NAWS-CL TP 003

Coso Monitoring Program
October 1992 Through September 1993

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Naval Air Weapons Station

FOREWORD

This report presents the status of the Coso Monitoring Program conducted for the period October 1992 through September 1993 by the Naval Air Weapons Station (NAWS), China Lake, Calif. The investigation, funded under the NAWS Coso Geothermal Development Program, is being conducted to provide baseline information on hydrology and surface geothermal activity in the Coso Hot Springs area.

Comarco personnel aided in the successful completion of the 1992-93 Coso Monitoring Program under contract N60530-88-D-0019 for the Public Works Department, NAWS, China Lake.

This report was reviewed for technical accuracy by Ailan Katzenstein (NAWS-CL C8306) and Charles Rodgers (Comarco).

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(U) The Coso Monitoring Program is a continuing effort in support of the Navy's geothermal resources within the Known Geothermal Resource Area (KGRA). Data are presented on the monitoring of steam flow rates and temperatures, water levels in ponds and wells, water chemistry, and rainfall in the Coso Hot Springs Resort Area. A monthly photographic essay of the mudfields and pools shows the variation of the surface water levels throughout the year.

14. SUBJECT TERMS

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INTRODUCTION

The Coso Monitoring Program was initiated in 1978 to gather baseline data on the surface and near-surface geothermal activity at Devils Kitchen and Coso Hot Springs, the main thermal sites within the Coso Known Geothermal Resource Area (Coso KGRA). This report represents the sixteenth year of continual baseline data collection.

Numerous changes in activity were noted at the thermal sites since the last report, as well as some equipment failures. Devils Kitchen was temporarily off line due to inconsistent recorded steam flow data. The cause of the inconsistency was isolated and resolved. These and other activities will be detailed in the individual site discussions.

Monitoring sites of the Coso Hot Springs area and type of data collected at each site are presented in Table 1. The location of each site is shown in Figure 1.

TABLE 1. Monitoring Functions and Locations.

Monitored sites	Continuous steam flow	Continuous water level	Periodic water level	Continuous steam temperature	Periodic water temperature	Ambient temperature	Barometric pressure	Relative humidity	Water level photography	Water chemistry
Schober's Resort (4A-2, 3)	X			X						
Well 4H-4	X									
Well 4A-4					X					X
Well 4P-1		X[a]			X					X
Well 4K-1			X[b]		X					X
Devils Kitchen	X									X
Observation Well No. 1		X[a]								X
Observation Well No. 2		X[a]								
Observation Well No. 3		X[a]								
South Pool		X[a]			X				X	X
Weather Station No. 1						X	X	X		

[a] Weekly monitoring.

[b] Less than weekly monitoring.

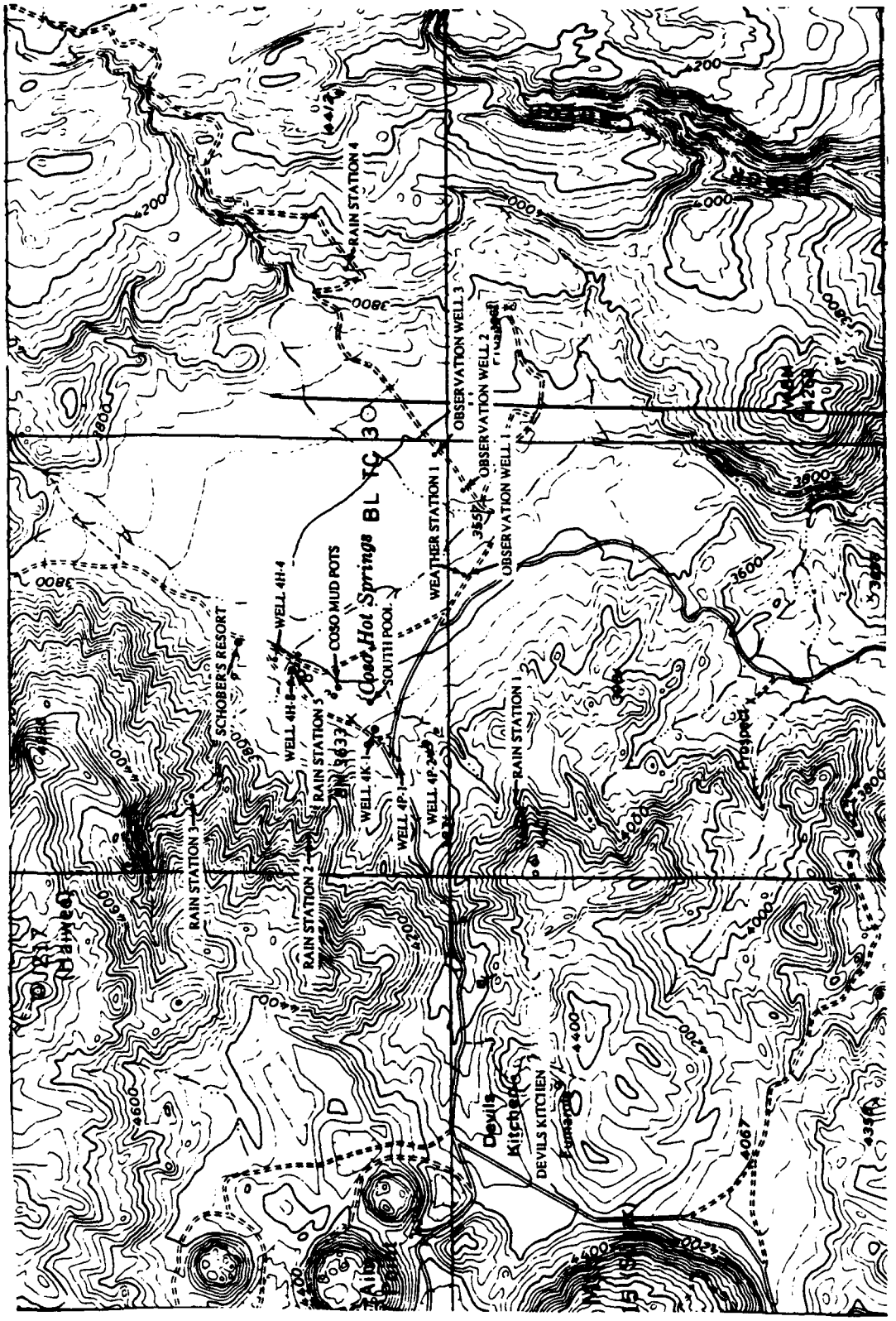

FIGURE 1. Coso Known Geothermal Resource Area Monitoring Sites.

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TEMPERATURE AND STEAM FLOW MONITORING

Steam flow is presently measured at three sites (Schober's, Devils Kitchen, and 4H-4 wells) with steam temperature also monitored at the Schober's Well site. One site is located within Devils Kitchen while the other sites are along the Coso Hot Springs-Airport Lake Fault. Temperature data are used as collected, while the steam flow data are converted from graph units to steam flow in pounds per hour. The conversion factors for steam flow data are calculated using the standard orifice equation for gas flow. The Barton pressure differential meters and temperature recorders are calibrated yearly. Periodic manometer readings are taken to ensure the data recorded are accurate.

DEVILS KITCHEN

Steam flow at Devils Kitchen is monitored using a 25-inch water column Barton differential pressure unit (DPU) and recorder. The conversion factor based on an orifice size of 1.387 inches is 40.23. Daily high and low steam flow data collected at Devils Kitchen for the period of this report are presented in Appendix A, Table A-1. These data are shown graphically in Figure 2. The mean flow and standard deviations for high and low steam flow are presented in Table 2. Devils Kitchen manometer readings may be found in Table 3.

As noted in last year's report, NAWS-CL TP 001, the Devils Kitchen site has been giving erratic data since January 1992. Numerous efforts to fix the problem were unsuccessful until June 1993 when the meter run for the steam collector was dismantled. It was discovered that when the collector was rebuilt in 1984 the meter run was installed in such a way that the vacuum side of the orifice plate was partially blocked. While this did not prevent accurate measurement of the steam flow rate most of the time, it created an opportunity for scale from the collector to more easily plug the meter. The problem was corrected; the meter serviced, zeroed, and balanced; and the output was checked for accuracy against manometer readings.

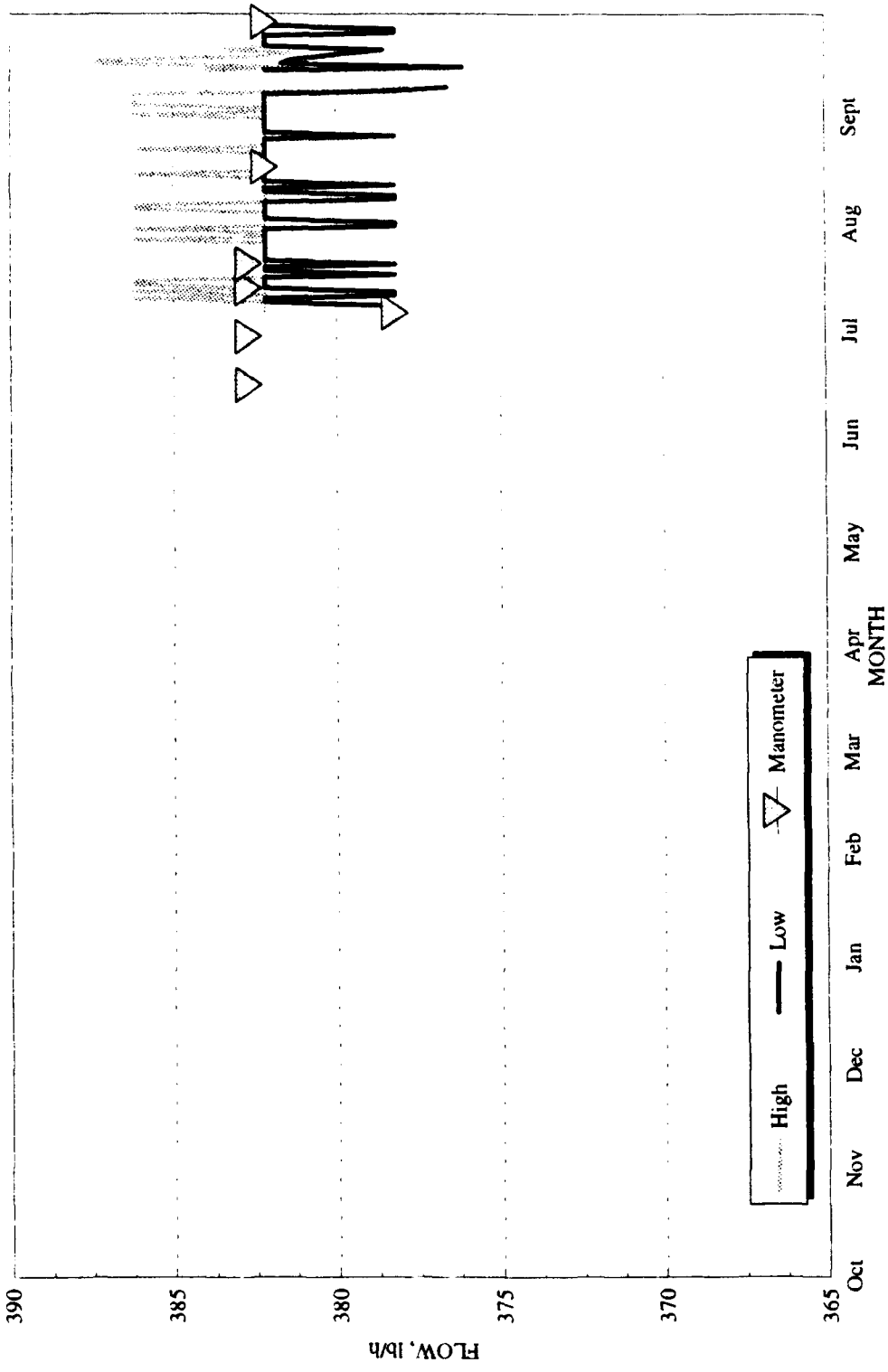

FIGURE 2. Devils Kitchen Steam Flow, 1 October 1992 through 30 September 1993.

TABLE 2. Devils Kitchen Statistical Steam Flow.

Date	High daily flow, lb/h		Low daily flow, lb/h	
	Mean	Standard deviation	Mean	Standard deviation
15 Jun 93 - 30 Sep 93	383.0	1.85	380.4	1.77

TABLE 3. Devils Kitchen Manometer Readings.

Date	lb/h
6 Jul 1993	378.7
13 Jul 1993	378.7
20 Jul 1993	378.7
17 Aug 1993	382.2
29 Sep 1993	382.2

WELL 4H-4

The daily steam flow for 4H-4 is presented in Appendix A, Table A-2. The mean flow data and the standard deviations for the high and low daily steam flow at this site are presented in Table 4. These data are shown graphically in Figure 3. This site is equipped with a 25-inch water column DPU meter and recorder. The conversion factor is 20.56.

TABLE 4. 4H-4 Statistical Steam Flow.

Date	High daily flow, lb/h		Low daily flow, lb/h	
	Mean	Standard deviation	Mean	Standard deviation
1 Oct 92 - 30 Sept 93	184.9	8.0	176.2	11.6

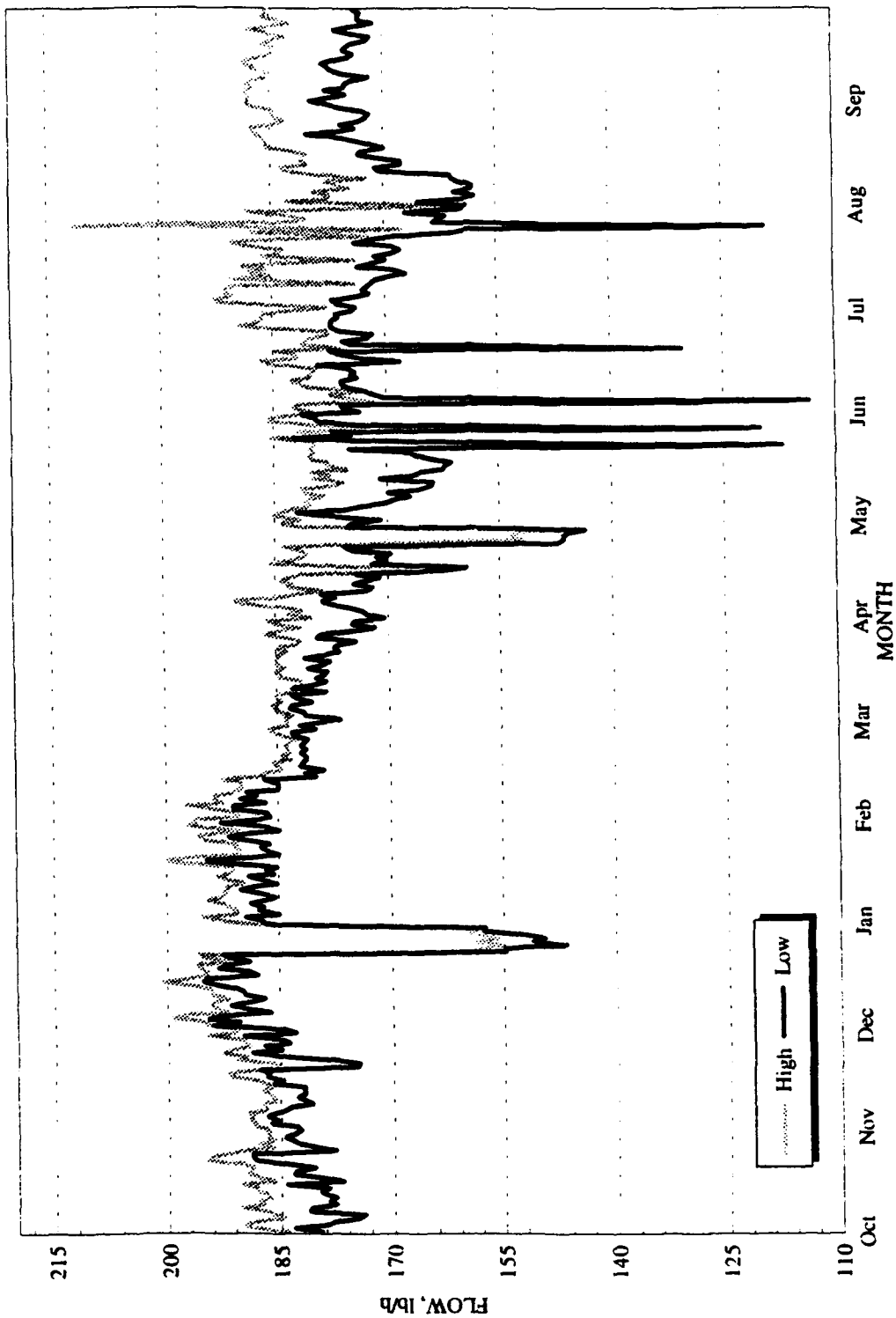

FIGURE 3. Wells 4H-4 Steam Flow, 1 October 1992 through 30 September 1993.

SCHOBER'S WELLS (4A-2 AND 4A-3)

The daily steam flow and temperature data for Wells 4A-2 and 4A-3 at Schober's Resort are presented in Appendicies A and B, Table A-3 and Table B-1. The mean data and standard deviations are presented for high and low daily steam flow (Table 5) and for high and low daily steam temperature (Table 6). Data are shown graphically in Figures 4 and 5. Steam flow is recorded using a 50-inch column DPU and recorder. The conversion factor is 150.8. Manometer readings were taken and the data are reliable.

The gradual decrease in steam flow from these two wells is due to the enlargement of a hole next to well 4A-3. During a period of heavy rain in December 1992 through March 1993 there was a substantial increase in the steam flow due to runoff from the adjacent hillside entering this shallow steam zone. The additional steam blew a hole in the hillside adjacent to the well, approximately 1 foot wide. The hole has continued to grow and is now about 2 feet in diameter. The total steam loss from this hole is estimated to be about 28% of the potential flow to these two wells.

TABLE 5. 4A-2 and 4A-3 Statistical Steam Flow.

Date	High daily flow, lb/h		Low daily flow, lb/h	
	Mean	Standard deviation	Mean	Standard deviation
1 Oct 92 - 30 Sept 93	1144.32	39.74	1103.64	51.94

TABLE 6. 4A-2 and 4A-3 Statistical Steam Temperature.

Date	High daily flow, °F		Low daily flow, °F	
	Mean	Standard deviation	Mean	Standard deviation
1 Oct 92 - 30 Sept 93	224.99	3.03	220.3	3.01

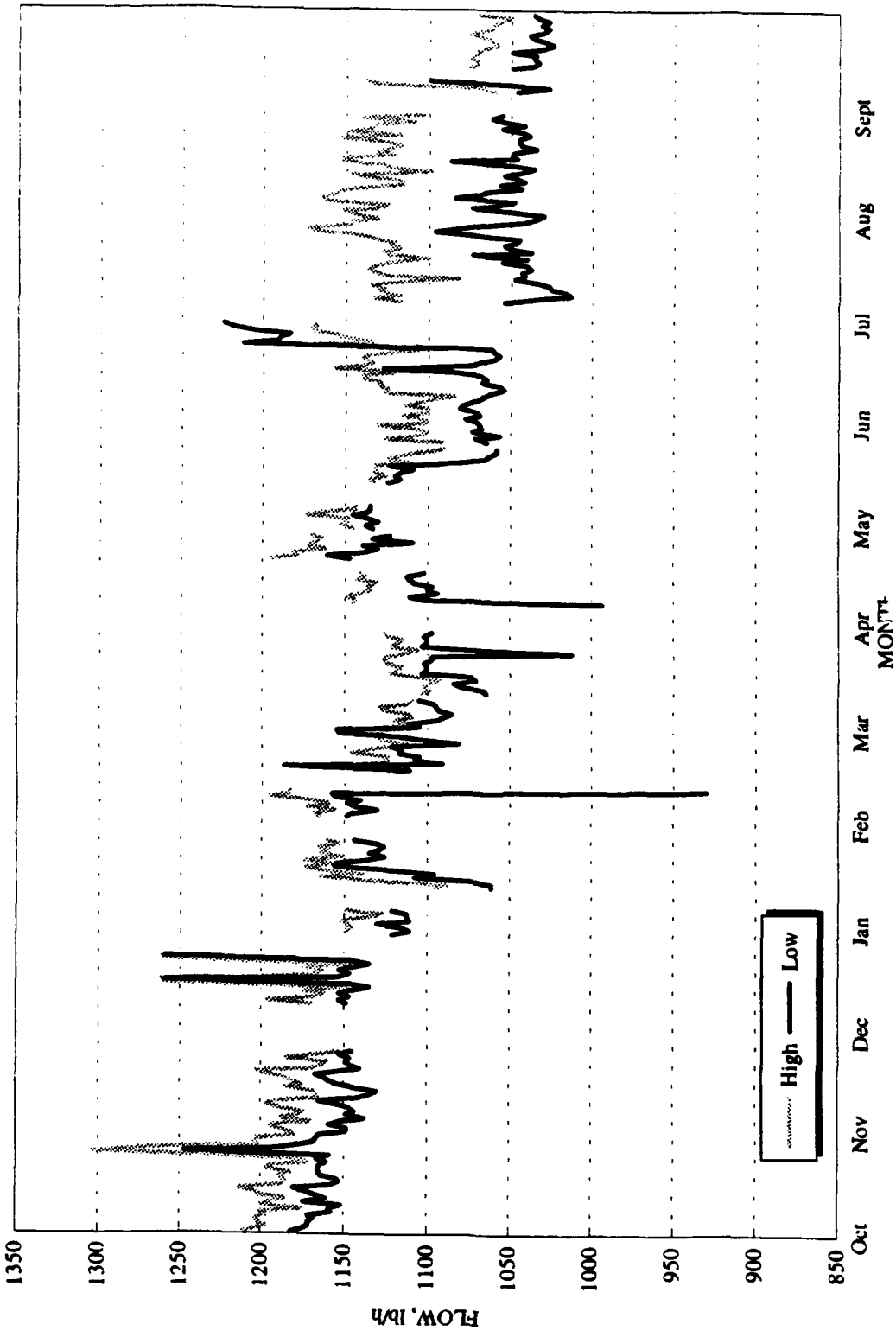

FIGURE 4. Wells 4A-2 and 4A-3 Steam Flow, 1 October 1992 through 30 September 1993.

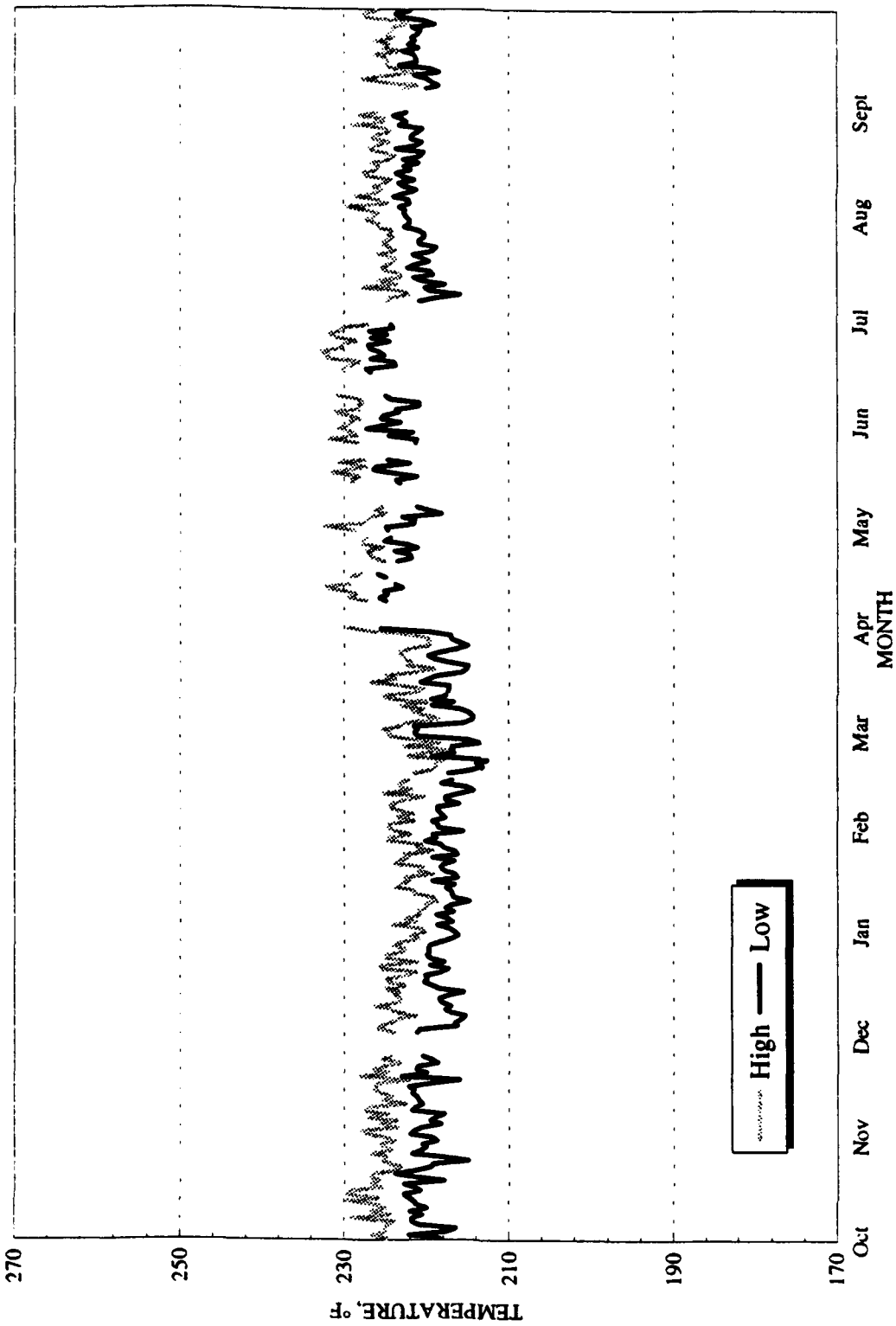

FIGURE 5. Wells 4A-2 and 4A-3 Steam Temperature, 1 October 1992 through 30 September 1993.

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COSO HOT SPRINGS MUDFIELD PHOTOGRAPHIC INVESTIGATION

A weekly photographic investigation was initiated in January 1978 to document the fluctuation in fluid levels in several of the more prominent mud pots in the Coso KGRA. This project has continued into the steam-production and power-generation stages of the geothermal development.

Steam and weather conditions often combine to partially obscure the Coso Resort area. To counter these effects, nine photo sites are distributed in and around the resort area so photographs can be taken each week that clearly show the physical status of the thermal activity. The Coso Resort sites are listed in Table 7 and shown in Figure 6. Figures 7 through 18 illustrate seasonal variations at several Coso Resort sites.

TABLE 7. Photographic Sites and Views.

