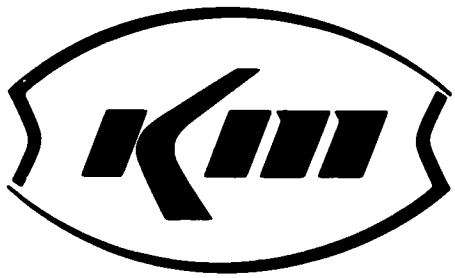
KERR-McGEE CORPORATION



SEMI-ANNUAL PERFORMANCE REPORT
CHROMIUM MITIGATION PROGRAM
KERR-McGEE CHEMICAL CORPORATION
HENDERSON, NEVADA

January - June 1993

SEMI-ANNUAL PERFORMANCE REPORT
CHROMIUM MITIGATION PROGRAM
KERR-McGEE CHEMICAL CORPORATION
HENDERSON, NEVADA

JANUARY - JUNE 1993

Submitted in Accordance with:

Chromium Mitigation Program
Consent Order
September 9, 1986

Prepared by:

Thomas W. Reed
Hydrology Department
Kerr-McGee Corporation

August 28, 1993

Susan Crowley

Susan Crowley, Staff Environmental Specialist
Kerr-McGee Chemical Corporation
Henderson, Nevada

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SEMI-ANNUAL PERFORMANCE REPORT
CHROMIUM MITIGATION PROGRAM
KERR-McGEE CHEMICAL CORPORATION
HENDERSON, NEVADA

INTRODUCTION

In accordance with the Consent Order for cleanup of chromium contaminated groundwater at the Henderson facility, finalized September 9, 1986, Kerr-McGee Chemical Corporation (KMCC) submits this semi-annual performance report to the Nevada Department of Environmental Protection. This report, covering the period January through June, 1993, summarizes performance data for the groundwater treatment plant and evaluates the effectiveness of the groundwater interception and treatment system installed to carry out the chromium mitigation program.

GROUNDWATER SURFACE CONFIGURATION

Figure 1 illustrates the Consent Order Monitoring Area as defined in Appendix D of the Consent Order, and shows the locations of all groundwater interceptor and monitor wells installed by KMCC within this area. Appendix A of this report lists monthly groundwater elevations recorded since September 1992 in wells within the Consent Order area. Appendix B presents the water table configuration in two formats, potentiometric surface maps and cross-sections for the first half of 1993, reflecting quarterly groundwater level measurements.

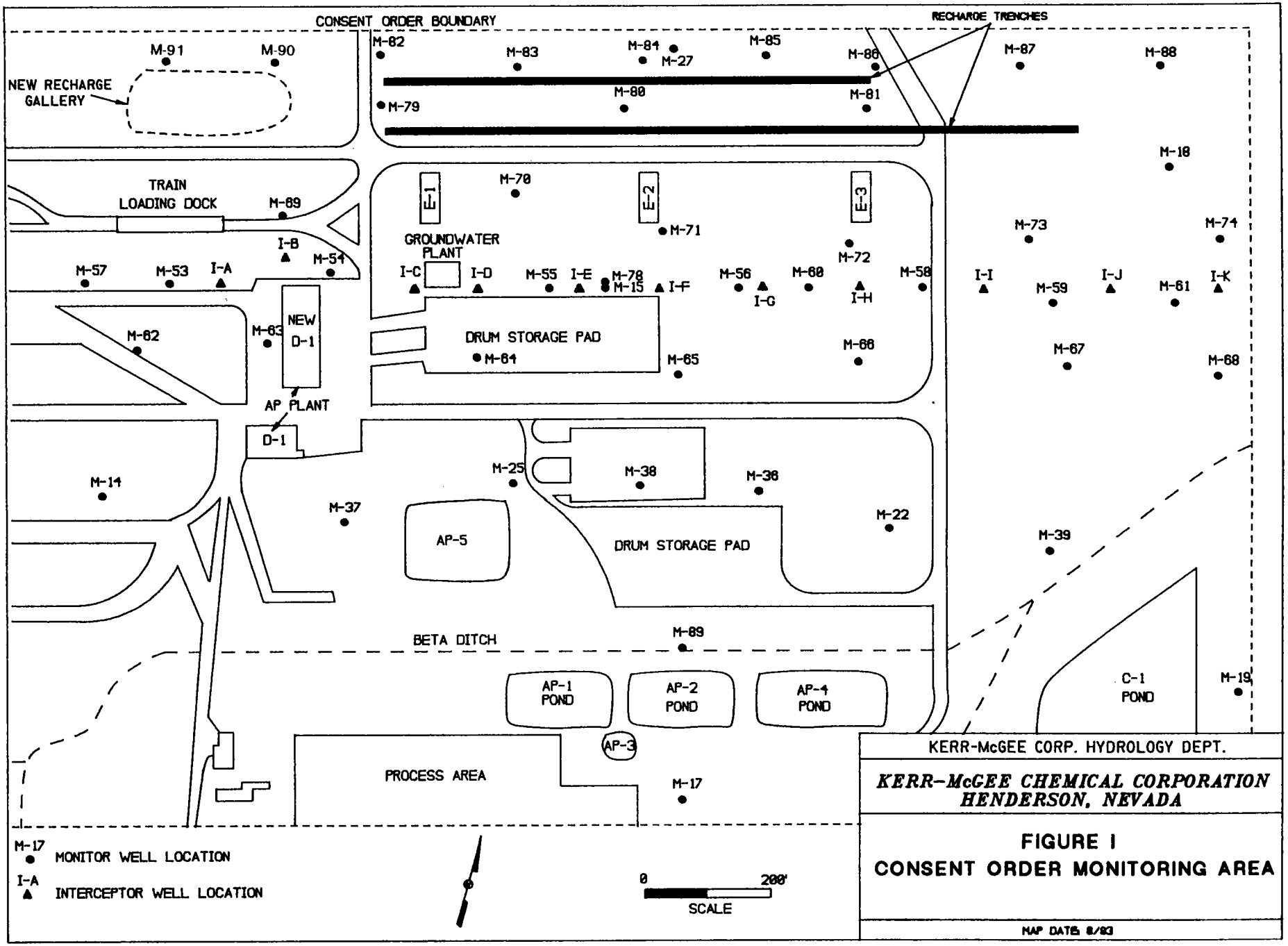

CONSENT ORDER BOUNDARY
RECHARGE TRENCHES
NEW RECHARGE GALLERY
M-91
M-90
M-82
M-83
M-84
M-27
M-85
M-86
M-87
M-88
M-79
M-80
M-81
M-18
TRAIN LOADING DOCK
M-89
E-1
M-70
E-2
E-3
M-71
M-72
M-73
M-74
GROUNDWATER PLANT
I-B
M-54
M-57
M-53
I-A
I-C
I-D
M-55
I-E
M-78
M-15
I-F
M-56
I-G
M-60
I-H
M-58
I-I
M-59
I-J
M-61
I-K
M-62
M-63
NEW D-1
DRUM STORAGE PAD
M-64
M-65
M-66
M-67
M-68
AP PLANT
D-1
M-14
M-25
M-38
M-36
M-37
AP-5
M-22
DRUM STORAGE PAD
M-39
BETA DITCH
M-89
AP-1 POND
AP-2 POND
AP-4 POND
C-1 POND
M-19
AP-3
PROCESS AREA
M-17
M-17 MONITOR WELL LOCATION
I-A INTERCEPTOR WELL LOCATION
0
200'
SCALE
KERR-McGEE CORP. HYDROLOGY DEPT.
KERR-McGEE CHEMICAL CORPORATION
HENDERSON, NEVADA
FIGURE 1
CONSENT ORDER MONITORING AREA
MAP DATE: 8/93

Figure B-1 (Appendix B) shows the potentiometric surface within the consent order monitoring area for the first quarter of 1993. Groundwater elevation data was recorded on March 3, 1993. Figure B-2 presents a cross-section of the groundwater interceptor line for the same date. Figures B-3 and B-4 present the same type map and cross-section for the second quarter of 1993, based on groundwater elevation data recorded on June 22, 1993. The static water level shown on the cross-sections represents the Consent Order reference groundwater elevation, established September 14, 1987, prior to startup of the interception system. Groundwater elevations continue to confirm that water levels in the Consent Order monitoring area have stabilized since the discharge of cooling water to the beta ditch was discontinued in November, 1987.

CONTINUOUS WATER LEVEL RECORDERS

Wells M-78 and M-80 (Figure 1) are equipped with continuous water level recorders. Appendix C contains copies of the recorder charts generated during the first half of 1993. The charts continue to show the water levels to be stabilized throughout both the interception and recharge areas.

INTERCEPTOR SYSTEM PERFORMANCE

Figures B-1 through B-4 (Appendix B) show the potentiometric surface configuration in the interceptor area during the first half of 1993. Cross-sections show that drawdown consistently exceeded the one foot below reference water level criterion across the entire interceptor well line.

Although the potentiometric surface maps (Figures B-1 and B-3) do not generally appear to show overlapping drawdown cones along the entire interceptor line, the cross-sections show that all interceptor wells are drawn down to the Muddy Creek Clay. Drawdowns to this degree indicate that the alluvial aquifer is locally being depleted of water and that interception of groundwater has been maximized with this recovery system.

Groundwater levels in the area of interception have been substantially reduced since the interception began in 1987. Current analytical data, however, indicate that some wells downgradient of interception are experiencing increasing levels of chromium. The altered pattern of groundwater flow through the area of interceptor wells and the well efficiency on individual wells are currently being evaluated consistent with the Consent Order Appendix E - Contingency Plan.

The gradual increase in chromium concentration in wells M-84 and M-86 is believed to be the result of some groundwater getting past the intercept system and not due to a failure in the treatment system. This interpretation is supported by the pattern seen in the analyses of upgradient monitor wells M-71, M-72, and M-73.

Chromium concentrations in the five Appendix J wells (see Figure 1) are displayed in Table 1. Figure D-1 in Appendix D presents this data graphically.

KMCC instituted a management program to assure maximization of groundwater removal at the individual well locations along the interceptor line by focusing on those wells showing the highest chromium concentrations. Figure D-2 portrays historical chromium concentration for each interceptor well. Discharge rates for each well are monitored closely and adjusted to provide maximum recovery of chromium based on the potentiometric surface configuration, chromium concentration, and well production capability. Table 2 lists the pumping rate of each interceptor well, as measured in December of each year.

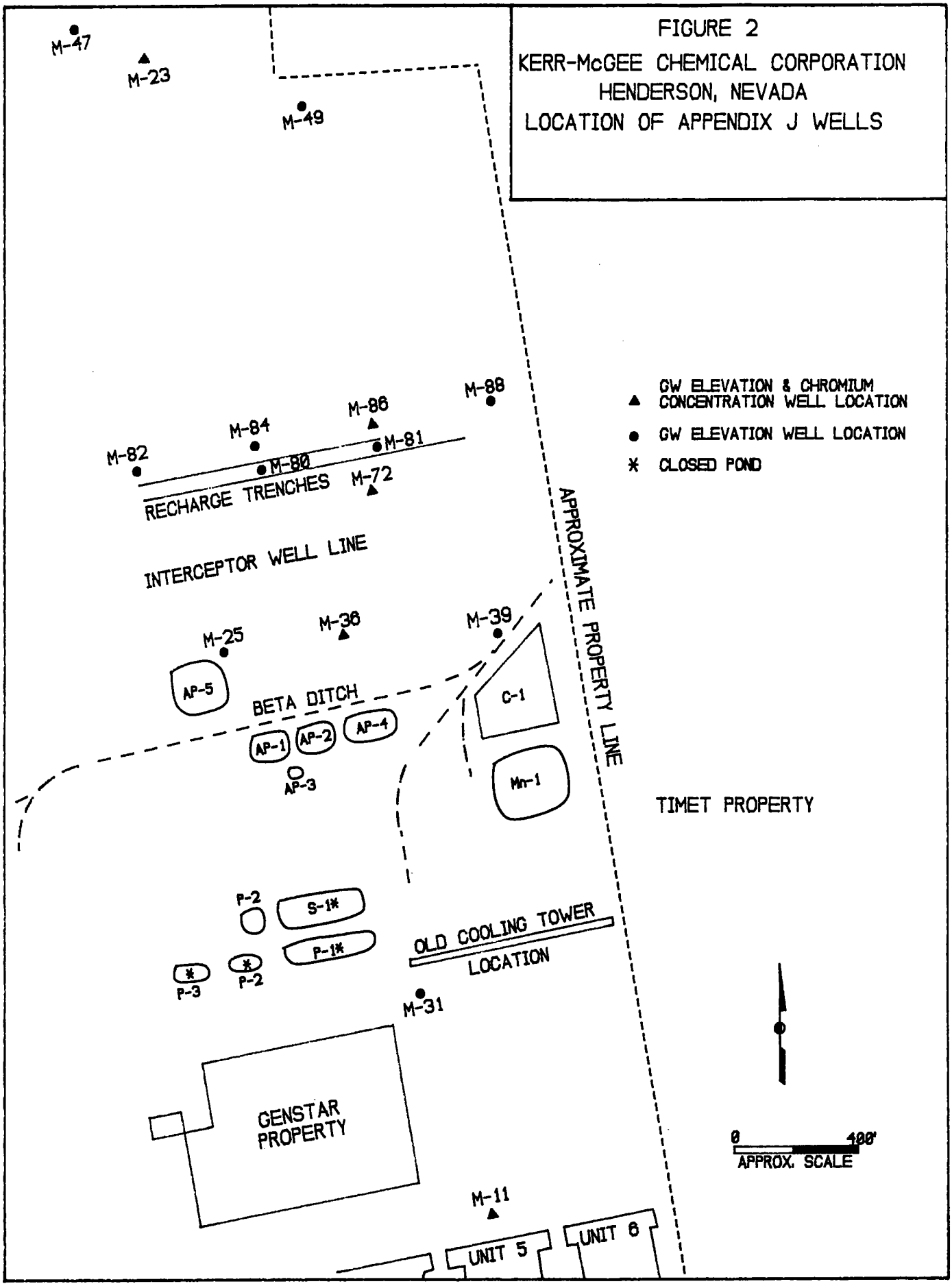


FIGURE 2
KERR-McGEE CHEMICAL CORPORATION
HENDERSON, NEVADA
LOCATION OF APPENDIX J WELLS
M-47
M-23
M-49
M-88
M-86
M-84
M-82
M-81
M-80
M-72
RECHARGE TRENCHES
INTERCEPTOR WELL LINE
APPROXIMATE PROPERTY LINE
GW ELEVATION & CHROMIUM CONCENTRATION WELL LOCATION
GW ELEVATION WELL LOCATION
CLOSED POND
M-25
M-36
M-39
AP-5
BETA DITCH
AP-1
AP-2
AP-4
AP-3
C-1
Mn-1
TIMET PROPERTY
P-2
S-1*
P-1*
P-3
P-2
OLD COOLING TOWER
LOCATION
M-31
GENSTAR
PROPERTY
M-11
UNIT 5
UNIT 6
0
400'
APPROX. SCALE

