#84

PHASE I REMEDIAL INVESTIGATION SUMMARY REPORT AND PRELIMINARY ANALYSIS OF SOIL DATA (As Appendix 1)

Volume 2

Northwest Natural - Gasco Facility
7900 NW St. Helens Road
Portland, Oregon

October 9, 1998

DMA

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Environmental Management

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PHASE I REMEDIAL INVESTIGATION SUMMARY REPORT AND PRELIMINARY ANALYSIS OF SOIL DATA

(As Appendix I)

Volume 2

Northwest Natural – Gasco Facility
7900 NW St. Helens Road
Portland, Oregon

October 9, 1998

Prepared for:

Northwest Natural
Portland, Oregon

Prepared by:

Hahn and Associates, Inc.
Portland, Oregon

and

Decision Management Associates LLC
Portland, Oregon
(Appendix I)

HAI Project No. 2708

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Remedial Investigation
Northwest Natural - Gasco Facility
Portland, Oregon

Project No. 2708

Elevation of Top of Casing

Date of Elevation Survey	Elevation of Top of Casing (feet msl)*																		River Benchmark (feet msl)*
	MW-1-22	MW-2-32	MW-3-26	MW-3-56	MW-4-35	MW-4-57	MW-5-32	MW-6-32	MW-6-61	MW-8-29	MW-8-56	MW-9-29	MW-10-25	MW-10-61	MW-11-32	MW-12-36	MW-13-30	MW-13-61	
7-Dec-95	34.75	34.46	34.11	34.07	34.54	34.53	27.83	35.51	34.50	39.09	39.13	37.65	39.22	39.33	38.39	38.69	34.86	34.78	32.12

Measured Water Level

Date Measured	Measured Water Level (feet btc)																		River Level (feet bbm)**
	MW-1-22	MW-2-32	MW-3-26	MW-3-56	MW-4-35	MW-4-57	MW-5-32	MW-6-32	MW-6-61	MW-8-29	MW-8-56	MW-9-29	MW-10-25	MW-10-61	MW-11-32	MW-12-36	MW-13-30	MW-13-61	
5-Dec-95	14.15	15.23	15.58	15.79	16.12	16.39	9.46	16.71	15.77	19.75	20.61	6.20	14.98	13.42	12.69	9.37	-	-	-
5-Jan-96	14.47	20.04	19.47	21.85	22.47	22.38	15.57	14.84	21.58	19.01	26.74	7.33	15.20	16.32	12.19	10.82	-	-	-
12-Feb-96	7.74	8.61	8.52	8.63	9.09	9.10	2.41	9.55	8.97	16.99	13.56	3.32	11.11	8.92	8.95	5.27	-	-	-
18-Mar-96	12.44	18.03	17.87	19.66	20.24	20.21	13.37	12.10	19.39	15.22	24.54	6.13	11.95	14.47	9.42	9.01	-	-	-
16-Apr-96	13.65	18.83	18.13	19.47	20.26	20.07	13.36	13.42	19.51	15.58	24.44	6.93	12.63	15.07	10.12	9.69	-	-	-
10-May-96	13.75	19.47	18.98	22.01	22.58	22.60	15.78	13.30	21.55	15.77	26.93	6.94	12.98	15.90	10.40	10.24	-	-	-
17-Jun-96	13.88	17.40	17.40	18.21	18.61	18.73	11.96	13.40	18.13	16.00	23.15	5.03	13.51	13.96	10.90	9.98	-	-	-
16-Jul-96	15.51	20.71	20.07	24.41	24.30	24.93	17.91	14.60	23.55	17.26	29.05	6.65	15.90	17.21	11.93	12.43	-	-	-
21-Aug-96	16.51	21.80	22.24	26.99	26.77	27.51	20.46	16.17	26.27	19.18	31.93	8.47	16.58	19.43	13.40	14.53	-	-	-
17-Sep-96	17.06	22.06	20.61	28.02	27.15	28.53	21.27	16.94	26.81	20.13	32.63	7.52	16.80	19.30	14.02	14.86	-	-	-
30-Sep-96	17.17	22.24	23.32	27.04	27.46	27.61	20.68	17.08	27.01	20.19	32.45	8.70	16.89	19.84	14.26	14.97	-	-	-
15-Nov-96	16.38	22.02	20.76	26.48	26.85	27.00	19.84	17.00	25.71	20.63	31.37	6.61	16.42	18.38	14.20	13.85	-	-	-
24-Feb-97	12.41	18.71	18.61	20.48	20.82	21.02	14.17	12.83	19.79	18.43	25.33	4.35	14.85	14.33	11.18	9.71	-	-	-
10-Jun-97	12.89	14.23	13.80	14.20	14.70	14.56	7.97	13.81	14.61	18.56	19.25	4.84	16.01	12.20	12.50	8.49	-	-	-
26-Aug-97	15.38	21.70	22.61	26.10	26.56	25.84	19.63	18.53	25.58	20.31	31.13	11.71	17.10	20.16	14.30	14.13	-	-	-
25-Nov-97	14.42	21.50	19.25	24.64	25.14	24.80	18.23	16.29	24.33	20.85	29.85	7.85	16.36	17.89	13.88	11.79	-	-	-
19-Dec-97	-	-	-	22.75	-	23.28	-	-	22.62	-	27.90	-	-	16.90	-	-	-	23.71	-
16-Feb-98	12.60	20.13	18.65	23.55	23.25	24.10	17.09	14.29	-	20.05	28.50	5.33	15.60	15.89	12.02	9.72	14.73	23.98	21.91
1-Jun-98	14.49	16.97	16.61	16.51	16.90	17.00	10.33	15.75	-	20.05	21.63	7.25	14.63	14.36	12.85	9.83	15.69	17.11	14.57

NOTE:
* = City of Portland Datum
bbm = below bench mark
btc = below top of casing
msl = mean sea level

**Willamette River, Portland Harbor Stage, obtained from National Weather Service and adjusted to feet msl - City of Portland datum: December 1995 to December 1997. Post December 1997 River Stage data measured directly from surveyed bench mark located on north end of PNO Dock.

TABLE E-1 - Summary of Water Level Measurements and Groundwater Elevations

Remedial Investigation
Northwest Natural - Gasco Facility
Portland, Oregon

Project No. 2708

Groundwater Elevation

Date Measured	Groundwater Elevation (feet msl)*																		River Stage (feet msl)*
	MW-1-22	MW-2-32	MW-3-26	MW-3-56	MW-4-35	MW-4-57	MW-5-32	MW-6-32	MW-6-61	MW-8-29	MW-8-56	MW-9-29	MW-10-25	MW-10-61	MW-11-32	MW-12-36	MW-13-30	MW-13-61	
5-Dec-95	20.60	19.23	18.53	18.28	18.42	18.14	18.37	18.80	18.73	19.34	18.52	31.45	24.24	25.91	25.70	29.32	-	-	18.9
5-Jan-96	20.28	14.42	14.64	12.22	12.07	12.15	12.26	20.67	12.92	20.08	12.39	30.32	24.02	23.01	26.20	27.87	-	-	12.4
12-Feb-96	27.01	25.85	25.59	25.44	25.45	25.43	25.42	25.96	25.53	22.10	25.57	34.33	28.11	30.41	29.44	33.42	-	-	26.4
18-Mar-96	22.31	16.43	16.24	14.41	14.30	14.32	14.46	23.41	15.11	23.87	14.59	31.52	27.27	24.86	28.97	29.68	-	-	14.4
16-Apr-96	21.10	15.63	15.98	14.60	14.28	14.46	14.47	22.09	14.99	23.51	14.69	30.72	26.59	24.26	28.27	29.00	-	-	14.5
10-May-96	21.00	14.99	15.13	12.06	11.96	11.93	12.05	22.21	12.95	23.32	12.20	30.71	26.24	23.43	27.99	28.45	-	-	11.6
17-Jun-96	20.87	17.06	16.71	15.86	15.93	15.80	15.87	22.11	16.37	23.09	15.98	32.62	25.71	25.37	27.49	28.71	-	-	15.7
16-Jul-96	19.24	13.75	14.04	9.66	10.24	9.60	9.92	20.91	10.95	21.83	10.08	31.00	23.32	22.12	26.46	26.26	-	-	-
21-Aug-96	18.24	12.66	11.87	7.08	7.77	7.02	7.37	19.34	8.23	19.91	7.20	29.18	22.64	19.90	24.99	24.16	-	-	6.6
17-Sep-96	17.69	12.40	13.50	6.05	7.39	6.00	6.56	18.57	7.69	18.96	6.50	30.13	22.42	20.03	24.37	23.83	-	-	5.8
30-Sep-96	17.58	12.22	10.79	7.03	7.08	6.92	7.15	18.43	7.49	18.90	6.68	28.95	22.33	19.49	24.13	23.72	-	-	5.4
15-Nov-96	18.37	12.44	13.35	7.59	7.69	7.53	7.99	18.51	8.79	18.46	7.76	31.04	22.80	20.95	24.19	24.84	-	-	7.2
24-Feb-97	22.34	15.75	15.50	13.59	13.72	13.51	13.66	22.68	14.71	20.66	13.80	33.30	24.37	25.00	27.21	28.98	-	-	13.6
10-Jun-97	21.86	20.23	20.31	19.87	19.84	19.97	19.86	21.70	19.89	20.53	19.88	32.81	23.21	27.13	25.89	30.20	-	-	19.8
26-Aug-97	19.37	12.76	11.50	7.97	7.98	8.69	8.20	16.98	8.92	18.78	8.00	25.94	22.12	19.17	24.09	24.56	-	-	7.9
25-Nov-97	20.33	12.96	14.86	9.43	9.40	9.73	9.60	19.22	10.17	18.24	9.28	29.80	22.86	21.44	24.51	26.90	-	-	8.72
19-Dec-97	-	-	-	11.32	-	11.25	-	-	11.88	-	11.23	-	-	22.43	-	-	-	11.07	-
16-Feb-98	22.15	14.33	15.46	10.52	11.29	10.43	10.74	21.22	-	19.04	10.63	32.32	23.62	23.44	26.37	28.97	20.13	10.80	10.21
1-Jun-98	20.26	17.49	17.50	17.56	17.64	17.53	17.50	19.76	-	19.04	17.50	30.40	24.59	24.97	25.54	28.86	19.17	17.67	17.55

NOTE: * = City of Portland Datum
msl = mean sea level

**Willamette River, Portland Harbor Stage, obtained from National Weather Service and adjusted to feet msl - City of Portland datum: December 1995 to December 1997. Post December 1997 River Stage data measured directly from surveyed bench mark located on north end of PNO Dock.

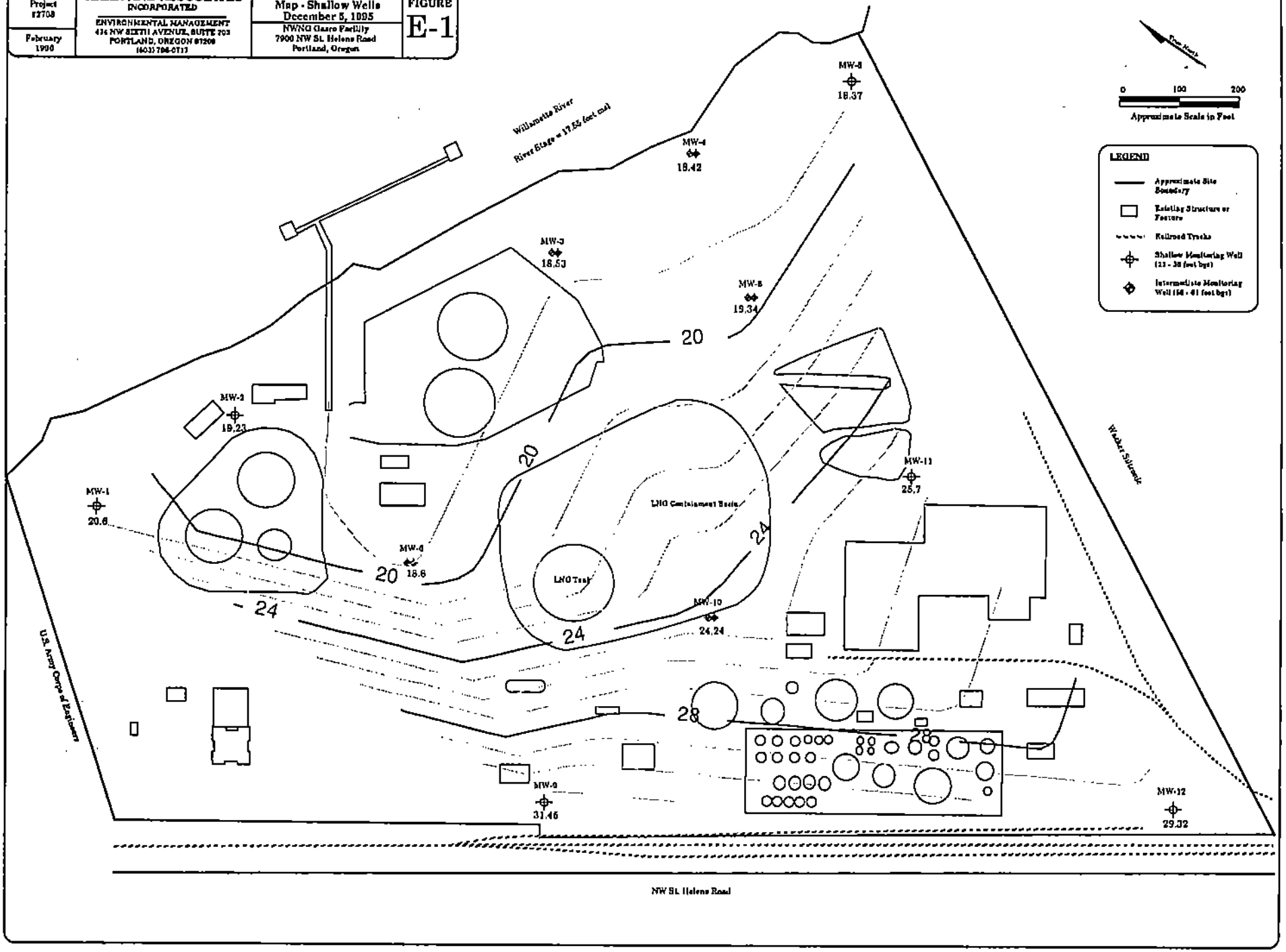
TABLE E-2 - Summary of Aquifer Characteristic Data: Slug Testing Results

Remedial Investigation
Former Gasco Facility
7900 NW St. Helens Road
Portland, Oregon

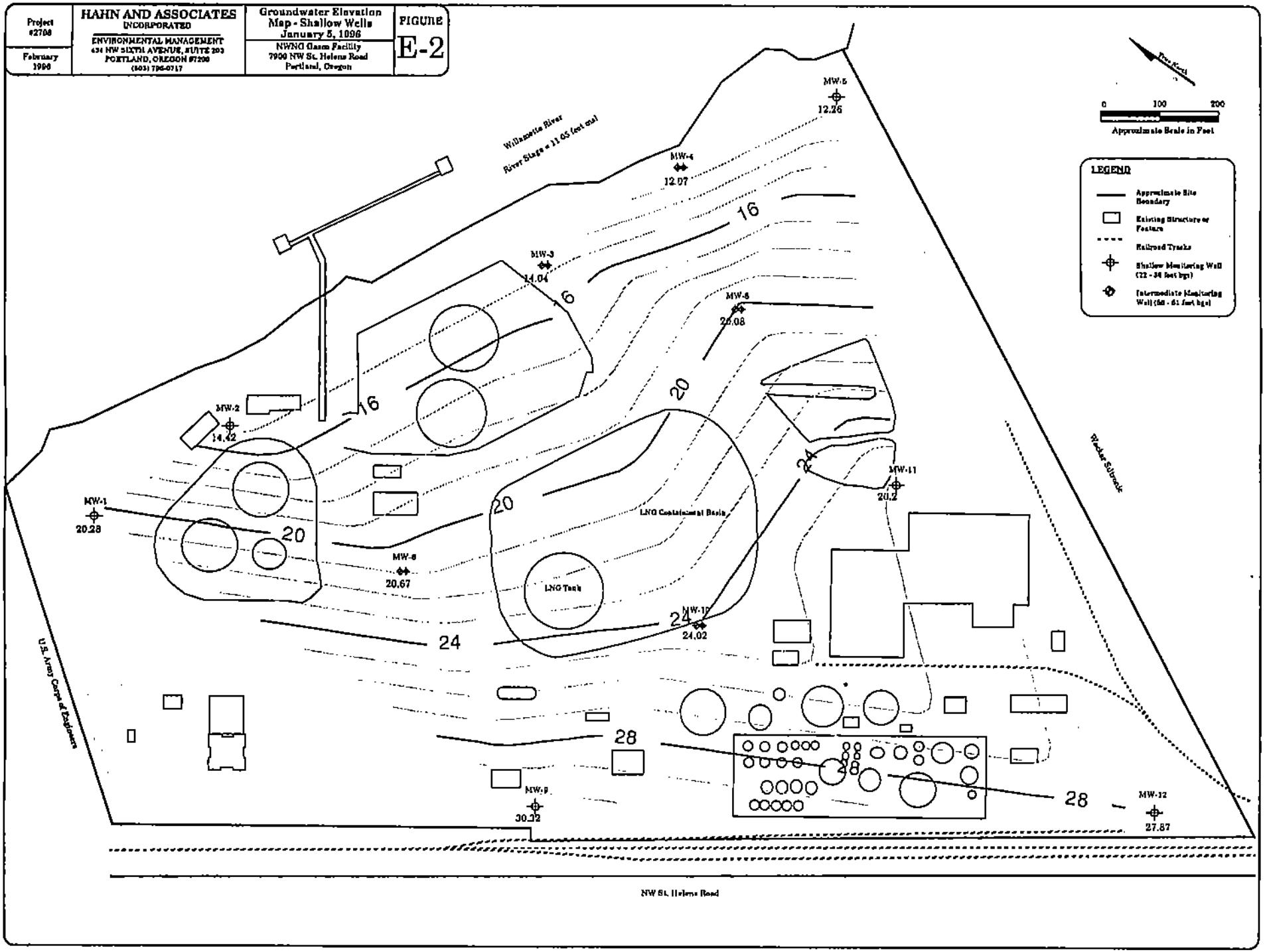
Monitoring Well	Date Installed	Screen Interval (feet msl)	Aquifer Zone Monitored	Aquifer Type (from boring log)	Calculated Hydraulic Conductivity (feet/day) (feet/day)	Effective Porosity (estimated)	Average Hydraulic Gradient	Seepage Velocity (feet/day)
MW-1-22	24-Oct-95	21.0 to 11.0	unconfined / shallow	gravely to silty sands (fill)	0.35	0.2	0.017	0.030
MW-2-32	6-Nov-95	14.3 to 4.3	unconfined / shallow	silty sands and fine sands (fill)	3.4	0.2	0.017	0.289
MW-3-26	1-Nov-95	16.2 to 6.2	unconfined / shallow	sandy gravels and silts (fill)	0.31	0.2	0.017	0.026
MW-3-56	1-Nov-95	-13.8 to -23.8	semi-confined / intermediate	medium grained sands	1.3	0.2	0.016	0.102
MW-4-35	31-Oct-95	7.7 to -2.3	unconfined / shallow	silts and sands (fill)	26	0.2	0.017	2.20
MW-4-57	30-Oct-95	-14.3 to -24.3	semi-confined / intermediate	medium grained sands	0.86	0.2	0.016	0.068
MW-5-32	27-Oct-95	4.1 to -5.9	unconfined / shallow	sands and silty sands (fill)	0.46	0.2	0.017	0.039
MW-6-32	9-Nov-95	14.8 to 4.8	unconfined / shallow	medium grained sands (fill)	-	0.2	0.017	-
MW-6-61	7-Nov-95	-14.2 to -24.2	semi-confined / intermediate	fine grained sands and silts	1.5	0.2	0.016	0.120
MW-8-29	26-Oct-95	18.5 to 8.5	unconfined / shallow	lampblack, tarry gravels and silts (fill)	0.0067	0.1	0.017	0.00114
MW-8-56	25-Oct-95	-8.5 to -18.5	semi-confined / intermediate	fine grained sands	0.08	0.2	0.016	0.0065
MW-9-29	23-Oct-95	19.9 to 9.9	unconfined / shallow	fine grained sands (fill)	0.28	0.2	0.017	0.023
MW-10-25	9-Nov-95	22.5 to 12.5	unconfined / shallow	tarry silts, fine grained sands (fill)	-	0.1	0.017	-
MW-10-61	8-Nov-95	-13.5 to -23.5	semi-confined / intermediate	fine grained sands and silty sands	0.23	0.2	0.016	0.018
MW-11-32	3-Nov-95	14.4 to 4.4	unconfined / shallow	silt and medium grained sands	-	0.2	0.017	-
MW-12-36	23-Oct-95	10.9 to 0.9	unconfined / shallow	fine grained sands	0.62	0.2	0.017	0.053

Groundwater Elevation Maps
Surficial Fill Water Bearing Zone

Project #2708	HAHN AND ASSOCIATES INCORPORATED	Groundwater Elevation Map - Shallow Wells December 5, 1995	FIGURE
February 1996	ENVIRONMENTAL MANAGEMENT 436 NW SIXTH AVENUE, SUITE 203 PORTLAND, OREGON 97209 (503) 796-0713	NWNG Gasco Facility 7900 NW St. Helens Road Portland, Oregon	E-1



Project #2708	HAHN AND ASSOCIATES INCORPORATED	Groundwater Elevation Map - Shallow Wells January 5, 1996	FIGURE
February 1996	ENVIRONMENTAL MANAGEMENT 434 NW SIXTH AVENUE, SUITE 203 PORTLAND, OREGON 97209 (503) 796-0717	NWNG Gasco Facility 7900 NW St. Helens Road Portland, Oregon	E-2



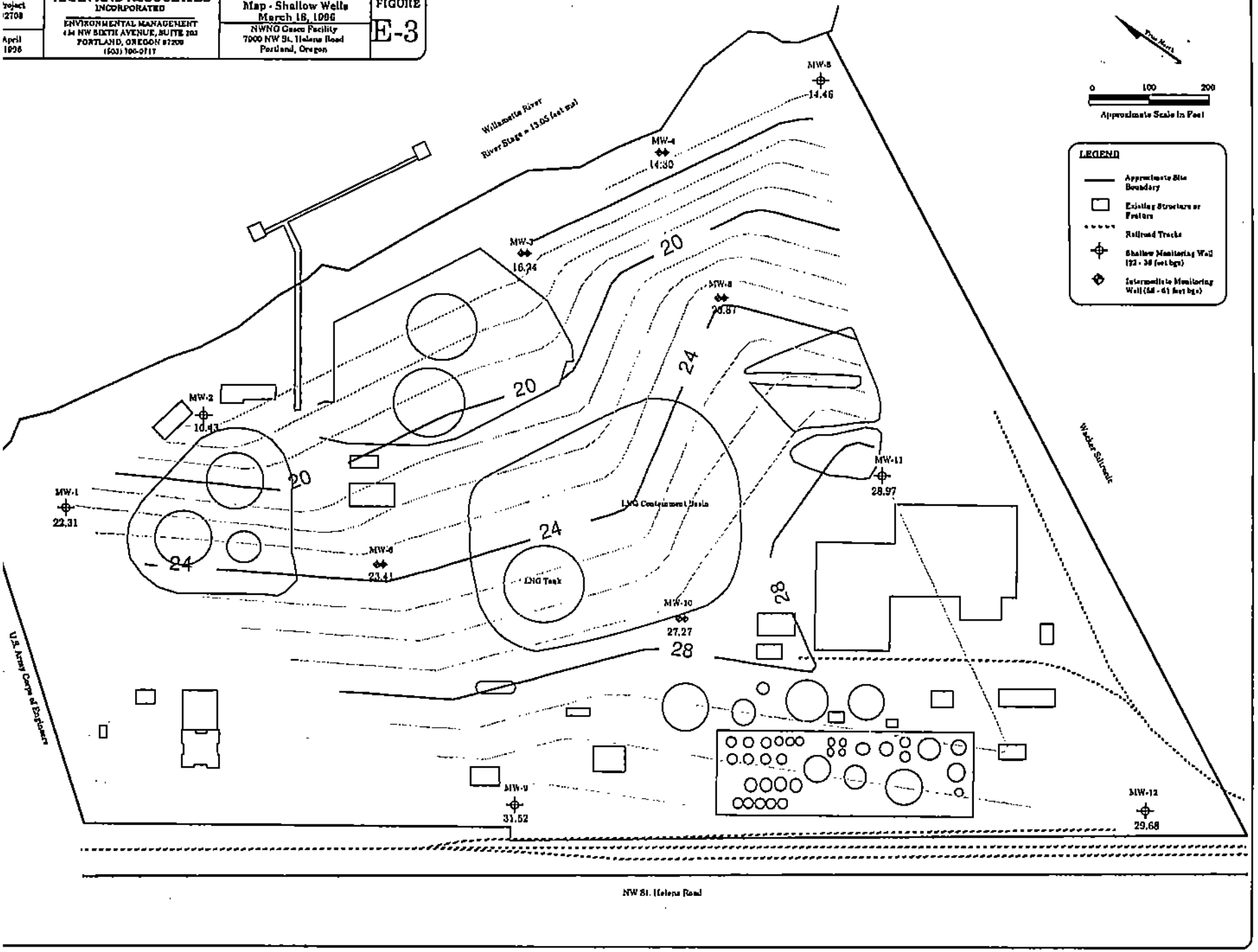
Project
2708

April
1996

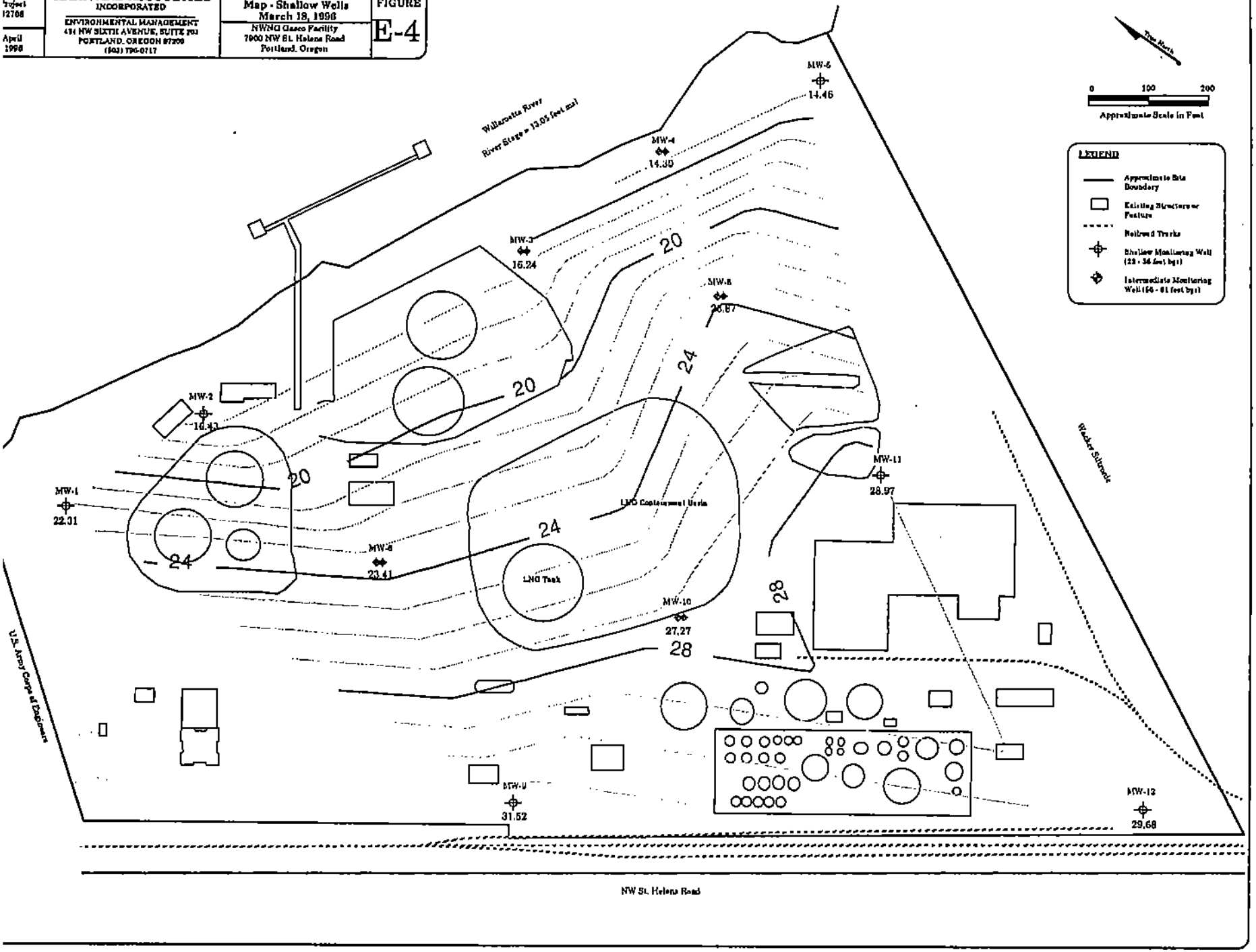
HAHN AND ASSOCIATES
INCORPORATED
ENVIRONMENTAL MANAGEMENT
434 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209
(503) 190-0717

Groundwater Elevation Map - Shallow Wells
March 18, 1996
NWNG Gasco Facility
7900 NW St. Helens Road
Portland, Oregon

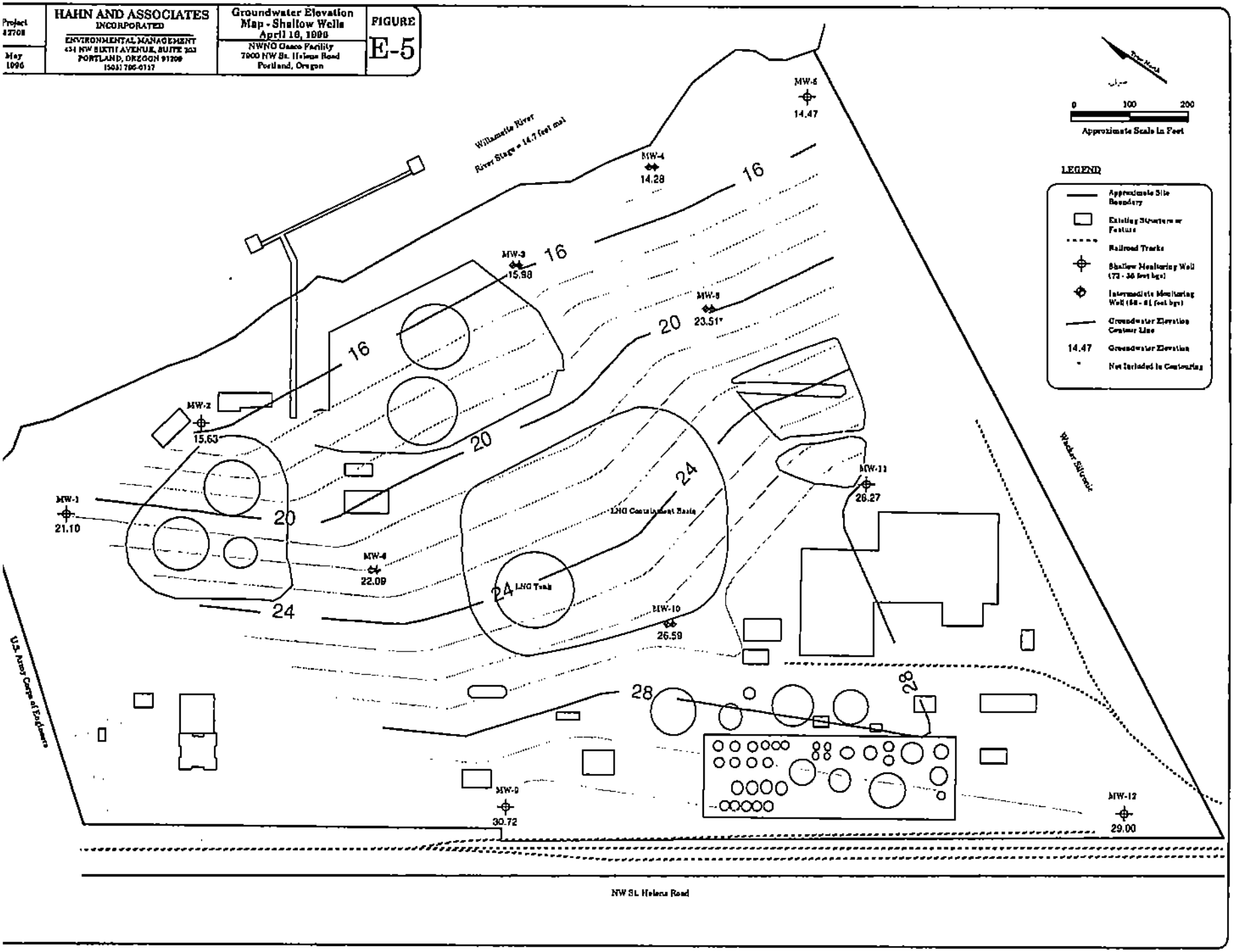
FIGURE
E-3



Project 12708	HAHN AND ASSOCIATES INCORPORATED ENVIRONMENTAL MANAGEMENT 431 NW SIXTH AVENUE, SUITE 701 PORTLAND, OREGON 97209 (503) 795-0717	Groundwater Elevation Map - Shallow Wells March 18, 1996 NWNG Gasco Facility 7900 NW St. Helens Road Portland, Oregon	FIGURE E-4
April 1996			



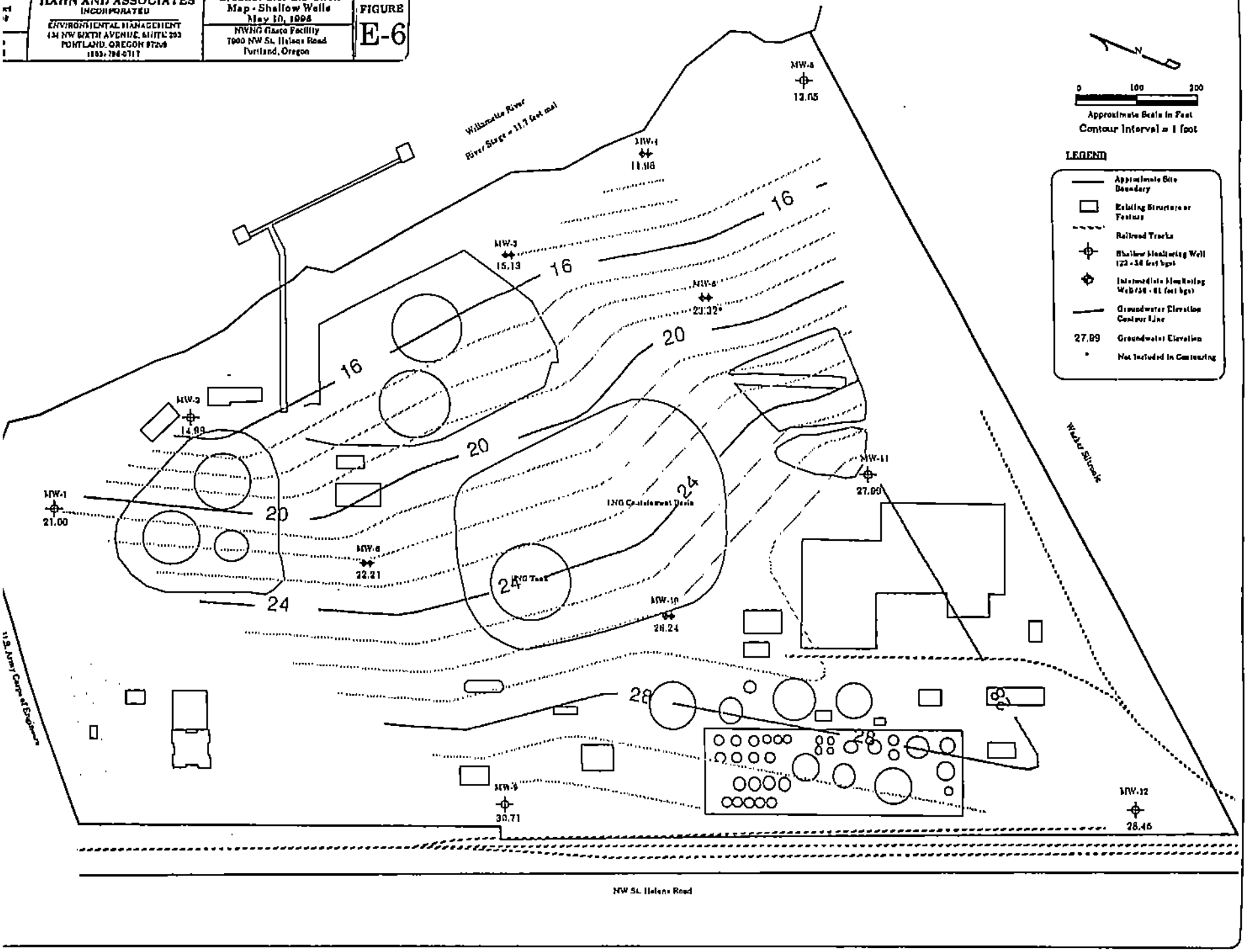
Project 82708	HAHN AND ASSOCIATES INCORPORATED	Groundwater Elevation Map - Shallow Wells April 16, 1996	FIGURE
May 1996	ENVIRONMENTAL MANAGEMENT 434 NW SIXTH AVENUE, SUITE 203 PORTLAND, OREGON 97209 (503) 705-0737	NWNO Gasco Facility 7000 NW St. Helens Road Portland, Oregon	E-5



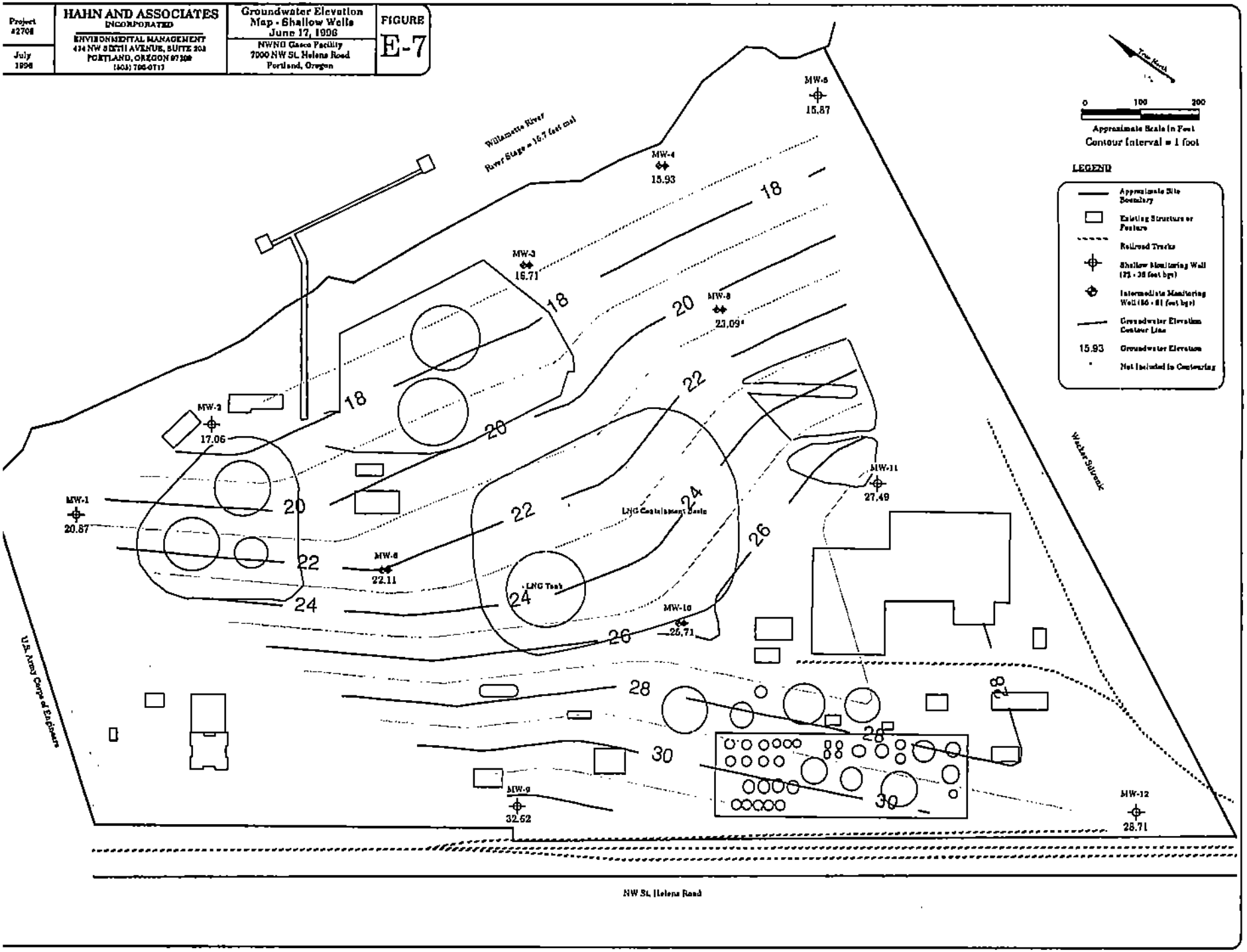
HAHN AND ASSOCIATES INCORPORATED
ENVIRONMENTAL MANAGEMENT
134 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209
(503) 294-0717

Groundwater Elevation Map - Shallow Wells
May 10, 1996
NWNG Gasco Facility
7000 NW St. Helens Road
Portland, Oregon

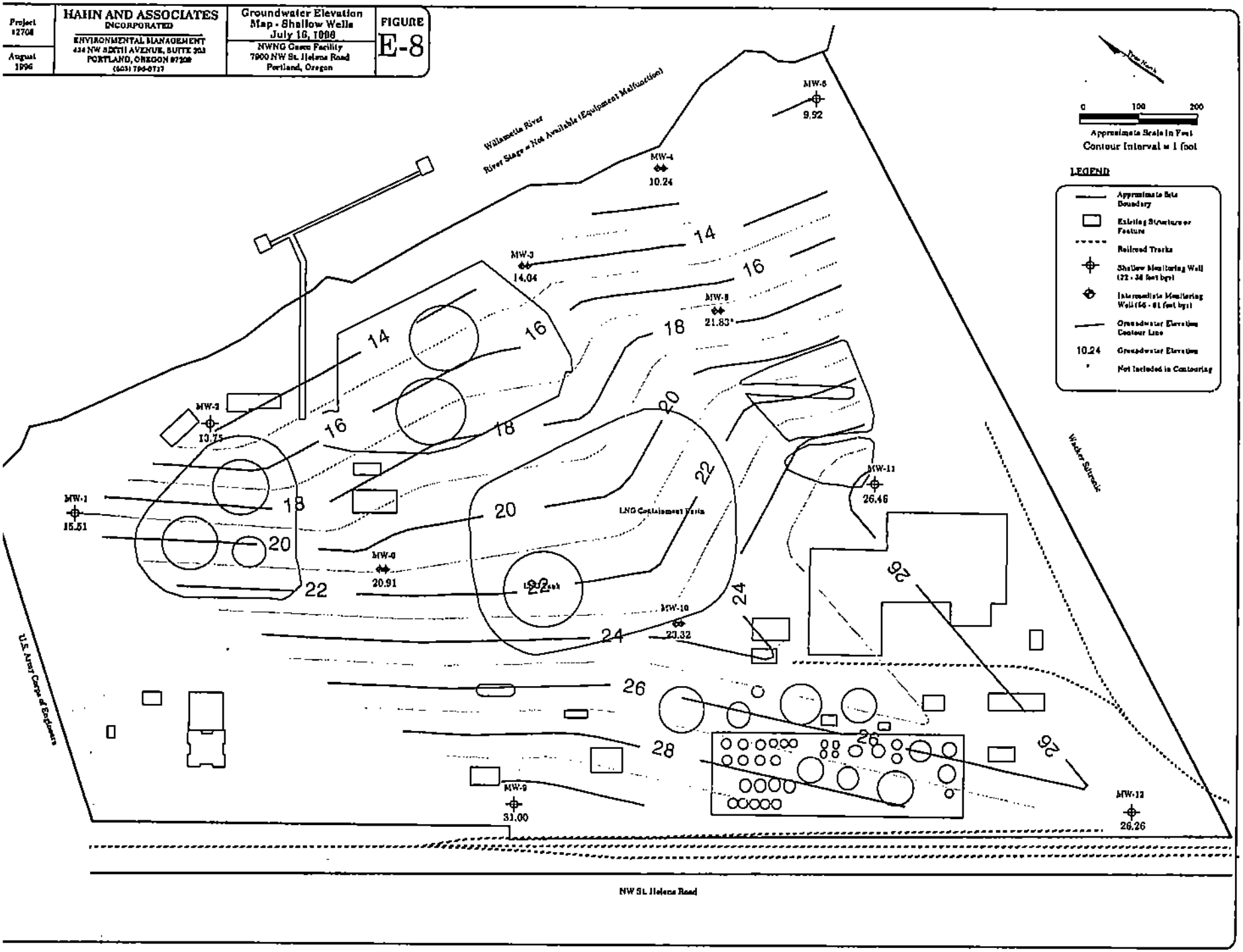
FIGURE E-6



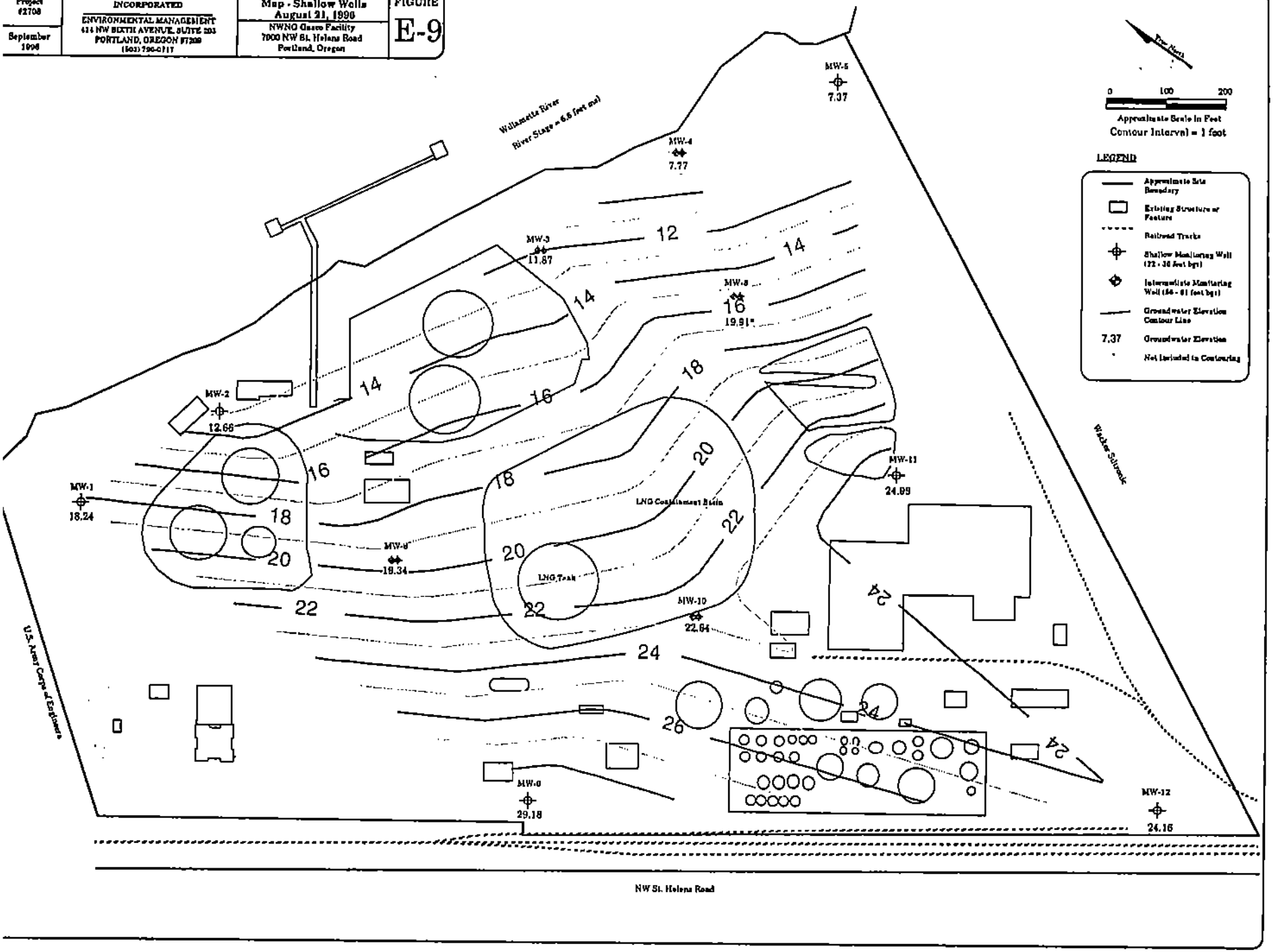
Project #2708	HAHN AND ASSOCIATES INCORPORATED	Groundwater Elevation Map - Shallow Wells June 17, 1996	FIGURE
July 1996	ENVIRONMENTAL MANAGEMENT 434 NW SIXTH AVENUE, SUITE 203 PORTLAND, OREGON 97209 (503) 796-0717	NWNG Gasco Facility 7000 NW St. Helens Road Portland, Oregon	E-7



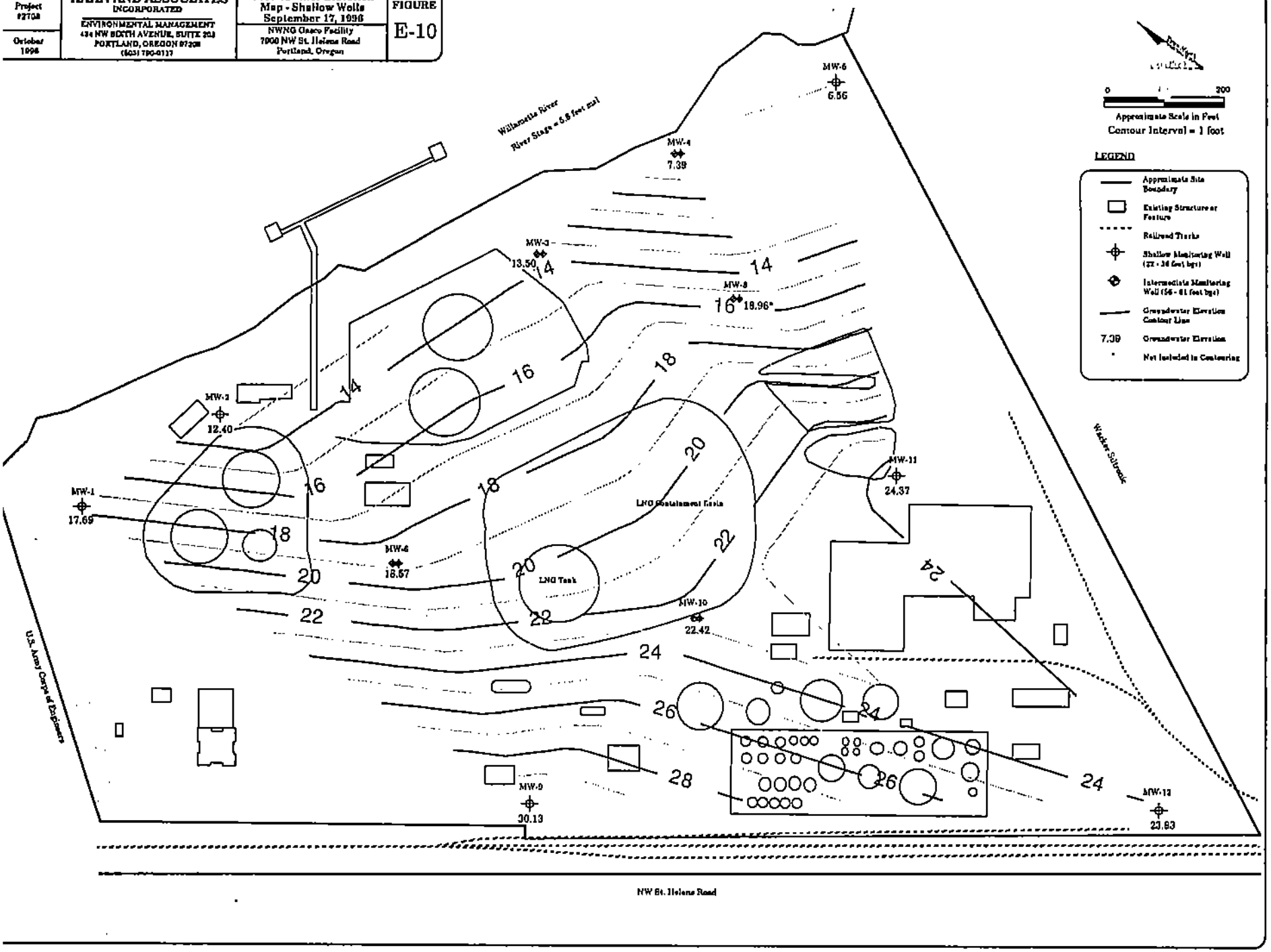
Project #2708	HAHN AND ASSOCIATES INCORPORATED	Groundwater Elevation Map - Shallow Wells July 16, 1996	FIGURE
August 1996	ENVIRONMENTAL MANAGEMENT 424 NW SIXTH AVENUE, SUITE 203 PORTLAND, OREGON 97209 (503) 796-0717	NWNG Gasco Facility 7900 NW St. Helens Road Portland, Oregon	E-8



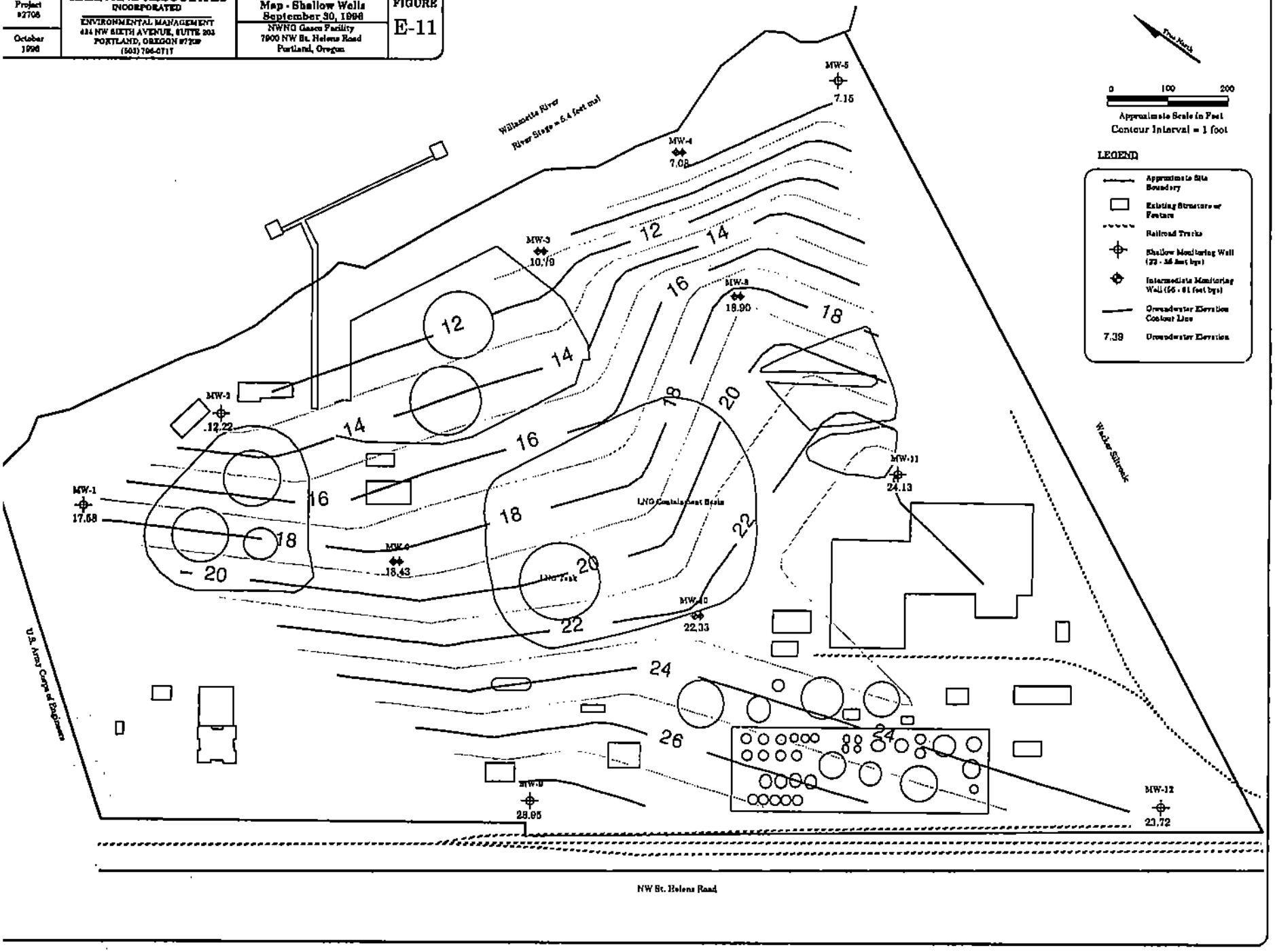
Project #2708	HAHN AND ASSOCIATES INCORPORATED ENVIRONMENTAL MANAGEMENT 414 NW SIXTH AVENUE, SUITE 203 PORTLAND, OREGON 97209 (503) 796-0717	Groundwater Elevation Map - Shallow Wells August 21, 1996	FIGURE
September 1996		NWNG Gasco Facility 7000 NW St. Helens Road Portland, Oregon	E-9



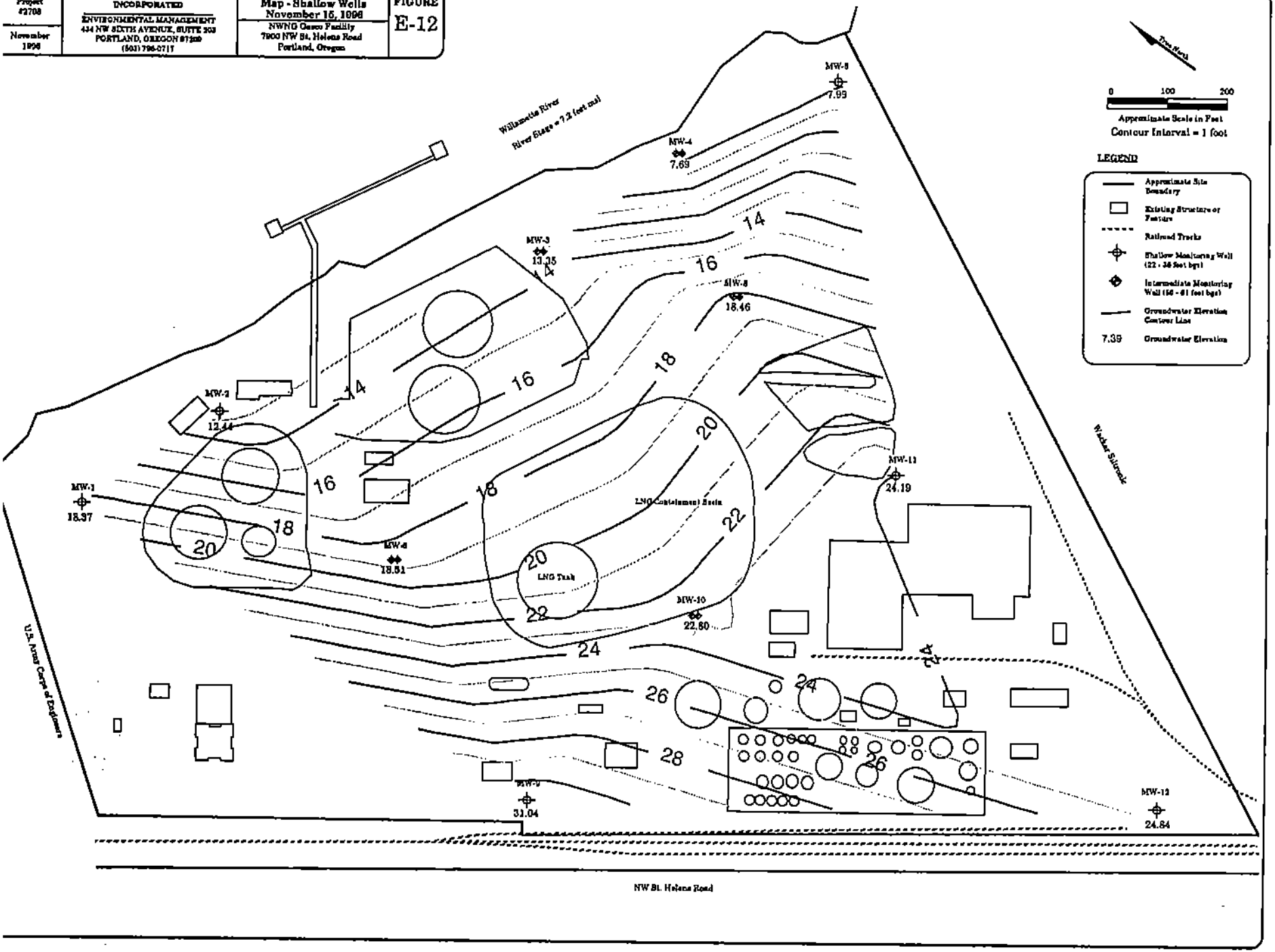
Project #2708	HAHN AND ASSOCIATES INCORPORATED	Groundwater Elevation Map - Shallow Wells September 17, 1998	FIGURE
October 1998	ENVIRONMENTAL MANAGEMENT 424 NW SIXTH AVENUE, SUITE 203 PORTLAND, OREGON 97209 (503) 790-0137	NWNG Gasco Facility 7000 NW St. Helens Road Portland, Oregon	E-10



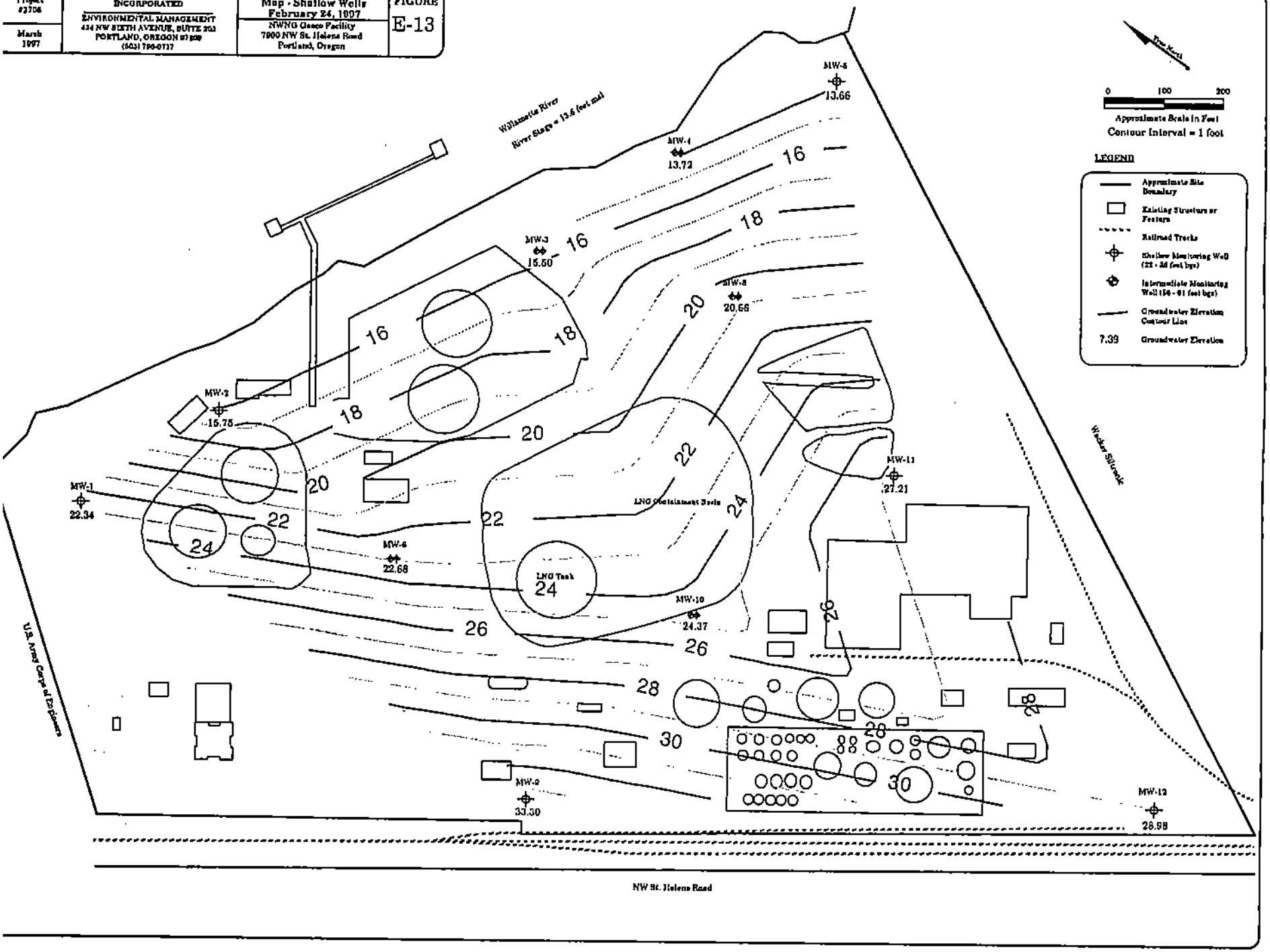
Project #2708	HAHN AND ASSOCIATES INCORPORATED ENVIRONMENTAL MANAGEMENT 434 NW SIXTH AVENUE, SUITE 203 PORTLAND, OREGON 97209 (503) 796-0717	Groundwater Elevation Map - Shallow Wells September 30, 1998 NWNG Gasco Facility 7900 NW St. Helens Road Portland, Oregon	FIGURE E-11
October 1998			



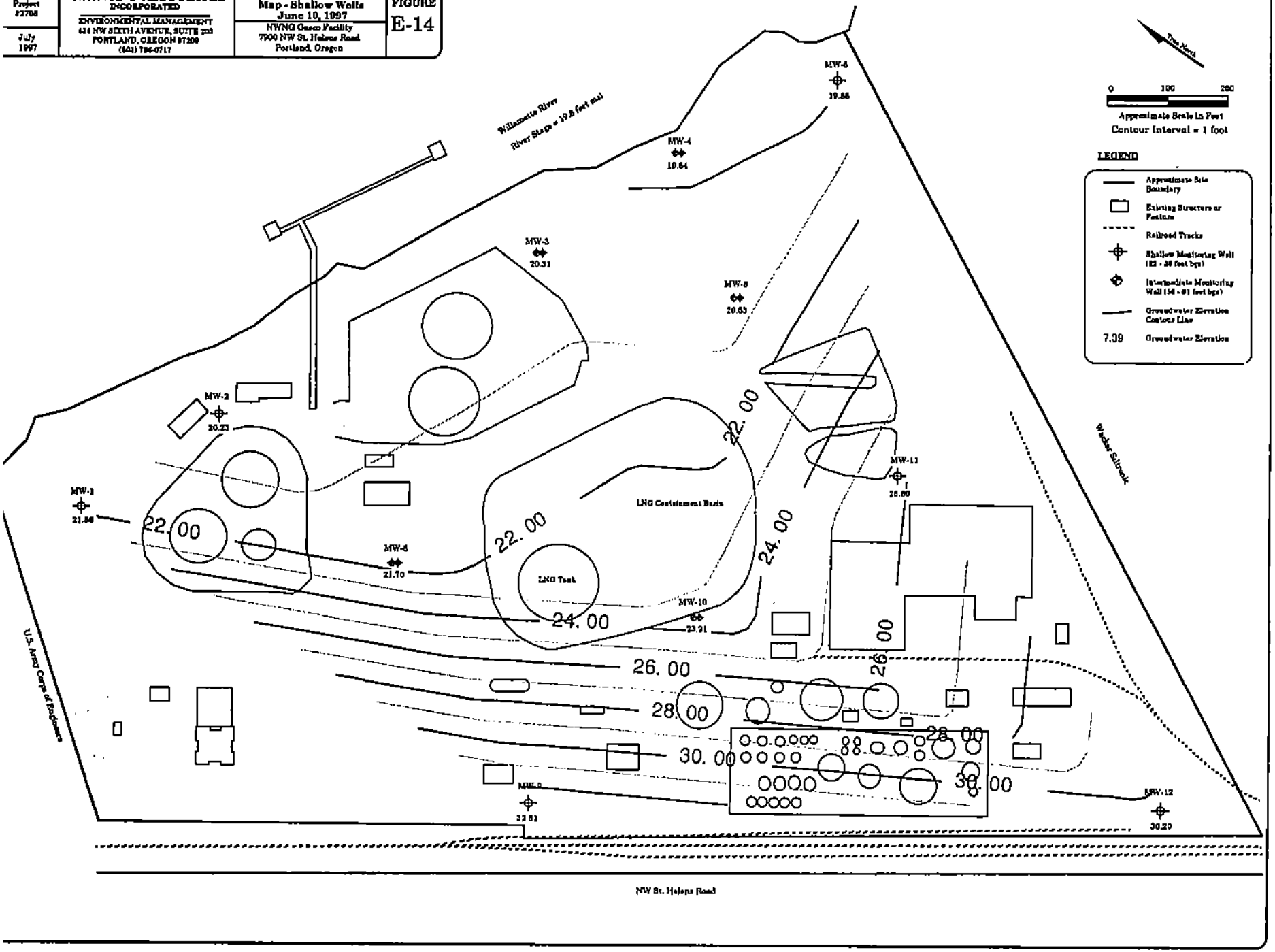
Project #2708	HAHN AND ASSOCIATES INCORPORATED	Groundwater Elevation Map - Shallow Wells November 16, 1996	FIGURE
November 1996	ENVIRONMENTAL MANAGEMENT 434 NW SIXTH AVENUE, SUITE 203 PORTLAND, OREGON 97209 (503) 796-0717	NWNG Gasco Facility 7900 NW St. Helens Road Portland, Oregon	E-12



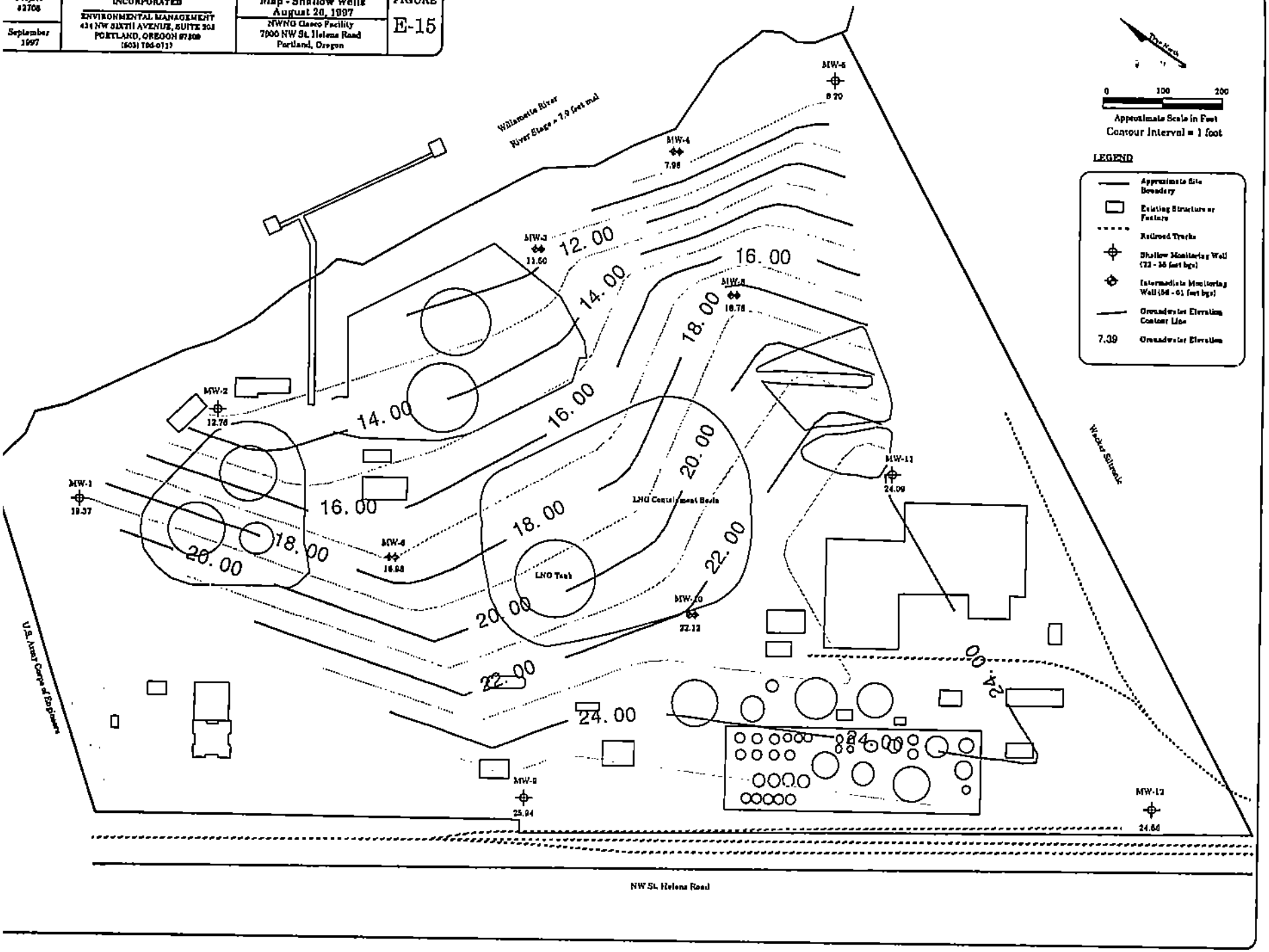
Project #3708	HAHN AND ASSOCIATES INCORPORATED	Groundwater Elevation Map - Shallow Wells February 24, 1997	FIGURE
March 1997	ENVIRONMENTAL MANAGEMENT 434 NW SIXTH AVENUE, SUITE 203 PORTLAND, OREGON 97209 (503) 796-0737	NWNG Gasco Facility 7900 NW St. Helens Road Portland, Oregon	E-13

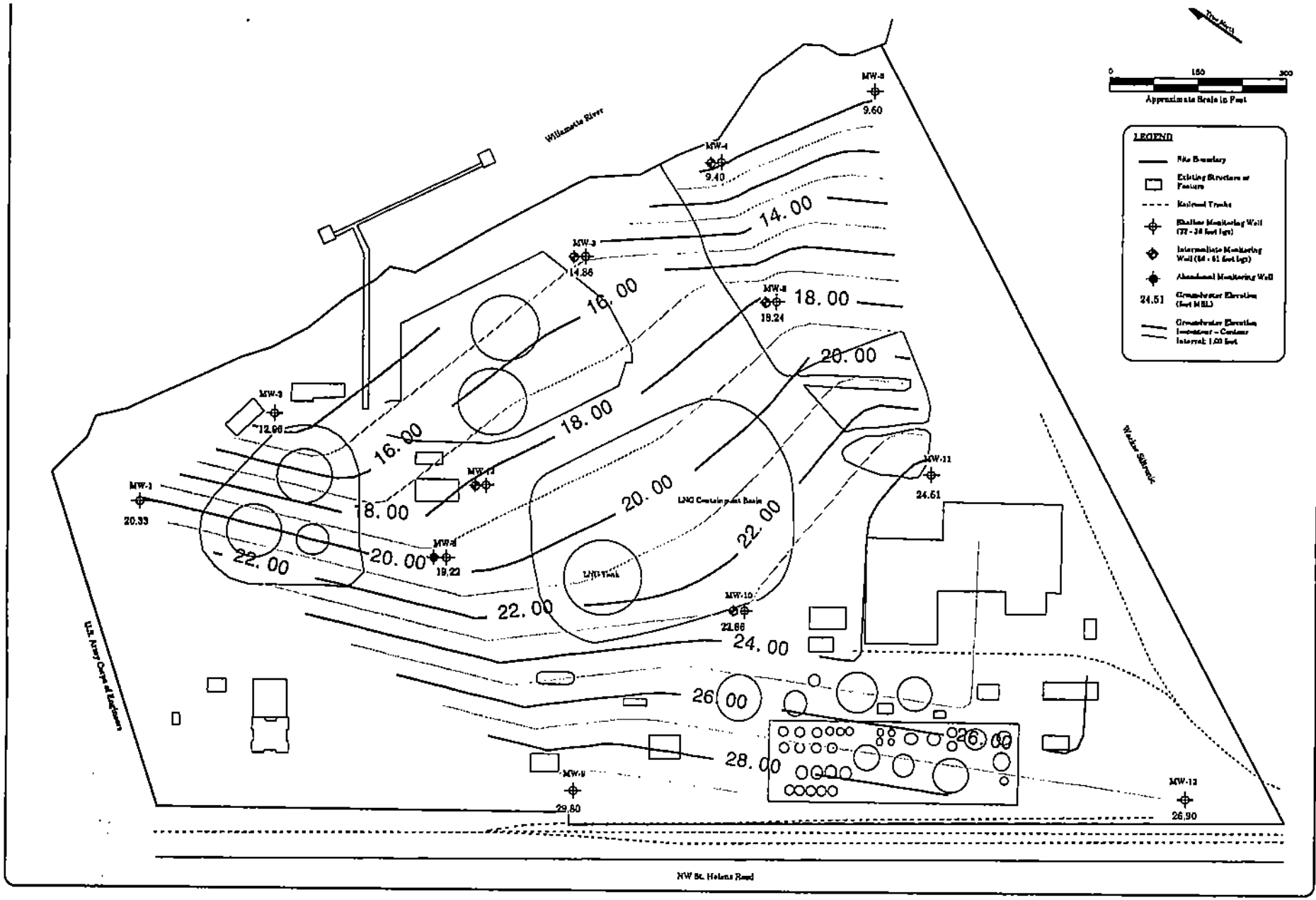


Project #2708	HAHN AND ASSOCIATES INCORPORATED ENVIRONMENTAL MANAGEMENT 414 NW SIXTH AVENUE, SUITE 203 PORTLAND, OREGON 97209 (503) 796-0717	Groundwater Elevation Map - Shallow Wells June 10, 1997 NWNG Gasco Facility 7900 NW St. Helens Road Portland, Oregon	FIGURE E-14
July 1997			



Project #2708	HAHN AND ASSOCIATES INCORPORATED	Groundwater Elevation Map - Shallow Wells August 26, 1997	FIGURE
September 1997	ENVIRONMENTAL MANAGEMENT 424 NW SIXTH AVENUE, SUITE 203 PORTLAND, OREGON 97209 (503) 780-0717	NWNG Gasco Facility 7000 NW St. Helens Road Portland, Oregon	E-15





E-16

Groundwater Elevation Map - Shallow Wells
November 25, 1997

RUPS
Northwest Natural - Gasco Facility
7540 NW St. Helens Road
Portland, Oregon

HAHN & ASSOCIATES, INC.
ENVIRONMENTAL MANAGEMENT
434 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209
503/736-0717

February 1998

Project #2708

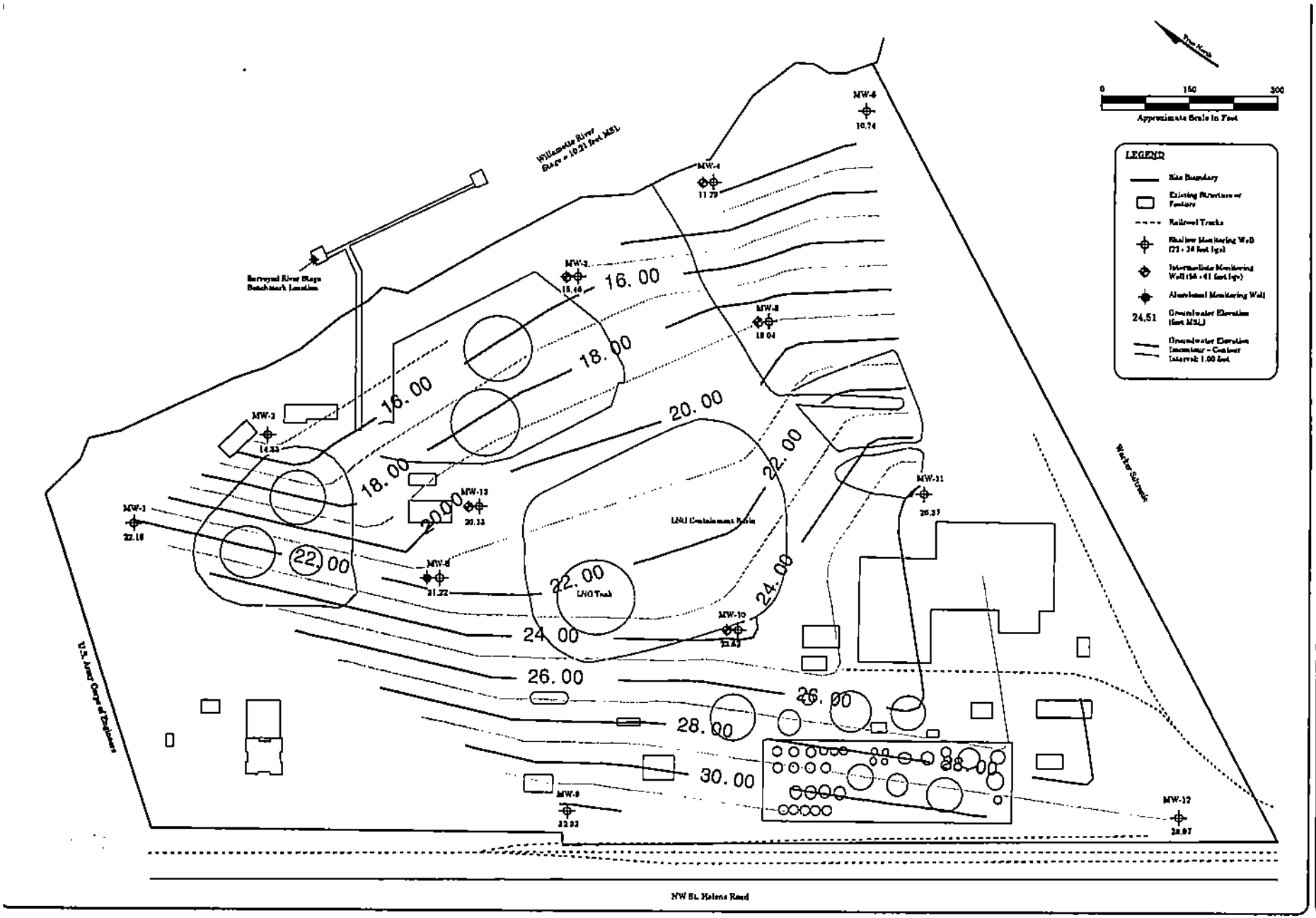


Figure
E-17
Groundwater Elevation Map - Shallow Wells
February 16, 1998
RI/FS
Northwest Natural - Gasco Facility
7540 NW St. Helens Road
Portland, Oregon
HAHN & ASSOCIATES, INC.
ENVIRONMENTAL MANAGEMENT
434 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209
503/796-0717
April 1998
Project #2708
LEGEND
Site Boundary
Existing Structures or Features
Railroad Tracks
Shallow Monitoring Well (71 - 34 feet bgs)
Intermediate Monitoring Well (56 - 41 feet bgs)
Abandoned Monitoring Well
24.51 Groundwater Elevation (feet MSL)
Groundwater Elevation Isocontour - Contour Interval: 1.00 feet
Approximate Scale in Feet
0
150
300
Willamette River Stage = 10.21 feet MSL
Barrycuda River Stage Benchmark Location
MW-1
22.18
MW-2
14.33
MW-3
15.46
MW-4
11.79
MW-5
10.74
MW-6
18.04
MW-7
21.22
MW-8
22.93
MW-9
22.43
MW-10
MW-11
26.37
MW-12
28.97
MW-13
20.13
LNG Containment Basin
LNG Tank
16.00
18.00
20.00
22.00
24.00
26.00
28.00
30.00
U.S. Army Corps of Engineers
Weber Slough
NW St. Helens Road

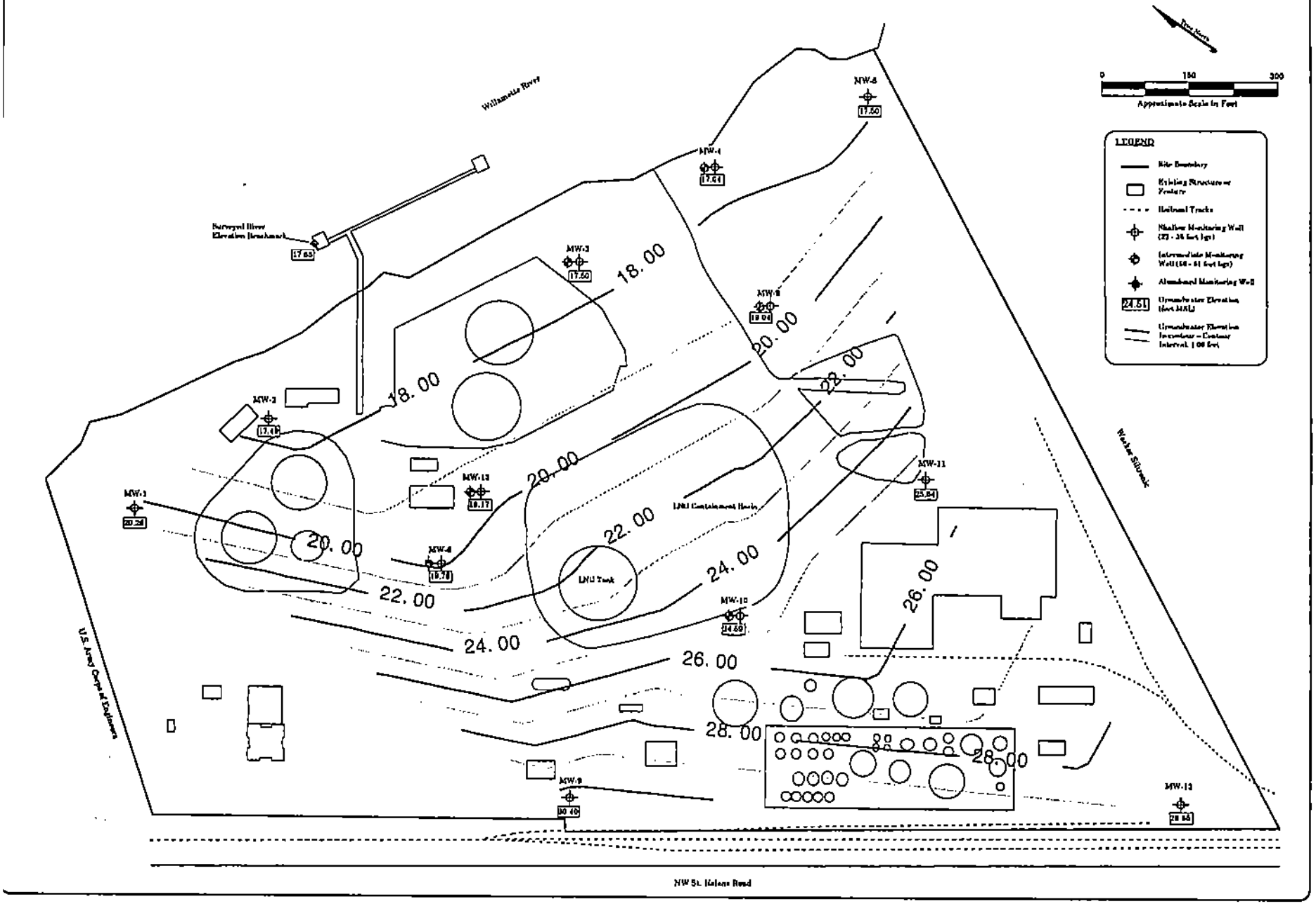
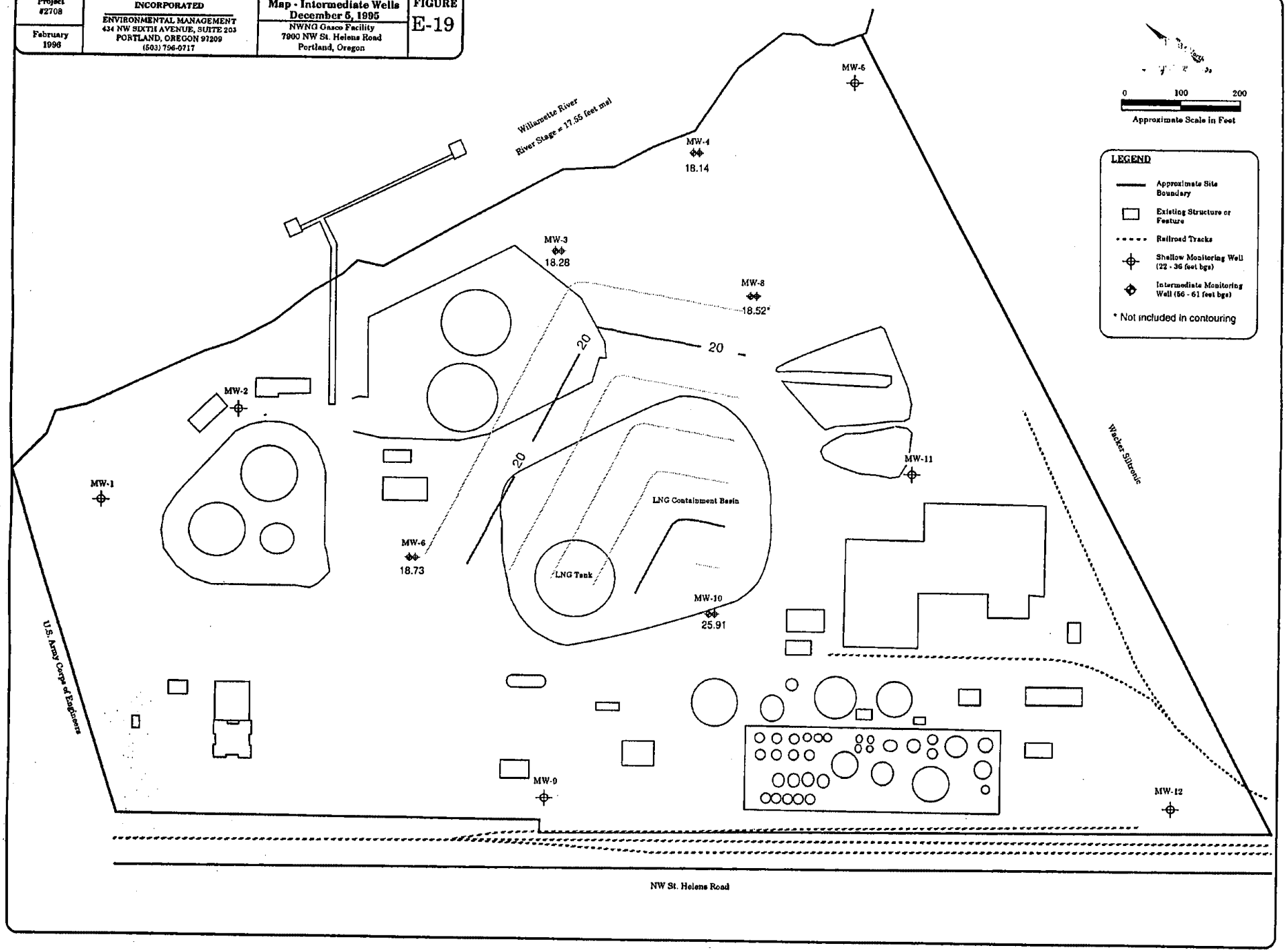


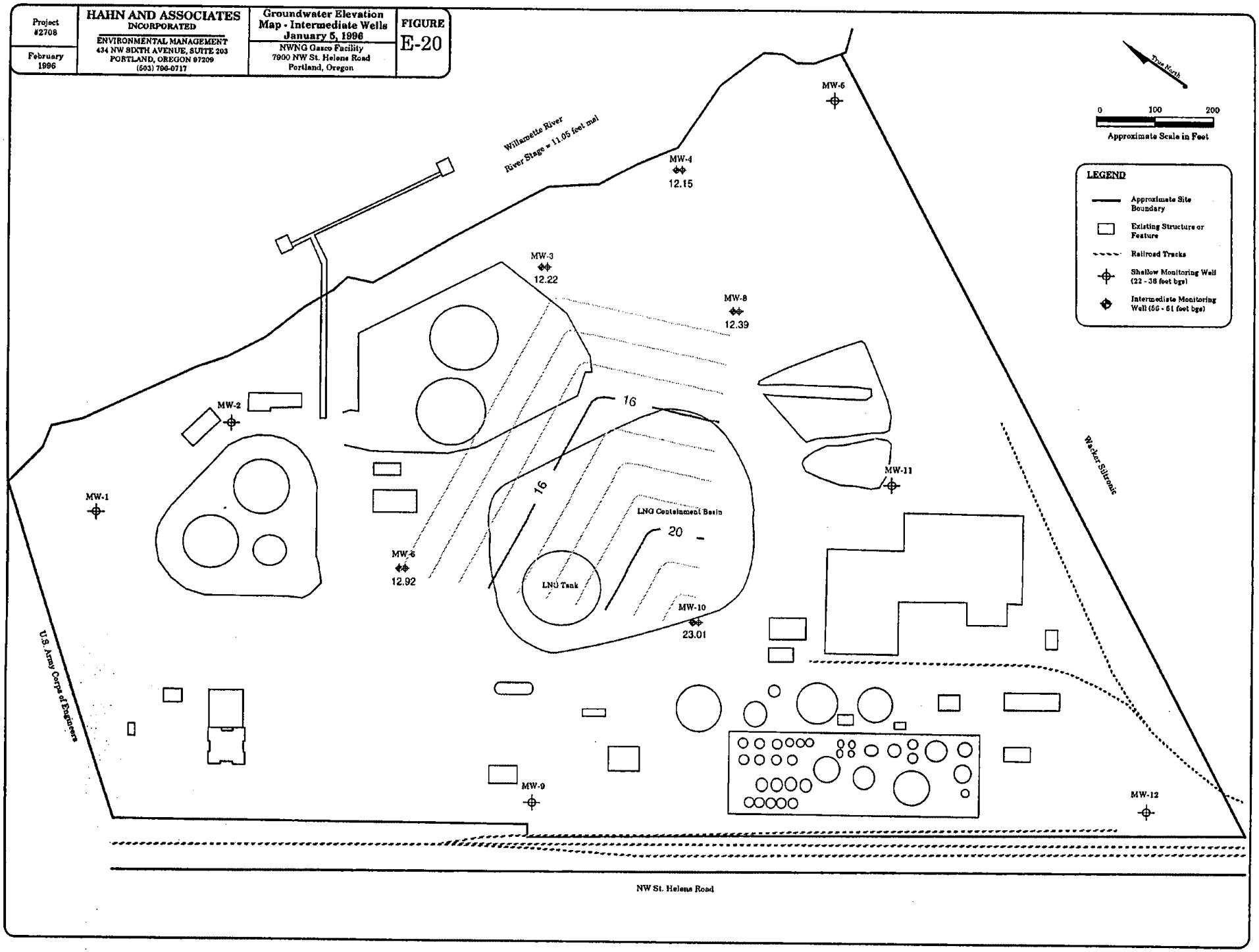
Figure
E-18
Groundwater Elevation Map - Shallow Wells
June 1, 1998
RI/FS Progress Report
Northwest Natural - Gasco Facility
7540 NW St. Helens Road
Portland, Oregon
HAHN & ASSOCIATES, INC.
ENVIRONMENTAL MANAGEMENT
434 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209
503/795-0717
June 1998
Project #2708
LEGEND
Site Boundary
Existing Structure or Feature
Railroad Tracks
Shallow Monitoring Well
Intermediate Monitoring Well
Abandoned Monitoring Well
Groundwater Elevation (feet MSL)
Groundwater Elevation Isocontour - Contour Interval 1.00 feet
Approximate Scale in Feet
0
150
300
True North
Willamette River
Surveyed River Elevation Benchmark
17.65
MW-1
20.26
MW-2
17.48
MW-3
17.60
MW-4
19.78
MW-5
17.50
MW-6
17.64
MW-7
19.04
MW-8
30.40
MW-9
24.60
MW-10
25.84
MW-11
28.86
MW-12
19.17
MW-13
LNG Containment Basin
LNG Tank
18.00
20.00
22.00
24.00
26.00
28.00
Washington Slough
U.S. Army Corps of Engineers
NW St. Helens Road

