RELATION BETWEEN GROUNDWATER AND SURFACE WATER AT THE UNIVERSITY OF IDAHO GROUNDWATER RESEARCH SITE

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AUTHORIZATION TO SUBMIT

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ABSTRACT

The relation between surface water and groundwater must be considered when defining the hydrogeological characteristics of a basin. The purpose of this thesis is to characterize the surface-groundwater relation at the University of Idaho Groundwater Research Site (UIGRS), in the Pullman-Moscow basin, Washington and Idaho. Eighteen wells at the UIGRS; six wells are completed in alluvial sediments and broken basalts, and twelve at different depths and fracture zones in the Wanapum basalt. Two main fracture zones define two aquifers: the E-fractured and the W-fractured basalt aquifers. The surface-groundwater relation was defined by using qualitative analysis. The methodology used in this analysis was the interpretation of the water changes throughout a four-year period and on specific events using hydrographs of stream stage and groundwater levels, as well as precipitation.

The water level of the creek and the shallow and E-fractured basalt aquifer wells followed the same fluctuation pattern, whereas the W-fractured aquifer wells behaved in a different manner. The difference may be related to the barometric effect and/or to different sources of recharge. The character of the fluctuation for the shallow and E-fractured aquifer was defined by the distance from the creek and by the intensity and distribution of precipitation. During the summer and early fall, as well as often during maximum streamflow events, Paradise Creek may recharge the shallow and E-fractured basalt aquifers. The main source of water may be direct precipitation throughout the rest of the year.

It is suggested that continuous data recording and chemical data analyses would contribute valuable additional information about the recharge and discharge mechanisms of the Pullman-Moscow basin.

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1. INTRODUCTION

1.1. STATEMENT OF THE PROBLEM

The University of Idaho Groundwater Research Site (UIGRS) is located at the western edge of the University of Idaho campus, in the Pullman-Moscow basin in southeastern Washington and northwestern Idaho (Figure 1.1). Paradise Creek, which is a tributary of the South Fork of the Palouse River, flows east to west on the north side of the site. The UIGRS has been developed to study a shallow aquifer and the main aquifers within the Wanapum Basalt of the Yakima Subgroup of the Columbia River Basalt Group. Several studies have been done on the UIGRS in order to understand its geology and hydrogeology, including studies of the hydraulic behavior of the fractured Wanapum basalt aquifers (Li, 1991), and surface-groundwater relations (Ralston and Li, 1989; Patrick, 1990).

Discontinuous daily groundwater-level data and stream water-level data have been collected since the creation of the site in late 1987. These data have been analyzed for various purposes and in different ways in several graduate papers (Patrick, 1990; Li, 1991; Baines, 1992). However, a more detailed analysis of these data is necessary in order to define the recharge-discharge mechanism within the aquifers. One step toward achieving this is to determine qualitatively the relations between the aquifers and Paradise Creek; that will define whether the creek is a recharge source for the aquifers or a groundwater discharge point.

1.2. PURPOSE AND OBJECTIVES

The purpose of this study is to improve understanding of the groundwater recharge and discharge patterns at the UIGRS. The general objective is to characterize the relation between the shallow and Wanapum basalt aquifers at the UIGRS and Paradise Creek. The following is a list of specific objectives.

1) Collect groundwater-level data and Paradise Creek stages.

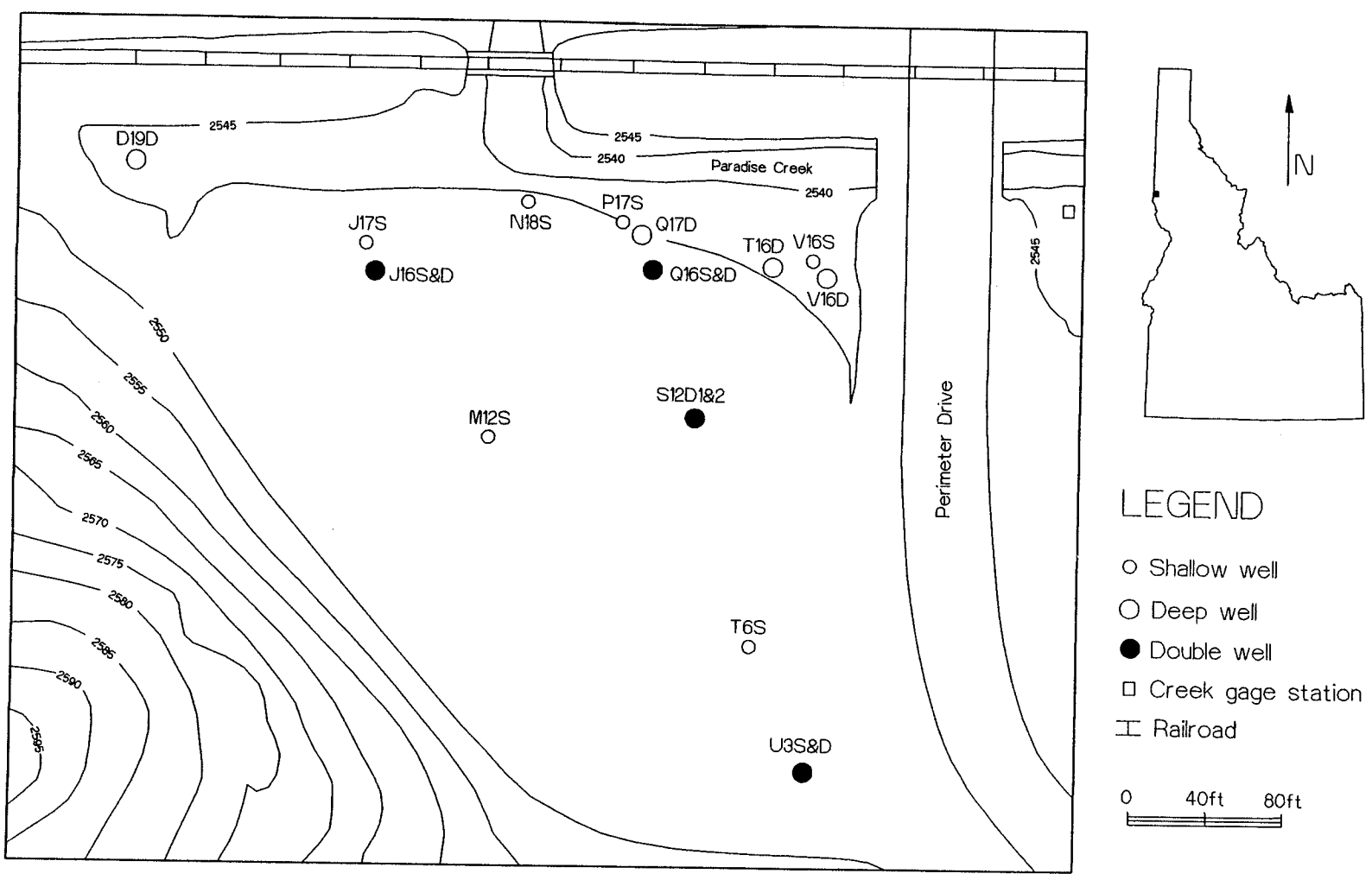

Figure 1.1. University of Idaho Groundwater Research Site plan view map.

2) Assemble a data base that includes groundwater levels, stream stage and precipitation for 1988-1992.

3) Analyze the relations between the water levels in the aquifers and the stages of Paradise Creek.

4) Discuss the results and present recommendations for future studies.

2. DESCRIPTION OF THE STUDY AREA

2.1. RESEARCH SITE DESCRIPTION

The UIGRS is located at the western edge of the University of Idaho Campus in section 12, T39N, R6W. The site is relatively flat with a moderate hill at its southwestern edge. Paradise Creek and Burlington Northern Railroad constitute the northern border of the site, and Perimeter Drive is its eastern boundary (Figure 2.1).

Paradise Creek is a tributary of the South Fork of the Palouse River which drains into the Snake River. The creek originates on Moscow Mountain and initially flows south; close to Moscow it changes direction and flows west. Paradise Creek data are collected via a United States Geological Survey (USGS) gage station located approximately 50 feet east of Perimeter Drive. Some characteristics of the watershed at the gage (Harenberg et al., 1991) are: (1) 17.7 square miles of drainage area; and (2) an average discharge based on a thirteen-year record of 6.73 cubic feet per second, with a maximum discharge for this period of 534 cubic feet per second and a minimum of 0.04 cubic feet per second.

Li (1991) reported in detail the UIGRS development with a complete description of the wells' construction and well logs. Table 2.1 summarizes the well information. Li (1991) defined three main phases in the site development:

Phase I: five deep wells (V16D, Q17D, T16D, D19D and S12D) were constructed in basalt in December 1987.

Phase II: five shallow wells (V16S, P17S, N18S, T6S and M12S) were constructed in sediments from April 1988 to April 1990.

Phase III: three deep wells and four shallow ones (Q16D, Q16S, U3D, U3S, J16D, J16S and J17S) were constructed in June 1990.

The first studies on the site (prior to Phase III) used a different well location nomenclature than the one that is currently used (Table 2.1). The latter is based on the spatial location of a well related to a 20 by 20 foot grid (Figure 2.1). The first letter on the well name corresponds to the location in the east-west direction (A to AB from west to east). After this letter, there is a number that tells the location in the north-south

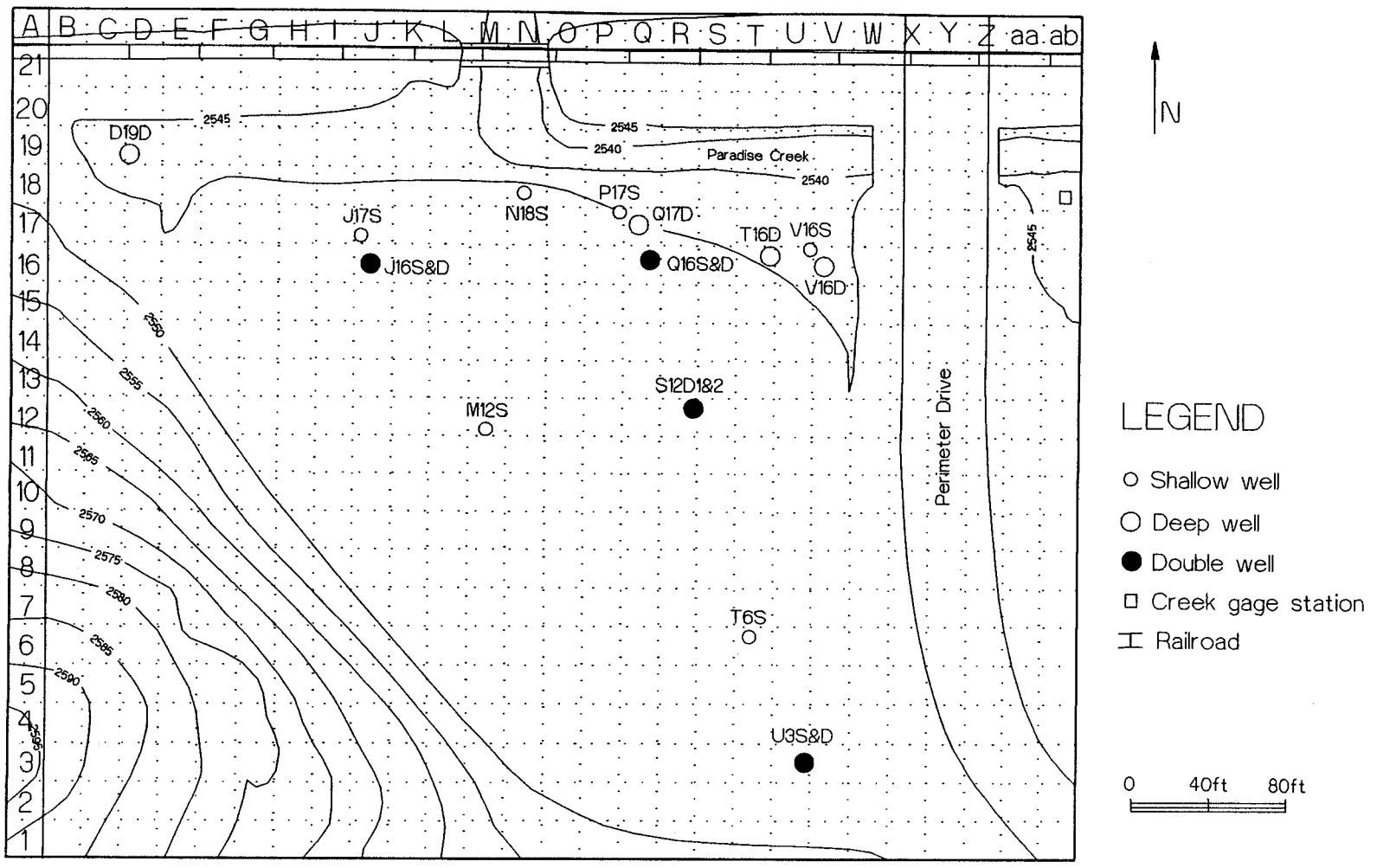

Figure 2.1. Grid map and nomenclature of the wells at the UIGRS.

WELL	TOP OF CASING ELEV. (feet)	TOTAL DEPTH (feet)	PERFORATION INTERVAL DEPTH (FEET)	WELL DIAMETER (inches)	DIST. FROM PARADISE CR. (feet)	LITHOLOGY COMPLETED IN	FORMER NAME
V16S	2544.86	12.0	11.5	1.0	50	sand & gravel	P-2
P17S	2546.27	12.0	11.5	1.0	25	coarse sand & gravel	P-1
N18S	2546.16	16.6	13.0-16.0	2.0	20	coarse sand w/ gravel & cobble	P-3
J17S	2545.50	16.0	14.0-16.0	2.0	95	medium to coarse sand w/ silty clay	
T6S	2546.50	15.0	13.0-15.0	2.0	245	coarse sand	T8S
M12S	2546.65	17.0	13.0-16.0	2.0	145	silty fine sand	H12S
Q16S	2545.10	80.0	26.0-27.0	1.25	50	broken basalt	
J16S	2545.60	68.0	19.0-20.0	1.25	100	broken basalt	
U3S	2547.65	83.0	33.0-34.0	1.25	310	broken basalt	
V16D	2544.41	71.0	63.5-68.5	4.0	55	basalt	1-A
Q17D	2546.95	102.0	76.0-79.0	4.0	30	basalt	1-B
Q16D	2545.10	80.0	70.0-72.5	4.0	50	basalt	
T16D	2545.24	82.0	65.0-69.0	4.0	50	basalt	1-E
S12D1	2546.93	148.3	119.0-126.5	1.5	125	basalt	1-D1
S12D2	2546.93	148.3	65.0-74.0	1.5	125	basalt	1-D2
J16D	2545.60	68.0	65.0-67.5	4.0	100	basalt	
U3D	2547.65	83.0	81.0-83.0	4.0	310	basalt	
D19D	2543.76	141.5	138.0-140.5	4.0	195	basalt	1-C

Table 2.1. Wells' description (based on Patrick [1990] and Li [1991]).

direction (1 to 21 from south to north). This is followed by the letters D or S which mean deep or shallow, respectively. If two deep or shallow wells are located in the same grid area, the number 1 or 2 is added at the end of the well name.

2.2. GEOLOGICAL SETTING

2.2.1. Regional Geology

The UIGRS is located in the Pullman-Moscow basin at the eastern edge of the Columbia Plateau within the Palouse Region. The following description of the geological characteristics of the region is based on Li (1991). Table 2.2. shows a summarized description of the geology of the Pullman-Moscow basin. The basement of the Pullman-Moscow basin consists of Cambrian orthoquartzite with Cretaceous granitic intrusions. These rocks are exposed on the ground surface in several places around the basin and in some isolated outcrops in the interior of the basin. These pre-Tertiary crystalline rocks are overlaid, with an irregular buried contact surface, by Miocene basalt interbeded with sediments. The thickness of the individual basalt flows ranges from a few feet to over several hundred feet; the most common thickness is between 50 and 100 feet. Thickness of the whole basalt sequence has been estimated at over 3000 feet in the western portion of the basin.

The basalt sequence is classified into the Wanapum and Grande Ronde Formations of the Yakima Basalt Subgroup of the Columbia River Basalt Group. The Wanapum Formation, which constitutes the uppermost section of the basalt sequence, is represented by the Priest Rapids Member. Its thickness ranges from zero to 250 feet. Most flows of this basalt sequence are absent in the basin. The Grande Ronde Formation consists of many flows and interbeded sediments. The thickness of this formation ranges from zero to 2500 feet with an increasing thickness from east to west. The average flow thickness of the Grande Ronde Formation is from 40 to 80 feet. The two formations are separated by a sedimentary interbed, the Vantage Member of the Miocene Ellensburg Formation. This member consists of claystone and shale; its thickness ranges from 5 to 10 feet. The sedimentary interbeds in the Wanapum and Grande Ronde Formations constitute a total thickness in the Moscow area of over 200 feet. These interbeds tend to be thinner to the

PERIOD	EPOCH	GROUP	SUBGROUP	FORMATION	K-Ar AGE (m-year)	MEMBER	STRATIGRAPHY	THICKNESS
Quaternary	Pleistocene/ Holocene	Surficial deposits				Stream Valley sediments	Alluvium	1-10 ft (0-3 m)
	Pleistocene			Palouse			Loess	0-250 ft (0-76 m)
Tertiary	Miocene	Columbia River Basalt Group	Yakima Basalt Subgroup	Wanapum Basalt	13.6-14.5	Priest Rapids	Lolo Flow w/ Rosalia Basalts	0-250 ft (0-76 m)
				Ellensburg interbeds		Vantage	Siltstone, claystone, tuffaceous rocks	5-10 ft (1.5-3 m)
				Grande Ronde Basalt	14.5-16.5		Many basalt flows	0-2500 ft (0-762 m)
Cretaceous					66-144		Granitic intrusives	
Cambrian					505-570		Orthoquartzite	

Table 2.2. Generalized Stratigraphic Section of the Pullman-Moscow Basin (from Li [1991]).

west of the basin and finer in grain size. The total thickness of the basalt sequence, calculated through geophysical methods, is 1300 feet near Moscow and more than 2000 feet near Pullman with an increase in thickness towards the western part of the basin (Lum et al., 1990). Three sets of cooling fractures of joints have been observed within the individual flows (Ralston and Li, 1989): columnar hexagonal joints with a width of 0.5 to 0.6 feet; vertical blocky joints with a diameter of 0.5 feet; and, horizontal platy fractures. With a dip of few degrees to the northwest (Lum et al., 1990), the basalt sequence is little deformed.

The Palouse Formation, overlying the basalt and covering the entire basin, consists of Pleistocene loess with quartz and feldspar composition; its thickness ranges from zero to several hundred feet. Along ancient and current stream channels are recent alluvial deposits that consist of loess, silt and clay, and sand and gravel formed from basalt, quartz, and granitoid rocks.

2.2.2. Geology of the University of Idaho Groundwater Research Site

Well logs at the UIGRS provide information about the geological characteristics of the site. Ralston and Li (1989) and Li (1991) described three main units (from top to bottom):

1) The first unit, Pleistocene sediments, is defined by two layers. The first layer consists of about 10 feet of loess soil and silty clay grading to silt at the top. The second layer, with a range of 2 to 10 feet thick, consists of sand with gravel lying below. These sediments are believed to be related to an ancient channel and tend to be thinner towards the south and southeast of the existing stream channel and finer in grain size. The second layer is absent at the west end of the site.

2) The second main unit consists of broken basalt (vesicular basalt rubble) and highly fractured basalt with a thickness that ranges from 6 to 16 feet. This unit is a part of the flow top of the Priest Rapids Flow.

3) The third unit consists of dark medium to very dense basalt with several fracture zones; this unit constitutes the interior of the Priest Rapids Flow. The fracture zones are intraflow structures and have thicknesses of 0.5 to 5 feet with significant lateral variation in thickness and depth.

The Lolo Basalt Flow of the Priest Rapids Member of the Wanapum Formation has been mapped in northern Idaho and eastern Washington. This flow is very thick (120 to 200 feet) and is divided in three parts based on its intraflow structures (Li, 1991). At the top, the flow is oxidized and has large frothy blocks and almost horizontal platy fractures at the top of the flow with some vesicular zones below. Alternating sequences of entablature and colonnade are in the middle of the flow. At the bottom are colonnade columns several feet in width. The interflow structures have significant horizontal variation and are vertically separated by sharp breaks with a dip of zero to 30 degrees.

2.3. HYDROGEOLOGICAL SETTING

2.3.1. Regional Hydrogeology

The Columbia Basalt Group is a complex, multiaquifer system in northern California, eastern Washington and Oregon, southern and western Idaho, and northern Nevada (Back et al., 1988). By the nature of its formational processes, basalt is heterogeneous and anisotropic. A median horizontal hydraulic conductivity of 2.1 feet per day has been estimated for the Grande Ronde Basalt and 5.25 feet per day for the Wanapum Basalt. The vertical hydraulic conductivity of the basalt is believed to range from $3.3*10^{-8}$ to 33 feet per day. Natural recharge to the basalt of northern Idaho and eastern Washington ranges from 0 to 9.8 inches per year, but generally is less than 1.97 inches per year. The chemical type of water in the Columbia River Basalt Group varies from calcium-magnesium bicarbonate to sodium-potassium bicarbonate.

In the Pullman-Moscow basin there are three main units, as have been described by Lum et al. (1990). The uppermost unit is loess, which constitutes an unconfined aquifer with short-term water-level fluctuations due to precipitation. Underlying the loess is basalt (divided into the Wanapum Basalt Formation and the Grande Ronde Formation), which is a major producing aquifer in the basin. Most of the water occurs in fracture zones near the tops and bottoms of the basalt flow. Near Moscow, sandy interbeds can also be an important source of water. Crystalline and metamorphic rocks that constitute the basement of the basin are less permeable than basalt and yield water only for stock and domestic use.

Lum et al. (1990) described the main hydrogeological characteristics of the Pullman-Moscow basin. Water movement is both vertical and lateral in the loess and the Wanapum and Grande Ronde basalts; the dominant flow direction is from east to west. The vertical movement of the water in the basalts is controlled by fractures and interbeds. The water level is lower in the Grande Ronde than in the Wanapum basalts; therefore the flow is downward. Water level decline in the Grande Ronde in the Pullman-Moscow area has occurred because of pumpage. The water pumped for municipal use is mostly from the Grande Ronde (97% of the total). Total water pumped in 1985 was 910,000 cubic feet per day. Pumpage was predominantly from the Wanapum basalts in Moscow prior to 1965, and the water levels have since recovered several tens of feet. The water level in the loess aquifer fluctuates with precipitation cycles and without significant changes in the water level in the last decades.

Foxworthy and Washburn (1963) suggested that the main source of recharge for the upper aquifers in the Pullman-Moscow basin is precipitation. Williams and Allman (1969) reported that optimal conditions exist for recharge of the groundwater in the Pullman-Moscow basin because of the low intensity of precipitation and of the fact that most of the precipitation happens during the period of minimum evapotranspiration.

The Snake and Palouse Rivers are groundwater discharge areas for the regional flow of the Grande Ronde Basalt. The Wanapum and loess discharge to small streams in local groundwater systems (Lum et al., 1990).

2.3.2. Hydrogeology of the University of Idaho Groundwater Research Site

Three main aquifers have been described within the upper 160 feet of the subsurface at the UIGRS by Li (1991). These aquifers were delineated by several methods: 1) logging of rock cutting while wells were drilled at the site together with the examination of the drilling penetration rate and water yield capacity; 2) examination of the basalt outcrops located along the Pullman-Moscow highway west of the UIGRS; 3) borehole geophysical logging of the wells; 4) aquifer tests; 5) static groundwater level measurements and analysis; and, 6) "in situ" microbial ecology analysis. Table 2.3 shows a summary of the characteristics of these aquifers, and a cross-section of the site is presented in Figure 2.2.

The first, the shallow alluvial aquifer, is composed of sand, gravel, broken basalt and basalt rubble. The aquifer ranges in depth from 15 to 30 feet; it is unconfined and has a saturated thickness of 5 to 10 feet that decreases from north to south and from northeast to southwest. The maximum yield capacity of the shallow alluvial aquifer is estimated to be 1 to 2 gallons per minute.

The water-level elevation of this aquifer is slightly higher than the water-level elevation of Paradise Creek. The shallow alluvial aquifer is recharged directly from infiltration of precipitation and snowmelt through the soil; discharge from this zone occurs laterally to Paradise Creek and vertically down to the basalt aquifers.

The wells completed in this aquifer are V16S, P17S, N18S, J17S, T6S, M12S, Q16S, J16S and U3S. All wells were completed in alluvial sediments with the exception of the last three, completed in broken basalt (see Figure 2.1 and Table 2.1).

The second aquifer, the E-fractured basalt aquifer, occurs in the northeast portion of the site at a depth of 65 to 75 feet and has a thickness of 1 to 3 feet. This is the major fracture that forms the horizontal break between the entablature and colonnade of the Lolo basalt flow. This break is associated with a set of horizontal joints and an internal vesicular zone.

The E-fractured aquifer is heterogeneous and anisotropic and behaves like a porous medium during well-aquifer testing. Transmissivity ranges from 14 to 580 square feet per day with an average of 80 square feet per day. Storativity ranges from $2*10^{-5}$ to $5*10^{-4}$ with an average of $9*10^{-5}$. Yield capacity ranges from 7 to 50 gallons per minute with higher values towards the east and northeast. The specific capacity ranges from 0.3 to 3.3 gallons per minute per foot.

The water level elevation of the E-fractured basalt aquifer is slightly higher than the shallow aquifer and Paradise Creek. Recharge to the E-fractured basalt aquifer is from infiltration from the shallow alluvial aquifer off the UIGRS, and discharge may be downward through vertical fractures to deeper aquifers and upward to the shallow alluvial aquifer. The wells completed in this aquifer are V16D, Q17D, Q16D, T16D and S12D1 (see Figure 2.1 and Table 2.1).

Aquifer	Character	Depth (feet)	Thickness (feet)	Yield Capacity (gpm)	Specific Yield (gpm/ft)	Transmissivity (ft^2/day)	Storativity
SHALLOW ALLUVIAL	Unconfined Heterogeneous	20-30 (bottom)	5-10	1-2			
E-FRACTURED	Heterogeneous Anisotropic Confined	65-75	1-3	7-50	0.3-3.3	14-580	$2*10^{-5}$- $-5*10^{-4}$
W-FRACTURED	Heterogeneous Anisotropic Confined	70-85	0.5-1	max. 60	< 0.5	0.5-3	$5*10^{-7}$- $-5*10^{-5}$

Table 2.3. Summary of the hydrogeological characteristics of the UIGRS (data from Li [1991]).

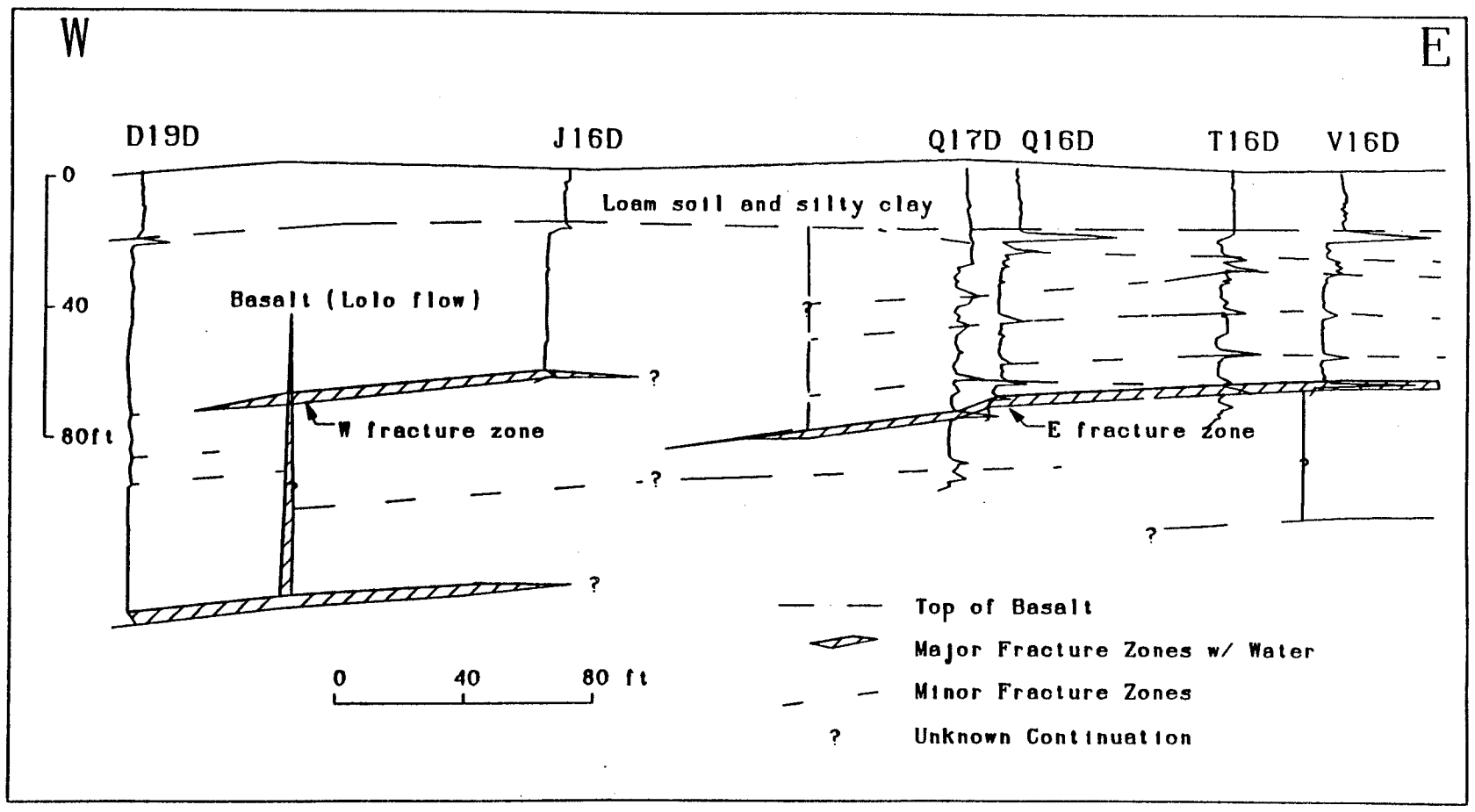

Figure 2.2. Cross-section with caliper logs along the north side of the UIGRS (from Li, 1991).

The third aquifer, the W-fractured basalt aquifer, occurs in the western and southern portion of the site at an average depth of 70 to 85 feet with a maximum of 135 feet in the west. The thickness of this aquifer ranges from 0.5 to 1 foot. The aquifer is formed by two horizontal fracture zones that probably correspond to intraflow breaks and are connected by columnar fractures.

The W-fractured aquifer is also heterogeneous and anisotropic and behaves as a double-porosity aquifer during well-aquifer testing. Transmissivity was estimated at 0.5 to 3 square feet per day. Storativity ranges from $5*10^{-7}$ to $5*10^{-5}$. Yield capacity is up to 60 gallons per minute with much greater drawdown than that in the E-fractured basalt aquifer. The maximum specific capacity is less than 0.5 gallons per minute per foot.

The water level in this aquifer is more than 10 feet lower than the E-fractured basalt aquifer. The sources of recharge are unknown, although there is some hydraulic connection with the E-fractured basalt aquifer through vertical fractures. Discharge occurs laterally to the southwest, following the regional flow direction, and there could be some downward flow. The wells completed in the W-fractured aquifer are S12D1, J16D, U3D, and D19D (see Figure 2.1 and Table 2.1).

Separating these three aquifers are two aquitards (Li, 1991). They consist of rock with minor intraflow fractures that have significant water storage as compared with the fractured aquifers. The aquitards are hydraulically connected with the aquifers through small joints. Interaquifer hydraulic connection leakage has been observed during aquifer tests.

The aquitard that separates the shallow alluvial aquifer and the E-fractured rock aquifer is observed mainly at the east portion of the site. It is believed to be an entablature section of the Lolo flow. The aquitard has minor fractures and vertical joints, and a thickness of approximately 40 feet. The aquitard located between E- and W-fractured basalt aquifers is possibly a section of colonnade of the flow. Another aquitard may be below the W-fractured basalt aquifer.

3. DATA DESCRIPTION

Three sets of data are used in the present study: aquifer water-levels, Paradise Creek stages, and precipitation.

3.1. AQUIFER WATER-LEVELS

Since the creation of the UIGRS in December 1987, University of Idaho graduate students have measured the static water-level in the wells on a discontinuous but often a daily basis. The levels have been measured from the top of the well casings using a steel tape. The tops of the casings were surveyed for the elevation above mean sea level (AMSL). The data collected were depth-to-water measurements converted into elevations by subtracting them from the elevations of the casing tops.

As described above, there were three drilling phases; therefore, the data collection started at different times in the various wells. The chronology of the data collection is shown in Table 3.1.

Table 3.2 shows an example of the depth-to-water of the shallow wells on different days during 1991. These days were chosen randomly but represent different seasons.

Some of the water-level data have been published: Patrick (1990) presented the data for 30 January 1990 to 3 May 1990; Li (1991) showed data from 28 December 1987 to 6 March 1991; in the present study, water-elevation data from 28 December 1987 to 16 May 1992 are used and are tabulated in Appendix A.

3.2. PARADISE CREEK STAGES

The second set of data is Paradise Creek stream stage collected from two sources. The USGS collects data from a stage gage station located approximately 100 feet east of Perimeter Drive (see Figure 1.1). The data are presented as daily streamflow data; they are available in yearly publications (Harenberg et al., 1989, 1990, 1991, 1992) and in a public-domain, computerized database. The other source of data is

WELL	DATE DATA COLLECTION STARTED
V16D Q17D D19D	28 Dec. 1987
T16D	22 Jan. 1988
V16S P17S	18 Apr. 1988
N18S	15 Sep. 1989
S12D1 S12D2	9 Jan. 1990
T6S M12S	9 May 1990
Q16D	21 May 1990
U3D	22 May 1990
J16D	23 May 1990
J17S	9 Jul. 1990
Q16S	30 Jul. 1990
U3S	7 Aug. 1990
J16S	11 Aug. 1990

Table 3.1. Chronology of the data collection.

	Feb. 2, 1991	Jul. 10, 1991	Dec. 24, 1991
U3S	5.55	6.93	8.04
V16S	7.21	8.01	8.02
T6S	8.39	10.16	10.19
P17S	9.18	10.00	10.02
J16S	8.97	10.33	10.19
N18S	9.23	10.03	10.02
M12S	9.02	10.58	10.31
J17S	8.92	10.42	10.33
Q16S	9.65	10.45	10.58
V16D	6.44	7.10	7.21
T16D	7.68	8.26	8.25
Q17D	8.43	9.12	9.15
Q16D	9.31	9.94	10.03
S12D1	11.97	13.39	14.07
D19D	26.73	30.68	18.83
J16D	29.29	29.69	21.03
S12D2	29.58	29.81	21.16
U3D	31.25	31.54	23.00

Table 3.2. Depth-to-water for the UIGRS wells, in feet.

a staff gage located in the stream below the bridge where Perimeter Drive crosses Paradise Creek. These data were collected as part of the well measurement program that started on 30 January 1990. Both the USGS gage station and the staff gage were equated to mean sea level based on a bench mark located close to the USGS station. These stream elevation data are tabulated in Appendix A.

When considering creek elevation, it is necessary to be aware of the gradient of the stream. Patrick (1990) reported that on 2 May 1990, the water elevation in the stage gage was 2537.17 feet, while 45 feet downstream from the stage gage it was 2536.08 feet, 150 feet downstream from the stage gage (north of well N18S) it was 2535.68 feet, and about 255 feet downstream from the stage gage it was 2535.65 feet. The difference in water elevation between the stage gage and the measurement point about 255 feet downstream (where Paradise Creek flows away from the site) is 1.52 feet. Since October 1992, the Paradise Creek elevation has been measured at the railroad bridge about 280 feet downstream from the stage gage. The site is measured at the same frequency as the wells and the stage gage. The measurement is made with a steel tape from the bridge. Accuracy of this measurement is poor in times of high wind. Table 3.3 shows the difference in water elevation between the stage gage and the railroad bridge over a short period of time.

3.3. PRECIPITATION

Daily precipitation data are available from the State Climatologist, Myron P. Molnau (College of Agriculture, University of Idaho). These data are given in water units and are measured in a container that collects the water and that has an antifreeze added. From the same source is available snowfall data (given in tenths of an inch of snow), and the depth of snow on the ground. Snow is collected in a different container from the one used for precipitation. Roy Patton, the Farm Operation Manager at the University of Idaho Sciences Farm, located about four miles east of the UIGRS, collects the precipitation, snowfall, and snow on the ground data (Kit Craine, 1993: personal communication). Precipitation data are tabulated in Appendix A.

	STAGE GAGE	RAILROAD BRIDGE	DIFFERENCE
30 Oct. 1992	2536.75	2535.01	1.74
6 Nov. 1992	2536.73	2534.86	1.87
9 Nov. 1992	2537.03	2534.96	2.07
13 Nov. 1992	2536.77	2534.56	2.21
16 Nov. 1992	2536.77	2534.56	2.21
18 Nov. 1992	2536.89	2534.76	2.13
22 Nov. 1992	2536.80	2534.66	2.14
23 Nov. 1992	2537.11	2535.06	1.74
25 Nov. 1992	2536.82	2534.71	2.11
28 Nov. 1992	2536.79	2534.61	2.18
2 Dec. 1992	2536.97	2534.96	2.01

Table 3.3. Example of the difference in elevation (in feet) of Paradise Creek between the stage gage and the railroad bridge.

4. DATA PRESENTATION

The data analysis consists of the description and interpretation of hydrographs of groundwater elevations, Paradise Creek elevation, and daily precipitation data. All these data, grouped in single years, were input into a spreadsheet program. Measurement or typing errors were corrected; data affected by pumping tests were eliminated because they do not represent undisturbed conditions. All these data were transferred to a graphics program in order to plot the necessary hydrographs. The graphs present time (in days) on the x-axis, and have a double-entrance y-axis, with water level elevations (in feet) on the left and precipitation (in inches per day) on the right.

A six-month scale was chosen for the hydrographs to represent the behavior of the system. These hydrographs show the seasonal fluctuations of the water level in the aquifers and the creek. The reason for representing six months instead of a year is that the graphics program used allows only 240 data in the x-axis. This problem could have been solved by switching to another computer program, but a whole-year scale would reduce readability. Therefore the six-month plots were judged to be appropriate for data analysis. All the available data were plotted with this scale. The graphs plotted are from 1 January to 30 June and 1 July to 31 December for the four years, 1988 through 1991. The year 1992 was not plotted; the water levels in the three aquifers were not static because of the drilling of a new well (the Idaho National Engineering Laboratory's well) in the UIGRS.

The semi-annual hydrographs show how the surface and groundwater levels behave throughout a year in relation to precipitation, snowmelt, evaporation, etc. By analyzing the hydrographs, it is possible to define different patterns in the relations among the aquifers, and the relations of the aquifers and the creek. Each semi-annual hydrograph is analyzed in detail in order to show these relations.

4.1. YEAR 1988

The 1988 data set is poor because few of the wells had been drilled at this time and also because the data were not measured as frequently as in later years. The wells from which data are available include:

V16S and P17S from the shallow aquifer;

V16D, T16D, and Q17D from the E-fractured aquifer; and,

D19D from the W-fractured aquifer.

There are no data for direct measurements of creek elevation for this year, although USGS streamflow data exist. The transformation of streamflow data into elevation data was not done; knowing the water level of the creek would not add information about surface-groundwater relations due to the scarcity of groundwater elevation data.

Well Q17D was completed 25 October 1988, approximately ten months after it was drilled. During this period Q17D was open both to the E-fractured and W-fractured aquifers. Thus, the hydrographs for Q17D and D19D are not representative of the behavior of these wells until completion.

All wells in the shallow and E-fractured aquifers follow the same fluctuation pattern. The W-fractured aquifer well D19D sometimes follows this same pattern, probably due to its connection with the E-fractured well through uncompleted well Q17D.

Before the completion of well Q17D, the wells' order based on groundwater elevation, from higher to lower, was V16D-V16S-T16D-P17S-Q17D. After the completion of Q17D, the order was V16D-V16S-T16D-Q17D-P17S. The water elevations in wells completed in the E-fractured and shallow aquifer were very similar throughout the year (around 0.60 feet for a given day). During most of the year, wells Q17D and Q16D presented slightly higher water elevations than their neighboring shallow wells, P17S and Q16S, respectively, and T16D was higher than its nearest shallow well, V16S.

Maximum water levels were reached during early spring, and minimum were reached during winter, as shown in Table 4.1. These data should be analyzed with

	MAXIMUM LEVEL (feet)	MINIMUM LEVEL (feet)	DIFFERENCE (feet)
V16D	2538.49 (1 Apr.)	2536.07 (8 Jan.)	2.42
V16S	2538.43[1] (29 Apr.)	2536.31[4] (1 Nov.)	2.12
T16D	2537.96 (1 Apr.)	2536.04[4] (13 Oct.)	1.92
Q17D	2536.17[2] (28 Mar.)	2533.77 (1 Jan.)	2.40
P17S	2537.33[1] (29 Apr.)	2535.85[4] (13 Oct.)	1.48
D19D	2527.81[3] (19 Sep.)	2519.85[3] (1 Nov.)	7.96[3]

[1] No data available for 1 April

[2] No data available for 1 April and 29 April

[3] Data affected by aquifers' interconnection

[4] No data available for January

Table 4.1. Maximum and minimum groundwater level during the year 1988.

caution because they are not absolute but relative maximum and minimum based on the data available. Wells in the E-fractured and shallow aquifer are expected to reach their maximum or minimum levels on similar dates. This information is unknown for the year 1988 because there is not a complete record of all wells. Analyzing the hydrographs for this year (Figures 4.1 and 4.2) without considering the extreme groundwater level values, it is noticeable that in general the groundwater levels were higher during winter and early spring and lower during summer.

4.2. YEAR 1989

The characteristics of the hydrographs for 1989 are very similar to those for 1988. The wells for which data are available include:

V16S, P17S, and N18S from the shallow aquifer;

V16D, T16D, and Q17D from the E-fractured aquifer; and,

D19D from the W-fractured aquifer.

The only well drilled and completed during this year is N18S (the data collection started on 15 September). S12D1 and S12D2 were drilled but their data collection did not start until the following year.

There are no data for direct measurements of creek elevation for 1989, although there are data for streamflow. The transformation of streamflow data into elevation data was not considered worthwhile, as was the case in 1988.

All wells in the shallow and E-fractured aquifer follow the same fluctuation pattern (Figures 4.3 and 4.4). The W-fractured aquifer well D19D follows this same pattern at times, although the peaks are smaller than for the upper aquifers. At other times, the well D19D hydrograph presents peaks that do not show up in the upper aquifers' hydrographs.

The order of the wells' groundwater elevation, from higher to lower, was: V16S-V16D-T16D-Q17D-P17S-N18S-D19D from 3 January to 27 April, and from 10 November to 29 December; and, V16D-V16S-T16D-Q17D-P17S-N18S-D19D from 30 April to 7 November. During the winter and early spring, the water level of V16S was

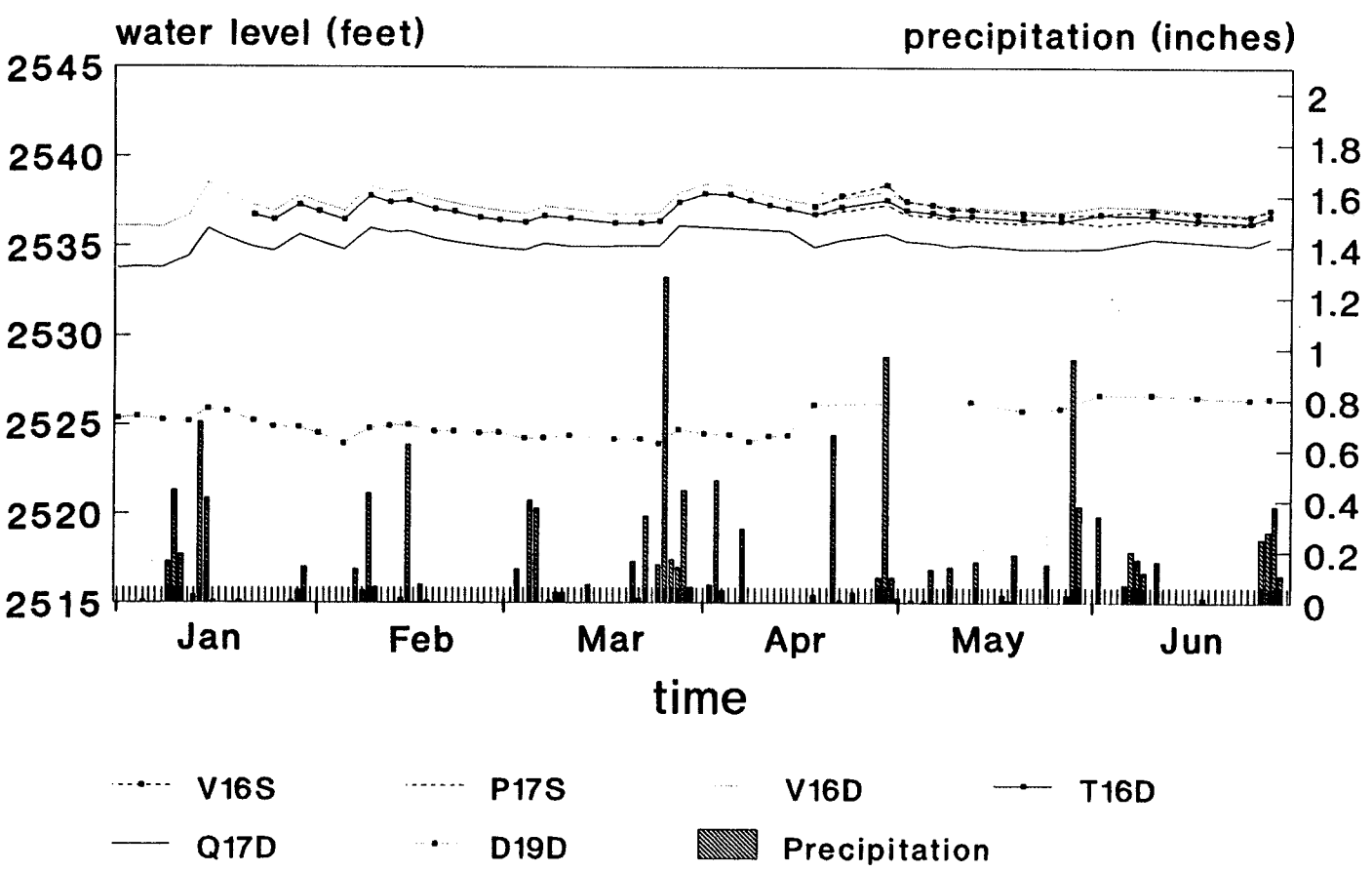

Figure 4.1. Daily precipitation and water-level hydrographs of Paradise Creek and all wells available for the first half of 1988.

