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Page 1 of 1

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7. Abstract

This document presents an initial evaluation of hydrogeologic characteristics, monitoring wells, water table elevations, and groundwater quality in the region of the Hanford Site north of Gable Mountain and Gable Butte. Monitoring wells are ranked according to their potential for future use. Water table maps are included for current conditions and for past years when groundwater mounds were prevalent. Contaminant plume maps are presented for gross alpha, gross beta, tritium, chromium, and nitrate for 1990.

Hartman, M. J., and R. E. Peterson, 1992, *Hydrologic Information Summary for the Northern Hanford Site*, WHC-SD-EN-TI-023, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

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1.0 INTRODUCTION

Waste site characterization is being conducted in the northern portion of the Hanford Site under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and the past-practices provisions of the Resource Conservation and Recovery Act of 1976 (RCRA). Waste sites are grouped into areas known as operable units. Selected characterization activities that are common to all of the groundwater operable units are conducted under an aggregate area approach. These activities include data compilation and evaluation in the areas of groundwater, surface water, and geology (e.g., Peterson 1992, Dirkes 1992).

The aggregate area concept involves systems that operate at a scale larger than individual waste sites. These systems include groundwater flow, river flow, and the hydrogeologic framework. Among the benefits of this approach are: (1) early and more efficient characterization of existing conditions; (2) availability of pertinent information to use in planning remedial investigations and risk assessments; and (3) identification of contamination problems that should receive an expedited response action.

1.1 PURPOSE

The various 100 Areas groundwater operable unit work plans include data evaluation tasks. Task 6 in each work plan pertains to groundwater investigations and task 4 pertains to surface water and sediment investigations. This report represents an initial step to integrate the data evaluation tasks. The work plans recognize that data compilation and evaluation continue as the remedial investigation proceeds.

This document includes an initial evaluation of information on hydrogeologic characteristics, monitoring wells, water table elevations, and groundwater quality for the 100 Aggregate Area. Published estimates of aquifer properties are reviewed and tabulated. This will provide a baseline for interpreting the results of theoretical work that relates water level fluctuations to aquifer properties (Tri-Party Agreement Milestone M-30-04). Existing groundwater monitoring wells are evaluated relative to their potential for use during remedial investigations. Water level data were interpreted to create water table maps for current and past conditions. This information may be used to predict movement of contaminant plumes. Maps of the water table in the past show areas where now-unsaturated sediments may have been contaminated from past waste disposal. Water quality data for key waste indicators are summarized and the levels among the various 100 Areas are compared to aid in setting remediation priorities.

There are no specific Tri-Party Agreement milestones directly associated with this work. However, Milestone M-29-00, which encompasses risk assessment, and M-30-00, which covers several integrated investigations for the 100 Aggregate Area, both benefit from the results of data compilation, review, and evaluation.

1.2 100 AGGREGATE AREA GROUNDWATER OPERABLE UNITS

There currently are five designated groundwater operable units in the region north of Gable Mountain: 100-BC-5, 100-KR-4, 100-NR-2, 100-HR-3, and 100-FR-3 (Figure 1-1). A groundwater operable unit has not been defined for the 600 Area between the various reactor areas, although information for that region is included in this evaluation. The status of the various work plans for these operable units is as follows:

<u>100-BC-5</u> *Remedial Investigation/Feasibility Study Work Plan for the 100-BC-5 Operable Unit*, DOE/RL-90-08, Rev. 0, August 1992.

<u>100-KR-4</u> *Remedial Investigation/Feasibility Study Work Plan for the 100-KR-4 Operable Unit*, DOE/RL-90-20, Rev. 0, August 1992.

<u>100-NR-2</u> *RCRA Facility Investigation/Corrective Measures Study Work Plan for the 100-NR-2 Operable Unit*, DOE/RL-91-46, Draft A, December 1991.

<u>100-HR-3</u> *RCRA Facility Investigation/Corrective Measures Study Work Plan for the 100-HR-3 Operable Unit*, DOE/RL-88-36, Rev. 0, August 1992.

<u>100-FR-3</u> *Remedial Investigation/Feasibility Study Work Plan for the 100-FR-3 Operable Unit*, DOE/RL-91-53, Draft A, November 1991.

Other groundwater monitoring programs in the 100 Areas operable units include RCRA treatment, storage, or disposal facilities at 100-N, 100-D, and 100-H (DOE 1991a) and operational monitoring for various facilities at 100-BC, 100-D, 100-K, and 100-F (DOE 1991b, Section II.B). The Hanford Environmental Surveillance and Oversight Program (Woodruff and Hanf 1991) also uses wells located throughout the 100 Aggregate Area.

1.3 DATABASES USED FOR THIS REPORT

The primary electronic database used for this report is GeoDat, a version of the former Hanford Groundwater Data Base (HGWDB) (PNL 1990). GeoDat currently is being maintained by the Westinghouse Hanford Company (WHC) Geosciences Group as part of a requirement to manage RCRA data. GeoDat contains all of the groundwater data previously contained in HGWDB, as well as new data collected under RCRA, operational, and the site-wide environmental monitoring programs. Hanford Site data collected under CERCLA are loaded directly into the Hanford Environmental Information System (HEIS) (WHC 1991a). Data from HEIS can be downloaded into GeoDat whenever that is required. GeoDat operates using Paradox (a tradename of Borland International) database management software.

Three important new databases are being developed. First, data on monitoring well characteristics and maintenance status are being assembled by the WHC Environmental Field Services Group. As fitness-for-use activities and resurveying of wells proceed, this database will offer the most current and easily accessible information on construction characteristics and maintenance status of existing wells. A second database is being constructed by the WHC

Geosciences Group that contains data collected by continuous monitoring equipment associated with wells and river stations. Finally, the Geosciences Group is assembling data on riverbank seepage, shoreline sediment quality, and nearshore river water quality data. Previously, these data have resided only in published reports.

1.4 OTHER DATA COMPILATION AND EVALUATION REPORTS

Several data compilation reports and initial data evaluation reports are currently available or are planned. An inventory of geologic and hydrologic data available is provided by Peterson (1992). A summary of existing monitoring wells and their construction characterisitcs is provided by Ledgerwood (1991). A review and summary of the geologic characteristics of the area north of Gable Mountain are provided by Lindsey (1992). The results of numerous Columbia River monitoring activities, along with an extensive annotated bibliography, are available by Dirkes (1992). The results of a riverbank seepage sampling and analysis project conducted during the fall of 1991 are presented by the U.S. Department of Energy (DOE 1992a).

Two reports are currently in progress. The first will compare recent riverbank seepage data with previously acquired data and with water quality data from monitoring wells located near the river shoreline. The second will describe the results of analyzing river stage and water table fluctuations for the purpose of inferring aquifer properties. These two reports are associated with Tri-Party Agreement Milestones M-30-01 and M-30-04, respectively.

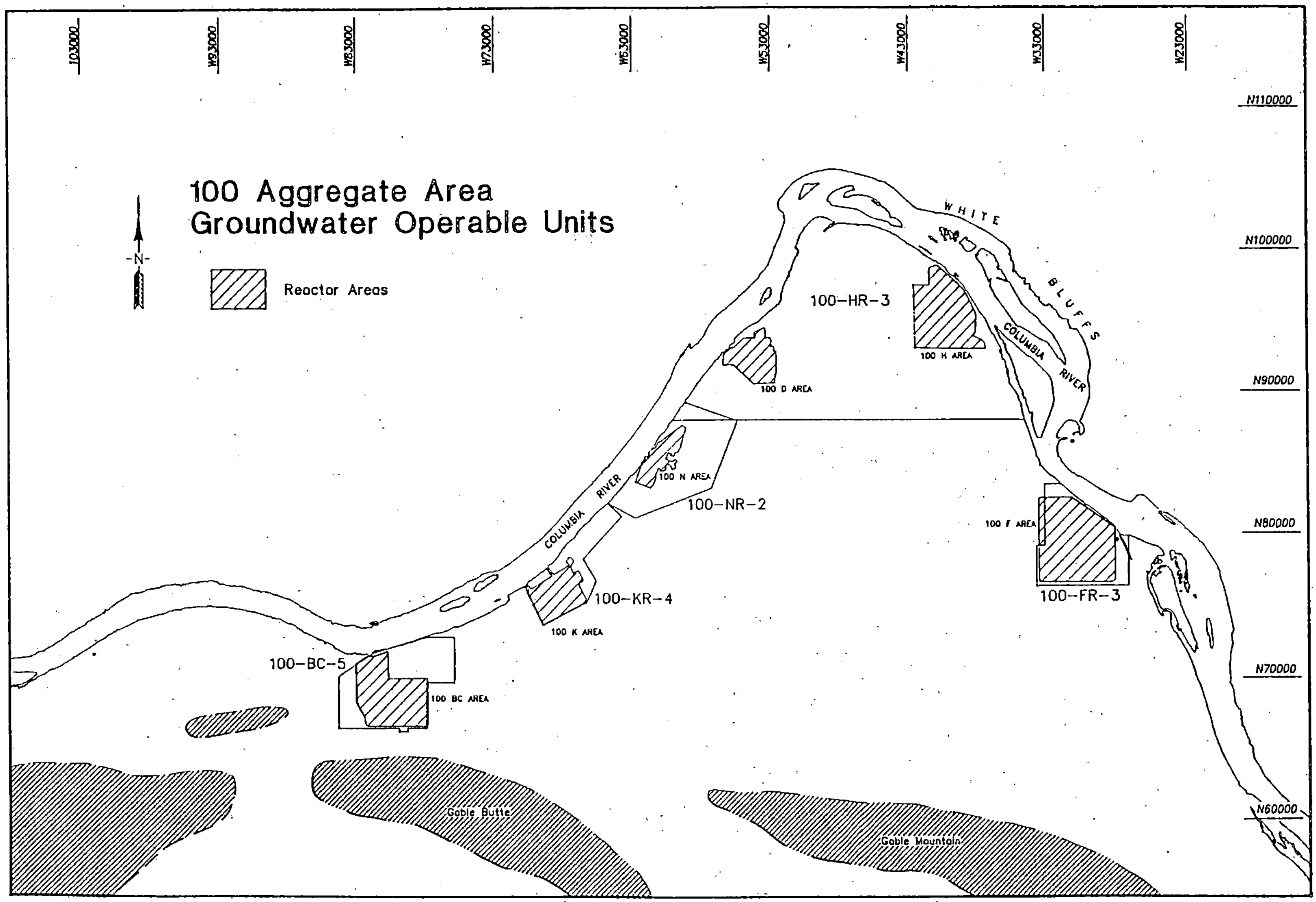

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Figure 1-1. Location Map for 100 Area Operable Units.

2.0 OVERVIEW OF HYDROGEOLOGY

A brief description of the principal features of the hydrogeologic setting of the 100 Aggregate Area is provided. For more detailed descriptions of the hydrogeologic setting, see Lindsey (1992), Lindsey (1991), Delaney et al. (1991), DOE (1988), and Gephart et al. (1979).

2.1 REGIONAL SETTING

The Hanford Site is located within a topographic and structural depression called the Pasco Basin. It is part of the larger Columbia Plateau physiographic province, which includes most of southeastern Washington and northeastern Oregon, a province that is roughly defined by the extent of Columbia River basalt flows. The Pasco Basin is bounded on the north by the Saddle Mountains and on the south by Rattlesnake Mountain. To the west lay anticlines of the Yakima Fold Belt, including Umtanum Ridge, Yakima Ridge, and the Rattlesnake Hills. The eastern boundary is formed by the Palouse Slope, a west-dipping monocline. Within the Pasco Basin lie several northwest-southeast trending synclines; the Wahluke Syncline crosses the northern portion of the basin.

Saturated sediments above the Columbia River Basalt form a series of aquifers and aquitards, collectively called the uppermost aquifer system. The shallowest aquifer in the system is unconfined over most of the Hanford Site, and is made up of Hanford and Ringold fluvial sediments. It is commonly termed the uppermost or unconfined aquifer. The uppermost aquifer is naturally recharged by runoff from surrounding highlands. Recharge via precipitation on the Hanford Site is negligible because of the desert climate. In some areas, there is evidence of leakage upward from confined aquifers into the uppermost aquifer. Artificial recharge also occurs from irrigation on lands adjacent to the Hanford Site and from liquid waste disposal on the Site. Groundwater in the uppermost aquifer primarily discharges to the Columbia River, and to a lesser extent, the Yakima River. Recharge to the underlying confined aquifers in the northern portion of the Pasco Basin primarily comes from the southwest, west, and north, with flow generally to the east-southeast across the 100 Areas, as suggested by the structural trend of the Wahluke Syncline.

2.2 100 AGGREGATE AREA HYDROGEOLOGY

The uppermost aquifer system in the 100 Areas is dominated by gravelly, sandy, and silty sediments associated with fluvial channel and overbank deposits of the ancestral Columbia River. Known groundwater contamination plumes are typically contained in the uppermost aquifer, which comprises sand and gravel. Generally upward hydraulic gradients prevent downward migration of contamination. Flow direction within each 100 Area generally is toward the Columbia River. Liquid effluent disposal in the past created groundwater mounds, which caused some migration inland as well. Flow rates are in the range of 1 to 15 ft/d under natural gradient conditions. When groundwater mounds were present, flow rates on the order of 50 ft/d were observed, due to the unnaturally steep gradients and thermally hot recharge sources (e.g., Eliason and Hajek, 1967, p 3). Short-term flow near the river is strongly influenced by daily fluctuations in river stage, which may be in the range of

6 to 8 ft daily and 8 to 10 ft seasonally. The following description of hydrostratigraphy for the 100 Areas is from Peterson (1992) and was developed from more detailed descriptions in Lindsey (1991) and Delaney et al. (1991).

A generalized stratigraphic and hydrologic column for the 100 Areas is shown in Figure 2-1. This representation was developed for the 100-N Area, but the basic units are generally found in other areas as well. Six hydrostratigraphic units are identified: Unsaturated (vadose) zone, Ringold/Hanford producing layer (i.e., uppermost aquifer), Ringold confining layer, Ringold confined aquifer, another Ringold confining layer, and another Ringold confined aquifer. Beneath this sequence, which in total is usually referred to as the unconfined aquifer system, lay Columbia River basalt flows; they contain their own series of confined aquifers. The uppermost confined aquifer in the basalt sequence may either be formed by flow tops in the Elephant Mountain Member or by the Rattlesnake Ridge interbed and underlying Pomona flow top zone.

The unsaturated (vadose) zone is contained in Hanford formation sediments throughout the 100 Areas. The zone ranges in thickness between 30 and 80 ft in the reactor areas, and approaches 130 ft in the central area north of Gable Mountain. These sediments typically are open-framework pebble- to boulder-sized gravels. Interstitial sand content is generally low and mud-sized sediment is limited to coatings on individual grains and rip-up clasts. Interstratified lenses of sand and mud may be encountered, but they are very localized. Perched water was reported during drilling of one well at the 100-N Area in 1984, near an active liquid waste disposal facility. That is the only known occurrence of perched water within the 100 Areas.

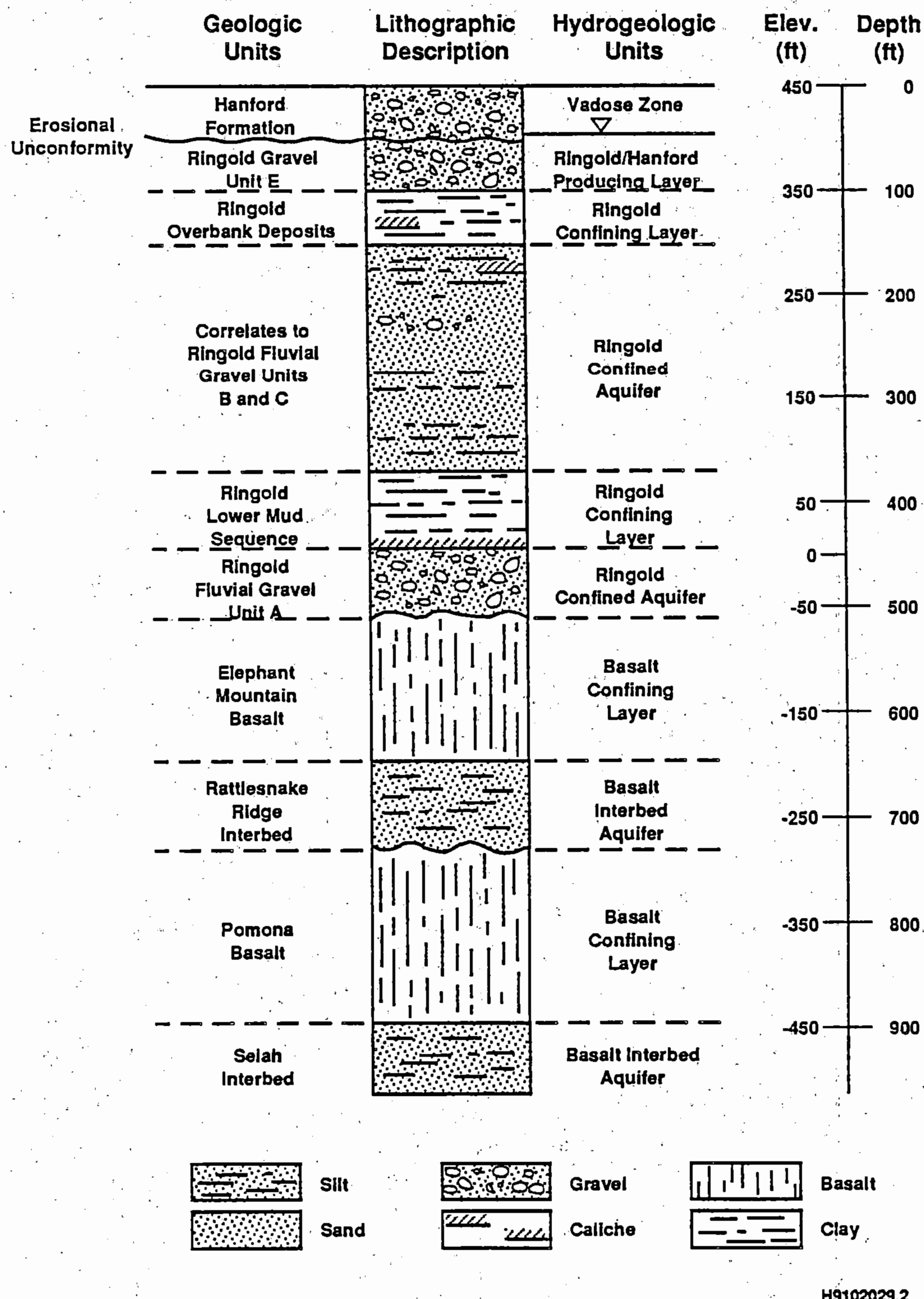
The fluvial sediments of Ringold gravel unit E comprise the uppermost aquifer through most of the 100 Areas. At some locations, the uppermost aquifer includes the bottom few feet of the Hanford sediments. In the region around 100-H and 100-F Areas, Ringold gravel unit E is absent and the uppermost aquifer consists entirely of Hanford gravels. Erosional features such as channels are present at the unconformity between the Ringold Formation and overlying Hanford sediments. The more transmissive Hanford deposits that fill these channels may act as preferred pathways for groundwater movement.

Underlying the uppermost aquifer is a confining bed that consists of interbedded clays, silts, and a few thin sand layers. These strata represent river overbank deposits. This interval ranges in thickness from 10 to 50 ft and is continuous across the 100 Areas.

Layers of silty sand to sandy silt that are equivalent to Ringold gravel units B and C form the fourth hydrogeologic unit, a confined aquifer. This unit is 175 to 200 ft thick. Alternating lithologies in the unit suggest the possibility of alternating producing and confining layers. This hydrostratigraphic unit becomes coarser toward the southwest near 100-K and 100-BC Areas, and finer toward the southeast in the vicinity of 100-H and 100-F Areas.

Another confining layer underlies the sand and silt aquifer. It consists of 100 to 150 ft of interbedded clay and silt assigned to the lower mud sequence of the Ringold Formation. These fine-grained sediments, which are predominantly lacustrine, are continuous across the 100 Areas.

Figure 2-1. Generalized Stratigraphic and Hydrologic Column for the 100 Areas (after Delaney et al. 1991).



The lowest unit of the unconfined aquifer system consists of fluvial sediments of Ringold gravel unit A. This unit lies unconformably over the Elephant Mountain Member of the Saddle Mountains Basalt. Unit A consists of interbedded sands and pebble- to cobble-sized gravels, with some caliche layers. It ranges in thickness from 18 to 65 ft. Unit A has not been encountered in the very few wells drilled to basalt at 100-F and 100-H Areas, but is present near the 100-N and 100-B/C Areas.

Within the Columbia River Basalt Group, the Rattlesnake Ridge Interbed and underlying Pomona flowtop zone form the uppermost confined aquifer in most locations. The Rattlesnake Ridge Interbed consists of 45 to 60 ft of tufface-ous siltstone and sandstone. The Elephant Mountain Member, which is found throughout the 100 Areas, forms the confining layer above the Rattlesnake Ridge Interbed.

2.3 AQUIFER PROPERTIES

Information on aquifer properties is used in modeling groundwater flow and contaminant transport, both of which are relevant to risk assessments associated with remedial investigations. Knowledge of aquifer properties is also important in designing remediation activities, such as pumping and treating contaminated groundwater. The following paragraphs summarize previously published estimates for aquifer properties for the Hanford Site in general and the 100 Areas specifically.

2.3.1 Estimates for the Hanford Site

Several publications summarize properties of the unconfined aquifer system on the Hanford Site. In general, the loosely consolidated, gravelly sediments of the Hanford formation are more transmissive than the relatively finer-grained, better consolidated sediments of the Ringold Formation. However, estimates of aquifer properties for any given hydrologic unit span a wide range. The publications are discussed below in chronological order.

2.3.1.1 Bierschenk (1959), pp 10 to 33. A comprehensive summary of aquifer properties on the Hanford Site is contained in this report. The information presented resulted from single and multiple well tests; tracer tests; analysis of cyclic fluctuations in water levels induced by river stage changes; and several other miscellaneous methods for determining aquifer properties. The work was performed because of an "obvious" need for a better understanding of the direction and rate of groundwater flow, a need brought on by the soil column disposal of large volumes of radioactive liquid wastes. Bierschenk's (1959) results are presented in Table 2-1. Field permeability units (gal/d/ft^2), as used by Bierschenk (1959), have been converted to hydraulic conductivity units (ft/d) by dividing by 7.48 and rounding off the result, to permit easier comparison with later summaries.

Table 2-1. Summary of Aquifer Hydraulic Conductivity (Permeability) Determined by Various Methods.

Unit Tested	Average Hydraulic Conductivity Calculated From				
	Pumping Tests	Specific Capacity	Tracer Tests	Cyclic Fluctuations	Gradient Method
Glacio-Fluviatile	1,700 to 9,000 ft/d 6.0E-3 to 3.2E-2 m/s	1,300 to 8,700 ft/d 4.6E-3 to 3.1E-2 m/s	>8,400 ft/d >3.0E-2 m/s	2,200 to 7,600 ft/d 7.8E-3 to 2.7E-2 m/s	-----
Glacio-Fluviatile and Ringold	120 to 670 ft/d 4.2E-4 to 2.4E-3 m/s	130 to 540 ft/d 4.6E-4 to 1.9E-3 m/s	-----	200 to 800 ft/d 7.1E-4 to 2.8E-3 m/s	-----
Ringold, Excluding Clay Zone	7 to 80 ft/d 2.5E-5 to 2.8E-4 m/s	8 to 40 ft/d 2.8E-5 to 1.4E-4 m/s	-----	20 to 70 ft/d 7.1E-5 to 2.5E-4 m/s	13 to 40 ft/d 4.6E-5 to 1.4E-4 m/s

Source: Bierschenk (1959), Table VIII, p 33. (1 ft/d = 7.48 gal/d/ft^2)

2.3.1.2 <u>Newcomb et al. (1972), pp 35 to 39</u>. A section of this report on the geologic and hydrologic characteristics of the Hanford Site is devoted to groundwater movement and aquifer properties, based on investigations conducted during the 1950's. There is some overlap with the results presented by Bierschenk (1959). A summary of the results of pumping tests conducted before 1956 is provided for the unconfined aquifer, and is reproduced in Table 2-2. Transmissivity and permeability (hydraulic conductivity) units, as listed by Newcomb et al. (1972) have been converted from units of gal/d/ft and gal/d/ft^2, to ft^2/d and ft/d.

This report also contains an estimate of effective porosity for saturated Ringold Formation sediments, based on an analysis of groundwater mounds in 200 East and 200 West Areas. The analysis yielded an estimate of 0.11 (11%) for effective porosity at both locations.

2.3.1.3 <u>Gephart et al. (1979), pp III-57 to III-86</u>. This report includes a summary of current knowledge regarding the unconfined aquifer system of the Pasco Basin. It contains an extensive bibliography of past investigations. Table 2-3 summarizes hydraulic conductivity for various geohydrologic units, and transmissivity by geographic area, as presented in the report. A listing of pumping tests conducted in the Pasco Basin up to the date of the report also is included.

2.3.1.4 <u>Graham et al. (1981), pp 3-1 to 3-13</u>. This report presents a description of unconfined aquifer properties for the 200 Areas and an excellent review of aquifer test methods. Hydraulic conductivity estimates for the various hydrogeologic units of the unconfined aquifer, and transmissivity estimates for 200 East and West Areas, are listed in Table 2-4. The difference in transmissivity between 200 East and 200 West are caused by a greater proportion of less transmissive Ringold sediments in the 200 West Area. Graham et al. (1981) also describe characteristics that suggest the lower and basal Ringold sediments behave as a confined aquifer in some areas.

Table 2-2. Hydraulic Properties from Pumping Tests on Various Hydrogeologic Units on the Hanford Site.

Location	Hydrogeologic Unit	Transmissivity		Hydraulic Conductivity		Storage Coefficient
		(ft^2/d)	(m^2/s)	(ft/d)	(m/s)	
Hanford Townsite	Glacio-Fluviatile	-----	-----	4,680	1.7E-2	-----
North of Gable Mountain	Glacio-Fluviatile (Channel)	191,200	0.21	6,150	2.2E-2	0.03
South of Gable Mountain	Glacio-Fluviatile (Channel)	401,100	0.43	8,960	3.2E-2	0.2
North Richland	Predominantly Glacio-Fluviatile	144,400	0.16	-----	-----	-----
North Richland	Predominantly Ringold Conglomerate	19,500	0.21	-----	-----	-----
13/26-5D2	Ringold Conglomerate	6,680	0.0072	60	2.1E-4	0.0002

Source: Newcomb et al. (1972), p 38. (1 ft/d = 7.48 gal/d/ft^2)

In addition to providing values for hydraulic conductivity and transmissivity, Graham et al. (1981) provide specific yield estimates at two locations of 0.15 and 0.18; and effective porosity estimates of 10% (lower Ringold Formation) and 30% (Hanford formation).

2.3.1.5 Newcomer et al. (1992a). Results of aquifer tests in the uppermost aquifer in the 200 West Area were recently compiled by Newcomer et al. (1992a). The document does not distinguish between Hanford and Ringold sediments. Types of tests included slug injection/withdrawal, constant discharge and recovery. Most of the listed estimates transmissivity were published in earlier reports. Estimates of transmissivity range from 14 to 57,000 ft^2/d and average 6,700 ft^2/d, based on 76 values. Storage coefficients were also estimated for several tests, ranging from 0.009 to 0.16 (Table 2-5).

Results of aquifer tests in the confined aquifer in the 200 West Area were recently compiled by Newcomer et al. (1992b). Most of the tests were conducted in the Rattlesnake Ridge Interbed, though a few were in the Elephant Mountain interflow and fracture zones. Types of tests included slug injection/withdrawal, constant discharge and recovery. Most of the listed estimates transmissivity were published in earlier reports. Transmissivity estimates for the Rattlesnake Ridge interbed range from 3 to 2,240 ft^2/d and average 400 ft^2/d, based on 65 tests. Three transmissivity values were listed for the Elephant Mountain interflow zone. They range from 8 to 1,175 ft^2/d and average 600 ft^2/d. One value of transmissivity was listed for the Elephant Mountain fracture zone, 710 ft^2/d (Table 2-5).

Table 2-3. Representative Hydraulic Properties of the Unconfined Aquifer on the Hanford Site.

Stratigraphic Interval	Hydraulic Conductivity (ft/d)	Hydraulic Conductivity (m/s)
Hanford Formation	500 to 20,000	2E-3 to 7E-2
Hanford/Middle Ringold (undifferentiated)	100 to 7,000	4E-4 to 2E-2
Middle Ringold Unit	20 to 600	7E-5 to 2E-3
Lower Ringold Unit	0.11 to 10	4E-7 to 4E-5
Geographic Region	**Transmissivity (ft^2/d)**	**Transmissivity (m^2/s)**
North of Gable Butte and Gable Mountain	4,000 to 25,000	4E-3 to 3E-2
Flanks of Gable Mountain and paleochannels	40,000 to 600,000	4E-2 to 7E-1
Other areas on the Hanford Site	2,000 to 40,000	2E-3 to 4E-2
Location	**Storage Coefficient**	
Throughout unconfined aquifer	0.01 to 0.1	

Source: Gephart et al. (1979), Table III-16, p III-77.

2.3.2 Estimates for the 100 Areas

Several investigations specific to the various 100 Areas have resulted in estimates for aquifer properties. These include tests in the 100-D Area to determine the infiltration capacity of reactor coolant disposal to the soil column, and pumping tests in wells at the 100-N and 100-H Areas. In addition, some of the summaries discussed include aquifer properties for locations in the 100 Areas. Documents specific to the 100 Areas are discussed below. Results of all the 100 Areas aquifer tests are listed in Table 2-6.

2.3.2.1 Eliason and Hajek (1967), pp 3 to 7. An infiltration rate test was conducted between March and June, 1967 at the 100-D Area. Approximately 3.3 million gal of reactor coolant effluent was discharged to an existing trench at a rate of approximately 1,300 gal/d. Existing wells in the area were used to monitor changes in water level and temperature caused by this discharge. Radioactivity in riverbank seepage downgradient from the trench also was monitored; these data were used to estimate travel times and retardation factors.

Table 2-4. Ranges of Hydraulic Properties for the Unconfined Aquifer in the 200 Areas, Central Hanford Site.

Interval Tested	Hydraulic Conductivity	
	(ft/d)	(m/s)
Hanford Formation	2,000 to 10,000	7.1E-3 to 3.5E-2
Middle Ringold Unit	9 to 230	3.2E-5 to 8.1E-4
Lower Ringold Unit	1 to 12	3.5E-6 to 4.2E-5
Region	**Transmissivity**	
	(ft^2/d)	(m^2/s)
200 West Area	300 to 5,400	3.2E-4 to 5.8E-3
200 East Area	5 to 135,000	5.4E-6 to 1.5E-1
Geohydrologic Unit	**Storativity**	
Hanford Formation	0.07	
Lower Ringold Unit	0.002	

(Source: Graham et al. (1981), Table 11)

Table 2-5. Hydraulic Properties in the 200 West Area.

Hydrogeologic Unit	Transmissivity		Storativity
	(ft^2/d)	(m^2/s)	
Uppermost Aquifer	6,700	7.2E-3	0.009 to 0.16
Rattlesnake Ridge Interbed	400	4.3E-4	--
Elephant Mountain Interflow	600	6.5E-4	--
Elephant Mountain Fracture	700	7.5E-4	--

Sources: Newcomer et al. (1992a,b)

Using a travel time of 50 ft/d and an assumed porosity of 30%, an average permeability of 3,740 gal/d/ft^2 was calculated for the sediments between the trench and the river. This equates to a hydraulic conductivity of 500 ft/d using a conversion factor of (1 ft/d = 7.48 gal/d/ft^2).

Table 2-6. Summary of Aquifer Tests Conducted in the 100 Aggregate Area (Page 1 of 3).

WELL OR LOCATION	GEOHYDROLOGIC UNIT	HYDRAULIC CONDUCTIVITY ft/d	HYDRAULIC CONDUCTIVITY m/s	TRANSMISSIVITY ft²/d	TRANSMISSIVITY m²/s	STORAGE COEFFICIENT	ORIGINAL SOURCE OR REMARKS
Eliason and Hajek (1967)							
100-D Area	Hanford	500*	1.8E-3*	--	--	--	Infiltration test. Estimate based on observed travel times and gradients
100-D Area	Hanford	--	--	70,000 to 115,000*	7.5E-2 to 1.2E-1	--	Infiltration test. Estimate based on water level fluctuations.
Gephart, et al. (1979), Table III-14							
F7-1	Ringold/Hanford unconfined	520	1.8E-3	7,800	8.4E-3	--	(a)
K-10	Ringold/Hanford unconfined	53	1.8E-4	4,500	4.8E-3	0.04	(c); 48-hr constant discharge w/ observation wells
61-66	Ringold/Hanford unconfined	600	2.1E-3	51,000	5.5E-2	--	(c); insuffiecient stress
62-43	Hanford	1,700	6.0E-3	50,000	5.4E-2	0.06	(c); 13 observation wells
63-90	Hanford	2,300	8.1E-3	296,000	3.2E-1	--	(b); insufficient stress
65-50	Hanford	1,800	6.4E-3	64,000	6.9E-2	--	(a); 8-hr constant discharge
71-77	Ringold unconfined	84	3.0E-4	1,600	1.7E-3	--	(c); 4-hr test; variations in discharge.
77-54	Ringold unconfined	175 (48)**	6.2E-4 (1.7E-4)**	13,000 (3,460)**	1.4E-2 (3.7E-3)	0.03	(c); 24-hr constant discharge
84-35	Ringold confined	0.11	3.9E-7	4	4.3E-6	--	(b); very short duration
87-55	Ringold unconfined	130 (55)**	4.6E-4 (1.9E-4)**	4,500 (1,950)**	4.8E-3 (2.1E-3)	--	(b); 24-hr constant discharge

Table 2-6. Summary of Aquifer Tests Conducted in the 100 Aggregate Area (Page 2 of 3).

WELL OR LOCATION	GEOHYDROLOGIC UNIT	HYDRAULIC CONDUCTIVITY ft/d	HYDRAULIC CONDUCTIVITY m/s	TRANSMISSIVITY ft^2/d	TRANSMISSIVITY m^2/s	STORAGE COEFFICIENT	ORIGINAL SOURCE OR REMARKS
Graham (1981), Tables 8 and 10							
60-57	Ringold unconfined	140	4.9E-4	9,800	1.1E-2	0.05	8-hr constant discharge
62-43	Hanford	1,700	6.0E-3	50,000	5.4E-2	0.06	(d) and (e); 7-day constant discharge
62-43	Hanford	1,800	6.4E-3	58,000	6.2E-2	--	1 day constant discharge
Hartman (1991), Table 2-3							
N-34 (observation well)	Ringold unconfined	--	--	26,000 (3-10 hr) 15,000 (>10 hr)	2.8E-2 1.6E-2	--	(f); 24-hr constant discharge
N-32	Ringold unconfined	--	--	5,800	6.2E-3	--	(f); 24-hr constant discharge; recovery data
N-27	Ringold unconfined	--	--	18,000 early time 11,000 mid time 26,000 late time	1.9E-2 1.2E-2 2.8E-2	--	(f); 24-hr constant discharge; recovery data
N-62	Ringold unconfined	--	--	27,000 (early DD) 11,000 (late DD) 20,000 (recovery)	2.9E-2 1.2E-2 2.2E-2	--	2-hr test during development
N-39 (observation well)	Ringold unconfined	--	--	5,200 (drawdown) 5,700 (recovery)	5.6E-3 6.1E-3	--	(g); 6-hr constant discharge at N-70
N-67 (observation well)	Ringold unconfined	--		8,200 (drawdown) 10,000 (recovery)	8.8E-3 1.1E-2	--	(g); 5-hr constant discharge at N-69
PNL (1987), Appendix G							
H3-2A	Hanford	1,900	6.7E-3	19,000	2.0E-2	--	8-hr constant discharge
H4-10	Hanford	5,940	2.1E-2	53,500	5.8E-2	--	8-hr constant discharge

Table 2-6. Summary of Aquifer Tests Conducted in the 100 Aggregate Area (Page 3 of 3).

WELL OR LOCATION	GEOHYDROLOGIC UNIT	HYDRAULIC CONDUCTIVITY		TRANSMISSIVITY		STORAGE COEFFICIENT	ORIGINAL SOURCE OR REMARKS
		ft/d	m/s	ft^2/d	m^2/s		
H4-11	Hanford	71	2.5E-4	1,070	1.2E-3	--	5-hr; variations in discharge
H4-12A	Hanford	213	7.5E-4	2,670	2.9E-3	--	5-h constant discharge
H4-14	Hanford	--	--	1,050	1.1E-3	--	8-hr; variations in discharge
H4-15A	Hanford	195	6.9E-4	2,340	2.5E-3	0.19	8-hr constant discharge w/ observation well
Liikala, et al. (1988), Table 8							
H3-2B	Hanford	100	3.5E-4	600	6.5E-4	--	type of test unspecified
H3-23	Ringold unconfined	70	2.5E-4	390	4.2E-4	--	type of test unspecified
H4-7	Hanford	70	2.5E-4	690	7.4E-4	--	type of test unspecified
H4-12B	Hanford	50	1.8E-4	635	6.8E-4	--	type of test unspecified
H4-12C	Ringold unconfined	60	2.1E-4	620	6.2E-4	--	type of test unspecified
H4-13	Hanford	420	1.5E-3	4240	4.6E-3	--	type of test unspecified
H4-15B	Hanford	460	1.6E-3	5,530	5.9E-3	--	type of test unspecified
H4-15C(R)	Ringold unconfined	350	1.2E-3	1,760	1.9E-3	--	slug test
H4-15C(Q)	Ringold unconfined	0.14	4.9E-7	0.7	7.5E-7	--	slug test
H4-16	Hanford	220	7.8E-4	2,200	2.4E-3	--	type of test unspecified
H4-18	Hanford	80	2.8E-4	550	5.9E-4	--	type of test unspecified
H4-12C (125-127 ft)	Ringold unconfined	Vertical: 0.015	Vertical: 5.3E-8	--	--	--	falling head test on split-spoon sample
H4-15C (120-122 ft)	Ringold unconfined	Vertical: 0.0029	Vertical: 1.0E-8	--	--	--	falling head test on split-spoon sample
H4-15C (275-277 ft)	Ringold confined	Vertical: 0.0004	Vertical: 1.4E-9	--	--	--	falling head test on split-spoon sample

(a) Bierschenk (1959); (b) Deju (1974); (c) Kipp and Mudd (1973); (d)Bierschenk (1957); (e) Honstead et al. (1955); (f) Data and interpretations presented in an unpublished report by L.S. Prater (PNL); (g) data and interpretations presented in an unpublished report by T.J. Gilmore, S.M. Goodwin, and D.R. Newcomer (PNL).

* The infiltration test created a large groundwater mound (thereby increasing aquifer thickness). The infiltrated water was thermally hot, which could increase hydraulic conductivity and transmissivity.

** The original data were reinterpreted by Gilmore et al. (1992) to produce the values reported above in parentheses.

Water level fluctuations, caused by the mound that was created during the test, were used to calculate a coefficient of transmissibility. Four wells, located northeast, southeast, and south of the trench, and within 3,200 ft of the trench, produced estimates for transmissibility ranging between 523,000 and 860,000 gal/d/ft. These values equate to transmissivity ranging between 70,000 and 115,000 ft^2/d using a conversion factor of 1 ft/d = 7.48 $gal/d/ft^2$.

It is important to note that the infiltration tests conducted by Eliason and Hajek (1967) used thermally hot water. The lower density of a hot liquid, and the fact that hot water could dissolve cementing agents in the aquifer, could have resulted in a higher than normal estimate of transmissivity.

2.3.2.2 Gilmore, et al. (1992), Appendix B. Gilmore et al. (1992) reanalyzed aquifer test data from previous studies [Bierschenk (1959), Kipp and Mudd (1973), and Deju (1974)] for several wells southeast of the 100-N Area. The authors believe that the previous investigators improperly interpreted their aquifer test data. Gilmore et al. (1992) estimated transmissivity to be 1,950 to 3,460 ft^2/d, and calculated the hydraulic conductivity to be 48 to 55 ft/d.

2.3.2.3 100-H Area Aquifer Tests. Aquifer tests in the 100-H Area are presented by PNL (1987) and Liikala (1988). The aquifer property estimates from these tests should be interpreted with caution for several reasons, as discussed in PNL (1987, p. G.4). First, tests were conducted in wells that were not specifically designed for aquifer testing. Second, most were single well tests and did not include data from observation wells. Third, fluctuating Columbia River levels and an irregular aquifer thickness have influenced the recovery curves.

Pumping tests were conducted in 13 wells completed in Hanford formation sediments of the unconfined aquifer at the 100-H Area (Liikala et al. 1988, p 57). Liikala et al. (1988) estimates for transmissivity range fr50m,580 to ft^2/d . The details of how tests for six of these wells were conducted are described in PNL (1987, pp 93-104 and Appendix G). They indicated that no observation wells exhibited sufficient water level response for data analysis; therefore, transmissivities were calculated from water level data obtained only from the pumping well. Hydraulic conductivity was computed from the estimated transmissivity and ranged between 50 and 5,900 ft/d (Liikala et al., 1988, p 57). However, the tests were conducted in partially penetrating wells and it is not always clear what values of aquifer thickness were used to calculate hydraulic conductivity.

Aquifer tests conducted in three 100-H Area wells that were completed in a "silty sand and gravelly silty sand" unit of the Ringold Formation yielded transmissivities between 390 and 1,760 ft^2/d, and calculated hydraulic conductivities between 39 and 350 ft/d (Liikala et al. 1988, p 57). Detailed descriptions of the tests in these wells are not provided in that report, nor are they included by PNL (1987, Appendix G).

One test was conducted at the 100-H Area in a semiconfined aquifer located in sandy sediment near the bottom of the Ringold Formation. This test yielded a transmissivity value of 0.7 ft^2/d, with a calculated hydraulic conductivity value of 0.14 ft/d (Liikala et al. 1988, p 57). The characteristics that suggest a confined nature for the lower and basal Ringold Formation are described by Graham et al. (1981, p 3-11 to 3-13).

Laboratory tests were performed on split-spoon sediment samples from three wells in the 100-H Area, at mid-depths in the Ringold Formation "silty sand and gravelly silty sand" unit (Liikala et al. 1988, p 56). Resulting vertical hydraulic conductivity values range from 0.015 ft/d at a depth of 126 ft to 0.0001 ft/d at a depth of 276 ft.

2.3.2.4 100-N Area Aquifer Tests. Several aquifer tests have been conducted in the unconfined aquifer in the 100-N Area. Here the aquifer is primarily in sands and gravel units of the Ringold Formation. Estimates for transmissivity range from 5,200 to 26,000 ft^2/d. Details and data from these tests are presented by Hartman (1991, Appendix B). Tests were run in completed wells, and in many cases, the pumping rates varied significantly. Interpretation of aquifer test data for the 100-N Area is also limited by variable pumping rates and short duration tests, which typically lasted only several hours. Short pumping tests may result in overestimates of transmissivity becasue of delayed yield effects. The published descriptions of these tests do not always provide details on how the tests were conducted and how the recovery curves were interpreted.

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3.0 GROUNDWATER MONITORING WELLS

This section describes existing groundwater monitoring wells that are candidates for use during remedial investigations. Existing wells are categorized regarding their fitness-for-use on the basis of construction characteristics, current use in other programs, and absence of evidence that indicates the well should not be considered for future use.

The following lists of wells were developed to support planning for: (1) groundwater sampling and analysis programs; (2) new groundwater monitoring wells; and (3) maintenance, remediation, or decomissioning of existing wells. The lists readily identify wells that can be used to obtain groundwater samples in support of remedial investigations. The lists can be used to identify other users of a well, thereby permitting integration of sampling schedules and laboratory analysis programs.

The lists include wells located in the general vicinity of each of the 100 Areas. Wells located some distance from the various 100 Areas, i.e., many 600 Area wells, are not included.

3.1 SOURCES FOR WELL INFORMATION

An inventory of all known wells located in the area of the Hanford Site north of the Gable Mountain trend is presented by Peterson (1992). That inventory was primarily derived from the WHC Geosciences Group database (GeoDat) and *Hanford Wells* (McGhan 1989). For this report, the inventory has been purged of wells that no longer exist or have very low potential for future use. Information is included on wells installed since either of the two sources cited above were updated. Finally, updated information on the current condition of existing wells has been added, based on the results of continuing fitness-for-use investigations (e.g., Ledgerwood 1991).

The well lists will be maintained in the interim as a working database for 100 Aggregate Area well information. As new wells are installed or planned, they will be added to the lists. Well coordinates will be updated as the resurveying of Hanford facilities proceeds. User program information will be updated annually. Finally, the fitness category of the well will be periodically revised as fitness-for-use investigations, well maintenance, remediation, and decomissioning proceed.

The WHC Environmental Field Services Group also maintains an electronic database containing abundant well information related to construction characteristics, maintenance and remediation history, and geographic survey results. This database is still under development, although it is accessible via the Hanford Local Area Network, using Paradox (a trademark of Borland International) database management software.

The characteristics of monitoring wells and other boreholes are also being loaded into the HEIS (WHC 1991). At some future date, all data on existing and new wells will be available from that database, which will be fully integrated with a geographic information system as well.

3.2 CANDIDATE WELL LISTS

A table of existing wells (Tables 3-1 through 3-6) and a well location map are presented for each of the 100 Areas (Figures 3-1 through 3-9). The numbering convention used in the tables and maps abbreviates the complete well number. For instance, the "99" is frequently dropped from either the 199- or 699- prefix in tables. The entire 199- and 699- prefixes are dropped from well numbers on maps and in the text of this document.

Wells known to be abandoned or clearly unsuitable for future consideration were removed from the inventory of all known groundwater wells located on the Hanford Site in the region north of Gable Mountain. Wells removed from the inventory are listed in Appendix A. The remaining wells were then divided into four categories according to their relative fitness-for-use in remedial investigations. The categories correspond in a general way to the levels of information described for CERCLA activities. No attempt was made to factor in the location of the well relative to a known source for groundwater contamination, or a known contaminant plume.

Category A wells are the top candidates for future use. They have been constructed to standards prescribed for RCRA monitoring wells and were installed since approximately mid-1985. They have stainless steel casings and screens, filter pack, full annular seals, surface pads, dedicated sampling pumps, and locking caps. Most are being used during FY 1992 to support RCRA monitoring programs at the 100-N, 100-D, and 100-H Areas. All new wells installed for CERLCA and RCRA projects meet these construction specifications. These wells should currently be acceptable to regulators as producers of groundwater data to support records-of-decision.

