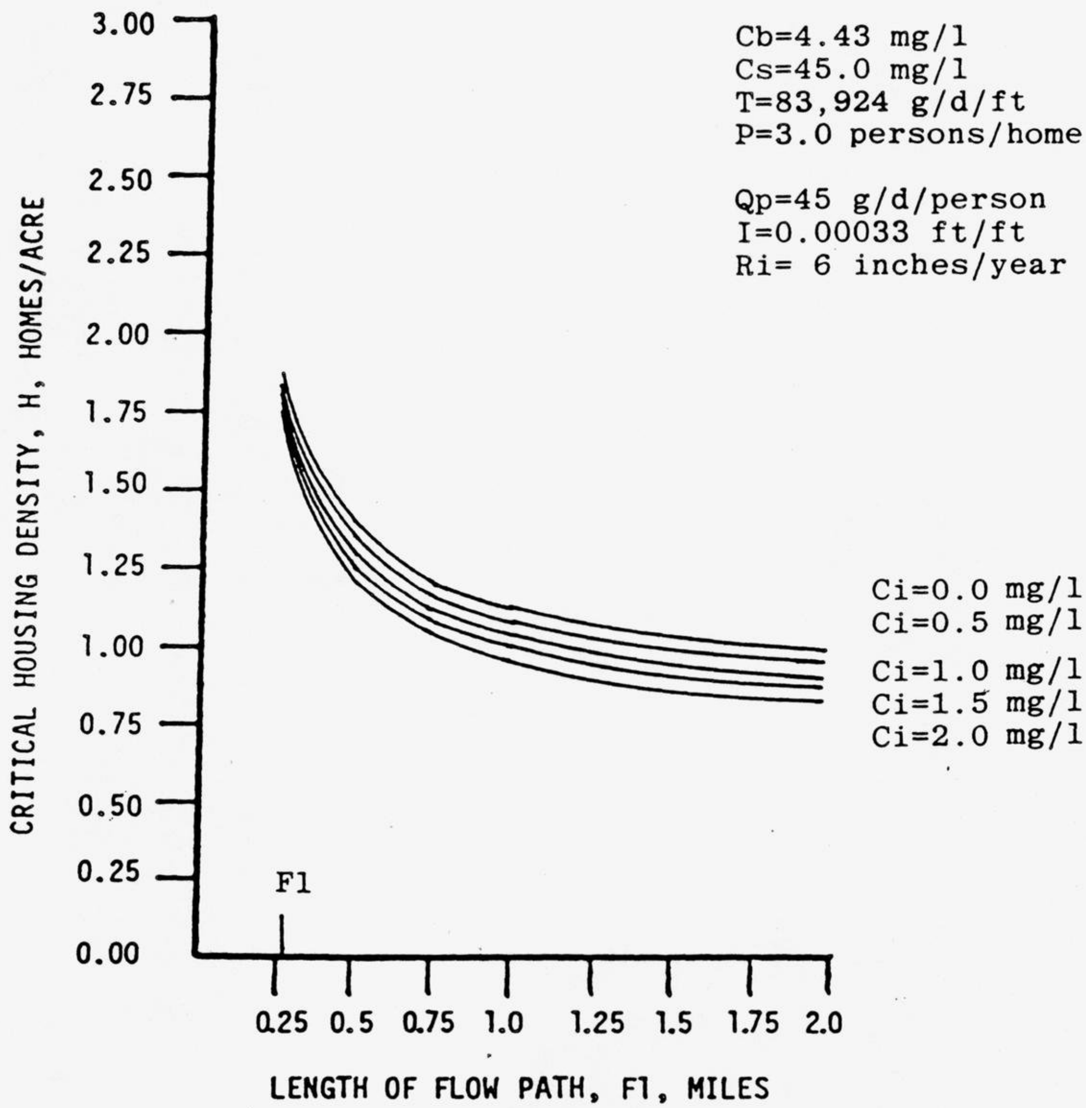


Figure 33. Critical housing density vs. length of flow path for different values of nitrate-nitrogen in recharge, Ci. Fl=0.27 miles for Mill Run First Edition subdivision.

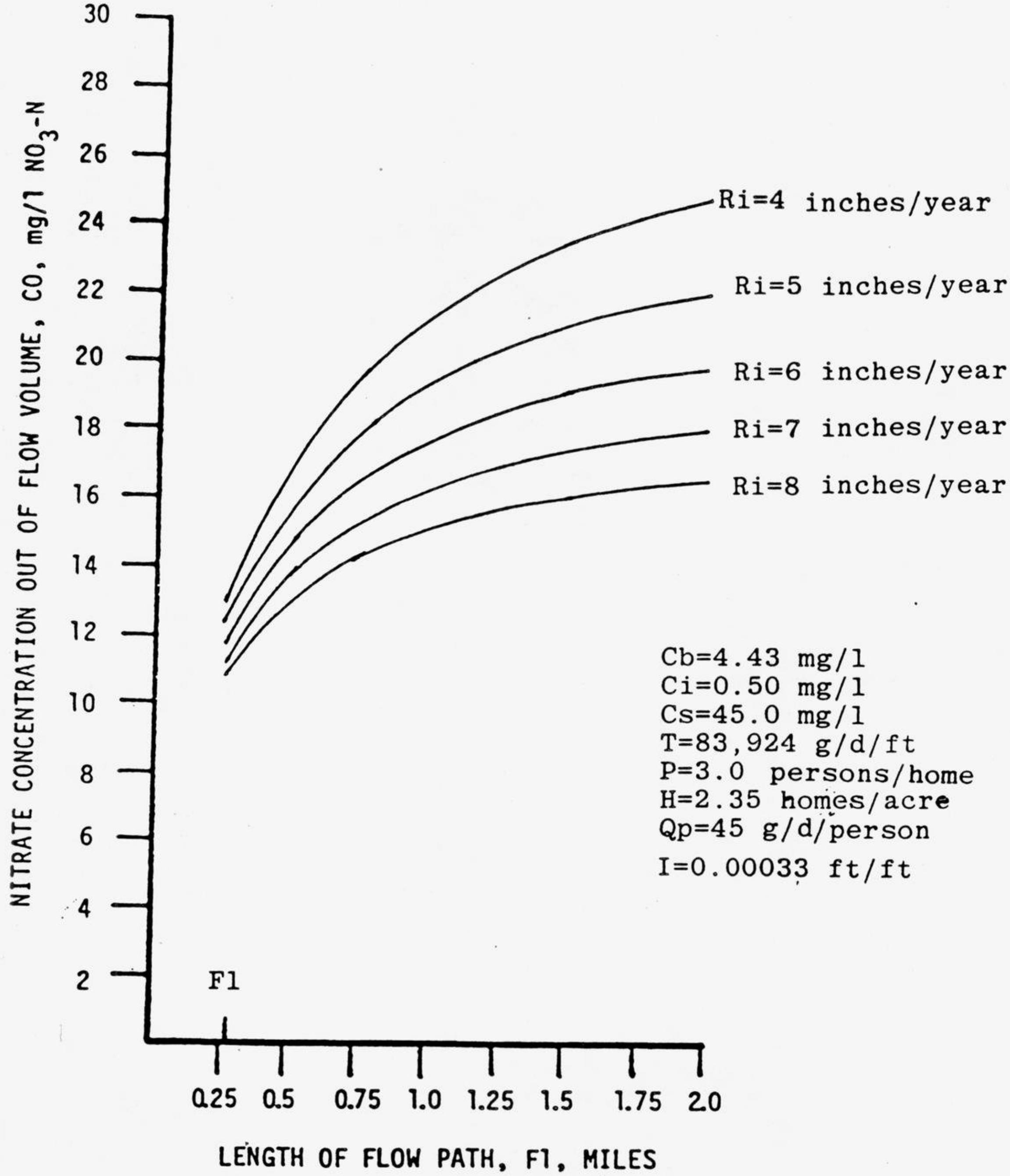


Figure 34. Nitrate concentration out of flow volume vs. length of flow path for different values of recharge, Ri. Fl=0.27 miles for Mill Run First Edition subdivision.

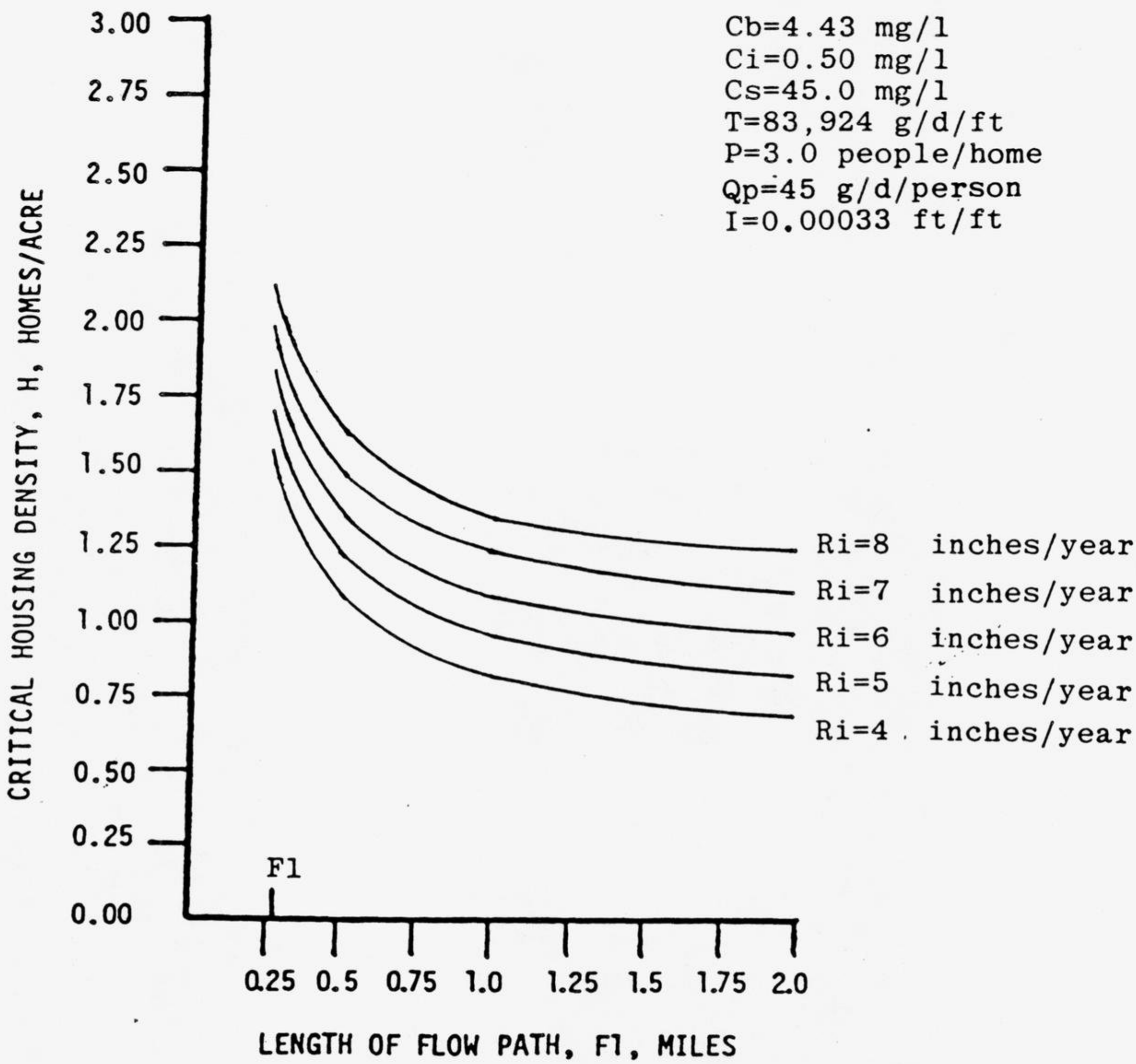


Figure 35. Critical housing density vs. length of flow path for different values of recharge from precipitation, Ri. Fl=0.27 miles for Mill Run First Edition subdivision.

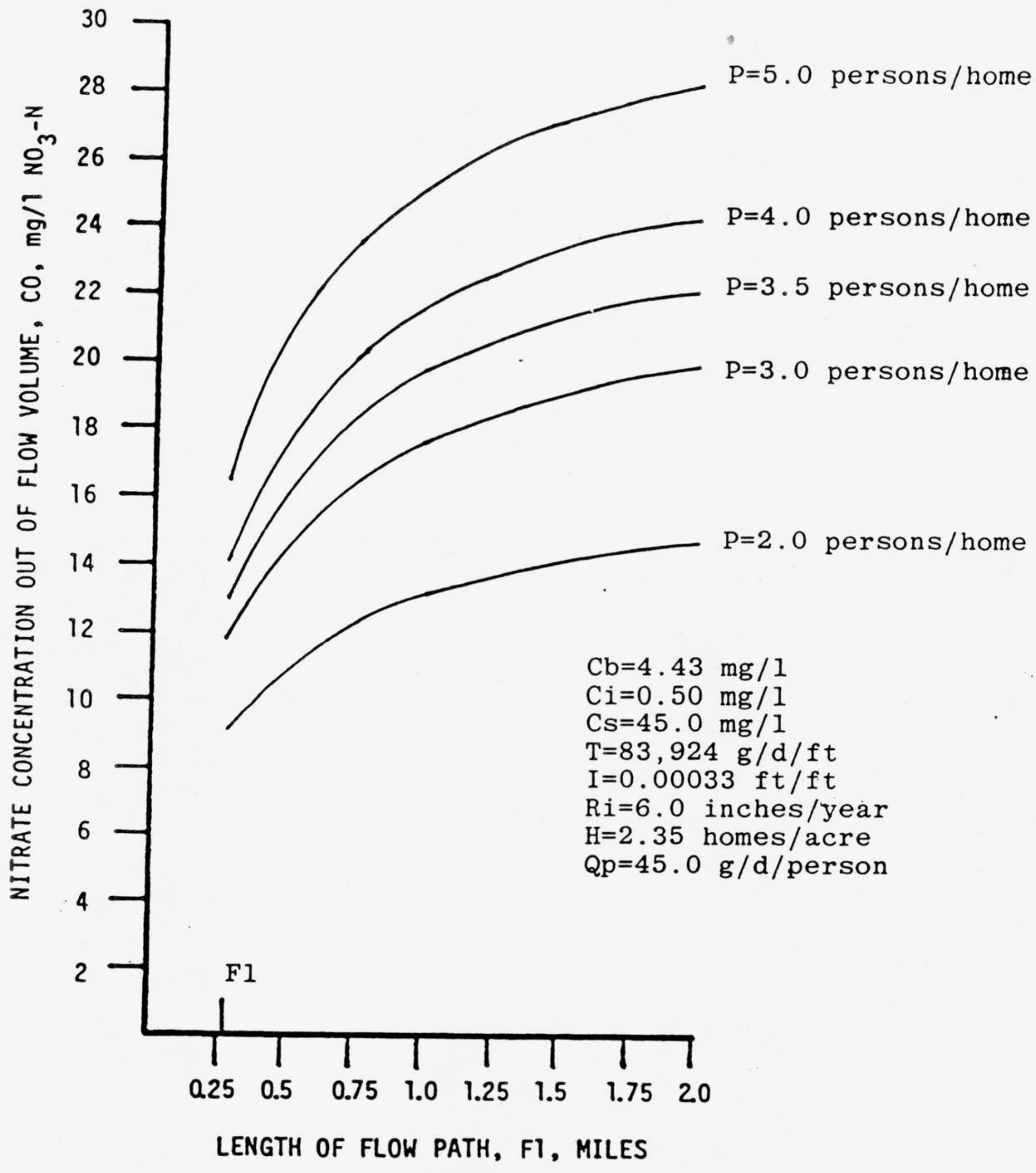


Figure 36. Nitrate concentration out of flow volume vs. length of flow path for different values of persons/home, P. Fl=0.27 miles for Mill Run First Edition subdivision.

