GROUNDWATER RESOURCES CONSULTANTS, INC.

TUCSON, ARIZONA

RESULTS OF
WELL RD-63 PILOT INTERIM GROUNDWATER
EXTRACTION TEST AND TREATMENT OPERATIONS
APRIL THROUGH OCTOBER, 1996
RMDF AREA
SANTA SUSANA FIELD LABORATORY
ROCKWELL INTERNATIONAL CORPORATION
ROCKETDYNE DIVISION
VENTURA COUNTY, CALIFORNIA

January 20, 1997
8640M-306

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January 20, 1997

Mr. Loren Stone
Rockwell International Corporation
Rocketdyne Division - ETEC
6633 Canoga Avenue, D/022 MS/T-038
Canoga Park, California 91303

RE: Data and Results for Recent Six-Month Interim Groundwater Extraction and Treatment Operations at Well RD-63, RMDF Area

Dear Mr. Stone:

Submitted herewith is our report summarizing the results of groundwater extraction and treatment operations and monitoring conducted in the RMDF Area during the period of April 25 to October 30, 1996. The program consisted of pumping well RD-63 at rates of 1.5 to 2 gpm and monitoring water levels in eleven nearby monitor wells, and water quality conditions in well discharge and treatment system effluent samples.

The total volume of degraded groundwater extracted during this six-month period was 361,910 gallons. TCE concentrations in well discharge samples ranged from 7.2 to 15 µg/l. Water level declines in nearby wells ranged from 0.88 feet at a distance of about 1,000 feet from well RD-63 to 34 feet at a well located at a distance of about 100 feet away.

As the extraction/treatment system continues to operate on an interim basis at the RMDF Area, this report will be followed by monthly progress letters.

8640M-306 GWRC

If you have any questions or wish further discussion, please contact us.

Respectfully submitted,

GROUNDWATER RESOURCES CONSULTANTS, INC.

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Project Environmental Engineer/Hydrologist

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CMD:mf/pm

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VENTURA COUNTY, CALIFORNIA

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EXTRACTION TEST AND TREATMENT OPERATIONS
APRIL THROUGH OCTOBER, 1996
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ROCKETDYNE DIVISION
VENTURA COUNTY, CALIFORNIA

INTRODUCTION

This report has been prepared to summarize the results of interim groundwater extraction and treatment operations conducted in the vicinity of the former Radioactive Materials Disposal Facility (RMDF) located in Area IV of the Rockwell International Corporation, Rocketdyne Division, Santa Susana Field Laboratory (the Facility) in Ventura County, California. This report presents the results of system operation during the period from April 25 to October 30, 1996 and follows an earlier pilot extraction test program conducted during the three month period from October 3, 1994 to January 4, 1995 (GWRC, 1995). The current reporting period consisted of operating extraction well RD-63 over a period of about six months, sampling and testing water quality, and monitoring the pumping rate and water levels at the extraction well and at eleven nearby monitor wells.

Currently, the extraction system is equipped to produce groundwater at a continuous rate of about 1.8 gallons per minute (gpm), which is about the yield capacity of the well. In the earlier pilot program, the well was dewatered by over-pumping which necessitated intermittent operation of the system. All groundwater produced from extraction well RD-63 has been treated by carbon adsorption to remove organic contaminants prior to release into to the Facility's NPDES permitted drainage.

Analytical results for samples collected from extraction well RD-63 consistently indicate low concentrations of VOCs that are comprised of trichloroethylene (TCE), cis-1,2-dichloroethylene (cis-1,2-DCE), 1,1-dichloroethylene (1,1-DCE), and 1,1-dichloroethane (1,1-DCA). Historically, higher concentrations of TCE have been detected at monitor wells in the RMDF area on the order of 75 to 90 micrograms per liter (μg/l).

DESCRIPTION OF TEST AREA

WELLS AND SITE LOCATION

Extraction well RD-63 was installed in 1994 in the RMDF area at the northwest portion of the Facility in Area IV along the Rockwell property boundary for the purpose of pilot extraction testing **(Figure 1)**. Nearby monitor wells included in the RMDF pilot extraction program include Chatsworth Formation wells RD-17, RD-18, RD-19, RD-27, RD-28, RD-30, and Shallow Zone wells RS-25 and RS-28, which are all located on-site within Area IV, and clustered wells RD-34A, RD-34B, and RD-34C, which are located off-site and immediately west of the Area IV boundary **(Figure 2)**.

Extraction well RD-63 and the wells used for monitoring are located within or directly adjacent to an east-west trending canyon which drains the RMDF area to the west **(Figure 2)**. The presence of the canyon is probably due to erosion of weaker or fractured rock. Fault conditions are not readily apparent in the canyon area, yet it does appear that subsurface fracturing may be generally more prevalent at this location when compared to the well yields and borehole video logs for other wells located in Area IV. The geology of this area has been discussed in several previous reports (GWRC,1992, 1995).

HISTORICAL GROUNDWATER LEVELS AND MOVEMENT

Shallow groundwater occurs within the alluvium and weathered upper surfaces of the Chatsworth Formation. Shallow Zone wells RS-25 and RS-28 were constructed for monitoring groundwater conditions within the alluvium and upper weathered portion of the Chatsworth Formation. Shallow groundwater levels in the area may be affected by evapotranspiration and most definitely by seasonal percolation. Depending on the season of precipitation generated runoff, shallow groundwater levels range from near surface to approximately 15 feet deep.

The apparent lateral movement of groundwater occurring in the Chatsworth Formation in the vicinity of the RMDF is generally directed west-northwest. Groundwater was encountered initially at depths of about 20 to 50 feet below land surface (bls) during the drilling of wells RD-30, RD-34A, RD-34B, RD-34C, and RD-63. Groundwater in A-Zone type wells RD-30 and RD-34A has ranged in depth from near land surface to about 30 feet bls.

Elevations of water levels in the area have ranged from about 1,732 to 1,769 feet above mean sea level (MSL). The water level elevation for deep well RD-34C has been consistently higher than for elevations at wells RD-34A and RD-34B, which suggests there may be a very limited potential for the degraded groundwater occurring in the A and B-Zones to migrate to the C-zone.

WATER QUALITY CONDITIONS

Water quality conditions in the vicinity of the RMDF area have been characterized by analyses of routinely collected water samples (GWRC, 1992, 1995, 1996a, 1996b). Groundwater has been degraded by VOCs, including TCE, cis-1,2-DCE, 1,1-DCE, and 1,1-DCA. Consistently, the highest VOC concentrations have been indicated for well RD-34A. The ranges of VOC concentrations detected in samples collected from well RD-34A from August 1991 to September 1996 have been summarized below.

TCE	<1 to 91 µg/l
cis-1,2-DCE	<1 to 39 µg/l
1,1-DCA	<1 to 4.8 µg/l
1,1-DCE	<0.5 to 18 µg/l

Similar VOC concentrations have been indicated for Shallow Zone well RS-28. Concentrations of these organic compounds at well RD-30 have been consistently lower than at well RD-34A.

Concentrations of TCE at well RD-34B have ranged from <0.5 to 11 µg/l during quarterly sampling from August 1991 to September 1996. No degraded groundwater has been detected in samples collected from well RD-34C.

EXTRACTION SYSTEM

This section of the report describes the pilot extraction system, the data pertaining to the period of pilot operation, and observed impacts resulting from system operation.

EXTRACTION WELL RD-63

Extraction well RD-63 was completed in May 1994 to a depth of 230 feet. The well was completed for the purpose of extracting degraded groundwater that occurs at depths within the Chatsworth Formation that have been classified as A and B zones. The A-Zone at the Facility generally encompasses the upper 40 to 50 feet of saturated Chatsworth Formation. In the vicinity of well RD-63, the A-Zone further extends to a depth of about 75 feet while the B-Zone extends to a depth of about 250 feet. Previous water quality investigations have indicated that degraded groundwater may extend to a depth of about 250 feet, and that the A and B zones are in direct hydraulic communication in the vicinity of the RMDF test site (GWRC, 1992).

The wellbore for RD-63 was drilled using conventional air-rotary method to a depth of 20 feet using a 12¾-inch tri-cone bit. Nominal 8-inch blank steel casing was installed and neat cement placed in the well annulus from land surface to the bottom of the wellbore. After allowing the cement to cure the borehole was drilled to a depth of 230 feet using a 6½-inch tri-cone bit and completed as an uncased, open-borehole. Well construction details for extraction well RD-63 and for monitor wells included in the pilot testing program have been presented in **Table 1.**

A one horsepower submersible pump was installed in the well to a depth of about 126 feet (**Figure 3**). Water level controls to the pump were installed to limit operation of the pump to water level depths between 60 and 125 feet bls. Electrical power was developed at the well site by Rockwell in September 1994. The initial pilot extraction test commenced on October 3, 1994 and continued until January 4, 1995. Initial operation utilized a Calgon Cyclesorb FP-2 carbon treatment unit to remove VOCs (GWRC, 1995).

The treatment components of the initial pilot extraction system were dismantled after the test and the extraction well was inactive until May 31,1995. At this time the treatment components were reconfigured to include twin, series connected Aqua-Scrub

carbon units manufactured by Western States Carbon, and about 250 gallons of groundwater was produced from extraction well RD-63 to observe system performance. The system then remained inactive following nearly 11 months for regulatory authorization to start the test program described in this report.

RESULTS OF GROUNDWATER EXTRACTION AND TREATMENT PROGRAM

Groundwater extraction and treatment from well RD-63 resumed on April 25, 1996 and continued for 47 days to June 11, 1996. The extraction system was then deactivated for a period of 45 days due to the Facility-wide Hydraulic Communications Study (HCS). Groundwater extraction resumed July 26, 1996 and the system has operated continuously since this time. GWRC submitted progress reports to ETEC-Rocketdyne Division on three occasions during the course of the pilot testing program.

WELL PUMPAGE

During the period from April 25 to October 30, 1996 a total of 361,910 gallons of groundwater was extracted and treated by the system. All groundwater extracted from well RD-63 was treated through activated carbon and periodically tested for effective removal of VOCs. The treated groundwater was released to the Facility's NPDES permitted drainage.