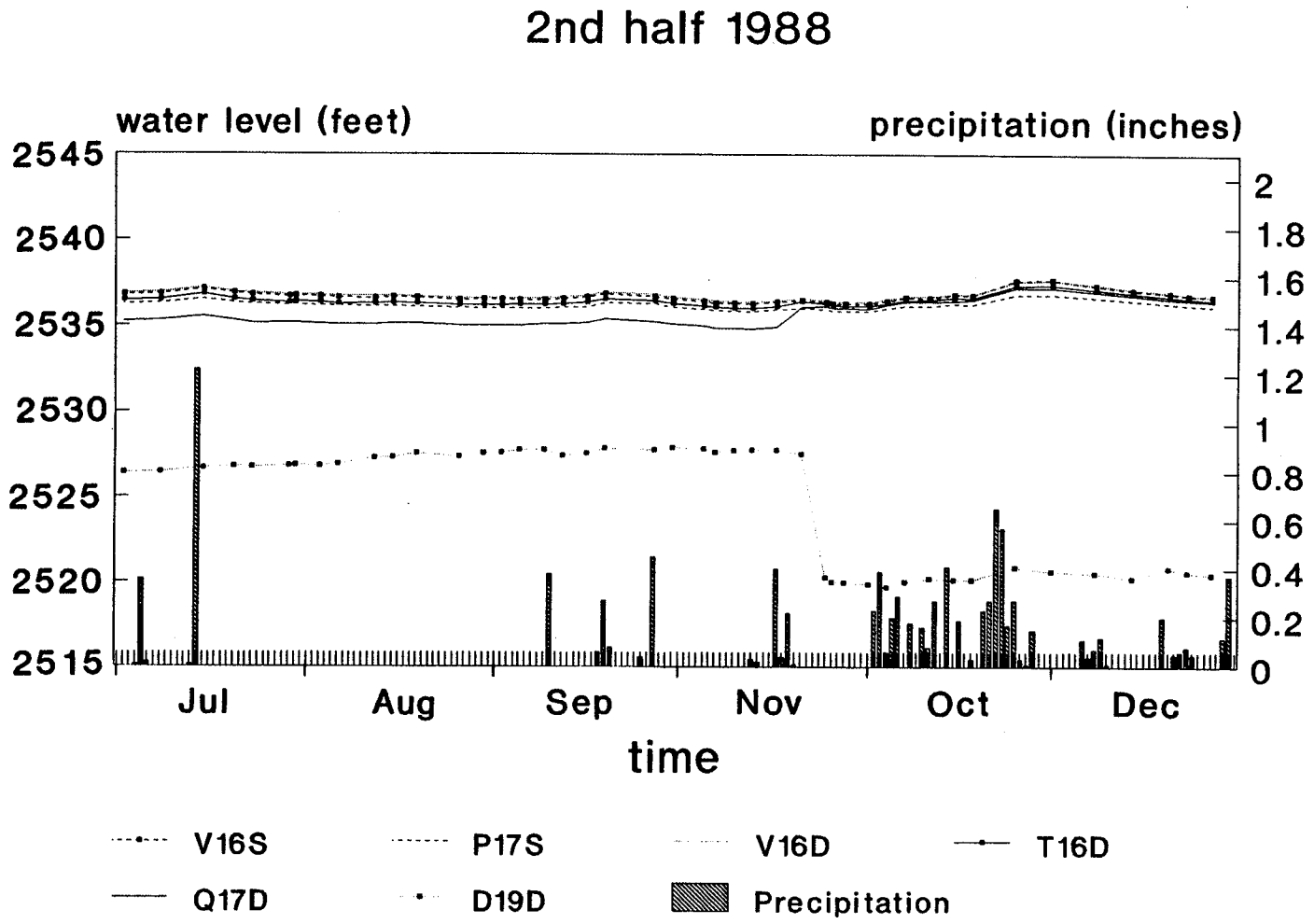

Figure 4.2. Daily precipitation and water-level hydrographs of Paradise Creek and all wells available for the second half of 1988.

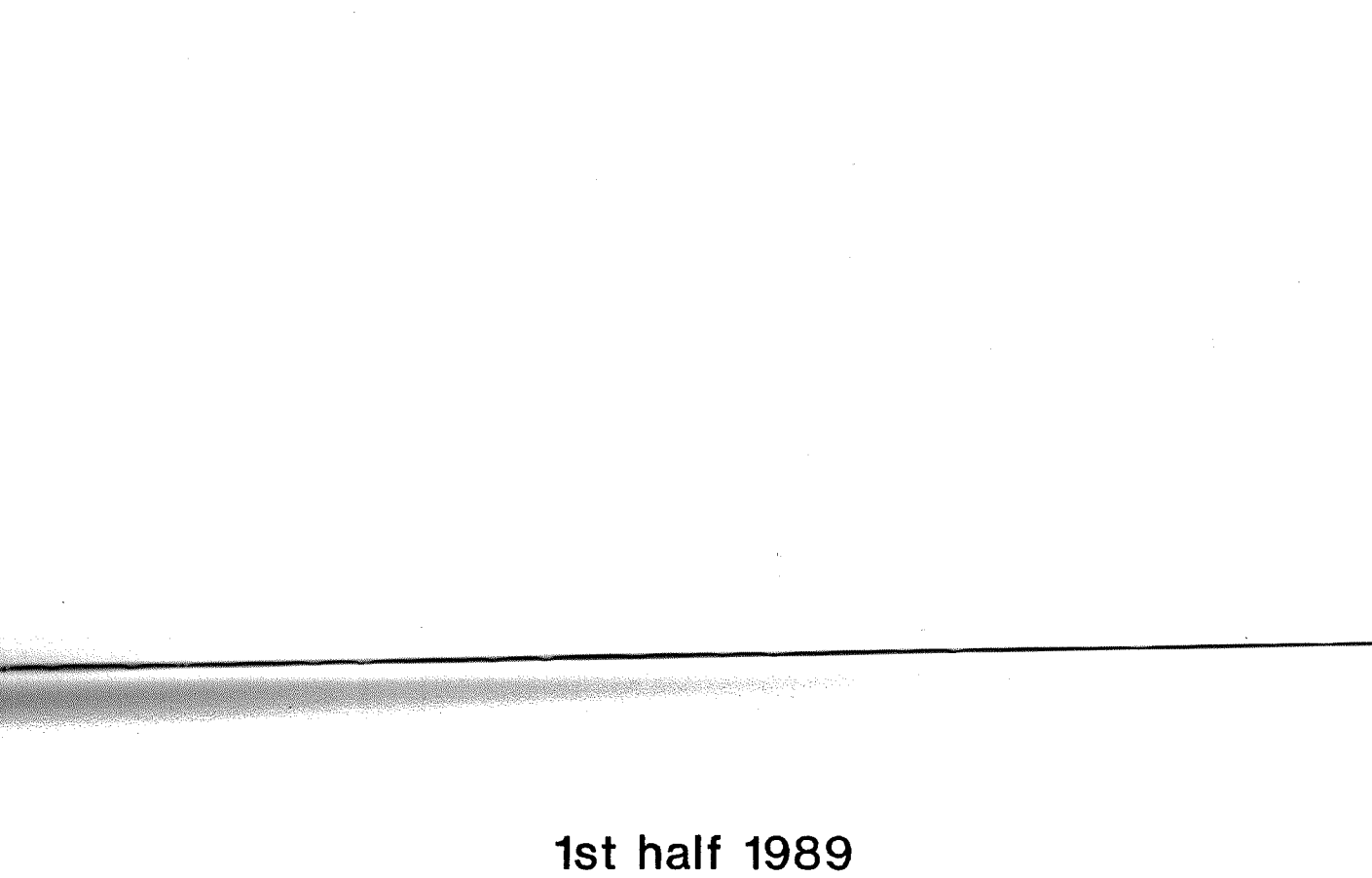

Figure 4.3. Daily precipitation and water-level hydrographs of Paradise Creek and all wells available for the first half of 1989.

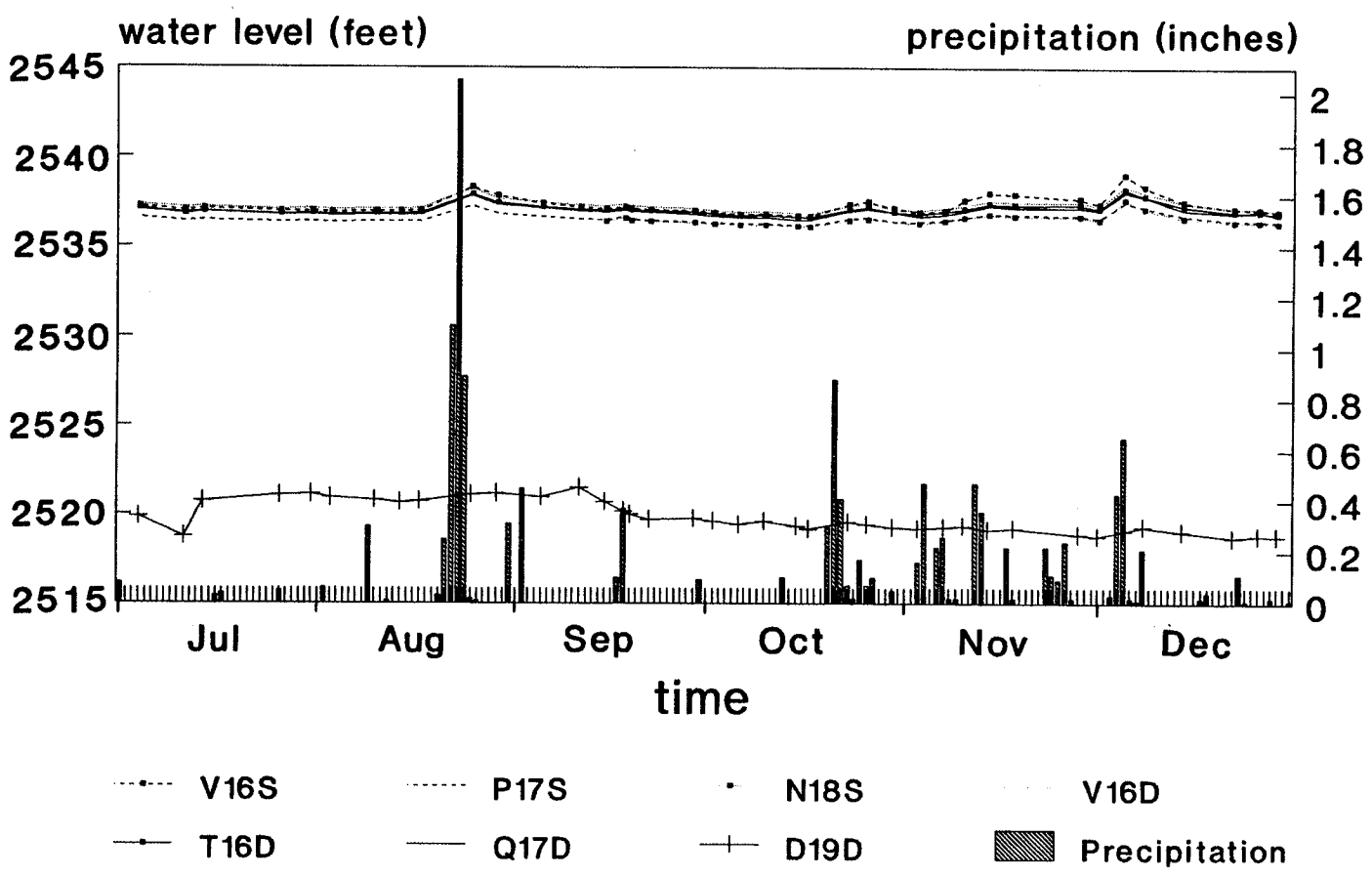

Figure 4.4. Daily precipitation and water-level hydrographs of Paradise Creek and all wells available for the second half of 1989.

higher than that of V16D, but during the rest of the year the level in V16S was lower than that in V16D. When the level of V16D was higher the difference in level with respect to V16S was very small; however, when the level of V16S was higher the difference with respect to V16D was greater. In all peaks, the groundwater level of V16S was higher than that of V16D, with a rising and falling limbs' slope steeper than that of the rest of the wells. The water level of the new well, N18S, was very similar to the level in P17S, with a water level elevation around 0.10 feet higher. The behavior of the rest of the wells in relation to each other was mostly the same as 1988.

The difference between maximum and minimum water levels in the shallow and E-fractured aquifer wells in 1989 was about 0.70 feet, which was slightly greater than in 1988; it was almost constant through the year. Table 4.2. shows the differences between the maximum and minimum groundwater levels during 1989. V16S had the greatest difference because the magnitude of its peaks was larger than the magnitude of the peaks for the rest of the wells. The maximum and the minimum levels in 1989 occurred on the same day in all the E-fractured and shallow aquifers' wells, and on dates close to that day in the W-fractured well. The maximum was reached in late winter and the minimum in early winter. The hydrographs for the year 1989 show that the average groundwater levels were higher during late winter and early spring and lower during summer.

4.3. YEAR 1990

Beginning with 1990 more continuous measurements were taken, allowing more detailed and accurate analysis of the data. Several wells were drilled or began to be measured during this year. The wells with available data include:

V16S, P17S, N18S, J17S, M12S, T6S, U3S, J16S, and Q16S from the shallow aquifer;

V16D, T16D, Q16D, Q17D, and S12D1 from the E-fractured aquifer; and,

J16D, D19D, U3D, and S12D2 from the W-fractured aquifer.

A complete water record of all wells was not made until the second half of the year. However, the best data record is from the first half of the year (for the wells

	MAXIMUM LEVEL (feet)	MINIMUM LEVEL (feet)	DIFFERENCE (feet)
V16D	2540.92 (11 Mar.)	2536.84 (17 Oct.)	4.08
V16S	2541.18 (11 Mar.)	2536.70 (17 Oct.)	4.48
T16D	2540.69 (11 Mar.)	2536.65 (17 Oct.)	4.04
Q17D	2540.50 (11 Mar.)	2536.51 (17 Oct.)	3.99
P17S	2540.10 (11 Mar.)	2536.22 (17 Oct.)	3.88
D19D	2521.74 (16 Mar.)	2518.69 (22 Dec.)	3.05

Table 4.2. Maximum and minimum groundwater level during the year 1989.

available at this time) because daily measurements were taken during five months. Data from this period are important, especially because wells were measured during winter and spring, the seasons with more rainfall and therefore more water fluctuations. Figures 4.5 to 4.12 show the hydrographs for 1990. Due to limitations of the graphics software used, it was not possible to plot all the wells on the same graph. The hydrographs for the wells in the shallow aquifer are represented in two graphs, and the ones for the wells in the E-fractured and W-fractured basalt aquifers are represented on one each.

The creek elevation data were measured beginning in 1990. The hydrographs (Figures 4.5 to 4.12) show only the creek elevation on the staff gage at the bridge where Perimeter Drive crosses Paradise Creek. However, the creek gradient must be considered when analyzing the relations between the aquifers and the creek.

Even though the relations among the different wells varied slightly throughout the year, the most frequent order of groundwater elevation, from higher to lower, was: U3S-T6S-M12S-V16D-T16D-Q16D-V16S-Q17D-Q16S-J16S-P17S-N18S-J17S-S12D1-J16D-S12D2-U3D-D19D. Most of the wells maintained their groundwater elevation position relative to the other wells throughout the year; however, the relative position of V16S, J16S, and Q16S varied during the year.

The difference in water elevation in a given day among the shallow aquifer wells was approximately 5 feet; among the E-fractured aquifer wells it was approximately 2.5 feet and when disregarding S12D1, approximately 0.5 feet; finally, the difference among the W-fractured wells was approximately 0.5 feet. The difference in groundwater elevation among the wells was broader for the shallow aquifer wells because this aquifer has a greater number of wells drilled in it (nine versus five in the E-fractured aquifer and four in the W-fracture aquifers), it has larger spatial distribution of the wells, and greater groundwater gradient. The groundwater elevation differences remained fairly constant throughout the year except for certain anomalies due to the completion of certain wells.

Table 4.3 shows the maximum and minimum water levels for the creek and the wells throughout 1990. The differences were slightly smaller than in 1989. V16S had a value of the highest difference because the slopes of the rising and falling limbs of its

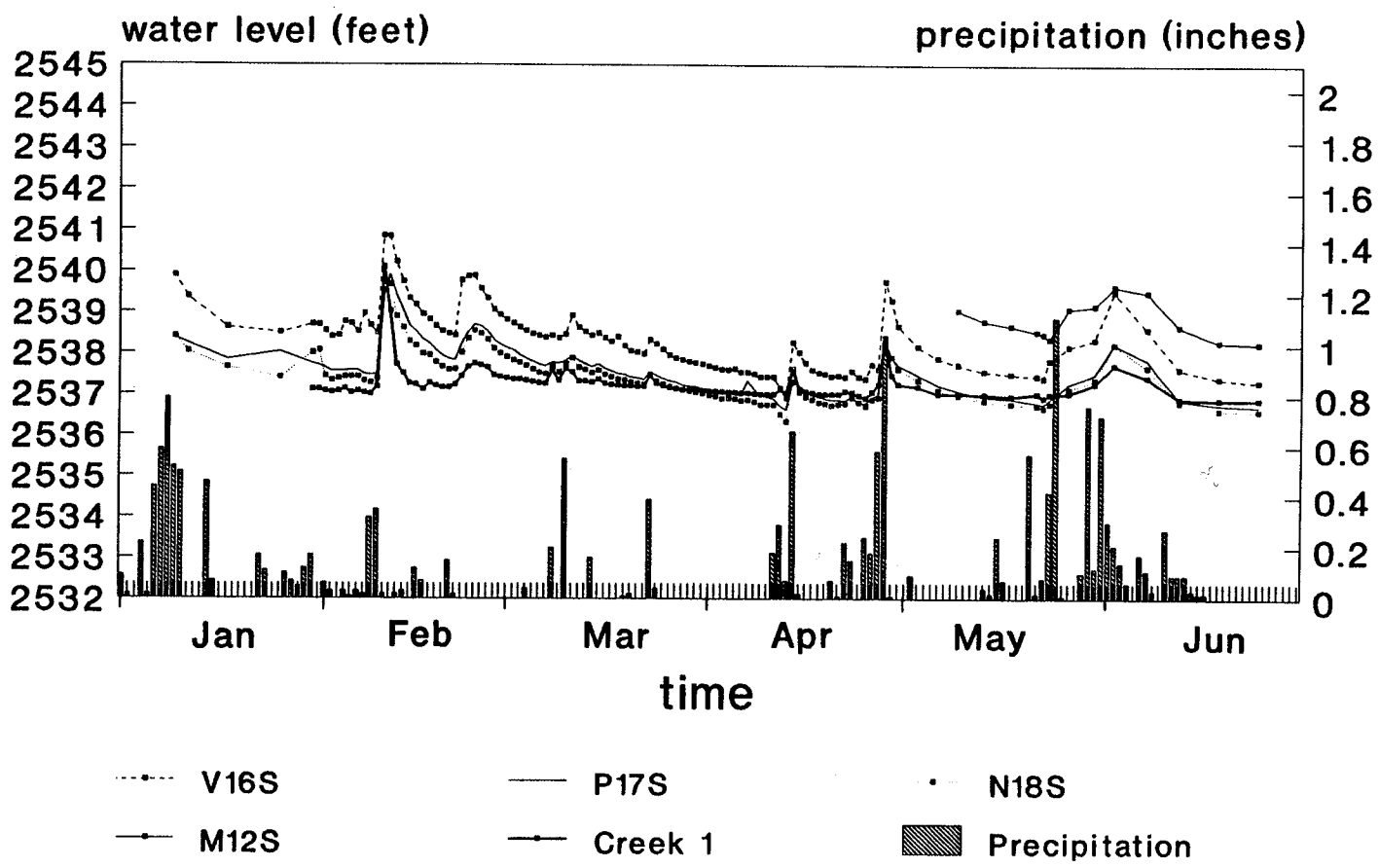

Figure 4.5. Daily precipitation and water-level hydrographs of Paradise Creek and shallow aquifer wells for the first half of 1990 (first part).

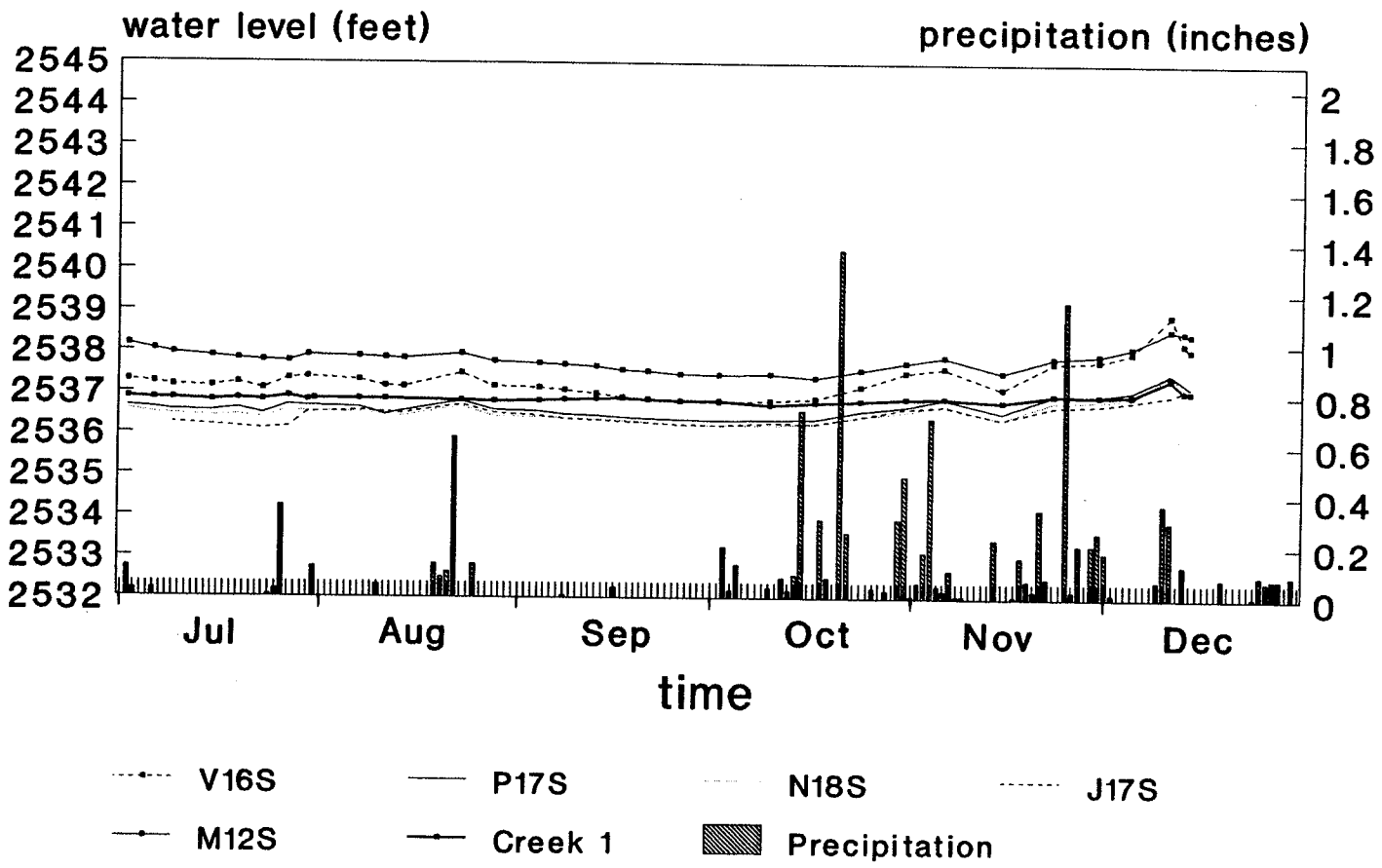

Figure 4.6. Daily precipitation and water-level hydrographs of Paradise Creek and shallow aquifer wells for the second half of 1990 (first part).

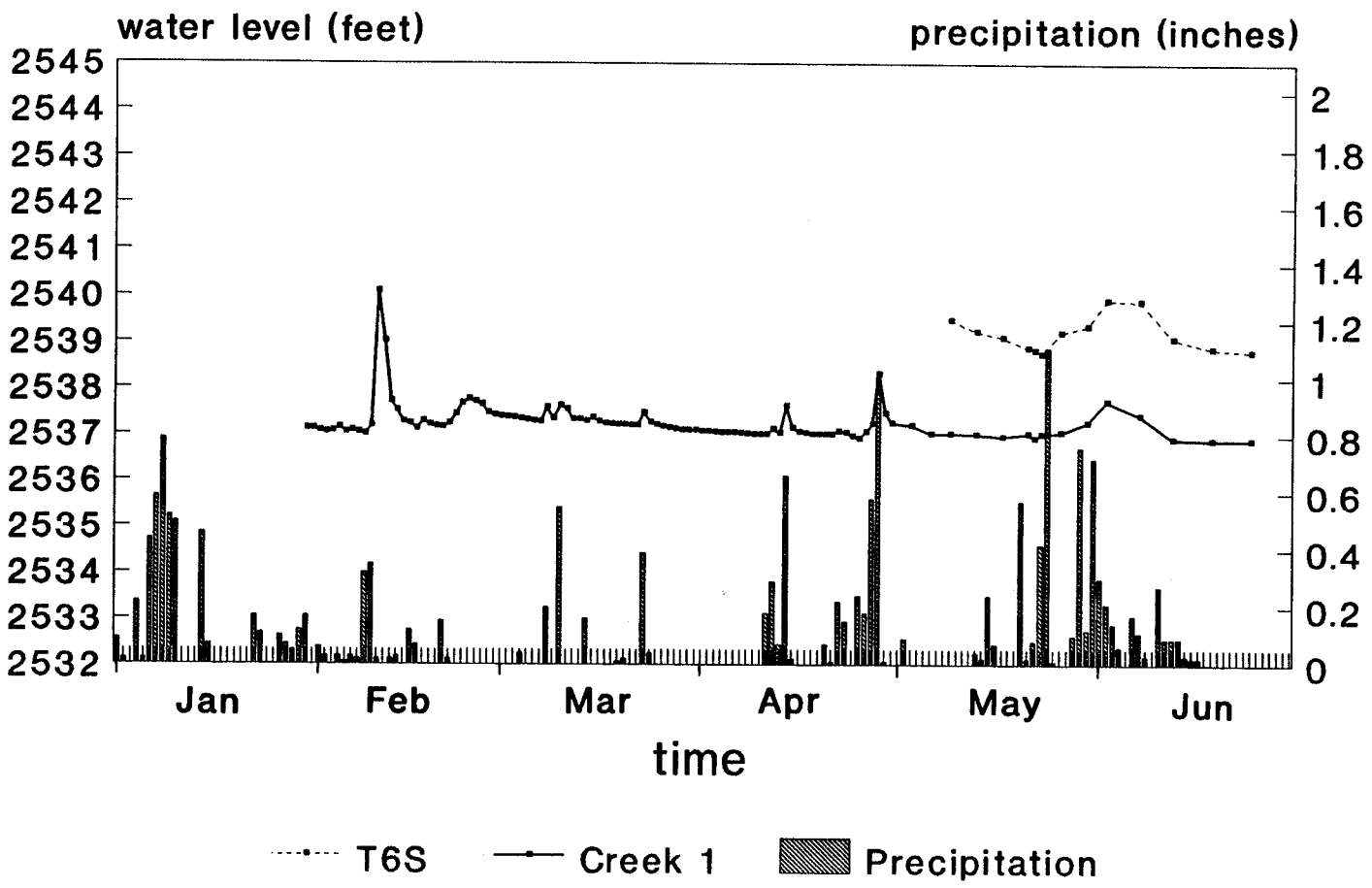

Figure 4.7. Daily precipitation and water-level hydrographs of Paradise Creek and shallow aquifer wells for the first half of 1990 (second part).

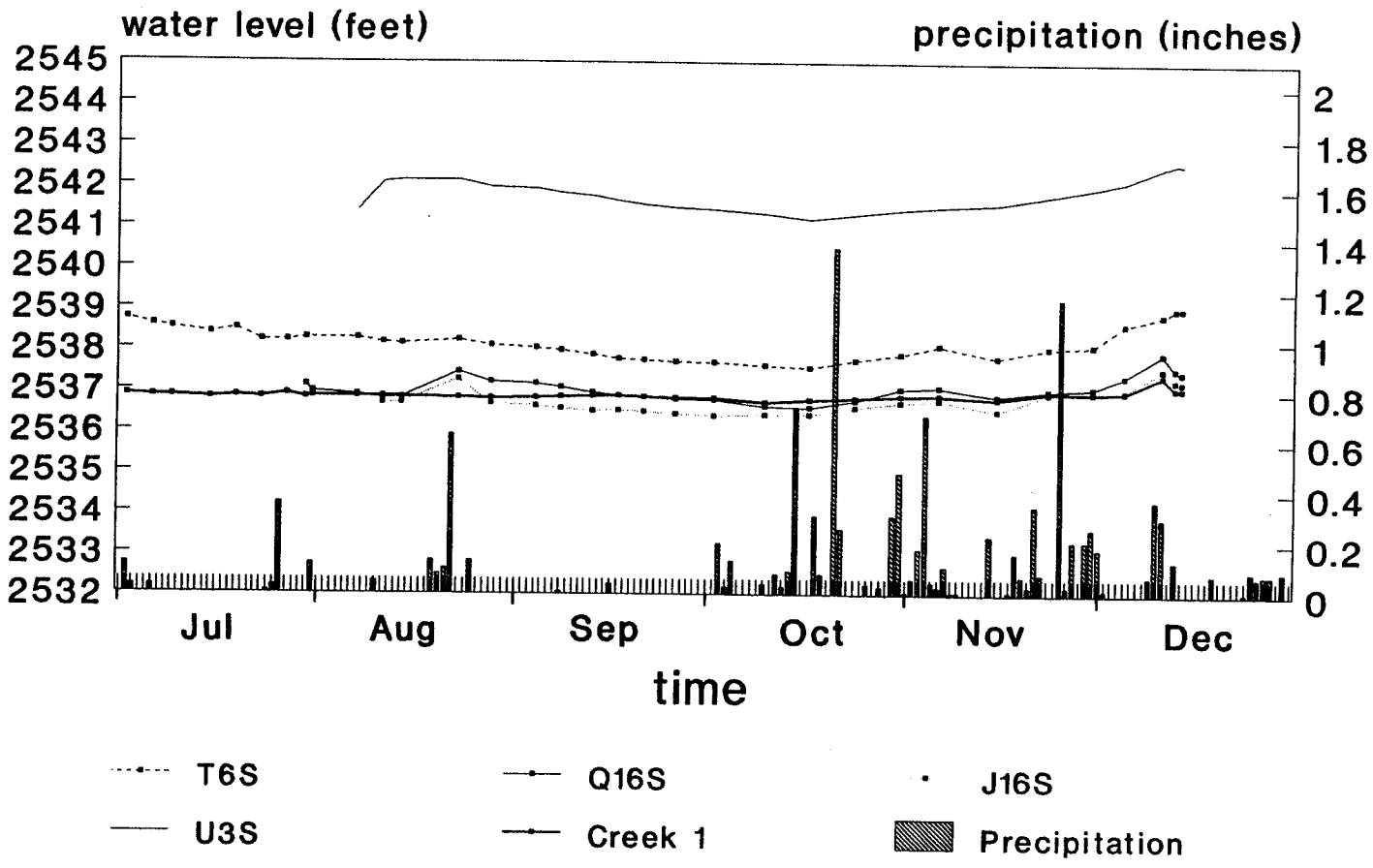

Figure 4.8. Daily precipitation and water-level hydrographs of Paradise Creek and shallow aquifer wells for the second half of 1990 (second part).

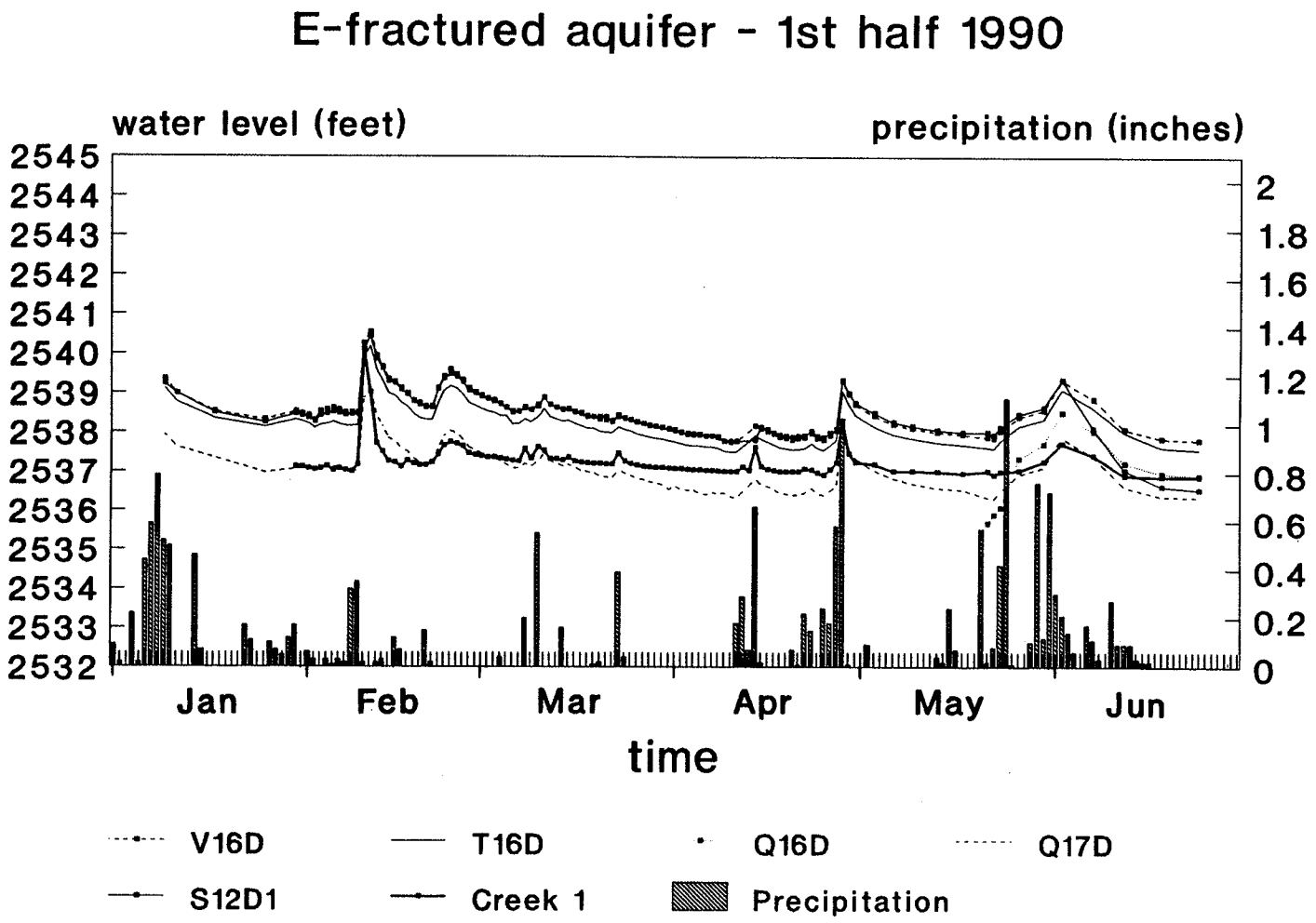

Figure 4.9. Daily precipitation and water-level hydrographs of Paradise Creek and E-fractured aquifer wells for the first half of 1990.

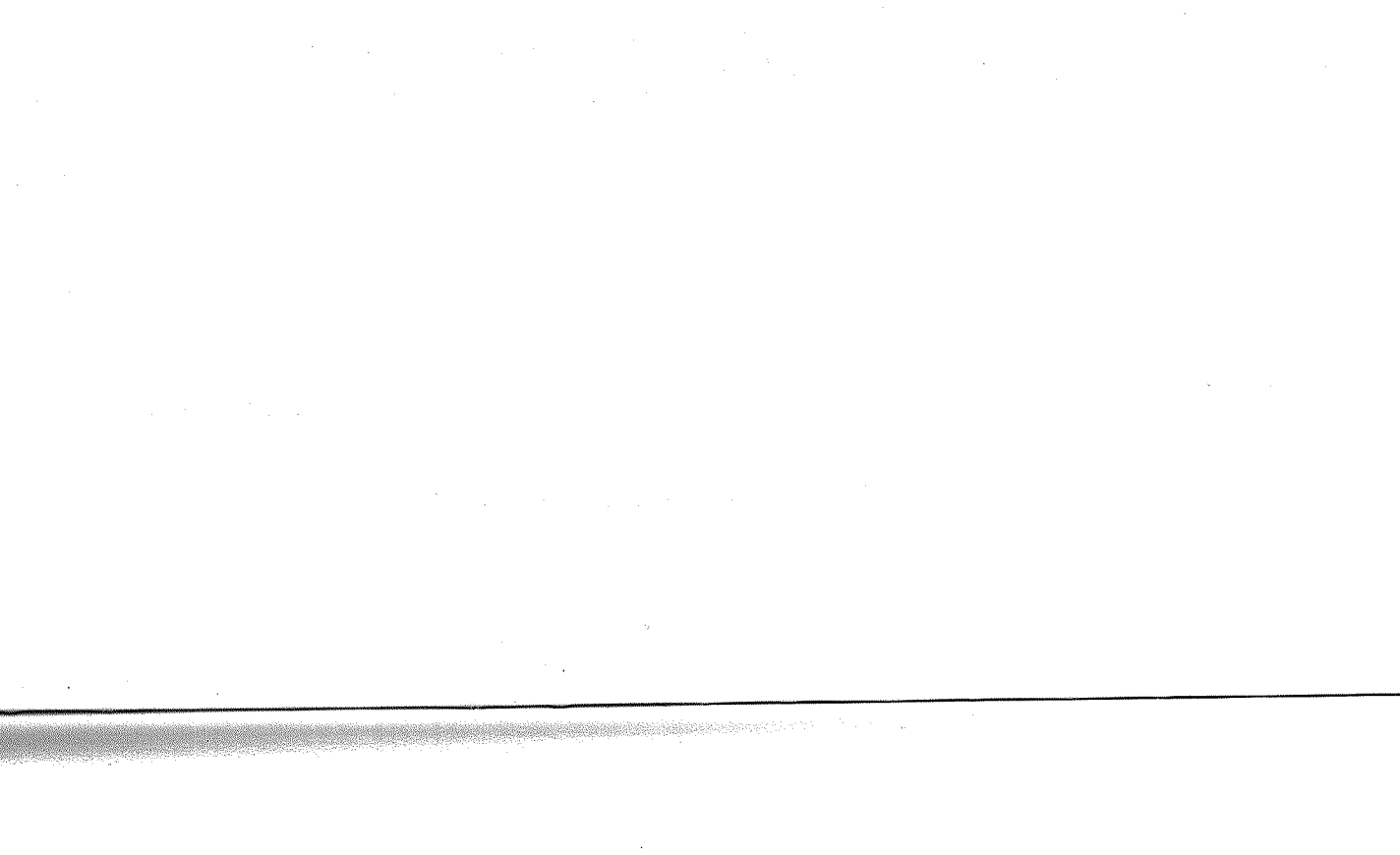

Figure 4.10. Daily precipitation and water-level hydrographs of Paradise Creek and E-fractured aquifer wells for the second half of 1990.

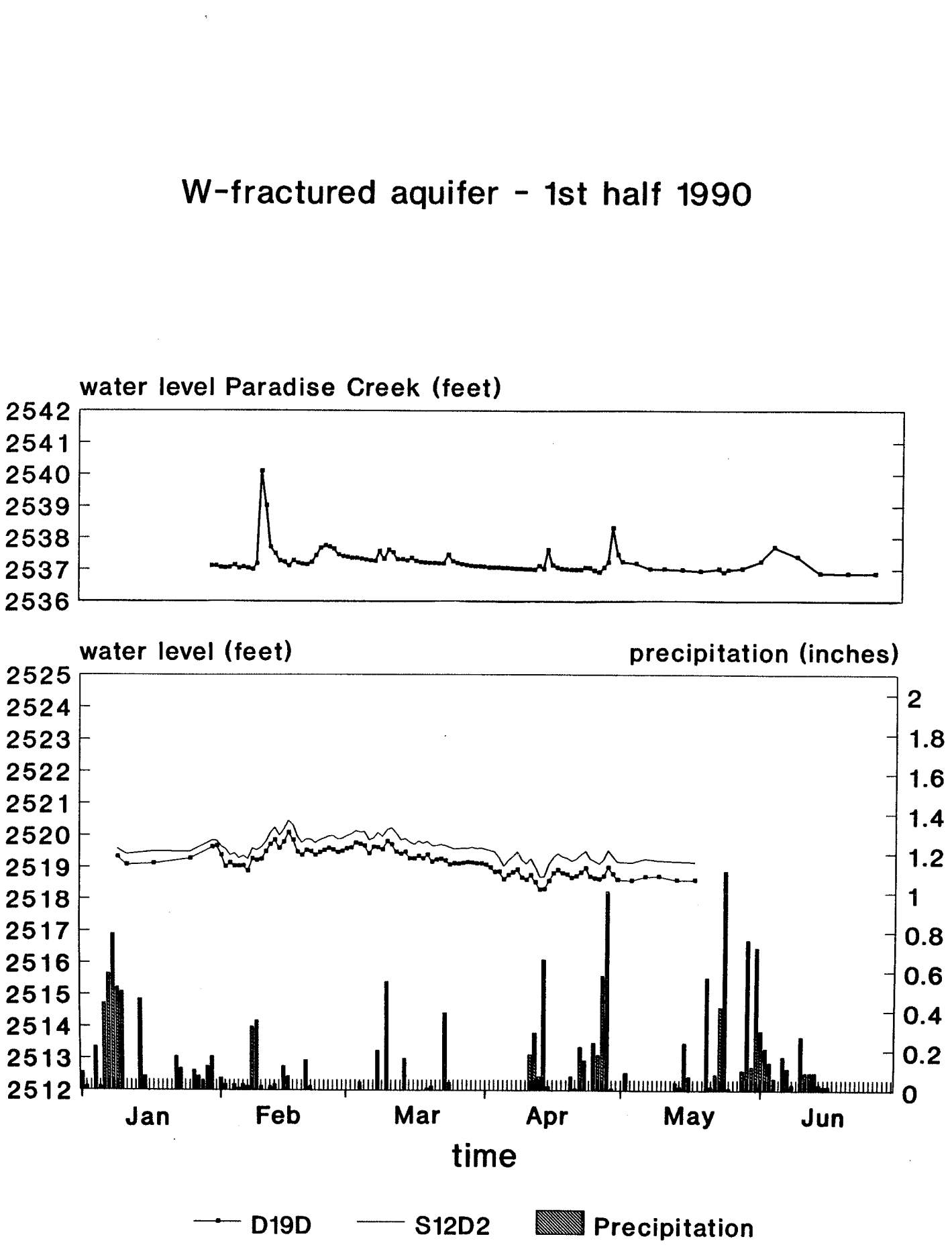

Figure 4.11. Daily precipitation and water-level hydrographs of Paradise Creek and W-fractured aquifer wells for the first half of 1990.

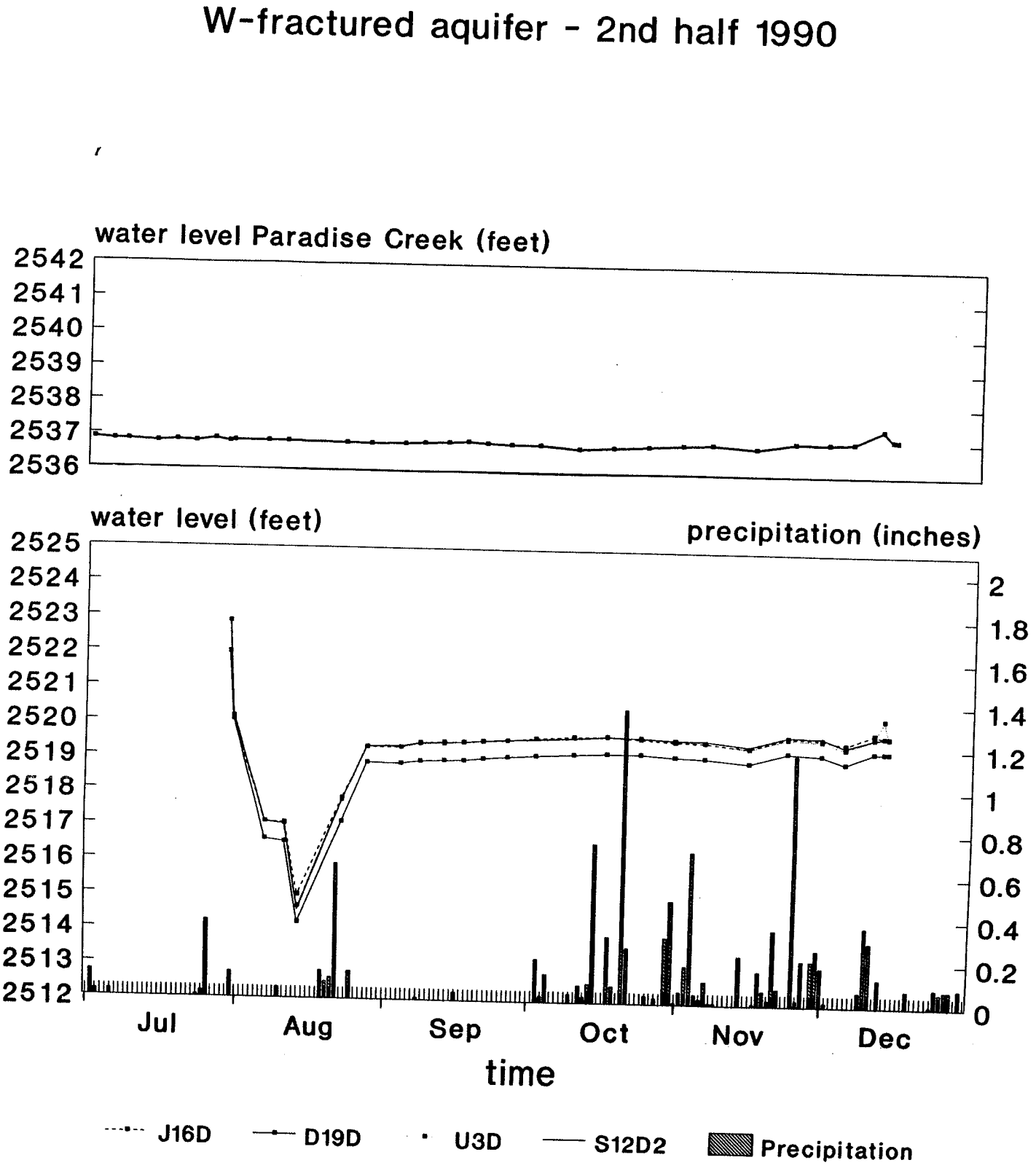

Figure 4.12. Daily precipitation and water-level hydrographs of Paradise Creek and W-fractured aquifer wells for the second half of 1990.

