

WELL-CONSTRUCTION AND HYDROGEOLOGIC DATA FOR OBSERVATION
WELLS IN THE VICINITY OF A LOW-LEVEL RADIOACTIVE-WASTE
DISPOSAL SITE NEAR SHEFFIELD, ILLINOIS

by Lawrence J. Mansue and Patrick C. Mills

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CONVERSION FACTORS AND ABBREVIATIONS

Inch-pound units used in this report may be converted to metric (International System) units by using the following conversion factors:

<u>Multiply inch-pound unit</u>	<u>by</u>	<u>To obtain metric unit</u>
foot (ft)	0.3048	meter (m)

Sea level: In this report, "sea level" refers to the National Geodetic Vertical Datum of 1929 (NGVD of 1929)--a geodetic datum derived from a general adjustment of the first-order level nets of both the United States and Canada, formerly called Sea Level Datum of 1929.

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ABSTRACT

The U.S. Geological Survey conducted hydrogeologic studies at the low-level radioactive-waste disposal site near Sheffield, Illinois, from 1976 through 1987. During that period, 108 observation wells were installed in the vicinity of the disposal site in glacial and post-glacial deposits of Quaternary age and bedrock of Pennsylvanian age. Data in this report include the location of each well, the date each well was drilled, the geologic units penetrated by each well, the physical measurements of each well, the elevations of the top (measuring point) of each well and geologic-unit contacts at each well, and the highest and lowest recorded water levels in each well.

INTRODUCTION

The U.S. Geological Survey (USGS) conducted hydrogeologic studies at a low-level radioactive-waste disposal site near Sheffield, Bureau County, Illinois (fig. 1), from 1976 through 1987 (Foster and others, 1984, 1984b; Garklavs and Healy, 1986; Ryan, 1989; Mills and Healy, 1991). During that period, the USGS installed 108 observation wells in the vicinity of the disposal site; the wells supplemented about 100 preexisting non-USGS wells.

The purpose of this report is to present diagrammatically well-construction data and selected hydrogeologic data for the 108 wells installed by the USGS in the vicinity of the low-level radioactive-waste disposal site near Sheffield, Illinois. The report updates earlier reports by Foster and Erickson (1980) and Foster and others (1984a) in which well-construction, geologic, hydrologic, and water-chemistry data were assembled in tabular format for 104 wells.

The authors would like to thank George Fitzgerald, formerly of the Illinois Department of Nuclear Safety (IDNS), for his review of the data. We also would like to acknowledge US Ecology, Inc., the disposal-site operator, for allowing the USGS to conduct hydrogeologic studies at the site.

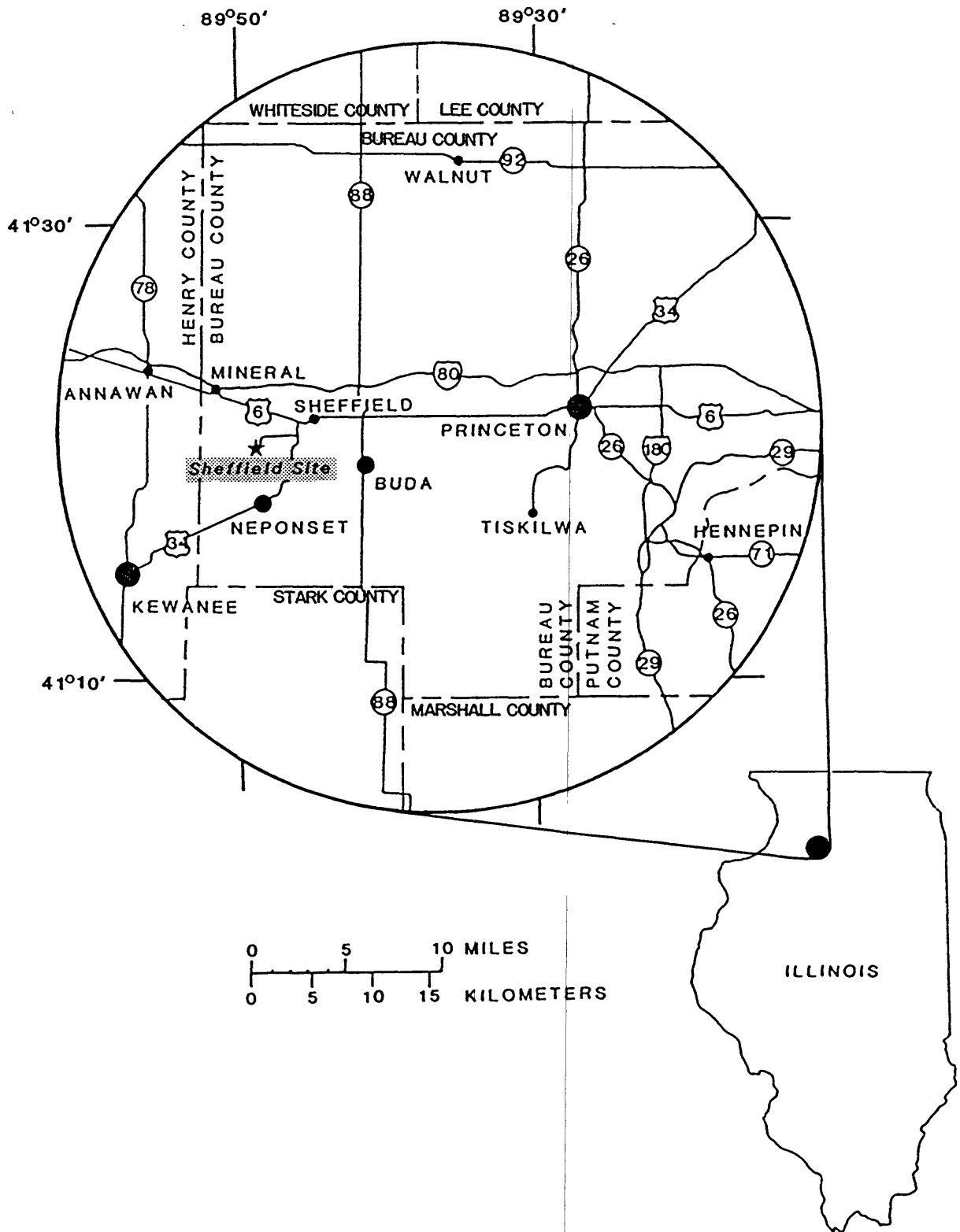


Figure 1.--Location of the low-level radioactive-waste disposal site near Sheffield, Illinois.

WELL-CONSTRUCTION AND HYDROGEOLOGIC DATA

The observation wells were installed in glacial and post-glacial deposits of Quaternary age and, to a lesser extent, bedrock of Pennsylvanian age (fig. 2), coal-mine spoil, and trench-construction earth fill¹. The geology in the vicinity of the site is described in detail in Foster and others (1984 and 1984b). Hydrogeologic and water-chemistry data obtained from the wells were used to delineate site stratigraphy, hydraulic characteristics of the unconsolidated deposits, areal and temporal water-table fluctuations, and rates and pathways of ground-water flow and tritium migration.

TIME STRATIGRAPHY			ROCK STRATIGRAPHY	
QUATERNARY SYSTEM	HOLOCENE SERIES		PEORIA LOESS ROXANA SILT CAHOKIA ALLUVIUM	
	PLEISTOCENE SERIES	WISCONSINAN STAGE		
		SANGAMONIAN STAGE		
		ILLINOIAN STAGE		GLASFORD FORMATION BERRY CLAY MEMBER RADNOR TILL MEMBER TOULON MEMBER HULICK TILL MEMBER DUNCAN MILLS MEMBER
PENNSYLVANIAN SYSTEM	DESMOINESIAN SERIES		CARBONDALE FORMATION	

Figure 2.--Time-stratigraphic and rock-stratigraphic classification of the geologic units in the vicinity of the disposal site. Modified from Willman and Frye, 1970, figure 1.

¹The stratigraphic nomenclature used in this report is that of the Illinois State Geological Survey and does not necessarily follow the usage of the USGS.

The locations of the 108 observation wells installed by the USGS in the vicinity of the disposal site are shown in figure 3; included are revised locations (from Foster and others, 1984a, fig. 2) for wells 588, 590, and 602-607 and the locations of wells 612-615, which were not presented in Foster and others (1984a). The horizontal coordinates for the wells are presented in table 1; included are revised coordinates (from Foster and others, 1984a, table 9) for wells 543, 554, and 602-607. The coordinates are referenced to an arbitrary horizontal control datum point established for the site. The control datum point, North 11,000 feet and East 15,000 feet, is located south-east of the site at the intersection of two township roads (fig. 3). The elevation above sea level of the north rim of each well is referenced to a vertical control datum point located at well 503 (fig. 3).

In the fall of 1987, 39 wells (table 1) that were closest to the radioactive-waste disposal trenches were sealed in accordance with existing State law. Ownership of the remaining wells was transferred to the IDNS.

The observation wells were drilled using hollow-stem augers and were constructed using different methods and materials. Geologic materials in wells 501-537 (Foster and Erickson, 1980, p. 4) and 612-615 (M. P. deVries, U.S. Geological Survey, oral commun., 1989) first were sampled with a Shelby tube or split spoon; the sampled section then was drilled with either a 4- or 6 7/8-inch-outside-diameter auger. Finally, the entire borehole was redrilled with a 9 1/4-inch-outside-diameter auger and an assembled casing and screen were set in the hole. The annulus around the screen was backfilled with sand and gravel for wells screened in dry sand or fine-grained deposits. A bentonite seal was placed on top of the backfill, and the remainder of the annulus to land surface was filled with expansion-compensating cement grout. Wells 586-611 (Foster and others, 1984a, p. 4) were constructed in a similar manner; however, geologic materials were not continuously sampled in advance of drilling. Wells 538-557 and 559-584 were constructed using a two-step method (Foster and others, 1984a, p. 4). First, the casing was set and grouted in a drilled 9 1/4-inch-diameter borehole. Second, the cased borehole was drilled farther to a depth necessary to accommodate the desired length of well screen; the screen was then set in the casing with a packer. All wells are sealed at their base--the bottom of the well screen, or in some cases, the bottom of the casing that extends below the well screen.

Water levels in the wells were measured monthly in the spring, summer, and fall during 1976-79 and quarterly to annually during 1980-84. Water levels in wells 502, 505, 512, and 524 were measured daily during 1985-87. With the exception of the high water levels in winter 1985, water levels during 1985-87 were similar to those during 1976-84.

Construction diagrams for the wells (figs. 4-111, located at the end of the report) show the date each well was drilled, the geologic units penetrated by each well, and the physical measurements of each well including screen and casing length and diameter. Also shown for each well are the elevations above sea level of the following: top of casing (measuring point of the well), the base of the borehole, land surface, geologic-unit contacts, and the highest and lowest water levels recorded by the USGS during 1976-87.

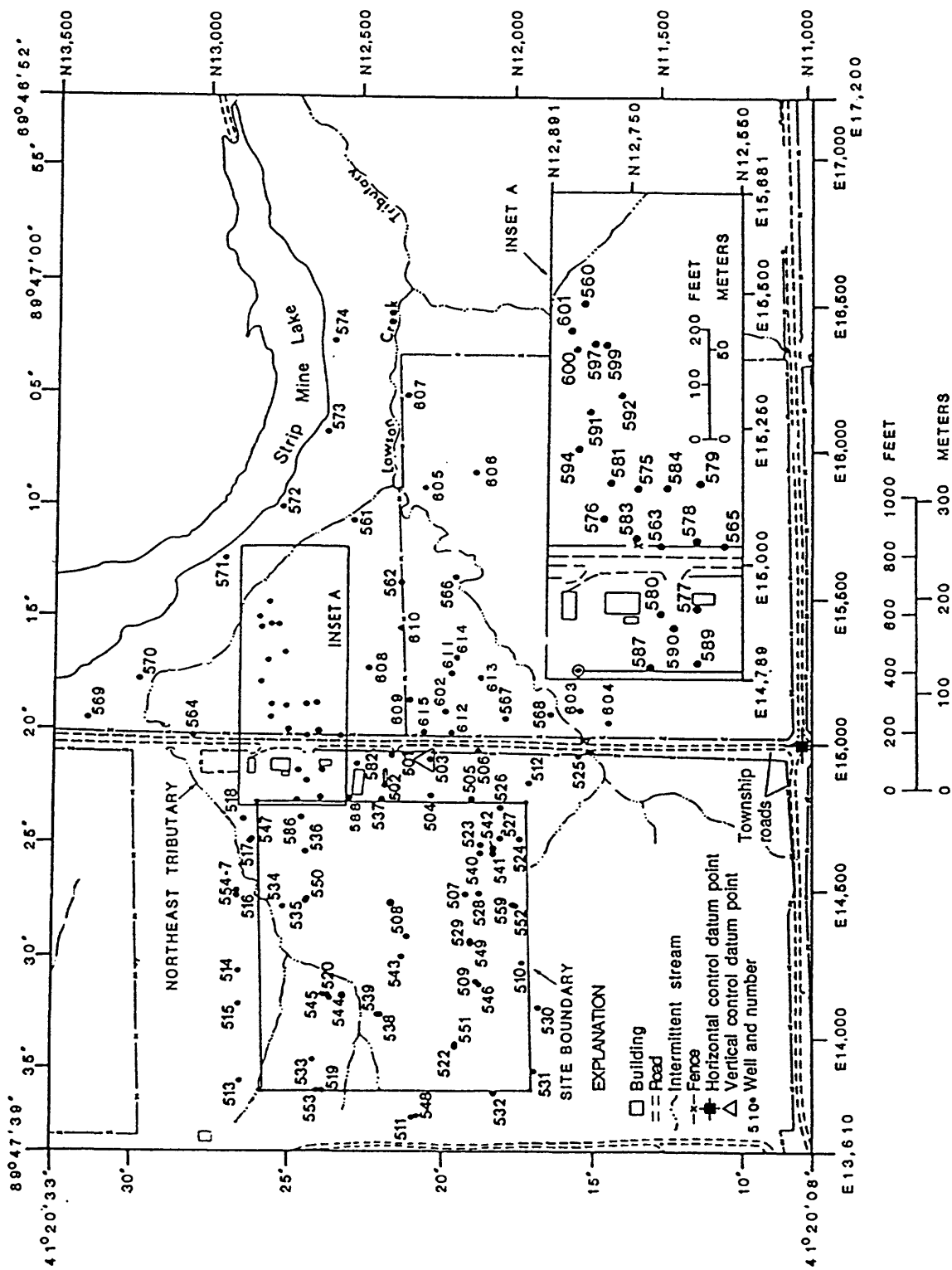


Figure 3.--Location of the observation wells installed by the U.S. Geological Survey in the vicinity of the disposal site. Modified from Foster and others, 1984a, figure 2.

Table 1.--Horizontal coordinates for wells

[ft, feet; modified from Foster and others, 1984a, table 9]

Well number	Coordinates (ft)		Well number	Coordinates (ft)	
	Northing	Easting		Northing	Easting
501	12,384.6	14,961.8	¹ 537	12,417.6	14,811.6
502	12,406.6	14,860.3	¹ 538	12,416.0	14,075.0
503	12,255.7	14,945.2	¹ 539	12,423.0	14,075.0
¹ 504	12,247.7	14,823.0	¹ 540	12,086.0	14,650.0
¹ 505	12,113.6	14,816.4	¹ 541	12,036.0	14,620.0
506	12,096.0	14,976.9	¹ 542	12,036.0	14,643.0
¹ 507	12,132.5	14,483.7	¹ 543	12,343.0	14,268.0
¹ 508	12,327.0	14,315.1	¹ 544	12,585.0	14,137.0
¹ 509	12,098.4	14,192.9	¹ 545	12,602.0	14,144.0
¹ 510	11,941.6	14,257.8	¹ 546	12,092.0	14,194.0
511	12,302.6	13,724.4	547	12,843.0	14,672.0
512	11,924.7	14,867.6	548	12,295.0	13,729.0
513	12,875.3	13,843.5	¹ 549	12,114.0	14,313.0
514	12,886.4	14,226.4	¹ 550	12,663.0	14,470.0
515	12,887.2	14,108.1	¹ 551	12,165.0	13,957.0
516	12,894.0	14,471.5	552	11,962.0	14,444.0
517	12,848.8	14,664.4	¹ 553	12,610.0	13,817.0
518	12,871.5	14,746.9	554	12,895.0	14,457.0
¹ 519	12,607.0	13,814.3	555	12,895.0	14,477.0
¹ 520	12,593.3	14,142.7	556	12,897.0	14,484.0
¹ 522	12,161.9	13,969.2	557	12,898.0	14,490.0
¹ 523	12,084.8	14,648.5	559	11,968.0	14,447.0
524	11,948.2	14,669.2	560	12,810.4	15,479.5
525	11,763.0	14,966.3	561	12,508.8	15,771.6
¹ 526	12,014.2	14,779.6	562	12,360.4	15,550.0
¹ 527	12,015.5	14,670.3	563	12,686.2	15,040.6
¹ 528	12,083.3	14,484.5	564	13,022.0	15,034.1
¹ 529	12,114.6	14,322.6	565	12,563.5	15,030.4
¹ 530	11,882.1	14,104.1	566	12,171.6	15,558.8
¹ 531	11,892.3	13,885.9	567	12,011.0	15,080.6
¹ 532	12,028.8	13,810.0	568	11,845.6	15,094.6
¹ 533	12,638.0	13,919.0	569	13,364.5	15,096.4
534	12,742.0	14,420.0	570	13,210.8	15,235.0
¹ 535	12,667.5	14,461.7	571	12,870.1	15,630.0
¹ 536	12,671.3	14,630.5	572	12,717.6	15,813.7

Table 1.--Horizontal coordinates for wells--Continued

Well number	Coordinates (ft)		Well number	Coordinates (ft)	
	Northing	Easting		Northing	Easting
573	12,588.3	16,047.9	597	12,791.0	15,401.0
574	12,590.3	16,386.1	599	12,768.0	15,400.0
575	12,727.4	15,134.3	600	12,825.0	15,396.0
576	12,786.3	15,084.0	601	12,828.0	15,430.0
577	12,616.0	14,917.0	602	12,179.0	15,108.0
578	12,644.0	15,044.0	603	11,747.0	15,098.0
579	12,655.0	15,133.0	604	11,633.0	15,078.0
¹ 580	12,685.0	14,928.0	605	12,289.0	15,857.0
581	12,779.0	15,135.0	606	12,127.0	15,929.0
582	12,512.0	14,927.0	607	12,361.0	16,221.0
583	12,732.0	15,042.0	608	12,492.0	15,256.0
584	12,686.0	15,135.0	609	12,342.0	15,130.0
¹ 586	12,679.0	14,754.0	610	12,370.0	15,383.0
¹ 587	12,700.0	14,798.0	611	12,191.0	15,227.0
588	12,527.0	14,815.0	612	12,171.0	15,034.0
¹ 589	12,615.0	14,813.0	613	12,109.0	15,214.0
¹ 590	12,661.0	14,876.0	614	12,175.0	15,288.0
591	12,811.0	15,278.0	615	12,284.0	15,035.0
592	12,755.0	15,305.0			
594	12,833.0	15,208.0			

¹Wells sealed in 1987.

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Figures 4 to 111

WELL 501

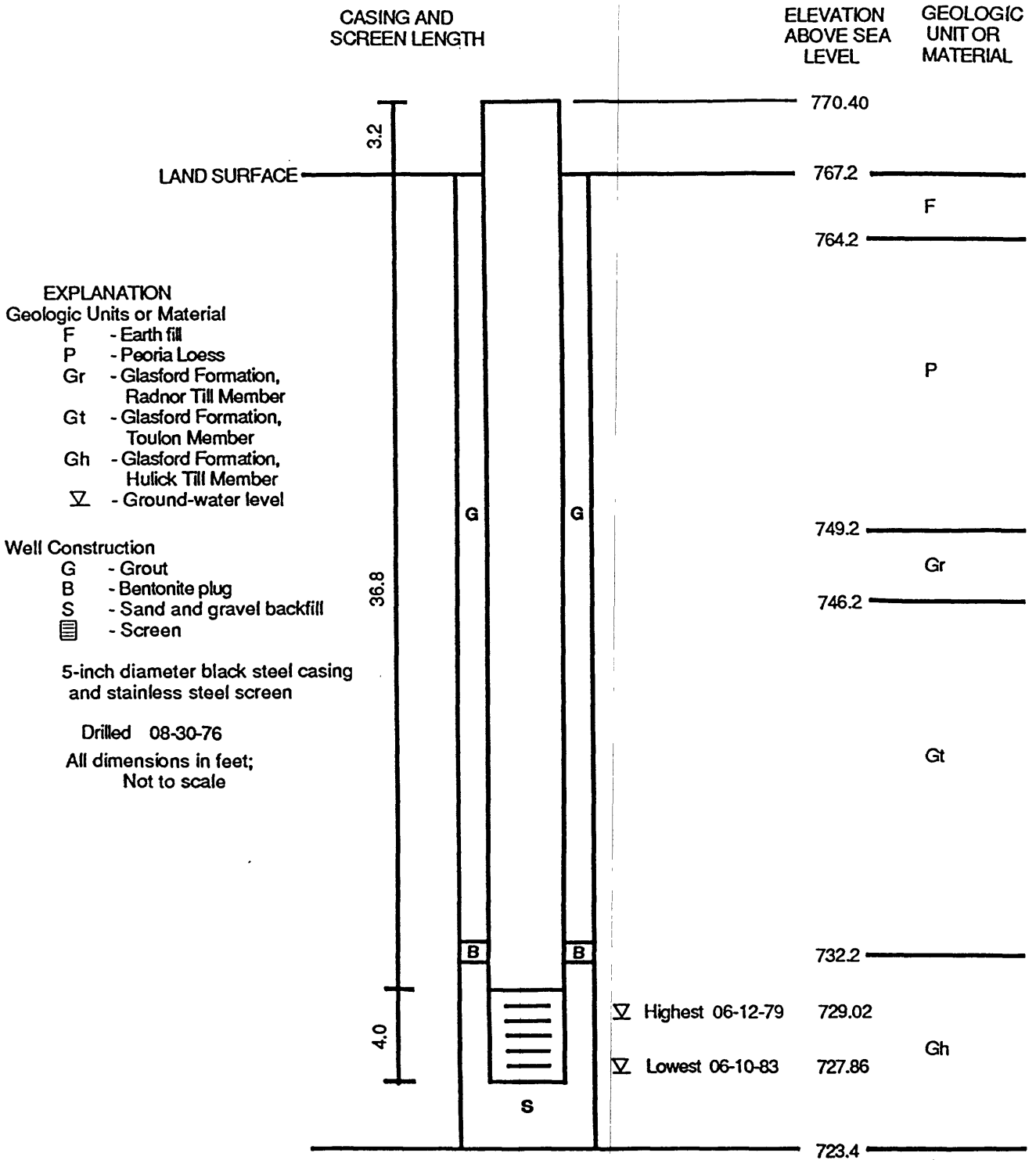


Figure 4.--Construction of well 501.

WELL 502

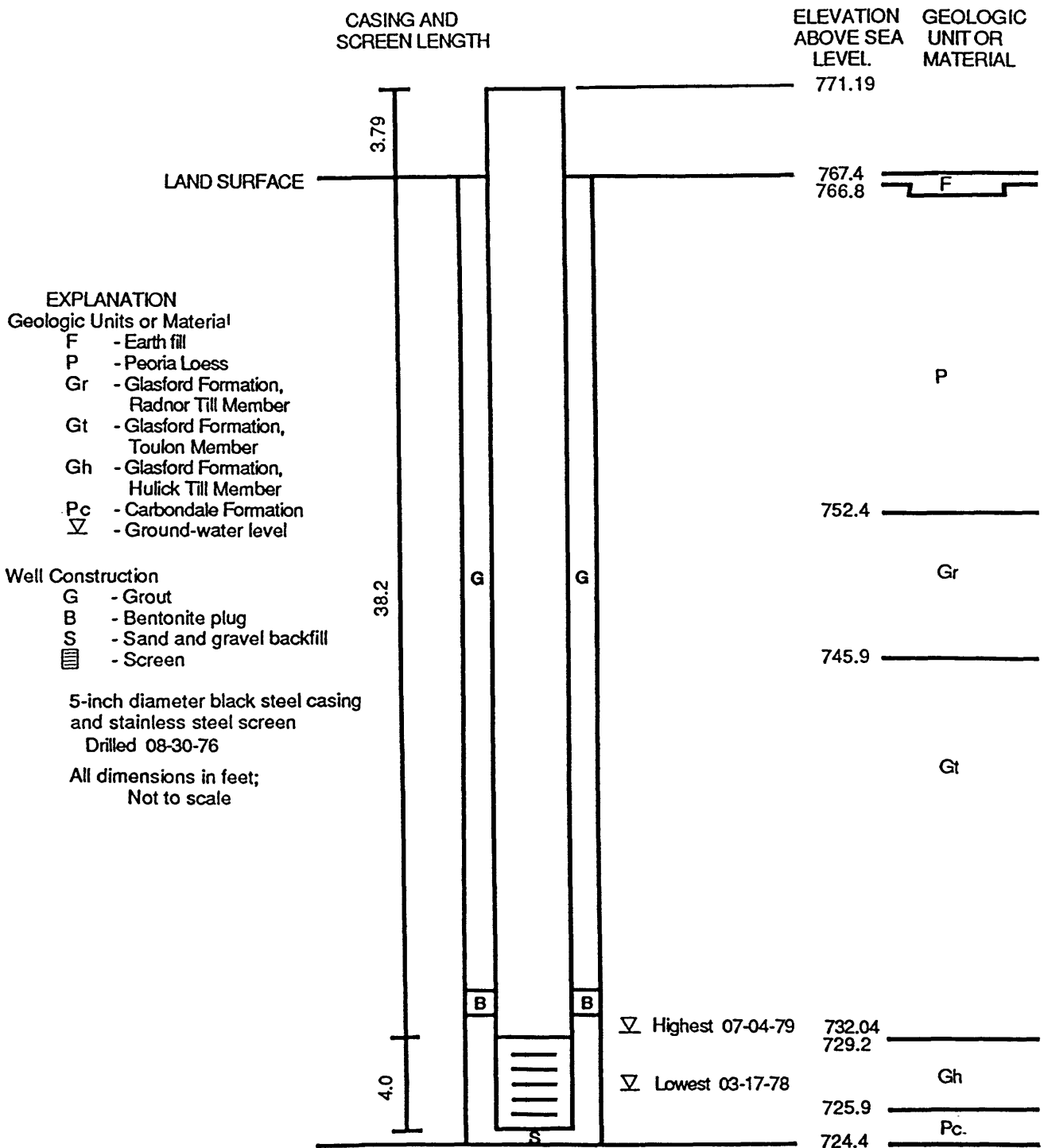


Figure 5.--Construction of well 502.

WELL 503

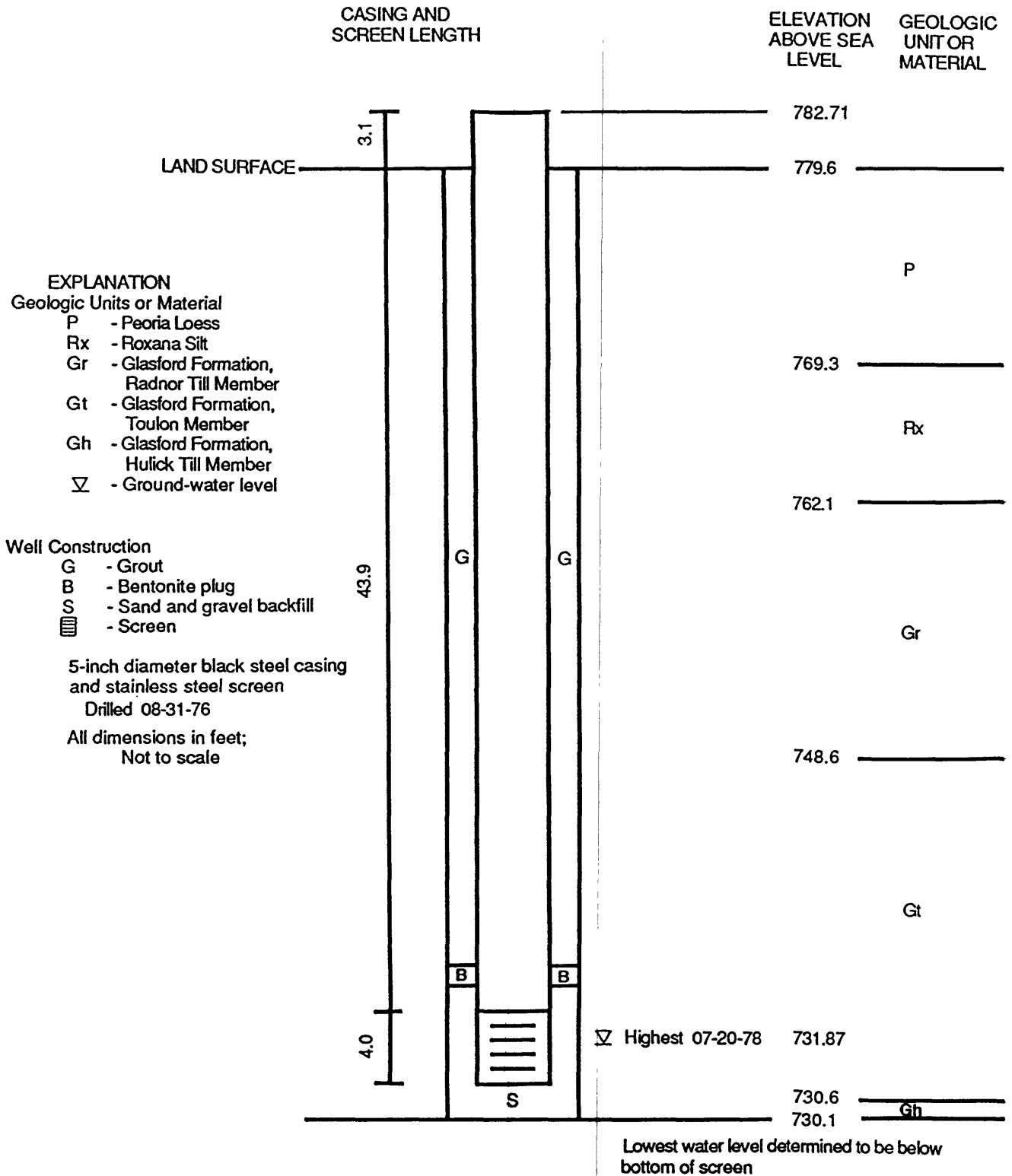


Figure 6.--Construction of well 503.

WELL 504

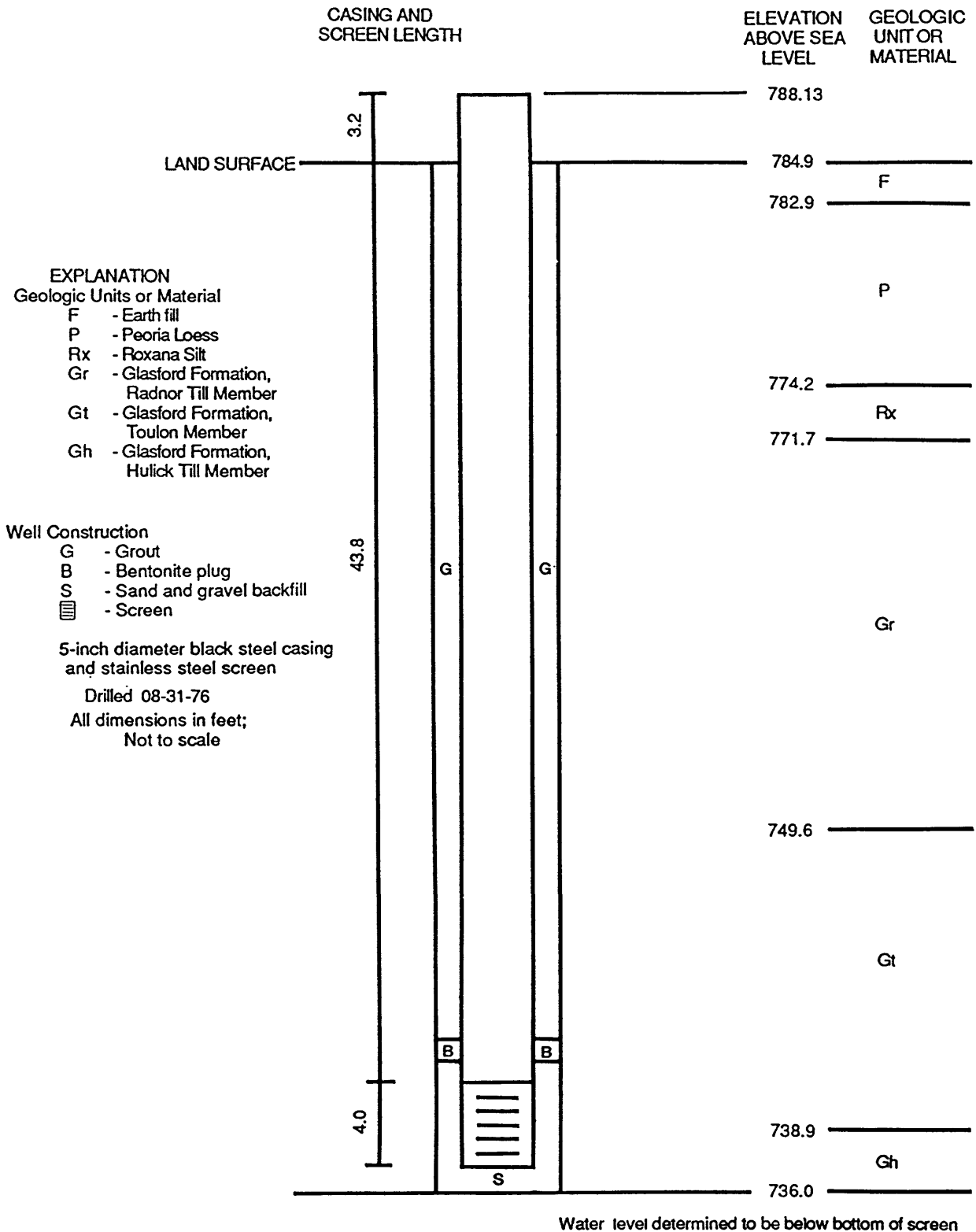


Figure 7.--Construction of well 504.

WELL 505

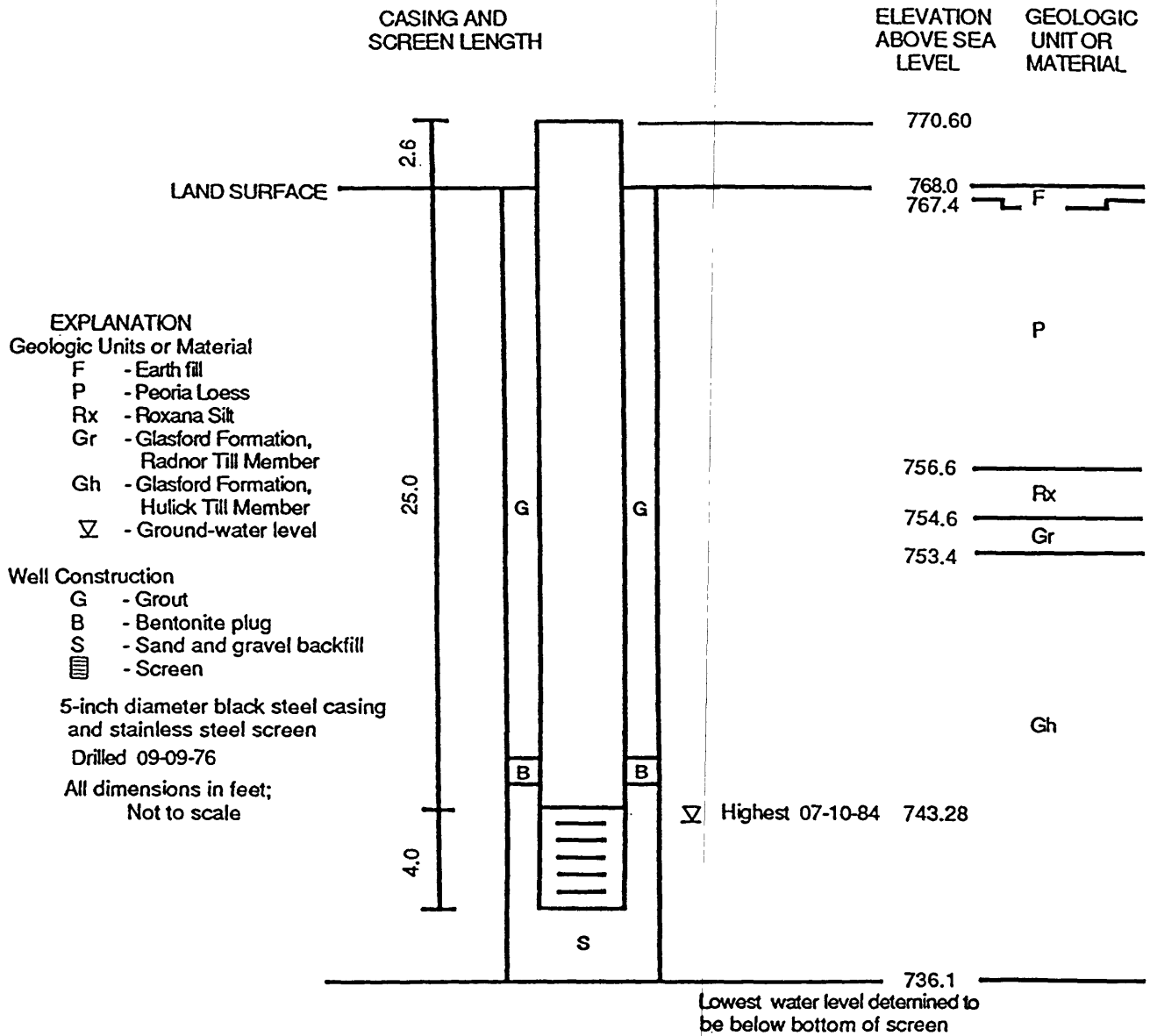


Figure 8.--Construction of well 505.

WELL 506

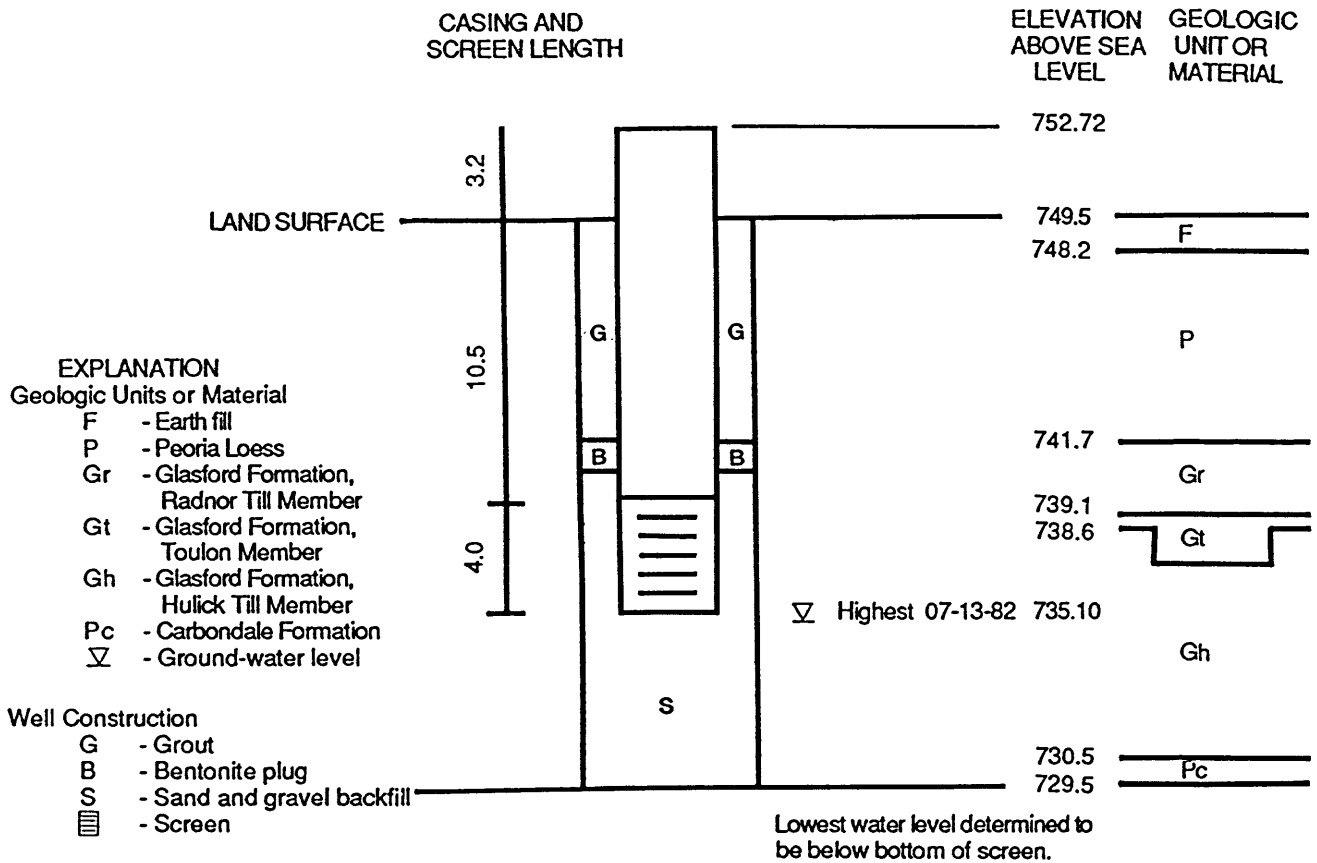


Figure 9.--Construction of well 506.

WELL 507

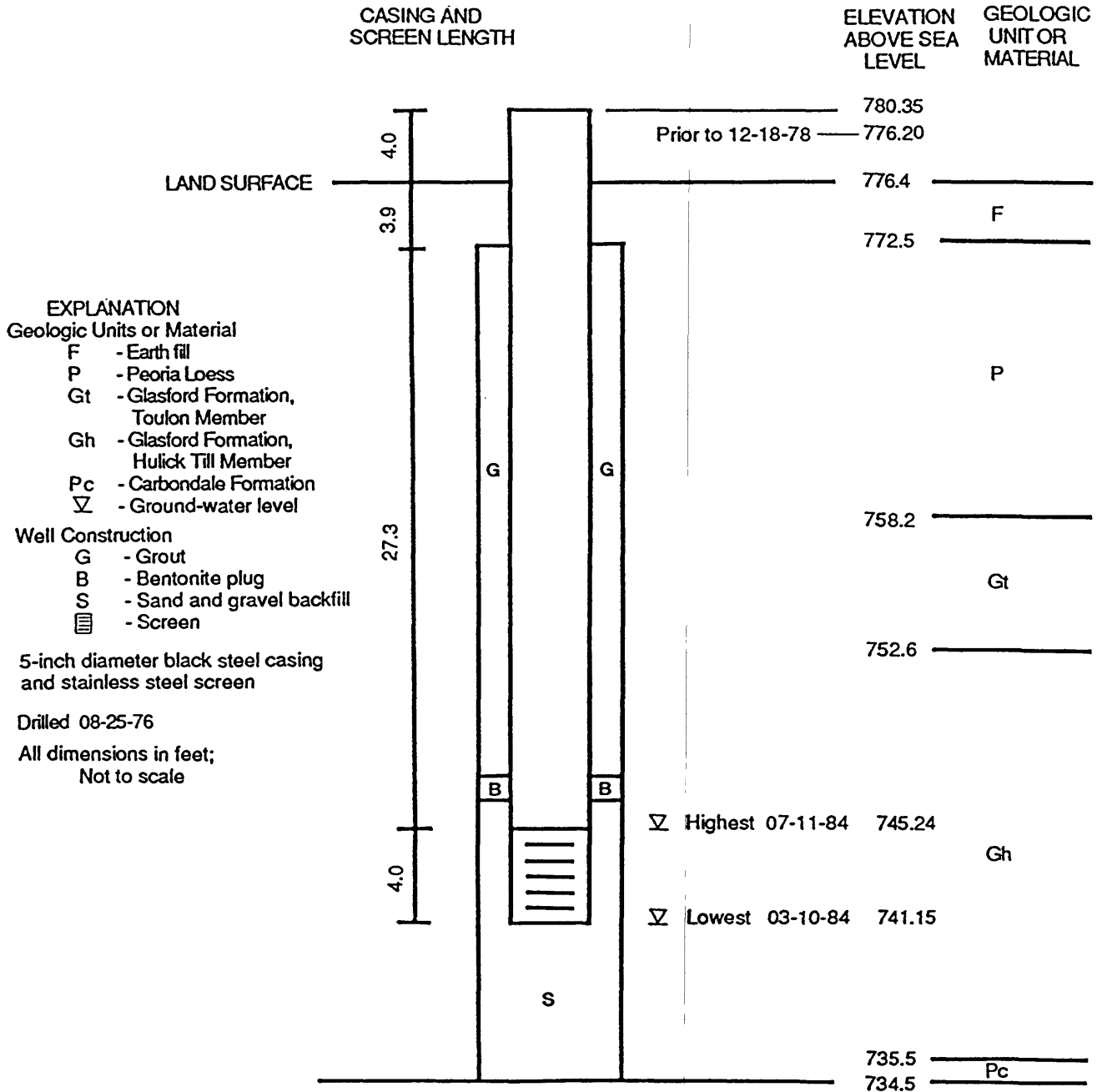


Figure 10.--Construction of well 507.

WELL 508

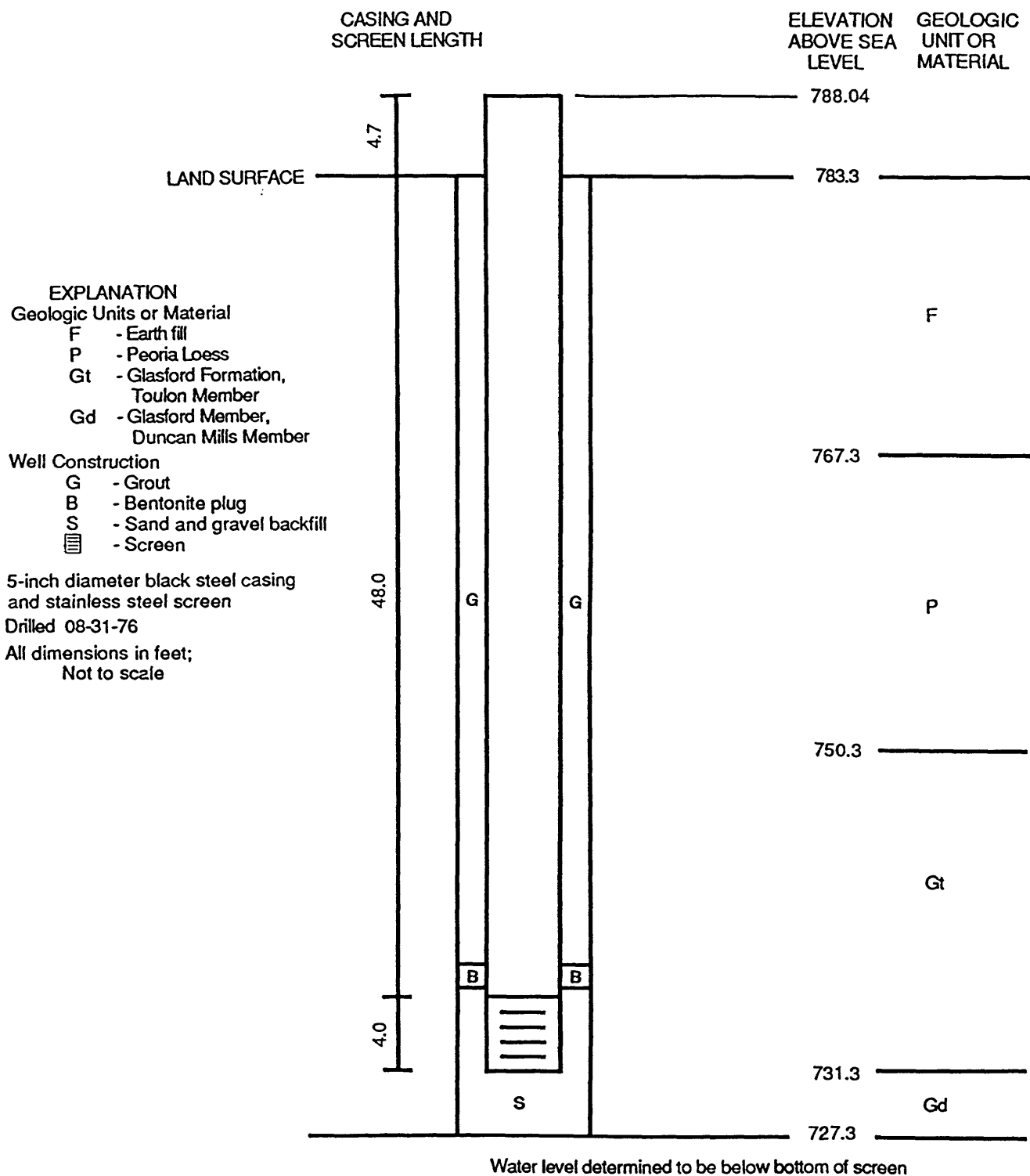


Figure 11.--Construction of well 508.

WELL 509

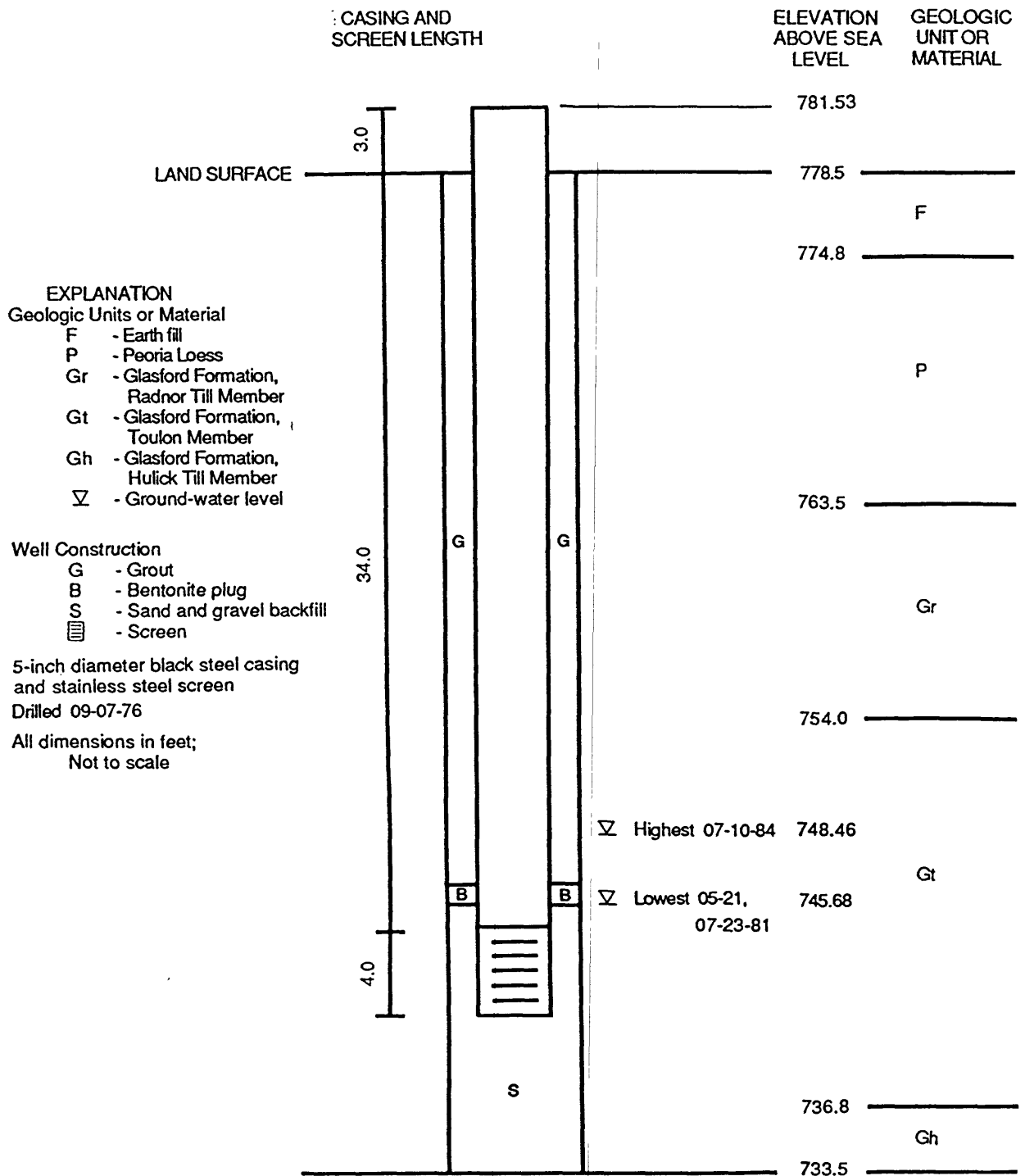


Figure 12.--Construction of well 509.