Category B wells are nearly as suitable for remedial investigations as category A wells, except for their construction characteristics. They were installed prior to the adoption of RCRA standards (approximately mid-1985). These wells typically have carbon steel casings, with either screened or perforated open intervals, and do not generally have full annular seals. Some have been upgraded with annular seals from the surface to approximately 20 ft, and with surface pads and locking caps. They may or may not have dedicated sampling pumps. Their suitability is supported by their current use in producing data that have been accepted for RCRA and other programs. For many groundwater contaminant indicators in the 100 Areas, the construction differences between category A and B wells, and the absence of an annular seal in B wells, probably does not significantly impact the validity of data produced.

Category C wells generally require some maintenance/upgrading prior to their use in collecting groundwater samples for remedial investigations. They were installed prior to RCRA standards and are currently not used to produce RCRA or CERCLA groundwater quality data. They may be in use to support the Sitewide Environmental Monitoring Program (e.g., Woodruff and Hanf 1991) and/or operational monitoring on the Hanford Site (e.g., Serkowski and Jordan, 1989). They may also be in use to produce water level information only. These wells require at least routine well maintenance per WHC procedures (WHC 1988, EII 6.4) before they can be sampled for remediation investigations. If they are in strategic locations relative to contaminant sources or migrating plumes, they should receive the highest priority for fitness-for-use evaluation and maintenance.

Category D wells have the least certain information concerning their construction characteristics, suitability for obtaining water samples or measuring water levels, and in some instances, location. These wells were retained on the lists primarily due to a lack of information describing their abandonment or unsuitability as a monitoring well. As the field aspects of remedial investigations proceed and resurveying of existing wells is conducted, many of the category D wells will probably be removed from any consideration for future use in the 100 Aggregate Areas management study.

The next two columns in the tables provide a status on fitness-for-use investigations conducted under WHC procedures (WHC 1988, EII 6.4). "Field Inspect" indicates the date that a well was located in the field and its condition assessed. "Well Maint" shows the date on which well maintence was completed. This included removing old equipment, swabbing the borehole, redeveloping the well, and upgrading the surface cap. The information in these two columns comes from Ledgerwood (1991) and progress reports of the WHC Environmental Field Services Group.

"User Program" information for RCRA and operational (OPER) monitoring programs comes from a statement of work for FY 1992 between WHC and Pacific Northwest Laboratory (PNL) for sampling and analysis services. Information on use of a well in the site-wide surveillance (SURV) program (Woodruff and Hanf 1991) comes from the site-wide program's CY 1992 schedule. "CERC" indicates a new well being installed during FY 1992 to support CERCLA remedial investigations. Former borehole numbers are listed under "User Program" to identify holes drilled for purposes other than groundwater monitoring, such as the Basalt Waste Isolation Program and drilling activities associated with licensing Washington Public Power Supply System nuclear reactors.

The Hanford Plant coordinates shown in these lists come from GeoDat. When no coordinates are listed in GeoDat for a well, two methods were used to derive approximate coordinates. First, if the well number indicates a specific reactor area (e.g., 199-D5-10), coordinates were estimated by conducting field visits and determining approximate locations from map coordinates. If no location information could be obtained for a well, it was deleted from the candidate well list. Second, if the well number indicates the 600 Area (e.g., 699-__-__), coordinates were listed using the second number group (e.g., ___-88-___) to indicate Hanford Plant Grid North (in thousands of feet) and the third group (e.g. ___-__-62) as Plant West. A coordinate qualifier "Approximate" identifies estimates made using this method.

Hanford Plant coordinates were converted to Washington State Plane coordinates using conversion factors for each of the 100 Areas, except for wells in the 100-K and 100-N Areas, where conversion factors for the local area grids in those areas are still being developed. These conversion factors were determined by Kaiser Engineers Hanford Company for selected benchmarks in each area. Washington State Plane coordinates are in metric and are based on a Lambert Conformal map projection, rather than on a ground level grid, as is the Hanford Plant system. The Washington State Plane system is referenced to the North American Horizontal Datum of 1983 (NAD-83). Wells that have been recently surveyed or resurveyed are referenced to NAD-83.

For new wells installed during FY 1991 and 1992 that have not yet been surveyed, and for wells whose locations have been verified on recent 1:2000 scale topographic maps by field visits, the coordinate qualifier "Field Est" for field estimate has been added. If a well has been resurveyed during FY 1991 or later, an "Survey 199_" appears as the coordinate qualifier. Resurveying of Hanford Site survey markers and facilities, including groundwater monitoring wells, will be conducted by the U.S. Army Corps of Engineers as part of environmental restoration activities.

3.3 CANDIDATE WELLS IN EACH REACTOR AREA

The following location maps and tables summarize the current status of groundwater monitoring wells in each of the 100 Areas. Selected liquid waste disposal facilities and reactor buildings are shown on the location maps. Locations along the river shoreline where bank seepage, sediment, and near-shore river water samples have been collected are also shown.

TABLE 3-1. 100-BC AREA WELLS THAT ARE CANDIDATES FOR FUTURE USE

Well Number	Fitness Category	Field Inspect	Well Maint	User Program/ Former Name	Completion Date	Dedicated Equipment	Plant W (ft)	Plant N (ft)	NAD-83 E (m)	NAD-83 N (m)	Coordinate Qualifier	Comments
1-B2-12	A			CERC	6/25/92	Hydrostar	80425	72000	565360.4	145401.7	Field Est	FY92-Drilled
1-B2-13	A			CERC	6/15/92	Hydrostar	83750	71475	564346.9	145241.7	Field Est	FY92-Drilled
1-B3-1	B	2/25/91	7/31/91	SURV/CERC	3/31/53	Submersible	79830	71800	565541.7	145340.8	Hanf Wells	
1-B3-2	C	2/25/91			8/31/53		78818	71752	565850.2	145326.2	Hanf Wells	Remedia 3/70
1-B3-2-p	C	2/25/91			3/31/70		78818	71752	565850.2	145326.2	Hanf Wells	
1-B3-2-q	C	2/25/91			3/31/70		78818	71752	565850.2	145326.2	Hanf Wells	
1-B3-46	A			CERC	5/05/92	Hydrostar	78700	71950	565886.2	145386.5	Field Est	FY92-Drilled
1-B3-47	A			CERC	6/23/92	Hydrostar	80300	72000	565398.5	145401.7	Field Est	FY92-Drilled
1-B4-1	B	2/25/91	7/30/91	SURV/CERC	2/28/49	Submersible	80650	70000	565291.8	144792.1	Hanf Wells	
1-B4-2	B	2/25/91	9/27/91	SURV	2/28/49		80672	69933	565285.1	144771.7	Hanf Wells	
1-B4-3	B	2/25/91	9/26/91	SURV	2/28/49		80636	69933	565296.1	144771.7	Hanf Wells	
1-B4-4	B	2/25/91	7/30/91	SURV/CERC	9/30/60	Submersible	80367	68978	565378.1	144480.6	Hanf Wells	
1-B4-5	A			SURV/CERC	2/20/90	Hydrostar	80340	68592	565386.3	144363.0	Field Est	ISV Project
1-B4-6	A			SURV	2/20/90	Hydrostar	80340	68687	565386.3	144391.9	Field Est	ISV Project
1-B4-7	A			SURV/CERC	2/20/90	Hydrostar	80315	68687	565393.9	144391.9	Field Est	ISV Project
1-B4-8	A			CERC	6/15/92	Hydrostar	79750	69375	565566.1	144601.6	Field Est	FY92-Drilled
1-B4-9	A			CERC	6/16/92	Hydrostar	80250	69175	565413.7	144540.7	Field Est	FY92-Drilled
1-B5-1	B	2/25/91	7/30/91		8/31/62	Submersible	82000	69930	564880.3	144770.8	Hanf Wells	
1-B5-2	A			CERC	6/23/92	Hydrostar	80475	70600	565345.1	144975.0	Field Est	FY92-Drilled
1-B8-6	A			CERC	6/10/92	Hydrostar	83250	67400	564499.3	143999.7	Field Est	FY92-Drilled
1-B9-1	B	2/25/91	7/30/91	SURV/CERC	7/31/52	Submersible	79961	67500	565501.8	144030.1	Hanf Wells	
1-B9-2	A			CERC	6/15/92	Hydrostar	79950	67625	565505.2	144068.2	Field Est	FY92-Drilled
1-B9-3	A			CERC	6/09/92	Hydrostar	79675	67625	565589.0	144068.2	Field Est	FY92-Drilled
6-65-72	B	8/20/91	9/16/91	SURV		Submersible	72156	64452	567880.8	143101.1	Hanf Wells	
6-65-83	B	6/21/91	8/21/91		4/30/67	Submersible	82961	64944	564587.4	143251.1	Hanf Wells	
6-67-86	B	6/21/91	8/02/91	SURV	10/31/62	Submersible	85997	66996	563662.0	143876.5	Hanf Wells	
6-71-77	B	6/10/91	8/02/91	SURV	9/30/62	Submersible	76997	70996	566405.2	145095.7	Hanf Wells	
6-72-73	B	6/10/91	8/02/91	SURV	9/30/61	Submersible	73222	72038	567555.9	145413.3	Hanf Wells	
6-72-88	B	6/21/91	8/02/91	SURV		Submersible	87500	72100	563203.9	145432.2	Hanf Wells	Farm well

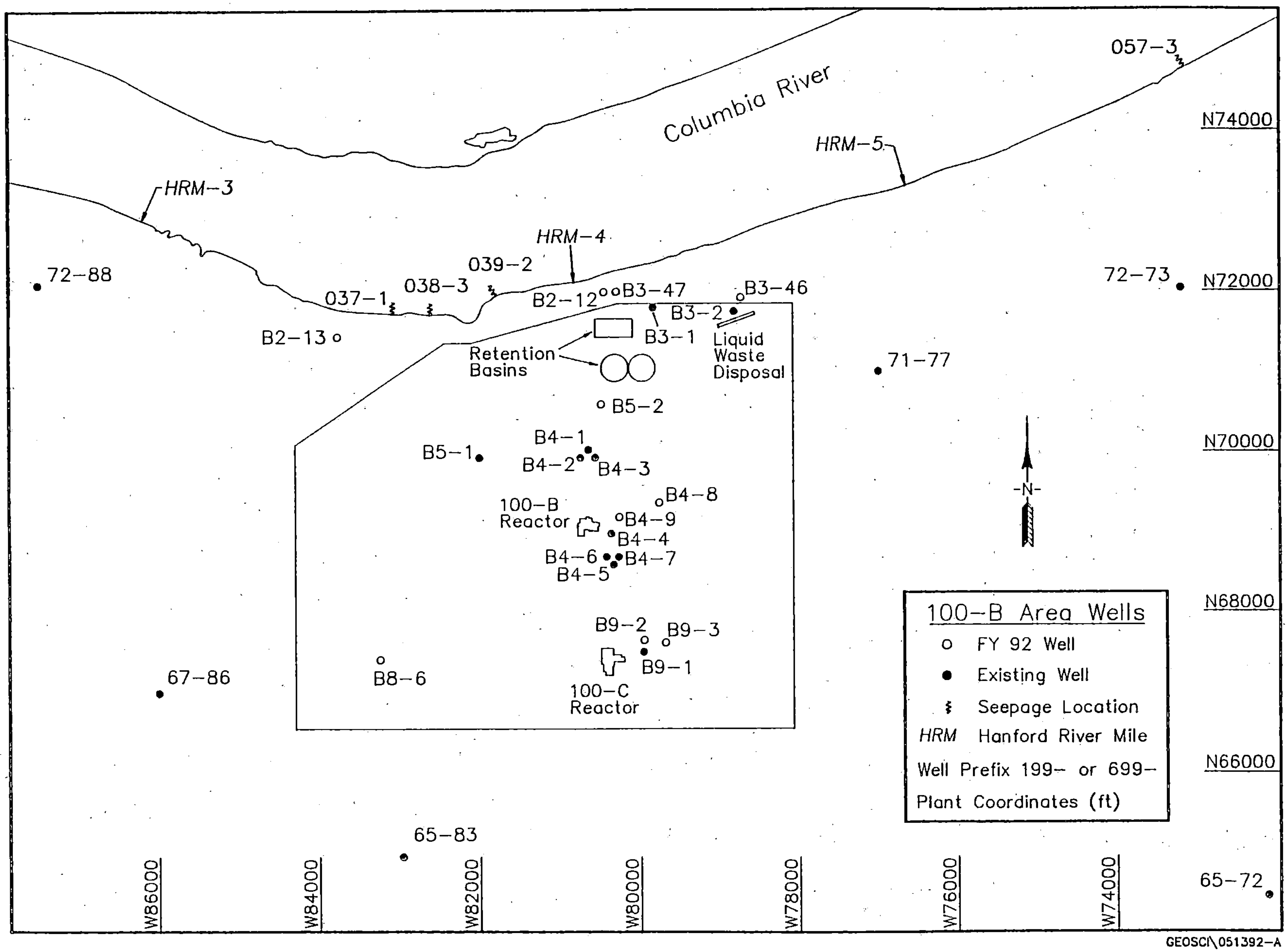

Figure 3-1. Well Locations In and Near the 100-B/C Area.

TABLE 3-2. 100-K AREA WELLS THAT ARE CANDIDATES FOR FUTURE USE

Well Number	Fitness Category	Field Inspect	Well Maint	User Program/ Former Name	Completion Date	Dedicated Equipment	Plant W (ft)	Plant N (ft)	NAD-83 E (m)	NAD-83 N (m)	Coordinate Qualifier	Comments
1-K-10	D	2/26/91			8/31/52		68800	76100			Hanf Wells	Cap welded
1-K-11	B	2/25/91	8/01/91	SURV/OPER/CERC	8/31/52	Submersible	68733	76030			Hanf Wells	
1-K-13	D	2/26/91			3/31/53		68803	76104			Hanf Wells	Oil in well
1-K-14	D				12/31/52		60000	71000			Approximate	
1-K-15	D				4/30/43		69050	77160			Hanf Wells	
1-K-16	D				2/28/53		67800	76300			Hanf Wells	
1-K-17	D				9/30/53		60000	70900			Approximate	
1-K-18	B	2/26/91	10/08/91		10/31/54							Coords Unknown
1-K-19	B	2/26/91	8/01/91	SURV/OPER/CERC	4/30/55	Submersible	67000	78000			Hanf Wells	
1-K-20	B	2/26/91	8/01/91	SURV/OPER/CERC	5/31/55	Submersible	66125	79500			Hanf Wells	
1-K-22	B	2/26/91	8/01/91	SURV/OPER/CERC	5/31/55	Submersible	65000	81000			Hanf Wells	
1-K-23	D	2/26/91			2/28/56		68000	78000			Hanf Wells	
1-K-24	D				12/31/52		69000	77000			Hanf Wells	
1-K-25	D				8/31/53		68000	78000			Hanf Wells	
1-K-26	D				8/31/53		60000	70700			Approximate	
1-K-27	B	2/26/91	10/08/91	SURV/OPER/CERC	9/30/79	Submersible	68000	76400			Hanf Wells	
1-K-28	B	2/26/91	10/08/91	SURV/OPER	9/30/79	Submersible	68060	76350			Hanf Wells	
1-K-29	B	2/26/91	10/08/91	SURV/OPER	9/30/79	Submersible	67775	76500			Hanf Wells	
1-K-30	B	2/26/91	10/08/91	SURV/OPER/CERC	10/31/79	Submersible	67700	76500			Hanf Wells	
1-K-31	C		3/31/92		5/31/86		71550	75650			Field Est	No documents
1-K-32A	A			CERC		Hydrostar	68275	77140			Field Est	FY92-Planned
1-K-32B	A			CERC		Hydrostar	68310	77140			Field Est	FY92-Planned
1-K-33	A			CERC		Hydrostar	69800	76175			Field Est	FY92-Planned
1-K-34	A			CERC		Hydrostar	69640	75475			Field Est	FY92-Planned
1-K-35	A			CERC		Hydrostar	68860	74370			Field Est	FY92-Planned
1-K-36	A			CERC		Hydrostar	67125	75260			Field Est	FY92-Planned
1-K-37	A			CERC		Hydrostar	64000	82000			Field Est	FY92-Planned
6-70-68	B	8/08/91	9/16/91		7/31/54	Submersible	68357	70123			Hanf Wells	
6-72-73	B	6/10/91	8/02/91	SURV	9/30/61	Submersible	73222	72038			Hanf Wells	
6-73-61	B	2/26/91	8/21/91	SURV/CERC	9/30/62	Submersible	60527	73195			Hanf Wells	

TABLE 3-2. 100-K AREA WELLS THAT ARE CANDIDATES FOR FUTURE USE

Well Number	Fitness Category	Field Inspect	Well Maint	User Program/ Former Name	Completion Date	Dedicated Equipment	Plant W (ft)	Plant N (ft)	NAD-83 E (m)	NAD-83 N (m)	Coordinate Qualifier	Comments
6-78-62	B	8/08/91	9/16/91	SURV/CERC	5/31/57	Submersible	62300	77750			Hanf Wells	
6-80-62	D						62000	81900			Hanf Wells	
6-80-73B	D						73000	79900			Approximate	School well
6-81-62	D	2/27/91		BH-17	3/31/73		62072	80813			Hanf Wells	
6-81-64B	D				12/31/43		64000	80900			Approximate	

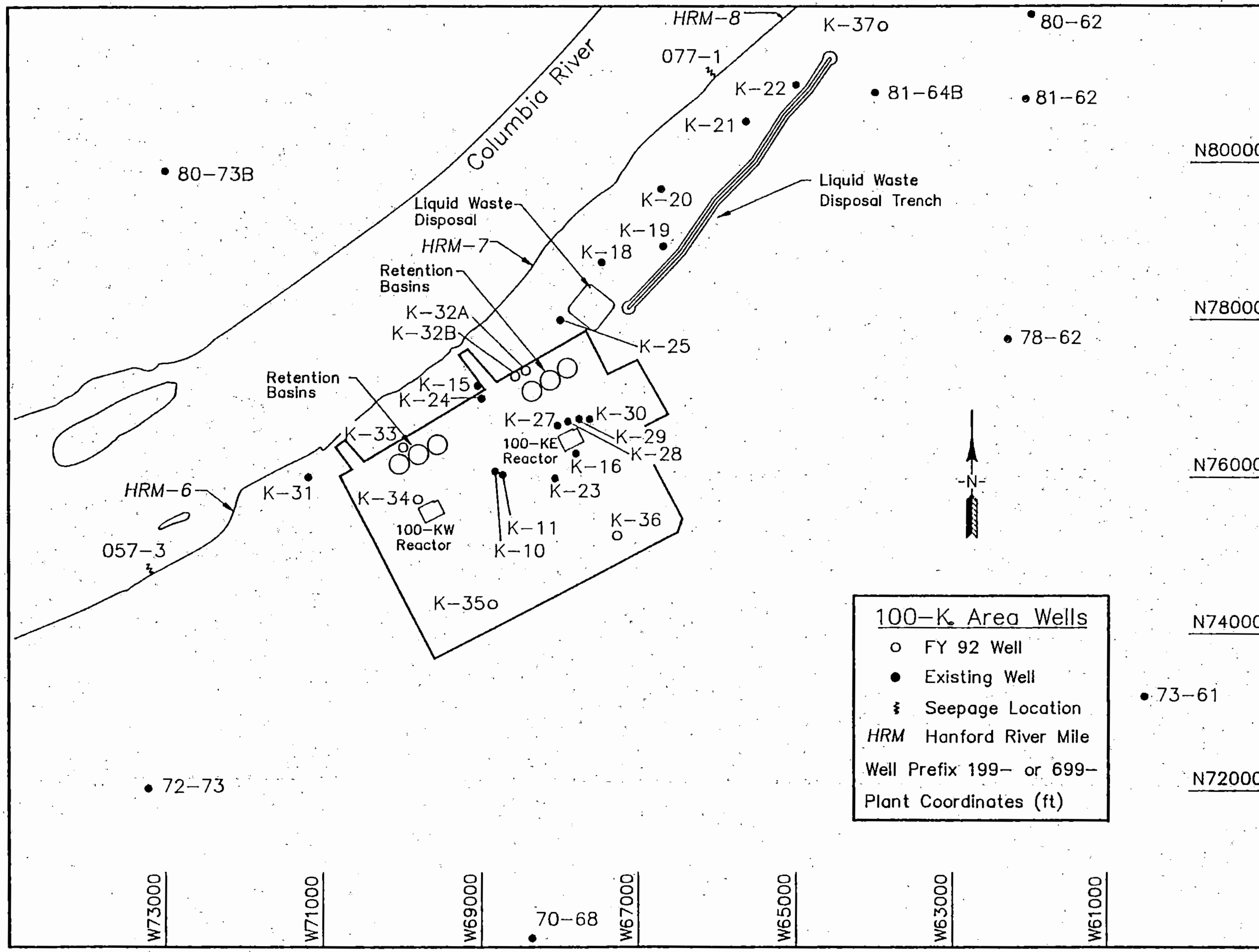

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Figure 3-2. Well Locations In and Near the 100-K Area.

TABLE 3-3. 100-N AREA WELLS THAT ARE CANDIDATES FOR FUTURE USE

Well Number	Fitness Category	Field Inspect	Well Maint	User Program/ Former Name	Completion Date	Dedicated Equipment	Plant W (ft)	Plant N (ft)	NAD-83 E (m)	NAD-83 N (m)	Coordinate Qualifier	Comments
1-D2-5	C	6/14/90		SURV	8/31/60	Submersible	52638	90783			Hanf Wells	
1-D2-6	A			CERC	2/14/92	Hydrostar	55400	90700			Field Est	New well FY92
1-K-22	B	2/26/91	8/01/91	SURV/OPER	5/31/55	Submersible	65000	81000			Hanf Wells	
1-N-1	D				5/31/64		60593	86157			Hanf Wells	
1-N-14	B	4/25/91		RCRA/SURV/DOH	4/30/69	Submersible	59535	87834			Hanf Wells	
1-N-15	C	3/28/90			5/31/69	Submersible	60181	85503			Hanf Wells	
1-N-16	B	8/15/89		RCRA/SURV	2/28/81	Submersible	60950	85208			Hanf Wells	
1-N-17	B	8/15/89		RCRA/SURV	1/31/81	Submersible	60963	86098			Hanf Wells	
1-N-18	C	8/15/89		SURV	2/28/81	Submersible	61012	86226			Hanf Wells	
1-N-19	C	8/15/89			1/31/81	Submersible	61185	86064			Hanf Wells	
1-N-1-o	D				10/31/64		60593	86157			Hanf Wells	
1-N-1-p	D				10/31/64		60593	86157			Hanf Wells	
1-N-1-q	D				10/31/64		60593	86157			Hanf Wells	
1-N-2	B	4/26/91		RCRA/SURV	6/30/64	Submersible	60306	86577			Hanf Wells	
1-N-20	C	8/15/89		SURV	1/31/81		61211	85926			Hanf Wells	
1-N-21	B	4/25/91		RCRA/SURV	1/31/81	Submersible	61285	85823			Hanf Wells	
1-N-22	C	9/28/89		SURV	1/31/81		61407	85676			Hanf Wells	
1-N-23	C				1/31/81		61469	85586			Hanf Wells	
1-N-24	C			SURV	1/31/81		61640	85460			Hanf Wells	Dry in 1992
1-N-25	C			SURV	1/31/81		61706	85351			Hanf Wells	
1-N-26	C			SURV	1/31/81		61687	85105			Hanf Wells	
1-N-27	B	4/25/91		RCRA/SURV	8/31/83	Submersible	58417	85915			Hanf Wells	
1-N-28	C	8/15/89		SURV	9/30/83	Submersible	58738	85315			Hanf Wells	
1-N-29	B	4/26/91		RCRA/SURV	8/31/83	Submersible	59112	85358			Hanf Wells	
1-N-2-o	D				10/31/64		60306	86577			Hanf Wells	
1-N-2-p	D				10/31/64		60306	86577			Hanf Wells	
1-N-2-q	D				10/31/64		60306	86577			Hanf Wells	
1-N-2-r	D				10/31/64		60306	86577			Hanf Wells	
1-N-3	B	4/26/91		RCRA/SURV/DOH	6/30/64	Submersible	60828	86365			Hanf Wells	Prtly sanded in
1-N-30	C	3/28/90			9/30/83	Submersible	59372	85671			Hanf Wells	Coord corr 2/92

Well Number	Fitness Category	Field Inspect	Well Maint	User Program/ Former Name	Completion Date	Dedicated Equipment	Plant W (ft)	Plant N (ft)	NAD-83 E (m)	NAD-83 N (m)	Coordinate Qualifier	Comments
1-N-31	B	4/25/91		RCRA/SURV	9/30/83	Submersible	59211	85993			Hanf Wells	
1-N-32	B	4/25/91		RCRA/SURV/DOH	9/30/83	Submersible	58893	86077			Hanf Wells	
1-N-33	B	4/25/91		RCRA/SURV	8/31/83	Hydrostar	59403	86148			Hanf Wells	
1-N-34	C	8/15/89			9/30/83	Submersible	59452	85899			Hanf Wells	
1-N-35	D				4/30/84		58776	85805			Hanf Wells	
1-N-36	B	4/25/91		RCRA/SURV	4/30/84	Submersible	58710	86204			Hanf Wells	Dry in 1992
1-N-37	C	8/15/89		SURV	4/30/84	Submersible	58687	86476			Hanf Wells	Dry in 1992
1-N-39	B	4/25/91		RCRA/SURV	4/30/84	Submersible	58461	86651			Hanf Wells	Dry in 1992
1-N-4	B	4/26/91		RCRA/SURV	6/30/64	Submersible	60042	85921			Hanf Wells	Dry in 1992
1-N-40	D	8/15/89			4/30/84		58241	86773			Hanf Wells	
1-N-41	B	4/25/91		RCRA/SURV	4/30/84	Submersible	57989	86916			Hanf Wells	
1-N-42	C	9/19/89		SURV	4/30/84	Submersible	57716	86724			Hanf Wells	Dry in 1992
1-N-43	D				4/30/84		57384	87488			Hanf Wells	
1-N-44	D	9/19/89			4/30/84	Submersible	57996	86390			Hanf Wells	Dry in 1992
1-N-45	C				4/30/84	Submersible	58673	85748			Hanf Wells	
1-N-46	D						60796	86781			Hanf Wells	No documents
1-N-47	B	9/28/89		RCRA	11/30/84	Submersible	61490	85690			Field Est	
1-N-48	D				11/30/84	Submersible	61630	85430			Field Est	
1-N-49	C				7/31/85	Submersible	58556	87202			Field Est	
1-N-5	C	4/26/91		SURV	6/30/64		60540	85973			Hanf Wells	
1-N-50	C			SURV	7/31/85	Submersible	58420	88090			Field Est	TOC error?
1-N-51	C			SURV	7/31/85	Submersible	59420	88350			Field Est	
1-N-52	C	8/15/89		SURV	7/31/85	Submersible	57658	85259			Field Est	
1-N-53	D	8/15/89			6/30/85		59060	86908			Field Est	
1-N-54	A	4/25/91		RCRA/SURV	6/30/87	Hydrostar	60678	85836			Hanf Wells	
1-N-55	A	4/25/91		RCRA/SURV	6/30/87	Hydrostar	60710	85758			Hanf Wells	
1-N-56	A	4/25/91		RCRA/SURV	6/30/87	Hydrostar	60637	86066			Hanf Wells	
1-N-57	A	4/25/91		RCRA/SURV	6/30/87	Hydrostar	60516	85535			Hanf Wells	
1-N-58	A			SURV	11/30/87	Hydrostar	60939	84487			Hanf Wells	Dry in 1992
1-N-59	A	8/31/89		RCRA/SURV	11/30/87	Hydrostar	61029	84252			Hanf Wells	
1-N-6	C	4/26/91		SURV	5/31/65	Submersible	59572	85925			Hanf Wells	Dry in 1992

TABLE 3-3. 100-N AREA WELLS THAT ARE CANDIDATES FOR FUTURE USE

Well Number	Fitness Category	Field Inspect	Well Maint	User Program/ Former Name	Completion Date	Dedicated Equipment	Plant W (ft)	Plant N (ft)	NAD-83 E (m)	NAD-83 N (m)	Coordinate Qualifier	Comments
1-N-60	A			RCRA/SURV	11/30/87	Hydrostar	60969	84416			Hanf Wells	
1-N-61	A	8/31/89		SURV	11/30/87	Hydrostar	60708	84272			Hanf Wells	Dry in 1992
1-N-62	A	8/31/89			10/31/87		59492	85339			Hanf Wells	Coord corr 2/92
1-N-63	A				11/30/87		59803	85459			Hanf Wells	Coord corr 2/92
1-N-64	A	3/28/90			11/30/87		60030	85564			Hanf Wells	Coord corr 2/92
1-N-65	A	3/28/90			11/30/87		60028	85797			Hanf Wells	Coord corr 2/92
1-N-66	A	4/26/91		RCRA/SURV	11/30/87	Hydrostar	59781	85999			Hanf Wells	Coord corr 2/92
1-N-67	A	4/26/91		RCRA/SURV	3/31/88	Hydrostar	60248	86377			Hanf Wells	
1-N-69	A	4/26/91		RCRA/SURV	6/07/88	Hydrostar	60282	86397			Hanf Wells	
1-N-70	A	4/25/91		RCRA/SURV/DOH	6/01/88	Hydrostar	58360	86600			Hanf Wells	
1-N-71	A			RCRA/SURV	11/05/91	Hydrostar	59946	83697	571589.0	148982.4	Survey 1991	New well FY92
1-N-72	A			RCRA/SURV	11/08/91	Hydrostar	60883	84577	571302.4	149249.9	Survey 1991	New well FY92
1-N-73	A			RCRA/SURV	11/06/91	Hydrostar	60917	84313	571292.2	149169.3	Survey 1991	New well FY92
1-N-74	A			RCRA/SURV	11/04/91	Hydrostar	58785	84264	571942.1	149156.4	Survey 1991	New well FY92
1-N-75	A			RCRA		Hydrostar	60200	87000			Field Est	FY92-Drilled
1-N-76	A			RCRA		Hydrostar	59800	87200			Field Est	FY92-Drilled
1-N-77	A			RCRA		Hydrostar	60870	84600			Field Est	FY92-Planned
1-N-78	A			OPER		Hydrostar	60550	85400			Field Est	FY92-Planned
1-N-79	A			OPER		Hydrostar	60500	85300			Field Est	FY92-Planned
1-N-8-p	D				5/31/66		60796	86790			Hanf Wells	Bent over
1-N-8-q	D				5/31/66		60782	86804			Hanf Wells	
1-N-8-r	D				6/30/66		60776	86810			Hanf Wells	Sanded in
1-N-8-s	D				6/30/66		60789	86798			Hanf Wells	
1-N-8-t	D				6/30/66	P-Cont Flow	60803	86784			Hanf Wells	
1-N-8-u	D				5/31/66		60770	86816			Hanf Wells	Plugged
1-N-8-v	D				6/30/66		60811	86776			Hanf Wells	Bent over
6-80-62	D						62000	81900			Hanf Wells	
6-81-58	B	8/30/89		RCRA/SURV	10/31/62	Submersible	57993	81004			Hanf Wells	
6-81-62	D	2/27/91		BH-17	3/31/73		62072	80813			Hanf Wells	
6-81-64B	D				12/31/43		64000	80900			Approximate	
6-83-60	D						60085	82680			Hanf Wells	

TABLE 3-3. 100-N AREA WELLS THAT ARE CANDIDATES FOR FUTURE USE

Well Number	Fitness Category	Field Inspect	Well Maint	User Program/ Former Name	Completion Date	Dedicated Equipment	Plant W (ft)	Plant N (ft)	NAD-83 E (m)	NAD-83 N (m)	Coordinate Qualifier	Comments
6-83-61A	D			BH-12	12/31/72		61150	82950			Hanf Wells	
6-83-61B	D			BH-14	12/31/72		60610	82500			Hanf Wells	
6-84-59	D			BH-16	2/28/73		59480	84325			Hanf Wells	6"casing to 120
6-84-61A	D						61000	84000			Approximate	
6-84-61B	D			BH-13	12/31/72		60880	83720			Hanf Wells	
6-84-62A	D			BH-1	1/31/73		62310	84000			Hanf Wells	5"casing to 440
6-84-62B	D			BH-2	1/31/73		62260	83950			Hanf Wells	
6-84-62C	D			BH-4	1/31/73		62350	83850			Hanf Wells	
6-84-62D	D			BH-5	12/31/72		62360	83700			Hanf Wells	
6-84-62E	D			BH-6	12/31/72		62450	83610			Hanf Wells	
6-84-62F	D			BH-7	12/31/72		62290	83690			Hanf Wells	
6-84-62G	D			BH-9	12/31/72		61990	83890			Hanf Wells	
6-84-62H	D			BH-10	10/31/72		61950	84100			Hanf Wells	
6-84-62J	D			BH-15	12/31/72		62300	84200			Hanf Wells	
6-84-62K	D			BH-20	1/31/73		62200	83690			Hanf Wells	
6-84-63A	D			BH-3	12/31/72		62620	83825			Hanf Wells	
6-84-63B	D			BH-8	1/31/73		62560	84100			Hanf Wells	
6-84-63C	D			BH-11	1/31/73		62680	83960			Hanf Wells	
6-84-63D	D			BH-19	1/31/73		62850	84050			Hanf Wells	
6-85-61	D						60873	85350			Hanf Wells	
6-86-64	D			BH-18	2/28/73		64060	85780			Hanf Wells	
6-87-55	C			SURV	6/30/69	Submersible	55405	86707			Hanf Wells	

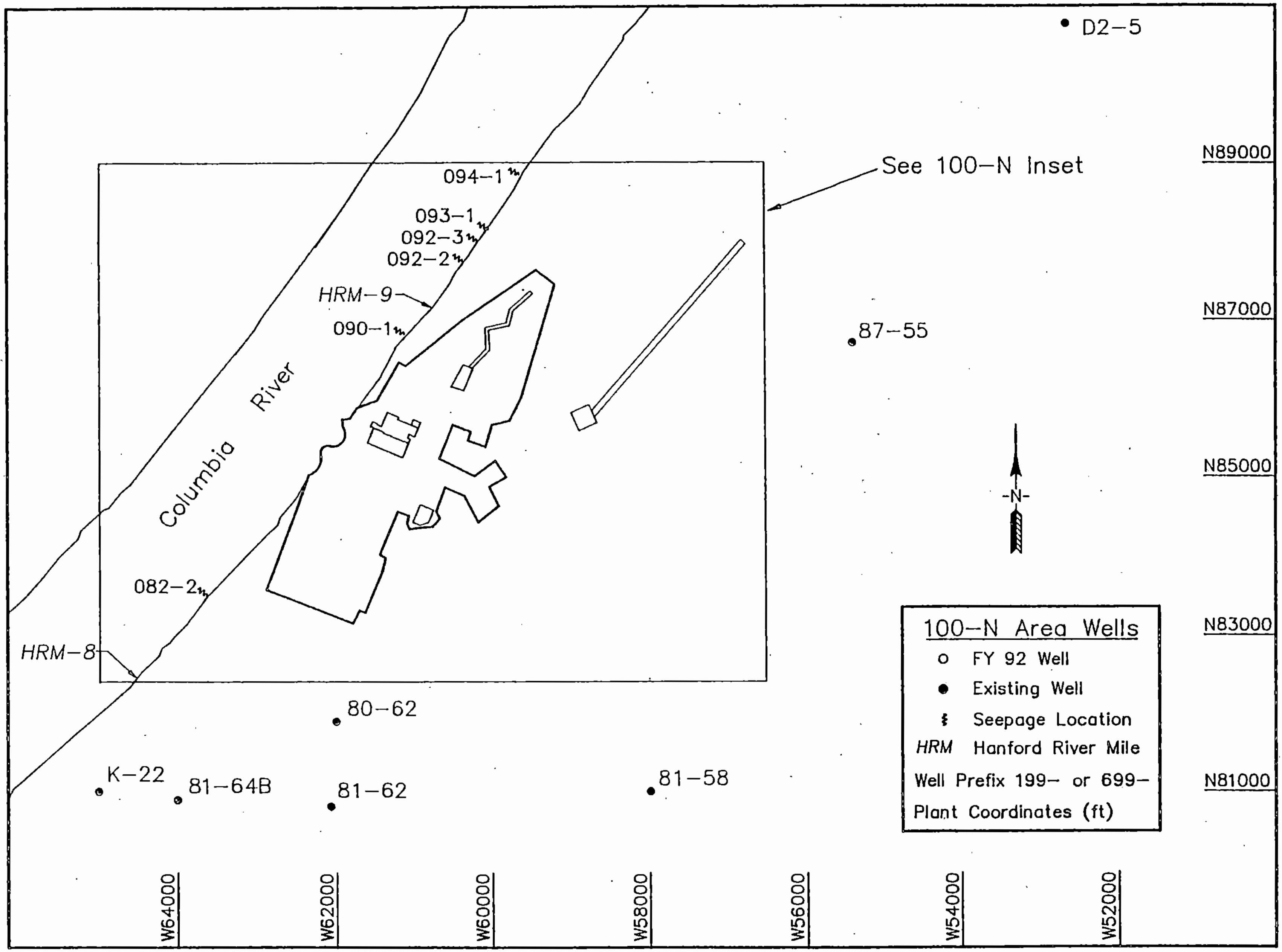

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Figure 3-3. Well Locations Near the 100-N Area.

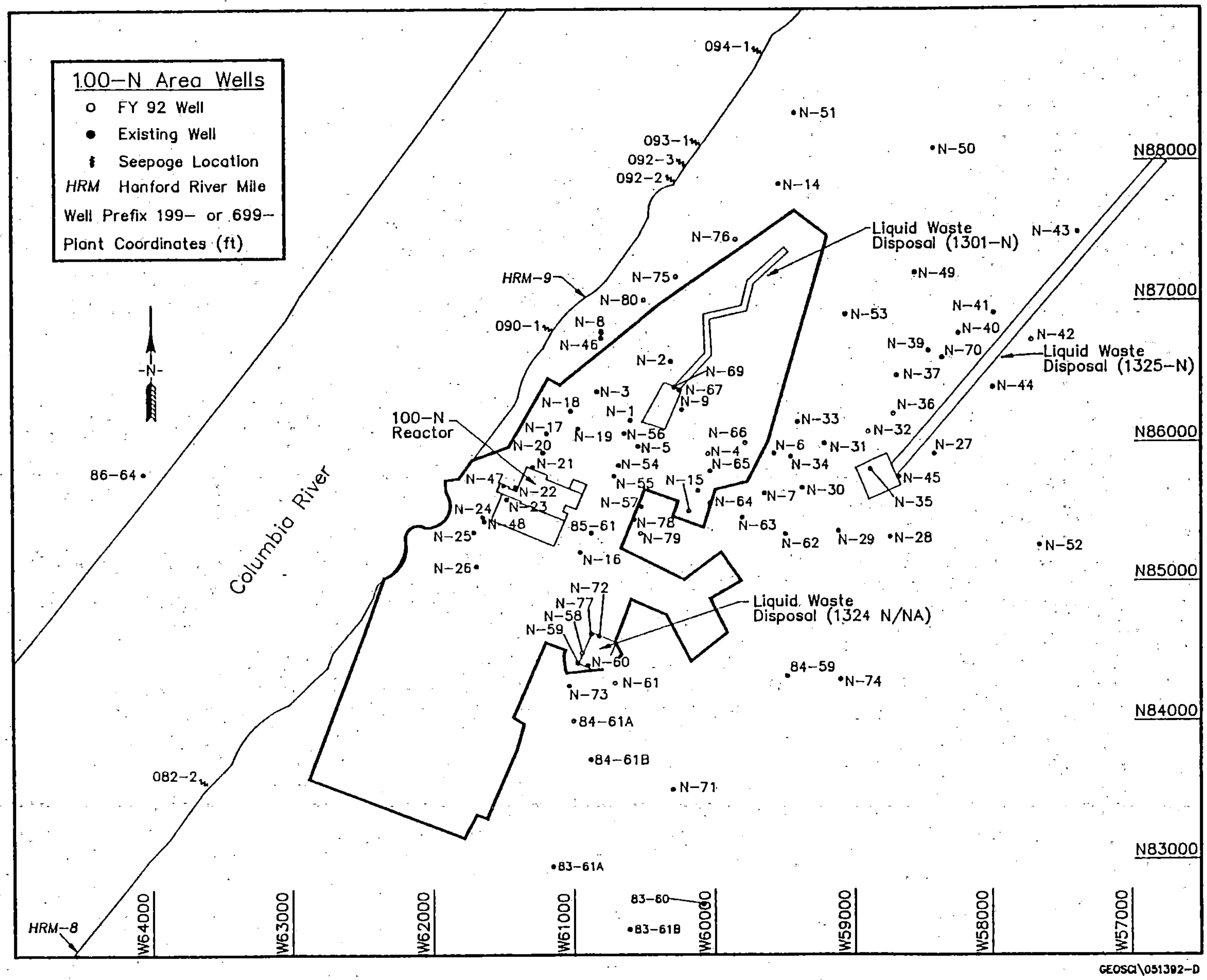


Figure 3-4. Well Locations In the 100-N Area.

TABLE 3-4. 100-D AREA WELLS THAT ARE CANDIDATES FOR FUTURE USE

Well Number	Fitness Category	Field Inspect	Well Maint	User Program/ Former Name	Completion Date	Dedicated Equipment	Plant W (ft)	Plant N (ft)	NAD-83 E (m)	NAD-83 N (m)	Coordinate Qualifier	Comments
1-D2-5	C	6/14/90	3/09/92	SURV/CERC	8/31/60	Submersible	52638	90783	573811.3	151147.4	Hanf Wells	
1-D2-6	A			CERC	2/14/92	Hydrostar	55400	90700	572969.4	151122.1	Field Est	New well FY92
1-D5-12	C	6/14/90	3/09/92	SURV/CERC	8/31/60	Submersible	52546	92125	573839.3	151556.5	Hanf Wells	
1-D5-13	A			RCRA/CERC	12/06/91	Hydrostar	53540	93433	573535.7	151955.4	Survey 1992	New well FY92
1-D5-14	A			CERC	3/17/92	Hydrostar	52750	92900	573777.2	151792.7	Field Est	New well FY92
1-D5-15	A			CERC	3/17/92	Hydrostar	52850	92600	573746.7	151701.3	Field Est	New well FY92
1-D5-16	A			CERC	3/20/92	Hydrostar	52450	92300	573868.6	151609.8	Field Est	New well FY92
1-D5-17	A			CERC	3/17/92	Hydrostar	52780	91520	573768.0	151372.1	Field Est	New well FY92
1-D5-18	A			CERC	2/24/92	Hydrostar	52520	91400	573847.3	151335.5	Field Est	New well FY92
1-D5-19	A			CERC	2/18/92	Hydrostar	52260	91100	573926.5	151244.1	Field Est	New well FY92
1-D5-20	A			CERC	2/24/92	Hydrostar	54440	93620	573262.1	152012.2	Field Est	New well FY92
1-D8-2	D	6/14/90			6/30/52		53018	94725	573695.5	152349.0	Hanf Wells	Dry in 1992
1-D8-3	C	6/14/90	3/09/92	SURV	6/30/52	Submersible	52205	94720	573943.3	152347.4	Hanf Wells	
1-D8-4	A			RCRA/CERC	12/04/91	Hydrostar	53829	93877	573447.4	152090.4	Survey 1992	New well FY92
1-D8-5	A			RCRA/CERC	12/05/91	Hydrostar	53532	94379	573537.4	152243.7	Survey 1992	New well FY92
1-D8-53	A			CERC	2/06/92	Hydrostar	52374	95060	573889.9	152452.3	Survey 1992	New well FY92
1-D8-54A	A			CERC	2/10/92	Hydrostar	52731	94916	573781.2	152408.0	Survey 1992	New well FY92
1-D8-54B	A			CERC	2/10/92	Hydrostar	52774	94886	573768.2	152398.7	Survey 1992	New well FY92
1-D8-55	A			CERC	2/11/92	Hydrostar	53300	94875	573609.5	152394.7	Field Est	New well FY92
1-D8-6	A			RCRA/CERC	12/23/91	Hydrostar	53870	93780	573434.9	152061.0	Survey 1992	New well FY92
1-N-50	C			SURV	7/31/85	Submersible	58420	88090	572048.9	150326.6	Field Est	TOC error?
1-N-51	C			SURV	7/31/85	Submersible	59420	88350	571744.1	150405.9	Field Est	
6-88-48	D						48000	88000	575225.0	150299.2	Approximate	
6-90-45	C	6/07/90		SURV		Submersible	45276	89626	576055.2	150794.8	Hanf Wells	
6-92-49	D						48571	92407	575050.9	151642.4	Hanf Wells	
6-93-46	A			CERC	4/28/92	Hydrostar	45975	93175	575842.2	151876.5	Field Est	New well FY92
6-93-49B	A			CERC	4/28/92	Hydrostar	49250	93000	574844.0	151823.2	Field Est	New well FY92
6-96-49	C	6/07/90	3/31/92	SURV	10/31/62	Submersible	49232	96388	574849.5	152855.8	Hanf Wells	
6-96-49-p	D	6/07/90			6/30/77		49232	96388	574849.5	152855.8	Hanf Wells	
6-96-52	D						51568	95982	574137.4	152732.1	Hanf Wells	Dug well

Well Number	Fitness Category	Field Inspect	Well Maint	User Program/ Former Name	Completion Date	Dedicated Equipment	Plant W (ft)	Plant N (ft)	NAD-83 E (m)	NAD-83 N (m)	Coordinate Qualifier	Comments
6-96-52-p	D						51568	95982	574137.4	152732.1	Hanf Wells	
6-97-47	D						47285	96735	575442.9	152961.6	Hanf Wells	Dug well
6-97-51A	C	6/07/90	3/31/92	SURV		Submersible	50507	97238	574460.8	153114.9	Hanf Wells	
6-97-51B	D						50605	96779	574431.0	152975.0	Hanf Wells	Corrugatd liner
6-98-54A	D						54000	98000	573396.2	153347.2	Approximate	

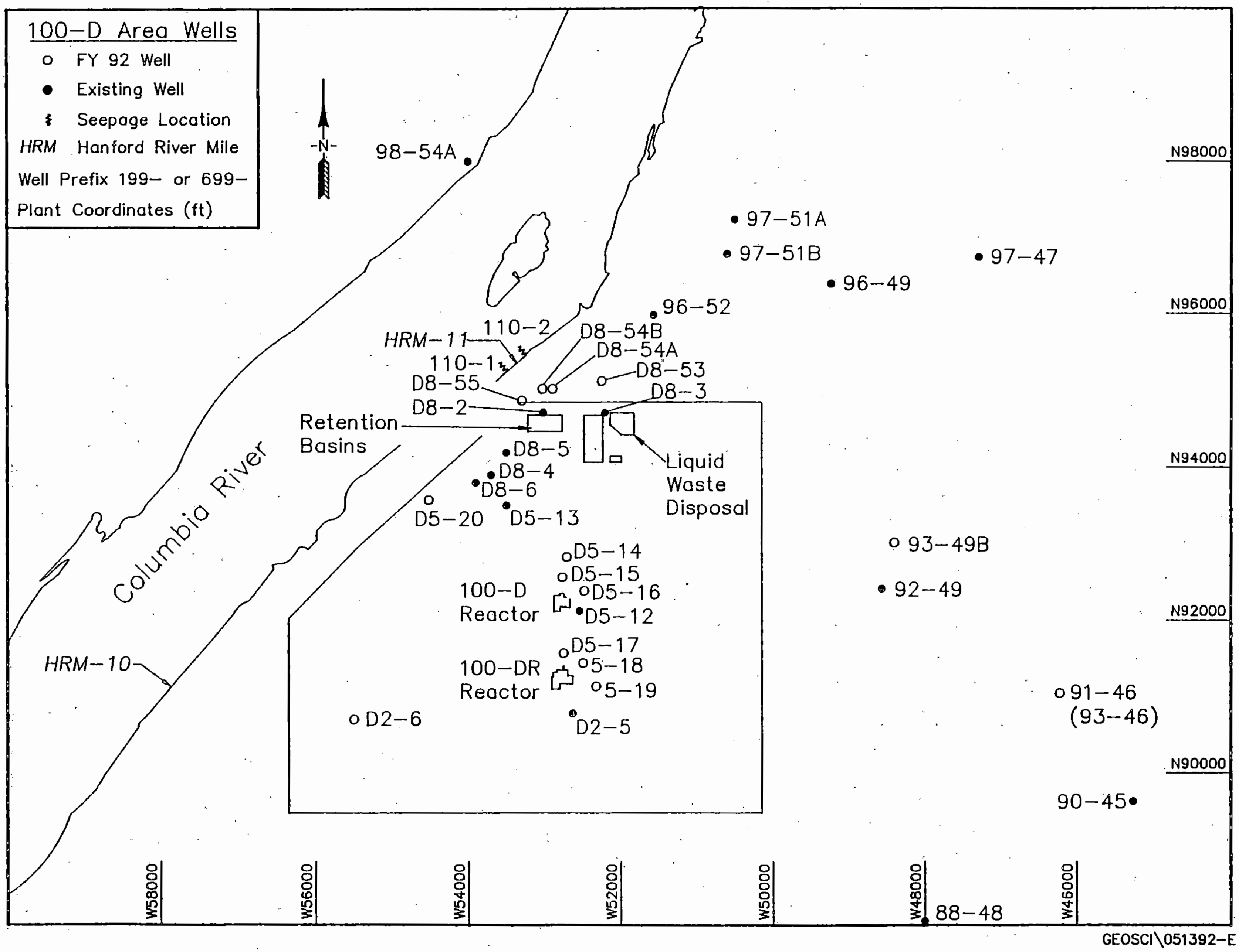


Figure 3-5. Well Locations In and Near the 100-D Area.

