Status of Ground-Water Resources at U.S. Navy Support Facility, Diego Garcia: Summary of Hydrologic and Climatic Data, January 1995 through September 1997

By Jill D. Torikai

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CONVERSION FACTORS AND ABBREVIATION

Multiply	By	To obtain
foot (ft)	0.3048	meter
gallon (gal)	3.785	liter
gallon per day (gal/d)	3.785	liter per day
million gallons per day (Mgal/d)	0.04381	cubic meter per second
inch per year (in/yr)	25.4	millimeter per year

Abbreviation used in water-quality descriptions
mg/L = milligrams per liter

STATUS OF GROUND-WATER RESOURCES AT U.S. NAVY SUPPORT FACILITY, DIEGO GARCIA: SUMMARY OF HYDROLOGIC AND CLIMATIC DATA, JANUARY 1995 THROUGH SEPTEMBER 1997

EXECUTIVE SUMMARY

This report describes the status of ground-water resources at U.S. Navy Support Facility, Diego Garcia. Data presented are from January 1995 through September 1997, with a focus on data from July through September 1997 (third quarter of 1997). A complete database of ground-water withdrawals and chloride-concentration records since 1985 is maintained by the U.S. Geological Survey from records provided by the U.S. Navy.

1. RAINFALL--Total rainfall for the period July through September 1997 was 18.58 inches, which is about 9 percent less than the mean rainfall of 20.48 inches for the period July through September. Mean rainfall is calculated for the base period 1951–96.

2. GROUND-WATER WITHDRAWAL--Islandwide ground-water withdrawal decreased each month from 952,100 gallons per day in July 1997 to 860,800 gallons per day in September 1997. A larger percentage of water was withdrawn from the Cantonment area as a result of well shutdowns in the Air Operations area.

3. CHLORIDE CONCENTRATION OF PUMPED GROUND WATER--At the end of September 1997, the chloride concentrations of water from the elevated tanks at Cantonment and Air Operations were 86 and 92 milligrams per liter, respectively. Water from the Cantonment and Air Operations elevated tanks had overall increasing chloride concentrations since February 1997 and May 1997, respectively.

4. CHLORIDE CONCENTRATION OF GROUND WATER IN MONITORING WELLS--The overall chloride concentration of ground water in selected monitoring wells at Cantonment and Air Operations increased during the period July through September 1997. Water from the deepest well at sites AW16 and BW09 increased in chloride concentration by about 2,500 and 900 milligrams per liter, respectively.

5. FUEL-DIVERSION PROGRAM AT AIR OPERATIONS--The diversion program was a result of a fuel-pipeline leak discovered at the South Ramp of Air Operations in May 1991. The target rates of withdrawal and injection were established to hydraulically divert fuel migration away from production wells. Ground-water injection into wells AO-10 through AO-12 using water pumped from wells AO-14 and AO-15 was stopped in August 1997 because of additional fuel contamination at the South Ramp.

STATUS OF GROUND-WATER RESOURCES AT U.S. NAVY SUPPORT FACILITY, DIEGO GARCIA: SUMMARY OF HYDROLOGIC AND CLIMATIC DATA, JANUARY 1995 THROUGH SEPTEMBER 1997

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INTRODUCTION

Diego Garcia Atoll is part of the British Indian Ocean Territory and the site of a U.S. Navy Support Facility. The island's drinking-water supply is derived from ground water, and recharge to the ground-water system is from rainfall. Since 1985, the island's water-supply system has produced about 1 Mgal/d by maintaining low individual pumping rates at many scattered wells (Torikai, 1995). Ground water is pumped from lens-shaped bodies of freshwater floating on seawater. Chloride concentrations of the water have been kept at acceptable levels for drinking by adjusting individual pumping rates. The water-supply system, which has been in operation since 1978, has 102 active wells in five production areas (fig. 1). Water from the Cantonment and Air Operations areas combined accounts for about 99 percent of islandwide withdrawal. The remainder is pumped for local use at Industrial Site South (I-Site), Transmitter Site (T-Site), and GEODSS Site.

Long-term ground-water monitoring has been facilitated by a cooperative agreement between the U.S. Navy Support Facility (NAVSUPPFAC) and the U.S. Geological Survey (USGS) since 1984. However, USGS involvement at Diego Garcia began in 1978 with a hydrogeologic investigation for the Naval Facilities Engineering Command, Pacific Division. The study provided estimates of ground-water resource potential, and helped with the subsequent design, layout, and testing of the water-supply wells (D.A. Davis, USGS, written commun. to U.S. Navy, 1979).

Organization of Report

This report contains hydrologic and climatic data that describe the status of ground-water resources at Navy Support Facility, Diego Garcia. Data presented are from January 1995 through September 1997. Data of primary relevance to the water supply are:

- Rainfall
- Volume of ground water withdrawn at production wells
- Chloride concentration of pumped ground water
- Chloride concentration of ground water sampled from monitoring wells
- Volume of ground water injected at Air Operations

The following narrative highlights trends in the data from July through September 1997 (third quarter of 1997), and makes comparisons with historical data. Ground-water withdrawal and chloride concentrations of water from individual wells are presented in the "Hydrologic-Data Section" at the back of this report. The data section contains the following:

A. Maps of production and monitoring wells at Cantonment and Air Operations
B. Graphs of monthly mean ground-water withdrawal, January 1995 through September 1997
C. Graphs of chloride concentration of pumped water, January 1995 through September 1997

This report is part of a series of USGS reports, "Status of ground-water resources at U.S. Navy Support Facility, Diego Garcia: summary of hydrologic and climatic data." The first report in this series began with data for the period January 1985 through September 1993 (Torikai, 1995). Successive reports have been done on a quarterly basis.

Acknowledgments

Ground-water withdrawal and chloride-concentration data were provided by the NAVSUPPFAC, Public Works Department. Rainfall data were provided by the Naval Pacific Meteorology and Oceanography Detachment at Diego Garcia (NAVPACMETOCDET). Logistical support from the staff of the Public Works Department is greatly appreciated.

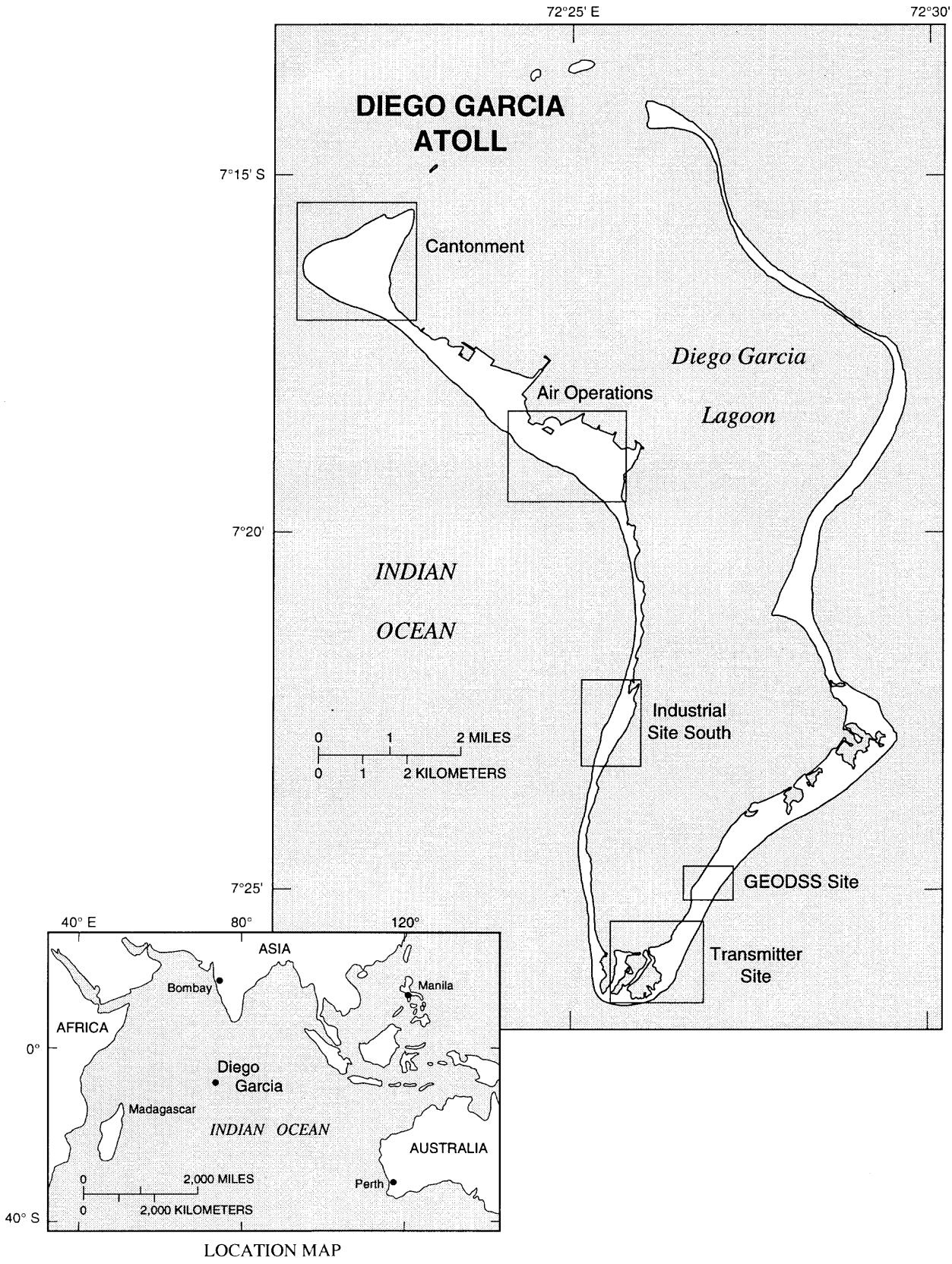


Figure 1. Areas of ground-water production, Diego Garcia.

RAINFALL

Background.--Rainfall data are available since 1951, and all mean rainfall values in this report are calculated for the base period 1951–96. Monthly rainfall are available in published records for the following periods: 1951–60 (U.S. Department of Commerce, 1968), 1961–70 (U.S. Department of Commerce, 1979), 1971 (U.S. Navy, 1978), and 1972–93 (U.S. Department of Commerce, 1995). Rainfall data for the period January 1994 through September 1997 are from the Naval Pacific Meteorology and Oceanography Detachment at Diego Garcia (NAVPACMETOCDET).

The mean annual rainfall at Diego Garcia is about 104 in/yr. Rainfall varies considerably from month to month and from year to year. A wet season occurs from about September through February, and a dry season from about March through August (Hunt, in press), although the periods March through May and October through November can be considered transitional periods with characteristics of either the wet or dry season (Naval Pacific Meteorology and Oceanography Detachment at Diego Garcia, written commun., 1997).

Recent trends.--Total rainfall for the period July through September 1997 (third quarter of 1997) was 18.58 inches, which is about 9 percent less than the mean rainfall of 20.48 inches for the period July through September. The cumulative rainfall from January through September 1997 was 81.99 inches. Figure 2 shows recorded rainfall amounts and rainfall departures from mean monthly rainfall values that were averaged for the base period 1951–96. Periods of below average rainfall can be inferred from the graph when the departure from the mean monthly rainfall is less than zero. Since January 1997, there were 5 months with negative rainfall departures, and 4 months with positive departures.

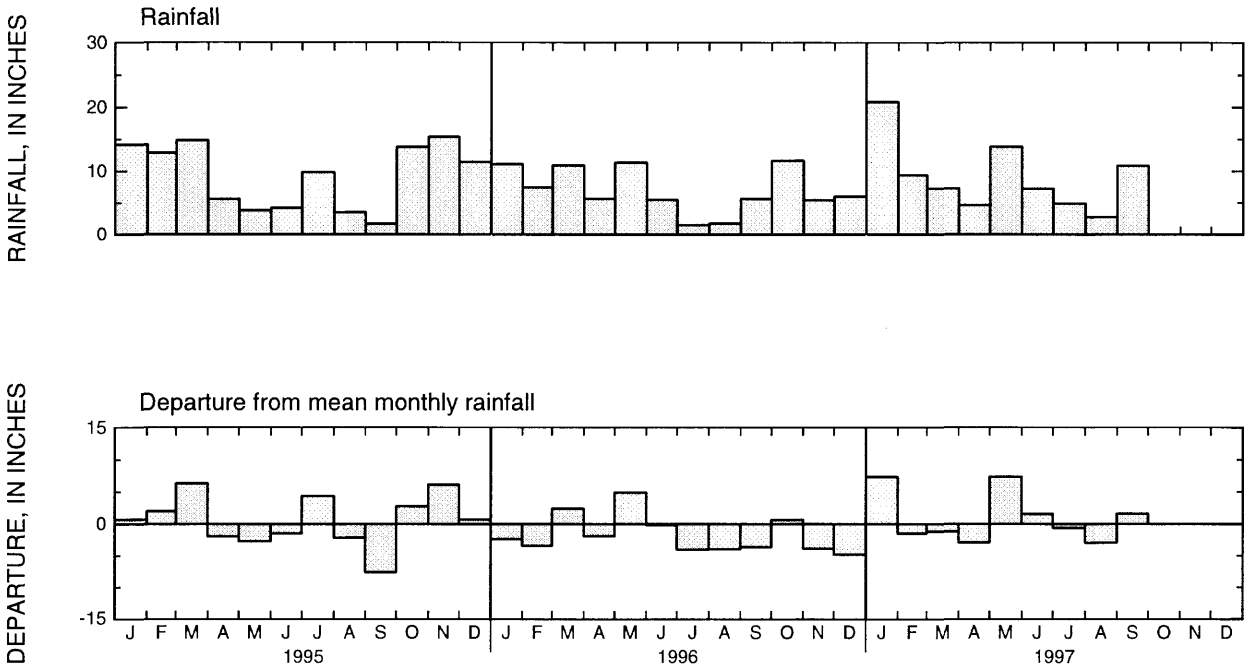


Figure 2. Monthly rainfall and monthly departure from mean monthly rainfall (for 1951-96) at Air Operations, Diego Garcia, January 1995 through September 1997. Data are from the Naval Pacific Meteorology and Oceanography Detachment at Diego Garcia (NAVPACMETOCDET).

GROUND-WATER WITHDRAWAL

Background.--There are 102 production wells in 5 ground-water production areas. The primary production areas are in the Cantonment area (80 wells; fig. A1) and the Air Operations area (18 wells; fig. A2). The wells in the Cantonment area are further separated into sub-groups, and the ground-water withdrawals are presented by sub-group in this report. Withdrawal is measured by flow meters at all production wells and storage tanks in the water-supply system. The data for withdrawal are provided by the U.S. Navy. Data were collected daily through November 1996, but since December 2, 1996, data are collected every Monday, Wednesday, Friday, and Saturday, and thus represent a total of 1 or 2 days of ground-water withdrawal. If the last day of a month is not a Monday, Wednesday, Friday, or Saturday, then the withdrawal is included in the withdrawal of the next month. Thus, some monthly mean withdrawal data may include the withdrawal data for the last day of the previous month.

Ground-water withdrawal from the Cantonment area increased in 1991 because of decreased withdrawal at Air Operations (Torikai, 1995). From May 1991 through April 1992, 10 wells at Air Operations were shut down because of an underground fuel-pipeline leak near those wells. Pumping resumed at four wells in May 1992, but six Air Operations wells were used in the Fuel-Diversion Program and did not contribute to the water supply. Thus, since May 1992, 12 wells (AO-2 through AO-9 and AO-16 through AO-19) were pumped for water supply.

Recent trends.--Ground-water withdrawal was further disrupted in August 1997 with the confirmation of an additional area of fuel contamination at Air Operations, and consequently production wells AO-16 through AO-19 were shut down about August 22, 1997. Therefore, by the end of August 1997, 8 wells (AO-2 through AO-9) were pumped for water supply and 10 wells (AO-10 through AO-19) were shut down. Prior to 1991, the 18 production wells at Air Operations provided about 240,000 gal/d of water. As of September 1997, the 8 wells still pumped provided about 60,000 gal/d of water.

Islandwide withdrawal decreased from 952,100 gal/d in July 1997 to 860,800 gal/d in September 1997. Figure 3 shows time-series graphs of monthly mean withdrawal islandwide and in each ground-water production area from January 1995 through September 1997. Withdrawals from individual wells both increased and decreased (figs. B1, B2, B3, B4, B5, and B6) during the same period. As a result of the additional contamination at Air Operations, a larger percentage of water was withdrawn from the Cantonment area, thereby altering the distribution of pumpage between the Cantonment and Air Operations areas (table 1). The mean withdrawals for the period January 1995 through June 1997 are included for comparison.