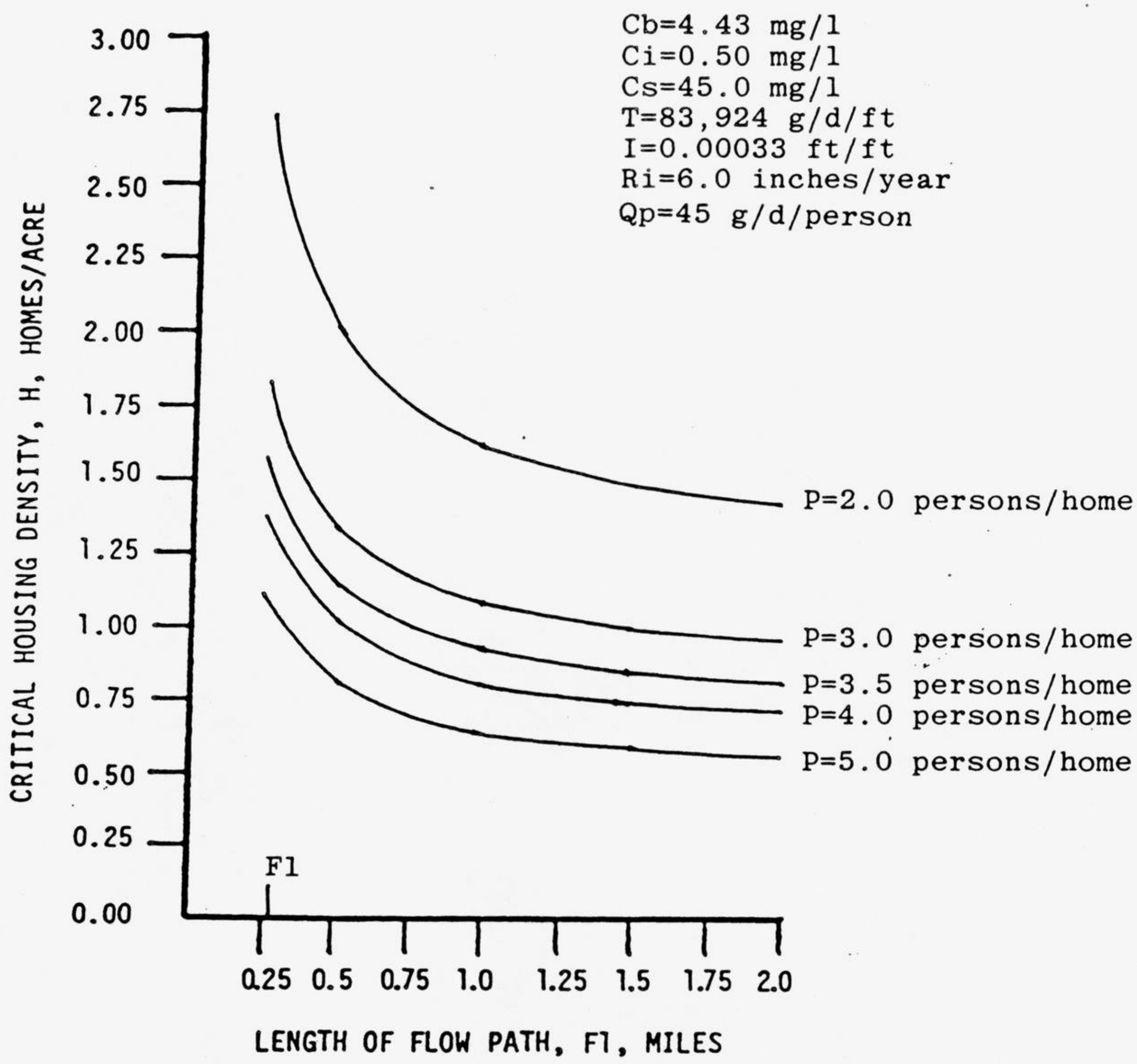


Figure 37. Critical housing density vs. length of flow path for different values of persons/home, P. Fl=0.27 miles for Mill Run First Edition subdivision.

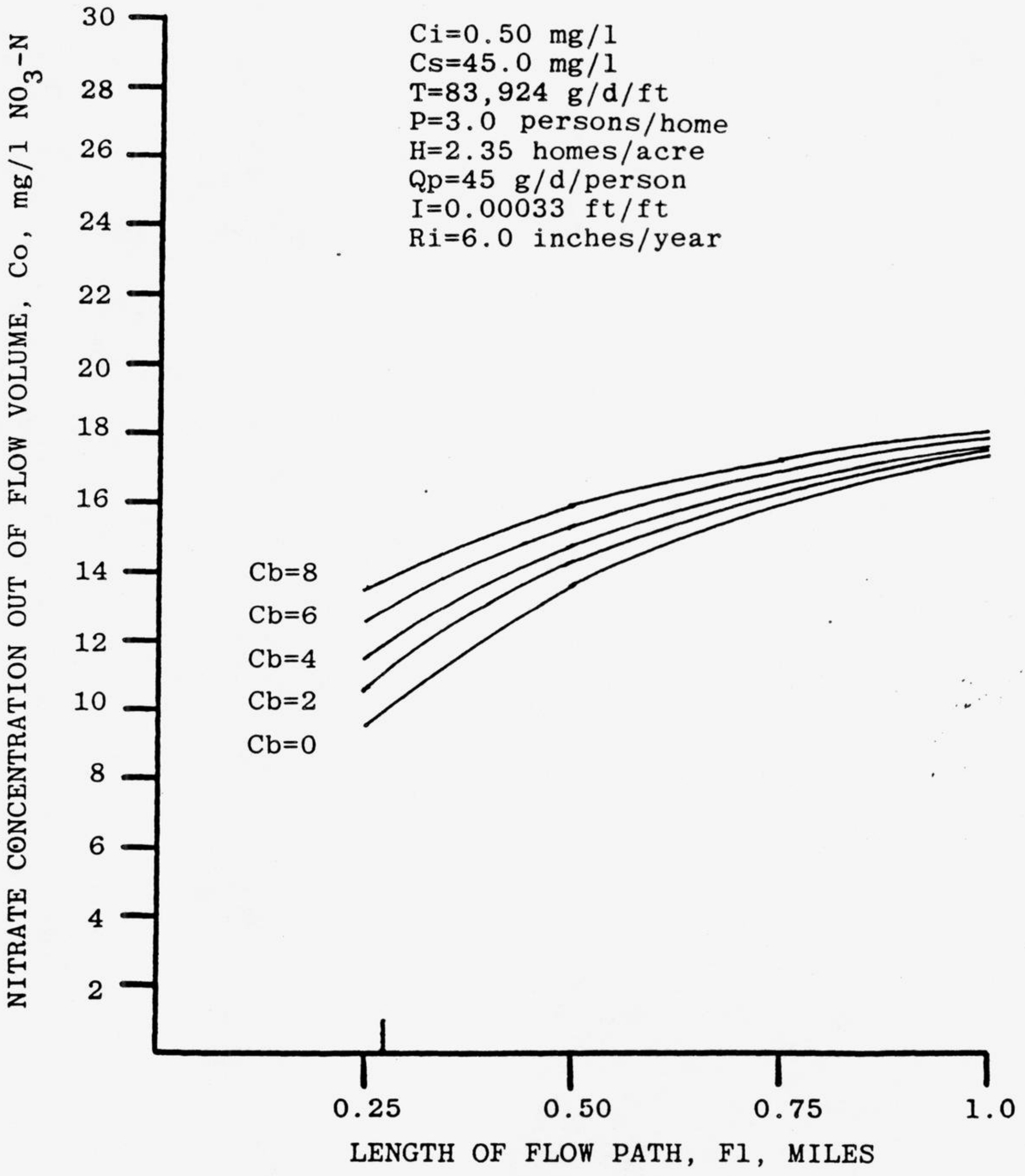


Figure 38. Nitrate concentration out of flow volume vs. length of flow path for different values of nitrate concentration of groundwater entering the subdivision, Cb. Fl=0.25 miles for Mill Run First Edition subdivision.

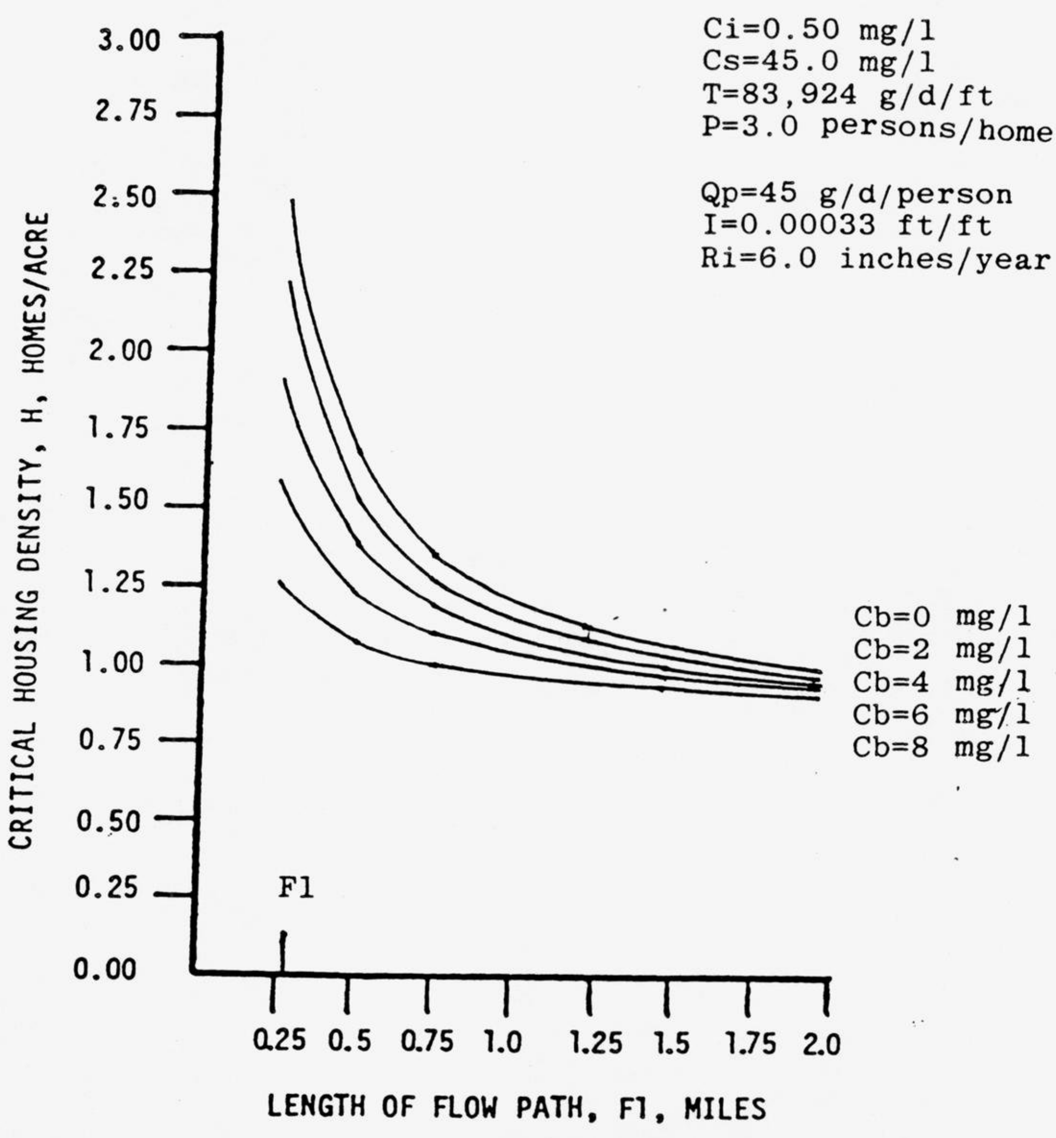


Figure 39. Critical housing density vs. length of flow path for different values of nitrate concentration of groundwater entering the subdivision, Cb. Fl=0.25 miles for Mill Run First Edition subdivision.