Groundwater Elevation Maps
Alluvial Sand Water Bearing Zone-Intermediate Depth

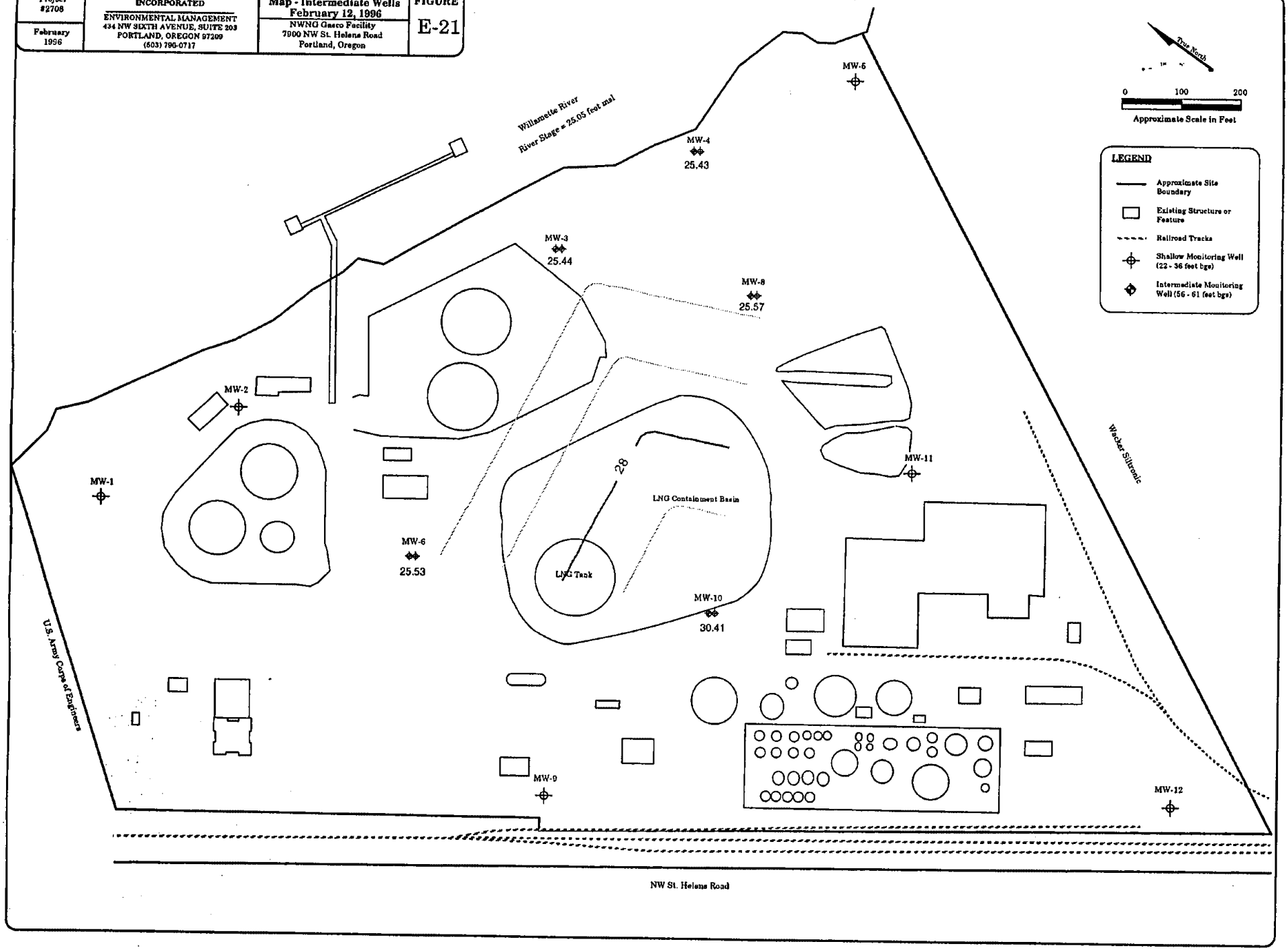
Project #2708	HAHN AND ASSOCIATES INCORPORATED ENVIRONMENTAL MANAGEMENT 434 NW SIXTH AVENUE, SUITE 203 PORTLAND, OREGON 97209 (503) 796-0717	Groundwater Elevation Map - Intermediate Wells December 5, 1995 NWNG Gasco Facility 7900 NW St. Helens Road Portland, Oregon	FIGURE E-19
February 1996			



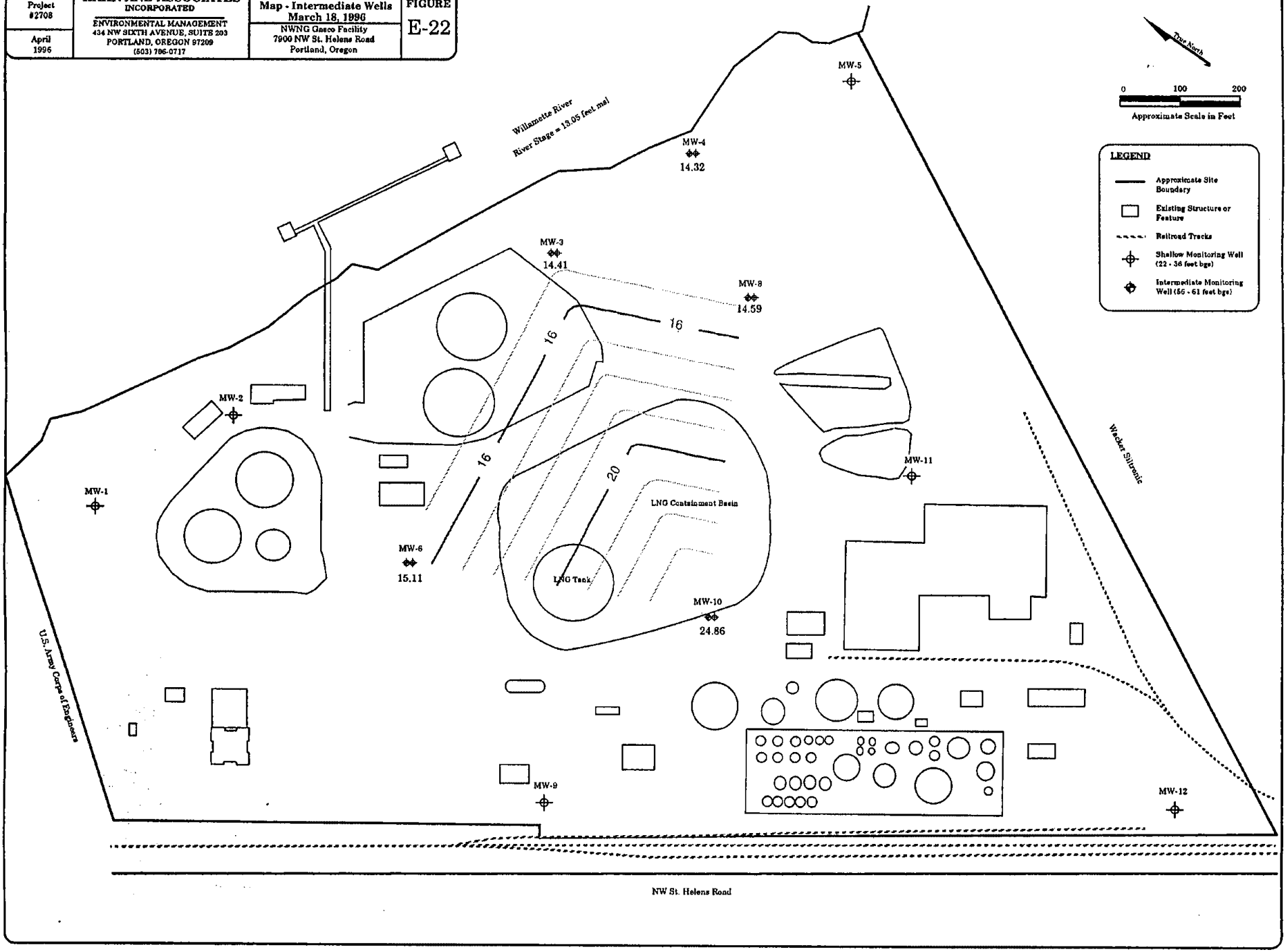
Project #2708	HAHN AND ASSOCIATES INCORPORATED ENVIRONMENTAL MANAGEMENT 434 NW SIXTH AVENUE, SUITE 203 PORTLAND, OREGON 97209 (503) 796-0717	Groundwater Elevation Map - Intermediate Wells January 5, 1996 NWNG Gasco Facility 7900 NW St. Helens Road Portland, Oregon	FIGURE E-20
February 1996			



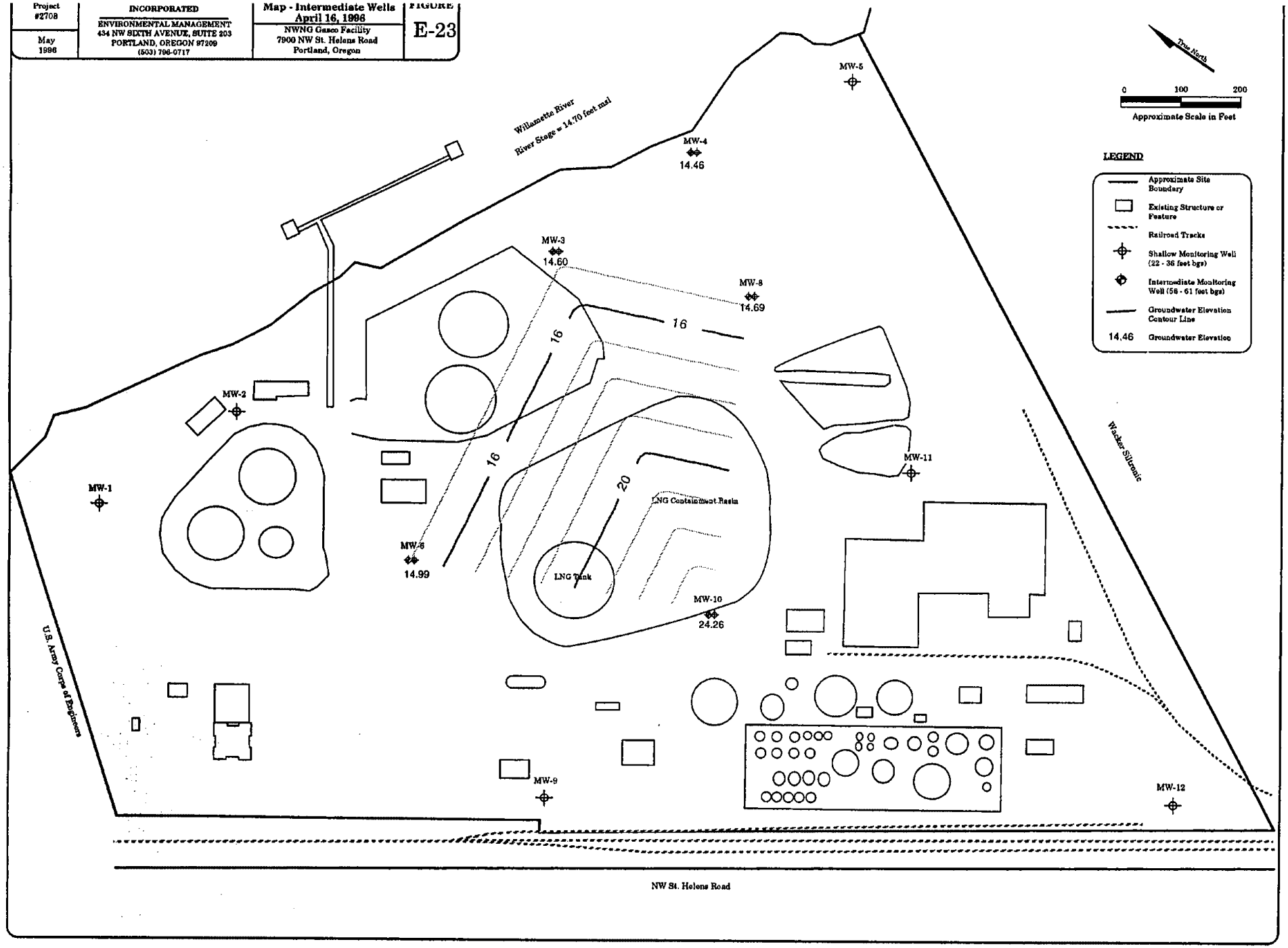
Project #2708	HAHN AND ASSOCIATES INCORPORATED	Groundwater Elevation Map - Intermediate Wells February 12, 1996	FIGURE
February 1996	ENVIRONMENTAL MANAGEMENT 434 NW SIXTH AVENUE, SUITE 203 PORTLAND, OREGON 97209 (503) 790-0717	NWNG Gasco Facility 7900 NW St. Helens Road Portland, Oregon	E-21



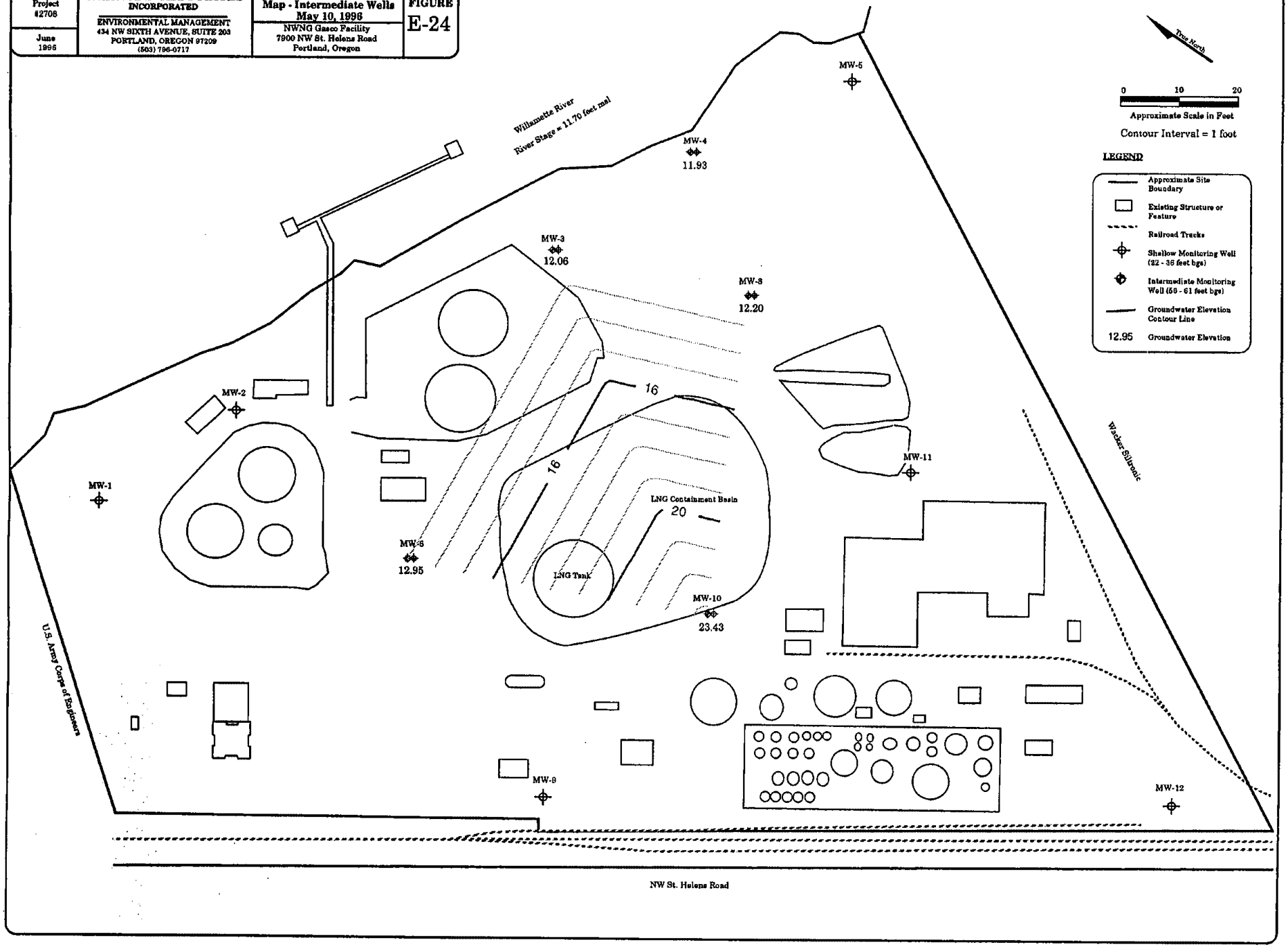
Project #2708	HAHN AND ASSOCIATES INCORPORATED ENVIRONMENTAL MANAGEMENT 434 NW SIXTH AVENUE, SUITE 203 PORTLAND, OREGON 97209 (503) 796-0717	Groundwater Elevation Map - Intermediate Wells March 18, 1996 NWNG Gasco Facility 7900 NW St. Helens Road Portland, Oregon	FIGURE E-22
April 1996			



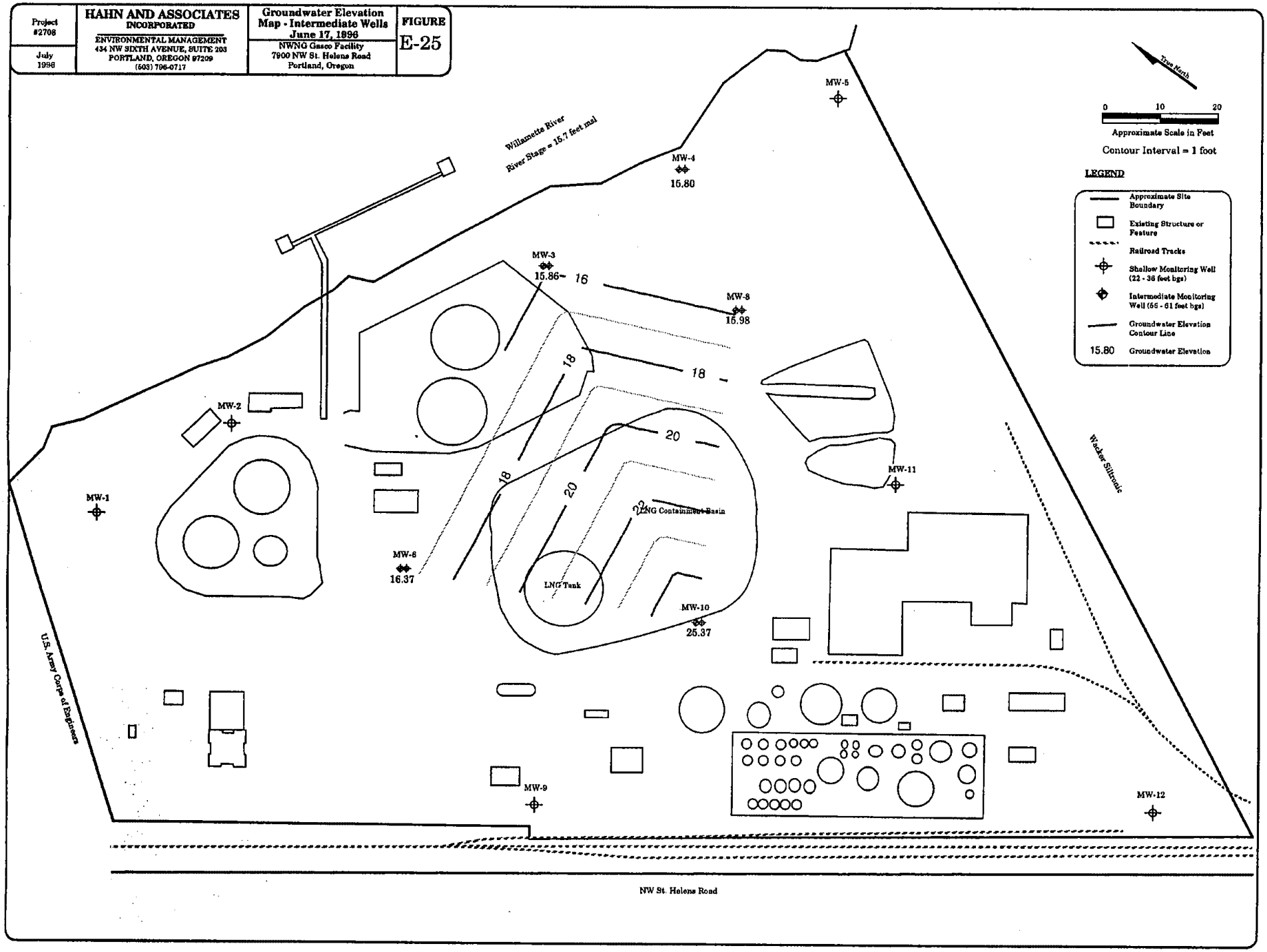
Project #2708	INCORPORATED ENVIRONMENTAL MANAGEMENT 434 NW SIXTH AVENUE, SUITE 203 PORTLAND, OREGON 97209 (503) 796-0717	Map - Intermediate Wells April 16, 1996 NWNG Gasco Facility 7900 NW St. Helens Road Portland, Oregon	FIGURE E-23
May 1996			



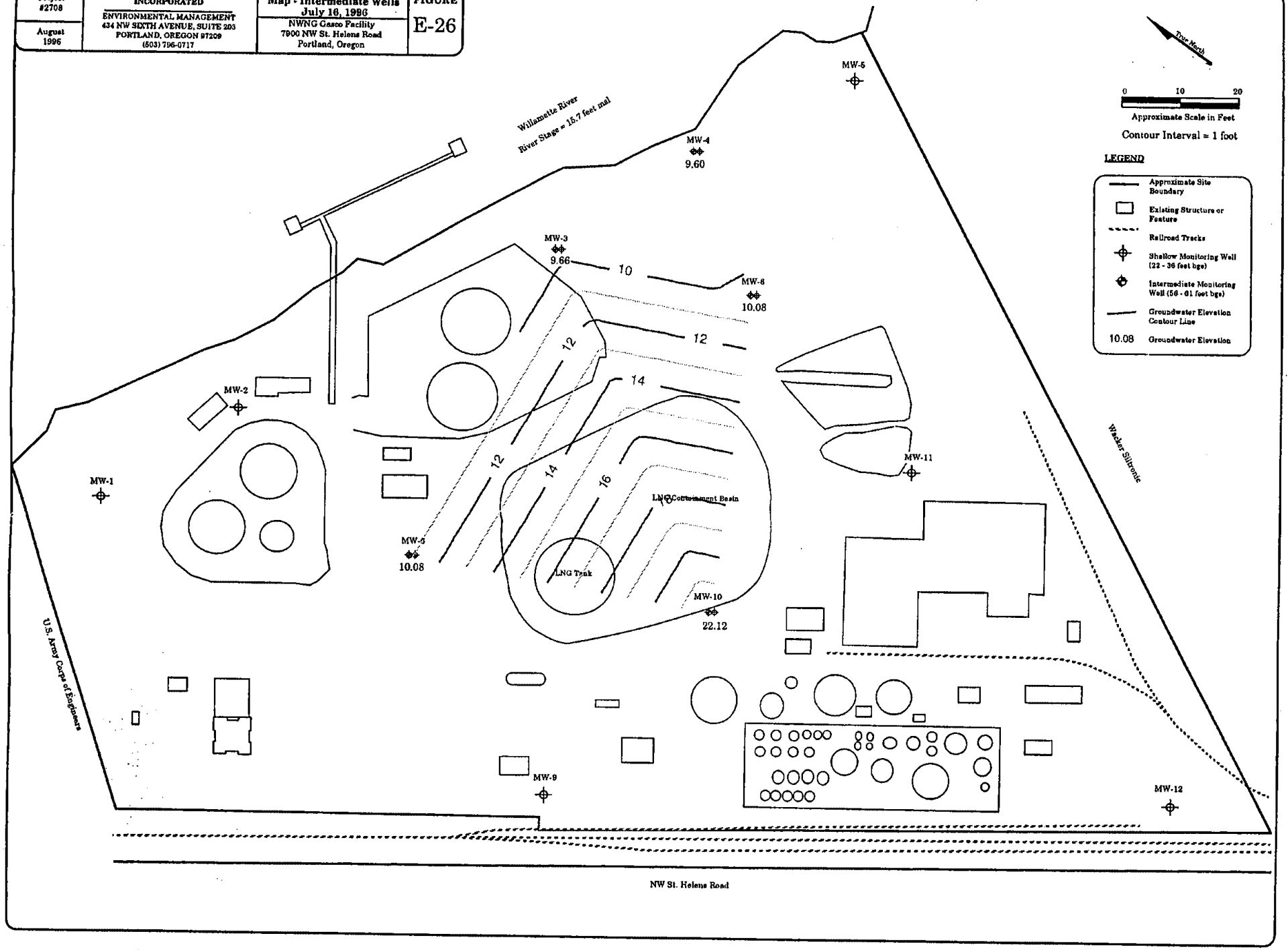
Project #2708	HAHN AND ASSOCIATES INCORPORATED ENVIRONMENTAL MANAGEMENT 434 NW SIXTH AVENUE, SUITE 203 PORTLAND, OREGON 97209 (503) 796-0717	Groundwater Elevation Map - Intermediate Wells May 10, 1996 NWNG Gasco Facility 7900 NW St. Helens Road Portland, Oregon	FIGURE E-24
June 1996			



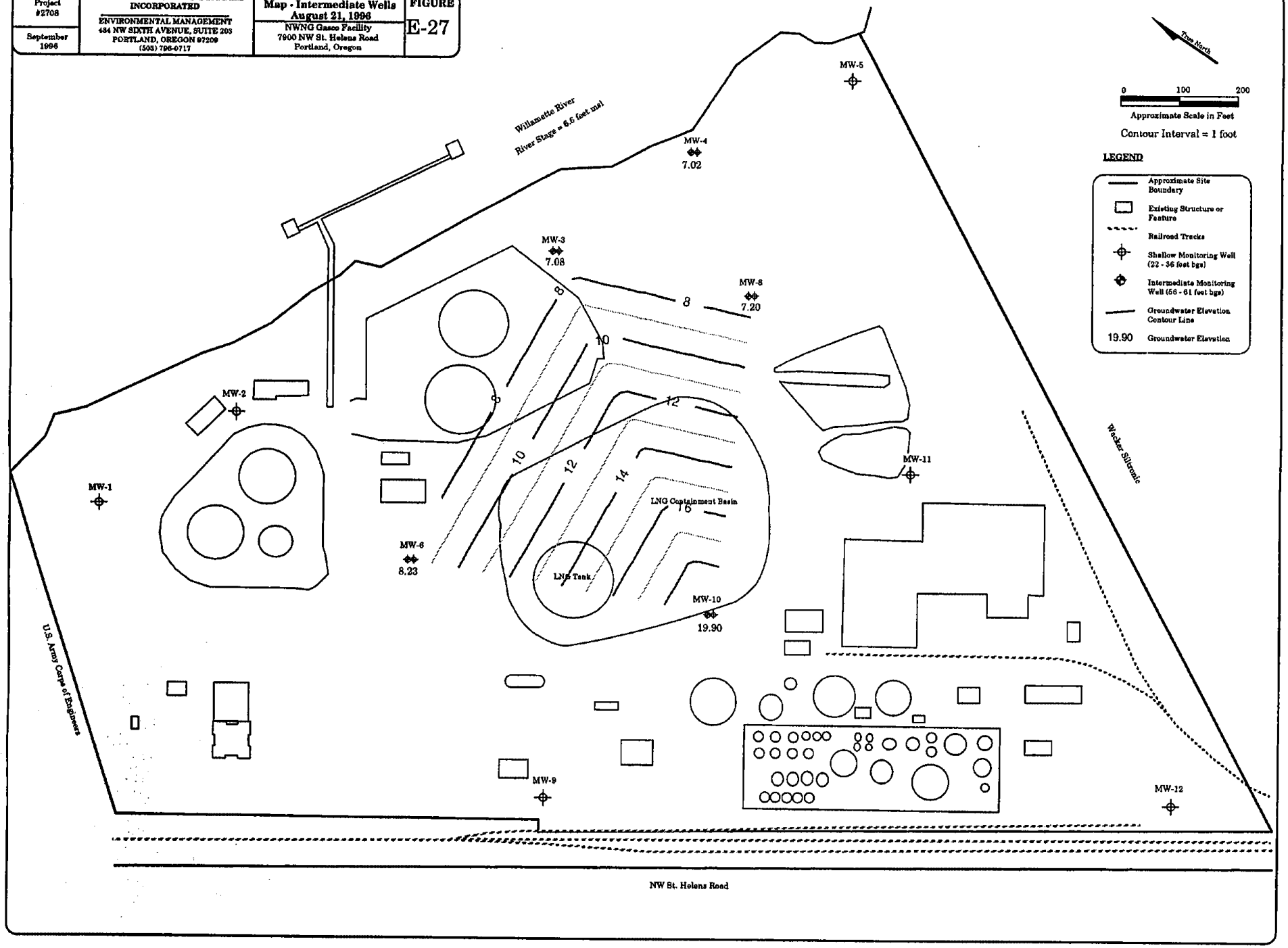
Project #2708	HAHN AND ASSOCIATES INCORPORATED	Groundwater Elevation Map - Intermediate Wells June 17, 1996	FIGURE
July 1996	ENVIRONMENTAL MANAGEMENT 434 NW SIXTH AVENUE, SUITE 203 PORTLAND, OREGON 97209 (503) 796-0717	NWNG Gasco Facility 7900 NW St. Helens Road Portland, Oregon	E-25



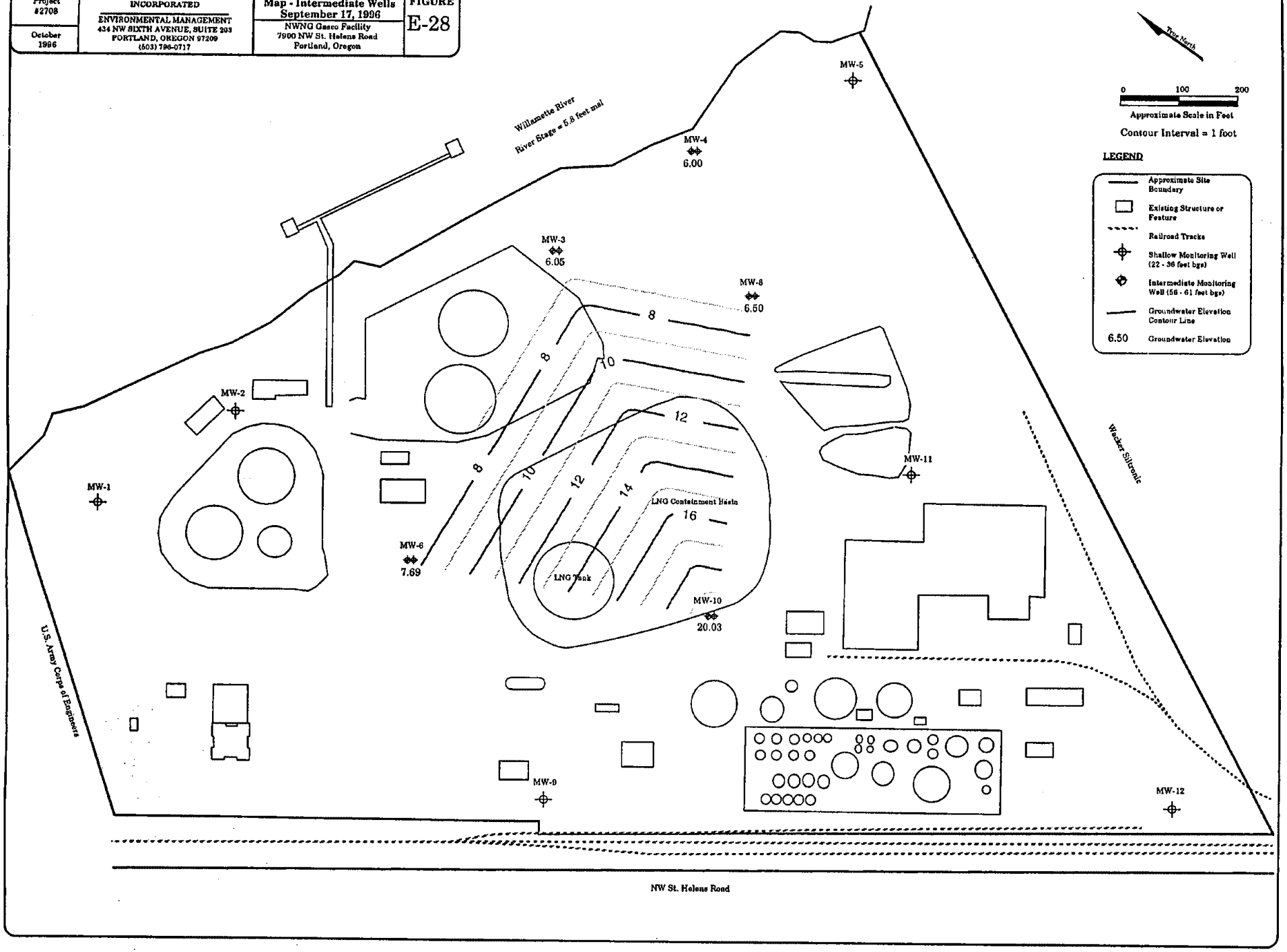
Project #2708	HAHN AND ASSOCIATES INCORPORATED ENVIRONMENTAL MANAGEMENT 434 NW SIXTH AVENUE, SUITE 203 PORTLAND, OREGON 97209 (503) 796-0717	Groundwater Elevation Map - Intermediate Wells July 16, 1996 NWNG Gasco Facility 7900 NW St. Helens Road Portland, Oregon	FIGURE E-26
August 1996			



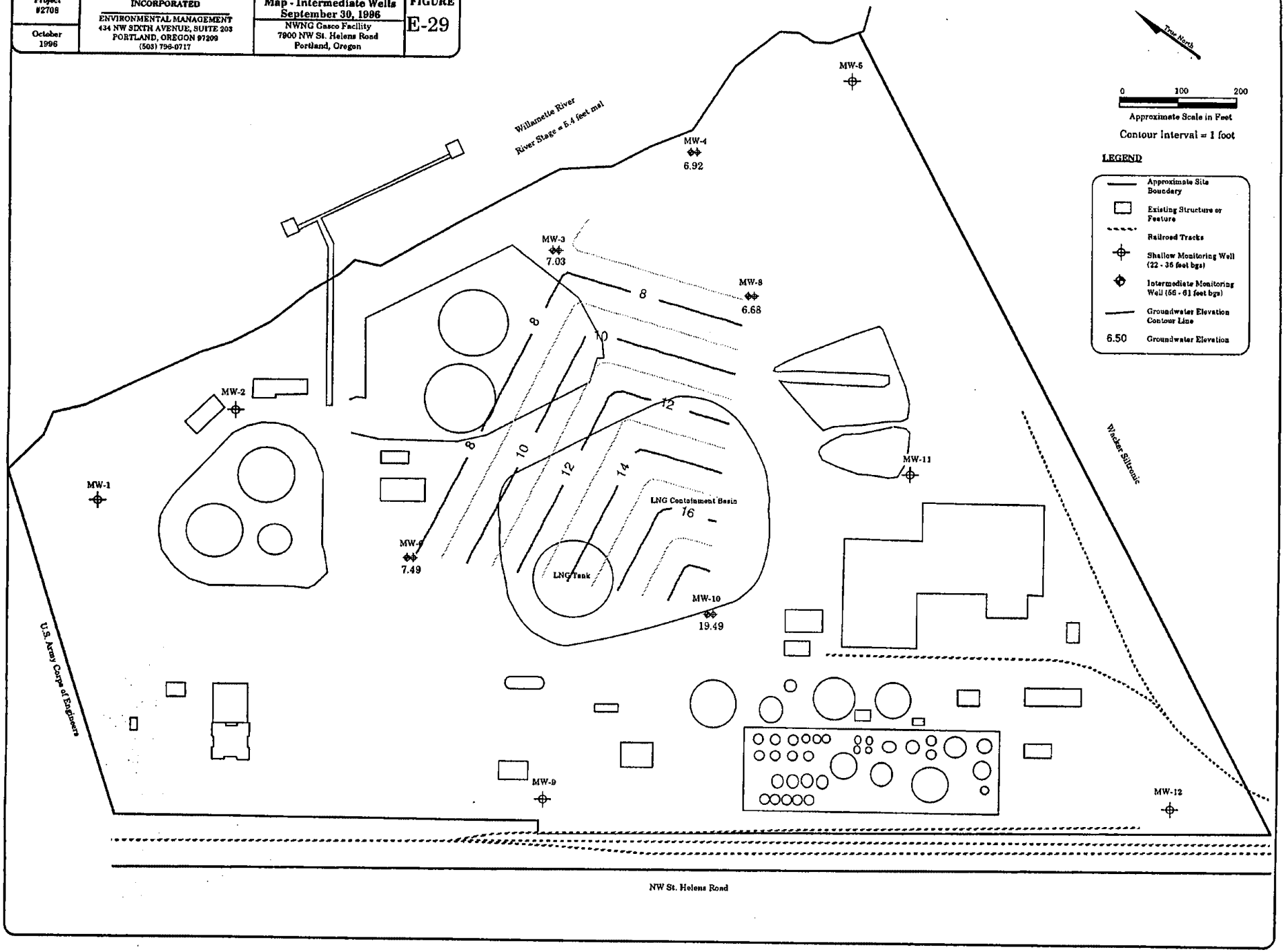
Project #2708	HAHN AND ASSOCIATES INCORPORATED ENVIRONMENTAL MANAGEMENT 434 NW SIXTH AVENUE, SUITE 203 PORTLAND, OREGON 97209 (503) 796-0717	Groundwater Elevation Map - Intermediate Wells August 21, 1996 NWNG Gasco Facility 7900 NW St. Helens Road Portland, Oregon	FIGURE E-27
September 1996			



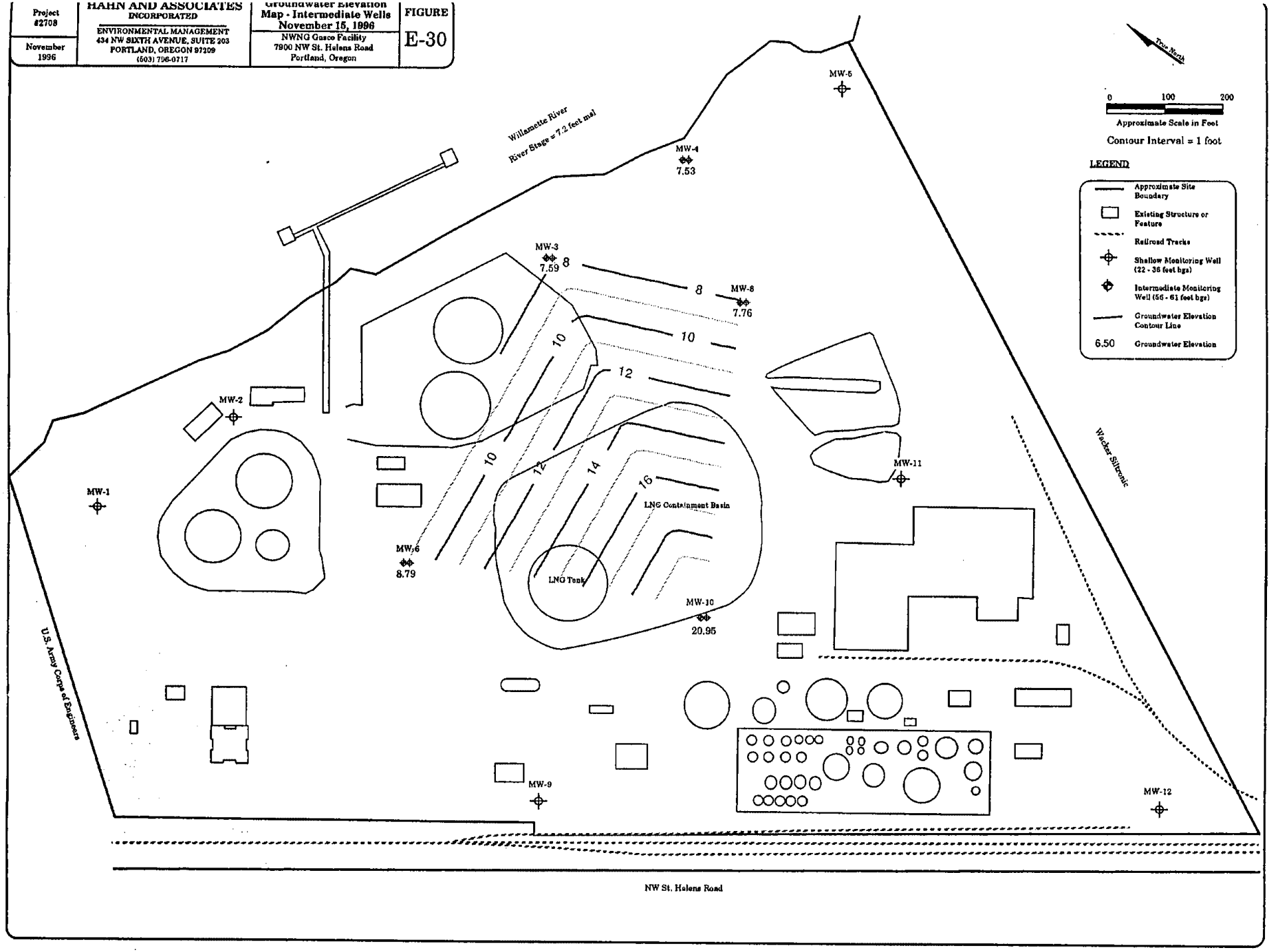
Project #2708	HAHN AND ASSOCIATES INCORPORATED ENVIRONMENTAL MANAGEMENT 434 NW SIXTH AVENUE, SUITE 203 PORTLAND, OREGON 97209 (503) 796-0717	Groundwater Elevation Map - Intermediate Wells September 17, 1996 NWNG Gasco Facility 7900 NW St. Helens Road Portland, Oregon	FIGURE E-28
October 1996			



Project #2708	HAHN AND ASSOCIATES INCORPORATED	Groundwater Elevation Map - Intermediate Wells September 30, 1996	FIGURE
October 1996	ENVIRONMENTAL MANAGEMENT 434 NW SIXTH AVENUE, SUITE 203 PORTLAND, OREGON 97209 (503) 796-0717	NWNG Gasco Facility 7900 NW St. Helens Road Portland, Oregon	E-29



Project #2708	HAHN AND ASSOCIATES INCORPORATED ENVIRONMENTAL MANAGEMENT 434 NW SIXTH AVENUE, SUITE 203 PORTLAND, OREGON 97209 (503) 796-0717	Groundwater Elevation Map - Intermediate Wells November 15, 1996 NWNG Gasco Facility 7900 NW St. Helens Road Portland, Oregon	FIGURE E-30
November 1996			



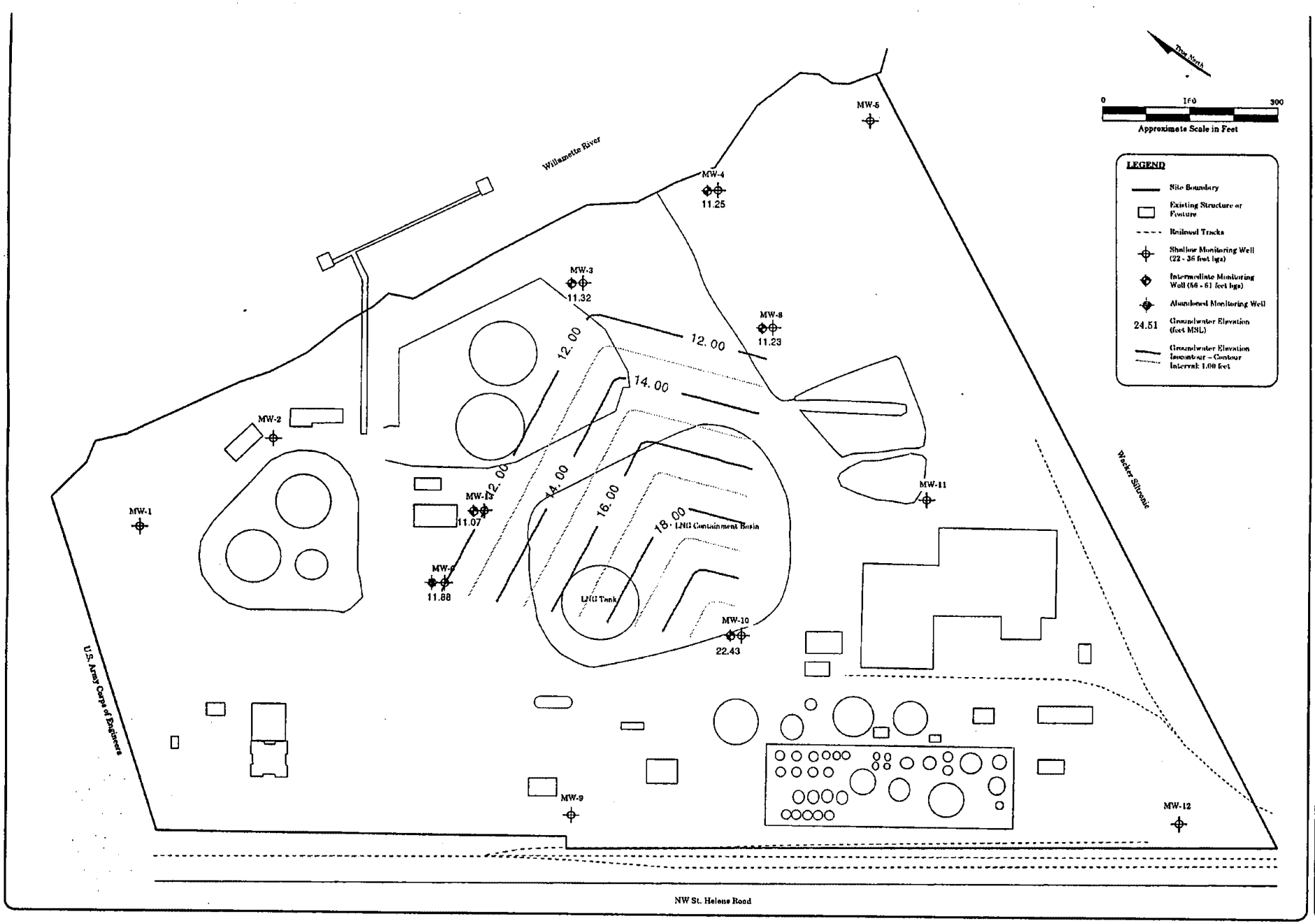


Figure
E-31

Groundwater Elevation Map - Intermediate Wells
December 19, 1997

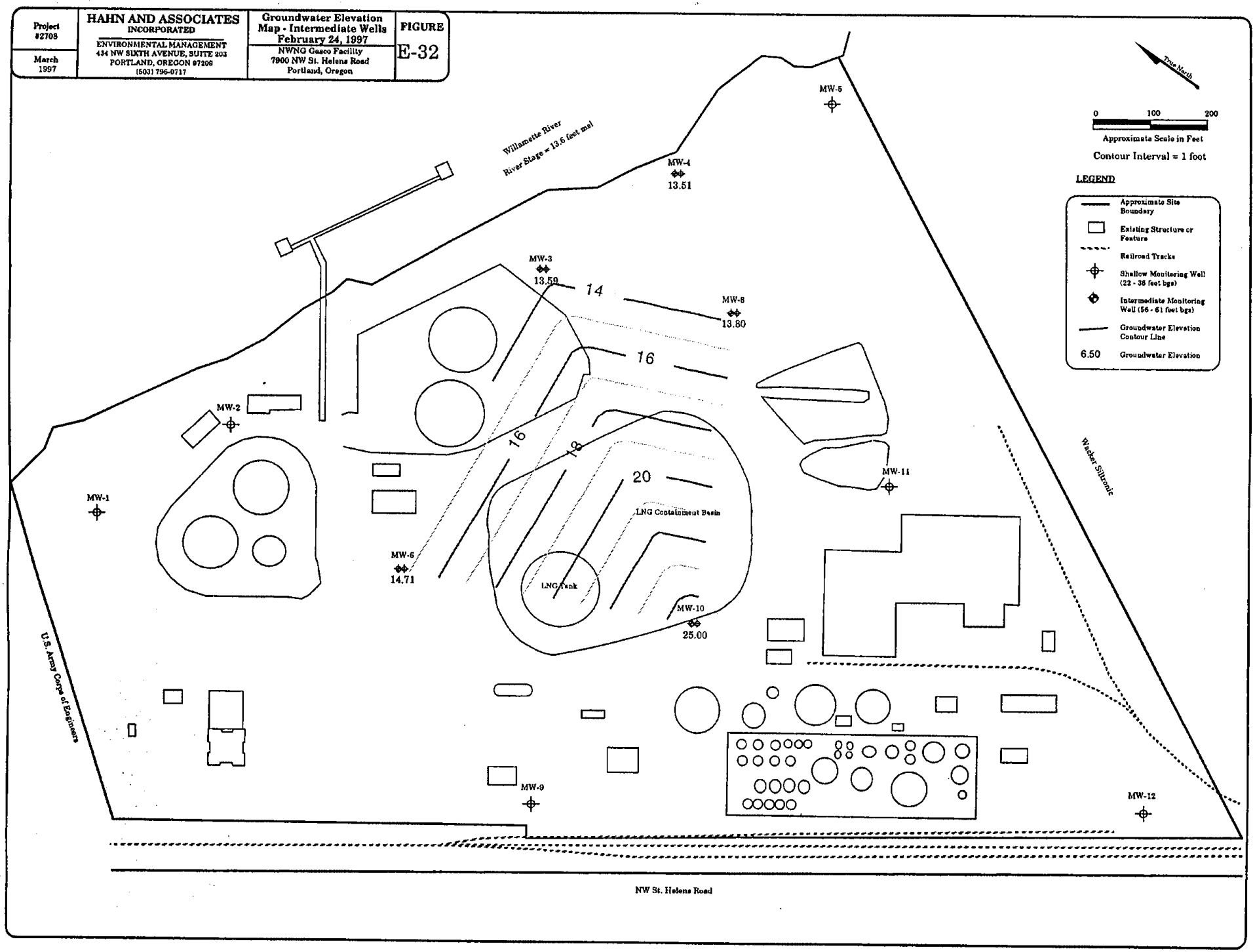
RI/FS
Northwest Natural - Gasco Facility
7540 NW St. Helens Road
Portland, Oregon

HAHN & ASSOCIATES, INC.
ENVIRONMENTAL MANAGEMENT
434 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209
503/796-0717

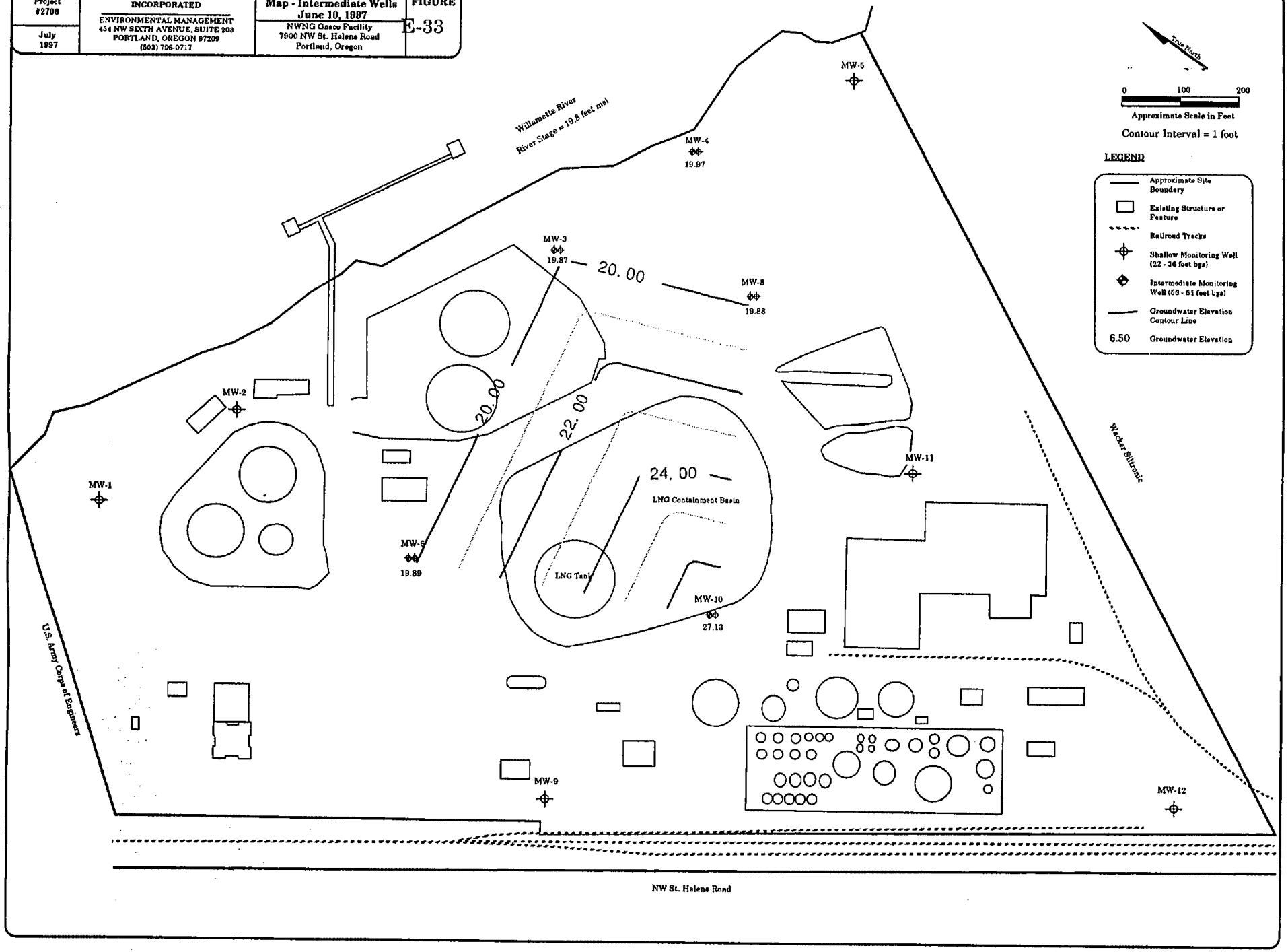
February 1998

Project #2708

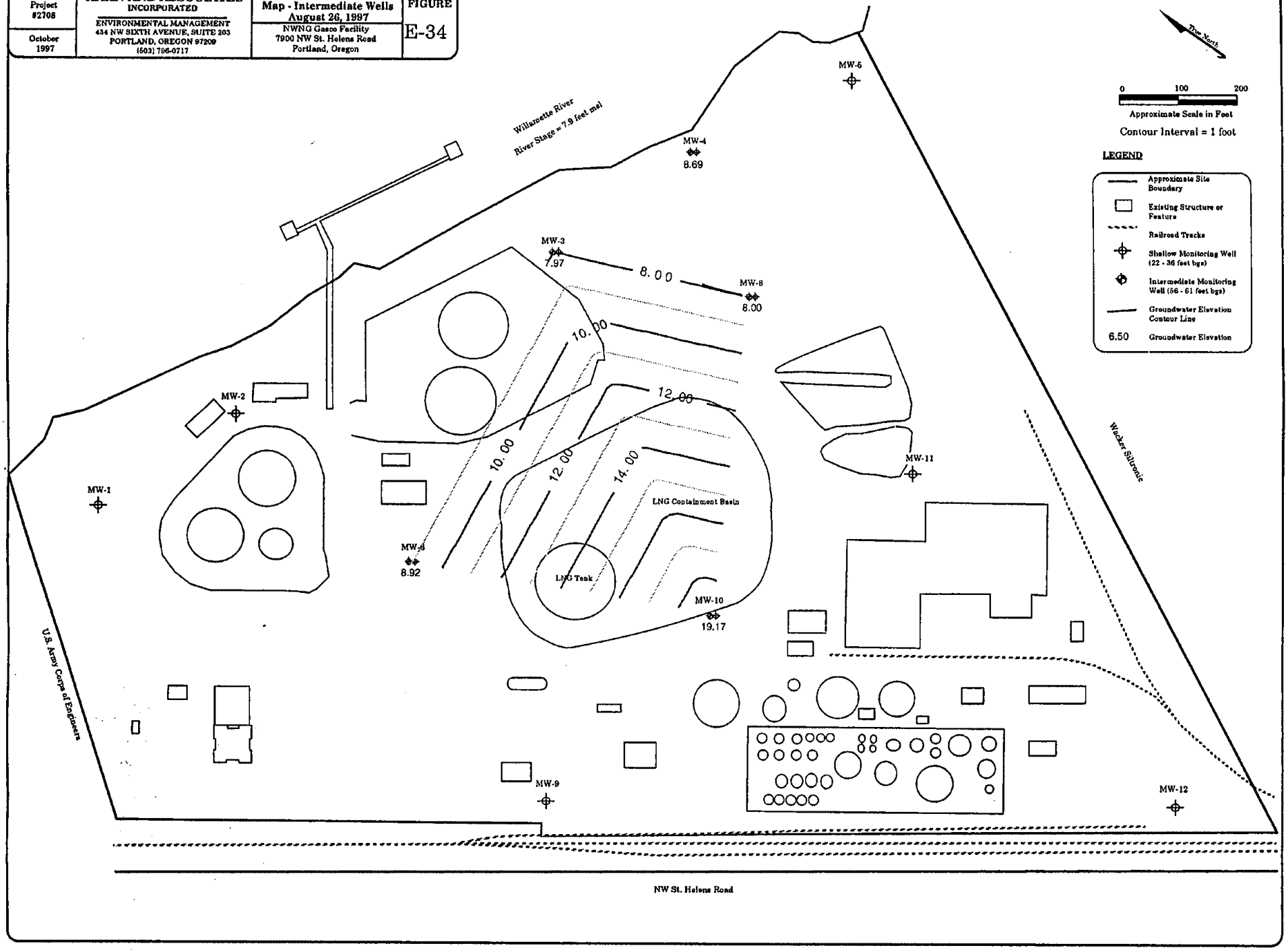
Project #2708	HAHN AND ASSOCIATES INCORPORATED	Groundwater Elevation Map - Intermediate Wells February 24, 1997	FIGURE
March 1997	ENVIRONMENTAL MANAGEMENT 434 NW SIXTH AVENUE, SUITE 203 PORTLAND, OREGON 97209 (503) 796-0717	NWNG Gasco Facility 7900 NW St. Helens Road Portland, Oregon	E-32



Project #2708	HAHN AND ASSOCIATES INCORPORATED	Groundwater Elevation Map - Intermediate Wells June 10, 1997	FIGURE
July 1997	ENVIRONMENTAL MANAGEMENT 434 NW SIXTH AVENUE, SUITE 203 PORTLAND, OREGON 97209 (503) 796-0717	NWNG Gasco Facility 7900 NW St. Helens Road Portland, Oregon	E-33



Project #2708	HAHN AND ASSOCIATES INCORPORATED	Groundwater Elevation Map - Intermediate Wells August 26, 1997	FIGURE
October 1997	ENVIRONMENTAL MANAGEMENT 434 NW SIXTH AVENUE, SUITE 203 PORTLAND, OREGON 97209 (503) 796-0717	NWNG Gasco Facility 7900 NW St. Helens Road Portland, Oregon	E-34



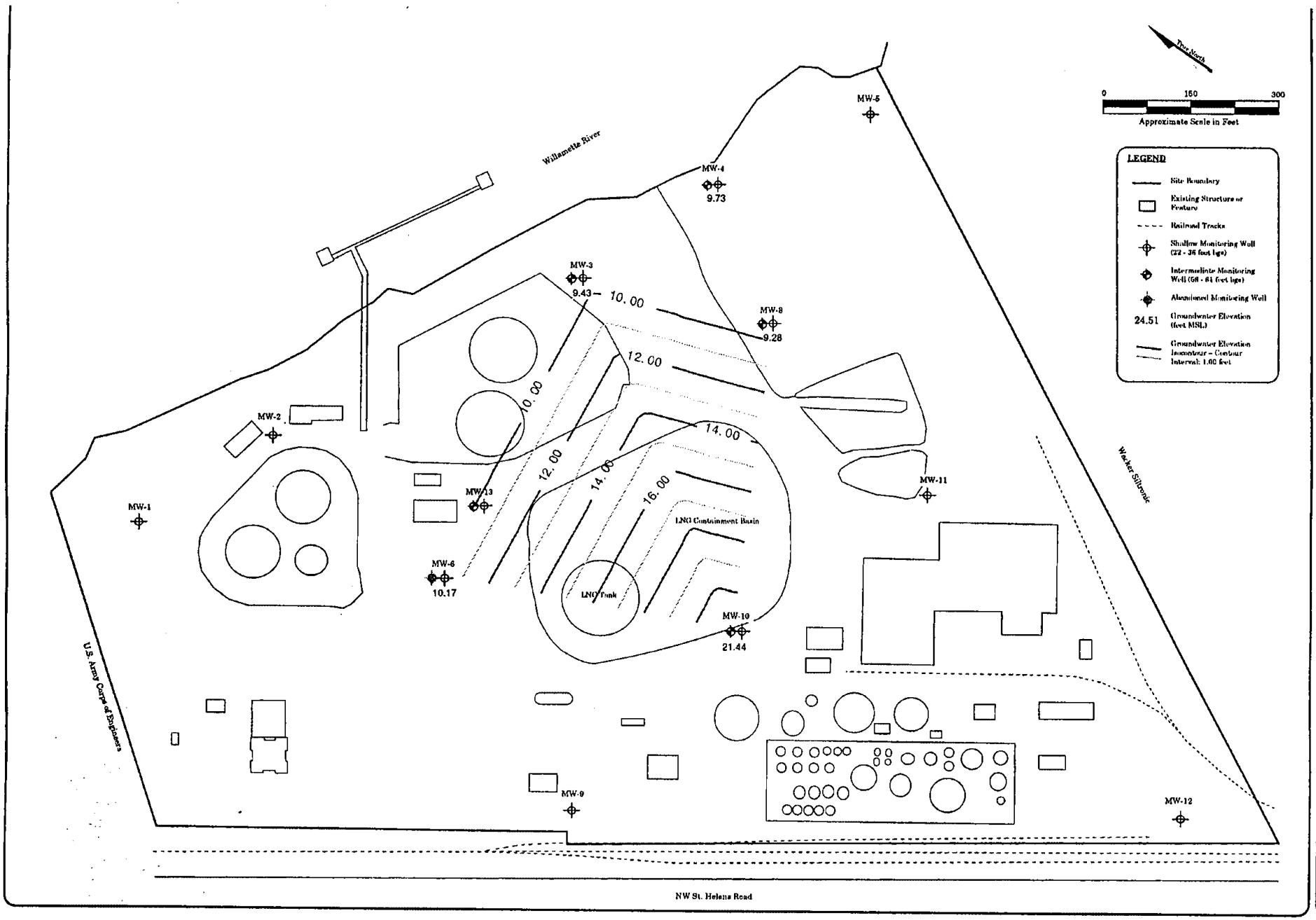


Figure
E-35

Groundwater Elevation Map - Intermediate Wells
November 25, 1997

RI/FS
Northwest Natural - Gasco Facility
7540 NW St. Helens Road
Portland, Oregon

HAHN & ASSOCIATES, INC.
ENVIRONMENTAL MANAGEMENT
434 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209
503/796-0717

February 1998

Project #2708

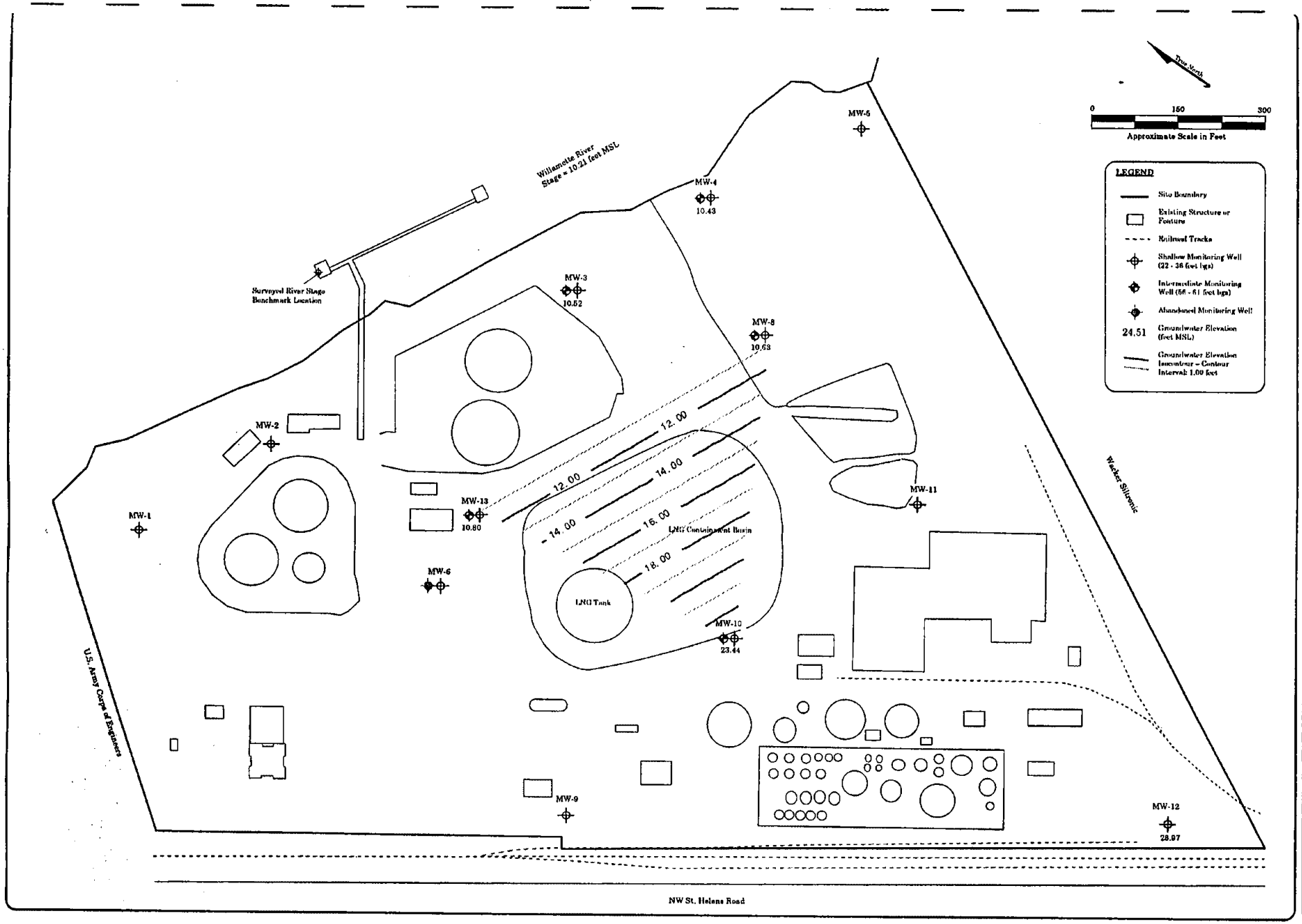


Figure
E-36

Groundwater Elevation Map - Intermediate Wells
February 16, 1998

RI/FS
Northwest Natural - Gasco Facility
7540 NW St. Helens Road
Portland, Oregon

HAHN & ASSOCIATES, INC.
ENVIRONMENTAL MANAGEMENT
434 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209
503/796-0717

April 1998

Project #2708

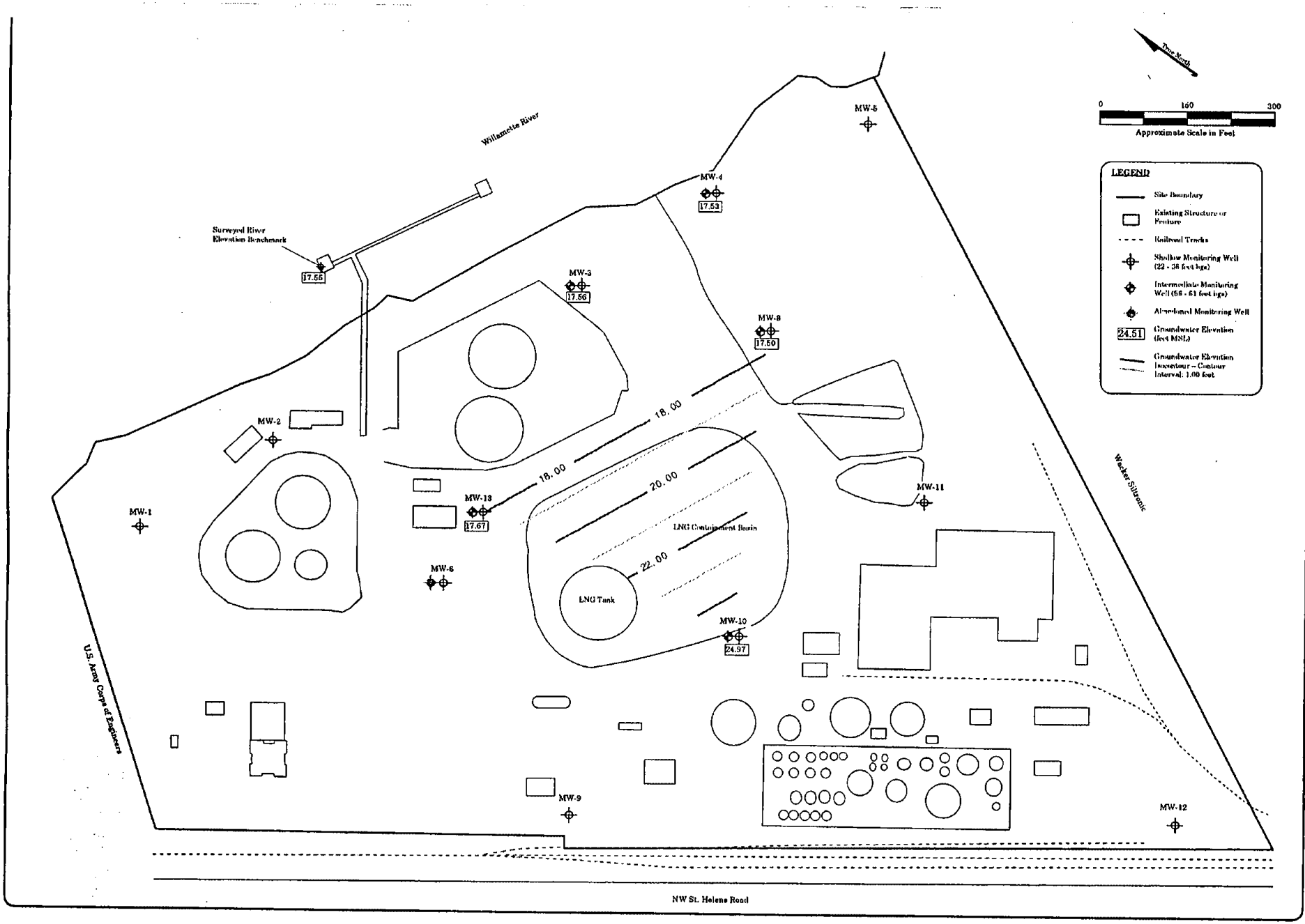


Figure
E-37

Groundwater Elevation Map - Intermediate Wells
June 1, 1998

RI/FS Progress Report
Northwest Natural - Gasco Facility
7540 NW St. Helens Road
Portland, Oregon

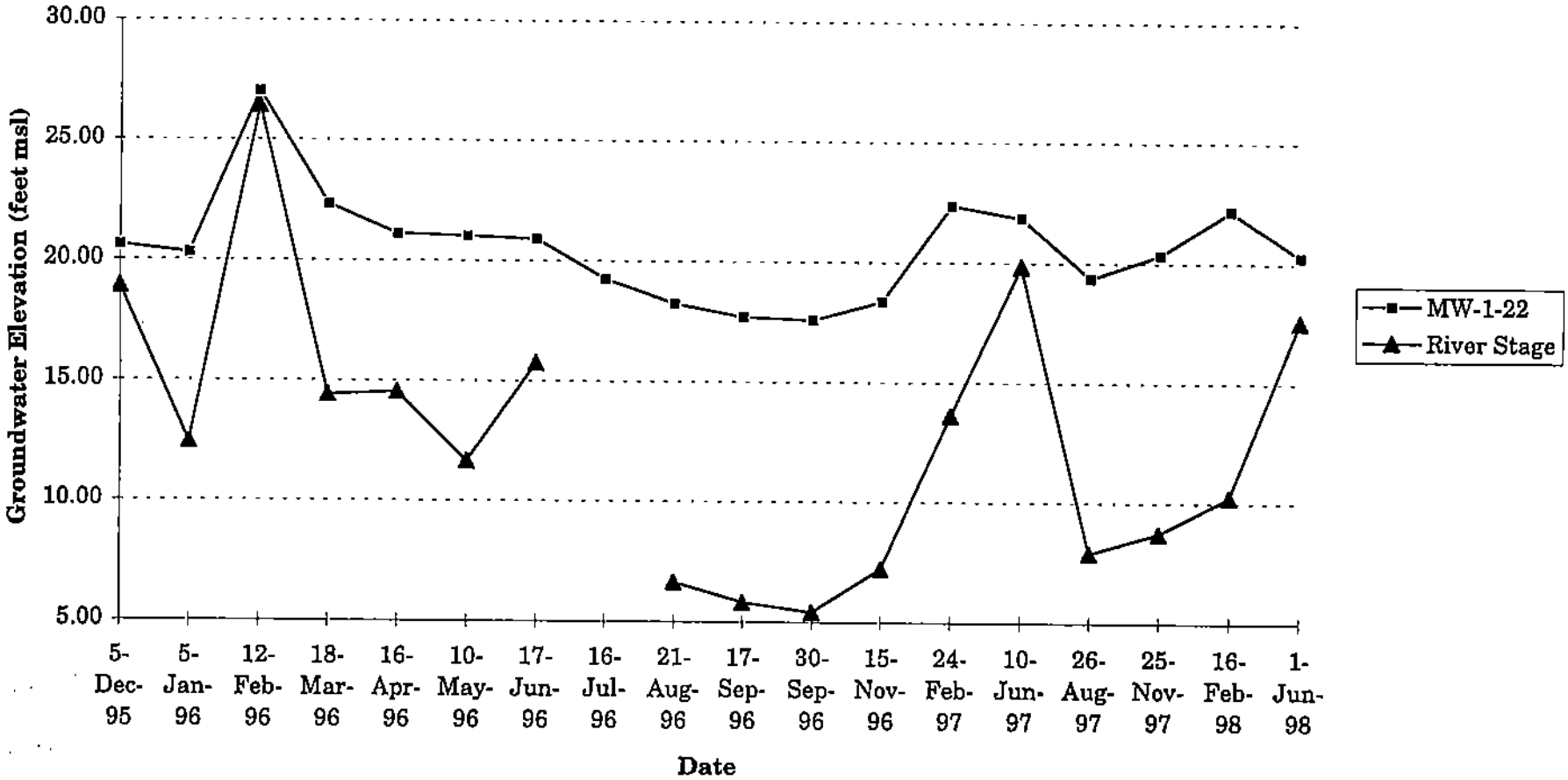
HAHN & ASSOCIATES, INC.
ENVIRONMENTAL MANAGEMENT
434 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209
503/796-0717

June 1998

Project #2708

Groundwater Elevation Hydrographs

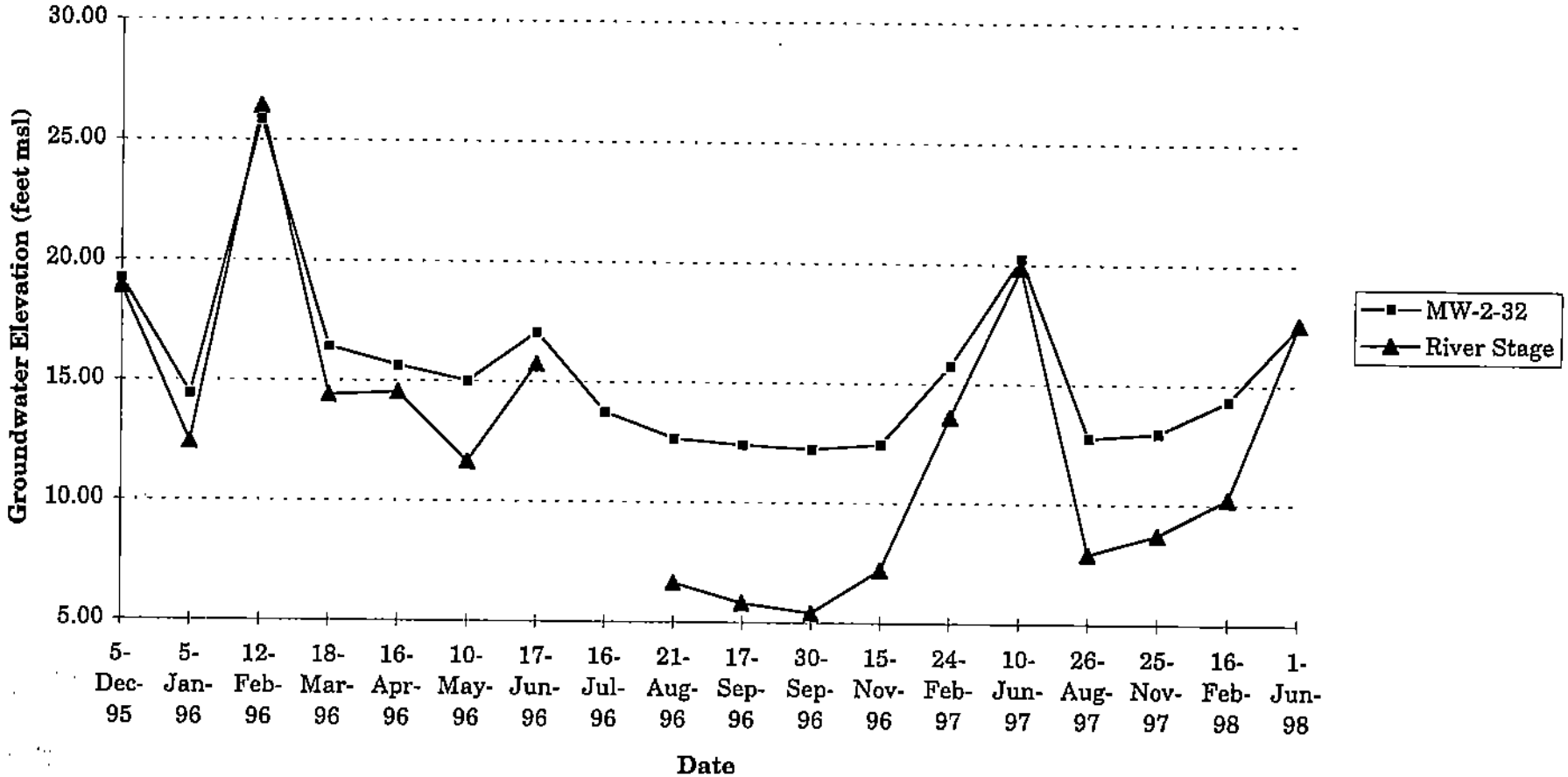
Groundwater Hydrograph
Well MW-1
Northwest Natural Gas Company - Gasco Facility



Updated: 9/21/98 RBE
File: 2708 GW Elevations/ MW-1

HAHN AND ASSOCIATES, INC.
Project # 2708

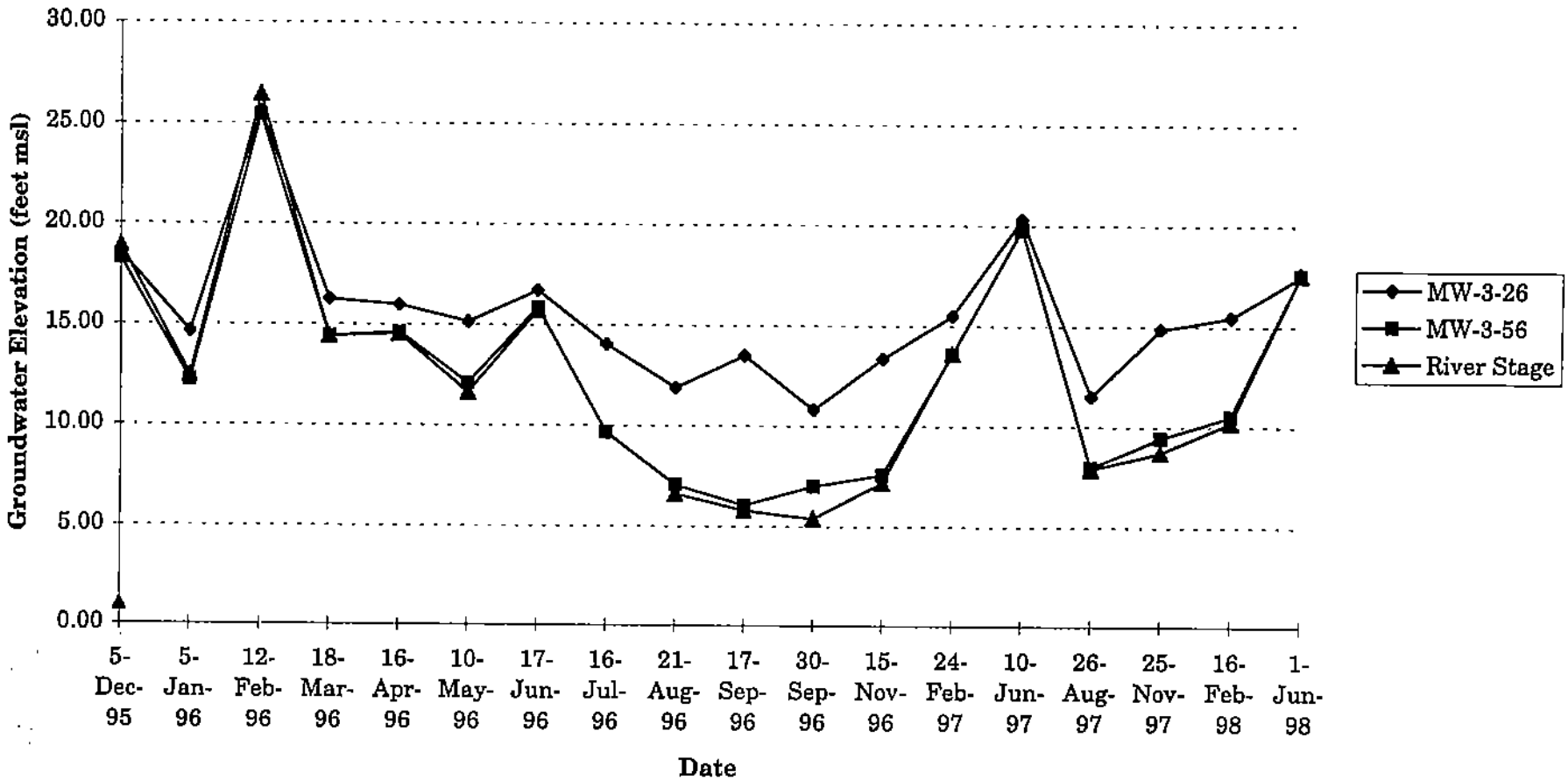
Groundwater Hydrograph
Well MW-2
Northwest Natural Gas Company - Gasco Facility



Updated: 9/21/98 RBE
File: 2708 GW Elevations/ MW-2

HAHN AND ASSOCIATES, INC.
Project # 2708

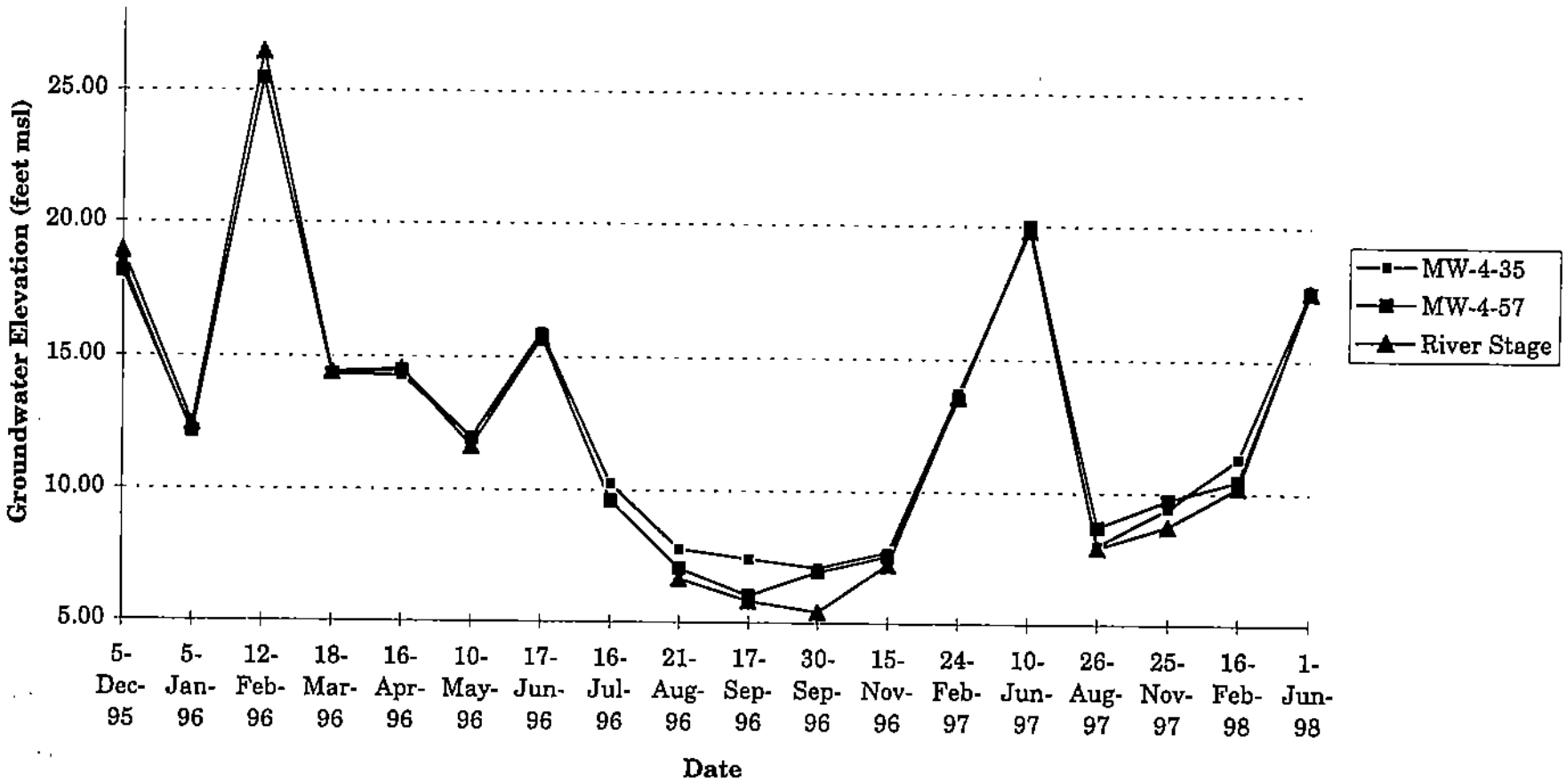
Groundwater Hydrograph
MW-3 Well Cluster
Northwest Natural Gas Company - Gasco Facility



Updated: 9/21/98 RBE
File: 2708 GW Elevations/ MW-3

HAHN AND ASSOCIATES, INC.
Project # 2708

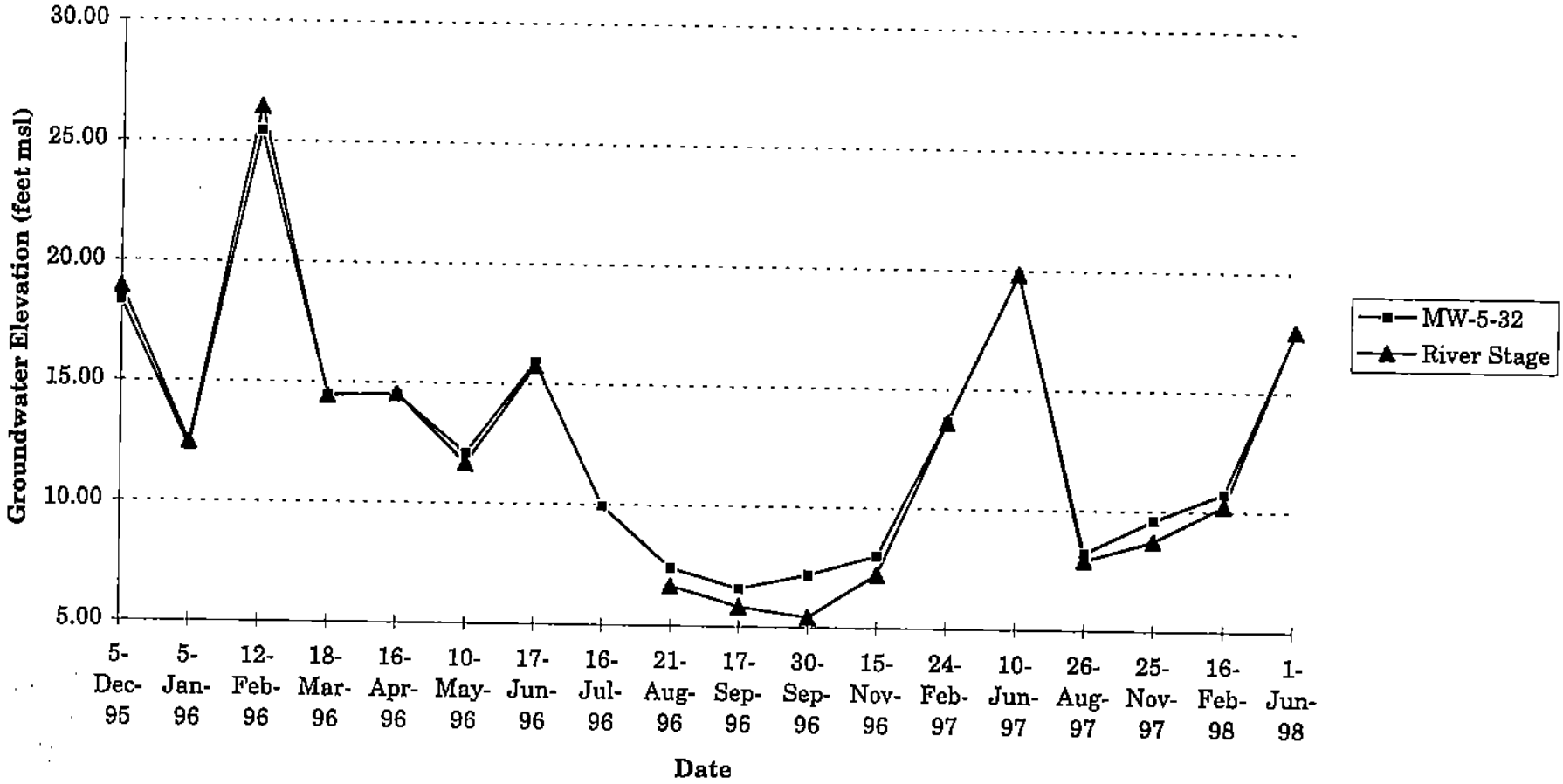
Groundwater Hydrograph
MW-4 Well Cluster
Northwest Natural Gas Company - Gasco Facility