Site Number	Primary view from each site
1	South Pool looking north
2	Overall Resort Mudfield looking southwest, and northwest
3	Overall Resort Mudfield looking southwest, west, north, and northeast
4	Mudfield looking west, north, and northwest
5	Mudfield looking south, southwest, and west
6	Mudfield looking south, southeast, and east
7	North side of Mudfield looking south
8	Crater 4KC-8 looking south, southeast, and east
9	Crater 4KC-8 looking northeast

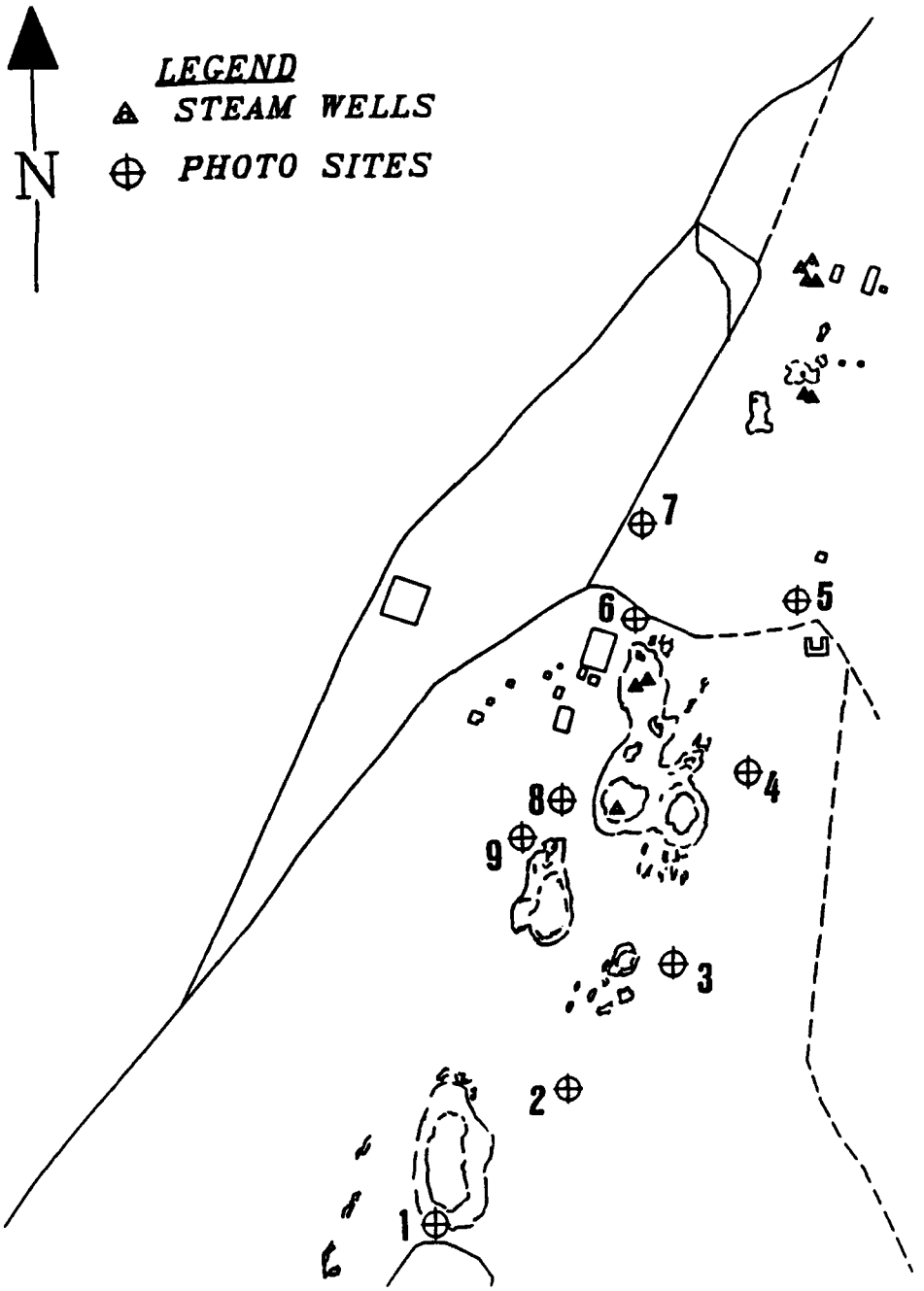


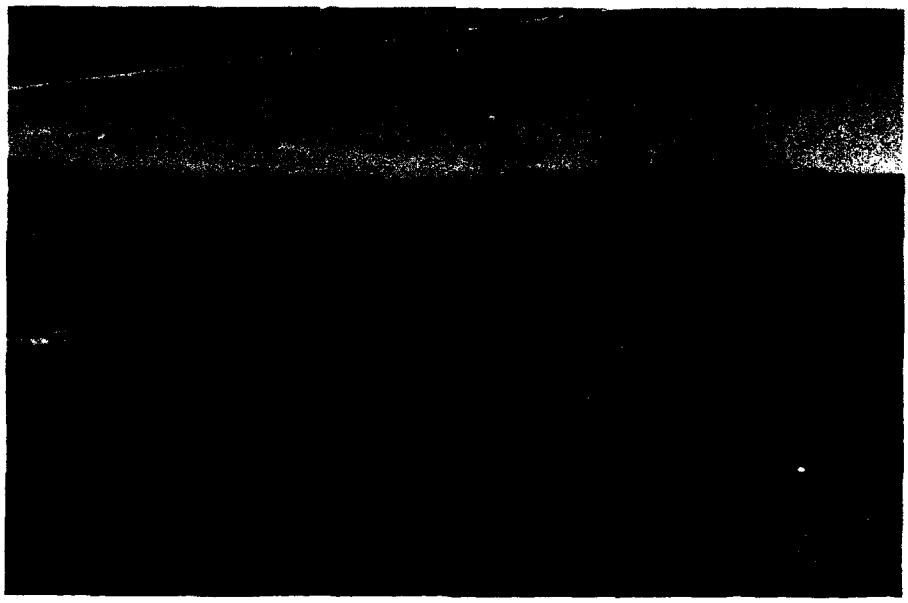
FIGURE 6. Photographic Locations.

(a) Site 1 looking north.

(b) Site 6 looking southeast.

FIGURE 7. Coso Hot Springs, 6 October 1992.

(c) Site 9 looking east.



(d) Site 9 looking northeast.

FIGURE 7. (Contd.)

(a) Site 1 looking north.

(b) Site 3 looking west.

FIGURE 8. Coso Hot Springs, 17 November 1992.

(c) Site 3 looking southwest.

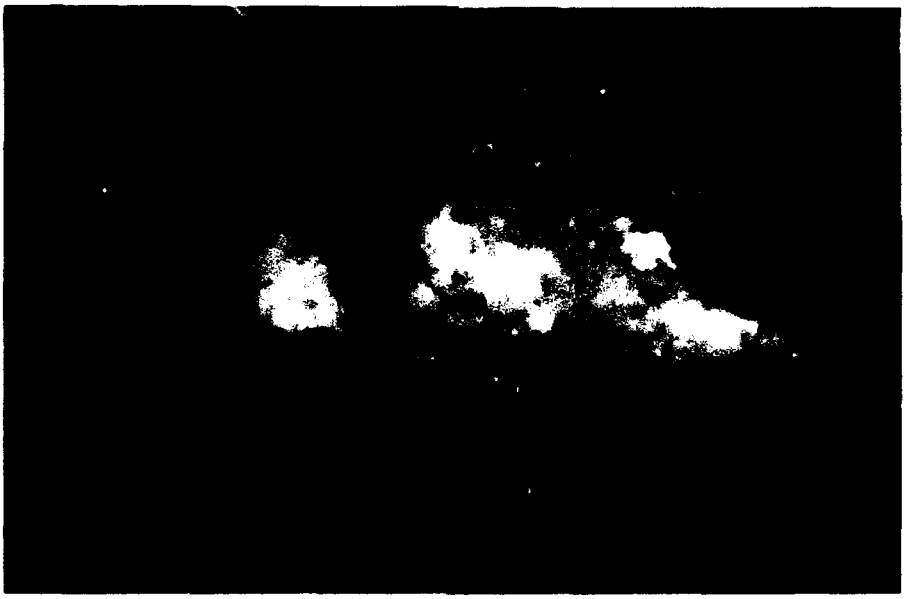
(d) Site 3 looking northwest.

FIGURE 8. (Contd.)

(a) Site 1 looking north.

(b) Site 9 looking east.

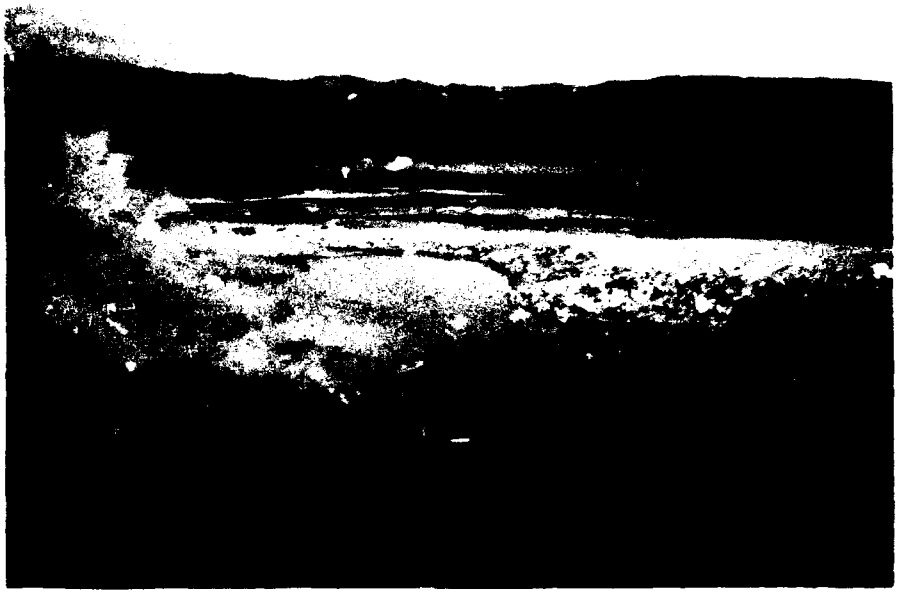
FIGURE 9. Coso Hot Springs, 1 December 1992.



(c) Site 3 looking north.

(d) Site 5 looking southwest.

FIGURE 9. (Contd.)



(a) Site 1 looking northeast.

(b) Site 8 looking east.

FIGURE 10. Coso Hot Springs, 25 January 1993.

(c) Site 3 looking northwest.

(d) Site 8 looking south.

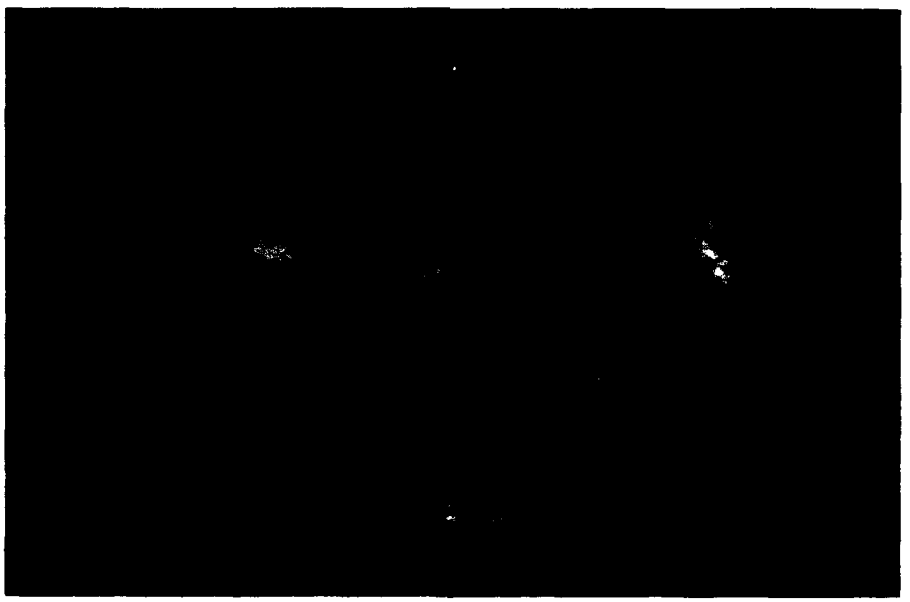
FIGURE 10. (Contd.)

(a) Site 1 looking northeast.

(b) Site 3 looking west.

FIGURE 11. Coso Hot Springs, 22 February 1993.

(c) Site 2 looking northwest.



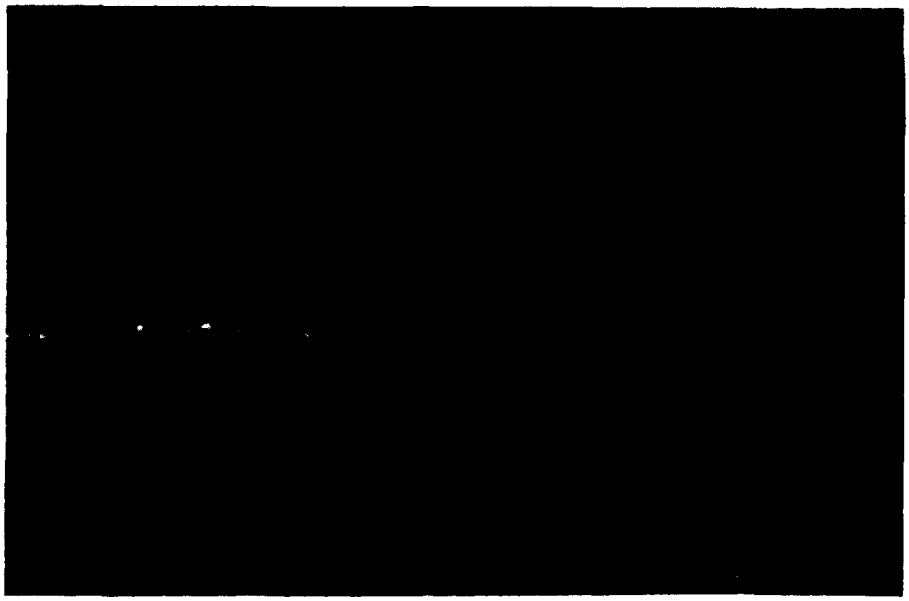
(d) Site 3 looking northwest.

FIGURE 11. (Contd.)

(a) Site 1 looking northeast.

(b) Midway between sites 1 and 2 looking northwest.

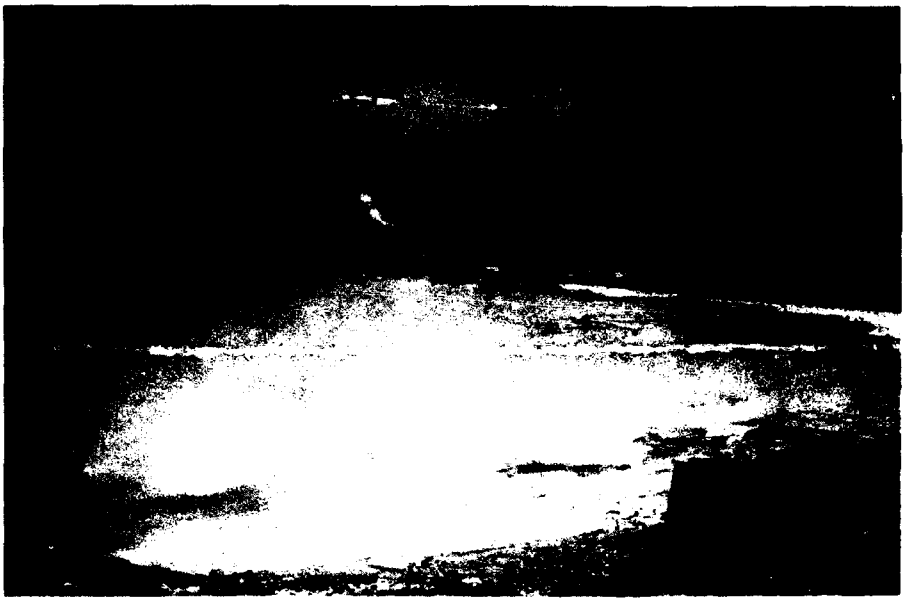
FIGURE 12. Coso Hot Springs, 16 March 1993.



(c) Site 8 looking east.

(d) Site 9 looking east.

FIGURE 12. (Contd.)



(a) Site 1 looking north.

(b) Site 3 looking west.

FIGURE 13. Coso Hot Springs, 29 April 1993.

(c) Site 2 looking north.

(d) Site 7 looking south.

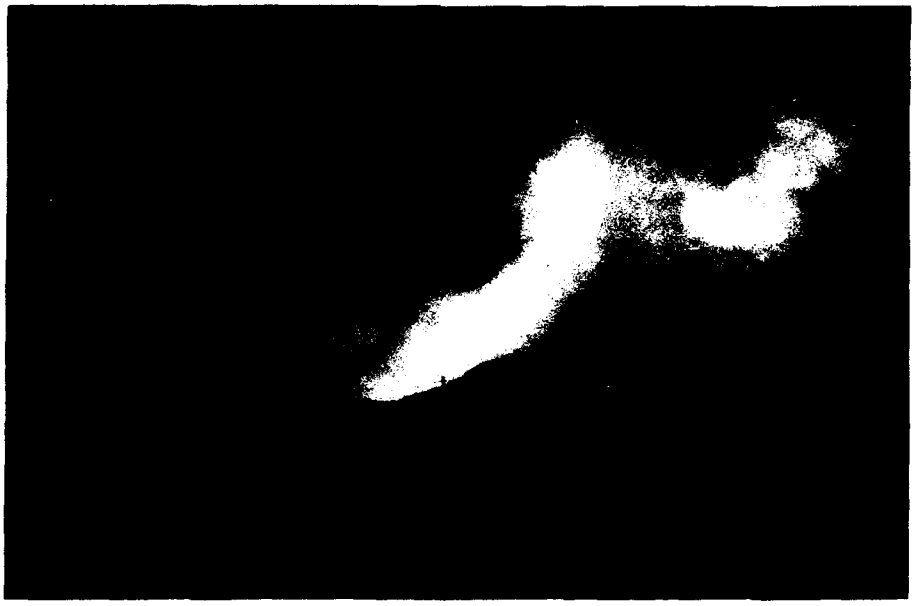
FIGURE 13. (Contd.)

(a) Site 1 looking north.

(b) Site 3 looking northwest.

FIGURE 14. Coso Hot Springs, 19 May 1993.

(c) Site 4 looking west.



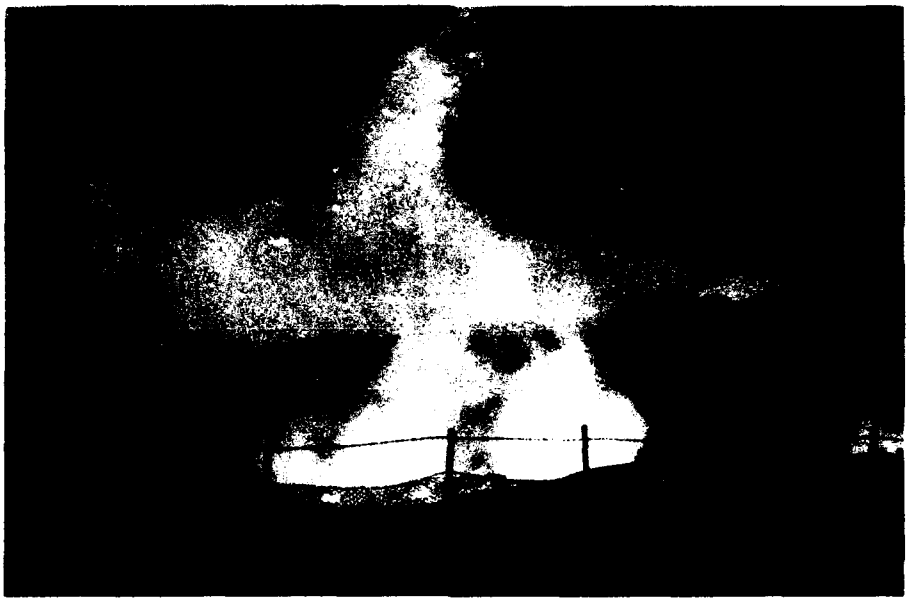
(d) Site 7 looking south.

FIGURE 14. (Contd.)

(a) Site 1 looking north.

(b) Site 4 looking west

FIGURE 15. Coso Hot Springs, 16 June 1993.



(c) Site 6 looking southeast.

(d) Site 8 looking south.

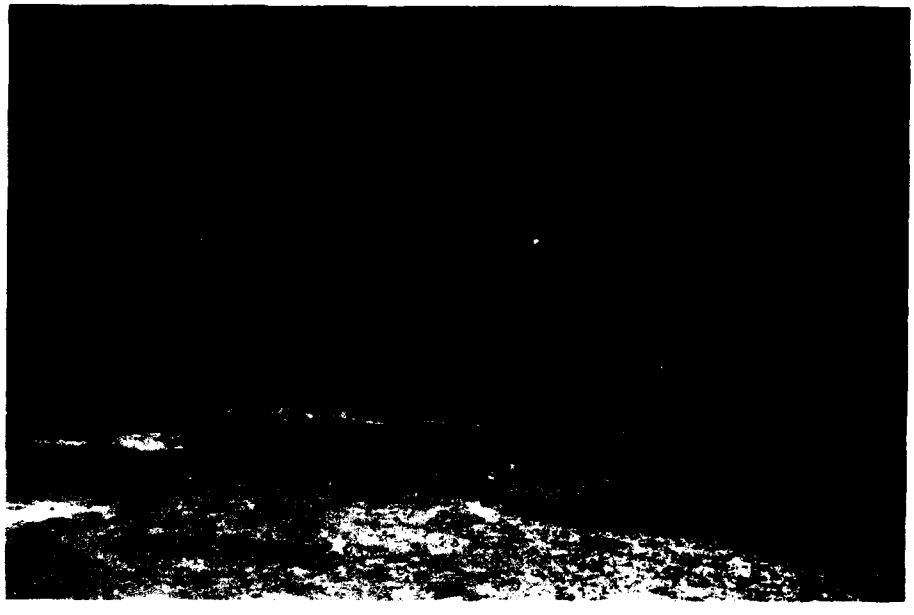
FIGURE 15. (Contd.)

(a) Site 1 looking north.

(b) Site 2 looking northwest.

FIGURE 16. Coso Hot Springs, 13 July 1993.

(c) Site 3 looking north.



(d) Site 4 looking west.

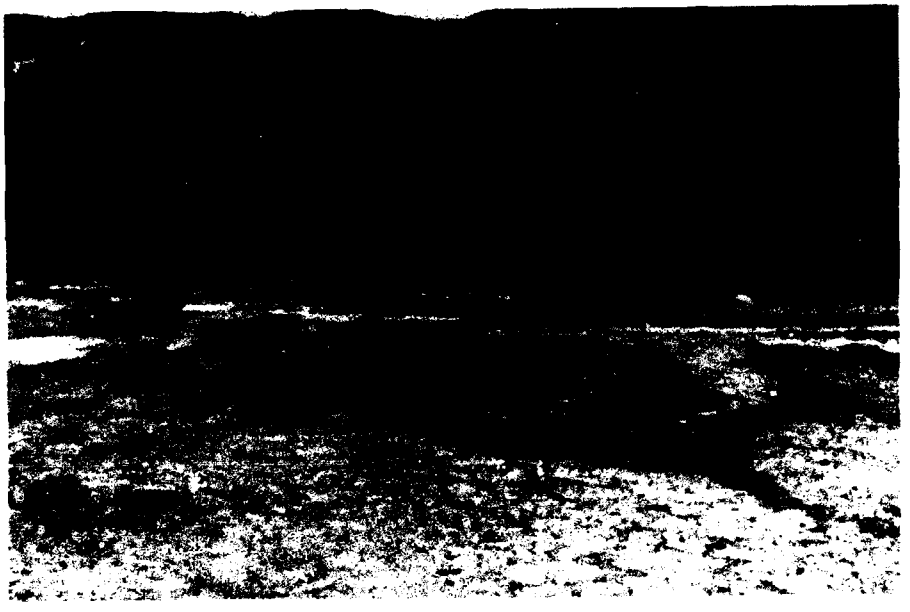
FIGURE 16. (Contd.)

(a) Site 1 looking northeast.

(b) Site 3 looking northwest.

FIGURE 17. Coso Hot Springs, 3 August 1993.

(c) Site 2 looking north.



(d) Site 4 looking west.

FIGURE 17. (Contd.)

(a) Site 1 looking north.

(b) Site 8 looking east

FIGURE 18. Coso Hot Springs, 21 September 1993.

(c) Site 8 looking south.

(d) Site 9 looking northeast.

FIGURE 18. (Contd.)

WATER LEVEL MONITORING

OBSERVATION WELLS

Water levels are presently monitored in five wells. Water levels are measured weekly at Wells 4P-1, Observation Wells (OB) 1, 2, and 3, and occasionally at Well 4K-1. These data can be seen in Table 8. Water levels at Wells 4P-1 and 4K-1 are measured with a modified Fisher electric water level meter because steam condensate accumulates on the probe of the Solist meter causing erroneous readings. The Solist meter is used at OB-1, 2, and 3. The water-filled pipe and manometer readings are used as secondary and comparison methods in case the Solist meter fails.

SOUTH POOL

The South Pool water level continued the pattern of seasonal fluctuations during this reporting period, ranging from a high of 3,622 feet in February 1993 to a low of 3,615.5 feet in September 1993 (Figure 19 and Table 9). The average level continues to be above historic (pre-1988) levels (Figure 20). The high-water marks from 22 February through 22 March were read from the scale mounted on the steam hut. All other levels were picked using a photographic comparison with known elevations and were extrapolated to the nearest half foot.

Water temperatures were measured sporadically, depending on the safety of access to the pool. Water temperatures ranged from 173° to 184°F through March 1993, but had jumped to around 210°F by September (Table 9 and Figure 19). This rise in temperature was accompanied by a change in the boiling activity in the pool. For the past few years there have been one or two hot spots in the pool. These spots have grown and shrunk at various times and the activity has varied from a gentle rolling action to violent boiling. By early fall of this year the activity had become a steady hard boil from three spots that had combined to involve almost the entire pool surface.

TABLE 8. Observation Well Water Level Data.

Date	Well depth to water, ft.					Date	Well depth to water, ft.				
	4P-1	4K-1	OB-1	OB-2	OB-3		4P-1	4K-1	OB-1	OB-2	OB-3
10 Oct 92	54.6	49.6	161.4	194.4	384.2	15 Mar 93	55.7		164.8	194.6	384.2
13 Oct 92	54.6		161.9	194.4	384.1	1 May 93	56.2		165.5	194.9	384.4
19 Oct 92	54.4		162.4	194.3	384.3	13 May 93	56.2		165.7	194.9	384.2
27 Oct 92	54.4		162.7	194.4	384.3	18 May 93	56.2		166.0	195.2	384.6
4 Nov 92	54.7	50.4	162.9	194.4	383.4	25 May 93	56.8		166.2	194.9	384.6
10 Nov 92	54.7		163.2	194.5	384.3	1 Jun 93	56.8		166.3	195.1	384.6
18 Nov 92	54.7		163.2	194.4	384.3	8 Jun 93	56.2		166.4	194.9	384.5
23 Nov 92	55.0		163.3	194.3	384.2	15 Jun 93	56.8		166.4	194.9	384.5
1 Dec 92	55.3		163.6	194.3	384.2	22 Jun 93	56.8		166.5	195.2	384.5
7 Dec 92	55.1		163.6	194.4	384.2	29 Jun 93	56.8		166.6	195.2	384.4
16 Dec 92	55.1	52.8	163.8	194.4	384.3	6 Jul 93	56.8		166.8	195.4	384.4
24 Dec 92	55.3		163.8	194.4	384.4	13 Jul 93	57.4		166.8	195.4	384.4
29 Dec 92	55.3		164.1	194.3	384.4	20 Jul 93	57.4		166.9	195.3	384.4
5 Jan 93	55.3	54.6	164.2	194.4	384.4	27 Jul 93	57.4		167.1	195.3	384.5
12 Jan 93	55.7		164.1	194.4	384.2	3 Aug 93	57.4		167.1	195.2	384.4
19 Jan 93	55.3		164.1	194.2	384.2	10 Aug 93	56.8		167.4	195.3	384.4
26 Jan 93	55.3	54.8	164.6	194.2	384.2	17 Aug 93	56.8		167.4	195.3	384.3
2 Feb 93	55.7		164.1	194.0	384.3	24 Aug 93	56.8		167.4	194.9	384.3
10 Feb 93	55.7		164.4	194.4	384.2	31 Aug 93	56.8		167.4	194.9	384.3
16 Feb 93	55.7	55.7	164.4	194.4	384.2	7 Sep 93	57.4		167.8	194.9	384.3
23 Feb 93	55.7		164.6	194.4	384.2	14 Sep 93	57.4		167.8	194.9	384.6
2 Mar 93	55.7		164.6	194.3	384.4	21 Sep 93	56.8		167.8	194.9	384.6
9 Mar 93	55.7	55.6	164.7	194.4	384.3	28 Sep 93	56.8		167.8	194.9	384.6

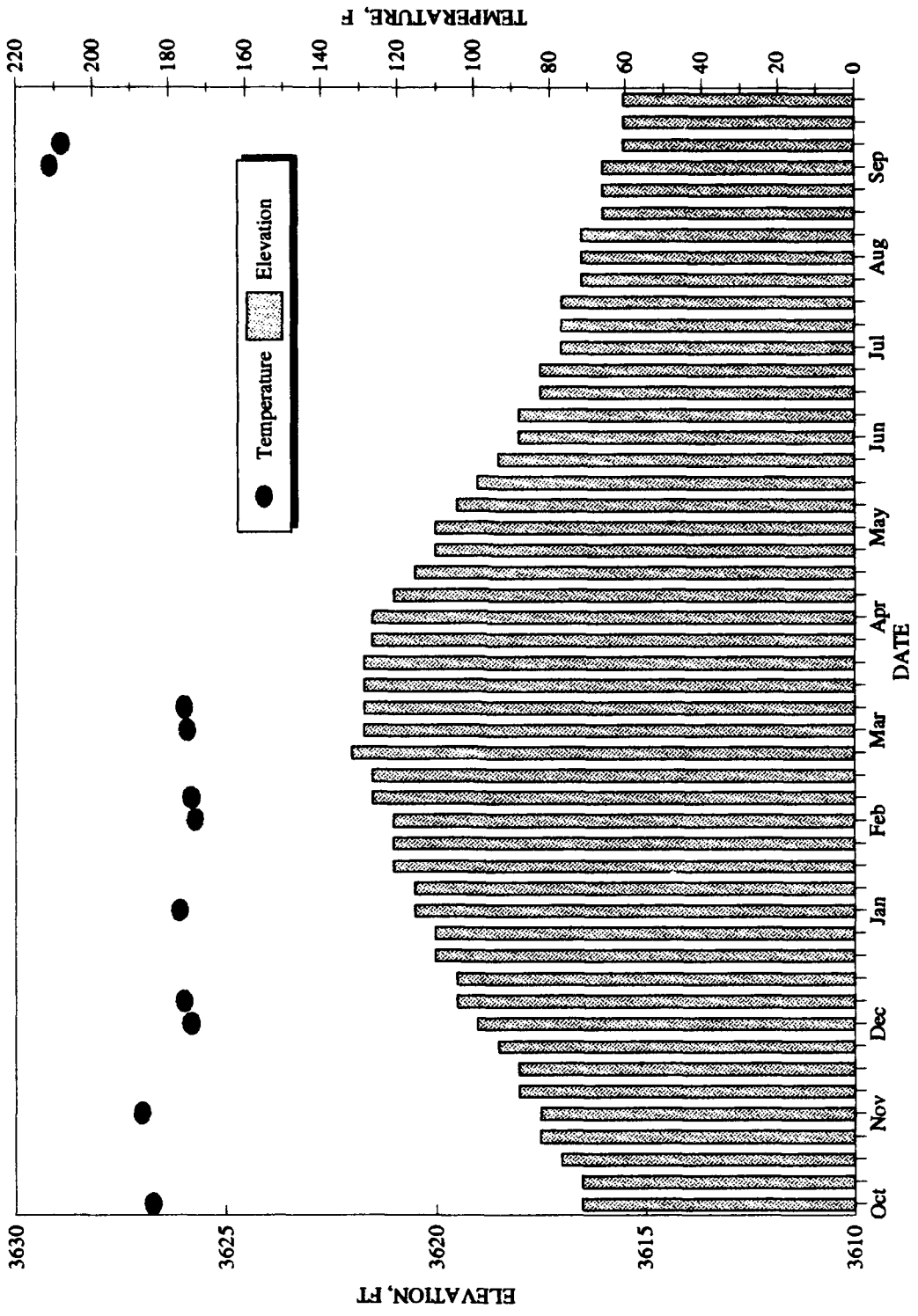


FIGURE 19. South Pool Elevation and Temperature, October 1992 through September 1993.