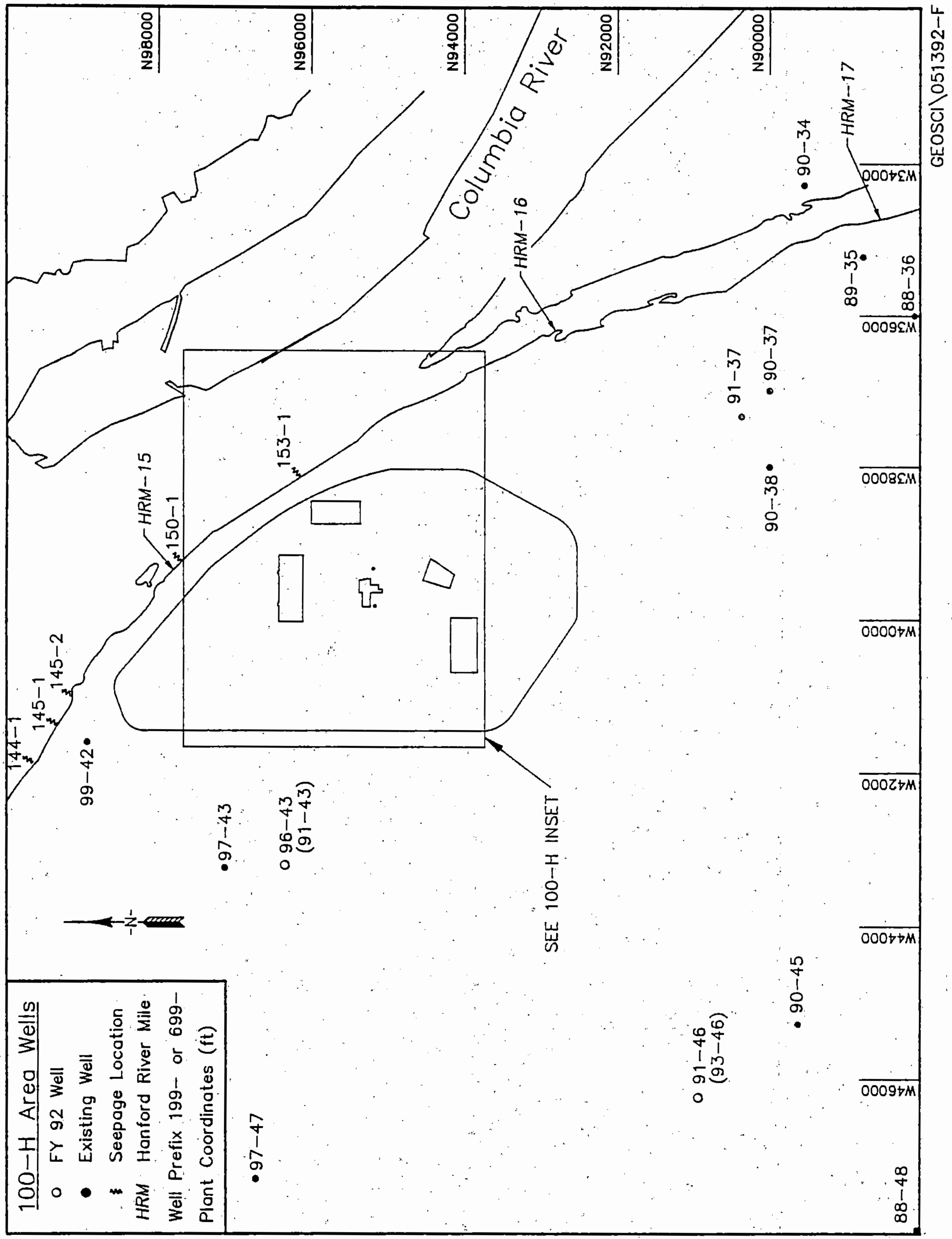
TABLE 3-5. 100-H AREA WELLS THAT ARE CANDIDATES FOR FUTURE USE

Well Number	Fitness Category	Field Inspect	Well Maint	User Program/ Former Name	Completion Date	Dedicated Equipment	Plant W (ft)	Plant N (ft)	NAD-83 E (m)	NAD-83 N (m)	Coordinate Qualifier	Comments
1-H3-1	B	6/12/90		RCRA/SURV	8/31/60	Hydrostar	40052	94994	577644.8	152438.7	Survey 1986	
1-H3-2A	A	6/12/90		RCRA/SURV	11/30/86	Hydrostar	40080	95997	577636.2	152744.4	Survey 1986	
1-H3-2B	A	6/12/90		RCRA/SURV	11/30/86	Hydrostar	40105	95998	577628.7	152744.7	Survey 1986	
1-H3-2C	A	6/12/90		RCRA	10/31/86	Hydrostar	40092	96019	577632.6	152751.2	Survey 1986	
1-H4-10	A	6/12/90		RCRA/SURV	9/30/86	Hydrostar	39449	97349	577828.7	153156.4	Survey 1986	
1-H4-11	A	6/12/90		RCRA/SURV/CERC	10/31/86	Hydrostar	38420	95943	578142.4	152728.0	Survey 1986	
1-H4-12A	A	6/12/90		RCRA/SURV	11/30/86	Hydrostar	38822	96577	578019.8	152921.0	Survey 1986	
1-H4-12B	A	6/12/90		RCRA/SURV	11/30/86	Hydrostar	38833	96554	578016.4	152914.0	Survey 1986	
1-H4-12C	A	6/12/90		RCRA/SURV	10/31/86	Hydrostar	38845	96573	578012.6	152919.9	Survey 1986	
1-H4-13	A	6/12/90		RCRA/SURV/CERC	11/30/86	Hydrostar	38168	95509	578219.2	152595.7	Survey 1986	
1-H4-14	A	6/12/90		RCRA/SURV/CERC	12/31/86	Hydrostar	39559	96028	577795.1	152753.7	Survey 1986	
1-H4-15A	A	6/12/90		RCRA/SURV/CERC	11/30/86	Hydrostar	39178	97056	577911.4	153067.2	Survey 1986	
1-H4-15B	A	6/12/90		RCRA/SURV	11/30/86	Hydrostar	39202	97049	577903.8	153065.1	Survey 1986	
1-H4-15C-p	D	6/12/90		RCRA	10/31/86		39186	97034	577908.9	153060.3	Survey 1986	Leaky seal
1-H4-15C-q	A	6/12/90		RCRA	10/31/86		39186	97034	577908.9	153060.3	Survey 1986	
1-H4-15C-r	A	6/12/90		RCRA	10/31/86		39186	97034	577908.9	153060.3	Survey 1986	
1-H4-15C-s	A	6/12/90		RCRA	10/31/86		39186	97034	577908.9	153060.3	Survey 1986	
1-H4-16	A	6/12/90		RCRA/SURV	4/30/87	Hydrostar	38946	95496	577982.0	152591.6	Survey 1987	
1-H4-17	A	6/12/90		RCRA/SURV	5/31/87	Hydrostar	39608	96961	577780.2	153038.2	Survey 1987	
1-H4-18	A	6/12/90		RCRA/SURV	5/31/87	Hydrostar	38825	96037	578018.9	152756.5	Survey 1987	
1-H4-2	C			SURV	5/31/52		38580	95200	578093.5	152501.3	Survey 1986	Flowing; capped
1-H4-3	B	6/12/90	5/08/92	RCRA/SURV/CERC	5/31/74	Hydrostar	39080	96372	577941.2	152858.7	Survey 1986	
1-H4-4	B	6/12/90	5/08/92	RC/SUR/CER/DOH	6/30/83	Hydrostar	38685	96356	578061.6	152853.9	Survey 1986	Remedia 5/87
1-H4-45	A			CERC	4/20/92	Hydrostar	38560	95050	578099.6	152455.7	Field Est	New well FY92
1-H4-46	A			CERC	3/26/92	Hydrostar	39300	94820	577874.1	152385.6	Field Est	New well FY92
1-H4-47	A			CERC	3/27/92	Hydrostar	39375	95400	577851.2	152562.4	Field Est	New well FY92
1-H4-48	A			CERC	3/30/92	Hydrostar	39670	95510	577761.3	152595.9	Field Est	New well FY92
1-H4-49	A			CERC	3/31/92	Hydrostar	39875	95050	577698.8	152455.7	Field Est	New well FY92
1-H4-5	B	6/12/90	5/08/92	RCRA/SURV/CERC	5/31/83	Hydrostar	39065	96639	577945.9	152939.9	Survey 1986	Remedia 5/87
1-H4-6	B	6/12/90	5/08/92	RCRA/SURV/CERC	5/31/83	Hydrostar	40245	96473	577586.0	152889.4	Survey 1986	Remedia 5/87

TABLE 3-5. 100-H AREA WELLS THAT ARE CANDIDATES FOR FUTURE USE

Well Number	Fitness Category	Field Inspect	Well Maint	User Program/ Former Name	Completion Date	Dedicated Equipment	Plant W (ft)	Plant N (ft)	NAD-83 E (m)	NAD-83 N (m)	Coordinate Qualifier	Comments
1-H4-7	A	6/12/90		RCRA/SURV	9/30/86	Hydrostar	39541	96468	577800.7	152888.0	Survey 1986	
1-H4-8	A	6/12/90		RCRA/SURV	5/31/86	Hydrostar	39341	96580	577861.7	152922.0	Survey 1986	
1-H4-9	A	6/12/90		RCRA/SURV	9/30/86	Hydrostar	39138	96488	577923.5	152893.9	Survey 1986	
1-H5-1	A			CERC	4/17/92	Hydrostar	40150	94275	577615.0	152219.5	Field Est	New well FY92
1-H6-1	A			CERC	4/21/92	Hydrostar	37900	94230	578300.8	152205.8	Field Est	New well FY92
6-88-36	D						36000	88000	578879.9	150306.9	Approximate	Farm well
6-88-48	D						48000	88000	575222.3	150306.9	Approximate	
6-89-35	C	6/14/90		SURV	9/30/61	Submersible	35221	88767	579117.4	150540.6	Hanf Wells	
6-90-34	D						34273	89550	579406.3	150779.3	Hanf Wells	
6-90-37	D						37000	90000	578575.1	150916.5	Approximate	
6-90-38	D						38000	90000	578270.3	150916.5	Approximate	12" corr. liner
6-90-45	C	6/07/90		SURV		Submersible	45276	89626	576052.6	150802.5	Hanf Wells	
6-91-37	D						37341	90373	578471.2	151030.2	Hanf Wells	12" corr. liner
6-91-43	A			CERC	4/23/92	Hydrostar	43300	90875	576654.9	151183.2	Field Est	New well FY92
6-93-46	A			CERC	4/26/92	Hydrostar	45975	93175	575839.5	151884.2	Field Est	New well FY92
6-97-43	C	6/07/90	3/31/92	SURV	10/31/62	Submersible	43241	97143	576672.9	153093.7	Hanf Wells	
6-97-47	D						47285	96735	575440.3	152969.3	Hanf Wells	Dug well
6-99-42	D						41606	98944	577171.2	153642.6	Hanf Wells	Dry in 1992

Figure 3-6. Well Locations Near the 100-H Area.



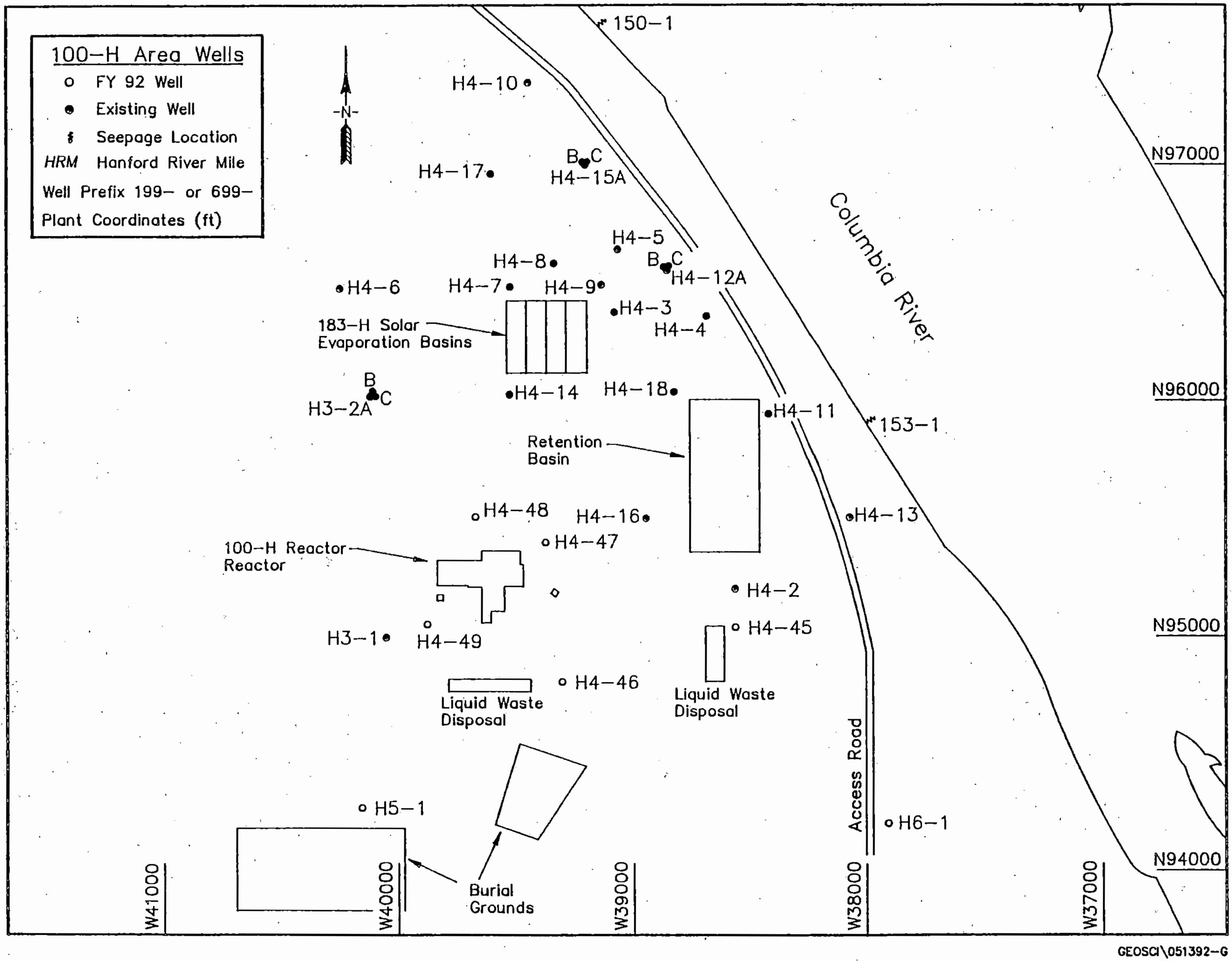


Figure 3-7. Well Locations In the 100-H Area.

TABLE 3-6. 100-F AREA WELLS THAT ARE CANDIDATES FOR FUTURE USE

Well Number	Fitness Category	Field Inspect	Well Maint	User Program/ Former Name	Completion Date	Dedicated Equipment	Plant W (ft)	Plant N (ft)	NAD-83 E (m)	NAD-83 N (m)	Coordinate Qualifier	Comments
1-F2-1	D				5/31/43		30906	82085	580443.9	148513.0	Hanf Wells	
1-F2-2	D				5/31/43		30827	82029	580468.0	148495.9	Hanf Wells	
1-F2-3	D				5/31/43		30730	82034	580497.6	148497.4	Hanf Wells	
1-F5-1	C	8/18/89		SURV	9/30/48	Submersible	28255	79531	581252.0	147734.5	Hanf Wells	
1-F5-2	D				2/28/53		28828	79738	581077.3	147797.6	Hanf Wells	
1-F5-3	C	8/18/89		SURV	1/31/53		28496	79588	581178.5	147751.9	Hanf Wells	
1-F5-4	C			SURV/OPER	2/28/53	Submersible	30650	79069	580522.0	147593.7	Hanf Wells	
1-F5-5	D				1/31/53		29174	80185	580971.8	147933.8	Hanf Wells	
1-F5-6	C	8/07/89		SURV/OPER	8/31/56	Submersible	29402	80537	580902.3	148041.1	Hanf Wells	
1-F5-7	D				4/30/58		31100	79300	580384.8	147664.1	Hanf Wells	
1-F7-1	C	8/18/89		SURV/OPER	8/31/56	Submersible	33394	77199	579685.6	147023.7	Hanf Wells	
1-F8-1	C	8/18/89		SURV/OPER	8/31/60	Submersible	31265	78536	580334.5	147431.2	Hanf Wells	
1-F8-2	C	8/18/89		SURV	8/31/60		31138	78661	580373.2	147469.3	Hanf Wells	
6-77-36	C			SURV	4/30/57	Submersible	36150	76700	578845.6	146871.6	Hanf Wells	
6-82-34	D						34000	82000	579500.9	148487.0	Approximate	
6-83-32	D						31611	82464	580229.0	148628.5	Hanf Wells	
6-83-36	D						36000	83000	578891.3	148791.8	Hanf Wells	Dug well
6-84-33	D						33860	84489	579543.5	149245.7	Hanf Wells	
6-84-34B	D			DC-14	2/28/81		33705	84482	579590.8	149243.6	Hanf Wells	3"casng to 1085
6-84-35A	D			SURV	10/31/62		34996	83999	579197.3	149096.3	Hanf Wells	
6-84-35A-o	C				5/31/65		34996	83999	579197.3	149096.3	Hanf Wells	
6-84-35A-p	D				6/30/63		34996	83999	579197.3	149096.3	Hanf Wells	
6-84-35A-q	D				6/30/63		34996	83999	579197.3	149096.3	Hanf Wells	
6-84-35A-r	D				6/30/63		34996	83999	579197.3	149096.3	Hanf Wells	
6-84-35A-s	D				6/30/63		34996	83999	579197.3	149096.3	Hanf Wells	
6-84-36D	D				4/30/74		36000	83800	578891.3	149035.7	Approximate	4" liner
6-84-36E	D				4/30/74		36000	83700	578891.3	149005.2	Approximate	4" liner
6-84-36F	D				4/30/74		36000	83600	578891.3	148974.7	Approximate	4" liner
6-84-37	D						37000	84000	578586.5	149096.6	Approximate	
6-85-21	D						21000	85000	583463.3	149401.4	Approximate	

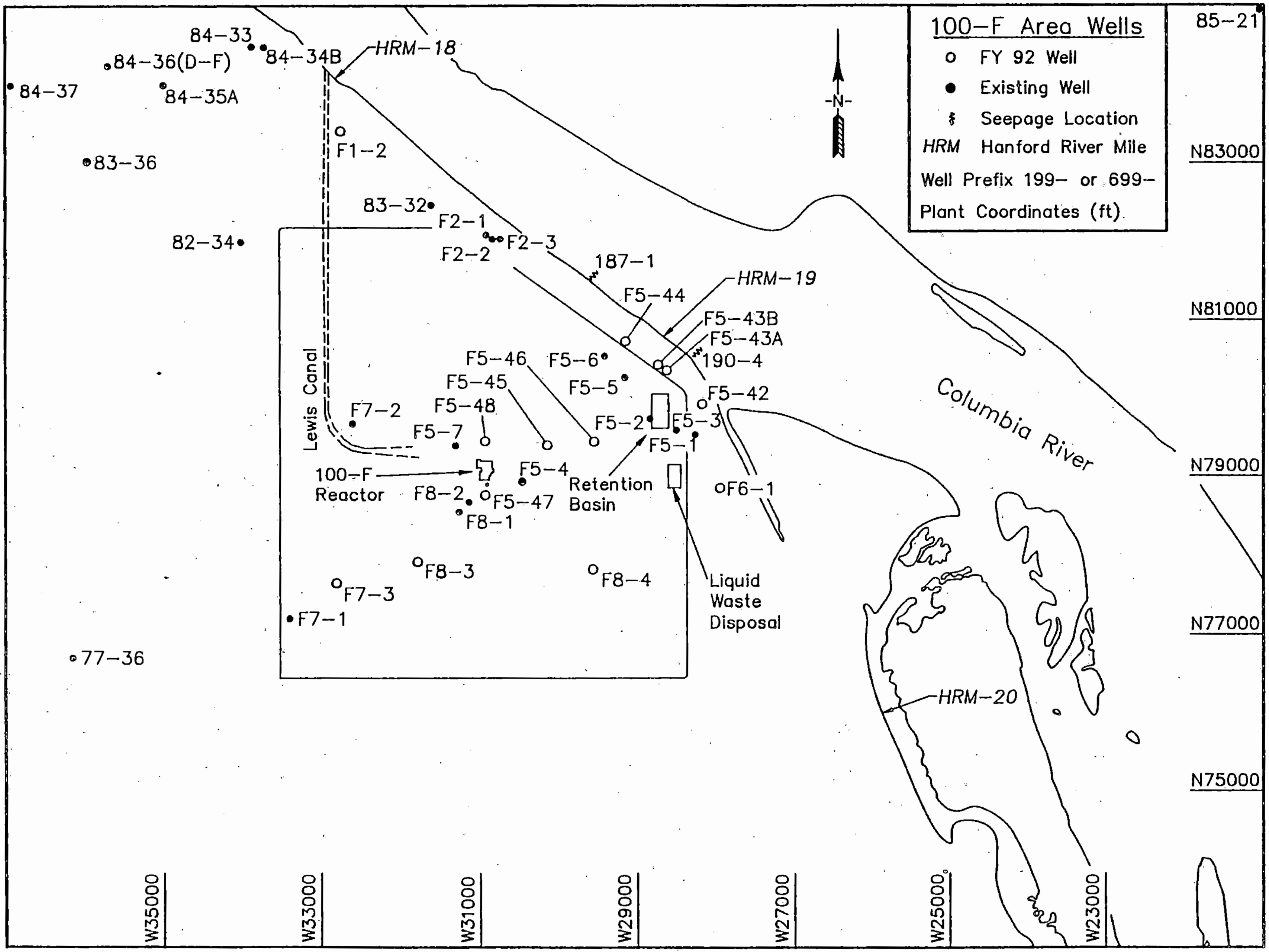


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Figure 3-8. Well Locations In and Near the 100-F Area.

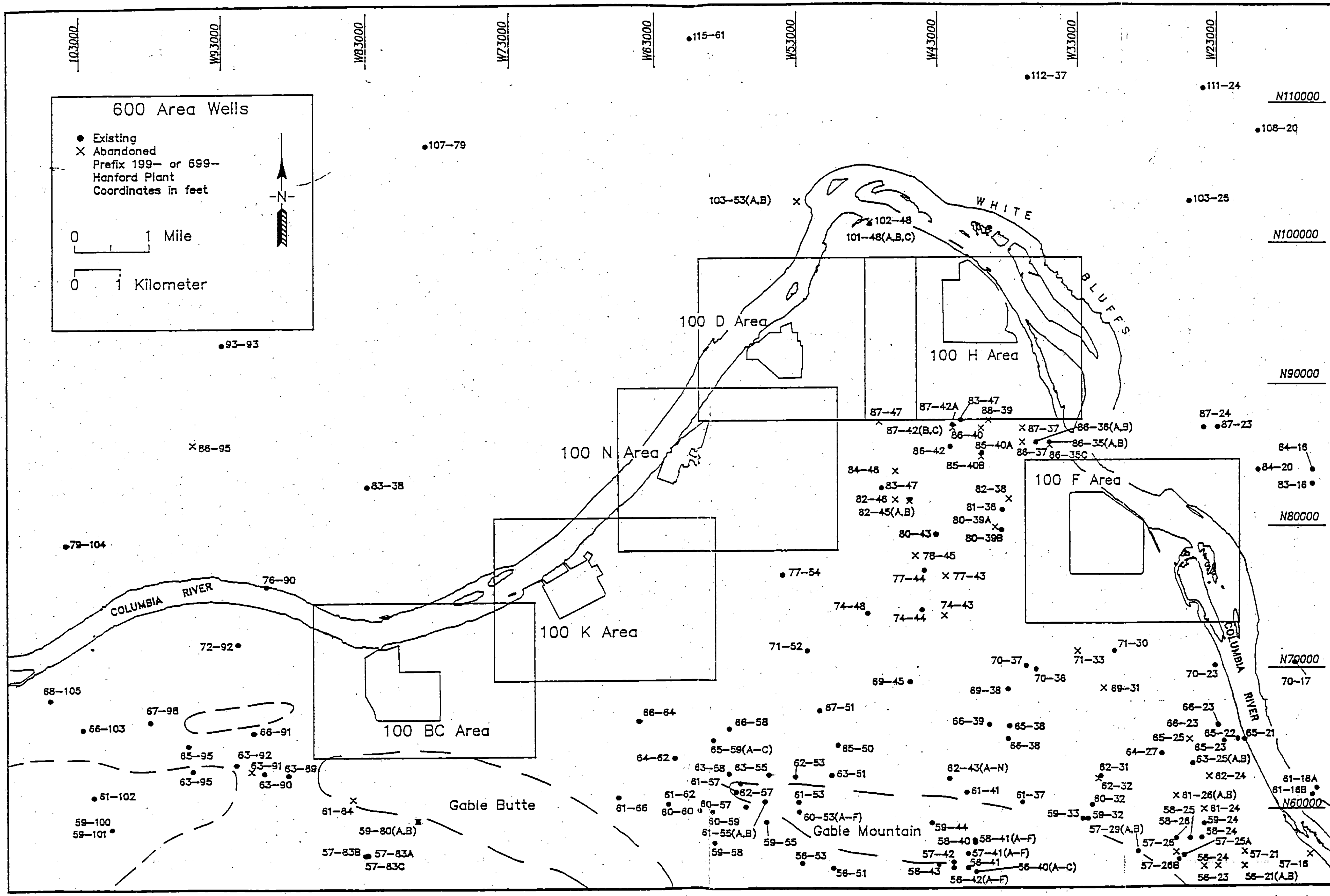

Figure 3-9. Well Locations in the 600 Area, Northern Hanford Site.

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4.0 GROUNDWATER ELEVATION DATA

4.1 INTRODUCTION

Potentiometric levels are important in determining groundwater flow paths and transport of contaminants. This chapter includes a series of hydrographs, water table maps, discussions of vertical gradients, seasonal and longer-term temporal changes in water levels. The chapter is divided into sections on: (a) the entire area between Gable Mountain/Gable Butte and the Columbia River; (b) the 100-BC and 100-K Areas; (c) the 100-N Area; (d) the 100-D and 100-H Areas, and (e) the 100-F Area.

Data were used to create water table maps if they met the following criteria: (a) wells completed in the unconfined aquifer within 100 ft of the average water table; (b) wells with wetted screened intervals shorter than 100 ft; and of course, (c) wells with surveyed elevations. In areas with heavy concentrations of wells, a representative subset was selected to construct the large-area map. If possible, measurements made within the same month were selected to provide a "snapshot" of the water table. Hydrographs were screened visually and obvious outliers were not used in maps or hydrographs. Data used to construct water table maps unique to this report are included in Appendix B.

Water table data were taken from GeoDat. Water level measurements recorded in this database were collected using various techniques, which are not specified in the database. Most of the measurements were taken with a chalked tape. The current procedure for water level measurement is Environmental Investigation Instruction (EII) 10.2, <u>Measurement of Groundwater Levels</u> (WHC 1988). Depths to water were subtracted from the elevation of the measuring point (usually top of casing) to determine head in ft above mean sea level. Casing elevations were surveyed to various datums; precision and accuracy are, in many cases, unknown. The contour intervals used in constructing the maps in this section are believed to be large enough that errors in elevation or measurement data are insignificant.

4.2 600 AREA NORTH OF GABLE MOUNTAIN

The study area includes the portion of the Hanford Site south of the Columbia River and north of Hanford 56,000 N, roughly the area north of Gable Mountain and Gable Butte. This area is sometimes referred to as the "horn" of the Hanford Site.

Sources of water level data include published reports and electronic databases. GeoDat includes head data for many wells in the study area, in some cases since the 1940s. Peterson (1991) summarizes available data for each well. Water levels are measured regularly in many of these wells for the RCRA, CERCLA, or sitewide monitoring programs. The current use of each well and measurement frequency is also listed by Peterson (1991).

Kipp and Mudd (1974) present a series of water table maps of the Hanford Site from 1944 to 1973. PNL produces annual water table maps for the Hanford Site (e.g., Evans et al., 1989). Water table maps of the northern Hanford Site for June and December 1990 are provided by Kasza et al. (1990, 1991).

Similar maps will be produced each year for June and December data, and will be used for CERCLA investigations. June groundwater levels usually show the influence of seasonal high river levels, while December data reflect low river levels.

4.2.1 Water Levels in the Uppermost Aquifer

The uppermost aquifer in the study area comprises sediments of the Hanford and Ringold formations (see Chapter 2). It is unconfined.

Figure 4-1 illustrates the water table and direction of groundwater flow in the northern Hanford Site in December 1990. Wells were identified in Figure 3-9. Groundwater is believed to flow between Gable Mountain and Gable Butte. From there, groundwater flows toward the north and east, where it discharges to the Columbia River.

Data are limited in the extreme western part of the area, where the groundwater gradient appears to be very flat. Average river elevation is 398 ft near the 100-B/C Area to 406 ft at the westernmost part of the area shown in Figure 3-9 (USGS 1986). The river apparently recharges the uppermost aquifer in this region when the river is at or above its average stage.

The hydraulic gradient is steepest in the eastern part of the area (0.004 between wells 61-41 and 60-32 in December 1990). There is a "ridge" of high groundwater levels just north of Gable Mountain. This feature has been present for many years (e.g., Bierschenk 1959), and is discussed below.

4.2.2 Variations in the Water Table

The water table in the northern Hanford Site is affected by: (a) liquid effluent disposal to the ground within the 100 Areas; (b) liquid effluent disposal in the 200 Areas, south of Gable Mountain and Gable Butte; and (c) daily to seasonal river-level stage changes. Effects of effluent disposal in the 200 Areas and river stage changes are discussed below.

Waste water discharge in and near the 200 Areas began the 1950s, forming large groundwater mounds. Prior to that time, groundwater flowed mainly west-to-east across the Hanford Site, with only a slight northerly component between Gable Mountain and Gable Butte (Figure 4-2) (ERDA 1975). As the groundwater mounds grew, flow between Gable Mountain and Gable Butte increased significantly. Water levels increased during the 1950s and 1960s in several wells in north of the gap (Figure 4-3a).

The groundwater "ridge" north of Gable Mountain may be related in part to the increased water levels from inflow of 200 Areas water. However, the water level in well 69-38 has remained relatively stable between 1951 and the present, not responding to increases in the water table from 200 Area waste disposal as do wells just north of the Gable "gap" (Figure 4-3b).

An alternate, and perhaps more likely explanation for the groundwater "ridge," is that the high water levels observed in wells 66-38, 66-39, and 65-38 are remnants of an elevated water table or perched water from the irrigation system used on ranches in that area before the Hanford Site existed (ERDA 1975). A driller's log for well 66-38 states that the upper 50 ft of sediments are primarily gravel to fine sand. The borehole penetrated clay from 50 to 150 ft, and the well was completed in the clay. There are no borehole logs for wells 66-39 or 65-38.

Waste water discharge in the 100 Areas created numerous groundwater mounds in the past. These may have been most significant in the late 1950s through the 1960s, when reactor operations created large volumes of water that were discharged to the soil column. Few data are available before the 1960s. Figure 4-4 is a water table map constructed of data collected in 1967. The water table across the study area was significantly higher than it is today, and groundwater mounds were present beneath all six of the reactor areas.

The Columbia River is considered free-flowing in the northern part of the Hanford Site, i.e., it is not impounded by dams (Gephart et al. 1979). River stage is affected by upstream dams, however. Daily fluctuations of 6 to 8 ft are common. River stage fluctuated approximately 12 ft in 1990 in the 100-N Area, with a high in June and a low in September-October (Figure 4-5).

During times of high river stage, the hydraulic gradient in the uppermost aquifer near the river reverses, causing the potential for water to flow into the aquifer from the river. Figure 4-6 illustrates the water table in June 1990, when the river had been unusually high for many weeks. The reversed gradient was most pronounced on the eastern side of the study area. For additional information on river-aquifer interaction in the 100 Areas, see Dirkes (1992).

4.2.3 Water Levels in the Confined Aquifers - Vertical Gradients

A number of multilevel piezometers have existed in the northern Hanford Site. Most of them have been removed and most of the data are not recorded in Geodat. Data are available for a few multilevel piezometers/shallow and deep well pairs in the 100-N and 100-H Areas.

Water level data were collected for various test intervals during drilling of deep boreholes in the northern Hanford Site. These data are generally of short duration (days to weeks) and are provided by Strait and Mercer (1987). Longer-term data (generally more than 1 yr) are provided by Swanson and Leventhal (1984).

Piezometric data in the uppermost aquifer indicate that downward gradients exist in the vicinity of waste disposal facilities and in the Rattlesnake Hills, located in the southern part of the Hanford Site. A downward gradient is characteristic of an area of groundwater recharge. Upward gradients, indicating groundwater discharge, are observed in piezometers located near the Columbia River (Gephart et al. 1979).

Fine-grained strata in the Ringold Formation form aquitards that confine underlying coarser-grained deposits locally. Few wells are completed in these deeper aquifers, and it is difficult to correlate them areally. Hydrographs for piezometers 80-43P (deep) and 80-43S (shallow) for 1966-1980 are illustrated in Figure 4-7. These hydrographs indicate an upward gradient in the Ringold Formation during that time period. Multilevel piezometers in the Hanford and Ringold formations in the 100-H Area also provide some data on water levels in Ringold confined aquifers.

Beneath the Ringold Formation is a series of aquifers and aquitards in the Columbia River Basalts Group (see Chapter 2). These units were studied extensively in the past (DOE 1988); however, most of the studies were concentrated on an area south of Gable Butte.

Spane (1987) produced a potentiometric map of the Mabton interbed, an aquifer between the Saddle Mountains and Wanapum Basalts, which indicates that groundwater flows from the northeast to the southwest. Boreholes 63-95 (formerly known as DB-12) and 84-34 (DC-14) are completed in aquifers in the Saddle Mountains Basalt. There is a downward gradient within the formation at 63-95, which is in the western part of the study area. There is an upward gradient at 84-34, in the eastern part of the study area (DOE 1988). This may indicate that the aquifers in the Saddle Mountains Basalt receive groundwater flow from the uppermost aquifer in the western part of the area, and provide flow to the uppermost aquifer in the eastern part of the site.

Figure 4-8 illustrates head at well 63-90, in the unconfined aquifer, and wells 65-95 and 66-91, in the uppermost confined aquifer in the basalt system. The unconfined aquifer clearly responds to river stage changes.

Nevulis et al. (1989) concluded that the confined (Rosalia flow top) aquifer in the northwestern Hanford Site also responds to changes in river stage, with only a 12-day lag time. This correlation implies that the confined aquifer is connected directly to the unconfined aquifer or to the river itself in this area. This phenomenon was also studied by DOE (1988).

4.3 100-B/C AND 100-K AREAS

The 100-B/C and 100-K Areas are the furthest west of the reactor areas. The B Reactor is the oldest on the Hanford Site, and operated from 1944 through 1968. The C Reactor was put into service in 1952 and ceased operating in 1969. The KE and KW Reactors operated from 1955 through 1971.

4.3.1 Water Levels in the Uppermost Aquifer

In general, groundwater in the uppermost aquifer flows from the south and southeast toward the river in the vicinity of the 100-B/C and 100-K Areas. West of the 100-B/C Area, the aquifer may be recharged by the river (see Section 4.2.1). The horizontal gradient is very small, approximately 0.0003 between wells 61-62 and 72-73 in December 1990.

4.3.2 Variations in the Water Table

Changes in river stage affect water table elevation in the 100-B/C and 100-K Areas. The range of water table variation from river stage changes decreases with increasing distance from the river (Figure 4-9).

A hydrograph of water levels in well B3-1 (Figure 4-10a) has a peak around 1968. Groundwater levels may have been higher before data collection began. Various liquid waste disposal trenches in the 100-B/C Area provided artificial recharge to the underlying aquifer. Leaking retention basins were another significant source of recharge.

Data in the 100-K Area show a peak water table elevation in the late 1950s to early 1960s (Figure 4-10b). Earlier data are unavailable. Probably the most significant source of artificial recharge in the 100-K Area was the 116-K-2 "mile long" trench. Approximately 3 billion liters of water were discharged there between 1955 and 1971.

4.3.3 Water Levels in the Confined Aquifers - Vertical Gradients

Well B3-2 monitors two aquifers in the Ringold Formation in the 100-B/C Area. When the well was installed, there was no seal between the aquifers. In 1970, the well was reconstructed to its current configuration: Piezometer B3-2P monitors the confined aquifer; B3-2Q and the annular space monitor the unconfined aquifer, with a cement seal between the piezometers (Ledgerwood 1991). Historical data from well B3-2 and its piezometers appear erratic and uninterpretable.

There are no other data from the deeper portion of the Hanford/Ringold aquifer system in the vicinity of the 100-B/C and 100-K Areas. Vertical gradients in this region are discussed in Section 4.2.2.

4.4 100-N AREA

N-Reactor was put into operation in the early 1960s, later than the other Hanford reactors, and has remained in some state of operation or standby until the present. Disposal of cooling water to various facilities has created groundwater mounds in the past: most significantly, the 1301-N facility from 1964 through 1985 and the 1325-N facility from 1985 till 1991.

4.4.1 Water Levels in the Uppermost Aquifer

Figure 4-11 shows the water table in the vicinity of the 100-N Area in December 1990. There was apparently a slight reversed gradient near the river at that time. In general, however, groundwater beneath the 100-N Area flows either directly northwestward toward the river, or northward, apparently to enter the river further downstream. The hydraulic gradient in December 1990 was 0.001 between wells 81-58 and N-14.

4.4.2 Variations in the Water Table

Figure 4-12 illustrates the range of variation in water table due to river stage changes in the 100-N Area. During times of high river stage, the gradient near the river is flat or even reversed.

Figure 4-13 contains a hydrograph from well N-2. High water levels in well N-2 were observed throughout the 1960s. Figure 4-14 shows the water table beneath the 100-N Area in September 1965.

Figure 4-15 shows a more recent groundwater mound in the 100-N Area, June 1989. At this time, a newer waste disposal facility was being used. The mound was apparently equal in size to, or perhaps even slightly larger than, the older mound. However, it was quite short-lived, and appears to have nearly disappeared by December 1990 (see Figure 4-10).

4.4.3 Water Levels in the Confined Aquifers - Vertical Gradients

Near the river in the 100-N Area there is a series of wells completed at various depths in the uppermost aquifer (the N-8 series). These wells show an upward gradient, indicating an area of groundwater discharge.

Two recently constructed wells further from the river (N-69 and N-70) are completed at the base of the uppermost producing layer. However, they are completed only about 20 ft deeper than nearby water table wells, and show no significant vertical gradient. There are no wells in the vicinity of the 100-N Area completed in the basalt and interbed aquifer system.

4.5 100-D AND 100-H AREAS

The 100-D and 100-H Areas are the furthest north reactor areas on the Hanford Site, located on the western and eastern sides, respectively, of the horn of the Hanford Site. The D Reactor operated from 1944 to 1967; the DR Reactor, from 1950 to 1964; and the H Reactor, from 1949 to 1965.

4.5.1 Water Levels in the Uppermost Aquifer

Figure 4-16 shows a water table map for December 1990 for the 100-D and 100-H Area and vicinity. Data in the western part of the area are sparse. Data in the 100-H Area show that the gradient was quite flat, and suggest that a reversed gradient was present near the river. Such reversed gradients are common in the 100-H Area (DOE 1991c).

There is a groundwater divide somewhere between the 100-D and 100-H Areas. Groundwater west of this divide flows toward the northwest. Groundwater further east flows toward the north and northeast. There is an overall eastward direction of flow. In December 1990, there was a shallow northward gradient between wells D2-5 and D8-3 (0.0007), and a slightly steeper gradient toward the northeast between wells 90-45 and H4-16 (0.001).

4.5.2 Variations in the Water Table

The effects of changing river levels on the water table are evident in the 100-H Area more than the other reactor areas because (a) the natural gradient is relatively gentle and (b) there are ample wells to provide water level data. During periods of high river level, the hydraulic gradient may be reversed (i.e., flow direction from the river inland) up to 1,000 ft from the river (DOE 1991c). Figure 4-17 illustrates the range and extent of water table variations due to changes in river stage.

Waste disposal in the 100-D and 100-H Areas has affected the water table in the past. Figures 4-18a shows hydrographs from two wells in the 100-D Area. A groundwater mound associated with waste discharge to leaking retention basins and disposal cribs was evident during the 1950s and 1960s. The sharp peak in water levels observed in 1967 was due to an infiltration test conducted by Eliason and Hajek (1967) (see Section 2.3.2).

Water level data were highest in the early 1960s in the 100-H Area (see Figure 4-18b). Primary sources of artificial recharge were a leaking retention basin and liquid waste disposal trenches.

Figure 4-19 is a water table map for the 100-D and 100-H Areas constructed from data collected in March and April 1967.

4.5.3 Water Levels in the Confined Aquifers - Vertical Gradients

No deep wells are present near the 100-D Area. Two clusters of wells in the 100-H Area monitor zones from the water table to a basalt interbed. One well cluster near the river shows there is an upward gradient in the uppermost aquifer system. There is also an upward gradient between the uppermost basalt aquifer and the overlying aquifer (PNL 1987).

4.6 100-F AREA

The 100-F Area is located in the northeastern portion of the Hanford Site. The F Reactor operated from 1945 to 1965. In addition to reactor operations, the 100-F Area housed biological experiments until 1976.

4.6.1 Water Levels in the Uppermost Aquifer

In the vicinity of the 100-F Area, groundwater in the uppermost aquifer flows west to east, toward the river. The horizontal gradient in December 1990 was approximately 0.0003 between wells 77-36 and F5-1.

4.6.2 Variations in the Water Table

Changes in river stage affect water levels in wells near the river in the 100-F Area (Figure 4-20). There are not enough data from 100-F Area wells to tell how far inland these variations are significant.

Figure 4-21 is a hydrograph of well F5-1. Water levels were highest in the 1950s and early 1960s. Figure 4-22 is a water table map of 100-F Area and vicinity for December 1961. Liquid wastes from reactor operations recharged the groundwater through leaking retention basins and waste disposal trenches. Liquid wastes from biological experiments provided additional recharge.

4.6.3 Water Levels in the Confined Aquifers - Vertical gradients

Well 84-34 (formerly known as DC-14) is completed in the Grande Ronde Basalt, and is an artesian well. Gradients within the uppermost aquifer system are unknown.