Updated 9/21/98 RBE
File2708 GW Elevations

HAHN AND ASSOCIATES, INC.
Project # 2708

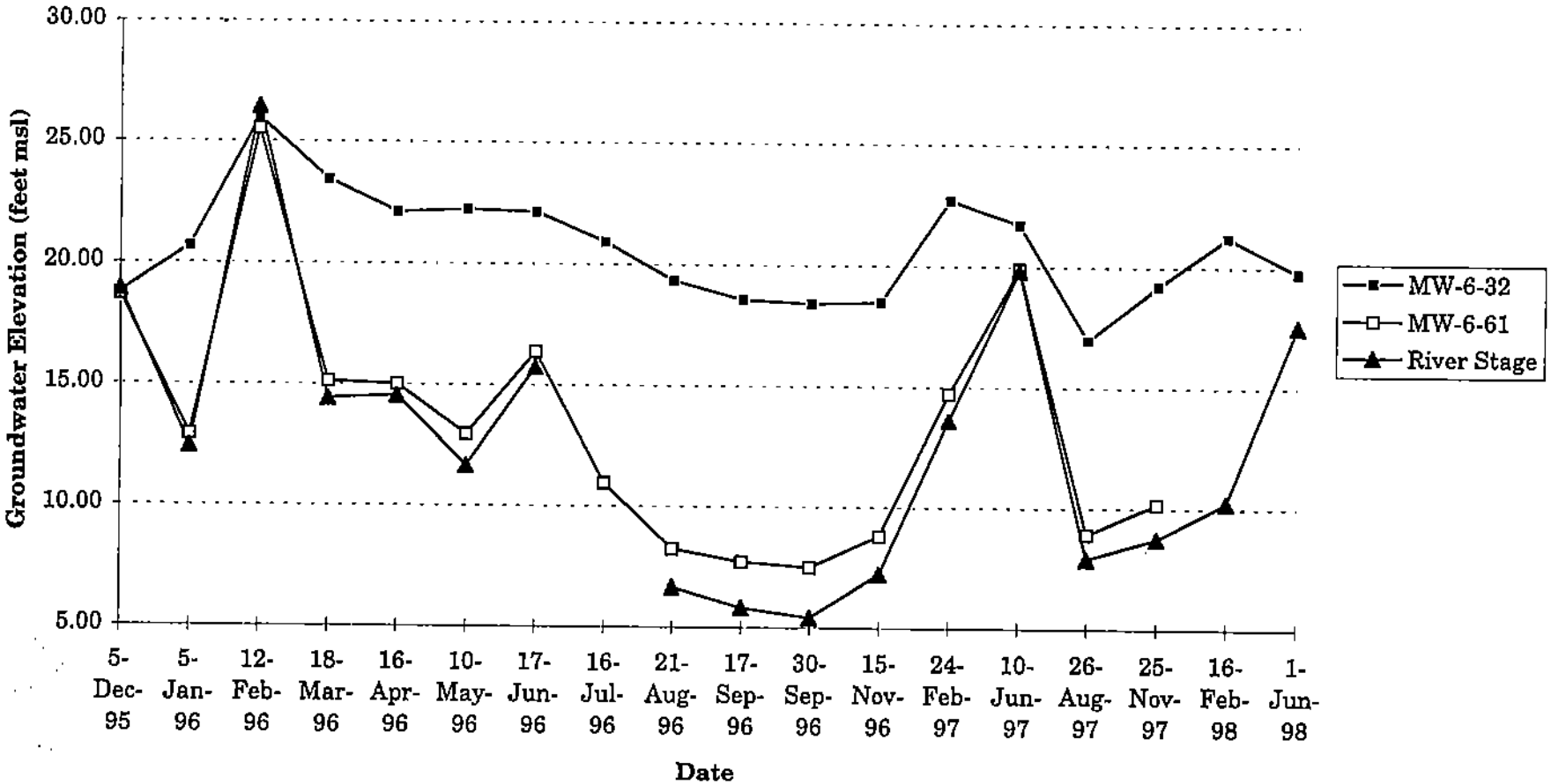
Groundwater Hydrograph
Well MW-5
Northwest Natural Gas Company - Gasco Facility



Updated: 9/21/98 RBE
File: 2708 GW Elevations/ MW-5

HAHN AND ASSOCIATES, INC.
Project # 2708

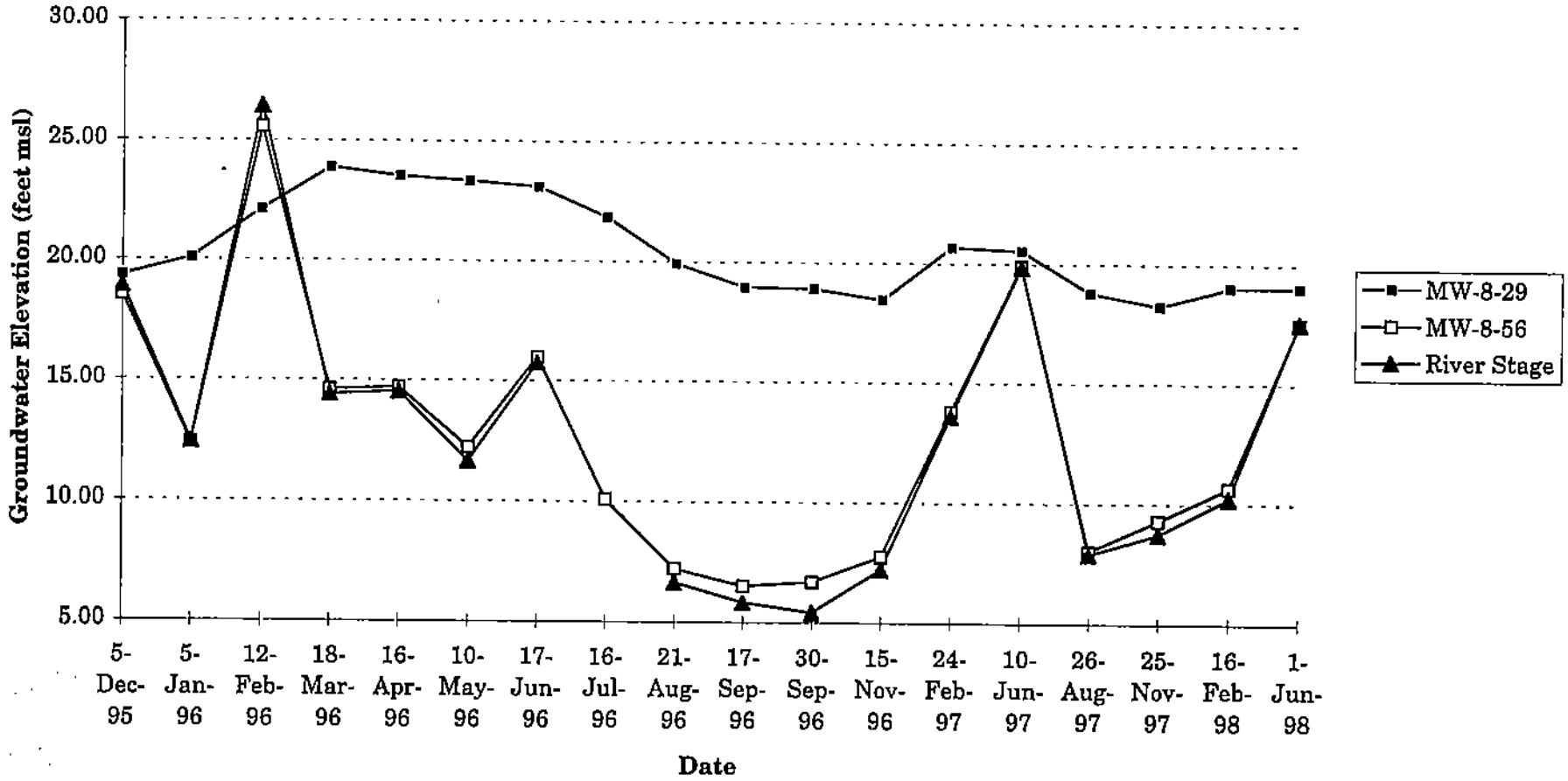
Groundwater Hydrograph
MW-6 Well Cluster
Northwest Natural Gas Company - Gasco Facility



Updated: 9/21/98 RBE
File: 2708 GW Elevations/ MW-6

HAHN AND ASSOCIATES, INC.
Project # 2708

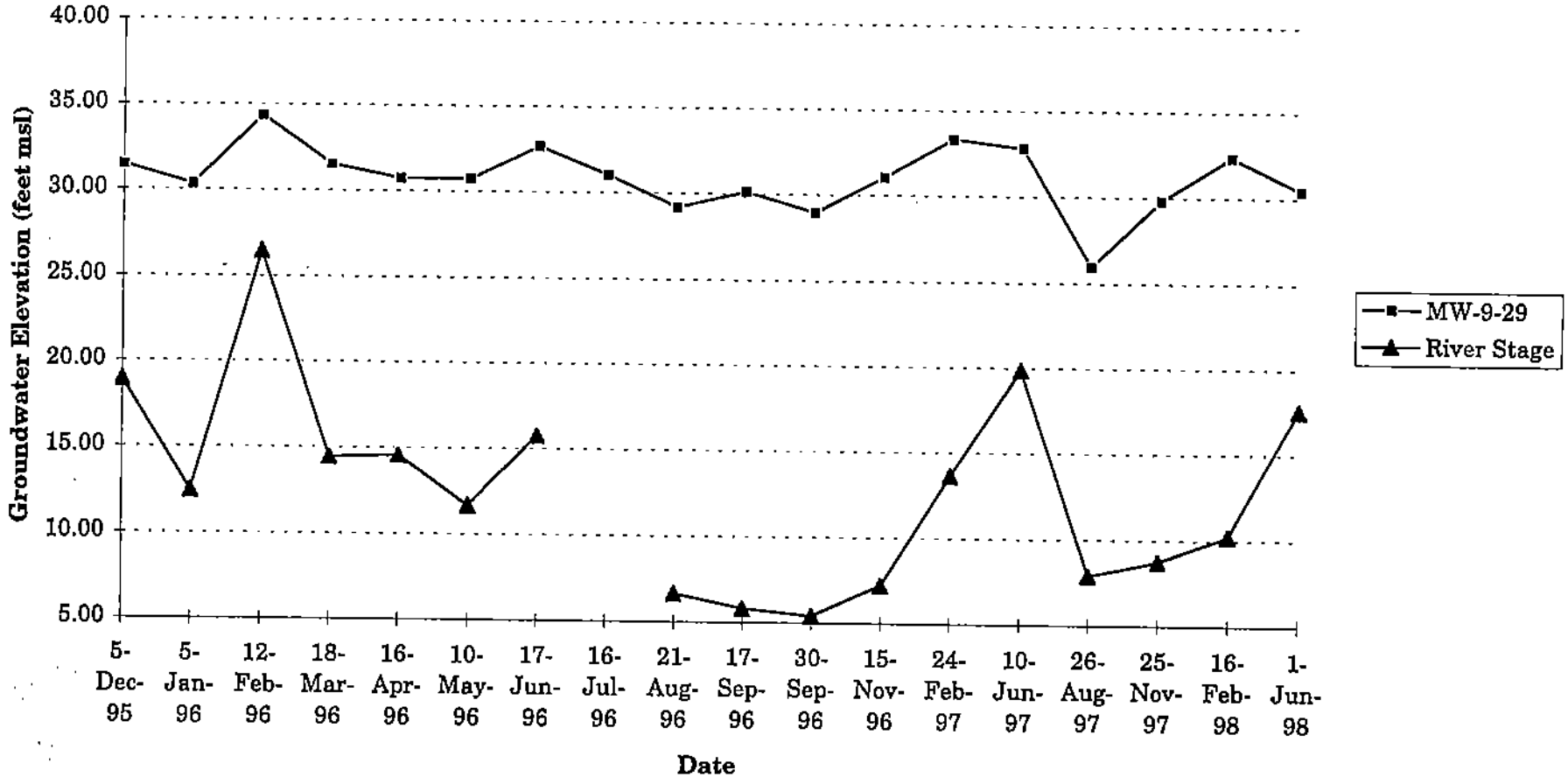
Groundwater Hydrograph
MW-8 Well Cluster
Northwest Natural Gas Company - Gasco Facility



Updated: 9/21/98 RBE
File: 2708 GW Elevations/ MW-8

HAHN AND ASSOCIATES, INC.
Project # 2708

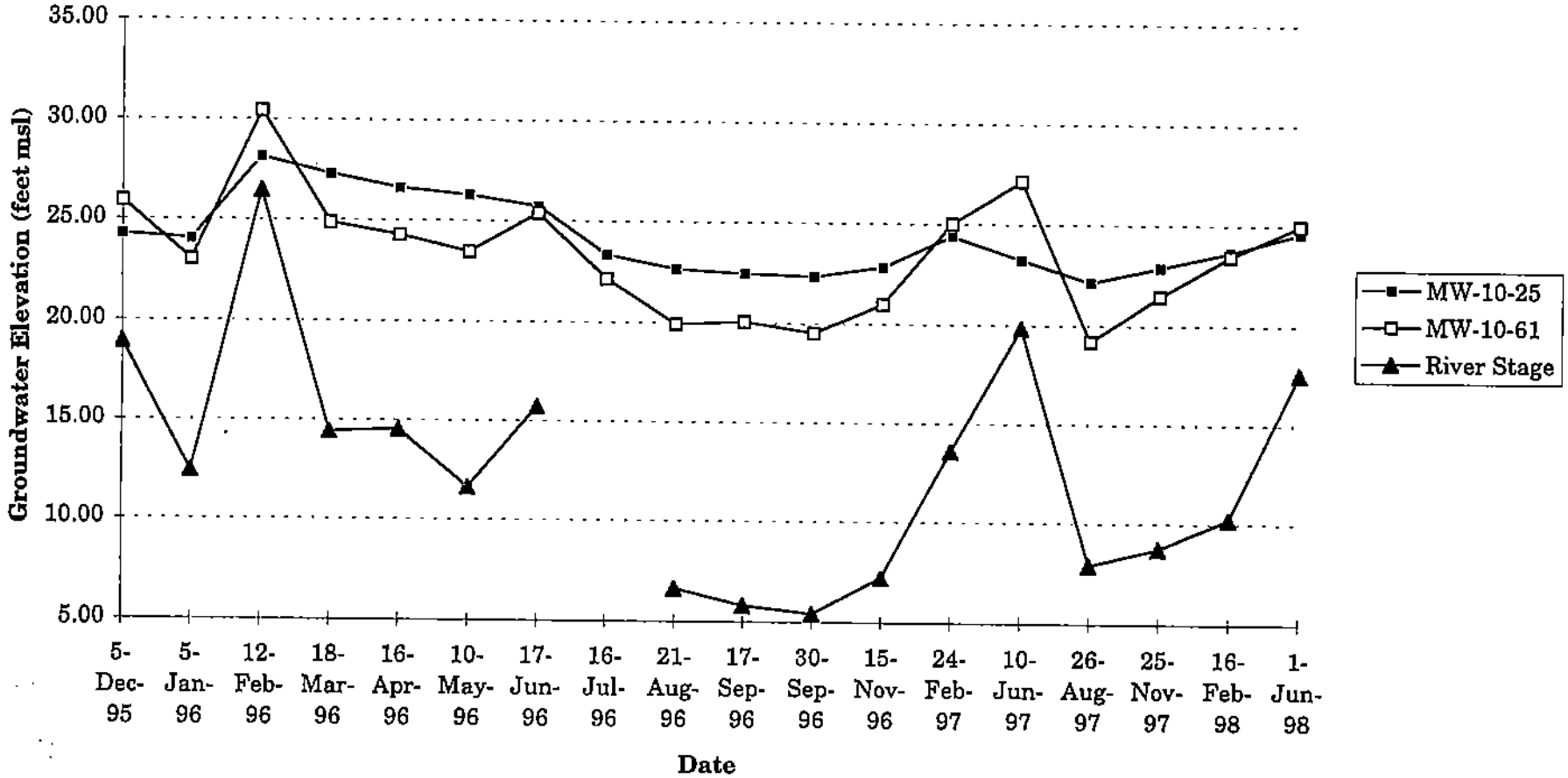
Groundwater Hydrograph
Well MW-9
Northwest Natural Gas Company - Gasco Facility



Updated: 9/21/98 RBE
File: 2708 GW Elevations/ MW-9

HAHN AND ASSOCIATES, INC.
Project # 2708

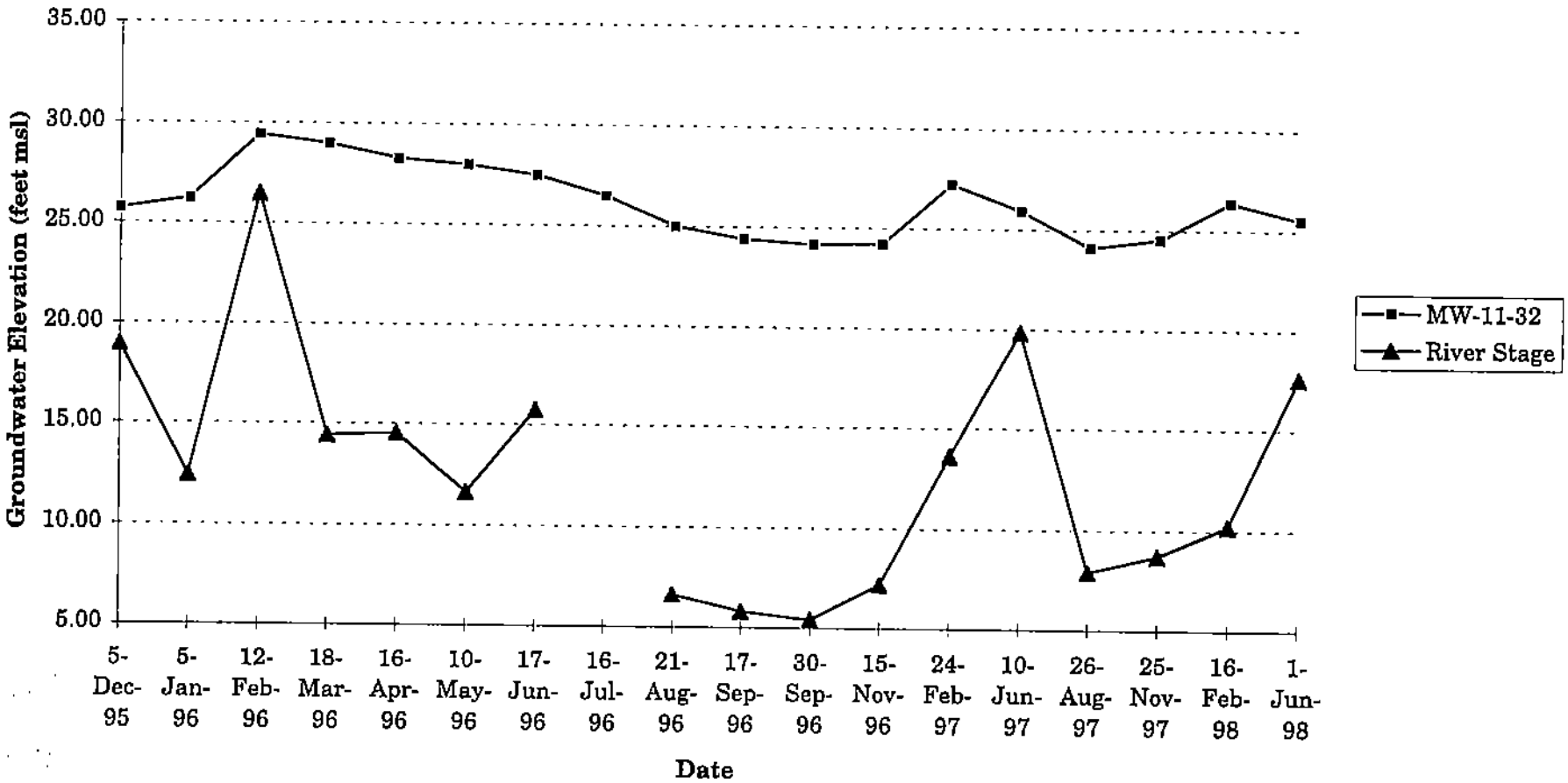
Groundwater Hydrograph
MW-10 Well Cluster
Northwest Natural Gas Company - Gasco Facility



Updated: 9/21/98 RBE
File: 2708 GW Elevations/ MW-10

HAHN AND ASSOCIATES, INC.
Project # 2708

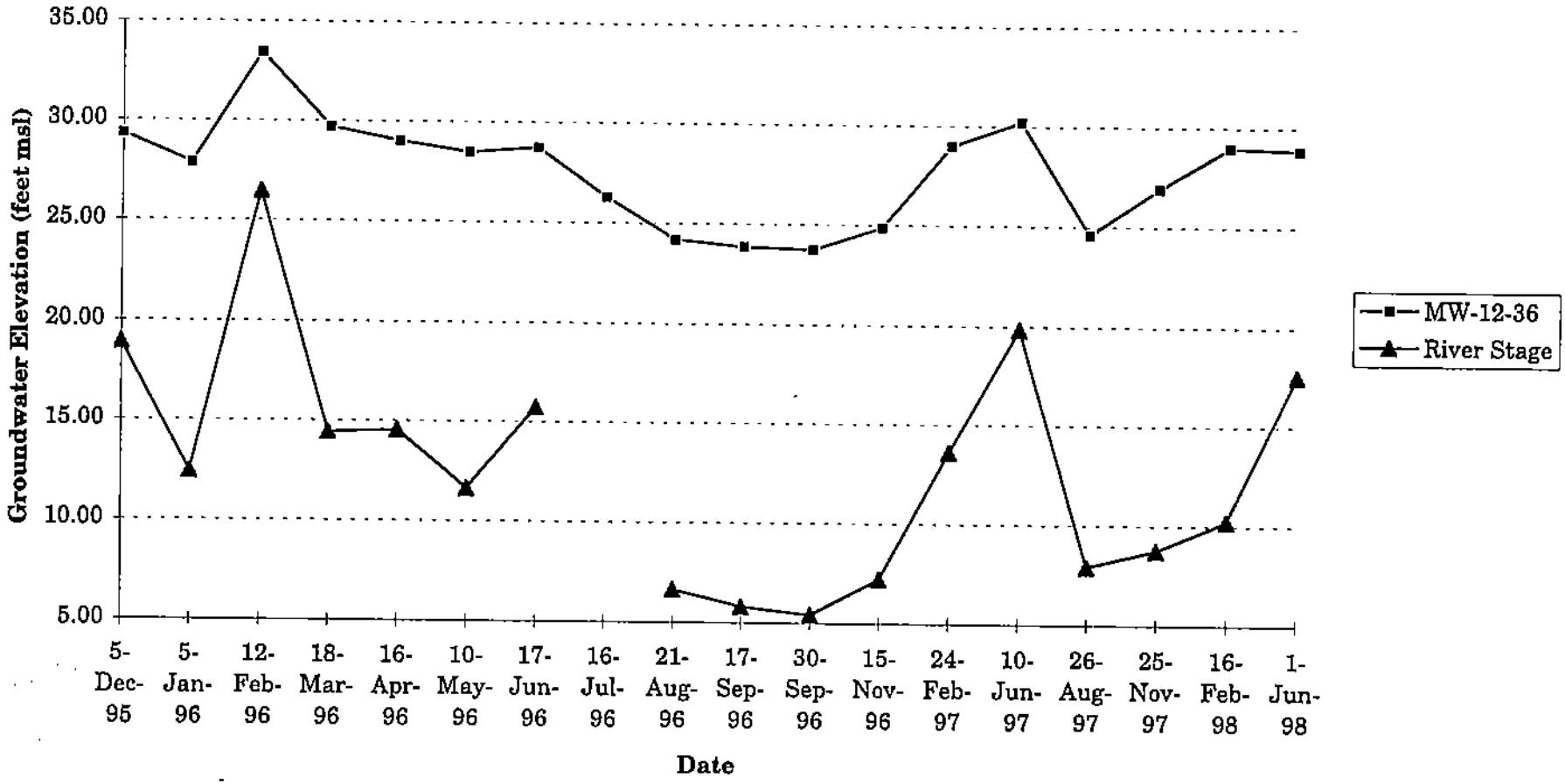
Groundwater Hydrograph
Well MW-11
Northwest Natural Gas Company - Gasco Facility



Updated: 9/21/98 RBE
File: 2708 GW Elevations/ MW-11

HAHN AND ASSOCIATES, INC.
Project # 2708

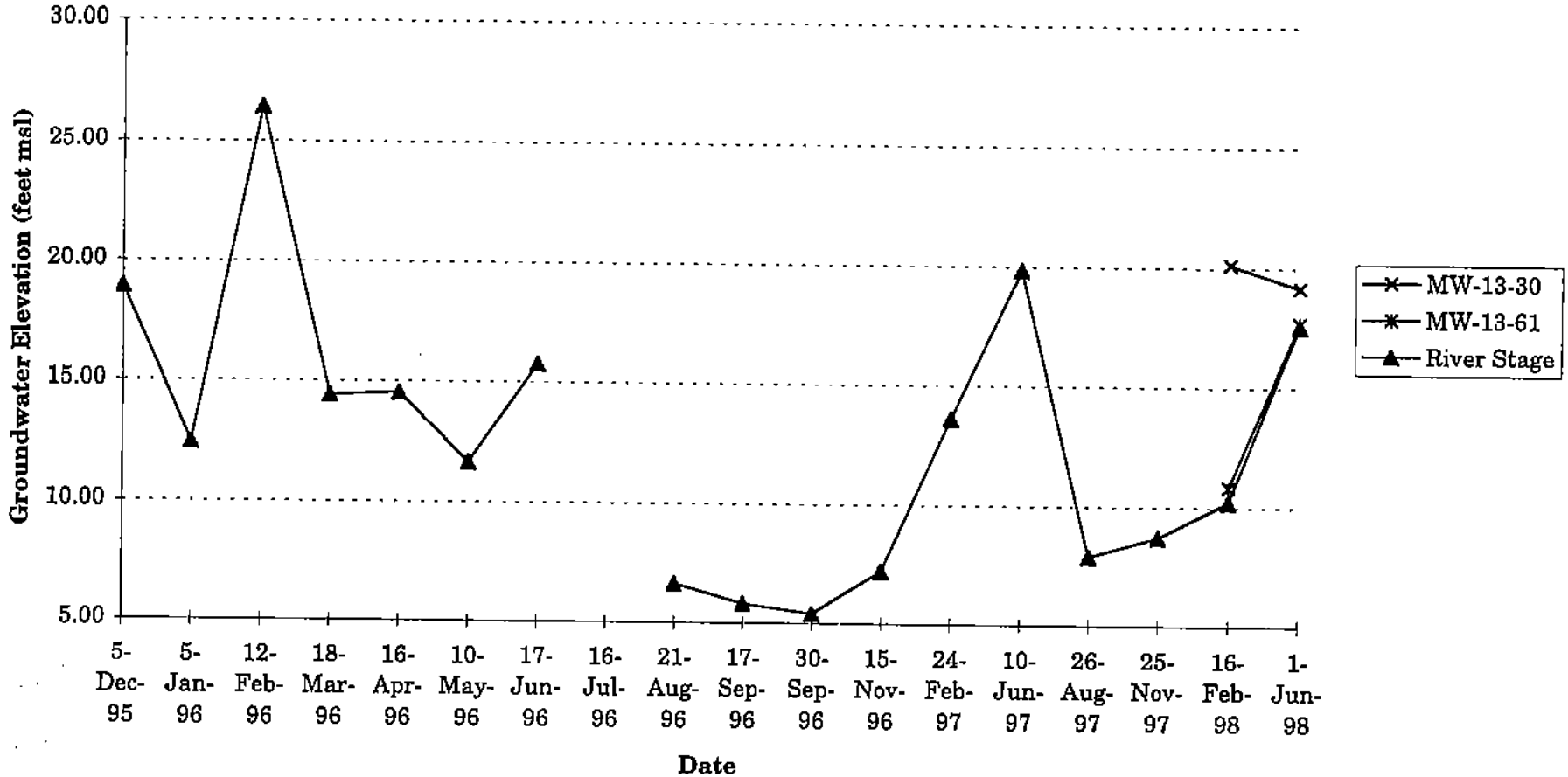
Groundwater Hydrograph
Well MW-12
Northwest Natural Gas Company - Gasco Facility



Updated: 9/21/98 RBE
File: 2708 GW Elevations/ MW-12

HAHN AND ASSOCIATES, INC.
Project # 2708

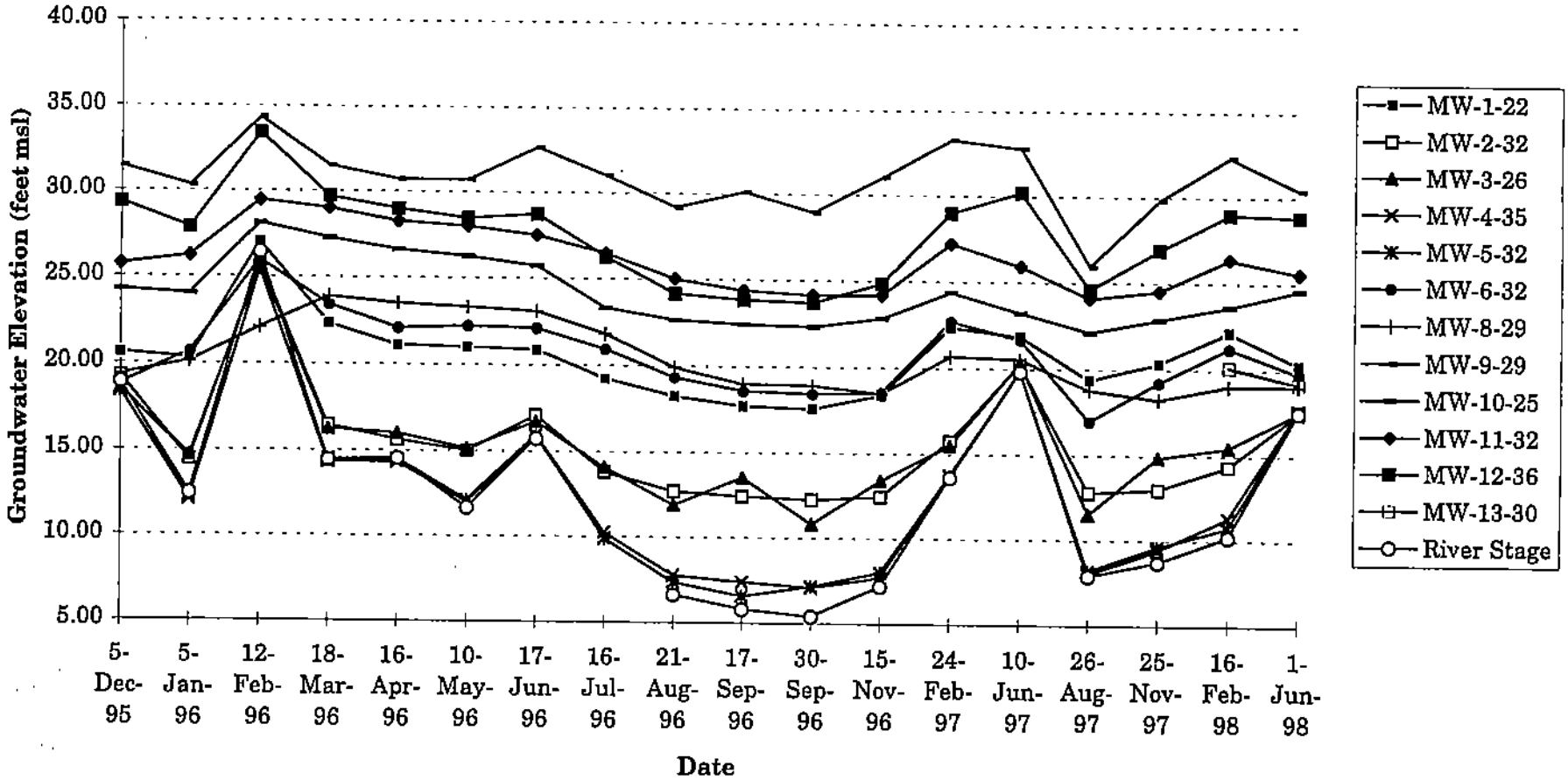
Groundwater Hydrograph
Well MW-13
Northwest Natural Gas Company - Gasco Facility



Updated: 9/21/98 RBE
File: 2708 GW Elevations/ MW-13

HAHN AND ASSOCIATES, INC.
Project # 2708

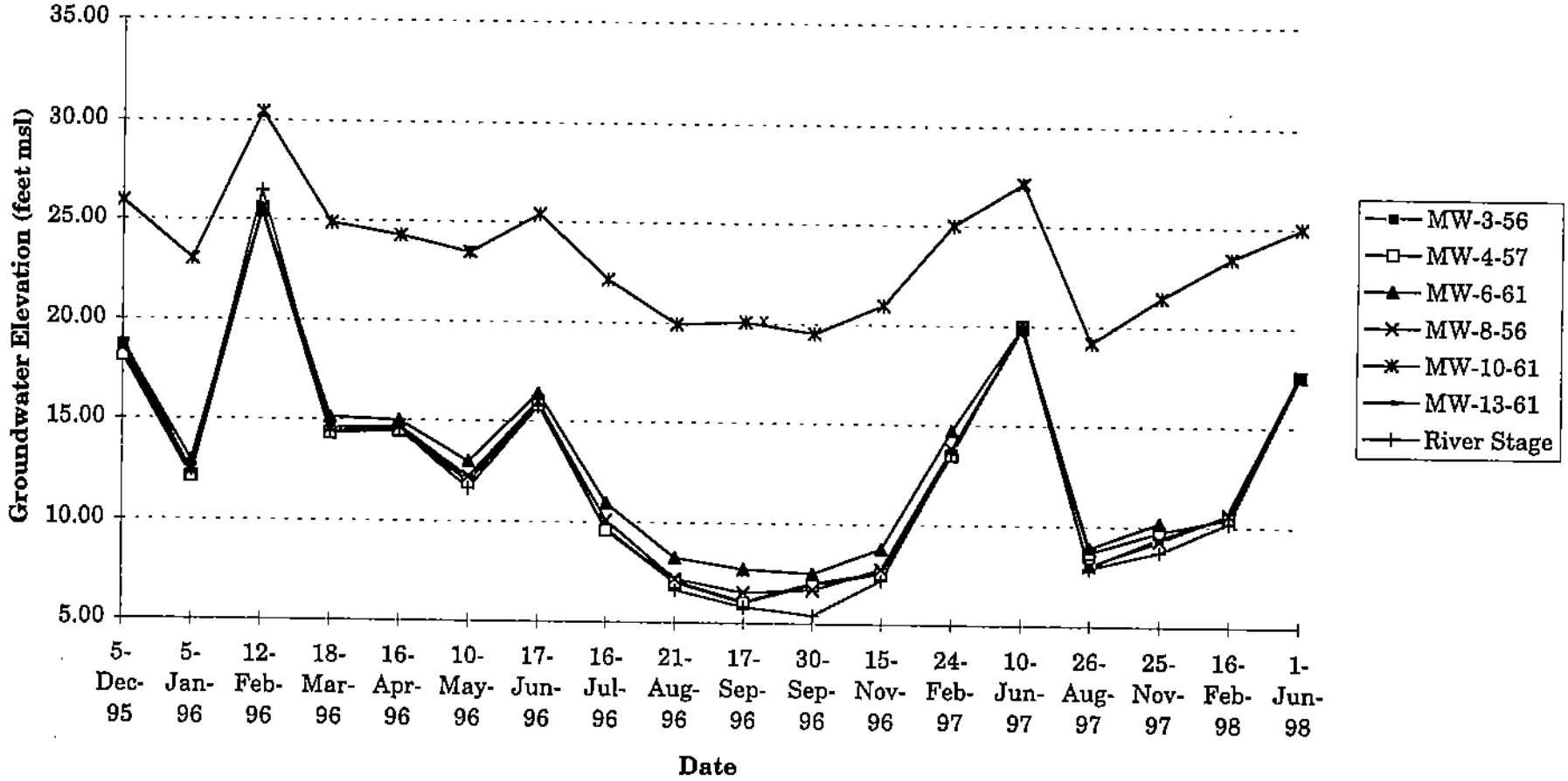
Groundwater Hydrograph
Shallow Depth Aquifer Zone Monitoring Wells
Northwest Natural Gas Company - Gasco Facility



Updated: 9/21/98 RBE
File: 2708 GW Elevations/ Hydrograph - Shallow

HAHN AND ASSOCIATES, INC.
Project # 2708

Groundwater Hydrograph
Intermediate Depth Aquifer Zone Monitoring Wells
Northwest Natural Gas Company - Gasco Facility



Updated: 9/21/98 RBE
File: 2708 GW Elevations/ Hydrograph - Deep

HAHN AND ASSOCIATES, INC.
Project # 2708

APPENDIX F

Residual Product Maps

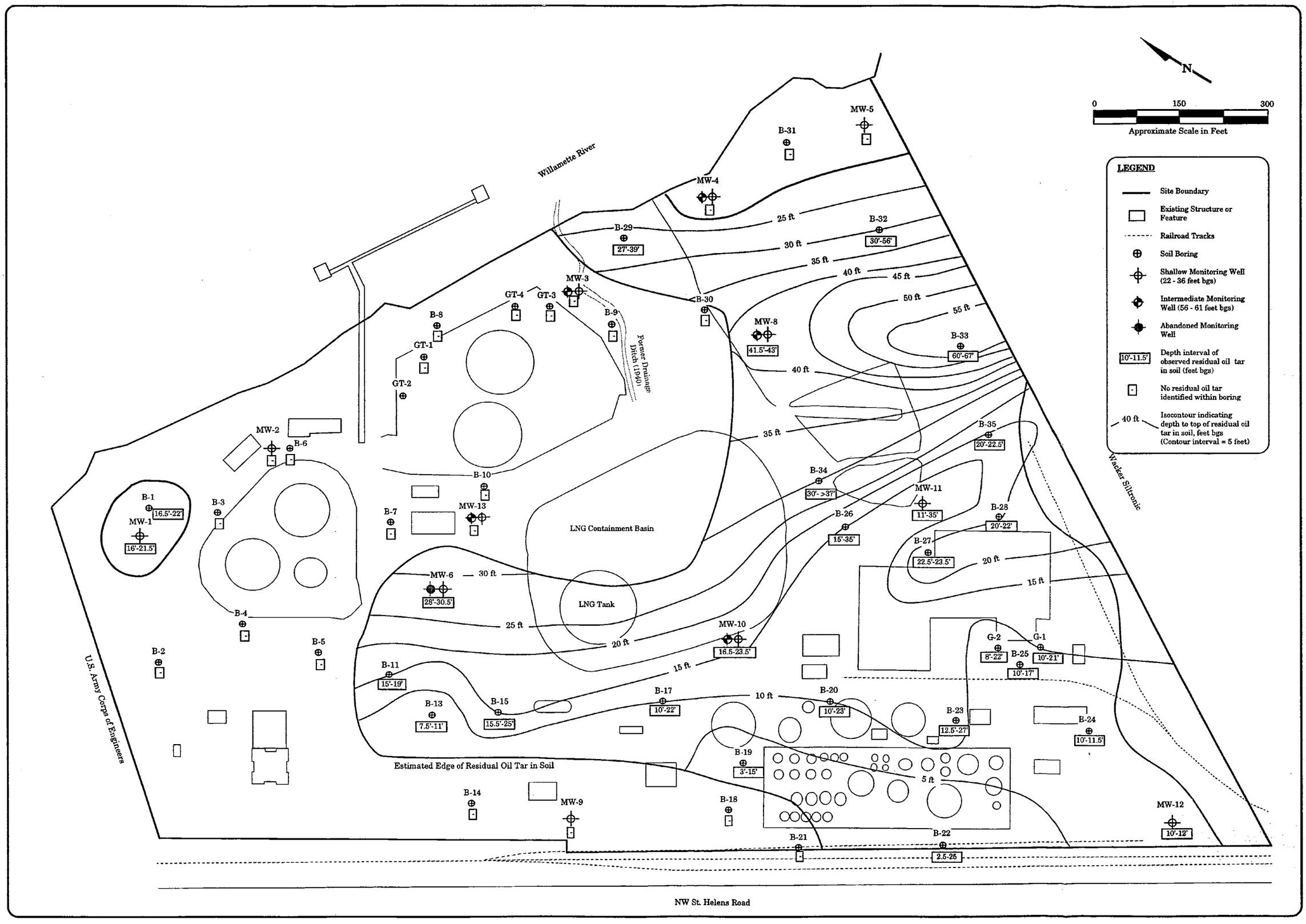


Figure F-1

Residual Oil Tar/ DNAPL in Soil: Depth to Top (feet bgs)

Remedial Investigation
Northwest Natural - Gasco Facility
7540 NW St. Helens Road
Portland, Oregon

HAHN & ASSOCIATES, INC.

ENVIRONMENTAL MANAGEMENT
434 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209
503/796-0717

September 1998

Project #2708

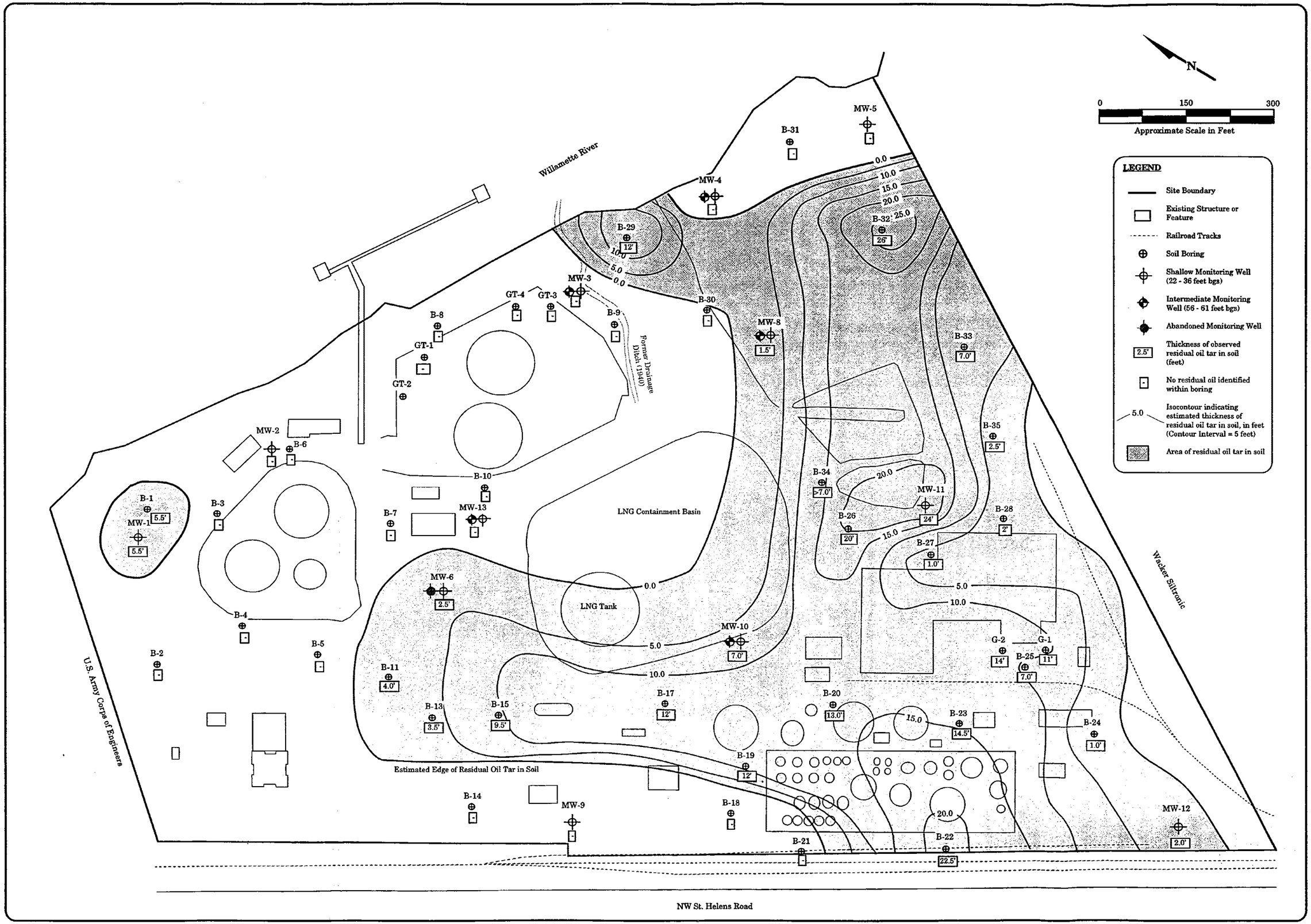


Figure F-2

Residual Oil Tar/ DNAPL in Soil: Thickness and Isopach Map

Remedial Investigation
Northwest Natural - Gasco Facility
7540 NW St. Helens Road
Portland, Oregon

HAHN & ASSOCIATES, INC.

ENVIRONMENTAL MANAGEMENT
434 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209
503/796-0717

September 1998

Project #2708

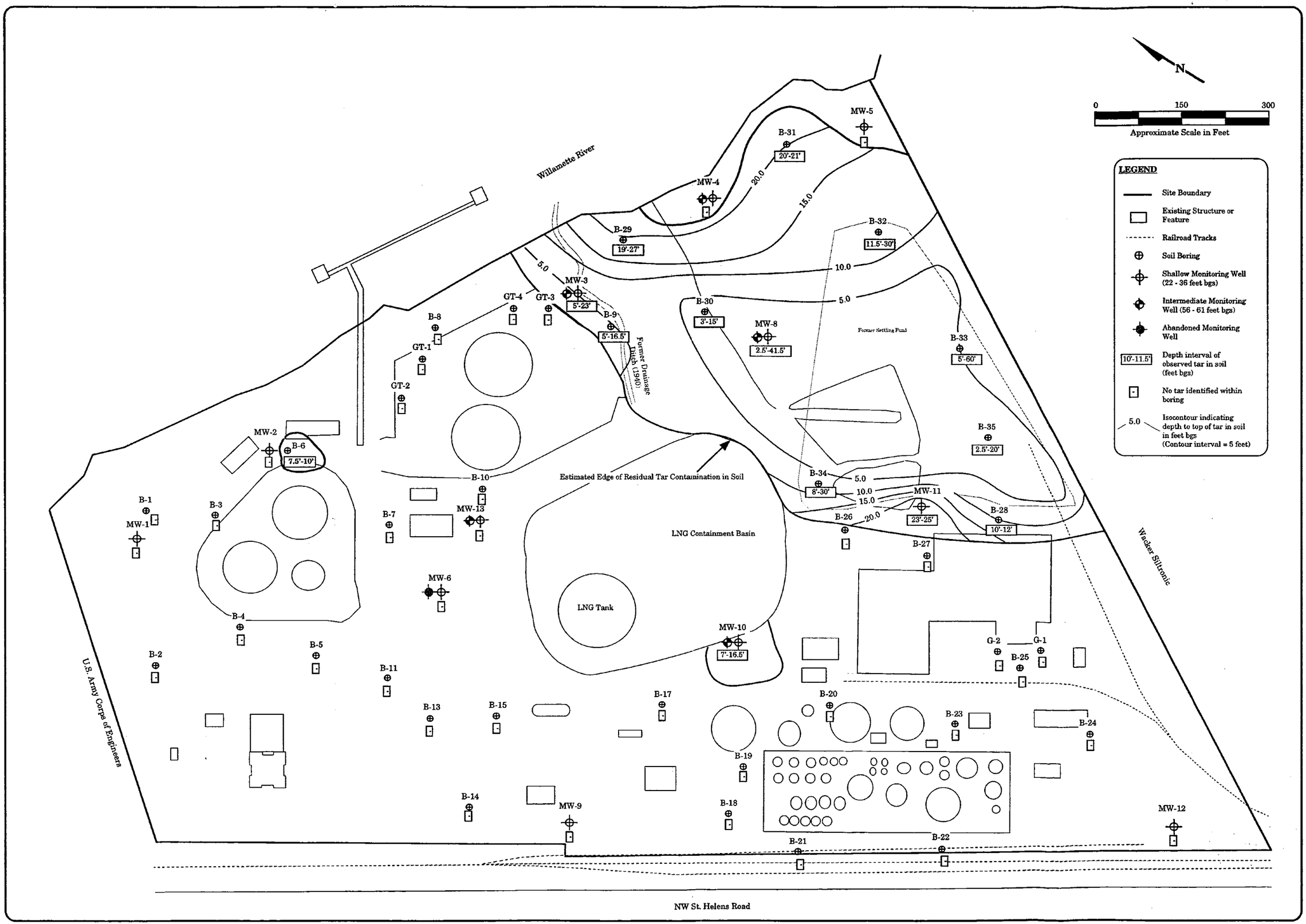


Figure
F-3

Tar in Soil: Depth to Top (feet bgs)

Remedial Investigation
Northwest Natural - Gasco Facility
7990 NW St. Helens Road
Portland, Oregon

HAHN & ASSOCIATES, INC.
ENVIRONMENTAL MANAGEMENT
434 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209
503/796-0717

February 1998

Project #2708

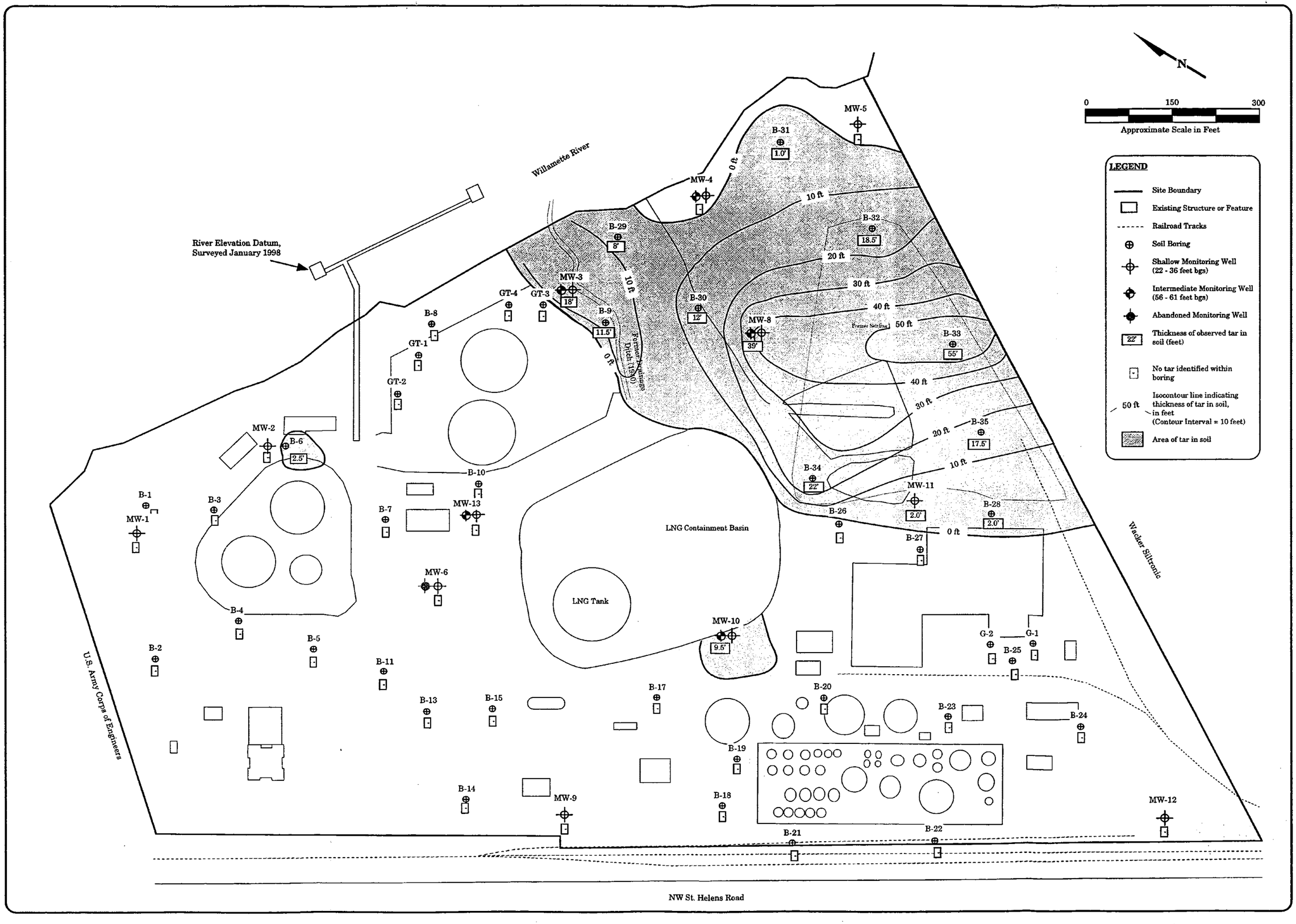


Figure F-4

Tar in Soil: Thickness and Isopach Map

Remedial Investigation
Northwest Natural - Gasco Facility
7540 NW St. Helens Road
Portland, Oregon

HAHN & ASSOCIATES, INC.

ENVIRONMENTAL MANAGEMENT
434 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209
503/796-0717

February 1998

Project #2708

APPENDIX G

Soil Quality Data

Summary Figures

Summary Tables

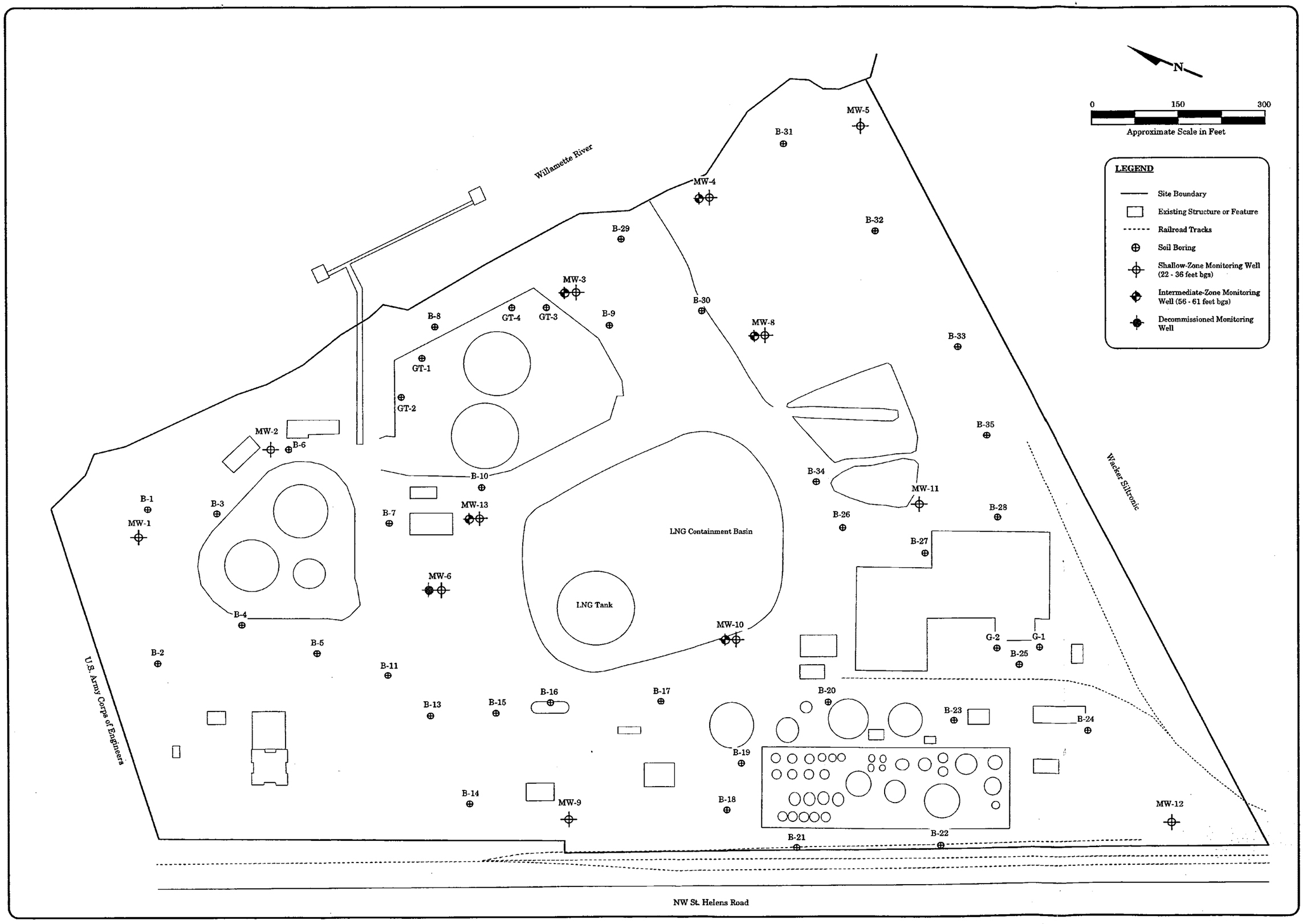


Figure G-1

Monitoring Well and Soil Boring Location Map

Remedial Investigation
Northwest Natural - Gasco Facility
7900 NW St. Helens Road
Portland, Oregon

HAHN & ASSOCIATES, INC.
ENVIRONMENTAL MANAGEMENT
434 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209
503/796-0717

September 1998

Project #2708

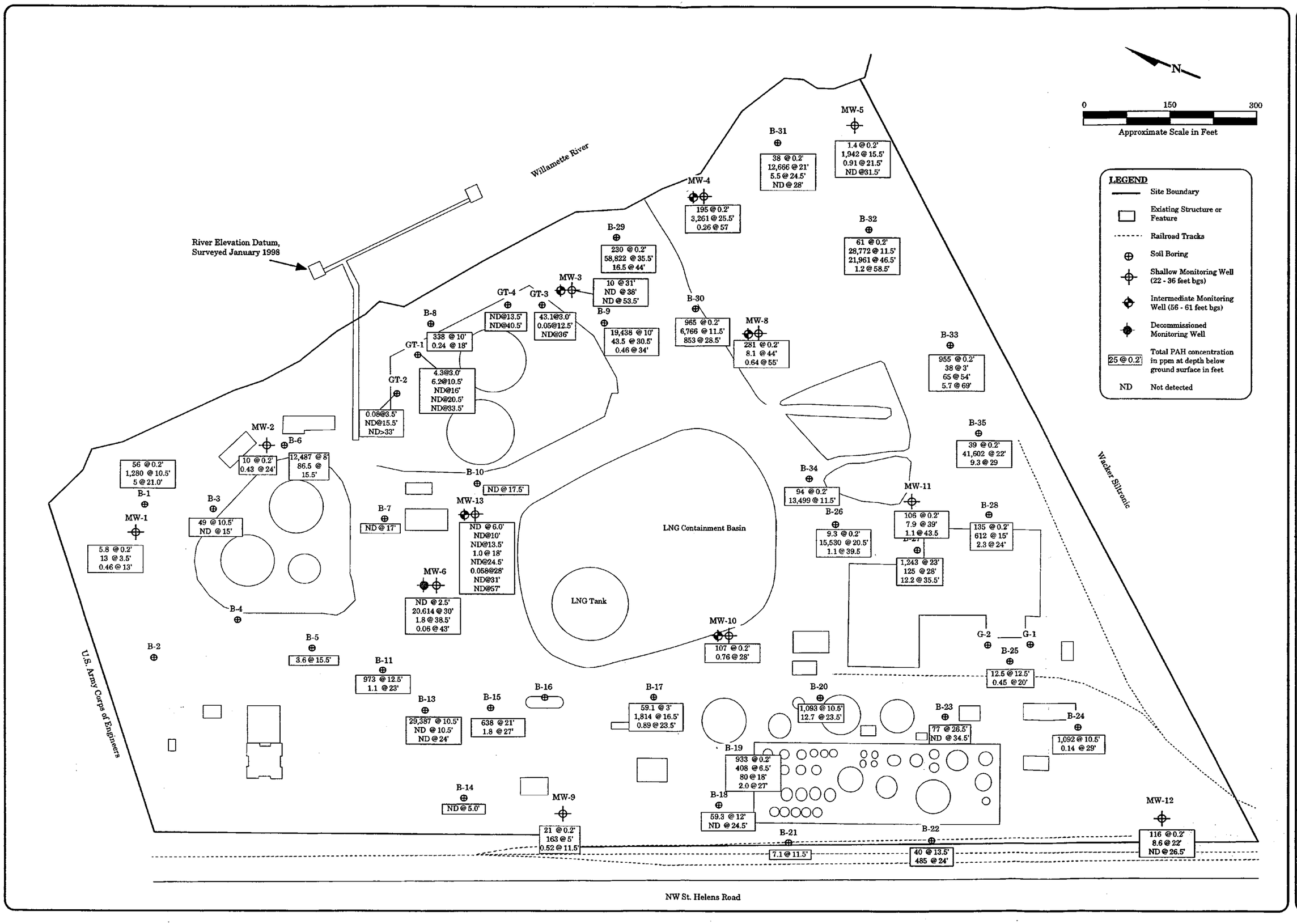


Figure G-2

Soil Sampling Results Map: Total PAHs

Remedial Investigation
Northwest Natural - Gasco Facility
7900 NW St. Helens Road
Portland, Oregon

HAHN & ASSOCIATES, INC.
ENVIRONMENTAL MANAGEMENT
434 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209
503/796-0717

September 1998

Project #2708

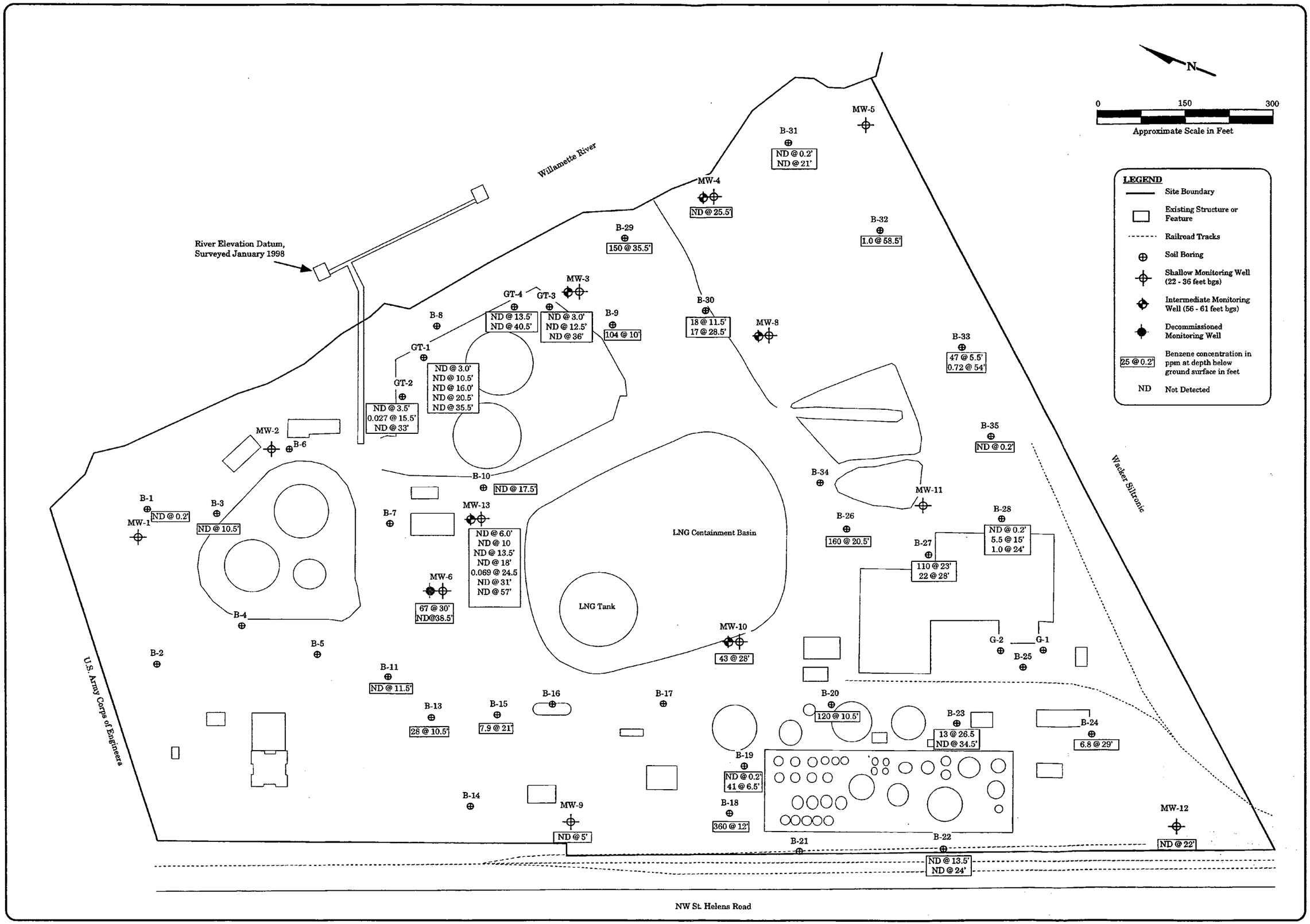


Figure G-3

Soil Sampling Results Map: Benzene

Remedial Investigation
Northwest Natural - Gasco Facility
7900 NW St. Helens Road
Portland, Oregon

HAHN & ASSOCIATES, INC.
ENVIRONMENTAL MANAGEMENT
434 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209
503/796-0717

September 1998

Project #2708

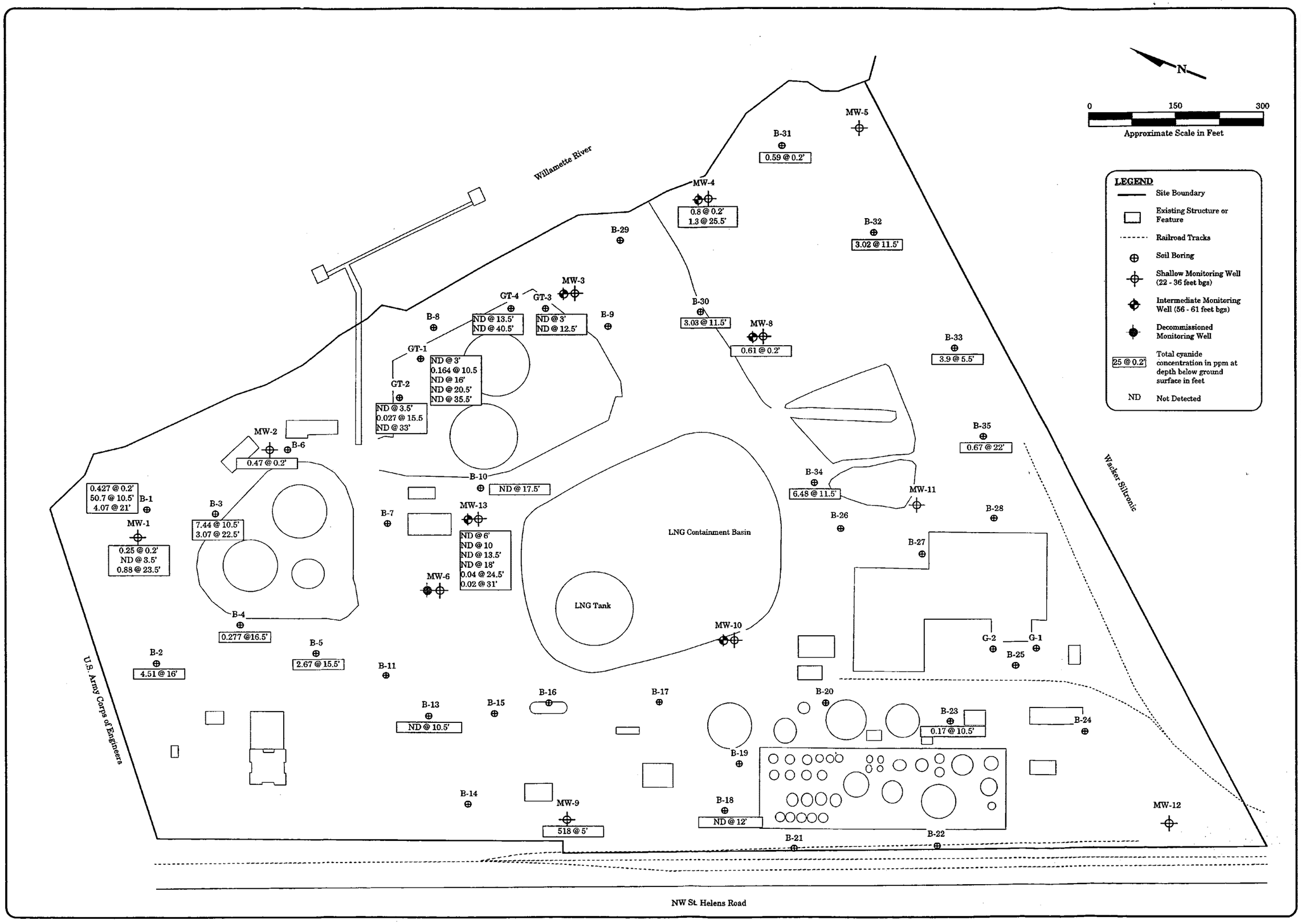


Figure G-4

Soil Sampling Results Map: Total Cyanide

Remedial Investigation
Northwest Natural - Gasco Facility
7900 NW St. Helens Road
Portland, Oregon

HAHN & ASSOCIATES, INC.
ENVIRONMENTAL MANAGEMENT
434 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209
503/796-0717

September 1998

Project #2708

TABLE G-1 – Summary of Analytical Results for Soil Samples
TPH, BTEX, Total PAHs, Total Phenols, Cyanide, and Lead
Remedial Investigation
Northwest Natural - Gasco Facility
Portland, Oregon

Project No. 2708

Soil Boring Number	Sample Number[1]	Chain of Custody Number	Sample Date	Depth (feet bgs)	Field Observation				Analytical Results mg/kg (ppm)											
									ODEQ Method		EPA Method 8270 SIM		EPA Method 8020					EPA Method 8270	EPA Method 9010	EPA Method 6010
									TPH-G	TPH-418.1M										
					Sheen	Oil Tar	Tar	Lamp Black	Gasoline	Diesel/Oil	Carcinogenic PAHs	Total PAHs	Benzene	Toluene	Ethyl benzene	Xylenes	Total BTEX	Total Phenols	Total Cyanide	Total Lead
B-01	950921-B1-01	2708-S009	21-Sep-95	0.2					ND>10	130.	7.17	13.358	ND>0.3	ND>0.3	ND>0.3	ND>0.3	ND		0.427	60.
	950921-B1-02	2708-S009	21-Sep-95	0.2 (dup)						220.	26.14	55.96							0.382	58.
	950921-B1-05	2708-S009	21-Sep-95	10.5	X			X		**640.**	336.7	1,279.7							50.7	130.
	950921-B1-06	2708-S009	21-Sep-95	12.0						**560.**										
	950921-B1-09	2708-S009	21-Sep-95	21.0							0.926	5.026							4.07	
B-02	950927-B2-05	2708-S016	27-Sep-95	16.0				X											4.51	15.
	950927-B2-07	2708-S016	27-Sep-95	20.5																
B-03	950921-B3-05	2708-S007	21-Sep-95	10.5				X		120.	23.04	49.04	ND>0.3	ND>0.3	ND>0.3	ND>0.3	ND	ND	7.44	22.
	950921-B3-07	2708-S007	21-Sep-95	15.0						5.9	ND	ND								
	950921-B3-10	2708-S007	21-Sep-95	22.5															3.07	
B-04	950921-B4-05	2708-S008	21-Sep-95	16.5															0.277	
B-05	950928-B5-05	2708-S021	28-Sep-95	15.5						**780.**	0.94	3.64							2.67	
B-06	950927-B6-02	2708-S016	27-Sep-95	8.0	X		X			**810.**	4,413.	12,486.8								
	950927-B6-03	2708-S016	27-Sep-95	15.5						54.	40.2	86.45								
B-07	950927-B7-05	2708-S017	27-Sep-95	17.0							ND	ND								
B-08	950918-B8-04	2708-S001	18-Sep-95	10.0				X		54.	185.	338.49								
	950918-B8-05	2708-S001	18-Sep-95	12.5						15.										
	950918-B8-06	2708-S001	18-Sep-95	12.5 (dup)						18.										
	950918-B8-08	2708-S001	18-Sep-95	18.0							ND	0.243								
B-09	950918-B9-02	2708-S002	18-Sep-95	10.0	X		X		**1,200.**	25.	2,421.5	19,437.5	**104.**	44.2	78.2	102.6	329.			
	950918-B9-08	2708-S002	18-Sep-95	28.0	X				**270.**	**1,600.**										
	950918-B9-09	2708-S002	18-Sep-95	30.5	X						9.48	43.54								
	950918-B9-10	2708-S002	18-Sep-95	34.0							ND	0.464								
B-10	950925-B10-04	2708-S013	25-Sep-95	17.5							ND	ND	ND>0.3	ND>0.3	ND>0.3	ND>0.3		ND	ND>0.5	2.
B-11	950928-B11-01	2708-S019	28-Sep-95	0.2						**1,600.**										
	950928-B11-06	2708-S020	28-Sep-95	12.5	X					**1,700.**	3.26	972.87	ND>0.3	ND>0.3	3.4	3.	6.4			
	950928-B11-09	2708-S020	28-Sep-95	23.0							ND	1.051								
B-13	951006-B13-03	2708-S035	6-Oct-95	10.5	X	X			**1,000.**	**2,700.**	3,915.9	29,386.9	**28.**	ND>20	**110.**	22.	160.	ND	ND>0.1	1.9
	951006-B13-07	2708-S035	6-Oct-95	18.5							ND	ND								
	951006-B13-10	2708-S036	6-Oct-95	24.0					ND>10	ND>5	ND	ND								
B-14	950928-B14-01	2708-S019	28-Sep-95	0.2																
	950928-B14-02	2708-S019	28-Sep-95	2.5	X					280.										
	950928-B14-03	2708-S019	28-Sep-95	5.0							ND	ND								
B-15	951006-B15-05	2708-S036	6-Oct-95	21.0	X				70.	200.	45.9	637.6	**7.9**	ND>0.3	3.9	2.5	14.3			
	951006-B15-08	2708-S036	6-Oct-95	27.0							0.21	1.791								
ODEQ Soil Cleanup Levels [2]					#	#	#	#	80 [4]	500 [4]	see Table G-2	see Table G-2	2.0	80	100	800	#	see Table G-3	40,000 [5]	2,000 [5]
EPA PRGs for Industrial Soil [3]					#	#	#	#	#	#	see Table G-2	see Table G-2	1.37	880	230	320	#	see Table G-3	13,626	1,000

NOTE:
1 = Sample number prefix: 2708-
2 = Reference Levels are Soil Cleanup Levels in the Soil Cleanup Table (OAR 340-122-045), unless otherwise noted
3 = Reference Levels are EPA Region 9 Preliminary Remediation Goals (PRGs) for Industrial Soil
4 = Reference Levels are ODEQ UST Level 2 Soil Cleanup Standards (OAR 340-122-335)
5 = Reference Levels are Industrial Maximum Allowable Soil Concentrations in the Soil Cleanup Table (OAR 340-122-045)

# = not established
BTEX = benzene, toluene, ethylbenzene, and xylenes
EPA = U.S. Environmental Protection Agency
mg/kg = milligrams/kilogram
ND = not detected above detection limit indicated

ODEQ = Oregon Department of Environmental Quality
PAHs = polynuclear aromatic hydrocarbons
ppm = parts per million
TPH = total petroleum hydrocarbons
BOLD = Detected above Reference Level

TABLE G-1 – Summary of Analytical Results for Soil Samples
TPH, BTEX, Total PAHs, Total Phenols, Cyanide, and Lead
Remedial Investigation
Northwest Natural - Gasco Facility
Portland, Oregon

Project No. 2708

Soil Boring Number	Sample Number[1]	Chain of Custody Number	Sample Date	Depth (feet bgs)	Field Observation				Analytical Results mg/kg (ppm)											
									ODEQ Method		EPA Method 8270 SIM		EPA Method 8020					EPA Method 8270	EPA Method 9010	EPA Method 6010
									TPH-G	TPH-418.1M										
					Sheen	Oil Tar	Tar	Lamp Black	Gasoline	Diesel/Oil	Carcinogenic PAHs	Total PAHs	Benzene	Toluene	Ethyl benzene	Xylenes	Total BTEX	Total Phenols	Total Cyanide	Total Lead
B-17	950929-B17-01	2708-S022	29-Sep-95	3.0							24.07	59.079								
	950929-B17-05	2708-S022	29-Sep-95	16.5	X	X			**2,400.**	**4,700.**	114.1	1,814.						ND		
	950929-B17-07	2708-S022	29-Sep-95	23.5							ND	0.888								
B-18	950919-B18-05	2708-S003	19-Sep-95	12.0	X				**3,100.**	99.	0.659	59.306	**360.**	**280.**	31.	220.	891.	0.36	ND>0.25	13.
	950919-B18-08	2708-S003	19-Sep-95	19.5	X				**850.**	44.										
	950919-B18-09	2708-S003	19-Sep-95	22.0					24.	380.										
	950919-B18-10	2708-S003	19-Sep-95	24.5							ND	ND								
B-19	950919-B19-01	2708-S003	19-Sep-95	0.2						68.	324.2	933.22	ND>0.3	ND>0.3	ND>0.3	ND>0.3	ND	ND		57.
	950919-B19-03	2708-S004	19-Sep-95	6.5	X	X			**1,600.**	**1,500.**	35.76	408.26	**41.**	**120.**	39.	160.	360.	ND		1.6
	950919-B19-04	2708-S004	19-Sep-95	10.5	X				**3,200.**	**1,500.**										11.
	950919-B19-05	2708-S004	19-Sep-95	12.0					**1,900.**	**6,800.**										
	950920-B19-07	2708-S005	20-Sep-95	18.0					**130.**	**760.**	0.101	80.001								
	950920-B19-08	2708-S005	20-Sep-95	27.0							0.027	1.956								
B-20	950929-B20-03	2708-S022	29-Sep-95	10.5	X	X			**940.**	340.	244.507	1,092.607	**120.**	64.	16.	60.	260.	ND		4.5
	950929-B20-07	2708-S023	29-Sep-95	23.5					**220.**	11.	0.255	12.686								
B-21	951003-B21-04	2708-S027	3-Oct-95	11.5							0.418	7.107								9.8
B-22	951003-B22-01	2708-S027	3-Oct-95	3.5	X	X				**530.**										
	951003-B22-05	2708-S027	3-Oct-95	13.5	X						1.727	40.268	ND>0.3	ND>0.3	ND>0.3	ND>0.3	ND	ND		5.9
	951003-B22-09	2708-S028	3-Oct-95	24.0	X	X				**600.**	30.23	485.234	ND>0.3	ND>0.3	ND>0.3	ND>0.3	ND	ND		2.5
	951003-B22-10	2708-S028	3-Oct-95	26.5						12.										
B-23	951003-B23-02	2708-S028	3-Oct-95	10.5	X				**1,300.**	**930.**									0.17	
	951003-B23-05	2708-S029	3-Oct-95	18.5	X					16.										
	951003-B23-08	2708-S029	3-Oct-95	26.5	X			X		110.	1.117	76.897	**13.**	ND>0.3	ND>0.3	1.3	14.3	ND		5.2
	951003-B23-10	2708-S029	3-Oct-95	31.5	X															
	951003-B23-12	2708-S029	3-Oct-95	34.5							ND	ND	ND>0.3	ND>0.3	ND>0.3	ND>0.3	ND			
B-24	951002-B24-03	2708-S024	2-Oct-95	10.5	X		X		**1,500.**	**640.**	276.5	1,091.8								
	951002-B24-10	2708-S024	2-Oct-95	29.0							ND	0.14	**6.8**	2.3	ND>0.3	0.34	9.44			
B-25	951002-B25-03	2708-S025	2-Oct-95	12.5	X				**120.**	35.	3.328	12.458								
	951002-B25-05	2708-S025	2-Oct-95	20.0							ND	0.45								
B-26	951003-B26-01	2708-S030	4-Oct-95	0.2							5.13	9.319								
	951003-B26-06	2708-S030	4-Oct-95	20.5	X	X			**1,300.**	**1,600.**	861.7	15,529.7	**160.**	**110.**	16.	90.	376.	ND		10.
	951003-B26-13	2708-S030	4-Oct-95	39.5					ND>10	ND>5	ND	1.12								
B-27	950920-B27-06	2708-S005	20-Sep-95	13.0	X					8.5										1.9
	950920-B27-08	2708-S005	20-Sep-95	18.0																
	950920-B27-10	2708-S005	20-Sep-95	23.0	X	X			**700.**	**570.**	90.5	1,243.4	**110.**	46.	ND>30	ND>30	156.	ND		5.2
	950920-B27-12	2708-S006	20-Sep-95	28.0					**94.**	ND>5	9.605	125.405	**22.**	3.6	ND>0.6	1.2	26.8			
	950920-B27-15	2708-S006	20-Sep-95	35.5							1.211	12.241								
ODEQ Soil Cleanup Levels [2]					#	#	#	#	80 [4]	500 [4]	see Table G-2	see Table G-2	2.0	80	100	800	#	see Table G-3	40,000 [5]	2,000 [5]
EPA PRGs for Industrial Soil [3]					#	#	#	#	#	#	see Table G-2	see Table G-2	1.37	880	230	320	#	see Table G-3	13,626	1,000

NOTE:
1 = Sample number prefix: 2708-
2 = Reference Levels are Soil Cleanup Levels in the Soil Cleanup Table (OAR 340-122-045), unless otherwise noted
3 = Reference Levels are EPA Region 9 Preliminary Remediation Goals (PRGs) for Industrial Soil
4 = Reference Levels are ODEQ UST Level 2 Soil Cleanup Standards (OAR 340-122-335)
5 = Reference Levels are Industrial Maximum Allowable Soil Concentrations in the Soil Cleanup Table (OAR 340-122-045)

# = not established
BTEX = benzene, toluene, ethylbenzene, and xylenes
EPA = U.S. Environmental Protection Agency
mg/kg = milligrams/kilogram
ND = not detected above detection limit indicated

ODEQ = Oregon Department of Environmental Quality
PAHs = polynuclear aromatic hydrocarbons
ppm = parts per million
TPH = total petroleum hydrocarbons
BOLD = Detected above Reference Level

TABLE G-1 – Summary of Analytical Results for Soil Samples
TPH, BTEX, Total PAHs, Total Phenols, Cyanide, and Lead
Remedial Investigation
Northwest Natural - Gasco Facility
Portland, Oregon

Project No. 2708

Soil Boring Number	Sample Number[1]	Chain of Custody Number	Sample Date	Depth (feet bgs)	Field Observation				Analytical Results mg/kg (ppm)											
									ODEQ Method		EPA Method 8270 SIM		EPA Method 8020					EPA Method 8270	EPA Method 9010	EPA Method 6010
									TPH-G	TPH-418.1M										
					Sheen	Oil Tar	Tar	Lamp Black	Gasoline	Diesel/Oil	Carcinogenic PAHs	Total PAHs	Benzene	Toluene	Ethyl benzene	Xylenes	Total BTEX	Total Phenols	Total Cyanide	Total Lead
B-28	951002-B28-01	2708-S025	2-Oct-95	0.2					ND>10	35.	45.5	86.836	ND>0.3	ND>0.3	ND>0.3	ND>0.3	ND	ND		21.
	951002-B28-02	2708-S025	2-Oct-95	0.2 (dup)							65.5	135.19								
	951002-B28-07	2708-S025	2-Oct-95	15.0	X	X			24.	200.	167.2	611.5	**5.5**	ND>2	ND>2	2.3	7.8	ND		5.6
	951002-B28-11	2708-S026	2-Oct-95	24.0					ND>10	ND>5	ND	2.298	0.99	ND>0.3	ND>0.3	ND>0.3	0.99			
B-29	950922-B29-01	2708-S011	22-Sep-95	0.2						190.	138.8	230.07								
	950922-B29-08	2708-S011	22-Sep-95	18.0			X													
	950922-B29-10	2708-S011	22-Sep-95	23.5					ND>10	9.3										
	950922-B29-12	2708-S012	22-Sep-95	28.0	X	X			53.	220.										
	950922-B29-15	2708-S012	22-Sep-95	35.5	X	X			**1,800.**	**4,800.**	5,214.1	58,821.7	**150.**	**140.**	35.	110.	435.	ND		1.7
	950925-B29-17	2708-S013	25-Sep-95	44.0					ND>10	44.	2.614	16.454								
	950925-B29-18	2708-S013	25-Sep-95	47.0							ND	0.18								
B-30A	950922-B30-01	2708-S010	22-Sep-95	0.2						390.	500.	964.5								
B-30	950922-B30-06	2708-S010	22-Sep-95	11.5	X			X	**320.**	**3,200.**	938.7	6,775.7	**18.**	1.9	12.	20.	51.9	ND	3.03	25.
	950922-B30-08	2708-S010	22-Sep-95	17.0																
	950922-B30-12	2708-S010	22-Sep-95	28.5	X				**150.**	120.	94.3	853.	**17.**	ND>3	2.8	ND>3	19.8			
	950922-B30-13	2708-S011	22-Sep-95	33.5					12.	ND>5										
B-31	950925-B31-01	2708-S013	25-Sep-95	0.2					-	240.	22.98	38.148	ND>0.3	ND>0.3	ND>0.3	ND>0.3	ND		0.59	14.
	950925-B31-06	2708-S014	25-Sep-95	21.0	X		X	X	**250.**	**2,200.**	1,846.1	12,665.7	ND>3	ND>3	9.1	9.6	18.7	ND		12.
	950925-B31-08	2708-S014	25-Sep-95	24.5					ND>10	34.	2.089	5.494								
	950925-B31-10	2708-S014	25-Sep-95	28.0							ND	ND								
	950925-B31-11	2708-S014	25-Sep-95	28.0 (dup)							ND	ND								
B-32	951003-B32-01	2708-S031	4-Oct-95	0.2						66.	34.8	61.21								
	951003-B32-03	2708-S031	4-Oct-95	11.5				X	**760.**	**6,600.**	3,156.3	28,772.3							3.02	
	951003-B32-15	2708-S032	4-Oct-95	46.5	X	X			**1,400.**	**4,100.**	1,728.	21,961.								
	951003-B32-18	2708-S032	4-Oct-95	58.5	X						ND	1.202	0.95	ND>.3	ND>.3	ND>.3	1.			
B-33	951005-B33-01	2708-S033	5-Oct-95	0.2						170.	575.3	955.4								
	951005-B33-02	2708-S033	5-Oct-95	3.0						140.	151.77	37.51								
	951005-B33-03	2708-S034	5-Oct-95	5.5	X		X		**430.**	**2,700.**	1,054.4	8,238.4	**47.**	22.	29.	28.	126.	ND	3.9	20.
	951005-B33-11	2708-S034	5-Oct-95	38.5	X		X		**1,700.**	**7,600.**										
	951005-B33-14	2708-S034	5-Oct-95	54.0	X		X		36.	230.	3.02	65.04	0.72	0.82	1.	1.1	3.64	ND		2.1
	951006-B33-18	2708-S035	6-Oct-95	69.0							0.525	5.682								
B-34	950926-B34-01	2708-S015	26-Sep-95	0.2						41.	49.2	94.09								
	950926-B34-05	2708-S015	26-Sep-95	11.5	X		X		**3,400.**	**4,200.**	1,639.	13,499.							6.48	
	950926-B34-12	2708-S015	26-Sep-95	36.5	X	X			**1,900.**	69.										
B-35	951005-B35-01	2708-S033	5-Oct-95	0.2						27.	19.49	38.94	ND>0.3	ND>0.3	ND>0.3	ND>0.3	ND	ND		
	951005-B35-06	2708-S033	5-Oct-95	22.0	X	X			**2,200.**	**7,700.**	4,013.5	41,601.5							0.67	
	951005-B35-10	2708-S033	5-Oct-95	29.0							0.784	9.294								
ODEQ Soil Cleanup Levels [2]					#	#	#	#	80 [4]	500 [4]	see Table G-2	see Table G-2	2.0	80	100	800	#	see Table G-3	40,000 [5]	2,000 [5]
EPA PRGs for Industrial Soil [3]					#	#	#	#	#	#	see Table G-2	see Table G-2	1.37	880	230	320	#	see Table G-3	13,626	1,000

NOTE:
1 = Sample number prefix: 2708-
2 = Reference Levels are Soil Cleanup Levels in the Soil Cleanup Table (OAR 340-122-045), unless otherwise noted
3 = Reference Levels are EPA Region 9 Preliminary Remediation Goals (PRGs) for Industrial Soil
4 = Reference Levels are ODEQ UST Level 2 Soil Cleanup Standards (OAR 340-122-335)
5 = Reference Levels are Industrial Maximum Allowable Soil Concentrations in the Soil Cleanup Table (OAR 340-122-045)

# = not established
BTEX = benzene, toluene, ethylbenzene, and xylenes
EPA = U.S. Environmental Protection Agency
mg/kg = milligrams/kilogram
ND = not detected above detection limit indicated

ODEQ = Oregon Department of Environmental Quality
PAHs = polynuclear aromatic hydrocarbons
ppm = parts per million
TPH = total petroleum hydrocarbons
BOLD = Detected above Reference Level

TABLE G-1 – Summary of Analytical Results for Soil Samples
TPH, BTEX, Total PAHs, Total Phenols, Cyanide, and Lead
Remedial Investigation
Northwest Natural - Gasco Facility
Portland, Oregon

Project No. 2708

Soil Boring Number	Sample Number[1]	Chain of Custody Number	Sample Date	Depth (feet bgs)	Field Observation				Analytical Results mg/kg (ppm)											
									ODEQ Method		EPA Method 8270 SIM		EPA Method 8020					EPA Method 8270	EPA Method 9010	EPA Method 6010
									TPH-G	TPH-418.1M										
					Sheen	Oil Tar	Tar	Lamp Black	Gasoline	Diesel/Oil	Carcinogenic PAHs	Total PAHs	Benzene	Toluene	Ethyl benzene	Xylenes	Total BTEX	Total Phenols	Total Cyanide	Total Lead
M-11	951102-M11-01	2708-S047	2-Nov-95	0.2						14.	67.4	105.83								9.9
	951102-M11-09	2708-S047	2-Nov-95	39.0	X						9.723	7.876								
	951102-M11-10	2708-S047	2-Nov-95	43.5							0.966	10.915								
MW-01-22	951024-M1-01	2708-S039	24-Oct-95	0.2							3.07	5.78							0.25	
	951024-M1-02	2708-S039	24-Oct-95	3.5						460.	8.35	12.84							ND>.5	
	951024-M1-06	2708-S039	24-Oct-95	23.5						ND>5	ND	0.461							0.88	
MW-02-32	951106-M2-01	2708-S049	6-Nov-95	0.2							5.2	10.293							0.47	4.9
	951106-M2-06	2708-S049	6-Nov-95	24.0						ND>5	0.152	0.432								
MW-03-56	951101-M3-10	2708-S045	1-Nov-95	31.0	X						3.718	10.128								
	951101-M3-13	2708-S046	1-Nov-95	38.0							ND	ND								
	951101-M3-17	2708-S046	1-Nov-95	53.5							ND	ND								
	951101-M3-18	2708-S046	1-Nov-95	53.5 (dup)							0.044	0.157								
MW-04-57	951030-M4-01	2708-S043	30-Oct-95	0.2						57.	114.	195.1						ND	0.8	29.
	951030-M4-06	2708-S043	30-Oct-95	25.5	X						872.	3,261.	ND>.3	ND>.3	ND>.3	ND>.3	ND	ND	1.3	15.
	951030-M4-15	2708-S044	30-Oct-95	57.0							ND	0.263								
MW-05-32	951027-M5-01	2708-S042	27-Oct-95	0.2							0.817	1.43								
	951027-M5-05	2708-S042	27-Oct-95	15.5					ND>10	350.	810.	1,942.1								
	951027-M5-07	2708-S042	27-Oct-95	21.5							0.242	0.908								
	951027-M5-10	2708-S042	27-Oct-95	31.5							ND	ND								
MW-06-61	951107-M6-01	2708-S050	7-Nov-95	2.5							ND	ND								
	951107-M6-08	2708-S050	7-Nov-95	30.0	X	X					1,389.	20,614.	**67.**	ND>30	**140.**	56.	263.			
	951107-M6-10	2708-S050	7-Nov-95	38.5							0.108	1.819	ND>.3	ND>.3	ND>.3	ND>.3	ND			
	951107-M6-11	2708-S050	7-Nov-95	43.0							ND	0.056								
MW-08-56	951025-M8-01	2708-S040	25-Oct-95	0.2							203.4	280.8							0.61	
	951025-M8-11	2708-S040	25-Oct-95	44.0	X						0.783	8.063								
	951025-M8-15	2708-S041	25-Oct-95	55.0							ND	0.642								
MW-09-29	951023-M9-01	2708-S037	23-Oct-95	0.2							11.7	21.502								
	951023-M9-04	2708-S037	23-Oct-95	5.0						19.	78.5	163.02	ND>.3	ND>.3	ND>.3	ND>.3	ND		518.	
	951023-M9-05	2708-S037	23-Oct-95	11.5							0.163	0.521								
MW-10-61	951108-M10-01	2708-S052	8-Nov-95	0.2							45.	78.741						ND		6.4
	951108-M10-02	2708-S052	8-Nov-95	0.2 (dup)							64.1	106.99								
	951108-M10-09	2708-S052	8-Nov-95	28.0							ND	0.764	**43.**	3.	0.73	ND>.3	46.73			
MW-12-36	951023-M12-01	2708-S037	23-Oct-95	0.2						29.	65.5	116.21								
	951023-M12-06	2708-S038	23-Oct-95	22.0	X	X			**160.**	30.	0.27	8.6	ND>3	8.2	3.5	21.	32.7	ND		2.9
	951023-M12-07	2708-S038	23-Oct-95	26.5							ND	ND								
ODEQ Soil Cleanup Levels [2]					#	#	#	#	80 [4]	500 [4]	see Table G-2	see Table G-2	2.0	80	100	800	#	see Table G-3	40,000 [5]	2,000 [5]
EPA PRGs for Industrial Soil [3]					#	#	#	#	#	#	see Table G-2	see Table G-2	1.37	880	230	320	#	see Table G-3	13,626	1,000

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TABLE G-1 – Summary of Analytical Results for Soil Samples
TPH, BTEX, Total PAHs, Total Phenols, Cyanide, and Lead
Remedial Investigation
Northwest Natural - Gasco Facility
Portland, Oregon