TABLE 1
TOTAL CHROMIUM CONCENTRATION (mg/l)
IN APPENDIX J WELLS

MONTH	WELL # M-11	M-36	M-72	M-86	M-23
DEC 1987	46.00	0.47	1.20	0.83	5.40
JAN 1988	20.00	0.65	1.20	0.40	5.50
FEB 1988	17.00	0.75	1.10	0.35	5.40
MAR 1988	55.00	1.00	1.10	0.17	5.10
APR 1988	55.00	1.80	1.00	0.29	5.00
MAY 1988	44.00	2.20	1.00	0.21	5.40
JUN 1988	44.00	2.50	1.00	0.21	5.40
JUL 1988	43.00	2.80	0.89	0.18	5.00
AUG 1988	39.00	2.80	0.91	0.21	5.10
SEP 1988	46.00	2.60	0.82	0.30	5.00
OCT 1988	46.00	8.80	1.00	0.31	4.60
NOV 1988	40.00	12.40	1.20	0.20	4.80
DEC 1988	54.00	2.90	1.40	0.12	4.90
JAN 1989	6.70	2.90	1.40	0.31	4.60
FEB 1989	40.00	3.10	1.20	0.06	4.10
MAR 1989	42.00	3.80	1.40	0.19	3.80
APR 1989	43.00	3.50	1.40	0.42	3.30
MAY 1989	44.00	3.60	1.40	0.27	3.20
JUN 1989	35.00	3.90	1.16	0.20	2.70
JUL 1989	34.00	4.00	1.28	0.13	2.70
AUG 1989	36.00	4.20	1.40	0.38	2.70
SEP 1989	35.00	3.80	1.30	0.17	2.30
OCT 1989	35.00	4.30	1.60	0.12	2.40
NOV 1989	33.00	4.00	1.80	0.13	2.30
DEC 1989	35.00	4.40	1.90	0.14	2.10
JAN 1990	34.00	4.50	2.60	0.14	2.00
FEB 1990	32.00	4.90	2.90	0.10	2.00
MAR 1990	31.00	5.00	3.00	0.25	1.80
APR 1990	30.00	5.10	3.20	0.12	1.70
MAY 1990	34.00	4.90	3.50	0.07	1.60
JUN 1990	33.00	5.10	3.50	0.06	1.50
JUL 1990	34.00	5.50	4.30	0.04	1.50
AUG 1990	37.00	5.20	4.60	0.19	1.40
SEP 1990	36.00	5.50	5.00	0.21	1.40
OCT 1990	36.00	5.40	5.30	0.12	1.30
NOV 1990	38.00	5.40	5.30	0.14	1.40
DEC 1990	37.00	5.50	5.30	0.13	1.30

TABLE 1 cont'd
TOTAL CHROMIUM CONCENTRATION (mg/l)
IN APPENDIX J WELLS

MONTH	WELL # M-11	M-36	M-72	M-86	M-23
JAN 1991	41.00	5.50	5.70	0.13	1.20
FEB 1991	42.00	11.60	6.20	0.20	1.10
MAR 1991	44.00	5.70	6.20	0.27	1.10
APR 1991	43.00	5.80	6.40	0.29	1.10
MAY 1991	36.00	5.40	6.40	0.32	1.00
JUN 1991	36.00	5.40	6.40	0.32	1.00
JUL 1991	42.00	5.60	5.50	0.46	0.94
AUG 1991	43.00	6.00	6.20	0.92	1.10
SEP 1991	41.00	6.20	6.60	1.80	1.30
OCT 1991	40.00	6.00	6.40	2.60	1.30
NOV 1991	40.00	6.20	6.60	3.40	1.30
DEC 1991	38.00	6.00	7.00	3.30	1.30
JAN 1992	38.00	6.8	7.0	3.3	1.4
FEB 1992	40.00	7.0	7.4	2.9	1.4
MAR 1992	48.00	11	13	1.4	1.3
APR 1992	40.00	8.6	8.5	1.2	1.5
MAY 1992	44.00	7.4	7.3	0.62	1.2
JUN 1992	42.00	6.4	5.7	1.1	1.2
JUL 1992	45.00	7.8	7.2	1.8	1.2
AUG 1992	44.00	8.2	7.2	2.7	1.2
SEP 1992	43.00	7.6	6.8	4.0	1.2
OCT 1992	41.00	8.0	6.8	4.1	1.2
NOV 1992	44.00	8.7	7.6	4.9	1.2
DEC 1992	44.00	9.2	7.4	5.3	1.1
JAN 1993	48.00	9.2	7.2	6.0	1.0
FEB 1993	53.00	10.0	7.6	5.8	0.99
MAR 1993	58.00	10.0	6.8	6.2	0.97
APR 1993	56.00	10.2	7.4	6.6	0.98
MAY 1993	59.00	9.2	6.4	5.4	0.82
JUN 1993	48.00	18.0	5.6	5.2	1.4

M-11 is 2500 ft. upgradient of the interceptor line.
M-36 is 550 ft. upgradient of the interceptor line.
M-72 is between the interceptor line and the recharge trenches.
M-86 is immediately downgradient of the recharge trenches.
M-23 is 1350 ft. downgradient of the recharge trenches.TABLE 1

TABLE 2
INTERCEPTOR WELL DISCHARGE RATES
DISCHARGE RATE (GPM)

WELL #	SEP. 1987	DEC. 1988	DEC. 1989	DEC. 1990	DEC. 1991	DEC. 1992
I-A	2.0	3.0	3.0	2.1	2.5	2.4
I-B	2.0	3.0	2.9	2.0	2.0	1.9
I-C	2.5	8.8	5.5	3.8	3.8	3.8
I-D	20.0	18.0	8.0	1.2	1.0	1.0
I-E	5.0	2.4	5.2	1.2	1.4	1.0
I-F	30.0	26.0	13.4	12.6	11.7	6.2
I-G	7.0	5.0	4.0	3.1	1.1	0.3
I-H*	8.0	3.0	7.8	2.0	1.4	1.2
I-I	15.0	15.0	16.0	9.5	7.1	6.7
I-J	10.0	8.0	8.0	5.8	4.6	4.5
I-K	10.0	8.2	7.5	4.9	4.3	3.9
TOTAL	111.5	100.4	81.3	48.2	40.9	32.9

In May, 1990, KMCC began monthly analysis for chromium in several other wells located both upgradient and downgradient from the recharge trench. The data is shown in Table 3, and is presented graphically as Figures D-3 and D-4. The M-70 series wells presented in Figure D-3 are located upgradient from the recharge trench. The M-80 series wells presented in Figure D-4 are located downgradient from the recharge trench.

TABLE 3
TOTAL CHROMIUM CONCENTRATION (mg/l)
IN SELECTED GROUNDWATER MONITOR WELLS

DATE	M-71	M-73	M-84	M-88
MAY 1990	0.22	0.65	0.78	0.28
JUL 1990	0.18	0.64	0.78	0.28
AUG 1990	0.18	0.64	0.31	0.30
SEP 1990	0.19	0.64	0.21	0.33
OCT 1990	0.24	0.68	0.07	0.34
NOV 1990	0.24	0.69	0.14	0.36
DEC 1990	0.27	0.74	0.12	0.38
JAN 1991	0.30	0.67	0.09	0.32
FEB 1991	0.39	0.71	0.22	0.45
MAR 1991	0.44	0.71	0.23	0.38
APR 1991	0.59	0.72	0.27	0.43
MAY 1991	5.50	0.73	0.34	0.43
JUN 1991	6.88	0.73	0.34	0.43
JUL 1991	7.0	0.83	0.14	0.43
AUG 1991	9.8	0.84	0.24	0.55
SEP 1991	10.0	0.94	0.24	0.40
OCT 1991	10.2	0.90	0.29	0.61
NOV 1991	10.2	0.94	0.44	0.56
DEC 1991	11.2	0.97	0.45	0.58
JAN 1992	12.0	1.0	0.27	0.72
FEB 1992	12.0	1.0	0.29	0.7
MAR 1992	16.0	1.1	0.3	0.8
APR 1992	10.6	0.84	0.21	0.8
MAY 1992	12.0	0.87	0.34	0.55
JUN 1992	11.0	0.89	0.43	0.39
JUL 1992	11.6	0.96	1.40	0.53
AUG 1992	12.0	1.00	0.87	0.56
SEP 1992	12.0	1.3	1.3	0.69
OCT 1992	11.6	1.3	1.2	0.76
NOV 1992	11.6	1.4	1.1	0.68
DEC 1992	10.8	1.3	1.1	0.75
JAN 1993	10.4	1.3	1.2	0.74
FEB 1993	10.0	1.2	1.2	0.69
MAR 1993	10.4	1.3	1.6	0.70
APR 1993	10.8	1.4	2.1	0.72
MAY 1993	9.9	1.4	2.3	0.59
JUN 1993	11.0	1.8	3.1	1.0

IMPACT OF DISPOSAL SYSTEM ON DOWNGRADIENT WATER LEVELS

The Disposal Contingency Plan (Appendix J) of the Consent Order identifies specific monitor wells that are to be utilized to evaluate any water level impact from recharge of treated water into the alluvium. Fifteen wells are monitored monthly for groundwater levels. Figure 2 shows the location of these wells.

Appendix A of this report shows that groundwater elevations have stabilized in that portion of the facility downgradient from the recharge system (evidenced by wells M-47, M-23, and M- 49), and are lower than in January, 1988.

CHROMIUM TREATMENT SYSTEM EFFECTIVENESS

The Consent Order specifies the following effluent concentration limits for the treatment plant discharge water:

Monthly average

Total Chromium	1.7 mg/l
Hexavalent Chromium	0.05 mg/l

Maximum single value on a composite sample

Total Chromium	3.4 mg/l
Hexavalent Chromium	0.1 mg/l

Table 4 updates the treatment plant feed and discharge chromium concentration data with data for the first half of 1993. Total Chromium and Hexavalent Chromium values for the first half of 1993 did not exceed either the monthly permissible average or the maximum composite sample value.

TABLE 4
GROUNDWATER TREATMENT ANALYSIS

WEEK OF	VOLUME TREATED (M gal.)	FEED CHROMIUM (mg/l)	TREATED TOTAL (mg/l)	EFFLUENT HEXAVALENT (mg/l)
Jul. 1 - Jul. 7	392	no sample	1.26	0.027
Jul. 8 - Jul. 14	346	4.21	0.192	0.0018
Jul. 15 - Jul. 21	345	4.45	0.042	0.0072
Jul. 22 - Jul. 28	340	4.25	0.026	0.0022
July, 1991 Average	356	4.30	0.380	0.0096
Jul. 29 - Aug. 4	314	4.70	0.035	0.0015
Aug. 5 - Aug. 11	332	4.60	0.272	0.0126
Aug. 12 - Aug. 18	348	3.70	0.056	0.0038
Aug. 19 - Aug. 25	335	3.30	0.023	0.0023
Aug. 26 - Sep. 1	372	4.00	0.030	0.0023
August, 1991 Average	344	4.06	0.083	0.0045
Sept. 2 - Sept. 8	362	4.50	0.360	0.388
Sept. 9 - Sept. 15	352	4.10	0.084	0.0084
Sept. 16 - Sept. 22	338	3.90	0.044	0.0156
Sept. 23 - Sept. 29	333	3.75	0.024	0.0022
Sept., 1991 Average	346	4.06	0.128	0.1036
Sept. 29 - Oct. 6	348	4.35	0.028	0.0042
Oct. 7 - Oct. 13	357	4.10	0.030	0.0030
Oct. 14 - Oct. 20	349	4.00	0.023	0.0017
Oct. 21 - Oct. 27	302	4.00	0.045	0.011
Oct. 28 - Nov. 3	336	3.65	0.120	0.224
October, 1991 Average	339	4.12	0.049	0.0484
Nov. 4 - Nov. 10	317	4.60	0.037	0.010
Nov. 11 - Nov. 17	336	4.70	0.368	0.363
Nov. 18 - Nov. 24	353	4.35	0.030	0.002
Nov. 25 - Dec. 1	344	4.00	0.050	0.003
Nov., 1991 Average	338	4.41	0.121	0.0945
Dec. 2 - Dec. 8.	303	4.50	0.063	0.017
Dec. 9 - Dec. 15	305	5.15	0.484	0.481
Dec. 16 - Dec. 22	336	4.10	00.065	0.0475
Dec. 23 - Dec. 31	329	4.70	0.153	0.0517
Dec., 1991 Average	318	4.61	0.191	0.1493