	MAXIMUM LEVEL (feet)	MINIMUM LEVEL (feet)	DIFFERENCE (feet)
V16D	2540.54 (11 Feb.)	2537.14 (2 Oct.)	3.40
V16S	2540.85 (10 Feb.)	2536.78 (2 Oct.)	4.07
T16D	2540.19 (11 Feb.)	2536.69 (2 Oct.)	3.50
Q17D	2540.05 (11 Feb.)	2536.69 (2 Oct.)	3.36
P17S	2539.91 (11 Feb.)	2536.33 (2 Oct.)	3.58
N18S	2539.66 (11 Feb.)	2536.21 (2 Oct.)	3.45
S12D1	2540.44 (11 Feb.)	2534.11 (2 Oct.)	6.31[1]
D19D	2520.07 (16 Feb.)	2514.19 (14 Aug.)	5.88[1]
Creek	2540.09 (10 Feb.)	2536.71 (10 Oct.)	3.88

[1] The behavior of these wells is affected by the completion of U3S and U3D.

Table 4.3. Maximum and minimum groundwater level during the year 1990.

peaks are steeper than those for the rest of the wells (Figures 4.5 and 4.6); it was followed by the value for the creek. The groundwater level of all the shallow and E-fractured wells was slightly lower during the summer and early fall.

The wells in the E-fractured aquifer are deeper than the shallow aquifer wells but their water levels were higher than most of the shallow ones in 1990, as well as in 1988 and 1989. V16S had a higher water elevation than Q17D. During some periods V16S had higher groundwater elevation than T16D and Q16D, although the differences were very small. The characteristics of the relation between V16S and V16D were the same as that those described for 1989. During most of 1990, the groundwater level in V16D was higher than in V16S. The magnitude of the peaks was greater in V16S than in any other well. Only the farthest shallow aquifer wells (U3S, T6S, and M12S) had higher groundwater levels than all the E-fractured aquifers. U3S had the highest groundwater elevation and significant water level differences with respect to the other shallow aquifer wells.

W-fractured aquifer wells presented a different fluctuation pattern from the rest of the wells, and they maintained a quite constant static water level elevation. The data for this aquifer for 1990 are not representative between mid-May and the end of August because all the wells were affected by the completion of U3S and U3D.

The creek followed the same fluctuations as the wells, and showed some differences in the slope of the peaks. In the second half of the year, several small fluctuations were noticeable for the wells but not for the creek. During more than half of the year (for wells P17S and N18S) and less than half of the year (for wells J17S and J16S), the levels were about a foot lower than the level of the creek at the stage gage. When considering the creek gradient (Chapter 3), it seems apparent that this difference in elevation is not enough to conclude that the water level of the creek was higher than the level of the shallow aquifer.

4.4. YEAR 1991

The year 1991 offers the best data because all the wells in the UIGRS are represented throughout the year. During the first three months the frequency of measurements was almost daily; the frequency declined during the rest of the year.

The relations among the different wells in the shallow and E-fractured basalt aquifers varied throughout the year, with significant differences between the winter and spring seasons and the summer and fall seasons. Based on groundwater elevation, the order (higher to lower) of the wells during the winter and spring was U3S-T6S-M12S-V16D-V16S-Q16D-T16D-Q17D-J16S-P17S-N18S-S12D1-S12D2-U3D-J16D-D19D (Figures 4.13 to 4.20). During the late summer and fall the order (higher to lower) was U3S-V16D-T6S-Q16D-T16D-Q17D-V16S-M12S-Q16S-P17S-J16S/N18S-J17S-S12D1-S12D2-U3D-J16D-D19D.

The range of groundwater elevation for the shallow aquifer wells was greater during the first half of the year, with a water level difference of approximately 6.4 feet in a given day, whereas the difference during the summer and fall was approximately 4.0 feet for a given day. E-fractured and W-fractured wells kept constant groundwater elevation differences throughout the year. The difference among the E-fractured wells was approximately 0.25 feet (disregarding S12D1) during the entire year. The water level of S12D1 decreased significantly during the year; the difference in groundwater elevation with respect to the other E-fractured wells increased from 2.2 feet on 15 March to 4.4 feet on 29 December. The water level difference among wells in the W-fractured aquifer (except D19D) remained approximately the same throughout the year. The difference in groundwater elevation of these wells with respect to D19D was greater during the late spring, summer, and early fall than the rest of the year, and ranged from 0.42 feet on 5 January to 4.16 feet on 17 July.

The groundwater levels for the shallow and E-fractured aquifer decreased notably during the summer and fall (Figures 4.13 to 4.18). The slope of the recession is greater for the shallow aquifer wells than for those of the E-fractured aquifer. The groundwater level in the W-fractured aquifer wells decreased during the summer and

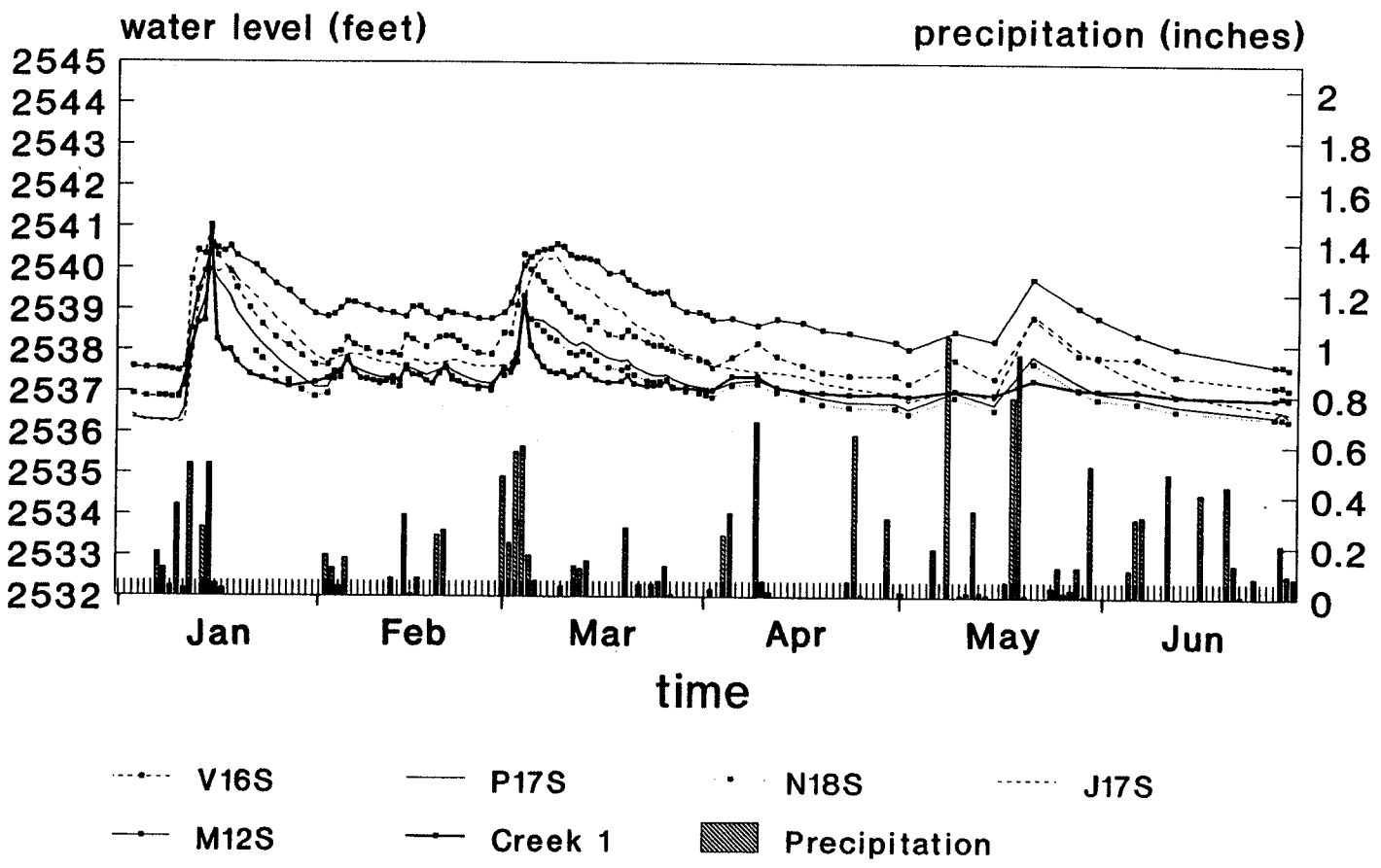

Figure 4.13. Daily precipitation and water-level hydrographs of Paradise Creek and shallow aquifer wells for the first half of 1991 (first part).

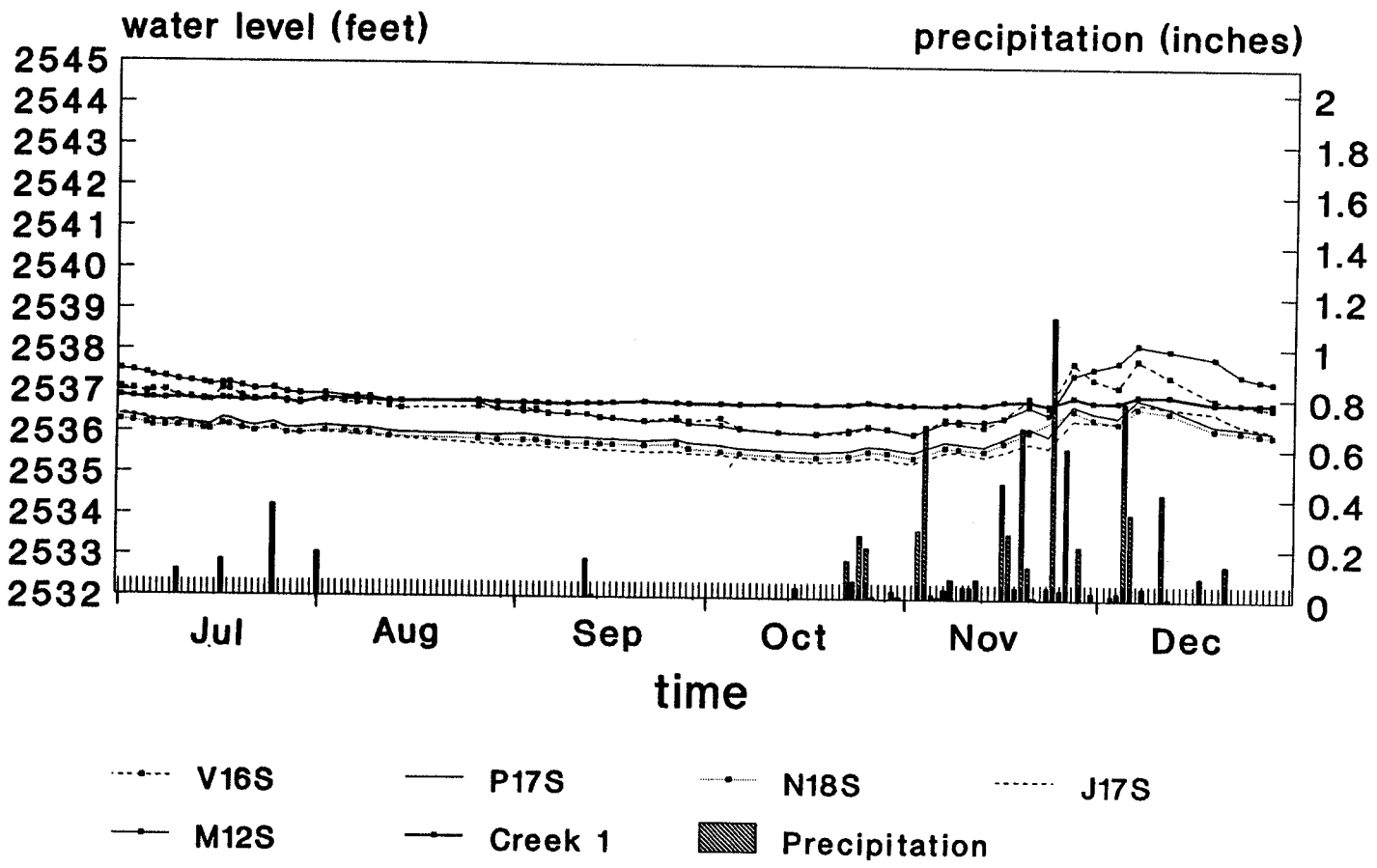

Figure 4.14. Daily precipitation and water-level hydrographs of Paradise Creek and shallow aquifer wells for the second half of 1991 (first part).

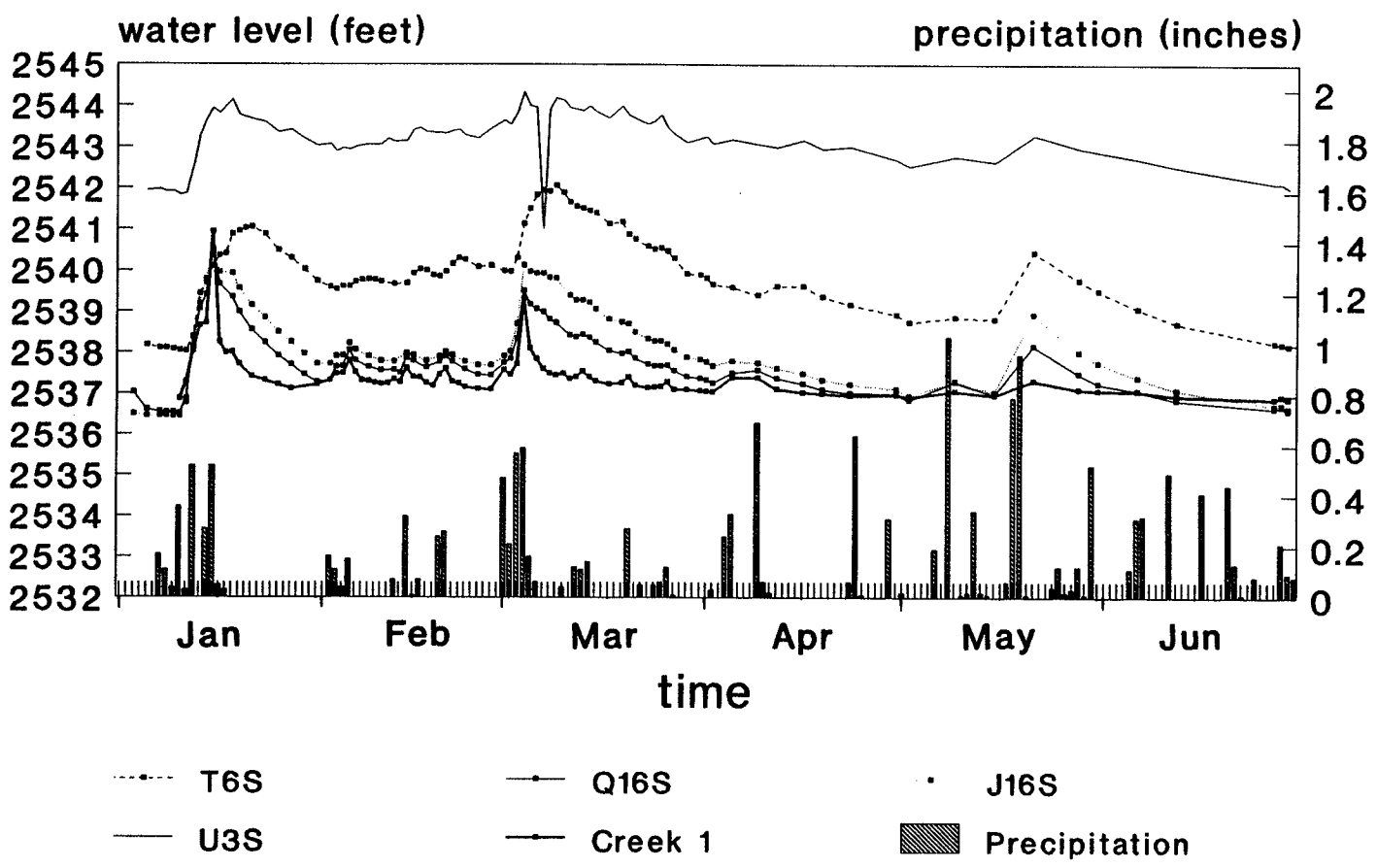

Figure 4.15. Daily precipitation and water-level hydrographs of Paradise Creek and shallow aquifer wells for the first half of 1991 (second part).

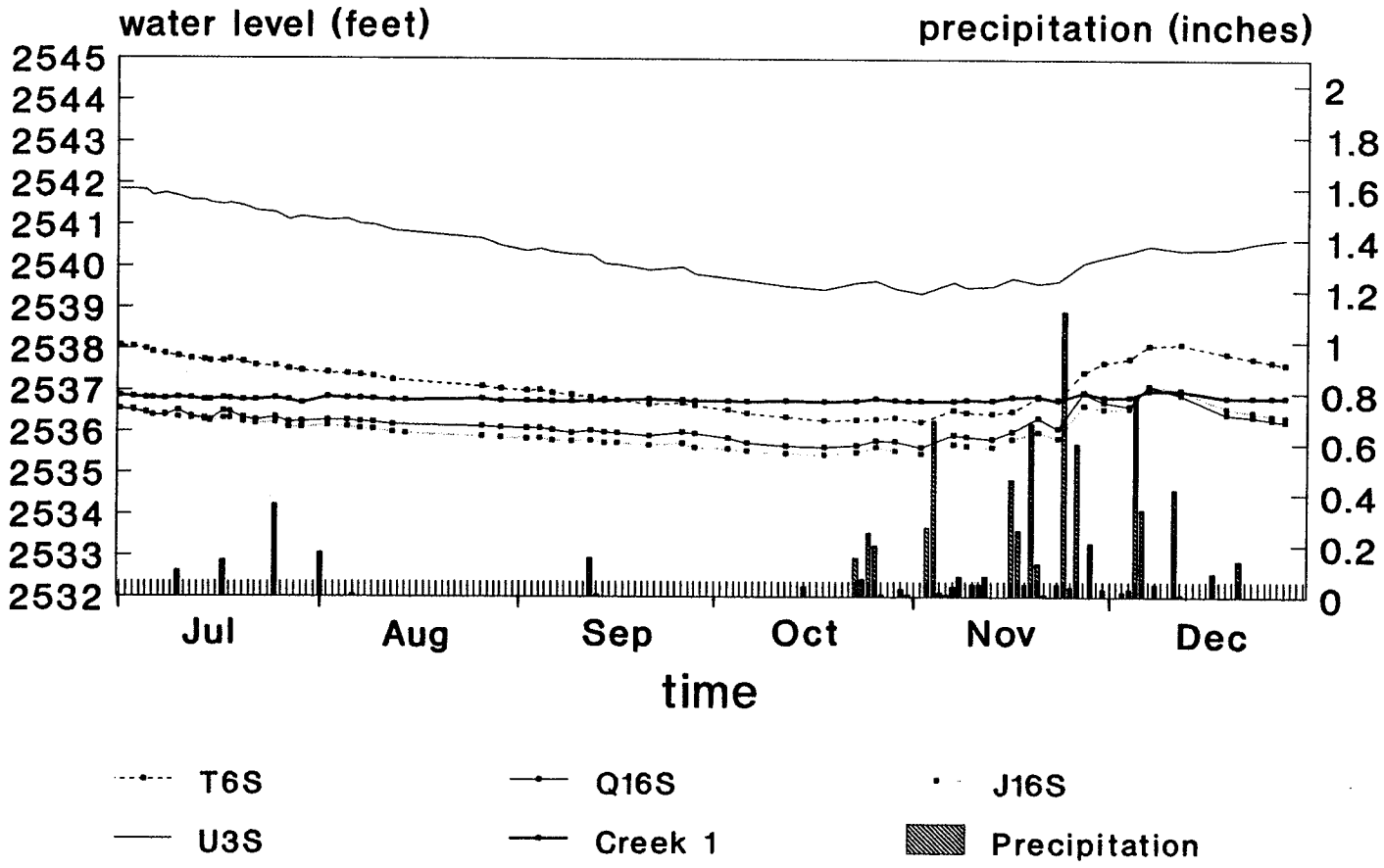

Figure 4.16. Daily precipitation and water-level hydrographs of Paradise Creek and shallow aquifer wells for the second half of 1991 (second part).

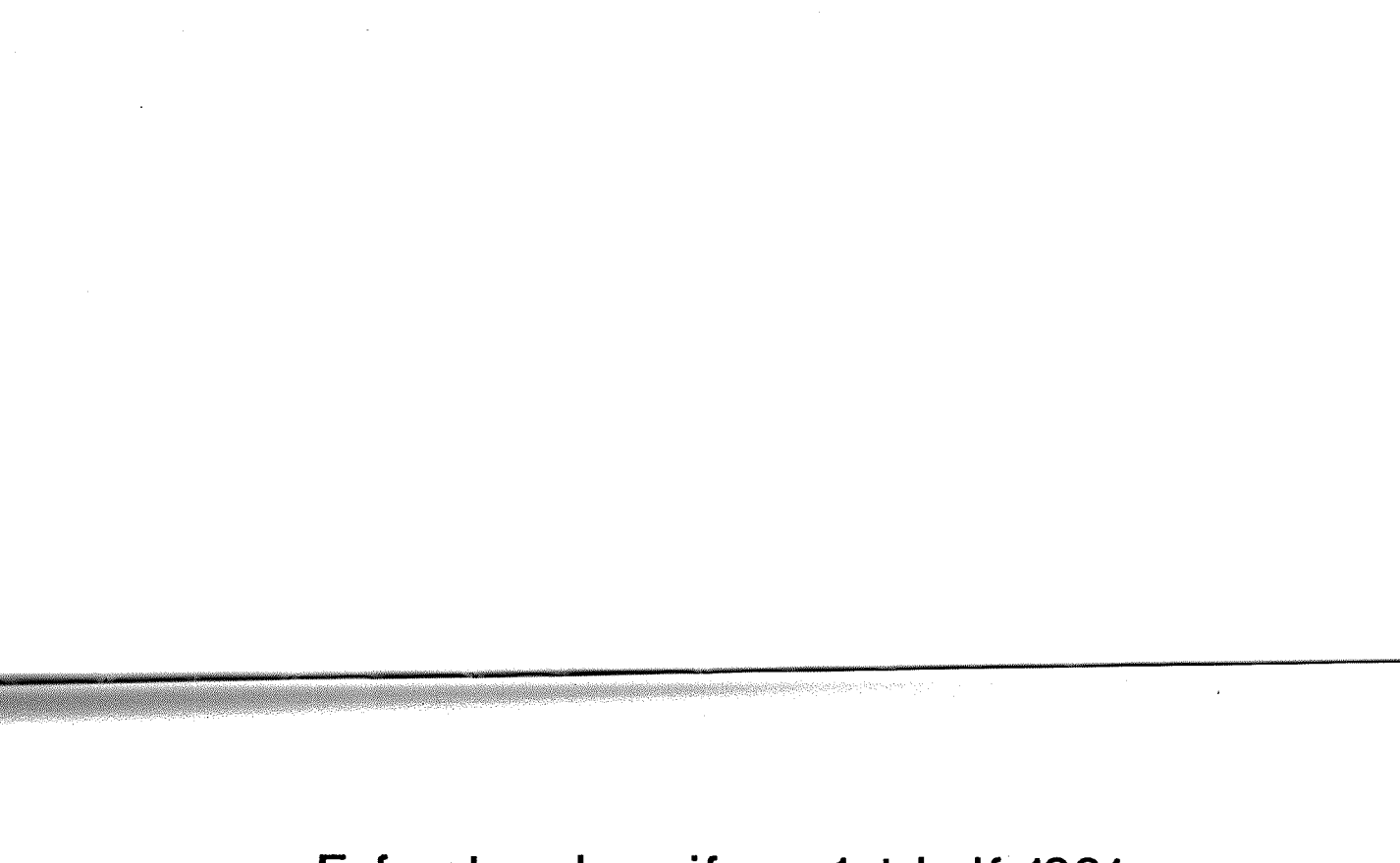

Figure 4.17. Daily precipitation and water-level hydrographs of Paradise Creek and E-fractured aquifer wells for the first half of 1991.

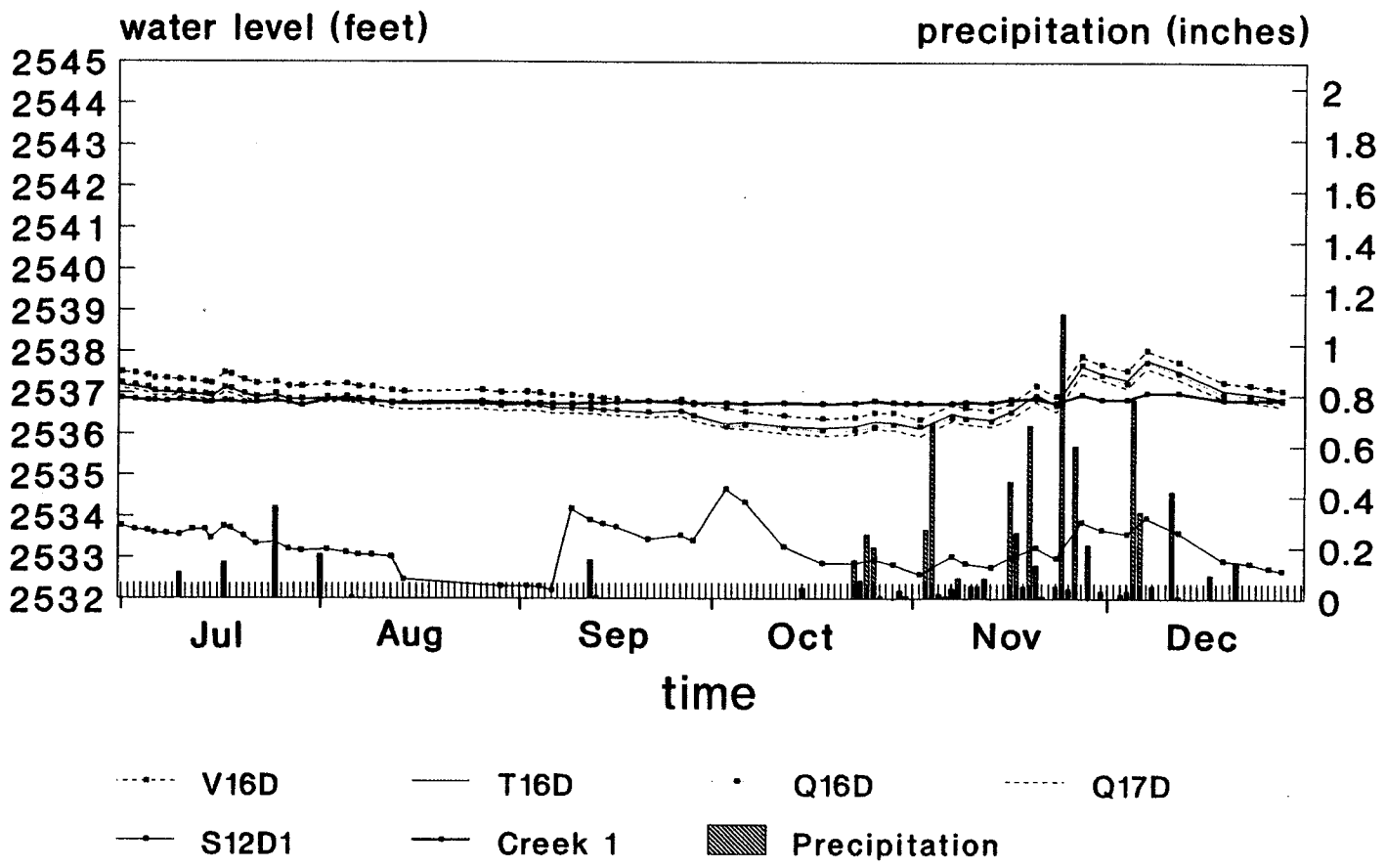

Figure 4.18. Daily precipitation and water-level hydrographs of Paradise Creek and E-fractured aquifer wells for the second half of 1991.

increased gradually during the fall (Figures 4.19 and 4.20); this increase was earlier and produced a greater slope than the slope of the wells of the other aquifers.

Table 4.4 shows the maximum and minimum water levels for all the shallow and E-fractured aquifer wells. The W-fractured aquifer wells are not represented because their water levels were greatly affected by the drilling and pumping of the University of Idaho's Aquaculture Lab water supply well located approximately 900 feet southwest of the UIGRS. The differences between the maximum and minimum values were greater than in the previous years. Furthermore, these differences were greater for the shallow aquifer wells because the decrease in their water level during the summer and fall was greater than for the E-fractured wells.

During most of the year the groundwater level of the E-fractured wells was higher than in the shallow aquifer wells (Figures 4.21 and 4.22), except for the shallow wells that are farther from the creek (U3S, T6S, and M12S). When the decrease in water level began at the start of the summer, the water level in M12S began falling below the E-fractured aquifer level. The groundwater level in T6S started falling below the level in V16D at the beginning of the fall, but it did not go below that of the other E-fractured aquifer wells. During most of the year the water levels of the E-fractured aquifer wells were higher than in the shallow aquifer wells close to them. The water levels in Q16D and Q17D were higher than in Q16S, and the level in V16D was higher than in V16S.

The creek had the same fluctuation pattern as the shallow and E-fractured aquifer wells. Throughout the year the groundwater level in the wells decreased more than in the creek; the general slope of the hydrograph for the creek is almost horizontal (without considering the peaks). During the summer and fall the water level of several wells fell below the water level of the creek; the difference was significant (between 1.31 feet with respect to N18S and 0.36 feet with respect to V16D, the lowest level of the year).

Figure 4.23 shows a hydrograph for several representative wells of the three aquifers during the entire period of study. The water levels do not have any overall trends throughout these years (1988 to 1992).

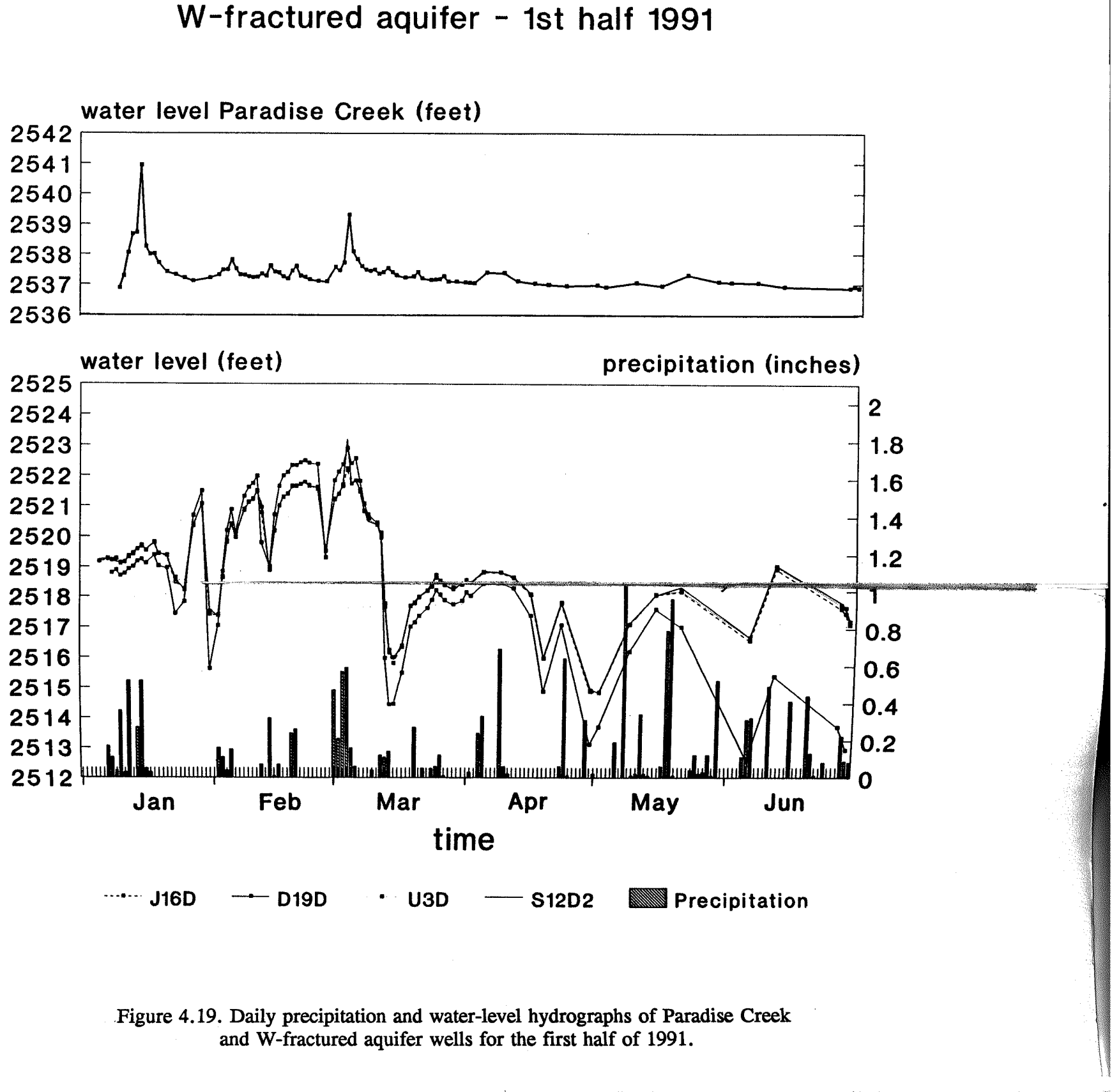

Figure 4.19. Daily precipitation and water-level hydrographs of Paradise Creek and W-fractured aquifer wells for the first half of 1991.

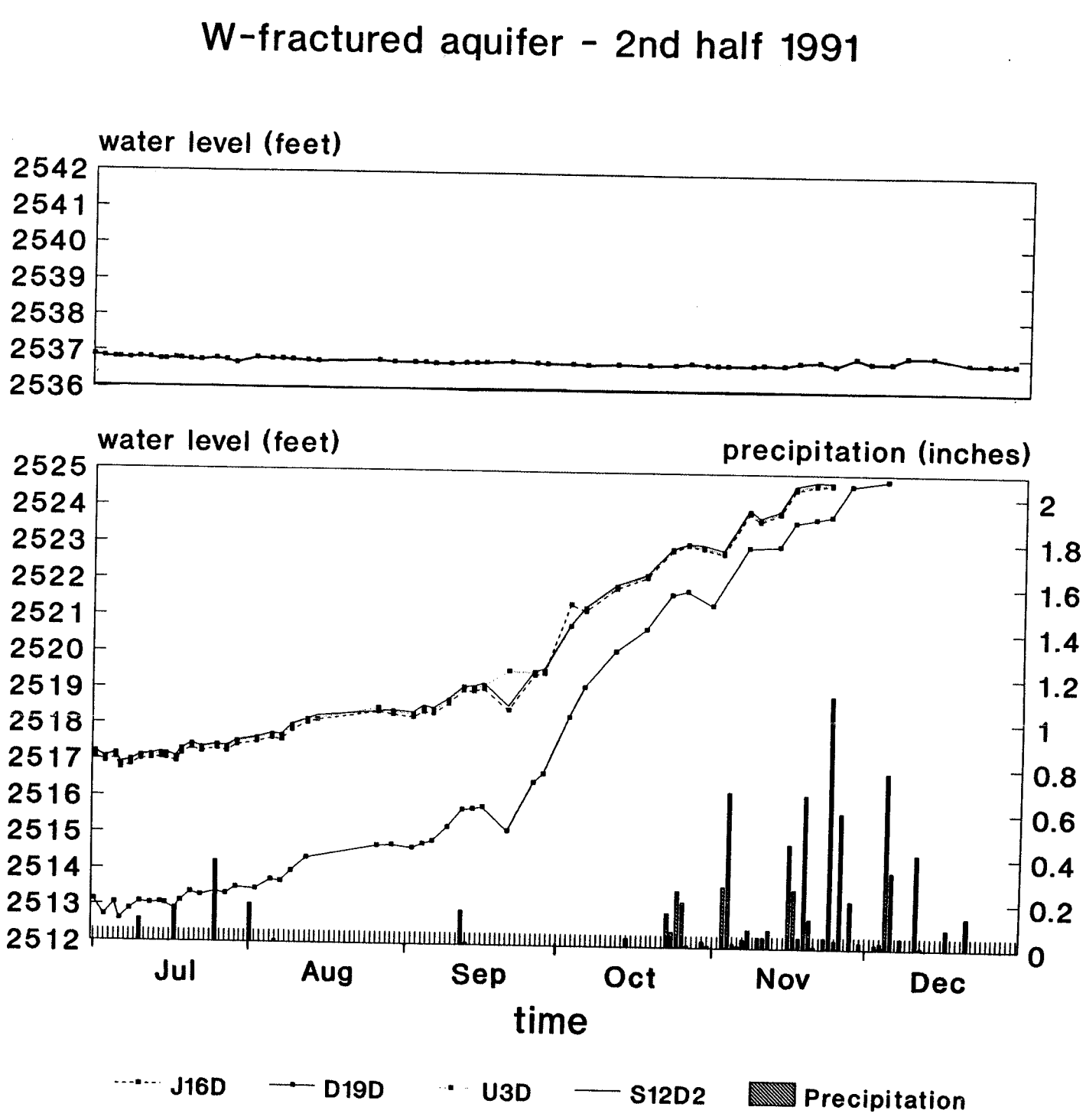

Figure 4.20. Daily precipitation and water level hydrographs of P

	MAX. LEVEL (feet)	MIN. LEVEL (feet)	DIFFERENCE (feet)
V16D	2540.92 (15 Jan.)	2536.88 (19 Oct.)	4.54
V16S	2541.02 (15 Jan.)	2536.02 (19 Oct.)	5.00
T16D	2540.50 (15 Jan.)	2536.14 (19 Oct.)	4.36
Q17D	2540.43 (15 Jan.)	2535.95 (19 Oct.)	4.80
P17S	2540.01 (15 Jan.)	2535.56 (19 Oct.)	4.45
M12S	2540.59 (9 Mar.)	2536.03 (19 Oct.)	4.56
T6S	2542.06 (9 Mar.)	2536.28 (19 Oct.)	5.78
U3S	2544.30 (4 Mar.)	2539.45 (19 Oct.)	4.85
N18S	2539.18[1] (4 Mar.)	2535.43 (19 Oct.)	3.75
J17S	2540.29 (7 Mar.)	2535.34 (19 Oct.)	4.95
J16S	2540.12 (4 Mar.)	2535.43 (19 Oct.)	4.69
Q16S	2540.48 (15 Jan.)	2535.62 (19 Oct.)	4.86
Q16D	2540.57 (15 Jan.)	2536.08 (19 Oct.)	4.49
S12D1	2538.14 (7 Mar.)	2532.21 (17 Sep.)	5.93
Creek	2540.93 (15 Jan.)	2536.69 (29 Jul.)	4.24

[1] No data available for Jan. 15.

Table 4.4. Maximum and minimum groundwater level during the year 1991.

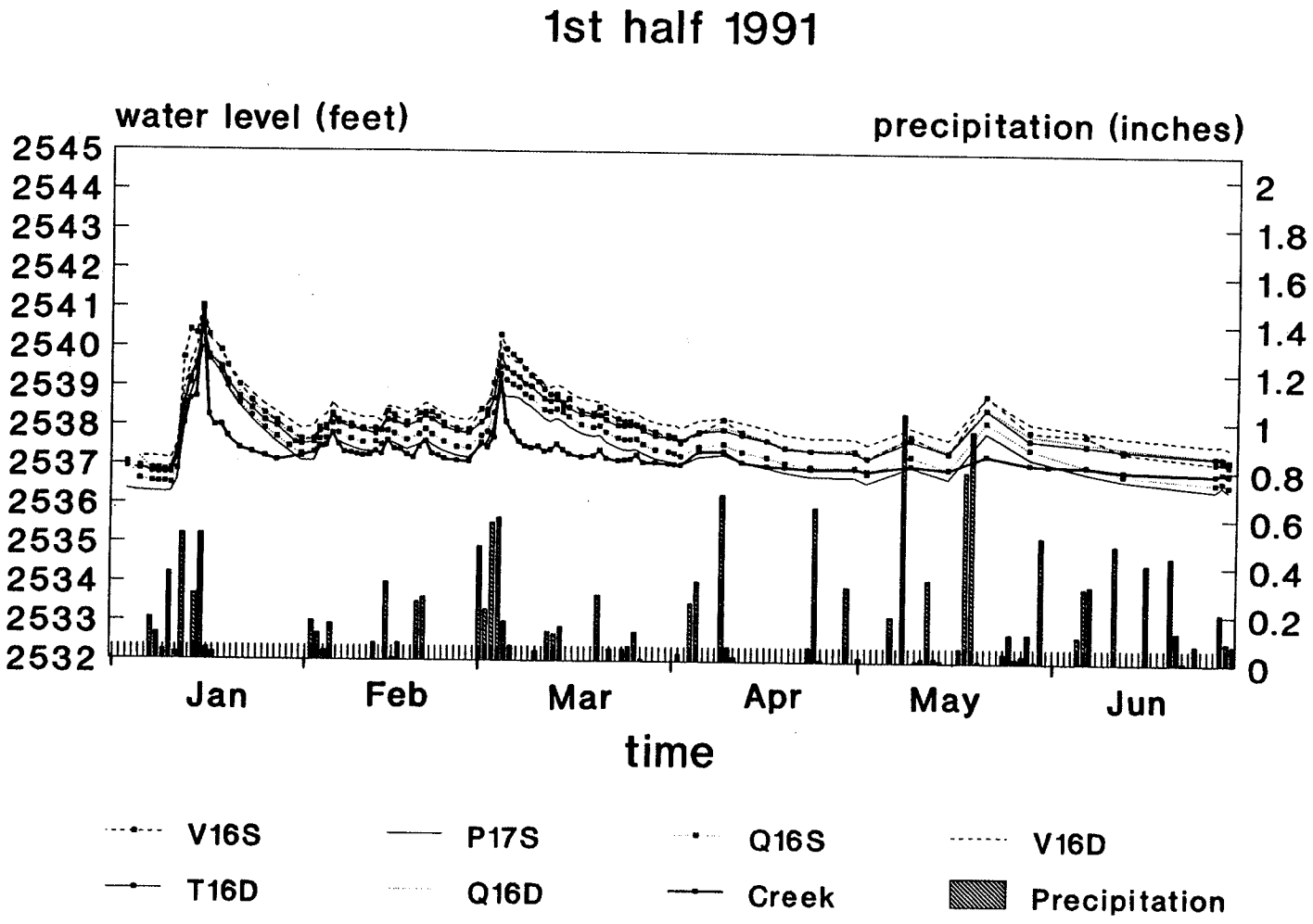

Figure 4.20. Daily precipitation and water-level hydrographs of Paradise Creek and W-fractured aquifer wells for the second half of 1991.

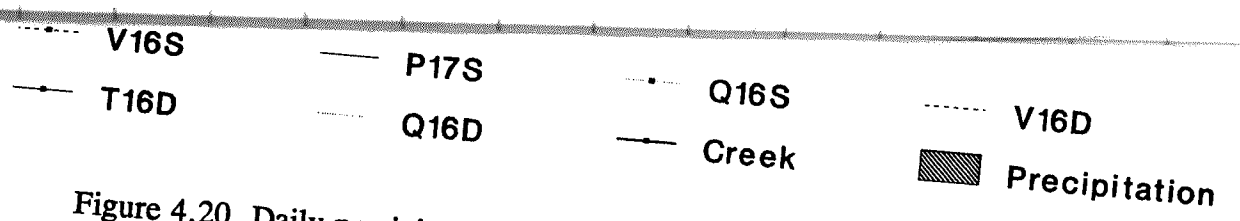

Figure 4.20. Daily precipitation and water-level hydrographs of Paradise Creek and W-fractured aquifer wells for the second half of 1991.

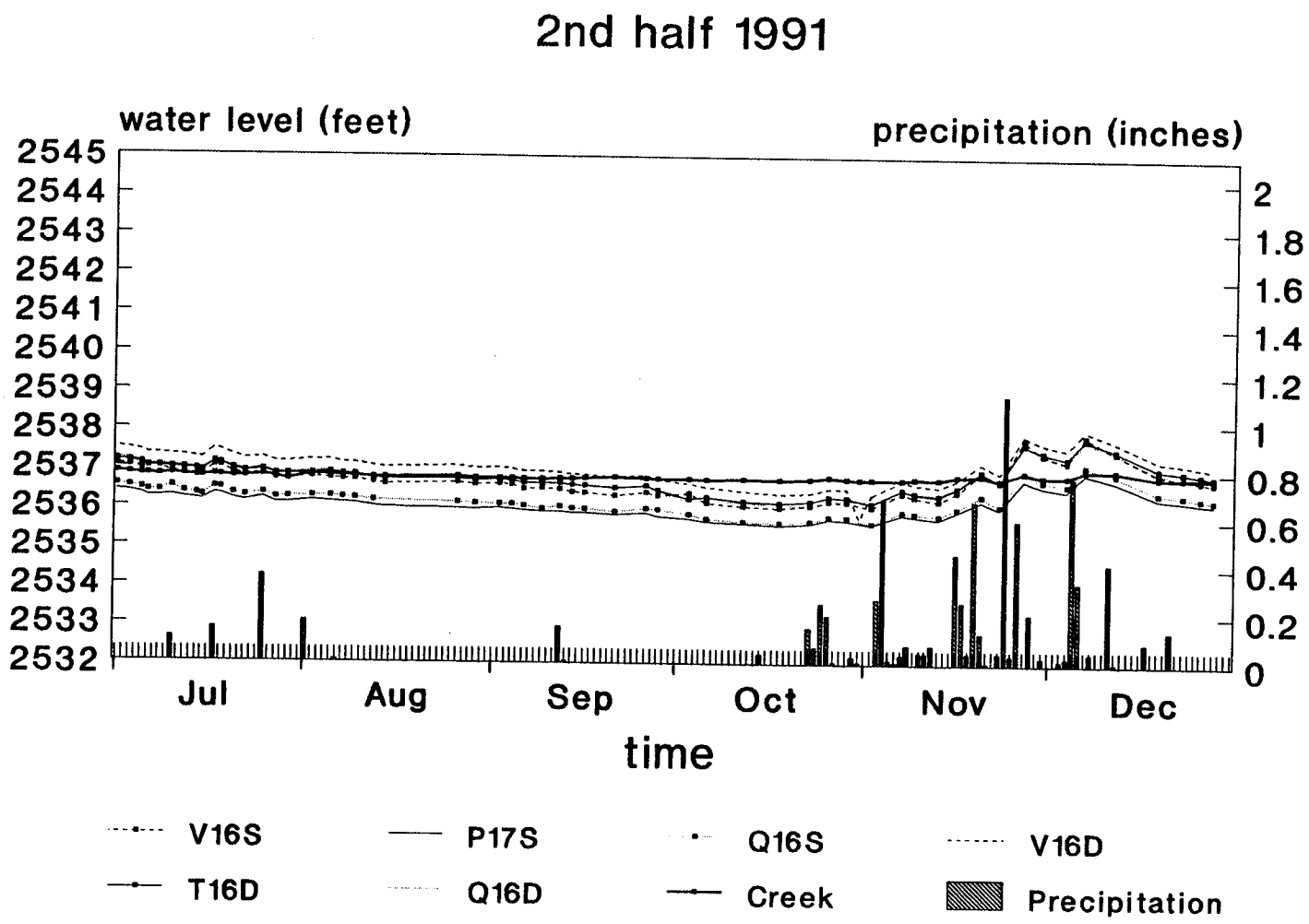

Figure 4.21. Daily precipitation and water-level hydrographs of Paradise Creek and some shallow and E-fractured aquifer wells for the first half of 1991.

