Westbay

MP Packer Inflation Record

Project: Beylik

Location: EL TORO MCAS

Hole No.: MW-10

Packer No.: 45

Inflation Tool Setting (psi) 320

Completed By: DMc

Date Completed: —

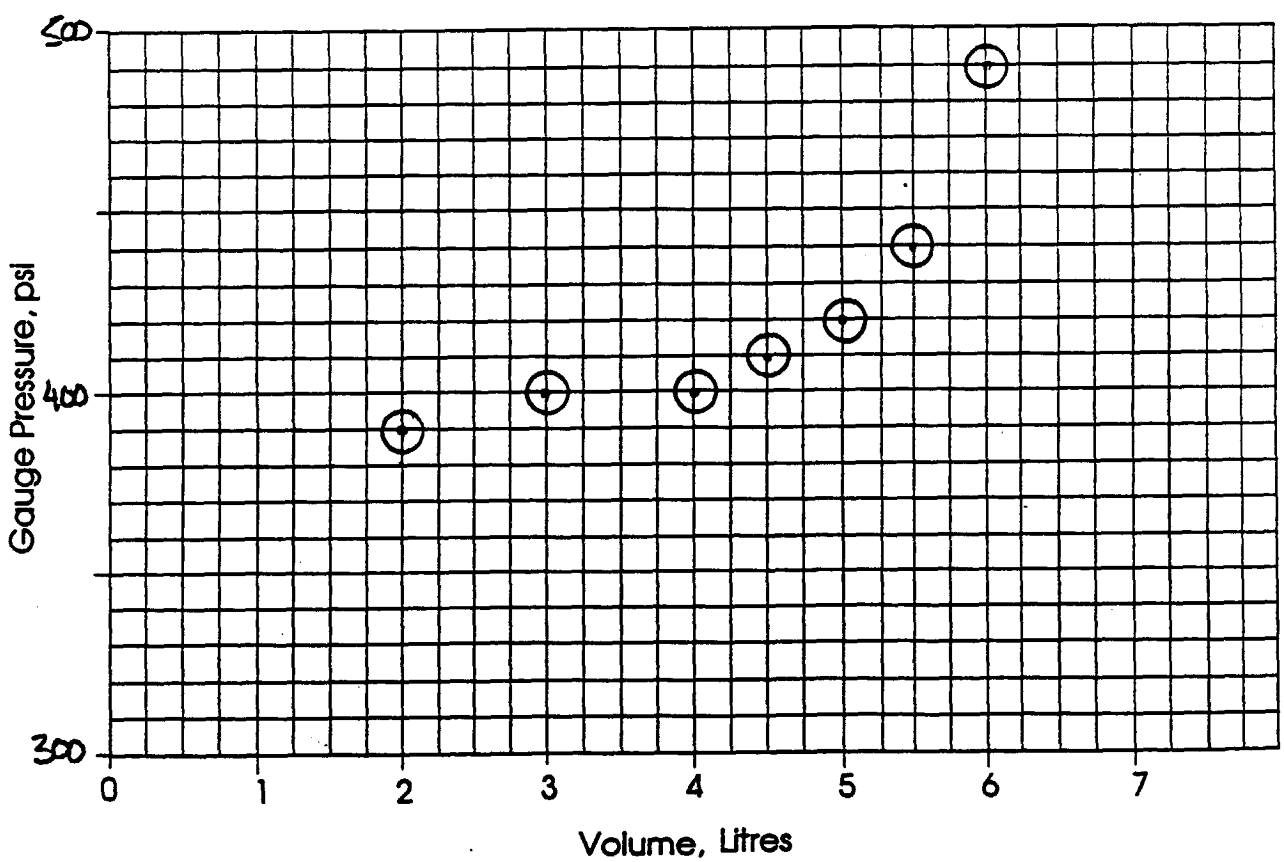
Date Inflated: Jan 9/93

Depth(~~m~~ / ft) 740

Depth to Standing Water (~~m~~ / ft) 6.0
- open hole

Volume (Litres)	10 2	8 3	5 4	10 4½	1 5	5 5½	10 6	4¾		
Pressure (PSI)	390	400	400	410	420	440	490	∅		

Plot of Gauge Pressure (PSI) vs. Volume (L)



Westbay

MP Packer Inflation Record

Project: Beylik
Completed By: DMc

Location: EL TORO MCAS
Date Completed: —

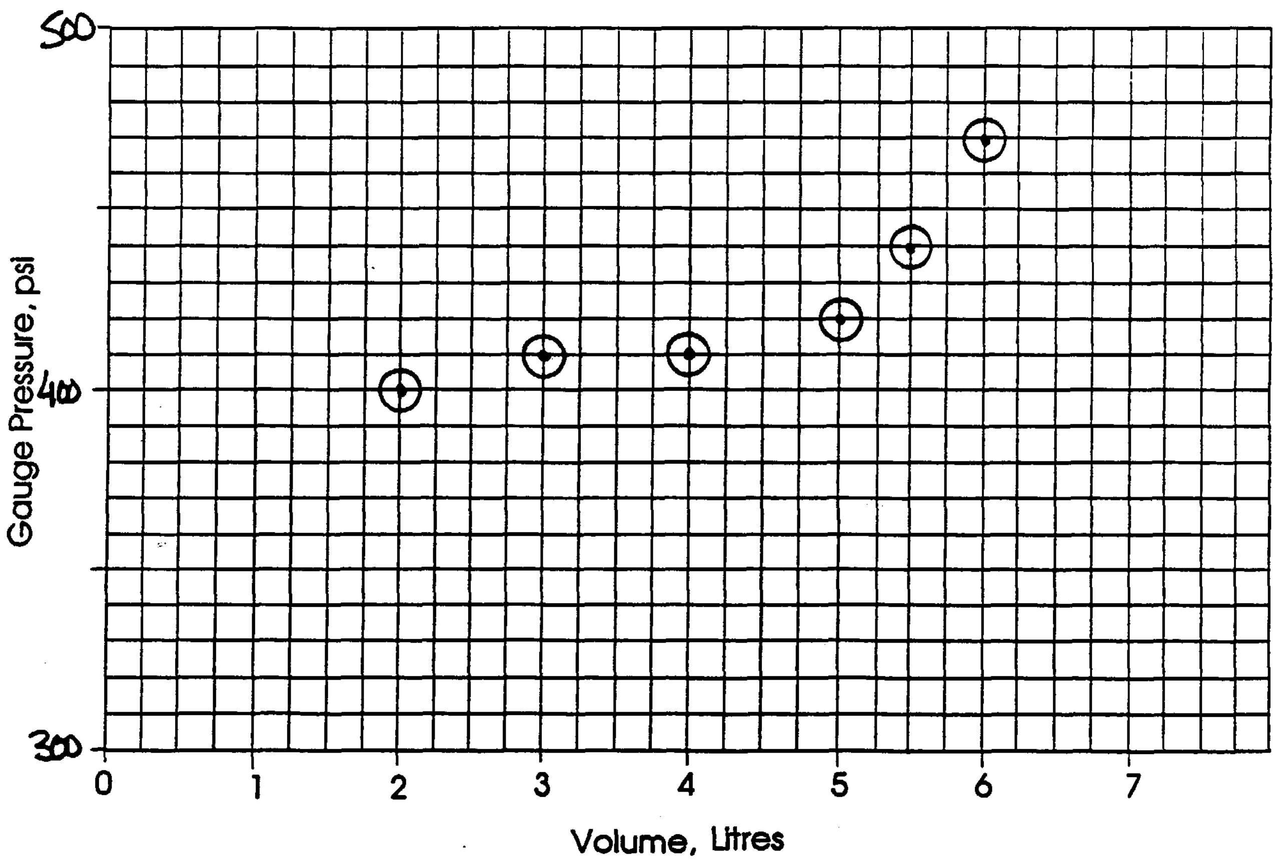
Hole No.: MW-10
Date Inflated: Jan 9/93

Packer No.: 65
Depth(~~m~~/ ft) 582

Inflation Tool Setting (psi) 320
Depth to Standing Water (~~m~~/ ft) 6.0
- open hole

Volume (Litres)	2	3 10	4 6	5 4	5½ :0	6	4¾			
Pressure (PSI)	400	410	410	420	440	470	∅			

Plot of Gauge Pressure (PSI) vs. Volume (L)



30/10/90

Westbay

MP Packer Inflation Record

Project: Beylik

Location: El Toro MCAS

Hole No.: MW-10

Packer No.: 69

Inflation Tool Setting (psi) 320

Completed By: DMc

Date Completed: —

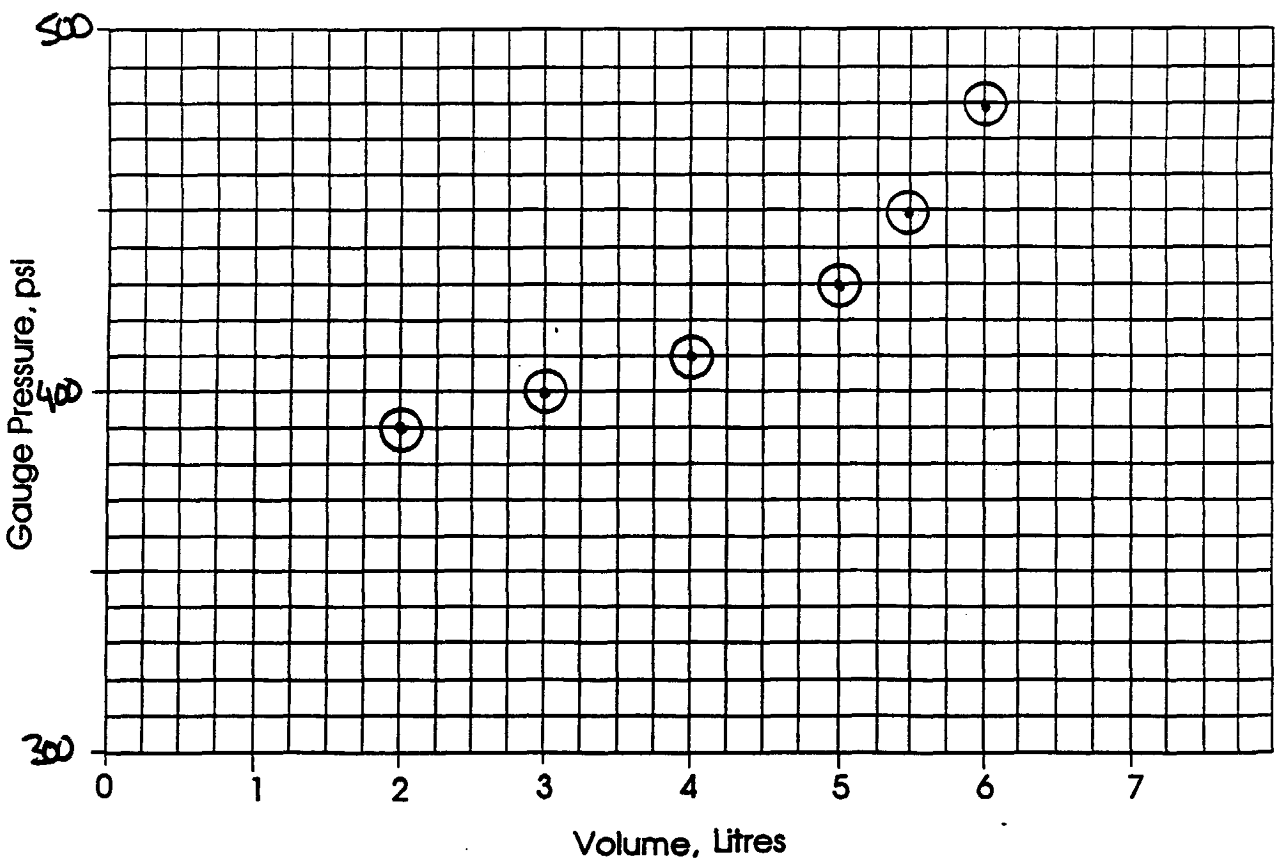
Date Inflated: Jan 9/92

Depth(~~m~~ / ft) 562

Depth to Standing Water (~~m~~ / ft) 6.0
- open hole

	9	7	7	5	12	4				
Volume (Litres)	2	3	4	5	5½	6	4¾			
Pressure (PSI)	390	400	410	430	450	480	∅			

Plot of Gauge Pressure (PSI) vs. Volume (L)



30/10/90

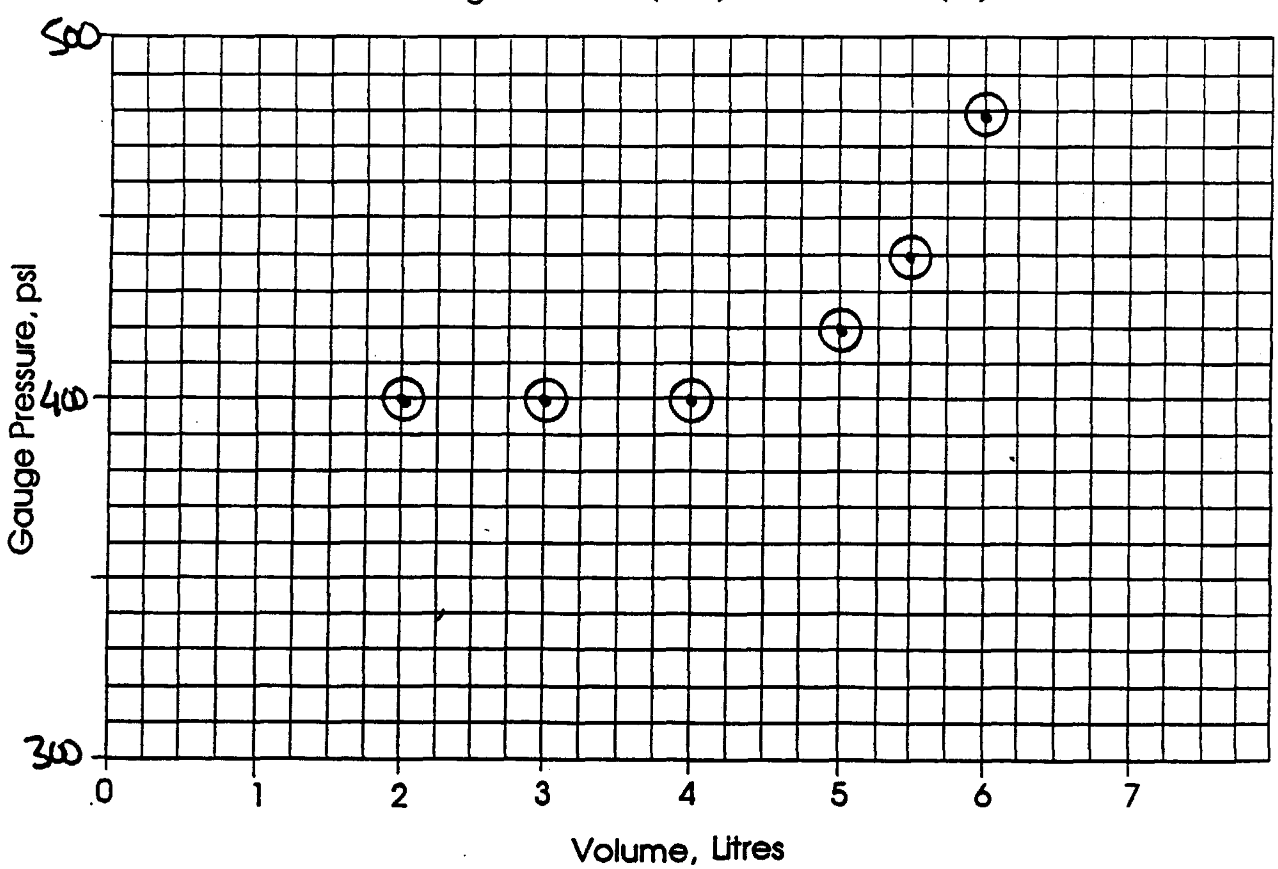
Westbay

MP Packer Inflation Record

Project: Baylik
Completed By: DMc
Location: EL Toro MCAS
Date Completed: —
Hole No.: MW-10
Date Inflated: Jan 9/93
Packer No.: 71
Depth(~~m~~ / ft) 552
Inflation Tool Setting (psi) 320
Depth to Standing Water (~~m~~ / ft) 6.0
- open hole

Volume (Litres)	2 [5]	3 [7]	4 [5]	5 [3]	5½ [8]	6 [3]	4¾			
Pressure (PSI)	400	400	400	420	440	480	∅			

Plot of Gauge Pressure (PSI) vs. Volume (L)



30/10/90

Westbay

MP Packer Inflation Record

Project: Beylik

Completed By: DMc

Location: EL Toro MCAS

Date Completed: —

Hole No.: MW-10

Date Inflated: Jan 9/93

Packer No.: 84

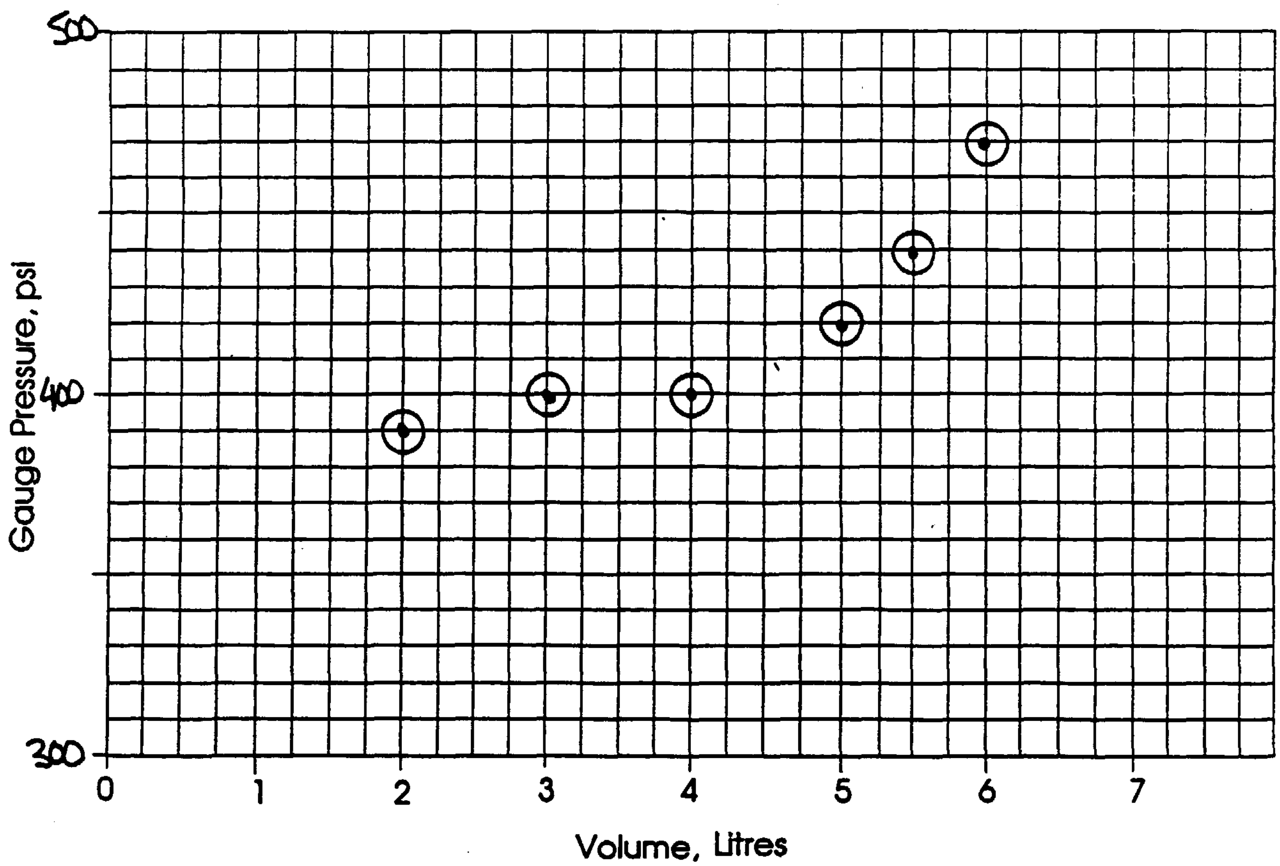
Depth(~~m~~ / ft) 447

Inflation Tool Setting (psi) 320

Depth to Standing Water (~~m~~ / ft) 6.0
- open hole

Volume (Litres)	2 8	3 6	4 4	5	5½	6	4¾			
Pressure (PSI)	390	400	400	420	440	470	∅			

Plot of Gauge Pressure (PSI) vs. Volume (L)



30/10/90

Westbay

MP Packer Inflation Record

Project: Beylik

Location: EL Toro MCAS

Hole No.: MW-10

Packer No.: 88

Inflation Tool Setting (psi) 320

Completed By: DMc

Date Completed: —

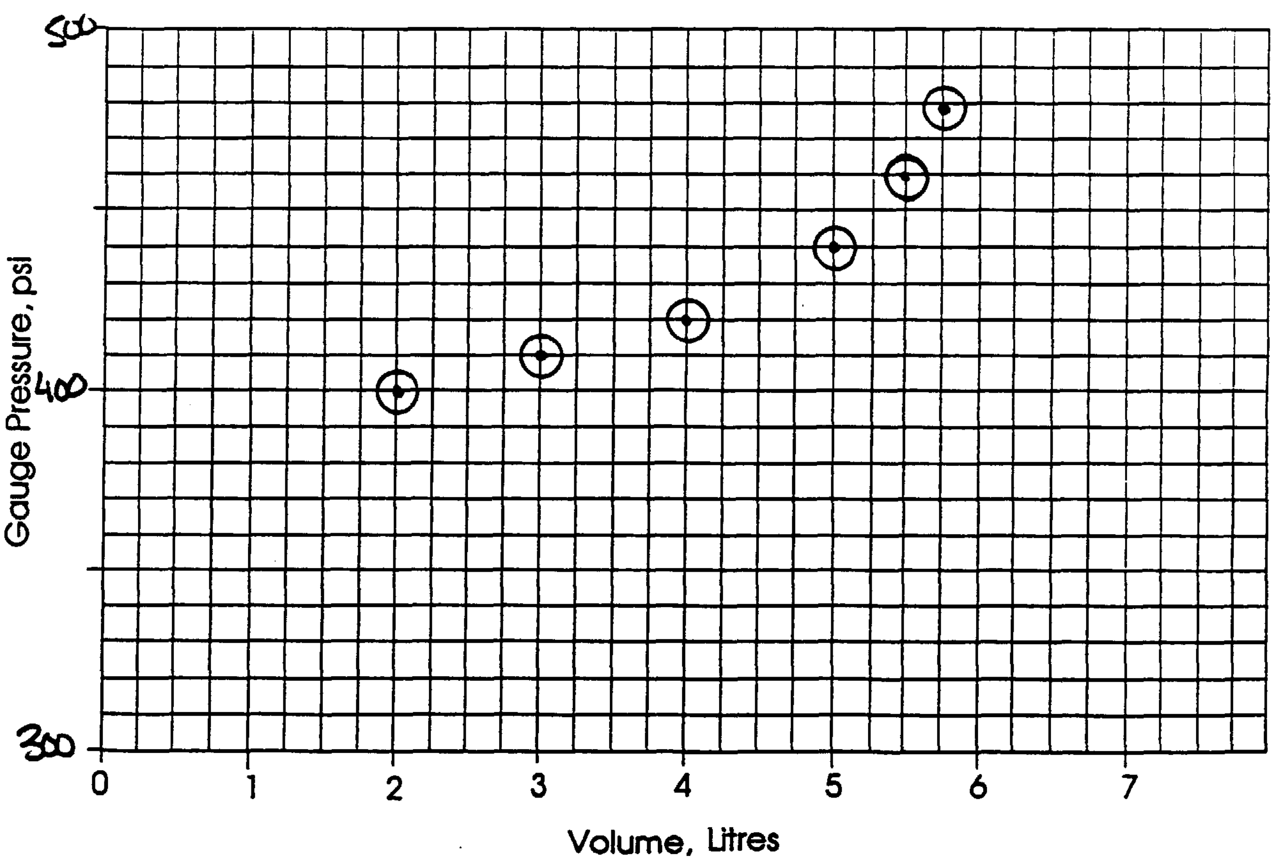
Date Inflated: Jan

Depth(~~m~~ / ft) 427

Depth to Standing Water (~~m~~ / ft) 6.0
- open hole

Volume (Litres)	2 [4]	3 [4]	4 [3]	5 [12]	5½ [8]	5¾ [3]	4½			
Pressure (PSI)	400	410	420	440	460	480	Ø			

Plot of Gauge Pressure (PSI) vs. Volume (L)



Westbay

MP Packer Inflation Record

Project: Beylik

Location: EL Toro MCAS

Hole No.: MW-10

Packer No.: 90

Inflation Tool Setting (psi) 320

Completed By: DMc

Date Completed: —

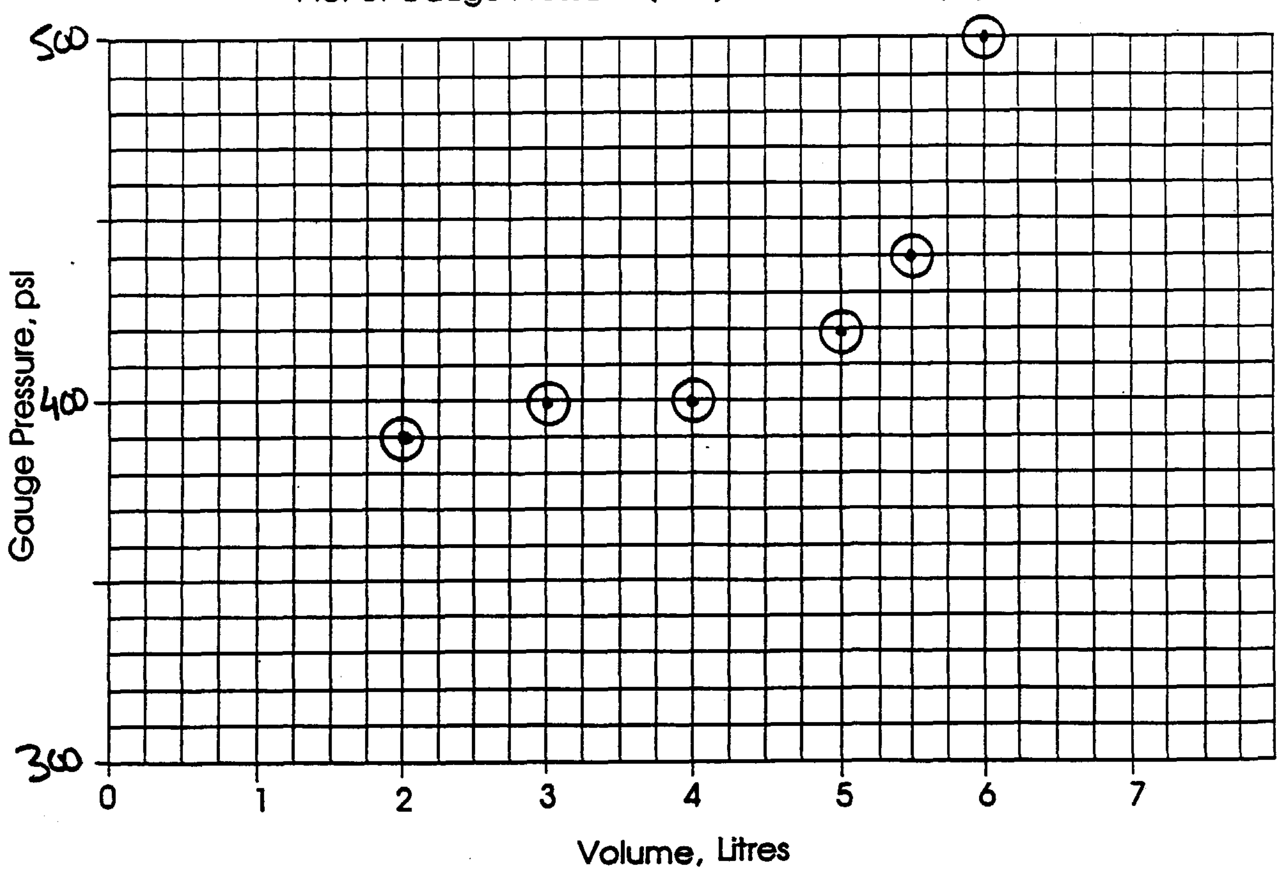
Date Inflated: Jan 9/93

Depth(~~m~~ / ft) 417

Depth to Standing Water (~~m~~ / ft) 6.0
- open hole

Volume (Litres)	2 [2]	3 [12]	4 [10]	5 [8]	5½ [1]	6 [7]	4¾			
Pressure (PSI)	390	400	400	420	440	500	∅			

Plot of Gauge Pressure (PSI) vs. Volume (L)



30/10/90

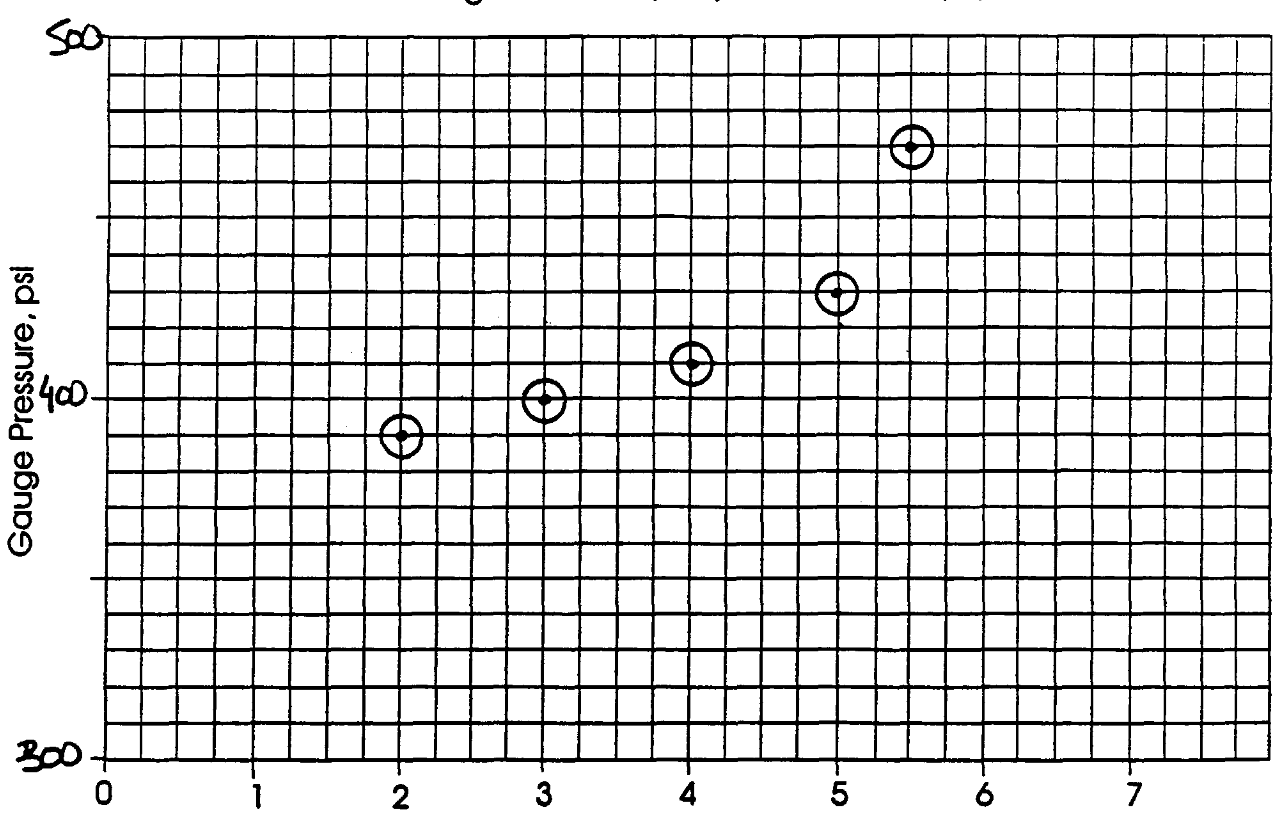
Westbay

MP Packer Inflation Record

Project: Beylik
Completed By: DMc
Location: EL Toro MCAS
Date Completed: —
Hole No.: MW-10
Date Inflated: Jan 9/92
Packer No.: 109
Depth(~~m~~ / ft) 237
Inflation Tool Setting (psi) 320
Depth to Standing Water (~~m~~ / ft) 60
- open hole

Volume (Litres)	2 [3]	3 [2]	4 [9]	5 [6]	5½ [11]	4½				
Pressure (PSI)	390	400	410	430	470	∅				

Plot of Gauge Pressure (PSI) vs. Volume (L)



30/10/90

Westbay

MP Packer Inflation Record

Project: Beylik
Completed By: DMc

Location: EL Toro MCAS
Date Completed: —

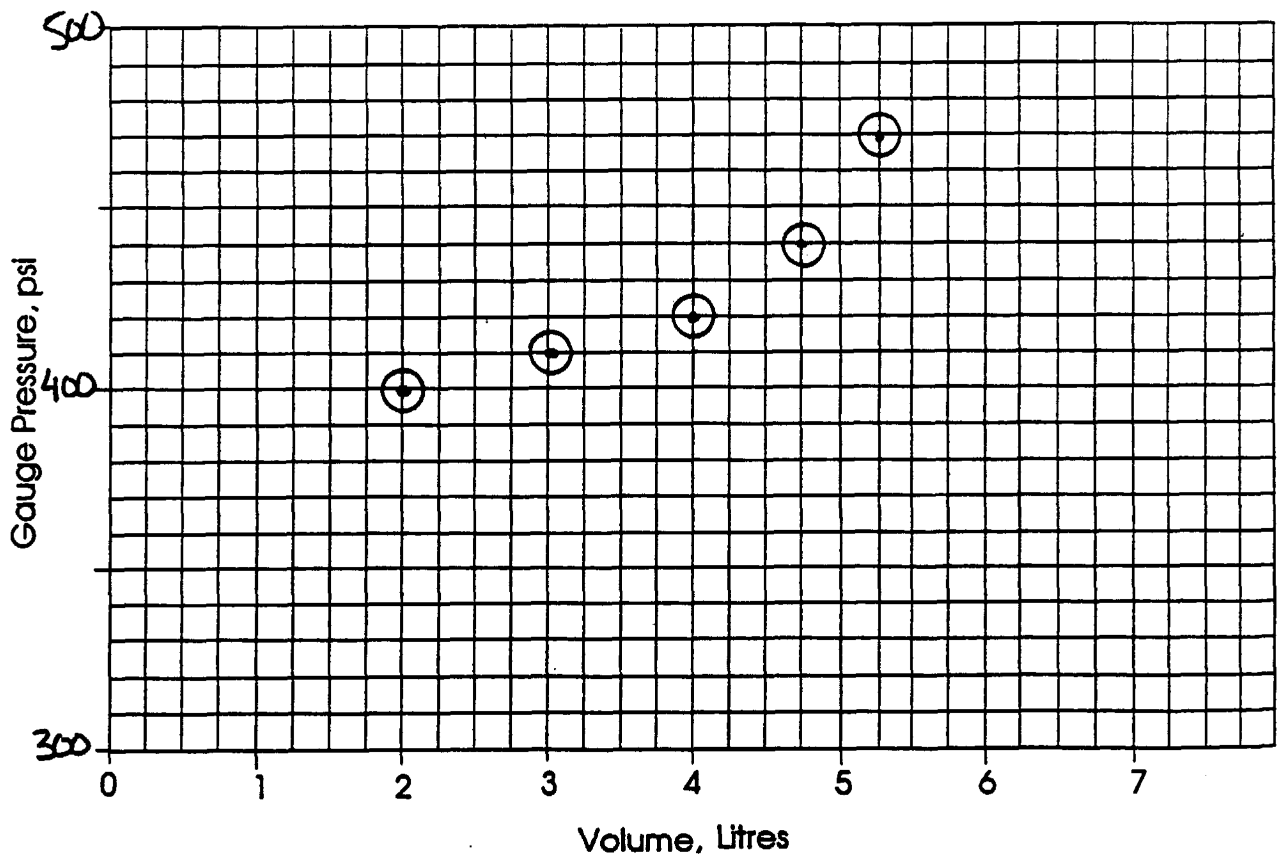
Hole No.: MW-10
Date Inflated: Jan 9/93

Packer No.: 113
Depth(~~m~~ / ft) 217

Inflation Tool Setting (psi) 320
Depth to Standing Water (~~m~~ / ft) 6.0
- open hole

Volume (Litres)	12 2	10 3	7 4	3 5	5½	4½				
Pressure (PSI)	400	410	420	440	470	∅				

Plot of Gauge Pressure (PSI) vs. Volume (L)



Westbay

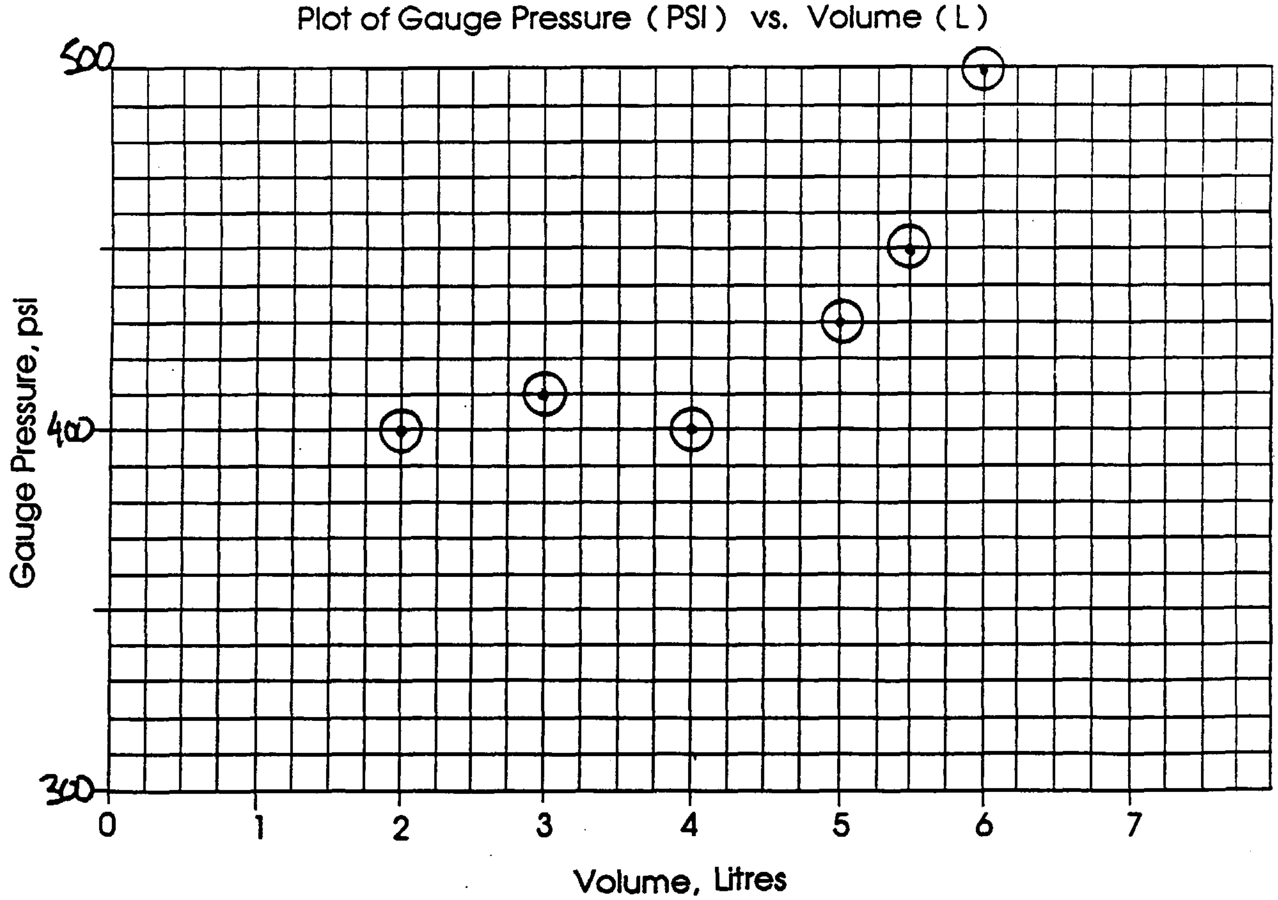
MP Packer Inflation Record

Project: Beylik
Location: El Toro MCAS
Hole No.: MW-10
Packer No.: 115
Inflation Tool Setting (psi) 320

Completed By: DMC
Date Completed: —
Date Inflated: Jan 9/93
Depth(~~m~~ / ft) 207
Depth to Standing Water (~~m~~ / ft) 6.0
- open hole

Volume (Litres)	15 2	8 3	4 4	9 5	1 5½	3 6				
Pressure (PSI)	400	410	400	430	450	500	∅			

Plot of Gauge Pressure (PSI) vs. Volume (L)



30/10/90

Westbay Hydraulic Conductivity Test
Field Data Sheet

Datum: Top of MP Probe Type: WLT Date: Jan 13/93 Job No.: 686
Elev. Ground Sfc: — Serial No.: — Monitoring Well No.: MW-10
Height MP Casing above Ground Sfc: 2 ft Range: 0 to — psi Project: EL Toro MCAS
Elev. top of MP Casing: — Riser Diameter (d): 3.8 in. ~~cm~~ Test Zone No.: A 227 ft
Test Type: Variable head Test Zone Diameter: 12" Test Zone Interval: 208-236 ft
Operator: DMc Test Zone Length (L): 28 ft
Initial Head Difference(H_o): 23.45 Initial Test Reading (h): 23.45
Calculated Hydraulic Conductivity (k): 5×10^{-4} cm/s Analysis Method: Hvorslev
Static Water Level in Test Zone: 0.0 ft. ~~m~~ ~~psi~~ Comments:

Clock Time	Elapsed Time min.	Elapsed Time sec.	Test Readings* (h) ft. ~~m~~ ~~psi~~	Normalized Test Readings	Clock Time	Elapsed Time min.	Elapsed Time sec.	Test Readings* (h) ft. m psi	Normalized Test Readings
	0	0	23.45	1.00					
		10	9.99	.43					
		22	3.0	.13					
		30	2.0	.085					
		40	1.0	.043					
		50	0.5	.021					
	1	—	0.0	—					

*Readings uncorrected for variations in Barometric Pressure

Westbay Hydraulic Conductivity Test

Field Data Sheet

Datum: Top of MP
Probe Type: WLT
Date: Jan 12/93
Job No.: 686
Elev. Ground Sfc: —
Serial No.: —
Monitoring Well No.: MW-10
Height MP Casing above Ground Sfc: 2 ft
Range: 0 to — psi
Project: El Toro MCAS
Elev. top of MP Casing: —
Riser Diameter (d): 3.8 ~~in.~~ cm
Test Zone No.: B (437 ft)
Test Type: Variable Head
Test Zone Diameter: 12"
Test Zone Interval: 419 – 446 ft
Operator: DMC / DGM
Test Zone Length (L): 27 ft
Initial Head Difference(H_0): 18.5 psi
Initial Test Reading (h): 2.42
Calculated Hydraulic Conductivity (k): 6×10^{-5} cm/s
Analysis Method: Hvorslev
Static Water Level in Test Zone: 20.90 ft. ~~m~~ ~~psi.~~
Comments:

Clock Time	Elapsed Time min.	Elapsed Time sec.	Test Readings* (h) ft. ~~m~~ ~~psi~~	Normalized Test Readings	Clock Time	Elapsed Time min.	Elapsed Time sec.	Test Readings* (h) ft. m psi	Normalized Test Readings
	0	0	2.40	1.00					
		10	5.00	.86					
		20	6.4	.78					
		30	7.1	.75					
		40	8.0	.70					
		50	9.0	.64					
	1	00	10.0	.60					
	1	10	10.6	.56					
	1	30	12.0	.48					
	2	—	13.8	.38					
	2	½	15.25						
	3	—	16.35						
	4	—	18.05						
	5	—	19.10						
	6	—	19.80						
	7	—	20.20						
	8	—	20.45						
	9	—	20.60						
	10	—	20.73						
	12	—	20.85						
	∞		20.90						

*Readings uncorrected for variations in Barometric Pressure

Westbay Hydraulic Conductivity Test

Field Data Sheet

Datum: Top of MP
Probe Type: WLT
Date: Jan 12/93
Job No.: 686
Elev. Ground Sfc: —
Serial No.: —
Monitoring Well No.: MW-10
Height MP Casing above Ground Sfc: 2 ft
Range: 0 to — psi
Project: EL Toro MCAS
Elev. top of MP Casing: —
Riser Diameter (d): 3.8 ~~in.~~ cm
Test Zone No.: C (572 ft)
Test Type: Variable Head
Test Zone Diameter: 12"
Test Zone Interval: 550-584 ft
Operator: DMC/AGM
Test Zone Length (L): 34 ft
Initial Head Difference(H_o): 9.00 psi
Initial Test Reading (h): 18.67
Calculated Hydraulic Conductivity (k): 5×10^{-5} cm/s
Analysis Method: Hvorslev
Static Water Level in Test Zone: 27.70 ft. ~~m~~ ~~psi~~.
Comments:

Clock Time	Elapsed Time min.	sec.	Test Readings* (h) ft. ~~m~~ ~~psi~~	Normalized Test Readings	Clock Time	Elapsed Time min.	sec.	Test Readings* (h) ft. m psi	Normalized Test Readings
	0	0	18.70	1.00					
		10	20.60	.79					
		20	21.10	.73					
		30	21.55	.68					
		40	21.95	.64					
		50	22.30	.60					
		60	22.65	.56					
	1	10	22.97	.53					
	1	30	23.60	.46					
	2		24.35						
	2	30	25.00						
	3		25.55						
	4		26.35						
	5		26.85						
	6		27.20						
	8		27.50						
	10		27.60						
	∞		27.70						

*Readings uncorrected for variations in Barometric Pressure

Westbay

Hydraulic Conductivity Test

Field Data Sheet

Datum: Top of MP | Probe Type: WLT | Date: Jan 12/93 | Job No.: 686

Elev. Ground Sfc: — | Serial No.: — | Monitoring Well No.: MW 40

Height MP Casing above Ground Sfc: 2 ft | Range: 0 to — psi | Project: EL Toro MCAS

Elev. top of MP Casing: — | Riser Diameter (d): 3.8 ~~in.~~ cm | Test Zone No.: D (760 ft)

Test Type: Variable head | Test Zone Diameter: 12" | Test Zone Interval: 741 - 782 ft

Operator: DMc /DGM | Test Zone Length (L): 41 ft

Initial Head Difference(H_0): 7.43 psi | Initial Test Reading (h): 21.20

Calculated Hydraulic Conductivity (k): 9×10^{-5} cm/s | Analysis Method: Hvoslev

Static Water Level in Test Zone: 28.63 ft. ~~m~~ ~~psi.~~ | Comments:

Clock Time	Elapsed Time min.	sec.	Test Readings* (h) ft. ~~m~~ ~~psi~~	Normalized Test Readings	Clock Time	Elapsed Time min.	sec.	Test Readings* (h) ft. m psi	Normalized Test Readings
		0	21.20	1.00					
		10	22.65	.81					
		20	23.50	.69					
		30	24.15	.60					
		40	24.70	.53					
		50	25.23	.46					
		60	25.70	.39					
		70	26.20	.33					
		90	26.70	.26					
	2		27.50	.15					
	2½		27.90						
	3		28.20						
	4		28.45						
	5		28.58						
	6		28.60						
	7		28.63						
	8		28.63						
	∞		28.63						

*Readings uncorrected for variations in Barometric Pressure

Westbay Hydraulic Conductivity Test

Field Data Sheet

Datum: Top of MP
Probe Type: WLT
Date: Jan 11/93
Job No.: 686
Elev. Ground Sfc: —
Serial No.: —
Monitoring Well No.: MW-10
Height MP Casing above Ground Sfc: 2 ft
Range: 0 to — psi
Project: EL Toro MCAS
Elev. top of MP Casing: —
Riser Diameter (d): 3.8 ~~in.~~ cm
Test Zone No.: E (894')
Test Type: Variable head
Test Zone Diameter: 12"
Test Zone Interval: 871-903 ft
Operator: DMc / DGM
Test Zone Length (L): 32 ft
Initial Head Difference(H_o): 15.86 psi
Initial Test Reading (h): 18.14
Calculated Hydraulic Conductivity (k): 6×10^{-5} cm/s
Analysis Method: Hvorslev
Static Water Level in Test Zone: 34.00 ft. ~~m~~ ~~psi~~
Comments:

Clock Time	Elapsed Time min.	sec.	Test Readings* (h) ft. m psi	Normalized Test Readings	Clock Time	Elapsed Time min.	sec.	Test Readings* (h) ft. m psi	Normalized Test Readings
		0	18.14	1.00			720	34.00	
		10	19.50	.91			∞	34.00	
		20	20.50	.85					
		30	21.40	.79					
		40	22.40	.73					
		50	23.20	.68					
		60	23.90	.64					
		70	24.80	.58					
		90	25.90	.51					
		120	27.60	.40					
		150	29.00						
		180	29.95						
		210	30.90						
		270	32.07						
		300	32.50						
		360	33.10						
		420	33.49						
		480	33.70						
		540	33.86						
		600	33.93						
		660	33.98						

*Readings uncorrected for variations in Barometric Pressure

Westbay Hydraulic Conductivity Test

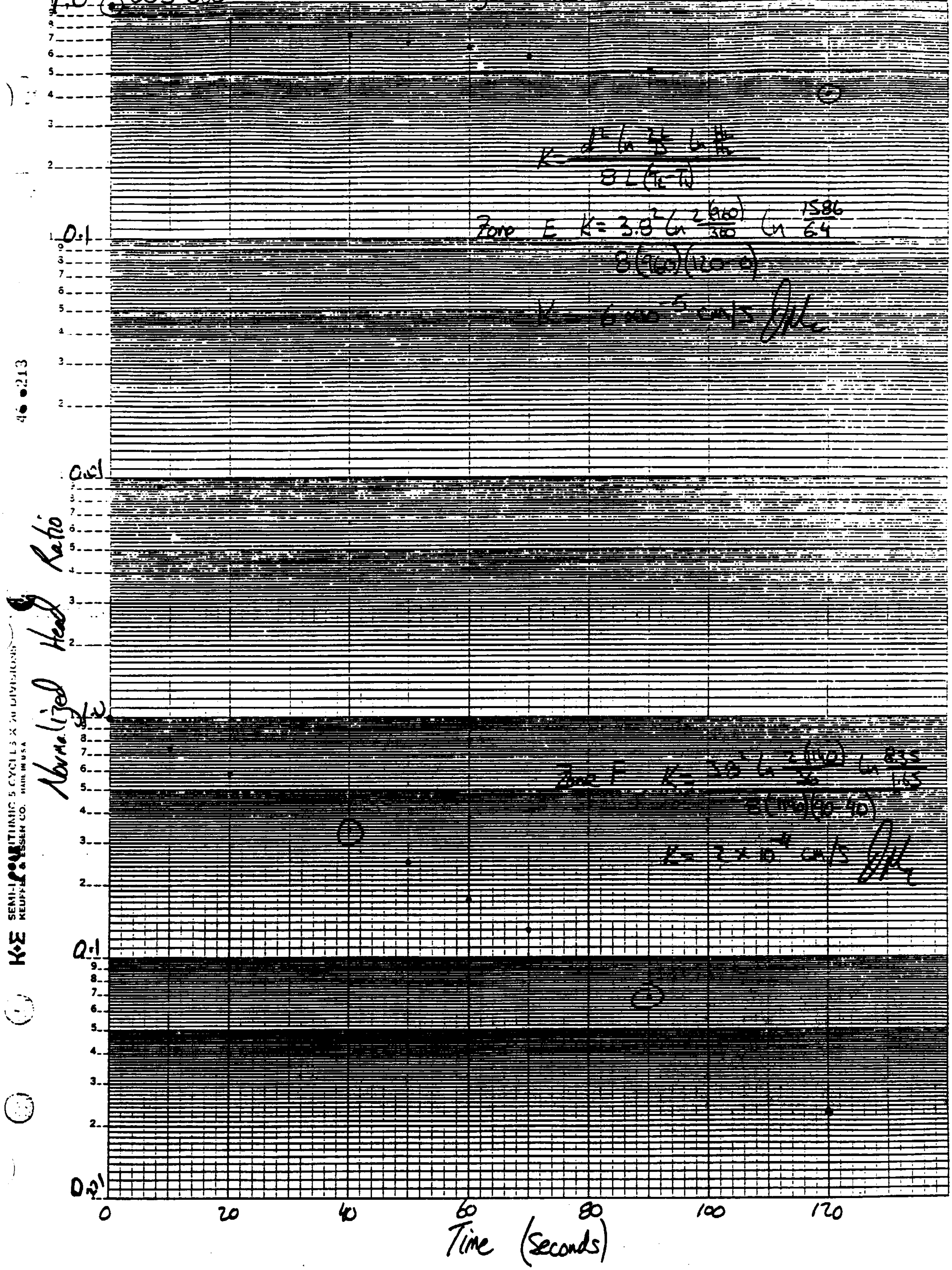
Field Data Sheet

Datum: 2 ft. A.G.S
Probe Type: WLT
Date: Jan 11/93
Job No.: 686
Elev. Ground Sfc: —
Serial No.: —
Monitoring Well No.: MW-10
Height MP Casing above Ground Sfc: 2 ft
Range: 0 to — psi
Project: EL Toro MCAS
Elev. top of MP Casing: —
Riser Diameter (d): 3.8 ~~in.~~ cm
Test Zone No.: F (100')
Test Type: Variable Head
Test Zone Diameter: 12"
Test Zone Interval: 990–1028 ft
Operator: DMc/DGM
Test Zone Length (L): 38 ft
Initial Head Difference (H_0): 24.37
Initial Test Reading (h): 63.12
Calculated Hydraulic Conductivity (k): 2 x10^{-4} cm/s
Analysis Method: Hvorslev
Static Water Level in Test Zone: 38.75 ft. ~~m/psi.~~
Comments:

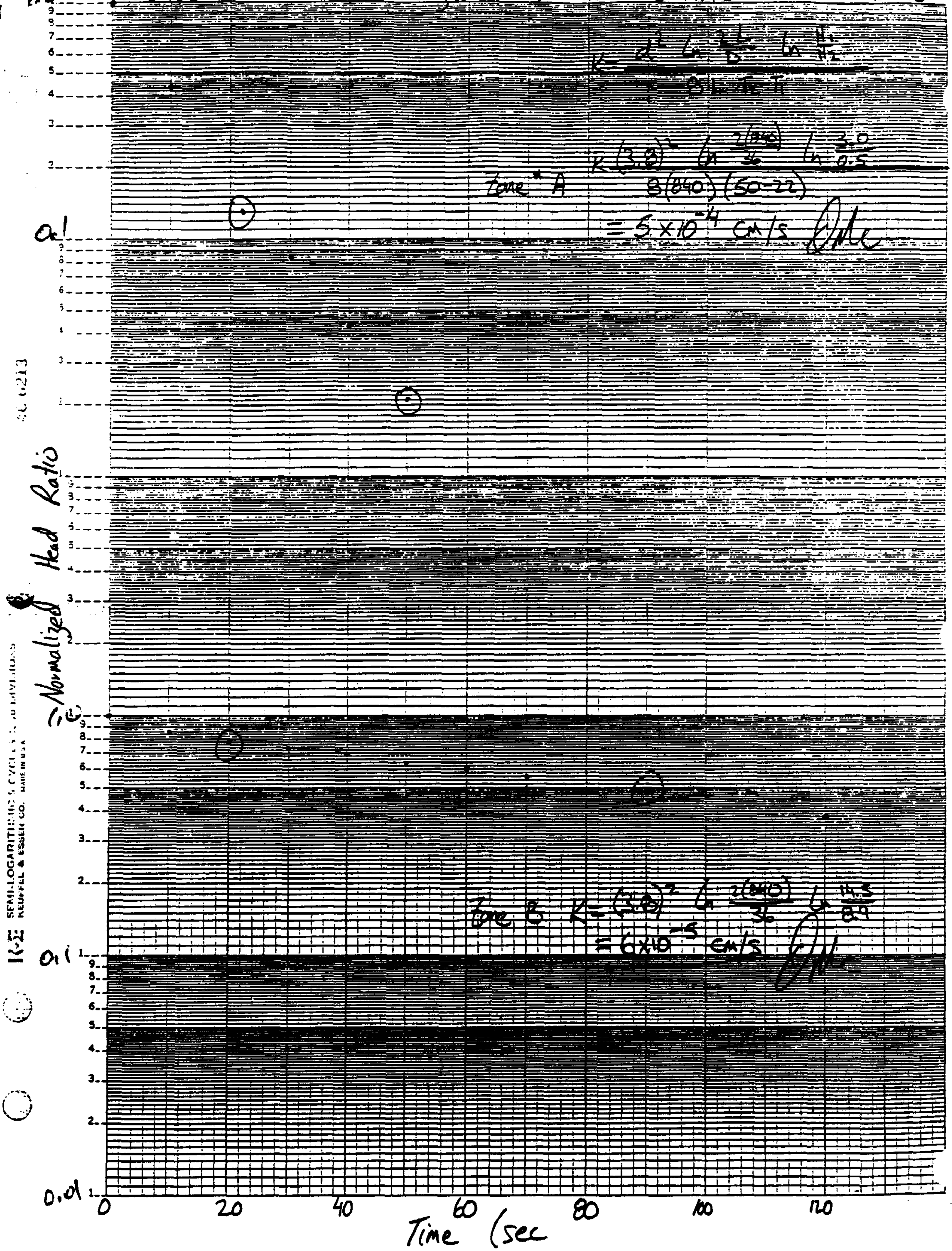
Clock Time	Elapsed Time min.	Elapsed Time sec.	Test Readings* (h) ft. m psi	Normalized Test Readings	Clock Time	Elapsed Time min.	Elapsed Time sec.	Test Readings* (h) ft. m psi	Normalized Test Readings
		0	63.12	1.00					
		10	57.00	.75					
		20	53.00	.59					
		30	50.00	.46					
		40	47.10	.34					
		50	44.80	.25					
		60	43.00	.174					
		70	41.90	.129					
		90	40.40	.068					
		120	39.30	.023					
		150	38.95						
		180	38.80						
		210	38.75						
		240	38.75						
		300	38.75						
		20	38.75						

*Readings uncorrected for variations in Barometric Pressure

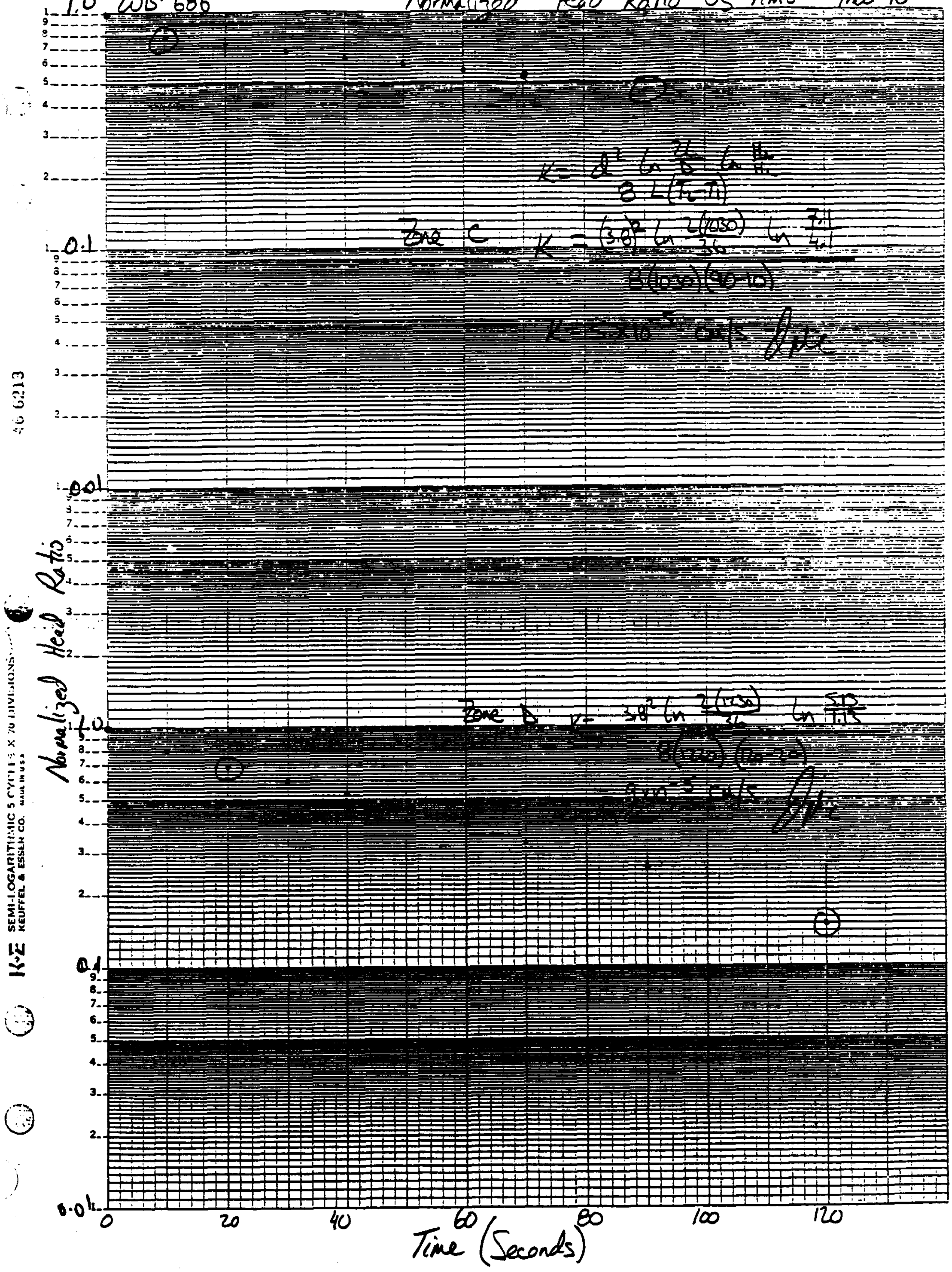
WB 686 Normalized Head Ratios VS Time MW-10



WB 686 Normalized Head Ratio Vs Time MW-10



1.0 WB-686 Normalized Head Ratio Vs Time MW-10



Westbay Instruments Inc.

PUMPING LOG
MP System Pumping Ports

Client: Beylik

Job No.: 686

Project/Location: El Toro MCAS.

Technician(s): Dale /DGM

Borehole No.: MW-10

Date: Jan 13/93

Drill Type: —

Drill Fluid: Mud

Zone No.: A (237')

Interval Length: —

Hole Size: 12"

Interval Depth: 227 ft

Elevation Head (wrt G.S.): ≈ 0 ft

Recommended Minimum Extraction: Stable Parameters

Date/Time Pumping Port Opened: Jan 13/93 Closed: Jan 13/93

Pump Type: Waterra

Pumping History

Date	Time	Volume Pumped	Cumulative Volume	Pumping Rate	ΔH	Comments
	8:30	—	—	≈ 2½ GPM		clear
	8:45	50	50	≈ 2½ GPM		clear
	9:00	50	100	≈ 2½ GPM		clear
	9:05	20	120	≈ 2½ GPM		clear

Apparent Transmissivity: T =

Westbay Instruments Inc.

PUMPING LOG
MP System Pumping Ports

Client: Beylik
Job No.: 686
Project/Location: EL Toro MCAS
Technician(s): DMc / DGM
Borehole No.: MW-10
Date: Jan 12/93
Drill Type: —
Drill Fluid: Mud
Zone No.: B (437')
Interval Length: —
Hole Size: 12"
Interval Depth: 432 ft
Elevation Head (wrt G.S.): ≈20 ft
Recommended Minimum Extraction: Stable Parameters
Date/Time Pumping Port Opened: Jan 12/93
Closed: Jan 12/93
Pump Type: Waterra

Pumping History

Date	Time	Volume Pumped	Cumulative Volume	Pumping Rate	ΔH	Comments
	2:25	0	0	≈ 2 GPM		clear
	2:45	50	50	"		dirty red brown fines
	3:05	50	100	"		clear
	3:15	20	120	"		clear

Apparent Transmissivity: T =

Westbay Instruments Inc.

PUMPING LOG
MP System Pumping Ports

Client: Beylik
Project/Location: EL Toro MCAS
Borehole No.: MW-10
Drill Type:
Drill Fluid: Mud
Zone No.: C (572 ft)
Hole Size: 12"
Elevation Head (wrt G.S.): ≈28 ft
Recommended Minimum Extraction: Stable Parameters
Date/Time Pumping Port Opened: Jan 12/93
Pump Type: Waterra

Job No.: 686
Technician(s): DGM/DMc
Date: Jan 12/93
Interval Length: —
Interval Depth: 572 ft
Closed: Jan 12/93

Pumping History

Date	Time	Volume Pumped	Cumulative Volume	Pumping Rate	ΔH	Comments
	12:30	0	0	≈ 2 G/M		clear
	12:45	50	50	"		clear
	12:46	0	"	"		dirty red brown
	13:03	50	100	"		clear
	13:20	50	150	"		clear

Apparent Transmissivity: T =

1

Westbay Instruments Inc.

PUMPING LOG
MP System Pumping Ports

Client: Beylik
Project/Location: EL Toro MCAS
Borehole No.: Mw-10
Drill Type: —
Drill Fluid: Mud
Zone No.: D (760 ft)
Hole Size: 12"
Elevation Head(wrt G.S.): ≃28 ft

Job No.: 686
Technician(s): DMc/DGM
Date: Jan 12/93

Interval Length: —
Interval Depth: 760 ft

Recommended Minimum Extraction: Stable Parameters
Date/Time Pumping Port Opened: Jan 12/93 Closed: Jan 12/93
Pump Type: Waterra

Pumping History

Date	Time	Volume Pumped	Cumulative Volume	Pumping Rate	ΔH	Comments
	10:20	0	0	≃ 2 GPM		clear
	10:40	50	50	"		clear
	10:45	—	50	"		dirty red brown (fines)
	11:00	50	100	"		clear.
	11:05	10.	110	"		clear

Apparent Transmissivity: T =

Westbay Instruments Inc.

PUMPING LOG
MP System Pumping Ports

Client: Beylik
Job No.: 686
Project/Location: El Toro MCAS
Technician(s): DMc/DGM
Borehole No.: MW-10
Date: Jan 12/93
Drill Type: —
Drill Fluid: Mud
Zone No.: E (894')
Interval Length: —
Hole Size: 12"
Interval Depth: 894'
Elevation Head(wrt G.S.): ≃32 ft
Recommended Minimum Extraction: Stable Parameters
Date/Time Pumping Port Opened: Jan 11/93
Closed: Jan 12/93
Pump Type: Waterra

Pumping History

Date	Time	Volume Pumped	Cumulative Volume	Pumping Rate	ΔH	Comments
Jan 12/93	7:55	0	0	≃ 2GPM		clear
	8:10	50	50	"		clear
	8:18					dirty red brown
	8:30	50	100	"		cloudy
	8:55	55	155	"		clear no fines

Apparent Transmissivity: T =

Westbay Instruments Inc.

PUMPING LOG
MP System Pumping Ports

Client: Beylik
Job No.: 686
Project/Location: EL Toro MCAS
Technician(s): DMc/DLM
Borehole No.: MW-10
Date: Jan 11/93
Drill Type: —
Drill Fluid: Mud
Zone No.: F (1010 ft)
Interval Length: 38 ft
Hole Size: 12"
Interval Depth: 1010 ft
Elevation Head (wrt G.S.): -36 ft
Recommended Minimum Extraction: Stable Parameters
Date/Time Pumping Port Opened: Jan 11/93
Closed: Jan 11/93
Pump Type: Waterra

Pumping History

Date	Time	Volume Pumped	Cumulative Volume	Pumping Rate	ΔH	Comments
	1:20	—	—	≈ 2 GPM		Start
	1:45	55	55	≈ 2 G/m		Clear
	1:50	—	55	"		dirty red brown (fines)
	2:00	50	105	≈ 2 G/m		dirty cloudy tan (fines)
	2:10	—	105	"		slightly cloudy (no fines)
	2:20	55	160	≈ 2 GPM		

Apparent Transmissivity: T =

MOSDAX Data Report (c) WESTBAY INSTRUMENTS 1990-1992

Date Of Report: Mon Jan 25 17:16:11 1993

Company Name: Beylik Drilling Inc.
Project Name: MCAS El Toro
Well ID: MW 10
Well Description:
Well Elevation: 0.00 (ft.)

Probe Information

Logical Probe-1 - Serial #: 1031 - Description: MOSDAX

Port Information

Port #:00 - Description	ATMOSPHERIC	- Depth	0.0	(ft.)	- ACF	1.0
Port #:01 - Description	LQA1	- Depth	1020.0	(ft.)	- ACF	1.0
Port #:02 - Description	ZONE #1	- Depth	1005.0	(ft.)	- ACF	1.0
Port #:03 - Description	SQA1	- Depth	990.0	(ft.)	- ACF	1.0
Port #:04 - Description	LQA2	- Depth	904.0	(ft.)	- ACF	1.0
Port #:05 - Description	ZONE #2	- Depth	889.0	(ft.)	- ACF	1.0
Port #:06 - Description	SQA2	- Depth	874.0	(ft.)	- ACF	1.0
Port #:07 - Description	LQA3	- Depth	770.0	(ft.)	- ACF	1.0
Port #:08 - Description	ZONE #3	- Depth	755.0	(ft.)	- ACF	1.0
Port #:09 - Description	SQA 3	- Depth	740.0	(ft.)	- ACF	1.0
Port #:10 - Description	LQA4	- Depth	582.0	(ft.)	- ACF	1.0
Port #:11 - Description	ZONE #4	- Depth	567.0	(ft.)	- ACF	1.0
Port #:12 - Description	SQA4	- Depth	552.0	(ft.)	- ACF	1.0
Port #:13 - Description	LQA5	- Depth	447.0	(ft.)	- ACF	1.0
Port #:14 - Description	ZONE #5	- Depth	432.0	(ft.)	- ACF	1.0
Port #:15 - Description	SQA5	- Depth	417.0	(ft.)	- ACF	1.0
Port #:16 - Description	LQA6	- Depth	237.0	(ft.)	- ACF	1.0
Port #:17 - Description	ZONE #6	- Depth	222.0	(ft.)	- ACF	1.0
Port #:18 - Description	SQA6	- Depth	207.0	(ft.)	- ACF	1.0

MOSDAX Data Report - PAGE 01

TIME DATE	PORT DESCRIPTION	PIEZ DP (ft.)	DEPTH (ft.)
Sat Jan 09 15:41:56 1993	LQA1	-96.05	1020.00
Sat Jan 09 15:41:56 1993	ZONE F	-38.83	1005.00
Sat Jan 09 15:41:56 1993	SQA1	-61.66	990.00
Sat Jan 09 15:41:56 1993	LQA2	-39.57	904.00
Sat Jan 09 15:41:56 1993	ZONE E	-33.10	889.00
Sat Jan 09 15:41:56 1993	SQA2	-61.71	874.00
Sat Jan 09 15:41:56 1993	LQA3	-30.91	770.00
Sat Jan 09 15:46:54 1993	ZONE D	-28.53	755.00
Sat Jan 09 15:51:39 1993	SQA 3	-60.35	740.00
Sat Jan 09 16:00:11 1993	LQA4	-25.04	582.00
Sat Jan 09 16:05:58 1993	ZONE C	-27.16	567.00
Sat Jan 09 16:10:55 1993	SQA4	-64.25	552.00
Sat Jan 09 16:17:56 1993	LQA5	-25.08	447.00
Sat Jan 09 16:21:57 1993	ZONE B	-19.97	432.00
Sat Jan 09 16:25:24 1993	SQA5	-61.38	417.00
Sat Jan 09 16:29:17 1993	LQA6	-50.47	237.00
Sat Jan 09 16:32:40 1993	ZONE A	1.09	222.00
Sat Jan 09 16:37:59 1993	SQA6	-44.36	207.00

Data Collected By:
DGM, DMc - 09/01/93

Westbay Instruments Inc.

Appendix G4

Multiple-Level Groundwater Monitoring with the MP System (29 May, 1989)

MULTIPLE-LEVEL GROUND WATER MONITORING

WITH THE MP SYSTEM*

W.H. Black, H.R. Smith and F.D. Patton

Westbay Instruments Ltd.
North Vancouver, B.C.

Abstract

Defining the extent of a groundwater contaminant plume in geologic materials requires a three-dimensional array of sampling points. Such an array is commonly installed by placing a single access tube and inlet screen in each of a series of boreholes. With this method, the number of sampling points at a given site is generally limited by the high cost of drilling. An alternative is to install monitoring points at many levels in each drillhole. Multiple-level monitoring can provide increased data density and therefore an improved understanding of site conditions. This paper describes how the MP System, one type of multiple-level monitoring well, is installed and operated. Field quality control procedures, 1) to verify the integrity of the access tube, inlet valves and screens, and drillhole seals, and 2) to confirm the operation of measuring and sampling equipment, are also discussed.

Introduction

When ground water contaminant plumes are suspected of having significant depth as well as lateral distribution, a three-dimensional array of monitoring points is needed to identify and characterize such plumes. Thus, ground water data must be obtained from a number of different locations and from a number of different depths at each location. As a result, either a large number of drillholes are required, each with a separate instrument installed, or instruments must be combined and installed at multiple levels in each of a smaller number of drillholes.

Reprint from Proceedings of the NWWA-AGU Conference on Surface and Borehole Geophysical Methods and Groundwater Instrumentation. Denver, Co., October 15-17, 1986, pp 41-61.

* Revised May 29, 1989. See Page 56.

Multiple-level ground water monitoring devices have been described by many writers including: Hansen and Harris (1974), Pickens et al. (1978), Patton (1979, 1983 and 1984), Cherry and Johnson (1982), Williams (1982), Barvenik and Cadwagan (1983), Davison (1984), Smith et al. (1984), Novakowski et al. (1985) and Molz et al. (1986). Patton and Smith (1986) proposed a classification of multiple-level ground water monitoring wells. Rehtlane and Patton (1982), Barvenik and Cadwagan (1983) and Nazar et al. (1984) have addressed some of the advantages to schedules and costs which can result when multiple-level monitoring devices are used to reduce the number of drillholes required. More important, however, are the technical advantages that accrue from the increased data density and from the field verification procedures that are available.

The basic requirements of any ground water monitoring system are that it provide the user with the ability to measure fluid pressure, purge the monitoring zone prior to sampling, obtain fluid samples, and undertake standard hydrogeologic tests, such as permeability tests and tracer tests. In addition, quality assurance plans for groundwater monitoring programs have led to a requirement for periodic testing and calibration of all aspects of ground water monitoring devices.

Quality assurance plans normally require field verification tests immediately following installation and again at periodic intervals during the operating lifetime of the installation. Not all ground water monitoring devices allow extensive field verification tests to be carried out. However, some types of multiple-level monitoring instruments, such as the MP System developed by Westbay Instruments Ltd., were designed with field verification tests in mind (Patton and Smith, 1986). With such systems, questions of data quality can be readily addressed.

General Description of the MP System

The MP System is a modular multiple-level ground water monitoring device employing a single, closed access tube with valved ports. The valved ports are used to provide access to several different levels of a drillhole in a single well casing. The modular design permits as many monitoring zones as desired to be established in a drillhole. Furthermore, at the time of installation, zones may be added or modified without affecting other zones or significantly complicating the installation.

The MP System consists of casing components, which are permanently installed in the drillhole, portable pressure measurement and sampling probes, and specialized tools. The casing components include casing sections of various lengths, regular couplings, two types of valved port couplings with different capabilities, and packers, which seal the annulus between the monitoring zones. The MP System has been used in many different geologic and climatic environments in drillholes ranging from a few feet to 4,000 ft (1,200 m).

Casing Components

The casing components of the MP System are made in either plastic or stainless steel. The descriptions that follow apply to both types of materials. Most of the components referred to are shown in Figures 1 and 2.

Casing

MP casing is supplied in a number of different lengths to provide flexibility in establishing the position of monitoring zones and associated seals in the drillhole. Common nominal casing lengths are 5 ft (1.5 m) and 10 ft (3.0 m). Actual casing lengths are less than the nominal lengths to account for the lengths of the couplings. The casing ends are machined to mate with MP System couplings.

Telescoping casing sections are used to protect the casing string from damage when ground movements are anticipated or where measurements of vertical displacements are desired.

Regular Couplings and End Caps

MP regular couplings are used to connect casing lengths where valved couplings are not required. The couplings incorporate O-rings for a positive hydraulic seal. A flexible shear rod assures a tensile connection. No adhesives are used when joining casings and couplings. Regular couplings incorporate an internal, helical shoulder for the accurate location of probes and tools in the well. End caps are placed on the bottom of a casing string. They also incorporate an O-ring seal so that the entire casing string is hydraulically sealed during installation. End caps are frequently used to seal the top of the casing between monitoring periods.

Valved Couplings

There are two types of valved couplings, measurement port couplings and pumping port couplings. Measurement port couplings (or measurement ports) are used where pressure measurements and fluid samples are required. In addition to the features of a regular coupling, measurement ports incorporate a valve in the wall of the coupling, a leaf spring which normally holds the valve closed, and a cover plate which holds the spring in place. When the valve is opened, an access port is provided for the ground water to enter the coupling.

Pumping port couplings (or pumping ports) are used where the injection or withdrawal of large volumes of fluid is desired (such as for well development or hydraulic conductivity testing). Pumping ports incorporate an interior sleeve valve, sealed by O-rings, which can be moved to expose or cover slots that allow ground water to pass through the wall of the coupling. A screen is normally fastened around the coupling outside the slots.

Seals

When there are many monitoring zones in a single drillhole, multiple seals are required to prevent fluid migration from one zone to another

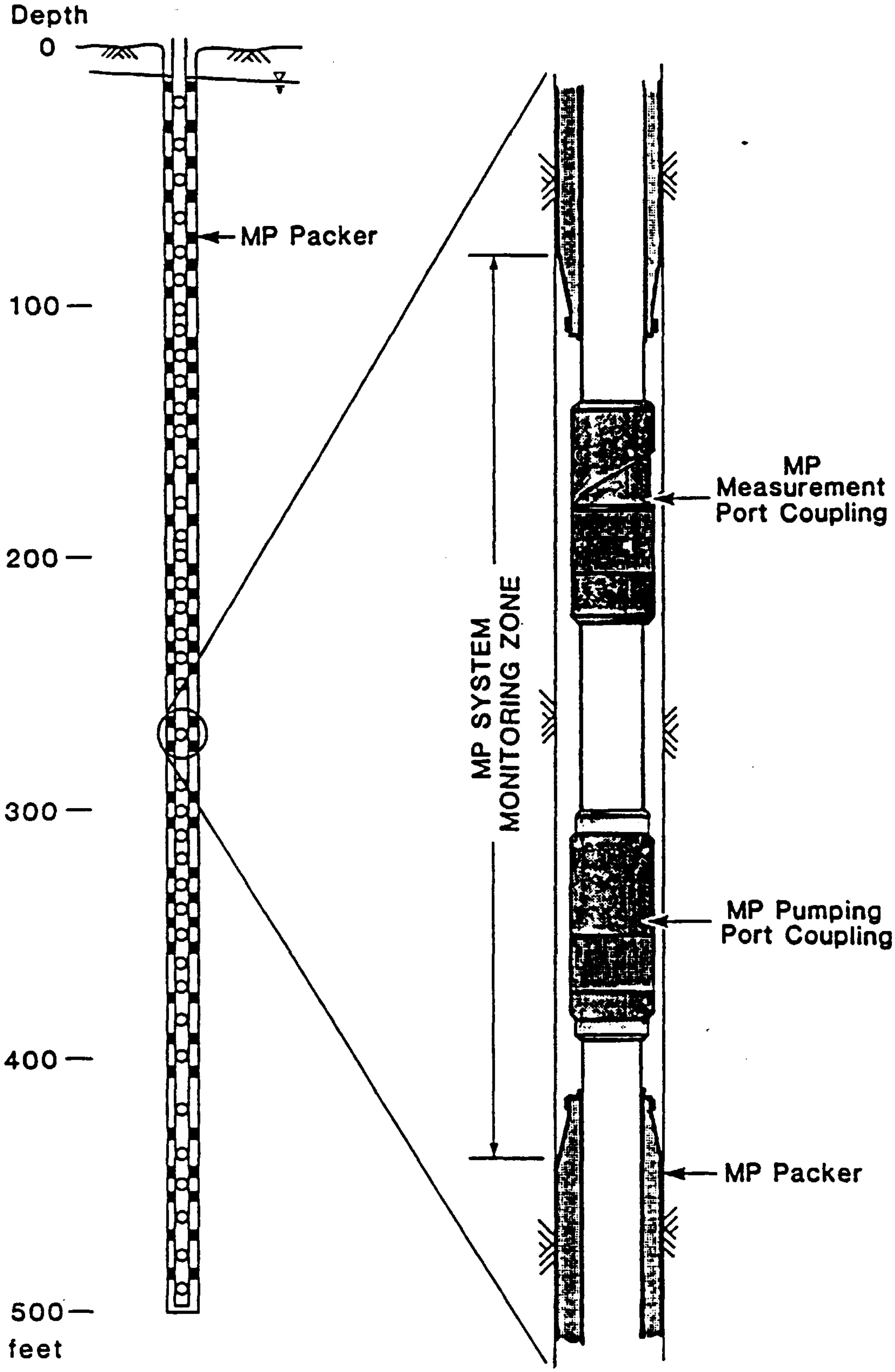


Figure 1. MP System installation with monitoring zones isolated by packers.

along the annular opening between the drillhole wall and the casing. Placement of these seals can be difficult with any ground water monitoring device. However, considerable success has been achieved with two types of seals used with the MP System, provided each is combined with specific drilling and placement methods.

With the MP System seals can be obtained by: a) using hydraulic (water) inflatable packers or b) backfilling with alternating layers of sand and bentonite or grout. A drillhole containing the MP System with packers is shown in Figure 1. A single measurement zone where the MP System is completed by backfilling is shown in Figure 2. Both sealing methods are possible in most environments, but in some situations one or the other may be preferred.

Hydraulic Inflatable Packers

MP casing packers incorporate an expandable gland mounted over a standard length of MP casing and a one-way valve that allows fluid to travel through the wall of the casing into the packer and prevents this fluid from flowing back out of the packer. Gland lengths are typically 3 ft (~1 m), although short glands are available which would permit monitoring zones to be placed as close as every 1.5 ft (0.46 m).

Packers are recommended for: a) small diameter drillholes (those too small for good quality backfilling to be achieved), b) deep drillholes, and c) sealing against significant flows (e.g., flowing artesian conditions) in the drillhole. When packers are used, field labour is reduced since packer inflation is generally much faster than backfilling.

Backfilling is recommended for: a) large diameter drillholes, b) shallow drillholes, c) drillholes where little or no fluid circulation is anticipated in the hole during installation (i.e., when near-hydrostatic fluid pressures or low hydraulic conductivity is present over the length of the drillhole), and d) where packer gland materials are incompatible with the chemistry of the fluids present.

Backfill seals may include bentonite and/or grout slurries, bentonite chips or pellets or other materials with a relatively low hydraulic conductivity in comparison to that of the natural formations present.

Screens and Filters

Where both pumping ports and measurement ports are being used and the ports are likely to be surrounded by sand fill or collapsed geologic material, a single well screen is generally placed over both the measurement port coupling and pumping port coupling in each monitoring zone as shown in Figure 2. The screen helps ensure that the zone influenced by pumping from a pumping port coupling will extend to and include the region surrounding the adjacent measurement port coupling. Screen slot size and length should be chosen with a knowledge of local site conditions. If only fluid pressure measurements are required, a simpler fabric filter tube can be placed over the measurement port

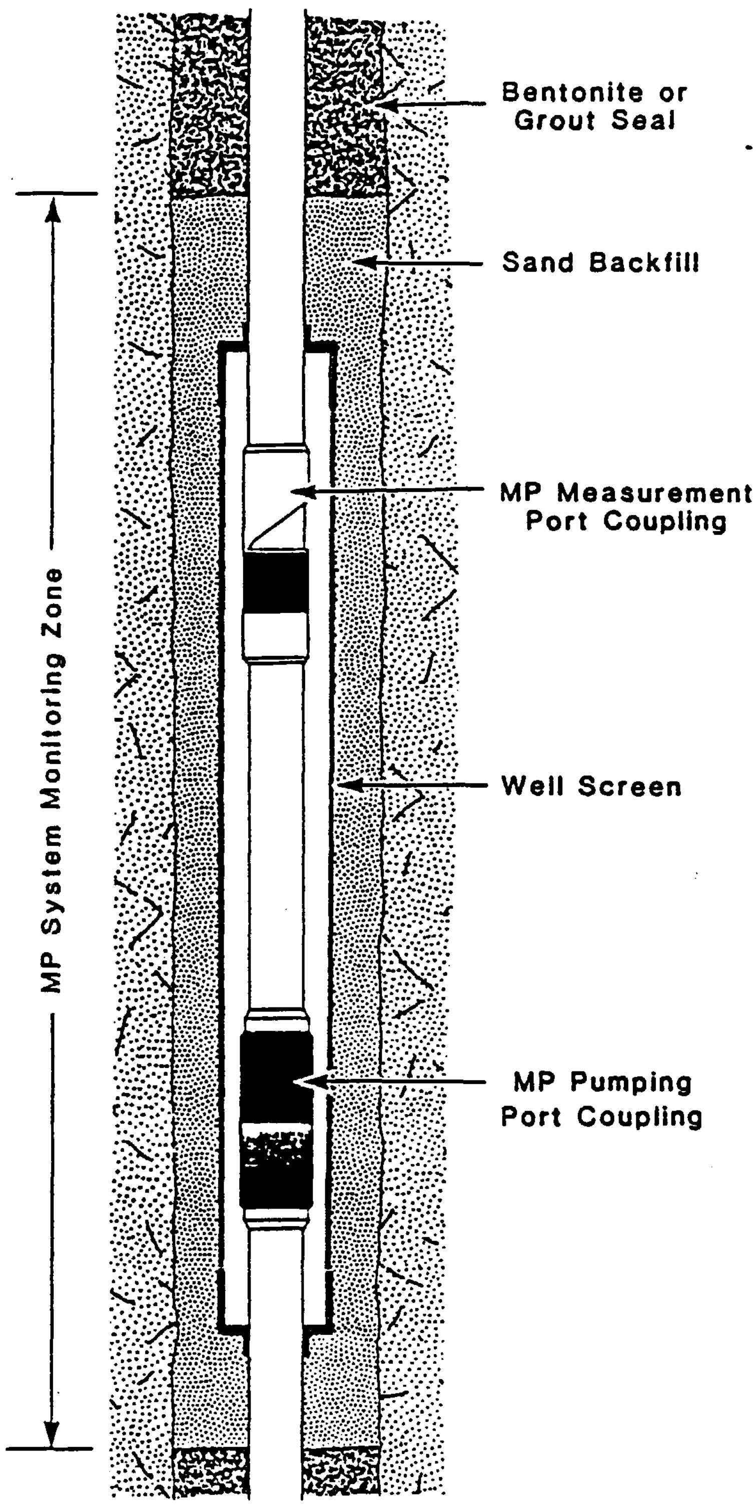


Figure 2. MP System monitoring zone isolated by backfilling

coupling and clamped at either end. This filter will help maintain the length of the monitoring zone and protect the measurement port valve from fine particles. The filter material should be compatible with the chemistry of the fluids present.

Installation Procedures

Selection of Casing Components

The valved couplings (measurement port couplings and pumping port couplings) allow many monitoring zones to be established in a single drillhole. Horizons of hydrogeological interest are targeted on the basis of the best drillhole geologic and geophysical logs available. An installation log is prepared showing the locations of the casing components. If only fluid pressures are needed, only a measurement port coupling is required in each monitoring zone. If sampling, fluid withdrawal or fluid injection is anticipated, both a pumping port coupling and a measurement port coupling are recommended in each monitoring zone. This is the case illustrated in Figures 1 and 2.

The casing lengths are chosen based on the desired locations of the monitoring zones and sealing elements. This requires an interpretation of the hydrogeologic conditions anticipated in each drillhole. Caliper logs and TV logs can be useful in selecting packer locations.

If consolidation or heave is expected along the borehole axis, telescoping casing sections may be used to minimize the opportunity for compressional or tensile forces to damage the casing.

MP Casing Installation

The downhole MP System components - casing, couplings and packers- are laid out at the site of the proposed monitoring well in accordance with the casing installation log. At that time, any last minute adjustments required to make the positions of the monitoring zones and seals match hydrogeologic details of the drillhole are completed and the appropriate revisions made to the installation log.

Next, the required coupling is attached to the top of each length of casing. The casing layout is checked again for compliance with the installation log. The casing string is then assembled by lowering the casing segments into the drillhole and attaching each successive segment to the adjacent coupling one at a time.

In collapsing soil and poor quality rock, MP casing with packers and screens may be installed inside 3 inch (76 mm) I.D. (H-size) wireline drill rods or equivalent. An H-size drill bit will result in a 4 inch (100 mm) drillhole. In noncollapsing soil and good quality rock, MP casing with packers may be placed in open drillholes from 3 to 4-1/2 inches (76 to 115 mm) in diameter. Casing without packers can be placed in various sizes of drillholes, with or without protective casing, as long as the drillhole diameter (and casing) is compatible with the backfilling method. Good backfilling techniques usually involve the use of one or more tremie pipes. During placement of the MP System casing in holes where there is a high static water level, clean water may be added to the inside of the MP casing to reduce its buoyancy.

Once the MP casing has been placed in the drillhole, the packers are inflated (see Figure 3) or backfill is placed (see Figure 2). If the MP casing was lowered inside protective steel rods or casing, this casing may be withdrawn all at once or in steps as the packer inflation or backfilling operation proceeds. An incremental casing withdrawal can reduce the opportunity for the drillhole wall to loosen and cave prior to the placement of seals.

Packer Inflation

Figure 3a shows the appearance of the casing packer when it has been placed in a drillhole before inflation. Figure 3b shows how the MP System casing packers are individually inflated using a packer inflation tool. This tool is lowered down the inside of the MP casing and is located in the correct position by the location arm seating in a coupling adjacent to the packer.

Two small packers (tool packers) are inflated. They isolate the short segment of the casing containing the valve for the casing packer. At a pre-set pressure, the tool injection valve opens and water is injected into the casing packer. Figure 3c shows the inflated MP packer after the inflation tool has been removed.

Packer inflation proceeds from the bottom of the hole to the top. There are no permanent inflation lines leading to each packer which would compromise the sealing conditions of adjacent packers. As a result, there is effectively no limit to the number of packers that can be placed in a drillhole apart from the finite limitations of packer length and drillhole depth.

Development of Monitoring Zones

The strategy for developing the monitoring zones may vary depending on site conditions. Figure 4 shows a typical sequence of events in developing measurement zones. Figure 4a shows a typical drillhole environment where the invasion of drilling fluids and/or the circulation of formation fluids has caused ground water adjacent to the drillhole to be nonrepresentative of the formation fluid. Once the casing and annular seals (packer seals are shown in Figure 4b) have been installed, the development of the monitoring zones can proceed. Monitoring zones can be developed individually or several at a time (as shown in Figure 4c). Individual hydrogeologists and hydrochemists may prefer different development techniques depending upon local conditions. However, the development procedures are essentially the same as would be used for a single standpipe piezometer. One procedure which has been successfully used is described below.

1) An acceptable and convenient tracer is added to the drill fluid during drilling.

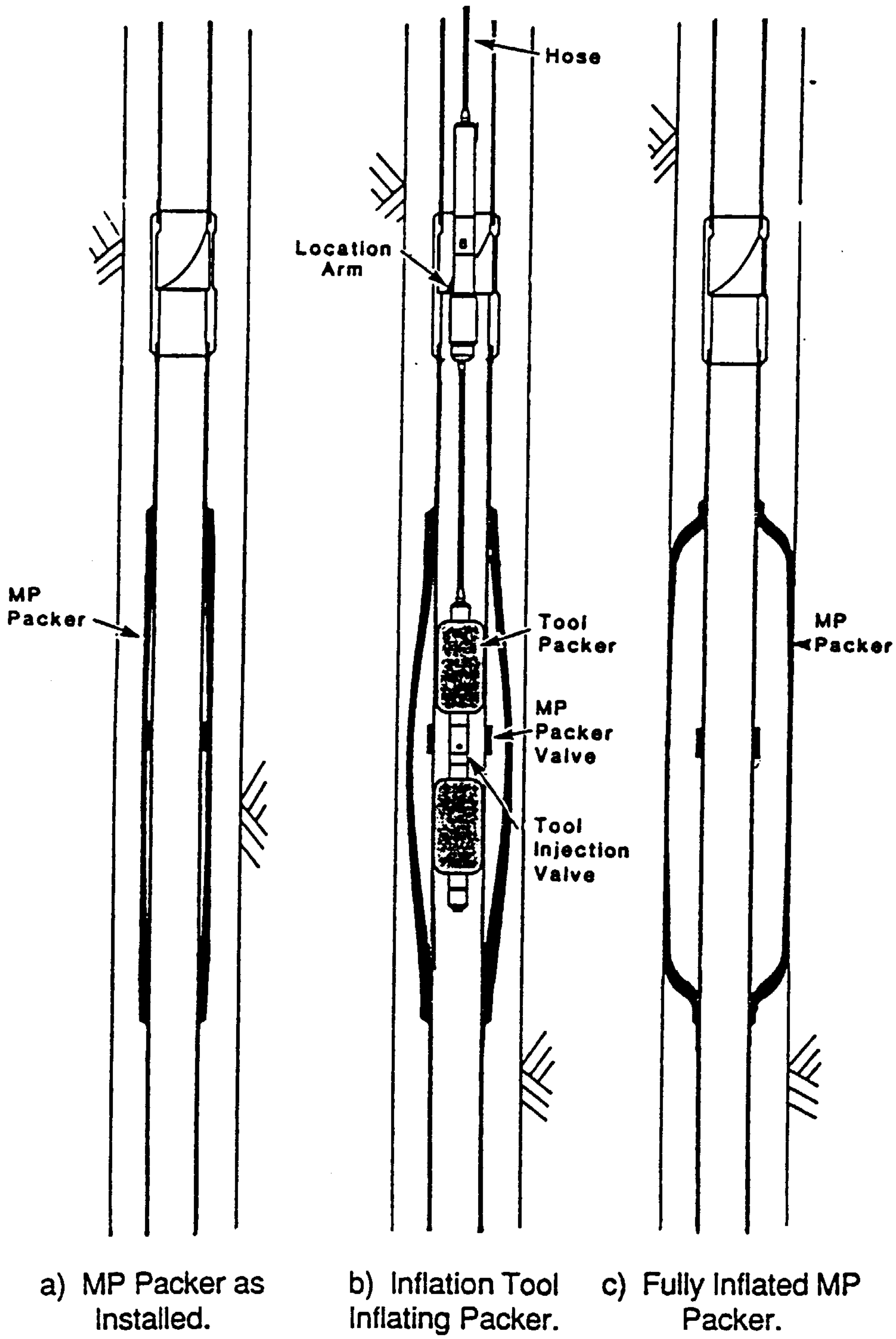


Figure 3. Steps in the inflation of an MP System packer.

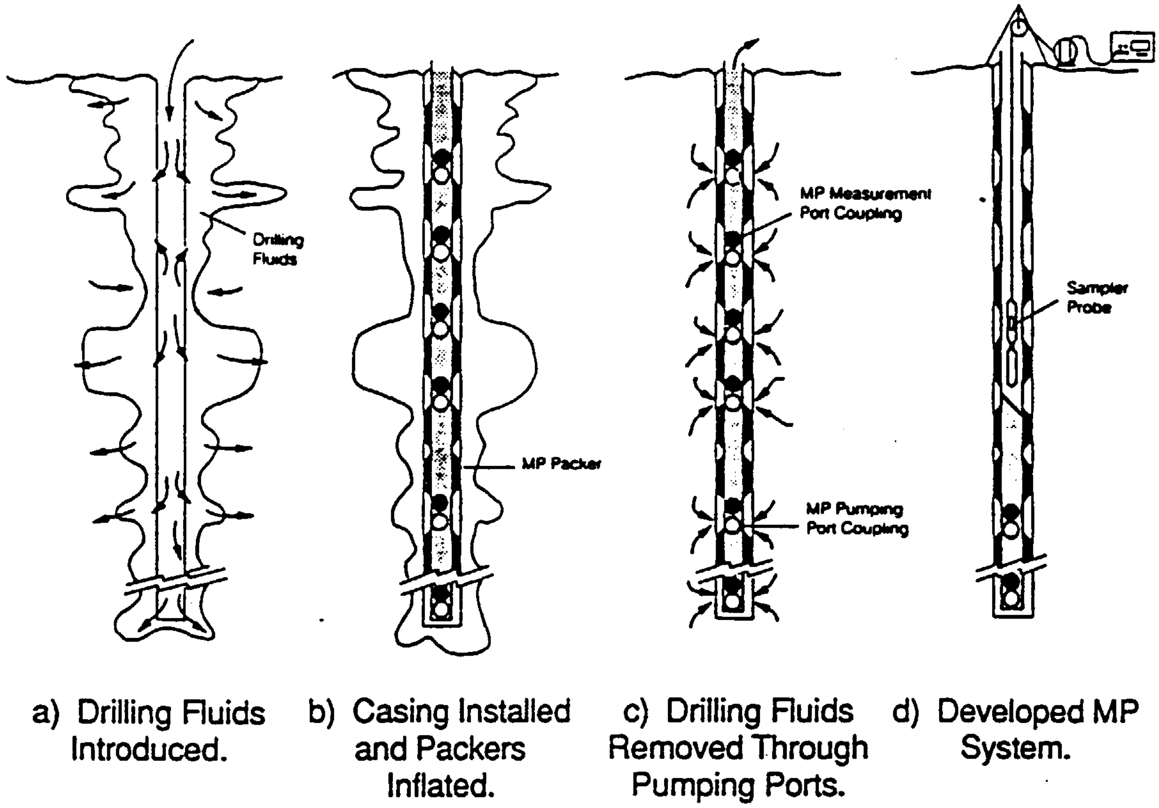


Figure 4. Typical sequence of events in developing monitoring zones.