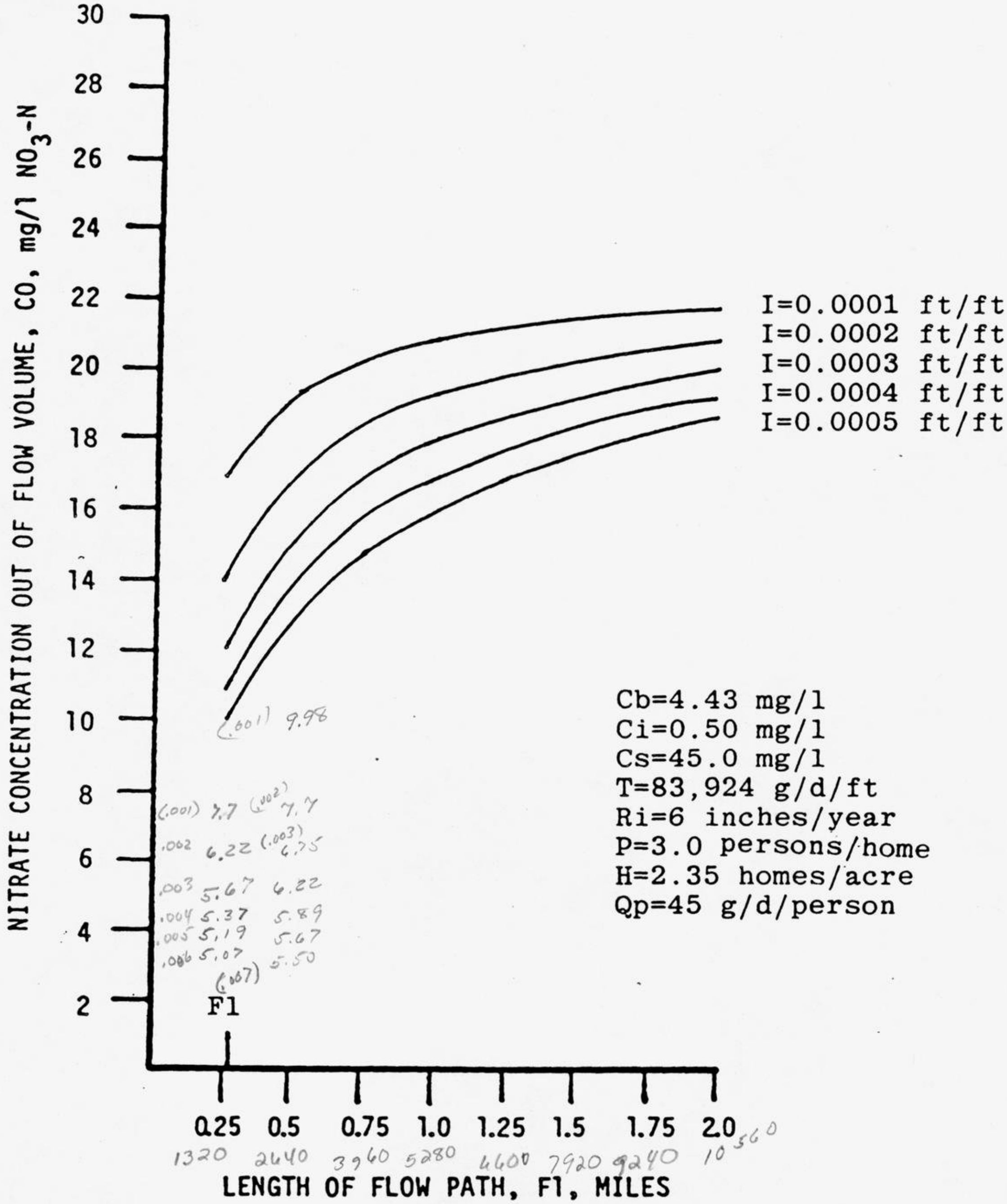


Figure 40. Nitrate concentration out of flow volume vs. length of flow path for different values of hydraulic gradient, I. Fl=0.27 miles for Mill Run First Edition subdivision.

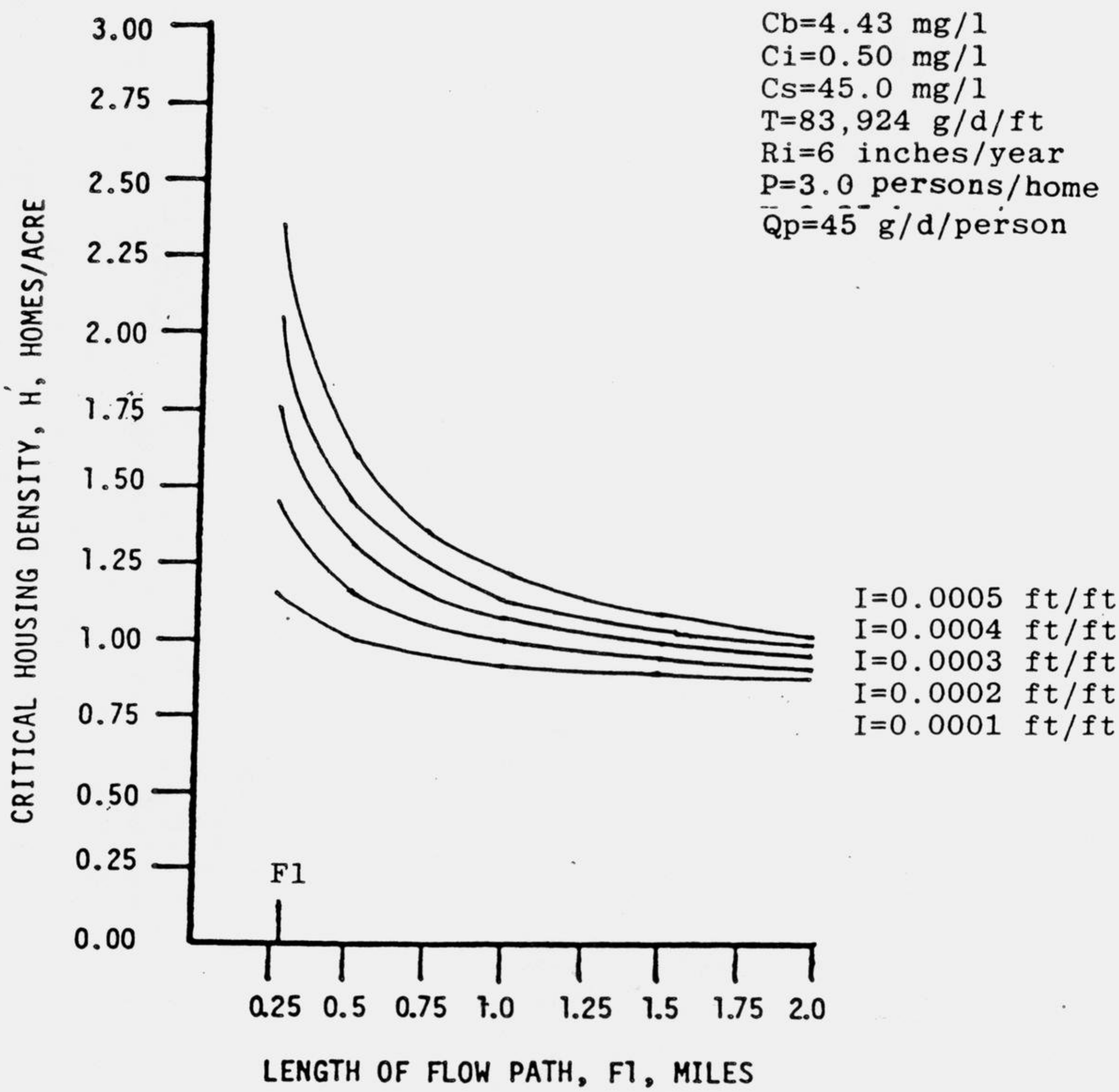


Figure 41 Critical housing density vs. length of flow path for different values of hydraulic gradient, I. Fl=0.27 miles for Mill Run First Edition subdivision.

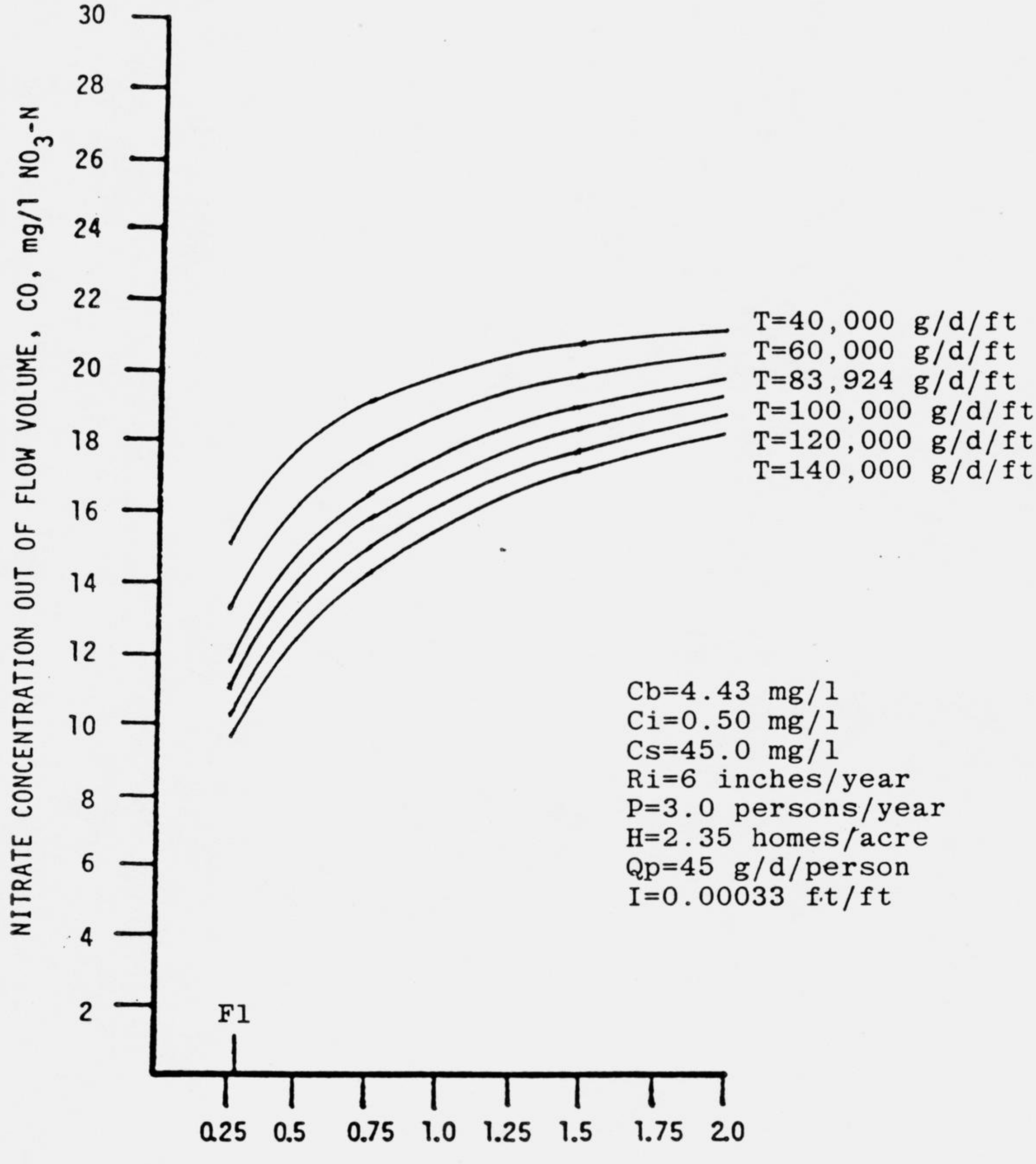


Figure 42. Nitrate concentration out of flow volume vs. length of flow path for different values of transmissivity with Cs=45 mg/l nitrate-nitrogen. Fl=0.27 miles for Mill Run First Edition subdivision.

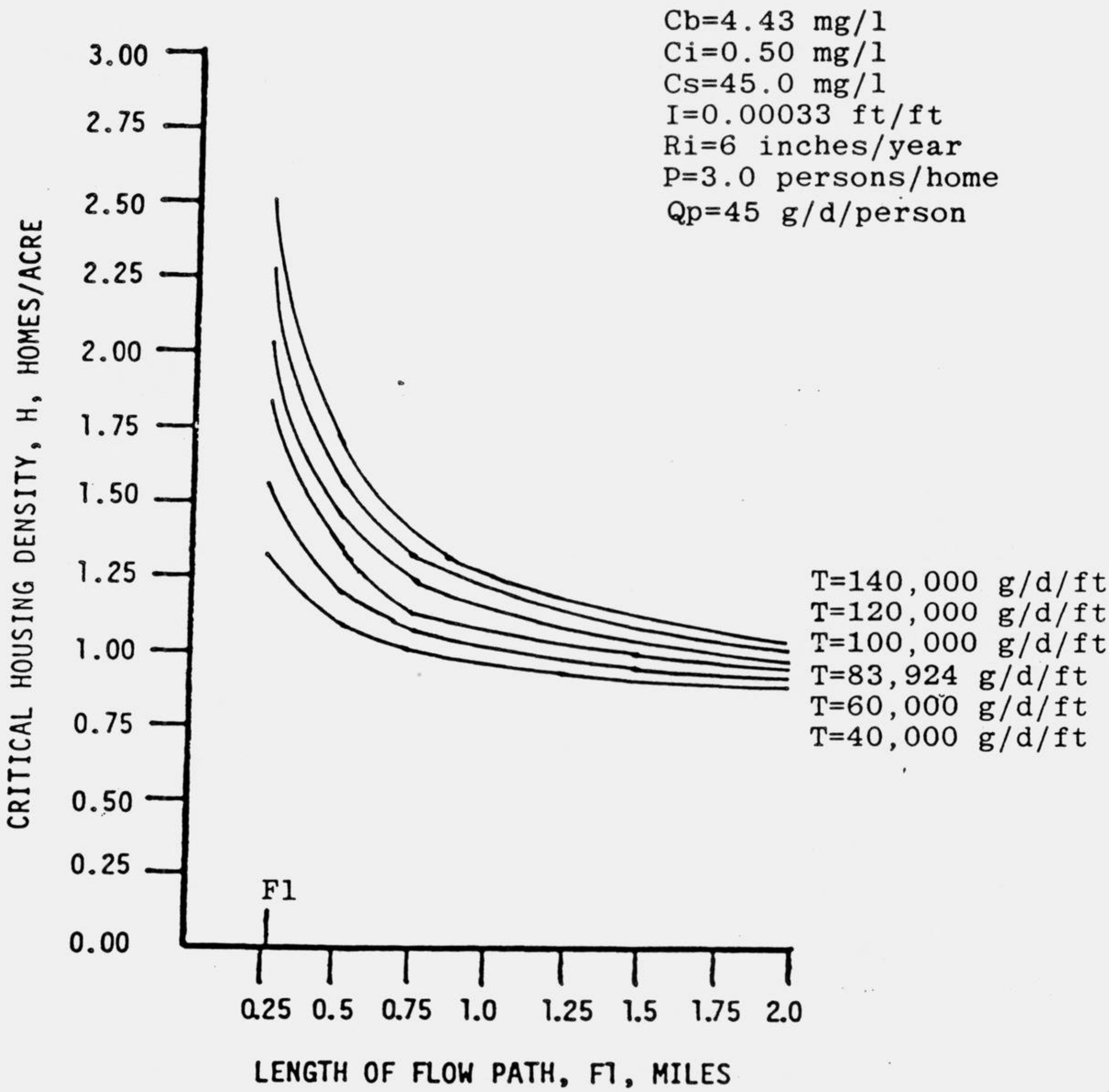


Figure 43. Critical housing density vs. length of flow path for different values of transmissivity with Cs=45 mg/l nitrate nitrogen. Fl=0.27 miles for Mill Run First Edition subdivision.