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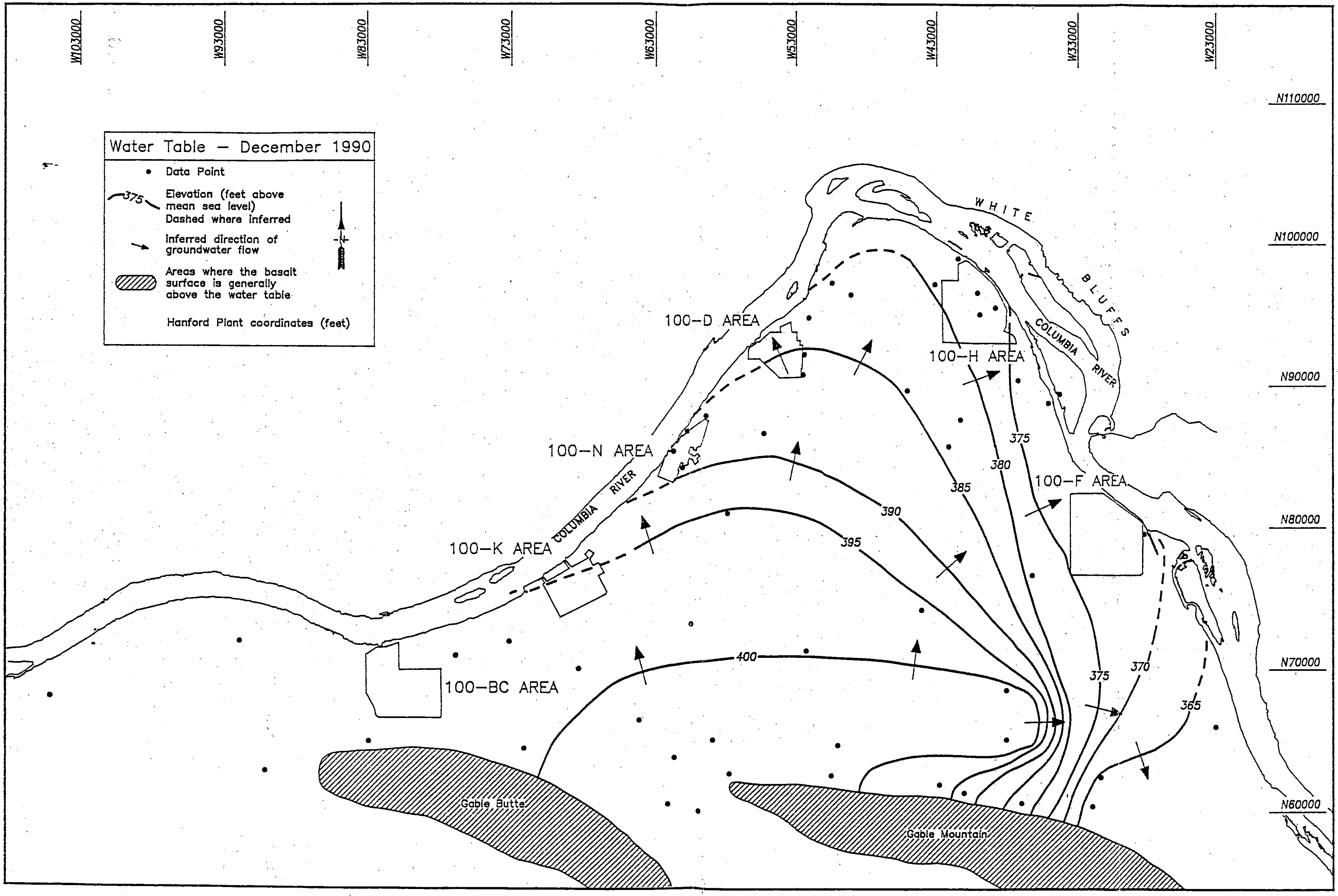

Figure 4-1. Water Table and Inferred Flow Directions in the Northern Hanford Site, December 1990 (after Kasza et al. 1991).

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Figure 4-2. Estimated Water Table on the Hanford Site, 1944 (ERDA 1975).

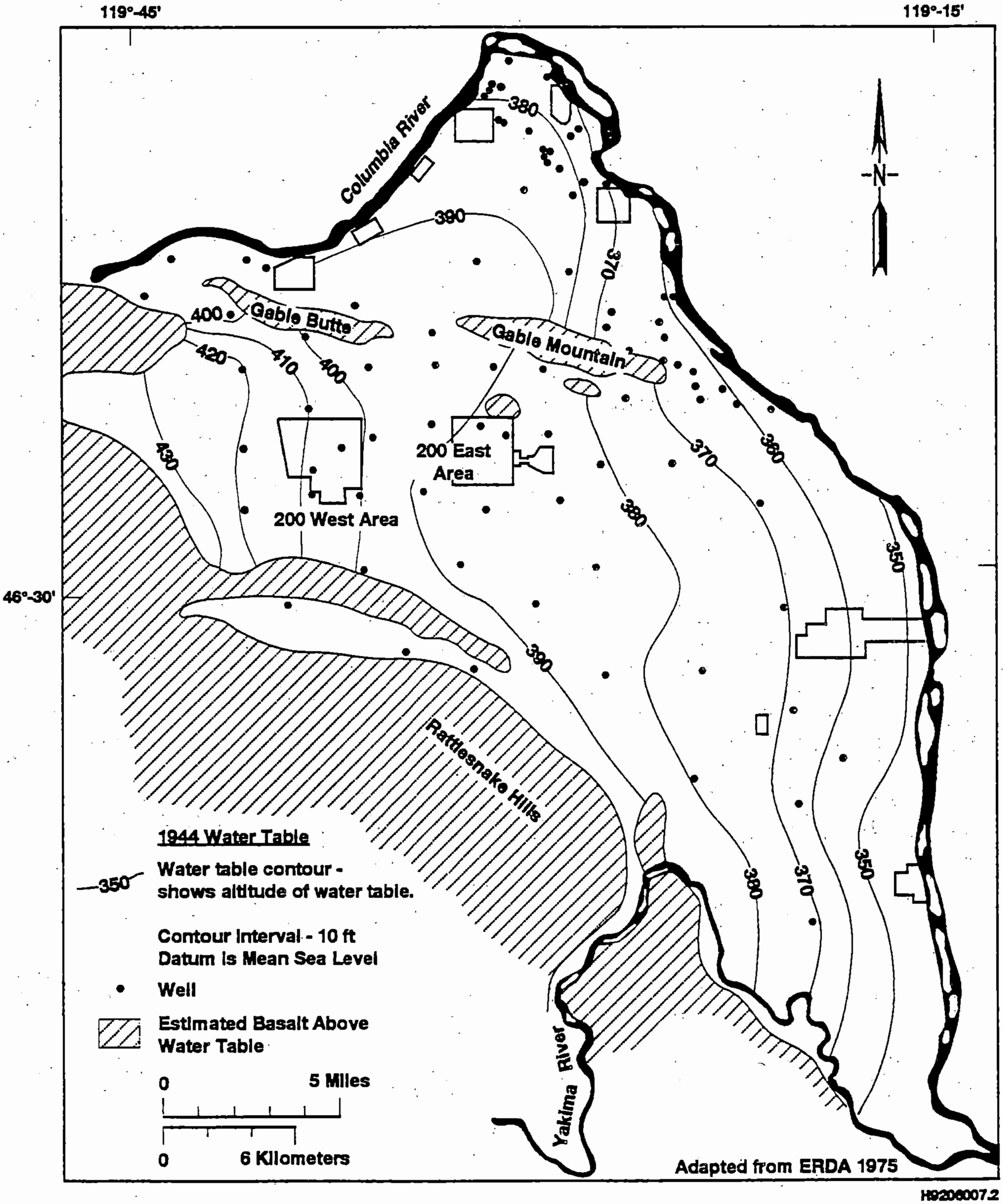
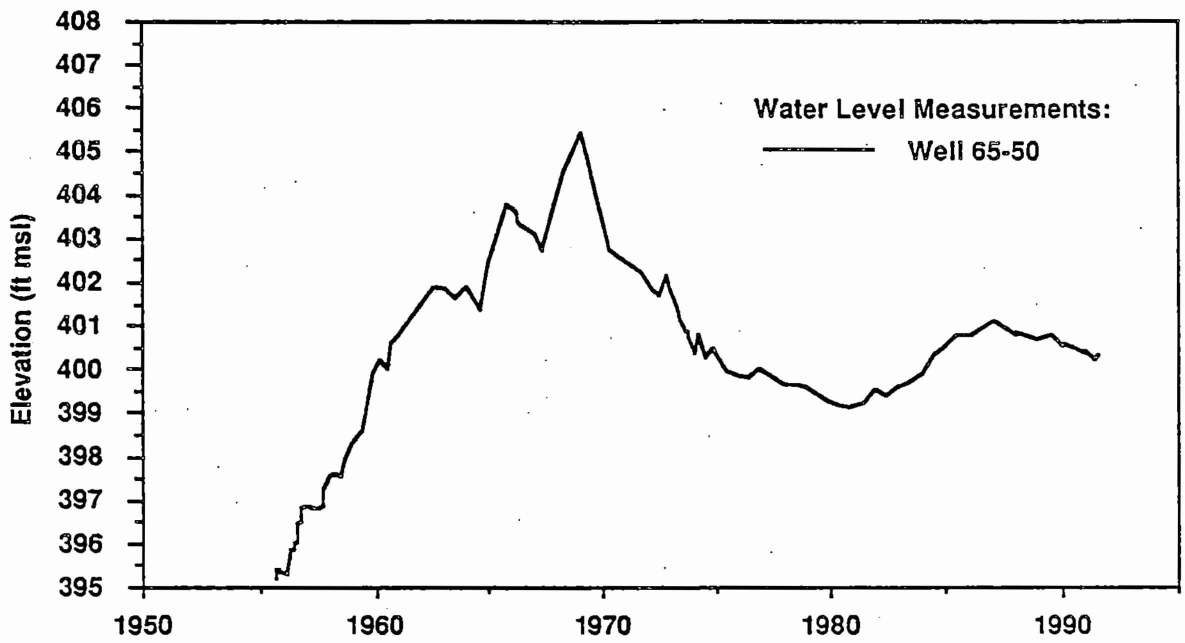
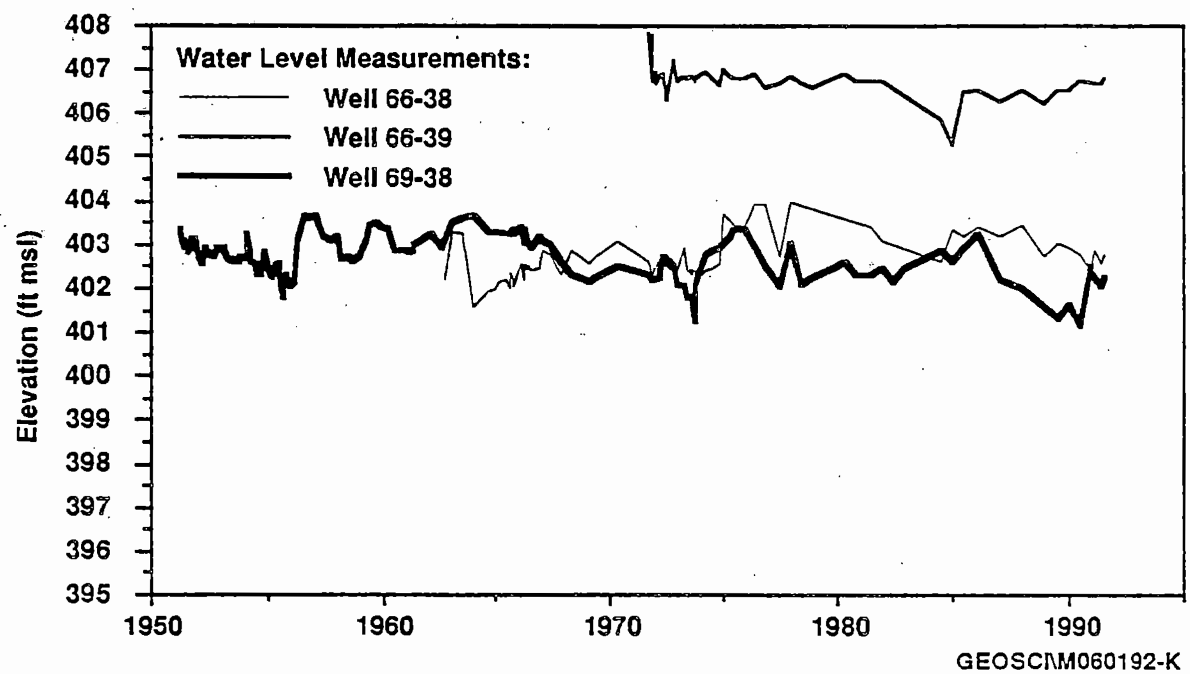


Figure 4-3. Ground Levels Versus Time.

(a) Well 699-65-50



(b) Wells 699-66-38, 699-66-39, and 699-69-38.



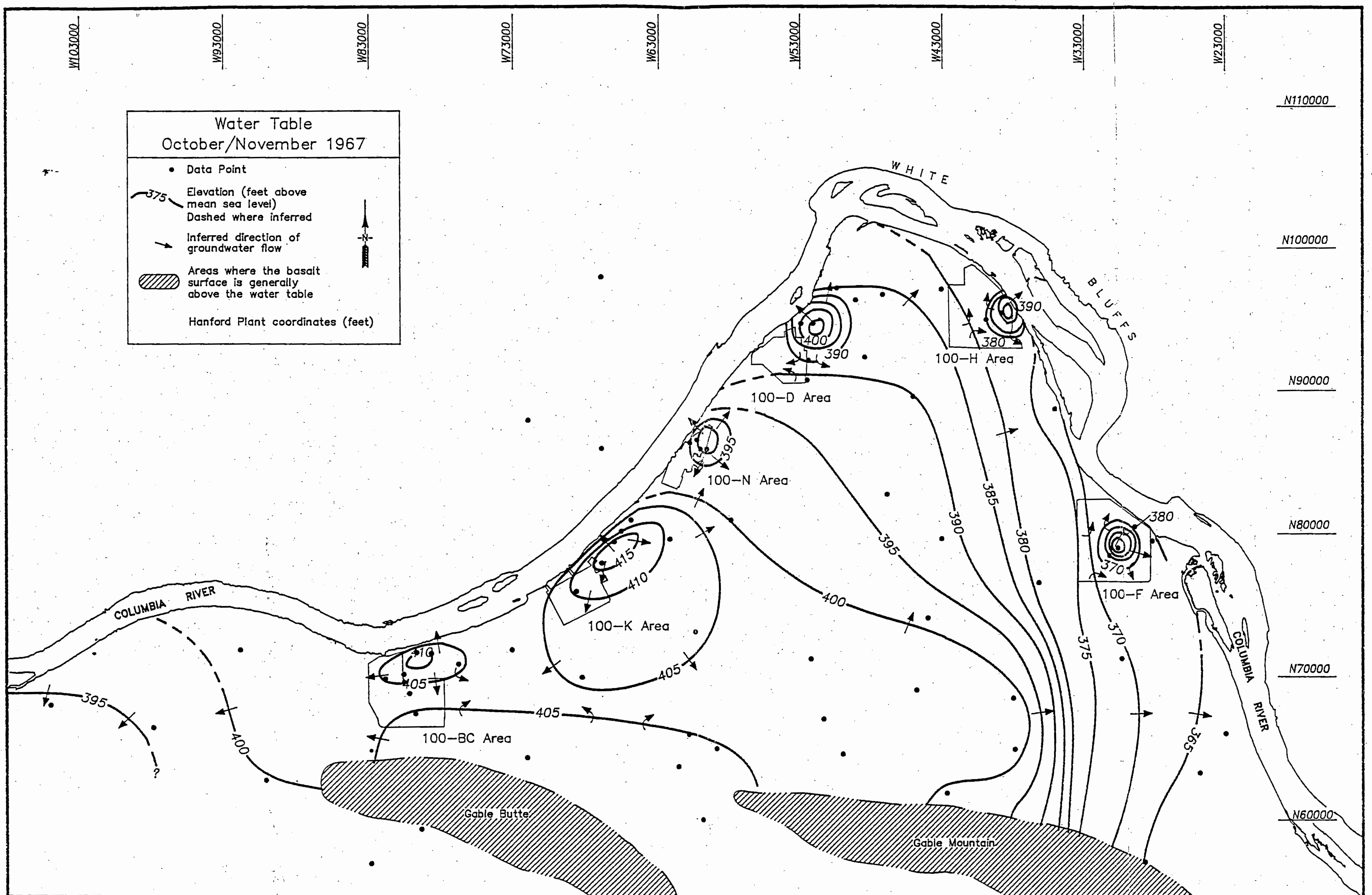


Figure 4-4. Water Table and Inferred Flow Directions in the Northern Hanford Site, Average of October and November 1967 Data.

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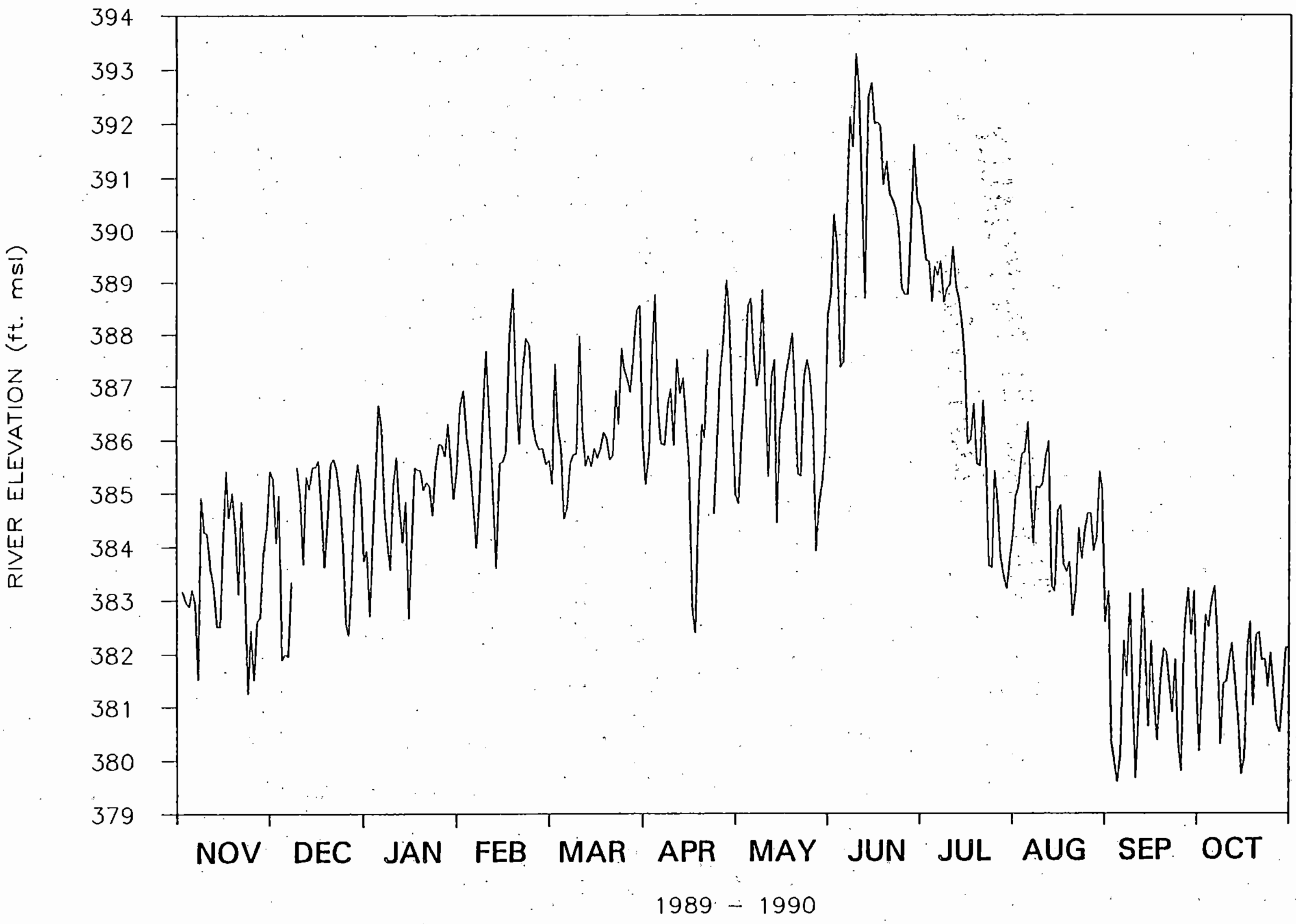

Figure 4-5. Daily Average Columbia River Stage at 100-N Area.

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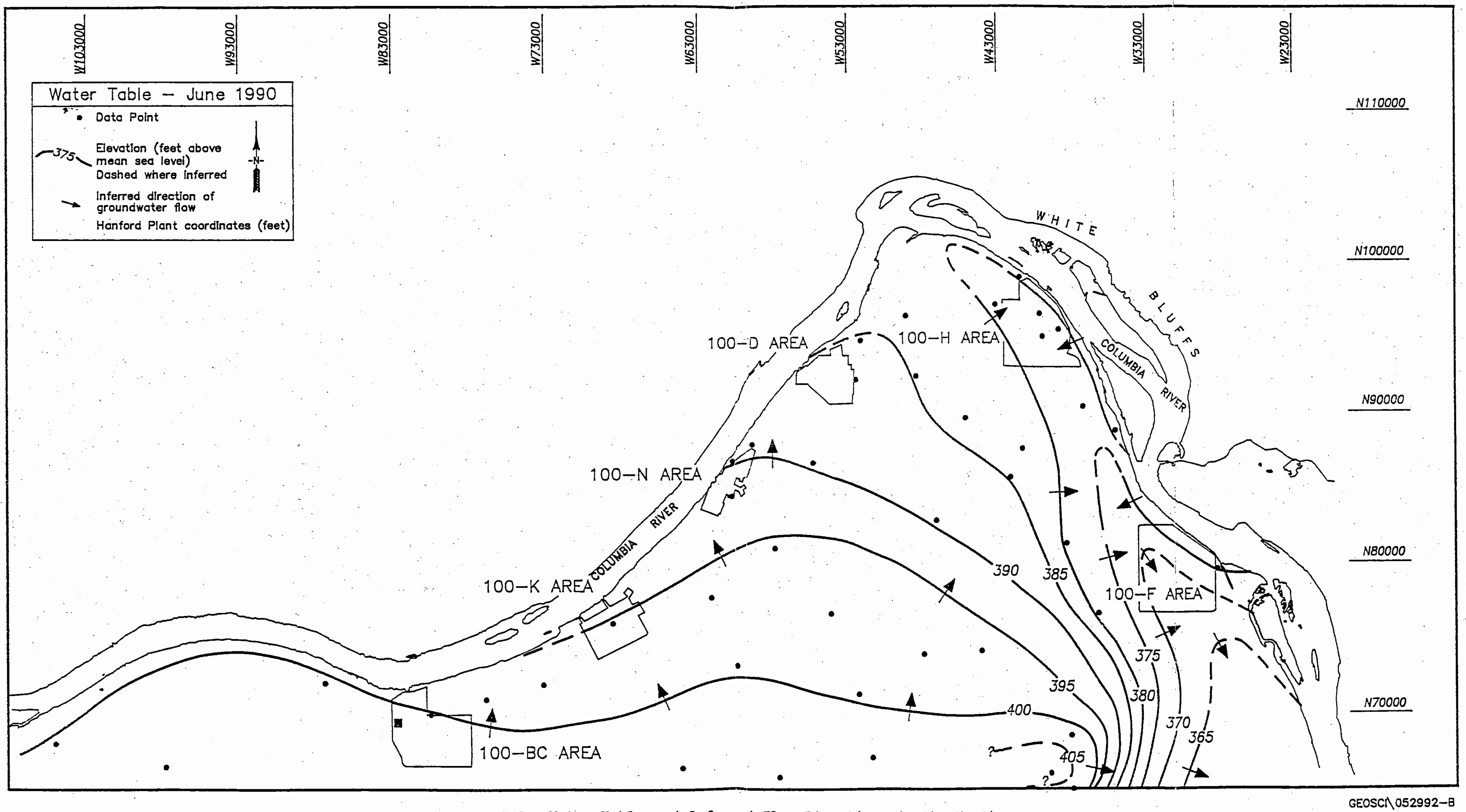

Figure 4-6. Water Table and Inferred Flow Directions in the Northern Hanford Site, June 1990 (after Kasza et al. 1991).

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Figure 4-7. Ground Levels Versus Time: Well 699-80-43P (completed in a Ringold confined aquifer) and Well 699-80-43S (completed at the water table), 1966-1980.

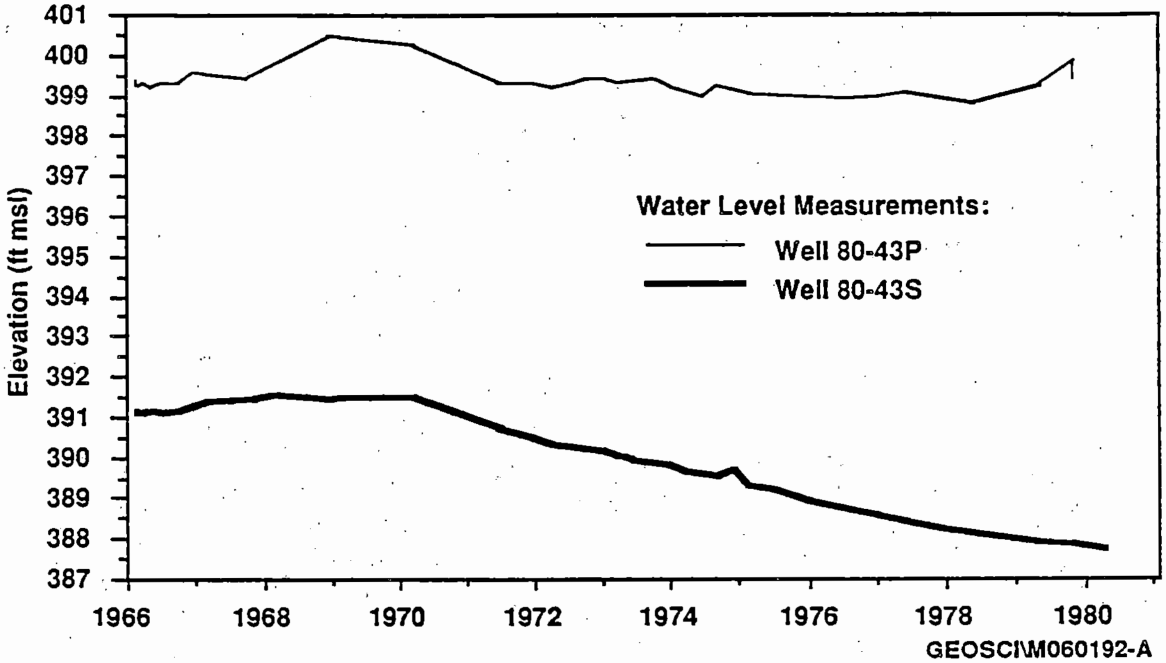
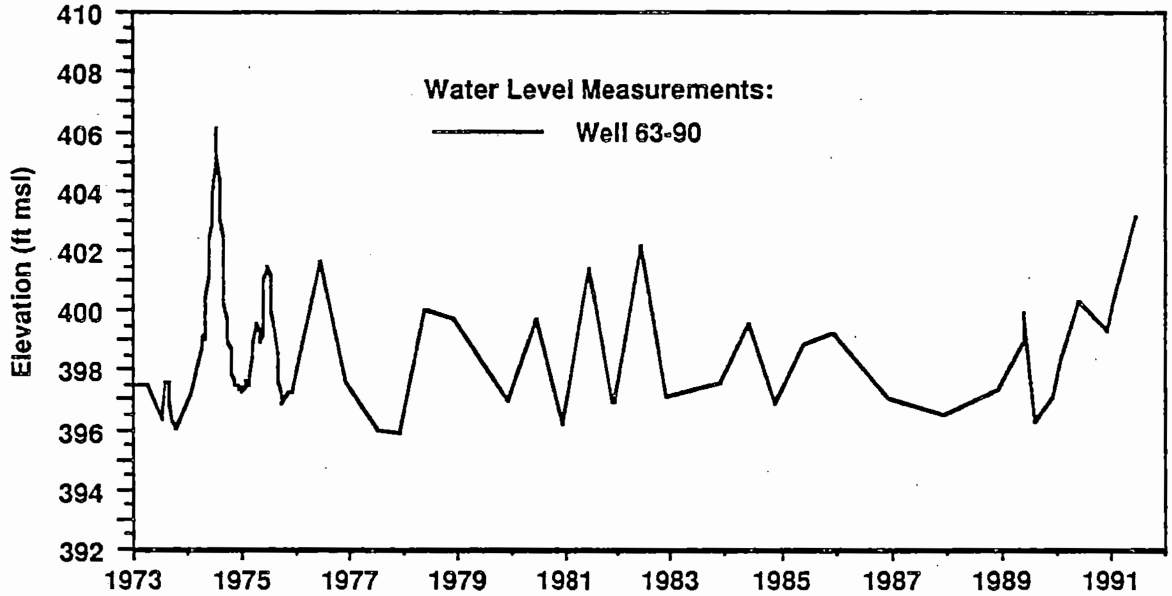
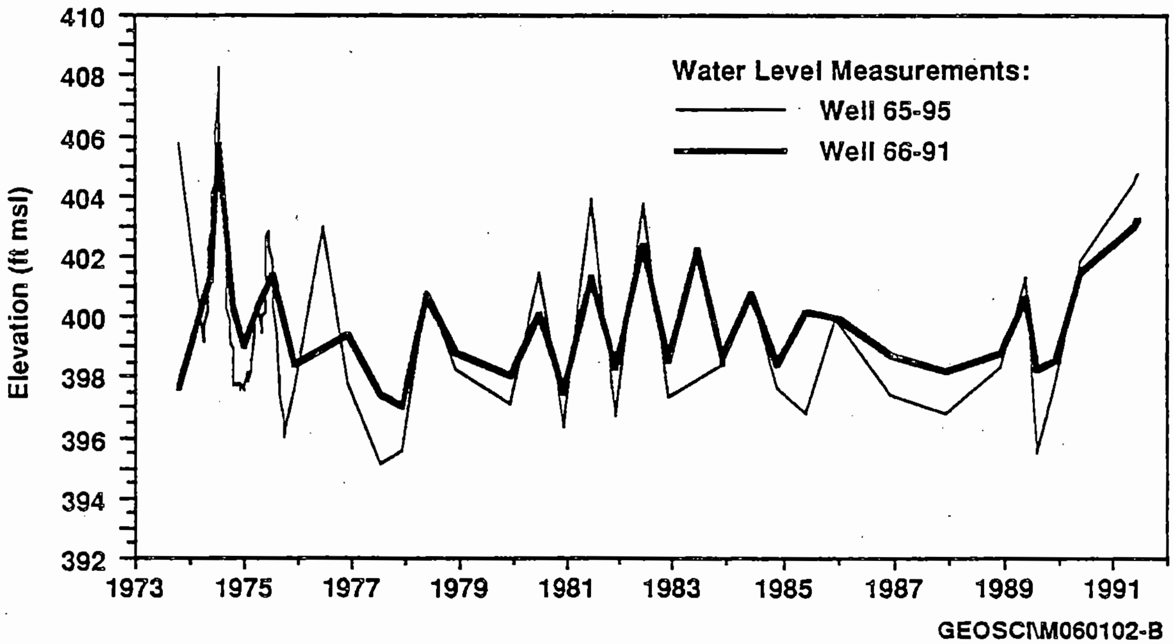


Figure 4-8. Groundwater Levels Versus Time

(a) Well 699-63-90 (completed in the uppermost interbed aquifer)



(b) Wells 699-65-95 and 699-66-91 (completed at the water table).



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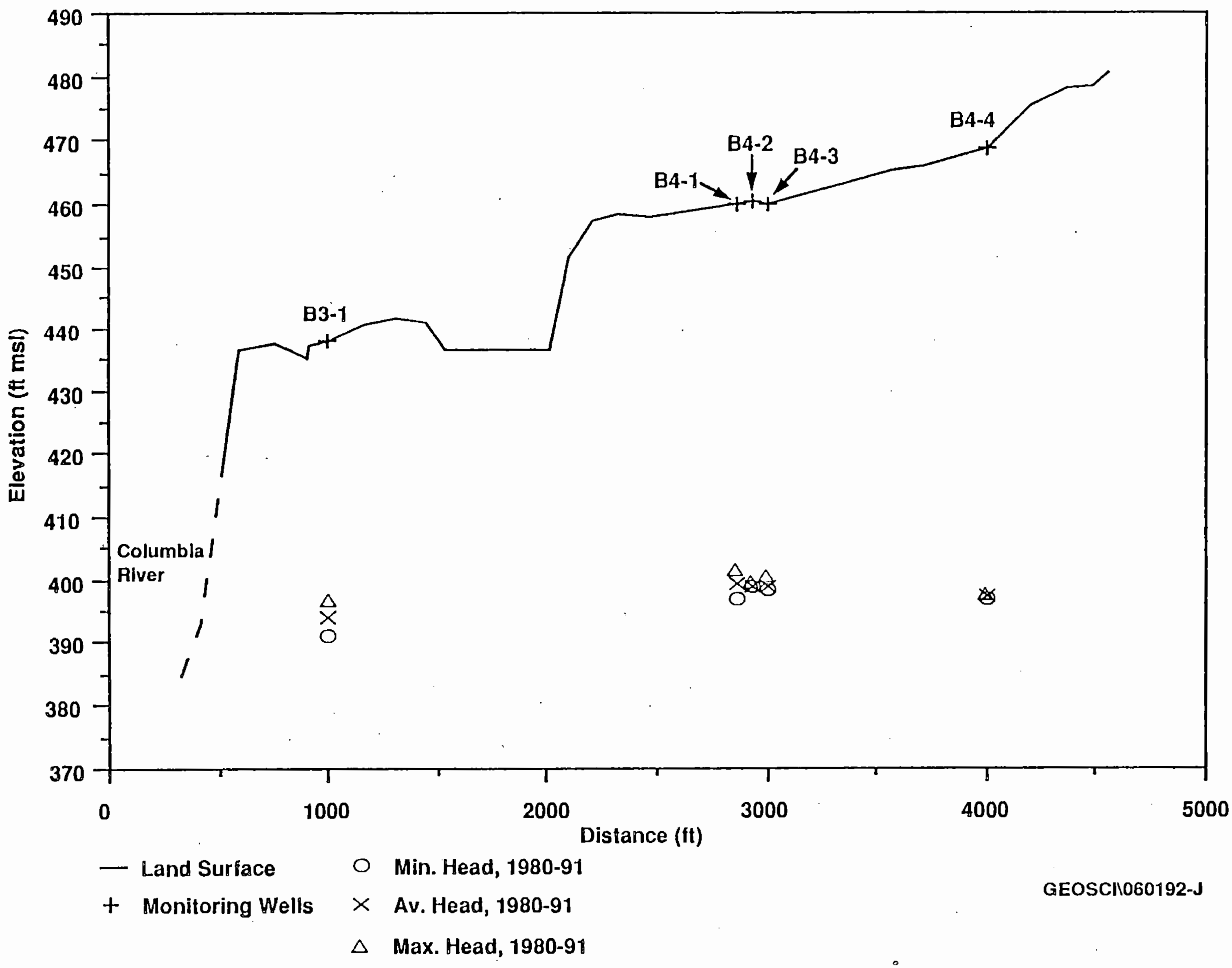
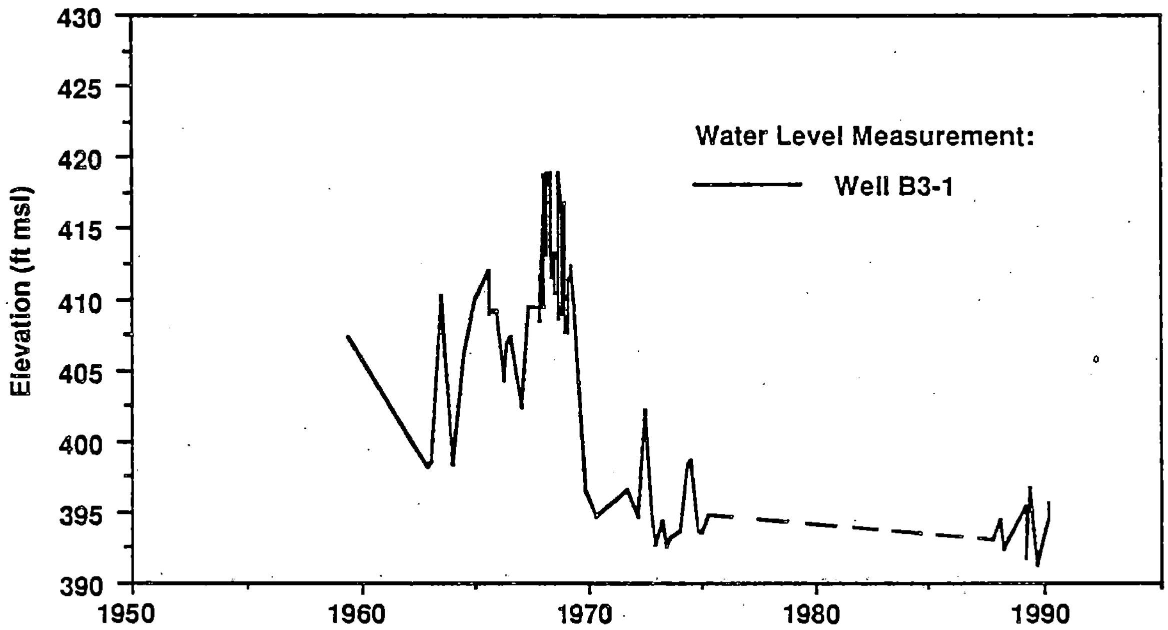


Figure 4-9. Topography and Water Table Variations in the 100-B/C Area.

Figure 4-10. Groundwater Levels Versus Time

(a) Well 199-B3-1.



(b) Well 199-K-20.

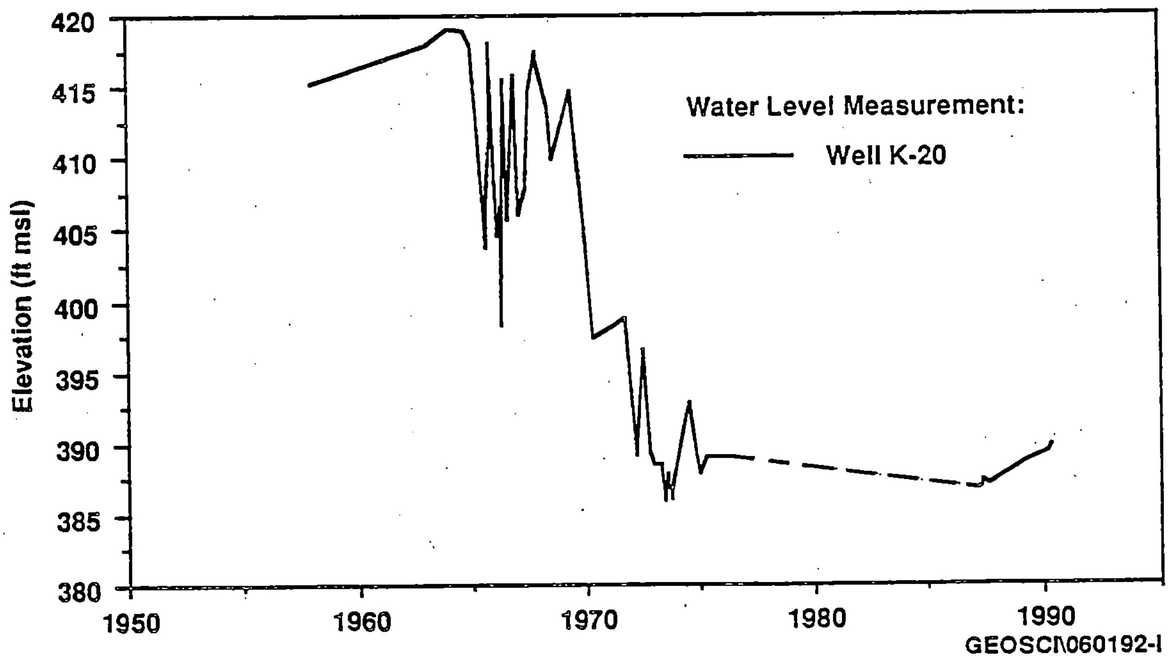


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Figure 4-11. Water Table and Inferred Flow Directions in the 100-N Area and Vicinity, December 1990.

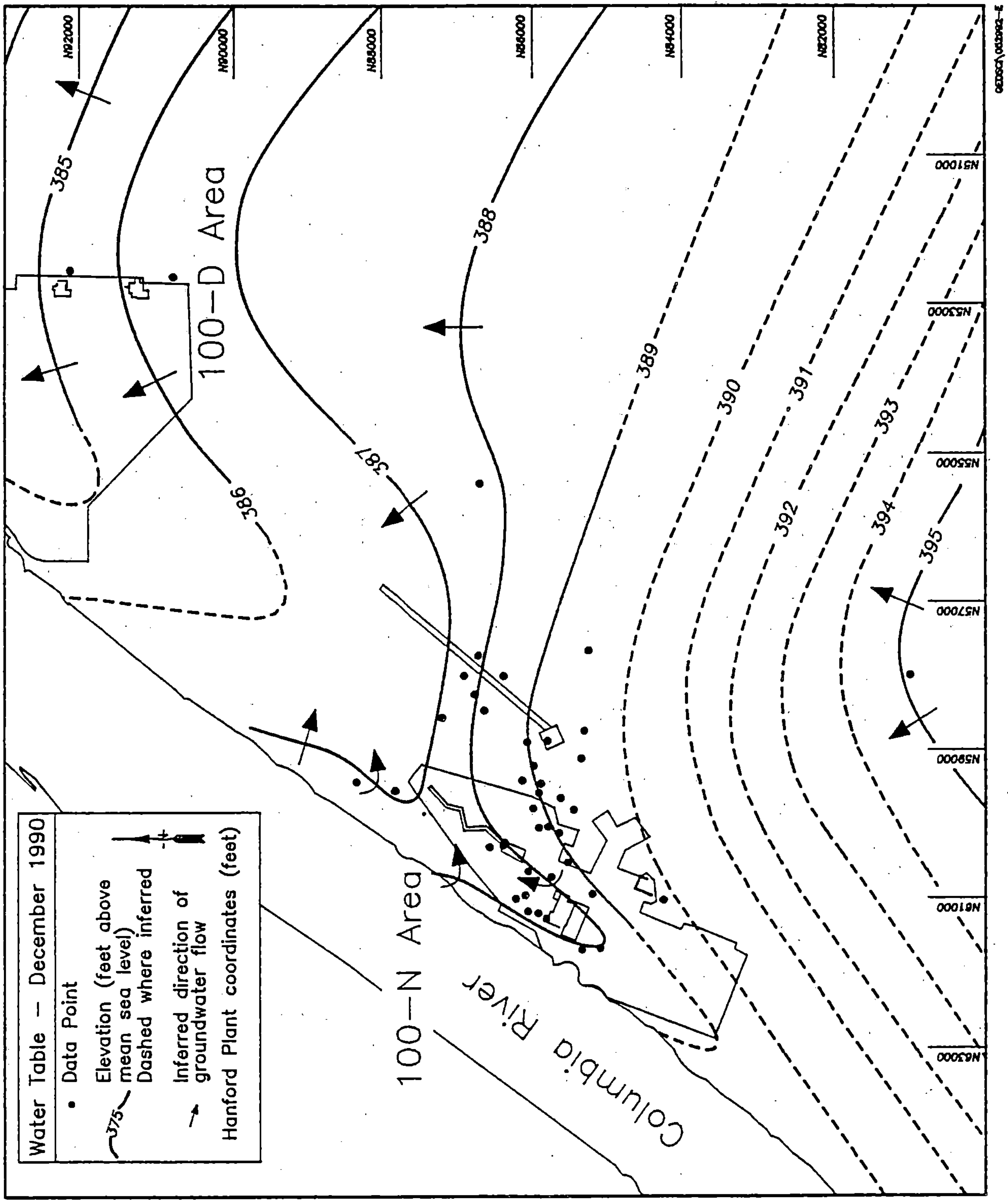
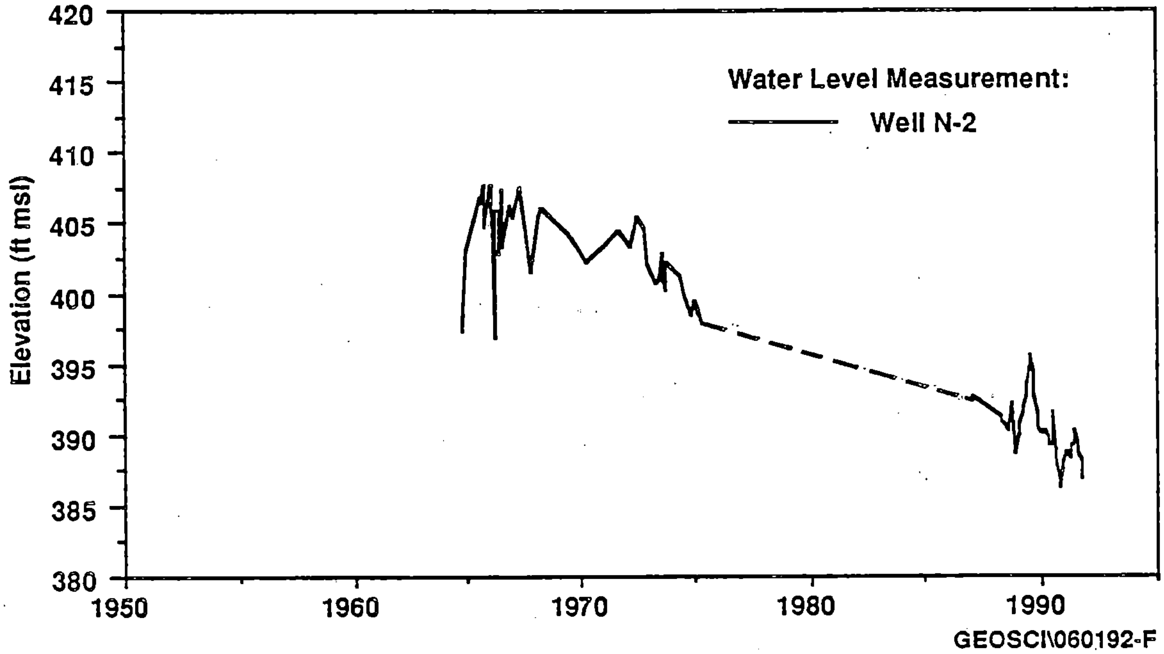


Figure 4-12. Groundwater Levels Versus Time: Well 199-N-2.