Extraction well discharge rates and volumes monitored during the period have been summarized in **Table 4.** Groundwater was discharged from well RD-63 at an initial rate of about 1.5 gpm, then later increased to 2 gpm. The discharge rate eventually was stabilized at about 1.7 gpm. A graph of groundwater volume extracted over the six month testing period has been presented on **Figure 4.** The graph indicates that groundwater was discharged on a continuous basis during operation of the system, and that daily operation was uninterrupted by water level controls installed in the well.

WATER LEVEL DECLINES

The pumping water levels measured at extraction well RD-63 were observed in two separate periods of extraction system operation due to the HCS. A summary of depth to water measurements for wells has been presented in **Table 2**, and a summary of water level declines for wells has been presented in **Table 3.** In the first period, the water level at well RD-63 declined from a static depth of about 10.0 to about 51.2 feet bls after 47 days of operation. Operation was interrupted during the 45-day HCS and the water level recovered to about 15.1 feet bls before extraction was resumed. After 96 days of operation in the second period, the pumping water level was measured at about 79.6 feet bls, amounting to about 69.6 feet of total water level decline since extraction testing commenced in April 1996. Nearly 45 feet of available drawdown

remained in the well before water level controls would limit further operation of the extraction system.

Water levels were periodically measured at nearby shallow monitor wells RS-25 and RS-28, and at monitor wells RD-17, RD-18, RD-19, RD-27, RD-28, RD-30, RD-34A, RD-34B, RD-34C. Water levels measured at all wells decreased overall by the end of the six-month reporting period ranging in depth from 11.59 to 81.53 feet bls **(Table 2).**

By the end of October 1996 water level elevations ranged from about 1817.2 feet above mean sea level (MSL) at well RD-17 to about 1703.6 feet MSL at well RD-34B. Water level hydrographs for each well monitored during the reporting period have been presented in **Appendix A, Figures A-1** through **A-12.**

Water level declines resulting during the six month period were determined from the water level measurements at each well. The largest water level declines were exhibited by nearby monitor wells RD-30, RD-34B and RD-34A, which indicated about 30.7, 31.7 and 34.2 feet of decline, respectively **(Table 3).** Deep well RD-34C also responded to extraction from well RD-63 and indicated a water level decline of about 6.5 feet.

Shallow Zone monitor well RS-25 was observed to be dry by the fourth week after extraction commenced, and Shallow Zone monitor well RS-28 was observed to be dry by the fourth week of extraction during the second period of operation **(Table 3).**

WATER QUALITY - WELL DISCHARGE

The schedule of sampling for water samples collected from the discharge of extraction well RD-63 (influent) and treated effluent during the pilot testing period has been listed in **Table 5.** The schedule of sampling was developed from previous extraction testing at well RD-63 (GWRC, 1993, 1995). Influent groundwater samples periodically collected from extraction well RD-63 were submitted to BC Analytical of Glendale, California to analyze for VOCs, common ions and trace metals. Influent samples collected to analyze for radiological parameters were submitted to Lockheed Analytical Services of Las Vegas, Nevada. Analytical results for VOCs, radiological parameters, common ions and trace metals have been summarized in **Tables 6, 7, 8** and 9 respectively. Copies of laboratory analytical reports excluding QA/QC documentation have been presented in **Appendix B.**

Influent water quality field parameters regarding pH, electrical conductivity and temperature were monitored at the well discharge **(Table 4)**. Influent groundwater field parameters for pH ranged from 6.2 to 7.6, electrical conductivity ranged from 750 to 1100 *u*mhos/cm, and temperature ranged from 19.0 to 22.0 degrees Celsius.

For influent groundwater samples collected from extraction well RD-63 during the reporting period, TCE was the most prevalent compound detected, and was indicated at concentrations ranging from 7.2 to 16 µg/l. Cis-1,2-DCE, 1,1-DCA, and 1,1-DCE were also consistently detected but at lower concentrations **(Table 6)**.

No significantly elevated values for radiological parameters were detected in the samples of influent groundwater that were collected on three separate occasions during the reporting period **(Table 7)**. Radioactive mid-potential values for gross alpha were detected to range from 10.1 to 23.6 pico Curies per liter (pCi/l); gross beta from 9.2 to 14.4 pCi/l; and tritium from 30 to 220 pCi/l.

No significantly elevated values for common ion constituents were detected in the samples of influent groundwater that were collected on three separate occasions during the reporting period **(Table 8)**. Calcium and bicarbonate were the predominant ions detected. Concentrations of total dissolved solids ranged from 650 to 730 mg/l.

No significantly elevated values for trace metal constituents were detected in the samples of influent groundwater that were collected on three separate occasions during the reporting period **(Table 9)**. Barium, iron, manganese and zinc were the trace metals consistently detected.

WATER QUALITY - TREATMENT UNIT EFFLUENT

Treated effluent samples were periodically collected from the primary carbon treatment unit and submitted to the SSFL field laboratory for VOC analyses by Columbia Analytical Services of Canoga Park, California. Results of laboratory analyses have been summarized in **Table 6**. TCE was detected at low concentrations of 0.5 and 0.7 *u*g/l for effluent samples collected on only two occasions during the reporting period from the primary carbon treatment unit. VOCs were reported to be less than the analytical detection limits in all other effluent samples collected during the reporting period.

SUMMARY OF RESULTS

Based on data compiled during the six-month extraction operation the following conclusions and recommendations have been prepared.

- The sustainable pumping capacity of well RD-63 is approximately 2 gpm. Pumping rates ranged from 1.5 to 2.0 gpm and averaged about 1.7 gpm.

- Water level declines were observed in all wells monitored during the six-month period. Water level declines ranged from 0.88 feet at well RD-28, which is located about 1,000 feet southwest of well RD-63, to about 34 feet at well RD-34A, which is located about 100 feet to the west.

- The most prevalent organic compound detected in discharge samples collected from well RD-63 was TCE at concentrations of 7.2 to 15 μg/l. Concentrations of TCE at nearby monitor wells have historically been as high as 90 μg/l.

- Total pumpage during the six-month operation was 361,910 gallons.

REFERENCES

Groundwater Resources Consultants, Inc., 1992. *Cluster Well Sites RD-33, RD-34, and RD-51, Santa Susana Field Laboratory, Rockwell International Corporation, Rocketdyne Division, Ventura County, California.* April 24, 1992.

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TABLE 1

WELL CONSTRUCTION DETAILS

WELL I.D.	BOREHOLE DEPTH (feet)	BOREHOLE		CASING[1/]		CEMENTED INTERVAL (feet)	OPEN HOLE INTERVAL (feet)	MEASURING POINT ELEVATION (ft MSL)	DATE DRILLING COMPLETED
		Diameter (inches)	Interval (feet)	Diameter (inches)	Interval (feet)				
RS-25	13.5	Trenched	0-13.5	4	0-13.5	0-2.0	8.5-13.5	1862.71	08/25/88
RS-28	19.0	8	0 - 19.0	4-1/2	0 - 19.0	0 - 9.0	14.0 - 19.0	1768.59	08/17/89
RD-17	125.0	12 6 1/2	0 - 30.0 30.0 - 125.0	8 1/4 ---	0 - 30.0 ---	0 - 30.0	30.0 - 125.0	1836.30	08/10/89
RD-18	240.0	12 6 1/2	0 - 30.0 30.0 - 240.0	8 1/4 ---	0 - 30.0	0 - 30.0	30.0 - 240.0	1839.49	07/28/89
RD-19	135.0	12 6 1/2	0 - 30.0 30.0 - 135.0	8 1/4 ---	0 - 30.0	0 - 30.0	30.0 - 135.0	1853.13	07/31/89
RD-19	135	12 6-1/2	0 - 30.0 30.0 - 135.0	1/4	0 - 30.0	0 - 30.0	30.0 - 135.0	1853.13	07-31-89
RD-27	150	12 6-1/2	0 - 30 150	8-5/8	0 - 30	0 - 30	30 - 150	1841.67	08/10/89
RD-28	150.0	12 6 1/2	0 - 0.30 30.0 - 150.0	8 1/4 ---	0 - 30.0	0 - 30.0	30.0 - 150.0	1810.92	08/10/89
RD-30	75	12 6-1/2	0 - 30.0 30.0 - 75.0	8-5/8	0 - 30.0	0 - 30.0	30.0 - 75.0	1768.69	08-11-89
RD-34A	60	12-1/4 6-1/2	0 - 16.0 16.0 - 60.0	8-5/8 ---	0 - 16.0 ---	0 - 16.0	16.0 - 60.0	1761.83	07-25-91
RD-34B	240	17-1/2 11 5-1/2	0 - 30.0 30.0 - 180.0 180.0 - 240.0	12-3/4 6-5/8 ---	0 - 30.0 0 - 180.0 ---	0 - 30.0 0 - 180.0	180.0 - 240.0	1762.51	08-11-91
RD-34C	450	17-1/2 11 5-1/2	0 - 30.0 30.0 - 380.0 380.0 - 450.0	12-3/4 6-5/8 ---	0 - 30.0 0 - 380.0 ---	0 - 30.0 0 - 38.0	380.0 - 450.0	1762.60	08-10-91

TABLE 1

WELL CONSTRUCTION DETAILS

WELL I.D.	BOREHOLE DEPTH (feet)	BOREHOLE		CASING[1/]		CEMENTED INTERVAL (feet)	OPEN HOLE INTERVAL (feet)	MEASURING POINT ELEVATION (ft MSL)	DATE DRILLING COMPLETED
		Diameter (inches)	Interval (feet)	Diameter (inches)	Interval (feet)				
RD-63	230	12-3/4 6-1/2	0 - 20 20 - 230	8-5/8	0 - 20	0 - 20	20 - 230	1764.85	05/10/94

TABLE 2

WATER LEVEL MEASUREMENTS AT MONITOR WELLS[1/]
(feet below measuring point)