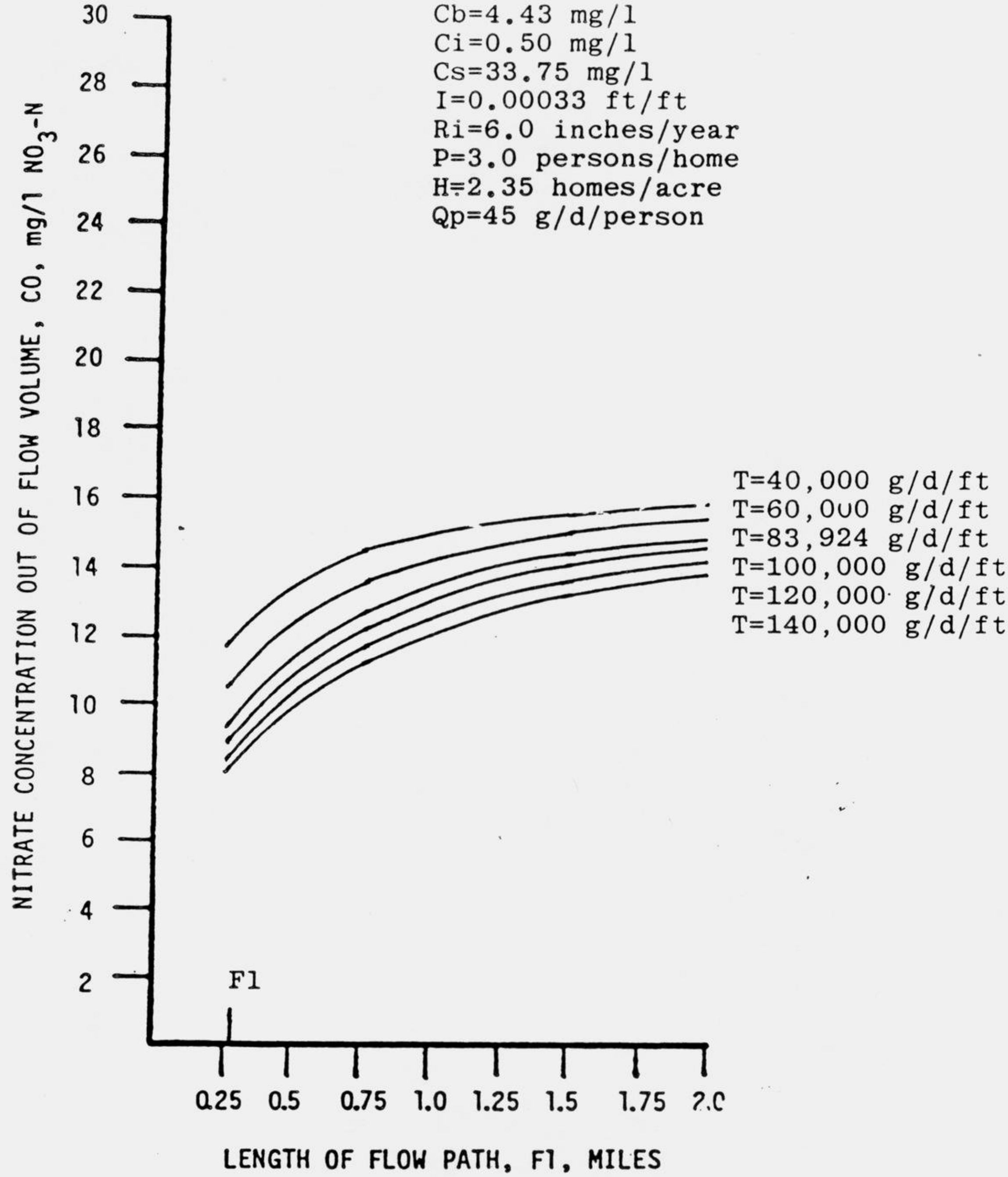


Figure 44. Nitrate concentration out of flow volume vs. length of flow path for different values of transmissivity with Cs=33.75 mg/l nitrate-nitrogen. Fl=0.27 miles for Mill Run First Edition subdivision.

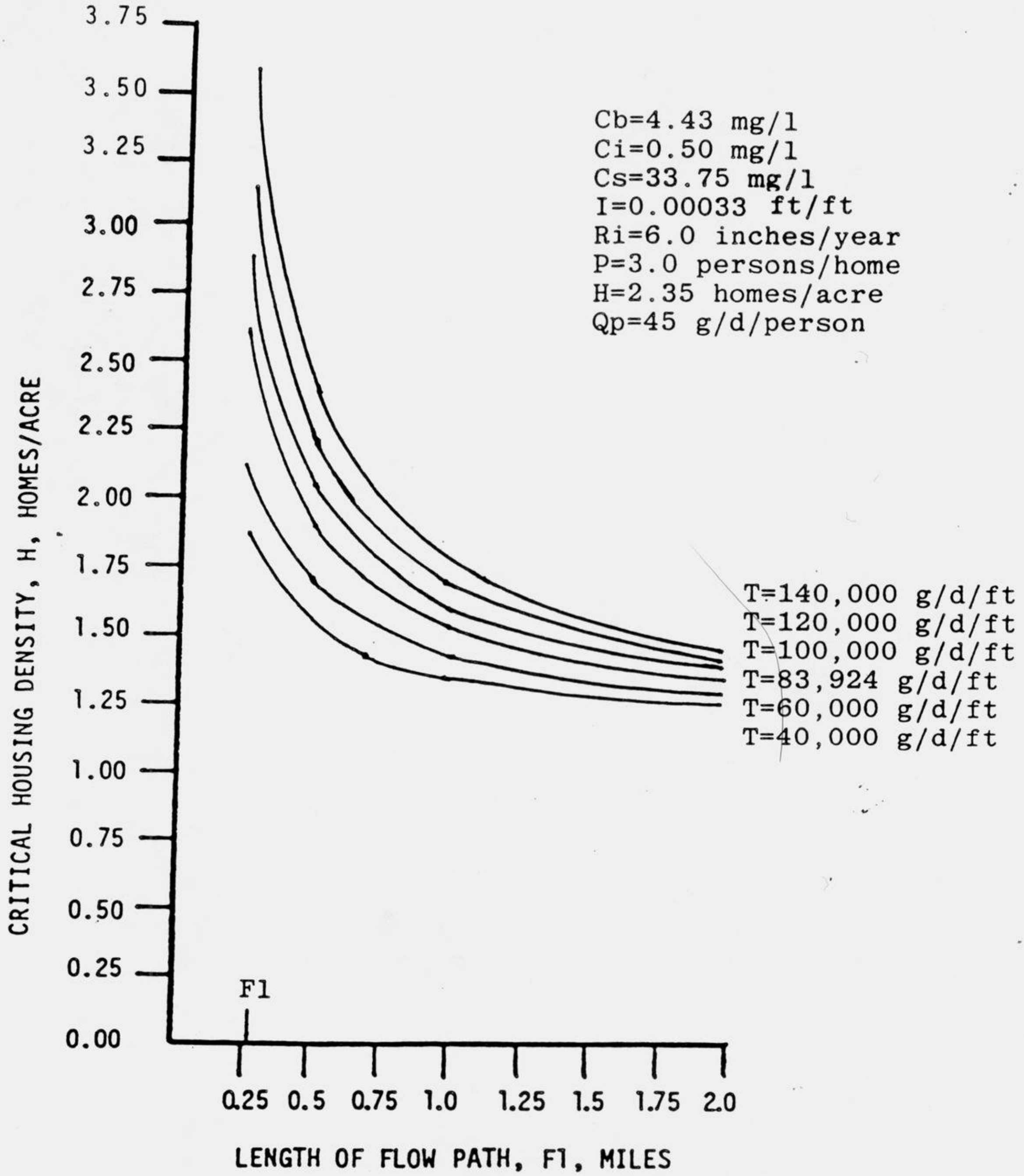


Figure 45. Critical housing density vs. length of flow path for different values of transmissivity with Cs=33.75 mg/l nitrate-nitrogen. Fl=0.27 miles for Mill Run First Edition subdivision.

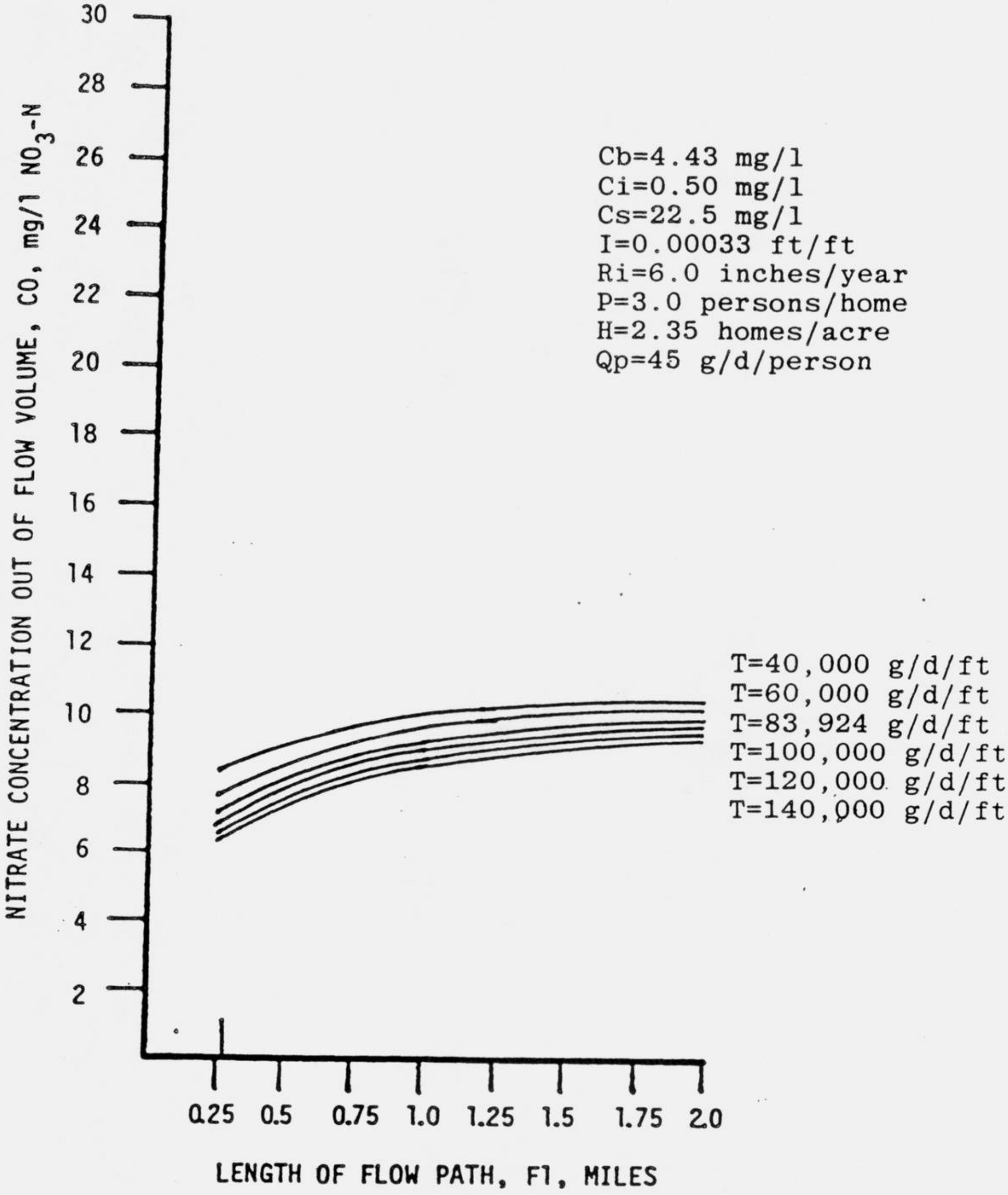


Figure 46. Nitrate concentration out of flow volume vs. length of flow path for different values of transmissivity with Cs=22.5 mg/l nitrate-nitrogen. Fl=0.27 miles for Mill Run First Edition subdivision.

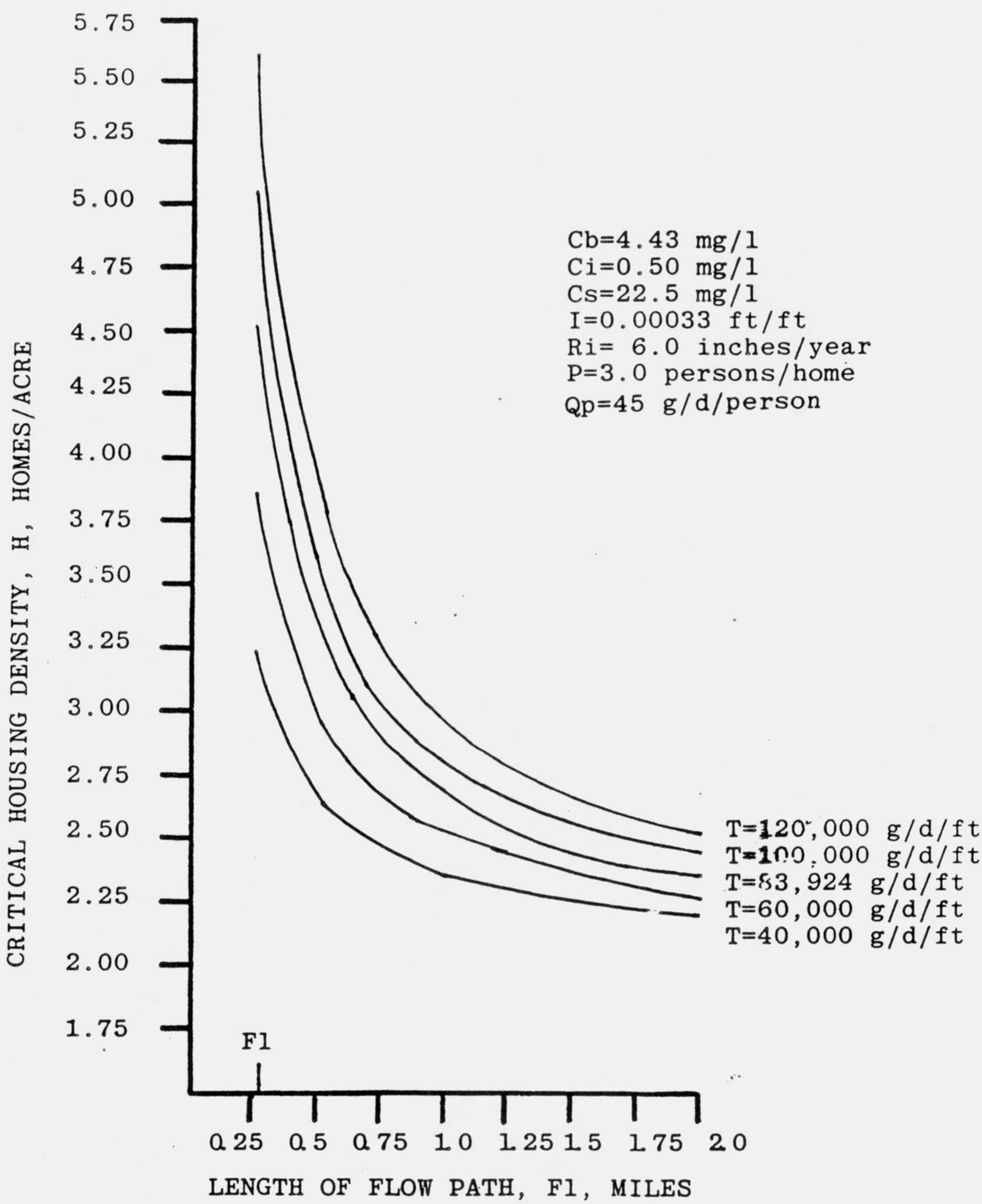


Figure 47. Critical housing density vs. length of flow path for different values of transmissivity with Cs=22.5 mg/l nitrate-nitrogen. Fl=0.27 miles for Mill Run First Edition subdivision.