2) After the casing has been installed and the packers have been inflated, the pumping ports in all or a portion of the monitoring zones are opened with the use of an open/close tool.

3) Fluid from the inside of the MP casing is airlifted out of the hole. During this procedure the bottom of the air lift must be kept well above the open pumping port valves. The volume of fluid removed and the pumping time will depend on many factors including: the drilling method, the length of time the hole was left open prior to completion, the hydrogeological conditions in the drillhole, and the accuracy required. The tracer can be helpful in determining when the pumping is completed.

4) Once the pumping has been completed, all the pumping ports except one are closed with the used of the open/close tool. With one pumping port open, the MP casing is hydraulically identical to a standpipe piezometer. A small quantity of fluid may be pumped from inside the MP casing to complete the development of this monitoring zone. Hydrogeologic testing of this zone and its adjacent casing seals can be done at this time. For example, slug tests can be undertaken to obtain transmissivity and storativity values. This pumping port can then be closed, the next one opened and the process repeated.

Following development, the MP system is ready for sampling and for pressure measurements as indicated in Figure 4d.

Operation of the Pumping Ports

To operate the pumping port valve, an open/close tool is used as illustrated in Figure 5. This tool has spring-loaded "jaws" which can be mechanically activated from the surface. The pumping port is shown closed in Figure 5a. To open the valve, the tool is lowered on a wireline with the jaws extended and pointing upward (i.e., so that they will catch on shoulders when the tool is raised). In this condition, the jaws will spring through the couplings as the tool is lowered to just below the desired pumping port coupling. The tool is then pulled up so that the jaws engage the bottom shoulder of the sliding valve. By continuing to pull up on the wireline, the valve can be opened, as in Figure 5b. Once the valve is opened, the jaws can be collapsed into the housing and the tool recovered. With this one valve opened, fluids can be added to or removed from the monitoring interval by injecting or pumping from the MP casing. Other zones may still be monitored in the normal manner using a pressure probe or sampling probe as they will not be hydraulically connected to the interior of the casing.

To close the pumping port coupling, the open/close tool is brought to the surface and the housing is reversed so that the jaws point downward (i.e., the tool will stop on exposed shoulders when the tool is lowered). The tool is lowered to the open pumping port with the jaws collapsed into the housing. Once the tool is located near the pumping port, the jaws are released and the valve is closed by tapping on the top shoulder of the sliding valve with the tool.

Testing and Monitoring

Fluid Pressure Measurements

Fluid pressure measurements can be made at each location in a drillhole where an MP measurement port coupling has been installed. The measurement coupling includes a helical landing ring and a leaf spring valve which is normally closed. The fluid pressure is measured using a pressure probe which incorporates a location arm, a backing shoe, a face seal, and a fluid pressure transducer. These features are shown on Figure 6. The probe is operated on a cable and a readout unit at the surface displays the transducer output. Electric pressure probes also display the temperature of the transducer.

The following procedure is used to make fluid pressure measurements. The probe is lowered to a point below the deepest measurement port to be accessed. The backing shoe is briefly activated (extended). This releases the location arm from within the probe body. The location arm will remain out until the probe is removed from the borehole and the location arm can be manually pushed back into the body. The probe is raised to just above the lowest measurement port coupling and then lowered until the location arm rests on the helical landing ring inside the coupling. The weight of the probe will cause it to rotate into position

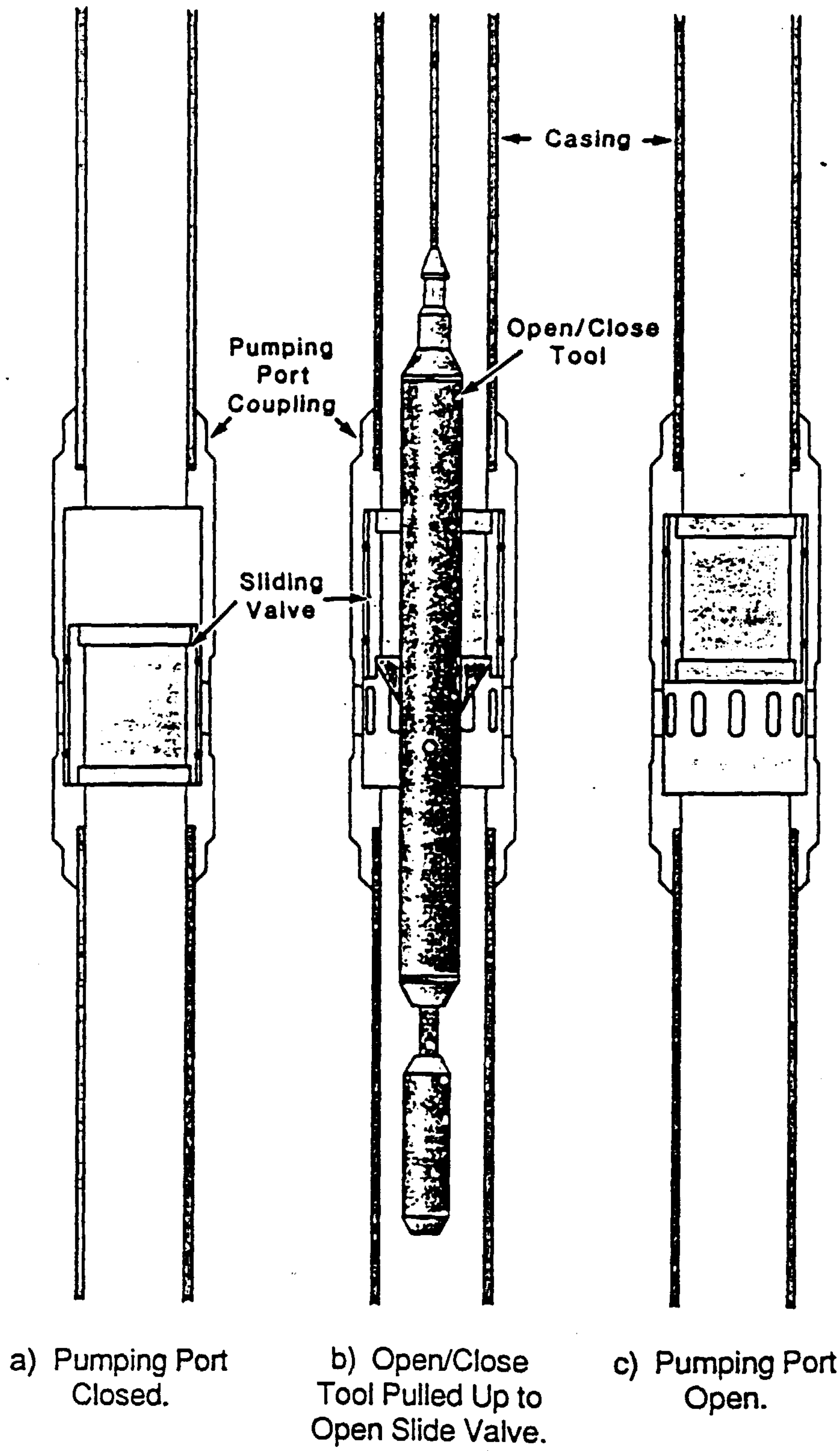


Figure 5. Steps in opening an MP pumping port.

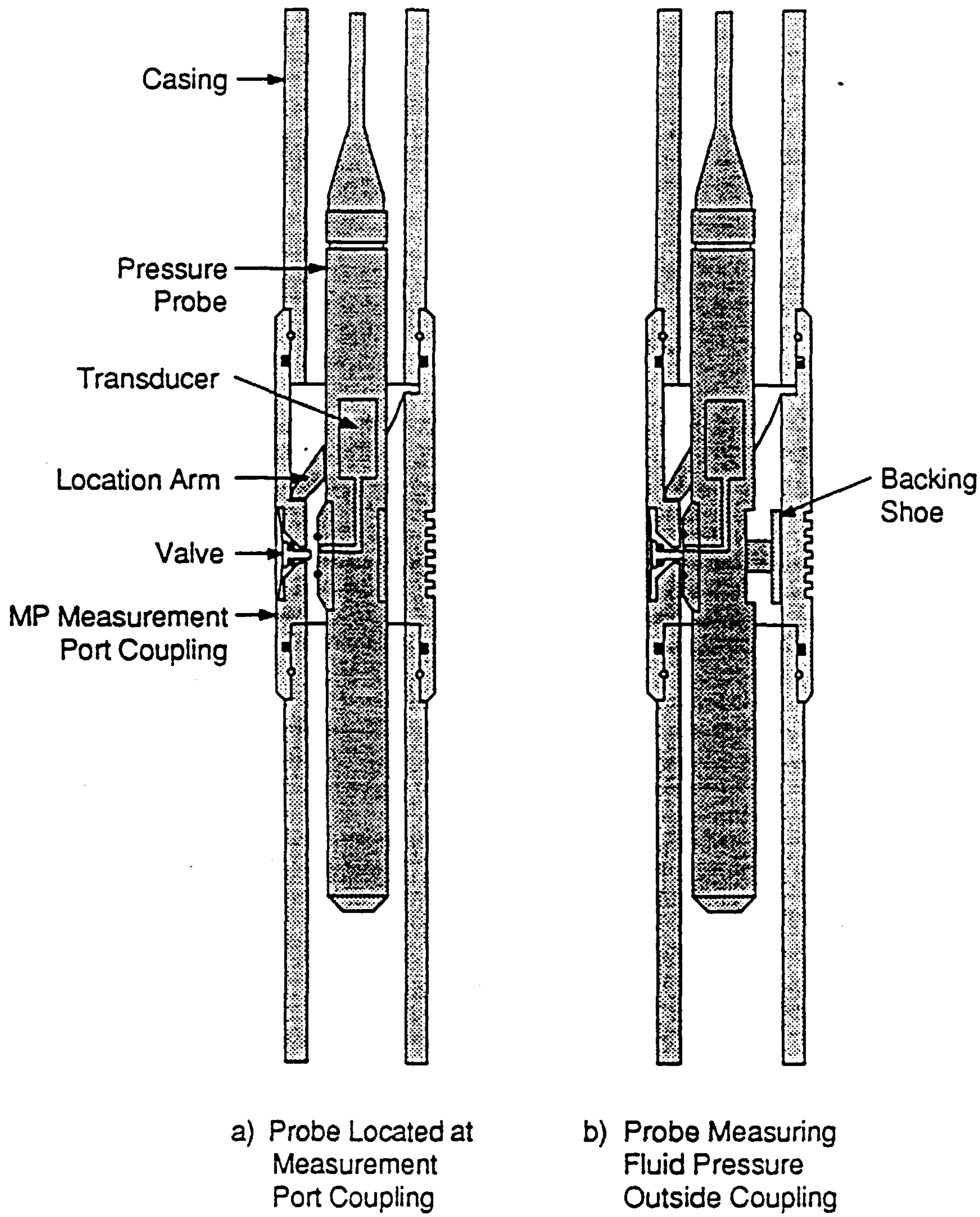


Figure 6. Operation of an MP pressure probe.

at the correct depth and orientation to operate the valve (Figure 6A). At this point the pressure transducer will be measuring the fluid pressure inside the MP casing at that depth and this reading will be displayed on the surface data unit.

The backing shoe is then activated. It pushes the probe to the wall of the coupling so that the face seal on the probe seals around the measurement port valve at the same time as the face of the probe pushes the valve open. The transducer is now hydraulically connected to the fluid outside the coupling and isolated from the fluid inside the casing (Figure 6B). The reading displayed on the surface data unit will be the fluid pressure in the formation outside the measurement port. After the reading has been recorded, the probe backing shoe is deactivated (retracted) and the valve in the coupling reseals. The probe will again be measuring the fluid pressure inside the MP casing (Figure 6A).

The probe is then moved up to the next measurement port and the procedure is repeated.

Fluid Sampling

Fluid samples are obtained by lowering a sampling probe and sample container to the desired measurement port coupling. As shown on Figure 7, the sampling probe operates in similar fashion to the pressure probe except that a ground water sample is drawn through the measurement port coupling.

The procedure for taking a ground water sample is as follows. A clean, empty sample container (sample bottle) is attached to the sampling probe. The sampling valve is closed to prevent the fluid inside the MP casing from entering the sample container. The probe and container are lowered to below a selected measurement port coupling. The backing shoe is briefly activated to release the location arm and the probe is then positioned in the measurement port coupling (Figure 7A).

The backing shoe is activated and pushes the probe to the wall of the coupling so that the face seal on the probe seals around the measurement port valve at the same time as the face of the probe pushes the valve open. The interior passage of the probe is now hydraulically connected to water outside the coupling (Figure 7B).

The sampling valve in the probe is opened by the surface controls allowing fluid from outside the measurement port to enter the sample bottle (Figure 7C). Once the bottle is full, the sampling valve is closed (Figure 7B), the backing shoe is deactivated (retracted) (Figure 7A) and the sampling probe and sample bottle are pulled to the surface. The sampling probe can then be cleaned, a clean bottle attached and the procedure repeated.

The advantages of this discrete sampling method can be summarized as follows:

1) The sample is drawn directly from formation fluids outside the measurement port and the fluids inside the casing are unlikely to be

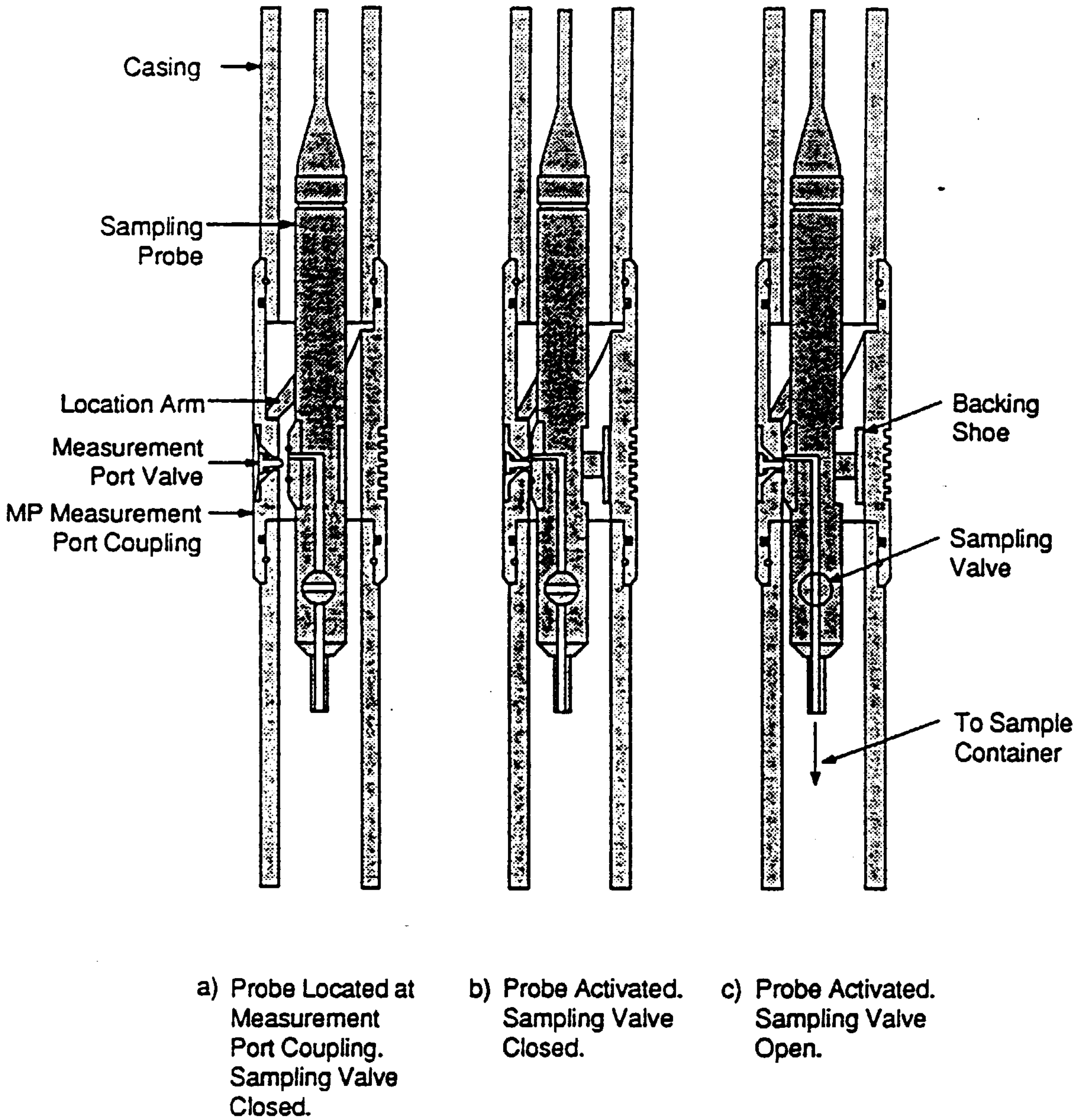


Figure 7. Operation of an MP sampling probe.

a significant factor. Therefore, there is no need for pumping a number of well volumes prior to each sampling period. Because there is no pumping prior to sampling, the sample is obtained with minimal distortion of the natural ground water flow regime.

2) The lack of pumping means samples can be obtained very quickly, often at an average rate of one sample every 5 to 10 minutes.

3) The sample travels a short distance into a sample container, typically from 1 to 2 ft (0.3 to 0.6 m), regardless of depth.

4) There is a greatly reduced requirement to safely dispose of purged fluids containing contaminants.

Several different containers can be used for samples. Samples can be obtained which have had no contact with the atmosphere. Containers are also available which maintain the sample at the pressure in the formation during recovery from the well and transportation to a laboratory. Other containers allow the sample to depressurize as it is brought to the surface.

One type of container, which is used for collecting samples for volatile organic analysis, is illustrated in Figure 8. With this container, the sample flows from the sampling probe through a 1/8 inch teflon tube and stainless steel hypodermic needle directly into a 40 ml VOA glass sample bottle. A second needle vents the glass bottle so that a full sample bottle can be collected. The second needle, together with the one-way pressure relief valve, also permits flushing of formation fluids through the sample bottle before the final sample is collected. In this manner, VOA samples can be taken and transported to the laboratory without ever removing the lid of the bottle and exposing the sample to the atmosphere.[1]

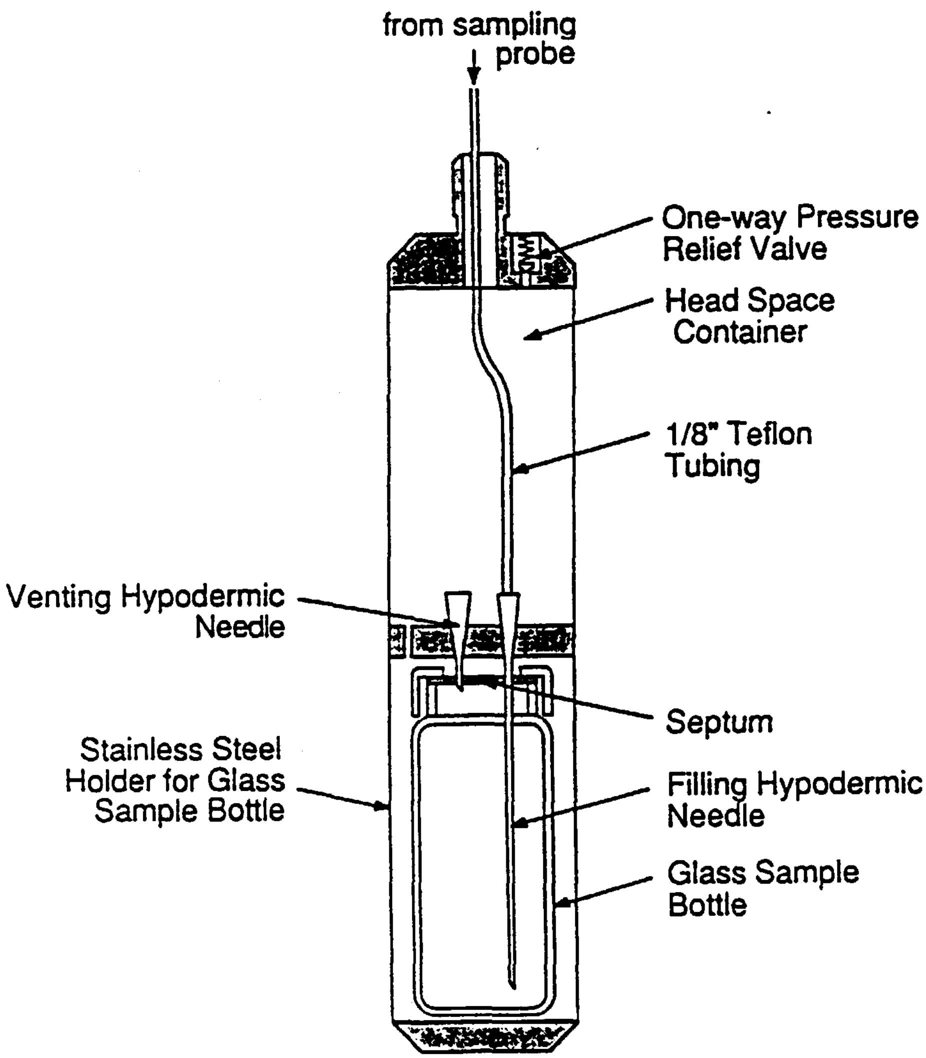


Figure 8. Sample bottle holder containing glass VOA sample bottle.

[1] More recent information has shown that sample quality will be affected unless the septum which has been perforated by the needles is replaced with a new, unperforated septum. Contact Westbay for further information. (Rev. May, 1989)

Field Quality Control Procedures

There are two distinctive parts to any quality assurance program. The first involves manufacturing and testing procedures which avoid the production or installation of equipment that may result in the collection of erroneous data. The second involves field operational procedures which will ensure that erroneous data are not generated as a result of the failure of borehole components or probes to function as intended. Although the first part is necessary to allow the installation of useful monitoring wells, the second must also be rigorously applied to identify sources of erroneous and misleading results.

The MP System has many unique features for field quality control which clearly separate it from other types of ground water monitoring instrumentation. This is the result of designing components in response to the stringent requirements of users in the fields of nuclear and hazardous waste management.

Quality control tests are carried out at various points during the field use of the MP System and tend to be grouped into three periods: during installation, following installation, and during routine monitoring.

<u>During Installation</u>

During installation of the MP System the following operations form part of the quality control procedures.

Drill core or cuttings and geophysical logs are carefully checked to see that monitoring zones and annular seals are placed at the optimum positions.

Casing components are carefully inspected to see that critical surfaces are undamaged, sealing O-rings are clean and in place, and components are correctly oriented. Serial numbers of port couplings are recorded and their position in the installation noted. These operations tie the field quality control to production test results.

When the MP casing string is lowered into the drillhole, the water level inside the casing can be kept at a different level than the water outside the casing. The level inside can be checked periodically to see that no leaks have developed. Also, each joint can be pressure tested to provide further verification of the integrity of hydraulic seals.

During inflation of each MP packer, incremental volumes and pressures are recorded and plotted. These data allow an evaluation of drillhole conditions and the quality of the annular seal obtained.

<u>Following Installation</u>

Immediately following installation further checks are carried out to verify the operation of the system. These include the initial pressure profile which serves to confirm the operation of the inlet valves of the measurement port couplings. Observed head differences across exterior casing seals direcly indicate the seal effectiveness. Where such head differences are not observed, the annular seals can be artificially stressed by opening a pumping port in one monitoring zone and withdrawing or adding a slug of water from inside the casing while using the pressure probe to observe the pressure response in the monitoring zone on the other side of the seal.

Packers can be reinflated at any time following installation and the pressure at which further fluid injection occurs can be compared with the final injection pressure recorded during the initial inflation.

During Routine Monitoring

A number of quality control checks are built into the routine monitoring procedures.

When measuring fluid pressures, the pressures measured inside the MP casing at each measurement port are recorded immediately before and after the measurement made through the port. These inside casing values serve a number of purposes: 1) comparison of the two values confirms that the transducer was operating the same way after the reading as before, 2) comparison of the inside values from one set of measurements to the next confirms transducer stability over the intervening time period, and 3) if the head of fluid inside the MP casing is known, a direct field calibration of head of water versus transducer pressure output is obtained. In addition, when the electric pressure probe is used, the temperature of the pressure transducer is recorded and may be used to further correct the transducer output. Any unacceptable changes which show up during monitoring can be checked and corrected by laboratory calibration of the instrument.

Water sampling procedures with the MP System improve quality control because: 1) the short flow path between the formation and the container greatly reduces the surface area contacted by the sample, 2) the contacts between the water sample and the atmosphere are eliminated, and 3) when the water level inside the MP casing can be observed during sampling and no change is noted, this confirms that the sample obtained is from outside the casing. Sampling methods can be varied to compare the effects of atmospheric contact versus no atmospheric contact and maintaining the sample under pressure versus allowing depressurization of the sample.

During water sampling, sample blanks and spikes may be collected using identical procedures for sampling, preservation, handling and shipping. Travel blanks and spikes may also be collected using identical procedures for handling, preservation and shipping. The chemical analyses of samples obtained using the MP System may be compared with those of samples collected by alternate means whenever desired.

Finally, the pumping port may be reopened should further purging appear to be desirable.

For both fluid pressure and water quality data, the MP System can provide corroborative data. That is, a high density of data can be obtained in a single installation so that significant changes in piezometric pressure and/or water quality can appear as transitions. Thus, neighboring values will corroborate one another rather than indicating abrupt changes which would cause one to question any anomalous values.

Conclusions

The modular nature of the MP System permits a large number of monitoring zones to be accessed through valves placed inside a single closed tube or casing installed in a single drillhole. Such a monitoring system can provide a detailed view of the variation of piezometric pressure and water quality with depth. The valved couplings permit purging of the well before sampling and allow all standard hydrogeologic tests to be carried out in each zone. The valves also permit an evaluation of the condition of exterior casing seals at any time after installation. Casing packers allow multiple seals to be established easily and quickly, providing the required hydraulic isolation of each monitoring zone. The modular design of the downhole components means the number and location of monitoring zones and seals can be modified on the basis of the best information available in the field at the time of installation. The exact depth of monitoring zones need not be known when equipment is purchased.

Field quality control procedures have been established which permit the quality of a well installation and the proper operation of testing and sampling procedures and equipment to be routinely verified. Thus, ground water data and the additional data required to define the quality of the field data can be routinely collected. Furthermore, when a high density of ground water monitoring zones are installed by using multiple-level monitoring wells, the redundant monitoring points can provide important corroborative field data to an extent which is seldom available with single level monitoring wells.

References

Barvenik, M.J. and R.M. Cadwagan. 1983. Multilevel gas drive sampling of deep fractured rock aquifers in Virginia. Ground Water Monitoring Review, v. 3, no. 4, pp. 34-40.

Cherry, J.A. and P.E. Johnson. 1982. A multilevel device for monitoring in fractured rock. Ground Water Monitoring Review, v. 2, no. 3, pp. 41-44.

Davison, C.C. 1984. Monitoring hydrogeological conditions in fractured rock at the site of Canada's Underground Research Laboratory. Ground Water Monitoring Review, v. 4, no. 4, pp. 95-102.

Hanson, E.A. and A.R. Harris. 1974. A ground-water profile sampler. Water Resources Research, v. 10, no. 2, p. 375.

Molz, F.J., J.G. Melville, O. Guven, R.D. Crocker and K.T. Matteson. 1986. Design and performance of single-well tracer tests at the Mobile Site. (Report), Dept. of Civil Engineering, Auburn University, Alabama, 19 pp.

Nazar, A., J. Prieur and D. Threlfall. 1984. An integrated ground water monitoring program using multiple gas driven samples and conventional monitoring wells. Ground Water Monitoring Review, v. 4, no. 4, pp. 43-47.

Novakowski, K.S., P.A. Flavelle, K.G. Raven and E.L. Cooper. 1985. Determination of groundwater flow pathways in fractured plutonic rock using a radioactive tracer. Int. J. Appl. Radiat. Isot., v. 36, no. 5, pp. 399-404.

Patton, F.D. 1979. Groundwater instrumenation for mining projects. Chapter 5 in Proceedings First International Mine Drainage Symposium. Denver, Miller Freeman Publications Inc., San Francisco. pp. 719-748.

Patton, F.D. 1983. The role of instrumentation in the analysis of the stability of rock slopes. Proc. Int. Symp. on Field Measurements in Geomechanics. Zurich, pp. 719-748.

Patton, F.D. 1984. Climate, groundwater pressures and stability analyses of landslides. Proc. IV Int. Symp. on Landslides, v. 3, pp. 43-60.

Patton, F.D. and H.R. Smith. 1986. Design considerations and the quality of data from multiple-level groundwater monitoring wells. Proc. ASTM Symp. on Field Methods for Groundwater Contamination Studies and Their Standardization. Cocoa Beach, Fl., (in press).

Pickens, J.F., J.A. Cherry, G.E. Grisak, W.F. Merritt and B.A. Risto. 1978. A multilevel device for ground-water sampling and piezometric monitoring. Ground Water, v. 16, no. 5, pp. 322-327.

Rehtlane, E.A. and F.D. Patton. 1982. Multiple port piezometers vs. standpipe piezometers: an economic comparison. Proc. 2nd Nat. Symp. on Aquifer Restoration and Ground Water Monitoring. Columbus, Ohio, pp. 287-295.

Smith, H.R., W.H. Black, E.A. Rehtlane and F.D. Patton. 1984. Modular piezometer system. Geotechnical News, v. 2, no. 4, pp. 44-46.

Williams, R.E. 1982. A Guide to the Prevention of Ground Water Contamination by Uranium Mill Wastes. Colorado State Univ., 123 pp.

Biographical Sketches

William H. Black (Westbay Instruments Ltd., 507 E.Third St., North Vancouver, B.C., V7L 1G4)) received his B.A.Sc. degree in geological engineering from the University of British Columbia in 1978. Since then he has been with Westbay Instruments where he has been involved with the marketing, installation and development of ground water monitoring equipment.

H. Rodney Smith (Westbay Instruments Ltd., 507 E.Third St., North Vancouver, B.C., V7L 1G4) received his B.A.Sc degree in geological engineering from the University of British Columbia in 1971 and completed his MASc. degree in mineral engineering from the same university in 1975. In 1980 he received his M.Eng. degree from the University of California, Berkeley. He has worked in geotechnical engineering and hydrogeology and for the past three years has been involved with the marketing, installation and development of ground water monitoring equipment for Westbay Instruments Ltd.

Franklin D. Patton (Westbay Instruments Ltd., 507 E. Third St., North Vancouver, B.C., V7L 1G4) received his B.Sc. in civil engineering from the University of Alberta, and his M.Sc. in civil engineering and Ph.D. in geology from the University of Illinois. He has taught engineering geology at the University of Wisconsin, Madison, the University of Illinois, Urbana, and the University of British Columbia, Vancouver. He is also a consultant in engineering geology and the founder and president of Westbay Instruments Ltd.

Appendix H

RISK ASSESSMENT DOCUMENTATION

H1: Risk Assessment Methodology

H2: Preliminary Risk-Based Concentration Calculations

H3: Ecological Assessment of Near-Surface Soil
Exposure for Terrestrial Mammals

H4: Expected Species at MCAS El Toro

Appendix H
RISK ASSESSMENT DOCUMENTATION

Appendix H contains the supporting documentation for the Preliminary Baseline Risk Assessment presented in Section 7.0.

Appendix H1, Risk Assessment Methodology, provides the detailed methodology for developing risk-based concentrations that are expected to be protective of human health. Appendix H2, Risk-Based Concentration Calculations, contains the spreadsheets used in calculating the risk-based concentrations for the exposure scenarios developed in the Preliminary Human Health Baseline Risk Assessment (Section 7.1). Appendix H3 summarizes and evaluates the toxicity information used in the ecological assessment of potential impact to terrestrial mammals (Section 7.2). Appendix H4 contains a tabular listing of expected species of amphibious, birds, reptiles, and mammals at MCAS El Toro.

Appendix H1

Risk Assessment Methodology

Appendix H1
HUMAN HEALTH: RISK ASSESSMENT METHODOLOGY
(CALCULATION OF RISK-BASED CONCENTRATIONS)

H1.1 Introduction

This appendix presents methodologies used to calculate risk-based concentrations. The specific guidance documents used in preparing this methodology are:

- *Risk Assessment Guidance for Superfund* (RAGS), *Volume I: Development of Risk-Based Preliminary Remediation Goals*, Part B, Publication 9285.7-01B (EPA, 1991)
- *Risk Assessment Guidance for Superfund* (RAGS), *Volume I: Human Health Evaluation Manual*, Part A, EPA/540/1-89/002 (EPA, 1989)

Risk-based concentrations are calculated to account for both noncancer and cancer health effects. The equations used to calculate chemical intakes and increased lifetime cancer risks from chemical concentrations are rearranged to solve for the chemical concentration equal to a specified risk level. In this preliminary risk assessment, the increased lifetime cancer risk level range is 10^{-4} to 1×10^{-6} for chemicals with cancer effects in each medium (such as air or groundwater). Similarly for chemicals with noncancer effects, the target hazard index has been set to 1.0 for each chemical in a particular medium.

The exposure parameters used to calculate the risk-based concentrations are selected to reflect both site-specific factors and Reasonable Maximum Exposure (RME) conditions (EPA, 1991a). Exposure parameters and toxicity values used to calculate risk-based concentrations for MCAS El Toro are presented in Subsection 7.1.

H1.2 Risk-Based Concentrations for Residential Groundwater Use

For residential land use, risks from chemicals in water are assumed to be related to exposures via ingestion and, for volatile organic compounds (VOCs), inhalation of concentrations in air that have desorbed from water. Inhalation of chemicals volatilized from water is assumed to be applicable only for chemicals with a Henry's Law constant

(HLC) greater than 10^{-5} atm-m^3/mole and a molecular weight (MW) of less than 200 g/mole (See Section 7.0, Table 7-9 for chemical-specific HCLs and MWs). Risk-based concentrations in groundwater for chemicals without these properties are calculated only for ingestion exposure. Exposure to chemicals in water can occur via dermal absorption. Intake from dermal absorption is relatively smaller as compared with intake from ingestion or inhalation and has not been calculated in this preliminary risk assessment.

Risk-based concentrations for chemicals with cancer effects are calculated using the following equation:

$$C = \frac{TR \times BW \times AT \times 365\,days/year}{EF \times ED \times [(SF_i \times K \times IR_a) + (SF_o \times IR_w)]}$$

Where:

Parameter	Description	Units
C	Chemical concentration in water	mg/L
TR	Target increased lifetime cancer risk	(unitless)
SF_i	Inhalation slope factor	$(mg/kg\text{-}day)^{-1}$
SF_o	Oral slope factor	$(mg/kg\text{-}day)^{-1}$
BW	Body weight	kg
AT	Averaging time	years
EF	Exposure frequency	days/year
ED	Exposure duration	years
IR_a	Daily inhalation rate	m^3/day
IR_w	Daily water ingestion rate	L/day
K	Volatilization factor	(unitless)

Risk-based concentrations for chemicals with noncancer effects are calculated using the following equation:

$$C = \frac{THI \times BW \times AT \times 365\,days/year}{EF \times ED \times \left[\left(\frac{1}{RfD_i} \times K \times IR_a\right) + \left(\frac{1}{RfD_o} \times IR_w\right)\right]}$$

Where:

Parameter	Description	Units
C	Chemical concentration in water	mg/L
THI	Target Hazard Index	(unitless)
RfD_i	Inhalation Reference Dose	mg/kg-day
RfD_o	Oral Reference Dose	mg/kg-day
BW	Body weight	kg
AT	Averaging time	years
EF	Exposure frequency	days/year
ED	Exposure duration	years
IR_a	Daily inhalation rate	m^3/day
IR_w	Daily water ingestion rate	L/day
K	Volatilization factor	(unitless)

The volatilization factor (K) characterizes the relationship between chemical concentration in household water and the average concentration of the volatilized chemical in air. EPA (1991a) states that the value for K is derived using data developed by Andelman (1990). Andelman states that this value is estimated using a simple predictive equation based on a one-compartment indoor air model; this model describes the range of average indoor air concentrations that are likely to be encountered from a chemical volatilizing at an average rate of 50 percent from all water uses. Volatilization rates for VOCs from water range from 30 to 90 percent, depending upon water use. The relationship obtained from this model is (Andelman, 1990; Andelman et al., 1987):

$$C_a = 0.1 \times 10^{-4} C_w$$

to

$$C_a = 5 \times 10^{-4} C_w$$

where C_a is the average indoor air concentration (mg/L) generated by the corresponding average water concentration, C_w (mg/L). Thus, a water concentration of 1 mg/L would be expected to generate a concentration of between 0.00001 and 0.0005 mg/L in air in the home (Andelman, 1990). A correction factor of 1,000 L/m^3 is used to convert the concentrations in air to mg/m^3. Other studies (McKone, 1987) have predicted similar estimated household air concentrations for different VOCs, with values of C_a ranging from 0.00002 to 0.00012 mg/L for a C_w of 1 mg/L (Andelman, 1990).

H1.3 Risk-Based Concentrations for Surface Water—Dermal Contact with Water

In addition to incidental ingestion, opportunities for dermal contact could occur during recreational use of surface water. The permeability of skin to chemicals in water is represented by a permeability coefficient (K_p). Other factors affecting the magnitude of chemical absorption are the exposed skin surface area and the duration that the skin is in contact with contaminated water.

Risk-based concentrations for chemicals with cancer effects are calculated using the following equation:

$$C = \frac{TR \times BW \times AT \times 365\ days/year}{SF_o \times SA \times K_p \times ET \times EF \times ED \times \left(\dfrac{1\ L}{1{,}000\ cm^3}\right)}$$

Where:

Parameter	Description	Units
C	Chemical concentration in water	mg/L
TR	Target increased lifetime cancer risk	(unitless)
SF_o	Oral slope factor	(mg/kg-day)$^{-1}$
BW	Body weight	kg
AT	Averaging time	years
EF	Exposure frequency	days/year

Parameter	Description	Units
ED	Exposure duration	years
ET	Exposure time per day	hours/day
SA	Exposed skin surface area	cm^2
K_p	Permeability constant	cm/hr

Risk-based concentrations for chemicals with noncancer effects are calculated using the following equation:

$$C = \frac{THI \times BW \times AT \times 365\ days/year}{\frac{1}{RFD_o} \times SA \times K_p \times ET \times EF \times ED \times \left(\frac{1\ L}{1{,}000\ cm^3}\right)}$$

Where:

Parameter	Description	Units
C	Chemical concentration in water	mg/L
THI	Target increased lifetime cancer risk	unitless
RFD_o	Oral Reference Dose	mg/kg-day
BW	Body weight	kg
AT	Averaging time	years
EF	Exposure frequency	days/year
ED	Exposure duration	years
ET	Exposure time per day	hours/day
SA	Exposed skin surface area	cm^2
K_p	Permeability constant	cm/hr

H1.4 Risk-Based Concentrations for Soil/Sediment—Residential Setting

Risk-based concentrations for chemicals in soil/sediment are calculated assuming that exposure occurs from ingestion of soil/sediment, inhalation of VOCs emitted from soil/sediment, inhalation of chemicals in dust suspended from soil/sediment, and dermal contact with soil or sediment.

Incidental Ingestion - Residential Setting

Soil ingestion rates are greater for children than adults. Higher soil ingestion rates in children coupled with lower body weights mean that rates of exposure to contaminants in soil are higher for children than adults (however, this higher exposure would occur over a shorter duration of time). Therefore, an age-adjusted soil ingestion factor is used in this equation to account for the differences in daily soil ingestion rates, body weights, and exposure durations between children (ages 1 to 6 years) and adults (ages 7 to 31 years). The soil ingestion rates for these two age ranges are time-weighted by the duration of exposure (6 years for children and 24 years for adults) and normalized to body weight to calculate the soil ingestion factor:

$$IF_{soil/adj} = \frac{IR_1 \times ED_1}{BW_1} + \frac{IR_2 \times ED_2}{BW_2}$$

Where:

Parameter	Description	Units
$IF_{soil/adj}$	Age-adjusted soil ingestion factor	mg-yr/kg-day
BW_1	Average body weight from ages 1-6	kg
BW_2	Average body weight from ages 7-31	kg
ED_1	Exposure duration from ages 1-6	years
ED_2	Exposure duration from ages 7-31	years
IR_1	Soil ingestion rate from ages 1-6	mg/day
IR_2	Soil ingestion rate from ages 7-31	mg/day

This factor is then inserted into the intake equation to calculate risk-based concentrations in soil associated with residential land uses.

Risk-based concentrations for chemicals with cancer effects are calculated using the following equation:

$$C = \frac{TR \times AT \times 365\, days/year}{SF_o \times 10^{-6}\, kg/mg \times EF \times IF_{soil/adj}}$$

Where:

Parameter	Description	Units
C	Chemical concentration in water	mg/L
TR	Target increased lifetime cancer risk	unitless
SF_o	Oral slope factor	$(mg/kg\text{-}day)^{-1}$
BW	Body weight	kg
AT	Averaging time	years
EF	Exposure frequency	days/year
$IF_{soil/adj}$	Age-adjusted soil ingestion factor	mg-yr/kg-day

Risk-based concentrations for chemicals with noncancer effects are calculated using the following equation:

$$C = \frac{THI \times BW \times AT \times 365\, days/year}{10^{-6}\, kg/mg \times EF \times \frac{1}{RfD_o} \times IF_{soil/adj}}$$

Where:

Parameter	Description	Units
C	Chemical concentration in water	mg/L
THI	Target Hazard Index	(unitless)
RfD_o	Oral Reference Dose	mg/kg-day
AT	Averaging time	years
EF	Exposure frequency	days/year
$IF_{soil/adj}$	Age-adjusted soil ingestion factor	mg-yr/kg-day

H1.5.1 Inhalation of VOCs and Airborne Particulates—Residential Setting

Inhalation of chemicals emitted from soil may be a pathway of exposure from a site. Volatile organic compounds (VOCs) could diffuse through soil and be emitted from the surface into the air. Contaminants in exposed soil could become suspended in the air as windblown dust or by mechanical disturbance, such as driving over unpaved surfaces, grading, or excavation. There may be a greater potential for contaminant emissions from soil for commercial/industrial land uses, where there is a greater potential for disturbance of soil. However, inhalation of VOCs and particulates from soil is a plausible exposure pathway for residential land use (for example, if residential housing is placed over VOCs in soil).

The relationships between concentrations of VOCs in soil and volatilized chemicals in air is expressed with a volatilization factor (VF). The relationship of chemicals adsorbed to soil and concentrations of respirable particles in air is expressed with a particulate emission factor (PEF). These two factors are developed on a chemical-specific basis, as described in the following sections.

H1.5.1.1 Soil to Air Volatilization Factor

Concentrations in air associated with volatilization of chemicals from soil were estimated using modeling techniques developed for PCBs in soil by EPA (Hwang and Falco, 1986; EPA, 1986). In calculating chemical concentrations in air, the initial task is to estimate the emissions rates from soil. Since the chemical concentrations in soil will change over time, as the chemical undergoes biodegradation or is depleted by volatilization from soil, the instantaneous (or transient) emission rate is obtained by solving a partial differential equation based on a chemical mass balance in the soil column. Integration of this equation resulted in a formula that is used to calculate the average emission rate over a specific period of time. The concentration in air from emissions from a specified area of contaminated soil is then estimated using a box model.

The assumptions inherent in this emissions model are:

- Concentration of contaminant is assumed at or below saturation. There is no free product (pure liquid phase) in the soil.

- Contaminant concentration is assumed to be homogenous laterally and vertically throughout the area

- There is no clean layer of soil over the contamination

The emissions model and the box model are then combined to estimate the VF, as follows (EPA, 1992):

$$VF = \frac{LS \times V \times h}{A} \times \frac{(\pi \times \alpha \times T)^{0.5}}{2 \times D_{ei} \times P_a \times K_{as} \times 10^{-3}\,kg/g}$$

Where

$$\alpha = \frac{D_{ei} \times P_a}{P_a + \left(\frac{p_s \times (1 - P_a)}{K_{as}}\right)}$$

Default values have been identified for the parameters in these two equations. However, site-specific values should be used when they are available.

Parameter	Description	Units	Default Value
VF	Volatilization factor	m^3/kg	Calculated
LS	Length of side of contaminated area	m	45 (default)
V	Wind speed in box	m/s	2.25 (default)
h	Box height	m	2 (default)
A	Area of contamination	m^2	2,025 (default)
D_{ei}	Effective diffusivity	cm^2/s	Calculated
P_a	"True" soil porosity	unitless	Calculated
K_{as}	Soil/air partition coefficient	g/cm^3	Calculated
p_s	Soil particulate density	g/cm^3	2.65
T	Exposure interval	s	7.9×10^8
D_i	Molecular diffusivity in air	cm^2/s	Chemical-specific
H	Henry's Law constant (Nondimensional)	unitless	Chemical-specific
K_d	Soil/water partition coefficient	cm^3/g	Calculated
K_{oc}	Organic carbon coefficient	cm^3/g	Chemical-specific

Parameter	Description	Units	Default Value
f_{oc}	Soil organic carbon content (fraction)	unitless	0.02 (default)

Several of the parameters used in the equation for the VF are calculated values. The calculation of these values is presented below.

Effective diffusivity (D_{ei}) is calculated as follows:

$$D_{ei} = D_i \times (P_a^{3.33}/Pt^2)$$

Values for D_i are available for several VOCs either from EPA, 1988 or Shen, 1981. For chemicals without tabulated values of D_i, values can be calculated using one of the methods presented in Lyman et al., 1990. The value for "true" soil porosity (air-filled soil porosity) is estimated as follows:

$$P_a = P_t - MB$$

Where:

P_t = total porosity in soil

M = soil moisture content

B = the soil bulk density

The soil/air partition coefficient is calculated as follows:

$$K_{as} = \frac{H}{K_d}$$

where K_d is calculated from the chemical-specific organic matter constant (K_{oc}) and the fraction of organic carbon in soil as follows:

$$K_d = K_{oc} \times f_{oc}$$

K_{oc} values may be tabulated in the literature, or may be calculated from the chemical-specific octanol/water partition coefficient (K_{ow}) using one of the methods presented in Lyman et al., 1990.

H1.5.1.2 Particulate Emissions Factor.

The PEF relates the chemical concentration in soil with concentrations in respirable particles in air due to windblown dust emissions. This relationship has been derived by EPA, 1985. This emissions model is considered to provide a conservative estimate of potential inhalation exposure associated with particulate emissions, because conditions at most sites would tend to limit windblown dust (i.e., less erodible surfaces). Note, however, that this model does not account for emissions from mechanical disturbances such as driving over unpaved surfaces or excavation.

The PEF is estimated as follows:

$$PEF = \frac{LS \times V \times h \times 3{,}600\, s/hr}{A} \times \frac{1{,}000\, g/kg}{0.036 \times (1 - V) \times \left(\frac{U_m}{U_t}\right)^3 \times F(x)}$$

Using the default values, the PEF is calculated to be 4.63×10^9 m^3/kg. The default values provide an emissions flux for a specific type of unlimited reservoir surface. This equation can be used to calculate a flux value more representative of site conditions, if site-specific data are available. EPA, 1985 should be consulted for selecting appropriate values for the parameters v, U_m, U_t and F(x). The default values for the parameters in the PEF equation are as follows:

Parameter	Description	Units	Default Value
PEF	Particulate emission factor	m^3/kg	4.63×10^9
LS	Length of side of contaminated area	m	45 (default)
V	Wind speed in box	m/s	2.25 (default)
h	Box height	m	2 (default)
A	Area of contamination	m^2	2,025 (default)
0.036	Respirable fraction of windblown dust	g/m^2-hr	--
v	Fraction of vegetative cover	unitless	0 (default)
U_m	Mean annual wind speed	m/s	4.5 (default)
U_t	Equivalent threshold friction velocity at 10 m	m/s	12.8 (default)
$F_{(x)}$	Function dependent upon U_m/U_t	unitless	0.0497

Risk-based concentrations in air for chemicals with cancer effects are calculated using the following equation:

$$C = \frac{TR \times BW \times AT \times 365\,days/year}{SF_i \times ED \times EF \times IR_a \times \left(\frac{1}{VF} + \frac{1}{PEF}\right)}$$

Where:

Parameter	Description	Units	Value
C	Chemical concentration in soil	mg/kg	Calculated
TR	Target increased lifetime cancer risk	unitless	10^{-6}

Parameter	Description	Units	Value
SF_i	Inhalation slope factor	$(mg/kg\text{-}day)^{-1}$	Chemical-specific
BW	Body weight	kg	70
AT	Averaging time	years	70
ED	Exposure duration	years	30
EF	Exposure frequency	days/year	350
IR_a	Daily inhalation rate	m^3/day	20
VF	Volatilization factor	m^3/kg	Chemical-specific
PEF	Particulate Emission Factor	m^3/kg	Chemical-specific

Risk-based concentrations for chemicals with noncancer effects are calculated using the following equation:

$$C = \frac{THI \times BW \times AT \times 365\,days/year}{ED \times EF \times \frac{1}{RfD_i} \times IR_a \times \left(\frac{1}{VF} + \frac{1}{PEF}\right)}$$

Where:

Parameter	Description	Units	Value
C	Chemical concentration in air	mg/m^3	Calculated
THI	Target Hazard Index	unitless	1.0
RfD_i	Inhalation Reference Dose	mg/kg-day	Chemical-specific
AT	Averaging time	years	30
ED	Exposure duration	years	30
EF	Exposure frequency	days/year	350
IR_a	Inhalation rate	m^3/day	20
VF	Volatilization factor	m^3/kg	Chemical-specific
PEF	Particulate Emission Factor	m^3/kg	Chemical-specific

H1.5.2 Dermal Contact—Residential Setting

The magnitude of exposure associated with dermal contact with soil/sediment is based on the quantity of soil/sediment that adheres to the skin, the amount of exposed skin surface that soil can adhere to, the frequency and duration of exposure, and the fraction of contaminant from soil/sediment that is absorbed through the skin. The amount of exposed skin surface, frequency of exposure, and duration of exposure are highly site-specific parameters. The highest dermal exposures to chemicals in soil/sediment would be expected in settings characterized by warm weather, where less skin surface would be covered with clothing and a significant fraction of time is spent outdoors. Dermal absorption of chemicals from soil/sediment is represented as a fraction of the chemicals in soil/sediment, and is estimated on a chemical-by-chemical basis.

Risk-based concentrations for chemicals with cancer effects are calculated using the following equation:

$$C = \frac{TR \times BW \times AT \times 365\ days/year}{SF_o \times SA \times AF \times 10^{-6}\ kg/mg \times ABS \times EF \times ED}$$

Where:

Parameter	Description	Units
C	Chemical concentration in soil	mg/kg
TR	Target increased lifetime cancer risk	(unitless)
SF_o	Oral slope factor	$(mg/kg\text{-}day)^{-1}$
BW	Body weight	kg
AT	Averaging time	years
EF	Exposure frequency	events/year
ED	Exposure duration	years
SA	Exposed skin surface area	cm^2/event
AF	Soil adherence factor	mg/cm^2
ABS	Dermal absorption factor	(unitless)

Risk-based concentrations for chemicals with noncancer effects are calculated using the following equation:

$$C = \frac{THI \times BW \times AT \times 365\ days/year}{\frac{1}{RFD_o} \times SA \times AF \times 10^{-6}\ kg/mg \times ABS \times EF \times ED}$$

Where:

Parameter	Description	Units
C	Chemical concentration in soil	mg/kg
THI	Target hazard index	unitless
RFD_o	Oral Reference Dose	mg/kg-day
BW	Body weight	kg
AT	Averaging time	years
EF	Exposure frequency	events/year
ED	Exposure duration	years
SA	Exposed skin surface area	cm^2/event
AF	Soil adherence factor	mg/cm^2
ABS	Dermal absorption factor	unitless

H1.5 Risk-Based Concentrations for Air—Residential Land Use

VOCs in soil or soil gas could diffuse through soil and become emitted from the soil surface. VOCs in groundwater could partition into soil gas and also become emitted from soil. Contaminants emitted into the air can become dispersed in the ambient air. Chemical intake can then occur via inhalation of the concentrations in ambient air. Exposure to contaminants in air in a residential exposure setting is based on an inhalation rate of 20 m^3/day. Activity-specific inhalation rates were combined with data on time and activity levels to derive daily inhalation values. This evaluation focused on populations that would be expected to spend a majority of their time at home: housewives, service and household workers, retirees, and unemployed individuals. The inhalation rate of 20 m^3/day was found to represent a reasonable upper-bound value for adults in these groups. This value was derived by combining inhalation rates for indoor and outdoor activities in a residential setting (EPA, 1991b).

Risk-based concentrations in ambient air for chemicals with cancer effects are calculated using the following equation:

$$C = \frac{TR \times BW \times AT \times 365\,days/year}{SF_i \times ED \times EF \times IR_a}$$

Where:

Parameter	Description	Units
C	Chemical concentration in ambient air	mg/m^3
TR	Target increased lifetime cancer risk	unitless
SF_i	Inhalation slope factor	$(mg/kg\text{-}day)^{-1}$
BW	Body weight	kg
AT	Averaging time	years
ED	Exposure duration	years
EF	Exposure frequency	days/year
IR_a	Daily inhalation rate	m^3/day

Risk-based concentrations in ambient air for chemicals with noncancer effects are calculated using the following equation:

$$C = \frac{THI \times BW \times AT \times 365\,days/year}{ED \times EF \times \frac{1}{RfD_i} \times IR_a}$$

Where:

Parameter	Description	Units
C	Chemical concentration in air	mg/m^3
THI	Target Hazard Index	(unitless)
RfD_i	Inhalation Reference Dose	mg/kg-day
AT	Averaging time	years
ED'	Exposure duration	years
EF	Exposure frequency	days/year
IR_a	Inhalation rate	m^3/day

H1.7 References

Andelman, J.B., L.C. Wilder and S.M. Myer. "Indoor Air Pollution from Volatile Chemicals in Water" *INDOOR AIR '87, Vol. I, Proceedings of the 4th International Conference on Indoor Air Quality and Climate*. Institute for Water, Soil and Air Hygiene. Berlin. 1987.

Andelman, J.B. "Total Exposure to Volatile Organic Chemicals in Potable Water" *Significance and Treatment of Volatile Organic Compounds in Water.* N.M. Ram, R.F. Christman and K.P. Cantor (eds.). Lewis Publishers. 1990.

McKone, T.E. "Human exposure to volatile organic compounds in household tap water: the indoor inhalation pathway." *Environ. Sci. Technol.* 21:1194-1201. 1987.

U.S. Environmental Protection Agency. Note from Janine Dinan/EPA Headquarters to Regional Toxic Integration Coordinators. Changes to Equations in the Part B Guidance. November 9, 1992.

U.S. Environmental Protection Agency (EPA). *Risk Assessment Guidance for Superfund. Volume I. Human Health Evaluation Manual (Part A)*. Interim Final. EPA/540/1-89/002. December. 1989.

U.S. Environmental Protection Agency (EPA). *Risk Assessment Guidance for Superfund. Volume I. Development of Risk-Based Preliminary Remediation Goals*. Interim. Publication 9285.7-01B. December. 1991a.

Appendix H2

Preliminary Risk-Based Concentration Calculations

Appendix H2

PRELIMINARY RISK-BASED CONCENTRATION CALCULATIONS

TABLES

Table H2-1
Risk-Based Concentrations-Noncarcinogenic Health Effects
Residential Scenario
Ingestion of Groundwater and Inhalation of Volatiles From Household Water Use
MCAS El Toro Phase I RI Technical Memorandum

Chemical	Oral Reference Dose (mg/kg-day)	U.S EPA Inhalation Carcinogen Classification	Inhalation Reference Dose (mg/kg-day)	Target Hazard Concentration (ug/L)
ORGANICS:				
1,1,2-Trichloroethane (a,b)	4.0E-03	C	4.0E-03	3.1E+01
1,1-Dichloroethane (a)	1.0E-01		1.0E-01	7.7E+02
1,1-Dichloroethene (a,b)	9.0E-03	C	9.0E-03	6.9E+01
1,2-Dichloroethane (a)	-		-	-
1,2-Dichloroethene (total) (a,b)	9.0E-03	D	9.0E-03	6.9E+01
2,4,5-T (b)	1.0E-02	-	1.0E-02	3.7E+02
2,4,5-Trichlorophenoxy proprionic acid	8.0E-03	-	8.0E-03	2.9E+02
2,4-D (b)	1.0E-02		1.0E-02	3.7E+02
2,4-DB (b)	8.0E-03		8.0E-03	2.9E+02
2-Hexanone (a)	-	-	-	-
4',4'-DDT (b)	5.0E-04	B2	5.0E-04	1.8E+01
4-Methyl-2-pentanone (a)	5.0E-02		2.0E-02	1.8E+02
Acetone (a,b)	1.0E-01	D	1.0E-01	7.7E+02
Benzene (a)	-	A	-	-
Benzyl butyl phthalate (b)	2.0E-01	C	2.0E-01	7.3E+03
Bis(2-ethylhexyl)phthalate (b)	2.0E-02	B2	2.0E-02	7.3E+02
Bromodichloromethane (a,b)	2.0E-02	-	2.0E-02	1.5E+02
Carbon disulfide (a)	2.0E+00	#VALUE!	2.0E+00	1.5E+04
Carbon tetrachloride (a,b)	7.0E-04	B2	7.0E-04	5.4E+00
Chlorobenzene (a)	2.0E-02		5.0E-03	4.6E+01
Chlorodibromomethane (b)	2.0E-02	C	2.0E-02	7.3E+02
Chloroform (a,b)	1.0E-02	B2	1.0E-02	7.7E+01
Dalapon (b)	3.0E-02	-	3.0E-02	1.1E+03
Dicamba (b)	3.0E-02	-	3.0E-02	1.1E+03
Dichloroprop	-	-	-	-
Dieldrin (b)	5.0E-05	B2	5.0E-05	1.8E+00
Dimethyl phthalate (b)	1.0E+01	D	1.0E+01	3.7E+05
Ethylbenzene (a)	1.0E-01		2.9E-01	1.6E+03
Hepatachlor (b)	5.0E-04	B2	5.0E-04	1.8E+01
Lindane (b)	3.0E-04	-	3.0E-04	1.1E+01
MCPA (b)	5.0E-04	-	5.0E-04	1.8E+01
MCPP (b)	1.0E-03	-	1.0E-03	3.7E+01
Methyl chloride (a)	-	C	-	-
Methylene chloride (a)	6.0E-02	B2	8.6E-01	1.7E+03
Phenol (b)	6.0E-01	#VALUE!	6.0E-01	2.2E+04
Tetrachloroethene (a,b)	1.0E-02	#VALUE!	1.0E-02	7.7E+01
TFH diesel (b)	2.0E-02	#VALUE!	2.0E-02	7.3E+02
TFH gasoline (b)	2.0E-01	#VALUE!	2.0E-01	7.3E+03
Toluene (a)	2.0E-01	#VALUE!	1.1E-01	9.7E+02
Trichloroethylene (a,b)	6.0E-03	#VALUE!	6.0E-03	4.6E+01
Vinyl chloride (a)	-	#VALUE!	-	-
Xylenes(total) (a,b)	2.0E+00	#VALUE!	2.0E+00	1.5E+04
INORGANICS:				
Aluminum	-	-	-	-
Antimony	4.0E-04	#VALUE!	-	1.5E+01
Arsenic	3.0E-04	A	-	1.1E+01
Barium	7.0E-02	-	1.4E-04	2.6E+03
Beryllium	5.0E-03	B2	-	1.8E+02
Cadmium	5.0E-04	B1	-	1.8E+01
Chromium	5.0E-03	A	-	1.8E+02
Cobalt	-	-	-	-
Copper	-	D	-	-
Cyanide	2.0E-02	D	-	7.3E+02
Lead	-		-	-
Manganese	5.0E-03	D	1.1E-04	1.8E+02
Mercury	3.0E-04	D	8.6E-05	1.1E+01
Nickel	2.0E-02	A	-	7.3E+02
Nitrate/nitrite	1.0E-01	-	-	3.7E+03
Selenium	5.0E-03	#VALUE!	-	1.8E+02
Silver	5.0E-03	D	-	1.8E+02
Thallium	8.0E-05	#VALUE!	-	2.9E+00

Table H2-1
Risk-Based Concentrations-Noncarcinogenic Health Effects
Residential Scenario
Ingestion of Groundwater and Inhalation of Volatiles From Household Water Use
MCAS El Toro Phase I RI Technical Memorandum

Chemical	Oral Reference Dose (mg/kg-day)	U.S EPA Inhalation Carcinogen Classification	Inhalation Reference Dose (mg/kg-day)	Target Hazard Concentration (ug/L)
Vanadium	7.0E-03	#VALUE!	-	2.6E+02
Zinc	3.0E-01	#VALUE!	-	1.1E+04
RADIONUCLIDES:				
Gross alpha	-	-	-	-
Gross beta	-	-	-	-

Exposure Setting:	Residential
THI: Target Hazard Index (unitless)	1
BW: Body weight (kg)	70
AT: Averaging Time (years)	30
EF: Exposure frequency (days/year)	350
ED: Exposure duration (years)	30
RfDi: Inhalation chronic reference dose (mg/kg-day)	chem. specific
K: Volatilization factor (unitless)(volatile chemicals only)	0.5
IR3: Daily indoor inhalation rate (m3/day)	15
RfDo: Oral chronic reference dose (mg/kg-day)	chem. specific
IRw: Daily water ingestion rate (L/day)	2

$$\text{Target Concentration (ug/L)} = \frac{\text{THI} \times \text{BW} \times \text{AT} \times 365 \text{ days/yr}}{\text{EF} \times \text{ED} \times [(1/\text{RfDi} \times \text{K} \times \text{IR3}) + (1/\text{RfDo} \times \text{IRw})]} \times 1000 \text{ ug/mg}$$

Notes:

(a) Inhhalation of volatile chemicals is calculated for all chemicals with a Henry's Law constant greater than or equal to 1 E-05 atm-m3/mole and a molecular weight less than or equal to 200 g/mole.

(b) The oral RfD was used for all organic chemicals with no inhalation RfD.

Table H2-2
Risk-Based Concentrations-Carcinogenic Health Effects
Residential Scenario
Ingestion of Groundwater and Inhalation of Volatiles From Household Water Use
MCAS El Toro Phase I RI Technical Memorandum

Chemical	EPA Oral WOE	Oral Slope Factor (kg-day/mg)	EPA Inhalation WOE	Inhalation Slope Factor (kg-day/mg)	Target Cancer Risk: 1E-04 (ug/L)	1E-05 (ug/L)	1E-06 (ug/L)
ORGANICS:							
1,1,2-Trichloroethane (a)	C	5.7E-02	C	5.8E-02	3.1E+01	3.1E+00	3.1E-01
1,1-Dichloroethane (a)	C	-	C	-	-	-	-
1,1-Dichloroethene (a)	C	6.0E-01	C	1.8E-01	6.8E+00	6.8E-01	6.8E-02
1,2-Dichloroethane (a)	B2	9.1E-02	B2	9.1E-02	2.0E+01	2.0E+00	2.0E-01
1,2-Dichloroethene (total) (	D	-	D	-	-	-	-
2,4,5-T	-	-	-	-	-	-	-
2,4,5-Trichlorophenoxy pro	D	-	D	-	-	-	-
2,4-D	-	-	-	-	-	-	-
2,4-DB	-	-	-	-	-	-	-
2-Hexanone (a)	-	-	-	-	-	-	-
4',4'-DDT	B2	3.4E-01	B2	3.4E-01	2.5E+01	2.5E+00	2.5E-01
4-Methyl-2-pentanone (a)	-	-	-	-	-	-	-
Acetone (a)	D	-	D	-	-	-	-
Benzene (a)	A	2.9E-02	A	2.9E-02	6.2E+01	6.2E+00	6.2E-01
Benzyl butyl phthalate	C	-	C	-	-	-	-
Bis(2-ethylhexyl)phthalate (	B2	1.4E-02	B2	1.4E-02	6.1E+02	6.1E+01	6.1E+00
Bromodichloromethane (a,b	B2	6.2E-02	-	6.2E-02	2.9E+01	2.9E+00	2.9E-01
Carbon disulfide (a)	-	-	-	-	-	-	-
Carbon tetrachloride (a)	B2	1.3E-01	B2	5.3E-02	2.6E+01	2.6E+00	2.6E-01
Chlorobenzene (a)	D	-	D	-	-	-	-
Chlorodibromomethane (b)	C	8.4E-02	C	8.4E-02	1.0E+02	1.0E+01	1.0E+00
Chloroform (a)	B2	6.1E-03	B2	8.1E-02	2.8E+01	2.8E+00	2.8E-01
Dalapon	-	-	-	-	-	-	-
Dicamba	-	-	-	-	-	-	-
Dichloroprop	-	-	-	-	-	-	-
Dieldrin	B2	1.6E+01	B2	1.6E+01	5.3E-01	5.3E-02	5.3E-03
Dimethyl phthalate	D	-	D	-	-	-	-
Ethylbenzene (a)	D	-	D	-	-	-	-
Hepatachlor	B2	4.5E+00	B2	4.6E+00	1.9E+00	1.9E-01	1.9E-02
Lindane (b)	B2	1.3E+00	-	1.3E+00	6.6E+00	6.6E-01	6.6E-02
MCPA	-	-	-	-	-	-	-
MCPP	-	-	-	-	-	-	-
Methyl chloride (a)	C	1.3E-02	C	6.3E-03	2.3E+02	2.3E+01	2.3E+00
Methylene chloride (a)	B2	7.5E-03	B2	1.6E-03	6.2E+02	6.2E+01	6.2E+00
Phenol	D	-	D	-	-	-	-
Tetrachloroethene (a)	B2	5.1E-02	B2	1.8E-03	1.5E+02	1.5E+01	1.5E+00
TFH diesel	D	-	D	-	-	-	-
TFH gasoline (b)	C	2.0E-03	C	2.0E-03	4.3E+03	4.3E+02	4.3E+01
Toluene (a)	D	-	D	-	-	-	-
Trichloroethylene (a)	B2	1.1E-02	B2	6.0E-03	2.5E+02	2.5E+01	2.5E+00
Vinyl chloride (a)	A	1.9E+00	A	3.0E-01	2.8E+00	2.8E-01	2.8E-02
Xylenes(total) (a)	D	-	D	-	-	-	-
INORGANICS:							
Aluminum	-	-	-	-	-	-	-
Antimony	-	-	-	-	-	-	-
Arsenic	A	1.8E+00	A	1.5E+01	4.9E+00	4.9E-01	4.9E-02
Barium	-	-	-	-	-	-	-
Beryllium	B2	4.3E+00	B2	8.4E+00	2.0E+00	2.0E-01	2.0E-02
Cadmium	-	-	B1	6.3E+00	-	-	-
Chromium	-	-	A	4.2E+01	-	-	-
Cobalt	-	-	-	-	-	-	-
Copper	D	-	D	-	-	-	-
Cyanide	D	-	D	-	-	-	-
Lead	-	-	-	-	-	-	-
Manganese	D	-	D	-	-	-	-
Mercury	D	-	D	-	-	-	-
Nickel	-	-	-	-	-	-	-
Nitrate/nitrite	-	-	-	-	-	-	-
Selenium	D	-	D	-	-	-	-
Silver	D	-	D	-	-	-	-
Thallium	D	-	D	-	-	-	-
Vanadium	-	-	-	-	-	-	-
Zinc	D	-	D	-	-	-	-
RADIONUCLIDES:							
Gross alpha	-	-	-	-	-	-	-
Gross beta	-	-	-	-	-	-	-

Table H2-2
Risk-Based Concentrations-Carcinogenic Health Effects
Residential Scenario
Ingestion of Groundwater and Inhalation of Volatiles From Household Water Use
MCAS El Toro Phase I RI Technical Memorandum

Chemical	EPA Oral WOE	Oral Slope Factor (kg-day/mg)	EPA Inhalation WOE	Inhalation Slope Factor (kg-day/mg)	Target Cancer Risk: 1E-04 (ug/L)	1E-05 (ug/L)	1E-06 (ug/L)
Exposure Setting:					Residential	Residential	Residential
TRL: Target Risk Level:					1E-04	1E-05	1E-06
BW: Body weight (kg)					70	70	70
AT: Averaging Time (years)					70	70	70
EF: Exposure frequency (days/year)					350	350	350
ED: Exposure duration (years)					30	30	30
SFi: Inhalation cancer slope factor (mg/kg-day)-1					chem. specifi	chem. specific	chem. specific
K: Volatilization factor (unitless)(for volatile chemicals only)					0.5	0.5	0.5
IR3: Daily indoor inhalation rate (m3/day)					15	15	15
SFo: Oral cancer slope factor (mg/kg-day)-1					chem. specifi	chem. specific	chem. specific
IRw: Daily water ingestion rate (L/day)					2	2	2

$$\text{Target Concentration (mg/L)} = \frac{\text{TRL} \times \text{BW} \times \text{AT} \times 365\ \text{days/yr}}{\text{EF} \times \text{ED} \times [(\text{SFi} \times \text{K} \times \text{IR3}) + (\text{SFo} \times \text{IRw})]} \times 1000\ \text{ug/mg}$$

Notes:
(a) Inhalation of volatile chemicals is calculated for all chemicals with a Henry's Law Constant greater than or equal to 1 E-05 atm-m3/mol
(b) The oral slope factor was used for all organic chemicals with no inhalation slope factor.

Table H2-3
Risk-Based Concentrations-Noncarcinogenic Health Effects
Residential Scenario
Ingestion of Soil, Inhalation of Soil Particulates,
Inhalation of Soil Volatiles, and Dermal Contact with Soil
MCAS El Toro Phase I RI Technical Memorandum

Chemical	Oral Reference Dose (mg/kg-day)	Inhalation Reference Dose (mg/kg-day)	Target Hazard Concentration (ug/kg)
ORGANICS:			
1,1,1-Trichloroethane (a)	9.0E-02	2.9E-01	6.3E+06
1,2-Dichloroethene (total) (a,b)	9.0E-03	9.0E-03	1.1E+05
2,4,5-T (b)	1.0E-02	1.0E-02	1.3E+06
2,4,5-Trichlorophenoxy proprionic acid (b)	8.0E-03	8.0E-03	1.1E+06
2,4-D (b)	1.0E-02	1.0E-02	1.3E+06
2,4-DB (b)	8.0E-03	8.0E-03	1.1E+06
2,4-Dimethylphenol (b)	2.0E-02	2.0E-02	2.6E+06
2-Butanone (a)	-	2.9E-01	6.0E+07
2-Hexanone (a)	-	-	-
2-Methylnaphthalene (a)	-	-	-
4',4'-DDD	-	-	-
4',4'-DDE	-	-	-
4',4'-DDT (b)	5.0E-04	5.0E-04	6.6E+04
4-Methyl-2-pentanone (a)	5.0E-02	2.0E-02	2.1E+06
4-Methylphenol (b)	5.0E-02	5.0E-02	6.6E+06
Acenaphthene (a,b)	6.0E-02	6.0E-02	7.5E+06
Acenaphthylene (a)	-	-	-
Acetone (a,b)	1.0E-01	1.0E-01	4.8E+06
Aldrin (b)	3.0E-05	3.0E-05	3.9E+03
Alpha chlordane (b)	6.0E-05	6.0E-05	7.9E+03
Alpha-BHC	-	-	-
Anthracene (a,b)	3.0E-01	3.0E-01	3.6E+07
Benzene (a)	-	-	-
Benzo(a)anthracene	-	-	-
Benzo(a)pyrene	-	-	-
Benzo(b)fluoranthene	-	-	-
Benzo(g,h,i)perylene	-	-	-
Benzo(k)fluoranthene	-	-	-
Benzyl butyl phthalate (b)	2.0E-01	2.0E-01	2.6E+07
Beta chlordane (b)	6.0E-05	6.0E-05	7.9E+03
Bis(2-ethylhexyl)phthalate (b)	2.0E-02	2.0E-02	2.6E+06
Bromodichloromethane (a,b)	2.0E-02	2.0E-02	1.1E+06
Bromoform (b)	2.0E-02	2.0E-02	2.6E+06
Carbazole	-	-	-
Carbon disulfide (a,b)	1.0E-01	1.0E-01	4.0E+06
Carbon tetrachloride (a,b)	7.0E-04	7.0E-04	1.2E+04
Chlorodibromomethane (b)	2.0E-02	2.0E-02	2.6E+06
Chloroform (a,b)	1.0E-02	1.0E-02	2.2E+05
Chrysene	-	-	-
Dalapon (b)	3.0E-02	3.0E-02	3.9E+06
Delta-BHC	-	-	-
Di-n-butyl phthalate (b)	1.0E-01	1.0E-01	2.7E+07
Dibenzo(a,h)anthracene	-	-	-
Dibenzofuran (b)	-	-	-
Dichloroprop	-	-	-
Dieldrin (b)	5.0E-05	5.0E-05	6.6E+03
Diethyl phthalate (b)	8.0E-01	8.0E-01	1.1E+08
Dimethyl phthalate (b)	1.0E+01	1.0E+01	1.3E+09
Endosulfan I	-	-	-
Endosulfan II	-	-	-
Endosulfan sulfate	-	-	-
Endrin (b)	3.0E-04	3.0E-04	3.9E+04
Endrin aldehyde	-	-	-
Endrin ketone	-	-	-
Ethylbenzene (a)	1.0E-01	2.9E-01	9.6E+06
Fluoranthene (b)	4.0E-02	4.0E-02	5.3E+06
Fluorene (a,b)	4.0E-02	4.0E-02	5.1E+06
Gamma chlordane (b)	6.0E-05	6.0E-05	7.9E+03
Heptachlor epoxide (b)	1.0E-05	1.0E-05	1.3E+03
Hexachloroethane (b)	1.0E-03	1.0E-03	1.3E+05
Indeno(1,2,3-cd)pyrene	-	-	-
Isophorone (b)	2.0E-01	2.0E-01	2.6E+07
Lindane (b)	3.0E-04	3.0E-04	3.9E+04
MCPA (b)	5.0E-04	5.0E-04	6.6E+04
MCPP (b)	1.0E-03	1.0E-03	1.3E+05
Methoxychlor (b)	5.0E-03	5.0E-03	6.6E+05
Methylene chloride (a)	6.0E-02	8.6E-01	5.0E+06
Naphthalene (a,b)	4.0E-02	4.0E-02	4.2E+06
Octachlorodibenzo-p-dioxins	-	-	-

Table H2-3
Risk-Based Concentrations-Noncarcinogenic Health Effects
Residential Scenario
Ingestion of Soil, Inhalation of Soil Particulates,
Inhalation of Soil Volatiles, and Dermal Contact with Soil
MCAS El Toro Phase I RI Technical Memorandum

Chemical	Oral Reference Dose (mg/kg-day)	Inhalation Reference Dose (mg/kg-day)	Target Hazard Concentration (ug/kg)
PCB 1248	-	-	-
PCB 1254	-	-	-
PCB 1260	-	-	-
Petroleum hydrocarbons (total recoverable) (	2.0E-01	2.0E-01	2.6E+07
Phenanthrene (a)	-	-	-
Phenol (b)	6.0E-01	6.0E-01	7.9E+07
Pyrene (b)	3.0E-02	3.0E-02	3.9E+06
Tetrachloroethene (a,b)	1.0E-02	1.0E-02	1.4E+05
TFH diesel (b)	2.0E-02	2.0E-02	2.6E+06
TFH gasoline (b)	2.0E-01	2.0E-01	2.6E+07
Toluene (a)	2.0E-01	1.1E-01	6.4E+06
Trichloroethylene (a,b)	6.0E-03	6.0E-03	1.7E+05
Xylenes (total) (a,b)	2.0E+00	2.0E+00	2.6E+08
INORGANICS:			
Aluminum	-	-	-
Antimony	4.0E-04	-	9.9E+04
Arsenic	3.0E-04	-	7.4E+04
Barium	7.0E-02	1.4E-04	1.7E+07
Beryllium	5.0E-03	-	1.2E+06
Cadmium	5.0E-04	-	1.2E+05
Chromium	5.0E-03	-	1.2E+06
Cobalt	-	-	-
Copper	-	-	-
Cyanide	2.0E-02	-	4.9E+06
Lead	-	-	-
Manganese	1.4E-01	1.1E-04	3.4E+07
Mercury	3.0E-04	8.6E-05	7.4E+04
Nickel	2.0E-02	-	4.9E+06
Nitrate/Nitrite	1.0E-01	-	2.5E+07
Selenium	5.0E-03	-	1.2E+06
Silver	5.0E-03	-	1.2E+06
Thallium	8.0E-05	-	2.0E+04
Vanadium	7.0E-03	-	1.7E+06
Zinc	3.0E-01	-	7.4E+07

Exposure Setting:	Residential
THI: Target Hazard Index (unitless)	1
BW: Body weight (kg)	70
AT: Averaging Time (years)	30
EF: Exposure frequency (days/year)	350
ED: Exposure duration (years)	30
RfDo: Oral chronic reference dose (mg/kg-day)	chem. specific
IF: Age adjusted soil ingestion factor (mg-yr/kg-day	114
RfDi: Inhalation reference dose (mg/kg-day)	chem. specific
IR3: Inhalation rate (m3/day)	20
VF: Soil-to-air volatilization factor (m3/kg)	chem. specific
PEF: Particulate emission factor (m3/kg)	4.63E+09
SA: Surface area (cm2)	5800
ABS: Absorption factor (fraction)	chem. specific
AF: Adherance factor (mg/cm2)	0.5

Target Concentration (ug/kg) =

$$\frac{THI \times BW \times AT \times 365 \text{ days/yr}}{EF \times [(1/RfDo \times 1E\text{-}6 \text{ kg/mg} \times IF \times BW) + (1/RfDo \times 1E\text{-}6 \times SA \times ABS \times AF \times ED) + ((1/RfDi \times IR3 \times ED \times (1/VF + 1/PEF))]} \times 1000 \text{ ug/kg}$$

Notes:
(a) Inhalation of volatiles was calculated for chemicals with a Henry's Law constant greater than or equal to 1E-05 atm-m3/mole and a molecular weight less than or equal to 200 g/mole.

(b) Oral reference doses were used for organic chemicals with no inhalation reference dose.

Table H2-4
Risk-Based Concentrations-Carcinogenic Health Effects
Residential Scenario
Ingestion of Soil, Inhalation of Soil Particulates,
Inhalation of Soil Volatiles, and Dermal Contact with Soil
MCAS El Toro Phase I RI Technical Memorandum

Chemical	EPA Oral WOE	Oral Slope Factor (kg-day/mg)	EPA Inhalation WOE	Inhalation Slope Factor (kg-day/mg)	Target Cancer Risk: 1E-04 (ug/kg)	1E-05 (ug/kg)	1E-06 (ug/kg)
ORGANICS:							
1,1,1-Trichloroethylene (a)	D	-	D	-	-	-	-
1,2-Dichloroethene (total) (a)	D	-	D	-	-	-	-
2,4,5-T	-	-	-	-	-	-	-
2,4,5-Trichlorophenoxy proprio	D	-	D	-	-	-	-
2,4-D	-	-	-	-	-	-	-
2,4-DB	-	-	-	-	-	-	-
2,4-Dimethylphenol	-	-	-	-	-	-	-
2-Butanone (a)	D	-	D	-	-	-	-
2-Hexanone (a)	-	-	-	-	-	-	-
2-Methylnaphthalene (a)	-	-	-	-	-	-	-
4',4'-DDD (b)	B2	2.4E-01	-	2.4E-01	1.3E+05	1.3E+04	1.3E+03
4',4'-DDE (b)	B2	3.4E-01	-	3.4E-01	9.0E+04	9.0E+03	9.0E+02
4',4'-DDT	B2	3.4E-01	B2	3.4E-01	9.0E+04	9.0E+03	9.0E+02
4-Methyl-2-pentanone	-	-	-	-	-	-	-
4-Methylphenol	C	-	C	-	-	-	-
Acenaphthene (a)	-	-	-	-	-	-	-
Acenaphthylene (a)	D	-	D	-	-	-	-
Acetone (a)	D	-	D	-	-	-	-
Aldrin	B2	1.7E+01	B2	1.7E+01	1.8E+03	1.8E+02	1.8E+01
Alpha chlordane	B2	1.3E+00	B2	1.3E+00	2.4E+04	2.4E+03	2.4E+02
Alpha-BHC	B2	6.3E+00	B2	6.3E+00	4.9E+03	4.9E+02	4.9E+01
Anthracene (a)	D	-	D	-	-	-	-
Benzene (a)	A	2.9E-02	D	2.9E-02	2.4E+05	2.4E+04	2.4E+03
Benzo(a)anthracene (b)	B2	7.3E+00	B2	7.3E+00	4.2E+03	4.2E+02	4.2E+01
Benzo(a)pyrene (b)	B2	7.3E+00	B2	7.3E+00	4.2E+03	4.2E+02	4.2E+01
Benzo(b)fluoranthene (b)	B2	7.3E+00	B2	7.3E+00	4.2E+03	4.2E+02	4.2E+01
Benzo(g,h,i)perylene	D	-	D	-	-	-	-
Benzo(k)fluoranthene (b)	B2	7.3E+00	B2	7.3E+00	4.2E+03	4.2E+02	4.2E+01
Benzyl butyl phthalate	C	-	C	-	-	-	-
Beta chlordane	B2	1.3E+00	B2	1.3E+00	2.4E+04	2.4E+03	2.4E+02
Bis(2-ethylhexyl)phthalate (b)	B2	1.4E-02	B2	1.4E-02	2.2E+06	2.2E+05	2.2E+04
Bromodichloromethane (a,b)	B2	6.2E-02	-	6.2E-02	2.1E+05	2.1E+04	2.1E+03
Bromoform	B2	7.9E-03	B2	3.9E-03	3.9E+06	3.9E+05	3.9E+04
Carbazole (b)	B2	2.0E-02	B2	2.0E-02	1.5E+06	1.5E+05	1.5E+04
Carbon disulfide (a)	-	-	-	-	-	-	-
Carbon tetrachloride (a)	B2	1.3E-01	B2	5.3E-02	6.3E+04	6.3E+03	6.3E+02
Chlorodibromomethane (b)	C	8.4E-02	C	8.4E-02	3.6E+05	3.6E+04	3.6E+03
Chloroform (a)	B2	6.1E-03	B2	8.1E-02	7.6E+04	7.6E+03	7.6E+02
Chrysene (b)	B2	7.3E+00	B2	7.3E+00	4.2E+03	4.2E+02	4.2E+01
Dalapon	-	-	-	-	-	-	-
Delta-BHC	D	-	D	-	-	-	-
Di-n-butyl phthalate	D	-	D	-	-	-	-
Dibenzo(a,h)anthracene (b)	B2	7.3E+00	B2	7.3E+00	4.2E+03	4.2E+02	4.2E+01
Dibenzofuran (a)	D	-	D	-	-	-	-
Dichloroprop	-	-	-	-	-	-	-
Dieldrin	B2	1.6E+01	B2	1.6E+01	1.9E+03	1.9E+02	1.9E+01
Diethyl phthalate	D	-	D	-	-	-	-
Dimethyl phthalate	D	-	-	-	-	-	-
Endosulfan I	-	-	-	-	-	-	-
Endosulfan II	-	-	-	-	-	-	-
Endosulfan sulfate	-	-	-	-	-	-	-
Endrin	D	-	D	-	-	-	-
Endrin aldehyde	-	-	-	-	-	-	-
Endrin ketone	-	-	-	-	-	-	-
Ethylbenzene (a)	D	-	D	-	-	-	-
Fluoranthene	D	-	D	-	-	-	-
Fluorene (a)	D	-	D	-	-	-	-
Gamma chlordane	B2	1.3E+00	B2	1.3E+00	2.4E+04	2.4E+03	2.4E+02
Heptachlor epoxide	B2	9.1E+00	B2	9.1E+00	3.4E+03	3.4E+02	3.4E+01
Hexachloroethane	C	1.4E-02	C	4.9E+01	2.1E+06	2.1E+05	2.1E+04
Indeno(1,2,3-cd)pyrene (b)	B2	7.3E+00	B2	7.3E+00	4.2E+03	4.2E+02	4.2E+01
Isophorone (b)	C	1.0E-03	C	1.0E-03	3.1E+07	3.1E+06	3.1E+05
Lindane (b)	B2	1.3E+00	B2	1.3E+00	2.4E+04	2.4E+03	2.4E+02

Table H2-4
Risk-Based Concentrations-Carcinogenic Health Effects
Residential Scenario
Ingestion of Soil, Inhalation of Soil Particulates,
Inhalation of Soil Volatiles, and Dermal Contact with Soil
MCAS El Toro Phase I RI Technical Memorandum

Chemical	EPA Oral WOE	Oral Slope Factor (kg-day/mg)	EPA Inhalation WOE	Inhalation Slope Factor (kg-day/mg)	Target Cancer Risk: 1E-04 (ug/kg)	1E-05 (ug/kg)	1E-06 (ug/kg)
MCPA	-	-	-	-	-	-	-
MCPP	-	-	-	-	-	-	-
Methoxychlor	D	-	D	-	-	-	-
Methylene chloride (a)	B2	7.5E-03	B2	1.6E-03	1.5E+06	1.5E+05	1.5E+04
Naphthalene (a)	D	-	D	-	-	-	-
Octachlorodibenzo-p-dioxins	B2	1.5E+05	B2	1.5E+05	2.0E-01	2.0E-02	2.0E-03
PCB 1248 (b)	B2	7.7E+00	B2	7.7E+00	4.0E+03	4.0E+02	4.0E+01
PCB 1254 (b)	B2	7.7E+00	B2	7.7E+00	4.0E+03	4.0E+02	4.0E+01
PCB 1260 (b)	B2	7.7E+00	B2	7.7E+00	4.0E+03	4.0E+02	4.0E+01
Petroleum hydrocarbons (total	C	1.7E-03	C	4.8E-07	1.8E+07	1.8E+06	1.8E+05
Phenanthrene (a)	D	-	D	-	-	-	-
Phenol	D	-	D	-	-	-	-
Pyrene	D	-	D	-	-	-	-
Tetrachloroethene (a)	B2	5.1E-02	B2	1.8E-03	4.6E+05	4.6E+04	4.6E+03
TFH diesel	D	-	D	-	-	-	-
TFH gasoline (b)	C	2.0E-03	C	2.0E-03	1.5E+07	1.5E+06	1.5E+05
Toluene (a)	D	-	D	-	-	-	-
Trichloroethylene (a)	B2	1.1E-02	B2	6.0E-03	9.3E+05	9.3E+04	9.3E+03
Xylenes (total) (a)	D	-	D	-	-	-	-
INORGANICS:							
Aluminum	-	-	-	-	-	-	-
Antimony	-	-	-	-	-	-	-
Arsenic	A	1.8E+00	A	1.5E+01	3.3E+04	3.3E+03	3.3E+02
Barium	-	-	-	-	-	-	-
Beryllium	B2	4.3E+00	B2	8.4E+00	1.3E+04	1.3E+03	1.3E+02
Cadmium	-	-	B1	6.3E+00	6.3E+08	6.3E+07	6.3E+06
Chromium	-	-	A	4.2E+01	9.4E+07	9.4E+06	9.4E+05
Cobalt	-	-	-	-	-	-	-
Copper	D	-	D	-	-	-	-
Cyanide	D	-	D	-	-	-	-
Lead	B2	-	B2	-	-	-	-
Manganese	D	-	D	-	-	-	-
Mercury	D	-	D	-	-	-	-
Nickel	-	-	-	-	-	-	-
Nitrate/Nitrite	-	-	-	-	-	-	-
Selenium	D	-	D	-	-	-	-
Silver	D	-	D	-	-	-	-
Thallium	D	-	D	-	-	-	-
Vanadium	-	-	-	-	-	-	-
Zinc	D	-	D	-	-	-	-

Table H2-4
Risk-Based Concentrations-Carcinogenic Health Effects
Residential Scenario
Ingestion of Soil, Inhalation of Soil Particulates,
Inhalation of Soil Volatiles, and Dermal Contact with Soil
MCAS El Toro Phase I RI Technical Memorandum

Chemical	EPA Oral WOE	Oral Slope Factor (kg-day/mg)	EPA Inhalation WOE	Inhalation Slope Factor (kg-day/mg)	Target Cancer Risk: 1E-04 (ug/kg)	1E-05 (ug/kg)	1E-06 (ug/kg)
Exposure Setting:					Residential	Residential	Residential
TRL: Target Risk Level:					1E-04	1E-05	1E-06
BW: Body weight (kg)					70	70	70
AT: Averaging time (years)					70	70	70
EF: Exposure frequency (days/year)					350	350	350
ED: Exposure duration (years)					30	30	30
SFo: Oral cancer slope factor (mg/kg-day)-1					chem. specifi	chem. specific	chem. specific
IF: Age adjusted ingestion factor (mg-yr/kg-day)					114	114	114
SFi: Inhalation cancer slope factor (mg/kg-day)-1					chem. specfi	chem. specific	chem. specific
IR3: Workday inhalation rate (m3/day)					20	20	20
VF:: Soil-to-air volatilization factor (m3/kg)					chem. specifi	chem. specific	chem. specific
PEF: Particulate emission factor (m3/kg)					4.63E+09	4.63E+09	4.63E+09
SA: Surface Area (cm2)					5800	5800	5800
ABS: Absorption factor (fraction)					chem. specifi	chem. specific	chem. specific
AF: Adherance factor (mg/cm2)					0.5	0.5	0.5

Target Concentration (ug/kg) =

$$\frac{\text{TRL} \times \text{BW} \times \text{AT} \times 365 \text{ days/yr}}{\text{EF} \times \{(\text{SFo} \times 10\text{-}6 \text{ kg/mg} \times \text{IF} \times \text{BW}) + (\text{SFo} \times 10\text{-}6 \text{ kg/mg} \times \text{SA} \times \text{ABS} \times \text{AF} \times \text{ED}) + [\text{SFi} \times \text{IR3} \times \text{ED} \times (1/\text{VF} + 1/\text{PEF})]\}} \times 1000 \text{ ug/kg}$$

Notes:
(a) Inhalation of volatiles was calculated for chemicals with a Henry's Law constant greater than or equal to 1E-05 atm-m3/mole and a molecular weight less than or equal to 200 g/mole.
(b) The oral RfD was used for chemicals with no inhalation RfD.

Table H2-5
Risk-Based Concentrations-Noncarcinogenic Health Effects
Recreational Scenario
Ingestion of Sediment, Inhalation of Sediment Particulates,
Inhaltion of Sediment Volatiles, and Dermal Contact with Sediment
MCAS El Toro Phase I RI Technical Memorandum

Chemical	Oral Reference Dose (mg/kg-day)	Inhalation Reference Dose (mg/kg-day)	Target Hazard Concentration (ug/kg)
ORGANICS:			
2,4,5-Trichlorophenoxy propionic acid (b)	8.0E-03	8.0E-03	1.4E+07
2,4-DB (b)	8.0E-03	8.0E-03	1.4E+07
2-Butanone (a)	-	2.9E-01	7.7E+09
2-Hexanone (a)	-	-	-
2-Methylnaphthalene (a)	-	-	-
4',4'-DDD	-	-	-
4',4'-DDE	-	-	-
4',4'-DDT (b)	5.0E-04	5.0E-04	8.5E+05
4-Methylphenol (b)	5.0E-02	5.0E-02	8.5E+07
Acenaphthene (a,b)	6.0E-02	6.0E-02	1.0E+08
Acenaphthylene (a)	-	-	-
Acetone (a,b)	1.0E-01	1.0E-01	1.4E+08
Alpha chlordane (b)	6.0E-05	6.0E-05	1.0E+05
Anthracene (a,b)	3.0E-01	3.0E-01	5.1E+08
Benzene (a)	-	-	-
Benzo(a)anthracene	-	-	-
Benzo(a)pyrene	-	-	-
Benzo(b)fluoranthene	-	-	-
Benzo(g,h,i)perylene	-	-	-
Benzo(k)fluoranthene	-	-	-
Benzyl butyl phthalate (b)	2.0E-01	2.0E-01	3.4E+08
Beta chlordane (b)	6.0E-05	6.0E-05	1.0E+05
Bis(2-ethylhexyl)phthalate (b)	2.0E-02	2.0E-02	3.4E+07
Carbazole	-	-	-
Carbon tetrachloride (a,b)	7.0E-04	7.0E-04	7.0E+05
Chrysene	-	-	-
Dalapon (b)	3.0E-02	3.0E-02	5.1E+07
Delta BHC	-	-	-
Dibenzo(a,h)anthracene	-	-	-
Dibenzofuran (a)	-	-	-
Dichloroprop	-	-	-
Dieldrin (b)	5.0E-05	5.0E-05	8.5E+04
Endosulfan II	-	-	-
Endosulfan sulfate	-	-	-
Endrin (b)	3.0E-04	3.0E-04	5.1E+05
Endrin ketone	-	-	-
Fluoranthene (b)	4.0E-02	4.0E-02	6.8E+07
Fluorene (a,b)	4.0E-02	4.0E-02	6.8E+07
Gamma chlordane (b)	6.0E-05	6.0E-05	1.0E+05
Indeno(1,2,3-cd)pyrene	-	-	-
MCPP (b)	1.0E-03	1.0E-03	1.7E+06
Methoxychlor (b)	5.0E-03	5.0E-03	8.5E+06
Methylene chloride (a)	6.0E-02	8.6E-01	9.6E+07
Petroleum hydrocarbons (total recoverable)	2.0E-01	2.0E-01	3.4E+08
Phenanthrene (a)	-	-	-
Pyrene (b)	3.0E-02	3.0E-02	5.1E+07
TFH diesel (b)	2.0E-02	2.0E-02	3.4E+07
TFH gasoline (b)	2.0E-01	2.0E-01	3.4E+08
Toluene (a)	2.0E-01	1.1E-01	2.6E+08
Trichloroethylene (b)	6.0E-03	6.0E-03	7.4E+06
INORGANICS:			
Aluminum	-	-	-
Antimony	4.0E-04	-	2.0E+06
Arsenic	3.0E-04	-	1.5E+06
Barium	7.0E-02	1.4E-04	3.5E+08
Beryllium	5.0E-03	-	2.5E+07
Cadmium	5.0E-04	-	2.5E+06
Chromium	5.0E-03	-	2.5E+07
Cobalt	-	-	-

Table H2-5
Risk-Based Concentrations-Noncarcinogenic Health Effects
Recreational Scenario
Ingestion of Sediment, Inhalation of Sediment Particulates,
Inhaltion of Sediment Volatiles, and Dermal Contact with Sediment
MCAS El Toro Phase I RI Technical Memorandum

Chemical	Oral Reference Dose (mg/kg-day)	Inhalation Reference Dose (mg/kg-day)	Target Hazard Concentration (ug/kg)
Copper	-	-	-
Lead	-	-	-
Manganese	1.4E-01	1.1E-04	7.0E+08
Mercury	3.0E-04	8.6E-05	1.5E+06
Nickel	2.0E-02	-	1.0E+08
Selenium	5.0E-03	-	2.5E+07
Silver	5.0E-03	-	2.5E+07
Thallium	8.0E-05	-	4.0E+05
Vanadium	7.0E-03	-	3.5E+07
Zinc	3.0E-01	-	1.5E+09

Exposure Setting:	Residential
THI: Target Hazard Index (unitless)	1
BW: Body weight age 9-16 (kg)	46
AT: Averaging Time (years)	7
EF: Exposure frequency (days/year)	26
ED: Exposure duration (years)	7
RfDo: Oral chronic reference dose (mg/kg-day)	chem. specific
IRs: Soil ingestion rate (mg/day)	100
RfDi: Inhalation reference dose (mg/kg-day)	chem. specific
IR3: Inhalation rate for exposure: 2 hrs/day at 0.7 m3/hr (m3/day)	1.4
VF: Soil-to-air volatilization factor (m3/kg)	chem. specific
PEF: Particulate emission factor (m3/kg)	4.63E+09
SA: Surface area (cm2)	5600
ABS: Absorption factor (fraction)	chem. specific
AF: Adherance factor (mg/cm2)	0.5

Target Concentration (ug/kg) =

$$\frac{THI \times BW \times AT \times 365\ \text{days/yr}}{ED \times EF \times [(1/RfDo \times 1E\text{-}6\ \text{kg/mg} \times IRs) + (1/RfDo \times 1E\text{-}6 \times SA \times ABS \times AF) + ((1/RfDi \times IR3 \times (1/VF + 1/PEF))]} \times 1000\ \text{ug/kg}$$

Notes:
(a) Inhalation of volatiles was calculated for chemicals with a Henry's Law constant greater than or equal to 1E-05 atm-m3/mole and a molecular weight less than or equal to 200 g/mole.
(b) Oral reference doses were used for organic chemicals with no inhalation reference dose.