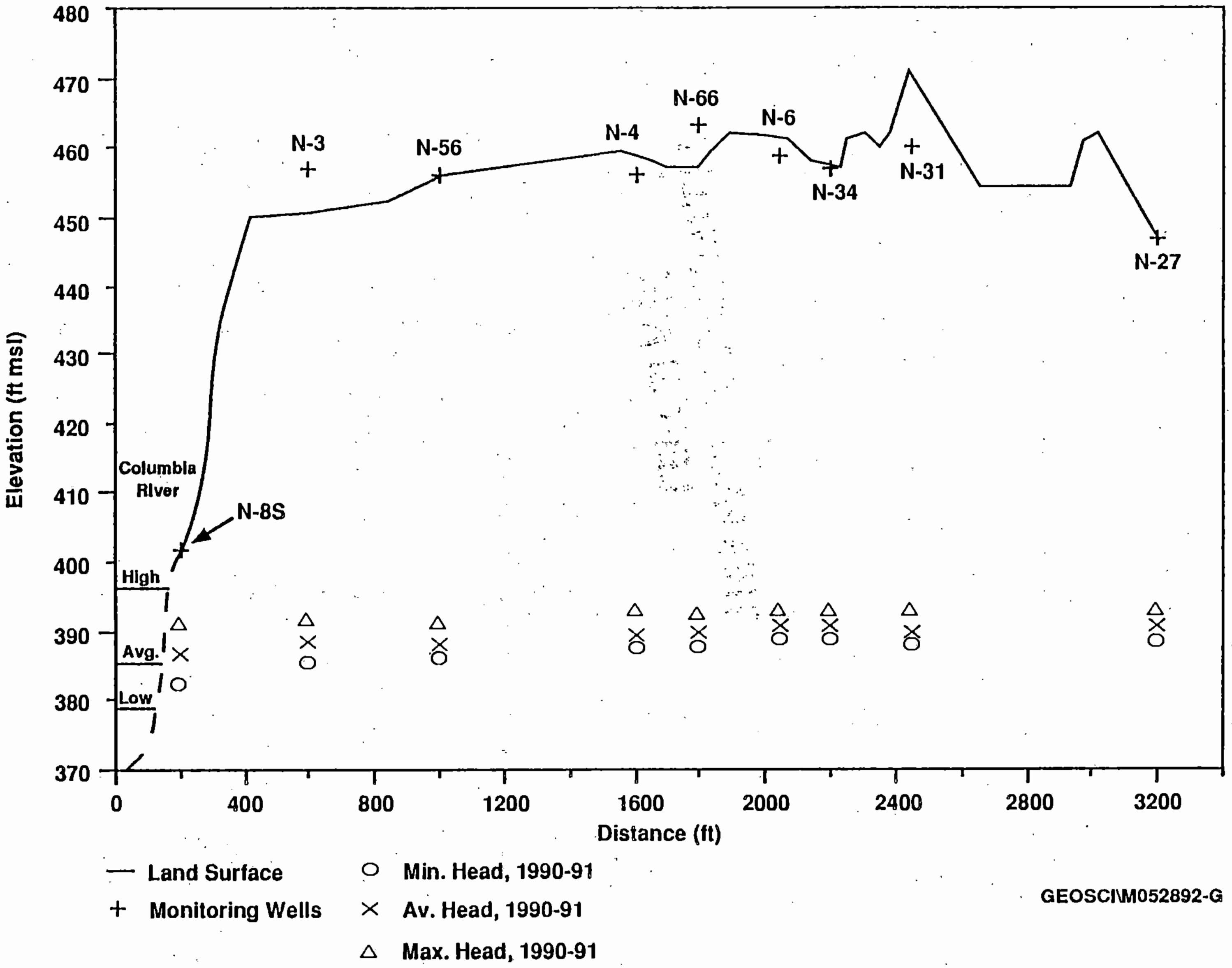


Figure 4-13. Topography and Water Table Variations in the 100-N Area.

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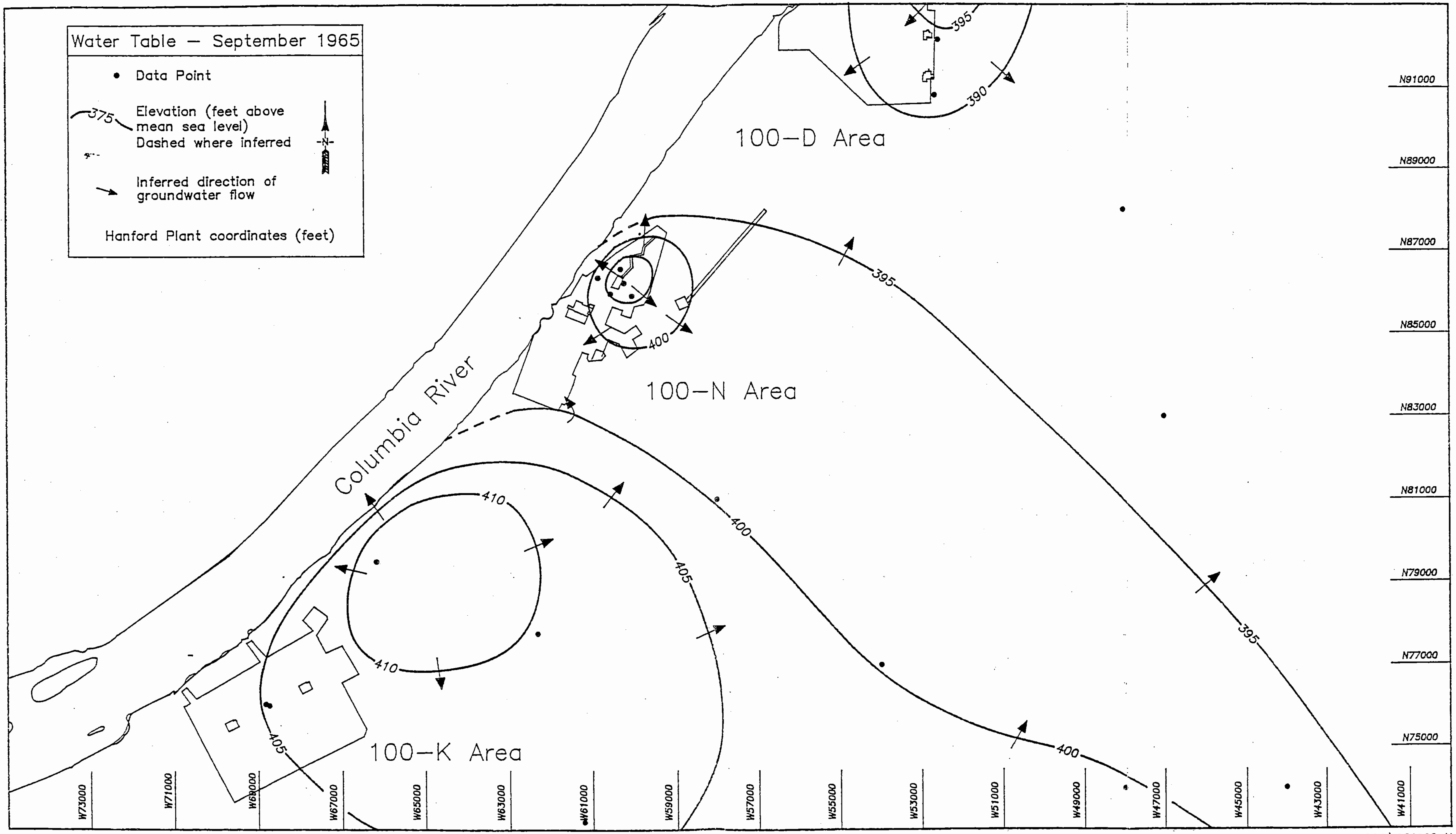

Figure 4-14. Water Table and Inferred Flow Directions in the 100-N Area and Vicinity, September 1965.

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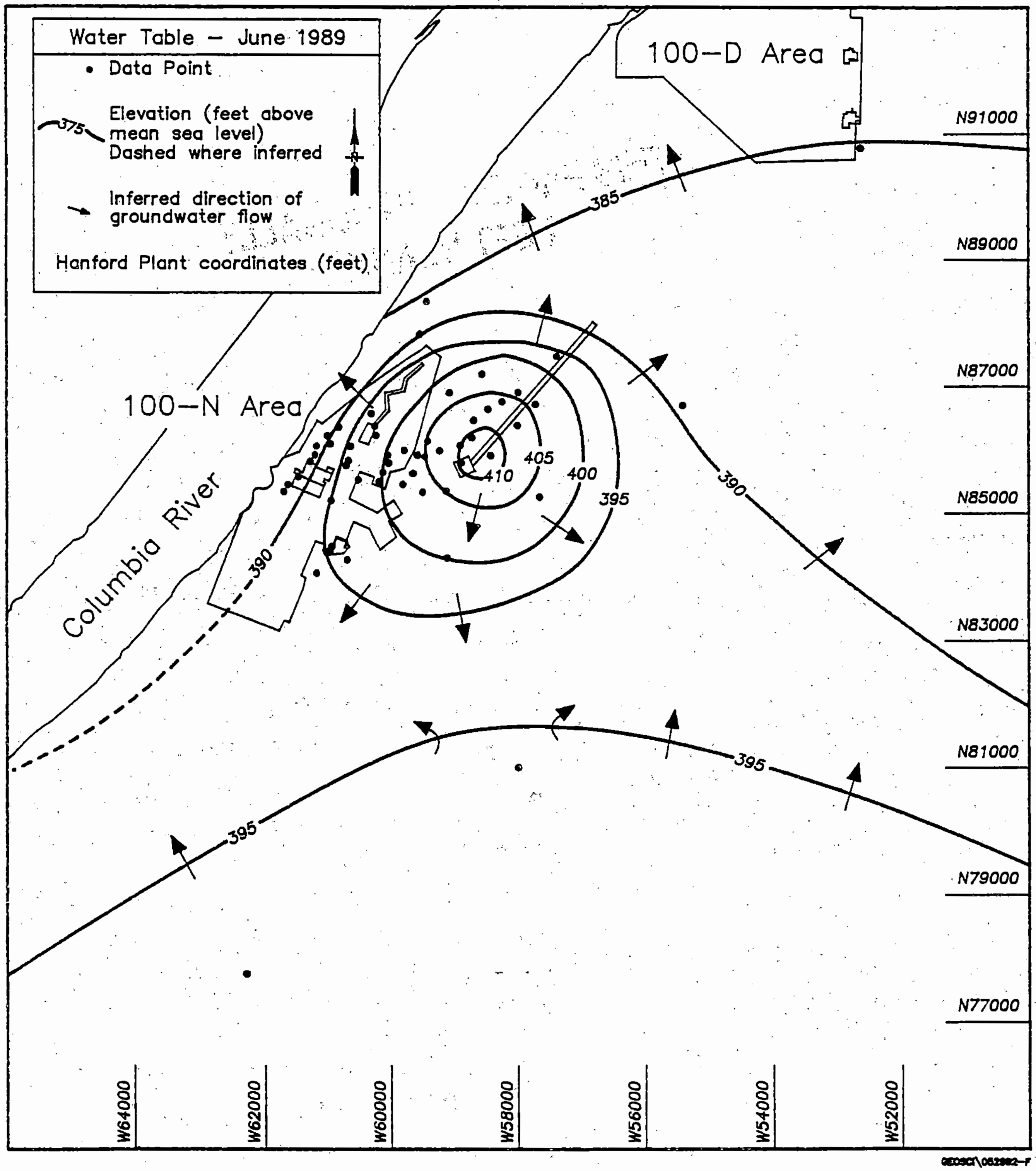
Figure 4-15. Water Table and Inferred Flow Directions in the 100-N Area and Vicinity, June 1989.



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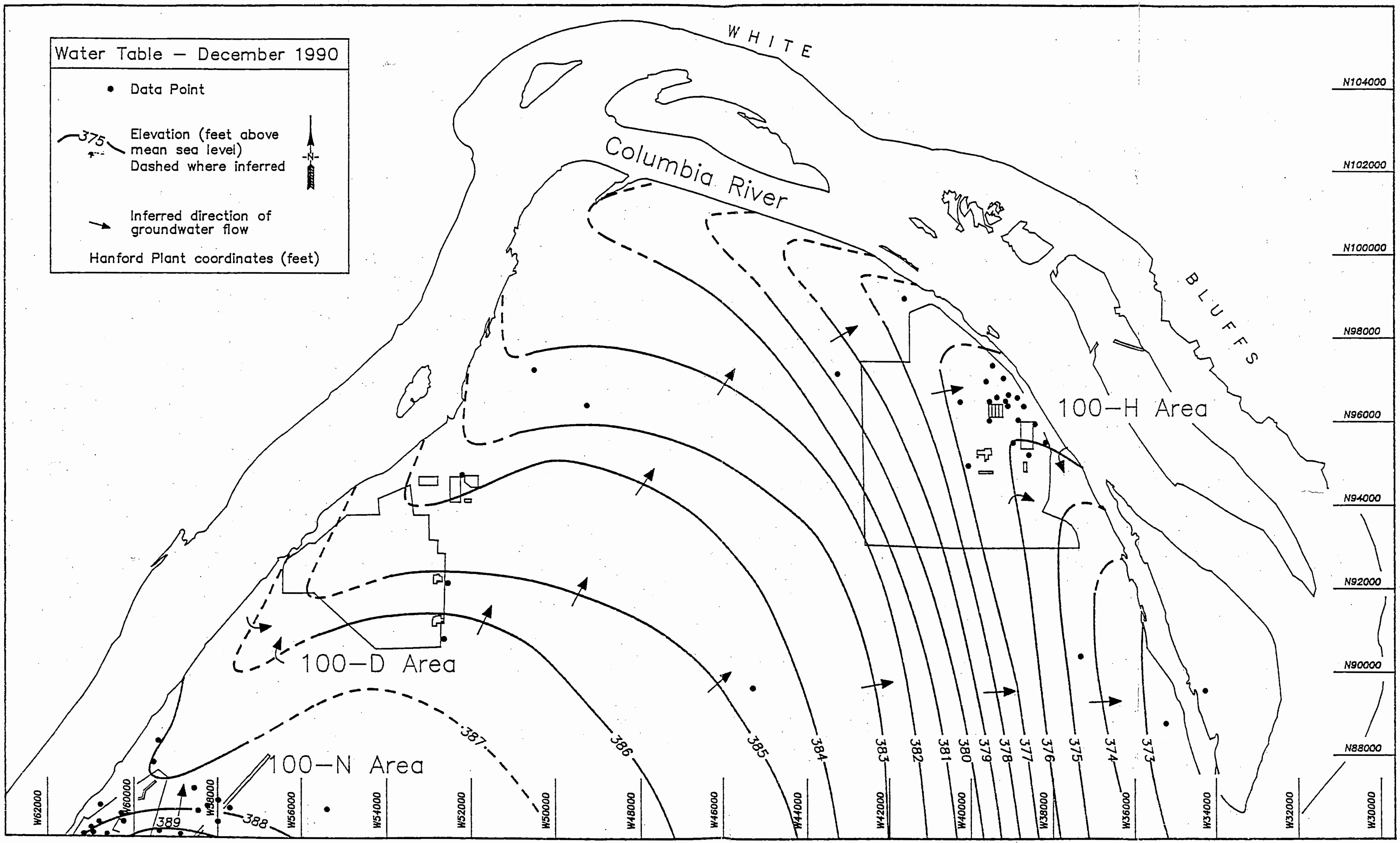

Figure 4-16. Water Table and Inferred Flow Directions in the 100-D and 100-H Areas and Vicinity, December 1990.

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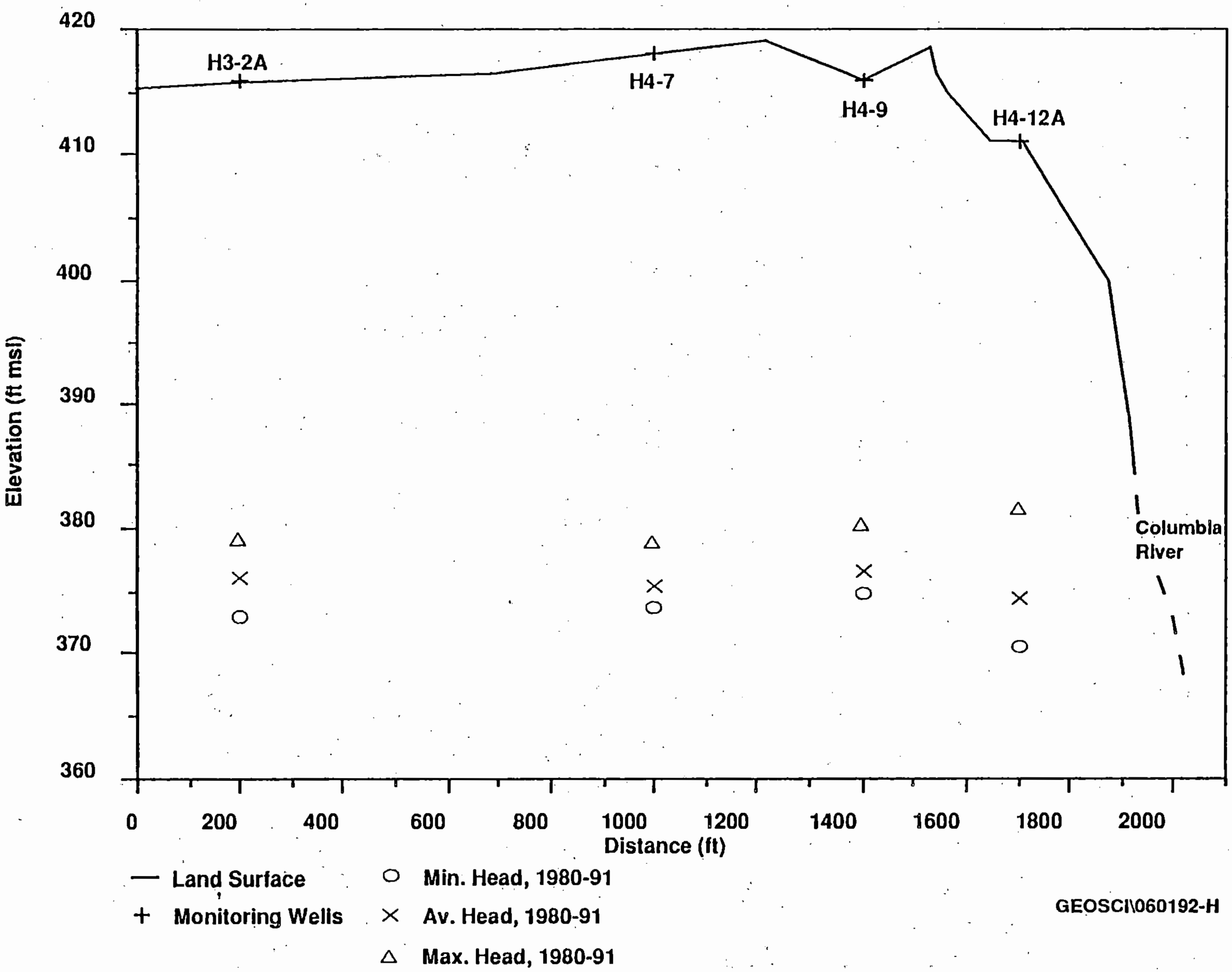
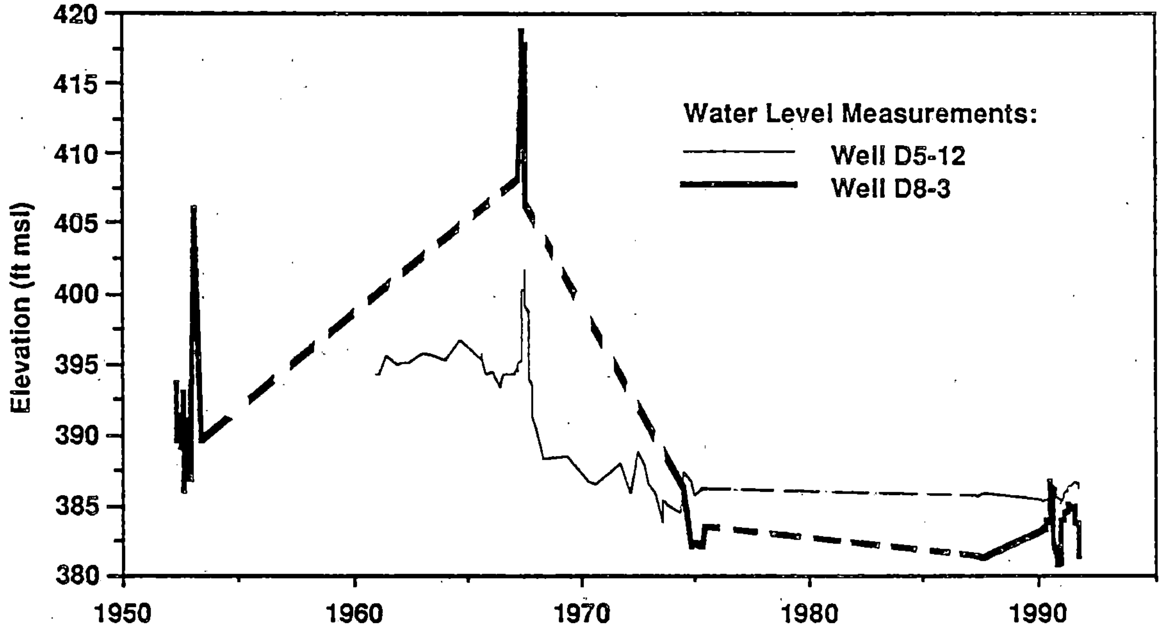


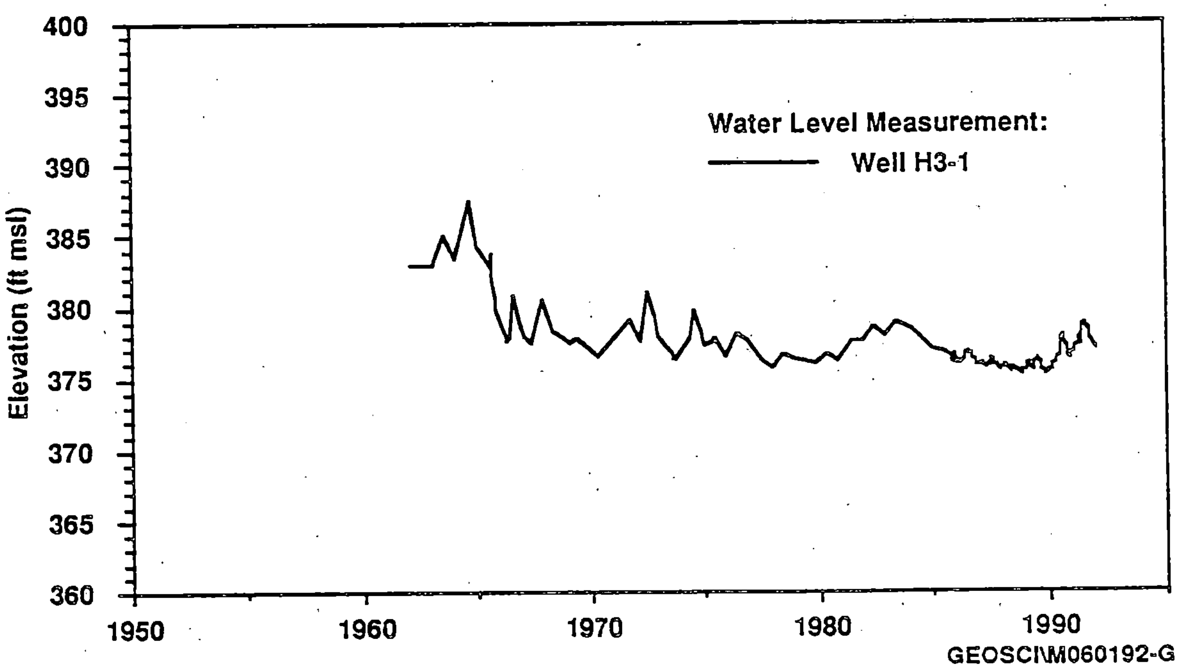
Figure 4-17. Topography and Water Table Variations in the 100-H Area.

Figure 4-18. Groundwater Levels Versus Time

(a) Wells 199-D5-12 and 19-D8-3.



(b) Well 199-H3-1.



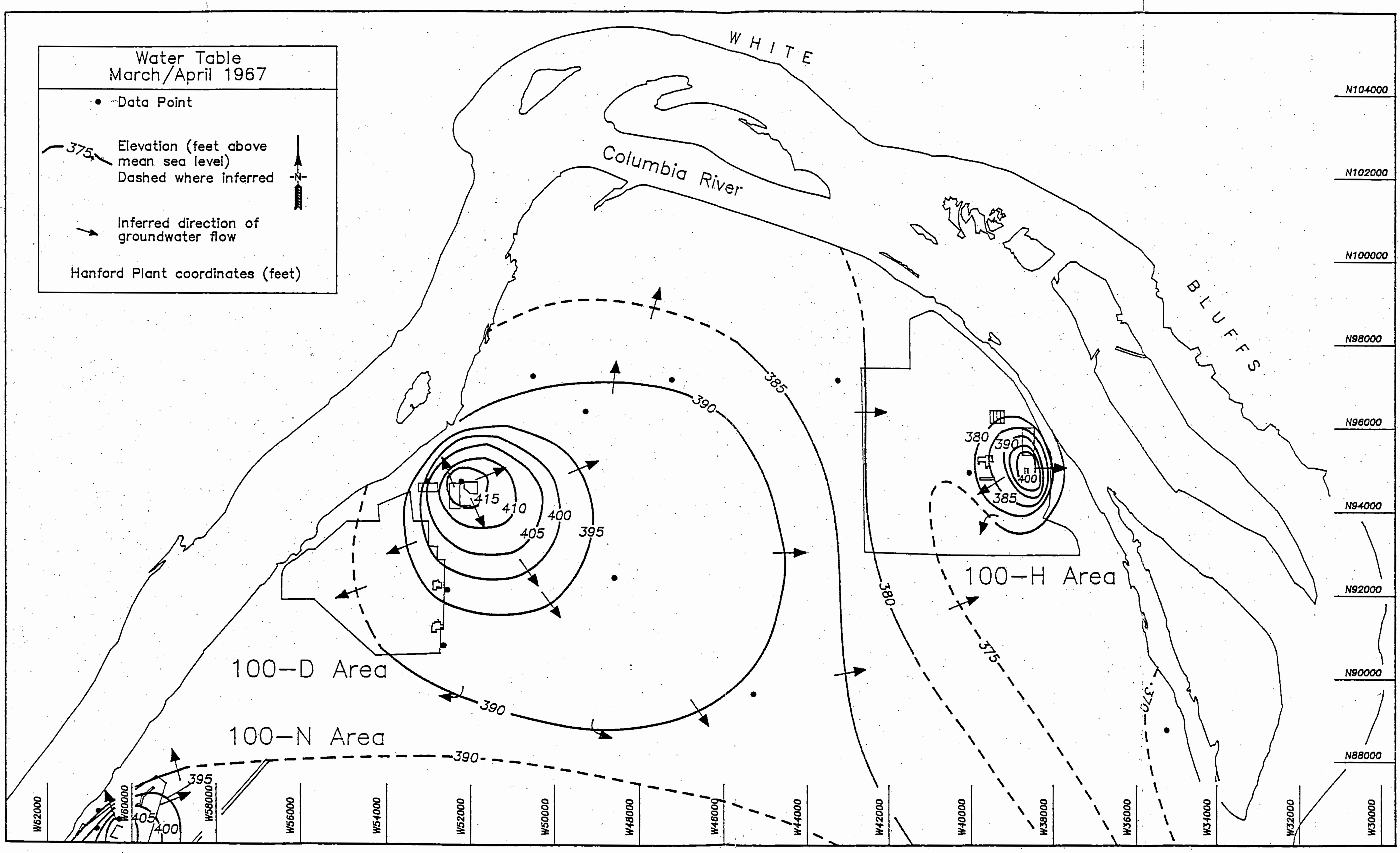


Figure 4-19. Water Table and Inferred Flow Directions in the 100-H and 100-D Areas and Vicinity, March/April 1967.

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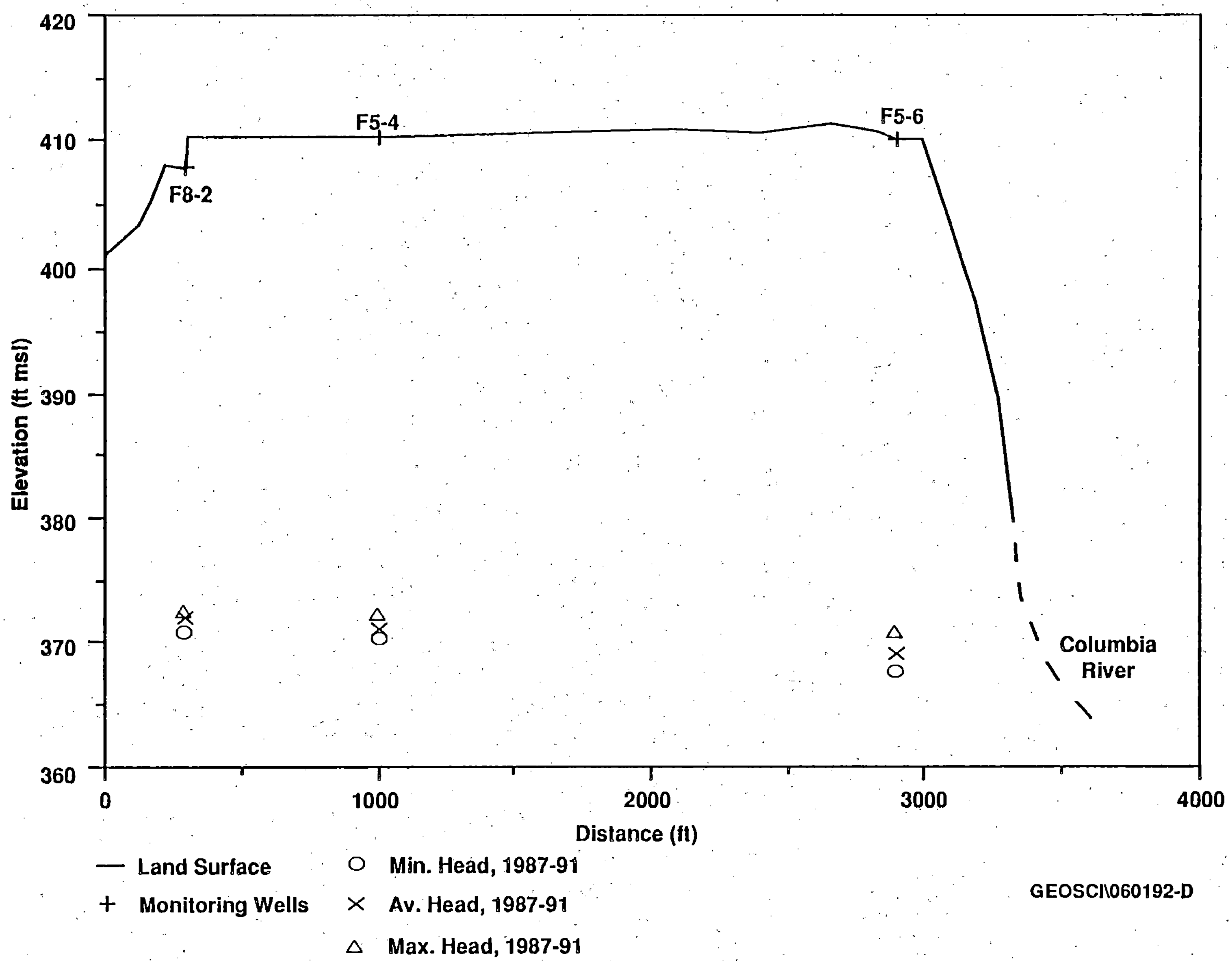


Figure 4-20. Topography and Water Table Variations in the 100-F Area.

Figure 4-21. Groundwater Levels Versus Time: Well 199-F5-1.

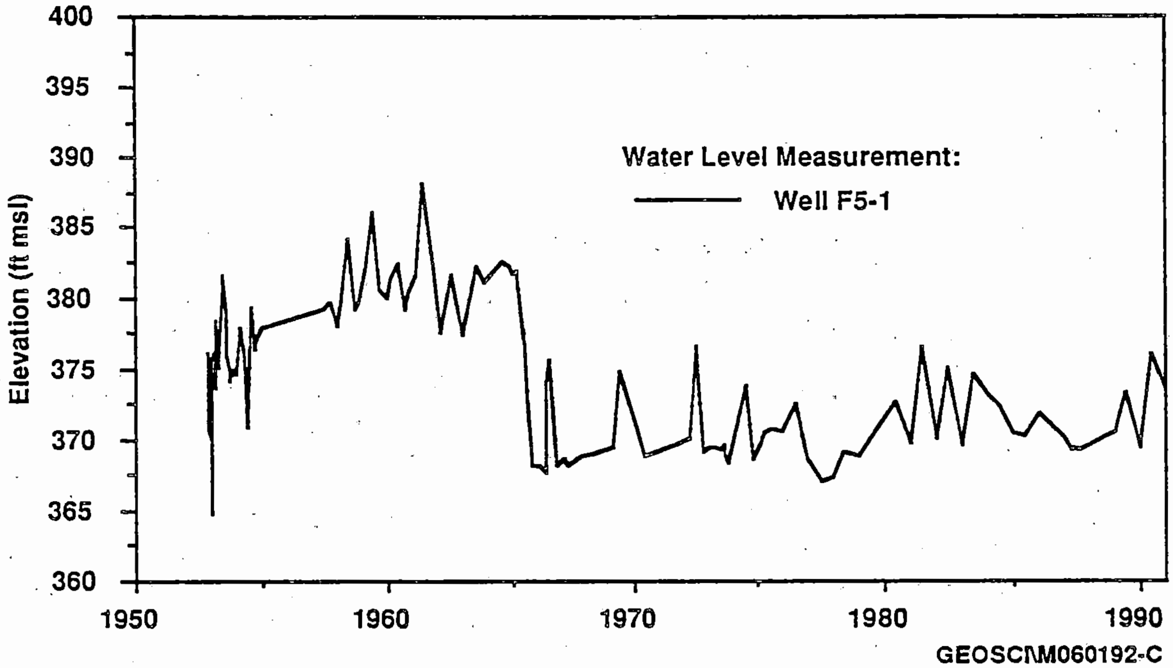
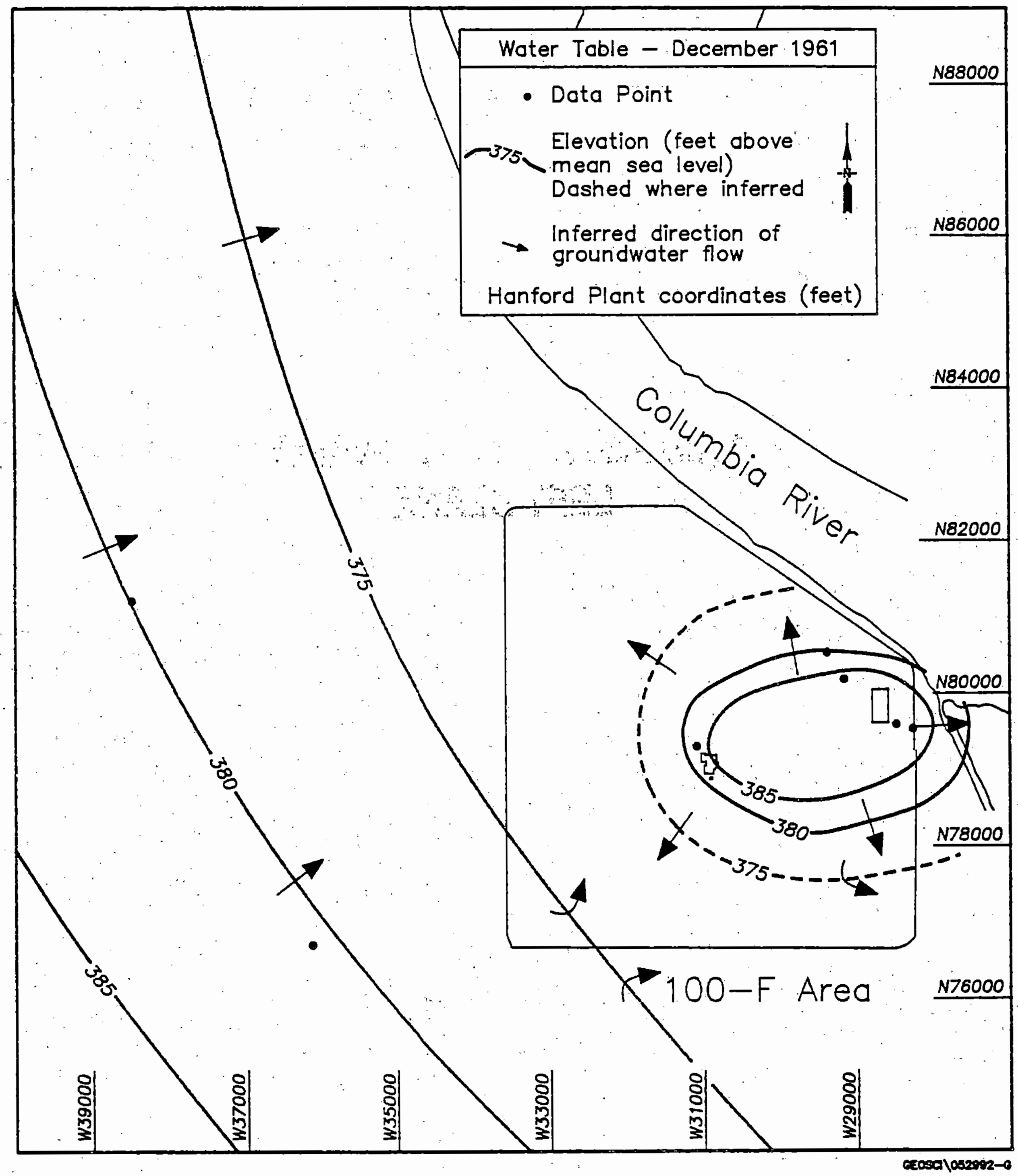


Figure 4-22. Water Table and Inferred Flow Directions in the 100-F Area and Vicinity, December 1961.



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5.0 GROUNDWATER CHEMISTRY DATA

This section contains a summary of recent groundwater chemistry in the uppermost aquifer of the northern Hanford Site. Interpretations presented in this section are based data retreived from the Geodat database.

5.1 INTRODUCTION

Groundwater monitoring programs in the 100 Areas include site-wide, operational, RCRA, and CERCLA monitoring.

Operational groundwater monitoring at Hanford focuses primarily on areas with active waste disposal facilities. In the 100 Areas, these include the 100-H, 100-K, and 100-N Areas. Groundwater from wells in these areas are analyzed at least semiannually for selected radionuclides and nitrate. Results are presented in annual reports (e.g., Serkowski and Jordan 1989). Data are available in GeoDat.

Hanford site-wide groundwater monitoring is conducted by PNL across the Site. In the northern Hanford Site, this program includes each reactor area, plus some wells in the 600 Area. Results are published annually (e.g., Evans et al. 1989). Data are available in GeoDat.

Five RCRA sites are located in the 100 Areas: three are in the 100-N, and one each in the 100-D and 100-H Areas. Groundwater data from these programs are included in quarterly and annual reports (e.g., DOE-RL 1991a,b). Data are also available in GeoDat.

Groundwater monitoring wells for the CERCLA program in the 100 Aggregate Area have been installed. The CERCLA sampling and analysis program will monitor the new wells and some of the older wells. To date, no groundwater chemistry data have been collected under the CERCLA program. Data will be stored in HEIS.

Groundwater in the 100-N Area is monitored for radionuclides and petroleum products for operational purposes. These data are not stored in GeoDat or HEIS. Data are presented in annual reports (e.g., Perkins 1988).

5.2 REGIONAL GROUNDWATER CHEMISTRY

Table 5-1 shows background levels for selected constituents in groundwater on the Hanford Site, estimated from wells unaffected by Hanford waste disposal (DOE-RL 1992b). Groundwater chemistry in the 100 Areas is also affected by Columbia River water, which flows into the aquifer (see Chapter 2). Concentrations of selected chemical constituents in Columbia River water are also listed in Table 5-1.

Table 5-2 contains water chemistry data for several 600 Area wells north of Gable Mountain, believed to be unaffected by waste disposal operations. These values are presented for comparison. They are not purported to represent Hanford Site background chemistry.

Table 5-1. Estimated Background Levels for Selected Constituents in Hanford Groundwater and Columbia River Water.

Constituent	Units	Groundwater		Columbia River Concentration Maxima
		Average	Provisional Threshold Values	
Gross Alpha	pCi/L	2.53	5.79	N/A
Gross Beta	pCi/L	7.14	12.62	N/A
Tritium	pCi/L	<500[a]	<500[a]	96
Nitrate	ppb	5,169	12,400	160
Chromium	ppb	<30	NC	34

Source: DOE-RL (1992b)
N/A = not available
NC = not calculated; proportion of undetected values >50%
[a]Average and threshold values were not presented by DOE-RL (1992b); however, that study used tritium <500 pCi/L as a screening criterion.

Table 5-2. Selected Constituents in Groundwater Unaffected by Hanford Operations, Northern Hanford Site[a]

Constituent (unit)	Detection Limit	Well 6-61-37	Well 6-67-98	Well 6-74-44	Well 6-101-48B	Average
Gross alpha (pCi/L)	4	2	2	2	0	2
Gross beta (pCi/L)	8	6	6	3	3	5
Tritium (pCi/L)	500	661	140	-81[b]	99	205
Nitrate (ppb)	500	9,835	8,903	6,245	9,519	8,626
Chromium (ppb)	10	<10	<10	No data	<10	<10

[a]Wells north of Gable Mountain that are apparently unaffected by groundwater contamination from the 100 or 200 Areas. Data were obtained from a query of GeoDat, averaging all data collected 1985 through 1990.

[b]Negative value means measured value was less than background noise.

5.3 GROUNDWATER CHEMISTRY IN THE 100 AREAS

This section includes discussions of groundwater contaminant plumes in the 100 Areas in recent years. Data were derived from Geodat. Data used to construct figures are included in Appendix C.

5.3.1 Contaminants of Concern

Parameters indicative of groundwater contamination in the 100 Areas include gross alpha, gross beta, tritium, nitrate, and chromium. These parameters represent constituents that are mobile in groundwater and were present in waste discharged in the 100 Areas. The site-wide and operational groundwater monitoring programs focus on tritium, gross beta, and nitrate. RCRA programs focus on a variety of constituents over relatively small areas.

The following paragraphs refer to bar graphs and groundwater contaminant plume maps. The bar graphs consist of maximum values for 1988, 1989, and 1990 in each reactor area (very few data exist for 1991). They were created by using Paradox software with Geodat to calculate the maximum concentration of each constituent for 1988, 1989, and 1990. This query was repeated for each of the areas illustrated in Figure 3-9. A few values appeared anomalous when compared to historical data and to nearby wells. The anomalous points were removed before creating the bar charts. Because the areas of interest overlap, maximum values were plotted for only one area. For example, the maximum nitrate values obtained in a query for the 100-N Area and vicinity wells was actually from a well in the 100-D Area. This value was excluded from the 100-N Area bar chart, since it appeared in the 100-D chart.

The contaminant plume maps were constructed from 1990 data, averaged for wells with more than one 1990 result for a given constituent. In many cases, the plume boundaries are not well defined due to a lack of data points.

5.3.1.1 Gross Alpha. Groundwater in the 100-H and 100-F Areas contains the most significant gross alpha contamination in the 100 Areas (Figure 5-1). The highest gross alpha activity is observed in the 100-H Area. Alpha activity in the 100-H Area declined from 1988 to 1990. The bar chart for the 100-F Area shows an apparent increase in gross alpha activity with time. However, the highest value, in 1990, was from a well for which there were no data in 1988 or 1989.

No plume map is included here for gross alpha activity. Only two wells in the 100-H Area and one well in the 100-F Area had alpha activities greater than detection limits in 1990 (see Section 5.3.2).

5.3.1.2 Gross Beta. Gross beta activity in groundwater in the 100-N Area is one to two orders of magnitude higher than in other 100 Areas (Figure 5-2); it also is somewhat elevated in the 100-H and 100-F Areas. Gross beta activity has decreased in the 100-N and 100-F Areas between 1988 and 1990. The bar chart for the 100-F Area shows a decrease between 1988 and 1989, and an increase in 1990. The maxima for the 100-F Area in Figure 5-2 are from a single well. There are relatively few data for this well in earlier years, and they are slightly erratic, but there are no obvious outliers. Thus, the apparent increase in gross beta activity in the 100-F Area between 1989 and 1990 appears to be real.