Figure 48. The sites of the Schlumberger electrode array for the earth resistivity survey.

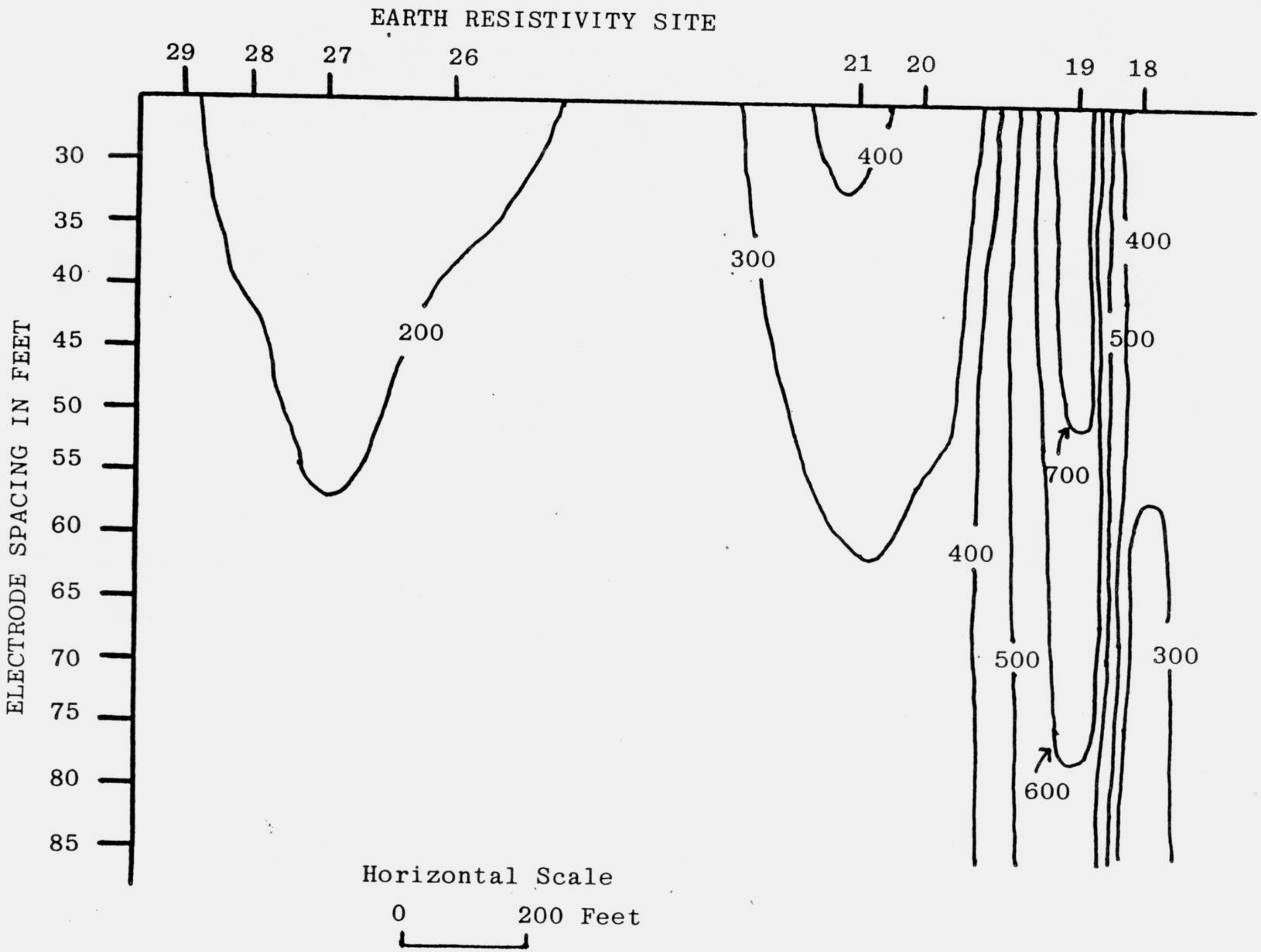


Figure 49. Longitudinal sounding for earth-resistivity sites 19, 19, 20, 21, 26, 27, 28, and 29 (See Figure 48).

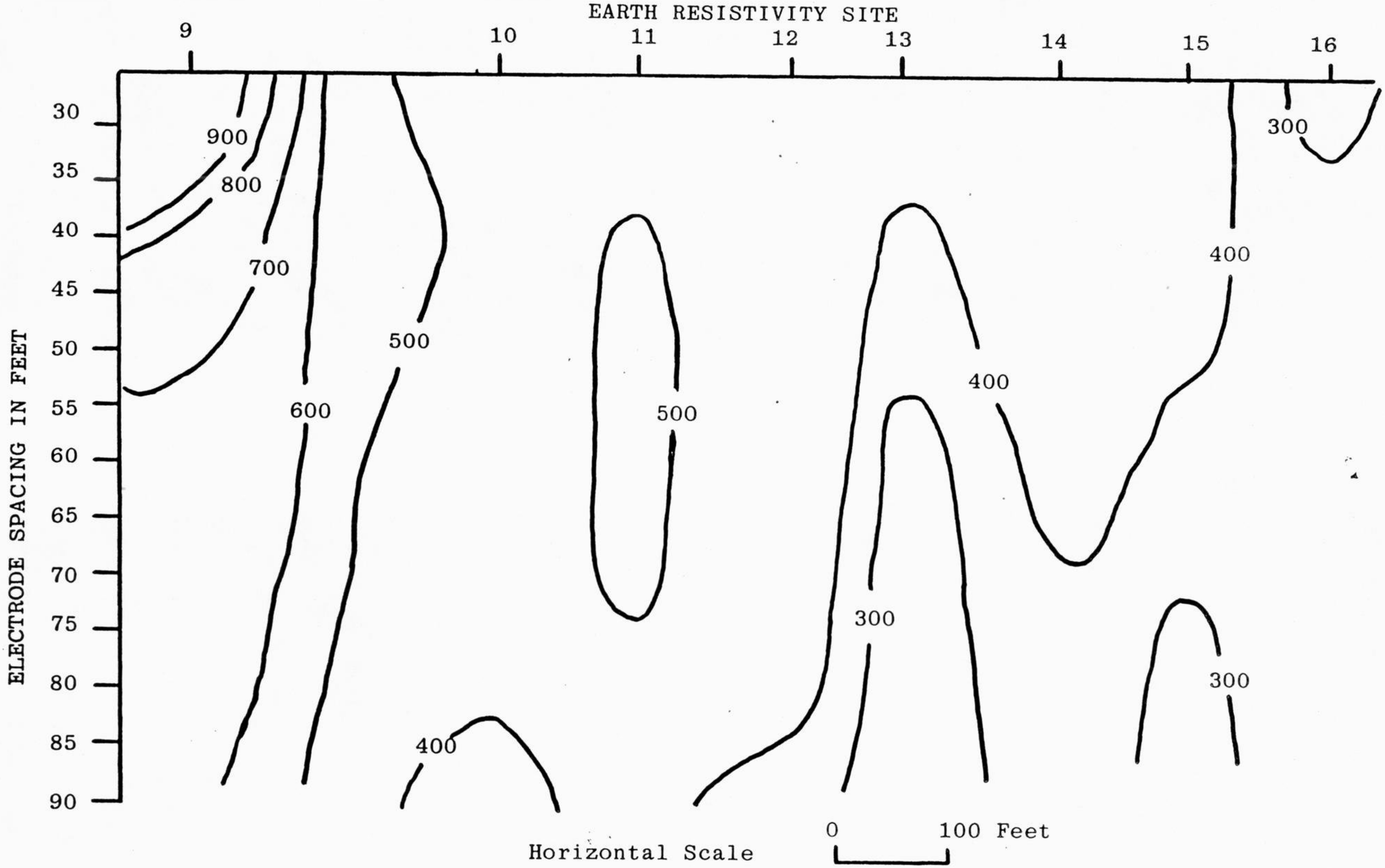


Figure 50. Longitudinal sounding for earth resistivity sites 9 to 16 (See Figure 48).

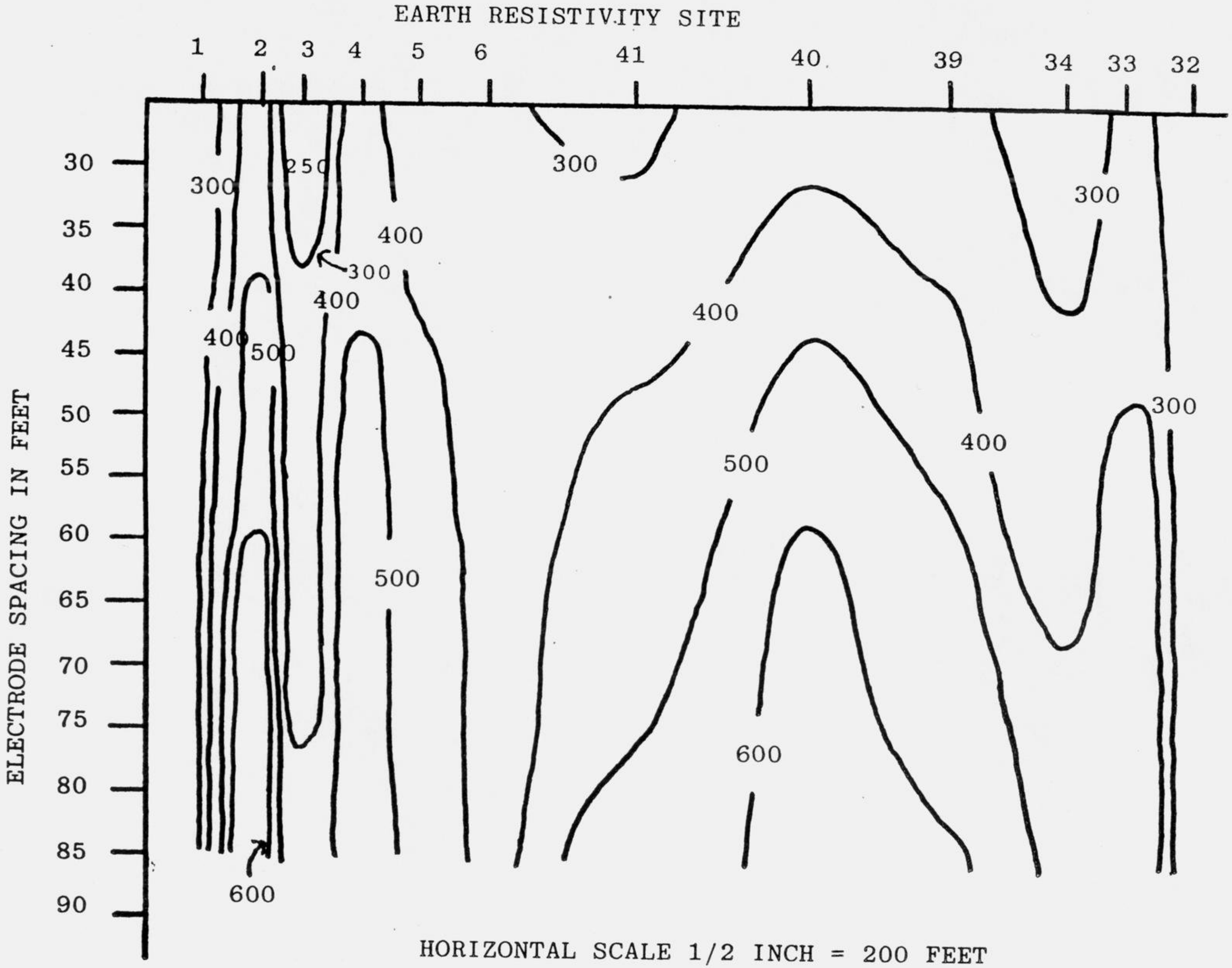


Figure 51. Longitudinal sounding for earth resistivity sites 1 to 6 and 32 to 41 (See Figure 48).