Table H2-6
Risk-Based Concentrations-Carcinogenic Health Effects
Recreational Scenario
Ingestion of Sediment, Inhalation of Sediment Particulates,
Inhalation of Sediment Volatiles, and Dermal Contact with Sediment
MCAS El Toro Phase I RI Technical Memorandum

Chemical	EPA Oral WOE	Oral Slope Factor (kg-day/mg)	EPA Inhalation WOE	Inhalation Slope Factor (kg-day/mg)	Target Cancer Risk: 1E-04 (ug/kg)	1E-05 (ug/kg)	1E-06 (ug/kg)
ORGANICS:							
2,4,5-Trichlorophenoxy propionic	D	-	D	-	-	-	-
2,4-DB	-	-	-	-	-	-	-
2-Butanone (a)	D	-	D	-	-	-	-
2-Hexanone (a)	-	-	-	-	-	-	-
2-Methylnaphthalene (a)	-	-	-	-	-	-	-
4',4'-DDD (b)	B2	2.4E-01	-	2.4E-01	7.1E+06	7.1E+05	7.1E+04
4',4'-DDE (b)	B2	3.4E-01	-	3.4E-01	5.0E+06	5.0E+05	5.0E+04
4',4'-DDT	B2	3.4E-01	B2	3.4E-01	5.0E+06	5.0E+05	5.0E+04
4-Methylphenol	C	-	C	-	-	-	-
Acenaphthene (a)	-	-	-	-	-	-	-
Acenaphthylene (a)	D	-	D	-	-	-	-
Acetone (a)	D	-	D	-	-	-	-
Alpha chlordane	B2	1.3E+00	B2	1.3E+00	1.3E+06	1.3E+05	1.3E+04
Anthracene (a)	D	-	D	-	-	-	-
Benzene (a)	A	2.9E-02	A	2.9E-02	4.3E+07	4.3E+06	4.3E+05
Benzo(a)anthracene (b)	B2	7.3E+00	B2	7.3E+00	2.3E+05	2.3E+04	2.3E+03
Benzo(a)pyrene (b)	B2	7.3E+00	B2	7.3E+00	2.3E+05	2.3E+04	2.3E+03
Benzo(b)fluoranthene (b)	B2	7.3E+00	B2	7.3E+00	2.3E+05	2.3E+04	2.3E+03
Benzo(g,h,i)perylene	D	-	D	-	-	-	-
Benzo(k)fluoranthene (b)	B2	7.3E+00	B2	7.3E+00	2.3E+05	2.3E+04	2.3E+03
Benzyl butyl phthalate	C	-	C	-	-	-	-
Beta chlordane	B2	1.3E+00	B2	1.3E+00	1.3E+06	1.3E+05	1.3E+04
Bis(2-ethylhexyl)phthalate (b)	B2	1.4E-02	B2	1.4E-02	1.2E+08	1.2E+07	1.2E+06
Carbazole (b)	B2	2.0E-02	-	2.0E-02	8.5E+07	8.5E+06	8.5E+05
Carbon tetrachloride (a)	B2	1.3E-01	B2	5.3E-02	1.0E+07	1.0E+06	1.0E+05
Chrysene (b)	B2	7.3E+00	B2	7.3E+00	2.3E+05	2.3E+04	2.3E+03
Dalapon	-	-	-	-	-	-	-
Delta BHC	D	-	D	-	-	-	-
Dibenzo(a,h)anthracene (b)	B2	7.3E+00	B2	7.3E+00	2.3E+05	2.3E+04	2.3E+03
Dibenzofuran (a)	D	-	D	-	-	-	-
Dichloroprop	-	-	-	-	-	-	-
Dieldrin	B2	1.6E+01	B2	1.6E+01	1.1E+05	1.1E+04	1.1E+03
Endosulfan II	-	-	-	-	-	-	-
Endosulfan sulfate	-	-	-	-	-	-	-
Endrin	D	-	D	-	-	-	-
Endrin ketone	-	-	-	-	-	-	-
Fluoranthene	D	-	D	-	-	-	-
Fluorene (a)	D	-	D	-	-	-	-
Gamma chlordane	B2	1.3E+00	B2	1.3E+00	1.3E+06	1.3E+05	1.3E+04
Indeno(1,2,3-cd)pyrene (b)	B2	7.3E+00	B2	7.3E+00	2.3E+05	2.3E+04	2.3E+03
MCPP	-	-	-	-	-	-	-
Methoxychlor	D	-	D	-	-	-	-
Methylene chloride (a)	B2	7.5E-03	B2	1.6E-03	1.9E+08	1.9E+07	1.9E+06
Petroleum hydrocarbons (total re	C	1.7E-03	C	4.8E-07	1.0E+09	1.0E+08	1.0E+07
Phenanthrene (a)	D	-	D	-	-	-	-
Pyrene	D	-	D	-	-	-	-
TFH diesel	D	-	D	-	-	-	-
TFH gasoline (b)	C	2.0E-03	C	2.0E-03	8.5E+08	8.5E+07	8.5E+06
Toluene (a)	D	-	D	-	-	-	-
Trichloroethylene (a)	B2	1.1E-02	B2	6.0E-03	1.3E+08	1.3E+07	1.3E+06

Table H2-6
Risk-Based Concentrations-Carcinogenic Health Effects
Recreational Scenario
Ingestion of Sediment, Inhalation of Sediment Particulates,
Inhalation of Sediment Volatiles, and Dermal Contact with Sediment
MCAS El Toro Phase I RI Technical Memorandum

Chemical	EPA Oral WOE	Oral Slope Factor (kg-day/mg)	EPA Inhalation WOE	Inhalation Slope Factor (kg-day/mg)	Target Cancer Risk: 1E-04 (ug/kg)	1E-05 (ug/kg)	1E-06 (ug/kg)
INORGANICS:							
Aluminum	-	-	-	-	-	-	-
Antimony	-	-	-	-	-	-	-
Arsenic	A	1.8E+00	A	1.5E+01	2.9E+06	2.9E+05	2.9E+04
Barium	-	-	-	-	-	-	-
Beryllium	B2	4.3E+00	B2	8.4E+00	1.2E+06	1.2E+05	1.2E+04
Cadmium	-	-	B1	6.3E+00	3.4E+11	3.4E+10	3.4E+09
Chromium	-	-	A	4.2E+01	5.1E+10	5.1E+09	5.1E+08
Cobalt	-	-	-	-	-	-	-
Copper	D	-	D	-	-	-	-
Lead	B2	-	B2	-	-	-	-
Manganese	D	-	D	-	-	-	-
Mercury	D	-	D	-	-	-	-
Nickel	-	-	-	-	-	-	-
Selenium	D	-	D	-	-	-	-
Silver	D	-	D	-	-	-	-
Thallium	D	-	D	-	-	-	-
Vanadium	-	-	-	-	-	-	-
Zinc	D	-	D	-	-	-	-

Exposure Setting:	Residential	Residential	Residential
TRL: Target Risk Level:	1E-04	1E-05	1E-06
BW: Body weight age 9-16 (kg)	46	46	46
AT: Averaging time (years)	70	70	70
EF: Exposure frequency (days/year)	26	26	26
ED: Exposure duration (years)	7	7	7
SFo: Oral cancer slope factor (mg/kg-day)-1	chem. specifi	chem. specific	chem. specific
IRs: Soil ingestion rate (mg/day)	100	100	100
SFi: Inhalation cancer slope factor (mg/kg-day)-1	chem. specfi	chem. specific	chem. specific
IR3: inhalation rate for exposure : 2 hrs at 0.7 m3/hr (m3/day)	1.4	1.4	1.4
VF:: Soil-to-air volatilization factor (m3/kg)	chem. specifi	chem. specific	chem. specific
PEF: Particulate emission factor (m3/kg)	4.63E+09	4.63E+09	4.63E+09
SA: Surface Area (cm2)	5600	5600	5600
ABS: Absorption factor (fraction)	chem. specifi	chem. specific	chem. specific
AF: Adherance factor (mg/cm2)	0.5	0.5	0.5

Target Concentration (ug/kg) =

$$\frac{TRL \times BW \times AT \times 365 \text{ days/yr}}{EF \times ED \times \{(SFo \times 10\text{-}6 \text{ kg/mg} \times IRs) + (SFo \times 10\text{-}6 \text{ kg/mg} \times SA \times ABS \times AF) + (SFi \times IR3 \times (1/VF + 1/PEF))\}} \times 1000 \text{ ug/kg}$$

Notes:
(a) Inhalation of volatiles was calculated for chemicals with a Henry's Law constant greater than or equal to 1E-05 atm-m3/mole and a molecular weight less than or equal to 200 g/mole.
(b) The oral slope factor was used for organic chemicals with no inhalation slope factor.

Table H2-7
Risk-Based Concentrations-Noncarcinogenic Health Effects
Recreational Scenario
Ingestion of Surface Water and Dermal Contact with Surface Water
MCAS El Toro Phase I RI Technical Memorandum

Chemical	Oral Reference Dose (mg/kg-day)	Target Hazard Concentration (ug/L)
ORGANICS:		
1,1,1-Trichloroethane	9.0E-02	1.9E+05
2-Butanone	-	-
2-Methylnaphthalene	-	-
4',4'-DDE	-	-
4',4'-DDT	5.0E-04	6.5E+01
4-Nitrophenol	-	-
Acetone	1.0E-01	4.7E+05
Benzyl butyl phthalate	2.0E-01	9.4E+05
Beta-BHC	-	-
Bis(2-ethylhexyl)phthalate	2.0E-02	2.6E+04
Chloroform	1.0E-02	4.1E+03
Delta-BHC	-	-
Endosulfan sulfate	-	-
Gamma chlordane	6.0E-05	5.5E+01
Methylene chloride	6.0E-02	2.3E+05
TFH diesel	2.0E-02	9.4E+04
Toluene	2.0E-01	1.1E+04
INORGANICS:		
Aluminum	-	-
Antimony	4.0E-04	2.0E+03
Arsenic	3.0E-04	1.5E+03
Barium	7.0E-02	3.4E+05
Beryllium	5.0E-03	2.5E+04
Cadmium	5.0E-04	2.5E+03
Chromium	5.0E-03	2.5E+04
Cobalt	-	-
Copper	-	-
Cyanide	2.0E-02	9.8E+04
Lead	-	-
Manganese	5.0E-03	2.5E+04
Mercury	3.0E-04	1.5E+03
Nickel	2.0E-02	9.8E+04
Nitrate/nitrite	1.0E-01	4.9E+05
Selenium	5.0E-03	2.5E+04
Thallium	8.0E-05	3.9E+02
Vanadium	7.0E-03	3.4E+04
Zinc	3.0E-01	1.5E+06
RADIONUCLIDES:		
Gross alpha	-	-
Gross beta	-	-

Exposure Setting:	Residential
THI: Target Hazard Index (unitless)	1
BW: Body weight ages 9-16 (kg)	46
AT: Averaging Time (years)	7
EF: Exposure frequency (days/year)	26
ED: Exposure duration (years)	7
ET: Exposure time (hours/day)	2
RfDo: Oral chronic reference dose (mg/kg-day)	chem. specific
IRw: Water ingestion rate (l/day)	0.12
SA: Surface area available for contact (cm2)	5600
PC: Dermal permeability constant (cm/hr)	chem. specific

Target Concentration (ug/L) = THI x BW x AT x 365 days/yr
-- x 1000 ug/mg
EF x ED x [(1/RfDo x IRw) + (1/RfDo x ET x SA x PC x 0.001 L/cm3)]

Table H2-8
Risk-Based Concentrations-Carcinogenic Health Effects
Recreational Scenario
Ingestion of Surface Water and Dermal Contact with Surface Water
MCAS El Toro Phase I RI Technical Memorandum

Chemical	EPA Oral WOE	Oral Slope Factor (kg-day/mg)	Target Cancer Risk: 1E-04 (ug/L)	1E-05 (ug/L)	1E-06 (ug/L)
ORGANICS:					
1,1,1-Trichloroethane	D	-	-	-	-
2-Butanone	D	-	-	-	-
2-Methylnaphthalene	-	-	-	-	-
4',4'-DDE	B2	3.4E-01	6.8E+02	6.8E+01	6.8E+00
4',4'-DDT	B2	3.4E-01	3.8E+02	3.8E+01	3.8E+00
4-Nitrophenol	-	-	-	-	-
Acetone	D	-	-	-	-
Benzyl butyl phthalate	C	-	-	-	-
Beta-BHC	C	1.8E+00	2.6E+03	2.6E+02	2.6E+01
Bis(2-ethylhexyl)phthalate	B2	1.4E-02	9.4E+04	9.4E+03	9.4E+02
Chloroform	B2	6.1E-03	6.7E+04	6.7E+03	6.7E+02
Delta-BHC	D	-	-	-	-
Endosulfan sulfate	-	-	-	-	-
Gamma chlordane	B2	1.3E+00	7.1E+02	7.1E+01	7.1E+00
Methylene chloride	B2	7.5E-03	5.1E+05	5.1E+04	5.1E+03
TFH diesel	D	-	-	-	-
Toluene	D	-	-	-	-
INORGANICS:					
Aluminum	-	-	-	-	-
Antimony	-	-	-	-	-
Arsenic	A	1.8E+00	2.8E+03	2.8E+02	2.8E+01
Barium	-	-	-	-	-
Beryllium	B2	4.3E+00	1.1E+03	1.1E+02	1.1E+01
Cadmium	-	-	-	-	-
Chromium	-	-	-	-	-
Cobalt	-	-	-	-	-
Copper	D	-	-	-	-
Cyanide	D	-	-	-	-
Lead	B2	-	-	-	-
Manganese	D	-	-	-	-
Mercury	D	-	-	-	-
Nickel	-	-	-	-	-
Nitrate/nitrite	-	-	-	-	-
Selenium	D	-	-	-	-
Silver	D	-	-	-	-
Thallium	D	-	-	-	-
Vanadium	-	-	-	-	-
Zinc	D	-	-	-	-
RADIONUCLIDES:					
Gross alpha	-	-	-	-	-
Gross beta	-	-	-	-	-

Exposure Setting:	Residential	Residential	Residential
TRL: Target Risk Level:	1E-04	1E-05	1E-06
BW: Body weight ages 9-16 (kg)	46	46	46
AT: Averaging Time (years)	70	70	70
EF: Exposure frequency (days/year)	26	26	26
ED: Exposure duration (years)	7	7	7
ET: Exposure time (hours/day)	2	2	2
SFo: Oral cancer slope factor (mg/kg-day)-1	chem. specifi	hem. specifi	chem. specific
IRw: Water ingestion rate during swimming (L/day)	0.12	0.12	0.12
SA: Skin surface area available for cotanct (cm2)	5600	5600	5600
PC: Dermal permeability constant (cm/hr)	chem. specifi	hem. specifi	chem. specific

$$\text{Target Concentration (ug/L)} = \frac{\text{TRL} \times \text{BW} \times \text{AT} \times 365 \text{ days/yr}}{\text{EF} \times \text{ED} \times [(\text{SFo} \times \text{IRw}) + (\text{SFo} \times \text{SA} \times \text{PC} \times \text{ET} \times 1\text{E-3 L/cm3})]} \times 1000 \text{ ug/mg}$$

Table H2-9
Risk-Based Concentrations for Individual Chemicals-Non Carcinogens
Residential Scenario
Inhalation of Soil- Gas
MCAS El Toro Phase I RI Technical Memorandum

Chemical	Inhalation Reference Dose (mg/kg-day)	Target Hazard Concentration (ug\m3)
ORGANICS:		
Benzene	-	-
Chloroform (a)	1.0E-02	3.7E+01
Methane	-	-
Methylene chloride	8.6E-01	3.1E+03
Tetrachloroethene (a)	1.0E-02	3.7E+01
Trichloroethylene (a)	6.0E-03	2.2E+01

Exposure Setting:	Residential
THI: Target Hazard Index (unitless)	1
BW: Body weight (kg)	70
AT: Averaging Time (years)	30
EF: Exposure frequency (days/year)	350
ED: Exposure duration (years)	30
CF: Conversion factor (ug/mg)	1000
RfDi: Inhalation chronic reference dose (mg/kg-day)	chem. specific
IR3: Daily indoor inhalation rate (m3/day)	20

$$\text{Target Concentration (ug/m3)} = \frac{THI \times BW \times AT \times 365 \text{ days/yr}}{EF \times ED \times [(1/RfDi \times K \times IR3) + (1/RfDo \times IRw)]}$$

Notes:
(a) The oral reference dose was used for chemicals with no inhalation reference dose.

Table H2-10
Risk-Based Concentrations-Carcinogenic Health Effects
Residential Scenario
Inhalation of Soil-Gas
MCAS El Toro Phase I RI Technical Memorandum

Chemical	EPA Inhalation WOE	Inhalation Slope Factor (kg-day/mg)	Target Cancer Risk: 1E-04 (ug/m3)	1E-05 (ug/m3)	1E-06 (ug/m3)
ORGANICS:					
Benzene	A	2.9E-02	2.9E+01	2.9E+00	2.9E-01
Chloroform	B2	8.1E-02	1.1E+01	1.1E+00	1.1E-01
Methane	-	-	-	-	-
Methylene chloride	B2	1.6E-03	5.2E+02	5.2E+01	5.2E+00
Tetrachloroethene	B2	1.8E-03	4.7E+02	4.7E+01	4.7E+00
Trichloroethylene	B2	6.0E-03	1.4E+02	1.4E+01	1.4E+00

Exposure Setting:	Residential	Residential	Residential
TRL: Target Risk Level:	1E-04	1E-05	1E-06
BW: Body weight (kg)	70	70	70
AT: Averaging Time (years)	70	70	70
EF: Exposure frequency (days/year)	350	350	350
ED: Exposure duration (years)	30	30	30
CF: Conversion factor (ug/mg)	1000	1000	1000
SFi: Inhalation cancer slope factor (mg/kg-day)-1	chem. specifi	hem. specifi	chem. specific
IR3: Daily inhalation rate (m3/day)	20	20	20

Target Concentration Calculation:

$$\text{Target Contentration (ug/m3)} = \frac{TR \times BW \times AT \times 365}{EF \times ED \times SFi \times IR3} \times 1000 \text{ ug/mg}$$

Appendix H3

Ecological Assessment of Near-Surface Soil Exposure for Terrestrial Mammals

Appendix H3
ECOLOGICAL ASSESSMENT OF NEAR-SURFACE SOIL EXPOSURE FOR TERRESTRIAL MAMMALS

This appendix presents the comparison of estimated exposure by soil ingestion (total ingested dose) to a derived acceptable dose. Comparisons were made for each chemical detected (on a site-by-site basis) for all OU-2 and OU-3 sites at MCAS El Toro. The methodology for calculating the total ingested dose and the acceptable dose is described in Subsection 7.2.3.1.

Each of the following Tables H3-1 through H3-22 is specific to a site within MCAS El Toro: Table H3-1 addresses Site 1; Table H3-2, Site 2; etc. (There is no table for Site 18, OU-1.)

The maximum concentrations presented in these tables represent surface and near-surface soil (0 to 4 feet bgs). Chemical concentrations that result in doses exceeding acceptable levels are those with ratios exceeding 1 (unity).

Toxicity values used in these calculations are taken from Table 7-30. Where data were not available for the rat, data for the mouse (barium, fluoranthene, phenanthrene, and pyrene) or mallard (endosulfan II and methoxychlor) were used. Mouse and mallard body weights and ingestion values were taken from Lewis, 1992. Where NORELs or LOAELs were not available, LD_{50} values were used; they were used for acetone, aldrin, benzo(a)pyrene, benzyl butyl phthalate, delta-BHC, di-n-butyl phthalate, dieldrin, diemthyl phthalate, endrin, endosulfan II, methoxychlor, and PCB-1260.

Table H3-1
Soil Criteria to Protect Terrestrial Mammals ; Comparison to Potential Dose
Site 1: Explosive Ordinance Range
MCAS El Toro Phase I RI Technical Memorandum

Chemical	Maximum Concentration (mg/kg)	Total Ingested Dose (mg/kg/day)	Toxicity Value (mg/kg /day)	Ratio of Ingested Dose to Toxicity Value (a)
ORGANICS:				
Petroleum hydrocarbons (total recoverable)	147	1.10E+01	-	-
TFH Diesel	61.6	4.62E+00	-	-
TFH Gasoline	0.219	1.64E-02	-	-
Toluene	0.006	4.50E-04	223	2.02E-06
INORGANICS:				
Aluminum	7490	5.62E+02	14	4.01E+01
Antimony	2.5	1.88E-01	-	-
Barium	41.4	4.97E+00	0.25	1.99E+01
Calcium	7290	5.47E+02	-	-
Chromium	4	3.00E-01	0.46	6.52E-01
Cobalt	3.1	2.33E-01	0.05	4.65E+00
Copper	4.3	3.23E-01	12.5	2.58E-02
Iron	4230	3.17E+02	900	3.53E-01
Lead	7	5.25E-01	0.45	1.17E+00
Magnesium	1790	1.34E+02	-	-
Mercury	0.05	3.75E-03	0.003	1.25E+00
Potassium	882	6.62E+01	-	-
Selenium	0.83	6.23E-02	-	-
Vanadium	9.8	7.35E-01	0.7	1.05E+00
Zinc	17.2	1.29E+00	98.3	1.31E-02

SC: Soil Criteria	Rat default values	Mouse default values (b)
C: Soil concentration (mg/kg)	sample specific	sample specific
CF: Soil conversion factor (kg/mg)	1.00E-06	1.00E-06
IR: Ingestion rate (mg/day)	15000	3000
BW: Body weight (kg)	0.2	0.025
1/BW:	5	40
TV: Toxicity value (mg/kg/day)	chemical specific	chemical specific

Soil Criteria Calculation

$$SC = \frac{C \times CF \times IR \times 1/BW}{TV}$$

Notes:
(a) If Index exceeds 1.0 , the chemical concentration present is potentially harmful to wildlife.
(b) Total ingested dose for barium was calculated using mouse values.

Table H3-2
Soil Criteria to Protect Terrestrial Mammals ; Comparison to Potential Dose
Site 2: Magazine Road Landfill
MCAS El Toro Phase I RI Technical Memorandum

Chemical	Maximum Concentration (mg/kg)	Total Ingested Dose (mg/kg/day)	Toxicity Value (mg/kg /day)	Ratio of Ingested Dose to Toxicity Value (a)
ORGANICS:				
2,4-DB (4-(2,4-dichlorophenoxy) butyric acid)	0.455	3.41E-02	-	-
2-Butanone (MEK)	0.004	3.00E-04	173	1.73E-06
2-Hexanone	0.017	1.28E-03	-	-
4',4'-DDD	0.00084	6.30E-05	-	-
4',4'-DDE	0.00445	3.34E-04	-	-
4',4'-DDT	0.0182	1.37E-03	113	1.21E-05
4-Methyl-2-pentanone	0.005	3.75E-04	-	-
Acetone	0.032	2.40E-03	9750	2.46E-07
Aldrin	0.00301	2.26E-04	67	3.37E-06
Alpha chlordane	0.00337	2.53E-04	15	1.69E-05
Benzene	0.004	3.00E-04	17.65	1.70E-05
Benzyl butyl phthalate	1.2	9.00E-02	735	1.22E-04
Bis(2-ethylhexyl)phthalate	4.2	3.15E-01	65	4.85E-03
Carbon tetrachloride	0.002	1.50E-04	-	-
Dalapon	0.0815	6.11E-03	15	4.08E-04
Dicamba	0.507	3.80E-02	400	9.51E-05
Ethylbenzene	0.006	4.50E-04	97.1	4.63E-06
Gamma chlordane	0.00386	2.90E-04	15	1.93E-05
MCPP	140	1.05E+01	-	-
Methyl chloride	0.092	6.90E-03	-	-
Methylene chloride	0.092	6.90E-03	5.85	1.18E-03
Petroleum hydrocarbons (total recoverable)	4555	3.42E+02	-	-
TFH Diesel	97.5	7.31E+00	-	-
TFH Gasoline	0.958	7.19E-02	-	-
Toluene	0.015	1.13E-03	223	5.04E-06
Trichloroethylene	0.003	3.60E-04	17.9	2.01E-05
Xylenes (total)	0.006	4.50E-04	179	2.51E-06
INORGANICS:				
Aluminum	15400	1.16E+03	14	8.25E+01
Antimony	3.9	2.93E-01	-	-
Arsenic	5.1	3.83E-01	6.4	5.98E-02
Barium	176	2.11E+01	0.25	8.45E+01
Beryllium	0.76	5.70E-02	0.54	1.06E-01
Cadmium	2	1.50E-01	0.004	3.75E+01
Calcium	19500	1.46E+03	-	-
Chromium	15.7	1.18E+00	0.46	2.56E+00
Cobalt	7	5.25E-01	0.05	1.05E+01
Copper	15.8	1.19E+00	12.5	9.48E-02
Iron	18600	1.40E+03	900	1.55E+00
Lead	28.3	2.12E+00	0.45	4.72E+00
Magnesium	10800	8.10E+02	-	-
Manganese	364	2.73E+01	290	9.41E-02
Mercury	0.57	4.28E-02	0.003	1.43E+01
Nickel	11.4	8.55E-01	5	1.71E-01
Potassium	4940	3.71E+02	-	-
Selenium	0.25	1.88E-02	-	-
Silver	0.76	5.70E-02	181.2	3.15E-04
Thallium	0.25	1.88E-02	-	-
Vanadium	44.9	3.37E+00	0.7	4.81E+00
Zinc	60.7	4.55E+00	98.3	4.63E-02

SC: Soil Criteria	Rat default values	Mouse default values (b)
C: Soil concentration (mg/kg)	sample specific	sample specific
CF: Soil conversion factor (kg/mg)	1.00E-06	1.00E-06
IR: Ingestion rate (mg/day)	15000	3000
BW: Body weight (kg)	0.2	0.025
1/BW:	5	40
TV: Toxicity value (mg/kg/day)	chemical specific	chemical specific

Soil Criteria Calculation

$$SC = \frac{C \times CF \times IR \times 1/BW}{TV}$$

Notes:

(a) If Index exceeds 1.0 , the chemical concentration present is potentially harmful to wildlife.

(b) Total ingested dose was calculated using mouse values for trichloroethylene and barium.

Table H3-3
Soil Criteria to Protect Terrestrial Mammals ; Comparison to Potential Dose
Site 3: Original Landfill
MCAS El Toro Phase I RI Technical Memorandum

Chemical	Maximum Concentration (mg/kg)	Total Ingested Dose (mg/kg/day)	Toxicity Value (mg/kg /day)	Ratio of Ingested Dose to Toxicity Value (a)
ORGANICS:				
2,4,5-TP	0.0496	3.72E-03	-	-
2-Butanone (MEK)	0.05	3.75E-03	173	2.17E-05
2-Hexanone	0.006	4.50E-04	-	-
4',4'-DDD	0.293	2.20E-02	-	-
4',4'-DDE	0.0477	3.58E-03	-	-
4',4'-DDT	0.209	1.57E-02	113	1.39E-04
Acetone	0.21	1.58E-02	9750	1.62E-06
Bis(2-ethylhexyl)phthalate	1.4	1.05E-01	65	1.62E-03
Carbon tetrachloride	0.011	8.25E-04	-	-
Methylene chloride	0.22	1.65E-02	5.85	2.82E-03
Octachlorodibenzo-p-dioxins	0.000001	7.50E-08	-	-
Petroleum hydrocarbons (total recoverable)	223	1.67E+01	-	-
TFH Diesel	79.9	5.99E+00	-	-
TFH Gasoline	13.8	1.04E+00	-	-
Toluene	0.009	6.75E-04	223	3.03E-06
INORGANICS:				
Aluminum	13000	9.75E+02	14	6.96E+01
Arsenic	4.2	3.15E-01	6.4	4.92E-02
Barium	196	2.35E+01	0.25	9.41E+01
Beryllium	0.49	3.68E-02	0.54	6.81E-02
Cadmium	3.2	2.40E-01	0.004	6.00E+01
Calcium	5810	4.36E+02	-	-
Chromium	16.9	1.27E+00	0.46	2.76E+00
Cobalt	6.6	4.95E-01	0.05	9.90E+00
Copper	22.6	1.70E+00	12.5	1.36E-01
Iron	19000	1.43E+03	900	1.58E+00
Lead	76.9	5.77E+00	0.45	1.28E+01
Magnesium	5770	4.33E+02	-	-
Manganese	224	1.68E+01	290	5.79E-02
Mercury	0.65	4.88E-02	0.003	1.63E+01
Nickel	13.7	1.03E+00	5	2.06E-01
Potassium	3960	2.97E+02	-	-
Silver	0.69	5.18E-02	181.2	2.86E-04
Thallium	0.31	2.33E-02	-	-
Vanadium	37.1	2.78E+00	0.7	3.98E+00
Zinc	104	7.80E+00	98.3	7.93E-02

SC: Soil Criteria	Rat default values	Mouse default values (b)
C: Soil concentration (mg/kg)	sample specific	sample specific
CF: Soil conversion factor (kg/mg)	1.00E-06	1.00E-06
IR: Ingestion rate (mg/day)	15000	3000
BW: Body weight (kg)	0.2	0.025
1/BW:	5	40
TV: Toxicity value (mg/kg/day)	chemical specific	chemical specific

Soil Criteria Calculation

$$SC = \frac{C \times CF \times IR \times 1/BW}{TV}$$

Notes:
(a) If Index exceeds 1.0 , the chemical concentration present is potentially harmful to wildlife.
(b) Total ingested dose for barium was calculated using mouse values.

Table H3-4
Soil Criteria to Protect Terrestrial Mammals ; Comparison to Potential Dose
Site 4: Ferrocine Spill Area
MCAS El Toro Phase I RI Technical Memorandum

Chemical	Maximum Concentration (mg/kg)	Total Ingested Dose (mg/kg/day)	Toxicity Value (mg/kg /day)	Ratio of Ingested Dose to Toxicity Value (a)
ORGANICS:				
2-Methylnaphthalene	2.9	2.18E-01	-	-
4',4'-DDD	0.0424	3.18E-03	-	-
4',4'-DDE	0.0158	1.19E-03	-	-
4',4'-DDT	0.0582	4.37E-03	113	3.86E-05
Acetone	0.024	1.80E-03	9750	1.85E-07
Alpha chlordane	0.00486	3.65E-04	15	2.43E-05
Benzo(a)pyrene	0.22	1.65E-02	50	3.30E-04
Benzo(b)fluoranthene	0.24	1.80E-02	4	4.50E-03
Benzo(k)fluoranthene	0.27	2.03E-02	72	2.81E-04
Benzyl butyl phthalate	0.17	1.28E-02	735	1.73E-05
Bis(2-ethylhexyl)phthalate	0.38	2.85E-02	65	4.38E-04
Chrysene	0.22	1.65E-02	99	1.67E-04
Delta-BHC	0.00247	1.85E-04	88	2.11E-06
Dieldrin	0.0328	2.46E-03	40	6.15E-05
Endosulfan I	0.00076	5.70E-05	2	2.85E-05
Endosulfan II	0.0141	1.41E-03	200	7.05E-06
Endosulfan sulfate	0.00093	6.98E-05	-	-
Endrin	0.013	9.75E-04	7.5	1.30E-04
Endrin aldehyde	0.00878	6.59E-04	-	-
Endrin ketone	0.007	5.25E-04	-	-
Fluoranthene	0.19	2.28E-02	125	1.82E-04
Gamma chlordane	0.00811	6.08E-04	15	4.06E-05
Methoxychlor	0.00326	3.26E-04	2000	1.63E-07
Naphthalene	23	1.73E+00	41	4.21E-02
Phenol	0.27	2.03E-02	60	3.38E-04
Pyrene	0.21	2.52E-02	125	2.02E-04
TFH Gasoline	3.11	2.33E-01	-	-
Toluene	0.027	2.03E-03	223	9.08E-06
Xylenes (total)	0.1	7.50E-03	179	4.19E-05
INORGANICS:				
Aluminum	29000	2.18E+03	14	1.55E+02
Antimony	3.5	2.63E-01	-	-
Arsenic	7.5	5.63E-01	6.4	8.79E-02
Barium	223	2.68E+01	0.25	1.07E+02
Beryllium	1	7.50E-02	0.54	1.39E-01
Cadmium	22.8	1.71E+00	0.004	4.28E+02
Calcium	10900	8.18E+02	-	-
Chromium	85.1	6.38E+00	0.46	1.39E+01
Cobalt	10.3	7.73E-01	0.05	1.55E+01
Copper	49.4	3.71E+00	12.5	2.96E-01
Lead	258	1.94E+01	0.45	4.30E+01
Magnesium	14600	1.10E+03	-	-
Manganese	402	3.02E+01	290	1.04E-01
Mercury	0.84	6.30E-02	0.003	2.10E+01
Nickel	22.1	1.66E+00	5	3.32E-01
Nickel	22.1	1.66E+00	5	3.32E-01
Potassium	8250	6.19E+02	-	-
Silver	1.3	9.75E-02	181.2	5.38E-04
Thallium	0.27	2.03E-02	-	-
Vanadium	67	5.03E+00	0.7	7.18E+00
Zinc	529	3.97E+01	98.3	4.04E-01

SC: Soil Criteria	Rat default values	Mouse default values (b)	Mallard default values (c)
C: Soil concentration (mg/kg)	sample specific	sample specific	sample specific
CF: Soil conversion factor (kg/mg)	1.00E-06	1.00E-06	1.00E-06
IR: Ingestion rate (mg/day)	15000	3000	250000
BW: Body weight (kg)	0.2	0.025	2.5
1/BW:	5	40	0.4
TV: Toxicity value (mg/kg/day)	chemical specific	chemical specific	chemical specific

Soil Criteria Calculation

$$SC = \frac{C \times CF \times IR \times 1/BW}{TV}$$

Notes:
(a) If Index exceeds 1.0 , the chemical concentration present is potentially harmful to wildlife.
(b) Total ingested dose was calculated using mouse values for fluoranthene, pyrene and barium.
(c) Total ingested dose was calculated using mallard values for endosulfan II and methoxychlor.

Table H3-5
Soil Criteria to Protect Terrestrial Mammals ; Comparison to Potential Dose
Site 5: Perimeter Road Landfill
MCAS El Toro Phase I RI Technical Memorandum

Chemical	Maximum Concentration (mg/kg)	Total Ingested Dose (mg/kg/day)	Toxicity Value (mg/kg /day)	Ratio of Ingested Dose to Toxicity Value (a)
ORGANICS:				
2,4,5-TP	0.0556	4.17E-03	-	-
4',4'-DDT	0.239	1.79E-02	113	1.59E-04
Methoxychlor	0.122	1.22E-02	2000	6.10E-06
Petroleum hydrocarbons (total recoverable)	877	6.58E+01	-	-
TFH Gasoline	0.0831	6.23E-03	-	-
Toluene	0.004	3.00E-04	223	1.35E-06
INORGANICS:				
Aluminum	8880	6.66E+02	14	4.76E+01
Arsenic	3.3	2.48E-01	6.4	3.87E-02
Barium	75.8	9.10E+00	0.25	3.64E+01
Beryllium	0.23	1.73E-02	0.54	3.19E-02
Cadmium	1.2	9.00E-02	0.004	2.25E+01
Calcium	12400	9.30E+02	-	-
Chromium	7.4	5.55E-01	0.46	1.21E+00
Cobalt	3.7	2.78E-01	0.05	5.55E+00
Copper	17.3	1.30E+00	12.5	1.04E-01
Iron	9790	7.34E+02	900	8.16E-01
Lead	38.5	2.89E+00	0.45	6.42E+00
Magnesium	3820	2.87E+02	-	-
Manganese	168	1.26E+01	290	4.34E-02
Mercury	0.05	3.75E-03	0.003	1.25E+00
Nickel	7.7	5.78E-01	5	1.16E-01
Potassium	2460	1.85E+02	-	-
Selenium	0.1	7.50E-03	-	-
Silver	0.5	3.75E-02	181.2	2.07E-04
Thallium	0.22	1.65E-02	-	-
Vanadium	23.3	1.75E+00	0.7	2.50E+00
Zinc	98	7.35E+00	98.3	7.48E-02

SC: Soil Criteria	Rat default values	Mouse default values (b)	Mallard default values (c)
C: Soil concentration (mg/kg)	sample specific	sample specific	sample specific
CF: Soil conversion factor (kg/mg)	1.00E-06	1.00E-06	1.00E-06
IR: Ingestion rate (mg/day)	15000	3000	250000
BW: Body weight (kg)	0.2	0.025	2.5
1/BW:	5	40	0.4
TV: Toxicity value (mg/kg/day)	chemical specific	chemical specific	chemical specific

Soil Criteria Calculation

$$SC = \frac{C \times CF \times IR \times 1/BW}{TV}$$

Notes:
(a) If Index exceeds 1.0 , the chemical concentration present is potentially harmful to wildlife.
(b) Total ingested dose for barium was calculated using mouse values.
(c) Total ingested dose for methoxychlor was calculated using mallard values.

Table H3-6
Soil Criteria to Protect Terrestrial Mammals ; Comparison to Potential Dose
Site 6: Drop Tank Drainage Area 1
MCAS El Toro Phase I RI Technical Memorandum

Chemical	Maximum Concentration (mg/kg)	Total Ingested Dose (mg/kg/day)	Toxicity Value (mg/kg /day)	Ratio of Ingested Dose to Toxicity Value (a)
ORGANICS:				
Acetone	0.049	3.68E-03	9750	3.77E-07
Benzyl butyl phthalate	0.44	3.30E-02	735	4.49E-05
Bis(2-ethylhexyl)phthalate	14	1.05E+00	65	1.62E-02
Carbon tetrachloride	0.007	5.25E-04	-	-
Fluoranthene	0.16	1.92E-02	125	1.54E-04
Methylene chloride	0.031	2.33E-03	5.85	3.97E-04
Petroleum hydrocarbons (total recoverable)	1297	9.73E+01	-	-
Pyrene	0.15	1.80E-02	125	1.44E-04
TFH Diesel	239	1.79E+01	-	-
TFH Gasoline	315	2.36E+01	-	-
Toluene	0.01	7.50E-04	223	3.36E-06
INORGANICS:				
Aluminum	18100	1.36E+03	14	9.70E+01
Antimony	5.3	3.98E-01	-	-
Arsenic	4.2	3.15E-01	6.4	4.92E-02
Barium	1280	1.54E+02	0.25	6.14E+02
Beryllium	0.83	6.23E-02	0.54	1.15E-01
Cadmium	11.8	8.85E-01	0.004	2.21E+02
Chromium	365	2.74E+01	0.46	5.95E+01
Cobalt	10.6	7.95E-01	0.05	1.59E+01
Copper	26.5	1.99E+00	12.5	1.59E-01
Lead	1410	1.06E+02	0.45	2.35E+02
Manganese	344	2.58E+01	290	8.90E-02
Mercury	0.2	1.50E-02	0.003	5.00E+00
Nickel	15.9	1.19E+00	5	2.39E-01
Selenium	1.1	8.25E-02	-	-
Silver	1.2	9.00E-02	181.2	4.97E-04
Thallium	0.5	3.75E-02	-	-
Vanadium	46.9	3.52E+00	0.7	5.03E+00
Zinc	266	2.00E+01	98.3	2.03E-01

SC: Soil Criteria	Rat default values	Mouse default values (b)
C: Soil concentration (mg/kg)	sample specific	sample specific
CF: Soil conversion factor (kg/mg)	1.00E-06	1.00E-06
IR: Ingestion rate (mg/day)	15000	3000
BW: Body weight (kg)	0.2	0.025
1/BW:	5	40
TV: Toxicity value (mg/kg/day)	chemical specific	chemical specific

Soil Criteria Calculation

$$SC = \frac{C \times CF \times IR \times 1/BW}{TV}$$

Notes:
(a) If Index exceeds 1.0 , the chemical concentration present is potentially harmful to wildlife.
(b) Total ingested dose for fluoranthene, pyrene, and barium was calculated using mouse values.

Table H3-7
Soil Criteria to Protect Terrestrial Mammals ; Comparison to Potential Dose
Site 7: Drop Tank Drainage Area 2
MCAS El Toro Phase I RI Technical Memorandum

Chemical	Maximum Concentration (mg/kg)	Total Ingested Dose (mg/kg/day)	Toxicity Value (mg/kg /day)	Ratio of Ingested Dose to Toxicity Value (a)
ORGANICS:				
4',4'-DDD	0.163	1.22E-02	-	-
4',4'-DDE	0.0387	2.90E-03	-	-
4',4'-DDT	0.2	1.50E-02	113	1.33E-04
Acetone	0.064	4.80E-03	9750	4.92E-07
Benzene	0.009	6.75E-04	17.65	3.82E-05
Benzo(a)anthracene	1.3	9.75E-02	0.006	1.63E+01
Benzo(a)pyrene	1.8	1.35E-01	50	2.70E-03
Benzo(b)fluoranthene	2.8	2.10E-01	4	5.25E-02
Benzo(g,h,i)perylene	6.9	5.18E-01	-	-
Benzo(k)fluoranthene	1.3	9.75E-02	72	1.35E-03
Bis(2-ethylhexyl)phthalate	1.4	1.05E-01	65	1.62E-03
Carbazole	0.46	3.45E-02	-	-
Carbon tetrachloride	0.002	1.50E-04	-	-
Chrysene	2.4	1.80E-01	99	1.82E-03
Dibenzo(a,h)anthracene	0.41	3.08E-02	-	-
Dieldrin	0.0253	1.90E-03	40	4.74E-05
Diethylphthalate	0.24	1.80E-02	-	-
Endosulfan sulfate	0.0669	5.02E-03	-	-
Endrin	0.00654	4.91E-04	7.5	6.54E-05
Endrin ketone	0.0021	1.58E-04	-	-
Fluoranthene	4.1	4.92E-01	125	3.94E-03
Indeno(1,2,3-cd)pyrene	1.5	1.13E-01	72	1.56E-03
Methylene chloride	0.014	1.05E-03	5.85	1.79E-04
Petroleum hydrocarbons (total recoverable)	32091	2.41E+03	-	-
Phenanthrene	1.4	1.68E-01	10	1.68E-02
Pyrene	3.5	4.20E-01	125	3.36E-03
TFH Diesel	686	5.15E+01	-	-
TFH Gasoline	2.68	2.01E-01	-	-
Toluene	0.014	1.05E-03	223	4.71E-06
Xylenes (total)	0.003	2.25E-04	179	1.26E-06
INORGANICS:				
Aluminum	16900	1.27E+03	14	9.05E+01
Arsenic	5.8	4.35E-01	6.4	6.80E-02
Barium	729	8.75E+01	0.25	3.50E+02
Beryllium	0.72	5.40E-02	0.54	1.00E-01
Cadmium	6	4.50E-01	0.004	1.13E+02
Chromium	62	4.65E+00	0.46	1.01E+01
Cobalt	31.2	2.34E+00	0.05	4.68E+01
Copper	46	3.45E+00	12.5	2.76E-01
Lead	931	6.98E+01	0.45	1.55E+02
Manganese	325	2.44E+01	290	8.41E-02
Mercury	0.51	3.83E-02	0.003	1.28E+01
Nickel	17	1.28E+00	5	2.55E-01
Selenium	0.2	1.50E-02	-	-
Thallium	0.47	3.53E-02	-	-
Vanadium	54.6	4.10E+00	0.7	5.85E+00
Zinc	151	1.13E+01	98.3	1.15E-01

SC: Soil Criteria	Rat default values	Mouse default values (b)
C: Soil concentration (mg/kg)	sample specific	sample specific
CF: Soil conversion factor (kg/mg)	1.00E-06	1.00E-06
IR: Ingestion rate (mg/day)	15000	3000
BW: Body weight (kg)	0.2	0.025
1/BW:	5	40
TV: Toxicity value (mg/kg/day)	chemical specific	chemical specific

Soil Criteria Calculation

$$SC = \frac{C \times CF \times IR \times 1/BW}{TV}$$

Notes:
(a) If Index exceeds 1.0 , the chemical concentration present is potentially harmful to wildlife.
(b) Total ingested dose for flouranthene, phenanthrene, pyrene, and barium were calculated using mouse values.

Table H3-8
Soil Criteria to Protect Terrestrial Mammals; Comparison to Potential Dose
Site 8: DRMO Storage Area
MCAS El Toro Phase I RI Technical Memorandum

Chemical	Maximum Concentration (mg/kg)	Total Ingested Dose (mg/kg/day)	Toxicity Value (mg/kg /day)	Ratio of Ingested Dose to Toxicity Value (a)
ORGANICS:				
2-Butanone (MEK)	0.004	3.00E-04	173	1.73E-06
2-Hexanone	0.013	9.75E-04	-	-
4',4'-DDD	0.15	1.13E-02	-	-
4',4'-DDE	0.0443	3.32E-03	-	-
4',4'-DDT	0.17	1.28E-02	113	1.13E-04
Alpha chlordane	0.453	3.40E-02	15	2.27E-03
Alpha-BHC	0.00357	2.68E-04	-	-
Benzo(a)pyrene	0.15	1.13E-02	50	2.25E-04
Benzo(g,h,i)perylene	0.14	1.05E-02	-	-
Benzyl butyl phthalate	1.9	1.43E-01	735	1.94E-04
Beta chlordane	0.0191	1.43E-03	-	-
Bis(2-ethylhexyl)phthalate	8.8	6.60E-01	65	1.02E-02
Chrysene	0.16	1.20E-02	99	1.21E-04
Di-n-butylphthalate	1.4	1.05E-01	8000	1.31E-05
Dieldrin	0.836	6.27E-02	40	1.57E-03
Dimethyl phthalate	0.33	3.96E-02	7200	5.50E-06
Endosulfan I	0.0635	4.76E-03	2	2.38E-03
Endosulfan II	0.0618	6.18E-03	200	3.09E-05
Endosulfan sulfate	0.012	9.00E-04	-	-
Endrin	0.216	1.62E-02	7.5	2.16E-03
Endrin aldehyde	0.292	2.19E-02	-	-
Endrin ketone	0.0101	7.58E-04	-	-
Ethylbenzene	0.002	1.50E-04	97.1	1.54E-06
Fluoranthene	0.16	1.92E-02	125	1.54E-04
Gamma chlordane	0.0758	5.69E-03	15	3.79E-04
Hexachloroethane	0.14	1.05E-02	-	-
Indeno(1,2,3-cd)pyrene	0.15	1.13E-02	72	1.56E-04
Methoxychlor	0.00428	4.28E-04	2000	2.14E-07
Methylene chloride	0.066	4.95E-03	5.85	8.46E-04
PCB 1248	17.8	1.34E+00	-	-
PCB 1254	20.4	1.53E+00	5	3.06E-01
PCB 1260	1.82	1.37E-01	841	1.62E-04
Petroleum hydrocarbons (total recoverable)	7730	5.80E+02	-	-
Pyrene	0.23	2.76E-02	125	2.21E-04
Tetrachloroethene	0.004	3.00E-04	-	-
TFH Diesel	1060	7.95E+01	-	-
TFH Gasoline	2.26	1.70E-01	-	-
Toluene	0.01	7.50E-04	223	3.36E-06
Xylenes (total)	0.016	1.20E-03	179	6.70E-06
INORGANICS:				
Aluminum	29800	2.24E+03	14	1.60E+02
Antimony	11.1	8.33E-01	-	-
Arsenic	7.9	5.93E-01	6.4	9.26E-02
Barium	287	3.44E+01	0.25	1.38E+02
Beryllium	0.92	6.90E-02	0.54	1.28E-01
Cadmium	108	8.10E+00	0.004	2.03E+03
Chromium	113	8.48E+00	0.46	1.84E+01
Cobalt	12.7	9.53E-01	0.05	1.91E+01
Copper	213	1.60E+01	12.5	1.28E+00
Lead	1520	1.14E+02	0.45	2.53E+02
Manganese	429	3.22E+01	290	1.11E-01
Mercury	15.1	1.13E+00	0.003	3.78E+02
Nickel	70.3	5.27E+00	5	1.05E+00
Selenium	0.27	2.03E-02	-	-
Silver	21.4	1.61E+00	181.2	8.86E-03
Thallium	0.51	3.83E-02	-	-
Vanadium	76.2	5.72E+00	0.7	8.16E+00
Zinc	1510	1.13E+02	98.3	1.15E+00

SC: Soil Criteria	Rat default values	Mouse default values (b)	Mallard default values (c)
C: Soil concentration (mg/kg)	sample specific	sample specific	sample specific
CF: Soil conversion factor (kg/mg)	1.00E-06	1.00E-06	1.00E-06
IR: Ingestion rate (mg/day)	15000	3000	2.50E+05
BW: Body weight (kg)	0.2	0.025	2.50E+00
1/BW:	5	40	0.4
TV: Toxicity value (mg/kg/day)	chemical specific	chemical specific	chemical specific

Soil Criteria Calculation

$$SC = \frac{C \times CF \times IR \times 1/BW}{TV}$$

Notes:
(a) If Index exceeds 1.0 , the chemical concentration present is potentially harmful to wildlife.
(b) Total ingested dose for dimethyl phthalate, fluoranthene, pyrene and barium was calculated using mouse values.
(c) Total ingested dose for endosulfan II and methoxychlor was calculated using mallard values.

Table H3-9
Soil Criteria to Protect Terrestrial Mammals; Comparison to Potential Dose
Site 9: Crash Crew Pit 1
MCAS El Toro Phase I RI Technical Memorandum

Chemical	Maximum Concentration (mg/kg)	Total Ingested Dose (mg/kg/day)	Toxicity Value (mg/kg /day)	Ratio of Ingested Dose to Toxicity Value (a)
ORGANICS:				
1,1,1-Trichloroethane	0.009	6.75E-04	500	1.35E-06
2-Butanone (MEK)	0.003	2.25E-04	173	1.30E-06
Carbon tetrachloride	0.003	2.25E-04	-	-
Dimethyl phthalate	0.36	4.32E-02	7200	6.00E-06
Petroleum hydrocarbons (total recoverable)	259	1.94E+01	-	-
TFH Diesel	51.1	3.83E+00	-	-
TFH Gasoline	0.89	6.68E-02	-	-
Toluene	0.002	1.50E-04	223	6.73E-07
INORGANICS:				
Aluminum	11600	8.70E+02	14	6.21E+01
Arsenic	4.7	3.53E-01	6.4	5.51E-02
Barium	2610	3.13E+02	0.25	1.25E+03
Cadmium	1.7	1.28E-01	0.004	3.19E+01
Chromium	23	1.73E+00	0.46	3.75E+00
Cobalt	6.1	4.58E-01	0.05	9.15E+00
Copper	13.1	9.83E-01	12.5	7.86E-02
Lead	62.5	4.69E+00	0.45	1.04E+01
Manganese	292	2.19E+01	290	7.55E-02
Nickel	8.5	6.38E-01	5	1.28E-01
Selenium	0.3	2.25E-02	-	-
Thallium	0.25	1.88E-02	-	-
Vanadium	35.7	2.68E+00	0.7	3.83E+00
Zinc	57.9	4.34E+00	98.3	4.42E-02

SC: Soil Criteria	Rat default values	Mouse default values (b)
C: Soil concentration (mg/kg)	sample specific	sample specific
CF: Soil conversion factor (kg/mg)	1.00E-06	1.00E-06
IR: Ingestion rate (mg/day)	15000	3000
BW: Body weight (kg)	0.2	0.025
1/BW:	5	40
TV: Toxicity value (mg/kg/day)	chemical specific	chemical specific

Soil Criteria Calculation

$$SC = \frac{C \times CF \times IR \times 1/BW}{TV}$$

Notes:
(a) If Index exceeds 1.0 , the chemical concentration present is potentially harmful to wildlife.
(b) Total ingested dose for dimethyl phthalate and barium was calculated using mouse values.

Table H3-10
Soil Criteria to Protect Terrestrial Mammals; Comparison to Potential Dose
Site 10: Petroleum Disposal Area
MCAS El Toro Phase I RI Technical Memorandum

Chemical	Maximum Concentration (mg/kg)	Total Ingested Dose (mg/kg/day)	Toxicity Value (mg/kg /day)	Ratio of Ingested Dose to Toxicity Value (a)
ORGANICS:				
1,2-Dichloroethene (total)	0.006	7.20E-04	17	4.24E-05
Acetone	0.13	9.75E-03	9750	1.00E-06
Benzo(a)anthracene	0.35	2.63E-02	0.006	4.38E+00
Benzo(a)pyrene	0.38	2.85E-02	50	5.70E-04
Benzo(b)fluoranthene	0.37	2.78E-02	4	6.94E-03
Benzo(g,h,i)perylene	0.22	1.65E-02	-	-
Benzo(k)fluoranthene	0.23	1.73E-02	72	2.40E-04
Bis(2-ethylhexyl)phthalate	0.28	2.10E-02	65	3.23E-04
Chrysene	0.46	3.45E-02	99	3.48E-04
Diethylphthalate	0.24	1.80E-02	-	-
Fluoranthene	0.77	9.24E-02	125	7.39E-04
Indeno(1,2,3-cd)pyrene	0.29	2.18E-02	72	3.02E-04
Petroleum hydrocarbons (total recoverable)	532	3.99E+01	-	-
Phenanthrene	0.34	4.08E-02	10	4.08E-03
Pyrene	0.78	9.36E-02	125	7.49E-04
Tetrachloroethene	0.019	1.43E-03	-	-
TFH Diesel	38.3	2.87E+00	-	-
TFH Gasoline	0.117	8.78E-03	-	-
Toluene	0.018	1.35E-03	223	6.05E-06
INORGANICS:				
Aluminum	23400	1.76E+03	14	1.25E+02
Arsenic	5	3.75E-01	6.4	5.86E-02
Barium	237	2.84E+01	0.25	1.14E+02
Beryllium	0.89	6.68E-02	0.54	1.24E-01
Cadmium	2.3	1.73E-01	0.004	4.31E+01
Chromium	20.4	1.53E+00	0.46	3.33E+00
Cobalt	10	7.50E-01	0.05	1.50E+01
Copper	15.8	1.19E+00	12.5	9.48E-02
Lead	19.2	1.44E+00	0.45	3.20E+00
Manganese	358	2.69E+01	290	9.26E-02
Mercury	0.06	4.50E-03	0.003	1.50E+00
Nickel	15	1.13E+00	5	2.25E-01
Selenium	0.17	1.28E-02	-	-
Silver	0.84	6.30E-02	181.2	3.48E-04
Thallium	0.4	3.00E-02	-	-
Vanadium	63.7	4.78E+00	0.7	6.83E+00
Zinc	79.8	5.99E+00	98.3	6.09E-02

SC: Soil Criteria	Rat default values	Mouse default values (b)
C: Soil concentration (mg/kg)	sample specific	sample specific
CF: Soil conversion factor (kg/mg)	1.00E-06	1.00E-06
IR: Ingestion rate (mg/day)	15000	3000
BW: Body weight (kg)	0.2	0.025
1/BW:	5	40
TV: Toxicity value (mg/kg/day)	chemical specific	chemical specific

Soil Criteria Calculation

$$SC = \frac{C \times CF \times IR \times 1/BW}{TV}$$

Notes:
(a) If Index exceeds 1.0 , the chemical concentration present is potentially harmful to wildlife.
(b) Total ingested dose for 1,2-dichloroethene, fluoranthene, phenanthrene, pyrene, and barium was calculated using mouse values.

Table H3-11
Soil Criteria to Protect Terrestrial Mammals; Comparison to Potential Dose
Site 11: Transformer Storage Area
MCAS El Toro Phase I RI Technical Memorandum

Chemical	Maximum Concentration (mg/kg)	Total Ingested Dose (mg/kg/day)	Toxicity Value (mg/kg /day)	Ratio of Ingested Dose to Toxicity Value (a)
ORGANICS:				
4',4'-DDD	0.137	1.03E-02	-	-
4',4'-DDE	0.00376	2.82E-04	-	-
4',4'-DDT	0.105	7.88E-03	113	6.97E-05
Endosulfan II	0.134	1.34E-02	200	6.70E-05
Endrin	0.0249	1.87E-03	7.5	2.49E-04
Endrin aldehyde	0.145	1.09E-02	-	-
PCB 1260	4.96	3.72E-01	841	4.42E-04

SC: Soil Criteria	Rat default values	Mallard default values (b)
C: Soil concentration (mg/kg)	sample specific	sample specific
CF: Soil conversion factor (kg/mg)	1.00E-06	1.00E-06
IR: Ingestion rate (mg/day)	15000	250000
BW: Body weight (kg)	0.2	2.5
1/BW:	5	0.4
TV: Toxicity value (mg/kg/day)	chemical specific	chemical specific

Soil Criteria Calculation

$$SC = \frac{C \times CF \times IR \times 1/BW}{TV}$$

Notes:
(a) If Index exceeds 1.0 , the chemical concentration present is potentially harmful to wildlife.
(b) Total ingested dose for endosulfan II was calculated using mallard values.

Table H3-12
Soil Criteria to Protect Terrestrial Mammals; Comparison to Potential Dose
Site 12: Sludge Drying Beds
MCAS El Toro Phase I RI Technical Memorandum

Chemical	Maximum Concentration (mg/kg)	Total Ingested Dose (mg/kg/day)	Toxicity Value (mg/kg /day)	Ratio of Ingested Dose to Toxicity Value (a)
ORGANICS:				
2,4-Dichlorophenoxy acetic acid	0.14	1.05E-02	-	-
2-Butanone (MEK)	0.079	5.93E-03	173	3.42E-05
4',4'-DDD	1.19	8.93E-02	-	-
4',4'-DDE	0.281	2.11E-02	-	-
4',4'-DDT	3.65	2.74E-01	113	2.42E-03
Acetone	0.035	2.63E-03	9750	2.69E-07
Alpha chlordane	0.0785	5.89E-03	15	3.93E-04
Benzo(a)anthracene	0.69	5.18E-02	0.006	8.63E+00
Benzo(a)pyrene	0.67	5.03E-02	50	1.01E-03
Benzo(b)fluoranthene	0.93	6.98E-02	4	1.74E-02
Benzo(g,h,i)perylene	0.34	2.55E-02	-	-
Benzo(k)fluoranthene	0.55	4.13E-02	72	5.73E-04
Bis(2-ethylhexyl)phthalate	0.6	4.50E-02	65	6.92E-04
Carbon disulfide	0.002	1.50E-04	11	1.36E-05
Carbon tetrachloride	0.011	8.25E-04	-	-
Chrysene	1	7.50E-02	99	7.58E-04
Dalapon	0.241	1.81E-02	15	1.21E-03
Dibenzo(a,h)anthracene	0.13	9.75E-03	-	-
Dieldrin	0.104	7.80E-03	40	1.95E-04
Endosulfan sulfate	0.047	3.53E-03	-	-
Endrin aldehyde	0.0856	6.42E-03	-	-
Endrin ketone	0.133	9.98E-03	-	-
Fluoranthene	1.7	2.04E-01	125	1.63E-03
Gamma chlordane	0.0931	6.98E-03	15	4.66E-04
Indeno(1,2,3-cd)pyrene	0.44	3.30E-02	72	4.58E-04
MCPP	153	1.15E+01	-	-
Methoxychlor	0.175	1.75E-02	2000	8.75E-06
Methylene chloride	0.035	2.63E-03	5.85	4.49E-04
PCB 1254	2.49	1.87E-01	5	3.74E-02
Petroleum hydrocarbons (total recoverable)	42529	3.19E+03	-	-
Phenanthrene	0.59	7.08E-02	10	7.08E-03
Pyrene	1.1	1.32E-01	125	1.06E-03
TFH Diesel	1970	1.48E+02	-	-
TFH Gasoline	24.7	1.85E+00	-	-
Toluene	0.01	7.50E-04	223	3.36E-06
Xylenes (total)	0.002	1.50E-04	179	8.38E-07
INORGANICS:				
Aluminum	28200	2.12E+03	14	1.51E+02
Arsenic	14.3	1.07E+00	6.4	1.68E-01
Barium	355	4.26E+01	0.25	1.70E+02
Beryllium	1.7	1.28E-01	0.54	2.36E-01
Cadmium	7.2	5.40E-01	0.004	1.35E+02
Chromium	35.7	2.68E+00	0.46	5.82E+00
Cobalt	11.7	8.78E-01	0.05	1.76E+01
Copper	45.4	3.41E+00	12.5	2.72E-01
Cyanide	1	7.50E-02	10.8	6.94E-03
Lead	531	3.98E+01	0.45	8.85E+01
Manganese	455	3.41E+01	290	1.18E-01
Mercury	1.3	9.75E-02	0.003	3.25E+01
Nickel	84.2	6.32E+00	5	1.26E+00
Selenium	0.33	2.48E-02	-	-
Silver	7.4	5.55E-01	181.2	3.06E-03
Thallium	0.38	2.85E-02	-	-
Vanadium	800	6.00E+01	0.7	8.57E+01
Zinc	418	3.14E+01	98.3	3.19E-01

SC: Soil Criteria	Rat default values	Mouse default values (b)	Mallard default values (c)
C: Soil concentration (mg/kg)	sample specific	sample specific	sample specific
CF: Soil conversion factor (kg/mg)	1.00E-06	1.00E-06	1.00E-06
IR: Ingestion rate (mg/day)	15000	3000	250000
BW: Body weight (kg)	0.2	0.025	2.5
1/BW:	5	40	0.4
TV: Toxicity value (mg/kg/day)	chemical specific	chemical specific	chemical specific

Soil Criteria Calculation

$$SC = \frac{C \times CF \times IR \times 1/BW}{TV}$$

Notes:
(a) If Index exceeds 1.0 , the chemical concentration present is potentially harmful to wildlife.
(b) Total ingested dose for fluoranthene, phenanthrene, pyrene, and barium was calculated using mouse values.
(c) Total ingested dose for methoxychlor was calculated using mallard values.

Table H3-13
Soil Criteria to Protect Terrestrial Mammals; Comparison to Potential Dose
Site 13: Oil Change Area
MCAS El Toro Phase I RI Technical Memorandum

Chemical	Maximum Concentration (mg/kg)	Total Ingested Dose (mg/kg/day)	Toxicity Value (mg/kg /day)	Ratio of Ingested Dose to Toxicity Value (a)
ORGANICS:				
Acetone	0.043	3.23E-03	9750	3.31E-07
Benzo(a)pyrene	0.21	1.58E-02	50	3.15E-04
Benzo(b)fluoranthene	0.26	1.95E-02	4	4.88E-03
Benzo(g,h,i)perylene	0.2	1.50E-02	-	-
Benzo(k)fluoranthene	0.19	1.43E-02	72	1.98E-04
Benzyl butyl phthalate	0.16	1.20E-02	735	1.63E-05
Bis(2-ethylhexyl)phthalate	0.27	2.03E-02	65	3.12E-04
Chrysene	0.21	1.58E-02	99	1.59E-04
Fluoranthene	0.33	3.96E-02	125	3.17E-04
Indeno(1,2,3-cd)pyrene	0.23	1.73E-02	72	2.40E-04
Petroleum hydrocarbons (total recoverable)	3340	2.51E+02	-	-
Phenanthrene	0.2	2.40E-02	10	2.40E-03
Pyrene	0.27	3.24E-02	125	2.59E-04
TFH Diesel	490	3.68E+01	-	-
TFH Gasoline	0.319	2.39E-02	-	-
Toluene	0.009	6.75E-04	223	3.03E-06
INORGANICS:				
Aluminum	17600	1.32E+03	14	9.43E+01
Antimony	3.7	2.78E-01	-	-
Arsenic	3.9	2.93E-01	6.4	4.57E-02
Barium	212	2.54E+01	0.25	1.02E+02
Beryllium	0.63	4.73E-02	0.54	8.75E-02
Cadmium	2	1.50E-01	0.004	3.75E+01
Chromium	18.3	1.37E+00	0.46	2.98E+00
Cobalt	9	6.75E-01	0.05	1.35E+01
Copper	14.8	1.11E+00	12.5	8.88E-02
Lead	250	1.88E+01	0.45	4.17E+01
Manganese	323	2.42E+01	290	8.35E-02
Mercury	0.55	4.13E-02	0.003	1.38E+01
Nickel	11.5	8.63E-01	5	1.73E-01
Selenium	0.18	1.35E-02	-	-
Silver	0.63	4.73E-02	181.2	2.61E-04
Thallium	0.29	2.18E-02	-	-
Vanadium	50.7	3.80E+00	0.7	5.43E+00
Zinc	90.1	6.76E+00	98.3	6.87E-02

SC: Soil Criteria	Rat default values	Mouse default values (b)
C: Soil concentration (mg/kg)	sample specific	sample specific
CF: Soil conversion factor (kg/mg)	1.00E-06	1.00E-06
IR: Ingestion rate (mg/day)	15000	3000
BW: Body weight (kg)	0.2	0.025
1/BW:	5	40
TV: Toxicity value (mg/kg/day)	chemical specific	chemical specific

Soil Criteria Calculation

$$SC = \frac{C \times CF \times IR \times 1/BW}{TV}$$

Notes:
(a) If Index exceeds 1.0 , the chemical concentration present is potentially harmful to wildlife.
(b) Total ingested dose for fluoranthene, phenanthrene, pyrene, and barium was calculated using mouse values.

Table H3-14
Soil Criteria to Protect Terrestrial Mammals; Comparison to Potential Dose
Site 14: Battery Acid Disposal Area
MCAS El Toro Phase I RI Technical Memorandum

Chemical	Maximum Concentration (mg/kg)	Total Ingested Dose (mg/kg/day)	Toxicity Value (mg/kg /day)	Ratio of Ingested Dose to Toxicity Value (a)
ORGANICS:				
Acetone	0.066	4.95E-03	9750	5.08E-07
Anthracene	0.24	1.80E-02	25	7.20E-04
Benzo(a)anthracene	2.2	1.65E-01	0.006	2.75E+01
Benzo(a)pyrene	3.1	2.33E-01	50	4.65E-03
Benzo(b)fluoranthene	3.8	2.85E-01	4	7.13E-02
Benzo(g,h,i)perylene	1.3	9.75E-02	-	-
Benzo(k)fluoranthene	3.1	2.33E-01	72	3.23E-03
Bis(2-ethylhexyl)phthalate	7.4	5.55E-01	65	8.54E-03
Carbazole	0.87	6.53E-02	-	-
Carbon tetrachloride	0.002	1.50E-04	-	-
Chrysene	3.6	2.70E-01	99	2.73E-03
Dibenzo(a,h)anthracene	0.64	4.80E-02	-	-
Fluoranthene	5.8	6.96E-01	125	5.57E-03
Indeno(1,2,3-cd)pyrene	1.5	1.13E-01	72	1.56E-03
Methylene chloride	0.02	1.50E-03	5.85	2.56E-04
Petroleum hydrocarbons (total recoverable)	7364	5.52E+02	-	-
Phenanthrene	1.6	1.92E-01	10	1.92E-02
Pyrene	4.7	5.64E-01	125	4.51E-03
TFH Gasoline	1.64	1.23E-01	-	-
Toluene	0.006	4.50E-04	223	2.02E-06
INORGANICS:				
Aluminum	25200	1.89E+03	14	1.35E+02
Antimony	4.2	3.15E-01	-	-
Arsenic	6.3	4.73E-01	6.4	7.38E-02
Barium	303	3.64E+01	0.25	1.45E+02
Beryllium	0.75	5.63E-02	0.54	1.04E-01
Cadmium	7.2	5.40E-01	0.004	1.35E+02
Chromium	38.4	2.88E+00	0.46	6.26E+00
Cobalt	8.7	6.53E-01	0.05	1.31E+01
Copper	31	2.33E+00	12.5	1.86E-01
Lead	923	6.92E+01	0.45	1.54E+02
Manganese	366	2.75E+01	290	9.47E-02
Mercury	1.4	1.05E-01	0.003	3.50E+01
Nickel	14.7	1.10E+00	5	2.21E-01
Selenium	0.48	3.60E-02	-	-
Silver	5.6	4.20E-01	181.2	2.32E-03
Thallium	0.18	1.35E-02	-	-
Vanadium	62	4.65E+00	0.7	6.64E+00
Zinc	288	2.16E+01	98.3	2.20E-01

SC: Soil Criteria	Rat default values	Mouse default values (b)
C: Soil concentration (mg/kg)	sample specific	sample specific
CF: Soil conversion factor (kg/mg)	1.00E-06	1.00E-06
IR: Ingestion rate (mg/day)	15000	3000
BW: Body weight (kg)	0.2	0.025
1/BW:	5	40
TV: Toxicity value (mg/kg/day)	chemical specific	chemical specific

Soil Criteria Calculation

$$SC = \frac{C \times CF \times IR \times 1/BW}{TV}$$

Notes:
(a) If Index exceeds 1.0 , the chemical concentration present is potentially harmful to wildlife.
(b) Total ingested dose for fluoranthene, phenanthrene, pyrene, and barium was calculated using mouse values.

Table H3-15
Soil Criteria to Protect Terrestrial Mammals ; Comparison to Potential Dose
Site 15: Suspended Fuel Tanks
MCAS El Toro Phase I RI Technical Memorandum

Chemical	Maximum Concentration (mg/kg)	Total Ingested Dose (mg/kg/day)	Toxicity Value (mg/kg /day)	Ratio of Ingested Dose to Toxicity Value (a)
ORGANICS:				
Acetone	0.087	6.53E-03	9750	6.69E-07
Benzyl butyl phthalate	1.2	9.00E-02	735	1.22E-04
Bis(2-ethylhexyl)phthalate	0.37	2.78E-02	65	4.27E-04
Chrysene	0.21	1.58E-02	99	1.59E-04
Methylene chloride	0.058	4.35E-03	5.85	7.44E-04
Petroleum hydrocarbons (total recoverable)	23034	1.73E+03	-	-
Phenanthrene	5.3	6.36E-01	10	6.36E-02
TFH Diesel	8530	6.40E+02	-	-
TFH Gasoline	21.1	1.58E+00	-	-
Toluene	0.004	3.00E-04	223	1.35E-06
INORGANICS:				
Aluminum	18300	1.37E+03	14	9.80E+01
Arsenic	3.5	2.63E-01	6.4	4.10E-02
Barium	157	1.88E+01	0.25	7.54E+01
Beryllium	0.58	4.35E-02	0.54	8.06E-02
Cadmium	1.6	1.20E-01	0.004	3.00E+01
Chromium	30.9	2.32E+00	0.46	5.04E+00
Cobalt	7.7	5.78E-01	0.05	1.16E+01
Copper	15	1.13E+00	12.5	9.00E-02
Lead	34.5	2.59E+00	0.45	5.75E+00
Manganese	298	2.24E+01	290	7.71E-02
Mercury	0.35	2.63E-02	0.003	8.75E+00
Nickel	15	1.13E+00	5	2.25E-01
Selenium	0.25	1.88E-02	-	-
Silver	0.79	5.93E-02	181.2	3.27E-04
Thallium	0.33	2.48E-02	-	-
Vanadium	46.7	3.50E+00	0.7	5.00E+00
Zinc	71.1	5.33E+00	98.3	5.42E-02

SC: Soil Criteria	Rat default values	Mouse default values (b)
C: Soil concentration (mg/kg)	sample specific	sample specific
CF: Soil conversion factor (kg/mg)	1.00E-06	1.00E-06
IR: Ingestion rate (mg/day)	15000	3000
BW: Body weight (kg)	0.2	0.025
1/BW:	5	40
TV: Toxicity value (mg/kg/day)	chemical specific	chemical specific

Soil Criteria Calculation

$$SC = \frac{C \times CF \times IR \times 1/BW}{TV}$$

Notes:
(a) If Index exceeds 1.0 , the chemical concentration present is potentially harmful to wildlife.
(b) Total ingested dose for phenanthrene and barium was calculated using mouse values.

Table H3-16
Soil Criteria to Protect Terrestrial Mammals ; Comparison to Potential Dose
Site 16: Crash Crew Pit 2
MCAS El Toro Phase I RI Technical Memorandum

Chemical	Maximum Concentration (mg/kg)	Total Ingested Dose (mg/kg/day)	Toxicity Value (mg/kg /day)	Ratio of Ingested Dose to Toxicity Value (a)
ORGANICS:				
2-Butanone (MEK)	13	9.75E-01	173	5.64E-03
2-Hexanone	0.003	2.25E-04	-	-
2-Methylnaphthalene	88	6.60E+00	-	-
Acetone	1.1	8.25E-02	9750	8.46E-06
Benzene	0.03	2.25E-03	17.65	1.27E-04
Bis(2-ethylhexyl)phthalate	0.52	3.90E-02	65	6.00E-04
Carbon tetrachloride	0.004	3.00E-04	-	-
Dibenzofuran	0.99	7.43E-02	1	7.43E-02
Ethylbenzene	3.6	2.70E-01	97.1	2.78E-03
Fluoranthene	0.21	2.52E-02	125	2.02E-04
Fluorene	2	1.50E-01	-	-
Methylene chloride	0.05	3.75E-03	5.85	6.41E-04
Naphthalene	50	3.75E+00	41	9.15E-02
Petroleum hydrocarbons (total recoverable)	39101	2.93E+03	-	-
Phenanthrene	0.87	1.04E-01	10	1.04E-02
Pyrene	0.27	3.24E-02	125	2.59E-04
TFH Gasoline	3120	2.34E+02	-	-
Toluene	3.4	2.55E-01	223	1.14E-03
Xylenes (total)	23	1.73E+00	179	9.64E-03
INORGANICS:				
Aluminum	22500	1.69E+03	14	1.21E+02
Antimony	3.3	2.48E-01	-	-
Arsenic	5.2	3.90E-01	6.4	6.09E-02
Barium	243	2.92E+01	0.25	1.17E+02
Beryllium	1.1	8.25E-02	0.54	1.53E-01
Cadmium	2.9	2.18E-01	0.004	5.44E+01
Chromium	26.3	1.97E+00	0.46	4.29E+00
Cobalt	10.2	7.65E-01	0.05	1.53E+01
Copper	51.1	3.83E+00	12.5	3.07E-01
Lead	291	2.18E+01	0.45	4.85E+01
Manganese	426	3.20E+01	290	1.10E-01
Mercury	0.05	3.75E-03	0.003	1.25E+00
Nickel	12.6	9.45E-01	5	1.89E-01
Selenium	0.2	1.50E-02	-	-
Silver	0.6	4.50E-02	181.2	2.48E-04
Thallium	0.64	4.80E-02	-	-
Vanadium	58.8	4.41E+00	0.7	6.30E+00
Zinc	198	1.49E+01	98.3	1.51E-01

SC: Soil Criteria	Rat default values	Mouse default values (b)
C: Soil concentration (mg/kg)	sample specific	sample specific
CF: Soil conversion factor (kg/mg)	1.00E-06	1.00E-06
IR: Ingestion rate (mg/day)	15000	3000
BW: Body weight (kg)	0.2	0.025
1/BW:	5	40
TV: Toxicity value (mg/kg/day)	chemical specific	chemical specific

Soil Criteria Calculation

$$SC = \frac{C \times CF \times IR \times 1/BW}{TV}$$

Notes:
(a) If Index exceeds 1.0 , the chemical concentration present is potentially harmful to wildlife.
(b) Total ingested dose for fluoranthene, phenanthrene, pyrene, and barium was calculated using mouse values.

Table H3-17
Soil Criteria to Protect Terrestrial Mammals ; Comparison to Potential Dose
Site 17: Communication Station Landfill
MCAS El Toro Phase I RI Technical Memorandum

Chemical	Maximum Concentration (mg/kg)	Total Ingested Dose (mg/kg/day)	Toxicity Value (mg/kg /day)	Ratio of Ingested Dose to Toxicity Value (a)
ORGANICS:				
2,4-DB (4-(2,4-dichlorophenoxy) butyric acid)	0.402	3.02E-02	-	-
2,4-Dimethylphenol	6	4.50E-01	-	-
4',4'-DDD	0.0381	2.86E-03	-	-
4',4'-DDE	0.0116	8.70E-04	-	-
4',4'-DDT	0.135	1.01E-02	113	8.96E-05
4-Methylphenol	34	2.55E+00	-	-
Acetone	0.086	6.45E-03	9750	6.62E-07
Alpha chlordane	0.00881	6.61E-04	15	4.41E-05
Benzo(a)anthracene	0.2	1.50E-02	0.006	2.50E+00
Benzo(a)pyrene	0.39	2.93E-02	50	5.85E-04
Benzo(g,h,i)perylene	0.16	1.20E-02	-	-
Chrysene	0.22	1.65E-02	99	1.67E-04
Delta-BHC	0.00664	4.98E-04	88	5.66E-06
Dieldrin	0.00377	2.83E-04	40	7.07E-06
Endosulfan sulfate	0.0276	2.07E-03	-	-
Endrin ketone	0.00866	6.50E-04	-	-
Fluoranthene	0.36	4.32E-02	125	3.46E-04
Gamma chlordane	0.00798	5.99E-04	15	3.99E-05
Heptachlor epoxide	0.00291	2.18E-04	0.25	8.73E-04
Indeno(1,2,3-cd)pyrene	0.24	1.80E-02	72	2.50E-04
Methoxychlor	0.00756	7.56E-04	2000	3.78E-07
Methylene chloride	0.047	3.53E-03	5.85	6.03E-04
Petroleum hydrocarbons (total recoverable)	2733	2.05E+02	-	-
Pyrene	0.32	3.84E-02	125	3.07E-04
TFH Diesel	1010	7.58E+01	-	-
TFH Gasoline	0.526	3.95E-02	-	-
Toluene	0.18	1.35E-02	223	6.05E-05
INORGANICS:				
Aluminum	7340	5.51E+02	14	3.93E+01
Antimony	2.8	2.10E-01	-	-
Arsenic	4.4	3.30E-01	6.4	5.16E-02
Barium	164	1.97E+01	0.25	7.87E+01
Beryllium	0.26	1.95E-02	0.54	3.61E-02
Cadmium	12	9.00E-01	0.004	2.25E+02
Chromium	297	2.23E+01	0.46	4.84E+01
Cobalt	5.9	4.43E-01	0.05	8.85E+00
Copper	82.5	6.19E+00	12.5	4.95E-01
Lead	361	2.71E+01	0.45	6.02E+01
Manganese	220	1.65E+01	290	5.69E-02
Mercury	0.14	1.05E-02	0.003	3.50E+00
Nickel	138	1.04E+01	5	2.07E+00
Selenium	1.4	1.05E-01	-	-
Silver	0.85	6.38E-02	181.2	3.52E-04
Thallium	0.15	1.13E-02	-	-
Vanadium	32.1	2.41E+00	0.7	3.44E+00
Zinc	260	1.95E+01	98.3	1.98E-01

SC: Soil Criteria	Rat default values	Mouse default values (b)	Mallard default values (c)
C: Soil concentration (mg/kg)	sample specific	sample specific	sample specific
CF: Soil conversion factor (kg/mg)	1.00E-06	1.00E-06	1.00E-06
IR: Ingestion rate (mg/day)	15000	3000	250000
BW: Body weight (kg)	0.2	0.025	2.5
1/BW:	5	40	0.4
TV: Toxicity value (mg/kg/day)	chemical specific	chemical specific	chemical specific

Soil Criteria Calculation

$$SC = \frac{C \times CF \times IR \times 1/BW}{TV}$$

Notes:

(a) If Index exceeds 1.0 , the chemical concentration present is potentially harmful to wildlife.
(b) Total ingested dose for fluoranthene, pyrene, and barium was calculated using mouse values.
(c) Total ingested dose for methoxychlor was calculated using mallard values.

Table H3-19
Soil Criteria to Protect Terrestrial Mammals ; Comparison to Potential Dose
Site 19: ACER (Fuel Bladder) Site
MCAS El Toro Phase I RI Technical Memorandum

Chemical	Maximum Concentration (mg/kg)	Total Ingested Dose (mg/kg/day)	Toxicity Value (mg/kg /day)	Ratio of Ingested Dose to Toxicity Value (a)
ORGANICS:				
2-Methylnaphthalene	0.3	2.25E-02	-	-
Acenaphthene	0.67	5.03E-02	-	-
Acenaphthylene	0.25	1.88E-02	-	-
Acetone	0.024	1.80E-03	9750	1.85E-07
Anthracene	1.1	8.25E-02	25	3.30E-03
Benzo(a)anthracene	1.2	9.00E-02	0.006	1.50E+01
Benzo(a)pyrene	1.1	8.25E-02	50	1.65E-03
Benzo(b)fluoranthene	1.2	9.00E-02	4	2.25E-02
Benzo(g,h,i)perylene	0.83	6.23E-02	-	-
Benzo(k)fluoranthene	0.97	7.28E-02	72	1.01E-03
Bis(2-ethylhexyl)phthalate	1.1	8.25E-02	65	1.27E-03
Carbazole	1.3	9.75E-02	-	-
Chrysene	1.5	1.13E-01	99	1.14E-03
Dibenzo(a,h)anthracene	0.32	2.40E-02	-	-
Dibenzofuran	0.86	6.45E-02	1	6.45E-02
Fluoranthene	3.9	4.68E-01	125	3.74E-03
Fluorene	0.96	7.20E-02	-	-
Indeno(1,2,3-cd)pyrene	0.78	5.85E-02	72	8.13E-04
Naphthalene	0.28	2.10E-02	41	5.12E-04
Petroleum hydrocarbons (total recoverable)	230	1.73E+01	-	-
Phenanthrene	5.9	7.08E-01	10	7.08E-02
Pyrene	2.7	3.24E-01	125	2.59E-03
TFH Diesel	162	1.22E+01	-	-
TFH Gasoline	0.488	3.66E-02	-	-
Toluene	0.011	8.25E-04	223	3.70E-06
INORGANICS:				
Aluminum	18400	1.38E+03	14	9.86E+01
Antimony	3.1	2.33E-01	-	-
Arsenic	5.1	3.83E-01	6.4	5.98E-02
Barium	254	3.05E+01	0.25	1.22E+02
Beryllium	1.4	1.05E-01	0.54	1.94E-01
Cadmium	2.8	2.10E-01	0.004	5.25E+01
Chromium	17.4	1.31E+00	0.46	2.84E+00
Cobalt	36.4	2.73E+00	0.05	5.46E+01
Copper	17.3	1.30E+00	12.5	1.04E-01
Lead	10.2	7.65E-01	0.45	1.70E+00
Manganese	374	2.81E+01	290	9.67E-02
Mercury	0.05	3.75E-03	0.003	1.25E+00
Nickel	18.7	1.40E+00	5	2.81E-01
Selenium	0.27	2.03E-02	-	-
Silver	2.4	1.80E-01	181.2	9.93E-04
Thallium	0.44	3.30E-02	-	-
Vanadium	54.2	4.07E+00	0.7	5.81E+00
Zinc	69.8	5.24E+00	98.3	5.33E-02

SC: Soil Criteria	Rat default values	Mouse default values (b)
C: Soil concentration (mg/kg)	sample specific	sample specific
CF: Soil conversion factor (kg/mg)	1.00E-06	1.00E-06
IR: Ingestion rate (mg/day)	15000	3000
BW: Body weight (kg)	0.2	0.025
1/BW:	5	40
TV: Toxicity value (mg/kg/day)	chemical specific	chemical specific

Soil Criteria Calculation

$$SC = \frac{C \times CF \times IR \times 1/BW}{TV}$$

Notes:
(a) If Index exceeds 1.0 , the chemical concentration present is potentially harmful to wildlife.
(b) Total ingested dose for fluoranthene, phenanthrene, pyrene, and barium was calculated using mouse values.

Table H3-20
Soil Criteria to Protect Terrestrial Mammals ; Comparison to Potential Dose
Site 20: Hobby Shop
MCAS El Toro Phase I RI Technical Memorandum

Chemical	Maximum Concentration (mg/kg)	Total Ingested Dose (mg/kg/day)	Toxicity Value (mg/kg /day)	Ratio of Ingested Dose to Toxicity Value (a)
ORGANICS:				
2-Butanone (MEK)	8	6.00E-01	173	3.47E-03
2-Methylnaphthalene	7.5	5.63E-01	-	-
4',4'-DDD	0.0458	3.44E-03	-	-
4',4'-DDE	0.0949	7.12E-03	-	-
4',4'-DDT	0.131	9.83E-03	113	8.69E-05
Acetone	0.098	7.35E-03	9750	7.54E-07
Alpha-BHC	0.0406	3.05E-03	-	-
Benzo(a)pyrene	0.79	5.93E-02	50	1.19E-03
Benzo(g,h,i)perylene	5.2	3.90E-01	-	-
Bis(2-ethylhexyl)phthalate	84	6.30E+00	65	9.69E-02
Carbon tetrachloride	0.005	3.75E-04	-	-
Delta-BHC	0.022	1.65E-03	88	1.88E-05
Dieldrin	0.005	3.75E-04	40	9.38E-06
Endosulfan sulfate	0.117	8.78E-03	-	-
Endrin	0.0279	2.09E-03	7.5	2.79E-04
Endrin ketone	0.137	1.03E-02	-	-
Gamma chlordane	0.0239	1.79E-03	15	1.20E-04
Methylene chloride	0.044	3.30E-03	5.85	5.64E-04
Naphthalene	5.6	4.20E-01	41	1.02E-02
Petroleum hydrocarbons (total recoverable)	84590	6.34E+03	-	-
Pyrene	9.6	1.15E+00	125	9.22E-03
TFH Gasoline	423	3.17E+01	-	-
Toluene	0.012	9.00E-04	223	4.04E-06
Xylenes (total)	6	4.50E-01	179	2.51E-03
INORGANICS:				
Aluminum	19900	1.49E+03	14	1.07E+02
Antimony	5.1	3.83E-01	-	-
Arsenic	7.1	5.33E-01	6.4	8.32E-02
Barium	300	3.60E+01	0.25	1.44E+02
Beryllium	0.63	4.73E-02	0.54	8.75E-02
Cadmium	18.8	1.41E+00	0.004	3.53E+02
Chromium	96.8	7.26E+00	0.46	1.58E+01
Cobalt	83.3	6.25E+00	0.05	1.25E+02
Copper	226	1.70E+01	12.5	1.36E+00
Lead	2870	2.15E+02	0.45	4.78E+02
Manganese	355	2.66E+01	290	9.18E-02
Mercury	0.76	5.70E-02	0.003	1.90E+01
Nickel	55.3	4.15E+00	5	8.30E-01
Selenium	0.34	2.55E-02	-	-
Silver	1.2	9.00E-02	181.2	4.97E-04
Thallium	0.35	2.63E-02	-	-
Vanadium	69.1	5.18E+00	0.7	7.40E+00
Zinc	2070	1.55E+02	98.3	1.58E+00

SC: Soil Criteria	Rat default values	Mouse default values (b)
C: Soil concentration (mg/kg)	sample specific	sample specific
CF: Soil conversion factor (kg/mg)	1.00E-06	1.00E-06
IR: Ingestion rate (mg/day)	15000	3000
BW: Body weight (kg)	0.2	0.025
1/BW:	5	40
TV: Toxicity value (mg/kg/day)	chemical specific	chemical specific

Soil Criteria Calculation

$$SC = \frac{C \times CF \times IR \times 1/BW}{TV}$$

Notes:
(a) If Index exceeds 1.0 , the chemical concentration present is potentially harmful to wildlife.
(b) Total ingested dose for pyrene and barium was calculated using mouse values.

Table H3-21
Soil Criteria to Protect Terrestrial Mammals ; Comparison to Potential Dose
Site 21: Materials Management Center
MCAS El Toro Phase I RI Technical Memorandum

Chemical	Maximum Concentration (mg/kg)	Total Ingested Dose (mg/kg/day)	Toxicity Value (mg/kg /day)	Ratio of Ingested Dose to Toxicity Value (a)
ORGANICS:				
2,4,5-T	0.0673	5.05E-03	-	-
2-Methylnaphthalene	0.15	1.13E-02	-	-
4',4'-DDD	0.109	8.18E-03	-	-
4',4'-DDE	0.109	8.18E-03	-	-
4',4'-DDT	0.557	4.18E-02	113	3.70E-04
Acenaphthene	1.2	9.00E-02	-	-
Acenaphthylene	0.17	1.28E-02	-	-
Acetone	0.46	3.45E-02	9750	3.54E-06
Alpha chlordane	0.00597	4.48E-04	15	2.99E-05
Anthracene	1.9	1.43E-01	25	5.70E-03
Benzo(a)anthracene	1.8	1.35E-01	0.006	2.25E+01
Benzo(a)pyrene	2	1.50E-01	50	3.00E-03
Benzo(b)fluoranthene	2.1	1.58E-01	4	3.94E-02
Benzo(g,h,i)perylene	0.67	5.03E-02	-	-
Benzo(k)fluoranthene	2	1.50E-01	72	2.08E-03
Benzyl butyl phthalate	0.18	1.35E-02	735	1.84E-05
Bis(2-ethylhexyl)phthalate	1.3	9.75E-02	65	1.50E-03
Carbazole	2.8	2.10E-01	-	-
Chrysene	3.1	2.33E-01	99	2.35E-03
Dalapon	0.707	5.30E-02	15	3.54E-03
Dibenzo(a,h)anthracene	0.57	4.28E-02	-	-
Dibenzofuran	0.49	3.68E-02	1	3.68E-02
Dieldrin	0.0116	8.70E-04	40	2.18E-05
Endosulfan I	0.00295	2.21E-04	2	1.11E-04
Endosulfan II	0.00827	8.27E-04	200	4.14E-06
Endosulfan sulfate	0.0108	8.10E-04	-	-
Endrin	0.0223	1.67E-03	7.5	2.23E-04
Endrin ketone	0.00487	3.65E-04	-	-
Fluoranthene	10	1.20E+00	125	9.60E-03
Fluorene	1.3	9.75E-02	-	-
Gamma chlordane	0.00775	5.81E-04	15	3.88E-05
Gamma-BHC (Lindane)	0.00014	1.05E-05	-	-
Indeno(1,2,3-cd)pyrene	1.1	8.25E-02	72	1.15E-03
Methoxychlor	0.00631	6.31E-04	2000	3.16E-07
Methylene chloride	0.38	2.85E-02	5.85	4.87E-03
Petroleum hydrocarbons (total recoverable)	2556	1.92E+02	-	-
Phenanthrene	14	1.68E+00	10	1.68E-01
Pyrene	6.2	7.44E-01	125	5.95E-03
TFH Diesel	192	1.44E+01	-	-
TFH Gasoline	0.168	1.26E-02	-	-
Toluene	0.027	2.03E-03	223	9.08E-06
INORGANICS:				
Aluminum	16800	1.26E+03	14	9.00E+01
Arsenic	9.9	7.43E-01	6.4	1.16E-01
Barium	227	2.72E+01	0.25	1.09E+02
Beryllium	0.71	5.33E-02	0.54	9.86E-02
Cadmium	4.1	3.08E-01	0.004	7.69E+01
Chromium	29.1	2.18E+00	0.46	4.74E+00
Cobalt	11.5	8.63E-01	0.05	1.73E+01
Copper	41.4	3.11E+00	12.5	2.48E-01
Lead	171	1.28E+01	0.45	2.85E+01
Manganese	468	3.51E+01	290	1.21E-01
Mercury	0.95	7.13E-02	0.003	2.38E+01
Nickel	20.4	1.53E+00	5	3.06E-01
Selenium	0.17	1.28E-02	-	-
Thallium	0.41	3.08E-02	-	-
Vanadium	54.2	4.07E+00	0.7	5.81E+00
Zinc	507	3.80E+01	98.3	3.87E-01

SC: Soil Criteria	Rat default values	Mouse default values (b)	Mallard default values (c)
C: Soil concentration (mg/kg)	sample specific	sample specific	sample specific
CF: Soil conversion factor (kg/mg)	1.00E-06	1.00E-06	1.00E-06
IR: Ingestion rate (mg/day)	15000	3000	250000
BW: Body weight (kg)	0.2	0.025	2.5
1/BW:	5	40	0.4
TV: Toxicity value (mg/kg/day)	chemical specific	chemical specific	chemical specific

Soil Criteria Calculation

$$SC = \frac{C \times CF \times IR \times 1/BW}{TV}$$

Notes:

(a) If Index exceeds 1.0 , the chemical concentration present is potentially harmful to wildlife.

(b) Total ingested dose for fluoranthene, phenanthrene, pyrene and barium was calculated using mouse values.

(c) Total ingested dose for endosulfan II and methoxychlor was calculated using mallard values.

Table H3-22
Soil Criteria to Protect Terrestrial Mammals ; Comparison to Potential Dose
Site 22: Tactical Air Fueling System
MCAS El Toro Phase I RI Technical Memorandum

Chemical	Maximum Concentration (mg/kg)	Total Ingested Dose (mg/kg/day)	Toxicity Value (mg/kg /day)	Ratio of Ingested Dose to Toxicity Value (a)
ORGANICS:				
2-Butanone (MEK)	0.005	3.75E-04	173	2.17E-06
2-Hexanone	0.004	3.00E-04	-	-
2-Methylnaphthalene	29	2.18E+00	-	-
Acetone	0.031	2.33E-03	9750	2.38E-07
Benzo(a)anthracene	0.39	2.93E-02	0.006	4.88E+00
Benzo(a)pyrene	0.32	2.40E-02	50	4.80E-04
Benzo(b)fluoranthene	0.37	2.78E-02	4	6.94E-03
Benzo(k)fluoranthene	0.24	1.80E-02	72	2.50E-04
Bis(2-ethylhexyl)phthalate	0.15	1.13E-02	65	1.73E-04
Carbazole	0.17	1.28E-02	-	-
Chrysene	0.4	3.00E-02	99	3.03E-04
Fluoranthene	1.2	1.44E-01	125	1.15E-03
Indeno(1,2,3-cd)pyrene	0.2	1.50E-02	72	2.08E-04
Isophorone	7.1	5.33E-01	-	-
Naphthalene	5.4	4.05E-01	41	9.88E-03
Petroleum hydrocarbons (total recoverable)	4666	3.50E+02	-	-
Phenanthrene	1	1.20E-01	10	1.20E-02
Pyrene	0.85	1.02E-01	125	8.16E-04
TFH Diesel	9140	6.86E+02	-	-
TFH Gasoline	916	6.87E+01	-	-
Toluene	0.009	6.75E-04	223	3.03E-06
INORGANICS:				
Aluminum	18000	1.35E+03	14	9.64E+01
Antimony	3	2.25E-01	-	-
Arsenic	5	3.75E-01	6.4	5.86E-02
Barium	178	2.14E+01	0.25	8.54E+01
Beryllium	0.66	4.95E-02	0.54	9.17E-02
Cadmium	1.7	1.28E-01	0.004	3.19E+01
Chromium	15.7	1.18E+00	0.46	2.56E+00
Cobalt	13.6	1.02E+00	0.05	2.04E+01
Copper	11.7	8.78E-01	12.5	7.02E-02
Lead	39.6	2.97E+00	0.45	6.60E+00
Manganese	797	5.98E+01	290	2.06E-01
Mercury	0.11	8.25E-03	0.003	2.75E+00
Nickel	11.8	8.85E-01	5	1.77E-01
Selenium	0.19	1.43E-02	-	-
Thallium	0.38	2.85E-02	-	-
Vanadium	47.8	3.59E+00	0.7	5.12E+00
Zinc	58	4.35E+00	98.3	4.43E-02

SC: Soil Criteria	Rat default values	Mouse default values (b)
C: Soil concentration (mg/kg)	sample specific	sample specific
CF: Soil conversion factor (kg/mg)	1.00E-06	1.00E-06
IR: Ingestion rate (mg/day)	1.50E+04	3000
BW: Body weight (kg)	0.2	0.025
1/BW:	5	40
TV: Toxicity value (mg/kg/day)	chemical specific	chemical specific

Soil Criteria Calculation

$$SC = \frac{C \times CF \times IR \times 1/BW}{TV}$$

Notes:
(a) If Index exceeds 1.0 , the chemical concentration present is potentially harmful to wildlife.
(b) Total ingested dose for fluoranthene, phenanthrene, pyrene, and barium was calculated using mouse values.