	WELL IDENTIFIER											
DATE (1996)	RD-17	RD-18	RD-19	RD-27	RD-28	RD-30	RD-34A	RD-34B	RD-34C	RD-63	RS-25	RS-28
04/22	15.77	79.40	70.56	47.18	50.45	2.92	15.94	27.26	5.05	9.85	3.95	2.57
04/25	15.81	79.42	70.57	47.20	50.48	2.96	16.01	27.28	5.07	10.04	3.96	2.60
04/26	15.78	79.51	70.69	47.24	50.71	5.28	16.62	28.02	5.03	19.43	14.04	3.11
05/02	15.73	79.25	70.23	47.11	50.05	6.44	20.66	30.68	4.78	27.82	14.06	6.00
05/13	15.47	78.82	70.64	47.15	49.98	8.77	23.61	33.32	4.76	32.40	14.17	8.18
05/20	16.03	78.70	70.96	47.07	49.97	10.28	25.15	34.81	4.93	39.70	DRY	9.63
05/28	16.19	78.55	71.42	47.10	49.93	11.99	27.62	37.02	5.43	44.93	DRY	11.17
06/11	16.37	78.43	72.04	47.20	49.88	14.08	31.00	39.82	6.22	51.16	DRY	13.33
06/18*	16.47	78.23	72.42	47.28	49.83	9.99	26.64	36.56	6.18	20.03	---	---
06/26*	16.64	78.13	72.52	47.36	49.94	8.36	24.17	34.81	6.10	17.36	---	---
07/04*	17.13	78.08	72.49	UTM	49.92	7.62	22.86	34.02	6.06	16.27	---	---
07/16*	17.11	78.17	72.50	47.46	49.98	7.24	22.55	33.74	6.11	15.55	---	---
07/25*	17.25	78.39	72.59	47.73	50.02	7.12	22.55	33.73	6.16	15.26	---	---
07/26	---	---	---	---	---	---	---	---	---	15.12**	---	---
08/09	17.31	78.84	72.64	47.63	49.83	8.17	23.02	32.87	5.33	31.08	DRY	7.98
08/24	17.93	79.15	74.10	UTM	50.60	19.54	38.80	45.30	9.60	58.08	DRY	DRY
09/05	18.03	79.40	74.58	47.77	50.61	22.82	41.08	47.95	8.28	63.00	DRY	DRY
10/11	18.89	80.82	74.62	47.92	50.65	30.97	47.87	55.54	10.73	73.53	DRY	DRY

TABLE 2

WATER LEVEL MEASUREMENTS AT MONITOR WELLS[1/]
(feet below measuring point)

	WELL IDENTIFIER											
DATE (1996)	RD-17	RD-18	RD-19	RD-27	RD-28	RD-30	RD-34A	RD-34B	RD-34C	RD-63	RS-25	RS-28
10/30	19.06	81.53	77.11	49.65	51.33	33.57	50.11	58.92	11.59	79.57	DRY	DRY

1/ Measurements for extraction well RD-63 were for pumping water levels only except where noted.
* Exraction system deactivated 06/11/96 to 07/26/96 - water level measurements listed were from HCS program.
** Extraction testing resumed 07/26/96.
--- Not measured.
UTM Unable to measure.

TABLE 3

WATER LEVEL DECLINES AT MONITOR WELLS[1/]

WELL IDENTIFICATION	WATER LEVEL DECLINE (feet)
RS-25	5 (DRY)
RS-28	0.22 (DRY)
RD-17	3.29
RD-18	2.13
RD-19	6.55
RD-27	2.47
RD-28	0.88
RD-30	30.65
RD-34A	34.17
RD-34B	31.66
RD-34C	6.54

1/ Measurements made for period ending 10-30-96 and beginning 04-22-96 before start-up of extraction well RD-63 on 04-25-96.

TABLE 4

EXTRACTION WELL RD-63 DISCHARGE RATES AND VOLUMES

DATE	TIME	INFLUENT FLOW DATA					COMMENTS
		Discharge Rate	Volume to Date	pH	E.C. (μmhos/cm)	Temperature (°C)	
04/25/96	15:00	1.5	0	---	---	---	System started
04/26/96	09:00	1.5	1780	6.8	1000	19.5	
05/02/96	13:25	1.5	15,146	7.6	1000	20.0	
05/13/96	14:00	1.65	39,159	6.2	1010	20.5	
05/20/96	09:00	2.0	55,320	7.3	750	20.0	Discharge rate increased 05/18/96
05/28/96	12:15	1.9	77,380	6.6	1075	21.5	
06/11/96	07:58	2.0	114,485	6.7	1100	22.0	System deactivated
07/26/96	12:21	2.0	114,485	---	---	---	System restarted
08/01/96	08:16	1.9	130,418	---	---	---	
08/06/96	08:45	1.9	143,984	---	---	---	
08/09/96	12:45	1.8	152,500	6.4	1000	21.5	
08/24/96	08:51	1.8	191,908	7.0	1000	21.0	
09/05/96	08:10	1.8	223,390	7.4	1000	20.0	
10/11/96	12:05	1.6	315,400	7.5	1100	20.0	
10/30/96	14:25	1.7	361,910	7.3	1025	19.0	

TABLE 5

SCHEDULE OF WATER QUALITY SAMPLING
RMDF AREA EXTRACTION TREATMENT SYSTEM PILOT OPERATION

DATE SAMPLED	CUMULATIVE DAYS OF SYSTEM OPERATION	LABORATORY ANALYSES	
		INFLUENT	EFFLUENT
04-26-96	1	VOC/RAD/GM	VOC
05-02-96	7	VOC	VOC
05-13-96	18	VOC	VOC
05-20-96	25	VOC	VOC
05-28-96	33	VOC/RAD/GM	VOC
06-11-96	47	VOC (split)	VOC
07-26-96	47*	---	VOC
08-09-96	61	VOC	VOC
08-17-96[1/]	69	VOC	---
08-24-96	76	VOC	VOC
09-05-96	88	VOC/RAD/GM	VOC
10-11-96	124	VOC	VOC
10-30-96	143	VOC	VOC

VOC = Volatile organic compounds
RAD = Radionuclides including gross alpha, gross beta, and tritium
GM = Common ions and trace metals
(*) = Treatment system deactivated 06/11/96 to 07/26/96 due to HCS
(---) = Not sampled
1/ = SSFL Quarterly Groundwater Monitoring Program

TABLE 6

SUMMARY OF INFLUENT AND EFFLUENT ANALYTICAL RESULTS FOR VOLATILE ORGANIC COMPOUNDS RMDF AREA EXTRACTION TREATMENT SYSTEM

DATE SAMPLED		04-26-96	05-02-96	05-13-96	05-20-96	05-28-96	06-11-96		07-26-96	08-09-96	08-17-96	08-24-96	09-05-96
CUMULATIVE DAYS OF SYSTEM OPERATION	MCL (µg/l)	1	7	18	25	33	47		47*	61	69	76	88
INFLUENT SAMPLE ANALYSES EPA 8010 (µg/l)													
1,1-Dichloroethane	5	0.68	0.69	0.76	0.63	1.5	0.97	0.8	---	1.2	1.4	1.7	0.68
1,1-Dichloroethylene	6	1.6	1.8	2.8	1.7	4.1	3.1	2.2	---	2.7	2.0	3.0	2.3
Cis-1,2-Dichloroethylene	6	4.7	4.2	5.3	4.1	7.4	5.9	4.7	---	6.0	4.9	5.7	3.7
Trichloroethylene	5	10	9.3	14	10	16	14	9.3	---	7.4	15	9.3	8.6
ANALYTICAL LABORATORY		BCA	BCA	BCA	BCA	BCA	BCA	CAS	---	BCA	BCA[2/]	BCA	BCA
EFFLUENT SAMPLE ANALYSES EPA 8010 (µg/l)													
1,1-Dichloroethane	5	-0.5	-0.5	-0.5	-1	-0.5	-0.5		-0.5	-0.5	---	-0.5	-0.5
1,1-Dichloroethylene	6	-0.5	-0.5	-0.5	-1	-0.5	-2		-2	-2	---	-2	-2
Cis-1,2-Dichloroethylene	6	-0.5	-0.5	-0.5	---	-0.5	-0.5		-0.5	-0.5	---	-0.5	-0.5
Trichloroethylene	5	-0.5	0.5	-0.5	-1	0.7	-0.5		-0.5	-0.5	---	-0.5	-0.5
ANALYTICAL LABORATORY		FGL	FGL	FGL	FGL[1/]	FGL	CAS		CAS	CAS	---	CAS	CAS

See last page of Table 6 for footnotes and explanations.

TABLE 6

SUMMARY OF INFLUENT AND EFFLUENT ANALYTICAL RESULTS FOR VOLATILE ORGANIC COMPOUNDS RMDF AREA EXTRACTION TREATMENT SYSTEM

DATE SAMPLED		10-11-96	10-30-96									
CUMULATIVE DAYS OF SYSTEM OPERATION	MCL (µg/l)	124	143									
INFLUENT SAMPLE ANALYSES EPA 8010 (µg/l)												
1,1-Dichloroethane	5	0.77	0.81									
1,1-Dichloroethylene	6	1.4	1.6									
Cis-1,2-Dichloroethylene	6	3.2	3.5									
Trichloroethylene	5	7.2	8.2									
ANALYTICAL LABORATORY		BCA	BCA									
EFFLUENT SAMPLE ANALYSES EPA 8010 (µg/l)												
1,1-Dichloroethane	5	-0.5	-0.5									
1,1-Dichloroethylene	6	-2	-0.5									
Cis-1,2-Dichloroethylene	6	-0.5	-0.5									
Trichloroethylene	5	-0.5	-0.5									
ANALYTICAL LABORATORY		CAS	CAS									

MCL Maximum contaminant level, California Title 22 (September 9, 1994)
(*) Effluent sample only; extraction well RD-63 and Treatment System deactivated 06/11/96 to 07/26/96 due to HCS
(---) Not analyzed
(-) Less than detection limit
BCA BC Analytical, Glendale, California
FGL FGL Environmental of Santa Paula, California
CAS Columbia Analytical Services of Canoga Park, California
1/ VOC sample analyzed using EPA method 624
2/ VOC sample analyzed using EPA Method 8260 (Quarterly General Monitoring Program)

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TABLE 7

SUMMARY OF ANALYTICAL RESULTS FOR RADIOLOGICAL PARAMETERS RMDF AREA EXTRACTION TREATMENT SYSTEM

DATE SAMPLED	04-26-96	05-28-96	09-05-96
CUMULATIVE DAYS OF OPERATION	1	33	88
INFLUENT SAMPLE ANALYSES (pCi/l)			
GROSS ALPHA MDA	10.1 ± 5.4 6.4	23.6 ± 7.8 7.0	11.1 ± 6.2 8.0
GROSS BETA MDA	11.9 ± 4.0 5.6	14.4 ± 4.6 6.3	9.2 ± 4.2 6.3
TRITIUM MDA	30 ± 160 210	110 ± 190 250	220 ± 120 180

NOTE:

Influent Treatment System samples collected from extraction well RD-63.
Results are reported in picoCuries per liter (pCi/l).
MDA represents Minimum Detectable Activity.
Gross Alpha/Beta radioactivity analyzed by EPA method 900.0 or equivalent. Tritium analyzed using liquid scintillation, by EPA method 906.0 or equivalent. Analyses performed by Lockheed Analytical Services of Las Vegas, Nevada.