TABLE 9. South Pool Elevation and Temperature Changes.

Date	Estimated elevation, ft	Water temperature, oF	Date	Estimated elevation, ft	Water temperature, oF
6 Oct 92	3616.5		30 Mar 93	3621.5	
13 Oct 92	3616.5	184	9 Apr 93	3621.5	
19 Oct 92	3617.0		15 Apr 93	3621.0	
27 Oct 92	3617.5		22 Apr 93	3620.5	
4 Nov 92	3617.5		29 Apr 93	3620.0	
10 Nov 92	3618.0		6 May 93	3620.0	
17 Nov 92	3618.0		13 May 93	3619.5	
18 Nov 92		187	19 May 93	3619.0	
24 Nov 92	3618.5		27 May 93	3618.5	
1 Dec 92	3619.0	174	9 Jun 93	3618.0	
7 Dec 92	3619.5		16 Jun 93	3618.0	
16 Dec 92	3619.5		20 Jun 93	3617.5	
21 Dec 92	3620.0		28 Jun 93	3617.5	
27 Dec 92		176	6 Jul 93	3617.0	
29 Dec 92	3620.0		13 Jul 93	3617.0	
5 Jan 93	3620.5		20 Jul 93	3617.0	
12 Jan 93	3620.5	177	27 Jul 93	3616.5	
19 Jan 93	3621.0		3 Aug 93	3616.5	
25 Jan 93	3621.0		10 Aug 93	3616.5	
2 Feb 93	3621.0	173	17 Aug 93	3616.5	
10 Feb 93	3621.5		24 Aug 93	3616.0	
16 Feb 93	3621.5		31 Aug 93	3616.0	
22 Feb 93	3622.0		7 Sep 93	3616.0	211
23 Feb 93		174	14 Sep 93	3615.5	
2 Mar 93	3621.7		21 Sep 93	3615.5	
9 Mar 93	3621.7		26 Sep 93		208
16 Mar 93	3621.7		28 Sep 93	3615.5	
22 Mar 93	3621.7	176			

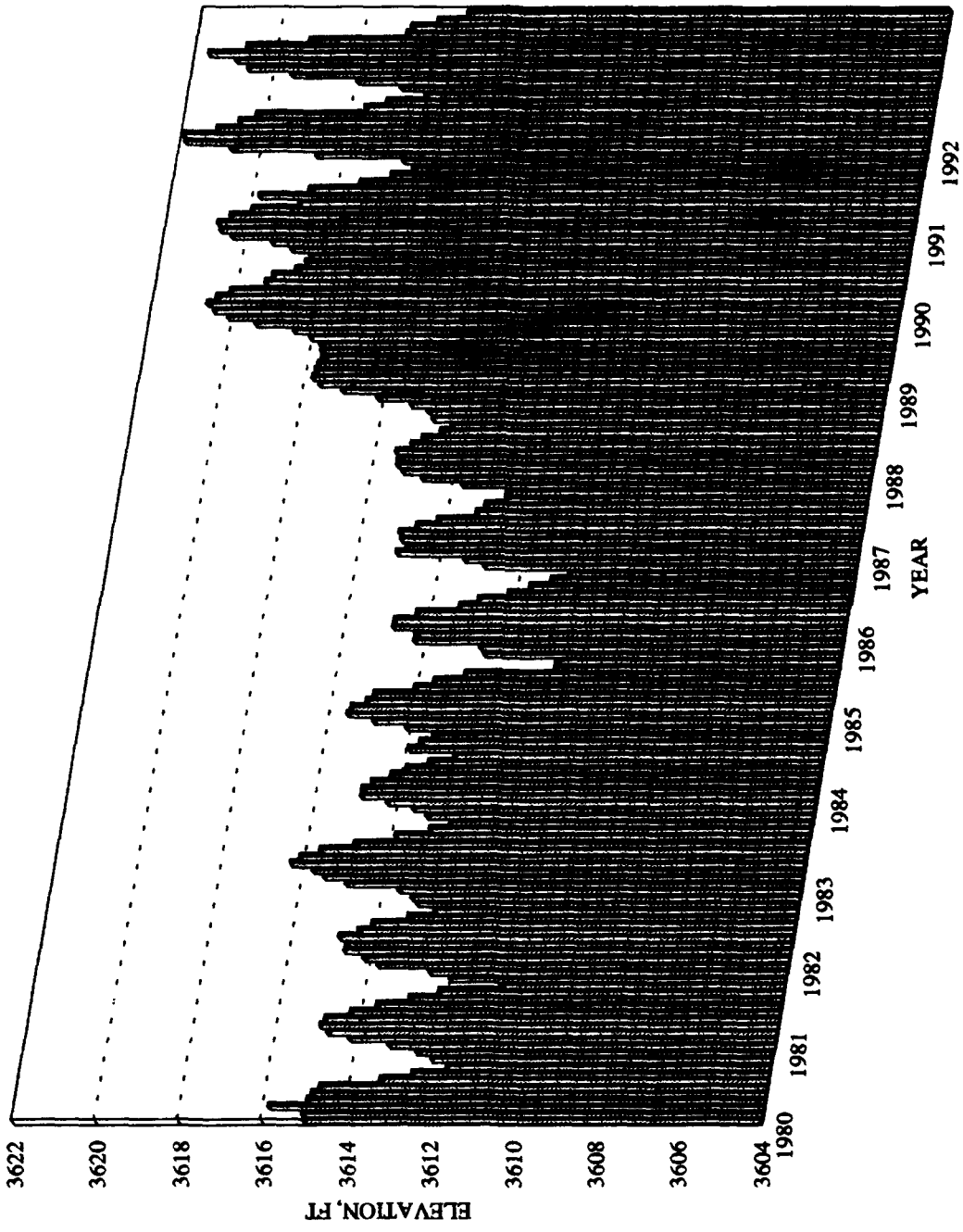


FIGURE 20 . South Pool Elevations, January 1980 through September 1993.

NAWS-CL TP 003

RAINFALL AT COSO RESORT AREA AND ROSE VALLEY

Rainfall in the Coso Hot Springs basin is monitored at five rain station sites, as shown in Figure 1. Instrumentation at each site consists of a battery-operated long-term strip recorder that is triggered by a tipping bucket. This year there were no interruptions in rainfall data collection caused by equipment failures, although we had a short period of time that we had to overlap the charts due to non-availability of charts from vendors. Rain stations are checked for proper operation prior to any major weather front that may bring rain to the area.

Data from the Coso stations presented in Table 10 show daily and cumulative rainfall. The Rose Valley data (Table 11) is collected at the Los Angeles Department of Water and Power Haiwee Reservoir Plant. As shown in Figures 21 and 22, the Coso area generally receives less annual rainfall than Rose Valley. This significant difference in rainfall between two such closely situated areas is not unusual given the nature of high desert storms.

Comparative rainfall data for Coso Basin, Rose Valley, and Indian Wells Valley (IWV) can be found in Table 12. The Indian Wells Valley data were gathered at Armitage Field, Naval Air Warfare Center Weapons Division (NAWCWPNS), and provided by a NAWCWPNS meteorologist.

TABLE 10. Rainfall Recorded at Coso Monitoring Stations.

Date	Tipping bucket stations (rainfall, in.)				
	1	2	3	4	5
24 Oct 92	.47	.30	.58	.07	---
27 Oct 92	.16	.06	.18	.12	.18
30 Oct 92	.02	.02	.04	.05	.02
4 Dec 92	---	---	.02	---	.05
5 Dec 92	---	.01	---	---	---
6 Dec 92	1.77	.14	.17	.78	.50
7 Dec 92	---	.15	1.44	---	---
8 Dec 92	---	.03	---	---	---
11 Dec 92	.06	.06	.03	---	.06
12 Dec 92	.04	---	---	---	---
17 Dec 92	.02	.01	.02	---	.01
28 Dec 92	.08	.04	.07	.06	.14
29 Dec 92	.15	.10	.04	.02	---
30 Dec 92	---	.05	.03	---	---
6 Jan 93	.08	.13	.20	.13	.70
13 Jan 93	.53	---	.55	.95	.05
14 Jan 93	---	---	.06	---	---
15 Jan 93	.15	---	.07	---	.28
16 Jan 93	---	---	---	---	.06
17 Jan 93	---	---	.08	---	.17
18 Jan 93	---	---	.02	.06	.36
19 Jan 93	---	---	---	---	.09
20 Jan 93	---	---	---	---	.07
21 Jan 93	---	---	---	.14	.06
22 Jan 93	---	---	---	.02	---
7 Feb 93	1.00	.14	.18	---	---
8 Feb 93	---	.55	.75	.01	
9 Feb 93	---	---	---	.01	---
11 Feb 93	---	---	---	---	.02
18 Feb 93	.88	.51	.76	.01	---
19 Feb 93	---	.15	.10	---	---
23 Feb 93	.10	.09	.10	---	---
26 Feb 93	.12	.10	.17	---	---

TABLE 10. (Contd.)

Date	Tipping bucket stations (rainfall, in.)				
	1	2	3	4	5
24 Mar 93	---	.16	---	---	---
25 Mar 93	.58	.44	.15	---	---
26 Mar 93	---	---	.43	---	---
27 Mar 93	---	.25	---	---	---
28 Mar 93	.35	.02	.35	---	---
29 Mar 93	---	---	.01	---	---
4 Apr 93	---	---	---	---	.02
TOTAL	6.57	3.51	6.60	2.41	2.85

TABLE 11. Rose Valley Cumulative Rainfall, October 1992 through September 1993.

Date	Daily, in.	Cumulative, in.	Date	Daily, in.	Cumulative, in.
24 Oct 92	0.14	0.14	8 Feb 93	1.05	4.98
25 Oct 92	0.26	0.40	9 Feb 93	1.03	6.01
28 Oct 92	0.03	0.43	19 Feb 93	0.80	6.81
30 Oct 92	0.08	0.51	20 Feb 93	0.02	6.83
31 Oct 92	0.03	0.54	23 Feb 93	0.14	6.97
Nov 92	0.0	0.54	24 Feb 93	0.04	7.01
7 Dec 92	0.67	1.21	26 Feb 93	0.01	7.02
8 Dec 92	0.59	1.80	27 Feb 93	0.21	7.23
11 Dec 92	0.01	1.81	1 Mar 93	0.12	7.35
12 Dec 92	0.02	1.83	25 Mar 93	0.02	7.37
18 Dec 92	0.13	1.96	26 Mar 93	0.86	8.13
29 Dec 92	0.03	1.99	27 Mar 93	0.01	8.14
30 Dec 92	0.08	2.07	28 Mar 93	0.18	8.32
7 Jan 93	0.46	2.53	Apr 93	0	8.32
8 Jan 93	0.52	3.05	May 93	0	8.32
11 Jan 93	0.04	3.09	June 93	0	8.32
13 Jan 93	0.15	3.24	Jul 93	0	8.32
16 Jan 93	0.23	3.47	3 Aug 93	0.08	8.40
18 Jan 93	0.44	3.91	Sept 93	0	8.40
19 Jan 93	0.02	3.93			

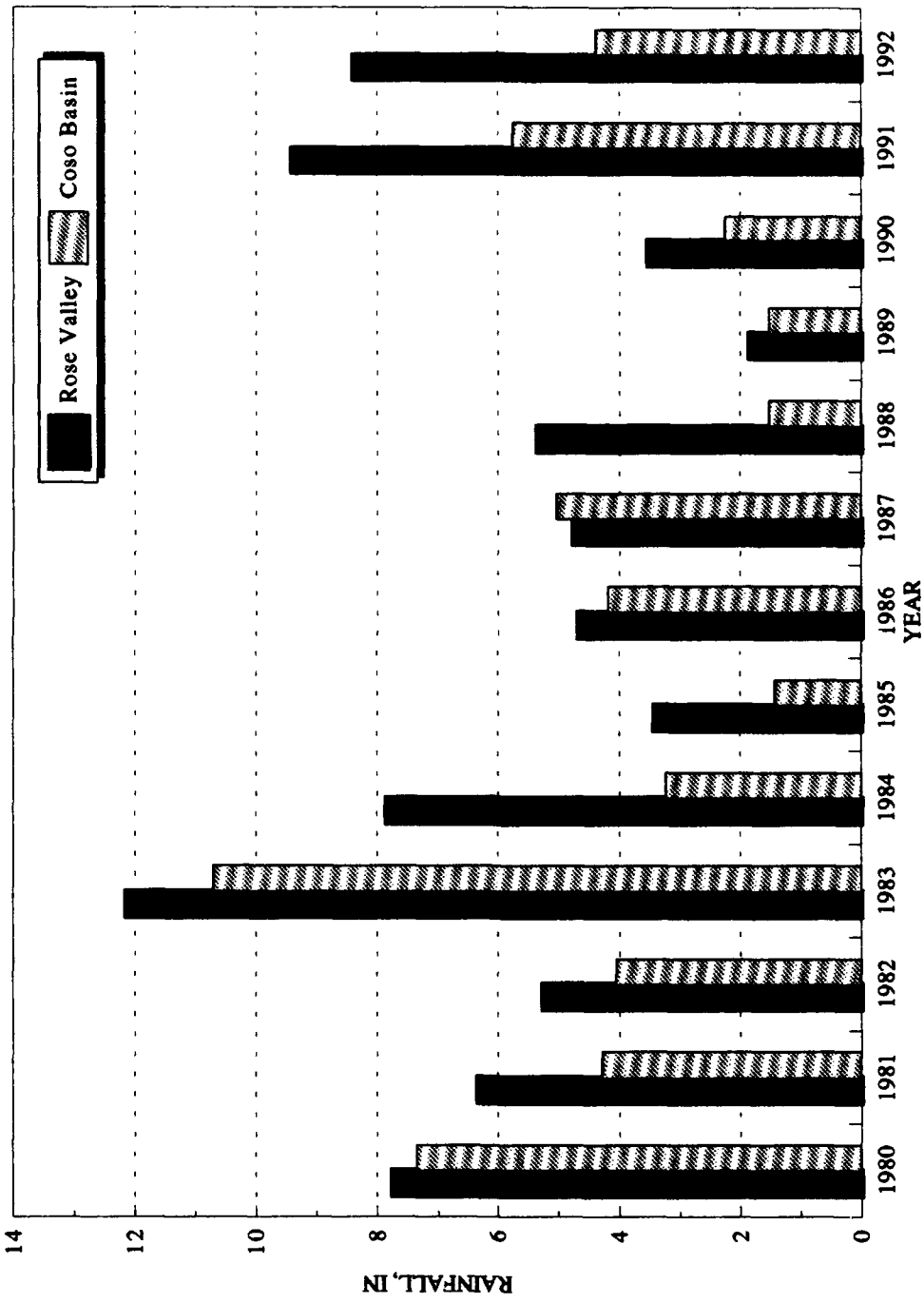


FIGURE 21. Comparison of Total Rainfall at Coso Basin and Rose Valley Sites, by Year.

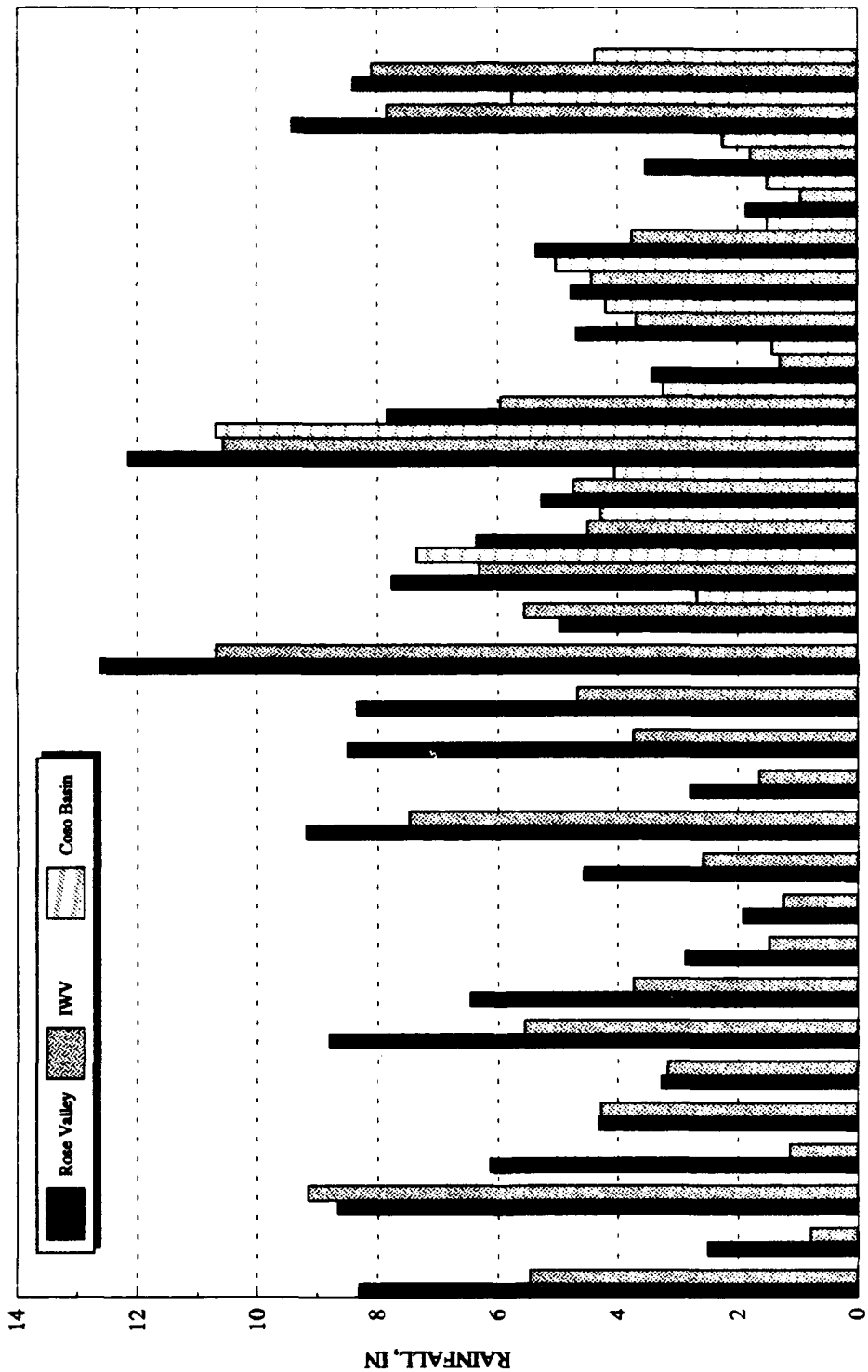


FIGURE 22. Comparison of Total Rainfall at Coso Basin, Rose Valley, and NAWC Sites, by Year, from 1963 to 1992.

TABLE 12. IWV, Rose Valley, and Coso Basin Rainfall Comparison, 1947 through 1992.

Year	Rainfall, in.		
	IWV	Rose Valley	Coso Basin
1947	2.03	---	---
1948	0.87	---	---
1949	1.30	---	---
1950	1.28	---	---
1951	0.84	---	---
1952	5.88	---	---
1953	0.14	---	---
1954	4 07	---	---
1955	0.56	---	---
1956	1.73	---	---
1957	2.68	---	---
1958	3.70	---	---
1959	2.98	---	---
1960	3.01	---	---
1961	2.46	---	---
1962	2.31	---	---
1963	5.45	8.30	---
1964	0.78	2.49	---
1965	9.15	8.66	---
1966	1.31	6.13	---
1967	4.28	4.32	---
1968	3.16	3.26	---
1969	5.55	8.80	---
1970	3.74	6.45	---
1971	1.47	2.87	---
1972	1.24	1.90	---
1973	2.58	4.56	---
1974	7.48	9.19	---
1975	1.64	2.79	---
1976	3.74	8.50	---

TABLE 12. (Contd.)

Year	Rainfall, in.		
	IWV	Rose Valley	Coso Basin
1977	4.67	8.34	---
1978	10.68	12.61	---
1979	5.65	4.97	2.67
1980	6.31	7.75	7.34
1981	4.49	6.34	4.28
1982	4.73	5.26	4.05
1983	10.56	12.14	10.70
1984	5.95	7.84	3.23
1985	1.29	3.42	1.42
1986	3.68	4.68	4.19
1987	4.43	4.77	5.04
1988	3.76	5.36	1.51
1989	0.94	1.85	1.51
1990	1.78	3.53	2.24
1991	7.83	9.41	5.15
1992	8.10	8.40	4.38

COSO HOT SPRINGS MINI-WEATHER RECORDING STATION

Weather Station No. 1 is a mini-weather station consisting of a micro-barograph, a hygrothermograph. A meteorgraph was added to the weather station in June as insurance against failure in the existing equipment. The meteorgraph records barometric pressure, relative humidity, and ambient temperature. Data from this back-up equipment was used several times due to two failures of the micro-barograph and one failure of the hygrothermograph, providing the data that we otherwise would not have been able to record.

An observation comparison study (equipment calibration) was performed quarterly this reporting period by the Range Support Branch (NAWS C32542) personnel using rotronics equipment.

These data are shown graphically in Figures 23, 24, 25, and 26, and also listed in Appendix C.

WATER ANALYSIS OF COSO HOT SPRINGS AREA

Water samples were collected from several sites in the Coso Hot Springs area. These samples were analyzed for a suite of geothermal constituents by B.C. Laboratories, Inc., Bakersfield, California. The results are provided in Tables 13 through 21.

Wells 4K-1, 4P-1, Observation Well No. 1, Schoeber's Well 4A-4, and the South Pool are the sites regularly analyzed. Other sites are occasionally analyzed for comparison studies of the area's water.

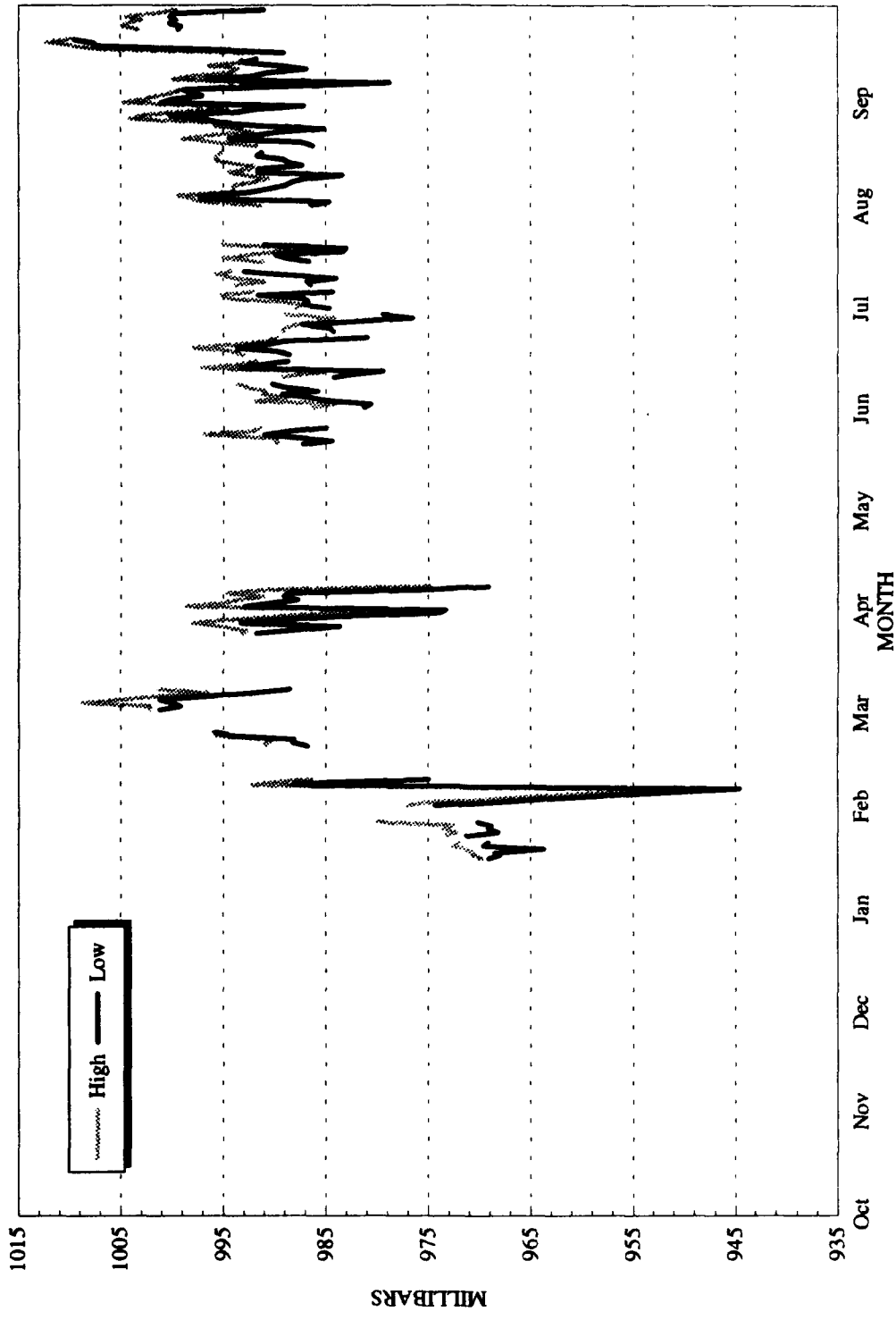


FIGURE 23. Weather Station No. 1 Barometric Pressure.