Appendix H4

Expected Species at MCAS El Toro

Table H4-1
Expected Species at MCAS El Toro
MCAS El Toro Phase I RI/FS Technical Memorandum

Common Name	Sceintific Name	Annual Grassland	Coastal Sage Scrub	Valley Foothill Riparian
Amphibians				
California Newt	*Taricha torosa*			
Black-bellied Slender Salamande	*Batrachoseps attenuatus*		X	X
Pacific Slender Salamander	*Batrachoseps pacificus*	X	X	X
Western Spadefoot	*Scaphiopus hammondi*	X		
Western Toad	*Bufo boreas*	X	X	
Southwestern Toad	*Bufo microscaphus*			X
California Treefrog	*Hyla cadaverina*		X	X
Pacific Treefrog	*Hyla regilla*	X	X	X
Bullfrog	*Rana catesbeiana*	X	X	X
Reptiles				
Western Pond Turtle	*Clemmys marmorata*	X	X	X
Western Fence Lizard	*Sceloporus occidentalis*	X*	X*	X
Side-blotched Lizard	*Uta stansburiana*	X*	X*	X
Coast Horned Lizard	*Phrynosoma coronatum*	X*	X*	X
Western Skink	*Eumeces skiltonianus*	X	X*	X
Gilbert's Skink	*Eumeces gilberti*	X		X
Orange-throated Whiptail	*Cnemidophorus hyperythrus*		X	
Southern Alligator Lizard	*Gerrhonotus multicarinatus*		X	X
California Legless Lizard	*Anniella pulchra*		X	X
Western Blind Snake	*Leptotyphlops humilis*		X*	X
Rosy Boa	*Lichanura trivirgata*		X*	
Ring-necked Snake	*Diadophis punctatus*		X	X
Racer	*Coluber constrictor*	X	X	X
California Whipsnake	*Masticophis lateralis*	X*		X
Western Patch-nosed Snake	*Salvadora hexalepis*		X	X
Gopher Snake	*Pituophis melanoleucus*	X*	X*	X
Common Kingsnake	*Lampropeltis getulus*	X*	X*	X
Long-nosed Snake	*Rhinocheilus lecontei*	X		
Common Garter Snake	*Thamnophis sirtalis*	X	X	X
Western Aquatic Garter Snake	*Thamnophis couchi*		X	X
Western Black-headed Snake	*Tantilla planiceps*	X	*	X
Lyre Snake	*Trimorphodon biscutatus*		X	
Night Snake	*Hypsiglena torquata*	X		X
Speckled Rattlesnake	*Crotalus mitchelli*		*	
Red Diamond Rattlesnake	*Crotalus ruber*		*	
Western Rattlesnake	*Crotalus viridis*	X*	X*	X
Birds				
Great Blue Heron	*Ardea herodias*	X	X	X
Great Egret	*Casmerodius albus*	X		X
Snowy Egret	*Egretta thula*			X
Cattle Egret	*Bubulcus ibis*	X		X
Green-backed Heron	*Butorides striatus*			X
Black-crowned Night Heron	*Nycticorax nycticorax*		X	X
Greater White-fronted Goose	*Anser albifrons*	X		
Snow Goose	*Chen caerulescens*	X		
Brant	*Branta bernicla*	X		
Canada Goose	*Branta canadensis*	X		
Wood Duck	*Aix sponsa*			X
Green-winged Teal	*Anas crecca*	X		
Mallard	*Anas platyrhynchos*	X		X
Northern Pintail	*Anas acuta*	X		
Blue-winged Teal	*Anas discors*	X		
Northern Shoveler	*Anas clypeata*	X		

Table H4-1
Expected Species at MCAS El Toro
MCAS El Toro Phase I RI/FS Technical Memorandum

Common Name	Sceintific Name	Annual Grassland	Coastal Sage Scrub	Valley Foothill Riparian
Gadwall	*Anas strepera*	X		
Eurasian Wigeon	*Anas penelope*	X		
American Wigeon	*Anas americana*	X		
Lesser Scaup	*Aythya affinis*	X		
Common Merganser	*Mergus merganser*			X
Turkey Vulture	*Cathartes aura*	X*	X	X
Black-shouldered Kite	*Elanus caeruleus*	X*	X	X
Bald Eagle	*Haliaeetus leucocephalus*			X
Northern Harrier	*Circus cyaneus*	X*	X	X
Sharp-shinned Hawk	*Accipiter striatus*	X	X	X
Cooper's Hawk	*Accipiter cooperii*	X*	X*	X
Red-shouldered Hawk	*Buteo lineatus*	X*	X	X
Red-tailed Hawk	*Buteo jamaicensis*	X*	X*	X
Ferruginous Hawk	*Buteo regalis*	X	X	X
Rough-legged Hawk	*Buteo lagopus*	X	X	X
Golden Eagle	*Aquila chrysaetos*	X*	X	X
American Kestrel	*Falco sparverius*	X	X	X
Merlin	*Falco columbarius*	X		X
Peregrine Falcon	*Falco peregrinus*	X	X	X
Prairie Falcon	*Falco mexicanus*	X	X	X
Ring-necked Pheasant	*Phasianus colchicus*			X
California Quail	*Callipepla californica*	X*	X*	X
Mountain Quail	*Oreortyx pictus*			X
American Coot	*Fulica americana*	X		
Killdeer	*Charadrius vociferus*	X		
Long-billed Curlew	*Numenius americanus*	X		
Ring-billed Gull	*Larus delawarensis*	X		
California Gull	*Larus californicus*	X		
Rhinoceros Auklet	*Cerorhinca monocerata*		X	
Band-tailed Pigeon	*Columba fasciata*		X	X
Rock Dove	*Columba livia*	X		
Mourning Dove	*Zenaida macroura*	X*	X*	X
Greater Roadrunner	*Geococcyx californianus*	X*	X*	
Common Barn Owl	*Tyto alba*	X*	X*	X
Western Screech Owl	*Otus kennicottii*	X	X	X
Great Horned Owl	*Bubo virginianus*	X	X	X
Burrowing Owl	*Athene cunicularia*	X	X	
Long-eared Owl	*Asio otus*			X
Short-eared Owl	*Asio flammeus*		X	
Common Nighthawk	*Chordeiles minor*		*	
Common Poorwill	*Phalaenoptilus nuttallii*		*	
White-throated Swift	*Aeronautes saxatalis*	X	X	X
Black-chinned Hummingbird	*Archilochus alexandri*			X
Anna's Hummingbird	*Calypte anna*		X*	X
Costa's Hummingbird	*Calypte costae*		X	X
Belted Kingfisher	*Ceryle alcyon*			X
Acorn Woodpecker	*Melanerpes formicivorus*			X
Red-breasted Sapsucker	*Sphyrapicus ruber*			X
Nuttall's Woodpecker	*Picoides nuttallii*			X
Downy Woodpecker	*Picoides pubescens*			X
Hairy Woodpecker	*Picoides villosus*			X
Northern Flicker	*Colaptes auratus*	X	X	X
Western Wood-pewee	*Contopus sordioulus*			X
Pacific-slope Flycatcher	*Empidonax difficilis*		X	X

Table H4-1
Expected Species at MCAS El Toro
MCAS El Toro Phase I RI/FS Technical Memorandum

Common Name	Sceintific Name	Annual Grassland	Coastal Sage Scrub	Valley Foothill Riparian
Black Phoebe	*Sayornis nigricans*	X	X*	X
Say's Phoebe	*Sayornis saya*	X	*	
Ash-throated Flycatcher	*Myiarchus cinerascens*			X
Cassin's Kingbird	*Tyrannus vociferans*	X	*	
Western Kingbird	*Tyrannus verticalis*	X		X
Horned Lark	*Eremophila alpestris*	X*		
Tree Swallow	*Tachycineta bicolor*	X		X
Violet-green Swallow	*Tachycineta thalassina*	X		X
Northern Rough-winged Swallo	*Stelgidopteryx serripennis*	X	X	X
Cliff Swallow	*Hirundo pyrrhonota*	X	X	X
American Crow	*Corvus brachyrhvnchos*	X		X
Common Raven	*Corvus corax*	X		X
Rock Wren	*Salpinctes obsoletus*		X	
Marsh Wren	*Cistothorus palustris*			X
Western Bluebird	*Sialia mexicana*	X		X
Mountain Bluebird	*Sialia currucoides*	X		
Swainson's Thrush	*Catharus ustulatus*		X	X
Hermit Thrush	*Catharus guttatus*		X*	X
American Robin	*Turdus migratorius*	X		X
Varied Thrush	*Ixoreus naevius*			X
Wrentit	*Chamaea fasciata*		X	
Northern Mockingbird	*Mimus polyglottos*	X*	X*	X
California Thrasher	*Toxostoma redivivum*		X*	X
American Pipit	*Anthus spinoletta*	X		
Cedar Waxwing	*Bombycilla cedrorum*			X
Phainopepla	*Phainopepla nitens*			X
Loggerhead Shrike	*Lanius ludovicianus*	X*	X*	X
European Starling	*Sturnus vulgaris*	X	X	X
Hutton's Vireo	*Vireo huttoni*			X
Warbling Vireo	*Vireo gilvus*			X
Orange-crowned Warbler	*Vermivora celata*		X	X
Yellow Warbler	*Dendroica petechia*			X
Yellow-rumped Warbler	*Dendroica coronata*	X	*	X
Black-throated Gray Warbler	*Dendroica nigrescens*			X
Townsend's Warbler	*Dendroica townsendi*			X
Hermit Warbler	*Dendroica occidentalis*			X
Wilson's Warbler	*Wilsonia pusilla*			X
Common Yellowthroat	*Geothlypis trichas*	X		X
Black-headed Grosbeak	*Pheucticus melanocephalus*			X
Blue Grosbeak	*Guiraca caerulea*	X		X
Lazuli Bunting	*Passerina amoena*		X	X
Rufous-sided Towhee	*Pipilo erythrophthalmus*		X	X
California Towhee	*Pipilo fuscus*		X*	X
Rufous-crowned Sparrow	*Aimophila ruficeps*	X*	X	
Chipping Sparrow	*Spizella passerina*	X		X
Black-chinned Sparrow	*Spizella atrogularis*		X*	
Lark Sparrow	*Chondestes grammacus*	X*	X	X
Sage Sparrow	*Amphispiza belli*		X*	
Savannah Sparrow	*Passerculus sandwichensis*	X	X	X
Grasshopper Sparrow	*Ammooramus savannarum*	X*		X
Song Sparrow	*Melospiza melodia*		X	X
Lincoln's Sparrow	*Melospiza lincolnii*	X	*	X
Golden-crowned Sparrow	*Regulus satrapa*		X	X
White-crowned Sparrow	*Zonotrichia leucophrys*		X*	X

Table H4-1
Expected Species at MCAS El Toro
MCAS El Toro Phase I RI/FS Technical Memorandum

Common Name	Sceintific Name	Annual Grassland	Coastal Sage Scrub	Valley Foothill Riparian
Dark-eyed Junco	*Junco hyemalis*			X
Red-winged Blackbird	*Agelaius phoeniceus*	X	X	X
Tricolored Blackbird	*Agelaius tricolor*	X		X
Western Meadowlark	*Sturnella neglecta*	X*	X*	
Brewer's Blackbird	*Euphagus cyanocephalus*	X	X	X
Brown-headed Cowbird	*Molothrus aeneus*	X	X	X
Hooded Oriole	*Icterus cucullatus*			X
Northern Oriole	*Icterus galbula*			X
Purple Finch	*Carpodacus purpureus*			X
House Finch	*Carpodacus mexicanus*	X	X	X
Pine Siskin	*Carduelis pinus*	X		X
Lesser Goldfinch	*Carduelis psaltria*	X	X	X
Lawrence's Goldfinch	*Carduelis lawrencei*	X		X
American Goldfinch	*Carduelis tristis*	X	X	X
Mammals				
Virginia Opossum	*Didelphis virginiana*		X	X
Ornate Shrew	*Sorex ornatus*	X		X
Broad-footed Mole	*Scapanus latimanus*	X		X
Yuma Myotis	*Myotis yumanensis*	X	X	X
Long-eared Myotis	*Myotis evotis*		X	X
Fringed Myotis	*Myotis thysanodes*			X
Long-legged Myotis	*Myotis volans*			X
California Myotis	*Myotis californicus*		X	X
Small-footed Myotis	*Myotis leibii*		X	X
Western Pipistrelle	*Pipistrellus hesperus*	X	X	X
Big Brown Bat	*Eptesicus fuscus*	X	X	X
Red Bat	*Lasiurus borealis*	X	X	X
Hoary Bat	*Lasiurus cinereus*			X
Townsend's Big-eared Bat	*Plecotus townsendii*		X	
Pallid Bat	*Antrozous pallidus*	X	X*	X
Brazilian Free-tailed Bat	*Tadarida brasiliensis*	X	X	X
Western Mastiff Bat	*Eumops perotis*	X	X	X
Brush Rabbit	*Sylvilagus bachmani*	X	X*	X
Desert Cottontail	*Sylvilagus audubonii*	X	X*	X
Black-tailed Hare	*Lepus californicus*	X*	X*	X
California Ground Squirrel	*Spermophilus beecheyi*	X*	X*	X
Western Gray Squirrel	*Sciurus griseus*			X
Southwestern Pocket Gopher	*Thomomys bottae*	X*	X*	X
Little Pocket Mouse	*Perognathus longimembris*		X*	
San Diego Pocket Mouse	*Chaetodipus fallax*	X	X*	
California Pocket Mouse	*Chaetodipus californicus*	X*	X*	
Pacific Kangaroo Rat	*Dipodomys agilis*	X	X*	X
Western Harvest Mouse	*Reithrodontomys megalotis*	X*	X*	X
Cactus Mouse	*Peromyscus eremicus*		X*	
California Mouse	*Peromyscus californicus*		X*	
Deer Mouse	*Peromyscus maniculatus*	X*	X*	X
Brush Mouse	*Peromyscus boylii*		X	X
Southern Grasshopper Mouse	*Onychomys torridus*	X	X	
Dusky-footed Woodrat	*Neotoma fuscipes*	X*	X	X
Desert Woodrat	*Neotoma lepida*	X*	X	
California Vole	*Microtus californicus*	X*	*	X
Norway Rat	*Rattus norvegicus*			X
Black Rat	*Rattus rattus*			X
House Mouse	*Mus musculus*	X		X

Table H4-1
Expected Species at MCAS El Toro
MCAS El Toro Phase I RI/FS Technical Memorandum

Common Name	Sceintific Name	Annual Grassland	Coastal Sage Scrub	Valley Foothill Riparian
Coyote	*Canis latrans*	X*	X*	X
Gray Fox	*Urocyon cinereoargenteus*	X	X*	X
Ringtail	*Bassariscus astutus*		X	X
Raccoon	*Procyon lotor*		X	X
Long-tailed Weasel	*Mustela frenata*	X	X	X
Badger	*Taxidea taxus*	X	X	
Western Spotted Skunk	*Spilogale gracilis*	X	X*	X
Striped Skunk	*Mephitis mephitis*	X	X*	X
Mountain Lion	*Felis concolor*		X	X
Bobcat	*Felis rufus*	X	X	X
Mule Deer	*Odocoileus hemionus*	X	X	X

*Known to occur

Appendix I

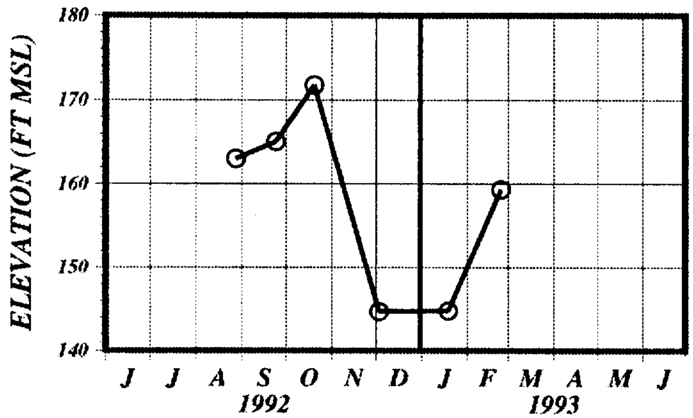
HYDROGRAPHS

I-1: Hydrographs for Phase I RT Wells (On-Station)
I-2: Hydrographs for OCWD Wells

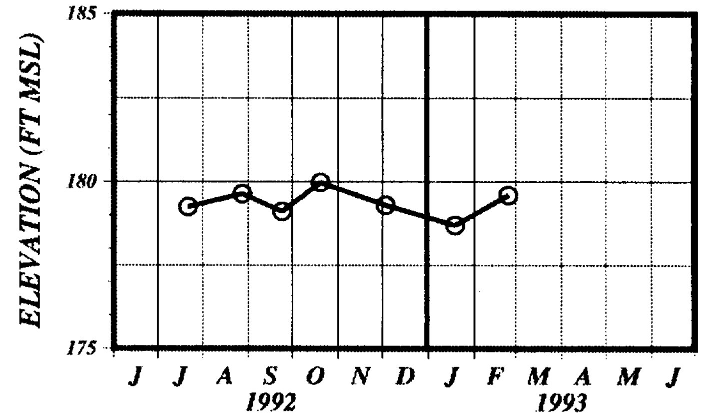
Appendix I-1

Hydrographs for Phase I RT Wells
(On-Station)

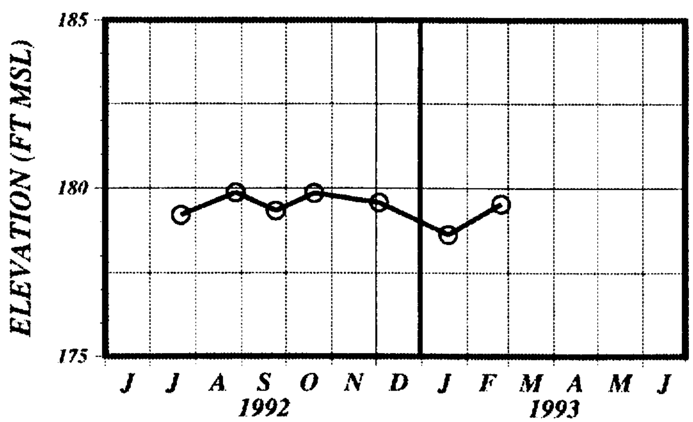
18_BGMW01A (466-486 ft bgs)



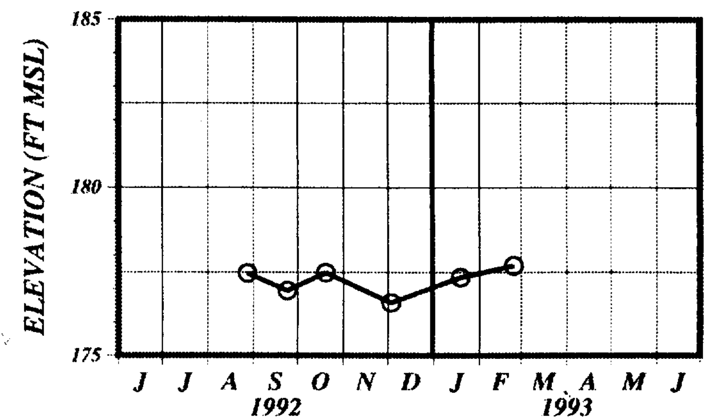
18_BGMW01C (330-350 ft bgs)



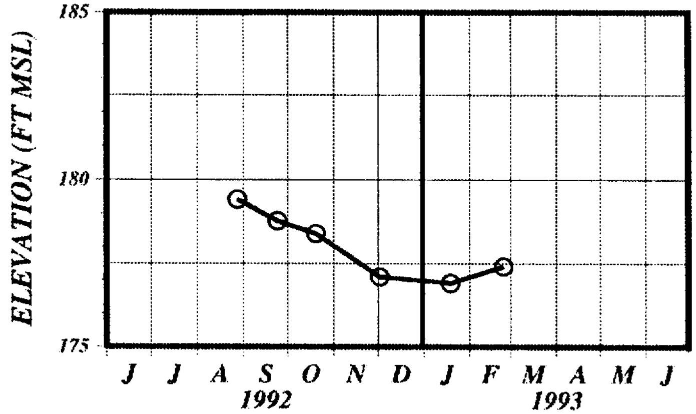
18_BGMW01B (396-416 ft bgs)



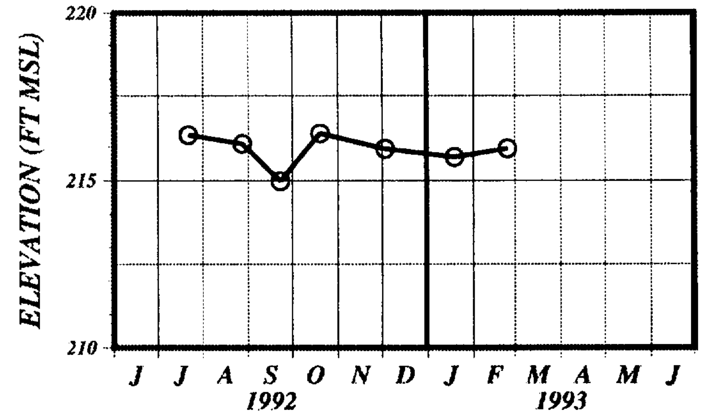
18_BGMW01D (242-262 ft bgs)



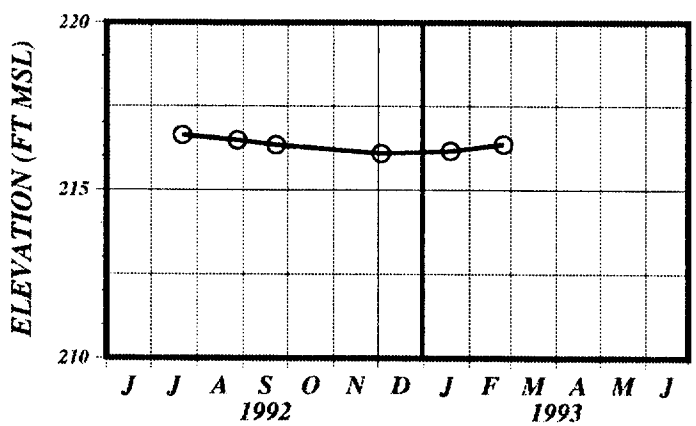
18_BGMW01E (205-225 ft bgs)



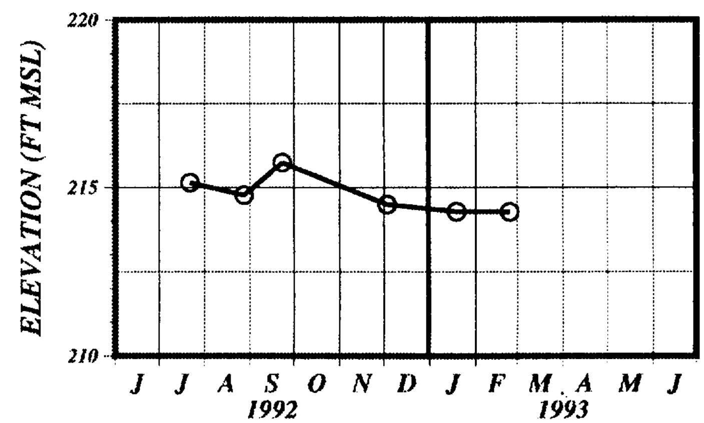
18_BGMW02C (358-378 ft bgs)



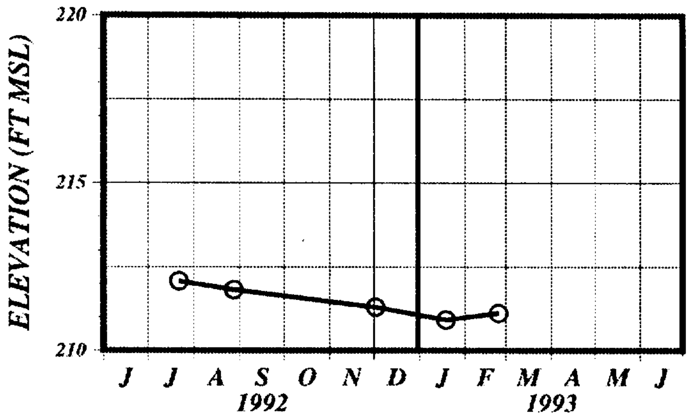
18_BGMW02A (462-482 ft bgs)



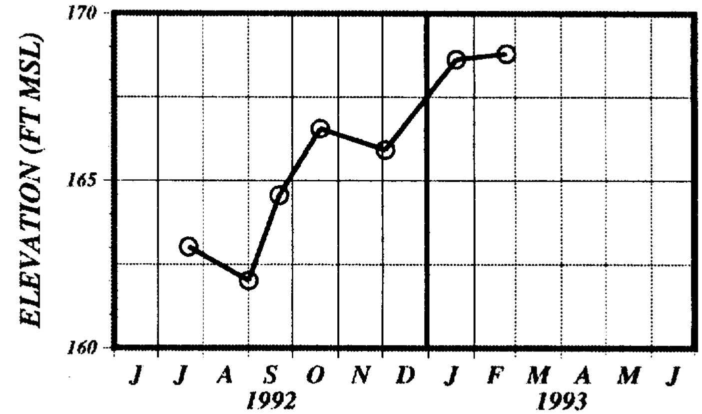
18_BGMW02D (294-314 ft bgs)



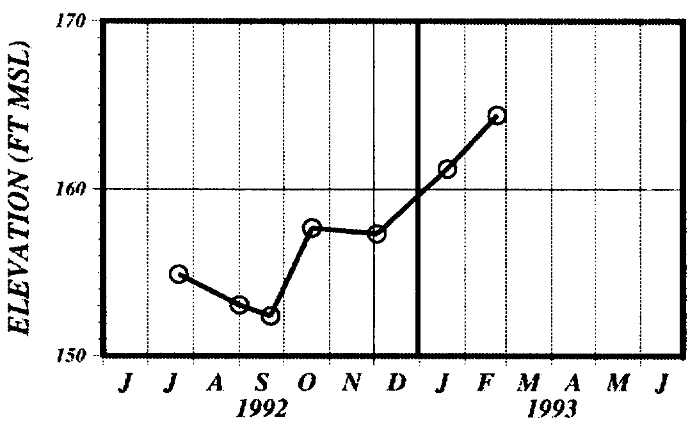
18_BGMW02E (193-233 ft bgs)



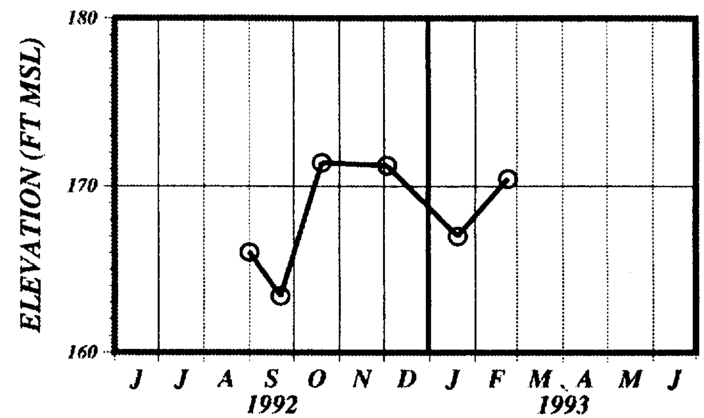
18_BGMW03B (280-300 ft bgs)



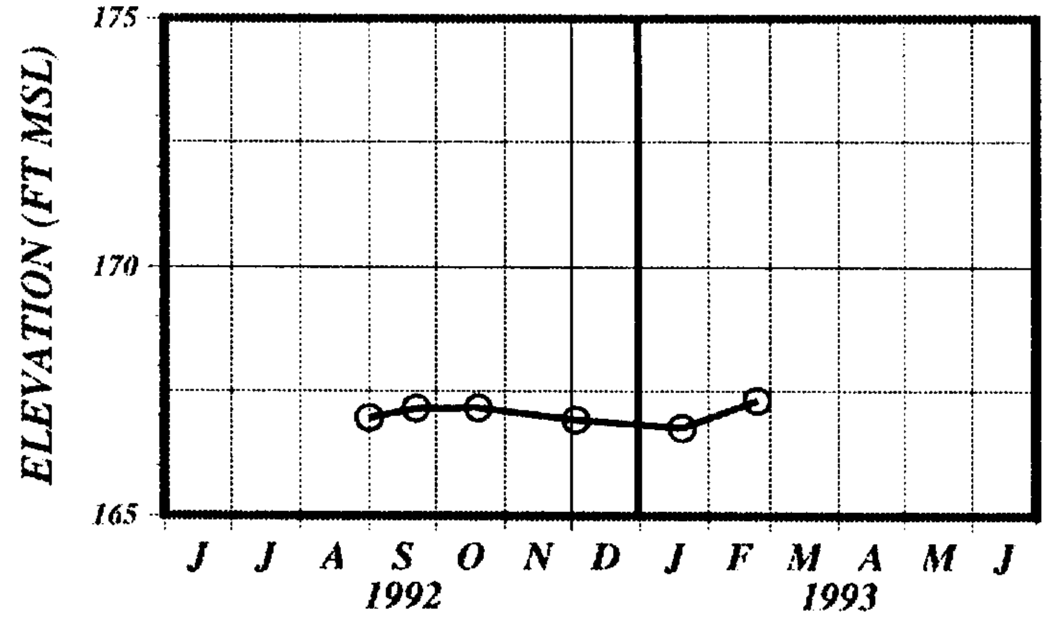
18_BGMW03A (370-390 ft bgs)



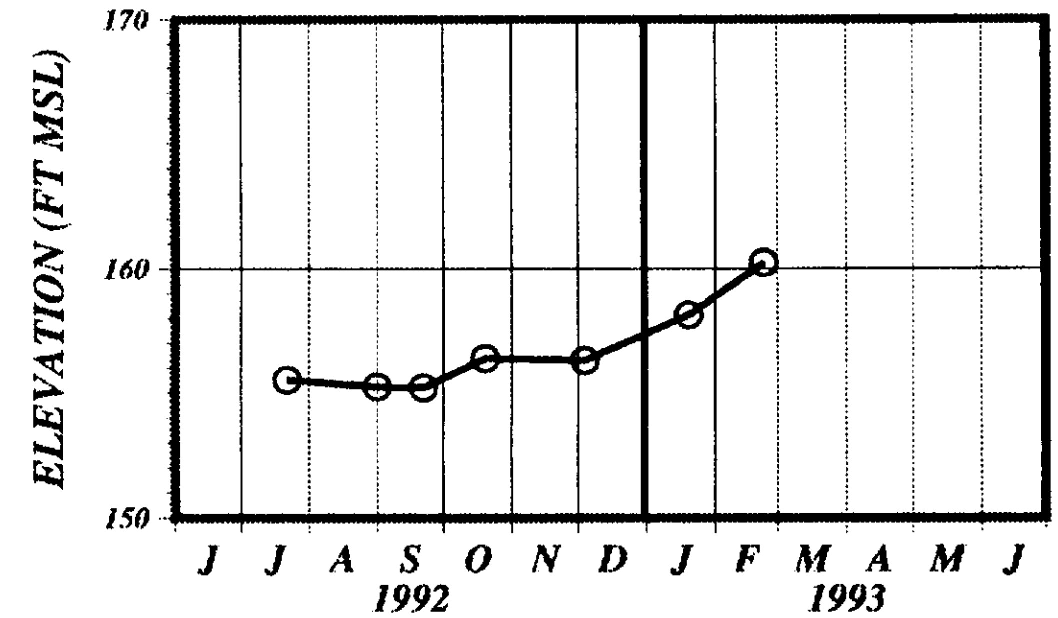
18_BGMW03C (222-242 ft bgs)



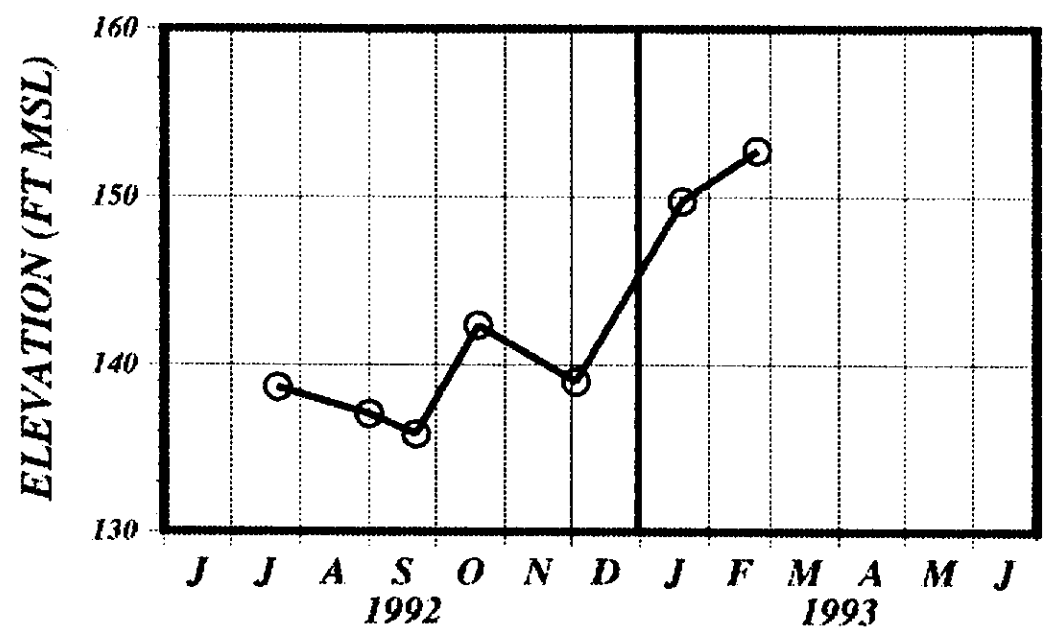
18_BGMW03E (124-164 ft bgs)



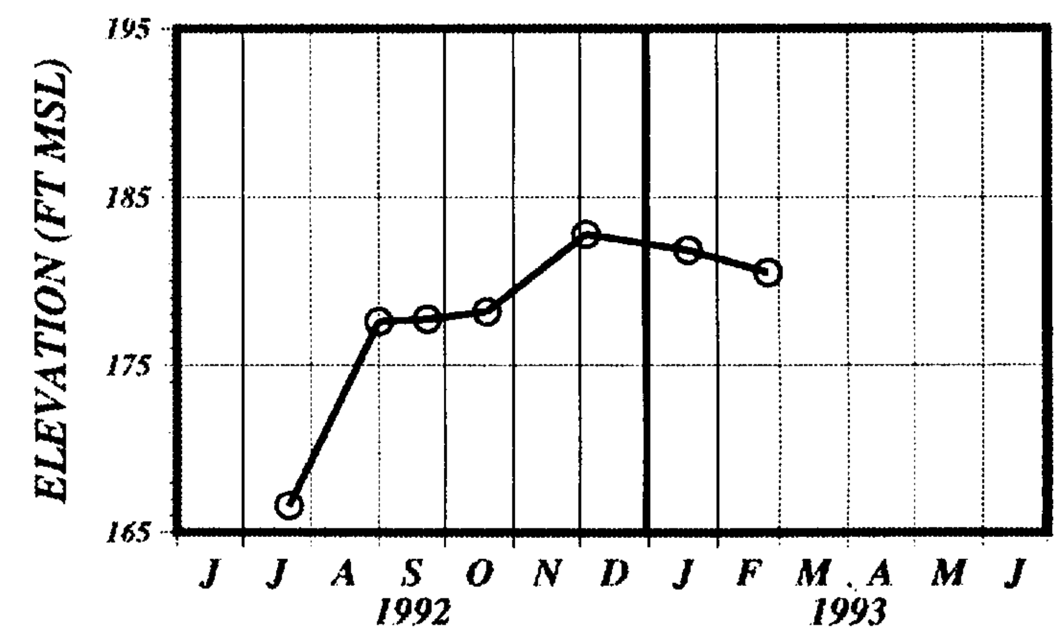
18_BGMW04B (190-210 ft bgs)



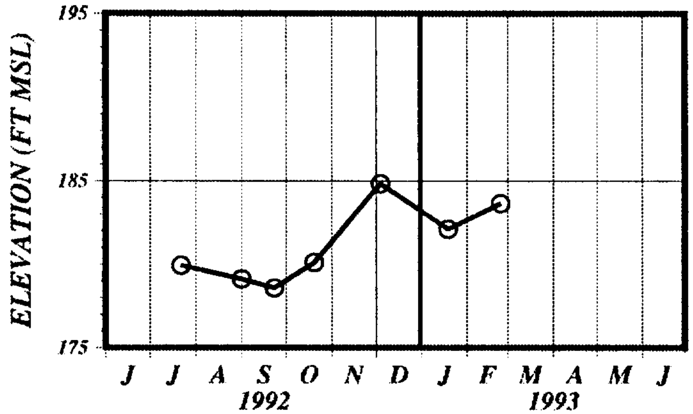
18_BGMW04A (286-306 ft bgs)



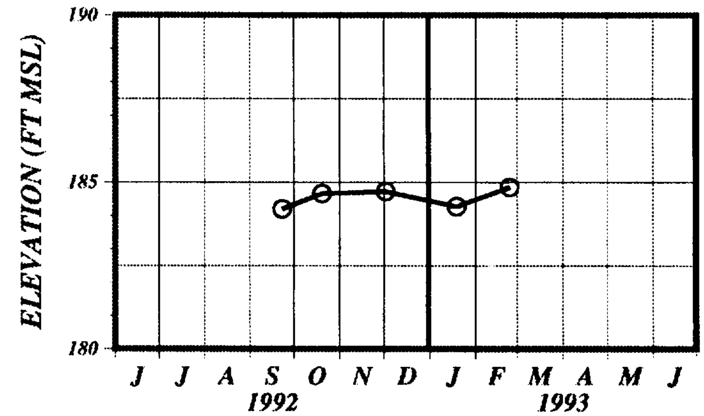
18_BGMW05A (462-482 ft bgs)



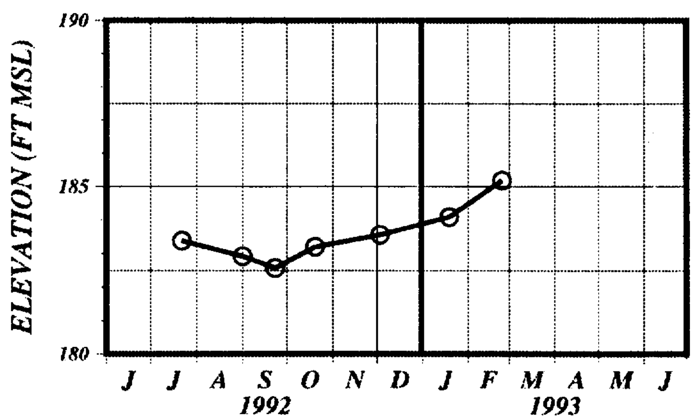
18_BGMW05B (321-341 ft bgs)



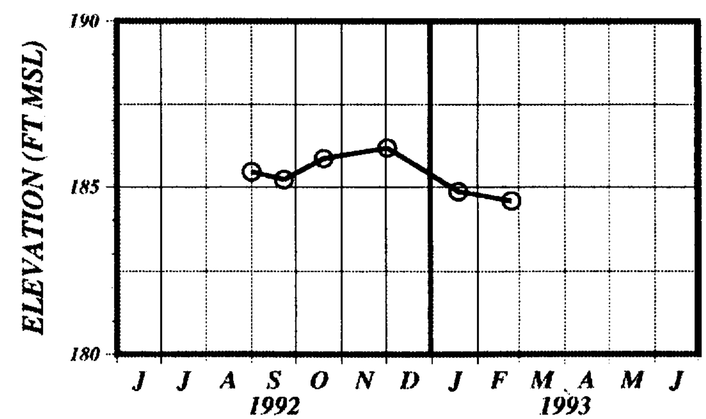
18_BGMW05D (83-133 ft bgs)



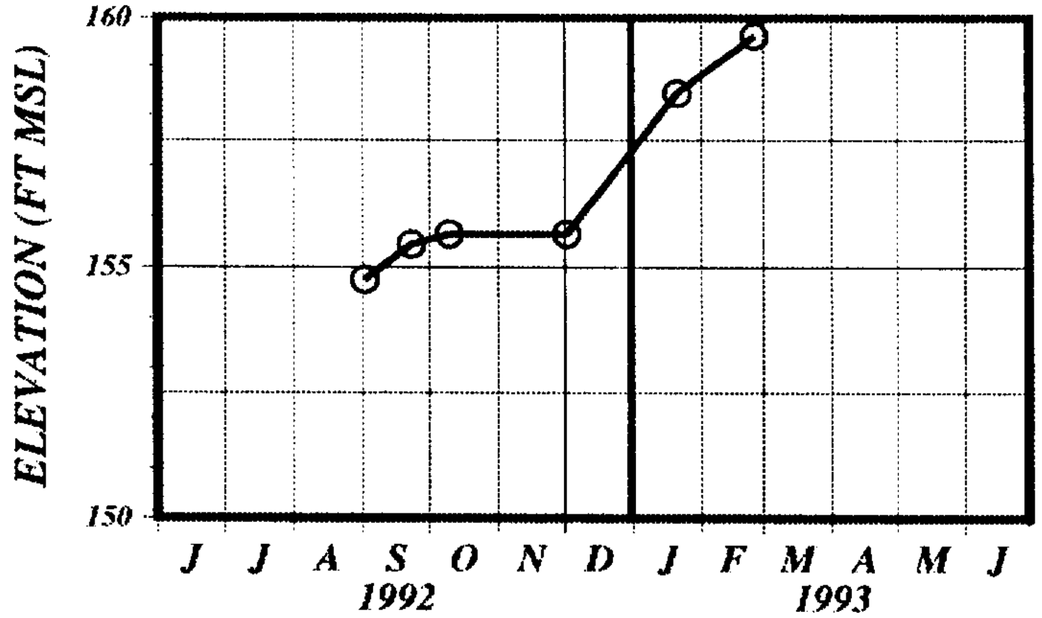
18_BGMW05C (225-245 ft bgs)



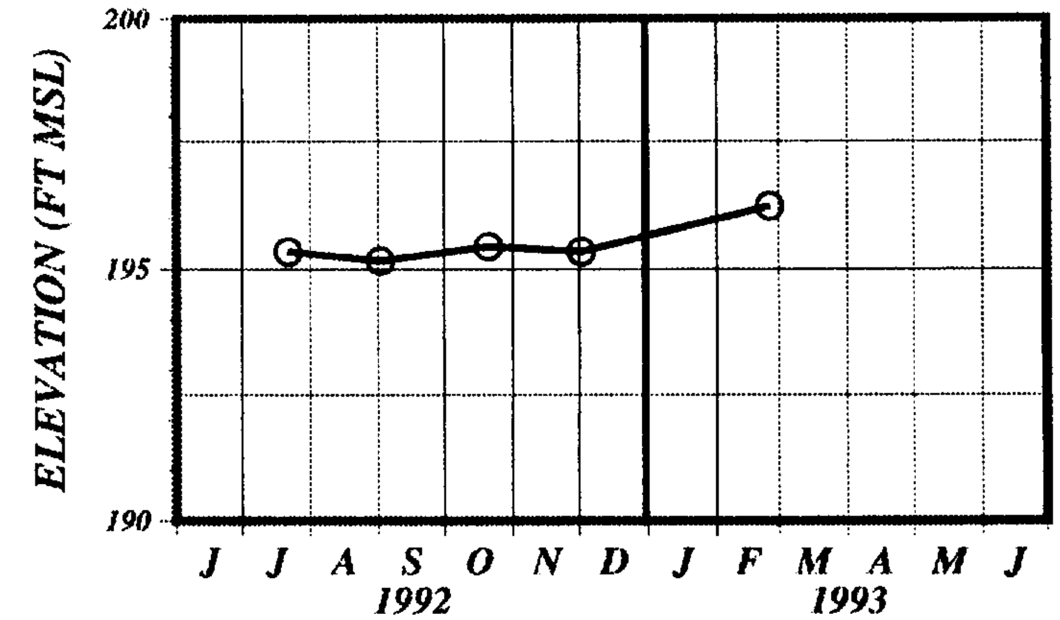
18_BGMW05E (80-130 ft bgs)



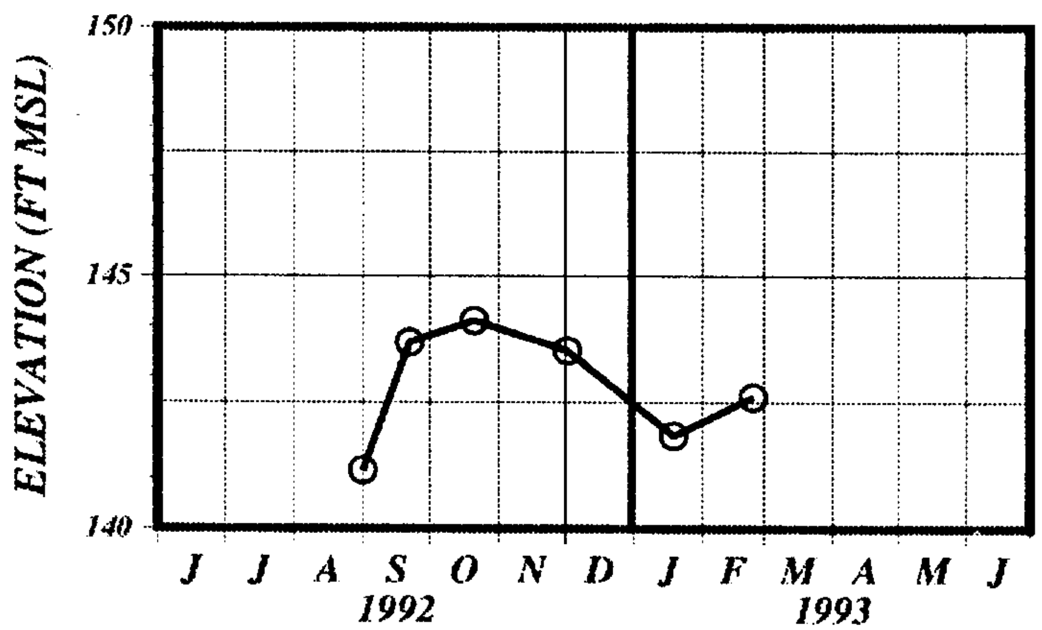
18_BGMW07 (25-65 ft bgs)



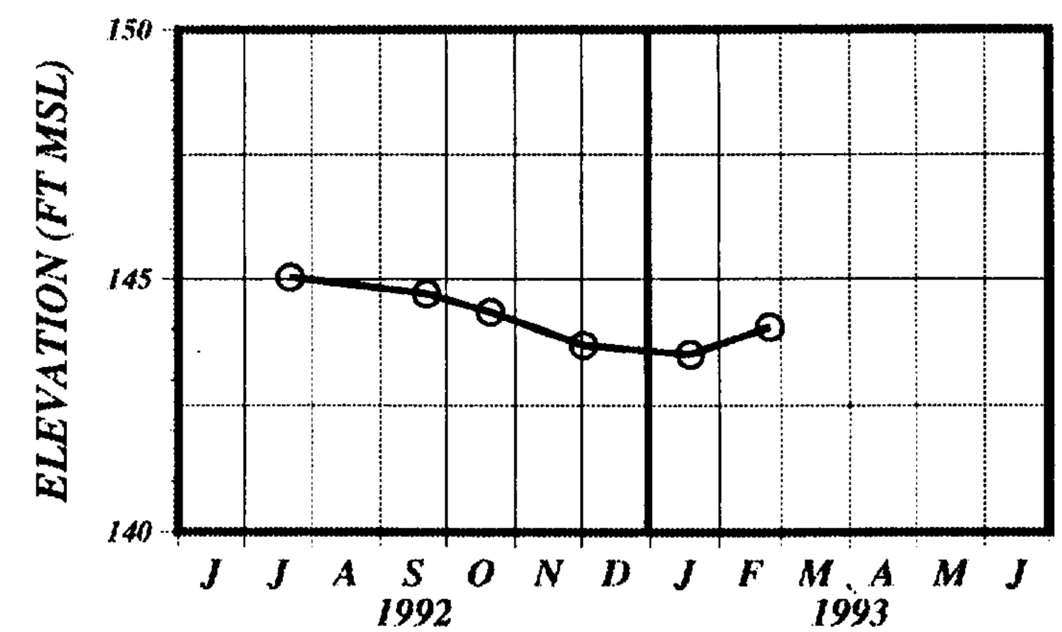
18_BGMW14 (75-115 ft bgs)



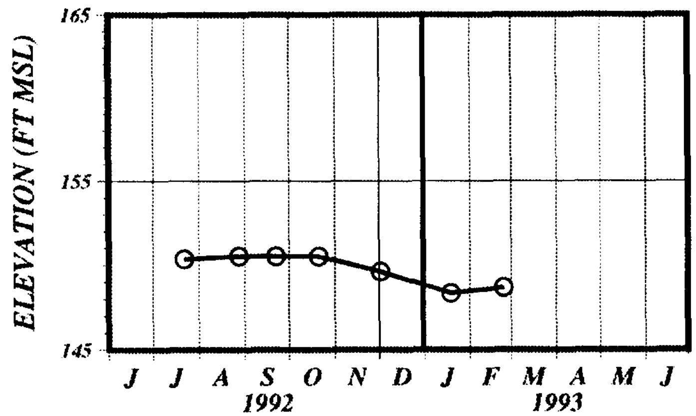
18_BGMW12 (165-205 ft bgs)



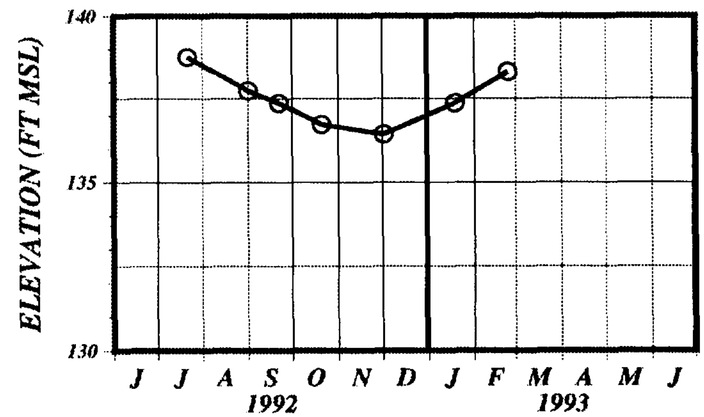
18_BGMW15 (175-215 ft bgs)



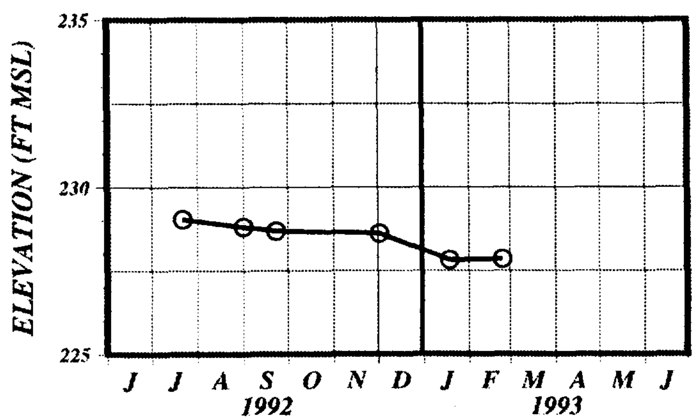
18_BGMW16 (223-263 ft bgs)



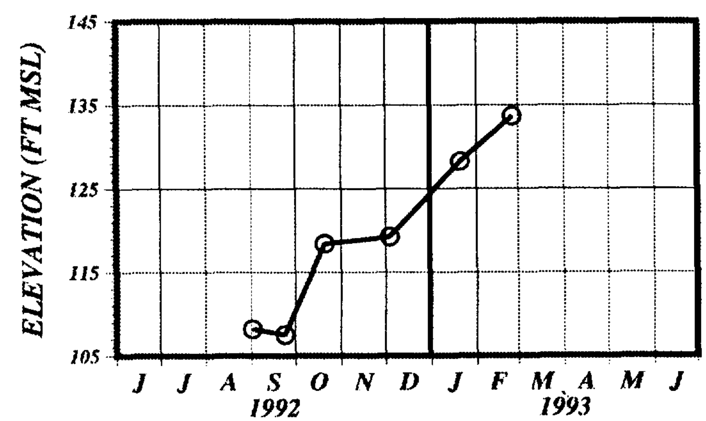
18_BGMW18 (140-180 ft bgs)



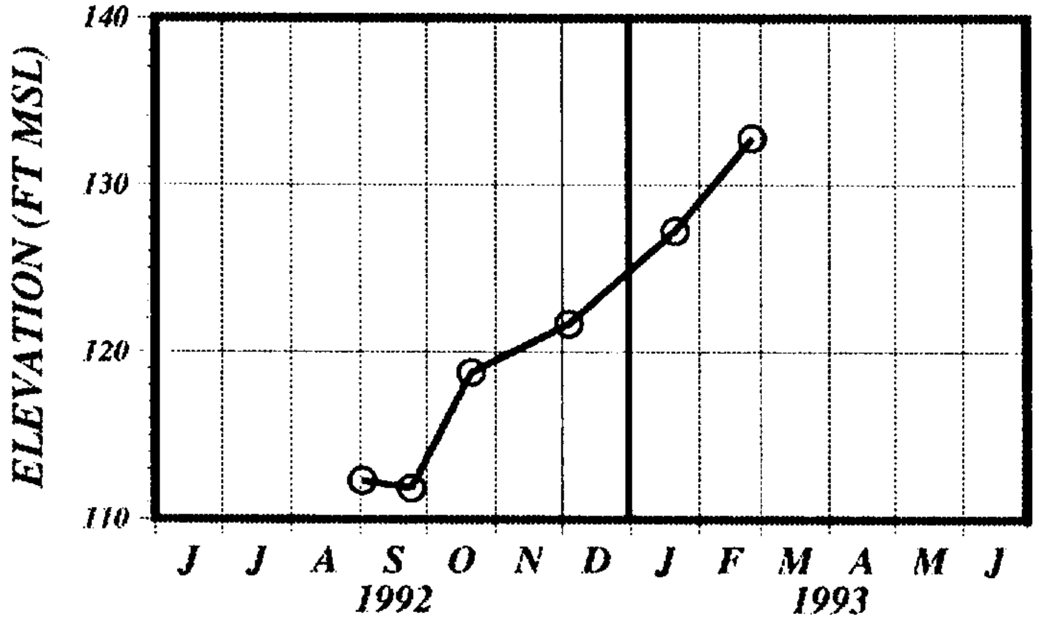
18_BGMW17 (215-255 ft bgs)



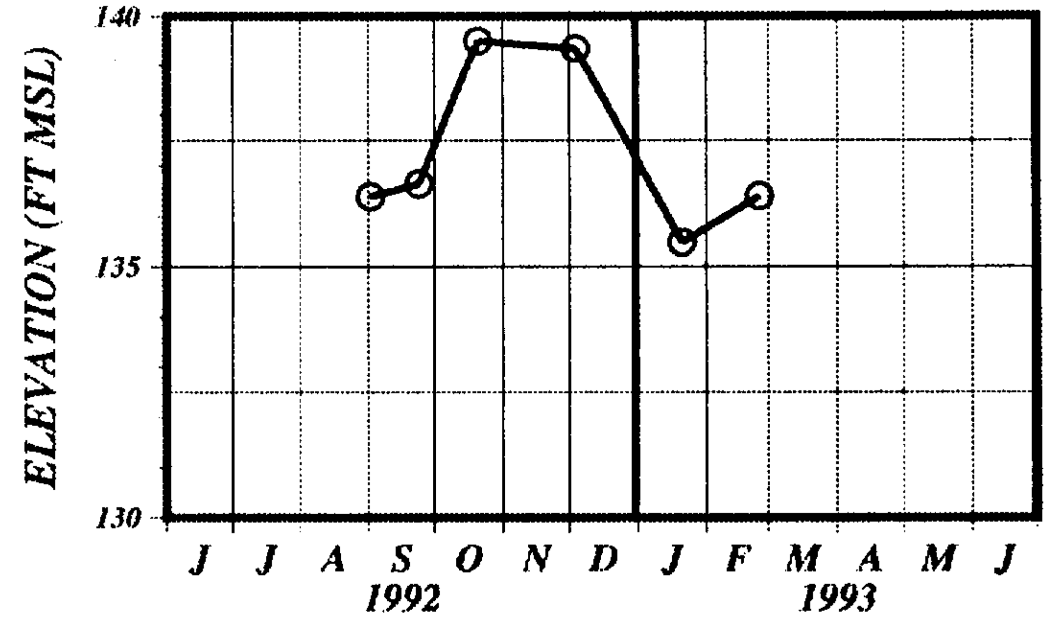
18_BGMW19A (448-468 ft bgs)



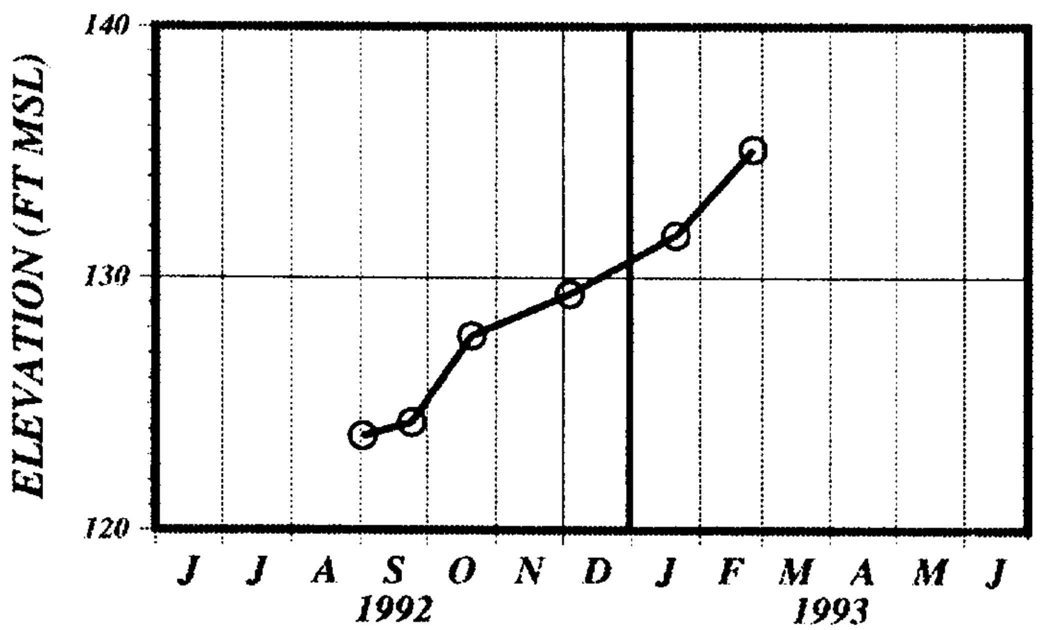
18_BGMW19B (400-420 ft bgs)



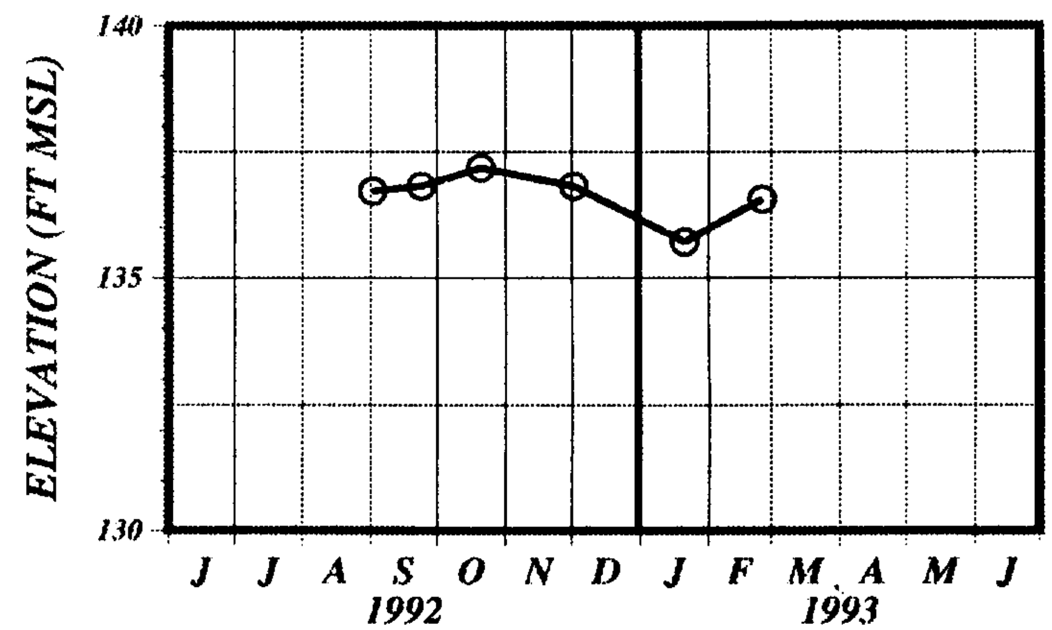
18_BGMW19D (150-170 ft bgs)



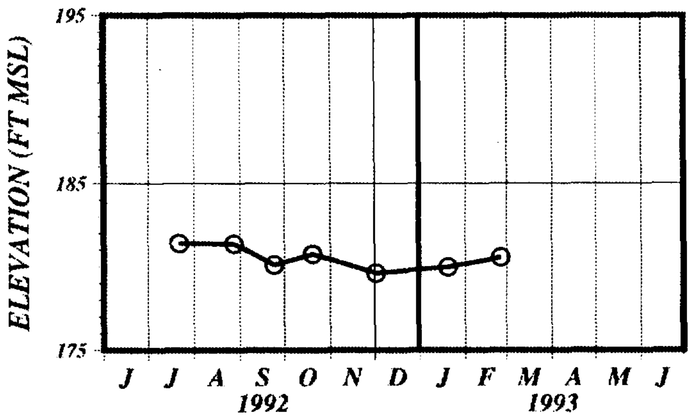
18_BGMW19C (257-277 ft bgs)



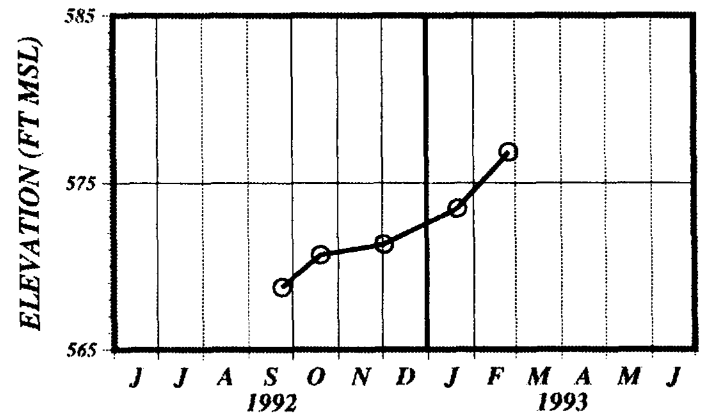
18_BGMW19E (98-138 ft bgs)



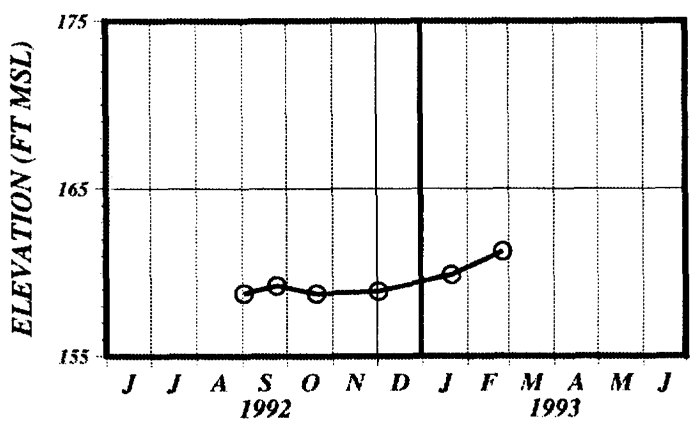
18_BGMW22 (247-287 ft bgs)



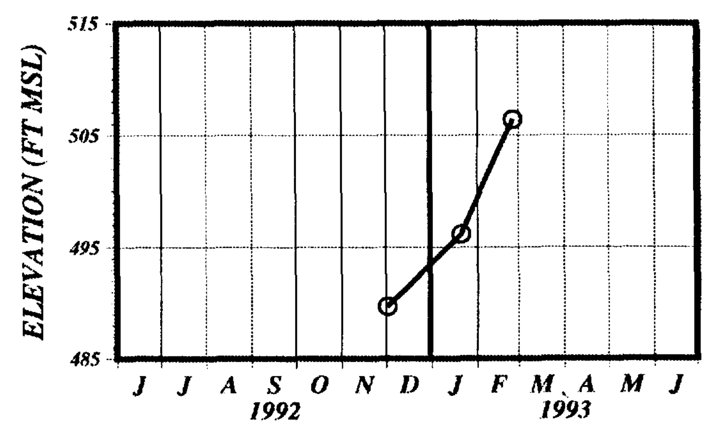
18_BGMW24 (51-71 ft bgs)

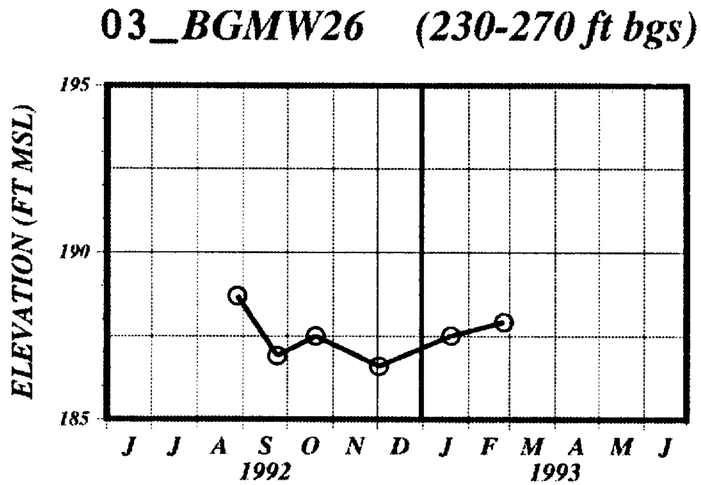


18_BGMW23 (64-104 ft bgs)

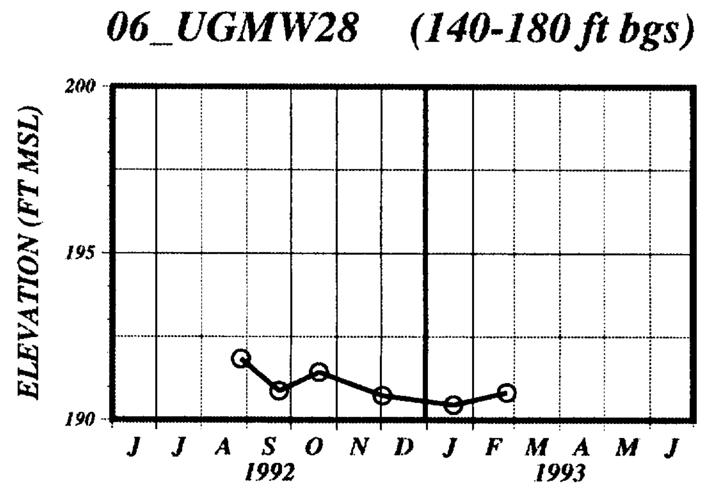


18_BGMW25 (55-75 ft bgs)

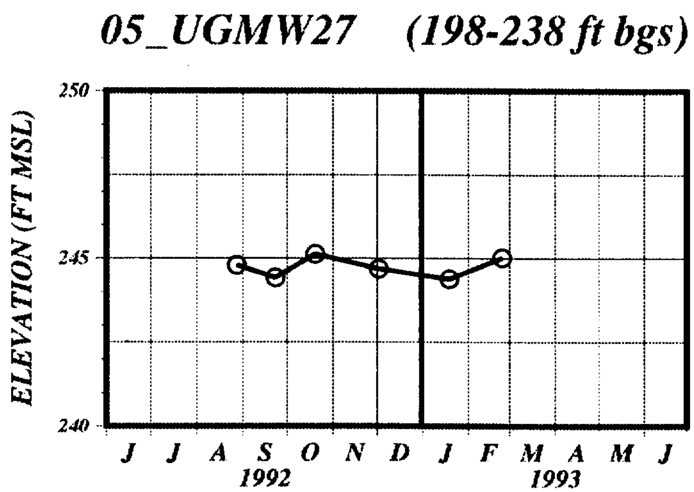




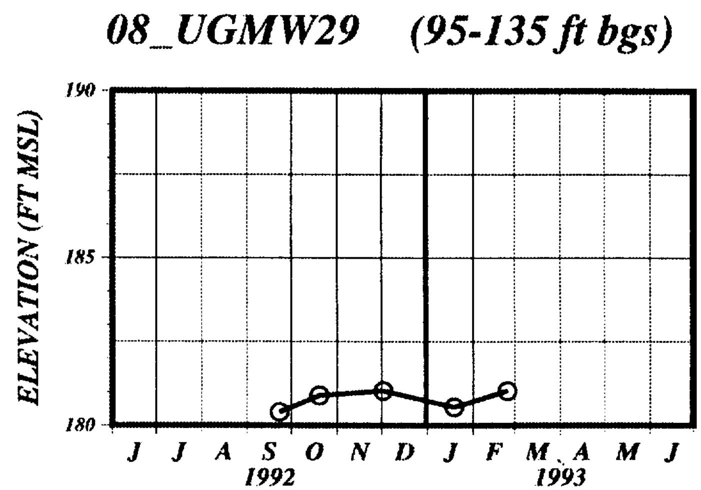
03_BGMW26 (230-270 ft bgs)
ELEVATION (FT MSL)
195
190
185
J J A S O N D J F M A M J
1992
1993



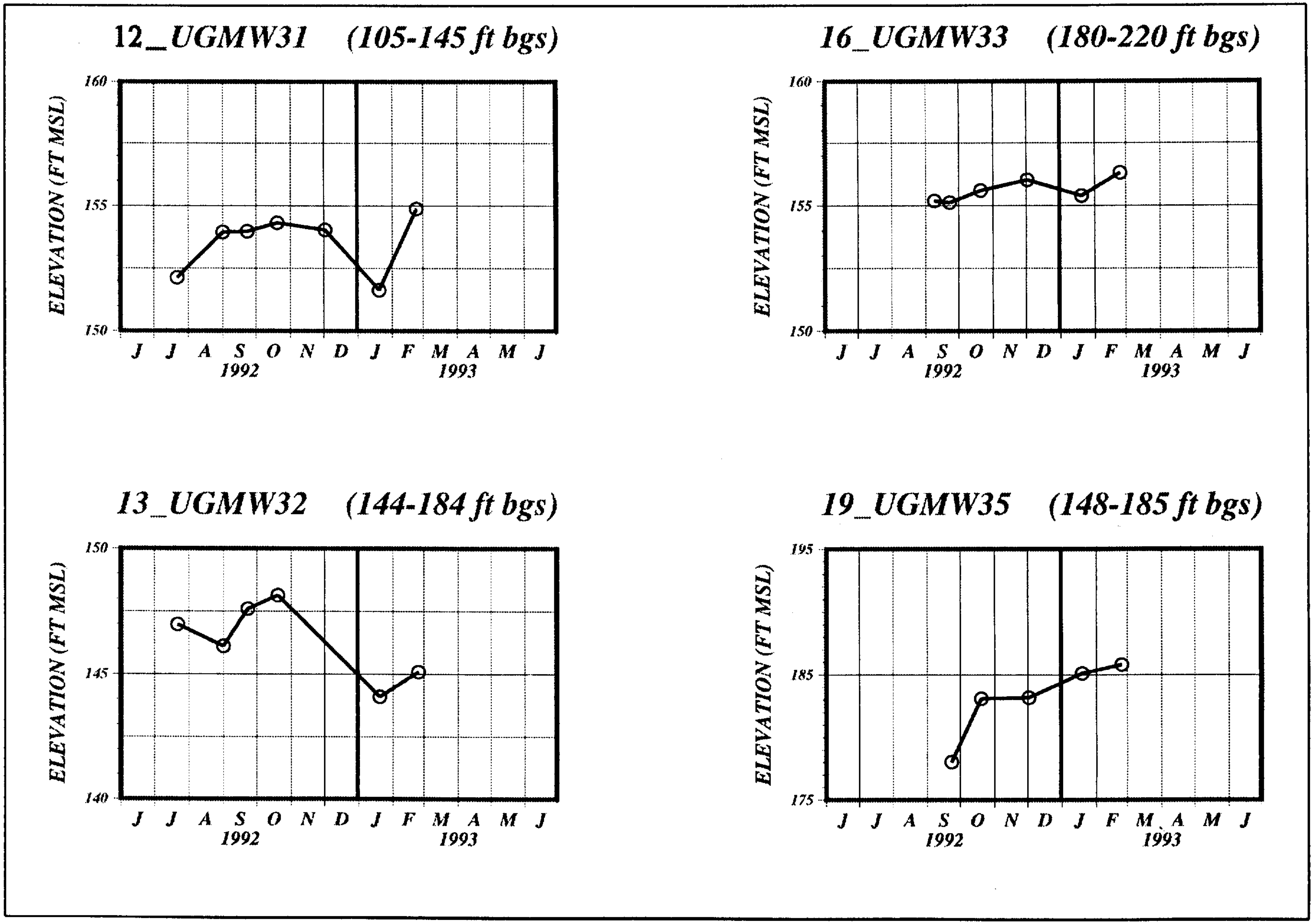
06_UGMW28 (140-180 ft bgs)
ELEVATION (FT MSL)
200
195
190
J J A S O N D J F M A M J
1992
1993



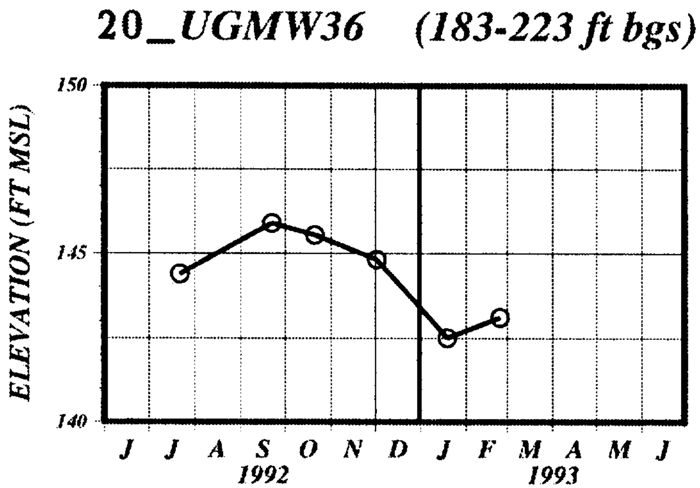
05_UGMW27 (198-238 ft bgs)
ELEVATION (FT MSL)
250
245
240
J J A S O N D J F M A M J
1992
1993



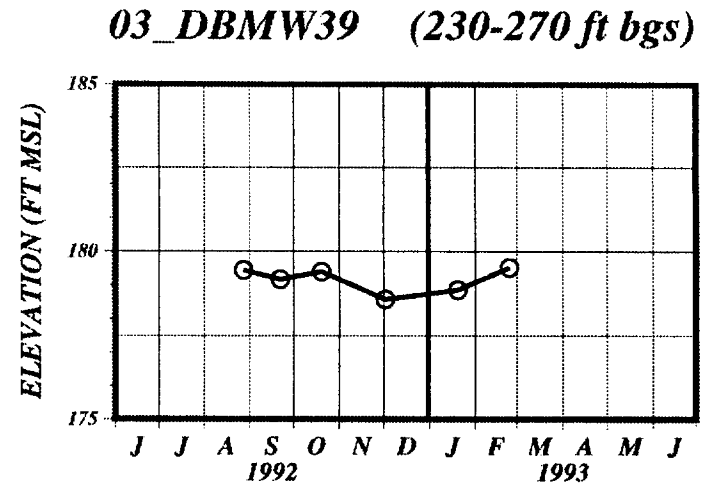
08_UGMW29 (95-135 ft bgs)
ELEVATION (FT MSL)
190
185
180
J J A S O N D J F M A M J
1992
1993



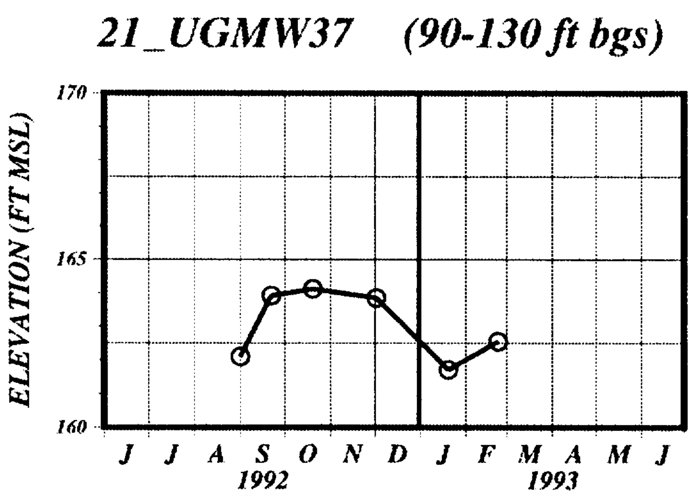
12_UGMW31 (105-145 ft bgs)
ELEVATION (FT MSL)
160
155
150
J J A S O N D J F M A M J
1992
1993
16_UGMW33 (180-220 ft bgs)
ELEVATION (FT MSL)
160
155
150
J J A S O N D J F M A M J
1992
1993
13_UGMW32 (144-184 ft bgs)
ELEVATION (FT MSL)
150
145
140
J J A S O N D J F M A M J
1992
1993
19_UGMW35 (148-185 ft bgs)
ELEVATION (FT MSL)
195
185
175
J J A S O N D J F M A M J
1992
1993



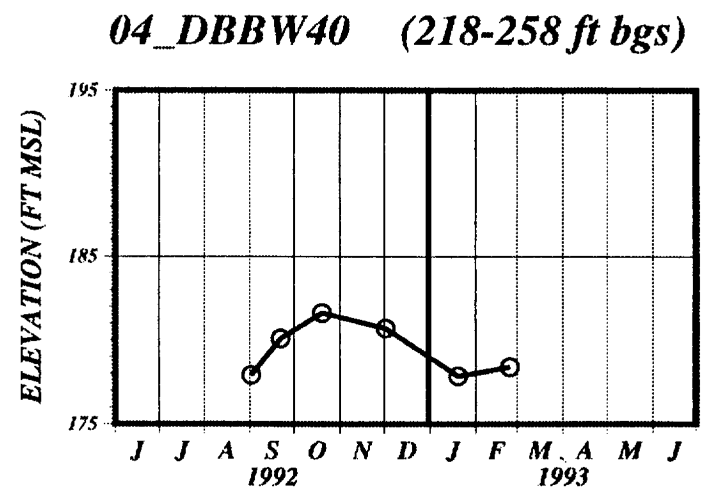
20_UGMW36 (183-223 ft bgs)
ELEVATION (FT MSL)
150
145
140
J J A S O N D J F M A M J
1992
1993



03_DBMW39 (230-270 ft bgs)
ELEVATION (FT MSL)
185
180
175
J J A S O N D J F M A M J
1992
1993

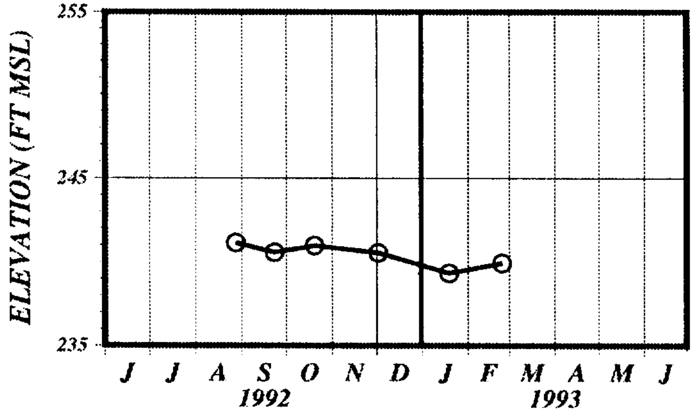


21_UGMW37 (90-130 ft bgs)
ELEVATION (FT MSL)
170
165
160
J J A S O N D J F M A M J
1992
1993

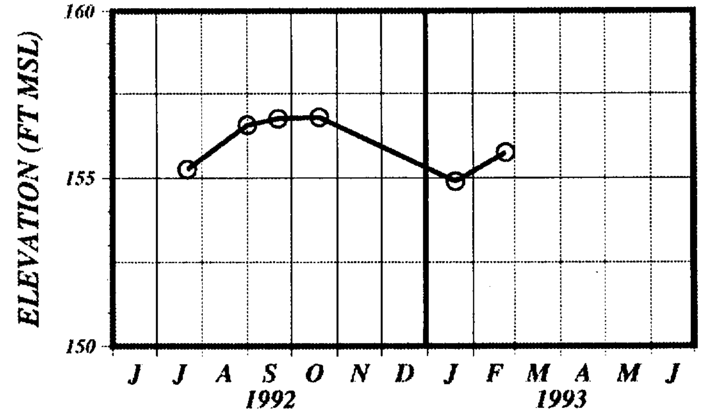


04_DBBW40 (218-258 ft bgs)
ELEVATION (FT MSL)
195
185
175
J J A S O N D J F M A M J
1992
1993

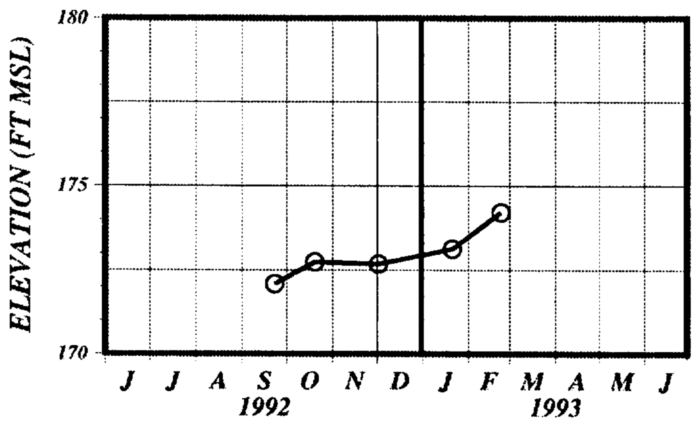
05_DBMW41 (182-222 ft bgs)



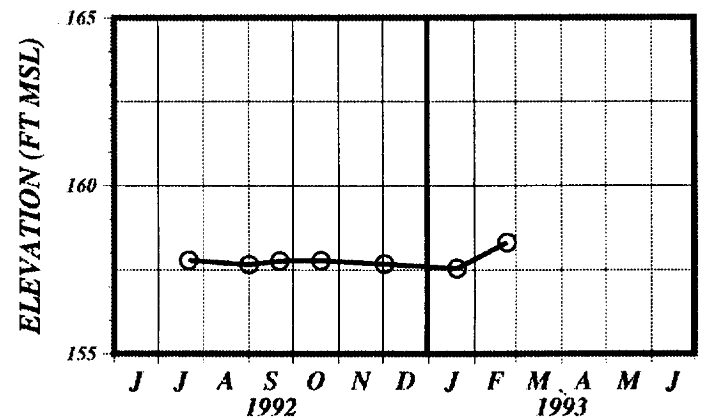
09_DBMW45 (117-157 ft bgs)



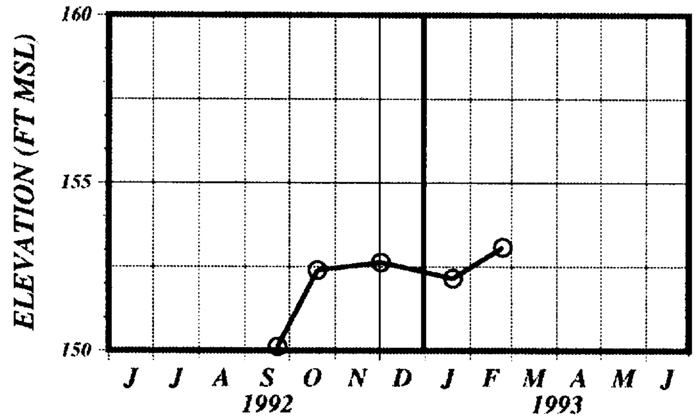
07_DBMW43 (150-190 ft bgs)



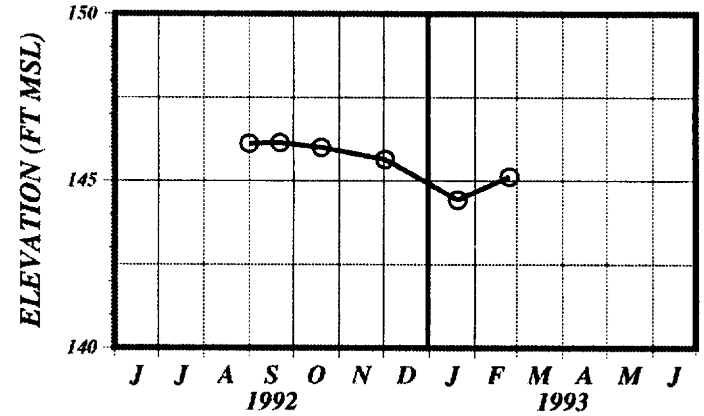
22_DBMW47 (116-156 ft bgs)



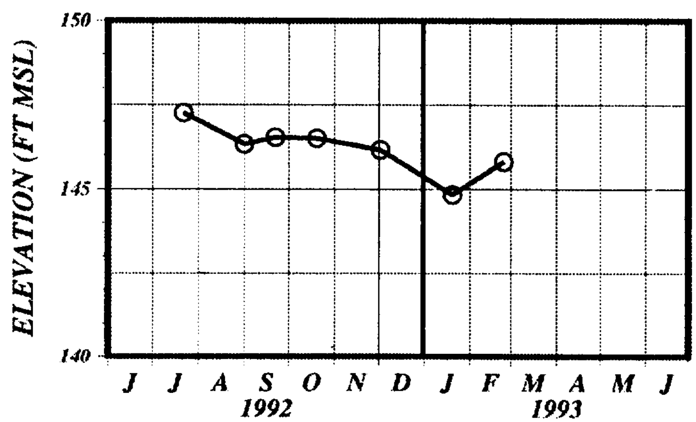
12_DBMW48 (95-135 ft bgs)



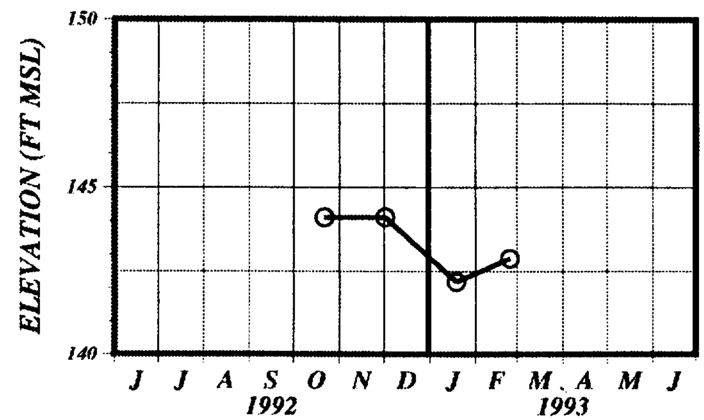
14_DBMW50 (120-160 ft bgs)

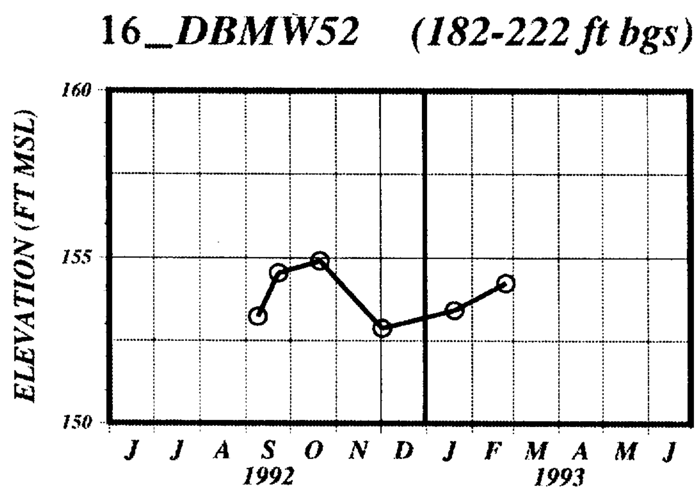


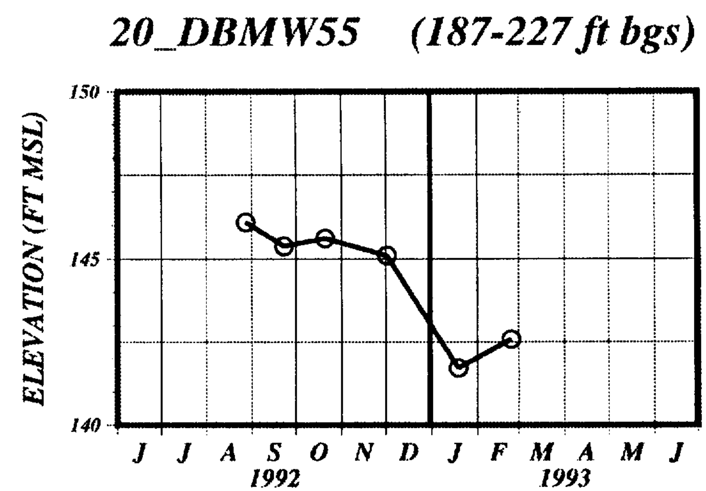
13_DBMW49 (142-182 ft bgs)

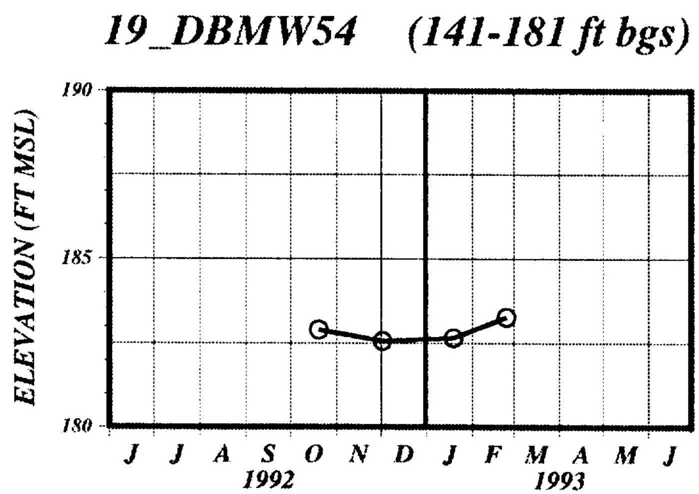


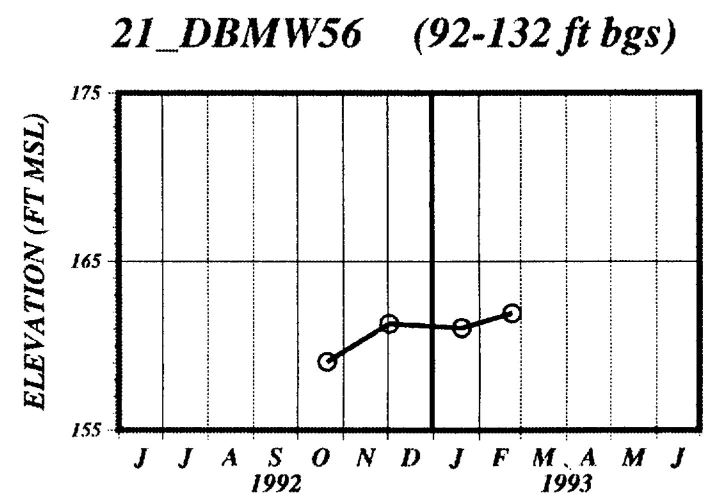
15_DBMW51 (125-165 ft bgs)



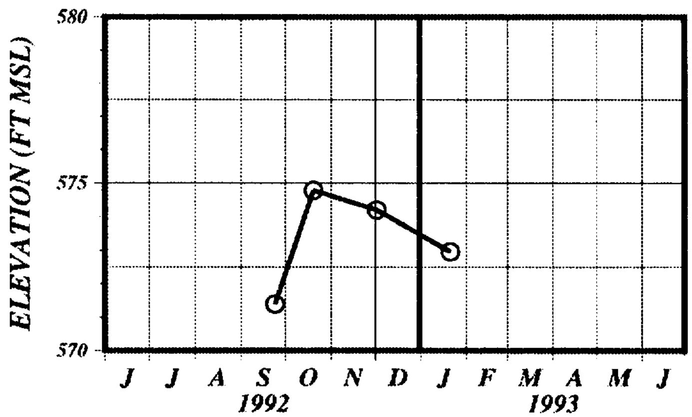

16_DBMW52 (182-222 ft bgs)
ELEVATION (FT MSL)
160
155
150
J J A S O N D J F M A M J
1992
1993


20_DBMW55 (187-227 ft bgs)
ELEVATION (FT MSL)
150
145
140
J J A S O N D J F M A M J
1992
1993

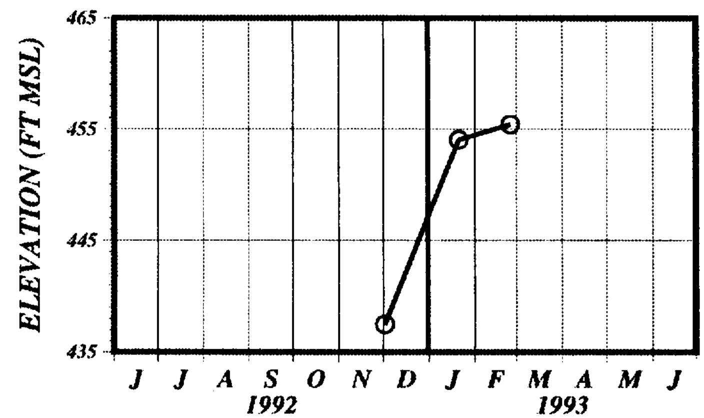

19_DBMW54 (141-181 ft bgs)
ELEVATION (FT MSL)
190
185
180
J J A S O N D J F M A M J
1992
1993


21_DBMW56 (92-132 ft bgs)
ELEVATION (FT MSL)
175
165
155
J J A S O N D J F M A M J
1992
1993

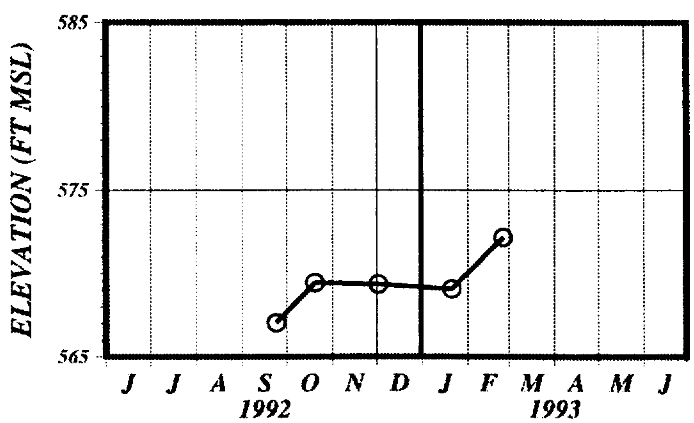
01_DGMW57 (63-83 ft bgs)



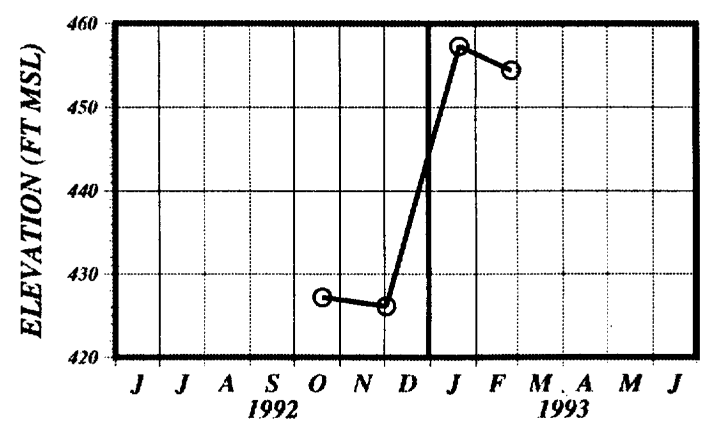
02_DGMW59 (69-89 ft bgs)



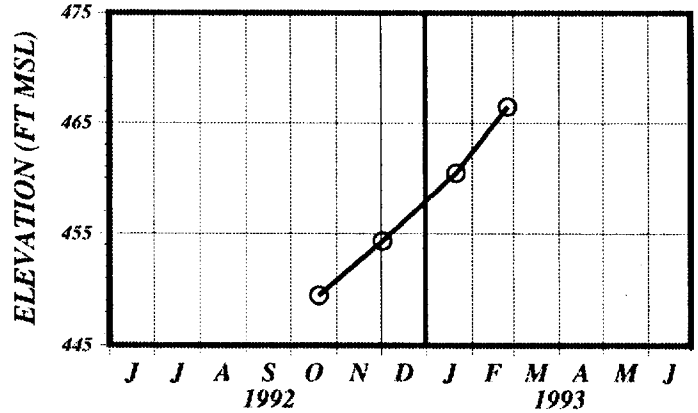
01_DGMW58 (57-77 ft bgs)