Project No. 2708

Soil Boring Number	Sample Number[1]	Chain of Custody Number	Sample Date	Depth (feet bgs)	Field Observation				Analytical Results mg/kg (ppm)											
									ODEQ Method		EPA Method 8270 SIM		EPA Method 8020					EPA Method 8270	EPA Method 9010	EPA Method 6010
									TPH-G	TPH-418.1M										
					Sheen	Oil Tar	Tar	Lamp Black	Gasoline	Diesel/Oil	Carcinogenic PAHs	Total PAHs	Benzene	Toluene	Ethyl benzene	Xylenes	Total BTEX	Total Phenols	Total Cyanide	Total Lead
MW-13-61	971218-M13-02	2708-S058	18-Dec-97	6.0							ND	ND	ND>0.025	ND>0.025	ND>0.025	ND>0.075	ND		ND>0.02	
	971218-M13-03	2708-S058	18-Dec-97	10.0							ND	ND	ND>0.025	ND>0.025	ND>0.025	ND>0.075	ND		ND>0.02	
	971218-M13-04	2708-S058	18-Dec-97	13.5							ND	ND	ND>0.025	ND>0.025	ND>0.025	ND>0.075	ND		ND>0.02	
	971218-M13-05	2708-S058	18-Dec-97	18.0							0.342	1.	ND>0.025	ND>0.025	ND>0.025	ND>0.075	ND		ND>0.02	
	971218-M13-08	2708-S058	18-Dec-97	24.5							ND	ND	0.069	ND>0.025	ND>0.025	ND>0.075	0.069		0.04	
	971218-M13-10	2708-S058	18-Dec-97	28.0							ND	0.058								
	971218-M13-11	2708-S058	18-Dec-97	31.0							ND	ND	ND>0.025	ND>0.025	ND>0.025	ND>0.075	ND		0.02	
	971218-M13-17	2708-S059	18-Dec-97	57.0							ND	ND	ND>0.025	ND>0.025	ND>0.025	ND>0.075	ND			
GT-1	971117-001	2708-S054	17-Nov-97	3.0							2.24	4.34	ND>0.025	ND>0.025	ND>0.025	ND>0.075	ND		ND>0.02	
	971117-004	2708-S054	17-Nov-97	10.5	X	X			**300** [6]	**13,400** [6]	ND	6.17	ND>0.025	ND>0.025	0.034	0.13	0.164		ND>0.03	
	971117-006	2708-S054	17-Nov-97	16.0							ND	ND	ND>0.025	ND>0.025	ND>0.075	ND>0.075	ND		ND>0.02	
	971117-008	2708-S054	17-Nov-97	20.5							ND	ND	ND>0.025	ND>0.025	ND>0.075	ND>0.075	ND		ND>0.02	
	971117-011	2708-S054	17-Nov-97	35.5							ND	ND	ND>0.025	ND>0.025	ND>0.075	ND>0.075	ND		ND>0.02	
GT-2	971117-012	2708-S054	17-Nov-97	3.5							ND	0.084	ND>0.025	ND>0.025	ND>0.075	ND>0.075	ND		ND>0.02	
	971117-017	2708-S055	17-Nov-97	15.5							ND	ND	0.027	ND>0.025	ND>0.075	ND>0.075	0.027		ND>0.02	
	971117-021	2708-S055	17-Nov-97	33.0							ND	ND	ND>0.025	ND>0.025	ND>0.075	ND>0.075	ND		ND>0.02	
GT-3	971118-023	2708-S056	18-Nov-97	3.0							21.9	43.09	ND>0.025	ND>0.025	ND>0.075	ND>0.075	ND		ND>0.02	
	971118-026	2708-S056	18-Nov-97	12.5							ND	0.05	ND>0.025	ND>0.025	ND>0.075	ND>0.075	ND		ND>0.02	
	971118-032	2708-S056	18-Nov-97	36.0							ND	ND	ND>0.025	ND>0.025	ND>0.075	ND>0.075	ND		ND>0.02	
GT-4	971118-034	2708-S056	18-Nov-97	13.5							ND	ND	ND>0.025	ND>0.025	ND>0.075	ND>0.075	ND		ND>0.02	
	971118-038	2708-S057	18-Nov-97	40.5							ND	ND	ND>0.025	ND>0.025	ND>0.075	ND>0.075	ND		ND>0.02	
ODEQ Soil Cleanup Levels [2]					#	#	#	#	80 [4]	500 [4]	see Table G-2	see Table G-2	2.0	80	100	800	#	see Table G-3	40,000 [5]	2,000 [5]
EPA PRGs for Industrial Soil [3]					#	#	#	#	#	#	see Table G-2	see Table G-2	1.37	880	230	320	#	see Table G-3	13,626	1,000

NOTE:
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3 = Reference Levels are EPA Region 9 Preliminary Remediation Goals (PRGs) for Industrial Soil
4 = Reference Levels are ODEQ UST Level 2 Soil Cleanup Standards (OAR 340-122-335)
5 = Reference Levels are Industrial Maximum Allowable Soil Concentrations in the Soil Cleanup Table (OAR 340-122-045)
6 = Analyzed via Northwest Methods NW-TPH-G and NW-TPH-Dx

# = not established
BTEX = benzene, toluene, ethylbenzene, and xylenes
EPA = U.S. Environmental Protection Agency
mg/kg = milligrams/kilogram
ND = not detected above detection limit indicated

ODEQ = Oregon Department of Environmental Quality
PAHs = polynuclear aromatic hydrocarbons
ppm = parts per million
TPH = total petroleum hydrocarbons
BOLD = Detected above Reference Level

Table G-2 – Summary of Analytical Results for Soil Samples, PAHs by EPA Method 8270 (SIM)
Remedial Investigation
Northwest Natural - Gasco Facility
Portland, Oregon

Project No. 2708

PAHs by EPA Method 8270 (SIM)					Analytical Results mg/kg (ppm)																
					Carcinogenic PAHs							Non-carcinogenic PAHs									
Soil Boring	Sample Number	Chain of Custody No.	Sample Date	Sample Depth (feet bgs)	Benzo (a) anthracene	Benzo (b) fluoranthene	Benzo (k) fluoranthene	Benzo (a) pyrene	Chrysene	Dibenzo (ah) anthracene	Indeno (1,2,3-cd) pyrene	Acenaphthene	Acenaphthylene	Anthracene	Benzo (ghi) perylene	Fluoranthene	Fluorene	Naphthalene	Phenanthrene	Pyrene	Total Carcinogenic PAHs	Total PAHs
B-01	950921-B1-01	2708-S009	21-Sep-95	0.2	**1.**	**1.6**	**0.52**	**1.5**	**1.4**	**0.22**	**0.93**	0.14	ND [a]	0.14	1.3	1.3	0.055	0.073	0.88	2.3	7.17	6.188
	950921-B1-02	2708-S009	21-Sep-95	0.2	**3.7**	**5.6**	**1.7**	**5.2**	**5.6**	**0.84**	**3.5**	0.51	0.41	1.1	5.1	5.7	0.34	0.46	5.8	10.4	26.14	29.82
	950921-B1-05	2708-S009	21-Sep-95	10.5	**45.3**	**72.3**	**26.7**	**55.7**	**82.8**	**7.7**	**46.2**	6.1	5.8	**21.7**	65.8	140.	9.6	**313.**	142.	**239.**	336.7	943.
	950921-B1-09	2708-S009	21-Sep-95	21.0	**0.19**	**0.21**	0.056	**0.17**	**0.19**	ND [a]	**0.11**	0.13	ND [a]	0.24	0.17	0.36	0.14	0.21	2.2	0.65	0.926	4.1
B-03	950921-B3-05	2708-S007	21-Sep-95	10.5	**3.2**	**5.2**	**1.9**	**4.8**	**4.1**	**0.64**	**3.2**	0.3	0.14	3.1	4.2	5.9	0.2	0.16	3.1	8.9	23.04	26.
	950921-B3-07	2708-S007	21-Sep-95	15.0	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND	ND
B-05	950928-B5-05	2708-S021	28-Sep-95	15.5	ND [b]	**0.2**	ND [b]	**0.18**	ND [b]	ND [b]	**0.56**	0.14	0.44	0.19	1.1	0.34	ND [b]	ND [b]	ND [b]	0.49	0.94	2.7
B-06	950927-B6-02	2708-S016	27-Sep-95	8.0	**574.**	**972.**	**370.**	**767.**	**833.**	**159.**	**738.**	21.	124.	**191.**	1,080.	1,680.	73.8	**884.**	1,180.	**2,840.**	4,413.	8,073.8
	950927-B6-03	2708-S016	27-Sep-95	15.5	**5.7**	**8.8**	**3.5**	**7.1**	**7.6**	**1.1**	**6.4**	ND>1.0	0.55	2.1	9.6	10.2	ND>1.0	ND>1.0	5.5	18.3	40.2	46.25
B-07	950927-B7-05	2708-S017	27-Sep-95	17.0	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND	ND
B-08	950918-B8-04	2708-S001	18-Sep-95	10.0	**18.**	**40.**	**12.**	**47.**	**24.**	**6.**	**38.**	0.48	4.	2.8	58.	26.	0.71	2.3	7.2	52.	185.	153.49
	950918-B8-08	2708-S001	18-Sep-95	18.0	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	0.18	ND [a]	ND [a]	ND [a]	ND [a]	0.063	ND [a]	ND [a]	ND [a]	ND	0.243
B-09	950918-B9-02	2708-S002	18-Sep-95	10.0	**472.**	**420.**	**139.**	**487.**	**601.**	**56.5**	**246.**	**558.**	457.	**603.**	344.	1,350.	**464.**	**7,560.**	3,410.	**2,270.**	2,421.5	17,016.
	950918-B9-09	2708-S002	18-Sep-95	30.5	**1.6**	**1.8**	**0.66**	**2.1**	**1.9**	**0.22**	**1.2**	1.9	0.17	1.3	1.8	4.4	0.99	8.3	7.8	7.4	9.48	34.06
	950918-B9-10	2708-S002	18-Sep-95	34.0	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	0.054	ND [a]	0.08	ND [a]	ND [a]	0.2	0.13	ND	0.464
B-10	950925-B10-04	2708-S013	25-Sep-95	17.5	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND	ND
B-11	950928-B11-06	2708-S020	28-Sep-95	12.5	**0.83**	**0.5**	ND [a]	**0.53**	**1.4**	ND [a]	ND [a]	7.8	0.61	2.7	ND [a]	4.2	6.7	**915.**	25.2	7.4	3.26	969.61
	950928-B11-09	2708-S020	28-Sep-95	23.0	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	0.071	ND [a]	0.094	ND [a]	0.17	0.076	ND [a]	0.35	0.29	ND	1.051
B-13	951006-B13-03	2708-S035	6-Oct-95	10.5	**564.**	**752.**	**238.**	**942.**	**811.**	**89.9**	**519.**	**1,630.**	155.	**578.**	747.	2,350.	**481.**	**13,000.**	2,950.	**3,580.**	3,915.9	25,471.
	951006-B13-07	2708-S035	6-Oct-95	18.5	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND	ND
	951006-B13-10	2708-S036	6-Oct-95	24.0	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND	ND
B-14	950928-B14-03	2708-S019	28-Sep-95	5.0	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND	ND
B-15	951006-B15-05	2708-S036	6-Oct-95	21.0	**6.8**	**9.7**	**3.2**	**9.3**	**9.7**	1.	**6.2**	16.1	4.1	**6.6**	9.	27.7	6.9	**400.**	80.	41.3	45.9	591.7
	951006-B15-08	2708-S036	6-Oct-95	27.0	ND [a]	0.05	0.16	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	0.053	0.13	ND [a]	0.24	0.038	0.13	0.59	0.4	0.21	1.581
B-17	950929-B17-01	2708-S022	29-Sep-95	3.0	**3.5**	**5.6**	**1.3**	**5.7**	**3.6**	0.67	**3.7**	0.026	0.22	0.92	5.3	10.5	0.15	0.093	4.	13.8	24.07	35.009
	950929-B17-05	2708-S022	29-Sep-95	16.5	**28.**	**15.**	**5.8**	**16.**	**44.**	**1.1**	**4.2**	**161.**	10.	**111.**	5.9	114.	**119.**	**478.**	477.	**224.**	114.1	1,699.9
	950929-B17-07	2708-S022	29-Sep-95	23.5	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	0.078	ND [a]	0.086	ND [a]	0.072	0.062	0.16	0.32	0.11	ND	0.888
B-18	950919-B18-05	2708-S003	19-Sep-95	12.0	**0.17**	0.09	0.032	0.074	**0.26**	ND [a]	0.033	1.9	0.16	0.44	0.047	1.1	1.8	**44.8**	6.7	1.7	0.659	58.647
	950919-B18-10	2708-S003	19-Sep-95	24.5	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND	ND
B-19	950919-B19-01	2708-S003	19-Sep-95	0.2	**53.1**	**57.6**	**29.6**	**61.**	**71.4**	**10.**	**41.5**	6.8	0.52	**212.**	46.	115.	20.1	2.9	91.7	**114.**	324.2	609.02
	950919-B19-03	2708-S004	19-Sep-95	6.5	**7.6**	**5.4**	**2.4**	**5.8**	**9.7**	**0.96**	**3.9**	13.4	4.6	**14.4**	5.1	25.4	13.	**180.**	83.3	33.3	35.76	372.5
	950920-B19-07	2708-S005	20-Sep-95	18.0	0.054	ND [a]	0.047	ND [a]	ND [a]	ND [a]	ND [a]	0.5	0.17	ND [a]	ND [a]	0.18	0.77	**76.3**	1.7	0.28	0.101	79.9
	950929-B19-08	2708-S005	20-Sep-95	27.0	0.027	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	0.081	ND [a]	0.081	ND [a]	0.13	0.097	1.1	0.3	0.14	0.027	1.929
B-20	950929-B20-03	2708-S022	29-Sep-95	10.5	**40.4**	**44.5**	**19.**	**45.**	**67.1**	**4.707**	**23.8**	35.8	9.4	**122.**	29.3	113.	57.8	27.8	239.	**214.**	244.507	848.1
	950929-B20-07	2708-S023	29-Sep-95	23.5	0.048	0.06	ND [a]	0.053	0.054	ND [a]	0.04	0.068	0.095	0.063	0.055	0.18	0.11	11.2	0.36	0.3	0.255	12.431
B-21	951003-B21-04	2708-S027	3-Oct-95	11.5	**0.12**	0.079	0.079	ND [a]	**0.14**	ND [a]	ND [a]	1.3	0.44	0.2	ND [a]	0.59	0.089	0.71	2.5	0.86	0.418	6.689
ODEQ Soil Cleanup Levels [2]					0.1	0.1	0.1	0.1	0.1	0.1	0.1	2,000.	#	20,000.	#	8,000.	2,000.	30.	#	6,000.	#	#
EPA PRGs for Industrial Soil [3]					2.61	2.61	26.13	0.26	7.2	0.26	2.61	110.	#	5.7	#	27,251.	90.	240.	#	100.	#	#

Note:
DEQ = Oregon Department of Environmental Quality
EPA = U.S. Environmental Protection Agency
mg/kg = milligrams/kilogram
ND = Not detected above detection limit indicated
PAHs = polynuclear aromatic hydrocarbons
ppm = parts per million

# = Reference level not established
1 = Sample number prefix: 2708-
2 = Reference Levels are Soil Cleanup Levels in the Soil Cleanup Table (OAR 340-122-045)
3 = Reference Levels are EPA Region 9 Preliminary Remediation Goals (PRGs) for Industrial Soil
Bold = Detected above Reference Levels

a = detection limit is 0.05 mg/kg (ppm)
b = detection limit is 0.2 mg/kg (ppm)
c = detection limit is 1 mg/kg (ppm)
d = detection limit is 100 mg/kg (ppm)
e = detection limit is 0.5 mg/kg (ppm)
f = detection limit is 0.7 mg/kg (ppm)

Table G-2 – Summary of Analytical Results for Soil Samples, PAHs by EPA Method 8270 (SIM)
Remedial Investigation
Northwest Natural - Gasco Facility
Portland, Oregon

Project No. 2708

PAHs by EPA Method 8270 (SIM)					Analytical Results mg/kg (ppm)																
					Carcinogenic PAHs							Non-carcinogenic PAHs									
Soil Boring	Sample Number	Chain of Custody No.	Sample Date	Sample Depth (feet bgs)	Benzo (a) anthracene	Benzo (b) fluoranthene	Benzo (k) fluoranthene	Benzo (a) pyrene	Chrysene	Dibenzo (ah) anthracene	Indeno (1,2,3-cd) pyrene	Acenaphthene	Acenaphthylene	Anthracene	Benzo (ghi) perylene	Fluoranthene	Fluorene	Naphthalene	Phenanthrene	Pyrene	Total Carcinogenic PAHs	Total PAHs
B-22	951003-B22-05	2708-S027	3-Oct-95	13.5	**0.63**	**0.19**	**0.12**	**0.15**	**0.58**	ND [a]	0.057	9.4	0.076	1.2	0.055	5.3	5.7	0.31	12.2	4.3	1.727	38.541
	951003-B22-09	2708-S028	3-Oct-95	24.0	**9.2**	**4.**	**1.7**	**2.6**	**12.**	0.15	**0.58**	78.8	0.504	**17.6**	0.49	65.4	59.9	0.41	160.2	71.7	30.23	455.004
B-23	951003-B23-08	2708-S029	3-Oct-95	26.5	**0.2**	**0.19**	0.097	**0.2**	**0.27**	ND [a]	**0.16**	0.87	1.2	0.52	0.19	1.4	3.	**58.8**	8.2	1.6	1.117	75.78
	951003-B23-12	2708-S029	3-Oct-95	34.5	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND	ND
B-24	951002-B24-03	2708-S024	2-Oct-95	10.5	**41.9**	**53.2**	**21.3**	**59.5**	**64.1**	**5.5**	**31.**	52.4	7.5	**34.9**	42.	132.	28.5	**115.**	186.	**217.**	276.5	815.3
	951002-B24-10	2708-S024	2-Oct-95	29.0	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	0.14	ND [a]	ND [a]	ND	0.14
B-25	951002-B25-03	2708-S025	2-Oct-95	12.5	**0.41**	**0.71**	**0.25**	**0.78**	**0.6**	0.078	**0.5**	0.41	0.15	0.29	0.75	1.2	0.53	1.2	2.5	2.1	3.328	9.13
	951002-B25-05	2708-S025	2-Oct-95	20.0	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	0.45	ND [a]	ND [a]	ND	0.45
B-26	951003-B26-01	2708-S030	4-Oct-95	0.2	**0.73**	**1.2**	**0.49**	**0.99**	**0.77**	**0.16**	**0.79**	0.092	ND [a]	0.097	0.84	1.5	ND [a]	ND [a]	0.46	1.2	5.13	4.189
	951003-B26-06	2708-S030	4-Oct-95	20.5	**124.**	**134.**	**57.**	**138.**	**265.**	**20.7**	**123.**	**608.**	449.	**1,220.**	171.	949.	**681.**	**6,420.**	2,630.	**1,540.**	861.7	14,668.
	951003-B26-13	2708-S030	4-Oct-95	39.5	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	0.059	0.046	0.051	ND [a]	0.066	0.059	0.55	0.19	0.099	ND	1.12
B-27	950920-B27-10	2708-S005	20-Sep-95	23.0	**17.2**	**16.3**	**6.2**	**18.3**	**21.**	**1.9**	**9.6**	53.	32.6	**21.9**	13.6	79.1	45.7	**586.**	208.	**113.**	90.5	1,152.9
	950920-B27-12	2708-S006	20-Sep-95	28.0	**1.9**	**1.6**	**0.78**	**1.7**	**2.6**	**0.11**	**0.915**	8.6	2.	3.1	1.3	9.9	6.5	**44.7**	26.4	13.3	9.605	115.8
	950920-B27-15	2708-S006	20-Sep-95	35.5	**0.31**	**0.26**	0.091	**0.16**	**0.28**	ND [a]	**0.11**	1.1	0.14	0.36	0.15	1.3	0.88	1.8	3.5	1.8	1.211	11.03
B-28	951002-B28-01	2708-S025	2-Oct-95	0.2	**6.1**	**10.1**	**4.3**	**8.6**	**8.2**	**1.6**	**6.6**	0.73	0.26	4.6	8.2	9.7	0.246	0.3	4.6	12.7	45.5	41.336
	951002-B28-02	2708-S025	2-Oct-95	0.2	**9.5**	**14.9**	**6.3**	**14.1**	**9.5**	**2.4**	**8.8**	1.1	0.86	1.8	12.3	17.3	0.55	0.88	9.2	25.7	65.5	69.69
	951002-B28-07	2708-S025	2-Oct-95	15.0	**19.1**	**33.4**	**12.6**	**42.7**	**30.2**	**3.6**	**25.6**	23.8	3.7	**11.2**	39.5	66.1	14.	**102.**	74.	**110.**	167.2	444.3
	951002-B28-11	2708-S026	2-Oct-95	24.0	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	0.057	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	2.2	0.041	ND [a]	ND	2.298
B-29	950922-B29-01	2708-S011	22-Sep-95	0.2	**10.5**	**31.7**	**11.6**	**32.5**	**19.3**	**4.8**	**28.4**	0.4	7.3	3.3	41.8	9.4	0.47	2.4	3.4	22.8	138.8	91.27
	950922-B29-15	2708-S012	22-Sep-95	35.5	**1,540.**	**758.**	**308.**	**571.**	**1,810.**	**46.1**	**181.**	**9,210.**	77.6	**1,650.**	230.	8,480.	**4,530.**	**7,400.**	15,500.	**6,530.**	5,214.1	53,607.6
	950925-B29-17	2708-S013	25-Sep-95	44.0	**0.56**	**0.45**	**0.12**	**0.51**	**0.68**	0.054	**0.24**	1.1	0.33	1.	0.3	1.6	0.84	0.77	5.1	2.8	2.614	13.84
	950925-B29-18	2708-S013	25-Sep-95	47.0	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	0.18	ND [a]	ND [a]	ND	0.18
B-30A	950922-B30-01	2708-S010	22-Sep-95	0.2	**49.8**	**110.**	**45.**	**99.6**	**75.4**	**20.2**	**100.**	9.2	13.4	**16.**	129.	110.5	5.9	9.4	37.3	**133.8**	500.	464.5
B-30	950922-B30-06	2708-S010	22-Sep-95	11.5	**167.**	**167.**	**71.9**	**182.**	**245.**	**16.5**	**89.3**	**220.**	228.	**417.**	125.	739.	**310.**	**1,730.**	1,260.	**808.**	938.7	5,837.
	950922-B30-12	2708-S010	22-Sep-95	28.5	**14.3**	**17.4**	**7.4**	**22.**	**19.8**	**1.8**	**11.6**	15.2	68.8	**28.7**	17.7	53.3	31.	**327.**	126.	91.	94.3	758.7
B-31	950925-B31-01	2708-S013	25-Sep-95	0.2	**2.1**	**5.4**	**1.8**	**4.8**	**3.**	**0.98**	**4.9**	0.11	1.3	0.59	6.8	1.6	0.058	0.3	0.71	3.7	22.98	15.168
	950925-B31-06	2708-S014	25-Sep-95	21.0	**319.**	**321.**	**119.**	**374.**	**394.**	**45.1**	**274.**	**1,120.**	50.6	**473.**	364.	1,290.	**422.**	**2,880.**	2,620.	**1,600.**	1,846.1	10,819.6
	950925-B31-08	2708-S014	25-Sep-95	24.5	**0.28**	**0.35**	**0.11**	**0.7**	**0.39**	0.039	**0.22**	0.072	ND [a]	0.18	0.27	0.88	0.063	ND>0.05	0.54	1.4	2.089	3.405
	950925-B31-10	2708-S014	25-Sep-95	28.0	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND	ND
	950925-B31-11	2708-S014	25-Sep-95	28.0	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND	ND
B-32	951004-B32-01	2708-S031	4-Oct-95	0.2	**2.9**	**6.9**	**2.5**	**7.4**	**5.6**	**1.8**	**7.7**	0.09	1.7	0.53	12.4	2.7	0.11	0.82	0.66	7.4	34.8	26.41
	951004-B32-03	2708-S031	4-Oct-95	11.5	**495.**	**500.**	**292.**	**585.**	**824.**	**87.3**	**373.**	**990.**	807.	**1,190.**	529.	2,050.	**810.**	**11,100.**	4,560.	**3,580.**	3,156.3	25,616.
	951004-B32-15	2708-S032	4-Oct-95	38.5	**259.**	**285.**	**81.**	**386.**	**427.**	**52.**	**238.**	**1,330.**	39.	**1,280.**	354.	1,180.	**520.**	**11,100.**	2,440.	**1,990.**	1,728.	20,233.
	951004-B32-18	2708-S032	4-Oct-95	58.5	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	0.064	ND [a]	0.061	ND [a]	0.13	0.047	0.38	0.31	0.21	ND	1.202
ODEQ Soil Cleanup Levels [2]					0.1	0.1	0.1	0.1	0.1	0.1	0.1	2,000.	#	20,000.	#	8,000.	2,000.	30.	#	6,000.	#	#
EPA PRGs for Industrial Soil [3]					2.61	2.61	26.13	0.26	7.2	0.26	2.61	110.	#	5.7	#	27,251.	90.	240.	#	100.	#	#

Note:
DEQ = Oregon Department of Environmental Quality
EPA = U.S. Environmental Protection Agency
mg/kg = milligrams/kilogram
ND = Not detected above detection limit indicated
PAHs = polynuclear aromatic hydrocarbons
ppm = parts per million

# = Reference level not established
1 = Sample number prefix: 2708-
2 = Reference Levels are Soil Cleanup Levels in the Soil Cleanup Table (OAR 340-122-045)
3 = Reference Levels are EPA Region 9 Preliminary Remediation Goals (PRGs) for Industrial Soil
Bold = Detected above Reference Levels

a = detection limit is 0.05 mg/kg (ppm)
b = detection limit is 0.2 mg/kg (ppm)
c = detection limit is 1 mg/kg (ppm)
d = detection limit is 100 mg/kg (ppm)
e = detection limit is 0.5 mg/kg (ppm)
f = detection limit is 0.7 mg/kg (ppm)

Table G-2 – Summary of Analytical Results for Soil Samples, PAHs by EPA Method 8270 (SIM)
Remedial Investigation
Northwest Natural - Gasco Facility
Portland, Oregon

Project No. 2708

PAHs by EPA Method 8270 (SIM)					Analytical Results mg/kg (ppm)																	
					Carcinogenic PAHs							Non-carcinogenic PAHs										
Soil Boring	Sample Number	Chain of Custody No.	Sample Date	Sample Depth (feet bgs)	Benzo (a) anthracene	Benzo (b) fluoranthene	Benzo (k) fluoranthene	Benzo (a) pyrene	Chrysene	Dibenzo (ah) anthracene	Indeno (1,2,3-cd) pyrene	Acenaphthene	Acenaphthylene	Anthracene	Benzo (ghi) perylene	Fluoranthene	Fluorene	Naphthalene	Phenanthrene	Pyrene	Total Carcinogenic PAHs	Total PAHs
B-33	951005-B33-01	2708-S033	5-Oct-95	0.2	**34.6**	**124.**	**44.**	**129.**	**70.**	**32.7**	**141.**	1.3	29.1	**9.9**	202.	29.5	1.6	9.1	10.5	87.1	575.3	380.1
	951005-B33-02	2708-S033	5-Oct-95	2.5	**1.9**	**2.4**	**0.88**	**2.8**	**2.5**	**0.29**	**1.5**	1.7	0.23	0.96	2.1	6.4	0.85	1.5	4.1	7.4	12.27	25.24
	951005-B33-03	2708-S034	5-Oct-95	5.5	**181.**	**185.**	**72.1**	**225.**	**262.**	**21.3**	**108.**	**369.**	133.	**263.**	152.	527.	**266.**	**3,460.**	1,190.	**824.**	1,054.4	7,184.
	951005-B33-14	2708-S034	5-Oct-95	54.0	**0.65**	**0.57**	ND [c]	**0.7**	**1.1**	ND [c]	ND [c]	3.4	ND [c]	2.1	0.62	3.4	1.5	**37.**	8.6	5.4	3.02	62.02
	951006-B33-18	2708-S035	6-Oct-95	69.0	0.045	0.054	ND [a]	**0.37**	0.056	ND [a]	ND [a]	0.06	0.35	0.12	0.047	0.18	0.12	3.5	0.47	0.31	0.525	5.157
B-34	950926-B34-01	2708-S015	26-Sep-95	0.2	**6.**	**10.**	**4.5**	**9.9**	**9.6**	**1.6**	**7.6**	0.99	0.46	1.5	9.5	11.7	0.44	1.1	5.6	13.6	49.2	44.89
	950926-B34-05	2708-S015	26-Sep-95	11.5	**227.**	**256.**	**153.**	**356.**	**383.**	**41.**	**223.**	**253.**	452.	**1,289.**	318.	849.	**409.**	**5,420.**	1,580.	**1,290.**	1,639.	11,860.
B-35	951005-B35-01	2708-S033	5-Oct-95	0.2	**2.2**	**4.**	**1.5**	**4.1**	**4.1**	**0.59**	**3.**	0.14	0.54	0.88	4.5	4.	0.15	0.34	2.2	6.7	19.49	19.45
	951005-B35-06	2708-S033	5-Oct-95	22.0	**613.**	**780.**	**269.**	**954.**	**809.**	**91.5**	**497.**	**532.**	1,960.	**880.**	714.	2,600.	**982.**	**20,700.**	4,890.	**4,330.**	4,013.5	37,588.
	951005-B35-10	2708-S033	5-Oct-95	29.0	**0.13**	**0.14**	0.068	**0.17**	**0.18**	ND [a]	0.096	0.52	0.28	0.27	0.14	0.5	0.28	4.3	1.4	0.82	0.784	8.51
M-11	951102-M11-01	2708-S047	2-Nov-95	0.2	**8.1**	**18.**	**6.**	**10.**	**6.9**	**2.3**	**9.2**	0.73	0.91	0.82	12.	12.	0.3	0.37	4.2	14.	67.4	45.33
	951102-M11-09	2708-S047	2-Nov-95	39.0	**0.16**	**0.11**	0.046	0.077	**0.13**	ND [a]	0.047	0.85	0.083	0.21	0.063	0.94	0.65	1.5	2.1	0.91	9.723	7.306
	951102-M11-10	2708-S047	2-Nov-95	43.5	**0.26**	**0.14**	0.07	**0.16**	**0.26**	ND [a]	0.076	0.8	0.089	0.4	0.11	1.4	0.65	2.	3.1	1.4	0.966	9.949
MW-01-22	951024-M1-01	2708-S039	24-Oct-95	0.2	**0.41**	**0.66**	ND [a]	**0.61**	**0.64**	ND [a]	**0.75**	ND [a]	ND [a]	ND [a]	1.	0.71	ND [a]	ND [a]	ND [a]	1.	3.07	2.71
	951024-M1-02	2708-S039	24-Oct-95	3.5	**0.91**	**1.5**	**0.74**	**1.7**	**1.3**	**0.4**	**1.8**	ND [b]	ND [b]	ND [b]	2.3	0.79	ND [b]	ND [b]	ND [b]	1.4	8.35	4.49
	951024-M1-06	2708-S039	24-Oct-95	23.5	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	0.19	ND [a]	0.032	ND [a]	ND [a]	0.15	0.089	ND	0.461
MW-02-32	951106-M2-01	2708-S049	6-Nov-95	0.2	0.73	**1.2**	0.49	**1.1**	0.83	0.16	0.69	0.047	0.083	0.14	1.	1.4	ND>0.05	0.053	0.57	1.8	5.2	5.093
	951106-M2-06	2708-S049	6-Nov-95	24.0	0.039	0.036	ND [a]	0.04	0.037	ND [a]	ND [a]	0.2	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	0.08	ND [a]	ND [a]	0.152	0.28
MW-03-56	951101-M3-10	2708-S045	1-Nov-95	31.0	**0.53**	**0.83**	**0.3**	**0.84**	**0.51**	0.098	**0.61**	0.19	0.14	0.14	0.96	1.4	0.16	0.65	0.77	2.	3.718	6.41
	951101-M3-13	2708-S046	1-Nov-95	38.0	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND	ND
	951101-M3-17	2708-S046	1-Nov-95	53.5	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND	ND
	951101-M3-18	2708-S046	1-Nov-95	53.5 (dup)	ND [a]	0.044	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	0.04	0.031	ND [a]	ND [a]	ND [a]	0.042	0.044	0.113
MW-04-57	951030-M4-01	2708-S043	30-Oct-95	0.2	**10.**	**26.**	**10.**	**28.**	**15.**	**4.**	**21.**	ND>5.0	4.4	2.6	35.	12.	ND>5.0	1.7	3.4	22.	114.	81.1
	951030-M4-06	2708-S043	30-Oct-95	25.5	**190.**	**200.**	**68.**	**210.**	**180.**	**24.**	ND [d]	65.	ND [d]	**110.**	190.	640.	49.	**25.**	480.	**830.**	872.	2,389.
	951030-M4-15	2708-S044	30-Oct-95	57.0	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	0.03	ND [a]	ND [a]	ND [a]	0.053	ND [a]	0.08	0.033	0.067	ND	0.263
MW-05-32	951027-M5-01	2708-S042	27-Oct-95	0.2	**0.13**	**0.22**	0.077	**0.15**	**0.13**	ND [a]	**0.11**	ND [a]	ND [a]	ND [a]	0.15	0.2	ND [a]	ND [a]	0.073	0.19	0.817	0.613
	951027-M5-05	2708-S042	27-Oct-95	15.5	**115.**	**170.**	**58.**	**208.**	**130.**	**25.**	**104.**	19.	15.	**41.**	153.	330.	16.	**8.1**	113.	**437.**	810.	1,132.1
	951027-M5-07	2708-S042	27-Oct-95	21.5	0.067	0.039	ND [a]	0.051	0.085	ND [a]	ND [a]	ND [a]	ND [a]	0.072	0.044	0.17	ND [a]	ND [a]	0.15	0.23	0.242	0.666
	951027-M5-10	2708-S042	27-Oct-95	31.5	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND	ND
MW-06-61	951107-M6-01	2708-S050	7-Nov-95	2.5	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND	ND
	951107-M6-08	2708-S050	7-Nov-95	30.0	**340.**	**170.**	**120.**	**190.**	**450.**	**25.**	**94.**	**2,350.**	25.	**1,420.**	130.	1,900.	**990.**	**3,650.**	5,780.	**2,980.**	1,389.	19,225.
	951107-M6-10	2708-S050	7-Nov-95	38.5	0.042	ND [a]	ND [a]	ND [a]	0.066	ND [a]	ND [a]	0.22	ND [a]	0.16	ND [a]	0.22	0.095	0.076	0.6	0.34	0.108	1.711
	951107-M6-11	2708-S050	7-Nov-95	43.0	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	0.056	ND [a]	ND	0.056
ODEQ Soil Cleanup Levels [2]					0.1	0.1	0.1	0.1	0.1	0.1	0.1	2,000.	#	20,000.	#	8,000.	2,000.	30.	#	6,000.	#	#
EPA PRGs for Industrial Soil [3]					2.61	2.61	26.13	0.26	7.2	0.26	2.61	110.	#	5.7	#	27,251.	90.	240.	#	100.	#	#

Note:
DEQ = Oregon Department of Environmental Quality
EPA = U.S. Environmental Protection Agency
mg/kg = milligrams/kilogram
ND = Not detected above detection limit indicated
PAHs = polynuclear aromatic hydrocarbons
ppm = parts per million

# = Reference level not established
1 = Sample number prefix: 2708-
2 = Reference Levels are Soil Cleanup Levels in the Soil Cleanup Table (OAR 340-122-045)
3 = Reference Levels are EPA Region 9 Preliminary Remediation Goals (PRGs) for Industrial Soil
Bold = Detected above Reference Levels

a = detection limit is 0.05 mg/kg (ppm)
b = detection limit is 0.2 mg/kg (ppm)
c = detection limit is 1 mg/kg (ppm)
d = detection limit is 100 mg/kg (ppm)
e = detection limit is 0.5 mg/kg (ppm)
f = detection limit is 0.7 mg/kg (ppm)

Table G-2 – Summary of Analytical Results for Soil Samples, PAHs by EPA Method 8270 (SIM)

Remedial Investigation
Northwest Natural - Gasco Facility
Portland, Oregon

Project No. 2708

PAHs by EPA Method 8270 (SIM)					Analytical Results mg/kg (ppm)																	
					Carcinogenic PAHs							Non-carcinogenic PAHs										
Soil Boring	Sample Number	Chain of Custody No.	Sample Date	Sample Depth (feet bgs)	Benzo (a) anthracene	Benzo (b) fluoranthene	Benzo (k) fluoranthene	Benzo (a) pyrene	Chrysene	Dibenzo (ah) anthracene	Indeno (1,2,3-cd) pyrene	Acenaphthene	Acenaphthylene	Anthracene	Benzo (ghi) perylene	Fluoranthene	Fluorene	Naphthalene	Phenanthrene	Pyrene	Total Carcinogenic PAHs	Total PAHs
MW-08-56	951025-M8-01	2708-S040	25-Oct-95	0.2	**12.**	**39.6**	**13.8**	**41.7**	**20.5**	**9.1**	**46.2**	ND>0.50	3.2	1.8	56.5	6.7	ND [a]	2.2	1.4	26.1	203.4	97.9
	951025-M8-11	2708-S040	25-Oct-95	44.0	0.17	0.12	0.053	0.15	0.21	ND [a]	0.08	0.74	0.3	0.22	0.13	0.6	0.48	2.6	1.5	0.71	0.783	7.28
	951025-M8-15	2708-S041	25-Oct-95	55.0	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	0.057	ND [a]	0.065	ND [a]	0.31	0.11	0.1	ND	0.642
MW-09-29	951023-M9-01	2708-S037	23-Oct-95	0.2	**1.4**	**2.7**	0.88	**2.5**	**1.9**	0.42	**1.9**	0.12	0.17	0.31	2.6	2.2	0.055	0.087	0.96	3.3	11.7	9.802
	951023-M9-04	2708-S037	23-Oct-95	5.0	**7.4**	**19.6**	**5.**	**14.4**	**13.3**	**2.7**	**16.1**	0.12	1.3	2.	22.6	17.9	0.4	1.2	8.6	30.4	78.5	84.52
	951023-M9-05	2708-S037	23-Oct-95	11.5	0.028	0.035	ND [a]	0.032	0.041	ND [a]	0.027	ND [a]	ND [a]	0.03	0.036	0.076	ND [a]	ND [a]	0.096	0.12	0.163	0.358
MW-10-61	951108-M10-01	2708-S052	8-Nov-95	0.2	**6.7**	**11.**	**5.1**	**9.5**	**6.3**	**1.4**	**5.**	0.83	ND [a]	1.7	6.7	11.	0.23	0.081	3.3	9.9	45.	33.741
	951108-M10-02	2708-S052	8-Nov-95	0.2 (dup)	**10.**	**17.**	**6.2**	**14.**	**7.5**	**2.2**	**7.2**	1.1	ND [a]	1.1	9.	14.	0.36	0.13	5.2	12.	64.1	42.89
	951108-M10-09	2708-S052	8-Nov-95	28.0	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	0.038	ND [a]	0.038	ND [a]	0.078	ND [a]	0.23	0.22	0.16	ND	0.764
MW-12-36	951023-M12-01	2708-S037	23-Oct-95	0.2	**8.5**	**15.3**	**5.2**	**13.3**	**12.3**	**2.2**	**8.7**	1.5	0.23	2.	10.8	12.4	0.54	0.34	5.8	17.1	65.5	50.71
	951023-M12-06	2708-S038	23-Oct-95	22.0	ND [a]	ND [a]	ND [a]	ND [a]	0.27	ND [a]	ND [a]	0.34	ND [a]	0.99	ND [a]	0.97	0.4	0.23	4.	1.4	0.27	8.33
	951023-M12-07	2708-S038	23-Oct-95	26.5	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND	ND
GT-1	971117-001	2708-S054	17-Nov-97	3.0	0.27	0.5	0.16	0.58	0.25	ND [a]	0.48	ND [a]	ND [a]	ND [a]	1.	0.38	ND [a]	ND [a]	0.06	0.66	2.24	2.1
	971117-004	2708-S054	17-Nov-97	10.5	ND [f]	ND [f]	ND [f]	ND [f]	ND [f]	ND [f]	ND [f]	**1.4**	ND [f]	0.97	ND [f]	ND [f]	2.1	ND [f]	ND [f]	1.7	ND	6.17
	971117-006	2708-S054	17-Nov-97	16.0	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND	ND
	971117-008	2708-S054	17-Nov-97	20.5	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND	ND
	971117-011	2708-S054	17-Nov-97	35.5	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND	ND
GT-2	971117-012	2708-S054	17-Nov-97	3.5	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	0.084	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND	0.084
	971117-017	2708-S055	17-Nov-97	15.5	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND	ND
	971117-021	2708-S055	17-Nov-97	33.0	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND	ND
GT-3	971118-023	2708-S056	18-Nov-97	3.0	**2.2**	**3.3**	**8.4**	**3.8**	**1.8**	ND [a]	**2.4**	0.33	0.29	0.11	4.1	7.5	ND [a]	0.14	0.12	8.6	21.9	21.19
	971118-026	2708-S056	18-Nov-97	12.5	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	0.05	ND [a]	ND [a]	ND [a]	0.049	ND	0.099
	971118-032	2708-S056	18-Nov-97	36.0	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND	ND
GT-4	971118-034	2708-S056	18-Nov-97	13.5	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND	ND
	971118-038	2708-S057	18-Nov-97	40.5	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND	ND
MW-13	971218-M13-02	2708-S058	18-Dec-97	6.0	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND	ND
	971218-M13-03	2708-S058	18-Dec-97	10.0	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND	ND
	971218-M13-04	2708-S058	18-Dec-97	13.5	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND	ND
	971218-M13-05	2708-S058	18-Dec-97	18.0	0.09	0.071	ND [a]	0.061	0.12	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	0.16	ND [a]	0.23	0.093	0.17	0.342	0.653
	971218-M13-08	2708-S058	18-Dec-97	24.5	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND	ND
	971218-M13-10	2708-S058	18-Dec-97	28.0	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	0.058	ND [a]	ND	0.058
	971218-M13-11	2708-S058	18-Dec-97	31.0	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND	ND
	971218-M13-17	2708-S059	18-Dec-97	57.0	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND	ND
ODEQ Soil Cleanup Levels [2]					0.1	0.1	0.1	0.1	0.1	0.1	0.1	2,000.	#	20,000.	#	8,000.	2,000.	30.	#	6,000.	#	#
EPA PRGs for Industrial Soil [3]					2.61	2.61	26.13	0.26	7.2	0.26	2.61	110.	#	5.7	#	27,251.	90.	240.	#	100.	#	#

Note:
DEQ = Oregon Department of Environmental Quality
EPA = U.S. Environmental Protection Agency
mg/kg = milligrams/kilogram
ND = Not detected above detection limit indicated
PAHs = polynuclear aromatic hydrocarbons
ppm = parts per million

# = Reference level not established
1 = Sample number prefix: 2708-
2 = Reference Levels are Soil Cleanup Levels in the Soil Cleanup Table (OAR 340-122-045)
3 = Reference Levels are EPA Region 9 Preliminary Remediation Goals (PRGs) for Industrial Soil
Bold = Detected above Reference Levels

a = detection limit is 0.05 mg/kg (ppm)
b = detection limit is 0.2 mg/kg (ppm)
c = detection limit is 1 mg/kg (ppm)
d = detection limit is 100 mg/kg (ppm)
e = detection limit is 0.5 mg/kg (ppm)
f = detection limit is 0.7 mg/kg (ppm)

TABLE G-3 – Summary of Analytical Results for Soil Samples
Phenols by EPA Method 8270

Remedial Investigation
Northwest Natural - Gasco Facility
Portland, Oregon

Project No. 2708

Phenols by EPA Method 8270					Analytical Results mg/kg (ppm)															
Soil Boring	Sample Number	Chain of Custody Number	Sample Date	Sample Depth (feet bgs)	4-Chloro-3-methylphenol	2-Chlorophenol	2,4-Dichlorophenol	2,4-Dimethylphenol	2,4-Dinitrophenol	2-Methyl-4,6-dinitrophenol	Cresols, Total	4-Methylphenol	2-Nitrophenol	4-Nitrophenol	2,3,4,6-Tetrachlorophenol	Pentachlorophenol	Phenol	2,4,5-Trichlorophenol	2,4,6-Trichlorophenol	Total Phenols
B-03	950921-B3-05	2708-S007	21-Sep-95	10.5	ND>1.7	ND>1.7	ND>1.7	ND>1.7	ND>3.3	ND>1.7	ND>1.7	ND>1.7	ND>1.7	ND>1.7	ND>1.7	ND>1.7	ND>1.7	ND>1.7	ND>1.7	ND
B-10	950925-B10-04	2708-S013	25-Sep-95	17.5	ND>5.1	ND>5.1	ND>5.1	ND>5.1	ND>9.9	ND>5.1	ND>5.1	ND>5.1	ND>5.1	ND>5.1	ND>5.1	ND>5.1	ND>5.1	ND>5.1	ND>5.1	ND
B-13	951006-B13-03	2708-S035	6-Oct-95	10.5	ND>51	ND>51	ND>51	ND>51	ND>99	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND
B-17	950929-B17-05	2708-S022	29-Sep-95	16.5	ND>5.1	ND>5.1	ND>5.1	ND>5.1	ND>9.9	ND>5.1	ND>5.1	ND>5.1	ND>5.1	ND>5.1	ND>5.1	ND>5.1	ND>5.1	ND>5.1	ND>5.1	ND
B-18	950919-B18-05	2708-S003	19-Sep-95	12.0	ND>0.17	ND>0.17	ND>0.17	ND>0.17	ND>0.17	ND>0.17	ND>0.17	ND>0.17	ND>0.17	ND>0.17	ND>0.17	**0.36**	ND>0.17	ND>0.17	ND>0.17	0.36
B-19	950919-B19-01	2708-S003	19-Sep-95	0.2	ND>0.17	ND>0.17	ND>0.17	ND>0.17	ND>0.33	ND>0.17	ND>0.17	ND>0.17	ND>0.17	ND>0.17	ND>0.17	ND>0.17	ND>0.17	ND>0.17	ND>0.17	ND
B-19	950919-B19-03	2708-S004	19-Sep-95	6.5	ND>26	ND>26	ND>26	ND>26	ND>50	ND>26	ND>26	ND>26	ND>26	ND>26	ND>26	ND>26	ND>26	ND>26	ND>26	ND
B-20	950929-B20-03	2708-S022	29-Sep-95	10.5	ND>26	ND>26	ND>26	ND>26	ND>50	ND>26	ND>26	ND>26	ND>26	ND>26	ND>26	ND>26	ND>26	ND>26	ND>26	ND
B-22	951003-B22-05	2708-S027	3-Oct-95	13.5	ND>0.17	ND>0.17	ND>0.17	ND>0.17	ND>0.33	ND>0.17	ND>0.17	ND>0.17	ND>0.17	ND>0.17	ND>0.17	ND>0.17	ND>0.17	ND>0.17	ND>0.17	ND
B-22	951003-B22-09	2708-S028	3-Oct-95	24.0	ND>0.17	ND>0.17	ND>0.17	ND>0.17	ND>.33	ND>0.17	ND>0.17	ND>0.17	ND>0.17	ND>0.17	ND>0.17	ND>0.17	ND>0.17	ND>0.17	ND>0.17	ND
B-23	951003-B23-08	2708-S029	3-Oct-95	26.5	ND>0.8	ND>0.8	ND>0.8	ND>0.8	ND>2.0	ND>0.8	ND>0.8	ND>0.8	ND>0.8	ND>0.8	ND>0.8	ND>0.8	ND>0.8	ND>0.8	ND>0.8	ND
B-26	951003-B26-06	2708-S030	4-Oct-95	20.5	ND>51	ND>51	ND>51	ND>51	ND>99	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND
B-27	950920-B27-10	2708-S005	20-Sep-95	23.0	ND>26	ND>26	ND>26	ND>26	ND>50	ND>26	ND>26	ND>26	ND>26	ND>26	ND>26	ND>26	ND>26	ND>26	ND>26	ND
B-28	951002-B28-01	2708-S025	2-Oct-95	0.2	ND>5.1	ND>5.1	ND>5.1	ND>5.1	ND>9.9	ND>5.1	ND>5.1	ND>5.1	ND>5.1	ND>5.1	ND>5.1	ND>5.1	ND>5.1	ND>5.1	ND>5.1	ND
B-28	951002-B28-07	2708-S025	2-Oct-95	15.0	ND>51	ND>51	ND>51	ND>51	ND>99	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND
B-29	950922-B29-15	2708-S012	22-Sep-95	35.5	ND>51	ND>51	ND>51	ND>51	ND>99	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND
B-30	950922-B30-06	2708-S010	22-Sep-95	11.5	ND>51	ND>51	ND>51	ND>51	ND>99	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND
B-31	950925-B31-06	2708-S014	25-Sep-95	21.0	ND>51	ND>51	ND>51	ND>51	ND>99	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND
B-33	951005-B33-03	2708-S034	5-Oct-95	5.5	ND>51	ND>51	ND>51	ND>51	ND>99	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND
B-33	951005-B33-14	2708-S034	5-Oct-95	54.0	ND>17	ND>17	ND>17	ND>17	ND>33	ND>17	ND>17	ND>17	ND>17	ND>17	ND>17	ND>17	ND>17	ND>17	ND>17	ND
B-35	951005-B35-01	2708-S033	5-Oct-95	0.2	ND>.17	ND>.17	ND>.17	ND>.17	ND>.33	ND>.17	ND>.17	ND>.17	ND>.17	ND>.17	ND>.17	ND>.17	ND>.17	ND>.17	ND>.17	ND
MW-04-57	951030-M4-01	2708-S043	30-Oct-95	0.2	ND>51	ND>51	ND>51	ND>51	ND>99	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND
MW-04-57	951030-M4-06	2708-S043	30-Oct-95	25.5	ND>51	ND>51	ND>51	ND>51	ND>99	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND
MW-10-60	951108-M10-01	2708-S052	8-Nov-95	0.2	ND>3.4	ND>3.4	ND>3.4	ND>3.4	ND>6.6	ND>3.4	ND>3.4	ND>3.4	ND>3.4	ND>3.4	ND>3.4	ND>3.4	ND>3.4	ND>3.4	ND>3.4	ND
MW-12-34	951023-M12-06	2708-S038	23-Oct-95	22.0	ND>1.7	ND>1.7	ND>1.7	ND>1.7	ND>3.3	ND>1.7	ND>1.7	ND>1.7	ND>1.7	ND>1.7	ND>1.7	ND>1.7	ND>1.7	ND>1.7	ND>1.7	ND
ODEQ Soil Cleanup Levels [2]					#	#	#	#	#	#	#	#	#	#	#	5	#	#	2	#
EPA PRGs for Industrial Soil [3]					#	367	2,044	13,625	1,363	#	34,063	3,406	#	#	20,438	7.95	100,000	68,126	173	#

Note: DEQ = Oregon Department of Environmental Quality
EPA = U.S. Environmental Protection Agency
mg/kg = milligrams/kilogram
ND = Not detected above detection limit indicated

[1] = Sample number prefix: 2708-
[2] = Reference Levels are Soil Cleanup Levels in the Soil Cleanup Table (OAR 340-122-045)
[3] = Reference Levels are EPA Region 9 Preliminary Remediation Goals (PRGs) for Industrial Soil
# = Reference level not established

TABLE G-4 – Summary of Analytical Results for Soil Samples
Priority Pollutant Metals by EPA Methods 6010 and 7470

Remedial Investigation
Northwest Natural - Gasco Facility
Portland, Oregon

Project No. 2708

Total Metals by EPA Method 6010 and 7470					Analytical Results mg/kg (ppm)												
Soil Boring	Sample Number[1]	Chain of Custody Number	Sample Date	Sample Depth (feet bgs)	Antimony	Arsenic	Beryllium	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Silver	Thallium	Zinc
B-1	950921-B1-01	2708-S009	21-Sep-95	0.2	ND>1.0	**6.6**	ND>1.0	ND>1.0	26.	41.	60.	ND>0.10	21.	ND>1.0	ND>1.0	4.1	140.
	950921-B1-02	2708-S009	21-Sep-95	0.2	6.6	**21.**	ND>1.0	1.1	30.	60.	58.	ND>0.10	26.	ND>1.0	ND>1.0	7.6	160.
	950921-B1-05	2708-S009	21-Sep-95	10.5	ND>1.0	**14.**	ND>1.0	3.4	11.	80.	130.	ND>0.10	36.	ND>1.0	ND>1.0	3.	670.
B-2	950927-B2-05	2708-S016	27-Sep-95	16.0	ND>1.0	**4.9**	ND>1.0	4.3	12.	20.	15.	ND>0.10	31.	ND>1.0	ND>1.0	3.8	3,000.
B-3	950921-B3-05	2708-S007	21-Sep-95	10.5	ND>1.0	**7.**	ND>1.0	ND>1.0	30.	36.	22.	ND>0.10	41.	ND>1.0	ND>1.0	5.	120.
GT-1	971117-001	2708-S054	17-Nov-97	3.0		1.8											
	971117-004	2708-S054	17-Nov-97	10.5		1.8											
	971117-006	2708-S054	17-Nov-97	16.0		**2.4**											
	971117-008	2708-S054	17-Nov-97	20.5		1.5											
	971117-011	2708-S054	17-Nov-97	35.5		1.2											
GT-2	971117-012	2708-S054	17-Nov-97	3.5		1.1											
	971117-017	2708-S055	17-Nov-97	15.5		2.2											
	971117-021	2708-S055	17-Nov-97	33.0		ND>1.0											
GT-3	971118-023	2708-S056	18-Nov-97	3.0		**2.7**											
	971118-026	2708-S056	18-Nov-97	12.5		1.9											
	971118-032	2708-S056	18-Nov-97	36.0		1.											
GT-4	971118-034	2708-S056	18-Nov-97	13.5		2.											
	971118-038	2708-S057	18-Nov-97	40.5		1.3											
MW-13	971218-M13-02	2708-S058	18-Dec-97	6.0		**2.7**											
	971218-M13-03	2708-S058	18-Dec-97	10.0		**2.8**											
	971218-M13-04	2708-S058	18-Dec-97	13.5		**2.7**											
	971218-M13-05	2708-S058	18-Dec-97	18.0		**2.5**											
	971218-M13-08	2708-S058	18-Dec-97	24.5		1.8											
	971218-M13-10	2708-S058	18-Dec-97	28.0													
	971218-M13-11	2708-S058	18-Dec-97	31.0		1.8											
	971218-M13-17	2708-S059	18-Dec-97	57.0													
ODEQ Industrial Maximum Allowable Soil Concentration [2] ->					#	3.	1.	1,000.	1,500.	80,000.	2,000.	600.	40,000.	#	10,000.	#	#
EPA PRGs for Industrial Soil [3] ->					681.	2.38	1.11	850.	64.1	63,263.	1,000.	#	#	8,517.	8,517.	136.27	100,000.

Note:
ODEQ = Oregon Department of Environmental Quality
EPA = U.S. Environmental Protection Agency
mg/kg = milligrams/kilogram
ND = not detected above detection limit indicated
ppm = parts per million
PRGs = EPA Region 9 Preliminary Remediation Goals

# = Reference level not established
1 = Sample number prefix: 2708-
2 = Reference Levels based on Oregon Soil Cleanup Table (OAR 340-122-045)
3 = Reference Levels are EPA Region 9 Preliminary Remediation Goals (PRGs) for Industrial Soil
Bold and Shaded = Detected above Reference Level

APPENDIX H

Groundwater Quality Data

Summary Figures

Summary Tables

Time Concentration Charts

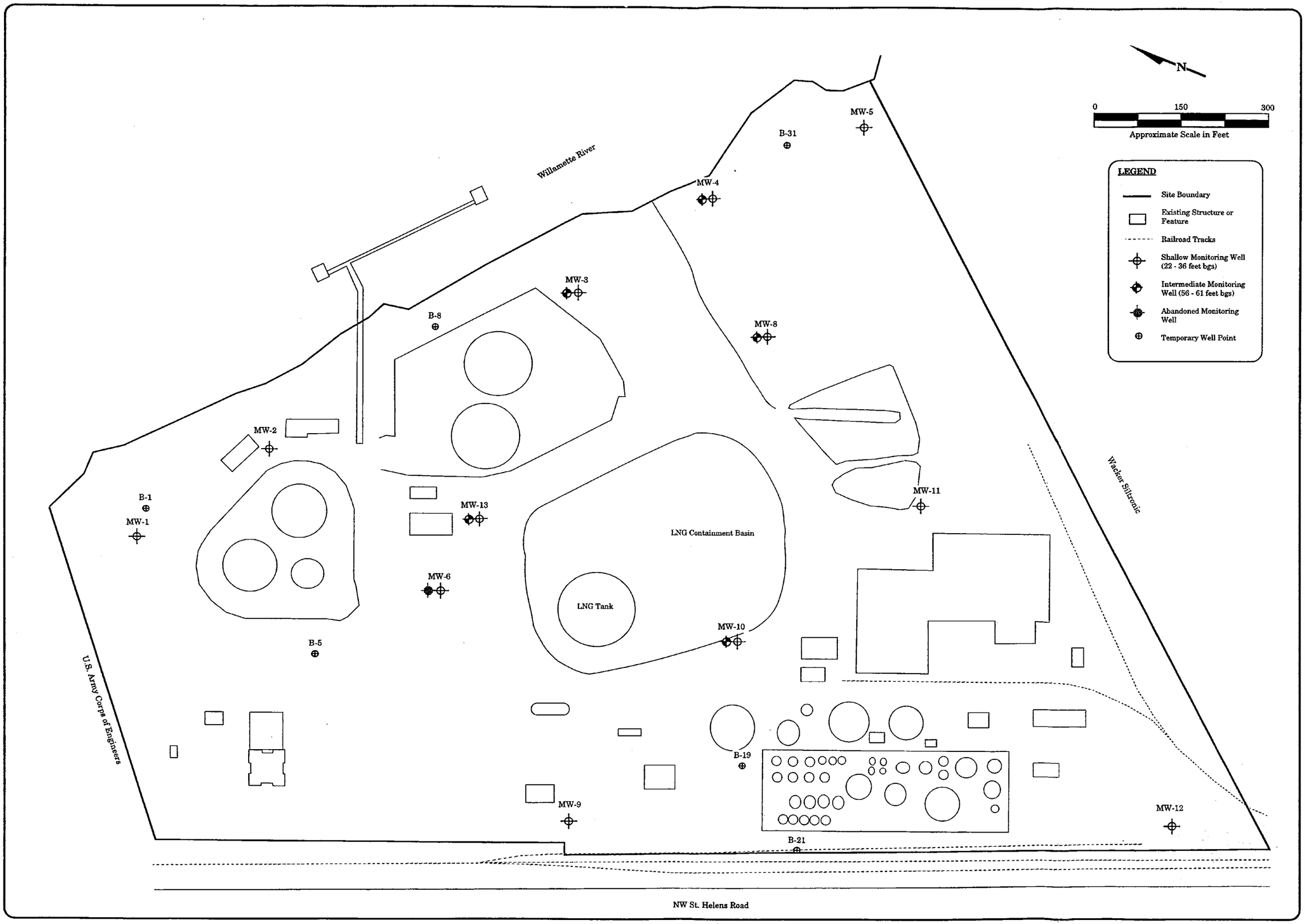

Figure
H-1

Monitoring Well and Temporary Well Point Location Map

RI/FS
Northwest Natural - Gasco Facility
7540 NW St. Helens Road
Portland, Oregon

HAHN & ASSOCIATES, INC.
ENVIRONMENTAL MANAGEMENT
434 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209
503/796-0717

February 1998

Project #2708

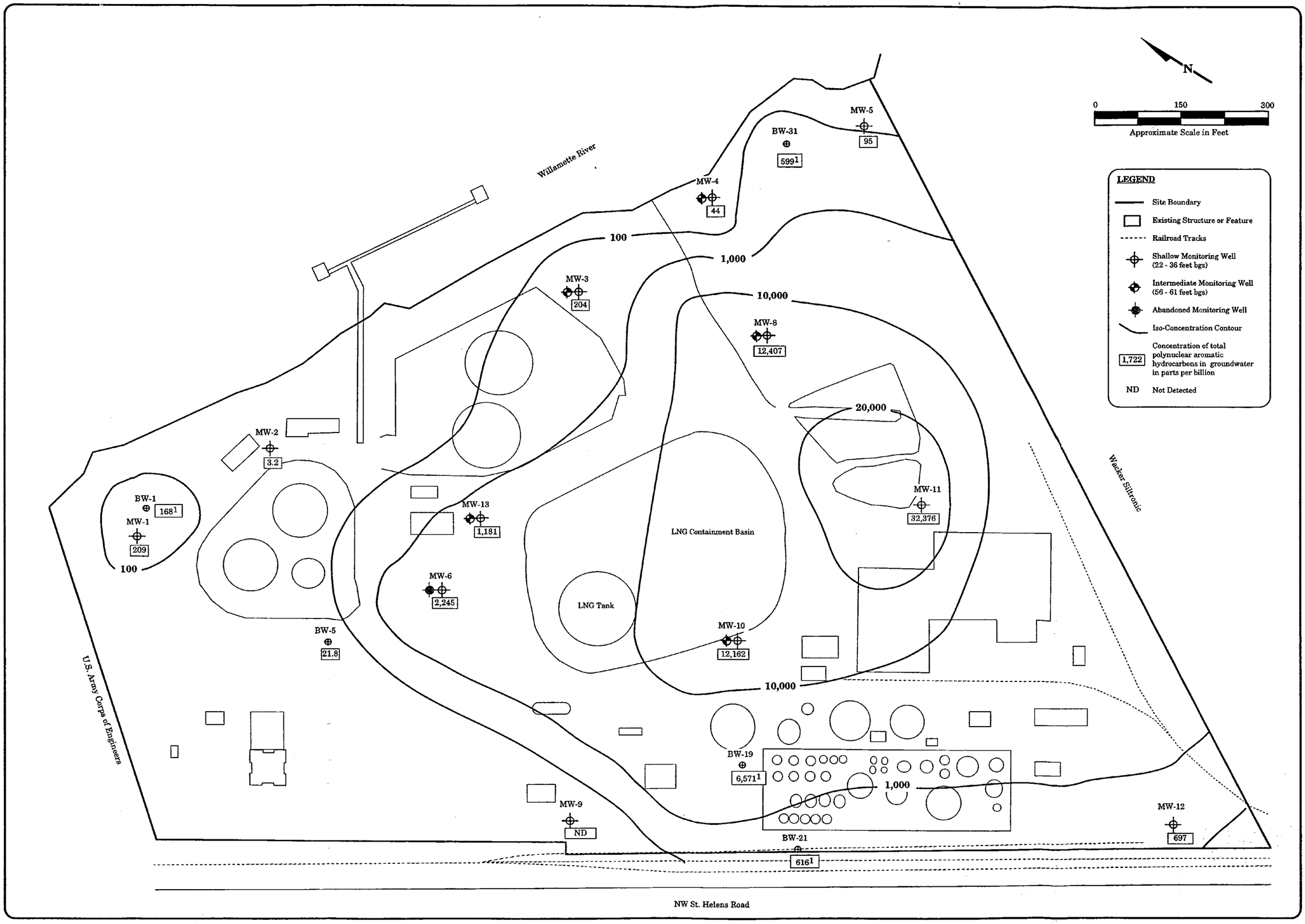

Figure
H-2

Groundwater Iso-Concentration Map for Total PAHs:
Surficial Fill Zone : June 1998

Remedial Investigation
Northwest Natural - Gasco Facility
7900 NW St. Helens Road
Portland, Oregon

HAHN & ASSOCIATES, INC.
ENVIRONMENTAL MANAGEMENT
434 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209
503/796-0717

September 1998

Project #2708

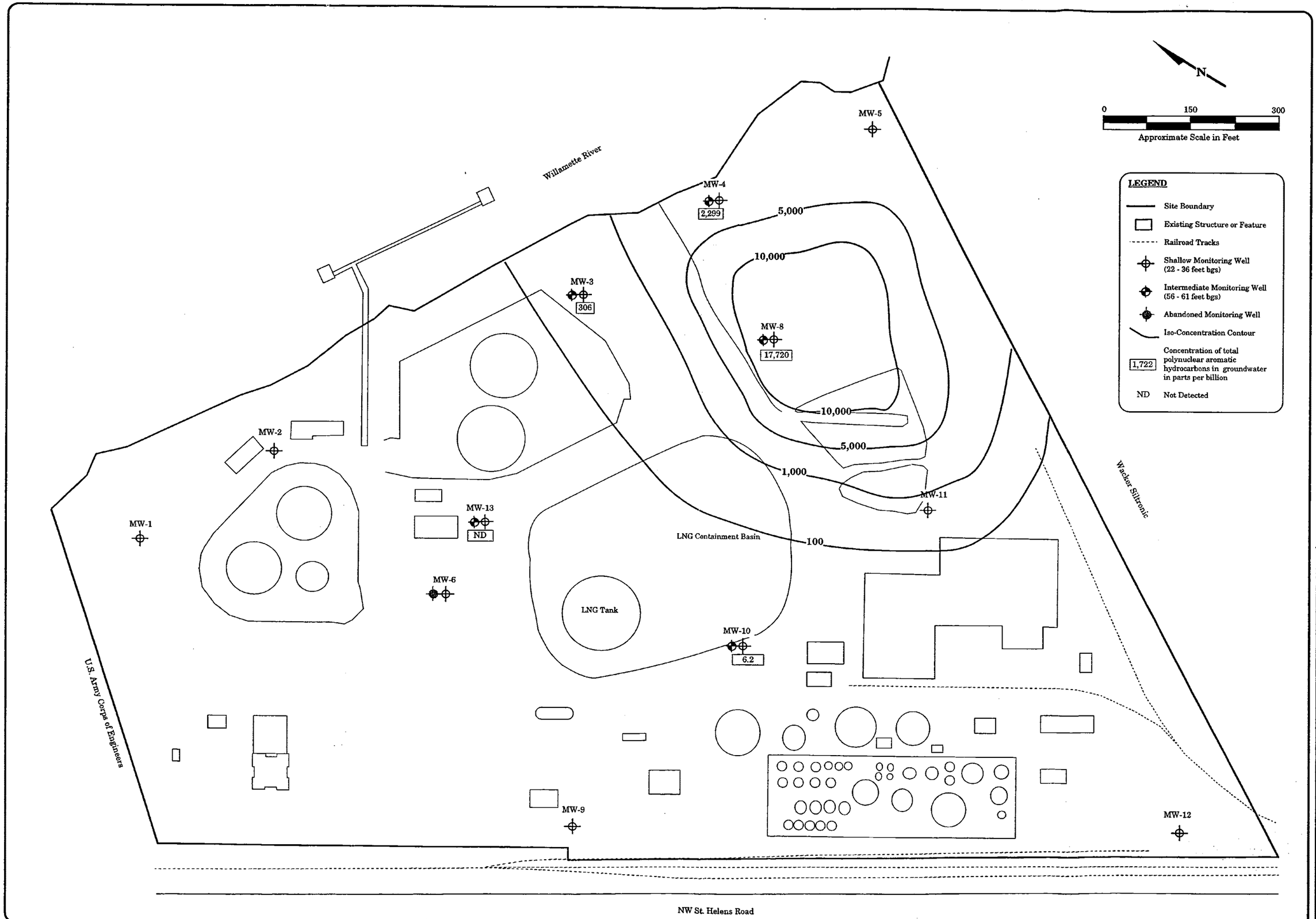

Figure
H-3

Groundwater Iso-Concentration Map for Total PAHs:
Alluvial Sand Zone: (Intermediate-Depth) : June 1998

Remedial Investigation
Northwest Natural - Gasco Facility
7900 NW St. Helens Road
Portland, Oregon

HAHN & ASSOCIATES, INC.

ENVIRONMENTAL MANAGEMENT
434 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209
503/796-0717

September 1998

Project #2708

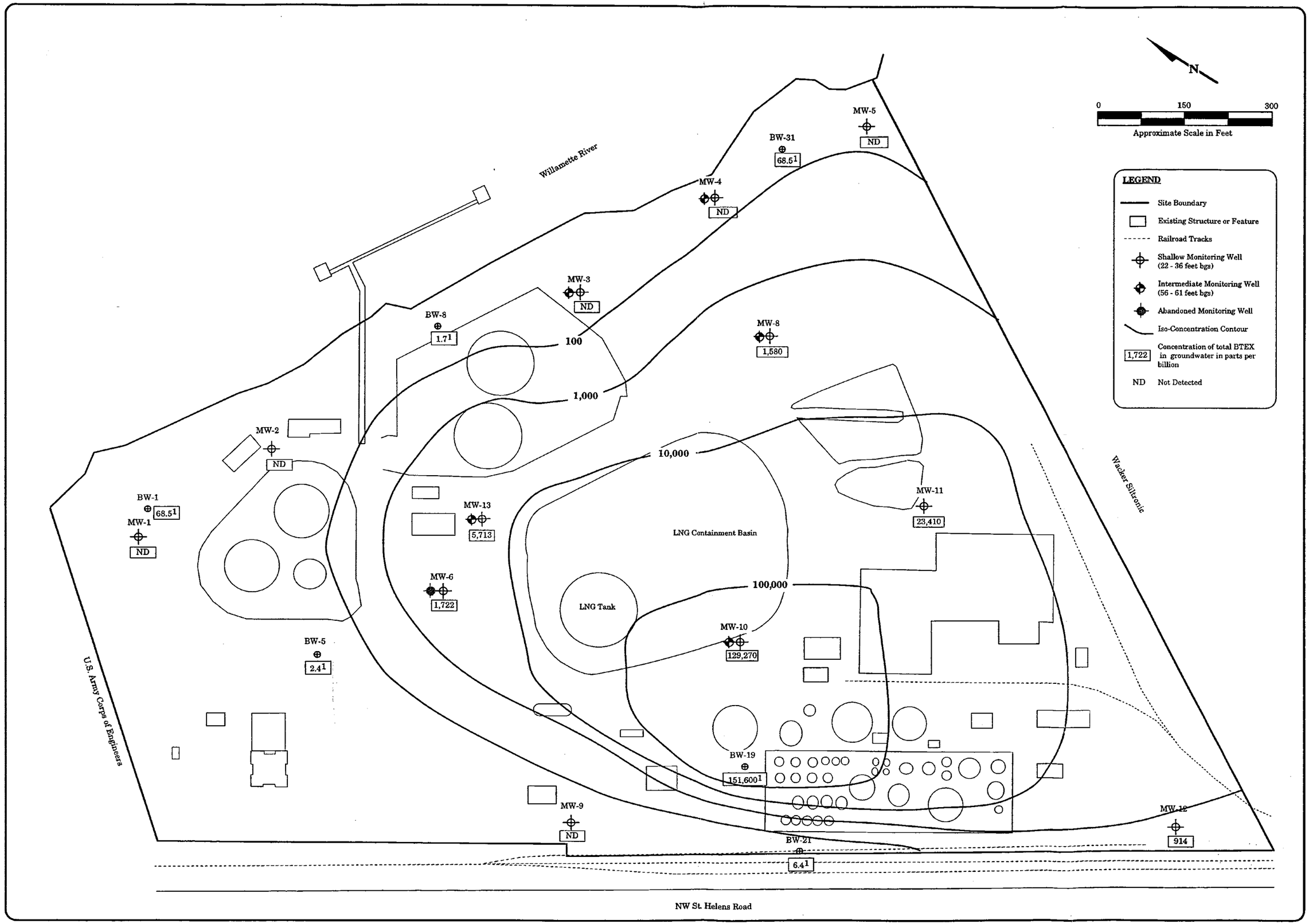

Figure
H-4

Groundwater Iso-Concentration Map for Total BTEX: Surficial Fill Zone: June 1998

Remedial Investigation
Northwest Natural - Gasco Facility
7900 NW St. Helens Road
Portland, Oregon

HAHN & ASSOCIATES, INC.
ENVIRONMENTAL MANAGEMENT
434 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209
503/796-0717

September 1998

Project #2708

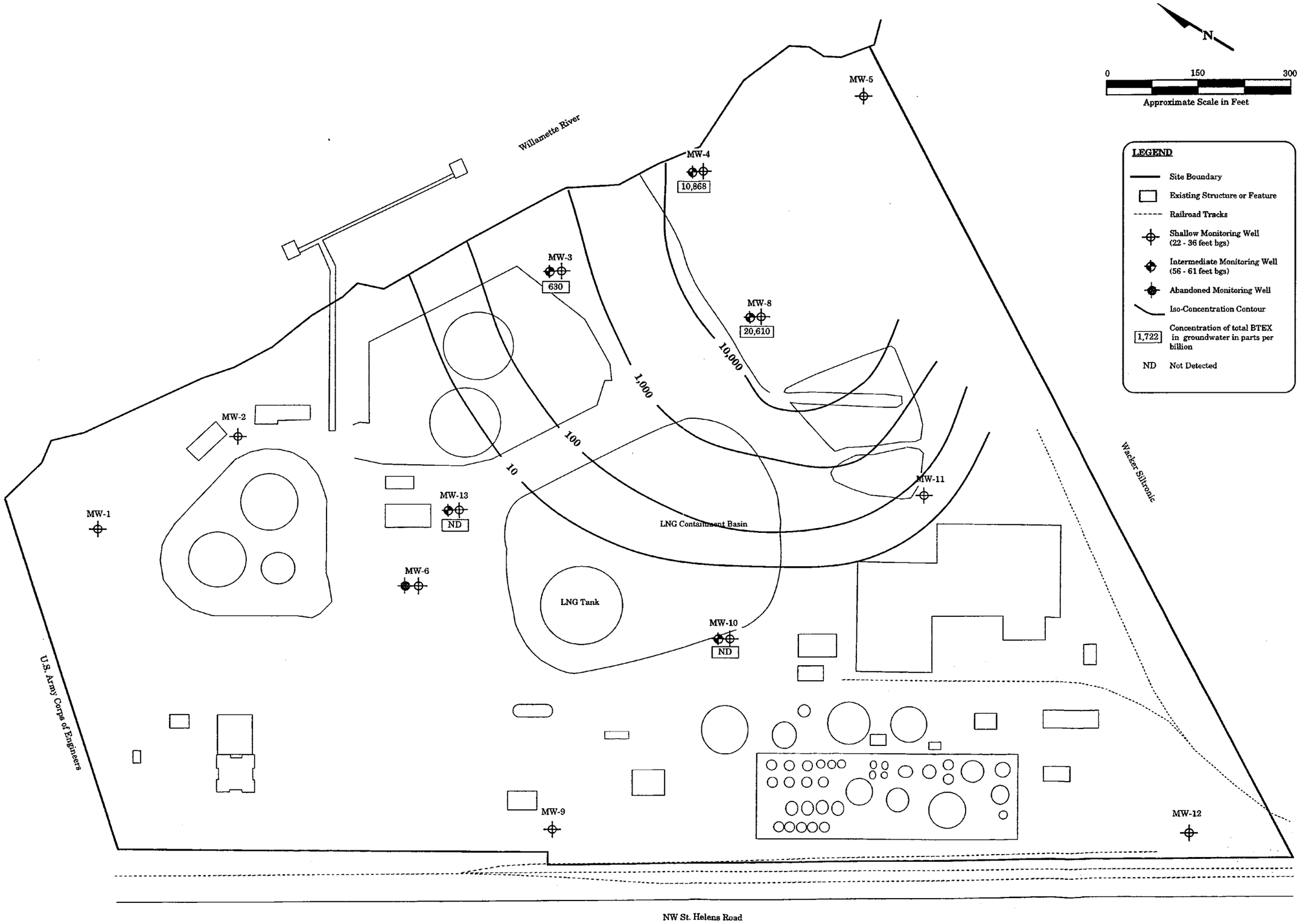

Figure
H-5

Groundwater Iso-Concentration Map for Total BTEX: Alluvial Sand Zone: Intermediate Depth June 1998

Remedial Investigation
Northwest Natural - Gasco Facility
7900 NW St. Helens Road
Portland, Oregon

HAHN & ASSOCIATES, INC.
ENVIRONMENTAL MANAGEMENT
434 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209
503/796-0717

September 1998

Project #2708

Table H-1 - Summary of Historical Analytical Results for Groundwater Samples - Monitoring Wells, December 1995 to Present
BTEX, Total PAHs, Total Phenols, and Cyanide

Remedial Investigation
Northwest Natural - Gasco Facility
Portland, Oregon

Project No. 2708

Well Number	HAI Sample Number[1]	Chain of Custody Number	Sample Date	Analytical Results									
				EPA Method 8020 ug/l (ppb)					EPA Method 8270 SIM ug/l (ppb)		EPA Method 8270 ug/l (ppb)	EPA Method 9010 mg/l (ppm)	EPA Method 901 mg/l (ppm)
				Benzene	Toluene	Ethyl benzene	Xylenes	Total BTEX	Carcinogenic PAHs	Total PAHs	Total Phenols	Total Cyanide	Amenable Cyanide
MW01-22	951207-MW1-22-01	2708-W011	7-Dec-95	13.	2.	1.8	3.2	20.	93.4	465.3		1.08	
	960319-MW1-22-01	2708-W014	19-Mar-96	3.5	3.5	2.3	23.	32.3	4.71	140.45		0.86	
	960618-MW1-22-01	2708-W018	18-Jun-96	2.4	9.5	3.2	15.	30.1	2.2	112.		1.91	
	961001-MW1-22-01	2708-W021	1-Oct-96	8.5	9.	7.7	72.	97.2	6.2	720.17		5.7	
	970225-MW1-22-01	2708-W024	25-Feb-97	3.2	1.7	ND>0.5	8.5	13.4	0.91	67.		1.24	
	970225-MW1-22-02	2708-W024	25-Feb-97	1.5	1.6	0.7	11.	14.8	2.2	64.			
	970827-MW1-22-01	2708-W027	27-Aug-97	7.5	8.2	6.9	62.	84.6	20.	988.2		11.	
	970827-MW1-22-02	2708-W027	27-Aug-97	6.7	7.4	6.2	55.	75.3	28.1	737.5		10.	
	980217-MW1-22-01	2708-W030	17-Feb-98	ND>0.5	ND>0.5	ND>0.5	1.6	1.6	4.45	23.23		0.34	ND>0.01
	980602-MW1-32-11	2708-W033	2-Jun-98	ND>0.5	ND>0.5	ND>0.5	ND>1.5	ND	93.	209.		0.46	0.045
MW02-32	951206-MW2-32-01	2708-W010	6-Dec-95	6.	ND>0.5	4.2	2.4	12.6	ND	51.55		0.353	
	960318-MW2-32-01	2708-W013	18-Mar-96	ND>0.5	ND>0.5	ND>0.5	ND>0.5	ND	ND	4.54		0.26	
	960618-MW2-32-01	2708-W018	18-Jun-96	ND>0.5	ND>0.5	ND>0.5	ND>0.5	ND	ND	2.6		0.44	
	961001-MW2-32-01	2708-W021	1-Oct-96	ND>0.5	ND>0.5	ND>0.5	ND>0.5	ND	ND	10.53		0.22	
	970225-MW2-32-01	2708-W024	25-Feb-97	ND>0.5	ND>0.5	ND>0.5	ND>0.5	ND	ND	1.6		0.16	
	970827-MW2-32-01	2708-W027	27-Aug-97	ND>0.5	ND>0.5	ND>0.5	ND>1.5	ND	0.2	18.04		0.28	
	980217-MW2-32-01	2708-W030	17-Feb-98	ND>0.5	ND>0.5	ND>0.5	ND>1.5	ND	ND	5.02		0.16	ND>0.01
	980601-MW2-32-05	2708-W032	1-Jun-98	ND>0.5	ND>0.5	ND>0.5	ND>1.5	ND	ND	3.2		0.26	ND>0.01
MW03-26	951206-MW3-26-01	2708-W010	6-Dec-95	30.	0.98	0.65	1.4	33.03	21.04	85.24			
	960318-MW3-26-02	2708-W013	18-Mar-96	1,300.	5.	2.2	5.6	1,312.8	1.71	42.39		0.27	
	960618-MW3-26-01	2708-W018	18-Jun-96	2,300.	22.	ND>10	27.	2,349.	2.6	48.		0.25	
	961001-MW3-26-01	2708-W021	1-Oct-96	0.55	0.95	ND>0.5	2.4	3.9	182.	334.		0.34	
	970225-MW3-26-01	2708-W024	25-Feb-97	130.	ND>0.5	ND>0.5	ND>0.5	130.	4.9	11.9		0.28	
	970827-MW3-26-01	2708-W027	27-Aug-97	ND>0.5	ND>0.5	ND>0.5	ND>1.5	ND	27.6	53.2		2.3	
	980217-MW3-26-01	2708-W030	17-Feb-98	2.	ND>0.5	ND>0.5	ND>1.5	2.	7.07	13.45		0.5	ND>0.01
	980602-MW3-26-09	2708-W033	2-Jun-98	ND>0.5	ND>0.5	ND>0.5	ND>1.5	ND	100.	204.		0.76	ND>0.01
MW03-56	951206-MW3-56-01	2708-W010	6-Dec-95	1,200.	24.	34.	90.	1,348.	2.69	1,384.75	ND		
	960319-MW3-56-01	2708-W014	19-Mar-96	730.	16.	27.	66.	839.	2.34	1,926.62		0.19	
	960620-MW3-56-01	2708-W019	20-Jun-96	730.	7.1	26.	73.	836.1	1.6	1,491.		0.08	
	961002-MW3-56-01	2708-W022	2-Oct-96	450.	ND>5	11.	27.	488.	0.54	938.		0.094	
	970226-MW3-56-01	2708-W025	26-Feb-97	750.	ND>5	ND>5	ND>5	750.	0.62	618.		0.13	
	970828-MW3-56-01	2708-W028	28-Aug-97	340.	0.9	2.5	11.	354.4	0.82	195.52		0.11	
	980218-MW3-56-01	2708-W031	18-Feb-98	520.	0.89	2.9	15.	538.79	0.58	129.58		0.16	ND>0.01
	980218-MW3-56-02	2708-W031	18-Feb-98	520.	1.1	4.	19.	544.1	0.46	155.56			
	980602-MW3-56-14	2708-W033	2-Jun-98	580.	25.	ND>10	ND>30	605.	25.	316.		0.15	ND>0.01
	980602-MW3-56-15	2708-W033	2-Jun-98	630.	ND>10	ND>10	ND>30	630.	24.	306.			
EPA Maximum Contaminant Levels (MCLs) for Drinking Water				5.	1,000.	700.	10,000.	#	#	#	#	0.2	#
EPA Region 9 Preliminary Remediation Goals (PRGs) for Tap Water				0.39	723.	1,340.	1,431.	#	#	#	#	#	0.73
DEQ Ambient Water Quality Criteria (AWQC) for Surface Water[2]				40.[3]	424.[3]	1,400.[3]	#	#	0.031[4]	#	#	0.0052[4]	#

Updated: 9/24/98 RBE
File Name: * 2708-H GW Results (Master)

Table H-1 - Summary of Historical Analytical Results for Groundwater Samples - Monitoring Wells, December 1995 to Present
BTEX, Total PAHs, Total Phenols, and Cyanide

Remedial Investigation
Northwest Natural - Gasco Facility
Portland, Oregon

Project No. 2708

Well Number	HAI Sample Number[1]	Chain of Custody Number	Sample Date	Analytical Results									
				EPA Method 8020 ug/l (ppb)					EPA Method 8270 SIM ug/l (ppb)		EPA Method 8270 ug/l (ppb)	EPA Method 9010 mg/l (ppm)	EPA Method 901 mg/l (ppm)
				Benzene	Toluene	Ethyl benzene	Xylenes	Total BTEX	Carcinogenic PAHs	Total PAHs	Total Phenols	Total Cyanide	Amenable Cyanide
MW04-35	951206-MW4-35-01	2708-W010	6-Dec-95	0.54	ND>0.5	ND>0.5	ND>0.5	0.54	0.69	54.49		0.079	
	960318-MW4-35-01	2708-W013	18-Mar-96	17.	0.96	ND>0.5	1.3	19.26	3.18	84.4		0.35	
	960318-MW4-35-02	2708-W013	18-Mar-96	18.	0.82	ND>0.5	2.1	20.92	2.41	79.1			
	960618-MW4-35-01	2708-W018	18-Jun-96	5.9	ND>0.5	ND>0.5	0.61	6.51	2.5	61.	ND	0.46	
	961001-MW4-35-01	2708-W021	1-Oct-96	5.9	ND>0.5	ND>0.5	1.4	7.3	1.7	42.33	ND	0.75	
	970225-MW4-35-01	2708-W024	25-Feb-97	14.	ND>0.5	ND>0.5	ND>0.5	14.	0.41	46.	ND	0.39	
	980827-MW4-57-01 [5]	2708-W027	27-Aug-97	8.8	ND>0.5	ND>0.5	1.7	10.5	0.53	36.26	ND	0.8	
	980217-MW4-35-01	2708-W030	17-Feb-98	15.	ND>0.5	ND>0.5	ND>1.5	15.	0.25	31.85	ND	0.36	ND>0.01
	980601-MW4-35-06	2708-W032	1-Jun-98	ND>0.5	ND>0.5	ND>0.5	ND>1.5	ND	0.48	44.		0.29	0.017
MW04-57	951205-MW4-57-01	2708-W009	5-Dec-95	9,600.	72.	590.	290.	10,552.	1.73	1,328.27		1.18	
	960321-MW4-57-01	2708-W016	21-Mar-96	11,000.	ND>50	520.	270.	11,790.	2.29	1,097.76		0.03	
	960620-MW4-57-01	2708-W019	20-Jun-96	10,000.	ND>200	480.	ND>200	10,480.	1.4	646.	2.8	0.88	
	961002-MW4-57-01	2708-W022	2-Oct-96	14,000.	ND>100	580.	400.	14,980.	0.64	1,707.	29.	1.	
	970226-MW4-57-01	2708-W025	26-Feb-97	16,000.	34.	630.	130.	16,794.	0.52	1,688.	4.8	1.52	
	970828-MW4-35-01 [5]	2708-W028	28-Aug-97	12,000.	ND>50	360.	ND>150	12,360.	0.44	1,691.74	4.6	2.	
	980218-MW4-57-01	2708-W031	18-Feb-98	15,600.	35.	530.	240.	16,405.	0.28	2,357.88	47.	2.	ND>0.05
	980603-MW4-57-18	2708-W034	3-Jun-98	10,100.	58.	540.	170.	10,868.	0.77	2,299.		1.9	0.008[6]
MW05-32	951205-MW5-32-01	2708-W009	5-Dec-95	ND>0.5	ND>0.5	ND>0.5	ND>0.5	ND	7.59	207.69		0.101	
	960319-MW5-32-01	2708-W014	19-Mar-96	ND>0.5	ND>0.5	ND>0.5	ND>0.5	ND	29.81	268.91		0.11	
	960319-MW5-32-01 (dissolved)	2708-W014	19-Mar-96						ND	45.			
	960620-MW5-32-01	2708-W019	20-Jun-96	ND>0.5	ND>0.5	ND>0.5	ND>0.5	ND	14.	83.		0.05	
	961001-MW5-32-01	2708-W021	1-Oct-96	ND>0.5	ND>0.5	ND>0.5	ND>0.5	ND	277.	773.		0.14	
	970225-MW5-32-01	2708-W024	25-Feb-97	ND>0.5	ND>0.5	ND>0.5	ND>0.5	ND	1.	9.7		0.11	
	970827-MW5-32-01	2708-W027	27-Aug-97	ND>0.5	ND>0.5	ND>0.5	ND>1.5	ND	10.4	24.3		0.14	
	980217-MW5-32-01	2708-W030	17-Feb-98	ND>0.5	ND>0.5	ND>0.5	ND>1.5	ND	3.23	7.57		0.17	ND>0.01
	980602-MW5-32-10	2708-W033	2-Jun-98	ND>0.5	ND>0.5	ND>0.5	ND>1.5	ND	36.	95.		0.18	0.038
MW06-32	951207-MW6-32-01	2708-W011	7-Dec-95	3,000.	150.	960.	740.	4,850.	7,470.	199,570.	ND	0.091	
	960319-MW6-32-01	2708-W014	19-Mar-96	640.	22.	400.	270.	1,332.	6.56	2,346.46		0.21	
	960319-MW6-32-01 (dissolved)	2708-W014	19-Mar-96						ND	1,940.			
	960617-MW6-32-01	2708-W017	17-Jun-96	410.	40.	280.	410.	1,140.	16.	1,878.		0.23	
	960930-MW6-32-01	2708-W020	30-Sep-96	1,100.	34.	470.	320.	1,924.	203.5	4,757.7		0.02	
	970224-MW6-32-01	2708-W023	25-Feb-97	1,100.	22.	370.	80.	1,572.	ND	1,308.		0.22	
	970826-MW6-32-01	2708-W026	26-Aug-97	1,200.	27.	420.	280.	1,927.	15.	2,069.65		0.15	
	980216-MW6-32-01	2708-W029	16-Feb-98	1,700.	ND>250	650.	ND>750	2,350.	161.9	3,554.2		0.18	ND>0.01
	980601-MW6-32-04	2708-W032	1-Jun-98	1,200.	32.	300.	190.	1,722.	20.	2,245.		0.1	ND>0.01
MW06-61	951206-MW6-61-01	2708-W010	6-Dec-95	6.7	0.71	8.9	5.8	22.11	8.17	744.89	ND	0.228	
	960319-MW6-61-01	2708-W014	19-Mar-96	11.	0.68	9.2	5.3	26.18	3.29	196.96		0.28	
	960620-MW6-61-01	2708-W019	20-Jun-96	8.4	ND>0.5	6.	3.3	17.7	4.3	139.		0.27	
	961001-MW6-61-01	2708-W021	1-Oct-96	20.	0.93	16.	8.	44.93	3.8	152.9		0.3	
	970225-MW6-61-01	2708-W024	25-Feb-97	82.	6.1	79.	41.	208.1	ND	365.		0.35	
	970828-MW6-61-01	2708-W028	28-Aug-97	130.	11.	180.	120.	441.	4.88	1,451.5		0.41	
EPA Maximum Contaminant Levels (MCLs) for Drinking Water				5.	1,000.	700.	10,000.	#	#	#	#	0.2	#
EPA Region 9 Preliminary Remediation Goals (PRGs) for Tap Water				0.39	723.	1,340.	1,431.	#	#	#	#	#	0.73
DEQ Ambient Water Quality Criteria (AWQC) for Surface Water[2]				40.[3]	424.[3]	1,400.[3]	#	#	0.031[4]	#	#	0.0052[4]	#

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File Name: * 2708-H GW Results (Master)

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BTEX, Total PAHs, Total Phenols, and Cyanide

Remedial Investigation
Northwest Natural - Gasco Facility
Portland, Oregon

Project No. 2708

Well Number	HAI Sample Number[1]	Chain of Custody Number	Sample Date	Analytical Results									
				EPA Method 8020 ug/l (ppb)					EPA Method 8270 SIM ug/l (ppb)		EPA Method 8270 ug/l (ppb)	EPA Method 9010 mg/l (ppm)	EPA Method 901 mg/l (ppm)
				Benzene	Toluene	Ethyl benzene	Xylenes	Total BTEX	Carcinogenic PAHs	Total PAHs	Total Phenols	Total Cyanide	Amenable Cyanide
MW08-29	951207-MW8-29-01	2708-W011	7-Dec-95	2,100.	510.	200.	320.	3,130.	315.	7,688.	114.	3.11	
	960321-MW8-29-01	2708-W016	21-Mar-96	1,700.	380.	170.	400.	2,650.	143.7	7,879.7		2.4	
	960619-MW8-29-01	2708-W019	20-Jun-96						5.4	2,087.			
	960619-MW8-29-02	2708-W019	20-Jun-96	1,300.	310.	170.	380.	2,160.	13.	2,166.	10.		
	961002-MW8-29-01	2708-W022	2-Oct-96	770.	210.	130.	270.	1,380.	25.9	6,086.4	ND	0.524	
	970226-MW8-29-01	2708-W025	26-Feb-97	860.	200.	150.	250.	1,460.	10.	6,204.	100.	1.46	
	970828-MW8-29-01	2708-W028	28-Aug-97	390.	130.	110.	190.	820.	171.7	11,712.7	36.	3.4	
	980218-MW8-29-01	2708-W031	18-Feb-98	620.	220.	170.	250.	1,260.	22.19	11,760.19	ND	2.6	ND>0.01
	980603-MW8-29-19	2708-W034	3-Jun-98	700.	320.	250.	310.	1,580.	196.	12,407.		4.9	0.022[6]
MW08-56	951207-MW8-56-01	2708-W011	7-Dec-95	13,000.	1,700.	850.	1,300.	16,850.	156.	21,200.		0.582	
	960321-MW8-56-01	2708-W016	21-Mar-96	17,000.	820.	730.	1,600.	20,150.	361.1	15,501.1		0.54	
	960620-MW8-56-01[7]	2708-W019	20-Jun-96	17,000.	650.	740.	1,100.	19,490.	35.	1,769.		0.31	
	961002-MW8-56-01	2708-W022	2-Oct-96	20,000.	690.	900.	1,800.	23,390.	114.	11,742.			
	970226-MW8-56-01	2708-W025	26-Feb-97	19,000.	630.	820.	1,100.	21,550.	ND	13,692.		0.7	
	970828-MW8-56-01	2708-W028	28-Aug-97	17,000.	350.	510.	810.	18,670.	20.	18,141.		0.66	
	980218-MW8-56-01	2708-W031	18-Feb-98	20,200.	410.	740.	1,100.	22,450.	11.18	12,944.88		0.74	ND>0.01
	980603-MW8-56-21	2708-W034	3-Jun-98	17,900.	470.	940.	1,300.	20,610.	68.	17,720.		0.77	0.018[6]
MW09-29	951205-MW9-29-01	2708-W009	5-Dec-95	ND>0.5	ND>0.5	ND>0.5	ND>0.5	ND	ND	1.29			
	960318-MW9-29-01	2708-W013	18-Mar-96	ND>0.5	ND>0.5	ND>0.5	ND>0.5	ND	ND	1.6		ND>0.01	
	960618-MW9-29-01	2708-W018	18-Jun-96	ND>0.5	ND>0.5	ND>0.5	ND>0.5	ND	ND	0.15		ND>0.01	
	961001-MW9-29-01	2708-W021	1-Oct-96	ND>0.5	ND>0.5	ND>0.5	ND>0.5	ND	ND	0.4		0.018	
	970225-MW9-29-01	2708-W024	25-Feb-97	ND>0.5	ND>0.5	ND>0.5	ND>0.5	ND	ND	ND		0.01	
	970827-MW9-29-01	2708-W027	27-Aug-97	ND>0.5	ND>0.5	ND>0.5	ND>1.5	ND	ND	ND		ND>0.02	
	980217-MW9-29-01	2708-W030	17-Feb-98	ND>0.5	ND>0.5	ND>0.5	ND>1.5	ND	ND	ND		ND>0.02	
	980602-MW9-29-07	2708-W033	2-Jun-98	ND>0.5	ND>0.5	ND>0.5	ND>1.5	ND	ND	ND		ND>0.02	
MW10-25	951207-MW10-25-01	2708-W011	7-Dec-95	120,000.	42,000.	2,000.	9,200.	173,200.	18.	13,316.5	2,560.		
	960320-MW10-25-01	2708-W015	20-Mar-96	32,000.	38,000.	3,100.	13,000.	86,100.	5.9	9,126.31	2,690.	0.07	
	960617-MW10-25-01	2708-W017	17-Jun-96	28,000.	32,000.	2,500.	8,600.	71,100.	6.8	10,266.	1,820.	ND>0.01	
	960930-MW10-25-01	2708-W020	30-Sep-96	17,000.	5,000.	ND>200	4,500.	26,500.	78.6	10,529.5	4,350.	0.204	
	970224-MW10-25-01	2708-W023	25-Feb-97	180,000.	54,000.	1,300.	6,800.	242,100.	74.	9,841.	ND>5,000	0.01	
	970827-MW10-25-01	2708-W027	27-Aug-97	168,000.	54,000.	850.	6,000.	228,850.	19.6	7,047.1	2,960.		
	980216-MW10-25-01	2708-W029	16-Feb-98	186,000.	51,100.	880.	6,500.	244,480.	58.1	9,165.2	2,620.	ND>0.02	
	980601-MW10-25-02	2708-W032	1-Jun-98	93,800.	30,900.	670.	3,900.	129,270.	35.	12,162.		0.21	
MW10-61	951206-MW10-61-01	2708-W010	6-Dec-95	75.	130.	26.	110.	341.	0.72	829.72	ND		
	960321-MW10-61-01	2708-W016	21-Mar-96	4.1	1.6	2.9	8.5	17.1	2.55	102.43		ND>0.01	
	960620-MW10-61-01	2708-W019	20-Jun-96	0.9	ND>0.5	1.1	1.7	3.7	2.	46.	ND	ND>0.01	
	960930-MW10-61-01	2708-W022	2-Oct-96	0.56	ND>0.5	0.69	1.1	2.35	1.5	25.15	ND	ND>0.01	
	970226-MW10-61-01	2708-W025	26-Feb-97	ND>0.5	ND>0.5	ND>0.5	ND>0.5	ND	1.	18.	8.4	ND>0.01	
	970828-MW10-61-01	2708-W028	28-Aug-97	ND>0.5	ND>0.5	ND>0.5	ND>1.5	ND	0.39	7.76	ND	ND>0.02	
	980218-MW10-61-01	2708-W031	18-Feb-98	ND>0.5	ND>0.5	ND>0.5	ND>1.5	ND	0.4	3.8	ND	ND>0.02	
	980603-MW10-61-16	2708-W034	3-Jun-98	ND>0.5	ND>0.5	ND>0.5	ND>1.5	ND	1.6	6.2		ND>0.02	
EPA Maximum Contaminant Levels (MCLs) for Drinking Water				5.	1,000.	700.	10,000.	#	#	#	#	0.2	#
EPA Region 9 Preliminary Remediation Goals (PRGs) for Tap Water				0.39	723.	1,340.	1,431.	#	#	#	#	#	0.73
DEQ Ambient Water Quality Criteria (AWQC) for Surface Water[5]				40.[3]	424.[3]	1,400.[3]	#	#	0.031[4]	#	#	0.0052[4]	#

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Portland, Oregon

Project No. 2708

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				EPA Method 8020 ug/l (ppb)					EPA Method 8270 SIM ug/l (ppb)		EPA Method 8270 ug/l (ppb)	EPA Method 9010 mg/l (ppm)	EPA Method 901 mg/l (ppm)
				Benzene	Toluene	Ethyl benzene	Xylenes	Total BTEX	Carcinogenic PAHs	Total PAHs	Total Phenols	Total Cyanide	Amenable Cyanide
MW11-32	951207-MW11-32-01	2708-W011	7-Dec-95	**25,000.**	**5,400.**	480.	**2,800.**	33,680.	**20.**	22,365.2	2,520.		
	960320-MW11-32-01	2708-W015	20-Mar-96	**24,000.**	**4,300.**	**970.**	**2,400.**	31,670.	**6.33**	14,676.08	1,420.	**0.24**	
	960617-MW11-32-01	2708-W017	17-Jun-96	**2,800.**	**2,000.**	**1,000.**	**1,940.**	7,740.	**14.**	11,608.	960.	**0.19**	
	960930-MW11-32-01	2708-W020	30-Sep-96	**17,000.**	**3,300.**	**900.**	**1,760.**	22,960.	**131.9**	17,603.9	1,681.	**0.249**	
	960930-MW11-32-02	2708-W020	30-Sep-96						**189.**	18,894.			
	970224-MW11-32-01	2708-W023	25-Feb-97	**21,000.**	**4,100.**	**750.**	**1,800.**	27,650.	**11.**	11,536.	240.	**0.22**	
	970826-MW11-32-01	2708-W026	26-Aug-97	**15,000.**	**4,400.**	**1,100.**	**2,500.**	23,000.	**20.5**	17,075.8	961.	**0.17**	
	980216-MW11-32-01	2708-W029	16-Feb-98	**12,600.**	**3,800.**	**930.**	**2,100.**	19,430.	**15.9**	9,769.2	450.	**0.2**	ND>0.01
	980601-MW11-32-03	2708-W032	1-Jun-98	**16,800.**	**4,000.**	**810.**	**1,800.**	23,410.	**112.**	32,376.		**0.21**	ND>0.01
MW12-36	951207-MW12-36-01	2708-W011	7-Dec-95	**95.**	410.	170.	590.	1,265.	**3.65**	3,377.55			
	960321-MW12-36-01	2708-W016	21-Mar-96	**170.**	180.	110.	550.	1,010.	**0.38**	2,010.03	ND	ND>0.01	
	960620-MW12-36-01	2708-W019	20-Jun-96	**250.**	250.	120.	440.	1,060.	**0.8**	1,621.		ND>0.01	
	961002-MW12-36-01	2708-W022	2-Oct-96	**330.**	390.	130.	510.	1,360.	**0.8**	1,375.		ND>0.01	
	970226-MW12-36-01	2708-W025	26-Feb-97	**260.**	310.	120.	470.	1,160.	**0.94**	1,033.		ND>0.01	
	970828-MW12-36-01	2708-W028	28-Aug-97	**230.**	**430.**	110.	430.	1,200.	**0.67**	839.77		ND>0.02	
	980218-MW12-36-01	2708-W031	18-Feb-98	**140.**	370.	82.	280.	872.	**0.69**	708.		ND>0.02	
	980603-MW12-36-17	2708-W034	3-Jun-98	**150.**	350.	74.	340.	914.	ND	697.		ND>0.02	
MW-13-30	980217-MW13-30-01	2708-W030	17-Feb-98	**6,900.**	ND>50	370.	ND>150	7,270.	ND	426.1		**0.28**	ND>0.01
	980602-MW13-30-12	2708-W033	2-Jun-98	**5,200.**	13.	380.	120.	5,713.	ND	1,181.		**0.28**	ND>0.01
MW-13-61	980218-MW13-61-01	2708-W031	18-Feb-98	ND>0.5	ND>0.5	ND>0.5	ND>1.5	ND	ND	ND		**0.14**	ND>0.01
	980602-MW13-61-13	2708-W033	2-Jun-98	ND>0.5	ND>0.5	ND>0.5	ND>1.5	ND	ND	ND		**0.13**	ND>0.01
Temporary Well Point Samples 1995													
B-01 at 23'	950921-BW1-01	2708-W003	21-Sep-95	**6.9**	2.5	3.1	56.	68.5	**0.09**	175.71		**7.8**	
B-05 at 28'	950925-BW05-01	2708-W005	29-Sep-95	ND>0.5	0.97	ND>0.5	1.4	2.37	ND	34.78		ND>0.02	
B-08 at 20'	950918-BW8-01	2708-W001	18-Sep-95	ND>0.5	0.85	ND>0.5	0.86	1.71					
B-19 at 13'	950920-BW19-01	2708-W002	20-Sep-95								164.5		
B-19 at 28'	950920-BW19-02	2708-W002	20-Sep-95	**100,000.**	**39,000.**	**1,600.**	**11,000.**	151,600.	**0.7**	6,610.2			
B-21 at 19.5'	951003-BW21-01	2708-W006	3-Oct-95	ND>0.5	1.2	1.9	3.3	6.4	**2.93**	726.25	ND		
B-31 at 29'	950925-BW31-01	2708-W004	25-Sep-95	3.	1.6	10.	13.	27.6	**13.28**	694.58		ND>0.02	
EPA Maximum Contaminant Levels (MCLs) for Drinking Water				5.	1,000.	700.	10,000.	#	#	#	#	0.2	#
EPA Region 9 Preliminary Remediation Goals (PRGs) for Tap Water				0.39	723.	1,340.	1,431.	#	#	#	#	#	0.73
DEQ Ambient Water Quality Criteria (AWQC) for Surface Water[4]				40.[3]	424.[3]	1,400.[3]	#	#	0.031[1]	#	#	0.0052[1]	#

Note:
BTEX = benzene, toluene, ethylbenzene, and xylenes
DEQ = Oregon Department of Environmental Quality
EPA = U.S. Environmental Protection Agency
mg/l = milligrams/liter
ND = not detected above detection limit indicated
PAHs = polynuclear aromatic hydrocarbons
ppb = parts per billion
ppm = parts per million
ug/l = micrograms per liter
= Reference Level not established
Bold and shaded = Detected above Lowest Identified Reference Level

1 = Sample number prefix: 2708-
2 = Reference Level indicated is the lowest guidance value provided in the Ambient Water Quality Criteria (OAR 340-41) based on Fresh Acute, Fresh Chronic (Aquatic Life Protection) and Fish Consumption (Human Health Protection)
3 = Reference Level based on Aquatic Fresh Chronic Criteria of AWQC
4 = Reference Level based on Human Fish Consumption Criteria of AWQC
5 = Due to mislabeling in the field or due to laboratory misidentification, the laboratory report transposed results for MW4-35 and MW-4-57 in August 1997. Tables attribute data to the correct well.
6 = Sample was analyzed outside of recommended holding time
7 = PAH results for sample 960620-MW8-56-01 should be considered qualitative due to an apparent error concerning sample identity.

