TABLE 2-10.
RIO GRANDE DAILY MEAN DISCHARGE RATES, CUBIC METERS PER SECOND

Date Measured	Pump House Below American Dam	Courchesne Bridge	Diversion at American Canal
3/27/97	6.01	36.6	27
3/28/97	5.32	33	24.3
3/29/97	5.26	27.7	19.5
3/30/97	5.22	25.6	17.4
3/31/97	5.24	29.1	19.5
4/1/97	5.64	26.7	17.3
4/2/97	5.73	24.1	15.1
4/3/97	5.79	22	13.5
4/4/97	5.76	22.5	14
4/5/97	5.42	22.9	14.7
4/6/97	5.24	22	13.9
4/7/97	5.21	24.6	16.5
4/8/97	5.38	24.6	16.6
4/9/97	5.52	21.1	14.1
4/10/97	5.58	20.4	13.7
4/11/97	5.61	22.4	15.4
4/12/97	5.39	22.7	16
4/13/97	5.31	22.2	15.7
4/14/97	5.31	20.4	14.4
4/15/97	5.56	19.7	13.5
4/16/97	5.58	18.6	12.3
4/17/97	5.68	16.9	10.2
4/18/97	5.50	17.7	10.4
4/19/97	5.06	18.5	11.5
4/20/97	4.92	19.8	12.7
4/21/97	5.04	18.2	11.7
4/22/97	5.23	19.3	12.8
4/23/97	5.20	19.4	13
4/24/97	4.97	17.8	11.8
4/25/97	5.14	16.9	10.8
4/26/97	5.55	18.6	11.9
4/27/97	5.67	21.6	14.7
4/28/97	5.62	21.3	14.8
4/29/97	5.44	19.2	13.1
4/30/97	3.93	17.5	13.2
5/1/97	3.42	15.1	11.7
5/2/97	3.45	17.8	13.9
5/3/97	3.28	16.2	12.4
5/4/97	3.23	15.4	12
5/5/97	3.22	17.9	14.3
5/6/97	3.32	17.1	13.5
5/7/97	3.34	16.1	12.7
5/8/97	3.38	18.5	14.6
5/9/97	3.44	25.1	20.6
5/10/97	3.39	26.3	21.4
5/11/97	3.42	23.4	19.3
5/12/97	3.34	20.1	16.3
5/13/97	3.43	20.4	16.2

TABLE 2-10.
RIO GRANDE DAILY MEAN DISCHARGE RATES, CUBIC METERS PER SECOND

Date Measured	Pump House Below American Dam	Courchesne Bridge	Diversion at American Canal
5/14/97	3.44	21.4	16.8
5/15/97	3.43	18.1	14.2
5/16/97	3.43	13.6	10
5/17/97	3.41	13.4	9.97
5/18/97	3.45	14.8	11.7
5/19/97	3.51	15.2	12.5
5/20/97	3.53	14.6	12.1
5/21/97	3.52	14.7	12.6
5/22/97	3.52	18.5	16.4
5/23/97	3.49	20.9	18.1
5/24/97	3.47	19.7	17.4
5/25/97	3.49	19.6	17.6
5/26/97	3.56	19.2	17
5/27/97	3.52	18.3	15.8
5/28/97	3.41	19.9	15.1
5/29/97	3.36	17.9	12.8
5/30/97	3.41	17.6	13.1
5/31/97	5.63	17.7	10.8
6/1/97	6.57	20.9	13.6
6/2/97	6.81	31.7	24.2
6/3/97	6.64	35.1	27.3
6/4/97	6.79	34.7	26.1
6/5/97	6.59	32.7	24.6
6/6/97	15.40	47.4	25.2
6/7/97	10.80	36.7	26.6
6/8/97	13.20	36.6	27.4
6/9/97	23.60	47.6	27.5
6/10/97	12.90	35.8	27.8
6/11/97	8.05	31.9	28.5
6/12/97	8.27	26.8	24.7
6/13/97	7.62	20.3	18.4
6/14/97	6.96	21.3	19.8
6/15/97	7.20	25.7	22.9
6/16/97	7.10	31.9	27.2
6/17/97	6.75	33.4	27.5
6/18/97	6.15	28.2	23.8
6/19/97	6.18	23.5	19.5
6/20/97	6.30	24.2	19.4
6/21/97	6.54	24.4	19.2
6/22/97	6.57	24.5	19.2
6/23/97	6.51	26.8	20.4
6/24/97	6.12	24.6	18.4
6/25/97	6.65	28.4	20.6
6/26/97	6.34	32.8	24
6/27/97	6.37	34.7	25.6
6/28/97	6.64	35.7	26.3
6/29/97	6.76	36.5	27.2
6/30/97	7.50	38.7	29.1

TABLE 2-10.
RIO GRANDE DAILY MEAN DISCHARGE RATES, CUBIC METERS PER SECOND

Date Measured	Pump House Below American Dam	Courchesne Bridge	Diversion at American Canal
7/1/97	6.96	38.9	29.7
7/2/97	6.72	38.3	29.6
7/3/97	6.58	36.4	27.7
7/4/97	6.67	34.4	26
7/5/97	6.57	32.3	24.5
7/6/97	6.63	36.1	26.7
7/7/97	6.61	39.1	29.8
7/8/97	6.69	38.5	29.5
7/9/97	6.69	37.1	27.5
7/10/97	6.95	33.3	24.6
7/11/97	7.01	33.2	24.2
7/12/97	6.69	32.4	24.3
7/13/97	6.74	31.4	23.6
7/14/97	6.71	30.9	23.6
7/15/97	6.59	30.8	23.5
7/16/97	6.38	30.1	23.2
7/17/97	6.42	34.1	26.1
7/18/97	6.73	35.4	27.7
7/19/97	6.85	34.2	27
7/20/97	6.79	32.3	25.8
7/21/97	6.82	32.9	26.4
7/22/97	6.73	36.8	29.9
7/23/97	12.40	44.6	30.1
7/24/97	9.29	38.2	29.5
7/25/97	6.64	33.8	27.5
7/26/97	6.64	36.8	29.3
7/27/97	6.49	35.4	27.8
7/28/97	6.61	37.5	29.1
7/29/97	8.43	41	30
7/30/97	7.30	37.3	28.9
7/31/97	7.22	40.5	31
8/1/97	9.16	43.9	30.8
8/2/97	6.24	36.6	29.2
8/3/97	4.96	26	21.6
8/4/97	5.56	23.9	18.2
8/5/97	6.05	26.5	19.5
8/6/97	5.99	27.8	20.8
8/7/97	6.07	31.2	22.8
8/8/97	5.79	34.3	26.2
8/9/97	5.40	30.3	23.8
8/10/97	5.43	28.7	21.6
8/11/97	5.43	30.2	22.6
8/12/97	5.51	29.1	21.9
8/13/97	5.50	28.6	21.2
8/14/97	5.78	34.2	25.7
8/15/97	7.57	38.9	28.2
8/16/97	6.23	30.5	23.1
8/17/97	5.57	29.1	22.1

TABLE 2-10.
RIO GRANDE DAILY MEAN DISCHARGE RATES, CUBIC METERS PER SECOND

Date Measured	Pump House Below American Dam	Courchesne Bridge	Diversion at American Canal
8/18/97	5.55	32.4	25
8/19/97	5.53	32.5	25
8/20/97	5.42	30.8	23.9
8/21/97	5.33	28.5	21.7
8/22/97	5.55	29.5	21.6
8/23/97	5.52	30.1	21.3
8/24/97	5.51	32.4	23.6
8/25/97	5.53	34.6	25.9
8/26/97	5.51	35.1	26
8/27/97	5.48	33.1	24.8
8/28/97	5.47	32.5	24.2
8/29/97	5.54	32.7	23.8
8/30/97	5.38	30.2	22.3
8/31/97	3.96	29.3	22.3
9/1/97	3.41	33	25.9
9/2/97	3.22	33.2	26.4
9/3/97	3.11	32.5	26.1
9/4/97	3.24	27.3	21.6
9/5/97	3.36	23.7	18.5
9/6/97	3.33	24.4	18.8
9/7/97	3.28	24.2	18.7
9/8/97	3.37	24.7	18.8
9/9/97	1.67	24.4	20
9/10/97	0.63	23.7	20.5
9/11/97	0.60	27	24
9/12/97	0.60	31.5	27.2
9/13/97	0.64	31.5	26.8
9/14/97	0.68	30.3	26
9/15/97	0.99	31.5	26.2
9/16/97	1.14	29.1	24.7
9/17/97	1.00	24.5	21.4
9/18/97	0.96	18.8	18.6
9/19/97	0.90	13.4	15.4
9/20/97	0.89	15.5	14.9
9/21/97	0.83	18.1	16
9/22/97	1.18	24.9	23.4
9/23/97	16.50	44.7	27.2
9/24/97	4.27	23.3	23.6
9/25/97	1.76	18	18.8
9/26/97	1.30	20.8	19.5
9/27/97	1.26	20.6	19.3
9/28/97	1.22	20	18.6
9/29/97	1.20	16.7	15.3
9/30/97	1.16	14.2	12.7
10/1/97	1.13	12.6	10.8
10/2/97	1.08	12.4	10.6
10/3/97	1.08	16.5	14.2
10/4/97	1.08	16.4	14.4

TABLE 2-10.
RIO GRANDE DAILY MEAN DISCHARGE RATES, CUBIC METERS PER SECOND

Date Measured	Pump House Below American Dam	Courchesne Bridge	Diversion at American Canal
10/5/97	1.09	16.7	14.7
10/6/97	1.07	16.1	14.4
10/7/97	1.03	17	15.5
10/8/97	1.00	14.4	13.4
10/9/97	0.97	12.3	11.1
10/10/97	0.99	12.9	11.5
10/11/97	0.94	13.4	12.1
10/12/97	0.88	12.3	11
10/13/97	0.85	15.5	14.3
10/14/97	6.75	18.3	11.2
10/15/97	21.00	20.3	0.19
10/16/97	28.70	29.4	0.19
10/17/97	25.60	23.9	0.19
10/18/97	19.20	17.5	0.18
10/19/97	17.00	16.3	0.17
10/20/97	15.80	15.8	0.15
10/21/97	14.70	15.4	0.14
10/22/97	14.20	15.2	0.13
10/23/97	11.90	12.9	0.12
10/24/97	9.85	10.9	0.1
10/25/97	11.70	12.4	0.09
10/26/97	9.25	9.88	0.09
10/27/97	8.83	9.14	0.08
10/28/97	8.81	8.87	0.08
10/29/97	8.64	8.51	0.07
10/30/97	8.45	8.17	0.07
10/31/97	8.01	7.86	0.06
1/1/98	3.86	3.86	0.02
1/2/98	3.88	3.82	0.02
1/3/98	3.86	3.82	0.02
1/4/98	3.83	3.85	0.02
1/5/98	4.12	4.21	0.02
1/6/98	4.08	4.09	0.02
1/7/98	3.81	3.87	0.02
1/8/98	3.77	3.75	0.02
1/9/98	3.67	3.60	0.02
1/10/98	3.56	3.45	0.02
1/11/98	3.47	3.23	0.02
1/12/98	3.46	3.10	0.02
1/13/98	3.41	3.07	0.02
1/14/98	3.35	2.96	0.02
1/15/98	3.32	2.83	0.02
1/16/98	3.48	2.87	0.02
1/17/98	3.46	2.70	0.02
1/18/98	3.42	2.61	0.02
1/19/98	3.52	2.52	0.03
1/20/98	6.86	6.88	0.03
1/21/98	8.49	8.86	0.03

TABLE 2-10.
RIO GRANDE DAILY MEAN DISCHARGE RATES, CUBIC METERS PER SECOND

Date Measured	Pump House Below American Dam	Courchesne Bridge	Diversion at American Canal
1/22/98	8.65	9.16	0.03
1/23/98	8.81	9.41	0.03
1/24/98	9.14	9.84	0.04
1/25/98	9.80	9.80	0.04
1/26/98	9.80	9.69	0.04
1/27/98	10.00	9.63	0.04
1/28/98	10.10	9.62	0.04
1/29/98	10.00	9.62	0.04
1/30/98	10.20	9.79	0.04
1/31/98	10.50	9.82	0.05
2/1/98	10.50	9.93	0.05
2/2/98	10.20	9.93	0.05
2/3/98	9.94	10.10	0.05
2/4/98	9.87	10.20	0.05
2/5/98	10.20	10.00	0.05
2/6/98	8.01	7.91	0.05
2/7/98	6.66	6.63	0.05
2/8/98	6.18	6.19	0.05
2/9/98	6.20	6.32	0.05
2/10/98	7.73	8.08	0.05
2/11/98	8.22	8.21	0.05
2/12/98	9.28	8.69	0.05
2/13/98	7.45	6.97	0.05
2/14/98	7.12	6.47	0.05
2/15/98	7.09	6.49	0.05
2/16/98	7.20	6.62	0.05
2/17/98	4.09	7.14	3.52
2/18/98	1.45	7.63	6.81
2/19/98	1.34	7.64	6.48
2/20/98	1.20	9.43	8.15
2/21/98	1.10	10.10	8.71
2/22/98	1.03	10.10	8.80
2/23/98	1.01	11.10	9.71
2/24/98	0.97	9.95	8.28
2/25/98	0.89	9.42	7.81
2/26/98	0.85	8.92	7.42
2/27/98	0.93	10.30	8.80
2/28/98	0.95	10.40	8.86
3/1/98	1.02	13.50	11.60
3/2/98	1.03	17.90	15.80
3/3/98	0.97	19.50	17.30
3/4/98	0.94	18.10	16.50
3/5/98	0.90	16.20	15.00
3/6/98	0.88	14.30	13.50
3/7/98	0.83	15.60	15.00
3/8/98	0.84	18.70	17.50
3/9/98	0.89	24.20	22.20
3/10/98	0.88	25.10	22.90

TABLE 2-10.
RIO GRANDE DAILY MEAN DISCHARGE RATES, CUBIC METERS PER SECOND

Date Measured	Pump House Below American Dam	Courchesne Bridge	Diversion at American Canal
3/11/98	0.81	22.30	20.60
3/12/98	0.76	23.60	21.50
3/13/98	0.77	23.50	21.40
3/14/98	0.84	23.60	21.30
3/15/98	0.88	25.80	23.00
3/16/98	1.01	28.60	25.70
3/17/98	2.52	27.80	24.10
3/18/98	3.44	26.00	22.00
3/19/98	4.76	25.10	20.70
3/20/98	5.41	24.90	19.60
3/21/98	5.45	23.60	19.00
3/22/98	5.53	23.70	19.30
3/23/98	5.50	25.40	20.10
3/24/98	5.43	28.20	21.60
3/25/98	5.44	29.60	23.70
3/26/98	5.34	28.50	23.20
3/27/98	5.22	26.70	21.90
3/28/98	5.28	23.20	19.50
3/29/98	5.18	19.50	16.00
3/30/98	5.23	16.80	13.70
3/31/98	5.32	20.10	16.10
4/1/98	5.29	20.80	16.30
4/2/98	5.17	19.30	14.90
4/3/98	5.28	17.30	12.90
4/4/98	5.25	18.40	13.60
4/5/98	5.15	18.90	14.80
4/6/98	5.12	17.80	13.50
4/7/98	5.27	19.50	13.70
4/8/98	5.25	17.30	12.20
4/9/98	5.34	18.80	13.20
4/10/98	5.37	23.70	17.40
4/11/98	5.35	20.40	15.00
4/12/98	5.42	21.90	15.60
4/13/98	5.39	24.20	18.50
4/14/98	5.17	24.60	18.80
4/15/98	5.07	21.80	17.00
4/16/98	5.05	19.10	14.70
4/17/98	5.05	19.40	14.60
4/18/98	5.00	19.80	14.80
4/19/98	4.88	20.80	15.30
4/20/98	4.88	19.00	13.60
4/21/98	5.34	17.70	12.20
4/22/98	5.47	16.90	11.20
4/23/98	5.31	16.00	10.50
4/24/98	5.20	15.90	10.30
4/25/98	5.17	16.80	10.70
4/26/98	5.11	18.20	10.90
4/27/98	5.16	19.70	12.30

TABLE 2-10.
RIO GRANDE DAILY MEAN DISCHARGE RATES, CUBIC METERS PER SECOND

Date Measured	Pump House Below American Dam	Courchesne Bridge	Diversion at American Canal
4/28/98	5.18	23.20	16.30
4/29/98	5.15	21.30	15.10
4/30/98	3.04	20.60	16.30
5/1/98	2.46	21.20	17.30
5/2/98	2.35	21.70	18.10
5/3/98	2.37	19.20	16.30
5/4/98	2.33	16.90	13.80
5/5/98	2.34	15.10	13.10
5/6/98	2.35	14.80	11.90
5/7/98	2.32	14.90	11.70
5/8/98	2.33	17.70	13.30
5/9/98	2.39	17.90	14.60
5/10/98	2.39	19.60	14.90
5/11/98	2.42	20.60	16.30
5/12/98	2.39	19.90	17.30
5/13/98	2.34	18.50	16.10
5/14/98	2.35	17.00	14.60
5/15/98	2.38	15.60	12.90
5/16/98	2.36	18.90	15.40
5/17/98	2.28	22.60	18.70
5/18/98	2.32	18.40	16.20
5/19/98	2.40	18.20	15.60
5/20/98	2.50	17.20	15.00
5/21/98	2.46	15.40	13.60
5/22/98	2.47	15.30	14.10
5/23/98	2.40	15.30	14.00
5/24/98	2.43	17.50	15.80
5/25/98	2.41	19.30	17.00
5/26/98	2.35	17.90	15.90
5/27/98	2.25	16.30	14.70
5/28/98	2.18	16.10	14.40
5/29/98	2.19	18.00	16.50
5/30/98	2.28	19.20	17.80
5/31/98	5.20	23.10	18.60