TABLE 4 cont'd
GROUNDWATER TREATMENT ANALYSIS

WEEK OF	VOLUME TREATED (M gal.)	FEED CHROMIUM (mg/l)	TREATED TOTAL (mg/l)	EFFLUENT HEXAVALENT (mg/l)
Jan. 1 - Jan. 5	195	4.3	0.033	0.0040
Jan. 6 - Jan. 12	331	4.6	0.134	0.0148
Jan. 13 - Jan. 19	332	4.4	0.232	0.0070
Jan. 20 - Jan.26	323	3.90	0.028	0.0034
Jan. 27 - Feb. 2	238	4.2	0.0044	0.0038
Jan., 1992 Average	283	4.28	0.0942	0.0066
Feb. 3 - Feb. 9	343	6.1	0.040	0.0023
Feb. 10 - Feb. 16	336	3.35	0.030	0.0016
Feb. 17 - Feb 23	338	4.35	0.117	0.182
Feb. 24 - Mar. 1	344	4.05	0.026	0.0010
Feb., 1992 Average	340	4.46	0.053	0.0467
Mar. 2 - Mar. 8	340	4.25	0.036	0.0050
Mar. 9 - Mar. 15	352	4.75	0.026	0.0010
Mar. 16 - Mar. 22	369	4.90	0.020	0.0043
Mar. 23 - Mar. 29	366	4.50	0.036	0.0118
Mar., 1992 Average	356	4.6	0.0295	0.0221
Mar. 30 - Apr. 5	360	4.10	0.024	0.0026
Apr. 6 - Apr. 12	378	3.90	0.022	0.010
Apr. 13 - Apr. 19	409	4.45	0.015	0.0055
Apr. 20 - Apr. 26	399	4.55	0.018	0.0028
Apr. 27 - May 3	347	5.5	0.016	0.0052
Apr., 1992 Average	378	4.5	0.019	0.0034
May 4 - May 10	341	5.55	0.014	0.0116
May 11 - May 17	354	4.65	0.063	0.112
May 18 - May 24	338	5.35	0.228	0.103
May 25 - May 31	323	5.25	0.151	0.002
May, 1992 Average	339	5.2	0.114	0.0572
Jun. 1 - Jun. 7	314	4.7	0.010	0.0020
Jun. 8 - Jun 14	429	4.35	0.0636	0.0035
Jun. 15 - Jun. 21	456	4.15	0.0638	0.1085
Jun. 22 - Jun. 28	447	4.5	0.0436	0.0734
June, 1992 Average	412	4.425	0.0453	0.0224

TABLE 4 cont'd
GROUNDWATER TREATMENT ANALYSES

WEEK OF	VOLUME TREATED (M gal.)	FEED CHROMIUM (mg/l)	TREATED TOTAL (mg/l)	EFFLUENT HEXAVALENT (mg/l)
Jun. 29 - Jul.5	401	5.70	0.615	0.1600
Jul. 6 - Jul 12	453	5.20	0.191	0.0050
Jul. 13 - Jul. 19	443	5.15	0.051	0.0160
Jul. 20 - Jul.26	382	4.40	0.020	0.0034
Jul. 27 - Aug.2	421	2.10	0.078	0.0178
July 1992 Average	340	4.50	0.191	0.0786
Aug. 3 - Aug.9	333	5.40	0.045	0.025
Aug. 10 - Aug.16	425	4.90	0.050	0.0084
Aug. 17 - Aug.23	313	7.20	0.055	0.0240
Aug. 24 - Aug. 30	409	5.50	0.042	0.0052
August 1992 Average	370	5.75	0.048	0.0157
Aug. 31 - Sept. 6	388	5.70	0.298	0.2842
Sept. 7 - Sept 13	253	7.10	0.028	0.0013
Sept. 14 - Sept 20	409	4.50	0.026	0.0080
Sept. 21 - Sept 27	425	4.40	0.063	0.0022
Sept. 28 - Oct. 4	362	4.60	0.187	0.0093
Sept. 1992 Average	367	4.86	0.120	0.0610
Oct. 5 - Oct. 11	345	3.09	2.005	1.1840
Oct. 12 - Oct. 18	333	4.70	0.030	0.0045
Oct. 19 - Oct. 25	357	4.65	0.022	0.0012
Oct. 26 - Nov. 1	360	4.95	0.045	0.0030
October 1992 Average	349	4.55	0.526	0.2993
Nov. 2 - Nov. 8	353	4.95	0.114	0.0058
Nov. 9 - Nov. 15	339	5.10	0.030	0.0118
Nov. 16 - Nov. 22	344	5.00	0.126	0.0332
Nov. 23 - Nov. 29	331	4.60	0.253	0.1473
November 1992 Average	341	4.91	0.131	0.0495
Nov. 30 - Dec. 6	328	4.80	0.909	0.0014
Dec. 7 - Dec. 13	317	4.40	0.206	0.0500
Dec. 14 - Dec. 20	317	4.60	0.018	0.0030
Dec. 21 - Dec. 27	318	3.90	0.059	0.0330
Dec. 1992 Average	320	4.43	0.093	0.0219

TABLE 4 cont'd
GROUNDWATER TREATMENT ANALYSES

WEEK OF	VOLUME TREATED (M gal.)	FEED CHROMIUM (mg/l)	TREATED TOTAL (mg/l)	EFFLUENT HEXAVALENT (mg/l)
Dec. 28 - Jan. 3	274	4.4	0.09	0.008
Jan. 4 - Jan. 10	309	4.6	0.05	0.002
Jan. 11 - Jan. 17	314	4.9	0.003	0.002
Jan. 18 - Jan. 24	242	4.8	0.19	0.003
Jan. 25 - Jan. 31	293	5.0	0.44	0.014
Jan. 1993 Average	286	4.7	0.16	0.006
Feb. 1 - Feb. 7	320	4.8	0.04	0.002
Feb. 8 - Feb. 14	333	5.9	0.51	0.046
Feb. 15 - Feb. 21	352	4.5	0.024	0.004
Feb. 22 - Feb. 28	304	4.3	0.025	0.002
Feb. 1993 Average	327	4.9	0.15	0.014
Mar. 1 - Mar. 7	368	4.4	0.68	0.05
Mar. 8 - Mar. 14	365	5.3	0.10	0.003
Mar. 15 - Mar 21	374	4.9	0.22	0.014
Mar. 22 - Mar. 28	386	5.5	0.17	0.03
Mar. 1993 Average	373	5.0	0.29	0.02
Mar. 29 - Apr. 4	368	5.7	0.058	0.004
Apr. 5 - Apr. 11	329	5.3	0.020	0.001
Apr. 12 - Apr 18	374	5.3	0.020	0.001
Apr. 19 - Apr. 25	388	5.9	0.038	0.003
Apr. 26 - May 2	369	5.0	0.03	0.003
Apr. 1993 Average	366	5.4	0.03	0.002
May 3 - May 9	387	5.2	0.18	0.005
May 10 - May 16	377	5.3	0.03	0.005
May 17 - May 23	364	5.9	0.07	0.008
May 24 - May 30	362	6.5	0.22	0.04
May 1993 Average	373	5.7	0.13	0.015
May 31 - Jun. 6	337	6.0	0.06	0.04
Jun. 7 - Jun. 13	288	5.9	0.17	0.002
Jun. 14 - Jun. 20	294	7.6	0.04	0.026
Jun. 21 - Jun. 27	322	5.7	0.03	0.004
Jun. 1993 Average	310	6.3	0.075	0.018

ADDITIONAL WORK PERFORMED

Approximately every twenty days, the electrodes in the treatment plant's electrolytic cells deteriorate to the point they require replacement. During the first half of 1993, electrodes were replaced January 18, February 5, March 5 and 26, April 26, May 19, and June 4 and 28, 1993. During cell replacement, a backup cell is placed in active service in the treatment circuit to maintain groundwater treatment.

In November, 1992, KMCC began construction of a new recharge gallery to the west of the original system. The new gallery became operational in February 1993. Monitor wells M-90 and M-91 were installed in May, 1993 to evaluate the performance of the new recharge gallery (Figure 1). These wells will be monitored monthly for groundwater levels and will be added to the Appendix J well list for quarterly chromium analysis.

Several interceptor well pumps were repaired during the first half of 1993. Pumps in wells I-D and I-J were repaired in January. The pump in well I-H was repaired in February and March. The pumps in wells I-G, I-J, and I-K were repaired in June.

Engine hour meters are being used to determine the average number of hours per day individual pumps are running. Six of the interceptor wells utilize a time-marking device that shuts the pump

off for a pre-determined amount of time if the well runs dry. If a pump spends a significant amount of time shut down, overall recovery can be increased by decreasing the pump rate, allowing a smaller discharge to occur a greater percentage of the time. Well discharge rates are adjusted periodically, as engine hour meters show either continuous pumping or a low percentage of pumping time.

All interceptor wells are checked for operation each day; flow rates are recorded for each well twice weekly. Flowmeter readings (total volume) are recorded for each time-marking well twice weekly. These records indicate when a pump needs to be replaced or a flow rate adjusted. In addition, other maintenance associated with maintaining treatment plant operations were performed.

CONCLUSIONS

Discharge chromium concentrations for the treatment facility are below established requirements. No adverse impacts to downgradient groundwater levels have been observed as a result of returning treated groundwater to the near-surface aquifer via the recharge galleries. Chromium concentrations in monitor wells immediately downgradient from the old recharge gallery show that some groundwater is not being captured by the interception system even though maximum drawdown are being attained in the interception wells.

PROPOSED FUTURE ACTIVITIES

KMCC will continue to record all water levels in the consent order area on a quarterly basis. Quarterly potentiometric surface maps and cross-sections will be developed. One of the water level recorders on monitor wells M-78 and M-80 will be moved to well M-91 to continuously gauge water levels downgradient from the new recharge gallery.

The effect of changing the pumping rates of the interceptor wells will continue to be monitored, and appropriate responses (i.e.- future pump rate adjustments) will be taken to assure optimal drawdown and plume interception.

KMCC is undertaking a comprehensive evaluation of the entire mitigation program. The four components of the program - interception, treatment, recharge, and monitoring - will be addressed separately. KMCC will submit to NDEP by September 15, 1993, an evaluation of the interception system which will include an updated map of the top of the Muddy Creek, efficiency tests on the interception wells and position of replacement and fill-in wells to restore the effectiveness of the interception system. By the end of 1993, KMCC will complete the evaluation of the other three components and report the findings and actions taken in the next semi-annual report.

APPENDIX A

GROUNDWATER ELEVATIONS

KERR-McGEE CHEMICAL CORPORATION
HENDERSON, NEVADA FACILITY
GROUNDWATER ELEVATIONS

TOC--->	M-11 1813.46		M-14 1758.83		M-15 1749.69		M-17 1769.54		M-18 1738.28		M-19 1766.55		M-22R 1758.68		M-23 1712.78		M-25 1758.15		M-27 1740.47	
	DTW	ELEV.	DTW	ELEV.	DTW	ELEV.	DTW	ELEV.	DTW	ELEV.	DTW	ELEV.	DTW	ELEV.	DTW	ELEV.	DTW	ELEV.	DTW	ELEV.
16-Sep-92	44.25	1769.21	32.95	1725.88	31.60	1718.09	36.00	1733.54	21.00	1717.28	34.50	1732.04	29.70	1728.85	19.7	1693.08	33.10	1725.05	25.60	1714.87
01-Dec-92	44.15	1769.31	33.30	1725.53	32.25	1717.44	36.15	1733.39	21.10	1717.18	34.00	1732.54	29.90	1728.45	20.15	1692.63	33.40	1724.75	26.00	1714.47
28-Jan-93	43.60	1769.86					36.00	1733.54			34.50	1732.04	29.95	1728.40	20.20	1692.58	33.35	1724.80		
19-Feb-93	47.30	1766.16					35.80	1733.74			33.20	1733.34	29.60	1728.75	19.10	1693.68	33.15	1725.00		
03-Mar-93	43.75	1769.71	32.90	1725.93			35.60	1733.94	20.40	1717.88	34.00	1732.54	29.50	1728.85	20.65	1692.13	33.00	1725.15	26.10	1714.37
29-Apr-93	44.00	1769.46					35.70	1733.84			34.50	1732.04	29.55	1728.80	19.50	1693.28	32.90	1725.25		
28-May-93	44.05	1769.41					35.75	1733.79			35.00	1731.54	29.65	1728.70	19.70	1693.08	33.00	1725.15		
22-Jun-93	44.45	1769.01	31.77	1727.06	31.27	1718.42	34.79	1734.75	21.10	1717.18	33.20	1733.34	22.70	1735.65	19.94	1692.84	33.26	1724.89	25.57	1714.90

TOC-->	M-31 1788.39		M-36 1757.94		M-37 1759.26		M-38 1757.88		M-39 1759.31		M-47 1716.51		M-49 1718.78		M-53 1751.56		M-54 1748.93		M-55 1749.35	
	DTW	ELEV.	DTW	ELEV.	DTW	ELEV.	DTW	ELEV.	DTW	ELEV.	DTW		DTW	ELEV.	DTW	ELEV.	DTW	ELEV.	DTW	ELEV.
16-Sep-92	41.15	1747.24	32.50	1725.44	21.55	1737.73	31.35	1726.53	30.80	1728.51	18.30	1698.21	18.70	1700.08	30.60	1720.96	27.70	1721.23	29.80	1719.55
01-Dec-92	41.10	1747.29	32.30	1725.64	31.80	1727.48	31.35	1726.53	30.95	1728.36	18.60	1697.91	19.00	1699.78	31.00	1720.56	28.25	1720.68	30.55	1718.80
28-Jan-93	40.10	1748.29	33.00	1724.94					30.95	1728.36	18.75	1697.76								
19-Feb-93	39.90	1748.49	32.00	1725.94					30.40	1728.91	18.10	1698.41								
03-Mar-93	40.35	1748.04	32.00	1725.94	31.30	1727.98	31.20	1726.68	30.35	1728.96	18.10	1698.41	18.40	1700.38	30.35	1721.21	27.80	1721.13	30.50	1718.85
29-Apr-93	40.90	1747.49	32.00	1725.94					30.65	1728.66	17.95	1698.56								
28-May-93	41.00	1747.39	32.00	1725.94					30.70	1728.61	18.20	1698.31								
01-Jun-93	41.10	1747.29	32.20	1725.74	31.09	1728.19	30.88	1727.00	30.45	1728.86	18.33	1698.18	18.43	1700.35	29.56	1722.00	28.69	1722.24	29.30	1720.05