Table H-2 - Summary of Historical Analytical Results for Groundwater Samples - Monitoring Wells, December 1995 to Present
PAHs by EPA Method 8270

Remedial Investigation
Northwest Natural - Gasco Facility
Portland, Oregon

Project No. 2708

PAHs by EPA Method 8270 (SIM)				Analytical Results ug/l (ppb)																	
				Carcinogenic PAHs							Non-carcinogenic PAHs										
Well Number	Sample Number	Chain of Custody Number	Sample Date	Benzo (a) anthracene	Benzo (b) fluoranthene	Benzo (k) fluoranthene	Benzo (a) pyrene	Chrysene	Dibenzo (ah) anthracene	Indeno (1,2,3-cd) pyrene	Acenaphthene	Acenaphthylene	Anthracene	Benzo (ghi) perylene	Fluoranthene	Fluorene	Naphthalene	Phenanthrene	Pyrene	Total Carcinogenic PAHs	Total PAHs
MW01-22	951207-MW1-22-01	2708-W011	7-Dec-95	24.	13.	4.8	12.	32.	1.3	6.3	11.	2.6	52.	9.3	74.	16.	39.	100.	68.	93.4	465.
	960319-MW1-22-01	2708-W014	19-Mar-96	1.2	0.7	0.28	0.64	1.6	ND [a]	0.29	9.6	0.33	4.1	0.41	4.4	7.3	90.	15.	4.6	4.7	140.
	960618-MW1-22-01	2708-W018	18-Jun-96	0.59	0.33	0.14	0.34	0.68	ND [a]	0.15	7.6	0.26	3.3	0.21	2.5	6.2	75.	12.	2.9	2.2	112.
	961001-MW1-22-01	2708-W021	1-Oct-96	1.7	1.4	ND [b]	1.3	1.8	ND [b]	ND [b]	55.	0.98	15.	0.99	7.	59.	440.	130.	6.	6.2	720.
	970225-MW1-22-01	2708-W024	25-Feb-97	0.36	0.13	ND [a]	0.12	0.3	ND [a]	ND [a]	3.7	ND [a]	1.6	ND [a]	1.8	3.1	47.	6.5	1.9	0.9	67.
	970225-MW1-22-02	2708-W024	25-Feb-97	0.72	0.34	0.12	0.31	0.64	ND [a]	0.1	3.2	ND [a]	1.6	0.13	2.1	2.9	44.	5.5	2.5	2.2	64.
	970827-MW1-22-01	2708-W027	27-Aug-97	3.8	4.	1.4	3.9	4.8	ND [b]	2.1	70.	1.6	16.	2.6	12.	75.	550.	230.	11.	20.	988.
	970827-MW1-22-02	2708-W027	27-Aug-97	5.2	5.4	2.	5.6	6.7	ND [b]	3.2	66.	ND [a]	19.	3.8	14.	73.	350.	170.	12.	28.1	736.
	980217-MW1-22-01	2708-W030	17-Feb-98	1.1	0.8	0.26	0.76	0.98	0.1	0.48	1.2	ND [a]	1.5	0.58	2.7	1.4	4.7	3.5	3.2	4.5	23.
	980602-MW1-32-11	2708-W033	2-Jun-98	15.	21.	6.7	18.	21.	1.8	9.6	3.3	0.89	14.	13.	25.	4.9	3.3	23.	29.	93.1	209.
MW02-32	951206-MW2-32-01	2708-W010	6-Dec-95	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	4.	0.29	0.28	ND [a]	0.48	0.32	45.	0.51	0.67	0.	51.6
	960318-MW2-32-01	2708-W013	18-Mar-96	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	4.	0.16	0.1	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	0.28	0.	4.5
	960618-MW2-32-01	2708-W018	18-Jun-96	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	1.5	0.23	0.15	ND [a]	ND [a]	0.22	0.09	ND [a]	0.41	0.	2.6
	961001-MW2-32-01	2708-W021	1-Oct-96	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	8.4	0.14	0.16	0.1	0.12	0.23	0.22	0.23	0.93	0.	10.5
	970225-MW2-32-01	2708-W024	25-Feb-97	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	1.1	ND [a]	ND [a]	ND [a]	ND [a]	0.15	ND [a]	ND [a]	0.37	0.	1.6
	970827-MW2-32-01	2708-W027	27-Aug-97	ND [a]	ND [a]	ND [a]	0.1	ND [a]	ND [a]	0.1	16.	0.17	0.19	0.14	ND [a]	0.21	0.17	ND [a]	0.96	0.2	18.
	980217-MW2-32-01	2708-W030	17-Feb-98	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	4.2	0.11	ND [a]	ND [a]	ND [a]	0.19	ND [a]	ND [a]	0.52	0.	5.
	980601-MW2-32-05	2708-W032	1-Jun-98	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	2.2	ND [a]	ND [a]	ND [a]	ND [a]	0.19	ND [a]	ND [a]	0.82	0.	3.2
MW03-26	951206-MW3-26-01	2708-W010	6-Dec-95	2.8	4.7	1.5	4.1	4.6	0.54	2.8	1.5	2.7	2.3	3.9	8.5	1.2	30.	4.7	9.4	21.	85.2
	960318-MW3-26-02	2708-W013	18-Mar-96	0.29	0.35	0.14	0.39	0.3	ND [a]	0.24	2.5	1.4	1.1	0.34	1.1	0.58	32.	0.36	1.3	1.7	42.4
	960618-MW3-26-01	2708-W018	18-Jun-96	0.49	0.47	0.17	0.56	0.55	ND [a]	0.31	5.5	2.6	1.5	0.42	1.3	1.3	30.	0.79	1.9	2.6	47.9
	961001-MW3-26-01	2708-W021	1-Oct-96	29.	41.	12.	47.	30.	ND [a]	23.	ND [a]	9.5	ND [a]	34.	36.	ND [a]	10.	8.6	54.	182.	334.
	970225-MW3-26-01	2708-W024	25-Feb-97	0.78	1.1	0.36	1.3	0.59	ND [a]	0.81	0.79	0.32	0.1	1.1	1.2	0.18	0.97	0.39	1.9	4.9	11.9
	970827-MW3-26-01	2708-W027	27-Aug-97	4.1	5.7	2.	7.7	3.9	ND [b]	4.2	1.3	1.7	1.1	5.6	6.7	ND [b]	ND [b]	1.4	7.8	27.6	53.2
	980217-MW3-26-01	2708-W030	17-Feb-98	0.68	1.5	0.39	1.8	0.44	0.35	1.9	0.18	0.5	0.24	2.4	1.	0.1	0.39	0.27	1.3	7.1	13.4
	980602-MW3-26-09	2708-W033	2-Jun-98	13.	24.	5.7	26.	11.	3.1	17.	0.3	1.6	1.5	25.	27.	0.47	1.8	3.8	43.	99.8	204.
MW03-56	951206-MW3-56-01	2708-W010	6-Dec-95	0.73	0.33	0.14	0.41	0.85	ND [a]	0.23	51.	46.	8.1	0.36	7.8	19.	1,200.	42.	7.8	2.7	1,385.
	960319-MW3-56-01	2708-W014	19-Mar-96	0.59	0.33	0.13	0.38	0.73	ND [a]	0.18	56.	70.	5.6	0.28	6.1	25.	1,700.	53.	8.3	2.3	1,927.
	960620-MW3-56-01	2708-W019	20-Jun-96	0.45	0.22	ND [a]	0.26	0.51	ND [a]	0.15	47.	56.	6.4	0.21	5.8	27.	1,300.	39.	8.1	1.6	1,491.
	961002-MW3-56-01	2708-W022	2-Oct-96	0.27	ND [a]	ND [a]	ND [a]	0.27	ND [a]	ND [a]	42.	62.	6.	ND [a]	6.7	27.	730.	58.	5.6	0.5	938.
	970226-MW3-56-01	2708-W025	26-Feb-97	0.33	ND [a]	ND [a]	ND [a]	0.29	ND [a]	ND [a]	42.	51.	ND [a]	ND [a]	3.2	21.	440.	53.	7.5	0.6	618.
	970828-MW3-56-01	2708-W028	28-Aug-97	0.28	0.13	ND [a]	0.13	0.28	ND [a]	ND [a]	21.	15.	7.3	ND [a]	7.	15.	85.	39.	5.4	0.8	196.
	980218-MW3-56-01	2708-W031	18-Feb-98	0.28	0.1	ND [a]	ND [a]	0.2	ND [a]	ND [a]	25.	14.	3.7	ND [a]	4.8	13.	22.	41.	5.5	0.6	130.
	980218-MW3-56-02	2708-W031	18-Feb-98	0.26	ND [a]	ND [a]	ND [a]	0.2	ND [a]	ND [a]	33.	17.	3.9	ND [a]	4.9	17.	26.	48.	5.3	0.5	156.
	980602-MW3-56-14	2708-W033	2-Jun-98	5.3	4.9	1.7	5.1	4.6	ND [b]	2.9	57.	19.	12.	4.3	20.	28.	37.	86.	28.	24.5	316.
	980602-MW3-56-15	2708-W033	2-Jun-98	5.1	4.7	1.9	5.3	4.5	ND [b]	2.8	54.	18.	12.	4.3	19.	28.	32.	86.	28.	24.3	306.
EPA Maximum Contaminant Levels (MCLs) for Drinking Water				#	#	#	2	#	#	#	#	#	#	#	#	#	#	#	#	#	#
EPA Region 9 Preliminary Remedial Goals (PRGs) for Tap Water				0.09	0.09	0.92	0.01	9.2	0.01	0.09	365	#	1,825	#	1,460	243	243	#	182	#	#
DEQ Ambient Water Quality Criteria (AWQC) for Surface Water[2]				#	#	#	#	#	#	#	520 [3]	#	#	#	54 [4]	#	620 [3]	#	#	0.031 [4]	#

Table H-2 - Summary of Historical Analytical Results for Groundwater Samples - Monitoring Wells, December 1995 to Present
PAHs by EPA Method 8270

Remedial Investigation
Northwest Natural - Gasco Facility
Portland, Oregon

Project No. 2708

PAHs by EPA Method 8270 (SIM)				Analytical Results ug/l (ppb)																	
				Carcinogenic PAHs							Non-carcinogenic PAHs										
Well Number	Sample Number	Chain of Custody Number	Sample Date	Benzo (a) anthracene	Benzo (b) fluoranthene	Benzo (k) fluoranthene	Benzo (a) pyrene	Chrysene	Dibenzo (ah) anthracene	Indeno (1,2,3-cd) pyrene	Acenaphthene	Acenaphthylene	Anthracene	Benzo (ghi) perylene	Fluoranthene	Fluorene	Naphthalene	Phenanthrene	Pyrene	Total Carcinogenic PAHs	Total PAHs
MW04-35	951206-MW4-35-01	2708-W010	6-Dec-95	0.34	ND [a]	ND [a]	ND [a]	0.35	ND [a]	ND [a]	13.	3.	2.5	ND [a]	9.7	6.1	2.	8.1	9.4	0.7	54.5
	960318-MW4-35-01	2708-W013	18-Mar-96	0.74	0.5	0.18	0.54	0.94	ND [a]	0.28	35.	2.7	2.7	0.42	8.4	11.	3.2	7.9	9.9	3.2	84.4
	960318-MW4-35-02	2708-W013	18-Mar-96	0.62	0.36	0.14	0.4	0.7	ND [a]	0.19	34.	2.8	2.8	0.29	8.1	9.2	2.5	7.9	9.1	2.4	79.1
	960618-MW4-35-01	2708-W018	18-Jun-96	0.66	0.37	0.12	0.43	0.71	ND [a]	0.22	25.	3.5	2.	0.3	7.8	8.5	0.59	1.9	9.3	2.5	61.4
	961001-MW4-35-01	2708-W021	1-Oct-96	0.41	0.3	0.1	0.3	0.46	ND [a]	0.13	19.	2.	1.2	0.18	6.1	4.9	0.41	0.34	6.5	1.7	42.3
	970225-MW4-35-01	2708-W024	25-Feb-97	0.22	ND [a]	ND [a]	ND [a]	0.19	ND [a]	ND [a]	24.	2.6	0.78	ND [a]	5.	6.	1.2	0.36	5.3	0.4	45.7
	980827-MW4-57-01 [5]	2708-W027	27-Aug-97	0.21	0.1	ND [a]	ND [a]	0.22	ND [a]	ND [a]	16.	2.3	0.93	ND [a]	5.3	5.3	0.49	0.31	5.1	0.5	36.3
	980217-MW4-35-01	2708-W030	17-Feb-98	0.15	ND [a]	ND [a]	ND [a]	0.1	ND [a]	ND [a]	16.	2.1	0.47	ND [a]	4.1	3.9	1.1	0.13	3.8	0.3	31.9
	980601-MW4-35-06	2708-W032	1-Jun-98	0.25	ND [a]	ND [a]	ND [a]	0.23	ND [a]	ND [a]	20.	2.9	0.74	ND [a]	6.6	6.2	0.12	0.19	6.4	0.5	43.6
MW04-57	951205-MW4-57-01	2708-W009	5-Dec-95	0.56	0.22	ND [a]	0.21	0.65	ND [a]	0.09	49.	2.2	5.8	0.14	7.8	11.	1,200.	42.	8.6	1.7	1,328.
	960321-MW4-57-01	2708-W016	21-Mar-96	0.59	0.34	0.12	0.35	0.71	ND [a]	0.18	35.	1.9	4.9	0.27	6.9	9.2	1,000.	31.	6.3	2.3	1,098.
	960620-MW4-57-01	2708-W019	20-Jun-96	0.45	0.19	ND [a]	0.21	0.46	ND [a]	0.11	39.	2.8	4.1	0.15	6.5	10.	540.	34.	8.5	1.4	646.
	961002-MW4-57-01	2708-W022	2-Oct-96	0.35	ND [a]	ND>0.1	ND [a]	0.29	ND [a]	ND [a]	48.	5.6	4.7	ND [a]	7.2	7.6	1,600.	27.	6.1	0.6	1,707.
	970226-MW4-57-01	2708-W025	26-Feb-97	0.3	ND [a]	ND [a]	ND [a]	0.22	ND [a]	ND [a]	39.	3.3	3.4	ND [a]	6.2	6.	1,600.	24.	6.	0.5	1,688.
	970828-MW4-35-01 [5]	2708-W028	28-Aug-97	0.24	ND [a]	ND [a]	ND [a]	0.2	ND [a]	ND [a]	49.	2.9	2.6	ND [a]	4.3	4.3	1,600.	24.	4.2	0.4	1,692.
	980218-MW4-57-01	2708-W031	18-Feb-98	0.17	ND [a]	ND [a]	ND [a]	0.11	ND [a]	ND [a]	45.	2.	1.6	ND [a]	3.6	3.4	2,280.	19.	3.	0.3	2,358.
	980603-MW4-57-18	2708-W034	3-Jun-98	0.35	0.1	ND [a]	ND [a]	0.32	ND [a]	ND [a]	51.	2.4	3.1	ND [a]	6.1	5.9	2,200.	23.	6.7	0.8	2,299.
MW05-32	951205-MW5-32-01	2708-W009	5-Dec-95	1.8	1.	0.41	1.1	2.6	0.12	0.56	12.	9.2	18.	0.9	15.	28.	11.	88.	18.	7.6	208.
	960319-MW5-32-01	2708-W014	19-Mar-96	5.7	4.7	1.7	5.5	8.5	0.61	3.1	4.2	2.1	20.	4.8	44.	10.	1.	100.	53.	29.8	269.
	960319-MW5-32-01 (dissolved)	2708-W014	19-Mar-96	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	2.5	1.1	4.4	ND [a]	0.96	5.3	0.61	29.	1.1	0.	45.
	960620-MW5-32-01	2708-W019	20-Jun-96	2.6	2.2	0.93	2.7	3.4	0.34	1.5	2.	1.1	9.2	2.3	12.	2.1	0.42	20.	20.	13.7	82.8
	961001-MW5-32-01	2708-W021	1-Oct-96	50.	55.	18.	63.	51.	ND [d]	40.	ND [d]	ND [d]	47.	56.	160.	ND [d]	ND [d]	83.	150.	277.	773.
	970225-MW5-32-01	2708-W024	25-Feb-97	0.32	0.19	ND [a]	0.16	0.33	ND [a]	ND [a]	0.16	ND [a]	0.95	0.12	3.	0.23	0.16	0.29	3.8	1.	9.7
	970827-MW5-32-01	2708-W027	27-Aug-97	2.	1.9	ND [b]	2.4	2.7	ND [b]	1.4	ND [b]	ND [b]	ND [b]	1.8	5.8	ND [b]	ND [b]	ND [b]	6.3	10.4	24.3
	980217-MW-5-32-01	2708-W030	17-Feb-98	0.57	0.55	0.19	0.67	0.65	0.11	0.49	ND [a]	0.1	0.19	0.62	1.5	ND [a]	ND [a]	0.23	1.7	3.2	7.6
	980602-MW5-32-10	2708-W033	2-Jun-98	7.	7.	1.9	7.6	7.	0.91	4.3	1.2	0.47	1.6	6.3	20.	0.57	0.67	4.2	24.	35.7	94.7
MW06-32	951207-MW6-32-01	2708-W011	7-Dec-95	2,400.	750.	280.	690.	3,100.	50.	200.	23,000.	220.	14,000.	280.	22,000.	4,600.	42,000.	61,000.	25,000.	7,470.	199,570.
	960319-MW6-32-01	2708-W014	19-Mar-96	1.9	0.85	0.3	0.79	2.5	ND [a]	0.22	280.	2.6	24.	0.3	16.	61.	1,800.	140.	16.	6.6	2,346.
	960319-MW6-32-01 (dissolved)	2708-W014	19-Mar-96	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	220.	2.	5.1	ND [a]	1.3	42.	1,600.	68.	1.7	0.	1,940.
	960617-MW6-32-01	2708-W017	17-Jun-96	4.5	2.4	0.87	2.5	5.	0.23	0.74	310.	2.4	29.	0.9	27.	82.	1,200.	170.	40.	16.2	1,878.
	960930-MW6-32-01	2708-W020	30-Sep-96	66.	32.	12.	29.	63.	1.5	ND [a]	620.	7.8	190.	6.4	320.	210.	1,900.	970.	330.	203.5	4,758.
	970224-MW6-32-01	2708-W023	25-Feb-97	ND [c]	ND [c]	ND [c]	ND [c]	ND [c]	ND [c]	ND [c]	260.	2.7	13.	ND [c]	ND [c]	64.	830.	130.	8.5	0.	1,308.
	970826-MW6-32-01	2708-W026	26-Aug-97	4.4	2.2	0.82	2.2	4.8	ND>0.5	0.58	350.	ND>5	29.	0.65	33.	97.	1,300.	220.	25.	15.	2,070.
	980216-MW6-32-01	2708-W029	16-Feb-98	48.	27.	7.	24.	47.	1.7	7.2	560.	7.1	96.	9.2	220.	170.	1,200.	840.	290.	161.9	3,554.
	980601-MW6-32-04	2708-W032	1-Jun-98	6.2	3.	0.85	2.6	6.4	0.19	0.74	410.	ND [d]	50.	0.98	38.	100.	1,300.	280.	46.	20.	2,245.
EPA Maximum Contaminant Levels (MCLs) for Drinking Water				#	#	#	2	#	#	#	#	#	#	#	#	#	#	#	#	#	#
EPA Region 9 Preliminary Remedial Goals (PRGs) for Tap Water				0.09	0.09	0.92	0.01	9.2	0.01	0.09	365	#	1,825	#	1,460	243	243	#	182	#	#
DEQ Ambient Water Quality Criteria (AWQC) for Surface Water [2]				#	#	#	#	#	#	#	520 [3]	#	#	#	54 [4]	#	620 [5]	#	#	0.031 [4]	#

Table H-2 - Summary of Historical Analytical Results for Groundwater Samples - Monitoring Wells, December 1995 to Present
PAHs by EPA Method 8270

Remedial Investigation
Northwest Natural - Gasco Facility
Portland, Oregon

Project No. 2708

PAHs by EPA Method 8270 (SIM)				Analytical Results ug/l (ppb)																
				Carcinogenic PAHs							Non-carcinogenic PAHs									
Well Number	Sample Number	Chain of Custody Number	Sample Date	Benzo (a) anthracene	Benzo (b) fluoranthene	Benzo (k) fluoranthene	Benzo (a) pyrene	Chrysene	Dibenzo (ah) anthracene	Indeno (1,2,3-cd) pyrene	Acenaphthene	Acenaphthylene	Anthracene	Benzo (ghi) perylene	Fluoranthene	Fluorene	Naphthalene	Phenanthrene	Pyrene	Total Carcinogenic PAHs	Total PAHs
MW06-61	951206-MW6-61-01	2708-W010	6-Dec-95	2.7	0.77	0.34	0.73	3.4	ND [a]	0.23	160.	1.4	29.	0.32	24.	48.	250.	200.	24.	8.2	745.
	960319-MW6-61-01	2708-W014	19-Mar-96	1.1	0.33	0.13	0.33	1.4	ND [a]	ND [a]	29.	0.24	9.6	0.13	13.	9.7	66.	53.	13.	3.3	197.
	960620-MW6-61-01	2708-W019	20-Jun-96	1.4	0.48	0.25	0.5	1.5	ND [a]	0.14	21.	0.3	6.1	0.21	9.9	7.5	44.	30.	16.	4.3	139.
	961001-MW6-61-01	2708-W021	1-Oct-96	2.	ND [b]	ND [b]	ND [b]	1.8	ND [b]	ND [b]	16.	ND [b]	4.8	ND [b]	9.9	5.4	76.	25.	12.	3.8	153.
	970225-MW6-61-01	2708-W024	25-Feb-97	ND [c]	ND [c]	ND [c]	ND [c]	ND [c]	ND [c]	ND [c]	32.	ND [c]	4.	ND [c]	3.5	7.7	290.	23.	4.9	0.	365.
	970828-MW6-61-01	2708-W028	28-Aug-97	1.5	0.66	0.23	0.62	1.7	ND [a]	0.17	210.	2.4	17.	0.22	17.	47.	1,000.	130.	23.	4.9	1,452.
MW08-29	951207-MW8-29-01	2708-W011	7-Dec-95	65.	34.	16.	44.	81.	50.	25.	94.	200.	110.	36.	230.	83.	6,000.	400.	220.	315.	7,688.
	960321-MW8-29-01	2708-W016	21-Mar-96	28.	23.	9.8	31.	33.	2.9	16.	140.	260.	56.	23.	98.	89.	6,700.	270.	100.	143.7	7,880.
micro-purge	960619-MW8-29-01	2708-W019	20-Jun-96	1.2	0.88	0.3	1.1	1.2	0.12	0.61	100.	310.	15.	0.88	15.	70.	1,400.	150.	21.	5.4	2,087.
	960619-MW8-29-02	2708-W019	20-Jun-96	2.5	2.4	0.82	3.	2.7	0.3	1.6	26.	49.	5.1	2.3	9.4	14.	2,000.	32.	15.	13.3	2,166.
	961002-MW8-29-01	2708-W022	2-Oct-96	5.4	4.4	1.6	6.2	4.8	ND [b]	3.5	120.	240.	29.	4.5	30.	71.	5,400.	140.	26.	25.9	6,086.
	970226-MW8-29-01	2708-W025	26-Feb-97	3.1	2.1	ND [b]	2.	2.7	ND [b]	ND [b]	120.	250.	17.	ND [b]	22.	52.	5,600.	110.	23.	9.9	6,204.
	970828-MW8-29-01	2708-W028	28-Aug-97	32.	29.	11.	39.	38.	4.7	18.	370.	230.	56.	25.	150.	120.	10,000.	380.	210.	171.7	11,713.
	980218-MW8-29-01	2708-W031	18-Feb-98	4.3	3.7	1.2	4.9	4.1	0.69	3.3	340.	110.	13.	4.	24.	65.	11,000.	150.	32.	22.2	11,760.
	980603-MW8-29-19	2708-W034	3-Jun-98	37.	37.	13.	45.	39.	3.8	21.	420.	130.	51.	30.	140.	120.	10,700.	440.	180.	195.8	12,407.
MW08-56	951207-MW8-56-01	2708-W011	7-Dec-95	25.	14.	60.	17.	30.	ND [c]	10.	130.	250.	53.	15.	110.	86.	20,000.	290.	110.	156.	21,200.
	960321-MW8-56-01	2708-W016	21-Mar-96	68.	66.	23.	74.	83.	7.1	40.	220.	300.	110.	60.	200.	130.	13,300.	580.	240.	361.1	15,501.
	960620-MW8-56-01 [6]	2708-W019	20-Jun-96	6.6	5.7	2.2	7.9	7.3	0.81	4.3	28.	66.	9.8	6.	21.	17.	1,500.	56.	30.	34.8	1,769.
	961002-MW8-56-01	2708-W022	2-Oct-96	26.	24.	ND [d]	27.	22.	ND [d]	15.	120.	230.	42.	20.	92.	74.	10,700.	250.	100.	114.	11,742.
	970226-MW8-56-01	2708-W025	26-Feb-97	ND>20	ND>20	ND>20	ND>20	ND>20	ND>20	ND>20	120.	240.	34.	ND>20	34.	60.	13,000.	160.	44.	0.	13,692.
	970828-MW8-56-01	2708-W028	28-Aug-97	4.1	3.7	1.4	4.4	4.1	ND [b]	2.3	160.	240.	16.	3.	24.	80.	17,400.	170.	28.	20.	18,141.
	980218-MW8-56-01	2708-W031	18-Feb-98	2.6	2.	0.58	2.4	1.8	0.3	1.5	130.	220.	18.	1.7	20.	67.	12,300.	150.	27.	11.2	12,945.
	980603-MW8-56-21	2708-W034	3-Jun-98	13.	13.	5.	15.	13.	1.3	7.5	190.	310.	31.	11.	61.	100.	16,600.	280.	69.	67.8	17,720.
MW09-29	951205-MW9-29-01	2708-W009	5-Dec-95	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	0.1	0.15	ND [a]	0.12	ND [a]	0.44	0.37	0.11	ND	1.3
	960318-MW9-29-01	2708-W013	18-Mar-96	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	0.11	ND [a]	0.18	ND [a]	0.29	0.15	ND [a]	0.6	0.27	ND	1.6
	960618-MW9-29-01	2708-W018	18-Jun-96	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	0.15	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND	0.2
	961001-MW9-29-01	2708-W021	1-Oct-96	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	0.12	ND [a]	ND [a]	ND [a]	0.28	ND [a]	ND [a]	ND	0.4
	970225-MW9-29-01	2708-W024	25-Feb-97	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND	ND
	970827-MW9-29-01	2708-W027	27-Aug-97	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND	ND
	980217-MW9-29-01	2708-W030	17-Feb-98	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND	ND
	980602-MW9-29-07	2708-W033	2-Jun-98	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND	ND
EPA Maximum Contaminant Levels (MCLs) for Drinking Water				#	#	#	2	#	#	#	#	#	#	#	#	#	#	#	#	#	#
EPA Region 9 Preliminary Remedial Goals (PRGs) for Tap Water				0.09	0.09	0.92	0.01	9.2	0.01	0.09	365	#	1,825	#	1,460	243	243	#	182	#	#
DEQ Ambient Water Quality Criteria (AWQC) for Surface Water [2]				#	#	#	#	#	#	#	520 [3]	#	#	#	54 [4]	#	620 [3]	#	#	0.031 [4]	#

Table H-2 - Summary of Historical Analytical Results for Groundwater Samples - Monitoring Wells, December 1995 to Present
PAHs by EPA Method 8270

Remedial Investigation
Northwest Natural - Gasco Facility
Portland, Oregon

Project No. 2708

PAHs by EPA Method 8270 (SIM)				Analytical Results ug/l (ppb)																	
				Carcinogenic PAHs							Non-carcinogenic PAHs										
Well Number	Sample Number	Chain of Custody Number	Sample Date	Benzo (a) anthracene	Benzo (b) fluoranthene	Benzo (k) fluoranthene	Benzo (a) pyrene	Chrysene	Dibenzo (ah) anthracene	Indeno (1,2,3-cd) pyrene	Acenaphthene	Acenaphthylene	Anthracene	Benzo (ghi) perylene	Fluoranthene	Fluorene	Naphthalene	Phenanthrene	Pyrene	Total Carcinogenic PAHs	Total PAHs
MW10-25	951207-MW10-25-01	2708-W011	7-Dec-95	4.	2.9	1.3	3.4	4.6	ND [b]	1.8	31.	88.	16.	2.5	21.	33.	13,000.	85.	22.	18.	13,317.
	960320-MW10-25-01	2708-W015	20-Mar-96	1.3	1.2	0.55	1.4	0.78	ND>0.3	0.67	70.	98.	11.	0.91	8.8	39.	8,800.	86.	6.7	5.9	9,126.
	960617-MW10-25-01	2708-W017	17-Jun-96	1.1	1.2	0.62	1.8	0.87	0.25	0.95	75.	130.	14.	1.1	1.6	49.	9,900.	82.	6.6	6.8	10,266.
	960930-MW10-25-01	2708-W020	30-Sep-96	20.	12.	3.9	15.	19.	1.7	7.	140.	87.	39.	9.9	95.	90.	9,600.	310.	80.	78.6	10,530.
	970224-MW10-25-01	2708-W023	25-Feb-97	21.	13.	3.4	15.	16.	ND [b]	5.9	210.	81.	30.	11.	ND [b]	95.	9,000.	340.	ND>1.0	74.3	9,841.
	970827-MW10-25-01	2708-W027	27-Aug-97	4.4	3.5	1.2	4.3	4.2	ND [b]	2.	72.	59.	11.	2.5	22.	41.	6,700.	100.	20.	19.6	7,047.
	980216-MW10-25-01	2708-W029	16-Feb-98	14.	11.	3.6	12.	11.	1.1	5.4	100.	87.	19.	8.1	59.	62.	8,500.	210.	62.	58.1	9,165.
	980601-MW10-25-02	2708-W032	1-Jun-98	8.2	6.7	1.9	7.	7.2	0.7	3.4	140.	150.	26.	4.8	45.	82.	11,400.	230.	49.	35.1	12,162.
MW10-61	951206-MW10-61-01	2708-W010	6-Dec-95	0.39	ND [a]	ND [a]	ND [a]	0.33	ND [a]	ND [a]	39.	17.	12.	ND [a]	12.	28.	620.	90.	11.	0.7	830.
	960321-MW10-61-01	2708-W016	21-Mar-96	0.75	0.34	0.12	0.36	0.8	ND [a]	0.18	5.8	2.2	4.7	0.28	7.3	1.5	43.	28.	7.1	2.6	102.
	960620-MW10-61-01	2708-W019	20-Jun-96	0.54	0.24	0.12	0.28	0.68	ND [a]	0.14	2.1	0.98	2.2	0.22	4.4	0.22	13.	15.	5.4	2.	45.5
	961002-MW10-61-01	2708-W022	2-Oct-96	0.48	0.23	ND [a]	0.25	0.42	ND [a]	0.12	0.88	0.54	1.5	0.17	4.1	0.16	4.6	8.5	3.2	1.5	25.2
	970226-MW10-61-01	2708-W025	26-Feb-97	0.41	0.15	ND [a]	0.13	0.35	ND [a]	ND [a]	0.73	0.45	1.	ND [a]	3.5	0.1	3.3	4.1	3.8	1.	18.
	970828-MW10-61-01	2708-W028	28-Aug-97	0.21	ND [a]	ND [a]	ND [a]	0.18	ND [a]	ND [a]	0.33	0.11	0.55	ND [a]	2.2	ND [a]	0.78	1.1	2.3	0.4	7.8
	980218-MW10-61-01	2708-W031	18-Feb-98	0.24	0.16	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	0.13	ND [a]	0.12	ND [a]	1.1	ND [a]	0.29	0.22	1.5	0.4	3.8
	980603-MW10-61-16	2708-W034	3-Jun-98	0.42	0.27	0.11	0.27	0.36	ND [a]	0.12	0.18	ND [a]	0.13	0.21	1.7	ND [a]	0.26	0.15	2.	1.6	6.2
MW11-32	951207-MW11-32-01	2708-W011	7-Dec-95	5.5	2.6	1.3	2.8	6.3	ND [b]	1.5	340.	340.	32.	2.2	48.	190.	21,000.	360.	33.	20.	22,365.
	960320-MW11-32-01	2708-W015	20-Mar-96	1.6	1.2	0.49	1.2	1.3	ND>0.5	0.54	200.	180.	20.	0.75	16.	90.	14,000.	150.	13.	6.3	14,676.
	960617-MW11-32-01	2708-W017	17-Jun-96	2.9	2.3	1.	2.8	2.8	0.31	1.4	160.	160.	19.	1.8	19.	90.	11,000.	120.	25.	13.5	11,608.
	960930-MW11-32-01	2708-W020	30-Sep-96	31.	22.	9.9	27.	27.	2.	13.	270.	220.	62.	20.	150.	150.	16,000.	430.	170.	131.9	17,604.
	960930-MW11-32-02	2708-W020	30-Sep-96	41.	36.	14.	40.	33.	3.	22.	270.	250.	74.	31.	200.	180.	17,000.	510.	190.	189.	18,894.
	970224-MW11-32-01	2708-W023	25-Feb-97	4.2	3.2	ND [b]	ND [b]	3.3	ND [b]	ND [b]	150.	140.	1.4	ND [b]	ND [b]	68.	11,000.	140.	26.	10.7	11,536.
	970826-MW11-32-01	2708-W026	26-Aug-97	4.6	3.7	1.3	4.3	4.1	0.5	2.	260.	190.	21.	2.3	37.	120.	16,200.	200.	25.	20.5	17,076.
	980216-MW11-32-01	2708-W029	16-Feb-98	4.1	3.1	1.	3.2	2.9	ND [b]	1.6	150.	120.	16.	2.3	25.	65.	9,200.	140.	25.	15.9	9,759.
	980601-MW11-32-03	2708-W032	1-Jun-98	26.	25.	ND [d]	24.	24.	ND [d]	13.	510.	360.	56.	18.	130.	250.	30,200.	580.	160.	112.	32,376.
MW12-36	951207-MW12-36-01	2708-W011	7-Dec-95	1.5	0.36	0.17	0.22	1.4	ND [a]	ND [a]	400.	7.8	21.	0.1	28.	170.	2,500.	230.	17.	3.7	3,378.
	960321-MW12-36-01	2708-W016	21-Mar-96	0.38	ND [a]	ND [a]	ND [a]	0.35	ND [a]	ND [a]	250.	3.3	16.	ND [a]	18.	110.	1,400.	200.	12.	0.7	2,010.
	960620-MW12-36-01	2708-W019	20-Jun-96	0.4	ND [a]	ND [a]	ND [a]	0.4	ND [a]	ND [a]	160.	2.4	11.	ND [a]	18.	81.	1,200.	130.	18.	0.8	1,621.
	961002-MW12-36-01	2708-W022	2-Oct-96	0.47	ND [a]	ND [a]	ND [a]	0.33	ND [a]	ND [a]	140.	2.	10.	ND [a]	25.	59.	990.	130.	18.	0.8	1,375.
	970226-MW12-36-01	2708-W025	26-Feb-97	0.63	ND [a]	ND [a]	ND [a]	0.31	ND [a]	ND [a]	100.	1.7	ND [a]	ND [a]	24.	40.	760.	88.	18.	0.9	1,033.
	970828-MW12-36-01	2708-W028	28-Aug-97	0.43	ND [a]	ND [a]	ND [a]	0.24	ND [a]	ND [a]	79.	1.4	7.7	ND [a]	19.	33.	620.	61.	18.	0.7	840.
	980218-MW12-36-01	2708-W031	18-Feb-98	0.51	ND [a]	ND [a]	ND [a]	0.18	ND [a]	ND [a]	71.	0.78	2.6	ND [a]	17.	25.	530.	52.	9.2	0.7	708.
	980603-MW12-36-17	2708-W034	3-Jun-98	ND [b]	ND [b]	ND [b]	ND [b]	ND [b]	ND [b]	ND [b]	77.	1.1	5.9	ND [b]	22.	30.	480.	62.	19.	0.	697.
																				0.	
MW-13-30	980217-MW13-30-01	2708-W030	17-Feb-98	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	190.	1.6	7.3	ND [a]	3.5	52.	69.	100.	2.7	ND	426.
	980602-MW13-30-12	2708-W033	2-Jun-98	ND [b]	ND [b]	ND [b]	ND [b]	ND [b]	ND [b]	ND [b]	300.	ND>1	16.	ND [b]	5.1	85.	610.	160.	4.8	ND	1,181.
MW-13-61	980218-MW13-61-01	2708-W031	18-Feb-98	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND	ND
	980602-MW13-61-13	2708-W033	2-Jun-98	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND	ND
EPA Maximum Contaminant Levels (MCLs) for Drinking Water				#	#	#	2	#	#	#	#	#	#	#	#	#	#	#	#	#	#
EPA Region 9 Preliminary Remedial Goals (PRGs) for Tap Water				0.09	0.09	0.92	0.01	9.2	0.01	0.09	365	#	1,825	#	1,460	243	243	#	182	#	#
DEQ Ambient Water Quality Criteria (AWQC) for Surface Water[2]				#	#	#	#	#	#	#	520 [3]	#	#	#	54 [4]	#	620 [5]	#	#	0.031 [4]	#

Table H-2 - Summary of Historical Analytical Results for Groundwater Samples - Monitoring Wells, December 1995 to Present
PAHs by EPA Method 8270

Remedial Investigation
Northwest Natural - Gasco Facility
Portland, Oregon

Project No. 2708

PAHs by EPA Method 8270 (SIM)				Analytical Results ug/l (ppb)																	
				Carcinogenic PAHs							Non-carcinogenic PAHs										
Well Number	Sample Number	Chain of Custody Number	Sample Date	Benzo (a) anthracene	Benzo (b) fluoranthene	Benzo (k) fluoranthene	Benzo (a) pyrene	Chrysene	Dibenzo (ah) anthracene	Indeno (1,2,3-cd) pyrene	Acenaphthene	Acenaphthylene	Anthracene	Benzo (ghi) perylene	Fluoranthene	Fluorene	Naphthalene	Phenanthrene	Pyrene	Total Carcinogenic PAHs	Total PAHs
Temporary Well Point Samples 1995																					
B-01 at 23'	950921-BW1-01	2708-W003	21-Sep-95	ND [a]	ND [a]	ND [a]	ND [a]	0.09	ND [a]	ND [a]	7.4	0.22	1.5	ND [a]	1.3	4.5	140.	19.	1.7	0.1	176.
B-05 at 28'	950925-BW05-01	2708-W005	29-Sep-95	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	ND [a]	13.	0.14	1.2	ND [a]	1.4	9.8	0.94	6.9	1.4	ND	34.8
B-19 at 28'	950920-BW19-02	2708-W002	20-Sep-95	**0.26**	**0.16**	ND [a]	ND [a]	0.28	ND [a]	ND [a]	39.	7.7	3.1	ND [a]	5.1	20.	**6,500.**	29.	5.6	0.7	6,610.
B-21 at 19.5'	951003-BW21-01	2708-W006	3-Oct-95	**0.53**	**0.66**	0.27	**0.34**	0.79	**0.07**	**0.27**	110.	1.83	2.66	0.37	5.04	21.	**560.**	17.	5.42	**2.9**	726.
B-31 at 29'	950925-BW31-01	2708-W004	25-Sep-95	**2.4**	**2.1**	**0.97**	**2.4**	3.9	**0.21**	**1.3**	96.	2.7	15.	1.6	16.	29.	**420.**	76.	25.	**13.3**	695.
EPA Maximum Contaminant Levels (MCLs) for Drinking Water				#	#	#	2	#	#	#	#	#	#	#	#	#	#	#	#	#	#
EPA Region 9 Preliminary Remedial Goals (PRGs) for Tap Water				0.09	0.09	0.92	0.01	9.2	0.01	0.09	365	#	1,825	#	1,460	243	243	#	182	#	#
DEQ Ambient Water Quality Criteria (AWQC) for Surface Water[2]				#	#	#	#	#	#	#	520 [3]	#	#	#	54 [4]	#	620 [5]	#	#	0.031 [4]	#

Note:
# = Reference Level not established
EPA = U.S. Environmental Protection Agency
ND = not detected above detection limit indicated
ODEQ = Oregon Department of Environmental Quality

PAHs = polynuclear aromatic hydrocarbons
ppb = parts per billion
ug/l = micrograms per liter
Bold and shaded = Detected above lowest identified Reference Level

a = detection limit is 0.1 ug/l (ppb)
b = detection limit is 1. ug/l (ppb)
c = detection limit is 2. ug/l (ppb)
d = detection limit is 10. ug/l (ppb)

1 = Sample number prefix: 2708-
2 = Reference Level indicated is the lowest guidance value provided in the Ambient Water Quality Criteria (OAR 340-41) based on Fresh Acute, Fresh Chronic (Aquatic Life Protection) and Fish Consumption Only (Human Health Protection)
3 = Reference Level based on Aquatic Fresh Chronic Criteria of AWQC
4 = Reference Level based on Human Fish Consumption Criteria of AWQC
5 = Due to mislabeling in the field or due to laboratory misidentification, the laboratory report transposed results for MW4-35 and MW-4-57 in August 1997. Tables attribute data to the correct well.
6 = Results for sample 960620-MW-8-56-01 should be considered qualitative due to an apparent error concerning sample identity with respect to PAH container

Table H-3 - Summary of Historical Analytical Results for Groundwater Samples - Monitoring Wells
Phenols by EPA Method 8270
December 1995 to Present

Remedial Investigation
Northwest Natural - Gasco Facility
Portland, Oregon

Project No. 2708

Phenols by EPA Method 8270				Analytical Results ug/l (ppb)															
Well Number	HAI Sample Number [1]	Chain of Custody Number	Sample Date	4-Chloro-3-methylphenol	2-Chlorophenol	2,4-Dichlorophenol	2,4-Dimethylphenol	2,4-Dinitrophenol	2-Methyl-4,6-dinitrophenol	2-Methylphnol (o-cresol)	3 and 4-Methylphenol (cresols)	2-Nitrophenol	4-Nitrophenol	2,3,4,6-Tetrachlorophenol	Pentachlorophenol	Phenol	2,4,5-Trichlorophenol	2,4,6-Trichlorophenol	Total Phenols
MW03-56	951206-MW3-56-01	2708-W010	6-Dec-95	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>10.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND
MW04-35	960618-MW4-35-01	2708-W018	18-Jun-96	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>10.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND
	961001-MW4-35-01	2708-W021	1-Oct-96	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>10.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND
	970225-MW4-35-01	2708-W024	25-Feb-97	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>10.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND
	980827-MW4-57-01 [5]	2708-W027	27-Aug-97	ND>50	ND>50	ND>50	ND>20	ND>50	ND>50	ND>50	ND>50	ND>50	ND>50	ND>50	ND>10	ND>10	ND>50	ND>50	ND
	980217-MW4-35-01	2708-W030	17-Feb-98	ND>5.0	ND>5.0	ND>5.0	ND>20	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>10	ND>10	ND>5.0	ND>5.0	ND
MW04-57	960620-MW4-57-01	2708-W019	20-Jun-96	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>10.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	2.8	ND>5.0	ND>5.0	2.8
	961002-MW4-57-01	2708-W022	2-Oct-96	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>10.0	20.	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	9.	ND>5.0	ND>5.0	29.0
	970226-MW4-57-01	2708-W025	26-Feb-97	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>10.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	4.8	ND>5.0	ND>5.0	4.8
	970828-MW4-35-01 [5]	2708-W028	28-Aug-97	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>20	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>10	4.6	ND>5.0	ND>5.0	4.6
	980218-MW4-57-01	2708-W031	18-Feb-98	ND>5.0	ND>5.0	ND>50	ND>50	ND>200	ND>50	ND>50	ND>50	ND>50	ND>5.0	ND>50	ND>10	47.	ND>50	ND>50	47.0
MW06-32	951207-MW6-32-01	2708-W011	7-Dec-95	ND>50	ND>50	ND>50	ND>50	ND>100	ND>50	ND>50	ND>50	ND>50	ND>50	ND>50	ND>50	ND>50	ND>50	ND>50	ND
MW06-61	951206-MW6-61-01	2708-W010	6-Dec-95	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>10.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND
MW08-29	960321-MW8-29-01	2708-W016	21-Mar-96	ND>50	ND>50	ND>50	69.	ND>50	ND>50	29.	15.	ND>50	ND>50	ND>50	ND>50	16.	ND>50	ND>50	129
	960619-MW8-29-02	2708-W019	20-Jun-96	ND>5.0	ND>5.0	ND>5.0	10.	ND>10.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	10
	961002-MW8-29-01	2708-W022	2-Oct-96	ND>500	ND>500	ND>500	ND>500	ND>1,000	ND>500	ND>500	ND>500	ND>500	ND>500	ND>500	ND>500	ND>500	ND>500	ND>500	ND
	970226-MW8-29-01	2708-W025	26-Feb-97	ND>5.0	ND>5.0	ND>5.0	82.	ND>10.0	ND>5.0	9.8	ND>5.0	ND>5.0	2.6	ND>5.0	ND>5.0	5.5	ND>5.0	ND>5.0	100
	970828-MW8-29-01	2708-W028	28-Aug-97	ND>50	ND>50	ND>50	23.	ND>20	ND>50	ND>50	ND>50	ND>50	ND>50	ND>50	ND>10	13.	ND>50	ND>50	36
	980218-MW8-29-01	2708-W031	18-Feb-98	ND>50	ND>50	ND>50	ND>50	ND>200	ND>50	ND>50	ND>50	ND>50	ND>50	ND>50	ND>100	ND>100	ND>50	ND>50	ND
MW10-25	951207-MW10-25-01	2708-W011	7-Dec-95	ND>50	ND>50	ND>50	490.	ND>100	ND>50	1,600.	**930.**	ND>50	ND>50	ND>50	ND>50	470.	ND>50	ND>50	3,490
	960320-MW10-25-01	2708-W015	20-Mar-96	ND>20	ND>20	ND>20	**760.**	ND>20	ND>20	1,300.	**810.**	ND>20	ND>20	ND>20	ND>20	630.	ND>20	ND>20	3,500
	960617-MW10-25-01	2708-W017	17-Jun-96	ND>500	ND>500	ND>500	440.	ND>1000	ND>500	1,100.	**670.**	ND>500	ND>500	ND>500	ND>500	280.	ND>500	ND>500	2,490
	960930-MW10-25-01	2708-W020	30-Sep-96	ND>50	ND>50	ND>50	550.	ND>100	ND>50	**2,800.**	**1,700.**	ND>50	ND>50	ND>50	ND>50	1,000.	ND>50	ND>50	6,050
	970224-MW10-25-01	2708-W023	25-Feb-97	ND>5,000	ND>5,000	ND>5,000	ND>5,000	ND>10,000	ND>5,000	ND>5,000	ND>5,000	ND>5,000	ND>5,000	ND>5,000	ND>5,000	ND>5,000	ND>5,000	ND>5,000	ND>5,000
	970827-MW10-25-01	2708-W027	27-Aug-97	ND>20	ND>20	ND>20	350.	ND>100	ND>20	730.	**1,200.**	ND>20	ND>20	ND>20	ND>50	680.	ND>20	ND>20	2,960
	980216-MW10-25-01	2708-W029	16-Feb-98	ND>50	ND>50	ND>50	250.	ND>200	ND>50	650.	**930.**	ND>50	ND>50	ND>50	ND>100	790.	ND>50	ND>50	2,620
EPA Maximum Contaminant Levels (MCLs) for Drinking Water				#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#
EPA Region 9 Preliminary Remediation Goals (PRGs) for Tap Water				#	38.4	110	730	73	#	1,825	183	#	#	1,095	0.56	21,900	3,650	6.1	#
DEQ Ambient Water Quality Criteria (AWQC) for Surface Water [2]				#	2,000 [4]	365 [4]	2,120 [3]	#	#	#	#	150 [4]	150 [4]	#	13 [4]	2,560 [4]	#	970 [4]	#

Note:
EPA = U.S. Environmental Protection Agency
ND = Not detected above detection limit indicated
ppb = parts per billion
ug/l = micrograms/liter
= Reference Levels not established
Bold and shaded = Detected above lowest identified Reference Level
1 = Sample number prefix: 2708-
2 = Reference Level indicated is the lowest guidance value provided in the Ambient Water Quality Criteria (OAR 340-41) based on Fresh Acute, Fresh Chronic (Aquatic Life Protection) and Fish Consumption Only (Human Health Protection)
3 = Reference Level based on Aquatic Fresh Acute Criteria of AWQC
4 = Reference Level based on Aquatic Fresh Chronic Criteria of AWQC
5 = Due to mislabeling in the field or due to laboratory misidentification, the laboratory report transposed results for MW4-35 and MW-4-57 in August 1997. Tables attribute data to the correct well.

Table H-3 - Summary of Historical Analytical Results for Groundwater Samples - Monitoring Wells
Phenols by EPA Method 8270
December 1995 to Present

Remedial Investigation
Northwest Natural - Gasco Facility
Portland, Oregon

Project No. 2708

Phenols by EPA Method 8270				Analytical Results ug/l (ppb)															
Well Number	HAI Sample Number [1]	Chain of Custody Number	Sample Date	4-Chloro-3-methylphenol	2-Chlorophenol	2,4-Dichlorophenol	2,4-Dimethylphenol	2,4-Dinitrophenol	2-Methyl-4,6-dinitrophenol	2-Methylphnol (o-cresol)	3 and 4-Methylphenol (cresols)	2-Nitrophenol	4-Nitrophenol	2,3,4,6-Tetrachlorophenol	Pentachlorophenol	Phenol	2,4,5-Trichlorophenol	2,4,6-Trichlorophenol	Total Phenols
MW10-61	951206-MW10-61-01	2708-W010	6-Dec-95	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>10.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND
	960620-MW10-61-01	2708-W019	20-Jun-96	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>10.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND
	960930-MW10-61-01	2708-W022	2-Oct-96	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>10	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND
	970226-MW10-61-01	2708-W025	26-Feb-97	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>10	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	8.4	ND>5.0	ND>5.0	8.4
	970828-MW10-61-01	2708-W028	28-Aug-97	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>20	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>10	ND>10	ND>5.0	ND>5.0	ND
	980218-MW10-61-01	2708-W031	18-Feb-98	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>20	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>10	ND>10	ND>5.0	ND>5.0	ND
MW11-32	951207-MW11-32-01	2708-W011	7-Dec-95	ND>50	ND>50	ND>50	**1,200.**	ND>100	ND>50	1,200.	**590.**	ND>50	ND>50	ND>50	ND>50	120.	ND>50	ND>50	3,110
	960320-MW11-32-01	2708-W015	20-Mar-96	ND>20	ND>20	ND>20	**820.**	ND>20	ND>20	540.	**230.**	ND>20	ND>20	ND>20	ND>20	60.	ND>20	ND>20	1,650
	960617-MW11-32-01	2708-W017	17-Jun-96	ND>500	ND>500	ND>500	540.	ND>1,000	ND>500	420.	170.	ND>500	ND>500	ND>500	ND>500	ND>500	ND>500	ND>500	1,130
	960930-MW11-32-01	2708-W020	30-Sep-96	ND>100	ND>100	ND>100	650.	ND>200	ND>100	960.	**540.**	ND>100	ND>100	ND>100	ND>100	71.	ND>100	ND>100	2,221
	970224-MW11-32-01	2708-W023	25-Feb-97	ND>500	ND>500	ND>500	ND>500	ND>1,000	ND>500	240.	ND>500	ND>500	ND>500	ND>500	ND>500	ND>500	ND>500	ND>500	240
	970826-MW11-32-01	2708-W026	26-Aug-97	ND>20	ND>20	ND>20	600.	ND>100	ND>20	210.	120.	ND>20	ND>20	ND>20	ND>50	31.	ND>20	ND>20	961
	980216-MW11-32-01	2708-W029	16-Feb-98	ND>50	ND>50	ND>50	200.	ND>200	ND>50	130.	120.	ND>50	ND>50	ND>50	ND>100	ND>100	ND>50	ND>50	450
MW12-36	960321-MW12-36-01	2708-W016	21-Mar-96	ND>5	ND>5	ND>5	ND>5	ND>10	ND>5	ND>5	ND>5	ND>5	ND>5	ND>5	ND>5	ND>5	ND>5	ND>5	ND
Temporary Well Point Samples 1995																			
B-19 at 28'	950920-BW19-02	2708-W002	20-Sep-95	ND>5.0	ND>5.0	ND>5.0	120.	ND>10	ND>5.0	27.	ND>5.0	ND>5.0	ND>5.0	ND>5.0	1.5	16.	ND>5.0	ND>5.0	165
B-21 at 19.5'	951003-BW21-01	2708-W006	3-Oct-95	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>10	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND
EPA Maximum Contaminant Levels (MCLs) for Drinking Water				#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#
EPA Region 9 Preliminary Remediation Goals (PRGs) for Tap Water				#	38.4	110	730	73	#	1,825	183	#	#	1,095	0.56	21,900	3,650	6.1	#
DEQ Ambient Water Quality Criteria (AWQC) for Surface Water[2]				#	2,000 [4]	365 [4]	2,120 [3]	#	#	#	#	150 [4]	150 [4]	#	13 [4]	2,560[4]	#	970[4]	#

Note:
EPA = U.S. Environmental Protection Agency
ND = Not detected above detection limit indicated
ppb = parts per billion
ug/l = micrograms/liter
= Reference Levels not established
Bold and shaded = Detected above lowest identified Reference Level
1 = Sample number prefix: 2708-
2 = Reference Level indicated is the lowest guidance value provided in the Ambient Water Quality Criteria (OAR 340-41) based on Fresh Acute, Fresh Chronic (Aquatic Life Protection) and Fish Consumption Only (Human Health Protection)
3 = Reference Level based on Aquatic Fresh Acute Criteria of AWQC
4 = Reference Level based on Aquatic Fresh Chronic Criteria of AWQC
5 = Due to mislabeling in the field or due to laboratory misidentification, the laboratory report transposed results for MW4-35 and MW-4-57 in August 1997. Tables attribute data to the correct well.

Table H-4 - Summary of Historical Analytical Results for Groundwater Samples - Monitoring Wells
Detected Volatiles by EPA Method 8260
December 1995 to Present
Remedial Investigation
Northwest Natural - Gasco Facility
Portland, Oregon

Project No. 2708

Detected Volatiles by EPA Method 8260				Analytical Results ug/l (ppb)															
Well Number	HAI Sample Number	Chain of Custody Number	Sample Date	Benzene	Toluene	Ethyl benzene	m,p-Xylene	o-Xylene	Xylene (total)	Naphthalene	Styrene	sec-Butylbenzene	Isopropylbenzene	p-Isopropyltoluene	n-Propylbenzene	1,2,3-Trimethylbenzene	1,2,4-Trimethylbenzene	1,3,5-Trimethylbenzene	Tetrachloroethene
MW4-57	960321-MW4-57-01	2708-W016	21-Mar-96	**3,700.**	**35.**	540.	80.	140.	220.	**1,700.**	ND>10	ND>10	ND>10	ND>10	ND>10	22.	19.	13.	ND>10
MW5-32	951205-MW5-32-01	2708-W009	5-Dec-95	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	11.	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0
MW8-56	951207-MW8-56-01	2708-W011	7-Dec-95	**18,600.**	**1,400.**	590.	600.	200.	800.	**13,300.**	ND>100	ND>100	ND>100	ND>100	ND>100	ND>100	110.	ND>100	ND>100
MW11-32	960320-MW11-32-01	2708-W015	20-Mar-96	**16,700.**	**3,300.**	620.	840.	400.	1,240.	**8,600.**	ND>2	9.	**42.**	35.	18.	110.	250.	79.	**2.2**
	960617-MW11-32-01	2708-W017	17-Jun-96	**2,800.**	**2,000.**	**1,000.**	1,300.	640.	**1,940.**	**4,100.**	ND>5	10.	**70.**	ND>5	17.	100.	260.	82.	ND>5
	960617-MW11-32-02	2708-W017	17-Jun-96	**4,100.**	**2,600.**	**960.**	1,200.	580.	**1,780.**	**5,600.**	ND>10	8.8	**59.**	ND>10	14.	86.	220.	70.	ND>10
	960930-MW11-32-01	2708-W020	30-Sep-96	**17,000.**	**3,300.**	**900.**	1,200.	560.	**1,760.**	**13,900.**	ND>1,200	ND>1,200	ND>1,200	ND>1,200	ND>1,200	ND>1,200	ND>1,200	ND>1,200	ND>1,200
MW12-36	951207-MW12-36-01	2708-W011	7-Dec-95	**92.**	**510.**	150.	460.	170.	630.	**2,300.**	100.	ND>50	ND>50	ND>50	ND>50	36.	88.	57.	ND>50
	960321-MW12-36-01	2708-W016	21-Mar-96	**210.**	220.	140.	310.	180.	490.	**1,900.**	**130.**	ND>10	ND>10	ND>10	ND>10	22.	51.	37.	ND>10
	960620-MW12-36-01	2708-W019	20-Jun-96	**250.**	250.	120.	280.	160.	440.	**1,500.**	**140.**	ND>10	ND>10	ND>10	ND>10	16.	42.	13.	ND>10
	961002-MW12-36-01	2708-W022	2-Oct-96	**330.**	390.	130.	330.	180.	510.	**1,100.**	**170.**	ND>50	ND>50	ND>50	ND>50	18.	42.	14.	ND>50
	970226-MW12-36-01	2708-W025	26-Feb-97	**260.**	310.	120.			470.	**960.**	**150.**	ND>1.0	4.	1.	3.	ND>1.0	31.	11.	ND>1.0
	970828-MW12-36-01	2708-W028	28-Aug-97	**230.**	**430.**	110.	280.	150.	430.	**820.**	**150.**	ND>1.0	4.2	1.9	2.8	12.	30.	8.5	ND>1.0
	980218-MW12-36-01	2708-W031	18-Feb-98	**140.**	370.	82.	180.	100.	280.	**530.**	94.	ND>1.0	2.2	1.1	1.8		22.	6.2	ND>1.0
EPA Maximum Contaminant Levels (MCLs) for Drinking Water				5.0	1,000	700	10,000	10,000	10,000	#	100	#	#	#	#	#	#	#	5
EPA Region 9 Preliminary Remediation Goals (PRGs) for Tap Water				0.39	723	1,340	1,431	1,431	1,431	243	1,641	#	18.5	#	#	#	#	#	1.08
DEQ Ambient Water Quality Criteria (AWQC) for Surface Water[2]				40 [4]	424 [4]	1,400 [4]	#	#	#	620 [3]	#	#	#	#	#	#	#	#	8.85 [4]

Note: EPA = U.S. Environmental Protection Agency
ND = Not detected above detection limit indicated
ODEQ = Oregon Department of Environmental Quality

ppb = parts per billion
ug/l = micrograms per liter

Bold and shaded = Detected above Reference Level
= Reference Level not established

1 = Sample number prefix: 2708-
2 = Reference Level indicated is the lowest guidance value provided in the Ambient Water Quality Criteria (OAR 340-41) based on Fresh Acute, Fresh Chronic (Aquatic Life Protection) and Fish Consumption Only (Human Health Protection)
3 = Reference Level based on Aquatic Fresh Chronic Criteria of AWQC
4 = Reference Level based on Human Fish Consumption Criteria of AWQC

Table H-5 - Summary of Historical Analytical Results for Groundwater Samples - Monitoring Wells, December 1995 to Present
Priority Pollutant Metals by EPA Methods 6010, 200.7 and/or 7000 Series

Remedial Investigation
Northwest Natural - Gasco Facility
Portland, Oregon

Project No. 2708

Priority Pollutant Metals by EPA Methods 6010, 7000, and 200 Series				Analytical Results mg/l (ppm)																	
Well Number	HAI Sample Number [1]	Chain of Custody Number	Sample Date	Antimony	Arsenic	Dissolved Arsenic	Beryllium	Cadmium	Dissolved Cadmium	Chromium	Dissolved Chromium	Copper	Lead	Dissolved Lead	Mercury	Nickel	Dissolved Nickel	Selenium	Silver	Thallium	Zinc
MW01-22	951207-MW1-22-01	2708-W011	7-Dec-95										0.041	ND [c]							
	960319-MW1-22-01	2708-W014	19-Mar-96	ND [c]	ND [c]		ND [b]	ND [b]		0.01		ND [c]	0.007	ND [c]	ND [c]	0.14	0.23	ND [b]	ND [b]	ND [d]	0.066
	960618-MW1-22-01	2708-W018	18-Jun-96		ND [c]					ND [c]		ND [c]	ND [c]			0.039					0.024
	961001-MW1-22-01	2708-W021	1-Oct-96		ND [c]					0.023	0.022	ND [c]	ND [c]	ND [c]		0.16	0.14				0.17
	970225-MW1-22-01	2708-W024	25-Feb-97		ND [c]					ND [c]		ND [c]	ND [c]			0.045					0.028
	970225-MW1-22-02	2708-W024	25-Feb-97		ND [c]					ND [c]		ND [c]	ND [c]			0.044					0.024
	970827-MW1-22-01	2708-W027	27-Aug-97		0.012					0.018		0.01	0.027	ND [c]		0.1	0.083				0.16
	970827-MW1-22-02	2708-W027	27-Aug-97		ND [c]					ND [c]		ND [c]	ND [c]	ND [c]		0.12	0.081				0.53
	980217-MW1-22-01	2708-W030	17-Feb-98		0.009					ND [c]		0.007	0.015	ND [c]		0.011					0.05
	980602-MW1-32-11	2708-W033	2-Jun-98		0.031					0.006			0.03	ND [c]		0.026					0.13
MW02-32	951206-MW2-32-01	2708-W010	6-Dec-95										ND [c]								
	960618-MW2-32-01	2708-W018	18-Jun-96		ND [c]					ND [c]		ND [c]	ND [c]			0.008					ND [c]
	961001-MW2-32-01	2708-W021	1-Oct-96		ND [c]					ND [c]		0.008	ND [c]			0.005					0.01
	970225-MW2-32-01	2708-W024	25-Feb-97		0.008					ND [c]		ND [c]	ND [c]			0.011					0.007
	970827-MW2-32-01	2708-W027	27-Aug-97		0.007					ND [c]		ND [c]	ND [c]			0.008					0.008
	980217-MW2-32-01	2708-W030	17-Feb-97		ND [c]					ND [c]		ND [c]	ND [c]			ND [c]					ND [c]
	980601-MW2-32-05	2708-W032	1-Jun-98		ND [c]					ND [c]						0.006					
MW03-26	951206-MW3-26-01	2708-W010	6-Dec-95										0.007	ND [c]							
	960318-MW3-26-02	2708-W013	18-Mar-96		ND [c]			ND [b]		ND [c]		ND [c]	ND [c]			0.36	0.4				0.005
	960618-MW3-26-01	2708-W018	18-Jun-96		ND [c]					ND [c]		ND [c]	ND [c]			0.33	0.39				0.014
	961001-MW3-26-01	2708-W021	1-Oct-96		0.026					0.44	ND [c]	0.41	0.11	ND [c]		1.5	0.15				0.98
	970225-MW3-26-01	2708-W024	25-Feb-97		ND [c]					0.006		ND [c]	ND [c]			0.27	0.2				0.017
	970827-MW3-26-01	2708-W027	27-Aug-97		0.031					0.39	ND [c]	0.38	0.099	ND [c]		1.4	0.05				0.71
	980218-MW3-26-01	2708-W031	18-Feb-98		ND [c]					0.017		0.009	0.007			0.21	0.15				0.04
	980602-MW3-26-09	2708-W033	2-Jun-98		ND [c]					ND [c]		0.008	0.005			0.29					0.028
MW03-56	951206-MW3-56-01	2708-W010	6-Dec-95	ND [c]	ND [c]		ND [b]	ND [b]		ND [c]		ND [c]	ND [c]		ND [a]	0.007		ND [c]	ND [c]	ND [d]	0.005
	960319-MW3-56-01	2708-W014	19-Mar-96		ND [c]			ND [b]		ND [c]		ND [c]	ND [c]			0.013					ND [c]
	980602-MW3-56-14	2708-W033	2-Jun-98		ND [c]					0.007						0.017					
MW04-35	951206-MW4-35-01	2708-W010	6-Dec-95										ND [c]								
	960618-MW4-35-01	2708-W018	18-Jun-96		ND [c]					ND [c]		ND [c]	ND [c]			ND [c]					ND [c]
	961001-MW4-35-01	2708-W021	1-Oct-96		0.007					ND [c]		ND [c]	ND [c]			ND [c]					0.008
	970225-MW4-35-01	2708-W024	25-Feb-97		0.006					ND [c]		ND [c]	ND [c]			ND [c]					ND [c]
	980827-MW4-57-01 [5]	2708-W027	27-Aug-97		ND [c]					ND [c]		ND [c]	ND [c]			ND [c]					ND [c]
	980217-MW4-35-01	2708-W030	17-Feb-98		ND [c]					0.007		ND [c]	ND [c]			0.005					0.005
	980601-MW4-35-06	2708-W032	1-Jun-98		ND [c]					ND [c]						ND [c]					
MW04-57	951205-MW4-57-01	2708-W009	5-Dec-95										ND [c]								
	960321-MW4-57-01	2708-W016	21-Mar-96		0.005			ND [b]		ND [c]		ND [c]	ND [c]			ND [c]					ND [c]
	960620-MW4-57-02	2708-W019	20-Jun-96		0.007					ND [c]		ND [c]	ND [c]			0.005					ND [c]
	961002-MW4-57-01	2708-W022	2-Oct-96		0.013					ND [c]		ND [c]	ND [c]			ND [c]					ND [c]
	970226-MW4-57-01	2708-W025	26-Feb-97		0.01					ND [c]		ND [c]	ND [c]			ND [c]					ND [c]
	970828-MW4-35-01 [5]	2708-W028	28-Aug-97		0.013					ND [c]		ND [c]	ND [c]			ND [c]					ND [c]
	980218-MW4-57-01	2708-W031	18-Feb-98		0.011					ND [c]		ND [c]	ND [c]			ND [c]					ND [c]
	980603-MW4-57-18	2708-W034	3-Jun-98		0.011					ND [c]						ND [c]					
EPA Maximum Contaminant Levels (MCLs) for Drinking Water				0.006	0.05	0.05	0.004	0.005	0.005	0.1	0.1	1	0.15	0.15	0.002	0.1	0.1	0.05	0.1	0.002	5
EPA Region 9 Preliminary Remediation Goals (PRGs) for Tap Water				0.0146	0.00004	0.00004	0.00002	0.018	0.018	0.183	0.183	1.356	0.004	0.004	#	0.73	0.73	0.183	0.183	0.0029	10.95
ODEQ Ambient Water Quality Criteria (AWQC) for Surface Water [2]				1.6 [3]	0.000017 [4]	0.000017 [4]	0.000117 [4]	0.0011 [3]	0.0011 [3]	0.011 [3]	0.011 [3]	0.012 [3]	0.0032 [3]	0.0032 [3]	0.000012 [3]	0.1 [4]	0.1 [4]	0.035 [3]	0.00012 [3]	0.04 [3]	0.11 [3]

Table H-5 - Summary of Historical Analytical Results for Groundwater Samples - Monitoring Wells, December 1995 to Present
Priority Pollutant Metals by EPA Methods 6010, 200.7 and/or 7000 Series

Remedial Investigation
Northwest Natural - Gasco Facility
Portland, Oregon

Project No. 2708

Priority Pollutant Metals by EPA Methods 6010, 7000, and 200 Series				Analytical Results mg/l (ppm)																	
Well Number	HAI Sample Number [1]	Chain of Custody Number	Sample Date	Antimony	Arsenic	Dissolved Arsenic	Beryllium	Cadmium	Dissolved Cadmium	Chromium	Dissolved Chromium	Copper	Lead	Dissolved Lead	Mercury	Nickel	Dissolved Nickel	Selenium	Silver	Thallium	Zinc
MW05-32	951205-MW5-32-01	2708-W009	5-Dec-95										ND [c]								
	960620-MW5-32-01	2708-W019	20-Jun-96		ND [c]					ND [c]		ND [c]	ND [c]			ND [c]					ND [c]
	961001-MW5-32-01	2708-W021	1-Oct-96		0.008					0.11	ND [c]	0.22	0.029	ND [c]		0.086					0.4
	970225-MW5-32-01	2708-W024	25-Feb-97		ND [c]					ND [c]		ND [c]	ND [c]			ND [c]					0.006
	970827-MW5-32-01	2708-W027	27-Aug-97		ND [c]					0.011		0.012	ND [c]			0.012					0.024
	980217-MW5-32-01	2708-W030	17-Feb-98		ND [c]					0.022		0.01	ND [c]			0.011					0.016
	980602-MW5-32-10	2708-W033	2-Jun-98		ND [c]					0.022						0.023					
MW06-32	951207-MW6-32-01	2708-W011	7-Dec-95	ND [c]	0.015		ND [b]	ND [b]		ND [c]		ND [c]	ND [c]		ND [a]	ND [c]		ND [c]	ND [c]	ND [d]	ND [c]
	960319-MW6-32-01	2708-W014	19-Mar-96		0.011			ND [b]		ND [c]		ND [c]	ND [c]			ND [c]					0.005
	960617-MW6-32-01	2708-W017	17-Jun-96		0.011					ND [c]		ND [c]	ND [c]			ND [c]					ND [c]
	960930-MW6-32-01	2708-W020	30-Sep-96		0.007					ND [c]		ND [c]	ND [c]			ND [c]					ND [c]
	970224-MW6-32-01	2708-W023	25-Feb-97		0.008					ND [c]		ND [c]	ND [c]			ND [c]					ND [c]
	970826-MW6-32-01	2708-W026	26-Aug-97		0.007					ND [c]		ND [c]	ND [c]			ND [c]					ND [c]
	980216-MW6-32-01	2708-W029	16-Feb-98		0.009					ND [c]		ND [c]	ND [c]			ND [c]					0.005
MW06-61	951206-MW6-61-01	2708-W010	6-Dec-95										ND [c]								
	960319-MW6-61-01	2708-W014	19-Mar-96	ND [c]	ND [c]			ND [c]		0.005		ND [c]	ND [c]			ND [c]					0.015
	960620-MW6-61-01	2708-W019	20-Jun-96		ND [c]					ND [c]		ND [c]	ND [c]			ND [c]					ND [c]
	961001-MW6-61-01	2708-W021	1-Oct-96		0.006					ND [c]		0.01	ND [c]			ND [c]					0.01
	970225-MW6-61-01	2708-W024	25-Feb-97		0.006					ND [c]		ND [c]	ND [c]			ND [c]					ND [c]
	970828-MW6-61-01	2708-W028	28-Aug-97		0.007					0.014		0.018	ND [c]			0.012					0.2
MW08-29	951207-MW8-29-01	2708-W011	7-Dec-95	ND [c]	ND [c]		ND [b]	ND [b]		0.031		0.023	0.011		ND [a]	0.075		ND [c]	ND [c]	ND [d]	0.3
	960321-MW8-29-01	2708-W016	21-Mar-96		ND [c]			ND [c]		0.008		0.005	ND [c]			0.015					0.26
	960619-MW8-29-02	2708-W019	20-Jun-96		ND [c]					ND [c]		ND [c]	ND [c]			0.008					0.014
	961002-MW8-29-01	2708-W022	2-Oct-96		ND [c]					ND [c]		ND [c]	ND [c]			0.008					ND [c]
	970226-MW8-29-01	2708-W025	26-Feb-97		ND [c]					ND [c]		ND [c]	ND [c]			0.007					0.01
	970828-MW8-29-01	2708-W028	28-Aug-97		ND [c]					ND [c]		ND [c]	ND [c]			0.011					0.2
	980218-MW8-29-01	2708-W031	18-Feb-98		ND [c]					ND [c]		ND [c]	ND [c]			0.009					0.21
MW08-56	951207-MW8-56-01	2708-W011	7-Dec-95	ND [c]	ND [c]		ND [b]	ND [b]		0.048		0.009	ND [c]		ND [a]	0.035		ND [c]	ND [c]	ND [d]	0.27
	960321-MW8-56-01	2708-W016	21-Mar-96		ND [c]			ND [b]		0.021		0.009	ND [c]			0.02					0.24
	960620-MW8-56-01	2708-W019	20-Jun-96		ND [c]					ND [c]		0.15	ND [c]			0.017					0.1
	961002-MW8-56-01	2708-W022	2-Oct-96		ND [c]					0.02		0.027	ND [c]			0.071					0.023
	970226-MW8-56-01	2708-W025	26-Feb-97		ND [c]					0.07		0.026	0.005			0.052					0.05
	970828-MW8-56-01	2708-W028	28-Aug-97		0.006					ND [c]		ND [c]	ND [c]			ND [c]					0.007
	980218-MW8-56-01	2708-W031	18-Feb-98		0.006					0.027		0.017	ND [c]			0.02					0.22
MW09-29	951205-MW9-29-01	2708-W009	5-Dec-95										0.022								
	960318-MW9-29-01	2708-W013	18-Mar-96	ND [c]	ND [c]		ND [b]	ND [b]		ND [c]		ND [c]	ND [c]		ND [a]	ND [c]		ND [c]	ND [c]	ND [d]	ND [c]
	960618-MW9-29-01	2708-W018	18-Jun-96		0.01					0.23		0.3	0.008			0.16	ND [c]				0.097
	961001-MW9-29-01	2708-W021	1-Oct-96		ND [c]					0.047		0.015	ND [c]			0.035					0.037
	970225-MW9-29-01	2708-W024	25-Feb-97		0.006					0.021		0.005	ND [c]			0.018					0.022
	970827-MW9-29-01	2708-W027	27-Aug-97		ND [c]					0.035		0.009	ND [c]			0.029					0.03
	980217-MW9-29-01	2708-W030	17-Feb-98		0.005					0.021		0.019	ND [c]			0.022					0.25
	980602-MW9-29-07	2708-W033	2-Jun-98		0.01					0.037						0.04					
EPA Maximum Contaminant Levels (MCLs) for Drinking Water				0.006	0.05	0.05	0.004	0.005	0.005	0.1	0.1	1	0.15	0.15	0.002	0.1	0.1	0.05	0.1	0.002	5
EPA Region 9 Preliminary Remediation Goals (PRGs) for Tap Water				0.0146	0.00004	0.00004	0.00002	0.018	0.018	0.183	0.183	1.356	0.004	0.004	#	0.73	0.73	0.183	0.183	0.0029	10.95
ODEQ Ambient Water Quality Criteria (AWQC) for Surface Water [2]				1.6 [3]	0.000017 [4]	0.000017 [4]	0.000117 [4]	0.0011 [3]	0.0011 [3]	0.011 [3]	0.011 [3]	0.012 [3]	0.0032 [3]	0.0032 [3]	0.000012 [3]	0.1 [4]	0.1 [4]	0.035 [3]	0.00012 [3]	0.04 [3]	0.11 [3]

Table H-5 - Summary of Historical Analytical Results for Groundwater Samples - Monitoring Wells, December 1995 to Present
Priority Pollutant Metals by EPA Methods 6010, 200.7 and/or 7000 Series

Remedial Investigation
Northwest Natural - Gasco Facility
Portland, Oregon

Project No. 2708

Priority Pollutant Metals by EPA Methods 6010, 7000, and 200 Series				Analytical Results mg/l (ppm)																	
Well Number	HAI Sample Number [1]	Chain of Custody Number	Sample Date	Antimony	Arsenic	Dissolved Arsenic	Beryllium	Cadmium	Dissolved Cadmium	Chromium	Dissolved Chromium	Copper	Lead	Dissolved Lead	Mercury	Nickel	Dissolved Nickel	Selenium	Silver	Thallium	Zinc
MW10-25	951207-MW10-25-01	2708-W011	7-Dec-95	ND [c]	**0.034**		ND [b]	**0.005**		**0.11**		ND [c]	ND [c]		ND [a]	**0.29**		ND [c]	ND [c]	ND [d]	**0.95**
	960320-MW10-25-01	2708-W015	20-Mar-96		**0.035**			**0.005**	ND [b]	**0.089**		ND [c]	ND [d]			**0.28**	**0.3**				**0.86**
	960617-MW10-25-01	2708-W017	17-Jun-96		**0.028**					**0.043**		ND [c]	ND [c]			**0.2**					**0.48**
	960930-MW10-25-01	2708-W020	30-Sep-96		**0.041**					**0.13**		ND [c]	ND>0.02			**0.43**					**1.3**
	970224-MW10-25-01	2708-W023	25-Feb-97		**0.058**	**0.052**				**0.17**	**0.16**	ND [c]	ND [c]			**0.41**	**0.37**				**1.3**
	970827-MW10-25-01	2708-W027	27-Aug-97		**0.045**					**0.36**	**0.23**	ND [c]	ND [a]	ND [a]		**0.83**	**0.53**				**3.**
	980216-MW10-25-01	2708-W029	16-Feb-98		**0.048**					**0.16**	**0.18**	ND [c]	ND>0.015			**0.39**	**0.46**				**1.5**
	980601-MW10-25-02	2708-W032	1-Jun-98		**0.031**					**0.12**	**0.12**					**0.29**	**0.28**				
MW10-61	951206-MW10-61-01	2708-W010	6-Dec-95										ND [c]								
	960321-MW10-61-01	2708-W016	21-Mar-96		**0.005**			ND [b]		**0.027**		0.009	ND [c]			0.022					0.025
	960620-MW10-61-01	2708-W019	20-Jun-96		ND [c]					ND [c]		ND [c]	ND [c]			0.007					0.008
	960930-MW10-61-01	2708-W022	2-Oct-96		**0.006**					**0.016**		ND [c]	ND [c]			0.011					0.012
	970226-MW10-61-01	2708-W025	26-Feb-97		ND [c]					**0.018**		ND [c]	ND [c]			0.015					0.015
	970828-MW10-61-01	2708-W028	28-Aug-97		ND [c]					ND [c]		ND [c]	ND [c]			ND [c]					ND [e]
	980218-MW10-61-01	2708-W031	18-Feb-98		ND [c]					0.01		ND [c]	ND [c]			0.009					0.015
	980603-MW10-61-16	2708-W034	3-Jun-98		**0.006**					0.009						0.009					
MW11-32	951207-MW11-32-01	2708-W011	7-Dec-95	ND [c]	ND [c]		ND [b]	ND [b]		ND [c]		ND [c]	ND [c]		ND [a]	ND [c]		ND [c]	ND [c]	ND [d]	ND [c]
	960320-MW11-32-01	2708-W015	20-Mar-96		ND [c]			ND [b]		ND [c]		ND [c]	ND [c]			ND [c]					0.008
	960930-MW11-32-01	2708-W020	30-Sep-96		ND [c]			ND [c]		ND [c]		ND [c]	ND [c]			ND [c]					ND [c]
	960930-MW11-32-02	2708-W020	30-Sep-96		ND [c]			ND [c]		ND [c]		ND [c]	ND [c]			ND [c]					ND [c]
	970224-MW11-32-01	2708-W023	25-Feb-97		ND [c]					ND [c]		ND [c]	ND [c]			ND [c]					ND [c]
	970826-MW11-32-01	2708-W026	26-Aug-97		ND [c]					ND [c]		ND [c]	ND [c]			ND [c]					ND [c]
	980216-MW11-32-01	2708-W029	16-Feb-98		ND [c]					ND [c]		ND [c]	ND [c]			ND [c]					ND [c]
MW12-36	951207-MW12-36-01	2708-W011	7-Dec-95	ND [c]	ND [c]		ND [b]	ND [b]		ND [c]		0.006	ND [c]		ND [a]	ND [c]		ND [c]	ND [c]	ND [d]	0.012
MW13-30	980602-MW13-30-12	2708-W033	2-Jun-98		**0.015**					0.009		0.007	ND [c]			0.008					0.008
MW13-61	980602-MW13-61-13	2708-W033	2-Jun-98		**0.007**					**0.013**		**0.015**	ND [c]			0.017					0.028
EPA Maximum Contaminant Levels (MCLs) for Drinking Water				0.006	0.05	0.05	0.004	0.005	0.005	0.1	0.1	1	0.15	0.15	0.002	0.1	0.1	0.05	0.1	0.002	5
EPA Region 9 Preliminary Remediation Goals (PRGs) for Tap Water				0.0146	0.00004	0.00004	0.00002	0.018	0.018	0.183	0.183	1.356	0.004	0.004	#	0.73	0.73	0.183	0.183	0.0029	10.95
ODEQ Ambient Water Quality Criteria (AWQC) for Surface Water [2]				1.6 [3]	0.000017 [4]	0.000017 [4]	0.000117 [4]	0.0011 [3]	0.0011 [3]	0.011 [3]	0.011 [3]	0.012 [3]	0.0032 [3]	0.0032 [3]	0.000012 [3]	0.1 [4]	0.1 [4]	0.035 [3]	0.00012 [3]	0.04 [3]	0.11 [3]

Note:
EPA = U.S. Environmental Protection Agency
mg/l = milligrams/liter
ND = not detected above detection limit indicated
ODEQ = Oregon Department of Environmental Quality
ppm = parts per million

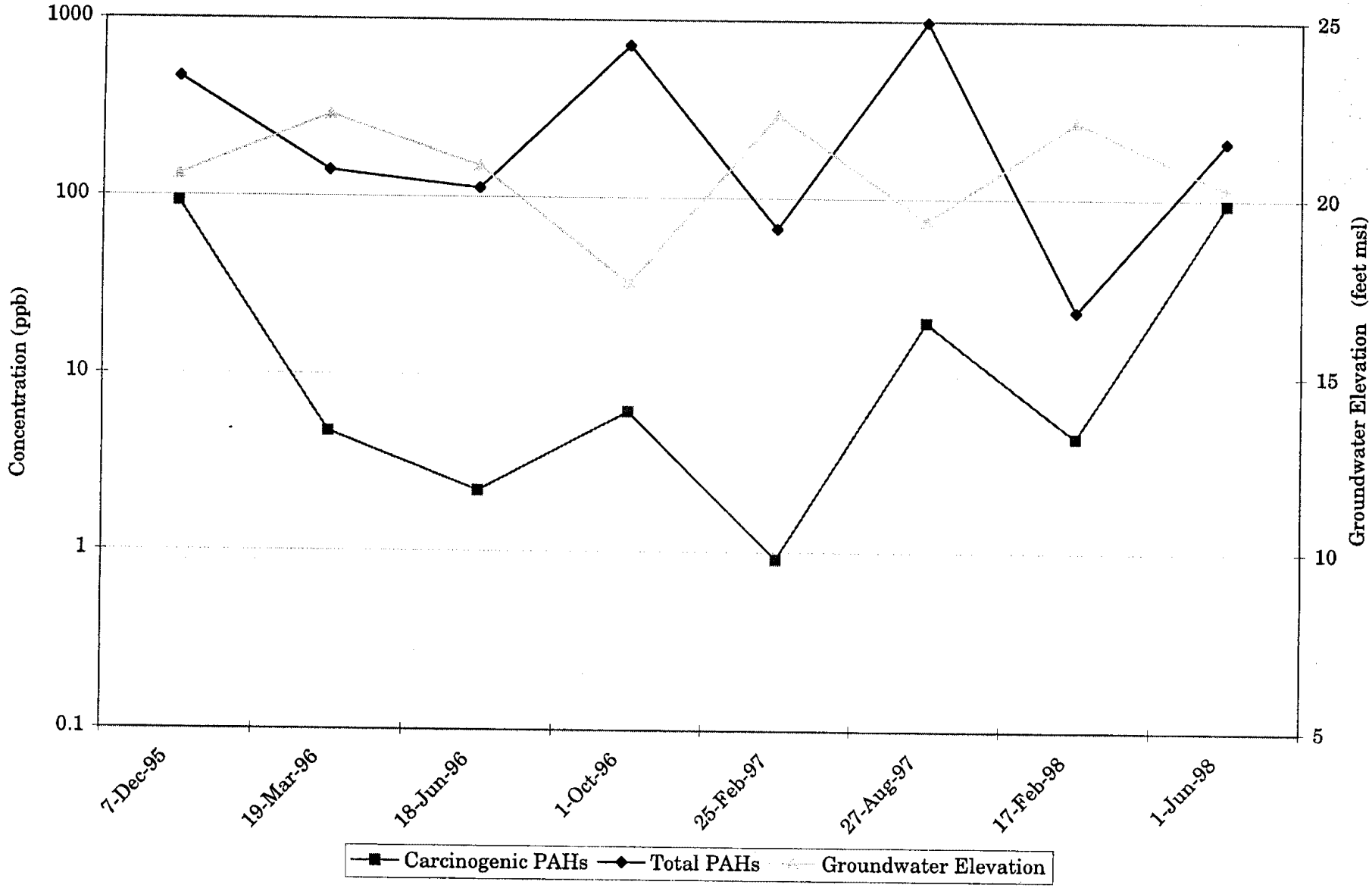
a = detection limit is 0.0002 mg/l (ppm)
b = detection limit is 0.002 mg/l (ppm)
c = detection limit is 0.005 mg/l (ppm)
d = detection limit is 0.01 mg/l (ppm)
e = detection limit is 0.05 mg/l (ppm)

= Reference Levels not established
Bold and shaded = Detected above lowest identified Reference Level

1 = Sample number prefix: 2708-
2 = Reference Level indicated is the lowest guidance value provided in the Ambient Water Quality Criteria (OAR 340-41) based on Fresh Acute, Fresh Chronic (Aquatic Life Protection) and Fish Consumption Only (Human Health Protection)
3 = Reference Level based on Aquatic Fresh Chronic Criteria of AWQC
4 = Reference Level based on Human Fish Consumption Criteria of AWQC
5 = Due to mislabeling in the field or due to laboratory misidentification, the laboratory report transposed results for MW4-35 and MW-4-57 in August 1997. Tables attribute data to the correct well.