TABLE 2-11. DEPTH TO WATER IN WELLS ADJACENT TO THE RIO GRANDE, 1995 THROUGH 1998

Date Measured	Well Identifier										
	EP-4	EP-5	EP-6	EP-7	EP-60	EP-61	EP-62	EP-63	EP-64	EP-65	EP-66
February 1995	6.34	6.89	8.01	7.22	10.45	10.84	8.66	8.08	11.50	16.00	11.52
May 1995	5.23	5.70	6.81	6.05	9.25	9.84	7.35	6.75	10.23	9.16	10.25
August 1995	4.55	5.11	5.85	5.08	8.11	8.97	6.69	6.02	9.00	7.89	9.21
November 1995	6.18	6.78	7.77	7.07	10.07	10.98	8.60	7.98	11.33	12.82	7.38
February 1996	6.33	6.96	8.13	7.52	10.37	10.87	8.70	8.05	11.56	12.85	11.55
May 1996	5.53	6.07	7.29	6.59	9.34	9.92	7.64	7.03	10.52	9.81	10.43
August 1996	5.30	4.89	6.77	6.33	9.18	NM	7.46	6.81	10.31	NM	10.23
November 1996	5.40	5.96	8.01	7.17	10.20	11.66	9.56	9.30	12.15	12.32	11.98
February 1997	6.56	6.12	7.94	7.21	10.27	11.67	9.59	9.38	12.24	12.77	11.90
May 1997	5.55	6.13	7.30	6.68	9.50	9.81	7.35	6.88	10.26	8.63	10.28
August 1997	5.28	5.78	6.70	6.02	9.00	9.58	7.32	6.62	10.18	8.25	10.02
November 1997	6.32	5.82	7.80	7.65	10.02	12.63	9.55	9.30	12.05	10.94	11.85
February 1998	5.00	5.51	7.61	8.00	10.17	11.84	9.64	9.42	12.27	10.73	11.21
May 1998	5.75	6.31	7.48	6.94	9.22	10.73	7.62	6.95	10.45	8.52	10.37

Notes: NM = Not Measured.
All values are feet below ground surface.
See Exhibit 1 for well locations.
Depth to water measurements are not adjusted for hydrocarbon occurrence, which depresses water level elevations.

TABLE 2-12. RIO GRANDE FLOW DATA TRENDS (MEAN DAILY DISCHARGE, CUBIC METERS/SECOND)

Date Measured	Courchesne Bridge	Pump House
06-01-96	22.00	5.37
12-01-96	3.63	4.07
07-01-97	38.90	6.96
10-31-97	7.86	8.01

Notes: See Figure 2-2 for sample locations.

TABLE 2-13. FLOW RATES AND ARSENIC CONCENTRATIONS IN THE AMERICAN CANAL

	Flow Rate[1]	Arsenic Concentrations (mg/l)		
Date Measured	**Diversion at American Canal**	**SEP-7**	**SEP-1**	**SEP-3**
August 1997	29.7	0.006	0.005	0.005
November 1997	0.06[2]	0.01	0.8	1.6

mg/l = milligrams per liter.
(1) = Flow rate as mean daily discharge in cubic meters per second.
(2) = Measured in October 1997.

TABLE 2-14. DRINKING WATER STANDARDS MAXIMUM CONTAMINANT LEVELS (MCL)

Parameter	Units	Federal[1]	Texas[2]
Arsenic	mg/l	0.05	0.05
Cadmium	mg/l	0.005	0.005
Chromium	mg/l	0.1	0.1
Copper	mg/l	1.3 (action level)	1.0 (secondary MCL)
Iron	mg/l	0.3 (secondary MCL)	0.3 (secondary MCL)
Lead	mg/l	0.015 (action level)	0.015 (action level)
Selenium	mg/l	0.05	0.05
Zinc	mg/l	5 (secondary MCL)	5.0 (secondary MCL)
pH	units	6.5 - 8.5 (secondary MCL)	>7.0 (secondary MCL)
Specific Conductivity	---	---	---
Total Dissolved Solids	mg/l	500 (secondary MCL)	1,000 (secondary MCL)

Notes:
MCLs are enforceable primary drinking water standards.
Secondary MCLs are nonenforceable federal guidelines.
Action levels are nonenforceable health-based guidance levels.
No standard has been established for specific conductivity.
mg/l = milligrams per liter.
(1) Source: EPA, Drinking Water Regulations and Health Advisories, October 1996.
(2) Source: Texas Natural Resource Conservation Commission, Chapter 290 – Water Hygiene, Subchapter F, Drinking Water Standards Governing Drinking Water Quality and Reporting Requirements for Public Water Supply Systems.

TABLE 2-15. SUMMARY OF HYDRAULIC GRADIENTS, AUGUST 1997 THROUGH MAY 1998

Gradient Measuring Locations	Distance (Feet)	August 1997		November 1997		February 1998		May 1998		Average Gradient
		Elevation Change (Feet)	Gradient	Elevation Change (Feet)	Gradient	Elevation Change (Feet)	Gradient	Elevation Change (Feet)	Gradient	
EP-82 to EP-62	2,425	44.91	0.019	46.58	0.019	47.15	0.019	43.71	0.018	0.019
EM-6 to EP-66	1,325	22.23	0.017	24.71	0.019	24.21	0.018	22.85	0.017	0.018
EP-15 to EP-4	785	3.87	0.005	5	0.006	3.99	0.005	4.76	0.006	0.005
EP-67 to EP-6	860	9.94	0.012	11.03	0.013	8.51	0.009	10.61	0.012	0.011
									Average Hydraulic Gradient	**0.013**

Locations:

EP-82 to EP-62 Section is from northeastern edge of site though the Acid Plant Arroyo to the American Canal.
EM-6 to EP-66 Section is from upgradient edge of Ponds 5 and 6 Arroyo to American Canal.
EM-15 to EP-4 Section is in the vicinity and through Pond 1 Arroyo.
EP-67 to EP-6 Section is through the South Staging Area and a minor arroyo in that area.
See Exhibit 1 for well locations.
All gradient measured as feet/feet.

TABLE 2-16. Wells Used in Aquifer Testing

Well Identifier	Test Dates	Total Well Depth (feet)	Estimated Saturated Thickness (feet)	Target Aquifer
EP-62	5/1/98	17	8	Rio Grande Fluvial
EP-72	4/29/98	75	16	Arroyo Colluvial
EP-73	4/29/98	80	9	Arroyo Colluvial
EP-77	5/1/98	55	14	Arroyo Colluvial
EP-85	4/30/98 and 5/1/98	25	10	Arroyo Colluvial

Note: Well locations shown on Exhibit 1.

TABLE 2-17. Summary of Aquifer Test Results

Aquifer	Testing Method	Saturated Thickness (feet)	Hydraulic Conductivity (cm/s)	Storativity (dimensionless)
Rio Grande Alluvial	Theis Recovery	20-50	0.006	0.018
Arroyo Colluvial	Theis Recovery	20-50	0.00025 - 0.001	0.013 - 0.038
Bedrock	N/A		N/A	

N/A = not available at the time of this study
cm/s = centimeter per second

TABLE 2-18. CONCEPTUAL MODEL 1 PARAMETERS

Parameter	Abbreviations	Value	Comments
Porosity	n	0.42	Collected 11/97 from Smeltertown
Aquifer thickness	b	15 feet	Averaged along flowpath.
Hydraulic Gradient	i	0.065 ft/ft	Calculated using the water elevation difference divided by distance between contour lines (e.g., 3730-3720/153).
Hydraulic Conductivity	K	1 ft/day	$1x10^{-3}$ to $2.5x10^{-4}$ cm/s; Approximate based on aquifer test results.
Source Area cross sectional width	---	80 feet	Approximated from Figure 2-42.
Groundwater flux at source	Q	100 ft^3/day	KiA=1*0.065*80*19
Arsenic Concentration	---	315 mg/l	EP-49 (closest well downgradient of source) (see Table G-3)
Arsenic Load	---	2 lb/day or 730 lb/year	Concentration · Flux = Load
Time started	---	1980	---
Bulk Density	rb	1.76 g/cm(3)	Estimated(1)
Seepage Velocity	v	0.155 ft/day	Ki/n= 1ft/day*0.065/0.42
Dispersivity	Dl/Dt	250ft/25ft	Estimated(2)
Partition Coefficient	K_d	10 l/kg	median partition b/t soils and groundwater (see Table K-1)
Retardation	R	43	$1+(rb/n)/K_d$
Decay	l	0.0	N/A(3)

(1) Bulk Density Reference: Deck, R.B. et al, Foundation Engineering 2nd edition, 1974, John Wiley & Sons, New York.

(2) Dispersivity Reference: A Critical Review of Data on Field Scale Dispersion in Aquifer, Gelhar, L.W. et al 1992. Water Resources Research, Vol. 28, No. 7pp, 1955/1974.

(3) Not applicable.

TABLE 2-19. CONCEPTUAL MODEL 2 PARAMETERS

Parameters	Abbreviations	Value	Comments
Porosity	n	0.42	Collected 11/97 from Smeltertown
Aquifer thickness	b	20 feet	Averaged along flowpath.
Hydraulic Gradient	i	0.0385 ft/ft	Calculated using the water elevation difference divided by distance between contour lines (e.g., 3735-3730/130).
Hydraulic Conductivity	K	1 ft/day	$1x10^{-3}$ to $2.5x10^{-4}$ cm/s; Approximated based on aquifer test results.
Source Area cross sectional width	---	300 feet	Approximated from Figure 2-42.
Groundwater flux at source	Q	230 ft^3/day	KiA=1*0.0385*300*20
Arsenic Concentration	---	2.25 mg/l	Pond-6 (see Table G-3).
Arsenic Load	---	0.032 lb/day or 11.8 lb/year	Concentration · Flux = Load
Time started	---	1930	---
Bulk Density	rb	1.76 g/cm^3	Estimated(1)
Seepage Velocity	v	0.092 ft/day	Ki/n= 1ft/day*0.0385/0.42
Dispersivity	Dl/Dt	250ft/25ft	Estimated(2)
Partition Coefficient	K_d	4 l/kg	Median partition b/t soils and groundwater (See Table K-1)
Retardation	R	20	$1+(rb/n)/K_d$
Decay	l	0.0	N/A(3)

(1) Bulk Density Reference: Deck, R.B. et al, Foundation Engineering 2nd edition, 1974, John Wiley & Sons, New York.

(2) Dispersivity Reference: A Critical Review of Data on Field Scale Dispersion in Aquifer, Gelhar, L.W. et al 1992. Water Resources Research, Vol. 28, No. 7pp, 1955/1974.

(3) Not applicable.

TABLE 2-20. CALIBRATION PARAMETERS: MODEL 1

Groundwater Velocity (ft/day)	Aquifer Thickness (ft)	Porosity	L_o/L_t (1)	r_f (2)	Source Length (ft)	Loading Rate (lbs/day)(3)
0.155	15	0.42	250/25	20	80	8

Notes:

(1) L_o,L_t are the longitudinal and latitudinal dispersivity factors, respectively.

(2) r_f is the retardation factor.

(3) Loading rate is distributed over two points fifty feet apart in the source area.

TABLE 2-21. CALIBRATION PARAMETERS: MODEL 2

Groundwater Velocity (ft/day)	Aquifer Thickness (ft)	Porosity	L_o/L_t (1)	r_f (2)	Source Length (ft)	Loading Rate (lbs/day)(3)
0.092	20	0.42	250/25	20	300	0.224

Notes:

(1) L_o,L_t are the longitudinal and latitudinal dispersivity factors, respectively.

(2) r_f is the retardation factor.

(3) Loading rate is distributed over five points in groups of 3 and 2 for each pond.

TABLE 2-22. AVERAGED WATER QUALITY IN MODELED SOURCE AREAS

Well	SC (µmhos/cm)	pH (s.u.)	As (mg/l)	Fe (mg/l)	Zn (mg/l)	Cd (mg/l)	SO_4 (mg/l)	Cl (mg/l)	HCO_3 (mg/l)	F (mg/l)	Na (mg/l)	Ca (mg/l)
Source Area 1 Wells												
EP-21	5993	7.87	0.06	0.3	0.03	0.0025	714	739	1815	5.3	1033	69
EP-25	5660	7.58	3.05	4.3	0.027	0.0025	429	1000	1408	1.7	1126	97
EP-55	10455	6.88	58.5	135	99	0.057	4867	919	802	21	1711	528
EP-49	11367	3.7	315	1907	1206	43	8661	779	1	29	804	476
EP-54	10493	7.05	32	8.2	70	3.4	4938	806	511	11.9	1797	442
EP-58	11430	6.85	3.7	1.37	0.0198	0.0025	4415	889	1560	4.8	2312	484
EP-64	10003	7.88	0.039	0.075	0.0325	0.0025	4091	821	307	1.9	2174	404
Source Area 2 Wells and Ponds												
EP-88	5270	8.03	0.022	0.05	0.027	0.0025	1773	457	499	2.15	1294	59
EM-7	5760	8	1.87	0.297	0.099	0.016	1894	669	357	5.9	1255	222
EM-5	6192	7.83	1.65	1.51	0.29	0.058	2061	707	189	7.5	1324	216
EP-77	5302	7.72	5.68	0.05	0.025	0.014	1844	618	317	2.46	1046	227
EP-90	2923	7.31	0.167	0.05	0.076	0.0025	856	304	326	0.56	520	113
Pond 6	4305	8.45	2.25	0.43	0.98	0.094	1498	457	112	6.65	931	158
Pond 5	1252	8.2	0.11	0.16	0.325	0.031	278	160	104	0.925	186	59

Note: Results are dissolved metal concentrations in milligrams per liter (mg/l)
Concentrations are averages of data collected in 1997 and 1998.
Wells are listed in order from upgradient to downgradient within a presumed source area flowpath.
See Exhibit 1 for sample locations.

TABLE 2-23. SURFACE WATER IMPACTS SUMMARY

Rio Grande Results			
	Arsenic Concentration (mg/l)(2)	**Arsenic Load (kg/day)(3)**	**Modeled Load from Groundwater (kg/day)**
Source Area 1(1)			
Current	0.006	0.047	---
With Source Control	0.019	0.146	0.099
With No Source Control	0.087	0.678	0.631
Source Area 2(1)			
Current	0.006	0.047	---
With Source Control	0.0066	0.052	0.005
With No Source Control	0.0075	0.058	0.012

(1) Source Area 1 = Acid Plant Mist Precipitator; Source Area 2 = Ponds 5 and 6 Arroyo

(2) From current data or groundwater modeling results. Model results for 280 years (Source Area 1) or 540 years (Source Area 2) from estimated release time.