TABLE 8

SUMMARY OF ANALYTICAL RESULTS FOR COMMON ION CONSTITUENTS
RMDF AREA EXTRACTION TREATMENT SYSTEM

CONSTITUENT (milligrams per liter)	DATE SAMPLED		
	04-26-96	05-28-96	09-05-96
CATIONS:			
Calcium	130	140	140
Magnesium	27	29	28
Sodium	48	46	50
Potassium	3.9	4.1	4.2
ANIONS:			
Carbonate	-10	-10	-10
Bicarbonate	360	350	340
Hydroxide	-10	-10	-10
Chloride	48	47	46
Fluoride	0.43	0.78	0.70
Boron	---	---	---
Silica	---	---	---
Sulfate	140	150	140
Nitrate	1.1	0.69	-0.5
Iron Balance (% difference)	2.8	0.38	2.7
TDS @ 180°C (lab)	650	730	650
EC (μmhos/cm) (lab)	1300	1000	980
pH (field)	6.8	6.6	7.4
Temperature, °C (field)	19.5	21.5	20.0
Laboratory	BCA	BCA	BCA

BCA = BC Analytical
(-) = Less than; numerical value is the Limit of Detection for that compound
(---) = Analysis not performed

TABLE 9

SUMMARY OF ANALYTICAL RESULTS FOR TRACE METAL CONSTITUENTS
RMDF AREA EXTRACTION TREATMENT SYSTEM

CONSTITUENT (milligrams per liter)	DATE SAMPLED		
	04-26-96	05-28-96	09-05-96
Antimony	---	---	---
Arsenic	-0.05	-0.05	-0.002
Barium	**0.042**	**0.044**	**0.048**
Beryllium	-0.001	-0.001	-0.001
Cadmium	-0.01	-0.01	-0.001
Chromium (total)	-0.01	-0.01	-0.01
Copper	-0.02	-0.02	-0.02
Iron	**0.18**	**0.074**	**0.28**
Lead	-0.05	-0.05	**0.0048**
Manganese	**0.027**	**0.021**	**0.027**
Mercury	-0.0002	-0.0002	-0.0002
Molybdenum	---	---	---
Nickel	---	---	---
Selenium	-0.1	-0.1	-0.004
Silver	-0.01	-0.01	-0.01
Strontium	---	---	---
Thallium	---	---	---
Zinc	**1.2**	**0.67**	**0.70**
Laboratory	BCA	BCA	BCA

BCA = BC Analytical
(-) = Less than; numerical value is the Limit of Detection for that compound

(---) = Analysis not performed

APPENDIX A

WATER LEVEL HYDROGRAPHS

GROUNDWATER RESOURCES CONSULTANTS, INC.