Table 1. Distribution of ground-water withdrawals, Diego Garcia

Month	Islandwide ground-water withdrawal (gal/d)	Percentage of ground-water withdrawal from		
		Cantonment	Air Operations	I-Site, T-Site, GEODSS Site
July 1997	952,100	81	18	1
August 1997	934,800	88	11	1
September 1997	860,800	92	7	1
Jan. 1995–June 1997	936,200	81	18	1

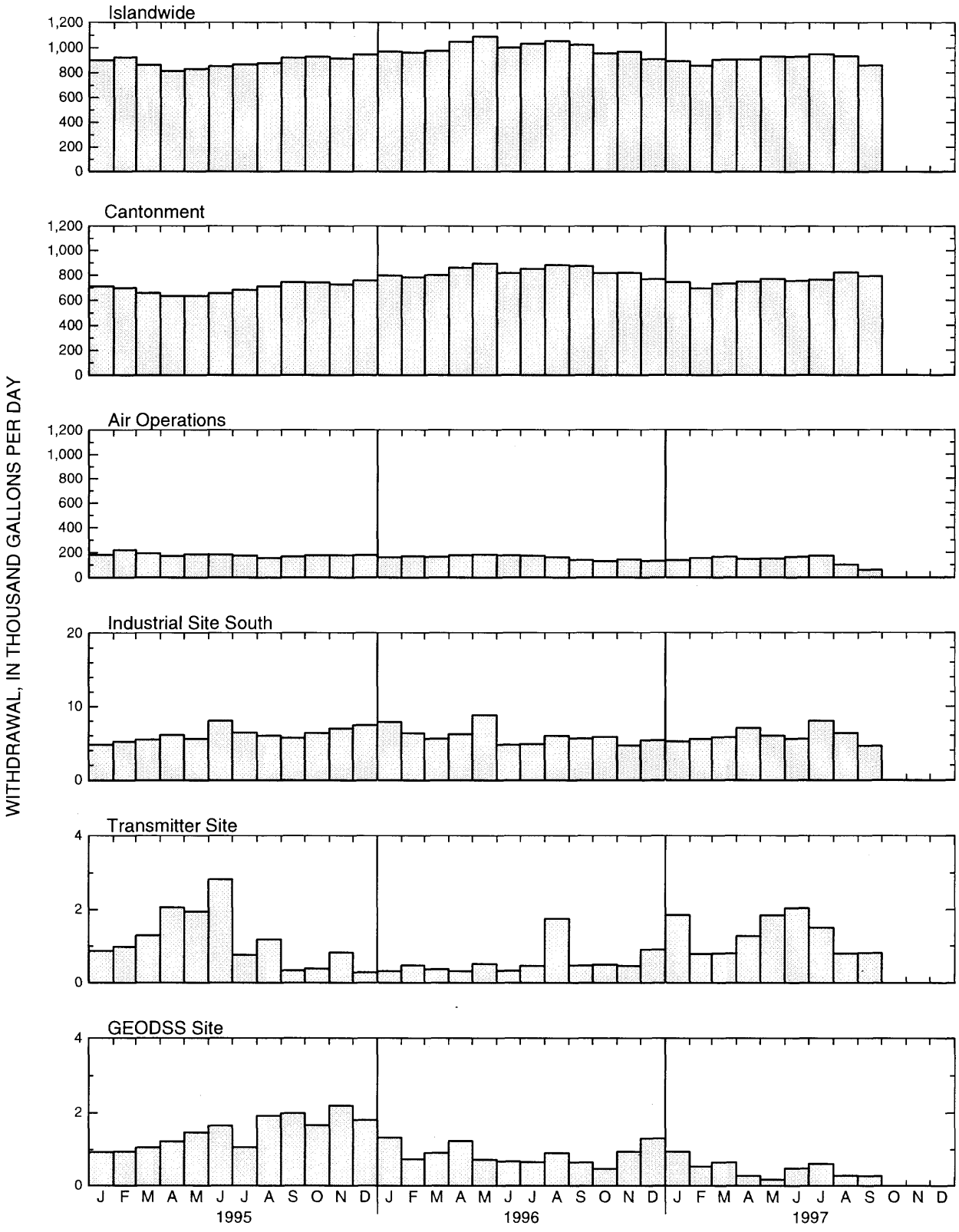


Figure 3. Monthly mean ground-water withdrawal islandwide and in the ground-water production areas, Diego Garcia, January 1995 through September 1997. Data are collected every Monday, Wednesday, Friday, and Saturday. If the last day of a month is not a scheduled data-collection day, then the withdrawal is included in the withdrawal of the next month.

CHLORIDE CONCENTRATION OF PUMPED GROUND WATER

Background.--Chloride concentration is an indication of the relative saltiness of the water. Freshwater is defined in this report as water with a maximum chloride concentration of 250 mg/L. For comparison, the chloride concentration of seawater at Diego Garcia is about 19,400 mg/L (G.W. Tribble, USGS, written commun., 1997). To maintain aesthetic qualities of drinking water such as taste and odor, the U.S. Environmental Protection Agency (1991) recommends a maximum chloride concentration of 250 mg/L.

Chloride-concentration data are provided by the U.S. Navy from analyses done at an on-island laboratory. Chloride concentrations were analyzed daily through November 1996 from water samples collected from the elevated tanks at Cantonment and Air Operations, and from the taps at Industrial Site South (I-Site), Transmitter Site (T-Site), and GEODSS Site. These samples are representative of each of the five ground-water production areas (fig. 1). Since December 2, 1996, chloride concentrations from the five production areas are measured in water samples collected every Monday, Wednesday, Friday, and Saturday. Although daily chloride concentration data were available from the five production areas until November 1996, this report only uses the chloride concentrations from every seventh day that were extracted from the daily record through November 1996. From December 2, 1996, this report only uses the chloride concentrations from water samples collected every Saturday from the representative sites at all five production areas. Chloride concentrations of water collected from individual wells islandwide have always been measured only once a week.

Recent trends.--At the end of September 1997, the chloride concentrations of water from the elevated tanks at Cantonment and Air Operations were 86 and 92 mg/L, respectively. In comparison, prior to the change in pumpage distribution between the two areas, the chloride concentrations from the Cantonment and Air Operations areas were 60 and 95 mg/L at the end of June 1997, respectively. The overall upward trend in chloride concentration at Cantonment, T-Site, and GEODSS Site started about February 1997, whereas the overall upward trends at Air Operations and I-Site started in May 1997 and July 1997, respectively.

Chloride concentrations of water from the modules at Cantonment remained below 50 mg/L, with the exception of Module I which fluctuated between 40 and 80 mg/L during the third quarter of 1997 (fig. C1). The Horizontal wells and Quad wells at Cantonment, and wells AO-4 through AO-9 at Air Operations (figs. C2, C3, and C4) showed overall increasing chloride concentrations of water since about July 1997.

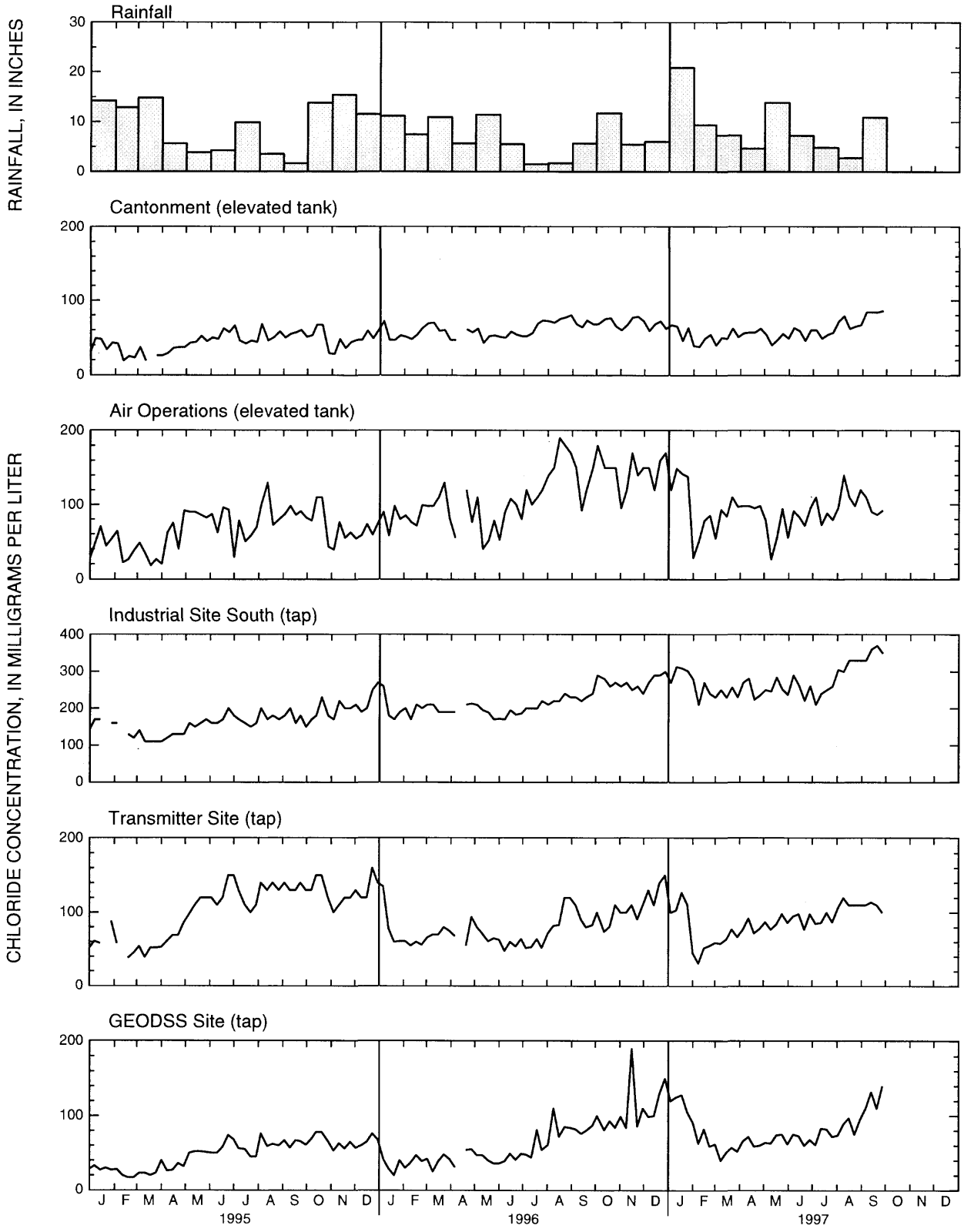


Figure 4. Chloride concentration of pumped water in the ground-water production areas, Diego Garcia, January 1995 through September 1997. Data shown for the period January 1995 through November 1996 are values from every seventh day extracted from the daily record. Data shown for the period December 1996 through March 1997 are values from every Saturday extracted from the data-collection schedule of every Monday, Wednesday, Friday, and Saturday. Rainfall data are shown for comparison.

CHLORIDE CONCENTRATION OF GROUND WATER IN MONITORING WELLS

Background.--Monitoring-well sites comprise one to four vertical wells, with each well having a short screened (open) interval 2 to 5 ft at the bottom of the well. At monitoring sites with more than one well, each well is screened at a different depth, usually between 10 and 80 ft below mean sea level. Some deeper wells tap the transition zone between freshwater and seawater. Monitoring-well sites are distributed islandwide, with 20 sites at Cantonment (fig. A3) and 8 at Air Operations within the active airfield (fig. A4). Additional monitoring-well sites are located south of the airfield, and at Industrial Site South and Transmitter Site. The chloride concentration of ground water is analyzed monthly from water samples collected at 35 monitoring-well sites. These data are provided by the U.S. Navy.

Recent trends.--Monitoring sites AW16 and BW09 (figs. A3, A4) were selected to show trends in ground-water chloride concentration at Cantonment and Air Operations, respectively. Figures 5 and 6 are graphs of chloride concentration at three depths compared with time at the Cantonment and Air Operations sites, respectively. Rainfall data are included in the figures for comparison. The overall chloride concentration of water from sites AW16 and BW09 increased throughout the period July through September 1997 (third quarter of 1997). However, the chloride concentration of water from the 10-ft well at site AW16 decreased during the quarter from 56 to 32 mg/L. During the quarter, the chloride concentration of water from the deepest wells at sites AW16 and BW09 increased by about 2,500 and 900 mg/L, respectively; increases at the shallower wells were between about 10 and 100 mg/L.

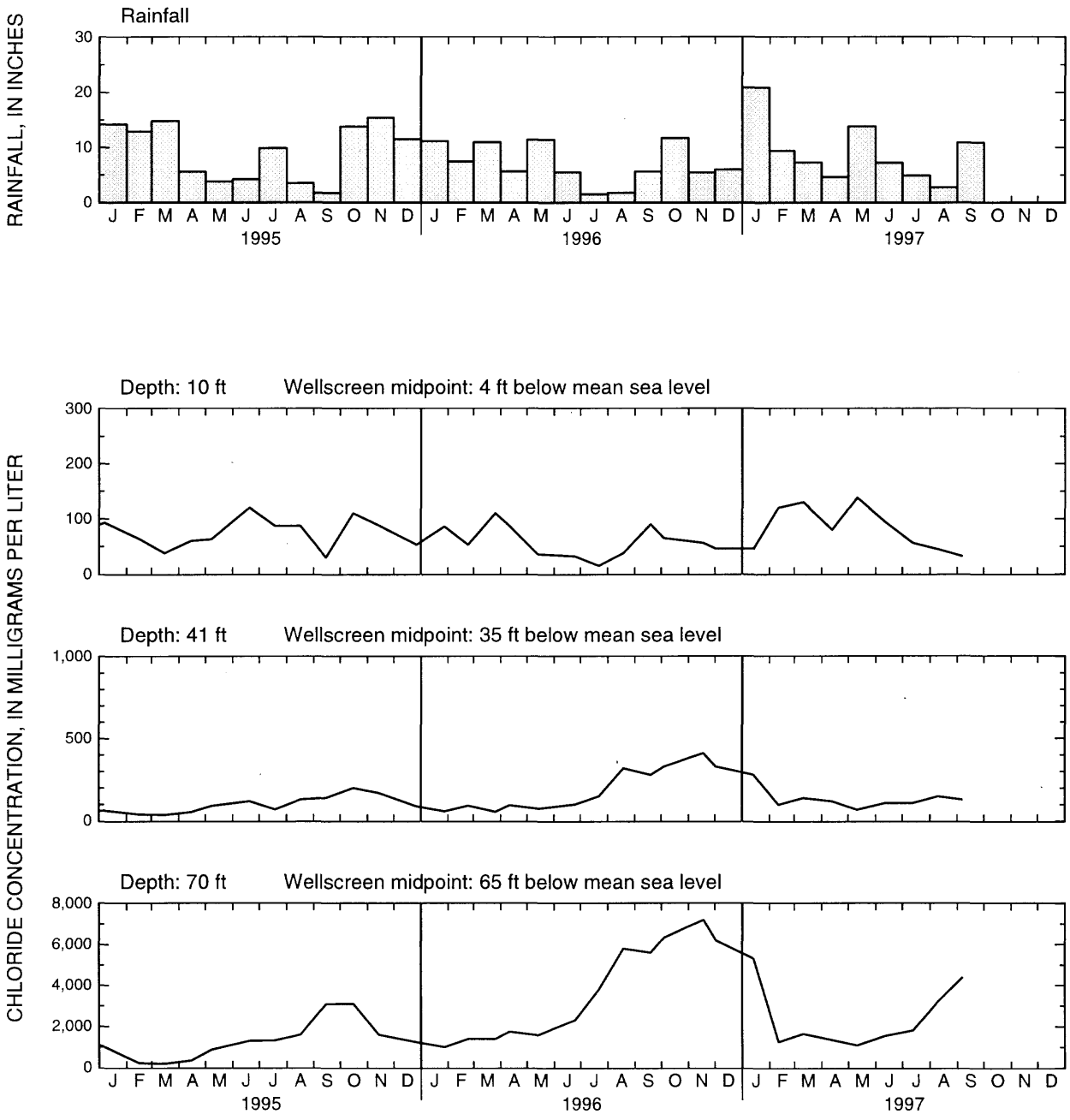


Figure 5. Chloride concentration of ground water (sampled at monthly intervals) in monitoring wells at site AW16 at Cantonment, Diego Garcia, January 1995 through September 1997. Rainfall data from figure 2 are shown for comparison.