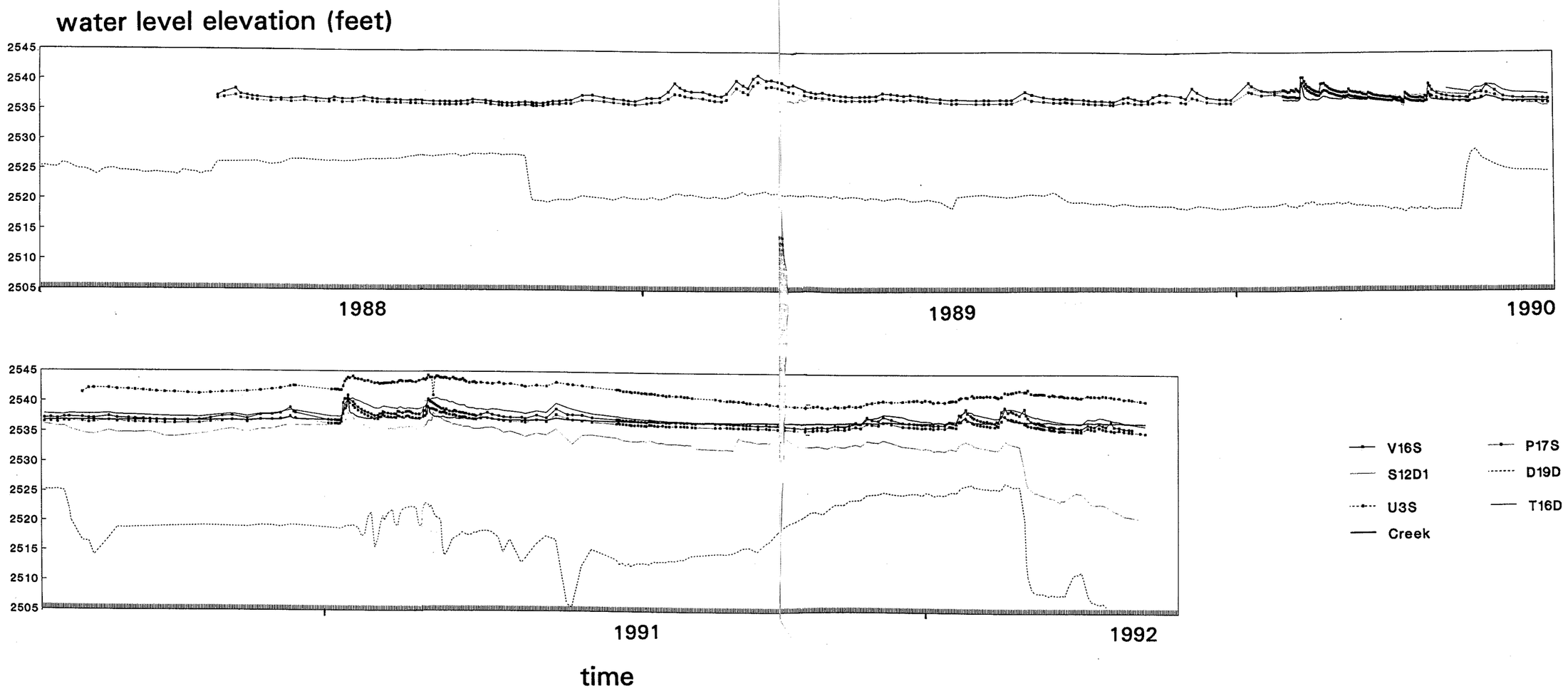

Figure 4.23. Hydrograph of some shallow, E-fractured and W-fractured aquifers wells for the period 1988 to 1992

5. DATA ANALYSIS

The purpose of this analysis is to define whether the main source of aquifer recharge is precipitation or Paradise Creek, and to describe the relations among the aquifers. The methodology for this analysis is the interpretation of the water changes throughout the year and for specific events, using the annual hydrographs presented in Chapter 4, as well as several precipitation-event hydrographs.

The criteria used to select the precipitation events for analysis were the availability of daily data and the significance of the event chosen to determine the precipitation-stream-groundwater relations. The best daily water-level data available were for the first four months of 1990 and 1991; therefore, winter and early spring precipitation events were selected for analysis. Although the length of the precipitation events differs from one to another, the same x-axis scale was chosen in all the graphs to facilitate the comparison among them.

The focus of these analyses is mainly the shallow and E-fractured aquifer wells because they show a more direct connection with the creek and precipitation; however, some comments are made about W-fractured aquifer behavior.

Before beginning the analysis, an initial consideration of some limitations of the data is necessary. The frequency of data measurements on which the study is based limits the analysis. The frequency of water-level measurements was daily, which may be adequate to analyze seasonal fluctuations; however, for the analysis of specific periods of time it is not sufficient because the frequency of changes in the system may occur in less than a 24-hour period. In addition, the data measurement was discontinuous during most of the period of the study; this makes it difficult to compare intervals of daily data with data from two or three measurements per week. The technique used to measure the creek (a staff stage) and the wells (a steel tape) could introduce error into the elevation data; however, it would not be greater than 1/100 of a foot, an admissible error.

All precipitation data and some of the water levels are daily but they have a different character. The elevations of the creek and the wells were measured at a given time, so the data represent the elevation for an instant in time. However, the data for

precipitation is accumulative and represents the total amount of precipitation for a 24-hour period. There is no control for knowing how long and at what time of day the precipitation took place; therefore, the measurements of the elevation of the creek and the wells could have been made before, during, or after the rain or snowfall. The only information available concerning this are some comments about the weather from those who measured the wells and the creek.

5.1. PRECIPITATION-STREAM-GROUNDWATER RELATIONSHIPS

Two hydrograph scales were used to analyze the relations among precipitation, Paradise Creek, and the aquifers at the UIGRS: semi-annual and detailed-events hydrographs. The purpose of the analysis of the semi-annual hydrographs is to define the variations in water-level elevation in relation to seasons. On the other hand, with the analysis of detailed precipitation events, it is possible to define the relations among precipitation events and associated changes in stream and groundwater levels as well as the effect of parameters such as moisture content, snow on the ground, depth to water, and distance to the creek.

5.1.1. Semi-Annual Water-Level Elevation Fluctuations

The comparison between the 1988 and 1991 hydrographs indicates that the intensity and distribution of precipitation are important factors in defining the seasonal water-level fluctuations in the creek and the shallow and E-fractured aquifers. In 1988, although the data set is poor, it is possible to note that there were no important differences in the water level of the wells during the year (around 0.5 feet) because the precipitation was quite spread out throughout the year; however, in 1991 there was a marked difference in water level between winter and summer and early fall (around 2.5 feet); during this year the summer and fall were quite dry. The water level in Paradise Creek shows short-term fluctuations during the periods of intense rainfall, but its level does not decline during the dry season as much as the wells. This, together with the observation that the magnitude of the peaks of water-level elevation is not directly

related to the intensity of rainfall, is indicative that other factors exist in addition to precipitation that define the seasonal fluctuations of the water level in the aquifers.

During most of the year, the elevation of the water levels in the shallow aquifer wells and the E-fractured aquifer wells (except S12D1) are higher than the creek; therefore, groundwater is going into the creek. However, during the summer and early fall the water levels in some shallow wells are lower than the creek (taking into consideration the water-level gradient of the creek); this is especially evident for 1991.

Another factor that may explain the difference in the recession slope between the creek and the shallow and E-fractured aquifers is a hydraulic connection of the system with the stream upgradient of the UIGRS. Therefore, there may be some recharge from the creek into the aquifers during the summer and early fall.

5.1.2. Precipitation Events

The selection of the events, as mentioned above, was based on the availability of data and the significance of the event. The events chosen represent different conditions that resulted in changes in water level in the creek and the wells. The events analyzed are: 14 to 17 January 1991; 2 to 5 February 1991; 25 to 29 April 1990; 21 to 28 February 1990; and, 1 to 10 February 1990.

In the hydrographs, the magnitude and distribution of the peaks of the creek and the wells are compared in order to define the stream-groundwater relation. The water-elevation data of the creek and the wells represent the elevation based on daily measurements; the water levels reached for the systems may not be the ones represented in the hydrograph. For the creek stage there is another source of data, the USGS streamflow data. These data do not represent a maximum value either because they are the daily mean streamflow; however, they can be used to complement the stage data.

The analysis of the precipitation events is based on the evaluation of several factors or relations: (1) the ratio between the water-level changes in the aquifers related to the water-level changes in the creek; (2) the relation between the water-level elevation in the creek and in the aquifers; (3) the time lag of the peaks; (4) the slope of the recession curve in the hydrographs; and, (5) the characteristics of the precipitation.

Event 1: 14 to 17 January 1991

The first precipitation event analyzed is a large winter precipitation event without snowfall (Figures 5.1 to 5.3; Tables 5.1 to 5.3). The first four days of precipitation (from 7 to 10 January) were in the form of snowfall with snow on the ground. From then until 12 January the precipitation was rainfall, and the snow remained on the ground.

The last day of important precipitation, 15 January, the creek and all wells, except those farther from the creek (U3S, T6S, and M12S) reached their maximum water elevation. The difference in water elevation in the creek from the initial level on 11 January, and the maximum reached on 15 January, was 4.06 feet (Table 5.1). Based on the USGS streamflow data, Paradise Creek had a difference of 4.43 feet. The shallow well farthest from the creek, U3S, and J17S peaked the same day, but they peaked again three days later on the same day as did M12S; T6S peaked six days later than the rest of the wells. The hydrographs for these four wells show broad flat peaks, not the steep peaks that the creek and the rest of the wells did.

The falling limb slope is higher for the creek than for the wells. The water level of the creek dropped 2.68 feet the day after the maximum (Tables 5.1 to 5.3); it took about five more days to reach a stable elevation. However, the water elevation of the wells decreased steadily and it took them seventeen days to reach an approximately stable elevation, about 0.80 feet higher than the initial elevation. Wells U3S and J17S delayed one more day before reaching a steady water level, and T6S and M12S delayed two more (nineteen) days.

Well S12D1 peaked the same day as the rest of the wells, and its falling limb slope is similar to that of the other wells although not so homogeneous (with several changes of the slope). Water elevation of W-fractured wells also rose during the event (Figure 4.19), but with lesser intensity than the shallow and E-fractured wells. The magnitude and distribution of the peaks in the W-fractured basalt aquifer do not seem related to the precipitation in the area, as do those of the shallow and E-fractured basalt aquifers. There may be some other factors, probably outside the UIGRS, that affect the W-fractured aquifer.

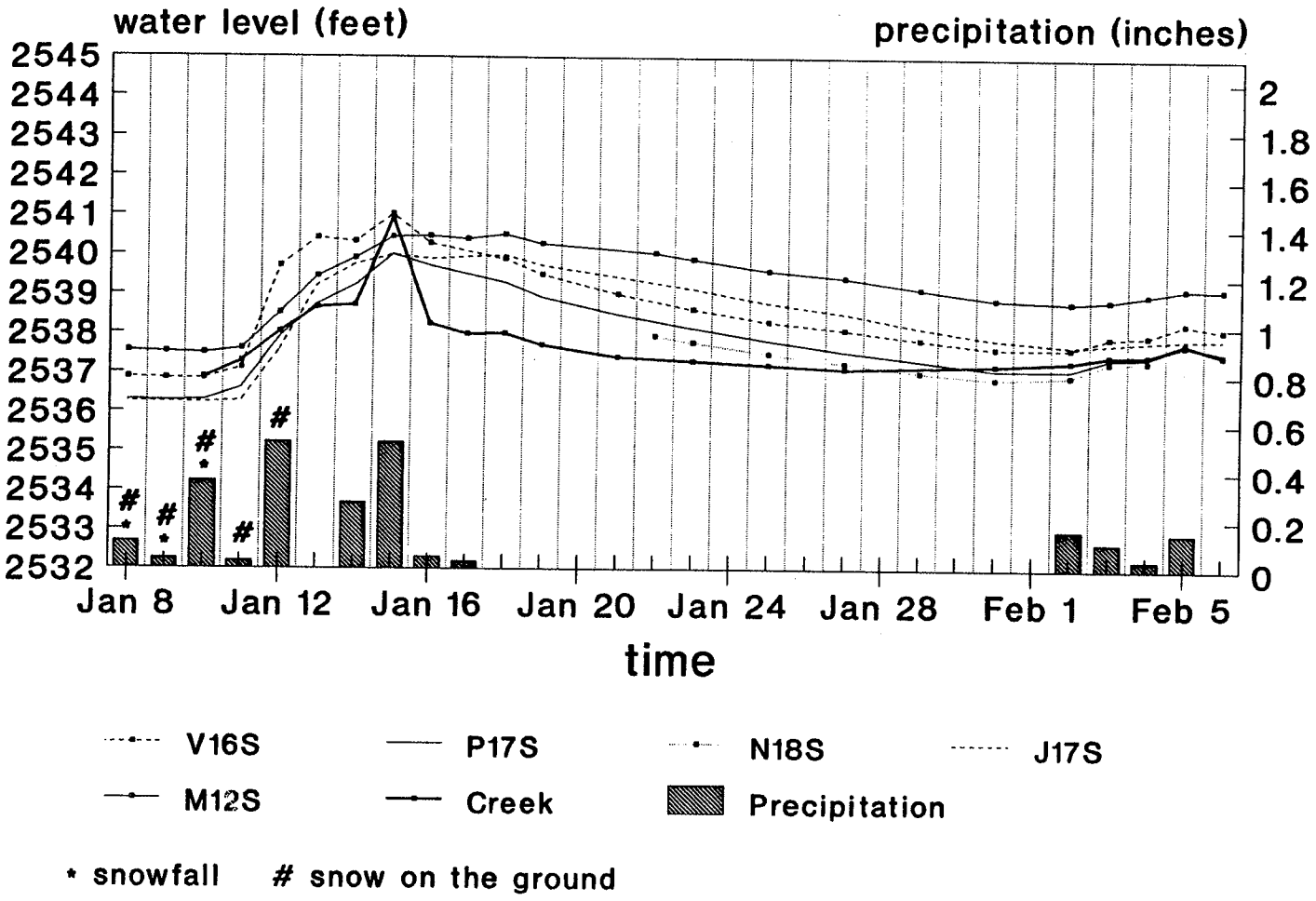

Figure 5.1. Daily precipitation and detailed water-level hydrographs of Paradise Creek and shallow aquifer wells for the precipitation events 14 to 17 January and 2 to 5 February 1991 (first part).

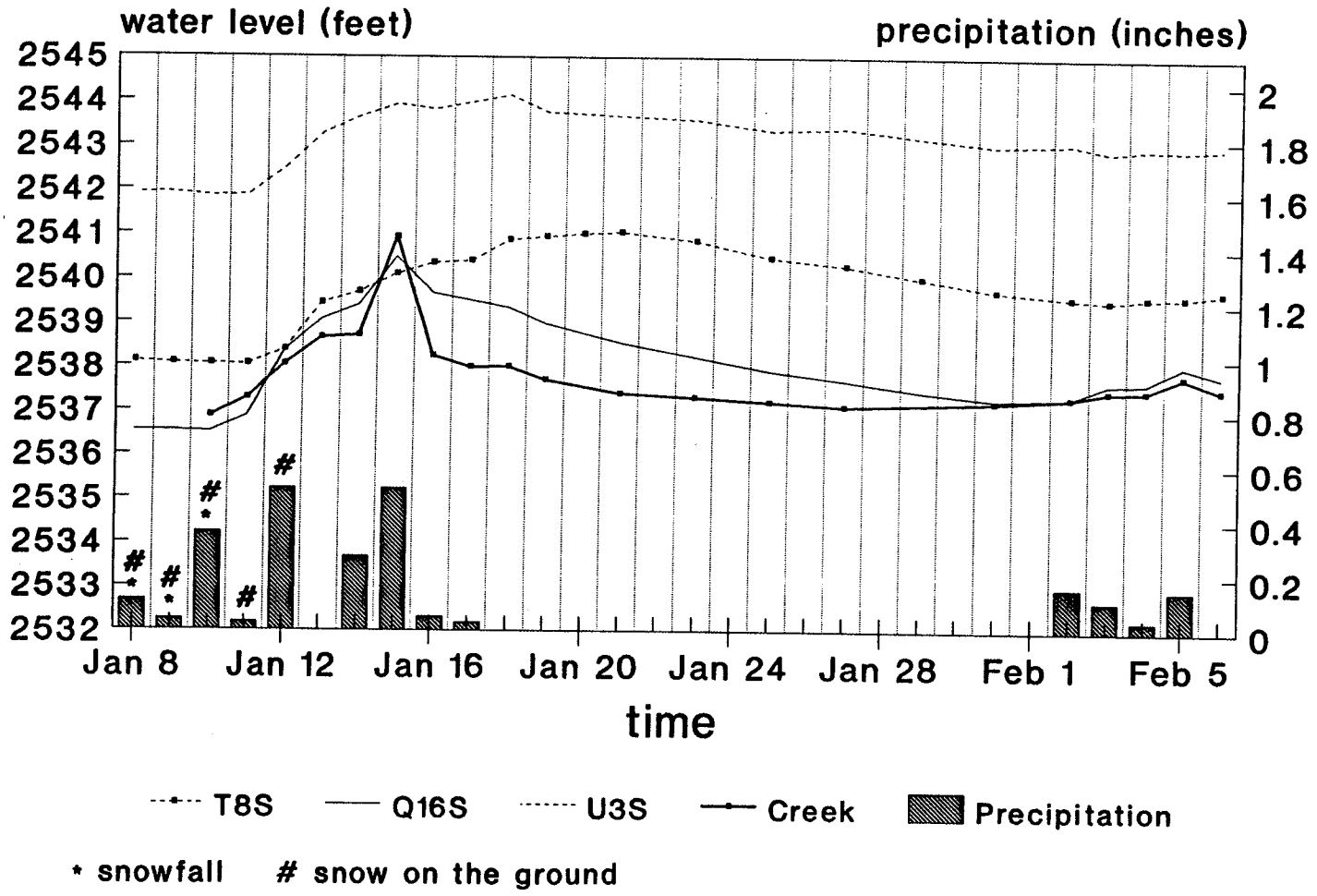

Figure 5.2. Daily precipitation and detailed water-level hydrographs of Paradise Creek and shallow aquifer wells for the precipitation events 14 to 17 January and 2 to 5 February 1991 (second part).

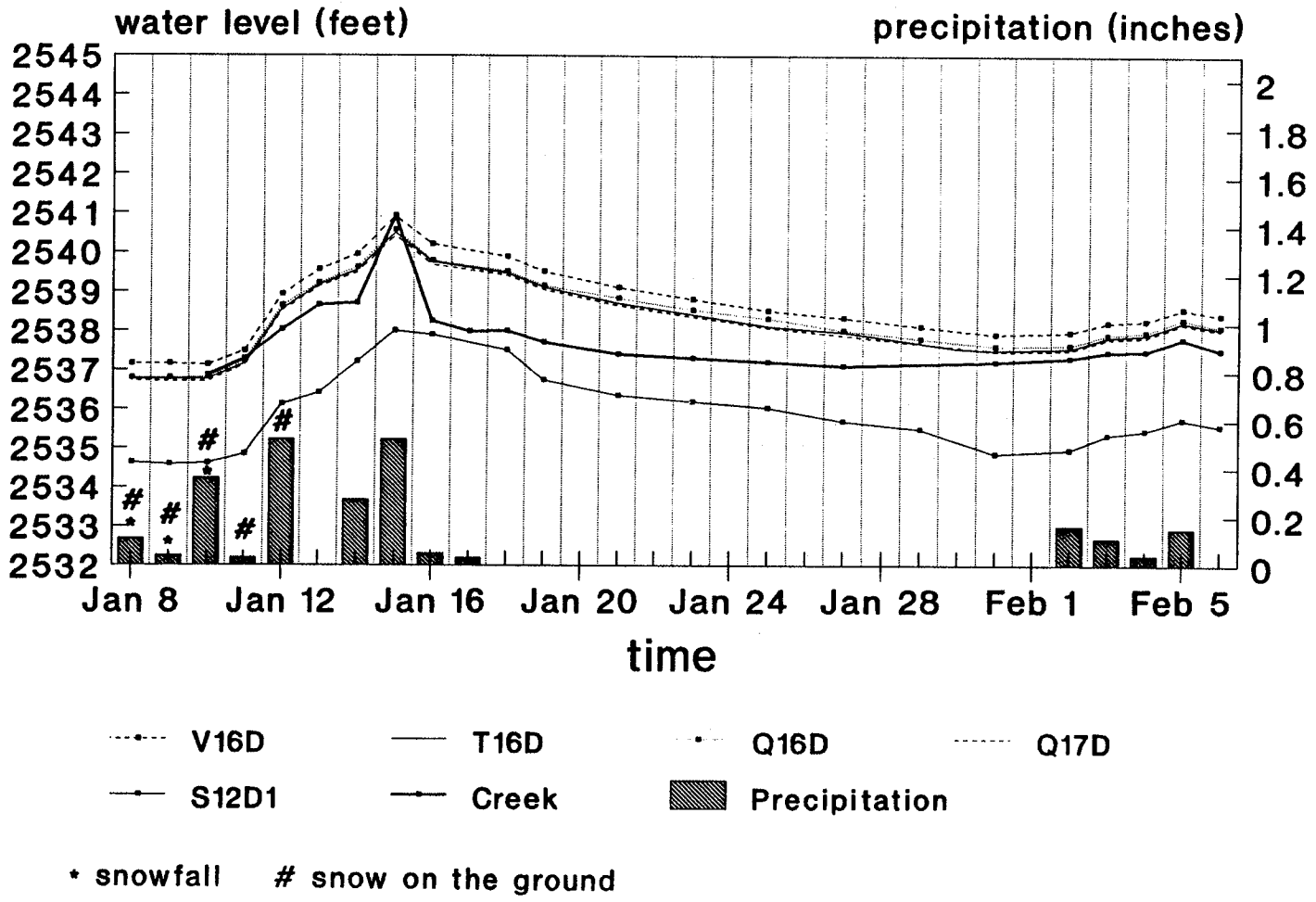

Figure 5.3. Daily precipitation and detailed water-level hydrographs of Paradise Creek and E-fractured aquifer wells for the precipitation events 14 to 17 January and 2 to 5 February 1991.

	Creek	V16S	P17S	J17S	M12S	Prec. (in.)
9 Jan. (3rd day)		2536.84	2536.28	2536.25	2537.52	0.04 *
10 Jan. (4th day)	2536.87	2536.83 (-0.01)	2536.29 (0.01)	2536.23 (-0.02)	2537.49 (-0.03)	0.36 *
11 Jan. (5th day)	2537.28 (0.41)	2537.11 (0.28)	2536.60 (0.31)	2536.27 (0.04)	2537.60 (0.11)	0.03
12 Jan. (6th day)	2538.04 (0.76)	2539.71 (2.60)	2537.90 (1.30)	2537.59 (1.32)	2538.51 (0.91)	**0.52**
13 Jan. (7th day)	2538.66 (0.62)	2540.41 (0.70)	2538.74 (0.84)	2539.22 (1.63)	2539.45 (0.94)	0.00
14 Jan. (8th day)	2538.71 (0.05)	2540.33 (-0.08)	2539.22 (0.48)	2539.75 (0.53)	2539.91 (0.46)	0.27
15 Jan. (9th day)	**2540.93** (2.22)	**2541.02** (0.69)	**2540.01** (0.68)	**2539.99** (0.24)	**2540.54** (0.54)	**0.52**
16 Jan. (10th day)	2538.25 (-2.63)	2540.29 (-0.73)	2539.72 (-0.29)	2539.89 (-0.10)	2540.47 (0.02)	0.05
17 Jan. (11th day)	2537.99 (-0.26)	-	-	-	2540.40 (-0.07)	0.03
18 Jan. (1 day after)	2538.00 (0.01)	2539.90 (-0.39)	2539.30 (-0.42)	2539.99 (0.10)	2540.51 (0.11)	0.00
19 Jan. (2 days after)	2537.71 (-0.29)	2539.51 (-0.39)	2538.93 (-0.37)	2539.74 (-0.25)	2540.29 (-0.22)	0.00

* Snowfall

Table 5.1. Precipitation event from 9 to 19 January 1991. Water elevation (in feet) and difference in water elevation with respect to the day before (within the parenthesis) for the shallow aquifer (first part). The maximum water-levels and precipitation are printed in boldface.

	Creek	T6S	J16S	U3S	Q16S	Prec. (in.)
9 Jan. (3rd day)		2538.07	2536.43	2541.93	2536.53	0.04 *
10 Jan. (4th day)	2536.87	2538.05 (-0.03)	2536.43 (0.00)	2541.85 (-0.08)	2536.51 (-0.02)	0.36 *
11 Jan. (5th day)	2537.28 (0.41)	2538.04 (-0.01)	2536.76 (0.33)	2541.87 (0.02)	2536.87 (0.36)	0.03
12 Jan. (6th day)	2538.04 (0.76)	2538.38 (0.34)	2538.13 (1.37)	2542.49 (0.62)	2538.36 (1.49)	**0.52**
13 Jan. (7th day)	2538.66 (0.62)	2539.43 (1.05)	2539.19 (1.06)	2543.27 (0.78)	2539.06 (0.70)	0.00
14 Jan. (8th day)	2538.71 (0.05)	2539.69 (0.26)	2539.78 (0.59)	2543.65 (0.38)	2539.40 (0.34)	0.27
15 Jan. (9th day)	**2540.93** (2.22)	2540.10 (0.41)	**2540.49** (0.71)	**2543.93** (0.28)	**2540.48** (1.08)	**0.52**
16 Jan. (10th day)	2538.25 (-2.63)	2540.35 (0.25)	2539.95 (-0.54)	2543.82 (-0.11)	2539.66 (-0.82)	0.05
17 Jan. (11th day)	2537.99 (-0.26)	2540.40 (0.05)	-	-	-	0.03
18 Jan. (1 day after)	2538.00 (0.01)	2540.88 (0.48)	2539.92 (-0.03)	**2544.13** (0.31)	2539.34 (-0.32)	0.00
19 Jan. (2 days after)	2537.71 (-0.29)	2540.95 (0.07)	2539.57 (-0.35)	2543.77 (-0.36)	2538.99 (-0.35)	0.00

* Snowfall

Table 5.2. Precipitation event from 9 to 19 January 1991. Water elevation (in feet) and difference in water elevation with respect to the day before (within the parenthesis) for the shallow aquifer (second part). The maximum water-levels and precipitation are printed in boldface.

	Creek	V16D	Q17D	Q16D	T16D	S12D1	Prec. (in.)
9 Jan. (3rd day)		2537.15	2536.70	2536.79	2536.76	2534.58	0.04 *
10 Jan. (4th day)	2536.87	2537.12 (-0.03)	2536.70 (0.00)	2536.81 (0.02)	2536.76 (0.00)	2534.61 (0.03)	0.36 *
11 Jan. (5th day)	2537.28 (0.41)	2537.48 (0.36)	2537.13 (0.43)	2537.22 (0.41)	2537.15 (0.39)	2534.85 (0.24)	0.03
12 Jan. (6th day)	2538.04 (0.76)	2538.93 (1.45)	2538.52 (1.39)	2538.64 (1.42)	2538.55 (1.40)	2536.13 (1.28)	**0.52**
13 Jan. (7th day)	2538.66 (0.62)	2539.57 (0.64)	2539.13 (0.61)	2539.22 (0.58)	2539.17 (0.62)	2536.42 (0.29)	0.00
14 Jan. (8th day)	2538.71 (0.05)	2539.95 (0.38)	2539.49 (0.36)	2539.62 (0.40)	2539.55 (0.38)	2537.21 (0.79)	0.27
15 Jan. (9th day)	**2540.93** (2.22)	**2540.92** (0.97)	**2540.43** (0.94)	**2540.57** (0.95)	**2540.50** (0.95)	**2538.01** (0.80)	**0.52**
16 Jan. (10th day)	2538.25 (-2.63)	2540.21 (-0.71)	2539.69 (-0.74)	2539.80 (-0.77)	2539.76 (-0.74)	2537.91 (-0.10)	0.05
17 Jan. (11th day)	2537.99 (-0.26)	-	-	-	-	-	0.05
18 Jan. (1 day after)	2538.00 (0.01)	2539.90 (-0.31)	2539.42 (-0.27)	2539.52 (-0.28)	2539.47 (-0.29)	2537.51 (-0.40)	0.00
19 Jan. (2 days after)	2537.71 (-0.29)	2539.52 (-0.38)	2539.06 (-0.36)	2539.16 (-0.36)	2539.12 (-0.35)	2536.75 (-0.76)	0.00

* Snowfall

Table 5.3. Precipitation event from 9 to 19 January 1991. Water elevation (in feet) and difference in water elevation with respect to the day before (within the parenthesis) for the E-fractured aquifer. The maximum water-levels and precipitation are printed in boldface.

The water elevation of the creek was higher than all the wells (except U3S) during the peak. The water-level difference between the creek and the wells closest to it was up to 1.5 feet, without considering the creek gradient.

The ratio between the increment in water level in the shallow aquifer wells close to the creek (P17S, J16S, Q16S, and J17S), E-fractured aquifer wells, and Paradise Creek ranges from 0.92 to 1.00. V16S presents a slightly higher ratio of 1.03 feet. The ratio in the shallow aquifer wells farther from the creek (U3S, T6S, and M12S) ranges from 0.5 to 0.75. Therefore, the farther from the stream the smaller the ratio between the water-level change in the shallow aquifer and in the stream; this indicates some influence by the stream on the aquifers' water level. The fact that the increment of the water level in the stream is greater than in the wells, together with the higher water-level elevation in the creek during maximum flow, is enough evidence to conclude that the stream at the UIGRS may be directly recharging the shallow aquifer and indirectly the E-fractured basalt aquifer.

Well V16S behaved very similarly to the creek, with almost the same increment in water level during the maximum (Figure 5.1; Table 5.1). This behavior may be explained by the direct effect of precipitation (as happened in the stream) due to the very shallow water level in V16S (Table 3.1).

Well U3S showed a different behavior from the other wells farther from the creek because it peaked the same day as the wells close to the creek (although with small magnitude), and peaked again the same day as the rest of the wells farther from the creek. This behavior may have been related to the depth-to-water in the well (Table 3.2), which is the shallowest of the site. In addition, during intense rainfall periods, a water pond forms in the southern portion of the site where U3S is located, and this pond may generate infiltration during the precipitation event. This may explain why U3S peaks the same day as the wells close to the stream.

In conclusion, the shallow and E-fractured basalt aquifers during this January 1991 precipitation event were recharged by the stream, but some direct recharge occurred from precipitation.

Event 2: 2 to 5 February 1991

This event was a small winter rainfall event. Figures 5.1 to 5.3 illustrate the hydrographs for this period, and Tables 5.4 to 5.6 show the water-level elevation in the wells and in the stream, as well as the differences in water elevation with respect to the day before. The water level in most of the wells and the creek started to rise slightly the second day of rainfall; T6S and U3S started to rise on the third day. The maximum was reached the fourth day by the creek and all wells except M12S, J17S, T6S, and U3S. M12S show an almost flat peak, and J17D and U3S none. Well T6S shows a flat peak about three days later than the rest of the wells. S12D1 peaked the same day as the other E-fractured wells and with a similar magnitude. The slope of the rising limb is similar for the creek and the wells, but the falling limb is greater for the creek.

The hydrographs of the W-fractured aquifer wells (Figure 4.19) also show a peak for the fourth day of the event but with a rising limb slope that was almost ten times greater than those of the rest of the wells; this peak is followed by another peak. These peaks in the W-fractured wells do not seem related to those of the other aquifers, the creek, or the precipitation at the UIGRS.

The water level of the creek was always lower than the level of the shallow and E-fractured aquifer wells (except S12D1). As in Event 1, the ratio between the increment in water-level elevation in the wells and in the creek is smaller for the wells farther from the creek than for those closer to it. The ratio for the shallow aquifer wells close to the stream and the E-fractured aquifer wells is 1.12, whereas for M12S (the only well far from the stream that peaks) it is 0.46. The ratio greater than one (for most of the wells and the lower elevation of the creek with respect to the aquifers) suggests that the creek does not recharge the aquifers during this event. However, the different behavior of the wells in relation to the distance from the creek indicates that there may be some upstream relation between the creek and the aquifers. Therefore, the source of recharge during this rainfall event may be mainly precipitation with some upstream flow recharge.

	Creek	V16S	P17S	J17S	M12S	Prec. (in.)
2 Feb. (1st day)	2537.31	2537.65	2537.09	2537.72	2538.82	**0.16**
3 Feb. (2nd day)	2537.47 (0.16)	2537.93 (0.28)	2537.40 (0.31)	2537.78 (0.06)	2538.87 (0.05)	0.11
4 Feb. (3rd day)	2537.48 (0.01)	2537.97 (0.04)	2537.43 (0.03)	2537.84 (0.06)	2539.02 (0.15)	0.04
5 Feb. (4th day)	**2537.81** (0.33)	**2538.29** (0.32)	**2537.78** (0.35)	2537.90 (0.06)	**2539.17** (0.15)	0.15
6 Feb. (1 day after)	2537.51 (-0.30)	2538.13 (-0.16)	2537.57 (-0.21)	**2537.91** (0.01)	2539.16 (-0.01)	0.00

Table 5.4. Precipitation event from 2 to 5 February 1991. Water elevation (in feet) and difference in water elevation with respect to the day before (within the parenthesis) for the shallow aquifer (first part). The maximum water-levels and precipitation are printed in boldface.

	Creek	T6S	J16S	U3S	Q16S	Prec. (in.)
2 Feb. (1st day)	2537.31	2539.59	2537.71	2543.07	2537.31	**0.16**
3 Feb. (2nd day)	2537.47 (0.16)	2539.53 (-0.06)	2537.90 (0.19)	2542.89 (-0.18)	2537.64 (0.33)	0.11
4 Feb. (3rd day)	2537.48 (0.01)	2539.60 (0.07)	2537.92 (0.02)	2542.97 (0.08)	2537.66 (0.02)	0.04
5 Feb. (4th day)	**2537.81** (0.33)	2539.61 (0.01)	**2538.22** (0.30)	2542.94 (-0.03)	2538.05 (0.39)	0.15
6 Feb. (1 day after)	2537.51 (-0.30)	**2539.72** (0.11)	2538.06 (-0.16)	**2542.99** (0.05)	**2537.81** (-0.24)	0.00

Table 5.5. Precipitation event from February 2 to 5, 1991. Water elevation (in feet) and difference in water elevation with respect to the day before (within the parenthesis) for the shallow aquifer (second part). The maximum water-levels and precipitation are printed in boldface.

	Creek	V16D	Q17D	Q16D	T16D	S12D1	Prec. (in.)
2 Feb. (1st day)	2537.31	2537.97	2537.52	2537.65	2537.56	2534.96	**0.16**
3 Feb. (2nd day)	2537.47 (0.16)	2538.22 (0.25)	2537.80 (0.28)	2537.91 (0.26)	2537.85 (0.29)	2535.33 (0.37)	0.11
4 Feb. (3rd day)	2537.48 (0.01)	2538.27 (0.05)	2537.85 (0.05)	2537.98 (0.07)	2537.91 (0.06)	2535.45 (0.12)	0.04
5 Feb. (4th day)	**2537.81** (0.33)	**2538.56** (0.29)	**2538.19** (0.34)	**2538.30** (0.32)	**2538.24** (0.34)	**2535.74** (0.29)	0.15
6 Feb. (1 d. after)	2537.51 (-0.30)	2538.41 (-0.15)	2538.02 (-0.17)	2538.11 (-0.19)	2538.06 (-0.18)	2535.56 (-0.18)	0.00

Table 5.6. Precipitation event from 2 to 5 February 1991. Water elevation (in feet) and difference in water elevation with respect to the day before (within the parenthesis) for the E-fractured aquifer. The maximum water-levels and precipitation are printed in boldface.

Event 3: 25 to 29 April 1990

This event is a large spring rainfall with some snowfall and small changes in water level. During this period there are no data for water-levels for the shallow aquifer wells farther from the stream. The hydrographs for this event (Figures 5.4 and 5.5; Table 5.7) show the water elevation of the wells and the creek.

From 20 to 23 April there was a small rainfall event with almost no effect on the water level of the creek and the wells. The magnitude of the precipitation event from 25 to 29 April was greater than the 14 to 17 January 1991 event. The creek and the shallow and E-fractured aquifer wells responded slightly the second day of precipitation, and both systems had the same intensity (except well V16S which rose almost twice as high as the rest and was the only one that decreased the next day). The maximum elevation of water level was reached 28 April, the day with higher intensity of rainfall (including some snowfall). The slope of the rising limb appears smaller for the creek than for the wells; the slope of the shallow aquifer wells is slightly greater than for the E-fractured aquifer wells, and well V16S shows the greatest slope. The slope of the falling limb is greater for the creek than for the wells, and again, the slope is slightly greater for the shallow aquifer wells than for the E-fractured wells. The creek reached the initial water level very quickly, whereas the recession curve for the wells is smoother and longer.

The water-level elevation of the creek was lower than the shallow and E-fractured aquifer wells (except S12D1). The ratio between the increment in water level in the aquifers and in the creek is about a foot for all wells represented, except V16S and the W-fractured aquifer wells. The ratio for V16S is 1.70. The source of recharge during this event seems to be precipitation, although the behavior of V16S suggests that there may be an upstream source of recharge.

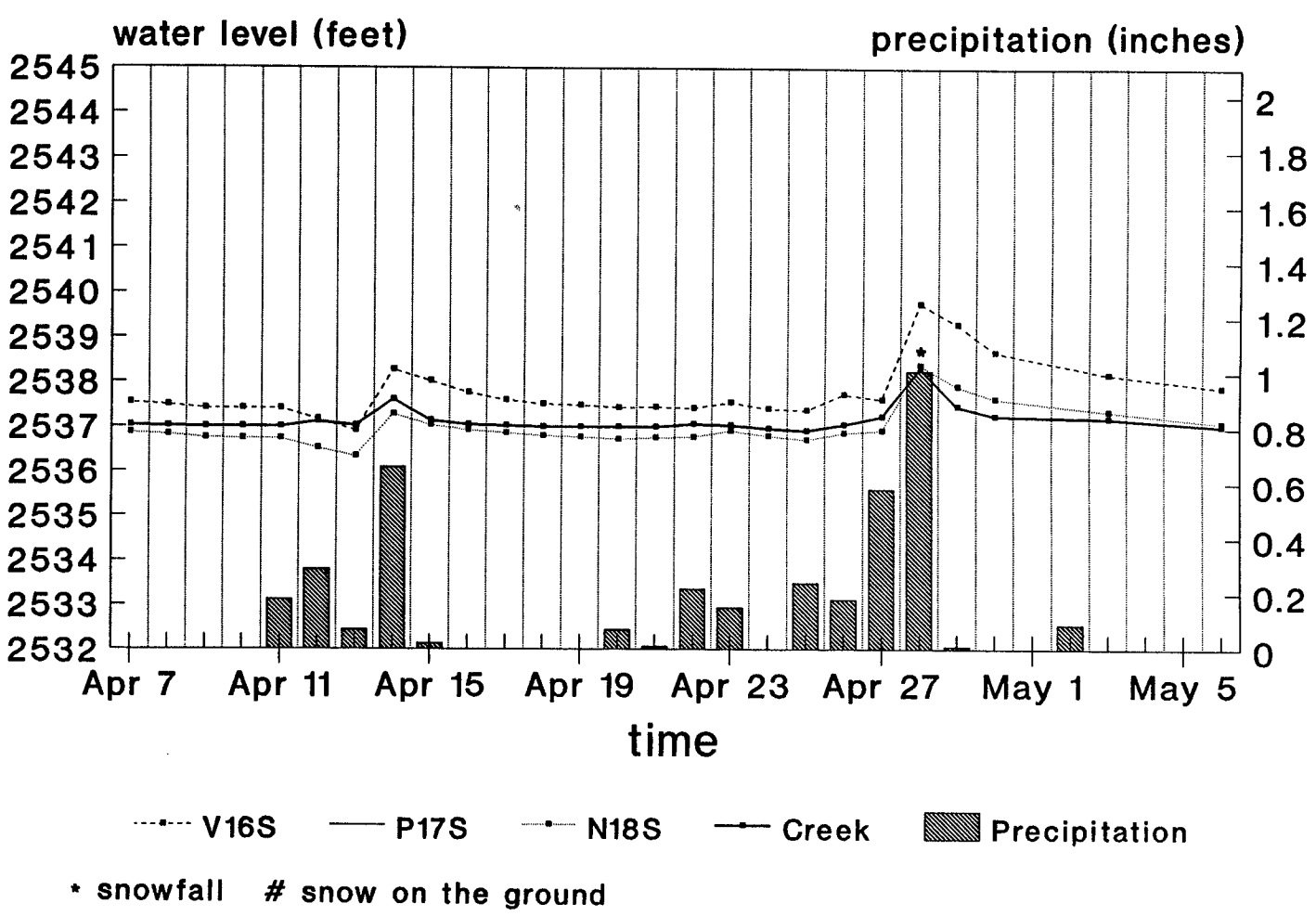

Figure 5.4. Daily precipitation and detailed water-level hydrographs of Paradise Creek and shallow aquifer wells for the precipitation event 25 to 29 April 1990.

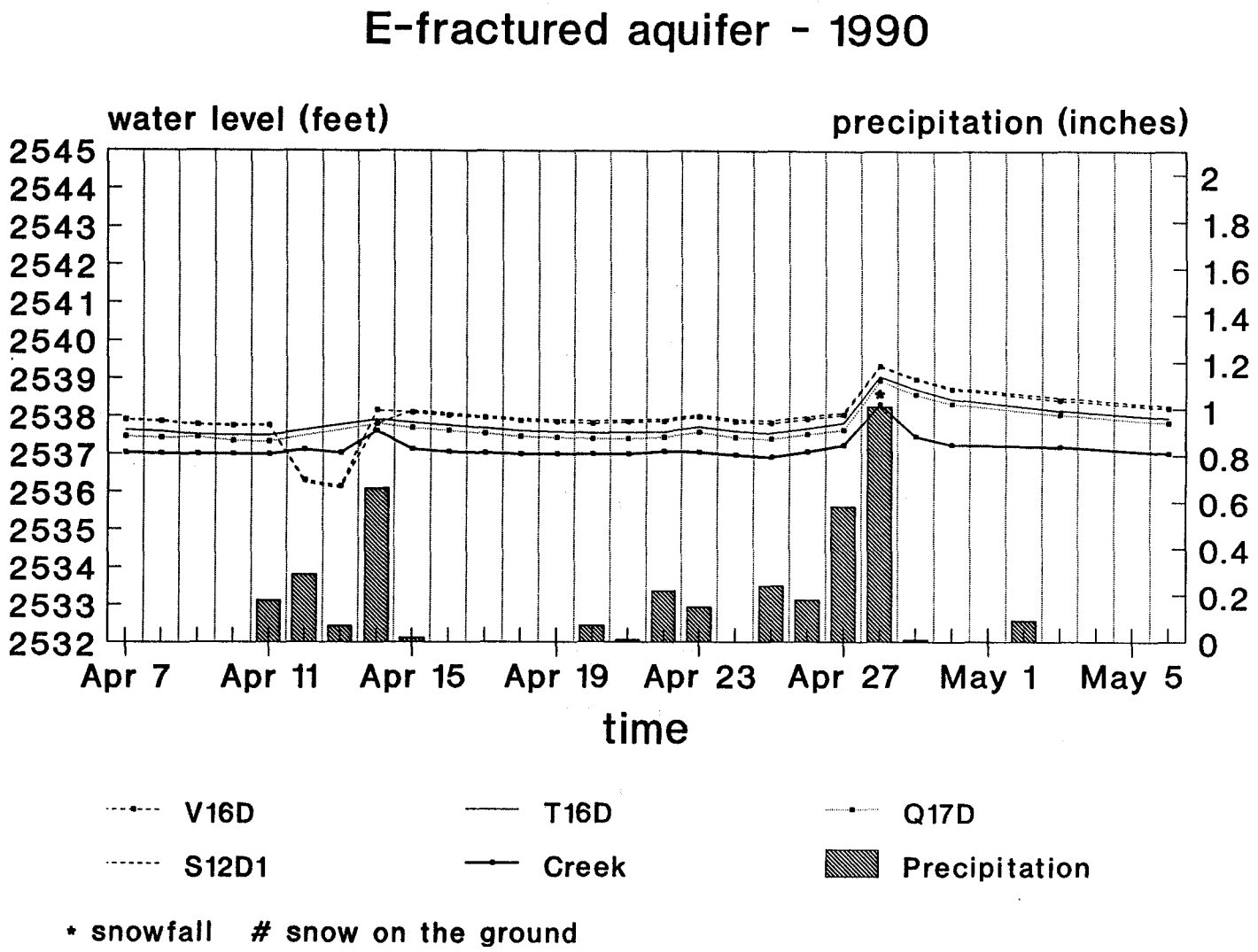

Figure 5.5. Daily precipitation and detailed water-level hydrographs of Paradise Creek and E-fractured aquifer wells for the precipitation event 25 to 29 April 1990.