APPENDIX A

WATER LEVEL HYDROGRAPHS

CONTENTS

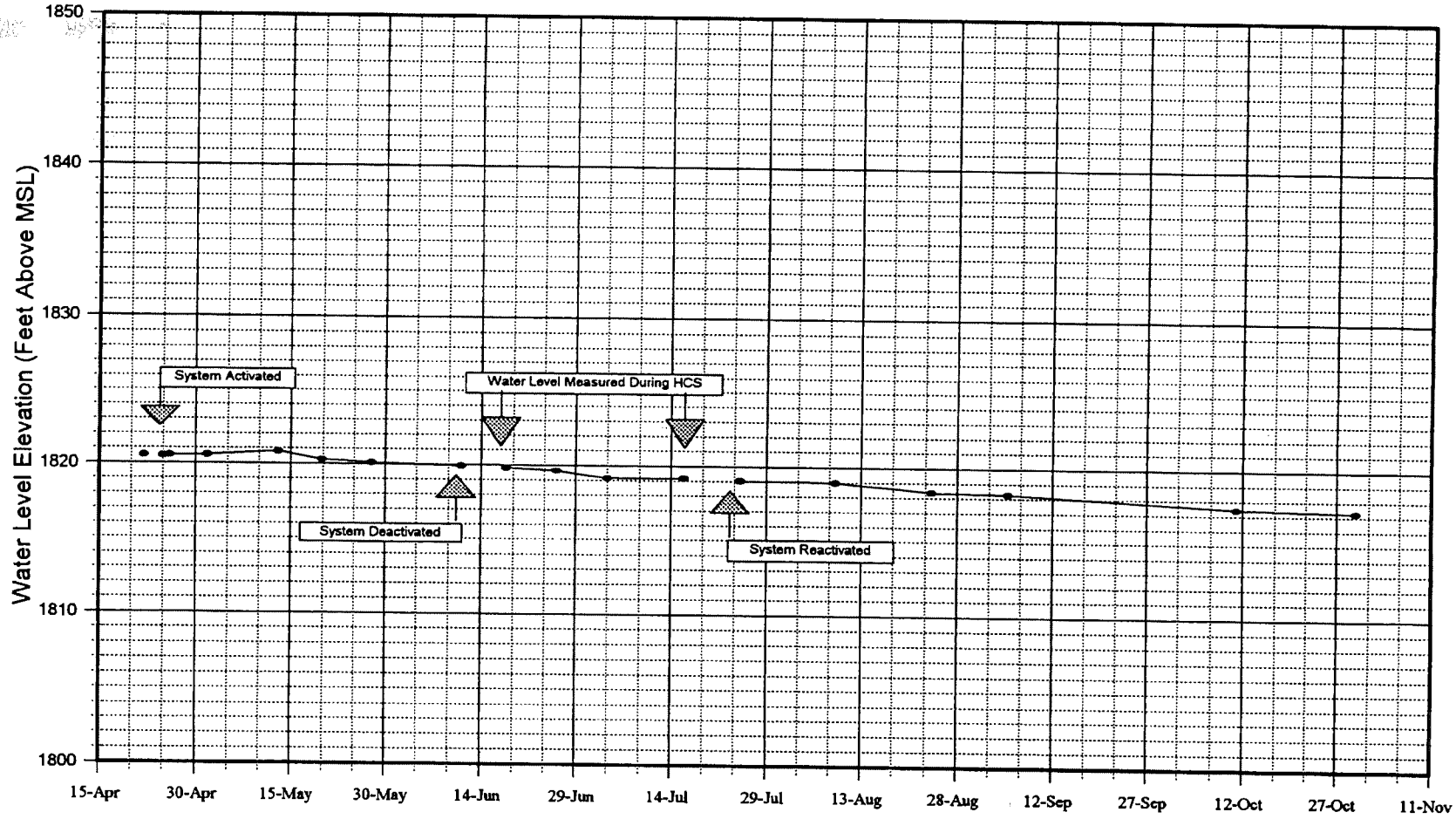

Figure A-1 WATER LEVEL HYDROGRAPH
Monitor Well RD-17

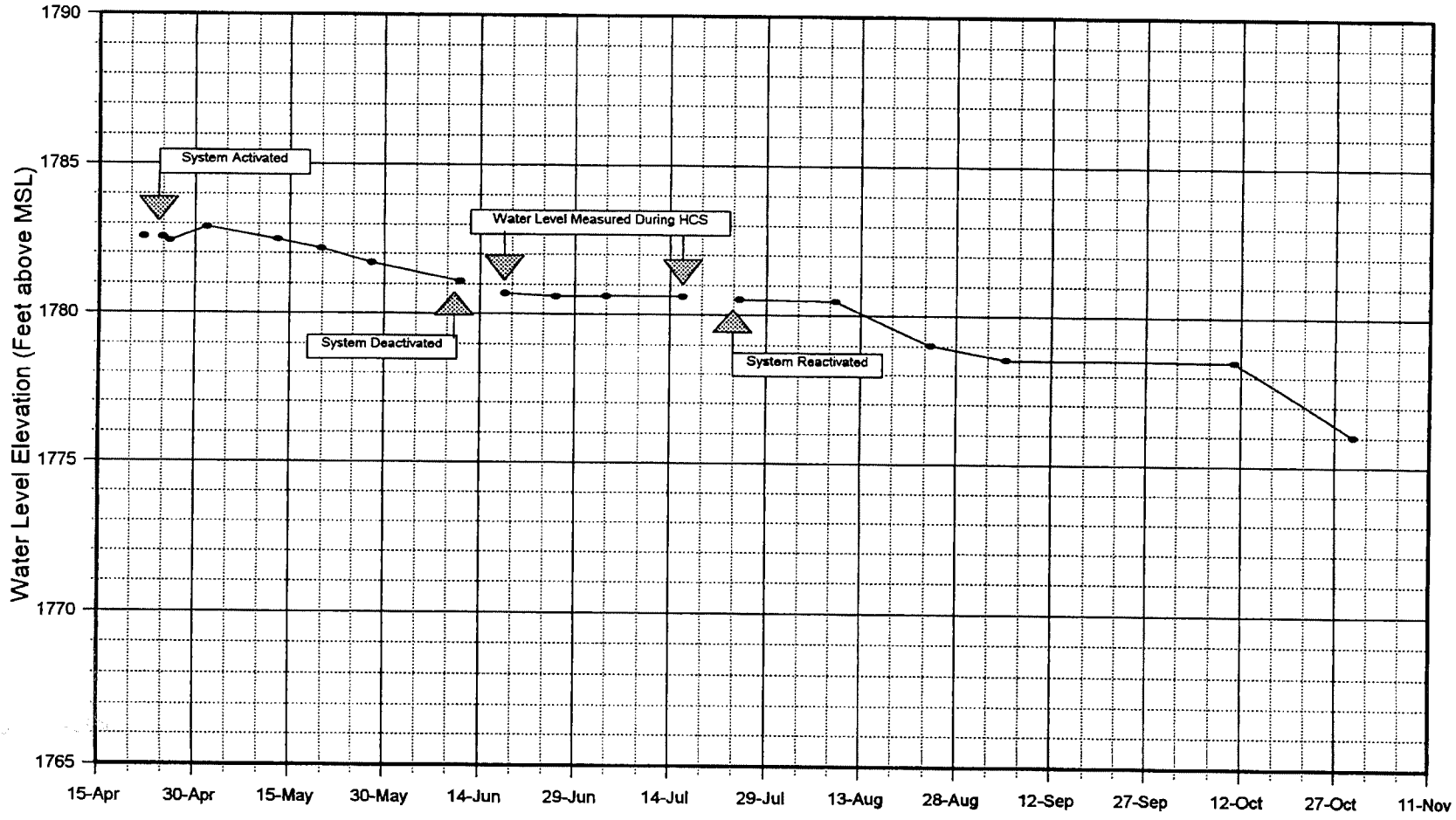

Figure A-2 WATER LEVEL HYDROGRAPH
Monitor Well RD-18

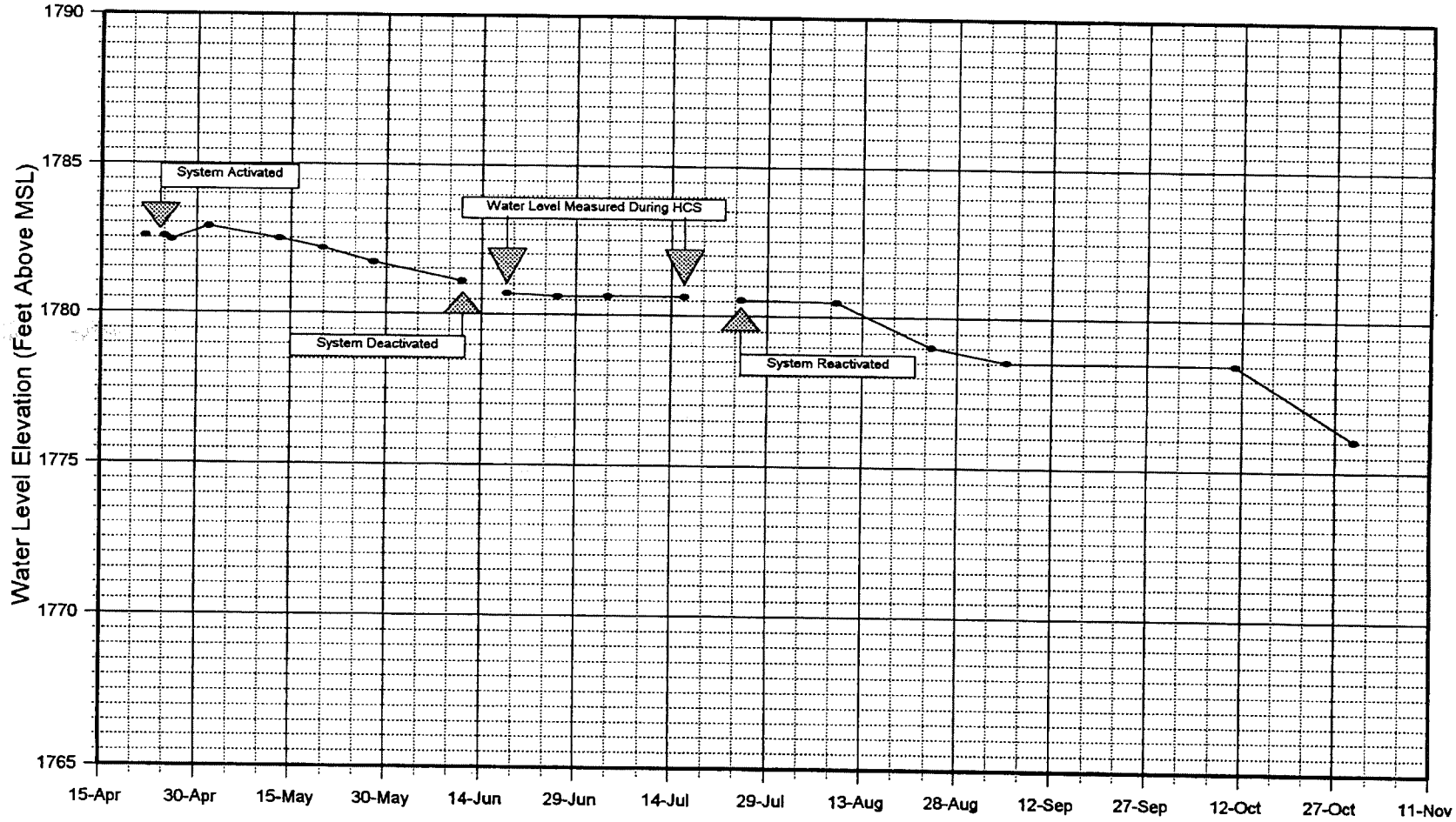

Figure A-3 WATER LEVEL HYDROGRAPH