Time -Concentration Charts
Polynuclear Aromatic Hydrocarbon Concentrations in Groundwater

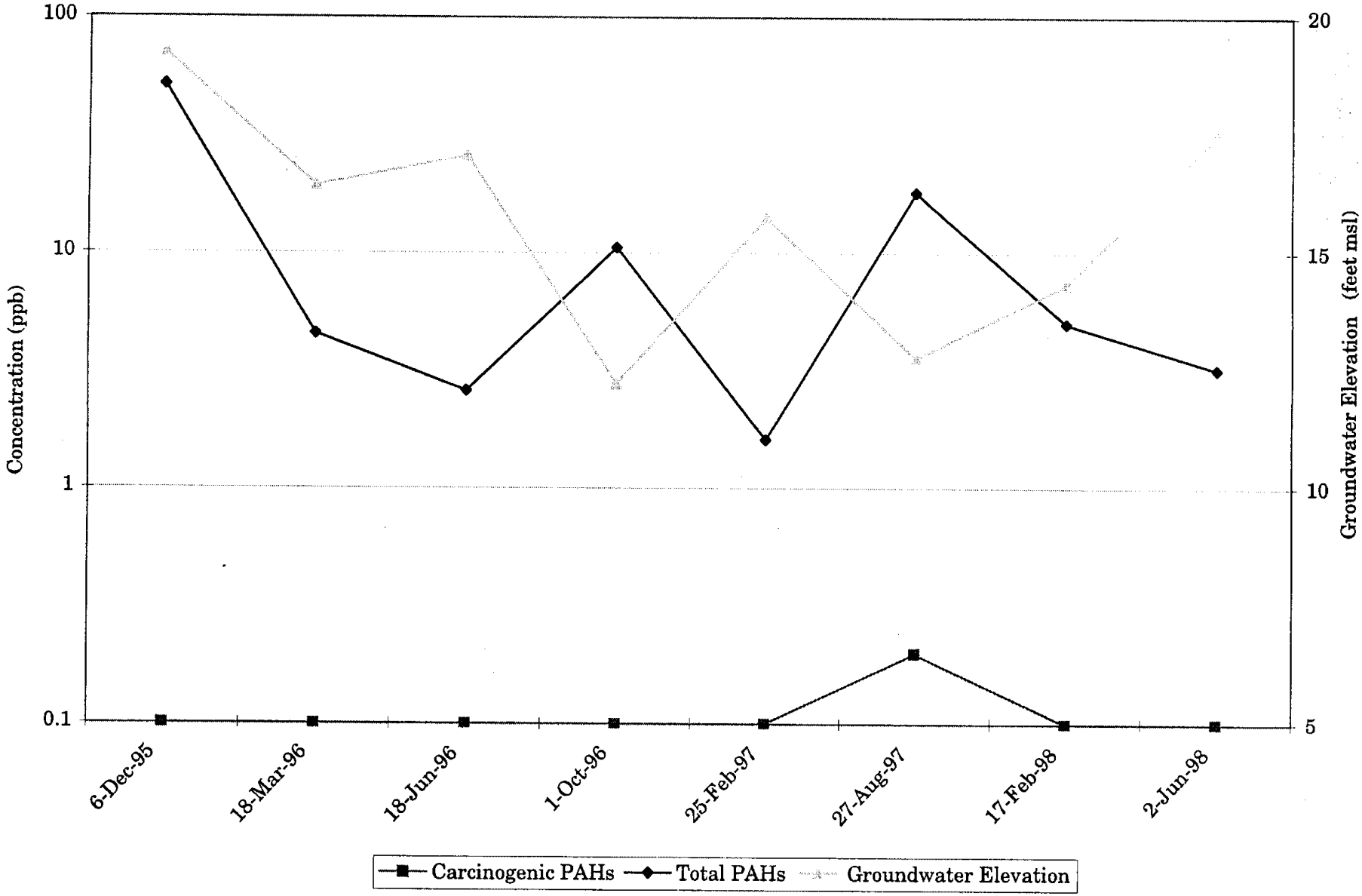
Total PAH Concentration and Groundwater Elevation through Time
Monitoring Well MW-1-26
Northwest Natural - Gasco Facility



Updated: 9/25/98 RBE
File: 2708 GW conc graphs

HAHN AND ASSOCIATES, INC.
Project No. 2708

Total PAH Concentration and Groundwater Elevation through Time
Monitoring Well MW-2-32
Northwest Natural - Gasco Facility



Updated: 9/25/98 RBE
File: 2708 GW conc graphs

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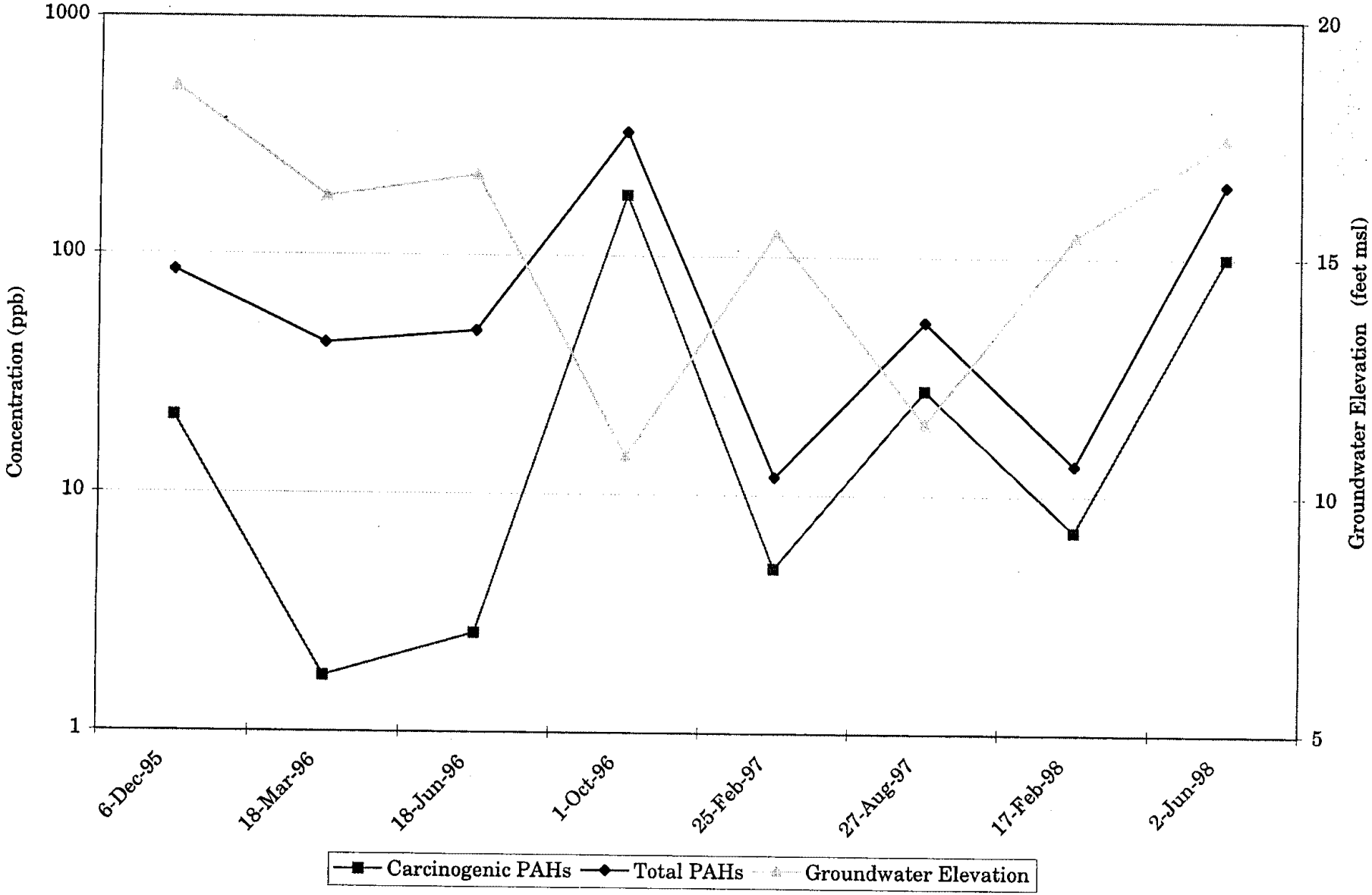
Project No. 2708

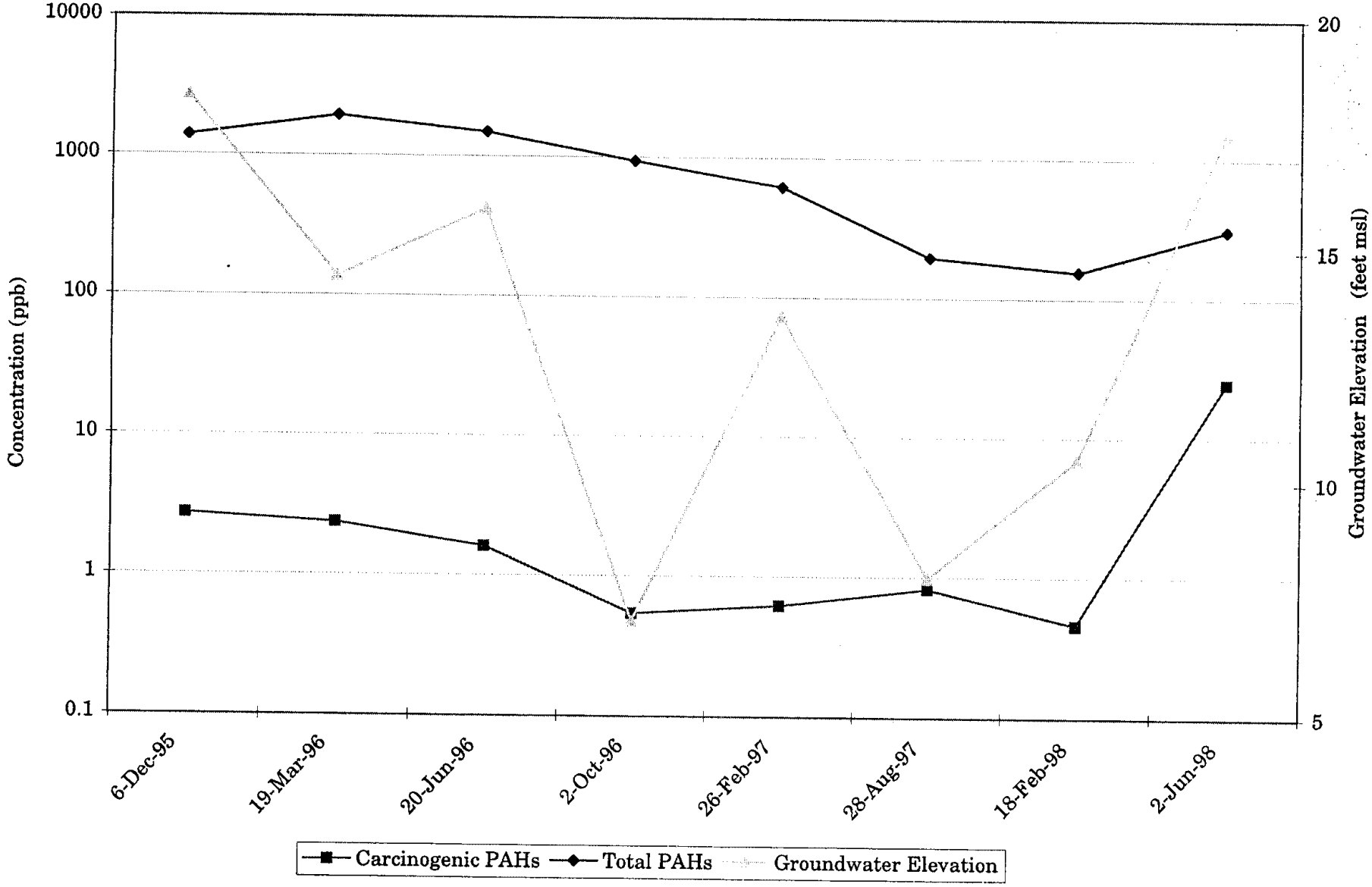
Total PAH Concentration and Groundwater Elevation through Time
Monitoring Well MW-3-26
Northwest Natural - Gasco Facility



Updated: 9/25/98 RBE
File: 2708 GW conc graphs

HAHN AND ASSOCIATES, INC.
Project No. 2708

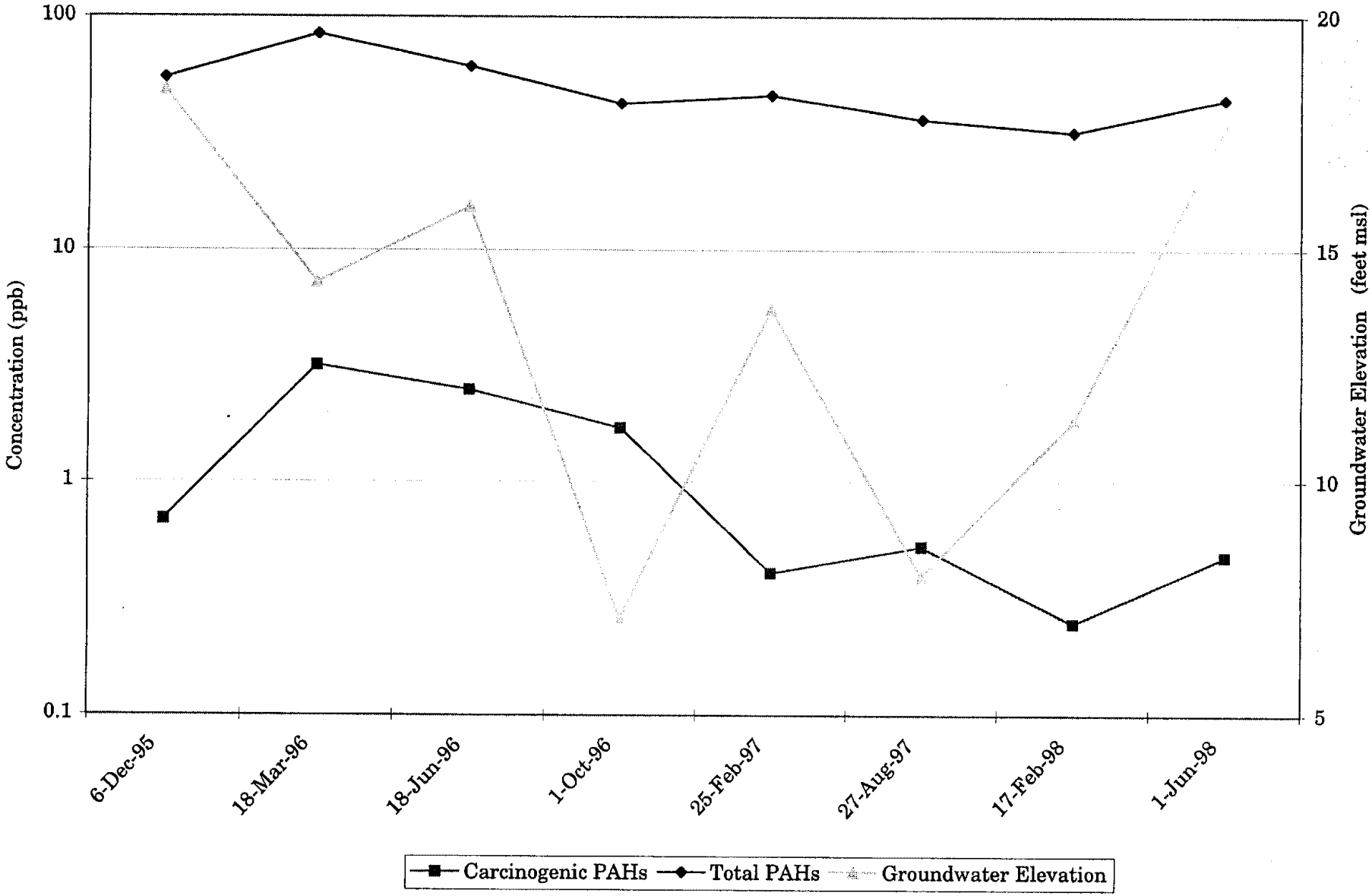
Total PAH Concentration and Groundwater Elevation through Time
Monitoring Well MW-3-56
Northwest Natural - Gasco Facility



Updated: 9/25/98 RBE
File: 2708 GW conc graphs

HAHN AND ASSOCIATES, INC.
Project No. 2708

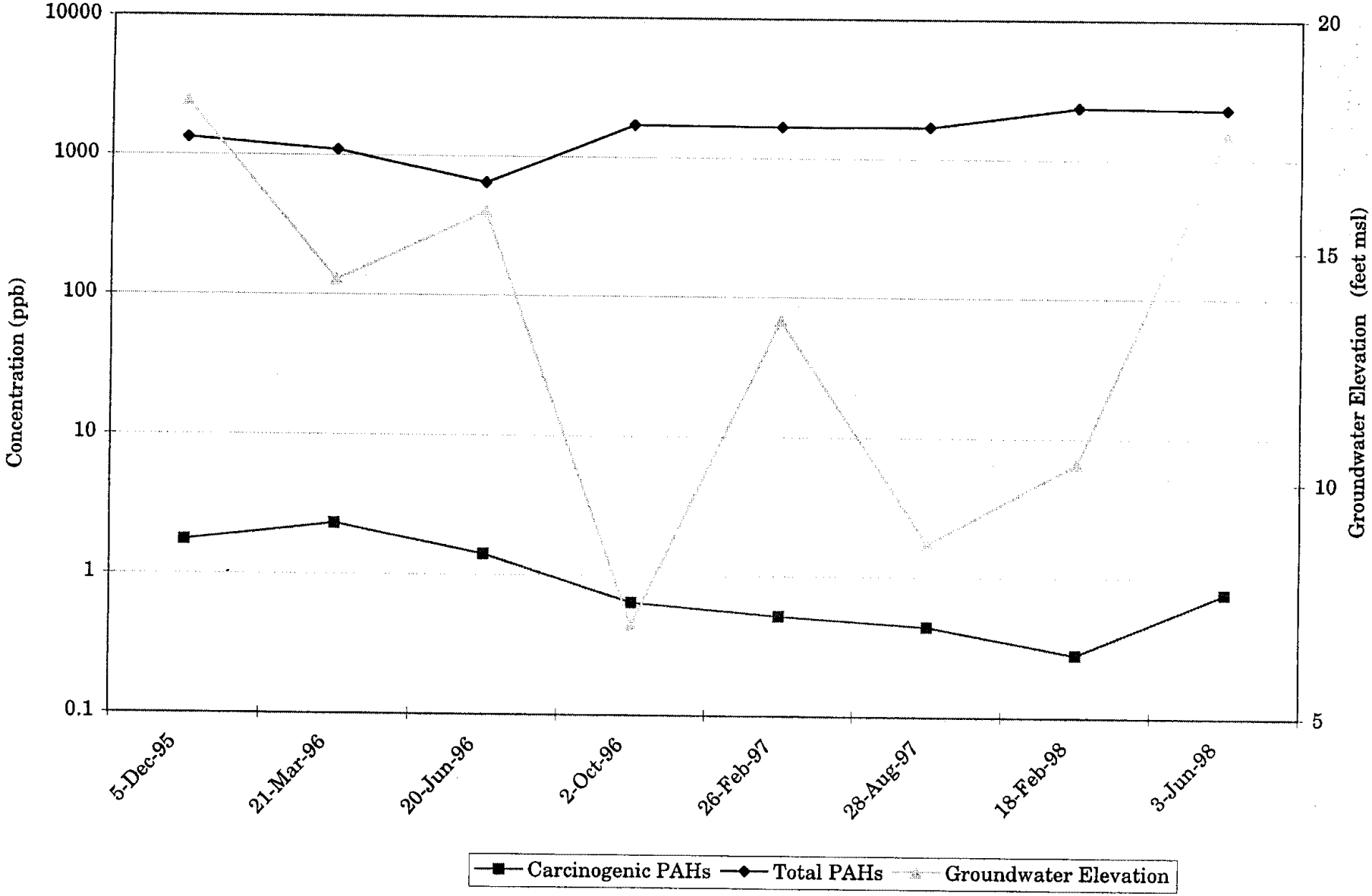
Total PAH Concentration and Groundwater Elevation through Time
Monitoring Well MW-4-35
Northwest Natural - Gasco Facility



Updated: 9/25/98 RBE
File: 2708 GW conc graphs

HAHN AND ASSOCIATES, INC.
Project No. 2708

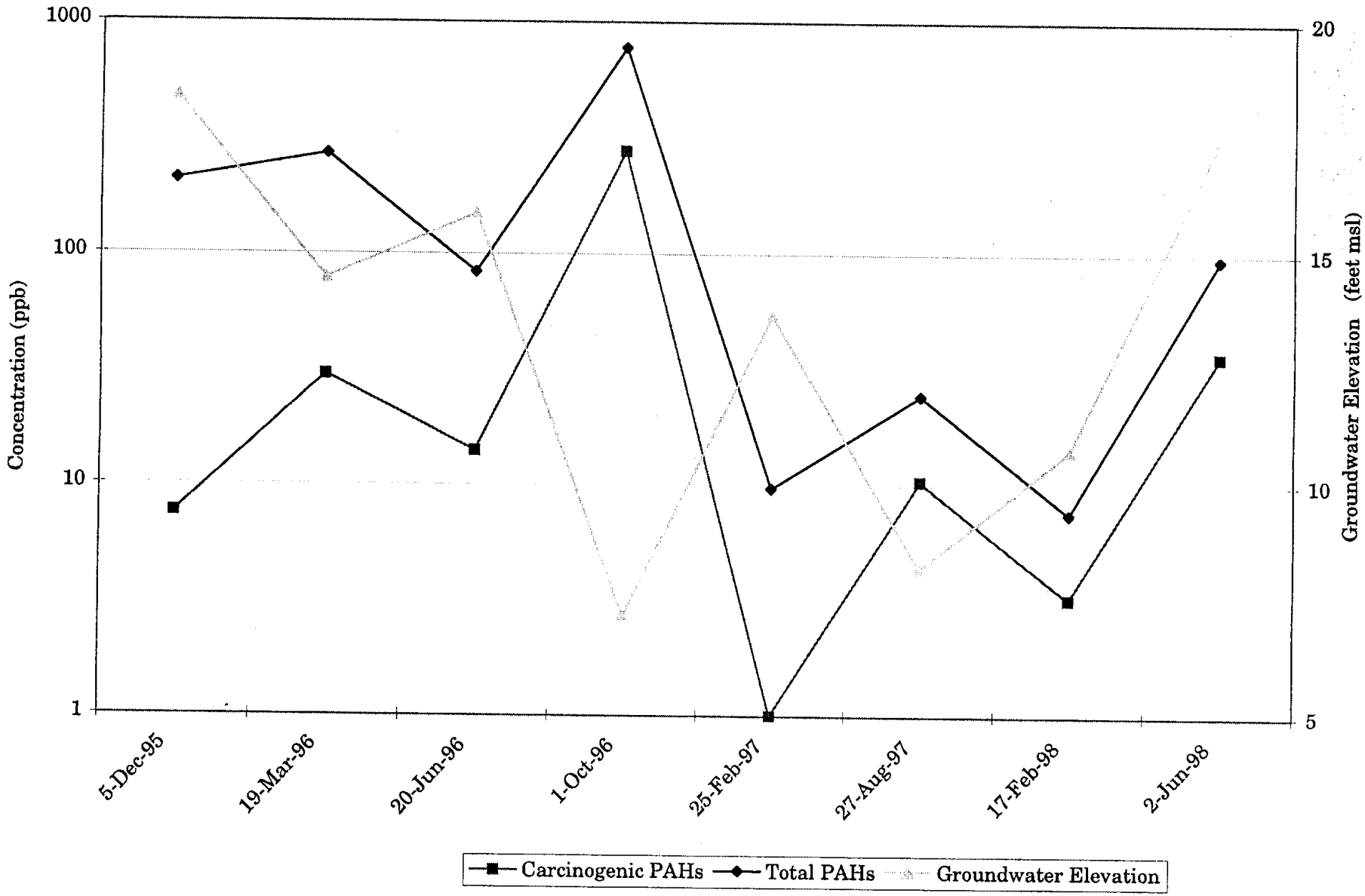
Total PAH Concentration and Groundwater Elevation through Time
Monitoring Well MW-4-57
Northwest Natural - Gasco Facility



Updated: 9/25/98 RBE
File: 2708 GW conc graphs

HAHN AND ASSOCIATES, INC.
Project No. 2708

Total PAH Concentration and Groundwater Elevation through Time
Monitoring Well MW-5-32
Northwest Natural - Gasco Facility



Updated: 9/25/98 RBE
File: 2708 GW conc graphs

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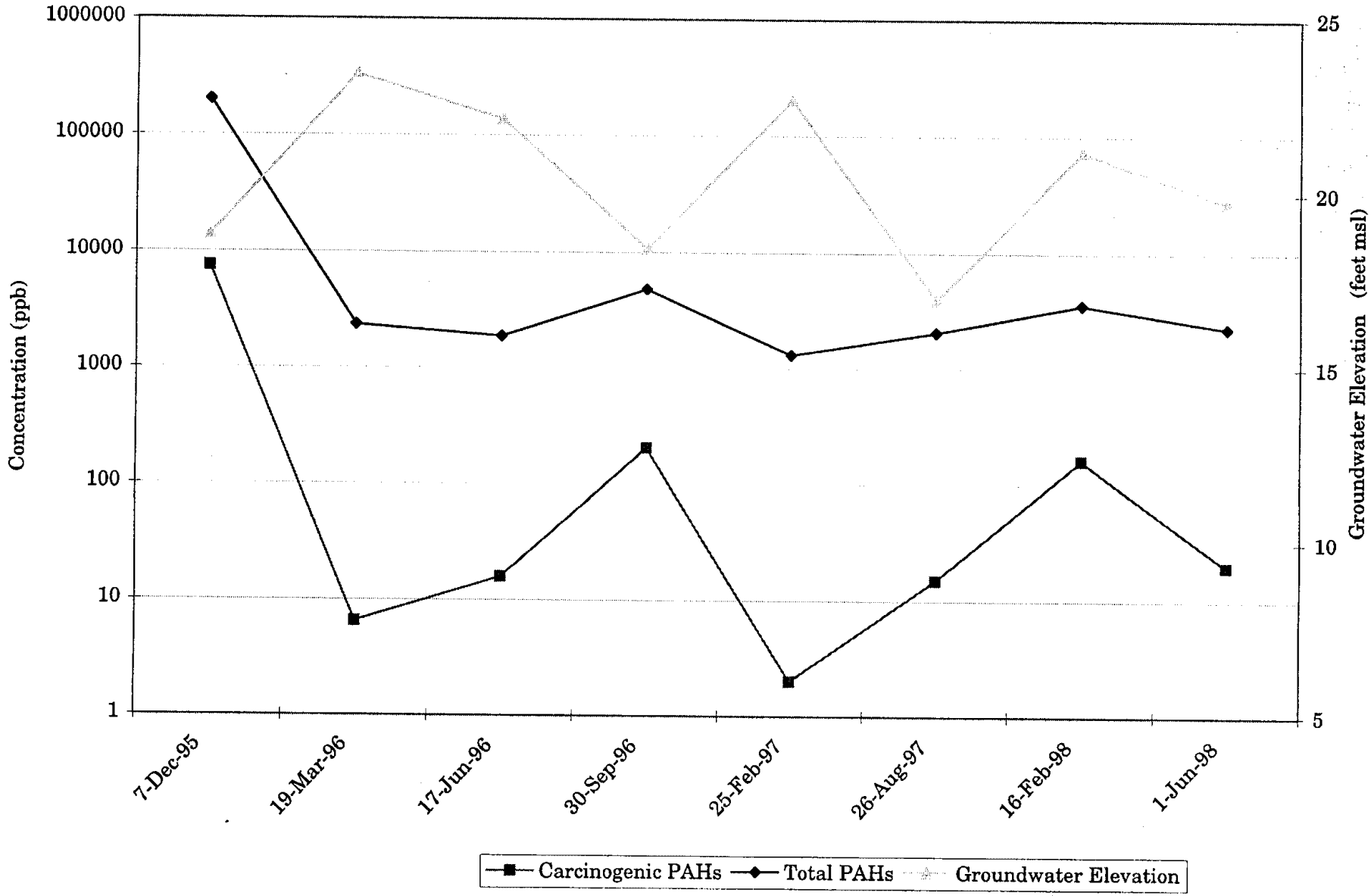
Project No. 2708

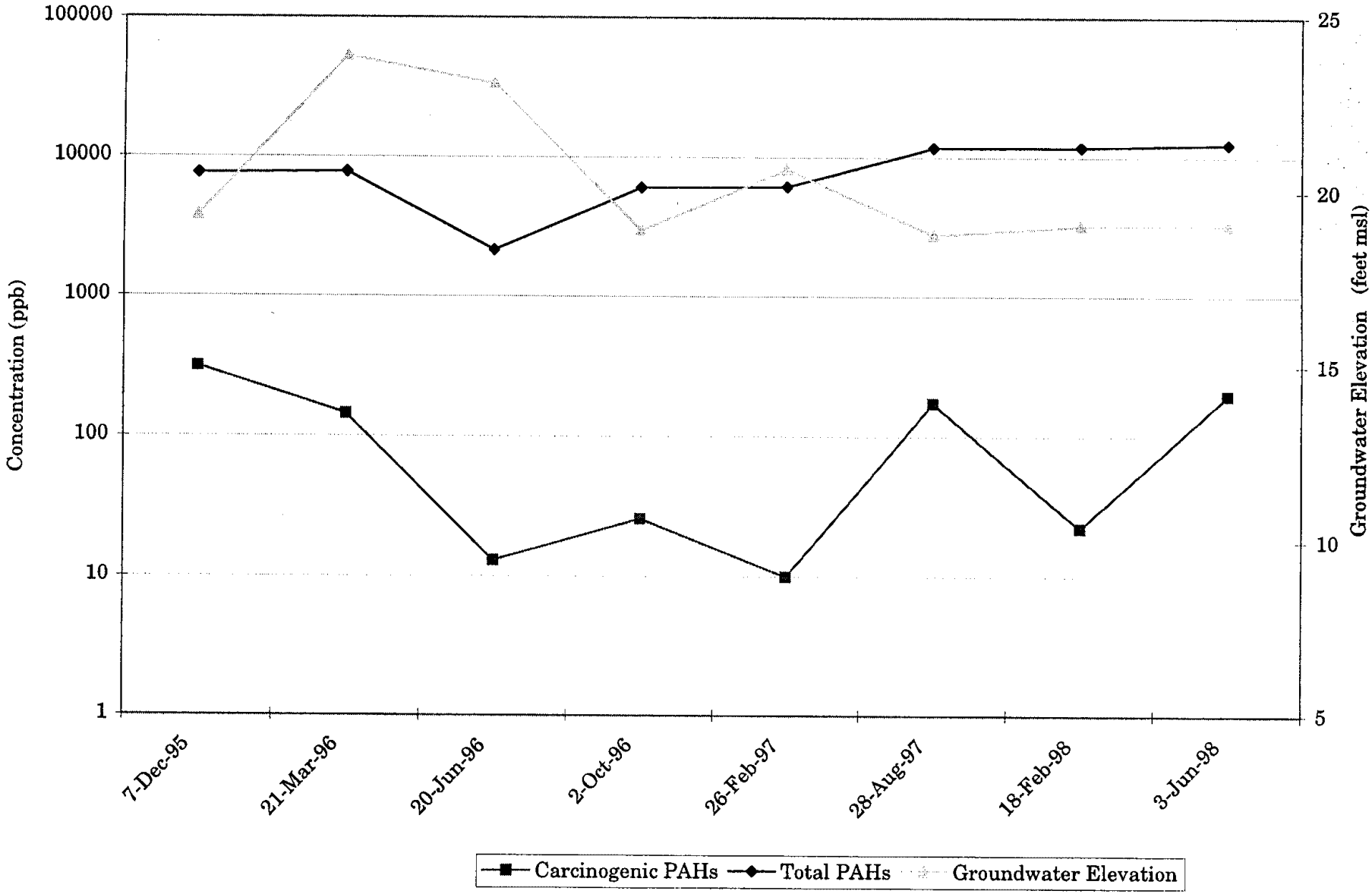
Total PAH Concentration and Groundwater Elevation through Time
Monitoring Well MW-6-32
Northwest Natural - Gasco Facility



Updated: 9/25/98 RBE
File: 2708 GW conc graphs

HAHN AND ASSOCIATES, INC.
Project No. 2708

Total PAH Concentration and Groundwater Elevation through Time
Monitoring Well MW-8-29
Northwest Natural - Gasco Facility



Updated: 9/25/98 RBE
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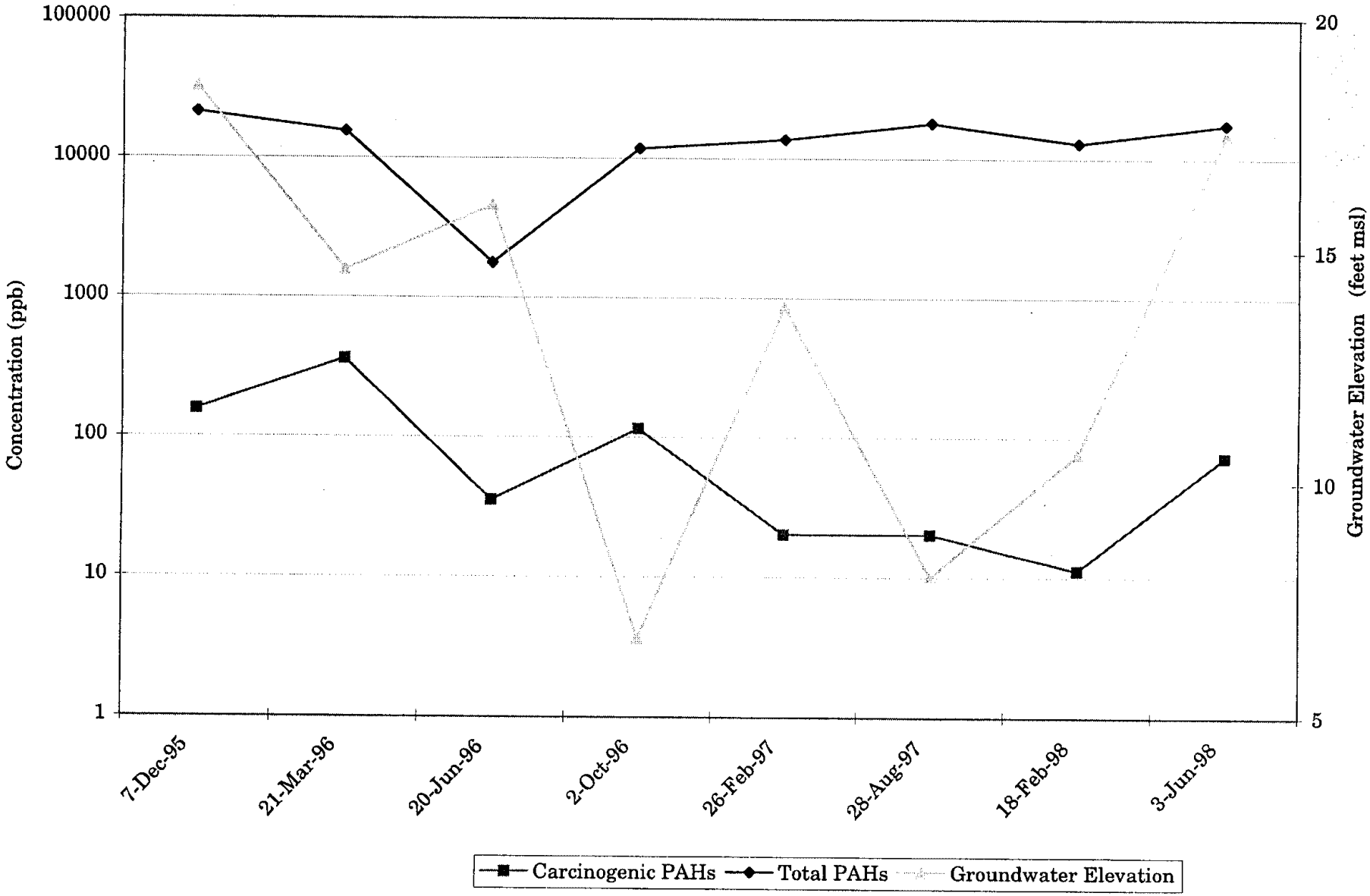
Project No. 2708

Total PAH Concentration and Groundwater Elevation through Time
Monitoring Well MW-8-56
Northwest Natural - Gasco Facility



Updated: 9/25/98 RBE
File: 2708 GW conc graphs

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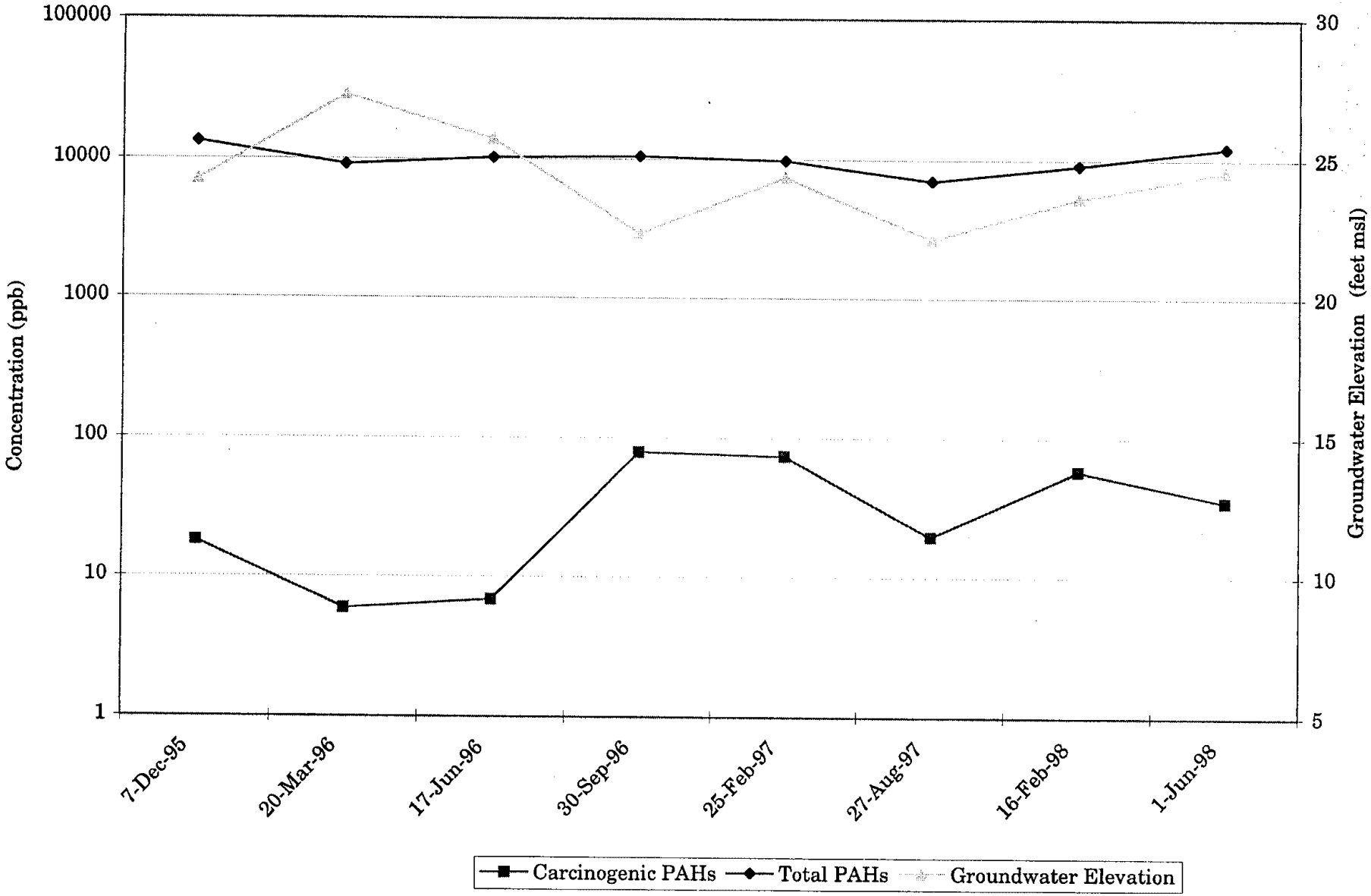
Project No. 2708

Total PAH Concentration and Groundwater Elevation through Time
Monitoring Well MW-10-25
Northwest Natural - Gasco Facility



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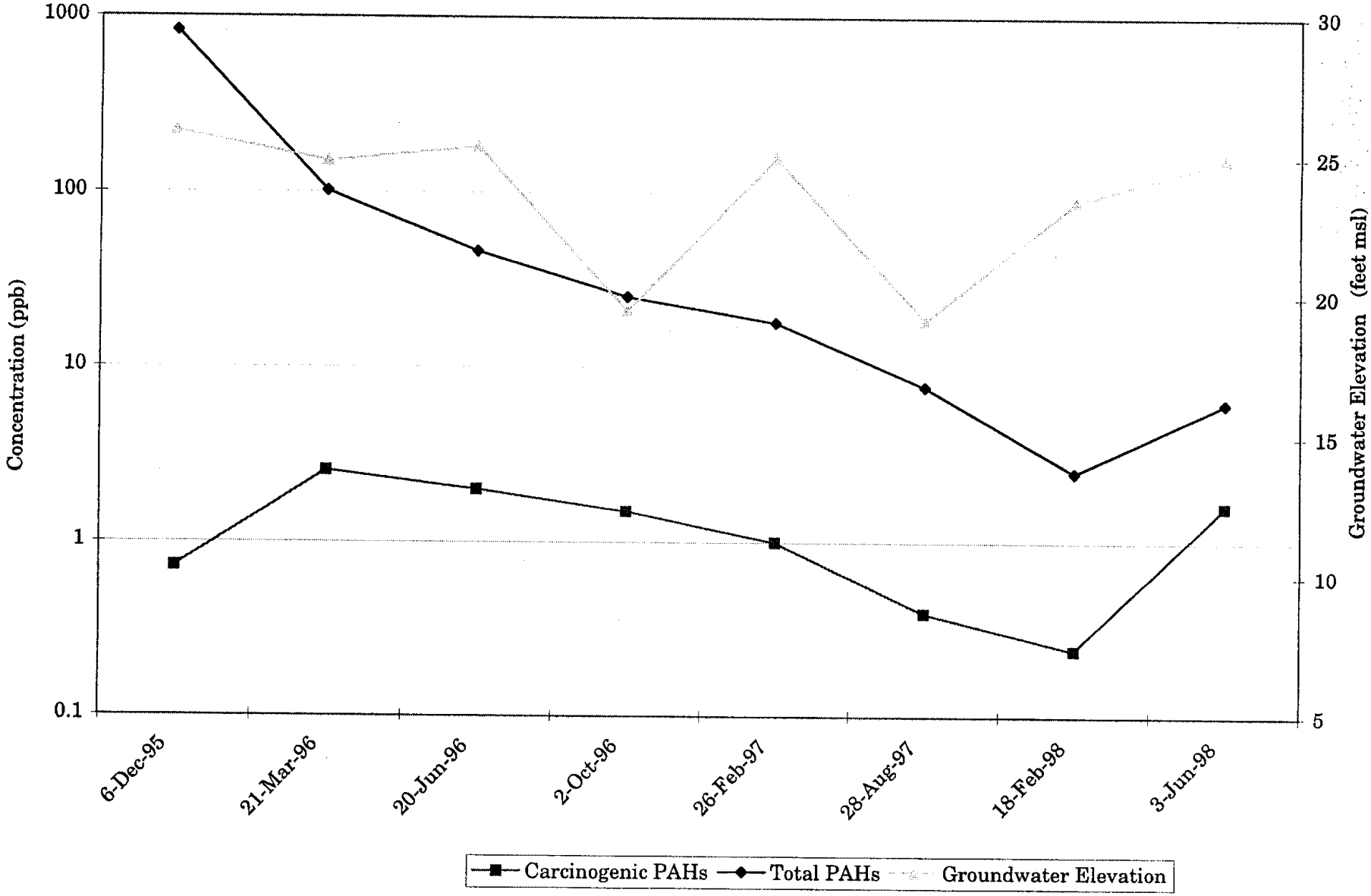
Total PAH Concentration and Groundwater Elevation through Time
Monitoring Well MW-10-61
Northwest Natural - Gasco Facility



Updated: 9/25/98 RBE
File: 2708 GW conc graphs

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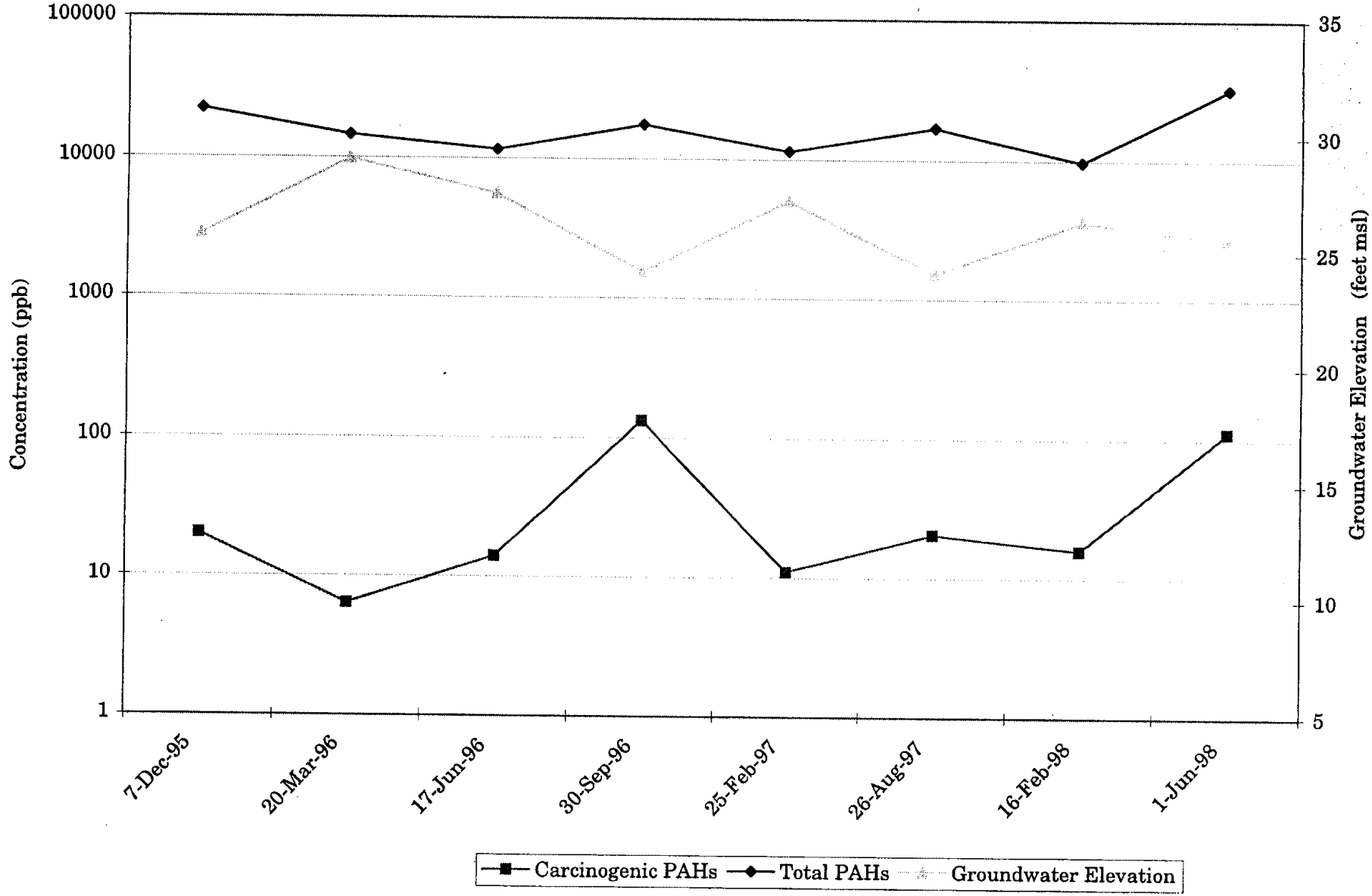
Total PAH Concentration and Groundwater Elevation through Time
Monitoring Well MW-11-32
Northwest Natural - Gasco Facility



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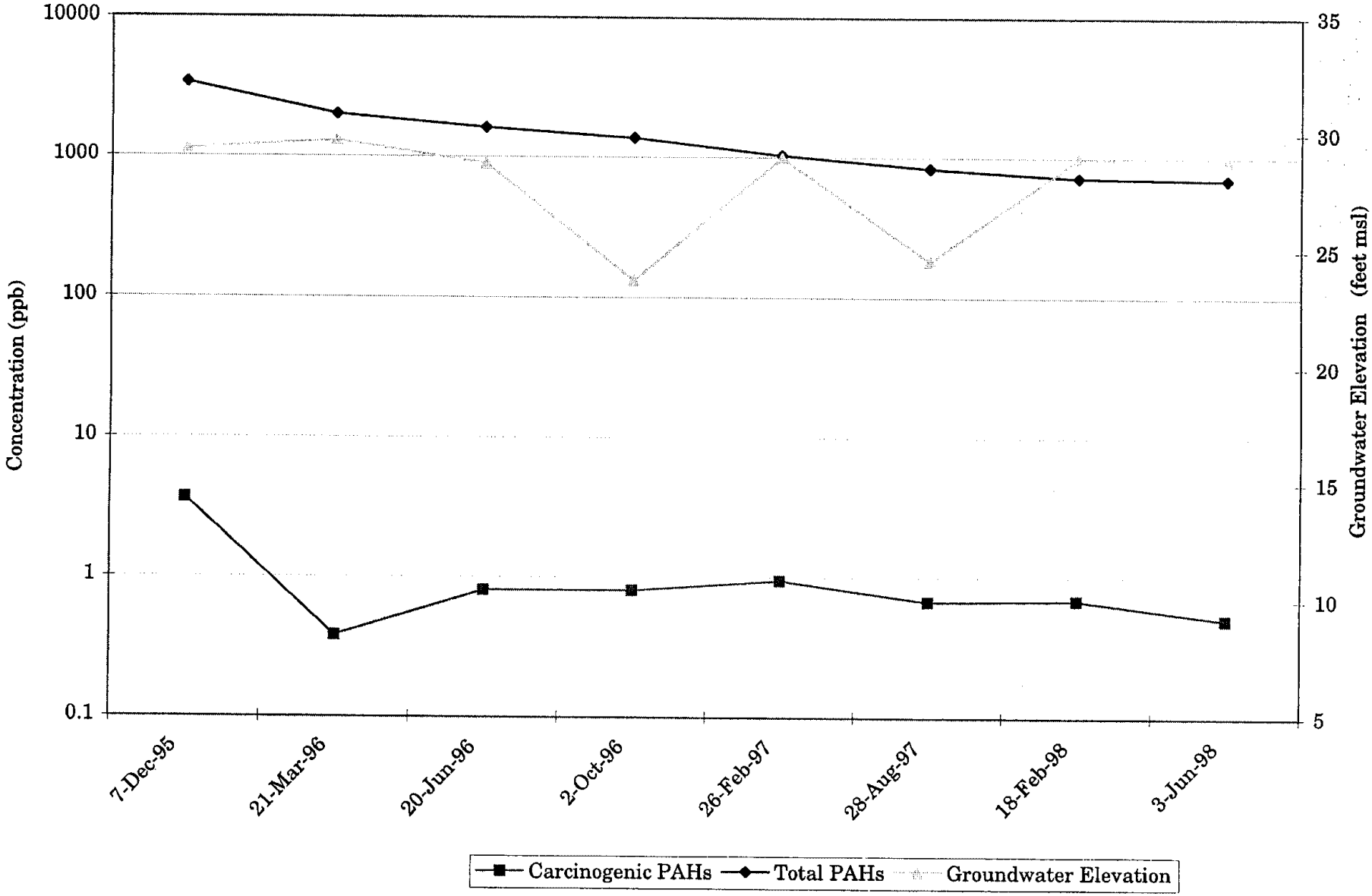
Total PAH Concentration and Groundwater Elevation through Time
Monitoring Well MW-12-36
Northwest Natural - Gasco Facility



Updated: 9/25/98 RBE
File: 2708 GW conc graphs

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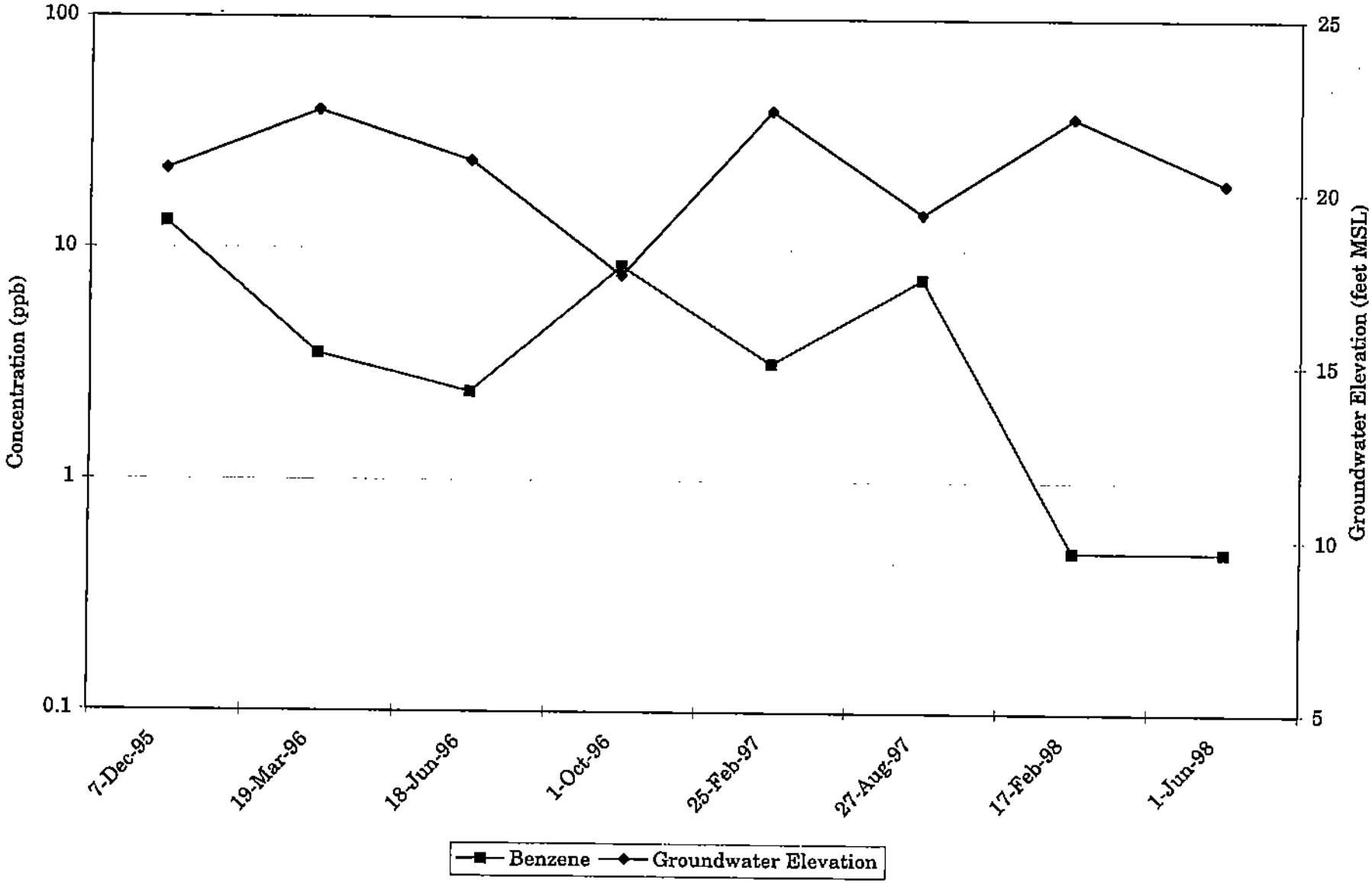
Project No. 2708

Time-Concentration Charts
Benzene Concentrations in Groundwater

Benzene Concentration and Groundwater Elevation through Time
Monitoring Well MW-1-26
Northwest Natural - Gasco Facility



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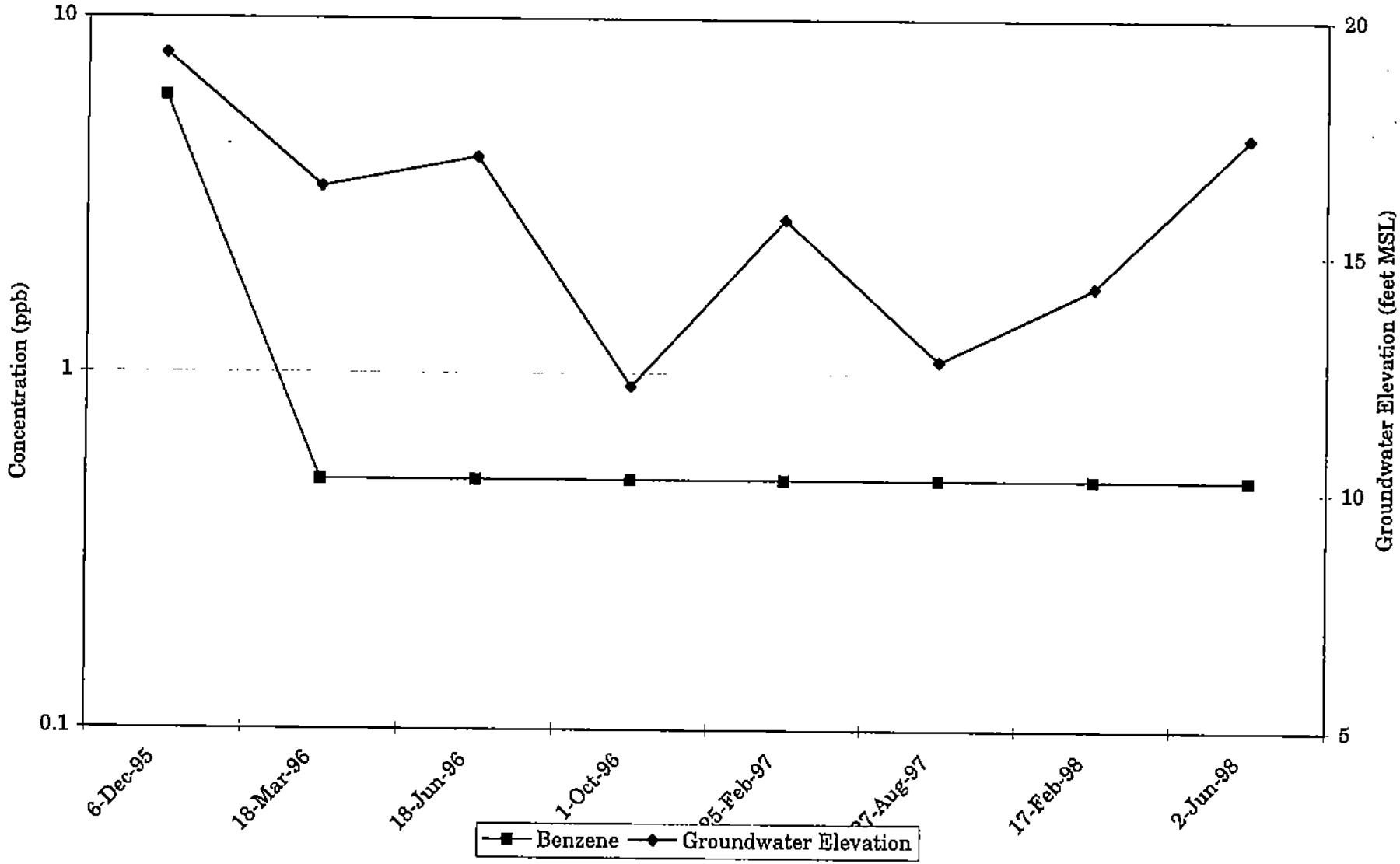
Benzene Concentration and Groundwater Elevation through Time
Monitoring Well MW-2-32
Northwest Natural - Gasco Facility



Updated: 9/25/98 RBE
File: 2708 GW conc graphs

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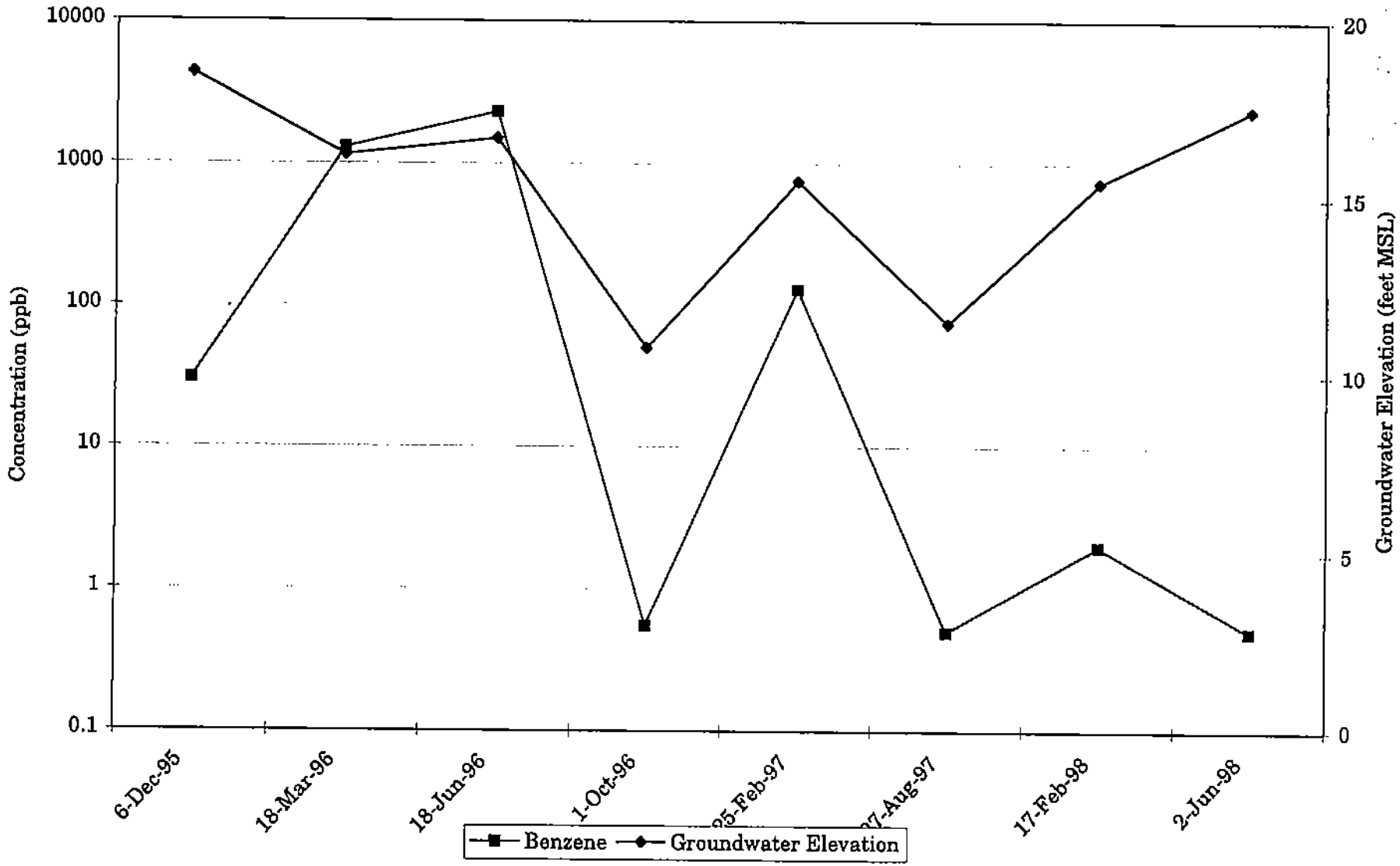
Benzene Concentration and Groundwater Elevation through Time
Monitoring Well MW-3-26
Northwest Natural - Gasco Facility



Updated: 9/25/98 RBE
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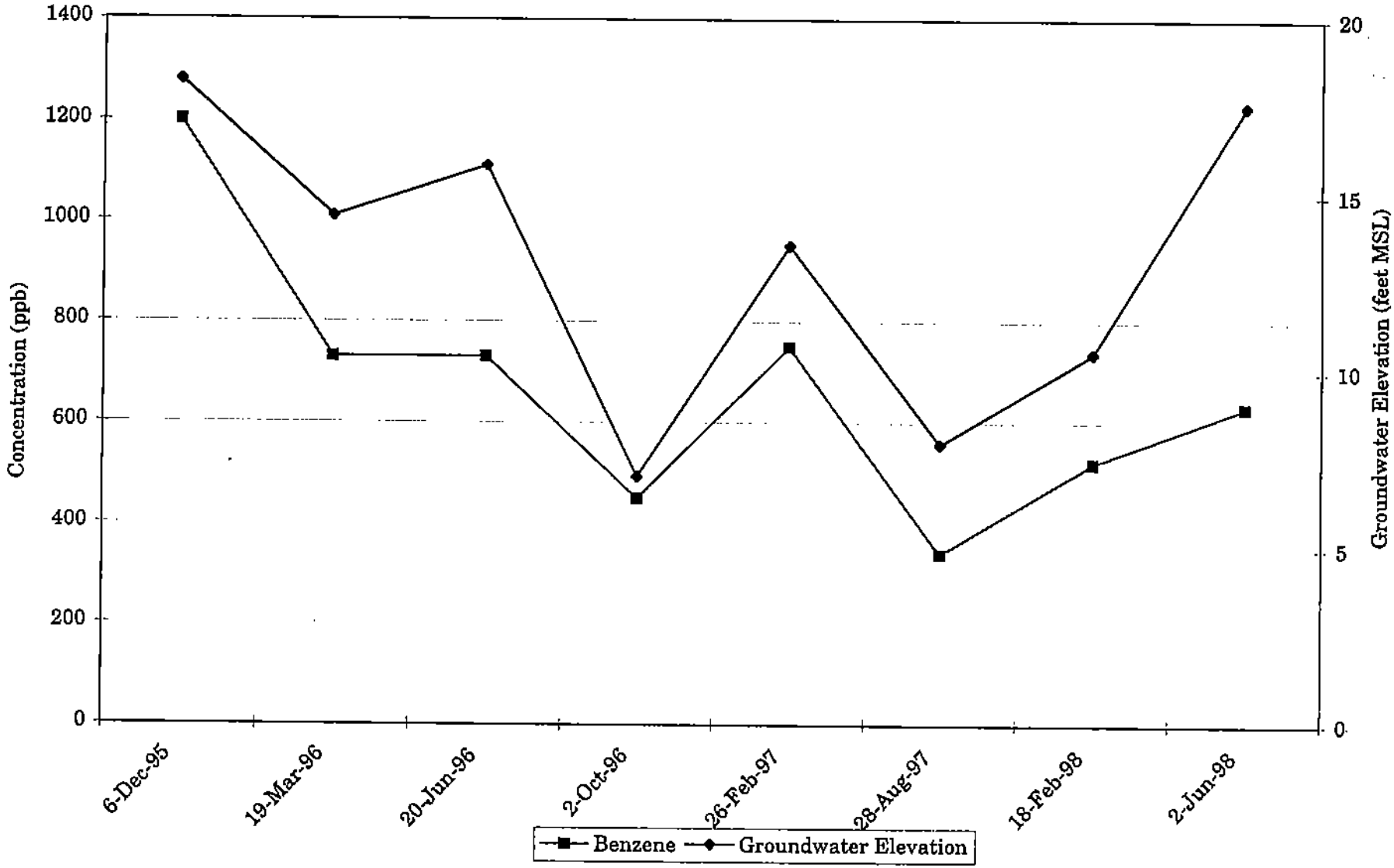
Project No. 2708

Benzene Concentration and Groundwater Elevation through Time
Monitoring Well MW-3-56
Northwest Natural - Gasco Facility



Updated: 9/25/98 RBE
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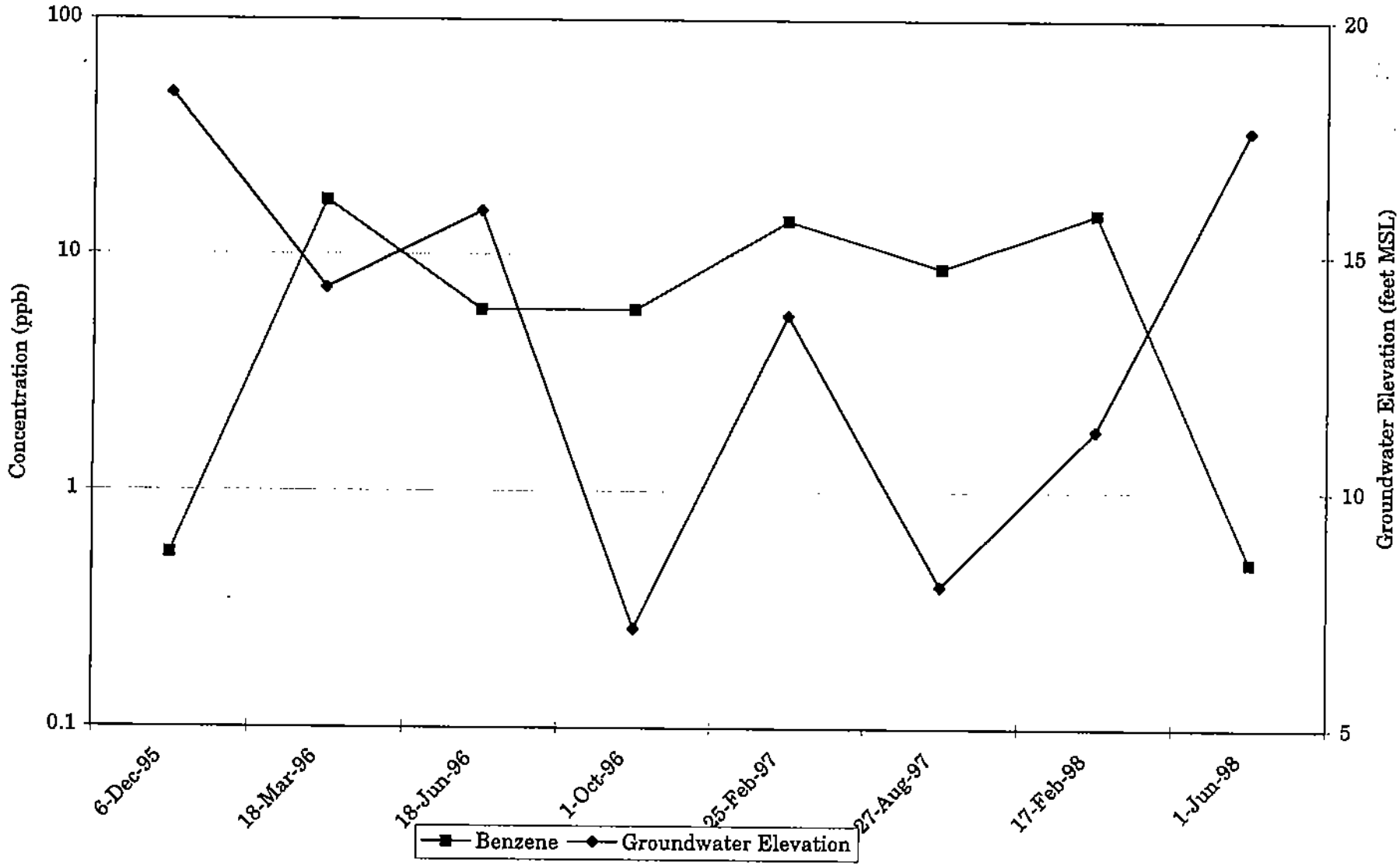
Benzene Concentration and Groundwater Elevation through Time
Monitoring Well MW-4-35
Northwest Natural - Gasco Facility



Updated: 9/25/98 RBE
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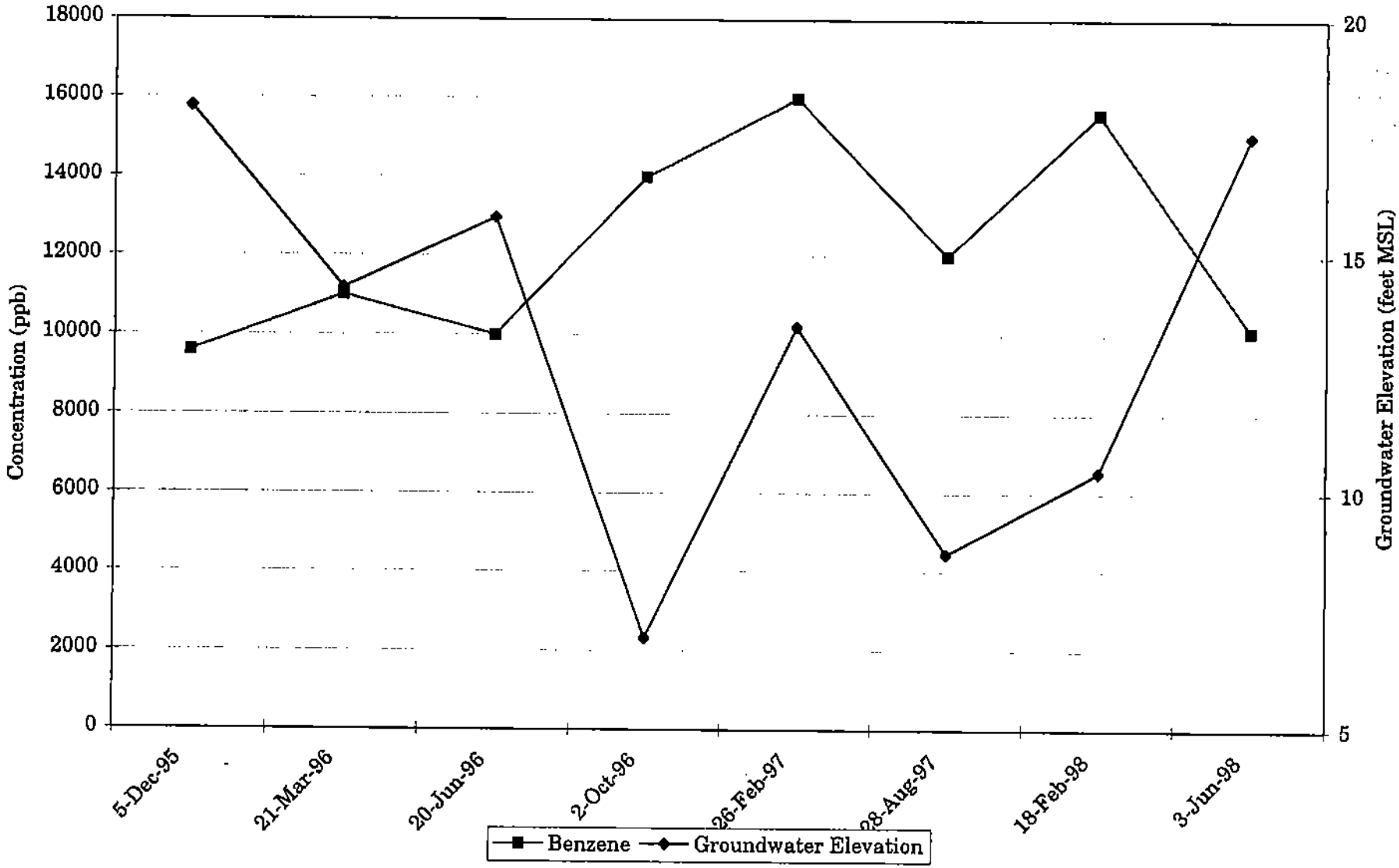
Benzene Concentration and Groundwater Elevation through Time
Monitoring Well MW-4-57
Northwest Natural - Gasco Facility



Updated: 9/25/98 RBE
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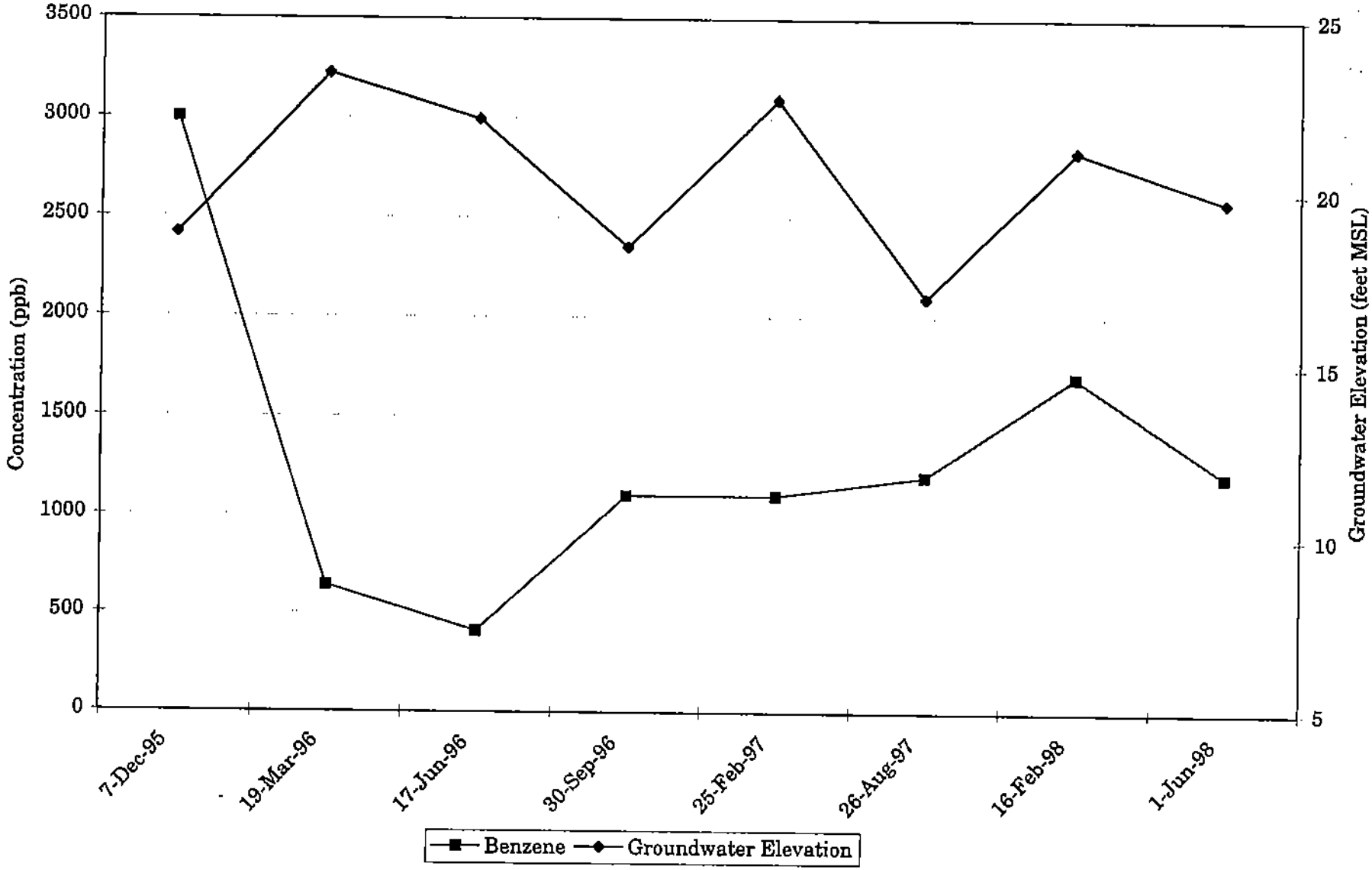
Project No. 2708

Benzene Concentration and Groundwater Elevation through Time
Monitoring Well MW-6-32
Northwest Natural - Gasco Facility



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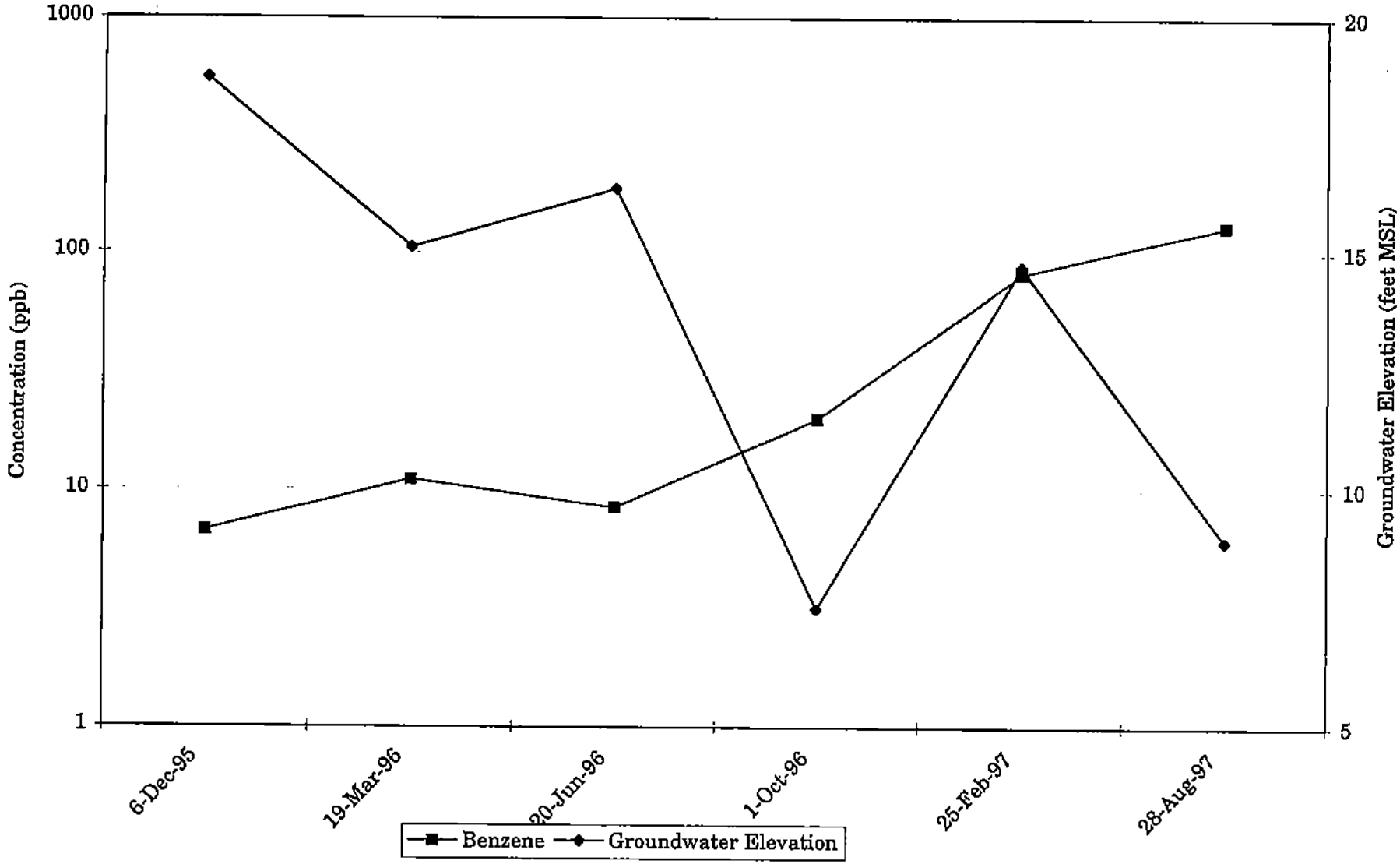
Project No. 2708

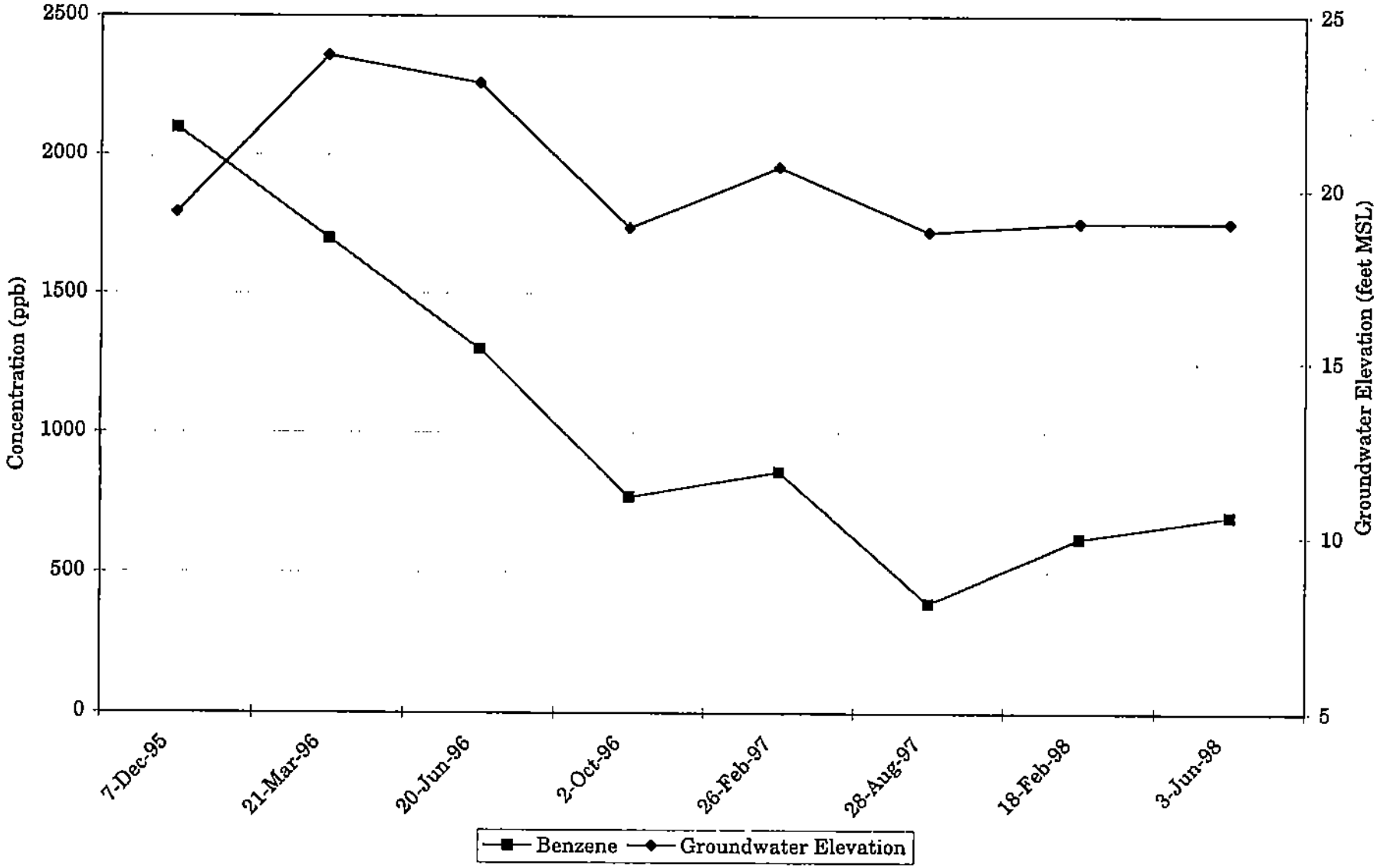
Benzene Concentration and Groundwater Elevation through Time
Monitoring Well MW-6-61
Northwest Natural - Gasco Facility



Updated: 9/25/98 RBE
File: 2708 GW conc graphs

HAHN AND ASSOCIATES, INC.
Project No. 2708

Benzene Concentration and Groundwater Elevation through Time
Monitoring Well MW-8-29
Northwest Natural - Gasco Facility



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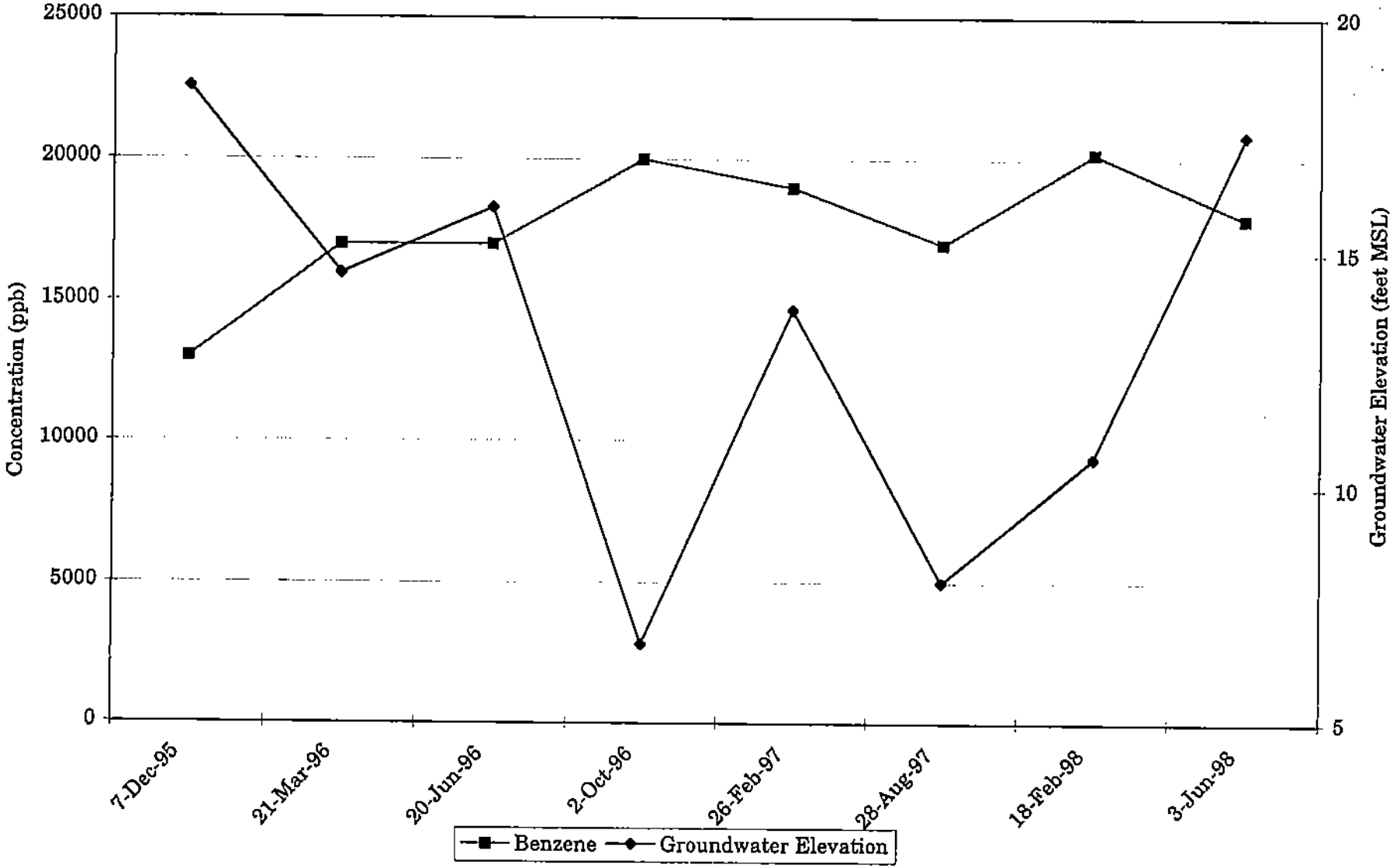
HAHN AND ASSOCIATES, INC.
Project No. 2708

Benzene Concentration and Groundwater Elevation through Time
Monitoring Well MW-8-56
Northwest Natural - Gasco Facility



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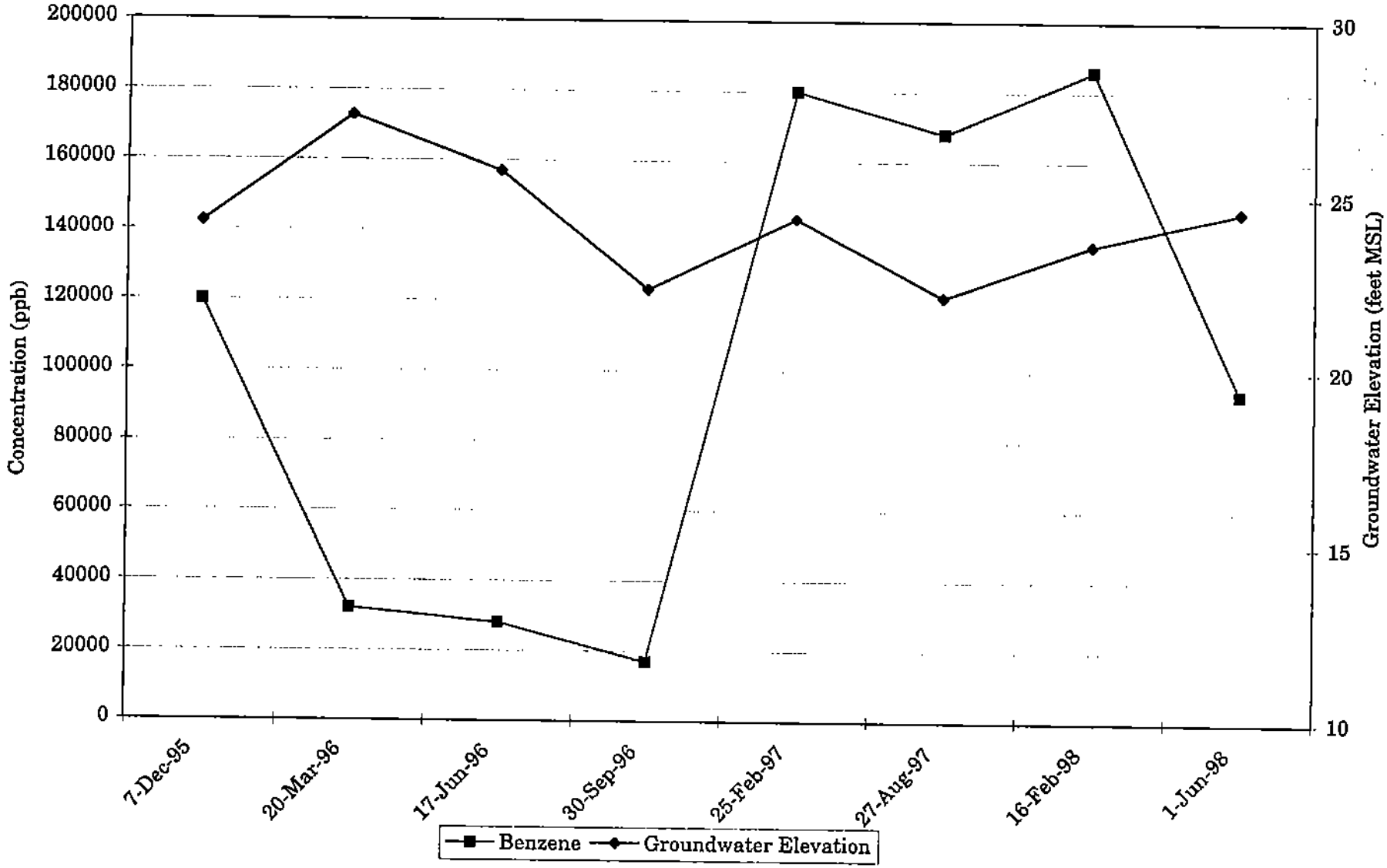
HAHN AND ASSOCIATES, INC.
Project No. 2708