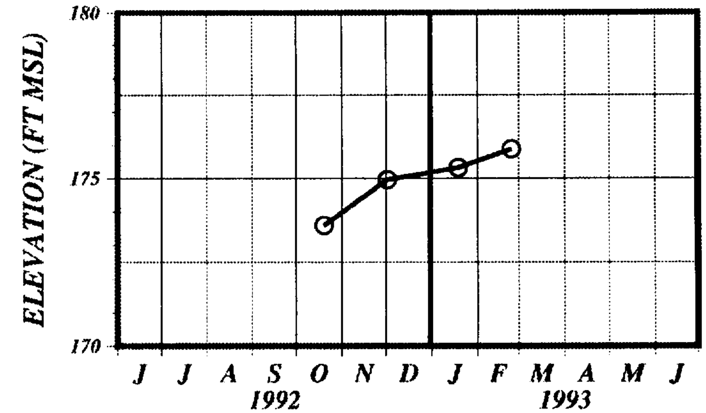
02_DGMW60 (80-100 ft bgs)



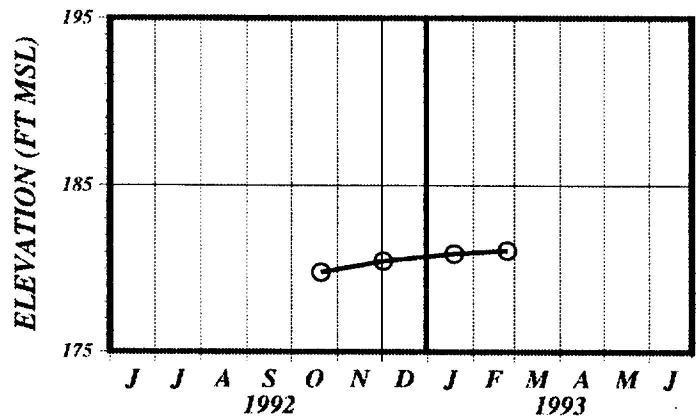
02_DGMW61 (80-100 ft bgs)



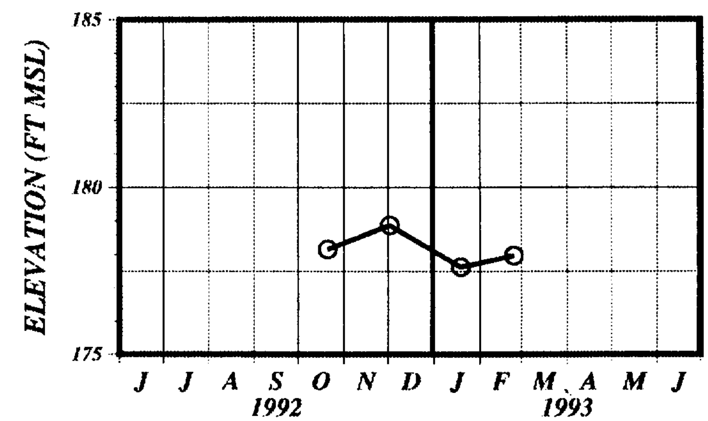
03_DGMW64 (245-285 ft bgs)

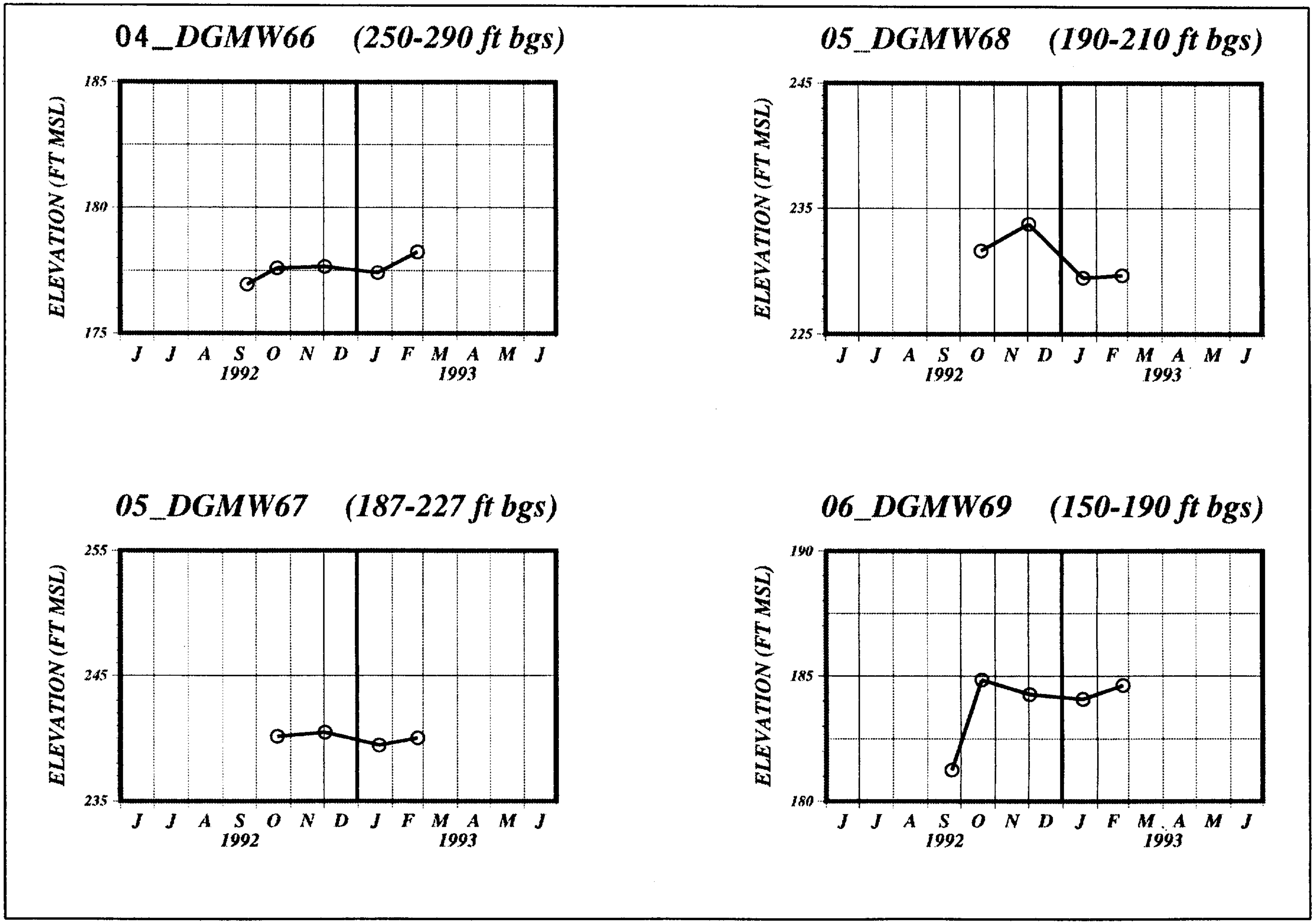


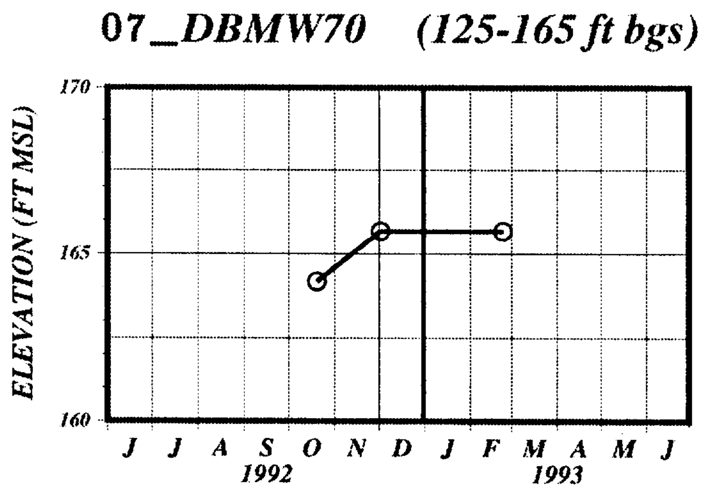
04_UGMW63 (235-275 ft bgs)

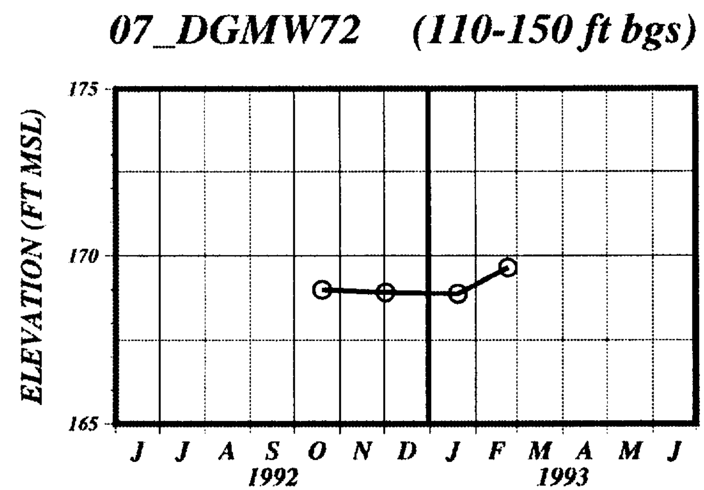


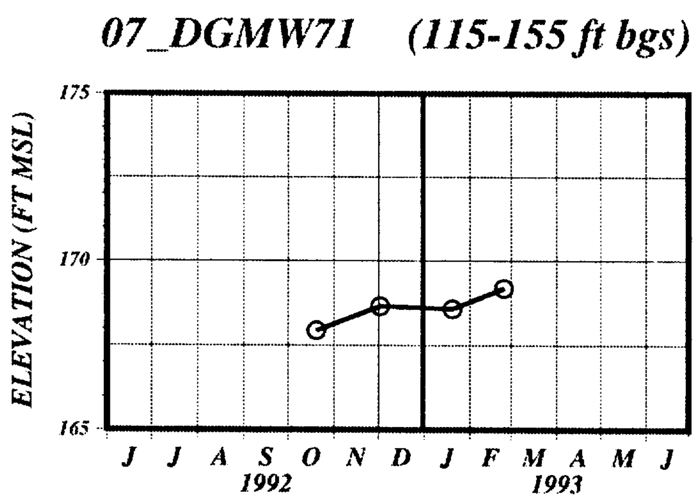
03_DGMW65X (230-270 ft bgs)

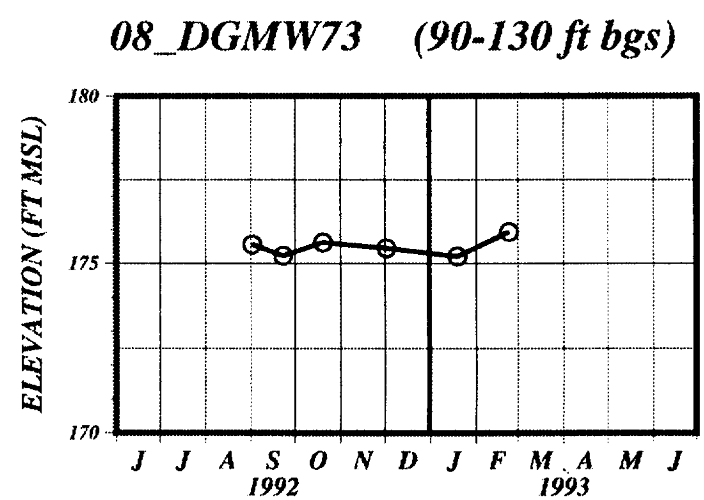



04_DGMW66 (250-290 ft bgs)
ELEVATION (FT MSL)
185
180
175
J J A S O N D J F M A M J
1992
1993
05_DGMW68 (190-210 ft bgs)
ELEVATION (FT MSL)
245
235
225
J J A S O N D J F M A M J
1992
1993
05_DGMW67 (187-227 ft bgs)
ELEVATION (FT MSL)
255
245
235
J J A S O N D J F M A M J
1992
1993
06_DGMW69 (150-190 ft bgs)
ELEVATION (FT MSL)
190
185
180
J J A S O N D J F M A M J
1992
1993

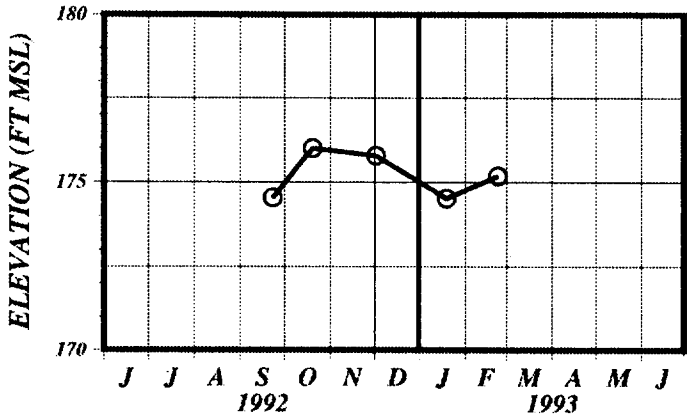

07_DBMW70 (125-165 ft bgs)
ELEVATION (FT MSL)
170
165
160
J J A S O N D J F M A M J
1992
1993


07_DGMW72 (110-150 ft bgs)
ELEVATION (FT MSL)
175
170
165
J J A S O N D J F M A M J
1992
1993

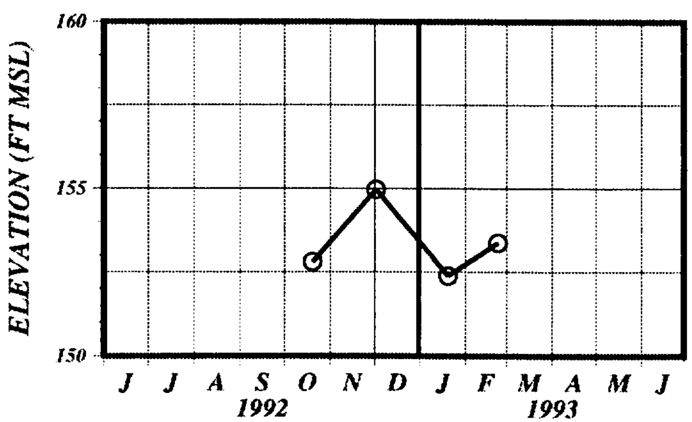

07_DGMW71 (115-155 ft bgs)
ELEVATION (FT MSL)
175
170
165
J J A S O N D J F M A M J
1992
1993


08_DGMW73 (90-130 ft bgs)
ELEVATION (FT MSL)
180
175
170
J J A S O N D J F M A M J
1992
1993

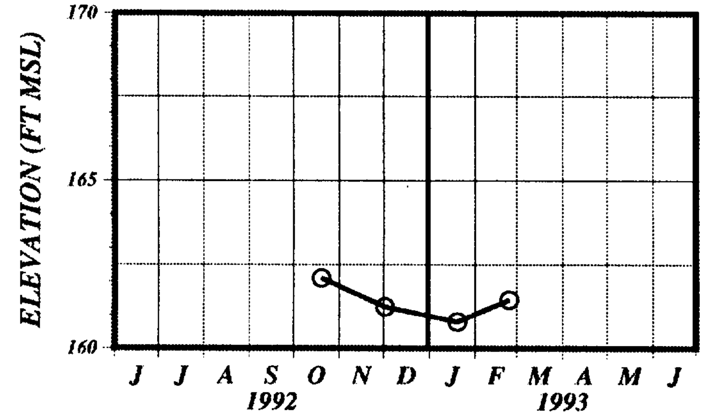
08_DGMW74 (90-130 ft bgs)



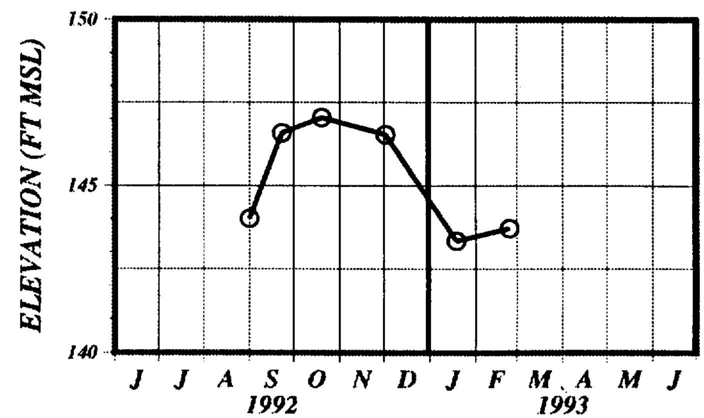
09_DGMW75 (114-154 ft bgs)



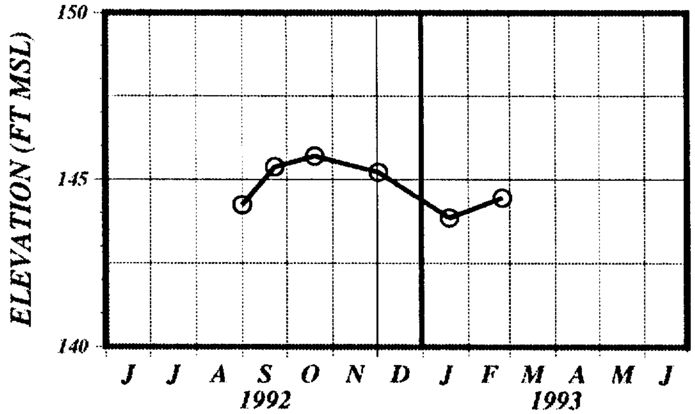
10_DGMW77 (130-170 ft bgs)



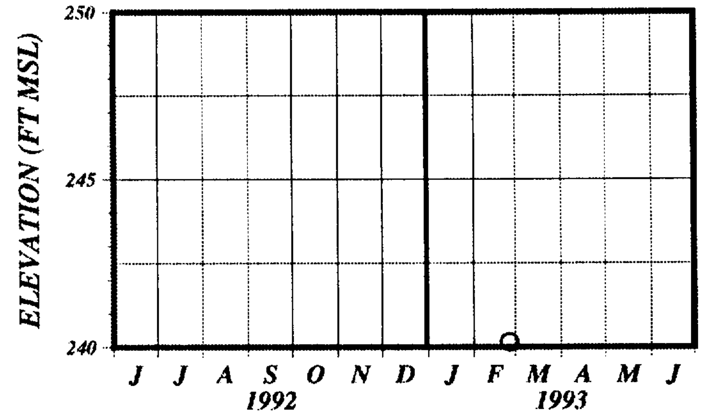
13_DGMW78 (127-167 ft bgs)



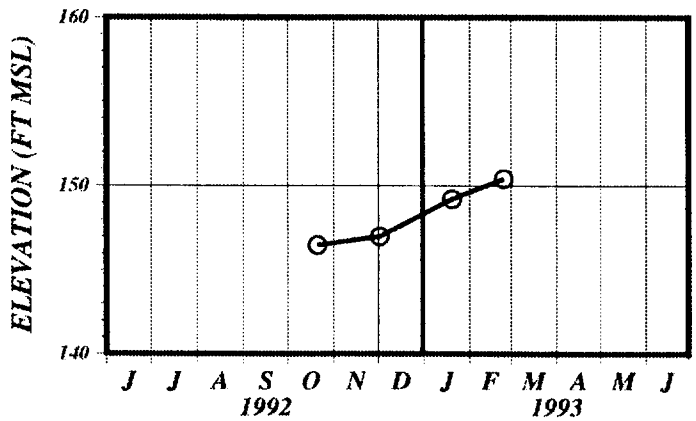
14_DGMW79 (118-158 ft bgs)



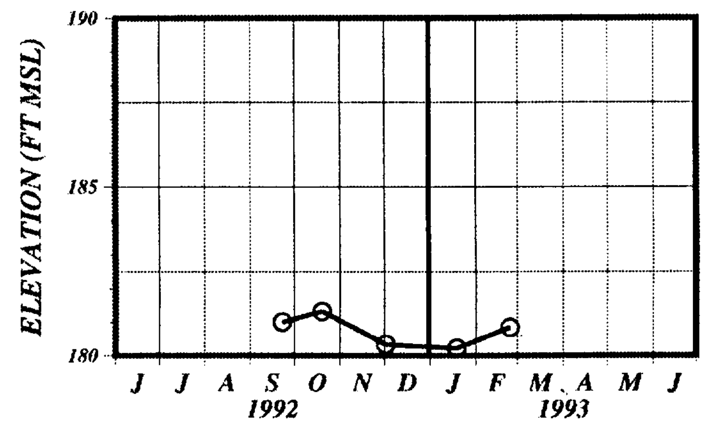
17_DGMW82 (235-255 ft bgs)



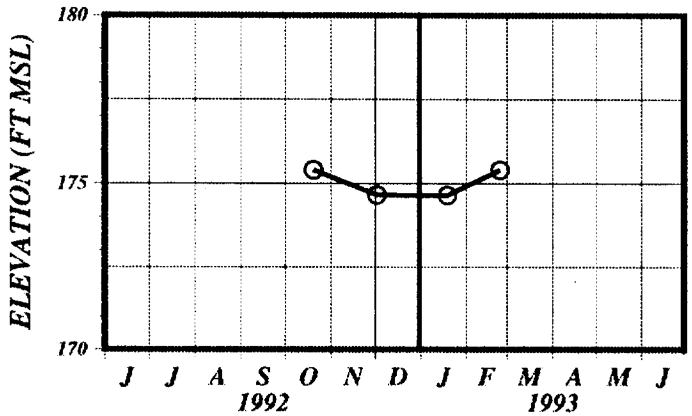
16_DGMW81 (176-216 ft bgs)



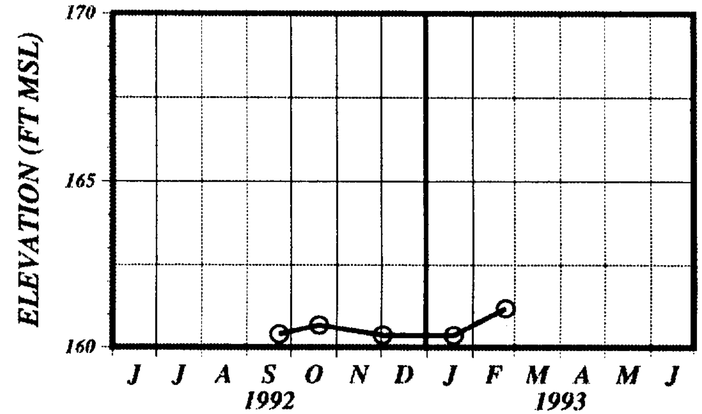
19_DGMW85 (143-183 ft bgs)



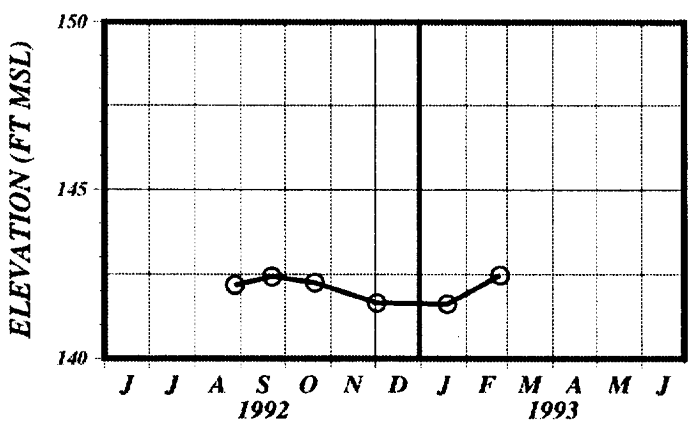
19_DGMW86 (158-198 ft bgs)



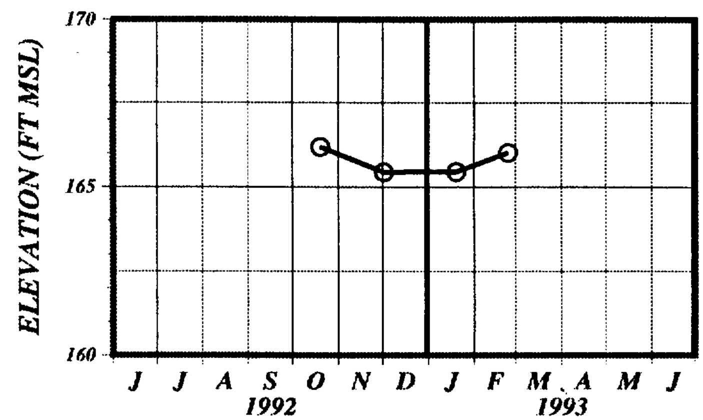
21_DGMW90 (95-135 ft bgs)



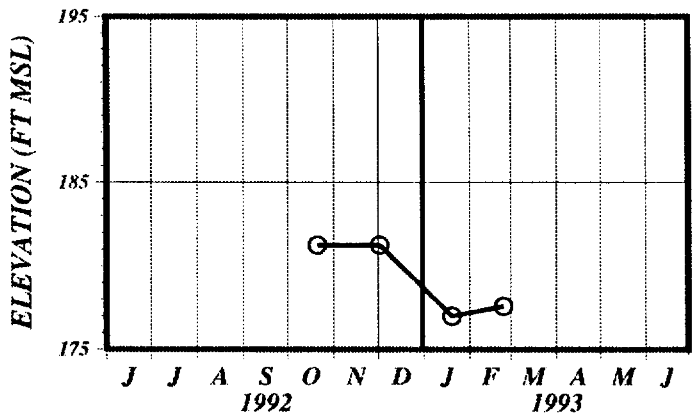
20_DGMW88 (185-225 ft bgs)



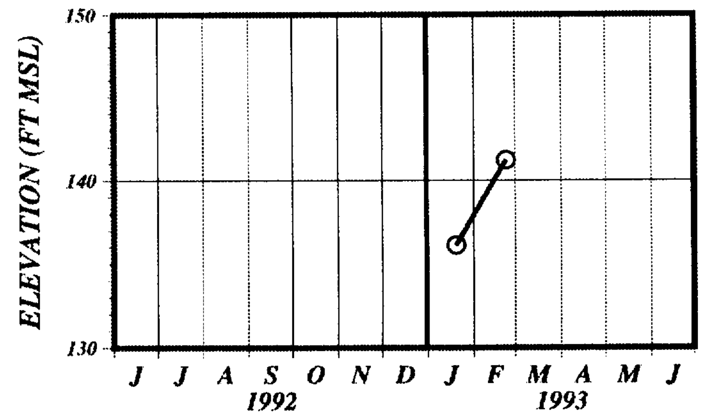
07_DGMW91 (110-150 ft bgs)



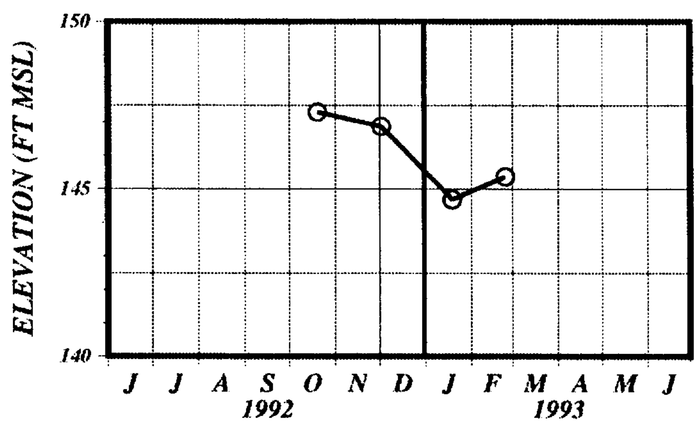
07_DBMW100 (131-171 ft bgs)



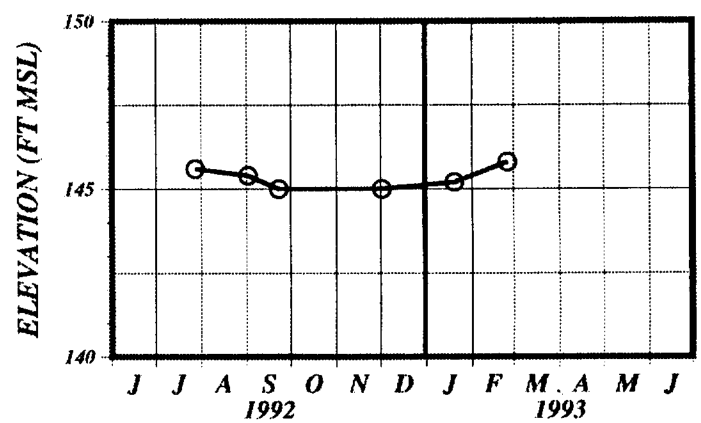
18_BGMW103 (397-497 ft bgs)

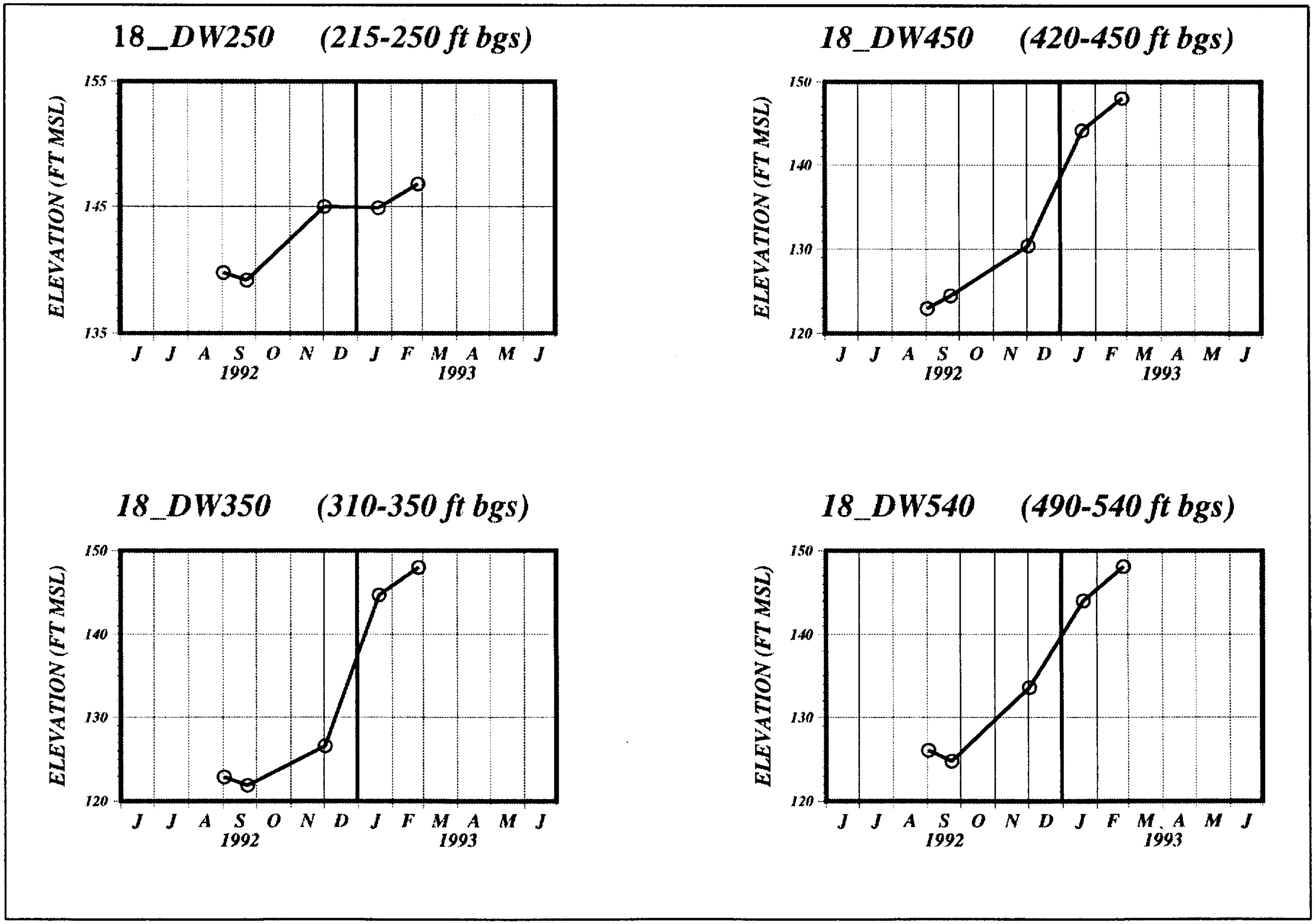


18_BGMW101 (90-130 ft bgs)

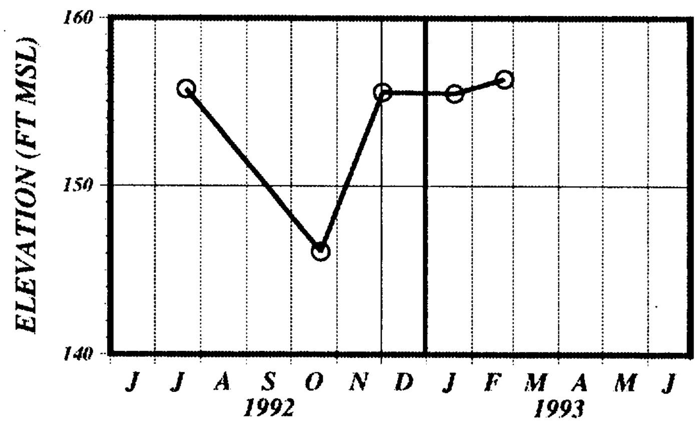


18_DW135 (115-135 ft bgs)

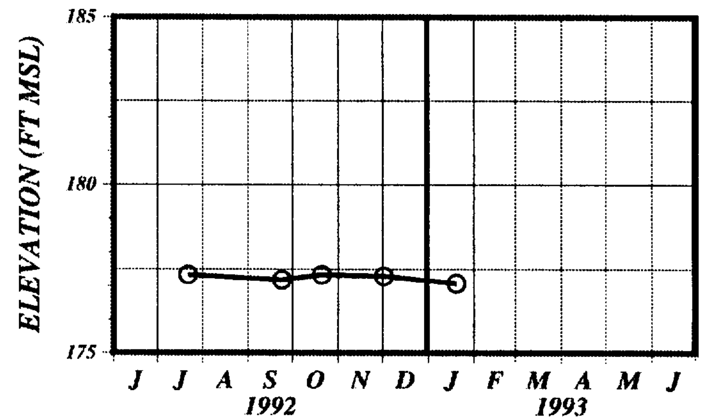



18_DW250 (215-250 ft bgs)
ELEVATION (FT MSL)
155
145
135
J J A S O N D J F M A M J
1992
1993
18_DW450 (420-450 ft bgs)
ELEVATION (FT MSL)
150
140
130
120
J J A S O N D J F M A M J
1992
1993
18_DW350 (310-350 ft bgs)
ELEVATION (FT MSL)
150
140
130
120
J J A S O N D J F M A M J
1992
1993
18_DW540 (490-540 ft bgs)
ELEVATION (FT MSL)
150
140
130
120
J J A S O N D J F M A M J
1992
1993

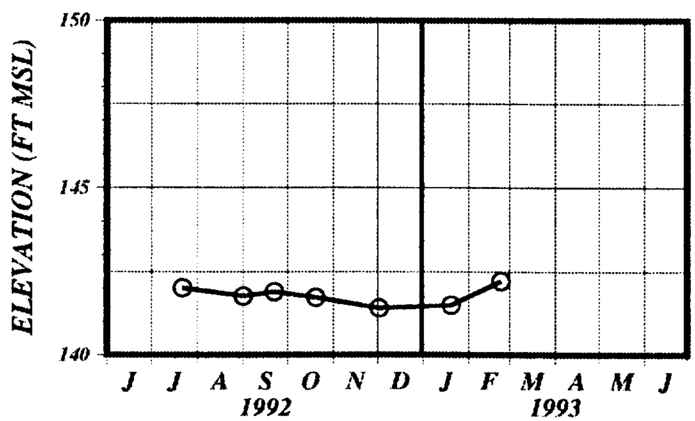
18_PS1 (102-122 ft bgs)



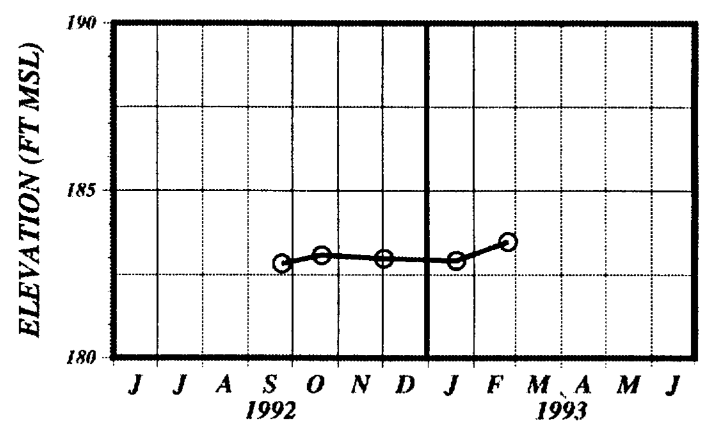
18_PS3 (102-122 ft bgs)



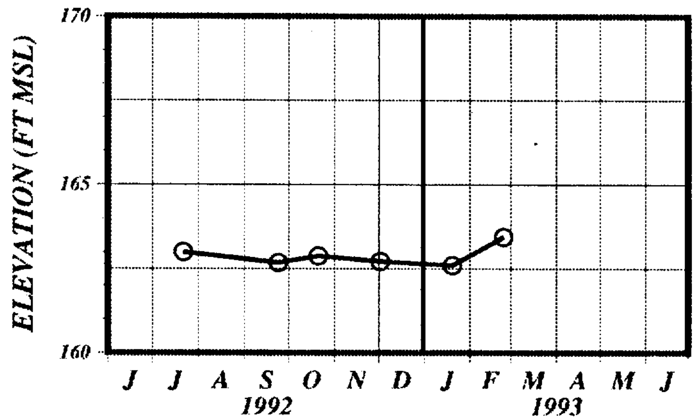
18_PS2 (103-133 ft bgs)



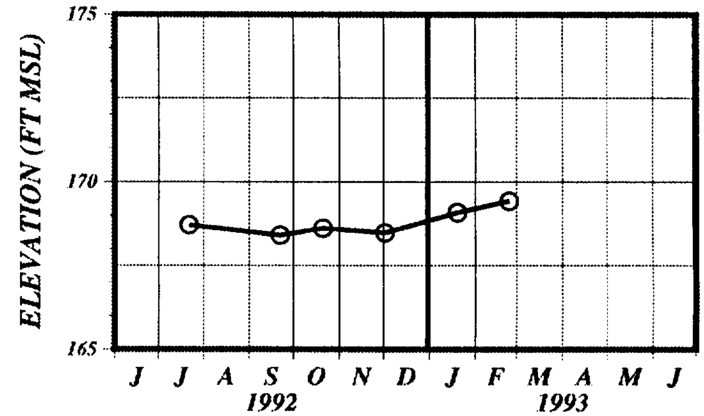
18_PS4 (98-118 ft bgs)



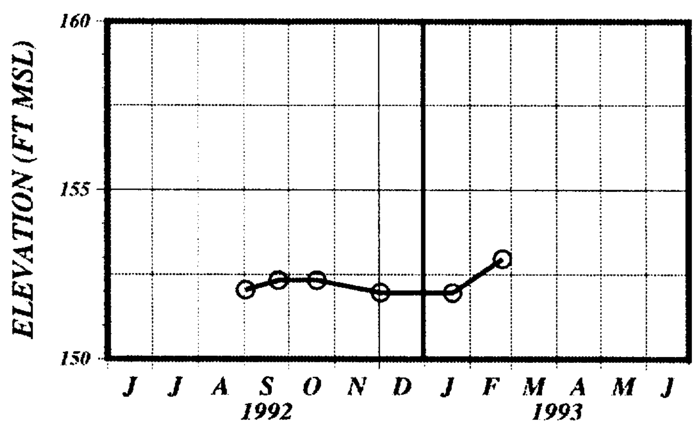
18_PS5 (106-126 ft bgs)



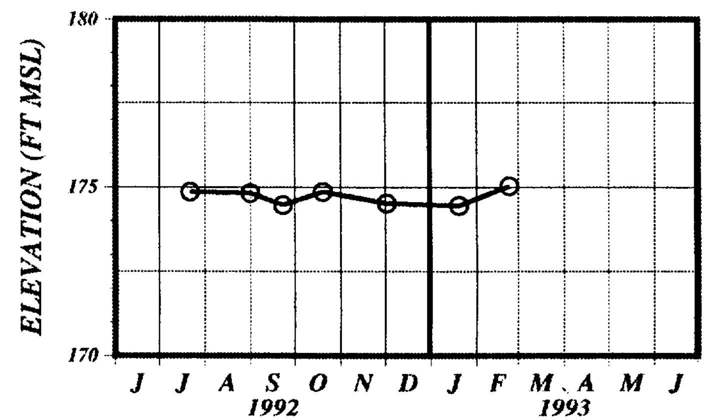
18_PS7 (106-126 ft bgs)



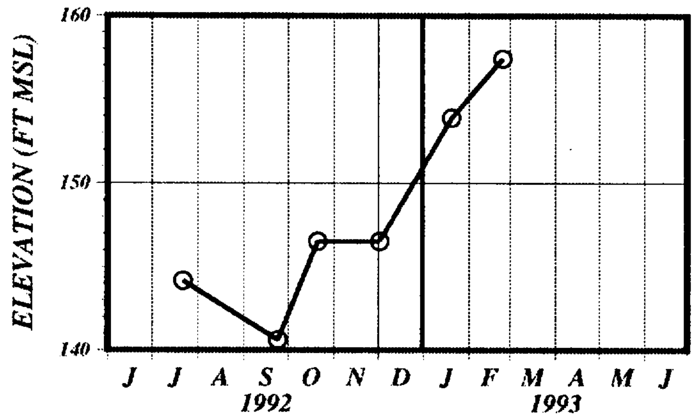
18_PS6 (130-150 ft bgs)



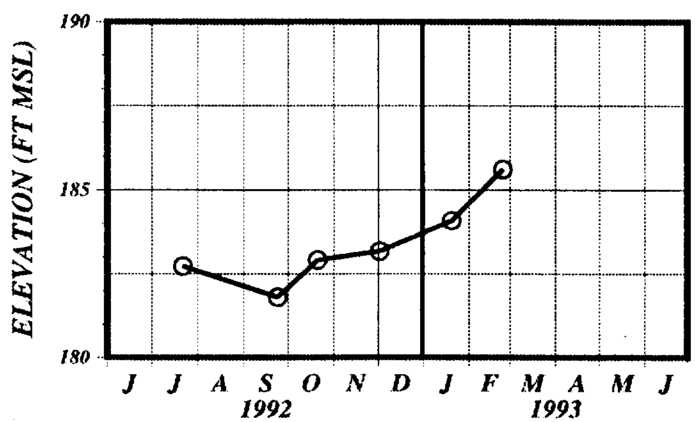
18_PS8 (125-145 ft bgs)

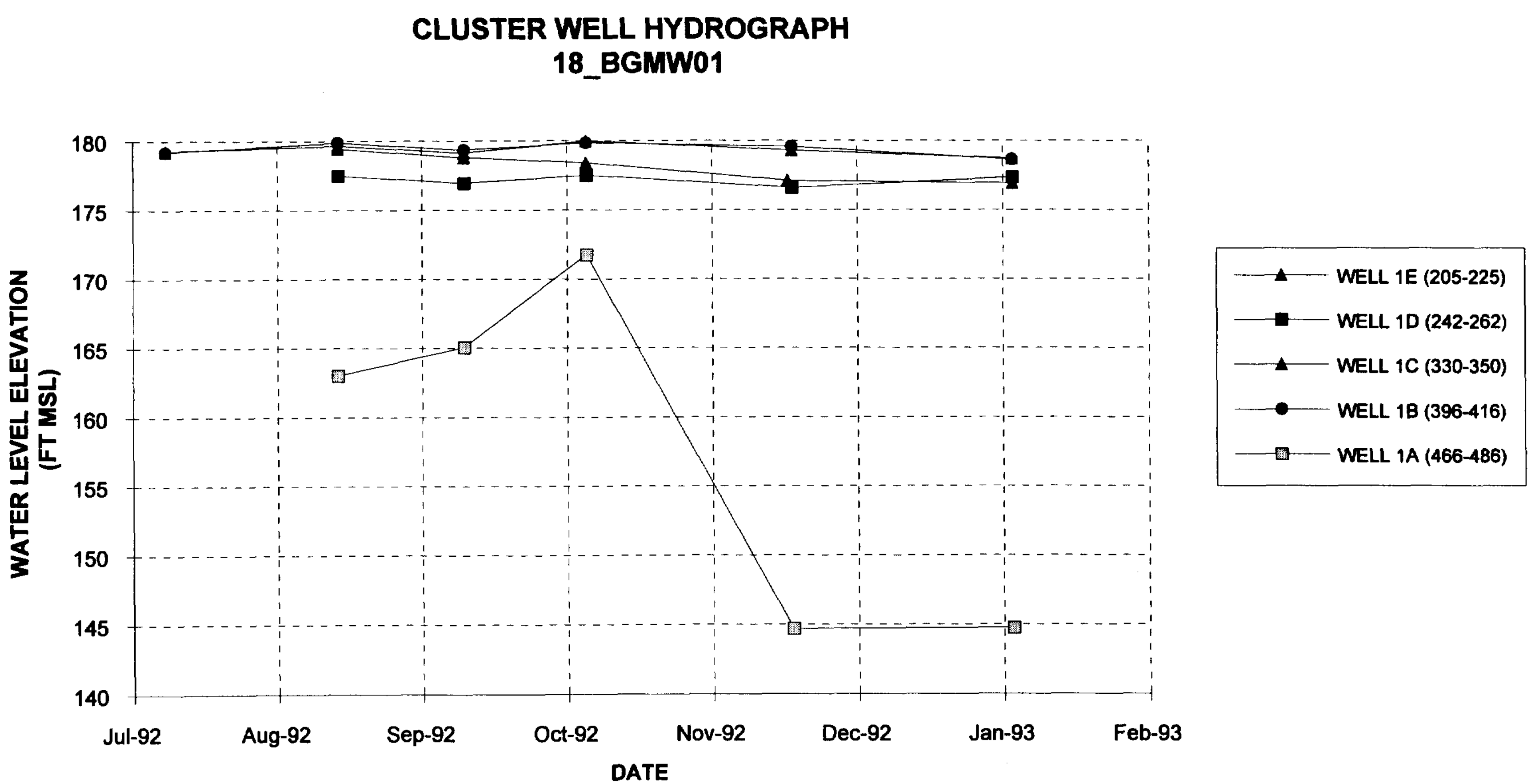


18_RW1 (430-470 ft bgs)

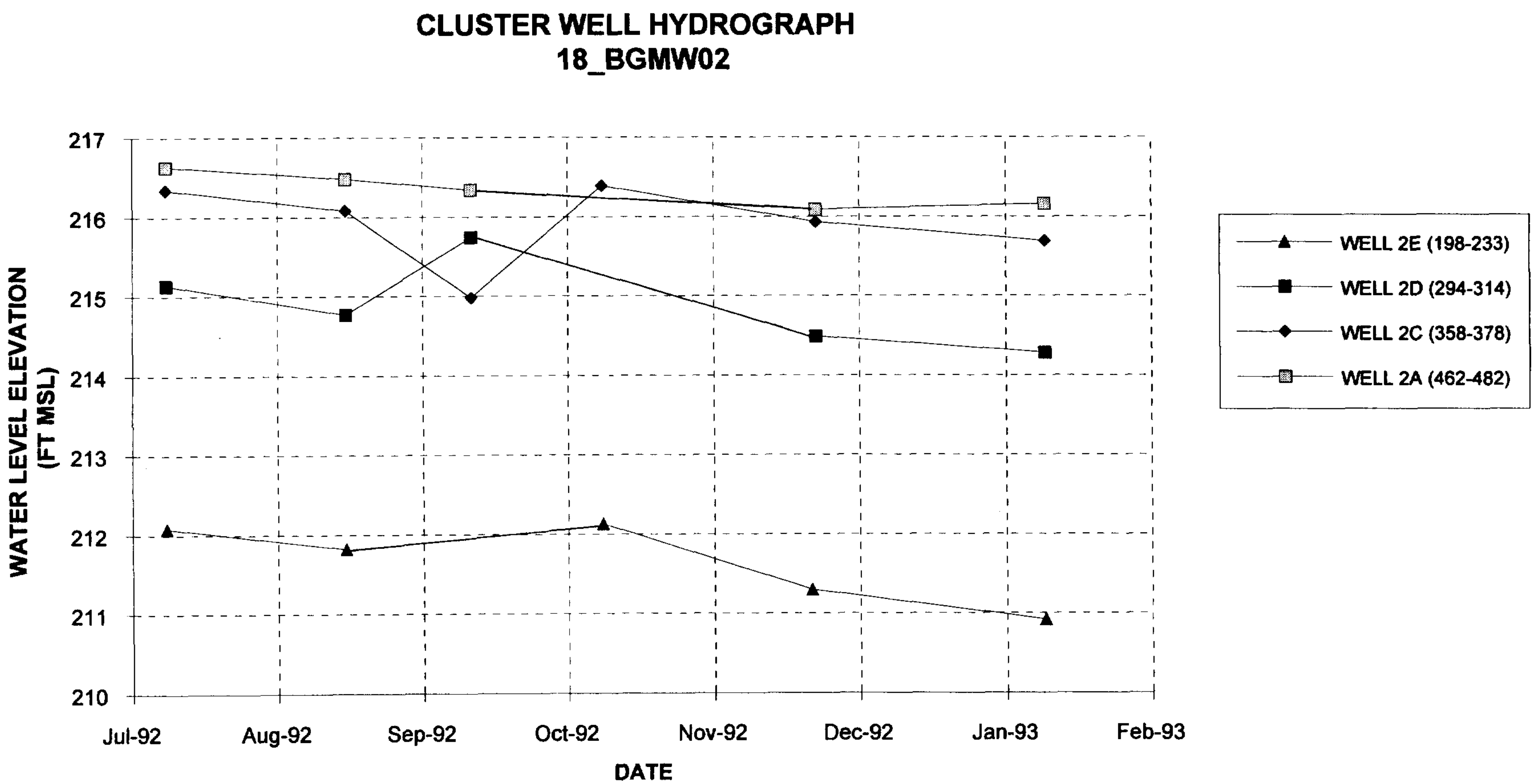


18_RW2 (270-310 ft bgs)



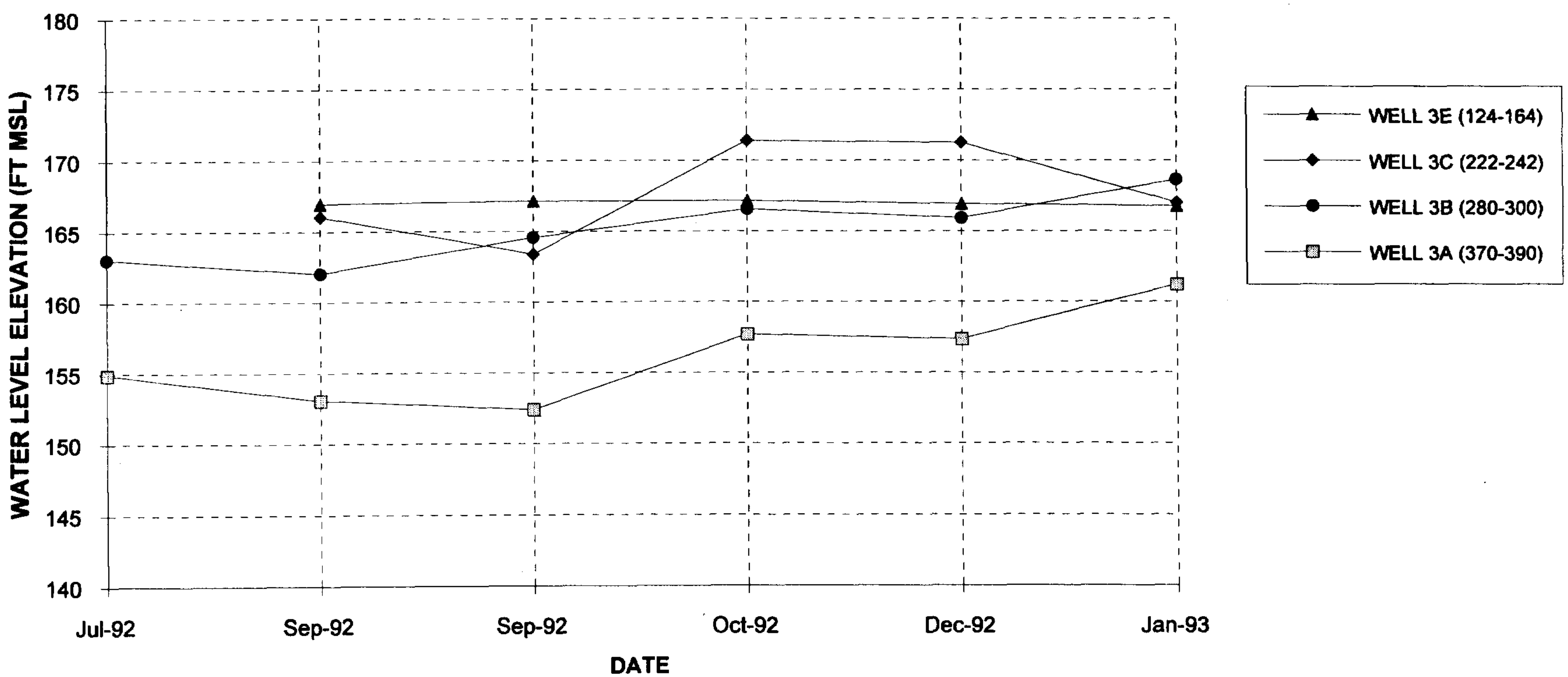


CW1HYDRO.XLC

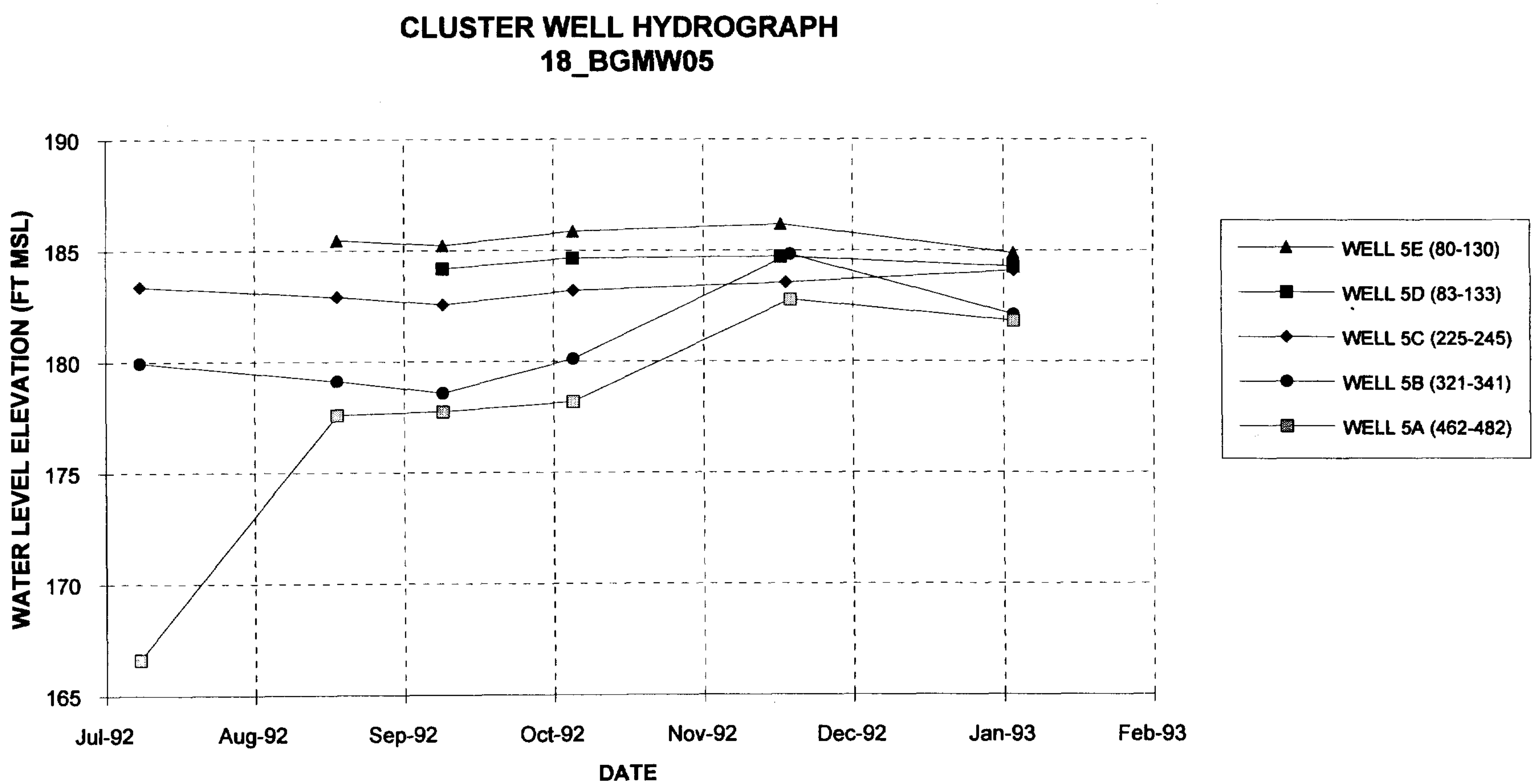


CW2HYDRO.XLC

CLUSTER WELL HYDROGRAPH
18_BGMW03



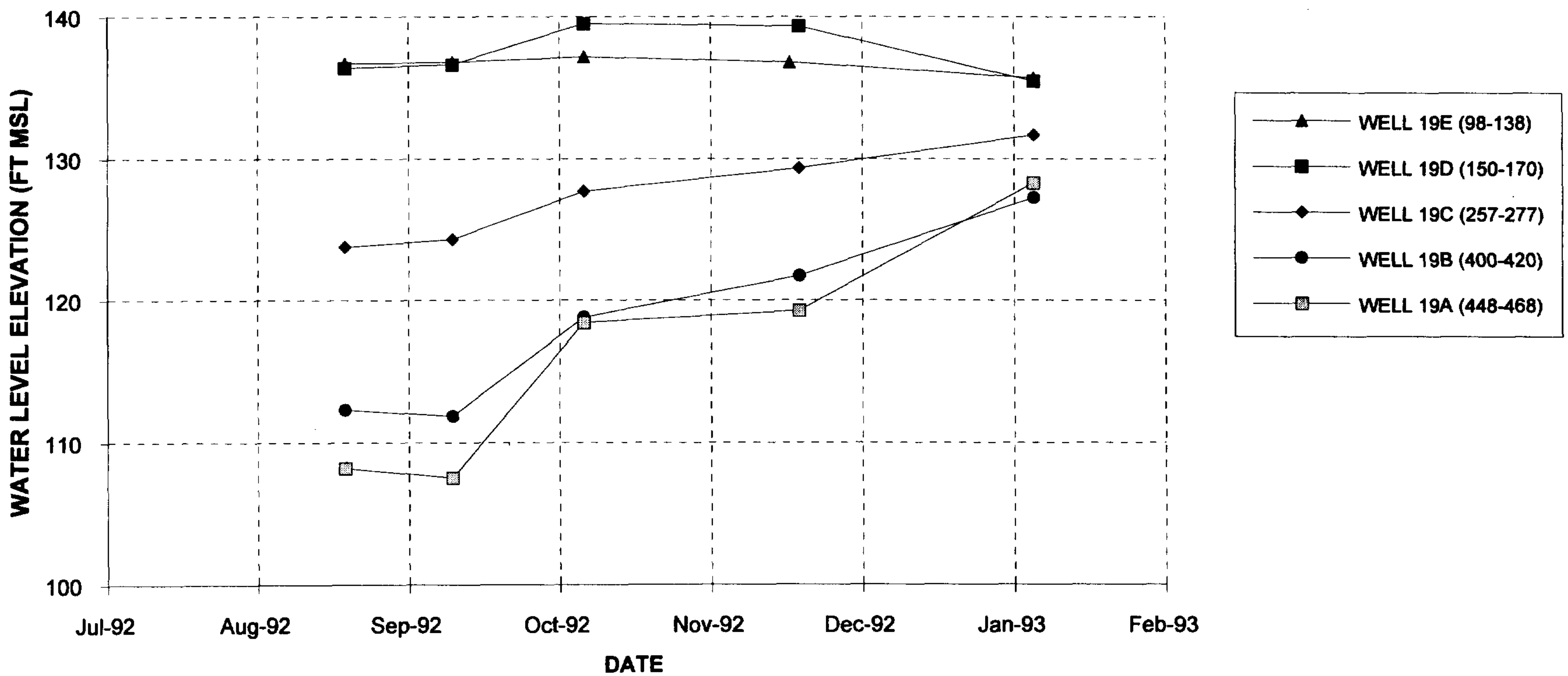
CW3HYD0.XLC



CLUSTER WELL HYDROGRAPH
18_BGMW05
WATER LEVEL ELEVATION (FT MSL)
190
185
180
175
170
165
Jul-92
Aug-92
Sep-92
Oct-92
Nov-92
Dec-92
Jan-93
Feb-93
DATE
WELL 5E (80-130)
WELL 5D (83-133)
WELL 5C (225-245)
WELL 5B (321-341)
WELL 5A (462-482)

CW5HYD0.XLC

CLUSTER WELL HYDROGRAPH
18_BGMW19



CW19HYD0.XLC

Appendix I-2

I-2: Hydrographs for OCWD Wells

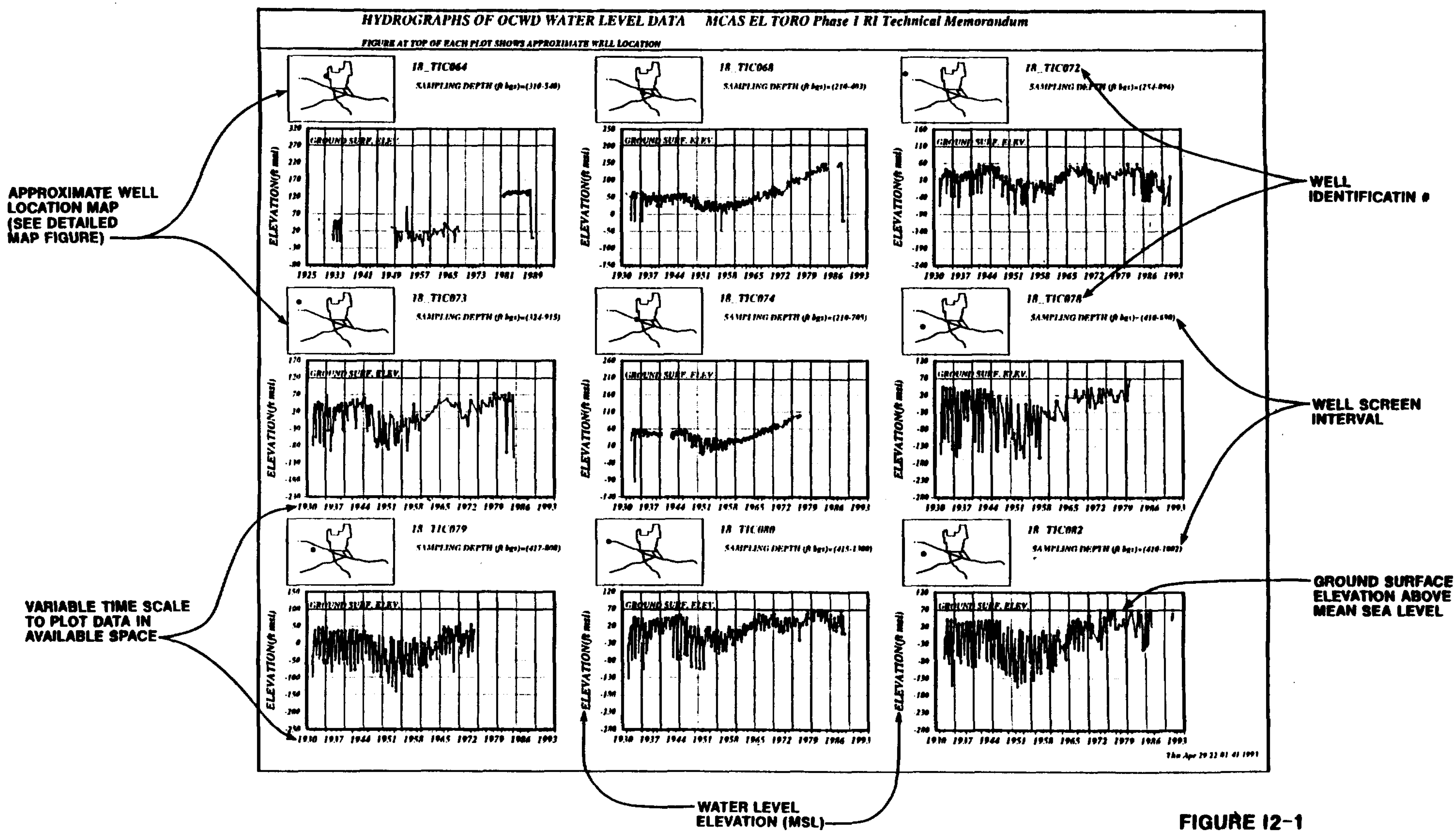


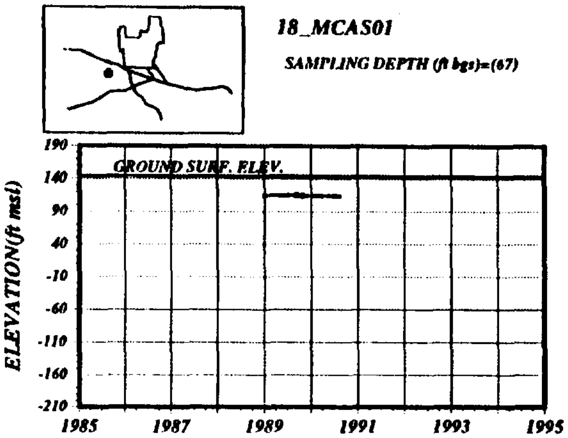
FIGURE 12-1
HYDROGRAPHS OF OCWD WATER LEVEL DATA
MCAS EL TORO PHASE I RI TECHNICAL MEMORANDUM

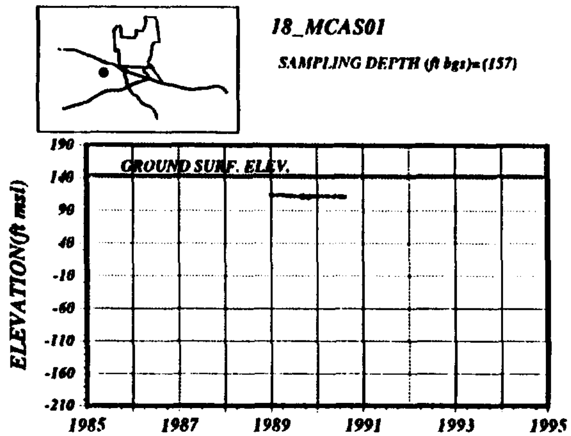
SCO31001 RV 40

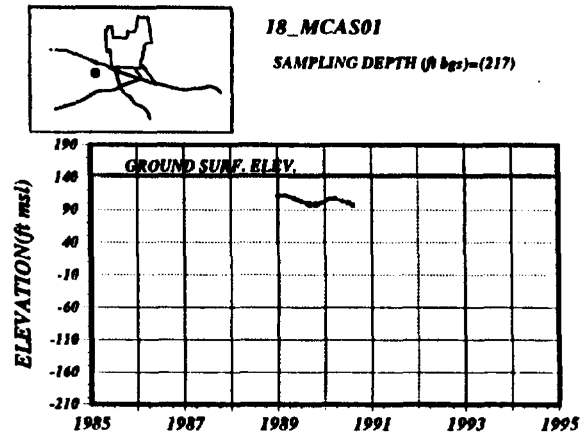
blank page

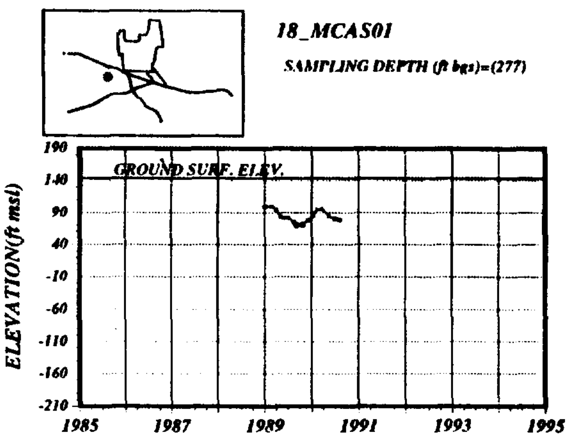
HYDROGRAPHS OF OCWD WATER LEVEL DATA   MCAS EL TORO Phase 1 RI Technical Memorandum

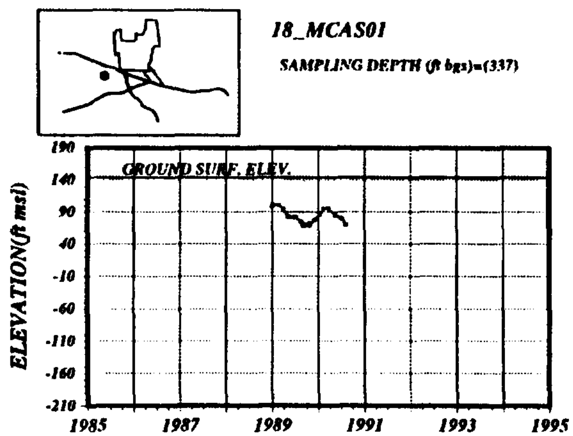
FIGURE AT TOP OF EACH PLOT SHOWS APPROXIMATE WELL LOCATION

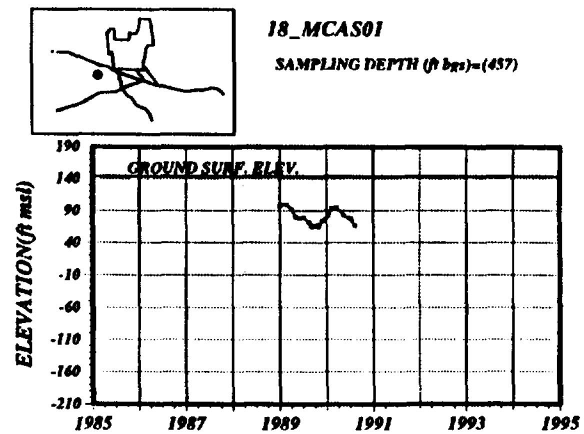


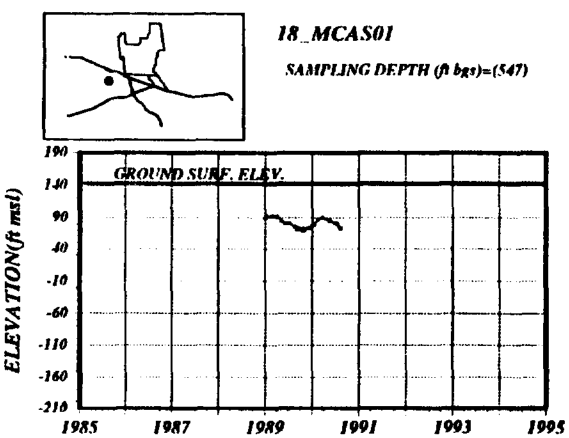










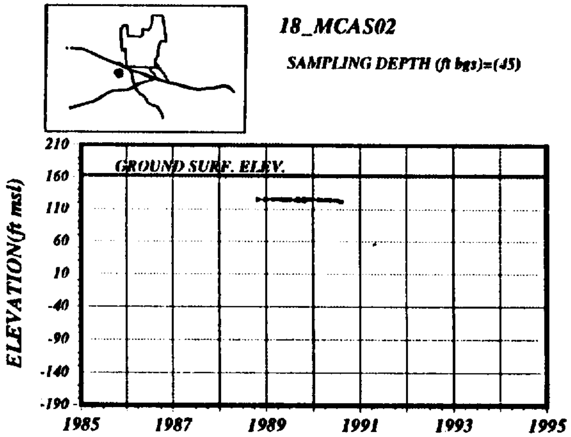


Sat May 1 15:18:08 1993

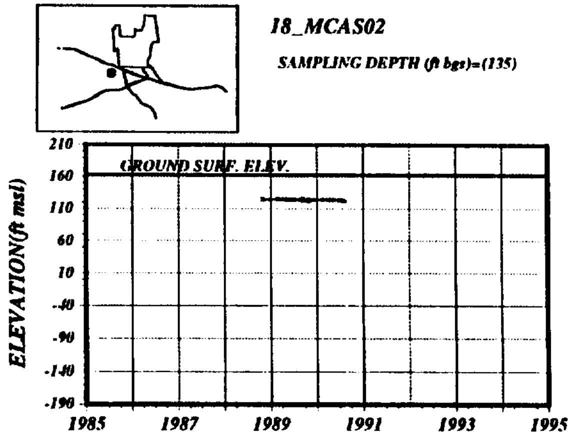
HYDROGRAPHS OF OCWD WATER LEVEL DATA   MCAS EL TORO Phase 1 RI Technical Memorandum

FIGURE AT TOP OF EACH PLOT SHOWS APPROXIMATE WELL LOCATION

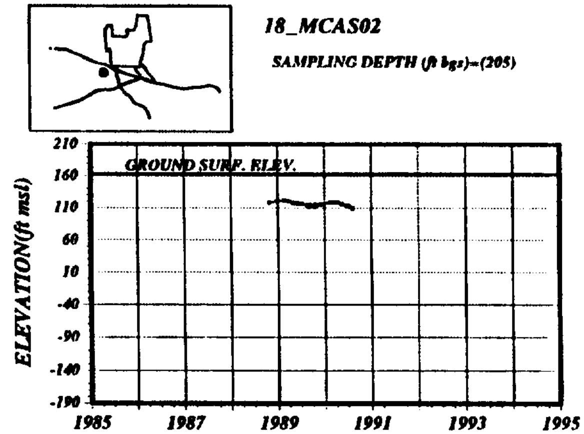
18_MCAS02
SAMPLING DEPTH (ft bgs)=(45)



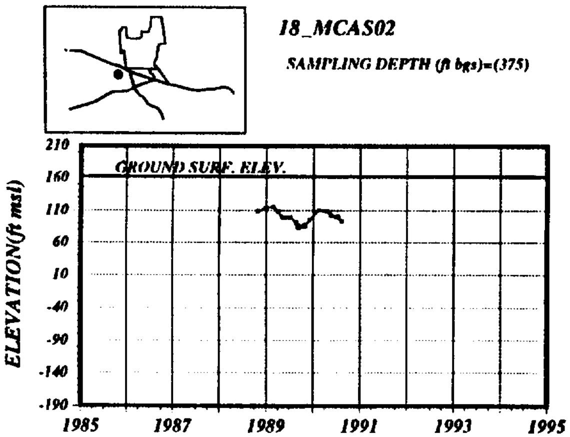
18_MCAS02
SAMPLING DEPTH (ft bgs)=(135)



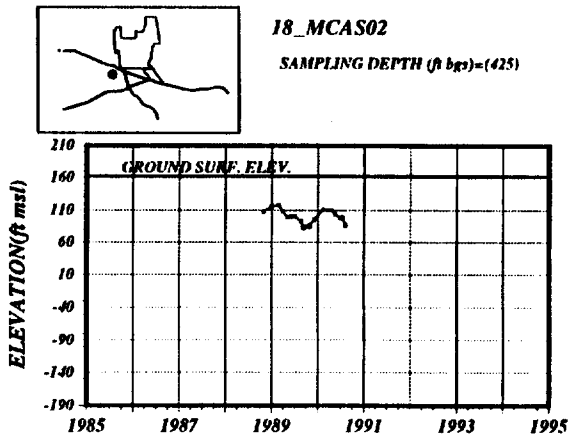
18_MCAS02
SAMPLING DEPTH (ft bgs)=(205)



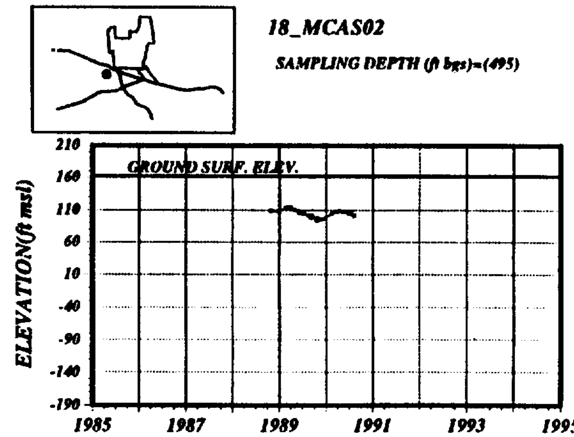
18_MCAS02
SAMPLING DEPTH (ft bgs)=(375)



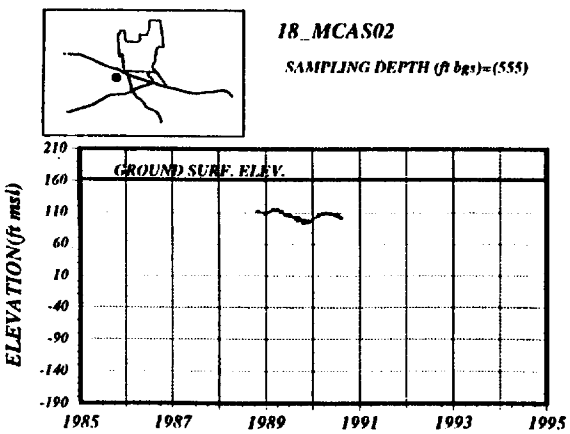
18_MCAS02
SAMPLING DEPTH (ft bgs)=(425)



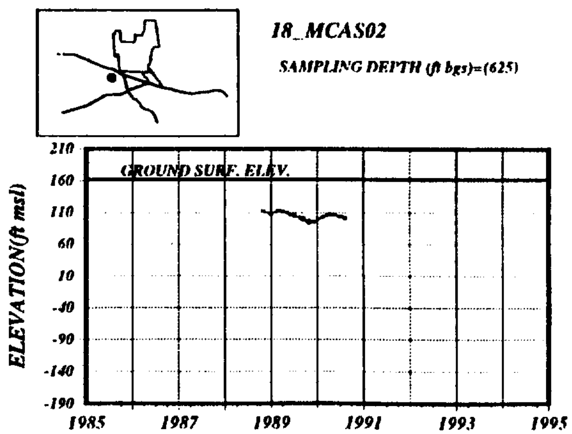
18_MCAS02
SAMPLING DEPTH (ft bgs)=(495)



18_MCAS02
SAMPLING DEPTH (ft bgs)=(555)



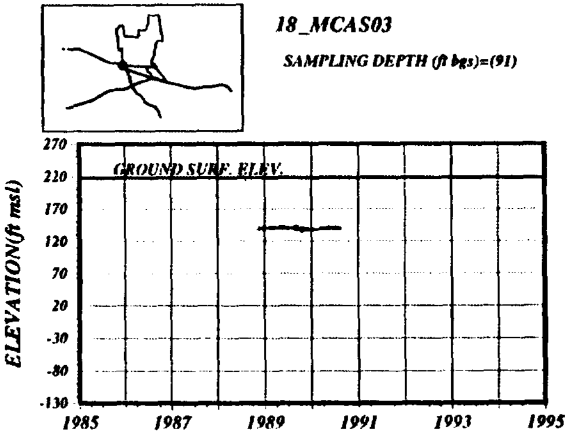
18_MCAS02
SAMPLING DEPTH (ft bgs)=(625)

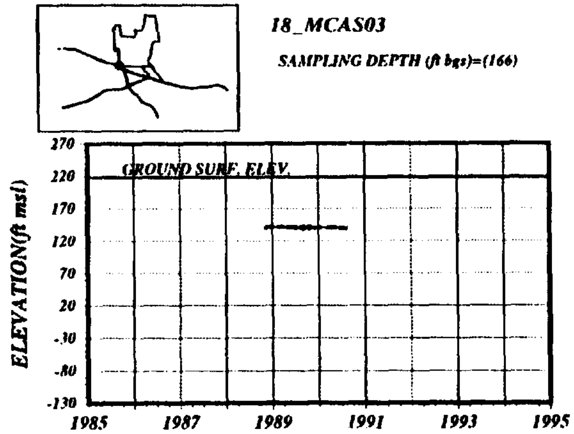


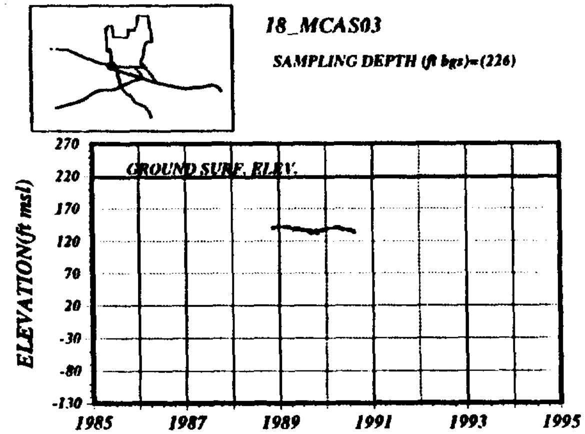
Sat May 1 15:19:31 1993

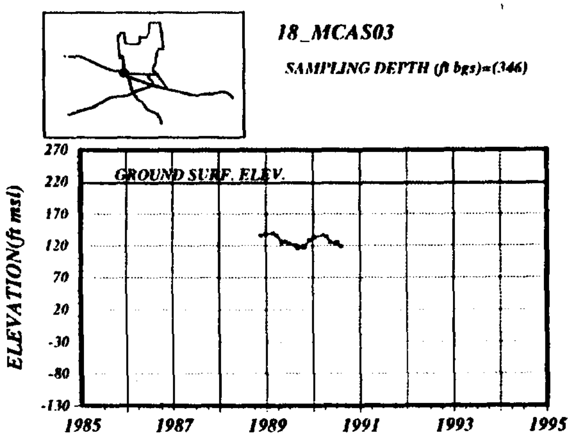
HYDROGRAPHS OF OCWD WATER LEVEL DATA   MCAS EL TORO Phase 1 RI Technical Memorandum

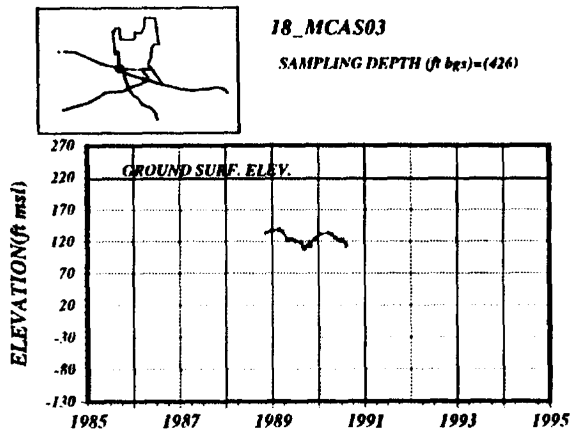
FIGURE AT TOP OF EACH PLOT SHOWS APPROXIMATE WELL LOCATION

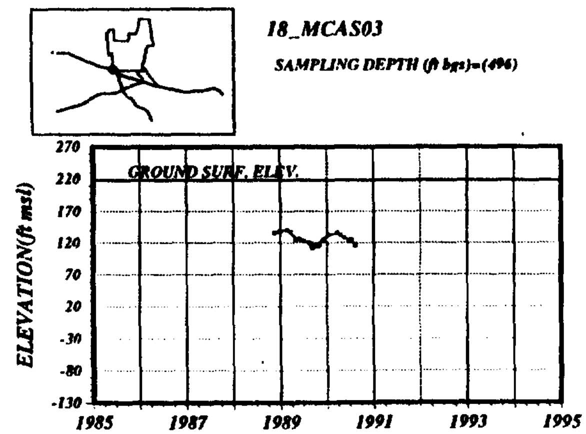








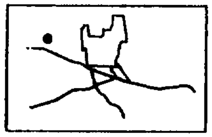




Sat May 1 15:21:13 1993

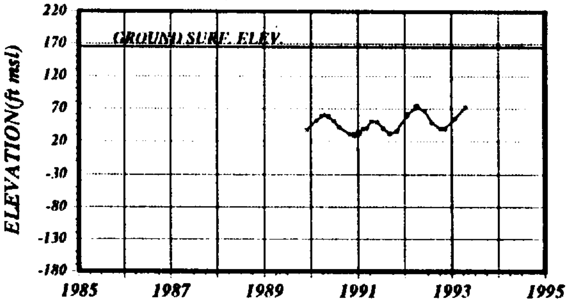
HYDROGRAPHS OF OCWD WATER LEVEL DATA   *MCAS EL TORO Phase 1 RI Technical Memorandum*

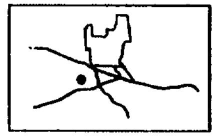
FIGURE AT TOP OF EACH PLOT SHOWS APPROXIMATE WELL LOCATION



18_IDM01

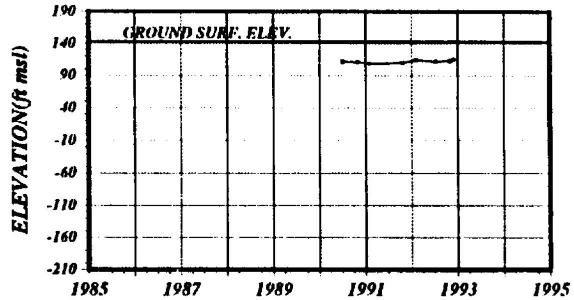
SAMPLING DEPTH (ft bgs)=(1053)

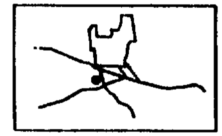




18_MCAS04

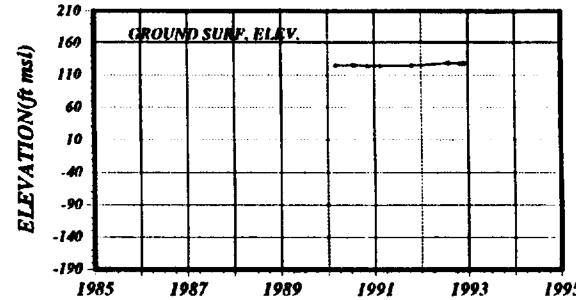
SAMPLING DEPTH (ft bgs)=(181-238)

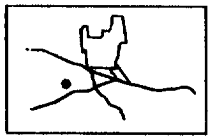




18_MCAS05

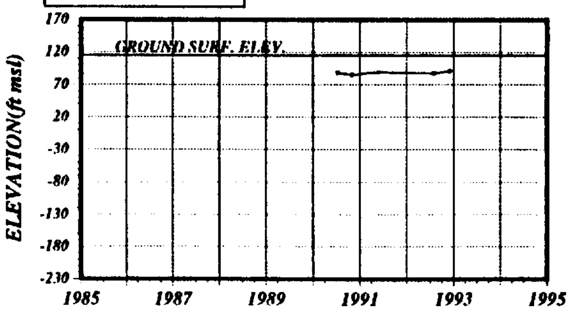
SAMPLING DEPTH (ft bgs)=(142-148)

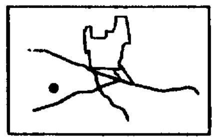




18_MCAS06

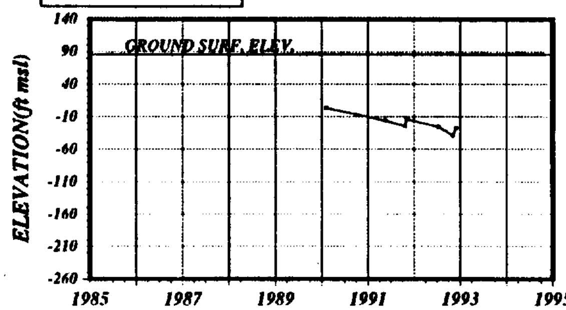
SAMPLING DEPTH (ft bgs)=(167-222)

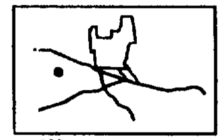




18_MCAS08

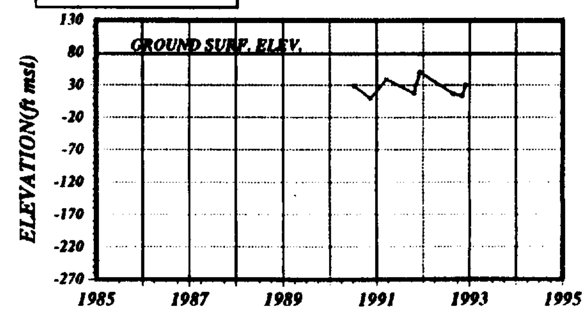
SAMPLING DEPTH (ft bgs)=(392-410)

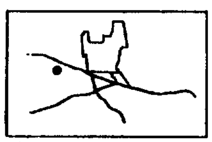




18_MCAS09

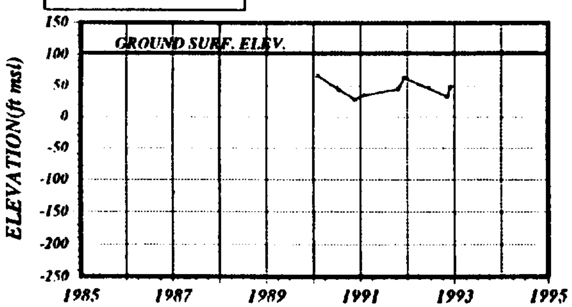
SAMPLING DEPTH (ft bgs)=(372-445)





18_MCAS10

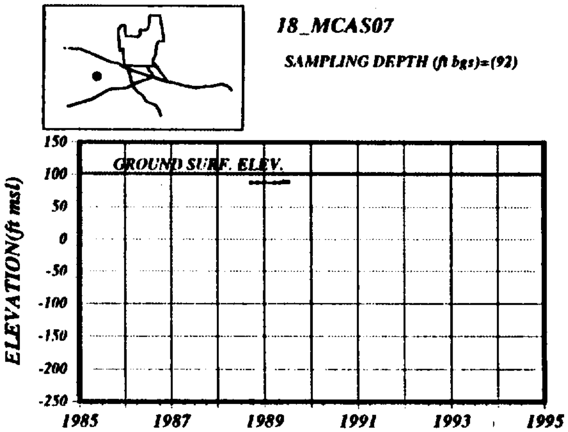
SAMPLING DEPTH (ft bgs)=(335-375)

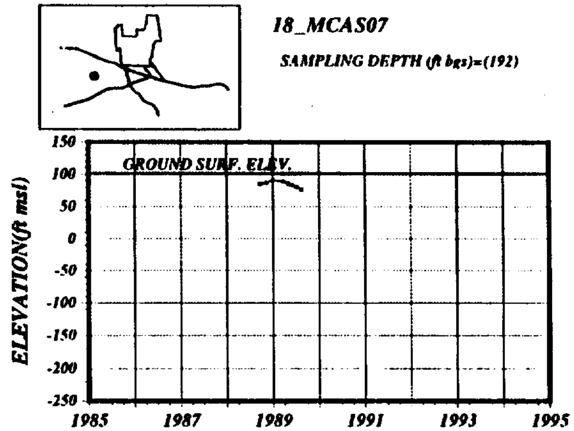


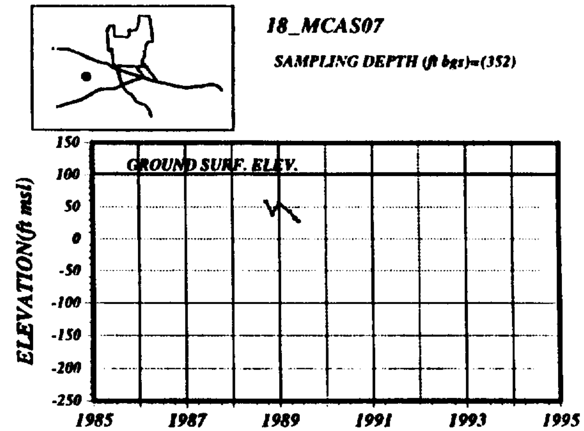
Sat May * **:28:23 1993

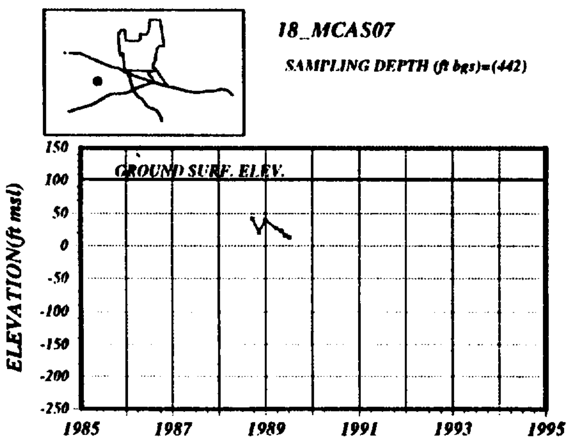
HYDROGRAPHS OF OCWD WATER LEVEL DATA   MCAS EL TORO Phase 1 RI Technical Memorandum

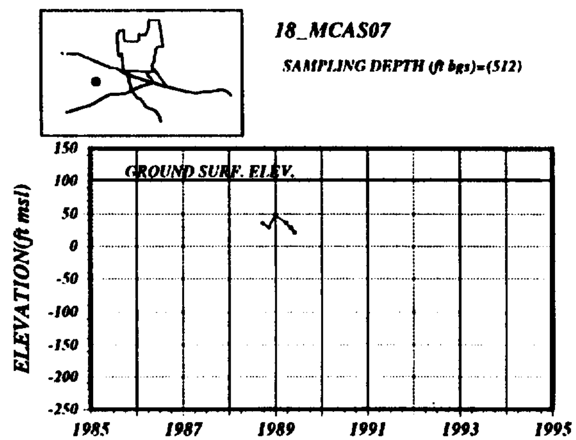
FIGURE AT TOP OF EACH PLOT SHOWS APPROXIMATE WELL LOCATION

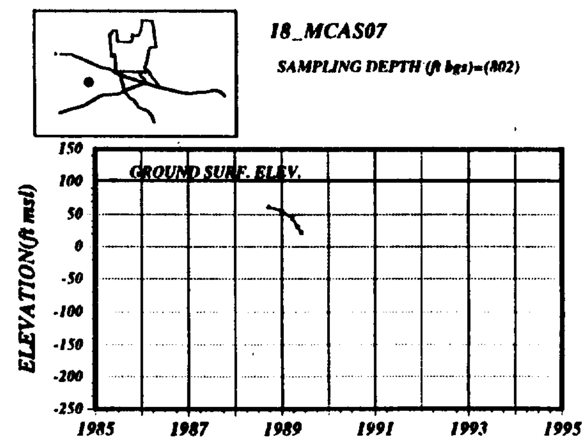


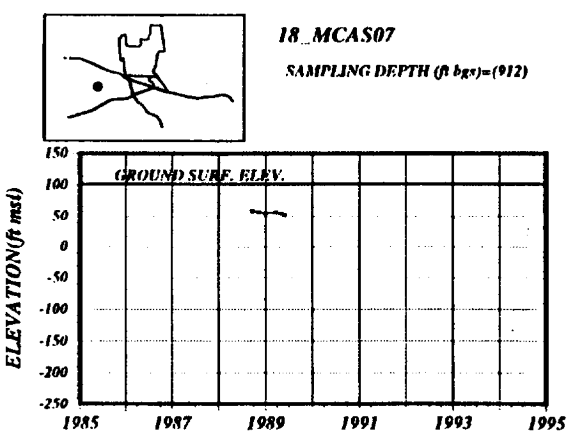


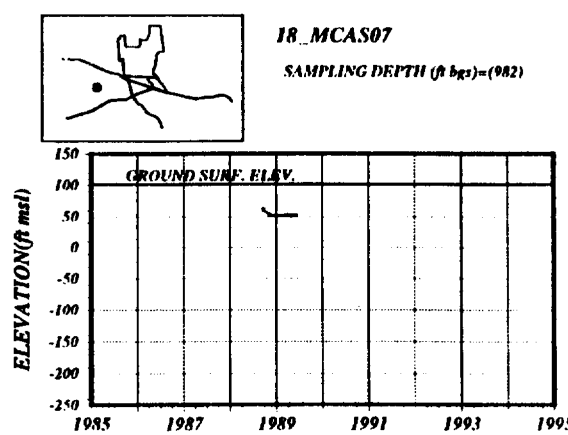


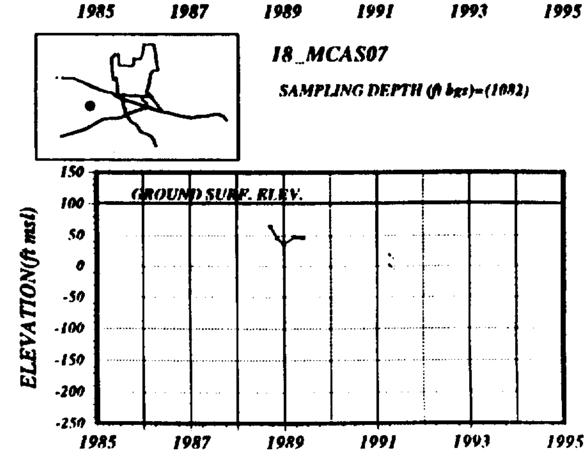








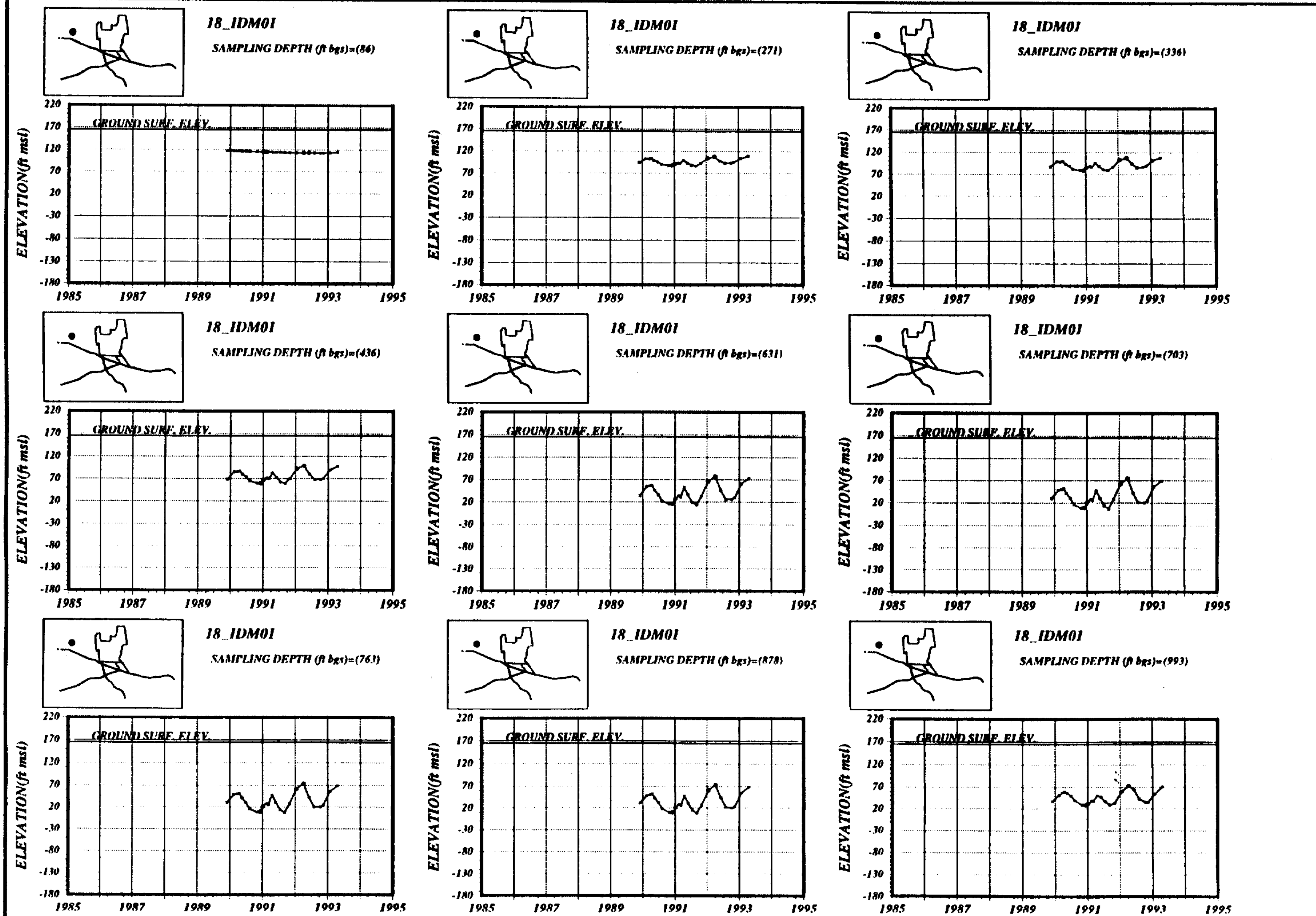




Sat May 1 15:23:19 1993

HYDROGRAPHS OF OCWD WATER LEVEL DATA   MCAS EL TORO Phase 1 RI Technical Memorandum