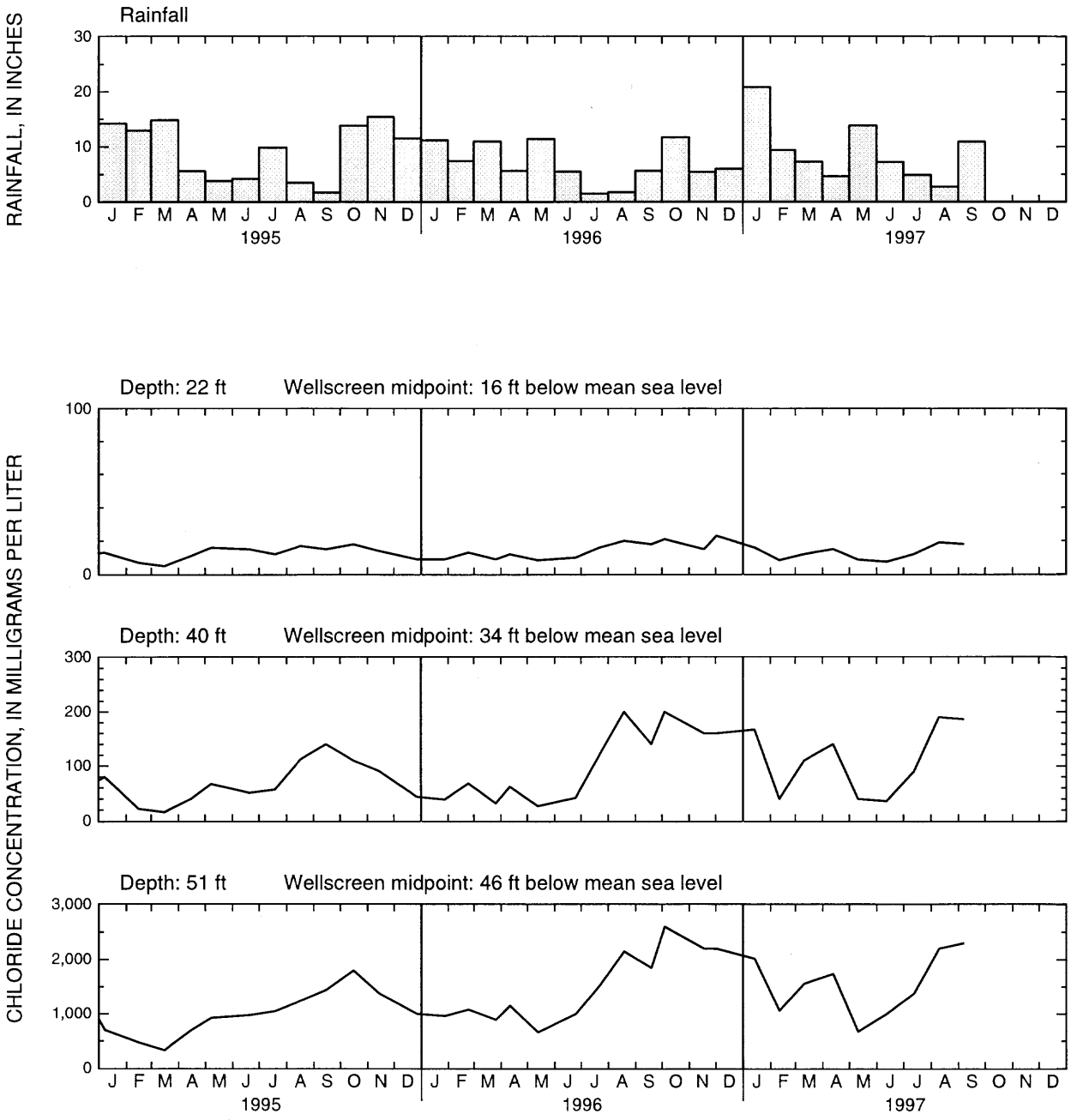


Figure 6. Chloride concentration of ground water (sampled at monthly intervals) in monitoring wells at site BW09 at Air Operations, Diego Garcia, January 1995 through September 1997. Rainfall data from figure 2 are shown for comparison.

FUEL-DIVERSION PROGRAM AT AIR OPERATIONS

Background.--The normal pattern of ground-water withdrawal at Air Operations was disrupted in May 1991 by an underground JP-5 fuel-pipeline leak at the South Ramp parking apron (fig. A2). The leak was about 800 ft from several production wells. To reduce the contamination threat to the freshwater lens at Air Operations, a program to divert fuel away from the production wells was initiated in April 1992. The fuel-diversion program was a closed recirculation loop of withdrawal and injection which hydraulically altered the direction of ground-water flow. The diversion utilized six wells (AO-10 through AO-15), and consisted of pumping about 150,000 gal/d of water from wells AO-14 and AO-15 and directing this water through the common collection main to the wells nearest the leak (AO-10 through AO-12), where it was injected back into the ground. Well AO-13 was used only intermittently since the fuel leak was detected in 1991 (Torikai, 1995).

An elevated mound in the water table created by the injection water helped retard the migration of fuel toward the production wells. Subsequent to the leak detection, 10 wells were shut down from May 1991 to April 1992. However, with the inception of the diversion program, only six wells did not contribute to the water supply. Lost production capacity was about 15 percent of islandwide withdrawal prior to the leak detection.

Injection data for wells AO-10 through AO-12 from May 10, 1993 through August 1997 are collected from water-meter readings. From April 1992 through early May 1993, meter readings of injection were not available, and daily injection at each of the three wells was estimated to be one-third of the total daily withdrawal from wells AO-14 and AO-15 which provided the injection-supply water (Torikai, 1995).

Recent trends.--Injection and withdrawal rates at wells AO-10 through AO-12, well AO-14, and well AO-15 during July and August 1997 were not steady because the recirculation of water was sometimes halted during investigation for further fuel contamination. These 5 wells were shut down about August 4, 1997 as a result of additional fuel contamination at the South Ramp. Target withdrawal and injection rates and daily mean withdrawal and injection rates for wells AO-10 through AO-15 are listed in table 2. Injection and withdrawal rates at wells AO-10 through AO-12, well AO-14, and well AO-15 were between 17 and 31 percent less than the established target rates during July 1997. The daily mean injection was about 104,200 gal/d, while the daily mean withdrawal was about 121,100 gal/d. The total target withdrawal was 150,000 gal/d, and the total target injection was 150,000 gal/d.

Monthly mean withdrawal and injection at wells AO-10 through AO-15 are shown in figure 7 for the period January 1995 through August 1997. Monthly mean withdrawal and injection for wells AO-10 through AO-12, well AO-14, and well AO-15 decreased since January 1997, following withdrawal and injection rates that were close to the target rates since the start of the program in April 1992 (Torikai, 1995).

Table 2. Target and actual withdrawal and injection rates for fuel-diversion program, Diego Garcia, July 1997
[Injection is denoted by negative values; gal/d, gallons per day]

Well	Target rate (gal/d)	Daily mean rate (gal/d)	Difference between target rate and daily mean rate (percent)
AO-10	-30,000	-21,400	29
AO-11	-50,000	-34,300	31
AO-12	-70,000	-48,500	31
AO-13	0	0	0
AO-14	70,000	54,600	22
AO-15	80,000	66,500	17

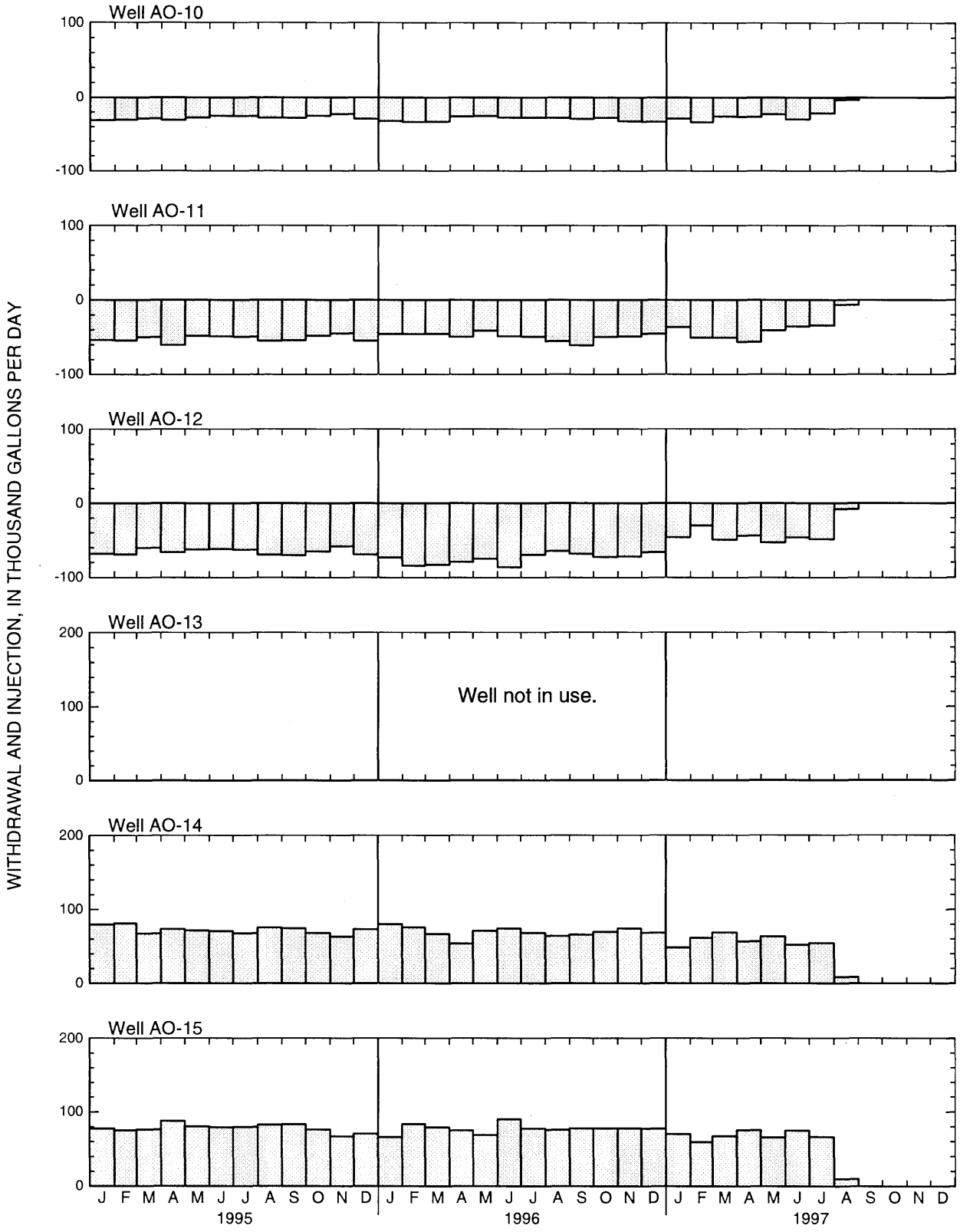


Figure 7. Monthly mean ground-water withdrawal and injection at wells AO-10 through AO-15 at Air Operations, Diego Garcia, January 1995 through August 1997. Injection is plotted as negative. Data are collected every Monday, Wednesday, Friday, and Saturday. If the last day of a month is not a scheduled data-collection day, then the withdrawal is included in the withdrawal of the next month.

HYDROLOGIC-DATA SECTION

TYPES OF DATA INCLUDED

A. Maps of production and monitoring wells at Cantonment and Air Operations
B. Graphs of monthly mean ground-water withdrawal, January 1995 through September 1997
C. Graphs of chloride concentration of pumped water, January 1995 through September 1997

DESCRIPTIONS OF PRINCIPAL PRODUCTION SOURCES AT CANTONMENT AND AIR OPERATIONS AREAS

Cantonment Area

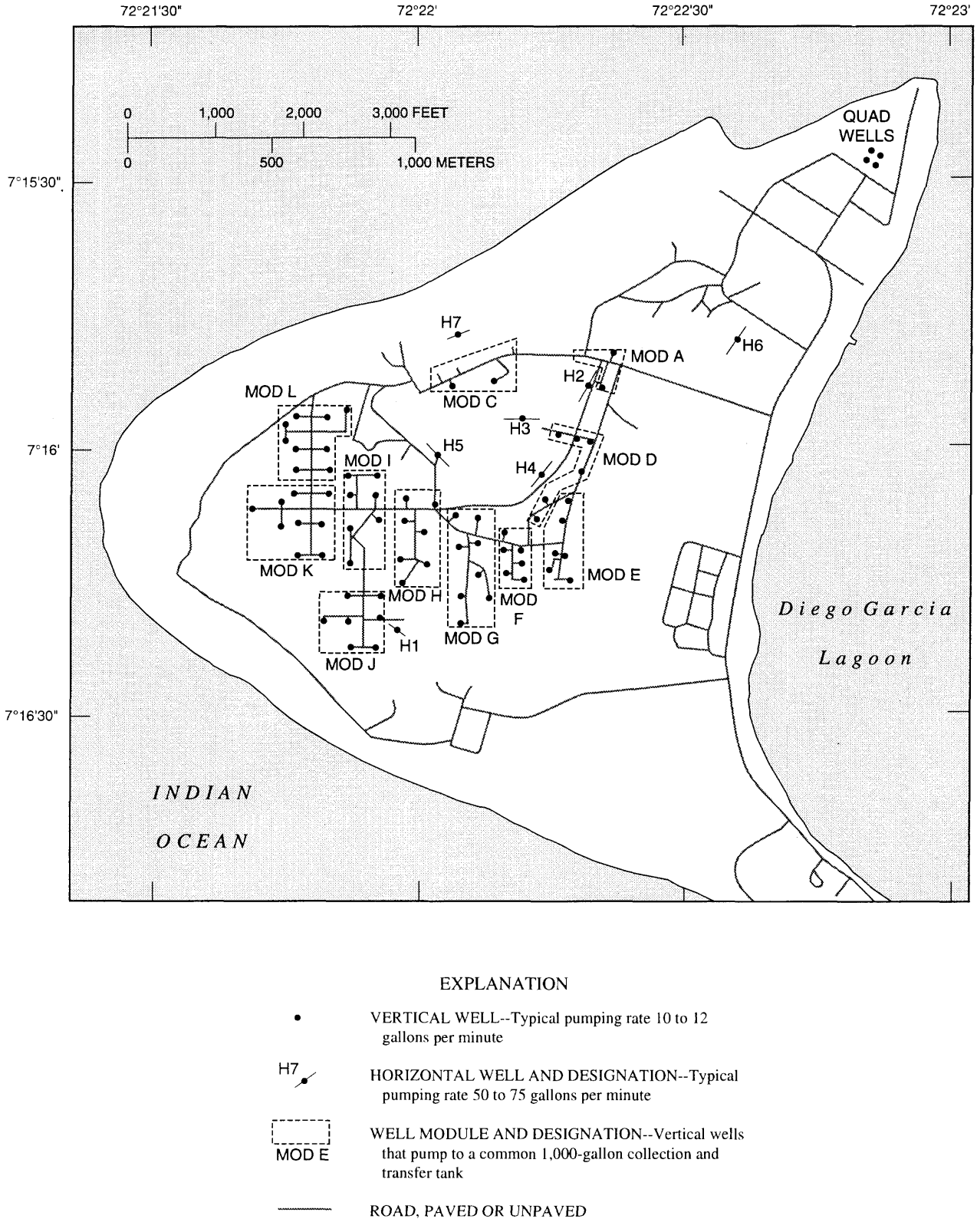
1. Modules A, C through L - each module is a well field of two to nine vertical wells that are pumped to a common collection/ transfer tank.
2. Wells H1 through H7 are horizontal wells.
3. Quad wells are a well field of four vertical wells

Air Operations Area

1. Wells AO-2 through AO-5 are vertical wells.
2. Wells AO-6 through AO-9 are horizontal wells.
3. Wells AO-10 through AO-15 are horizontal wells which were used in the Fuel-Diversion Program since April 1992. Wells AO-10 through AO-12 received injection water from water pumped at wells AO-14 and AO-15; AO-13 was intermittently pumped. The Fuel-Diversion Program was stopped in August 1997, and since then wells AO-10 through AO-15 remain shut down.
4. Wells AO-16 through AO-19 are horizontal wells which were shut down in August 1997.

SECTION A

Maps of production and monitoring wells at Cantonment and Air Operations



EXPLANATION

- • VERTICAL WELL--Typical pumping rate 10 to 12 gallons per minute
- H7 HORIZONTAL WELL AND DESIGNATION--Typical pumping rate 50 to 75 gallons per minute
- MOD E WELL MODULE AND DESIGNATION--Vertical wells that pump to a common 1,000-gallon collection and transfer tank
- ROAD, PAVED OR UNPAVED

Figure A1. Ground-water production wells at Cantonment, Diego Garcia.