WELL 510

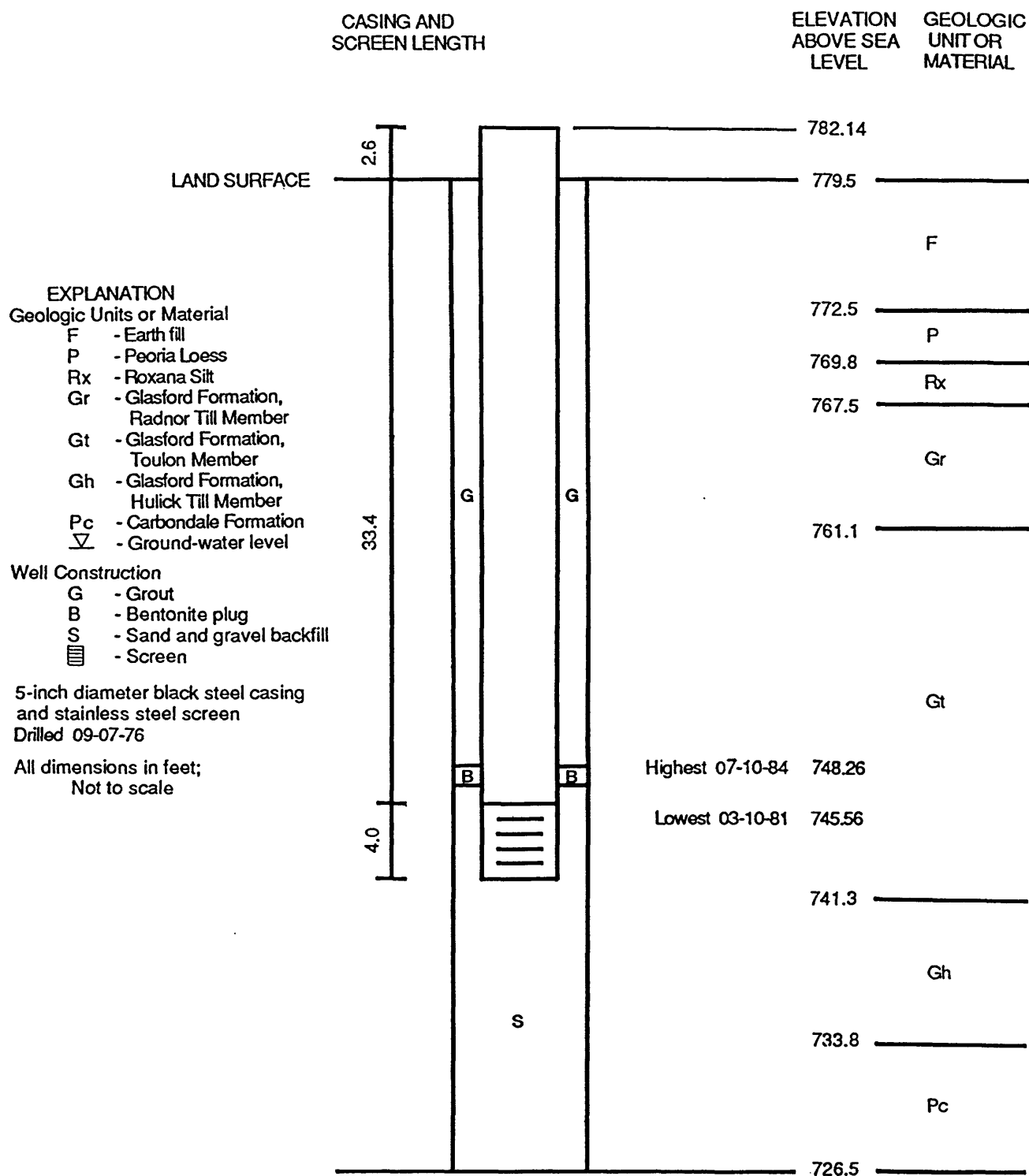


Figure 13.--Construction of well 510.

WELL 511

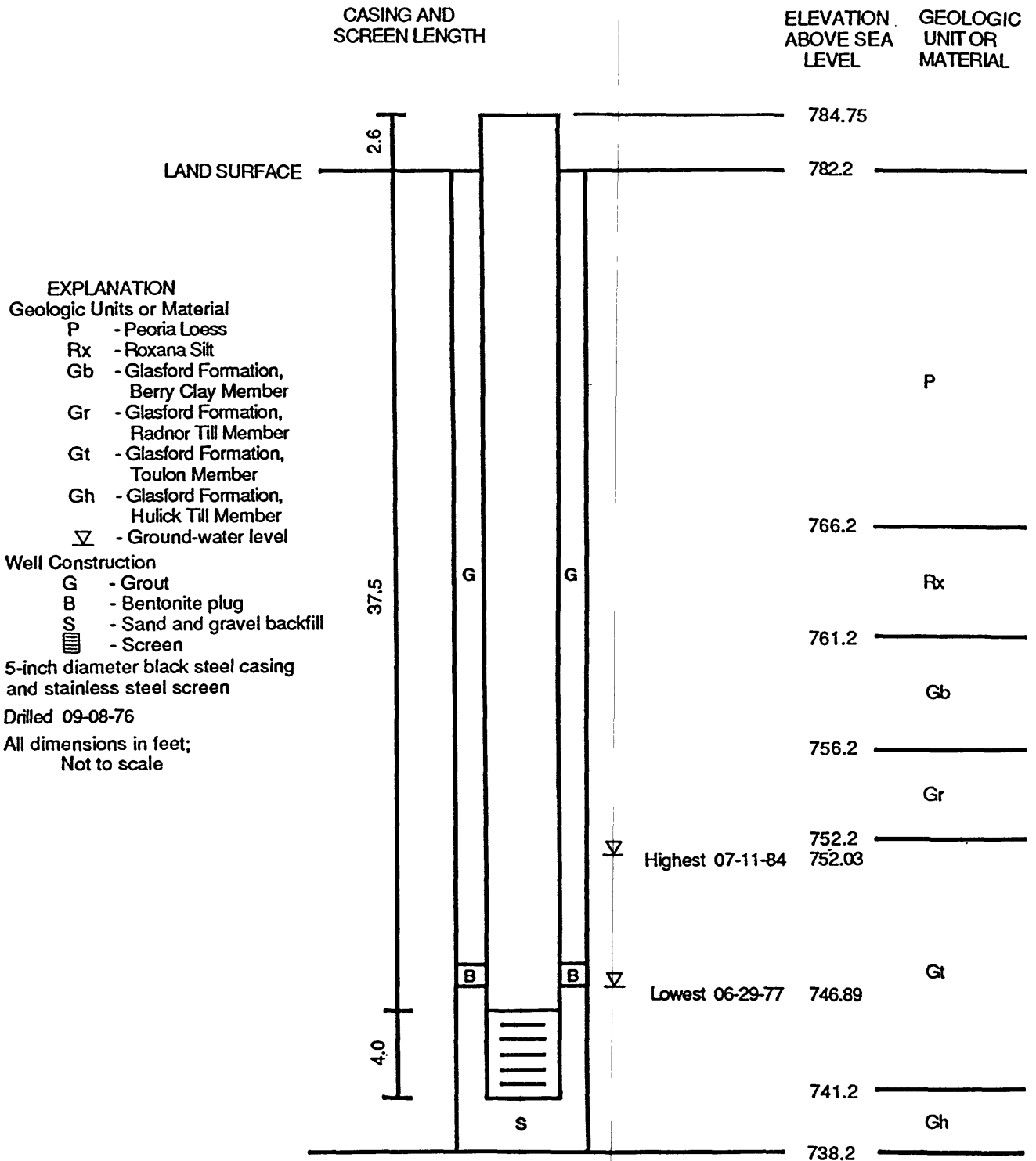


Figure 14.--Construction of well 511.

WELL 512

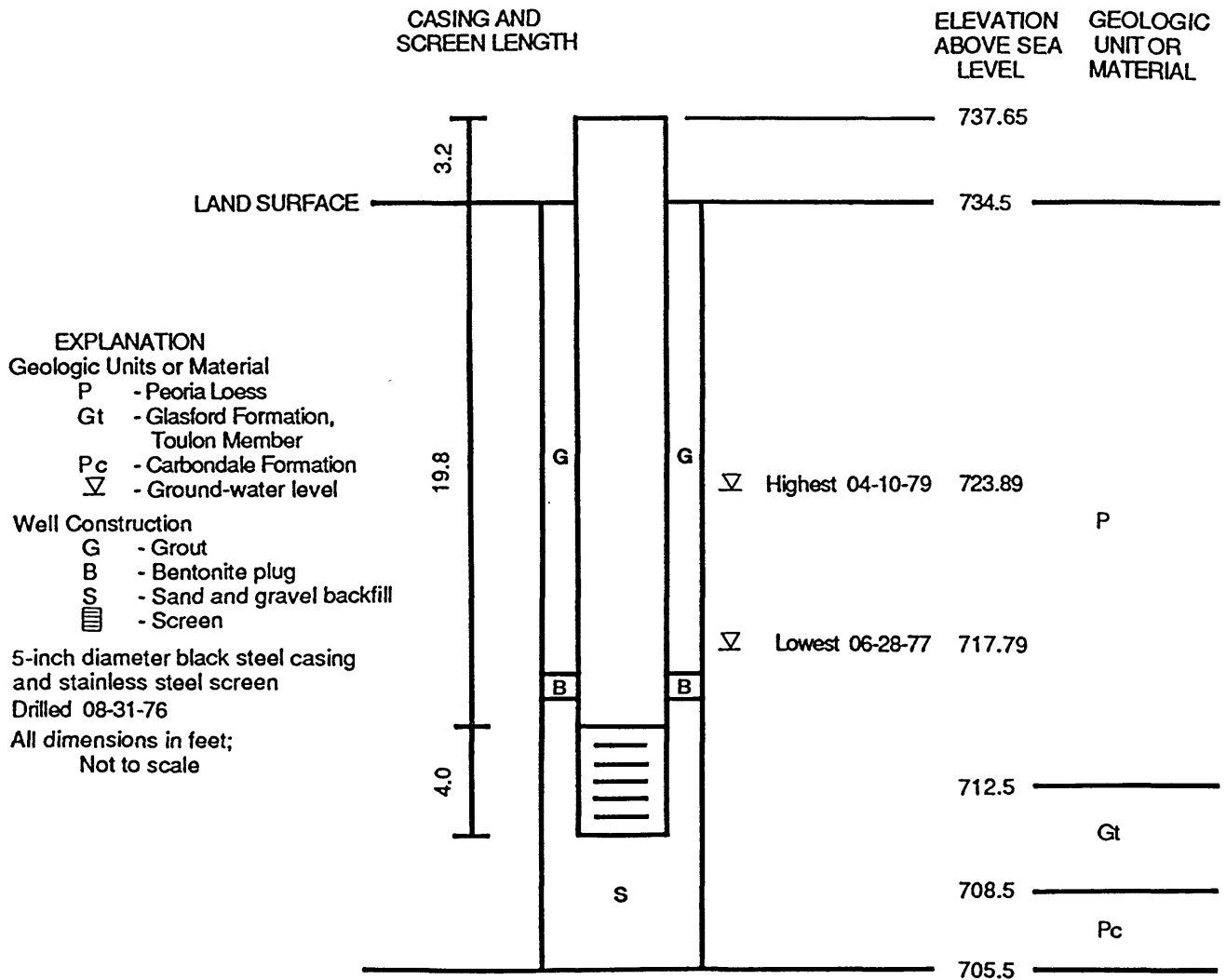


Figure 15.--Construction of well 512.

WELL 513

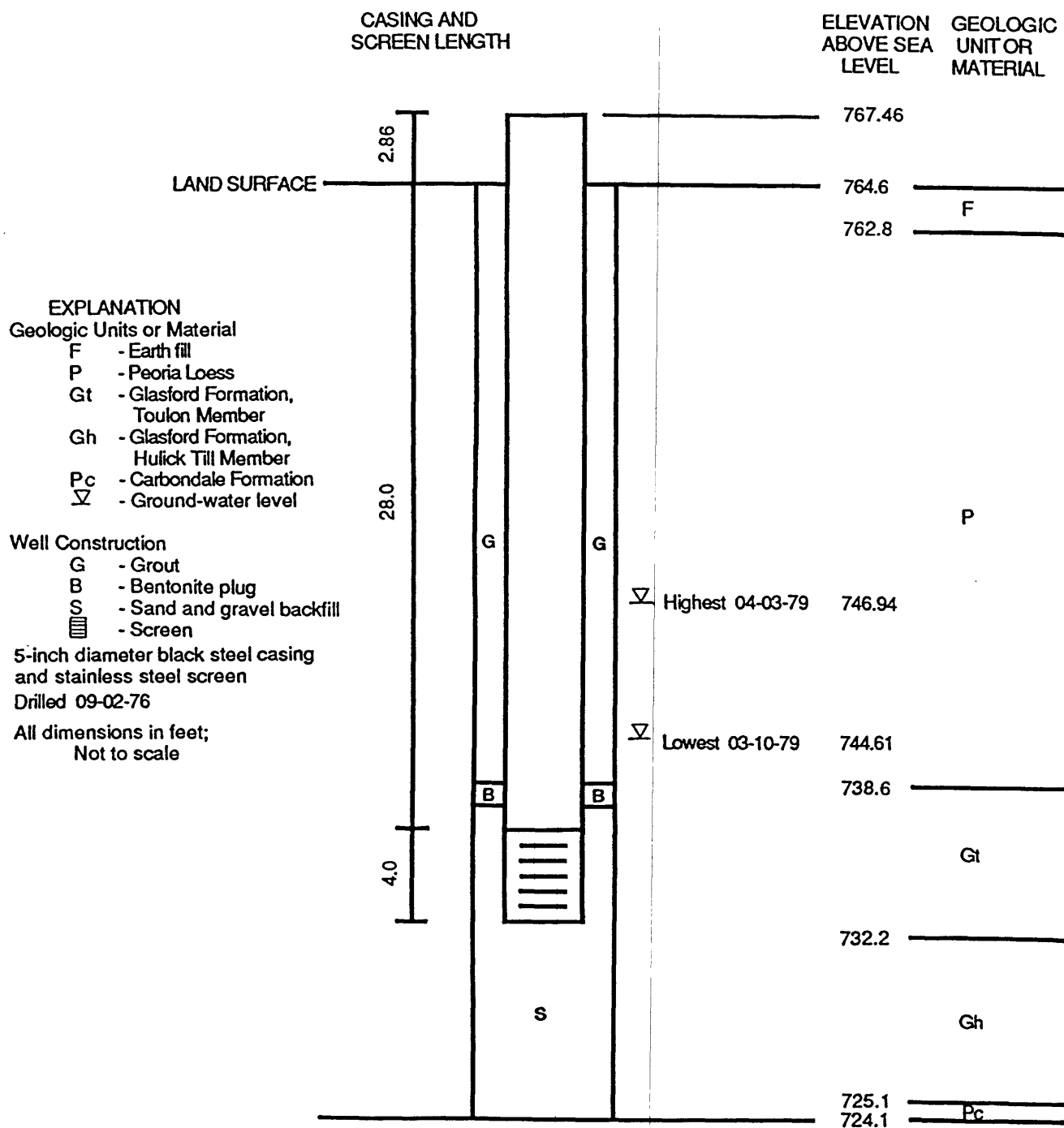


Figure 16.--Construction of well 513.

WELL 514

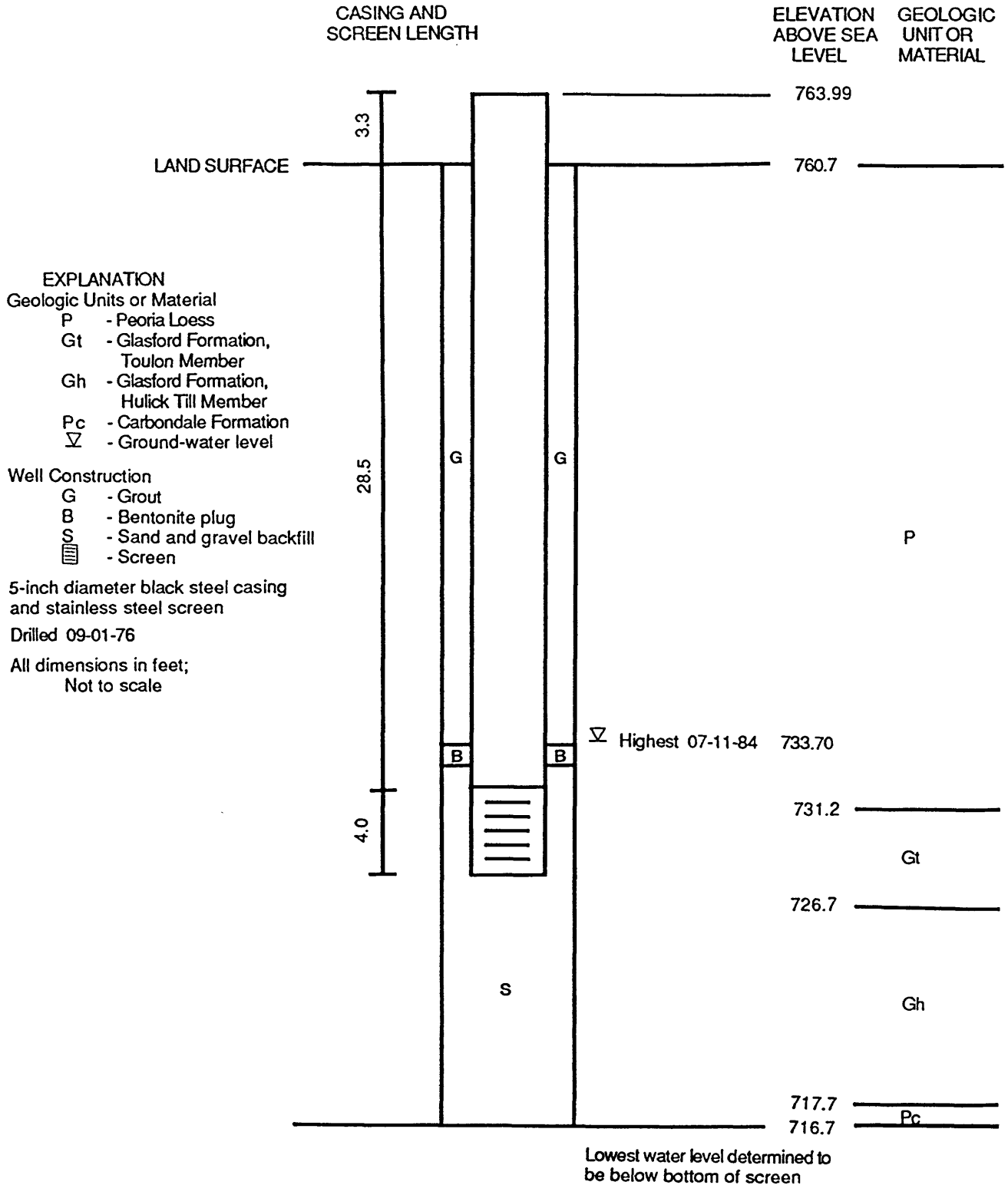


Figure 17.--Construction of well 514.

WELL 515

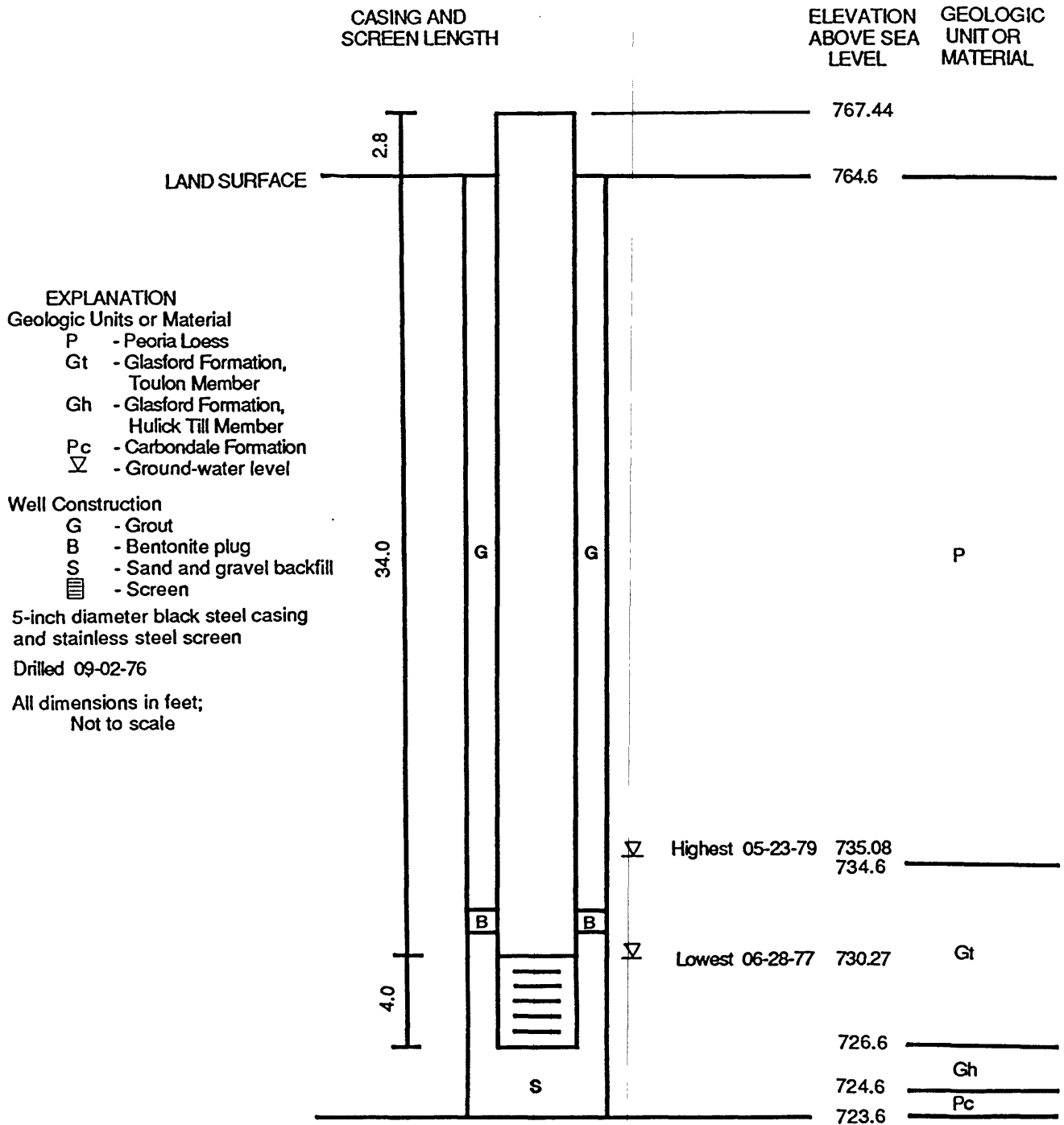


Figure 18.--Construction of well 515.

WELL 516

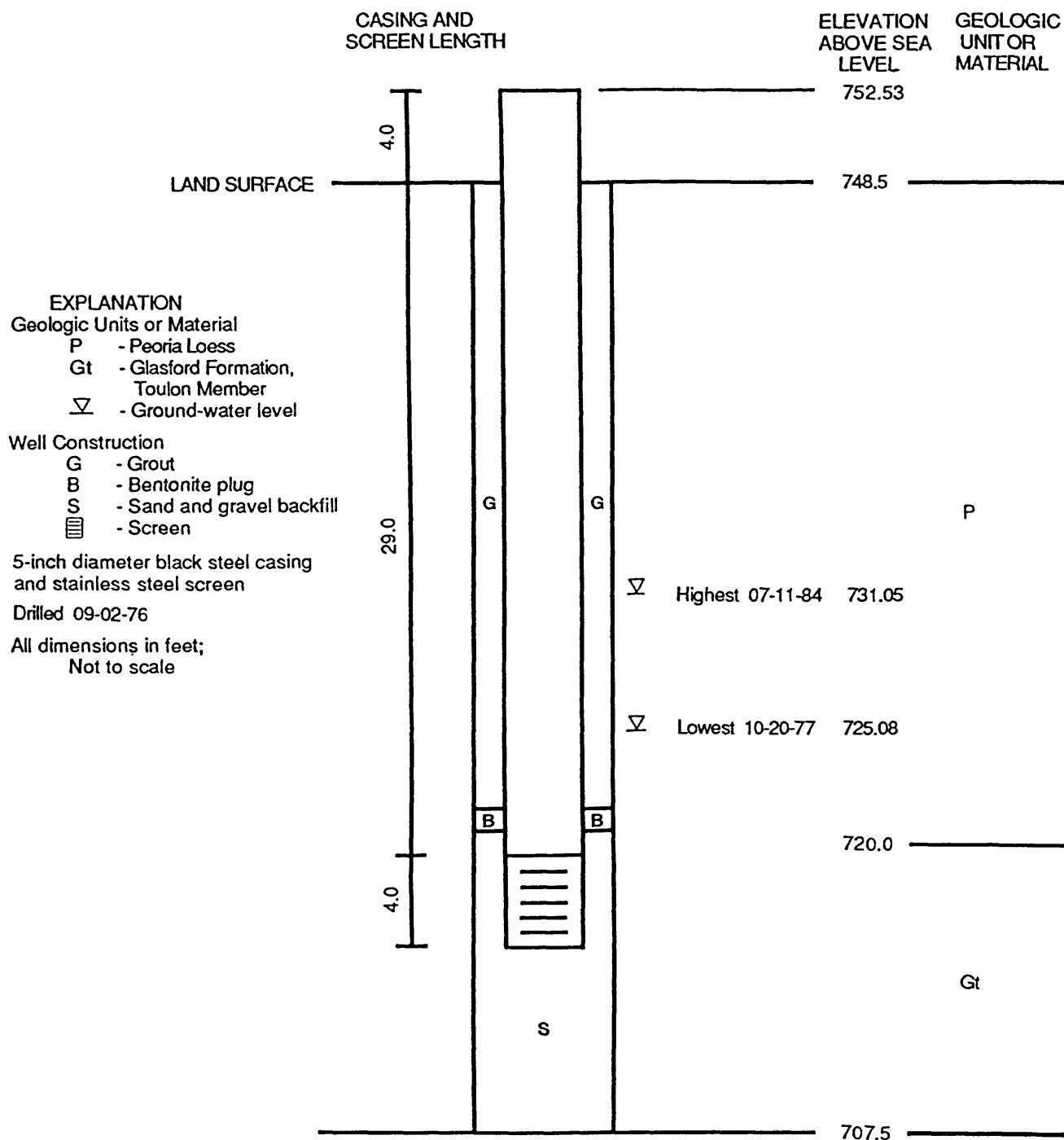


Figure 19.--Construction of well 516.

WELL 517

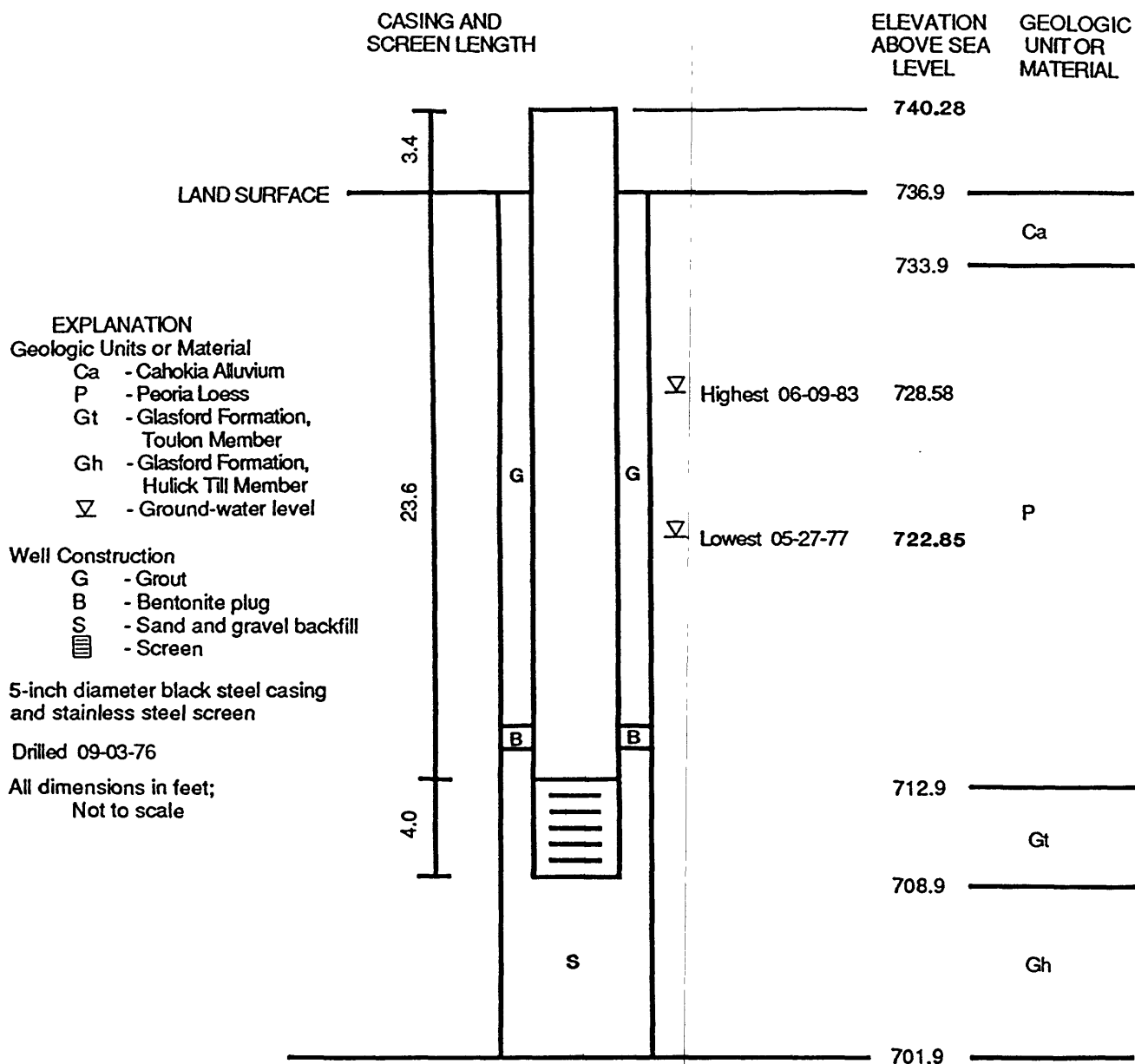


Figure 20.--Construction of well 517.

WELL 518

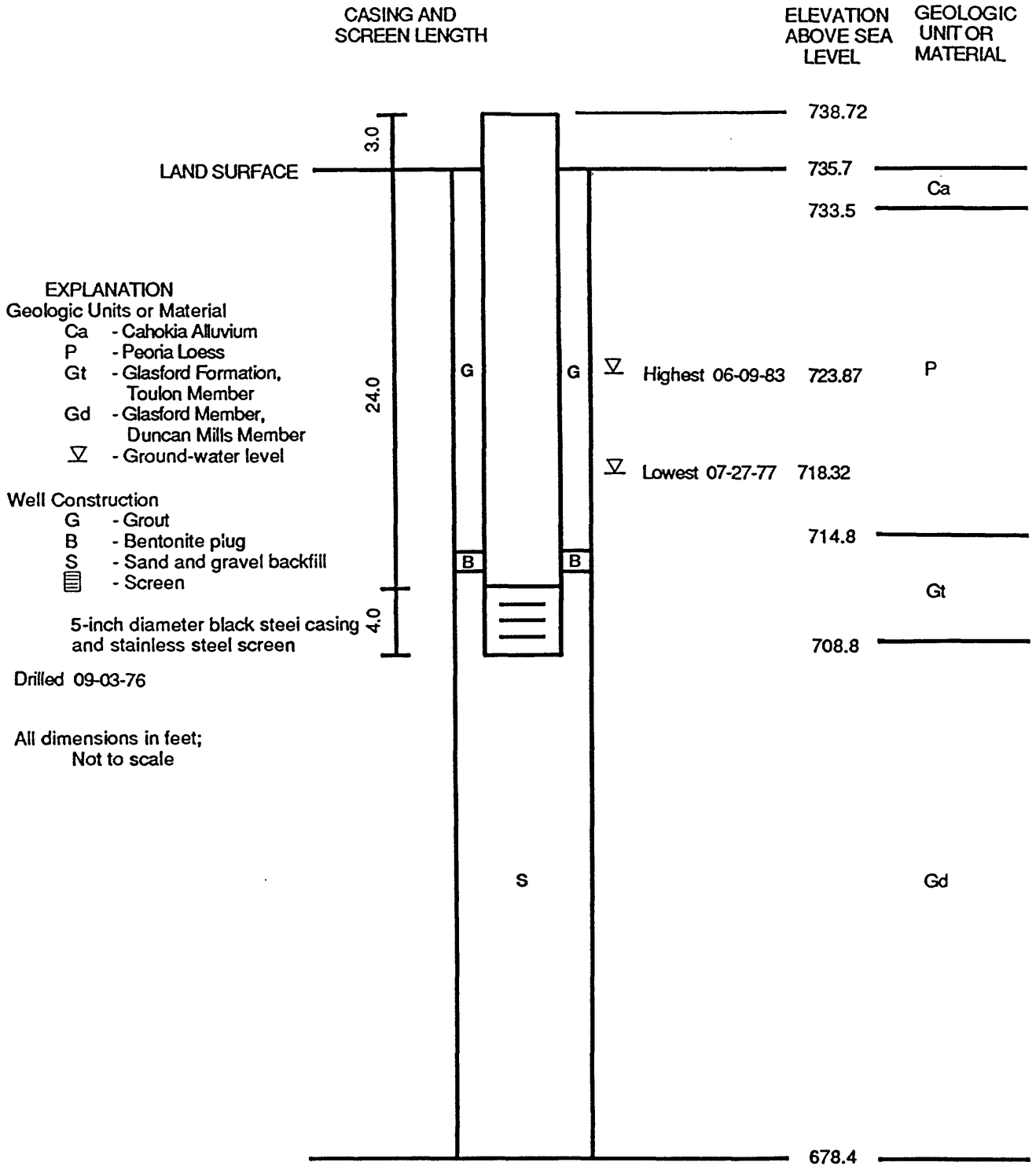


Figure 21.--Construction of well 518.

WELL 519

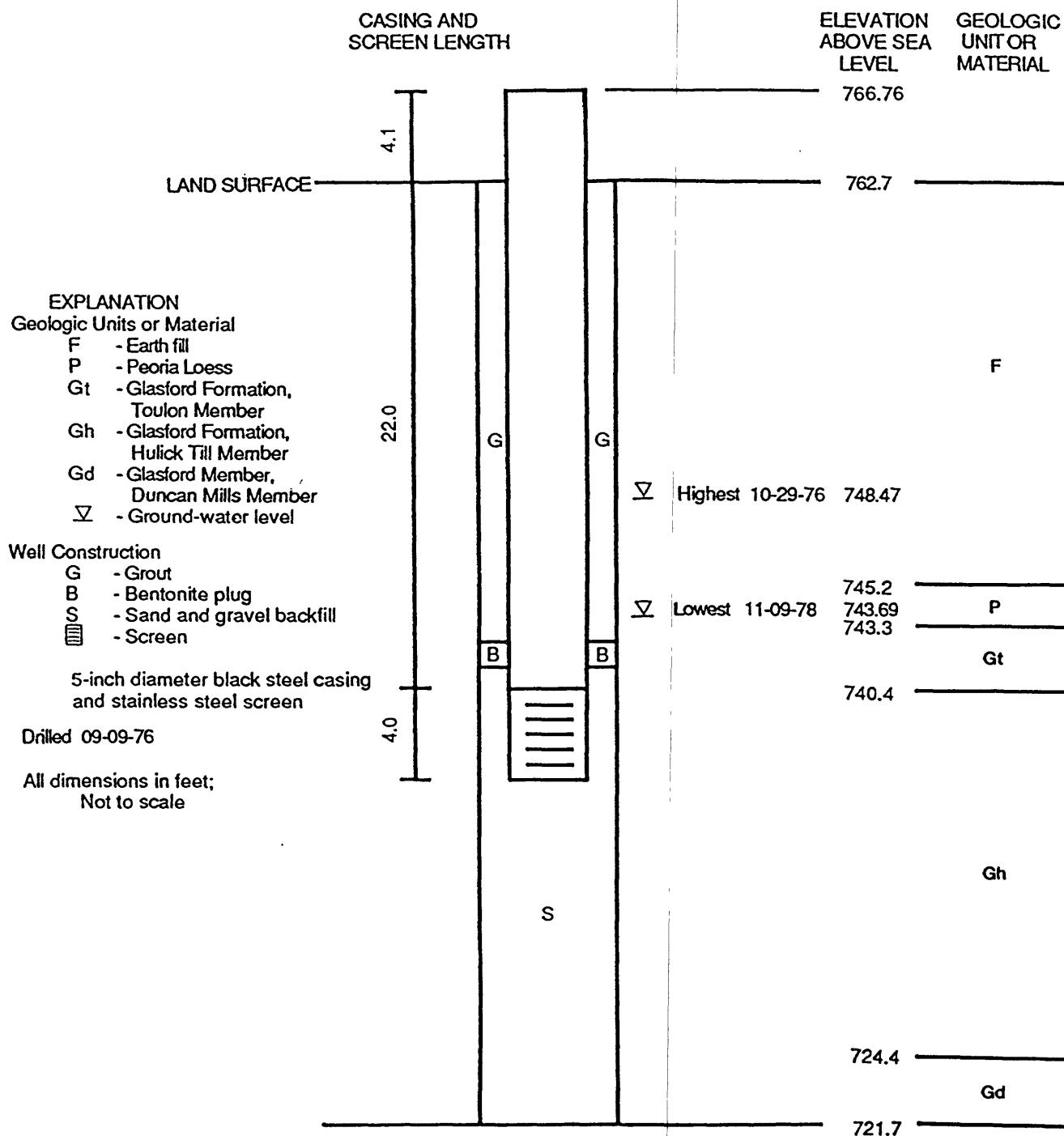


Figure 22.--Construction of well 519.

WELL 520

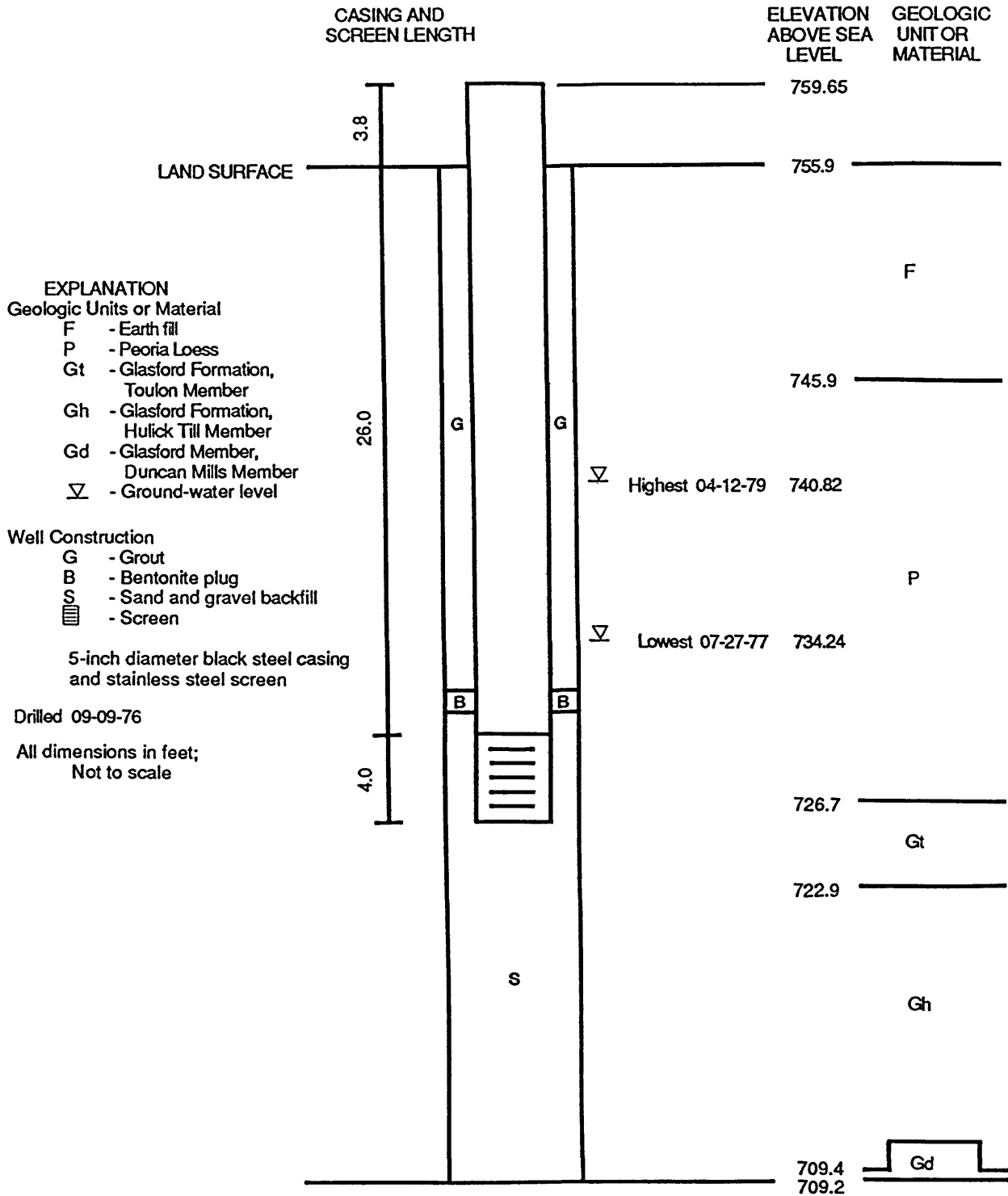


Figure 23.--Construction of well 520.

WELL 522

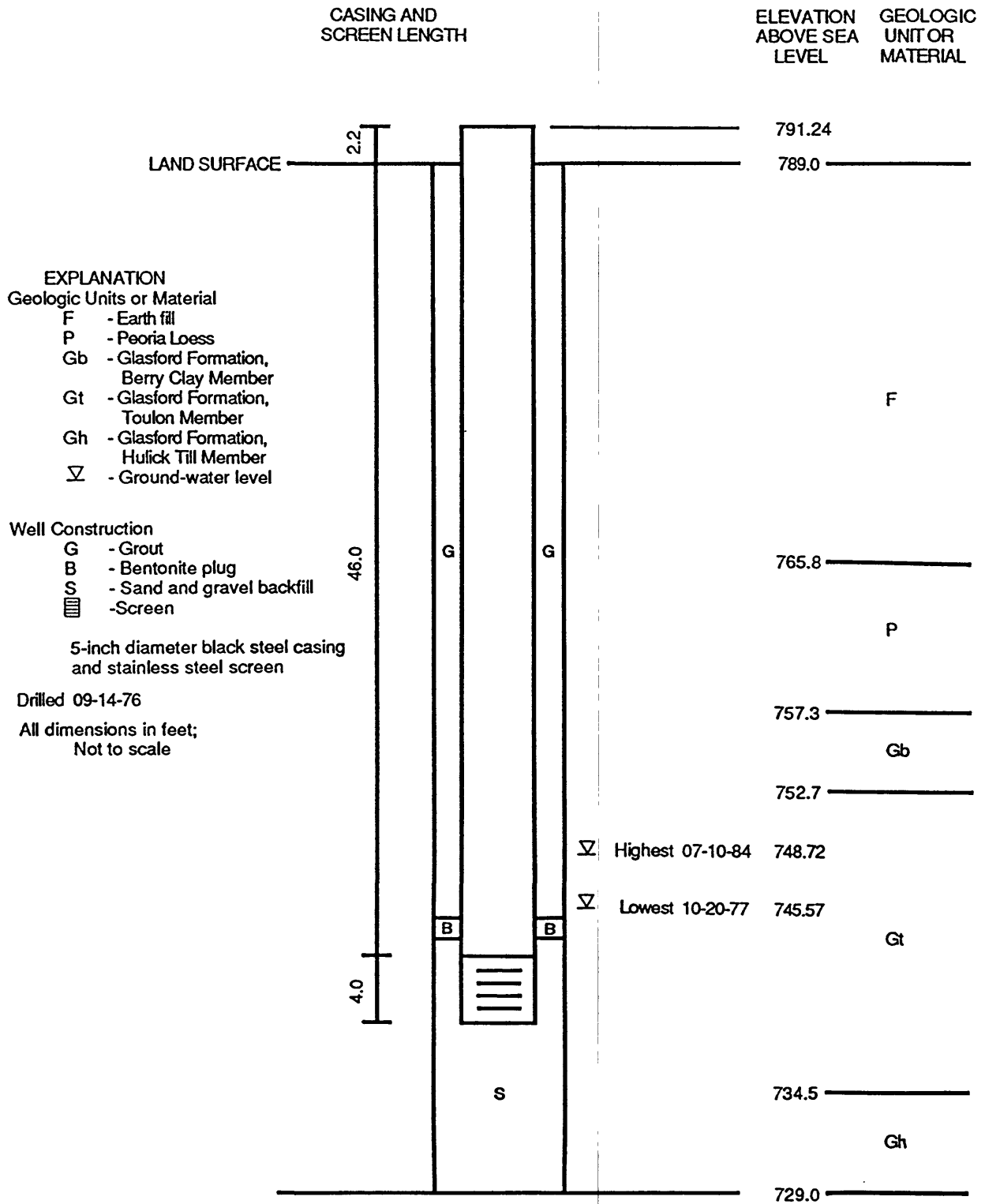


Figure 24.--Construction of well 522.

WELL 523

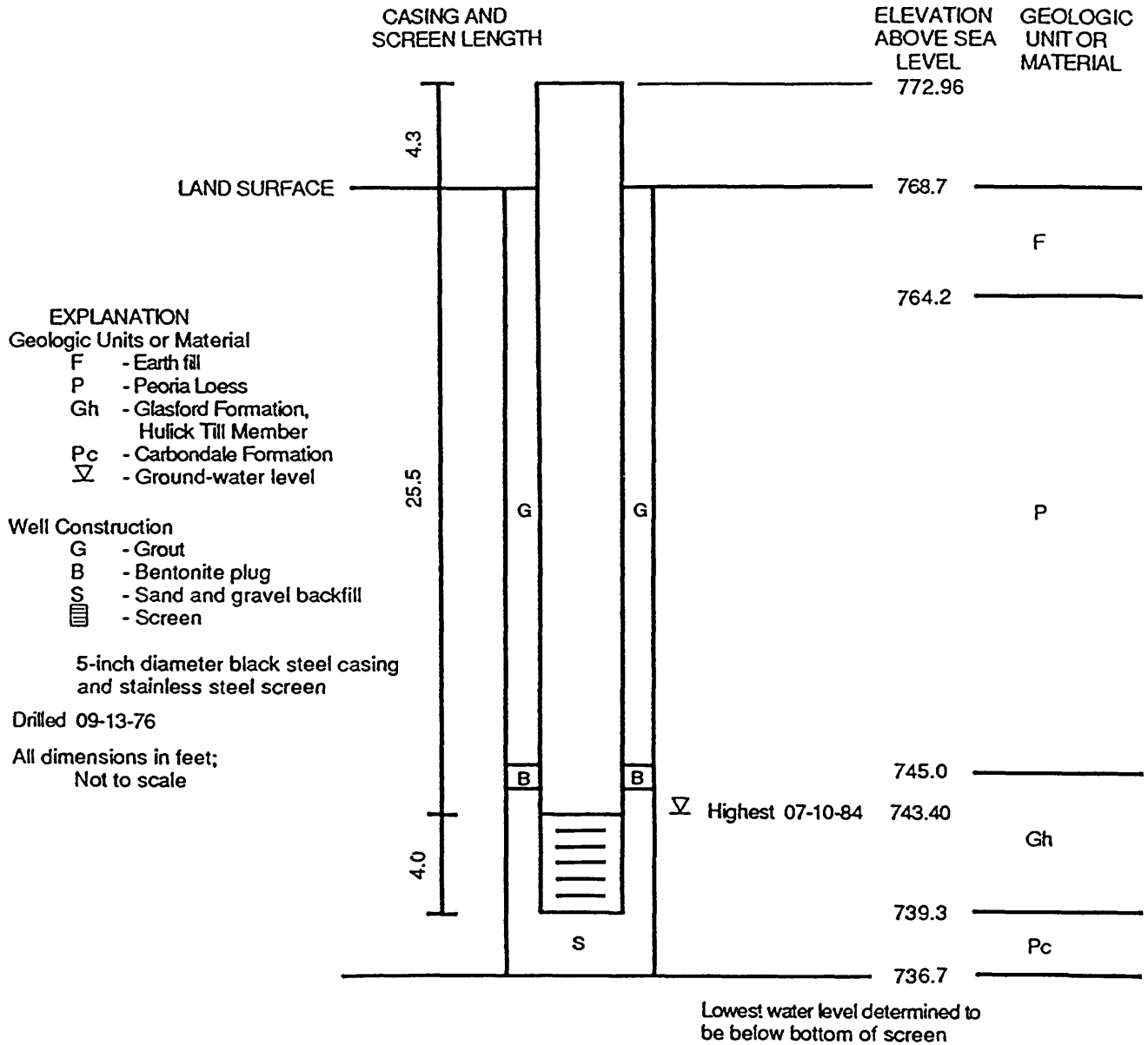


Figure 25.--Construction of well 523.

WELL 524

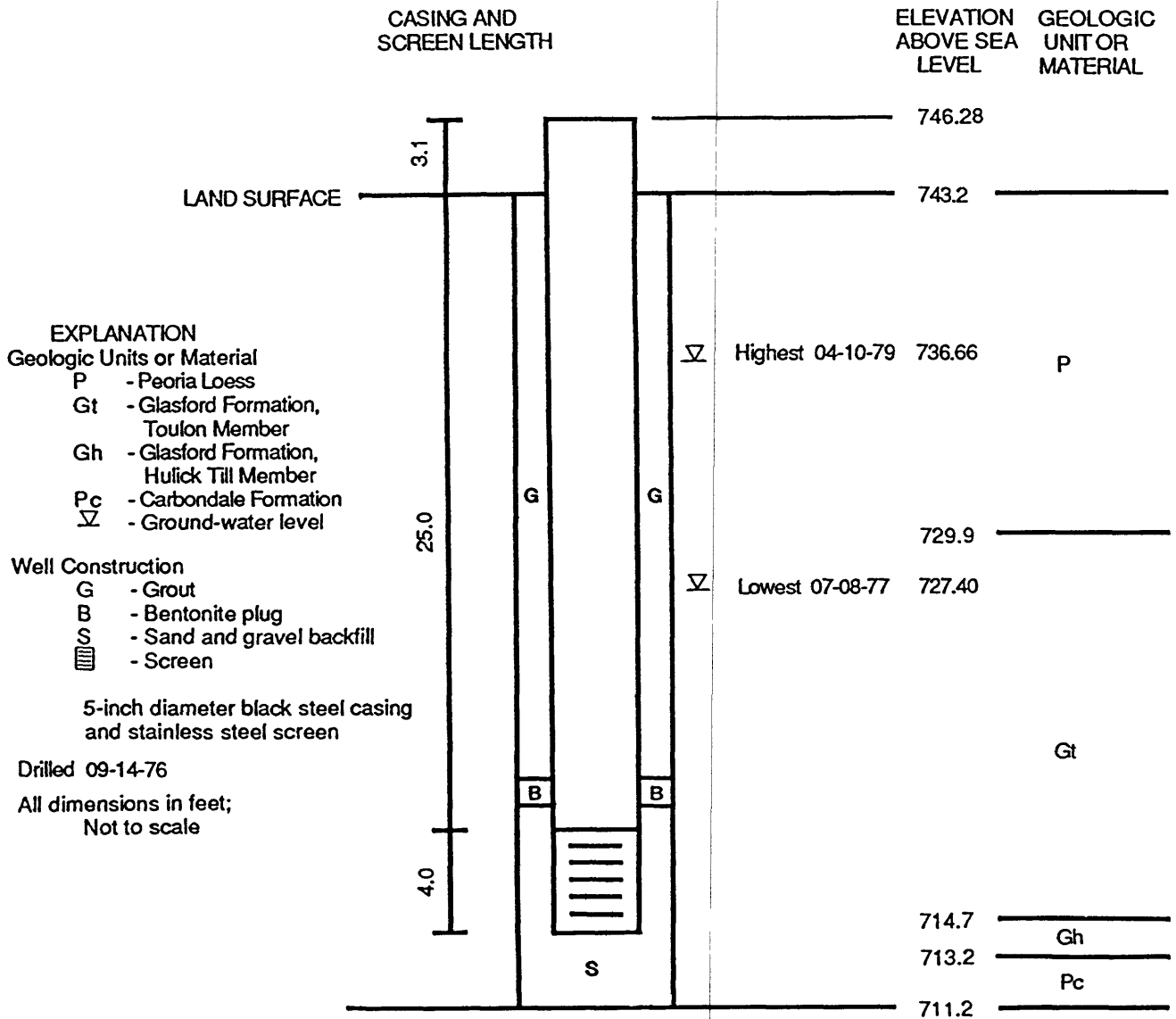


Figure 26.--Construction of well 524.