(3) Calculated using model results and presumed low flow conditions:

- 0.09 m^3/sec river flow
- 1132 ft^3/day groundwater flux, 3.1 mg/l groundwater arsenic for Source Area 1 with source control
- 1212 ft^3/day groundwater flux, 18.4 mg/l groundwater arsenic for Source Area 1 with no source control
- 375 ft^3/day groundwater flux, 0.48 mg/l groundwater arsenic for Source Area 2 with source control
- 578 ft^3/day groundwater flux, 0.711 mg/l

TABLE 3-1. SUMMARY OF BOREHOLE SAMPLE RESULTS, INVESTIGATION AREA 1

Location	Depth	Arsenic (mg/kg)	Cadmium (mg/kg)	Lead (mg/kg)	Selenium (mg/kg)
SSIA1-1	0-2 in.	3,200	1,900	11,000	190
	1.5-2.5 ft.	2,300	91	5,000	13
	3-4 ft.	4,700	1,700	12,000	110
	4 -5 ft.	2,600	900	20,000	220
SSIA1-2	0-2 in.	21,000	1,100	15	1,300
	1.5-2.5 ft.	22,000	1,600	5,400	200
	3-4 ft.	15,000	1,200	8,900	230
	4 - 5 ft.	22,000	1,300	4,000	120

TABLE 3-2. SUMMARY OF GROUNDWATER SAMPLE RESULTS, INVESTIGATION AREA 1

Monitor Well	Arsenic (mg/l)	Cadmium (mg/l)	Lead (mg/l)	Selenium (mg/l)
EP-51	2.17	0.89	< 0.003	0.17
EP-52	1.29	0.68	0.044	0.33

TABLE 3-3. SUMMARY OF GROUNDWATER SAMPLE RESULTS, INVESTIGATION AREA 2 (SUB-AREA 1)

Well	Arsenic (mg/l)	Cadmium (mg/l)	Lead (mg/l)	Selenium (mg/l)
EP-53	57	1.4	< 0.003	1.2
EP-75	17	0.030	0.003	5
EP-76	0.48	< 0.005	0.004	0.15

TABLE 3-4. SUMMARY OF BOREHOLE SAMPLE RESULTS, INVESTIGATION AREA 2 (SUB-AREA 2)

Borehole	Arsenic (mg/kg)	Cadmium (mg/kg)	Lead (mg/kg)	Selenium (mg/kg)
RIBH-1	4,400	2,100	11,000	20
RIBH-2	82	<10	39	<10
RIBH-3	<20	<10	800	<10
RIBH-4	280	24	970	<10
RIBH-5	<20	<10	210	<10
RIBH-6	270	<10	830	15
EP-78	990	46	530	<10
EP-79	<20	<10	17	<10
EP-81	150	15	790	<10
EP-83	<20	<10	20	<10
EP-85	59	<10	150	<10

TABLE 3-5. SUMMARY OF GROUNDWATER SAMPLE RESULTS, INVESTIGATION AREA 2 (SUB-AREA 2)

Well	Arsenic (mg/l)	Cadmium (mg/l)	Lead (mg/l)	Selenium (mg/l)
EP-78	5.8	< 0.005	< 0.003	0.25
EP-79	0.009	< 0.005	< 0.003	0.18
EP-81	0.24	< 0.005	< 0.003	0.21
EP-83	0.008	< 0.005	< 0.003	0.047
EP-85	3.0	< 0.005	< 0.003	0.18

TABLE 3-6. SUMMARY OF BOREHOLE SAMPLE RESULTS, INVESTIGATION AREA 3

Metal	Depth	Minimum (mg/kg)	Maximum (mg/kg)
Arsenic	0 - 2 in.	<20	7,800
	1.5-2.5 ft.	10	3,000
	3-4 ft.	28	2,000
	4 - 5 ft.	<20	3,500
Cadmium	0 - 2 in.	25	1,600
	1.5-2.5 ft.	< 5	440
	3-4 ft.	< 5	270
	4 - 5 ft.	<10	550
Lead	0 - 2 in.	220	19,000
	1.5-2.5 ft.	37	6,900
	3-4 ft.	95	4,200
	4 - 5 ft.	45	20,000
Selenium	0 - 2 in.	<10	77
	1.5-2.5 ft.	< 5	94
	3-4 ft.	< 5	46
	4 - 5 ft.	<10	44

TABLE 3-7. SUMMARY OF GROUNDWATER SAMPLE RESULTS, INVESTIGATION AREA 3

Well	Arsenic (mg/l)	Cadmium (mg/l)	Lead (mg/l)	Selenium (mg/l)
EP-25	3.1	< 0.005	0.004	0.094
EP-49	315	43	0.04	0.15
EP-52	1.29	0.68	0.044	0.33
EP-54	32	3	0.004	0.073
EP-55	59	0.06	0.006	0.22
EP-73	0.049	< 0.005	0.003	1.2

TABLE 3-8. SUMMARY OF SOIL SAMPLE RESULTS, 1995 ACID SPILL INVESTIGATION

Borehole	Depth (feet)	Arsenic (mg/kg)	Cadmium (mg/kg)	Lead (mg/kg)	Selenium (mg/kg)	Sulfate (mg/kg)
AB-1	3-5	2,920	185	918	<12	26,900
	7-9	2,140	294	2610	<12	11,200
	11-12	585	98	388	<12	10,400
AB-2	3-5	1,000	470	1100	<12	8,900
	7-9	640	32	221	<12	6,150
	11-13	430	108	162	<12	11,750
AB-3	3-5	378	236	404	<12	5,050
	7-9	304	63	139	<12	5,250
	9-11	524	17	19	<12	6,800
AB-4	3-5	91	<10	268	<12	1,815
	7-9	32	<10	90	<12	1,540
	9-11	<20	<10	59	<12	2,395
AB-5	4-5	28	<10	169	<12	401
	7-9	<20	<10	135	<10	417

Locations?

TABLE 3-9. SUMMARY OF BOREHOLE SAMPLE RESULTS, INVESTIGATION AREA 4 (DOWNSLOPE OF MEDFORD SUMP)

Metal	Depth	Minimum (mg/kg)	Maximum (mg/kg)
Arsenic	0-2 in.	1200	4900
	1.5-2.5 ft.	1,100	6,200
	3-4 ft.	40	2,000
	4-5 ft.	<20	1200
Cadmium	0-2 in.	360	1300
	1.5-2.5 ft.	66	1,500
	3-4 ft.	22	1,300
	4-5 ft.	15	170
Lead	0-2 in.	7500	11,000
	1.5-2.5 ft.	200	11,000
	3-4 ft.	58	2,900
	4-5 ft.	27	5800
Selenium	0-2 in.	33	74
	1.5-2.5 ft.	< 5	120
	3-4 ft.	< 5	41
	4-5 ft.	<20	19

TABLE 3-10. SUMMARY OF BOREHOLE SAMPLE RESULTS, INVESTIGATION AREA 4 (DOWNSLOPE OF LEAD PLANT)

Metal	Depth	Minimum (mg/kg)	Maximum (mg/kg)
Arsenic	0-2 in.	840	17,000
	1.5-2.5 ft.	680	2,200
	3-4 ft.	95	1,900
	4-5 ft.	35	1,500
Cadmium	0-2 in.	290	980
	1.5-2.5 ft.	55	600
	3-4 ft.	< 5	300
	4-5 ft.	<10	430
Lead	0-2 in.	5,100	49,000
	1.5-2.5 ft.	1,300	12
	3-4 ft.	130	7,500
	4-5 ft.	72	6,800
Selenium	0-2 in.	24	1,600
	1.5-2.5 ft.	< 5	110
	3-4 ft.	< 5	130
	4-5 ft.	<10	88

TABLE 3-11. SUMMARY OF BOREHOLE SAMPLE RESULTS, INVESTIGATION AREA 4 (DOWNSLOPE OF SAMPLE MILL)

Location	Depth	Arsenic (mg/kg)	Cadmium (mg/kg)	Lead (mg/kg)	Selenium (mg/kg)
SSIA4-12	0-2 in.	4800	930	13,000	63
	1.5-2.5 ft.	< 10	18	10,000	< 5
	3-4 ft.	< 10	< 5	2,300	15
	4-5 ft.	<20	<10	3,200	<10
SSIA4-13	0-2 in.	860	320	11,000	52
	1.5-2.5 ft.	790	320	12,000	70
	3-4 ft.	78	170	1,000	11
	4-5 ft.	78	170	1,000	11
SSIA4-14	0-2 in.	1,600	640	14,000	50
	1.5-2.5 ft.	490	190	4,500	16
	3-4 ft.	< 10	16	280	< 5
	4-5 ft.	110	82	1,900	<10
SSIA4-15	0-2 in.	480	300	6,800	33
	1.5-2.5 ft.	440	240	5,300	21
	3-4 ft.	< 10	13	540	< 5
	4-5 ft.	74	23	930	<10
SSIA4-16	0-2 in.	520	350	5,900	32
	1.5-2.5 ft.	66	30	710	< 5
	3-4 ft.	< 10	10	210	< 5
	4-5 ft.	<20	<10	18	<10

TABLE 3-12. SUMMARY OF GROUNDWATER SAMPLE RESULTS, INVESTIGATION AREA 4 (DOWNSLOPE OF SAMPLE MILL)

Well	Arsenic (mg/l)	Cadmium (mg/l)	Lead (mg/l)	Selenium (mg/l)
EP-13	45	0.75	0.003	6.4
EP-29	0.32	< 0.005	< 0.003	0.17

TABLE 3-13. SUMMARY OF BOREHOLE SAMPLE RESULTS, INVESTIGATION AREA 4 (DOWNSLOPE OF SOUTH TERRACE AREA)

Location	Depth	Arsenic (mg/kg)	Cadmium (mg/kg)	Lead (mg/kg)	Selenium (mg/kg)
SSIA4-22	0-2 in.	140	62	2,200	<5
	1.5-2.5 ft.	45	22	1,200	< 5
	3-4 ft.	< 10	< 5	21	< 5
	4-5 ft.	<10	<5	210	<5
SSIA4-23	0-2 in.	250	91	4,600	17
	1.5-2.5 ft.	< 10	13	370	< 5
	3-4 ft.	< 10	< 5	75	< 5
	4-5 ft.	29	15	520	<5
SSIA4-24	0-2 in.	120	38	1,800	<5
	1.5-2.5 ft.	< 10	< 5	260	< 5
	3-4 ft.	22	< 5	190	< 5
	4-5 ft.	<10	<5	75	<5
SSIA4-25	0-2 in.	380	200	9,400	24
	1.5-2.5 ft.	< 10	< 5	370	< 5
	3-4 ft.	< 10	< 5	200	< 5
	4-5 ft.	120	13	620	<5
SSIA4-26	0-2 in.	320	82	3,800	<5
	1.5-2.5 ft.	< 10	< 5	180	< 5
	3-4 ft.	< 10	< 5	270	< 5
	4-5 ft.	<10	11	550	<5
SSIA4-27	0-2 in.	370	140	5,300	22
	1.5-2.5 ft.	25	<5	82	<5

TABLE 3-14. SUMMARY OF GROUNDWATER SAMPLE RESULTS, INVESTIGATION AREA 4 (DOWNSLOPE OF SOUTH TERRACE AREA)

Monitor Well	Arsenic (mg/l)	Cadmium (mg/l)	Lead (mg/l)	Selenium (mg/l)
EP-20	1.05	0.042	< 0.003	0.36
EP-70	1.4	0.013	< 0.003	0.22
EP-71	0.16	< 0.005	< 0.003	0.28
EP-72	0.49	0.21	< 0.003	0.41

TABLE 3-15. SUMMARY OF BOREHOLE SAMPLE RESULTS, INVESTIGATION AREA 5

Metal	Depth	Minimum (mg/kg)	Maximum (mg/kg)
Arsenic	0-2 in.	<20	240
	1.5-2.5 ft.	< 10	32
	3-4 ft.	< 10	100
	4-5 ft.	<20	60
Cadmium	0-2 in.	<10	150
	1.5-2.5 ft.	< 5	44
	3-4 ft.	< 5	46
	4-5 ft.	<10	17
Lead	0-2 in.	170	4,200
	1.5-2.5 ft.	30	1,800
	3-4 ft.	11	2,200
	4-5 ft.	11	810
Selenium	0-2 in.	<10	30
	1.5-2.5 ft.	< 5	12
	3-4 ft.	< 5	< 5
	4-5 ft.	<10	<10

TABLE 3-16. SUMMARY OF GROUNDWATER SAMPLE RESULTS, INVESTIGATION AREA 5

Well	Arsenic (mg/l)	Cadmium (mg/l)	Lead (mg/l)	Selenium (mg/l)
EP-57	0.96	< 0.005	< 0.003	0.011
EP-58	3.73	< 0.005	< 0.003	0.062
EP-59	3.48	< 0.005	< 0.003	0.23
EP-60	0.007	< 0.005	< 0.003	0.25
EP-61	0.012	< 0.005	< 0.003	0.36
EP-62	1.03	< 0.005	< 0.003	0.38
EP-63	0.02	< 0.005	< 0.003	0.22
EP-64	0.04	< 0.005	< 0.003	0.62
EP-65	0.008	< 0.005	< 0.003	0.25
EP-66	10.93	< 0.005	< 0.003	0.26
EP-80	0.019	< 0.005	< 0.003	0.03

TABLE 3-17. SUMMARY OF BOREHOLE SAMPLE RESULTS, INVESTIGATION AREA 8

Metal	Depth	Minimum (mg/kg)	Maximum (mg/kg)
Arsenic	0-2 in.	<20	6,600
	1.5-2.5 ft.	< 10	3,700
	3-4 ft.	< 10	6,600
	4-5 ft.	<20	3,100
Cadmium	0-2 in.	<10	1,800
	1.5-2.5 ft.	< 5	1,300
	3-4 ft.	< 5	1,000
	4-5 ft.	<10	530
Lead	0-2 in.	44	25,000
	1.5-2.5 ft.	73	43,000
	3-4 ft.	36	71,000
	4-5 ft.	13	22,000
Selenium	0-2 in.	<10	180
	1.5-2.5 ft.	< 5	60
	3-4 ft.	< 5	68
	4-5 ft.	<10	72

TABLE 3-18. SUMMARY OF GROUNDWATER SAMPLE RESULTS, INVESTIGATION AREA 8

Well	Arsenic (mg/l)	Cadmium (mg/l)	Lead (mg/l)	Selenium (mg/l)
EP-15	0.032	0.006	< 0.003	0.17
EP-67	0.020	< 0.005	< 0.003	0.14
EP-70	1.64	0.012	< 0.003	0.23
EP-72	0.49	0.21	< 0.003	0.41

TABLE 3-19. SUMMARY OF POND WATER SAMPLES, INVESTIGATION AREA 9

Pond	Arsenic (mg/l)	Cadmium (mg/l)	Lead (mg/l)	Selenium (mg/l)
Pond 1	0.26	12.7	0.13	1.12
Pond 5	0.11	5.02	0.18	0.13
Pond 6	2.73	0.08	0.13	0.09

TABLE 3-20a. SUMMARY OF POND 1 ARROYO GROUNDWATER SAMPLE RESULTS, INVESTIGATION AREA 9

Pond 1				
Well	Arsenic (mg/l)	Cadmium (mg/l)	Lead (mg/l)	Selenium (mg/kg)
EM-2	0.635	0.005	< 0.003	0.13
EM-4	0.01	0.004	< 0.003	0.005
EP-12	1.167	< 0.005	< 0.003	3.057
EP-14	1.267	< 0.005	0.0032	0.297
EP-29	0.323	< 0.005	< 0.003	0.168
EP-35	0.448	< 0.005	< 0.003	3.675
EP-43	0.90	< 0.005	< 0.003	0.241

TABLE 3-20b. SUMMARY OF PONDS 5 AND 6 ARROYO GROUNDWATER SAMPLE RESULTS, INVESTIGATION AREA 9

Ponds 5 and 6				
Well	Arsenic (mg/l)	Cadmium (mg/l)	Lead (mg/l)	Selenium (mg/kg)
EM-5	1.65	0.0580	0.0075	0.0153
EM-6	0.027	< 0.005	< 0.003	0.105
EP-26	0.418	0.620	0.016	0.115
EP-56	2.22	0.003	< 0.003	0.053
EP-66	10.93	< 0.005	< 0.003	0.026
EP-77	5.68	0.014	0.005	0.020

TABLE 3-21. SUMMARY OF BOREHOLE SAMPLE RESULTS, INVESTIGATION AREA 10

Location	Depth	Arsenic (mg/kg)	Cadmium (mg/kg)	Lead (mg/kg)	Selenium (mg/kg)
SSENT-1	0-2 in.	470	75	5,700	15
	1.5-2.5 ft.	< 10	< 5	300	15
	3-4 ft.	< 10	< 5	160	< 5
	4-5 ft.	< 10	<5	94	< 5
SSENT-2	0-2 in.	340	100	3,300	15
	1.5-2.5 ft.	< 10	< 5	330	< 5
	3-4 ft.	< 10	< 5	430	< 5
	4-5 ft.	20	< 5	26	< 5
SSENT-3	0-2 in.	340	99	2,800	18
	1.5-2.5 ft.	34	< 5	160	< 5
SSENT-4	0-2 in.	190	80	1,800	< 5
	1.5-2.5 ft.	35	< 5	37	< 5
SSENT-5	0-2 in.	750	160	5,400	< 5
	1.5-2.5 ft.	< 10	< 5	210	< 5
SSENT-6	0-2 in.	380	100	3,800	16
	1.5-2.5 ft.	< 10	34	2,200	< 5
	3-4 ft.	< 10	< 5	610	< 5
	4-5 ft.	< 10	< 5	38	< 5
SSENT-7	0-2 in.	250	93	2,800	< 5
	1.5-2.5 ft.	< 10	< 5	30	< 5
	3-4 ft.	< 10	< 5	25	< 5
SSENT-8	0-2 in.	520	120	3,000	11
	1.5-2.5 ft.	710	250	1,300	12

TABLE 4-1. SUMMARY OF ESTIMATED COSTS FOR CORRECTIVE ACTION MEASURES

	Subtotal Base Construction	Mobilization	Texas State Sales Tax	Scope Contingency	Health and Safety Premium	Subtotal Construction	Other Misc. Costs	Engineering Design/ Oversight	Subtotal Corrective Action Measures	Monitoring and O&M	TOTAL CAPITAL OUTLAY
CORRECTIVE ACTION MEASURES COSTS with Disposal at ON-SITE REPOSITORY											
Investigation Area #1 -- Medford Sump	$68,713	$2,061	$694	$17,178	$6,871	$95,518	$12,417	$42,983	$150,918	$7,668	$158,587
Investigation Area #2 -- North Plant/Slag/Boneyard	$163,587	$4,908	$355	$40,897	$16,359	$226,104	$29,394	$101,747	$357,244	$11,057	$368,301
Investigation Area #3 -- Acid Plants	$256,351	$7,691	$8,088	$64,088	$25,635	$361,852	$47,041	$162,834	$571,727	$14,580	$586,306
Investigation Area #4 -- Front Slope	$805,802	$24,174	$6,852	$201,450	$80,580	$1,118,859	$145,452	$335,658	$1,599,968	$34,223	$1,634,191
Investigation Area #5 -- Historic Smelter Town	$83,192	$2,496	$439	$20,798	$8,319	$115,243	$14,982	$51,860	$182,085	$8,180	$190,265
Investigation Area #8 -- Bedding and Unloading Facility	$1,945,971	$58,379	$70,172	$486,493	$194,597	$2,755,612	$220,449	$551,122	$3,527,184	$76,696	$3,603,879
Investigation Area #9 -- Ponds 1, 5 and 6 (Repository)	$2,202,904	$66,087	$69,823	$550,726	$220,290	$3,109,831	$202,139	$513,122	$3,825,092	$85,887	$3,910,979
Investigation Area #10 -- Plant Entrance	$32,291	$969	$795	$8,073	$3,229	$45,356	$5,896	$20,410	$71,662	$6,367	$78,029
TOTAL CAPITAL OUTLAY-Remediation	$5,558,811	$166,764	$157,217	$1,389,703	$555,881	$7,828,376	$677,769	$1,779,735	$10,285,880	$244,658	$10,530,538