Monitor Well RD-19

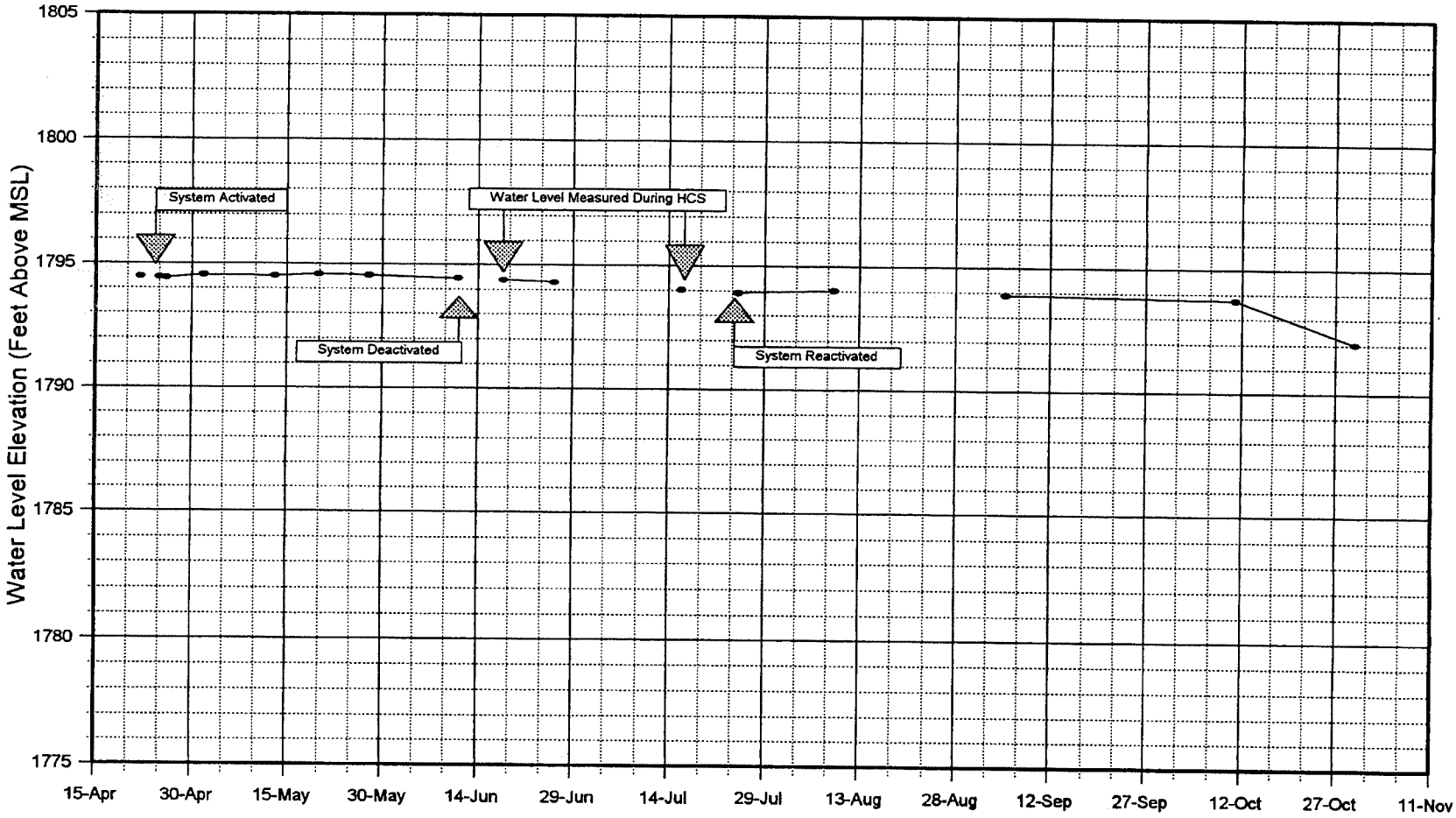

Figure A-4 WATER LEVEL HYDROGRAPH
Monitor Well RD-27

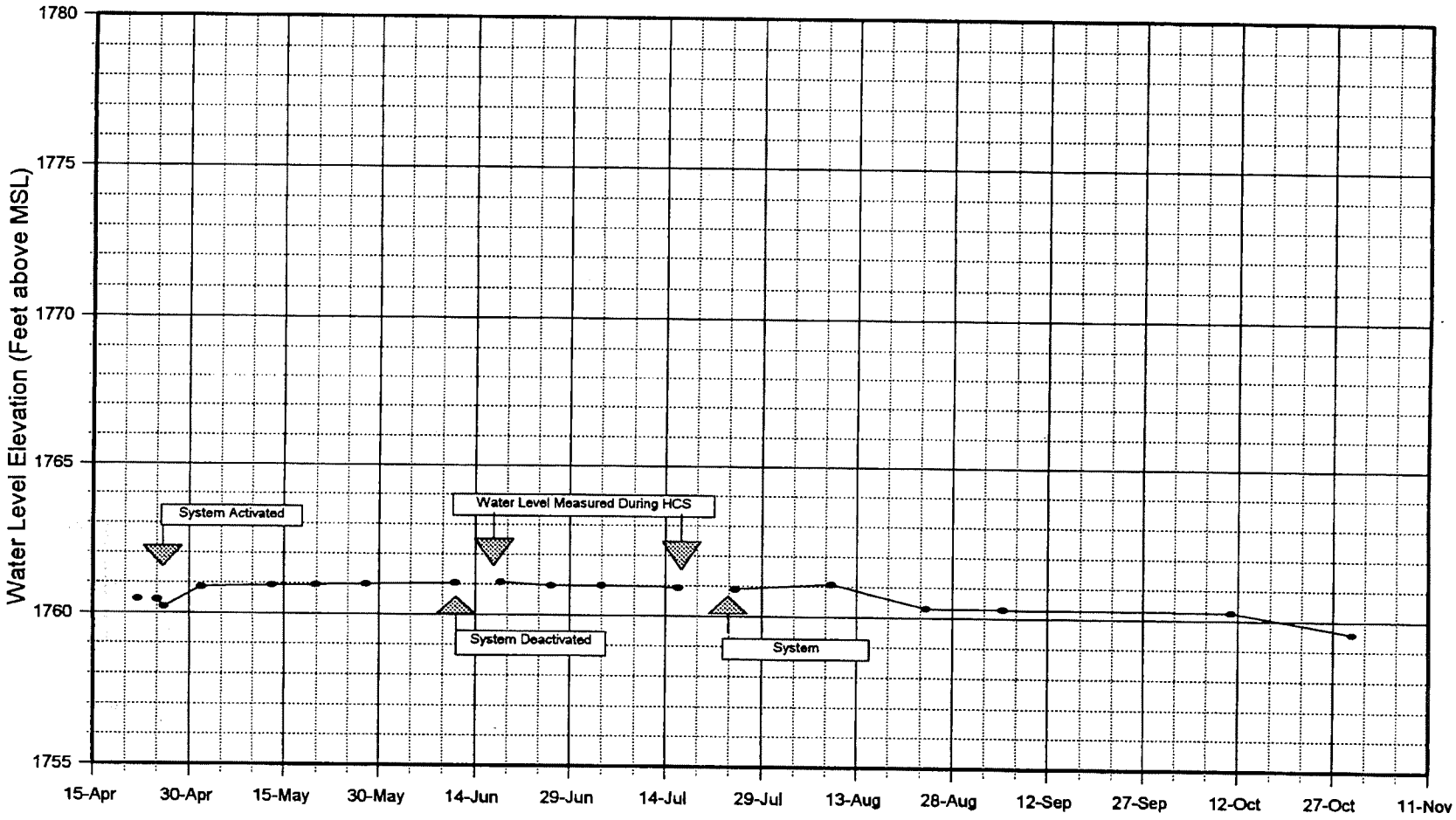

Figure A-5 WATER LEVEL HYDROGRAPH
Monitor Well RD-28

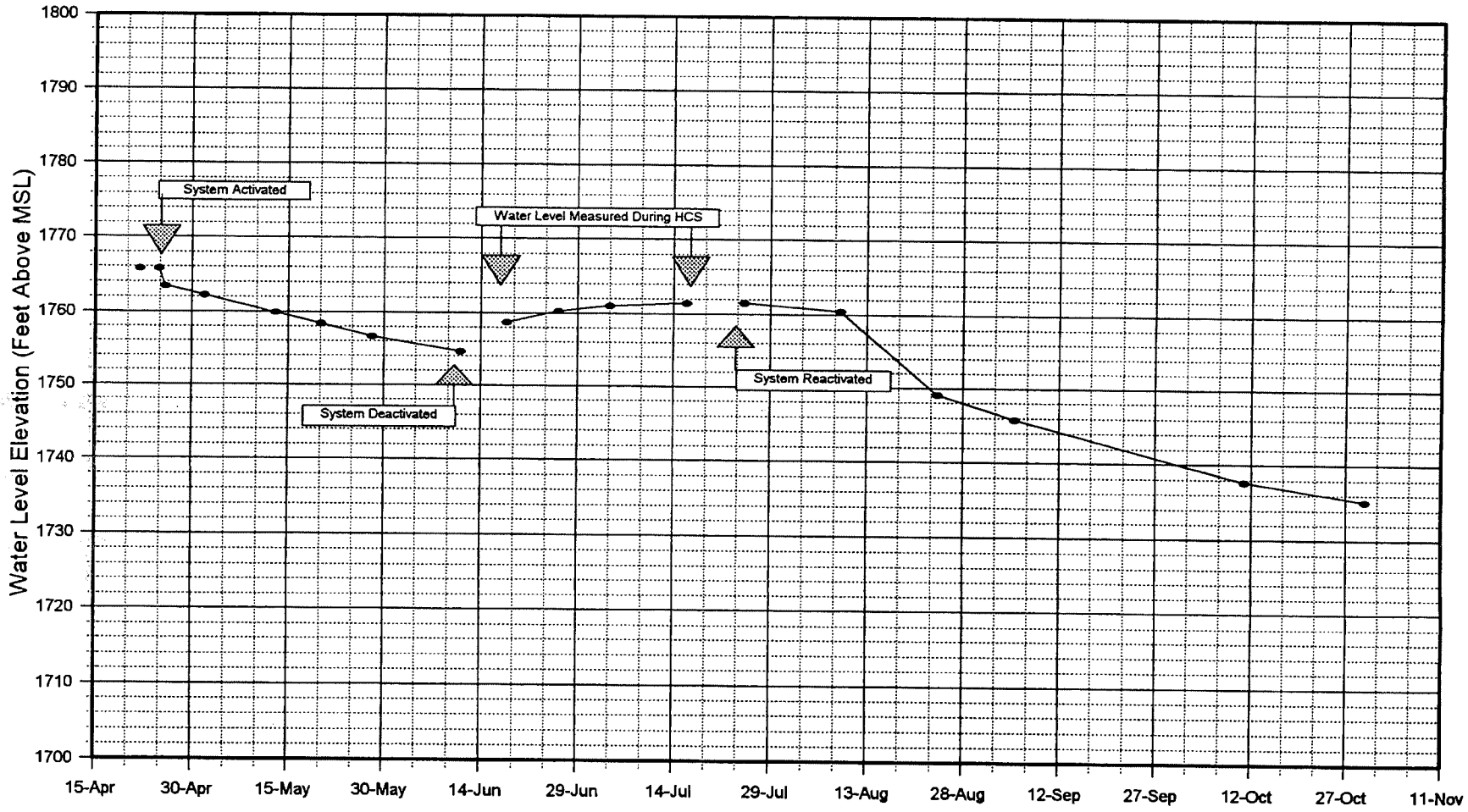

Figure A-6 WATER LEVEL HYDROGRAPH
Monitor Well RD-30