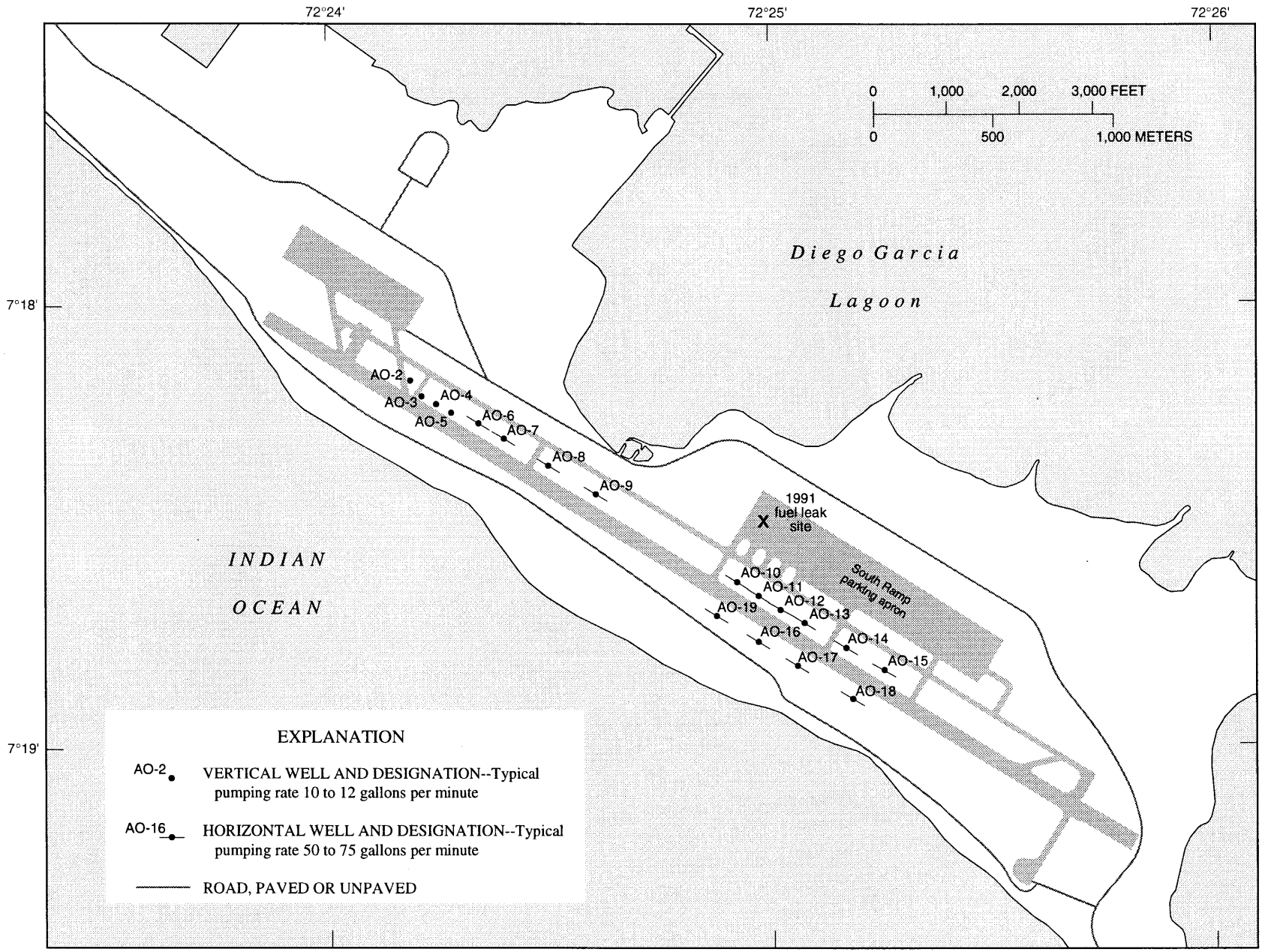


Figure A2. Ground-water production wells at Air Operations, Diego Garcia.

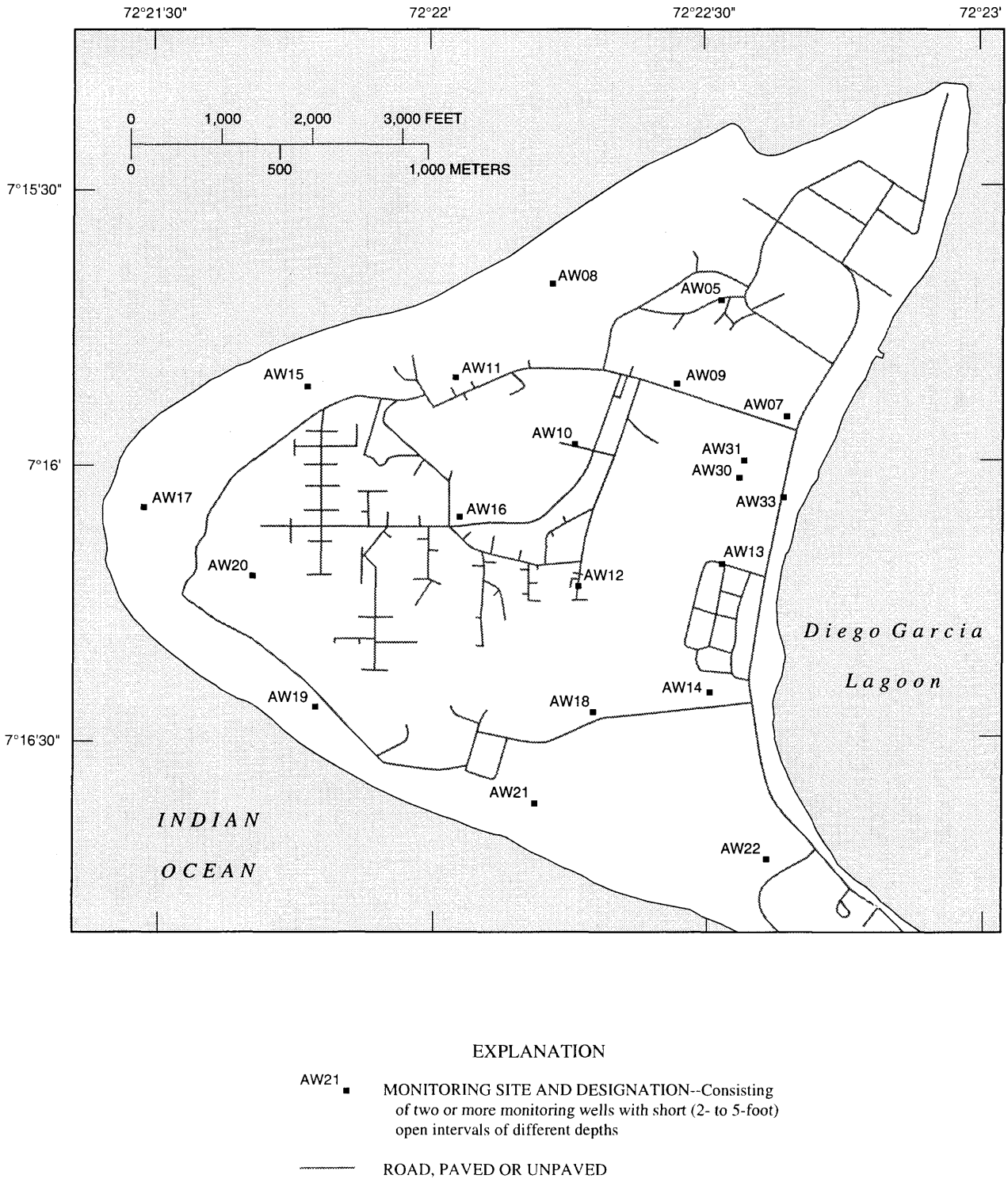


Figure A3. Monitoring wells at Cantonment, Diego Garcia.

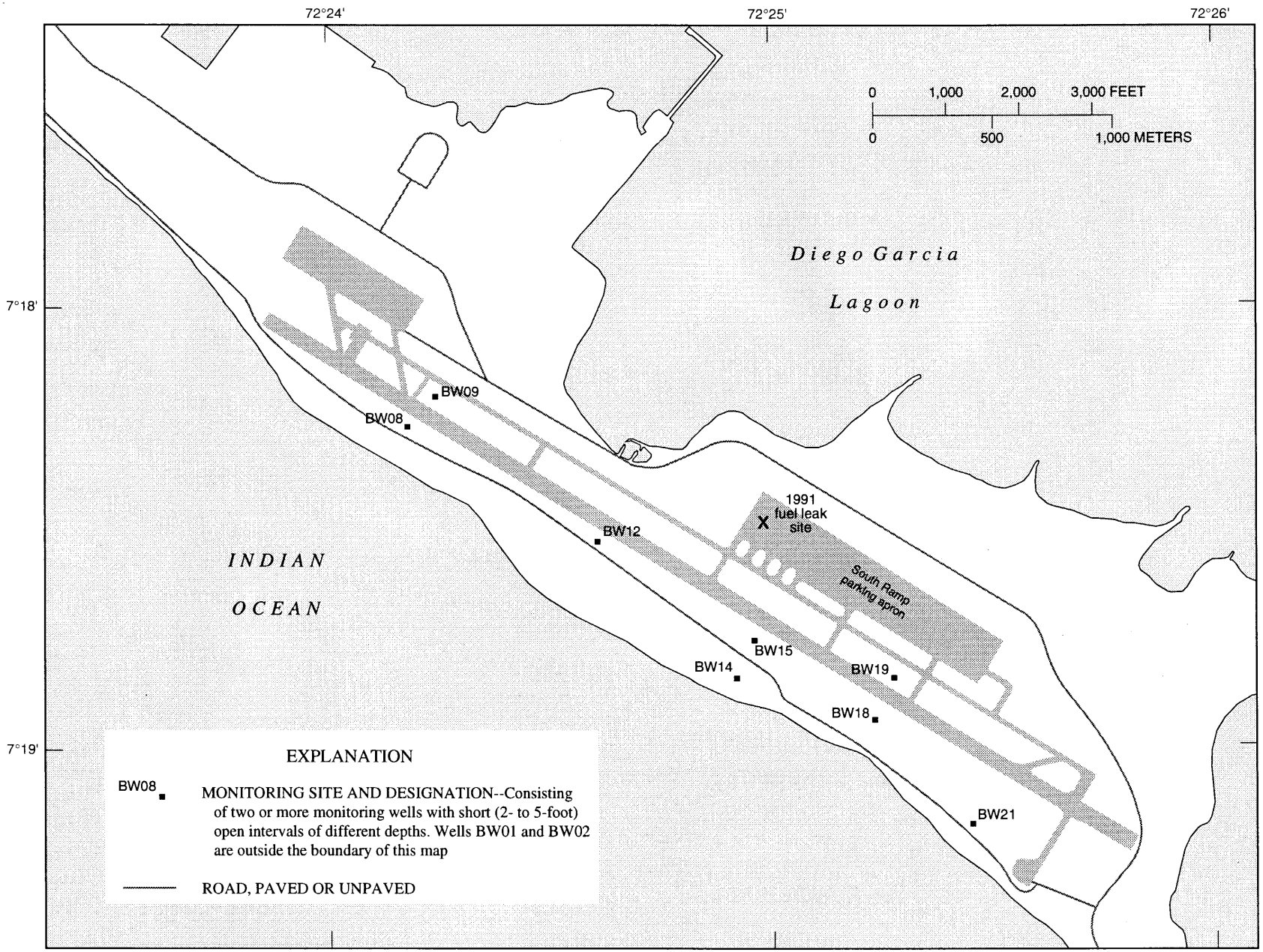


Figure A4. Monitoring wells at Air Operations, Diego Garcia.

SECTION B

Graphs of monthly mean ground-water withdrawal, January 1995 through September 1997

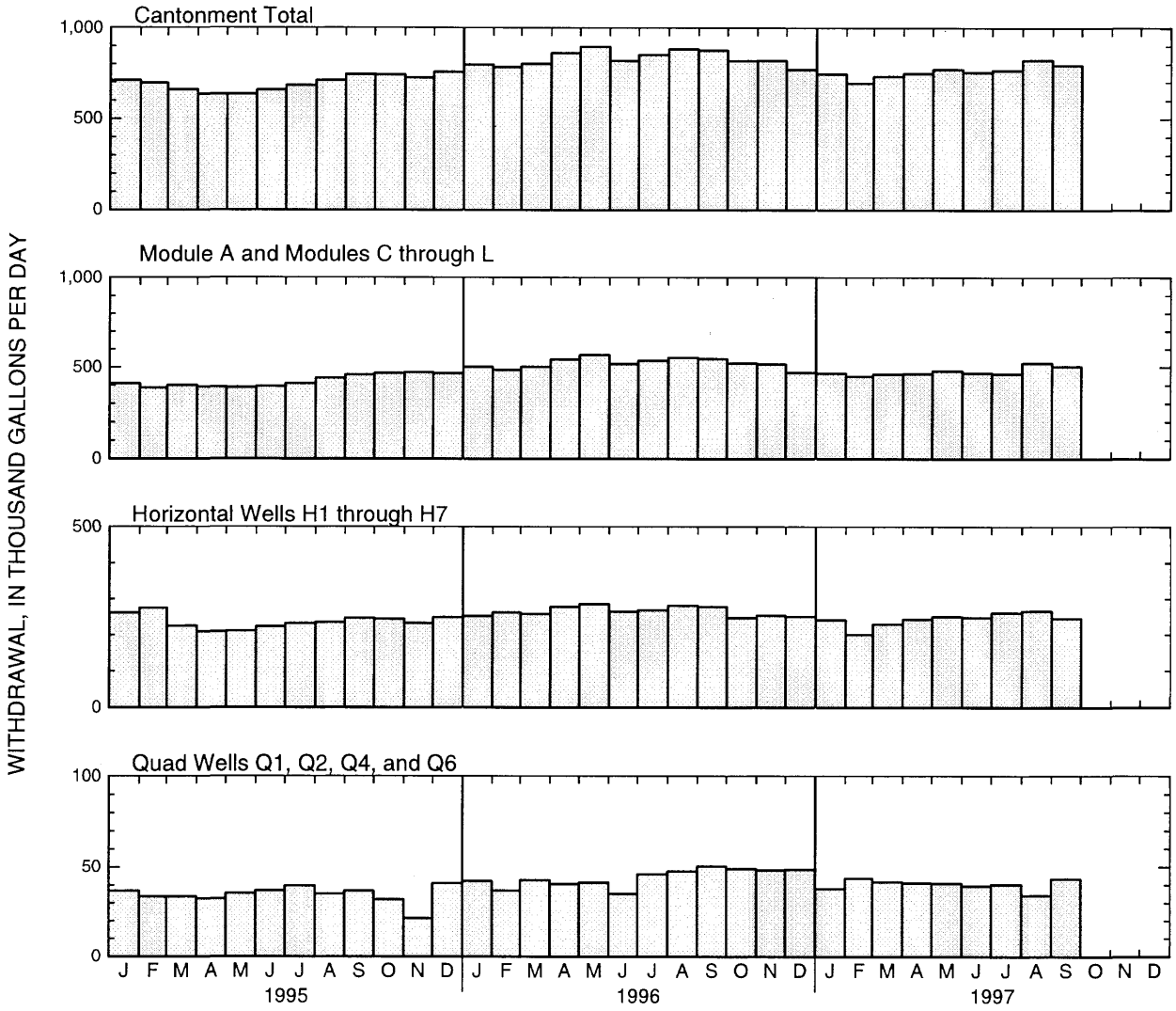


Figure B1. Monthly mean ground-water withdrawal at Cantonment, Diego Garcia, January 1995 through September 1997. Data are collected every Monday, Wednesday, Friday, and Saturday. If the last day of a month is not a scheduled data-collection day, then the withdrawal is included in the withdrawal of the next month.