Other Costs

	Base							Engr Admin/Meetings	Annual Expenses	Present Worth	Total
Long-Term Monitoring Issues and 50% Investigation Area #7 - Surface Water Issues)	$210,000	$2,100	$248	$21,000			$2,100	$14,553	$250,000	$2,594,915	$2,594,915

TABLE 4-2. PROPOSED SAMPLE ANALYSIS MATRIX

DESCRIPTION					NUMBER OF SAMPLES TO BE ANALYZED[1]					
NUMBER	INVESTIGATION AREA	MEDIA	NUMBER OF SAMPLING SITES	SAMPLE DEPTHS[3]	FIELD	DI BLANK[2]	DUP.[2]	TOTAL	NEW MONITOR WELLS	DESCRIPTION OF SAMPLING LOCATIONS
1	Conveyor Baghouse - Medford Sump	soil	3	every 5' to groundwater	36	NA	4	40	1	Boring closest to Medford Sump will be converted to a monitor well.
						NA	0			
						0	0			
2	Boneyard/Slag	soil	8	every 5' to groundwate	96	NA	9	105		Borings to be located around Boneyard to locate containment sources
3	Acid Plants 1 & 2	soil	8	every 5' to groundwate	96	NA	10	106		Acid Plants 1 & 2 including Acid Mist Precipitator Building
4	Front Slope									Western boundary of Plant
5	Smelortown	soil	3	0-2"	3	NA	0	3	3	Three new monitor wells between American Canal and Rio Grande
		soil	3	every 5' to groundwater	6	NA	0	6		
6	Groundwater	groundwater	83	NA	332	4	36	368		Will sample existing monitor wells, plus add proposed wells - EP - 8 and EP - 42 when constructed.
7	Surface Water	surface water	16	NA	64	4	4	72		Sample at 7 locations in Rio Grande and 4 from American Canal. Add 1 downgradient location (SEP-6; near International Dam); sample Ponds 1,5,6 plus ephemeral pond. Collect surface grabs at Rio Grande locations. Collect bottom sediment at American Canal locations.
			16	bottom sediment	64	NA	4	68		
8	Building and Unloading Buildings	soil	9	every 5' to groundwater	117	NA	13	130	5	Locations equivalent to those areas with lead concentrations >5,000 mg/kg at 4-5' interval. 4 wells in locations of max concentrations of lead and arsenic, and 1 well in receiving area.
9	Ponds 1, 5, 6	sediment	26	0-2"	26	NA	1	27		All locations will correspond to Work Plan (Hydrometrics, 1996)
		subsurface soil	26	every 1' to 55	78	NA	3	78		
		subsurface soil	26		26	NA	1	27		
10	Plant Entrance – Storm Water Sump	soil	2	every 2' to groundwater	20	NA	2	22	2	Convert 2 borings to monitor wells, to be completed below new Sump is installed. 1 after sump is installed.
11	EP-84 (Southern Arroyo)	soil	30	every 1' to 5	150	NA	15	165	4	Investigate up/downgradient of wells EP-84 to EP-83.
		soil	10	every 5' to groundwate	40	NA	4	44		10 borings advanced to water table; convert 6 to monitor wells.
12	Ephemeral Pond and Pond Sediment Storage Area	soil	5	every 5' to groundwater	30	NA	3	33	1	Pond Sediment Storage Area (PSSA); ephemeral pond; 1 boring in PSSA to be converted to monitor well; 1 boring upgradient of Ephemeral Pond to be converted to monitor well.
		soil	6	every 5' to groundwate	30	NA	3	33	1	
13	EP-13 (Sample Mill) Area	soil	5	every 5' to groundwater	70	NA	7	77	3	5 borings; 3 to be converted to monitor wells. Locations for new monitor wells: east of EP-13, west of EP-13, and north of EP-13.
						1	1			
14	South Staging Area	soil	10	every 5' to groundwate	10	NA	11	111		Borings will be located around South Staging Arroyo to identify containment source
	TOTALS	soil	89	all depths	794	NA	88	882		
		groundwater[1]	83	NA	332	4	36	372		
		surface water[1]	16	NA	64	4	4	72		
		bottom sediment	16	surface	64	NA	4	68		
		pond sediment/soil	26	all depths	130	NA	5	135		

NOTES NA = Not Applicable DI = Deionized Water DUP = Duplicate Mg/kg = milligrams per kilogram.

(1) Number of samples reflects four quarterly events in a one-year period.

(2) QA/C samples are figured based on one in twenty per Investigation Area. Depending on actual sampling events and conditions, the number of QA/QC samples collected may be more or fewer than those listed.

(3) Soil borings to shallow depths and to groundwater will be drilled using the same measures. Soil samples will be collected at five foot intervals, beginning just below slag where present. First two samples will be submitted for initial analysis.
In areas with no slag, a surface sample will also be collected prior to drilling.

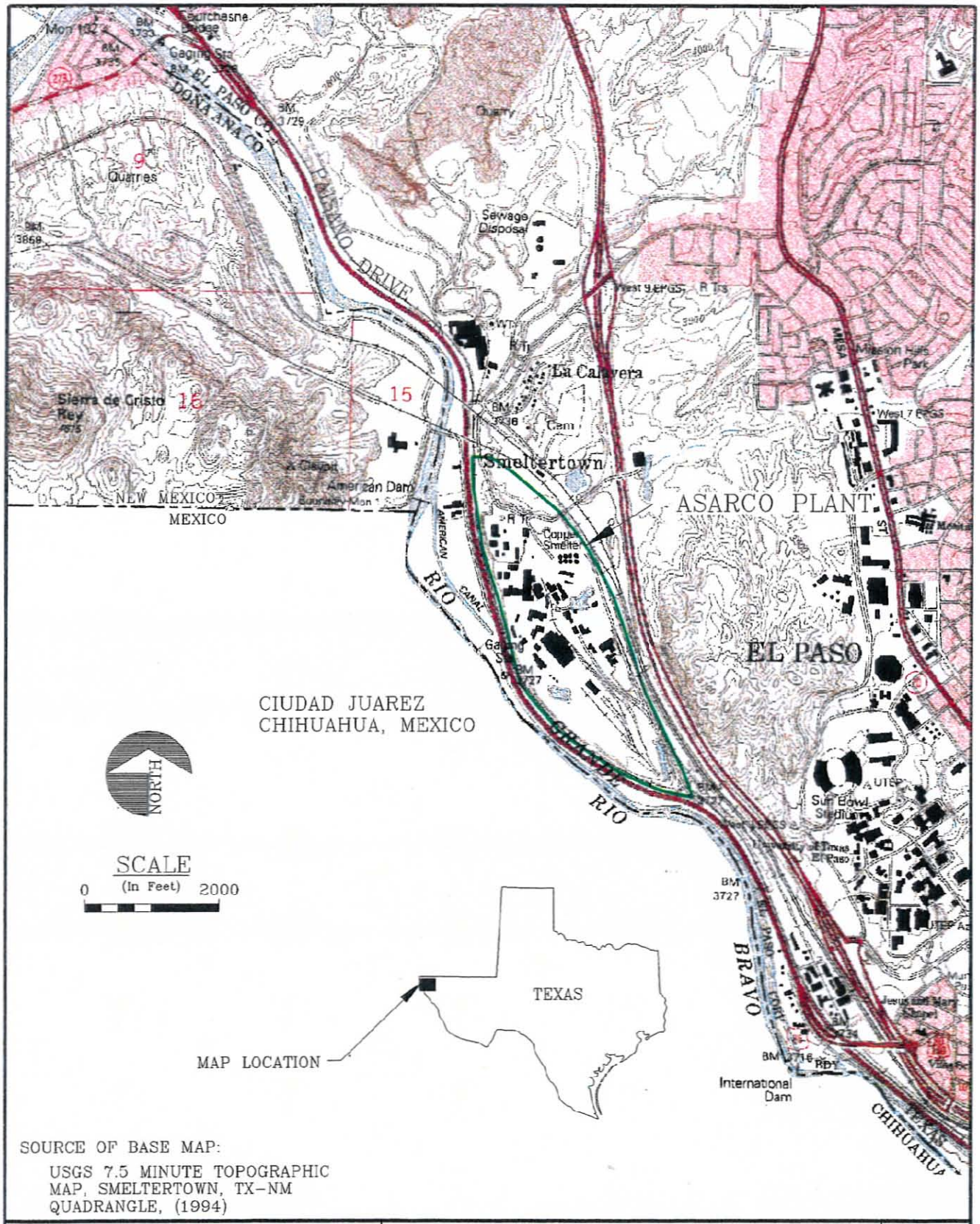
NOTES: Judgment will be used to collect samples from stained soil areas, and the remaining samples will be collected systematically at approximately equally spaced distances along the base of the slope. Solid slag and large pieces of slag are to be excluded from the samples.

All wells shown on Exhibit 2 are to be sampled. Soil samples to be collected at five foot intervals during new well installations.

Hydrometrics, 1996. Asarco El Paso Smelter Redial Investigation Work Plan, El Paso, Texas. November 1996.

FIGURES

FIGURES



SOURCE OF BASE MAP:

USGS 7.5 MINUTE TOPOGRAPHIC MAP, SMELTERTOWN, TX-NM QUADRANGLE, (1994)

ASARCO INCORPORATED EL PASO COPPER SMELTER REMEDIAL INVESTIGATION REPORT EL PASO, TEXAS	PROJECT VICINITY MAP	FIGURE 1-1

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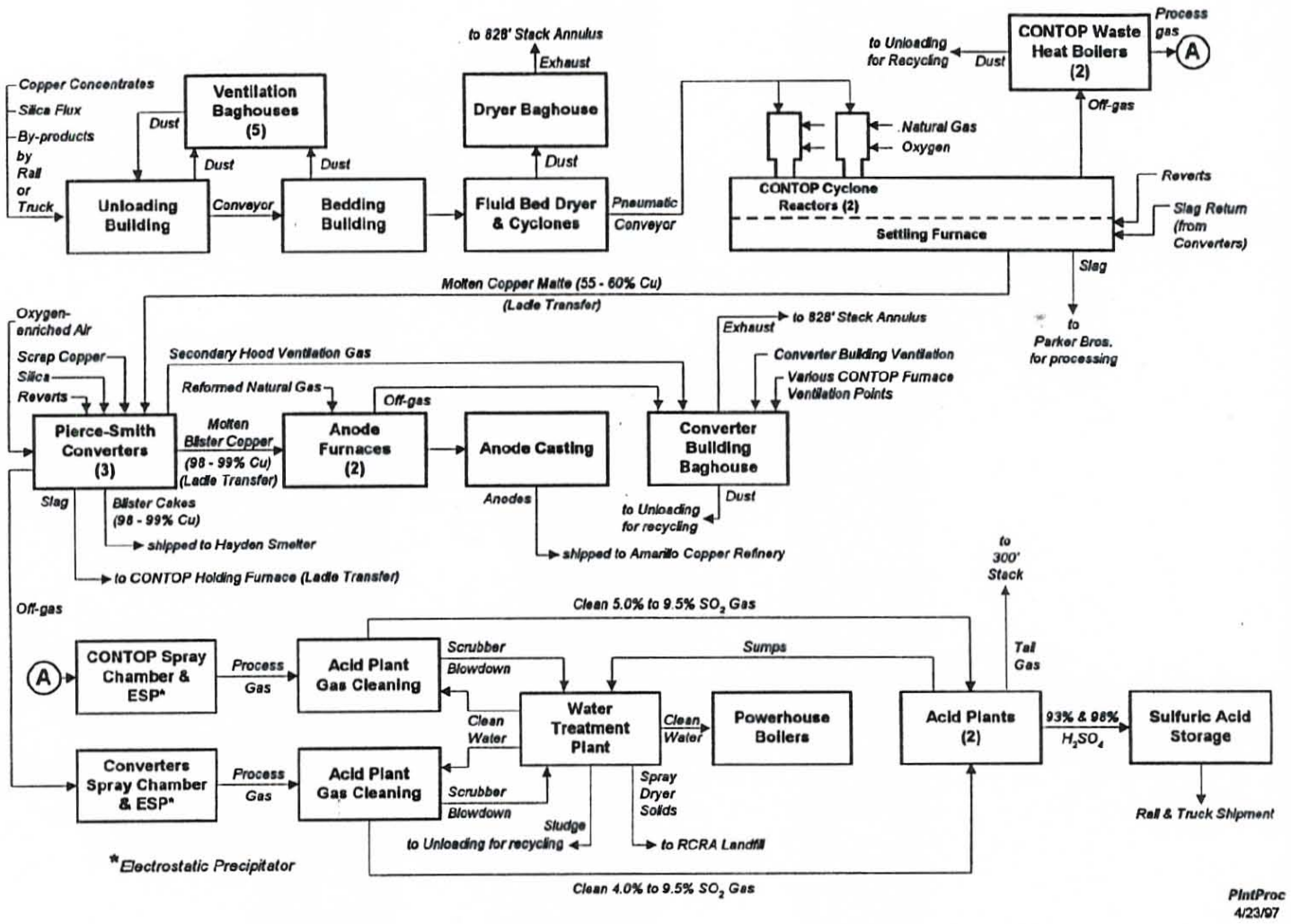

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EL PASO, TEXAS

PROCESS DIAGRAM

FIGURE
1-2

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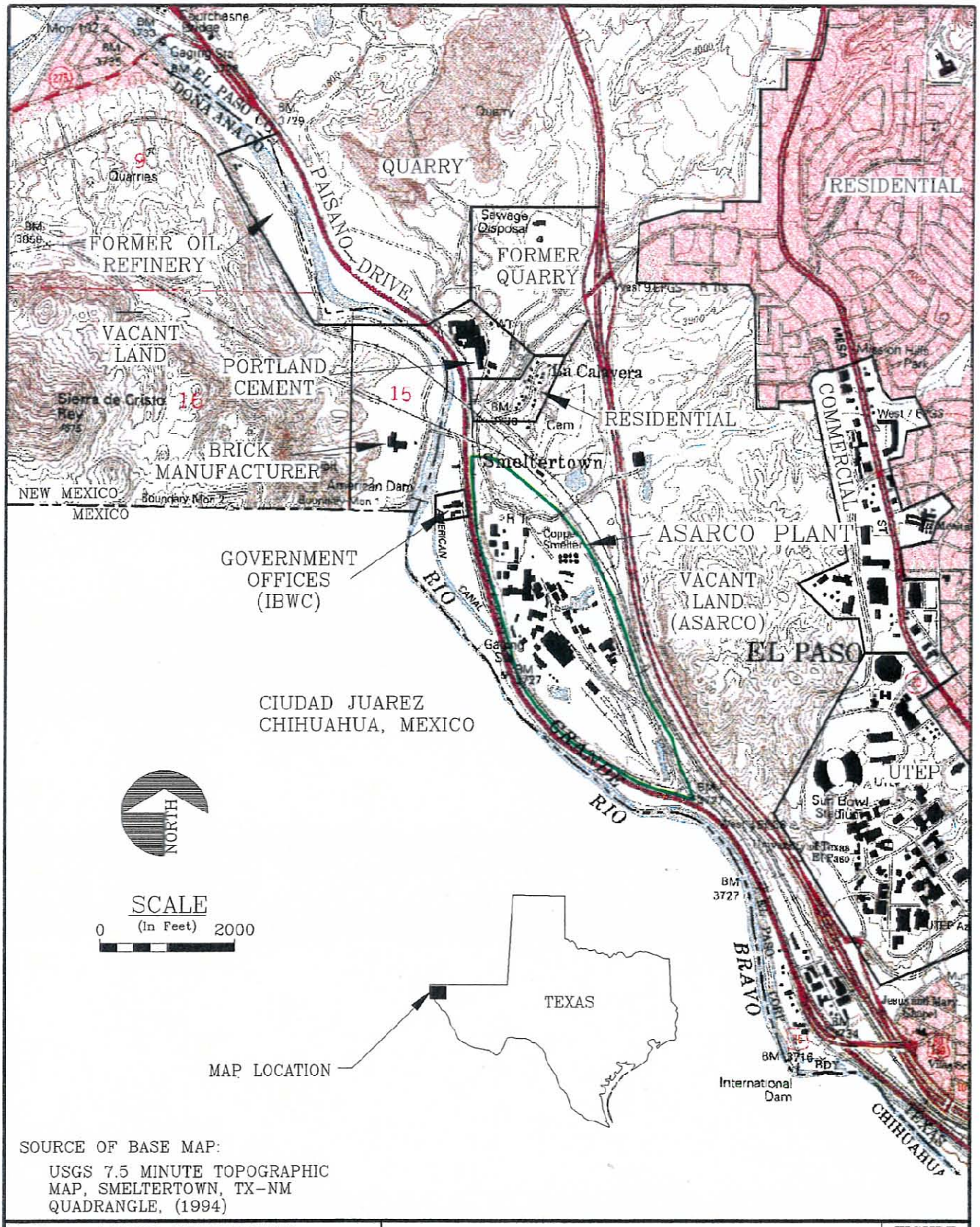