KERR-McGEE CHEMICAL CORPORATION

HENDERSON, NEVADA FACILITY

GROUNDWATER ELEVATIONS

	M-56		M-57		M-58		M-59		M-60		M-61		M-62		M-63		M-64		M-65	
TOC--->	1749.60		1752.29		1749.25		1743.01		1750.13		1745.55		1752.92		1750.59		1749.76		1752.88	
	DTW	ELEV.	DTW	ELEV.	DTW	ELEV.	DTW	ELEV.	DTW	ELEV.	DTW		DTW	ELEV.	DTW	ELEV.	DTW	ELEV.	DTW	ELEV.
16-Sep-92	30.90	1718.70	30.45	1721.84	28.90	1720.35	22.45	1720.56	30.00	1720.13	24.30	1721.25	30.00	1722.92	27.60	1722.99	28.85	1720.91	33.25	1719.63
01-Dec-92	31.30	1718.30	30.80	1721.49	29.15	1720.10	22.60	1720.41	30.30	1719.83	24.40	1721.15	30.35	1722.57	28.00	1722.59	29.35	1720.41	33.50	1719.38
03-Mar-93	31.05	1718.55	30.40	1721.89	28.85	1720.60	22.10	1720.91	29.85	1720.28	23.70	1721.85	29.90	1723.02	27.50	1723.09	29.15	1720.61	33.25	1719.63
01-Jun-93	29.91	1719.69	29.52	1722.77	28.81	1720.44	21.96	1721.05	28.67	1721.46	23.39	1722.16	28.34	1724.58	27.51	1723.08	28.71	1721.05	32.00	1720.88

	M-66	M-66	M-67		M-68		M-69		M-70		M-71		M-72		M-73		M-74		M-75	
TOC--->	1752.33		1744.98		1747.44		1748.77		1746.96		1745.88		1745.49		1740.05		1743.42		1751.01	
	DTW	ELEV.	DTW	ELEV.	DTW	ELEV.	DTW	ELEV.	DTW	ELEV.	DTW	ELEV.	DTW	ELEV.	DTW	ELEV.	DTW	ELEV.	DTW	ELEV.
16-Sep-92	30.00	1722.33	22.00	1722.98	23.70	1723.74	29.60	1719.17	27.55	1719.41	30.00	1715.88	26.70	1718.59	21.00	1719.05	23.70	1719.72	33.15	1717.86
01-Dec-92	30.10	1722.23	22.15	1722.83	23.70	1723.74	30.20	1718.57	28.40	1718.56	30.60	1715.28	27.00	1718.29	21.20	1718.85	23.70	1719.72	33.85	1717.16
28-Jan-93			22.10	1722.88	23.65	1723.79							27.35	1717.94						
19-Feb-93			21.50	1723.48	22.60	1724.84							26.55	1718.74						
03-Mar-93	29.80	1722.53	21.60	1723.38	22.90	1724.54	28.80	1719.97	28.65	1718.31	30.35	1715.53	26.50	1718.79	21.00	1719.05	22.95	1720.47	33.45	1717.56
29-Apr-93			22.00	1722.98	23.55	1723.89							26.90	1718.39						
28-May-93			22.00	1722.98	23.75	1723.69							26.70	1718.59						
01-Jun-93	30.12	1722.21	20.70	1724.28	23.58	1723.86	274.90	1473.87	26.34	1720.62	29.20	1716.68	25.72	1719.57	20.07	1719.98	22.52	1720.90	30.33	1720.68

KERR-McGEE CHEMICAL CORPORATION
HENDERSON, NEVADA FACILITY
GROUNDWATER ELEVATIONS

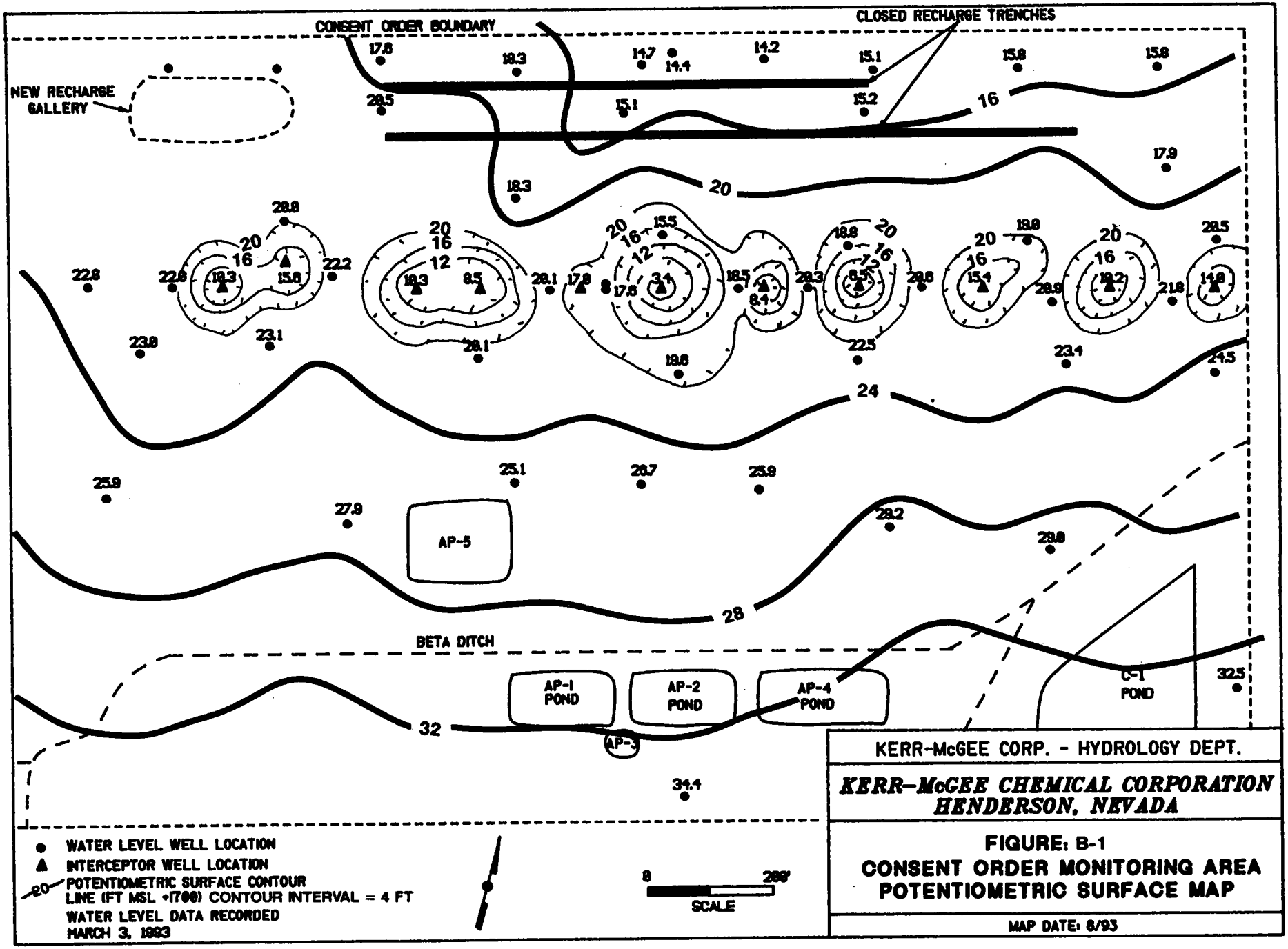
TOC--->	M-79 1742.93		M-80 1745.73		M-81 1743.73		M-82 1739.38		M-83 1740.83		M-84 1739.63		M-85 1741.19		M-86 1742.73		M-87 1742.27		M-88 1737.99	
	DTW	ELEV.	DTW	ELEV.	DTW	ELEV.	DTW	ELEV.	DTW	ELEV.	DTW		DTW	ELEV.	DTW	ELEV.	DTW	ELEV.	DTW	ELEV.
16-Sep-92	24.45	1718.48	29.50	1716.23	28.00	1715.73	21.90	1717.48	22.90	1717.93	25.00	1714.63	26.70	1714.49	27.75	1714.98	26.70	1715.57	22.65	1715.34
01-Dec-92	24.10	1718.83	29.90	1715.83	28.45	1715.28	21.60	1717.78	23.90	1716.93	24.85	1714.78	27.20	1713.99	28.00	1714.73	27.00	1715.27	22.85	1715.14
28-Jan-93															28.60	1714.13				
19-Feb-93															27.50	1715.23				
03-Mar-93	22.45	1720.48	30.65	1715.08	28.50	1715.23	21.80	1717.58	22.55	1718.28	24.90	1714.73	27.00	1714.19	27.60	1715.13	26.50	1715.77	22.20	1715.79
29-Apr-93															28.10	1714.63				
28-May-93															26.95	1715.78				
01-Jun-93	24.27	1718.66	30.55	1715.18	27.60	1716.13	21.59	1717.79	23.36	1717.47	24.61	1715.02	26.07	1715.12	27.10	1715.63	26.67	1715.60	22.12	1715.87

TOC--->	I-A 1751.06		I-B 1750.69		I-C 1750.44		I-D 1750.54		I-E 1750.22		I-F 1747.58		I-G 1750.42		I-H 1751.07		I-I 1743.36		I-J 1747.95		I-K 1743.97	
	DTW	ELEV.	DTW	ELEV.	DTW	ELEV.	DTW	ELEV.	DTW	ELEV.	DTW		DTW	ELEV.	DTW	ELEV.	DTW	ELEV.	DTW	ELEV.	DTW	ELEV.
16-Sep-92	41.00	1710.06	33.10	1717.59	32.85	1717.59	44.00	1706.54	38.00	1712.22	40.00	1707.58	41.00	1709.42	44.40	1706.67	28.00	1715.36	40.00	1707.95	34.00	1709.97
01-Dec-92	41.00	1710.06	36.80	1713.89	37.20	1713.24	44.10	1706.44	43.80	1706.42	44.70	1702.88	38.80	1711.62	44.50	1706.57	39.70	1703.66	38.90	1709.05	36.00	1707.97
28-Jan-93	42.00	1709.06	44.10	1706.59	43.20	1707.24	32.00	1718.54	40.00	1710.22	45.10	1702.48	42.00	1708.42	44.55	1706.52	38.80	1704.56	42.00	1705.95	38.00	1705.97
19-Feb-93	41.00	1710.06	37.80	1712.89	43.90	1706.54	44.00	1706.54	44.00	1706.22	45.00	1702.58	41.00	1709.42	32.90	1718.17	40.10	1703.26	38.90	1709.05	33.95	1710.02
03-Mar-93	40.80	1710.26	35.10	1715.59	40.10	1710.34	42.00	1708.54	33.20	1717.02	44.20	1703.38	42.00	1708.42	44.60	1706.47	28.00	1715.36	37.75	1710.20	30.00	1713.97
29-Apr-93	35.50	1715.56	32.80	1717.89	39.80	1710.64	36.00	1714.54	32.40	1717.82	45.00	1702.58	40.00	1710.42	42.00	1709.07	41.70	1701.66	40.40	1707.55	37.30	1706.67
28-May-93	38.00	1713.06	33.00	1717.69	33.80	1716.64	38.00	1712.54	32.00	1718.22	44.40	1703.18	30.80	1719.62	36.90	1714.17	41.00	1702.36	42.10	1705.85	36.60	1707.37
22-Jun-93	36.11	1714.95	33.62	1717.07	30.35	1720.09	44.10	1706.44	32.80	1717.42	44.72	1702.86	40.10	1710.32	35.25	1715.82	32.78	1710.58	33.60	1714.35	34.20	1709.77