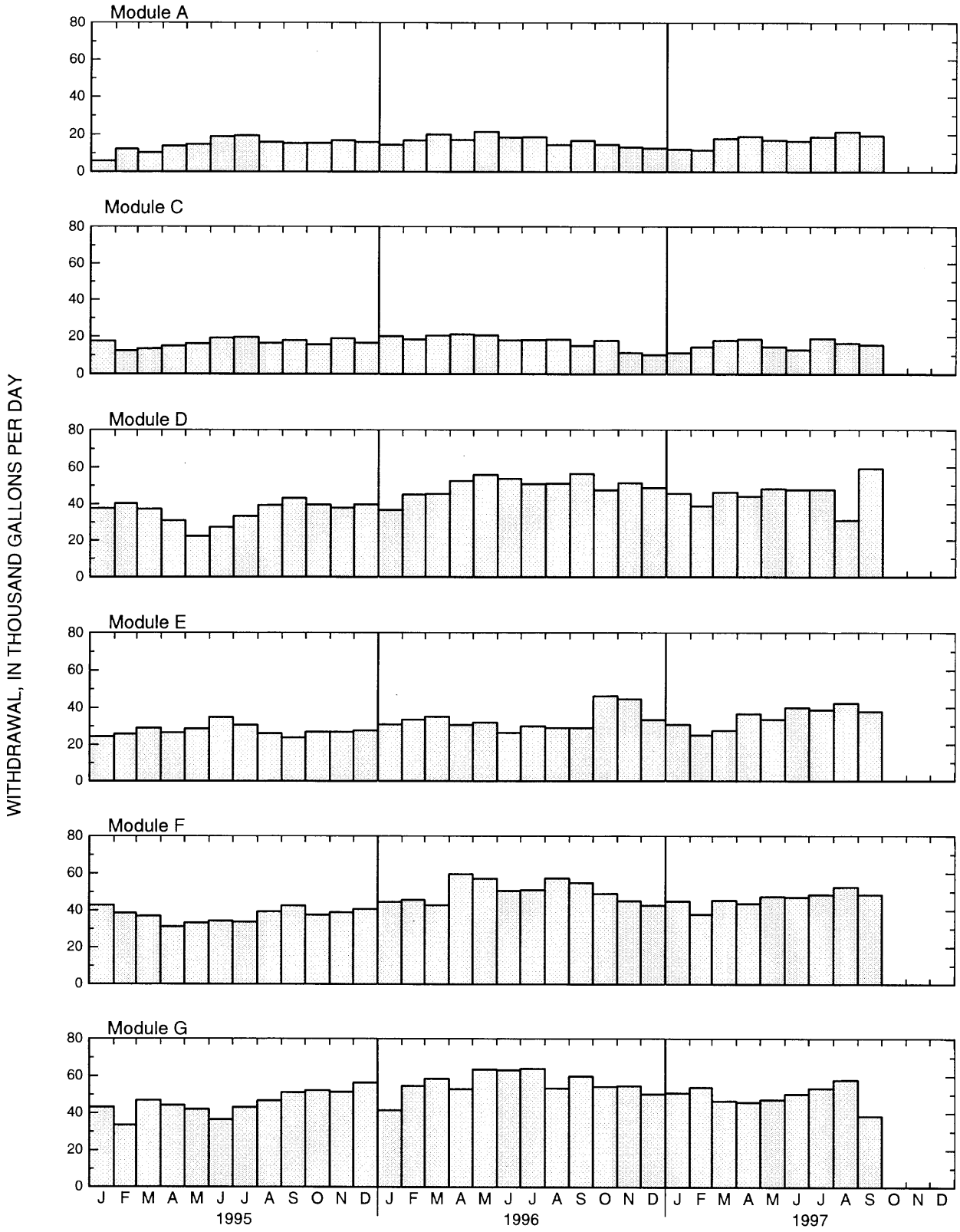


Figure B2. Monthly mean ground-water withdrawal at Module A and Modules C through L at Cantonment, Diego Garcia, January 1995 through September 1997. Data are collected every Monday, Wednesday, Friday, and Saturday. If the last day of a month is not a scheduled data-collection day, then the withdrawal is included in the withdrawal of the next month.

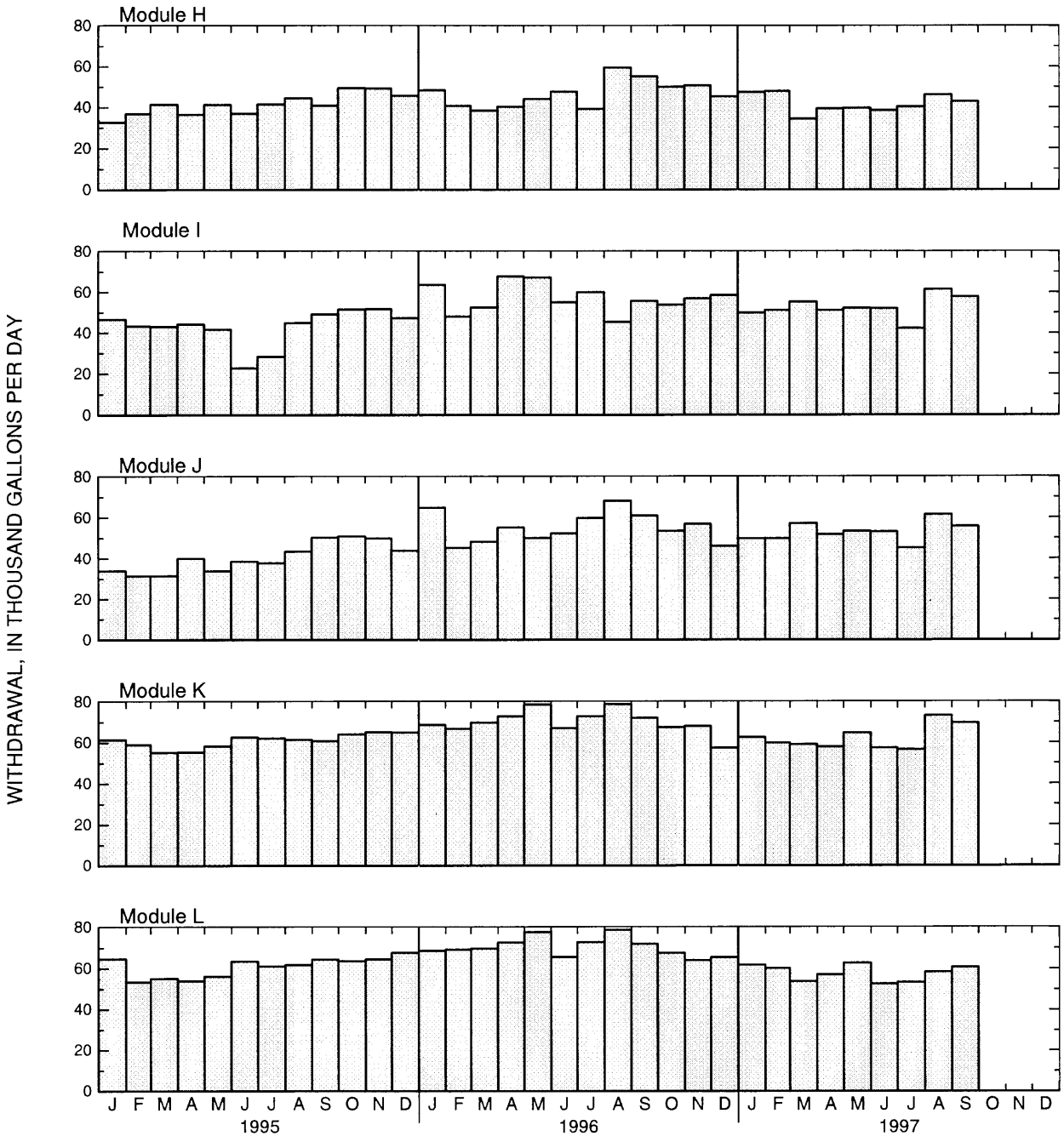


Figure B2. Monthly mean ground-water withdrawal at Module A and Modules C through L at Cantonment, Diego Garcia, January 1995 through September 1997. Data are collected every Monday, Wednesday, Friday, and Saturday. If the last day of a month is not a scheduled data-collection day, then the withdrawal is included in the withdrawal of the next month--Continued.

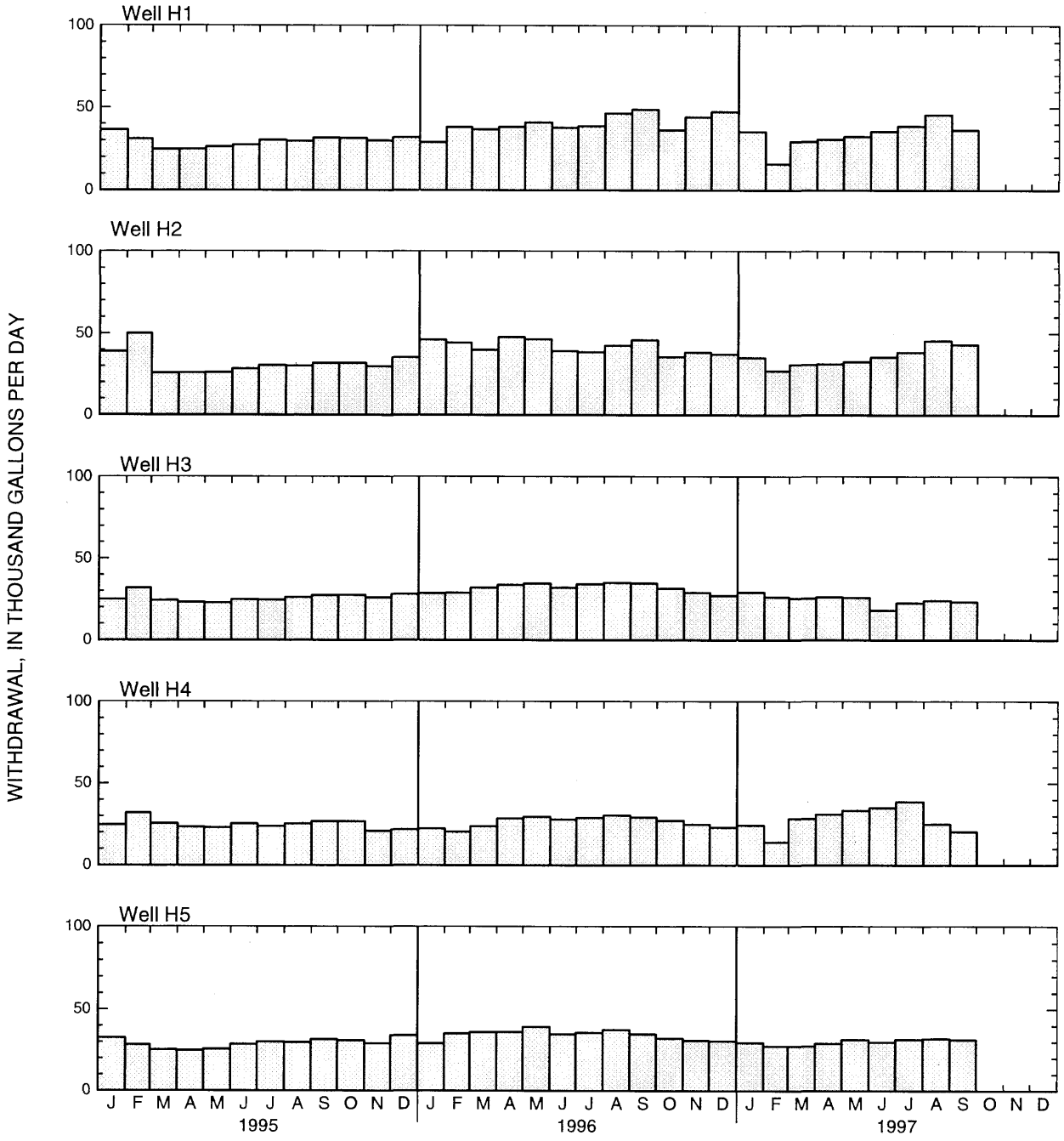


Figure B3. Monthly mean ground-water withdrawal at Horizontal wells H1 through H7 at Cantonment, Diego Garcia, January 1995 through September 1997. Data are collected every Monday, Wednesday, Friday, and Saturday. If the last day of a month is not a scheduled data-collection day, then the withdrawal is included in the withdrawal of the next month.

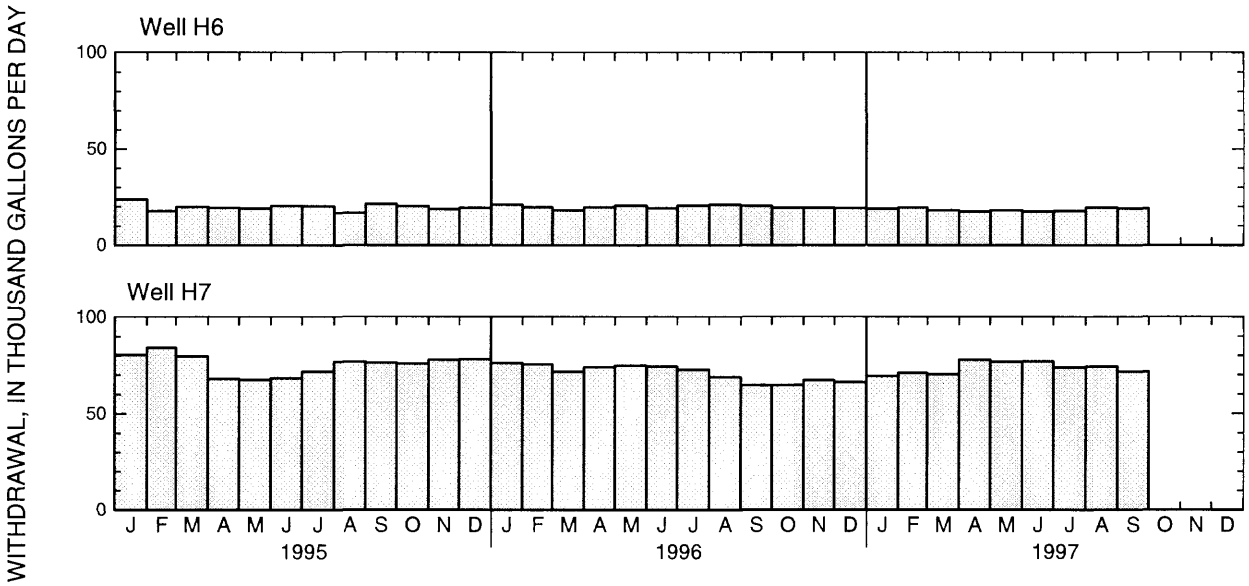


Figure B3. Monthly mean ground-water withdrawal at Horizontal wells H1 through H7 at Cantonment, Diego Garcia, January 1995 through September 1997. Data are collected every Monday, Wednesday, Friday, and Saturday. If the last day of a month is not a scheduled data-collection day, then the withdrawal is included in the withdrawal of the next month--Continued.

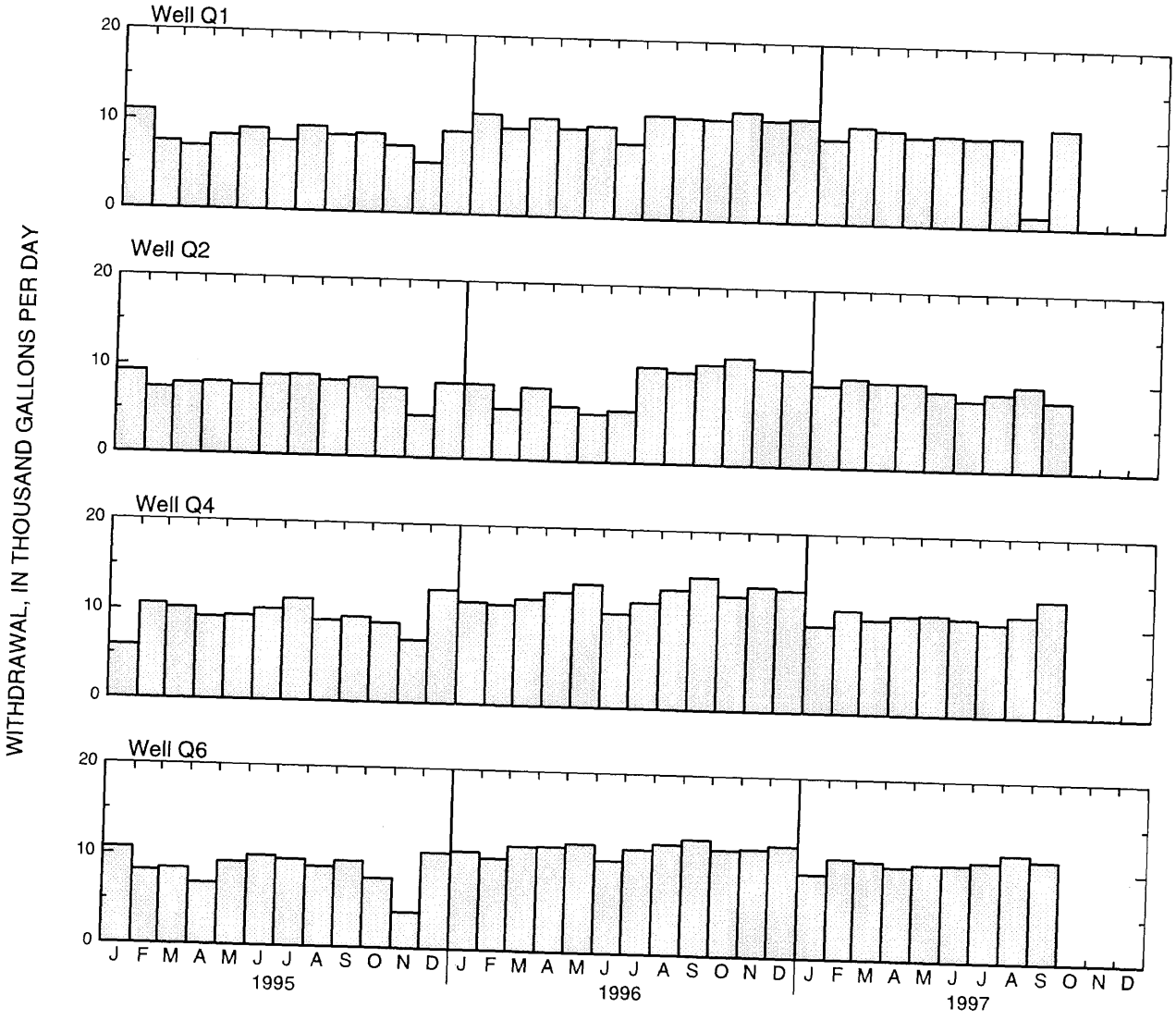


Figure B4. Monthly mean ground-water withdrawal at Quad wells Q1, Q2, Q4, and Q6 at Cantonment, Diego Garcia, January 1995 through September 1997. Data are collected every Monday, Wednesday, Friday, and Saturday. If the last day of a month is not a scheduled data-collection day, then the withdrawal is included in the withdrawal of the next month.