	Creek	Shallow Aquifer			E-fractured Aquifer				W-frac.	Prec. (in.)
		V16S	P17S	N18S	V16D	T16D	Q17D	S12D1	D19D	
21 Apr. (day after)	2536.99	2537.44	2536.86	2536.75	2537.84	2537.57	2537.40	2537.90	2518.62	0.01
22 Apr. (1st day)	**2537.06** (0.07)	2537.42 (-0.02)	2536.84 (-0.02)	2536.76 (0.01)	2537.86 (0.02)	2537.58 (0.01)	2537.44 (0.04)	2537.92 (0.02)	2518.83 (0.11)	**0.22**
23 Apr. (2nd day)	2537.04 (-0.02)	**2537.55** (0.13)	**2536.97** (0.13)	**2536.91** (0.15)	**2537.98** (0.12)	**2537.52** (0.15)	**2537.57** (0.13)	**2538.03** (0.11)	2518.71 (0.26)	0.15
24 Apr. (3rd day)	2536.96 (-0.08)	2537.41 (-0.14)	2536.80 (-0.17)	2536.79 (-0.12)	2537.85 (-0.13)	2537.60 (-0.12)	2537.43 (-0.14)	2537.90 (-0.13)	2518.65 (-0.06)	0.00
25 Apr. (4th day)	2536.91 (-0.07)	2537.37 (-0.04)	2536.78 (-0.02)	2536.70 (-0.09)	2537.80 (-0.05)	2537.54 (-0.06)	2537.39 (-0.04)	2537.87 (-0.03)	2518.63 (-0.02)	0.24
26 Apr. (5th day)	2537.05 (0.14)	2537.72 (0.35)	2536.92 (0.14)	2536.86 (0.16)	2537.62 (0.12)	2537.67 (0.13)	2537.52 (0.13)	2537.99 (0.12)	2518.72 (0.09)	0.18
27 Apr. (6th day)	2537.22 (0.17)	2537.61 (-0.11)	2536.99 (0.07)	2536.91 (0.05)	2538.04 (0.12)	2537.82 (0.15)	2537.63 (0.11)	2538.09 (0.10)	2519.00 (0.28)	**0.58**
28 Apr. (7th day)	**2538.31** (1.09)	**2539.75** (2.14)	**2538.29** (1.30)	**2538.38** (1.47)	**2539.31** (1.27)	**2539.05** (1.23)	**2538.92** (1.29)	**2539.33** (1.24)	2518.79 (-0.21)	**1.01** *
29 Apr. (1 day after)	2537.46 (-0.85)	2539.29 (-0.46)	2537.90 (-0.39)	2537.90 (-0.48)	2538.97 (-0.34)	2538.71 (-0.34)	2538.56 (-0.36)	2539.00 (-0.33)	2518.79 (-0.21)	0.01
30 Apr. (2 d. after)	2537.24 (-0.22)	2538.67 (-0.62)	2537.71 (-0.19)	2537.62 (-0.28)	2538.71 (-0.26)	2538.54 (-0.17)	2538.32 (-0.24)	2538.76 (-0.24)	2518.62 (-0.17)	0.00

* Snowfall

Table 5.7. Precipitation event 22 to 28 April 1990. Water elevation (in feet) and difference in water elevation with respect to the day before (within the parenthesis). The maximum water-levels and precipitation are printed in bold.

Comparison of Events 1, 2 and 3

The three events described had rainfall with almost no snowfall. Event 1 is a large rainfall event that occurred after a significant snowfall event and instigated a great rise in the water level of the aquifers and the creek. By contrast, Event 3 is a large rainfall event that did not generate such a great rise in the water levels. The different behavior is due to the following factors: (1) the amount of precipitation was greater during the first event; (2) the moisture content of the soil was higher; and, (3) the evapotranspiration was lower. Event 1 occurred during the winter, whereas Event 3 occurred during the spring. When the moisture content is high, such as during winter after a precipitation event such as Event 1, the recharge to groundwater is higher. On the other hand, when the moisture content is low, such as in spring Event 3, the soil requires water (higher evapotranspiration), and therefore the actual water going into the aquifer is less than in conditions of high moisture content. At the same time, the runoff decreases when the evapotranspiration is higher; therefore, there is less water going into the creek and it peaks with less intensity than during the winter.

During precipitation Event 1, the main source of recharge for the shallow and E-fractured basalt aquifers seems to have been the stream, although precipitation was the other primary source of recharge. However, during the events 2 and 3, the main source of recharge seems to have been precipitation with some influence by the stream occurring upgradient. The fluctuation pattern of water-level elevation in the wells remains very similar to that of the creek, whether the stream at the UIGRS is the main source of recharge or not.

Event 4: 21 to 28 February 1990

This event is a snowmelt event without precipitation (Figures 5.6 and 5.7; Table 5.8). On 20 February, some snowfall accumulated on the ground. The creek reacted the next day (21 February) with a slight rise of water level, but there was no reaction by the wells until the second day after the snowfall. The groundwater elevation in well V16S rose 1.34 feet in only one day, whereas the rest of the wells and the creek reached their maximum four days after the event (24 February) and after a gradual increase (Figure 5.7).

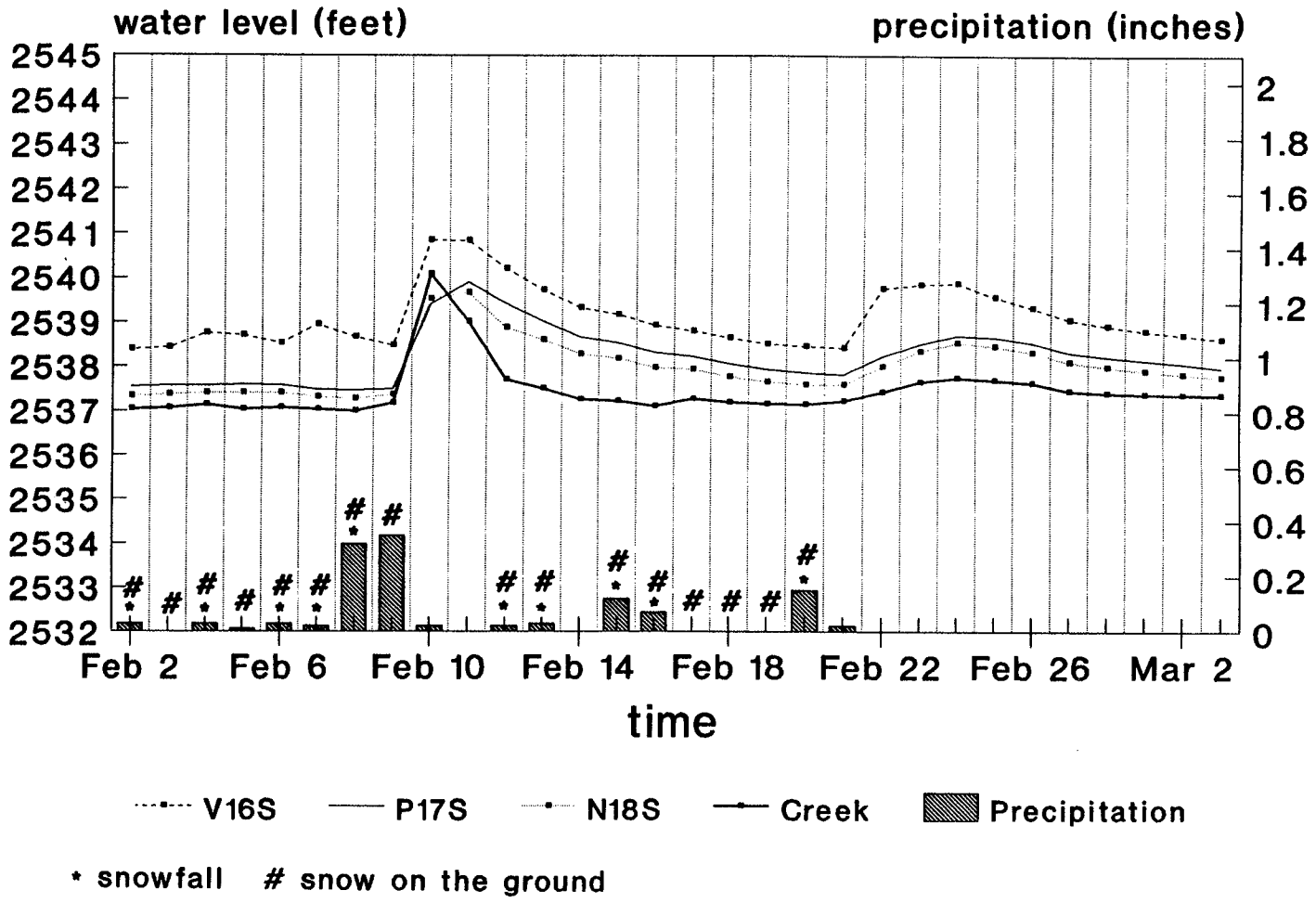

Figure 5.6. Daily precipitation and detailed water-level hydrographs of Paradise Creek and shallow aquifer wells for the precipitation events 1 to 10 and 21 to 28 February 1990.

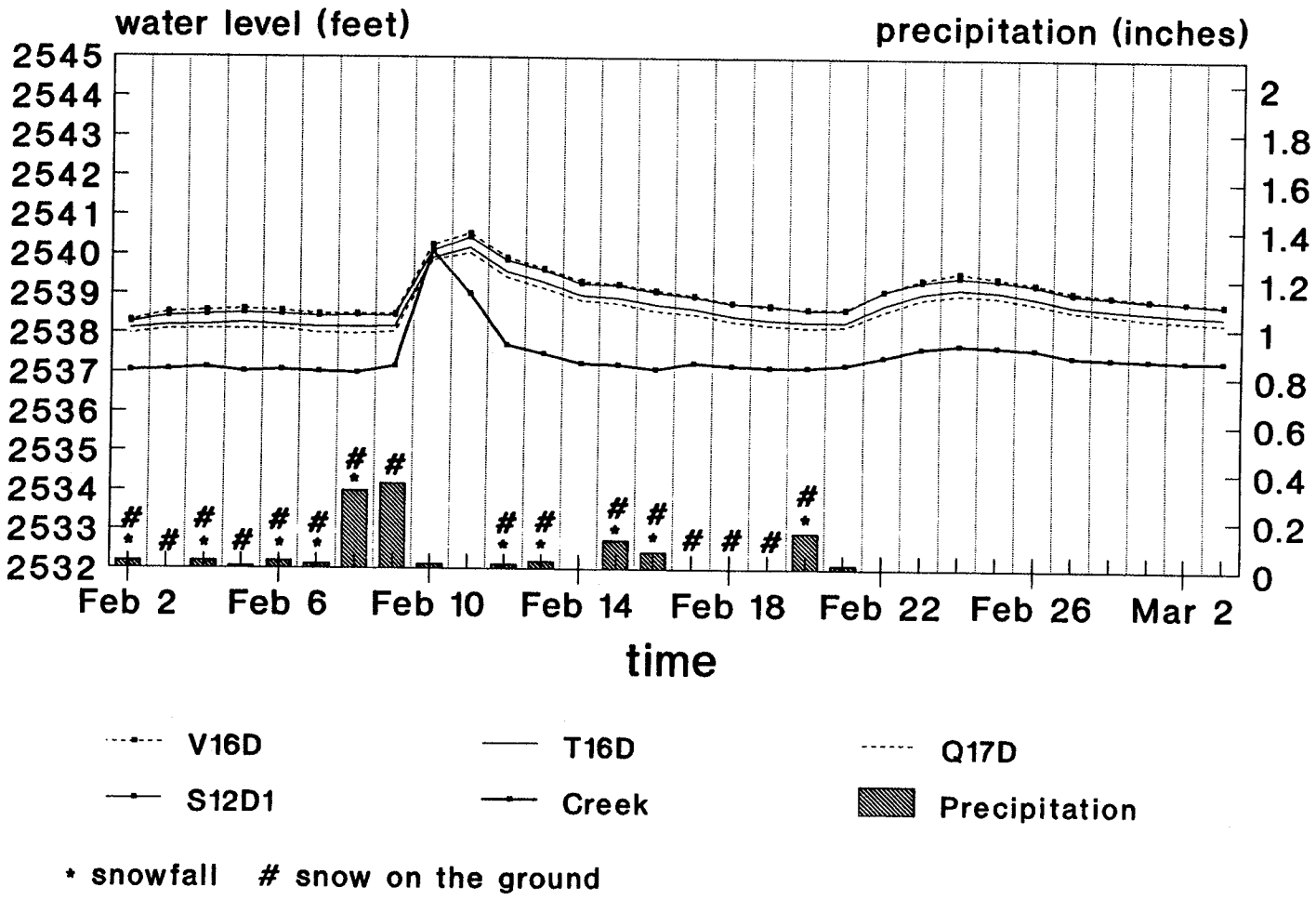

Figure 5.7. Daily precipitation and detailed water-level hydrographs of Paradise Creek and E-fractured aquifer wells for the precipitation events 1 to 10 and 21 to 28 February 1990.

	Creek	Shallow Aquifer			E-fractured Aquifer				W-frac.	Prec. (in.)
		V16S	P17S	N18S	V16D	T16D	Q17D	S12D1	D19D	
21 Feb.	2537.23	2538.43	2537.83	2537.60	2538.65	2538.32	2538.20	2538.63	2519.48	0.02
22 Feb.	2537.43 (-0.20)	2539.77 (1.34)	2538.23 (0.40)	2538.00 (0.40)	2539.10 (0.45)	2538.75 (0.43)	2538.59 (0.39)	2539.12 (0.49)	2519.37 (-0.11)	0.00
23 Feb.	2537.66 (0.23)	2539.86 (0.09)	2538.52 (0.29)	2538.35 (0.35)	2539.42 (0.32)	2539.06 (0.31)	2538.91 (0.32)	2539.36 (0.24)	2519.46 (0.09)	0.00
24 Feb.	**2537.75** (0.09)	**2539.88** (0.02)	**2538.70** (0.18)	**2538.54** (0.19)	**2539.59** (0.17)	**2539.18** (0.12)	**2539.03** (0.12)	**2539.48** (0.12)	2519.52 (0.06)	0.00
25 Feb.	2537.70 (-0.05)	2539.57 (-0.31)	2538.67 (-0.03)	2538.46 (-0.08)	2539.46 (-0.13)	2539.11 (-0.07)	2538.97 (-0.06)	2539.41 (-0.07)	**2519.59** (0.07)	0.00
26 Feb.	2537.64 (-0.06)	2539.33 (-0.24)	2538.54 (-0.13)	2538.32 (-0.14)	2539.31 (-0.15)	2538.96 (-0.85)	2538.82 (-0.15)	2539.27 (-0.14)	2519.54 (-0.05)	0.00
27 Feb.	2537.46 (-0.18)	2539.06 (-0.27)	2538.32 (-0.22)	2538.10 (-0.22)	2539.11 (-0.20)	2538.76 (-0.20)	2538.62 (-0.20)	2539.06 (-0.21)	2519.46 (-0.08)	0.00
28 Feb.	2537.41 (-0.05)	2538.93 (-0.11)	2538.22 (-0.10)	2537.99 (-0.11)	2539.01 (-0.10)	2538.67 (-0.09)	2538.54 (-0.08)	2538.98 (-0.08)	2519.50 (0.04)	0.00

Table 5.8. Precipitation event 21 to 28 February 1990. Water elevation (in feet) and difference in water elevation with respect to the day before (within the parenthesis). The maximum water-levels and precipitation are printed in boldface.

The increment in water level in the aquifers is greater than in the creek, and the water elevation of the creek is lower than in all wells, except in the W-fractured aquifer wells. These two factors suggest that the source of recharge cannot be the stream on the site but upgradient from UIGRS. In addition, the storage of snow and water in the soil during the snowfall event could be another source of recharge for the aquifers after the precipitation ended.

Event 5: 1 to 10 February 1990

This event is a snow and rainfall event with an accumulation of snow on the ground (Figures 5.6 and 5.7; Table 5.9). The first day of important precipitation (8 February 1990) was in the form of snowfall, with some snow on the ground, whereas the second day was rainfall and some snow still on the ground. Only the creek and wells N18S, T16D, and Q17D showed some slight rise during the day after the snowfall. All wells and the creek drastically increased their elevation on 10 February (one day after the rainfall). However, only the creek and V16S achieved their maximum on this day; the rest of the shallow and E-fractured wells reached their maximum elevations on 11 February (two days after the rainfall).

The peak of the water-level elevation of the creek is the steepest in both the rising and the falling limbs; it took only one day to reach its maximum and two days to return to close to its initial elevation. The falling limbs for the wells have a lower slope; it took these wells at least ten days to reach an elevation close to the initial one. The increase in groundwater elevation due to the event was greater for the shallow aquifer than for the E-fractured aquifer. The W-fractured wells had two peaks following the event (Figure 4.11), one four days after the event and a higher one seven days after the event. However, the magnitude of these peaks is small when compared with those of the other two aquifers and does not seem related to the creek or to the shallow and E-fractured aquifers.

The water elevation of the creek was higher than in the shallow aquifer wells (except V16S). The ratio between the increment in water level in the aquifers and the creek ranges from 0.60 to 0.75 for the shallow and E-fractured aquifer wells. For

	Creek	Shallow Aquifer			E-fractured Aquifer				W-frac.	Prec. (in.)
		V16S	P17S	N18S	V16D	T16D	Q17D	S12D1	D19D	
7 Feb. (day after)	2537.03	2538.95	2537.48	2537.31	2538.50	2538.16	2538.00	2538.44	2518.87	0.02
8 Feb. (1st day)	2536.99 (-0.04)	2538.67 (-0.28)	2537.47 (-0.01)	2537.27 (-0.04)	2538.50 (0.00)	2538.16 (0.00)	2537.99 (-0.01)	2538.45 (0.01)	2519.25 (0.38)	**0.32** *
9 Feb. (2nd day)	2537.17 (0.18)	2538.48 (-0.19)	2537.49 (-0.02)	2537.37 (0.10)	2538.49 (-0.01)	2538.18 (0.02)	2538.03 (0.04)	2538.45 (0.00)	2519.20 (-0.05)	**0.35**
10 Feb. (1 day after)	**2540.09** (2.92)	**2540.85** (2.37)	**2539.41** (1.92)	**2539.53** (2.15)	**2540.26** (1.77)	**2539.93** (1.75)	**2539.87** (1.84)	**2540.11** (1.66)	2519.24 (0.04)	0.02
11 Feb. (2 days after)	2539.01 (-1.08)	2540.84 (-0.01)	**2539.91** (0.50)	**2539.66** (0.14)	**2540.54** (0.28)	**2540.19** (0.26)	**2541.05** (0.18)	**2540.44** (0.33)	2519.49 (0.25)	0.00
12 Feb. (3 days after)	2537.71 (-1.30)	2540.21 (-0.63)	2539.42 (-0.49)	2538.89 (-0.77)	2539.94 (-0.60)	2539.58 (-0.61)	2540.43 (-0.62)	2539.86 (-0.58)	2519.70 (0.21)	0.02

* Snowfall

Table 5.9. Precipitation event 8 to 9 February 1990. Water elevation (in feet) and difference in water elevation with respect to the day before (within the parenthesis). The maximum water-levels and precipitation are printed in boldface.

this event it is not possible to describe the influence of the distance from the creek because there are no data for the shallow wells farther from the creek.

The source of recharge seems mainly to be the creek, either at the UIGRS or upgradient. The snow on the ground and the water in the soil in the form of ice constitute another source of recharge to the aquifers.

Comparison between events 4 and 5

Both events are related to snowfall and the presence of snow on the ground. The character of the water-level fluctuation, and therefore the character of the recharge, is different when precipitation is in the form of snowfall. The infiltration rate and saturated hydraulic conductivity are reduced in frozen soils as a result of blockage of the pores by ice, and this condition increases with moisture content (Kane, 1980). Another factor related to snowfall is that water tied up in snowpack will infiltrate only when it has melted. As a result, the water-levels of the creek and the shallow and E-fractured aquifer wells do not rise on the same days of the snowfall event but during the later snowmelt.

In Event 5, the sources of recharge are mainly the stream and the snow on the ground. In Event 4 the recharge seems related to upstream flow into the aquifer and the snow on the ground.

The time lag between the peak of water elevation in the creek and the peak in the wells is one day in Event 5; whereas in Event 4, this time lag is less than 24 hours. This difference may be related to the greater presence of snow on the ground in Event 5.

5.2. RELATIONSHIPS AMONG THE AQUIFERS

The relations among the three aquifers represented at the UIGRS, as well as the differences in behavior of the different wells in a given aquifer, are analyzed based on the semi-annual hydrographs, the precipitation events, and the potentiometric maps (Figures 5.8 to 5.10).

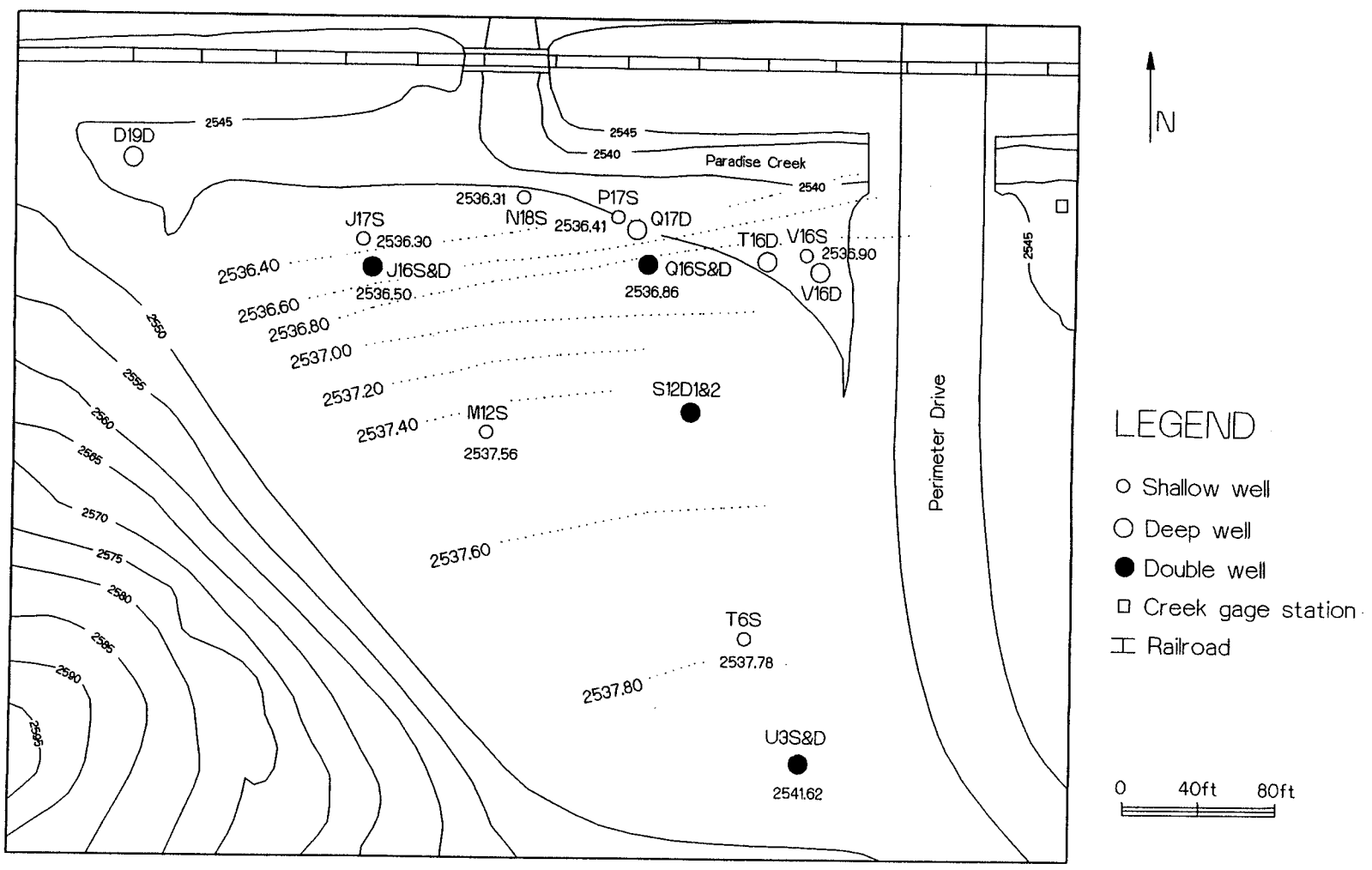

Figure 5.8. Potentiometric surface of the shallow aquifer for 17 September 1990.

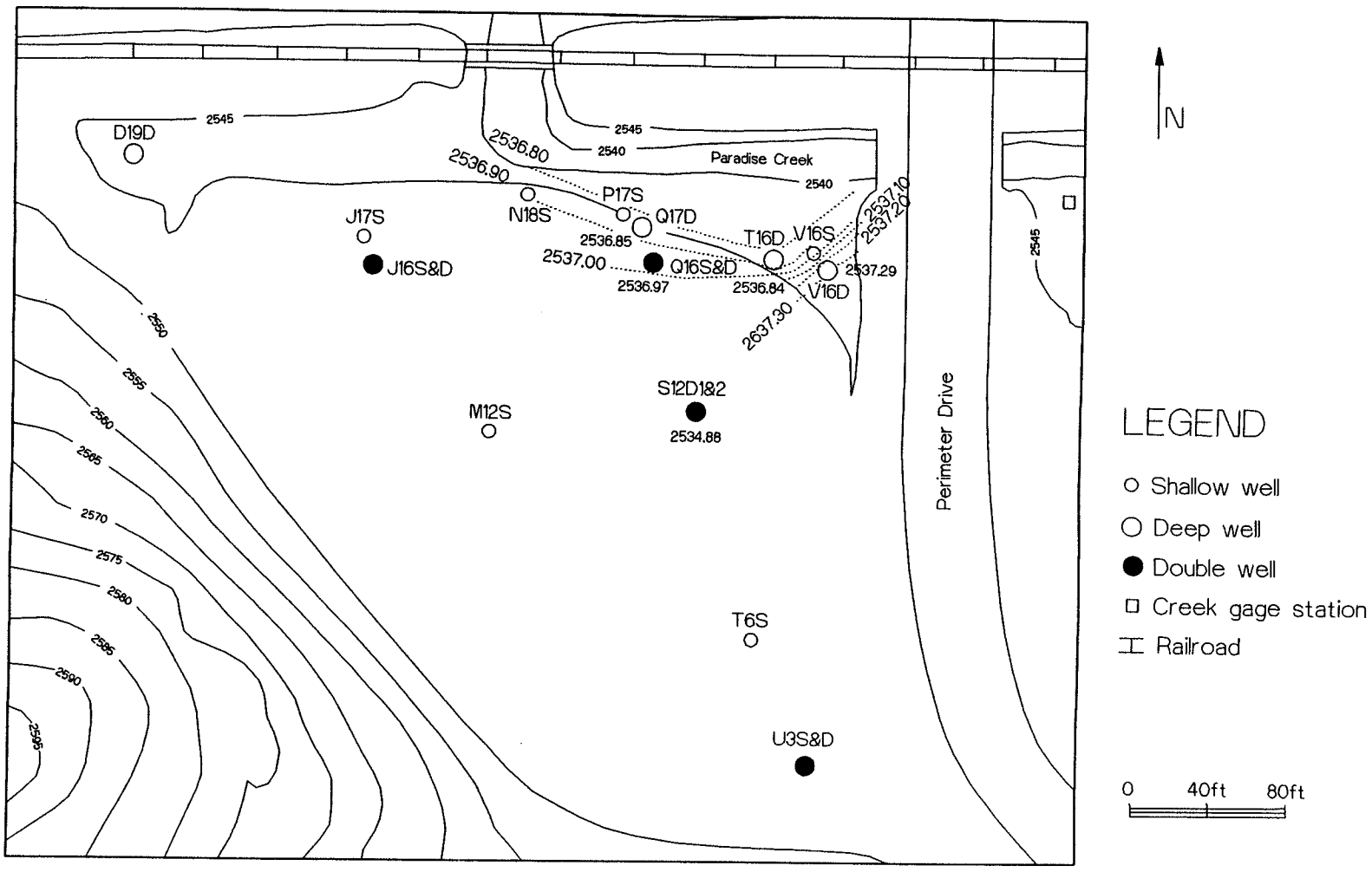

Figure 5.9. Potentiometric surface of the E-fractured aquifer for 17 September 1990.

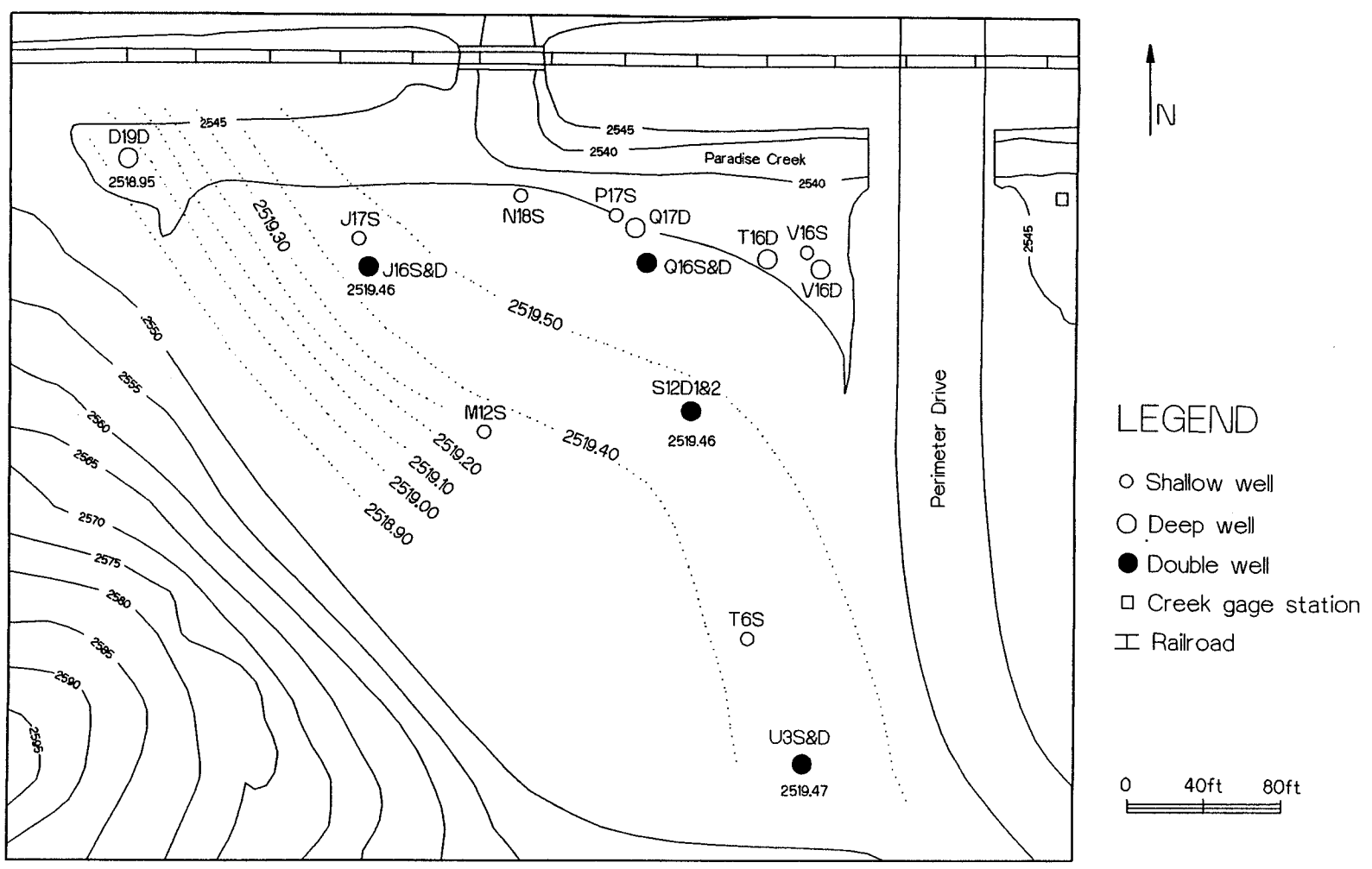

Figure 5.10. Potentiometric surface of the W-fractured aquifer for 17 September 1990.

Relations among the wells in the shallow aquifer

The different behavior of the shallow aquifer wells seems to be related mostly to the distance from the creek when recharge is considered. Based on this, three main groups of wells exist: the wells near to the creek (V16S, Q16S, P17S, and N18S); the wells in the southwestern part of the site (J17S, J16S and M12S); and, the wells farther from the creek (T6S and U3S) (Figure 2.1). All the shallow wells were completed in alluvial sediments except Q16S, J16S, and U3S, which were completed in broken basalt at the top of the flow. The four wells closer to the creek behave in a very similar way, although the peaks in V16S are higher than for the rest of the wells, as mentioned above. The wells in the southwestern part of the site do not respond in the same way. J16S and J17S are very close to each other but show a different fluctuation pattern; J16S behaves similarly to the wells close to the river, in spite of small differences, whereas J17S behaves similarly to M12S and T6S.

Well U3S is an unusual well because of its behavior and its high groundwater elevation. The occurrence of peaks in U3S is similar to the wells close to the creek although the magnitude of the peak is smaller, and it is also similar to the wells farther from the stream, such as T6S and M12S. The other difference of U3S with respect to the other wells is its very high groundwater elevation. Figure 5.8 shows the potentiometric surface of the shallow aquifer for a given day; the shape remains fairly similar throughout the year. The groundwater flow direction is towards the creek. The potentiometric surface does not have a constant slope; the greatest slope is in the southern part of the site. The difference in water elevation with respect to T6S is about 3.8 feet; the distance between the two wells is about 40 feet. The difference of water elevation between T6S and Q16S, separated by 200 feet, is about a foot. One explanation for this difference could be that U3S is the farthest well from the discharge outlet; however, this does not seem sufficient explanation for such a large difference. The fact that U3S is not completed in the alluvial sediments but in broken basalts on the top of the Lolo flow could be related. But this fact does not explain either of the differences because there are two other wells, J16S and Q16S, completed in broken basalts and their levels are very similar to those of the rest of the alluvial wells. Although not based on evidence, a more valid reason may be what Li (1991) suggested:

a complex fracture pattern may exist in the upper portion of the Lolo flow in the southern part of the site that makes the well behave differently from the other wells.

Relations among the wells in the E-fractured basalt aquifer

All wells except S12D1 in the E-fractured aquifer behave alike. The fluctuation pattern is the same for the four wells (V16D, T16D, Q16D, and Q17D), and they maintain a constant difference in water level all the time. This similarity verifies that the four wells are completed in the same fracture.

Figure 5.9 shows the potentiometric surface for the E-fractured aquifer. As in the shallow aquifer, the groundwater flow is towards the creek. Well S12D1, as mentioned above, has a water elevation significantly lower than that of the other E-fractured aquifer wells and behaves in a different manner. Well S12D1, the deepest of all the E-fractured aquifer wells (Figure 2.1), behaved like the other wells before the drilling of U3D (Figure 4.9). Well U3D was drilled on 22 May 1990, and quickly caused a reaction in the W-fractured wells; groundwater levels rose drastically about 9 feet (2.75 meters). S12D2 did not respond the same day (probably due to a recharge event that was happening at the same time), but after this event the groundwater level dropped gradually. On 7 August 1990 (Figure 4.10), the wells U3D and U3S were completed, and the groundwater levels of the W-fractured wells dropped until they reached almost the initial elevation. S12D1 responded the same day with a new decrease of water level. Li (1991) reported that the E-fractured aquifer occurs only in the northern portion of the UIGRS. However, an E-fractured aquifer well (S12D1) was affected by drilling in the southern part of the site. An explanation could be that during the period when the shallow and W-fractured aquifers were connected through U3D some changes in pressure occurred; this might initiate the reactivation of a possible system of fractures close to the location of U3D, and related to the E-fractured system in S12D1. Well S12D1 could have lost some water through these fractures to produce a decrease in its water level. After 15 days, the system reached an equilibrium, as shown by S12D1 responding as an E-fractured well to changes in precipitation. This equilibrium was broken again because of the completion of U3D and U3S, which could have been the reason for another change in pressure and the decline of the water level in

S12D1. After another 15 days, the water level in S12D1 reached a new equilibrium. As a result of this, the groundwater of well S12D1 reached an elevation about 2 feet lower than in the rest of the E-fractured wells, and had a fluctuation pattern that at times appears similar to those of the rest of the E-fractured and shallow aquifer wells, and at other times varies significantly. Therefore, although this reason for the change in S12D1 is conjecture, what is true is that the change is related to the drilling of U3D.

Relations among the wells of the W-fractured basalt aquifer

All of the W-fractured aquifer wells act in a similar manner. The hydrographs (Figures 4.11, 4.12, 4.19, and 4.20) show that J16D, U3D, and S12D2 have a very similar water-level elevation with exactly the same fluctuation pattern, and D19D, the deepest well, has the same fluctuation but a lower water elevation. Figure 5.10 shows the potentiometric surface for the W-fractured aquifer, which does not have a constant slope. Groundwater flows towards the west and southwest. The magnitude of the peaks in the W-fractured aquifer could be related to the barometric effect. Patrick (1990) noticed that wells D19D and S12D2 rose and fell when barometric pressure fell and rose, respectively. He estimated the barometric efficiency of these wells for the first half of 1990 at 60% (D19D) and 57% (S12D2); a similar value could be expected for the other two W-fractured aquifer wells, J16D and U3D. The four wells followed the same fluctuation pattern and had very similar groundwater elevations. The deviation due to barometric effect is 0.5 feet maximum (Dale Ralston, 1993: personal communication). However, the water-level fluctuations of the W-fractured aquifer wells are greater than this (Figure 4.19), which means that there are some other factors, together with barometric pressure, that may affect the magnitude and the distribution of the peaks in this aquifer.

Relations among the aquifers

The elevation of the groundwater level is usually higher for the E-fractured aquifer wells than for the shallow aquifer wells close to them (Figures 2.1, 4.21, and 4.22). The elevation of the water level in V16S is lower than in V16D during most of the year except in periods of short-term recharge, where the level of V16S rises higher

than the level of V16D. Therefore, there is upward flow from the E-fractured aquifer to the shallow aquifer in this location most of the time. The water level of T16D is usually lower than in V16S, but this does not necessarily mean downward flow because the well T16D is located downgradient from V16S (Figure 5.2). Q17D and Q16D have water levels that are higher than in their nearby shallow aquifer wells (P17S and N18S), and indicate an upward flow. It can be concluded that during most of the year there is an upward flow between the E-fractured and the shallow aquifers.

The amplitude and occurrence of the peaks in the W-fractured basalt aquifer are not similar to those of the peaks in the shallow and E-fractured aquifers. The fluctuations do not seem directly related to precipitation or to the stream at the UIGRS; sometimes the wells peak during a precipitation event and at other times they do not react to an event. Therefore, the source of recharge is not the same as for the other aquifers at the UIGRS.

6. CONCLUSIONS AND RECOMMENDATIONS

Evidence supports the idea that during the period of study Paradise Creek recharges the shallow and E-fractured aquifers at the UIGRS during the summer and early fall, as well as frequently during maximum streamflow events. During the rest of the year the main source of water is direct precipitation.

In addition to this general conclusion, the following conclusions were drawn.

1. The different behavior of the shallow aquifer wells seems to be related mostly to the distance from the creek.

2. The wells in the E-fractured aquifer (except S12D1) behave alike, which verifies that the four wells are completed in the same fracture.

3. All wells in the W-fractured aquifer act in a similar manner.

4. The water levels of the creek and the shallow and E-fractured aquifer wells follow the same fluctuation pattern.

5. The water level in the creek and the aquifers is lower during the summer and early fall; seasonal decline is greater in the shallow aquifer wells, and less in the creek.

6. The aquifers and the creek react very differently to rainfall than to snowfall.

7. The intensity and distribution of precipitation are important factors that define the fluctuations of the water level in the creek and the shallow and E-fractured aquifer.

8. During most of the year there is upward flow from the E-fractured to the shallow aquifers.

9. Well V16S has a higher water elevation than that of V16D during rainfall events; therefore, during the high flow periods, the flow from the E-fractured to the shallow aquifer could be downward at this location.

10. The fluctuation pattern of the W-fractured aquifer wells is different from the two other aquifers, which may be related to the barometric effect and to a different source of recharge to be defined in further investigations.

11. Another source of recharge may be the stream upgradient from the UIGRS, mostly during spring precipitation events.

Concerning future work with groundwater and surface water relations and recharge and discharge characteristics at the UIGRS, the following recommendations are offered for consideration.

1. Continuous records of the creek and the most representative wells should be kept in order to calculate the time lag between the maximum water level of the creek and the aquifers during a precipitation event. Therefore, some recorders should be installed during winter and early spring in wells V16S, P17S, U3S, T16D and U3D.

2. A minimum of daily data recording is necessary for future research projects.

3. Chemical data of the wells and the creek should be obtained. These data will add valuable information about recharge and discharge. Samples collected twice a year, during winter and summer, would be adequate but a greater number of analyses would increase the possibilities of more significant study and conclusions.

4. The drilling of some shallow wells north of Paradise Creek would be useful to define the behavior of the aquifer in the system at this margin.

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APPENDIX

WATER LEVEL ELEVATION (in feet) AND PRECIPITATION (in inches)
FOR THE PERIOD 1988-1992

Date	V16D	V16S	T16D	Q17D	P17S	D19D	Prec.(in)
28-Dec-87	2536.21			2533.96		2525.89	0.00
01-Jan-88	2536.10			2533.77		2525.35	0.00
02-Jan-88							0.00
03-Jan-88							0.00
04-Jan-88	2536.11			2533.85		2525.45	0.00
05-Jan-88							0.01
06-Jan-88							0.00
07-Jan-88							0.00
08-Jan-88	2536.07			2533.81		2525.25	0.00
09-Jan-88							0.16
10-Jan-88							0.44
11-Jan-88							0.19
12-Jan-88	2536.71			2534.45		2525.19	0.00
13-Jan-88							0.03
14-Jan-88							0.71
15-Jan-88	2538.51			2535.97		2525.90	0.41
16-Jan-88							0.01
17-Jan-88							0.00
18-Jan-88	2537.89			2535.47		2525.77	0.00
19-Jan-88							0.00
20-Jan-88							0.01
21-Jan-88							0.00
22-Jan-88	2537.29		2536.74	2534.95		2525.21	0.00
23-Jan-88							0.00
24-Jan-88							0.00
25-Jan-88	2536.96		2536.47	2534.74		2524.90	0.00
26-Jan-88							0.00
27-Jan-88							0.00
28-Jan-88							0.01
29-Jan-88	2537.83		2537.30	2535.66		2524.87	0.05
30-Jan-88							0.14
31-Jan-88							0.00
01-Feb-88	2537.45		2536.93	2535.28		2524.53	0.00
02-Feb-88							0.00
03-Feb-88							0.00
04-Feb-88							0.00
05-Feb-88	2536.98		2536.47	2534.80		2523.94	0.00
06-Feb-88							0.00
07-Feb-88							0.13
08-Feb-88							0.05
09-Feb-88	2538.34		2537.81	2536.03		2524.78	0.43
10-Feb-88							0.06
11-Feb-88							0.00
12-Feb-88	2538.01		2537.44	2535.78		2524.93	0.00
13-Feb-88							0.00
14-Feb-88							0.02
15-Feb-88	2538.10		2537.54	2535.86		2525.00	0.62
16-Feb-88							0.00
17-Feb-88							0.07
18-Feb-88							0.01
19-Feb-88	2537.65		2537.09	2535.45		2524.64	0.00
20-Feb-88							0.00
21-Feb-88							0.00
22-Feb-88	2537.40		2536.93	2535.25		2524.64	0.00
23-Feb-88							0.00
24-Feb-88							0.00
25-Feb-88							0.00
26-Feb-88	2537.14		2536.61	2535.04		2524.54	0.00
27-Feb-88							0.00
28-Feb-88							0.00
29-Feb-88	2537.00		2536.48	2534.91		2524.55	0.00
01-Mar-88							0.00
02-Mar-88							0.00
03-Mar-88							0.13
04-Mar-88	2536.86		2536.34	2534.82		2524.23	0.00
05-Mar-88							0.40
06-Mar-88							0.37
07-Mar-88	2537.24		2536.73	2535.18		2524.27	0.00
08-Mar-88							0.01
09-Mar-88							0.04
10-Mar-88							0.04
11-Mar-88	2537.10		2536.58	2535.00		2524.39	0.00
12-Mar-88							0.00
13-Mar-88							0.00

Date	V16D	V16S	T16D	Q17D	P17S	D19D	Prec.(in)
14-Mar-88							0.07
15-Mar-88							0.00
16-Mar-88							0.00
17-Mar-88							0.00
18-Mar-88	2536.83		2536.32			2524.19	0.00
19-Mar-88							0.00
20-Mar-88							0.00
21-Mar-88							0.00
22-Mar-88	2536.81		2536.30			2524.18	0.16
23-Mar-88							0.02
24-Mar-88							0.34
25-Mar-88	2536.90		2536.41	2535.04		2523.93	0.00
26-Mar-88							0.15
27-Mar-88							1.28
28-Mar-88	2538.02		2537.49	2536.17		2524.72	0.17
29-Mar-88							0.14
30-Mar-88							0.44
31-Mar-88							0.06
01-Apr-88	2538.49		2537.96			2524.49	0.00
02-Apr-88							0.00
03-Apr-88							0.07
04-Apr-88							0.48
05-Apr-88	2538.43		2537.90			2524.42	0.05
06-Apr-88							0.00
07-Apr-88							0.00
08-Apr-88	2538.12		2537.59			2524.03	0.29
09-Apr-88							0.00
10-Apr-88							0.00
11-Apr-88	2537.84		2537.32			2524.37	0.00
12-Apr-88							0.00
13-Apr-88							0.00
14-Apr-88	2537.62		2537.11	2535.88		2524.38	0.00
15-Apr-88							0.00
16-Apr-88							0.00
17-Apr-88							0.00
18-Apr-88	2537.35	2537.26	2536.83	2534.97	2536.78	2526.14	0.00
19-Apr-88							0.03
20-Apr-88							0.00
21-Apr-88							0.00
22-Apr-88	2537.70	2537.84	2537.20	2535.40	2536.98		0.66
23-Apr-88							0.01
24-Apr-88							0.00
25-Apr-88							0.04
26-Apr-88							0.00
27-Apr-88							0.00
28-Apr-88							0.00
29-Apr-88	2538.07	2538.43	2537.60	2535.72	2537.33		0.10
30-Apr-88							0.97
01-May-88							0.10
02-May-88	2537.55	2537.55	2537.05	2535.30	2536.83		0.02
03-May-88							0.00
04-May-88							0.01
05-May-88							0.00
06-May-88	2537.39	2537.34	2536.91	2535.20	2536.72		0.01
07-May-88							0.13
08-May-88							0.00
09-May-88	2537.21	2537.13	2536.72	2535.02	2536.56		0.00
10-May-88							0.14
11-May-88							0.00
12-May-88	2537.19	2537.07	2536.73	2535.11	2536.48	2526.29	0.00
13-May-88							0.00
14-May-88							0.16
15-May-88							0.00
16-May-88							0.00
17-May-88							0.00
18-May-88							0.03
19-May-88							0.01
20-May-88	2537.03	2536.87	2536.54	2534.89	2536.30	2525.78	0.19
21-May-88							0.00
22-May-88							0.00
23-May-88							0.00
24-May-88							0.00
25-May-88							0.15
26-May-88	2536.93	2536.79	2536.44	2534.88	2536.49	2525.94	0.00
							0.00