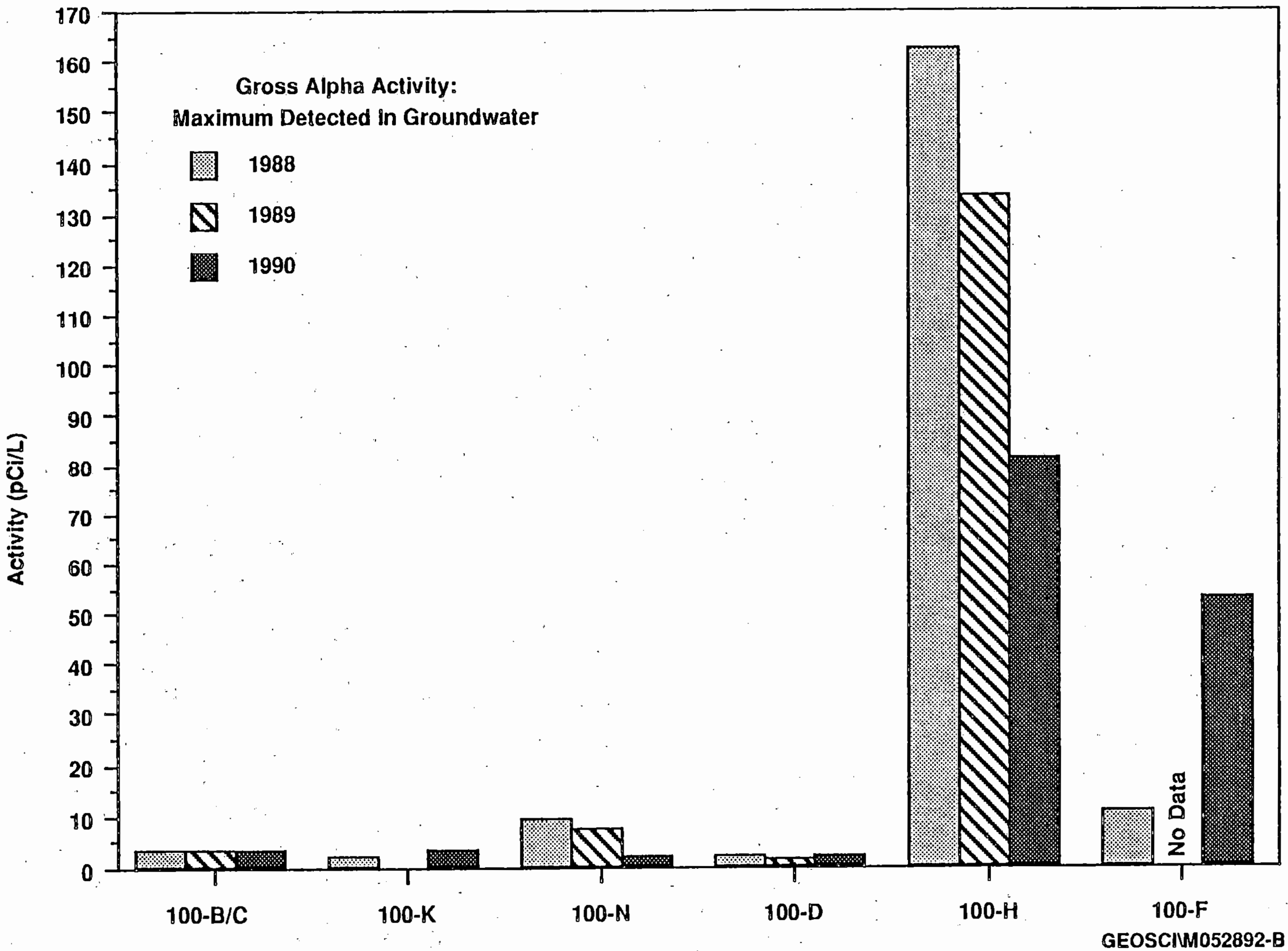

Figure 5-1. Maximum Gross Alpha Activity in Groundwater: 1988, 1989, and 1990.

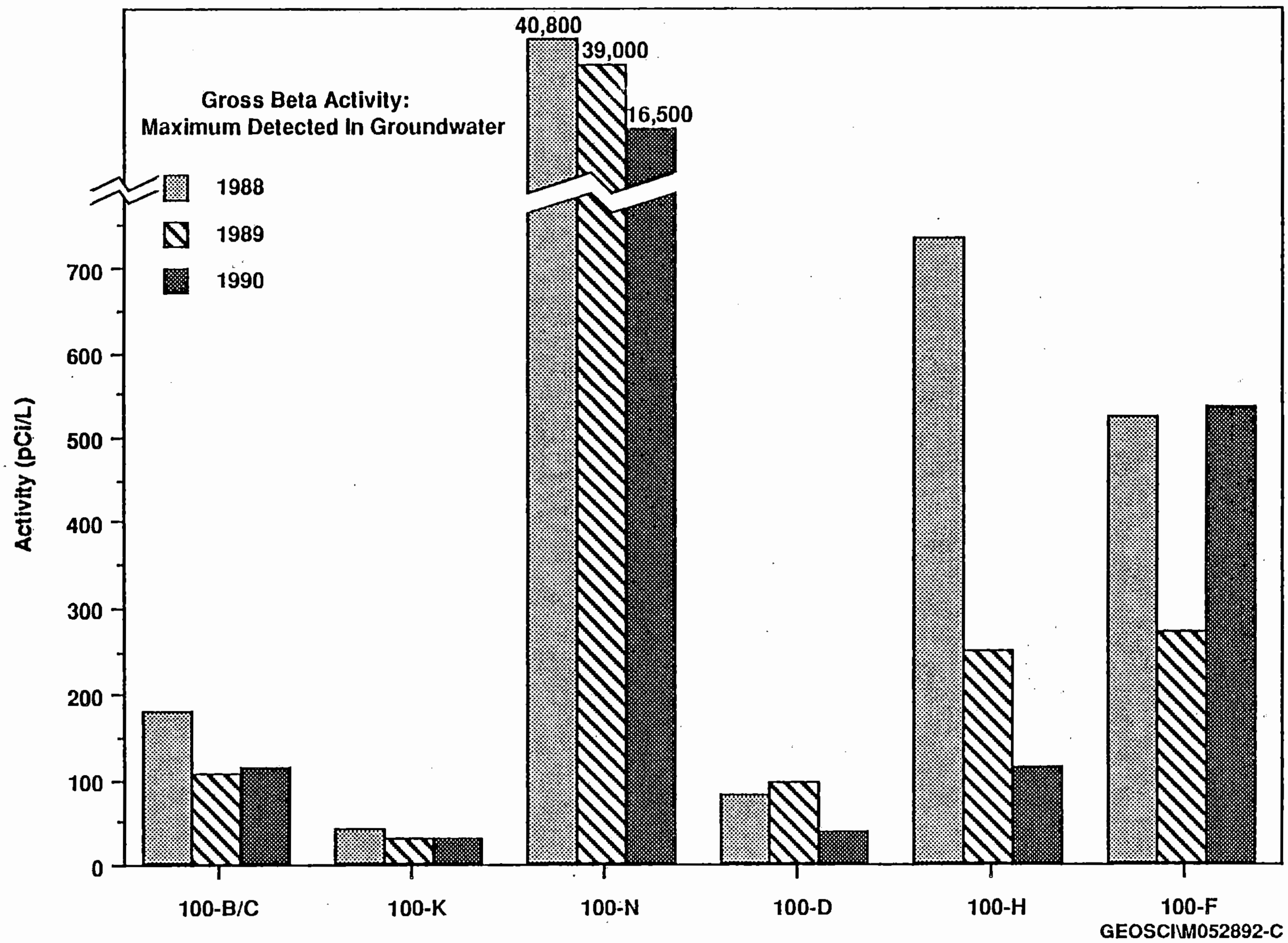

Figure 5-2. Maximum Gross Beta Activity in Groundwater: 1988, 1989, and 1990.

Figure 5-3 is a contour plot of gross beta activity in groundwater for 1990. Gross beta activity greater than the drinking water standard (50 pCi/L) was observed in all of the reactor areas except the 100-K and 100-D Areas. As discussed previously, the 100-N Area contains the highest beta activity in groundwater; it also appears to contain the most widespread plume.

Wells 61-62 and 56-53 are located between Gable Mountain and Gable Butte an area commonly called Gable Gap. Samples from these wells apparently had elevated gross beta activities in 1990. The 1990 data are comparable to earlier data from these wells (see Figure 5-3). Groundwater in this area may contain contaminants from Gable Mountain Pond, a former liquid disposal facility that was located south of Gable Mountain, or from facilities in the 200 Areas (Serkowski et al. 1989).

5.1.3.3 <u>Tritium</u>. Tritium contamination of groundwater in the 100 Areas is most significant in the 100-K and 100-N Areas (Figure 5-4). The values plotted in Figure 5-4 for the 100-K and 100-N Areas are for wells adjacent to active or recently active storage or disposal facilities.

Figure 5-5 is a contour map of tritium in groundwater in the 100 Areas for 1990 (1989 for the 100-H Area). Detectible tritium was observed in wells in all reactor areas. The largest and most concentrated plumes were in the 100-N and 100-K Areas. Tritium concentrations greater than the drinking water standard (20,000 pCi/L) were observed in the 100-N and 100-K Areas in 1990.

Figure 5-6 shows tritium vs time in groundwater samples from three wells in Gable Gap. Tritium is elevated in all three of these wells, and increased sharply in one of the wells in the late 1970s. The source of this contamination is not known conclusively. Northward groundwater flow through Gable Gap may have carried contaminants from the 200 Areas.

5.1.3.4 <u>Nitrate</u>. The highest concentration of nitrate in groundwater in the 100 Areas is seen in the 100-H Area (Figure 5-7), where concentrations are decreasing with time. Nitrate concentrations are also elevated in the 100-D and 100-F Areas. Concentrations higher than the drinking water standard (45,000 ppb) were observed in the 100-D, 100-H, and 100-F Areas.

Figure 5-8 shows contoured nitrate concentrations for 1990. Groundwater in all six of the reactor areas had nitrate concentrations higher than in 600 Area wells. The plumes in the 100-D and 100-F Areas are ill-defined due to lack of data.

Well 61-62, located in Gable Gap, had nitrate concentrations an order of magnitude higher than nearby wells in 1990 and in previous years. The source of nitrate contamination at this well is unknown.

5.1.3.5 <u>Chromium</u>. The 100-D and 100-H Areas contain the highest concentrations of chromium in the 100 Areas (Figure 5-9). The bar chart for the 100-D Area appears to show a sharp increase between 1988 and 1989, and a decrease in 1990. However, the 1989 and 1990 values are from a well near the D-Reactor building. There were no data from this or any other D-Area wells in 1988; the value shown in the figure for 1988 is for a well in the 600 Area. A similar situation occurs in the 100-K Area. The 1988 data shown in the figure are for a well in the 600-Area; the 1989 and 1990 data are for wells near former waste disposal facilities.

Chromium plumes were observed in the 100-K, 100-D, and 100-H Areas in 1990 (Figure 5-10). The plumes in the 100-D and 100-K Areas appear to be widespread; however, the shape of these plumes is not well-defined, due to lack of data.

5.3.2 Contamination Indicators in the Reactor Areas

This section includes summaries of each of the five contamination indicators for each reactor area.

5.3.2.1 100-BC Area. There are few wells that have been sampled in the 100-B/C Area, so it is possible that there is undetected contamination. The following conclusions were based on recent data:

- Gross alpha: less than analytical detection limits in all wells in 1990; probably not a constituent of concern.
- Gross beta: elevated in most wells; greater than the drinking water standard in some wells. High beta activity is probably due primarily to strontium-90.
- Tritium: greater than the drinking water standard in recent years in well B4-1 (1988, 1989), but decreased in late 1989 and 1990; nearby well B4-2, which is completed at the same depth as B4-1, has much lower levels of tritium.
- Nitrate: elevated above background (13,000 to 33,000 ppb in 1990), but no wells showed concentrations greater than the drinking water standard.
- Chromium: all wells below or near the detection limit in 1990; probably not a constituent of concern.

5.3.2.2 100-K Area. There are few wells that have been sampled in the 100-K Area, so it is possible that there is undetected contamination. The following conclusions were based on recent data:

- Gross alpha: all wells showed concentrations less than the analytical detection limit in 1990; probably not a constituent of concern.
- Gross beta: possibly slightly elevated in some wells; below the drinking water standard; probably not a constituent of concern.
- Tritium: highest levels in the 100 Areas; elevated in most wells; above the drinking water standard in several wells; highest in well K-30, and other wells adjacent to fuel storage basins; declining in most wells, but increasing in well K-30.
- Nitrate: elevated in some wells; below the drinking water standard; maximum concentrations are decreasing with time.
- Chromium: elevated above the drinking water standard in wells near the 116-K-2 trench.

5.3.2.3 <u>100-N Area</u>. Groundwater monitoring is conducted in the 100-N Area for three RCRA sites and for operational purposes. There are more wells and more frequent sampling than in most of the other reactor areas, so the groundwater contaminant plumes are more well defined.

- Gross alpha: has been slightly elevated in the past; below the detection limit in all wells in 1990; probably not a constituent of concern.
- Gross beta: highest values in the 100 Areas are observed at well N-67, near the inactive 1301-N facility; decreasing with time; greater than the drinking water standard in most wells in the northern part of the 100-N area; primarily due to strontium-90.
- Tritium: greater than the drinking water standard in many wells in the northern part of the 100-N Area, particularly wells located near the recently active 1325-N liquid waste disposal facility. Decreasing with time.
- Nitrate: elevated above background in a few, isolated wells. Less than the drinking water standard in all wells in 1990.
- Chromium: all wells less than or near detection limit; not a constituent of concern.

5.3.2.4 <u>100-D Area</u>. Until late 1991, there were only 3 active wells in the 100-D Area, so knowledge of groundwater chemistry is limited. Based on data from those three wells, the following conclusions were drawn:

- Gross alpha: less than the analytical detection limit in all wells in 1990; probably not a contaminant of concern.
- Gross beta: possibly slightly elevated; below the drinking water standard in all wells in 1990.
- Tritium: elevated in all three wells; greater than the drinking water standard in two wells; levels have increased since the mid 1980s.
- Nitrate: greater than the drinking water standard in all three wells in 1990; increasing in two of the wells (D5-12 and D8-3); decreasing in one well (D2-5)
- Chromium: highest levels in the 100 Areas; greater than the drinking water standard in all 3 wells; decreasing; extent of plume unknown.

5.3.2.5 <u>100-H Area</u>. Contaminant plumes are fairly well-defined in the 100-H Area, because there are a lot of wells that are sampled frequently for RCRA monitoring.

- Gross alpha: highest levels in the 100 Areas, but only elevated in one well (H4-3); decreasing with time; primarily due to uranium

- Gross beta: above or near the drinking water standard in three wells in 1990; highest in well H4-3; decreasing with time; plume appears relatively small; believed to be due to technecium-99.

- Tritium: no data in 1990; below the drinking water standard in all wells in 1988 and 1989; elevated above background in most wells in 1989.

- Nitrate: highest levels in the 100 Areas; greater than background in most wells; greater than the drinking water standard in several wells in 1990; highest in well H4-3; decreasing with time.

- Chromium: greater than the drinking water standard in nearly all wells; highest in well H4-14; decreasing with time.

5.3.2.6 100-F Area. There are few wells that have been sampled in the 100-F Area, so it is possible that there is undetected contamination.

- Gross alpha: less than or near detection limit in all but one well in 1990; above the drinking water standard in well F8-2; possibly due to uranium; extent of contamination and trends in data unknown, due to limited data

- Gross beta: elevated above the drinking water standard in a few wells; highest in well F5-3; probably due to strontium-90, though data on other beta-emitting radionuclides are limited

- Tritium: elevated above background in most wells, but below the drinking water standard in all wells in 1990; generally declining with time.

- Nitrate: above the drinking water standard in several wells; decreasing; extent of plume uncertain due to lack of wells.

- Chromium: near or below the detection limit in all wells in 1990; probably not a contaminant of concern.

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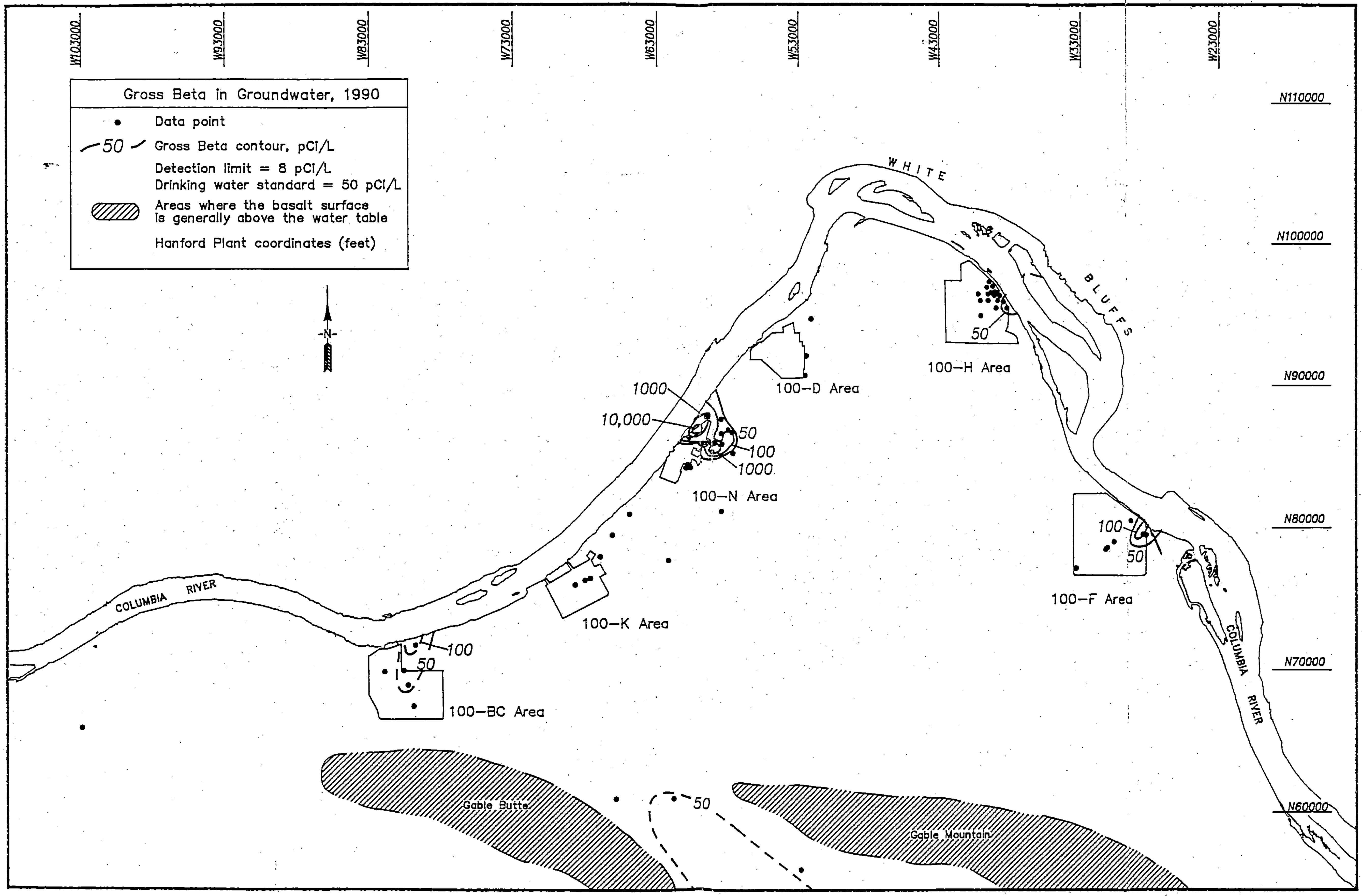

Figure 5-3. Gross Beta Activity in the Unconfined Aquifer of the Northern Hanford Site, 1990.

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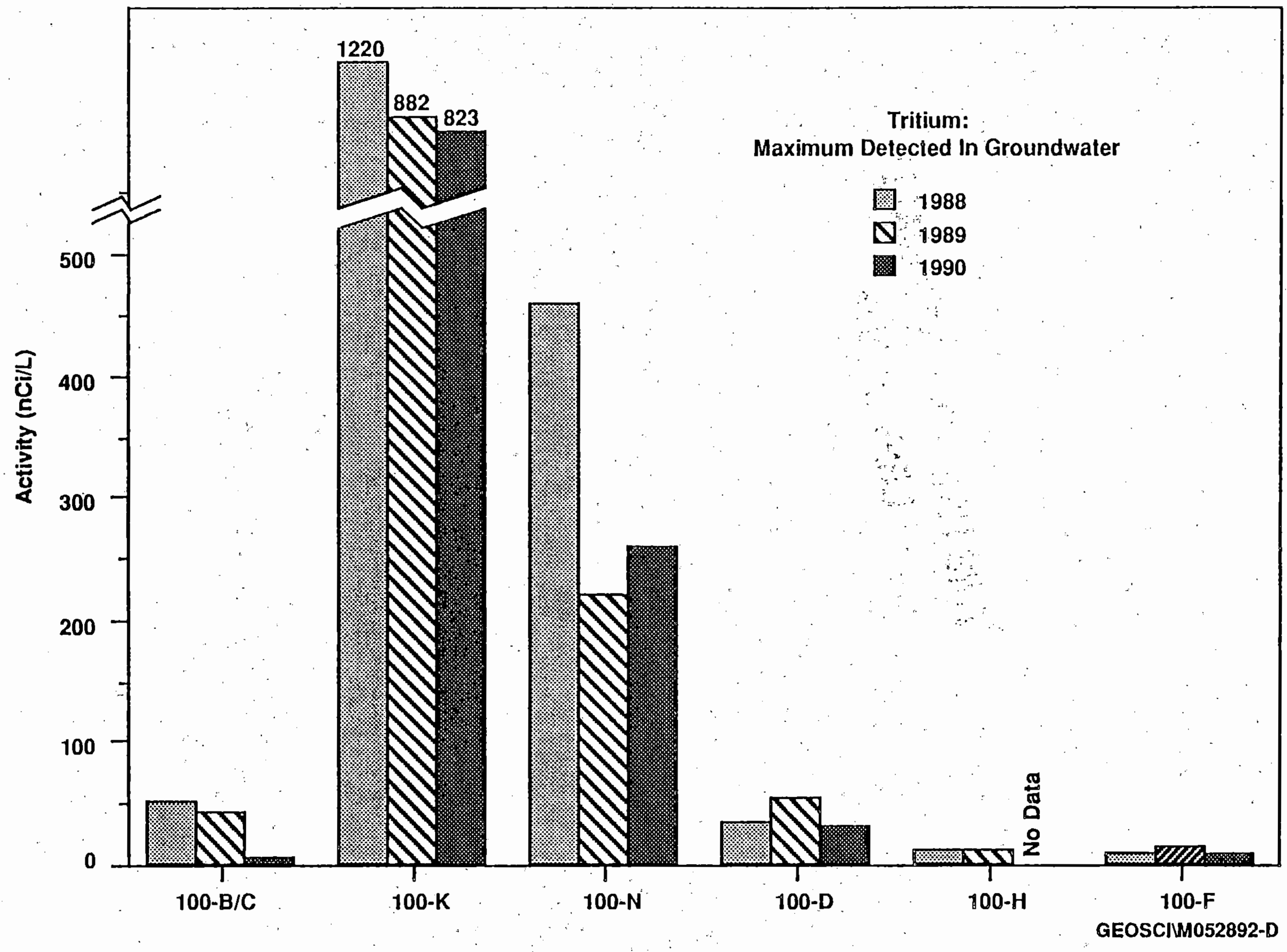

Figure 5-4. Maximum Tritium Concentration in Groundwater: 1988, 1989, and 1990.

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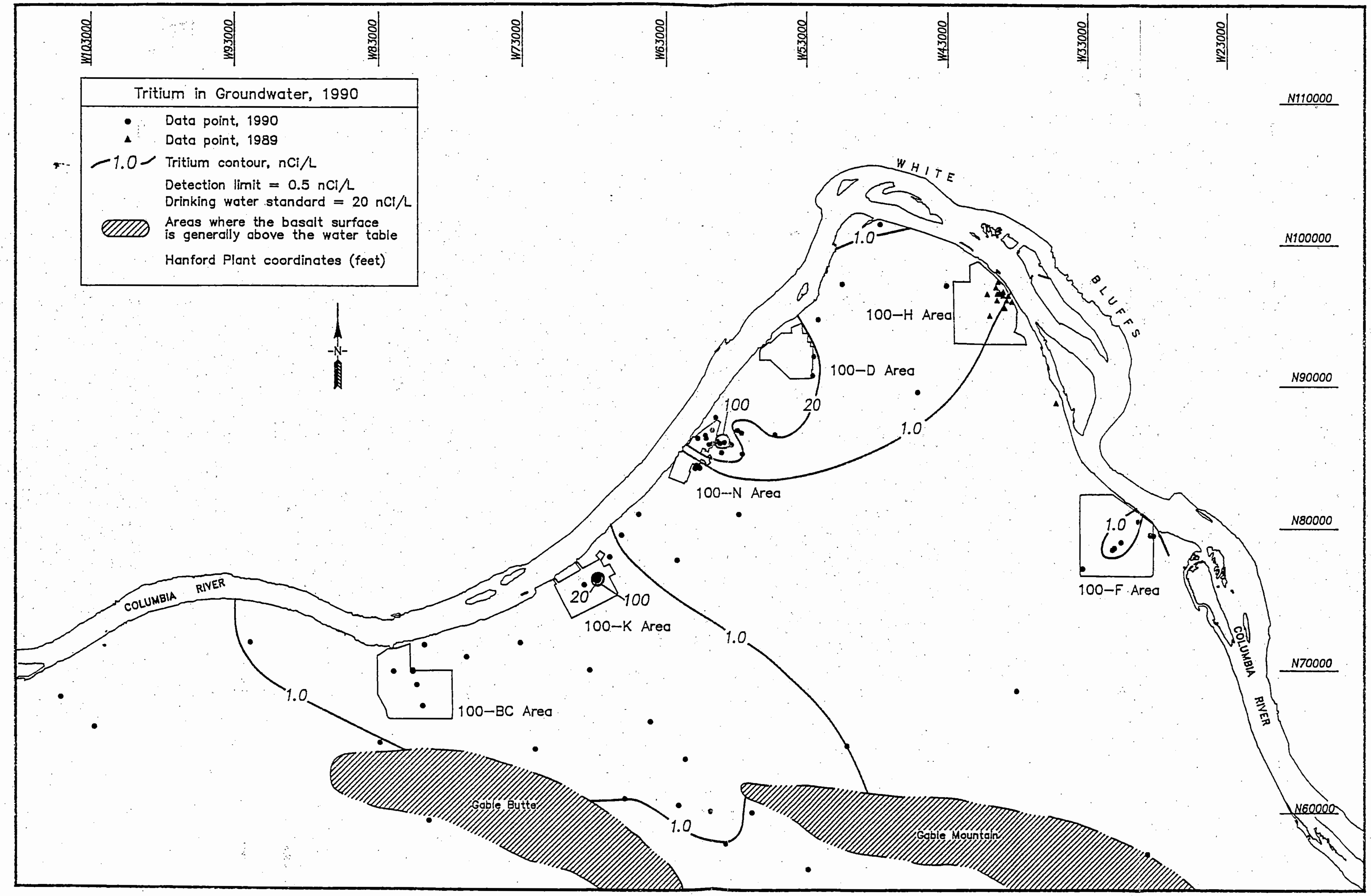

Figure 5-5. Tritium Concentration in the Unconfined Aquifer of the Northrn Hanford Site, 1990.

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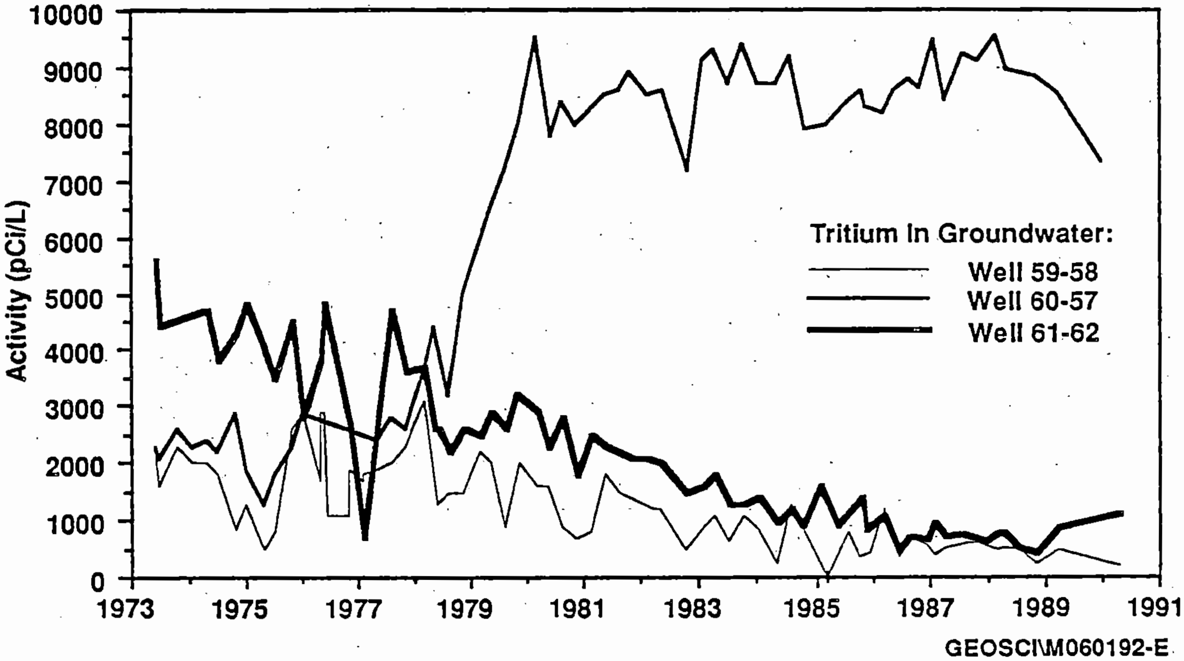
Figure 5-6. Tritium Concentration Versus Time in Wells Between Gable Mountain and Gable Gap.



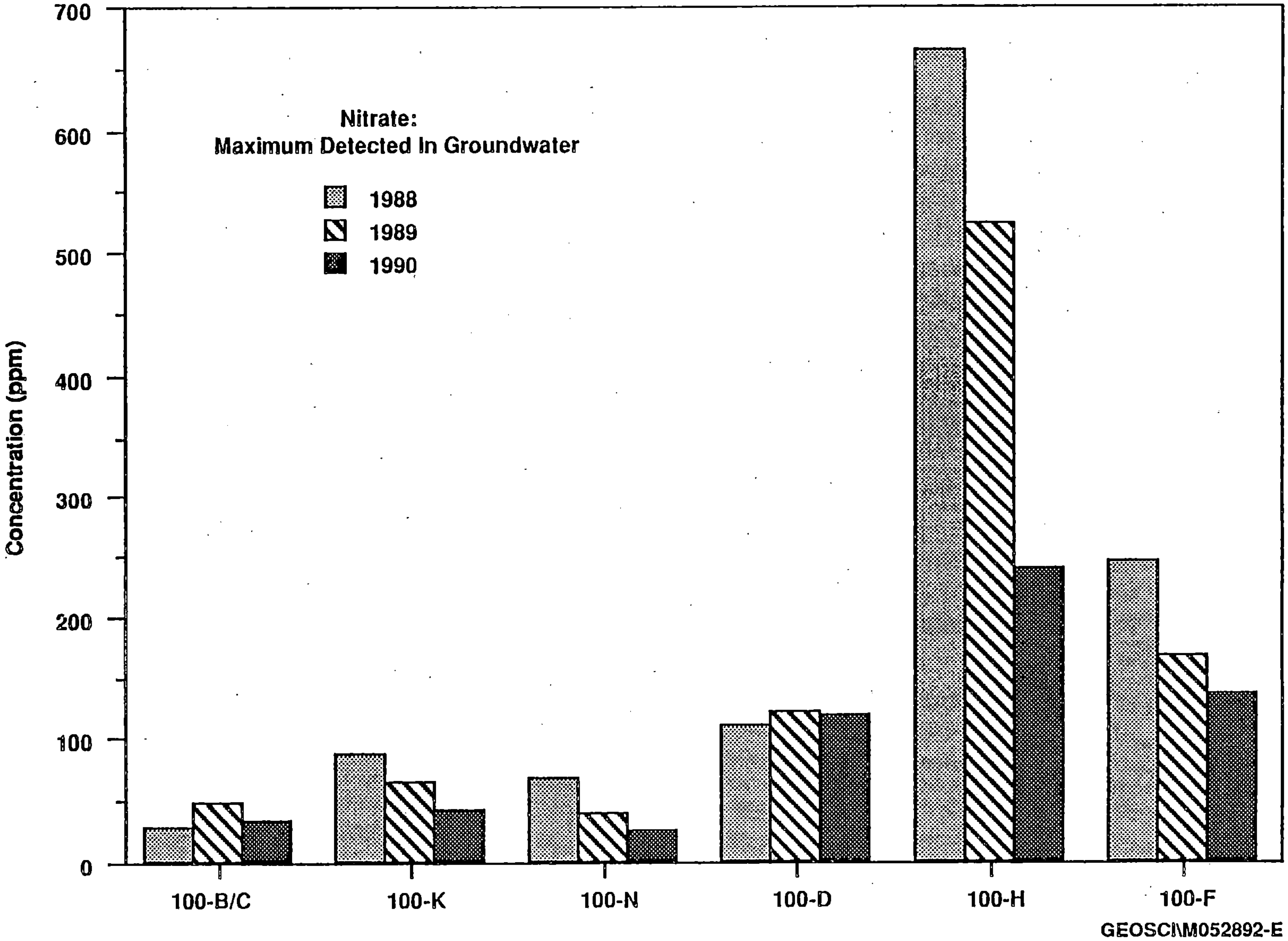


Figure 5-7. Maximum Nitrate Concentration in Groundwater: 1988, 1989, and 1990.

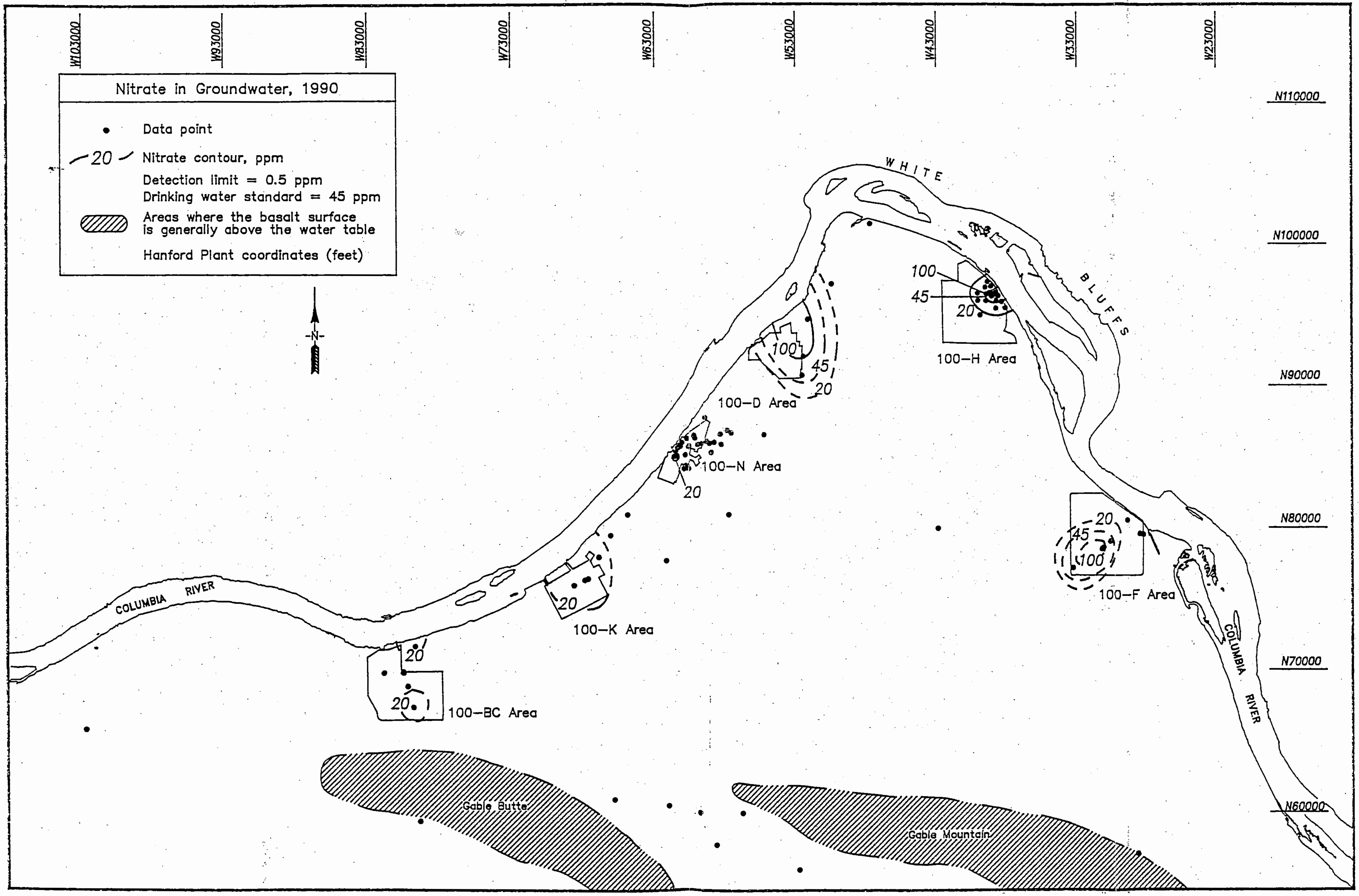


Figure 5-8. Nitrate Concentration in the Unconfined Aquifer of the Northern Hanford Site, 1990.

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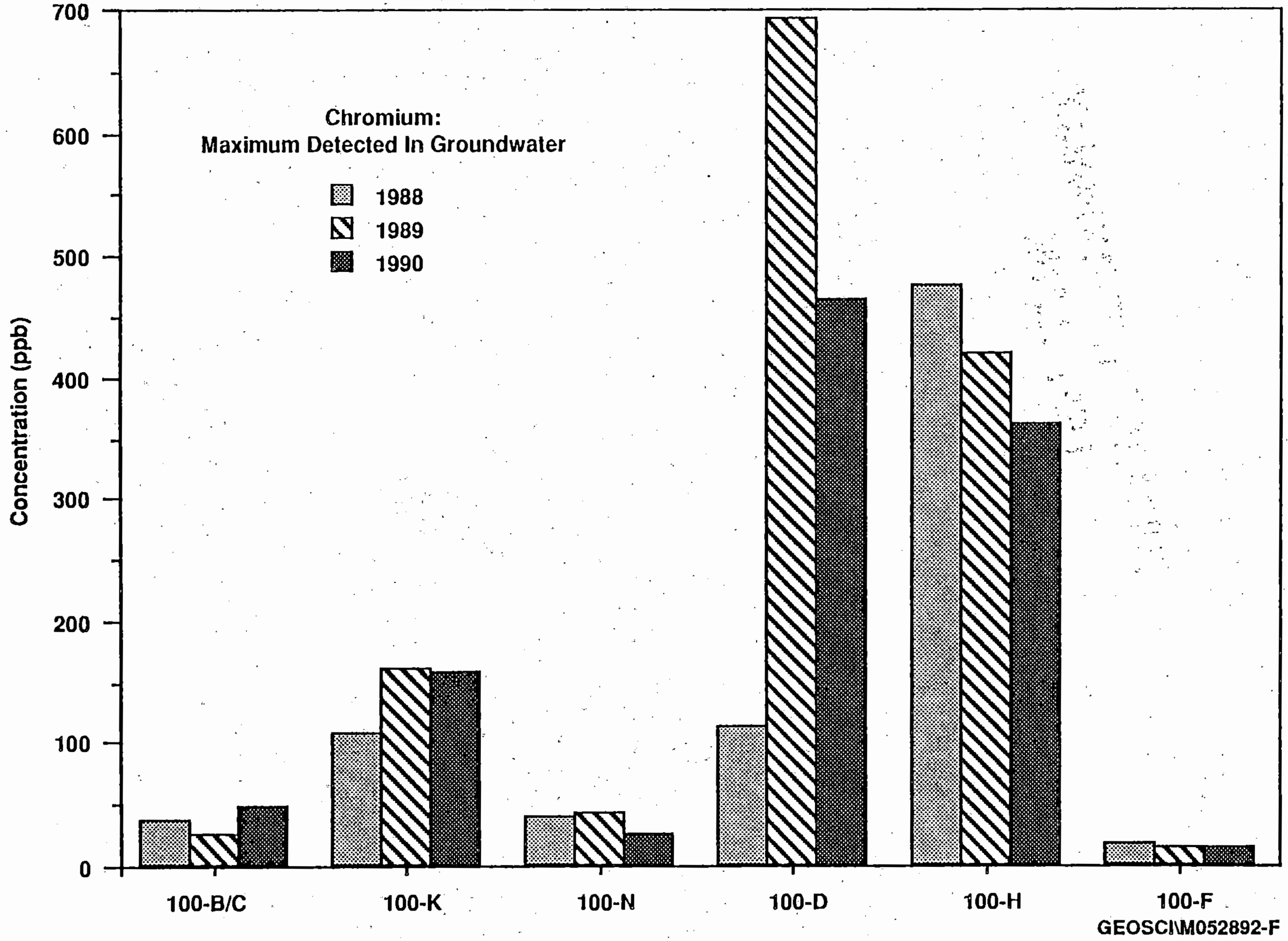

Figure 5-9. Maximum Chromium Concentration in Groundwater: 1988, 1989, and 1990.

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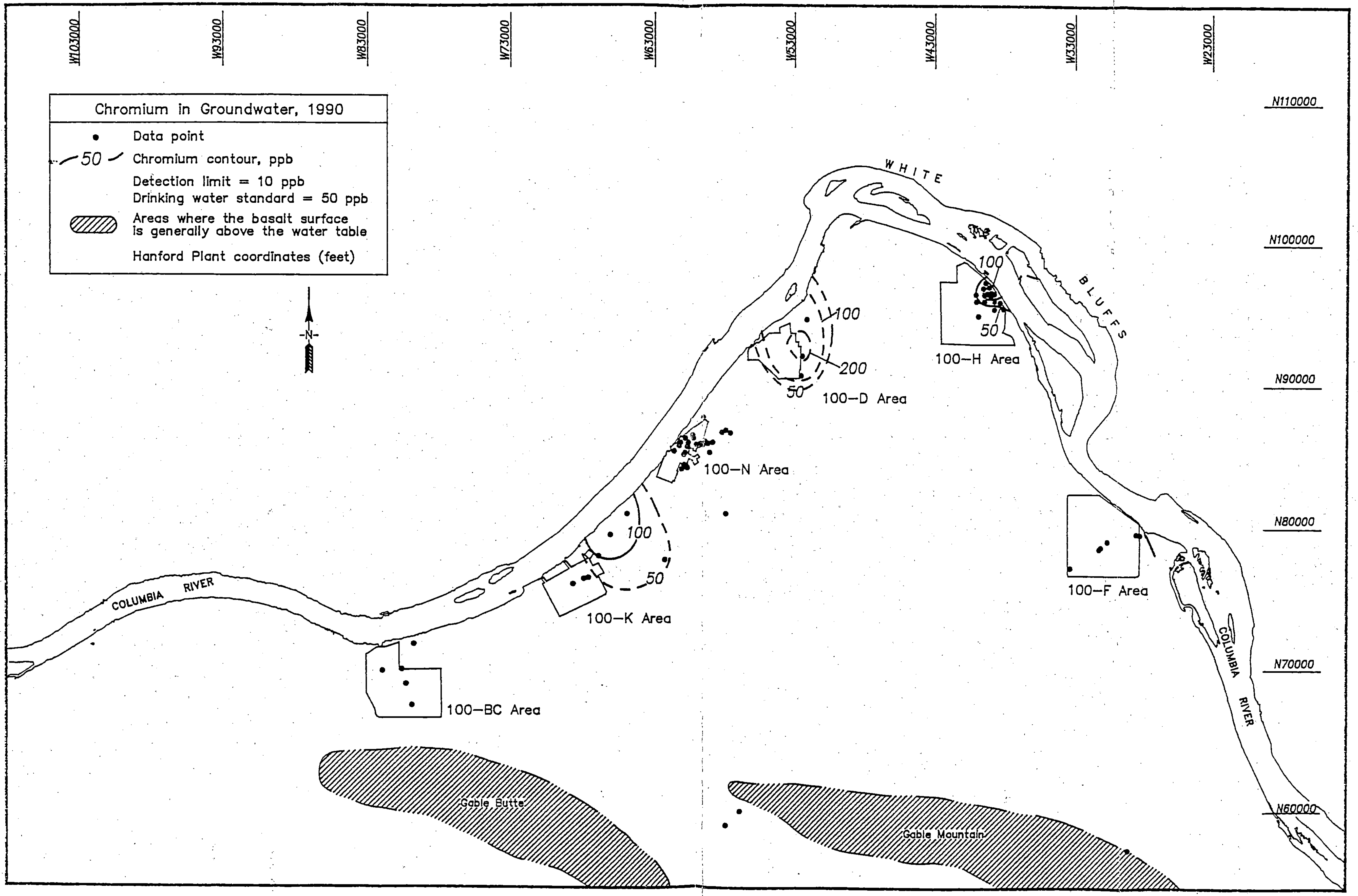

Figure 5-10. Chromium Concentration in the Unconfined Aquifer of the Northern Hanford Site, 1990.