APPENDIX B

POTENTIOMETRIC SURFACE MAPS

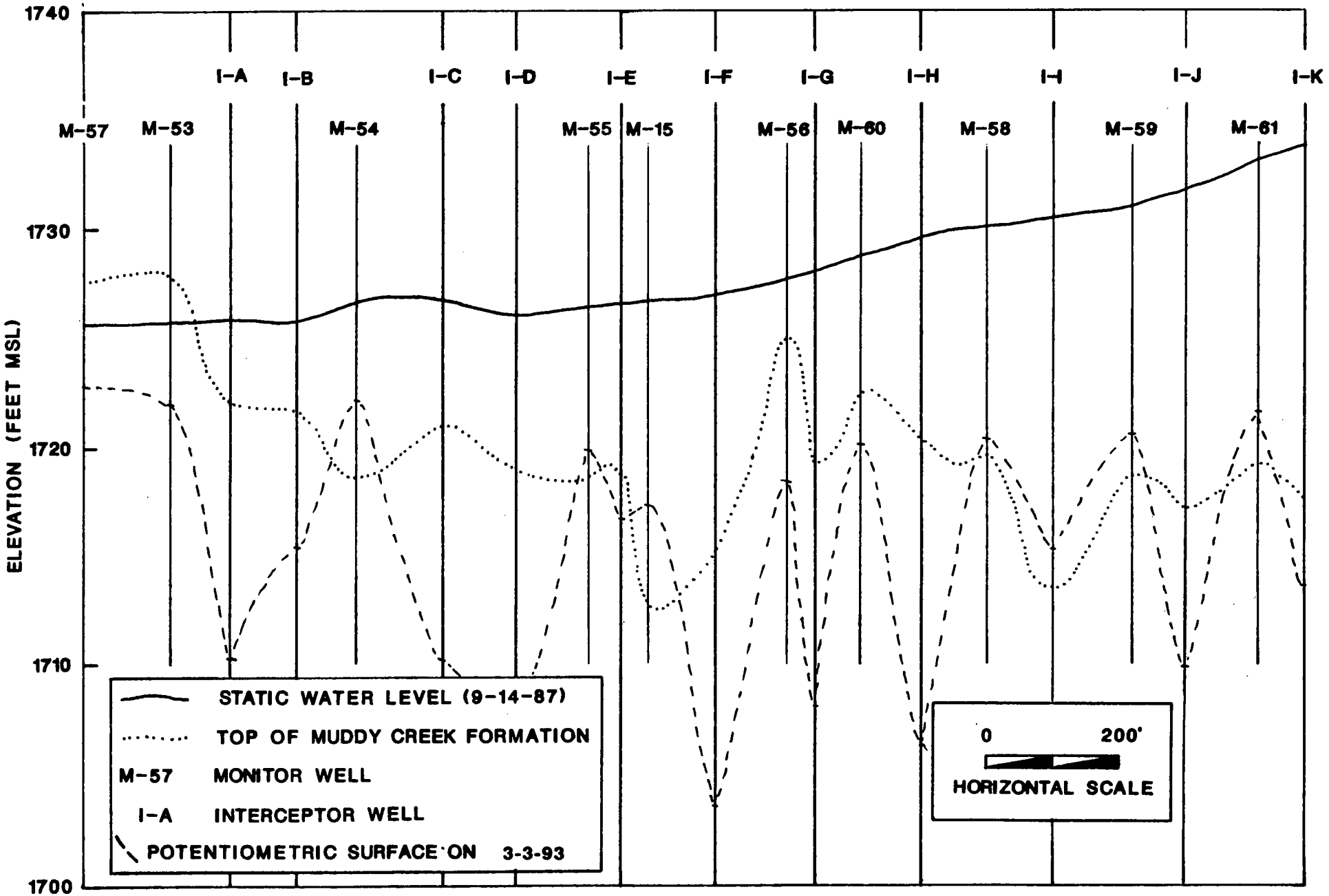
INTERCEPTOR AREA CROSS-SECTIONS

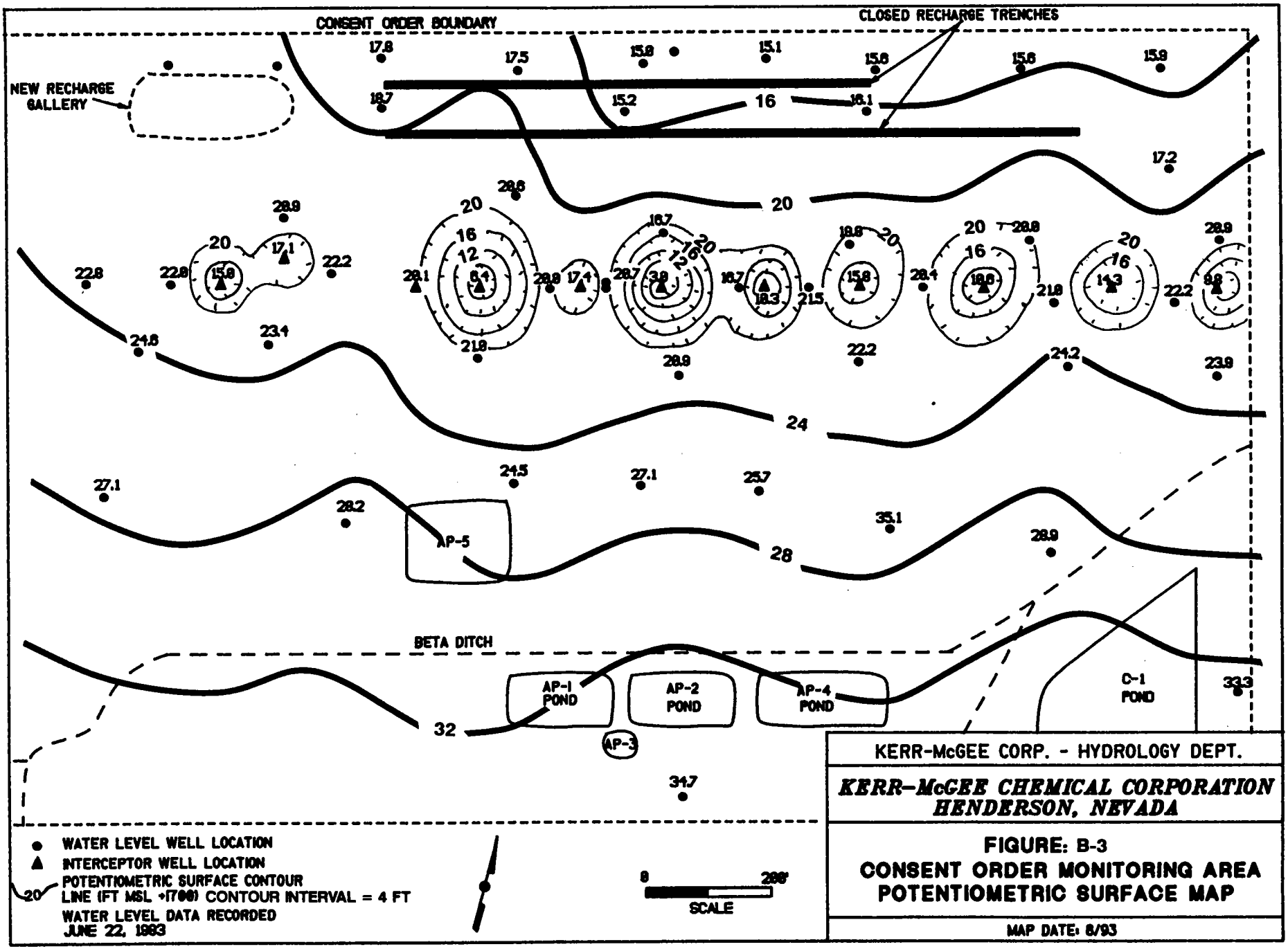

CONSENT ORDER BOUNDARY
CLOSED RECHARGE TRENCHES
NEW RECHARGE GALLERY
AP-5
AP-1 POND
AP-2 POND
AP-3
AP-4 POND
C-1 POND
BETA DITCH
WATER LEVEL WELL LOCATION
INTERCEPTOR WELL LOCATION
POTENTIOMETRIC SURFACE CONTOUR LINE (FT MSL +(700)) CONTOUR INTERVAL = 4 FT
WATER LEVEL DATA RECORDED MARCH 3, 1993
0
200'
SCALE
KERR-McGEE CORP. - HYDROLOGY DEPT.
KERR-McGEE CHEMICAL CORPORATION
HENDERSON, NEVADA
FIGURE: B-1
CONSENT ORDER MONITORING AREA
POTENTIOMETRIC SURFACE MAP
MAP DATE: 6/93

KERR-McGEE CHEMICAL CORPORATION - HENDERSON, NEVADA

GROUNDWATER INTERCEPTOR LINE CROSS-SECTION

FIGURE B-2

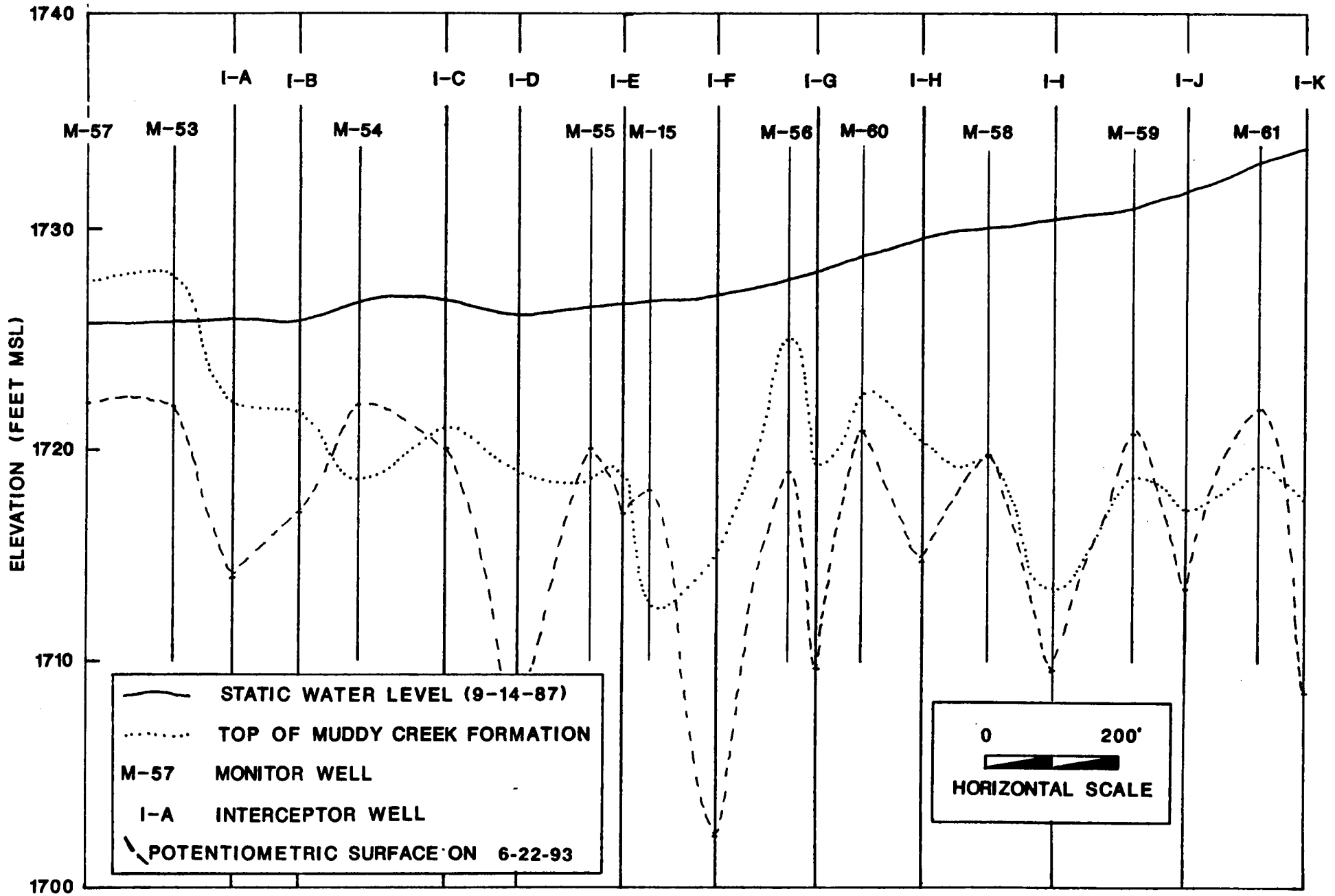



CONSENT ORDER BOUNDARY
CLOSED RECHARGE TRENCHES
NEW RECHARGE GALLERY
AP-5
BETA DITCH
AP-1 POND
AP-2 POND
AP-3
AP-4 POND
C-1 POND
WATER LEVEL WELL LOCATION
INTERCEPTOR WELL LOCATION
POTENTIOMETRIC SURFACE CONTOUR
LINE (FT MSL +1700) CONTOUR INTERVAL = 4 FT
WATER LEVEL DATA RECORDED
JUNE 22, 1993
0
200'
SCALE
KERR-McGEE CORP. - HYDROLOGY DEPT.
KERR-McGEE CHEMICAL CORPORATION
HENDERSON, NEVADA
FIGURE: B-3
CONSENT ORDER MONITORING AREA
POTENTIOMETRIC SURFACE MAP
MAP DATE: 8/93