FIGURE AT TOP OF EACH PLOT SHOWS APPROXIMATE WELL LOCATION

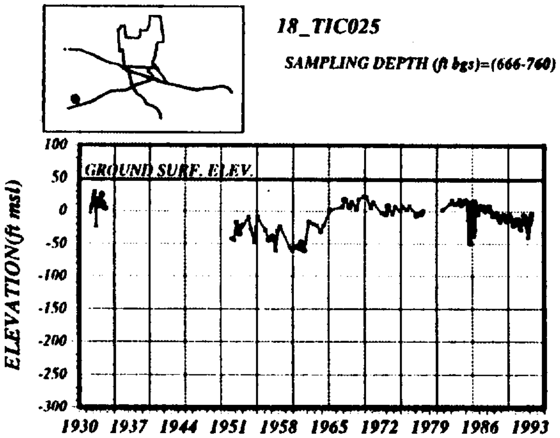


HYDROGRAPHS OF OCWD WATER LEVEL DATA MCAS EL TORO Phase 1 RI Technical Memorandum

FIGURE AT TOP OF EACH PLOT SHOWS APPROXIMATE WELL LOCATION

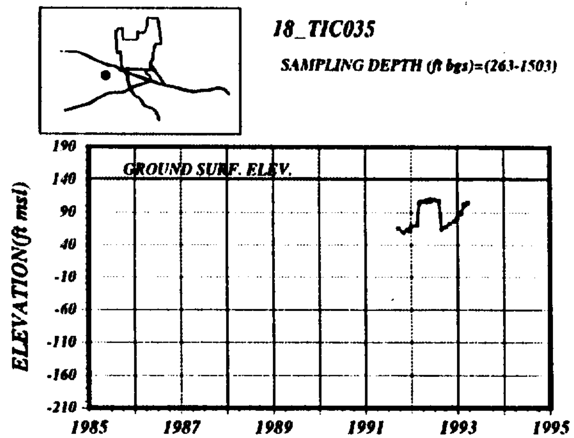
18_TIC025

SAMPLING DEPTH (ft bgs)=(666-760)



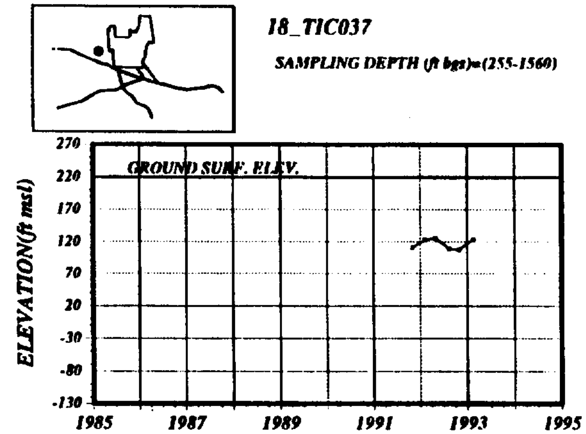
18_TIC035

SAMPLING DEPTH (ft bgs)=(263-1503)



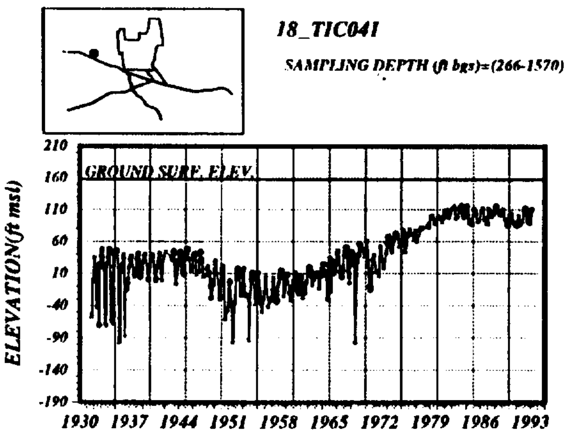
18_TIC037

SAMPLING DEPTH (ft bgs)=(255-1560)



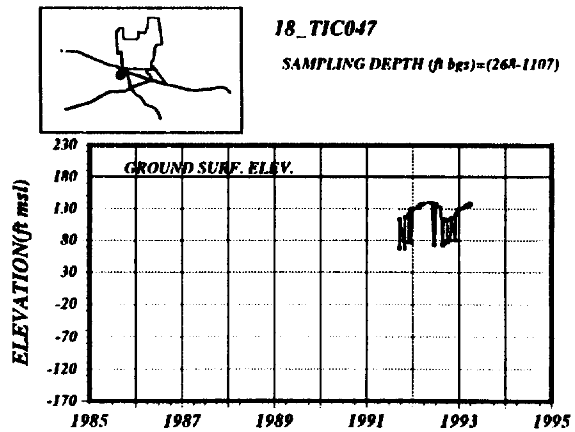
18_TIC041

SAMPLING DEPTH (ft bgs)=(266-1570)



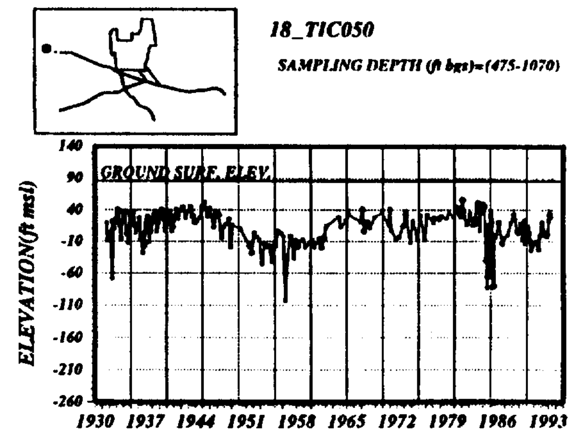
18_TIC047

SAMPLING DEPTH (ft bgs)=(268-1107)



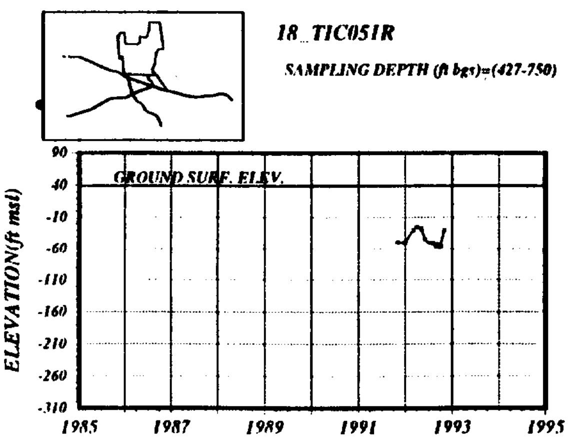
18_TIC050

SAMPLING DEPTH (ft bgs)=(475-1070)



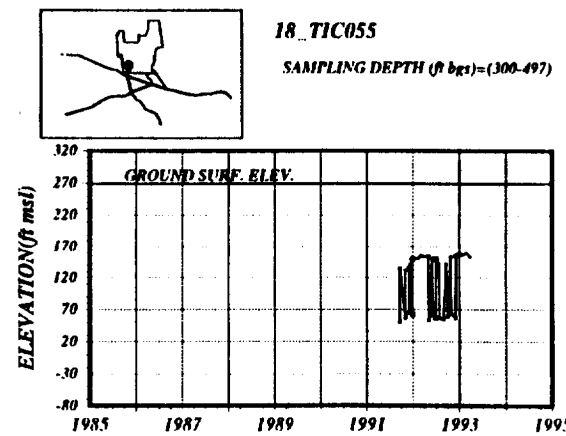
18_TIC051R

SAMPLING DEPTH (ft bgs)=(427-750)



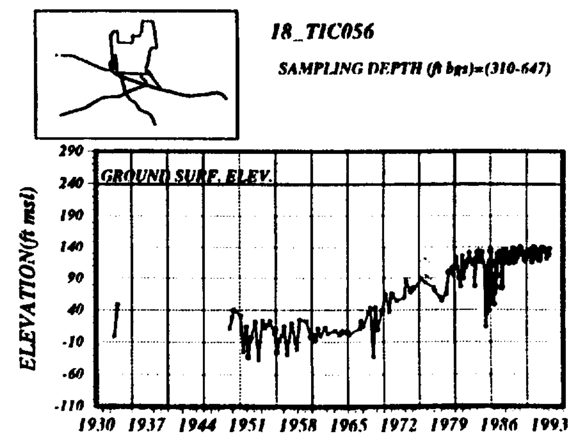
18_TIC055

SAMPLING DEPTH (ft bgs)=(300-497)



18_TIC056

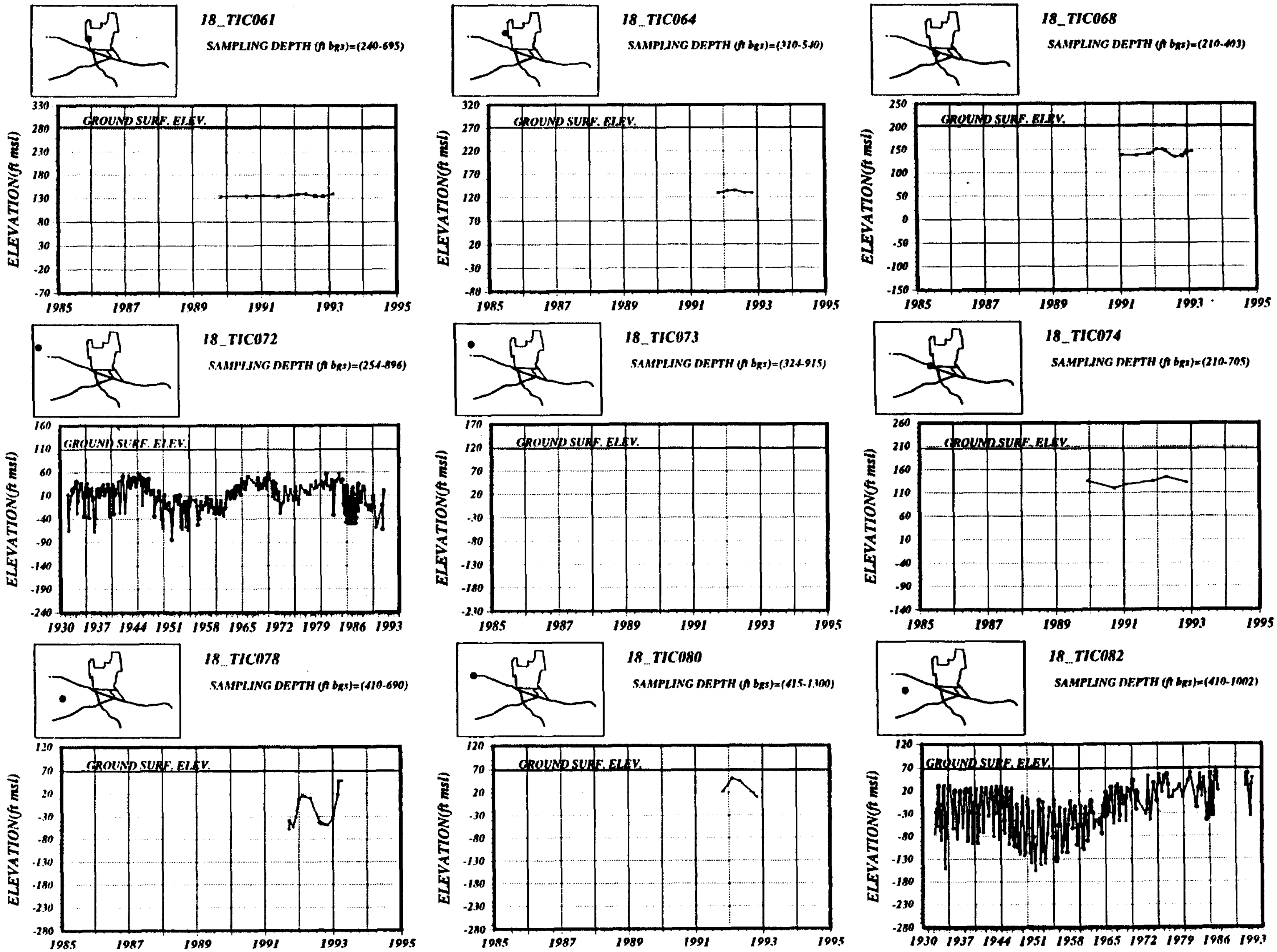
SAMPLING DEPTH (ft bgs)=(310-647)



Sat May 1 15:29:34 1993

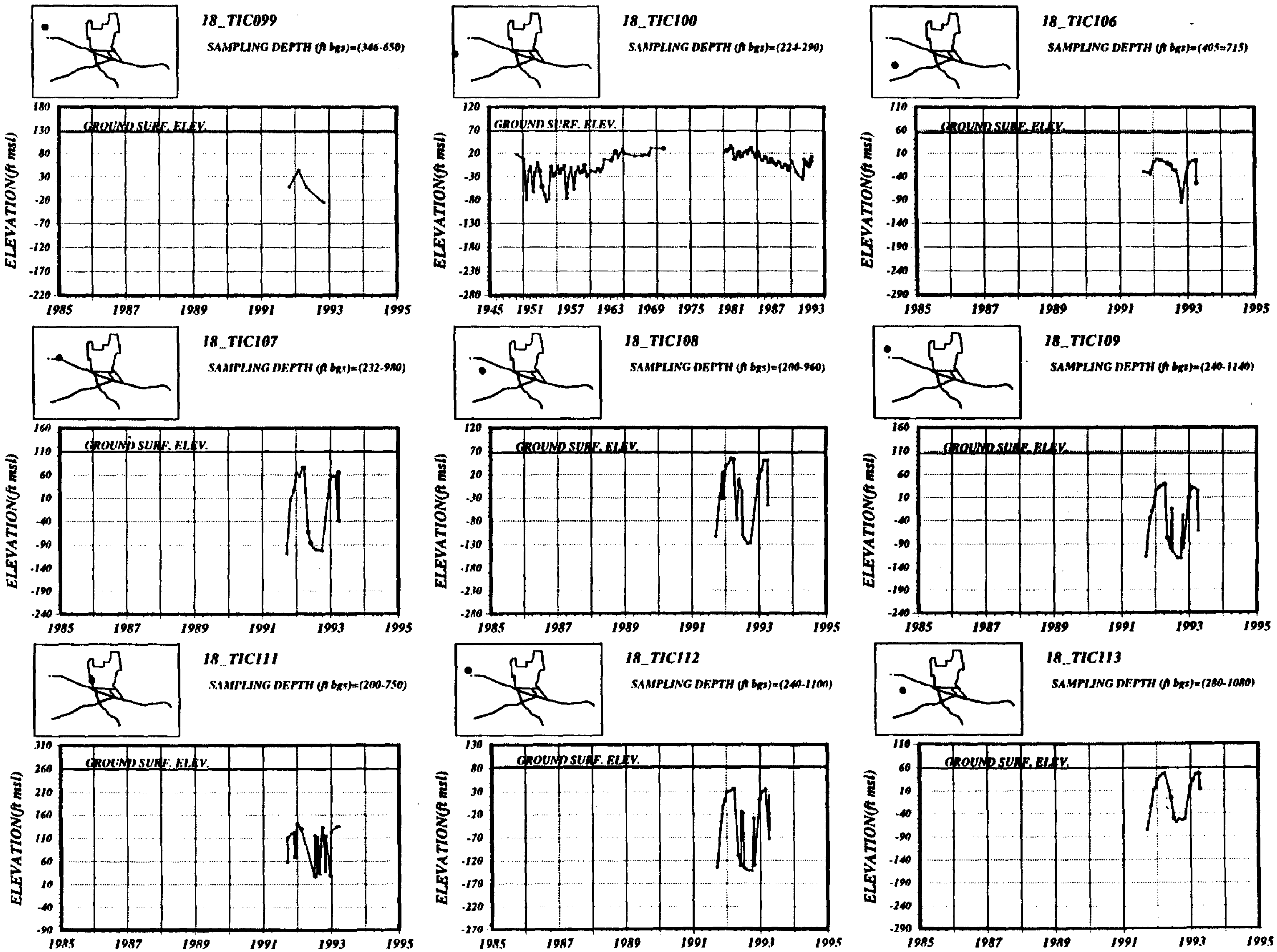
HYDROGRAPHS OF OCWD WATER LEVEL DATA MCAS EL TORO Phase 1 RI Technical Memorandum

FIGURE AT TOP OF EACH PLOT SHOWS APPROXIMATE WELL LOCATION



HYDROGRAPHS OF OCWD WATER LEVEL DATA   MCAS EL TORO Phase 1 RI Technical Memorandum

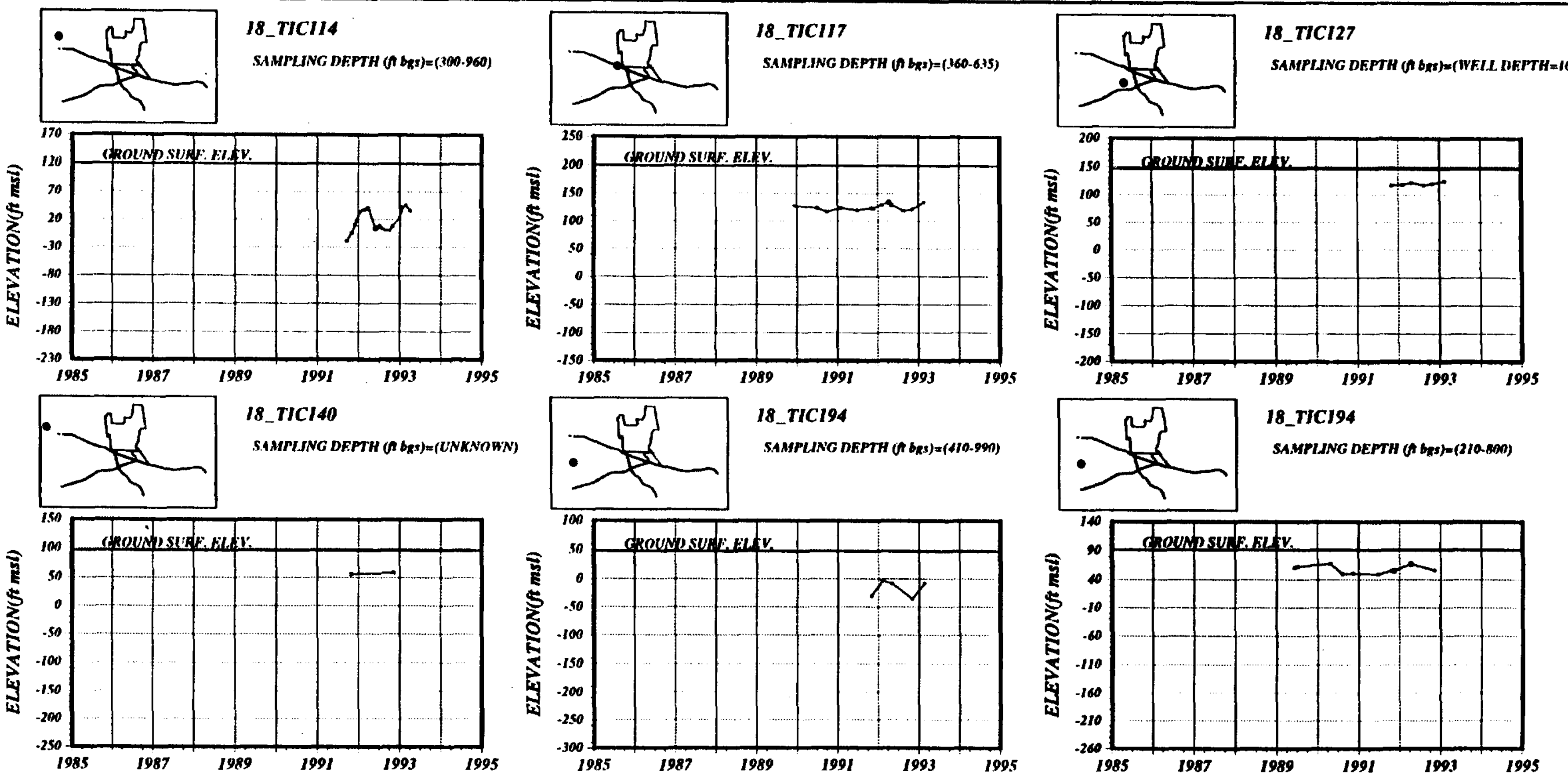
FIGURE AT TOP OF EACH PLOT SHOWS APPROXIMATE WELL LOCATION



Sat May 1 15:38:59 1993

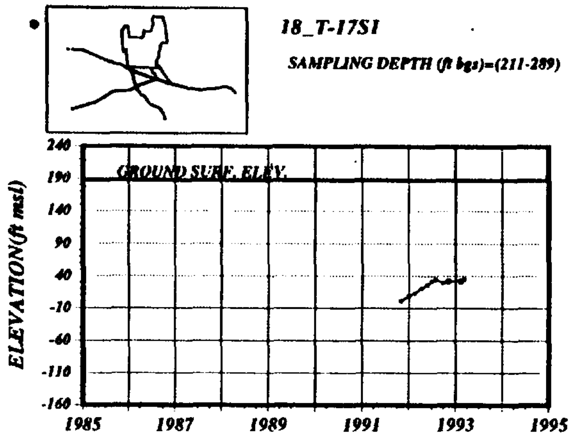
HYDROGRAPHS OF OCWD WATER LEVEL DATA   MCAS EL TORO Phase 1 RI Technical Memorandum

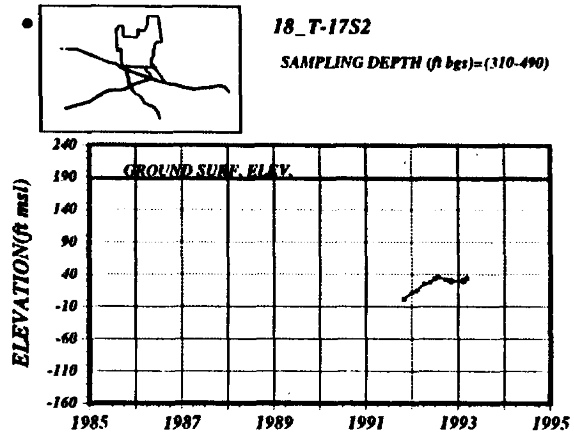
FIGURE AT TOP OF EACH PLOT SHOWS APPROXIMATE WELL LOCATION

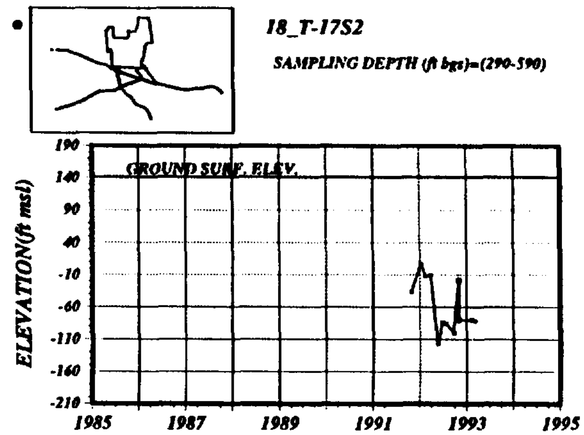


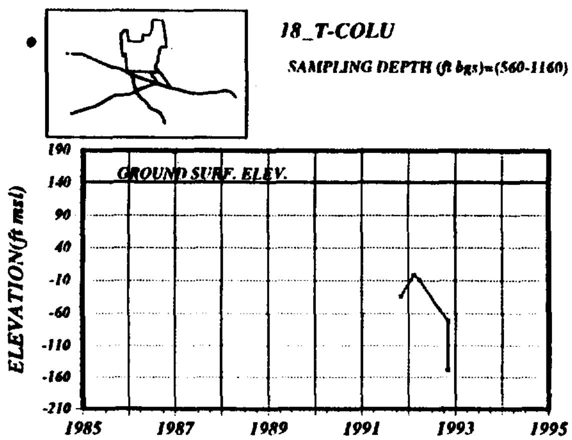
HYDROGRAPHS OF OCWD WATER LEVEL DATA   MCAS EL TORO Phase 1 RI Technical Memorandum

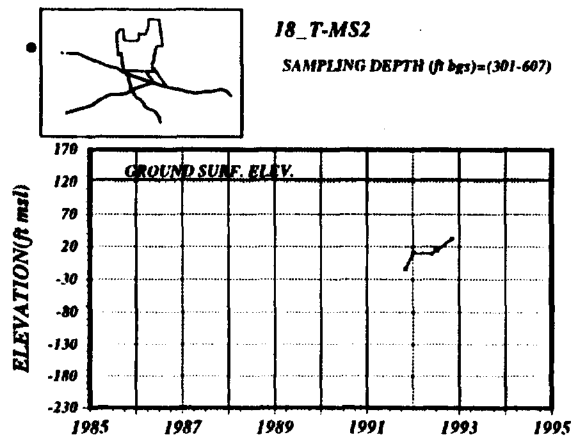
FIGURE AT TOP OF EACH PLOT SHOWS APPROXIMATE WELL LOCATION

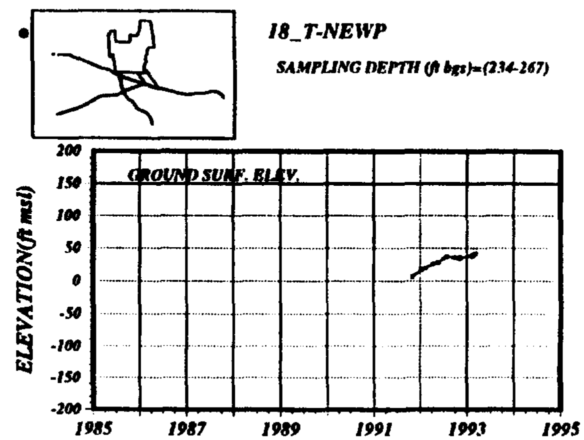


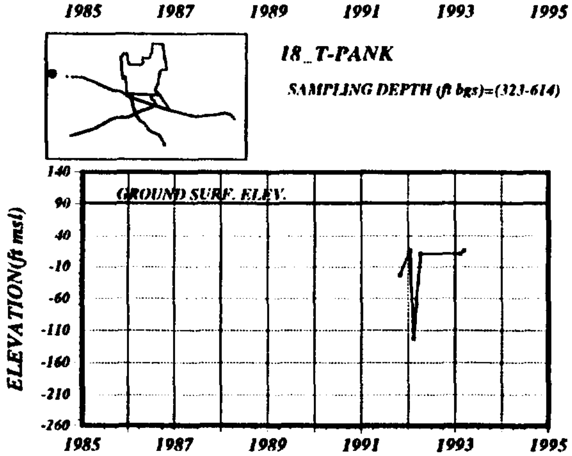


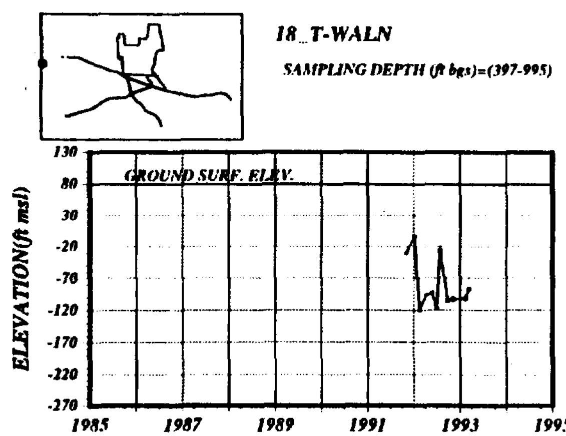












Sat May 1 15:42:26 1993

Appendix J

STIFF-TYPE AND PIPER DIAGRAMS

Appendix J1

Stiff-Type Diagrams

Appendix J1
STIFF-TYPE DIAGRAMS

Stiff diagrams customarily use seven major ions to illustrate the general chemistry of groundwater. These ions include sodium (Na), potassium (K), calcium (Ca), magnesium (mg), chloride (Cl), sulfate (SO_4), and alkalinity (HCO_3 + CO_3).

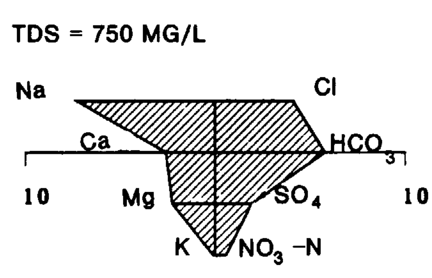
For this report, the standard Stiff diagram was modified to separate Na and K and to include nitrate, a contaminant found in groundwater in the vicinity of MCAS El Toro. Carbonate (CO_3) at all groundwater well locations was zero, therefore bicarbonate (HCO_3) is provided rather than alkalinity.

The concentrations of these ions are converted from milligrams per liter (mg/l) to milliequivalents per liter (meq/l), and then plotted with the anions on the right and the cations on the left side of the scale bar. Nitrate is plotted across from potassium.

Each ion is plotted as a point, then lines are added to create a polygon. The overall width of the polygon is proportional to the total dissolved solids (TDS). These diagrams provide a visual aid in making a quick assessment of the dominant cation/anion chemistry and TDS contents of the groundwater. Wells showing similar Stiff diagrams indicate similar water chemistry.

Plate J-1 provides stiff-type diagrams for each cluster and multiple port well. Plate J-2 provides stiff-type diagrams for each water table well.

The following figure is an example of the Stiff-type diagram presented on plates J-1 and J-2.



blank page

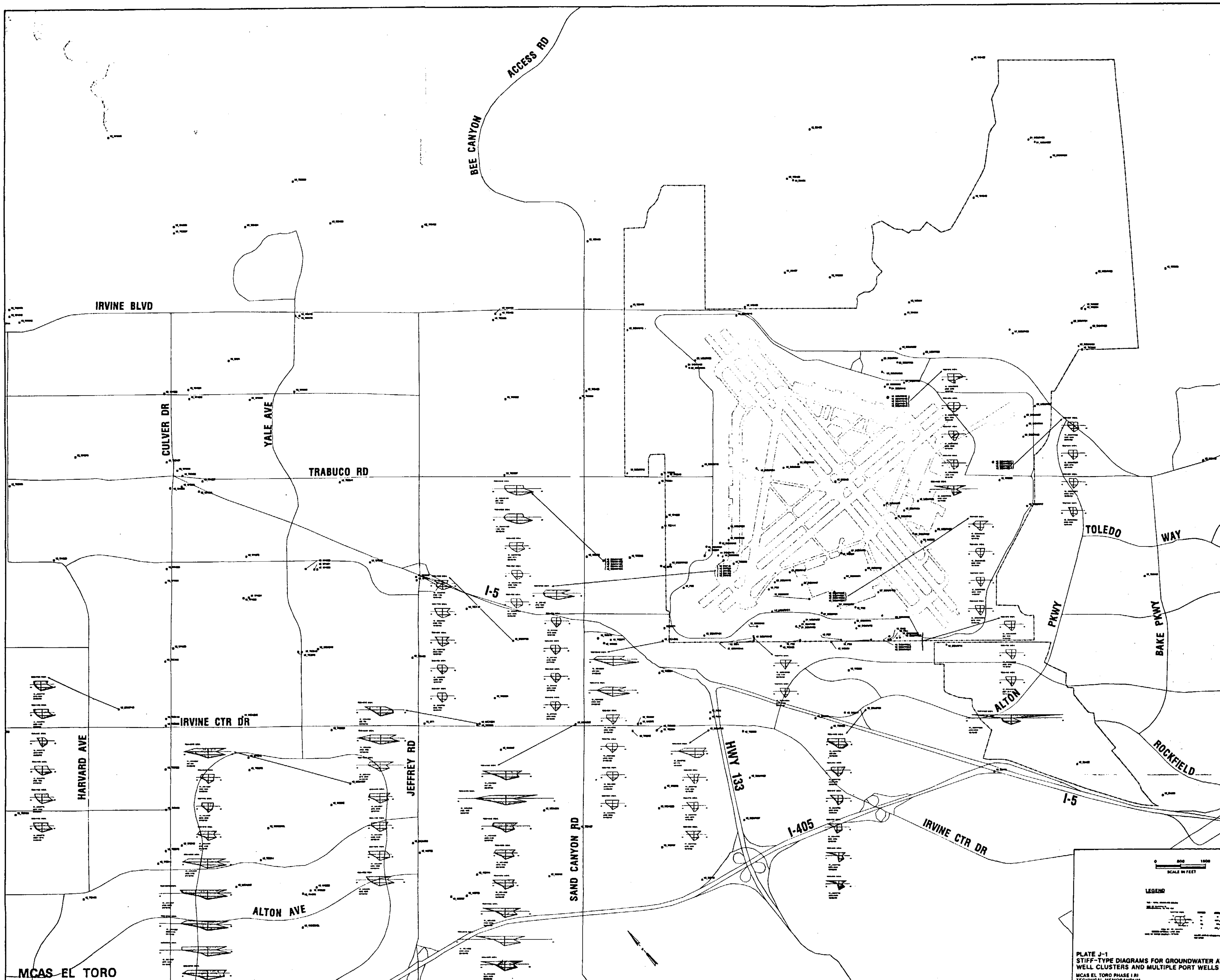


PLATE J-1
STIFF-TYPE DIAGRAMS FOR GROUNDWATER AT WELL CLUSTERS AND MULTIPLE PORT WELLS
MCAS EL TORO PHASE I RI
TECHNICAL MEMORANDUM

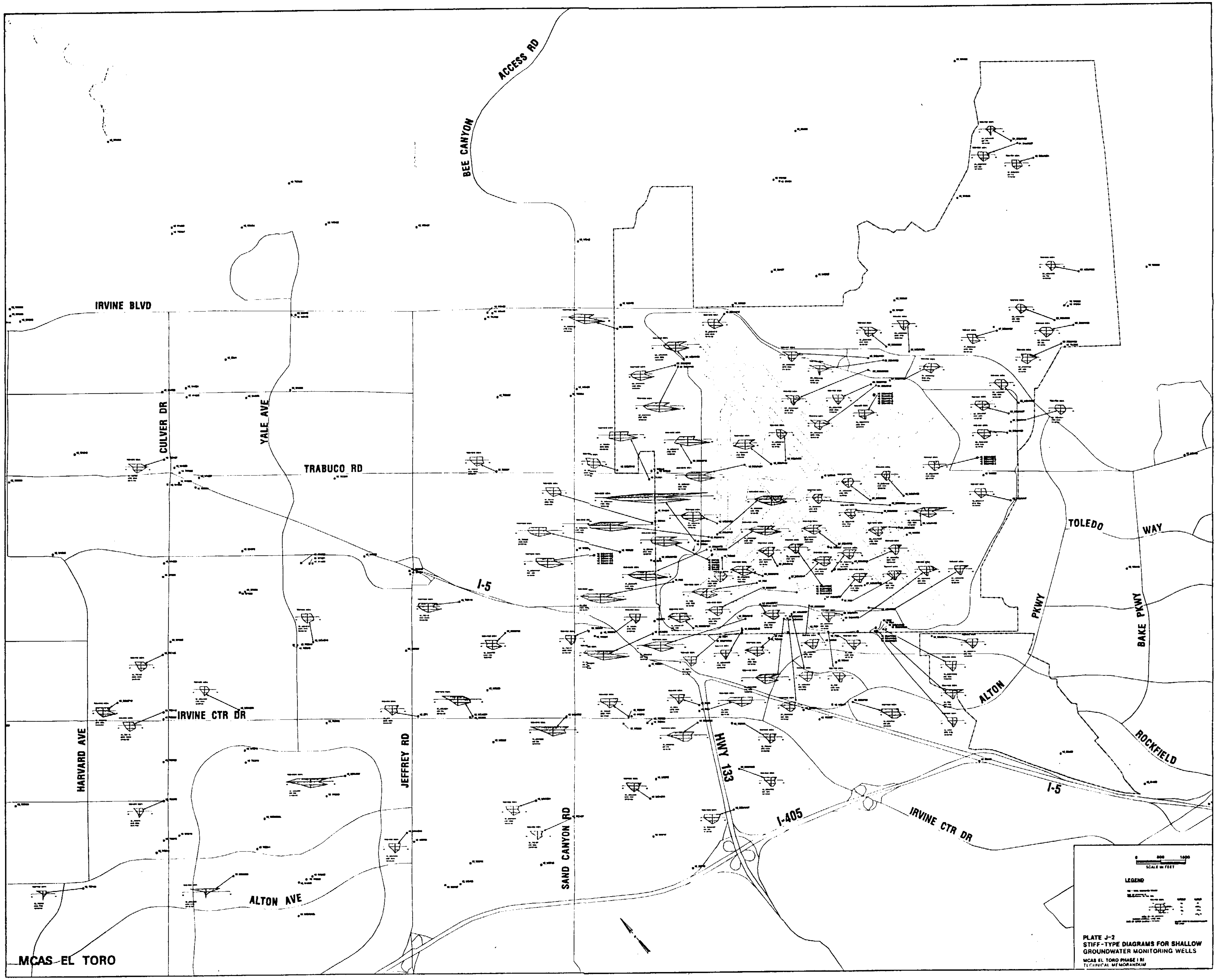
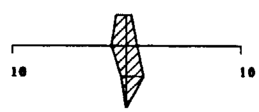


PLATE J-2
STIFF-TYPE DIAGRAMS FOR SHALLOW GROUNDWATER MONITORING WELLS

MCAS EL TORO PHASE I RI
TECHNICAL MEMORANDUM

TDS=299 MG/L



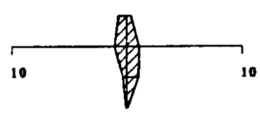
02_EF1
(0-0)
12/07/92

STIFF DIAGRAM
SURFACE WATER

02_EF1

Fri Apr 30 18:44:35 1993

TDS=307 MG/L



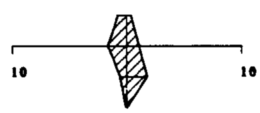
02_EF2
(0-0)
12/07/82

STIFF DIAGRAM
SURFACE WATER

02_EF2

Fri Apr 30 18:44:43 1993

TDS=320 MG/L

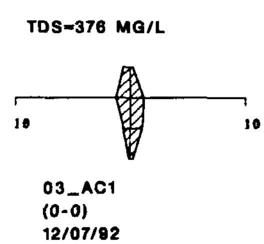


02_WF1
(0-0)
12/07/92

STIFF DIAGRAM
SURFACE WATER

02_WF1

Fri Apr 30 10:44:56 1993

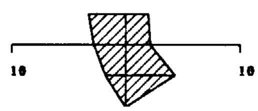


STIFF DIAGRAM
SURFACE WATER

03_AC1

Fri Apr 30 10:45:03 1993

TDS=527 MG/L

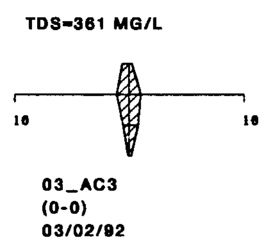


03_AC2
(0-0)
03/02/92

STIFF DIAGRAM
SURFACE WATER

03_AC2

Fri Apr 30 18:45:10 1993

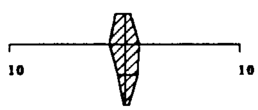


STIFF DIAGRAM
SURFACE WATER

03_AC3

Fri Apr 30 10:45:10 1993

TDS=455 MG/L



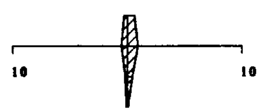
18_AC1
(0-0)
12/07/92

STIFF DIAGRAM
SURFACE WATER

18_AC1

Fri Apr 30 18:45:26 1993

TDS=144 MG/L

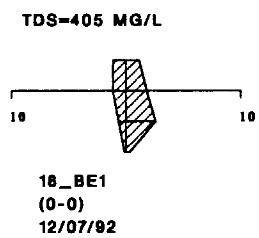


18_AC2
(0-0)
03/02/92

STIFF DIAGRAM
SURFACE WATER

18_AC2

Fri Apr 30 18:45:33 1993

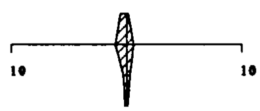


STIFF DIAGRAM
SURFACE WATER

18_BE1

Fri Apr 30 16:45:40 1993

TDS=190 MG/L



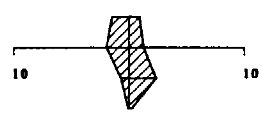
18_BE2
(0-0)
03/02/92

STIFF DIAGRAM
SURFACE WATER

18_BE2

Fri Apr 30 18:45:47 1993

TDS=429 MG/L



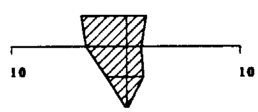
18_BO2
(0-0)
03/02/92

STIFF DIAGRAM
SURFACE WATER

18_BO2

Fri Apr 30 18:45:55 1993

TDS=458 MG/L



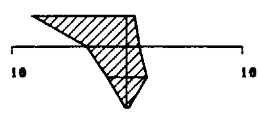
18_DC1
(0-0)
03/02/92

STIFF DIAGRAM
SURFACE WATER

18_DC1

Fri Apr 30 18:46:02 1993

TDS=391 MG/L

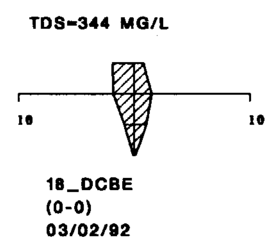


18_DCAC
(0-0)
03/02/92

STIFF DIAGRAM
SURFACE WATER

18_DCAC

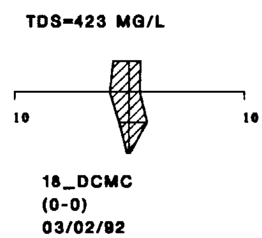
Fri Apr 30 18:46:18 1993



STIFF DIAGRAM
SURFACE WATER

18_DCBE

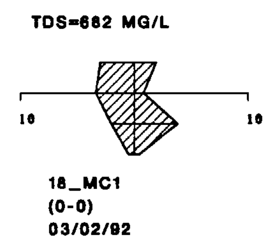
Fri Apr 30 18:46:17 1993



STIFF DIAGRAM
SURFACE WATER

18_DCMC

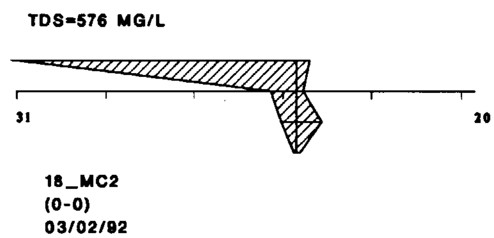
Fri Apr 30 10:46:34 1993



STIFF DIAGRAM
SURFACE WATER

18_MC1

Fri Apr 30 18:46:32 1993



STIFF DIAGRAM
SURFACE WATER

18_MC2

Fri Apr 30 10:46:39 1993

Appendix J2

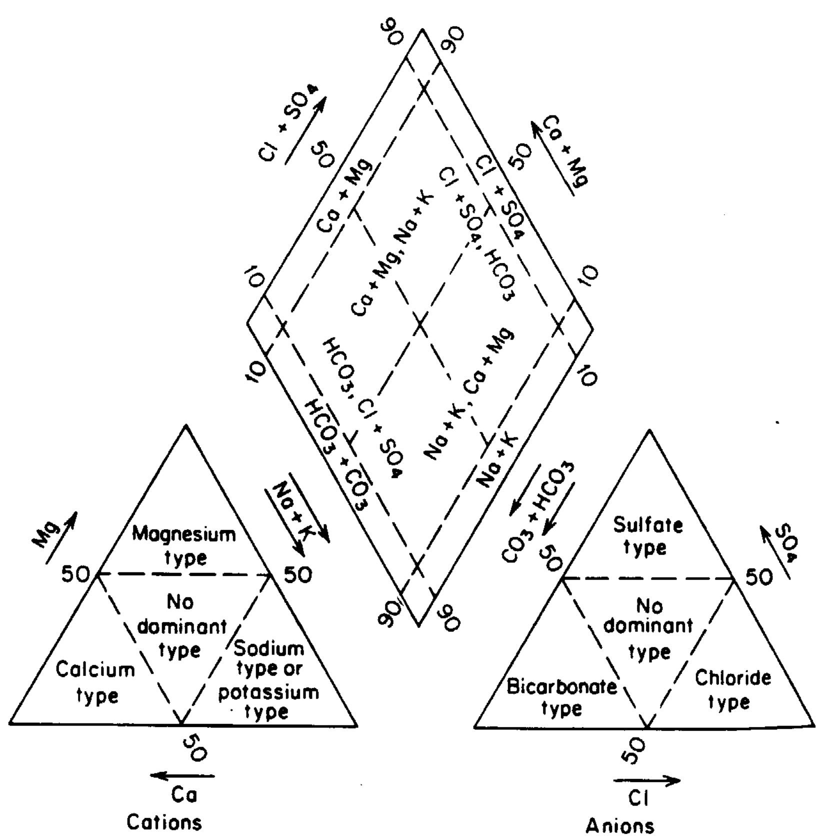
Piper Diagrams

Appendix J2
PIPER DIAGRAMS

J.2 Explanation of Piper Diagrams

Piper diagrams represent the cation and anion compositions of many samples on a single graph in which major groupings or trends in the data can be discerned visually. They are useful for visually describing differences in major-ion chemistry in groundwater flow systems. Another use is in the classification of water compositions that can be identified in groups or categories (referred to as hydrochemical facies).

The following figure is an example a of classification scheme. Concentrations of major ions are given in percentages of total equivalents per liter (Freeze and Cherry, 1979).



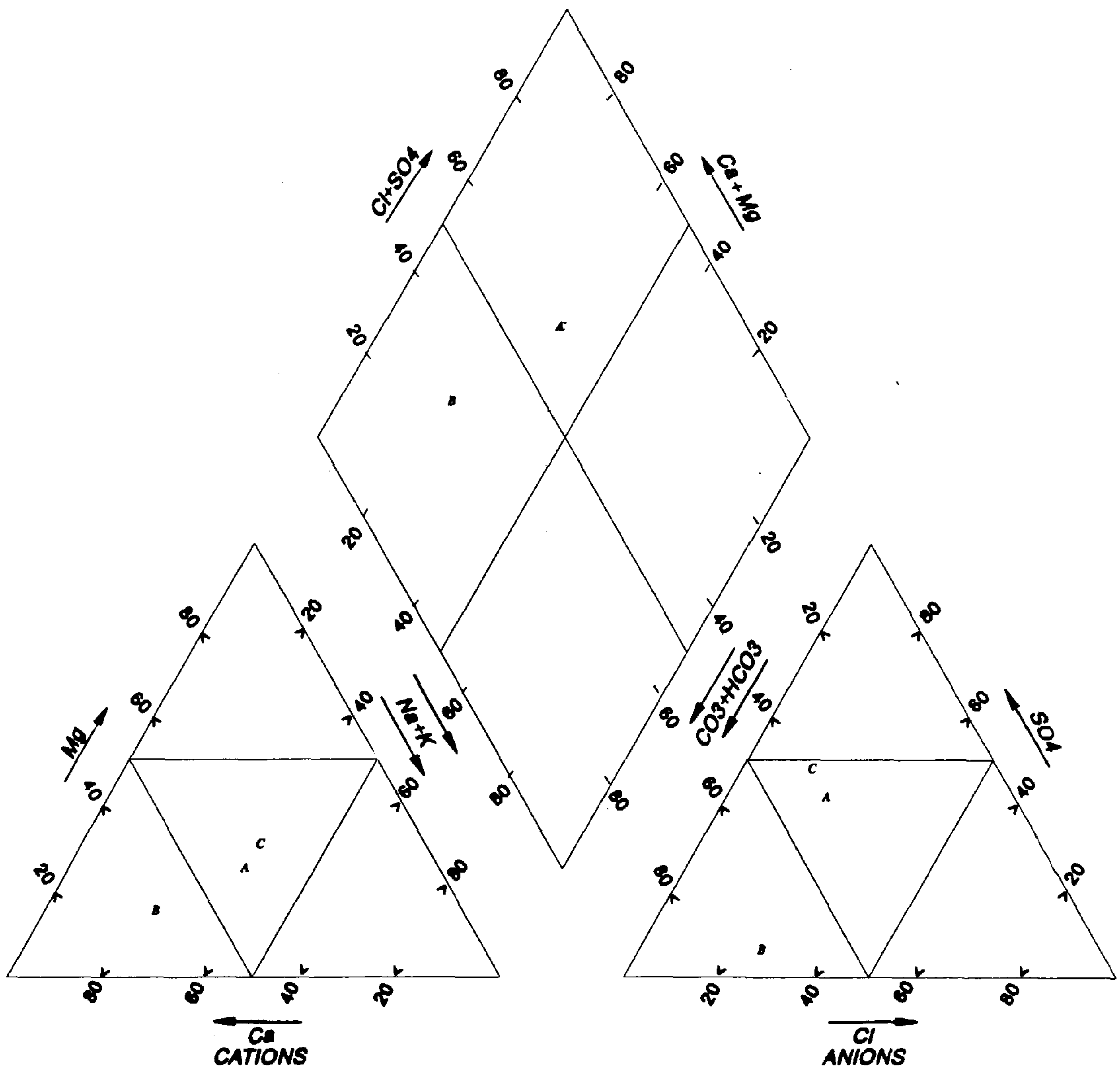
• Classification diagram for anion and cation facies in terms of major-ion percentages. Water types are designated according to the domain in which they occur on the diagram segments

blank page

SITE 1 & WELL 24
PIPER DIAGRAM

(Percent of total milliequilivalents per liter)

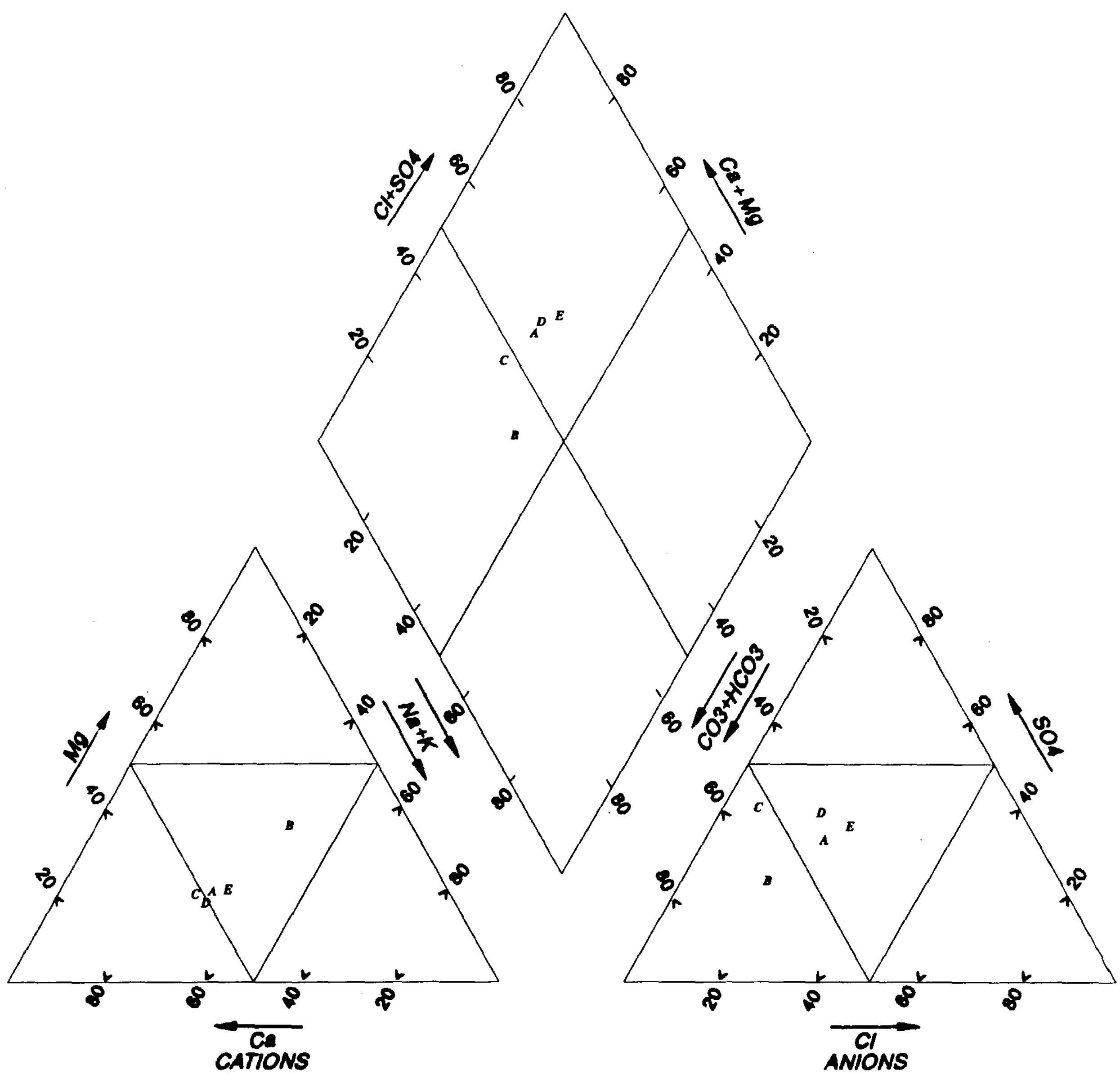
SYM.	WELLID	DEPTH	DATE
A	01_DGMW57	(63-83)	12/10/1992
B	01_DGMW58	(57-77)	12/14/1992
C	18_BGMW24	(51-71)	11/12/1992



SITE 2 & WELL 17
PIPER DIAGRAM

(Percent of total milliequilivalents per liter)

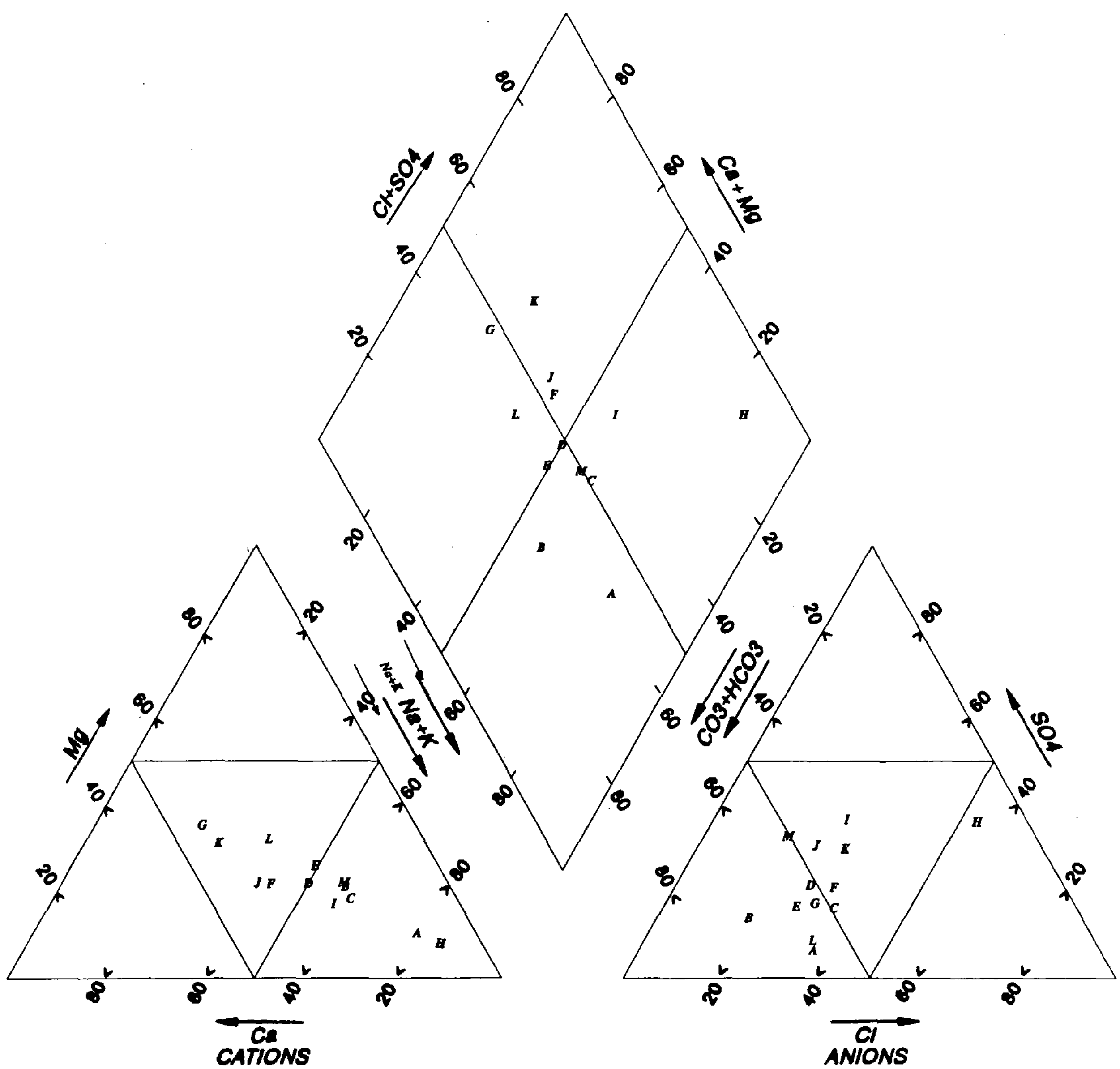
SYM.	WELLID	DEPTH	DATE
A	02_DGMW59	(69-89)	12/15/1992
B	02_DGMW60	(80-100)	11/18/1992
C	02_DGMW61	(80-100)	12/14/1992
D	02_UGMW25	(55-75)	12/ 9/1992
E	18_BGMW17	(215-255)	10/22/1992



SITE 3 AND 4 & WELLS 22, 1A, 1B, 1C, 1D, 1E
PIPER DIAGRAM

(Percent of total milliequilivalents per liter)

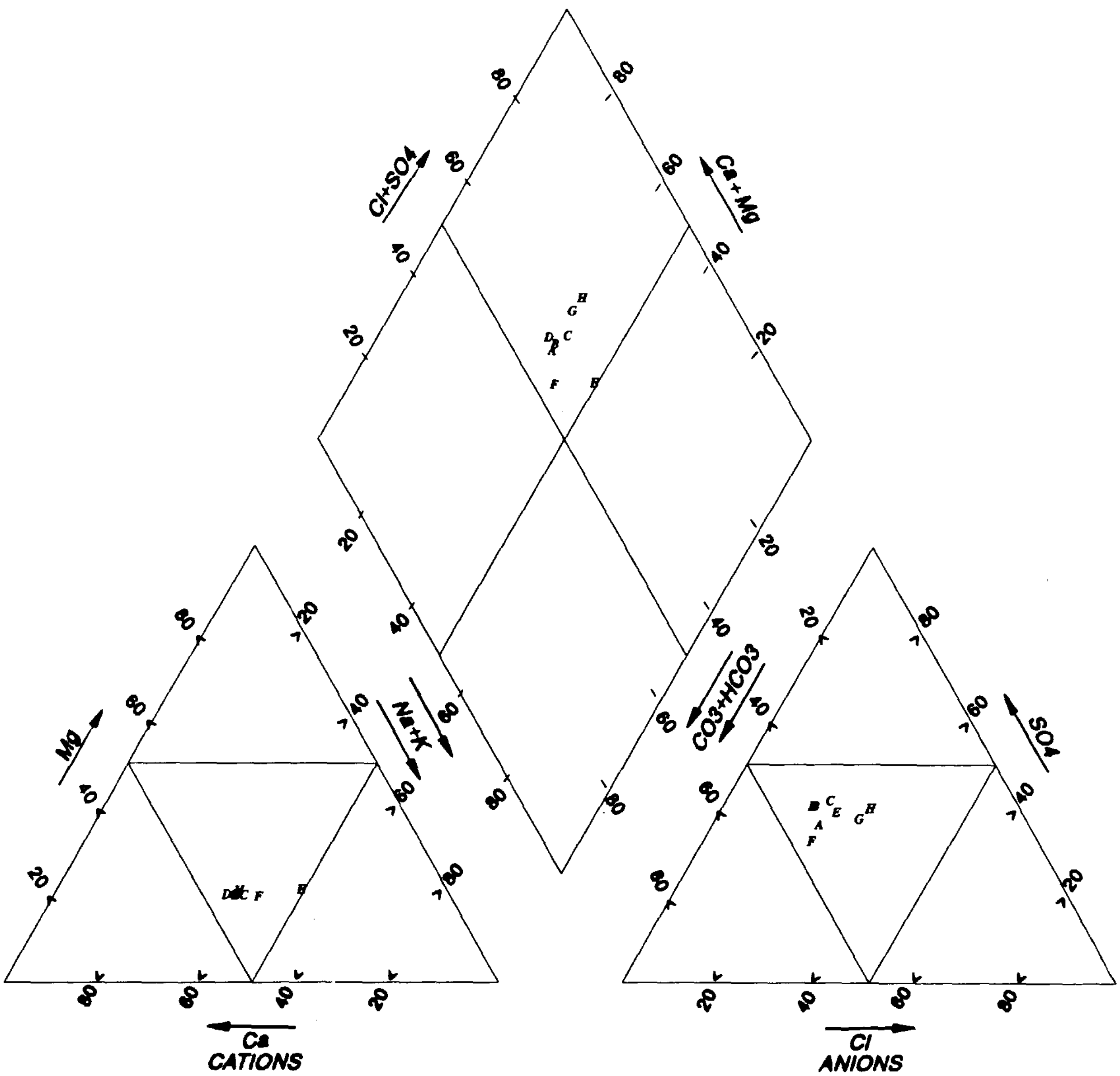
SYM.	WELLID	DEPTH	DATE
A	03_DBMW39	(230-270)	10/ 9/1992
B	03_DGMW64	(245-285)	1/15/1993
C	03_DGMW65X	(230-270)	1/18/1993
D	03_UGMW26	(230-270)	10/ 1/1992
E	04_DBMW40	(220-260)	12/ 3/1992
F	04_DGMW66	(250-290)	11/20/1992
G	04_UGMW63	(235-275)	11/24/1992
H	18_BGMW01A	(466-486)	12/11/1992
I	18_BGMW01B	(396-416)	12/14/1992
J	18_BGMW01C	(330-350)	12/16/1992
K	18_BGMW01D	(242-262)	12/ 9/1992
L	18_BGMW01E	(205-225)	10/27/1992
M	18_BGMW22	(247-287)	12/ 9/1992



SITE 5 & WELLS 2A, 2C, 2D, 2E
PIPER DIAGRAM

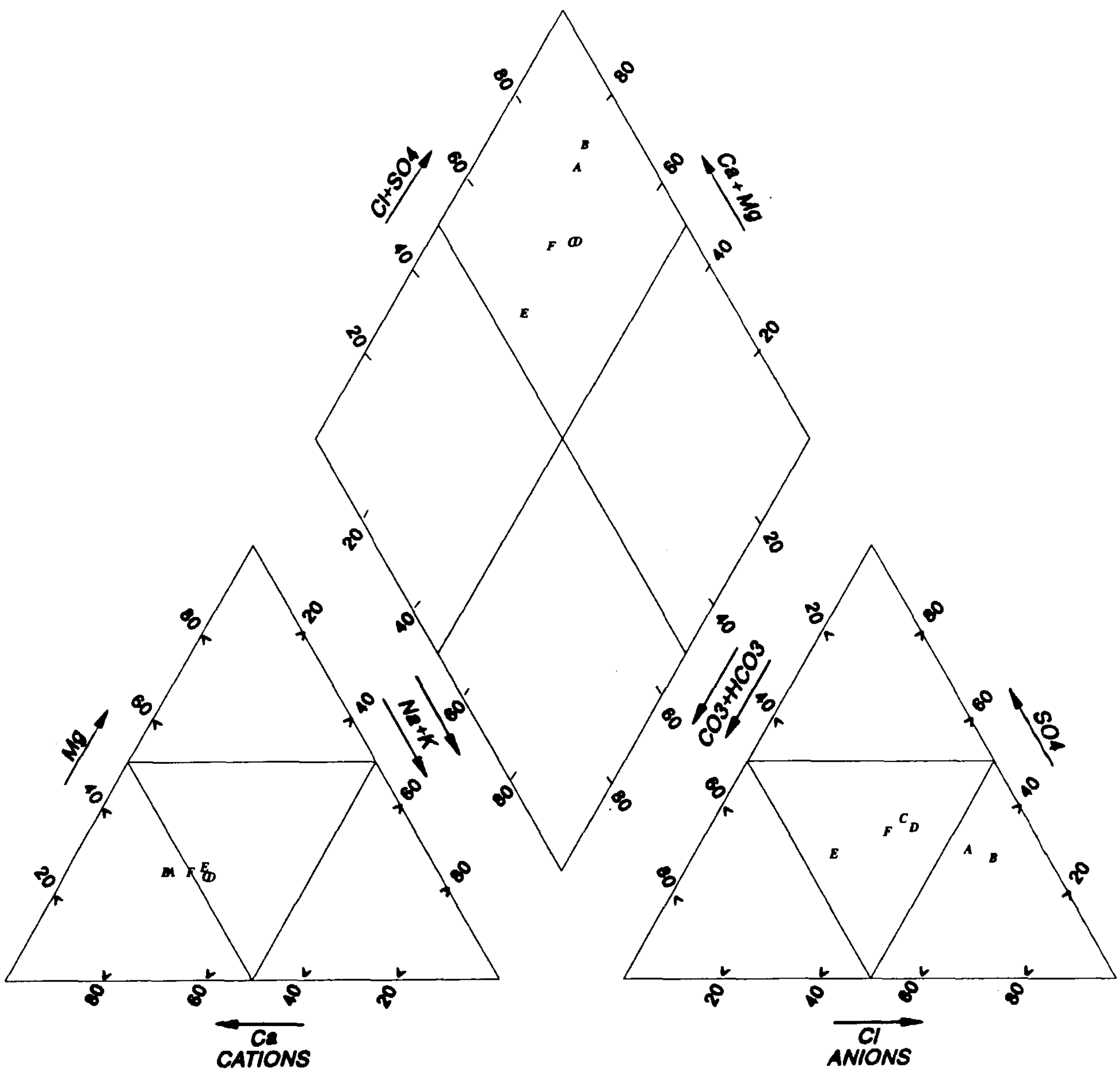
(Percent of total milliequilivalents per liter)

SYM.	WELLID	DEPTH	DATE
A	05_DBMW41	(182-222)	11/16/1992
B	05_DGMW67	(187-227)	11/30/1992
C	05_DGMW68	(190-210)	12/17/1992
D	05_UGMW27	(198-238)	12/ 3/1992
E	18_BGMW02A	(462-482)	12/21/1992
F	18_BGMW02C	(358-378)	12/22/1992
G	18_BGMW02D	(294-314)	12/18/1992
H	18_BGMW02E	(193-233)	9/21/1992



SITES 6 & 19
PIPER DIAGRAM
(Percent of total milliequilivalents per liter)

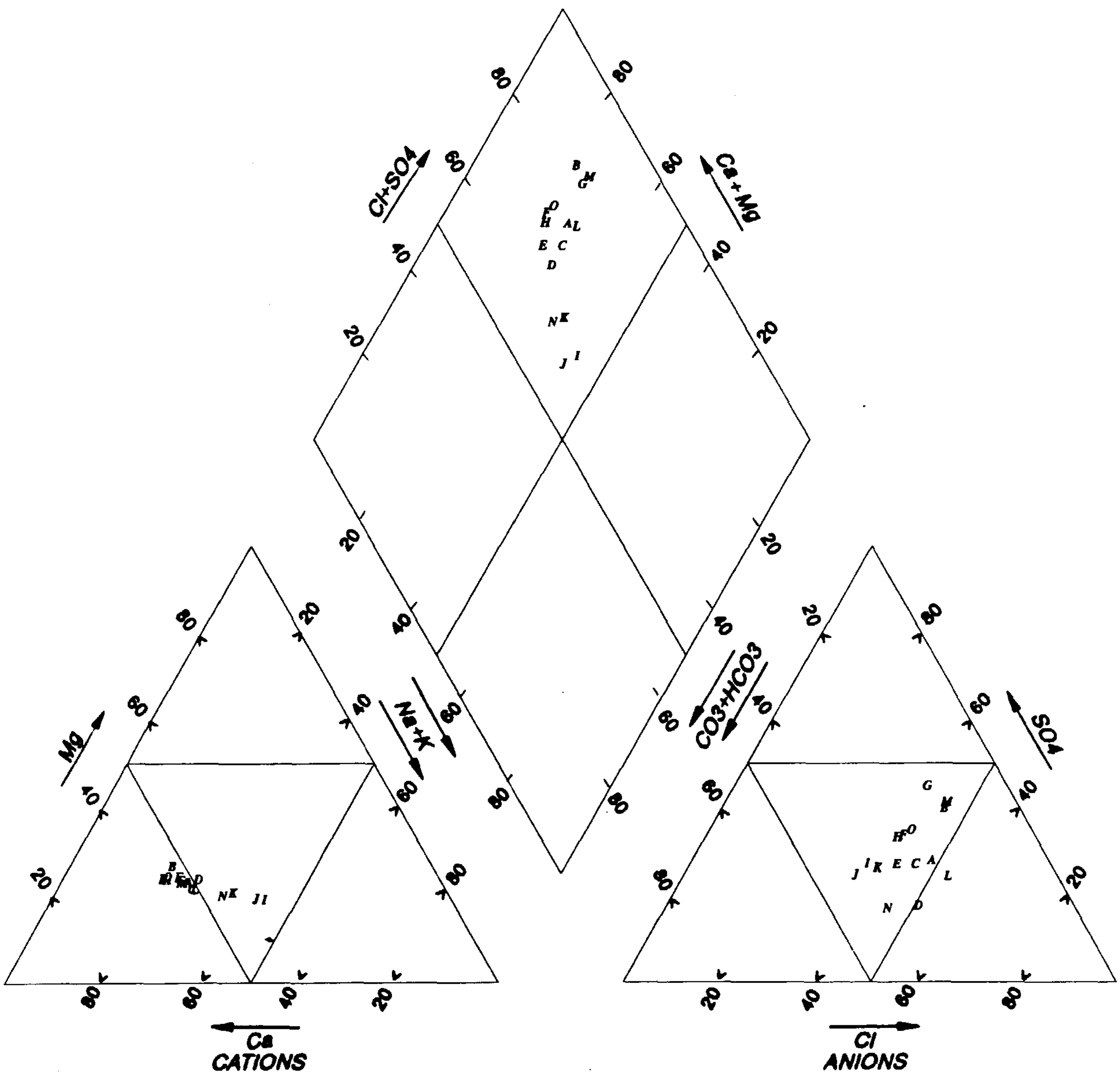
SYM.	WELLID	DEPTH	DATE
A	06_DGMW69	(150-190)	12/ 2/1992
B	06_UGMW28	(140-180)	11/13/1992
C	19_DBMW54	(141-181)	12/18/1992
D	19_DGMW85	(143-183)	12/16/1992
E	19_DGMW86	(158-198)	12/17/1992
F	19_UGMW35	(148-185)	12/ 8/1992



SITE 7, 9, 10, 22 & WELLS 3A, 3B, 3C, 3E, PS6 & PS8 PIPER DIAGRAM

(Percent of total milliequilivalents per liter)

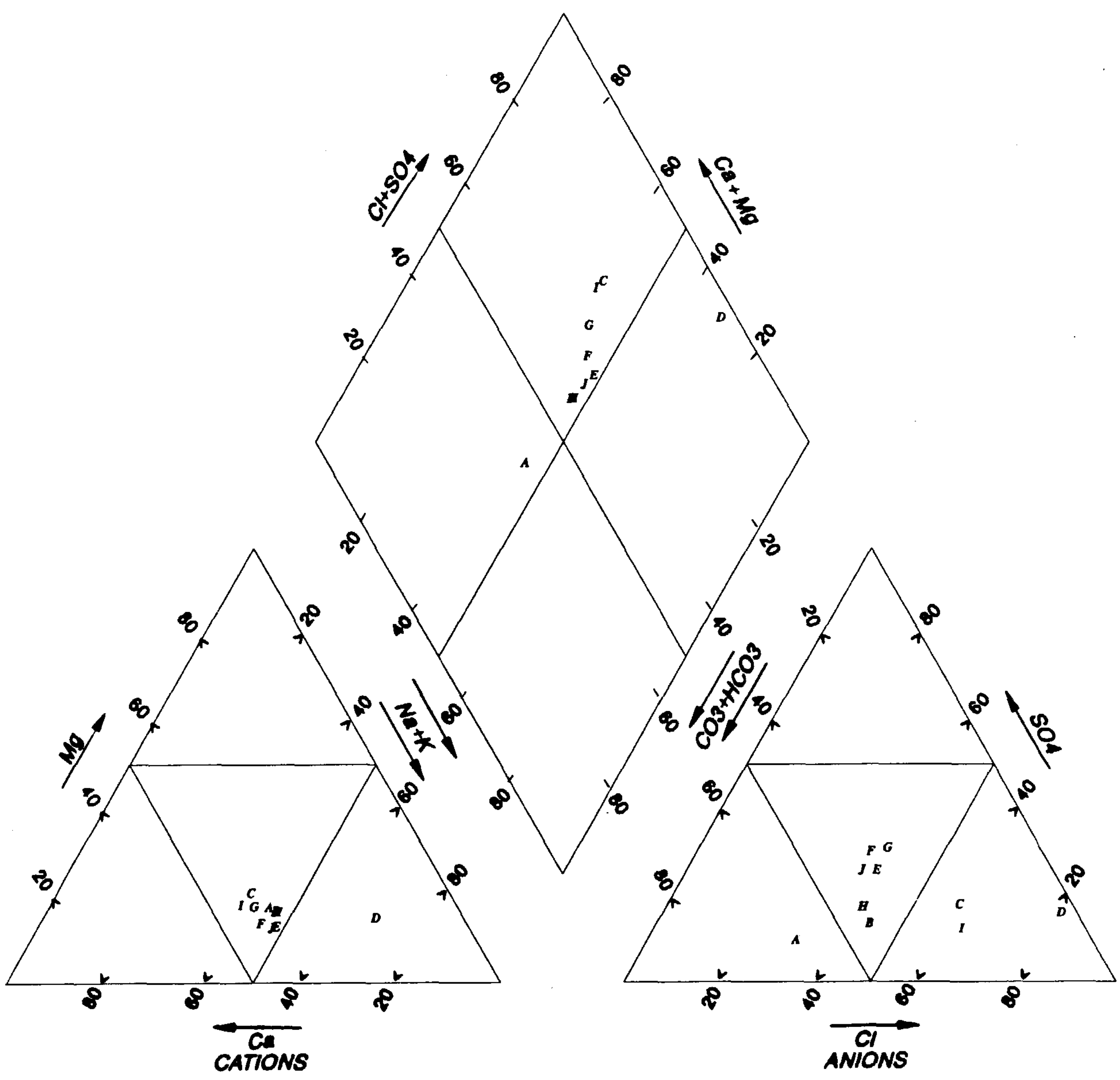
SYM.	WELLID	DEPTH	DATE
A	07_DBMW43	(150-190)	12/ 1/1992
B	07_DBMW70	(125-165)	12/ 8/1992
C	07_DGMW71	(115-155)	12/15/1992
D	07_DGMW72	(110-150)	11/19/1992
E	07_DGMW91	(110-150)	12/18/1992
F	09_DBMW45	(117-157)	12/10/1992
G	09_DGMW75	(114-154)	12/ 1/1992
H	10_DGMW77	(130-170)	11/17/1992
I	18_BGMW03A	(370-390)	10/29/1992
J	18_BGMW03B	(280-300)	10/28/1992
K	18_BGMW03C	(222-242)	12/17/1992
L	18_BGMW03E	(124-164)	12/17/1992
M	18_PS6	(130-150)	12/15/1992
N	18_PS8	(125-145)	12/14/1992
O	22_DBMW47	(116-156)	9/29/1992



SITE 8 & WELLS 5A, 5B, 5C, 5D, PS3, PS4 & RW2
PIPER DIAGRAM

(Percent of total milliequilivalents per liter)

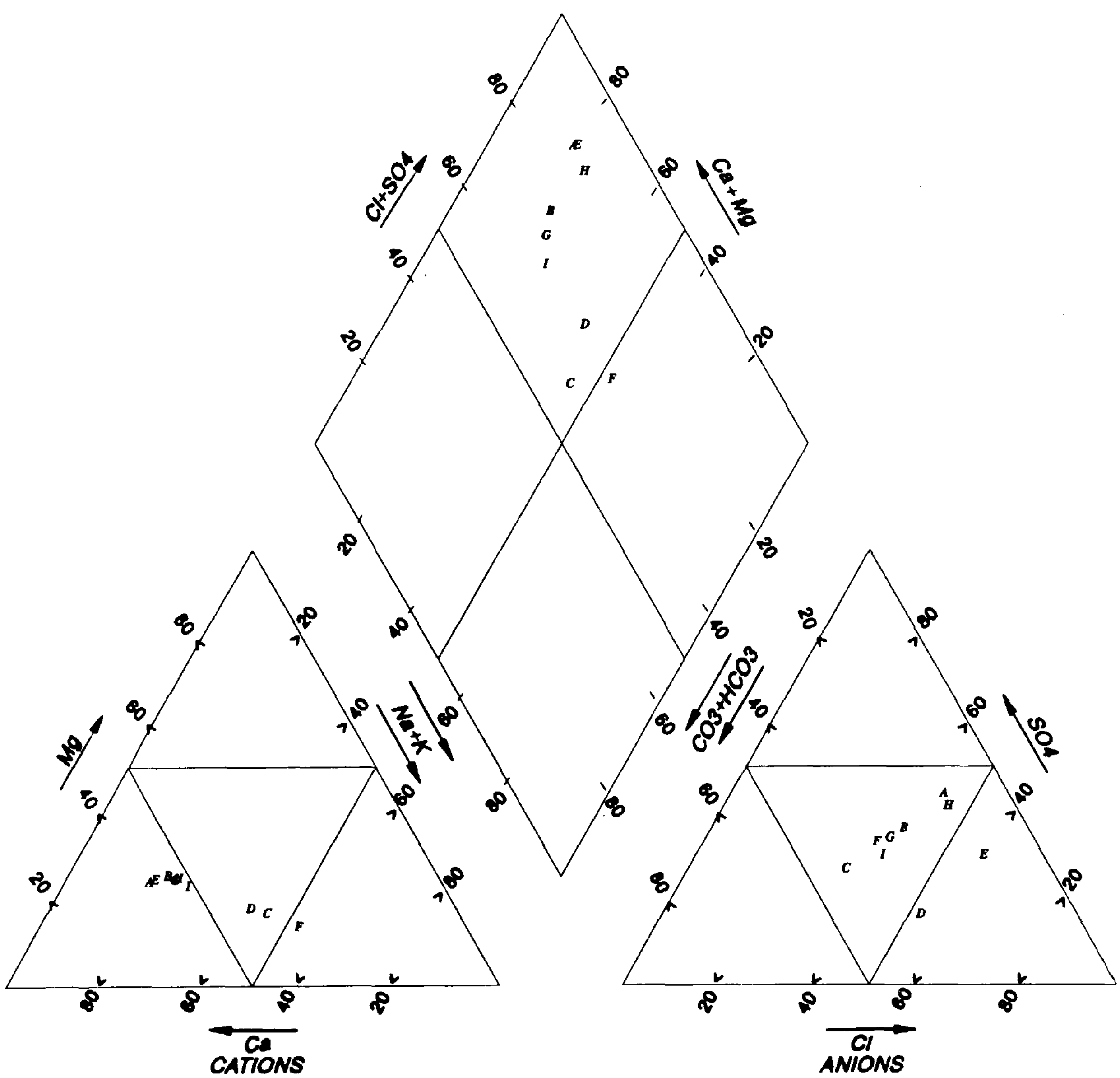
SYM.	WELLID	DEPTH	DATE
A	08_DGMW73	(90-130)	12/ 2/1992
B	08_DGMW74	(90-130)	11/16/1992
C	08_UGMW29	(95-135)	12/ 8/1992
D	18_BGMW05A	(462-482)	12/15/1992
E	18_BGMW05B	(321-341)	11/11/1992
F	18_BGMW05C	(225-245)	11/10/1992
G	18_BGMW05D	(83-133)	11/ 3/1992
H	18_PS3	(102-122)	12/10/1992
I	18_PS4	(98-118)	12/11/1992
J	18_RW2	(270-310)	12/22/1992



SITES 12 AND 21 & WELLS 4A, 4B, PS1, RW1
PIPER DIAGRAM

(Percent of total milliequilivalents per liter)

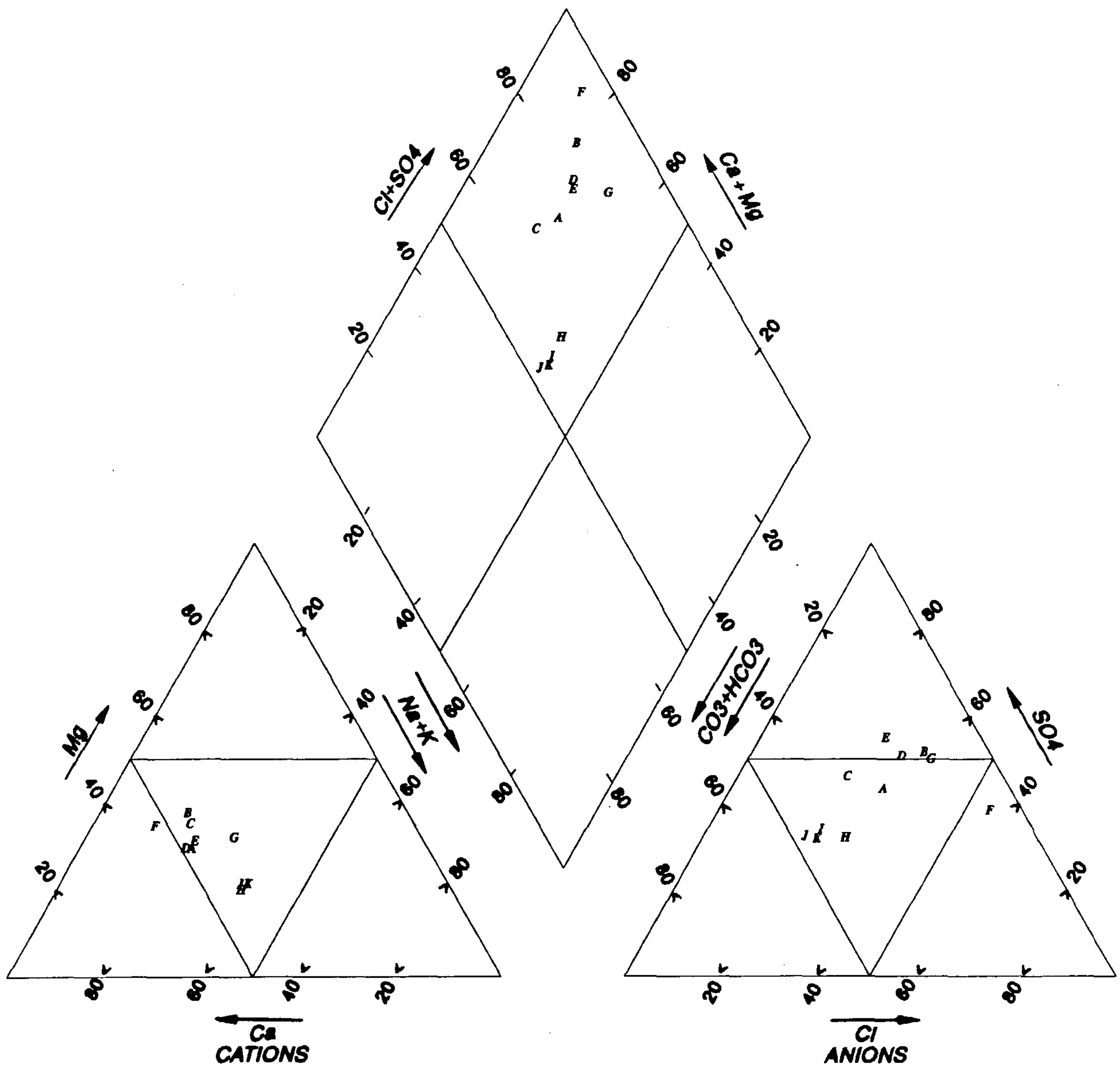
SYM.	WELLID	DEPTH	DATE
A	12_DBMW48	(95-135)	11/17/1992
B	12_UGMW31	(105-145)	10/ 8/1992
C	18_BGMW04A	(286-306)	9/30/1992
D	18_BGMW04B	(190-210)	9/29/1992
E	18_PS1	(102-122)	1/22/1989
F	18_RW1	(430-470)	12/14/1992
G	21_DBMW56	(92-132)	11/18/1992
H	21_DGMW90	(95-135)	11/20/1992
I	21_UGMW37	(90-130)	11/13/1992



SITE 13,14,15 & DW WELLS
PIPER DIAGRAM

(Percent of total milliequilivalents per liter)

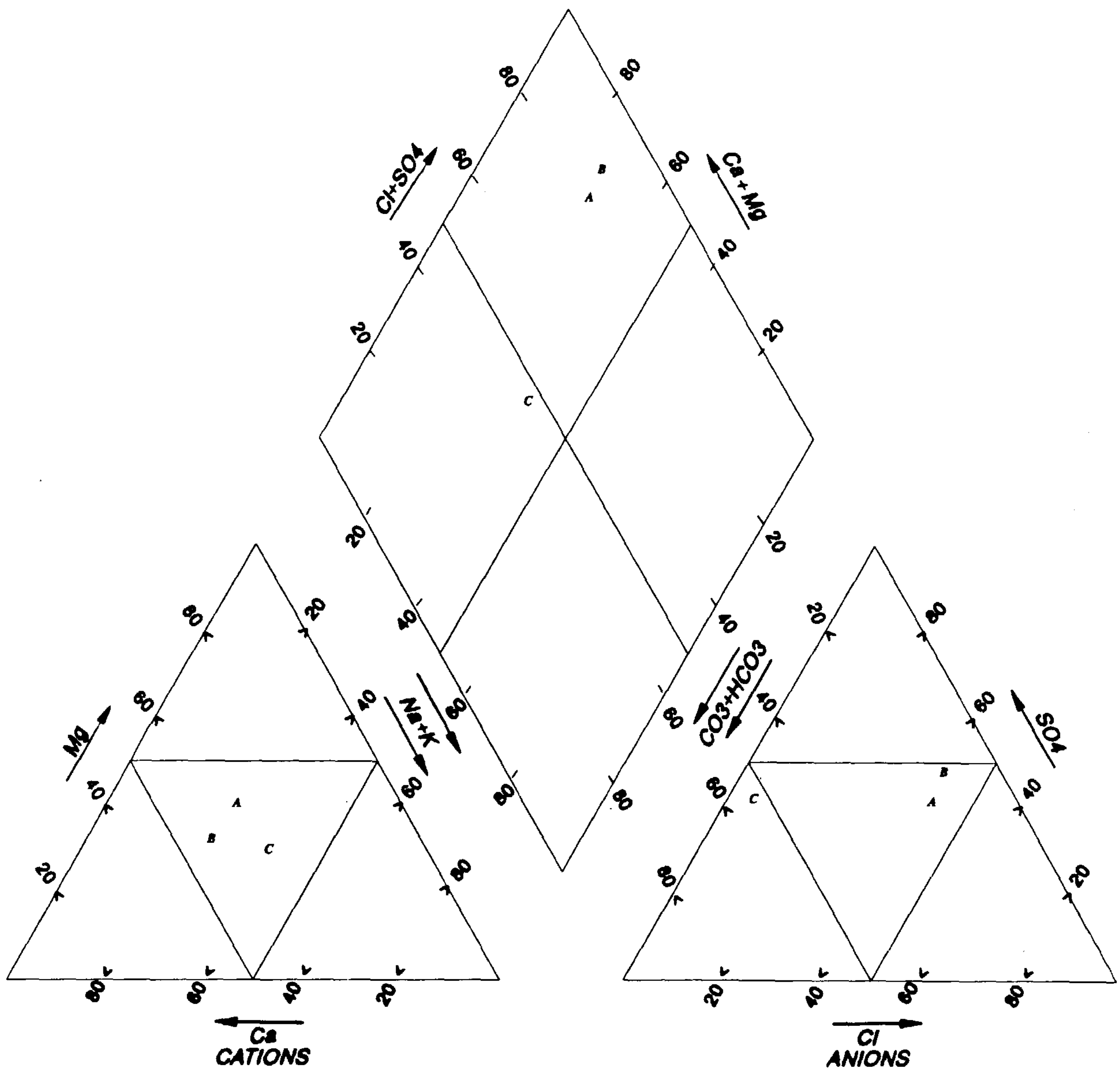
SYM.	WELLID	DEPTH	DATE
A	13_DBMW49	(142-182)	11/16/1992
B	13_DGMW78	(127-167)	11/23/1992
C	13_UGMW32	(144-184)	10/28/1992
D	14_DBMW50	(120-160)	12/ 2/1992
E	14_DGMW79	(118-158)	11/20/1992
F	15_DBMW51	(125-165)	12/ 4/1992
G	18_DW135	(115-135)	12/22/1992
H	18_DW250	(215-250)	12/21/1992
I	18_DW350	(310-350)	1/11/1993
J	18_DW450	(420-450)	1/12/1993
K	18_DW540	(490-540)	1/13/1993



SITE 16
PIPER DIAGRAM

(Percent of total milliequilivalents per liter)

SYM.	WELLID	DEPTH	DATE
A	16_DBMW52	(182-222)	11/ 4/1992
B	16_DGMW81	(176-216)	12/11/1992
C	16_UGMW33	(180-220)	12/17/1992



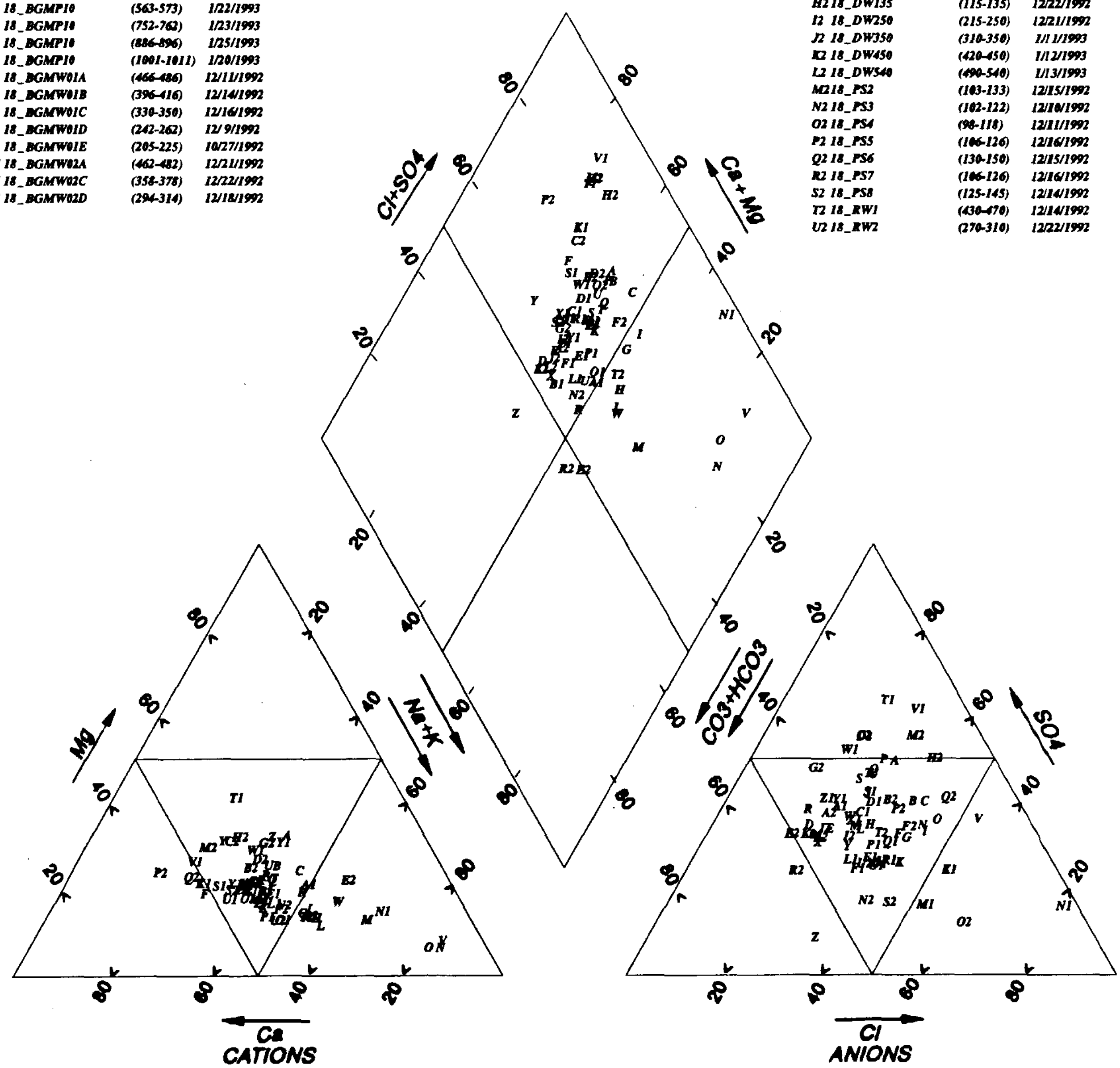
SITE 18

PIPER DIAGRAM

(Percent of total milliequilivalents per liter)