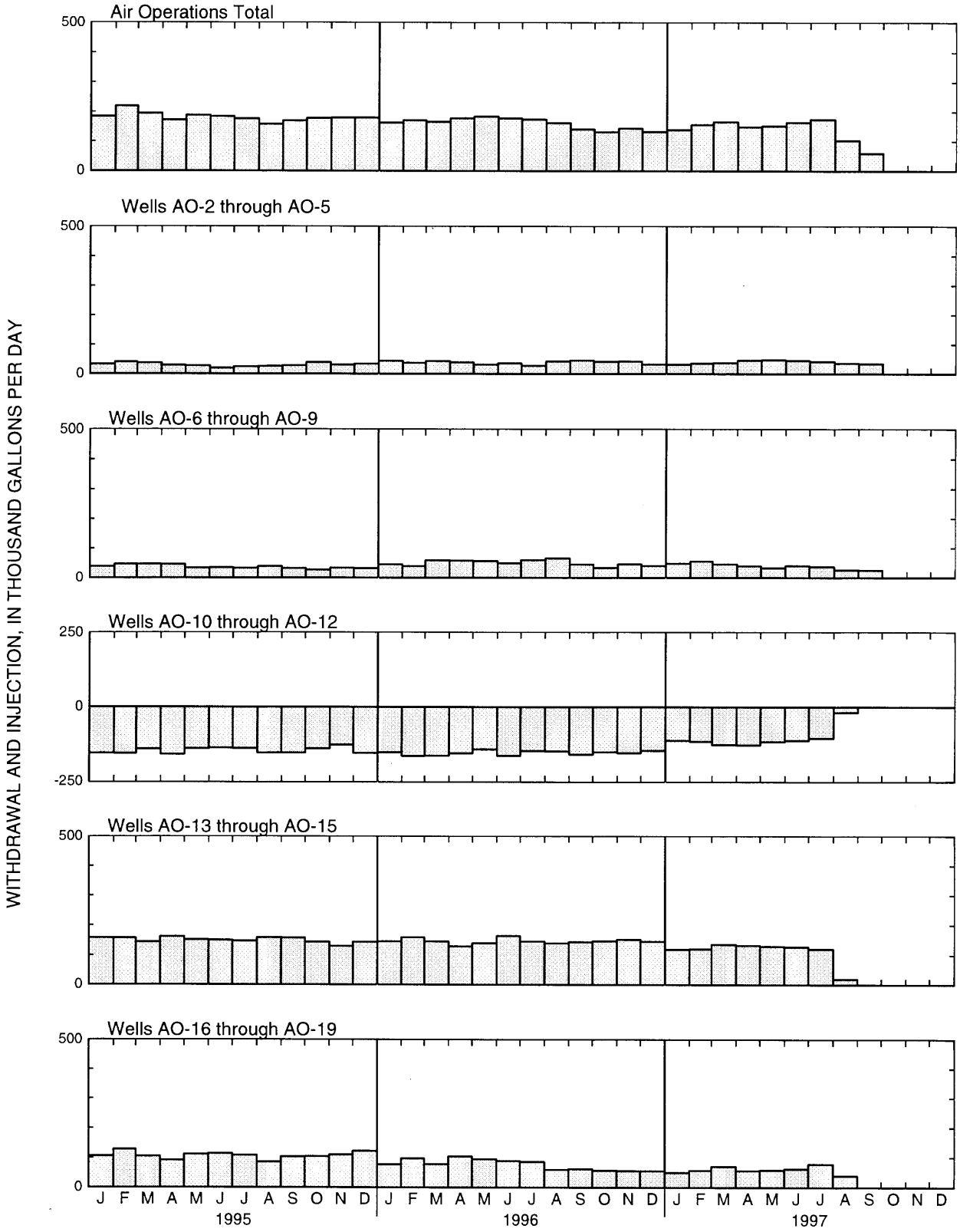


Figure B5. Monthly mean ground-water withdrawal and injection at Air Operations, Diego Garcia, January 1995 through September 1997. Data are collected every Monday, Wednesday, Friday, and Saturday. If the last day of a month is not a scheduled data-collection day, then the withdrawal is included in the withdrawal of the next month. Injection is plotted as negative.

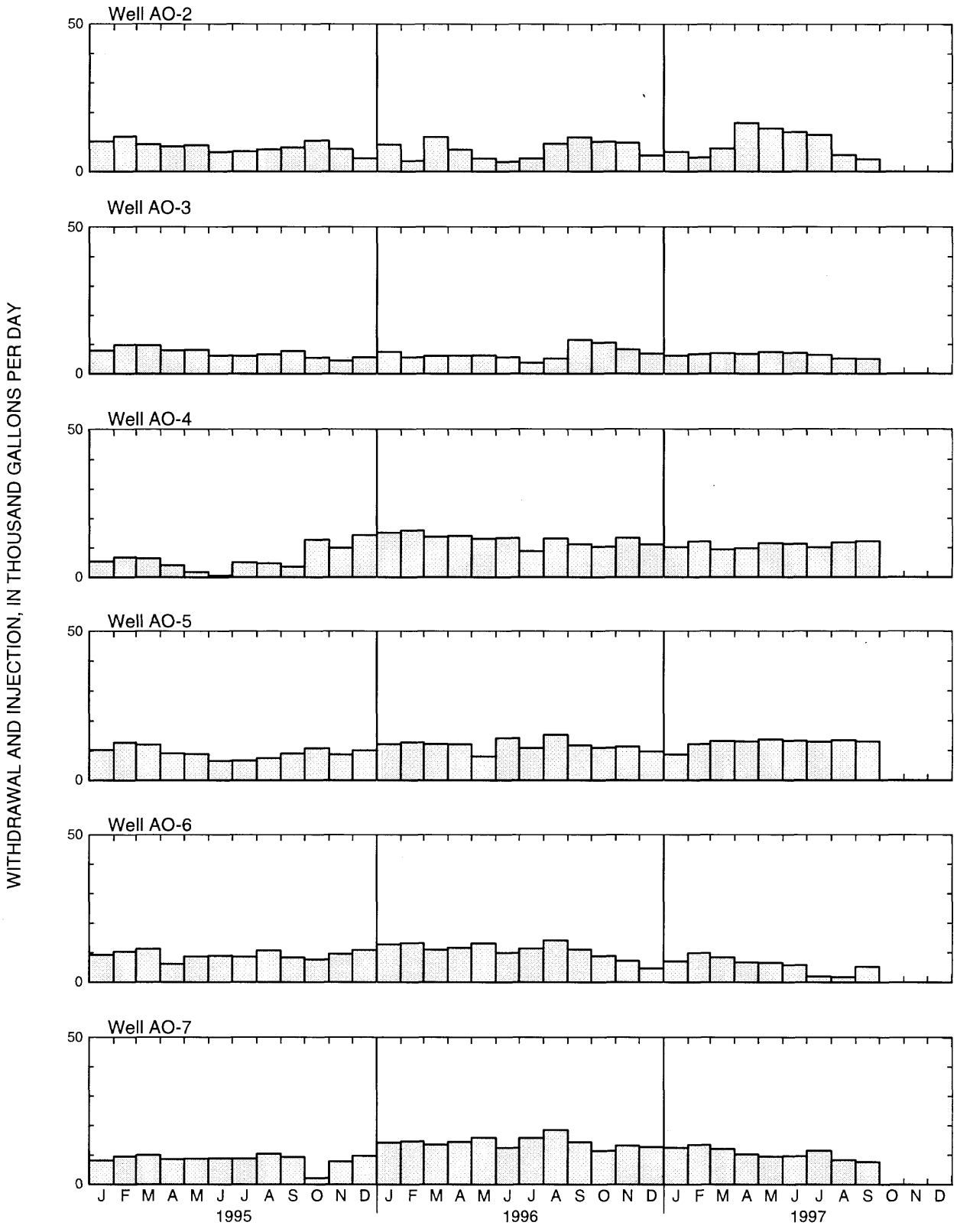


Figure B6. Monthly mean ground-water withdrawal and injection at wells AO-2 through AO-19 at Air Operations, Diego Garcia, January 1995 through September 1997. Data are collected every Monday, Wednesday, Friday, and Saturday. If the last day of a month is not a scheduled data-collection day, then the withdrawal is included in the withdrawal of the next month. Injection is plotted as negative.

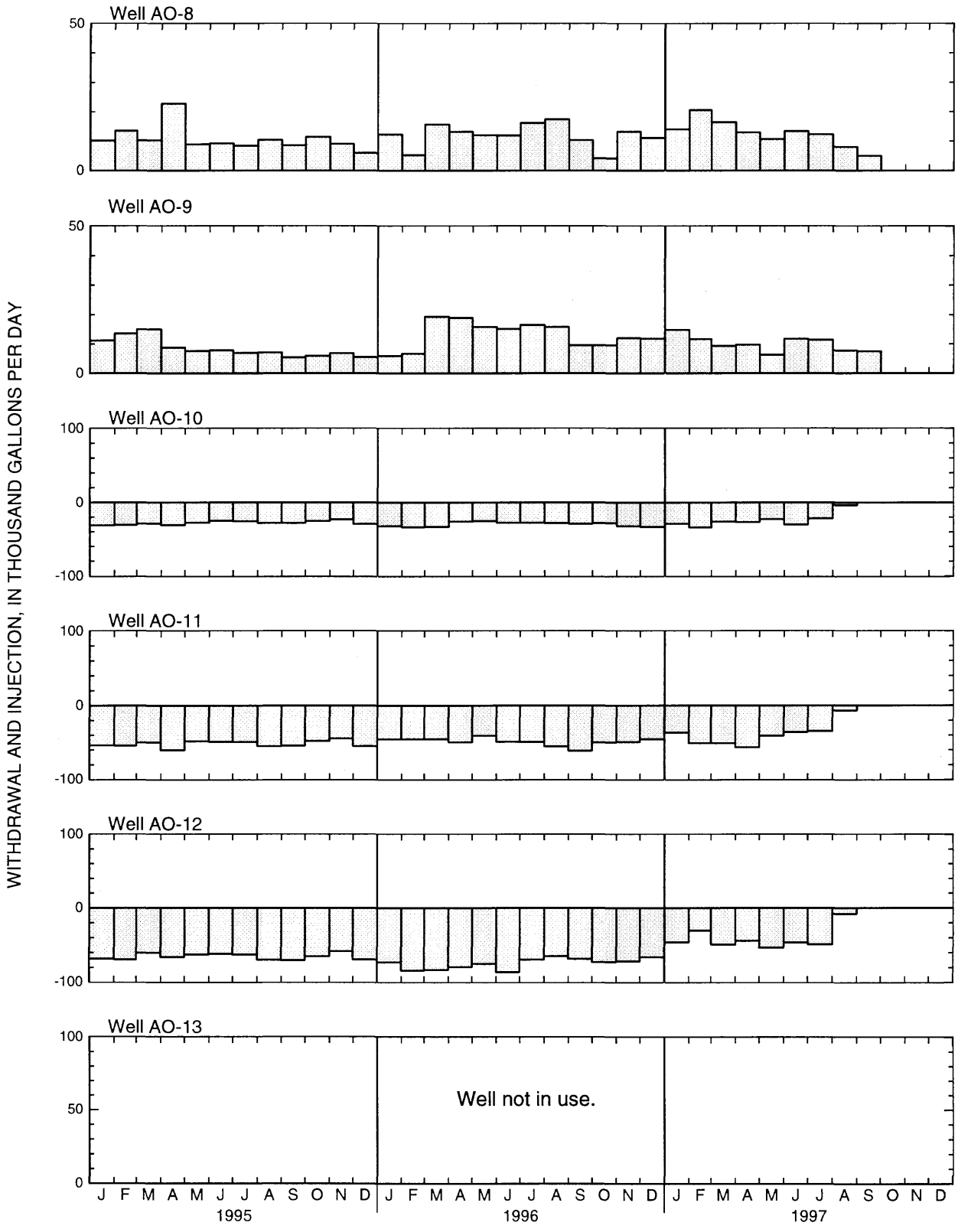


Figure B6. Monthly mean ground-water withdrawal and injection at wells AO-2 through AO-19 at Air Operations, Diego Garcia, January 1995 through September 1997. Data are collected every Monday, Wednesday, Friday, and Saturday. If the last day of a month is not a scheduled data-collection day, then the withdrawal is included in the withdrawal of the next month. Injection is plotted as negative--Continued.

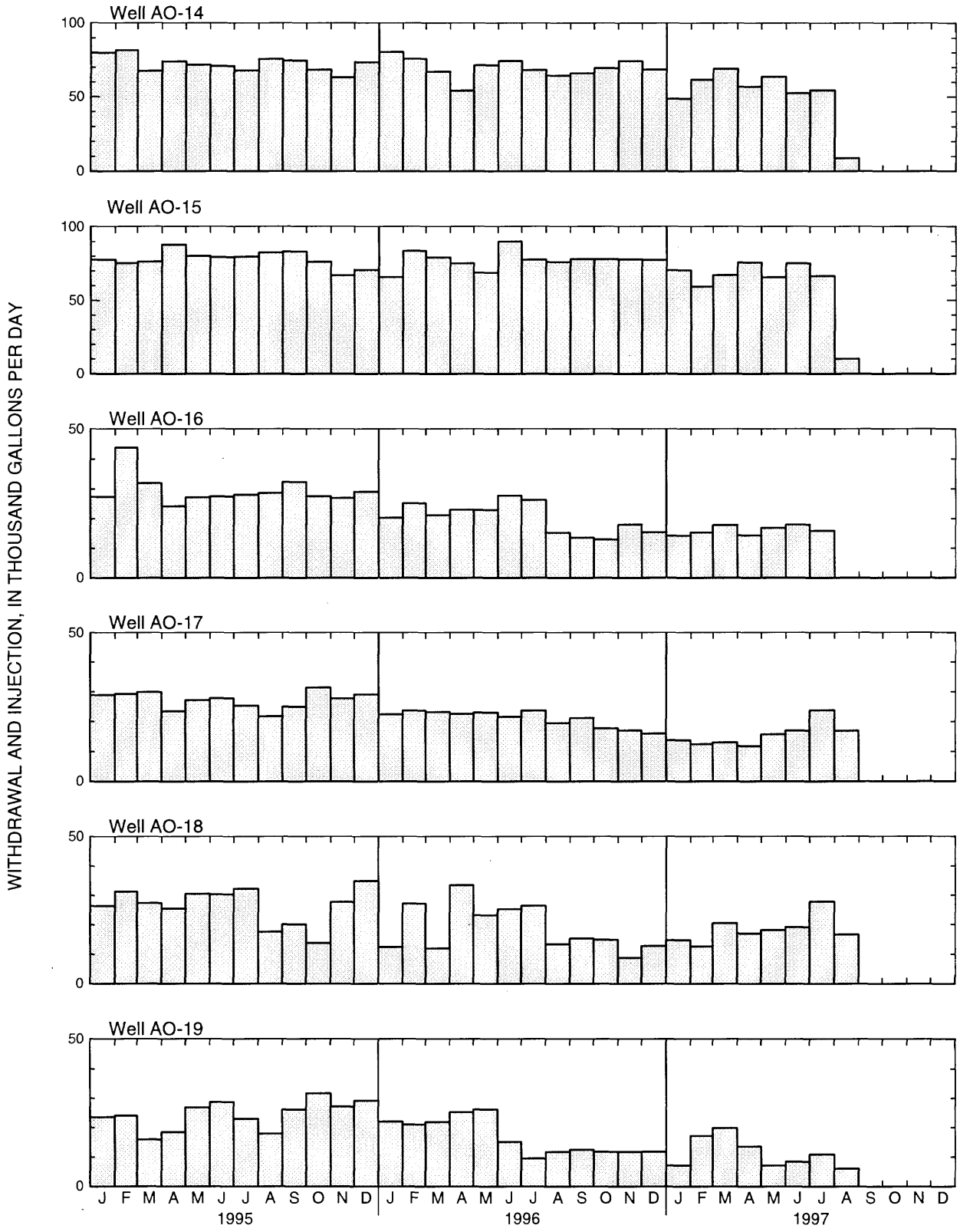


Figure B6. Monthly mean ground-water withdrawal and injection at wells AO-2 through AO-19 at Air Operations, Diego Garcia, January 1995 through September 1997. Data are collected every Monday, Wednesday, Friday, and Saturday. If the last day of a month is not a scheduled data-collection day, then the withdrawal is included in the withdrawal of the next month. Injection is plotted as negative--Continued.