KERR-McGEE CHEMICAL CORPORATION - HENDERSON, NEVADA

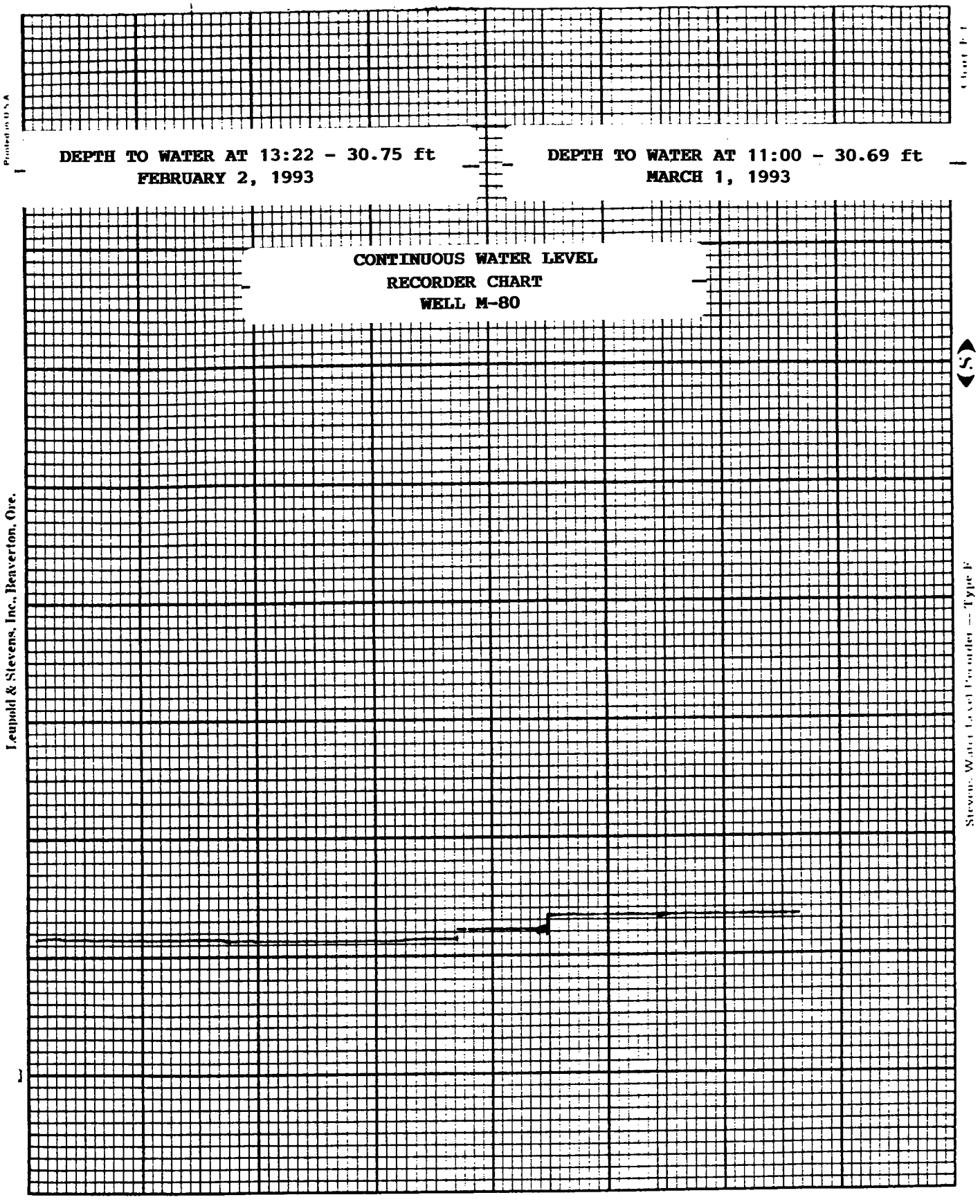
GROUNDWATER INTERCEPTOR LINE CROSS-SECTION

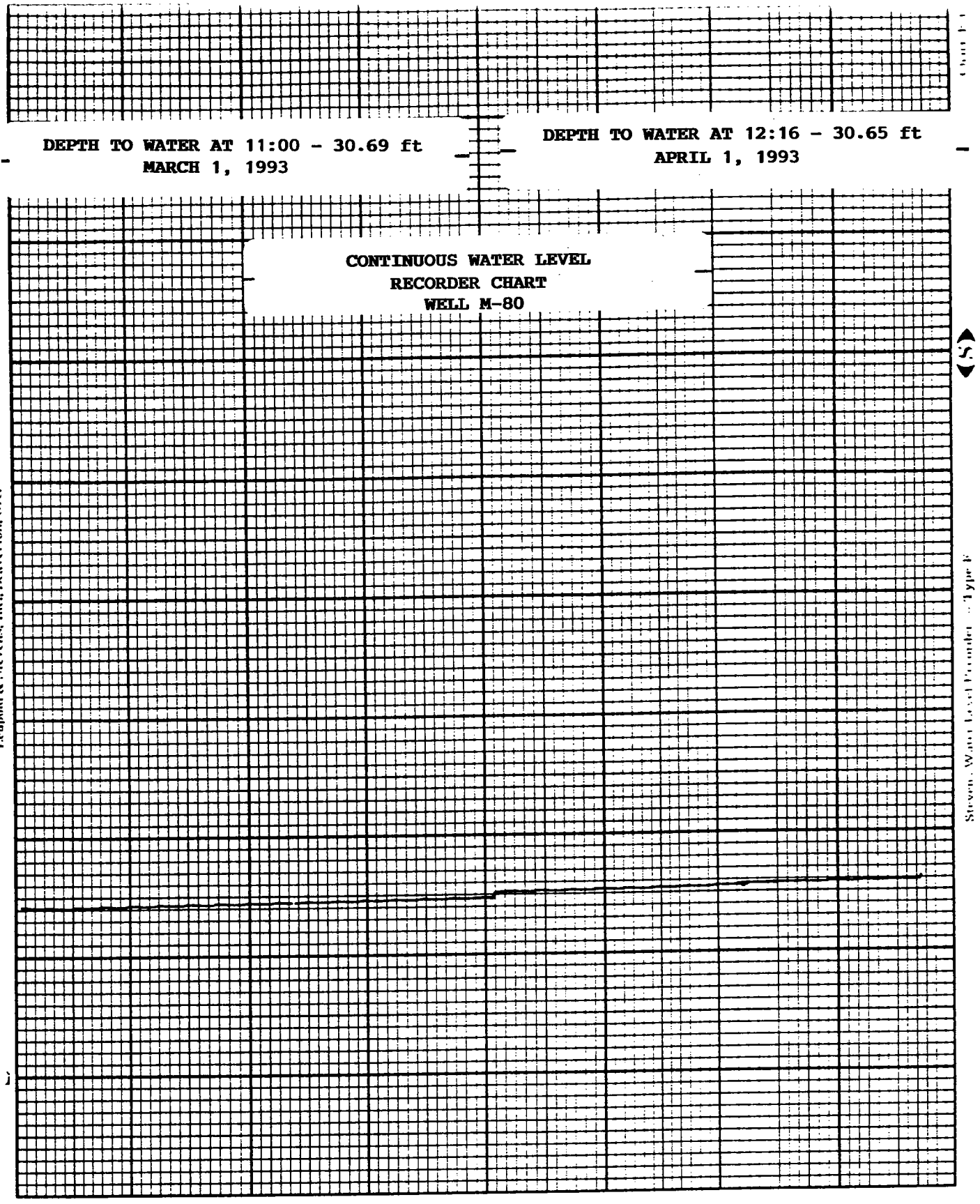
FIGURE B-4

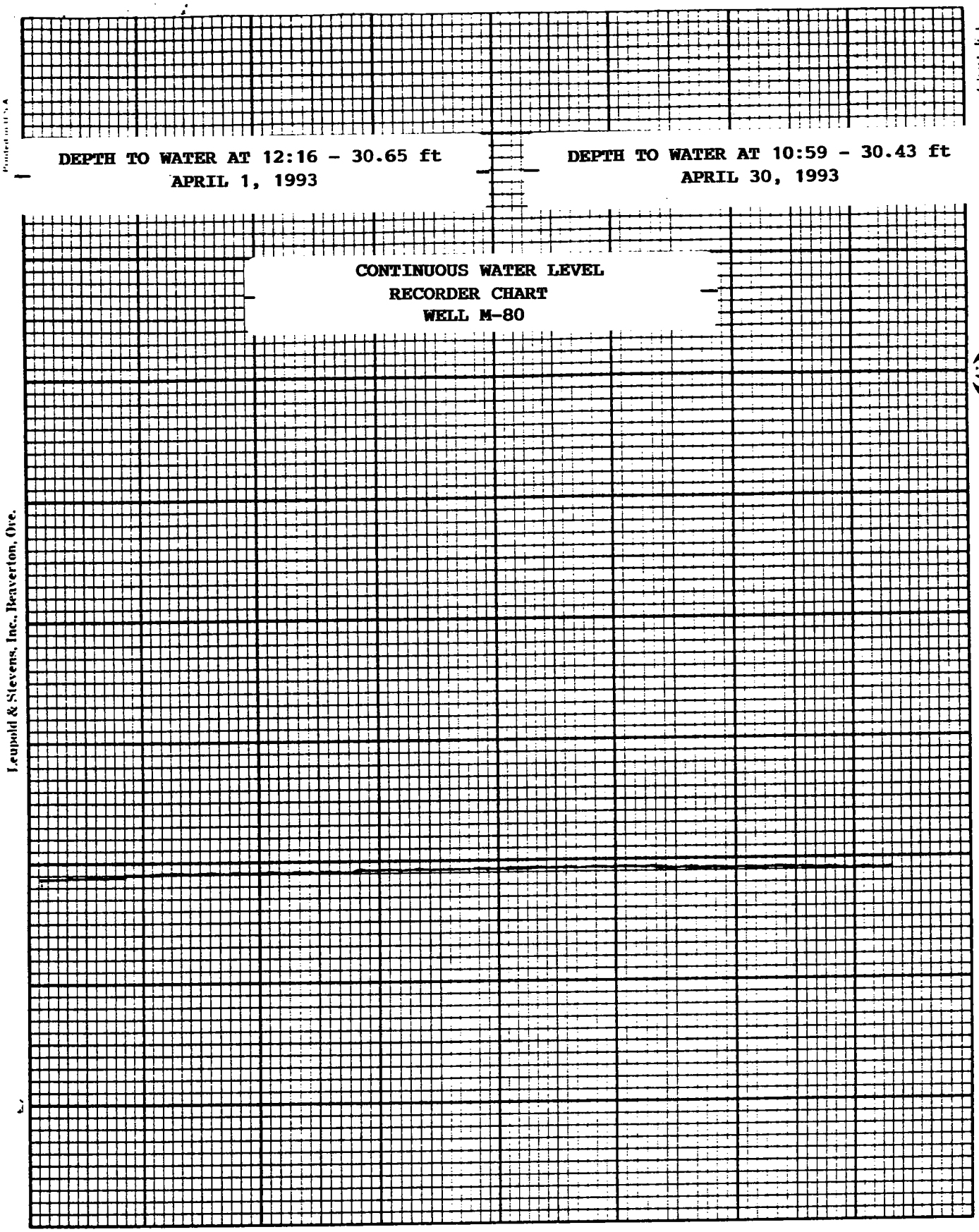


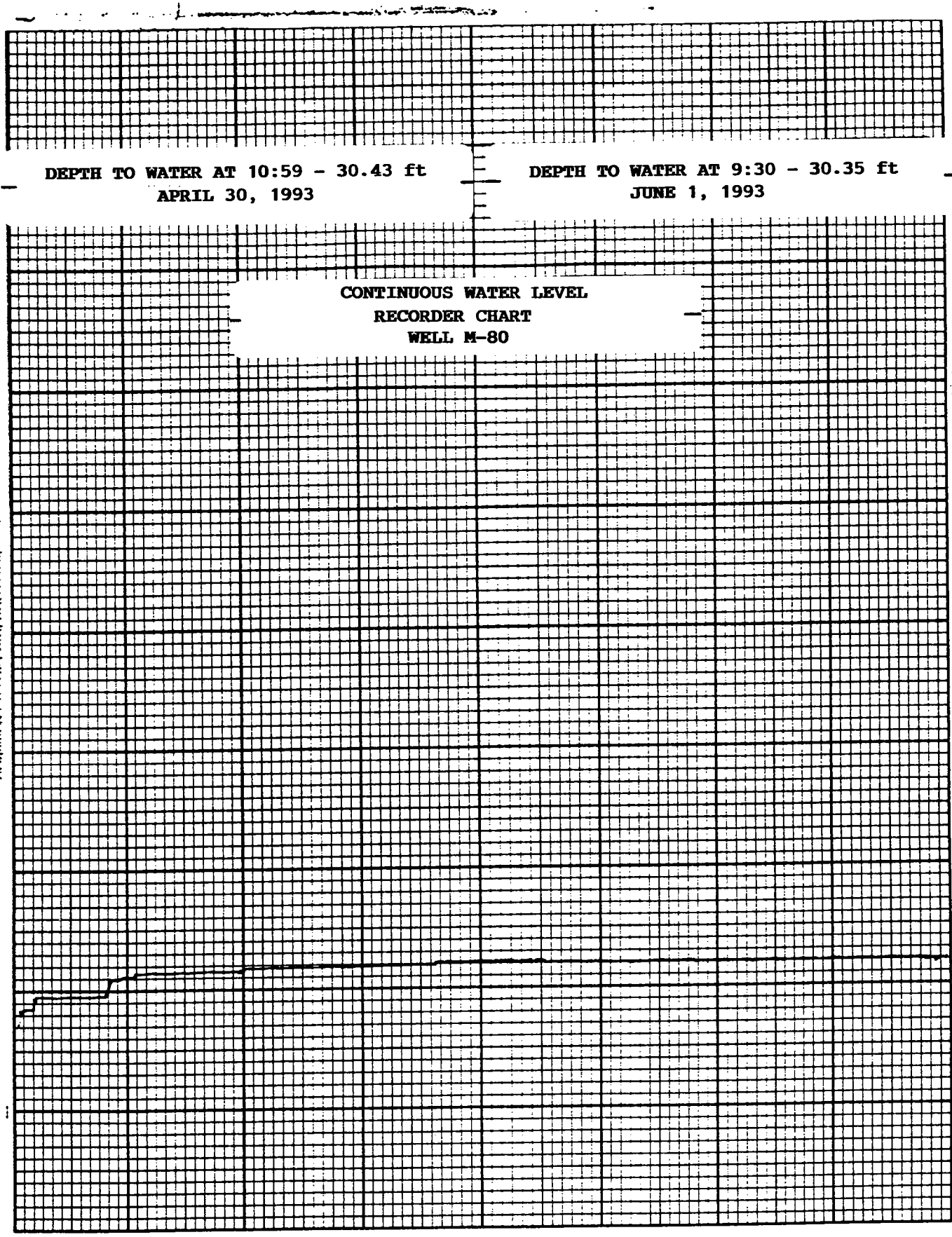
APPENDIX C

CONTINUOUS WATER LEVEL RECORDER CHARTS


DEPTH TO WATER AT 13:22 - 30.75 ft
FEBRUARY 2, 1993
DEPTH TO WATER AT 11:00 - 30.69 ft
MARCH 1, 1993
CONTINUOUS WATER LEVEL
RECORDER CHART
WELL M-80
Leupold & Stevens, Inc., Beaverton, Ore.
Stevens Water Level Recorder — Type F


DEPTH TO WATER AT 11:00 - 30.69 ft
MARCH 1, 1993
DEPTH TO WATER AT 12:16 - 30.65 ft
APRIL 1, 1993
CONTINUOUS WATER LEVEL
RECORDER CHART
WELL M-80
Leupold & Stevens, Inc., Beaverton, Ore.


DEPTH TO WATER AT 12:16 - 30.65 ft
APRIL 1, 1993
DEPTH TO WATER AT 10:59 - 30.43 ft
APRIL 30, 1993
CONTINUOUS WATER LEVEL
RECORDER CHART
WELL M-80
Leupold & Stevens, Inc., Beaverton, Ore.
Stevens Water Level Recorder - Type F


DEPTH TO WATER AT 10:59 - 30.43 ft
APRIL 30, 1993
DEPTH TO WATER AT 9:30 - 30.35 ft
JUNE 1, 1993
CONTINUOUS WATER LEVEL
RECORDER CHART
WELL M-80
Leupold & Stevens, Inc., Beaverton, Ore.
Stevens Water Level Recorder — Type F