WELL 525

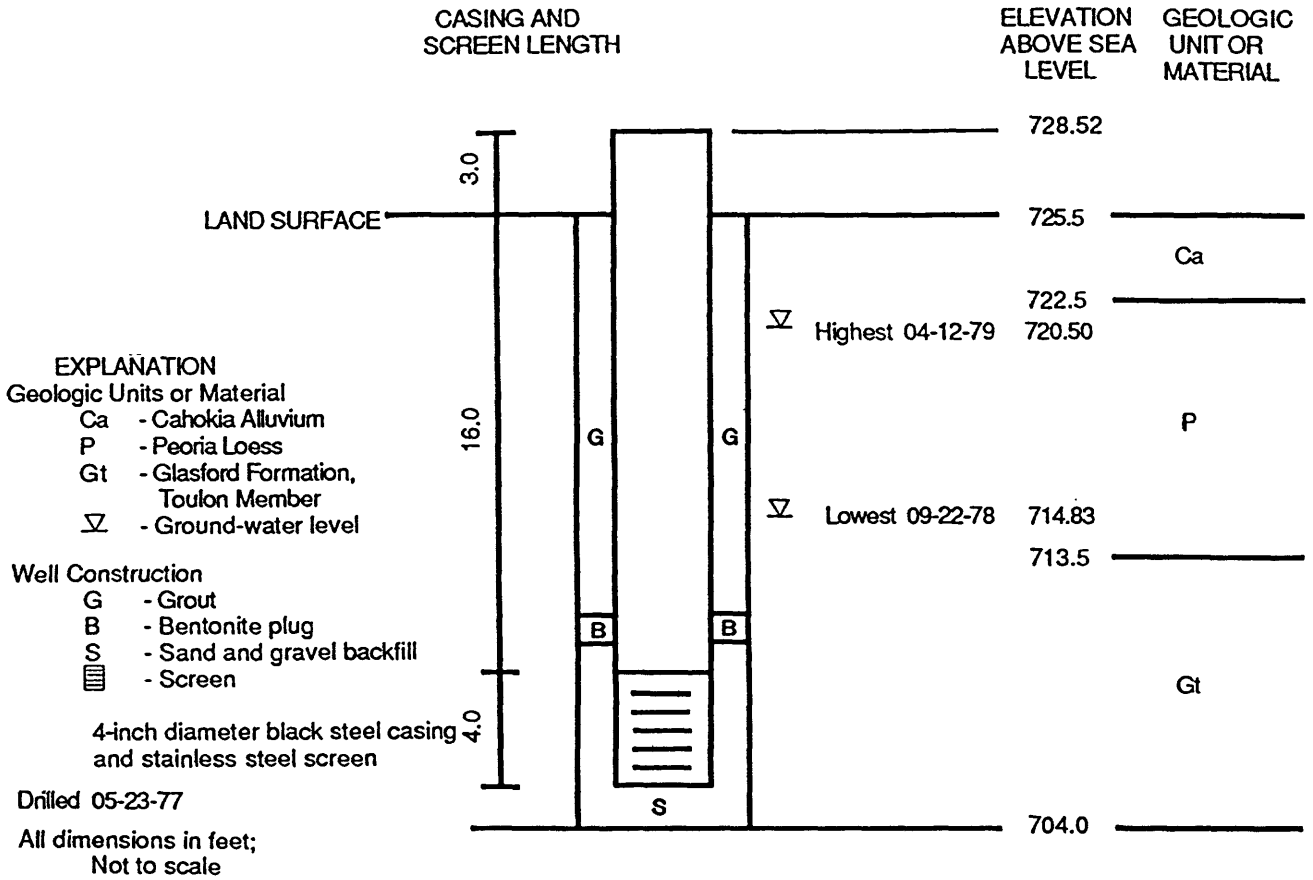


Figure 27.--Construction of well 525.

WELL 526

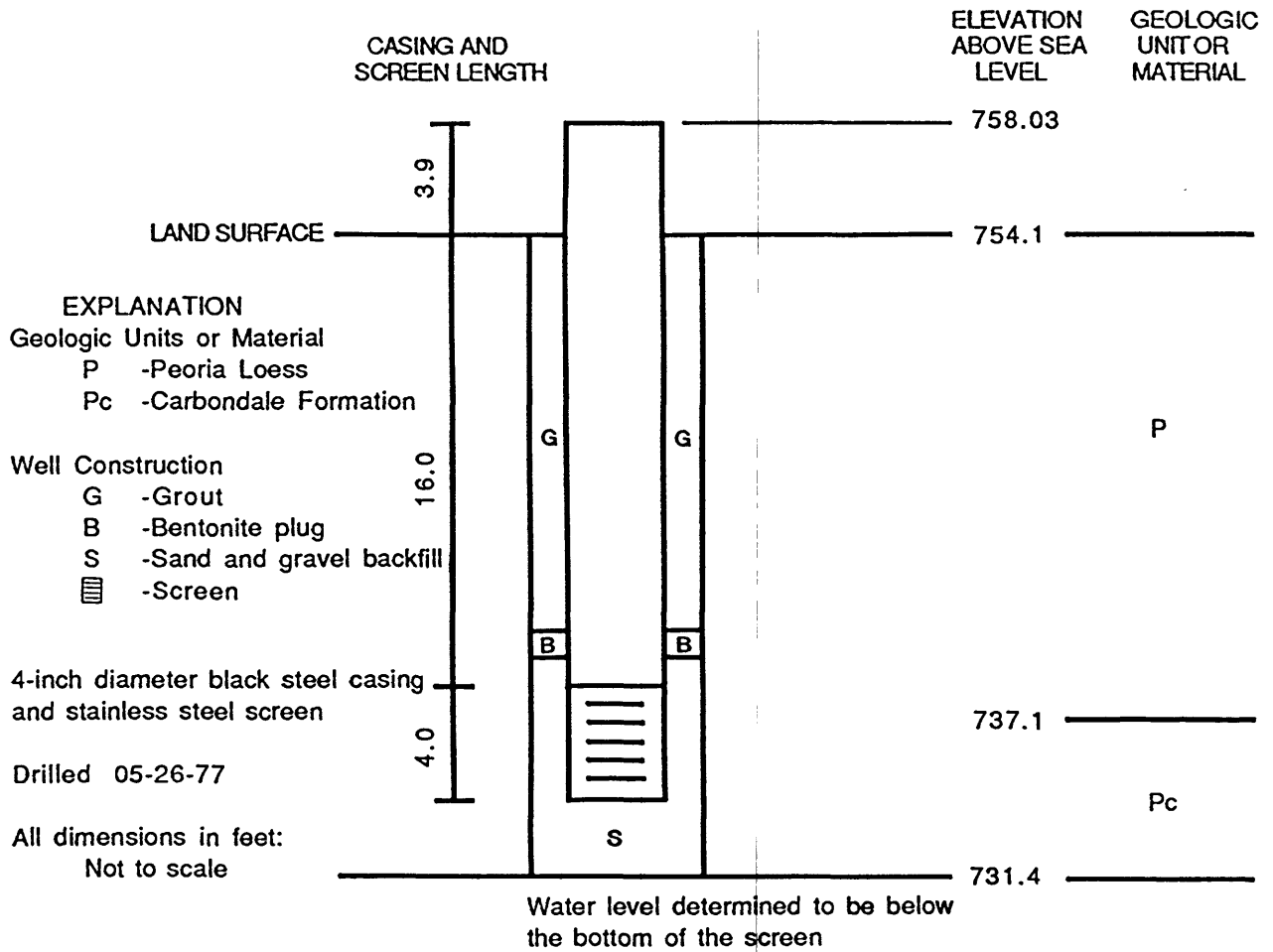


Figure 28.--Construction of well 526.

WELL 527

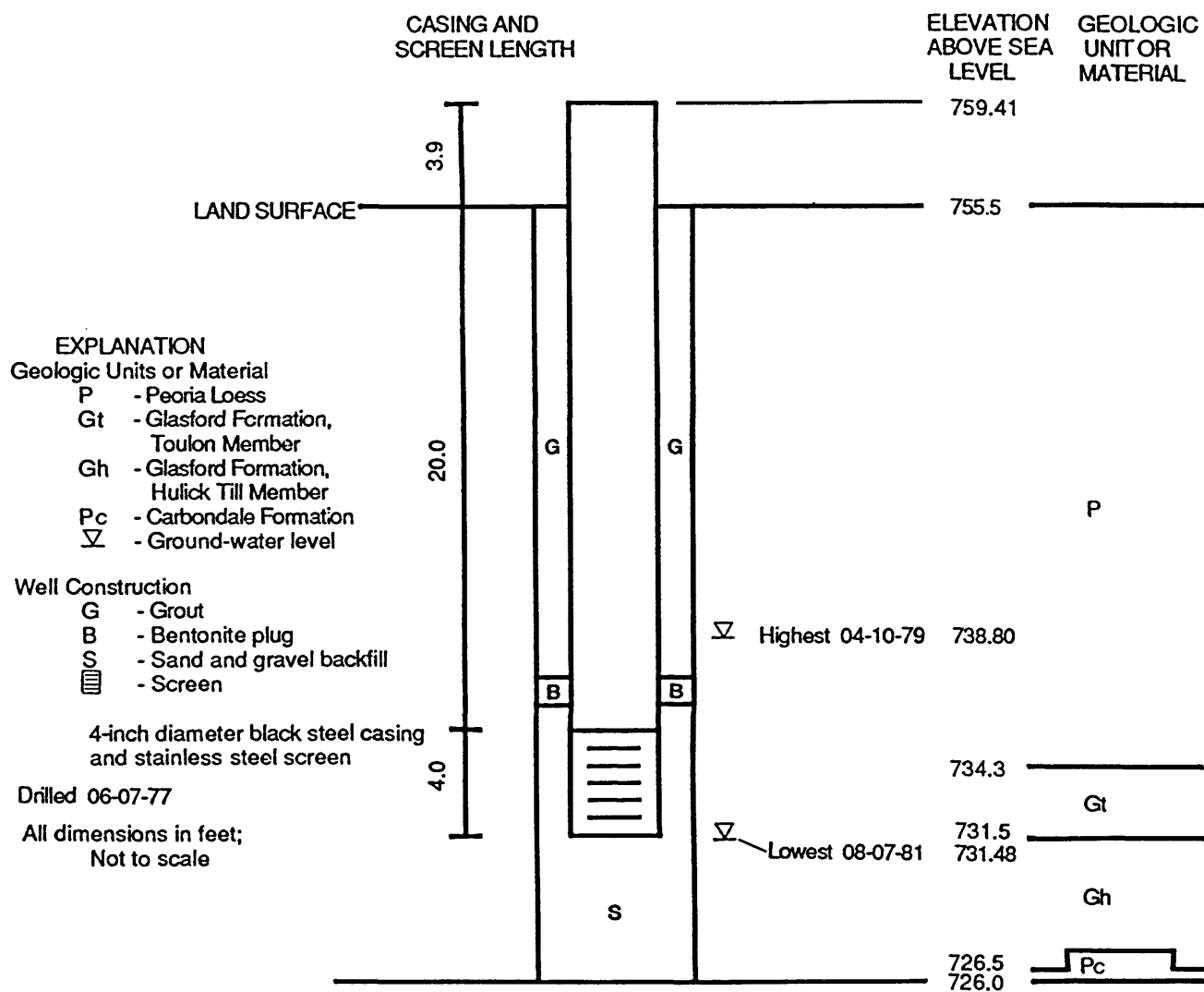


Figure 29.--Construction of well 527.

WELL 528

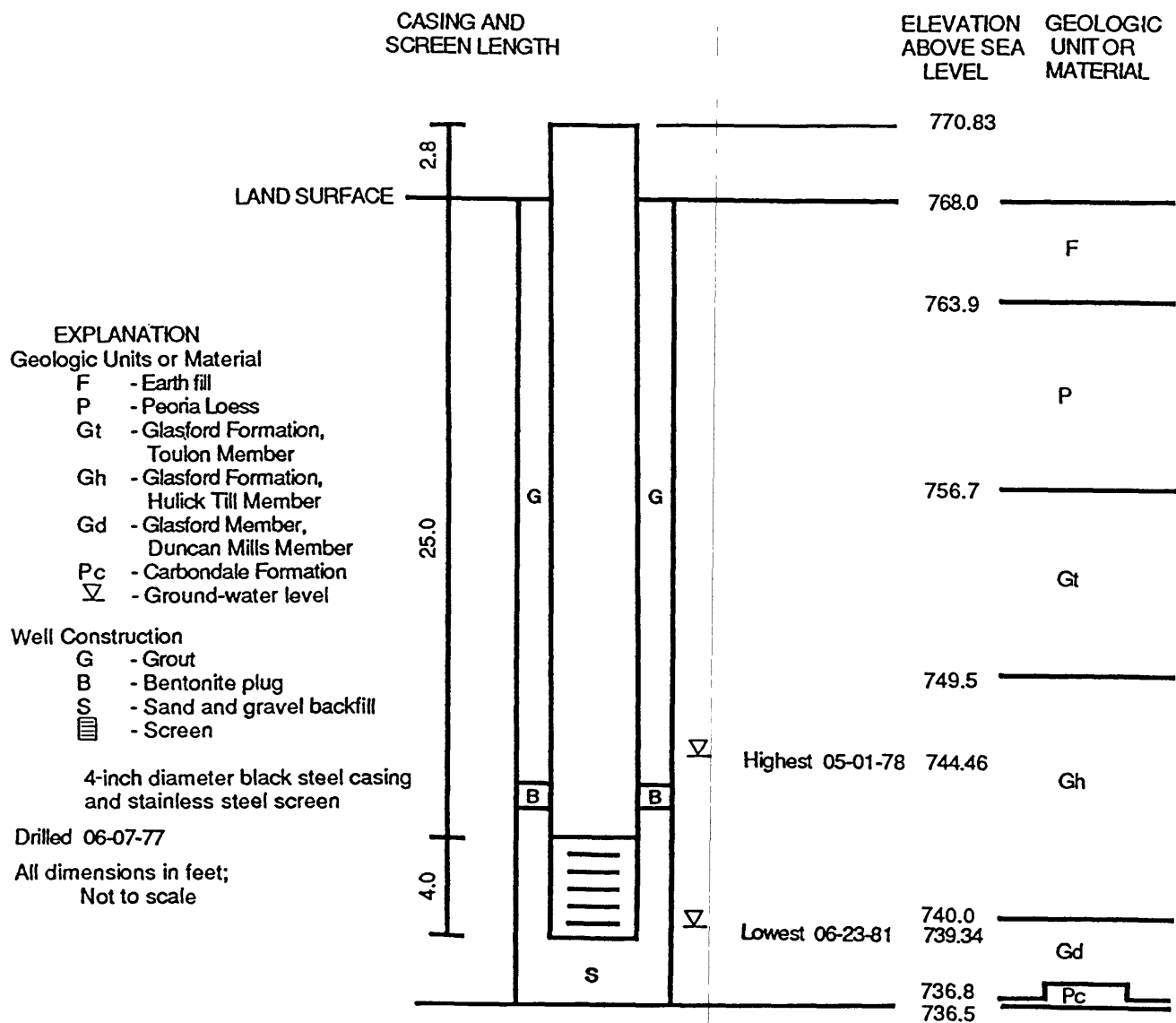


Figure 30.--Construction of well 528.

WELL 529

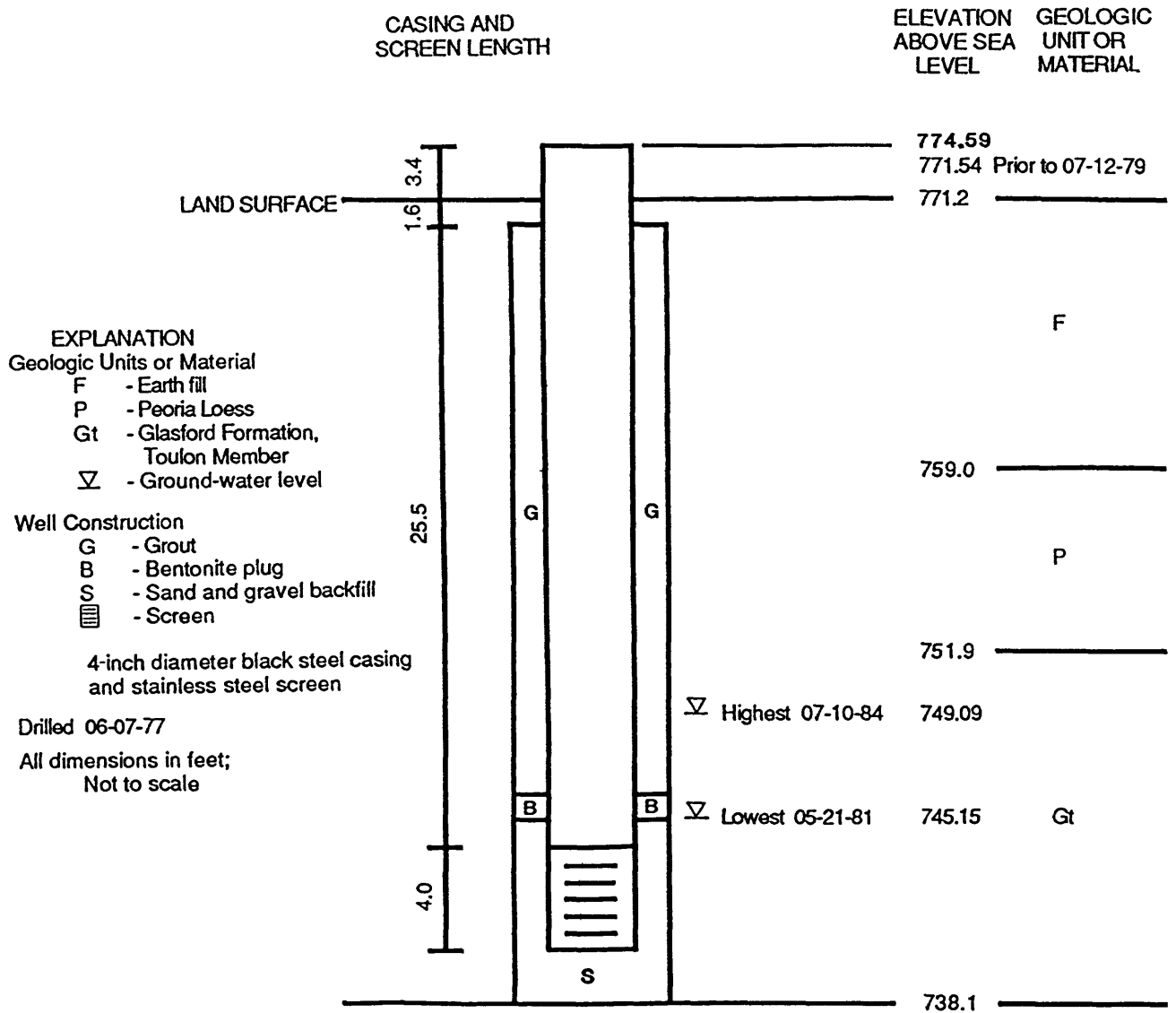


Figure 31.--Construction of well 529.

WELL 530

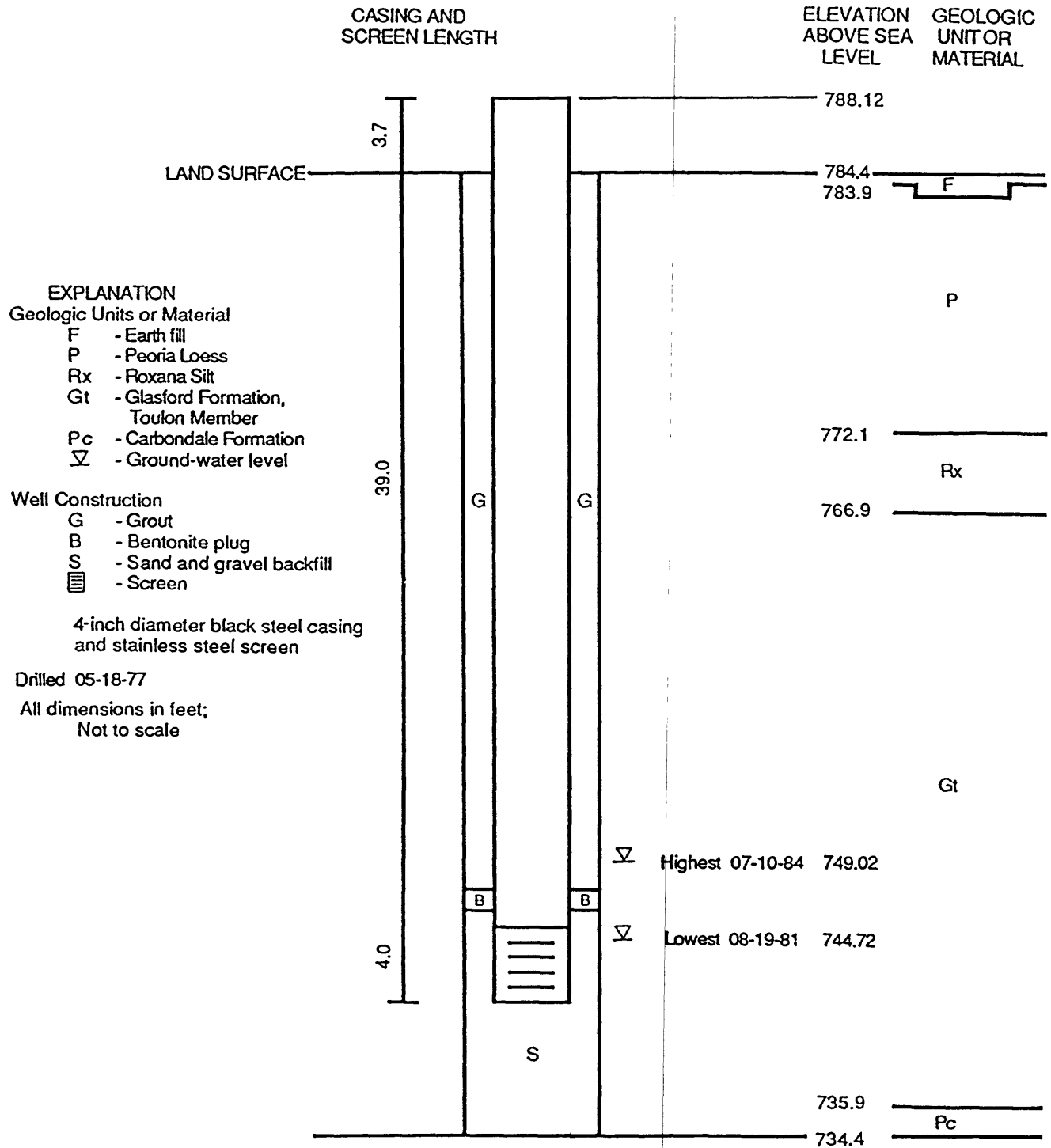


Figure 32.--Construction of well 530.

WELL 531

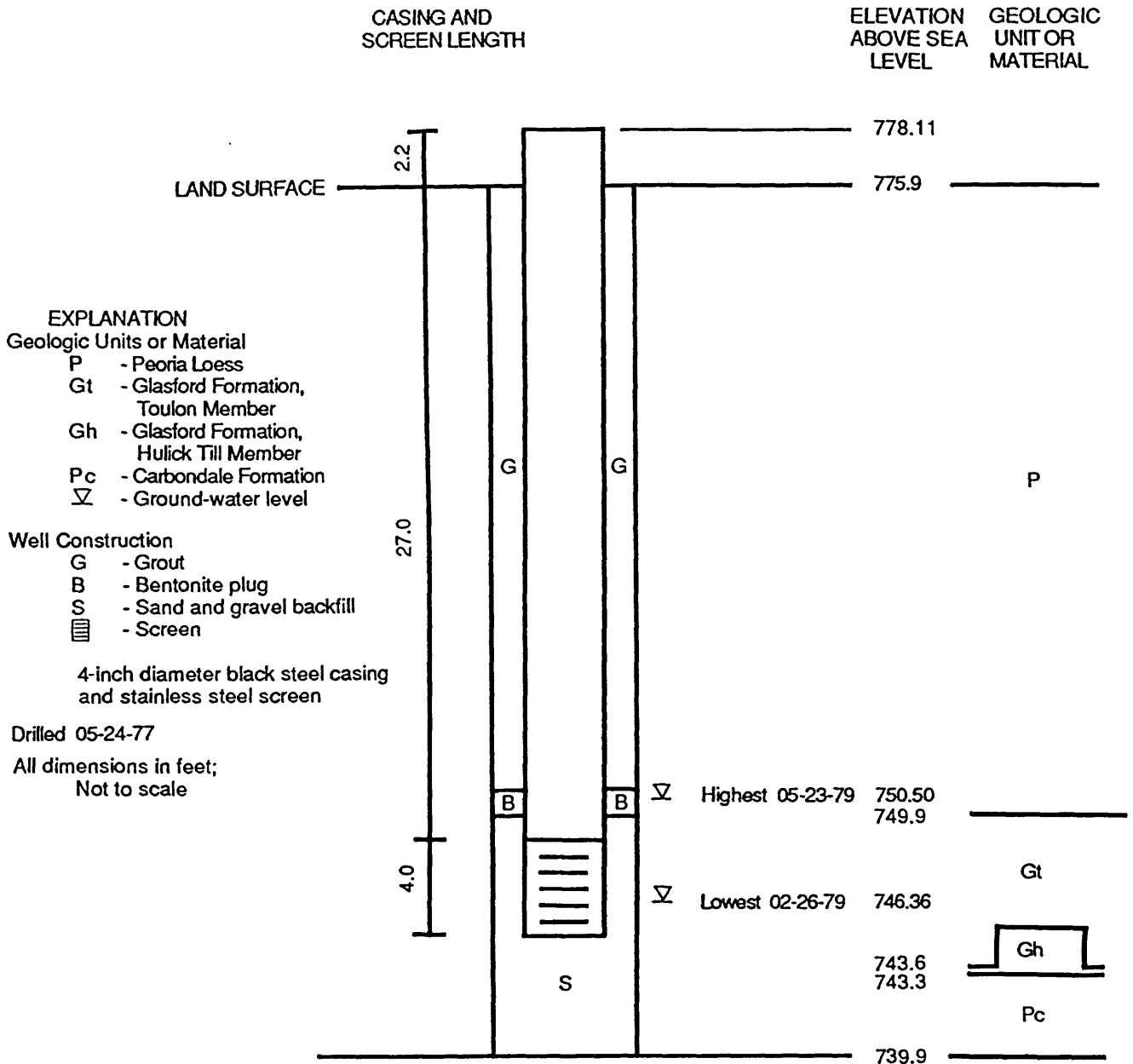


Figure 33.--Construction of well 531.

WELL 532

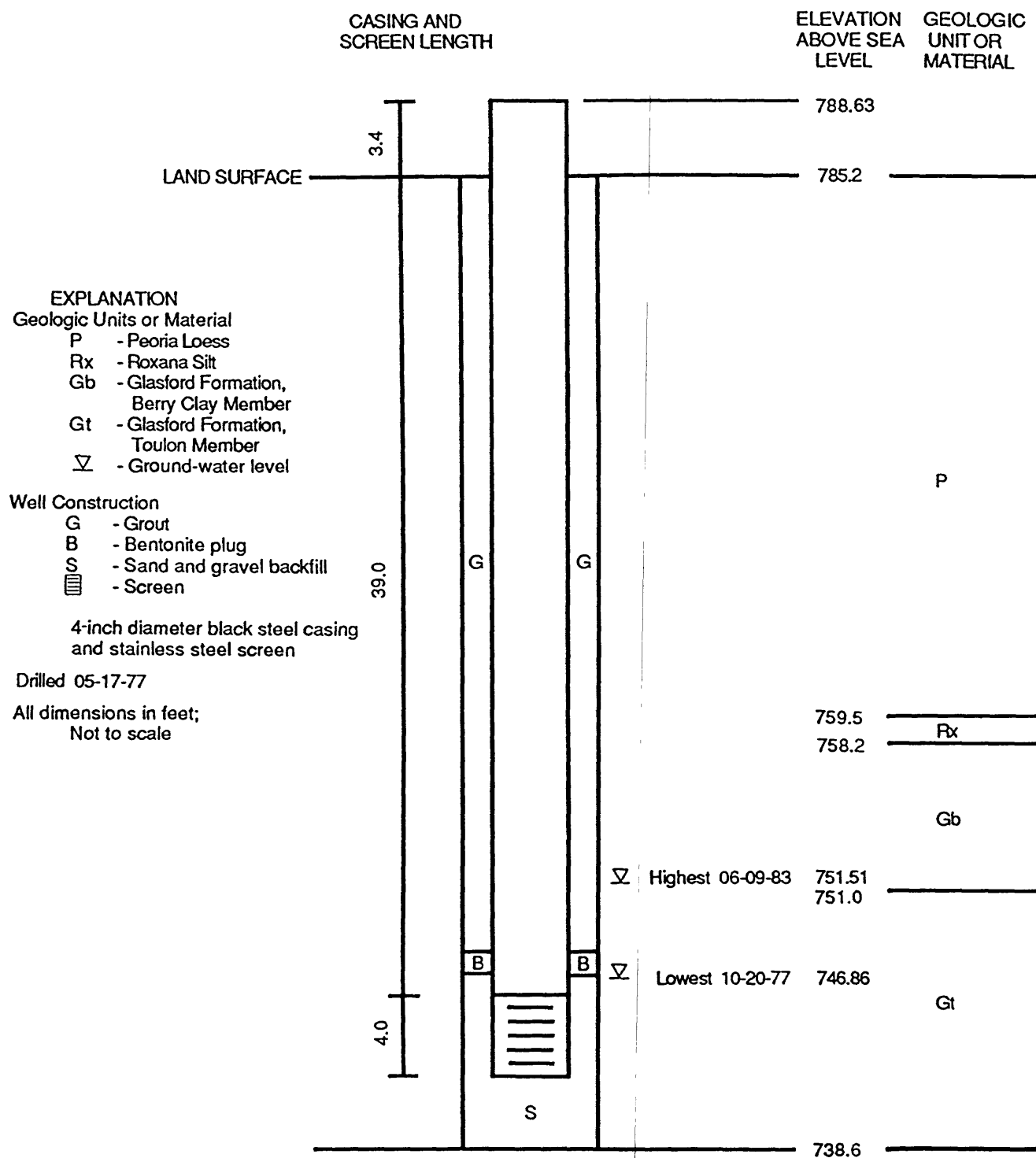


Figure 34.--Construction of well 532.

WELL 533

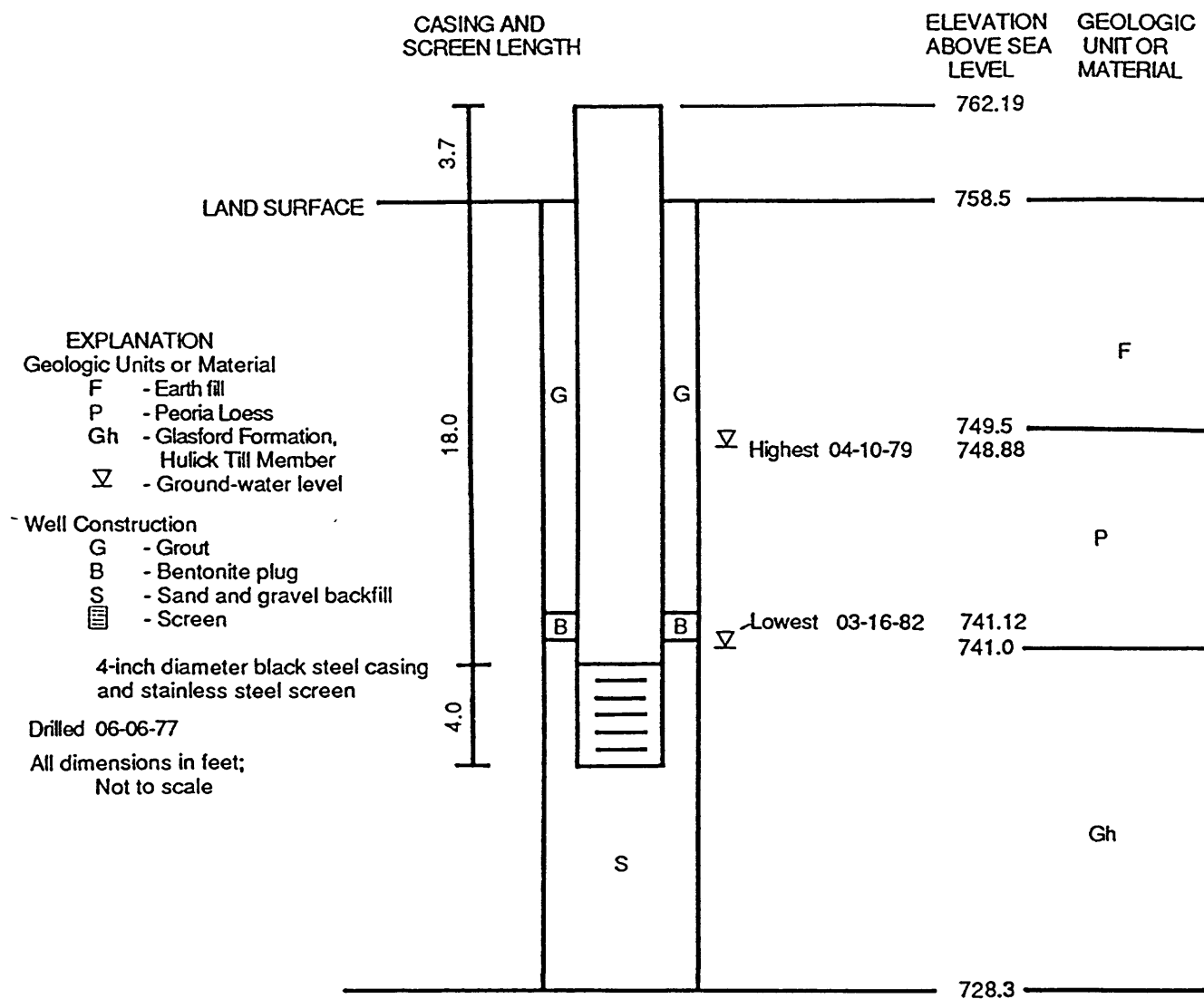


Figure 35.--Construction of well 533.

WELL 534

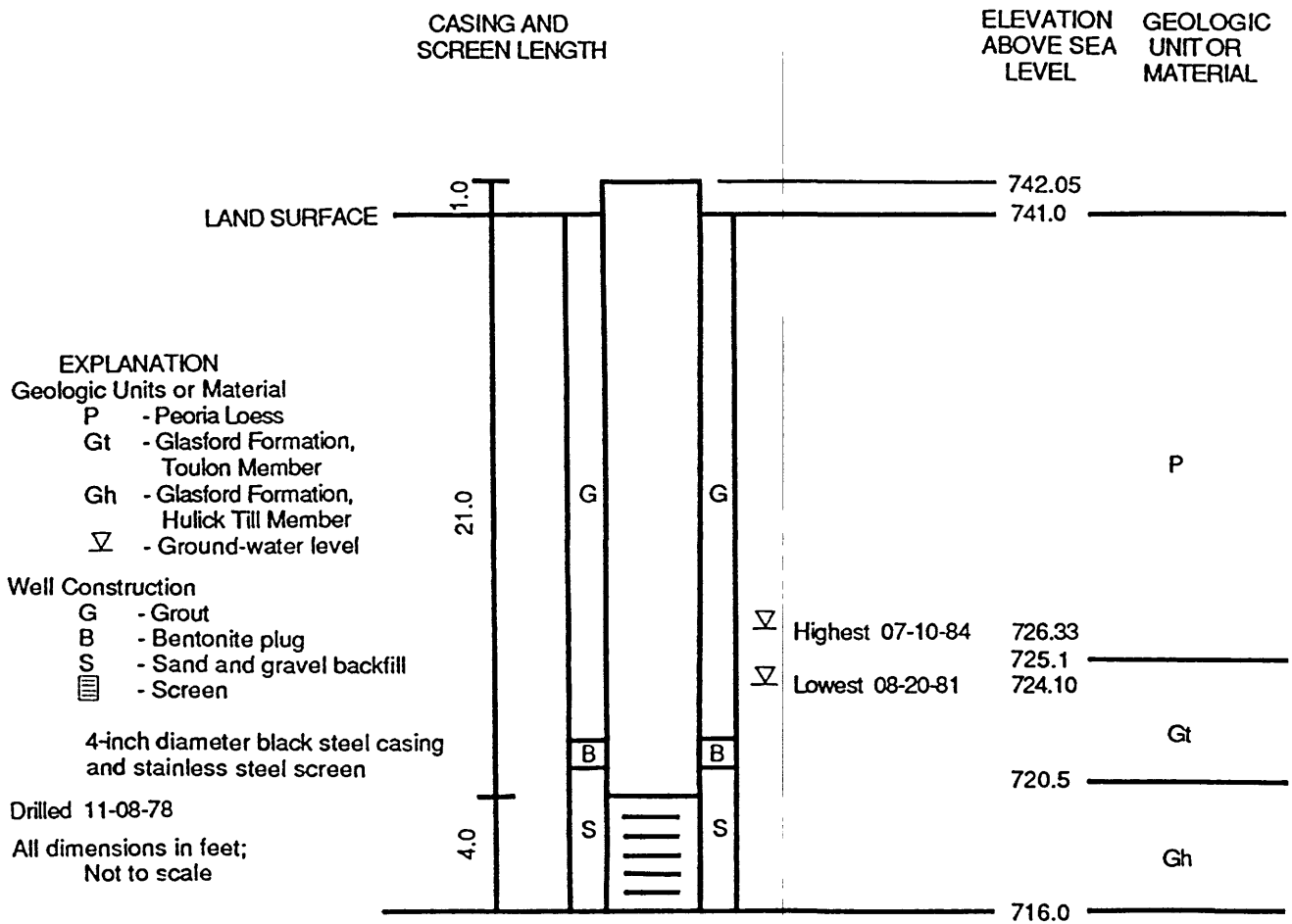


Figure 36.--Construction of well 534.

WELL 535

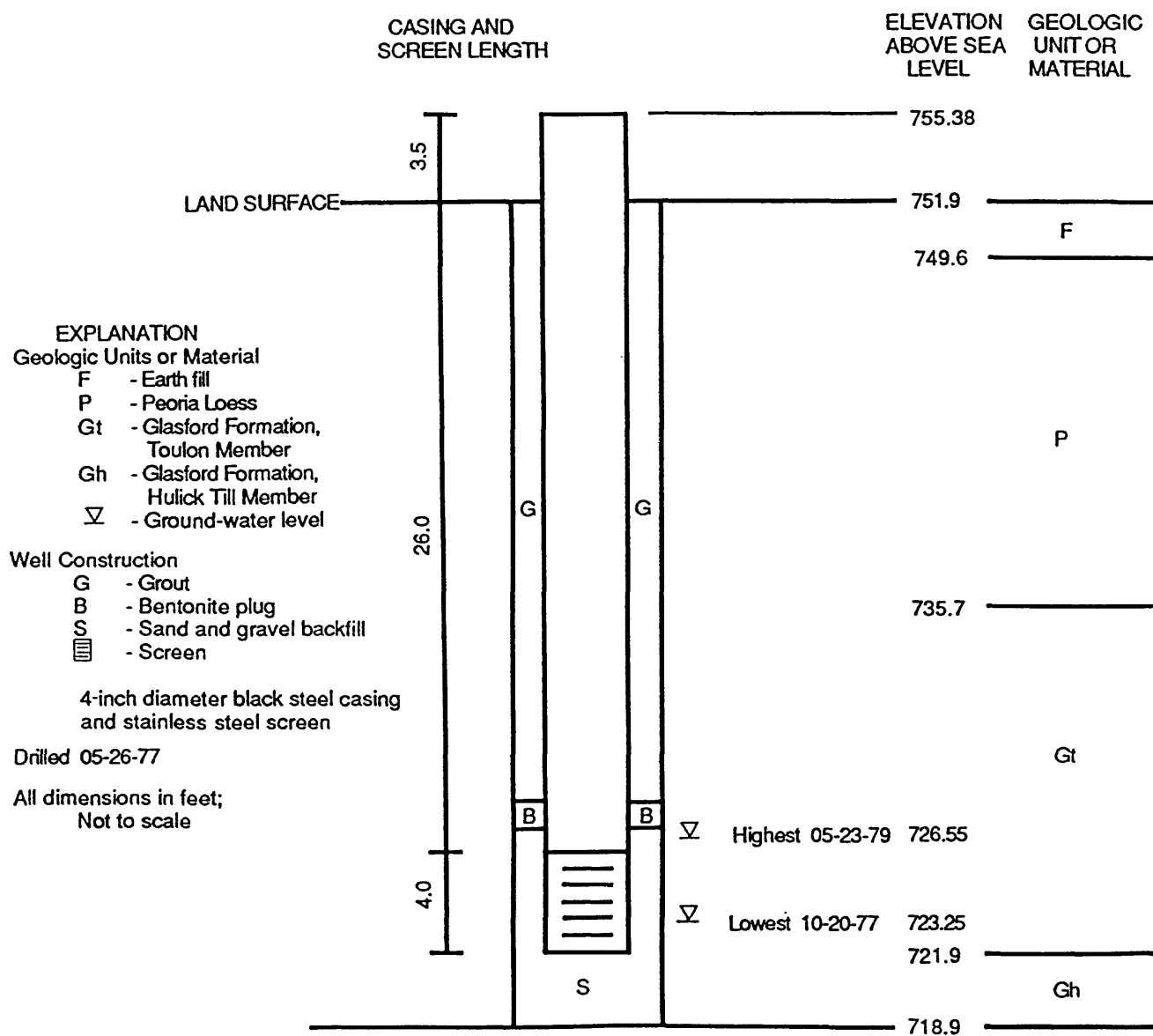


Figure 37.--Construction of well 535.

WELL 536

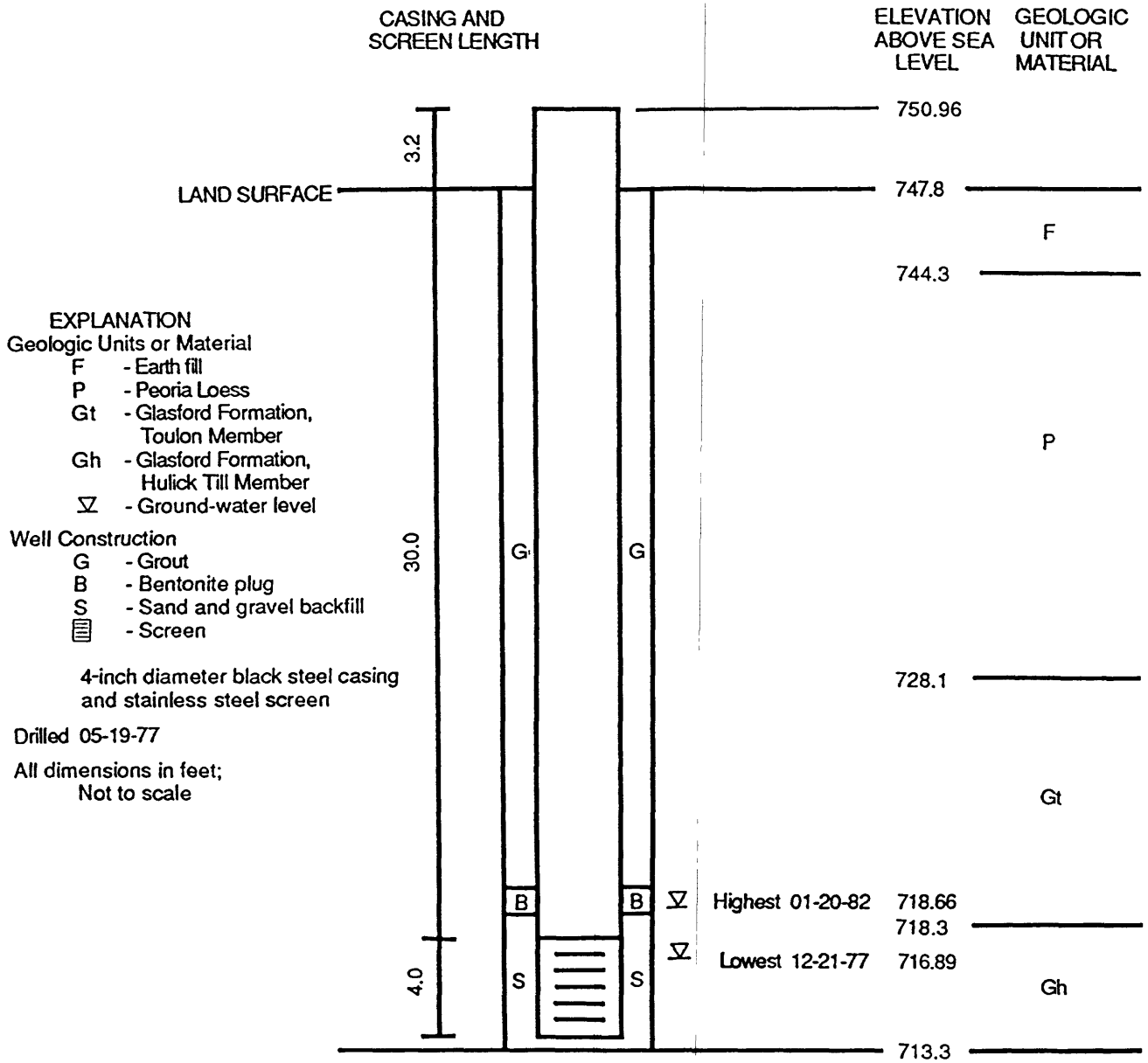


Figure 38.--Construction of well 536.

WELL 537

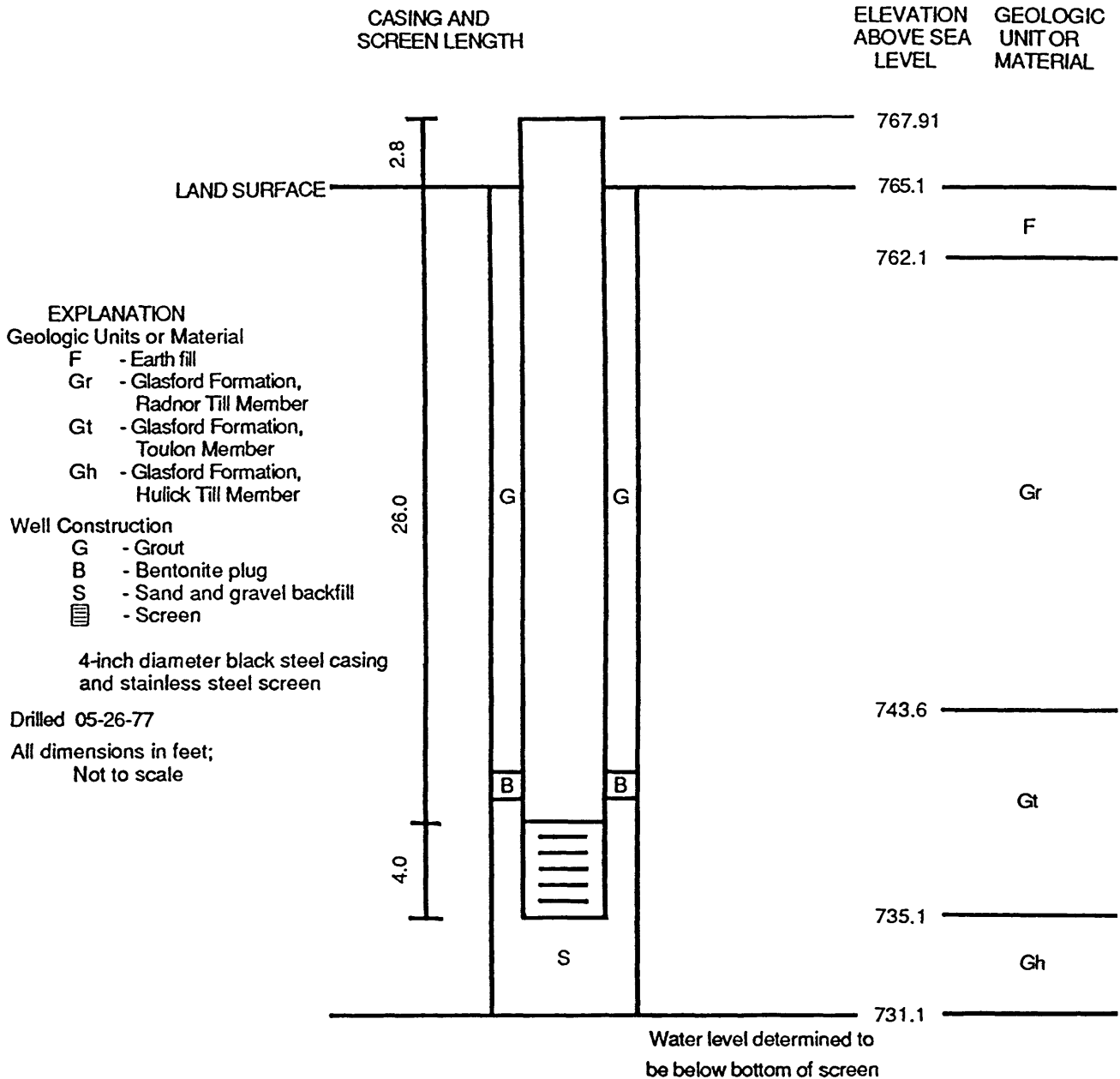


Figure 39.--Construction of well 537.