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APPENDIX A

100 AREAS WELLS DELETED FROM CONSIDERATION FOR FUTURE USE

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TABLE A-1. 100 AREAS WELLS DELETED FROM CONSIDERATION FOR FUTURE USE

Well	Field Inspect	Completion Date	Plant West	Plant North	Coord Qual	Comments
1-B8-1		31-Mar-51	80490	67375		Not accessible
1-B8-2		30-Apr-51	80800	67400		Casing removed
1-B8-3		30-Apr-51	81110	67455		Casing removed
1-B8-4		30-Apr-51	81420	67510		Casing removed
1-B8-5		30-Apr-51	81730	67565		Casing removed
1-D2-1		30-Nov-49	54135	90910		Casing removed
1-D2-2		30-Nov-49	54135	90660		Casing removed
1-D2-3		30-Nov-49	54940	90810		Casing removed
1-D2-4		30-Nov-49	53565	90910		Casing removed
1-D3-1		31-Jan-49	56250	89550		Casing removed
1-D5-1		30-Nov-49	54135	91170		Casing removed
1-D5-2		30-Nov-49	53740	91065		Casing removed
1-D5-3		31-Mar-49	51790	93520		Casing removed
1-D5-4		30-Apr-49	52690	93520		Casing removed
1-D5-5		30-Apr-49	52290	93520		Casing removed
1-D5-6		30-Apr-49	52240	93420		Casing removed
1-D5-7		31-Mar-49	52140	93520		Casing removed
1-D5-8		31-Mar-49	52090	93520		Casing removed
1-D5-9		31-Mar-49	51990	93520		Casing removed
1-D5-10		30-Apr-57	59000	89000	D	No information
1-D5-11		30-Apr-57	59000	88900	D	No information
1-D7-1			59000	88800	D	Filled in
1-D7-2			59000	88700	D	Filled in
1-D8-1		31-May-43	53140	95230		Filled in
1-F1-1		31-May-43	36000	74000	D	Not located
1-F2-4		31-May-43	36000	73900	D	No information
1-F2-5		31-May-43	36000	73800	D	No information
1-F7-2		31-Mar-88	36000	73700	D	No information
1-H4-1		31-Mar-52	38400	95700		Casing removed
1-K-1		31-Mar-52	69930	76800		Casing removed
1-K-12		30-Sep-52	68803	76104		Covered over
1-K-14		31-Dec-52	60000	71000	D	No information

Well	Field Inspect	Completion Date	Plant West	Plant North	Coord Qual	Comments
1-K-17		30-Sep-53	60000	70900	D	No information
1-K-2		28-Feb-52	68628	75569		Casing removed
1-K-21	26-Feb-91	31-May-55	66000	80000		Filled w/sand
1-K-26		31-Aug-53	60000	70700	D	No information
1-K-3		31-Aug-52	67582	74493		Casing removed
1-K-4		31-Mar-52	68220	78052		Casing removed
1-K-5		31-Jan-52	67175	76975		Casing removed
1-K-6		31-Jan-52	66131	75889		Casing removed
1-K-7		28-Feb-52	67480	78620		Casing removed
1-K-8		28-Feb-52	65733	78371		Casing removed
1-K-9		28-Feb-52	64688	77295		Casing removed
1-N-10		31-Dec-66	60091	86786		Casing removed
1-N-10-o		28-Feb-67	60091	86786		Piezo removed
1-N-10-p		28-Feb-67	60091	86786		Piezo removed
1-N-12		31-Dec-66	60374	86218		Casing removed
1-N-12-o		31-Jan-67	60374	86218		Piezo removed
1-N-12-p		31-Jan-67	60374	86218		Piezo removed
1-N-13		31-Dec-66	60454	86342		Casing removed
1-N-13-o		31-Jan-67	60454	86342		Piezo removed
1-N-13-p		31-Jan-67	60454	86342		Piezo removed
1-N-3-o		31-Oct-64	60828	86365		Piezo removed
1-N-3-p		31-Oct-64	60828	86365		Piezo removed
1-N-3-q		31-Oct-64	60828	86365		Piezo removed
1-N-3-r		31-Oct-64	60828	86365		Piezo removed
1-N-38		30-Apr-84	58319	86247		Abandoned 6/85
1-N-4-o		30-Apr-64	60042	85921		Piezo removed
1-N-4-p		31-Oct-64	60042	85921		Piezo removed
1-N-4-q		31-Oct-64	60042	85921		Piezo removed
1-N-4-r		31-Oct-64	60042	85921		Piezo removed
1-N-4-s		31-Oct-64	60042	85921		Piezo removed
1-N-5-o		31-Oct-64	60540	85973		Piezo removed
1-N-5-p		31-Oct-64	60540	85973		Piezo removed
1-N-5-q		31-Oct-64	60540	85973		Piezo removed

Well	Field Inspect	Completion Date	Plant West	Plant North	Coord Qual	Comments
1-N-7		31-May-65	59643	85634		Abandoned 4/87
1-N-9		31-Dec-66	60229	86235		Casing removed
1-N-9-o		28-Feb-67	60229	86235		Piezo removed
1-N-9-p		28-Feb-67	60229	86235		Piezo removed
6-100-43			43000	100000	D	Filled in
6-100-54			54000	100000	D	Filled in
6-67-77			77000	67000	D	Filled in
6-67-86-p		30-Sep-63	85997	66996		Piezo removed
6-67-86-q		30-Sep-63	85997	66996		Piezo removed
6-67-86-r		30-Sep-63	85997	66996		Piezo removed
6-67-86-s		30-Sep-63	85997	66996		Piezo removed
6-71-85			84753	70736		Filled in
6-72-86		01-May-43	86000	72000	D	Casing removed
6-73-25			25000	73000		Filled in
6-74-23		31-May-43	23330	74490		Silted in
6-74-74			74075	73650		Filled in
6-75-23A		31-May-43	23350	74590		Silted in
6-75-23B		31-May-43	23370	74690		Silted in
6-76-34			34000	76000	D	Filled in
6-77-34			34275	76925		Filled in
6-78-36			36000	78000	D	Filled in
6-80-73A			73000	80000	D	Filled in
6-81-58-o		31-Dec-65	57993	81004		Piezo removed
6-81-58-p		31-Aug-63	57993	81004		Piezo removed
6-81-64A		31-Dec-43	64000	81000	D	Abandoned
6-81-64C		31-May-43	64000	80800	D	Casing removed
6-82-35			35000	82000	D	Filled in
6-84-34A			34000	84000	D	Filled in
6-84-35B			35000	84000	D	Filled in
6-84-36A			35700	84375		Filled in
6-84-36B			36000	84000	D	Filled in
6-84-36C			36000	83900	D	Filled in
6-86-60		31-Oct-61	59826	85723		Abandoned,seal

Well	Field Inspect	Completion Date	Plant West	Plant North	Coord Qual	Comments
6-88-42			42425	88085		Filled in
6-88-47			47000	88000	D	Filled in
6-90-47			47000	90000	D	Filled in
6-90-49			49000	90000	D	Filled in
6-91-45			45000	91000	D	Filled in
6-91-48A			47878	91474		Filled in
6-91-48B			48000	91000	D	Filled in
6-92-47			47000	92000	D	Filled in
6-93-37			37475	92650		Filled in
6-93-49			49000	93000	D	Filled in
6-93-50			49884	92871		Filled in
6-94-47			47000	94000	D	Filled in
6-94-48			48000	94000	D	Filled in
6-96-49-o	07-Jun-90	31-Dec-65	49232	96388		Piezo removed
6-97-43-o	07-Jun-90	31-Dec-65	43241	97143		Piezo removed
6-97-43-p	07-Jun-90	31-Aug-63	43241	97143		Piezo removed
6-97-48			48000	97000	D	Filled in
6-97-52		31-May-43	52000	97000	D	Filled in
6-98-49A			49125	97500		Backfilled
6-98-49B			49000	98000	D	Filled in

Notes:

1. "Coord Qual" indicates coordinate qualifier; "D" indicates dummy coordinate.

2. "Field Inspect" is the date the well location was visited to verify abandonment.

APPENDIX B:

WATER LEVEL DATA

The figures in Chapter 4 were constructed from the data in Tables B-1 through B-13. These data were extracted from a copy of the Hanford Groundwater Database that is maintained by the Geosciences Group of Westinghouse Hanford Company.

Well numbers in the following tables are abbreviated: e.g., 199-N-2 was written N-2; 699-65-60 was written 65-50. Head is in feet above mean sea level.

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Table B-1. Water Levels in Gable Gap Wells (sheet 1 of 4).

Well	Date	Head	Well	Date	Head
65-50	8/31/55	395.23	65-50	7/10/62	401.90
65-50	9/22/55	395.41	65-50	1/08/63	401.83
65-50	10/27/55	395.44	65-50	7/24/63	401.64
65-50	11/18/55	395.35	65-50	12/12/63	401.88
65-50	1/26/56	395.31	65-50	7/28/64	401.35
65-50	2/24/56	395.36	65-50	1/08/65	402.43
65-50	3/27/56	395.76	65-50	9/22/65	403.71
65-50	4/03/56	395.78	65-50	10/20/65	403.77
65-50	4/17/56	395.68	65-50	1/04/66	403.69
65-50	5/01/56	395.87	65-50	3/04/66	403.57
65-50	5/15/56	395.82	65-50	4/12/66	403.42
65-50	5/29/56	395.89	65-50	5/19/66	403.29
65-50	6/12/56	395.91	65-50	10/21/66	403.14
65-50	6/19/56	395.91	65-50	12/30/66	403.07
65-50	6/27/56	395.94	65-50	4/05/67	402.73
65-50	7/10/56	395.97	65-50	10/20/67	403.65
65-50	7/17/56	396.02	65-50	3/14/68	404.56
65-50	8/01/56	396.14	65-50	1/17/69	405.46
65-50	8/07/56	396.18	65-50	4/25/69	404.79
65-50	8/14/56	396.27	65-50	5/11/70	402.72
65-50	8/21/56	396.35	65-50	9/14/71	402.19
65-50	8/28/56	396.41	65-50	3/09/72	401.82
65-50	9/04/56	396.46	65-50	7/11/72	401.66
65-50	9/11/56	396.54	65-50	10/05/72	402.15
65-50	9/18/56	396.51	65-50	1/05/73	401.85
65-50	9/25/56	396.68	65-50	4/12/73	401.44
65-50	10/01/56	396.74	65-50	7/06/73	401.09
65-50	10/09/56	396.80	65-50	8/15/73	400.97
65-50	10/16/56	396.83	65-50	8/29/73	400.91
65-50	1/18/57	396.88	65-50	9/13/73	400.85
65-50	3/13/57	396.81	65-50	9/27/73	400.80
65-50	6/26/57	396.82	65-50	10/18/73	400.74
65-50	8/28/57	396.86	65-50	1/23/74	400.39
65-50	9/20/57	397.25	65-50	4/21/74	400.81
65-50	10/22/57	397.41	65-50	7/17/74	400.28
65-50	12/18/57	397.58	65-50	10/18/74	400.46
65-50	3/26/58	397.59	65-50	1/08/75	400.31
65-50	6/24/58	397.57	65-50	4/14/75	400.08
65-50	9/02/58	397.92	65-50	7/07/75	399.96
65-50	12/10/58	398.29	65-50	12/03/75	399.83
65-50	3/18/59	398.48	65-50	6/15/76	399.78
65-50	6/24/59	398.61	65-50	12/08/76	399.99
65-50	9/22/59	399.42	65-50	7/01/77	399.78
65-50	12/21/59	399.89	65-50	12/07/77	399.66
65-50	3/30/60	400.22	65-50	6/01/78	399.64
65-50	6/21/60	400.01	65-50	12/01/78	399.60
65-50	9/22/60	400.57	65-50	12/01/79	399.30
65-50	12/12/60	400.79	65-50	6/01/80	399.20

Table B-1. Water Levels in Gable Gap Wells (sheet 2 of 4).

Well	Date	Head
65-50	12/01/80	399.14
65-50	6/01/81	399.23
65-50	12/01/81	399.54
65-50	6/01/82	399.40
65-50	12/01/82	399.57
65-50	6/01/83	399.70
65-50	12/01/83	399.93
65-50	6/01/84	400.33
65-50	12/01/84	400.51
65-50	6/14/85	400.80
65-50	1/02/86	400.78
65-50	12/10/86	401.13
65-50	12/07/87	400.82
65-50	12/08/87	400.86
65-50	12/07/88	400.70
65-50	6/07/89	400.80
65-50	12/05/89	400.56
65-50	12/07/89	400.57
65-50	6/07/90	400.47
65-50	6/18/90	400.46
65-50	12/04/90	400.38
65-50	12/07/90	400.41
65-50	6/03/91	400.21
65-50	6/26/91	400.32
66-38	10/23/62	402.20
66-38	1/08/63	403.29
66-38	7/24/63	403.26
66-38	12/12/63	401.58
66-38	7/23/64	401.93
66-38	11/19/64	401.99
66-38	1/11/65	402.16
66-38	5/07/65	402.23
66-38	7/12/65	401.98
66-38	8/16/65	402.34
66-38	9/22/65	402.20
66-38	10/20/65	402.06
66-38	1/05/66	402.55
66-38	3/04/66	402.18
66-38	4/12/66	402.54
66-38	5/19/66	402.44
66-38	7/19/66	402.39
66-38	10/21/66	402.46
66-38	12/30/66	402.87
66-38	4/05/67	402.76
66-38	10/20/67	402.33
66-38	3/14/68	402.89
66-38	1/17/69	402.56
66-38	4/25/69	402.75
66-38	5/11/70	403.08
66-38	9/14/71	402.63
66-38	11/18/71	402.29
66-38	3/09/72	402.70
66-38	10/02/72	402.36
66-38	1/05/73	402.39
66-38	4/12/73	402.94
66-38	7/10/73	402.43
66-38	8/15/73	402.36
66-38	8/29/73	402.40
66-38	9/13/73	402.40
66-38	9/27/73	401.99
66-38	10/18/73	402.32
66-38	1/24/74	402.32
66-38	4/21/74	402.43
66-38	7/17/74	402.46
66-38	10/18/74	402.57
66-38	1/08/75	403.74
66-38	4/14/75	403.56
66-38	7/07/75	403.48
66-38	12/03/75	403.41
66-38	6/15/76	403.91
66-38	12/15/76	403.91
66-38	7/01/77	402.75
66-38	12/07/77	403.96
66-38	6/01/81	403.38
66-38	12/01/81	403.11
66-38	6/01/84	402.62
66-38	12/01/84	403.36
66-38	6/14/85	403.21
66-38	1/03/86	403.40
66-38	12/11/86	403.22
66-38	12/08/87	403.46
66-38	12/07/88	402.75
66-38	6/02/89	403.05
66-38	12/05/89	402.96
66-38	6/07/90	402.80
66-38	12/21/90	402.43
66-38	1/31/91	402.90
66-38	6/04/91	402.57
66-38	6/26/91	402.78
66-39	9/10/71	407.82
66-39	11/04/71	406.80
66-39	11/18/71	407.70
66-39	12/01/71	407.81
66-39	12/08/71	406.76
66-39	1/19/72	406.98
66-39	2/02/72	406.67

Table B-1. Water Levels in Gable Gap Wells (sheet 3 of 4).

Well	Date	Head	Well	Date	Head
66-39	3/09/72	406.86	69-38	7/18/51	402.93
66-39	4/11/72	406.90	69-38	8/15/51	402.85
66-39	7/05/72	406.31	69-38	9/12/51	402.96
66-39	10/02/72	407.20	69-38	10/22/51	403.13
66-39	1/05/73	406.77	69-38	11/14/51	403.13
66-39	4/12/73	406.84	69-38	1/28/52	402.74
66-39	7/10/73	406.82	69-38	3/21/52	402.57
66-39	8/15/73	406.87	69-38	4/18/52	402.93
66-39	8/29/73	406.84	69-38	5/21/52	402.90
66-39	9/13/73	406.81	69-38	6/25/52	402.80
66-39	9/27/73	406.75	69-38	7/16/52	402.80
66-39	10/18/73	406.79	69-38	8/22/52	402.72
66-39	1/24/74	406.88	69-38	9/19/52	402.72
66-39	4/21/74	406.94	69-38	10/24/52	402.87
66-39	7/19/74	406.79	69-38	11/21/52	402.92
66-39	10/18/74	406.62	69-38	12/22/52	402.89
66-39	1/08/75	407.00	69-38	1/26/53	402.93
66-39	4/14/75	406.85	69-38	2/25/53	402.84
66-39	7/07/75	406.81	69-38	4/15/53	402.70
66-39	12/03/75	406.82	69-38	5/28/53	402.63
66-39	6/15/76	406.90	69-38	6/19/53	402.68
66-39	12/08/76	406.58	69-38	7/22/53	402.60
66-39	7/01/77	406.71	69-38	9/21/53	402.64
66-39	12/07/77	406.84	69-38	10/23/53	402.73
66-39	6/01/78	406.69	69-38	11/30/53	402.75
66-39	12/01/78	406.59	69-38	12/21/53	402.71
66-39	12/01/79	406.78	69-38	1/29/54	402.69
66-39	6/01/80	406.90	69-38	2/17/54	403.23
66-39	12/01/80	406.73	69-38	3/24/54	402.83
66-39	6/01/81	406.73	69-38	4/14/54	402.60
66-39	12/01/81	406.77	69-38	5/24/54	402.58
66-39	6/01/84	405.84	69-38	6/28/54	402.33
66-39	12/01/84	405.26	69-38	7/15/54	402.47
66-39	6/14/85	406.50	69-38	8/23/54	402.43
66-39	1/03/86	406.54	69-38	9/15/54	402.58
66-39	12/11/86	406.27	69-38	10/15/54	402.29
66-39	12/08/87	406.53	69-38	11/16/54	402.85
66-39	12/07/88	406.20	69-38	12/28/54	402.46
66-39	6/02/89	406.54	69-38	1/24/55	402.43
66-39	12/05/89	406.55	69-38	3/16/55	402.28
66-39	6/07/90	406.75	69-38	4/21/55	402.52
66-39	1/30/91	406.68	69-38	5/26/55	402.53
66-39	6/04/91	406.70	69-38	6/30/55	402.55
66-39	6/26/91	406.78	69-38	7/18/55	402.18
69-38	3/16/51	403.34	69-38	8/22/55	401.79
69-38	4/16/51	403.23	69-38	9/22/55	402.08
69-38	5/17/51	402.95	69-38	10/23/55	402.33
69-38	6/13/51	403.07	69-38	11/18/55	402.25

Table B-1. Water Levels in Gable Gap Wells (sheet 4 of 4).

Well	Date	Head	Well	Date	Head
69-38	12/30/55	402.06	69-38	4/25/69	402.28
69-38	1/26/56	402.14	69-38	5/11/70	402.51
69-38	4/18/56	403.10	69-38	9/10/71	402.31
69-38	8/13/56	403.68	69-38	11/18/71	402.21
69-38	10/09/56	403.62	69-38	3/09/72	402.28
69-38	1/18/57	403.66	69-38	5/18/72	402.73
69-38	3/13/57	403.43	69-38	10/24/72	402.50
69-38	6/14/57	403.18	69-38	1/05/73	402.11
69-38	9/16/57	403.11	69-38	4/12/73	402.04
69-38	10/22/57	403.15	69-38	7/10/73	401.79
69-38	12/19/57	403.22	69-38	8/16/73	401.84
69-38	3/26/58	402.69	69-38	8/29/73	401.80
69-38	6/19/58	402.75	69-38	9/13/73	401.28
69-38	9/04/58	402.64	69-38	9/27/73	401.62
69-38	12/10/58	402.73	69-38	10/18/73	402.08
69-38	3/18/59	403.10	69-38	4/21/74	402.78
69-38	6/24/59	403.44	69-38	7/19/74	402.89
69-38	9/25/59	403.51	69-38	10/18/74	402.91
69-38	12/21/59	403.41	69-38	1/08/75	403.03
69-38	3/30/60	403.35	69-38	4/14/75	403.18
69-38	6/20/60	402.88	69-38	7/07/75	403.36
69-38	9/22/60	402.87	69-38	12/03/75	403.37
69-38	12/12/60	402.89	69-38	12/08/76	402.50
69-38	3/22/61	402.82	69-38	7/01/77	402.03
69-38	4/13/61	402.89	69-38	12/07/77	403.04
69-38	5/25/61	403.01	69-38	6/01/78	402.10
69-38	6/22/61	403.05	69-38	12/01/78	402.25
69-38	12/11/61	403.19	69-38	12/01/79	402.47
69-38	2/12/62	403.23	69-38	6/01/80	402.60
69-38	7/10/62	402.95	69-38	12/01/80	402.31
69-38	1/08/63	403.52	69-38	6/01/81	402.29
69-38	7/24/63	403.64	69-38	12/01/81	402.44
69-38	12/12/63	403.65	69-38	6/01/82	402.15
69-38	7/23/64	403.30	69-38	12/01/82	402.49
69-38	8/16/65	403.24	69-38	6/01/84	402.89
69-38	9/22/65	403.34	69-38	12/01/84	402.60
69-38	10/20/65	403.26	69-38	6/14/85	402.94
69-38	1/05/66	403.38	69-38	12/31/85	403.25
69-38	3/04/66	403.06	69-38	12/11/86	402.19
69-38	4/12/66	403.35	69-38	12/08/87	401.98
69-38	5/19/66	403.04	69-38	12/07/88	401.57
69-38	7/19/66	402.91	69-38	6/02/89	401.31
69-38	10/21/66	403.20	69-38	12/05/89	401.64
69-38	12/30/66	403.11	69-38	6/07/90	401.15
69-38	4/05/67	402.97	69-38	12/05/90	402.50
69-38	10/20/67	402.61	69-38	12/21/90	402.38
69-38	3/14/68	402.31	69-38	6/04/91	402.05
69-38	1/17/69	402.17	69-38	6/26/91	402.25

Data are plotted in Figure 4-3.

Table B-2: 100 Areas Water Levels - October/November 1967.

Well	Average Head Oct/Nov 1967	Well	Average Head Oct/Nov 1967
B3-1	412.14	67-98	396.52
B3-2	407.61	68-105	391.94
B4-1	406.79	69-38	402.61
B4-3	405.95	69-45	402.13
B4-4	404.23	70-68	405.34
B5-1	405.18	71-30	372.54
B9-1	406.46	71-52	403.35
D2-5	392.95	71-77	405.28
D5-12	391.61	72-73	404.12
D8-2	401.20*	72-88	401.73
D8-3	406.40*	72-92	401.17
F5-1	368.76	73-61	405.33
F5-4	388.29	74-44	398.65
F5-6	369.86	74-48	401.59
F8-1	374.88	77-36	378.78
H3-1	380.63	77-54	400.97
H4-2	400.57	78-62	408.34
K-11	413.94	80-43S	391.43
K-19	419.05	81-58	400.15
K-20	417.18	83-47	392.97
K-21	408.98	84-35A	377.83
K-22	408.06	89-35	371.44
N-2	401.57	90-45	390.06
N-3	396.10	92-49	390.04
N-4	402.21	96-49	386.20
N-6	402.41	97-43	383.91
57-29A	365.09	97-47	386.59
57-83A	426.68	97-51A	384.33
59-80B	416.38		
60-60	405.98		
61-66	406.52		
62-43A	397.96		
63-25A	364.59		
63-90	398.91		
65-50	403.65		
65-59A	405.23		
65-72	405.29		
65-83	404.91		
66-23	362.14		
66-38	402.33		
67-51	403.84		
67-86	404.23		

* Measurements for wells D8-2 and D8-3 were made in July and August, 1967, respectively.

Data are plotted in Figure 4-4.

Table B-3. Groundwater Levels in Wells 80-43P and 80-43S.

Well	Date	Head	Well	Date	Head
80-43P	3/01/66	399.38	80-43S	12/30/66	391.29
80-43P	3/04/66	399.25	80-43S	3/27/67	391.38
80-43P	3/17/66	399.28	80-43S	11/20/67	391.43
80-43P	4/12/66	399.34	80-43S	3/12/68	391.55
80-43P	5/18/66	399.20	80-43S	1/17/69	391.42
80-43P	7/19/66	399.30	80-43S	4/24/69	391.52
80-43P	10/18/66	399.32	80-43S	5/11/70	391.48
80-43P	12/30/66	399.62	80-43S	9/10/71	390.73
80-43P	3/27/67	399.54	80-43S	3/14/72	390.47
80-43P	10/20/67	399.45	80-43S	7/13/72	390.33
80-43P	1/17/69	400.48	80-43S	10/15/72	390.24
80-43P	4/24/69	400.45	80-43S	1/05/73	390.21
80-43P	5/11/70	400.29	80-43S	4/11/73	390.13
80-43P	9/10/71	399.32	80-43S	7/11/73	390.04
80-43P	3/14/72	399.32	80-43S	8/13/73	390.02
80-43P	7/13/72	399.19	80-43S	8/28/73	389.99
80-43P	10/19/72	399.34	80-43S	9/13/73	389.97
80-43P	1/05/73	399.43	80-43S	10/01/73	389.94
80-43P	4/11/73	399.45	80-43S	10/15/73	389.94
80-43P	7/11/73	399.29	80-43S	1/24/74	389.84
80-43P	1/24/74	399.43	80-43S	4/21/74	389.80
80-43P	4/26/74	399.20	80-43S	7/22/74	389.66
80-43P	10/15/74	398.96	80-43S	1/08/75	389.52
80-43P	1/08/75	399.28	80-43S	4/14/75	389.71
80-43P	7/15/75	399.03	80-43S	7/07/75	389.30
80-43P	12/15/75	398.91	80-43S	12/03/75	389.18
80-43P	6/15/76	398.87	80-43S	6/15/76	388.89
80-43P	12/15/76	398.98	80-43S	12/15/76	388.75
80-43P	7/01/77	398.98	80-43S	7/01/77	388.55
80-43P	12/07/77	399.08	80-43S	12/07/77	388.39
80-43P	6/01/78	398.90	80-43S	6/01/78	388.23
80-43P	12/01/78	398.83	80-43S	12/01/78	388.10
80-43P	12/01/79	399.25	80-43S	12/01/79	387.89
80-43P	6/01/80	399.44	80-43S	6/01/80	387.83
80-43S	3/01/66	391.17	80-43S	12/01/80	387.75
80-43S	3/04/66	391.08			
80-43S	3/17/66	391.09			
80-43S	4/12/66	391.10			
80-43S	5/18/66	391.14			
80-43S	7/19/66	391.13			
80-43S	10/18/66	391.17			

Data are plotted in Figure 4-7.

Table B-4. Groundwater Levels in Wells 63-90, 65-95, and 66-91 (sheet 1 of 5).

Well	Date	Head	Well	Date	Head
63-90	1/09/49	393.16	63-90	5/15/52	396.16
63-90	4/19/49	392.99	63-90	6/19/52	404.90
63-90	5/24/49	399.03	63-90	7/16/52	405.03
63-90	6/27/49	406.06	63-90	8/20/52	400.94
63-90	7/25/49	402.39	63-90	9/18/52	397.53
63-90	9/09/49	397.09	63-90	10/20/52	395.11
63-90	10/10/49	395.01	63-90	11/21/52	393.63
63-90	11/21/49	393.73	63-90	12/26/52	392.93
63-90	12/27/49	393.33	63-90	1/22/53	393.43
63-90	2/14/50	393.27	63-90	2/20/53	393.56
63-90	3/16/50	393.31	63-90	3/19/53	393.63
63-90	4/18/50	394.03	63-90	4/27/53	393.68
63-90	5/16/50	396.13	63-90	5/20/53	394.26
63-90	5/22/50	396.91	63-90	6/22/53	402.39
63-90	5/29/50	398.10	63-90	7/13/53	405.52
63-90	6/05/50	400.04	63-90	8/14/53	403.36
63-90	6/12/50	401.92	63-90	9/21/53	398.41
63-90	6/19/50	403.64	63-90	10/22/53	397.88
63-90	7/03/50	407.42	63-90	11/19/53	396.23
63-90	7/10/50	409.33	63-90	12/21/53	394.58
63-90	7/17/50	410.55	63-90	1/29/54	394.13
63-90	7/24/50	410.65	63-90	2/24/54	394.21
63-90	7/31/50	409.71	63-90	3/24/54	394.05
63-90	8/07/50	408.47	63-90	4/15/54	394.40
63-90	8/14/50	407.23	63-90	5/24/54	395.99
63-90	8/21/50	405.15	63-90	6/28/54	407.22
63-90	8/28/50	403.78	63-90	7/19/54	409.20
63-90	9/05/50	402.32	63-90	8/16/54	406.93
63-90	9/11/50	401.44	63-90	9/15/54	402.23
63-90	9/18/50	400.39	63-90	10/14/54	398.68
63-90	10/04/50	398.16	63-90	11/19/54	395.98
63-90	11/14/50	395.59	63-90	12/20/54	395.43
63-90	12/14/50	394.92	63-90	1/20/55	394.67
63-90	1/15/51	395.45	63-90	3/14/55	395.11
63-90	2/19/51	394.96	63-90	4/18/55	395.16
63-90	3/21/51	394.81	63-90	5/17/55	396.23
63-90	4/16/51	395.19	63-90	6/15/55	396.23
63-90	5/17/51	399.00	63-90	7/18/55	406.59
63-90	6/12/51	406.08	63-90	8/17/55	405.28
63-90	7/17/51	407.91	63-90	9/22/55	399.23
63-90	8/15/51	405.30	63-90	10/24/55	396.43
63-90	9/13/51	400.01	63-90	11/23/55	395.44
63-90	10/23/51	396.33	63-90	12/29/55	395.18
63-90	11/14/51	395.65	63-90	1/25/56	395.08
63-90	1/29/52	394.53	63-90	2/24/56	395.24
63-90	3/18/52	394.50	63-90	3/20/56	394.63
63-90	4/16/52	394.82	63-90	4/18/56	395.70

Data are plotted in Figure 4-8.

Table B-4. Groundwater Levels in Wells 63-90, 65-95, and 66-91 (sheet 2 of 5).

Well	Date	Head
63-90	5/14/56	401.43
63-90	6/20/56	410.03
63-90	7/16/56	408.94
63-90	8/13/56	404.88
63-90	10/12/56	397.28
63-90	12/19/56	395.33
63-90	3/13/57	394.88
63-90	4/16/57	394.90
63-90	5/17/57	396.53
63-90	6/13/57	405.73
63-90	7/26/57	404.38
63-90	8/17/57	400.83
63-90	9/16/57	397.52
63-90	10/15/57	395.81
63-90	12/18/57	394.63
63-90	3/25/58	395.54
63-90	6/19/58	404.19
63-90	9/02/58	398.61
63-90	12/11/58	394.79
63-90	3/17/59	395.99
63-90	6/23/59	406.44
63-90	9/28/59	399.66
63-90	12/22/59	397.90
63-90	3/29/60	395.18
63-90	6/20/60	404.27
63-90	9/22/60	398.38
63-90	12/09/60	395.43
63-90	12/28/60	395.21
63-90	1/04/61	395.04
63-90	1/11/61	394.93
63-90	1/23/61	394.86
63-90	1/30/61	394.85
63-90	2/06/61	394.91
63-90	2/13/61	395.20
63-90	2/20/61	395.37
63-90	2/27/61	395.64
63-90	3/06/61	396.01
63-90	3/13/61	396.36
63-90	3/20/61	396.42
63-90	3/27/61	396.40
63-90	4/03/61	396.47
63-90	4/17/61	396.79
63-90	4/24/61	397.08
63-90	5/01/61	397.11
63-90	5/08/61	397.22
63-90	5/15/61	397.55
63-90	5/22/61	398.50
63-90	5/29/61	400.11
63-90	6/05/61	402.26
63-90	6/12/61	404.85
63-90	6/19/61	407.59
63-90	6/26/61	409.63
63-90	7/05/61	410.37
63-90	7/10/61	409.75
63-90	7/24/61	407.00
63-90	8/09/61	404.24
63-90	8/16/61	402.83
63-90	8/30/61	400.75
63-90	9/08/61	399.65
63-90	9/19/61	398.69
63-90	9/27/61	397.84
63-90	10/10/61	396.87
63-90	10/17/61	396.54
63-90	10/24/61	396.20
63-90	10/31/61	395.95
63-90	11/08/61	395.84
63-90	11/21/61	395.70
63-90	11/28/61	395.59
63-90	12/05/61	395.48
63-90	12/12/61	395.40
63-90	12/19/61	395.31
63-90	12/26/61	395.24
63-90	1/03/62	395.19
63-90	1/09/62	395.01
63-90	1/16/62	394.89
63-90	1/23/62	394.90
63-90	1/30/62	395.08
63-90	2/06/62	395.38
63-90	2/13/62	395.67
63-90	2/20/62	395.91
63-90	2/27/62	395.87
63-90	3/06/62	396.01
63-90	3/13/62	395.72
63-90	3/20/62	395.61
63-90	7/02/62	404.98
63-90	12/17/62	395.87
63-90	7/19/63	403.75
63-90	12/05/63	395.03
63-90	7/14/64	408.73
63-90	12/18/64	396.09
63-90	8/18/65	403.09
63-90	9/21/65	399.51
63-90	10/19/65	397.26
63-90	12/29/65	396.10
63-90	3/03/66	396.14

Table B-4. Groundwater Levels in Wells 63-90, 65-95, and 66-91 (sheet 3 of 5).

Well	Date	Head	Well	Date	Head
63-90	4/13/66	395.84	63-90	8/06/74	403.61
63-90	5/17/66	397.16	63-90	8/13/74	403.10
63-90	7/26/66	405.35	63-90	8/20/74	402.46
63-90	10/28/66	396.42	63-90	8/27/74	401.70
63-90	1/03/67	395.75	63-90	9/03/74	400.94
63-90	3/24/67	396.32	63-90	9/10/74	400.21
63-90	9/26/67	399.18	63-90	9/17/74	399.72
63-90	10/12/67	398.91	63-90	9/24/74	399.29
63-90	3/07/68	396.71	63-90	10/01/74	398.95
63-90	4/22/69	400.48	63-90	10/08/74	398.71
63-90	8/26/69	400.36	63-90	10/18/74	398.47
63-90	9/16/69	398.28	63-90	10/22/74	398.16
63-90	9/24/69	397.91	63-90	10/29/74	397.87
63-90	5/06/70	396.58	63-90	11/05/74	397.64
63-90	9/13/71	399.67	63-90	11/12/74	397.58
63-90	3/09/72	397.60	63-90	11/20/74	397.49
63-90	7/10/72	409.56	63-90	11/26/74	397.52
63-90	10/02/72	399.12	63-90	12/03/74	397.42
63-90	1/04/73	397.47	63-90	12/10/74	397.33
63-90	4/09/73	397.50	63-90	12/26/74	397.38
63-90	7/05/73	396.34	63-90	1/02/75	397.25
63-90	8/13/73	397.58	63-90	1/08/75	397.29
63-90	8/27/73	397.54	63-90	1/15/75	397.44
63-90	9/12/73	396.92	63-90	1/23/75	397.61
63-90	9/28/73	396.30	63-90	1/30/75	397.56
63-90	10/11/73	396.02	63-90	2/07/75	397.53
63-90	1/16/74	397.22	63-90	2/13/75	397.62
63-90	4/03/74	398.69	63-90	3/06/75	398.38
63-90	4/09/74	398.69	63-90	3/18/75	398.79
63-90	4/16/74	398.88	63-90	4/02/75	399.40
63-90	4/21/74	399.47	63-90	4/14/75	399.53
63-90	4/23/74	399.03	63-90	4/23/75	399.34
63-90	4/30/74	399.52	63-90	4/30/75	398.98
63-90	5/07/74	400.29	63-90	5/07/75	398.93
63-90	5/14/74	401.09	63-90	5/14/75	399.15
63-90	5/21/74	401.34	63-90	5/21/75	399.40
63-90	5/28/74	401.86	63-90	5/28/75	400.03
63-90	6/04/74	402.32	63-90	6/04/75	400.98
63-90	6/11/74	402.82	63-90	6/11/75	401.34
63-90	6/18/74	403.15	63-90	6/18/75	401.46
63-90	6/25/74	403.76	63-90	6/25/75	401.44
63-90	7/02/74	404.91	63-90	7/02/75	401.13
63-90	7/09/74	406.13	63-90	7/07/75	400.46
63-90	7/16/74	406.11	63-90	7/16/75	400.45
63-90	7/17/74	406.11	63-90	7/24/75	400.03
63-90	7/23/74	405.28	63-90	8/01/75	399.50
63-90	7/30/74	404.45	63-90	8/20/75	398.54
			63-90	8/26/75	398.07

Table B-4. Groundwater Levels in Wells 63-90, 65-95, and 66-91 (sheet 4 of 5).

Well	Date	Head	Well	Date	Head
63-90	9/03/75	397.76	65-95	6/04/74	404.05
63-90	9/10/75	397.62	65-95	6/11/74	404.41
63-90	9/17/75	397.28	65-95	6/18/74	404.83
63-90	9/24/75	396.86	65-95	6/25/74	405.96
63-90	12/03/75	397.23	65-95	7/02/74	407.42
63-90	6/15/76	401.59	65-95	7/09/74	408.22
63-90	12/08/76	397.59	65-95	7/16/74	407.02
63-90	7/01/77	395.98	65-95	7/17/74	407.02
63-90	12/07/77	395.90	65-95	7/23/74	405.90
63-90	6/01/78	400.03	65-95	7/30/74	405.03
63-90	12/01/78	399.73	65-95	8/06/74	404.29
63-90	12/01/79	396.94	65-95	8/13/74	403.88
63-90	6/01/80	399.72	65-95	8/20/74	402.87
63-90	12/01/80	396.20	65-95	8/27/74	401.86
63-90	6/01/81	401.39	65-95	9/03/74	401.00
63-90	12/01/81	396.72	65-95	9/10/74	400.34
63-90	6/01/82	402.15	65-95	9/17/74	399.85
63-90	12/01/82	397.08	65-95	9/24/74	399.54
63-90	6/01/83	401.51	65-95	10/01/74	399.16
63-90	12/01/83	397.60	65-95	10/08/74	398.98
63-90	6/01/84	399.57	65-95	10/18/74	398.59
63-90	12/01/84	396.85	65-95	10/22/74	398.00
63-90	6/13/85	398.85	65-95	10/29/74	397.76
63-90	12/27/85	399.23	65-95	11/05/74	397.79
63-90	12/10/86	397.06	65-95	11/12/74	397.74
63-90	12/11/87	396.49	65-95	11/20/74	397.77
63-90	12/05/88	397.32	65-95	11/26/74	397.78
63-90	5/22/89	398.94	65-95	12/03/74	397.56
63-90	6/02/89	399.96	65-95	12/10/74	397.68
63-90	8/16/89	396.31	65-95	12/26/74	397.69
63-90	12/04/89	397.12	65-95	1/02/75	397.57
63-90	1/24/90	398.33	65-95	1/08/75	397.71
63-90	6/04/90	400.34	65-95	1/15/75	398.15
63-90	12/19/90	399.36	65-95	1/23/75	398.15
63-90	1/30/91	400.36	65-95	1/30/75	397.90
63-90	6/03/91	402.65	65-95	2/07/75	398.20
63-90	6/11/91	403.14	65-95	2/13/75	398.41
65-95	10/15/73	405.75	65-95	3/06/75	399.46
65-95	4/02/74	399.17	65-95	3/18/75	399.80
65-95	4/09/74	399.63	65-95	4/02/75	400.65
65-95	4/16/74	399.74	65-95	4/14/75	400.27
65-95	4/23/74	400.16	65-95	4/23/75	399.65
65-95	4/30/74	400.99	65-95	4/30/75	399.49
65-95	5/07/74	402.18	65-95	5/07/75	400.03
65-95	5/14/74	402.80	65-95	5/14/75	400.14
65-95	5/21/74	402.94	65-95	5/21/75	400.88
65-95	5/28/74	403.67	65-95	5/28/75	401.86

Table B-4. Groundwater Levels in Wells 63-90, 65-95, and 66-91 (sheet 5 of 5).

Well	Date	Head
65-95	6/04/75	402.58
65-95	6/11/75	402.86
65-95	6/18/75	402.79
65-95	6/25/75	402.35
65-95	7/02/75	401.86
65-95	7/07/75	401.24
65-95	7/16/75	401.06
65-95	7/24/75	400.49
65-95	8/01/75	399.53
65-95	8/20/75	397.41
65-95	8/26/75	397.85
65-95	9/03/75	398.01
65-95	9/10/75	397.39
65-95	9/17/75	396.66
65-95	9/24/75	396.01
65-95	12/03/75	397.68
65-95	6/15/76	402.99
65-95	12/08/76	397.83
65-95	7/01/77	395.14
65-95	12/07/77	395.61
65-95	6/01/78	400.88
65-95	12/01/78	398.28
65-95	12/01/79	397.10
65-95	6/01/80	401.50
65-95	12/01/80	396.38
65-95	6/01/81	403.87
65-95	12/01/81	396.76
65-95	6/01/82	403.74
65-95	12/01/82	397.37
65-95	12/01/83	398.39
65-95	6/01/84	400.72
65-95	12/01/84	397.67
65-95	6/12/85	396.77
65-95	12/27/85	399.94
65-95	12/10/86	397.40
65-95	12/11/87	396.77
65-95	12/05/88	398.37
65-95	6/02/89	401.33
65-95	8/16/89	395.51
65-95	12/04/89	397.82
65-95	6/06/90	401.88
65-95	6/03/91	404.41
65-95	6/11/91	404.76
66-91	10/15/73	397.68
66-91	5/14/74	401.38
66-91	7/19/74	405.63
66-91	10/18/74	400.33
66-91	1/08/75	399.02
66-91	4/14/75	400.42
66-91	7/07/75	401.39
66-91	12/03/75	398.43
66-91	12/08/76	399.39
66-91	7/01/77	397.40
66-91	12/07/77	397.05
66-91	6/01/78	400.73
66-91	12/01/78	398.81
66-91	12/01/79	398.06
66-91	6/01/80	400.12
66-91	12/01/80	397.53
66-91	6/01/81	401.29
66-91	12/01/81	398.35
66-91	6/01/82	402.39
66-91	12/01/82	398.59
66-91	6/01/83	402.20
66-91	12/01/83	398.65
66-91	6/01/84	400.75
66-91	12/01/84	398.39
66-91	6/13/85	400.18
66-91	1/03/86	399.94
66-91	12/10/86	398.72
66-91	12/11/87	398.18
66-91	12/05/88	398.77
66-91	6/02/89	400.64
66-91	8/16/89	398.28
66-91	12/04/89	398.56
66-91	6/06/90	401.48
66-91	6/03/91	402.95
66-91	6/11/91	403.23

Data are plotted in Figure 4-8.

Table B-5. Groundwater Levels in Wells B3-1 and K-20 (sheet 1 of 2).

Well	Date	Head	Well	Date	Head
B3-1	26-May-59	407.41	B3-1	11-Mar-68	418.25
B3-1	05-Nov-62	398.19	B3-1	18-Mar-68	418.22
B3-1	27-Dec-62	398.49	B3-1	25-Mar-68	418.19
B3-1	19-Jul-63	410.29	B3-1	01-Apr-68	411.54
B3-1	06-Dec-63	398.29	B3-1	08-Apr-68	418.94
B3-1	21-Jul-64	406.09	B3-1	15-Apr-68	413.82
B3-1	29-Dec-64	409.93	B3-1	22-Apr-68	416.30
B3-1	13-Jul-65	412.07	B3-1	29-Apr-68	412.47
B3-1	16-Jul-65	408.99	B3-1	06-May-68	412.08
B3-1	18-Aug-65	409.14	B3-1	13-May-68	410.46
B3-1	21-Sep-65	409.04	B3-1	20-May-68	411.38
B3-1	19-Oct-65	409.24	B3-1	27-May-68	411.65
B3-1	27-Oct-65	409.12	B3-1	03-Jun-68	411.41
B3-1	03-Mar-66	404.58	B3-1	10-Jun-68	412.32
B3-1	13-Apr-66	404.24	B3-1	17-Jun-68	412.99
B3-1	18-May-66	406.85	B3-1	24-Jun-68	413.26
B3-1	27-Jul-66	407.33	B3-1	01-Jul-68	413.00
B3-1	29-Dec-66	402.42	B3-1	02-Aug-68	408.71
B3-1	28-Mar-67	409.39	B3-1	13-Aug-68	418.96
B3-1	22-Sep-67	409.37	B3-1	19-Aug-68	418.92
B3-1	27-Sep-67	408.49	B3-1	26-Aug-68	416.11
B3-1	12-Oct-67	409.92	B3-1	16-Sep-68	408.96
B3-1	19-Oct-67	409.64	B3-1	21-Oct-68	416.84
B3-1	27-Oct-67	411.74	B3-1	28-Oct-68	409.42
B3-1	30-Oct-67	409.62	B3-1	04-Nov-68	410.31
B3-1	08-Nov-67	409.54	B3-1	11-Nov-68	411.03
B3-1	09-Nov-67	409.37	B3-1	18-Nov-68	410.77
B3-1	15-Nov-67	415.79	B3-1	25-Nov-68	407.73
B3-1	17-Nov-67	418.39	B3-1	02-Dec-68	411.07
B3-1	22-Nov-67	409.39	B3-1	09-Dec-68	410.48
B3-1	29-Nov-67	418.01	B3-1	16-Dec-68	410.26
B3-1	04-Dec-67	410.21	B3-1	23-Dec-68	410.10
B3-1	11-Dec-67	418.51	B3-1	30-Dec-68	411.43
B3-1	12-Dec-67	418.75	B3-1	06-Jan-69	409.94
B3-1	18-Dec-67	417.74	B3-1	13-Jan-69	409.50
B3-1	22-Dec-67	418.56	B3-1	20-Jan-69	409.89
B3-1	29-Dec-67	417.95	B3-1	27-Jan-69	407.70
B3-1	04-Jan-68	417.27	B3-1	03-Feb-69	411.17
B3-1	08-Jan-68	418.65	B3-1	17-Feb-69	411.72
B3-1	15-Jan-68	413.12	B3-1	10-Mar-69	412.34
B3-1	22-Jan-68	415.49	B3-1	23-Apr-69	409.66
B3-1	29-Jan-68	418.88	B3-1	12-Nov-69	396.37
B3-1	05-Feb-68	418.05	B3-1	06-May-70	394.62
B3-1	13-Feb-68	413.21	B3-1	10-Sep-71	396.51
B3-1	19-Feb-68	417.82	B3-1	10-Mar-72	394.72
B3-1	26-Feb-68	418.35	B3-1	11-Jul-72	402.23
B3-1	04-Mar-68	418.12	B3-1	02-Oct-72	394.58

Table B-5. Groundwater Levels in Wells B3-1 and K-20 (sheet 2 of 2).

Well	Date	Head	Well	Date	Head
B3-1	04-Jan-73	392.81	K-20	10-Sep-71	389.83
B3-1	11-Apr-73	394.29	K-20	10-Mar-72	389.22
B3-1	06-Jul-73	392.49	K-20	13-Jul-72	396.59
B3-1	15-Aug-73	393.26	K-20	02-Oct-72	389.34
B3-1	17-Jan-74	393.63	K-20	04-Jan-73	388.59
B3-1	26-Apr-74	398.39	K-20	11-Apr-73	388.45
B3-1	06-May-74	398.39	K-20	06-Jul-73	385.98
B3-1	22-Jul-74	398.64	K-20	13-Aug-73	387.91
B3-1	23-Jul-74	398.64	K-20	27-Aug-73	386.93
B3-1	15-Oct-74	393.68	K-20	12-Sep-73	386.67
B3-1	18-Oct-74	393.68	K-20	28-Sep-73	386.17
B3-1	08-Jan-75	393.56	K-20	11-Oct-73	386.62
B3-1	14-Apr-75	394.88	K-20	06-May-74	391.76
B3-1	19-Oct-87	393.07	K-20	23-Jul-74	392.86
B3-1	21-Jan-88	394.57	K-20	18-Oct-74	389.10
B3-1	04-Apr-88	392.37	K-20	08-Jan-75	387.90
B3-1	07-Feb-89	395.39	K-20	14-Apr-75	389.03
B3-1	13-Feb-89	394.23	K-20	18-Apr-76	389.03
B3-1	21-Mar-89	391.84	K-20	18-Mar-87	386.75
B3-1	22-May-89	396.78	K-20	25-Mar-87	386.91
B3-1	01-Aug-89	391.24	K-20	23-Apr-87	387.37
B3-1	24-Jan-90	394.56	K-20	28-Jul-87	386.99
B3-1	01-Mar-90	395.57	K-20	16-Feb-89	388.75
K-20	30-Dec-57	415.17	K-20	01-Mar-90	389.37
K-20	27-Dec-62	417.87	K-20	09-Apr-90	389.82
K-20	10-Dec-63	418.96			
K-20	22-Jul-64	418.90			
K-20	18-Dec-64	417.84			
K-20	16-Jul-65	403.83			
K-20	17-Aug-65	406.44			
K-20	21-Sep-65	411.06			
K-20	19-Oct-65	418.02			
K-20	27-Dec-65	404.64			
K-20	03-Mar-66	406.49			
K-20	13-Apr-66	398.35			
K-20	18-May-66	415.51			
K-20	27-Jul-66	405.63			
K-20	19-Oct-66	415.77			
K-20	29-Dec-66	405.99			
K-20	06-Apr-67	407.79			
K-20	19-Jun-67	414.63			
K-20	12-Oct-67	417.48			
K-20	19-Oct-67	416.87			
K-20	05-Mar-68	413.50			
K-20	04-Jun-68	409.94			
K-20	23-Apr-69	414.69			
K-20	06-May-70	397.37			

Data are plotted in Figure 4-10.