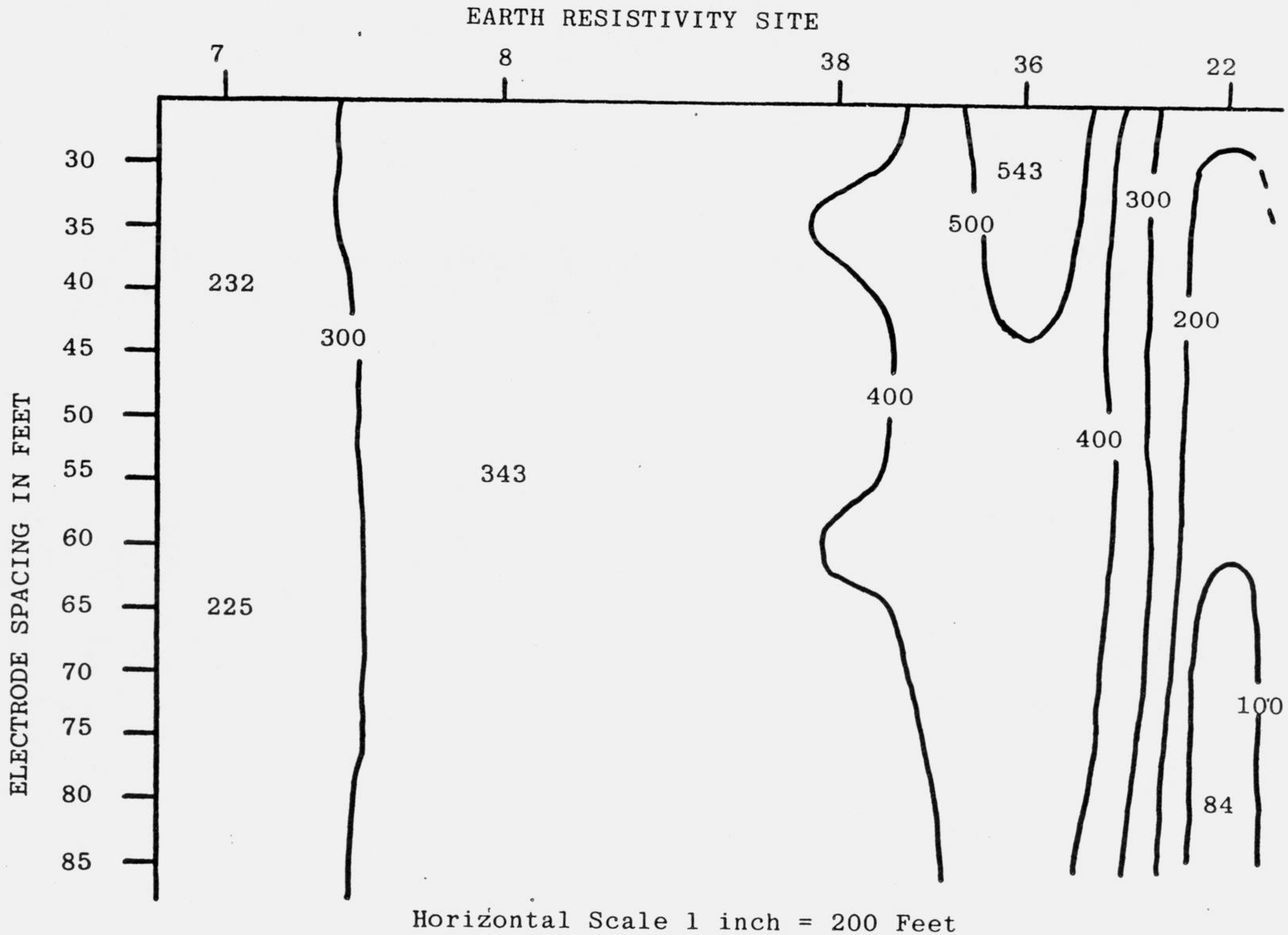
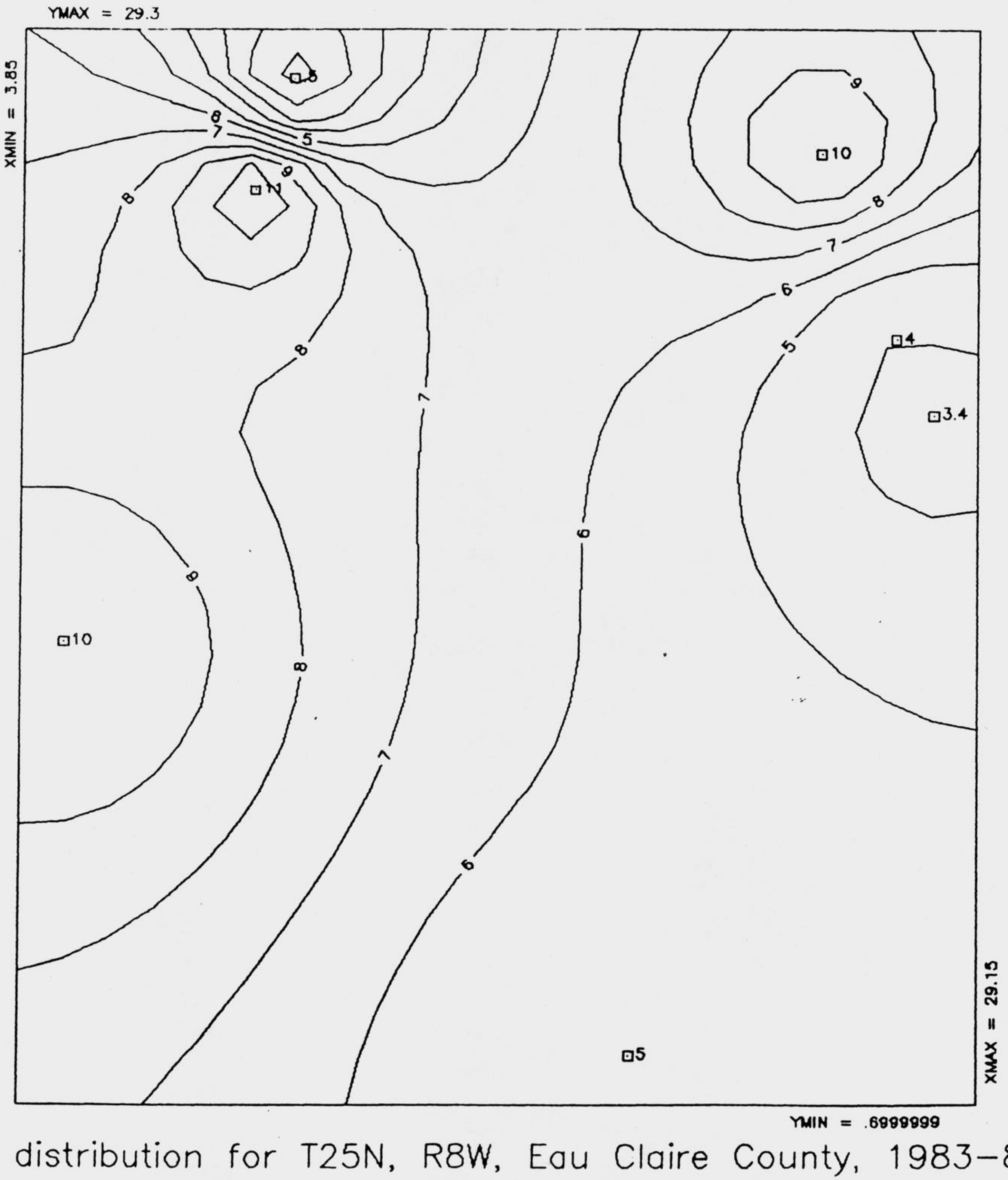


Figure 52. Longitudinal sounding for earth resistivity sites 7, 8, 38, 36, and 22. (See Figure 48).



Nitrate distribution for T25N, R8W, Eau Claire County, 1983–85.

Figure 53. An example of nitrate-nitrogen data management for T25N, R8W, Eau Claire County, WI.

APPENDIX A

Mill Run Subdivision and Adjacent Area
Nitrate-Nitrogen Data

Name and Location:
Garman Wold
Lot 1
5711 Renee Dr.
Eau Claire, WI
NW,Sec10,T27N,R10W

Well # 1
Information from Driller's Log

Depth of Well	93 feet
Aquifer	glacial
Casing Depth	89 feet
Static Water Level	59 feet
Well Diameter	5 inches
Open Interval	4 feet

Water Quality Data

Date of Sample	Nitrate-Nitrogen (mg/l)
December 7, 1985	--
January 18, 1986	--
February 15, 1986	15.0
March 22, 1986	--
April 27, 1986	--
June 2, 1986	14.5

Mean = 14.8

Standard Deviation = 0.35

Mill Run Subdivision and Adjacent Area
Nitrate-Nitrogen Data

Name and Location:
Occupant
Lot 2
5817 Renee Dr.
Eau Claire, WI
NW,Sec10,T27N,R10W

Well # 2
Information from Driller's Log

Depth of Well	79 feet
Aquifer	glacial
Casing Depth	75 feet
Static Water Level	42 feet
Well Diameter	6 inches
Open Interval	4 feet

Water Quality Data

Date of Sample	Nitrate-Nitrogen (mg/l)
December 7, 1985	--
January 18, 1986	--
February 15, 1986	--
March 22, 1986	--
April 27, 1986	--
June 2, 1986	8.7

Mean = --

Standard Deviation = --

Mill Run Subdivision and Adjacent Area
Nitrate-Nitrogen Data

Name and Location:
Occupant
Lot 3-4
4333 Town Hall Rd.
Eau Claire, WI
NW,Sec10,T27N,R10W

Well # 3-4
Information from Driller's Log

Depth of Well	80 feet
Aquifer	glacial
Casing Depth	76 feet
Static Water Level	48 feet
Well Diameter	5 inches
Open Interval	4 feet

Water Quality Data

Date of Sample	Nitrate-Nitrogen (mg/l)
December 7, 1985	--
January 18, 1986	--
February 15, 1986	--
March 22, 1986	--
April 27, 1986	--
June 2, 1986	18.7

Mean = --

Standard Deviation = --

Mill Run Subdivision and Adjacent Area
Nitrate-Nitrogen Data

Name and Location:
Ray Morris
Lot 6
4225 Town Hall Rd.
Eau Claire, WI
NW,Sec10,T27N,R10W

Well # 5
Information from Driller's Log

Depth of Well	73 feet
Aquifer	glacial
Casing Depth	70 feet
Static Water Level	44 feet
Well Diameter	5 inches
Open Interval	3 feet

Water Quality Data

Date of Sample	Nitrate-Nitrogen (mg/l)
December 7, 1985	--
January 18, 1986	--
February 15, 1986	11.3
March 22, 1986	11.1
April 27, 1986	10.6
June 2, 1986	10.6

Mean = 10.9

Standard Deviation = 0.36

Mill Run Subdivision and Adjacent Area
Nitrate-Nitrogen Data

Name and Location:
Scott & Kerri Qualley
Lot 8
4173 (same well as 4207) Town Hall Rd.
Eau Claire, WI
NW,Sec10,T27N,R10W

Well # 7
Information from Driller's Log

Depth of Well	68 feet
Aquifer	glacial
Casing Depth	64 feet
Static Water Level	42 feet
Well Diameter	5 inches
Open Interval	4 feet

Water Quality Data

Date of Sample	Nitrate-Nitrogen (mg/l)
December 7, 1985	--
January 18, 1986	--
February 15, 1986	18.0
March 22, 1986	18.0
April 27, 1986	17.6
June 2, 1986	18.3

Mean = 18.0

Standard Deviation = 0.29

Mill Run Subdivision and Adjacent Area
Nitrate-Nitrogen Data

Name and Location:
Dave Welk
Lot 10
5812 Christopher Dr.
Eau Claire, WI
NW,Sec10,T27N,R10W

Well # 10
Information from Driller's Log

Depth of Well	87 feet
Aquifer	glacial
Casing Depth	83 feet
Static Water Level	57 feet
Well Diameter	5 inches
Open Interval	4 feet

Water Quality Data

Date of Sample	Nitrate-Nitrogen (mg/l)
December 7, 1985	--
January 18, 1986	--
February 15, 1986	18.9
March 22, 1986	19.1
April 27, 1986	19.0
June 2, 1986	19.4

Mean = 19.1

Standard Deviation = 0.22

Mill Run Subdivision and Adjacent Area
Nitrate-Nitrogen Data

Name and Location:
Jim Anthony
Lot 11
5716 Christopher Dr.
Eau Claire, WI
NW,Sec10,T27N,R10W

Well # 11
Information from Driller's Log

Depth of Well	87 feet
Aquifer	glacial
Casing Depth	83 feet
Static Water Level	57 feet
Well Diameter	5 inches
Open Interval	4 feet

Water Quality Data

Date of Sample	Nitrate-Nitrogen (mg/l)
December 7, 1985	--
January 18, 1986	--
February 15, 1986	12.2
March 22, 1986	12.5
April 27, 1986	12.1
June 2, 1986	--

Mean = 12.3

Standard Deviation = 0.21

Mill Run Subdivision and Adjacent Area
Nitrate-Nitrogen Data

Name and Location:
Occupant
Lot 14
4146 Paula Pl.
Eau Claire, WI
NW,Sec10,T27N,R10W

Well # 14
Information from Driller's Log

Depth of Well	86 feet
Aquifer	glacial
Casing Depth	82 feet
Static Water Level	57 feet
Well Diameter	5 inches
Open Interval	4 feet

Water Quality Data

Date of Sample	Nitrate-Nitrogen (mg/l)
December 7, 1985	--
January 18, 1986	--
February 15, 1986	13.1
March 22, 1986	13.1
April 27, 1986	13.0
June 2, 1986	13.2

Mean = 13.1

Standard Deviation = 0.08

Mill Run Subdivision and Adjacent Area
Nitrate-Nitrogen Data

Name and Location:
Occupant
Lot 16
4216 Paula Pl.
Eau Claire, WI
NW,Sec10,T27N,R10W

Well # 16
Information from Driller's Log

Depth of Well	89 feet
Aquifer	glacial
Casing Depth	85 feet
Static Water Level	60 feet
Well Diameter	5 inches
Open Interval	4 feet

Water Quality Data

Date of Sample	Nitrate-Nitrogen (mg/l)
December 7, 1985	--
January 18, 1986	--
February 15, 1986	19.2
March 22, 1986	18.9
April 27, 1986	18.6
June 2, 1986	18.2

Mean = 18.7

Standard Deviation = 0.43

Mill Run Subdivision and Adjacent Area
Nitrate-Nitrogen Data

Name and Location:
Occupant
Lot 18
5647 Renee Dr.
Eau Claire, WI
NW,Sec10,T27N,R10W

Well # 18
Information from Driller's Log

Depth of Well	90 feet
Aquifer	glacial
Casing Depth	86 feet
Static Water Level	59 feet
Well Diameter	5 inches
Open Interval	4 feet

Water Quality Data

Date of Sample	Nitrate-Nitrogen (mg/l)
December 7, 1985	--
January 18, 1986	--
February 15, 1986	14.8
March 22, 1986	14.9
April 27, 1986	14.7
June 2, 1986	14.5

Mean = 14.8

Standard Deviation = 0.17

Mill Run Subdivision and Adjacent Area
Nitrate-Nitrogen Data

Name and Location:
Occupant
Lot 21
4205 Paula Pl.
Eau Claire, WI
NW,Sec10,T27N,R10W

Well # 21
Information from Driller's Log

Depth of Well	--
Aquifer	--
Casing Depth	--
Static Water Level	--
Well Diameter	--
Open Interval	--

Water Quality Data

Date of Sample	Nitrate-Nitrogen (mg/l)
December 7, 1985	--
January 18, 1986	--
February 15, 1986	20.0
March 22, 1986	19.6
April 27, 1986	19.8
June 2, 1986	20.1

Mean = 19.9

Standard Deviation = 0.22

Mill Run Subdivision and Adjacent Area
Nitrate-Nitrogen Data

Name and Location:
Occupant
4117 Paula Pl.
Eau Claire, WI
NW,Sec10,T27N,R10W

Well # 23-24
Information from Driller's Log

Depth of Well	--
Aquifer	--
Casing Depth	--
Static Water Level	--
Well Diameter	--
Open Interval	--

Water Quality Data

Date of Sample	Nitrate-Nitrogen (mg/l)
December 7, 1985	--
January 18, 1986	--
February 15, 1986	--
March 22, 1986	--
April 27, 1986	--
June 2, 1986	15.2

Mean = --

Standard Deviation = --

Mill Run Subdivision and Adjacent Area
Nitrate-Nitrogen Data

Name and Location:
Mrs. Goss
Lot 26
4013 Paula Pl.
Eau Claire, WI
NW,Sec10,T27N,R10W

Well # 25
Information from Driller's Log

Depth of Well	--
Aquifer	--
Casing Depth	--
Static Water Level	--
Well Diameter	--
Open Interval	--

Water Quality Data

Date of Sample	Nitrate-Nitrogen (mg/l)
December 7, 1985	--
January 18, 1986	--
February 15, 1986	14.3
March 22, 1986	--
April 27, 1986	--
June 2, 1986	14.3