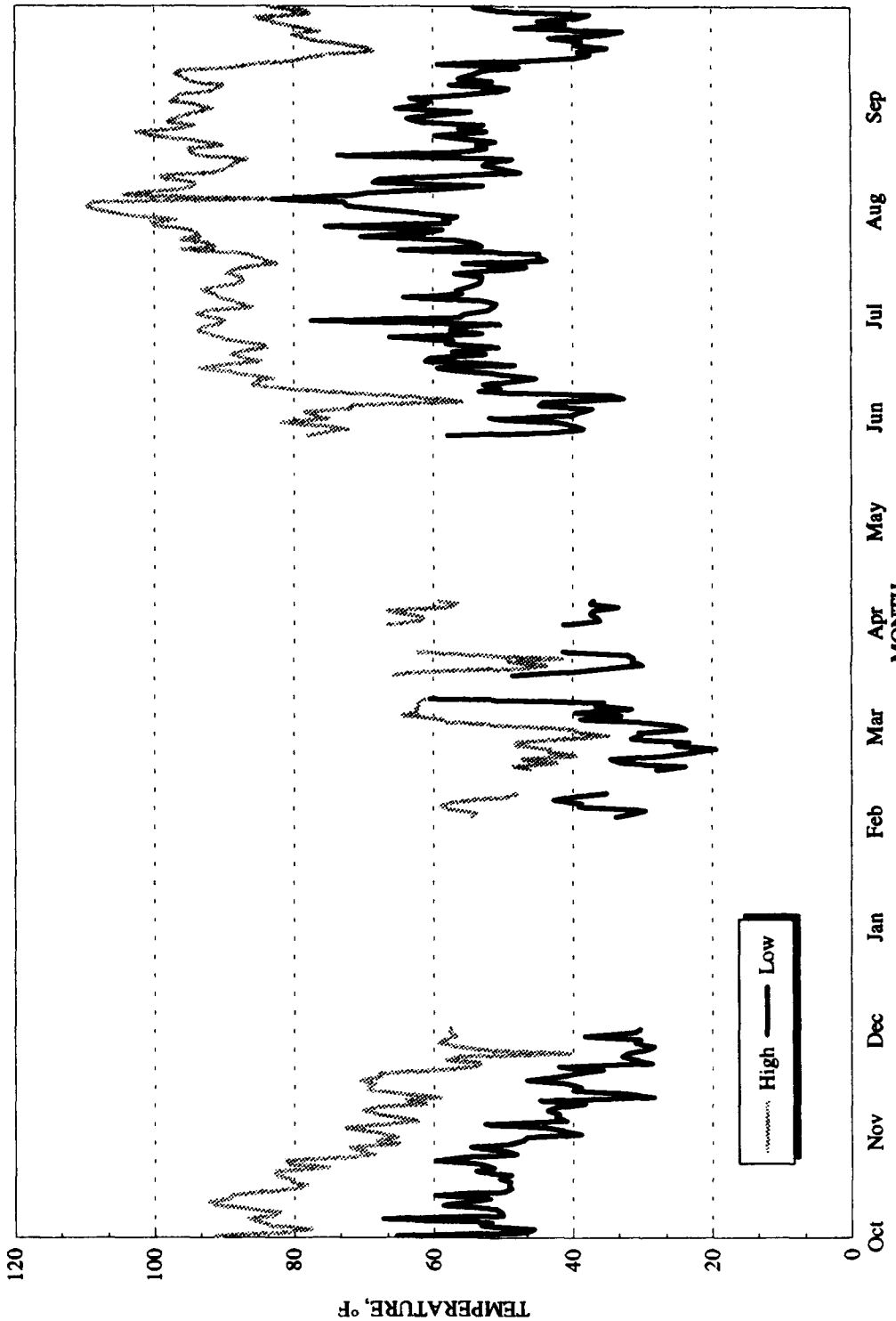


FIGURE 24. Weather Station No. 1 Ambient Temperature.

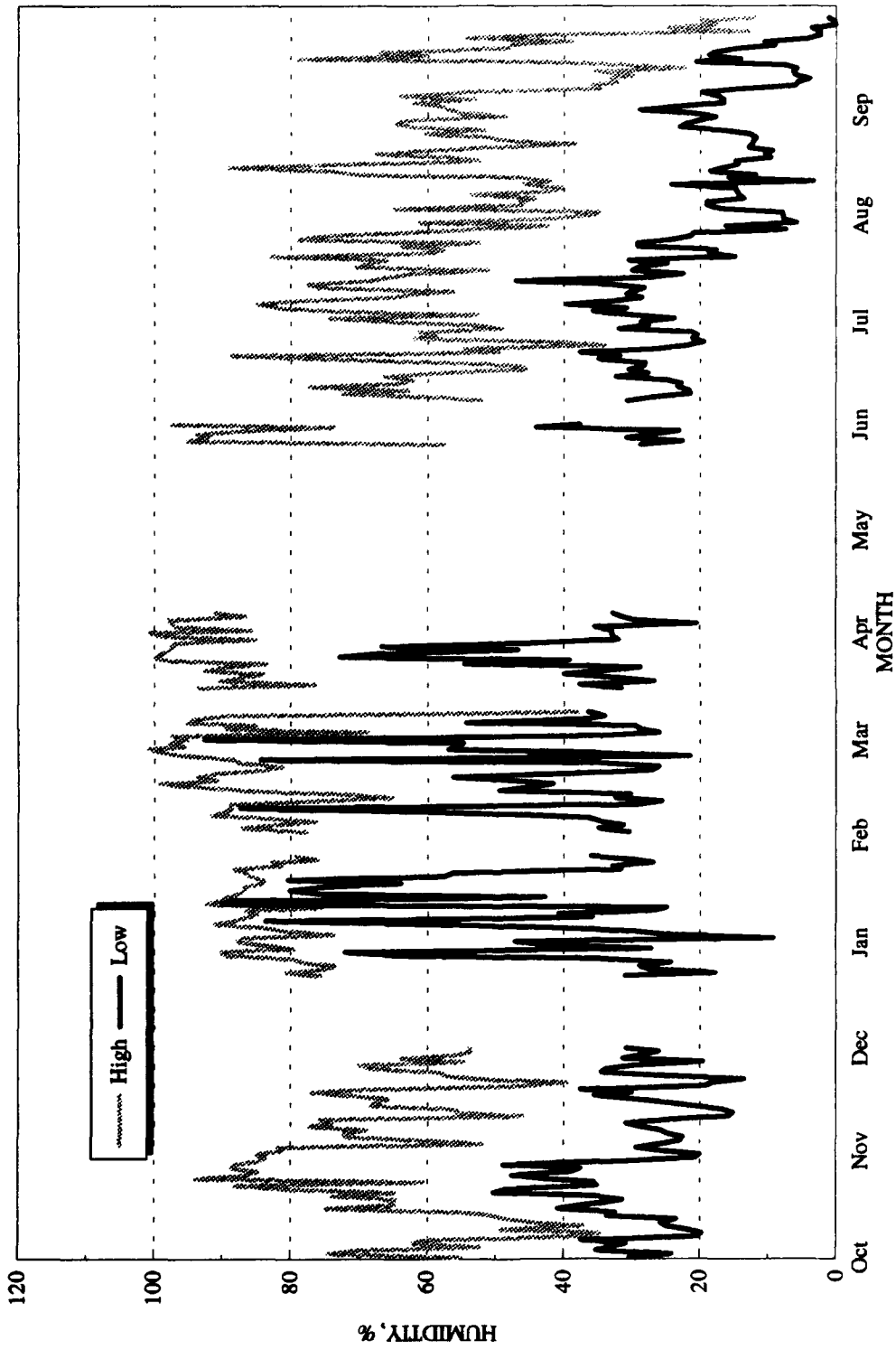


FIGURE 25. Weather Station No. 1 Relative Humidity.

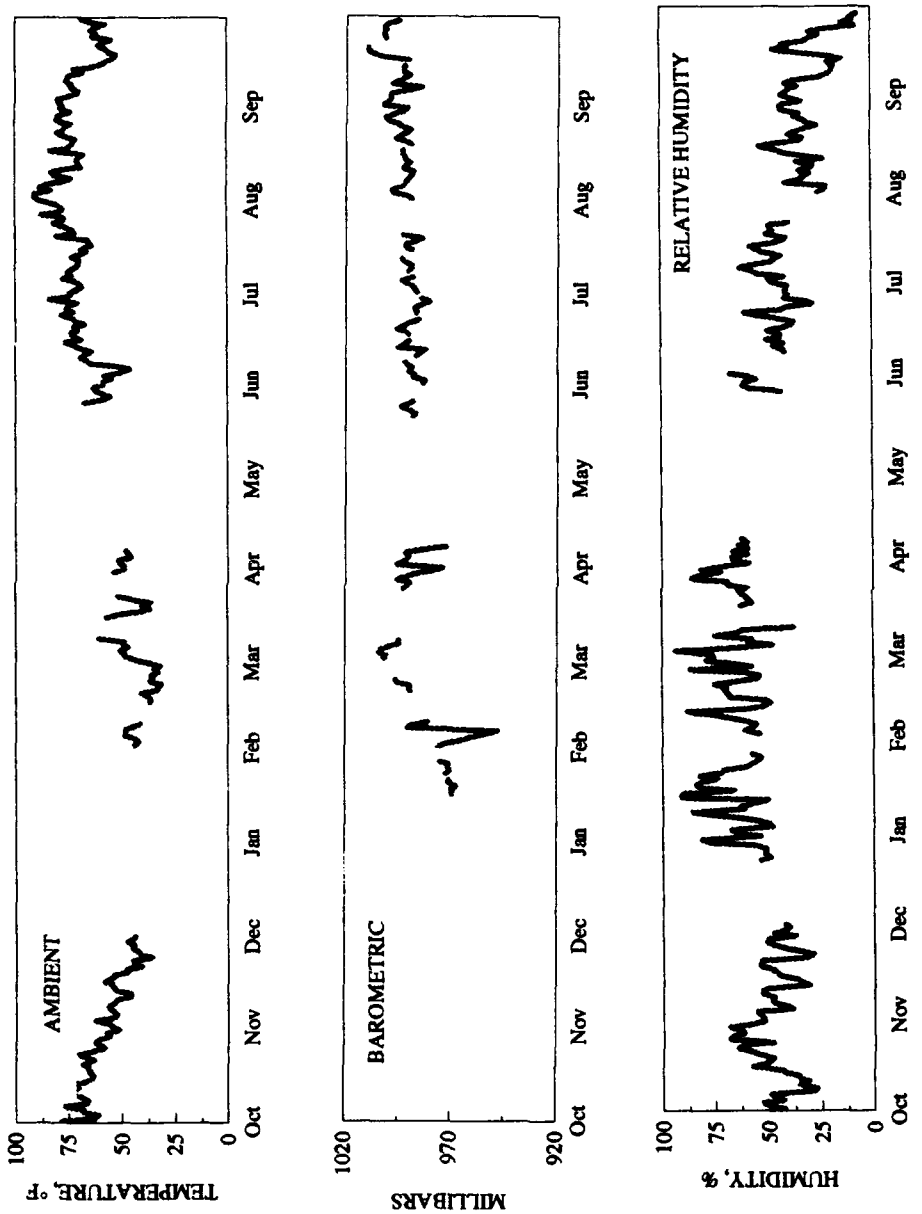


FIGURE 26. Average Highs and Lows for Weather Station No. 1.

TABLE 13. Chemical Analysis of Devils Kitchen.

Constituent	Units	9 Jul 93
Calcium	mg/L	69.
Magnesium	mg/L	26.
Sodium	mg/L	49.
Potassium	mg/L	37.
Carbonate	mg/L	*a*
Bicarbonate	mg/L	*a*
Chloride	mg/L	2.8
Sulfate	mg/L	1120.
Nitrate as NO_3	mg/L	*a*
Fluoride	mg/L	.4
Bromide	mg/L	.8
pH	pH	2.2
Electrical conductivity	umhos/cm	4700.
Total dissolved solids	mg/L	1700.
Acidity as H ion	mg/L	14.4
Aluminum	µg/L	11800.
Antimony	µg/L	*a*
Arsenic	µg/L	25.
Boron	µg/L	4.2
Copper	µg/L	*a*
Lithium	µg/L	70.
Manganese	µg/L	1900.
Mercury	µg/L	1.1
Selenium	µg/L	*a*
Si as SiO_2	mg/L	315.
Strontium	µg/L	92.
Thallium	µg/L	*a*
Zinc	µg/L	63.
Total Iron	µg/L	56300.
Ammonia as NH_3	mg/L	13.8
Nitrite Nitrogen	mg/L	*a*
Ortho-Phosphate	mg/L	.63

a None detected.

TABLE 14. Chemical Analysis of Observation Well No. 1.

Constituent	Units	9 Jul 93
Calcium	mg/L	18.3
Magnesium	mg/L	2.
Sodium	mg/L	815.
Potassium	mg/L	77.
Carbonate	mg/L	*a*
Bicarbonate	mg/L	203.
Chloride	mg/L	1160.
Sulfate	mg/L	105.
Nitrate as NO_3	mg/L	6.6
Fluoride	mg/L	7.6
Bromide	mg/L	1.8
pH	pH	7.3
Electrical conductivity	umhos/cm	4600.
Total dissolved solids	mg/L	2510.
Acidity as H ion	mg/L	*a*
Aluminum	µg/L	*a*
Antimony	µg/L	*a*
Arsenic	µg/L	10050.
Boron	µg/L	33.00
Copper	µg/L	*a*
Lithium	µg/L	6290.
Manganese	µg/L	75.
Mercury	µg/L	7.8
Selenium	µg/L	*a*
Si as SiO_2	mg/L	95.
Strontium	µg/L	1050.
Thallium	µg/L	*a*
Zinc	µg/L	708.
Total Iron	µg/L	1240.
Ammonia as NH_3	mg/L	*a*
Nitrite Nitrogen	mg/L	*a*
Ortho-Phosphate	mg/L	1.1

a None detected.

Table 15. Chemical Analysis of 4P-1.

Constituent	Units	23 Mar 93	9 Jul 93
Calcium	mg/L	15.7	17.7
Magnesium	mg/L	.43	.31
Sodium	mg/L	66.	76.
Potassium	mg/L	34.	43.
Carbonate	mg/L	*a*	*a*
Bicarbonate	mg/L	130.	124.
Chloride	mg/L	3.5	4.
Sulfate	mg/L	114.	135.
Nitrate as NO_3	mg/L	*a*	*a*
Fluoride	mg/L	.56	.58
Bromide	mg/L	*a*	2.5
pH	pH	8.1	8.1
Electrical conductivity	umhos/cm	500.	550.
Total dissolved solids	mg/L	685.	785.
Acidity as H ion	mg/L	*a*	*a*
Aluminum	µg/L	72.	62.
Antimony	µg/L	*a*	*a*
Arsenic	µg/L	4.6	42.
Boron	µg/L	.3	.16
Copper	µg/L	*a*	11.
Lithium	µg/L	31.	*a*
Manganese	µg/L	139.	166.
Mercury	µg/L	14.	1.5
Selenium	µg/L	*a*	*a*
Si as SiO_2	mg/L	385.	340.
Strontium	µg/L	240.	274.
Thallium	µg/L	*a*	*a*
Zinc	µg/L	113.	1600.
Total Iron	µg/L	450.	1470.
Ammonia as NH_3	mg/L	.78	.7
Nitrite Nitrogen	mg/L	*a*	*a*
Ortho-Phosphate	mg/L	.3	.39

a None detected.

TABLE 16. Chemical Analysis of 4K-1.

Constituent	Units	23 Mar 93	9 Jul 93
Calcium	mg/L	3.7	2.6
Magnesium	mg/L	.13	.14
Sodium	mg/L	40.	41.
Potassium	mg/L	6.3	7.7
Carbonate	mg/L	*a*	*a*
Bicarbonate	mg/L	56.5	61.7
Chloride	mg/L	5.2	5.2
Sulfate	mg/L	50.	46.
Nitrate as NO_3	mg/L	*a*	*a*
Fluoride	mg/L	1.1	1.
Bromide	mg/L	*a*	.23
pH	pH	7.3	7.3
Electrical conductivity	umhos/cm	260.	250.
Total dissolved solids	mg/L	420.	415.
Acidity as H ion	mg/L	a	*a*
Aluminum	µg/L	602.	60.
Antimony	µg/L	*a*	*a*
Arsenic	µg/L	2.2	20.
Boron	µg/L	.31	.25
Copper	µg/L	50.	a
Lithium	µg/L	33.	a
Manganese	µg/L	49.	37.
Mercury	µg/L	185.	65.
Selenium	µg/L	*a*	*a*
Si as SiO_2	mg/L	270.	267.
Strontium	µg/L	75.	28.
Thallium	µg/L	*a*	*a*
Zinc	µg/L	182.	239.
Total Iron	µg/L	1580.	1810.
Ammonia as NH_3	mg/L	2.1	2.2
Nitrite Nitrogen	mg/L	*a*	*a*
Ortho-Phosphate	mg/L	.39	.51

a None detected.

TABLE 17. Chemical Analysis of 4A-4 (Schobers).

Constituent	Units	23 Mar 93	9 Jul 93
Calcium	mg/L	119.	21.
Magnesium	mg/L	.7	.24
Sodium	mg/L	55.	44.
Potassium	mg/L	3.5	1.7
Carbonate	mg/L	*a*	4.3
Bicarbonate	mg/L	*a*	75.6
Chloride	mg/L	2.1	5.7
Sulfate	mg/L	110.	71.
Nitrate as NO_3	mg/L	306.	*a*
Fluoride	mg/L	.58	.35
Bromide	mg/L	a	.26
pH	pH	3.6	8.4
Electrical conductivity	umhos/cm	1100.	300.
Total dissolved solids	mg/L	910.	345.
Acidity as H *ion*	mg/L	.9	*a*
Aluminum	µg/L	909.	115.
Antimony	µg/L	*a*	*a*
Arsenic	µg/L	12.	24.
Boron	µg/L	.1	*a*
Copper	µg/L	*a*	*a*
Lithium	µg/L	*a*	*a*
Manganese	µg/L	901.	16.
Mercury	µg/L	.34	7930.
Selenium	µg/L	*a*	*a*
Si as SiO_2	mg/L	133.	87.
Strontium	µg/L	1480.	216.
Thallium	µg/L	*a*	*a*
Zinc	µg/L	129.	17.
Total Iron	µg/L	1590.	115000.
Ammonia as NH_3	mg/L	.87	.62
Nitrite Nitrogen	mg/L	*a*	*a*
Ortho-Phosphate	mg/L	18.	.3

a None detected.

TABLE 18. Chemical Analysis of South Pool.

Constituent	Units	23 Mar 93	9 Jul 93
Calcium	mg/L	85.	80.
Magnesium	mg/L	57.	56.
Sodium	mg/L	19.4	17.6
Potassium	mg/L	24.	4.6
Carbonate	mg/L	*a*	*a*
Bicarbonate	mg/L	*a*	*a*
Chloride	mg/L	6.	*a*
Sulfate	mg/L	4120.	2490.
Nitrate as NO_3	mg/L	*a*	*a*
Fluoride	mg/L	*a*	0.25
Bromide	mg/L	*a*	*a*
pH	pH	2.	2.3
Electrical conductivity	umhos/cm	9600.	6400.
Total dissolved solids	mg/L	5720.	4240.
Acidity as H ion	mg/L	69.	31.5
Aluminum	µg/L	138000.	24400.
Antimony	µg/L	*a*	*a*
Arsenic	µg/L	15.	138.
Boron	µg/L	18.5	21.
Copper	µg/L	399.	*a*
Lithium	µg/L	113.	134.
Manganese	µg/L	3530.	3370.
Mercury	µg/L	*a*	0.8
Selenium	µg/L	*a*	*a*
Si as SiO_2	mg/L	722.	414.
Strontium	µg/L	24.	*a*
Thallium	µg/L	5.6	*a*
Zinc	µg/L	1180.0	1160.
Total Iron	µg/L	665000.	713500.
Ammonia as NH_3	mg/L	92.	82.
Nitrite Nitrogen	mg/L	*a*	*a*
Ortho-Phosphate	mg/L	2.4	2.5

a None detected.

TABLE 19. Chemical Analysis of West Canyon Water.

Constituent	Units	23 Mar 93	9 Jul 93
Calcium	mg/L	36.	92.
Magnesium	mg/L	7.4	13.3
Sodium	mg/L	39.	94.
Potassium	mg/L	17.9	36.
Carbonate	mg/L	*a*	*a*
Bicarbonate	mg/L	*a*	*a*
Chloride	mg/L	*a*	17.2
Sulfate	mg/L	245.	515.
Nitrate as NO_3	mg/L	*a*	*a*
Fluoride	mg/L	.36	.33
Bromide	mg/L	*a*	.11
pH	pH	4.1	3.7
Electrical conductivity	umhos/cm	610.	1210.
Total dissolved solids	mg/L	705.	1180.
Acidity as H ion	mg/L	.5	.7
Aluminum	µg/L	601.	232.
Antimony	µg/L	*a*	*a*
Arsenic	µg/L	15.	28.
Boron	µg/L	.11	.31
Copper	µg/L	43.	10.
Lithium	µg/L	*a*	*a*
Manganese	µg/L	1520.	5800.
Mercury	µg/L	13.	3.2
Selenium	µg/L	*a*	33.
Si as SiO_2	mg/L	289.	300.
Strontium	µg/L	130.	271.
Thallium	µg/L	*a*	*a*
Zinc	µg/L	71.	20.
Total Iron	µg/L	4910.	4360.
Ammonia as NH_3	mg/L	4.4	11.6
Nitrite Nitrogen	mg/L	*a*	*a*
Ortho-Phosphate	mg/L	1.08	.96

a None detected.

TABLE 20. Chemical Analysis of Fault Line Pools.

Constituent	Units	23 Mar 93	9 Jul 93
Calcium	mg/L	7.	40.
Magnesium	mg/L	4.7	13.
Sodium	mg/L	9.3	29.
Potassium	mg/L	8.	16.2
Carbonate	mg/L	*a*	*a*
Bicarbonate	mg/L	*a*	*a*
Chloride	mg/L	*a*	*a*
Sulfate	mg/L	520.	414.
Nitrate as NO_3	mg/L	*a*	*a*
Fluoride	mg/L	.12	.56
Bromide	mg/L	*a*	*a*
pH	pH	2.6	2.8
Electrical conductivity	umhos/cm	2200.	1350.
Total dissolved solids	mg/L	900.	920.
Acidity as H ion	mg/L	8.1	2.5
Aluminum	µg/L	22500.	2860.
Antimony	µg/L	*a*	*a*
Arsenic	µg/L	4.7	3.
Boron	µg/L	*a*	.18
Copper	µg/L	*a*	*a*
Lithium	µg/L	*a*	*a*
Manganese	µg/L	297.	3660.
Mercury	µg/L	43.	.66
Selenium	µg/L	*a*	*a*
Si as SiO_2	mg/L	190.	262.
Strontium	µg/L	21.	64.
Thallium	µg/L	*a*	*a*
Zinc	µg/L	64.	23.
Total Iron	µg/L	57000.	7320.
Ammonia as NH_3	mg/L	19.4	27.
Nitrite Nitrogen	mg/L	*a*	*a*
Ortho-Phosphate	mg/L	.39	.51

a None detected.

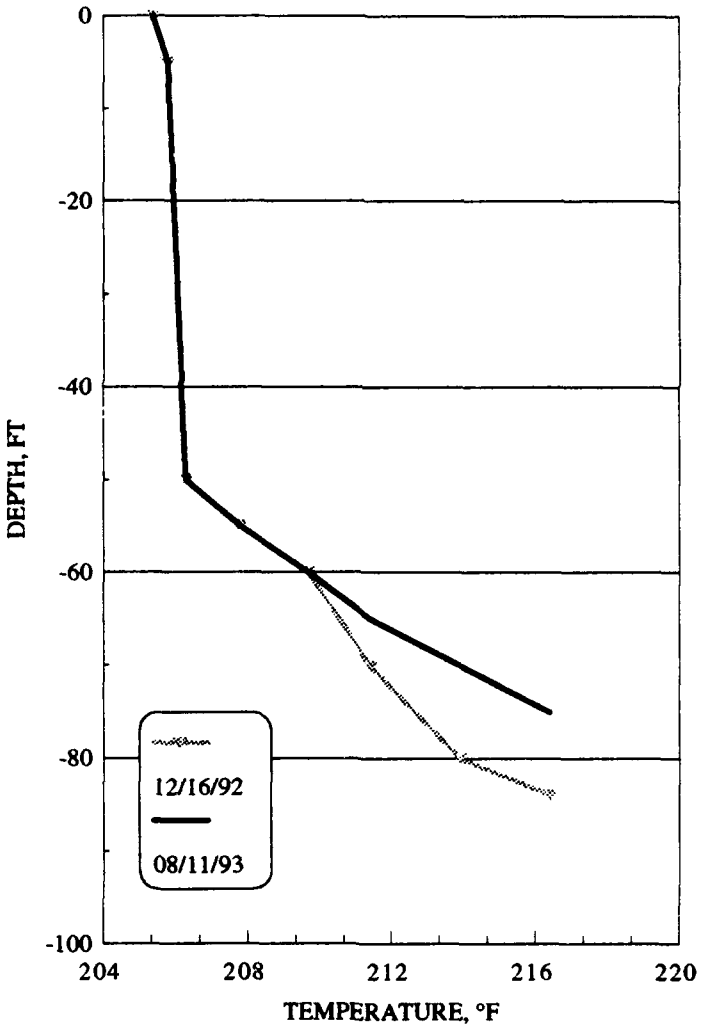
TABLE 21. Chemical Analysis of Nicol Prospect.

Constituent	Units	23 Mar 93	9 Jul 93
Calcium	mg/L	39.	31.
Magnesium	mg/L	12.1	9.6
Sodium	mg/L	624.	510.
Potassium	mg/L	68.	87.
Carbonate	mg/L	*a*	*a*
Bicarbonate	mg/L	*a*	*a*
Chloride	mg/L	1100.	955.
Sulfate	mg/L	390.	685.
Nitrate as NO_3	mg/L	*a*	*a*
Fluoride	mg/L	.42	.32
Bromide	mg/L	2.2	1.8
pH	pH	2.4	2.2
Electrical conductivity	umhos/cm	5900.	6600.
Total dissolved solids	mg/L	2540.	2380.
Acidity as H ion	mg/L	8.70	12.5
Aluminum	µg/L	13200.	16100.
Antimony	µg/L	*a*	*a*
Arsenic	µg/L	505.	588.
Boron	µg/L	24.	20.
Copper	µg/L	*a*	*a*
Lithium	µg/L	970.	1280.
Manganese	µg/L	1550.	1290.
Mercury	µg/L	27.	53.
Selenium	µg/L	*a*	*a*
Si as SiO_2	mg/L	364.	302.
Strontium	µg/L	50.	66.
Thallium	µg/L	7.1	5.7
Zinc	µg/L	103.	109.
Total Iron	µg/L	38600.	34100.
Ammonia as NH_3	mg/L	5.5	3.3
Nitrite Nitrogen	mg/L	*a*	*a*
Ortho-Phosphate	mg/L	.96	.69

a None detected.

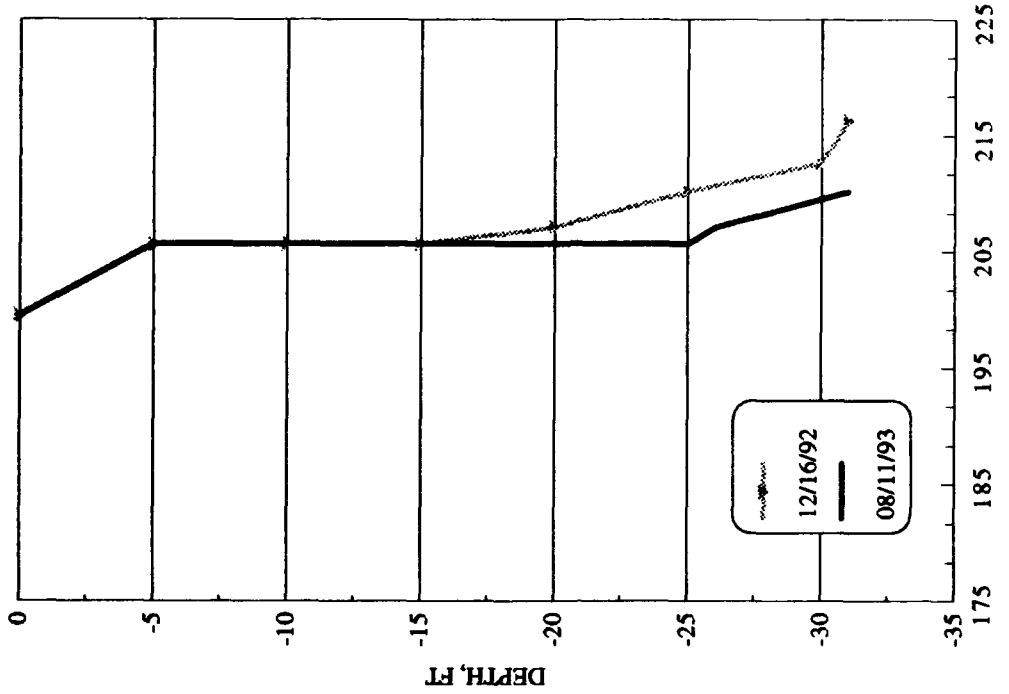
TEMPERATURE RECORDINGS OF THE COSO RESORT AREA WELLS

The temperature logs from Wells 4K-1, 4P-1, Schoeber's Well 4A-4, and Observation Wells OB-1, OB-2, and OB-3 are graphed in Figure 27, with the data listed in Appendix D. These data were recorded using the TD Probe System, manufactured by Natural Progress Instruments, Dallas, Texas.