Table B-6: 100 Areas Water Levels - December, 1990 (sheet 1 of 2).

Well	Average Head December, 1990	Well	Average Head December, 1990
D2-5	386.70	N-39	388.17
D5-12	385.31	N-4	388.87
D8-3	383.80	N-40	387.72
F5-1	373.68	N-41	386.95
H3-1	376.76	N-42	387.38
H3-2A	376.71	N-44	388.68
H3-2B	376.72	N-49	387.02
H3-2C	376.73	N-51	387.22
H4-10	376.54	N-52	390.37
H4-11	376.07	N-54	388.48
H4-12A	376.20	N-55	388.50
H4-12B	376.40	N-56	387.91
H4-12C	376.22	N-57	389.49
H4-13	376.06	N-59	389.77
H4-14	376.43	N-6	389.97
H4-15A	376.48	N-60	389.79
H4-15B	376.48	N-62	390.35
H4-16	375.95	N-63	390.00
H4-17	376.49	N-64	389.59
H4-18	376.24	N-65	389.17
H4-3	376.02	N-66	389.03
H4-4	376.21	N-67	387.65
H4-5	376.29	N-8S	387.97
H4-6	376.64	101-48B	380.90
H4-7	376.28	57-83A	433.03
H4-8	376.36	59-32	362.54
H4-9	376.16	59-58	402.09
N-14	386.90	59-80B	429.04
N-16	388.71	60-32	362.35
N-17	387.71	60-60	402.83
N-18	387.51	61-37	382.06
N-19	387.88	61-41	396.26
N-2	387.96	61-62	402.73
N-20	388.15	61-66	401.90
N-21	388.11	62-31	362.28
N-23	387.75	62-43A	396.64
N-25	388.05	63-51	400.37
N-26	387.99	63-58	401.61
N-27	389.62	63-90	399.36
N-28	390.20	64-62	401.33
N-29	390.18	65-50	400.40
N-3	387.96	65-59A	401.29
N-31	389.22	65-72	399.59
N-32	389.30	65-83	398.73
N-33	389.09	66-23	363.33
N-34	389.52	66-38	402.43
		66-64	400.70

Table B-6: 100 Areas Water Levels - December, 1990 (sheet 2 of 2).

Well	Average Head December, 1990
68-105	398.64
69-38	402.44
70-68	399.81
71-52	399.80
71-77	397.81
72-73	397.94
72-92	400.95
73-61	399.82
74-44	396.83
77-36	376.06
81-58	395.35
86-42	384.80
87-55	387.60
88-41	382.37
89-35	372.92
90-34	372.69
90-45	384.91
91-37	374.45
96-49	382.51
97-43	379.64
97-51A	382.70
99-42	377.46

Data are plotted in Figures 4-11 and 4-16.

Table B-7. Groundwater Levels in Well N-2.

Well	Date	Head	Well	Date	Head
N-2	23-Oct-64	397.36	N-2	14-Apr-75	397.86
N-2	05-Jan-65	403.05	N-2	22-Dec-86	392.33
N-2	16-Jul-65	406.88	N-2	06-Jan-87	392.38
N-2	17-Aug-65	406.40	N-2	15-Jan-87	392.66
N-2	21-Sep-65	407.63	N-2	29-Feb-88	391.19
N-2	18-Oct-65	404.70	N-2	24-Mar-88	391.00
N-2	27-Dec-65	407.58	N-2	23-May-88	390.69
N-2	23-Feb-66	396.81	N-2	24-Jun-88	390.34
N-2	04-Mar-66	404.05	N-2	16-Sep-88	392.28
N-2	11-Apr-66	405.84	N-2	28-Oct-88	388.66
N-2	02-May-66	405.88	N-2	19-Dec-88	390.00
N-2	03-May-66	404.24	N-2	30-Jan-89	390.73
N-2	05-May-66	405.43	N-2	24-Feb-89	391.64
N-2	09-May-66	404.83	N-2	09-Mar-89	391.59
N-2	13-May-66	403.55	N-2	31-Mar-89	391.93
N-2	16-May-66	404.79	N-2	26-Apr-89	392.65
N-2	23-May-66	403.94	N-2	30-May-89	393.32
N-2	31-May-66	402.89	N-2	30-Jun-89	394.9
N-2	06-Jun-66	403.39	N-2	26-Jul-89	395.63
N-2	22-Jun-66	407.26	N-2	28-Jul-89	395.59
N-2	30-Jun-66	407.18	N-2	15-Aug-89	394.48
N-2	18-Jul-66	403.37	N-2	31-Aug-89	392.87
N-2	19-Oct-66	406.12	N-2	27-Sep-89	391.61
N-2	28-Dec-66	405.43	N-2	31-Oct-89	390.44
N-2	06-Apr-67	407.40	N-2	21-Dec-89	390.13
N-2	16-Oct-67	401.57	N-2	02-Feb-90	390.33
N-2	13-Dec-67	403.29	N-2	28-Mar-90	389.82
N-2	17-Jan-68	405.42	N-2	24-Apr-90	389.37
N-2	07-Mar-68	406.08	N-2	30-May-90	389.28
N-2	24-Apr-69	404.32	N-2	22-Jun-90	391.56
N-2	06-May-70	402.16	N-2	30-Jul-90	389.06
N-2	10-Sep-71	404.44	N-2	30-Aug-90	388.22
N-2	14-Mar-72	403.26	N-2	26-Sep-90	386.95
N-2	13-Jul-72	405.40	N-2	30-Oct-90	386.27
N-2	06-Oct-72	404.55	N-2	29-Nov-90	387.52
N-2	04-Jan-73	402.07	N-2	20-Dec-90	387.96
N-2	11-Apr-73	400.78	N-2	30-Jan-91	388.84
N-2	05-Jul-73	400.94	N-2	27-Feb-91	388.28
N-2	13-Aug-73	402.76	N-2	28-Mar-91	389.08
N-2	27-Aug-73	401.02	N-2	26-Apr-91	389.34
N-2	13-Sep-73	400.18	N-2	30-May-91	390.24
N-2	28-Sep-73	401.06	N-2	25-Jun-91	389.47
N-2	15-Oct-73	402.17	N-2	31-Jul-91	388.66
N-2	06-May-74	401.23	N-2	28-Aug-91	388.14
N-2	23-Jul-74	399.96	N-2	20-Sep-91	386.85
N-2	18-Oct-74	398.47			
N-2	08-Jan-75	399.39			

Data are plotted in Figure 4-12.

Table B-8: 100-N and Vicinity Water Levels - Sept. 1965

Well	Average Head Sept., 1965	Well	Average Head Sept., 1965
D2-5	393.92	N-5	405.86
D5-12	394.53	73-61	405.66
K-11	404.74	74-44	397.18
K-13	405.92*	74-48	401.08
K-20	411.06	77-54	399.96
N-1	405.96	78-62	409.86
N-2	407.63	81-58	399.81
N-3	400.71	83-47	392.08
N-4	407.84		

* calculated from an estimated casing elevation.

Data are plotted in Figure 4-14.

Table B-9: 100-N and Vicinity Water Levels - June 1989.

Well	Average Head June, 1989	Well	Average Head June, 1989
D2-5	386.64	N-53	403.42
K-11	395.21	N-54	397.82
N-14	393.28	N-55	397.81
N-16	397.45	N-56	396.51
N-17	393.98	N-57	399.46
N-18	390.51	N-58	398.39
N-19	391.54	N-59	397.64
N-2	394.90	N-6	406.51
N-20	393.90	N-60	397.93
N-21	392.75	N-61	400.52
N-23	389.56	N-62	404.69
N-24	386.55	N-63	403.01
N-25	384.52	N-64	401.55
N-27	412.09	N-65	401.24
N-28	406.95	N-66	403.67
N-29	407.36	N-67	395.73
N-3	393.64	N-8S	385.87
N-31	408.48	73-61	400.11
N-32	410.86	74-44	397.03
N-33	406.75	74-48	398.96
N-34	407.08	77-54	398.08
N-36	410.77	78-62	396.13
N-37	408.44	81-58	397.20
N-39	407.24	83-47	389.15
N-4	400.88	86-42	384.76
N-40	405.22	87-55	389.08
N-41	399.69	88-41	382.29
N-42	399.35	90-45	384.69
N-44	406.77	92-49	383.57
N-49	401.85		
N-51	385.40		
N-52	403.94		

Data are plotted in Figure 4-15.

Table B-10. Water Levels in Wells D5-12, D8-3, and H3-1 (sheet 1 of 5).

Well	Date	Head	Well	Date	Head
D5-12	09-Dec-60	394.37	D5-12	25-May-67	400.25
D5-12	22-Mar-61	394.23	D5-12	29-May-67	400.25
D5-12	23-Jun-61	395.61	D5-12	05-Jun-67	400.19
D5-12	11-Dec-61	395.00	D5-12	08-Jun-67	400.38
D5-12	21-Feb-62	395.07	D5-12	12-Jun-67	400.75
D5-12	05-Jul-62	395.09	D5-12	15-Jun-67	401.00
D5-12	07-Jan-63	395.69	D5-12	19-Jun-67	401.28
D5-12	22-Jul-63	395.63	D5-12	22-Jun-67	401.43
D5-12	10-Dec-63	395.32	D5-12	26-Jun-67	401.63
D5-12	22-Jul-64	396.69	D5-12	29-Jun-67	401.50
D5-12	31-Dec-64	396.22	D5-12	03-Jul-67	401.09
D5-12	13-Jul-65	395.25	D5-12	06-Jul-67	400.68
D5-12	16-Jul-65	395.82	D5-12	10-Jul-67	399.97
D5-12	17-Aug-65	395.33	D5-12	13-Jul-67	399.56
D5-12	21-Sep-65	394.53	D5-12	17-Jul-67	399.04
D5-12	19-Oct-65	394.36	D5-12	20-Jul-67	398.70
D5-12	28-Dec-65	394.49	D5-12	25-Jul-67	398.09
D5-12	03-Mar-66	393.84	D5-12	01-Aug-67	397.30
D5-12	13-Apr-66	394.00	D5-12	07-Aug-67	396.67
D5-12	18-May-66	393.39	D5-12	14-Aug-67	396.54
D5-12	18-Jul-66	394.34	D5-12	21-Aug-67	395.48
D5-12	19-Oct-66	394.31	D5-12	28-Aug-67	393.97
D5-12	28-Dec-66	394.28	D5-12	06-Sep-67	394.27
D5-12	23-Feb-67	395.01	D5-12	11-Sep-67	394.01
D5-12	02-Mar-67	394.87	D5-12	19-Sep-67	393.48
D5-12	06-Mar-67	394.61	D5-12	25-Sep-67	393.13
D5-12	09-Mar-67	394.51	D5-12	09-Oct-67	392.40
D5-12	13-Mar-67	394.72	D5-12	17-Oct-67	392.26
D5-12	16-Mar-67	394.86	D5-12	08-Nov-67	391.25
D5-12	20-Mar-67	395.03	D5-12	29-Nov-67	390.51
D5-12	23-Mar-67	395.15	D5-12	05-Mar-68	388.37
D5-12	27-Mar-67	395.25	D5-12	24-Apr-69	388.48
D5-12	30-Mar-67	395.23	D5-12	07-May-70	386.79
D5-12	03-Apr-67	395.56	D5-12	19-May-70	386.65
D5-12	06-Apr-67	395.91	D5-12	09-Sep-71	387.99
D5-12	10-Apr-67	396.62	D5-12	14-Mar-72	385.94
D5-12	13-Apr-67	397.03	D5-12	13-Jul-72	388.77
D5-12	17-Apr-67	397.71	D5-12	19-Oct-72	387.88
D5-12	20-Apr-67	398.00	D5-12	05-Jan-73	386.56
D5-12	24-Apr-67	398.50	D5-12	11-Apr-73	385.94
D5-12	27-Apr-67	398.82	D5-12	11-Jul-73	383.93
D5-12	01-May-67	398.94	D5-12	13-Aug-73	385.41
D5-12	04-May-67	398.98	D5-12	27-Aug-73	385.38
D5-12	08-May-67	399.11	D5-12	13-Sep-73	385.29
D5-12	11-May-67	399.38	D5-12	28-Sep-73	385.21
D5-12	15-May-67	399.78	D5-12	15-Oct-73	385.11
D5-12	18-May-67	400.03			
D5-12	22-May-67	400.29			

Table B-10. Water Levels in Wells D5-12, D8-3, and H3-1 (sheet 2 of 5).

Well	Date	Head	Well	Date	Head
D5-12	06-May-74	384.46	D8-3	07-Jul-52	390.76
D5-12	23-Jul-74	387.42	D8-3	11-Jul-52	389.71
D5-12	18-Oct-74	386.79	D8-3	14-Jul-52	389.12
D5-12	08-Jan-75	385.76	D8-3	18-Jul-52	391.48
D5-12	14-Apr-75	386.21	D8-3	21-Jul-52	389.57
D5-12	07-Jul-75	386.29	D8-3	25-Jul-52	390.70
D5-12	25-Mar-87	385.76	D8-3	28-Jul-52	390.74
D5-12	21-Apr-87	385.57	D8-3	01-Aug-52	390.16
D5-12	30-Jul-87	385.89	D8-3	04-Aug-52	389.36
D5-12	06-Mar-90	385.42	D8-3	08-Aug-52	391.31
D5-12	08-Mar-90	385.33	D8-3	11-Aug-52	390.58
D5-12	22-Mar-90	385.43	D8-3	15-Aug-52	392.44
D5-12	05-Apr-90	385.53	D8-3	18-Aug-52	390.75
D5-12	19-Apr-90	385.62	D8-3	22-Aug-52	389.61
D5-12	03-May-90	385.65	D8-3	26-Aug-52	387.57
D5-12	17-May-90	385.70	D8-3	29-Aug-52	387.38
D5-12	31-May-90	385.70	D8-3	02-Sep-52	386.76
D5-12	14-Jun-90	385.80	D8-3	05-Sep-52	386.12
D5-12	28-Jun-90	386.07	D8-3	08-Sep-52	393.02
D5-12	12-Jul-90	386.21	D8-3	12-Sep-52	391.45
D5-12	26-Jul-90	386.37	D8-3	15-Sep-52	391.30
D5-12	09-Aug-90	386.48	D8-3	19-Sep-52	392.96
D5-12	23-Aug-90	386.39	D8-3	23-Sep-52	389.30
D5-12	06-Sep-90	386.22	D8-3	26-Sep-52	388.06
D5-12	20-Sep-90	386.04	D8-3	29-Sep-52	387.26
D5-12	04-Oct-90	385.82	D8-3	03-Oct-52	387.16
D5-12	18-Oct-90	385.61	D8-3	06-Oct-52	387.07
D5-12	01-Nov-90	385.42	D8-3	13-Oct-52	386.97
D5-12	14-Nov-90	385.29	D8-3	17-Oct-52	389.53
D5-12	28-Nov-90	385.18	D8-3	20-Oct-52	391.08
D5-12	12-Dec-90	385.29	D8-3	24-Oct-52	388.93
D5-12	21-Dec-90	385.33	D8-3	28-Oct-52	387.53
D5-12	09-Jan-91	385.62	D8-3	31-Oct-52	388.16
D5-12	23-Jan-91	385.79	D8-3	04-Nov-52	387.56
D5-12	21-Feb-91	386.02	D8-3	07-Nov-52	387.31
D5-12	15-Mar-91	386.14	D8-3	10-Nov-52	388.55
D5-12	17-Apr-91	386.38	D8-3	21-Nov-52	388.42
D5-12	17-May-91	386.50	D8-3	24-Nov-52	388.66
D5-12	26-Jun-91	386.73	D8-3	05-Dec-52	386.94
D5-12	29-Jul-91	386.73	D8-3	08-Dec-52	387.46
D5-12	23-Aug-91	386.55	D8-3	12-Dec-52	393.66
D5-12	24-Sep-91	386.29	D8-3	15-Dec-52	392.66
D8-3	16-Jun-52	390.98	D8-3	19-Dec-52	393.36
D8-3	20-Jun-52	393.65	D8-3	22-Dec-52	392.46
D8-3	23-Jun-52	391.47	D8-3	26-Dec-52	391.68
D8-3	26-Jun-52	390.13	D8-3	29-Dec-52	389.46
D8-3	30-Jun-52	389.57	D8-3	02-Jan-53	388.26
			D8-3	06-Jan-53	389.46

Table B-10. Water Levels in Wells D5-12, D8-3, and H3-1 (sheet 3 of 5).

Well	Date	Head	Well	Date	Head
D8-3	09-Jan-53	389.91	D8-3	14-Jun-90	386.69
D8-3	15-Jan-53	389.16	D8-3	28-Jun-90	386.49
D8-3	21-Jan-53	387.62	D8-3	12-Jul-90	386.04
D8-3	29-Jan-53	406.03	D8-3	26-Jul-90	383.87
D8-3	03-Jul-53	389.59	D8-3	09-Aug-90	383.34
D8-3	16-Mar-67	408.11	D8-3	23-Aug-90	382.57
D8-3	27-Mar-67	415.11	D8-3	06-Sep-90	381.52
D8-3	30-Mar-67	412.56	D8-3	20-Sep-90	380.95
D8-3	03-Apr-67	418.64	D8-3	04-Oct-90	381.08
D8-3	06-Apr-67	417.82	D8-3	18-Oct-90	380.84
D8-3	10-Apr-67	417.28	D8-3	01-Nov-90	380.93
D8-3	13-Apr-67	417.29	D8-3	14-Nov-90	381.79
D8-3	17-Apr-67	418.01	D8-3	29-Nov-90	383.52
D8-3	20-Apr-67	417.67	D8-3	12-Dec-90	383.56
D8-3	24-Apr-67	416.89	D8-3	21-Dec-90	384.03
D8-3	27-Apr-67	415.20	D8-3	09-Jan-91	384.02
D8-3	01-May-67	415.43	D8-3	23-Jan-91	384.26
D8-3	04-May-67	417.02	D8-3	21-Feb-91	384.55
D8-3	08-May-67	418.01	D8-3	15-Mar-91	384.72
D8-3	11-May-67	417.39	D8-3	17-Apr-91	385.16
D8-3	15-May-67	416.93	D8-3	17-May-91	384.74
D8-3	18-May-67	416.54	D8-3	26-Jun-91	384.98
D8-3	22-May-67	414.60	D8-3	29-Jul-91	383.89
D8-3	25-May-67	415.70	D8-3	23-Aug-91	383.76
D8-3	29-May-67	417.35	D8-3	24-Sep-91	381.49
D8-3	05-Jun-67	417.74	H3-1	22-Feb-62	382.92
D8-3	08-Jun-67	417.49	H3-1	07-Jan-63	383.03
D8-3	12-Jun-67	417.29	H3-1	23-Jul-63	385.05
D8-3	15-Jun-67	416.94	H3-1	11-Dec-63	383.45
D8-3	19-Jun-67	416.60	H3-1	22-Jul-64	387.54
D8-3	22-Jun-67	416.38	H3-1	31-Dec-64	384.24
D8-3	26-Jun-67	416.07	H3-1	13-Jul-65	382.87
D8-3	29-Jun-67	406.38	H3-1	16-Jul-65	383.75
D8-3	23-Jul-74	386.23	H3-1	17-Aug-65	382.20
D8-3	18-Oct-74	382.10	H3-1	21-Sep-65	380.79
D8-3	08-Jan-75	382.38	H3-1	19-Oct-65	379.89
D8-3	14-Apr-75	382.12	H3-1	28-Dec-65	378.62
D8-3	07-Jul-75	383.59	H3-1	03-Mar-66	377.96
D8-3	21-Apr-87	381.41	H3-1	13-Apr-66	377.66
D8-3	30-Jul-87	381.21	H3-1	18-May-66	377.95
D8-3	08-Mar-90	383.24	H3-1	19-Jul-66	380.90
D8-3	22-Mar-90	383.49	H3-1	19-Oct-66	378.87
D8-3	05-Apr-90	384.05	H3-1	28-Dec-66	377.94
D8-3	19-Apr-90	383.30	H3-1	28-Mar-67	377.50
D8-3	03-May-90	383.89	H3-1	17-Oct-67	380.63
D8-3	17-May-90	383.81	H3-1	07-Mar-68	378.34
D8-3	31-May-90	383.83	H3-1	17-Jan-69	377.47

Table B-10. Water Levels in Wells D5-12, D8-3, and H3-1 (sheet 4 of 5).

Well	Date	Head	Well	Date	Head
H3-1	24-Apr-69	377.91	H3-1	25-Feb-86	376.00
H3-1	07-May-70	376.60	H3-1	24-Mar-86	376.03
H3-1	09-Sep-71	379.08	H3-1	25-Apr-86	376.37
H3-1	14-Mar-72	377.73	H3-1	28-May-86	376.70
H3-1	13-Jul-72	381.03	H3-1	17-Jun-86	376.80
H3-1	19-Oct-72	379.29	H3-1	26-Jun-86	376.85
H3-1	05-Jan-73	378.05	H3-1	01-Jul-86	376.75
H3-1	11-Apr-73	377.27	H3-1	15-Jul-86	376.65
H3-1	12-Jul-73	376.64	H3-1	29-Jul-86	376.74
H3-1	13-Aug-73	376.70	H3-1	21-Aug-86	376.63
H3-1	27-Aug-73	376.65	H3-1	26-Aug-86	376.60
H3-1	13-Sep-73	376.56	H3-1	16-Sep-86	376.40
H3-1	28-Sep-73	376.46	H3-1	23-Sep-86	376.33
H3-1	15-Oct-73	376.34	H3-1	07-Oct-86	376.17
H3-1	06-May-74	377.87	H3-1	23-Oct-86	375.92
H3-1	23-Jul-74	379.77	H3-1	24-Oct-86	376.01
H3-1	18-Oct-74	378.35	H3-1	04-Nov-86	375.94
H3-1	08-Jan-75	377.35	H3-1	19-Nov-86	375.97
H3-1	14-Apr-75	377.48	H3-1	20-Nov-86	375.95
H3-1	07-Jul-75	377.80	H3-1	05-Dec-86	375.91
H3-1	03-Dec-75	376.55	H3-1	11-Dec-86	375.89
H3-1	15-Jun-76	378.11	H3-1	19-Dec-86	375.92
H3-1	08-Dec-76	377.69	H3-1	12-Jan-87	375.89
H3-1	01-Jul-77	376.24	H3-1	13-Jan-87	375.90
H3-1	07-Dec-77	375.69	H3-1	28-Jan-87	376.10
H3-1	01-Jun-78	376.74	H3-1	10-Feb-87	376.08
H3-1	01-Dec-78	376.43	H3-1	19-Feb-87	376.02
H3-1	01-Dec-79	376.01	H3-1	05-Mar-87	375.96
H3-1	01-Jun-80	376.67	H3-1	10-Mar-87	375.95
H3-1	01-Dec-80	376.20	H3-1	24-Mar-87	375.82
H3-1	01-Jun-81	377.63	H3-1	08-Apr-87	375.75
H3-1	01-Dec-81	377.66	H3-1	10-Apr-87	375.74
H3-1	01-Jun-82	378.63	H3-1	14-Apr-87	375.73
H3-1	01-Dec-82	377.98	H3-1	01-May-87	375.70
H3-1	01-Jun-83	378.94	H3-1	13-May-87	375.82
H3-1	01-Dec-83	378.44	H3-1	27-May-87	376.13
H3-1	01-Jun-84	377.89	H3-1	16-Jun-87	375.96
H3-1	01-Dec-84	377.07	H3-1	01-Jul-87	376.35
H3-1	17-Jun-85	376.89	H3-1	13-Jul-87	376.28
H3-1	24-Jun-85	376.93	H3-1	15-Jul-87	376.26
H3-1	01-Aug-85	376.68	H3-1	29-Jul-87	376.14
H3-1	27-Aug-85	376.52	H3-1	12-Aug-87	376.05
H3-1	03-Oct-85	376.18	H3-1	14-Aug-87	376.03
H3-1	31-Oct-85	376.04	H3-1	25-Aug-87	375.96
H3-1	13-Dec-85	376.72	H3-1	09-Sep-87	375.86
H3-1	17-Dec-85	376.14	H3-1	17-Sep-87	375.76
H3-1	22-Jan-86	376.15	H3-1	23-Sep-87	375.77

Table B-10. Water Levels in Wells D5-12, D8-3, and H3-1 (sheet 5 of 5).

Well	Date	Head	Well	Date	Head
H3-1	07-Oct-87	375.73	H3-1	15-Jan-90	375.60
H3-1	21-Oct-87	375.70	H3-1	25-Jan-90	375.65
H3-1	04-Nov-87	375.69	H3-1	14-Feb-90	375.80
H3-1	18-Nov-87	375.53	H3-1	28-Feb-90	375.95
H3-1	02-Dec-87	375.59	H3-1	16-Mar-90	376.08
H3-1	09-Dec-87	375.61	H3-1	30-Mar-90	376.18
H3-1	16-Dec-87	375.60	H3-1	16-Apr-90	376.38
H3-1	28-Dec-87	375.75	H3-1	17-Apr-90	376.39
H3-1	30-Dec-87	375.68	H3-1	30-Apr-90	376.46
H3-1	20-Jan-88	375.82	H3-1	15-May-90	376.62
H3-1	03-Feb-88	375.87	H3-1	31-May-90	376.74
H3-1	19-Feb-88	375.89	H3-1	07-Jun-90	376.84
H3-1	27-Apr-88	375.44	H3-1	14-Jun-90	377.05
H3-1	17-Jun-88	375.77	H3-1	28-Jun-90	377.66
H3-1	17-Aug-88	375.54	H3-1	16-Jul-90	378.07
H3-1	12-Sep-88	375.37	H3-1	27-Jul-90	377.96
H3-1	27-Oct-88	375.30	H3-1	15-Aug-90	377.64
H3-1	29-Nov-88	375.47	H3-1	29-Aug-90	377.44
H3-1	06-Dec-88	375.51	H3-1	14-Sep-90	377.19
H3-1	14-Dec-88	375.58	H3-1	28-Sep-90	376.98
H3-1	06-Jan-89	375.79	H3-1	15-Oct-90	376.74
H3-1	31-Jan-89	375.97	H3-1	31-Oct-90	376.56
H3-1	15-Feb-89	376.05	H3-1	15-Nov-90	376.41
H3-1	28-Feb-89	376.03	H3-1	30-Nov-90	376.45
H3-1	16-Mar-89	375.92	H3-1	13-Dec-90	376.74
H3-1	30-Mar-89	375.76	H3-1	14-Dec-90	376.67
H3-1	14-Apr-89	375.62	H3-1	31-Dec-90	376.87
H3-1	28-Apr-89	375.55	H3-1	15-Jan-91	376.99
H3-1	15-May-89	375.79	H3-1	30-Jan-91	377.11
H3-1	24-May-89	375.93	H3-1	14-Feb-91	377.25
H3-1	31-May-89	376.14	H3-1	28-Feb-91	377.31
H3-1	02-Jun-89	376.18	H3-1	14-Mar-91	377.41
H3-1	16-Jun-89	376.39	H3-1	27-Mar-91	377.58
H3-1	29-Jun-89	376.33	H3-1	11-Apr-91	377.71
H3-1	14-Jul-89	376.19	H3-1	30-Apr-91	377.93
H3-1	31-Jul-89	376.02	H3-1	16-May-91	378.03
H3-1	15-Aug-89	375.86	H3-1	29-May-91	378.19
H3-1	30-Aug-89	375.73	H3-1	04-Jun-91	378.33
H3-1	15-Sep-89	375.62	H3-1	06-Jun-91	377.40
H3-1	28-Sep-89	375.49	H3-1	14-Jun-91	378.67
H3-1	17-Oct-89	375.39	H3-1	20-Jun-91	378.77
H3-1	30-Oct-89	375.34	H3-1	26-Jul-91	378.63
H3-1	14-Nov-89	375.34	H3-1	23-Aug-91	378.34
H3-1	29-Nov-89	375.38	H3-1	19-Sep-91	377.90
H3-1	05-Dec-89	375.40			
H3-1	14-Dec-89	375.45			
H3-1	29-Dec-89	375.54			

Data are plotted in Figure 4-18.

Table B-11. 100-D and 100-H Area Groundwater Levels: 1967.

Well	Average head Mar-Apr 1967
D2-5	392.88
D5-12	396.02
D8-2	405.50
D8-3	415.87
H3-1	377.50
H4-2	400.53
N-2	407.40
N-3	398.86
N-8S	390.02
89-35	370.64
90-45	389.71
92-49	394.33
96-49	392.92
97-43	381.73
97-47	391.99
97-51A	388.28

Data are plotted in Figure 4-19.

APPENDIX C:

GROUNDWATER CHEMISTRY DATA

The figures in Chapter 5 were constructed from the data in Tables C-1 through C-10. These data were extracted from a copy of the Hanford Groundwater Database that is maintained by the Geosciences Group of Westinghouse Hanford Company.

Well numbers in the following tables are abbreviated: e.g., 199-N-2 was written N-2; 699-65-60 was written 65-50.

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Table C-1. Maximum Gross Alpha Activity in Groundwater (pCi/L).

Area	1988	1989	1990
100-B/C	3.23*	3.33*	3.48*
100-K	2.23*	0.0729*	3.02*
100-N	9.34	7.51	2.2*
100-D	2.02*	1.17*	2.31*
100-H	162	133	81
100-F	10.8	---	52.8

* reported value is less than the contractual detection limit of 4.0 pCi/L.
--- = no data.
Data are plotted in Figure 5-1.

Table C-2. Maximum Gross Beta Activity in Groundwater (pCi/L).

Area	1988	1989	1990
100-B/C	179	105	113
100-K	40.6	29.8	27.6
100-N	40800	39000	16500
100-D	80.7	94.7	38.1
100-H	733	250	113
100-F	521	271	533

Contractual detection limit = 8.0 pCi/L.
Data are plotted in Figure 5-2.

Table C-3. Gross Beta Activity in Groundwater -- 1990.

Well	Average of Result (pCi/L)	Well	Average of Result (pCi/L)
B3-1	113.00	K-19	27.60
B4-1	41.50	K-20	25.60
B4-2	43.80	K-22	8.72
B4-3	48.60	K-27	21.00
B4-4	63.10	K-28	6.31*
B5-1	20.00	K-29	3.67*
B9-1	18.90	K-30	3.80*
D2-5	3.43*	N-14	2100.00
D5-12	38.10	N-2	3320.00
D8-3	14.20	N-27	574.00
F5-1	50.70	N-29	2170.00
F5-3	533.00	N-3	680.00
F5-4	3.08*	N-31	119.00
F5-6	7.29*	N-32	42.30
F7-1	7.74*	N-33	370.00
F8-1	15.00	N-39	851.00
F8-2	14.50	N-4	31.35
H3-1	3.83*	N-41	12.20
H3-2A	4.44*	N-42	13.50
H4-10	4.10*	N-52	7.23*
H4-11	65.30	N-58	3.18*
H4-12B	8.93	N-59	3.30*
H4-13	57.85	N-60	3.36*
H4-14	4.17*	N-61	.59*
H4-15A	5.15*	N-66	67.80
H4-15B	4.45*	N-67	16500.00
H4-16	22.30	56-53	43.00
H4-17	10.20	61-62	67.60
H4-18	14.00	61-66	5.69*
H4-3	91.16	66-103	1.98*
H4-4	45.30	78-62	6.26*
H4-5	4.25*	81-58	2.55*
H4-6	6.33*		
H4-7	8.89		
H4-8	12.50		
H4-9	16.69		
K-11	5.96*		

* Reported value is less than the contractual detection limit of 8.0 pCi/L.
Data are plotted in Figure 5-3.

Table C-4. Maximum Tritium Concentration in Groundwater (nCi/L).

Area	1988	1989	1990
100-B/C	49.7	42.9	4.57
100-K	1220	882	823
100-N	459	218	260
100-D	33.5	53.3	32.3
100-H	10.2	10.3	--
100-F	9.55	13.5	9.52

Contractual detection limit = 0.5 nCi/L.
-- = no data
Data are plotted in Table 5-4.

Table C-5a. Tritium Activity in Groundwater -- 1990

Well	Average of Result (pCi/L)	Well	Average of Result (pCi/L)
B3-1	3980	N-41	8380
B4-1	4570	N-42	9500
B4-2	3330	N-52	41500
B4-3	3140	N-58	239*
B4-4	3120	N-59	24*
B5-1	2090	N-60	144*
B9-1	2310	N-61	234*
D2-5	32300	N-66	43400
D5-12	29300	N-67	47400
D8-3	3180	101-48B	57*
F5-1	70*	56-43	21*
F5-3	883	56-53	-29*
F5-4	9520	57-29A	373*
F5-6	1450	59-58	1110
F7-1	407*	59-80B	-19*
F8-1	3860	60-57	194*
F8-2	2200	60-60	5660
K-11	3670	61-62	7350
K-19	2690	61-66	121*
K-20	754	64-62	7260
K-22	536	65-50	1220
K-27	134000	65-72	4010
K-28	1860	65-83	961
K-29	9730	66-103	302*
K-30	823000	66-64	6100
N-14	43500	68-105	-93*
N-2	60000	69-38	53*
N-27	194000	70-68	2270
N-29	60650	71-77	1770
N-3	25100	72-73	2310
N-31	260000	72-92	1270
N-32	129000	78-62	-44*
N-33	208000	81-58	353*
N-4	43550	87-55	52800
		90-45	1590
		97-43	10300
		97-51A	10600

* Reported value is less than the contractual detection limit of 500 pCi/L.
Negative values occur when measured value is less than background measurement.
Data are plotted in Figure 5-5.

Table C-5b. Tritium Activity in Groundwater -- 1989.

Well	Average of Result (pCi/L)	Well	Average of Result (pCi/L)
H3-1	2780	H4-4	1149
H4-10	2029	H4-5	1960
H4-11	1344	H4-6	5170
H4-14	1300	H4-7	3890
H4-16	612	H4-8	3350
H4-17	3890	H4-9	2165
H4-18	1490	89-35	553
H4-3	2670		

* Reported value is less than the contractual detection limit of 500 pCi/L.
Negative values occur when measured value is less than background measurement.
Data are plotted in Figure 5-5.

Table C-6. Tritium Concentration in Wells in Gable Gap.

Well	Date	Result (pCi/L)	Well	Date	Result (pCi/L)
59-58	08-Jun-73	5600	59-58	27-Nov-85	840
59-58	09-Jul-73	4400	59-58	20-Mar-86	1100
59-58	16-Jan-74	4600	59-58	11-Jun-86	470*
59-58	01-May-74	4700	59-58	18-Aug-86	730
59-58	09-Jul-74	3800	59-58	12-Dec-86	688
59-58	30-Oct-74	4300	59-58	30-Jan-87	951
59-58	02-Jan-75	4800	59-58	26-Apr-87	709
59-58	30-Apr-75	4000	59-58	09-Jul-87	766
59-58	02-Jul-75	3500	59-58	21-Dec-87	652
59-58	03-Nov-75	4500	59-58	06-Mar-88	751
59-58	02-Jan-76	2800	59-58	26-Apr-88	800
59-58	03-May-76	3800	59-58	19-Jul-88	530
59-58	29-Jun-76	4800	59-58	10-Nov-88	442
59-58	03-Nov-76	2700	59-58	03-Apr-89	894
59-58	03-Feb-77	740	59-58	27-Apr-90	1110
59-58	28-Apr-77	2800	60-57	08-Jun-73	2200
59-58	26-Jul-77	4700	60-57	09-Jul-73	1600
59-58	07-Nov-77	3600	60-57	31-Oct-73	2300
59-58	24-Feb-78	3700	60-57	16-Jan-74	2000
59-58	18-May-78	2600	60-57	01-May-74	2000
59-58	31-May-78	2600	60-57	09-Jul-74	1800
59-58	09-Aug-78	2200	60-57	30-Oct-74	840
59-58	03-Nov-78	2600	60-57	02-Jan-75	1300
59-58	28-Feb-79	2500	60-57	30-Apr-75	480*
59-58	21-May-79	2900	60-57	02-Jul-75	810
59-58	06-Aug-79	2600	60-57	03-Nov-75	2600
59-58	30-Oct-79	3200	60-57	02-Jan-76	2900
59-58	29-Feb-80	2900	60-57	03-May-76	1700
59-58	14-May-80	2300	60-57	29-Jun-76	1100
59-58	08-Aug-80	2800	60-57	03-Nov-76	1100
59-58	07-Nov-80	1800	60-57	03-Feb-77	1800
59-58	23-Feb-81	2500	60-57	28-Apr-77	1900
59-58	14-May-81	2300	60-57	26-Jul-77	2000
59-58	03-Nov-81	2100	60-57	07-Nov-77	2300
59-58	22-Jan-82	2100	60-57	24-Feb-78	3100
59-58	19-Apr-82	2000	60-57	31-May-78	1300
59-58	05-Oct-82	1500	60-57	09-Aug-78	1500
59-58	19-Jan-83	1600	60-57	03-Nov-78	1500
59-58	13-Apr-83	1800	60-57	28-Feb-79	2200
59-58	11-Jul-83	1300	60-57	21-May-79	2000
59-58	05-Oct-83	1300	60-57	06-Aug-79	900
59-58	18-Jan-84	1400	60-57	31-Oct-79	2000
59-58	08-May-84	980	60-57	29-Feb-80	1600
59-58	02-Aug-84	1200	60-57	14-May-80	1600
59-58	03-Oct-84	920	60-57	08-Aug-80	900
59-58	21-Jan-85	1600	60-57	07-Nov-80	700
59-58	28-May-85	910	60-57	23-Feb-81	800
59-58	02-Nov-85	1400	60-57	14-May-81	1800
			60-57	26-Aug-81	1500

Table C-6. Tritium Concentration in Wells in Gable Gap (cont.).

Well	Date	Result (pCi/L)	Well	Date	Result (pCi/L)
60-57	09-Mar-82	1200	61-62	26-Jul-77	2800
61-62	03-May-76	2900	61-62	07-Nov-77	2600
61-62	29-Jun-76	2900	61-62	03-Mar-78	3600
61-62	03-Nov-76	1900	61-62	18-May-78	4400
61-62	03-Feb-77	1700	61-62	09-Aug-78	3200
60-57	19-Apr-82	1200	61-62	07-Nov-78	5000
60-57	05-Oct-82	480*	61-62	28-Feb-79	5900
60-57	18-Jan-83	880	61-62	17-May-79	6500
60-57	13-Apr-83	1100	61-62	06-Aug-79	7200
60-57	11-Jul-83	640	61-62	31-Oct-79	8000
60-57	05-Oct-83	1100	61-62	29-Feb-80	9500
60-57	18-Jan-84	830	61-62	29-May-80	7800
60-57	08-May-84	230*	61-62	06-Aug-80	8400
60-57	02-Aug-84	1300	61-62	07-Nov-80	8000
60-57	21-Mar-85	0*	61-62	20-May-81	8500
60-57	03-Aug-85	820	61-62	26-Aug-81	8600
60-57	22-Oct-85	360*	61-62	03-Nov-81	8900
60-57	12-Dec-85	440*	61-62	24-Feb-82	8500
60-57	26-Mar-86	1200	61-62	11-May-82	8600
60-57	11-Jun-86	380*	61-62	29-Oct-82	7200
60-57	20-Sep-86	670	61-62	19-Jan-83	9100
60-57	12-Dec-86	582	61-62	13-Apr-83	9300
60-57	04-Feb-87	412*	61-62	11-Jul-83	8700
60-57	26-Apr-87	515	61-62	05-Oct-83	9400
60-57	23-Aug-87	616	61-62	18-Jan-84	8700
60-57	08-Nov-87	614	61-62	08-May-84	8700
60-57	22-Feb-88	495*	61-62	02-Aug-84	9200
60-57	26-Apr-88	505	61-62	02-Nov-84	7900
60-57	19-Jul-88	479*	61-62	21-Mar-85	8000
60-57	15-Nov-88	227*	61-62	03-Aug-85	8400
60-57	03-Apr-89	483*	61-62	08-Nov-85	8600
60-57	27-Apr-90	194*	61-62	04-Dec-85	8300
61-62	08-Jun-73	2300	61-62	26-Mar-86	8200
61-62	09-Jul-73	2100	61-62	28-May-86	8600
61-62	31-Oct-73	2600	61-62	18-Aug-86	8780
61-62	16-Jan-74	2300	61-62	05-Nov-86	8640
61-62	01-May-74	2400	61-62	30-Jan-87	9470
61-62	09-Jul-74	2200	61-62	26-Apr-87	8420
61-62	30-Oct-74	2900	61-62	20-Aug-87	9240
61-62	02-Jan-75	1900	61-62	08-Nov-87	9110
61-62	30-Apr-75	1300	61-62	22-Feb-88	9550
61-62	02-Jul-75	1800	61-62	26-Apr-88	9190
61-62	03-Nov-75	2300	61-62	21-Jul-88	8970
61-62	02-Jan-76	2900	61-62	15-Nov-88	8820
61-62	28-Apr-77	2400	61-62	04-Apr-89	8540
			61-62	04-Jan-90	7350

* Reported value is less than the contractual detection limit of 500 pCi/L.
Data are plotted in Figure 5-6.

Table C-7. Maximum Nitrate Concentration in Groundwater (ppm).

Area	1988	1989	1990
100-B/C	28.5	48.4	33.3
100-K	86.8	66	42.3
100-N	67.1	38.8	24.9
100-D	109	122	118
100-H	663	524	240
100-F	244	167	134

Contractual detection limit = 0.5 ppm
Data are plotted in Figure 5-7.

Table C-8. Nitrate Concentration in Groundwater -- 1990.

Well	Average of Result (ppb)	Well	Average of Result (ppb)
B3-1	33300	K-30	42300
B4-1	16700	N-14	7600
B4-2	17700	N-16	700
B4-3	15750	N-17	4300
B4-4	19300	N-2	8700
B5-1	13200	N-21	6800
B9-1	24300	N-24	6100
D2-5	54800	N-26	24900
D5-12	118000	N-27	6700
D8-3	109000	N-29	7100
F5-1	2100	N-3	7800
F5-3	7150	N-31	4600
F5-4	74100	N-32	3200
F5-6	14300	N-33	6100
F7-1	91000	N-39	7900
F8-1	106000	N-4	6600
F8-2	131000	N-41	1400
H3-1	14900	N-42	1600
H3-2A	26350	N-47	1100
H4-10	12300	N-52	13000
H4-11	42900	N-54	10100
H4-12B	40950	N-55	10450
H4-13	20350	N-56	8300
H4-14	15700	N-58	2200
H4-15A	29600	N-59	1750
H4-15B	23300	N-60	2500
H4-16	21800	N-61	2200
H4-17	58800	N-66	4500
H4-18	33000	N-67	7300
H4-3	193800	56-43	2500
H4-4	85240	56-53	<500
H4-5	47000	57-29A	3300
H4-6	38050	59-58	6800
H4-7	35200	59-80B	2500
H4-8	39800	60-57	<500
H4-9	45620	60-60	1500
K-11	31900	61-62	43200
K-19	35500	61-66	4900
K-20	16000	66-103	2500
K-22	4900	78-62	10000
K-27	5100	80-43P	2500
K-28	21400	80-43Q	2500
K-29	9500	80-43R	2500
		80-43S	5000
		81-58	2750

Contractual detection limit = 500 ppb; <500 = no detected nitrate.
Data are plotted in Figure 5-8.

Table C-9. Maximum Chromium Concentration in Groundwater (ppb).

Area	1988	1989	1990
100-B/C	36	25	49
100-K	106	160	157
100-N	39	42	24
100-D	112	692	464
100-H	474	420	359
100-F	17	13	14

Contractual detection limit = 10 ppb.
Data are plotted in Figure 5-9.

Table C-10. Chromium Concentration in Groundwater -- 1990.

Well	Average of Result ppb	Well	Average of Result ppb
B3-1	17.0	K-20	156.0
B4-1	<10.0	K-22	157.0
B4-2	25.0	K-27	<10.0
B4-3	13.0	K-28	<10.0
B4-4	12.0	K-29	<10.0
B5-1	14.0	K-30	<10.0
B9-1	13.0	N-14	<10.0
D2-5	120.0	N-16	<10.0
D5-12	464.0	N-17	<10.0
D8-3	146.0	N-2	<10.0
F5-1	<10.0	N-21	<10.0
F5-3	<10.0	N-24	<10.0
F5-4	14.0	N-27	<10.0
F7-1	<10.0	N-29	<10.0
F8-1	<10.0	N-3	<10.0
F8-2	<10.0	N-31	<10.0
H3-1	10.5	N-32	<10.0
H3-2A	77.3	N-33	16.8
H4-10	52.0	N-4	<10.0
H4-11	145.5	N-41	<10.0
H4-12B	79.5	N-42	<10.0
H4-13	66.5	N-47	<10.0
H4-14	358.5	N-52	<10.0
H4-15A	112.5	N-54	<10.0
H4-15B	106.5	N-55	11.5
H4-16	38.5	N-56	<10.0
H4-17	100.0	N-58	<10.0
H4-18	143.5	N-59	10.8
H4-3	136.4	N-60	12.0
H4-4	90.5	N-61	10.5
H4-5	86.2	N-66	<10.0
H4-6	68.8	N-67	14.0
H4-7	133.5	57-29A	<10.0
H4-8	111.5	59-58	<10.0
H4-9	102.3	60-57	<10.0
K-11	25.0	78-62	65.5
K-19	109.0	81-58	<10.0

Contractual detection limit = 10 ppb.
<10.0 = no detected chromium.
Data are plotted in Figure 5-10.

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