SOURCE OF BASE MAP:

USGS 7.5 MINUTE TOPOGRAPHIC MAP, SMELTERTOWN, TX-NM QUADRANGLE, (1994)

ASARCO INCORPORATED EL PASO COPPER SMELTER REMEDIAL INVESTIGATION REPORT EL PASO, TEXAS	ADJACENT LAND USE	FIGURE 1-3

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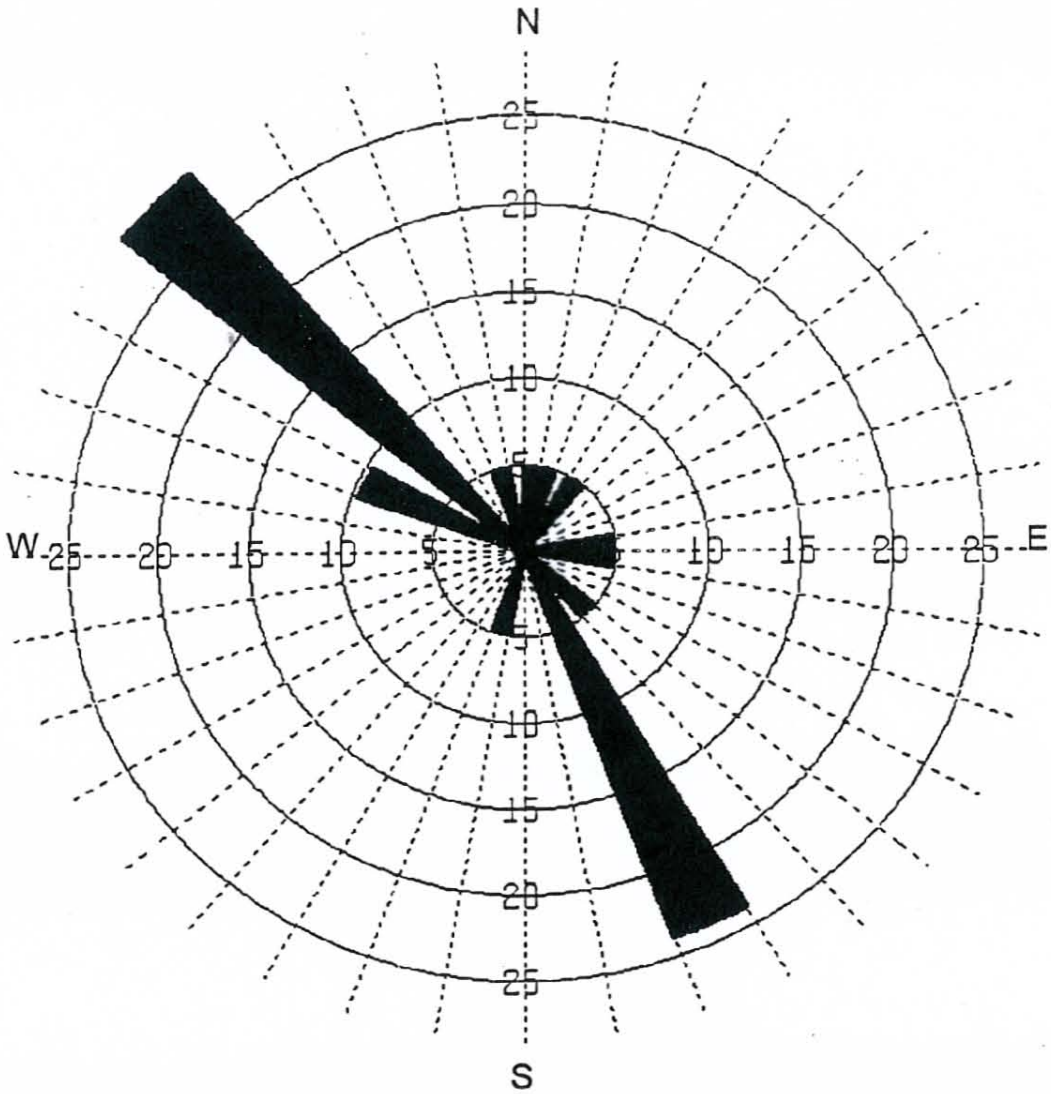
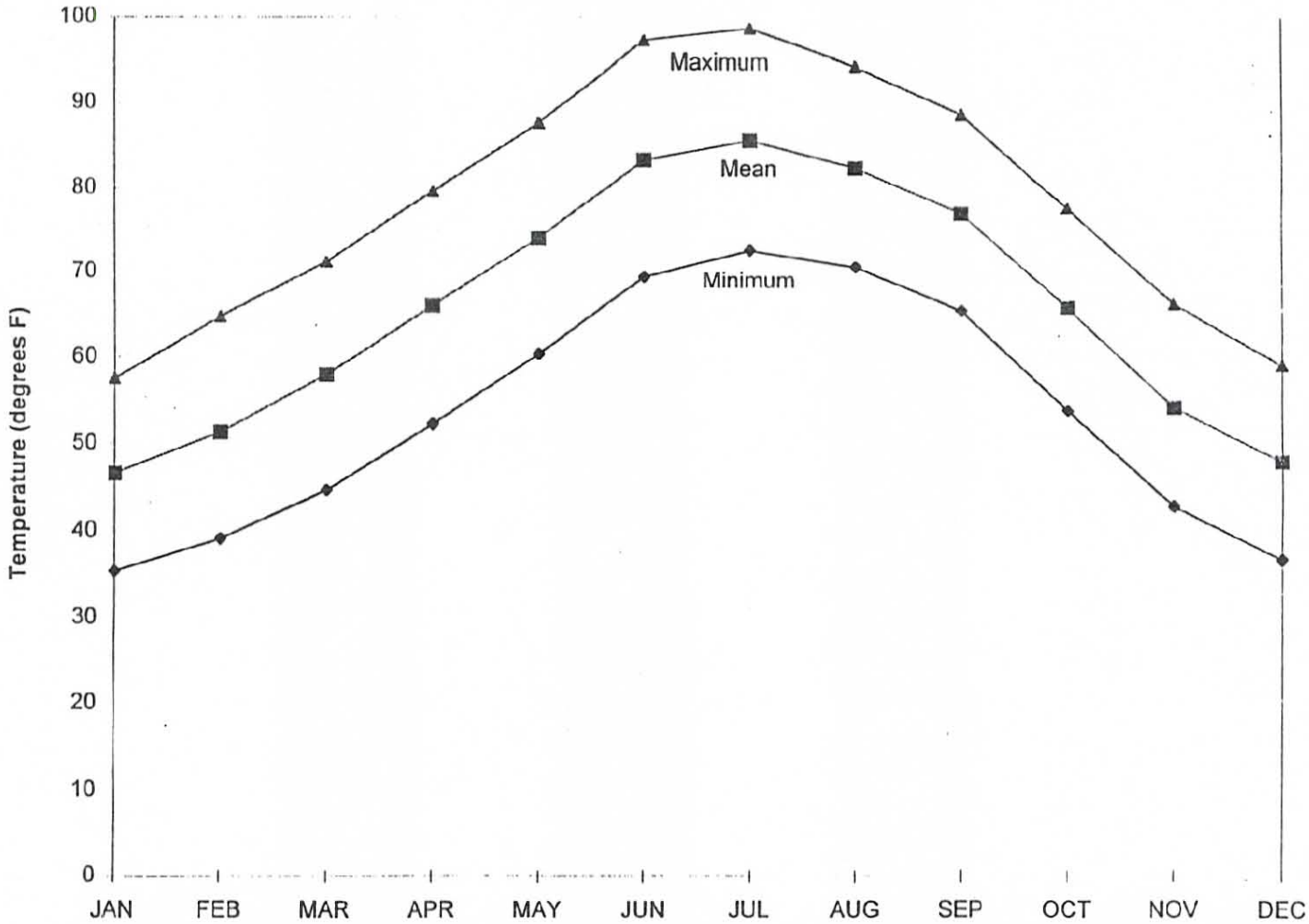


Figure 1-4
Annual Wind Rose for the Asarco El Paso Plant
(1977-1986)

NOTE: Wind rose shows the direction from which the wind blows as a percentage of time. The northwesterly winds predominate in the winter months (November through May) while the southeasterly winds predominate in the summer months (June through October).

Source: Jaco, 1971.

Figure 1-5
Average Monthly Temperatures at the Asarco El Paso Plant



Source: Hydrometrics, 1996d.

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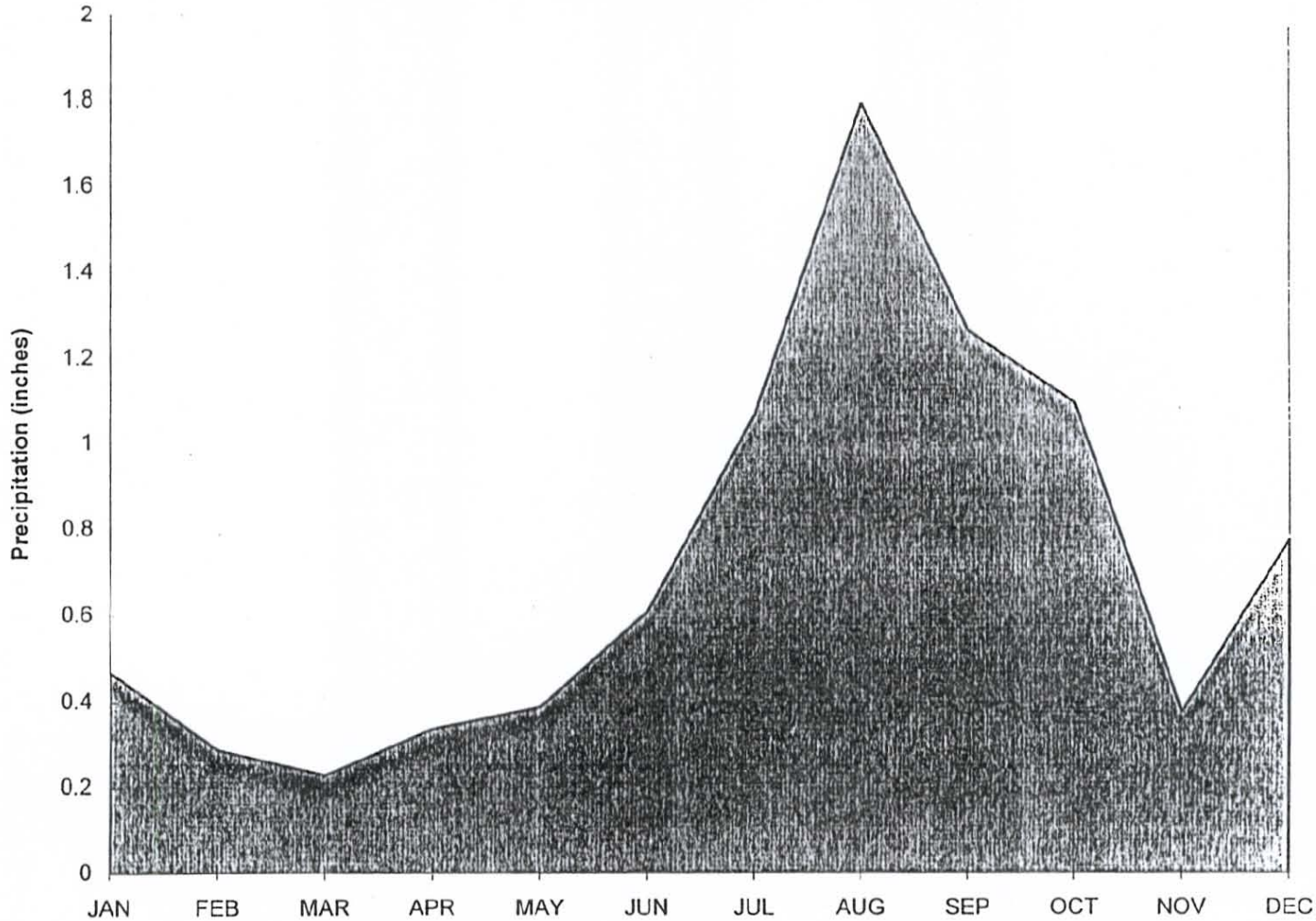
Figure 1-6
Average Monthly Precipitation at the Asarco El Paso Plant



Source: Hydrometrics, 1996d.

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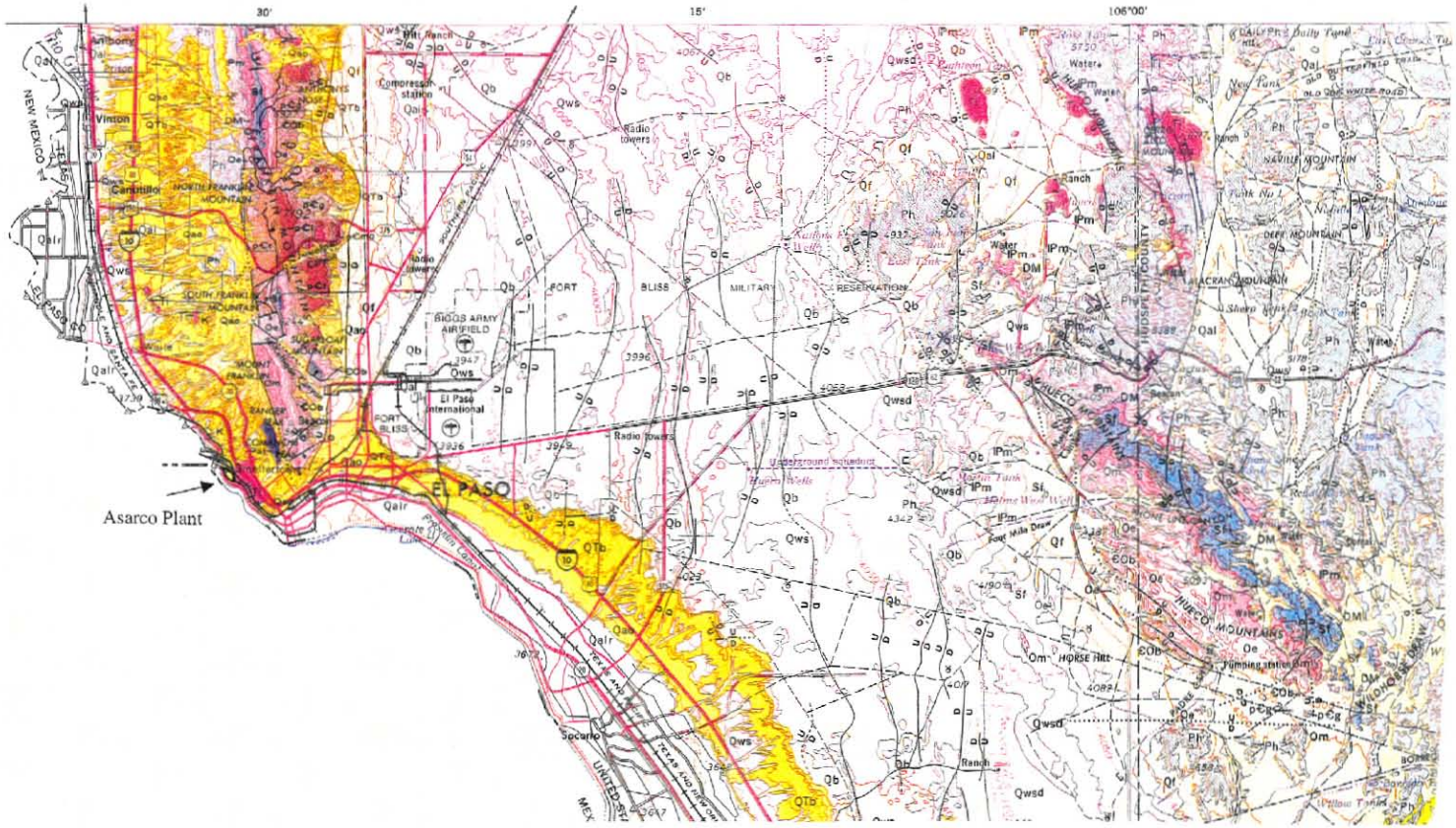

Scale 1:250,000

5 0 5 10 15 20 25 30 Kilometers

5 0 5 10 15 20 Statute Miles

MAP SOURCE: BUREAU OF ECONOMIC GEOLOGY, GEOLOGIC ATLAS OF TEXAS, 1995. VAN HORN – EL PASO SHEET

See Figure 1-7a for explanation.