DEPTH TO WATER AT 9:30 - 30.35 ft
JUNE 1, 1993

DEPTH TO WATER AT 9:25 - 31.35 ft
JULY 1, 1993

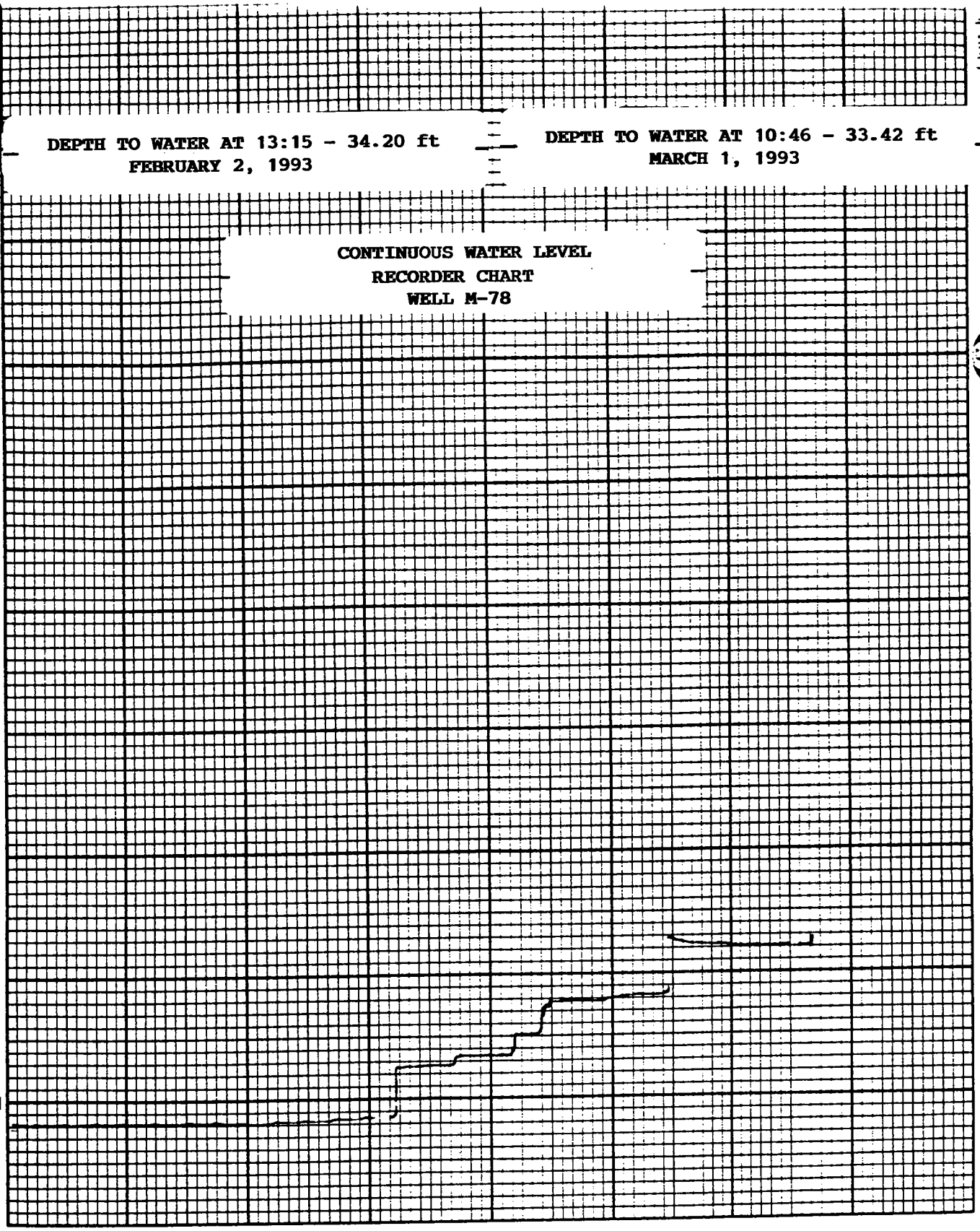
CONTINUOUS WATER LEVEL
RECORDER CHART
WELL M-80

Leupold & Stevens, Inc., Beaverton, Ore.

DEPTH TO WATER AT 13:15 - 34.20 ft
FEBRUARY 2, 1993

DEPTH TO WATER AT 10:46 - 33.42 ft
MARCH 1, 1993

CONTINUOUS WATER LEVEL
RECORDER CHART
WELL M-78



Leupold & Stevens, Inc., Beaverton, Ore.

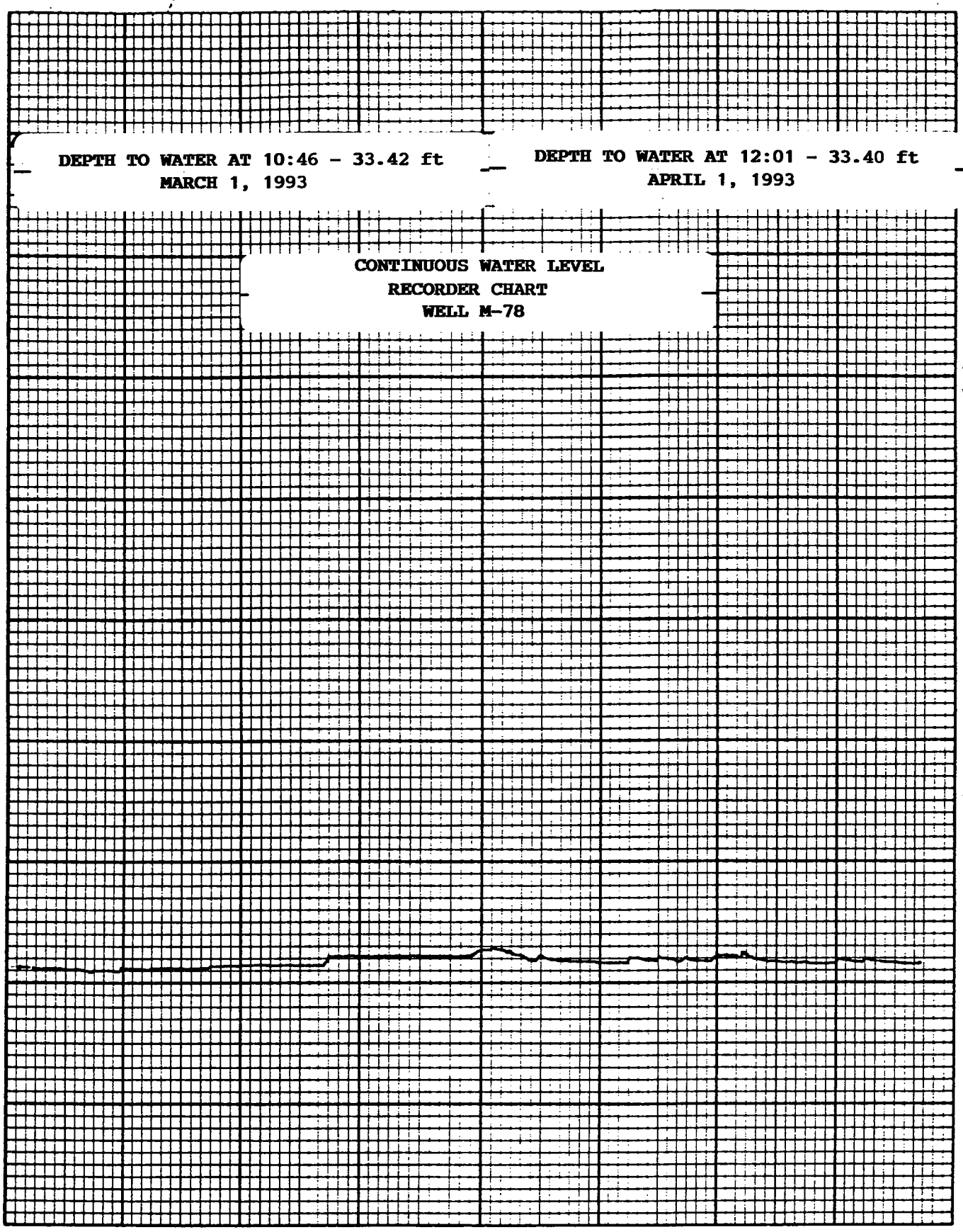
Stevens Water Level Recorder — Type F

Printed in U.S.A.

DEPTH TO WATER AT 10:46 - 33.42 ft
MARCH 1, 1993

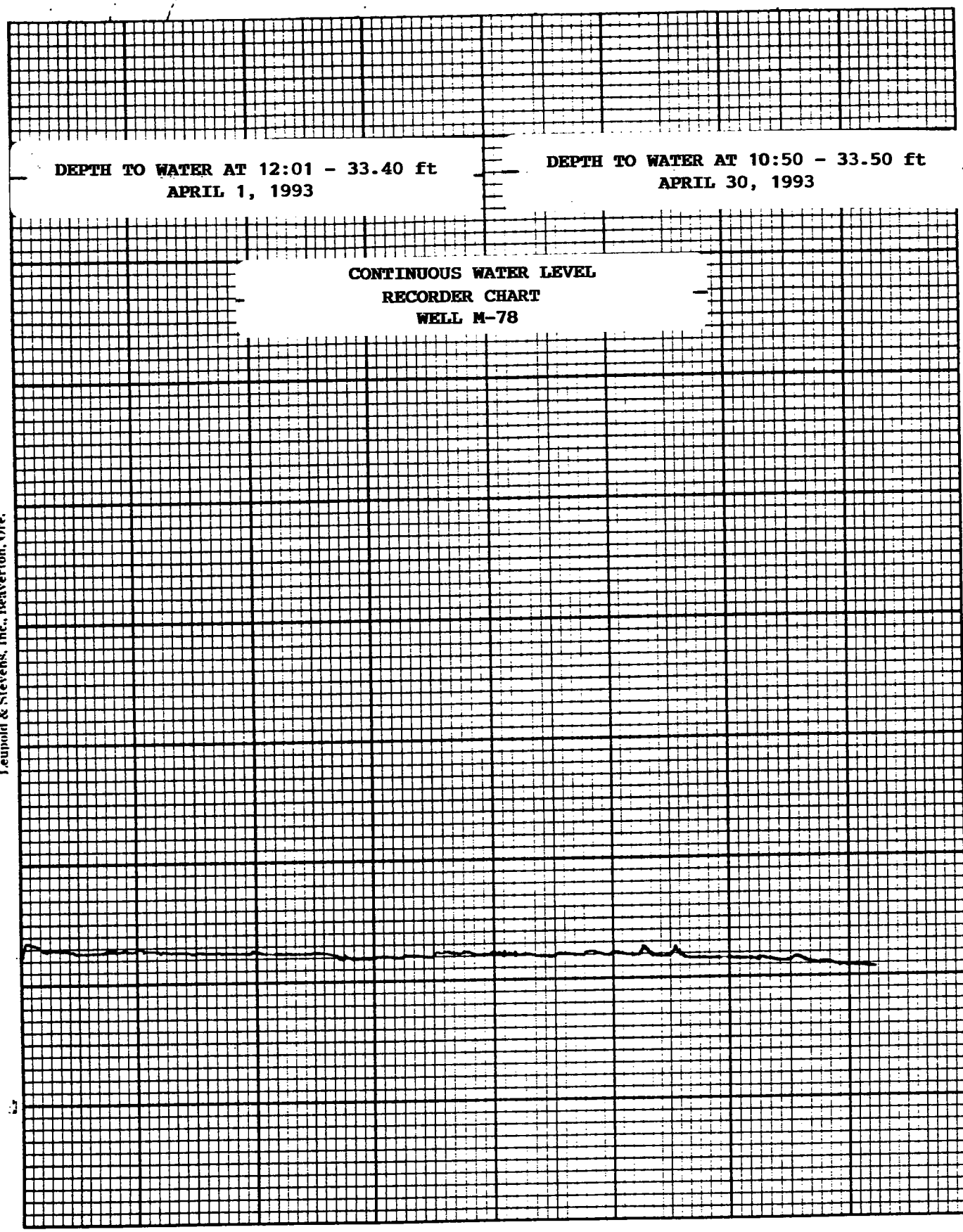
DEPTH TO WATER AT 12:01 - 33.40 ft
APRIL 1, 1993

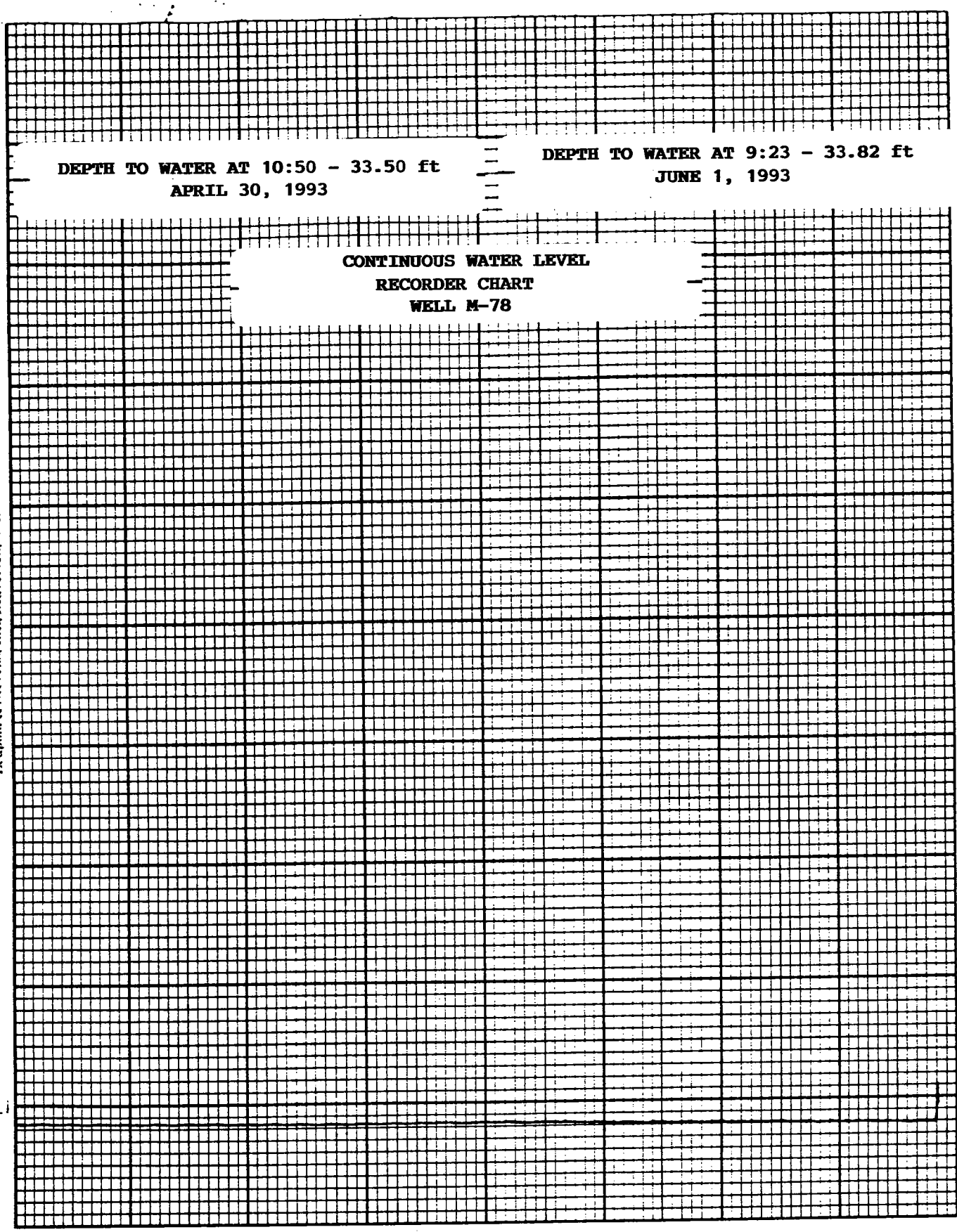
CONTINUOUS WATER LEVEL
RECORDER CHART
WELL M-78



Leupold & Stevens, Inc., Beaverton, Ore.