Mean = 14.3

Standard Deviation = 0

Mill Run Subdivision and Adjacent Area
Nitrate-Nitrogen Data

Name and Location:
David Pagenkopf
Lot 65
5544 Christopher Drive
Eau Claire, WI
NW,Sec10,T27N,R10W

Well # 27
Information from Driller's Log

Depth of Well	--
Aquifer	--
Casing Depth	--
Static Water Level	--
Well Diameter	--
Open Interval	--

Water Quality Data

Date of Sample	Nitrate-Nitrogen (mg/l)
December 7, 1985	13.0
January 18, 1986	13.0
February 15, 1986	--
March 22, 1986	12.9 (13.1 - Duplicate)
April 27, 1986	13.0
June 2, 1986	13.0

Mean = 13.0

Standard Deviation = 0.04

Mill Run Subdivision and Adjacent Area
Nitrate-Nitrogen Data

Name and Location:
Occupant
Lot 28
5613 Christopher Dr.
Eau Claire, WI
NW,Sec10,T27N,R10W

Well # 28
Information from Driller's Log

Depth of Well	--
Aquifer	--
Casing Depth	--
Static Water Level	--
Well Diameter	--
Open Interval	--

Water Quality Data

Date of Sample	Nitrate-Nitrogen (mg/l)
December 7, 1985	--
January 18, 1986	--
February 15, 1986	10.3
March 22, 1986	10.6
April 27, 1986	9.9
June 2, 1986	9.8

Mean = 10.2

Standard Deviation = 0.37

Mill Run Subdivision and Adjacent Area
Nitrate-Nitrogen Data

Name and Location:
Becky Manske
Lot 29
3921 Paula Ct.
Eau Claire, WI
NW,Sec10,T27N,R10W

Well # 29
Information from Driller's Log

Depth of Well	--
Aquifer	--
Casing Depth	--
Static Water Level	--
Well Diameter	--
Open Interval	--

Water Quality Data

Date of Sample	Nitrate-Nitrogen (mg/l)
December 7, 1985	--
January 18, 1986	--
February 15, 1986	15.6
March 22, 1986	16.2
April 27, 1986	--
June 2, 1986	--

Mean = 15.9

Standard Deviation = 0.42

Mill Run Subdivision and Adjacent Area
Nitrate-Nitrogen Data

Name and Location:
Mrs. Stovern
Lot 31
3813 Paula Ct.
Eau Claire, WI
NW,Sec10,T27N,R10W

Well # 31
Information from Driller's Log

Depth of Well	--
Aquifer	--
Casing Depth	--
Static Water Level	--
Well Diameter	--
Open Interval	--

Water Quality Data

Date of Sample	Nitrate-Nitrogen (mg/l)
December 7, 1985	--
January 18, 1986	--
February 15, 1986	12.3
March 22, 1986	13.3
April 27, 1986	13.6
June 2, 1986	14.1

Mean = 13.3

Standard Deviation = 0.76

Mill Run Subdivision and Adjacent Area
Nitrate-Nitrogen Data

Name and Location:
Occupant
Lot 36
5709 Christopher Dr.
Eau Claire, WI
NW,Sec10,T27N,R10W

Well # 35
Information from Driller's Log

Depth of Well	--
Aquifer	--
Casing Depth	--
Static Water Level	--
Well Diameter	--
Open Interval	--

Water Quality Data

Date of Sample	Nitrate-Nitrogen (mg/l)
December 7, 1985	--
January 18, 1986	--
February 15, 1986	--
March 22, 1986	--
April 27, 1986	--
June 2, 1986	10.8

Mean = --

Standard Deviation = --

Mill Run Subdivision and Adjacent Area
Nitrate-Nitrogen Data

Name and Location:
Occupant
Lot 41
5514 Normandale Dr.
Eau Claire, WI
NW,Sec.10,R27N,R10W

Well # 41
Information from Driller's Log

Depth of Well	--
Aquifer	--
Casing Depth	--
Static Water Level	--
Well Diameter	--
Open Interval	--

Water Quality Data

Date of Sample	Nitrate-Nitrogen (mg/l)
December 7, 1985	--
January 18, 1986	--
February 15, 1986	--
March 22, 1986	--
April 27, 1986	--
June 2, 1986	1.7

Mean = --

Standard Deviation = --

Mill Run Subdivision and Adjacent Area
Nitrate-Nitrogen Data

Name and Location:
Mike Maslanka
Lot 43
5540 Normandale Dr.
Eau Claire, WI
NW,Sec10,T27N,R10W

Well # 43
Information from Driller's Log

Depth of Well	88 feet
Aquifer	glacial
Casing Depth	85 feet
Static Water Level	55 feet
Well Diameter	6 inches
Open Interval	3 feet

Water Quality Data

Date of Sample	Nitrate-Nitrogen (mg/l)
December 7, 1985	6.7
January 18, 1986	6.5
February 15, 1986	--
March 22, 1986	6.7
April 27, 1986	6.8
June 2, 1986	--

Mean = 6.7

Standard Deviation = 0.13

Mill Run Subdivision and Adjacent Area
Nitrate-Nitrogen Data

Name and Location:
Occupant
Lot 45
5535 Christopher Dr.
Eau Claire, WI
NW,Sec10,T27N,R10W

Well # 45
Information from Driller's Log

Depth of Well	--
Aquifer	--
Casing Depth	--
Static Water Level	--
Well Diameter	--
Open Interval	--

Water Quality Data

Date of Sample	Nitrate-Nitrogen (mg/l)
December 7, 1985	--
January 18, 1986	--
February 15, 1986	--
March 22, 1986	--
April 27, 1986	--
June 2, 1986	11.3

Mean = --

Standard Deviation = --

Mill Run Subdivision and Adjacent Area
Nitrate-Nitrogen Data

Name and Location:
Occupant
Lot 47
5443 Christopher Dr.
Eau Claire, WI
NW,Sec10,T27N,R10W

Well # 47
Information from Driller's Log

Depth of Well	--
Aquifer	--
Casing Depth	--
Static Water Level	--
Well Diameter	--
Open Interval	--

Water Quality Data

Date of Sample	Nitrate-Nitrogen (mg/l)
December 7, 1985	--
January 18, 1986	--
February 15, 1986	16.9
March 22, 1986	16.7
April 27, 1986	16.9
June 2, 1986	16.7

Mean = 16.8

Standard Deviation = 0.12

Mill Run Subdivision and Adjacent Area
Nitrate-Nitrogen Data

Name and Location:
Occupant
Lot 50
5412 Christopher Dr.
Eau Claire, WI
NW,Sec10,T27N,R10W

Well # 50
Information from Driller's Log

Depth of Well	120 feet
Aquifer	sandstone
Casing Depth	73 feet
Static Water Level	34 feet
Well Diameter	6 inches
Open Interval	47 feet

Water Quality Data

Date of Sample	Nitrate-Nitrogen (mg/l)
December 7, 1985	--
January 18, 1986	--
February 15, 1986	--
March 22, 1986	--
April 27, 1986	--
June 2, 1986	2.2

Mean = --

Standard Deviation = --

Mill Run Subdivision and Adjacent Area
Nitrate-Nitrogen Data

Name and Location:
Occupant
Lot 53
5432 Christopher Dr.
Eau Claire, WI
NW,Sec10,T27N,R10W

Well # 53
Information from Driller's Log

Depth of Well	78 feet
Aquifer	glacial
Casing Depth	74 feet
Static Water Level	29 feet
Well Diameter	6 inches
Open Interval	4 feet

Water Quality Data

Date of Sample	Nitrate-Nitrogen (mg/l)
December 7, 1985	--
January 18, 1986	--
February 15, 1986	13.9
March 22, 1986	--
April 27, 1986	--
June 2, 1986	16.1

Mean = 15.0

Standard Deviation = 1.56

Mill Run Subdivision and Adjacent Area
Nitrate-Nitrogen Data

Name and Location:
Occupant
Lot 54
4121 Mary Pl.
Eau Claire, WI
NW,Sec10,T27N,R10W

Well # 54
Information from Driller's Log

Depth of Well	--
Aquifer	--
Casing Depth	--
Static Water Level	--
Well Diameter	--
Open Interval	--

Water Quality Data

Date of Sample	Nitrate-Nitrogen (mg/l)
December 7, 1985	--
January 18, 1986	--
February 15, 1986	--
March 22, 1986	--
April 27, 1986	--
June 2, 1986	13.1

Mean = --

Standard Deviation = --

Mill Run Subdivision and Adjacent Area
Nitrate-Nitrogen Data

Name and Location:
Occupant
Lot 56
4147-49 Mary Pl.
Eau Claire, WI
NW,Sec10,T27N,R10W

Well # 58
Information from Driller's Log

Depth of Well	--
Aquifer	--
Casing Depth	--
Static Water Level	--
Well Diameter	--
Open Interval	--

Water Quality Data

Date of Sample	Nitrate-Nitrogen (mg/l)
December 7, 1985	--
January 18, 1986	--
February 15, 1986	15.2
March 22, 1986	15.3
April 27, 1986	--
June 2, 1986	13.8

Mean = 14.8

Standard Deviation = 0.84

Mill Run Subdivision and Adjacent Area
Nitrate-Nitrogen Data

Name and Location:
Occupant
Lot 60
4154 Mary Pl.
Eau Claire, WI
NW,Sec10,T27N,R10W

Well # 59
Information from Driller's Log

Depth of Well	73 feet
Aquifer	glacial
Casing Depth	69 feet
Static Water Level	37 feet
Well Diameter	6 inches
Open Interval	4 feet

Water Quality Data

Date of Sample	Nitrate-Nitrogen (mg/l)
December 7, 1985	--
January 18, 1986	--
February 15, 1986	14.5
March 22, 1986	14.7
April 27, 1986	14.3
June 2, 1986	14.3

Mean = 14.5

Standard Deviation = 0.19

Mill Run Subdivision and Adjacent Area
Nitrate-Nitrogen Data

Name and Location:
Occupant
Lot 63
4126 Mary Place
Eau Claire, WI
NW,Sec10,T27N,R10W

Well # 63
Information from Driller's Log

Depth of Well	74 feet
Aquifer	glacial
Casing Depth	70 feet
Static Water Level	37 feet
Well Diameter	6 inches
Open Interval	4 feet

Water Quality Data

Date of Sample	Nitrate-Nitrogen (mg/l)
December 7, 1985	--
January 18, 1986	--
February 15, 1986	11.1
March 22, 1986	11.7
April 27, 1986	11.4
June 2, 1986	11.3

Mean = 11.4

Standard Deviation = 0.25

Mill Run Subdivision and Adjacent Area
Nitrate-Nitrogen Data

Name and Location:
Occupant
Lot 66
5588 Normandale Dr.
Eau Claire, WI
NW,Sec10,T27N,R10W

Well # 66
Information from Driller's Log

Depth of Well	82 feet
Aquifer	glacial
Casing Depth	78 feet
Static Water Level	47 feet
Well Diameter	6 inches
Open Interval	4 feet

Water Quality Data

Date of Sample	Nitrate-Nitrogen (mg/l)
December 7, 1985	--
January 18, 1986	--
February 15, 1986	--
March 22, 1986	--
April 27, 1986	--
June 2, 1986	9.5

Mean = --

Standard Deviation = --

Mill Run Subdivision and Adjacent Area
Nitrate-Nitrogen Data

Name and Location:
Occupant
Lot 67
5574 Normandale Dr.
Eau Claire, WI
NW,Sec10,T27N,R10W

Well # 68
Information from Driller's Log

Depth of Well	120 feet
Aquifer	sandstone
Casing Depth	86 feet
Static Water Level	52 feet
Well Diameter	6 inches
Open Interval	34 feet

Water Quality Data

Date of Sample	Nitrate-Nitrogen (mg/l)
December 7, 1985	--
January 18, 1986	--
February 15, 1986	--
March 22, 1986	--
April 27, 1986	--
June 2, 1986	14.2

Mean = --

Standard Deviation = --

Mill Run Subdivision and Adjacent Area
Nitrate-Nitrogen Data

Name and Location:
Billie Webb
Lot 70
5537 Normandale Drive
Eau Claire, WI
NW,Sec10,T27N,R10W

Well # 70
Information from Driller's Log

Depth of Well	146 feet
Aquifer	sandstone
Casing Depth	137 feet
Static Water Level	58 feet
Well Diameter	6 inches
Open Interval	9 feet

Water Quality Data

Date of Sample	Nitrate-Nitrogen (mg/l)
December 7, 1985	10.6
January 18, 1986	9.9
February 15, 1986	--
March 22, 1986	--
April 27, 1986	--
June 2, 1986	--

Mean = 10.3

Standard Deviation = 0.49

Mill Run Subdivision and Adjacent Area
Nitrate-Nitrogen Data

Name and Location:
Gladys Prochaska
Lot 71
5523 Normandale Drive
Eau Claire, WI
NW,Sec10,T27N,R10W

Well # 71
Information from Driller's Log

Depth of Well	174 feet
Aquifer	sandstone
Casing Depth	167 feet
Static Water Level	54 feet
Well Diameter	6 inches
Open Interval	7 feet

Water Quality Data

Date of Sample	Nitrate-Nitrogen (mg/l)
December 7, 1985	2.5
January 18, 1986	1.8
February 15, 1986	--
March 22, 1986	1.8
April 27, 1986	--
June 2, 1986	--

Mean = 2.0

Standard Deviation = 0.40

Mill Run Subdivision and Adjacent Area
Nitrate-Nitrogen Data

Name and Location:
Mike Goodness
Lot 73
5505 Normandale Dr.
Eau Claire, WI
NW,Sec10,T27N,R10W

Well # 73
Information from Driller's Log

Depth of Well	87 feet
Aquifer	glacial
Casing Depth	84 feet
Static Water Level	40 feet
Well Diameter	6 inches
Open Interval	3 feet

Water Quality Data

Date of Sample	Nitrate-Nitrogen (mg/l)
December 7, 1985	3.0
January 18, 1986	--
February 15, 1986	--
March 22, 1986	--
April 27, 1986	--
June 2, 1986	--

Mean = --

Standard Deviation = --

Mill Run Subdivision and Adjacent Area
Nitrate-Nitrogen Data

Name and Location:
David Goldbach
Lot 76
5540 Cyndi Ct.
Eau Claire, WI
NW,SW,Sec10,T27N,R10W

Well # 76
Information from Driller's Log

Depth of Well	--
Aquifer	--
Casing Depth	--
Static Water Level	--
Well Diameter	--
Open Interval	--

Water Quality Data

Date of Sample	Nitrate-Nitrogen (mg/l)
December 7, 1985	4.0
January 18, 1986	3.9
February 15, 1986	--
March 22, 1986	3.9
April 27, 1986	--
June 2, 1986	--