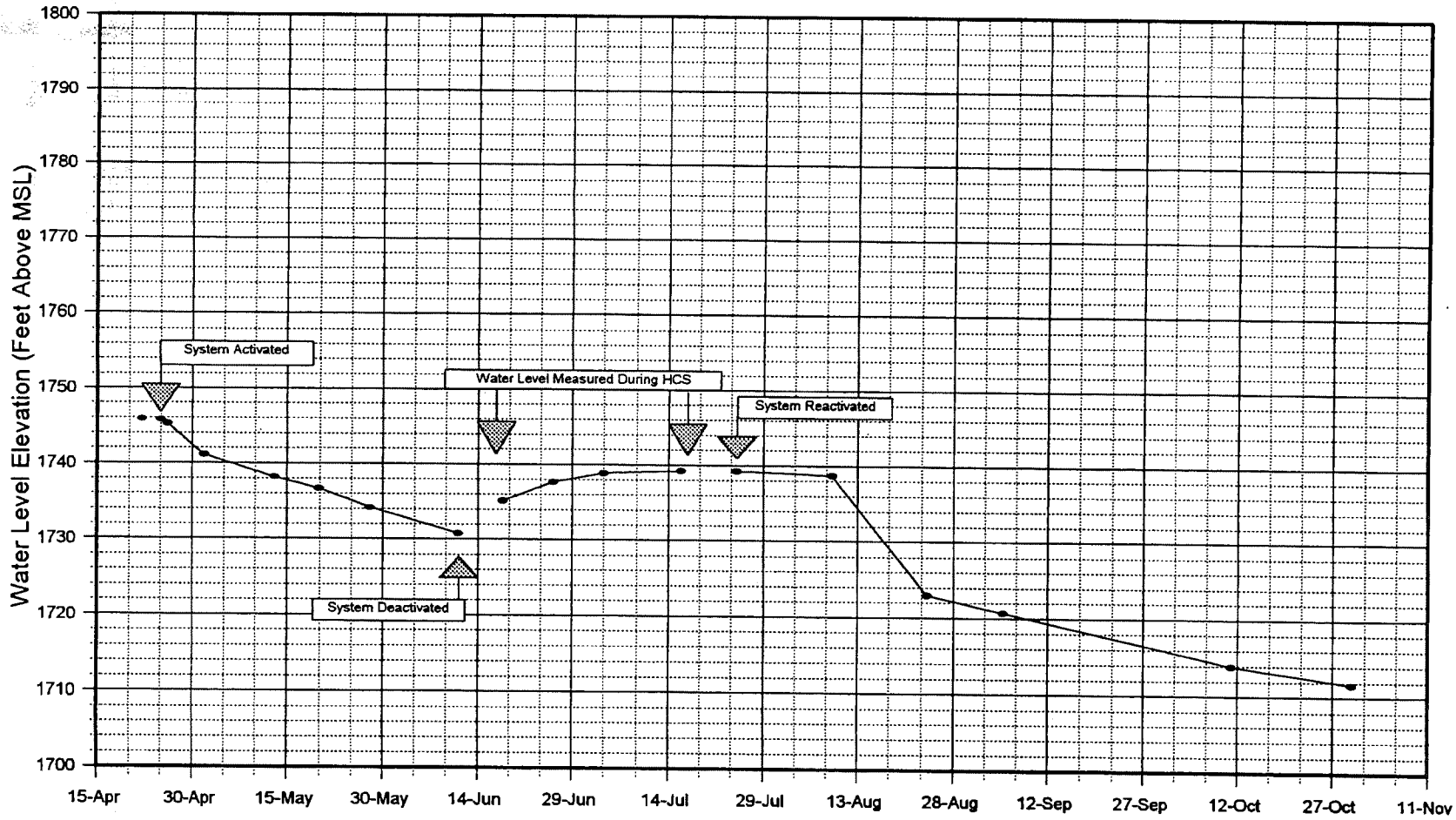

Figure A-7 WATER LEVEL HYDROGRAPH
Monitor Well RD-34A

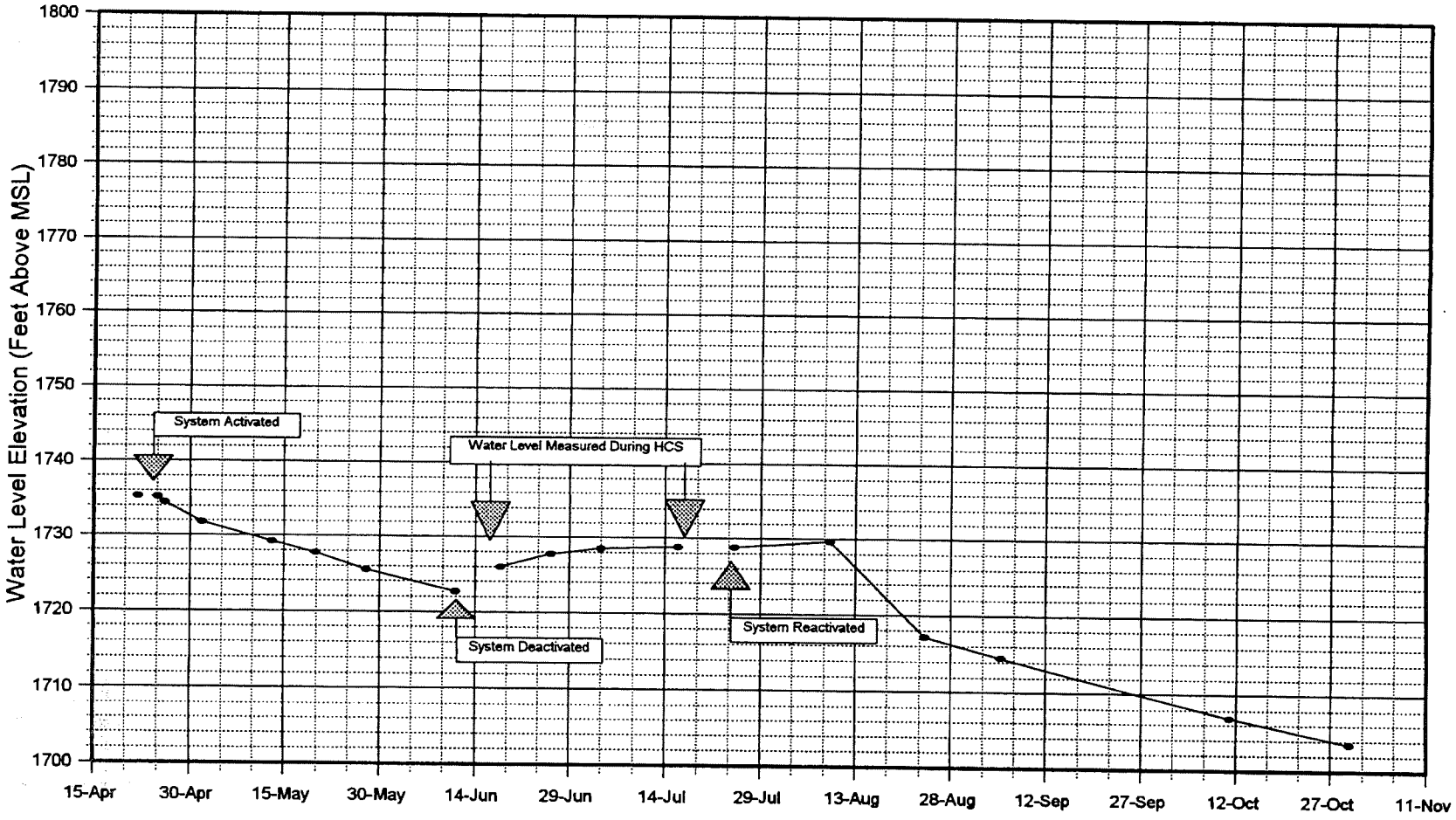

Figure A-8 WATER LEVEL HYDROGRAPH
Monitor Well RD-34B

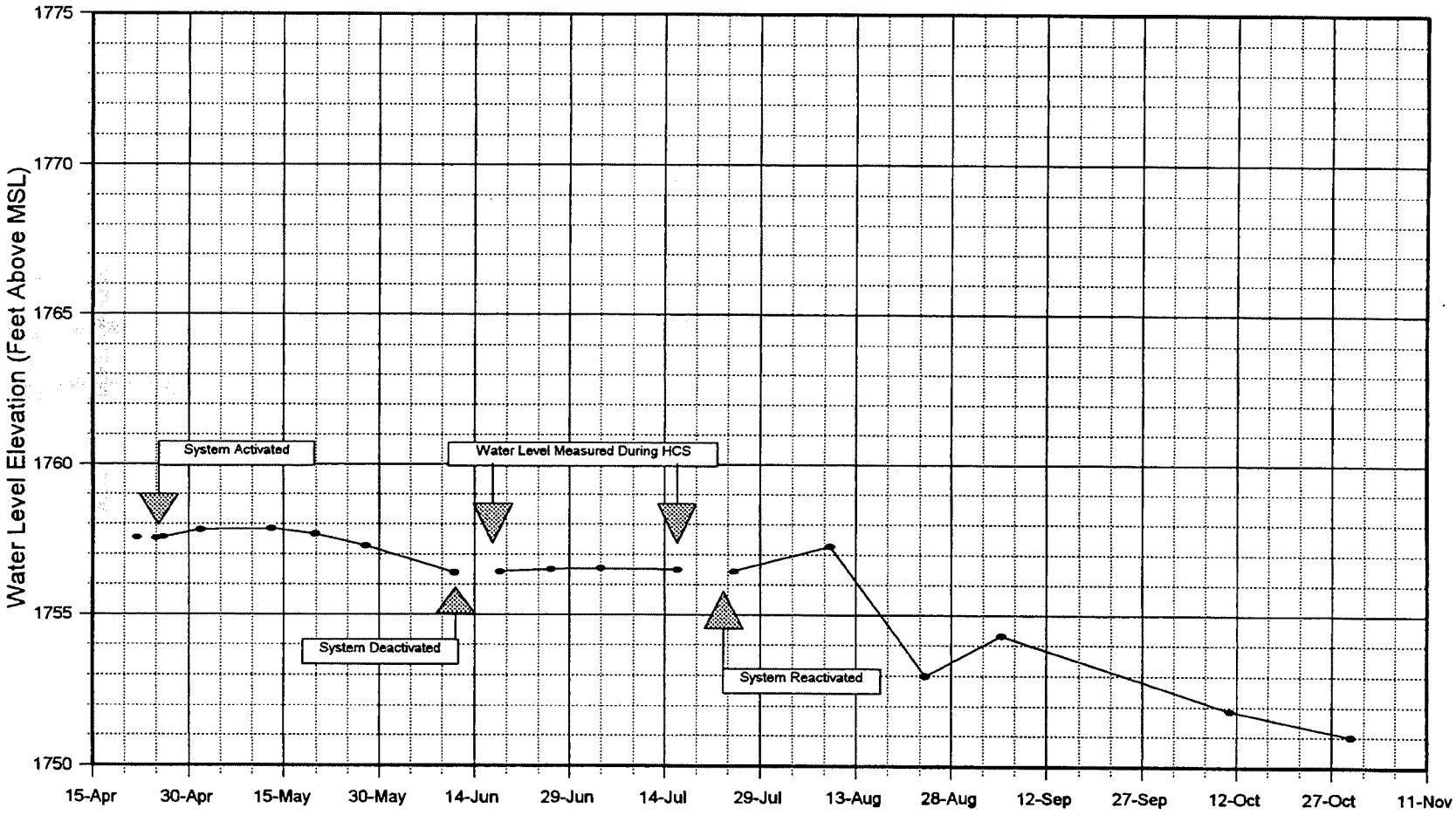

Figure A-9 WATER LEVEL HYDROGRAPH
Monitor Well RD-34C