SYM.	WELLID	DEPTH	DATE
A	18_BGMP06	(105-115)	10/ 1/1992
B	18_BGMP06	(168-178)	10/ 6/1992
C	18_BGMP06	(295-305)	10/ 7/1992
D	18_BGMP06	(380-390)	10/ 7/1992
E	18_BGMP06	(445-455)	10/ 8/1992
F	18_BGMP08	(61-71)	10/12/1992
G	18_BGMP08	(126-136)	10/13/1992
H	18_BGMP08	(297-307)	10/15/1992
I	18_BGMP08	(439-449)	10/17/1992
J	18_BGMP09	(59-69)	10/19/1992
K	18_BGMP09	(133-143)	10/20/1992
L	18_BGMP09	(222-232)	10/21/1992
M	18_BGMP09	(268-278)	10/22/1992
N	18_BGMP09	(374-384)	10/23/1992
O	18_BGMP09	(453-463)	10/23/1992
P	18_BGMP10	(218-228)	1/20/1993
Q	18_BGMP10	(429-439)	1/21/1993
R	18_BGMP10	(563-573)	1/22/1993
S	18_BGMP10	(752-762)	1/23/1993
T	18_BGMP10	(886-896)	1/25/1993
U	18_BGMP10	(1001-1011)	1/20/1993
V	18_BGMW01A	(466-486)	12/11/1992
W	18_BGMW01B	(396-416)	12/14/1992
X	18_BGMW01C	(330-350)	12/16/1992
Y	18_BGMW01D	(242-262)	12/ 9/1992
Z	18_BGMW01E	(205-225)	10/27/1992
A1	18_BGMW02A	(462-482)	12/21/1992
B1	18_BGMW02C	(358-378)	12/22/1992
C1	18_BGMW02D	(294-314)	12/18/1992

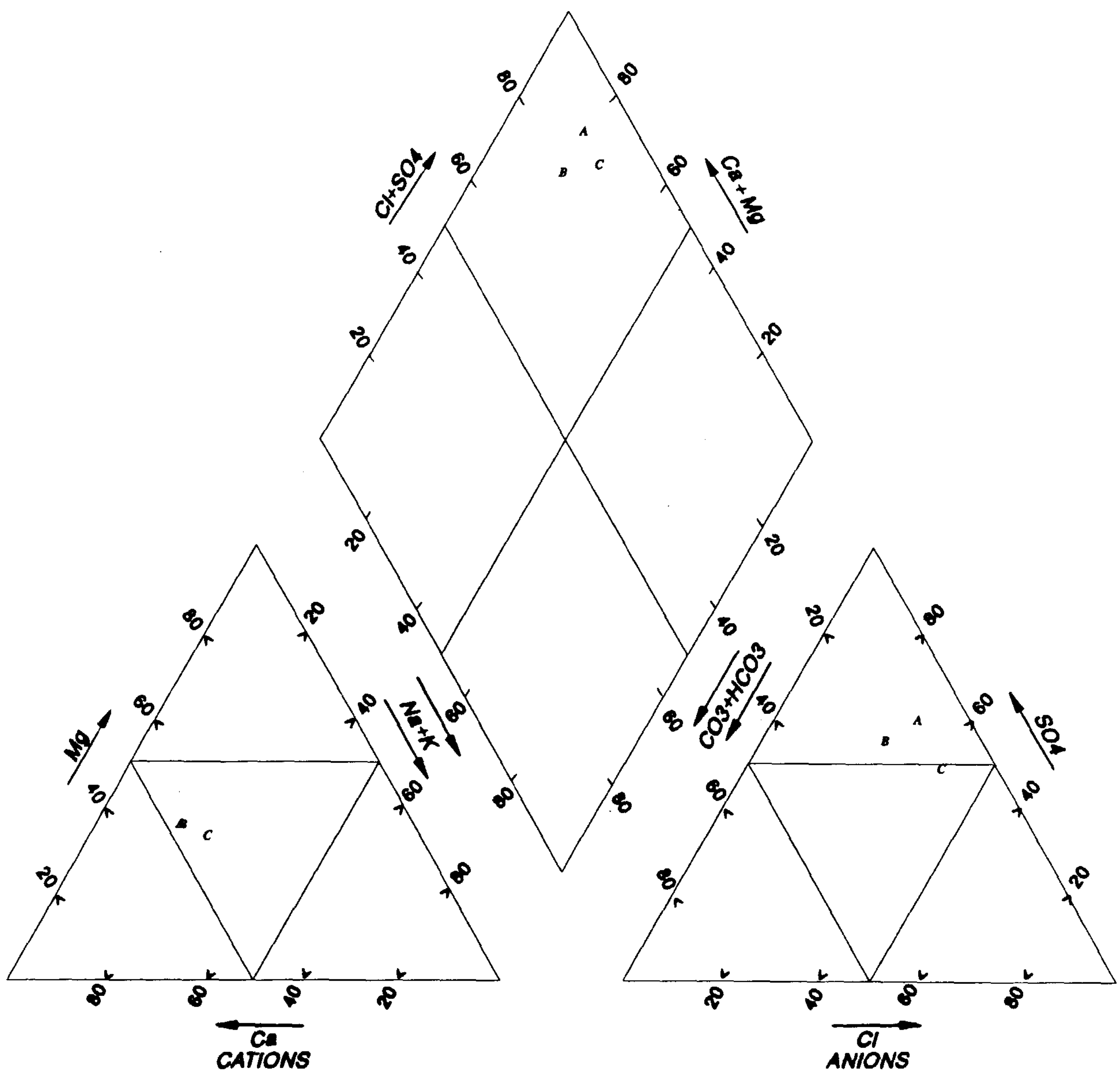
SYM.	WELLID	DEPTH	DATE
D1	18_BGMW02E	(193-233)	9/21/1992
E1	18_BGMW03A	(370-390)	10/29/1992
F1	18_BGMW03B	(280-300)	10/28/1992
J1	18_BGMW03C	(222-242)	12/17/1992
K1	18_BGMW03E	(124-164)	12/17/1992
L1	18_BGMW04A	(286-306)	9/30/1992
M1	18_BGMW04B	(190-210)	9/29/1992
N1	18_BGMW05A	(462-482)	12/15/1992
O1	18_BGMW05B	(321-341)	11/11/1992
P1	18_BGMW05C	(225-245)	11/10/1992
Q1	18_BGMW05D	(83-133)	11/ 3/1992
R1	18_BGMW07	(25-65)	12/ 9/1992
S1	18_BGMW101	(90-130)	11/13/1992
T1	18_BGMW12	(165-205)	11/ 9/1992
U1	18_BGMW14	(75-115)	10/20/1992
V1	18_BGMW15	(175-215)	10/30/1992
W1	18_BGMW16	(223-263)	10/23/1992
X1	18_BGMW17	(215-255)	10/22/1992
Y1	18_BGMW18	(140-180)	11/10/1992
Z1	18_BGMW19A	(448-468)	12/22/1992
A2	18_BGMW19B	(400-420)	12/17/1992
B2	18_BGMW19C	(257-277)	9/24/1992
C2	18_BGMW19D	(150-170)	9/25/1992
D2	18_BGMW19E	(98-138)	11/12/1992
E2	18_BGMW22	(247-287)	12/ 9/1992
F2	18_BGMW23	(64-104)	12/10/1992
G2	18_BGMW24	(51-71)	11/12/1992
H2	18_DW135	(115-135)	12/22/1992
I2	18_DW250	(215-250)	12/21/1992
J2	18_DW350	(310-350)	1/11/1993
K2	18_DW450	(420-450)	1/12/1993
L2	18_DW540	(490-540)	1/13/1993
M2	18_PS2	(103-133)	12/15/1992
N2	18_PS3	(102-122)	12/10/1992
O2	18_PS4	(98-118)	12/11/1992
P2	18_PS5	(106-126)	12/16/1992
Q2	18_PS6	(130-150)	12/15/1992
R2	18_PS7	(106-126)	12/16/1992
S2	18_PS8	(125-145)	12/14/1992
T2	18_RW1	(430-470)	12/14/1992
U2	18_RW2	(270-310)	12/22/1992



SITE 20
PIPER DIAGRAM

(Percent of total milliequilivalents per liter)

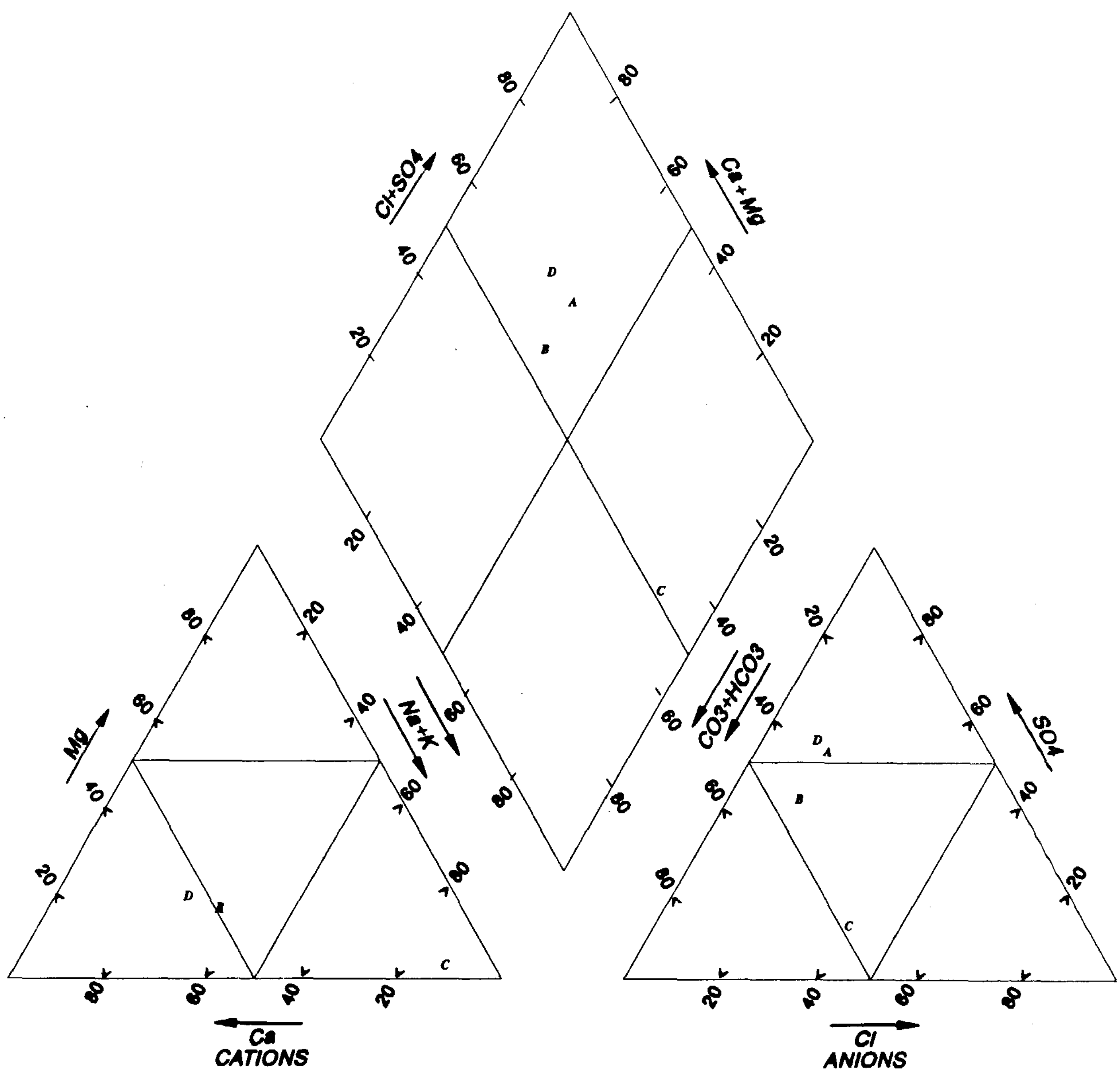
SYM.	WELLID	DEPTH	DATE
A	20_DBMW55	(187-227)	12/ 9/1992
B	20_DGMW88	(185-225)	11/ 4/1992
C	20_UGMW36	(183-223)	10/28/1992



SITE 2 - SURFACE RUNOFF
PIPER DIAGRAM

(Percent of total milliequilivalents per liter)

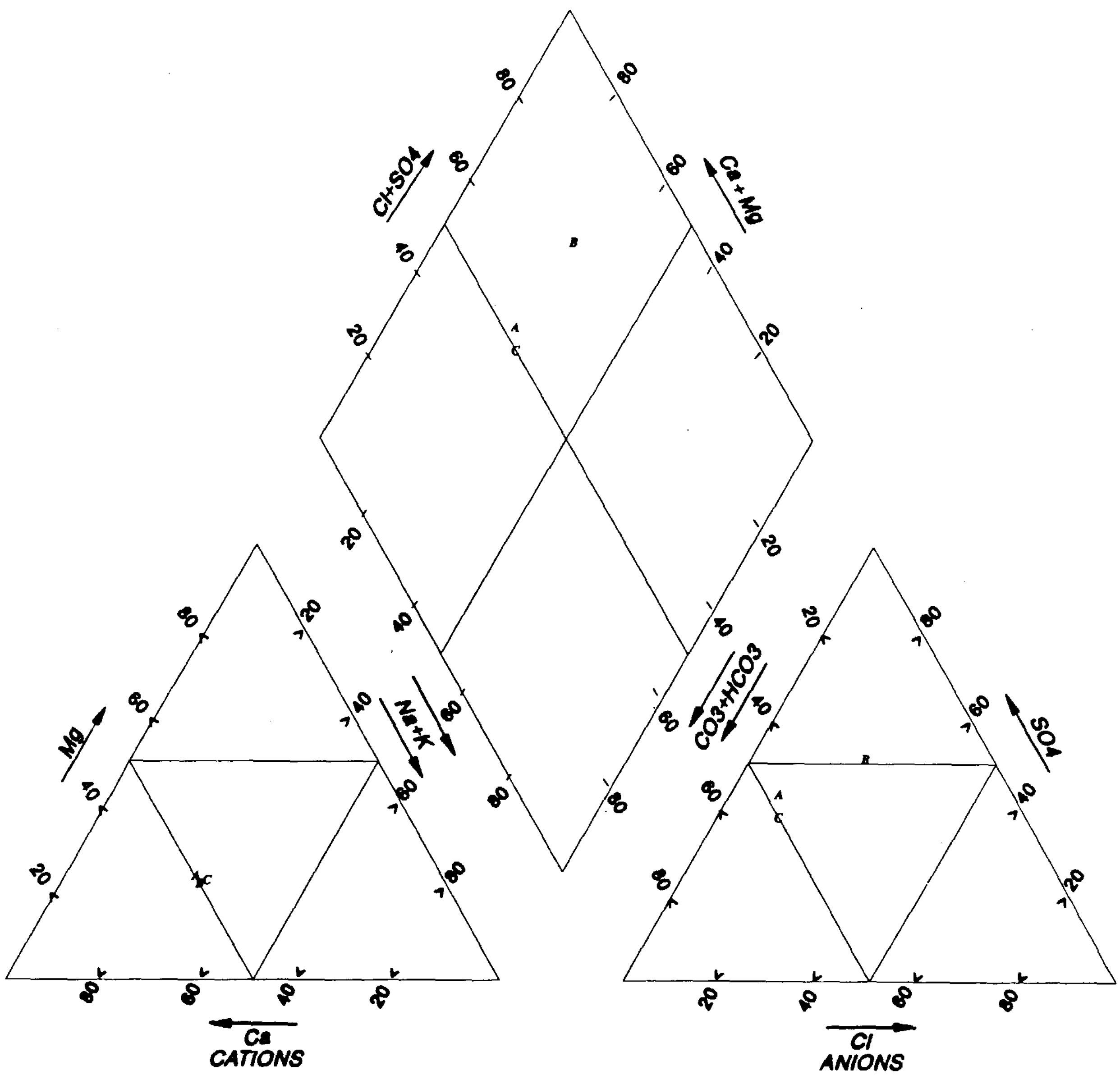
SYM.	WELLID	DEPTH	DATE
A	02_EF1	(0-0)	12/ 7/1992
B	02_EF2	(0-0)	12/ 7/1992
C	02_MM1	(0-0)	12/ 7/1992
D	02_WF1	(0-0)	12/ 7/1992



SITE 3 - SURFACE RUNOFF
PIPER DIAGRAM

(Percent of total milliequilivalents per liter)

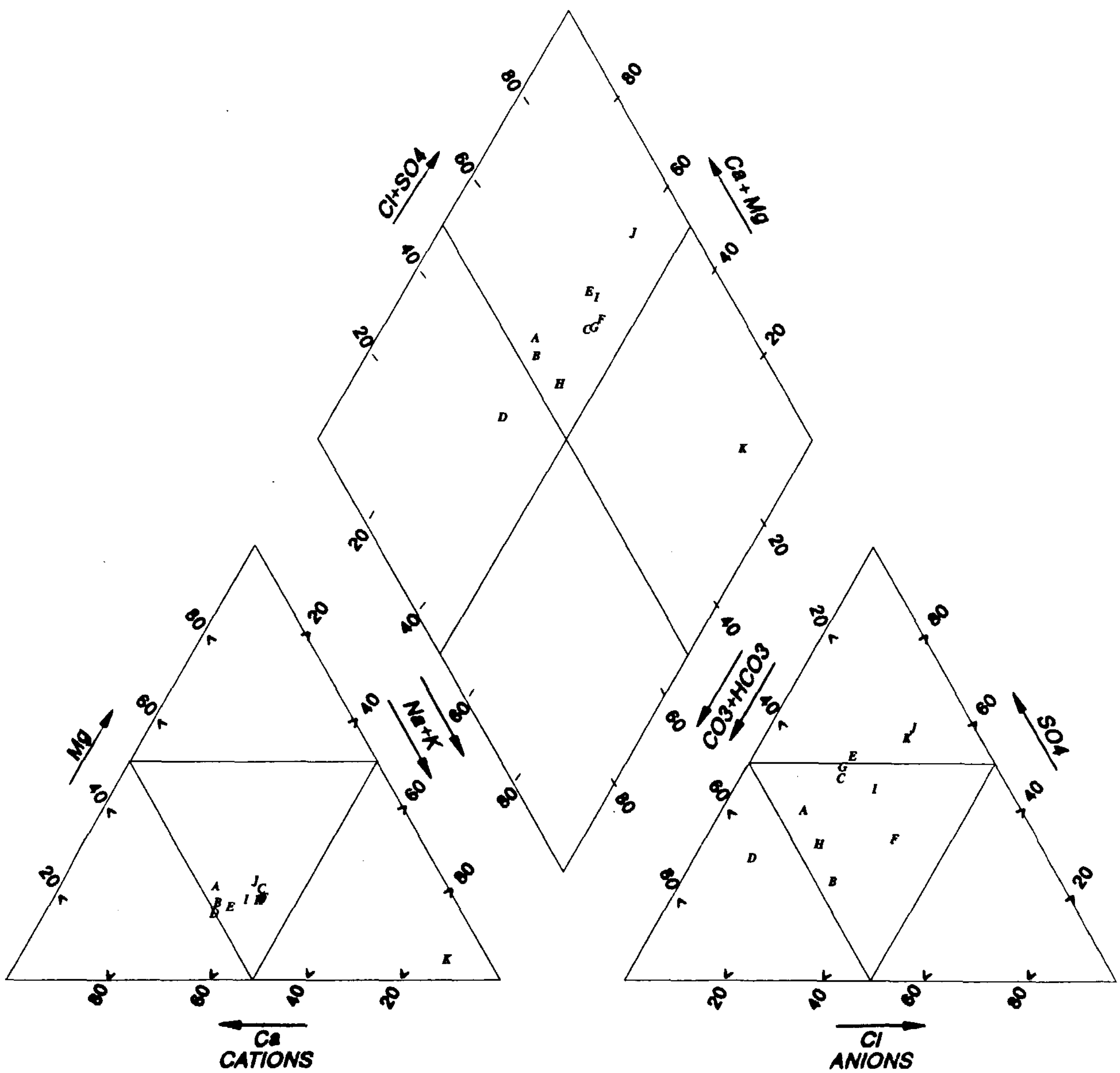
SYM.	WELLID	DEPTH	DATE
A	03_AC1	(0-0)	12/ 7/1992
B	03_AC2	(0-0)	3/ 2/1992
C	03_AC3	(0-0)	3/ 2/1992



SITE18 - SURFACE RUNOFF
PIPER DIAGRAM

(Percent of total milliequilivalents per liter)

SYM.	WELLID	DEPTH	DATE
A	18_AC1	(0-0)	12/ 7/1992
B	18_AC2	(0-0)	3/ 2/1992
C	18_BE1	(0-0)	12/ 7/1992
D	18_BE2	(0-0)	3/ 2/1992
E	18_BO2	(0-0)	3/ 2/1992
F	18_DC1	(0-0)	3/ 2/1992
G	18_DCAC	(0-0)	3/ 2/1992
H	18_DCBE	(0-0)	3/ 2/1992
I	18_DCMC	(0-0)	3/ 2/1992
J	18_MC1	(0-0)	3/ 2/1992
K	18_MC2	(0-0)	3/ 2/1992



Appendix K

GEOLOGIC LOGS OF BORINGS

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW- 1A	SHEET 1 OF 17

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18 East of Building 114

ELEVATION 392.8 ft DRILLING CONTRACTOR Beylik Drilling, Inc.

DRILLING METHOD AND EQUIPMENT Mud Rotary (Ingersol-Rand TH 100) 18" Flight Auger from 0 to 14 ft

WATER LEVEL AND DATE 248.6 1/19/93 START 6/15/92 FINISH 6/18/92 LOGGER J. Lovenburg

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					SANDY SILT (ML), light brown, dry, loose, trace subangular gravel to 2 inches, roots, fine sand		
5.0							
					SILTY SAND (SM), brown, slightly moist, loose, fine to medium sand, trace clay		
10.0	10.0–12.0	1-C			WELL GRADED SAND (SW), light brown, dry, fine to coarse, coarsening downwards, trace gravel, roots	F: 1.0 ppm	
15.0							
20.0	20.0–21.0	2-C	1.0		WELL GRADED SAND (SW), orange-brown, moist, mostly fine to medium sand, 60%, little silt, trace muscovite mica, mild HCl reaction	F: 0.6 ppm	
25.0							
30.0							

PROJECT NUMBER	BORING NUMBER
LAO31981	MW- 1A SHEET 2 OF 17

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18 East of Building 114

ELEVATION 392.8 ft DRILLING CONTRACTOR Beylik Drilling, Inc.

DRILLING METHOD AND EQUIPMENT Mud Rotary (Ingersol-Rand TH 100) 18" Flight Auger from 0 to 14 ft

WATER LEVEL AND DATE 248.6 1/19/93 START 6/15/92 FINISH 6/18/92 LOGGER J. Lovenburg

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	30.0 – 31.5	3-C		1.5	WELL GRADED SAND (SW), light brown, moist, fine to medium grained sand, little silt, no HCl reaction	F: 1.5 ppm	
35.0							
40.0	40.0 – 41.5	4-C		1.5	WELL GRADED SAND WITH GRAVEL (SW), light brown, fine to coarse sand, subangular 1 inch shale fragment	F: 0.1 ppm	
					SANDY SILT WITH CLAY (ML), light brown, fine sand, fining downward, tan-white weathered calcareous clay in cracks, slight plasticity, mild HCl reaction with silt		
45.0							
50.0	50.0 – 50.5	5-C	0.5		SILTY SAND (SM), light brown, moist, fine to medium sand, mostly fine	F: 0.5 ppm	
55.0							
60.0							

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW- 1A	SHEET 3 OF 17

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18 East of Building 114

ELEVATION 392.8 ft DRILLING CONTRACTOR Beylik Drilling, Inc.

DRILLING METHOD AND EQUIPMENT Mud Rotary (Ingersol-Rand TH 100) 18" Flight Auger from 0 to 14 ft

WATER LEVEL AND DATE 248.6 1/19/93 START 6/15/92 FINISH 6/18/92 LOGGER J. Lovenburg

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION (SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY)	FID/PID READING	COMMENTS (DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION)
	60.0 61.0	6-C		1.0	SILTY SAND (SM), light yellowish brown, moist, tan weathered clay in cracks, strong HCl reaction with tan clay, mild reaction with sand	F: 0 ppm	
65.0							
70.0	70.0 71.0	7-C			SAND WITH SILT (SM), light brown, moist, fine to coarse sand, no HCl reaction	F: 1.4 ppm	
75.0							
80.0							
85.0							
90.0							

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW- 1A	SHEET 4 OF 17

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18 East of Building 114

ELEVATION 392.8 ft DRILLING CONTRACTOR Beylik Drilling, Inc.

DRILLING METHOD AND EQUIPMENT Mud Rotary (Ingersol-Rand TH 100) 18" Flight Auger from 0 to 14 ft

WATER LEVEL AND DATE 248.6 1/19/93 START 6/15/92 FINISH 6/18/92 LOGGER J. Lovenburg

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	90.0 90.5	8-C		1.0	SILTY SAND (SM), greenish-gray, moist, fine to medium sand, trace white calcareous clay	F: 0.9 ppm	Driller reports relatively fast drilling to this point without rig chatter
95.0							
100.0							
105.0							
110.0	110.0 111.0	9-C		1.0	SILTY SAND WITH CLAY (SM), light brown to olive-green-gray, moist, fine sand with trace calcareous layers and trace gravel	F: 1.8 ppm	
115.0							
120.0							

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW- 1A	SHEET 5 OF 17

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18 East of Building 114

ELEVATION 392.8 ft DRILLING CONTRACTOR Beylik Drilling, Inc.

DRILLING METHOD AND EQUIPMENT Mud Rotary (Ingersol-Rand TH 100) 18" Flight Auger from 0 to 14 ft

WATER LEVEL AND DATE 248.6 1/19/93 START 6/15/92 FINISH 6/18/92 LOGGER J. Lovenburg

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
125.0							
130.0	130.0 – 131.5	10-C		1.5	WELL GRADED SAND (SW), brown moist, fine to medium sand	F: 25 ppm	
					SILTY SAND (SM), greenish gray, moist, fine sand, slight HCl reaction		
135.0							
140.0							
145.0							
150.0							

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW- 1A	SHEET 6 OF 17

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18 East of Building 114

ELEVATION 392.8 ft DRILLING CONTRACTOR Beylik Drilling, Inc.

DRILLING METHOD AND EQUIPMENT Mud Rotary (Ingersol-Rand TH 100) 18" Flight Auger from 0 to 14 ft

WATER LEVEL AND DATE 248.6 1/19/93 START 6/15/92 FINISH 6/18/92 LOGGER J. Lovenburg

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
							Drilling substantially more difficult, could not retrieve a sample at 150 ft, rig chatter. Discharge coarse cuttings taken with sieve at 150 ft. One clast retrieved at 153 ft.
	153.0–153.2	11-C		0.2	WELL GRADED GRAVEL WITH SAND (GW), brown, fine to medium sand, black and olive-green siltstone, red volcanics, felsic angular fragments	F: 0.0 ppm	Drilling easier again at ~153 ft
155.0					WELL GRADED GRAVEL WITH SAND (GW), brown, fine to medium sand, dark gray quartzite, hematite staining		
160.0							
165.0							
170.0	170.0–171.5	12-C		1.5	SILTY SAND (SM), dusky yellow, moist, fine to medium sand, no HCl reaction, trace gravel, trace white calcareous siltstone-weathered, trace clay	F: 35 ppm	
175.0							
180.0							

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW- 1A	SHEET 7 OF 17

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18 East of Building 114

ELEVATION 392.8 ft DRILLING CONTRACTOR Beylik Drilling, Inc.

DRILLING METHOD AND EQUIPMENT Mud Rotary (Ingersol-Rand TH 100) 18" Flight Auger from 0 to 14 ft

WATER LEVEL AND DATE 248.6 1/19/93 START 6/15/92 FINISH 6/18/92 LOGGER J. Lovenburg

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
185.0							
190.0							Driller reports a little slower drilling No sample retrieval at 190 ft
195.0							
	196.0 197.0	13-C		1.0	SILTY SAND (SM), dusky yellowish-brown, moist, fine sand, with trace white silty calcareous veinlets	F: 350 ppm	
200.0							
205.0							Driller indicates possible gravel
210.0							

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW- 1A	SHEET 8 OF 17

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18 East of Building 114

ELEVATION 392.8 ft DRILLING CONTRACTOR Beylik Drilling, Inc.

DRILLING METHOD AND EQUIPMENT Mud Rotary (Ingersol-Rand TH 100) 18" Flight Auger from 0 to 14 ft

WATER LEVEL AND DATE 248.6 1/19/93 START 6/15/92 FINISH 6/18/92 LOGGER J. Lovenburg

DEPTH BELOW SURFACE (FT)	SAMPLE			PENETRATION TEST RESULTS	SOIL DESCRIPTION	FID/PID READING	COMMENTS
	INTERVAL	TYPE AND NUMBER	RECOVERY (FT)	6"-6"-6"	SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	210.0 211.0	14-C		1.0	POORLY GRADED GRAVEL WITH SAND (GP), light yellowish brown, wet, fine to medium sand, red and yellow angular clasts to 1.5 inches, no HCl reaction	F: 1.5 ppm P: 5.0 ppm	Note: After 210 ft samples will be logged using a sieve in the cuttings, some of the fines may be missing.
215.0							
220.0					From 220 ft, Cuttings: POORLY GRADED GRAVEL WITH SAND, as above with little silt/fine sand balls		
225.0							Driller notes likely 6 to 8 inch gravel lens at 225 ft
230.0							
235.0							
240.0							

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW- 1A	SHEET 9 OF 17

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18 East of Building 114

ELEVATION 392.8 ft DRILLING CONTRACTOR Beylik Drilling, Inc.

DRILLING METHOD AND EQUIPMENT Mud Rotary (Ingersol-Rand TH 100) 18" Flight Auger from 0 to 14 ft

WATER LEVEL AND DATE 248.6 1/19/93 START 6/15/92 FINISH 6/18/92 LOGGER J. Lovenburg

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					From 240 ft, Cuttings: SANDY GRAVEL WITH SILT (GM), light brown, mostly fine sand, fine to medium sand, gravel to 1/4 inch, subrounded to angular		Driller indicates a few feet of gravel
245.0							
							Some caving between 230 and 250 ft Rereamed and 2 bags bentonite added
250.0					From 250 ft, Cuttings: SANDY GRAVEL WITH SILT (GM), as above, includes red volcanics, white quartz, green and black siltstone, and yellow fragments		
255.0							
260.0					From 260 ft, Cuttings: SANDY GRAVEL WITH SILT (GM), as above, with gravel to 1/2-inch		
265.0							Some rig chatter
270.0							

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW- 1A	SHEET 10 OF 17

SOIL BORING LOG

PROJECT: MCAS El Toro RI/FS Phase I LOCATION: Site 18 East of Building 114

ELEVATION: 392.8 ft DRILLING CONTRACTOR: Beylik Drilling, Inc.

DRILLING METHOD AND EQUIPMENT: Mud Rotary (Ingersol-Rand TH 100) 18" Flight Auger from 0 to 14 ft

WATER LEVEL AND DATE: 248.6 1/19/93 START: 6/15/92 FINISH: 6/18/92 LOGGER: J. Lovenburg

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					From 270 ft, Cuttings: SILTY SANDY GRAVEL WITH CLAY (GM), light brown, fine sand, with clayey silt balls, red and black gravel		Added 14 bags bentonite
275.0							
280.0					From 280 ft, Cuttings: SANDY GRAVEL WITH SILT (GM), light brown, fine to medium sand		Some fines may be lost in sieve
							Some rig chatter
285.0							
							Some rig chatter
290.0					From 290 ft, Cuttings: SANDY GRAVEL WITH SILT (GM), as above, with mostly green siltstone gravel		
295.0							
300.0							

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW- 1A	SHEET 11 OF 17

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18 East of Building 114

ELEVATION 392.8 ft DRILLING CONTRACTOR Beylik Drilling, Inc.

DRILLING METHOD AND EQUIPMENT Mud Rotary (Ingersol-Rand TH 100) 18" Flight Auger from 0 to 14 ft

WATER LEVEL AND DATE 248.6 1/19/93 START 6/15/92 FINISH 6/18/92 LOGGER J. Lovenburg

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					From 300 ft, Cuttings: SILTY GRAVEL (GM), light brown, fine to medium sand		
305.0							
310.0					From 310 ft, Cuttings: SILTY SAND WITH GRAVEL (SM), light brown, fine sand, variety of gravel colors		Relatively easy drilling reported by driller
315.0							
320.0					From 319 ft, Cuttings: SILTY GRAVEL WITH SILT (GM), light brown, fine to medium sand, angular gravel		Rig chatter- gravel at 319 to 323 ft
					From 323 ft, Cuttings: SILTY SAND WITH GRAVEL (SM), light brown, fine to medium sand, trace clay		
325.0							
330.0							

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW- 1A	SHEET 12 OF 17

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18 East of Building 114

ELEVATION 392.8 ft DRILLING CONTRACTOR Beylik Drilling, Inc.

DRILLING METHOD AND EQUIPMENT Mud Rotary (Ingersol-Rand TH 100) 18" Flight Auger from 0 to 14 ft

WATER LEVEL AND DATE 248.6 1/19/93 START 6/15/92 FINISH 6/18/92 LOGGER J. Lovenburg

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION (SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY)	FID/PID READING	COMMENTS (DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION)
					From 330 ft, Cuttings: ~~SILTY GRAVEL (GM)~~, as above SILTY SAND w/ GRAVEL (SM)		
335.0							
340.0					From 340 ft, Cuttings: SILTY SAND WITH GRAVEL (SM), as above, with few gray silty clay balls		Driller holding back on weight, easier drilling
345.0							
350.0					From 350 ft, Cuttings: SILTY GRAVEL WITH SILT (GM), as above, some clay, no gray silty clay balls		
					From 352 ft, Cuttings: POORLY GRADED GRAVEL WITH SAND (GP), light brown, fine sand, little silt, trace tan silt balls		Difficult drilling 352 to 358 ft
355.0							Trying to thicken mud to stop water loss into formation
					From 358 ft, Cuttings: WELL GRADED SAND WITH GRAVEL (SW), light brown, fine to medium sand, angular gravel		
360.0							

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW- 1A	SHEET 13 OF 17

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18 East of Building 114

ELEVATION 392.8 ft DRILLING CONTRACTOR Beylik Drilling, Inc.

DRILLING METHOD AND EQUIPMENT Mud Rotary (Ingersol-Rand TH 100) 18" Flight Auger from 0 to 14 ft

WATER LEVEL AND DATE 248.6 1/19/93 START 6/15/92 FINISH 6/18/92 LOGGER J. Lovenburg

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					From 360 ft, Cuttings: WELL GRADED SAND WITH GRAVEL, as above		Driller has been slowly adding bentonite to reduce water loss and caving
365.0							
370.0					From 370 ft, Cuttings: WELL GRADED SAND WITH GRAVEL, as above, light tan-brown		
375.0					From 375 ft, Cuttings: GRAVEL WITH SAND (GW), light tan-brown, fine sand, little silt and clay, gravel to 1 inch		Driller reports rig chatter between 375 and 382 ft
380.0					From 382 ft, Cuttings: SILTY SAND WITH GRAVEL (SM), light tan-brown, fine sand, some tannish-yellow clay balls		
385.0							
390.0							

CH2MHILL

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW- 1A	SHEET 14 OF 17

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18 East of Building 114

ELEVATION 392.8 ft DRILLING CONTRACTOR Beylik Drilling, Inc.

DRILLING METHOD AND EQUIPMENT Mud Rotary (Ingersol-Rand TH 100) 18" Flight Auger from 0 to 14 ft

WATER LEVEL AND DATE 248.6 1/19/93 START 6/15/92 FINISH 6/18/92 LOGGER J. Lovenburg

DEPTH BELOW SURFACE (FT)	SAMPLE			PENETRATION TEST RESULTS	SOIL DESCRIPTION	FID/PID READING	COMMENTS
	INTERVAL	TYPE AND NUMBER	RECOVERY (FT)	6"-6"-6"	SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					From 390 ft, Cuttings: SILTY SAND WITH GRAVEL (SM), as above , except tan, abundant tan silt balls		*Driller reports significantly easier* drilling, lithology change
395.0							
400.0					From 400 ft, Cuttings: SILTY SAND WITH GARVEL (SM), *tan to yellowish orange, fine to medium grained,* some gravel altered to yellow-orange clay		
405.0							Drilling a little slower
410.0							
415.0					From 415 ft, Cuttings: SANDY SILT WITH GRAVEL (ML), yellowish orange to light tan green, little clay, fining downwards		
420.0							

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW- 1A	SHEET 15 OF 17

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18 East of Building 114

ELEVATION 392.8 ft DRILLING CONTRACTOR Beylik Drilling, Inc.

DRILLING METHOD AND EQUIPMENT Mud Rotary (Ingersol-Rand TH 100) 18" Flight Auger from 0 to 14 ft

WATER LEVEL AND DATE 248.6 1/19/93 START 6/15/92 FINISH 6/18/92 LOGGER J. Lovenburg

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
							Driller reports "stickier" drilling
					From 422 ft, Cuttings: SANDY SILT (ML), olive-green, fine sand, orange and red clasts weathered to silt and clay, little gravel		
425.0							
430.0					From 431 ft, Cuttings: SILTY SAND WITH GARVEL (SM), light pinkish tan, fine and coarse sand, abundant weathered granitic clasts		
435.0							More difficult drilling reported by driller
440.0							
445.0					From 444 ft, Cuttings: POORLY GRADED GRAVEL WITH SAND (GP), light tan brown, fine to coarse sand, angular granitic and volcanic fragments, little silt		
450.0							

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW- 1A	SHEET 16 OF 17

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18 East of Building 114

ELEVATION 392.8 ft DRILLING CONTRACTOR Beylik Drilling, Inc.

DRILLING METHOD AND EQUIPMENT Mud Rotary (Ingersol-Rand TH 100) 18" Flight Auger from 0 to 14 ft

WATER LEVEL AND DATE 248.6 1/19/93 START 6/15/92 FINISH 6/18/92 LOGGER J. Lovenburg

DEPTH BELOW SURFACE (FT)	SAMPLE			PENETRATION TEST RESULTS	SOIL DESCRIPTION	FID/PID READING	COMMENTS
	INTERVAL	TYPE AND NUMBER	RECOVERY (FT)	6"-6"-6"	SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					From 450 ft, Cuttings: SILTY SAND WITH GRAVEL (SW), pinkish-rust color, fine and coarse sand, mostly fine, trace clay, weathered granitic fragments, some green sitstone fragments		
455.0							Driller reports difficult drilling, but no rig chatter
460.0					From 460 ft, Cuttings: SILTY SAND WITH GRAVEL (SW), as above, abundant weathered granitics		
465.0							
470.0					From 470 ft, Cuttings: SILTY SAND WITH GRAVEL (SW), as above, gravel not as weathered		
475.0							
480.0							

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW- 1A	SHEET 17 OF 17

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18 East of Building 114

ELEVATION 392.8 ft DRILLING CONTRACTOR Beylik Drilling, Inc.

DRILLING METHOD AND EQUIPMENT Mud Rotary (Ingersol-Rand TH 100) 18" Flight Auger from 0 to 14 ft

WATER LEVEL AND DATE 248.6 1/19/93 START 6/15/92 FINISH 6/18/92 LOGGER J. Lovenburg

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					From 480 ft, Cuttings: SILTY GRAVEL WITH SAND (GM), pinkish tan, coarse sand, subangular to angular gravel to 1/4 inch, little clay		480 to 490 rig chatter, slow drilling Drilling mud seems thicker
485.0							
490.0					From 490 ft, Cuttings: SILTY GRAVEL WITH SAND (GM), as above, pinkish rust, some green and black clasts		
495.0							Difficult drilling Pieces of drill bit observed in cuttings
500.0					Total Depth - 500 ft		
505.0							
510.0							

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-1E	SHEET 1 OF 8

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18

ELEVATION 391.5 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT CME 95 HSA, 11 1/4" O.D., 7 1/4" I.D., California Modified Sampler

WATER LEVEL AND DATE 215.2 ft 1/19/93 START 8/5/92 16:42 FINISH 8/7/92 15:00 LOGGER C.D.Webb

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					From 0-7 ft, Cuttings: ORGANIC SOIL WITH SAND (OL/OH), dusky yellow brown (10 YR 2/2), moist, fine sand, musty organic odor		Headspace measured with OVA-128
5.0							
	8.0 - 10.0	1-C	1.1	7-7-9	WELL GRADED SAND WITH SILT (SW-SM), moderate yellow brown, (10 YR 5/4), moist to medium sand, fine mica, 10-15% silt, trace fine clay, trace roots, trace fine gravel	F: 0 ppm	
10.0							Rig chattering Cuttings have musty organic smell like peat moss
15.0							
	18.0 - 20.0	2-C	1.1	11-17-23	SILTY SAND (SM), light brown (5 YR 5/6), moist, fine to medium sand, approximately 30% silt, some mica	F: 0 ppm	
20.0							
25.0							
	28.0 - 30.0	3-C	1.5	8-12-16	SILTY SAND (SM), medium to dark yellow brown (10 YR 5/4) moist, fine to medium sand, approximately 15% silt, micaceous	F: 0 ppm	
30.0							

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
LAO31981	1E	SHEET 2 OF 8

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18

ELEVATION 391.5 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT CME 95 HSA, 11 1/4" O.D., 7 1/4" I.D., California Modified Sampler

WATER LEVEL AND DATE 215.2 ft 1/19/93 START 8/5/92 16:42 FINISH 8/7/92 15:00 LOGGER C.D.Webb

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
35.0							Large gravel in cuttings at 35 ft bgs
	38.0 – 40.0	4-C	1.5	12-21-30	SANDY SILT (ML), medium to dark yellow brown (10 YR 5/4-10 YR 4/2), moist, fine sand, approximately 30-35% sand, calcareous seams, trace gravel, some clay, tight	F:0.8 ppm	
40.0							
45.0							Cuttings steaming Driller says hard drilling until last 5 ft
	48.0 – 50.0	5-C	1.5	8-11-11	WELL GRADED SAND WITH SILT (SW-SM), medium yellow brown (10 YR 5/4), moist, fine to medium sand, approximately 10% silt, loose, with tubular chunks of caliche-like material, approximately 1/2 inch diameter by 1 inch long	F:3.0 ppm	
50.0							Driller added water outside augers
55.0							55-60 ft hot cuttings, gravel in cutttings
	58.0 – 50.0	6-C		16-40-40	WELL GRADED SAND (SW), medium yellow brown (10 YR 5/4), moist, fine to coarse sand, some gravel, sub-rounded to sub-angular	F:9.0 ppm	
60.0							

PROJECT NUMBER	BORING NUMBER	
LAO31981	1E	SHEET 3 OF 8

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18

ELEVATION 391.5 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT CME 95 HSA, 11 1/4" O.D., 7 1/4" I.D., California Modified Sampler

WATER LEVEL AND DATE 215.2 ft 1/19/93 START 8/5/92 16:42 FINISH 8/7/92 15:00 LOGGER C.D.Webb

DEPTH BELOW SURFACE (FT)	SAMPLE			PENETRATION TEST RESULTS	SOIL DESCRIPTION	FID/PID READING	COMMENTS
	INTERVAL	TYPE AND NUMBER	RECOVERY (FT)	6"-6"-6"	SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
65.0							
70.0					From 70 ft, Cuttings: SANDY SILT (ML), dark yellow brown (10 YR 4/2), moist (added water), fine sand, clayey		Driller added water outside augers
75.0							
	78.0 – 80.0	7-C	1.5	13-25-35	SILT WITH SAND, (ML), medium yellow brown (10 YR 5/4), moist, tight, fine sand approximately 20%, mica, some clay	F:0.8 ppm	
80.0							Driller added water outside augers
85.0							
90.0					From 90 ft, Cuttings: SILTY SAND (SM), dark yellow brown, (10 YR 4/2) moist, fine to medium, sand, some clay		

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
LAO31981	1E	SHEET 4 OF 8

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18

ELEVATION 391.5 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT CME 95 HSA, 11 1/4" O.D., 7 1/4" I.D., California Modified Sampler

WATER LEVEL AND DATE 215.2 ft 1/19/93 START 8/5/92 16:42 FINISH 8/7/92 15:00 LOGGER C.D.Webb

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
95.0							
	98.0–100.0	8-C	1.5	11-17-25	SILT WITH SAND (ML), dark yellow brown (10 YR 4/2), moist, fine sand, approximately 5-10% sand, riddled with pale yellow brown calcareous seams, clayey	F:0.5 ppm	
100.0							Break for lunch, drilling again 13:0 Driller added water outside augers
105.0							
110.0					From about 110 ft, Cuttings: SILT WITH SAND (ML), similar to above, except can't see calcareous seams in disturbed cuttings		Driller added water outside augers
115.0							
	118.0–120.0	9-C	1.5	10-17-29	Top 15 inches: SILT WITH SAND (ML), similar to 8-C with seams, gravel Bottom 3 inches: SANDY SILT (ML), moderate yellow brown, moist, fine sand, micaceous	F:3.9 ppm	
120.0							

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
LAO31981	1E	SHEET 5 OF 8

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18

ELEVATION 391.5 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT CME 95 HSA, 11 1/4" O.D., 7 1/4" I.D., California Modified Sampler

WATER LEVEL AND DATE 215.2 ft 1/19/93 START 8/5/92 16:42 FINISH 8/7/92 15:00 LOGGER C.D.Webb

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
125.0							
130.0					From about 130 ft, Cuttings: SILT WITH SAND (ML), dark yellow brown (10 YR 4/2), moist, 5-10% fine sand, some clay, slightly moldable		Driller added water outside augers Slow going
135.0							
	138.0						
		10-C	1.5	14-27-16	Top 3": SILTY SAND (SM), medium yellow brown, moist, fine to medium sand, some gravel and clay Middle 12" WELL GRADED SAND WITH GRAVEL (SW), pale yellow brown, moist, fine to coarse sand, gravel up to 1/2" dia., some silt Bottom 3": SILT WITH SAND (ML), medium yellow brown (10 YR 5/4), fine sand, micaceous, some clay and calcareous seams	F:20 ppm	
140.0	140.0						Driller added water outside augers
145.0							
					From about 150 ft, Cuttings: SILT WITH SAND (ML), dark yellow brown (10 YR 5/4), moist, fine sand, about 10%, trace rounded gravel, clayey		
150.0							

PROJECT NUMBER	BORING NUMBER	
LAO31981	1E	SHEET 6 OF 8

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18

ELEVATION 391.5 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT CME 95 HSA, 11 1/4" O.D., 7 1/4" I.D. California Modified Sampler

WATER LEVEL AND DATE 215.2 ft 1/19/93 START 8/5/92 16:42 FINISH 8/7/92 15:00 LOGGER C.D.Webb

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
155.0							
	158.0–160.0	11-C	1.5	12-36-50/(2")	Top 15": SILTY SAND (SM), medium yellow brown (10 YR 5/4), moist, fine sand to very fine sand and silt, trace mica, trace ferrous material, trace calcareous seams, increased sand with depth Bottom 3": WELL GRADED SAND WITH SILT AND GRAVEL (SW-SM), similar to above, with increasingly large sand fraction and some gravel up to 2" dia., siltstone	F:6.4 ppm	
160.0							
165.0							
170.0					From about 170 ft, Cuttings: WELL GRADED SAND WITH SILT AND GRAVEL (SW-SM), similar to 11-C, bottom 3 inches		Gravel in cuttings up to 2" in diameter rounded to subrounded fossiliferous limestone, chert
175.0							
	178.0–180.0	12-C	1.5	20-39-52	SILTY SAND (SM), medium yellow brown, moist, fine to medium sand, dense, some gravel, siltstone, trace clay	F:20 ppm	
180.0							

PROJECT NUMBER	BORING NUMBER	
LAO31981	1E	SHEET 7 OF 8

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18

ELEVATION 391.5 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT CME 95 HSA, 11 1/4" O.D., 7 1/4" I.D., California Modified Sampler

WATER LEVEL AND DATE 215.2 ft 1/19/93 START 8/5/92 16:42 FINISH 8/7/92 15:00 LOGGER C.D.Webb

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
							Driller added water to outside of augers
185.0							
190.0					From about 190 ft, Cuttings: SILTY SAND (SM), dark yellow brown (10 YR 4/2), moist, fine to coarse sand, some mica, some clay (slightly moldable)		
195.0							
	198.0						
		13-C	1.5	11-21-32	SANDY LEAN CLAY WITH GRAVEL, (CL), moderate yellow brown (10 YR 5/4), moist stiff, fine to medium sand, rounded gravel up to 0.5" diameter, ferrous dicolorations (black seams)	F:1.5 ppm	
200.0	200.0						
205.0							
					From about 210 ft, Cuttings: SANDY SILT (ML), medium yellow brown (10 YR 5/4), moist, stiff, moldable with clay, fine sand, some fine gravel		
210.0							

PROJECT NUMBER	BORING NUMBER
LAO31981	1E SHEET 8 OF 8

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18

ELEVATION 391.5 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT CME 95 HSA, 11 1/4" O.D., 7 1/4" I.D., California Modified Sampler

WATER LEVEL AND DATE 215.2 ft 1/19/93 START 8/5/92 16:42 FINISH 8/7/92 15:00 LOGGER C.D.Webb

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
215.0							
	218.0						
	220.0	14-C	1.5	14-26-34	SANDY SILT (ML), similar to cuttings at 210 ft with siltstone and some calcareous nodules	F:4.2 ppm	
220.0							Sampler wet
							Driller added water inside augers
225.0							
230.0					From center bit at 233 ft, Cuttings: SILTY SAND WITH GRAVEL (SM), medium yellow brown (10 YR 5/4), wet, fine sand, fine rounded to subrounded gravel up to 2" diameter		
					Total Depth = 233 ft bgs		
235.0							
240.0							

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW- 2A	SHEET 1 OF 16

SOIL BORING LOG

PROJECT: MCAS El Toro RI/FS Phase I
LOCATION: Site 18 North of Golf Course
ELEVATION: 391.1 ft
DRILLING CONTRACTOR: Beylik Drilling, Inc.
DRILLING METHOD AND EQUIPMENT: Mud Rotary (Ingersol-Rand TH 100) 18" flight auger to 8'
WATER LEVEL AND DATE: 175.6 ft 1/19/93
START: 5/19/92
FINISH: 5/19/92
LOGGER: J. Lovenburg

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					From 0.0 to 5.0 ft, Cuttings: SILT (ML), dark brown, dry		18" flight auger to 8 ft.
5.0					From 5.0 to 8.0 ft, Cuttings: SILTY SAND (SM), brown, dry, loose		12 ft of 14" mild steel conductor casing 8 ft in hole, 4 ft above ground
10.0	10.0–12.0	1-CB	2.0		SILTY SAND (SM), brown, moist	P: 0 ppm	
15.0							
20.0	20.0–21.0	2-CB			SILTY SAND (SM), brown, moist	P: 0 ppm	
25.0							
30.0							

CH2MHILL

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW- 2A	SHEET 2 OF 16

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18 North of Golf Course

ELEVATION 391.1 ft DRILLING CONTRACTOR Beylik Drilling, Inc.

DRILLING METHOD AND EQUIPMENT Mud Rotary (Ingersol-Rand TH 100) 18" flight auger to 8'

WATER LEVEL AND DATE 175.6 ft 1/19/93 START 5/19/92 FINISH 5/19/92 LOGGER J. Lovenburg

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	30.0 32.0	3-CB	2		WELL GRADED SAND (SW), brown, moist	P: 0.5 ppm	
35							
40	40.0 43.0	4-CB	4		WELL GRADED SAND (SW), light brown, moist	P: 0 ppm	
45							
50	50.0 53.0	5-CB	3		WELL GRADED SAND WITH SILT (SW-SM), light brown, moist, mostly quartz and plagioclase	P: 0 ppm	
55							
60							

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW- 2A	SHEET 3 OF 16

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18 North of Golf Course

ELEVATION 391.1 ft DRILLING CONTRACTOR Beylik Drilling, Inc.

DRILLING METHOD AND EQUIPMENT Mud Rotary (Ingersol-Rand TH 100) 18" flight auger to 8'

WATER LEVEL AND DATE 175.6 ft 1/19/93 START 5/19/92 FINISH 5/19/92 LOGGER J. Lovenburg

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	60.0 62.0	6-CB	2		SILTY SAND (SM), light brown, moist, some brown staining	P: 0 ppm	
65							
70							Smooth drilling
75							
80	80.0 81.0	7-CB	1		WELL GRADED SAND WITH SILT (SM), light brown, moist	P: 0 ppm	
85							
90							

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW- 2A	SHEET 4 OF 16

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18 North of Golf Course

ELEVATION 391.1 ft DRILLING CONTRACTOR Beylik Drilling, Inc.

DRILLING METHOD AND EQUIPMENT Mud Rotary (Ingersol-Rand TH 100) 18" flight auger to 8'

WATER LEVEL AND DATE 175.6 ft 1/19/93 START 5/19/92 FINISH 5/19/92 LOGGER J. Lovenburg

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
95							
100	100.0						
	101.0	8-CB	1.0		SILTY SAND (SM), light brown, moist, some brown staining, quartz and plagioclase with some pyrite	P: 0 ppm	
105							
110					From about 110 ft, Cuttings: SAND WITH SILT (SM), light brown, well graded		
115							
120							

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW- 2A	SHEET 5 OF 16

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18 North of Golf Course

ELEVATION 391.1 ft DRILLING CONTRACTOR Beylik Drilling, Inc.

DRILLING METHOD AND EQUIPMENT Mud Rotary (Ingersol-Rand TH 100) 18" flight auger to 8'

WATER LEVEL AND DATE 175.6 ft 1/19/93 START 5/19/92 FINISH 5/19/92 LOGGER J. Lovenburg

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	120.0 121.5	9-CB	1.5		SILTY SAND (SM), light brown, moist, medium dense, trace gravel, some gravel has been altered to clay (yellow mottling)	P: 0 ppm	
125							
130							
135							Driller notes a little more difficult drilling - grinding sound
140	140.0 141.5	10-CB	1.5		POORLY GRADED SAND (SP), light brown, moist, coarse-medium sand	P: 0 ppm	Driller notes that drilling is smooth again
145							
150							

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW- 2A	SHEET 6 OF 16

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18 North of Golf Course

ELEVATION 391.1 ft DRILLING CONTRACTOR Beylik Drilling, Inc.

DRILLING METHOD AND EQUIPMENT Mud Rotary (Ingersol-Rand TH 100) 18" flight auger to 8'

WATER LEVEL AND DATE 175.6 ft 1/19/93 START 5/19/92 FINISH 5/19/92 LOGGER J. Lovenburg

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
155							
							Driller notes a little rougher drilling at this interval
160	160.0						
	161.0	11-CB	< 1.0		SILTY SAND (SM), light brown, moist, medium dense, well graded sand, trace olive-gray siltstone chips	P: 0 ppm	
165							
170							
175							
180							

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW- 2A	SHEET 7 OF 16

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18 North of Golf Course

ELEVATION 391.1 ft DRILLING CONTRACTOR Beylik Drilling, Inc.

DRILLING METHOD AND EQUIPMENT Mud Rotary (Ingersol-Rand TH 100) 18" flight auger to 8'

WATER LEVEL AND DATE 175.6 ft 1/19/93 START 5/19/92 FINISH 5/19/92 LOGGER J. Lovenburg

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	180.0–184.0	12-CB	4.0		SILTY SAND WITH GRAVEL (SM), light brown, wet, gravel to 1" max., gravel includes siltstone and altered cobbles	P: 0 ppm	
185							
190							
195							
200	200.0–202.0	13-CB	2.0		SILTY SAND (SM), light brown, wet, fine-medium sand, trace gravel fragments and SILT (ML), olive-green, moist, silt lens, about 0.5 ft thick		
205							
210							

CH2M HILL

PROJECT NUMBER	BORING NUMBER
LAO31981	MW- 2A SHEET 8 OF 16

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18 North of Golf Course

ELEVATION 391.1 ft DRILLING CONTRACTOR Beylik Drilling, Inc.

DRILLING METHOD AND EQUIPMENT Mud Rotary (Ingersol-Rand TH 100) 18" flight auger to 8'

WATER LEVEL AND DATE 175.6 ft 1/19/93 START 5/19/92 FINISH 5/19/92 LOGGER J. Lovenburg

DEPTH BELOW SURFACE (FT)	SAMPLE			PENETRATION TEST RESULTS	SOIL DESCRIPTION	FID/PID READING	COMMENTS
	INTERVAL	TYPE AND NUMBER	RECOVERY (FT)	6"-6"-6"	SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					From about 210.0 to 220.0 ft, Cuttings: WELL-GRADED GRAVEL WITH SAND (GW), brown, wet, gravel to 1/4"		Driller indicates water table at about 210 ft.
215							
220					From about 220.0 to 235.0 ft, Cutting: WELL-GRADED GRAVEL WITH SAND (GW), light brown, wet		Bentonite was added to stop water loss at water table
225							Some rig chatter
230							
235					from about 235.0 to 245.0 ft, Cutting: WELL-GRADED GRAVEL WITH SAND (GW), light brown, wet, trace silt balls		
240							

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW- 2A	SHEET 9 OF 16

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18 North of Golf Course

ELEVATION 391.1 ft DRILLING CONTRACTOR Beylik Drilling, Inc.

DRILLING METHOD AND EQUIPMENT Mud Rotary (Ingersol-Rand TH 100) 18" flight auger to 8'

WATER LEVEL AND DATE 175.6 ft 1/19/93 START 5/19/92 FINISH 5/19/92 LOGGER J. Lovenburg

DEPTH BELOW SURFACE (FT)	SAMPLE			PENETRATION TEST RESULTS	SOIL DESCRIPTION	FID/PID READING	COMMENTS
	INTERVAL	TYPE AND NUMBER	RECOVERY (FT)	6"-6"-6"	SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
245					From about 245.0 to 255.0 ft, Cuttings: WELL-GRADED GRAVEL WITH SAND (GW), light brown, same as above		
250							
255					From about 255.0 to 280.0 ft, Cuttings: SILTY SAND (SM), olive-green, wet, fine sand, trace gravel		NOTE: Mud is very thick. Logging is difficult. Samples are pulled from screen - much of fine portion may be lost
260							
265							
270							

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW- 2A	SHEET 10 OF 16

SOIL BORING LOG

PROJECT: MCAS El Toro RI/FS Phase I LOCATION: Site 18 North of Golf Course

ELEVATION: 391.1 ft DRILLING CONTRACTOR: Beylik Drilling, Inc.

DRILLING METHOD AND EQUIPMENT: Mud Rotary (Ingersol-Rand TH 100) 18" flight auger to 8'

WATER LEVEL AND DATE: 175.6 ft 1/19/93 START: 5/19/92 FINISH: 5/19/92 LOGGER: J. Lovenburg

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION (SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY)	FID/PID READING	COMMENTS (DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION)
275							
280					From about 280.0 to 290.0 ft, Cuttings: SILTY SAND WITH GRAVEL (SM), olive-green, fine sand, abundant silt balls		
285							
290					From about 290.0 to 300.0 ft, Cuttings: SILTY SAND WITH GRAVEL (SM), same as above, olive-green, fine sand and silt balls, angular to subangular gravel, some gravel has been altered to orangish silt		Drill bit chatter - may be on gravel NOTE: Logging off screen. Mud is too thick to get samples from discharge. May be missing fines. Drilling smooth again
295							
300							

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW- 2A	SHEET 11 OF 16

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18 North of Golf Course

ELEVATION 391.1 ft DRILLING CONTRACTOR Beylik Drilling, Inc.

DRILLING METHOD AND EQUIPMENT Mud Rotary (Ingersol-Rand TH 100) 18" flight auger to 8'

WATER LEVEL AND DATE 175.6 ft 1/19/93 START 5/19/92 FINISH 5/19/92 LOGGER J. Lovenburg

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					From about 300.0 to 315.0 ft, Cuttings: SILTY SAND WITH GRAVEL (SM), same as above		
305							
310							Driller reports smooth drilling - a little slowed
315					From 315.0 to 325.0 ft, Cuttings: SILTY SAND WITH GRAVEL (SM), olive-green, fine sand and silt, angular to subangular gravel to 1/8"		
							Pop-off valve blew drilling stopped
320							
325					From about 325.0 to 330.0 ft, Cuttings: SILTY SAND WITH GRAVEL (SM), olive-green, fine sand, some gravel is altered to orangish yellow silt		
							Driller reports drilling was slower from 310 to 330 ft
330							

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW- 2A	SHEET 12 OF 16

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18 North of Golf Course

ELEVATION 391.1 ft DRILLING CONTRACTOR Beylik Drilling, Inc.

DRILLING METHOD AND EQUIPMENT Mud Rotary (Ingersol-Rand TH 100) 18" flight auger to 8'

WATER LEVEL AND DATE 175.6 ft 1/19/93 START 5/19/92 FINISH 5/19/92 LOGGER J. Lovenburg

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					From about 330.0 to 340.0 ft, Cuttings: SILTY SAND WITH GRAVEL (SM), same as above		Drilling a little faster
335							
340					From about 340.0 to 350.0 ft, Cuttings: POORLY-GRADED SAND WITH SILT AND GRAVEL (SP-SM), tan, fine sand, trace silt and angular gravel		Driller reports easier drilling from 340 ft
345							
350					From 350.0 to 360.0 ft, Cuttings: POORLY-GRADED SAND WITH GRAVEL (SP), tan-grey, fine-medium sand, alternating with SILTY SAND WITH GRAVEL (SM), olive-green, tan and grey units alternate every few feet		Tan sand drills easier Driller reports alternating easy and hard drilling every few feet between 350 and 365 feet b.g.s.
355							
360							

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW- 2A	SHEET 13 OF 16

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18 North of Golf Course

ELEVATION 391.1 ft DRILLING CONTRACTOR Beylik Drilling, Inc.

DRILLING METHOD AND EQUIPMENT Mud Rotary (Ingersol-Rand TH 100) 18" flight auger to 8'

WATER LEVEL AND DATE 175.6 ft 1/19/93 START 5/19/92 FINISH 5/19/92 LOGGER J. Lovenburg

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					From 360.0 to 365.0 ft, Cuttings: POORLY-GRADED SAND WITH GRAVEL (SP), and SILTY SAND WITH GRAVEL (SM), same as above		
365					From 365.0 to 369.0 ft Cuttings: POORLY-GRADED SAND WITH GRAVEL (SP),light grey, medium-fine sand, angular gravel		
370	370.0 371.0	14-CB	0.25		POORLY-GRADED SAND (SP), olive-green, dense, fine-medium sand, not cemented	P: 0 ppm	Very hard drilling reported
375							Driller reports hard drilling with rig chatter from 370 ft down
380							
385					From 385.0 to 390.0 ft, Cuttings: POORLY-GRADED SAND (SP), same as above, with grey clay balls		
390							

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW- 2A	SHEET 14 OF 16

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18 North of Golf Course

ELEVATION 391.1 ft DRILLING CONTRACTOR Beylik Drilling, Inc.

DRILLING METHOD AND EQUIPMENT Mud Rotary (Ingersol-Rand TH 100) 18" flight auger to 8'

WATER LEVEL AND DATE 175.6 ft 1/19/93 START 5/19/92 FINISH 5/19/92 LOGGER J. Lovenburg

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					From 390.0 to 405.0 ft, Cuttings: SANDY SILT WITH GRAVEL (ML), olive-grey, clay balls (grey), some tan silt balls, trace granite fragments		13:15 start 5/22 Rough drilling, drill pipe bouncing in hole
395							
400							
405					From 405.0 to 410.0 ft, Cuttings: SILTY SAND (SM), light brown, trace gravel		
410					From 410.0 to 430.0 ft, Cuttings: SILTY SAND (SM), gray, trace granitic gravel, fine sand		Drilling is substantially slower. Drill pipe is bouncing back and forth in hole. Driller notes very difficult drilling, indicates larger pieces may be broken up into sand and silt.
415							Driller notes he has increased drilling pressure significantly
420							

PROJECT NUMBER	BORING NUMBER		
LAO31981	MW- 2A	SHEET 15	OF 16

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18 North of Golf Course

ELEVATION 391.1 ft DRILLING CONTRACTOR Beylik Drilling, Inc.

DRILLING METHOD AND EQUIPMENT Mud Rotary (Ingersol-Rand TH 100) 18" flight auger to 8'

WATER LEVEL AND DATE 175.6 ft 1/19/93 START 5/19/92 FINISH 5/19/92 LOGGER J. Lovenburg

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
							Driller indicates bit may be chewed up
425							
430					From 430.0 to 450.0 ft, Cuttings: SILTY SAND (SM), same as above, with some green siltstone chips		
435							
440							Driller has eased back on pressure and drilling is quicker
445							
							Last 20 ft in 14 minutes
450							

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW- 2A	SHEET 16 OF 16

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18 North of Golf Course

ELEVATION 391.1 ft DRILLING CONTRACTOR Beylik Drilling, Inc.

DRILLING METHOD AND EQUIPMENT Mud Rotary (Ingersol-Rand TH 100) 18" flight auger to 8'

WATER LEVEL AND DATE 175.6 ft 1/19/93 START 5/19/92 FINISH 5/19/92 LOGGER J. Lovenburg

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					From 450.0 to 455.0 ft, Cuttings: SILTY SAND (SM), same as above, no siltstone chips, no gravel		
455					From 455.0 to 460.0 ft, Cuttings: SILTY SAND (SM), gray, and POORLY-GRADED SAND (SP), tan interbedded, every few feet, sand is fine-grained		Drilling more difficult Alternating hard and soft sections
460					From 460.0 to 470.0 ft, Cuttings: SILTY SAND WITH GRAVEL (SM), gray, fine-grained sand		Drilling slower, rig chatter
465							
470					Total Depth - 470 ft		
475							
480							

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-3A	SHEET 1 OF 16

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18 Near Building 297

ELEVATION 279.6 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Ingersoll Rand TH 100 Mud Rotary

WATER LEVEL AND DATE 118.0 ft 1/19/93 START 6/22/92 FINISH 6/23/92 LOGGER MacGillivray / Chuang

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
5.0							
10.0	10.0–12.0	1-C			POORLY GRADED SAND (SP), reddish brown, moist, some silt, no gravel, fine to medium sand		
15.0							
20.0	20.0–22.0	2-C	2.0		POORLY GRADED SAND WITH SILT (SP-SM), reddish brown, moist, fine to medium sand, some gravel fragments	F: 45 ppm	
25.0							
30.0							

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-3A	SHEET 2 OF 16

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18 Near Building 297

ELEVATION 279.6 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Ingersoll Rand TH 100 Mud Rotary

WATER LEVEL AND DATE 118.0 ft 1/19/93 START 6/22/92 FINISH 6/23/92 LOGGER MacGillivray / Chuang

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	30.0–34.0	3-C	.5		POORLY GRADED SAND (SP), reddish brown, moist, some silt, no gravel, reddish brown, fine to medium sand	F: 18 ppm	
35.0							
40.0	40.0–42.0	4-C	2.0		POORLY GRADED SAND (SP), reddish brown, moist, some silt, trace gravel, fine to coarse sand	F: 12 ppm	
45.0							
50.0	50.0–52.0	5-C	2.0		POORLY GRADED SAND (SP), reddish brown, moist to wet, some silt, trace gravel, fine to coarse sand	F: 8 ppm	
55.0							
60.0							

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-3A	SHEET 3 OF 16

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18 Near Building 297

ELEVATION 279.6 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Ingersoll Rand TH 100 Mud Rotary

WATER LEVEL AND DATE 118.0 ft 1/19/93 START 6/22/92 FINISH 6/23/92 LOGGER MacGillivray / Chuang

DEPTH BELOW SURFACE (FT)	SAMPLE			PENETRATION TEST RESULTS	SOIL DESCRIPTION	FID/PID READING	COMMENTS
	INTERVAL	TYPE AND NUMBER	RECOVERY (FT)	6"-6"-6"	SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	60.0 – 62.0	6-C	2.0		SILT (ML), reddish brown to dark brown, moist, some sand, hard, could not roll ribbon		
65.0							
70.0	70.0 – 72.0	7-C	2.0		SILTY SAND (SM), trace brown black organic mottles, (leaf like) fine to medium sand		
75.0							
80.0	80.0 – 82.0	8-C			POORLY GRADED SAND (SP), brown, wet, some silt, trace gravel, fine to coarse sand, some rig shake		
85.0							
90.0							

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-3A	SHEET 4 OF 16

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18 Near Building 297

ELEVATION 279.6 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Ingersoll Rand TH 100 Mud Rotary

WATER LEVEL AND DATE 118.0 ft 1/19/93 START 6/22/92 FINISH 6/23/92 LOGGER MacGillivray / Chuang

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
95.0							
100.0					From about 100 ft, Cuttings: SILTY SAND (SM), brown, wet		
105.0							
110.0					From about 110 ft, Cuttings: POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM), green gravel chips,wet silt is olive gray, gravel chips subrounded and oblong		Smooth drilling
115.0							
120.0							

CH2MHILL

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-3A	SHEET 5 OF 16

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18 Near Building 297

ELEVATION 279.6 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Ingersoll Rand TH 100 Mud Rotary

WATER LEVEL AND DATE 118.0 ft 1/19/93 START 6/22/92 FINISH 6/23/92 LOGGER MacGillivray / Chuang

DEPTH BELOW SURFACE (FT)	SAMPLE			PENETRATION TEST RESULTS	SOIL DESCRIPTION	FID/PID READING	COMMENTS
	INTERVAL	TYPE AND NUMBER	RECOVERY (FT)	6"-6"-6"	SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
125.0							
130.0					From about 130 ft, Cuttings: SILTY SAND AND GRAVEL (SP-SM), green gray gravel chips, wet		Smooth drilling
135.0							
140.0					From about 140 ft, Cuttings: POORLY GRADED SILTY SAND AND GRAVEL (SP-SM), green gray gravel chips rounded and oblong		
145.0							
150.0							

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-3A	SHEET 6 OF 16

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18 Near Building 297

ELEVATION 279.6 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Ingersoll Rand TH 100 Mud Rotary

WATER LEVEL AND DATE 118.0 ft 1/19/93 START 6/22/92 FINISH 6/23/92 LOGGER MacGillivray / Chuang

DEPTH BELOW SURFACE (FT)	SAMPLE			PENETRATION TEST RESULTS	SOIL DESCRIPTION	FID/PID READING	COMMENTS
	INTERVAL	TYPE AND NUMBER	RECOVERY (FT)	6"-6"-6"	SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					From about 150 ft, Cuttings: SILTY SAND (SM), greenish gray gravel chips, possibly shale, wet		Continued smooth drilling
155.0							
160.0					From about 160 ft, Cuttings: SILTY SAND (SM), gravel chips range from greenish gray to light-brown, wet		
165.0							
170.0					From about 170 ft, Cuttings: SILTY SAND (SM), light brown, wet		Continued smooth drilling
175.0							
180.0							

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-3A	SHEET 7 OF 16

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18 Near Building 297

ELEVATION 279.6 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Ingersoll Rand TH 100 Mud Rotary

WATER LEVEL AND DATE 118.0 ft 1/19/93 START 6/22/92 FINISH 6/23/92 LOGGER MacGillivray / Chuang

DEPTH BELOW SURFACE (FT)	SAMPLE			PENETRATION TEST RESULTS	SOIL DESCRIPTION	FID/PID READING	COMMENTS
	INTERVAL	TYPE AND NUMBER	RECOVERY (FT)	6"-6"-6"	SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					From about 180 ft, Cuttings: POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM), light brown, gravel chips range from black to greenish gray, subrounded, oblong, wet		
185.0							
190.0					From about 190 ft, Cuttings: POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM), gravel chips range from black, greenish-gray, yellowish orange		Continued smooth drilling
195.0							
200.0					From about 200 ft, Cuttings: SILTY SAND (SM), light brown, wet		Slower drilling last 5 ft
205.0							
210.0							

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-3A	SHEET 8 OF 16

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18 Near Building 297

ELEVATION 279.6 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Ingersoll Rand TH 100 Mud Rotary

WATER LEVEL AND DATE 118.0 ft 1/19/93 START 6/22/92 FINISH 6/23/92 LOGGER MacGillivray / Chuang

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
215.0							
220.0					From about 220 ft, Cuttings: <u>SILTY SAND WITH GRAVEL</u> (SM), light brown, wet		
225.0							
230.0					From about 230 ft, Cuttings: <u>SILTY SAND</u> (SM), light brown, wet		Drilling mud thicker, appears to be picking up fines
235.0							
240.0							

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-3A	SHEET 9 OF 16

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18 Near Building 297

ELEVATION 279.6 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Ingersoll Rand TH 100 Mud Rotary

WATER LEVEL AND DATE 118.0 ft 1/19/93 START 6/22/92 FINISH 6/23/92 LOGGER MacGillivray / Chuang

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					From about 240 ft, Cuttings: POORLY GRADED SAND (SP), medium to coarse, wet		
245.0							
250.0					From about 250 ft, Cuttings: SILTY SAND WITH GRAVEL (SM), light brown, gravel greenish-gray, subrounded, wet		Continued smooth drilling
255.0							
260.0					From about 260 ft, Cuttings: SILTY SAND WITH GRAVEL (SM), gravel chips angular		
265.0							
270.0							

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-3A	SHEET 10 OF 16

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18 Near Building 297

ELEVATION 279.6 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Ingersoll Rand TH 100 Mud Rotary

WATER LEVEL AND DATE 118.0 ft 1/19/93 START 6/22/92 FINISH 6/23/92 LOGGER MacGillivray / Chuang

DEPTH BELOW SURFACE (FT)	SAMPLE			PENETRATION TEST RESULTS	SOIL DESCRIPTION	FID/PID READING	COMMENTS
	INTERVAL	TYPE AND NUMBER	RECOVERY (FT)	6"-6"-6"	SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					From about 270 ft, Cuttings: SILTY SAND WITH GRAVEL (SM), gravel chips appear to be from larger masses, wet		Continued smooth drilling
275.0							
280.0					From about 280 ft, Cuttings: SILTY SAND (SM), light brown, wet, medium to coarse sand		
285.0							
290.0					From about 290 ft, Cuttings: SILTY SAND (SM), light brown, wet, medium to coarse sand		Continued smooth drilling
295.0							
300.0							

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-3A	SHEET 11 OF 16

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18 Near Building 297

ELEVATION 279.6 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Ingersoll Rand TH 100 Mud Rotary

WATER LEVEL AND DATE 118.0 ft 1/19/93 START 6/22/92 FINISH 6/23/92 LOGGER MacGillivray / Chuang

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					From about 300 ft, Cuttings: SILTY SAND (SM), light brown, wet		
305.0							
310.0					From about 310 ft, Cuttings: SILTY SAND WITH GRAVEL (SM), light brown, wet, gravel to 1/2-inch maximum, subangular		Continued smooth drilling
315.0							
320.0					From about 320 ft, Cuttings: SILTY SAND WITH GRAVEL (SM), observe gravel chips ranging from dark brown to light gray, chipped off larger masses		
325.0					WELL GRADED SAND (SW), some stones with soft clay		
330.0							

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-3A	SHEET 12 OF 16

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18 Near Building 297

ELEVATION 279.6 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Ingersoll Rand TH 100 Mud Rotary

WATER LEVEL AND DATE 118.0 ft 1/19/93 START 6/22/92 FINISH 6/23/92 LOGGER MacGillivray / Chuang

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
335.0							
340.0							Increasing clay content
345.0							
350.0					From about 350 ft, Cuttings: WELL GRADED SAND WITH CLAY (SW-SC), with soft clay		
355.0							
360.0							

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-3A	SHEET 13 OF 16

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18 Near Building 297

ELEVATION 279.6 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Ingersoll Rand TH 100 Mud Rotary

WATER LEVEL AND DATE 118.0 ft 1/19/93 START 6/22/92 FINISH 6/23/92 LOGGER MacGillivray / Chuang

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
365.0							
370.0							
375.0					From about 375 ft, Cuttings: WELL GRADED SAND WITH CLAY (SW), sticky and soft clay, decreasing clay with depth		
380.0					From about 380 ft, Cuttings: LEAN CLAY (CL), gray and brown, with sand		Mud appears to thicken
385.0							
390.0							

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-3A	SHEET 14 OF 16

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18 Near Building 297

ELEVATION 279.6 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Ingersoll Rand TH 100 Mud Rotary

WATER LEVEL AND DATE 118.0 ft 1/19/93 START 6/22/92 FINISH 6/23/92 LOGGER MacGillivray / Chuang

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
395.0							
400.0							
405.0							
410.0							
415.0					From about 415 ft, Cuttings: LEAN CLAY (CL), gray and tan, 10-20% fine to coarse sand, some light green silt and clay		
420.0							

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-3A	SHEET 15 OF 16

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18 Near Building 297

ELEVATION 279.6 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Ingersoll Rand TH 100 Mud Rotary

WATER LEVEL AND DATE 118.0 ft 1/19/93 START 6/22/92 FINISH 6/23/92 LOGGER MacGillivray / Chuang

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
425.0					From about 425 ft, Cuttings: LEAN CLAY (CL), gray tan-green, increased sand and gravel, silty		Dry drilling
430.0							
435.0							
440.0							
445.0							
450.0							

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-3A	SHEET 16 OF 16

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18 Near Building 297

ELEVATION 279.6 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Ingersoll Rand TH 100 Mud Rotary

WATER LEVEL AND DATE 118.0 ft 1/19/93 START 6/22/92 FINISH 6/23/92 LOGGER MacGillivray / Chuang

DEPTH BELOW SURFACE (FT)	SAMPLE			PENETRATION TEST RESULTS	SOIL DESCRIPTION	FID/PID READING	COMMENTS
	INTERVAL	TYPE AND NUMBER	RECOVERY (FT)	6"-6"-6"	SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
455.0							
460.0					From about 460 ft, Cuttings: LEAN CLAY (CL), brown with some green clay, silty, 10% sand		Mud thickening, cuttings from 460-480 ft appear weathered, shale
465.0							
470.0					From aboput 470 ft, Cuttings: LEAN CLAY (CL), dark gray , plastic, no sand or gravel		Thick mud, 470-471 ft- hard shale
					Total Depth - 471.0 ft		
475.0							
480.0							

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-4A	SHEET 1 OF 8

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18 Bee Canyon Wash

ELEVATION 242.6 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Ingersoll-Rand TH100 Mud Rotary (Bucket Auger to 20 ft)

WATER LEVEL AND DATE 93.6 ft 1/20/93 START 5/28/92 FINISH 6/5/92 LOGGER T. MacGillivray

DEPTH BELOW SURFACE (FT)	SAMPLE			PENETRATION TEST RESULTS	SOIL DESCRIPTION	FID/PID READING	COMMENTS
	INTERVAL	TYPE AND NUMBER	RECOVERY (FT)	6"-6"-6"	SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	0.0 1.0	1-B			Cuttings 0 to 1 ft: SANDY SILT (ML), dark brown, dry, with trace rootlets, gravel fragments, and clay, possible fill est. 50% silt, 40% sand, 5% each clay and gravel		Sample 1-B from auger cuttings
5.0							Concrete fragments at 4.5 ft
					At 7.5 ft, Cuttings: POORLY GRADED SAND WITH SILT (SP-SM), light reddish brown, moist	F: 0 ppm	Change at 7.5 ft
10.0	10.0 11.5	2-CB	1.5		SILTY SAND (SM), medium brown, moist, hard, fine to medium grained, estimated 85% sand, 15% silt	F: 0 ppm	
15.0	15.0 16.5	3-CB	1.5		SILTY SAND (SM), same as above, darker and more moist, slight odor	F: 2 ppm	
20.0							
25.0							
30.0							

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-4A	SHEET 2 OF 8

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18 Bee Canyon Wash

ELEVATION 242.6 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Ingersoll-Rand TH100 Mud Rotary (Bucket Auger to 20 ft)

WATER LEVEL AND DATE 93.6 ft 1/20/93 START 5/28/92 FINISH 6/5/92 LOGGER T. MacGillivray

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
							Auger to 16' Place conductor casing at 16' with 4' stickup Cement (5% Bentonite) into place
							Drill to 20 ft. and attempt to sample No recovery Drill to 22 ft. and attempt to sample
20.0							
	22.0 – 24.0	4-CB	1.25		POORLY GRADED SAND WITH SILT (SP-SM), medium-dark brown, fine to medium sand, trace shell fragments and gravel Estimated: Sand 90% Silt 8% Gravel 2%	P: 0.0 ppm	
30.0	30.0 – 32.0	5-CB	1.3		POORLY GRADED SAND WITH SILT (SP-SM), as above Estimated: Sand 90% Silt 6% Gravel 3%	P: 0.0 ppm	
40.0							

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-4	SHEET 3 OF 8

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION El Toro, CA
ELEVATION 242.6 ft DRILLING CONTRACTOR Beylik Drilling Inc.
DRILLING METHOD AND EQUIPMENT Ingersoll-Rand TH100 Mud Rotary (Bucket Auger to 20 ft)
WATER LEVEL AND DATE 93.6 ft 1/20/93 START FINISH LOGGER T. MacGillivray

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	40.0 – 42.0	6-CB	1.5		SILTY SAND (ML), medium-dark brown, moist, sandier towards tip, trace gravel Estimated: Sand 55% Silt 40% Gravel 5%	P: 0.0 ppm	
50.0	50.0 – 52.0	7-CB	2.0		SILTY SAND (SM), medium-dark brown, moist, fine to medium, some medium sand pockets with no silt, trace of gravel Estimated: Sand 80% Silt 15% Gravel 5%	P: 0.0 ppm	
60.0	60.0 – 62.0	8-CB			SILTY SAND (SM), medium to dark brown, moist, fine to medium gravel Estimated: Sand 80% Silt 15% Gravel 15%	P: 0.0 ppm	
70.0							

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-4	SHEET 4 OF 8

SOIL BORING LOG

PROJECT: MCAS El Toro RI/FS Phase I LOCATION: El Toro, CA

ELEVATION: 242.6 ft DRILLING CONTRACTOR: Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT: Ingersoll-Rand TH100 Mud Rotary (Bucket Auger to 20 ft)

WATER LEVEL AND DATE: 93.6 ft 1/20/93 START: ______ FINISH: ______ LOGGER: T. MacGillivray

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
70.0	72.0	9-CB	0.75		POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM), medium brown, moist, fine to coarse Estimated: Sand 85% Silt 8% Gravel 7%	F: 10.0 ppm P:0.0 ppm	
	80.0						
80.0	82.0	10-CB	0.8		POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM), as above, moist to wet, trace shell and gravel Estimated: Sand 85% Silt 10% Gravel 5%	F: 6.0 ppm P:0.0 ppm	
	90.0						
90.0	92.0	11-CB	0.9		POORLY GRADED SAND (SP), brown, moist to wet, trace silt and gravel, fine to coarse, trace live green silt pieces Estimated: Sand 90% Silt 5% Gravel 5%	F: 0.0 ppm P:0.0 ppm	Some but no significant mud loss Some rig shag
	100.0						
100.0	102.0	12-CB	2.6		100.0 - 100.8 ft: POORLY GRADED SAND (SP), as above, wet 100.8 - 102.0 ft: SILTY SAND (SM), moist, compact SANDY SILT (ML), with red, black, and white clay/silt mottles Estimated: Silt 55% Sand 40% Gravel 2% Clay 2%	F: 0.0 ppm P:0.0 ppm	

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-4A	SHEET 5 OF 8

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18 Bee Canyon Wash

ELEVATION 242.6 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Ingersoll-Rand TH100 Mud Rotary (Bucket Auger to 20 ft)

WATER LEVEL AND DATE 93.6 ft 1/20/93 START 5/28/92 FINISH 6/5/92 LOGGER T. MacGillivray

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
110.0	110.0 - 112.0	13-CB	9"		110.0 - 110.3 ft: SANDY SILT (ML), as above 110.3 - 110.8 ft: POORLY GRADED SAND (SP), brown, moist	F: 0.0 ppm P: 0.0 ppm	
120.0	120.0 - 122.0	14-CB			SILTY SAND (SM), medium to dark brown, moist, trace gravel		
130.0					From 130 - 140 ft, Cuttings: SILTY SAND (SM), as above, with sandy silt balls		
140.0					From 140 - 160 ft, Cuttings: SILTY SAND (SM), similar to 130 ft		
150.0							

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-4A	SHEET 6 OF 8

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18 Bee Canyon Wash

ELEVATION 242.6 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Ingersoll-Rand TH100 Mud Rotary (Bucket Auger to 20 ft)

WATER LEVEL AND DATE 93.6 ft 1/20/93 START 5/28/92 FINISH 6/5/92 LOGGER T. MacGillivray

DEPTH BELOW SURFACE (FT)	SAMPLE			PENETRATION TEST RESULTS	SOIL DESCRIPTION	FID/PID READING	COMMENTS
	INTERVAL	TYPE AND NUMBER	RECOVERY (FT)	6"-6"-6"	SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
160.0					From 160 - 180 ft, Cuttings: POORLY GRADED SAND WITH SILT (SP-SM), medium to light brown, trace gravel, with sandy silt balls, coarse sand		
180.0					From 180 - 200 ft, Cuttings: more and more silt balls in cuttings and less coarse sand		Rig Shake less silt balls, in coarse sand and gravel
200.0					From 200 - 240 ft, Cuttings: POORLY GRADED SAND WITH GRAVEL (SP), trace silt, medium to coarse sand		Rig Shake increased to coarse sand, gravel very little silt balls
220.0							
240.0					From 240 - 260 ft, Cuttings: POORLY GRADED SAND WITH GRAVEL (SP), medium to light brown, medium to coarse sand, increased sandy silt balls		
260.0					From 260 - 280 ft, Cuttings: POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM), medium to light brown, fine to coarse sand		
280.0							

PROJECT NUMBER	BORING NUMBER
LAO31981	MW-4A SHEET 7 OF 8

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18 Bee Canyon Wash

ELEVATION 242.6 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Ingersoll-Rand TH100 Mud Rotary (Bucket Auger to 20 ft)

WATER LEVEL AND DATE 93.6 ft 1/20/93 START 5/28/92 FINISH 6/5/92 LOGGER T. MacGillivray

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
280.0					From 280 - 340 ft, Cuttings: POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM), similar to 240 ft cuttings, fine to coarse		
300.0							
320.0							
340.0					From 340 - 370 ft, Cuttings: POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM), similar to above		Hole caved @ 180 ft OK @ 222 ft
360.0							Rig Shake increased sand and gravel @ 355-360 less silt balls
					From 370 - 380 ft, Cuttings: SILTY SAND WITH GRAVEL (SM), medium to light brown and light gray-brown, fine to coarse sand		
380.0					From 380 - 400 ft, Cuttings: SILTY SAND WITH GRAVEL (SM), similar to 370 ft cuttings, light to medium gray-brown		

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-4A	SHEET 8 OF 8

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18 Bee Canyon Wash

ELEVATION 242.6 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Ingersoll-Rand TH100 Mud Rotary (Bucket Auger to 20 ft)

WATER LEVEL AND DATE 93.6 ft 1/20/93 START 5/28/92 FINISH 6/5/92 LOGGER T. MacGillivray

DEPTH BELOW SURFACE (FT)	SAMPLE			STANDARD PENETRATION TEST RESULTS	SOIL DESCRIPTION	FID/PID READING	COMMENTS
	INTERVAL	TYPE AND NUMBER	RECOVERY (FT)	6"-6"-6" (N)	SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
400.0					From 400 - 420 ft, Cuttings: POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM), fine to coarse sand with light grayish brown sandy silt balls, some reddish brown clay silt balls on rig shaking at 420 ft		
420.0					Total Depth - 420.0 ft		Circulate drill mud for a 1/2 hour before removing drill string and borehole geophysics

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-5 composite	SHEET 1 OF 11

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18, at Motor Pool

ELEVATION 5B 270.4 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Dresser T-70W Air Rotary 10 3/4" O.D., 9 1/2" I.D. Casing Diameter

WATER LEVEL AND DATE 87.8 ft 1/19/93 START 8/27/92 FINISH 9/10/92 LOGGER J. Little

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
							California modified sampler 2 1/2" O.D., 2" I.D. with 6" x 2" stainless steel liners, 140 lb. down hole
5.0					From 0.5 - 9 ft, Cuttings: Gravel LAO31981		Hard drilling at 5 ft
10.0					From 9 - 10 ft, Cuttings: SILT (ML), dark brown, moist, moderate plasticity, some clay and trace sand		
	12.5 - 14.0	1-CS	1.6	N.M.	SILT (ML), dark brown, moist med. dense, trace sand, minor clay		Driller had to hammer sampler back out after driving sampler, poor recovery, take 2nd sample
15.0	14.0 - 16.0	2-CS	1.2	N.M.	SILT WITH SAND (ML), medium reddish brown with some white and black mottles, dry medium dense, minor clay, ~ 20-25% fine sand		
						F: 0.0 ppm	
20.0					At 18 ft, Cuttings: medium brown, same lithology as CS-2		
25.0	23.5 - 25.5	3-CS	2.0	N.M.	SILTY SAND (SM), reddish brown, dry, medium dense, ~ 65% fine to medium sand, minor clay	F: 0.2 ppm	
30.0							

PROJECT NUMBER	BORING NUMBER
LAO31981	MW-5 composite SHEET 2 OF 11

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18, at Motor Pool

ELEVATION 5B 270.4 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Dresser T-70W Air Rotary 10 3/4" O.D., 9 1/2" I.D. Casing Diameter

WATER LEVEL AND DATE 87.8 ft 1/19/93 START 8/27/92 FINISH 9/10/92 LOGGER J. Little

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
30.0	31.0				At 30 ft, Cuttings: Same as CS-3		
	31.0–33.0	4-C	1.75	N.M.	SILT (ML), medium brown, dry, medium dense, slight plasticity when wet, minor clay, trace fine sand	F: 1.5 ppm	
	33.0–35.0	5-C	1.5	N.M.			
35.0							
40.0					At 40 ft, Cuttings: WELL GRADED SAND (SW), light brown, dry, trace gravel		
45.0					From 44 ft, Cuttings: SILTY SAND (SM), light brown, dry, no gravel		
50.0	50.0–52.0	6-C	1.3	N.M.	SILT (ML), medium brown, dry, medium dense, slight plasticity when wet, minor sand, trace fine gravel.	F: 1.0 ppm	
55.0							
60.0							

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-5 composite	SHEET 3 OF 11

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18, at Motor Pool

ELEVATION 5B 270.4 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Dresser T-70W Air Rotary 10 3/4" O.D., 9 1/2" I.D. Casing Diameter

WATER LEVEL AND DATE 87.8 ft 1/19/93 START 8/27/92 FINISH 9/10/92 LOGGER J. Little

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
60.0					At 60 ft, Cuttings: WELL GRADED GRAVEL WITH SAND (GW), dry		
					At 63 ft, Cuttings: WELL GRADED SAND WITH GRAVEL (SW), moist		
65.0					At 64 ft, Cuttings: WELL GRADED SAND (SW), trace gravel, light brown, moist		
					At 66 ft, Cuttings: POORLY GRADED SAND (SP), light brown, moist, medium		
70.0					At 68 ft, Cuttings: WELL GRADED SAND WITH GRAVEL (SW), moist, medium brown, dry at 69 ft		
	74.0						
75.0	74.0–76.0	7-C	2.0	N.M.	WELL GRADED SAND (SW), brown, moist, loose, trace gravel	F: 0.2 ppm	
	76.0–78.0	X	0	N.M.	Small amount subangular, subrounded gravel, up to 1/4".		
80.0	78.0–80.0	8-C	0.5	N.M.	WELL GRADED SAND (SW), same as 7-C		
85.0					At 83 ft, Cuttings: POORLY GRADED FINE SAND (SW), moist, medium brown		At 84 ft., lost drill head tool down hole. Hole is abandoned 9-1-92. Start new hole 10 feet southwest of first hole.
	87.0–89.0	9-C	2.0	N.M.	ELASTIC SILT (MH), brown, moist, dense, quite plastic, minor fine sand, grades into CLAYEY SAND (SC), brown, wet, then POORLY GRADED SAND (SP), with depth, brown, wet, loose,medium trace fine gravel	F: 1.0 ppm P: 0.2 ppm	
90.0							

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-5 composite	SHEET 4 OF 11

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18, at Motor Pool

ELEVATION 5B 270.4 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Dresser T-70W Air Rotary 10 3/4" O.D., 9 1/2" I.D. Casing Diameter

WATER LEVEL AND DATE 87.8 ft 1/19/93 START 8/27/92 FINISH 9/10/92 LOGGER J. Little

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
90.0					At 85 - 87 ft, Cuttings: CLAYEY SAND (SC), brown, moist, moderately plastic		
95.0							Driller adds water to as drilling.
100.0							
	101.5 - 103.0	10-C	1.6	NR	101.5 - 101.8 ft: SILTY SAND (SM), brown, moist, moderately plastic, some clay 101.8 - 102.0 ft: SILTY SAND (SM), brown, moist, loose, little plasticity 102.3 - 103.0 ft: ELASTIC SILT WITH SAND (MH), medium, brownish gray, moist, very stiff, plastic ~ 20% fine to medium sand, possible silica cementation?	F: 0.3 ppm	
105.0							
					At 108 ft, Cuttings: WELL GRADED SAND (SW), primarily silica sand, sub-rounded, trace gravel up to 3 cm diameter		
110.0							
	111.5 - 113.5	11-C	1.5	NR	WELL GRADED SAND (SW), light brown, medium dense, trace gravel up to 2.5 cm diameter.	F: 0.4 ppm	
					From 113 - 118 ft, Cuttings: CLAYEY SAND (SC), brown, fine		
115.0							
120.0							

PROJECT NUMBER	BORING NUMBER		
LAO31981	MW-5 composite	SHEET 5	OF 11

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18, at Motor Pool

ELEVATION 5B 270.4 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Dresser T-70W Air Rotary 10 3/4" O.D., 9 1/2" I.D. Casing Diameter

WATER LEVEL AND DATE 87.8 ft 1/19/93 START 8/27/92 FINISH 9/10/92 LOGGER J. Little

DEPTH BELOW SURFACE (FT)	SAMPLE			PENETRATION TEST RESULTS	SOIL DESCRIPTION	FID/PID READING	COMMENTS
	INTERVAL	TYPE AND NUMBER	RECOVERY (FT)	6"-6"-6"	SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
120.0	121.0	12-C	1.6		SILTY SAND, (SM), brown, few black streaks, wet, medium, dense, slightly plastic, some clay, black streaks/specks (manganese oxide?), sand poorly graded, fine.		Driller adds water to >300 gallons
125.0					At about 125 ft, Cuttings: SILTY SAND (SM), some clay		Driller adds water to as drilling.
	128.0				At about 128 ft, Cuttings: SILTY SAND WITH GRAVEL (SC), some clay		
130.0	130.0	13-C	2.0	N.M.	128.0 - 129.1 ft: POORLY GRADED SAND (SW), light brown, wet, medium dense to loose, fine 129.1 - 130.0 ft: SILT WITH SAND (ML), light brown, moist, medium dense, slightly plastic, some clay, minor, some orange-brown mottles, and black specks	F: 0.2 ppm	
135.0							
140.0							
145.0							
150.0							

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-5 composite	SHEET 6 OF 11

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18, at Motor Pool

ELEVATION 5B 270.4 ft (TOC) DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Dresser T-70W Air Rotary 10 3/4" O.D., 9 1/2" I.D. Casing Diameter

WATER LEVEL AND DATE 87.8 ft 1/19/93 START 8/27/92 FINISH 9/10/92 LOGGER J. Little

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
130.0					From 130 to 135 ft, Cuttings: LEAN CLAY (CL), with coarse grained sand		
140.0							
150.0							
160.0					From 165 to 170 ft, Cuttings: POORLY GRADED SAND WITH SILT (SP-SM)		
170.0					From 170 to 173 ft, Cuttings: LEAN CLAY WITH SAND (CL)		
180.0							
190.0							

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-5 composite	SHEET 7 OF 11

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18, at Motor Pool

ELEVATION 5B 270.4 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Dresser T-70W Air Rotary 10 3/4" O.D., 9 1/2" I.D. Casing Diameter

WATER LEVEL AND DATE 87.8 ft 1/19/93 START 8/27/92 FINISH 9/10/92 LOGGER J. Little

DEPTH BELOW SURFACE (FT)	SAMPLE			PENETRATION TEST RESULTS	SOIL DESCRIPTION	FID/PID READING	COMMENTS
	INTERVAL	TYPE AND NUMBER	RECOVERY (FT)	6"-6"-6"	SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
190.0					From 192 to 200 ft, Cuttings: WELL GRADED SAND WITH GRAVEL (SW), angular gravel, with silt		
200.0					From 205 to 210 ft, Cuttings: LEAN CLAY WITH SAND (CL)		
210.0					From 210 to 215 ft, Cuttings: SANDY FAT CLAY (CH)		
					From 215 to 220 ft, Cuttings: POORLY GRADED SAND WITH SILT (SP-SM), coarse gravel		
220.0					From 220 to 230 ft, Cuttings: GRAVEL, broken into angular chips		
230.0					From 230 to 235 ft, Cuttings: WELL GRADED SAND WITH SILT (SW-SM)		
					From 235 to 240 ft, Cuttings: LEAN CLAY WITH SAND (CL), rock chips		
240.0					From 240 to 245 ft, Cuttings: LEAN CLAY WITH SAND (CL)		
					From 245 to 250 ft, Cuttings: WELL GRADED SAND WITH CLAY (SW-SC), occasionally chips of rock		
250.0							

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-5 composite	SHEET 8 OF 11

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18, at Motor Pool

ELEVATION 5B 270.4 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Dresser T-70W Air Rotary 10 3/4" O.D., 9 1/2" I.D. Casing Diameter

WATER LEVEL AND DATE 87.8 ft 1/19/93 START 8/27/92 FINISH 9/10/92 LOGGER J. Little

DEPTH BELOW SURFACE (FT)	SAMPLE			PENETRATION TEST RESULTS	SOIL DESCRIPTION	FID/PID READING	COMMENTS
	INTERVAL	TYPE AND NUMBER	RECOVERY (FT)	6"-6"-6"	SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
260.0							
270.0							
280.0					From 285 to 290 ft, Cuttings: WELL GRADED SAND WITH SILT (SW-SM)		
290.0							
300.0							
310.0							
320.0							

CH2M HILL

PROJECT NUMBER	BORING NUMBER
LAO31981	MW-5 composite SHEET 9 OF 11

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18, at Motor Pool

ELEVATION 5B 270.4 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Dresser T-70W Air Rotary 10 3/4" O.D., 9 1/2" I.D. Casing Diameter

WATER LEVEL AND DATE 87.8 ft 1/19/93 START 8/27/92 FINISH 9/10/92 LOGGER J. Little

DEPTH BELOW SURFACE (FT)	SAMPLE			PENETRATION TEST RESULTS	SOIL DESCRIPTION	FID/PID READING	COMMENTS
	INTERVAL	TYPE AND NUMBER	RECOVERY (FT)	6"-6"-6"	SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
320.0							
330.0					From 325 to 340 ft, Cuttings: POORLY GRADED SAND (SP), medium to coarsegrained		
340.0					From 340 to 350 ft, Cuttings: SANDY SILT (ML), orange-brown		Slow drilling, heavy rig shaking
350.0					From 350 to 355 ft, Cuttings: SILTY SAND (SM)		
					From 355 to 365 ft, Cuttings: SANDY SILT (ML), orange-brown		
360.0							Samples can't be driven inch 80 blows 1" of penetration, no samples taken
370.0							
380.0							

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-5 composite	SHEET 10 OF 11

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18, at Motor Pool

ELEVATION 5B 270.4 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Dresser T-70W Air Rotary 10 3/4" O.D., 9 1/2" I.D. Casing Diameter

WATER LEVEL AND DATE 87.8 ft 1/19/93 START 8/27/92 FINISH 9/10/92 LOGGER J. Little

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
380.0					From 380 ft, Cuttings: POORLY GRADED SAND WITH CLAY (SP-SC), orange and some light ???, increased clay balls, heavy oxidation on gravel fragments		
390.0							
400.0					From 400 ft, Cuttings: POORLY GRADED SAND WITH CLAY (SP-SC), some blue clay balls increasing, heavy oxidation on gravel and coarse sand fragments		
410.0					From 410 ft, Cuttings: CLAYEY SAND (SC), gravel, with trace orange clay		
420.0							
430.0					From 430 ft, Cuttings: CLAYEY SAND (SC), as above, changing to salt and pepper sandy clay balls with coarse sand and some gravel fragments		
440.0							

PROJECT NUMBER	BORING NUMBER
LAO31981	MW-5 composite SHEET 11 OF 11

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18, at Motor Pool

ELEVATION 5B 270.4 ft (TOC) DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Dresser T-70W Air Rotary 10 3/4" O.D., 9 1/2" I.D. Casing Diameter

WATER LEVEL AND DATE 87.8 ft 1/19/93 START 8/27/92 FINISH 9/10/92 LOGGER J. Little

DEPTH BELOW SURFACE (FT)	SAMPLE			PENETRATION TEST RESULTS	SOIL DESCRIPTION	FID/PID READING	COMMENTS
	INTERVAL	TYPE AND NUMBER	RECOVERY (FT)	6"-6"-6"	SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
440.0							
450.0							Getting harder
460.0							
470.0					From 470 ft, Cuttings: dark gray to black cuttings, less sand and gravel in cuttings to total depth		
480.0							Mud thickening
490.0							
500.0					Total Depth - 500 ft		

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-6	SHEET 1 OF 9

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18 N. of trailer park, I-5 & Sante Fe RR

ELEVATION 175.4 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Mud Rotary, 1-R TH-100, 6 inch diameter pilot hole

WATER LEVEL AND DATE Assumed 85 ft. bgs for sampling START 7/22/92 FINISH 7/27/92 LOGGER S. Terentieff

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					Cuttings 2-4 ft: WELL GRADED SAND (SW), dark brown, moist to dry, very fine to medium sand, trace silt	P: 1.0 ppm	Driller notes clayey material starting at ~7 ft.
10.0					Cuttings 10-12 ft: SANDY LEAN CLAY (CL), brown, moist to dry, stiff, fine sand, very sandy		Noted alternating zones of well graded sand in lean clay
							Driller notes silty sand starting at 17 ft
20.0	20.0 22.0	1-C	1.5		SILTY SAND (SM), brown, moist, medium dense, fine sand, subrounded	P: 0.6 ppm	Driller notes drilling in similar material from 20-60 ft.
30.0							
40.0	40.0 42.0	2-C	2.0		Upper 1.0 ft: POORLY GRADED SAND (SP), yellowish-brown, moist, loose, subrounded, medium sand Lower 1.0 ft: POORLY GRADED SAND WITH GRAVEL (SP-GP), yellowish-orange, loose, subangular, gravel up to 1/4 in. max. observed size, some silty fine sand mixed in with gravel (may be slough)	P: 1.0 ppm	
50.0					Cuttings 50-60 ft: POORLY GRADED SAND (SP), yellowish-orange, fine to medium sand, subrounded		Driller notes relatively easy drilling, suggesting loose sand and gravel
60.0							

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-6	SHEET 2 OF 9

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18 N. of trailer park, I-5 & Sante Fe RR

ELEVATION 175.4 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Mud Rotary, 1-R TH-100, 6 inch diameter pilot hole

WATER LEVEL AND DATE Assumed 85 ft. bgs for sampling START 7/22/92 FINISH 7/27/92 LOGGER S. Terentieff

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	60.0 62.0	3-C	2.0		SILTY SAND to SANDY CLAY (SM-ML), tan, wet, very loose, appears to have liquified, fine to very fine sand	F: 1.8 ppm	Marsh Funnel Velocity = 31 sec.
70.0							
80.0	80.0 82.0	4-C	2.0		SANDY FAT CLAY (CH), tan-brown, moist, hard, very sandy, some olive, thin calcium carbonate interbeds, sand is fine to medium, subrounded	F: 4.6 ppm	Marsh Funnel Velocity = 31 sec.
90.0							
100.0					From 100 to 110 ft, Cuttings: POORLY GRADED SAND (SP), yellowish-orange, wet, medium, subangular		
110.0							
120.0							

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-6	SHEET 3 OF 9

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18 N. of trailer park, I-5 & Sante Fe RR

ELEVATION 175.4 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Mud Rotary, 1-R TH-100, 6 inch diameter pilot hole

WATER LEVEL AND DATE Assumed 85 ft. bgs for sampling START 7/22/92 FINISH 7/27/92 LOGGER S. Terentieff

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					From 125 ft, Cuttings: POORLY GRADED SAND (SP), yellowish-orange, medium, subangular		Driller notes harder drilling starting at 128 ft.
130.0							
					From 135 ft, Cuttings: POORLY GRADED SAND WITH SILT (SP-SM), coarse sand, with some fine gravel		
140.0	140.0 142.0	5-C	0.0				No recovery, will attempt sampling from 160-162 ft. with a sand catcher Driller notes no recovery because of very sandy and wet formation
150.0							
160.0	160.0 162.0	6-C	0.0				No recovery, will attempt coring from 162-164 ft. with spoon 18 inches ahead of bit
	164.0	7-C	0.0				No recovery again, suggesting a very sandy, loose, and wet formation material
170.0							
					From 175 ft, Cuttings: WELL GRADED SAND WITH SILT (SW-SM), tan to yellowish-orange, fine to coarse sand, subangular		
180.0							

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-6	SHEET 4 OF 9

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18 N. of trailer park, I-5 & Sante Fe RR

ELEVATION 175.4 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Mud Rotary, 1-R TH-100, 6 inch diameter pilot hole

WATER LEVEL AND DATE Assumed 85 ft. bgs for sampling START 7/22/92 FINISH 7/27/92 LOGGER S. Terentieff

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					From 180 to 200 ft, Cuttings: POORLY GRADED SAND (SP), tan-gray, loose, medium to coarse sand, subangular to angular		Driller notes relatively easy drilling, loose formation material
190.0							
200.0					From 205 ft, Cuttings: WELL GRADED SAND (SW), tan to yellowish-orange, wet, loose, medium to coarse, very angular, trace clay		
210.0					From 215 ft, Cuttings: INTERLAYERED WELL GRADED SAND to FAT CLAY WITH SAND (SW/CH), well graded sand cuttings similar to cuttings at 205 ft, clay cuttings are gray-olive, sandy, stiff		
220.0	220.0 – 222.0	8-C	0.0		From 220 to 240 ft, Cuttings: POORLY GRADED SAND WITH SILT (SP-SM), tan-gray, wet, loose, coarse, very angular, some siltstone fragments (fine gravel)		No recovery, formation material may still be very sandy and loose
230.0							
240.0							

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-6	SHEET 5 OF 9

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18 N. of trailer park, I-5 & Sante Fe RR

ELEVATION 175.4 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Mud Rotary, 1-R TH-100, 6 inch diameter pilot hole

WATER LEVEL AND DATE Assumed 85 ft. bgs for sampling START 7/22/92 FINISH 7/27/92 LOGGER S. Terentieff

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					From 140 to 260 ft, Cuttings: POORLY GRADED SAND WITH CLAY (SP-SC), tan-gray, wet, coarse sand, very angular		
250.0							
260.0							Driller notes similar drilling conditions, no significant material change
270.0					From 270 ft, Cuttings: POORLY GRADED SAND WITH CLAY (SP-SC), tan-gray, wet, coarse, trace of fine gravel, very angular, noted trace sandy fat clay cuttings		
280.0					From 280 to 300 ft, Cuttings: POORLY GRADED SAND (SP), no trace of clay		
							Marsh funnel velocity = 32 sec.
290.0							
300.0							

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-6	SHEET 6 OF 9

SOIL BORING LOG

PROJECT: MCAS El Toro RI/FS Phase I
LOCATION: Site 18 N. of trailer park, I-5 & Sante Fe RR
ELEVATION: 175.4 ft
DRILLING CONTRACTOR: Beylik Drilling Inc.
DRILLING METHOD AND EQUIPMENT: Mud Rotary, 1-R TH-100, 6 inch diameter pilot hole
WATER LEVEL AND DATE: Assumed 85 ft. bgs for sampling
START: 7/22/92
FINISH: 7/27/92
LOGGER: S. Terentieff

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					From 300 to 320 ft, Cuttings: POORLY GRADED SAND WITH CLAY (SP-SC), similar to cuttings at 270 ft		
310.0							Driller notes loss of circulation in sandy formation at 310-320 ft.
320.0							
					From 325 to 330 ft, Cuttings: POORLY GRADED SAND WITH CLAY (SP-SC), sand is yellowish-orange and fat clay cuttings are olive-gray, wet, varying amounts of clay		
330.0							
					From 335 to 340 ft, Cuttings: POORLY GRADED GRAVEL (GP), orange-gray, wet, medium dense, fine gravel with some coarse sand		Driller notes gravel starting at 335 ft.
340.0	340.0 - 343.0	9-C	3.0		From 340 to 342 ft, Cuttings: CLAYEY SAND (SC), light brown, moist, loose sand, fine-grained, moderate plasticity	F: 0.0 ppm	
					From 342 to 343 ft, Cuttings CLAYEY SAND (SC), yellowish-brown, moist, moderate plasticity, medium dense sand, mostly fine sand, trace coarse		
350.0							
360.0							Driller indicates relatively consistant drilling last 20 ft., a little harder at 360 ft.