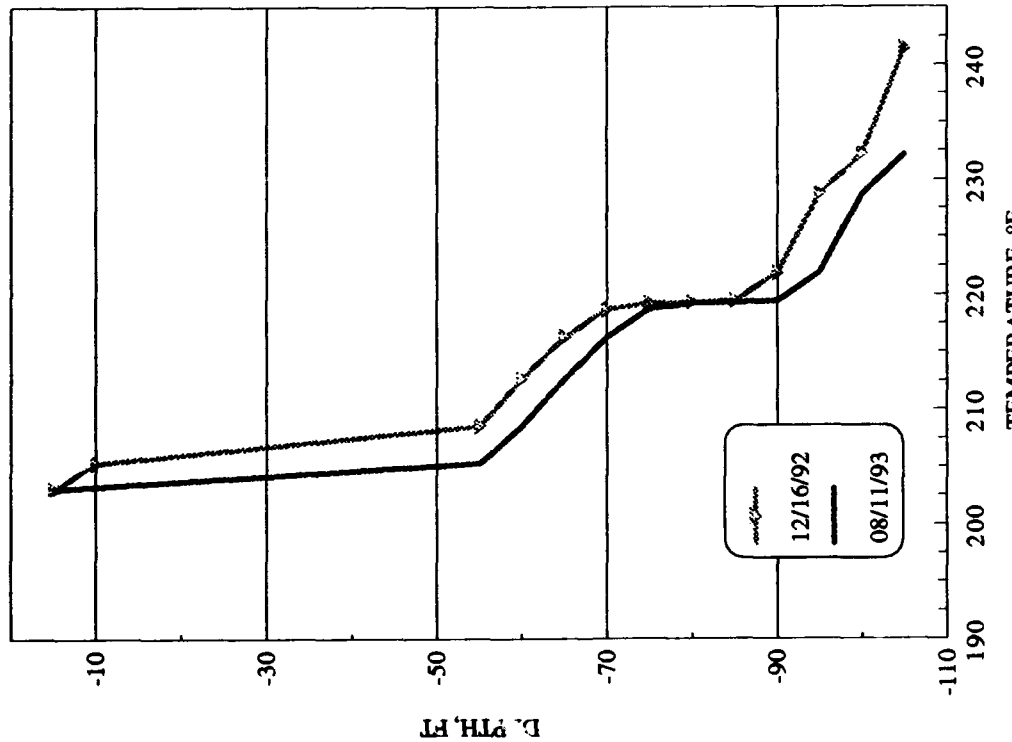


(a) Well 4K-1.

FIGURE 27. Temperature Profiles.

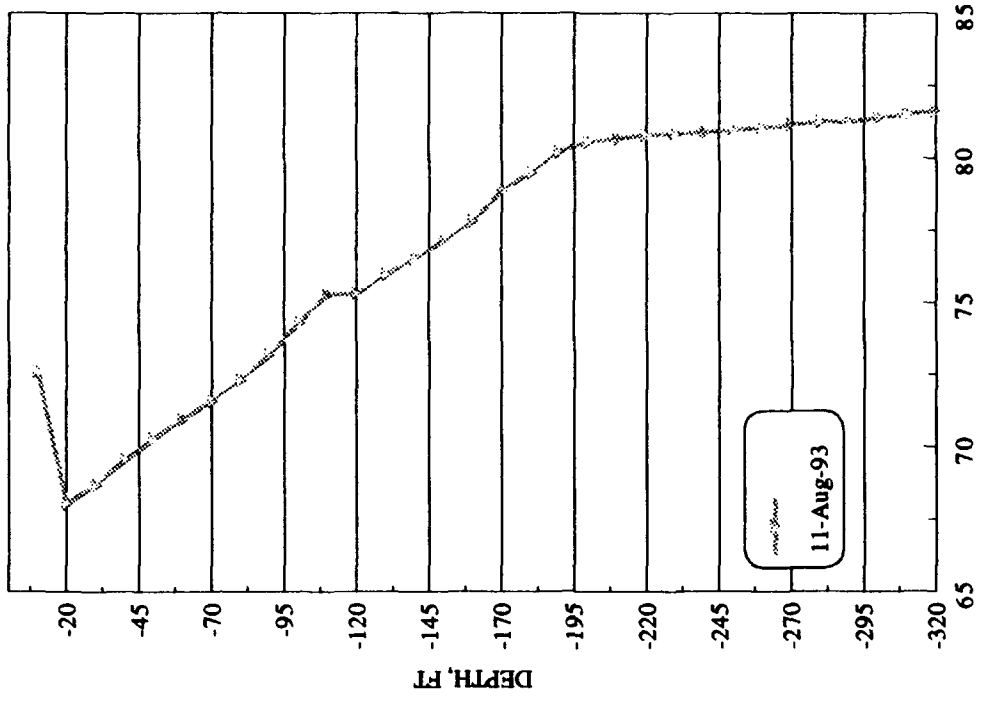


(c) Well 4A-4.

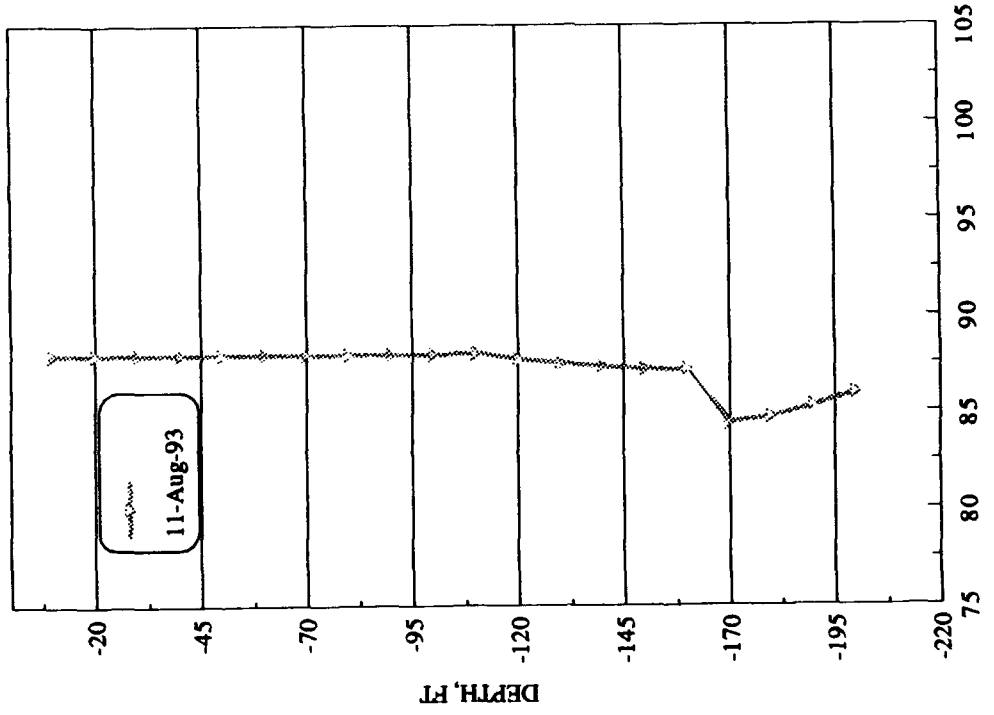


(b) Well 4P-1.

FIGURE 27. (Contd.)

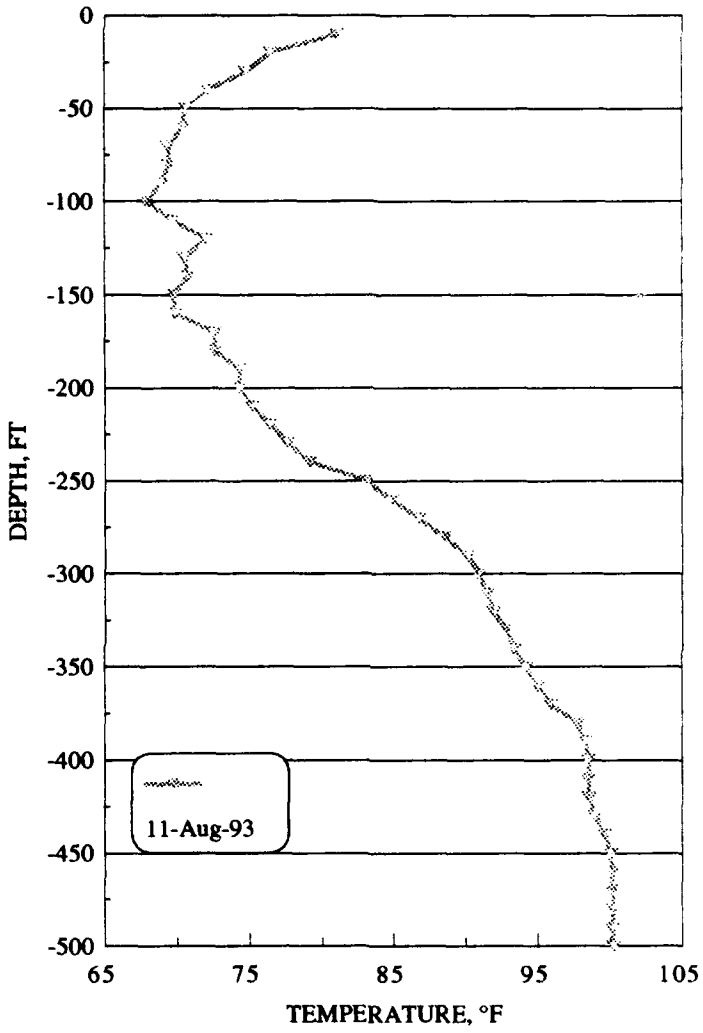


(e) Well OB-2.



(d) Well OB-1.

FIGURE 27. (Contd.)



(f) Well OB-3.

FIGURE 27. (Contd.)

OTHER GEOTHERMAL ACTIVITY AT COSO HOT SPRINGS

WEST CANYONS

These two canyons are located west of the Resort and run perpendicular to the strike of the Coso Hot Springs fault. The southerly canyon is directly below rain station No. 2 and includes both thermal features in the canyon and a wide area at the mouth of the canyon of hydrothermal alteration and scattered thermal activity. There is substantial evidence for a long history of thermal activity in the canyon, as well as historic utilization of these thermal features.

In March, 1993 rainfall run-off caused several small features, including steam vents, mud pots, and boiling water pools, to combine forming a single boiling pool 15 feet long by 5 feet wide. The majority of the steam at this site appears to have been redirected to a single, 4-foot diameter steam vent adjacent to this pool. Water chemistry of the boiling pool is presented in Table 18.

The northerly canyon holds a wide area of hydrothermal alteration and fossil hot springs deposits but current thermal activity is limited to warm to hot ground with a few small steam vents. The ground slump noted in last years report, NAWS-CL TP-001, has not yet stabilized. Figure 28 shows the slump in aerial view. The highwall at the top shows up to 3 feet of separation and the toe has also moved several feet. As previously noted, the geology, as well as the geometry of these two canyons, indicates that this is a recurring phenonena caused by the combination of a variety of things, including hydrothermal alteration and active steam discharge, sharp topography, and desert rainfall and runoff patterns.

COSO RESORT MUDFIELD

The mud field has again remained fairly dormant. Seasonal cycles of wet and dry were repeated but the activity was not severe and there was no significant growth in crater diameter. Over 80 percent of the crater dryed out during the summer, leaving only scattered steam vents in the bottom. This left observers with the impression that the crater was deeper than it had been in past years. The area will probably continue to slowly enlarge over the next couple of years, particularly due to sloughing of the crater highwall on the west and south sides. The area is shown in the aerial photo, Figure 29.

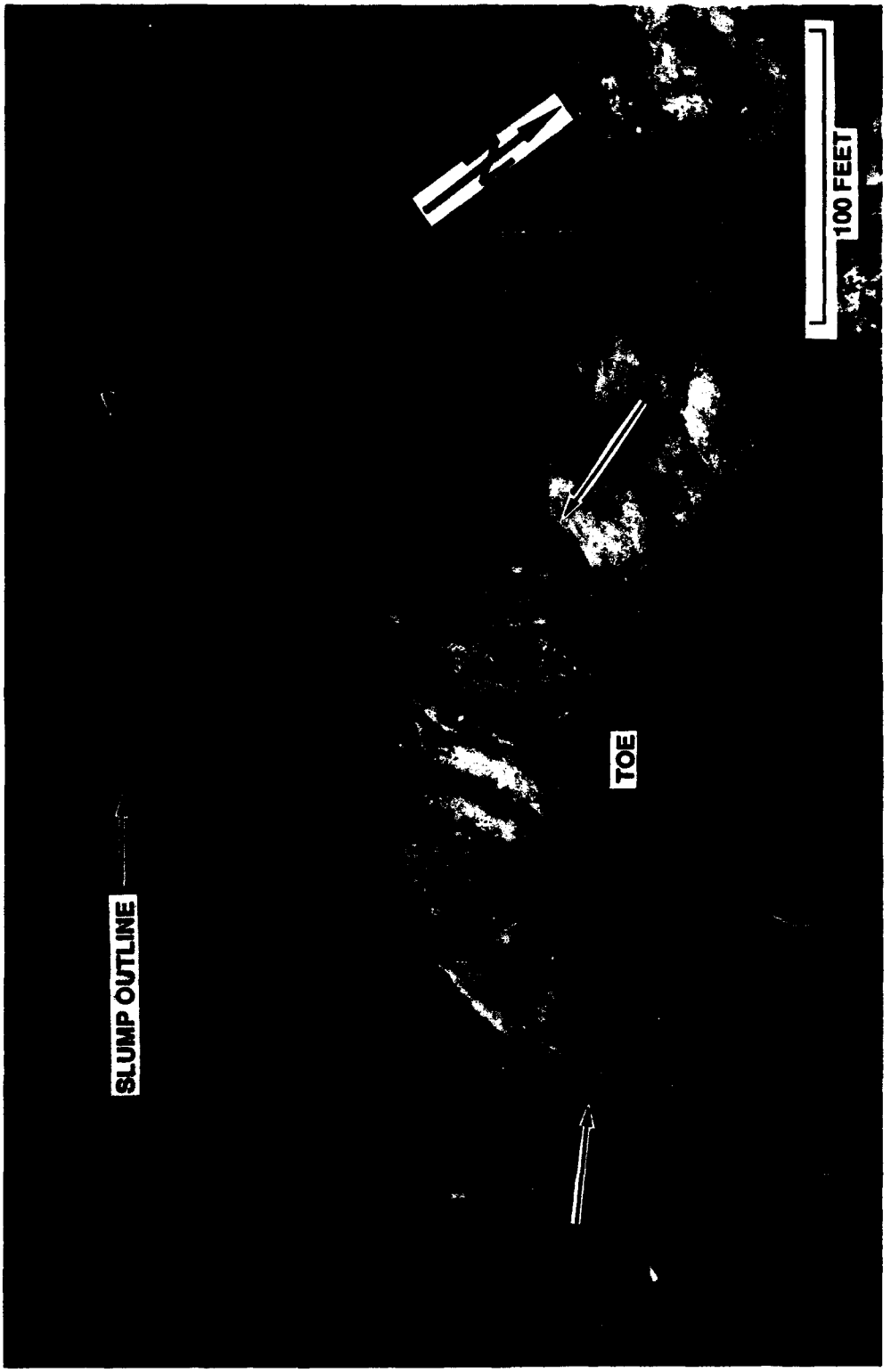


FIGURE 28. West Canyon Slump.

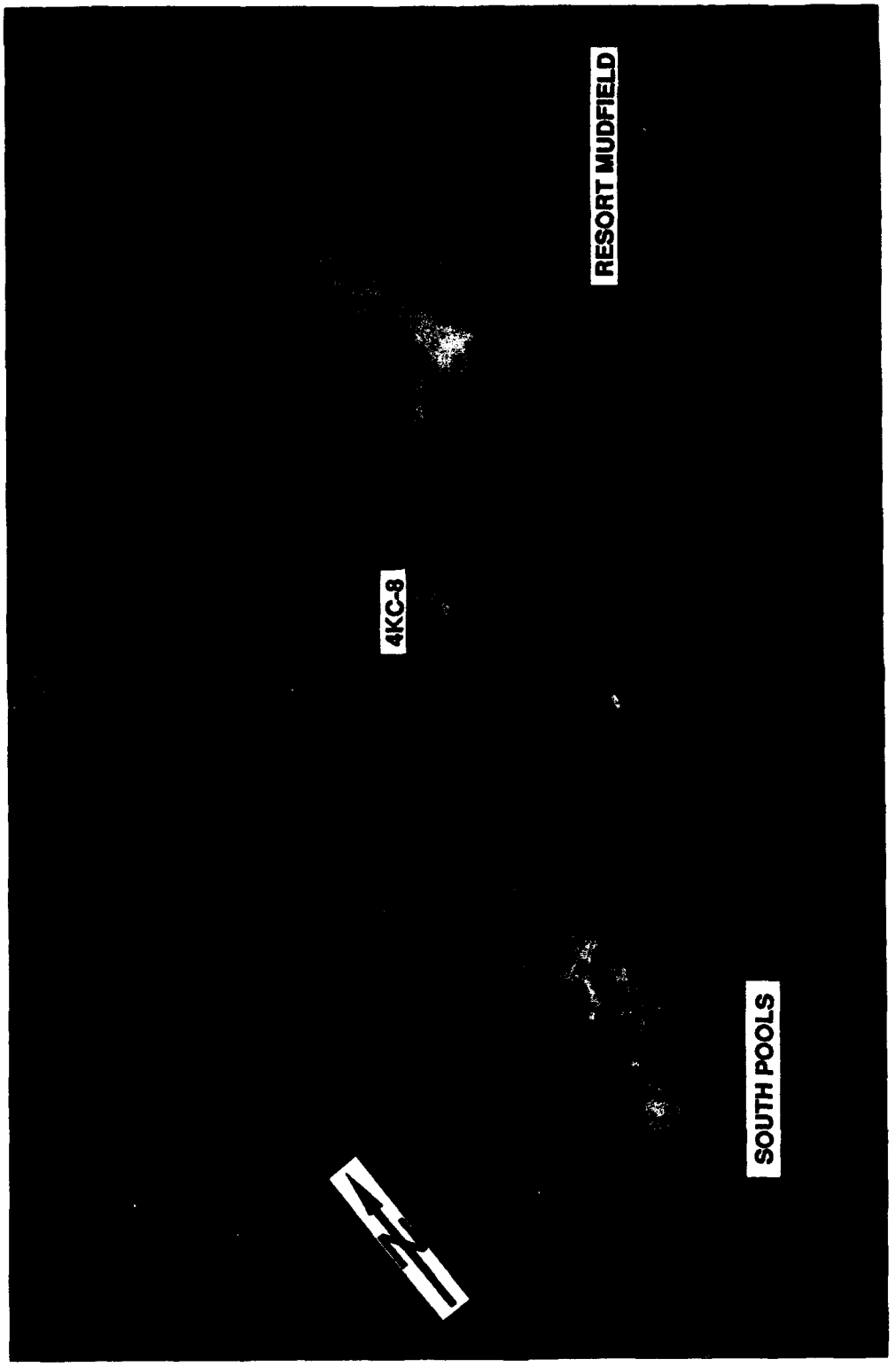


FIGURE 29. Aerial Photo of Coso Hot Springs Activity.

BETWEEN THE SOUTH POOL AND THE RESORT MUDFIELD

This area, today, as in the past, has several sites of minor mud pool and fumerole activity in addition to some moderate to large craters, including 4KC-8. The two moderate craters on the east side have shown little sign of growth during the past year. Interestingly, one of the craters exhibits typical seasonal behavior while the other, directly adjacent to it, maintains a constant level of bright rust-colored, 182°F, water. As can be seen in Figure 29, one of the sites of minor activity adjacent to the south rim of the Resort mud field has grown into a crater that is approximately 15 feet in diameter and is still very active. Crater 4KC-8 continues to exhibit a moderate level of activity following typical seasonal variations, but it has not grown any larger.

ALONG FAULT LINE, BETWEEN THE SOUTH POOL AND THE COSO ROAD

This area, consisting of a series of small mud pots and pools strung along 300 feet of the down-thrown edge of the Coso Hot Springs fault, has exhibited steady activity and slow growth over the past year. Most of the growth occured during January through March when rainfall caused the up-thrown and undercut edges of a number of the holes to cave-in. The largest of the resulting pools is approximately 25 to 30 feet long and 15 feet wide. In contrast to the rest of the thermal activity of the Hot Springs, there has never been any violent perking of mud or water on this zone.

WELL 4H-8 (Coso No. 1)

Well 4H-8 was drilled in 1967 as part of a study of the Coso Thermal Area to determine the applicability of the local shallow steam or hot water deposits to anticipated Navy research projects. The well, located on the Coso Fault Zone, was completed to 375 feet in granite bedrock and initially provided data on the depth and type of hydrothermal alteration, as well as, uncontaminated geothermal fluids. When the Coso Hot Springs monitoring program began in 1978, this well was included as a data collection site and ultimately became a primary monitoring site for tracking thermal emissions at the hot springs (Reference NWC TP-6195, July 1980).

In 1988, the water level of Coso No. 1 dropped about 55 feet and the fluid chemistry showed a marked increase in salinity. These changes indicated that the amount of water entering the well was not keeping up with the evaporation rate, or boiling, in the well bore (Reference NWC TP 6988, April 1989).

By 1989, the well bore was totally blocked at about 210 feet. In February 1989, a workover rig was contracted to rehabilitate the well. The constriction was enlarged and well fluids were lifted using compressed air. The well produced mud, sand, plastic fittings; and other debris, then water and steam. A 2-inch pipe was hung in the well down to 344 feet. The rehabilitation was completed in May 1989. Within several days the water in the well had returned to historic levels. By January 1991, however, the well had again become totally plugged.

In an effort to rehabilitiate this site, the Geothermal Program Office (GPO) plans to work-over this well in January 1994. We will refurbish the wellhead, remove the 2-inch pipe, as well as all other obstructions inside the 4-inch casing, run a video log to check casing integrity, and run a string of 2-7/8 inch pipe inside the 4-inch casing to total depth, as needed. Monitoring equipment will then be installed and a maintenance program established to keep the well open.

The well has the potential to provide several different data sets important to the continued assessment of the hydrology of the hot springs. These include depth to water of the hot springs brine reservoir and chemistry of this brine, temperature profiles of the upper 375 feet of the hot springs, and steam pressure in the near surface steam zone below the surface condensate interval. None of these data are available from any other monitoring site.

DISCUSSION AND SUMMARY

The hot springs monitoring program has existed since 1978. Several different forms of thermal emissions (fumaroles, boiling mud pots, hot water pools, steam wells, and hot water wells) are monitored at a number of sites scattered in and around the Coso Hot Springs. All of the data now recorded must be manually input into computer form none are available without manipulation. Data from the Barton meters and the weather station are digitized, tabulated, and edited before it can be used. All other data is either manually recorded at the time its taken or hand-picked from strip charts. All of this data is then tabulated and input into a data base that eventually becomes an annual report. In addition, many sites are only recorded on an irregular basis-weekly, quarterly, etc. Because of the disparent data sets, statistical comparisons and manipulations have been difficult.

Computerizing the monitoring stations would have several advantages including continuous data recording at all sites and the elimination of numerous holes in the data that are inherent in the system today. Computerized data can be scaled, averaged, selected, or otherwise screened at the data site or modified to meet specific short-term data requirements. This transformation is now under way.

The GPO has purchased and is installing a new weather station at the WS-1 site. The station will include tower with solar panels, barometer, thermometer, hygrometer, H_2S monitor, wind speed and direction sensor, and data recorder with associated down-load software. The data can be acquired for up to several weeks at a time and then downloaded directly into a GPO field computer. The station is being purchased from the Handar Corporation, Sunnyvale, California.

Each of the other sites includes some significant environment limitations in regard to computer equipment. The general limitations include (1) all sites must be considered remote; (2) all equipment must run on solar/battery power; and (3) these sites are unprotected from the weather. In addition, individual sites or thermal activity pose specific problems. These are listed in Table 22. During the first quarter of 1994 the individual monitoring site equipment requirements will be completed, new equipment purchased, and then installed.

TABLE 22. Site or Activity Specific Limitations.

A. Steam wells:
   1. Potentially corrosive environment
   2. Requires a 30-day recording parameter
   3. Potentially limited solar exposure at Devils Kitchen
   4. Must record flow and temperature data every 1/2 hour.

B. Rain stations:
   1. Recording period of 90 to 120 days for these remote locations
   2. Time versus event recording stations

C. South Pool:
   1. Potentially corrosive environment
   2. Must record level and temperature data every hour
   3. Equipment must be protected from burros and cows
   4. Equipment should be readily removable, if necessary

D. Hot wells:
   1. Maximum 1.5-inch diameter tools
   2. 225°F fluid environment

E. Cold wells:
   1. Maximum: 1.5-inch diameter tools
   2. 150°F fluid environment

For the first time since beginning this monitoring program in 1978, data from each of the major sites have been compiled into databases. The data include well water levels, South Pool water elevations and temperatures, steam flow, and water geochemistry. The geochemistry database is being produced as part of a study being conducted by the University of Utah Research Institute for the GPO and is not yet available. The other databases have been compiled by the GPO. The four figures that follow (Figures 30, 31, 32, and 33) graphically represent these data.

When examining these graphs a number of observations can readily be made. For example, as seen in Figure 30, the water levels of OB-1 and OB-2 appear to be approaching one another. In Figure 31, the temperature of the South Pool water has jumped about 35°F twice since 1988 and these temperature changes appear to coincide with changes in the amplitude of the annual water-level fluctuations. In Figures 32 and 33, the Devils Kitchen site has had the most steady and dependable steam flow of all the steam sites. Well 4P-2 and the Corrosion Array both show fairly steady activity until late 1986 when flow first declined, then began a steady increase. The increased flow from 4P-2 lasted until 1991 when the steam flow from this site stopped altogether, while at the Corrosion Array it culminated with the blow-out of two of the shallow feeder wells in 1988. As seen in Figure 33, well 4H-4 (the 8-inch well) was the most erratic of all the steam sites through 1989 and the Schobers site shows a wild rise in activity in 1989. (The original Schobers well blew-out in early-1988 and the site was rebuilt in 1989 to include two new wells with substantially greater flow).

Some of these events or trends appear to be easily related to the change in Coso Hot Springs thermal activity in 1988, while others do not. What is readily apparent is that the significance (or lack of significance) of any such observations cannot be defined without integrating all the data sets and studying them in the context of local hydrology, regional hydrology, and the geothermal reservoir. It is beyond the scope of this report to conduct such a study.

The GPO and the Navy's Coso geothermal contractor, the California Energy Company, have begun integrating the Coso monitoring data with data from both geothermal field production and injection and reservoir observation sites. Assessments of the hot springs data and their significance to Coso Hot Springs hydrology will be reported in subsequent monitoring reports as these studies progress.