Benzene Concentration and Groundwater Elevation through Time
Monitoring Well MW-10-25
Northwest Natural - Gasco Facility



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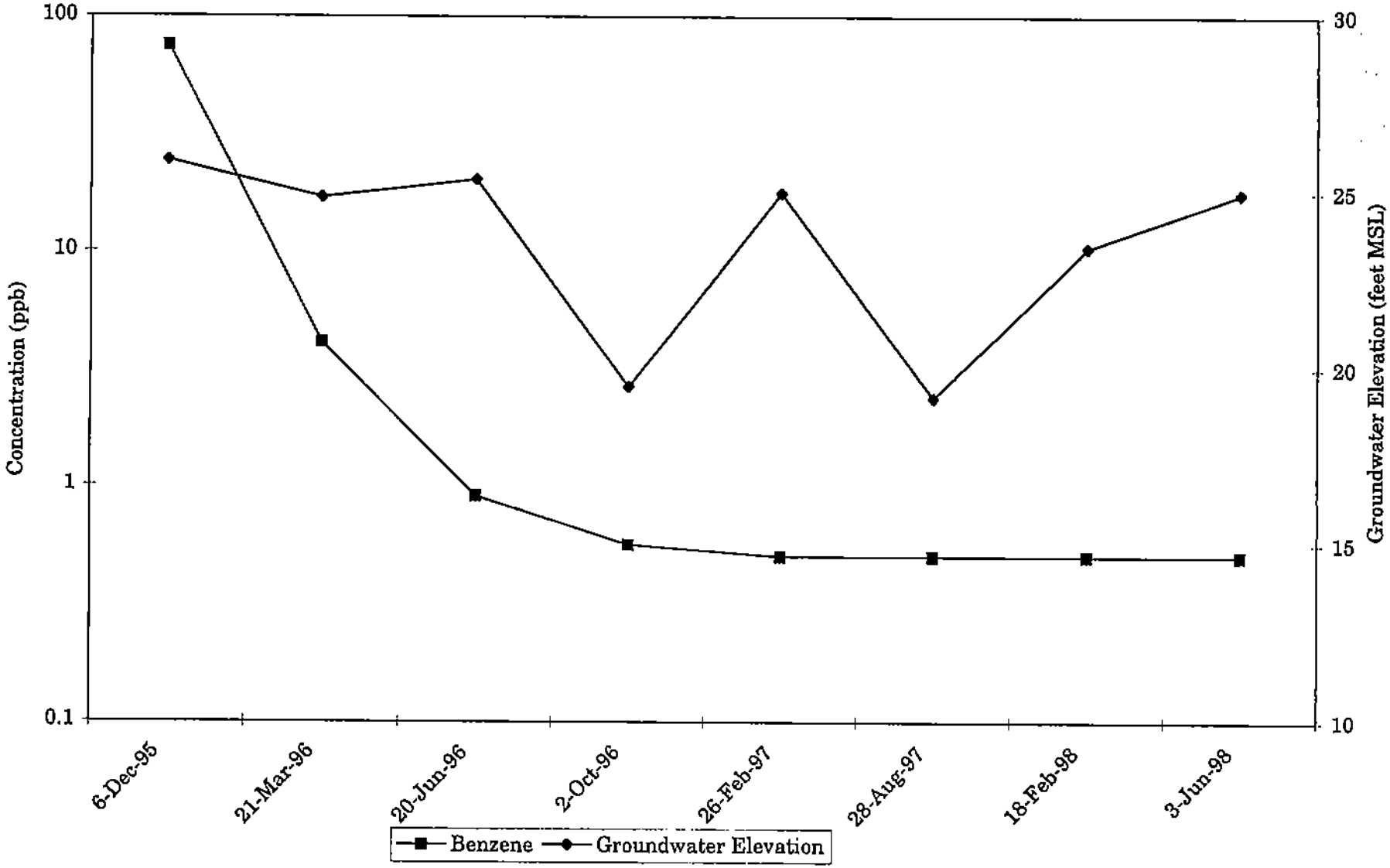
HAHN AND ASSOCIATES, INC.
Project No. 2708

Benzene Concentration and Groundwater Elevation through Time
Monitoring Well MW-10-61
Northwest Natural - Gasco Facility



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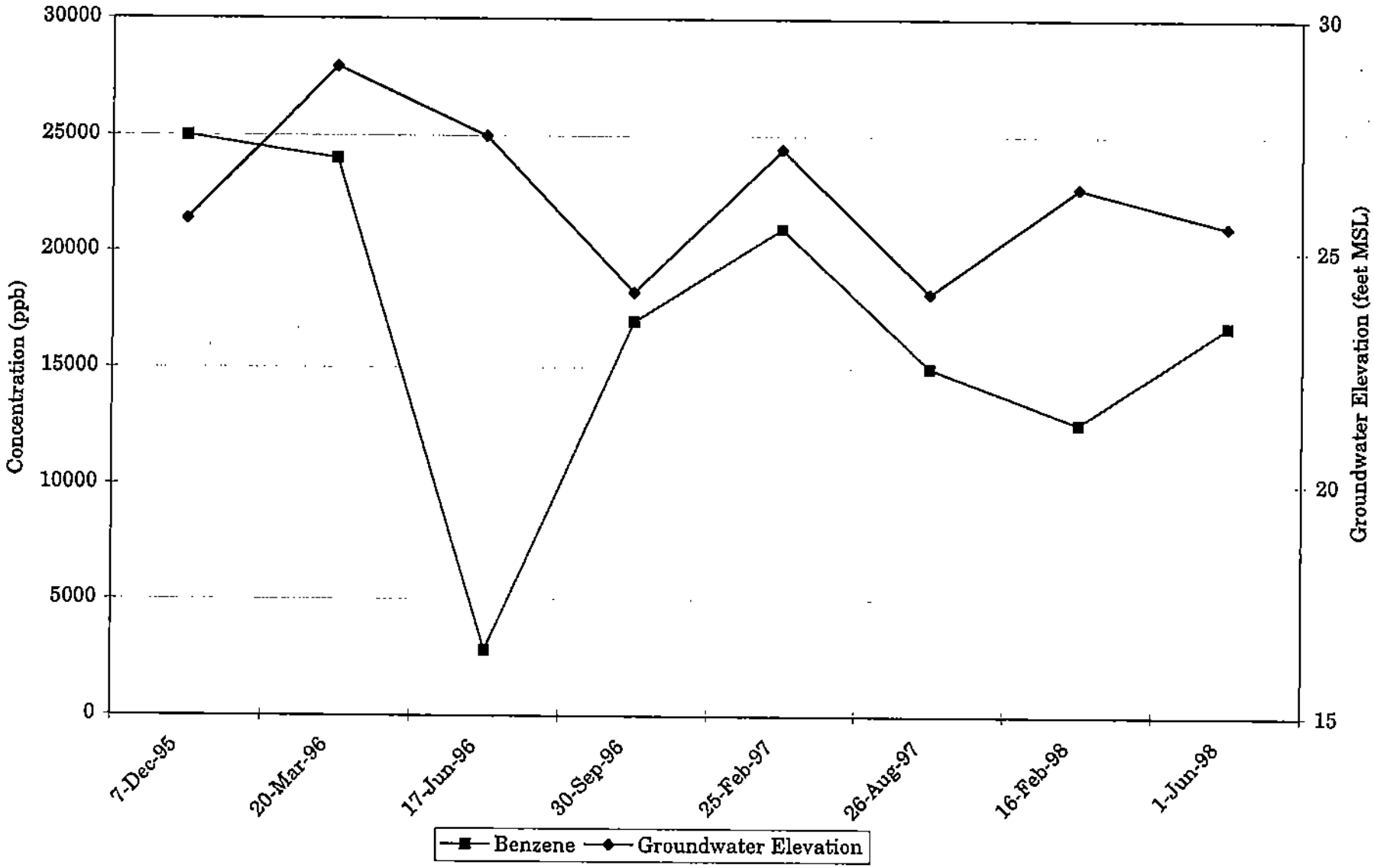
HAHN AND ASSOCIATES, INC.
Project No. 2708

Benzene Concentration and Groundwater Elevation through Time
Monitoring Well MW-11-32
Northwest Natural - Gasco Facility



Updated: 9/25/98 RBE
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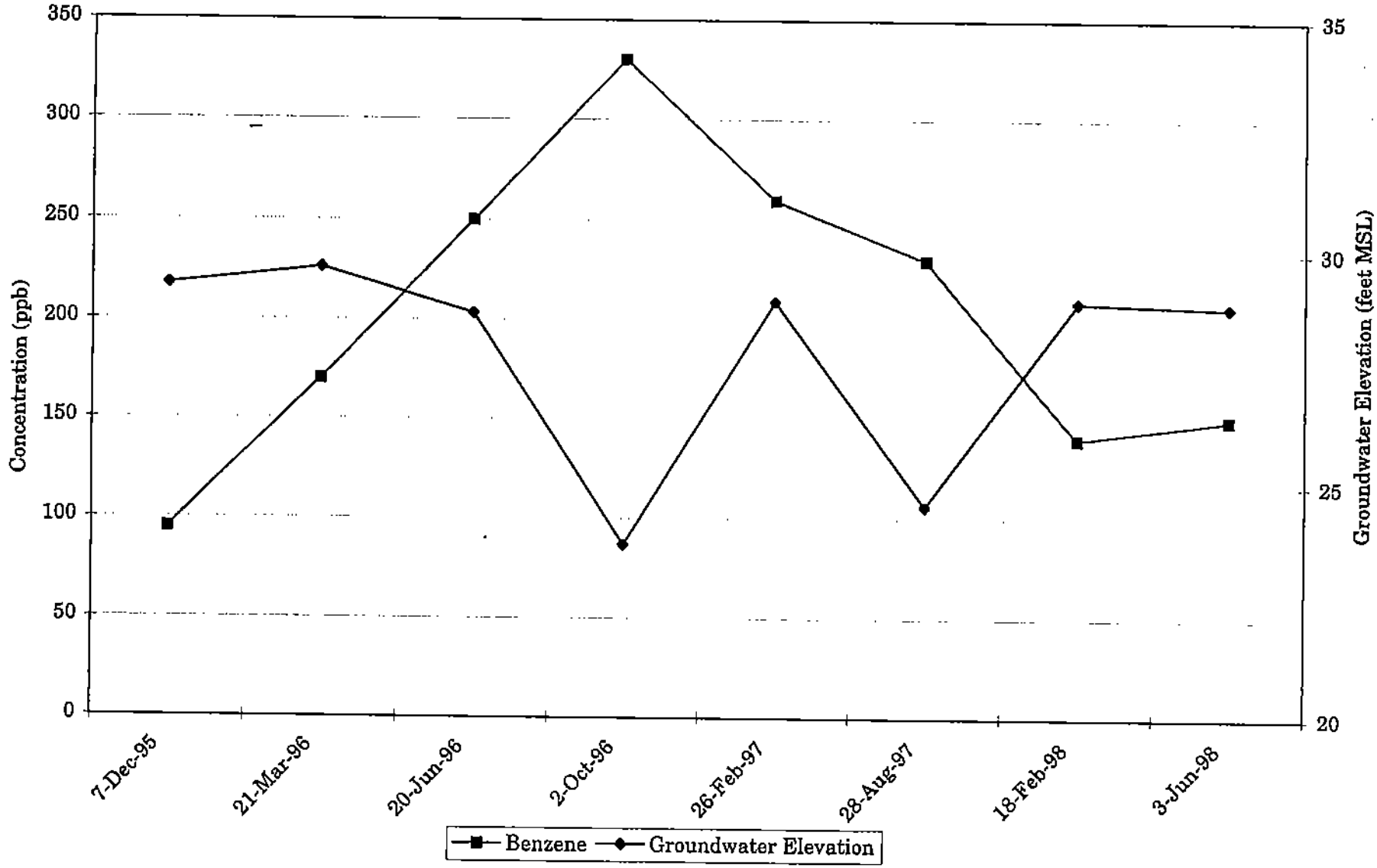
HAHN AND ASSOCIATES, INC.
Project No. 2708

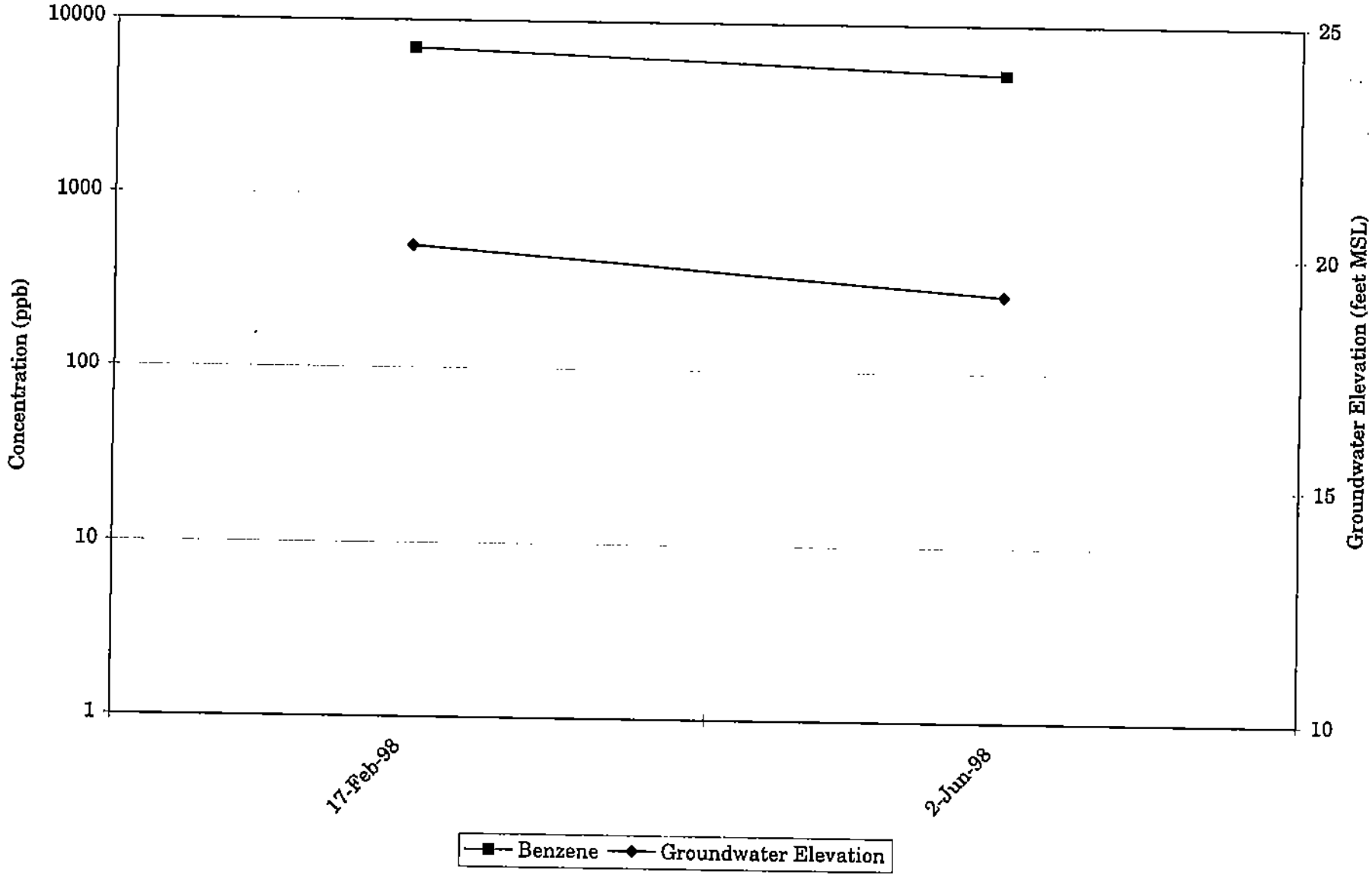
Benzene Concentration and Groundwater Elevation through Time
Monitoring Well MW-12-36
Northwest Natural - Gasco Facility



Updated: 9/25/98 RBE
File: 2708 GW conc graphs

HAHN AND ASSOCIATES, INC.
Project No. 2708

Benzene Concentration and Groundwater Elevation through Time
Monitoring Well MW-13-30
Northwest Natural - Gasco Facility



Updated: 9/25/98 RBE
File: 2708 GW conc graphs

HAHN AND ASSOCIATES, INC.
Project No. 2708

APPENDIX I

On-Site Surface Water and Sediment Quality Data

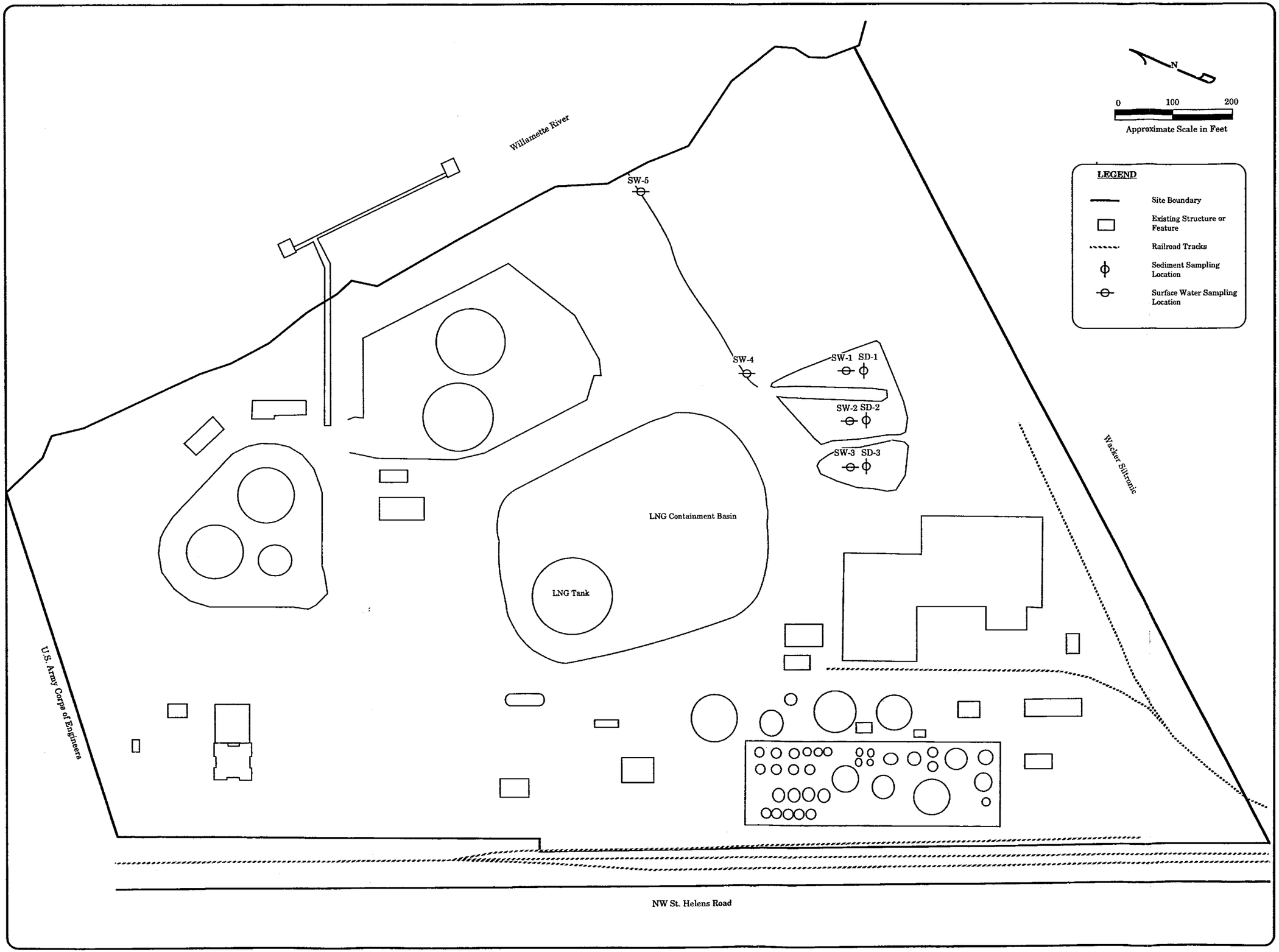


Figure I-1

On-Site Sediment and Surface Water Sampling Location Map

RI/FS
Northwest Natural Gas Company Gasco Facility
7540 NW St. Helens Road
Portland, Oregon

HAHN & ASSOCIATES, INC.

ENVIRONMENTAL MANAGEMENT
434 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209
503/796-0717

July 1996

Project #2708

TABLE I-1 – Summary of Analytical Results for On-Site Surface Water Samples
BTEX, Total PAHs, TPH, and Lead

Remedial Investigation
Northwest Natural Gas Company - Gasco Facility
Portland, Oregon

Project #2708

Sample Location ID	Sample Location	Sample Number*	Chain of Custody Number	Sample Date	Analytical Results								
					ug/l (ppb)							mg/l (ppm)	
					EPA Method 8020					EPA Method 8270 SIM		EPA Method 418.1	EPA Method 6010
					Benzene	Toluene	Ethyl benzene	Xylenes	Total BTEX	Carcinogenic PAHs	Total PAHs	TPH	Dissolved Lead
SW1	East Pond	SW1-01	2708-W012	30-Jan-96	0.92	ND>0.5	ND>0.5	ND>0.5	0.92	6.6	12.1	ND>0.5	ND>0.005
SW2	Middle Pond	SW2-01	2708-W012	30-Jan-96	3.1	ND>0.5	0.82	2.1	6.02	0.24	23.7	ND>0.5	ND>0.005
SW3	West Pond	SW3-01	2708-W012	30-Jan-96	0.92	ND>0.5	ND>0.5	ND>0.5	0.92	0.76	16.3	ND>0.5	ND>0.005
SW4	Ditch, West	SW4-01	2708-W012	30-Jan-96	**110.**	9.	0.55	ND>0.5	119.55	0.55	4.7	ND>0.5	ND>0.005
SW5	Ditch, East	SW5-01	2708-W012	30-Jan-96	6.2	0.75	ND>0.5	ND>0.5	6.95	0.62	20.1	22.	ND>0.005
SW5 (duplicate)	Ditch, East	SW1-02	2708-W012	30-Jan-96	-	-	-	-	-	0.69	22.6	-	ND>0.005
				Reference Levels [1] ->	40 [2]	424 [2]	1,400 [3]	#	#	#	#	#	0.0032[1]

Note:
= Cleanup level not established
* = Sample number prefix: 2708-960130-
BTEX = benzene, toluene, ethylbenzene, and xylenes
EPA = U.S. Environmental Protection Agency

mg/l = milligrams/liter
ND = not detected above detection limit indicated
ODEQ = Oregon Department of Environmental Quality
PAHs = polynuclear aromatic hydrocarbons

ppb = parts per billion
ppm = parts per million
TPH = total petroleum hydrocarbons
ug/l = micrograms/liter

1 = Reference Level indicated is the lowest guidance value provided in the Ambient Water Quality Criteria (OAR 340-41)
2 = Reference Level based on Human Fish Consumption Criteria of Ambient Water Quality Criteria
3 = Reference Level based on Human Fish Consumption Criteria of AWQC

BOLD = Detected above Reference Level

TABLE I-2 – Summary of Analytical Results for On-Site Surface Water Samples
PAHs by EPA Method 8270

Remedial Investigation
Northwest Natural - Gasco Facility
Portland, Oregon

Project #2708

PAHs by EPA Method 8270 (SIM)				Analytical Results ug/l (ppb)																	
Sample Location ID	Sample Location	Sample Number*	Sample Date	Acenaphthene	Acenaphthylene	Anthracene	Benzo (a) anthracene	Benzo (b) fluoranthene	Benzo (k) fluoranthene	Benzo (a) pyrene	Benzo (ghi) perylene	Chrysene	Dibenzo (ah) anthracene	Fluoranthene	Fluorene	Indeno (1,2,3-cd) pyrene	Naphthalene	Phenanthrene	Pyrene	Total Carcinogenic PAHs	Total PAHs
SW1	East Pond	SW1-01	30-Jan-96	ND>0.3	0.6	0.87	0.75	1.8	0.64	1.1	1.8	1.1	ND>0.3	0.9	ND>0.3	1.2	ND>0.3	ND>0.3	1.3	6.59	12.1
SW2	Middle Pond	SW2-01	30-Jan-96	2.9	0.3	0.4	ND>0.1	0.13	ND>0.1	ND>0.1	0.1	0.11	ND>0.1	0.85	1.2	ND>0.1	16.	0.96	0.71	0.24	23.7
SW3	West Pond	SW3-01	30-Jan-96	2.8	0.48	0.56	0.11	0.19	ND>0.1	0.13	0.17	0.21	ND>0.1	1.1	1.3	0.12	7.2	1.1	0.86	0.76	16.3
SW4	Ditch, West	SW4-01	30-Jan-96	0.31	ND>0.1	ND>0.1	ND>0.1	0.17	ND>0.1	0.12	0.18	0.15	ND>0.1	0.28	0.22	0.11	2.5	0.4	0.28	0.55	4.7
SW5	Ditch, East	SW5-01	30-Jan-96	1.1	0.31	ND>0.1	0.1	0.16	ND>0.1	0.11	0.14	0.15	ND>0.1	0.32	0.41	0.1	16.	0.88	0.32	0.62	20.1
SW5 (duplicate)	Ditch, East	SW1-02	30-Jan-96	1.2	0.35	0.16	0.11	0.18	ND>0.1	0.12	0.17	0.16	ND>0.1	0.3	0.44	0.12	18.	1.	0.29	0.69	22.6
			Reference Levels [1] ->	520 [2]	#	#	520 [2]	#	#	#	#	#	#	54 [3]	#	#	620 [2]	#	#	#	#

Note:
* = Sample number prefix: 2708-960130-
# = Cleanup level not established

DEQ = Oregon Department of Environmental Quality
EPA = U.S. Environmental Protection Agency

ND = Not detected above detection limit indicated
PAHs = polynuclear aromatic hydrocarbons

ppb = parts per billion
ug/l = micrograms/liter

1 = Reference Level indicated is the lowest guidance value provided in the Ambient Water Quality Criteria (OAR 340-41)
2 = Reference Level based on Aquatic Fresh Chronic Criteria of AWQC
3 = Reference Level based on Human Fish Consumption Criteria of AWQC

Updated: 8/25/98 RBE
File Name: *2708-1 Surface Wtr Rslts

HAHN AND ASSOCIATES, INC.

TABLE I-3 – Summary of Analytical Results for Sediment Samples: On-Site Ponds
TPH, BTEX, Total PAHs, Total Organic Carbon, and Lead

Remedial Investigation
Northwest Natural - Gasco Facility
Portland, Oregon

Project #2708

Soil Boring Number	Sample Number*	Chain of Custody Number	Sample Date	Depth (feet bgs)	ODEQ Method		EPA Method 8270 SIM		EPA Method 8020					EPA Method 415.1	EPA Method 6010
					TPH-G	TPH-418.1M									
					Gasoline	Diesel/Oil	Carcinogenic PAHs	Total PAHs	Benzene	Toluene	Ethyl benzene	Xylenes	Total BTEX	Total Organic Carbon	Total Lead
SD-1	960130-SD1-01	2708-SD010	30-Jan-96	0.5	ND>20 by HCID	140.	1,082.9	1,934.7	ND>0.3	ND>0.3	ND>0.3	ND>0.3	ND	90,700.	14.
SD-2	960130-SD2-01	2708-SD010	30-Jan-96	0.5	16.	1,200.	3,721.6	21,664.6	ND>0.3	ND>0.3	ND>0.3	0.34	0.34	134,000.	6.8
SD-3	960130-SD3-01	2708-SD010	30-Jan-96	0.5	ND>10	1,100.	2,628.1	10,669.9	ND>0.3	ND>0.3	ND>0.3	ND>0.3	ND	75,500.	18.
Reference Level [1] ->					-	-	See Table I-4	See Table I-4	-	-	-	-	-	-	450

Note:
* = Sample number prefix: 2708-
BTEX = benzene, toluene, ethylbenzene, and xylenes
EPA = U.S. Environmental Protection Agency
HCID = hydrocarbon identification
mg/kg = milligrams/kilogram
ND = not detected above detection limit indicated
ODEQ = Oregon Department of Environmental Quality
PAHs = polynuclear aromatic hydrocarbons
ppm = parts per million
TPH = total petroleum hydrocarbons
BOLD = Detected above Reference Level

1 = Reference Levels based on Sediment Screening Levels provided within Draft Dredged Material Evaluation Framework, Lower Columbia River Management Area, April 1998.

TABLE I-4 – Summary of Analytical Results for Sediment Samples: On-Site Ponds
PAHs by EPA Method 8270
Remedial Investigation
Northwest Natural - Gasco Facility
Portland, Oregon

Project No. 2708

PAHs by EPA Method 8270 (SIM)					Analytical Results mg/kg (ppm)																	
Soil Boring /Sample Station	Sample Number	Chain of Custody No.	Sample Date	Sample Depth (feet bgs)	Acenaphthene	Acenaphthylene	Anthracene	Benzo (a) anthracene	Benzo (b) fluoranthene	Benzo (k) fluoranthene	Benzo (a) pyrene	Benzo (ghi) perylene	Chrysene	Dibenzo (ah) anthracene	Fluoranthene	Fluorene	Indeno (1,2,3-cd) pyrene	Naphthalene	Phenanthrene	Pyrene	Total Carcinogenic PAHs	Total PAHs
SD-1	960130-SD1-01	2708-SD010	30-Jan-96	0.5	5.7	41.3	24.	141.	246.	76.	205.	226.	215.	28.9	255.	ND>5	151.	8.1	14.7	297.	1,063	1,935
SD-2	960130-SD2-01	2708-SD010	30-Jan-96	0.5	1,408.	194.	1,030.	688.	695.	262.	729.	594.	899.	68.6	3,006.	1,038.	380.	1,437.	6,001.	3,295.	3,722	21,665
SD-3	960130-SD3-01	2708-SD010	30-Jan-96	0.5	397.	104.	419.	459.	498.	182.	472.	422.	693.	46.1	2,013.	304.	269.	12.8	2,230.	2,140.	2,620	10,662
				Reference Level [1] ->	0.5	0.6	1.	1.3	3.2	3.2	1.6	0.7	1.4	0.2	1.7	0.5	0.6	2.1	1.5	2.6	#	#

Note: # = Cleanup level not established
bgs = below ground surface

EPA = U.S. Environmental Protection Agency
mg/kg = milligrams/kilogram

ND = not detected above detection limit indicated
PAHs = polynuclear aromatic hydrocarbons

ppm = parts per million
BOLD = Detected above Reference Level

1 = Reference Levels based on Sediment Screening Levels provided within Draft Dredged Material Evaluation Framework, Lower Columbia River Management Area, April 1998.

Updated: 9/23/98 RBE
File Name: Workbook1

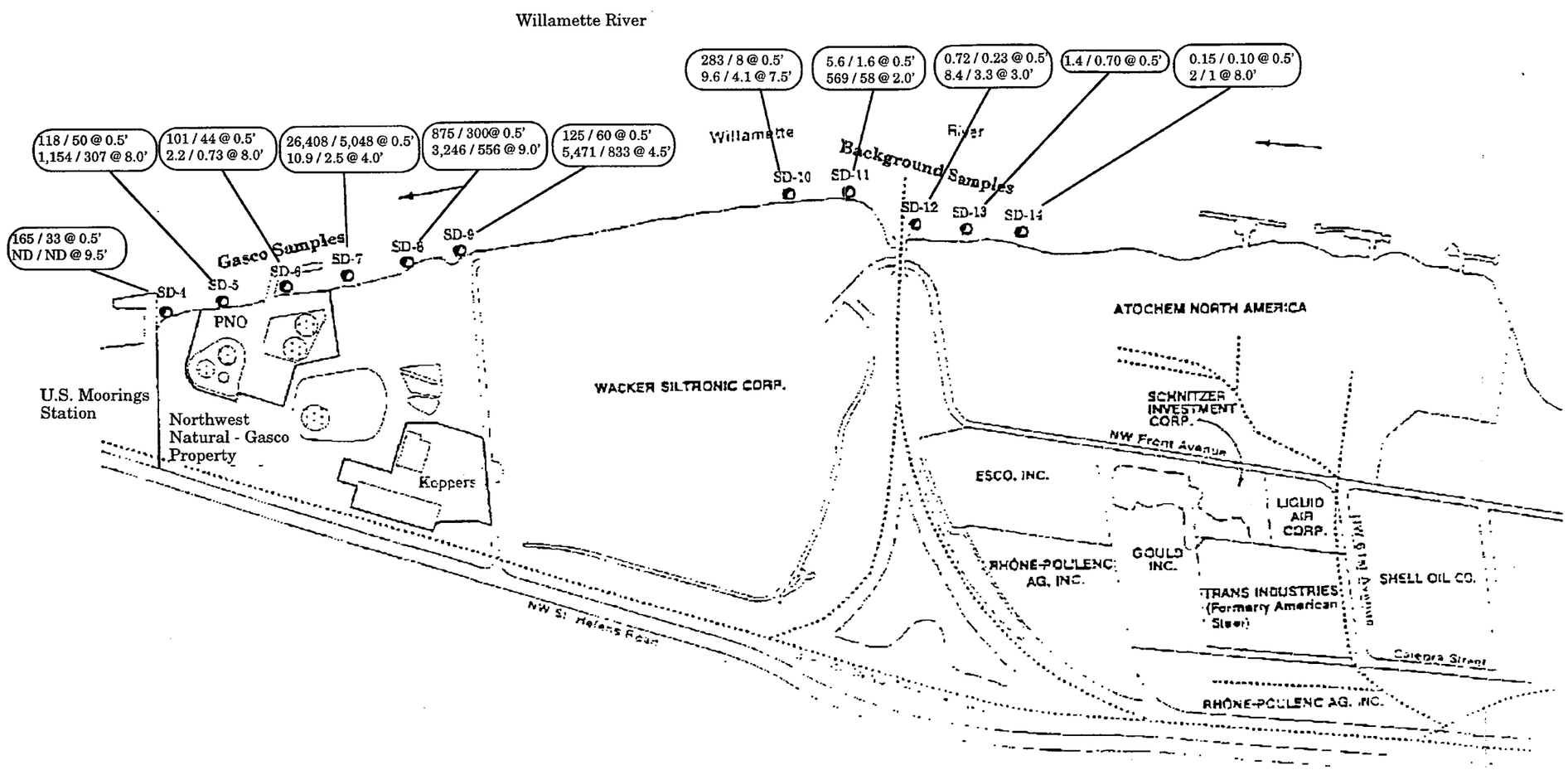
HAHN AND ASSOCIATES, INC.

APPENDIX J

Willamette River Sediment Quality Data

Note: Aerial photograph from Portland Harbor Sediment Investigation Report, Multnomah County, Oregon (EPA 910/R-98-006), dated May 1998

Project No. 2708	**HAHN AND ASSOCIATES** INCORPORATED	**SEDIMENT SAMPLE LOCATION MAP, WILLAMETTE RIVER**	FIGURE
September 1998	ENVIRONMENTAL MANAGEMENT 434 NW SIXTH AVENUE, SUITE 203 PORTLAND, OREGON 97209 (503) 796-0717	Northwest Natural Gasco Facility 7900 NW St. Helens Road Portland, Oregon	**J-1**



LEGEND

118 / 50 @ 0.5' 1,154 / 307 @ 8.0'	Total PAHs / Total Carcinogenic PAHs in parts per million (ppm) @ feet below ground surface
ND	Not Detected
○	Sediment Boring Location

Note: Base Map from Geraghty & Miller, Inc. Hydrogeological Investigation of the Doane Lake Area,February 1991

Figure J-2

Willamette River: Site and Background Locations - PAHs

Remedial Investigation
Northwest Natural - Gasco Facility
7900 NW St. Helens Road
Portland, Oregon

HAHN & ASSOCIATES, INC.
ENVIRONMENTAL MANAGEMENT
434 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209
503/796-0717

July 1996

Project #2708

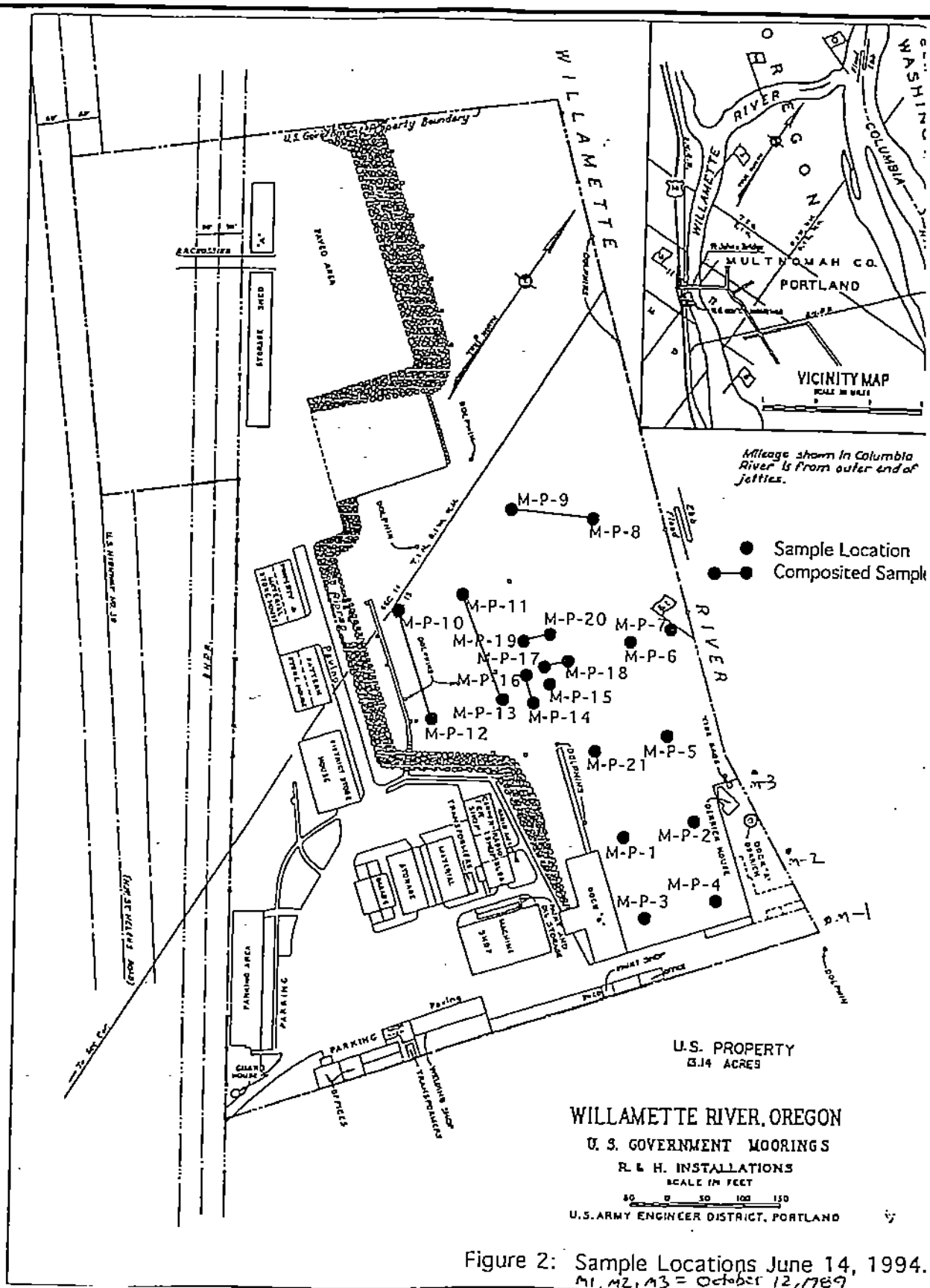
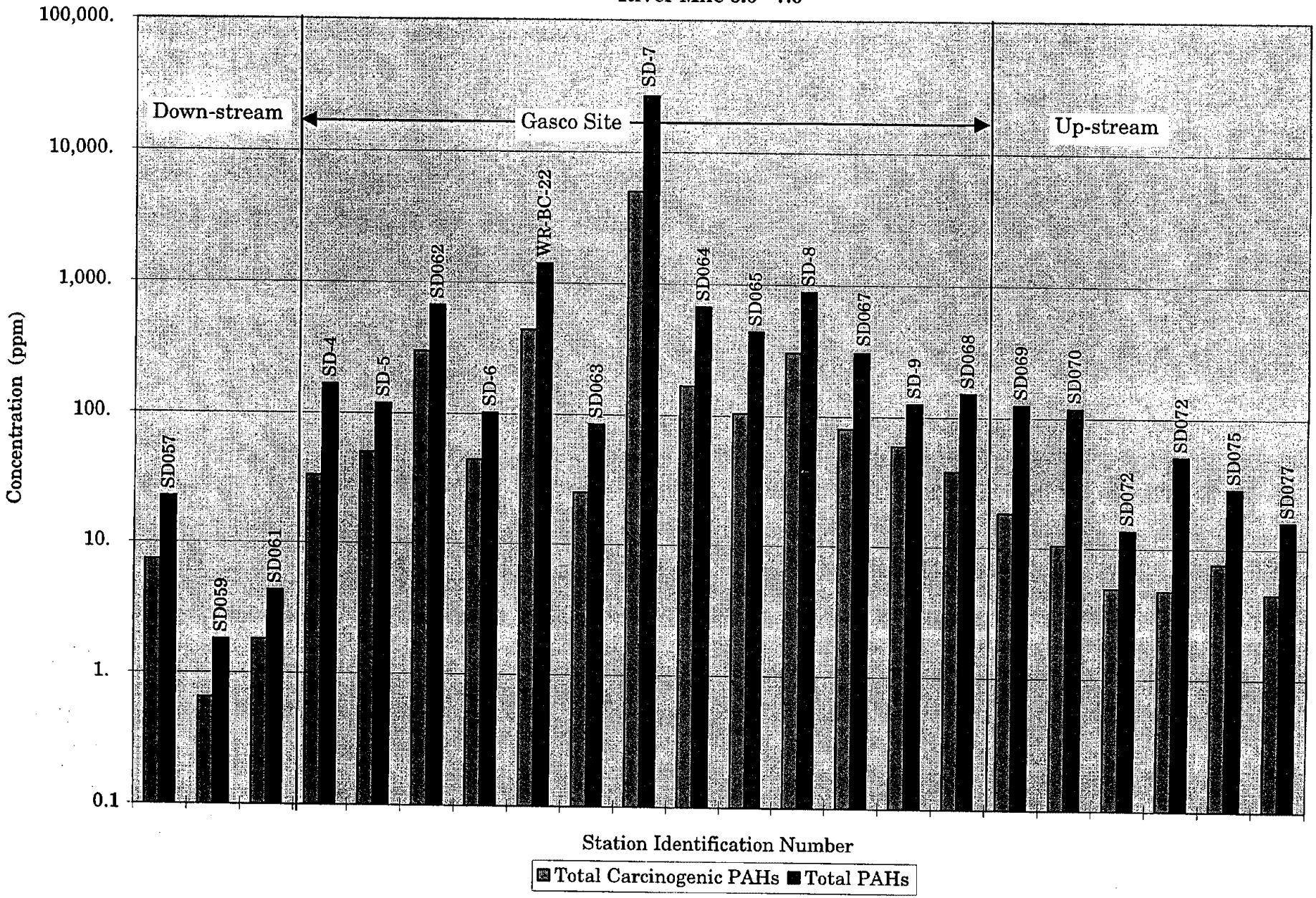


Figure 2: Sample Locations June 14, 1994.
M1, M2, M3 = October 12, 1989

Note: Map from COE Report "Results of U.S. Moorings Sediment Study, by Siipola, M.D. and Britton, J.L., June 14, 1994

Project No. 2708	**HAHN AND ASSOCIATES** INCORPORATED	**U.S. Moorings Sediment Sample Locations**	**FIGURE**
September 1998	ENVIRONMENTAL MANAGEMENT 434 NW SIXTH AVENUE, SUITE 203 PORTLAND, OREGON 97209 (503) 796-0717	Northwest Natural Gasco Facility 7900 NW St. Helens Road Portland, Oregon	**J-3**

Figure J-4
Total PAHs and Carcinogenic PAHs in Willamette River Surface Sediment
River Mile 6.0 - 7.0



2708-J Sed Chart: Updated9/28/98:RBE

HAHN AND ASSOCIATES, INC.

TABLE J-1 – Summary of Analytical Results for Sediment Samples: Willamette River
TPH, BTEX, Total PAHs, Total Organic Carbon, and Lead

Remedial Investigation
Northwest Natural - Gasco Facility
Portland, Oregon

Project #2708

Sample Station ID	Sample Number*	Chain of Custody Number	Sample Date	Depth (feet brbs)	Analytical Results mg/kg (ppm)													
					ODEQ Method TPH-HCID			ODEQ Method		EPA Method 8270 SIM		EPA Method 8020					EPA Method 415.1	EPA Method 6010
								TPH-G	TPH-418.1M									
					Gasoline	Diesel	Oil	Gasoline	Diesel/Oil	Carcinogenic PAHs	Total PAHs	Benzene	Toluene	Ethyl benzene	Xylenes	Total BTEX	Total Organic Carbon	Total Lead
SD-4	960123-SD4-01	2708-SD003	23-Jan-96	0.5	ND>20	Detected	Detected		91.	32.95	164.94	ND>0.3	ND>0.3	ND>0.3	ND>0.3	ND	17,000.	32.
SD-4	960123-SD4-11	2708-SD003	23-Jan-96	9.5	ND>20	ND>50	ND>100			0.1	0.15	ND>0.3	ND>0.3	ND>0.3	ND>0.3	ND		2.3
SD-5	960123-SD5-01	2708-SD003	23-Jan-96	0.5	ND>20	ND>50	ND>100			50.1	118.1	ND>0.3	ND>0.3	ND>0.3	ND>0.3	ND	18,500.	9.3
SD-5	960123-SD5-09	2708-SD004	23-Jan-96	8.0				ND>10	160.	306.6	1,153.6	ND>0.3	ND>0.3	ND>0.3	ND>0.3	ND		20.
SD-6	960123-SD6-01	2708-SD004	23-Jan-96	0.5	ND>20	Detected	Detected		240.	44.16	101.43	ND>0.3	ND>0.3	ND>0.3	ND>0.3	ND	5,400.	25.
SD-6	960123-SD6-09	2708-SD005	23-Jan-96	8.0	ND>20	ND>50	ND>100			0.73	2.2	ND>0.3	ND>0.3	ND>0.3	ND>0.3	ND		10.
SD-7	960123-SD7-01	2708-SD006	23-Jan-96	0.5	Detected	Detected	Detected	300.	5,100.	5,048.	26,408.	22.	4.2	10.	18.	54.2	120,000.	35.
SD-7	960123-SD7-05	2708-SD006	23-Jan-96	8.5	ND>20	ND>50	ND>100			2.46	10.89	ND>0.3	ND>0.3	ND>0.3	ND>0.3	ND		2.8
SD-8	960123-SD8-01	2708-SD006	23-Jan-96	0.5	ND>20	ND>50	ND>100			299.9	874.5	ND>0.3	ND>0.3	ND>0.3	ND>0.3	ND	41,000.	47.
SD-8	960123-SD8-10	2708-SD007	23-Jan-96	9.0				44.	910.	556.	3,254.	ND>0.3	ND>0.3	1.3	1.3	2.6		26.
SD-9	960124-SD9-01	2708-SD007	24-Jan-96	0.5	ND>20	ND>50	ND>100			59.5	124.94	ND>0.3	ND>0.3	ND>0.3	ND>0.3	ND	34,000.	20.
SD-9	960124-SD9-02 (Dup)	2708-SD007	24-Jan-96	0.5						44.	94.						28,000.	
SD-9	960124-SD9-06	2708-SD008	24-Jan-96	4.5				110.	380.	833.	5,471.	1.8	ND>0.3	6.2	6.	14.		10.
SD-10	960123-SD10-01	2708-SD008	23-Jan-96	0.5	ND>20	ND>50	ND>100			7.95	283.34	ND>0.3	ND>0.3	ND>0.3	ND>0.3	ND	9,600.	2.8
SD-10	960123-SD10-09	2708-SD008	23-Jan-96	7.5	ND>20	Detected	ND>100		290.	4.13	9.57	ND>0.3	ND>0.3	ND>0.3	ND>0.3	ND		7.8
SD-11	960123-SD11-01	2708-SD008	23-Jan-96	0.5				ND>10	9.6	1.6	5.62	ND>0.3	ND>0.3	ND>0.3	ND>0.3	ND	830.	5.1
SD-11	960123-SD11-03	2708-SD009	23-Jan-96	2.0					280.	58.4	569.38	ND>0.3	ND>0.3	ND>0.3	ND>0.3	ND		6.3
SD-12	960124-SD12-01	2708-SD002	24-Jan-96	0.5	ND>20	ND>50	ND>100			0.23	0.72	ND>0.3	ND>0.3	ND>0.3	ND>0.3	ND	5,000.	10.
SD-12	960124-SD12-04	2708-SD002	24-Jan-96	3.0	ND>20	ND>50	ND>100			3.27	8.36	ND>0.3	ND>0.3	ND>0.3	ND>0.3	ND		6.6
SD-13	960124-SD13-01	2708-SD001	24-Jan-96	0.5	ND>20	ND>50	ND>100			0.7	1.37	ND>0.3	ND>0.3	ND>0.3	ND>0.3	ND	4,800.	13.
SD-14	960124-SD14-01	2708-SD005	24-Jan-96	0.5	ND>20	Detected	ND>100		96.	0.1	0.15	ND>0.3	ND>0.3	ND>0.3	ND>0.3	ND	8,000.	13.
SD-14	960124-SD14-09	2708-SD005	24-Jan-96	8.0						0.69	1.5	ND>0.3	ND>0.3	ND>0.3	ND>0.3	ND		2.6
				Reference Level [1] ->	-	-	-	-	-	-	-	-	-	-	-	-	-	450

Note:
* = Sample number prefix: 2708-
BTEX = benzene, toluene, ethylbenzene, and xylenes
brbs = below river bottom surface
EPA = U.S. Environmental Protection Agency
HCID = hydrocarbon identification
mg/kg = milligrams/kilogram
ND = not detected above detection limit indicated
ODEQ = Oregon Department of Environmental Quality
PAHs = polynuclear aromatic hydrocarbons
ppm = parts per million
TPH = total petroleum hydrocarbons

1 = Reference Levels based on Sediment Screening Levels provided within Draft Dredged Material Evaluation Framework, Lower Columbia River Management Area, April 1998.

TABLE J-2 – Summary of Analytical Results for Sediment Samples: Willamette River
PAHs by EPA Method 8270

Remedial Investigation
Northwest Natural - Gasco Facility
Portland, Oregon

Project No. 2708

PAHs by EPA Method 8270 (SIM)				Analytical Results mg/kg (ppm)																
				Carcinogenic PAHs							Non-carcinogenic PAHs									
Sample Station ID	Sample Number	Sample Date	Sample Depth (feet brbs)	Benzo (a) anthracene	Benzo (b) fluoranthene	Benzo (k) fluoranthene	Benzo (a) pyrene	Chrysene	Dibenzo (ah) anthracene	Indeno (1,2,3-cd) pyrene	Acenaphthene	Acenaphthylene	Anthracene	Benzo (ghi) perylene	Fluoranthene	Fluorene	Naphthalene	Phenanthrene	Pyrene	Total Carcinogenic PAHs	Total PAHs
Northwest Natural Sediment Investigation Data																					
SD-4	2708-960123-SD4-01	23-Jan-96	0.5	5.6	6.8	2.7	**5.6**	**7.8**	**0.65**	**3.8**	**5.9**	**0.59**	**4.9**	**6.1**	**19.9**	**4.8**	**32.2**	**34.6**	**23.**	33.	165.
SD-4	2708-960123-SD4-11	23-Jan-96	9.5	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND	ND
SD-5	2708-960123-SD5-01	23-Jan-96	0.5	8.4	9.3	3.	**11.1**	**11.2**	**1.3**	**5.8**	**4.3**	ND>0.05	**4.**	**9.9**	**13.**	2.	1.6	**14.8**	**18.4**	50.1	118.
SD-5	2708-960123-SD5-09	23-Jan-96	8.0	52.7	56.8	**20.6**	**64.5**	**72.5**	**6.6**	**32.9**	**45.8**	**2.3**	**63.4**	**47.1**	**174.**	**28.9**	**6.5**	**266.**	**213.**	307.	1,154.
SD-6	2708-960123-SD6-01	23-Jan-96	0.5	6.6	9.4	**3.7**	**9.7**	**8.8**	**0.86**	**5.1**	**1.3**	**0.65**	**2.**	**8.**	**18.2**	**0.75**	0.37	**3.5**	**22.5**	44.2	101.4
SD-6	2708-960123-SD6-09	23-Jan-96	8.0	0.096	0.14	0.056	0.17	0.15	ND>0.05	0.12	0.054	ND>0.05	0.072	0.21	0.34	ND>0.05	0.06	0.26	0.47	0.7	2.2
SD-7	2708-960123-SD7-01	23-Jan-96	0.5	840.	930.	**350.**	**1,000.**	**1,300.**	**98.**	**530.**	**1,600.**	**140.**	**1,100.**	**820.**	3,000.	**800.**	**5,100.**	**5,400.**	**3,400.**	5,048.	26,408.
SD-7	2708-960123-SD7-05	23-Jan-96	8.5	0.37	0.45	0.18	0.52	0.64	ND>075	0.3	0.25	0.24	0.51	0.49	1.4	0.24	1.4	**2.1**	1.8	2.5	10.9
SD-8	2708-960123-SD8-01	23-Jan-96	0.5	49.	59.	**21.**	**69.**	**58.**	**6.9**	**37.**	**21.**	**6.7**	**28.**	**57.**	**160.**	**12.**	**3.9**	**96.**	**190.**	300.	875.
SD-8	2708-960123-SD8-10	23-Jan-96	9.0	120.	100.	**36.**	**110.**	**140.**	**10.**	**48.**	**170.**	**13.**	**190.**	**75.**	**340.**	**120.**	**580.**	**770.**	**440.**	564.	3,262.
SD-9	2708-960124-SD9-01	24-Jan-96	0.5	8.7	12.	**4.5**	**14.**	**11.**	**1.4**	**7.9**	**1.6**	**1.5**	**2.6**	**12.**	**18.**	**0.83**	0.81	**8.1**	**20.**	59.5	124.9
SD-9	2708-960124-SD9-02 (Dup)	24-Jan-96	0.5	6.5	8.6	**3.3**	**10.**	**8.8**	**1.1**	**5.9**	**1.1**	0.88	**1.5**	**9.6**	**14.**	0.45	0.73	**5.1**	**16.**	44.2	93.6
SD-9	960124-SD9-06	24-Jan-96	4.5	150.	160.	**57.**	**180.**	**180.**	**16.**	**90.**	**460.**	**28.**	**230.**	**140.**	**540.**	**190.**	**1,500.**	**1,000.**	**550.**	833.	5,471.
SD-10	2708-960123-SD10-01	23-Jan-96	0.5	2.1	1.3	0.5	1.1	**2.4**	0.1	0.46	**16.**	**190.**	**5.5**	0.69	**12.**	**11.**	0.096	**31.**	**9.1**	8.	283.
SD-10	2708-960123-SD10-09	23-Jan-96	7.5	0.64	0.82	0.29	0.84	1.	0.085	0.45	0.1	0.093	0.18	0.67	1.5	ND>0.068	ND>0.068	1.	1.9	4.1	9.6
SD-11	2708-960123-SD11-01	23-Jan-96	0.5	0.25	0.32	0.12	0.32	0.38	ND>0.066	0.21	0.34	ND>0.066	0.21	0.33	0.87	0.39	ND>66	1.1	0.78	1.6	5.6
SD-11	2708-960123-SD11-03	23-Jan-96	2.0	17.	8.1	**3.7**	**5.3**	**16.**	ND>0.074	**1.3**	**40.**	0.38	**58.**	**1.6**	**100.**	**66.**	ND>.074	**260.**	**74.**	51.4	651.4
SD-12	2708-960124-SD12-01	24-Jan-96	0.5	ND>0.05	0.067	ND>0.05	0.055	0.053	ND>0.05	0.055	ND>0.05	ND>0.05	ND>0.05	0.11	0.13	ND>0.05	ND>0.05	0.06	0.19	0.2	0.7
SD-12	2708-960124-SD12-04	24-Jan-96	3.0	0.38	0.66	0.22	0.83	0.53	0.063	0.59	0.055	0.049	0.13	**1.2**	1.1	ND>0.05	0.058	0.39	2.1	3.3	8.4
SD-13	2708-960124-SD13-01	24-Jan-96	0.5	0.097	0.15	0.066	0.13	0.17	ND>0.05	0.085	ND>0.05	ND>0.05	0.044	0.14	0.2	ND>0.05	ND>0.05	0.079	0.21	0.7	1.4
SD-14	2708-960124-SD14-01	24-Jan-96	0.5	ND>0.05	0.049	ND>0.05	0.051	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	0.054	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	0.1	0.2
SD-14	2708-960124-SD14-09	24-Jan-96	8.0	0.16	0.12	0.054	0.13	0.18	ND>0.05	0.047	ND>0.05	ND>0.05	0.067	0.06	0.22	ND>0.05	ND>0.05	0.12	0.31	0.7	1.5
			Reference Level [1] ->	1.3	3.2	3.2	1.6	1.4	0.23	0.6	0.5	0.56	0.96	0.67	1.7	0.54	2.1	1.5	2.6	#	#

Note: # = Cleanup level not established
brbs = below river bottom surface
EPA = U.S. Environmental Protection Agency
mg/kg = milligrams/kilogram
ND = not detected above detection limit indicated
PAHs = polynuclear aromatic hydrocarbons
ppm = parts per million
BOLD = Detected above Reference Level

1 = Reference Levels based on Sediment Screening Levels provided within Draft Dredged Material Evaluation Framework, Lower Columbia River Management Area, April 1998.

TABLE J-2 – Summary of Analytical Results for Sediment Samples: Willamette River
PAHs by EPA Method 8270

Remedial Investigation
Northwest Natural - Gasco Facility
Portland, Oregon

Project No. 2708

PAHs by EPA Method 8270 (SIM)				Analytical Results mg/kg (ppm)																	
				Carcinogenic PAHs							Non-carcinogenic PAHs										
Sample Station ID	Sample Number	Sample Date	Sample Depth (feet brbs)	Benzo (a) anthracene	Benzo (b) fluoranthene	Benzo (k) fluoranthene	Benzo (a) pyrene	Chrysene	Dibenzo (ah) anthracene	Indeno (1,2,3-cd) pyrene	Acenaphthene	Acenaphthylene	Anthracene	Benzo (ghi) perylene	Fluoranthene	Fluorene	Naphthalene	Phenanthrene	Pyrene	Total Carcinogenic PAHs	Total PAHs
Selected EPA Portland Harbor Sediment Investigation Data																					
SD057	WR-SD-SD057-0000	20-Sep-97	0.1	0.16	0.17	0.17	0.23	0.22	0.045	0.14	0.11	ND>0.019	0.21	0.17	0.41	0.11	0.062	0.44	0.37	1.1	3.
SD057	WR-SD-SD057-0000A	20-Sep-97	0.0-2.5	0.95	1.2	1.	1.2	1.4	0.2	1.4	0.41	0.087	0.29	1.8	4.2	0.13	0.23	2.3	5.6	7.4	22.4
SD058	WR-SD-SD058-0000	20-Sep-97	0.1	0.19	0.18	0.22	0.31	0.23	0.053	0.19	0.045	0.02	0.041	0.24	0.34	0.033	0.09	0.15	0.38	1.4	2.7
SD059	WR-SD-SD059-0000	20-Sep-97	0.1	0.1	0.095	0.093	0.12	0.14	0.025	0.079	0.073	ND>0.02	0.055	0.097	0.29	0.061	0.054	0.27	0.25	0.7	1.8
SD060	WR-SD-SD060-0000	20-Sep-97	0.1	0.33	0.41	0.34	0.51	0.44	0.098	0.31	0.06	0.057	0.09	0.4	0.79	0.056	0.16	0.45	0.82	2.4	5.3
SD061	WR-SD-SD061-0000	20-Sep-97	0.1	0.29	0.31	0.24	0.33	0.38	0.065	0.19	0.063	0.024	0.082	0.22	0.91	0.061	0.04	0.42	0.69	1.8	4.3
SD062	WR-SD-SD062-0000	20-Sep-97	0.1	72.	33.	14.	57.	100.	9.2	12.	15.	0.56	2.4	40.	4.7	20.	1.9	150.	140.	297.	672.
SD063	WR-SD-SD063-0000	20-Sep-97	0.1	4.	3.1	3.2	5.1	5.6	1.	3.	2.6	0.37	3.4	3.6	11.	2.4	1.2	17.	18.	25.	84.6
SD064	WR-SD-SD064-0000	20-Sep-97	0.1	28.	23.	14.	40.	36.	6.2	19.	51.	3.4	26.	24.	110.	22.	130.	17.	120.	166.	670.
SD065	WR-SD-SD065-0000	20-Sep-97	0.1	18.	14.	12.	23.	23.	3.8	10.	15.	3.6	17.	13.	72.	10.	20.	100.	80.	104.	434.
SD066	WR-SD-SD066-0000	20-Sep-97	0.1	0.36	0.3	0.29	0.41	0.47	0.071	0.22	0.22	0.034	0.21	0.27	1.1	0.12	0.32	1.	0.99	2.1	6.4
SD067	WR-SD-SD067-0000	20-Sep-97	0.1	14.	12.	10.	15.	17.	2.5	9.5	11.	2.	13.	13.	45.	9.4	13.	64.	54.	80.	304.4
SD068	WR-SD-SD068-0000	20-Sep-97	0.1	6.3	3.9	5.4	8.	8.6	1.5	4.2	15.	0.74	6.	5.9	20.	4.9	0.79	33.	26.	37.9	150.2
SD069	WR-SD-SD069-0000	20-Sep-97	0.1	4.8	1.9	1.4	2.4	6.3	0.39	1.1	5.6	0.18	22.	1.1	22.	6.7	0.2	31.	17.	18.3	124.1
SD070	WR-SD-SD070-0000	20-Sep-97	0.1	2.9	1.1	1.2	1.4	3.2	0.21	0.52	11.	0.064	8.	0.46	19.	11.	0.51	40.	17.	10.5	117.6
SD071	WR-SD-SD071-0000	20-Sep-97	0.1	0.04	0.044	0.039	0.04	0.056	ND>0.02	0.022	ND>0.02	ND>0.02	ND>0.02	0.028	0.11	ND>0.02	0.036	0.06	0.087	0.2	0.6
SD071	WR-SD-SD071A-0000	20-Sep-97	0.0-2.5	0.13	0.15	0.092	0.1	0.21	0.023	0.056	0.22	ND>0.02	0.075	0.064	0.44	0.16	0.096	0.44	0.43	0.8	2.7
SD072	WR-SD-SD072-0000	20-Sep-97	0.1	0.7	0.8	0.63	0.98	1.1	0.16	0.56	1.5	0.085	0.44	0.6	1.5	0.96	0.21	1.8	1.6	4.9	13.6
SD072	WR-SD-SD072A-0000	20-Sep-97	0.0-2.5	1.1	0.46	0.69	0.66	1.5	ND>.11	0.31	7.2	ND>0.11	3.1	0.34	7.2	5.	0.2	16.	6.6	4.7	50.4
SD073	WR-SD-SD073-0000	20-Sep-97	0.1	0.024	0.025	0.028	0.024	0.036	ND>0.02	ND>0.02	ND>0.02	ND>0.02	ND>0.02	ND>0.02	0.071	ND>0.02	0.024	0.054	0.057	0.1	0.3
SD075	WR-SD-SD075-0000	20-Sep-97	0.1	1.5	1.1	1.1	1.3	1.7	0.22	0.73	3.8	0.14	1.3	0.81	3.5	2.4	0.35	5.5	3.3	7.7	28.8
SD077	WR-SD-SD077-0000	20-Sep-97	0.1	0.74	0.7	0.67	0.89	0.92	0.14	0.38	2.4	0.14	0.42	0.42	1.7	1.4	0.3	2.2	2.5	4.4	15.9
			Reference Level [1] ->	1.3	3.2	3.2	1.6	1.4	0.23	0.6	0.5	0.56	0.96	0.67	1.7	0.54	2.1	1.5	2.6	#	#

Note: # = Cleanup level not established
brbs = below river bottom surface

EPA = U.S. Environmental Protection Agency
mg/kg = milligrams/kilogram

ND = not detected above detection limit indicated
PAHs = polynuclear aromatic hydrocarbons

ppm = parts per million
BOLD = Detected above Reference Level

1 = Reference Levels based on Sediment Screening Levels provided within Draft Dredged Material Evaluation Framework, Lower Columbia River Management Area, April 1998.

TABLE J-2 – Summary of Analytical Results for Sediment Samples: Willamette River
PAHs by EPA Method 8270

Remedial Investigation
Northwest Natural - Gasco Facility
Portland, Oregon

Project No. 2708

PAHs by EPA Method 8270 (SIM)				Analytical Results mg/kg (ppm)																	
				Carcinogenic PAHs							Non-carcinogenic PAHs										
Sample Station ID	Sample Number	Sample Date	Sample Depth (feet brbs)	Benzo (a) anthracene	Benzo (b) fluoranthene	Benzo (k) fluoranthene [2]	Benzo (a) pyrene	Chrysene	Dibenzo (ah) anthracene	Indeno (1,2,3-cd) pyrene	Acenaphthene	Acenaphthylene	Anthracene	Benzo (ghi) perylene	Fluoranthene	Fluorene	Naphthalene	Phenanthrene	Pyrene	Total Carcinogenic PAHs	Total PAHs
Selected US Army Corps of Engineers Sediment Investigation Data – Willamette River																					
WR-BC-22	WR-BC-22	25-Jul-97	0.25	67.	51.5	51.5	99.	86.	9.1	74.	79.	8.5	77.	76.	250.	44.	5.3	180.	260.	438.1	1,417.9
Selected US Army Corps of Engineers Sediment Investigation Data – U.S. Moorings Site																					
M-P-1	M-P-1	14-Jun-94	0.25	2.5	_ [2]	4.	2.5	3.1	0.33	2.3	-	0.17	0.81	1.5	6.	0.6	0.17	4.2	6.4	15.2	35.1
M-P-2	M-P-2	14-Jun-94	0.25	2.	_ [2]	3.5	2.3	2.3	0.34	2.1	-	0.17	0.86	1.4	5.1	0.47	0.18	4.4	5.6	12.5	30.7
M-P-3	M-P-3	14-Jun-94	0.25	4.2	_ [2]	7.6	4.6	4.7	0.73	4.9	-	0.35	1.2	3.	11.	0.64	0.32	5.1	11.	26.7	59.3
M-P-4	M-P-4	14-Jun-94	0.25	2.4	_ [2]	4.6	3.	2.8	0.47	2.8	-	0.19	0.89	1.8	5.8	0.3	0.28	2.8	6.	16.1	34.1
M-P-5	M-P-5	14-Jun-94	0.25	1.8	_ [2]	3.3	2.1	2.1	0.33	1.9	-	0.12	0.56	1.1	4.5	0.31	0.15	2.3	4.5	11.5	25.1
M-P-6	M-P-6	14-Jun-94	0.25	1.4	_ [2]	2.6	1.9	1.6	0.234	1.6	-	0.096	0.42	0.93	3.	0.18	0.13	1.5	3.2	9.3	18.8
M-P-7	M-P-7	14-Jun-94	0.25	1.1	_ [2]	2.2	1.6	1.2	0.3	1.7	-	0.077	0.4	1.1	2.4	0.12	0.092	1.2	2.7	8.1	16.2
M-P-8/9	M-P-8/9	14-Jun-94	0.25	1.3	_ [2]	2.4	1.7	1.4	0.24	1.5	-	0.088	0.32	0.79	2.4	0.14	0.11	1.2	2.6	8.5	16.2
M-P-10/12	M-P-10/12	14-Jun-94	0.25	2.2	_ [2]	4.3	2.7	2.1	0.5	2.3	-	0.053	0.42	1.1	3.5	0.22	0.099	1.7	3.4	14.1	24.6
M-P-11/13	M-P-11/13	14-Jun-94	0.25	0.91	_ [2]	1.8	1.2	1.	0.18	1.	-	0.05	0.21	0.51	1.8	0.11	0.065	0.89	1.7	6.1	11.4
M-P-14/16	M-P-14/16	14-Jun-94	0.25	1.	_ [2]	1.9	1.3	1.2	0.19	1.1	-	0.072	0.26	0.6	2.1	0.15	0.091	0.98	2.1	6.7	13.
M-P-15	M-P-15	14-Jun-94	0.25	3.3	_ [2]	4.4	2.2	3.5	0.23	1.5	-	0.099	0.92	0.76	12.	1.3	0.12	6.5	9.2	15.1	46.
M-P-17/18	M-P-17/18	14-Jun-94	0.25	0.96	_ [2]	1.8	1.2	1.1	0.09	9.9	-	0.055	0.5	0.51	2.2	0.15	0.1	1.	2.4	15.1	22.
M-P-19/20	M-P-19/20	14-Jun-94	0.25	0.63	_ [2]	1.2	0.78	0.73	0.061	0.63	-	0.05	0.16	0.37	1.4	0.092	0.061	0.64	1.5	4.	8.3
M-P-21	M-P-21	14-Jun-94	0.25	1.3	_ [2]	2.6	1.8	1.5	0.19	2.2	-	0.12	0.42	1.	3.5	0.21	0.15	1.7	1.	9.6	17.7
M-1	M-1	12-Oct-89	0-6.5	4.7	_ [2]	6.8	5.5	5.9	0.76	3.9	-	0.47	5.5	5.7	20.	5.3	21.	29.	27.	27.6	141.5
M-2	M-2	12-Oct-89	0-6.5	3.6	_ [2]	4.9	4.1	4.8	0.5	2.4	-	0.5	5.4	3.	13.	4.6	0.55	23.	19.	20.3	89.4
M-3	M-3	12-Oct-89	0-6.5	4.4	_ [2]	5.7	4.6	5.3	0.83	3.2	-	0.3	5.4	4.9	12.	3.9	0.84	21.	20.	24.	92.4
Reference Level [1] ->				1.3	3.2	3.2	1.6	1.4	0.23	0.6	0.5	0.56	0.96	0.67	1.7	0.54	2.1	1.5	2.6	#	#

Note:
# = Cleanup level not established
brbs = below river bottom surface
EPA = U.S. Environmental Protection Agency
mg/kg = milligrams/kilogram
ND = not detected above detection limit indicated
PAHs = polynuclear aromatic hydrocarbons
ppm = parts per million
BOLD = Detected above Reference Level

1 = Reference Levels based on Sediment Screening Levels provided within Draft Dredged Material Evaluation Framework, Lower Columbia River Management Area, April 1998.
2 = All Pre-1997 U.S. Army Corps of Engineers Data combines Benzo(b) and (k) fluoranthene as one value.

APPENDIX K

Air Data

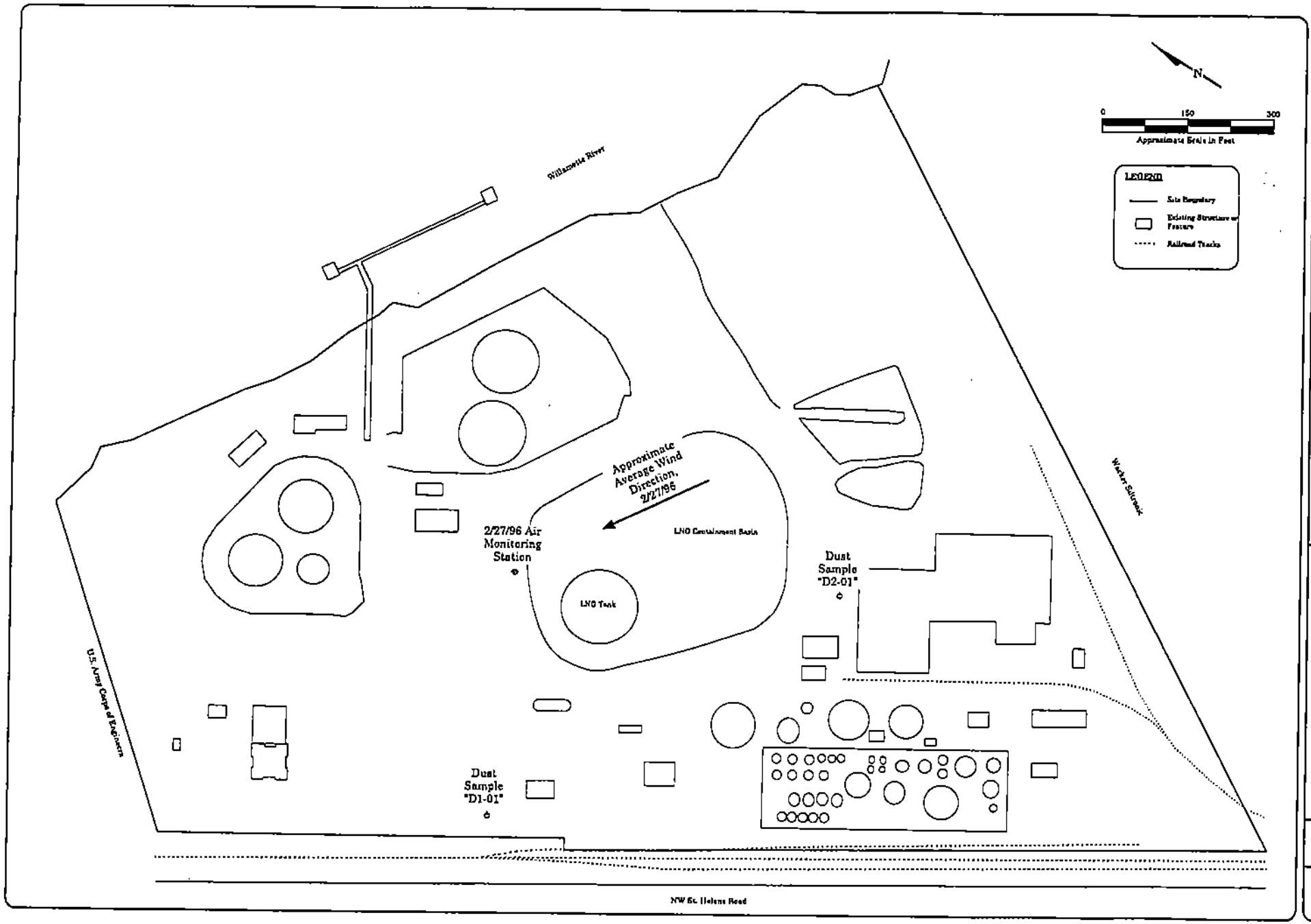


Figure
K-1

Dust and Air Sampling Locations

Remedial Investigation
Northwest Natural - Gasco Facility
7900 NW St. Helens Road
Portland, Oregon

HAHN & ASSOCIATES, INC.
ENVIRONMENTAL MANAGEMENT
434 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209
503/796-0712

September 1998

Project #2708

Chemical Exposure Air Monitoring Report,
Paul Carlson and Associates, Inc.

PAUL CARLSON ASSOCIATES, INC.
Industrial Hygiene Consultants
4511 S.E. Hawthorne Blvd.
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Portland, Oregon 97215
(503) 232-0200 FAX (503) 230-0259

October 13, 1995

Rob Ede
Hahn and Associates, Inc.
434 NW 6th Avenue, Ste. 203
Portland, Oregon 97209

Re: Chemical Exposure Monitoring

INTRODUCTION

This report summarizes the results of exposure monitoring conducted September 19 - 21, 1995 during soil sample acquisition at the Northwest Natural Gas, Gasco Facility, 7900 NW St. Helen's Road in Portland, Oregon. Sampling was conducted to ensure adequate personal respiratory protection during drilling and sampling of potentially contaminated soil.

METHODOLOGY

Representative full-shift breathing zone concentrations of Polynuclear Aromatic Hydrocarbons (PAHs), Aromatic Hydrocarbons (BTEX), metals, total particulate, and cyanide were measured on personnel performing various tasks on the remedial site investigation. These included the driller, driller's helper, driller's third hand, and geologist. The specific test bore location, position monitored, and analyte were determined by Hahn and Associates, Inc.. Subsequent analysis was performed by Clayton Environmental Consultants, an AIHA accredited laboratory. Analytical results from the laboratory are attached.

LEGAL REQUIREMENTS

The Oregon Occupational Safety & Health Administration (OR-OSHA) has adopted Permissible Exposure Limits (PEL's) to protect the health of employees. Three types of limits have been established: Time Weighted Average (TWA), Excursion (E) and Ceiling (C) limits. The TWA's act as an eight hour average such that exposures over the TWA at times during the work shift can be compensated by exposure time below the TWA. Excursion's in worker exposure levels may exceed 3 times the TWA for no more than a total of 30 minutes during a workday, and under no circumstances exceed 5 times the TWA, provided that the TWA is not exceeded. The ceiling is assessed as a 15-minute time weighted average exposure and measured during peak exposure periods. Only the TWA applied in this survey since no job task during this project subjected workers to short duration peak exposures. The PEL's are expressed in units of milligrams (mg) or micrograms (ug) per cubic meter (mg/m^3 or ug/m^3) of air of dusts, gases, mists, and fumes, and parts per million parts (ppm) of air by volume of vapor or gas. Some of the PAH compounds have no established PEL as indicated in Table I.

Cyanide and toluene carry a "skin designation" in the PEL, meaning that skin absorption can contribute significantly to overall exposure. Appropriate skin protection should be considered when handling such chemicals.

Arsenic, benzene, cadmium, and lead are regulated substances that require additional methods of compliance. OR-OSHA has established a 8HR-TWA "action level" for these substances, a level triggering other protective provisions such as exposure monitoring and medical surveillance. Generally, the provisions will require all affected employers to use engineering and other work practices as the primary method of compliance once an employee is exposed above the PEL on a total of 30 or more working days a year. In addition, where the PEL is exceeded, the employer shall establish and implement a written compliance program to reduce employee exposure at or below the PEL. Where engineering and work practice controls do not reduce employee exposures at or below the PEL, the employer shall supplement these controls with respirators, requiring a written respiratory protection program.

RESULTS

Chemical exposure sampling results have been tabulated as follows:

Table I - Polynuclear Aromatic Hydrocarbons (PAHs)
Table II - BTEX (benzene, toluene, ethyl benzene, xylene)
Table III - Metals (antimony, arsenic, beryllium, cadmium, chromium, copper, lead, nickel, selenium, silver, titanium, zinc)
Table IV - Total Particulate
Table V - Cyanide

Each sample record in the tables indicates the person monitored, job position, test bore number during sampling, analyte, exposure concentration, and applicable PEL. All exposures were below their respective PEL's and applicable "action level's", and at times below the limit of detection for the analytical method. The latter case is denoted by a "<" preceding the reported exposure concentration in the table. Sampling was not conducted continuously over an 8-hour work shift so daily average exposures would likely be lower.

FINDINGS AND RECOMMENDATIONS

Based on the results of the sampling, the following findings and recommendations are made:

1. All monitored chemicals were below their respective legal standards.

2. While Level C respiratory protection is not required based on the monitoring results, this level of protection is recommended where unknown hazards exist based on the level of ground contamination. This judgement should be made by the geologist or knowledgeable individual familiar with the hazards at this site.

3. As a minimum safeguard, it is recommended that workers wear appropriate body protection to reduce the hazard of chemical absorption through the skin.

It has been a pleasure assisting you on this project. Please call if you have any questions.

Brad Johnson

Brad Johnson

Enclosures

Table I
Hahn and Associates, Inc.

PAHs Exposure Summary
NIOSH Method 5506

Sample Date:	9/19/95			**Test Bore No:**	B18, B19	
Sample No.:	7083/7084			**Time On:**	10:00	
Name:	John Henson			**Time Off:**	15:16	
Position:	Driller's 3rd Hand			**Total Min:**	316	
Analyte	**Sample Results (ug/m³) Filter**	**Tube**	**Total**	**TWA (ug/m³)**	**OR-OSHA PEL E (ug/m³)**	**C (ug/m³)**
Acenaphthene	< 0.5	< 0.5	< 0.9	NE		
Acenapthylene	< 0.2	< 0.2	< 0.3	NE		
Anthracene	< 0.02	0.17	0.17	200	600	
Benzo (a) anthracene	0.03	< 0.02	0.03	NE		
Benzo (b) fluoranthene	0.03	< 0.03	0.03	NE		
Benzo (k) fluranthene	< 0.02	< 0.02	< 0.03	NE		
Benzo (g,h,i) perylene	0.05	< 0.02	0.05	NE		
Benzo (a) pyrene	0.03	< 0.02	0.03	200	600	
Chrysene	0.05	< 0.02	0.05	200	600	
Dibenzo (a,h) anthracene	< 0.02	< 0.02	< 0.03	NE		
Fluoranthene	0.08	< 0.02	0.08	NE		
Fluorene	< 0.02	< 0.02	1.9	NE		
Indeno(1,2,3-cd) pyrene	0.06	< 0.02	0.06	NE		
Naphthalene	< 0.2	80	80	50,000	150,000	
Phenanthrene	0.1	2.0	2.2	200	600	
Pyrene	0.08	0.02	0.09	200	600	

Sample Date:	9/20/95			**Test Bore No:**	B27	
Sample No.:	7087/7088			**Time On:**	12:36	
Name:	Jerry Rogers			**Time Off:**	15:27	
Position:	Driller's Helper			**Total Min:**	171	
Analyte	**Sample Results (ug/m³) Filter**	**Tube**	**Total**	**TWA (ug/m³)**	**OR-OSHA PEL E (ug/m³)**	**C (ug/m³)**
Acenaphthene	< 0.9	< 9	< 9	NE		
Acenapthylene	< 0.3	< 0.3	< 0.6	NE		
Anthracene	0.12	0.15	0.3	200	600	
Benzo (a) anthracene	0.45	< 0.03	0.45	NE		
Benzo (b) fluoranthene	0.66	< 0.06	0.66	NE		
Benzo (k) fluranthene	0.39	< 0.03	0.39	NE		
Benzo (g,h,i) perylene	1.7	< 0.03	1.7	NE		
Benzo (a) pyrene	0.93	< 0.03	0.93	200	600	
Chrysene	0.27	< 0.03	0.3	200	600	
Dibenzo (a,h) anthracene	1.1	< 0.03	1.1	NE		
Fluoranthene	0.93	< 0.03	0.93	NE		
Fluorene	0.06	< 0.03	0.06	NE		
Indeno(1,2,3-cd) pyrene	0.81	< 0.03	0.81	NE		
Naphthalene	< 0.3	360	360	50,000	150,000	
Phenanthrene	0.69	3.6	4.2	200	600	
Pyrene	1.4	< 0.03	1.4	200	600	

NE = PEL Not Established

Table II
Hahn and Associates, Inc.

BTEX Exposure Summary
NIOSH Method 1501

Sample Date: 9/19/95 **Sample No.:** 7081 **Name:** Jerry Rogers **Position:** Driller's Helper		**Test Bore No:** B18, B19 **Time On:** 10:00 **Time Off:** 15:20 **Total Min:** 320		
Analyte	**Sample Results ppm**	**TWA (ppm)**	**OR-OSHA PEL E (ppm)**	**C (ppm)**
Benzene	0.018	1	5	500
Toluene	0.007	100 (Skin)	300	
Ethyl benzene	0.090	100	300	
Xylene	0.046	100	300	

Sample Date: 9/19/95 **Sample No.:** 7082 **Name:** Rob Ede **Position:** Geologist		**Test Bore No:** B18, B19 **Time On:** 10:00 **Time Off:** 15:16 **Total Min:** 316		
Analyte	**Sample Results ppm**	**TWA (ppm)**	**OR-OSHA PEL E (ppm)**	**C (ppm)**
Benzene	0.064	1	5	500
Toluene	< 0.007	100 (Skin)	300	
Ethyl benzene	0.03	100	300	
Xylene	< 0.01	100	300	

Sample Date: 9/20/95 **Sample No.:** 7086 **Name:** Jerry Rogers **Position:** Driller's Helper		**Test Bore No:** B27 **Time On:** 12:36 **Time Off:** 15:27 **Total Min:** 171		
Analyte	**Sample Results ppm**	**TWA (ppm)**	**OR-OSHA PEL E (ppm)**	**C (ppm)**
Benzene	0.11	1	5	500
Toluene	< 0.01	100 (Skin)	300	
Ethyl benzene	0.02	100	300	
Xylene	< 0.03	100	300	

Sample Date: 9/21/95 **Sample No.:** 7091 **Name:** John Henson **Position:** Driller's 3rd Hand		**Test Bore No:** B4, B3, B1 **Time On:** 08:15 **Time Off:** 15:27 **Total Min:** 432		
Analyte	**Sample Results ppm**	**TWA (ppm)**	**OR-OSHA PEL E (ppm)**	**C (ppm)**
Benzene	0.02	1	5	500
Toluene	< 0.005	100 (Skin)	300	
Ethyl benzene	0.02	100	300	
Xylene	0.01	100	300	

Table III
Hahn and Associates, Inc.

Metals Exposure Summary
NIOSH Method 7300

Sample Date: 9/21/95 **Sample No.:** 7092 **Name:** Jerry Rogers **Position:** Driller's Helper		**Test Bore No:** B4, B3 **Time On:** 08:17 **Time Off:** 15:28 **Total Min:** 431		
Analyte	**Sample Results (mg/m^3)**	**TWA (mg/m^3)**	**OR-OSHA PEL E (mg/m^3)**	**C (mg/m^3)**
Antimony	< 0.009	0.5	1.5	
Arsenic	< 0.0009	0.01	0.03	
Beryllium	< 0.0005	0.002	0.005	0.025
Cadmium	< 0.0002	0.005	0.015	
Chromium	< 0.002	0.5	1.5	
Copper	< 0.002	0.1	0.3	
Lead	< 0.0009	0.05	0.15	
Nickel	< 0.0005	1	3	
Selenium	< 0.002	0.2	0.6	
Silver	< 0.0005	0.01	0.03	
Titanium	0.005	10[1]	30	
Zinc	< 0.002	5[2]	15	

[1]As Titanium Oxide
[2]As Zinc Oxide

Lead Exposure Summary
NIOSH 7300

Sample Date: 9/19/95 **Sample No.:** 7080 **Name:** Bradley James **Position:** Driller		**Test Bore No:** B18, B19 **Time On:** 10:00 **Time Off:** 15:13 **Total Min:** 313		
Analyte	**Sample Results (mg/m^3)**	**TWA (mg/m^3)**	**OR-OSHA PEL E (mg/m^3)**	**C (mg/m^3)**
Lead	< 0.001	0.01	0.03	

Table IV
Hahn and Associates, Inc.

Total Particulate Exposure Summary
NIOSH Method 0500

Sample Date: 9/19/95 Sample No.: 7079 Name: Area Sample Position: 6' Downwind of Drill Rig		Test Bore No: B18, B19 Time On: 10:00 Time Off: 15:18 Total Min: 318		
Analyte	Sample Results (mg/m^3)	TWA (mg/m^3)	OR-OSHA PEL E (mg/m^3)	C (mg/m^3)
Total Dust	< 0.2	10	30	

Table V
Hahn and Associates, Inc.

Cyanide Exposure Summary
NIOSH Method 7904

Sample Date: 9/21/95 Sample No.: 7093/7094 Name: Bradley James Position: Driller				Test Bore No: B4, B3, B1 Time On: 08:14 Time Off: 15:30 Total Min: 436		
Analyte	Sample Results (mg/m^3) Filter	Impinger	Total	TWA (mg/m^3)	OR-OSHA PEL E (mg/m^3)	C (mg/m^3)
Cyanide	< 0.007	< 0.007	< 0.01	5 (Skin)	15	

Clayton
ENVIRONMENTAL CONSULTANTS

Analytical Results
for
Paul Carlson Associates
Client Reference: HA16399
Clayton Project No. 95093.35

Sample Identification: 7083/7084
Lab Number: 9509335-11A
Sample Matrix/Media: FILT_SORBENT
Method Reference: NIOSH 5506

Date Sampled: 09/19/95
Date Received: 09/25/95
Date Analyzed: 09/27/95
Analyst: FHK
Air Volume: 639.9 (L)

Compound	Filter (ug)	Tube Front (ug)	Tube Back (ug)	Total (ug)	Concentration (ug/m3)	Method Detection Limit (ug)
Polynuclear Aromatic Hydrocarbons						
Acenaphthene	<0.3	<0.3	<0.3	<0.6	<0.9	0.3
Acenaphthylene	<0.1	<0.1	<0.1	<0.2	<0.3	0.1
Anthracene	<0.01	0.11	<0.01	0.11	0.17	0.01
Benzo(a)anthracene	0.02	<0.01	<0.01	0.02	0.03	0.01
Benzo(b)fluoranthene	0.02	<0.02	<0.02	0.02	0.03	0.02
Benzo(k)fluoranthene	<0.01	<0.01	<0.01	<0.02	<0.03	0.01
Benzo(g,h,i)perylene	0.03	<0.01	<0.01	0.03	0.05	0.01
Benzo(a)pyrene	0.02	<0.01	<0.01	0.02	0.03	0.01
Chrysene	0.03	<0.01	<0.01	0.03	0.05	0.01
Dibenzo(a,h)anthracene	<0.01	<0.01	<0.01	<0.02	<0.03	0.01
Fluoranthene	0.05	<0.01	<0.01	0.05	0.08	0.01
Fluorene	<0.01	1.2	<0.01	1.2	1.9	0.01
Indeno(1,2,3-cd)pyrene	0.04	<0.01	<0.01	0.04	0.06	0.01
Naphthalene	<0.1	48	3.4	51	80	0.1
Phenanthrene	0.07	1.3	<0.01	1.4	2.2	0.01
Pyrene	0.05	0.01	<0.01	0.06	0.09	0.01

< : Less than the indicated limit of detection
--: Information not available or not applicable

Clayton
ENVIRONMENTAL CONSULTANTS

Analytical Results
for
Paul Carlson Associates
Client Reference: HA16399
Clayton Project No. 95092.85

Sample Identification: 7087/7088
Lab Number: 9509285-02A
Sample Matrix/Media: FILT_SORBENT
Method Reference: NIOSH 5506

Date Sampled: 09/20/95
Date Received: 09/21/95
Date Analyzed: 09/21/95
Analyst: FHK
Air Volume: 331.7 (L)

Compound	Filter (ug)	Tube Front (ug)	Tube Back (ug)	Total (ug)	Concentration (ug/m3)	Method Detection Limit (ug)
Polynuclear Aromatic Hydrocarbons						
Acenaphthene	<0.3	<3 a	<0.3	<3	<9	3 a
Acenaphthylene	<0.1	<0.1	<0.1	<0.2	<0.6	0.1
Anthracene	0.04	0.05	<0.01	0.09	0.3	0.01
Benzo(a)anthracene	0.15	<0.01	<0.01	0.15	0.45	0.01
Benzo(b)fluoranthene	0.22	<0.02	<0.02	0.22	0.66	0.02
Benzo(k)fluoranthene	0.13	<0.01	<0.01	0.13	0.39	0.01
Benzo(g,h,i)perylene	0.57	<0.01	<0.01	0.57	1.7	0.01
Benzo(a)pyrene	0.31	<0.01	<0.01	0.31	0.93	0.01
Chrysene	0.09	<0.01	<0.01	0.09	0.3	0.01
Dibenzo(a,h)anthracene	0.37	<0.01	<0.01	0.37	1.1	0.01
Fluoranthene	0.31	<0.01	<0.01	0.31	0.93	0.01
Fluorene	0.02	<0.01	<0.01	0.02	0.06	0.01
Indeno(1,2,3-cd)pyrene	0.27	<0.01	<0.01	0.27	0.81	0.01
Naphthalene	<0.1	110	11	120	360	0.1
Phenanthrene	0.23	1.2	<0.01	1.4	4.2	0.01
Pyrene	0.47	<0.01	<0.01	0.47	1.4	0.01

< : Less than the indicated limit of detection
--: Information not available or not applicable

[a] Detection limit increased due to matrix interference.