WELL 538

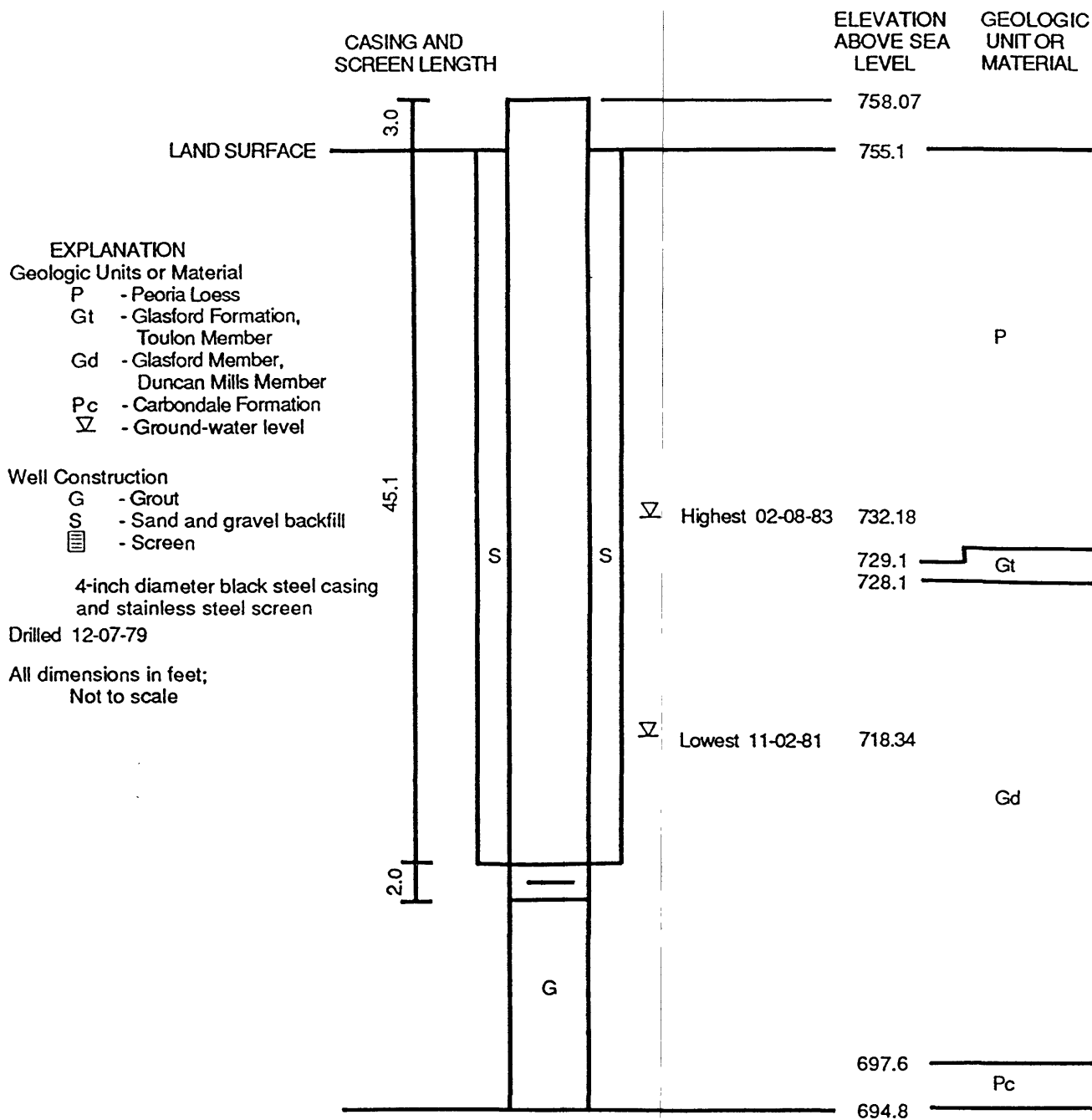


Figure 40.--Construction of well 538.

WELL 539

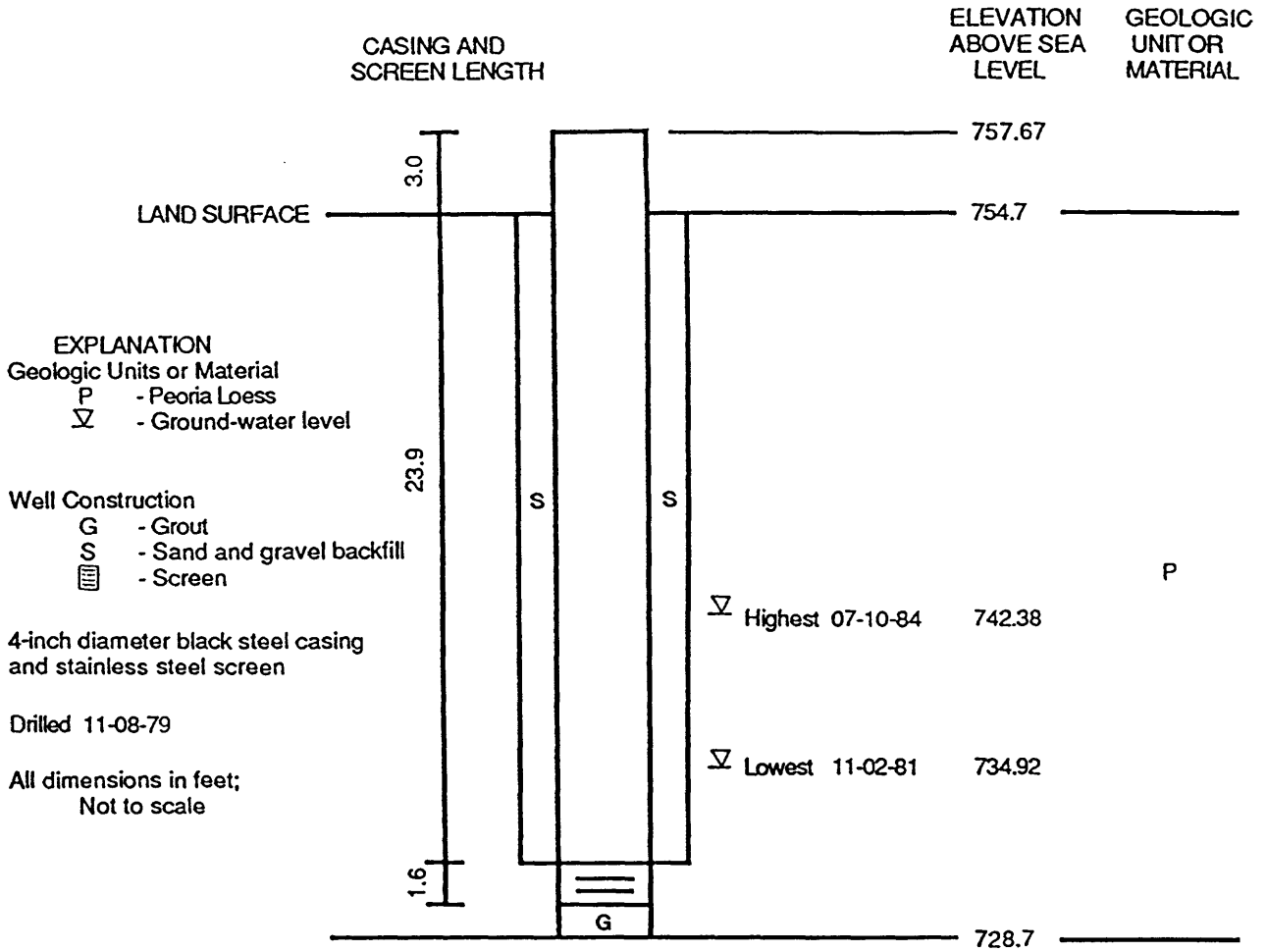


Figure 41.--Construction of well 539.

WELL 540

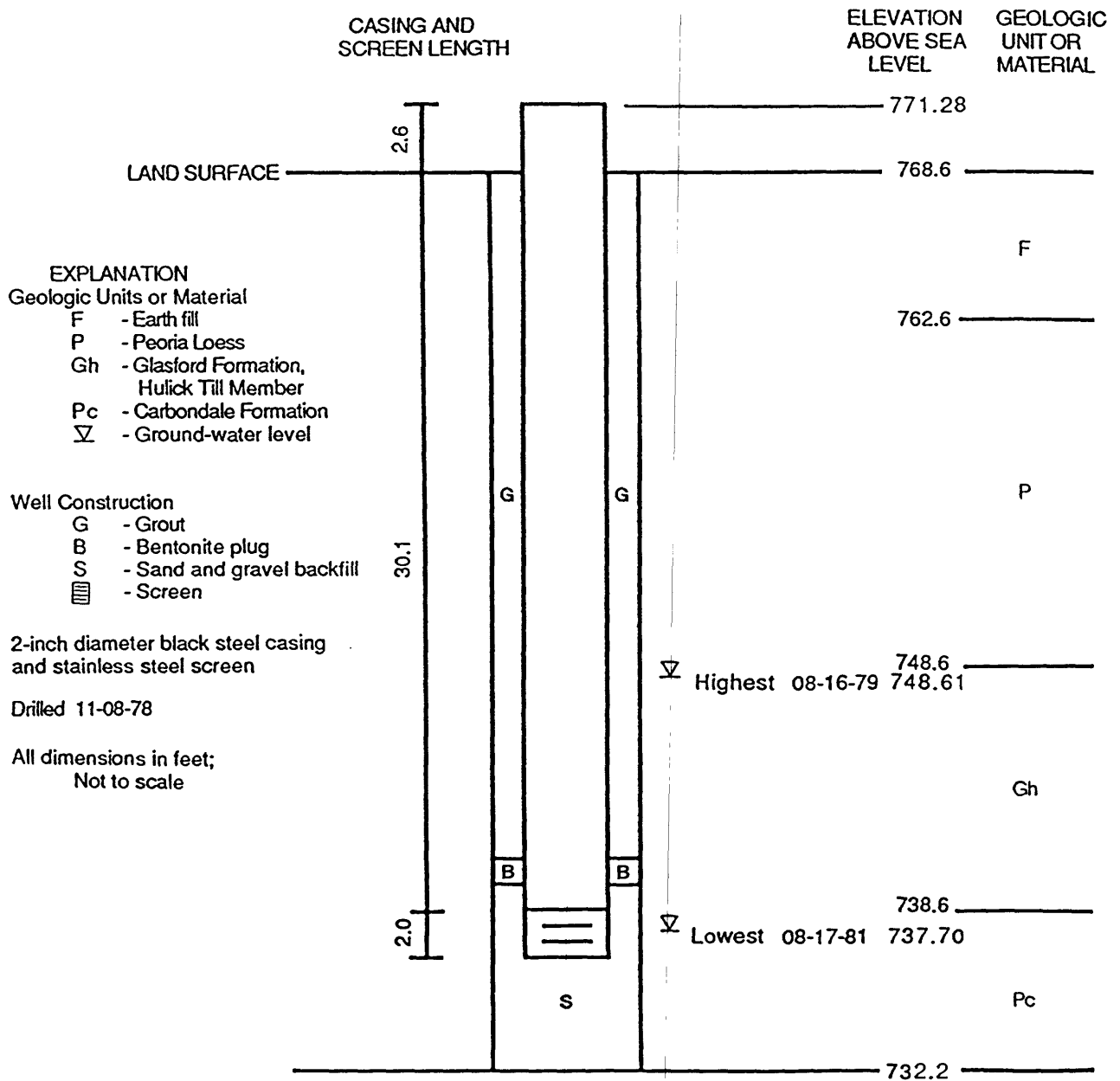


Figure 42.--Construction of well 540.

WELL 541

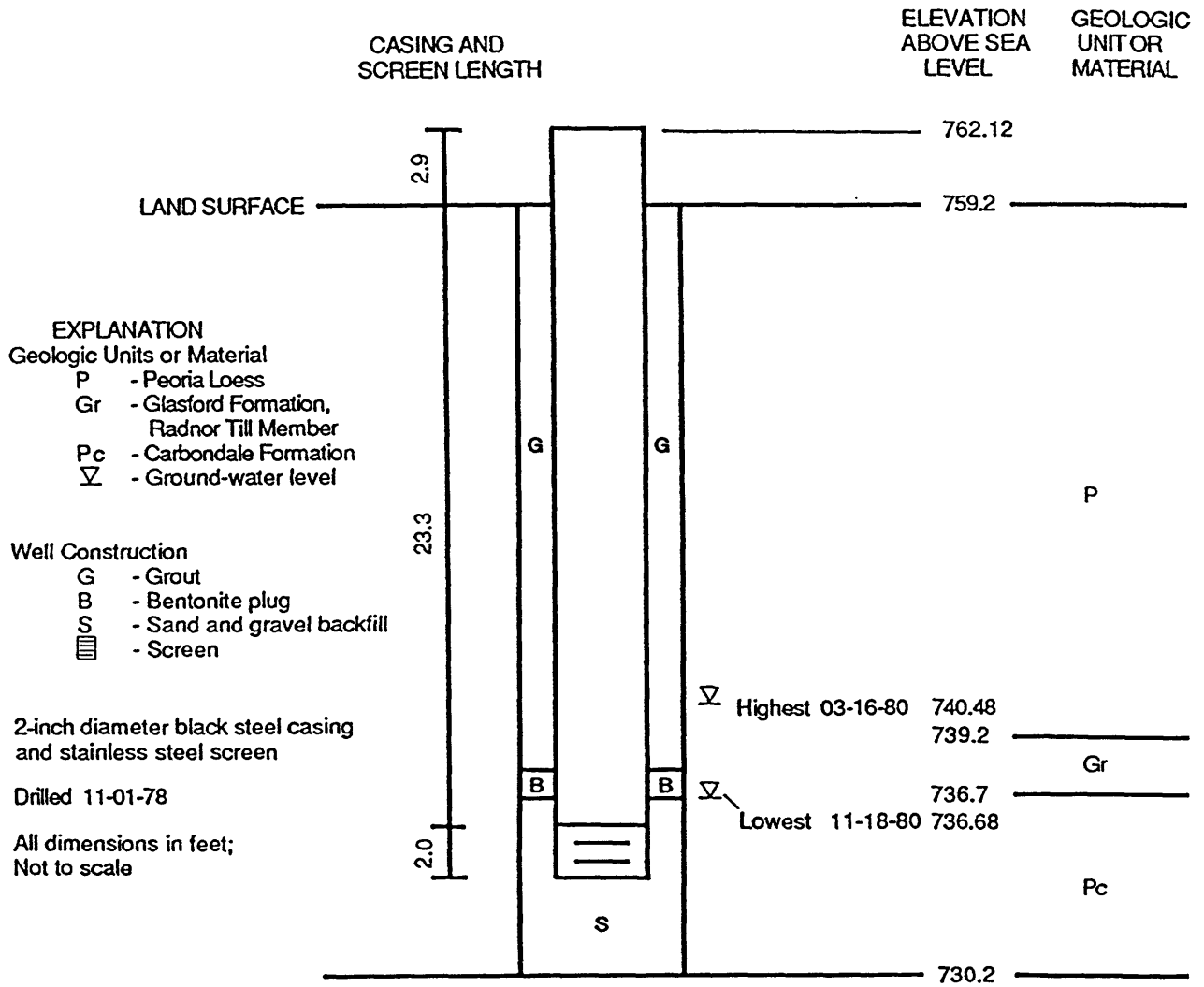


Figure 43.--Construction of well 541.

WELL 542

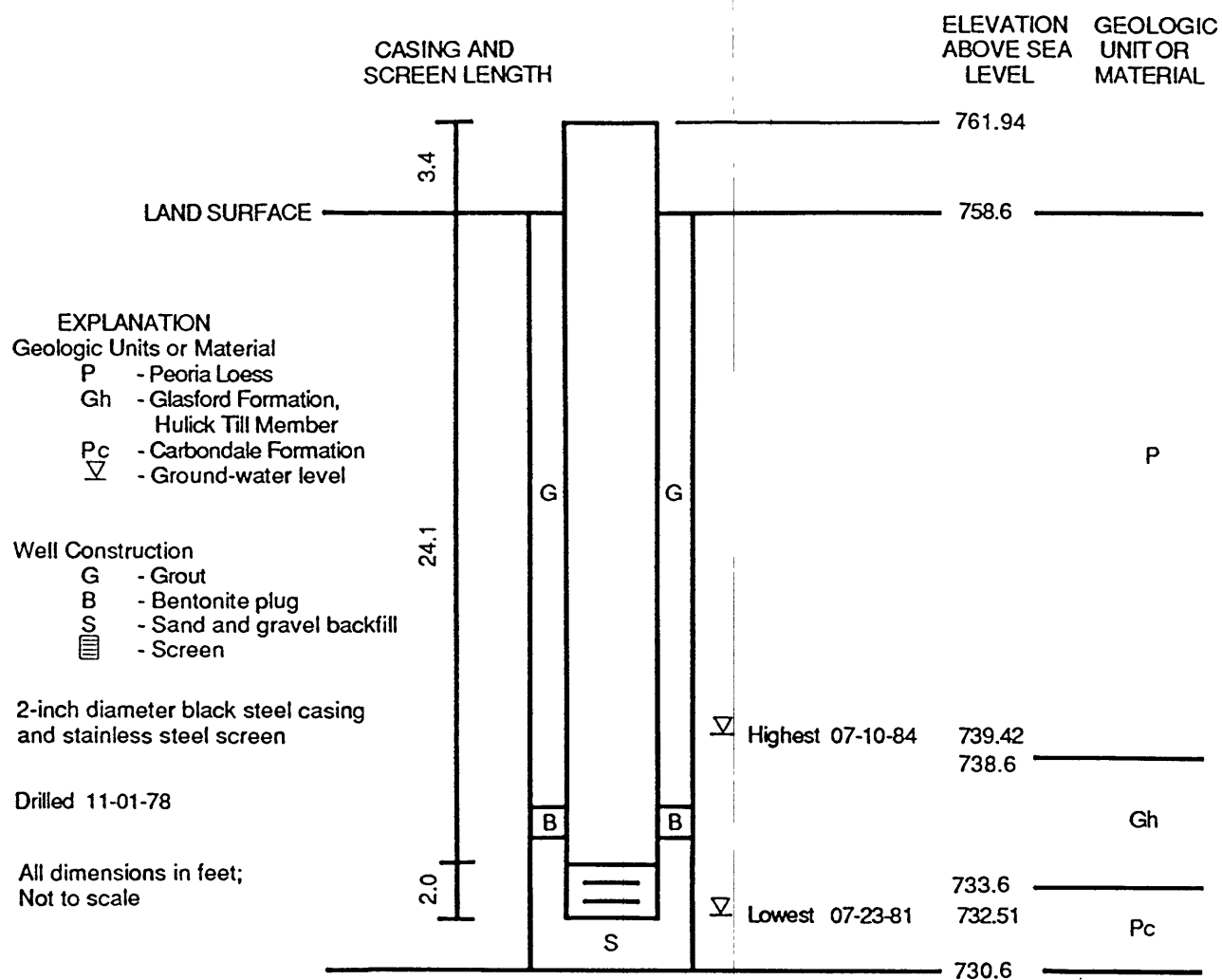


Figure 44.--Construction of well 542.

WELL 543

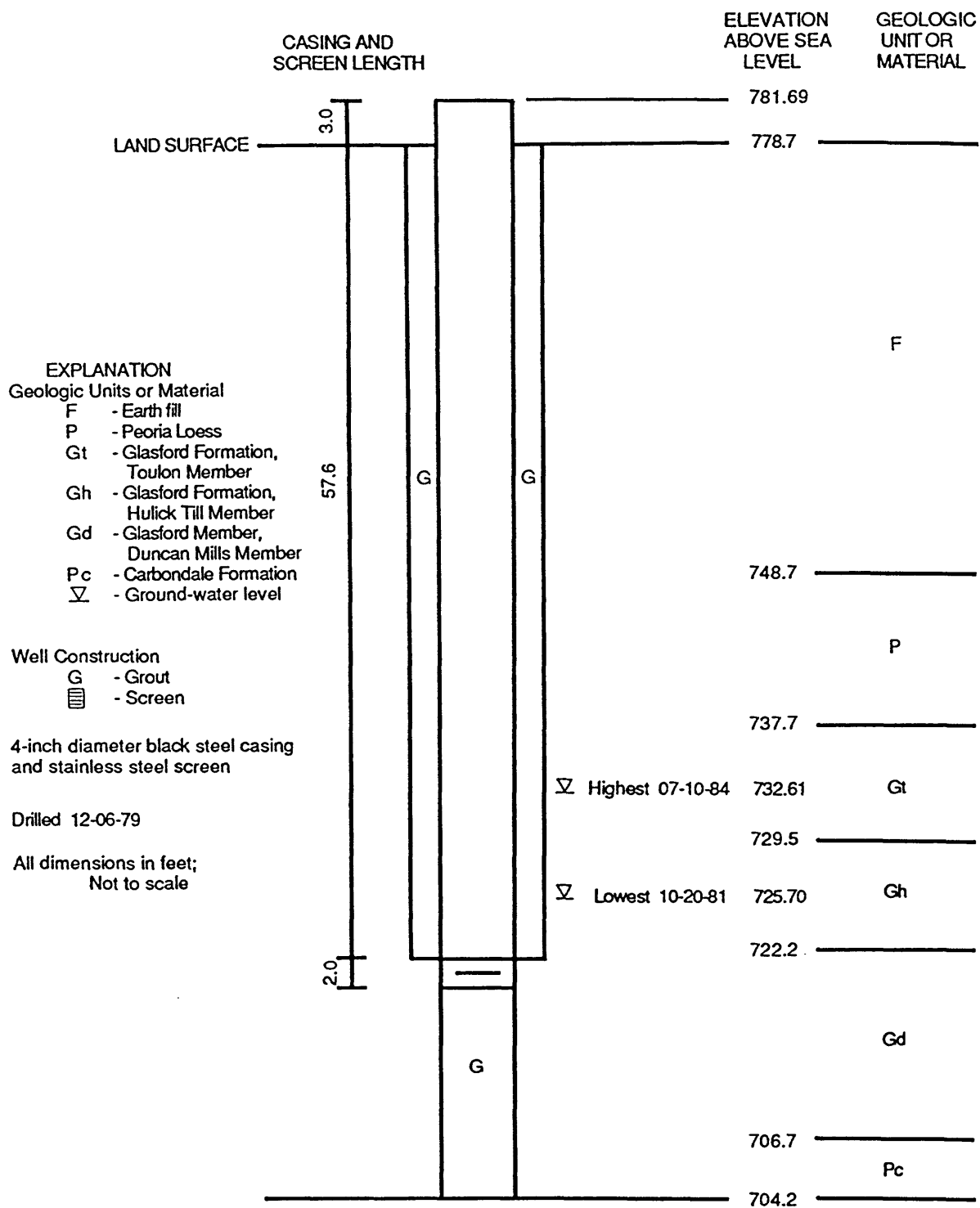


Figure 45.--Construction of well 543.

WELL 544

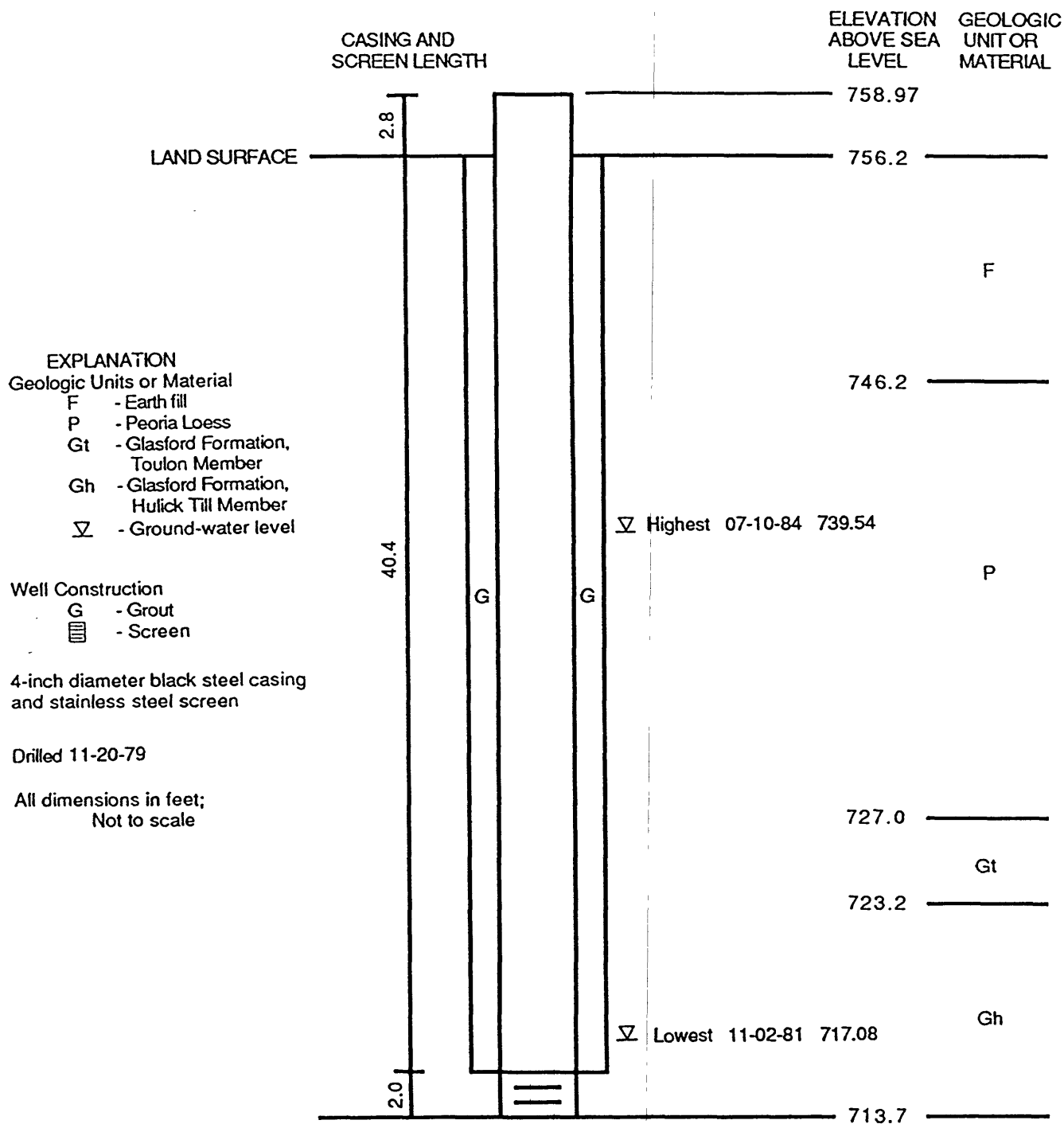


Figure 46.--Construction of well 544.

WELL 545

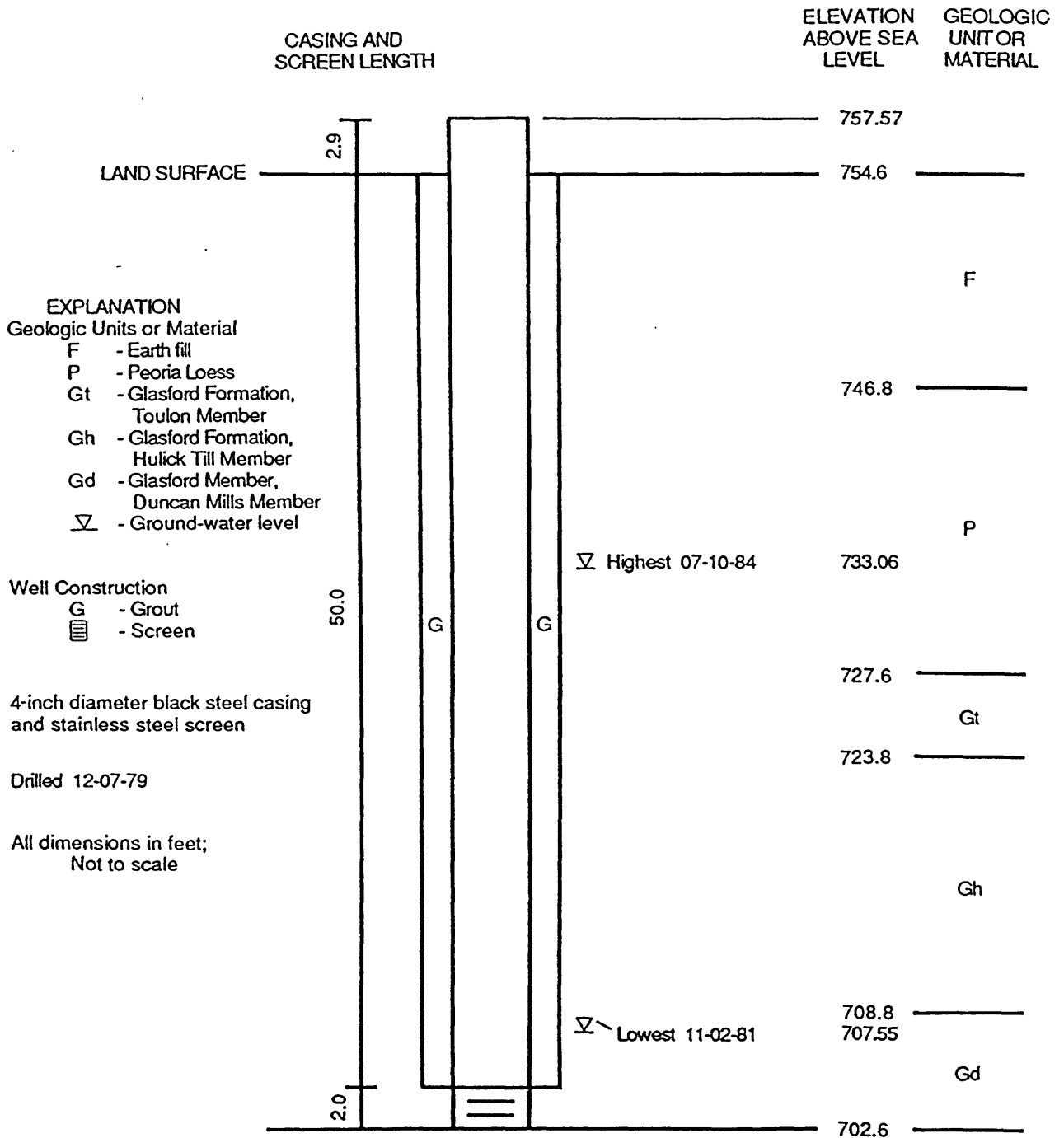


Figure 47.--Construction of well 545.

WELL 546

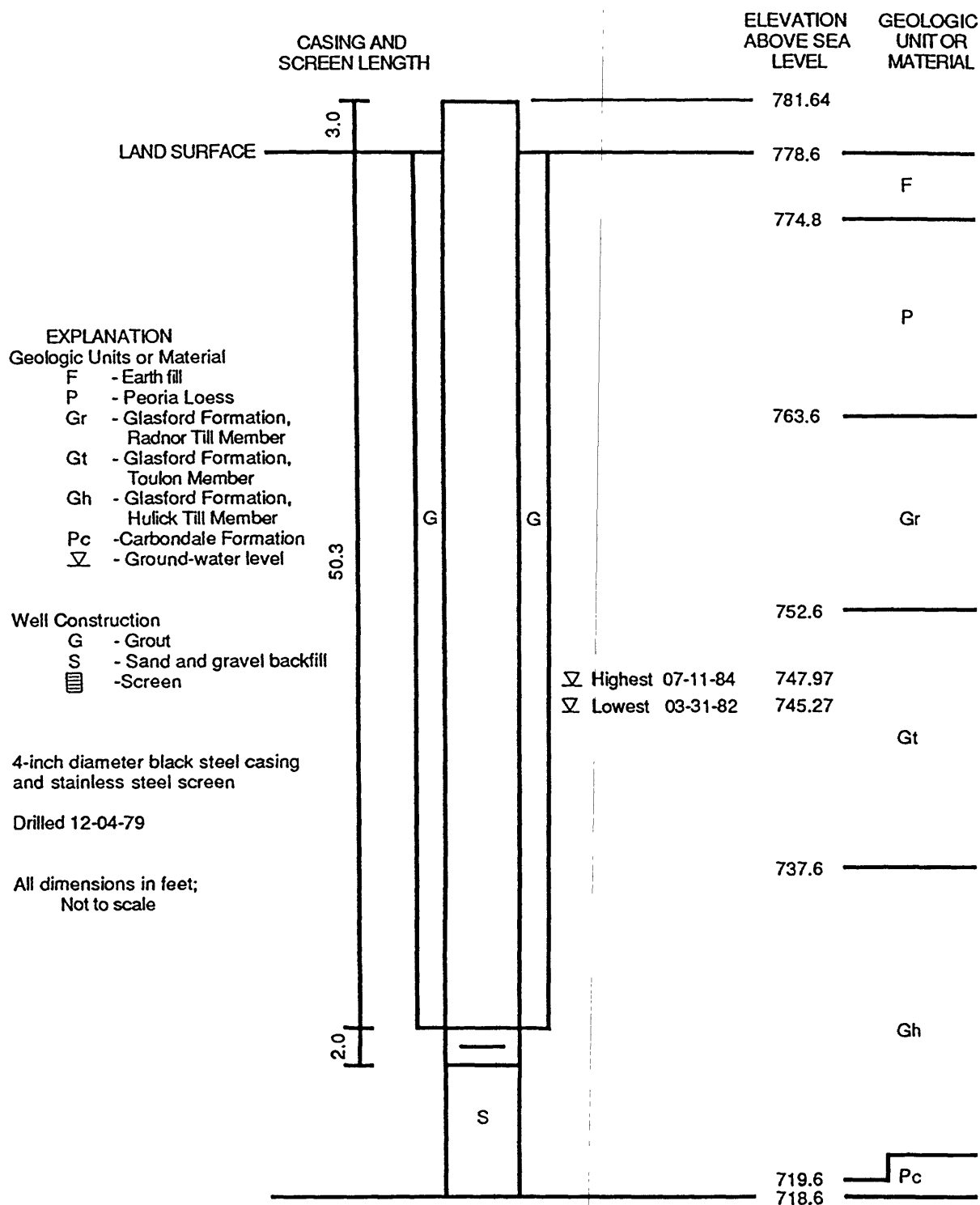


Figure 48.--Construction of well 546.

WELL 547

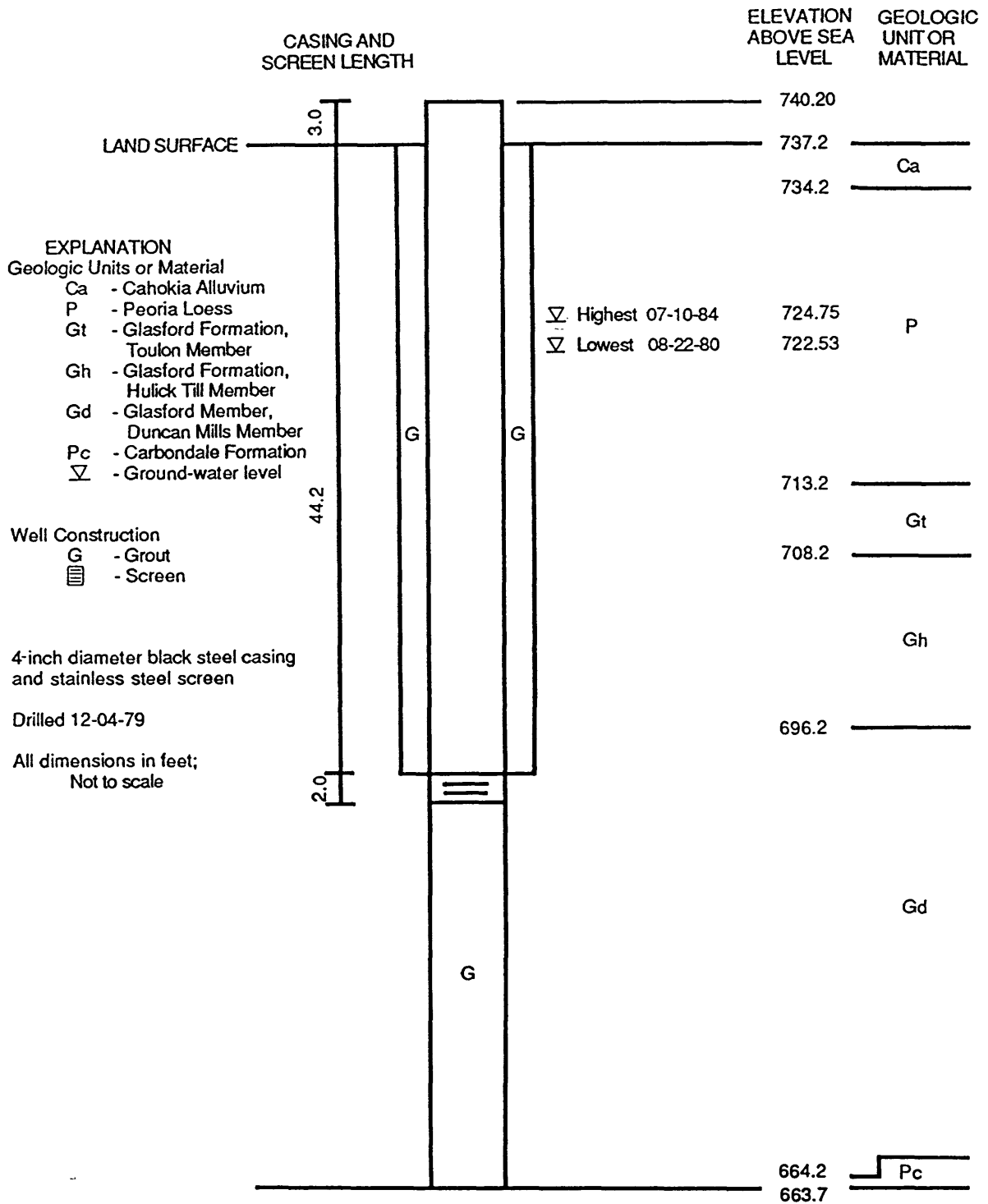


Figure 49.--Construction of well 547.

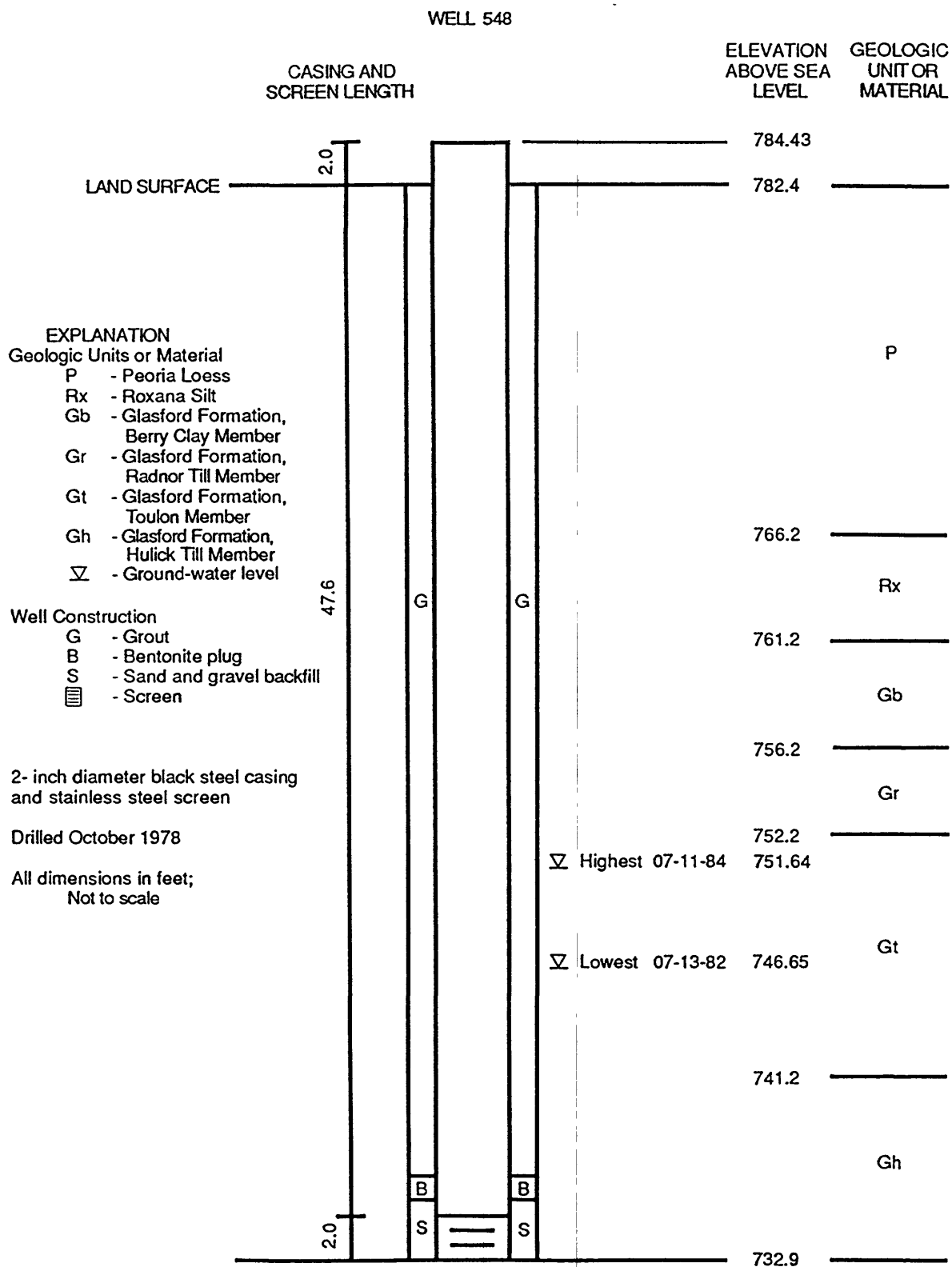


Figure 50.--Construction of well 548.

WELL 549

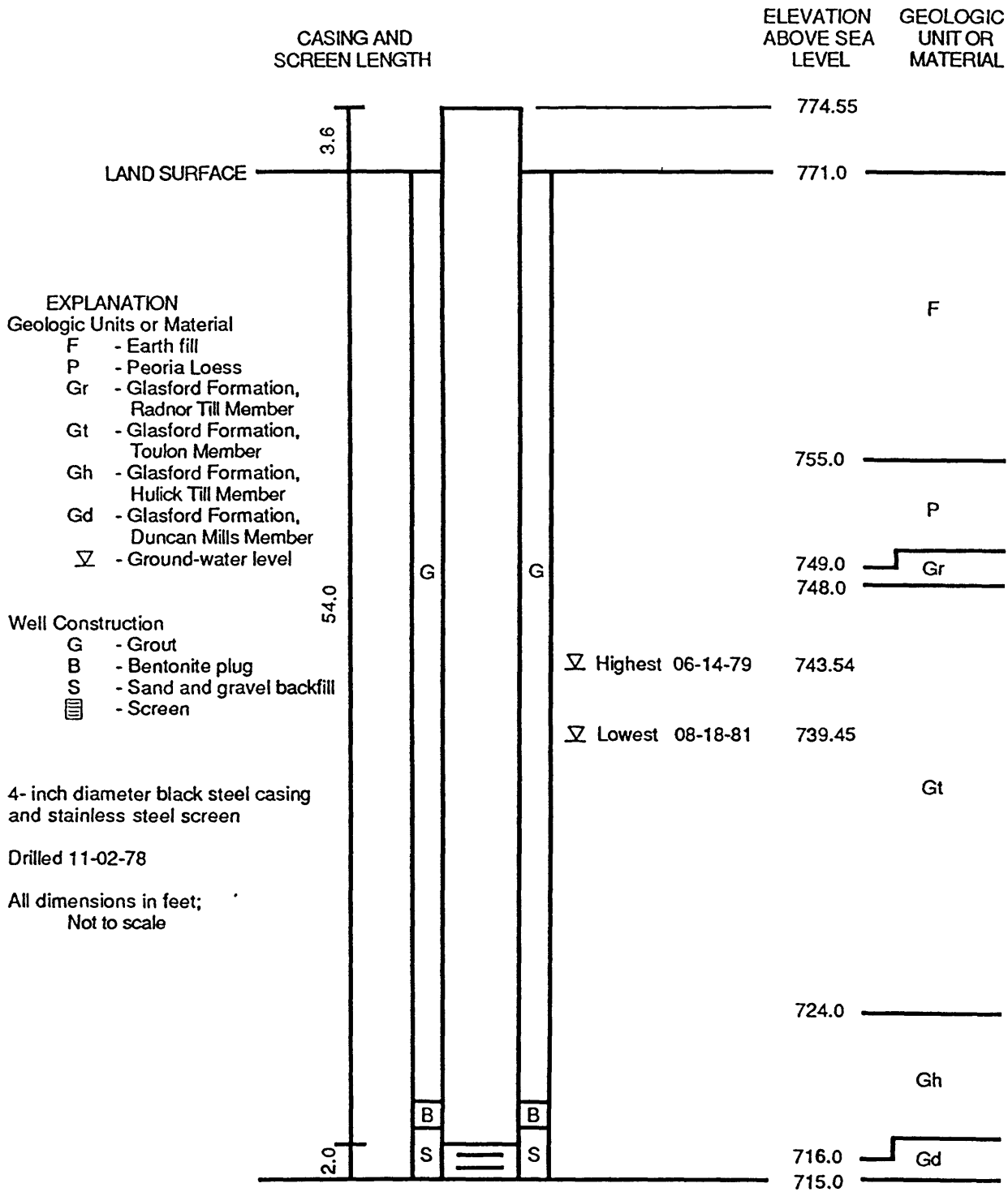


Figure 51.--Construction of well 549.

WELL 550

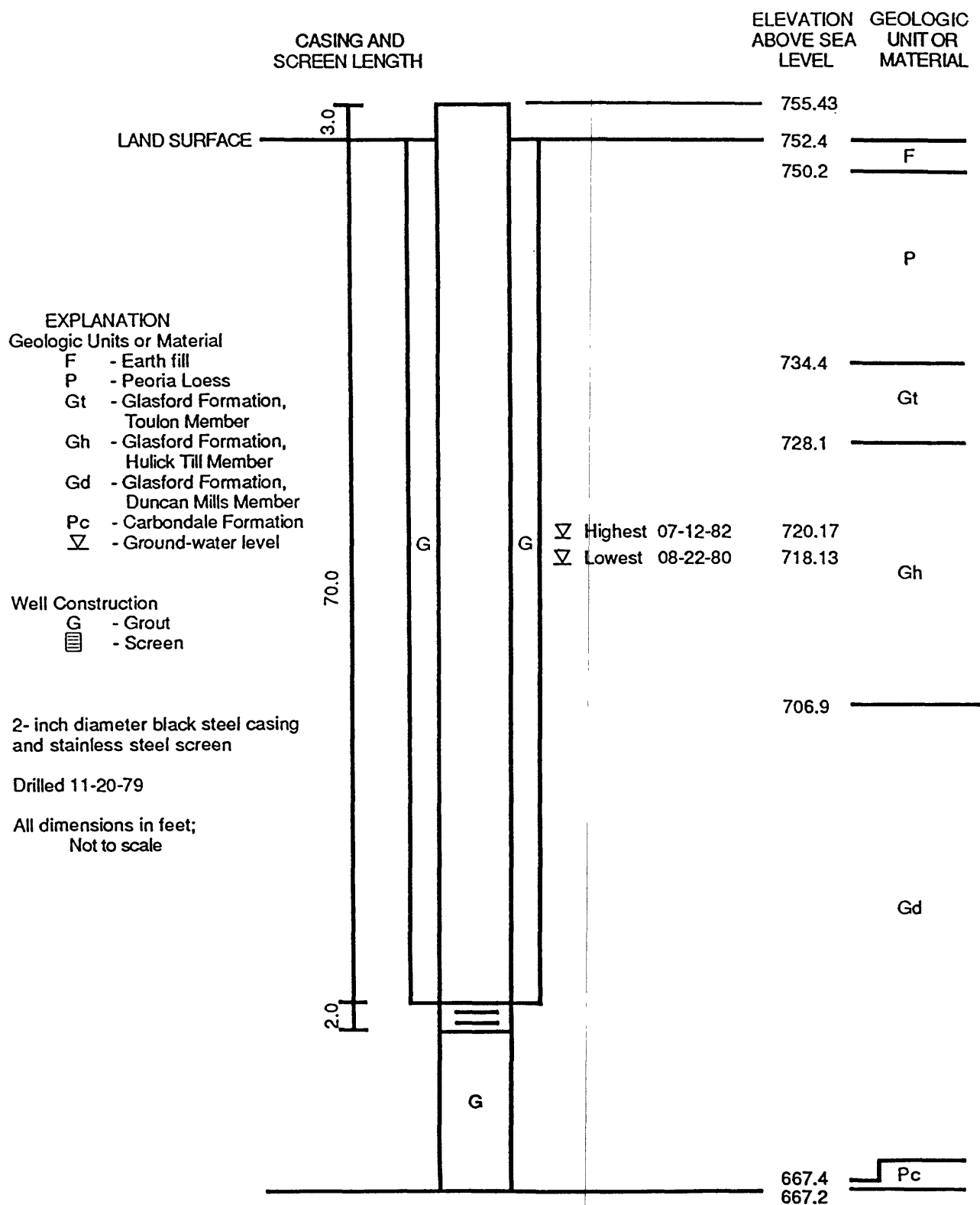


Figure 52.--Construction of well 550.

WELL 551

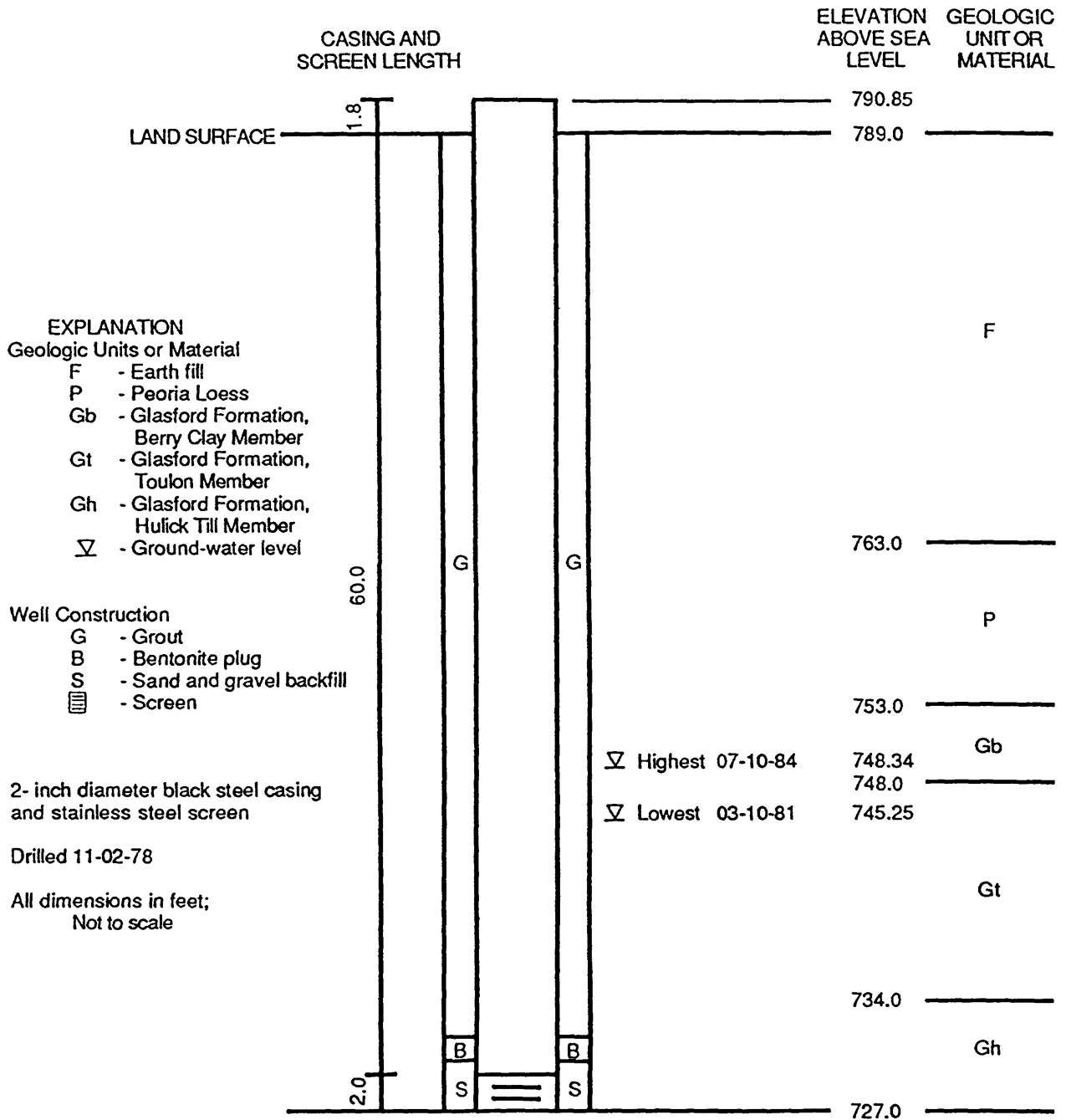


Figure 53.--Construction of well 551.