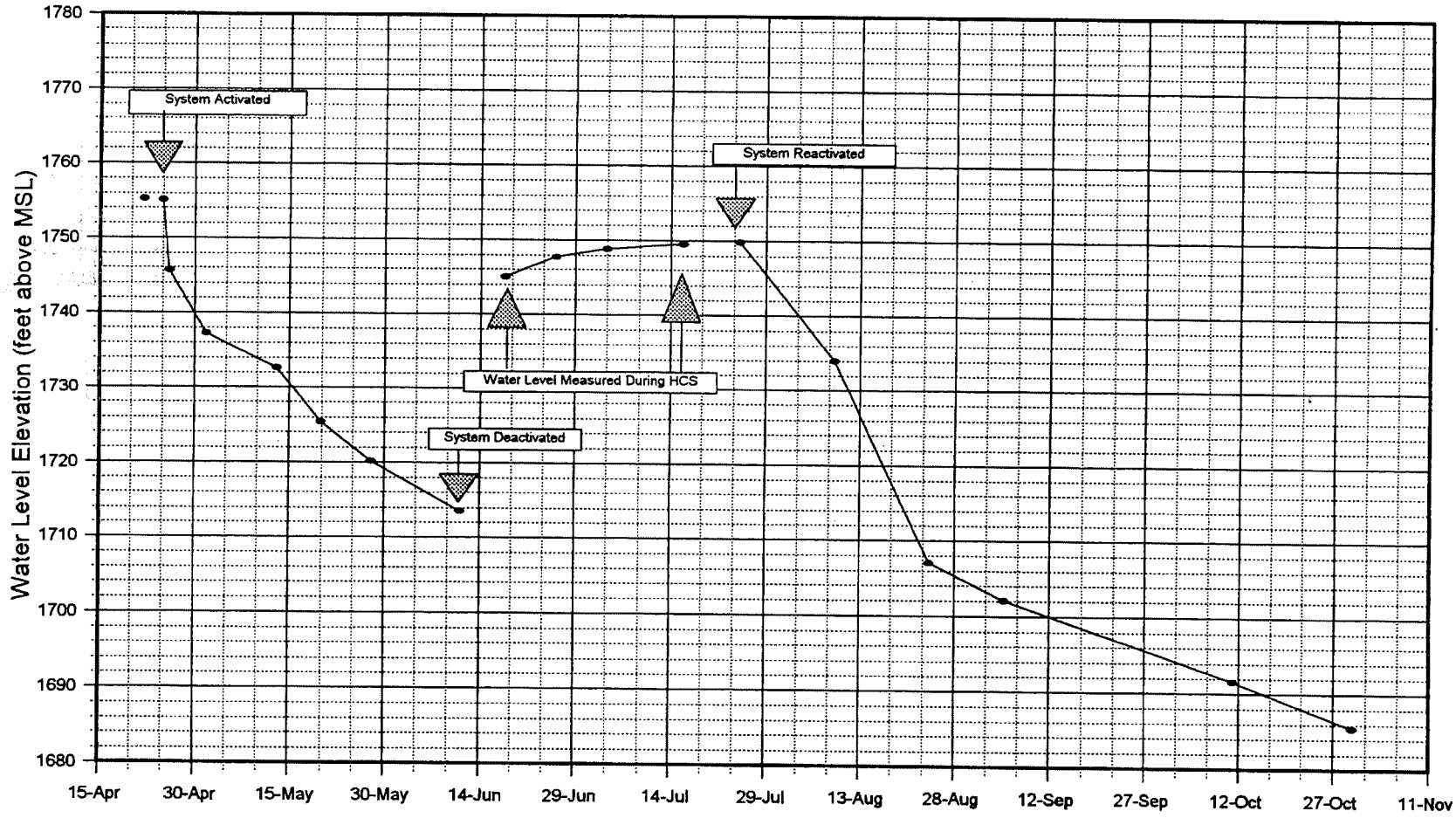

Figure A-10 WATER LEVEL HYDROGRAPH
RMDF Area Extraction Well RD-63

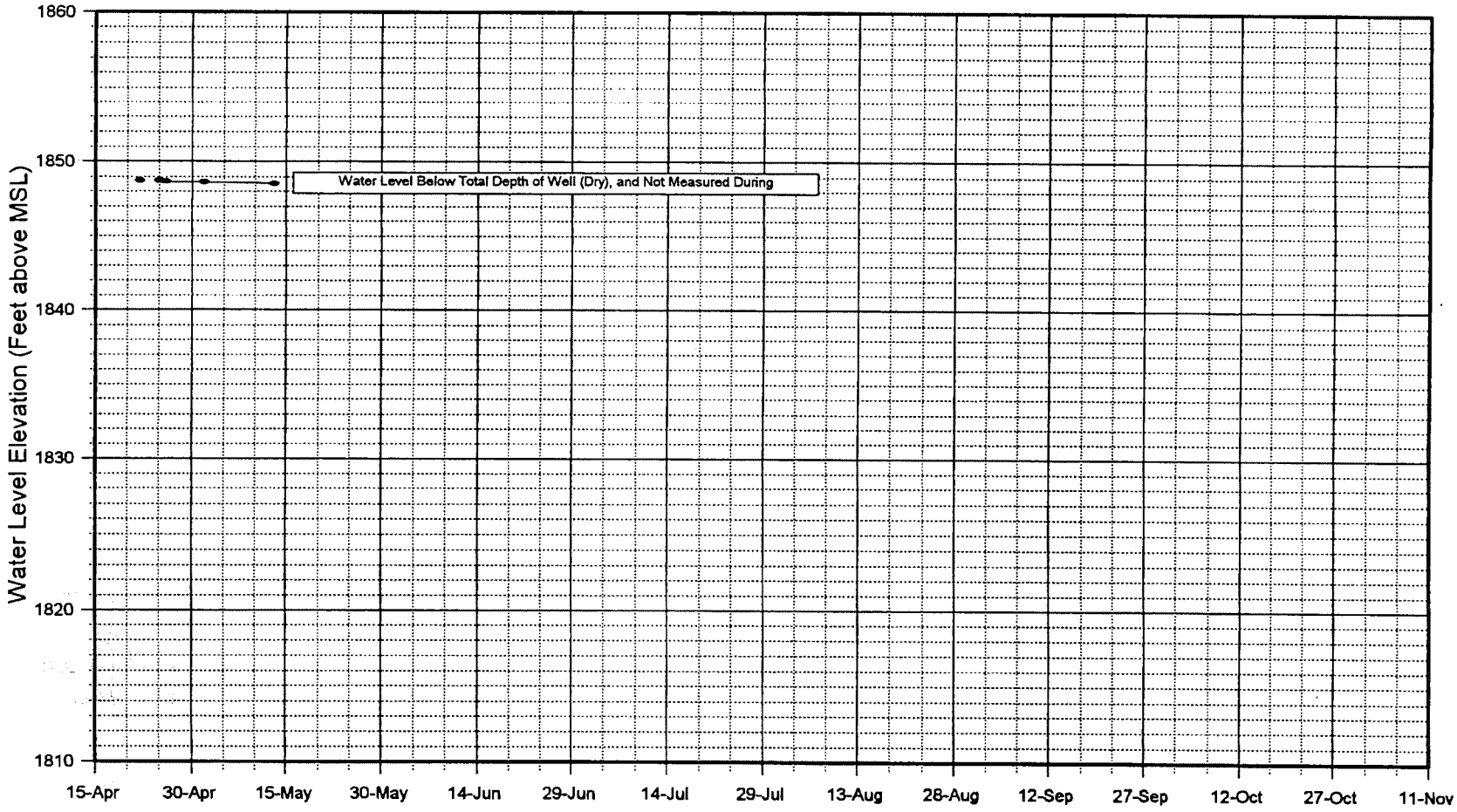

Figure A-11 WATER LEVEL HYDROGRAPH
Shallow Monitor Well RS-25

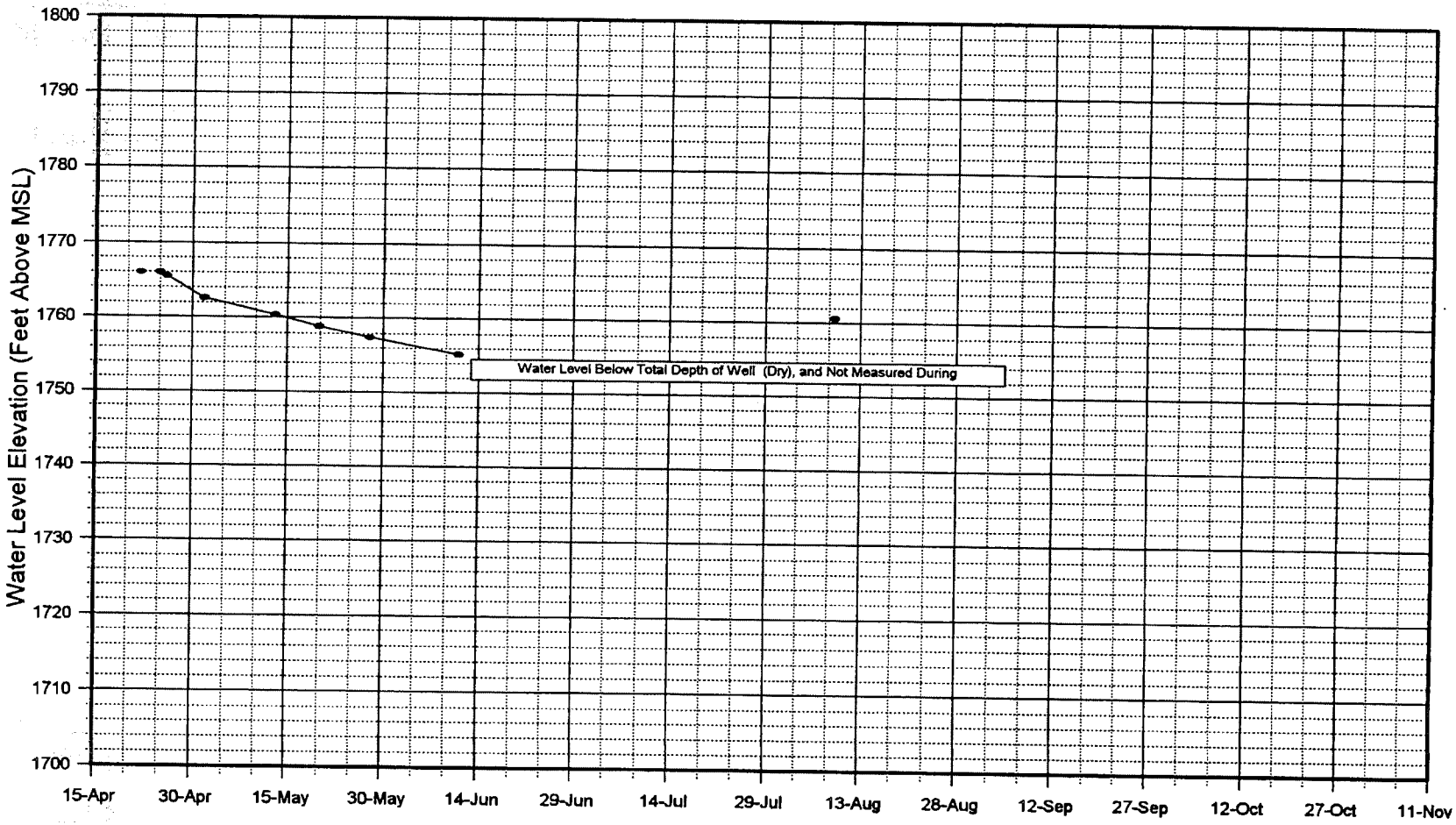

Figure A-12 WATER LEVEL HYDROGRAPH
Shallow Monitor Well RS-28