Date	V16D	V16S	T16D	Q17D	P17S	D19D	Prec.(in)
27-May-88							0.03
28-May-88							0.96
29-May-88							0.38
30-May-88							0.00
31-May-88							0.00
01-Jun-88	2537.27	2536.85	2536.82	2534.92	2536.26	2526.69	0.34
02-Jun-88							0.00
03-Jun-88							0.00
04-Jun-88							0.00
05-Jun-88							0.07
06-Jun-88							0.20
07-Jun-88							0.17
08-Jun-88							0.12
09-Jun-88	2537.20	2537.08	2536.74	2535.45	2536.52	2526.68	0.00
10-Jun-88							0.16
11-Jun-88							0.00
12-Jun-88							0.00
13-Jun-88							0.00
14-Jun-88							0.00
15-Jun-88							0.00
16-Jun-88	2536.98	2536.87	2536.51	2535.27	2536.33	2526.56	0.00
17-Jun-88							0.02
18-Jun-88							0.00
19-Jun-88							0.00
20-Jun-88							0.00
21-Jun-88							0.00
22-Jun-88							0.00
23-Jun-88							0.00
24-Jun-88	2536.78	2536.71	2536.35	2535.07	2536.26	2526.41	0.00
25-Jun-88							0.00
26-Jun-88							0.25
27-Jun-88	2537.16	2537.08	2536.72	2535.47	2536.53	2526.50	0.28
28-Jun-88							0.38
29-Jun-88							0.11
30-Jun-88							0.00
01-Jul-88							0.00
02-Jul-88	2536.92	2536.83	2536.49	2535.25	2536.27	2526.38	0.00
03-Jul-88							0.00
04-Jul-88							0.01
05-Jul-88							0.36
06-Jul-88							0.02
07-Jul-88							0.00
08-Jul-88	2536.95	2536.85	2536.51	2535.31	2536.30	2526.41	0.00
09-Jul-88							0.00
10-Jul-88							0.00
11-Jul-88							0.00
12-Jul-88							0.00
13-Jul-88							0.01
14-Jul-88							1.22
15-Jul-88	2537.23	2537.16	2536.86	2535.55	2536.55	2526.67	0.00
16-Jul-88							0.00
17-Jul-88							0.00
18-Jul-88							0.00
19-Jul-88							0.00
20-Jul-88	2536.99	2536.90	2536.56	2535.33	2536.36	2526.76	0.00
21-Jul-88							0.00
22-Jul-88							0.00
23-Jul-88	2536.91	2536.82	2536.44	2535.16	2536.27	2526.73	0.00
24-Jul-88							0.00
25-Jul-88							0.00
26-Jul-88							0.00
27-Jul-88							0.00
28-Jul-88							0.00
29-Jul-88	2536.83	2536.71	2536.34	2535.17	2536.23	2526.78	0.00
30-Jul-88	2536.83	2536.76	2536.43	2535.17	2536.24	2526.84	0.00
31-Jul-88							0.00
01-Aug-88							0.00
02-Aug-88							0.00
03-Aug-88	2536.81	2536.71	2536.39	2535.12	2536.19	2526.79	0.00
04-Aug-88							0.00
05-Aug-88							0.00
06-Aug-88	2536.74	2536.66	2536.28	2535.08	2536.17	2526.88	0.00
07-Aug-88							0.00
08-Aug-88							0.00

Date	V16D	V16S	T16D	Q17D	P17S	D19D	Prec.(in)
09-Aug-88							0.00
10-Aug-88							0.00
11-Aug-88							0.00
12-Aug-88	2536.74	2536.62	2536.32	2535.07	2536.14	2527.26	0.00
13-Aug-88							0.00
14-Aug-88							0.00
15-Aug-88	2536.76	2536.69	2536.35	2535.14	2536.15	2527.30	0.00
16-Aug-88							0.00
17-Aug-88							0.00
18-Aug-88							0.00
19-Aug-88	2536.73	2536.66	2536.31	2535.14	2536.13	2527.52	0.00
20-Aug-88							0.00
21-Aug-88							0.00
22-Aug-88							0.00
23-Aug-88							0.00
24-Aug-88							0.00
25-Aug-88							0.00
26-Aug-88	2536.63	2536.53	2536.23	2535.01	2536.04	2527.33	0.00
27-Aug-88							0.00
28-Aug-88							0.00
29-Aug-88							0.00
30-Aug-88	2536.62	2536.55	2536.22	2535.00	2536.02	2527.53	0.00
31-Aug-88							0.00
01-Sep-88							0.00
02-Sep-88	2536.62	2536.54	2536.23	2535.00	2536.02	2527.56	0.00
03-Sep-88							0.00
04-Sep-88							0.00
05-Sep-88	2536.63	2536.52	2536.24	2535.02	2536.03	2527.71	0.00
06-Sep-88							0.00
07-Sep-88							0.00
08-Sep-88							0.00
09-Sep-88	2536.62	2536.50	2536.24	2535.12	2536.02	2527.72	0.00
10-Sep-88							0.38
11-Sep-88							0.00
12-Sep-88	2536.69	2536.58	2536.28	2535.13	2536.08	2527.38	0.00
13-Sep-88							0.00
14-Sep-88							0.00
15-Sep-88							0.00
16-Sep-88	2536.77	2536.67	2536.37	2535.18	2536.08	2527.52	0.00
17-Sep-88							0.00
18-Sep-88							0.06
19-Sep-88	2536.97	2536.88	2536.58	2535.41	2536.35	2527.81	0.27
20-Sep-88							0.08
21-Sep-88							0.00
22-Sep-88							0.00
23-Sep-88							0.00
24-Sep-88							0.00
25-Sep-88							0.04
26-Sep-88							0.00
27-Sep-88	2536.86	2536.72	2536.47	2535.26	2536.31	2527.74	0.45
28-Sep-88							0.00
29-Sep-88							0.00
30-Sep-88	2536.68	2536.58	2536.31	2535.12	2536.09	2527.86	0.00
01-Oct-88							0.00
02-Oct-88							0.00
03-Oct-88							0.00
04-Oct-88							0.00
05-Oct-88	2536.56	2536.46	2536.18	2535.00	2535.98	2527.78	0.00
06-Oct-88							0.00
07-Oct-88	2536.47	2536.35	2536.10	2534.90	2535.92	2527.60	0.00
08-Oct-88							0.00
09-Oct-88							0.00
10-Oct-88	2536.42	2536.34	2536.06	2534.88	2535.88	2527.70	0.00
11-Oct-88							0.00
12-Oct-88							0.00
13-Oct-88	2536.40	2536.33	2536.04	2534.84	2535.85	2527.74	0.03
14-Oct-88							0.02
15-Oct-88							0.00
16-Oct-88							0.00
17-Oct-88	2536.49	2536.41	2536.14	2534.94	2535.97	2527.71	0.40
18-Oct-88							0.04
19-Oct-88							0.22
20-Oct-88							0.01
21-Oct-88	2536.62	2536.51	2536.46	2536.10	2536.02	2527.49	0.00

Date	V16D	V16S	T16D	Q17D	P17S	D19D	Prec.(in)
22-Oct-88							0.00
23-Oct-88							0.00
24-Oct-88							0.00
25-Oct-88	2536.51	2536.43	2536.31	2536.15	2535.97	2520.24	0.00
26-Oct-88	2536.45	2536.32	2536.20	2536.06	2535.89	2519.98	0.00
27-Oct-88							0.00
28-Oct-88	2536.42	2536.32	2536.19	2536.04	2535.89	2519.92	0.00
29-Oct-88							0.00
30-Oct-88							0.00
31-Oct-88							0.00
01-Nov-88	2536.40	2536.31	2536.18	2536.01	2535.87	2519.85	0.00
02-Nov-88							0.23
03-Nov-88							0.39
04-Nov-88	2536.58	2536.49	2536.35	2536.24	2536.05	2519.66	0.06
05-Nov-88							0.20
06-Nov-88							0.29
07-Nov-88	2536.75	2536.67	2536.53	2536.44	2536.17	2519.97	0.00
08-Nov-88							0.18
09-Nov-88							0.00
10-Nov-88							0.16
11-Nov-88	2536.74	2536.66	2536.54	2536.45	2536.17	2520.17	0.08
12-Nov-88							0.27
13-Nov-88							0.00
14-Nov-88							0.41
15-Nov-88	2536.88	2536.84	2536.68	2536.48	2536.31	2520.11	0.00
16-Nov-88							0.19
17-Nov-88							0.00
18-Nov-88	2536.86	2536.81	2536.65	2536.56	2536.28	2520.11	0.03
19-Nov-88							0.00
20-Nov-88							0.23
21-Nov-88							0.27
22-Nov-88							0.65
23-Nov-88							0.57
24-Nov-88							0.17
25-Nov-88	2537.63	2537.67	2537.39	2537.26	2536.84	2520.82	0.27
26-Nov-88							0.03
27-Nov-88							0.01
28-Nov-88							0.15
29-Nov-88							0.00
30-Nov-88							0.00
01-Dec-88	2537.67	2537.72	2537.41	2537.25	2536.85	2520.61	0.00
02-Dec-88							0.00
03-Dec-88							0.00
04-Dec-88							0.00
05-Dec-88							0.00
06-Dec-88							0.11
07-Dec-88							0.04
08-Dec-88	2537.42	2537.37	2537.16	2537.02	2536.69	2520.45	0.07
09-Dec-88							0.12
10-Dec-88							0.01
11-Dec-88							0.00
12-Dec-88							0.00
13-Dec-88							0.00
14-Dec-88	2537.17	2537.11	2536.93	2536.80	2536.50	2520.16	0.00
15-Dec-88							0.00
16-Dec-88							0.00
17-Dec-88							0.00
18-Dec-88							0.00
19-Dec-88							0.20
20-Dec-88	2536.99	2536.96	2536.75	2536.63	2536.34	2520.75	0.00
21-Dec-88							0.05
22-Dec-88							0.06
23-Dec-88	2536.86	2536.81	2536.64	2536.55	2536.26	2520.52	0.08
24-Dec-88							0.05
25-Dec-88							0.00
26-Dec-88							0.00
27-Dec-88	2536.77	2536.74	2536.56	2536.47	2536.19	2520.40	0.00
28-Dec-88							0.00
29-Dec-88							0.12
30-Dec-88							0.37
31-Dec-88							0.00

Date	V16D	V16S	T16D	Q17D	P17S	N18S	D19D	S12D1	S12D2	Prec.(in)
01-Jan-89										0.00
02-Jan-89										0.06
03-Jan-89	2536.99	2537.32	2536.79	2536.68	2536.39		2520.35			0.20
04-Jan-89										0.00
05-Jan-89										0.15
06-Jan-89	2537.29	2537.28	2537.07	2536.97	2536.55		2520.68			0.00
07-Jan-89										0.02
08-Jan-89										0.15
09-Jan-89										0.62
10-Jan-89										0.78
11-Jan-89	2537.40	2537.39	2537.18	2537.10	2536.63		2520.26			0.04
12-Jan-89										0.00
13-Jan-89										0.01
14-Jan-89										0.03
15-Jan-89										0.22
16-Jan-89	2538.14	2538.38	2537.92	2537.78	2537.22		2520.68			0.26
17-Jan-89										0.00
18-Jan-89										0.02
19-Jan-89										0.00
20-Jan-89	2539.30	2539.81	2539.00	2538.88	2538.00		2521.25			0.00
21-Jan-89										0.46
22-Jan-89										0.11
23-Jan-89	2538.96	2539.11	2538.68	2538.56	2537.90		2521.29			0.12
24-Jan-89										0.00
25-Jan-89										0.00
26-Jan-89	2538.60	2538.68	2538.32	2538.36	2537.67		2521.00			0.00
27-Jan-89										0.03
28-Jan-89										0.00
29-Jan-89										0.00
30-Jan-89	2538.35	2538.44	2538.10	2538.00	2537.47		2521.13			0.00
31-Jan-89										0.07
01-Feb-89										0.09
02-Feb-89										0.00
03-Feb-89										0.00
04-Feb-89										0.00
05-Feb-89										0.00
06-Feb-89	2538.21	2538.45	2537.97	2537.87	2537.32		2520.72			0.00
07-Feb-89										0.00
08-Feb-89										0.00
09-Feb-89										0.00
10-Feb-89	2537.80	2538.09	2537.58	2537.47	2537.07		2520.59			0.00
11-Feb-89										0.00
12-Feb-89										0.00
13-Feb-89	2537.69	2537.85	2537.47	2537.37	2536.93		2520.82			0.00
14-Feb-89										0.00
15-Feb-89										0.00
16-Feb-89										0.00
17-Feb-89	2537.62	2537.68	2537.43	2537.34	2536.86		2520.58			0.05
18-Feb-89										0.37
19-Feb-89										0.12
20-Feb-89	2537.97	2538.17	2537.75	2537.65	2537.14		2520.60			0.14
21-Feb-89										0.12
22-Feb-89										0.00
23-Feb-89										0.16
24-Feb-89										0.03
25-Feb-89										0.00
26-Feb-89	2539.66	2540.29	2539.40	2539.23	2539.03		2521.11			0.00
27-Feb-89										0.10
28-Feb-89										0.00
01-Mar-89										0.00
02-Mar-89	2539.12	2539.54	2538.89	2538.72	2538.46		2521.63			0.07
03-Mar-89										0.34
04-Mar-89										0.00
05-Mar-89	2538.77	2539.10	2538.55	2538.43	2538.10		2521.09			0.00
06-Mar-89										0.00
07-Mar-89										0.15
08-Mar-89	2540.15	2540.64	2539.91	2539.71	2539.46		2521.25			0.03
09-Mar-89										0.00
10-Mar-89										0.35
11-Mar-89	2540.92	2541.18	2540.69	2540.50	2540.10		2521.42			0.05
12-Mar-89										0.07
13-Mar-89										0.00
14-Mar-89										0.37
15-Mar-89										0.01
										0.06

Date	V16D	V16S	T16D	Q17D	P17S	N18S	D19D	S12D1	S12D2	Prec.(in)
16-Mar-89	2539.92	2540.30	2539.68	2539.55	2539.22		2521.74			0.27
17-Mar-89										0.36
18-Mar-89										0.14
19-Mar-89	2539.98	2540.41	2539.72	2539.55	2539.31		2521.26			0.00
20-Mar-89										0.00
21-Mar-89										0.54
22-Mar-89										0.00
23-Mar-89	2539.80	2540.13	2539.55	2539.39	2539.09		2521.38			0.09
24-Mar-89										0.00
25-Mar-89										0.57
26-Mar-89	2540.05	2540.35	2539.81	2539.62	2539.31		2521.43			0.00
27-Mar-89										0.15
28-Mar-89										0.23
29-Mar-89	2539.74	2540.06	2539.52	2539.39	2539.02		2521.15			0.05
30-Mar-89										0.00
31-Mar-89										0.20
01-Apr-89										
02-Apr-89	2539.37	2539.49	2539.14	2539.05	2538.65		2521.30	2537.05	2521.84	0.00
03-Apr-89								2537.15	2520.64	0.00
04-Apr-89								2537.10	2519.92	0.01
05-Apr-89	2539.28	2539.70	2539.09	2538.93	2538.51		2521.09	2536.99	2519.86	0.00
06-Apr-89								2536.88	2519.73	0.40
07-Apr-89								2536.90	2519.78	0.00
08-Apr-89								2536.74	2519.54	0.00
09-Apr-89								2536.78	2519.39	0.00
10-Apr-89								2537.20	2519.70	0.00
11-Apr-89								2537.30	2519.58	0.00
12-Apr-89	2538.61	2538.66	2538.43	2538.24	2537.90		2521.14	2537.05	2519.42	0.00
13-Apr-89								2536.95	2519.39	0.00
14-Apr-89								2537.10	2519.45	0.00
15-Apr-89								2537.24	2519.49	0.00
16-Apr-89	2538.37	2538.43	2538.20	2538.07	2537.67		2521.13	2537.50	2519.45	0.03
17-Apr-89								2537.44	2519.38	0.00
18-Apr-89								2537.46	2519.07	0.00
19-Apr-89	2538.17	2538.22	2538.01	2537.89	2537.54		2520.97	2537.24	2518.97	0.00
20-Apr-89								2538.41	2519.36	0.00
21-Apr-89								2538.00	2519.51	0.00
22-Apr-89								2537.48	2517.32	0.00
23-Apr-89	2538.25	2538.37	2538.09	2537.98	2537.47		2520.99	2537.10	2518.99	0.31
24-Apr-89								2537.10	2519.05	0.21
25-Apr-89								2537.02	2519.04	0.00
26-Apr-89										0.00
27-Apr-89	2538.22	2538.06	2537.98	2537.88	2537.39		2520.73			0.03
28-Apr-89										0.04
29-Apr-89										0.00
30-Apr-89	2537.92	2537.99	2537.77	2537.64	2537.16		2521.10			0.00
01-May-89										0.00
02-May-89										0.07
03-May-89										0.03
04-May-89	2537.79	2537.82	2537.60	2537.51	2537.04		2520.63			0.01
05-May-89										0.00
06-May-89										0.00
07-May-89	2537.71	2537.75	2537.56	2537.45	2536.98		2520.80			0.00
08-May-89										0.02
09-May-89										0.00
10-May-89										0.00
11-May-89	2537.76	2537.66	2537.55	2537.49	2537.02		2520.86			0.51
12-May-89										0.00
13-May-89										0.00
14-May-89										0.00
15-May-89										0.00
16-May-89	2537.75	2537.66	2537.58	2537.45	2537.00		2520.70			0.00
17-May-89										0.00
18-May-89										0.00
19-May-89	2537.74	2537.65	2537.57	2537.40	2536.98		2520.34			0.39
20-May-89										0.00
21-May-89										0.00
22-May-89	2537.77	2537.68	2537.61	2537.46	2536.99		2520.64			0.00
23-May-89										0.00
24-May-89										0.23
25-May-89										0.20
26-May-89	2537.84	2537.75	2537.66	2537.54	2537.06		2520.56			0.03
27-May-89										0.01
28-May-89										0.37
										0.34

Date	V16D	V16S	T16D	Q17D	P17S	N18S	D19D	S12D1	S12D2	Prec.(in)
29-May-89										0.61
30-May-89	2538.14	2538.19	2537.99	2537.90	2537.36		2520.22			0.02
31-May-89										0.00
01-Jun-89										0.00
02-Jun-89										0.21
03-Jun-89										0.00
04-Jun-89	2538.07	2538.08	2537.88	2537.76	2537.22		2520.51			0.00
05-Jun-89										0.00
06-Jun-89										0.00
07-Jun-89										0.00
08-Jun-89	2537.92	2537.93	2537.73	2537.58	2537.11		2520.61			0.00
09-Jun-89										0.00
10-Jun-89										0.00
11-Jun-89										0.00
12-Jun-89	2537.81	2537.76	2537.63	2537.46	2536.95		2520.46			0.00
13-Jun-89										0.00
14-Jun-89										0.11
15-Jun-89										0.71
16-Jun-89	2537.92	2537.88	2537.72	2537.70	2537.13		2520.05			0.24
17-Jun-89										0.00
18-Jun-89										0.00
19-Jun-89										0.00
20-Jun-89										0.08
21-Jun-89	2537.87	2537.67	2537.56	2537.44	2537.00		2520.11			0.00
22-Jun-89										0.11
23-Jun-89	2537.61	2537.61	2537.45	2537.37	2536.94		2520.23			0.00
24-Jun-89										0.00
25-Jun-89										0.00
26-Jun-89	2537.44	2537.42	2537.28	2537.22	2536.80		2520.30			0.00
27-Jun-89										0.00
28-Jun-89										0.00
29-Jun-89										0.00
30-Jun-89										0.00
01-Jul-89										0.08
02-Jul-89										0.00
03-Jul-89										0.00
04-Jul-89	2537.32	2537.20	2537.13	2537.06	2536.62		2519.88			0.00
05-Jul-89										0.00
06-Jul-89										0.00
07-Jul-89										0.00
08-Jul-89										0.00
09-Jul-89										0.00
10-Jul-89										0.00
11-Jul-89	2537.18	2537.01	2536.83	2536.88	2536.43		2518.73			0.00
12-Jul-89										0.00
13-Jul-89										0.00
14-Jul-89	2537.23	2537.11	2536.95	2536.96	2536.49		2520.73			0.00
15-Jul-89										0.00
16-Jul-89										0.00
17-Jul-89										0.03
18-Jul-89										0.04
19-Jul-89										0.00
20-Jul-89										0.00
21-Jul-89										0.00
22-Jul-89										0.00
23-Jul-89										0.00
24-Jul-89										0.00
25-Jul-89										0.00
26-Jul-89	2537.09	2536.97	2536.82	2536.77	2536.38		2521.08			0.00
27-Jul-89										0.05
28-Jul-89										0.00
29-Jul-89										0.00
30-Jul-89										0.00
31-Jul-89	2537.14	2536.99	2536.85	2536.80	2536.40		2521.12			0.00
01-Aug-89										0.00
02-Aug-89										0.00
03-Aug-89	2537.09	2536.95	2536.81	2536.76	2536.39		2520.94			0.06
04-Aug-89										0.00
05-Aug-89										0.00
06-Aug-89										0.00
07-Aug-89										0.00
08-Aug-89										0.00
09-Aug-89										0.30
10-Aug-89	2537.12	2536.98	2536.84	2536.79	2536.41		2520.79			0.00

Date	V16D	V16S	T16D	Q17D	P17S	N18S	D19D	S12D1	S12D2	Prec.(in)
11-Aug-89										0.00
12-Aug-89										0.01
13-Aug-89	2537.11	2536.97	2536.84	2536.77	2536.40		2520.66			0.00
14-Aug-89										0.00
15-Aug-89										0.00
16-Aug-89	2537.14	2537.00	2536.87	2536.78	2536.41		2520.72			0.00
17-Aug-89										0.00
18-Aug-89										0.00
19-Aug-89										0.00
20-Aug-89										0.03
21-Aug-89										0.25
22-Aug-89										1.09
23-Aug-89										2.05
24-Aug-89	2538.21	2538.32	2537.92	2537.86	2537.28		2521.09			0.89
25-Aug-89										0.02
26-Aug-89										0.01
27-Aug-89										0.00
28-Aug-89	2537.69	2537.84	2537.43	2537.36	2536.86		2521.16			0.00
29-Aug-89										0.00
30-Aug-89										0.00
31-Aug-89										0.31
01-Sep-89										0.00
02-Sep-89										0.45
03-Sep-89										0.00
04-Sep-89	2537.47	2537.41	2537.23	2537.17	2536.68		2520.97			0.00
05-Sep-89										0.00
06-Sep-89										0.00
07-Sep-89										0.00
08-Sep-89										0.00
09-Sep-89										0.00
10-Sep-89	2537.31	2537.20	2537.07	2537.00	2536.55		2521.51			0.00
11-Sep-89										0.00
12-Sep-89										0.00
13-Sep-89										0.00
14-Sep-89	2537.27	2537.11	2537.02	2536.93	2536.50	2536.41	2520.69			0.00
15-Sep-89										0.00
16-Sep-89										0.00
17-Sep-89	2537.38	2537.23	2537.14	2537.06	2536.67	2536.57	2520.16			0.10
18-Sep-89	2537.29	2537.15	2537.06	2536.98	2536.56	2536.45	2519.99			0.37
19-Sep-89										0.00
20-Sep-89										0.00
21-Sep-89	2537.23	2537.08	2537.00	2536.94	2536.48	2536.40	2519.70			0.00
22-Sep-89										0.00
23-Sep-89										0.00
24-Sep-89										0.00
25-Sep-89										0.00
26-Sep-89										0.00
27-Sep-89										0.00
28-Sep-89	2537.14	2537.01	2536.93	2536.83	2536.43	2536.34	2519.78			0.00
29-Sep-89										0.00
30-Sep-89										0.09
01-Oct-89	2537.03	2536.90	2536.84	2536.73	2536.36	2536.28	2519.61			0.00
02-Oct-89										0.00
03-Oct-89										0.00
04-Oct-89										0.00
05-Oct-89	2536.96	2536.81	2536.76	2536.64	2536.30	2536.23	2519.44			0.00
06-Oct-89										0.00
07-Oct-89										0.00
08-Oct-89										0.00
09-Oct-89	2536.97	2536.84	2536.77	2536.65	2536.31	2536.22	2519.60			0.00
10-Oct-89										0.00
11-Oct-89										0.00
12-Oct-89										0.00
13-Oct-89	2536.88	2536.74	2536.69	2536.51	2536.23	2536.14	2519.32			0.10
14-Oct-89										0.00
15-Oct-89										0.00
16-Oct-89	2536.84	2536.70	2536.65	2536.51	2536.22	2536.13	2519.18			0.00
17-Oct-89										0.00
18-Oct-89										0.00
19-Oct-89										0.30
20-Oct-89										0.88
21-Oct-89										0.41
22-Oct-89	2537.27	2537.37	2537.09	2537.02	2536.59	2536.49	2519.56			0.07
23-Oct-89										

Date	V16D	V16S	T16D	Q17D	P17S	N18S	D19D	S12D1	S12D2	Prec.(in)
24-Oct-89										0.02
25-Oct-89										0.17
26-Oct-89	2537.40	2537.54	2537.20	2537.13	2536.65	2536.55	2519.43			0.07
27-Oct-89										0.10
28-Oct-89										0.00
29-Oct-89										0.00
30-Oct-89	2537.13	2537.19	2536.95	2536.93	2536.45	2536.16	2519.27			0.05
31-Oct-89										0.00
01-Nov-89										0.00
02-Nov-89										0.00
03-Nov-89	2537.04	2536.95	2536.86	2536.72	2536.41	2536.33	2519.21			0.16
04-Nov-89										0.47
05-Nov-89										0.00
06-Nov-89										0.22
07-Nov-89	2537.18	2537.00	2536.99	2536.81	2536.53	2536.45	2519.27			0.26
08-Nov-89										0.02
09-Nov-89										0.02
10-Nov-89	2537.30	2537.63	2537.13	2537.00	2536.64	2536.64	2519.32			0.00
11-Nov-89										0.00
12-Nov-89										0.47
13-Nov-89										0.36
14-Nov-89	2537.58	2538.03	2537.41	2537.30	2536.89	2536.81	2519.14			0.00
15-Nov-89										0.00
16-Nov-89										0.00
17-Nov-89										0.22
18-Nov-89	2537.51	2537.96	2537.35	2537.22	2536.80	2536.71	2519.21			0.02
19-Nov-89										0.00
20-Nov-89										0.00
21-Nov-89										0.00
22-Nov-89										0.00
23-Nov-89										0.22
24-Nov-89										0.11
25-Nov-89										0.09
26-Nov-89										0.24
27-Nov-89										0.02
28-Nov-89	2537.53	2537.71	2537.37	2537.20	2536.79	2536.72	2518.87			0.00
29-Nov-89										0.00
30-Nov-89										0.00
01-Dec-89	2537.32	2537.40	2537.14	2537.07	2536.63	2536.52	2518.77			0.00
02-Dec-89										0.00
03-Dec-89										0.03
04-Dec-89										0.43
05-Dec-89	2538.41	2539.06	2538.25	2538.08	2537.50	2537.64	2519.06			0.65
06-Dec-89										0.02
07-Dec-89										0.01
08-Dec-89	2538.09	2538.38	2537.86	2537.85	2537.25	2537.16	2519.29			0.21
09-Dec-89										0.00
10-Dec-89										0.00
11-Dec-89										0.00
12-Dec-89										0.00
13-Dec-89										0.00
14-Dec-89	2537.50	2537.54	2537.32	2537.12	2536.78	2536.65	2519.04			0.00
15-Dec-89										0.00
16-Dec-89										0.00
17-Dec-89										0.00
18-Dec-89										0.02
19-Dec-89										0.04
20-Dec-89										0.00
21-Dec-89										0.00
22-Dec-89	2537.17	2537.19	2536.99	2536.91	2536.51	2536.41	2518.69			0.00
23-Dec-89										0.00
24-Dec-89										0.11
25-Dec-89										0.01
26-Dec-89	2537.17	2537.14	2536.99	2537.06	2536.52	2536.41	2518.81			0.00
27-Dec-89										0.00
28-Dec-89										0.00
29-Dec-89	2537.06	2537.02	2536.89	2536.79	2536.45	2536.34	2518.78			0.02
30-Dec-89										0.00
31-Dec-89										0.00
										0.01

date	V16D	V16S	T16D	Q16D	Q16S	Q17D	P17S	N18S	J16D	J16S
01-Jan-90										
02-Jan-90										
03-Jan-90										
04-Jan-90										
05-Jan-90										
06-Jan-90										
07-Jan-90										
08-Jan-90										
09-Jan-90	2539.34	2539.88	2539.11							
10-Jan-90						2538.93	2538.37	2538.39		
11-Jan-90	2538.98	2539.36	2538.77							
12-Jan-90						2538.62	2538.24	2538.04		
13-Jan-90										
14-Jan-90										
15-Jan-90										
16-Jan-90										
17-Jan-90	2538.52	2538.63	2538.35							
18-Jan-90						2538.34	2537.85	2537.64		
19-Jan-90										
20-Jan-90										
21-Jan-90										
22-Jan-90										
23-Jan-90										
24-Jan-90										
25-Jan-90	2538.32	2538.49	2538.13							
26-Jan-90						2537.96	2538.03	2537.40		
27-Jan-90										
28-Jan-90										
29-Jan-90										
30-Jan-90	2538.52	2538.70	2538.32							
31-Jan-90	2538.47	2538.68	2538.28				2537.74	2538.00		
01-Feb-90	2538.43	2538.54	2538.22				2537.70	2538.06		
02-Feb-90	2538.31	2538.39	2538.11			2538.09	2537.64	2537.43		
03-Feb-90	2538.53	2538.43	2538.19			2537.98	2537.55	2537.33		
04-Feb-90	2538.56	2538.76	2538.21			2538.09	2537.57	2537.37		
05-Feb-90	2538.61	2538.71	2538.26			2538.11	2537.57	2537.41		
06-Feb-90	2538.56	2538.53	2538.21			2538.11	2537.59	2537.41		
07-Feb-90	2538.50	2538.95	2538.16			2538.10	2537.58	2537.41		
08-Feb-90	2538.50	2538.67	2538.16			2538.00	2537.48	2537.31		
09-Feb-90	2538.49	2538.48	2538.18			2537.99	2537.47	2537.27		
10-Feb-90	2540.26	2540.85	2539.93			2538.03	2537.49	2537.37		
11-Feb-90	2540.54	2540.84	2540.19			2539.87	2539.41	2539.52		
12-Feb-90	2539.94	2540.21	2539.58			2540.05	2539.91	2539.66		
13-Feb-90	2539.66	2539.73	2539.32			2539.43	2539.42	2538.89		
14-Feb-90	2539.34	2539.33	2538.99			2539.16	2539.03	2538.61		
15-Feb-90	2539.27	2539.18	2538.93			2538.85	2538.67	2538.28		
16-Feb-90	2539.11	2538.94	2538.75			2538.78	2538.54	2538.18		
17-Feb-90	2538.98	2538.81	2538.66			2538.59	2538.33	2537.98		
18-Feb-90	2538.80	2538.65	2538.47			2538.51	2538.23	2537.94		
19-Feb-90	2538.69	2538.52	2538.37			2538.33	2538.07	2537.77		
20-Feb-90	2538.65	2538.46	2538.32			2538.23	2537.94	2537.66		
21-Feb-90	2538.65	2538.43	2538.32			2538.18	2537.86	2537.59		
22-Feb-90	2539.10	2539.77	2538.75			2538.20	2537.83	2537.60		
23-Feb-90	2539.42	2539.86	2539.06			2538.59	2538.23	2538.00		
24-Feb-90	2539.59	2539.88	2539.18			2538.91	2538.52	2538.35		
25-Feb-90	2539.46	2539.57	2539.11			2539.03	2538.70	2538.54		
26-Feb-90	2539.31	2539.33	2538.96			2538.97	2538.67	2538.46		
27-Feb-90	2539.11	2539.06	2538.76			2538.82	2538.54	2538.32		
28-Feb-90	2539.01	2538.93	2538.67			2538.62	2538.32	2538.10		
01-Mar-90	2538.93	2538.81	2538.59			2538.54	2538.22	2537.99		
02-Mar-90	2538.86	2538.72	2538.54			2538.44	2538.14	2537.90		
03-Mar-90	2538.81	2538.62	2538.49			2538.38	2538.07	2537.82		
04-Mar-90	2538.73	2538.54	2538.42			2538.34	2537.96	2537.76		
05-Mar-90	2538.63	2538.47	2538.42			2538.26	2537.87	2537.68		
06-Mar-90	2538.52	2538.42	2538.21			2538.18	2537.80	2537.60		
07-Mar-90	2538.53	2538.38	2538.22			2538.08	2537.73	2537.51		
08-Mar-90	2538.64	2538.43	2538.33			2538.08	2537.68	2537.49		
09-Mar-90	2538.57	2538.37	2538.26			2538.20	2537.77	2537.68		
10-Mar-90	2538.70	2538.45	2538.39			2538.12	2537.76	2537.53		
11-Mar-90	2538.89	2538.91	2538.59			2538.26	2537.80	2537.71		
12-Mar-90	2538.69	2538.62	2538.39			2538.46	2537.95	2537.87		
13-Mar-90	2538.63	2538.53	2538.33			2538.27	2537.82	2537.64		
14-Mar-90	2538.58	2538.43	2538.28			2538.20	2537.74	2537.58		
15-Mar-90	2538.60	2538.48	2538.31			2538.14	2537.67	2537.52		
						2538.17	2537.73	2537.57		

date	V16D	V16S	T16D	Q16D	Q16S	Q17D	P17S	N18S	J16D	J16S
16-Mar-90	2538.53	2538.36	2538.22			2538.09	2537.63	2537.47		
17-Mar-90	2538.49	2538.28	2538.17			2538.03	2537.57	2537.41		
18-Mar-90	2538.42	2538.39	2538.11			2537.99	2537.50	2537.36		
19-Mar-90	2538.40	2538.18	2538.10			2537.96	2537.48	2537.34		
20-Mar-90	2538.32	2538.05	2538.02			2537.88	2537.42	2537.28		
21-Mar-90	2538.31	2538.02	2538.00			2537.86	2537.40	2537.25		
22-Mar-90	2538.29	2537.98	2537.99			2537.84	2537.36	2537.23		
23-Mar-90	2538.44	2538.32	2538.14			2538.02	2537.54	2537.47		
24-Mar-90	2538.37	2538.22	2538.07				2537.46	2537.31		
25-Mar-90	2538.32	2538.09	2538.03			2537.90	2537.39	2537.24		
26-Mar-90	2538.26	2537.94	2537.96			2537.82	2537.32	2537.18		
27-Mar-90	2538.22	2537.88	2537.92			2537.79	2537.29	2537.14		
28-Mar-90	2538.18	2537.83	2537.88			2537.73	2537.23	2537.09		
29-Mar-90	2538.15	2537.79	2537.85			2537.70	2537.20	2537.07		
30-Mar-90	2538.12	2537.76	2537.83			2537.66	2537.18	2537.04		
31-Mar-90	2538.09	2537.73	2537.79			2537.55	2537.14	2537.01		
01-Apr-90	2538.06	2537.69	2537.76			2537.62	2537.11	2536.97		
02-Apr-90	2538.00	2537.64	2537.71			2537.55	2537.05	2536.93		
03-Apr-90	2537.97	2537.60	2537.67			2537.52	2537.01	2536.88		
04-Apr-90	2537.96	2537.59	2537.66			2537.52	2537.02	2536.89		
05-Apr-90	2537.93	2537.62	2537.66			2537.44	2537.01	2536.88		
06-Apr-90	2537.91	2537.53	2537.63			2537.41	2536.96	2536.84		
07-Apr-90	2537.90	2537.53	2537.63			2537.46	2537.33	2536.85		
08-Apr-90	2537.86	2537.48	2537.60			2537.43	2537.13	2536.81		
09-Apr-90	2537.77	2537.41	2537.52			2537.44	2536.98	2536.74		
10-Apr-90	2537.75	2537.41	2537.50			2537.34	2536.93	2536.73		
11-Apr-90	2537.76	2537.41	2537.50			2537.33	2536.90	2536.73		
12-Apr-90	2536.30	2537.16	2531.70			2511.17	2536.72	2536.51		
13-Apr-90	2536.15	2536.91	2531.42			2510.75	2536.62	2536.33		
14-Apr-90	2538.17	2538.27	2537.92			2537.81	2537.37	2537.28		
15-Apr-90	2538.09	2538.02	2537.83			2537.68	2537.20	2537.04		
16-Apr-90	2538.02	2537.76	2537.76			2537.62	2537.10	2536.92		
17-Apr-90	2537.96	2537.59	2537.69			2537.54	2537.00	2536.86		
18-Apr-90	2537.88	2537.51	2537.61			2537.45	2536.94	2536.79		
19-Apr-90	2537.85	2537.48	2537.58			2537.43	2536.90	2536.76		
20-Apr-90	2537.81	2537.43	2537.55			2537.40	2536.86	2536.72		
21-Apr-90	2537.84	2537.44	2537.57			2537.40	2536.86	2536.75		
22-Apr-90	2537.86	2537.42	2537.58			2537.44	2536.84	2536.76		
23-Apr-90	2537.98	2537.55	2537.72			2537.57	2536.97	2536.91		
24-Apr-90	2537.85	2537.41	2537.60			2537.43	2536.80	2536.79		
25-Apr-90	2537.80	2537.37	2537.54			2537.39	2536.78	2536.70		
26-Apr-90	2537.92	2537.72	2537.67			2537.52	2536.92	2536.86		
27-Apr-90	2538.04	2537.61	2537.82			2537.63	2536.99	2536.91		
28-Apr-90	2539.31	2539.75	2539.05			2538.92	2538.29	2538.38		
29-Apr-90	2538.97	2539.29	2538.71			2538.56	2537.90	2537.90		
30-Apr-90	2538.71	2538.67	2538.45			2538.32	2537.71	2537.62		
01-May-90										
02-May-90										
03-May-90	2538.43	2538.17	2538.15			2538.03	2537.47	2537.34		
04-May-90										
05-May-90										
06-May-90	2538.21	2537.88	2537.95			2537.82	2537.22	2537.09		
07-May-90										
08-May-90										
09-May-90	2538.10	2537.72	2537.84			2537.69	2537.08	2536.96		
10-May-90										
11-May-90										
12-May-90										
13-May-90	2538.00	2537.55	2537.74			2537.58	2536.93	2536.83		
14-May-90										
15-May-90										
16-May-90										
17-May-90	2537.94	2537.49	2537.68			2537.53	2536.89	2536.77		
18-May-90										
19-May-90										
20-May-90										
21-May-90	2537.87	2537.44	2537.61	2535.67		2537.33	2536.80	2536.72		
22-May-90	2537.84	2537.39	2537.59	2535.89		2537.30	2536.75	2536.66		
23-May-90	2538.04	2537.82	2537.79	2536.07		2537.51	2536.88	2536.77	2529.75	
24-May-90										
25-May-90										
26-May-90	2538.39	2538.17	2538.17	2537.33		2537.92	2537.25	2537.13	2529.83	
27-May-90										
28-May-90										

date	V16D	V16S	T16D	Q16D	Q16S	Q17D	P17S	N18S	J16D	J16S
29-May-90										
30-May-90	2538.56	2538.34	2538.33	2537.70		2538.11	2537.48	2537.35	2528.46	
31-May-90										
01-Jun-90										
02-Jun-90	2539.33	2539.50	2539.10	2538.51		2538.87	2538.23	2538.22	2528.24	
03-Jun-90										
04-Jun-90										
05-Jun-90										
06-Jun-90										
07-Jun-90	2538.86	2538.60	2538.62	2538.02		2538.38	2537.85	2537.66	2527.67	
08-Jun-90										
09-Jun-90										
10-Jun-90										
11-Jun-90										
12-Jun-90	2538.09	2537.62	2538.00	2537.21		2537.60	2536.86	2536.79	2527.06	
13-Jun-90										
14-Jun-90										
15-Jun-90										
16-Jun-90										
17-Jun-90										
18-Jun-90	2537.84	2537.38	2537.61	2536.95		2537.36	2536.75	2536.60	2526.85	
19-Jun-90										
20-Jun-90										
21-Jun-90										
22-Jun-90										
23-Jun-90										
24-Jun-90	2537.81	2537.30	2537.56	2536.90		2537.34	2536.70	2536.59	2526.84	
25-Jun-90										
26-Jun-90										
27-Jun-90										
28-Jun-90										
29-Jun-90										
30-Jun-90										
01-Jul-90										
02-Jul-90	2537.78	2537.28	2537.54	2536.88		2537.29	2536.65	2536.56	2526.83	
03-Jul-90										
04-Jul-90										
05-Jul-90										
06-Jul-90	2537.42	2537.22	2537.40	2536.81		2536.98	2536.60	2536.48	2526.73	
07-Jul-90										
08-Jul-90										
09-Jul-90	2537.68	2537.16	2537.44	2536.78		2537.17	2536.55	2536.44	2526.79	
10-Jul-90										
11-Jul-90										
12-Jul-90										
13-Jul-90										
14-Jul-90										
15-Jul-90	2537.63	2537.14	2537.42	2536.74		2537.14	2536.53	2536.41	2526.99	
16-Jul-90										
17-Jul-90										
18-Jul-90										
19-Jul-90	2537.66	2537.22	2537.44	2536.77		2537.16	2536.60	2536.43	2526.93	
20-Jul-90										
21-Jul-90										
22-Jul-90										
23-Jul-90	2537.57	2537.08	2537.35	2536.69		2537.07	2536.48	2536.36	2527.07	
24-Jul-90										
25-Jul-90										
26-Jul-90										
27-Jul-90	2537.77	2537.33	2537.54	2536.87		2537.26	2536.69	2536.56	2526.95	
28-Jul-90										
29-Jul-90										
30-Jul-90	2537.79	2537.37	2537.55	2536.88	2537.11	2537.25	2536.66	2536.52	2522.85	
31-Jul-90				2537.46	2536.95				2520.03	
01-Aug-90										
02-Aug-90										
03-Aug-90										
04-Aug-90										
05-Aug-90										
06-Aug-90										
07-Aug-90	2537.68	2537.30	2537.40	2537.35	2536.88	2537.22	2536.64	2536.50	2517.09	
08-Aug-90										
09-Aug-90										
10-Aug-90										

date	V16D	V16S	T16D	Q16D	Q16S	Q17D	P17S	N18S	J16D	J16S
11-Aug-90	2537.59	2537.15	2537.32	2537.28	2536.79	2537.16	2536.46	2536.44	2517.06	2536.68
12-Aug-90										
13-Aug-90										
14-Aug-90	2537.51	2537.14	2537.15	2537.19	2536.81	2537.24	2536.55	2536.42	2514.98	2536.68
15-Aug-90										
16-Aug-90										
17-Aug-90										
18-Aug-90										
19-Aug-90										
20-Aug-90										
21-Aug-90										
22-Aug-90										
23-Aug-90	2537.78	2537.47	2537.23	2537.40	2537.44	2537.25	2536.79	2536.66	2517.79	2537.26
24-Aug-90										
25-Aug-90										
26-Aug-90										
27-Aug-90										
28-Aug-90	2537.52	2537.16	2536.92	2537.16	2537.20	2537.03	2536.58	2536.42	2519.30	2536.66
29-Aug-90										
30-Aug-90										
31-Aug-90										
01-Sep-90										
02-Sep-90										
03-Sep-90										
04-Sep-90	2537.47	2537.12	2536.90	2537.11	2537.15	2536.98	2536.54	2536.41	2519.30	2536.60
05-Sep-90										
06-Sep-90										
07-Sep-90										
08-Sep-90	2537.40	2537.06	2536.88	2537.05	2537.06	2536.93	2536.48	2536.37	2519.44	2536.54
09-Sep-90										
10-Sep-90										
11-Sep-90										
12-Sep-90										
13-Sep-90	2537.33	2536.98	2536.87	2537.02	2536.94	2536.89	2536.45	2536.35	2519.46	2536.49
14-Sep-90										
15-Sep-90										
16-Sep-90										
17-Sep-90	2537.29	2536.90	2536.84	2536.97	2536.86	2536.85	2536.41	2536.31	2519.46	2536.50
18-Sep-90										
19-Sep-90										
20-Sep-90										
21-Sep-90	2537.23	2536.85	2536.79	2536.91	2536.84	2536.79	2536.38	2536.27	2519.50	2536.47
22-Sep-90										
23-Sep-90										
24-Sep-90										
25-Sep-90										
26-Sep-90	2537.16	2536.79	2536.72	2536.85	2536.78	2536.71	2536.34	2536.22	2519.54	2536.42
27-Sep-90										
28-Sep-90										
29-Sep-90										
30-Sep-90										
01-Oct-90										
02-Oct-90	2537.14	2536.78	2536.69	2536.83	2536.76	2536.69	2536.33	2536.21	2519.61	2536.38
03-Oct-90										
04-Oct-90										
05-Oct-90										
06-Oct-90										
07-Oct-90										
08-Oct-90										
09-Oct-90										
10-Oct-90	2537.15	2536.81	2536.74	2536.86	2536.61	2536.72	2536.35	2536.22	2519.67	2536.40
11-Oct-90										
12-Oct-90										
13-Oct-90										
14-Oct-90										
15-Oct-90										
16-Oct-90										
17-Oct-90	2537.17	2536.87	2536.78	2536.89	2536.57	2536.76	2536.36	2536.24	2519.69	2536.40
18-Oct-90										
19-Oct-90										
20-Oct-90										
21-Oct-90										
22-Oct-90										
23-Oct-90										

date	V16D	V16S	T16D	Q16D	Q16S	Q17D	P17S	N18S	J16D	J16S
24-Oct-90	2537.41	2537.15	2536.97	2537.15	2536.75	2537.00	2536.56	2536.43	2519.64	2536.58
25-Oct-90										
26-Oct-90										
27-Oct-90										
28-Oct-90										
29-Oct-90										
30-Oct-90										
31-Oct-90	2537.70	2537.50	2537.22	2537.50	2537.04	2537.20	2536.67	2536.54	2519.58	2536.71
01-Nov-90										
02-Nov-90										
03-Nov-90										
04-Nov-90										
05-Nov-90										
06-Nov-90	2537.75	2537.61	2537.33	2537.65	2537.08	2537.32	2536.86	2536.70	2519.56	2536.77
07-Nov-90										
08-Nov-90										
09-Nov-90										
10-Nov-90										
11-Nov-90										
12-Nov-90										
13-Nov-90										
14-Nov-90										
15-Nov-90	2537.32	2537.11	2536.91	2537.09	2536.86	2536.90	2536.53	2536.38	2519.43	2536.50
16-Nov-90										
17-Nov-90										
18-Nov-90										
19-Nov-90										
20-Nov-90										
21-Nov-90										
22-Nov-90										
23-Nov-90	2537.42	2537.76	2537.00	2537.01	2537.01	2537.02	2536.96	2536.81	2519.75	2536.92
24-Nov-90										
25-Nov-90										
26-Nov-90										
27-Nov-90										
28-Nov-90										
29-Nov-90										
30-Nov-90	2537.50	2537.80	2537.07	2537.09	2537.06	2537.08	2536.97	2536.84	2519.71	2536.96
01-Dec-90										
02-Dec-90										
03-Dec-90										
04-Dec-90										
05-Dec-90	2538.01	2538.01	2537.58	2537.69	2537.36	2537.54	2537.07	2536.89	2519.57	2537.00
06-Dec-90										
07-Dec-90										
08-Dec-90										
09-Dec-90										
10-Dec-90										
11-Dec-90	2538.58	2538.91	2538.16	2538.26	2537.92	2538.13	2537.50	2537.49	2519.88	2537.53
12-Dec-90										
13-Dec-90	2538.27	2538.22	2538.06	2537.93	2537.54	2537.79		2537.17	2519.79	2537.26
14-Dec-90	2538.18	2538.07	2537.77	2537.83	2537.46	2537.73	2537.17	2537.05	2519.78	2537.21
15-Dec-90										
16-Dec-90										
17-Dec-90										
18-Dec-90										
19-Dec-90										
20-Dec-90										
21-Dec-90										
22-Dec-90										
23-Dec-90										
24-Dec-90										
25-Dec-90										
26-Dec-90										
27-Dec-90										
28-Dec-90										
29-Dec-90										
30-Dec-90										
31-Dec-90										