SECTION C

Graphs of chloride concentration of pumped water, January 1995 through September 1997

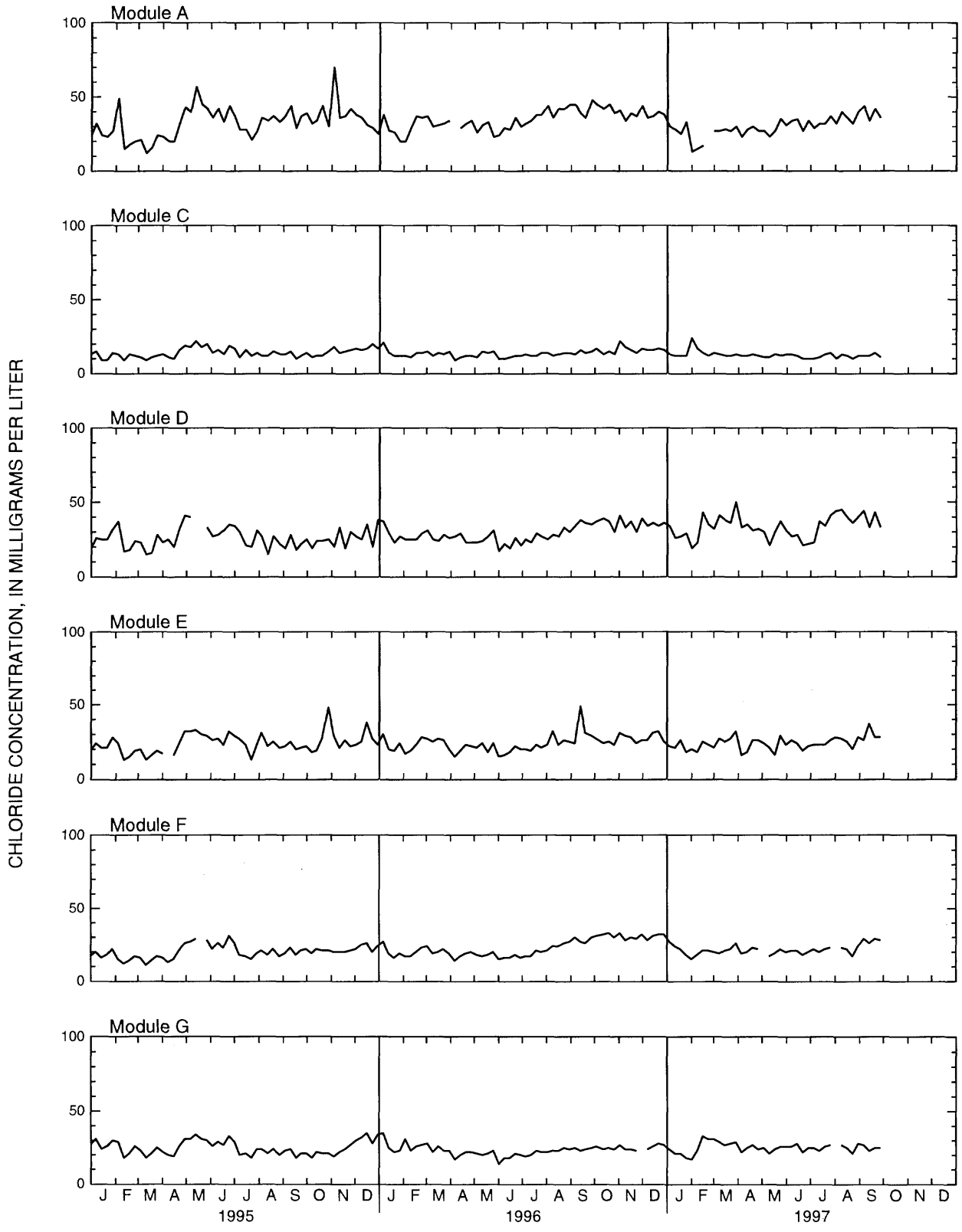


Figure C1. Chloride concentration of pumped water (sampled at weekly intervals) at Module A and Modules C through L at Cantonment, Diego Garcia, January 1995 through September 1997.

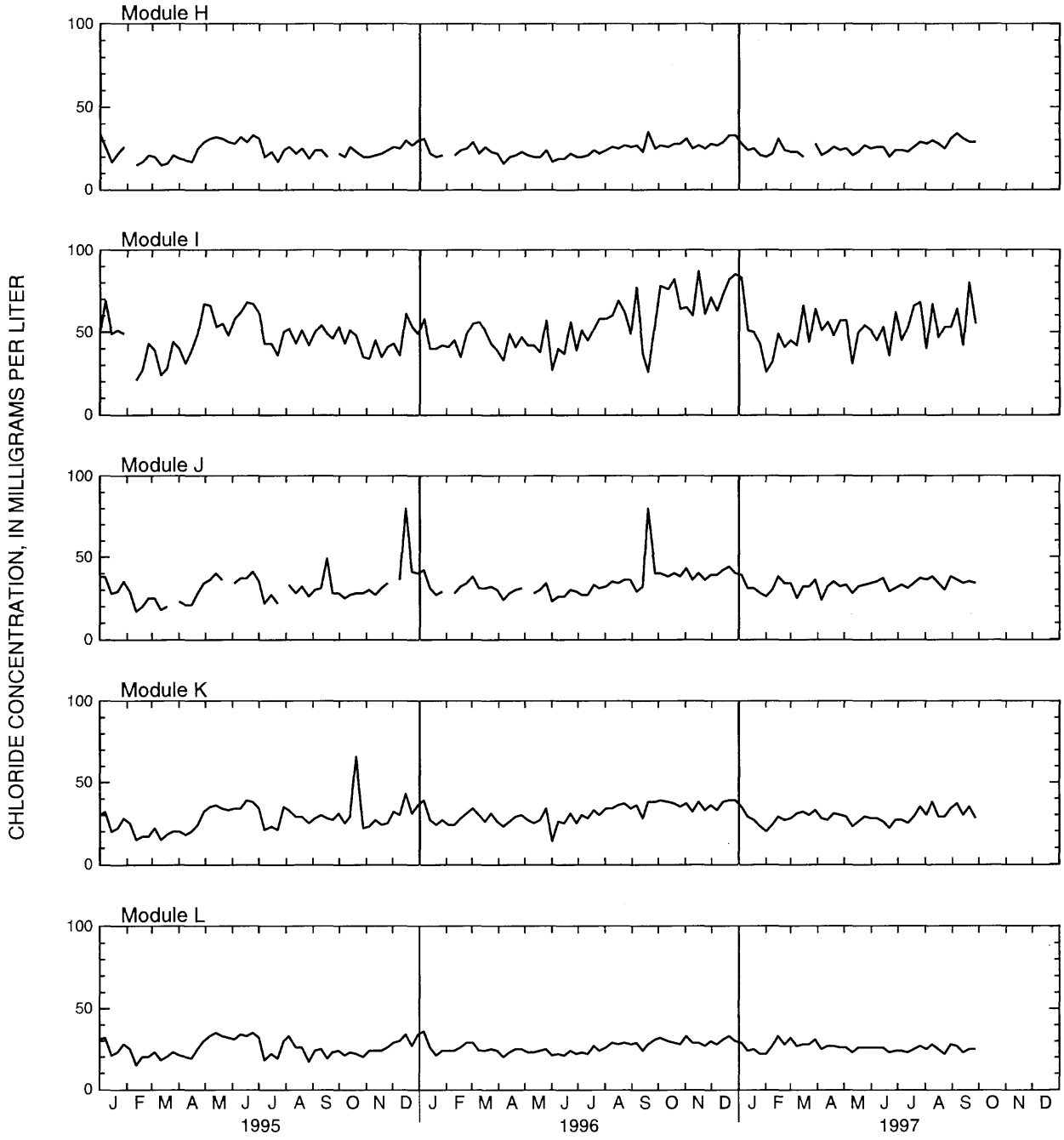


Figure C1. Chloride concentration of pumped water (sampled at weekly intervals) at Module A and Modules C through L at Cantonment, Diego Garcia, January 1995 through September 1997--Continued.

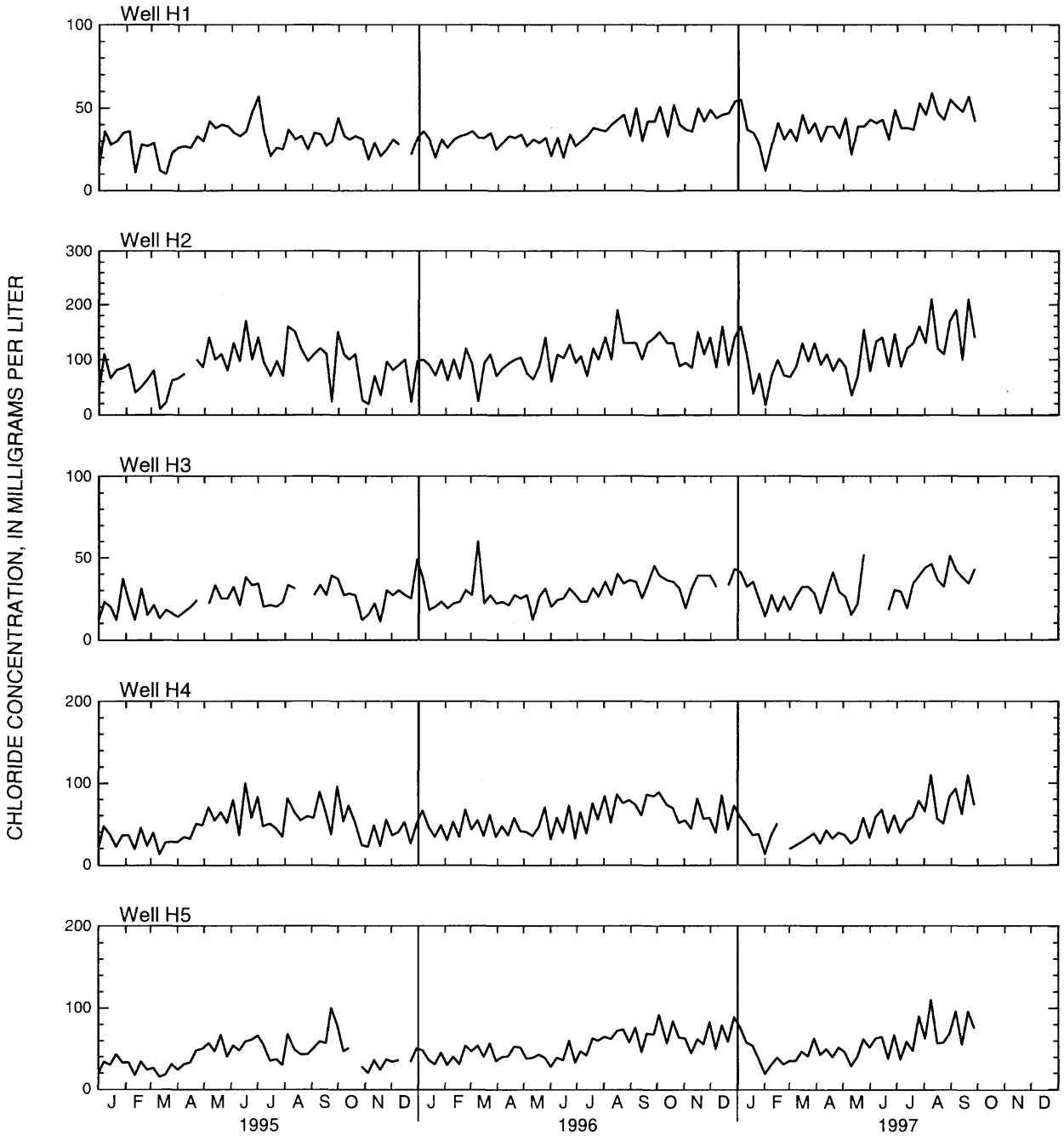


Figure C2. Chloride concentration of pumped water (sampled at weekly intervals) at Horizontal wells H1 through H7 at Cantonment, Diego Garcia, January 1995 through September 1997.

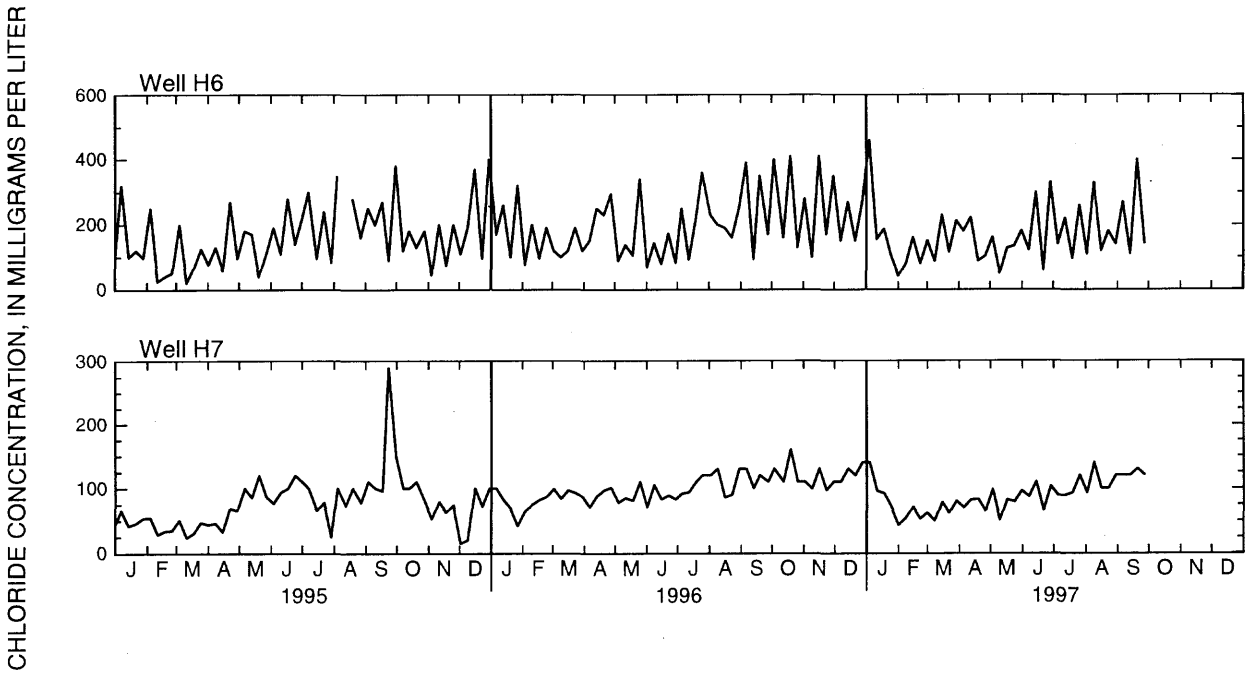


Figure C2. Chloride concentration of pumped water (sampled at weekly intervals) at Horizontal wells H1 through H7 at Cantonment, Diego Garcia, January 1995 through September 1997--Continued.