ASARCO INCORPORATED EL PASO COPPER SMELTER REMEDIAL INVESTIGATION REPORT EL PASO, TEXAS	GEOLOGIC MAP OF THE EL PASO AREA	FIGURE 1-7

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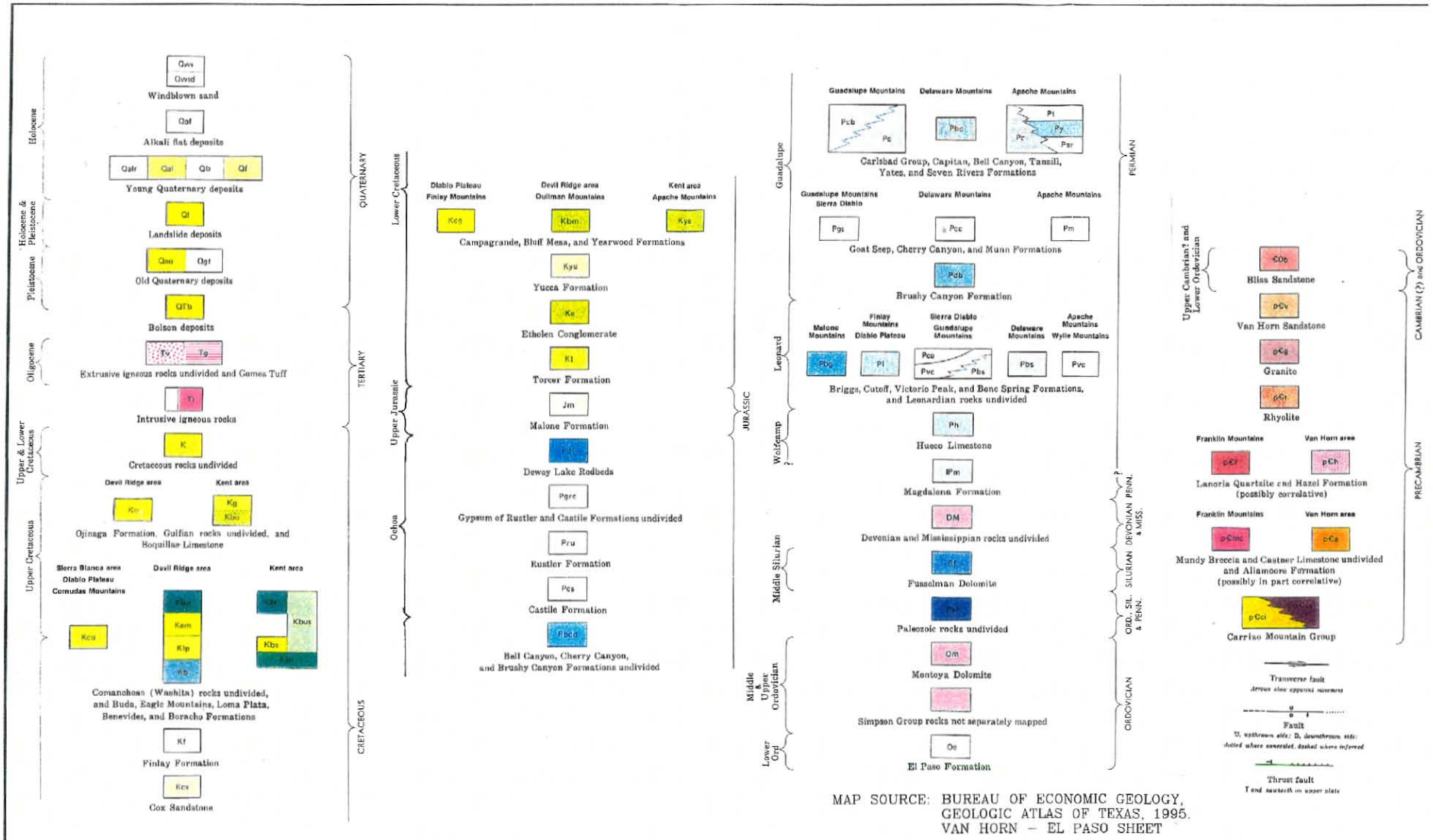

MAP SOURCE: BUREAU OF ECONOMIC GEOLOGY, GEOLOGIC ATLAS OF TEXAS, 1995. VAN HORN – EL PASO SHEET

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GEOLOGIC EXPLANATION OF THE EL PASO AREA

FIGURE 1-7a

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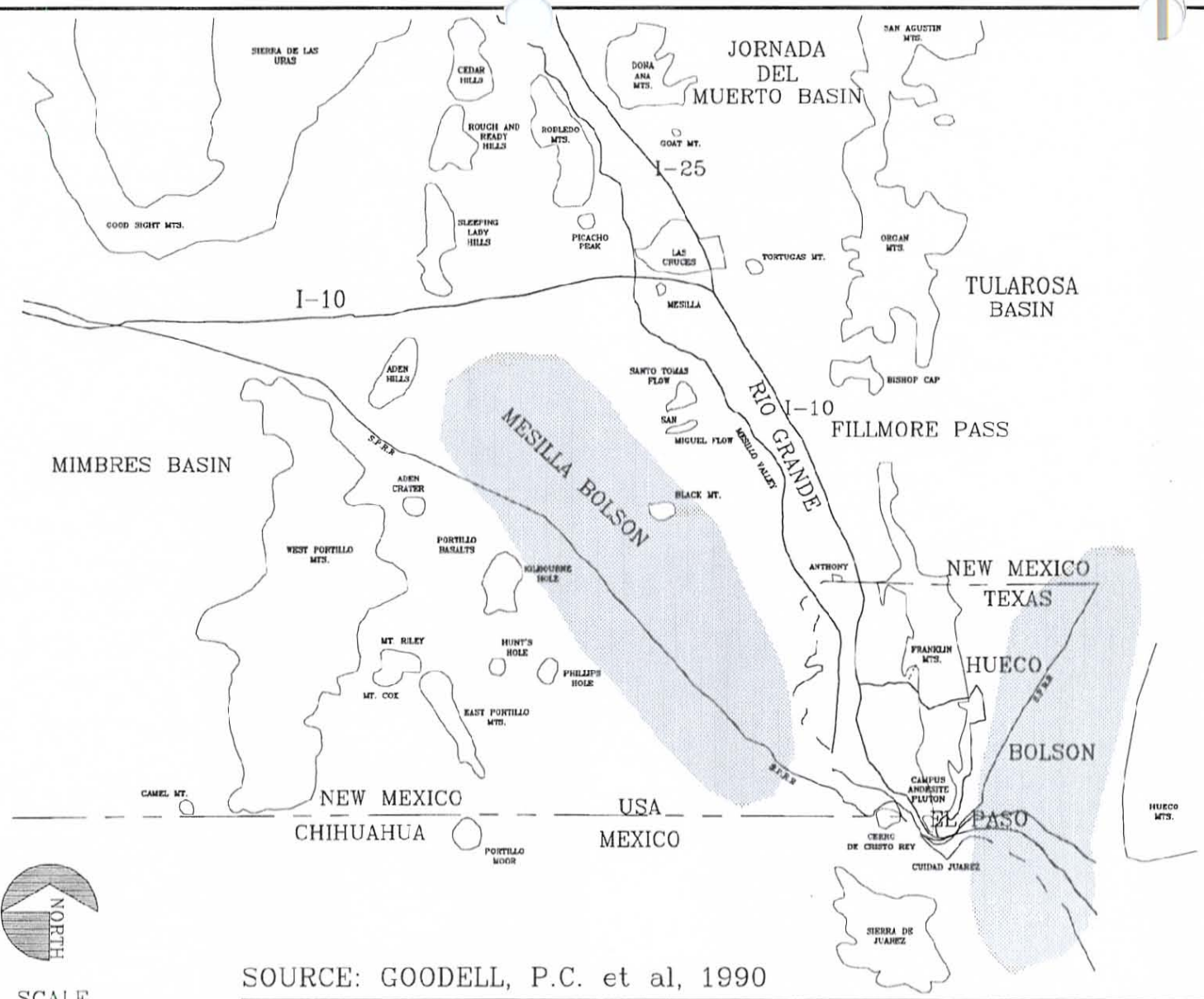

SOURCE: GOODELL, P.C. et al, 1990

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PHYSIOGRAPHIC MAP OF THE EL PASO AREA

FIGURE 1-8

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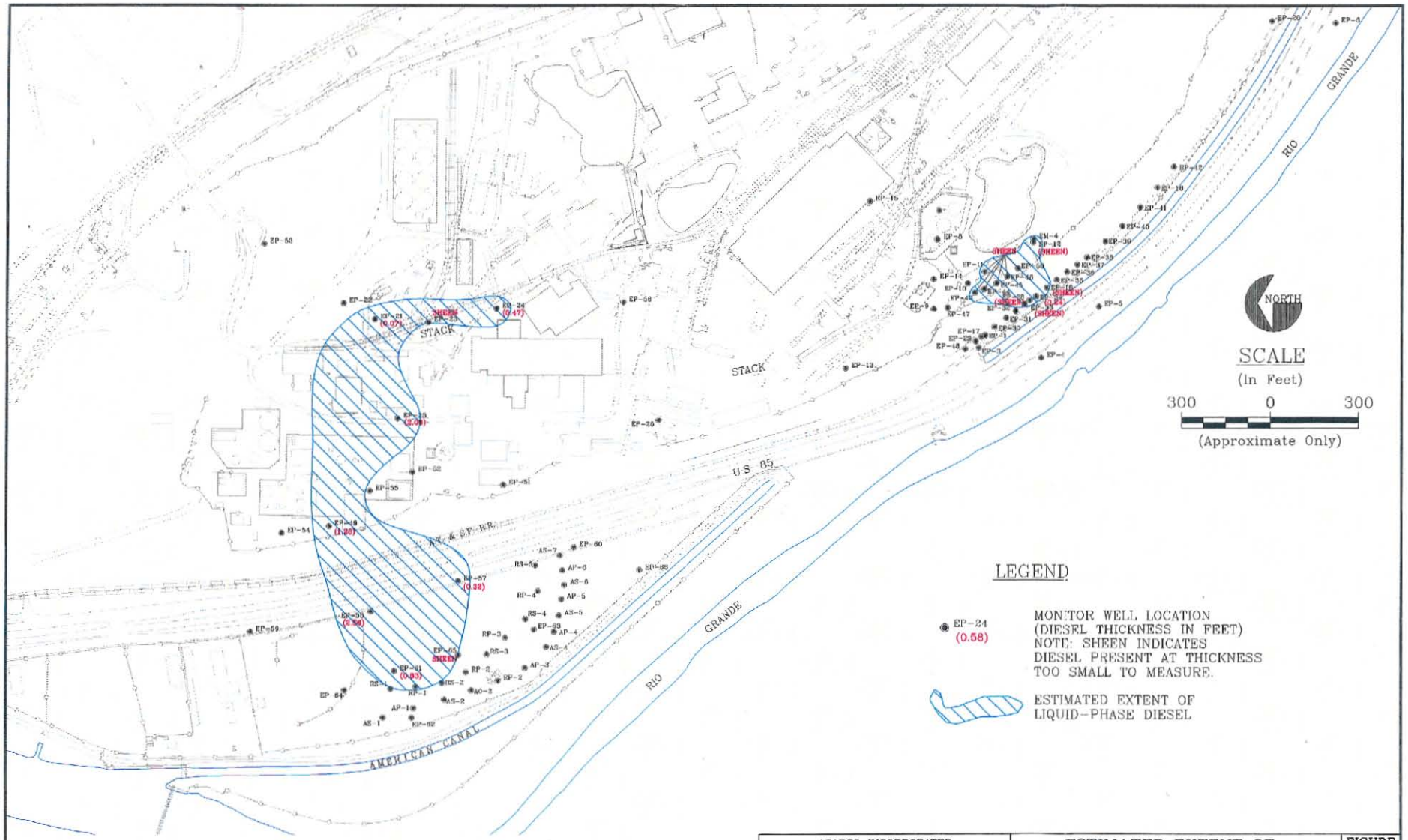

ASARCO INCORPORATED EL PASO COPPER SMELTER REMEDIAL INVESTIGATION REPORT EL PASO, TEXAS	ESTIMATED EXTENT OF LIQUID - PHASE DIESEL MAY 1998	FIGURE 1-9

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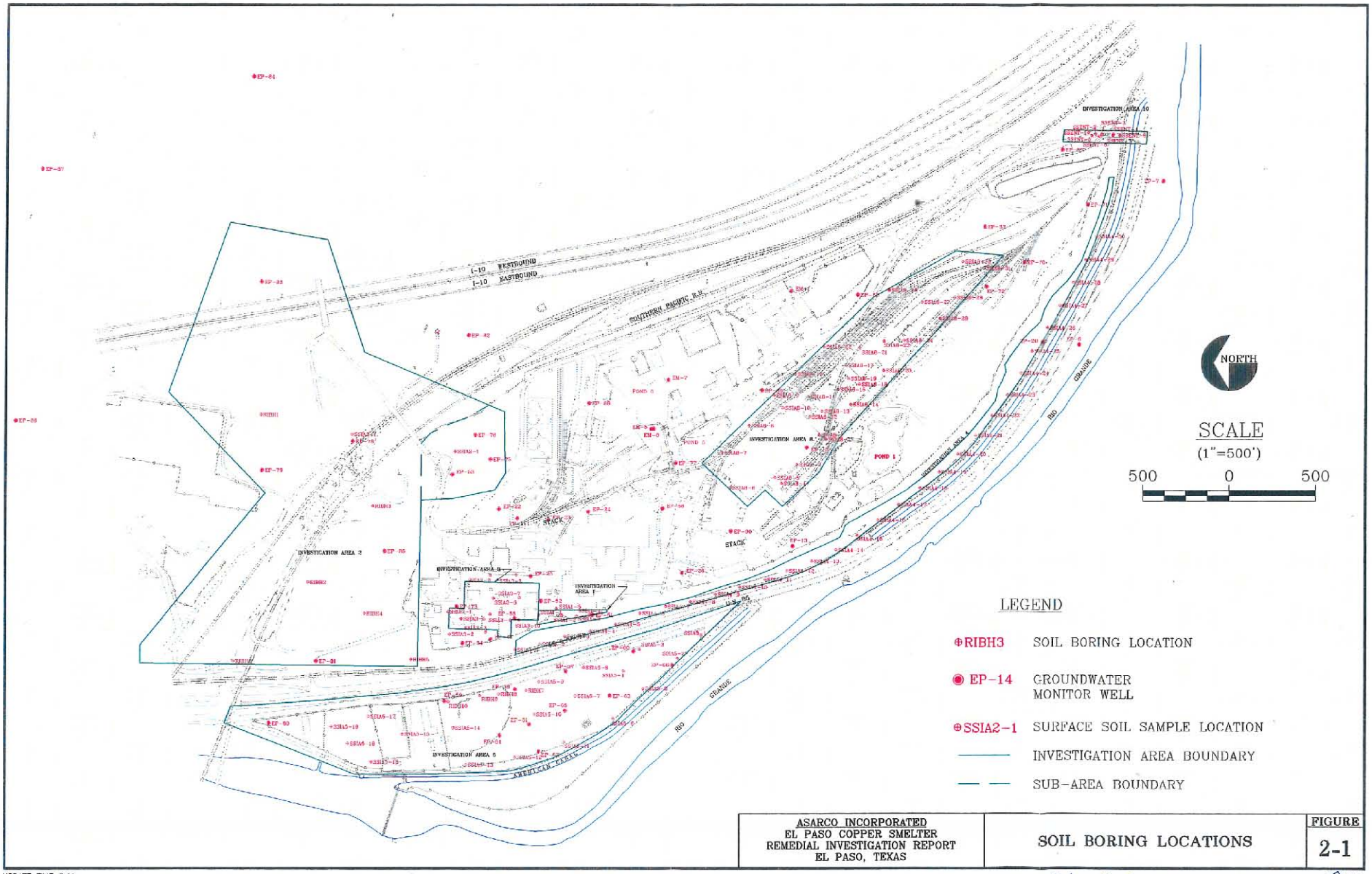