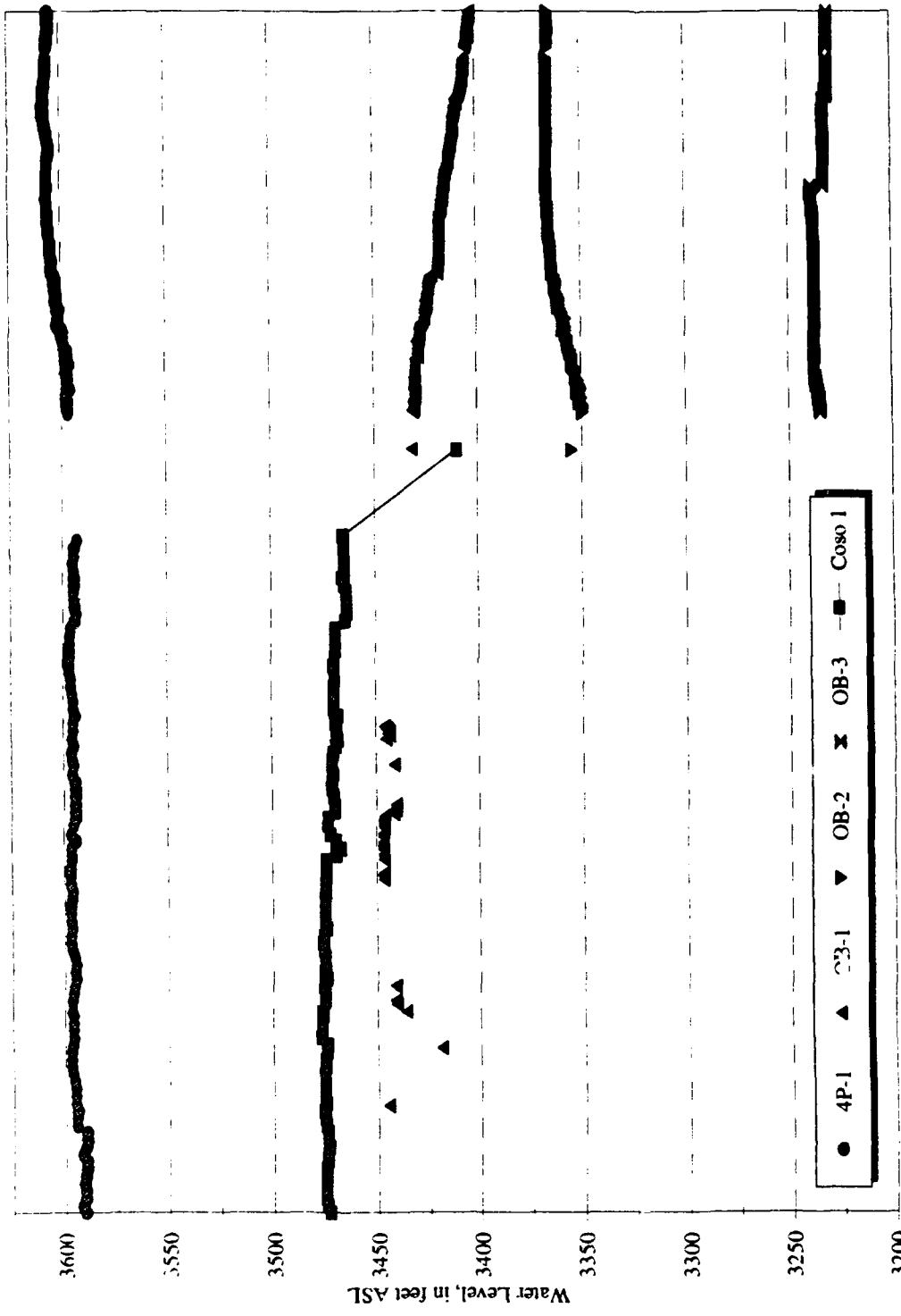


Figure 30. Water Levels in Coso Observation Wells, January 1980 - September 1993.

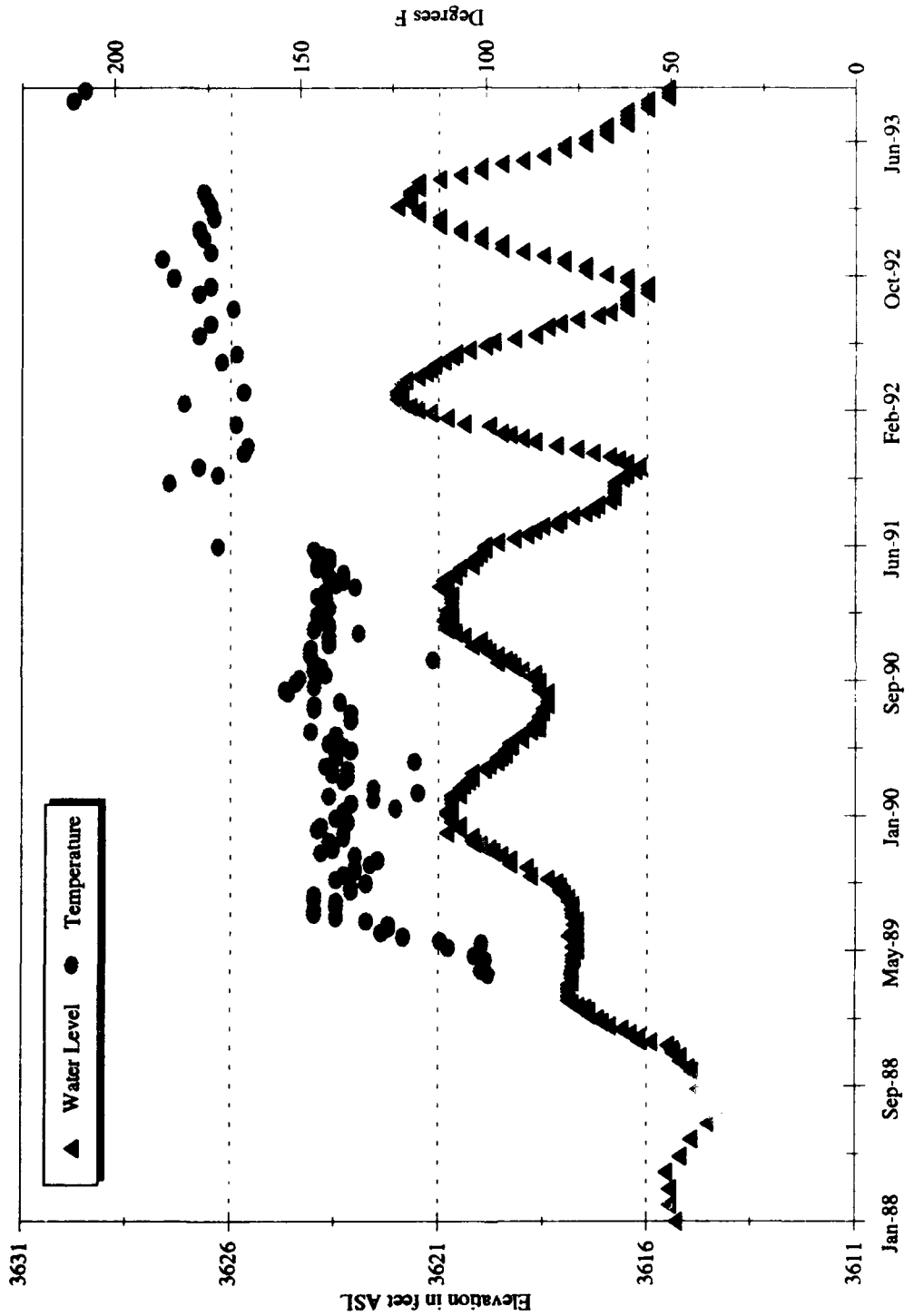


Figure 31. South Pool Elevations and Temperatures, January 1988 - September 1993.

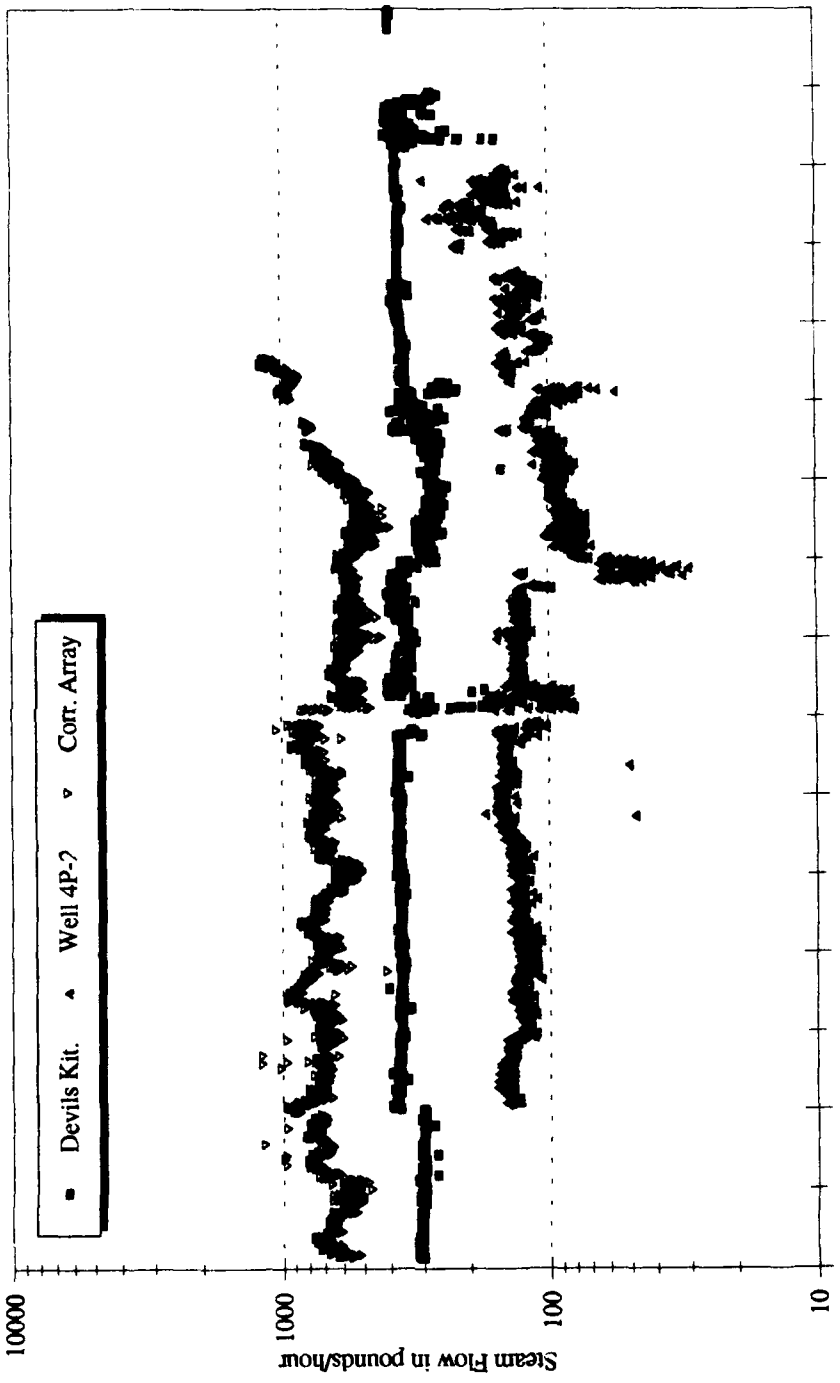


FIGURE 32. Composite Graph of High Steam Flow for Three Coso Wells, January 1978 to the Present.

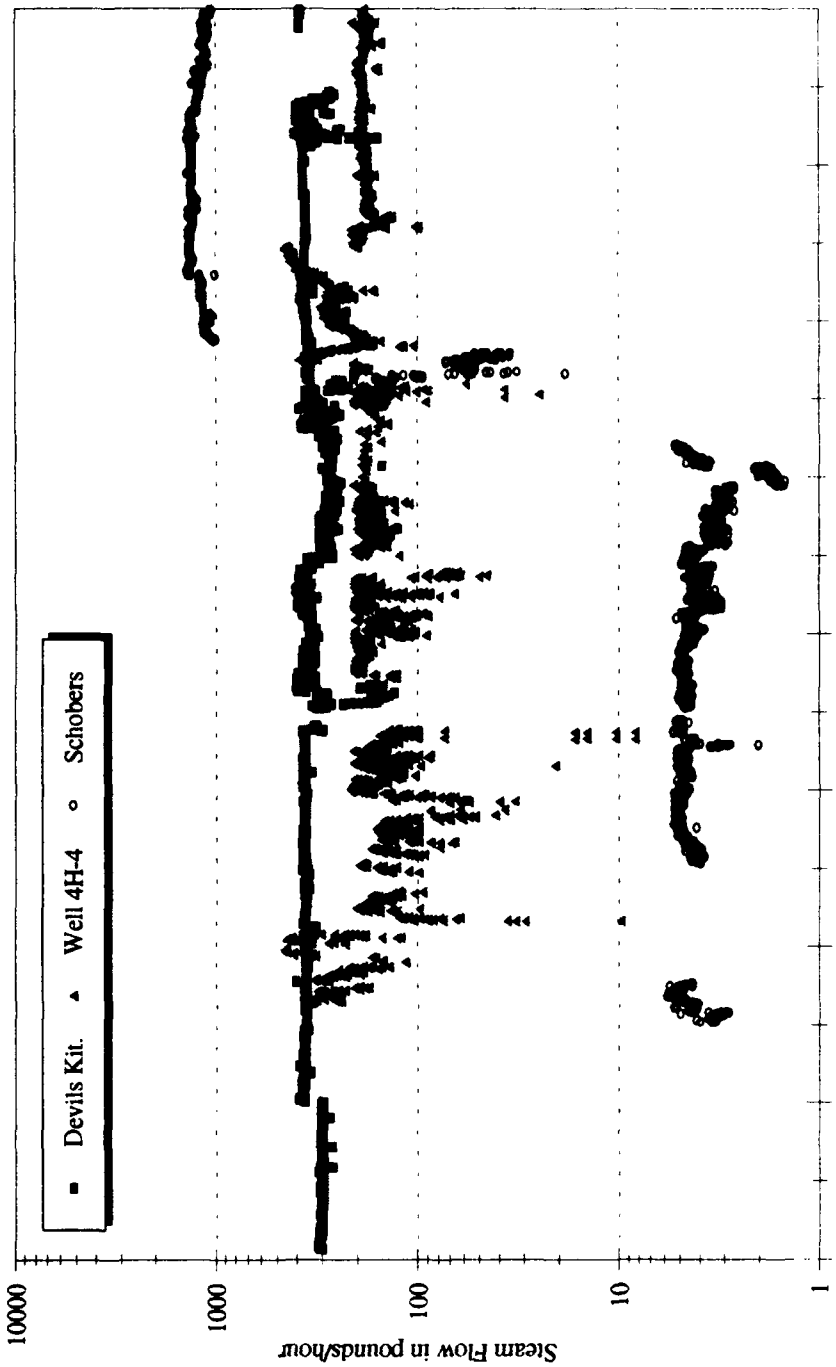


FIGURE 33. Composite Graph of High Steam Flow for Three Coso Wells, January 1978 to the Present.

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1. Naval Air Weapons Station. *Coso Monitoring Program, October 1991 Through September 1992*, by J. H. Monanan and K. L. Larson, Comarco Weapons Support Division, Ridgecrest, Calif. China Lake, Calif., NAWS-CL, December 1992. 123 pp. (NAWS-CL TP 001, publication UNCLASSIFIED.)

2. Naval Weapons Center. *Coso Monitoring Program, October 1990 Through September 1991*, by J. H. Monahan and D. E. Condon, Comarco Weapons Support Division, Ridgecrest, Calif. China Lake, Calif., NWC, December 1991. 131 pp. (NWC TP 7194, publication UNCLASSIFIED.)

3. Naval Weapons Center. *Coso Monitoring Program, October 1989 Through September 1990*, by J. H. Monahan and D. E. Condon, Comarco Weapons Support Division, Ridgecrest, Calif. China Lake, Calif., NWC, January 1991. 138 pp. (NWC TP 7138, publication UNCLASSIFIED.)

Appendix A

DAILY STEAM FLOW DATA

TABLE A-1. Devils Kitchen Site Steam Flow Data.

Date	High, lb/h	Low,lb/h	Date	High, lb/h	Low, lb/h
6 Jul 93	382.2	378.2	6 Aug 93	382.2	382.2
7 Jul 93	382.2	378.2	7 Aug 93	382.2	382.2
8 Jul 93	382.2	378.2	8 Aug 93	382.2	382.2
9 Jul 93	382.2	382.2	9 Aug 93	382.2	378.2
10 Jul 93	382.2	382.2	10 Aug 93	382.2	378.2
11 Jul 93	382.2	378.2	11 Aug 93	382.2	382.2
12 Jul 93	382.2	378.2	12 Aug 93	382.2	382.2
13 Jul 93	382.2	382.2	13 Aug 93	382.2	378.2
14 Jul 93	382.2	382.2	14 Aug 93	382.2	382.2
15 Jul 93	382.2	382.2	15 Aug 93	382.2	382.2
16 Jul 93	382.2	382.2	16 Aug 93	382.2	382.2
17 Jul 93	382.2	378.2	17 Aug 93	382.2	382.2
18 Jul 93	382.2	382.2	18 Aug 93	382.2	382.2
19 Jul 93	382.2	382.2	19 Aug 93	382.2	382.2
20 Jul 93	382.2	378.2	20 Aug 93	382.2	382.2
21 Jul 93	382.2	382.2	21 Aug 93	382.2	382.2
22 Jul 93	382.2	382.2	22 Aug 93	382.2	382.2
23 Jul 93	382.2	382.2	23 Aug 93	382.2	382.2
24 Jul 93	382.2	382.2	24 Aug 93	382.2	382.2
25 Jul 93	382.2	382.2	25 Aug 93	382.2	382.2
26 Jul 93	382.2	382.2	26 Aug 93	382.2	382.2
27 Jul 93	382.2	382.2	27 Aug 93	382.2	378.2
28 Jul 93	382.2	382.2	28 Aug 93	382.2	382.2
30 Jul 93	382.2	382.2	29 Aug 93	382.2	382.2
31 Jul 93	382.2	382.2	30 Aug 93	382.2	382.2
1 Aug 93	382.2	378.2	31 Aug 93	382.2	382.2
2 Aug 93	382.2	378.2	1 Sep 93	382.2	382.2
3 Aug 93	382.2	382.2	2 Sep 93	382.2	382.2
4 Aug 93	382.2	382.2	3 Sep 93	382.2	382.2
5 Aug 93	382.2	382.2	4 Sep 93	382.2	382.2

TABLE A-1. (Contd.)

Date	High, lb/h	Low,lb/h	Date	High, lb/h	Low, lb/h
5 Sep 93	382.2	382.2	18 Sep 93	382.6	308.6
6 Sep 93	382.2	386.2	19 Sep 93	381.4	372.5
7 Sep 93	382.2	382.2	20 Sep 93	383.4	378.6
8 Sep 93	336.7	332.3	21 Sep 93	382.2	382.2
9 Sep 93	379.0	373.3	22 Sep 93	382.2	382.2
10 Sep 93	377.8	349.6	23 Sep 93	382.2	382.2
14 Sep 93	384.2	382.2	24 Sep 93	382.2	382.2
15 Sep 93	381.4	376.2	25 Sep 93	382.2	378.2
16 Sep 93	337.5	327.5	26 Sep 93	382.2	378.2
17 Sep 93	338.3	328.7	27 Sep 93	382.2	382.2
			28 Sep 93	382.2	382.2
			29 Sep 93	382.2	382.2
			30 Sep 93	382.2	382.2

TABLE A-2. 4H-4 (8-Inch Well) Steam Flow Data.

Date	High, lb/h	Low, lb/h	Date	High, lb/h	Low, lb/h
1 Oct 92	184.0	179.7	5 Nov 92	189.2	185.9
2 Oct 92	189.4	183.2	6 Nov 92	186.9	184.4
3 Oct 92	189.8	179.1	7 Nov 92	187.1	183.6
4 Oct 92	188.1	177.6	8 Nov 92	187.1	180.7
5 Oct 92	184.6	174.8	9 Nov 92	185.7	181.5
6 Oct 92	185.7	173.9	10 Nov 92	185.9	182.6
7 Oct 92	187.3	181.1	11 Nov 92	186.5	181.8
8 Oct 92	190.2	180.9	12 Nov 92	187.5	181.8
9 Oct 92	187.3	177.8	13 Nov 92	186.1	181.8
10 Oct 92	187.9	178.7	14 Nov 92	186.9	185.9
11 Oct 92	186.5	177.8	15 Nov 92	188.5	184.6
12 Oct 92	186.9	179.1	16 Nov 92	191.2	186.7
13 Oct 92	188.3	179.7	17 Nov 92	192.0	186.5
14 Oct 92	188.3	178.7	18 Nov 92	187.9	187.5
15 Oct 92	190.2	184.2	19 Nov 92	185.0	174.8
16 Oct 92	185.9	176.8	20 Nov 92	185.9	174.6
17 Oct 92	187.7	179.5	21 Nov 92	190.8	178.0
18 Oct 92	189.4	183.2	22 Nov 92	189.6	184.6
19 Oct 92	188.9	183.0	23 Nov 92	192.6	188.7
20 Oct 92	188.7	180.5	24 Nov 92	191.2	184.8
21 Oct 92	190.0	183.8	25 Nov 92	189.2	187.1
22 Oct 92	194.9	188.3	26 Nov 92	189.6	183.8
23 Oct 92	194.3	188.7	27 Nov 92	189.8	184.8
24 Oct 92	192.2	188.7	28 Nov 92	194.5	189.8
25 Oct 92	189.8	177.8	29 Nov 92	191.0	183.0
26 Oct 92	186.1	180.1	30 Nov 92	190.2	184.4
27 Oct 92	187.9	182.6	1 Dec 92	194.7	193.9
28 Oct 92	185.9	183.4	2 Dec 92	194.7	190.4
29 Oct 92	186.7	184.4	3 Dec 92	199.4	194.5
30 Oct 92	186.9	183.2	4 Dec 92	198.0	192.0
31 Oct 92	186.5	182.4	5 Dec 92	192.0	186.3
1 Nov 92	188.3	182.8	6 Dec 92	193.3	189.8
2 Nov 92	188.5	186.3	7 Dec 92	194.1	191.4
3 Nov 92	188.9	185.5	8 Dec 92	193.7	188.7
4 Nov 92	188.7	186.7	9 Dec 92	191.8	187.1

TABLE A-2. (Contd.)

Date	High, lb/h	Low, lb/h	Date	High, lb/h	Low, lb/h
10 Dec 92	194.1	189.6	14 Jan 93	188.3	188.9
11 Dec 92	194.1	189.8	15 Jan 93	193.1	185.7
12 Dec 92	194.1	190.6	16 Jan 93	191.8	186.7
13 Dec 92	197.4	193.1	17 Jan 93	191.0	185.2
14 Dec 92	200.5	195.1	18 Jan 93	191.2	191.2
15 Dec 92	197.0	194.5	19 Jan 93	197.0	194.7
16 Dec 92	194.7	187.9	20 Jan 93	200.0	188.1
17 Dec 92	194.7	188.9	21 Jan 93	196.1	185.0
18 Dec 92	195.5	193.1	22 Jan 93	190.2	186.7
19 Dec 92	195.9	191.8	23 Jan 93	190.2	187.3
20 Dec 92	191.8	188.9	24 Jan 93	191.0	186.3
21 Dec 92	194.9	191.2	25 Jan 93	190.4	189.6
22 Dec 92	195.7	192.4	26 Jan 93	194.7	191.6
23 Dec 92	159.5	154.7	27 Jan 93	195.7	188.7
24 Dec 92	158.4	154.7	28 Jan 93	193.7	184.8
25 Dec 92	154.8	146.6	29 Jan 93	190.0	186.7
26 Dec 92	158.7	151.1	30 Jan 93	197.4	192.6
27 Dec 92	155.4	149.5	31 Jan 93	196.1	187.7
28 Dec 92	158.9	152.6	1 Feb 93	196.1	186.1
29 Dec 92	160.0	157.7	2 Feb 93	190.2	186.5
30 Dec 92	157.7	157.5	3 Feb 93	190.8	190.8
31 Dec 92	189.6	186.7	4 Feb 93	193.7	191.0
1 Jan 93	192.6	187.3	5 Feb 93	197.2	186.7
2 Jan 93	195.3	189.4	6 Feb 93	192.4	190.0
3 Jan 93	190.6	185.0	7 Feb 93	193.7	187.9
4 Jan 93	190.8	187.7	8 Feb 93	193.5	189.2
5 Jan 93	191.4	187.1	9 Feb 93	191.0	185.0
6 Jan 93	192.4	188.7	10 Feb 93	190.0	184.8
7 Jan 93	194.5	186.9	11 Feb 93	189.8	185.0
8 Jan 93	192.4	185.5	12 Feb 93	190.0	186.9
9 Jan 93	192.2	187.5	13 Feb 93	192.4	179.9
10 Jan 93	191.8	190.0	14 Feb 93	187.1	181.3
11 Jan 93	191.8	188.3	15 Feb 93	186.5	178.9
12 Jan 93	189.6	185.2	16 Feb 93	184.6	182.0
13 Jan 93	191.6	187.3	17 Feb 93	184.8	181.5

TABLE A-2. (Contd.)

Date	High, lb/h	Low, lb/h	Date	High,lb/h	Low, lb/h
18 Feb 93	185.7	181.1	25 Mar 93	182.2	174.3
19 Feb 93	183.2	181.1	26 Mar 93	181.8	179.5
20 Feb 93	184.4	181.8	27 Mar 93	184.4	178.9
21 Feb 93	183.2	181.1	28 Mar 93	186.5	175.2
22 Feb 93	183.6	181.8	29 Mar 93	184.4	171.9
23 Feb 93	183.8	181.3	30 Mar 93	181.8	174.8
24 Feb 93	183.4	180.9	31 Mar 93	184.8	174.3
25 Feb 93	182.6	182.4	1 Apr 93	186.1	170.4
26 Feb 93	184.4	183.0	2 Apr 93	180.3	172.7
27 Feb 93	185.5	179.9	3 Apr 93	183.2	173.3
28 Feb 93	186.1	182.0	4 Apr 93	181.5	175.0
1 Mar 93	183.6	179.5	5 Apr 93	183.8	177.8
2 Mar 93	183.8	176.6	6 Apr 93	189.8	178.7
3 Mar 93	183.8	181.1	7 Apr 93	190.4	177.0
4 Mar 93	182.8	181.3	8 Apr 93	184.2	178.9
5 Mar 93	185.0	183.2	9 Apr 93	182.2	172.9
6 Mar 93	185.0	182.8	10 Apr 93	178.9	172.1
7 Mar 93	185.7	180.3	11 Apr 93	183.2	174.6
8 Mar 93	184.4	182.2	12 Apr 93	183.0	173.3
9 Mar 93	185.0	183.0	13 Apr 93	184.4	171.1
10 Mar 93	185.0	178.5	14 Apr 93	183.0	174.1
11 Mar 93	182.6	182.6	15 Apr 93	181.5	162.8
12 Mar 93	183.2	180.1	16 Apr 93	166.9	159.5
13 Mar 93	181.8	178.5	17 Apr 93	172.1	169.8
14 Mar 93	181.8	179.7	18 Apr 93	185.7	170.2
15 Mar 93	184.4	178.7	19 Apr 93	183.0	171.5
16 Mar 93	184.6	178.3	20 Apr 93	181.3	169.6
17 Mar 93	185.0	180.7	21 Apr 93	180.7	174.6
18 Mar 93	183.8	179.1	22 Apr 93	181.5	175.6
19 Mar 93	184.8	177.8	23 Apr 93	184.0	147.4
20 Mar 93	184.8	181.1	24 Apr 93	173.1	146.4
21 Mar 93	184.8	178.5	25 Apr 93	151.9	146.4
22 Mar 93	184.4	176.6	26 Apr 93	153.2	145.8
23 Mar 93	183.6	177.2	27 Apr 93	152.8	143.5
24 Mar 93	185.0	176.6	28 Apr 93	175.2	148.9

TABLE A-2. (Contd.)