date	J17S	D19D	H12S	U3D	U3S	T8S	S12D1	S12D2	Creek	Prec.(in)
01-Jan-90										
02-Jan-90										0.09
03-Jan-90										0.02
04-Jan-90										0.00
05-Jan-90										0.22
06-Jan-90										0.02
07-Jan-90										0.44
08-Jan-90										0.59
09-Jan-90		2519.32								0.79
10-Jan-90							2539.23	2519.58		0.52
11-Jan-90		2519.08								0.50
12-Jan-90							2538.99	2519.41		0.00
13-Jan-90										0.00
14-Jan-90										0.00
15-Jan-90										0.46
16-Jan-90										0.07
17-Jan-90		2519.12								0.00
18-Jan-90							2538.50	2519.50		0.00
19-Jan-90										0.00
20-Jan-90										0.00
21-Jan-90										0.00
22-Jan-90										0.00
23-Jan-90										0.17
24-Jan-90										0.11
25-Jan-90		2519.27								0.00
26-Jan-90							2538.25	2519.49		0.00
27-Jan-90										0.10
28-Jan-90										0.07
29-Jan-90										0.05
30-Jan-90		2519.62								0.12
31-Jan-90		2519.66					2538.46	2519.84	2537.11	0.17
01-Feb-90		2519.37					2538.43	2519.83	2537.11	0.00
02-Feb-90		2519.01					2538.37	2519.65	2537.06	0.06
03-Feb-90		2519.13					2538.26	2519.58	2537.04	0.03
04-Feb-90		2519.03					2538.43	2519.38	2537.06	0.00
05-Feb-90		2519.03					2538.46	2519.44	2537.13	0.03
06-Feb-90		2519.04					2538.51	2519.28	2537.03	0.01
07-Feb-90		2518.87					2538.48	2519.36	2537.07	0.03
08-Feb-90		2519.25					2538.44	2519.25	2537.03	0.02
09-Feb-90		2519.20					2538.45	2519.59	2536.99	0.32
10-Feb-90		2519.24					2538.45	2519.54	2537.17	0.35
11-Feb-90		2519.49					2540.11	2519.62	2540.09	0.02
12-Feb-90		2519.70					2540.44	2519.81	2539.01	0.00
13-Feb-90		2519.84					2539.86	2520.07	2537.71	0.02
14-Feb-90		2519.59					2539.62	2520.24	2537.50	0.03
15-Feb-90		2519.78					2539.29	2520.00	2537.26	0.00
16-Feb-90		2520.07					2539.24	2520.18	2537.22	0.12
17-Feb-90		2519.84					2539.07	2520.46	2537.11	0.07
18-Feb-90		2519.47					2538.95	2520.32	2537.27	0.00
19-Feb-90		2519.37					2538.79	2519.95	2537.20	0.00
20-Feb-90		2519.53					2538.74	2519.76	2537.16	0.00
21-Feb-90		2519.48					2538.63	2519.88	2537.15	0.15
22-Feb-90		2519.37					2538.63	2519.87	2537.23	0.02
23-Feb-90		2519.46					2539.12	2519.77	2537.43	0.00
24-Feb-90		2519.52					2539.36	2519.85	2537.66	0.00
25-Feb-90		2519.59					2539.48	2519.91	2537.75	0.00
26-Feb-90		2519.54					2539.41	2519.97	2537.70	0.00
27-Feb-90		2519.46					2539.27	2519.98	2537.64	0.00
28-Feb-90		2519.50					2539.06	2519.88	2537.46	0.00
01-Mar-90		2519.58					2538.98	2519.90	2537.41	0.00
02-Mar-90		2519.60					2538.90	2519.98	2537.38	0.00
03-Mar-90		2519.75					2538.86	2520.03	2537.36	0.00
04-Mar-90		2519.72					2538.79	2520.14	2537.35	0.00
05-Mar-90		2519.66					2538.71	2520.10	2537.33	0.04
06-Mar-90		2519.42					2538.62	2520.11	2537.30	0.00
07-Mar-90		2519.62					2538.50	2519.86	2537.27	0.00
08-Mar-90		2519.61					2538.52	2519.91	2537.26	0.00
09-Mar-90		2519.55					2538.61	2520.09	2537.57	0.20
10-Mar-90		2519.80					2538.56	2519.96	2537.33	0.00
11-Mar-90		2519.70					2538.66	2520.18	2537.61	0.55
12-Mar-90		2519.47					2538.88	2520.23	2537.53	0.00
13-Mar-90		2519.41					2538.69	2520.07	2537.31	0.00
14-Mar-90		2519.47					2538.62	2519.86	2537.31	0.00
15-Mar-90		2519.27					2538.57	2519.90	2537.28	0.16
							2538.58	2519.79	2537.35	0.00

date	J17S	D19D	H12S	U3D	U3S	T8S	S12D1	S12D2	Creek	Prec.(in)
16-Mar-90		2519.27					2538.51	2519.71	2537.26	0.00
17-Mar-90		2519.35					2538.47	2519.82	2537.22	0.00
18-Mar-90		2519.27					2538.39	2519.75	2537.21	0.00
19-Mar-90		2519.38					2538.40	2519.81	2537.20	0.01
20-Mar-90		2519.17					2538.40	2519.67	2537.20	0.02
21-Mar-90		2519.23					2538.40	2519.68	2537.18	0.00
22-Mar-90		2519.26					2538.27	2519.72	2537.18	0.00
23-Mar-90		2519.21					2538.40	2519.67	2537.46	0.39
24-Mar-90		2519.08					2538.35	2519.63	2537.25	0.04
25-Mar-90		2519.11					2538.31	2519.57	2537.20	0.00
26-Mar-90		2519.10					2538.25	2519.59	2537.16	0.00
27-Mar-90		2519.13					2538.22	2519.60	2537.13	0.00
28-Mar-90		2519.15					2538.16	2519.59	2537.11	0.00
29-Mar-90		2519.14					2538.15	2519.63	2537.09	0.00
30-Mar-90		2519.12					2538.12	2519.59	2537.09	0.00
31-Mar-90		2519.12					2538.08	2519.60	2537.08	0.00
01-Apr-90		2519.08					2538.04	2519.56	2537.06	0.00
02-Apr-90		2518.99					2537.99	2519.53	2537.06	0.00
03-Apr-90		2518.85					2537.94	2519.48	2537.05	0.00
04-Apr-90		2518.86					2537.93	2519.29	2537.04	0.00
05-Apr-90		2518.62					2537.94	2519.04	2537.04	0.00
06-Apr-90		2518.74					2537.90	2519.22	2537.03	0.00
07-Apr-90		2518.84					2537.90	2519.33	2537.02	0.00
08-Apr-90		2518.93					2537.89	2519.48	2537.01	0.00
09-Apr-90		2518.67					2537.78	2519.23	2537.00	0.00
10-Apr-90		2518.60					2537.78	2519.12	2537.00	0.00
11-Apr-90		2518.75					2537.78	2519.27	2536.99	0.18
12-Apr-90		2518.53					2536.25	2519.01	2537.11	0.29
13-Apr-90		2518.30					2536.10	2518.69	2537.02	0.07
14-Apr-90		2518.31					2537.81	2518.71	2537.61	0.66
15-Apr-90		2518.57					2538.13	2519.10	2537.13	0.02
16-Apr-90		2518.81					2538.07	2519.31	2537.05	0.00
17-Apr-90		2518.91					2537.99	2519.44	2537.02	0.00
18-Apr-90		2518.81					2537.93	2519.33	2537.00	0.00
19-Apr-90		2518.77					2537.90	2519.29	2536.99	0.00
20-Apr-90		2518.67					2537.87	2519.20	2536.99	0.07
21-Apr-90		2518.72					2537.90	2519.25	2536.99	0.01
22-Apr-90		2518.83					2537.92	2519.39	2537.06	0.22
23-Apr-90		2518.97					2538.03	2519.51	2537.04	0.15
24-Apr-90		2518.71					2537.90	2519.27	2536.96	0.00
25-Apr-90		2518.65					2537.87	2519.20	2536.91	0.24
26-Apr-90		2518.63					2537.99	2519.11	2537.05	0.18
27-Apr-90		2518.72					2538.09	2519.24	2537.22	0.58
28-Apr-90		2519.00					2539.33	2519.54	2538.31	1.01
29-Apr-90		2518.79					2539.00	2519.35	2537.46	0.01
30-Apr-90		2518.62					2538.76	2519.18	2537.24	0.00
01-May-90										0.00
02-May-90										0.09
03-May-90		2518.59					2538.49	2519.15	2537.18	0.00
04-May-90										0.00
05-May-90										0.00
06-May-90		2518.70					2538.27	2519.27	2537.01	0.00
07-May-90										0.00
08-May-90										0.00
09-May-90		2518.72	2539.04			2539.47	2538.16	2519.22	2537.01	0.00
10-May-90										0.00
11-May-90										0.00
12-May-90										0.00
13-May-90		2518.61	2538.79			2539.23	2538.06	2519.19	2536.99	0.04
14-May-90										0.02
15-May-90										0.24
16-May-90										0.07
17-May-90		2518.61	2538.67			2539.10	2538.01	2519.17	2536.95	0.00
18-May-90										0.00
19-May-90										0.00
20-May-90										0.57
21-May-90		2526.24	2538.53			2538.87	2538.00	2527.46	2537.01	0.02
22-May-90		2526.94	2538.46	2535.95		2538.82	2537.93	2529.04	2536.91	0.08
23-May-90		2528.17	2538.35			2538.75	2538.13	2529.48	2536.99	0.42
24-May-90										1.11
25-May-90										0.01
26-May-90		2528.84	2539.09	2536.58		2539.20	2538.47	2529.74	2537.03	0.00
27-May-90										0.00
28-May-90										0.10

date	J17S	D19D	H12S	U3D	U3S	T8S	S12D1	S12D2	Creek	Prec.(in)
29-May-90										0.76
30-May-90		2527.30	2539.16	2537.04		2539.35	2538.64	2528.24	2537.25	0.12
31-May-90										0.72
01-Jun-90										0.30
02-Jun-90		2526.91	2539.64	2538.15		2539.91	2539.35	2528.13	2537.71	0.21
03-Jun-90										0.14
04-Jun-90										0.06
05-Jun-90										0.00
06-Jun-90										0.17
07-Jun-90		2526.18	2539.49	2538.85		2539.88	2538.11	2527.40	2537.41	0.11
08-Jun-90										0.03
09-Jun-90										0.00
10-Jun-90										0.27
11-Jun-90										0.09
12-Jun-90		2525.64	2538.66	2539.04		2539.07	2537.04	2526.79	2536.89	0.09
13-Jun-90										0.09
14-Jun-90										0.03
15-Jun-90										0.02
16-Jun-90										0.02
17-Jun-90										0.00
18-Jun-90		2525.28	2538.28	2539.08		2538.86	2536.62	2526.58	2536.87	0.00
19-Jun-90										0.00
20-Jun-90										0.00
21-Jun-90										0.00
22-Jun-90										0.00
23-Jun-90										0.00
24-Jun-90		2525.24	2538.24	2539.07		2538.79	2536.53	2526.56	2536.87	0.00
25-Jun-90										0.00
26-Jun-90										0.00
27-Jun-90										0.00
28-Jun-90										0.00
29-Jun-90										0.00
30-Jun-90										0.00
01-Jul-90										0.00
02-Jul-90		2525.21	2538.16	2539.03		2538.72	2536.49	2526.57	2536.87	0.12
03-Jul-90										0.03
04-Jul-90										0.00
05-Jul-90										0.00
06-Jul-90		2525.08	2538.04	2539.03		2538.58	2536.08	2526.45	2536.84	0.03
07-Jul-90										0.00
08-Jul-90										0.00
09-Jul-90	2536.25	2525.11	2537.95	2538.99		2538.51	2536.15	2526.51	2536.83	0.00
10-Jul-90										0.00
11-Jul-90										0.00
12-Jul-90										0.00
13-Jul-90										0.00
14-Jul-90										0.00
15-Jul-90	2536.18	2525.27	2537.88	2539.09		2538.38	2536.15	2526.74	2536.79	0.00
16-Jul-90										0.00
17-Jul-90										0.00
18-Jul-90										0.00
19-Jul-90	2536.15	2525.19	2537.82	2539.00		2538.48	2536.01	2526.66	2536.84	0.00
20-Jul-90										0.00
21-Jul-90										0.00
22-Jul-90										0.00
23-Jul-90	2536.10	2525.28	2537.77	2539.07		2538.20	2535.78	2526.84	2536.81	0.00
24-Jul-90										0.01
25-Jul-90										0.03
26-Jul-90										0.36
27-Jul-90	2536.14	2525.04	2537.76	2538.95		2538.21	2535.86	2526.72	2536.89	0.00
28-Jul-90										0.00
29-Jul-90										0.00
30-Jul-90	2536.50	2521.98	2537.91	2537.63		2538.27	2535.38	2522.91	2536.81	0.00
31-Jul-90		2520.06		2520.12				2520.18	2536.83	0.12
01-Aug-90										0.00
02-Aug-90										0.00
03-Aug-90										0.00
04-Aug-90										0.00
05-Aug-90										0.00
06-Aug-90										0.00
07-Aug-90	2536.54	2516.59	2537.88	2517.09	2541.39	2538.26	2534.73	2517.08	2536.83	0.00
08-Aug-90										0.00
09-Aug-90										0.00
10-Aug-90										0.05

date	J17S	D19D	H12S	U3D	U3S	T8S	S12D1	S12D2	Creek	Prec.(in)
11-Aug-90	2536.52	2516.51	2537.85	2517.04	2542.07	2538.16	2534.55	2517.02	2536.83	0.00
12-Aug-90										0.00
13-Aug-90										0.00
14-Aug-90	2536.49	2514.19	2537.83	2514.64	2542.12	2538.14	2534.48	2514.55		0.00
15-Aug-90										0.00
16-Aug-90										0.00
17-Aug-90										0.00
18-Aug-90										0.13
19-Aug-90										0.08
20-Aug-90										0.10
21-Aug-90										0.63
22-Aug-90										0.00
23-Aug-90	2536.70	2517.11	2537.95	2517.74	2542.12	2538.22	2535.11	2517.72	2536.81	0.00
24-Aug-90										0.13
25-Aug-90										0.00
26-Aug-90										0.00
27-Aug-90										0.00
28-Aug-90	2536.50	2518.85	2537.76	2519.30	2541.94	2538.09	2534.79	2519.32	2536.79	0.00
29-Aug-90										0.00
30-Aug-90										0.00
31-Aug-90										0.00
01-Sep-90										0.00
02-Sep-90										0.00
03-Sep-90										0.00
04-Sep-90	2536.44	2518.84	2537.72	2519.30	2541.92	2538.04	2534.82	2519.33	2536.81	0.00
05-Sep-90										0.00
06-Sep-90										0.00
07-Sep-90										0.00
08-Sep-90	2536.37	2518.91	2537.68	2519.41	2541.81	2537.97	2534.79	2519.42	2536.83	0.01
09-Sep-90										0.00
10-Sep-90										0.00
11-Sep-90										0.00
12-Sep-90										0.00
13-Sep-90	2536.33	2518.94	2537.64	2519.42	2541.74	2537.88	2534.85	2519.45	2536.85	0.00
14-Sep-90										0.00
15-Sep-90										0.00
16-Sep-90										0.04
17-Sep-90	2536.30	2518.95	2537.56	2519.47	2541.62	2537.78	2534.88	2519.46	2536.87	0.00
18-Sep-90										0.00
19-Sep-90										0.00
20-Sep-90										0.00
21-Sep-90	2536.27	2519.01	2537.53	2519.51	2541.54	2537.74	2534.60	2519.51	2536.83	0.00
22-Sep-90										0.00
23-Sep-90										0.00
24-Sep-90										0.00
25-Sep-90										0.00
26-Sep-90	2536.23	2519.06	2537.46	2519.54	2541.47	2537.70	2534.15	2519.55	2536.81	0.00
27-Sep-90										0.00
28-Sep-90										0.00
29-Sep-90										0.00
30-Sep-90										0.00
01-Oct-90										0.00
02-Oct-90	2536.22	2519.11	2537.44	2519.61	2541.42	2537.68	2534.13	2519.58	2536.81	0.00
03-Oct-90										0.20
04-Oct-90										0.03
05-Oct-90										0.13
06-Oct-90										0.00
07-Oct-90										0.00
08-Oct-90										0.00
09-Oct-90										0.00
10-Oct-90	2536.27	2519.16	2537.45	2519.65	2541.32	2537.61	2534.33	2519.63	2536.71	0.04
11-Oct-90										0.00
12-Oct-90										0.08
13-Oct-90										0.03
14-Oct-90										0.09
15-Oct-90										0.74
16-Oct-90										0.00
17-Oct-90	2536.26	2519.21	2537.37	2519.70	2541.20	2537.56	2534.53	2519.69	2536.77	0.00
18-Oct-90										0.31
19-Oct-90										0.08
20-Oct-90										0.00
21-Oct-90										1.37
22-Oct-90										0.26
23-Oct-90										0.00

date	J17S	D19D	H12S	U3D	U3S	T8S	S12D1	S12D2	Creek	Prec.(in)
24-Oct-90	2536.43	2519.21	2537.56	2519.67	2541.31	2537.75	2534.77	2519.67	2536.81	0.00
25-Oct-90										0.00
26-Oct-90										0.04
27-Oct-90										0.00
28-Oct-90										0.03
29-Oct-90										0.00
30-Oct-90										0.31
31-Oct-90	2536.63	2519.14	2537.74	2519.61	2541.42	2537.89	2535.22	2519.63	2536.86	0.48
01-Nov-90										0.01
02-Nov-90										0.06
03-Nov-90										0.18
04-Nov-90										0.71
05-Nov-90										0.05
06-Nov-90	2536.69	2519.11	2537.89	2519.57	2541.49	2538.10	2535.42	2519.62	2536.88	0.03
07-Nov-90										0.11
08-Nov-90										0.01
09-Nov-90										0.01
10-Nov-90										0.00
11-Nov-90										0.00
12-Nov-90										0.00
13-Nov-90										0.00
14-Nov-90										0.23
15-Nov-90	2536.38	2519.00	2537.52	2519.42	2541.57	2537.82	2534.85	2519.48	2536.79	0.00
16-Nov-90										0.00
17-Nov-90										0.01
18-Nov-90										0.16
19-Nov-90										0.07
20-Nov-90										0.03
21-Nov-90										0.35
22-Nov-90										0.08
23-Nov-90	2536.69	2519.31	2537.87	2519.72	2541.77	2538.05	2535.38	2519.78	2536.96	0.00
24-Nov-90										0.00
25-Nov-90										1.17
26-Nov-90										0.03
27-Nov-90										0.21
28-Nov-90										0.00
29-Nov-90										0.21
30-Nov-90	2536.74	2519.26	2537.94	2519.66	2541.96	2538.10	2535.43	2519.76	2536.95	0.26
01-Dec-90										0.18
02-Dec-90										0.02
03-Dec-90										0.00
04-Dec-90										0.00
05-Dec-90	2536.84	2519.03	2538.13	2519.45	2542.11	2538.63	2535.82	2519.51	2536.97	0.00
06-Dec-90										0.00
07-Dec-90										0.00
08-Dec-90										0.00
09-Dec-90										0.07
10-Dec-90										0.37
11-Dec-90	2536.98	2519.34	2538.56	2519.75	2542.48	2538.85	2536.12	2519.75	2537.37	0.30
12-Dec-90										0.00
13-Dec-90	2537.11	2519.35	2538.51	2520.29	2542.56	2539.02	2536.08	2519.79	2537.07	0.13
14-Dec-90	2537.06	2519.34	2538.45	2519.76	2542.53	2539.02	2536.02	2519.77	2537.05	0.00
15-Dec-90										0.00
16-Dec-90										0.00
17-Dec-90										0.00
18-Dec-90										0.00
19-Dec-90										0.08
20-Dec-90										0.00
21-Dec-90										0.00
22-Dec-90										0.00
23-Dec-90										0.00
24-Dec-90										0.01
25-Dec-90										0.09
26-Dec-90										0.07
27-Dec-90										0.08
28-Dec-90										0.08
29-Dec-90										0.00
30-Dec-90										0.09
31-Dec-90										0.00

Date	V16D	V16S	T16D	Q16D	Q16S	Q17D	P17S	N18S	J16D	J16S
01-Jan-91										
02-Jan-91										
03-Jan-91		2536.92			2537.02		2536.34			2536.49
04-Jan-91										
05-Jan-91	2537.17	2536.86	2536.92	2537.16	2536.61		2536.30		2519.17	2536.45
06-Jan-91										
07-Jan-91	2537.20	2536.86	2536.78	2536.83	2536.55	2536.71	2536.29		2519.24	2536.45
08-Jan-91	2537.15	2536.87	2536.77	2536.80	2536.53	2536.72	2536.29		2519.20	2536.44
09-Jan-91	2537.15	2536.84	2536.76	2536.79	2536.53	2536.70	2536.28		2519.25	2536.43
10-Jan-91	2537.12	2536.83	2536.76	2536.81	2536.51	2536.70	2536.29		2519.10	2536.43
11-Jan-91	2537.48	2537.11	2537.15	2537.22	2536.87	2537.13	2536.60		2519.15	2536.76
12-Jan-91	2538.93	2539.71	2538.55	2538.64	2538.36	2538.52	2537.90		2519.35	2538.13
13-Jan-91	2539.57	2540.41	2539.17	2539.22	2539.06	2539.13	2538.74		2519.41	2539.19
14-Jan-91	2539.95	2540.33	2539.55	2539.62	2539.40	2539.49	2539.22		2519.58	2539.78
15-Jan-91	2540.92	2541.02	2540.50	2540.57	2540.48	2540.43	2540.01		2519.66	2540.49
16-Jan-91	2540.21	2540.29	2539.76	2539.80	2539.66	2539.69	2539.72		2519.54	2539.95
17-Jan-91										
18-Jan-91	2539.90	2539.90	2539.47	2539.52	2539.34	2539.42	2539.30		2519.80	2539.92
19-Jan-91	2539.52	2539.51	2539.12	2539.16	2538.99	2539.06	2538.93		2519.42	2539.57
20-Jan-91										
21-Jan-91	2539.11	2539.01	2538.71	2538.84	2538.55	2538.65	2538.50		2519.37	2539.14
22-Jan-91								2537.94		
23-Jan-91	2538.82	2538.62	2538.43	2538.54	2538.23	2538.36	2538.15	2537.79	2518.47	2538.84
24-Jan-91										
25-Jan-91	2538.52	2538.31	2538.12	2538.32	2537.92	2538.09	2537.83	2537.50	2518.25	2538.50
26-Jan-91										
27-Jan-91	2538.34	2538.10	2537.97	2538.02	2537.70	2537.89	2537.56	2537.25	2520.36	2538.25
28-Jan-91										
29-Jan-91	2538.12	2537.86		2537.80	2537.46		2537.32	2537.03	2521.07	2537.96
30-Jan-91			2537.56			2537.58				
31-Jan-91	2537.92	2537.64	2537.52	2537.61	2537.27	2537.49	2537.10	2536.87	2517.40	2537.72
01-Feb-91										
02-Feb-91	2537.97	2537.65	2537.56	2537.65	2537.31	2537.52	2537.09	2536.93	2517.39	2537.71
03-Feb-91	2538.22	2537.93	2537.85	2537.91	2537.64	2537.80	2537.40	2537.30	2518.68	2537.90
04-Feb-91	2538.27	2537.97	2537.91	2537.98	2537.66	2537.85	2537.43	2537.32	2519.84	2537.92
05-Feb-91	2538.56	2538.29	2538.24	2538.30	2538.05	2538.19	2537.78	2537.74	2520.41	2538.22
06-Feb-91	2538.41	2538.13	2538.06	2538.11	2537.81	2538.02	2537.57	2537.48	2519.98	2538.06
07-Feb-91										
08-Feb-91	2538.29	2538.02	2537.95	2537.99	2537.64	2537.88	2537.44	2537.28	2520.89	2537.91
09-Feb-91									2521.13	
10-Feb-91	2538.21	2537.92	2537.88	2537.90	2537.56	2537.78	2537.34	2537.18	2521.24	2537.79
11-Feb-91									2521.48	
12-Feb-91	2538.20	2537.92	2537.79	2537.91	2537.57	2537.79	2537.34	2537.20	2520.78	2537.78
13-Feb-91	2538.10	2537.86		2537.88	2537.50	2537.70	2537.28	2537.11		
14-Feb-91	2538.48	2538.35	2538.13	2538.18	2537.86	2538.06	2537.60	2537.52	2518.91	2537.97
15-Feb-91	2538.46	2538.26	2538.11	2538.15	2537.79	2538.03	2537.54	2537.40	2520.20	2537.93
16-Feb-91	2538.43								2521.00	
17-Feb-91	2538.32	2538.07	2537.99	2538.02	2537.63	2537.90	2537.40	2537.26	2521.29	2537.79
18-Feb-91									2521.40	
19-Feb-91	2538.44	2538.30	2538.12	2538.10	2537.77	2538.03	2537.52	2537.43	2521.66	2537.90
20-Feb-91	2538.58	2538.34	2538.25	2538.29	2537.91	2538.18	2537.64	2537.56	2521.65	2538.01
21-Feb-91	2538.50	2538.34	2538.16	2538.19	2537.77	2538.08	2537.52	2537.36	2521.72	2537.93
22-Feb-91		2538.22							2521.78	
23-Feb-91	2538.30	2538.06	2537.98	2538.01	2537.59	2537.89	2537.36	2537.17	2521.68	2537.78
24-Feb-91										
25-Feb-91	2538.18	2537.93	2537.86	2537.87	2537.46	2537.77	2537.24	2537.05	2521.62	2537.68
26-Feb-91										
27-Feb-91	2538.16	2537.90	2537.82	2537.86	2537.44	2537.71	2537.19	2537.03	2519.53	2537.69
28-Feb-91										
01-Mar-91	2538.43	2538.42	2538.09	2538.13	2537.74	2538.02	2537.48	2537.39	2521.21	2537.90
02-Mar-91	2538.57	2538.41	2538.26	2538.19	2537.85	2538.16	2537.58	2537.48	2521.40	2538.02
03-Mar-91	2539.02	2539.10	2538.71	2538.70	2538.33	2538.60	2537.98	2537.93	2521.71	2538.70
04-Mar-91	2540.12	2540.33	2539.79	2539.80	2539.50	2539.68	2538.94	2539.18	2522.23	2540.12
05-Mar-91	2539.81	2539.97	2539.48	2539.48	2539.18	2539.37	2538.76	2538.76	2521.73	2539.96
06-Mar-91	2539.68	2539.82	2539.35	2539.36	2539.06	2539.23	2538.76	2538.61	2521.83	2539.93
07-Mar-91	2539.60	2539.66	2539.25	2539.24	2538.98	2539.13	2538.72	2538.46	2521.54	2539.92
08-Mar-91	2539.43	2539.46	2539.07	2539.09	2538.81	2538.98	2538.59	2538.31	2520.85	2539.83
09-Mar-91	2539.38	2539.29	2539.01	2539.01	2538.72	2538.91	2538.51	2538.23	2520.66	2539.81
10-Mar-91	2539.26	2539.13								
11-Mar-91	2539.06	2538.94	2538.70	2538.74	2538.43	2538.62	2538.21	2537.95	2520.38	2539.39
12-Mar-91	2539.00	2538.81	2538.64	2538.65	2538.38	2538.53	2538.13	2537.89	2520.07	2539.27
13-Mar-91	2539.06	2538.81	2538.68	2538.71	2538.44	2538.59	2538.20	2537.98	2517.65	2539.27
14-Mar-91	2539.00	2538.51	2538.60	2538.67	2538.36	2538.54	2538.14	2537.90	2516.14	2539.22
15-Mar-91	2538.88	2538.71	2538.48	2538.61	2538.25	2538.42	2538.00	2537.76	2515.79	2539.06

Date	V16D	V16S	T16D	Q16D	Q16S	Q17D	P17S	N18S	J16D	J16S
16-Mar-91										
17-Mar-91	2538.71	2538.39	2538.30	2538.37	2538.05	2538.25	2537.83	2537.59	2516.37	2538.81
18-Mar-91										
19-Mar-91	2538.67	2538.33	2538.27	2538.32	2537.97	2538.21	2537.76	2537.53	2517.67	2538.74
20-Mar-91	2538.62	2538.50	2538.29	2538.33	2538.02	2538.24	2537.79	2537.60	2517.78	2538.69
21-Mar-91	2538.56	2538.35	2538.18	2538.24	2537.86	2538.12	2537.62	2537.42	2517.97	2538.50
22-Mar-91										
23-Mar-91	2538.40	2538.20	2538.04	2538.10	2537.71	2537.96	2537.47	2537.27	2518.18	2538.33
24-Mar-91	2538.37	2538.14	2538.02	2538.06	2537.67	2537.95	2537.42	2537.24	2518.39	2538.28
25-Mar-91	2538.39	2538.14	2538.03	2538.08	2537.67	2537.97	2537.42	2537.25	2518.74	2538.28
26-Mar-91	2538.37	2538.06	2538.03	2538.09	2537.69	2537.95	2537.43	2537.29	2518.54	2538.21
27-Mar-91	2538.23	2538.01	2537.90	2537.98	2537.55	2537.83	2537.32	2537.13	2518.37	2538.06
28-Mar-91										
29-Mar-91	2538.12	2537.88	2537.78	2537.81	2537.42	2537.70	2537.20	2537.01	2518.23	2537.89
30-Mar-91										
31-Mar-91	2538.06	2537.79	2537.73	2537.78	2537.37	2537.66	2537.12	2536.96	2518.39	2537.83
01-Apr-91	2538.06	2537.74	2537.72	2537.76	2537.33	2537.63	2537.09	2536.92	2518.57	2537.78
02-Apr-91	2537.97	2537.58	2537.64	2537.69	2537.26	2537.55	2537.04	2536.86	2518.46	2537.67
03-Apr-91										
04-Apr-91										
05-Apr-91	2538.18	2537.84	2537.87	2537.90	2537.50	2537.79	2537.24	2537.16	2518.84	2537.79
06-Apr-91										
07-Apr-91										
08-Apr-91										
09-Apr-91	2538.24	2538.19	2537.93	2538.01	2537.57	2537.85	2537.30	2537.20	2518.84	2537.74
10-Apr-91										
11-Apr-91										
12-Apr-91	2538.13	2537.88	2537.81	2537.87	2537.37	2537.73	2537.13	2537.00	2518.66	2537.61
13-Apr-91										
14-Apr-91										
15-Apr-91										
16-Apr-91	2537.97	2537.66	2537.66	2537.69	2537.24	2537.56	2536.98	2536.84	2518.05	2537.48
17-Apr-91										
18-Apr-91										
19-Apr-91	2537.82	2537.48	2537.47	2537.52	2537.09	2537.40	2536.87	2536.71	2515.96	2537.33
20-Apr-91										
21-Apr-91										
22-Apr-91										
23-Apr-91	2537.74	2537.41	2537.41	2537.44	2537.01	2537.32	2536.76	2536.63	2517.78	2537.22
24-Apr-91										
25-Apr-91										
26-Apr-91										
27-Apr-91										
28-Apr-91										
29-Apr-91										
30-Apr-91	2537.73	2537.42	2537.38	2537.45	2537.00	2537.33	2536.75	2536.62	2514.86	2537.11
01-May-91										
02-May-91	2537.58	2537.22	2537.22	2537.27	2536.83	2537.16	2536.61	2536.47	2514.83	2536.93
03-May-91										
04-May-91										
05-May-91										
06-May-91										
07-May-91										
08-May-91										
09-May-91	2538.02	2537.81	2537.69	2537.76	2537.28	2537.64	2537.02	2536.88	2517.09	2537.30
10-May-91										
11-May-91										
12-May-91										
13-May-91										
14-May-91										
15-May-91	2537.71	2537.36	2537.39	2537.43	2536.97	2537.31	2536.72	2536.57	2518.08	2537.02
16-May-91										
17-May-91										
18-May-91										
19-May-91										
20-May-91										
21-May-91	2538.83	2538.84	2538.49	2538.52	2538.17	2538.40	2537.91	2537.73	2518.18	2538.93
22-May-91										
23-May-91										
24-May-91										
25-May-91										
26-May-91										
27-May-91										
28-May-91	2538.15	2537.93	2537.72	2537.84	2537.48	2537.72	2537.25	2537.06	2509.53	2538.01

Date	V16D	V16S	T16D	Q16D	Q16S	Q17D	P17S	N18S	J16D	J16S
29-May-91										
30-May-91										
31-May-91	2537.17	2537.89	2534.11	2530.32	2537.24	2525.57	2537.03	2536.85	2508.98	2537.75
01-Jun-91										
02-Jun-91										
03-Jun-91										
04-Jun-91										
05-Jun-91										
06-Jun-91	2537.95	2537.85	2537.59	2537.67	2537.07	2537.54	2536.90	2536.76	2516.56	2537.39
07-Jun-91										
08-Jun-91										
09-Jun-91										
10-Jun-91										
11-Jun-91										
12-Jun-91	2537.82	2537.43	2537.49	2537.54	2536.84	2537.42	2536.70	2536.57	2518.96	2537.08
13-Jun-91										
14-Jun-91										
15-Jun-91										
16-Jun-91										
17-Jun-91										
18-Jun-91										
19-Jun-91										
20-Jun-91										
21-Jun-91										
22-Jun-91										
23-Jun-91										
24-Jun-91										
25-Jun-91										
26-Jun-91										
27-Jun-91	2537.61	2537.17	2537.31	2537.34	2536.63	2537.25	2536.46	2536.40	2517.62	2536.70
28-Jun-91	2537.64	2537.20	2537.30	2537.37	2536.68	2537.24	2536.59	2536.41	2517.46	2536.72
29-Jun-91	2537.55	2537.11	2537.23	2537.28	2536.58	2537.16	2536.46	2536.34	2517.08	2536.63
30-Jun-91										
01-Jul-91	2537.50	2537.06	2537.17	2537.22	2536.55	2537.10	2536.41	2536.28	2517.07	2536.55
02-Jul-91										
03-Jul-91	2537.47	2537.02	2537.14	2537.18	2536.51	2537.06	2536.37	2536.25	2516.92	2536.53
04-Jul-91										
05-Jul-91	2537.41	2536.95	2537.08	2537.12	2536.45	2537.00	2536.32	2536.18	2517.03	2536.46
06-Jul-91	2537.34	2537.00	2537.01	2537.04	2536.39	2536.92	2536.24	2536.13	2516.75	2536.39
07-Jul-91										
08-Jul-91	2537.34	2537.00	2537.01	2537.04	2536.39	2536.92	2536.24	2536.13	2516.84	2536.40
09-Jul-91										
10-Jul-91	2537.31	2536.85	2536.98	2537.02	2536.51	2536.93	2536.27	2536.13	2516.99	2536.35
11-Jul-91										
12-Jul-91	2537.29	2536.83	2536.97	2537.00	2536.36	2536.87	2536.22	2536.10	2517.02	2536.31
13-Jul-91										
14-Jul-91	2537.26	2536.80	2536.94	2536.97	2536.32	2536.85	2536.18	2536.06	2517.06	2536.28
15-Jul-91	2537.23	2536.76	2536.90	2536.94	2536.28	2536.82	2536.16	2536.04	2517.04	2536.25
16-Jul-91										
17-Jul-91	2537.48	2537.04	2537.12	2537.13	2536.49	2537.01	2536.33	2536.19	2516.94	2536.31
18-Jul-91	2537.44	2537.02	2537.09	2537.10	2536.47	2536.98	2536.31	2536.16	2517.16	2536.31
19-Jul-91										
20-Jul-91	2537.31	2536.87	2536.96	2536.98	2536.33	2536.86	2536.20	2536.07	2517.33	2536.23
21-Jul-91										
22-Jul-91	2537.22	2536.79	2536.89	2536.91	2536.27	2536.79	2536.14	2536.02	2517.23	2536.18
23-Jul-91										
24-Jul-91										
25-Jul-91	2537.26	2536.83	2536.94	2536.98	2536.35	2536.84	2536.23	2536.09	2517.31	2536.22
26-Jul-91										
27-Jul-91	2537.16	2536.72	2536.83	2536.85	2536.23	2536.73	2536.10	2535.97	2517.24	2536.10
28-Jul-91										
29-Jul-91	2537.16	2536.73	2536.83	2536.85	2536.24	2536.72	2536.10	2535.97	2517.42	2536.10
30-Jul-91										
31-Jul-91										
01-Aug-91										
02-Aug-91	2537.19	2536.76	2536.85	2536.90	2536.27	2536.76	2536.16	2536.03	2517.50	2536.14
03-Aug-91										
04-Aug-91										
05-Aug-91	2537.21	2536.74	2536.88	2536.91	2536.27	2536.78	2536.13	2536.03	2517.61	2536.12
06-Aug-91										
07-Aug-91	2537.14	2536.70	2536.83	2536.85	2536.24	2536.72	2536.11	2535.98	2517.57	2536.07
08-Aug-91										
09-Aug-91	2537.14	2536.71	2536.83	2536.83	2536.23	2536.71	2536.10	2535.97	2517.84	2536.05
10-Aug-91										

Date	V16D	V16S	T16D	Q16D	Q16S	Q17D	P17S	N18S	J16D	J16S
11-Aug-91										
12-Aug-91	2537.05	2536.63	2536.74	2536.74	2536.17	2536.62	2536.03	2535.90	2518.04	2535.99
13-Aug-91										
14-Aug-91	2537.02	2536.59	2536.72			2536.59	2536.00		2518.13	2535.96
15-Aug-91										
16-Aug-91										
17-Aug-91										
18-Aug-91										
19-Aug-91										
20-Aug-91										
21-Aug-91										
22-Aug-91										
23-Aug-91										
24-Aug-91										
25-Aug-91										
27-Aug-91	2537.06	2536.63	2536.74	2536.72	2536.13	2536.61	2535.97	2535.86	2518.37	2535.88
28-Aug-91										
29-Aug-91										
30-Aug-91	2537.01	2536.59	2536.70	2536.68	2536.10	2536.56	2535.96	2535.82	2518.31	2535.85
31-Aug-91										
01-Sep-91										
02-Sep-91										
03-Sep-91	2537.03	2536.61	2536.72	2536.70	2536.09	2536.57	2535.99	2535.82	2518.23	2535.83
04-Sep-91										
05-Sep-91	2537.00	2536.59	2536.69	2536.69	2536.09	2536.56	2535.96	2535.83	2518.39	2535.84
06-Sep-91										
07-Sep-91	2536.94	2536.48	2536.64	2536.63	2536.04	2536.50	2535.92	2535.77	2518.35	2535.78
08-Sep-91										
09-Sep-91										
10-Sep-91	2536.94	2536.50	2536.64	2536.62	2535.97	2536.50	2535.90	2535.76	2518.62	2535.77
11-Sep-91										
12-Sep-91										
13-Sep-91	2536.91	2536.48	2536.63	2536.61	2536.03	2536.49	2535.90	2535.76	2518.99	2535.79
14-Sep-91										
15-Sep-91	2536.87	2536.40	2536.59	2536.58	2535.98	2536.46	2535.87	2535.74	2518.98	2535.73
16-Sep-91										
17-Sep-91	2536.85	2536.39	2536.58	2536.57	2535.97	2536.44	2535.87	2535.74	2519.04	2535.72
18-Sep-91										
19-Sep-91										
20-Sep-91										
21-Sep-91										
22-Sep-91	2536.80	2536.31	2536.52	2536.53	2535.90	2536.40	2535.83	2535.71	2518.46	2535.67
23-Sep-91										
24-Sep-91										
25-Sep-91										
26-Sep-91										
27-Sep-91	2536.84	2536.41	2536.57	2536.55	2535.98	2536.43	2535.87	2535.74	2519.43	2535.71
28-Sep-91										
29-Sep-91	2536.72	2536.31	2536.46	2536.44	2535.96	2536.31	2535.78	2535.64	2519.48	2535.61
30-Sep-91										
01-Oct-91										
02-Oct-91										
03-Oct-91										
04-Oct-91	2536.64	2536.39	2536.24	2536.17	2535.84	2536.14	2535.72	2535.57	2521.39	2535.58
05-Oct-91										
06-Oct-91										
07-Oct-91	2536.54	2536.14	2536.29	2536.22	2535.73	2536.12	2535.66	2535.52	2521.21	2535.52
08-Oct-91										
09-Oct-91										
10-Oct-91										
11-Oct-91										
12-Oct-91										
13-Oct-91	2536.44	2536.06	2536.19	2536.15	2535.66	2536.02	2535.61	2535.46	2521.83	2535.46
14-Oct-91										
15-Oct-91										
16-Oct-91										
17-Oct-91										
18-Oct-91										
19-Oct-91	2536.38	2536.02	2536.14	2536.08	2535.62	2535.95	2535.56	2535.43	2522.14	2535.43
20-Oct-91										
21-Oct-91										
22-Oct-91										
23-Oct-91										
24-Oct-91	2536.41	2536.07	2536.18	2536.09	2535.67	2535.99	2535.61	2535.48	2522.88	2535.50

Date	V16D	V16S	T16D	Q16D	Q16S	Q17D	P17S	N18S	J16D	J16S
25-Oct-91										
26-Oct-91										
27-Oct-91	2536.52	2536.18	2536.30	2536.17	2535.78	2536.11	2535.73	2535.60	2523.03	2535.62
28-Oct-91										
29-Oct-91										
30-Oct-91	2536.52	2536.17	2536.29	2536.23	2535.77	2536.10	2535.70	2535.57	2522.94	2535.54
31-Oct-91										
01-Nov-91	2535.72									
02-Nov-91										
03-Nov-91	2536.36	2536.04	2536.14	2536.18	2535.63	2535.96	2535.59	2535.45	2522.80	2535.46
04-Nov-91										
05-Nov-91										
06-Nov-91										
07-Nov-91										
08-Nov-91	2536.74	2536.40	2536.51	2536.41	2535.93	2536.32	2535.85	2535.71	2523.92	2535.70
09-Nov-91										
10-Nov-91	2536.65	2536.31	2536.42	2536.38	2535.88	2536.25	2535.81	2535.68	2523.70	2535.66
11-Nov-91										
12-Nov-91										
13-Nov-91										
14-Nov-91	2536.58	2536.22	2536.36	2536.31	2535.82	2536.18	2535.74	2535.62	2523.90	2535.62
15-Nov-91										
16-Nov-91										
17-Nov-91	2536.77	2536.45	2536.56	2536.53	2536.02	2536.38	2535.94	2535.82	2524.57	2535.82
18-Nov-91										
19-Nov-91										
20-Nov-91										
21-Nov-91	2537.18	2536.93	2536.98	2536.93	2536.34	2536.80	2536.22	2536.10	2524.68	2536.00
22-Nov-91										
23-Nov-91										
24-Nov-91	2536.93	2536.70	2536.72	2536.70	2536.09	2536.55	2536.02		2524.69	2535.84
25-Nov-91										
26-Nov-91										
27-Nov-91										
28-Nov-91	2537.90	2537.81	2537.67	2537.68	2536.95	2537.48	2536.76	2536.64	2525.56	2536.65
29-Nov-91										
30-Nov-91										
01-Dec-91	2537.70	2537.41	2537.48	2537.44	2536.74		2536.59	2536.43	2525.63	2536.56
02-Dec-91										
03-Dec-91										
04-Dec-91										
05-Dec-91	2537.55	2537.22	2537.32	2537.24	2536.63	2537.12	2536.49	2536.33	2525.68	2536.57
06-Dec-91										
07-Dec-91										
08-Dec-91	2538.05	2537.89	2537.82	2537.76	2537.13	2537.62	2536.93	2536.70	2526.05	2537.13
09-Dec-91										
10-Dec-91										
11-Dec-91										
12-Dec-91										
13-Dec-91	2537.76	2537.48	2537.54	2537.48	2536.91	2537.34	2536.73	2536.61	2525.73	2537.03
14-Dec-91										
15-Dec-91										
16-Dec-91										
17-Dec-91										
18-Dec-91										
19-Dec-91										
20-Dec-91	2537.27	2536.93	2537.06	2536.96	2536.43	2536.87	2536.30	2536.18	2525.45	2536.58
21-Dec-91										
22-Dec-91										
23-Dec-91										
24-Dec-91	2537.20	2536.84	2536.99	2536.93	2536.38	2536.80	2536.25	2536.14	2525.65	2536.49
25-Dec-91										
26-Dec-91										
27-Dec-91	2537.13	2536.77	2536.92	2536.85	2536.30	2536.73	2536.19	2536.07	2525.68	2536.41
28-Dec-91										
29-Dec-91	2537.07	2536.72	2536.87	2536.81	2536.26	2536.68	2536.16	2536.04	2525.68	2536.36
30-Dec-91										
31-Dec-91										