WELL 552

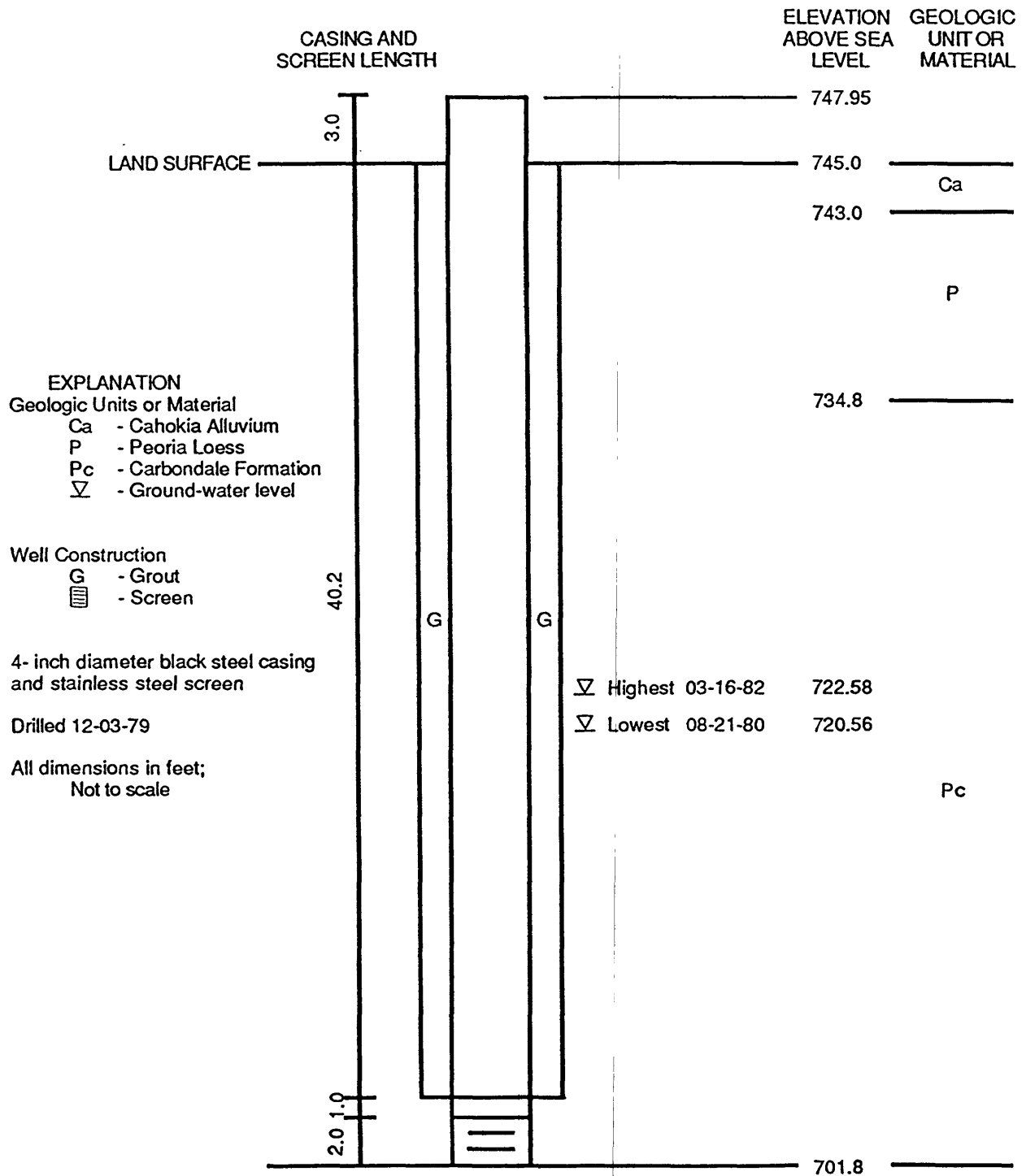


Figure 54.--Construction of well 552.

WELL 553

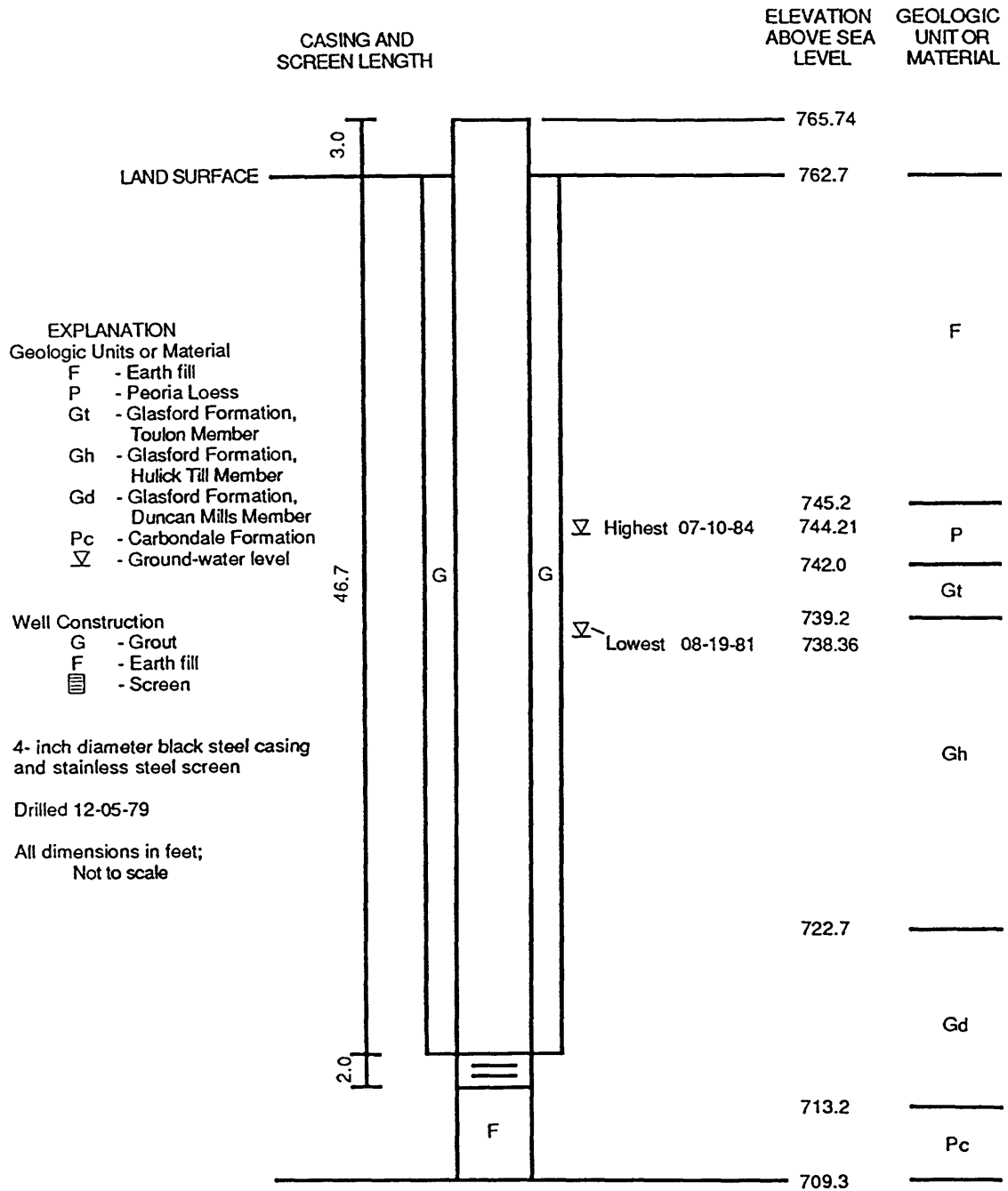


Figure 55.--Construction of well 553.

WELL 554

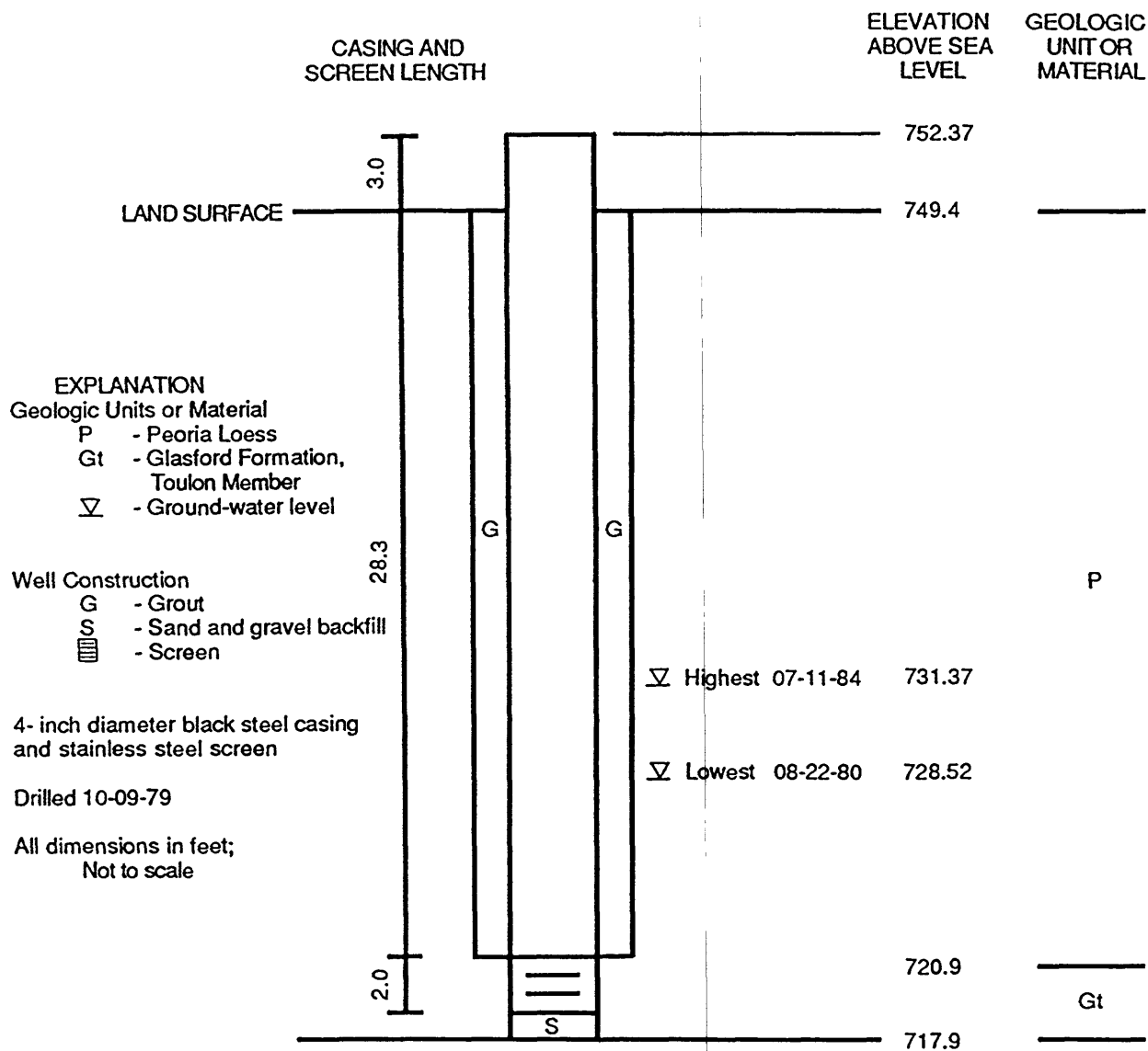


Figure 56.--Construction of well 554.

WELL 555

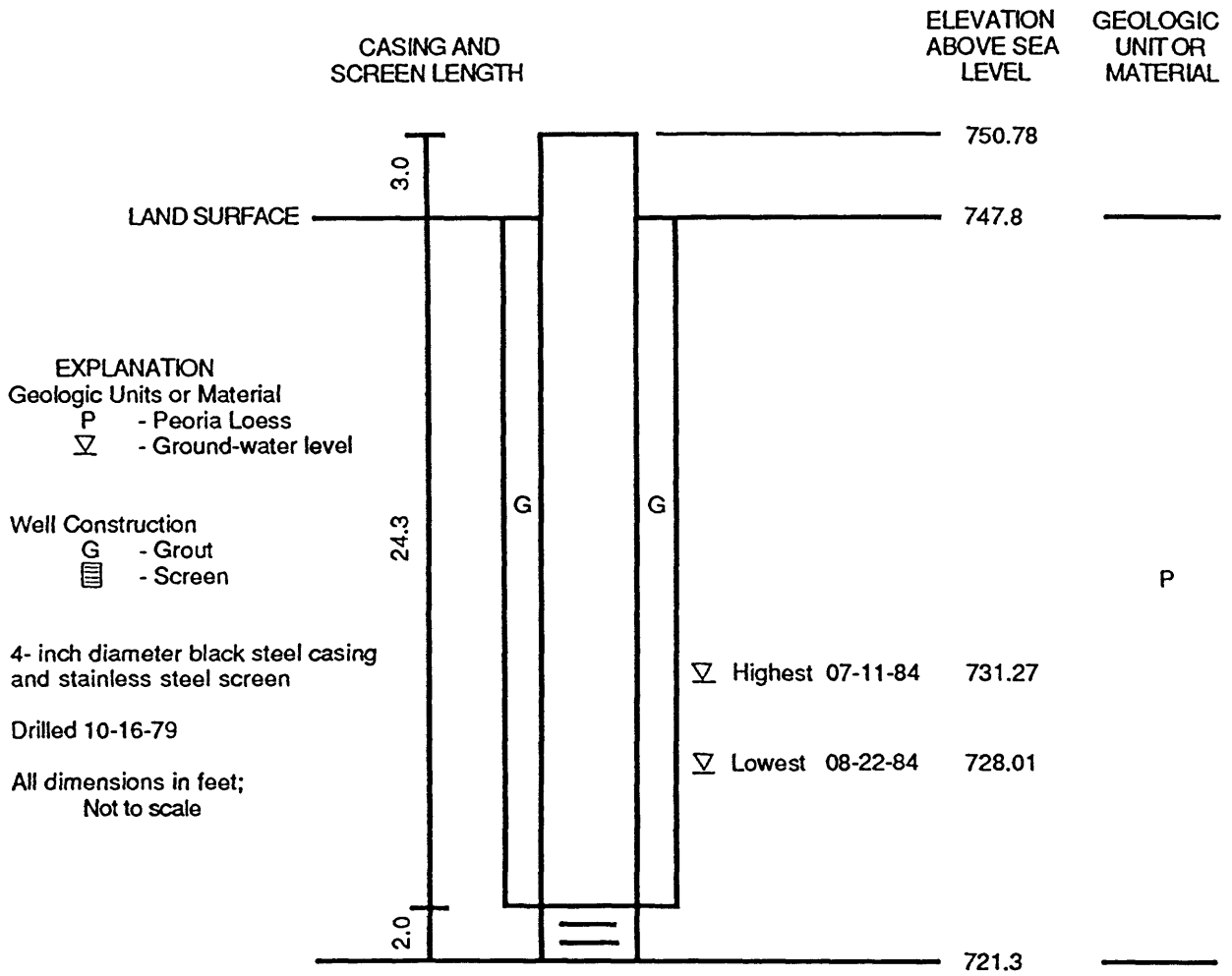


Figure 57.--Construction of well 555.

WELL 556

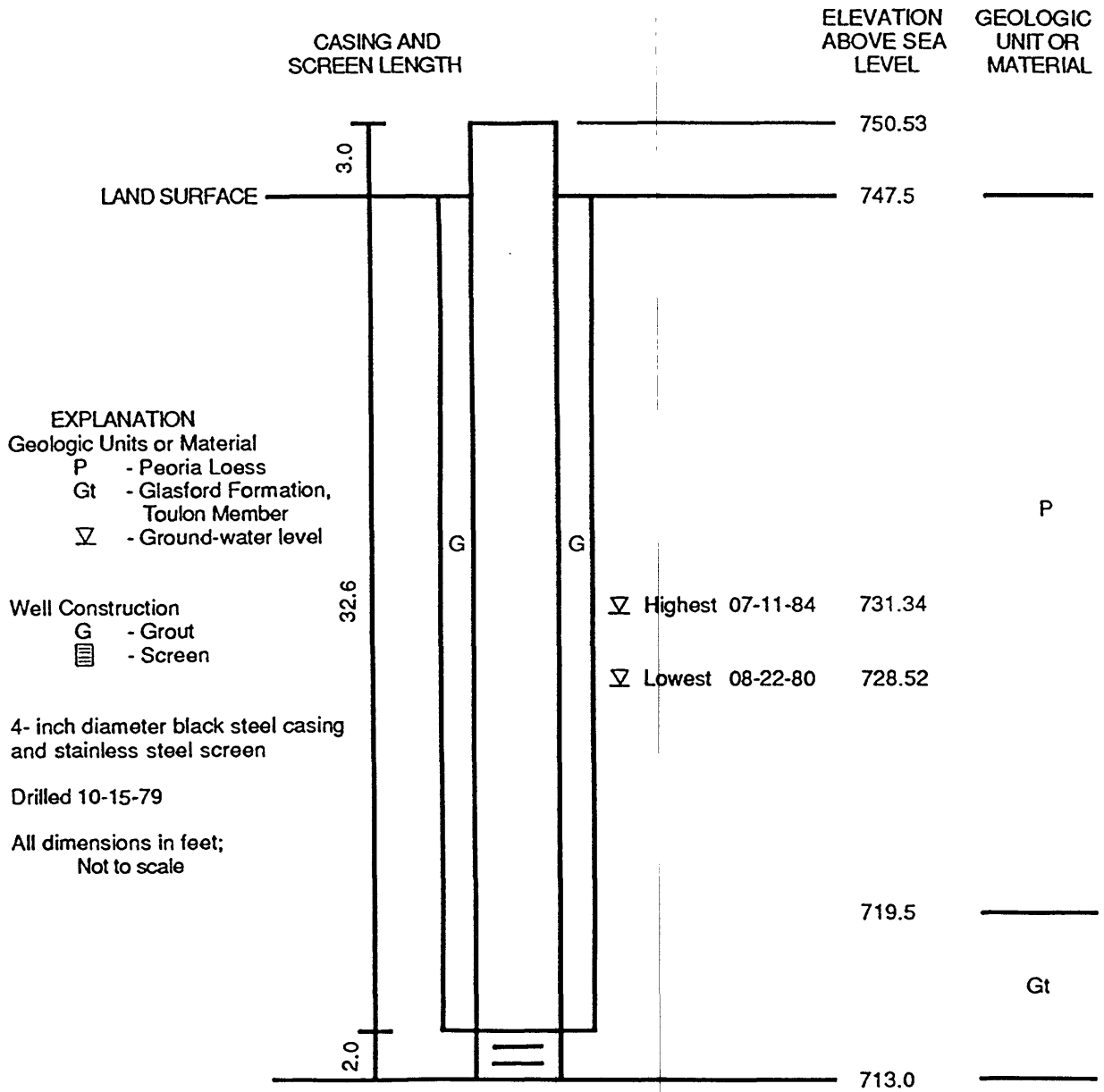


Figure 58.--Construction of well 556.

WELL 557

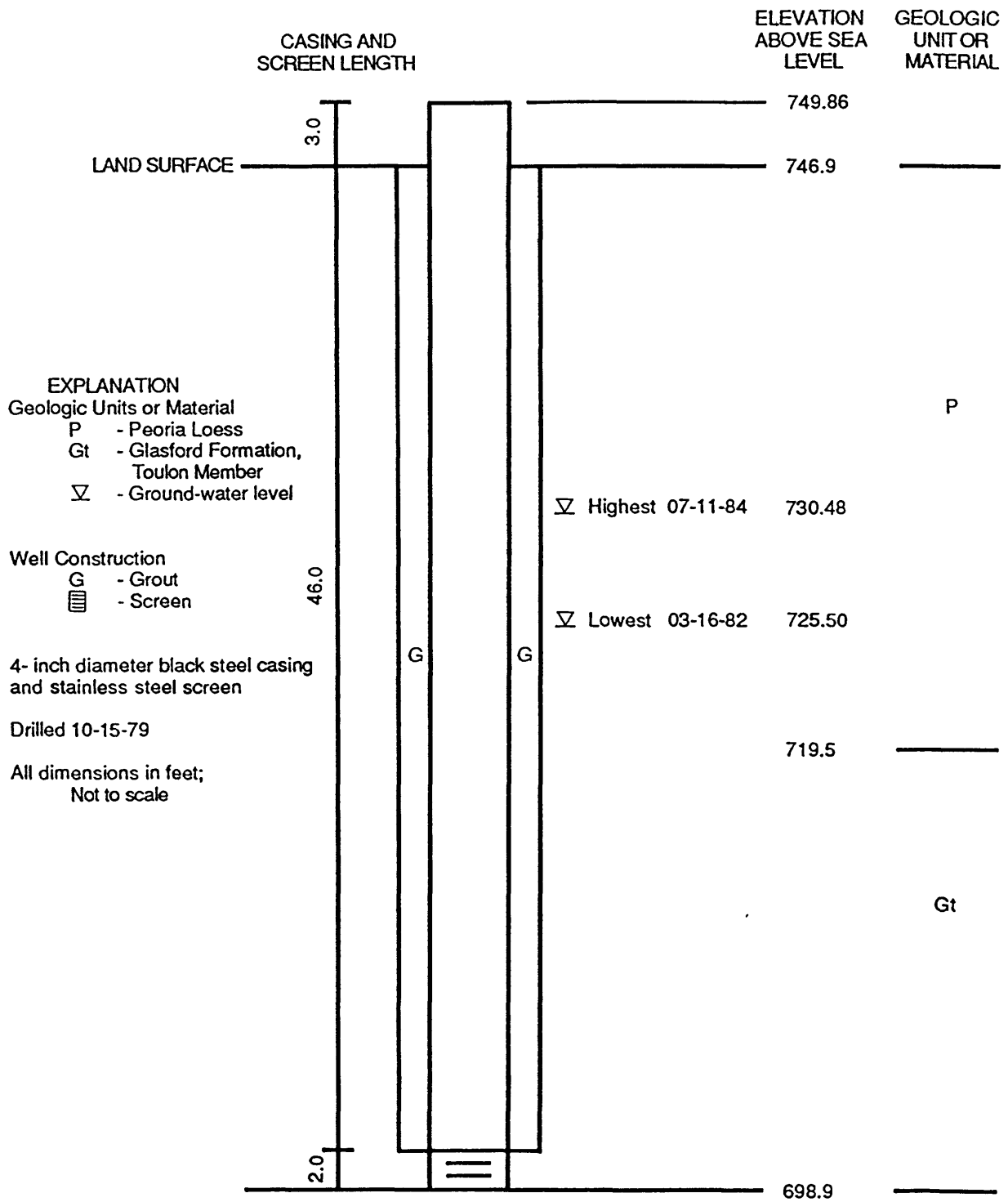
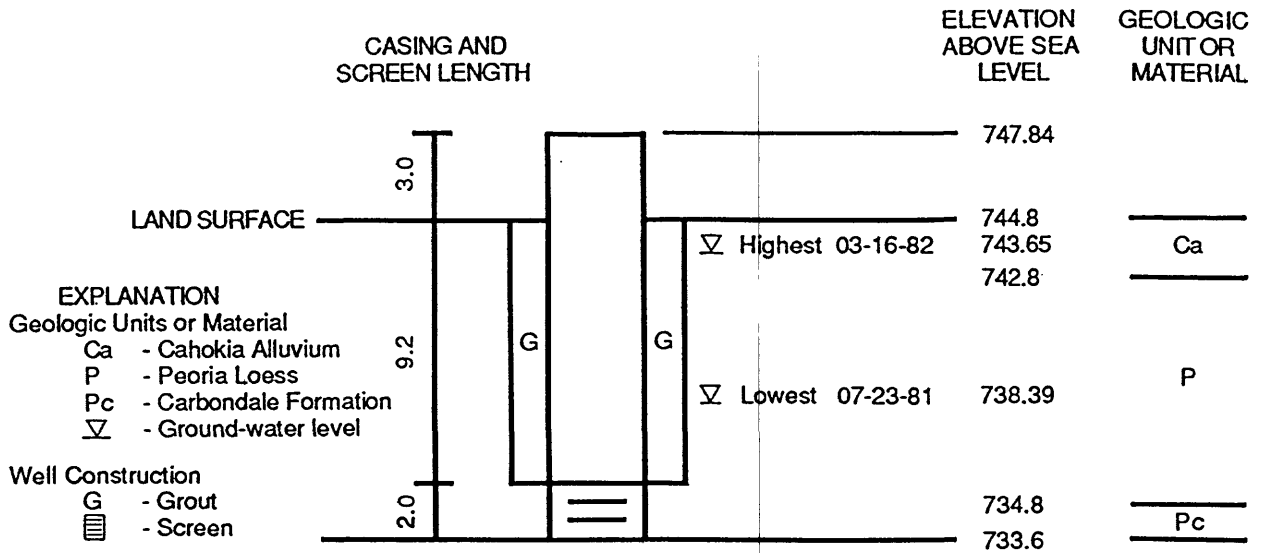


Figure 59.--Construction of well 557.

WELL 559



4- inch diameter black steel casing and stainless steel screen

Drilled 12-03-79

All dimensions in feet;
Not to scale

Figure 60.--Construction of well 559.

WELL 560

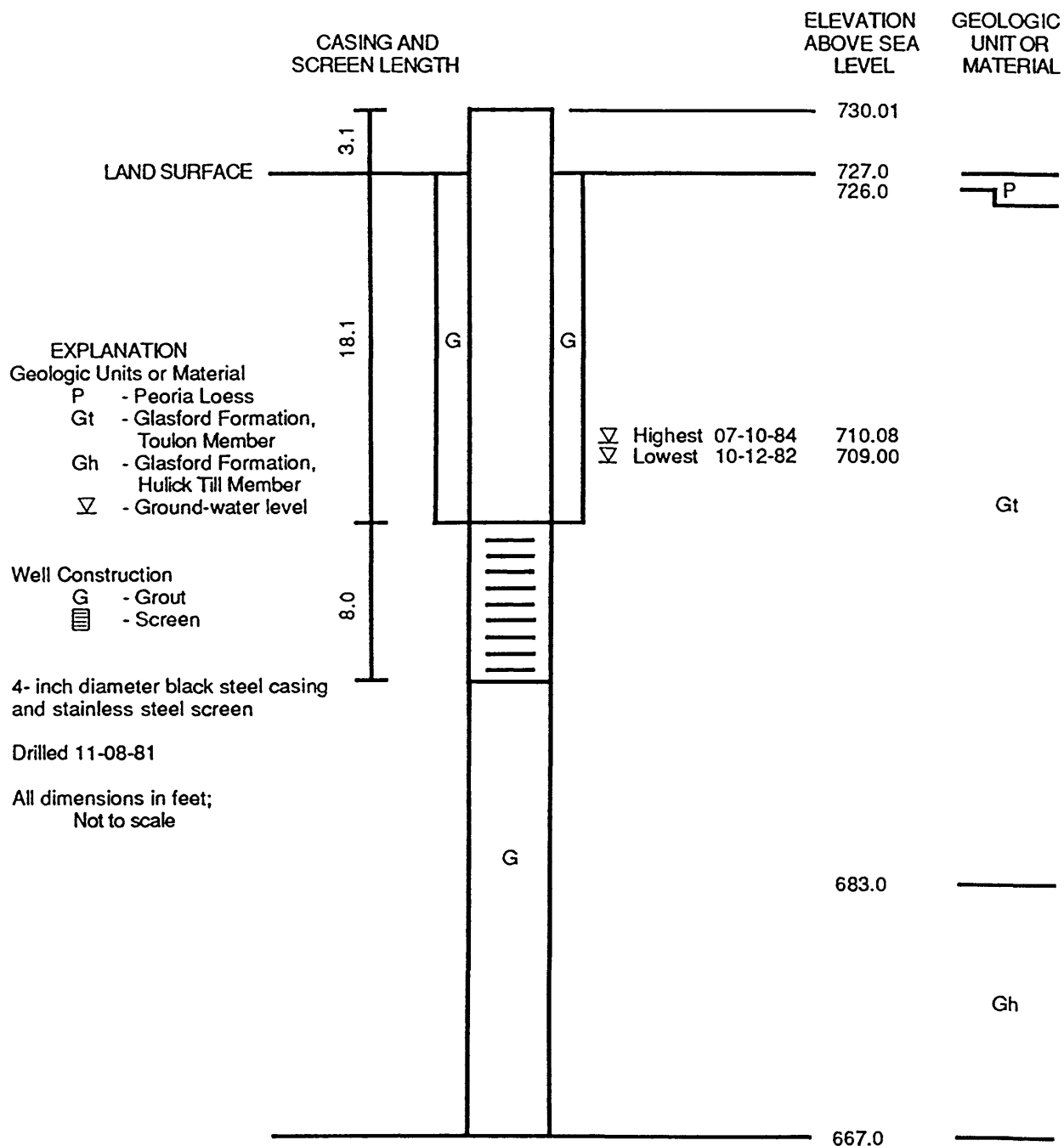


Figure 61.--Construction of well 560.

WELL 561

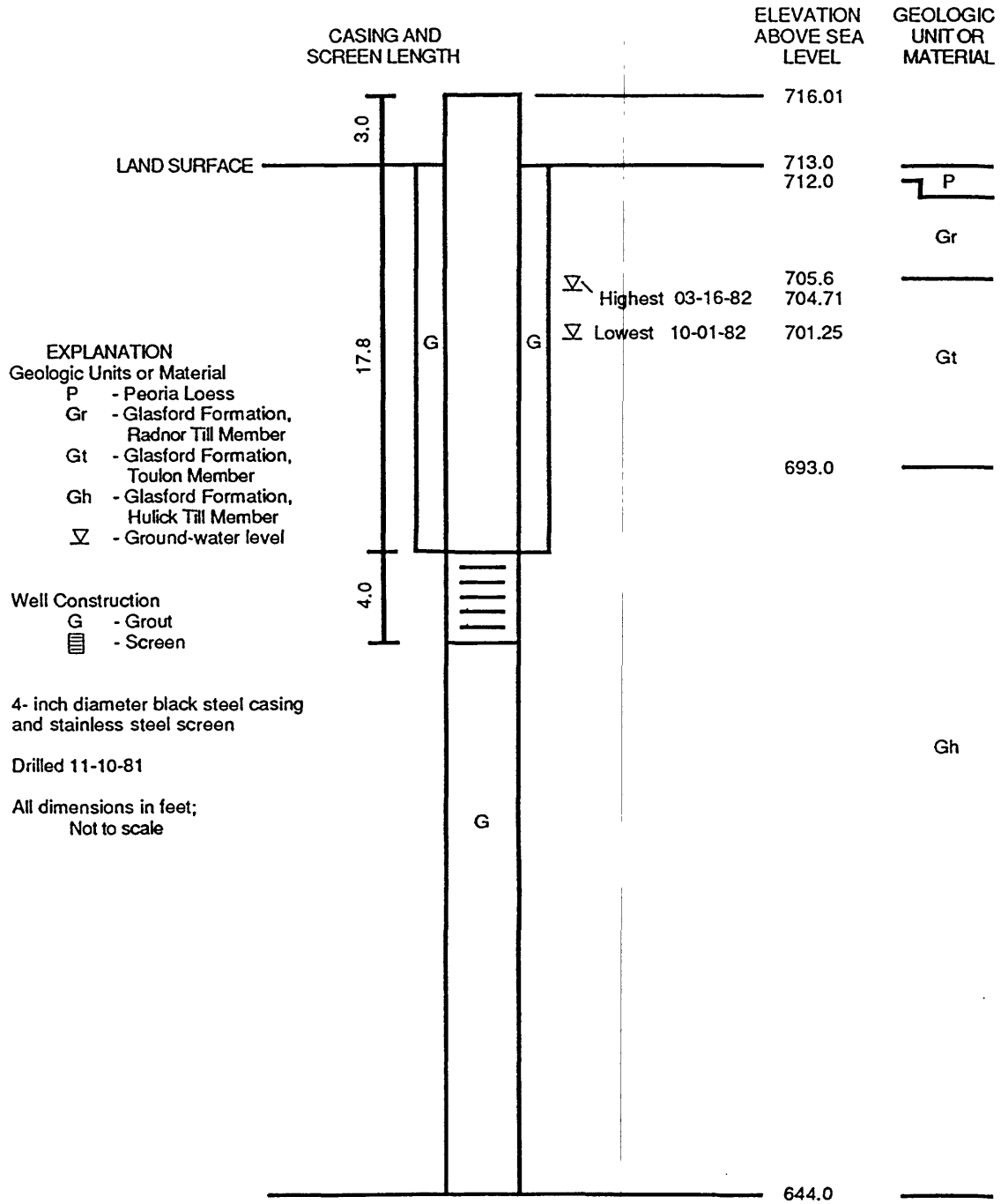


Figure 62.--Construction of well 561.

WELL 562

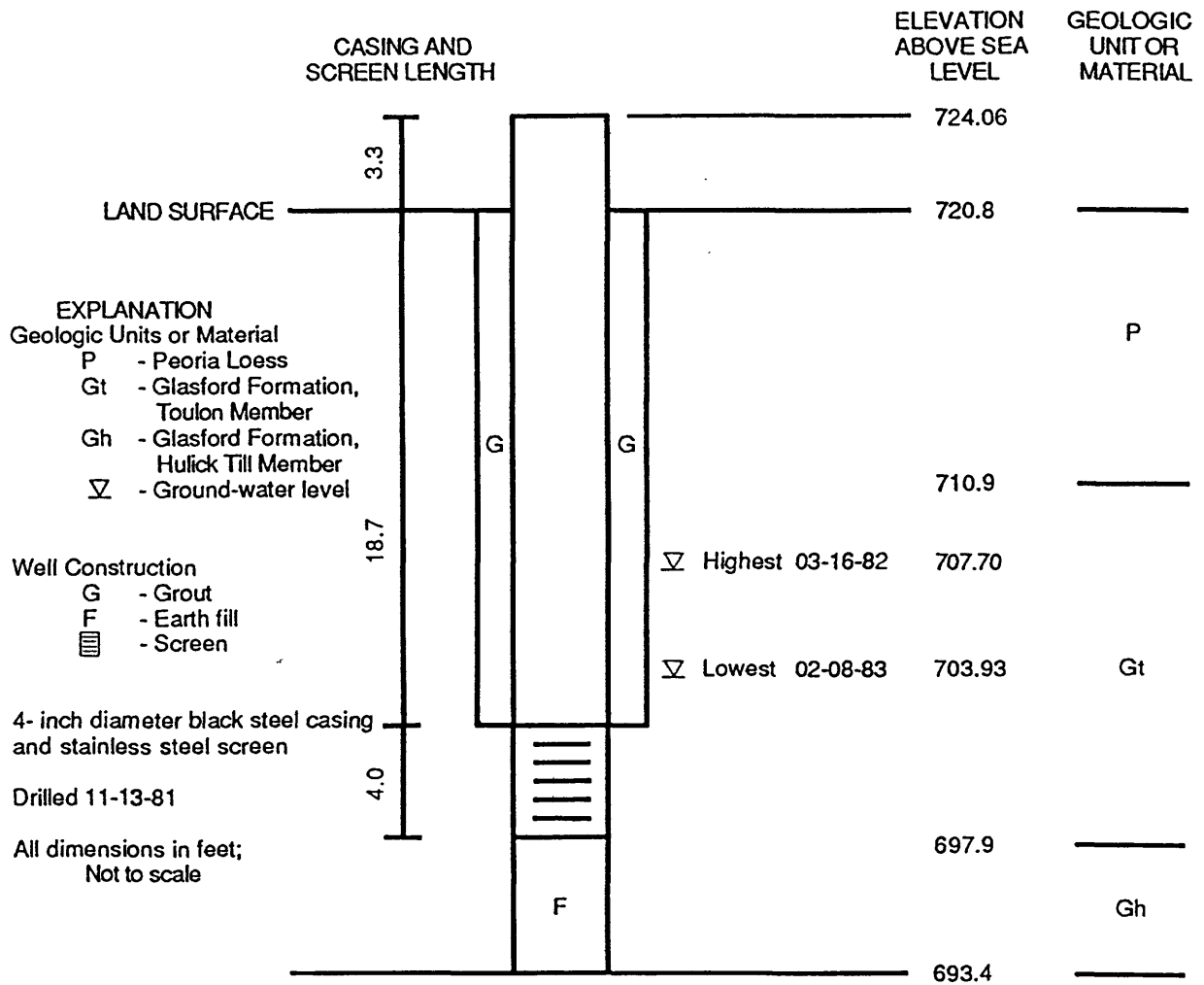


Figure 63.--Construction of well 562.

WELL 564

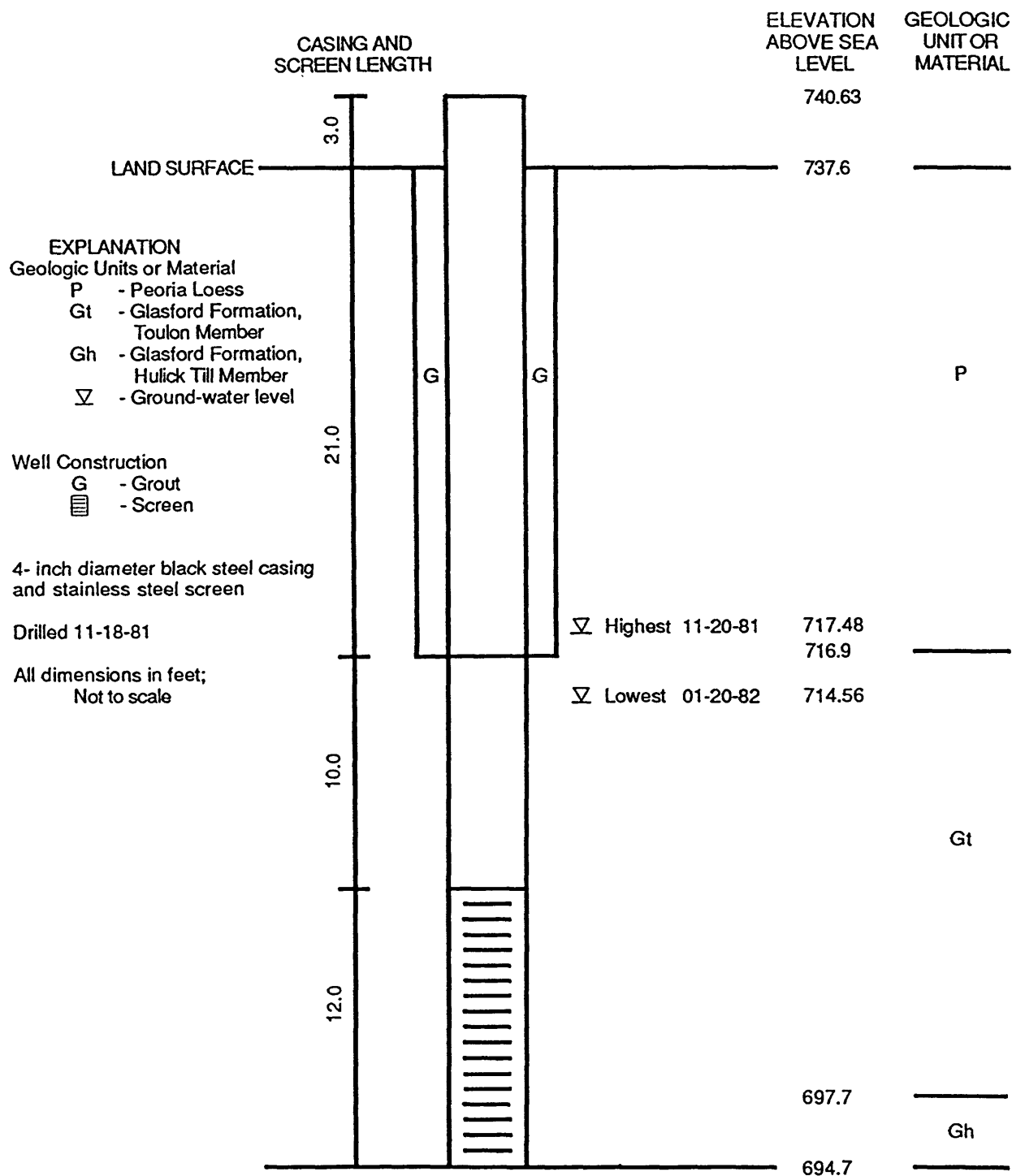


Figure 65.--Construction of well 564.

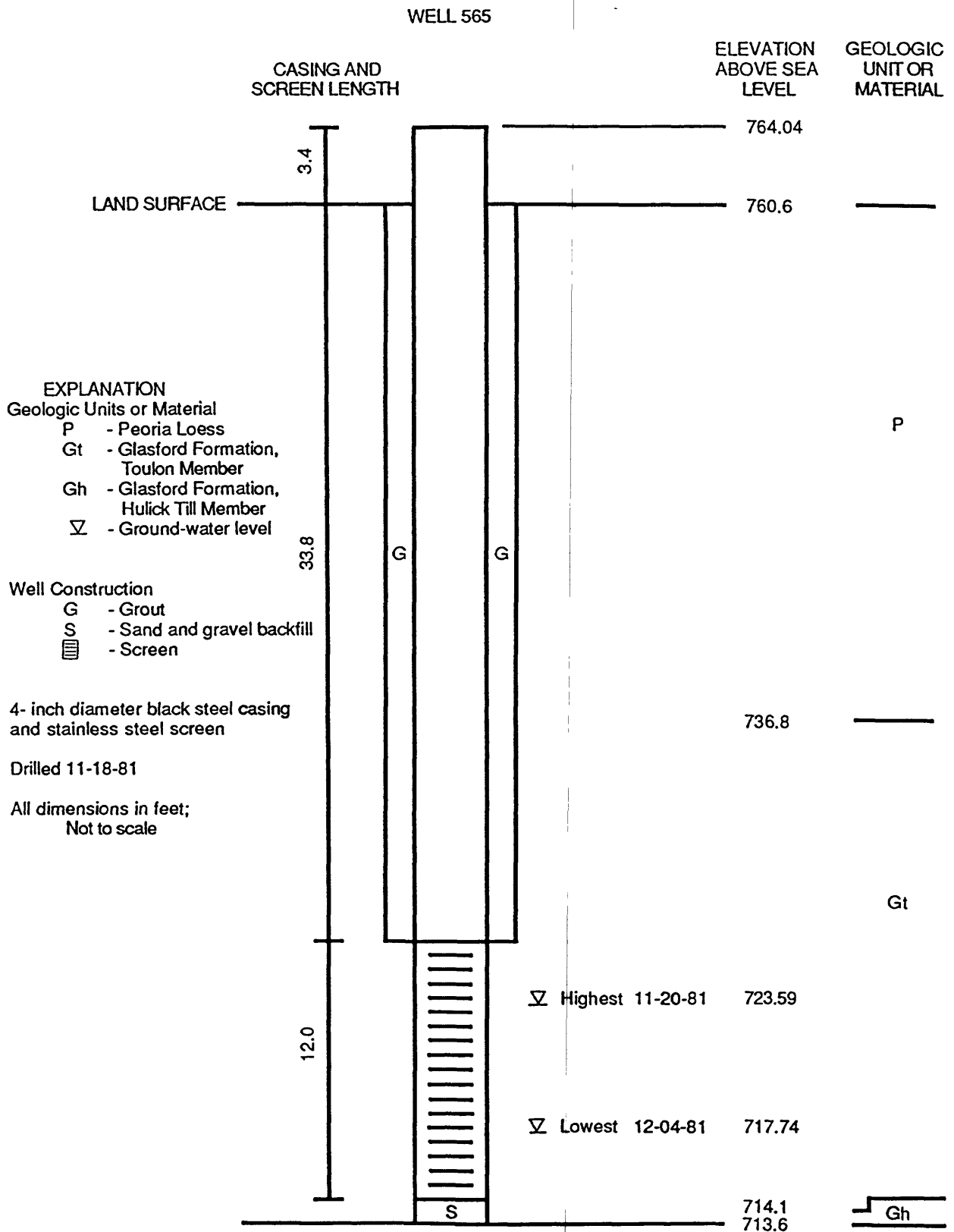


Figure 66.--Construction of well 565.

WELL 566

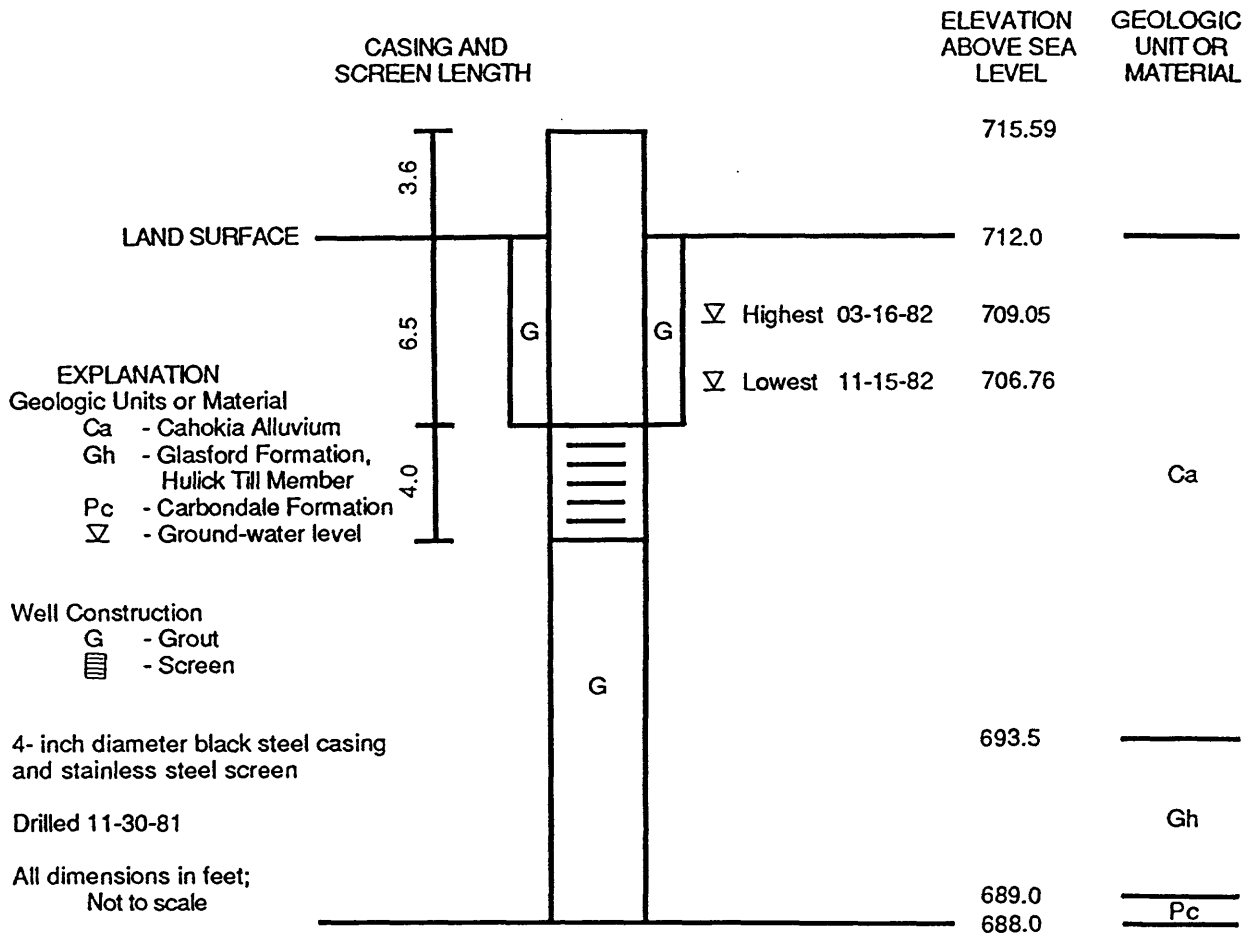


Figure 67.--Construction of well 566.

WELL 567

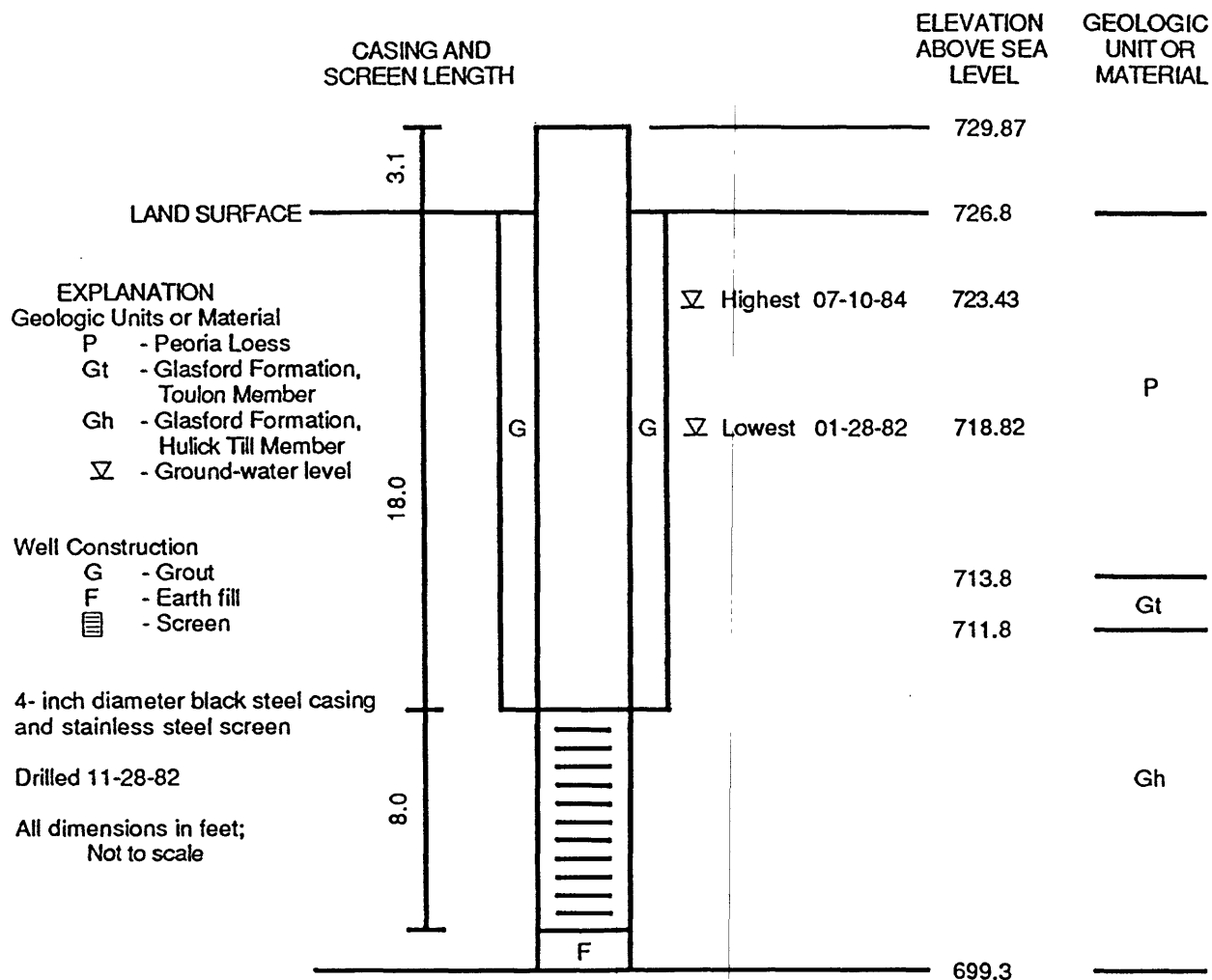


Figure 68.--Construction of well 567.