ASARCO INCORPORATED EL PASO COPPER SMELTER REMEDIAL INVESTIGATION REPORT EL PASO, TEXAS	SOIL BORING LOCATIONS	FIGURE 2-1

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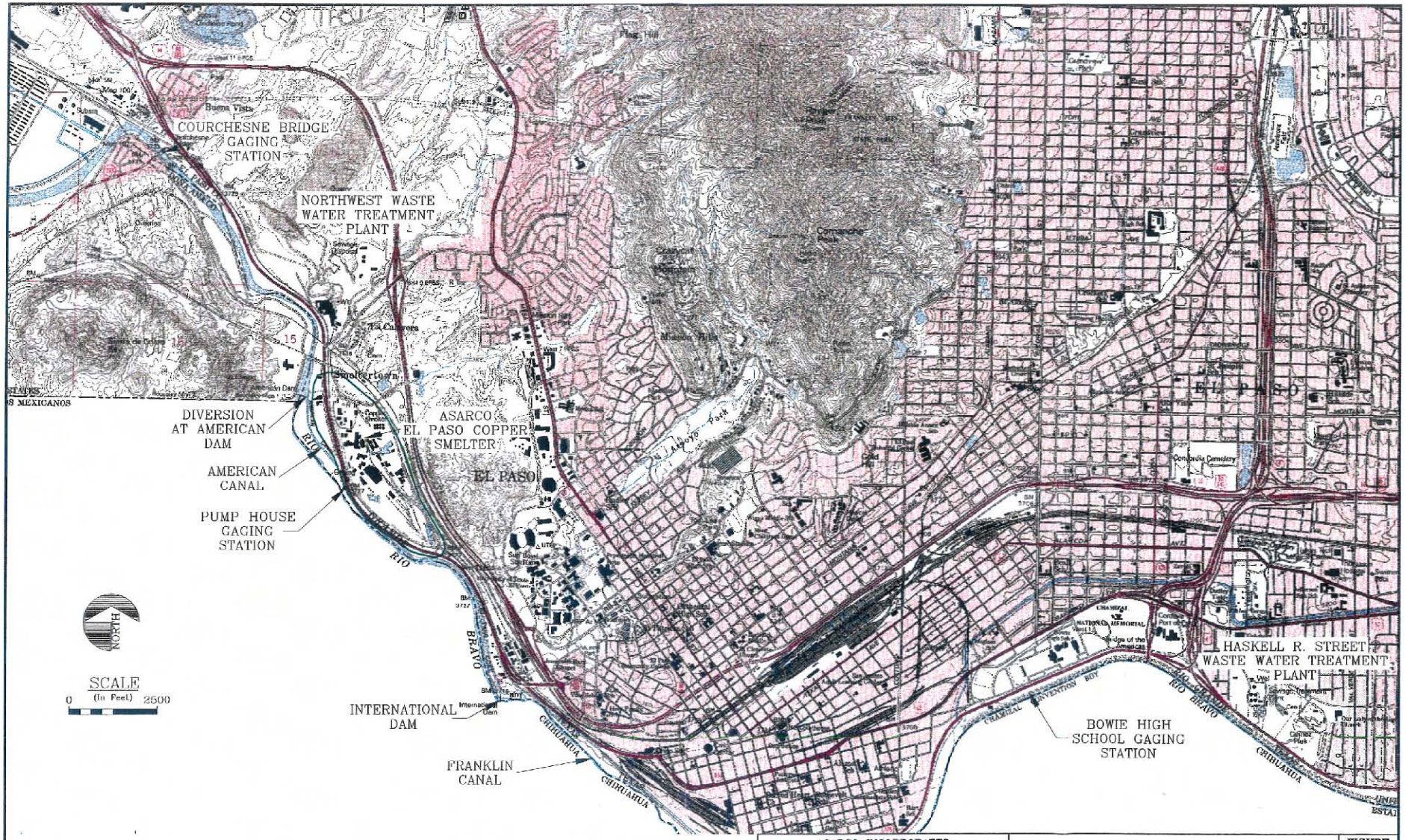

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IBWC SURFACE WATER MONITORING LOCATIONS

FIGURE 2-2

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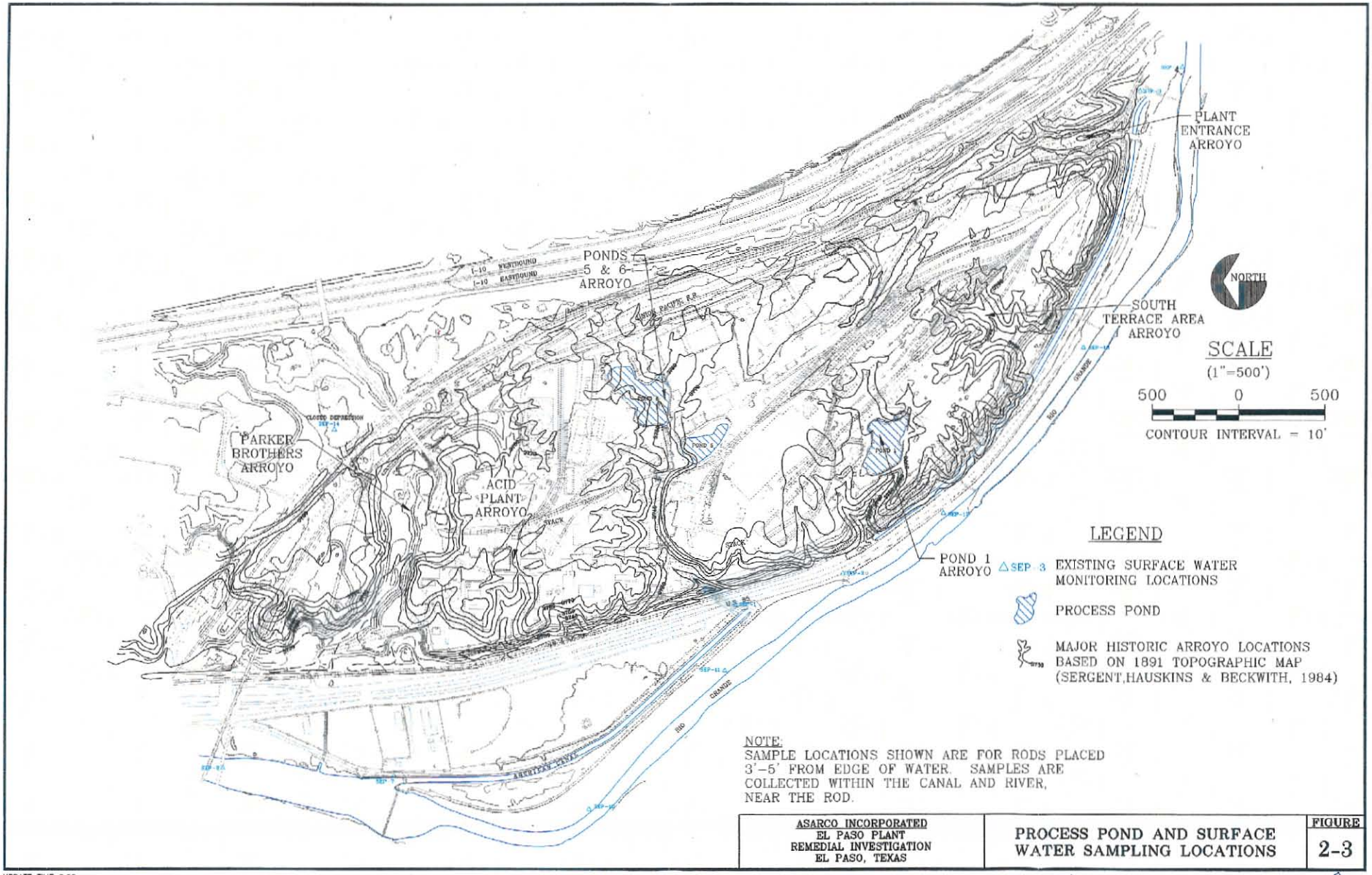

ASARCO INCORPORATED EL PASO PLANT REMEDIAL INVESTIGATION EL PASO, TEXAS	PROCESS POND AND SURFACE WATER SAMPLING LOCATIONS	FIGURE 2-3

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Figure 2-4. Water Quality Data for Rio Grande at Courchesne Bridge, August 31, 1995

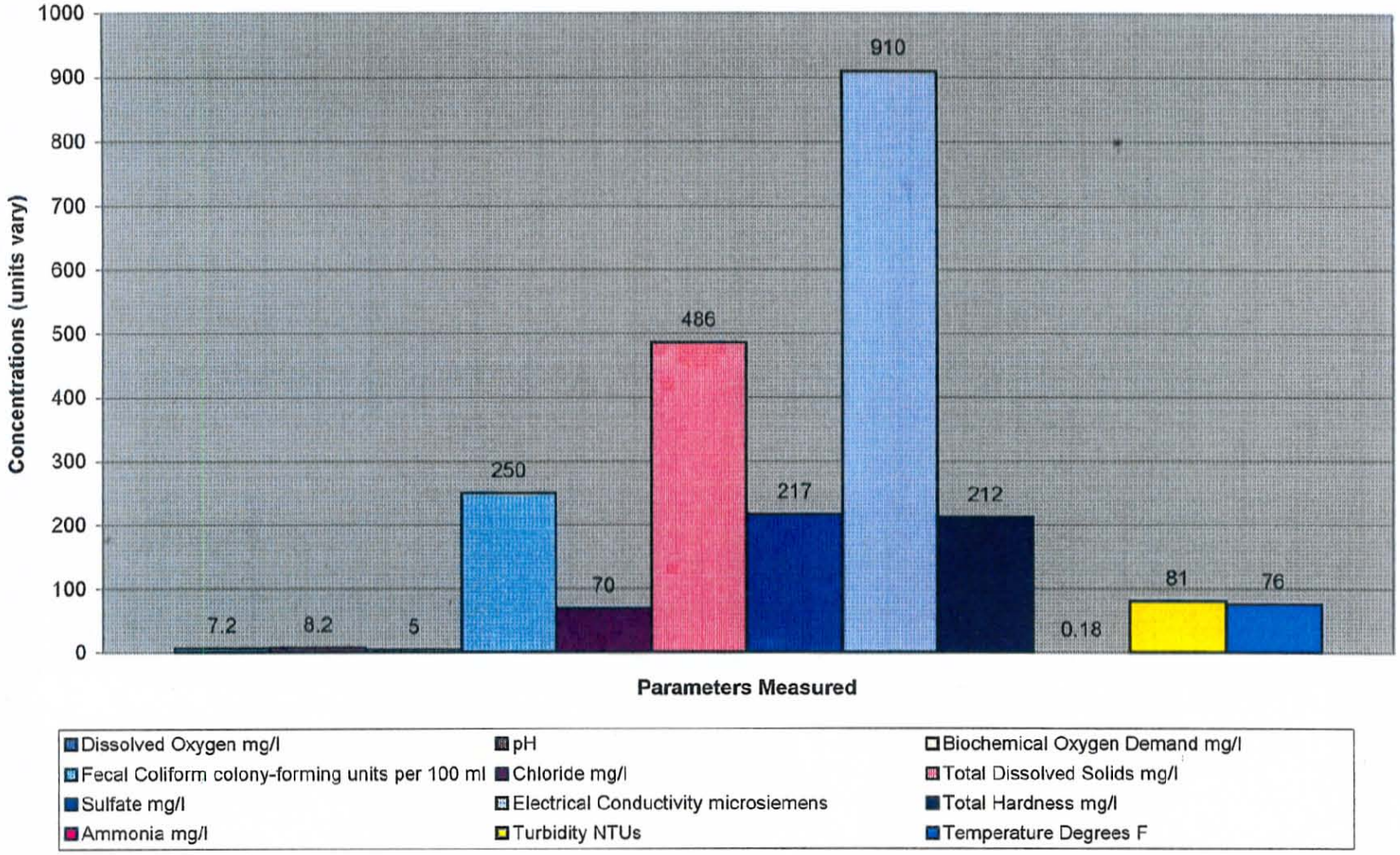

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Figure 2-5. Water Quality Data for Rio Grande at Courchesne Bridge, August 29, 1996

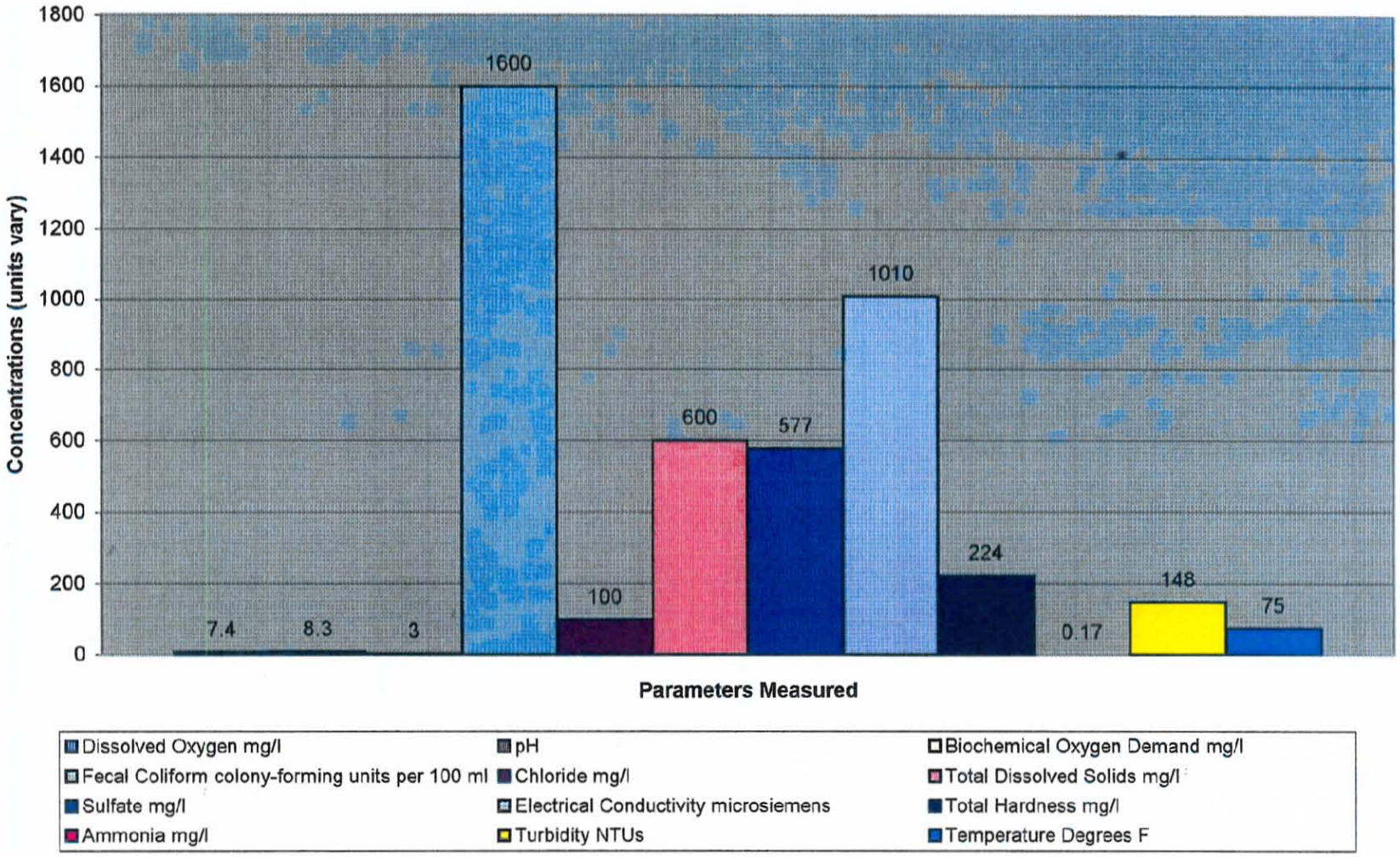

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Figure 2-6. Water Quality Data for Rio Grande at Courchesne Bridge, August 21, 1997

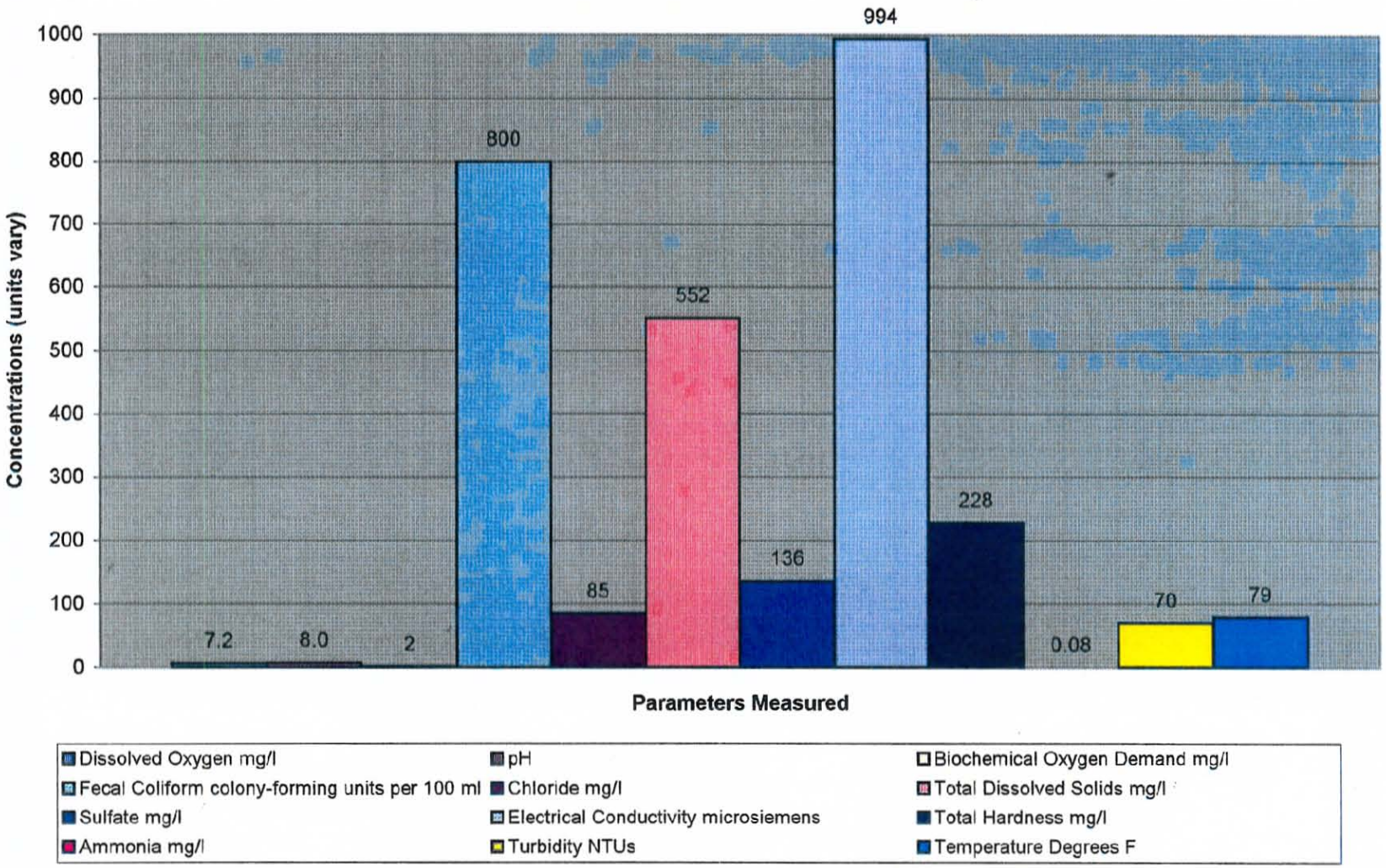

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Figure 2-7. Water Quality Data for Rio Grande at Bowie High Football Stadium, August 31, 1995