Clayton
ENVIRONMENTAL CONSULTANTS

Analytical Results
for
Paul Carlson Associates
Client Reference: HA16399
Clayton Project No. 95092.58

Sample Identification: See Below
Lab Number: 9509258
Sample Matrix/Media: SM_CHAR_TUBE

Date Sampled: 09/19/95
Date Received: 09/20/95
Date Analyzed: 09/21/95
Analyst: FHK

Lab No.	Sample I.D.	Sample Volume (liters)	Compound	Front (mg)	Back (mg)	Total (mg)	Concentration (mg/m3)	Concentration (ppm)	Method Detection Limit (mg)
-01	7085-BLANK	--	Benzene	<0.002	<0.002	<0.002	--	--	0.002
			Ethyl benzene	<0.002	<0.002	<0.002	--	--	0.002
			Toluene	<0.002	<0.002	<0.002	--	--	0.002
			Xylene	<0.004	<0.004	<0.004	--	--	0.004
-02	7081	64.96	Benzene	0.037	<0.002	0.037	0.57	0.18	0.002
			Ethyl benzene	0.002	<0.002	0.002	0.03	0.007	0.002
			Toluene	0.022	<0.002	0.022	0.34	0.090	0.002
			Xylene	0.013	<0.004	0.013	0.20	0.046	0.004

ND: Not detected at or above limit of detection
--: Information not available or not applicable
Airborne concentrations are based on the air volumes provided
Results have been corrected using laboratory-derived desorption efficiencies

Compound	Method Reference
Benzene	NIOSH 1501
Ethyl benzene	NIOSH 1501
Toluene	NIOSH 1501
Xylene	NIOSH 1501

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Analytical Results
for
Paul Carlson Associates
Client Reference: HA16399
Clayton Project No. 95093.35

Sample Identification: See Below
Lab Number: 9509335
Sample Matrix/Media: SM_CHAR_TUBE

Date Sampled: 09/19/95
Date Received: 09/25/95
Date Analyzed: 09/27/95
Analyst: FHK

Lab No.	Sample I.D.	Sample Volume (liters)	Compound	Front (mg)	Back (mg)	Total (mg)	Concentration (mg/m3)	(ppm)	Method Detection Limit (mg)
-01	7082	63.99	Benzene	0.013	<0.002	0.013	0.20	0.064	0.002
			Ethyl benzene	<0.002	<0.002	<0.002	<0.03	<0.007	0.002
			Toluene	0.007	<0.002	0.007	0.1	0.03	0.002
			Xylene	<0.004	<0.004	<0.004	<0.06	<0.01	0.004
-02	7086	35.65	Benzene	0.013	<0.002	0.013	0.36	0.11	0.002
			Ethyl benzene	<0.002	<0.002	<0.002	<0.06	<0.01	0.002
			Toluene	0.003	<0.002	0.003	0.08	0.02	0.002
			Xylene	<0.004	<0.004	<0.004	<0.1	<0.03	0.004
-03	7091	87.48	Benzene	0.005	<0.002	0.005	0.06	0.02	0.002
			Ethyl benzene	<0.002	<0.002	<0.002	<0.02	<0.005	0.002
			Toluene	0.006	<0.002	0.006	0.07	0.02	0.002
			Xylene	0.005	<0.004	0.005	0.06	0.01	0.004
-04	5482 BLANK	--	Benzene	<0.002	<0.002	<0.002	--	--	0.002
			Ethyl benzene	<0.002	<0.002	<0.002	--	--	0.002
			Toluene	<0.002	<0.002	<0.002	--	--	0.002
			Xylene	<0.004	<0.004	<0.004	--	--	0.004

ND: Not detected at or above limit of detection
--: Information not available or not applicable
Airborne concentrations are based on the air volumes provided
Results have been corrected using laboratory-derived desorption efficiencies

Compound	Method Reference
Benzene	NIOSH 1501
Ethyl benzene	NIOSH 1501
Toluene	NIOSH 1501
Xylene	NIOSH 1501

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Analytical Results
for
Paul Carlson Associates
Client Reference: HA16399
Clayton Project No. 95093.35

Sample Identification: 7092
Lab Number: 9509335-08
Sample Matrix/Media: FILTER

Date Sampled: 09/21/95
Date Received: 09/25/95
Air Volume: 1081.8 (L)

Analyte	Amount (mg)	Concentration (mg/m3)	Method Detection Limit (mg)	Date Prepared	Date Analyzed	Prep/ Analysis Method
Antimony	<0.01	<0.009	0.01	09/27/95	09/28/95	NIOSH 7300
Arsenic	<0.001	<0.0009	0.001	09/27/95	09/28/95	NIOSH 7300
Beryllium	<0.0005	<0.0005	0.0005	09/27/95	09/28/95	NIOSH 7300
Cadmium	<0.0002	<0.0002	0.0002	09/27/95	09/28/95	NIOSH 7300
Chromium	<0.002	<0.002	0.002	09/27/95	09/28/95	NIOSH 7300
Copper	<0.002	<0.002	0.002	09/27/95	09/28/95	NIOSH 7300
Lead	<0.001	<0.0009	0.001	09/27/95	09/28/95	NIOSH 7300
Nickel	<0.0005	<0.0005	0.0005	09/27/95	09/28/95	NIOSH 7300
Selenium	<0.002	<0.002	0.002	09/27/95	09/28/95	NIOSH 7300
Silver	<0.0005	<0.0005	0.0005	09/27/95	09/28/95	NIOSH 7300
Titanium	0.005	0.005	0.002	09/27/95	09/28/95	NIOSH 7300
Zinc	<0.002	<0.002	0.002	09/27/95	09/28/95	NIOSH 7300

ND: Not detected at or above limit of detection
--: Information not available or not applicable

Metal results have been corrected using laboratory derived recovery coefficients

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Analytical Results
for
Paul Carlson Associates
Client Reference: HA16399
Clayton Project No. 95093.35

Sample Identification: 7080
Lab Number: 9509335-07
Sample Matrix/Media: FILTER

Date Sampled: 09/19/95
Date Received: 09/25/95
Air Volume: 795 (L)

Analyte	Amount (mg)	Concentration (mg/m3)	Method Detection Limit (mg)	Date Prepared	Date Analyzed	Prep/ Analysis Method
Lead	<0.001	<0.001	0.001	09/27/95	09/28/95	NIOSH 7300

ND: Not detected at or above limit of detection
--: Information not available or not applicable

Metal results have been corrected using laboratory derived recovery coefficients

Clayton
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CONSULTANTS

Analytical Results
for
Paul Carlson Associates
Client Reference: HA16399
Clayton Project No. 95093.35

Sample Identification: 7079
Lab Number: 9509335-05
Sample Matrix/Media: FILTER

Date Sampled: 09/19/95
Date Received: 09/25/95
Air Volume: 636 (L)

Analyte	Amount (mg)	Concentration (mg/m3)	Method Detection Limit (mg)	Date Prepared	Date Analyzed	Prep/ Analysis Method
Total Dust	<0.1	<0.2	0.1	--	09/28/95	NIOSH 0500

ND: Not detected at or above limit of detection
--: Information not available or not applicable

Clayton
ENVIRONMENTAL CONSULTANTS

Analytical Results
for
PAUL CARLSON ASSOCIATES
Clayton Project No. 30988.00
Client Reference: HA16399

Sample Type:	Filter/Impinger	Date Sampled:	09/21/95
Analytical Method:	NIOSH 7904	Date Received:	09/22/95
Analyst:	SM	Date Analyzed:	09/25/95

Lab No.	Sample Identification	Cyanide Filter (mg)	Cyanide Impinger (mg)	Combined Total (mg)	Maximum LOD (mg)
001a	7093/7094	<0.003	<0.003	<0.006	<0.006
002a	7095/7096 BLANK	<0.003	<0.003	<0.006	<0.006

General Notes:
<: Less than the indicated limit of detection (LOD)
--: Information not available or not applicable

Ambient Air Quality Monitoring Report,
Paul Carlson and Associates, Inc.

PAUL CARLSON ASSOCIATES, INC.
Industrial Hygiene Consultants
4511 S.E. Hawthorne Blvd.
Suite 213
Portland, Oregon 97215
(503) 232-0200 FAX (503) 230-0259

March 27, 1996

Rob Ede
Hahn and Associates, Inc.
434 NW 6th Avenue, Ste. 203
Portland, Oregon 97209

Re: Ambient Air Monitoring

INTRODUCTION

This report summarizes the results of ambient air monitoring conducted on February 27,1996 at the Northwest Natural Gas, Gasco Facility, 7900 NW St. Helen's Road in Portland, Oregon. Sampling was conducted to assess ambient air concentrations downwind of the collection pond located on the east side of the blue LNG Storage Tank.

METHODOLOGY

Ambient air concentrations of Polynuclear Aromatic Hydrocarbons (PAHs) in airborne dust, Aromatic Hydrocarbons (BTEX), and total particulate were measured at a location downwind of the collection pond located on the east side of the blue LNG Storage Tank. The specific location was determined by Hahn and Associates, Inc. Subsequent analysis was performed by Clayton Environmental Consultants, an AIHA accredited laboratory. Analytical results from the laboratory are attached.

LEGAL REQUIREMENTS

The Oregon Occupational Safety & Health Administration (OR-OSHA) has adopted Permissible Exposure Limits (PEL's) to protect the health of employees. Three types of limits have been established: Time Weighted Average (TWA), Excursion (E) and Ceiling (C) limits. The TWA's act as an eight hour average such that exposures over the TWA at times during the work shift can be compensated by exposure time below the TWA. Excursion's in worker exposure levels may exceed 3 times the TWA for no more than a total of 30 minutes during a workday, and under no circumstances exceed 5 times the TWA, provided that the TWA is not exceeded. The ceiling is assessed as a 15-minute time weighted average exposure and measured during peak exposure periods. Only the TWA applied in this survey since ambient air concentrations would be expected to be at a consistent level through out the sampling, with no anticipated peak, short duration exposure concentrations. The PEL's are expressed in units of milligrams (mg) or micrograms (ug) per cubic meter (mg/m^3 or ug/m^3) of air of dusts, gases, mists, and fumes, and parts per million parts (ppm) of air by volume of vapor or gas. Some of the PAH compounds have no established PEL as indicated in Table I.

Toluene carries a "skin designation" in the PEL, meaning that skin absorption can contribute significantly to overall exposure. Appropriate skin protection should be considered when handling this chemical.

Benzene is a regulated substance that requires additional methods of compliance. OR-OSHA has established a 8HR-TWA "action level" for benzene of 0.5 ppm, a level triggering other protective provisions such as exposure monitoring and medical surveillance. Generally, the provisions will require all affected employers to use engineering and other work practices as the primary method of compliance once an employee is exposed above the PEL on a total of 30 or more working days a year. In addition, where the PEL is exceeded, the employer shall establish and implement a written compliance program to reduce employee exposure at or below the PEL. Where engineering and work practice controls do not reduce employee exposures at or below the PEL, the employer shall supplement these controls with respirators, requiring a written respiratory protection program.

RESULTS

Chemical exposure sampling results have been tabulated as follows:

Table I	-	Polynuclear Aromatic Hydrocarbons (PAHs)
Table II	-	BTEX (benzene, toluene, ethyl benzene, xylene)
Table III	-	Total Particulate

Each sample record in the tables indicates the analyte, exposure concentration, and applicable PEL. All exposures were below their respective PEL and applicable action level, and the limit of detection for the analytical method. The latter case is denoted by a "<" preceding the reported exposure concentration in the table.

FINDINGS AND RECOMMENDATIONS

Based on the results of the sampling, the following findings and recommendations are made:

1. All monitored chemicals were below their respective legal standards.

2. While Level C respiratory protection is not required based on the monitoring results, this level of protection is recommended where unknown hazards exist based on the level of ground contamination. This judgement should be made by the geologist or knowledgeable individual familiar with the hazards at this site, with particular attention given to appropriate respiratory protection when the contaminated soil is disturbed.

3. As a minimum safeguard, it is recommended that workers wear appropriate body protection to reduce the hazard of chemical absorption through the skin during soil sample acquisitions.

It has been a pleasure assisting you on this project. Please call if you have any questions.

Brad Johnson

Brad Johnson

Enclosures

Table I
Hahn and Associates, Inc.

PAHs Exposure Summary
NIOSH Method 5506

Sample Date: 2/27/96 Sample No.: 0316 Type: Area Sample				Time On: 09:37 Time Off: 15:27 Total Min: 350		
Analyte	Sample Results (ug/m³) Filter	Tube	Total	TWA (ug/m³)	OR-OSHA PEL E (ug/m³)*	C (ug/m³)**
Acenaphthene	< 0.3	—	< 0.3	NE		
Acenapthylene	< 0.1	—	< 0.1	NE		
Anthracene	< 0.01	—	< 0.01	200	600	
Benzo (a) anthracene	< 0.01	—	< 0.01	NE		
Benzo (b) fluoranthene	< 0.02	—	< 0.02	NE		
Benzo (k) fluranthene	< 0.01	—	< 0.01	NE		
Benzo (g,h,i) perylene	< 0.01	—	< 0.01	NE		
Benzo (a) pyrene	< 0.01	—	< 0.01	200	600	
Chrysene	< 0.01	—	< 0.01	200	600	
Dibenzo (a,h) anthracene	< 0.01	—	< 0.01	NE		
Fluoranthene	< 0.01	—	< 0.01	NE		
Fluorene	< 0.01	—	< 0.01	NE		
Indeno(1,2,3-cd) pyrene	< 0.01	—	< 0.01	NE		
Naphthalene	< 0.1	—	< 0.1	50,000	150,000	
Phenanthrene	< 0.01	—	< 0.01	200	600	
Pyrene	< 0.01	—	< 0.01	200	600	

NE = PEL Not Established

Table II
BTEX Exposure Summary
NIOSH Method 1501

Sample Date: 2/27/96 Sample No.: 0314 Type: Area Sample		Time On: 09:37 Time Off: 15:27 Total Min: 350		
Analyte	Sample Results ppm	TWA (ppm)	OR-OSHA PEL E (ppm)*	C (ppm)**
Benzene	< 0.005	1	5	
Toluene	< 0.005	100 (Skin)	300	500
Ethyl benzene	< 0.004	100	300	
Xylene	< 0.008	100	300	

* Excursion limit
** Ceiling Limit

Table III
Total Particulate Exposure Summary
NIOSH Method 0500

Sample Date: 2/27/96 Sample No.: 0315 Name: Area Sample		Time On: 09:37 Time Off: 15:27 Total Min: 350		
Analyte	Sample Results (mg/m^3)	OR-OSHA PEL TWA (mg/m^3)	E (mg/m^3)*	C (mg/m^3)**
Total Dust	< 0.1	10	30	

* Excursion limit
** Ceiling Limit

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Analytical Results
for
Paul Carlson Associates

Clayton Project No. 96023.26

Sample Identification: 0316
Lab Number: 9602326-03A
Sample Matrix/Media: FILTER

Date Sampled: 02/27/96
Date Received: 02/29/96
Date Analyzed: 03/05/96
Air Volume: 860.7 (L)

Compound	Filter (ug)	Tube Front (ug)	Tube Back (ug)	Total (ug)	Concentration (ug/m3)	Method Detection Limit (ug)
Polynuclear Aromatic Hydrocarbons						
Acenaphthene	<0.3	--	--	<0.3	<0.4	0.3
Acenaphthylene	<0.1	--	--	<0.1	<0.2	0.1
Anthracene	<0.01	--	--	<0.01	<0.01	0.01
Benzo(a)anthracene	<0.01	--	--	<0.01	<0.01	0.01
Benzo(b)fluoranthene	<0.02	--	--	<0.02	<0.02	0.02
Benzo(k)fluoranthene	<0.01	--	--	<0.01	<0.01	0.01
Benzo(g,h,i)perylene	<0.01	--	--	<0.01	<0.01	0.01
Benzo(a)pyrene	<0.01	--	--	<0.01	<0.01	0.01
Chrysene	<0.01	--	--	<0.01	<0.01	0.01
Dibenzo(a,h)anthracene	<0.01	--	--	<0.01	<0.01	0.01
Fluoranthene	<0.01	--	--	<0.01	<0.01	0.01
Fluorene	<0.01	--	--	<0.01	<0.01	0.01
Indeno(1,2,3-cd)pyrene	<0.01	--	--	<0.01	<0.01	0.01
Naphthalene	<0.1	--	--	<0.1	<0.1	0.1
Phenanthrene	<0.01	--	--	<0.01	<0.01	0.01
Pyrene	<0.01	--	--	<0.01	<0.01	0.01

< : Less than the indicated limit of detection
--: Information not available or not applicable

Clayton
ENVIRONMENTAL
CONSULTANTS

Analytical Results
for
Paul Carlson Associates

Clayton Project No. 96023.26

Sample Identification: See Below
Lab Number: 9602326
Sample Matrix/Media: SM_CHAR_TUBE

Date Sampled: 02/27/96
Date Received: 02/29/96
Date Analyzed: 03/04/96
Analyst: FHK

Lab No.	Sample I.D.	Sample Volume (liters)	Compound	Front (mg)	Back (mg)	Total (mg)	Concentration (mg/m3)	Concentration (ppm)	Method Detection Limit (mg)
-01	0314	114.3	Benzene	<0.002	<0.002	<0.002	<0.02	<0.005	0.002
			Ethyl benzene	<0.002	<0.002	<0.002	<0.02	<0.004	0.002
			Toluene	<0.002	<0.002	<0.002	<0.02	<0.005	0.002
			Xylene	<0.004	<0.004	<0.004	<0.03	<0.008	0.004
-02	0318-BLANK	--	Benzene	<0.002	<0.002	<0.002	--	--	0.002
			Ethyl benzene	<0.002	<0.002	<0.002	--	--	0.002
			Toluene	<0.002	<0.002	<0.002	--	--	0.002
			Xylene	<0.004	<0.004	<0.004	--	--	0.004

ND: Not detected at or above limit of detection
--: Information not available or not applicable
Airborne concentrations are based on the air volumes provided
Results have been corrected using laboratory-derived desorption efficiencies

Compound	Method Reference
Benzene	NIOSH 1501
Ethyl benzene	NIOSH 1501
Toluene	NIOSH 1501
Xylene	NIOSH 1501

Clayton
ENVIRONMENTAL
CONSULTANTS

Analytical Results
for
Paul Carlson Associates

Clayton Project No. 96023.26

Sample Identification: See Below
Lab Number: 9602326
Sample Matrix/Media: FILTER
Method Reference: NIOSH 0500

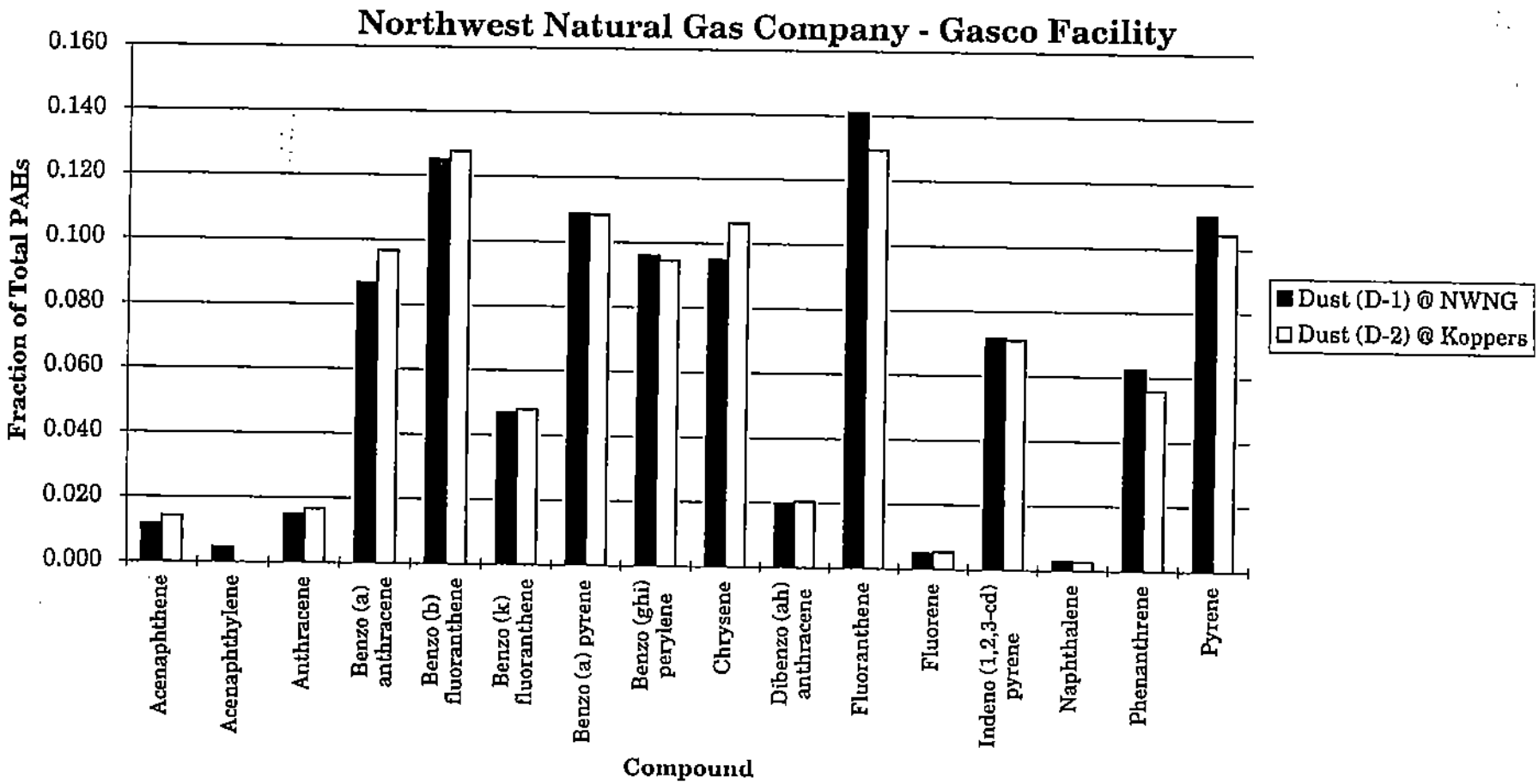
Date Sampled: 02/27/96
Date Received: 02/29/96
Date Analyzed: 02/29/96

Lab Number	Sample Identification	Date Sampled	Volume (liters)	Total Dust (mg)	Total Dust (mg/m3)	Method Detection Limit (mg)
-05	0315	02/27/96	861.3	<0.1	<0.1	0.1

ND: Not detected at or above limit of detection
--: Information not available or not applicable

Dust Sample Evaluation and Laboratory Data Sheets

Comparison of PAH Compound Mix
Dust Samples



Updated: 6/12/96 RBE
File: 2708 Soil Results-Working/ Dust 1 vs Dust 2

HAHN AND ASSOCIATES, INC.
Project # 2708

NATIONAL ENVIRONMENTAL TESTING, INC.

Portland Division
17400 SW Upper Boones Ferry Rd.
Suite #260
Portland, OR 97224
Tel: (503) 624-5449
Fax: (503) 639-6889

Roger Brown
Hahn & Associates
434 N.W. 6th Ave.
Suite 203
Portland, OR 97209

Date: 02/16/1996
NET Account No.: 13500
NET Job Number: 96.00363

Project: NWNG Gasco Site
Location: 2708

Sample analysis in support of the project referenced above has been completed and results are presented on the following pages. Should you have questions regarding procedures or results, please feel welcome to contact Client Services.

Sample Number	Sample Description	Matrix Type	Date Taken	Date Received
59783	2708-960212-D1-01	MISC. SOLID	02/12/1996	02/13/1996

(LNG Process Area Fire-hose Box)

Approved by:

Marty French
NET, INC. Division Manager

ANALYTICAL REPORT

Roger Brown
Hahn & Associates
434 N.W. 6th Ave.
Suite 203
Portland, OR 97209

02/16/1996
Job No.: 96.00363

Project Name: NWNG Gasco Site
Date Received: 02/13/1996

Sample Number	Sample Description
59783	2708-960212-D1-01

PARAMETERS	METHODS	RESULTS	REPORT LIMIT	UNITS	DATE ANALYZED	FLAG
PAH BY GC/MS SIM PREP		-			02/15/1996	
PAH BY GC/MS SIM (S)						
Dilution Factor	8270M	104			02/15/1996	
Acenaphthene	8270M	4400	50	ug/Kg	02/15/1996	
Acenaphthylene	8270M	1700	50	ug/Kg	02/15/1996	
Anthracene	8270M	5600	50	ug/Kg	02/15/1996	
Benzo(a)anthracene	8270M	33,000	50	ug/Kg	02/15/1996	
Benzo(b)fluoranthene	8270M	47,600	50	ug/Kg	02/15/1996	
Benzo(k)fluoranthene	8270M	17,900	50	ug/Kg	02/15/1996	
Benzo(a)pyrene	8270M	41,400	50	ug/Kg	02/15/1996	
Benzo(ghi)perylene	8270M	36,500	50	ug/Kg	02/15/1996	
Chrysene	8270M	36,100	50	ug/Kg	02/15/1996	
Dibenzo(a,h)anthracene	8270M	7500	50	ug/Kg	02/15/1996	
Fluoranthene	8270M	53,700	50	ug/Kg	02/15/1996	
Fluorene	8270M	1900	50	ug/Kg	02/15/1996	
Indeno(1,2,3)pyrene	8270M	27,300	50	ug/Kg	02/15/1996	
Naphthalene	8270M	1100	50	ug/Kg	02/15/1996	
Phenanthrene	8270M	23,700	50	ug/Kg	02/15/1996	
Pyrene	8270M	41,900	50	ug/Kg	02/15/1996	

A sample result of ND indicates the parameter was Not Detected at the reporting limit.

NET NATIONAL ENVIRONMENTAL TESTING, INC.

Portland Division
17400 SW Upper Boones Ferry Rd.
Suite #260
Portland, OR 97224
Tel: (503) 624-5449
Fax: (503) 639-6889

Roger Brown
Hahn & Associates
434 N.W. 6th Ave.
Suite 203
Portland, OR 97209

Date: 03/04/1996
NET Account No.: 13500
NET Job Number: 96.00470

Project: NWNG Gasco Site
Location: 2708

Sample analysis in support of the project referenced above has been completed and results are presented on the following pages. Should you have questions regarding procedures or results, please feel welcome to contact Client Services.

Sample Number	Sample Description	Matrix Type	Date Taken	Date Received
60208	2708-960227-D2-01	other	02/27/1996	02/27/1996

(Koppers Pencil Pitch Warehouse Fire-hose Box)

Post-it® Fax Note 7671	Date 6/12	# of pages ▶
To ROB E.	From JC	
Co./Dept.	Co.	
Phone #	Phone #	
Fax #	Fax #	

Approved by:

Marty French
NET, INC. Division Manager

ANALYTICAL REPORT

Roger Brown
Hahn & Associates
434 N.W. 6th Ave.
Suite 203
Portland, OR 97209

03/04/1996
Job No.: 96.00470

Project Name: NWNG Gasco Site
Date Received: 02/27/1996

Sample Number	Sample Description
60208	2708-960227-DZ-01

PARAMETERS	METHODS	RESULTS	REPORT LIMIT	UNITS	DATE ANALYZED	FLAG
PAH BY GC/MS STM PREP		-			02/29/1996	
PAH BY GC/MS SIM (6)						
Dilution Factor	8270M	400+			03/01/1996	-
Acenaphthene	8270M	375,000	20,000	ug/Kg	03/01/1996	
Acenaphthylene	8270M	ND	20,000	ug/Kg	03/01/1996	
Anthracene	8270M	444,000	20,000	ug/Kg	03/01/1996	
Benzo(a)anthracene	8270M	2,600,000	20,000	ug/Kg	03/01/1996	
Benzo(b)fluoranthene	8270M	3,436,000	20,000	ug/Kg	03/01/1996	
Benzo(k)fluoranthene	8270M	1,292,000	20,000	ug/Kg	03/01/1996	
Benzo(a)pyrene	8270M	2,915,000	20,000	ug/Kg	03/01/1996	
Benzo(ghi)perylene	8270M	2,543,000	20,000	ug/Kg	03/01/1996	
Chrysene	8270M	2,856,000	20,000	ug/Kg	03/01/1996	
Dibenzo(a,h)anthracene	8270M	547,000	20,000	ug/Kg	03/01/1996	
Fluoranthene	8270M	3,483,000	20,000	ug/Kg	03/01/1996	
Fluorene	8270M	145,000	20,000	ug/Kg	03/01/1996	
Indeno(1,2,3)pyrene	8270M	1,908,000	20,000	ug/Kg	03/01/1996	
Naphthalene	8270M	68,000	20,000	ug/Kg	03/01/1996	
Phenanthrene	8270M	1,501,000	20,000	ug/Kg	03/01/1996	
Pyrene	8270M	2,806,000	20,000	ug/Kg	03/01/1996	

A sample result of ND indicates the parameter was Not Detected at the reporting limit.

APPENDIX L

Geophysical Evaluation of Former Tar Ponds Area, GeoPotential, Inc.

GeoPotential

ENVIRONMENTAL & EXPLORATION GEOPHYSICS

437 N.E. LIBERTY AVE. GRESHAM, OR 97030 • PH (503) 665-7520 • FAX (503) 492-4404

RESULTS

GROUND PENETRATING SURVEY FOR TAR DEPOSITS AND SILT STRATA PILOT PROJECT

AT

NWNG GASCO FACILITY
PORTLAND, OREGON

PERFORMED FOR

HAI
434 NW 6TH AVENUE, SUITE 203
PORTLAND, OREGON 97209-3600

PERFORMED BY

GEOPOTENTIAL
437 NE LIBERTY AVENUE
GRESHAM, OREGON 97030

DECEMBER 5, 1995

INTRODUCTION

GeoPotential performed a GROUND PENETRATING RADAR SURVEY (GPR SURVEY) for HAI, Portland, Oregon.

TIMING

Field work was performed on November 22, 1995. Report and site diagram completed and mailed to HAI December 5, 1995.

PURPOSE

The subsurface locating survey was designed to test the ability of GPR to map the extent of tar deposits and silt strata.

SURVEY SITE

The SURVEY SITE consisted of the northeast portion of the NWNG Gasco Facility located at 7900 NW St. Helens Road in Portland, Oregon. The site has been used for hydrocarbon storage for many years and contains a variety of buried hydrocarbon materials including tar, lampblack and liquid hydrocarbons. Former settling ponds are also buried on the site.

In general, data supplied by HAI from lithology, indicates that the surficial materials consist of primarily sandy gravels grading downward into sandy silts and silts. Interspersed among these sediments are the hydrocarbon occurrences. These hydrocarbon occurrences and silt strata were the targets of this GPR pilot project.

The areas covered by the three GPR profiles (see map) are grass covered and slope gently up to the northeast until a 8 foot scarp is encountered at the northeast end of PROFILE ee'.

SURVEY SPECIFICATIONS

Three geophysical instruments were used for the survey:

1. AQUA-TRONICS A-6 ELECTROMAGNETIC TRACER (EM SURVEY).
2. SCHONSTEDT GA-52B MAGNETIC GRADIOMETER (MAG SURVEY).
3. MALA RAMAC GROUND PENETRATING RADAR (GPR SURVEY).

EM and MAG data were acquired along GPR PROFILES to aid in the interpretation of the GPR data.

Profile locations were selected to approximately coincide with HAI profiles AA' and EE' and are shown as yellow lines on the accompanying Well Location Map. The PROFILE along HAI PROFILE AA' had to be broken into two profiles aa' and ff' due to the scarp at a'. PROFILE ff' followed the gravel road to the bank of the Willamette River and is therefor offset from the northeast end of PROFILE AA'.

GPR data was acquired along each profile using a 50 MHz antenna and a 80 meter per microsecond sediment velocity. The data was filtered with a 3X3 moving average filter to suppress high frequency noise in the data. The maximum depth of penetration for this GPR configuration is about 45 feet.

MAG and EM data were acquired at 1 second intervals (approximately 3 to 4 feet intervals) along each GPR PROFILE and plotted as shown.

Each GPR PROFILE is presented twice; once with the EM and MAG profiles to compare the various data and once with the GPR alone to better show GPR features. The depth/length ratio for the GPR on composite profile is 2.2:1 and 5.1:1 on GPR only PROFILES.

RESULTS

The results are shown on the accompanying PROFILES.

PROFILE aa'

The GPR record shows three prominent horizons. The most shallow horizon occurs at a depth of about 10 feet and is the gradational layer from a sandy gravel to a silty sand. this horizon is not marked and is apparent on all three PROFILES.

A second horizon starts at a depth of 12 feet at the intersection of PROFILE ee' and dips down to a depth of 28 feet at a. This horizon is a silt/tar layer encountered in drill holes B-35 and B-33 . A second silty/tar horizon

occurs as shown on the GPR PROFILE. Both of these horizons go up and over a structurally shallow feature just to the northeast of the intersection of ee'. This feature is designated as F2 on the PROFILE. The MAG low and EM high anomalies over F2 indicate it is a sedimentary feature and may indicate a mound of hydrocarbon enriched sediments.

Feature F1 has a strong MAG response and a weak EM anomaly indicating metallic debris, buried structural foundations or utilities.

A EM/MAG positive anomaly at length 70 are caused by the well casing of B-35.

The positive MAG anomaly at length 120 is probably caused by a feature in the volcanic basement at a depth of 70 feet or more.

PROFILE ff'

The same three horizons identified on PROFILE aa' are interpreted to occur along profile ff' where the two silt/tar layers dip down to the northeast.

F2 is also identified on the southwest end of ff' where it is associated with a magnetic anomaly indicative of a scarp or fault in the deep volcanic basement. This may indicate that faulting in the basement may be responsible for feature F2.

F3 has a EM/MAG positive anomaly and may be a utility pipe.

The gradual slopes in the MAG and EM profile down to the northeast probably indicate deepening volcanic basement.

PROFILE EE'

The GPR data along this profile demonstrated very subtle layering. The silt-tar horizon interpreted along the profile is very tentative. The character of the reflections along this profile is identical to the character of the reflections over F2 on PROFILES aa' and ff'. Since this is near the location of the intersection of these PROFILES with ee' it is apparent that PROFILE ee' runs parallel to the strike of feature F2 and along or near the apex of the axis.

The observations of layering either side of ee' but not along ee' may indicate that the areas on either side of F2 were settling ponds which therefore produced more contiguous layering. The apparent onlap of the layers onto F2 would support this interpretation.

An EM/MAG positive anomaly on the southeast end of ee' is interpreted to be caused by buried pipes.

The MAG/EM anomalies to the northwest of length 420 show a general lowering of the fields with a series of low amplitude high frequency anomalies. This is interpreted to be caused by a combination of a deeper volcanic basement to the northwest and sandier soil containing volcanic gravels.

LIMITATIONS

Geophysical surveys consist of interpreting geophysical responses from subsurface objects. Since a variety of subsurface objects can produce identical geophysical responses it is necessary to perform intrusive investigations (drilling or excavating) to confirm the geophysical interpretation. In addition non-conductive utilities (e.g. plastic pipes, concrete pipes, tile pipes) are not detectable with geophysical methods.

Depths interpreted from GPR SURVEYS are a function of the soil velocities used during processing. Significant variations from these velocities can cause significant errors in interpreted depths.

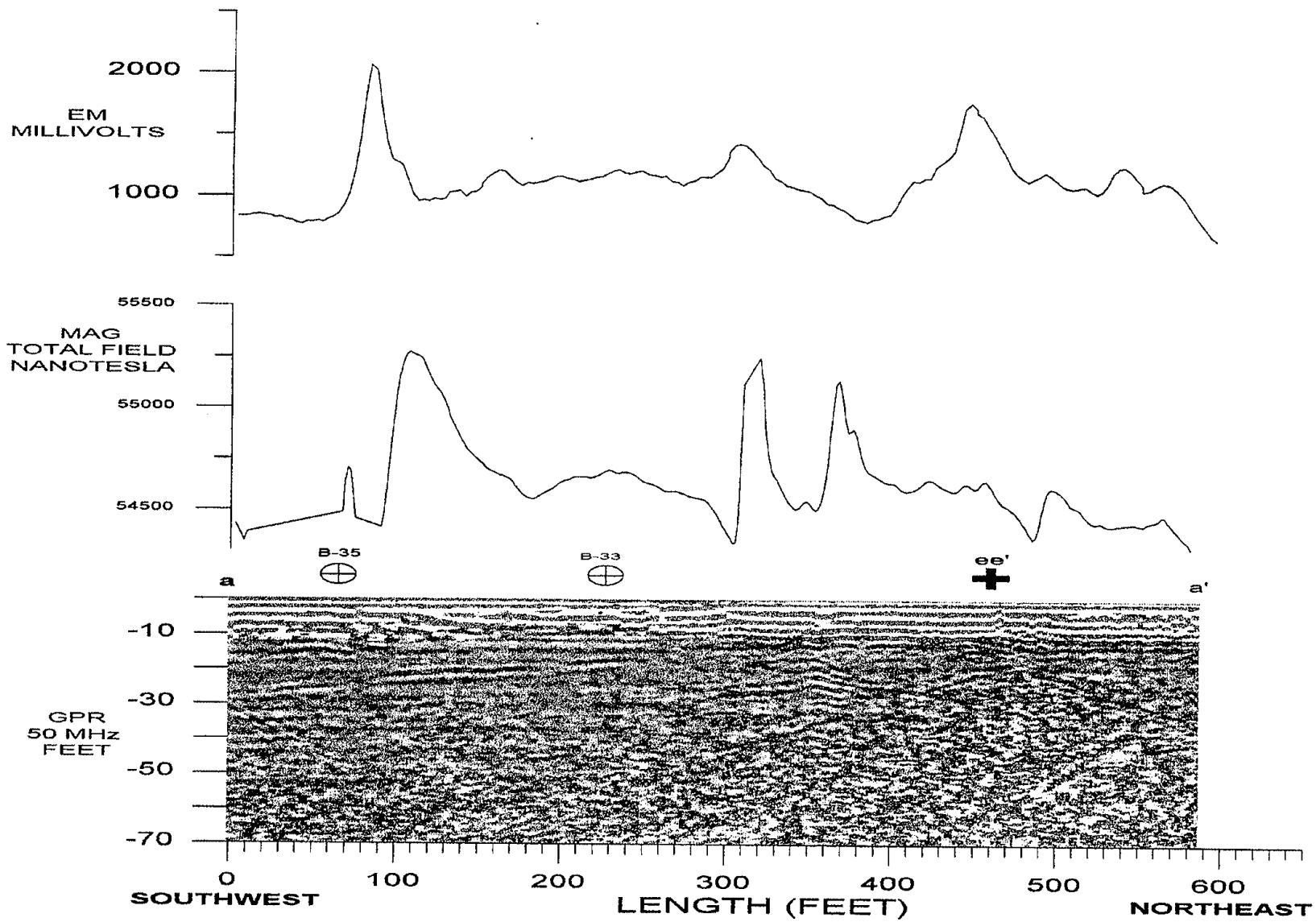
The use of this geophysical interpretation is the sole responsibility of the client.

Ralph Soule
GeoPotential

December 5, 1995

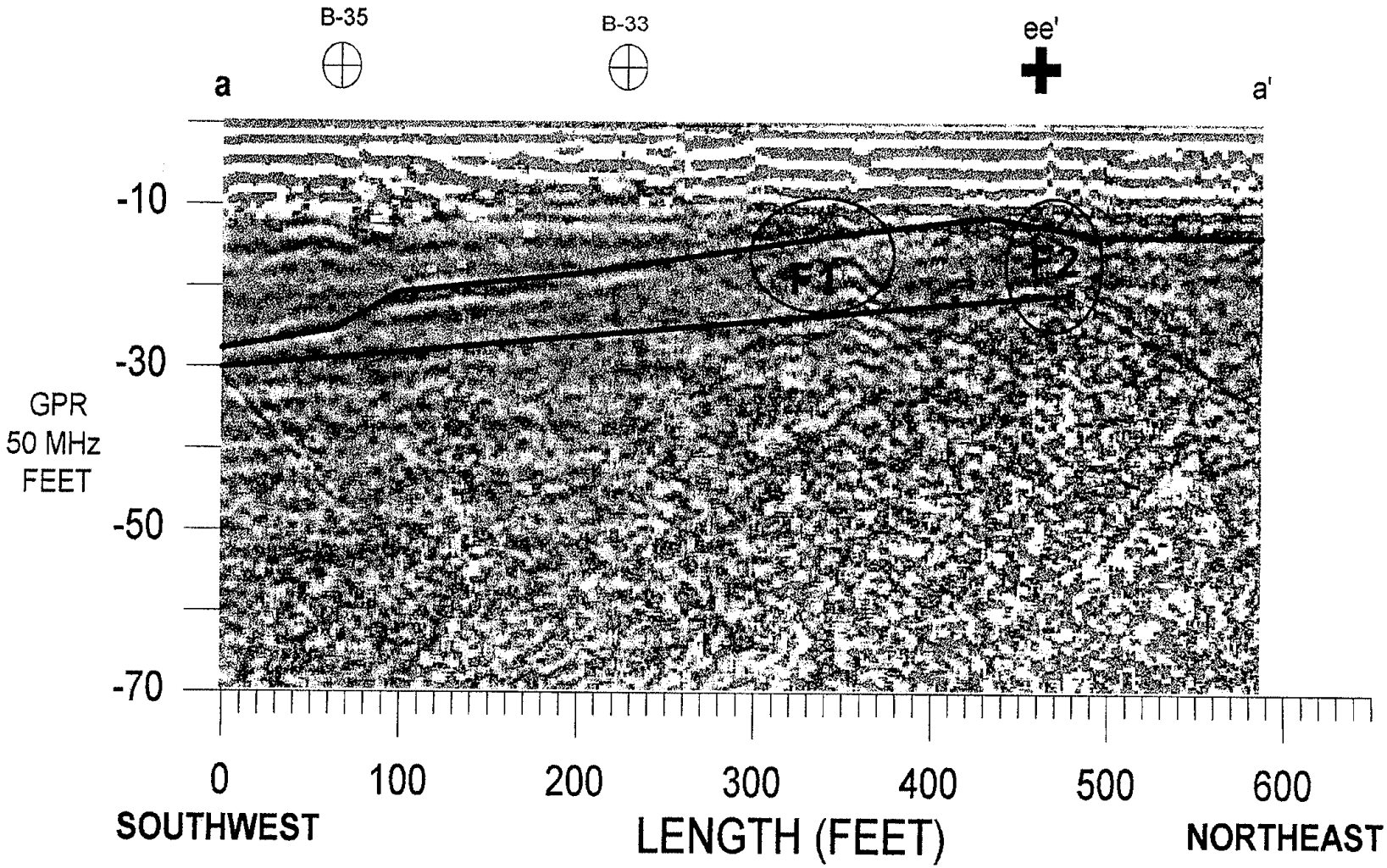
GeoPotential
NWNG Gasco Facility
Portland, Oregon
NOVEMBER 22, 1995

PROFILE aa'



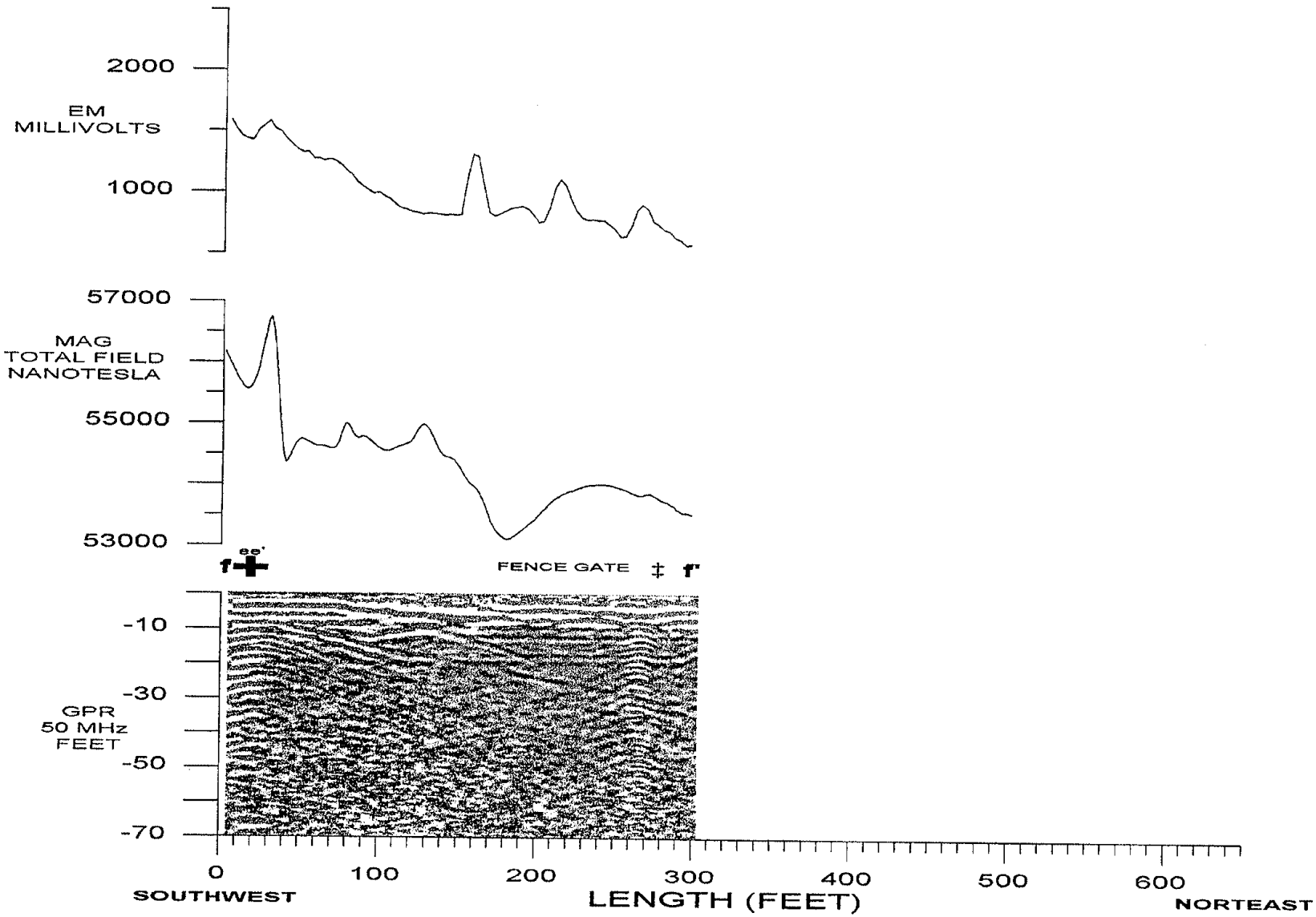
GeoPotential
NWNG Gasco Facility
Portland, Oregon
NOVEMBER 22, 1995

PROFILE aa'



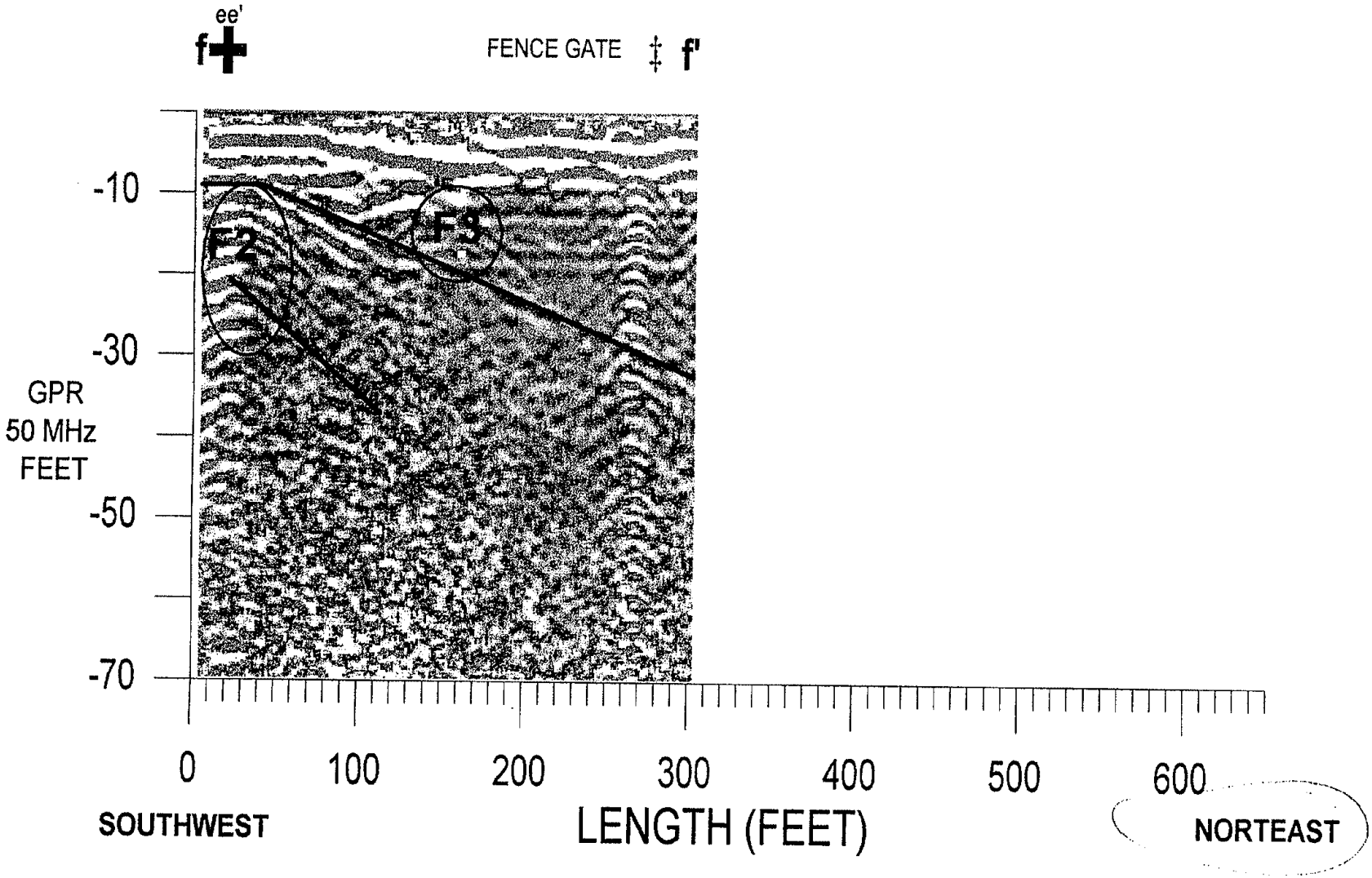
GeoPotential
NWNG Gasco Facility
Portland, Oregon
NOVEMBER 22, 1995

PROFILE ff'



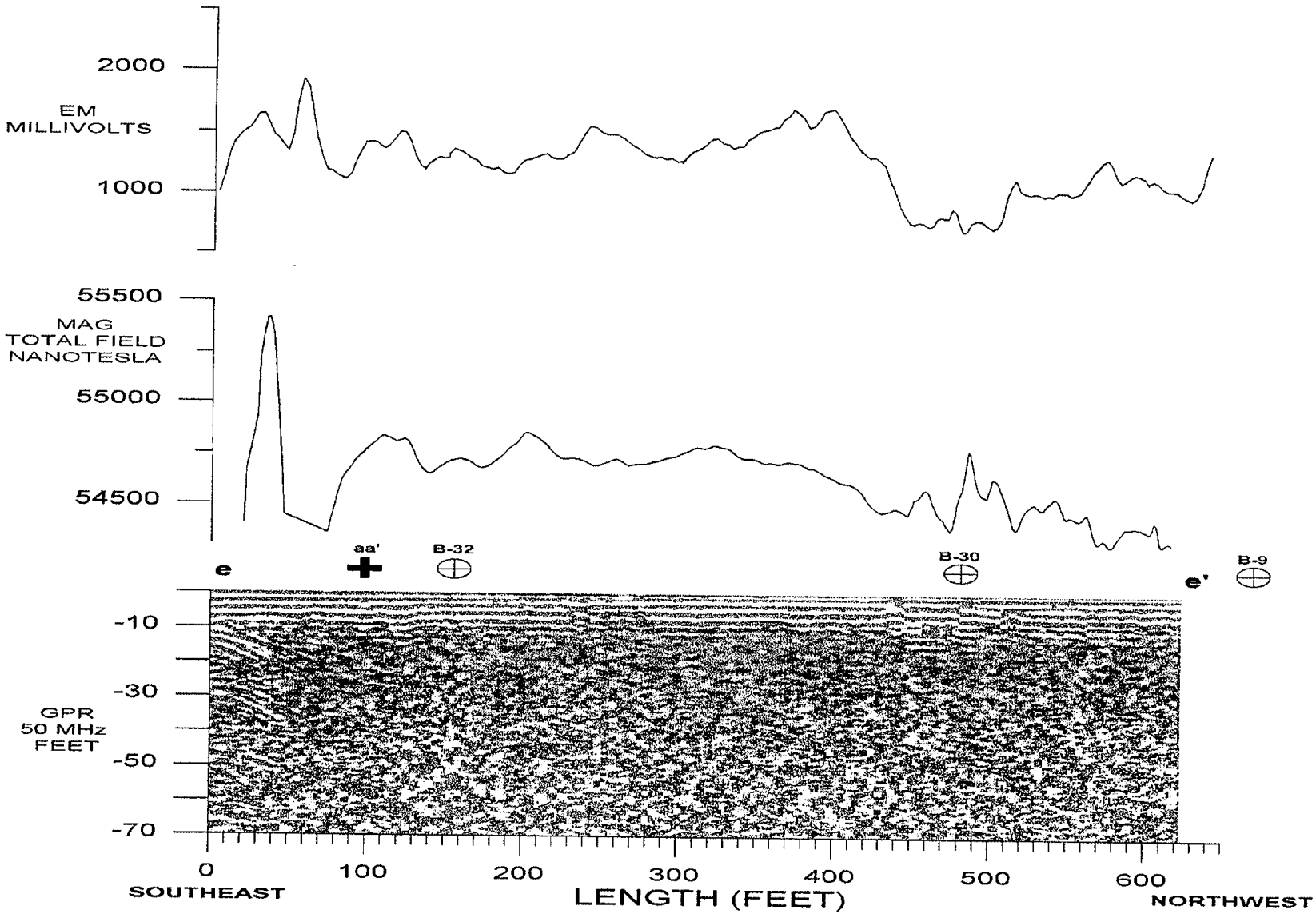
GeoPotential
NWNG Gasco Facility
Portland, Oregon
NOVEMBER 22, 1995

PROFILE ff'



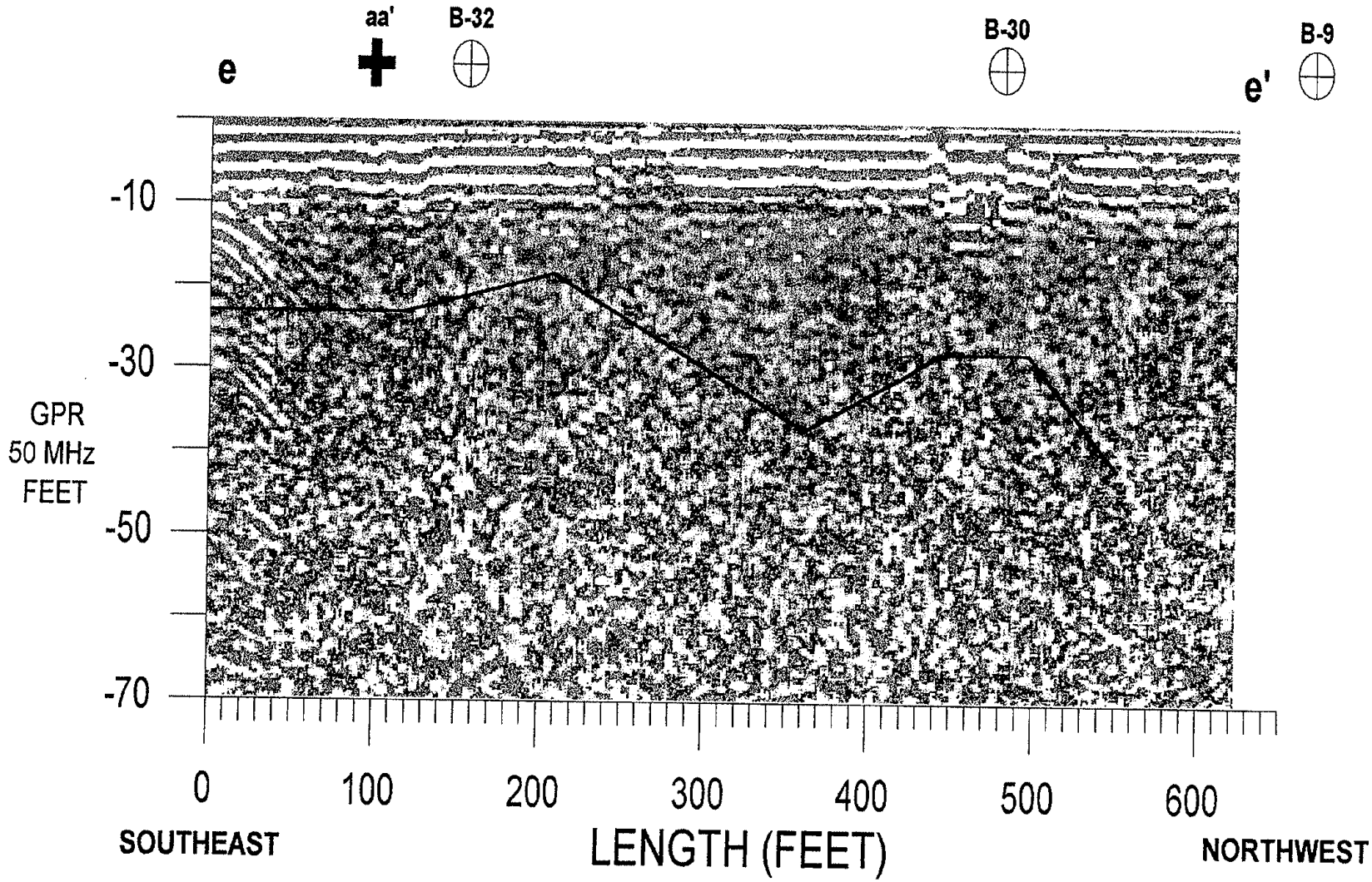
GeoPotential
NWNG Gasco Facility
Portland, Oregon
NOVEMBER 22, 1995

PROFILE ee'

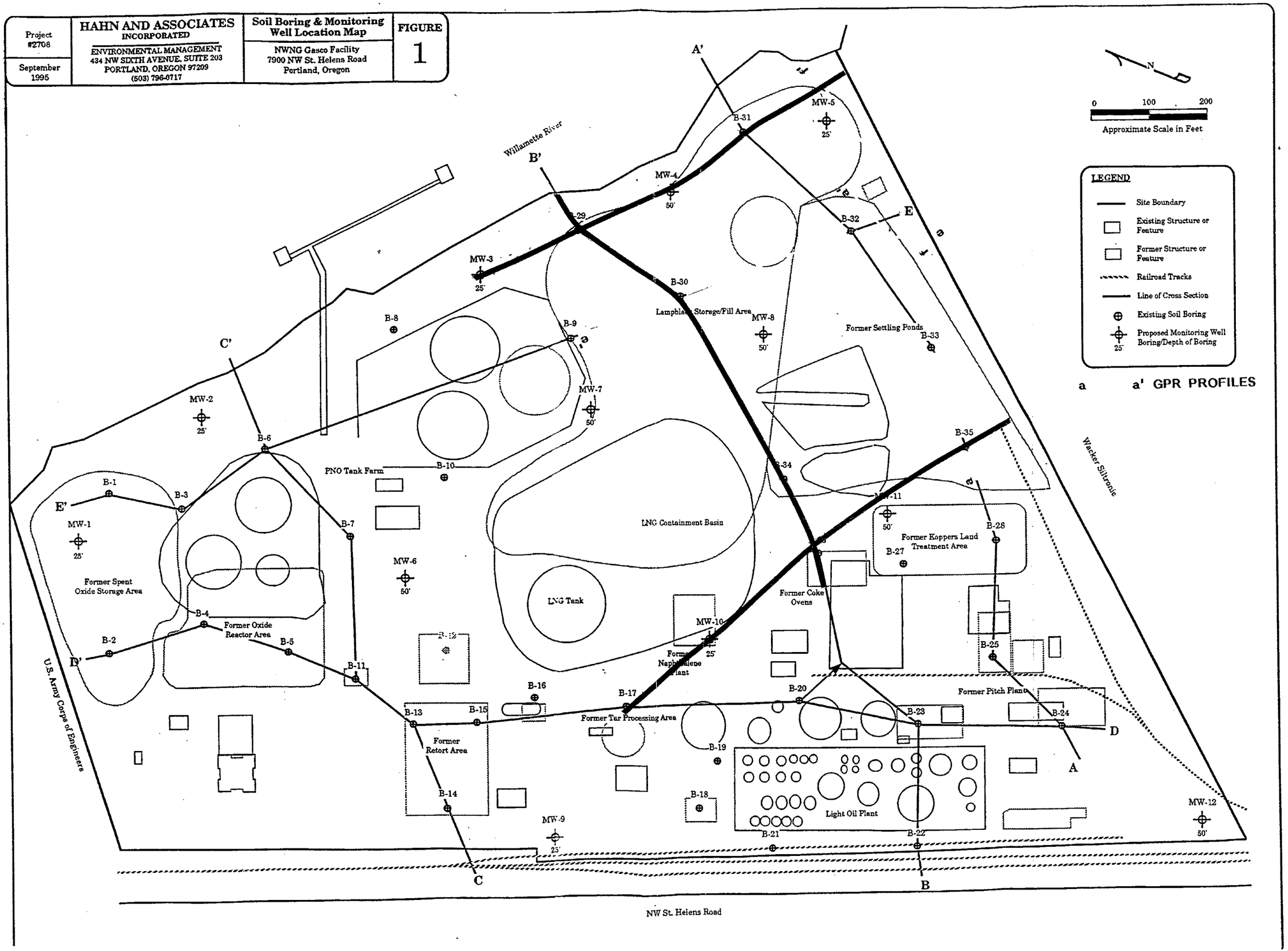


GeoPotential
NWNG Gasco Facility
Portland, Oregon
NOVEMBER 22, 1995

PROFILE ee'



Project #2708	HAHN AND ASSOCIATES INCORPORATED ENVIRONMENTAL MANAGEMENT 434 NW SIXTH AVENUE, SUITE 203 PORTLAND, OREGON 97209 (503) 796-0717	Soil Boring & Monitoring Well Location Map	FIGURE
September 1995		NWNG Gasco Facility 7900 NW St. Helens Road Portland, Oregon	1



RECOMMENDATIONS

The results of this GPR PIOLT PROJECT demonstrate that GPR can be used to map soil-tar strata in areas where contiguous layering occurs. To generate a depth map of these horizons it is recommended that the additional GPR/MAG/EM PROFILES be acquired as shown by the red lines on the Well location map. This would provide a network of data over the area of interest. Next generating contour maps of the tar-strata layer(s), and EM and MAG fields and interpreting this data would provide addtional information on the shallow stratigraphy of this area.

The cost for the data aquisition and integrated interpretation would be $2,500.00 or approximately $1.00 per line foot of new data.

Ralph Soule

Ralph Soule
GeoPotential

December 5, 1995

APPENDIX M

Geological Cross-Sections

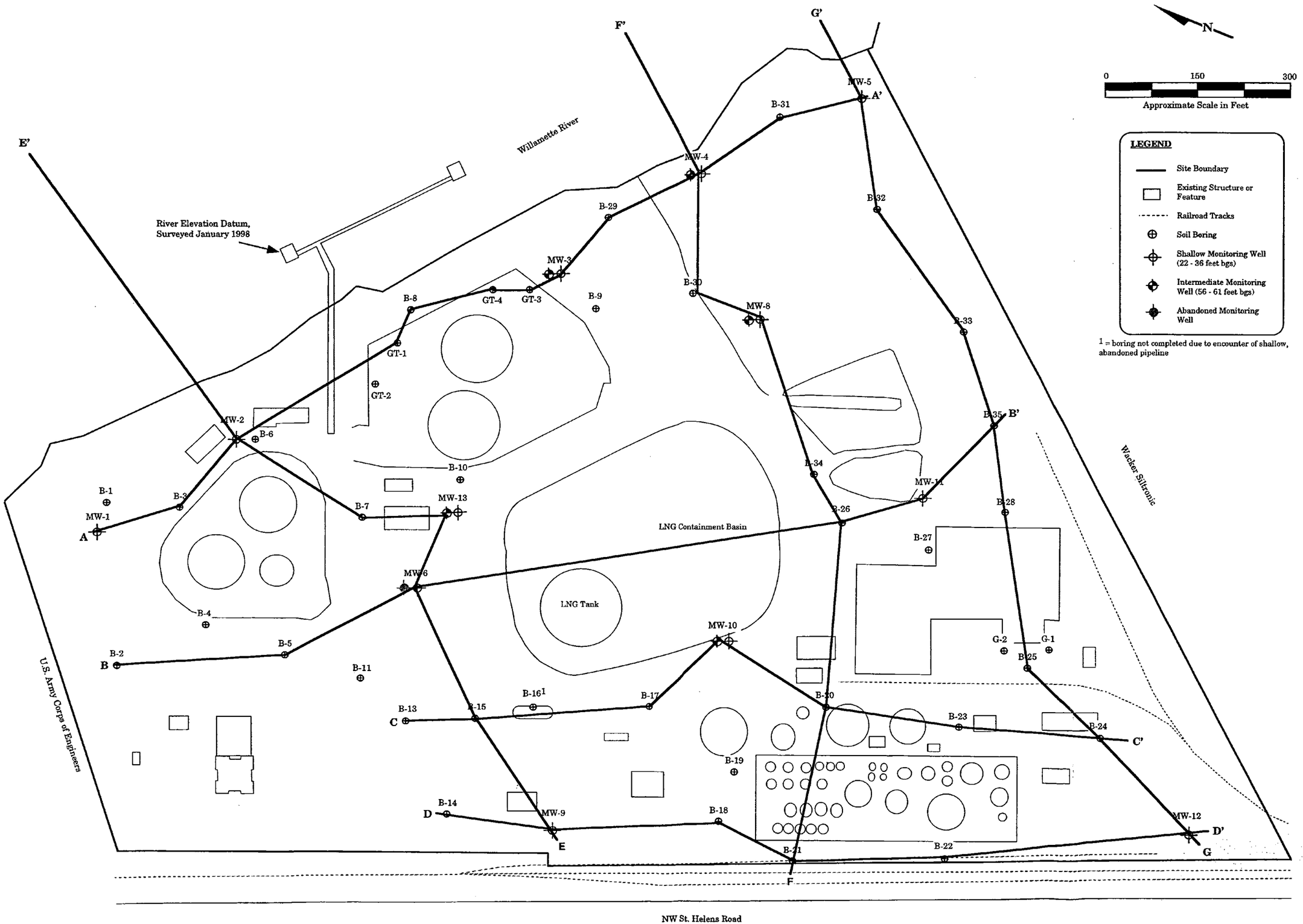


Figure
M-1

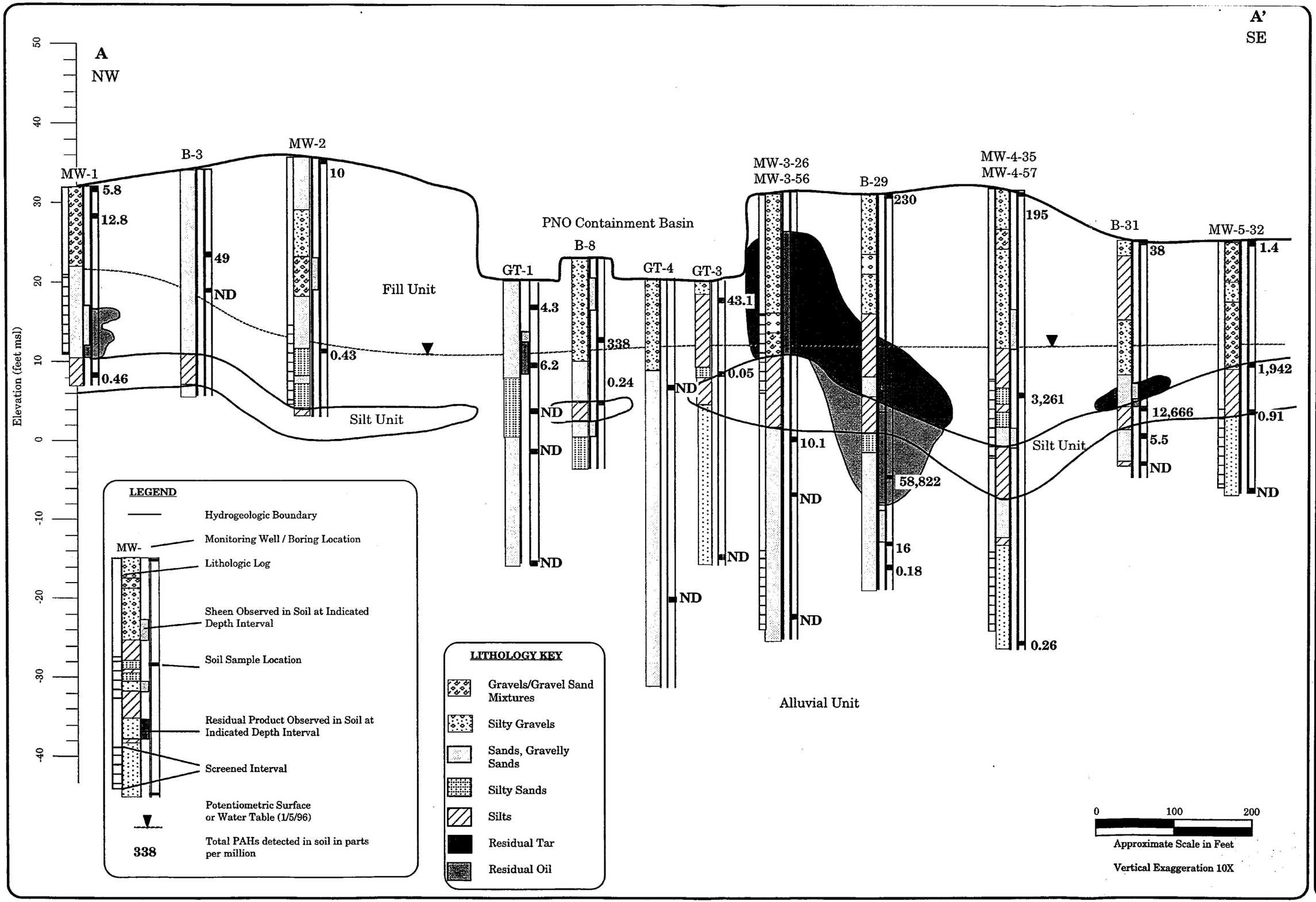
Cross-Section Line Location Map

RI/FS
Northwest Natural - Gasco Facility
7540 NW St. Helens Road
Portland, Oregon

HAHN & ASSOCIATES, INC.
ENVIRONMENTAL MANAGEMENT
434 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209
503/796-0717

September 1998

Project No. 2708



Figure

M-2

Hydrogeologic Cross Section A - A'
Soil Quality - Total PAHs

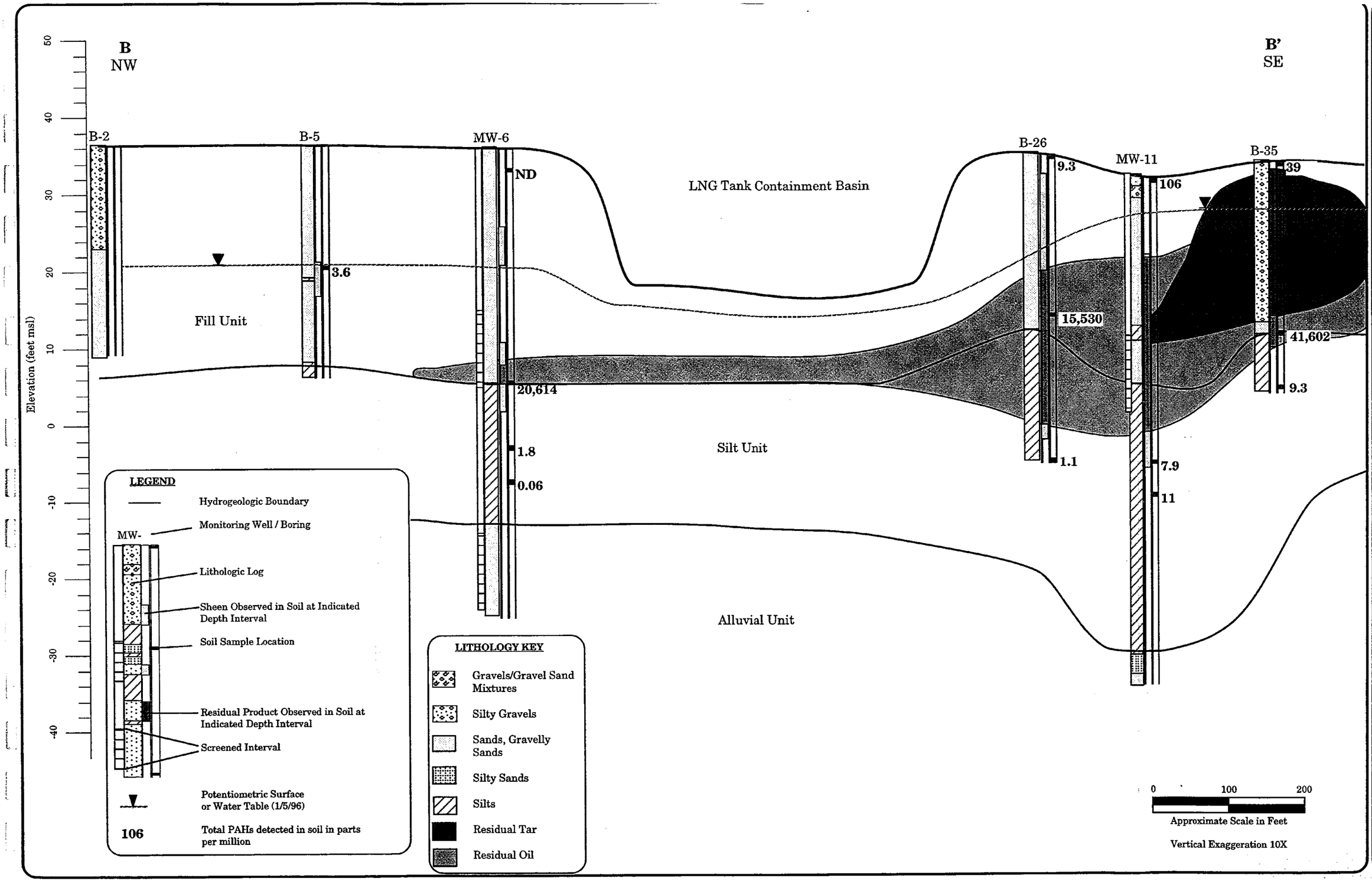
Remedial Investigation
Northwest Natural - Gasco Facility
7900 NW St. Helens Road
Portland, Oregon

HAHN AND ASSOCIATES, INC.

ENVIRONMENTAL MANAGEMENT
434 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209
(503) 796-0717

September 1998

Project No. 2708



Figure

M-3

Hydrogeologic Cross Section B - B'
Soil Quality - Total PAHs

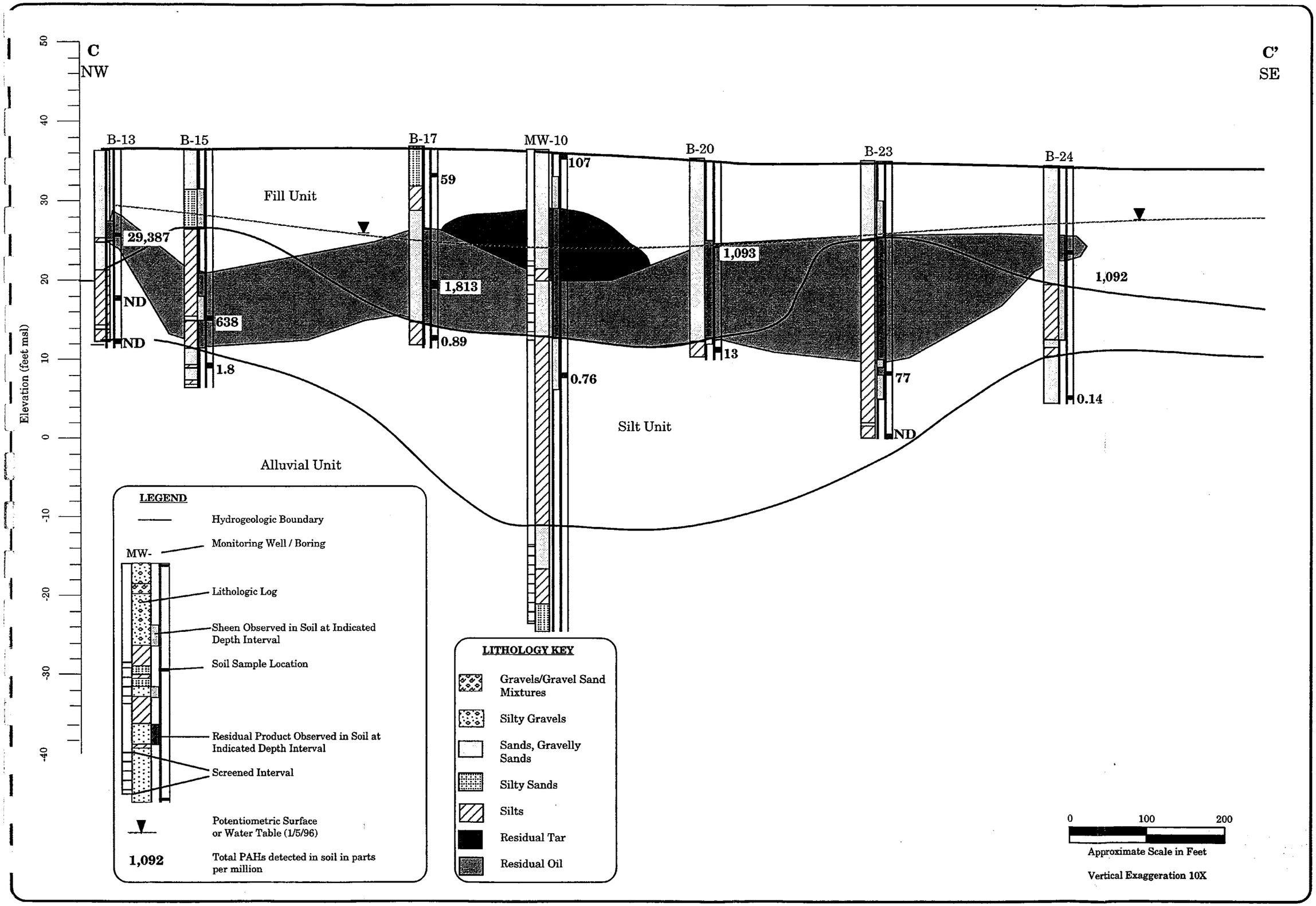
Remedial Investigation
Northwest Natural - Gasco Facility
7900 NW St. Helens Road
Portland, Oregon

HAHN AND ASSOCIATES, INC.

ENVIRONMENTAL MANAGEMENT
434 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209
(503) 796-0717

September 1998

Project No. 2708



Figure

M-4

Hydrogeologic Cross Section C-C'
Soil Quality - Total PAHs

Remedial Investigation
Northwest Natural - Gasco Facility
7900 NW St. Helens Road
Portland, Oregon

HAHN AND ASSOCIATES, INC.

ENVIRONMENTAL MANAGEMENT
434 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209
(503) 796-0717

September 1998

Project No. 2708

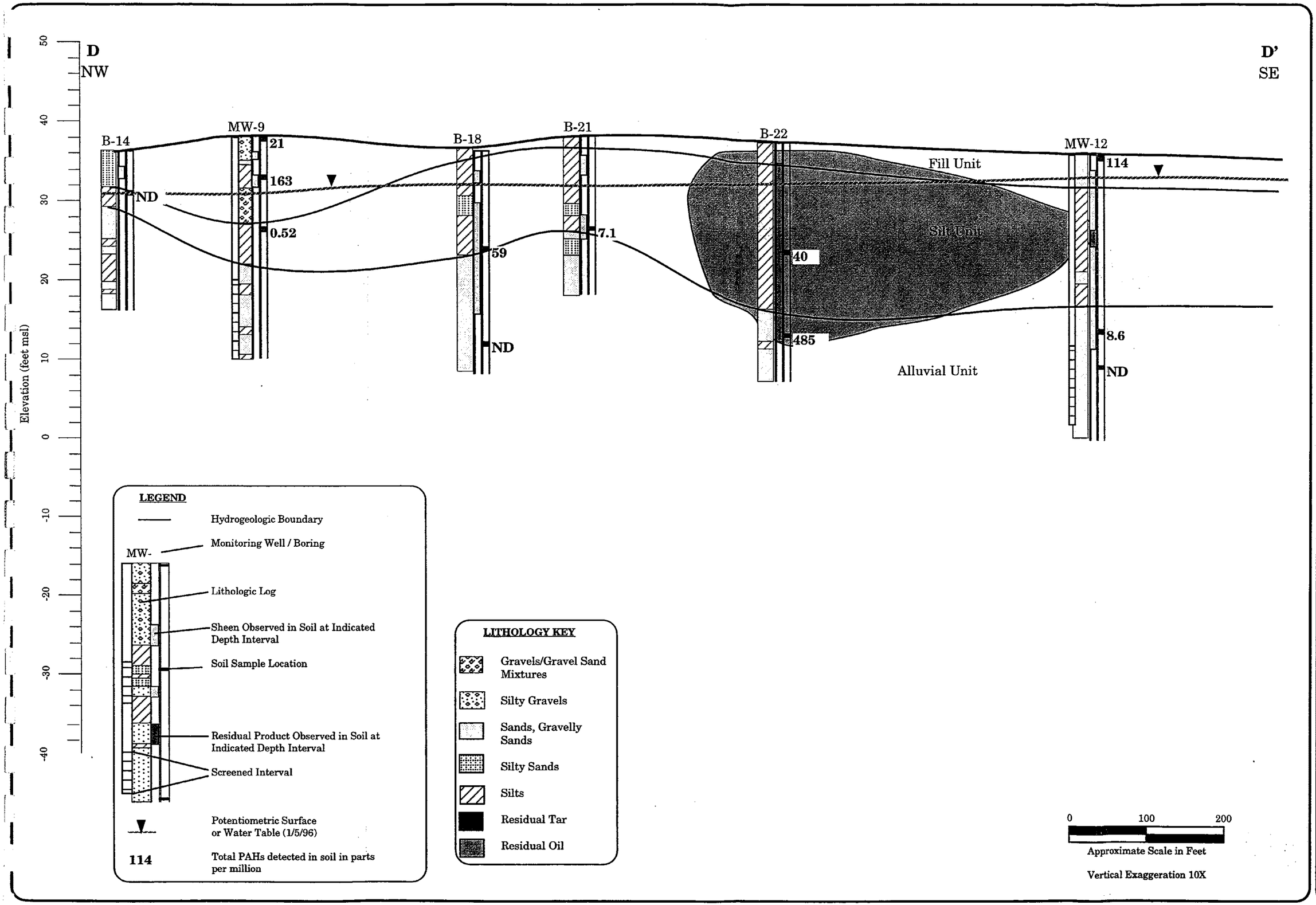


Figure
M-5

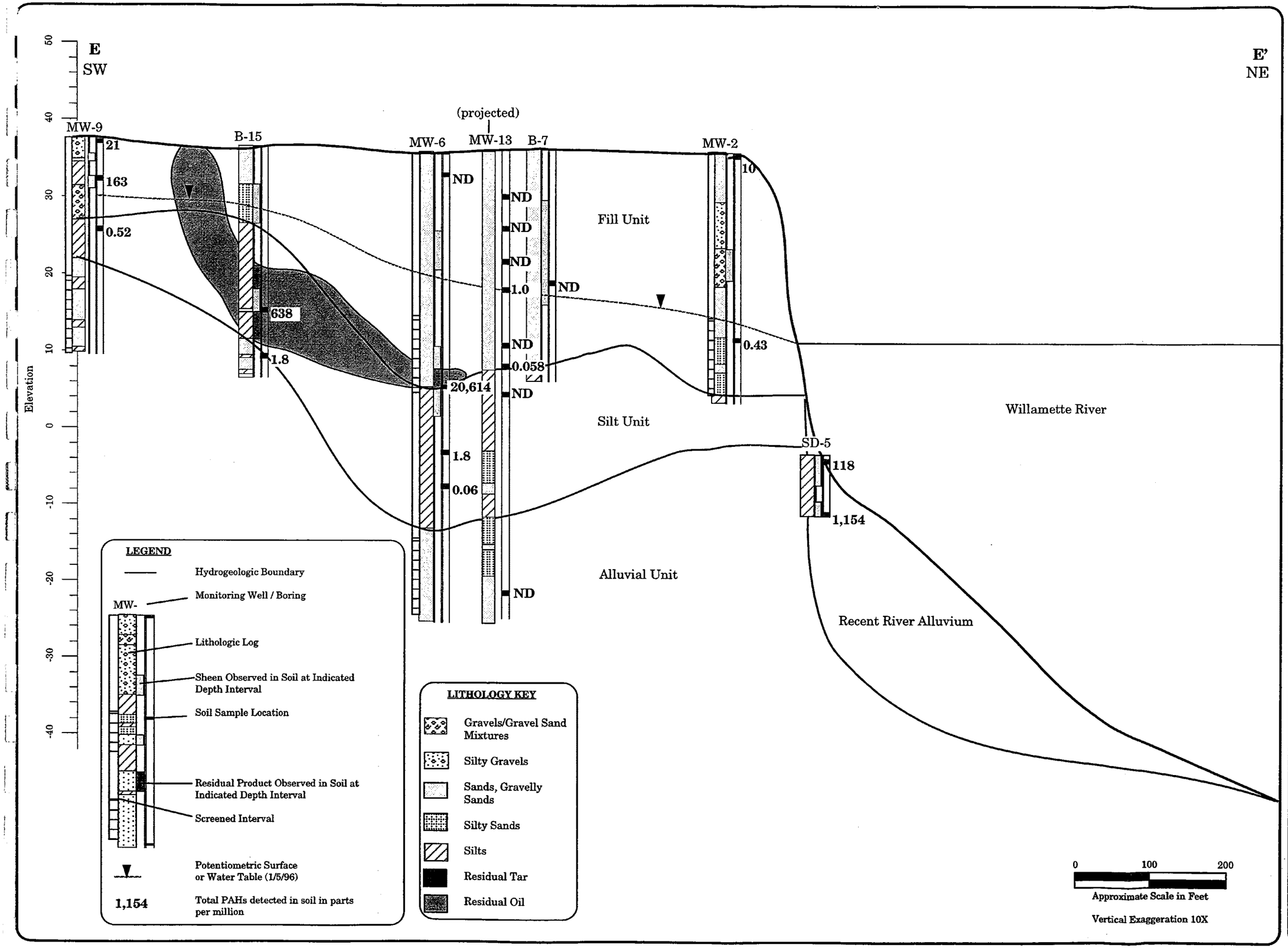
Hydrogeologic Cross Section D-D'
Soil Quality - Total PAHs

Remedial Investigation
Northwest Natural - Gasco Facility
7900 NW St. Helens Road
Portland, Oregon

HAHN AND ASSOCIATES, INC.
ENVIRONMENTAL MANAGEMENT
434 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209
(503) 796-0717

September 1998

Project No. 2708



Figure

M-6

Hydrogeologic Cross Section E - E'
Soil Quality - Total PAHs

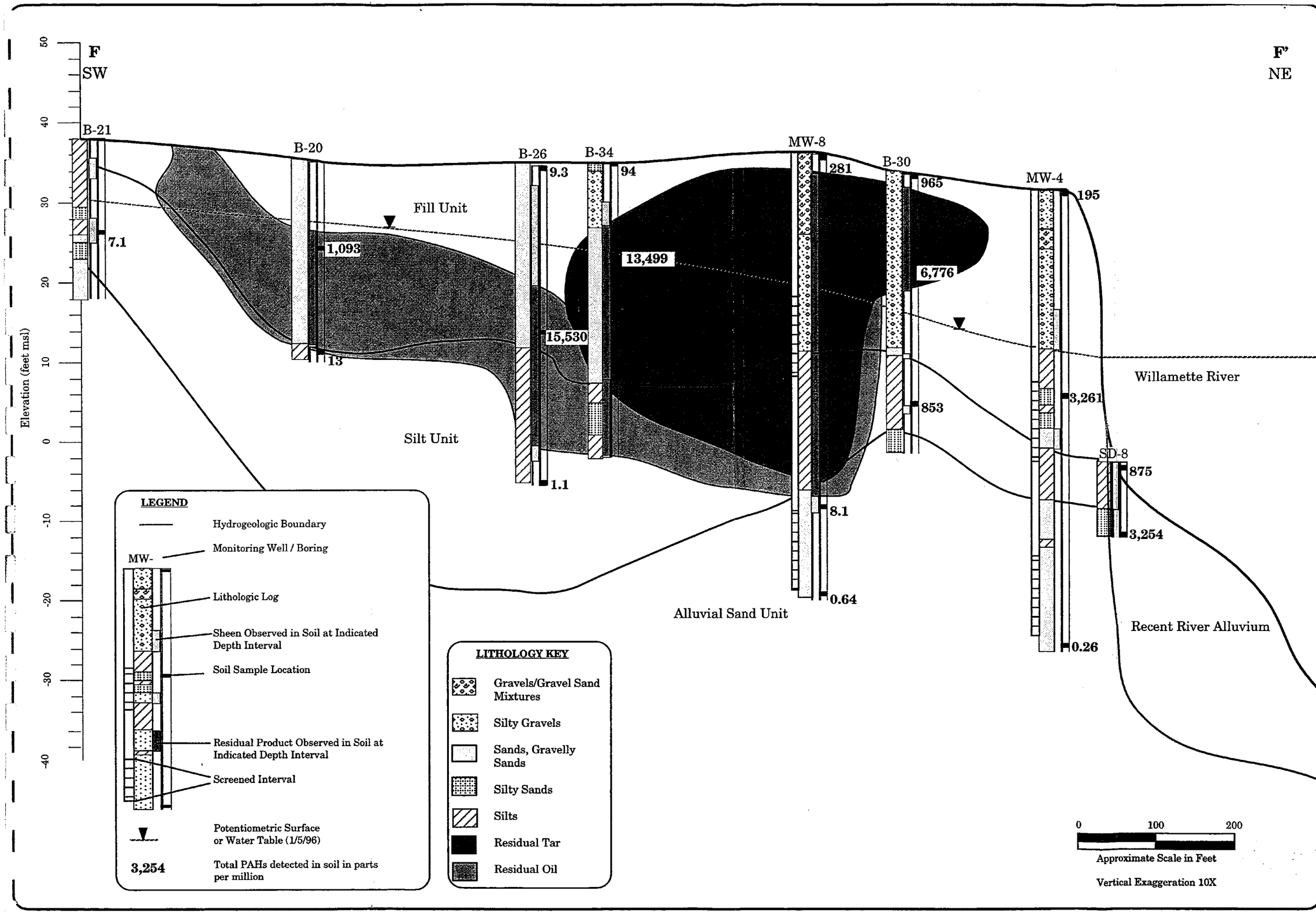
Remedial Investigation
Northwest Natural - Gasco Facility
7900 NW St. Helens Road
Portland, Oregon

HAHN AND ASSOCIATES, INC.

ENVIRONMENTAL MANAGEMENT
434 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209
(503) 796-0717

September 1998

Project No. 2708



Figure

M-7

Hydrogeologic Cross Section F - F'
Soil Quality - Total PAHs

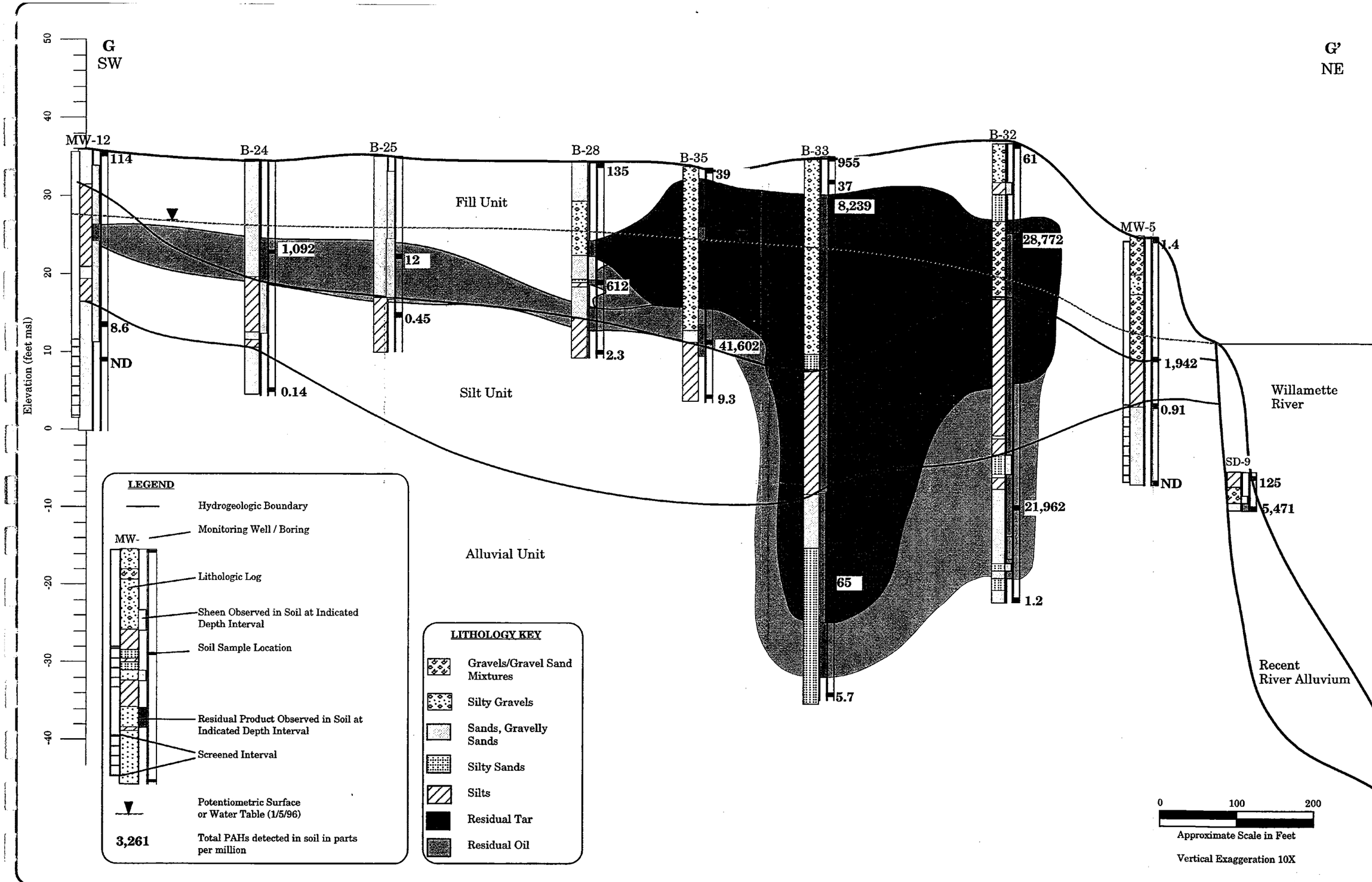
Remedial Investigation
Northwest Natural - Gasco Facility
7900 NW St. Helens Road
Portland, Oregon

HAHN AND ASSOCIATES, INC.

ENVIRONMENTAL MANAGEMENT
434 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209
(503) 796-0717

September 1998

Project No. 2708



Figure

M-8

Hydrogeologic Cross Section G - G'
Soil Quality - Total PAHs

Remedial Investigation
Northwest Natural - Gasco Facility
7900 NW St. Helens Road
Portland, Oregon

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