Date	High, lb/h	Low, lb/h	Date	High, lb/h	Low, lb/h
29 Apr 93	183.0	174.8	3 Jun 93	183.6	176.0
30 Apr 93	184.2	170.9	4 Jun 93	182.2	113.5
1 May 93	181.5	177.2	5 Jun 93	182.0	170.2
2 May 93	185.0	182.0	6 Jun 93	171.5	171.7
3 May 93	184.2	175.8	7 Jun 93	175.8	172.7
4 May 93	182.8	173.5	8 Jun 93	177.6	175.0
5 May 93	180.1	170.2	9 Jun 93	176.0	173.5
6 May 93	180.7	169.0	10 Jun 93	180.3	176.0
7 May 93	180.5	166.9	11 Jun 93	181.3	173.9
8 May 93	178.5	169.8	12 Jun 93	182.8	174.8
9 May 93	180.9	165.5	13 Jun 93	180.3	174.1
10 May 93	181.3	164.1	14 Jun 93	180.1	175.0
11 May 93	177.4	163.9	15 Jun 93	179.7	179.1
12 May 93	175.8	170.9	16 Jun 93	179.3	168.2
13 May 93	179.7	166.7	17 Jun 93	184.8	173.3
14 May 93	177.4	165.3	18 Jun 93	186.7	175.6
15 May 93	180.1	162.4	19 Jun 93	181.5	177.4
16 May 93	175.2	162.2	20 Jun 93	182.2	130.6
17 May 93	177.6	161.4	21 Jun 93	184.6	174.6
18 May 93	178.0	164.3	22 Jun 93	176.0	175.8
19 May 93	179.9	165.9	23 Jun 93	181.1	172.5
20 May 93	180.1	166.9	24 Jun 93	180.7	171.7
21 May 93	179.7	175.0	25 Jun 93	179.7	176.0
22 May 93	180.3	117.2	26 Jun 93	177.4	177.2
23 May 93	179.7	163.9	27 Jun 93	177.8	177.2
24 May 93	182.2	179.9	28 Jun 93	189.6	177.0
25 May 93	185.7	174.8	29 Jun 93	187.5	176.4
26 May 93	178.7	177.2	30 Jun 93	186.5	176.6
27 May 93	181.8	120.1	1 Jul 93	186.5	174.6
28 May 93	172.9	173.1	2 Jul 93	186.3	173.9
29 May 93	179.7	179.1	3 Jul 93	182.4	176.4
30 May 93	185.7	179.5	4 Jul 93	177.6	177.0
31 May 93	185.2	181.1	5 Jul 93	192.0	174.3
1 Jun 93	182.0	173.5	6 Jul 93	192.6	172.1
2 Jun 93	179.9	175.8	7 Jul 93	190.4	172.9

TABLE A-2. (Contd.)

Date	High, lb/h	Low, lb/h	Date	High, lb/h	Low, lb/h
8 Jul 93	191.2	172.3	12 Aug 93	180.3	171.1
9 Jul 93	191.2	171.7	13 Aug 93	179.3	167.8
10 Jul 93	189.8	171.1	14 Aug 93	183.4	167.8
11 Jul 93	173.7	169.4	15 Aug 93	183.6	171.3
12 Jul 93	190.4	167.2	16 Aug 93	180.3	173.3
13 Jul 93	185.2	169.0	17 Aug 93	180.9	172.9
14 Jul 93	187.9	173.5	18 Aug 93	180.5	170.0
15 Jul 93	185.9	171.7	19 Aug 93	182.6	171.5
16 Jul 93	188.9	169.8	20 Aug 93	185.7	173.5
17 Jul 93	184.2	171.3	21 Aug 93	185.5	175.6
18 Jul 93	173.9	169.0	22 Aug 93	185.9	180.1
19 Jul 93	186.3	168.0	23 Aug 93	186.1	176.4
20 Jul 93	184.0	169.0	24 Aug 93	186.9	173.7
21 Jul 93	183.4	173.9	25 Aug 93	187.3	175.6
22 Jul 93	189.4	171.5	26 Aug 93	187.5	173.3
23 Jul 93	190.4	168.8	27 Aug 93	185.0	172.3
24 Jul 93	184.4	161.0	28 Aug 93	183.0	171.9
25 Jul 93	172.1	158.9	29 Aug 93	184.4	172.7
26 Jul 93	187.7	119.2	30 Aug 93	184.8	175.8
27 Jul 93	167.8	163.5	31 Aug 93	184.6	177.6
28 Jul 93	211.6	162.8	1 Sep 93	187.1	179.7
29 Jul 93	182.4	161.8	2 Sep 93	188.3	176.8
30 Jul 93	180.3	167.2	3 Sep 93	187.9	175.0
31 Jul 93	183.6	160.0	4 Sep 93	187.9	177.6
1 Aug 93	188.3	159.1	5 Sep 93	188.1	175.2
2 Aug 93	176.0	165.5	6 Sep 93	188.1	175.0
3 Aug 93	160.0	159.3	7 Sep 93	187.3	174.1
4 Aug 93	182.8	157.9	8 Sep 93	188.1	171.9
5 Aug 93	177.2	160.6	9 Sep 93	187.1	175.4
6 Aug 93	177.2	158.3	10 Sep 93	185.5	176.8
7 Aug 93	179.3	158.1	11 Sep 93	185.5	177.4
8 Aug 93	174.6	160.0	12 Sep 93	187.1	178.0
9 Aug 93	176.4	161.0	13 Sep 93	187.3	176.6
10 Aug 93	177.8	161.2	14 Sep 93	188.5	174.6
11 Aug 93	172.3	170.4	15 Sep 93	188.1	173.9

TABLE A-2. (Contd.)

Date	High, lb/h	Low, lb/h	Date	High, lb/h	Low, lb/h
16 Sep 93	186.3	175.2	24 Sep 93	187.9	171.3
17 Sep 93	184.8	174.8	25 Sep 93	185.5	173.1
18 Sep 93	185.0	174.1	26 Sep 93	182.4	173.1
19 Sep 93	184.4	172.1	27 Sep 93	184.4	172.9
20 Sep 93	186.1	171.7	28 Sep 93	186.3	173.7
21 Sep 93	184.8	174.3			
22 Sep 93	183.0	176.4			
23 Sep 93	185.0	174.3			

TABLE A-3. 4A-2 and 4A-3 (Schoeber's Resort Wells) Steam Flow Data.

Date	High, lb/h	Low, lb/h	Date	High, lb/h	Low, lb/h
1 Oct 92	1210.92	1182.27	5 Nov 92	1177.75	1149.10
2 Oct 92	1204.89	1176.24	6 Nov 92	1174.73	1144.57
3 Oct 92	1197.35	1171.72	7 Nov 92	1188.30	1147.59
4 Oct 92	1203.38	1171.72	8 Nov 92	1197.35	1155.13
5 Oct 92	1203.38	1168.70	9 Nov 92	1191.32	1165.68
6 Oct 92	1197.35	1171.72	10 Nov 92	1165.68	1143.06
7 Oct 92	1200.37	1158.14	11 Nov 92	1167.19	1135.52
8 Oct 92	1176.24	1159.65	12 Nov 92	1168.70	1131.00
9 Oct 92	1200.37	1152.11	13 Nov 92	1185.29	1144.57
10 Oct 92	1195.84	1174.73	14 Nov 92	1176.24	1155.13
11 Oct 92	1185.29	1161.16	15 Nov 92	1182.27	1159.65
12 Oct 92	1203.38	1167.19	16 Nov 92	1186.80	1162.67
13 Oct 92	1203.38	1173.22	17 Nov 92	1194.34	1167.19
14 Oct 92	1213.94	1180.76	18 Nov 92	1203.38	1152.11
15 Oct 92	1188.30	1158.14	19 Nov 92	1170.21	1141.56
16 Oct 92	1186.80	1153.62	20 Nov 92	1164.18	1147.59
17 Oct 92	1185.29	1155.13	21 Nov 92	1161.16	1149.10
18 Oct 92	1189.81	1164.18	22 Nov 92	1185.29	1147.59
19 Oct 92	1182.27	1165.68	23 Nov 92	1170.21	1153.62
20 Oct 92	1197.35	1165.68	24 Nov 92	1153.62	1146.08
21 Oct 92	1195.84	1165.68	4 Dec 92	1183.78	1158.14
22 Oct 92	1171.72	1161.16	10 Dec 92	1170.21	1149.10
23 Oct 92	1179.26	1167.19	11 Dec 92	1197.35	1153.62
24 Oct 92	1253.15	1159.65	12 Dec 92	1168.70	1147.59
25 Oct 92	1302.91	1247.12	13 Dec 92	1162.67	1153.62
26 Oct 92	1269.74	1191.32	14 Dec 92	1174.73	1146.08
27 Oct 92	1201.88	1179.26	15 Dec 92	1147.59	1135.52
28 Oct 92	1204.89	1168.70	16 Dec 92	1257.67	1146.08
29 Oct 92	1203.38	1167.19	17 Dec 92	1262.20	1259.18
30 Oct 92	1180.76	1165.68	18 Dec 92	1197.35	1153.62
31 Oct 92	1182.27	1149.10	19 Dec 92	1168.70	1147.59
1 Nov 92	1192.83	1149.10	20 Dec 92	1162.67	1153.62
2 Nov 92	1194.34	1159.65	21 Dec 92	1174.73	1146.08
3 Nov 92	1170.21	1152.11	22 Dec 92	1147.59	1135.52
4 Nov 92	1188.30	1138.54	23 Dec 92	1257.67	1146.08

TABLE A-3. (Contd.)

Date	High, lb/h	Low, lb/h	Date	High, lb/h	Low, lb/h
24 Dec 92	1262.20	1259.18	17 Feb 93	1135.52	1091.79
31 Dec 92	1150.60	1121.95	18 Feb 93	1124.97	1108.38
1 Jan 93	1149.10	1111.40	19 Feb 93	1124.97	1105.36
2 Jan 93	1146.08	1115.92	20 Feb 93	1146.08	1117.43
3 Jan 93	1149.10	1131.00	21 Feb 93	1138.54	1115.92
4 Jan 93	1152.11	1111.40	22 Feb 93	1123.46	1121.95
5 Jan 93	1137.03	1112.90	23 Feb 93	1112.90	1081.24
6 Jan 93	1127.98	1112.90	24 Feb 93	1127.98	1103.86
7 Jan 93	1149.10	1121.95	25 Feb 93	1132.51	1117.43
13 Jan 93	1096.32	1061.63	26 Feb 93	1153.62	1129.49
14 Jan 93	1088.78	1061.63	27 Feb 93	1124.97	1155.13
15 Jan 93	1135.52	1075.20	1 Mar 93	1126.48	1105.36
16 Jan 93	1164.18	1108.38	2 Mar 93	1111.40	1111.40
17 Jan 93	1140.05	1096.32	3 Mar 93	1120.44	1094.81
18 Jan 93	1165.68	1118.94	4 Mar 93	1109.89	1090.28
19 Jan 93	1173.22	1156.64	5 Mar 93	1111.40	1085.76
20 Jan 93	1156.64	1155.13	6 Mar 93	1126.48	1093.30
21 Jan 93	1174.73	1137.03	7 Mar 93	1129.49	1094.81
22 Jan 93	1150.60	1126.48	8 Mar 93	1112.90	1096.32
23 Jan 93	1164.18	1135.52	9 Mar 93	1109.89	1105.36
24 Jan 93	1159.65	1129.49	10 Mar 93	1103.86	1064.65
25 Jan 93	1165.68	1126.48	11 Mar 93	1099.33	1066.16
26 Jan 93	1153.62	1131.00	12 Mar 93	1102.35	1079.73
27 Jan 93	1161.16	1144.57	13 Mar 93	1099.33	1084.25
2 Feb 93	1165.68	1149.10	14 Mar 93	1093.30	1070.68
3 Feb 93	1168.70	1146.08	15 Mar 93	1106.87	1073.70
4 Feb 93	1156.64	1131.00	16 Mar 93	1123.46	1103.86
5 Feb 93	1173.22	1144.57	17 Mar 93	1118.94	1100.84
6 Feb 93	1159.65	1149.10	18 Mar 93	1115.92	1100.84
7 Feb 93	1168.70	1141.56	19 Mar 93	1124.97	1102.35
8 Feb 93	1195.84	1156.64	20 Mar 93	1126.48	1097.82
9 Feb 93	1183.78	1158.14	21 Mar 93	1124.97	1097.82
10 Feb 93	1183.78	1130.44	22 Mar 93	1114.41	1011.87
11 Feb 93	1129.49	1111.40	23 Mar 93	1106.87	1073.70
16 Feb 93	1186.80	1147.59	24 Mar 93	1123.46	1103.86

TABLE A-3. (Contd.)

Date	High, lb/h	Low, lb/h	Date	High, lb/h	Low, lb/h
25 Mar 93	1118.94	1100.84	16 May 93	1132.51	1117.43
26 Mar 93	1115.92	1100.84	17 May 93	1132.51	1109.89
27 Mar 93	1124.97	1102.35	18 May 93	1132.51	1123.46
28 Mar 93	1126.48	1097.82	19 May 93	1111.40	1079.73
29 Mar 93	1126.48	1097.82	20 May 93	1124.97	1066.16
6 Apr 93	1146.08	993.77	21 May 93	1118.94	1063.14
7 Apr 93	1144.57	1102.35	22 May 93	1106.87	1058.62
8 Apr 93	1149.10	1111.40	23 May 93	1091.79	1058.62
9 Apr 93	1140.05	1094.81	25 May 93	1091.79	1064.65
10 Apr 93	1135.52	1100.84	26 May 93	1126.48	1072.19
11 Apr 93	1137.03	1097.82	27 May 93	1109.89	1057.11
12 Apr 93	1131.00	1108.38	28 May 93	1100.84	1073.70
13 Apr 93	1143.06	1111.40	29 May 93	1108.38	1067.66
14 Apr 93	1138.54	1112.90	30 May 93	1131.00	1069.17
15 Apr 93	1141.56	1102.35	31 May 93	1100.84	1070.68
16 Apr 93	1194.34	1147.59	1 Jun 93	1103.86	1078.22
20 Apr 93	1179.26	1161.16	2 Jun 93	1115.92	1069.17
21 Apr 93	1182.27	1140.05	3 Jun 93	1100.84	1070.68
22 Apr 93	1162.67	1131.00	4 Jun 93	1100.84	1081.24
23 Apr 93	1173.22	1140.05	5 Jun 93	1114.41	1079.73
24 Apr 93	1167.19	1109.89	6 Jun 93	1106.87	1073.70
25 Apr 93	1164.18	1134.02	7 Jun 93	1097.82	1069.17
26 Apr 93	1170.21	1123.46	8 Jun 93	1084.25	1066.16
27 Apr 93	1146.08	1134.02	9 Jun 93	1126.48	1061.63
29 Apr 93	1153.62	1138.54	10 Jun 93	1124.97	1054.09
30 Apr 93	1153.62	1138.58	11 Jun 93	1129.49	1057.11
1 May 93	1149.10	1131.00	12 Jun 93	1129.49	1067.66
2 May 93	1149.10	1137.03	13 Jun 93	1140.05	1064.65
3 May 93	1174.73	1146.08	14 Jun 93	1140.05	1069.17
4 May 93	1164.18	1137.03	15 Jun 93	1121.95	1085.76
5 May 93	1144.57	1135.52	16 Jun 93	1156.64	1127.98
6 May 93	1144.57	1135.52	17 Jun 93	1138.54	1073.70
13 May 93	1132.51	1124.97	18 Jun 93	1134.02	1069.17
14 May 93	1135.52	1117.43	19 Jun 93	1140.05	1060.12
15 May 93	1126.48	1120.44	20 Jun 93	1137.03	1057.11

TABLE A-3. (Contd.)

Date	High, lb/h	Low, lb/h	Date	High, lb/h	Low, lb/h
21 Jun 93	1120.44	1060.12	1 Aug 93	1143.06	1029.96
22 Jun 93	1094.81	1061.63	2 Aug 93	1152.11	1048.06
23 Jun 93	1170.21	1212.43	3 Aug 93	1131.00	1073.70
24 Jun 93	1134.02	1191.32	4 Aug 93	1124.97	1058.62
25 Jun 93	1152.11	1189.81	5 Aug 93	1162.67	1048.06
26 Jun 93	1155.13	1183.78	6 Aug 93	1164.18	1084.25
27 Jun 93	1204.89	1168.70	7 Aug 93	1158.14	1069.17
28 Jun 93	1216.96	1170.21	8 Aug 93	1153.62	1064.65
29 Jun 93	1224.50	1167.19	9 Aug 93	1141.56	1043.54
6 Jul 93	1117.43	1054.09	10 Aug 93	1115.92	1057.11
7 Jul 93	1134.02	1036.00	11 Aug 93	1117.43	1042.03
8 Jul 93	1117.43	1013.38	12 Aug 93	1135.52	1046.55
9 Jul 93	1131.00	1016.39	13 Aug 93	1147.59	1054.09
10 Jul 93	1127.98	1025.44	14 Aug 93	1099.33	1043.54
11 Jul 93	1135.52	1026.95	15 Aug 93	1124.97	1036.00
12 Jul 93	1123.46	1034.49	17 Aug 93	1127.98	1049.57
13 Jul 93	1082.74	1048.06	16 Aug 93	1152.11	1087.27
14 Jul 93	1126.48	1042.03	18 Aug 93	1152.11	1046.55
15 Jul 93	1134.02	1043.54	19 Aug 93	1121.95	1049.57
16 Jul 93	1137.03	1037.50	20 Aug 93	1132.51	1048.06
17 Jul 93	1131.00	1040.52	21 Aug 93	1123.46	1034.49
18 Jul 93	1123.46	1055.60	22 Aug 93	1117.43	1043.54
19 Jul 93	1100.84	1040.52	23 Aug 93	1131.00	1045.04
20 Jul 93	1124.97	1073.70	24 Aug 93	1153.62	1045.04
21 Jul 93	1127.98	1037.50	25 Aug 93	1117.43	1039.01
22 Jul 93	1117.43	1051.08	26 Aug 93	1149.10	1043.54
23 Jul 93	1123.46	1054.09	27 Aug 93	1134.02	1055.60
24 Jul 93	1120.44	1046.55	28 Aug 93	1132.51	1042.03
25 Jul 93	1134.02	1045.04	29 Aug 93	1109.59	1054.09
26 Jul 93	1141.56	1075.20	30 Aug 93	1141.56	1061.63
27 Jul 93	1168.70	1096.32	31 Aug 93	1103.86	1055.60
28 Jul 93	1173.22	1081.24	7 Sep 93	1060.12	1046.55
29 Jul 93	1147.59	1066.16	8 Sep 93	1070.68	1026.95
30 Jul 93	1147.59	1042.03	9 Sep 93	1132.51	1051.08
31 Jul 93	1131.00	1034.49	10 Sep 93	1138.54	1100.00

TABLE A-3. (Contd.)

Date	High, lb/h	Low,lb/h	Date	High, lb/h	Low, lb/h
14 Sep 93	1076.71	1049.57	24 Sep 93	1075.20	1039.01
15 Sep 93	1070.68	1036.00	25 Sep 93	1069.17	1029.96
16 Sep 93	1070.68	1032.98	26 Sep 93	1061.63	1026.95
17 Sep 93	1075.20	1036.00	27 Sep 93	1061.63	1031.47
18 Sep 93	1070.68	1034.49	28 Sep 93	1057.11	1026.95
19 Sep 93	1070.68	1049.57	29 Sep 93	1049.57	1032.98
20 Sep 93	1066.16	1031.47	30 Sep 93	1070.68	1036.00
21 Sep 93	1058.62	1023.93			
22 Sep 93	1061.63	1028.46			
23 Sep 93	1064.65	1036.00			

Appendix B

DAILY TEMPERATURE DATA

TABLE B-1. 4A-2 and 4A-3 (Schoeber's Resort Wells) Steam Temperature.

Date	High, °F	Low, °F	Date	High, °F	Low, °F
1 Oct 92	225	218	5 Nov 92	224	220
2 Oct 92	227	222	6 Nov 92	227	219
3 Oct 92	225	218	7 Nov 92	225	218
4 Oct 92	225	217	8 Nov 92	228	222
5 Oct 92	225	221	9 Nov 92	227	221
6 Oct 92	224	222	10 Nov 92	222	220
7 Oct 92	229	222	11 Nov 92	226	221
8 Oct 92	225	221	12 Nov 92	224	221
9 Oct 92	227	222	13 Nov 92	225	222
10 Oct 92	225	220	14 Nov 92	226	222
11 Oct 92	226	221	15 Nov 92	226	222
12 Oct 92	230	222	16 Nov 92	226	219
13 Oct 92	226	222	17 Nov 92	222	216
14 Oct 92	230	223	18 Nov 92	228	223
15 Oct 92	229	221	19 Nov 92	225	220
16 Oct 92	225	222	20 Nov 92	227	221
17 Oct 92	227	223	21 Nov 92	225	221
18 Oct 92	226	218	22 Nov 92	223	219
19 Oct 92	227	221	23 Nov 92	225	219
20 Oct 92	227	224	24 Nov 92	224	220
21 Oct 92	224	222	1 Dec 92	224	221
22 Oct 92	223	220	2 Dec 92	226	221
23 Oct 92	224	219	3 Dec 92	226	216
24 Oct 92	225	215	4 Dec 92	224	217
25 Oct 92	225	218	5 Dec 92	224	216
26 Oct 92	227	222	6 Dec 92	221	215
27 Oct 92	224	221	7 Dec 92	224	217
28 Oct 92	225	220	8 Dec 92	224	218
29 Oct 92	226	221	9 Dec 92	226	217
30 Oct 92	224	219	10 Dec 92	223	218
31 Oct 92	225	219	11 Dec 92	223	218
1 Nov 92	227	222	12 Dec 92	224	217
2 Nov 92	228	222	13 Dec 92	223	216
3 Nov 92	224	221	14 Dec 92	225	218
4 Nov 92	226	218	15 Dec 92	223	219

TABLE B-1. (Contd.)

Date	High, °F	Low, °F	Date	High, °F	Low, °F
16 Dec 92	224	220	20 Jan 93	224	218
17 Dec 92	225	220	21 Jan 93	223	217
18 Dec 92	223	220	22 Jan 93	222	219
19 Dec 92	221	218	23 Jan 93	223	216
20 Dec 92	226	217	24 Jan 93	219	217
21 Dec 92	226	220	25 Jan 93	221	218
22 Dec 92	221	218	26 Jan 93	221	218
23 Dec 92	225	219	27 Jan 93	225	220
24 Dec 92	225	220	28 Jan 93	225	219
25 Dec 92	223	220	29 Jan 93	222	219
26 Dec 92	223	220	30 Jan 93	224	216
27 Dec 92	224	220	31 Jan 93	225	219
28 Dec 92	223	218	1 Feb 93	225	219
29 Dec 92	221	217	2 Feb 93	222	219
30 Dec 92	222	216	3 Feb 93	224	218
31 Dec 92	220	217	4 Feb 93	222	218
1 Jan 93	221	217	5 Feb 93	224	219
2 Jan 93	224	219	6 Feb 93	224	219
3 Jan 93	221	217	7 Feb 93	224	216
4 Jan 93	223	218	8 Feb 93	223	218
5 Jan 93	221	219	9 Feb 93	220	218
6 Jan 93	221	217	10 Feb 93	225	216
7 Jan 93	220	218	11 Feb 93	222	214
8 Jan 93	220	217	12 Feb 93	223	215
9 Jan 93	219	215	13 Feb 93	223	218
10 Jan 93	219	217	14 Feb 93	222	217
11 Jan 93	221	217	16 Feb 93	221	217
12 Jan 93	221	217	17 Feb 93	220	215
13 Jan 93	224	218	18 Feb 93	219	213
14 Jan 93	223	217	19 Feb 93	219	214
15 Jan 93	222	219	20 Feb 93	218	213
16 Jan 93	223	216	21 Feb 93	222	219
17 Jan 93	219	217	22 Feb 93	221	217
18 Jan 93	221	218	23 Feb 93	217	217
19 Jan 93	221	218	24 Feb 93	223	217

TABLE B-1. (Contd.)

Date	High, °F	Low, °F	Date	High, °F	Low, °F
25 Feb 93	218	214	8 Apr 93	227	225
26 Feb 93	222	215	9 Apr 93	230	226
27 Feb 93	224	221	10 Apr 93	228	225
28 Feb 93	224	221	11 Apr 93	231	225
1 Mar 93	225	221	12 Apr 93	232	223
2 Mar 93	223	222	13 Apr 93	229	224
3 Mar 93	222	216	15 Apr 93	229	225
4 Mar 93	219	214	16 Apr 93	228	226
5 Mar 93	220	214	20 Apr 93	225	224
6 Mar 93	222	215	21 Apr 93	227	222
7 Mar 93	220	216	22 Apr 93	227	222
8 Mar 93	223	219	23 Apr 93	227	224
9 Mar 93	220	217	24 Apr 93	225	221
10 Mar 93	224	219	25 Apr 93	228	222
11 Mar 93	225	218	26 Apr 93	228	225
12 Mar 93	222	218	27 Apr 93	227	224
13 Mar 93	220	217	29 Apr 93	229	225
14 Mar 93	223	217	30 Apr 93	233	225
15 Mar 93	227	221	1 May 93	228	222
16 Mar 93	224	220	2 May 93	227	221
17 Mar 93	225	219	3 May 93	227	223
18 Mar 93	222	216	4 May 93	225	218
19 Mar 93	219	215	5 May 93	226	220
20 Mar 93	222	215	6 May 93	225	221
21 Mar 93	222	217	13 May 93	229	223
22 Mar 93	222	219	14 May 93	229	224
23 Mar 93	223	220	15 May 93	228	221
24 Mar 93	223	218	16 May 93	231	224
25 Mar 93	222	217	17 May 93	229	226
26 Mar 93	220	215	18 May 93	227	226
27 Mar 93	220	216	19 May 93	231	222
28 Mar 93	220	217	20 May 93	227	225
29 Mar 93	221	217	25 May 93	228	221
30 Mar 93	226	220	26 May 93	232	221
31 Mar 93	230	226	27 May 93	229	225

TABLE B-1. (Contd.)

Date	High, °F	Low, °F	Date	High, °F	Low, °F
28 May 93	229	222	14 Jul 93	223	219
29 May 93	231	227	15 Jul 93	225	220
30 May 93	229	225	16 Jul 93	226	222
31 May 93	229	223	17 Jul 93	225	221
1 Jun 93	228	226	18 Jul 93	224	220
2 Jun 93	230	225	19 Jul 93	224	221
3 Jun 93	231	223	20 Jul 93	226	222
4 Jun 93	228	224	21 Jul 93	224	219
5 Jun 93	228	221	22 Jul 93	225	219
6 Jun 93	228	221	23 Jul 93	225	221
7 Jun 93	228	224	24 Jul 93	225	221
8 Jun 93	231	225	25 Jul 93	224	220
15 Jun 93	230	227	26 Jul 93	225	220
16 Jun 93	230	227	27 Jul 93	224	221
17 Jun 93	229	224	28 Jul 93	226	223
18 Jun 93	228	224	29 Jul 93	226	222
19 Jun 93	232	227	30 Jul 93	227	222
20 Jun 93	232	225	31 Jul 93	226	222
21 Jun 93	233	226	1 Aug 93	226	223
22 Jun 93	230	227	2 Aug 93	227	223
23 Jun 93	230	227	3 Aug 93	230	223
24 Jun 93	229	225	4 Aug 93	225	222
25 Jun 93	231	227	5 Aug 93	226	222
26 Jun 93	232	225	6 Aug 93	228	224
27 Jun 93	231	227	7 Aug 93	226	223
28 Jun 93	230	224	8 Aug 93	225	221
29 Jun 93	227	224	9 Aug 93	227	223
6 Jul 93	225	221	10 Aug 93	225	223
7 Jul 93	224	219	11 Aug 93	224	222
8 Jul 93	222	216	12 Aug 93	227	223
9 Jul 93	223	220	13 Aug 93	228	224
10 Jul 93	228	220	14 Aug 93	226	222
11 Jul 93	224	218	15 Aug 93	226	223
12 Jul 93	226	221	16 Aug 93	227	221
13 Jul 93	223	222	17 Aug 93	225	223

TABLE B-1. (Contd.)

Date	High, °F	Low, °F	Date	High, °F	Low, °F
18 Aug 93	224	221	13 Sep 93	224	220
19 Aug 93	226	220	14 Sep 93	225	223
20 Aug 93	227	224	15 Sep 93	225	221
21 Aug 93	226	221	16 Sep 93	225	221
22 Aug 93	225	221	17 Sep 93	226	222
23 Aug 93	227	222	18 Sep 93	223	223
24 Aug 93	226	222	19 Sep 93	225	221
25 Aug 93	224	221	20 Sep 93	224	222
26 Aug 93	225	221	21 Sep 93	226	222
27 Aug 93	229	223	22 Sep 93	224	222
28 Aug 93	225	222	23 Sep 93	225	221
29 Aug 93	225	223	24 Sep 93	224	221
30 Aug 93	228	224	25 Sep 93	224	222
31 Aug 93	226	222	26 Sep 93	222	219
7 Sep 93	223	220	27 Sep 93	223	220
8 Sep 93	221	219	28 Sep 93	227	223
9 Sep 93	226	219	29 Sep 93	228	224
10 Sep 93	228	220	30 Sep 93	226	222
11 Sep 93	224	221			
12 Sep 93	221	219			

Appendix C

WEATHER STATION NO. 1 DATA

TABLE C-1. Weather Station No. 1 Ambient Temperature.

