

- Further, XRD analysis has shown that slag is composed of about 30% magnetite and other Fe rich minerals. This finding helps explain the observed increase in Fe in metal impacted soils.
- CCSEM analysis of the select samples also clearly shows abundant slag particles enriched in both Pb and As. This confirms that slag is a major source of Pb and As to the residential soils. SEM analysis also reveals that the slag sample does contain some particles containing Pb, As and other metals, but no Fe; this may explain some of the observed Pb and As enrichment not explained by the Fe/Pb mixing line. The SEM analysis also points to several other Pb sources in the residential soils. For example, Pb in paint is found in one sample, Pb with P and Ca was found in several samples, suggesting fertilizer use, and Pb in Ca, Al and Si phases were also found, suggesting a natural occurrence associated with shales and limestones native to the area.
- The effect of background levels of Pb and As have not yet been figured into this analysis. This is also under investigation.

EPA Samplin Results  
San Marcos  
Sampling daste August 3, 2001  
Method of Analysis 6010B

SMS01-004-51-01	080301007-57	220	6.0	26	3.0
SMS01-004-51-02	080301007-58	560	15	59	3.0
SMS01-005-51-01	080301007-55	111	3.0	16	3.0
SMS01-005-51-02	080301007-56	270	12	21	3.0
SMS01-006-51-01	080301007-53	200	6.0	22	3.0
SMS01-006-51-02	080301007-54	480	15	62	3.0
SMS01-007-51-01	080301007-51	140	6.0	18	3.0
SMS01-007-51-02	080301007-52	95	3.0	6.7	3.0
SMS01-008-51-01	080301007-50	140	6.0	14	3.0
SMS01-009-51-01	080301007-48	190	6.0	24	3.0
SMS01-009-51-02	080301007-49	150	6.0	13	3.0
SMS01-009-52-01	080301007-85	240	12	23	3.0
SMS01-009-52-02	080301007-84	180	6.0	10	3.0
SMS01-010-51-01	080301007-46	68	3.0	<5.0	5.0
SMS01-010-51-02	080301007-47	34	3.0	<3.0	3.0
SMS01-011-51-01	080301007-44	100	3.0	12	3.0
SMS01-011-51-02	080301007-45	120	3.0	16	3.0
SMS01-012-51-01	080301007-42	45	3.0	<3.0	3.0
SMS01-012-51-02	080301007-43	69	3.0	4.4	3.0
SMS01-013-51-01	080301007-40	100	3.0	<3.0	3.0
SMS01-013-51-02	080301007-41	170	6.0	4.9	3.0
SMS01-014-51-01	080301007-38	150	6.0	11	3.0
SMS01-014-51-02	080301007-39	220	6.0	16	3.0
SMS01-015-51	080301007-37	70	3.0	8.7	3.0
SMS01-016-51	080301007-36	43	3.0	<3.0	3.0
SMS01-017-51	080301007-34	32	3.0	<5.0	5.0
SMS01-017-51	080301007-35	120	3.0	<3.0	3.0
SMS01-018-51	080301007-32	19	3.0	<3.0	3.0
SMS01-018-51	080301007-33	13	3.0	<3.0	3.0
SMS01-019-51-01	080301007-30	25	3.0	<3.0	3.0
SMS01-019-51-02	080301007-31	17	3.0	<3.0	3.0
SMS01-025-51-01	080301007-28	260	15	34	3.0
SMS01-025-51-02	080301007-29	110	3.0	15	3.0
SMS01-026-51-01	080301007-26	180	6.0	17	3.0
SMS01-026-51-02	080301007-27	850	30	28	3.0
SMS01-027-51-01-	080301007-24	180	6.0	23	3.0
SMS01-027-51-02	080301007-25	57	3.0	14	3.0
SMS01-028-51-01	080301007-22	210	6.0	25	3.0

EPA Samplin Results  
San Marcos  
Sampling daste August 3, 2001  
Method of Analysis 6010B

SMS01-028-51-02	080301007-23	240	12	28	3.0
SMS01-029-51-01	080301007-20	210	6.0	22	3.0
SMS01-029-51-02	080301007-21	88	3.0	11	3.0