(10)

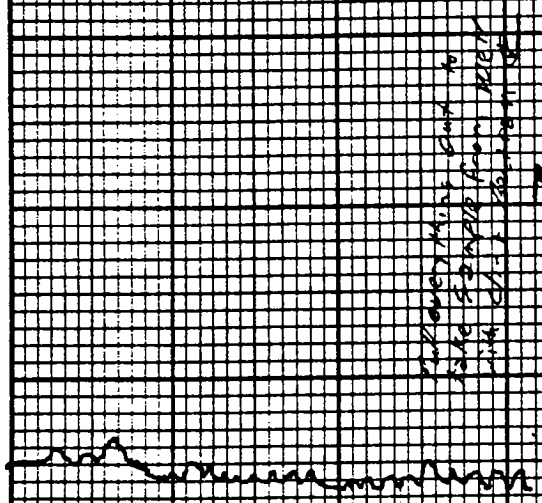

DEPTH TO WATER AT 12:01 - 33.40 ft
APRIL 1, 1993
DEPTH TO WATER AT 10:50 - 33.50 ft
APRIL 30, 1993
CONTINUOUS WATER LEVEL
RECORDER CHART
WELL M-78
Leupold & Stevens, Inc., Beaverton, Ore.



DEPTH TO WATER AT 9:23 - 33.82 ft
JUNE 1, 1993

DEPTH TO WATER AT 9:04 - 33.25 ft
JULY 1, 1993

CONTINUOUS WATER LEVEL
RECORDER CHART
WELL M-78



Battery out
Replace 7-1-93

Printed in U.S.A.

Leupold & Stevens, Inc., Beaverton, Ore.

Stevens Water Level Recorder Type F

(4)

APPENDIX D

CHROMIUM CONCENTRATIONS IN

MONITOR WELLS AND INTERCEPTOR WELLS

FIGURE D-1: APPENDIX J WELLS
KMCC HENDERSON, NEVADA FACILITY

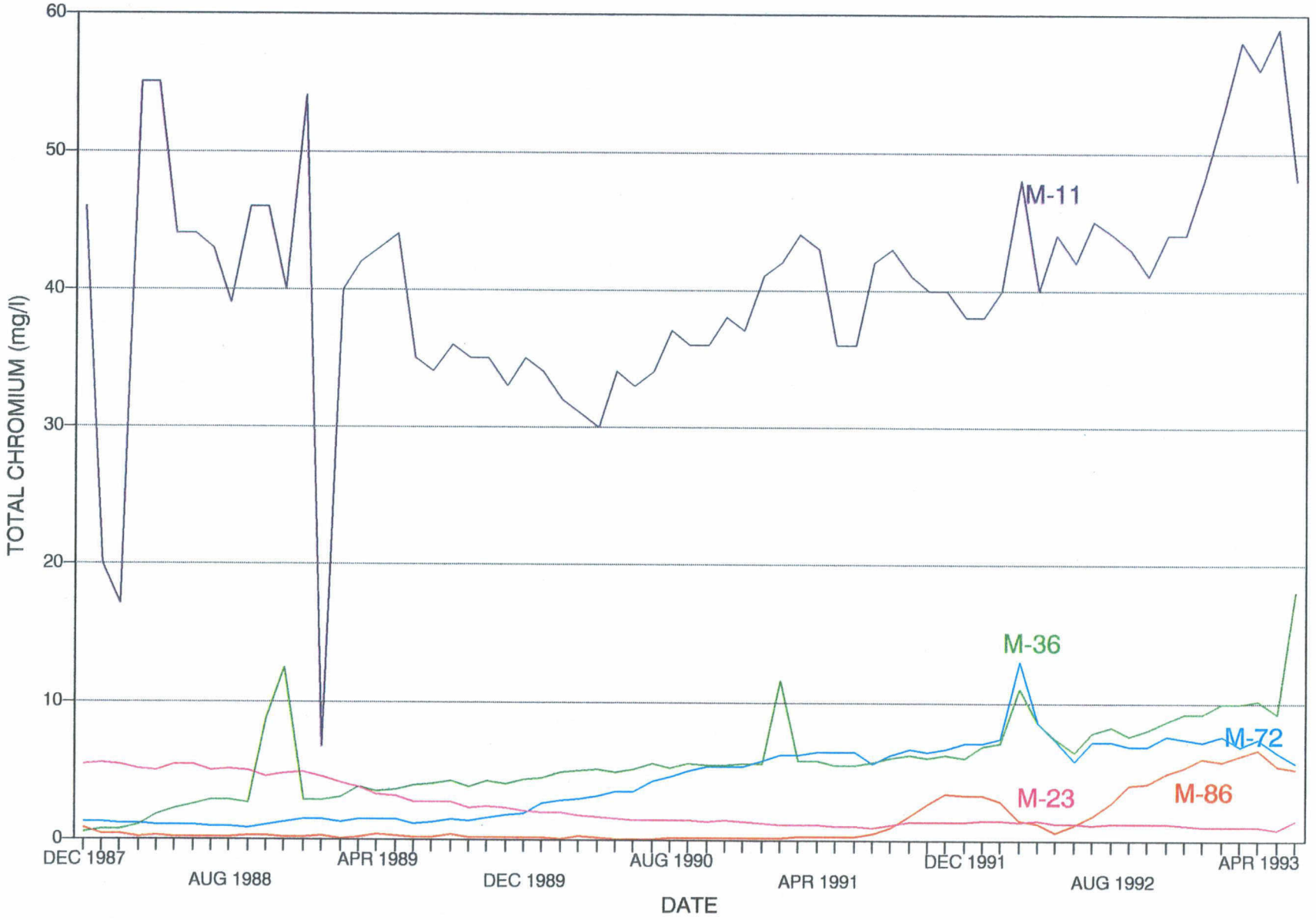


FIGURE D-2: INTERCEPTOR LINE
KMCC HENDERSON, NEVADA FACILITY

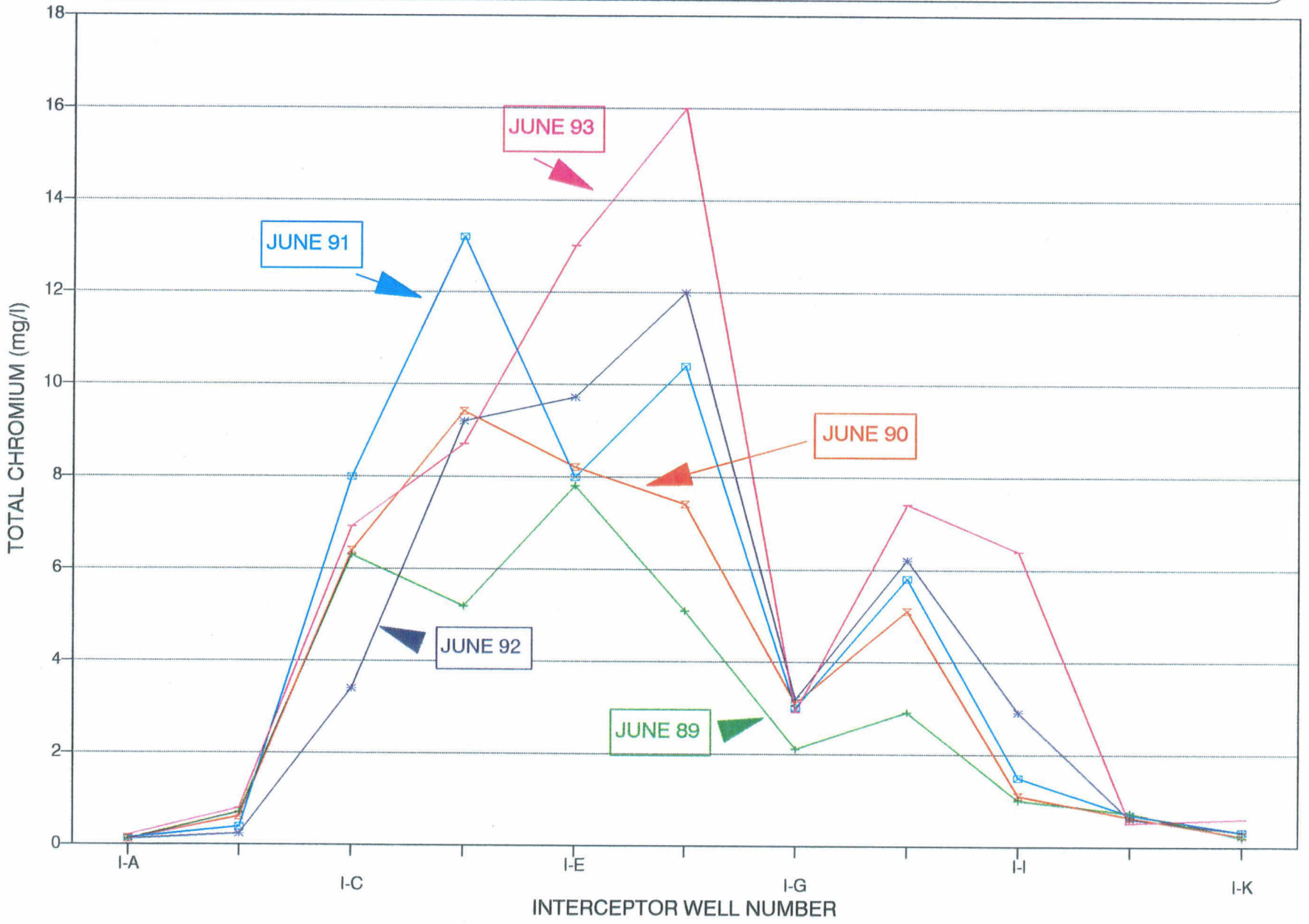


FIGURE D-3: MONITOR WELLS
KMCC HENDERSON, NEVADA FACILITY

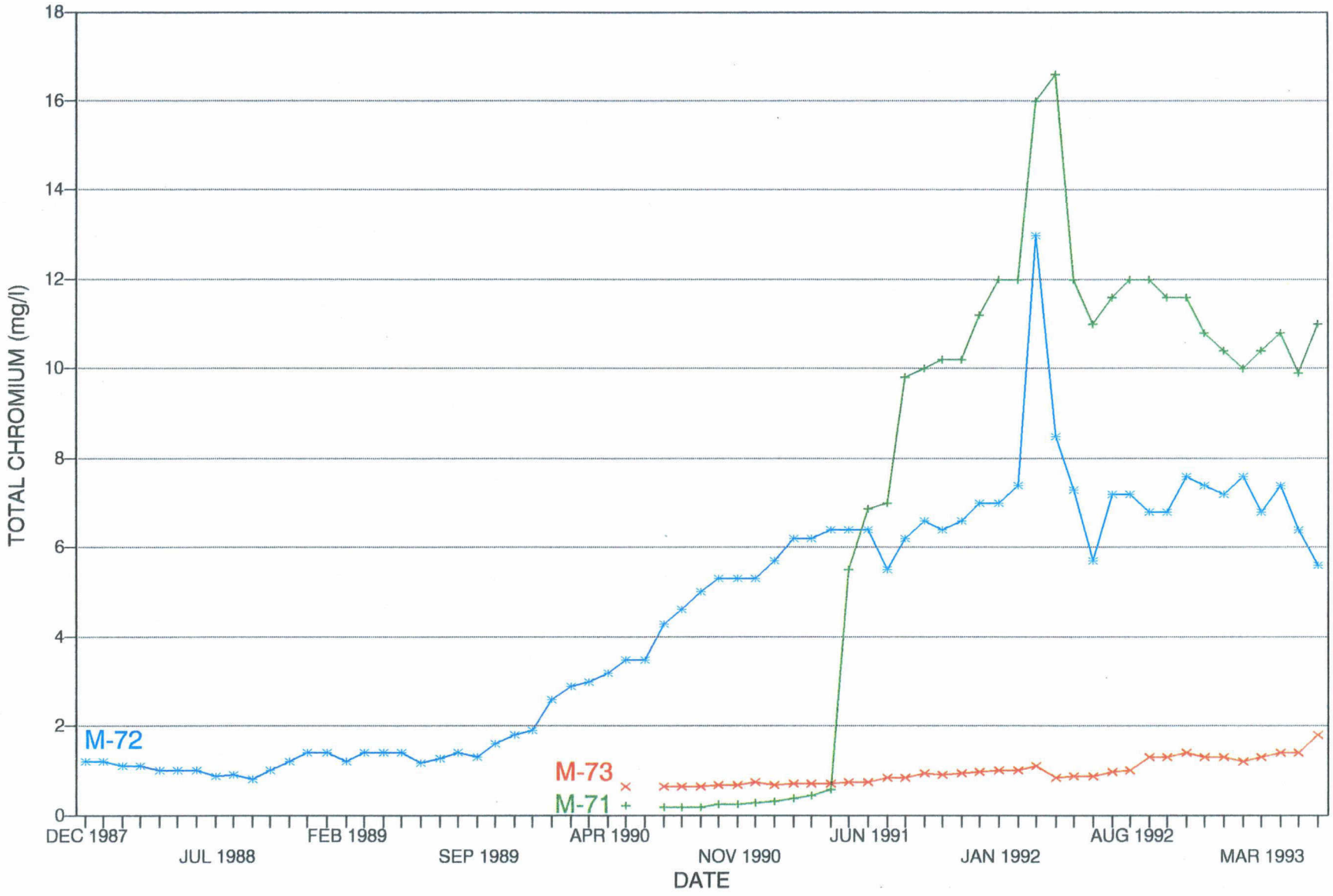


FIGURE D-4: MONITOR WELLS
KMCC HENDERSON, NEVADA FACILITY