WELL 568

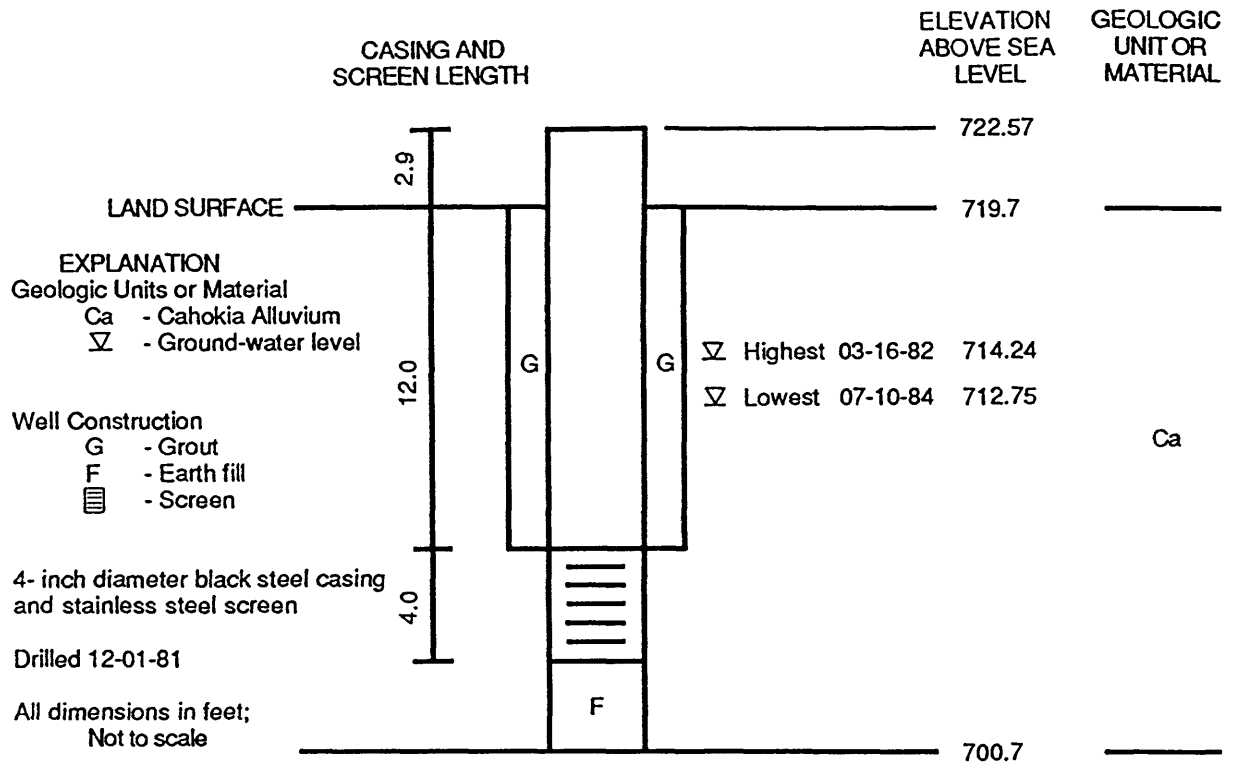


Figure 69.--Construction of well 568.

CASING AND SCREEN LENGTH

GEOLOGIC
UNIT OR
MATERIAL

LAND SURFACE

2.8

734.95

732.2

▽ Highest 07-13-82 724.55

▽	Lowest	01-20-82	722.55
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Geologic Units or Material

Pc - Carbondale Formation

∇ - Ground-water level

G - Grout

- Screen

screen

36.0

G

G

SP

Drilled 12-07-81

**All dimensions in feet;
Not to scale**

4.0

F

691.0
690.7

Pc

76

WELL 570

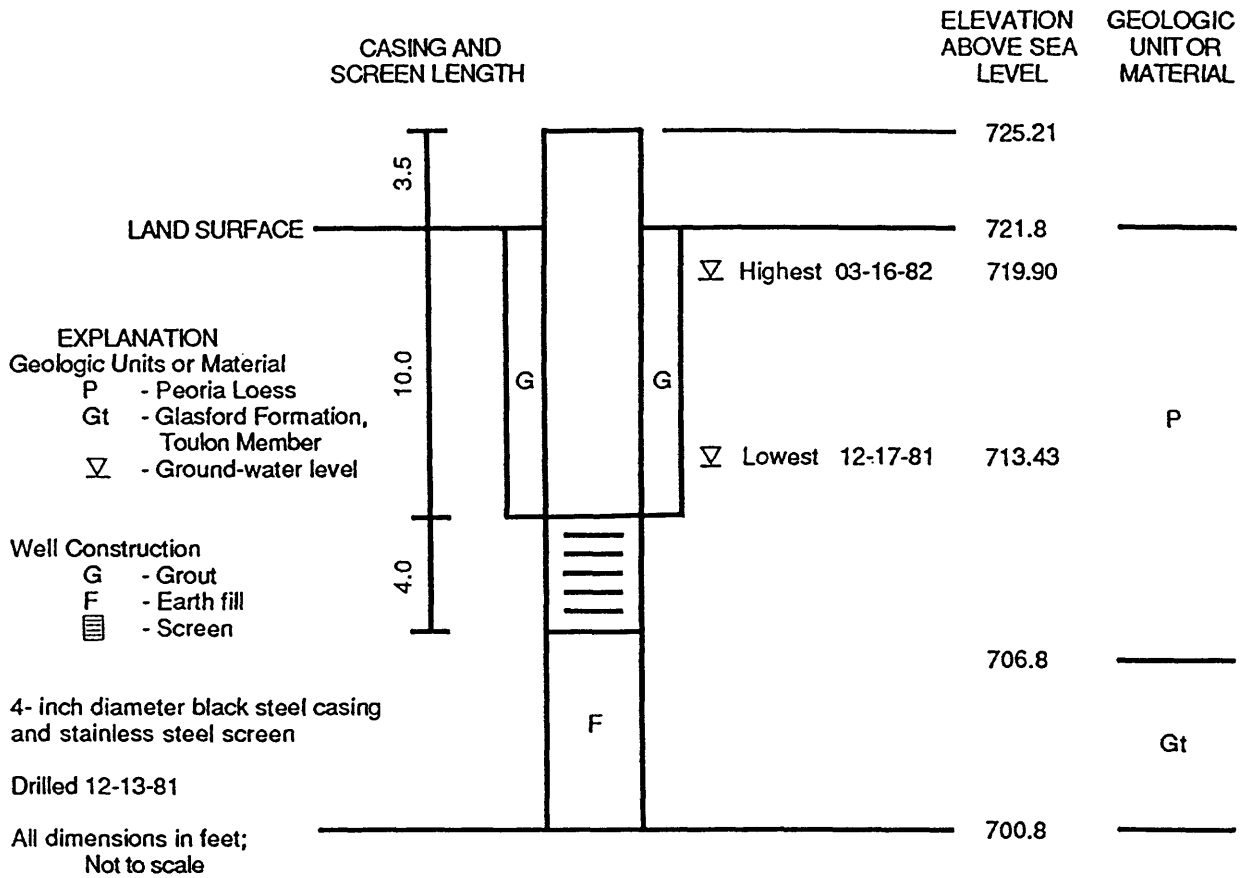


Figure 71.--Construction of well 570.

WELL 571

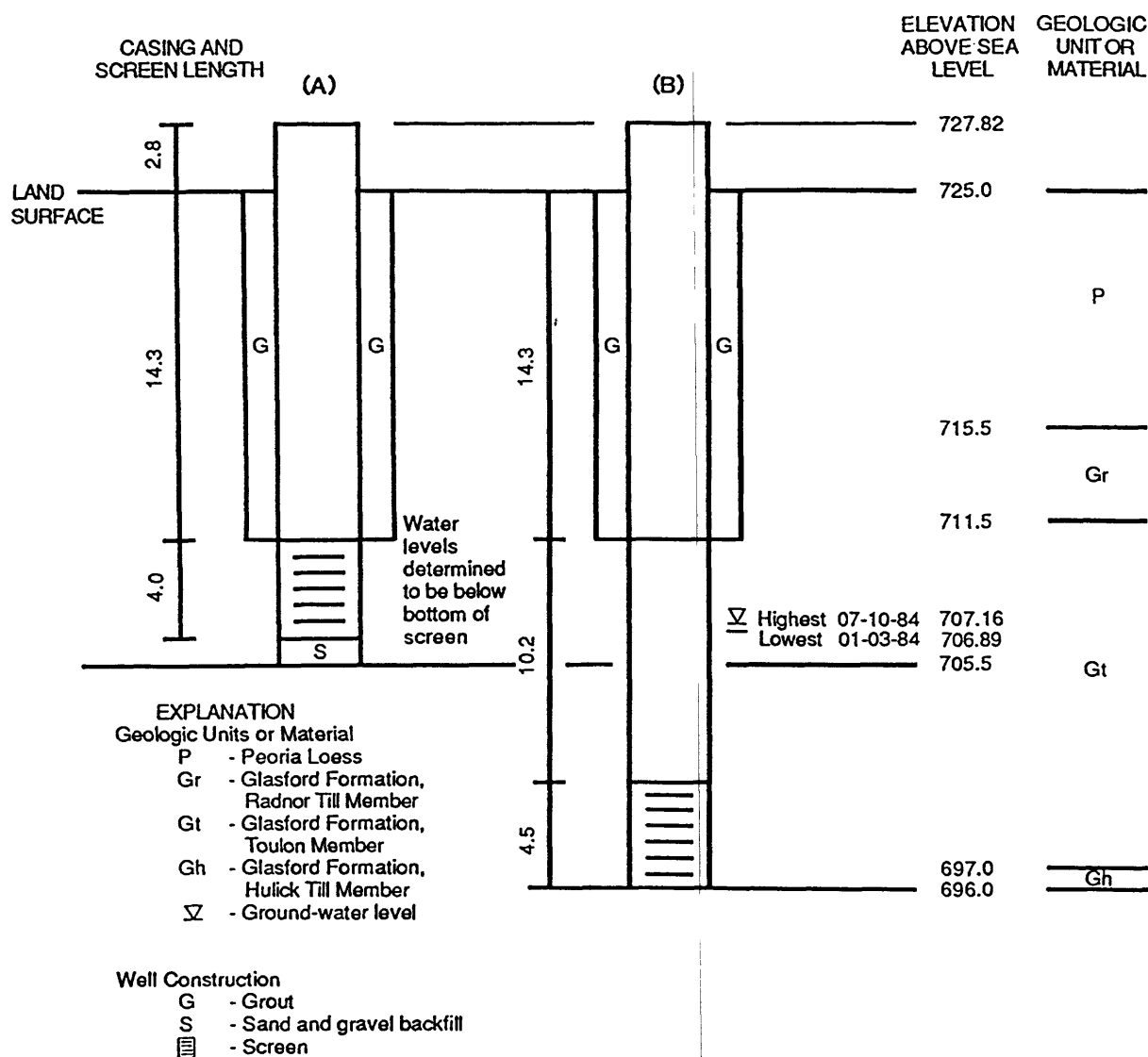


Figure 72.--Construction of well 571.

WELL 572

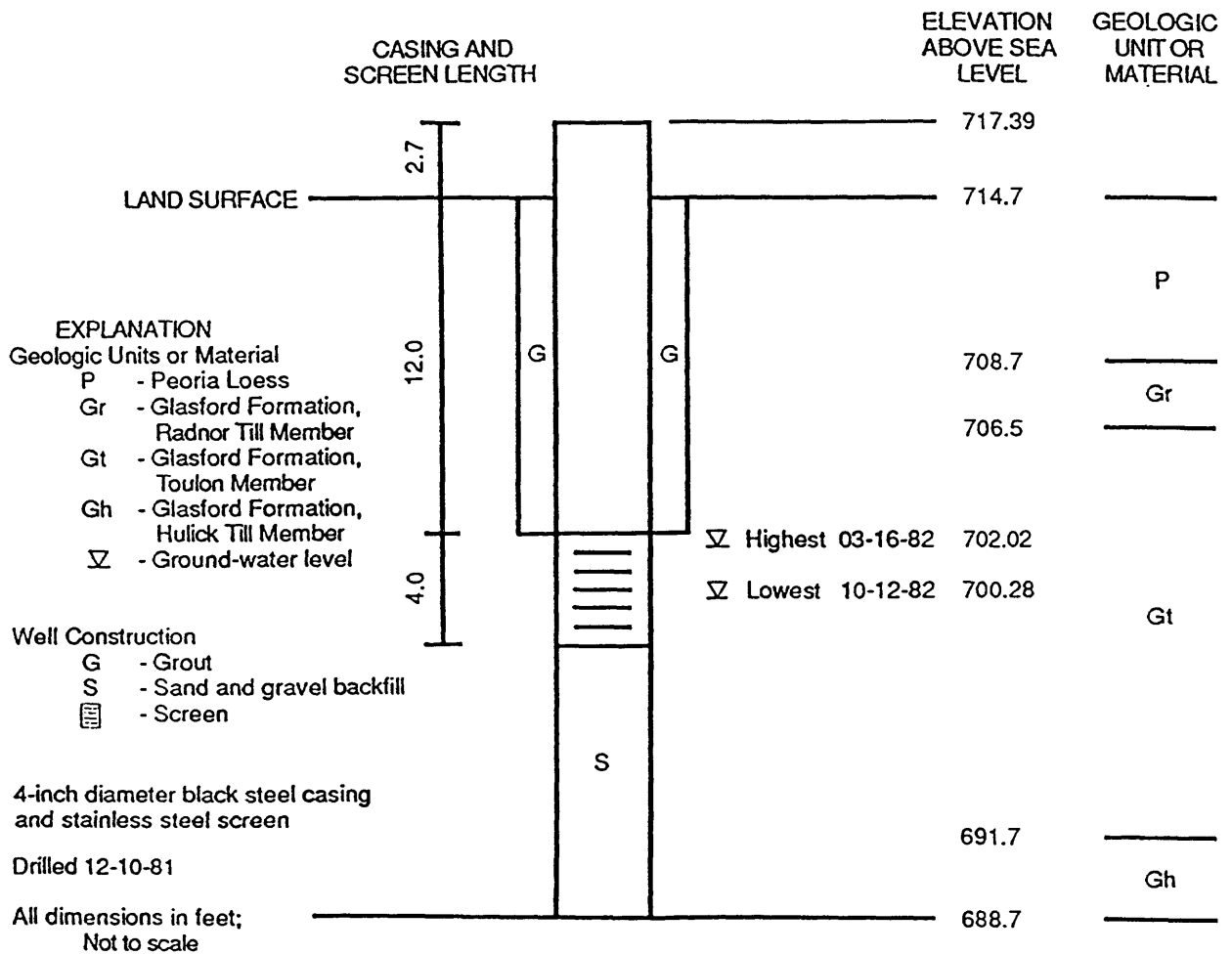


Figure 73.--Construction of well 572.

WELL 573

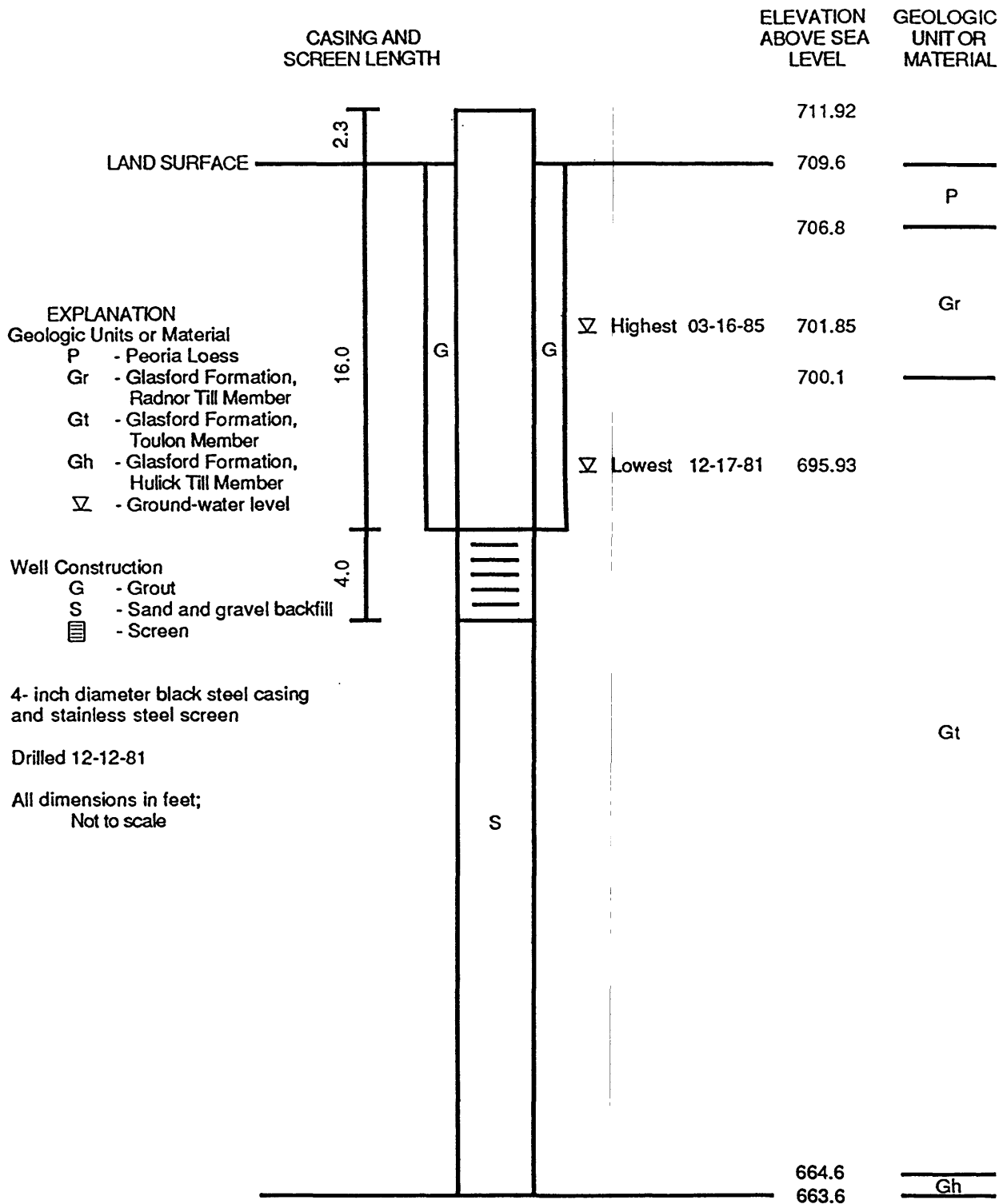


Figure 74.--Construction of well 573.

WELL 574

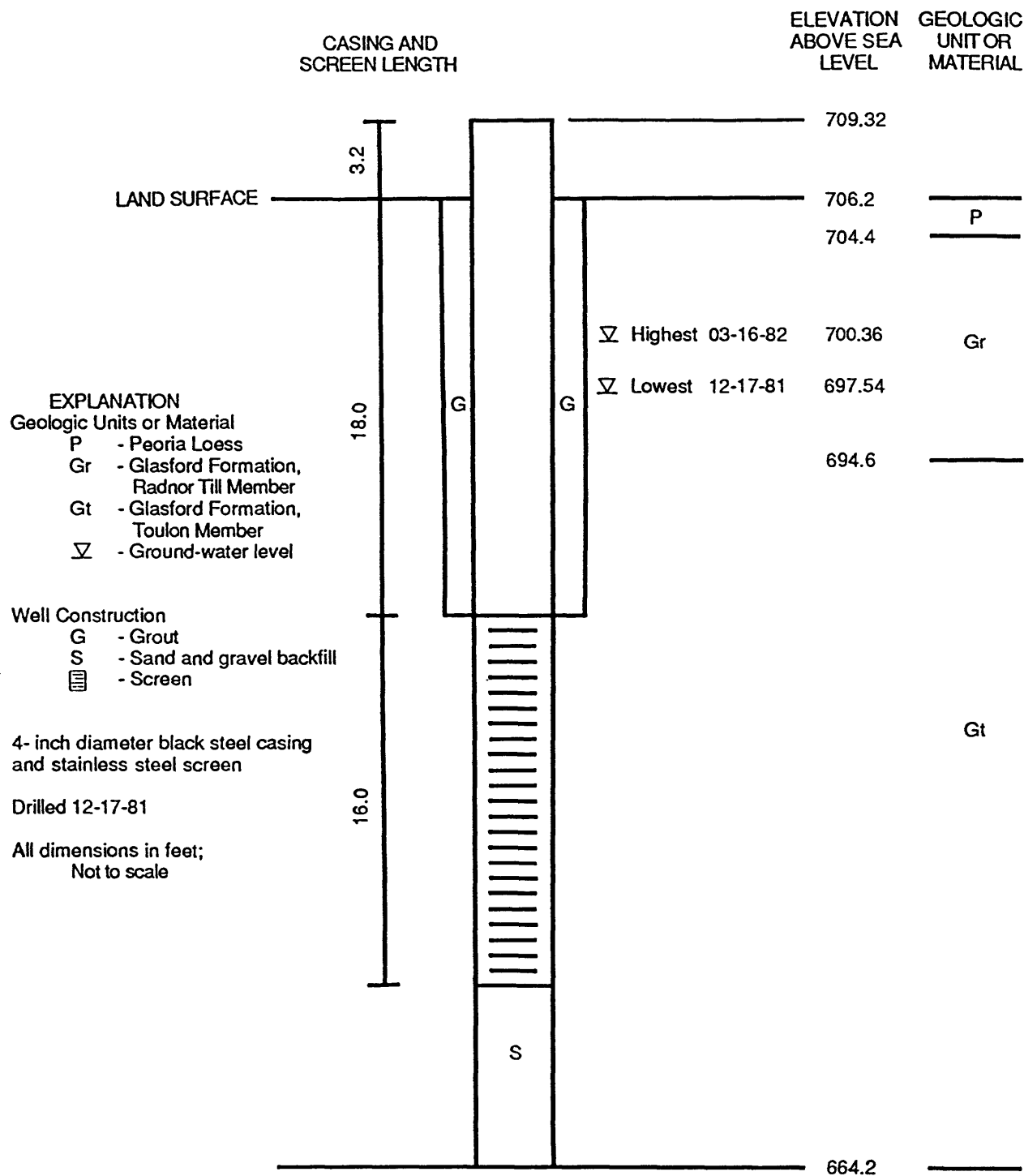


Figure 75.--Construction of well 574.

WELL 575

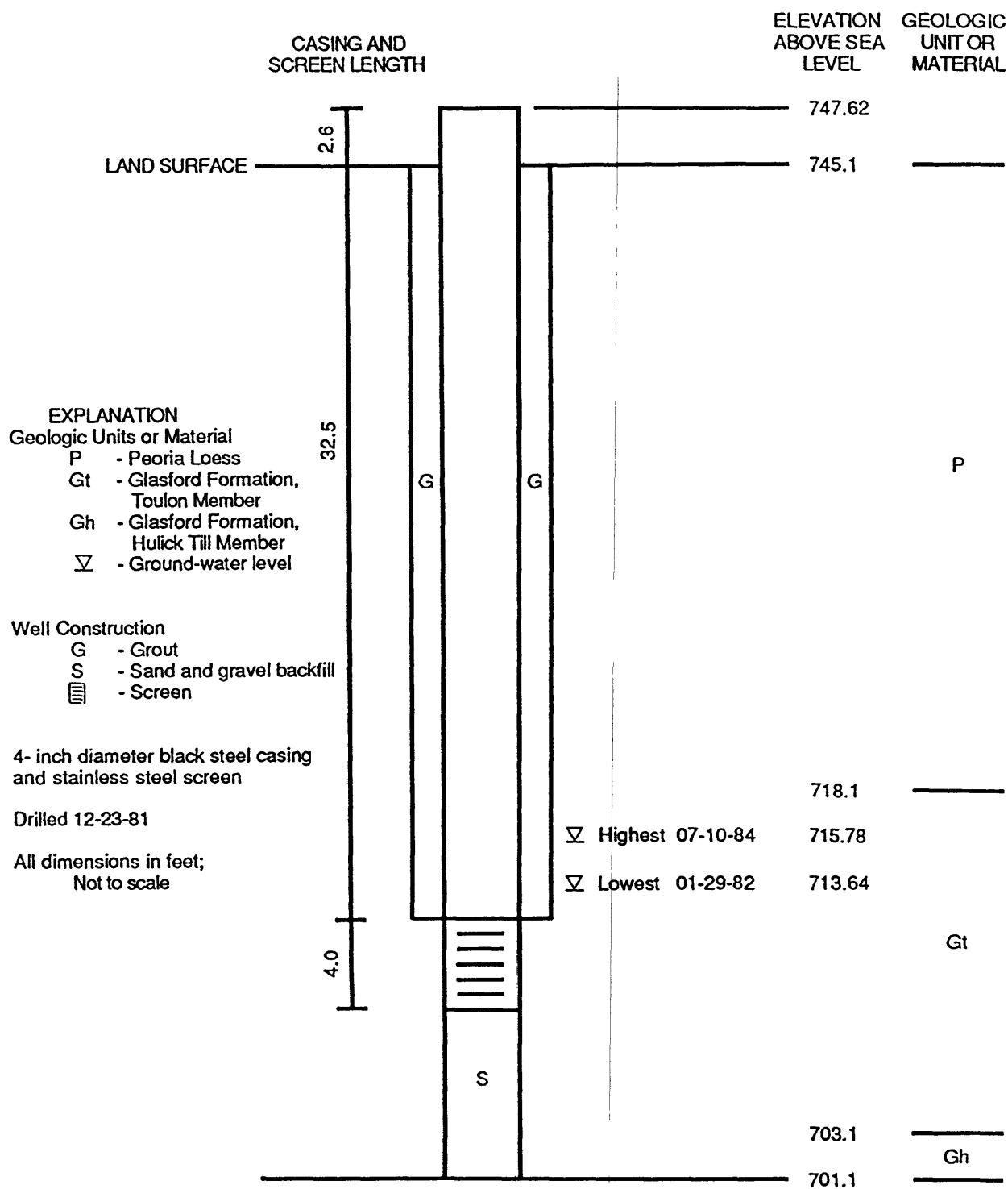


Figure 76.--Construction of well 575.

WELL 576

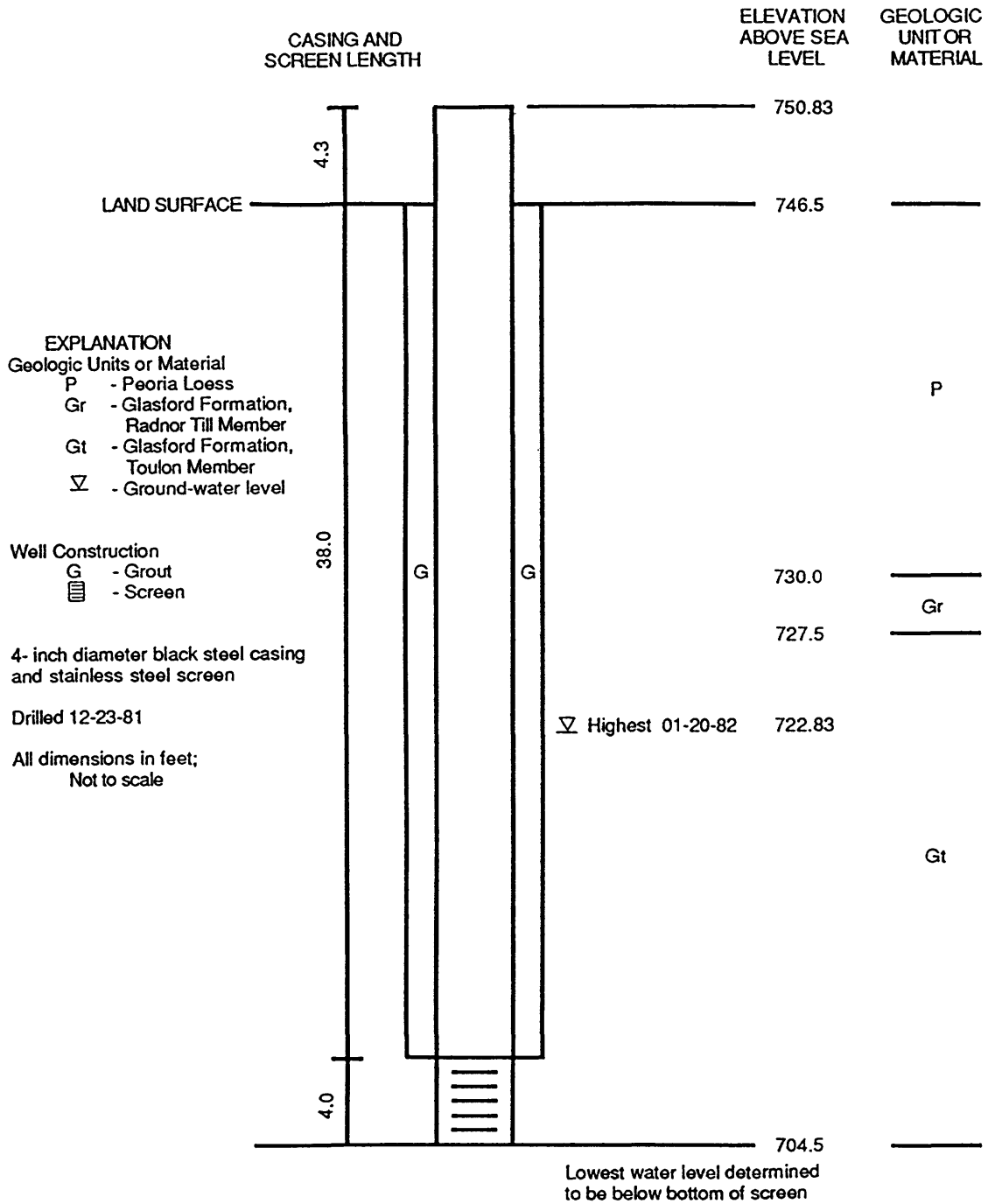


Figure 77.--Construction of well 576.

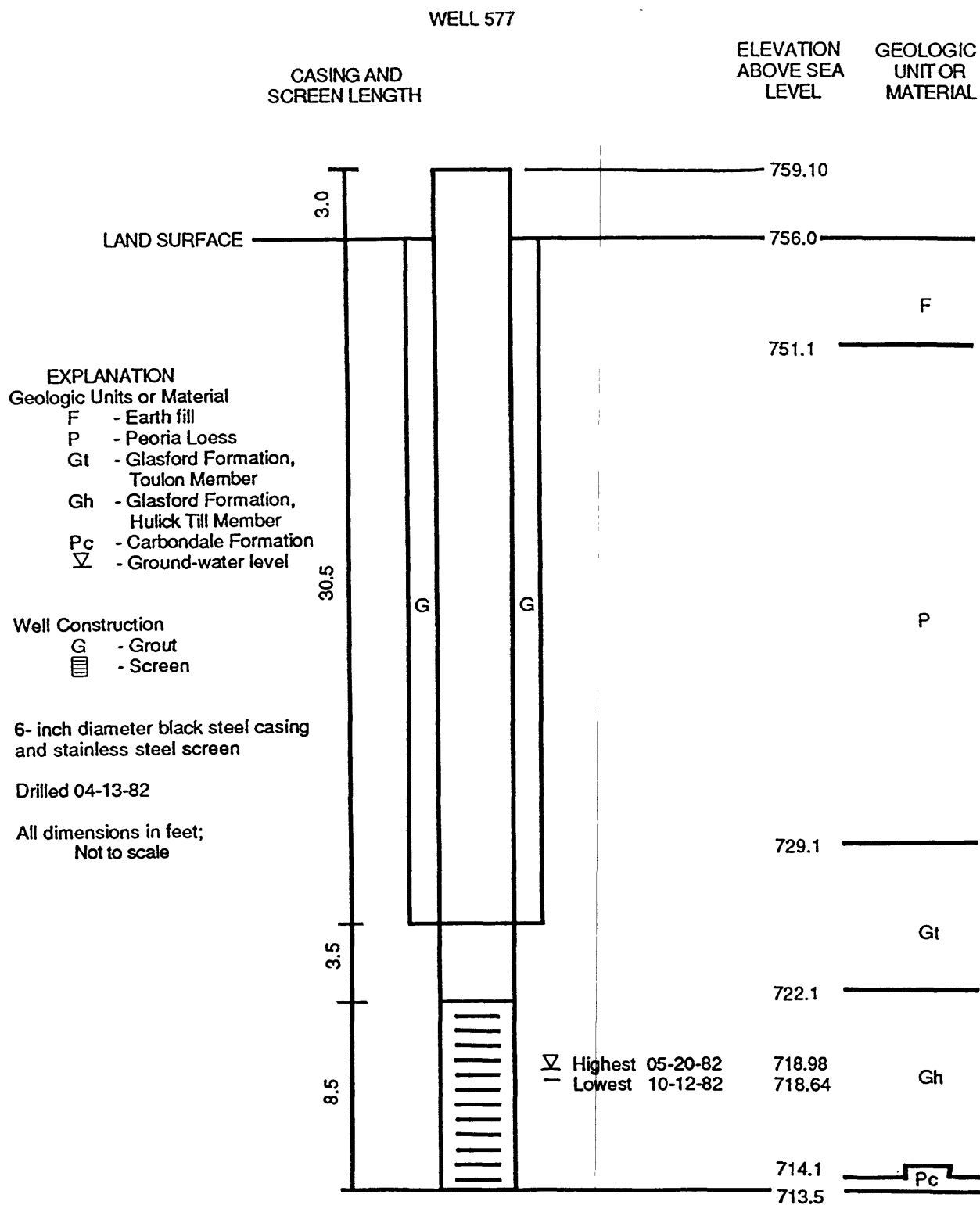


Figure 78.--Construction of well 577.

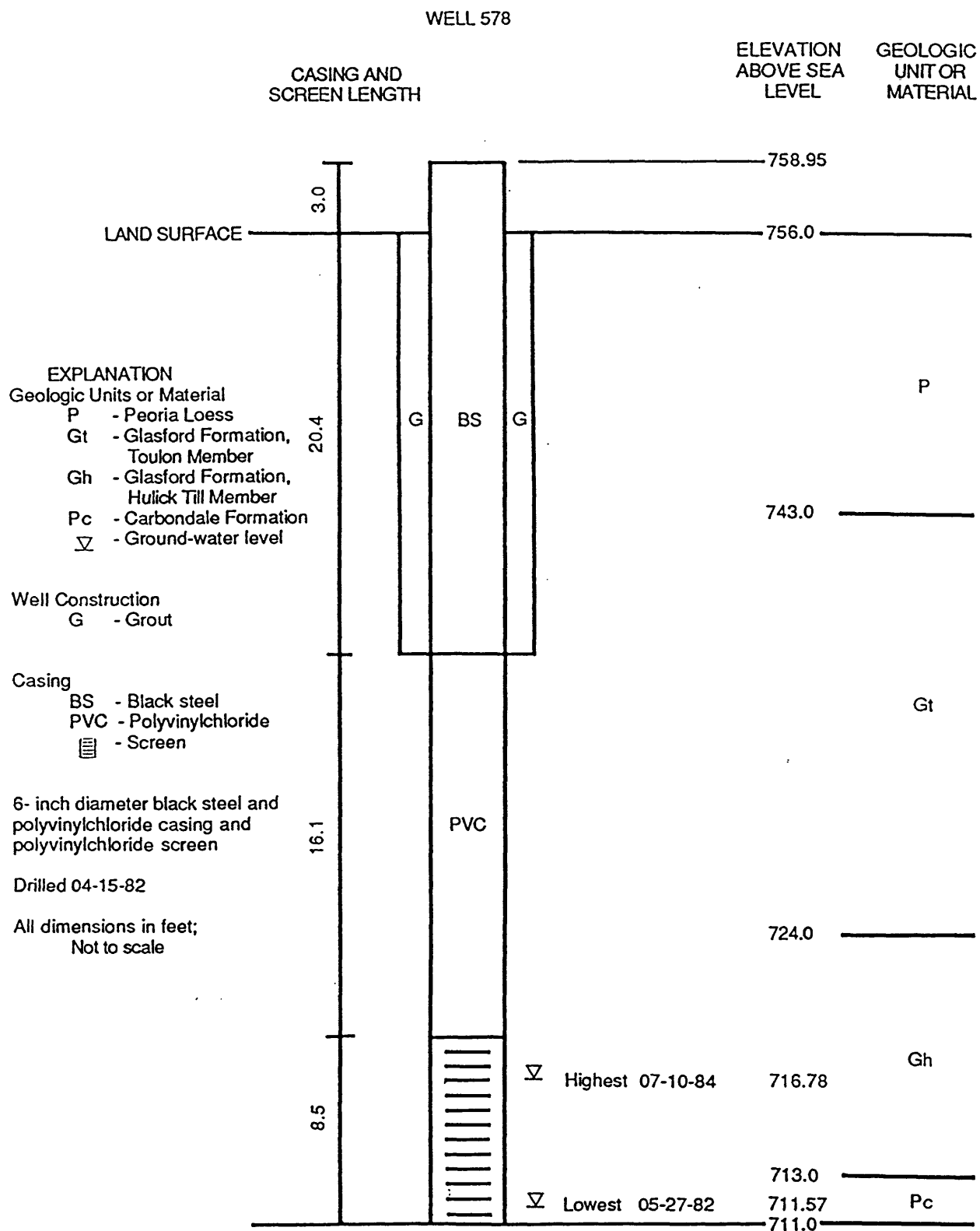


Figure 79.--Construction of well 578.

WELL 579

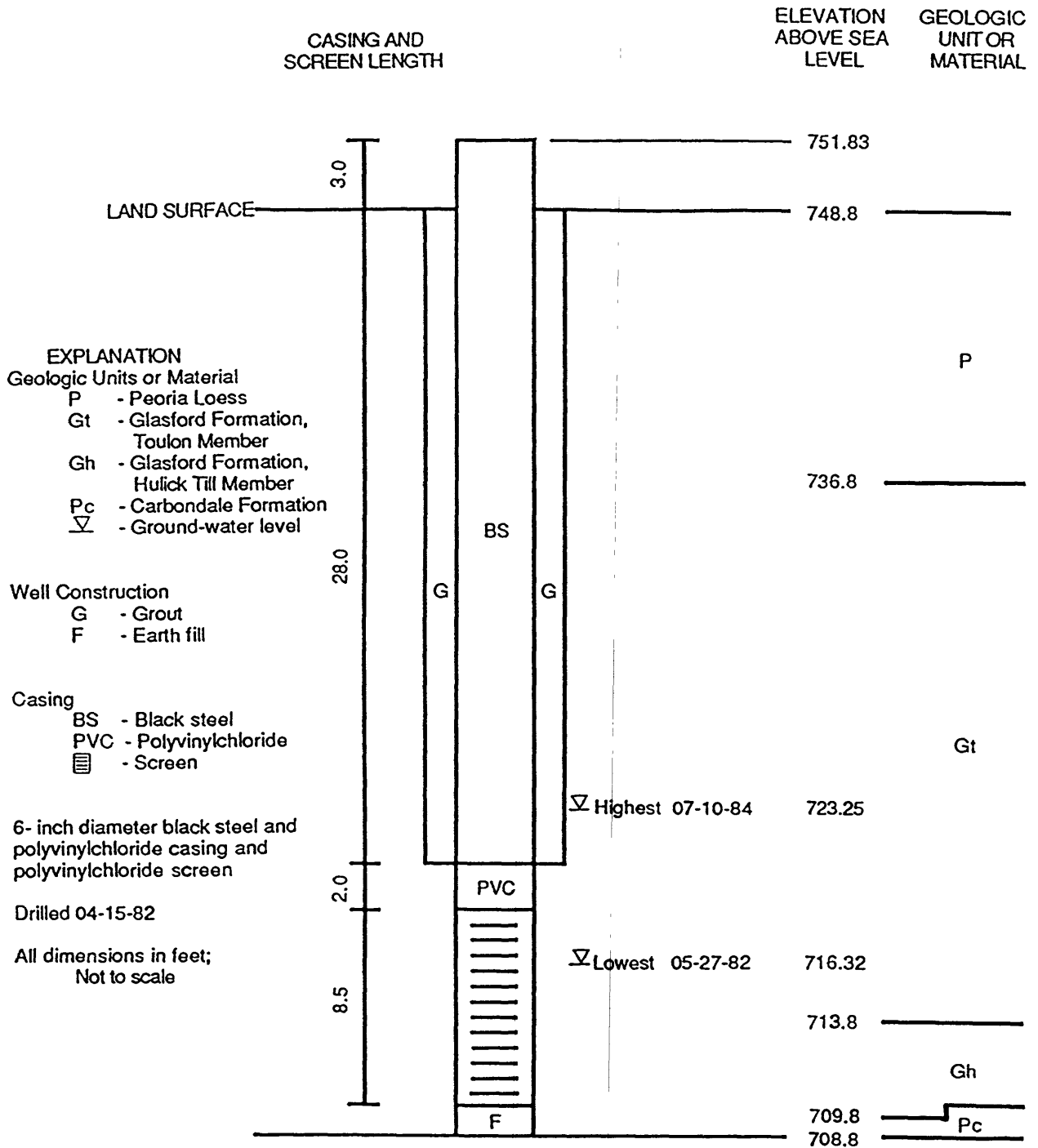


Figure 80.--Construction of well 579.

WELL 580

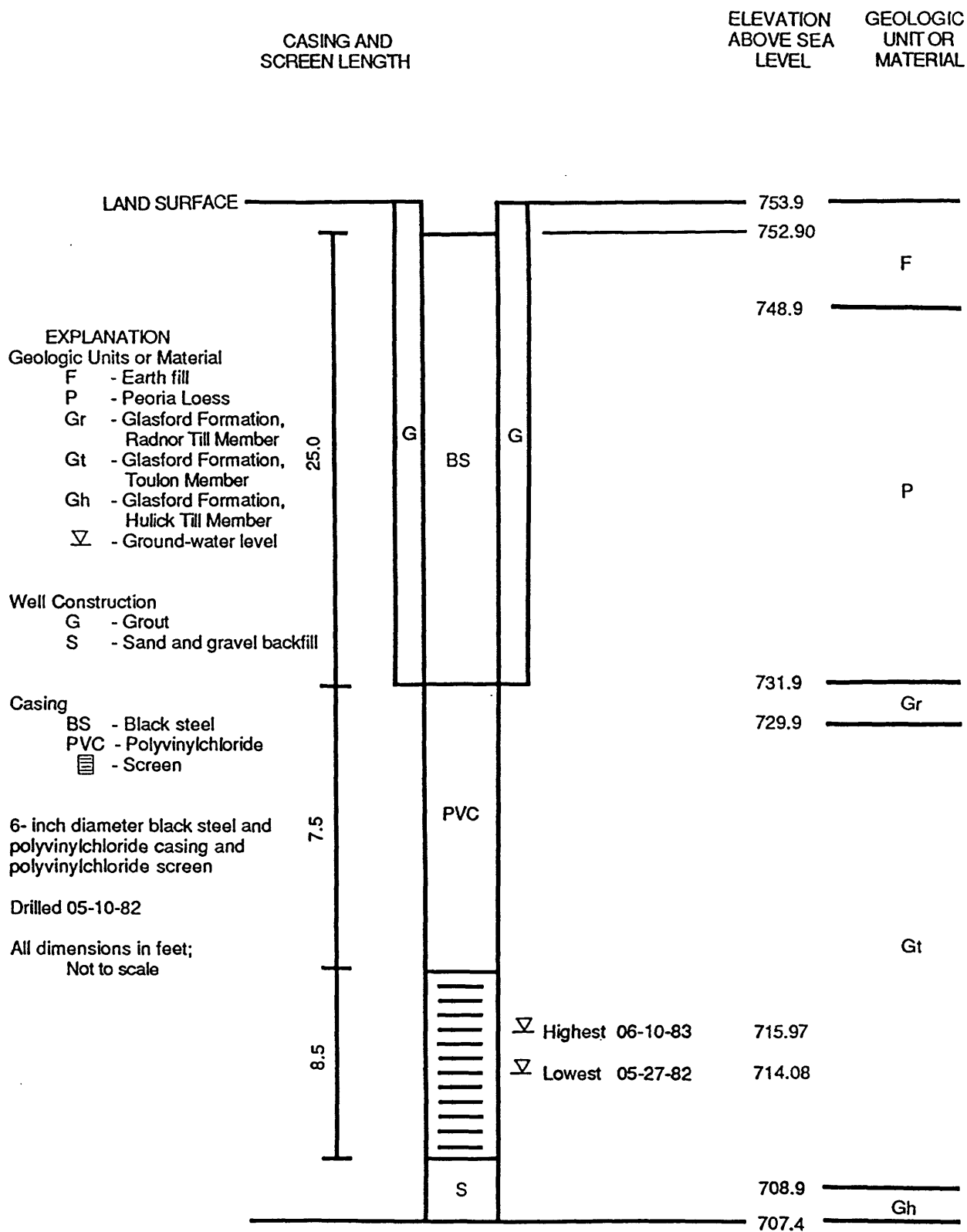


Figure 81.--Construction of well 580.

WELL 581

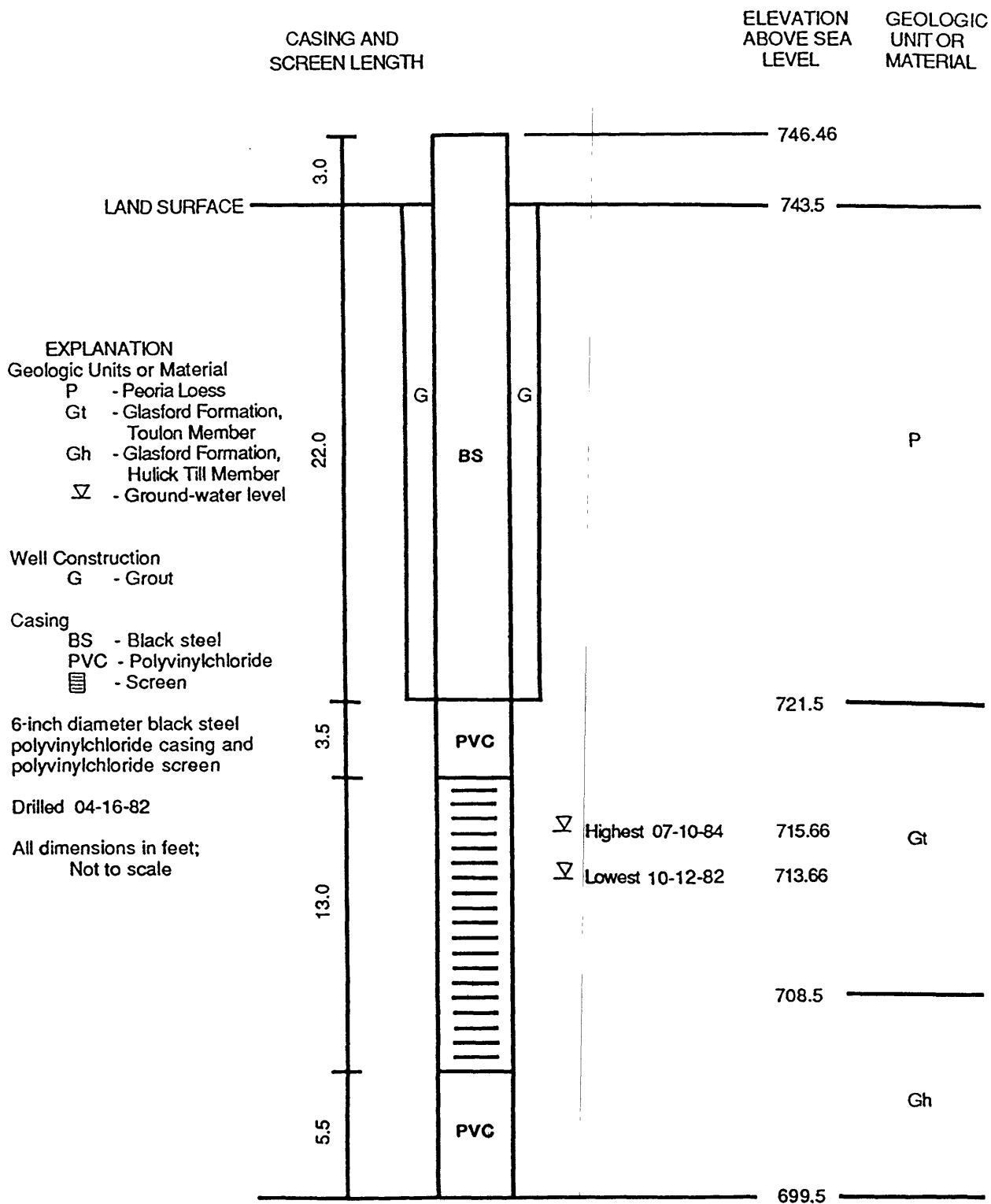


Figure 82.--Construction of well 581.

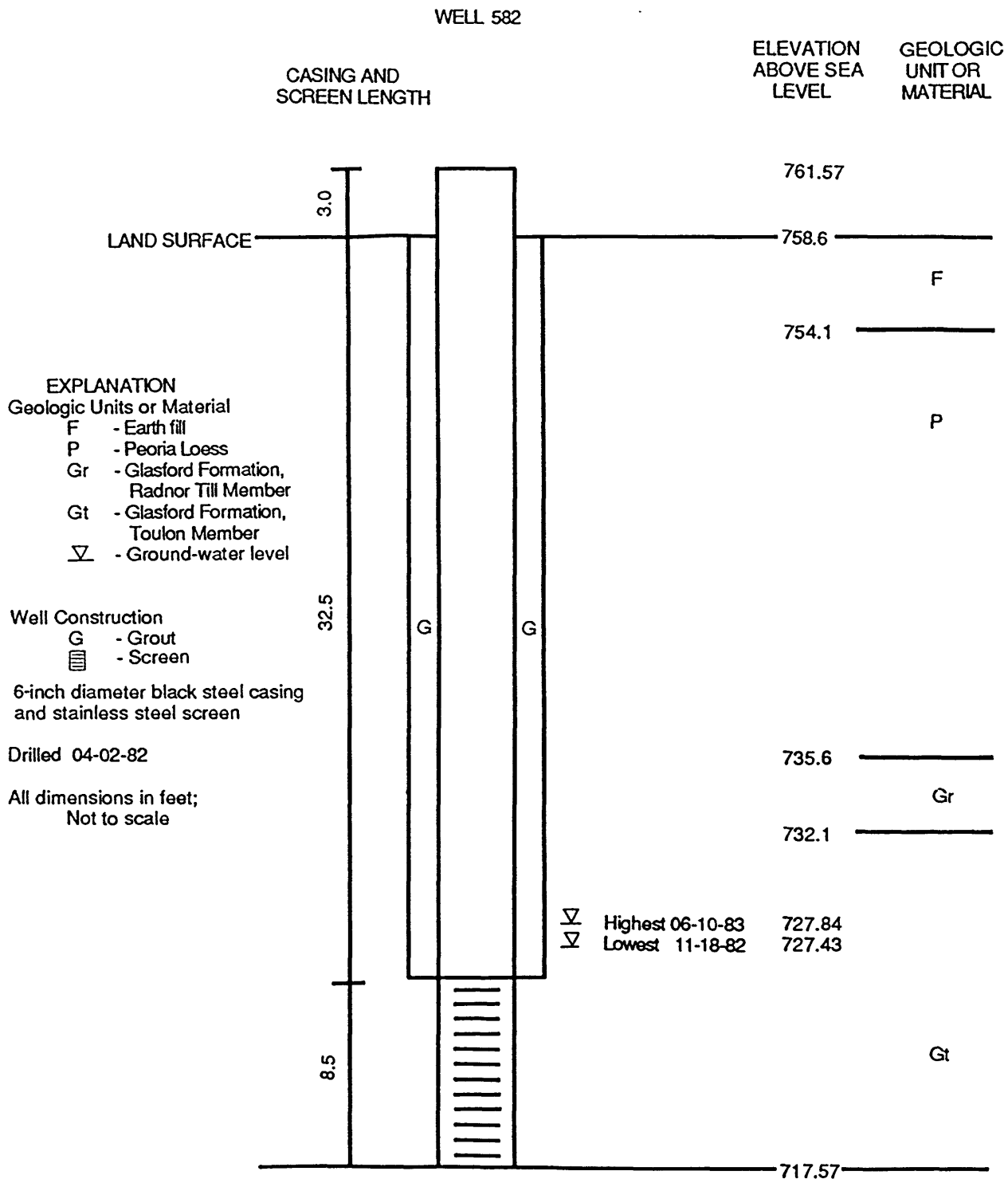


Figure 83.--Construction of well 582.