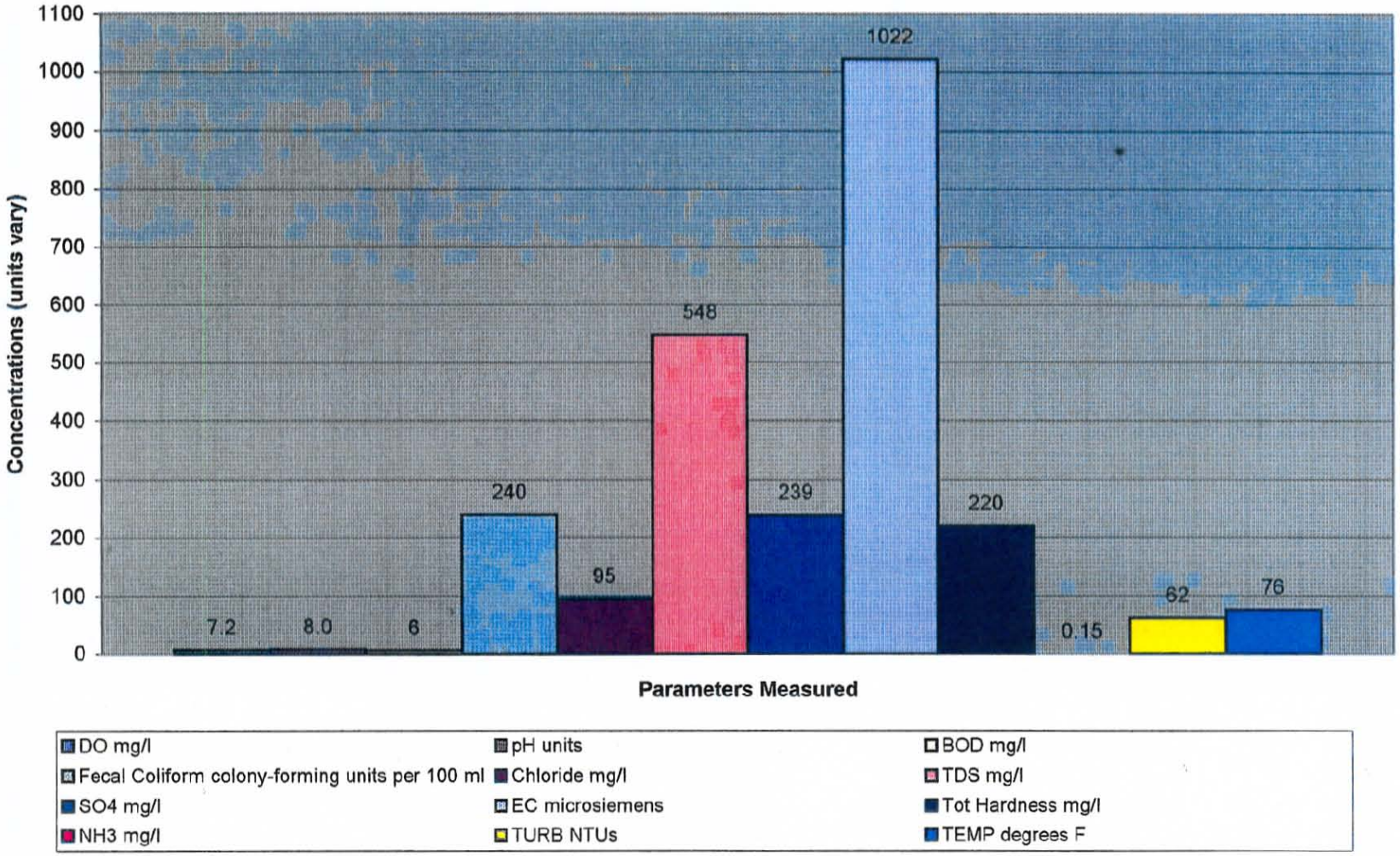

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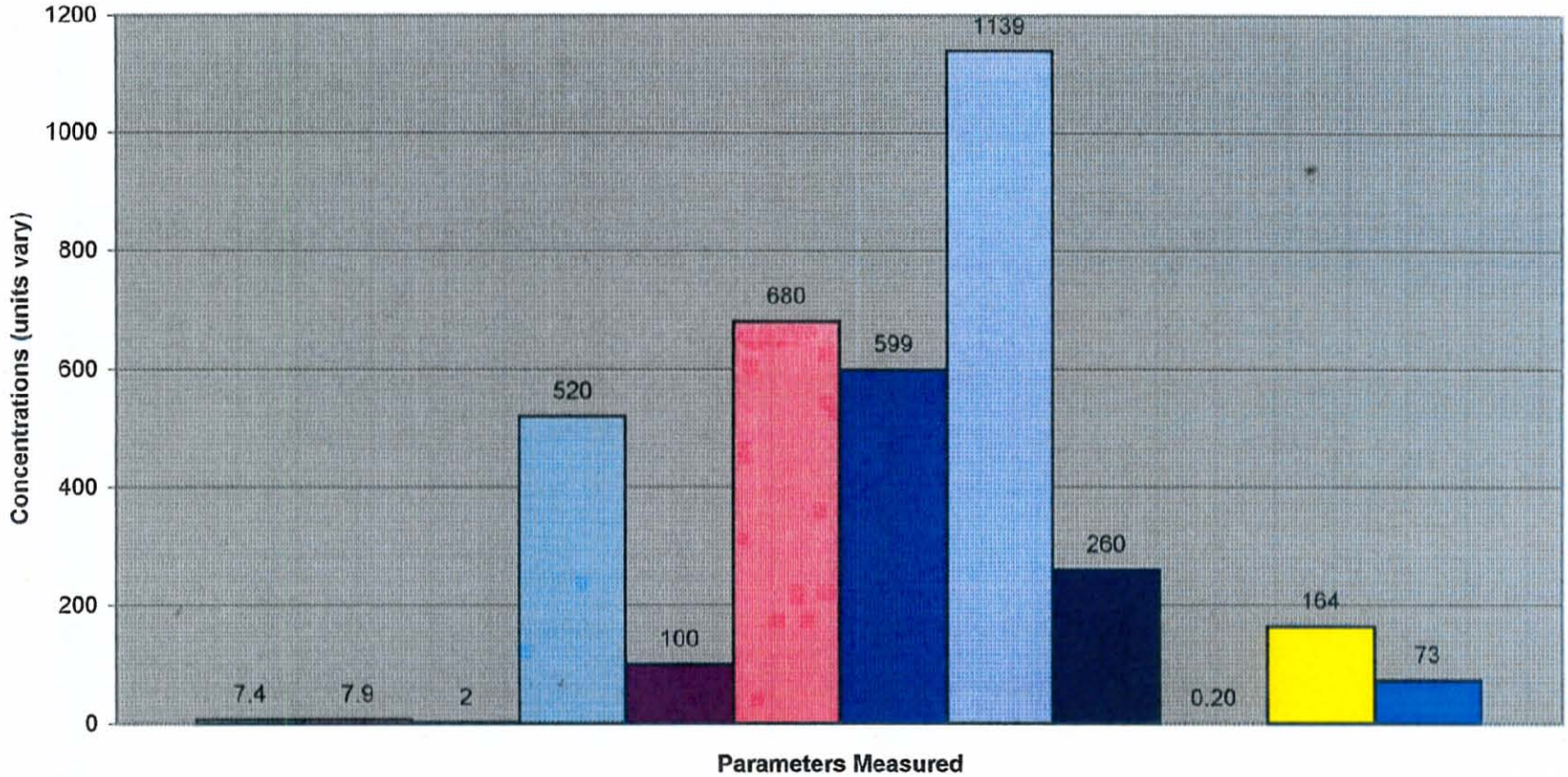
Figure 2-8. Water Quality Data for Rio Grande at Bowie High Football Stadium, August 29, 1996



DO mg/l	pH units	BOD mg/l
Fecal Coliform colony-forming units per 100 ml	Chloride mg/l	TDS mg/l
SO4 mg/l	EC microsiemens	Tot Hardness mg/l
NH3 mg/l	TURB NTUs	TEMP degrees F

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Figure 2-9. Water Quality Data for Rio Grande at Bowie High Football Stadium, August 28, 1997

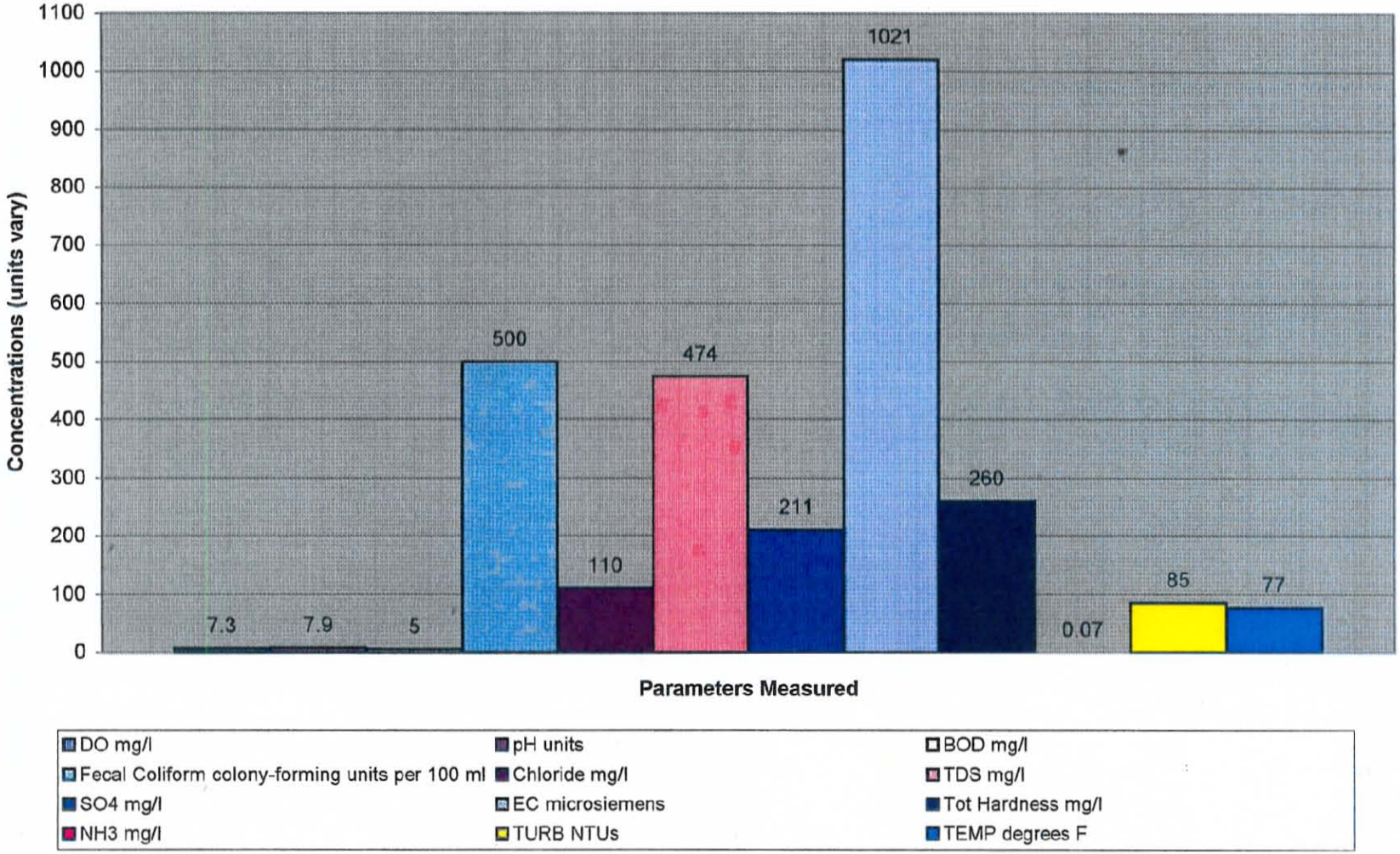

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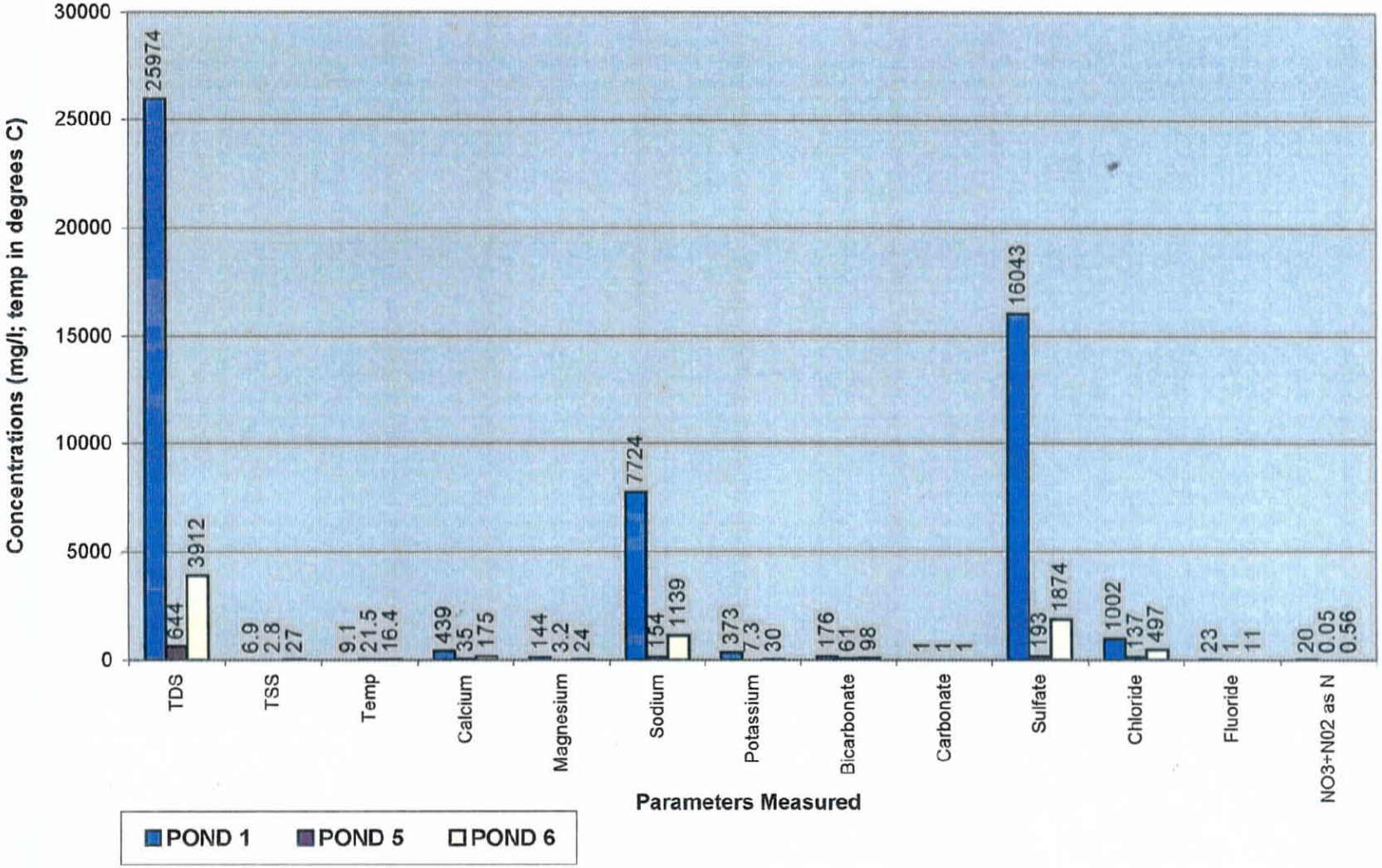
Figure 2-10. Water Quality Data for Ponds 1, 5 and 6
Sampled December 12, 1997



H:\FILES\128\0734\RIREPORT\FIGURES\H20anal\Figure 2-10 WQ ponds\TUC\9/15/98\065