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-6	SHEET 7 OF 9

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18 N. of trailer park, I-5 & Sante Fe RR

ELEVATION 175.4 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Mud Rotary, 1-R TH-100, 6 inch diameter pilot hole

WATER LEVEL AND DATE Assumed 85 ft. bgs for sampling START 7/22/92 FINISH 7/27/92 LOGGER J. Lovenburg

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
370.0					From about 370 ft, Cuttings: CLAYEY SAND (SC), light brown, clayey sand balls in cuttings		Viscosity = 37 vis. Thickening somewhat- may indicate increase in clay
380.0							
	382.0 385.0	10-C	3.0		382-383 ft: SANDY CLAY (CL), light brown, wet, stiff, moderate plasticity, fine sand, some black organics, trace thin rust oxidized layers 383-385 ft: CLAYEY SAND (SC), yellowish-brown, fine to medium sand, moist, trace gravel to 1 cm, some silt, some black organic material	F: 0.7 ppm	Driller notes relatively easy drilling from 380 to 420 ft, a few soft spots but mostly consistent
390.0					From 390 ft, Cuttings: same as above, as in 10-C		
400.0							
410.0							More fluid loss indicated here by driller. More sandy material indicated by fluid loss
420.0							

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-6	SHEET 8 OF 9

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18 N. of trailer park, I-5 & Sante Fe RR

ELEVATION 175.4 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Mud Rotary, 1-R TH-100, 6 inch diameter pilot hole

WATER LEVEL AND DATE Assumed 85 ft. bgs for sampling START 7/22/92 FINISH 7/27/92 LOGGER S. Terentieff

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	420.0 422.5	11-C	2.5		SANDY CLAY (CL), light brown, moist, stiff, fine sand, some black organics, trace coarse sand	F: 0.2 ppm	
							Driller notes relatively easy drilling
430.0							
							Viscosity = 35 vis slightly reduced viscosity
440.0					From 440 ft, Cuttings: CLAYEY SAND WITH GRAVEL (SC), light brown, fine to coarse snad, subangular to subrounded gravel to 1 cm		
450.0							
							455-457 ft. driller notes harder, drilling possibly gravel
460.0	460.0 462.5	12-C	2.0		SANDY CLAY (CL), light brown, moist, medium stiff, fine sand	F: 1.2 ppm	
					From 465 ft, Cuttings: CLAYEY GRAVEL WITH SAND (GC), light brown, subangular gravel, fine to coarse sand		465-480 ft. drilling reported harder by driller
470.0							
480.0							

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-6	SHEET 9 OF 9

SOIL BORING LOG

PROJECT: MCAS El Toro RI/FS Phase I LOCATION: Site 18 N. of trailer park, I-5 & Sante Fe RR

ELEVATION: 175.4 ft DRILLING CONTRACTOR: Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT: Mud Rotary, 1-R TH-100, 6 inch diameter pilot hole

WATER LEVEL AND DATE: Assumed 85 ft. bgs for sampling START: 7/22/92 FINISH: 7/27/92 LOGGER: S. Terentieff

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					From 485 ft, Cuttings: CLAYEY SAND WITH GRAVEL (SC), light brown, fine to coarse sand, mostly fine gravel to 1 cm		Some circulation loss Driller describes as "stickier", some back pressure
490.0							
500.0					Total Depth - 500 ft		
550.0							
560.0							
570.0							
580.0							

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-7	SHEET 1 OF 3

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18 El Toro (S.P. Creek and 133 Hwy)

ELEVATION 179.5 ft DRILLING CONTRACTOR Brylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Bucket Auger (0-20") Mud Rotary (Below 20-90') TH-100

WATER LEVEL AND DATE 21.5 ft 1/21/93 START 7/17/92 FINISH 7/20/92 LOGGER J. Lovenburg

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					From 2 ft, Cuttings: CLAYEY SAND WITH SILT (ML), light brown, dry, very stiff, fine sand, fine roots, low plasticity		Driller notes change in drilling from clay to sand at 2 ft
					From 3 - 5 ft, Cuttings: SILTY SAND WITH GRAVEL (SM), yellowish-brown, dry, fine to coarse sand, trace gravel		
5.0							Rock or boulder at 5 ft - driller
					From 6 - 10 ft, Cuttings: SANDY GRAVEL (GW), light brown, dryl loose, fine to coarse, 1 ft limestone boulder		
10.0					From 10 - 18 ft, Cuttings: SAND WITH CLAY (SC), brown, moist, loose, fine to medium, up to 3" clayey sand balls	F: 0.5 ppm	
15.0							
					From 18 - 20 ft, Cuttings: POORLY GRADED SAND (SP), tan, loose medium coarse		
20.0					At about 20 ft, Cuttings: SILTY SAND (SM), light brown, moist	F: 0.8 ppm	Grab sample Stopped at 20 ft at 9:51 End of bucket auger
25.0							
30.0							

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-7	SHEET 2 OF 3

SOIL BORING LOG

PROJECT: MCAS El Toro RI/FS Phase I LOCATION: Site 18 El Toro (S.P. Creek and 133 Hwy)

ELEVATION: 179.5 ft DRILLING CONTRACTOR: Brylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT: Bucket Auger (0-20") Mud Rotary (Below 20-90') TH-100

WATER LEVEL AND DATE: 21.5 ft 1/21/93 START: 7/17/92 FINISH: 7/20/92 LOGGER: J. Lovenburg

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	30.0–32.0	1-CB	1.0		WELL GRADED SAND WITH SILT AND GRAVEL (SWSM), light brown, wet (saturated), fine to coarse sand, 10-15% silt, some oxidation on gravel fragments, observed the occasional silty sand seam (not cohesive)	F: 1.9 ppm	
35.0							
							37 ft: Driller indicates presence of gravel (i.e. coarse materials) Drill chatter
40.0							Attempted sample at 40-42 ft, however, it was unsuccessful
	43.0–45.0	2-CB	0.83		SILTY SAND WITH GRAVEL (SM), weathered zones, red, whitish brown, purples and brown, oxidized, moist to wet, trace clay <5%, >15% gravel, gravel was oxidized occasionally		Noted numerous hard and soft zones beginning at 40 ft (likely sand and gravel seams)
45.0							
							Hard 48 ft Soft 48.5
50.0	50.0–52.0	3-CB	0.17		SILTY SAND WITH GRAVEL (SM), similar to above, except increase in gravel (recovered ??? gravel fragments) oxidized	F: 4.3 ppm	
55.0					From 55 ft, Cuttings: LEAN CLAY/FAT CLAY (CL/CH)		Soft 55 ft
60.0							

PROJECT NUMBER	BORING NUMBER
LAO31981	MW-7 SHEET 3 OF 3

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18 El Toro (S.P. Creek and 133 Hwy)

ELEVATION 179.5 ft DRILLING CONTRACTOR Brylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Bucket Auger (0-20") Mud Rotary (Below 20-90') TH-100

WATER LEVEL AND DATE 21.5 ft 1/21/93 START 7/17/92 FINISH 7/20/92 LOGGER J. Lovenburg

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
		4-CB	0.5		LEAN TO FAT CLAY (CL-CH), dark brown, moist, medium to high plasticity can roll ribbon, <15% sand (very fine), some silt	F: 1.9 ppm	Drilling is smooth from 55-75 ft
65.0							
70.0							
		5-CB			SANDSTONE, dusky yellow and grayish-green, fine to medium grained, well to moderately cemented with trace black layering alternating yellow and green 1mm thick bedding in moderately cemented portion (no response to HCL)		Hard drilling Lost circulation Approximately 1/2 ft recovery in hand of drilling bit No recovery in sampler
75.0							
		6-CB	0.5		6C: SILTSTONE, yellowish-green, moist, soft, weathered, oxidized, fine bedding, rusty orange and black (magnesium precipitate), weathered surfaces		
80.0		7-CB	0.5		7-C: SILTSTONE, as above, except more weathered, 1 cm seashell, cohesive, some clay	F: 0.6 ppm	
		8-CB	4.0		8-C: SILTSTONE, as above with trace very fine sand and a few vertical and subvertical fractures		
85.0		9-CB	5.5		9-C: SILTSTONE, as above, some fractures at a 45 degree angle to bedding, oxidation on fractures and some bedding planes, very weakened		
90.0					Total Depth - 90 ft	F: 0.2 ppm	

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-8	SHEET 1 OF 17

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18, Irvine Ctr. Dr. and 133 Fwy

ELEVATION 194.2 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Mud Rotary (1-R TH100) 0-2-0 W/18 in. Flight Auger

WATER LEVEL AND DATE N.R. START 8/3/92 FINISH 8/5/92 LOGGER J. Lovenburg/T. Mac G

DEPTH BELOW SURFACE (FT)	SAMPLE			PENETRATION TEST RESULTS	SOIL DESCRIPTION	FID/PID READING	COMMENTS
	INTERVAL	TYPE AND NUMBER	RECOVERY (FT)	6"-6"-6"	SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					From 0 to 6 ft, Cuttings: SANDY SILT WITH CLAY (ML), dark brown, moist, fine to medium sand, low plasticity, moderate cohesiveness		
5.0					From 6 to 15 ft, Cuttings: SILTY SAND WITH GRAVEL (SM), brown, moist, fine to coarse sand, subrounded gravel to 8" trace to some clay (slight increase with depth)		Cuttings: F: 140 ppm
10.0							
15.0					From 15 to 18 ft, Cuttings: WELL-GRADED SAND (SW), light brown, moist, fine to coarse sand, trace clay		
					From 18 to 20 ft, Cuttings: POORLY-GRADED SAND (SP), tan, dry to moist, medium sand		Cuttings: F: 120 ppm
20.0					From 20 to 30 ft, Cuttings: FAT CLAY (CH), medium brown, moist, hard, trace to some sand		
25.0							
30.0							

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-8	SHEET 2 OF 17

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18, Irvine Ctr. Dr. and 133 Fwy

ELEVATION 194.2 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Mud Rotary (1-R TH100) 0-2-0 W/18 in. Flight Auger

WATER LEVEL AND DATE N.R. START 8/3/92 FINISH 8/5/92 LOGGER J. Lovenburg/T. Mac G

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	30.0 – 32.0	1-C	1.5		LEAN CLAY (CL), medium brown, moist, trace coarse sand, no gravel	P: 1.8 ppm	
35.0							Some dark brown clay with sand balls in cuttings
40.0	40.0 – 42.0	2-C	1.3		FAT TO LEAN CLAY (CH-CL), dark brown, very moist, trace to some sand fine grained, no gravel, Increasing sand content to bottom of sample (shoe contained increased medium to coarse sand)	P: 1.8 ppm F: 2.4 ppm	
45.0							
50.0	50.0 – 51.0	3-C	1.0		WELL-GRADED SAND (SW), light brown, moist, loose, fine to medium sand, little silt, slightly cohesive, no HCl reaction	F: .25 ppm	Driller indicates viscosity is approximately 35
55.0							
60.0							

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-8	SHEET 3 OF 17

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18, Irvine Ctr. Dr. and 133 Fwy

ELEVATION 194.2 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Mud Rotary (1-R TH100) 0-2-0 W/18 in. Flight Auger

WATER LEVEL AND DATE N.R. START 8/3/92 FINISH 8/5/92 LOGGER J. Lovenburg/T. Mac G

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	62.5	4-C	2.5		SILTY SAND (SM), light brown, moist, medium stiff, fine to medium grained, mostly fine, slightly cohesive, trace clay, no HCl reaction	F: 25 ppm	Driller indicates silty sand on drill bit
65.0							
70.0							Driller indicates consistent drilling from 60-80 ft.
75.0							
80.0	80.0–82.0	5-C	2.0		SILT (ML), light brown, moist, some fine and coarse sand, low plasticity, moderately cohesive	F: 0.8 ppm	
85.0							Water loss between 80 and 100 ft, water table?
90.0							

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-8	SHEET 4 OF 17

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18, Irvine Ctr. Dr. and 133 Fwy

ELEVATION 194.2 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Mud Rotary (1-R TH100) 0-2-0 W/18 in. Flight Auger

WATER LEVEL AND DATE N.R. START 8/3/92 FINISH 8/5/92 LOGGER J. Lovenburg/T. Mac G

DEPTH BELOW SURFACE (FT)	SAMPLE			PENETRATION TEST RESULTS	SOIL DESCRIPTION	FID/PID READING	COMMENTS
	INTERVAL	TYPE AND NUMBER	RECOVERY (FT)	6"-6"-6"	SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
95.0							
100.0	100.0 101.0	6-C	1.0		WELL-GRADED SAND (SW), gray, wet, loose, fine to coarse, no gravel, trace silt	F: 4.2 ppm	Added 4 bags of bentonite to slow water loss
105.0							
110.0					From about 110 ft, Cuttings: WELL GRADED SAND WITH GRAVEL (SW), gray, medium to coarse, subrounded gravel to 1/2 inch diameter		Driller indicates sand/gravel No rig chatter
115.0							
120.0							

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-8	SHEET 5 OF 17

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18, Irvine Ctr. Dr. and 133 Fwy

ELEVATION 194.2 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Mud Rotary (1-R TH100) 0-2-0 W/18 in. Flight Auger

WATER LEVEL AND DATE N.R. START 8/3/92 FINISH 8/5/92 LOGGER J. Lovenburg/T. Mac G

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	123.5	7-C	3.5		From 120-121 ft.: SILTY SAND (SM), light brown and greenish-gray, fine to medium grained, trace black organics in green portion From 121-123.5 ft.: LEAN CLAY (CL), mostly greenish gray with some light brown, moist, moderately plastic, little fine sand, silt, little black organics	F: 0.8 ppm	
125.0							
130.0					From about 130 ft, Cuttings: GRAVELLY CLAYEY SAND (SC), gray, fine to medium sand, subrounded gravel to 1/4 inch, low plasticity		Cuttings may lack some fines, Gravels seem to be washing throughout pipe
135.0							
140.0	140.0 141.5	8-C	1.5		From 140-140.5 ft.: GRAVELLY LEAN CLAY (CL), light brown, some fine sand and silt, moderately plastic From 140.5-141.5 ft.: SILTY SAND WITH GRAVEL (SM), light brown, fine to medium sand, subangular to subrounded gravel to 2 inch diameter maximum, cohesive	F: 2.2 ppm	
145.0							
150.0							

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-8	SHEET 6 OF 17

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18, Irvine Ctr. Dr. and 133 Fwy

ELEVATION 194.2 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Mud Rotary (1-R TH100) 0-2-0 W/18 in. Flight Auger

WATER LEVEL AND DATE N.R. START 8/3/92 FINISH 8/5/92 LOGGER J. Lovenburg/T. Mac G

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					Cuttings: Same as 8-C, gray	F: 2.4 ppm	
155.0							
160.0	160.0 160.25	9-C	0.25		LEAN TO FAT CLAY (CL/CH), dark brown, moist, medium stiff, medium plasticity, trace fine sand, little black organics		
165.0							
170.0					From about 170 ft, Cuttings: CLAYEY SAND (SC), light brown, fine to coarse sand, some silt, low plasticity		
175.0					From about 175 ft, Cuttings: CLAYEY SAND (SC), same as above cuttings except brown-gray with mostly coarse sand		Driller reports easier drilling from 175-180 ft
180.0							

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-8	SHEET 7 OF 17

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18, Irvine Ctr. Dr. and 133 Fwy

ELEVATION 194.2 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Mud Rotary (1-R TH100) 0-2-0 W/18 in. Flight Auger

WATER LEVEL AND DATE N.R. START 8/3/92 FINISH 8/5/92 LOGGER J. Lovenburg/T. Mac G

DEPTH BELOW SURFACE (FT)	SAMPLE			PENETRATION TEST RESULTS	SOIL DESCRIPTION	FID/PID READING	COMMENTS
	INTERVAL	TYPE AND NUMBER	RECOVERY (FT)	6"-6"-6"	SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	180.25 - 182.0	10-C	0.25		LEAN CLAY (CL), light brown, moist, soft, trace fine sand, silt, medium plasticity	F: 1.0 ppm	
	182.0 - 184.0	11-C	0.05		Same as above, except brown-gray with fine laminations, little gravel to 0.5 inch diameter	F: 1.0 ppm	
185.0							
190.0							
195.0							
200.0	200.0 - 204.0	12-C	4.0		SANDY LEAN CLAY (CL), light brown, moist, medium stiff, low plasticity, fine to coarse sand	F: 0.4 ppm	
205.0							
210.0							

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-8	SHEET 8 OF 17

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18, Irvine Ctr. Dr. and 133 Fwy

ELEVATION 194.2 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Mud Rotary (1-R TH100) 0-2-0 W/18 in. Flight Auger

WATER LEVEL AND DATE N.R. START 8/3/92 FINISH 8/5/92 LOGGER J. Lovenburg/T. Mac G

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
215.0							
220.0					From about 220 ft, Cuttings: GRAVELLY LEAN CLAY WITH SAND (CL), light brown to tan, wet, fine to medium sand, many fine sandy clay balls in cuttings		Driller indicates smooth drilling from 220 to 240 ft
225.0							
230.0							
235.0							
240.0							

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-8	SHEET 9 OF 17

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18, Irvine Ctr. Dr. and 133 Fwy

ELEVATION 194.2 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Mud Rotary (1-R TH100) 0-2-0 W/18 in. Flight Auger

WATER LEVEL AND DATE N.R. START 8/3/92 FINISH 8/5/92 LOGGER J. Lovenburg/T. Mac G

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	240.0–244.0	13-C	4.0		SANDY LEAN CLAY (CL), greenish-gray, moist, some black organics, low plasticity, with thin interbeds of WELL GRADED SAND (SW), light brown to greenish-gray, medium to coarse sand, trace clay		Driller indicates alternate soft and harder drilling
							Hard drilling
245.0							
							Easier drilling agin
250.0					From about 250 ft, Cuttings: WELL GRADED SAND (SW), tan, fine to coarse, trace angular gravel to 0.25 inch		
255.0							
260.0							
							Inner bit stuck
265.0					From about 265 ft, Cuttings: SAND WITH CLAY		
270.0							

PROJECT NUMBER LAO31981

BORING NUMBER MW-8

SHEET 10 OF 17

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18, Irvine Ctr. Dr. and 133 Fwy

ELEVATION 194.2 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Mud Rotary (1-R TH100) 0-2-0 W/18 in. Flight Auger

WATER LEVEL AND DATE N.R. START 8/3/92 FINISH 8/5/92 LOGGER J. Lovenburg/T. Mac G

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					From about 270 ft, Cuttings: LEAN CLAY (CL), medium to dark brown with some fine to coarse angular and subangular sand		
275.0							
280.0	280.0–280.0	14-C	1.25		LEAN TO FAT CLAY (CL to CH), medium brown, moist, some fine sand, no gravel, trace organic black streak (leaf)		
285.0					From about 285 ft, Cuttings: CLAY (CL), medium brown with sand		
290.0							
295.0							
300.0							

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-8	SHEET 11 OF 17

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18, Irvine Ctr. Dr. and 133 Fwy

ELEVATION 194.2 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Mud Rotary (1-R TH100) 0-2-0 W/18 in. Flight Auger

WATER LEVEL AND DATE N.R. START 8/3/92 FINISH 8/5/92 LOGGER J. Lovenburg/T. Mac G

DEPTH BELOW SURFACE (FT)	SAMPLE			PENETRATION TEST RESULTS	SOIL DESCRIPTION	FID/PID READING	COMMENTS
	INTERVAL	TYPE AND NUMBER	RECOVERY (FT)	6"-6"-6"	SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					From about 300 ft, Cuttings: LEAN CLAY (CL), medium brownish gray, increasing sand fine to coarse, angular		
305.0							
310.0							
315.0					From about 315 ft, Cuttings: CLAYEY SAND (SC), brownish gray, trace gravel, increased medium to coarse sand, some reddish brown sandy clay		
320.0	320.0 322.0	15-C	0				Too hard sample
325.0					From about 325 ft, Cuttings: LEAN CLAY (CL), brownish gray, sandy, medium, trace gravel, (rounded mud stone)		Seems like hard clay drilling
330.0							

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-8	SHEET 12 OF 17

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18, Irvine Ctr. Dr. and 133 Fwy

ELEVATION 194.2 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Mud Rotary (1-R TH100) 0-2-0 W/18 in. Flight Auger

WATER LEVEL AND DATE N.R. START 8/3/92 FINISH 8/5/92 LOGGER J. Lovenburg/T. Mac G

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
335.0							
340.0	340.0 – 342.0	16-C	1.2		LEAN CLAY (CL), medium brown, moist, trace coarse sand	F: 3 ppm	
345.0							
350.0					From about 350 ft, Cuttings: LEAN CLAY (CL), medium brownish gray, some coarse sand, trace small gravel fragments		
355.0							
360.0							

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-8	SHEET 13 OF 17

SOIL BORING LOG

PROJECT: MCAS El Toro RI/FS Phase I LOCATION: Site 18, Irvine Ctr. Dr. and 133 Fwy

ELEVATION: 194.2 ft DRILLING CONTRACTOR: Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT: Mud Rotary (1-R TH100) 0-2-0 W/18 in. Flight Auger

WATER LEVEL AND DATE: N.R. START: 8/3/92 FINISH: 8/5/92 LOGGER: J. Lovenburg/T. Mac G

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					From about 360 ft, Cuttings: CLAYEY SAND (SC), brownish gray, some gravel		
365.0							
370.0							
375.0							
380.0	380.0 382.0	17-C	0				Too hard to sample, drill to depth of 405 ft
385.0					From about 385 ft, Cuttings: CLAYEY SAND (SC), brownish gray with areas of reddish brown, some gravel		
390.0							

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-8	SHEET 14 OF 17

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18, Irvine Ctr. Dr. and 133 Fwy

ELEVATION 194.2 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Mud Rotary (1-R TH100) 0-2-0 W/18 in. Flight Auger

WATER LEVEL AND DATE N.R. START 8/3/92 FINISH 8/5/92 LOGGER J. Lovenburg/T. Mac G

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					From about 390 ft, Cuttings: SANDY LEAN CLAY (CL), brownish gray, some clay balls, increased gravel content, mostly fragmented due to drill bit, some rounded		Viscosity = 35
395.0							
400.0	400.0 - 402.0	18-C	0				Too hard to sample
					From about 402 ft, Cuttings: WELL GRADED GRAVEL WITH SAND AND SILT (GW-GM), brownish-gray, fine to coarse sand , with subrounded quartz and darker angular gravel to 1/2 in.		
405.0							Drilling a little quicker
410.0					From about 410 ft, Cuttings: WELL-GRADED GRAVEL WITH SAND (GW), brownish-gray, fine to coarse sand, mostly coarse, subrounded, angular to subangular red, white, yellow, black, green and gray gravel to 1/2 inch, trace clay and silt		
415.0							
420.0							

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-8	SHEET 15 OF 17

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18, Irvine Ctr. Dr. and 133 Fwy

ELEVATION 194.2 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Mud Rotary (1-R TH100) 0-2-0 W/18 in. Flight Auger

WATER LEVEL AND DATE N.R. START 8/3/92 FINISH 8/5/92 LOGGER J. Lovenburg/T. Mac G

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	420.75	19-C	.75		POORLY GRADED SAND (SP), gray-green, moist, medium dense, fine to medium sand, mostly medium sand, trace clay, little gravel, some black staining	F: 0.6 ppm	Driller reports easy drilling from 420 to 440 ft
425.0							
430.0					From about 430 ft, Cuttings: WELL-GRADED SAND WITH GRAVEL (SW), light brown, fine to coarse, subrounded to subangular gravel to 1/4 in., cuttings coarsen with depth, some fines		
435.0							
440.0					From about 440 ft, Cuttings: WELL-GRADED SAND WITH GRAVEL (SW), same as at 430 ft cuttings		
445.0							
450.0							

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-8	SHEET 16 OF 17

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18, Irvine Ctr. Dr. and 133 Fwy

ELEVATION 194.2 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Mud Rotary (1-R TH100) 0-2-0 W/18 in. Flight Auger

WATER LEVEL AND DATE N.R. START 8/3/92 FINISH 8/5/92 LOGGER J. Lovenburg/T. Mac G

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					From about 450 ft, Cuttings: WELL GRADED SAND WITH GRAVEL (SW), some gray silt balls, trace to some fines		
455.0					From about 455 to 460 ft, Cuttings: SANDY SILT (ML), dusky yellow, fine sand, trace coarse sand and gravel		Drilling reports hard drilling from 455 to 460 ft
460.0	460.0 460.25	S-22	.25		SILTY SAND (SM), dusky yellow to olive-green, fine sand, no HCl reaction		
465.0					From about 465 ft, Cuttings: SILTY SAND (SM), some coarse sand		Drilling still harder Some circulation loss between 460 to 470 ft.
470.0					From about 470 to 475 ft, Cuttings: INTERBEDDED SANDY SILT (ML), olive green, fine sand, and SILTY SAND (SM), dusky yellow, fine sand		Viscosity = 33 from 470 to 475 ft
475.0					From about 475 to 480 ft, Cuttings: SANDY SILT (ML), gray, fine sand, trace medium sand		Some circulation loss
480.0							

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-8	SHEET 17 OF 17

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18, Irvine Ctr. Dr. and 133 Fwy

ELEVATION 194.2 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Mud Rotary (1-R TH100) 0-2-0 W/18 in. Flight Auger

WATER LEVEL AND DATE N.R. START 8/3/92 FINISH 8/5/92 LOGGER J. Lovenburg/T. Mac G

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					From about 480 ft, Cuttings: SANDY SILT (ML), orangish-yellow, fine sand, trace medium sand, trace clay		
485.0					From about 485 ft, Cuttings: SANDY SILT (ML), Same as above, except brownish-yellow, some medium and coarse sand		
490.0					From about 490 ft, Cuttings: SILTY SAND (SM), light brown, fine to coarse sand		
495.0					From about 490 ft, Cuttings: SILTY SAND (SM) Same as above, except light yellow-brown		
500.0					Total Depth - 500 ft		
505.0							
510.0							

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-9	SHEET 1 OF 9

SOIL BORING LOG

PROJECT: MCAS El Toro RI/FS Phase I   LOCATION: Site 18 Alton Parkway and Technology W.

ELEVATION: 234.7 ft   DRILLING CONTRACTOR: Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT: TH-100 (Mud)

WATER LEVEL AND DATE: N.R.   START: 7/1/92   FINISH: 7/16/92   LOGGER: Y. Chuang / T. Mac

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					0 to 0.5 ft, Asphalt 0.5 to 2.0 ft, Cuttings: GRAVELLY SILT WITH SAND (ML), blackish brown, moist to wet, soft, gravel to 1/2-inch From 2.0 to 5.0 ft, Cuttings: SANDY LEAN CLAY (CL), dark brown to brown, moist to wet, medium firm, fine to medium sand From 5.0 to 20.0 ft, Cuttings: SILTY SAND (SM), dark brown to light brown, moist to wet layers, loose, coarse to fine sand, occasional gravel to 1/4-inch diameter	F: 0.0 ppm	Top 8 ft. is fill
10.0							
20.0					From 20 to 40 ft, Cuttings: CLAYEY SAND (SC), brown, trace gravel	F: 0.0 ppm	Bottom of conductor casing at 20 ft
30.0							Mud velosity = 38 sec.
40.0	40.0 42.0	1-C	2.0		POORLY GRADED SAND (SP), trace fines, some gravel to 1 inch diameter	F: 1.0 ppm P: 2.5 ppm	Hard drilling at 40 ft Soft zone at 42 ft
50.0							
60.0							

PROJECT NUMBER LAO31981

BORING NUMBER MW-9

SHEET 2 OF 9

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18 Alton Parkway and Technology W.

ELEVATION 234.7 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT TH-100 (Mud)

WATER LEVEL AND DATE N.R. START 7/1/92 FINISH 7/16/92 LOGGER J. Coyle

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	60.0 62.0	2-C	2.0		Upper 6 inches: POORLY GRADED SAND (SP), light brown, wet, loose, fine grained sand Middle 10 inches: WELL GRADED SAND (SW), brown, wet, loose, trace clay and gravel, fine to medium grained Bottom 8 inches: SANDY CLAY (CL), brown, moist, hard, fine to coarse sand, can roll ribbon		Some mud loss
70.0							
80.0	80.0 82.0	3-C	0.0			F: 0.5 ppm P: 0.5 ppm	
	83.0 85.0	4-C	2.0		Interlayered SILTY SAND (SM), and LEAN CLAY (CL), brown, moist, poorly graded, fine to medium sand, small pyrite/muscovite specks	F: 1.0 ppm	
90.0							
100.0	100.0 103.0	5-C	3.0		Layered SILTY SAND (SM), and LEAN CLAY (CL), brown to gray, wet, medium dense, fine to medium sand, poorly graded, trace coarse sand, minor amount of white weathered clasts in clay	F: 3.0 ppm	
110.0							
120.0							

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-9	SHEET 3 OF 9

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18 Alton Parkway and Technology W.

ELEVATION 234.7 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT TH-100 (Mud)

WATER LEVEL AND DATE N.R. START 7/1/92 FINISH 7/16/92 LOGGER J. Coyle

DEPTH BELOW SURFACE (FT)	SAMPLE			PENETRATION TEST RESULTS	SOIL DESCRIPTION	FID/PID READING	COMMENTS
	INTERVAL	TYPE AND NUMBER	RECOVERY (FT)	6"-6"-6"	SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	120.0 - 123.0	6-C	3.0		LAYERED SILTY SAND TO SANDY SILT (SM to ML), reddish-brown, moist, fine sand, few coarse sand grains	F: 3.2 ppm	Moderate mud loss 115-130 ft
130.0							
140.0	140.0 - 142.0	7-C	1.5		WELL GRADED SAND (SW), brown, wet, less than 15% silt and clay, minor olive-green sand and gravel sized, less than 5% siltstone	P: 4.0 ppm	
150.0							
							157-159 ft: Driller noted hard drilling
160.0	160.0 - 163.0	8-C	1.5		SILTY SAND (SM), wet, brown, well graded, fine to coarse grained, trace green and red siltstone clasts, occasional CLAYEY SILT (ML) seams	F: 2.2 ppm	Mud viscosity = 32 sec.
170.0							
180.0							

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-9	SHEET 4 OF 9

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18 Alton Parkway and Technology W.

ELEVATION 234.7 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT TH-100 (Mud)

WATER LEVEL AND DATE N.R. START 7/1/92 FINISH 7/16/92 LOGGER J. Coyle

DEPTH BELOW SURFACE (FT)	SAMPLE			PENETRATION TEST RESULTS	SOIL DESCRIPTION	FID/PID READING	COMMENTS
	INTERVAL	TYPE AND NUMBER	RECOVERY (FT)	6"-6"-6"	SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					From 180 to 300 ft, Cuttings: Same as 8-C, SILTY SAND (SM), with possible clay stringers		Lag time of cuttings in borehole is becoming increasingly long making geologic characterization difficult (greater than 7 minutes)
190.0							
200.0							
210.0							
220.0							
230.0							
240.0							

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-9	SHEET 5 OF 9

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18 Alton Parkway and Technology W.
ELEVATION 234.7 ft DRILLING CONTRACTOR Beylik Drilling Inc.
DRILLING METHOD AND EQUIPMENT TH-100 (Mud)
WATER LEVEL AND DATE N.R. START 7/1/92 FINISH 7/16/92 LOGGER J. Coyle

DEPTH BELOW SURFACE (FT)	SAMPLE			PENETRATION TEST RESULTS	SOIL DESCRIPTION	FID/PID READING	COMMENTS
	INTERVAL	TYPE AND NUMBER	RECOVERY (FT)	6"-6"-6"	SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					From 300 ft, Cuttings: Same as 8-C, SILTY SAND (SM)		
250.0							
260.0							
270.0							
280.0							
290.0							
300.0							

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-9	SHEET 6 OF 9

SOIL BORING LOG

PROJECT: MCAS El Toro RI/FS Phase I — LOCATION: Site 18 Alton Parkway and Technology W.

ELEVATION: 234.7 ft — DRILLING CONTRACTOR: Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT: TH-100 (Mud)

WATER LEVEL AND DATE: N.R. — START: 7/1/92 — FINISH: 7/16/92 — LOGGER: J. Coyle

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	300.0 - 302.0	9-C	2.0		SILTY SAND (SM), orange-brown, moist, fine grained, occasional elastic silt (MH) seams, less than 5% gravel and less than 15% coarse sand		
310.0							
320.0					From 320 to 360 ft, Cuttings: SILTY SAND (SM), coarse grained		
330.0							
340.0					At about 340 ft, Cuttings: Color change to red-brown		
350.0							
360.0							

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-9	SHEET 7 OF 9

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Alton Parkway and Technology W.

ELEVATION 234.7 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT TH-100 (Mud)

WATER LEVEL AND DATE N.R. START 7/1/92 FINISH 7/16/92 LOGGER J. Coyle

DEPTH BELOW SURFACE (FT)	SAMPLE			PENETRATION TEST RESULTS	SOIL DESCRIPTION	FID/PID READING	COMMENTS
	INTERVAL	TYPE AND NUMBER	RECOVERY (FT)	6"-6"-6"	SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					At about 360 ft, Cuttings: Color change to SANDY SILT (ML), blackish-gray		at 360 ft: Definite density change, drilling rate very slow
370.0							
380.0							
390.0	380.0 – 382.0	10-C	2.0		INTERBEDDED SANDY SILT (ML) AND SILTY SAND (SM), layered brown gray and black with some oxidized zones, dry to moist, very dense, fine to medium grained sand, poorly graded		
400.0							
410.0							
420.0							

PROJECT NUMBER LAO31981

BORING NUMBER MW-9

SHEET 8 OF 9

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18 Alton Parkway and Technology W.

ELEVATION 234.7 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT TH-100 (Mud)

WATER LEVEL AND DATE N.R. START 7/1/92 FINISH 7/16/92 LOGGER J. Coyle

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
430.0							
440.0					From about 440 to 460 ft, Cuttings: SANDY SILT (ML), gray, very fine grained, trace gravel, with about 15 to 20 % clay with occasional light gray sand seams		
450.0							
460.0							
470.0					At about 470 ft, Cuttings: SANDY SILT (ML), with a high coarse sand fraction or broken gravel		at 470 ft: Very dense, drilling rate declines rapidly
480.0							

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-9	SHEET 9 OF 9

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18 Alton Parkway and Technology W.

ELEVATION 234.7 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT TH-100 (Mud)

WATER LEVEL AND DATE N.R. START 7/1/92 FINISH 7/16/92 LOGGER J. Coyle

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
							From about 482-485 ft- softer, drilling rate increases
490.0					From about 485 to 500 ft, Cuttings: SILTY SAND (SM), gray, 5 to 10% clay, less than 15% gravel		From about 485-500 ft- difficult drilling very dense, lots of drill rod vibration
500.0					Total Depth - 500 ft		
510.0							
520.0							
530.0							
540.0							

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-10	SHEET 1 OF 20

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS LOCATION Site 18 Irvine Co., Irvine Ctr. Dr & ~~Hearthstone~~

ELEVATION 58.2 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Portadrill Mud Rotary TXT-100

WATER LEVEL AND DATE NR START 11/2/92 FINISH 11/29/92 LOGGER K. J. Gally

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					From about 0 to 3 ft, Cuttings: LEAN CLAY (CL), trace gravel, medium brown		Sample with 3 connected 2 ft 2-inch diameter split spoons
					From about 3 to 12 ft, Cuttings: LEAN CLAY (CL), medium dark brown, moist, medium stiff, trace fine sand		
10							
					From about 12 to 19 ft, Cuttings: LEAN CLAY WITH SAND (CL), medium light brown, wet, medium stiff, fine to medium sand		Water at approximately 15 ft, Driller thinks that water is due to extensive watering of lawns in the region
20	19.0–22.0	1-CB	2.0	N.A.	SANDY CLAY (CL), medium brown, moist, medium sand	F: 0.0 ppm	
					From about 22 ft, Cuttings: LEAN CLAY WITH SAND (CL), medium brown, medium sand		
30							
40							
	43.0–47.0	2-CB	4.0	N.A.	LEAN CLAY (CL), medium brown, moist, medium stiff	F: 0.0 ppm	
					From about 47 ft' Cuttings: LEAN CLAY, similar to sample 2-CB		
50							
60							

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-10	SHEET 2 OF 20

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS LOCATION Site 18 Irvine Co., Irvine Ctr. Dr. & Hearthstone

ELEVATION 58.2 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Portadrill Mud Rotary TXT-100

WATER LEVEL AND DATE NR START 11/2/92 FINISH 11/29/92 LOGGER K. J. Gally

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					From about 60 ft, Cuttings: LEAN CLAY WITH SAND (CL), brown, trace medium sand, increasing sand content with depth		
70							
					From about 75 ft, Cuttings: SANDY CLAY (CL), brown, medium to coarse sand		
80							
	83.0–88.0	3-CB	2.5	N.A.	CLAYEY SAND (SC), medium brown, wet, soft, very fine sand, poorly graded, sand content increasing with depth.	F: 0.0 ppm	
					From about 88 ft, Cuttings: SANDY LEAN CLAY (CL), brown, fine to medium sand, trace of coarse sand		
90							
100							
					From about 104 ft, Cuttings: SANDY LEAN CLAY (CL), as above, except with Increased clay content and medium grained sand		
110							
120							

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-10	SHEET 3 OF 20

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS LOCATION Site 18 Irvine Co., Irvine Ctr. Dr & Hearthstone

ELEVATION 58.2 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Portadrill Mud Rotary TXT-100

WATER LEVEL AND DATE NR START 11/2/92 FINISH 11/29/92 LOGGER K. J. Gally

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	123.0–127.0	4-CB	3.0	N.A.	From 123.0 to 124.5 ft: POORLY GRADED SAND WITH CLAY (SP-SC), medium light brown, wet, fine sand, trace medium sand and silt From 124.5 to 126.0 ft: WELL-GRADED SAND WITH CLAY (SW-SC), medium light brown, wet, fine to coarsesand, subangular	F: 0.0 ppm	0830 Decreasing clay content transition to a better water bearing zone at approx 125.0 ft
130					From about 127 ft' Cuttings: WELL GRADED SAND WITH CLAY (SW-SC), similar to above, coarse sand		
140							At about 145 ft, increased clay content in cuttings
150					From about 150 ft' Cuttings: CLAYEY SAND (SC), coarse sand, subangular, increasing clay content		
160	163.0–167.0	5-CB	4.0	N.A.	From 163.0 to 165.0 ft: SANDY CLAY (CL), medium light brown with gray mottling, moist, medium stiff, very fine sand From 165.0 to 166.5 ft: WELL-GRADED SAND WITH CLAY (SW-SC), medium light brown, wet From 166.5 to 167.0 ft: LEAN CLAY WITH SAND (CL), medium light brown, moist, medium stiff, very fine sand	F: 0.0 ppm	Sand lens at 168 ft
170							
180							

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-10	SHEET 4 OF 20

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS LOCATION Site 18 Irvine Co., Irvine Ctr. Dr & Hearthstone

ELEVATION 58.2 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Portadrill Mud Rotary TXT-100

WATER LEVEL AND DATE NR START 11/2/92 FINISH 11/29/92 LOGGER K. J. Gally

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
							Viscosity = 38 secs
							Fine to medium grained sand in cuttings
190							
200							
	203.0–207.0	6-CB	4.0	N.A.	From 203.0 to 206.0 ft, LEAN CLAY (CL), dark brown, with small amount of light and medium brown mottling, moist, stiff, trace fine sand From 206.0 to 207.0 ft, LEAN CLAY, similar to above with increasing sand content (fine to medium sand)	F: 0.0 ppm	
210							
					From about 215 ft, Cuttings: CLAYEY SAND (SC), medium to coarse sand, subangular		
220							
							Rig Chatter
					From about 228 ft, Cuttings: SANDY CLAY (SC)		
230							
240							

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-10	SHEET 5 OF 20

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS LOCATION Irvine Co., Irvine Ctr. Dr & Hearthstone

ELEVATION 58.2 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Portadrill Mud Rotary TXT-100

WATER LEVEL AND DATE NR START 11/2/92 FINISH 11/29/92 LOGGER K. J. Gally

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	243.0–247.0	7-CB	3.0	N.A.	LEAN CLAY WITH SAND (CL), medium dark brown, moist, increasing stiffness with depth, fine-grained sand, trace silt.		Viscosity = 38 secs
250							
260					From about 260 ft' Cuttings: SANDY CLAY (SC)	F: 0.0 ppm	Easier drilling
							Increased clay content in cuttings at 268 ft
270							
280							
	283.0–287.0	8-CB	3.5	N.A.	LEAN CLAY (CL), olive/dark brown, moist, very stiff	F: 0.0 ppm	
290					From about 290 ft, Cuttings: LEAN CLAY (CL), similar to 8-C		
300							

CH2M HILL

PROJECT NUMBER	BORING NUMBER
LAO31981	MW-10 SHEET 6 OF 20

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS LOCATION Irvine Co., Irvine Ctr. Dr & Hearthstone

ELEVATION 58.2 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Portadrill Mud Rotary TXT-100

WATER LEVEL AND DATE NR START 11/2/92 FINISH 11/29/92 LOGGER J. McHugh

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
310					From about 310 ft, Cuttings: SANDY SILT (ML), brown, fine to coarse sand, well graded, subangular		
320	323.0				From 323.0 to 324.0 ft: CLAYEY SAND (SC), brown, dry, medium dense, fine sand, trace medium to coarse sand, poorly graded, subrounded.		
	327.0	9-C	3.8	N.A.	From 324.0 to 326.0 ft: POORLY GRADED SAND (SP-SM), brown, wet, medium dense, fine sand, trace medium to coarse sand From 326.0 to 327.0 ft: LEAN CLAY (CL), brown, dry, very stiff, gray at tip	F: 0.0 ppm	
330					From about 330 ft, Cuttings: LEAN CLAY (CL), grey and white, (calcite?)		
340							
350							
360							

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-10	SHEET 7 OF 20

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS LOCATION Site 18 Irvine Co., Irvine Ctr. Dr & Hearthstone

ELEVATION 58.2 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Portadrill Mud Rotary TXT-100

WATER LEVEL AND DATE NR START 11/2/92 FINISH 11/29/92 LOGGER J. McHugh

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	363.0–367.0	10-CB	2.0	N.A.	From 363.0 to 364.0 ft, LEAN CLAY (CL), greenish grey, hard, dry, From 364.0 to 365 ft, SILTY SAND (SM), greenish gray, wet, medium, dense, fine sand, poorly graded, 40% shells,1-5 cm, broken, fragile, tan	F: 0.4 ppm	
370					From about 370 ft, Cuttings: SILTY SAND (SM), similar to above in 10-CB		
380					From about 385 ft, Cuttings: SILTY SAND (SM), greenish gray, fine sand, poorly graded, 20% shells, approx 1 cm, broken		Mud Viscosity = 37 seconds Mud Density = 1120 kg/m^3
390							Mud Viscosity = 37 seconds Mud Density = 1120 kg/m^3
400	403.0–407.0	11-CB	1.5	N.A.	Top 6": SILT (ML), orange brown, dry, very stiff, Middle 8": LEAN CLAY (CL), grey brown, dry, hard Bottom 4": LEAN CLAY (CL), light brown, calcite cemented	F: 0.2 ppm	At 403 ft to 407 ft: rig chatter
410							At 410.0 ft: rig chatter
420							

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-10	SHEET 8 OF 20

SOIL BORING LOG

PROJECT: MCAS El Toro RI/FS   LOCATION: Site 18 Irvine Co., Irvine Ctr. Dr & Hearthstone

ELEVATION: 58.2 ft   DRILLING CONTRACTOR: Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT: Portadrill Mud Rotary TXT-100

WATER LEVEL AND DATE: NR   START: 11/2/92   FINISH: 11/29/92   LOGGER: J. McHugh

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
430					From about 430 ft, Cuttings: SILTY SAND (SM), brown, fine to medium sand		At approx 431 ft : rig chatters
440							
	443.0 – 447.0	12-CB	1.5	N.A.	Top 6 in: FAT CLAY (CH), brown, wet, very stiff, trace fine sand 6 in: LEAN CLAY WITH SAND (CL), brown, wet, hard fine sand 6 in: SILTY SAND (SM), brown, wet, very dense, fine sand Bottom 2.5 ft: POORLY GRADED SAND WITH SILT (SP-SM), brown, wet, medium dense	F: >5.0 ppm	Mud Viscosity = 39 seconds Mud Density = 1140 kg/m^3
450							
460					From about 465 ft, Cuttings: Approx 30% LEAN CLAY and 70% WELL GRADED SAND, interbedded? LEAN CLAY (CL), brown, WELL GRADED SAND (SW), brown, fine to coarse sand , subrounded, quartz rich, contains approx 20% calcite and shell fragments		At approx 465 ft 1028: Mud Viscosity ≈ 37 seconds Mud Density = 9.3 lb/gal = 1140 kg/m^3
470					From about 475 ft, Cuttings: Similar to above, except 50% LEAN CLAY, and 50% WELL GRADED SAND		Rig chatters: 470 ft to 474 ft At 474 ft: faster drilling At 476 to 477 ft: rig chatters
480							

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-10	SHEET 9 OF 20

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS LOCATION Site 18 Irvine Co., Irvine Ctr. Dr & Hearthstone

ELEVATION 58.2 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Portadrill Mud Rotary TXT-100

WATER LEVEL AND DATE NR START 11/2/92 FINISH 11/29/92 LOGGER J. McHugh

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	482.0 – 486.0	13-CB	3.3	N.A.	Top 2.7 ft: POORLY GRADED SAND (SP), light brown, wet, loose, fine to medium sand Bottom 0.6 ft: LEAN CLAY WITH SAND (CL), greenish gray, dry, hard, fine sand	F: 4 ppm	From 486 to 502 ft: fast drilling
490					From about 490 ft, Cuttings: About 30% LEAN CLAY and 70% WELL GRADED SAND, interbedded, LEAN CLAY (CL), brown, WELL GRADED SAND (SW), brown, fine to coarse sand, subrounded, quartz rich, contains ~20% calcite and shell fragments		
500							
510					From about 510 ft, Cuttings: SILTY SAND (SM), brown, sand is fine to coarse sand, well graded		
520	522.0 – 526.0	14-CB	3.7	N.A.	At 522.0 to 522.2 ft: SILTY SAND (SM), greenish gray, wet, medium dense, fine sand, poorly graded From 522.2 to 523.1 ft: LEAN CLAY (CL), greenish gray, moist, very stiff, trace fine sand, minor calcite cementation, low plasticity From 523.1 to 523.7 ft: SILT (ML), greenish gray, moist, firm, thin fine sand interbeds, slight plasticity From 523.7 to 525.0 ft: FAT CLAY (CH), greenish gray, dry, hard, high plasticity, trace carbon plant fragments 1-2 mm From 525.0 to 526.7 ft: LEAN CLAY (CL), 3 colored zones: greenish grey, followed by brown, followed by tan with specks of green and white, moist, firm, low plasticity	F: 1.6 ppm	
530					From about 535 ft, Cuttings: LEAN CLAY (CL), greenish gray		
540							

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-10	SHEET 10 OF 20

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS LOCATION Site 18 Irvine Co., Irvine Ctr. Dr & Hearthstone

ELEVATION 58.2 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Portadrill Mud Rotary TXT-100

WATER LEVEL AND DATE NR START 11/2/92 FINISH 11/29/92 LOGGER J. McHugh

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
550					From about 555.0 ft, Cuttings: WELL GRADED SAND (SW), 80%, with LEAN CLAY (CL), 20% greenish gray		558 to 561 ft: Slow drilling
560	562.0 – 566.0	15-CB	2.0	N.A.	From 562.0 to 562.7 ft, SILTY SAND (SM), brown, wet, medium dense, fine to medium, sand poorly graded From 562.7 to 563.7 ft, SANDY SILT (ML), brown, wet, hard, fine to medium (trace coarse) sand well graded From 563.7 to 563.8 ft, SILTY SAND, as in 562.0 to 562.7 ft	F: 3 ppm	Mud Viscosity - 39 seconds Mud Density = 9.6 lb/gal = 1155 kg/m^3
570					From approx 570 to 575 ft, Cuttings: WELL GRADED SAND (SW), brown, fine to medium (trace coarse) sand, well graded, subrounded, quartz rich		570 to 575 ft: Fast drilling 575 to 581 ft: Very slow drilling
580					From about 578 ft, Cuttings: LEAN CLAY (CL), and fine to coarse sand		
590					From about 590 ft, Cuttings: SANDY SILT (ML), brown, fine to coarse sand, well graded		
600					From about 600 ft, Cuttings: WELL GRADED SAND (SW), fine to coarse sand, quartz rich, subangular		596 to 602 ft: Very slow drilling 597 to 602 ft: Rig Chatters

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-10	SHEET 11 OF 20

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS LOCATION Site 18 Irvine Co., Irvine Ctr. Dr & Hearthstone

ELEVATION 58.2 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Portadrill Mud Rotary TXT-100

WATER LEVEL AND DATE NR START 11/2/92 FINISH 11/29/92 LOGGER J. McHugh

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION (SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY)	FID/PID READING	COMMENTS (DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION)
	602.0–606.0	16-CB	1.5	N.A.	From 602 to 602.3 ft: SILTY SAND (SM), brown, wet, loose, very fine to fine (trace medium) sand, poorly graded From 602.3 to 602.6 ft: SANDY SILT (ML), brown, wet, firm, very fine sand, poorly graded From 602.6 to 603.5 ft: LEAN CLAY (CL), brown with small black and tan specs, dry, hard, trace fine sand, low plasticity, occassional thin laminae	F: 2.2 ppm	From about 606 ft to 622 ft: fast drilling
610					From about 610 ft, Cuttings: WELL GRADED SAND (SW), brown, fine to medium sand		
620							
630					From about 630 ft, Cuttings: LEAN CLAY (CL), brown		From about 630 to 640 ft: fast drilling
640					From about 640 ft, Cuttings: LEAN CLAY WITH SAND (CL), brown, trace white, fine to medium sand		
	642.0–646.0	17-CB	2.2	N.A.	From 642 to 642.2 ft, Cuttings: LEAN CLAY (CL), gray, moist, very firm, low plasticity, laminations (1 mm) From 642.2 to 642.7 ft, Cuttings: SILTY SAND to SANDY SILT (SM to ML), gray, wet, firm, fine sand, poorly graded, undulating high angle laminations (1 mm) From 642.7 to 644.2 ft, Cuttings: LEAN CLAY (CL), gray, dry, hard, low plasticity, occassional calcite nodules, thin undulatory laminations (1 mm) of white calcite rich clay	F: 3.0 ppm	
650					From about 650 ft, Cuttings: LEAN CLAY WITH SAND (CL), fine to medium sand		
660							

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-10	SHEET 12 OF 20

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS LOCATION Site 18 Irvine Co., Irvine Ctr. Dr & Hearthstone

ELEVATION 58.2 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Portadrill Mud Rotary TXT-100

WATER LEVEL AND DATE NR START 11/2/92 FINISH 11/29/92 LOGGER J. McHugh

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
670							Finer sand size in cuttings at 670 ft
680							
	682.0 – 686.0	18-CB	1.8	N.A.	From 682.0 to 682.2 ft, LEAN CLAY WITH SAND (CL), grey, wet, firm, fine sand, trace medium, From 682.2 to 682.8 ft, SILTY SAND (SM), grey, wet, dense, fine sand, poorly graded From 682.8 to 683.7 ft, LEAN CLAY WITH SAND (CL), grey, dry to moist, very firm, fine sand, poorly graded From 683.7 to 683.8 ft, POORLY GRADED SAND WITH CLAY (SP-SC), grey, wet, loose, fine sand	F: 1.6 ppm	
690							
700					From about 690 ft, Cuttings: SANDY LEAN CLAY (CL), fine to medium sand		Mud Viscosity = 47 seconds Mud Density = 9.9 lb/gal = 1200kg/m^3
							More fine sand in cuttings at 705 ft
710							
720					From about 720 ft, Cuttings: 50% POORLY GRADED SAND (SP), fine to medium sand, subrounded, quartz rich, 50% LEAN CLAY WITH SAND (CL), grey, fine sand		

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-10	SHEET 13 OF 20

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS LOCATION Site 18 Irvine Co., Irvine Ctr. Dr & Hearthstone

ELEVATION 58.2 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Portadrill Mud Rotary TXT-100

WATER LEVEL AND DATE NR START 11/2/92 FINISH 11/29/92 LOGGER J. McHugh

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	722.0–726.0	19-CB	3.3	N.A.	From 722.0 to 722.1 ft, Cuttings: SANDY SILT (ML), brown, moist, firm, very fine sand , poorly graded From 722.1 to 722.8 ft, Cuttings: FAT CLAY (CH), brown, dry, hard From 722.8 to 723.3 ft, Cuttings: POORLY GRADED SAND WITH SILT (SP-SM), brown, wet, medium dense, fine to medium sand, subrounded From 723.3 to 723.9 ft, Cuttings: SILTY SAND (SM), brown, wet, medium dense, fine sand, poorly graded From 723.9 to 725.3 ft, Cuttings: WELL GRADED SAND (SW), brown, wet, medium dense, fine to coarse sand, subrounded, quartz rich	F: 3.4 ppm	Mud Viscosity = 37 seconds Mud Density = 9.8 lb/gal = 1170kg/m^3
730					At about 730 ft, Cuttings: 70% WELL GRADED SAND (SW), brown, fine to coarse sand, subrounded, quartz rich , brown, 30% SANDY CLAY, brown, fine sand At about 735 ft, Cuttings: 80% SANDY CLAY (SC), brown, 20% fine to medium sand		At approx 745 ft: Rig chatter At approx 748 ft: Rig chatter
740							
750					At about 750 ft, Cuttings: WELL GRADED SAND (SW), brown, fine to medium sand		At 757 ft: Rig chatter
760					At about 760 ft, Cuttings: WELL GRADED SAND (SW), brown, fine to coarse sand, subrounded		
	762.0–766.0	20-CB	1.7	N.A.	From 762.0 to 767.7 ft, Cuttings: WELL GRADED SAND (SW), light brown, wet, medium dense, fine to medium sand (trace coarse), subangular to subrounded, quartz rich, thin 1 cm interbeds of coarse sand and fine gravel, gravel is 1-3 cm, subround to rounded, poorly graded	F: 2.2 ppm	From 766 to 782 ft: Slow drilling
770					At about 775 ft, Cuttings: WELL GRADED SAND (SW), light brown, fine to medium sand		
780							

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-10	SHEET 14 OF 20

SOIL BORING LOG

PROJECT: MCAS El Toro RI/FS LOCATION: Site 18 Irvine Co., Irvine Ctr. Dr & Hearthstone

ELEVATION: 58.2 ft DRILLING CONTRACTOR: Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT: Portadrill Mud Rotary TXT-100

WATER LEVEL AND DATE: NR START: 11/2/92 FINISH: 11/29/92 LOGGER: J. McHugh

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					From about 780 ft, Cuttings: 80% SANDY SILT (ML), brown, fine sand, 10% POORLY GRADED SAND (SP), medium sand, 10% LEAN CLAY (CL), gray		At approx 783 ft: Rig chatter From 783 to 788 ft: Very slow drilling At 788 ft : Rig chatter
790					At about 790 ft, Cuttings: 60% SANDY SILT (ML), brown, fine sand, 40% POORLY GRADED SAND (SP), medium sand		Mud Viscosity = 39 seconds Mud Density = 9.8 lb/gal = 1180kg/m^3
800	802.0–806.0	21-CB	2.8	N.A.	From 802.0 to 803.1 ft, LEAN CLAY (CL), brown, dry, hard, thin laminations (<1mm) From 803.1 to 803.4 ft, SILTY SAND (SM), brown, wet, medium dense, fine sand, poorly graded From 803.4 to 804.3 ft, SANDY LEAN CLAY (CL), brown, moist, hard, fine sand, poorly graded From about 804.3 to 804.8 ft cuttings: CLAYEY SAND, (SC), brown, moist, very dense, sand is fine, poorly graded	F: 2.0 ppm	
810					From about 810 ft, Cuttings: SANDY LEAN CLAY (CL), 90%, brown, fine sand, 10% POORLY GRADED SAND (SP), fine to medium sand, rounded		From 810 to 818 ft: Slow drilling At 810 ft: Rig chatter Mud Viscosity = 39 seconds Mud Density = 10.9 lb/gal = 1190kg/m^3
820							
830					From about 830ft, Cuttings: 70% SANDY LEAN CLAY (CL), fine sand, 30% POORLY GRADED SAND (SP), fine to medium sand From about 840 ft. Cuttings: SANDY LEAN CLAY (CL), 50% brown, 50% POORLY GRADED SAND (SP), gray, fine to medium sand		At approx 835 ft: Very slow drilling
840							

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-10	SHEET 15 OF 20

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS LOCATION Site 18 Irvine Co., Irvine Ctr. Dr. & Hearthstone

ELEVATION 58.2 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Portadrill Mud Rotary TXT-100

WATER LEVEL AND DATE NR START 11/2/92 FINISH 11/29/92 LOGGER John McHugh

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION (SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY)	FID/PID READING	COMMENTS (DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION)
	842.0–846.0	22-CB	1.1	N.A.	From 842.0 to 842.1 ft, SANDY LEAN CLAY (CL), brown, moist, firm, fine sand, poorly graded From 842.1 to 842.6 ft, LEAN CLAY (CL), grey, hard From 842.6 to 843.1 ft, SILTY SAND (SM) to POORLY GRADED SAND WITH SILT (SP-SM), light grey, wet, medium dense, fine sand	F: 0.6 ppm	
850					From about 850 ft, Cuttings: POORLY GRADED SAND (SP), medium sand From about 855 ft, Cuttings: SANDY CLAY (SC), gray and brown		
860					From about 860 ft, Cuttings: SANDY CLAY (SC), predominately brown, minor gray, fine to medium sand		
870							At 873 ft - very slow drilling Note: Driller believes his bit is worn down
880							Mud Viscosity = 47 sec Mud Density = 10.1 lb/gal = 1210 kg/m^3
	882.0–886.0	23-CB	2.5	N.A.	From 882.0 to 882.8 ft, LEAN CLAY WITH SAND (CL), brown, moist, firm to hard, fine sand, poorly graded From 882.8 to 883.1 ft, CLAYEY SAND (SC), brown, moist, dense, fine sand, poorly graded From 883.1 to 883.2 ft, POORLY GRADED SAND WITH SILT (SP-SM), brown with small zones of gray, wet, medium dense From 883.2 to 883.4 ft, SILTY SAND (SM), brown, wet, medium dense, fine sand, poorly graded From 883.4 to 884.5 ft, LEAN CLAY (CL), interbedded with LEAN CLAY WITH SAND, brown, dry, hard, fine sand, poorly graded, very dense	F: 5.8 ppm	Mud Viscosity = 43 sec Mud Density = 10.0 lb/gal = 1200 kg/m^3 886 to 895 ft: slow drilling 895 to 902 ft: fast drilling 904 to 907 ft: fast drilling
890					From about 890 ft, SANDY LEAN CLAY (CL), brown, fine sand (trace medium) From about 895 ft, SILTY SAND (SM), brown, fine to coarse sand		
900							

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-10	SHEET 16 OF 20

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS LOCATION Site 18 Irvine Co., Irvine Ctr Dr & Hearthstone

ELEVATION 58.2 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Portadrill Mud Rotary TXT-100

WATER LEVEL AND DATE NR START 11/2/92 FINISH 11/29/92 LOGGER John McHugh

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
910					From about 900 ft, Cuttings: SANDY LEAN CLAY (CL), brown, fine sand, < 5% medium to coarse sand From about 905 ft, Cuttings: CLAYEY SAND (SC), brown, fine to medium sand, subangular, well graded From about 910 ft, Cuttings: SANDY CLAY (CL), brown and gray, fine to medium sand, trace shell fragments		Mud Viscosity = 44 sec Mud Density = 10.2 lb/gal = 1230 kg/m^3 Similar to shell found at 364 ft At approx 912 ft - rig chatter At approx 911 to 920 ft: Very slow drilling At approx 920 to 922 ft: Extremely slow drilling and rig chatter at approx. 3 min/ft
920	922.0 – 926.0	24-CB	2.8	N.A.	From 922.0 to 922.1 ft, LEAN CLAY WITH SAND (CL), brown, moist, firm, fine sand From 922.1 to 922.6 ft, POORLY GRADED SAND WITH SILT (SP-SM), light brown, wet, medium dense, fine to medium sand From 922.6 to 924.8 ft, INTERBEDDED LEAN CLAY and LEAN CLAY WITH SAND (CL), brown, dry, hard, fine sand, minor % of gray 1cm clay zones, also thin (<1mm), subhorizontal laminations		
930					From about 930 ft, LEAN CLAY to SANDY LEAN CLAY (CL), brown, 10% fine to medium sand		
940							Mud Viscosity = 47 seconds Density = 10.316/gal = 1230 kg/m^3 Driller notes faster drilling today is in part due to new bit. Driller thinks that there is a 5-6 minute delay between drilling and surfacing of cuttings.
950					From about 950 ft, Cuttings: POORLY GRADED SAND (SP), brown, medium sand (trace fine & coarse), subrounded		At approx. 958 ft: Rig chatter
960							

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-10	SHEET 17 OF 20

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS LOCATION Site 18 Irvine Co., Irvine Ctr. Dr & Hearthstone

ELEVATION 58.2 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Portadrill Mud Rotary TXT-100

WATER LEVEL AND DATE NR START 11/2/92 FINISH 11/29/92 LOGGER John McHugh

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					From about 960 ft, Cuttings: 50% SANDY LEAN CLAY (CL), brown, fine sand, 50% POORLY GRADED SAND (SP), medium sand, subangular		At 965 ft to 967 ft Slow drilling
970							
					From about 975 ft, Cuttings: SANDY LEAN CLAY (CL), brown, fine sand		At approx 978 ft cuttings: Rig chatter
980					From about 980 ft, Cuttings: CLAYEY SAND (SC), brown, medium sand, (trace fine & coarse), well graded		At approx 978 ft to 982 ft: slow drilling
							At 986 ft: Rig chatter At 986 ft to 991 ft: slow drilling At 991 ft: very slow drilling At 991 ft to 1002 ft: Fast drilling
990					From about 990 ft to 1000 ft, Cuttings: WELL GRADED SAND (SW), brown, fine to coarse sand, subrounded		
1000					From about 1000 ft to 1020 ft, Cuttings: >90% WELL GRADED SAND (SW), brown, fine to medium sand, subrounded, quartz rich Interbedded with SANDY LEAN CLAY (CL), brown, fine sand		Rig chatter and fast drilling
1010							
1020							

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-10	SHEET 18 OF 20

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS LOCATION Site 18 Irvine Co. , Irvine Ctr Dr. & Hearthstone

ELEVATION 58.2 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Portadrill Mud Rotary TXT-100

WATER LEVEL AND DATE NR START 11/2/92 FINISH 11/29/92 LOGGER John McHugh

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					From about 1020 ft, Cuttings: POORLY GRADED SAND (SP), brown, medium sand (trace fine & coarse), subangular		At 1022 to 1042 ft: fast drilling At approx 1026 ft: rig chatter
1030							
					From about 1035 ft, Cuttings: SANDY LEAN CLAY (CL), brown, minor grey and white clay, fine to coarse sand, quartz rich, subangular		At approx 1035 ft: rig chatter
1040							
					From about 1045 ft, Cuttings: SANDY LEAN CLAY to LEAN CLAY (CL), brown, (minor grey and white), fine to medium sand, poorly graded, subangular		
1050							
					From about 1055 ft, Cuttings: CLAYEY SAND (SC), brown, fine to medium sand, poorly graded		At 1055 to 1057 ft: slow drilling At 1056 ft: rig chatter
1060					From about 1060 ft, Cuttings: 70% LEAN CLAY WITH SAND (CL), brown, fine sand, CLAYEY to SILTY SAND (SC-SM), fine to medium sand		Mud Viscosity = 43 seconds Mud Density = 10.5 lb/gal = 1260 kg/m^3
							At 1068 to 1072 ft: very slow drilling At 1070 ft: rig chatter
1070					From about 1070 ft, Cuttings: SILTY SAND (SM), brown, medium sand, poorly graded, quartz-rich, subangular		
1080							At 1080 ft: rig chatter At 1080 to 1082 ft: slow drilling

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-10	SHEET 19 OF 20

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS LOCATION Site 18 Irvine Co., Irvine Ctr Dr. & Hearthstone

ELEVATION 58.2 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Portadrill Mud Rotary TXT-100

WATER LEVEL AND DATE NR START 11/2/92 FINISH 11/29/92 LOGGER John McHugh

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					From about 1085 ft, Cuttings: POORLY GRADED SAND (SP), gray, medium sand, (trace fine & coarse), subangular		At 1082 to 1088 ft: very fast drilling At 1087 ft: rig chatter At 1088 to 1022 ft: fast drilling
1090							
1100					From about 1100 ft, Cuttings: SILTY SAND to POORLY GRADED SAND WITH SILT (SM to SP-SM), gray, dense, fine to medium sand (trace coarse), subrounded, quartz rich, approx 5% black dense clay From about 1107 ft, Cuttings: 90% LEAN CLAY WITH SAND (CL), brown, fine sand 10%, SILTY SAND (SM), gray, fine (trace medium)		
1110							Mud Viscosity = 39 sec Mud Density = 10.3 lb/gal = 1240 kg/m^3 At 1114 ft: rig chatter At 1117 to 1122 ft: rig chatter At 1125 ft: rig chatter
1120					From about 1122 ft, Cuttings: 70% LEAN CLAY WITH SAND (CL), brown, fine sand, 30% SANDY CLAY (CL), gray, fine sand		
1130					From about 1135 ft, Cuttings: 90% LEAN CLAY WITH SAND (CL), brown, fine sand 10%, SANDY CLAY (CL), gray, fine sand		
1140							

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-10	SHEET 20 OF 20

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS LOCATION Site 18 Irvine Co. Irvine Ctr Dr. & Hearthstone

ELEVATION 58.2 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Portadrill Mud Rotary TXT-100

WATER LEVEL AND DATE NR START 11/2/92 FINISH 11/29/92 LOGGER John McHugh

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
							At 1138 to 1142 ft: slow drilling Mud Density = 1230 kg/m^3 = 10.8 lb/gal Mud Viscosity = 47 seconds
1150							At 1150 ft: rig chatter
1160							
1170							At 1174 ft: rig chatter
1180							
1190							At 1193 ft rig chatter At 1197 to 1202 ft: rig chatter and slow drilling
1200					Total Depth - 1202 feet		

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-12	SHEET 1 OF 8

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18, North of Trabuco & W. Marine Way

ELEVATION 304.7 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Failing F-10 HSA 10 1/8" O.D., 6 1/4" I.D., 140 lb. Downhole Hammer

WATER LEVEL AND DATE 162.6 ft 1/19/93 START 8/20/92 FINISH 8/25/92 LOGGER J. Little

DEPTH BELOW SURFACE (FT)	SAMPLE			PENETRATION TEST RESULTS	SOIL DESCRIPTION	FID/PID READING	COMMENTS
	INTERVAL	TYPE AND NUMBER	RECOVERY (FT)	6"-6"-6"	SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					0 to 0.5 ft asphalt From 0 to 10 ft, Cuttings: SILT (ML), brown, moist, trace sand, some clay, trace mica		Samples taken with California modified split spoon samples
5.0							HNu reading on cuttings 0 to 10 ft: 2 ppm
10.0	10.0 11.5	1-C	1.5	6-7-12	SILTY SAND (SM), medium brown, moist, trace clay, minor mica	P: 0.2 ppm	
15.0							
20.0	20.0 21.5	2-C	1.5	8-8-11	Upper 1.0 ft: SILTY SAND (SM), medium brown, moist, trace carbonate Lower 0.5 ft: POORLY GRADED SAND (SP), brown, slightly moist, medium grained	P: 0.4 ppm	
25.0							
30.0							

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-12	SHEET 2 OF 8

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18, North of Trabuco & W. Marine Way

ELEVATION 304.7 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Failing F-10 HSA 10 1/8" O.D., 6 1/4" I.D., 140 lb. Downhole Hammer

WATER LEVEL AND DATE 162.6 ft 1/19/93 START 8/20/92 FINISH 8/25/92 LOGGER J. Little

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	30.0–31.5	3-C	1.5	7-6-7	SILT WITH SAND (ML), medium brown, moist, thin, 1 to 3 cm sand stringers, some clay, trace mica, minor carbonate	P: 0.4 ppm	
35.0							
40.0	40.0–41.5	4-C	1.5	7-12-16	POORLY GRADED SAND (SP), fine, medium brown, moist, trace clay, minor biotite, trace carbonate	P: 0.1 ppm	
45.0							
50.0	50.0–51.5	5-C	1.7	16-19-21	POORLY GRADED SAND (SP), light orange-brown, slightly moist, fine grained with minor medium sand, trace mica	P: 0.2 ppm	stiffer drilling at 51 ft
55.0							
60.0							

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-12	SHEET 3 OF 8

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18, North of Trabuco & W. Marine Way

ELEVATION 304.7 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Failing F-10 HSA 10 1/8" O.D., 6 1/4" I.D., 140 lb. Downhole Hammer

WATER LEVEL AND DATE 162.6 ft 1/19/93 START 8/20/92 FINISH 8/25/92 LOGGER J. Little

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	60.0 61.5	6-C	1.7	12-26-39	POORLY GRADED SAND WITH SILT (SP-SM), brown to light brown, slightly moist, fine grained, with grading depth to POORLY GRADED SAND, (SP), medium grained, trace mica	P: 0.2 ppm	
65.0							
70.0							
75.0							
80.0	80.0 81.5	7-C	1.5	10-22-45	POORLY GRADED SAND WITH SILT (SP-SM), brown, slightly moist, fine to medium grained, no carbonate, possible silica cementation	P: 0.2 ppm	
85.0							
90.0							

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-12	SHEET 4 OF 8

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18, North of Trabuco & W. Marine Way

ELEVATION 304.7 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Failing F-10 HSA 10 1/8" O.D., 6 1/4" I.D., 140 lb. Downhole Hammer

WATER LEVEL AND DATE 162.6 ft 1/19/93 START 8/20/92 FINISH 8/25/92 LOGGER J. Little

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
95.0							
100.0	100.0–101.5	8-C	1.5	19-24-44	Upper 0.6 ft: ELASTIC SILT (MH), brown, slightly moist, minor fine sand, approximately 10% clay, some carbonate veins Lower 0.9 ft: CLAYEY SAND (SC), brown, dry, trace carbonate		
105.0							
110.0					From about 110 ft, Cuttings: SILT WITH SAND (ML), brown, slightly moist, trace fine gravel		
115.0							
120.0							

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-12	SHEET 5 OF 8

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18, North of Trabuco & W. Marine Way

ELEVATION 304.7 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Failing F-10 HSA 10 1/8" O.D., 6 1/4" I.D., 140 lb. Downhole Hammer

WATER LEVEL AND DATE 162.6 ft 1/19/93 START 8/20/92 FINISH 8/25/92 LOGGER T. MacGillivray/K.Gally

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	120.0–121.5	9-C	1.4	22-28-47	Upper 0.7 ft: POORLY GRADED SAND (SP), light brown, slightly moist, minor mica and fine-to-medium gravel Lower 0.7 ft: SILTY SAND (SM), fine, brown, moist, fine grained, minor mica		
125.0							
130.0							smooth drilling
135.0							
140.0	140.0–141.5	10-C	2.0	14-16-36	LEAN CLAY WITH SAND (CL), dark-medium brown, slightly moist, fine-grained sand	F: 50 ppm	
145.0							
150.0							

PROJECT NUMBER	BORING NUMBER
LAO31981	MW-12 SHEET 6 OF 8

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18, North of Trabuco & W. Marine Way

ELEVATION 304.7 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Failing F-10 HSA 10 1/8" O.D., 6 1/4" I.D., 140 lb. Downhole Hammer

WATER LEVEL AND DATE 162.6 ft 1/19/93 START 8/20/92 FINISH 8/25/92 LOGGER K. Gally

DEPTH BELOW SURFACE (FT)	SAMPLE			PENETRATION TEST RESULTS	SOIL DESCRIPTION	FID/PID READING	COMMENTS
	INTERVAL	TYPE AND NUMBER	RECOVERY (FT)	6"-6"-6"	SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
155.0							
160.0	160.0 161.5	11-C	2.0	6-8-32	LEAN CLAY WITH SAND (CL), medium brown with light mottling, slightly moist, very fine-grained sand	F: 10 ppm	
165.0							
							Groundwater encountered at 168 ft
170.0							
175.0							
180.0							

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-12	SHEET 7 OF 8

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18, North of Trabuco & W. Marine Way

ELEVATION 304.7 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Failing F-10 HSA 10 1/8" O.D., 6 1/4" I.D., 140 lb. Downhole Hammer

WATER LEVEL AND DATE 162.6 ft 1/19/93 START 8/20/92 FINISH 8/25/92 LOGGER K. Gally

DEPTH BELOW SURFACE (FT)	SAMPLE			PENETRATION TEST RESULTS	SOIL DESCRIPTION	FID/PID READING	COMMENTS
	INTERVAL	TYPE AND NUMBER	RECOVERY (FT)	6"-6"-6"	SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	180.0 181.5	12-C	1.5	24 for 24"	WELL-GRADED SAND WITH GRAVEL (SW), medium brown, wet		
185.0							
190.0					From about 190 ft, Cuttings: ELASTIC SILT WITH SAND (MH), medium brown		
195.0							
200.0							
205.0							
210.0							

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-12	SHEET 8 OF 8

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18, North of Trabuco & W. Marine Way

ELEVATION 304.7 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Failing F-10 HSA 10 1/8" O.D., 6 1/4" I.D., 140 lb. Downhole Hammer

WATER LEVEL AND DATE 162.6 ft 1/19/93 START 8/20/92 FINISH 8/25/92 LOGGER J. Little

DEPTH BELOW SURFACE (FT)	SAMPLE			PENETRATION TEST RESULTS	SOIL DESCRIPTION	FID/PID READING	COMMENTS
	INTERVAL	TYPE AND NUMBER	RECOVERY (FT)	6"-6"-6"	SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					Total Depth - 214 ft		
215.0							
220.0							

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-14	SHEET 1 OF 5

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18 Borrego Canyon Wash

ELEVATION 268.2 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Dual Tube Air DWP 1200

WATER LEVEL AND DATE 72.1 ft 1/21/93 START 6/12/92 FINISH 6/16/92 LOGGER T. Williams

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
5.0							
10.0	10.0–12.0	1-C	2.0		SANDY LEAN CLAY (CL), brown		
15.0							
20.0	20.0–22.0	2-C	2.0		FAT CLAY WITH SAND (CH), brown, hard		
25.0							
30.0							

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-14	SHEET 1 OF 5

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18 Borrego Canyon Wash

ELEVATION 268.2 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Dual Tube Air DWP 1200

WATER LEVEL AND DATE 72.1 ft 1/21/93 START 6/12/92 FINISH 6/16/92 LOGGER T. Williams

DEPTH BELOW SURFACE (FT)	SAMPLE			PENETRATION TEST RESULTS	SOIL DESCRIPTION	FID/PID READING	COMMENTS
	INTERVAL	TYPE AND NUMBER	RECOVERY (FT)	6"-6"-6"	SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
5.0							
10.0	10.0–12.0	1-C	2.0		SANDY LEAN CLAY (CL), brown		
15.0							
20.0	20.0–22.0	2-C	2.0		FAT CLAY WITH SAND (CH), brown, hard		
25.0							
30.0							

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-14	SHEET 3 OF 5

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18 Borrego Canyon Wash

ELEVATION 268.2 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Dual Tube Air DWP 1200

WATER LEVEL AND DATE 72.1 ft 1/21/93 START 6/12/92 FINISH 6/16/92 LOGGER T. Williams

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	60.0 62.0	6-C	2.0		LEAN CLAY WITH SAND (CL), gray, hard		
65.0							
70.0					From 70 to 80 ft, Cuttings: WELL GRADED SAND (SW), brown, coarse to fine		
75.0							
80.0	80.0 82.0	7-C	2.0		SILT (ML), gray, stiff		
85.0							
90.0							

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-14	SHEET 4 OF 5

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18 Borrego Canyon Wash

ELEVATION 268.2 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Dual Tube Air DWP 1200

WATER LEVEL AND DATE 72.1 ft 1/21/93 START 6/12/92 FINISH 6/16/92 LOGGER T. Williams

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					From 90 ft, Cuttings: POORLY GRADED SAND WITH SILT (SP-SM), fine to POORLY GRADED SAND (SP), coarse		
95.0							
100.0	100.0–102.0	8-C	1.0		WELL GRADED SAND (SW)		
105.0							
110.0	110.0–112.0	9-C	2.0		WELL GRADED SAND (SW)		Flowing sand
115.0							Cuttings to 123 ft are a flowing sand
120.0							

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-14	SHEET 5 OF 5

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18 Borrego Canyon Wash

ELEVATION 268.2 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Dual Tube Air DWP 1200

WATER LEVEL AND DATE 72.1 ft 1/21/93 START 6/12/92 FINISH 6/16/92 LOGGER T. Williams

DEPTH BELOW SURFACE (FT)	SAMPLE			STANDARD PENETRATION TEST RESULTS	SOIL DESCRIPTION	FID/PID READING	COMMENTS
	INTERVAL	TYPE AND NUMBER	RECOVERY (FT)	6"-6"-6" (N)	SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					Same as above		
					Total Depth -123 ft		
125.0							
130.0							
135.0							
140.0							
145.0							
150.0							

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-15	SHEET 1 OF 8

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Well 15, OU-1

ELEVATION 319.9 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Air Dual-Tube PD-1200

WATER LEVEL AND DATE 176.1 ft 1/19/93 START 6/8/92 FINISH 6/26/92 LOGGER T. Williams

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					From 0 to 10.0 ft, Cuttings: WELL GRADED SAND (SW), with gravel		
5.0							
10.0	10.0–12.0	1-C	2		LEAN CLAY (CL), brown, very stiff, some mica and quartz		
15.0							
20.0	20.0–22.0	2-C	2		WELL GRADED SAND WITH GRAVEL (SW), within interbedded SILT (ML), brown, micas present, laminations in silt layers, clay binding		
25.0							
30.0							

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-15	SHEET 2 OF 8

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Well 15, OU-1

ELEVATION 319.9 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Air Dual-Tube PD-1200

WATER LEVEL AND DATE 176.1 ft 1/19/93 START 6/8/92 FINISH 6/26/92 LOGGER T. Williams

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	30.0–32.0	3-C	2		SANDY SILT (ML), brown, very stiff, some gravel particles, trace clay		
35.0							
40.0	40.0–42.0	4-C	2		SANDY SILT (ML), brown, moist, some clay and gravel		
45.0							
50.0	50.0–52.0	5-C	2		SANDY SILT (ML), brown, moist, some clay and gravel		~ 50 ft easier drilling
55.0							~ 55 ft cuttings balled up due to moistness and clay content
60.0							

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-15	SHEET 3 OF 8

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Well 15, OU-1

ELEVATION 319.9 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Air Dual-Tube PD-1200

WATER LEVEL AND DATE 176.1 ft 1/19/93 START 6/8/92 FINISH 6/26/92 LOGGER T. Williams

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	60.0–62.0	6-C	2		WELL GRADED SAND (SW), medium to coarse grained, brown, some silt in top 6"		
65.0							
70.0	70.0–72.0	7-C			WELL GRADED SAND WITH GRAVEL AND SILT (SW- SM)		
75.0							
80.0	80.0–82.0	8-C	2		WELL GRADED SAND WITH GRAVEL AND SILT (SW- SM)		
85.0							
90.0							

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-15	SHEET 4 OF 8

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Well 15, OU-1

ELEVATION 319.9 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Air Dual-Tube PD-1200

WATER LEVEL AND DATE 176.1 ft 1/19/93 START 6/8/92 FINISH 6/26/92 LOGGER T. Williams

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
							At 93 ft ran into plugging and high pressure, added water in augers
95.0							
100.0	100.0 - 102.0	9-C	2		WELL GRADED SAND WITH GRAVEL AND SILT (SW- SM)		
105.0							
110.0	100.0 - 112.0	10-C	2		SANDY SILT (ML), grading to LEAN CLAY (CL), very stiff to hard		
115.0					From about 112 ft, Cuttings: SANDY CLAY (CL), in chunks		
120.0							

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-15	SHEET 5 OF 8

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Well 15, OU-1

ELEVATION 319.9 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Air Dual-Tube PD-1200

WATER LEVEL AND DATE 176.1 ft 1/19/93 START 6/8/92 FINISH 6/26/92 LOGGER T. Williams

DEPTH BELOW SURFACE (FT)	SAMPLE			PENETRATION TEST RESULTS	SOIL DESCRIPTION	FID/PID READING	COMMENTS
	INTERVAL	TYPE AND NUMBER	RECOVERY (FT)	6"-6"-6"	SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	120.0–122.0	11-C	2.0		SANDY LEAN CLAY (CL), hard		
125.0							
130.0	130.0–132.0	12-C	2.0		SANDY LEAN CLAY (CL), hard, medium plasticity, some lenses of coarse sand		
135.0					From 130 to 140 ft, Cuttings: SANDY CLAY (CL), in chunks		
140.0	140.0–142.0	13-C	1.25		WELL GRADED SAND WITH SILT (SW-SM), dry, medium to fine grained From 142 ft, Cuttings: WELL GRADED SAND WITH SILT AND GRAVEL (SW-SM), gravel rounded to subangular		
145.0							
150.0							

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-15	SHEET 6 OF 8

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Well 15, OU-1

ELEVATION 319.9 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Air Dual-Tube PD-1200

WATER LEVEL AND DATE 176.1 ft 1/19/93 START 6/8/92 FINISH 6/26/92 LOGGER T. Williams

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	150.0–152.0	14-C	1.5		WELL-GRADED SAND WITH SILT AND GRAVEL (SW-SM), gravel to 2 in. dia. with green, red and brown coloring, appears to be cemented stones of quartz, hemetite		Note change in sampling method Driving sampler with 1000-lb hammer
155.0							
160.0	160.0–162.0	15-C	2.0		SILTY SAND (SM), light brown, moist, dense to very dense, fine to medium grained sand, poorly graded, subrounded, one thin olive green siltstone clast ~1 cm long		Driller notes: Encountering moisture at ~157 ft. At 160 ft did not encounter water table
165.0							
170.0							
175.0							
180.0							

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-15	SHEET 7 OF 8

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Well 15, OU-1

ELEVATION 319.9 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Air Dual-Tube PD-1200

WATER LEVEL AND DATE 176.1 ft 1/19/93 START 6/8/92 FINISH 6/26/92 LOGGER J. McHugh/S. Diehl

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION (SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY)	FID/PID READING	COMMENTS (DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION)
	180.0–182.0	16-C		4-10-9-14/1"	SILTY SAND (SM), light brown, wet at bottom of sample, moist, middle and top, poorly graded, fine to medium grained sand, traces of organic material, trace clay		
185.0							
190.0	190.0–192.0	17-C	2.0		SANDY SILT (ML), light brown, moist, hard, fine to medium grained with some coarse sand, some subrounded grave 3/4 in. to 1 in., sand is subrounded, several 1 cm red clay or siltstone fragments	F: 0.0 ppm	Sample was only moist, which does not confirm that 190 ft is below the water table
195.0							
200.0							
205.0					From about 205 ft, Cuttings: SANDY SILT (ML), with minor gravel		
210.0							

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-15	SHEET 8 OF 8

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Well 15, OU-1

ELEVATION 319.9 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Air Dual-Tube PD-1200

WATER LEVEL AND DATE 176.1 ft 1/19/93 START 6/8/92 FINISH 6/26/92 LOGGER T. Williams

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
215.0					From about 215 ft, Cuttings: SANDY SILT (ML), with minor gravel		
					No sample collected		
220.0					Total Depth - 222 ft		
225.0							
230.0							
235.0							
240.0							

Continue

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
LAO31981	MW-16	SHEET 1 OF 9

SOIL BORING LOG

PROJECT MCAS El Toro RI/FS Phase I LOCATION Site 18

ELEVATION 375.9 ft DRILLING CONTRACTOR Beylik Drilling Inc.

DRILLING METHOD AND EQUIPMENT Dual Tube Air (Drill System 520)

WATER LEVEL AND DATE 228.3 ft 1/19/93 START 6/11/92 FINISH 6/26/92 LOGGER Jeff Coyle

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: SOIL NAME, USGS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	FID/PID READING	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
5.0							
	8.5						Drill tube dropped quickly into subsurface between 7 and 8.5 ft
10.0	10.0	1-C	1.2	NR (Not Recorded)	POORLY GRADED SAND WITH SILT (SP-SM), mostly fine to mediun sand, dry, medium brown, low plasticity, loose, trace gravel ≤5%, observed small pyrite mineral flakes, trace to some clay <15%, this material is likely a fill	P: 1.0 ppm	
15.0	17.0						
	18.5	2-C	1.5	NR (Not Recorded)	SILT WITH SAND (ML), 15% fine to medium sand, 25-30% clay, loose, dry, moderate plasticity, observed pyrite flakes	P: 1.0 ppm	
20.0							
25.0	27.0						
	28.5	3-C	1.5	22-35-40	SANDY SILT (ML), medium brown, dry, 15% clay, 30% sand, low to medium plasticity	P:150 ppm	Poor reaction to dilatency test Slightly cohesive, mostly fine sand, observed pyrite flakes
30.0							