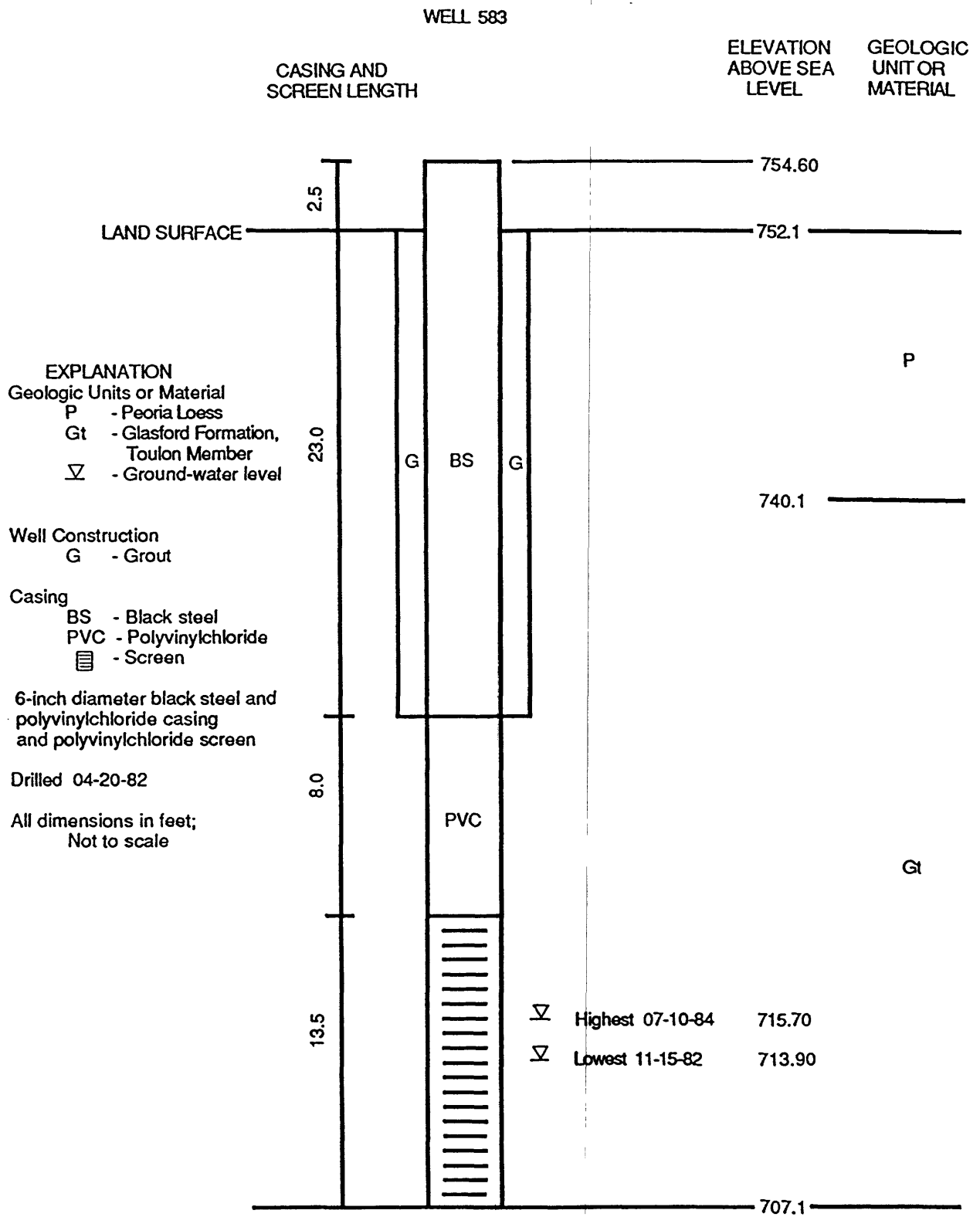


Figure 84.--Construction of well 583.

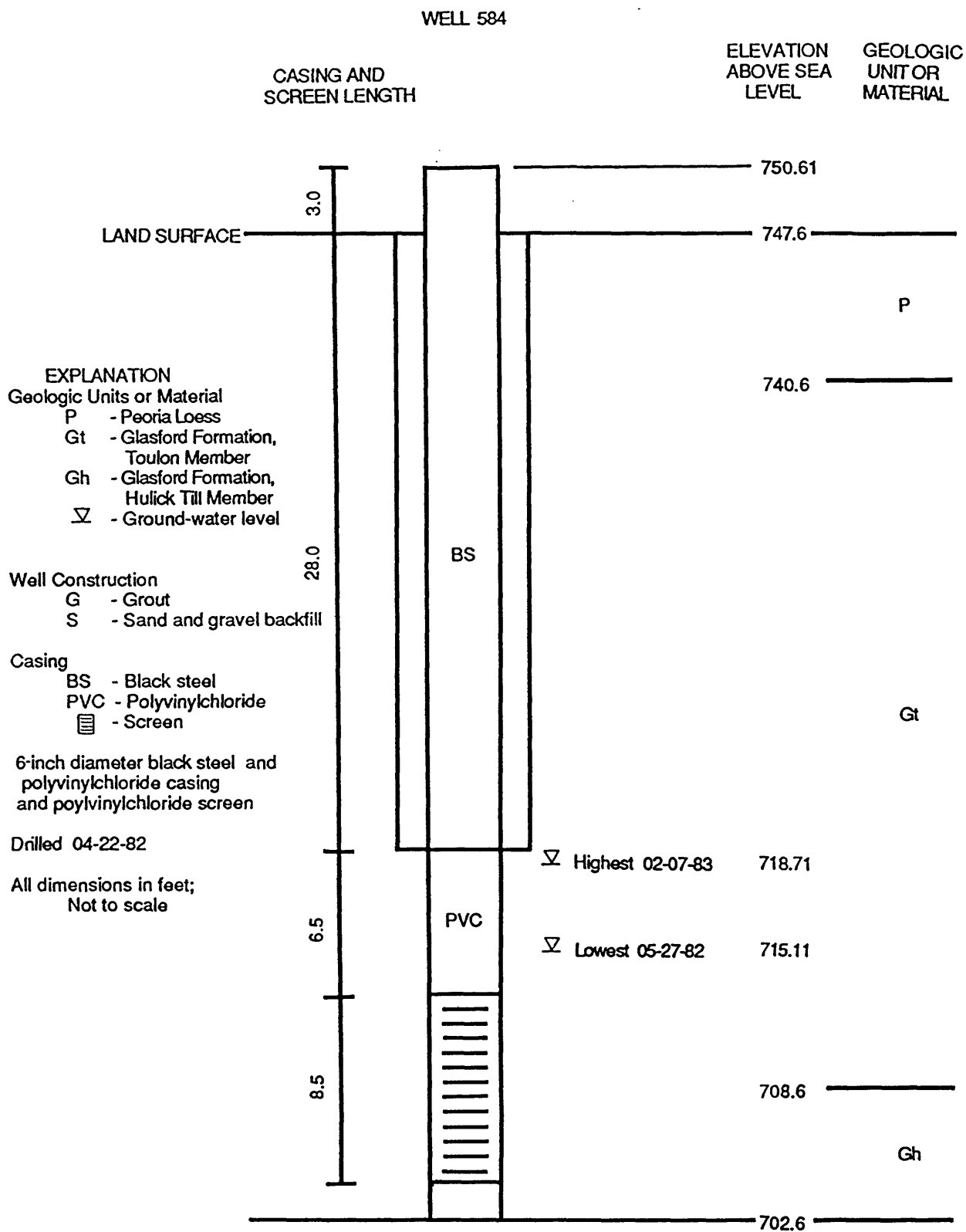


Figure 85.--Construction of well 584.

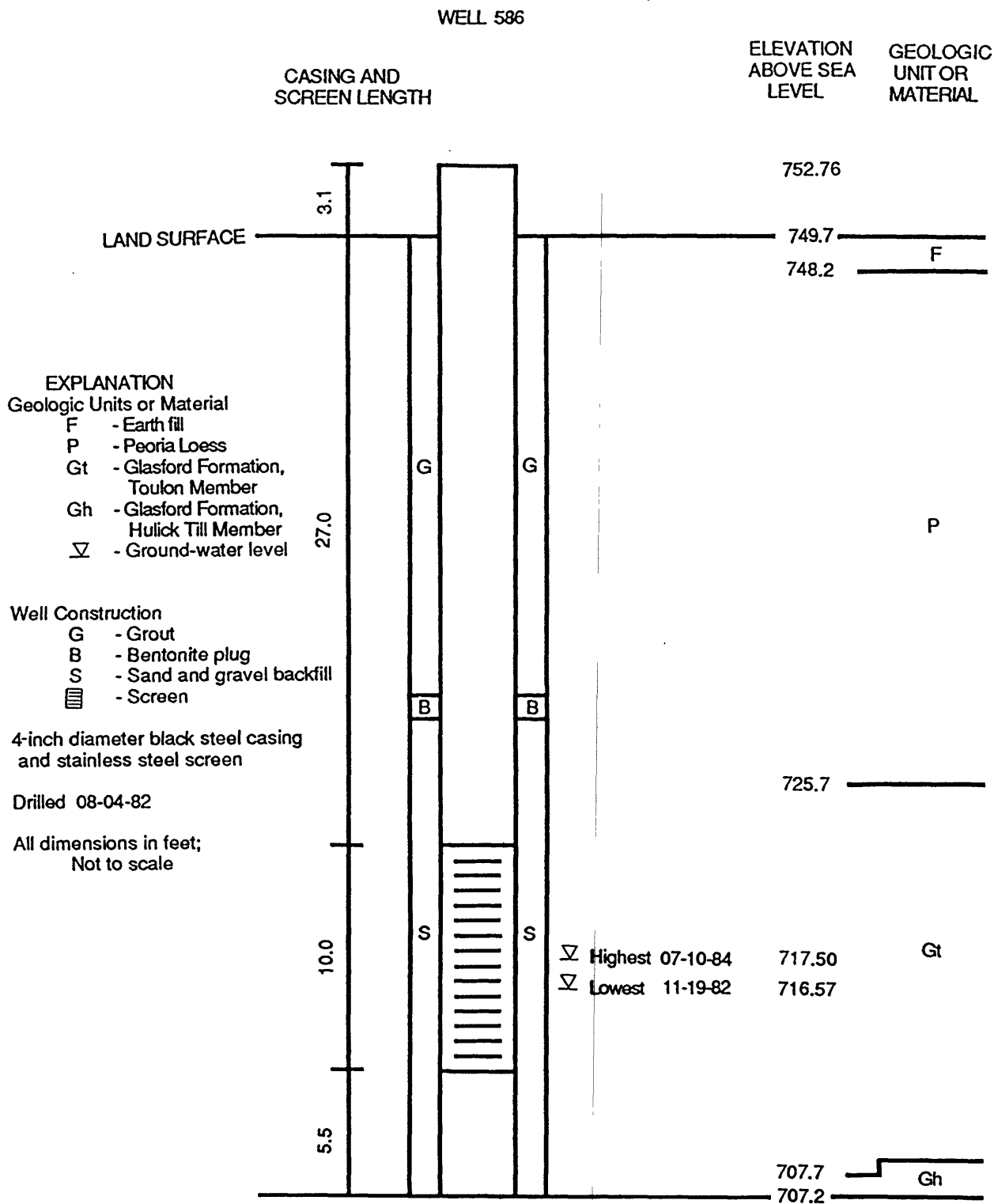


Figure 86.--Construction of well 586.

WELL 587

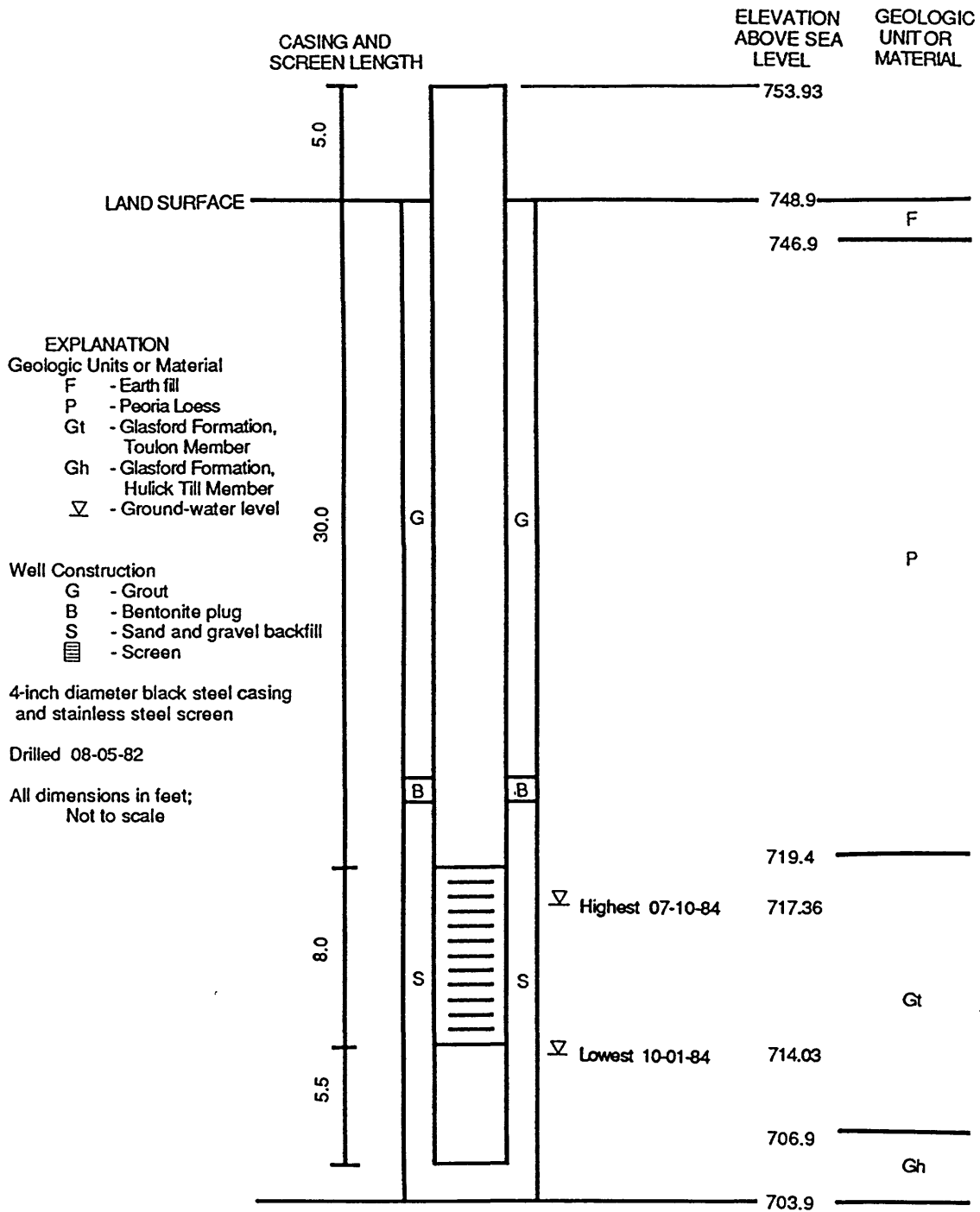


Figure 87.--Construction of well 587.

WELL 588

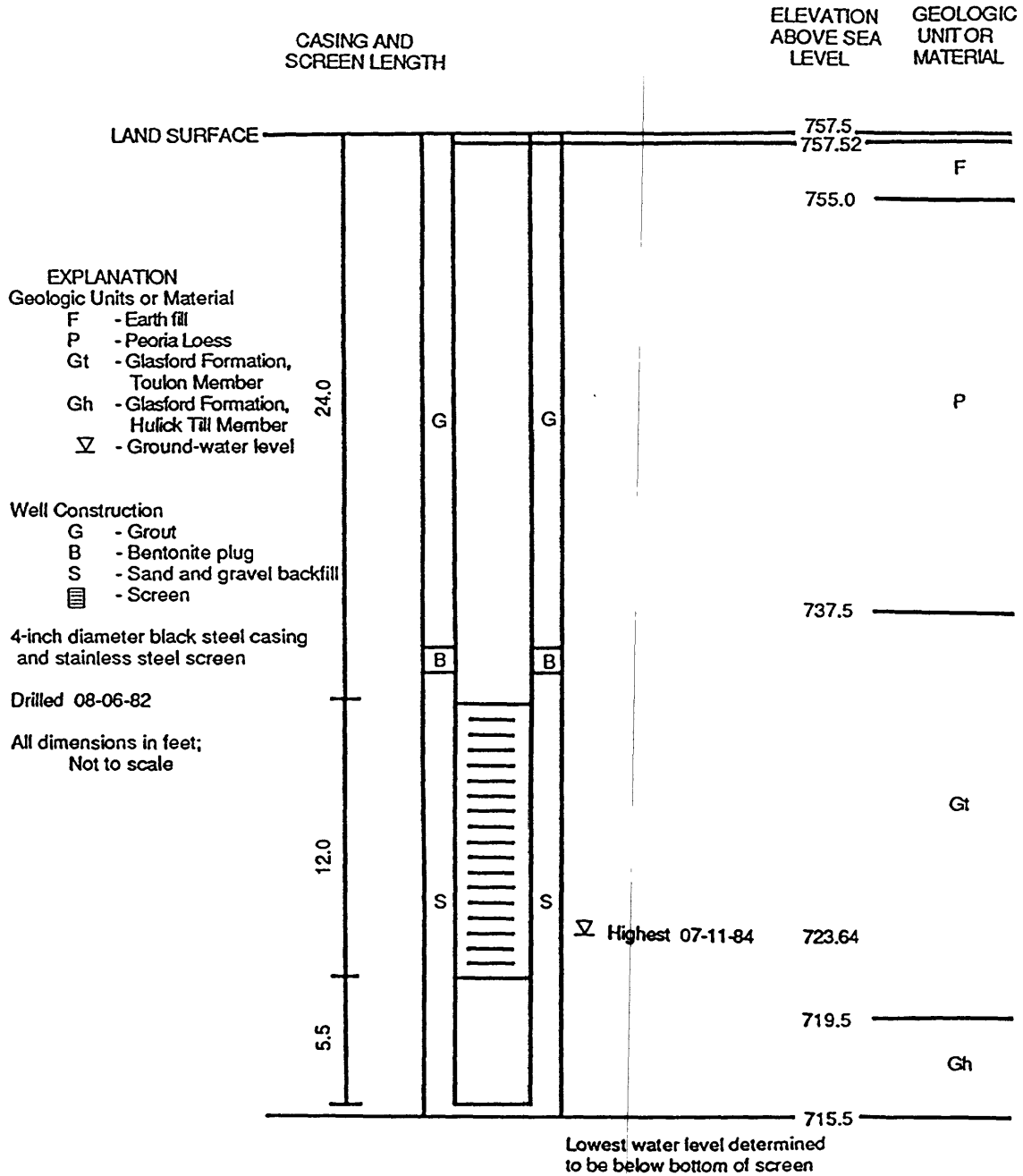


Figure 88.--Construction of well 588.

WELL 589

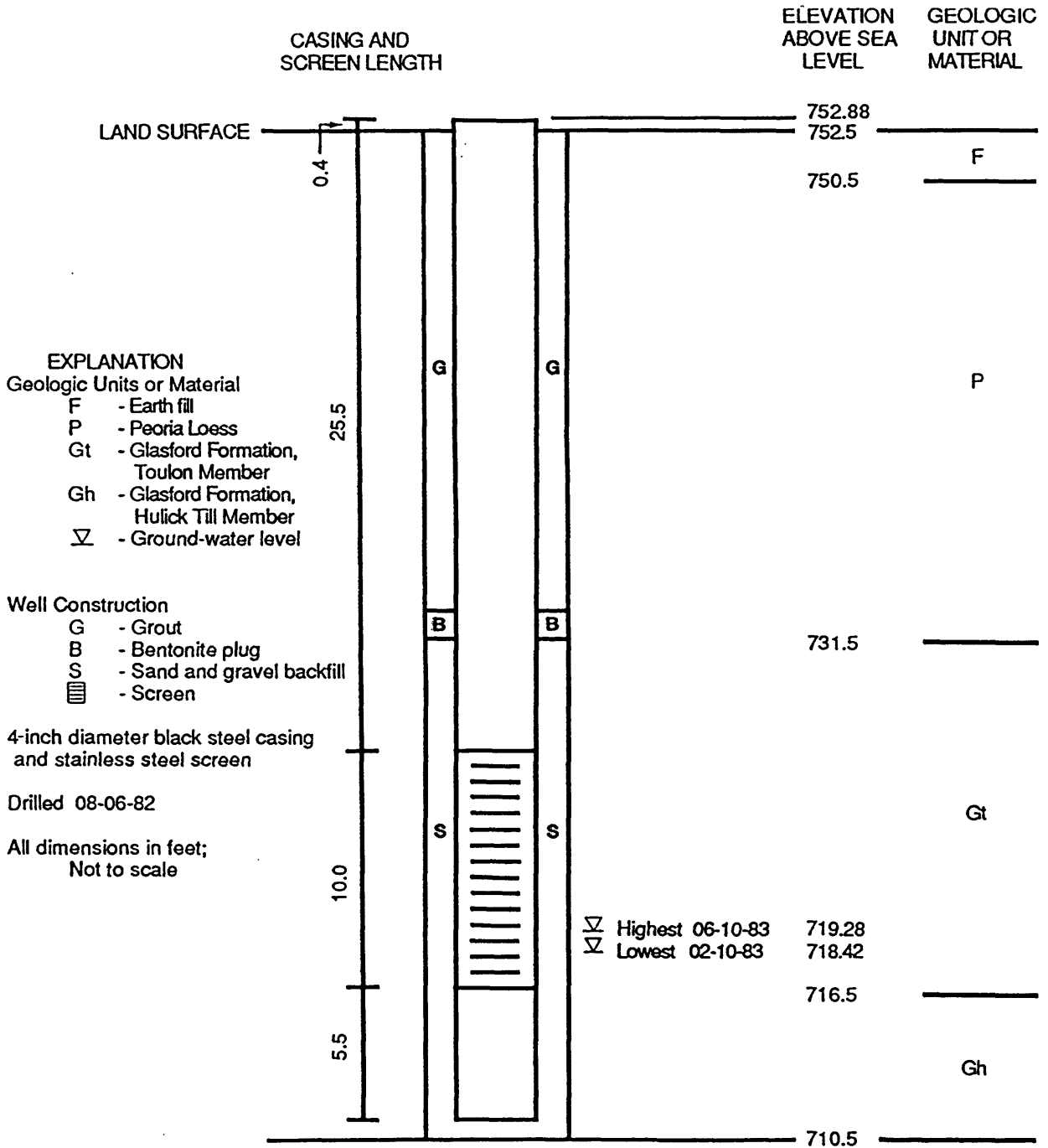


Figure 89.--Construction of well 589.

WELL 590

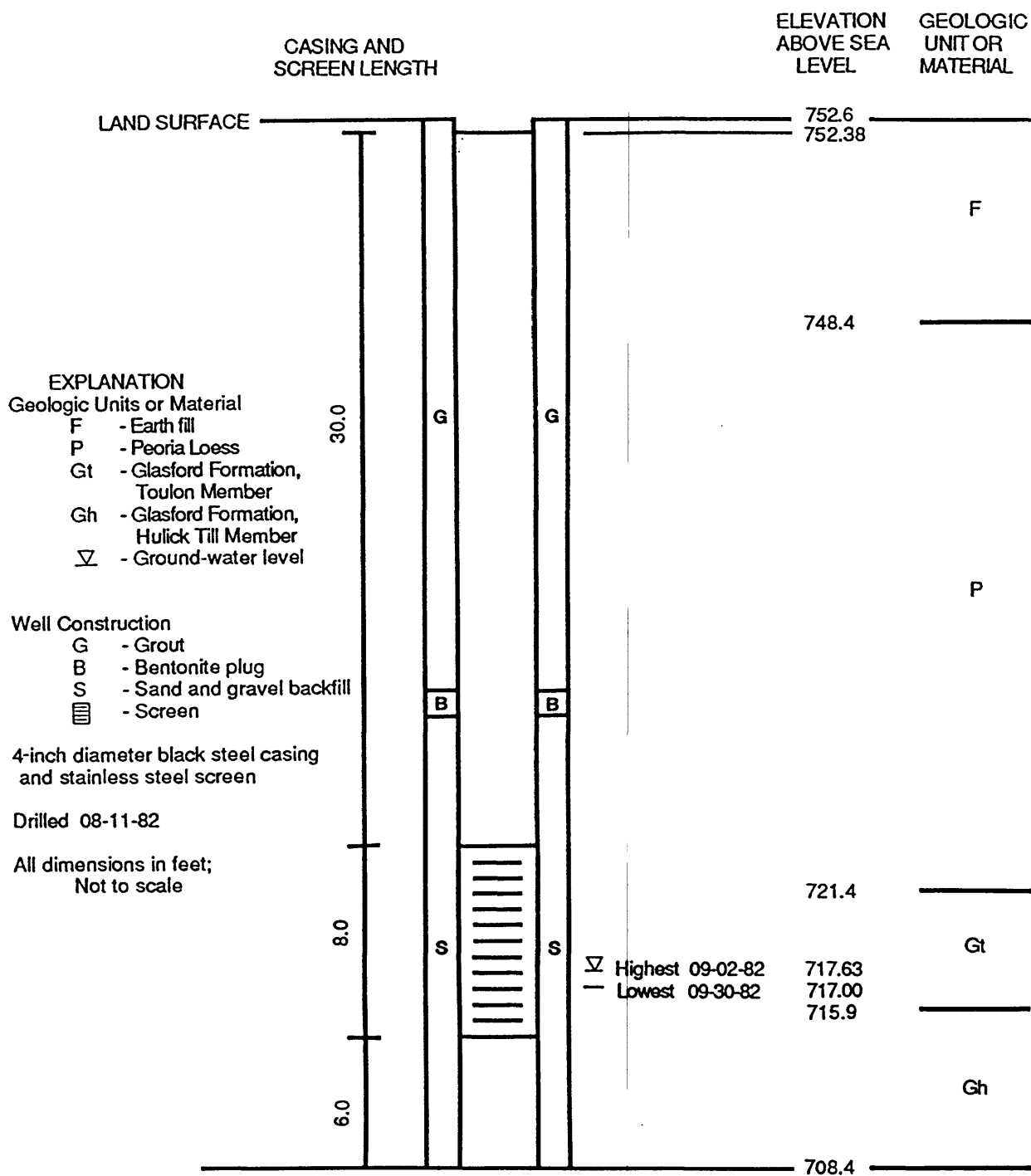


Figure 90.--Construction of well 590.

WELL 591

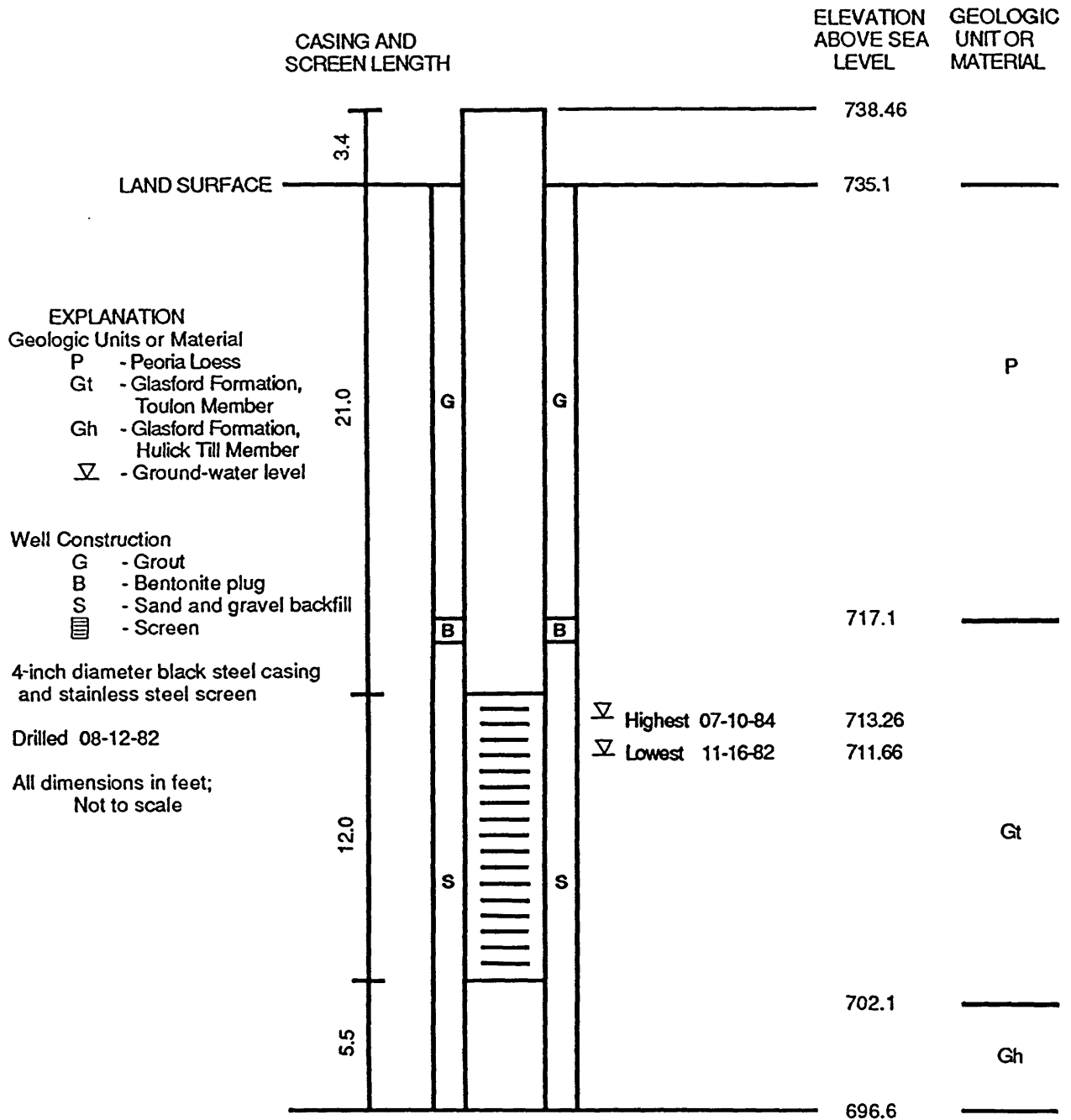


Figure 91.--Construction of well 591.

WELL 592

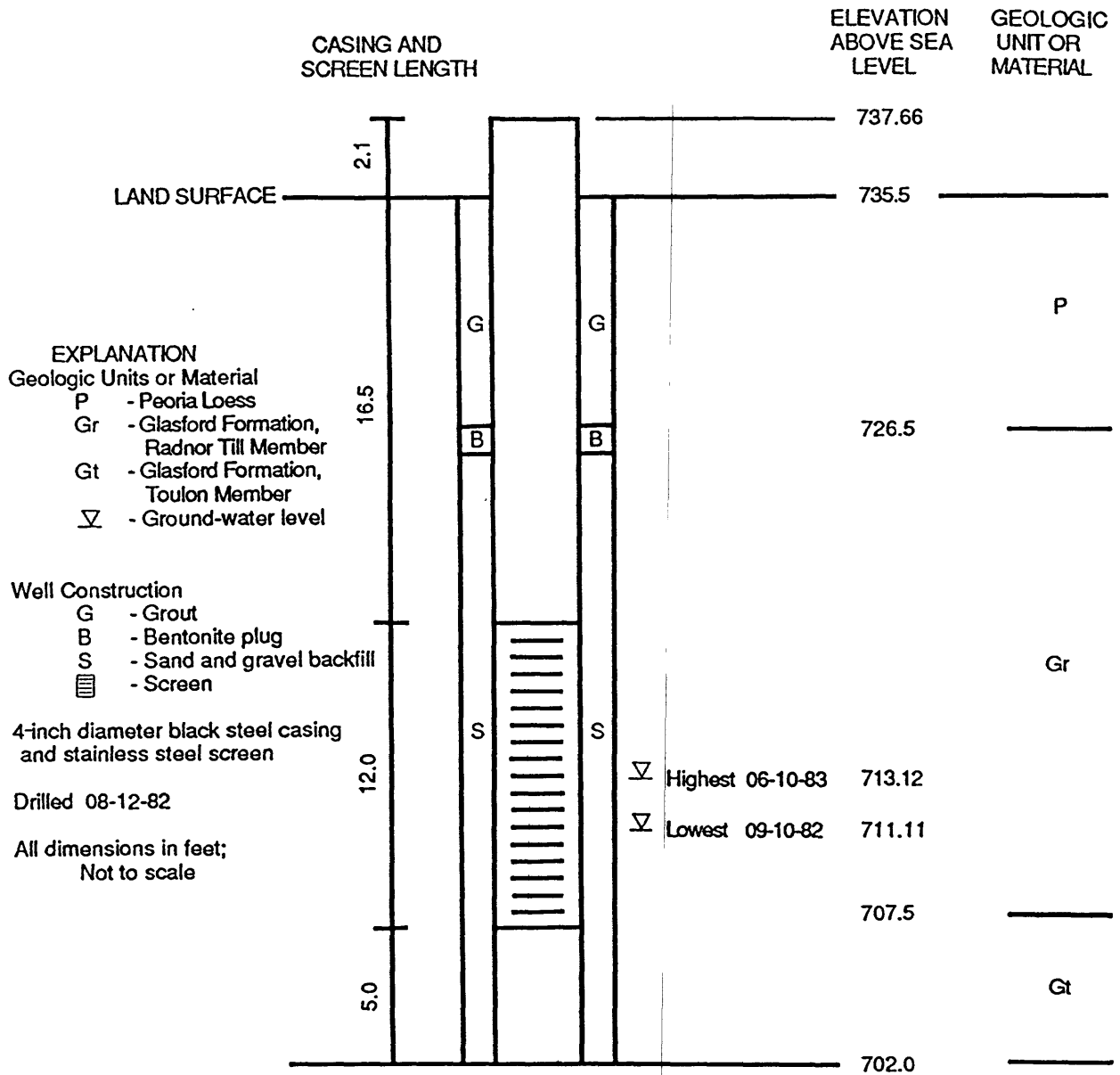


Figure 92.--Construction of well 592.

WELL 594

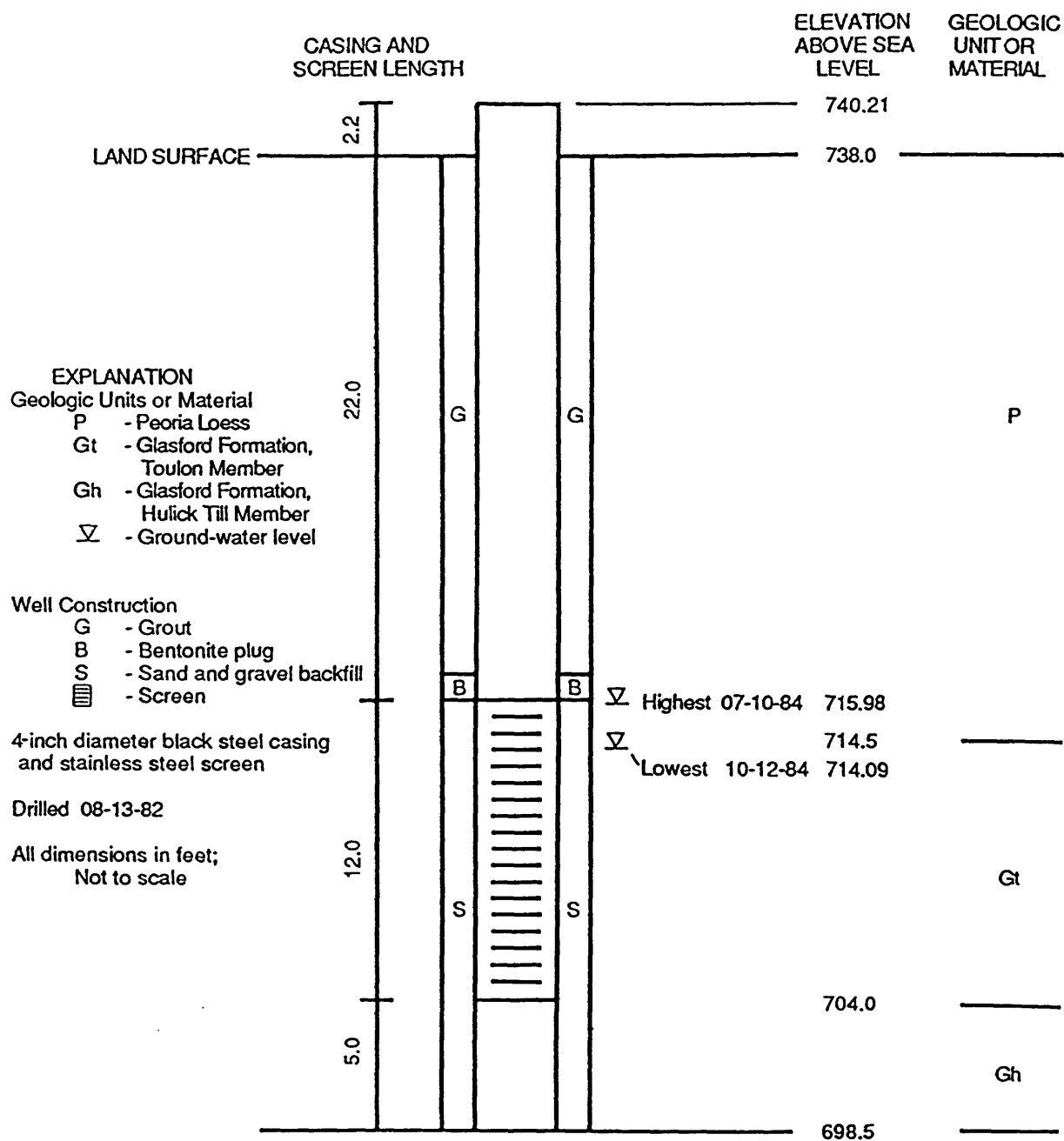


Figure 93.--Construction of well 594.

WELL 597

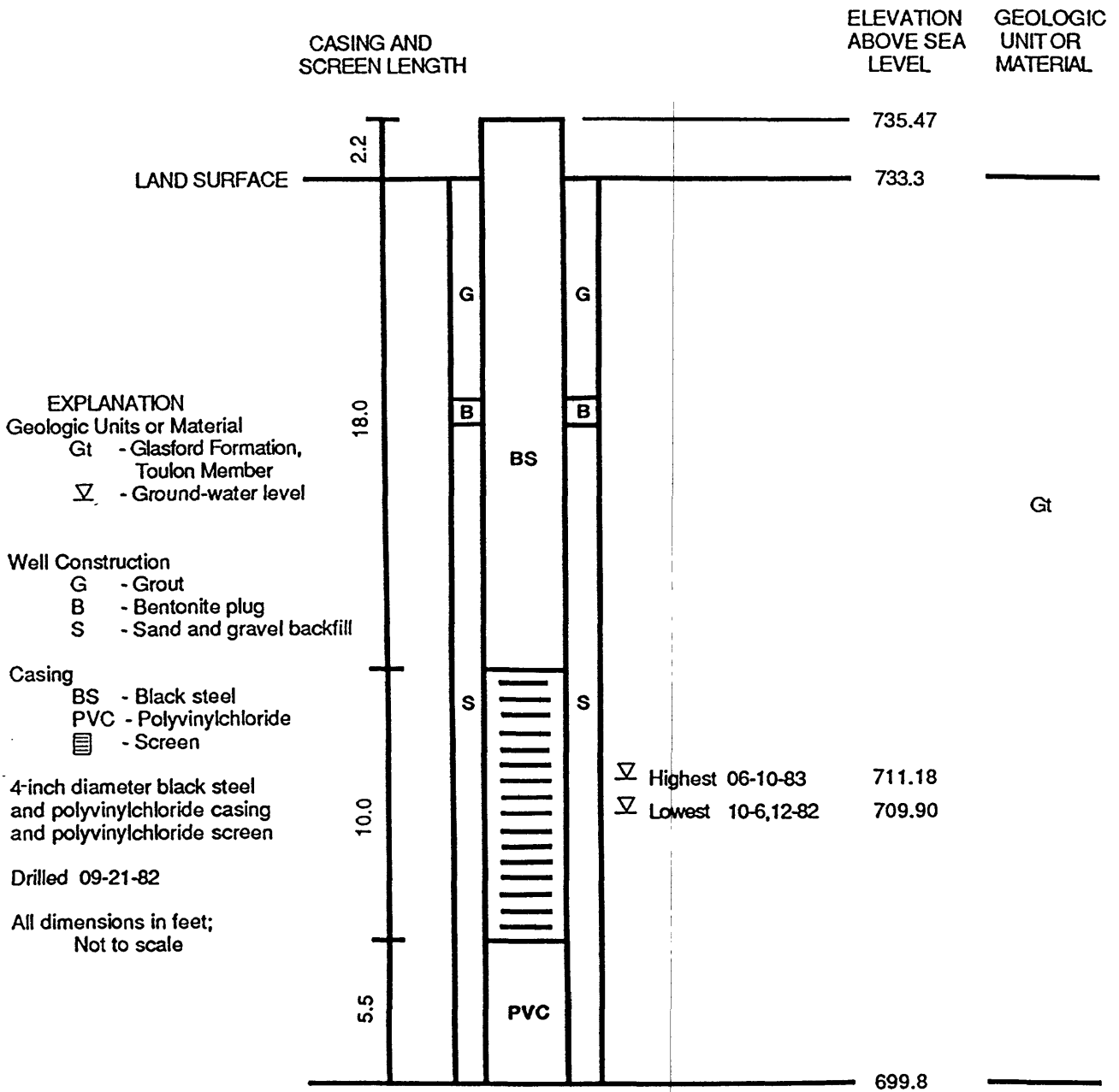


Figure 94.--Construction of well 597.

WELL 599

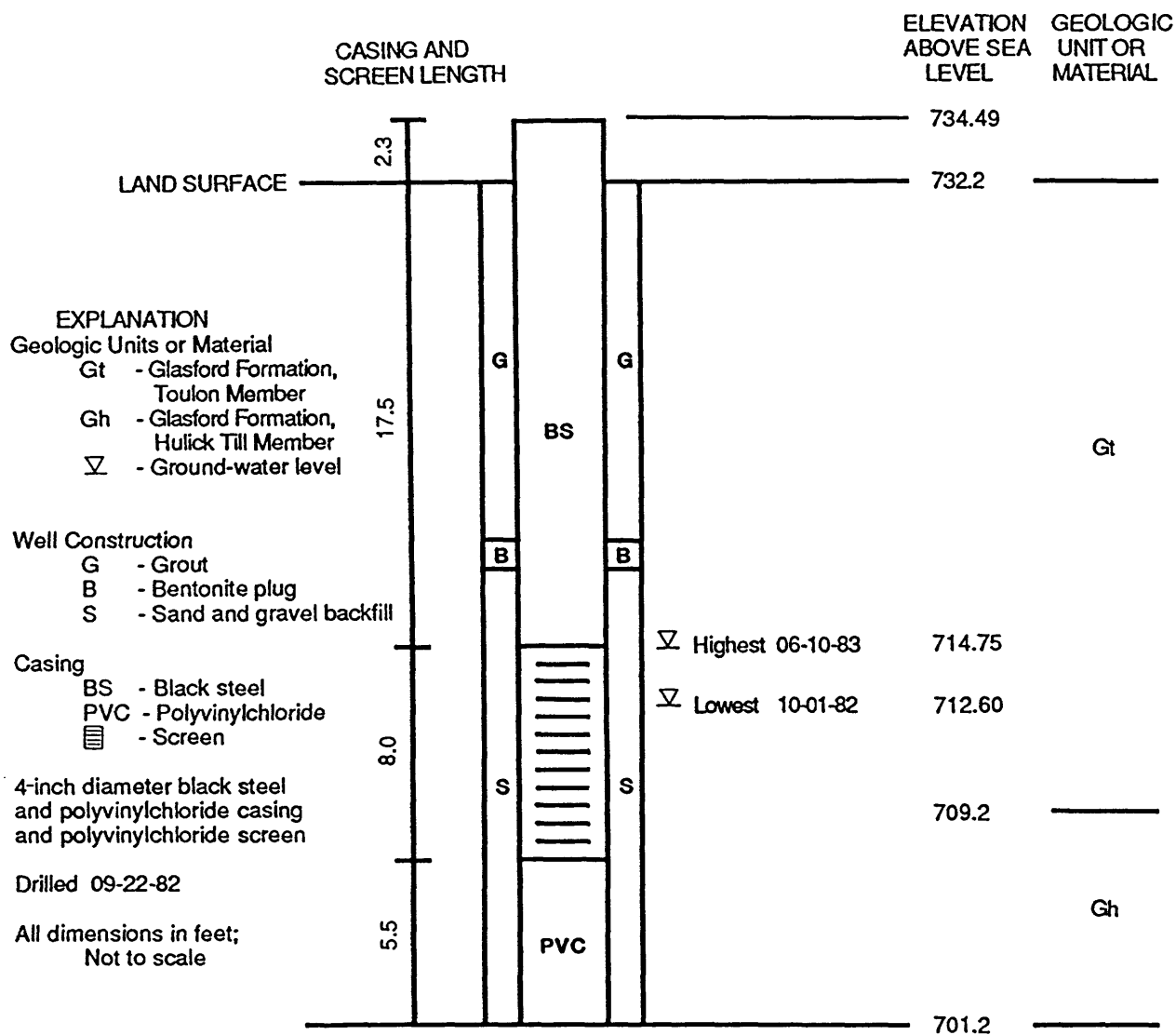


Figure 95.--Construction of well 599.

WELL 600

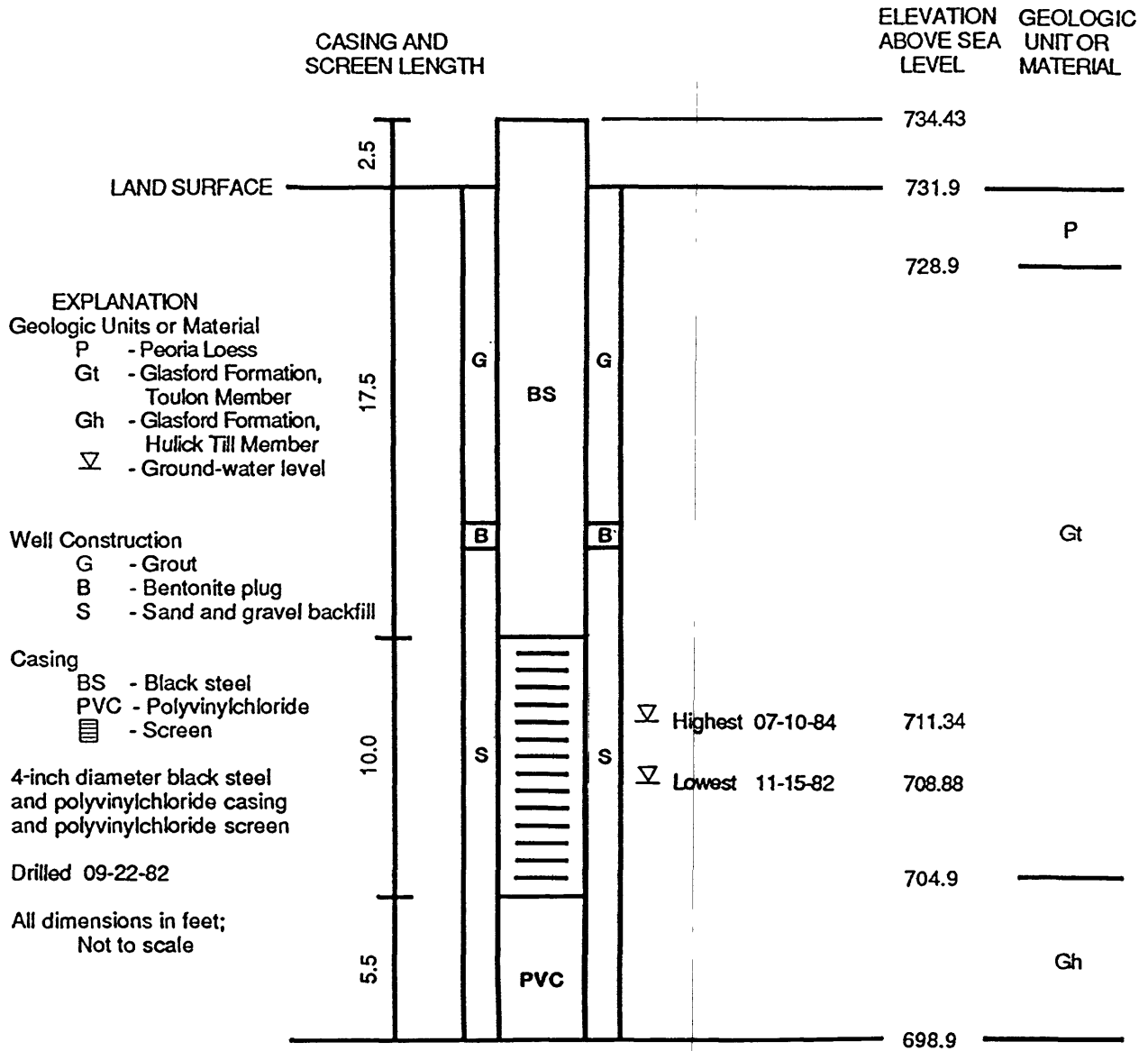


Figure 96.--Construction of well 600.

WELL 601

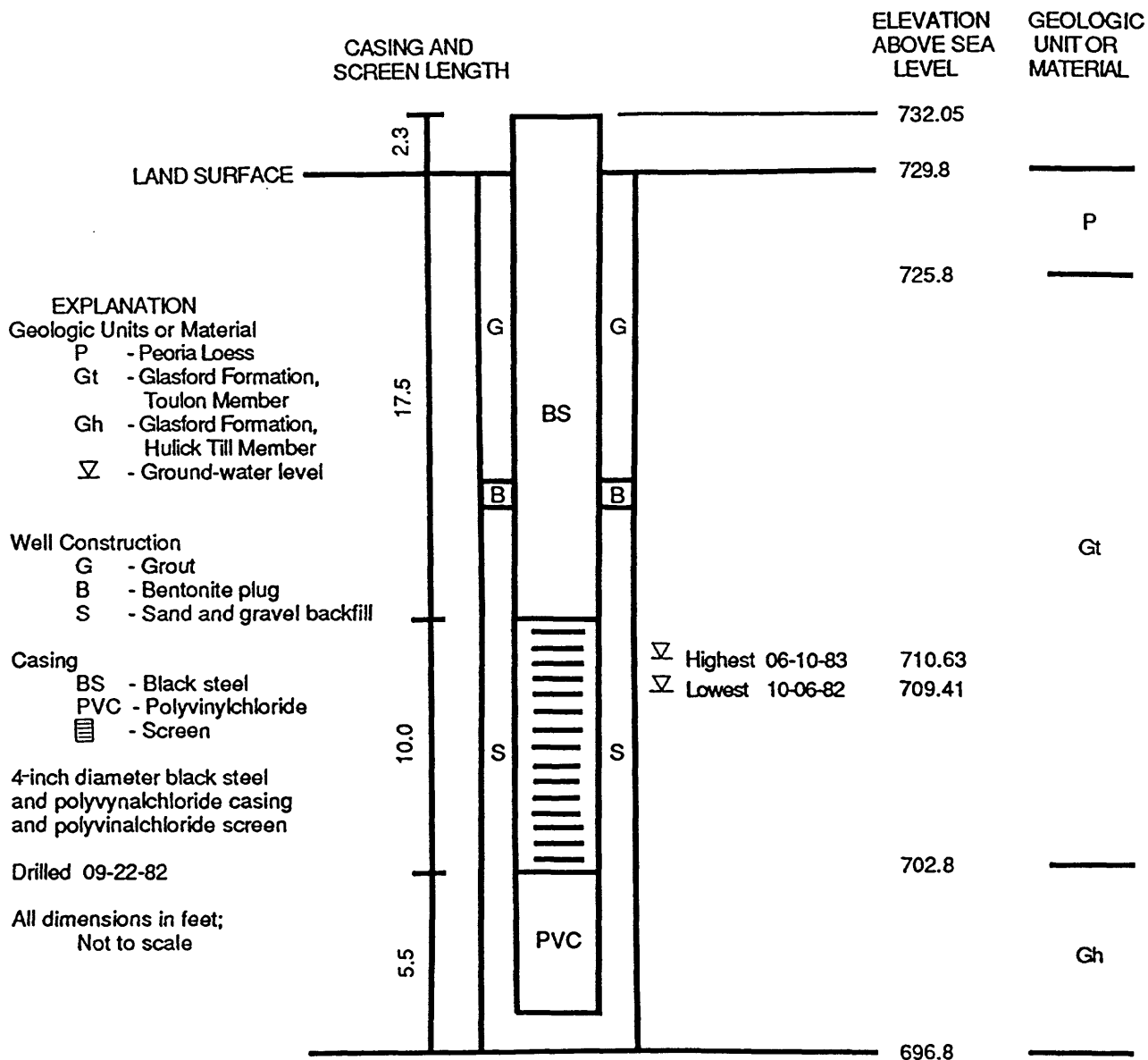


Figure 97.--Construction of well 601.