Date	High, °F	Low, °F	Date	High, °F	Low, °F
1 Oct 92	91	65	5 Nov 92	66	42
2 Oct 92	81	47	6 Nov 92	68	42
3 Oct 92	78	46	7 Nov 92	70	44
4 Oct 92	83	53	8 Nov 92	68	42
5 Oct 92	85	52	9 Nov 92	61	38
6 Oct 92	87	67	10 Nov 92	64	45
7 Oct 92	83	50	11 Nov 92	59	28
8 Oct 92	82	50	12 Nov 92	65	32
9 Oct 92	87	51	13 Nov 92	69	40
10 Oct 92	91	59	14 Nov 92	69	39
11 Oct 92	92	55	15 Nov 92	68	41
12 Oct 92	89	52	16 Nov 92	71	47
13 Oct 92	89	60	17 Nov 92	68	42
14 Oct 92	84	50	18 Nov 92	68	40
15 Oct 92	79	49	19 Nov 92	59	36
16 Oct 92	78	49	20 Nov 92	54	42
17 Oct 92	81	49	21 Nov 92	53	29
18 Oct 92	81	50	22 Nov 92	58	31
19 Oct 92	83	49	23 Nov 92	56	33
20 Oct 92	83	54	24 Nov 92	40	32
21 Oct 92	75	51	25 Nov 92	53	30
22 Oct 92	81	53	26 Nov 92	57	28
23 Oct 92	81	60	27 Nov 92	59	31
24 Oct 92	72	56	28 Nov 92	58	30
25 Oct 92	68	48	29 Nov 92	57	38
26 Oct 92	70	50	30 Nov 92	58	31
27 Oct 92	72	55	1 Dec 92	58	30
28 Oct 92	65	49	2 Feb 93	55	34
29 Oct 92	68	47	3 Feb 93	54	31
30 Oct 92	65	47	4 Feb 93	57	30
31 Oct 92	67	39	5 Feb 93	59	39
1 Nov 92	69	41	6 Feb 93	58	39
2 Nov 92	73	44	7 Feb 93	54	43
3 Nov 92	66	53	8 Feb 93	49	40
4 Nov 92	62	41	9 Feb 93	48	35

TABLE C-1. (Contd.)

Date	High, °F	Low, °F	Date	High, °F	Low, °F
16 Feb 93	46	28	5 Apr 93	58	33
17 Feb 93	49	24	6 Apr 93	56	37
18 Feb 93	42	33	7 Apr 93	59	37
19 Feb 93	47	35	26 May 93	78	58
20 Feb 93	40	26	27 May 93	75	42
21 Feb 93	43	23	28 May 93	72	38
22 Feb 93	43	19	29 May 93	77	40
23 Feb 93	48	25	30 May 93	82	42
24 Feb 93	48	23	31 May 93	75	52
25 Feb 93	41	32	1 Jun 93	77	40
26 Feb 93	35	30	2 Jun 93	78	39
27 Feb 93	39	30	3 Jun 93	72	37
28 Feb 93	40	24	4 Jun 93	72	45
29 Feb 93	49	25	5 Jun 93	56	44
1 Mar 93	58	29	6 Jun 93	60	33
2 Mar 93	59	39	7 Jun 93	67	34
3 Mar 93	65	33	8 Jun 93	76	53
4 Mar 93	62	40	9 Jun 93	82	50
5 Mar 93	62	32	10 Jun 93	86	53
6 Mar 93	62	37	11 Jun 93	85	49
7 Mar 93	62	35	12 Jun 93	83	45
8 Mar 93	61	60	13 Jun 93	87	49
15 Mar 93	66	49	14 Jun 93	89	56
16 Mar 93	62	40	15 Jun 93	93	59
17 Mar 93	47	35	16 Jun 93	90	48
18 Mar 93	44	30	17 Jun 93	85	61
19 Mar 93	49	31	18 Jun 93	87	60
20 Mar 93	41	31	19 Jun 93	89	52
21 Mar 93	55	32	20 Jun 93	88	57
22 Mar 93	62	41	21 Jun 93	84	51
31 Mar 93	66	41	22 Jun 93	85	58
1 Apr 93	62	36	23 Jun 93	89	57
2 Apr 93	61	37	24 Jun 93	90	66
3 Apr 93	64	37	25 Jun 93	92	53
4 Apr 93	67	37	26 Jun 93	94	58

TABLE C-1. (Contd.)

Date	High, °F	Low, °F	Date	High, °F	Low, °F
27 Jun 93	93	57	1 Aug 93	109	68
28 Jun 93	91	50	2 Aug 93	110	72
29 Jun 93	90	77	3 Aug 93	109	73
30 Jun 93	92	56	4 Aug 93	83	83
1 Jul 93	94	55	5 Aug 93	104	72
2 Jul 93	92	52	6 Aug 93	102	69
3 Jul 93	86	51	7 Aug 93	96	59
4 Jul 93	88	51	8 Aug 93	94	53
5 Jul 93	89	53	9 Aug 93	94	69
6 Jul 93	91	64	10 Aug 93	99	68
7 Jul 93	91	56	11 Aug 93	99	57
8 Jul 93	93	57	12 Aug 93	91	47
9 Jul 93	91	55	13 Aug 93	90	50
10 Jul 93	88	53	14 Aug 93	89	53
11 Jul 93	87	53	15 Aug 93	88	52
12 Jul 93	87	53	16 Aug 93	87	49
13 Jul 93	90	57	17 Aug 93	94	74
14 Jul 93	89	51	18 Aug 93	95	57
15 Jul 93	86	47	19 Aug 93	95	52
16 Jul 93	82	56	20 Aug 93	90	54
17 Jul 93	84	44	21 Aug 93	92	51
18 Jul 93	86	45	22 Aug 93	97	56
19 Jul 93	87	45	23 Aug 93	101	60
20 Jul 93	96	65	24 Aug 93	103	52
21 Jul 93	91	53	25 Aug 93	96	56
22 Jul 93	92	54	26 Aug 93	94	53
23 Jul 93	96	57	27 Aug 93	98	62
24 Jul 93	93	70	28 Aug 93	97	64
25 Jul 93	94	62	29 Aug 93	95	60
26 Jul 93	95	59	30 Aug 93	94	55
27 Jul 93	100	75	31 Aug 93	92	65
28 Jul 93	100	58	1 Sep 93	94	61
29 Jul 93	97	58	2 Sep 93	98	60
30 Jul 93	101	56	3 Sep 93	97	63
31 Jul 93	105	61	4 Sep 93	97	56

TABLE C-1. (Contd.)

Date	High, °F	Low, °F	Date	High, °F	Low, °F
5 Sep 93	92	50	19 Sep 93	73	40
6 Sep 93	91	49	20 Sep 93	76	39
7 Sep 93	90	58	21 Sep 93	79	43
8 Sep 93	95	51	22 Sep 93	80	35
9 Sep 93	96	56	23 Sep 93	76	33
10 Sep 93	97	54	24 Sep 93	79	48
11 Sep 93	96	53	25 Sep 93	81	41
12 Sep 93	89	48	26 Sep 93	84	45
13 Sep 93	86	59	27 Sep 93	85	39
14 Sep 93	80	48	28 Sep 93	78	37
15 Sep 93	78	40	29 Sep 93	78	51
16 Sep 93	75	37	30 Sep 93	83	54
17 Sep 93	69	39			
18 Sep 93	69	35			

TABLE C-2. Weather Station No. 1 Relative Humidity.

Date	High, %	Low, %	Date	High, %	Low, %
1 Oct 92	55.2	30.3	5 Nov 92	71.9	22.6
2 Oct 92	74.4	24.1	6 Nov 92	72.2	24.8
3 Oct 92	70.6	35.2	7 Nov 92	69.0	25.9
4 Oct 92	52.3	33.2	8 Nov 92	77.3	28.8
5 Oct 92	62.2	31.0	9 Nov 92	74.1	30.9
6 Oct 92	60.6	37.6	10 Nov 92	75.9	24.2
7 Oct 92	37.2	20.4	11 Nov 92	46.2	15.8
8 Oct 92	34.9	19.8	12 Nov 92	55.4	15.2
9 Oct 92	49.2	21.9	13 Nov 92	56.1	16.7
10 Oct 92	37.2	24.9	14 Nov 92	68.3	21.4
11 Oct 92	44.8	25.9	15 Nov 92	67	25.3
12 Oct 92	48.0	23.5	16 Nov 92	65.8	29.9
13 Oct 92	50.2	33.6	17 Nov 92	72.0	35.5
14 Oct 92	54.6	32.5	18 Nov 92	77.1	30.0
15 Oct 92	74.8	40.9	19 Nov 92	69.2	37.6
16 Oct 92	65.0	37.3	20 Nov 92	45.9	19.2
17 Oct 92	65.3	34.4	21 Nov 92	39.6	18.2
18 Oct 92	64.7	31.4	22 Nov 92	52.4	13.6
19 Oct 92	74.0	35.5	23 Nov 92	57.1	25.7
20 Oct 92	64.8	50.4	24 Nov 92	58.4	34.5
21 Oct 92	80.6	48.5	25 Nov 92	68.0	33.8
22 Oct 92	88.2	35.2	26 Nov 92	70.1	29.7
23 Oct 92	60.7	35.6	27 Nov 92	54.8	19.5
24 Oct 92	94.0	43.2	28 Nov 92	63.7	31.3
25 Oct 92	86.8	47.7	29 Nov 92	55.6	28.7
26 Oct 92	84.9	38.8	30 Nov 92	53.7	26.0
27 Oct 92	88.5	37.6	1 Dec 92	53.8	30.8
28 Oct 92	88.4	48.9	22 Dec 92	75.9	31.0
29 Oct 92	84.7	32.1	23 Dec 92	80.7	17.7
30 Oct 92	83.9	20.7	24 Dec 92	75.4	27.5
31 Oct 92	85.0	20.1	25 Dec 92	73.5	28.9
1 Nov 92	81.5	25.4	26 Dec 92	78.0	24.3
2 Nov 92	81.8	29.3	27 Dec 92	80.0	33.9
3 Nov 92	51.8	25.6	28 Dec 92	89.4	64.2
4 Nov 92	59.7	22.8	29 Dec 92	90.1	72.1

TABLE C-2. (Contd.)

Date	High, %	Low, %	Date	High, %	Low, %
30 Dec 92	79.6	27.1	9 Feb 93	88.7	87.5
31 Dec 92	84.6	42.1	10 Feb 93	88.8	29.6
1 Jan 93	87.9	47.1	11 Feb 93	77.6	25.6
2 Jan 93	87.1	11.2	12 Feb 93	65.1	32.4
3 Jan 93	73.7	25.0	13 Feb 93	71.9	30.3
4 Jan 93	80.0	29.6	14 Feb 93	86.5	49.5
5 Jan 93	84.5	42.0	15 Feb 93	92.4	45.0
6 Jan 93	91.1	58.6	16 Feb 93	99.3	41.7
7 Jan 93	88.3	83.8	17 Feb 93	90.7	48.2
8 Jan 93	86.5	35.9	18 Feb 93	93.6	56.3
9 Jan 93	84.9	40.8	19 Feb 93	91.1	37.7
10 Jan 93	86.7	26.8	20 Feb 93	83.6	27.0
11 Jan 93	75.4	25.0	21 Feb 93	81.4	26.1
12 Jan 93	92.4	90.2	22 Feb 93	87.6	33.8
13 Jan 93	90.3	88.7	23 Feb 93	88.3	84.4
14 Jan 93	89.2	42.8	24 Feb 93	94.2	21.5
15 Jan 93	87.6	75.7	25 Feb 93	98.4	36.0
16 Jan 93	87.0	80.2	26 Feb 93	98.7	57.0
17 Jan 93	86.8	75.1	27 Feb 93	95.7	55.1
18 Jan 93	84.0	64.0	28 Feb 93	97.8	54.9
19 Jan 93	84.2	80.4	1 Mar 93	95.1	92.7
20 Jan 93	86.1	57.6	2 Mar 93	97.4	35.5
21 Jan 93	86.4	56.3	3 Mar 93	68.9	26.0
22 Jan 93	88.5	31.7	4 Mar 93	89.6	28.7
23 Jan 93	81.5	32.8	5 Mar 93	85.1	29.6
24 Jan 93	82.7	26.9	6 Mar 93	95.2	54.3
25 Jan 93	76.1	29.8	7 Mar 93	93.9	36.3
26 Jan 93	79.2	36.0	8 Mar 93	89.5	34.0
2 Feb 93	77.8	30.4	9 Mar 93	37.8	36.3
3 Feb 93	87.1	34.9	16 Mar 93	93.6	31.6
4 Feb 93	82.5	31.2	17 Mar 93	76.4	37.7
5 Feb 93	76.4	34.6	18 Mar 93	90.4	26.8
6 Feb 93	84.7	36.3	19 Mar 93	87.7	32.0
7 Feb 93	91.5	45.2	20 Mar 93	84.1	39.9
8 Feb 93	89.5	60.6	21 Mar 93	92.6	34.1

TABLE C-2. (Contd.)

Date	High, %	Low, %	Date	High, %	Low,%
22 Mar 93	89.8	28.8	19 Jun 93	57.2	28.1
23 Mar 93	83.7	54.6	20 Jun 93	73.3	34.9
24 Mar 93	99.2	39.2	21 Jun 93	88.9	31.8
25 Mar 93	99.9	72.8	22 Jun 93	49.4	37.7
26 Mar 93	98.7	67.0	23 Jun 93	54.7	26.5
27 Mar 93	97.8	46.8	24 Jun 93	34.0	21.9
28 Mar 93	97.3	66.6	25 Jun 93	42.5	19.5
29 Mar 93	97.0	44.0	26 Jun 93	62.0	21.1
30 Mar 93	85.3	32.0	27 Jun 93	58.9	20.4
31 Mar 93	99.1	32.8	28 Jun 93	61.2	21.2
1 Apr 93	99.3	32.9	29 Jun 93	48.9	31.9
2 Apr 93	85.8	32.9	30 Jun 93	52.5	27.6
3 Apr 93	96.8	35.5	1 Jul 93	64.7	28.7
4 Apr 93	97.4	20.4	2 Jul 93	74.4	23.8
5 Apr 93	97.9	29.6	3 Jul 93	52.8	30.1
6 Apr 93	86.7	31.5	4 Jul 93	72.9	35.7
7 Apr 93	91.0	32.7	5 Jul 93	82.0	30.8
26 May 93	57.5	28.8	6 Jul 93	85.0	39.6
27 May 93	95.1	22.6	7 Jul 93	79.8	32.9
28 May 93	92.2	30.8	8 Jul 93	65.6	28.5
29 May 93	93.8	26.7	9 Jul 93	62.2	30.8
30 May 93	86.4	23.1	10 Jul 93	56.2	29.8
31 May 93	73.8	44.1	11 Jul 93	75.9	28.2
1 Jun 93	97.3	37.7	12 Jul 93	77.5	33.2
8 Jun 93	52.0	30.7	13 Jul 93	68.4	47.0
9 Jun 93	57.7	27.1	14 Jul 93	65.8	27.4
10 Jun 93	72.6	21.4	15 Jul 93	62.8	22.5
11 Jun 93	62.8	21.6	16 Jul 93	51.0	30.0
12 Jun 93	77.3	23.2	17 Jul 93	70.5	28.9
13 Jun 93	64.4	22.7	18 Jul 93	68.6	24.8
14 Jun 93	62.2	25.0	19 Jul 93	65.9	30.5
15 Jun 93	66.5	32.5	20 Jul 93	83.0	14.9
16 Jun 93	59.1	27.7	21 Jul 93	59.8	18.7
17 Jun 93	45.6	30.5	22 Jul 93	57.6	17.6
18 Jun 93	46.3	28.3	23 Jul 93	63.8	29.2

TABLE C-2. (Contd.)

Date	High, %	Low, %	Date	High, %	Low, %
24 Jul 93	52.3	29.1	28 Aug 93	64.8	21.9
25 Jul 93	79.0	24.5	29 Aug 93	63.1	19.8
26 Jul 93	76.7	21.5	30 Aug 93	48.5	17.7
27 Jul 93	65.0	20.9	31 Aug 93	55.1	21.3
28 Jul 93	53.6	17.4	1 Sep 93	56.6	28.9
29 Jul 93	42.3	16.2	2 Sep 93	58.0	22.6
30 Jul 93	61.2	15.9	3 Sep 93	62.1	16.6
31 Jul 93	42.8	17.7	4 Sep 93	53.1	16.5
1 Aug 93	36.1	17.8	5 Sep 93	63.9	17.3
2 Aug 93	34.7	18.0	6 Sep 93	55.3	19.7
3 Aug 93	64.9	16.8	7 Sep 93	34.6	14.6
4 Aug 93	45.9	19.0	8 Sep 93	35.8	16.0
5 Aug 93	46.5	19.0	9 Sep 93	32.1	15.6
6 Aug 93	44.3	13.5	10 Sep 93	33.2	13.9
7 Aug 93	53.6	14.3	11 Sep 93	29.7	15.9
8 Aug 93	42.0	14.6	12 Sep 93	35.4	16.3
9 Aug 93	40.1	14.8	13 Sep 93	21.9	15.7
10 Aug 93	45.9	24.2	14 Sep 93	31.8	17.5
11 Aug 93	41.8	13.4	15 Sep 93	45.1	20.5
12 Aug 93	45.9	15.7	16 Sep 93	79.0	14.0
13 Aug 93	70.3	11.8	17 Sep 93	60.3	18.7
14 Aug 93	73.0	18.6	18 Sep 93	67.0	18.0
15 Aug 93	89.1	16.9	19 Sep 93	48.2	14.8
16 Aug 93	73.7	14.5	20 Sep 93	47.9	12.8
17 Aug 93	52.5	14.7	21 Sep 93	38.9	10.6
18 Aug 93	55.4	11.7	22 Sep 93	54.3	13.9
19 Aug 93	67.5	10.6	23 Sep 93	41.8	12.3
20 Aug 93	60.7	12.2	24 Sep 93	12.9	12.3
21 Aug 93	50.4	12.9	25 Sep 93	24.7	13.6
22 Aug 93	38.4	12.4	26 Sep 93	17.6	10.1
23 Aug 93	48.9	12.2	27 Sep 93	19.8	10.2
24 Aug 93	52.2	11.8	28 Sep 93	12.0	11.1
25 Aug 93	60.5	12.7			
26 Aug 93	51.5	16.3			
27 Aug 93	61.6	23.0			

TABLE C-3. Weather Station No. 1 Barometric Pressure Data.

Date	High, mbar	Low, mbar	Date	High, mbar	Low, mbar
16 Jan 93	969.8	969.11	7 Mar 93	996.5	992.00
17 Jan 93	970.7	967.97	8 Mar 93	1001.2	988.51
18 Jan 93	970.6	968.47	25 Mar 93	993.2	991.81
19 Jan 93	971.3	963.74	26 Mar 93	992.7	987.97
20 Jan 93	972.6	969.56	27 Mar 93	995.3	983.72
21 Jan 93	972.0	969.20	28 Mar 93	998.0	993.28
23 Jan 93	973.2	971.27	29 Mar 93	994.2	989.35
24 Jan 93	972.3	968.14	30 Mar 93	989.3	983.76
25 Jan 93	973.6	969.15	31 Mar 93	984.7	973.96
26 Jan 93	972.6	968.90	1 Apr 93	974.6	973.32
27 Jan 93	980.0	970.24	2 Apr 93	998.6	992.97
1 Feb 93	977.0	974.37	3 Apr 93	995.0	990.48
2 Feb 93	975.1	968.46	4 Apr 93	993.6	987.75
3 Feb 93	968.4	963.49	5 Apr 93	991.1	989.07
4 Feb 93	963.3	957.36	6 Apr 93	994.6	988.62
5 Feb 93	957.3	950.98	7 Apr 93	990.6	975.14
6 Feb 93	950.8	944.59	8 Apr 93	974.9	969.21
7 Feb 93	992.2	988.11	21 May 93	989.85	987.19
8 Feb 93	990.6	986.33	22 May 93	989.54	984.36
9 Feb 93	986.4	975.02	23 May 93	990.40	987.49
19 Feb 93	990.8	986.79	24 May 93	996.84	990.94
20 Feb 93	991.0	988.26	25 May 93	992.15	988.58
21 Feb 93	989.9	988.10	26 May 93	991.42	984.99
22 Feb 93	995.8	994.14	1 Jun 93	986.16	981.28
23 Feb 93	996.0	995.72	2 Jun 93	984.09	980.67
2 Mar 93	1002.2	1001.17	3 Jun 93	991.79	984.25
3 Mar 93	1002.1	999.21	4 Jun 93	988.88	986.38
4 Mar 93	1008.7	999.82	5 Jun 93	991.17	989.26
5 Mar 93	1004.7	1001.18	6 Jun 93	990.88	985.81
6 Mar 93	1001.1	996.42	7 Jun 93	992.54	988.93

TABLE C-3. (Contd.)

Date	High, mbar	Low, mbar	Date	High, mbar	Low, mbar
8 Jun 93	993.63	990.22	20 Jul 93	995.04	991.01
10 Jun 93	989.20	984.20	1 Aug 93	991.31	986.44
11 Jun 93	987.43	982.57	2 Aug 93	997.20	984.64
12 Jun 93	984.85	979.42	3 Aug 93	998.12	997.20
13 Jun 93	997.16	993.22	4 Aug 93	999.39	996.45
14 Jun 93	993.52	991.59	5 Aug 93	993.99	992.47
15 Jun 93	991.84	988.64	6 Aug 93	994.08	990.61
17 Jun 93	993.00	988.50	7 Aug 93	993.98	988.95
18 Jun 93	994.18	989.83	8 Aug 93	991.87	988.30
19 Jun 93	997.96	993.65	9 Aug 93	990.58	986.84
20 Jun 93	993.55	990.66	10 Aug 93	992.78	983.38
21 Jun 93	990.69	989.05	11 Aug 93	994.36	991.64
22 Jun 93	989.82	980.96	12 Aug 93	992.35	991.61
24 Jun 93	989.21	984.26	13 Aug 93	992.08	987.34
25 Jun 93	989.10	984.59	14 Aug 93	995.28	988.66
26 Jun 93	987.61	987.21	15 Aug 93	995.72	989.14
27 Jun 93	985.57	981.90	16 Aug 93	995.64	991.70
28 Jun 93	984.17	976.54	17 Aug 93	995.05	991.23
29 Jun 93	988.98	979.40	19 Aug 93	991.80	986.22
1 Jul 93	987.83	984.65	20 Aug 93	996.19	987.38
2 Jul 93	987.22	987.06	21 Aug 93	998.94	994.45
3 Jul 93	990.11	986.67	22 Aug 93	996.33	992.09
4 Jul 93	994.70	987.11	23 Aug 93	992.16	989.53
5 Jul 93	995.14	991.61	24 Aug 93	993.50	985.18
6 Jul 93	992.02	984.30	25 Aug 93	995.90	991.27
8 Jul 93	993.74	986.47	26 Aug 93	995.96	995.44
9 Jul 93	990.90	986.79	27 Aug 93	1004.08	996.98
10 Jul 93	993.75	983.99	28 Aug 93	1002.76	1000.09
11 Jul 93	995.67	988.94	29 Aug 93	999.96	993.71
12 Jul 93	994.29	992.94	30 Aug 93	994.57	991.67
15 Jul 93	991.18	986.63	31 Aug 93	995.26	987.14
16 Jul 93	994.97	988.74	1 Sep 93	1004.67	1001.11
17 Jul 93	992.59	989.91	2 Sep 93	1002.57	999.89
18 Jul 93	989.77	983.29	3 Sep 93	1001.37	997.07
19 Jul 93	984.46	983.06	4 Sep 93	1000.03	998.22

TABLE C-3. (Contd.)

Date	High, mbar	Low, mbar	Date	High, mbar	Low, mbar
5 Sep 93	999.01	998.84	17 Sep 93	1006.43	996.55
6 Sep 93	993.06	988.37	18 Sep 93	1009.00	1007.32
7 Sep 93	989.94	978.76	19 Sep 93	1012.20	1007.62
8 Sep 93	999.94	996.56	20 Sep 93	1009.91	1009.50
9 Sep 93	998.07	992.10	23 Sep 93	1003.27	999.40
10 Sep 93	993.96	990.63	24 Sep 93	1004.79	999.11
11 Sep 93	993.57	986.88	25 Sep 93	1004.34	1000.24
12 Sep 93	996.46	989.22	26 Sep 93	1002.97	999.62
13 Sep 93	993.14	992.95	27 Sep 93	1004.47	1000.17
14 Sep 93	993.25	991.77	28 Sep 93	1001.53	999.66
16 Sep 93	992.00	989.06	29 Sep 93	999.55	991.01

Appendix D

WELL TEMPERATURE DATA

TABLE D-1. Well 4K-1 Temperature.

11 August 1993		16 December 1993	
Depth, ft	Temp, °F	Depth, ft	Temp, °F
0		0	205.4
5	204.75	5	205.8
50	205.13	50	206.3
55	208.54	55	207.8
60	209.87	60	209.7
65	210.39	70	211.4
70	210.50	80	213.9
75	211.24	84	216.4
80	211.88		
85	211.94		

TABLE D-2. Well 4P-1 Temperature.

11 August 1993		16 December 1993	
Depth, ft	Temp, °F	Depth, ft	Temp, °F
0		0	203.7
5	203.09	5	206.1
50	205.32	50	207.7
55	208.54	55	208.3
60	212.65	58	210.7
65	216.28	60	211.5
70	218.70	65	214.2
75	219.19	70	218.8
80	219.32	75	219.4
85	219.44	80	220.2
90	221.88	85	220.8
95	228.76	90	222.4
100	232.18	93	225.3
105	241.44	97	228.7
		100	233.8
		104	239.9

TABLE D-3. Well 4A-4 Temperature.

16 March 1992		29 September 1992	
Depth, ft	Temp, °F	Depth, ft	Temp, °F
0	199.6	0	204.6
5	205.7	5	205.7
10	205.7	19	209.9
15	205.7	20	210.1
20	207.2	25	210.3
25	210.2	28	212.8
30	212.7	30	213.3
31	216.3	31	214.7

TABLE D-4. Well OB-1 Temperature.

11 August 1993	
Depth, ft	Temp, °F
10	88.0
20	88.0
30	88.0
40	88.0
50	88.0
60	88.0
70	88.0
80	88.0
90	88.0
100	88.0
110	88.1
120	87.7
130	87.5
140	87.4
150	87.2
160	87.2
170	84.5
180	84.8
190	85.3
200	86.0
210	86.5

a The old pump became lodged in the well casing during removal at a depth of 210 feet. A smaller pump for taking water samples was then installed above the old pump.

TABLE D-5. Well OB-2 Temperature.

11 August 1993	
Depth, ft	Temp, °F
0	
10	72.61
20	68.07
30	68.71
40	69.50
50	70.29
60	70.98
70	71.60
80	72.35
90	73.19
100	74.32
110	75.31
120	75.98
130	76.55
140	77.13
150	77.80
160	78.42
170	78.93
180	79.50
190	80.22
200	80.58
210	80.69
220	80.80
230	80.85
240	80.91
250	80.98
260	81.06
270	81.17
280	81.27
290	81.34
300	81.41
310	81.52
320	81.62

TABLE D-6. Well OB-3 Temperature.

11 August 1993			
Depth, ft.	Temp, oF	Depth, ft.	Temp, oF
0		260	84.94
10	81.10	270	86.73
20	76.57	280	88.59
30	74.81	290	90.12
40	72.16	300	90.91
50	70.64	310	91.47
60	70.49	320	91.95
70	69.43	330	92.73
80	69.45	340	93.42
90	68.96	350	94.20
100	68.02	360	95.05
110	69.83	370	95.93
120	71.99	380	97.73
130	70.53	390	98.38
140	70.80	400	98.49
150	69.84	410	98.51
160	69.90	420	98.55
170	72.65	430	98.96
180	72.68	440	99.64
190	74.34	450	100.07
200	74.40	460	100.14
210	75.20	470	100.16
220	76.55	480	100.19
230	77.76	490	100.20
240	79.19	500	100.21
250	83.15		

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