Date	J17S	D19D	H12S	U3D	U3S	T8S	S12D1	S12D2	Creek	Prec.(in)
01-Jan-91										0.00
02-Jan-91										0.00
03-Jan-91	2536.42		2537.58							0.00
04-Jan-91										0.00
05-Jan-91	2536.28		2537.55	2519.17	2541.94	2538.18	2536.07	2519.24		0.00
06-Jan-91										0.00
07-Jan-91	2536.27		2537.55	2519.27	2541.97	2538.11	2534.69	2519.27		0.17
08-Jan-91	2536.25	2518.80	2537.54	2519.22	2541.91	2538.11	2534.63	2519.20		0.11
09-Jan-91	2536.25	2518.88	2537.52	2519.27	2541.93	2538.07	2534.58	2519.17		0.04
10-Jan-91	2536.23	2518.71	2537.49	2519.13	2541.85	2538.05	2534.61	2519.14	2536.87	0.36
11-Jan-91	2536.27	2518.77	2537.60	2519.14	2541.87	2538.04	2534.85	2519.14	2537.28	0.03
12-Jan-91	2537.59	2518.93	2538.51	2519.31	2542.49	2538.38	2536.13	2519.35	2538.04	0.52
13-Jan-91	2539.22	2519.00	2539.45	2519.45	2543.27	2539.43	2536.42	2519.46	2538.66	0.00
14-Jan-91	2539.75	2519.18	2539.91	2519.57	2543.65	2539.69	2537.21	2519.58	2538.71	0.27
15-Jan-91	2539.99	2519.24	2540.45	2519.70	2543.93	2540.10	2538.01	2519.71	2540.93	0.52
16-Jan-91	2539.89	2519.11	2540.47	2519.54	2543.82	2540.35	2537.91	2519.57	2538.25	0.05
17-Jan-91			2540.40			2540.40			2537.99	0.03
18-Jan-91	2539.99	2519.38	2540.51	2519.79	2544.13	2540.88	2537.51	2519.80	2538.00	0.00
19-Jan-91	2539.74	2519.03	2540.29	2519.43	2543.77	2540.95	2536.75	2519.45	2537.71	0.00
20-Jan-91						2541.02				0.00
21-Jan-91	2539.45	2518.96		2519.38	2543.68	2541.05	2536.36	2519.40	2537.41	0.00
22-Jan-91			2540.05							0.00
23-Jan-91	2539.15	2517.43	2539.90	2518.64	2543.60	2540.87	2536.20	2518.56	2537.31	0.00
24-Jan-91										0.00
25-Jan-91	2538.79	2517.82	2539.61	2518.21	2543.35	2540.48	2536.04	2518.25	2537.21	0.00
26-Jan-91										0.00
27-Jan-91	2538.52	2520.69	2539.44	2520.34	2543.41	2540.30	2535.69	2520.34	2537.11	0.00
28-Jan-91										0.00
29-Jan-91	2538.16	2521.49	2539.15	2521.07	2543.20	2540.02	2535.49	2521.07		0.00
30-Jan-91										0.00
31-Jan-91	2537.87	2515.62	2538.89	2517.49	2543.02	2539.74	2534.86	2517.59	2537.21	0.00
01-Feb-91										0.00
02-Feb-91	2537.72	2517.03	2538.82	2517.37	2543.07	2539.59	2534.96	2517.35	2537.31	0.16
03-Feb-91	2537.78	2518.85	2538.87	2518.64	2542.89	2539.53	2535.33	2518.67	2537.47	0.11
04-Feb-91	2537.84	2520.19	2539.02	2519.81	2542.97	2539.60	2535.45	2519.80	2537.48	0.04
05-Feb-91	2537.90	2520.88	2539.17	2520.41	2542.94	2539.61	2535.74	2520.45	2537.81	0.15
06-Feb-91	2537.91	2520.13	2539.16	2519.96	2542.99	2539.72	2535.56	2519.99	2537.51	0.00
07-Feb-91	2537.89				2543.04	2539.77			2537.31	0.00
08-Feb-91	2537.82	2521.31	2539.07	2520.85	2543.05	2539.78	2535.48	2520.86	2537.30	0.00
09-Feb-91		2521.60		2521.11	2543.06	2539.76		2521.09	2537.25	0.00
10-Feb-91	2537.71	2521.73	2538.95	2521.21	2543.06	2539.72	2535.50	2521.21	2537.23	0.00
11-Feb-91		2521.98		2521.50	2543.20			2521.46	2537.24	0.00
12-Feb-91	2537.67	2519.79	2538.90	2520.95	2543.13	2539.67	2535.38	2521.08	2537.34	0.07
13-Feb-91									2537.27	0.00
14-Feb-91	2537.58	2519.01	2538.81	2518.88	2543.14	2539.68	2535.64	2518.86	2537.62	0.32
15-Feb-91	2537.76	2520.71	2539.05	2520.17	2543.41	2539.93	2535.73	2520.15	2537.40	0.01
16-Feb-91	2537.74	2521.64	2539.06	2521.00	2543.46	2540.03	2535.79	2520.99	2537.38	0.07
17-Feb-91	2537.66	2521.99	2538.90	2521.30	2543.35	2540.00	2535.66	2521.31	2537.25	0.00
18-Feb-91		2522.10		2521.39		2539.88		2521.38	2537.18	0.00
19-Feb-91	2537.67	2522.33	2538.77	2521.63	2543.34	2539.85	2535.78	2521.62	2537.45	0.24
20-Feb-91	2537.72	2522.33	2538.94	2521.64	2543.33	2539.96	2535.91	2521.66	2537.60	0.26
21-Feb-91	2537.76	2522.42	2538.90	2521.71	2543.38	2540.15	2535.80	2521.70	2537.28	0.00
22-Feb-91	2537.76	2522.49		2521.78	2543.42	2540.30		2521.79	2537.24	0.00
23-Feb-91	2537.69	2522.41	2538.85	2521.65	2543.28	2540.25	2535.83	2521.66	2537.16	0.00
24-Feb-91										0.00
25-Feb-91	2537.61	2522.37	2538.77	2521.55	2543.21	2540.08	2535.61	2521.62	2537.11	0.00
26-Feb-91										0.00
27-Feb-91	2537.62	2519.31	2538.77	2519.53	2543.45	2540.11	2535.23	2519.53	2537.10	0.00
28-Feb-91										0.00
01-Mar-91	2537.65	2521.84	2538.91	2521.23	2543.65	2539.98	2535.61	2521.19	2537.57	0.47
02-Mar-91	2537.69	2522.11	2539.14	2521.39	2543.54	2539.97	2535.84	2521.39	2537.46	0.21
03-Mar-91	2538.05	2522.36	2539.52	2521.64	2543.82	2540.30	2536.20	2521.68	2537.72	0.57
04-Mar-91	2539.25	2522.90	2540.05	2522.17	2544.33	2541.13	2536.85	2523.19	2539.31	0.59
05-Mar-91	2539.83	2522.40	2540.27		2543.99	2541.50	2536.84	2521.73	2538.10	0.16
06-Mar-91	2540.14	2522.56	2540.39		2543.97	2541.83	2536.75	2521.87	2537.84	0.06
07-Mar-91	2540.29	2521.82	2540.45	2521.46	2541.00	2541.94	2538.14	2521.53	2537.60	0.00
08-Mar-91	2540.23	2521.08	2540.47	2520.83	2543.91	2541.91	2537.95	2520.89	2537.48	0.00
09-Mar-91	2540.29	2520.73	2540.59	2520.59	2544.18	2542.06	2537.57	2520.51	2537.44	0.00
10-Mar-91	2540.04		2540.52		2544.14	2541.88			2537.48	0.04
11-Mar-91	2539.78	2520.45	2540.33	2520.39	2543.95	2541.66	2537.50	2520.41	2537.35	0.00
12-Mar-91	2539.64	2519.96	2540.26	2520.12	2543.92	2541.55	2537.16	2520.10	2537.40	0.12
13-Mar-91	2539.56	2515.96	2540.25	2517.76	2543.87	2541.51	2537.01	2517.82	2537.54	0.11
14-Mar-91	2539.50	2514.43	2540.22	2516.23	2543.99	2541.46	2536.79	2516.21	2537.40	0.14
15-Mar-91	2539.35	2514.44	2540.19	2515.98	2543.86	2541.39	2536.69	2515.92	2537.30	0.00

Date	J17S	D19D	H12S	U3D	U3S	T8S	S12D1	S12D2	Creek	Prec.(in)
16-Mar-91										0.00
17-Mar-91	2539.07	2515.47	2539.88	2516.32	2543.71	2541.13	2536.57	2516.40	2537.23	0.00
18-Mar-91										0.00
19-Mar-91	2538.98	2516.99	2539.91	2517.69	2543.99	2541.18	2536.17	2517.68	2537.26	0.00
20-Mar-91	2538.80	2517.14	2539.74	2517.79	2543.77	2540.88	2536.27	2517.81	2537.40	0.27
21-Mar-91	2538.67	2517.35	2539.61	2517.98	2543.69	2540.76	2536.22	2517.99	2537.20	0.00
22-Mar-91										0.05
23-Mar-91	2538.49	2517.61	2539.45	2518.18	2543.56	2540.59	2536.03	2518.19	2537.14	0.00
24-Mar-91	2538.39	2517.87	2539.41	2518.31	2543.63	2540.52	2536.09	2518.43	2537.16	0.05
25-Mar-91	2538.39	2518.19	2539.42	2518.65	2543.77	2540.55	2535.82	2518.73	2537.17	0.06
26-Mar-91	2538.22	2518.06	2539.45	2518.55	2543.47	2540.47	2535.89	2518.57	2537.28	0.12
27-Mar-91	2538.13	2517.87	2539.15	2518.37	2543.31	2540.30	2535.87	2518.39	2537.10	0.01
28-Mar-91										0.00
29-Mar-91	2537.95	2517.73	2538.96	2518.30	2543.11	2539.93	2535.84	2518.25	2537.09	0.00
30-Mar-91										0.00
31-Mar-91	2537.87	2517.85	2538.94	2518.41	2543.21	2539.90	2535.55	2518.43	2537.07	0.00
01-Apr-91	2537.80	2518.13	2538.89	2518.58	2543.26	2539.82	2535.50	2518.58	2537.05	0.00
02-Apr-91	2537.68	2518.02	2538.76	2518.47	2543.09	2539.67	2535.49	2518.49	2537.04	0.03
03-Apr-91										0.00
04-Apr-91										0.24
05-Apr-91	2537.59	2518.41	2538.80	2518.85	2543.18	2539.59	2535.53	2518.87	2537.39	0.33
06-Apr-91										0.00
07-Apr-91										0.00
08-Apr-91										0.00
09-Apr-91	2537.50	2518.46	2538.62	2518.84	2543.07	2539.41	2535.73	2518.85	2537.38	0.69
10-Apr-91										0.06
11-Apr-91										0.02
12-Apr-91	2537.49	2518.27	2538.79	2518.67	2543.00	2539.62	2535.75	2518.70	2537.11	0.00
13-Apr-91										0.00
14-Apr-91										0.00
15-Apr-91										0.00
16-Apr-91	2537.40	2517.36	2538.70	2518.07	2543.17	2539.62	2535.43	2518.11	2537.03	0.00
17-Apr-91										0.00
18-Apr-91										0.00
19-Apr-91	2537.24	2514.86	2538.52	2515.97	2542.95	2539.36	2534.92	2515.98	2536.99	0.00
20-Apr-91										0.00
21-Apr-91										0.00
22-Apr-91										0.00
23-Apr-91	2537.12	2517.06	2538.45	2517.80	2543.01	2539.18	2535.12	2517.81	2536.95	0.06
24-Apr-91										0.64
25-Apr-91										0.01
26-Apr-91										0.00
27-Apr-91										0.00
28-Apr-91										0.00
29-Apr-91										0.31
30-Apr-91	2536.97	2513.10	2538.24	2514.90	2542.69	2538.93	2534.52	2514.95	2536.97	0.00
01-May-91										0.02
02-May-91	2536.80	2513.68	2538.06	2514.84	2542.53	2538.74	2534.25	2514.83	2536.91	0.00
03-May-91										0.00
04-May-91										0.00
05-May-91										0.00
06-May-91										0.19
07-May-91										0.00
08-May-91										1.03
09-May-91	2537.11	2516.19	2538.50	2517.10	2542.77	2538.85	2534.82	2517.13	2537.05	0.00
10-May-91										0.01
11-May-91										0.02
12-May-91										0.34
13-May-91										0.02
14-May-91										0.01
15-May-91	2536.86	2517.59	2538.26	2518.06	2542.64	2538.81	2534.55	2518.06	2536.95	0.00
16-May-91										0.00
17-May-91										0.06
18-May-91										0.79
19-May-91										0.96
20-May-91										0.01
21-May-91	2538.93	2517.01	2539.78	2518.22	2543.28	2540.45	2535.54	2518.34	2537.31	0.00
22-May-91										0.00
23-May-91										0.00
24-May-91										0.04
25-May-91										0.12
26-May-91										0.02
27-May-91										0.03
28-May-91	2538.08	2506.24	2539.08	2509.67	2542.97	2539.76	2533.84	2509.61	2537.09	0.12

Date	J17S	D19D	H12S	U3D	U3S	T8S	S12D1	S12D2	Creek	Prec.(in)
29-May-91										0.01
30-May-91										0.52
31-May-91	2537.82	2505.64	2538.84	2509.04	2542.88	2539.51	2533.08	2509.06	2537.07	0.00
01-Jun-91										0.00
02-Jun-91										0.00
03-Jun-91										0.00
04-Jun-91										0.00
05-Jun-91										0.11
06-Jun-91	2537.34	2512.57	2538.43	2516.66	2542.71	2539.07	2534.52	2516.67	2537.05	0.31
07-Jun-91										0.32
08-Jun-91										0.00
09-Jun-91										0.00
10-Jun-91										0.00
11-Jun-91										0.49
12-Jun-91	2537.00	2515.36	2538.11	2519.06	2542.50	2538.71	2534.58	2519.09	2536.93	0.00
13-Jun-91										0.00
14-Jun-91										0.00
15-Jun-91										0.00
16-Jun-91										0.41
17-Jun-91										0.00
18-Jun-91										0.00
19-Jun-91										0.00
20-Jun-91										0.44
21-Jun-91										0.13
22-Jun-91										0.01
23-Jun-91										0.00
24-Jun-91										0.08
25-Jun-91										0.00
26-Jun-91										0.00
27-Jun-91	2536.61	2513.69	2537.69	2517.75	2542.11	2538.24	2534.12	2517.82	2536.87	0.00
28-Jun-91	2536.59	2513.33	2537.68	2517.65	2542.11	2538.21	2534.10	2517.63	2536.92	0.21
29-Jun-91	2536.53	2512.92	2537.61	2517.20	2542.02	2538.16	2533.93	2517.24	2536.87	0.09
30-Jun-91										0.08
01-Jul-91	2536.44	2513.13	2537.52	2517.18	2541.84	2538.08	2533.76	2517.21	2536.87	0.00
02-Jul-91										0.00
03-Jul-91	2536.41	2512.70	2537.47	2517.03	2541.85	2538.05	2533.68	2517.07	2536.83	0.00
04-Jul-91										0.00
05-Jul-91	2536.35	2513.04	2537.42	2517.14	2541.83	2537.99	2533.65	2517.16	2536.81	0.00
06-Jul-91	2536.29	2512.60	2537.34	2516.86	2541.70	2537.92	2533.59	2516.92	2536.81	0.00
07-Jul-91										0.00
08-Jul-91	2536.26	2512.87	2537.32	2516.97	2541.76	2537.88	2533.58	2516.97	2536.79	0.00
09-Jul-91										0.00
10-Jul-91	2536.22	2513.08	2537.26	2517.08	2541.69	2537.82	2533.54	2517.12	2536.82	0.10
11-Jul-91										0.00
12-Jul-91	2536.18	2513.03	2537.22	2517.11	2541.58	2537.76	2533.68	2517.15	2536.81	0.00
13-Jul-91										0.00
14-Jul-91	2536.14	2513.06	2537.18	2517.13	2541.59	2537.73	2533.68	2517.21	2536.77	0.00
15-Jul-91	2536.12	2513.03	2537.15	2517.14	2541.53	2537.70	2533.46	2517.19	2536.77	0.00
16-Jul-91										0.00
17-Jul-91	2536.13	2512.89	2537.17	2517.05	2541.48	2537.70	2533.75	2517.10	2536.81	0.14
18-Jul-91	2536.16	2513.11	2537.18	2517.27	2541.51	2537.75	2533.70	2517.30	2536.80	0.00
19-Jul-91										0.00
20-Jul-91	2536.09	2513.36	2537.11	2517.42	2541.46	2537.68	2533.51	2517.46	2536.77	0.00
21-Jul-91										0.00
22-Jul-91	2536.04	2513.28	2537.04	2517.33	2541.33	2537.60	2533.33	2517.36	2536.76	0.00
23-Jul-91										0.00
24-Jul-91										0.00
25-Jul-91	2536.09	2513.38	2537.06	2517.41	2541.29	2537.58	2533.38	2517.43	2536.81	0.36
26-Jul-91										0.00
27-Jul-91	2535.98	2513.32	2536.96	2517.34	2541.12	2537.51	2533.20	2517.39	2536.77	0.00
28-Jul-91										0.00
29-Jul-91	2535.97	2513.49	2536.94	2517.51	2541.19	2537.47	2533.15	2517.54	2536.69	0.00
30-Jul-91										0.00
31-Jul-91										0.00
01-Aug-91										0.17
02-Aug-91	2536.00	2513.46	2536.94	2517.59	2541.11	2537.43	2533.18	2517.63	2536.83	0.00
03-Aug-91										0.00
04-Aug-91										0.00
05-Aug-91	2535.97	2513.71		2517.70	2541.13	2537.40	2533.11	2517.75	2536.81	0.00
06-Aug-91										0.01
07-Aug-91	2535.93	2513.67	2536.87	2517.67	2541.02	2537.37	2533.05	2517.72	2536.81	0.00
08-Aug-91										0.00
09-Aug-91	2535.92	2513.95	2536.86	2517.95	2541.00	2537.34	2533.06	2518.00	2536.79	0.00
10-Aug-91										0.00

Date	J17S	D19D	H12S	U3D	U3S	T8S	S12D1	S12D2	Creek	Prec.(in)
11-Aug-91										0.00
12-Aug-91	2535.87	2514.33	2536.78	2518.13	2540.86	2537.26	2533.02	2518.16	2536.77	0.00
13-Aug-91										0.00
14-Aug-91	2535.87						2532.47	2518.26	2536.76	0.00
15-Aug-91										0.00
16-Aug-91										0.00
17-Aug-91										0.00
18-Aug-91										0.00
19-Aug-91										0.00
20-Aug-91										0.00
21-Aug-91										0.00
22-Aug-91										0.00
23-Aug-91										0.00
24-Aug-91										0.00
25-Aug-91										0.00
27-Aug-91	2535.74	2514.68	2536.75	2518.47	2540.67	2537.09			2536.79	0.00
28-Aug-91										0.00
29-Aug-91										0.00
30-Aug-91	2535.71	2514.71	2536.59	2518.39	2540.50	2537.04	2532.30	2518.43	2536.75	0.00
31-Aug-91										0.00
01-Sep-91										0.00
02-Sep-91										0.00
03-Sep-91	2535.68	2514.63	2536.53	2518.31	2540.37	2536.99	2532.31	2518.37	2536.75	0.00
04-Sep-91										0.00
05-Sep-91	2535.70	2514.75	2536.55	2518.49	2540.43	2537.01	2532.29	2518.56	2536.75	0.00
06-Sep-91										0.00
07-Sep-91	2535.65	2514.83	2536.50	2518.44	2540.36	2536.94	2532.21	2518.50	2536.73	0.00
08-Sep-91										0.00
09-Sep-91										0.00
10-Sep-91	2535.64	2515.22	2536.47	2518.71	2540.30	2536.90	2534.18	2518.76	2536.73	0.00
11-Sep-91										0.00
12-Sep-91										0.00
13-Sep-91	2535.64	2515.71	2536.47	2519.07	2540.28	2536.84	2533.90	2519.10	2536.75	0.15
14-Sep-91										0.01
15-Sep-91	2535.60	2515.73	2536.39	2519.06	2540.07	2536.80	2533.80	2519.11	2536.75	0.00
16-Sep-91										0.00
17-Sep-91	2535.59	2515.78	2536.37	2519.13	2540.06	2536.76	2533.73	2519.20	2536.77	0.00
18-Sep-91										0.00
19-Sep-91										0.00
20-Sep-91										0.00
21-Sep-91										0.00
22-Sep-91	2535.55	2515.13	2536.30	2519.54	2539.92	2536.66	2533.43	2518.58	2536.79	0.00
23-Sep-91										0.00
24-Sep-91										0.00
25-Sep-91										0.00
26-Sep-91										0.00
27-Sep-91	2535.56	2516.47	2536.35	2519.51	2540.00	2536.69	2533.53	2519.55	2536.77	0.00
28-Sep-91										0.00
29-Sep-91	2535.52	2516.72	2536.26	2519.55	2539.83	2536.63	2533.40	2519.61	2536.75	0.00
30-Sep-91										0.00
01-Oct-91										0.00
02-Oct-91										0.00
03-Oct-91										0.00
04-Oct-91	2535.49	2518.28	2536.21	2520.79	2539.72	2536.53	2534.66	2520.82	2536.75	0.00
05-Oct-91										0.00
06-Oct-91										0.00
07-Oct-91	2535.43	2519.12	2536.13	2521.28	2539.67	2536.45	2534.34	2521.33	2536.73	0.00
08-Oct-91										0.00
09-Oct-91										0.00
10-Oct-91										0.00
11-Oct-91										0.00
12-Oct-91										0.00
13-Oct-91	2535.38	2520.11	2536.05	2521.89	2539.54	2536.36	2533.26	2521.94	2536.75	0.00
14-Oct-91										0.00
15-Oct-91										0.00
16-Oct-91										0.04
17-Oct-91										0.00
18-Oct-91										0.00
19-Oct-91	2535.34	2520.73	2536.03	2522.19	2539.45	2536.28	2532.85	2522.23	2536.74	0.00
20-Oct-91										0.00
21-Oct-91										0.00
22-Oct-91										0.00
23-Oct-91										0.00
24-Oct-91	2535.36	2521.68	2536.11	2522.92	2539.62	2536.29	2532.86	2522.95	2536.75	0.15

Date	J17S	D19D	H12S	U3D	U3S	T8S	S12D1	S12D2	Creek	Prec.(in)
25-Oct-91										0.07
26-Oct-91										0.25
27-Oct-91	2535.45	2521.78	2536.21	2523.06	2539.67	2536.30	2532.94	2523.09	2536.81	0.20
28-Oct-91										0.01
29-Oct-91										0.00
30-Oct-91	2535.43		2536.16	2522.99	2539.47	2536.35	2532.82	2523.06	2536.77	0.00
31-Oct-91										0.03
01-Nov-91	2535.35	2521.40							2536.75	0.01
02-Nov-91										0.00
03-Nov-91	2535.34		2536.03	2522.86	2539.36	2536.25	2532.60	2522.91	2536.75	0.00
04-Nov-91										0.27
05-Nov-91										0.69
06-Nov-91										0.02
07-Nov-91										0.01
08-Nov-91	2535.59	2522.99	2536.34	2523.97	2539.63	2536.53	2533.03	2524.03	2536.75	0.04
09-Nov-91										0.08
10-Nov-91	2535.61		2536.37	2523.75	2539.50	2536.48	2532.86	2523.80	2536.78	0.00
11-Nov-91										0.05
12-Nov-91										0.05
13-Nov-91										0.08
14-Nov-91	2535.50	2523.02	2536.36	2523.94	2539.54	2536.44	2532.76	2523.99	2536.77	0.00
15-Nov-91										0.00
16-Nov-91										0.00
17-Nov-91	2535.61	2523.68	2536.45	2524.62	2539.74	2536.51	2533.00	2524.68	2536.85	0.46
18-Nov-91										0.26
19-Nov-91										0.05
20-Nov-91										0.68
21-Nov-91	2535.83	2523.78	2536.73	2524.72	2539.60	2536.84	2533.24	2524.80	2536.87	0.13
22-Nov-91										0.01
23-Nov-91										0.00
24-Nov-91	2535.73	2523.85	2536.53	2524.73	2539.67	2536.80	2532.98	2524.79	2536.77	0.05
25-Nov-91										1.12
26-Nov-91										0.04
27-Nov-91										0.60
28-Nov-91	2536.40	2524.70	2537.52	2525.61	2540.11	2537.46	2533.86	2525.66	2536.97	0.00
29-Nov-91										0.21
30-Nov-91										0.00
01-Dec-91	2536.37		2537.67	2525.57	2540.24	2537.68	2533.68	2525.70	2536.85	0.03
02-Dec-91										0.00
03-Dec-91										0.00
04-Dec-91										0.02
05-Dec-91	2536.36	2524.83	2537.83	2525.72	2540.39	2537.79	2533.58	2525.78	2536.85	0.03
06-Dec-91										0.78
07-Dec-91										0.34
08-Dec-91	2536.84	2525.16	2538.26	2526.08	2540.52	2538.11	2533.97	2526.15	2537.01	0.00
09-Dec-91										0.05
10-Dec-91										0.00
11-Dec-91										0.00
12-Dec-91										0.42
13-Dec-91	2536.74	2524.88	2538.13	2525.77	2540.41	2538.13	2533.60	2525.86	2537.01	0.01
14-Dec-91										0.00
15-Dec-91										0.00
16-Dec-91										0.00
17-Dec-91										0.00
18-Dec-91										0.09
19-Dec-91										0.00
20-Dec-91	2536.60	2524.69	2537.94	2525.48	2540.45	2537.90	2532.93	2525.55	2536.83	0.00
21-Dec-91										0.00
22-Dec-91										0.14
23-Dec-91										0.00
24-Dec-91	2536.31	2524.93	2537.53	2525.62	2540.58	2537.79	2532.86	2525.77	2536.84	0.00
25-Dec-91										0.00
26-Dec-91										0.00
27-Dec-91	2536.23	2524.96	2537.42	2525.71	2540.65	2537.70	2532.74	2525.77	2536.83	0.00
28-Dec-91										0.00
29-Dec-91	2536.18	2524.96	2537.35	2525.71	2540.68	2537.64	2532.68	2525.77	2536.83	0.00
30-Dec-91										0.00
31-Dec-91										0.00

Date	V16D	V16S	T16D	Q16D	Q16S	Q17D	P17S	N18S	J16D	J16S
01-Jan-92	2536.95	2536.61	2536.75	2536.69	2536.16	2536.55	2536.07	2535.95	2525.43	2536.24
02-Jan-92										
03-Jan-92	2537.02	2536.70	2536.85	2536.75	2536.21	2536.63	2536.12	2536.00	2525.85	2536.29
04-Jan-92										
05-Jan-92										
06-Jan-92	2536.97	2536.61	2536.78	2536.64	2536.18	2536.58	2536.09	2535.98	2525.73	2536.22
07-Jan-92										
08-Jan-92	2536.83	2536.49	2536.64	2536.76	2536.07	2536.46	2535.98	2535.87	2525.27	2536.07
09-Jan-92										
10-Jan-92										
11-Jan-92	2537.00	2536.57	2536.75	2536.70	2536.27	2536.56	2536.08	2536.02	2525.52	2536.18
12-Jan-92										
13-Jan-92										
14-Jan-92										
15-Jan-92	2536.86	2536.51	2536.67	2536.73	2536.08	2536.49	2535.99	2535.89	2525.43	2536.05
16-Jan-92										
17-Jan-92										
18-Jan-92	2537.31	2537.06	2537.11	2537.10	2536.49	2536.93	2536.36	2536.23	2525.88	2536.35
19-Jan-92	2537.27	2536.98	2537.06	2537.00	2536.42	2536.86	2536.30	2536.17	2525.97	2536.31
20-Jan-92	2537.19	2536.89	2536.98	2536.91	2536.35	2536.78	2536.23	2536.10	2525.98	2536.24
21-Jan-92										
22-Jan-92	2537.06	2536.73	2536.85	2536.76	2536.24	2536.65	2536.12	2535.99	2525.84	2536.15
23-Jan-92										
24-Jan-92	2538.18	2538.26	2537.98	2537.92	2537.40	2537.78	2537.11	2537.13	2526.57	2536.61
25-Jan-92	2538.17	2538.09	2537.96	2537.89	2537.37	2537.75	2537.13	2537.06	2526.93	2537.70
26-Jan-92										
27-Jan-92										
28-Jan-92	2538.73	2539.20	2538.54	2538.47	2537.98	2538.36	2537.63	2537.77	2527.21	2538.37
29-Jan-92	2537.46	2538.53	2538.24	2538.17	2537.58	2538.04	2537.36	2537.32	2527.24	2538.14
30-Jan-92										
31-Jan-92	2538.31	2538.18	2538.10	2538.01						
01-Feb-92	2538.12	2537.94	2537.90	2537.82	2537.21	2537.69	2537.03	2536.91	2527.35	2537.78
02-Feb-92	2537.89	2537.74	2537.68	2537.60	2537.01	2537.48	2536.86	2536.73	2526.87	2537.55
03-Feb-92										
04-Feb-92	2537.75	2537.53	2537.55	2537.40	2536.88	2537.34	2536.72	2536.60	2526.85	2537.41
05-Feb-92										
06-Feb-92	2537.62	2537.36	2537.41	2537.29	2536.74	2537.20	2536.60	2536.47	2526.74	2537.28
07-Feb-92										
08-Feb-92	2537.50	2537.20	2537.29	2537.23	2536.65	2537.09	2536.51	2536.39	2526.66	2537.12
09-Feb-92										
10-Feb-92	2537.44	2537.22	2537.23	2537.16	2536.58	2537.04	2536.45	2536.34	2526.67	2537.03
11-Feb-92										
12-Feb-92	2537.32	2537.03	2537.12	2537.05	2536.48	2536.92	2536.35	2536.23	2526.53	2536.88
13-Feb-92	2537.27	2536.95	2537.07	2537.00	2536.43					
14-Feb-92										
15-Feb-92	2537.22	2536.88	2537.02	2536.95	2536.40	2536.82	2536.27	2536.16	2526.55	2536.74
16-Feb-92	2537.46	2537.17	2537.29	2537.23	2536.67	2537.09	2536.54	2536.45	2526.53	2536.90
17-Feb-92	2537.33	2537.02	2537.14	2537.18	2536.50	2536.96	2536.38	2536.26	2526.35	2536.73
18-Feb-92										
19-Feb-92	2538.31	2538.83	2538.15	2538.11	2537.61	2537.99	2537.26	2537.51	2526.73	2537.60
20-Feb-92										
21-Feb-92	2539.23	2539.45	2539.02	2538.94	2538.41	2538.81	2538.03	2538.17	2527.72	2538.98
22-Feb-92										
23-Feb-92	2538.70	2538.67	2538.49	2538.38	2537.84	2538.28	2537.59	2537.52	2527.43	2538.55
24-Feb-92										
25-Feb-92	2538.71	2538.88	2538.49	2538.48	2537.78	2538.28	2537.59	2537.49	2527.02	2538.54
26-Feb-92	2538.61	2538.71	2538.39	2538.31	2537.66	2538.17	2537.48	2537.37	2526.92	2538.43
27-Feb-92										
28-Feb-92	2538.46	2538.46	2538.26	2538.16	2537.50	2538.02	2537.34	2537.20	2526.90	2538.24
29-Feb-92										
01-Mar-92	2538.26	2538.21	2538.05	2537.96	2537.30	2537.84	2537.15	2537.02	2526.88	2538.01
02-Mar-92										
03-Mar-92										
04-Mar-92	2537.13	2539.23	2535.59	2536.62	2536.34	2536.50	2536.80	2536.64	2517.17	2537.65
05-Mar-92	2536.99	2538.25	2535.42	2536.48	2536.19	2536.37	2536.69	2536.54	2511.02	2537.56
06-Mar-92	2536.80	2537.77	2535.24	2536.19	2535.98	2536.17	2536.48	2536.36	2508.92	2537.38
07-Mar-92										
08-Mar-92	2536.65	2537.17	2535.09	2536.18	2535.86	2536.05	2536.35	2536.25	2507.44	2537.20
09-Mar-92										
10-Mar-92	2536.55	2536.98	2535.00	2536.06	2535.78	2535.94	2536.26	2536.16	2506.85	2537.04
11-Mar-92	2536.45	2536.88	2534.91	2535.97	2535.70	2535.91	2536.17	2536.07	2506.82	2536.94
12-Mar-92	2536.43	2536.98	2535.00	2536.06	2535.78	2535.94	2536.26	2536.16	2506.85	2537.04
13-Mar-92	2536.44	2536.77	2534.92	2535.97	2535.68	2535.86	2536.16	2536.12	2506.81	2536.89
14-Mar-92	2536.35	2536.69	2534.82	2535.87	2535.58	2535.75	2536.05	2535.96	2506.84	2536.77

Date	V16D	V16S	T16D	Q16D	Q16S	Q17D	P17S	N18S	J16D	J16S
15-Mar-92	2536.28	2536.59	2534.77	2535.81	2535.53	2535.70	2535.99	2535.91	2506.79	2536.70
16-Mar-92	2536.26	2536.55	2534.76	2535.80	2535.50	2535.69	2535.98	2535.91	2506.74	2536.65
17-Mar-92										
18-Mar-92										
19-Mar-92	2536.17	2536.34	2534.67	2535.72	2535.43	2535.61	2535.90	2535.88	2506.42	2536.49
20-Mar-92	2536.10	2536.33	2534.60	2535.64	2535.33	2535.52	2535.81	2535.74	2506.58	2536.41
21-Mar-92	2536.09	2536.30	2534.59	2535.63	2535.31	2535.51	2535.81	2535.74	2506.58	2536.39
22-Mar-92	2536.03	2536.25	2534.54	2535.57	2535.26	2535.45	2535.75	2535.67	2506.55	2536.32
23-Mar-92										
24-Mar-92										
25-Mar-92		2536.09	2532.66	2534.28	2535.12	2534.53	2535.59	2535.48	2506.46	2536.16
26-Mar-92	2535.93	2536.24	2534.43	2535.46	2535.16	2535.34	2535.64	2535.58	2506.54	2536.17
27-Mar-92	2535.90	2536.15	2534.41	2535.44	2535.15	2535.33	2535.62	2535.56	2506.53	2536.14
28-Mar-92	2535.88	2536.11	2534.54	2535.38	2535.12	2535.33	2535.59	2535.53	2507.16	2536.09
29-Mar-92										
30-Mar-92										
31-Mar-92								2535.50	2509.15	2536.01
01-Apr-92										
02-Apr-92	2535.87	2536.02	2534.82	2535.52	2535.07	2535.41	2535.52	2535.46	2511.06	2535.97
03-Apr-92										
04-Apr-92	2535.86	2535.98	2534.85	2535.53	2535.05	2535.41	2535.52	2535.46	2511.81	2535.94
05-Apr-92	2535.82	2535.94	2534.82	2535.49	2535.00	2535.37	2535.47	2535.41	2511.82	2535.89
06-Apr-92										
07-Apr-92	2535.79	2535.91	2534.82	2535.46	2534.98	2535.34	2535.45	2535.38	2512.21	2535.84
08-Apr-92										
09-Apr-92										
10-Apr-92										
11-Apr-92	2536.37	2536.58	2534.85	2535.95	2535.60	2535.83	2536.05	2536.00	2506.84	2536.55
12-Apr-92										
13-Apr-92	2536.19	2536.40	2534.66	2535.75	2535.47	2535.64	2535.91	2535.86	2505.95	2536.47
14-Apr-92										
15-Apr-92	2536.09	2536.30	2534.55	2535.64	2535.34	2535.52	2535.79	2535.74	2505.74	2536.39
16-Apr-92										
17-Apr-92										
18-Apr-92	2536.41	2536.82	2534.89	2536.01	2535.69	2535.89	2536.14	2536.12	2505.52	2536.86
19-Apr-92										
20-Apr-92	2536.24	2536.50	2534.70	2535.80	2535.49	2535.69	2535.93	2535.89	2505.69	2536.83
21-Apr-92										
22-Apr-92	2536.07	2536.30	2534.54	2535.63	2535.34	2535.52	2535.79	2535.75	2505.45	2536.66
23-Apr-92										
24-Apr-92										
25-Apr-92	2535.86	2537.10	2534.25	2535.46	2535.24	2535.35	2535.71	2535.66	2503.70	2536.51
26-Apr-92										
27-Apr-92	2535.71	2536.26	2534.13	2535.32	2535.10	2535.21	2535.59	2535.55	2503.06	2536.31
28-Apr-92										
29-Apr-92										
30-Apr-92	2535.84	2536.22	2534.25	2535.46	2535.27	2535.34	2535.74	2535.68	2502.64	2536.31
01-May-92										
02-May-92										
03-May-92	2535.63	2535.98	2534.03	2535.23	2535.02	2535.12	2535.50	2535.45	2501.96	2536.05
04-May-92										
05-May-92										
06-May-92	2535.57	2535.90	2533.98	2535.18	2534.97	2535.06	2535.44	2535.38	2501.94	2535.95
07-May-92										
08-May-92	2535.52	2535.86	2533.94	2535.13	2534.94	2535.01	2535.40	2535.34	2501.84	2535.88
09-May-92										
10-May-92										
11-May-92										
12-May-92										
13-May-92	2535.40		2533.80	2535.00	2534.83	2534.89	2535.31	2535.25	2501.52	2535.71
14-May-92										
15-May-92										
16-May-92	2535.36		2533.72	2534.93	2534.78	2534.81	2535.17	2535.20	2501.26	2535.62

Date	J17S	D19D	H12S	U3D	U3S	T8S	S12D1	S12D2	Creek	Prec.(in)
01-Jan-92	2536.09	2524.67	2537.16	2525.43	2540.48	2537.47	2532.45	2525.48	2536.82	0.00
02-Jan-92										0.13
03-Jan-92	2536.14	2525.14	2537.21	2525.90	2540.71	2537.51	2532.63	2525.93	2536.82	0.00
04-Jan-92										0.10
05-Jan-92										0.00
06-Jan-92	2536.03	2525.00	2537.15	2525.76	2540.59	2537.42	2532.48	2525.84	2536.89	0.06
07-Jan-92										0.00
08-Jan-92	2535.92	2524.56	2536.95	2525.31	2540.30	2537.29	2532.18	2525.37	2536.82	0.00
09-Jan-92										0.00
10-Jan-92										0.00
11-Jan-92	2535.93	2524.78	2536.99	2525.59	2540.43	2537.28	2532.29	2525.63	2537.01	0.14
12-Jan-92										0.00
13-Jan-92										0.00
14-Jan-92										0.02
15-Jan-92	2535.87	2524.70	2536.84	2525.43	2540.34	2537.17	2532.14	2525.52	2536.85	0.00
16-Jan-92										0.40
17-Jan-92										0.00
18-Jan-92	2536.15	2525.13	2537.21	2525.89	2540.51	2537.48	2532.55	2525.98	2536.93	0.00
19-Jan-92	2536.12	2525.22	2537.19	2526.00	2540.57	2537.51	2532.53	2526.06	2536.91	0.00
20-Jan-92	2536.09	2525.24	2537.16	2526.02	2540.61	2537.50	2532.47	2526.08	2536.85	0.00
21-Jan-92										0.01
22-Jan-92	2535.89	2525.10	2537.06	2525.87	2540.57	2537.43	2532.31	2525.93	2536.83	0.00
23-Jan-92										0.70
24-Jan-92	2536.78	2525.69	2538.17	2526.61	2540.95	2537.87	2533.28	2526.68	2537.45	0.03
25-Jan-92	2537.19	2526.08	2538.42	2526.98	2541.12	2538.08	2533.40	2527.06	2537.27	0.00
26-Jan-92										0.00
27-Jan-92										0.32
28-Jan-92	2537.54	2526.30	2538.83	2527.26	2541.21	2538.41	2533.76	2527.33	2537.97	0.51
29-Jan-92	2537.72	2526.38	2538.82	2527.29	2541.17	2538.50	2533.60	2527.37	2537.35	0.23
30-Jan-92										0.01
31-Jan-92									2537.23	0.00
01-Feb-92	2537.63	2526.56	2538.69	2527.39	2541.52	2538.68	2533.38	2527.47	2537.08	0.00
02-Feb-92	2537.54	2526.09	2538.42	2526.92	2541.23	2538.52	2533.04	2526.98	2537.03	0.06
03-Feb-92										0.00
04-Feb-92	2537.30	2526.11	2538.33	2526.85	2541.33	2538.47	2532.90	2526.93	2536.99	0.00
05-Feb-92										0.00
06-Feb-92	2537.17	2525.98	2538.20	2526.79	2541.38	2538.38	2532.79	2526.86	2536.95	0.00
07-Feb-92										0.00
08-Feb-92	2537.02	2525.86	2538.06	2526.78	2541.35	2538.26	2532.67	2526.78	2536.95	0.00
09-Feb-92										0.03
10-Feb-92	2536.91	2525.88	2537.96	2526.72	2541.44	2538.19	2532.60	2526.79	2536.94	0.00
11-Feb-92										0.00
12-Feb-92	2536.75	2525.74	2537.83	2526.58	2541.36	2538.06	2532.47	2526.64	2536.89	0.00
13-Feb-92		2525.77							2536.89	0.00
14-Feb-92										0.00
15-Feb-92	2536.59	2525.80	2537.67	2526.59	2541.36	2537.94	2532.33	2526.67	2536.89	0.14
16-Feb-92	2536.65	2525.76	2537.67	2526.59	2541.26	2537.94	2532.45	2526.64	2537.13	0.36
17-Feb-92	2536.57	2525.58	2537.71	2526.39	2541.14	2537.88	2532.28	2526.46	2536.96	0.00
18-Feb-92										0.11
19-Feb-92	2536.67	2525.86	2537.87	2526.72	2541.32	2537.93	2532.92	2526.81	2538.25	0.80
20-Feb-92										0.88
21-Feb-92	2538.21	2526.75	2539.27	2527.76	2541.95	2539.17	2533.92	2527.83	2537.95	0.16
22-Feb-92										0.02
23-Feb-92	2538.36	2526.55	2539.20	2527.46	2541.85	2539.39	2533.48	2527.55		0.00
24-Feb-92										0.34
25-Feb-92	2538.28	2526.24	2539.22	2527.06	2541.94	2539.55	2533.35	2527.14	2537.33	0.02
26-Feb-92	2538.31	2526.14	2539.19	2526.96	2542.01	2539.66	2533.24	2527.02	2537.23	0.01
27-Feb-92										0.00
28-Feb-92	2538.15	2526.17	2539.03	2526.96	2542.14	2539.67	2533.11	2527.00	2537.17	0.01
29-Feb-92										0.00
01-Mar-92	2537.93	2526.15	2538.91	2526.92	2542.23	2539.53	2532.95	2526.99	2537.12	0.00
02-Mar-92										0.10
03-Mar-92										0.02
04-Mar-92	2537.62	2520.47	2538.57	2517.09	2542.09	2539.19	2528.75	2517.00	2537.07	0.00
05-Mar-92	2537.52	2513.40	2538.48	2510.97	2542.09	2539.09	2527.02	2511.04	2537.07	0.00
06-Mar-92	2537.37	2510.93	2538.31	2508.87	2542.42	2538.93	2526.23	2508.87	2537.01	0.00
07-Mar-92										0.00
08-Mar-92	2537.12	2509.03	2538.09	2507.38	2541.83	2538.67	2525.68	2507.37	2537.05	0.00
09-Mar-92										0.02
10-Mar-92	2536.90	2508.33	2537.89	2507.34	2541.69	2538.42	2525.14	2506.64	2537.09	0.00
11-Mar-92	2536.83	2508.27	2537.82	2506.77	2541.73	2538.33	2525.17	2506.72	2536.96	0.00
12-Mar-92	2536.90	2508.33	2537.89	2506.80	2541.69	2538.42	2525.14	2506.64	2537.09	0.00
13-Mar-92	2536.72	2508.24	2537.74	2506.76	2541.75	2538.21	2524.89	2506.72	2537.13	0.00
14-Mar-92	2536.66	2508.30	2537.69	2506.79	2541.76	2538.14	2524.84	2506.73	2536.93	0.00

Date	J17S	D19D	H12S	U3D	U3S	T8S	S12D1	S12D2	Creek	Prec.(in)
15-Mar-92	2536.57	2508.24	2537.60	2506.73	2541.73	2538.05	2524.73	2506.69	2536.93	0.00
16-Mar-92	2536.51	2508.16	2537.53	2506.69	2541.71	2538.00	2524.64	2506.66	2536.99	0.10
17-Mar-92										0.08
18-Mar-92										0.00
19-Mar-92	2536.31	2507.83	2537.44	2506.36	2541.47	2537.74	2524.35	2506.31	2537.09	0.00
20-Mar-92	2536.26	2508.09	2537.31							0.00
21-Mar-92	2536.25	2508.03	2537.28	2506.54	2541.60	2537.68	2524.25	2506.51	2536.94	0.00
22-Mar-92	2536.18	2507.96	2537.23	2506.48	2541.52	2537.60	2524.14	2506.46	2536.89	0.00
23-Mar-92										0.00
24-Mar-92										0.00
25-Mar-92	2536.05	2507.90	2537.07	2506.40	2541.39	2537.42	2523.56	2506.35	2536.85	0.00
26-Mar-92	2536.03	2508.03	2537.07	2506.52	2541.46	2537.40	2523.94	2506.47	2536.85	0.00
27-Mar-92	2535.99	2507.99	2537.04	2506.48	2541.43	2537.36	2523.85	2506.45	2536.85	0.08
28-Mar-92	2535.94	2507.83	2536.96	2507.10	2541.29	2537.29	2523.89	2507.03	2536.85	0.00
29-Mar-92										0.00
30-Mar-92	2535.87	2509.46	2536.89	2509.12	2541.25	2537.20	2524.33	2509.07	2536.85	0.00
31-Mar-92										0.00
01-Apr-92										0.00
02-Apr-92	2535.82	2511.18	2536.82	2511.04	2541.23	2537.12	2524.94	2511.03	2536.83	0.00
03-Apr-92										0.00
04-Apr-92	2535.79	2511.59	2536.79	2511.80	2541.22	2537.07	2525.19	2511.81	2536.83	0.00
05-Apr-92	2535.75	2511.37	2536.73	2511.81	2541.10	2537.03	2525.08	2511.82	2536.82	0.00
06-Apr-92										0.00
07-Apr-92	2535.69	2511.86	2536.66	2512.21	2541.07	2536.95	2525.05	2512.22	2536.81	0.00
08-Apr-92										0.00
09-Apr-92										0.66
10-Apr-92										0.60
11-Apr-92	2536.25	2507.89	2537.61	2506.80	2541.42	2537.42	2523.86	2506.79	2536.99	0.09
12-Apr-92										0.09
13-Apr-92	2536.22	2506.95	2537.55	2505.92	2541.33	2537.47	2523.31	2505.89	2536.97	0.11
14-Apr-92										0.10
15-Apr-92	2536.17	2506.77	2537.49	2505.70	2541.35	2537.45	2523.12	2505.65	2536.89	0.00
16-Apr-92										0.17
17-Apr-92										0.39
18-Apr-92	2536.44	2506.40	2537.82	2505.48	2541.29	2537.68	2523.20	2505.47	2537.09	0.31
19-Apr-92										0.00
20-Apr-92	2536.59	2506.66	2537.79	2505.64	2541.42	2537.70	2523.17	2505.61	2536.91	0.00
21-Apr-92										0.00
22-Apr-92	2536.46	2506.12	2537.60	2505.42	2541.33	2537.61	2522.93	2505.41	2536.89	0.00
23-Apr-92										0.00
24-Apr-92										0.00
25-Apr-92	2536.32	2503.60	2537.45	2503.67	2541.29	2537.50	2522.42	2503.65	2536.87	0.00
26-Apr-92										0.00
27-Apr-92	2536.15	2502.33	2537.24	2503.05	2541.12	2537.36	2522.05	2503.02	2536.87	0.00
28-Apr-92										0.00
29-Apr-92										0.00
30-Apr-92	2536.13	2501.41	2537.19	2502.64	2541.10	2537.31	2521.80	2502.63	2536.97	0.52
01-May-92										0.00
02-May-92										0.00
03-May-92	2535.89	2500.27	2536.92	2501.96	2540.86	2537.10	2521.26	2501.93	2536.84	0.00
04-May-92										0.00
05-May-92										0.00
06-May-92	2535.80	2500.27	2536.81	2501.94	2540.88	2537.01	2521.12	2501.91	2536.83	0.00
07-May-92										0.00
08-May-92	2535.74	2500.03	2536.73	2501.85	2540.80	2536.94	2521.05	2501.83	2536.79	0.00
09-May-92										0.00
10-May-92										0.00
11-May-92										0.00
12-May-92										0.00
13-May-92	2535.58	2499.75	2536.52	2501.53	2540.58	2536.76	2520.74	2501.53	2536.80	0.00
14-May-92										0.00
15-May-92										0.00
16-May-92	2535.52	2499.47	2536.40	2501.27	2540.47	2536.68	2520.42	2501.23	2536.79	0.00