WELL 602

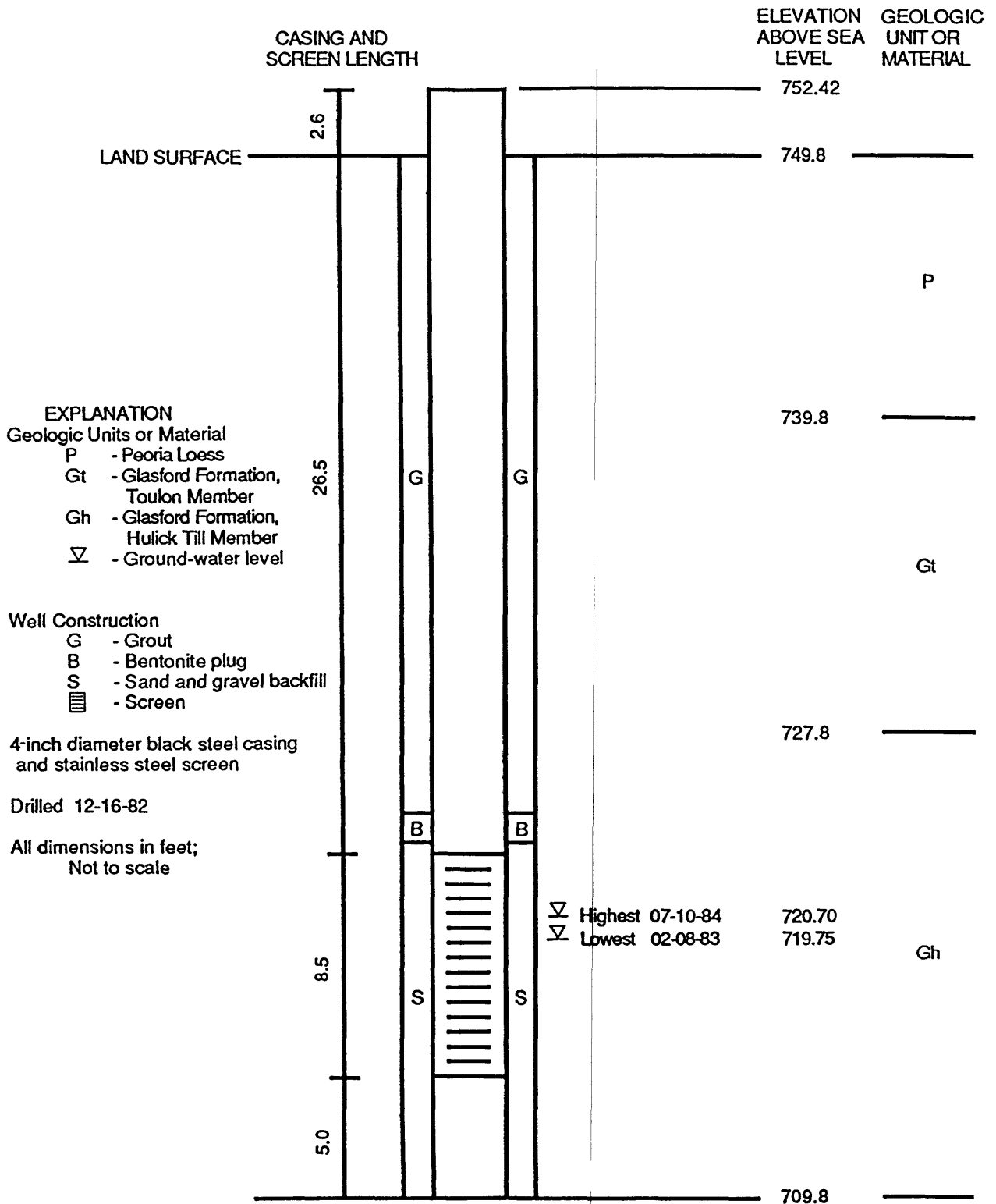


Figure 98.--Construction of well 602.

WELL 603

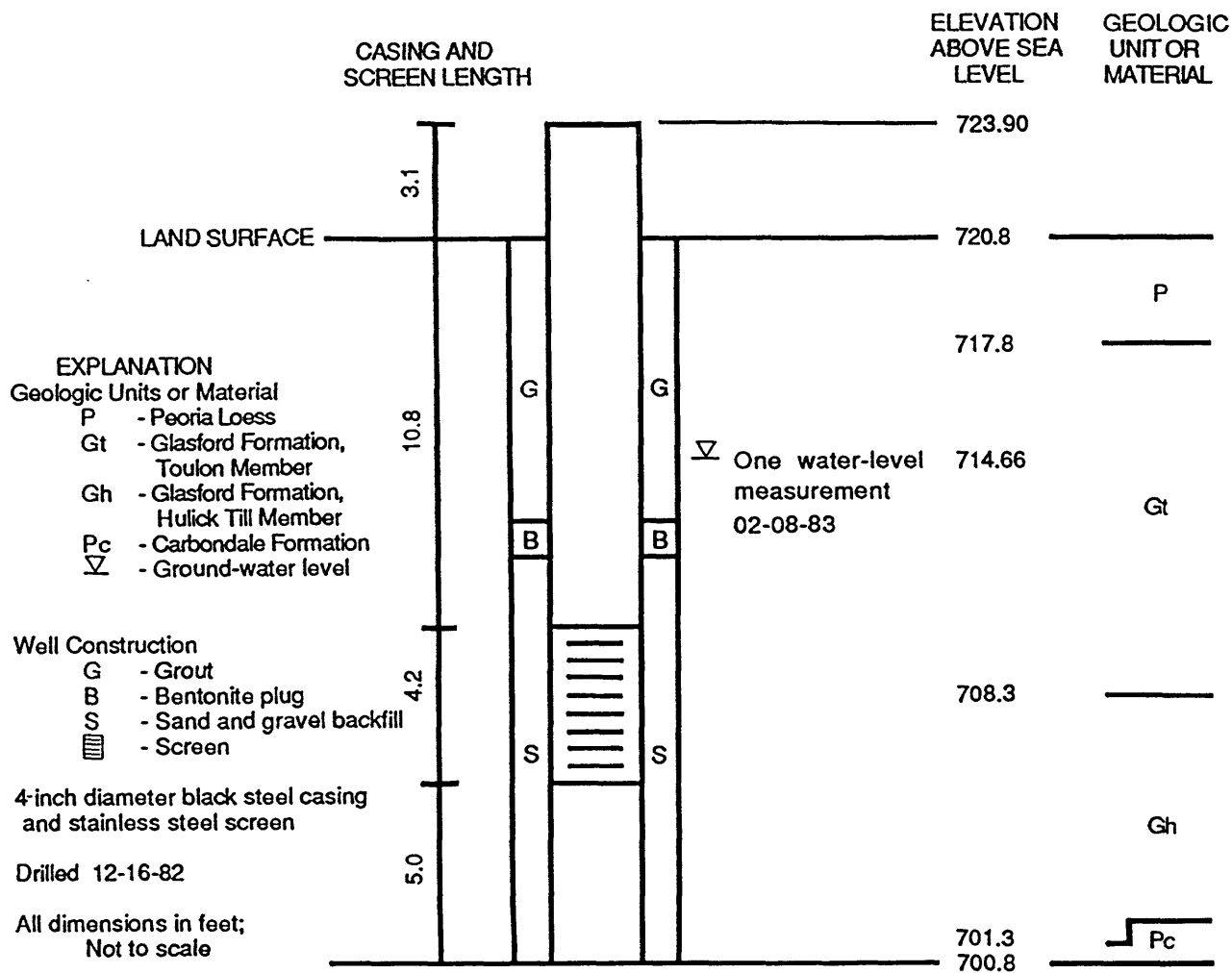


Figure 99.--Construction of well 603.

WELL 604

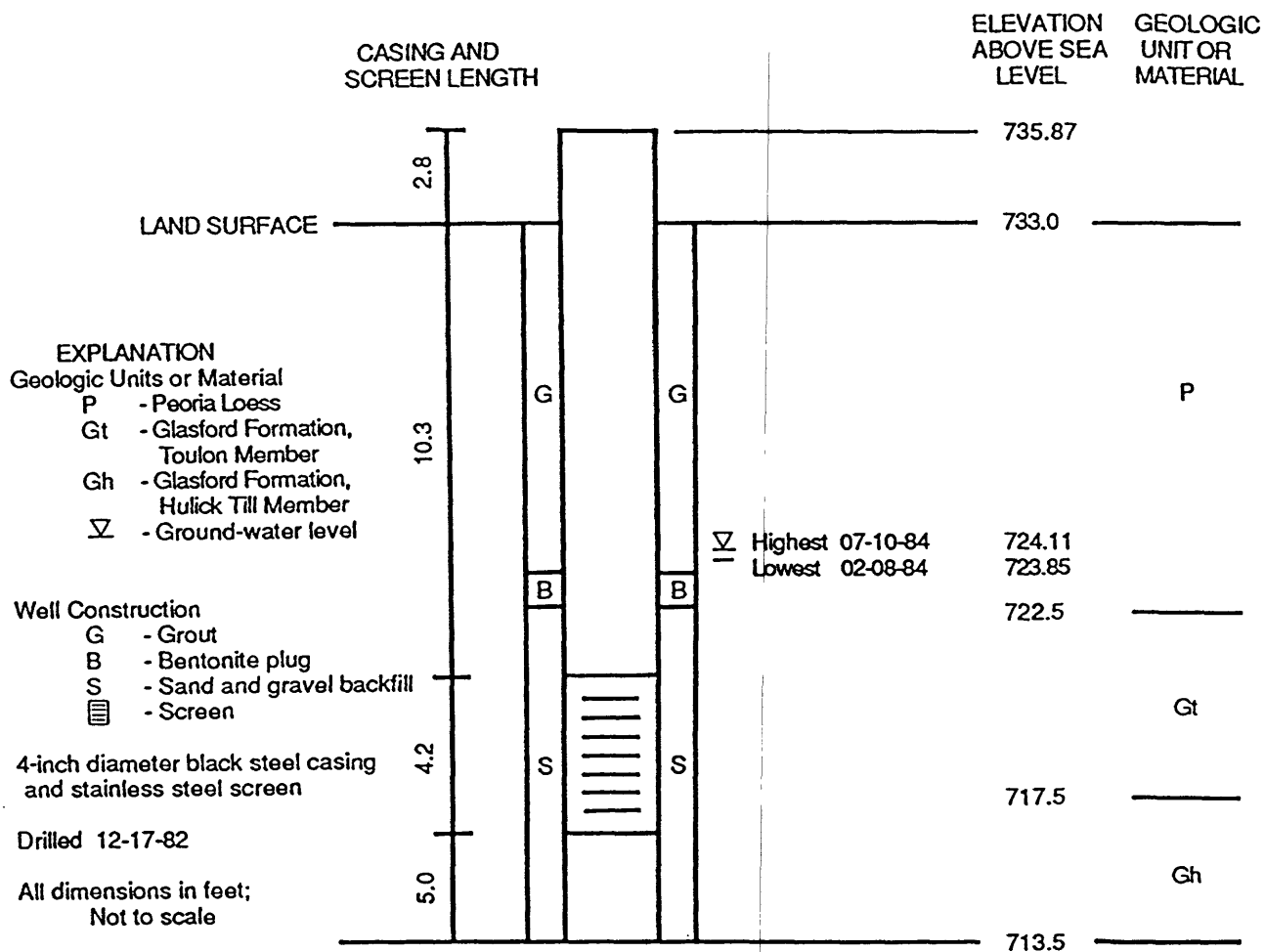


Figure 100.--Construction of well 604.

WELL 605

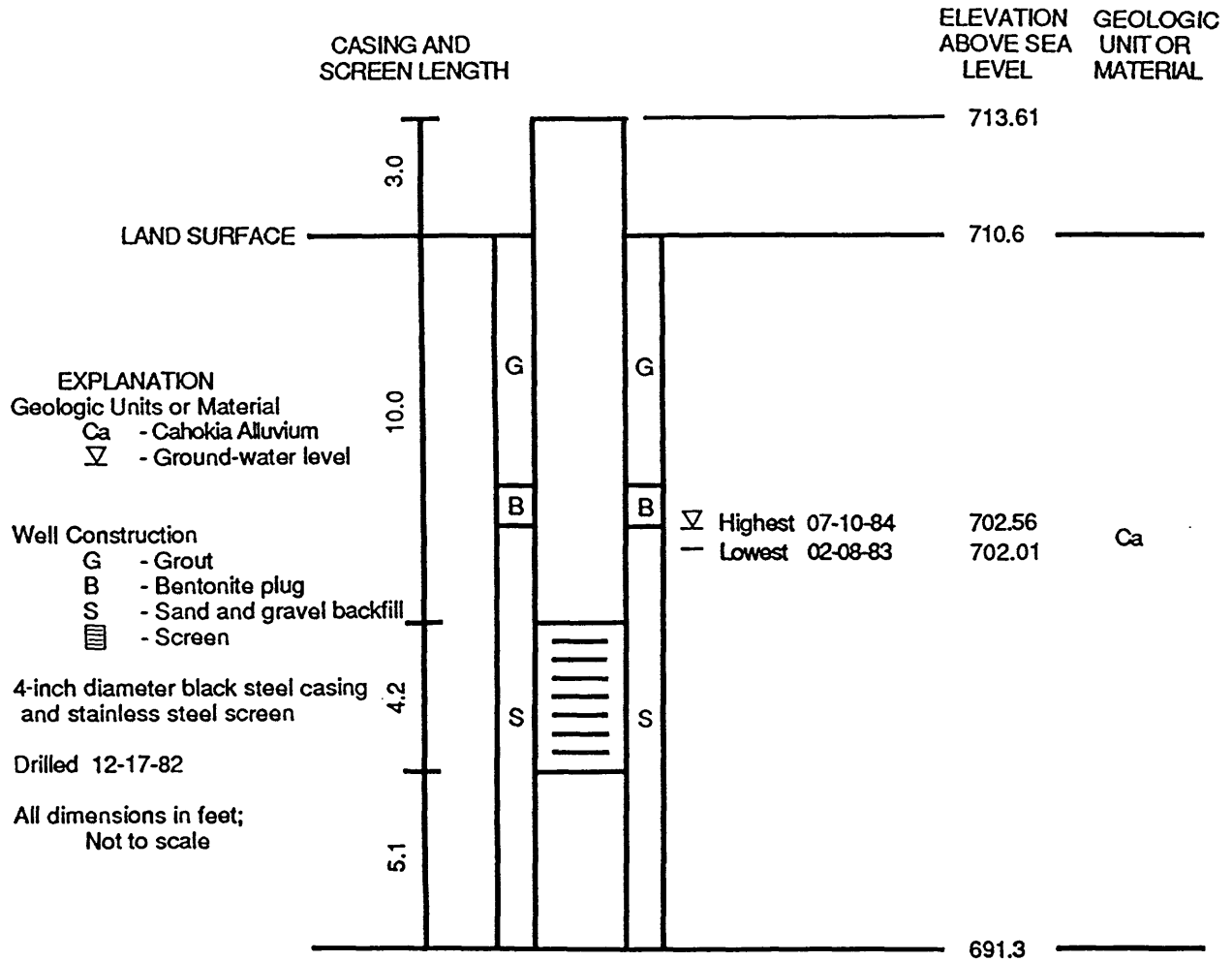


Figure 101.--Construction of well 605.

WELL 606

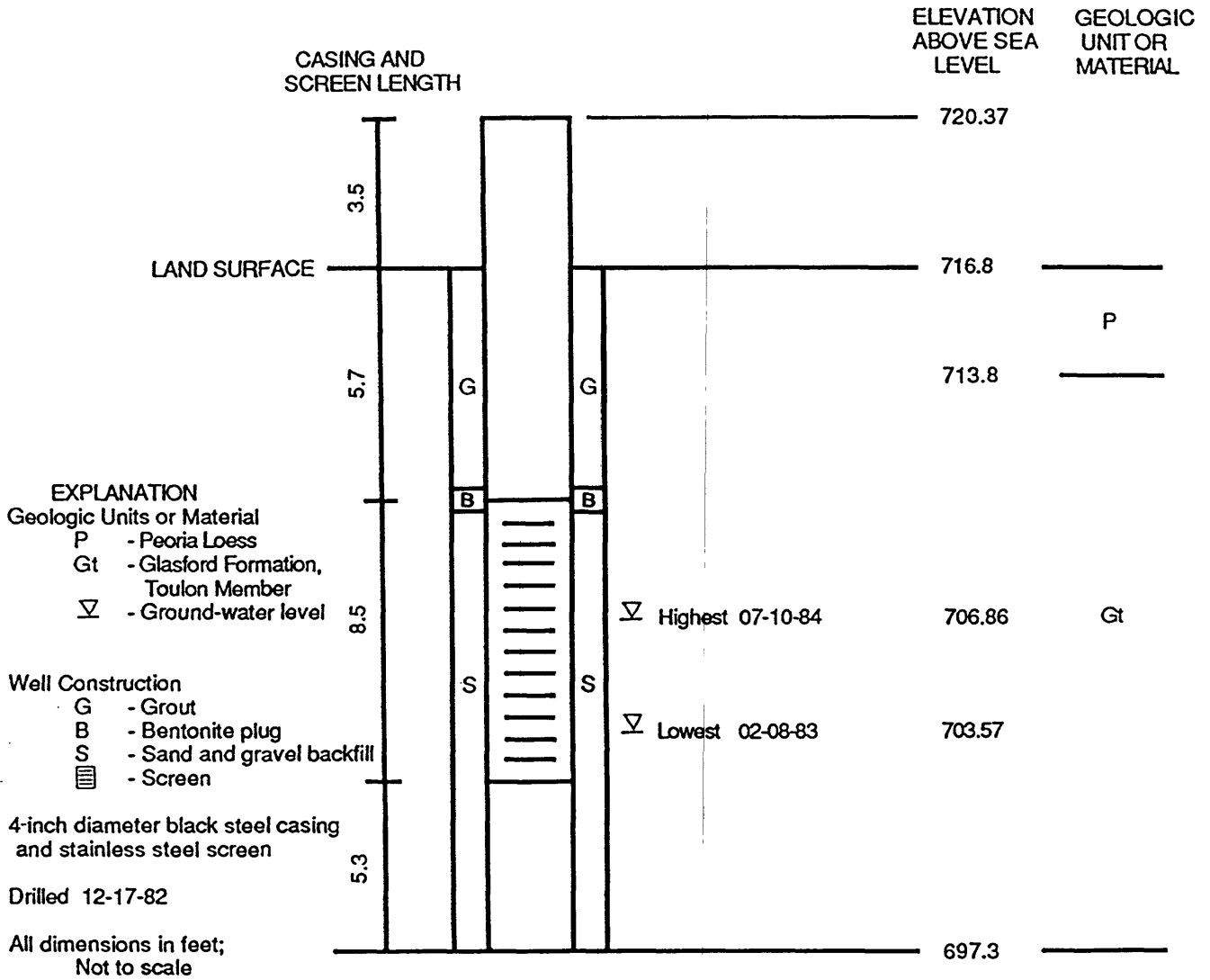


Figure 102.--Construction of well 606.

WELL 607

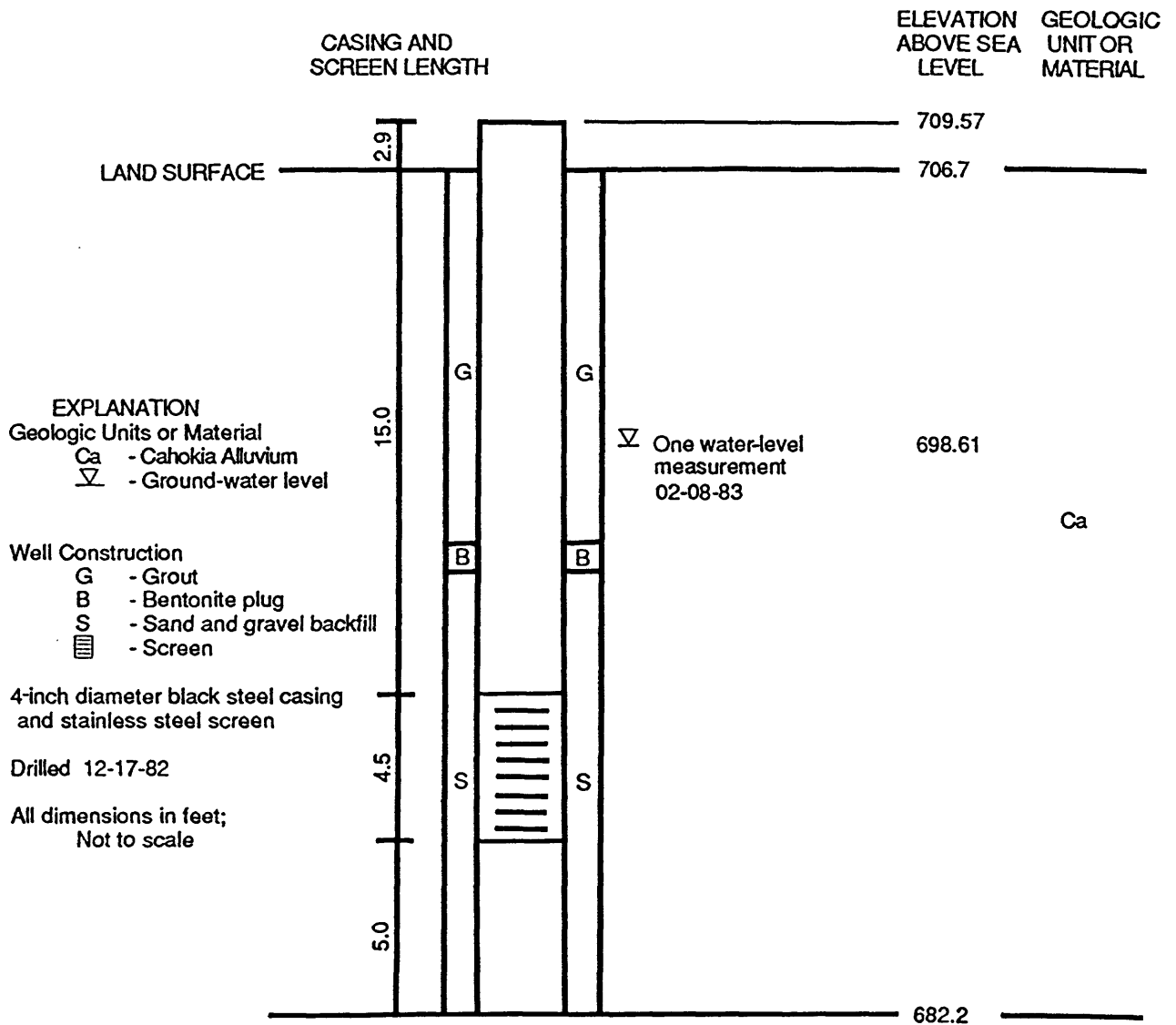


Figure 103.--Construction of well 607.

WELL 608

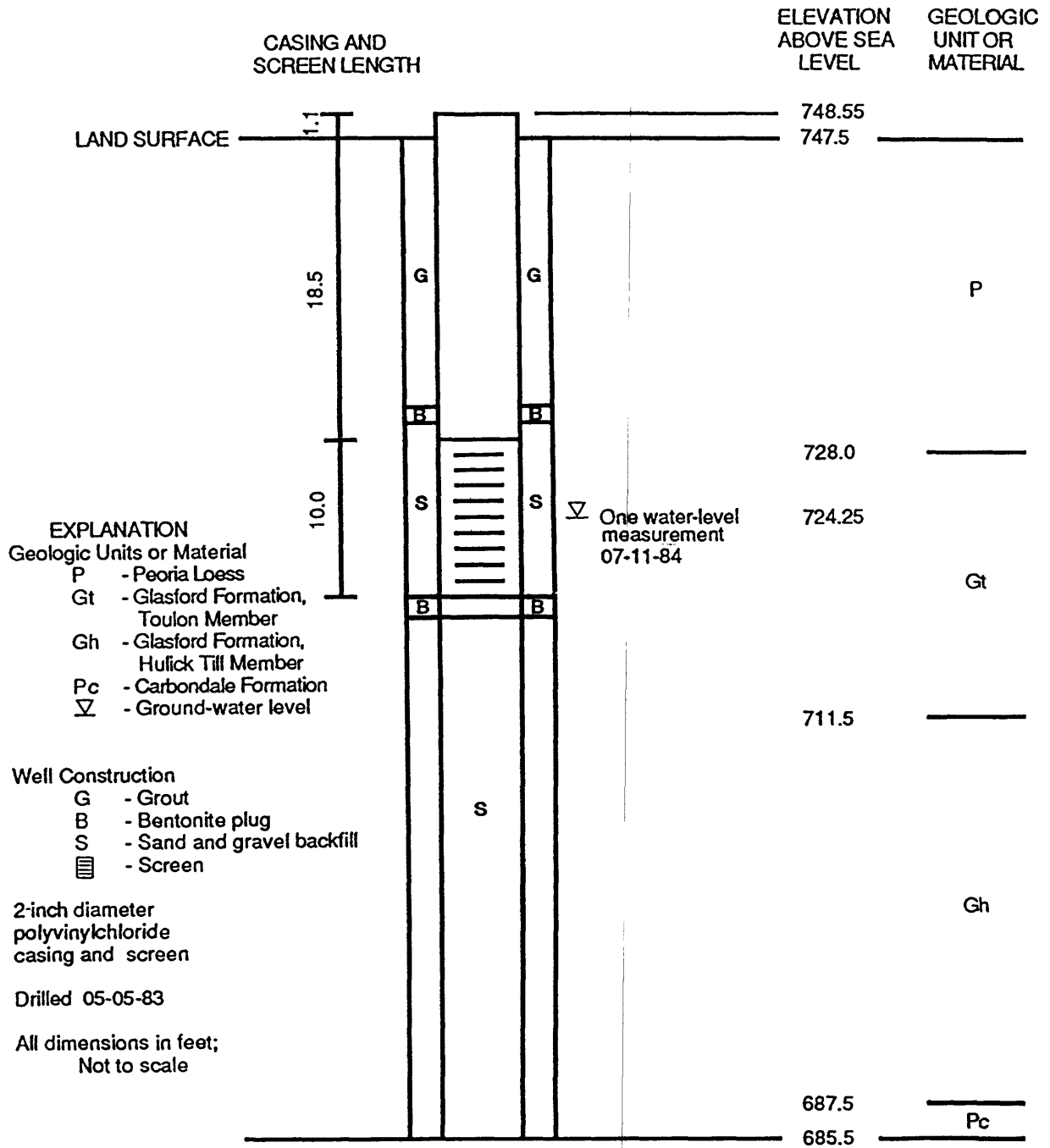


Figure 104.--Construction of well 608.

WELL 609

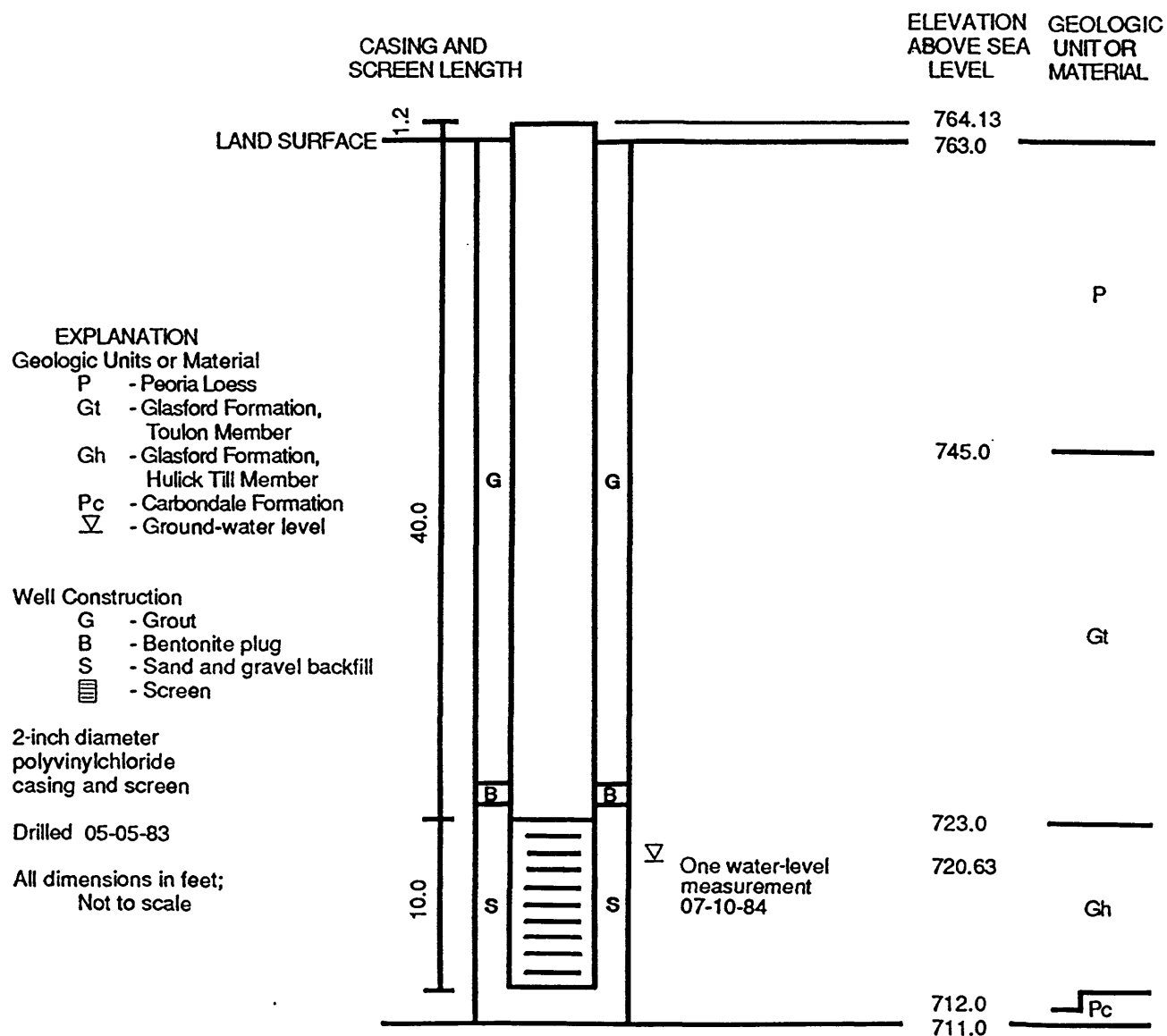


Figure 105.--Construction of well 609.

WELL 610

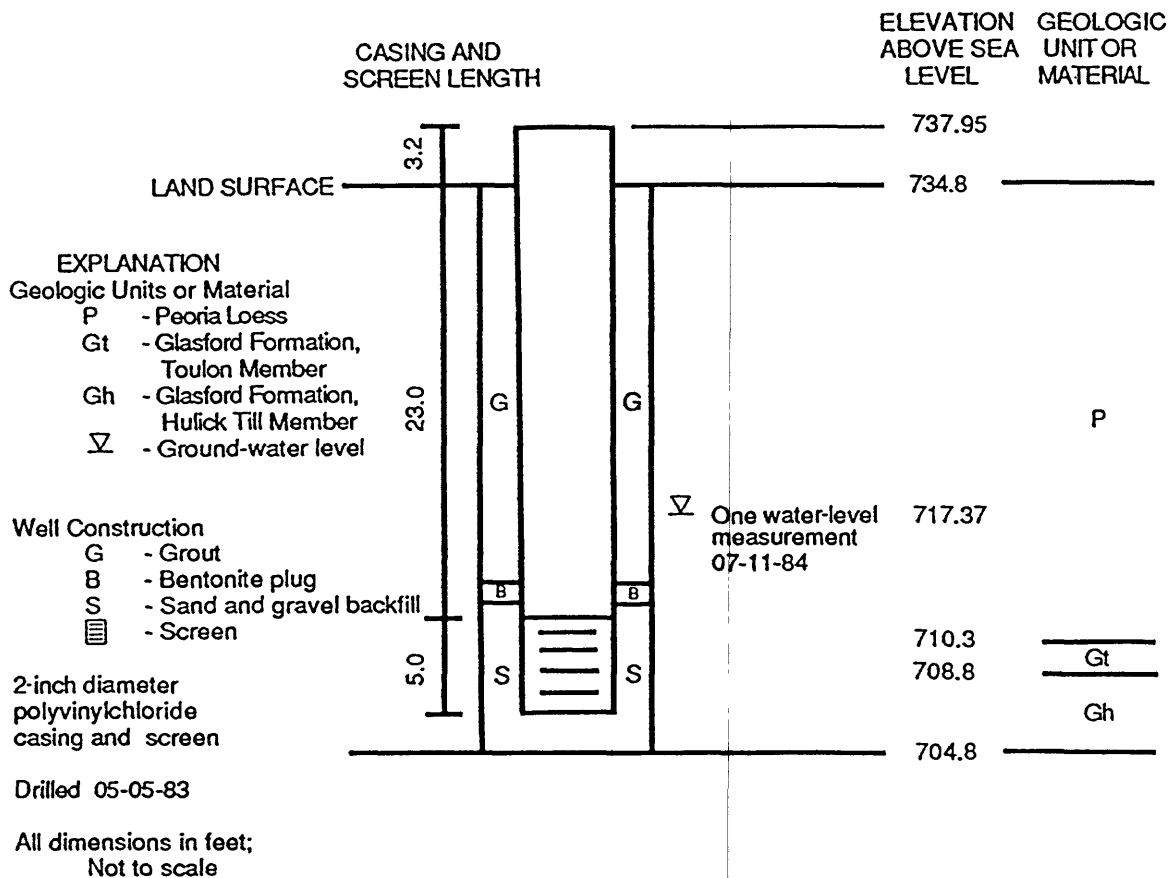


Figure 106.--Construction of well 610.

WELL 611

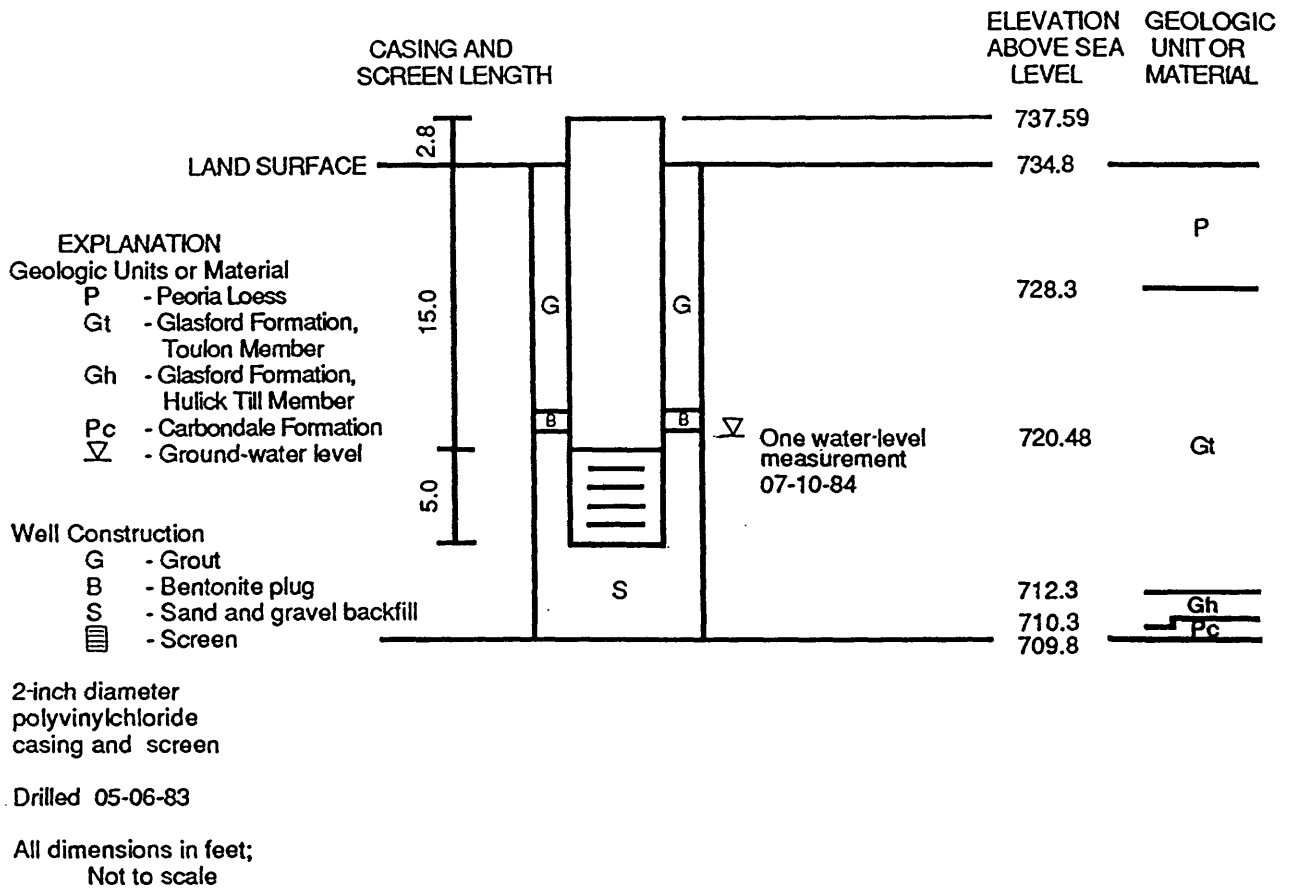


Figure 107.--Construction of well 611.

WELL 612

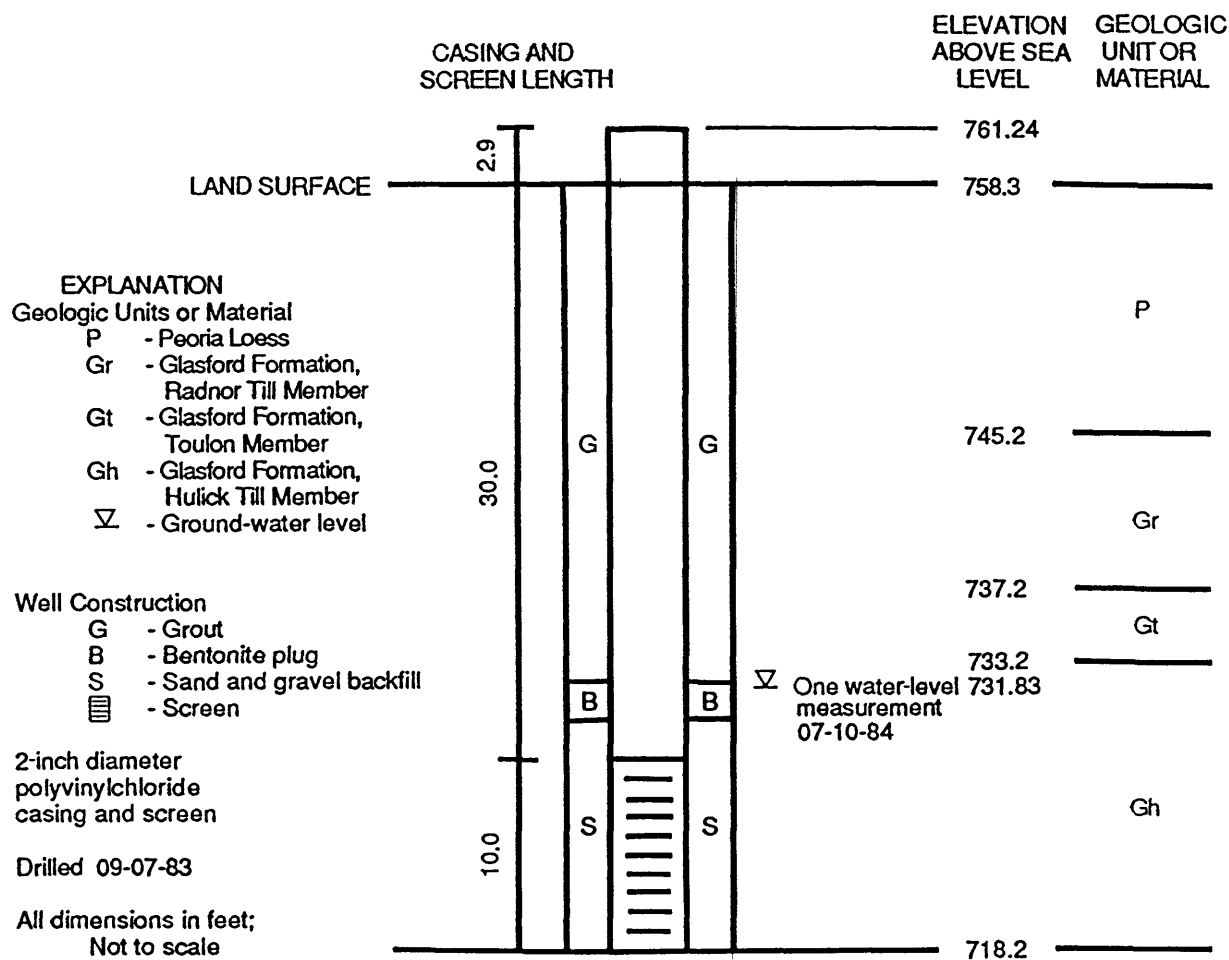


Figure 108.--Construction of well 612.

WELL 613

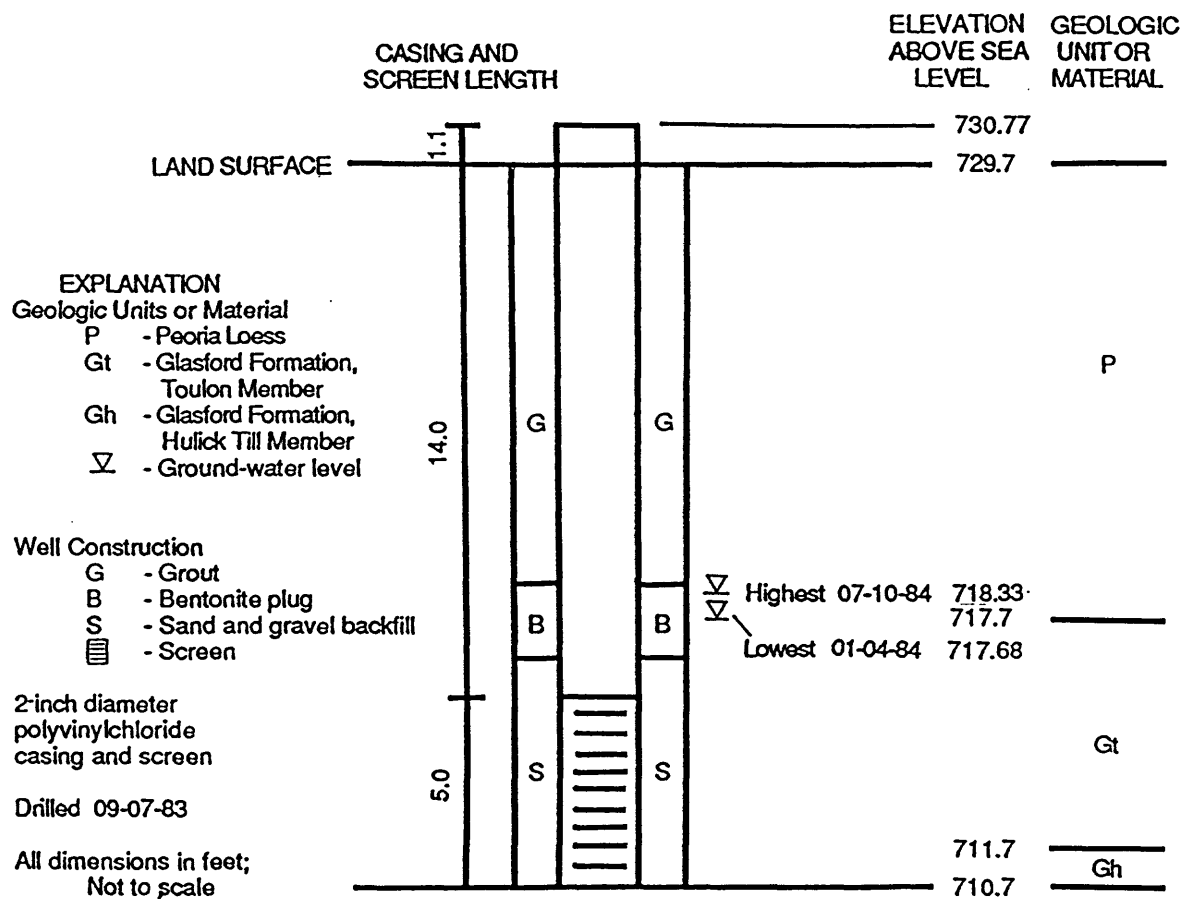


Figure 109.--Construction of well 613.

WELL 614

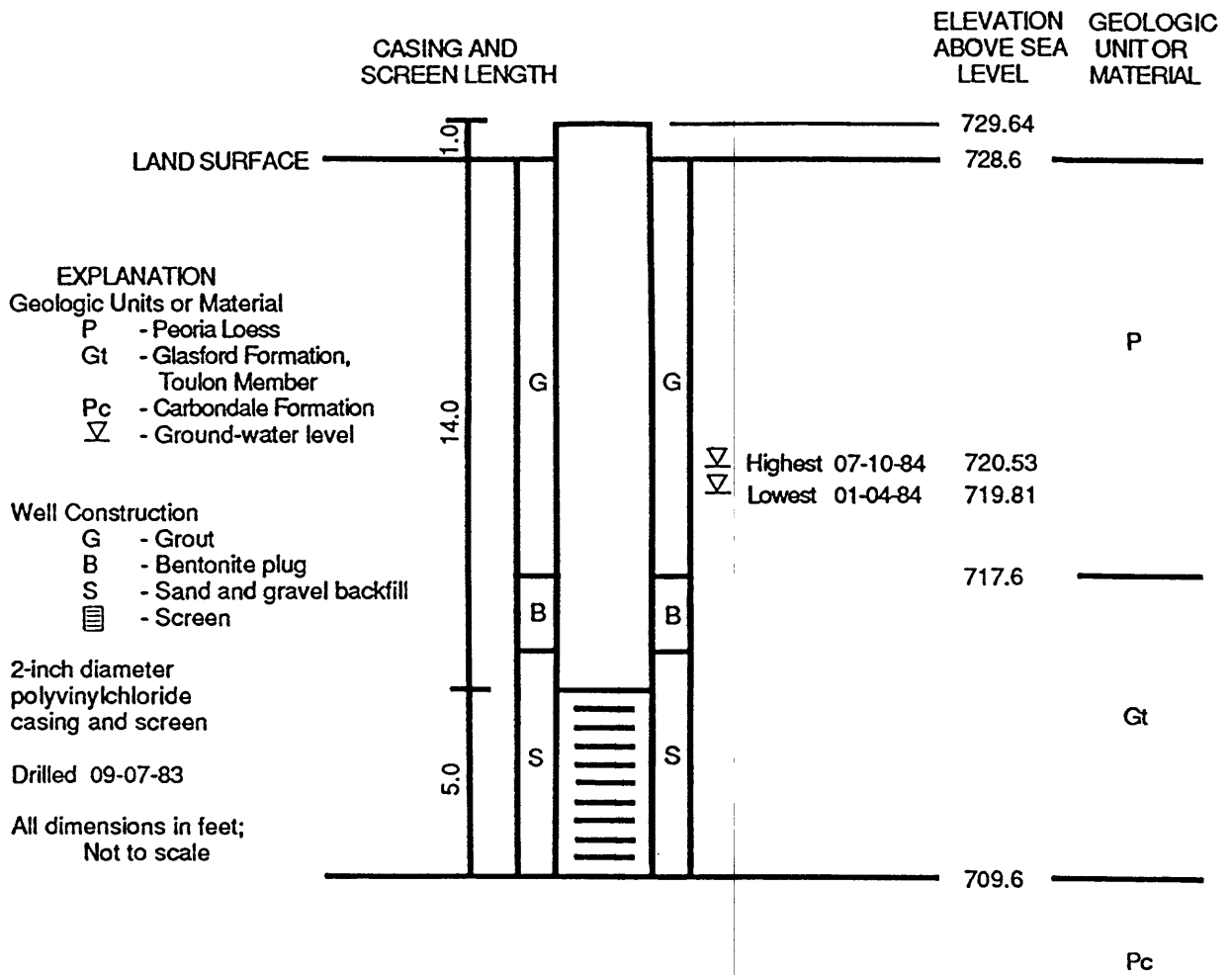


Figure 110.--Construction of well 614.

WELL 615

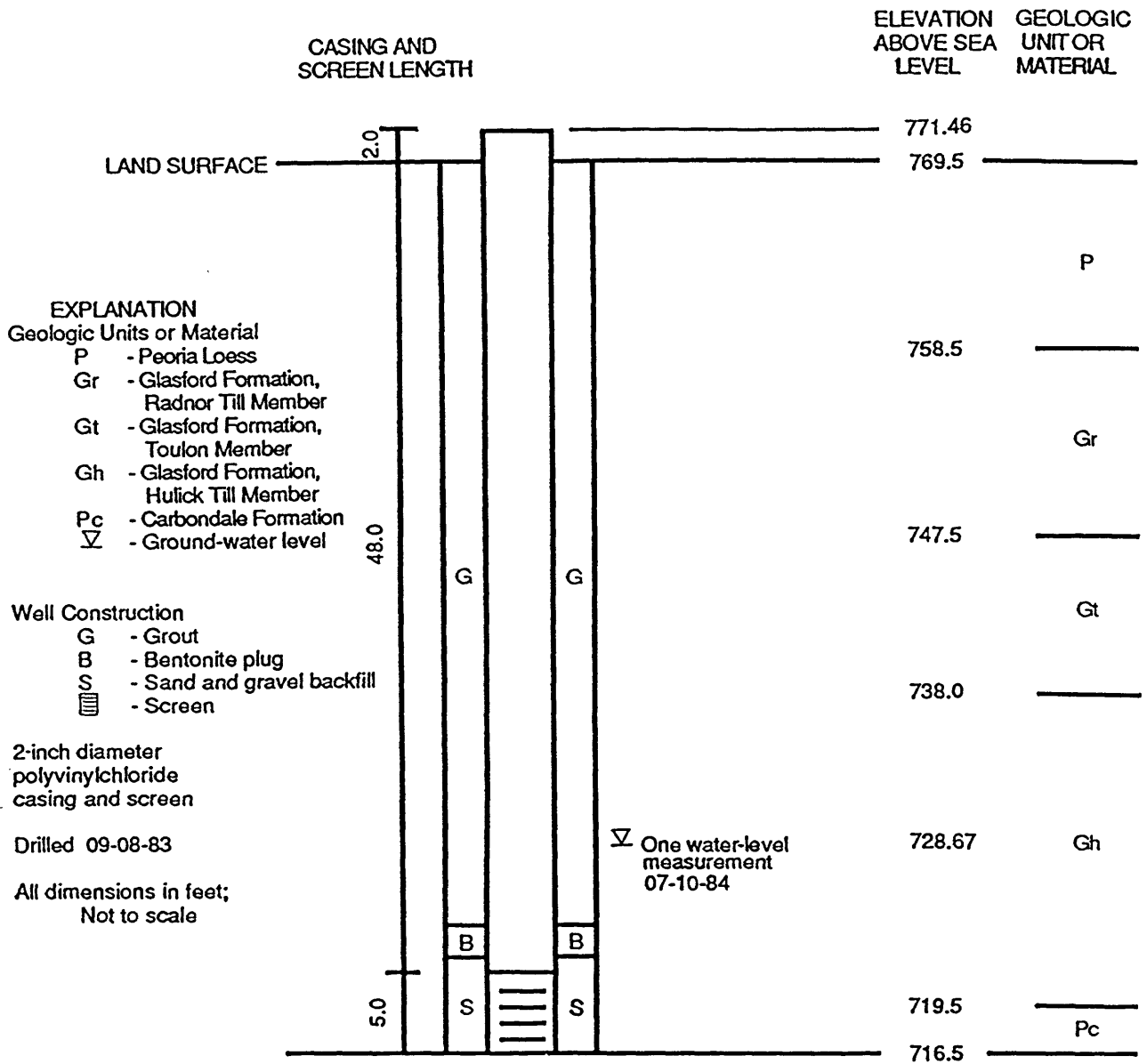


Figure 111.--Construction of well 615.