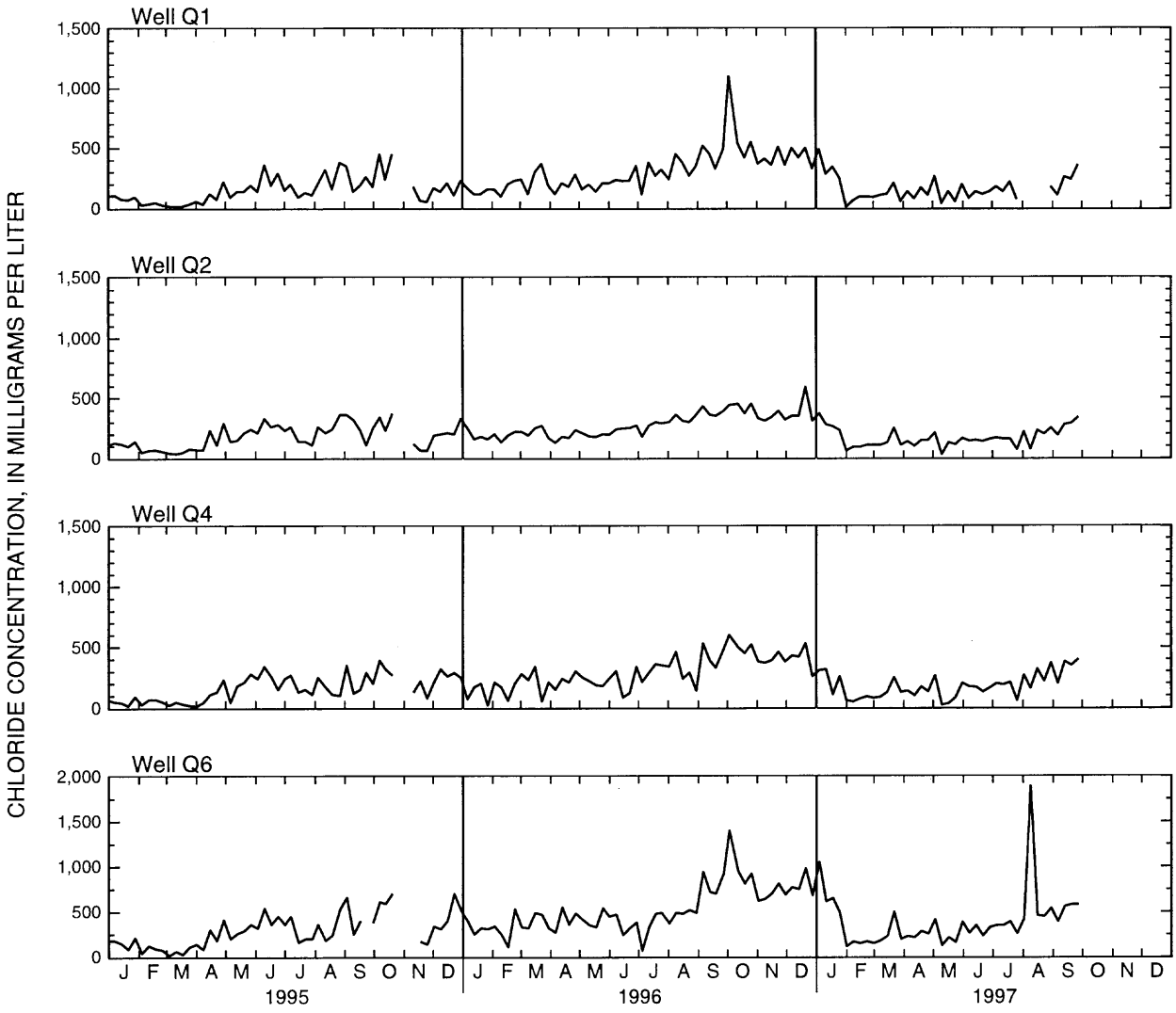


Figure C3. Chloride concentration of pumped water (sampled at weekly intervals) at Quad wells Q1, Q2, Q4, and Q6 at Cantonment, Diego Garcia, January 1995 through September 1997.

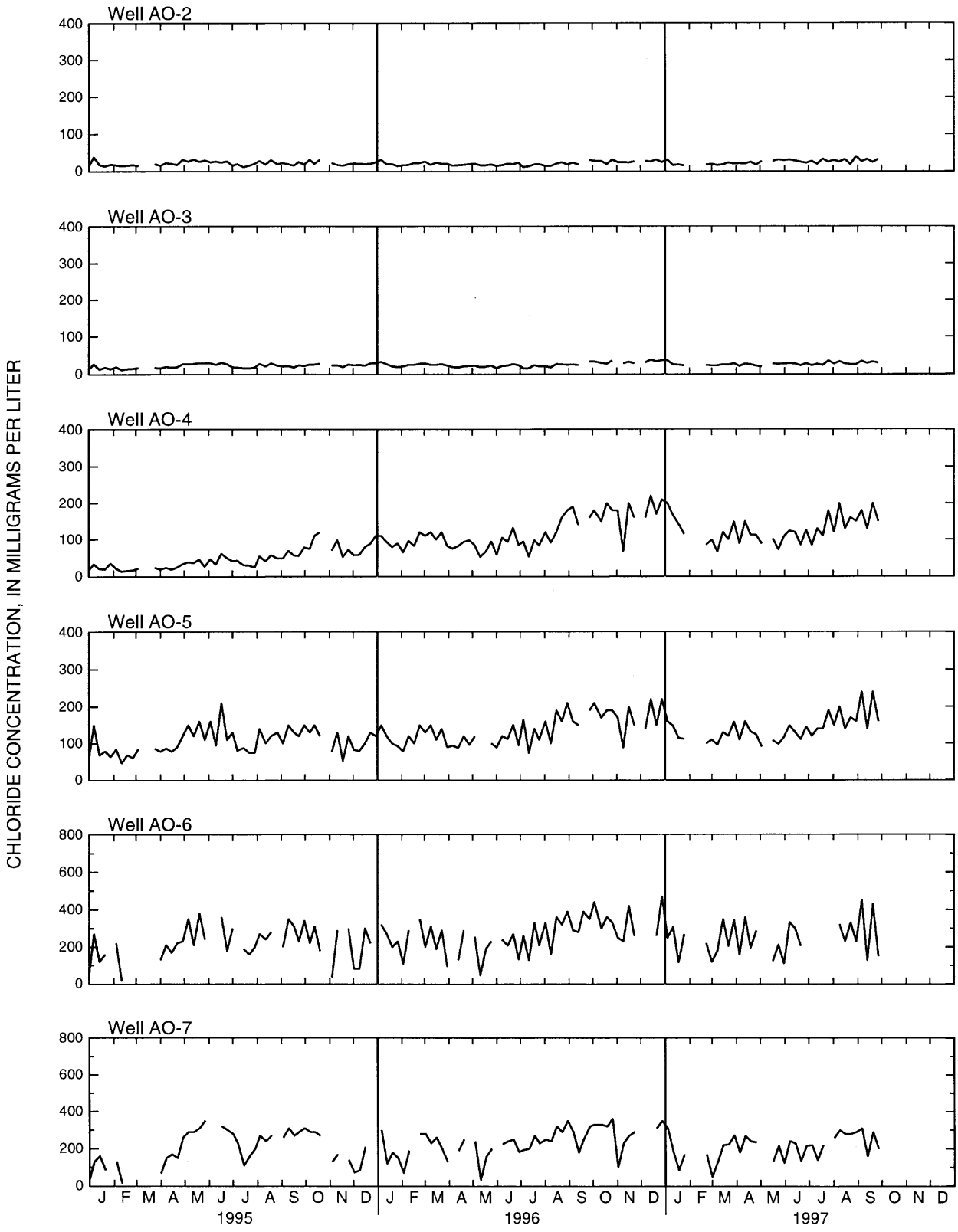


Figure C4. Chloride concentration of pumped water (sampled at weekly intervals) at wells AO-2 through AO-9 and wells AO-13 through AO-19 at Air Operations, Diego Garcia, January 1995 through September 1997. Water from well AO-13 has not been sampled since April 1993.

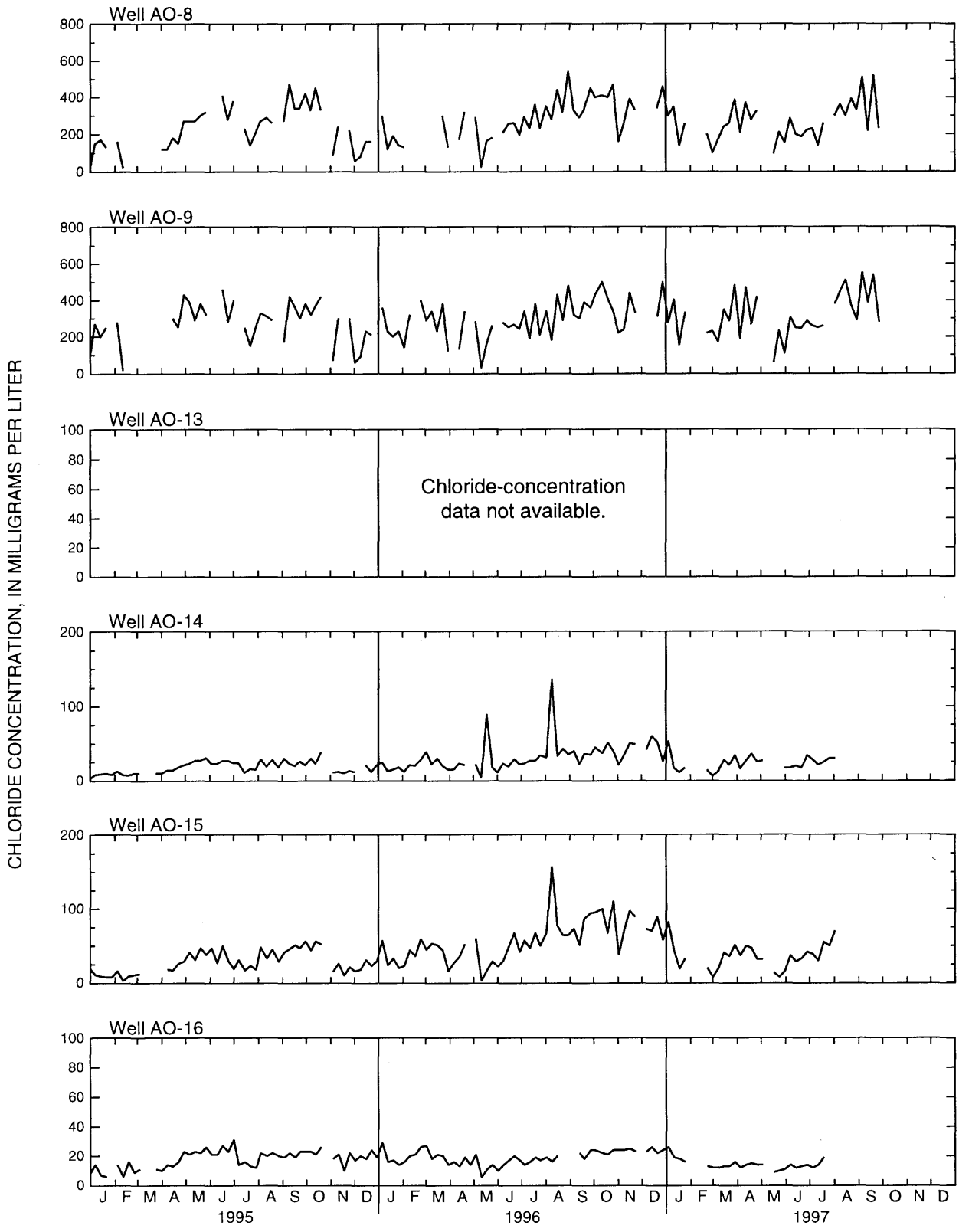


Figure C4. Chloride concentration of pumped water (sampled at weekly intervals) at wells AO-2 through AO-9 and wells AO-13 through AO-19 at Air Operations, Diego Garcia, January 1995 through September 1997. Water from well AO-13 has not been sampled since April 1993--Continued.

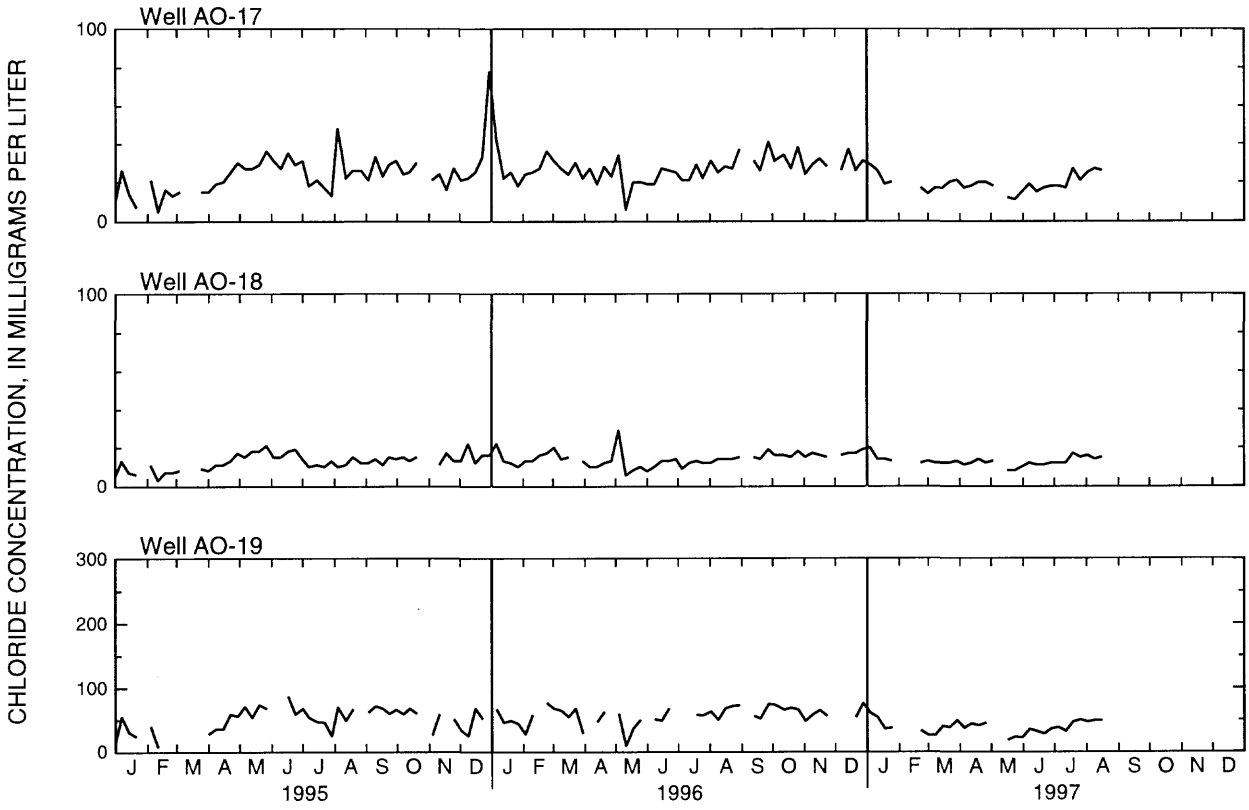


Figure C4. Chloride concentration of pumped water (sampled at weekly intervals) at wells AO-2 through AO-9 and wells AO-13 through AO-19 at Air Operations, Diego Garcia, January 1995 through September 1997. Water from well AO-13 has not been sampled since April 1993--Continued.

REFERENCES CITED

Hunt, C.D., Jr., in press, Hydrogeology of Diego Garcia, chap. 32 *of* Vacher, H.L. and Quinn, T., eds., Geology and hydrogeology of carbonate islands: Amsterdam, The Netherlands, Elsevier Science Publishers.

Torikai, J.D., 1995, Status of ground-water resources at U.S. Navy Support Facility, Diego Garcia: Summary of hydrologic and climatic data through September 1993; U.S. Geological Survey Open-File Report 94-306, 51 p.

U.S. Department of Commerce, 1968, World weather records, 1951-60: Washington, D.C., U.S. Government Printing Office, 6 vols.

_____, 1979, World weather records, 1961-70: Washington, D.C., U.S. Government Printing Office, 6 vols.

_____, 1995, International station meteorological climate summary (ISMCS), ver. 3.0 [CD-ROM]: Asheville, N.C., National Oceanic and Atmospheric Administration.

U.S. Environmental Protection Agency, 1991, Secondary maximum contaminant levels (section 143.3 of part 143, National secondary drinking water regulations): U.S. Code of Federal Regulations, Title 40, Parts 100 to 149, revised through July 1, 1991.

U.S. Navy, 1978, Station climatic summary, January 1951-December 1977: Asheville, N.C., Naval Weather Service Detachment, 4 p.