Mean = 4.0

Standard Deviation = 0.07

Mill Run Subdivision and Adjacent Area
Nitrate-Nitrogen Data

Name and Location:
Jeff Smith
Lot 83
3624 Flynn Pl.
Eau Claire, WI
NW,SW,Sec10,T27N,R10W

Well # 83
Information from Driller's Log

Depth of Well	95 feet
Aquifer	sandstone
Casing Depth	55 feet
Static Water Level	40 feet
Well Diameter	6 inches
Open Interval	40 feet

Water Quality Data

Date of Sample	Nitrate-Nitrogen (mg/l)
December 7, 1985	4.0
January 18, 1986	--
February 15, 1986	--
March 22, 1986	--
April 27, 1986	--
June 2, 1986	--

Mean = --

Standard Deviation = --

Mill Run Subdivision and Adjacent Area
Nitrate-Nitrogen Data

Name and Location:
Dennis Bauer
Lot 85
3604 Flynn Pl
Eau Claire, WI
NW,SW,Sec10,T27N,R10W

Well # 85
Information from Driller's Log

Depth of Well	87 feet
Aquifer	sandstone
Casing Depth	60 feet
Static Water Level	35 feet
Well Diameter	6 inches
Open Interval	27 feet

Water Quality Data

Date of Sample	Nitrate-Nitrogen (mg/l)
December 7, 1985	2.9
January 18, 1986	2.9
February 15, 1986	--
March 22, 1986	3.0
April 27, 1986	2.9
June 2, 1986	2.9

Mean = 2.9

Standard Deviation = 0.04

Mill Run Subdivision and Adjacent Area
Nitrate-Nitrogen Data

Name and Location:
Gordon Smith
Lot 88
3911 Flynn Pl.
Eau Claire, WI
SW,NW,Sec10,T27N,R10W

Well # 88
Information from Driller's Log

Depth of Well	--
Aquifer	--
Casing Depth	--
Static Water Level	--
Well Diameter	--
Open Interval	--

Water Quality Data

Date of Sample	Nitrate-Nitrogen (mg/l)
December 7, 1985	--
January 18, 1986	4.2
February 15, 1986	4.1
March 22, 1986	4.2
April 27, 1986	4.1
June 2, 1986	4.0

Mean = 4.1

Standard Deviation = 0.08

Mill Run Subdivision and Adjacent Area
Nitrate-Nitrogen Data

Name and Location:
Occupant
5332-34 Christopher Dr.
Eau Claire, WI
SE,NW,Sec10,T27N,R10W

Well # 90
Information from Driller's Log

Depth of Well	--
Aquifer	--
Casing Depth	--
Static Water Level	--
Well Diameter	--
Open Interval	--

Water Quality Data

Date of Sample	Nitrate-Nitrogen (mg/l)
December 7, 1985	--
January 18, 1986	--
February 15, 1986	7.6
March 22, 1986	7.9
April 27, 1986	7.6
June 2, 1986	7.3

Mean = 7.6

Standard Deviation = 0.24

Mill Run Subdivision and Adjacent Area
Nitrate-Nitrogen Data

Name and Location:
Laben Miller
Lot 10
Rt. #5
W. Folsum St. - Guthrie Heights
Eau Claire, WI
SE,SW,Sec10,T27N,R10W

Well # --
Information from Driller's Log

Depth of Well	--
Aquifer	--
Casing Depth	--
Static Water Level	--
Well Diameter	--
Open Interval	--

Water Quality Data

Date of Sample	Nitrate-Nitrogen (mg/l)
December 7, 1985	3.1
January 18, 1986	2.2
February 15, 1986	--
March 22, 1986	--
April 27, 1986	--
June 2, 1986	--

Mean = 2.7

Standard Deviation = 0.64

Mill Run Subdivision and Adjacent Area
Nitrate-Nitrogen Data

Name and Location:
Carl Piecuch
5316 W. Folsum St.
Eau Claire, WI
SE,SW,Sec10,T27N,R10W

Well # --
Information from Driller's Log

Depth of Well	--
Aquifer	--
Casing Depth	--
Static Water Level	--
Well Diameter	--
Open Interval	--

Water Quality Data

Date of Sample	Nitrate-Nitrogen (mg/l)
December 7, 1985	4.8
January 18, 1986	4.9
February 15, 1986	--
March 22, 1986	--
April 27, 1986	--
June 2, 1986	--

Mean = 4.9

Standard Deviation = 0.07

Mill Run Subdivision and Adjacent Area
Nitrate-Nitrogen Data

Name and Location:
Gerald Smith
Rt. #2, Box 55
N. Town Hall Rd.
Eau Claire, WI
SW,SW,Sec3,T27N,R10W

Well # --
Information from Driller's Log

Depth of Well	--
Aquifer	--
Casing Depth	--
Static Water Level	--
Well Diameter	--
Open Interval	--

Water Quality Data

Date of Sample	Nitrate-Nitrogen (mg/l)
December 7, 1985	16.3
January 18, 1986	15.8
February 15, 1986	--
March 22, 1986	--
April 27, 1986	14.6
June 2, 1986	14.1

Mean = 15.2

Standard Deviation = 1.02

Mill Run Subdivision and Adjacent Area
Nitrate-Nitrogen Data

Name and Location:
Lyla & Loin Pederson
Rt. #2, Box 55B
Eau Claire, WI 54701
SE,Sec4,T27N,R10W

Well # --
Information from Driller's Log

Depth of Well	--
Aquifer	--
Casing Depth	--
Static Water Level	--
Well Diameter	--
Open Interval	--

Water Quality Data

Date of Sample	Nitrate-Nitrogen (mg/l)
December 7, 1985	--
January 18, 1986	--
February 15, 1986	--
March 22, 1986	--
April 27, 1986	--
June 2, 1986	12.7

Mean = --

Standard Deviation = --

Mill Run Subdivision and Adjacent Area
Nitrate-Nitrogen Data

Name and Location:
Virginia Nowak
Rt. #2, Box 55A
Eau Claire, WI 54703
SW,Sec3,T27N,R10W

Well # --
Information from Driller's Log

Depth of Well	--
Aquifer	--
Casing Depth	--
Static Water Level	--
Well Diameter	--
Open Interval	--

Water Quality Data

Date of Sample	Nitrate-Nitrogen (mg/l)
December 7, 1985	--
January 18, 1986	--
February 15, 1986	--
March 22, 1986	--
April 27, 1986	--
June 2, 1986	12.6

Mean = --

Standard Deviation = --

Mill Run Subdivision and Adjacent Area
Nitrate-Nitrogen Data

Name and Location:
Earl Brownell
4404 N Town Hall Rd.
Eau Claire, WI
NE,NE,Sec9,T27N,R10W

Well # --
Information from Driller's Log

Depth of Well	94 feet
Aquifer	glacial
Casing Depth	91 feet
Static Water Level	45 feet
Well Diameter	5 inches
Open Interval	3 feet

Water Quality Data

Date of Sample	Nitrate-Nitrogen (mg/l)
December 7, 1985	9.2
January 18, 1986	8.7
February 15, 1986	--
March 22, 1986	8.8
April 27, 1986	8.7
June 2, 1986	8.6

Mean = 8.8

Standard Deviation = 0.23

Mill Run Subdivision and Adjacent Area
Nitrate-Nitrogen Data

Name and Location:
Earl Brownell (farmhouse)
Rt. #2, Truax Blvd.
Eau Claire, WI 54703
NW,Sec9,T27N,R10W

Well # --
Information from Driller's Log

Depth of Well	--
Aquifer	--
Casing Depth	--
Static Water Level	--
Well Diameter	--
Open Interval	--

Water Quality Data

Date of Sample	Nitrate-Nitrogen (mg/l)
December 7, 1985	--
January 18, 1986	--
February 15, 1986	--
March 22, 1986	--
April 27, 1986	--
June 2, 1986	10.8

Mean = --

Standard Deviation = --

Mill Run Subdivision and Adjacent Area
Nitrate-Nitrogen Data

Name and Location:
Mary Welch
3555 Town Line
Eau Claire, WI
NW,SW,Sec10,T27N,R10W

Well # --
Information from Driller's Log

Depth of Well	--
Aquifer	--
Casing Depth	--
Static Water Level	--
Well Diameter	--
Open Interval	--

Water Quality Data

Date of Sample	Nitrate-Nitrogen (mg/l)
December 7, 1985	12.0
January 18, 1986	12.1 - treated 8.5
February 15, 1986	--
March 22, 1986	--
April 27, 1986	--
June 2, 1986	11.5

Mean = 11.9

Standard Deviation = 0.32

Mill Run Subdivision and Adjacent Area
Nitrate-Nitrogen Data

Name and Location:
Joan Geissler
3579 Town Hall Rd.
Eau Claire, WI
NW,SW,Sec10,T27N,R10W

Well # --
Information from Driller's Log

Depth of Well	--
Aquifer	--
Casing Depth	--
Static Water Level	--
Well Diameter	--
Open Interval	--

Water Quality Data

Date of Sample	Nitrate-Nitrogen (mg/l)	
December 7, 1985	10.0	
January 18, 1986	10.1	
February 15, 1986	--	
March 22, 1986	10.6	- treated 10.8
April 27, 1986	10.2	
June 2, 1986	10.2	

Mean = 10.2

Standard Deviation = 0.23

Mill Run Subdivision and Adjacent Area
Nitrate-Nitrogen Data

Name and Location:
Gas Good Grocery
Truax Blvd.
Eau Claire, WI
SW,SE,Sec4,T27N,R10W

Well # --
Information from Driller's Log

Depth of Well	--
Aquifer	--
Casing Depth	--
Static Water Level	--
Well Diameter	--
Open Interval	--

Water Quality Data

Date of Sample	Nitrate-Nitrogen (mg/l)
December 7, 1985	12.6
January 18, 1986	12.4
February 15, 1986	--
March 22, 1986	--
April 27, 1986	--
June 2, 1986	11.5

Mean = 12.2

Standard Deviation = 0.59

Mill Run Subdivision and Adjacent Area
Nitrate-Nitrogen Data

Name and Location:
Donald Bushendorf
Rt. #2, Box 56
N. Town Hall Rd.
Eau Claire, WI
SE,SE,Sec4,T27N,R10W

Well # --
Information from Driller's Log

Depth of Well	70 feet
Aquifer	glacial
Casing Depth	67 feet
Static Water Level	28 feet
Well Diameter	5 inches
Open Interval	3 feet

Water Quality Data

Date of Sample	Nitrate-Nitrogen (mg/l)
December 7, 1985	8.0
January 18, 1986	7.6
February 15, 1986	--
March 22, 1986	--
April 27, 1986	7.1
June 2, 1986	6.9

Mean = 7.4

Standard Deviation = 0.5

Mill Run Subdivision and Adjacent Area
Nitrate-Nitrogen Data

Name and Location:
Loren Lee
4310 Truax Blvd.
Eau Claire, WI
SE,SE,Sec3,T27N,R10W

Well # --
Information from Driller's Log

Depth of Well	129 feet
Aquifer	sandstone
Casing Depth	122 feet
Static Water Level	27 feet
Well Diameter	4 inches
Open Interval	7 feet

Water Quality Data

Date of Sample	Nitrate-Nitrogen (mg/l)
December 7, 1985	<0.5
January 18, 1986	<0.5
February 15, 1986	--
March 22, 1986	0.1
April 27, 1986	--
June 2, 1986	<0.5

Mean = <0.5

Standard Deviation = --

Mill Run Subdivision and Adjacent Area
Nitrate-Nitrogen Data

Name and Location:
Menards Lumber
Truax Blvd.
Eau Claire, WI
SW,Sec3,T27N,R10W

Well # --
Information from Driller's Log

Depth of Well	--
Aquifer	--
Casing Depth	--
Static Water Level	--
Well Diameter	--
Open Interval	--

Water Quality Data

Date of Sample	Nitrate-Nitrogen (mg/l)
December 7, 1985	--
January 18, 1986	--
February 15, 1986	--
March 22, 1986	4.5
April 27, 1986	4.4
June 2, 1986	4.1

Mean = 4.3

Standard Deviation = 0.21

Mill Run Subdivision and Adjacent Area
Nitrate-Nitrogen Data

Name and Location:
H.T. Gilbert
5909 Truax Blvd.
Eau Claire, WI
NE,NE,Sec9,T27N,R10W

Well # --
Information from Driller's Log

Depth of Well	--
Aquifer	--
Casing Depth	--
Static Water Level	--
Well Diameter	--
Open Interval	--

Water Quality Data

Date of Sample	Nitrate-Nitrogen (mg/l)
December 7, 1985	11.9
January 18, 1986	12.0
February 15, 1986	--
March 22, 1986	12.0
April 27, 1986	11.7
June 2, 1986	11.6

Mean = 11.8

Standard Deviation = 0.18

Mill Run Subdivision and Adjacent Area
Nitrate-Nitrogen Data

Name and Location:
1st Wisconsin Bank
Truax Blvd.
Eau Claire, WI
SW,Sec3,T27N,R10W

Well # --
Information from Driller's Log

Depth of Well	--
Aquifer	--
Casing Depth	--
Static Water Level	--
Well Diameter	--
Open Interval	--

Water Quality Data

Date of Sample	Nitrate-Nitrogen (mg/l)
December 7, 1985	--
January 18, 1986	--
February 15, 1986	--
March 22, 1986	14.8
April 27, 1986	14.1
June 2, 1986	14.1

Mean = 14.3

Standard Deviation = 0.4

Mill Run Subdivision and Adjacent Area
Nitrate-Nitrogen Data

Name and Location:
N. King
4704 Truax Blvd.
Eau Claire, WI
SW,SE,Sec3,T27N,R10W

Well # --
Information from Driller's Log

Depth of Well	77 feet
Aquifer	glacial
Casing Depth	74 feet
Static Water Level	24 feet
Well Diameter	4 inches
Open Interval	3 feet

Water Quality Data

Date of Sample	Nitrate-Nitrogen (mg/l)
December 7, 1985	4.8
January 18, 1986	4.9
February 15, 1986	--
March 22, 1986	4.4
April 27, 1986	3.8
June 2, 1986	--

Mean = 4.5

Standard Deviation = 0.5

Mill Run Subdivision and Adjacent Area
Nitrate-Nitrogen Data

Name and Location:
Coop Cenex
Truax Blvd.
Eau Claire, WI
SW,SE,Sec3,T27N,R10W

Well # --
Information from Driller's Log

Depth of Well	--
Aquifer	--
Casing Depth	--
Static Water Level	--
Well Diameter	--
Open Interval	--

Water Quality Data

Date of Sample	Nitrate-Nitrogen (mg/l)
December 7, 1985	--
January 18, 1986	--
February 15, 1986	--
March 22, 1986	4.5
April 27, 1986	4.4
June 2, 1986	--

Mean = 4.5

Standard Deviation = 0.07