**RESULTS OF *IN VITRO* TESTING:  
BIOACCESSABILITY OF LEAD AND ARSENIC  
IN RESIDENTIAL SOILS  
NEAR THE ASARCO COPPER SMELTER  
EL PASO, TEXAS**

January 10, 2002

Submitted to:  
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## Bioaccessability Testing Results

*In Vitro* bioaccessability testing was performed on 17 surface soil samples collected from residential properties in the vicinity of the ASARCO smelter in El Paso, Texas. The *In Vitro* testing was done in accordance with the method of Ruby et al., 1996 and as modified by Ruby et al., in 1999. Details of the methodology are attached.

For lead (Pb), *In Vitro* testing is typically accomplished by examining the mass of Pb dissolved in synthetic stomach fluid at pH 1.5 after a 1 hr contact time. Intestinal absorption of Pb is not considered significant, mainly due to the low solubility of Pb at the higher pH observed in the upper intestine (pH 5.5 to 7). Therefore, Pb bioaccessability was only measured in the stomach phase of the investigation as recommended by Ruby et al., 1999.

For arsenic (As), both the stomach phase and intestinal phase dissolution concentrations are considered significant in the *In Vitro* test. Therefore, As was determined in both phases and presented as such in the attached data summary spreadsheet. In the actual test, the stomach fluid (pH 1.5) samples were collected after 1 hr at 37 °C and then buffered to pH 7. Bile salts were added in accordance with Ruby et al., 1996. Arsenic was determined in the pH 7 (intestinal phase) after 3 hrs of equilibration. Bioaccessability is calculated as a fraction or percentage of the total sample As or Pb (e.g. mass dissolved in stomach or intestine/total mass x 100).

The attached spreadsheet (Tables 1 and 2) shows the sample id's, total sample Pb and As and the results of the *In Vitro* testing. Summary statistics for the same data is shown in Table 2. For Pb, the absolute bioaccessability ranged from 8% to 22% with a mean from the 17 samples of 12.7%, considerably less than the EPA default values for Pb bioavailability of 35%. This is not unexpected since the samples appear to contain slag like particles composed of a dense Fe rich matrix which is likely resistant to attack by acids (see speciation report). Hence, Pb associated with slag would have a fairly low solubility even at very low pH.

Arsenic absolute bioaccessability (Table 2) in the stomach (low pH) phase was only 2.5 to 15.5 % of the total sample arsenic with a mean of 6.8%. At high pH (intestinal phase), the bioaccessability ranged only from 2 to 8.7% with a mean of 5% (Table 2). As before, arsenic associated with or bound within the dense iron matrix of the slag particles would not be expected to dissolve significantly under most conditions.

Code Sheet for Analytical Data Summaries (Attached) -  
Technical Services Center-ASARCO, Salt Lake City, UT

Tech Services Sample ID	Soil Sample ID Location in El Paso	Sample Type
1A	17A	pH 1.5
1B	17A	pH 7.0
2A	3A	pH 1.5
2B	3A	pH 7.0
3A	34A	pH 1.5
3B	34A	pH 7.0
4A	6C	pH 1.5
4B	6C	pH 7.0
5A	2A	pH 1.5
5B	2A	pH 7.0
6A	1A	pH 1.5
6B	1A	pH 7.0
7A	30A	pH 1.5
7B	30A	pH 7.0
8A	11A	pH 1.5
8B	11A	pH 7.0
9A	18A	pH 1.5
9B	18A	pH 7.0
10A	24A	pH 1.5
10B	24A	pH 7.0
11A	25A	pH 1.5
11B	25A	pH 7.0
12A	16A	pH 1.5
12B	16A	pH 7.0
13A	19A	pH 1.5
13B	19A	pH 7.0
14A	32A	pH 1.5
14B	32A	pH 7.0
15A	28A	pH 1.5
15B	28A	pH 7.0
16A	27A	pH 1.5
16B	27A	pH 7.0
17A	9A	pH 1.5
17B	9A	pH 7.0
18A	17C	pH 1.5
18B	17C	pH 7.0
19A	32A DUP	pH 1.5
19B	32A DUP	pH 7.0
20A	9A DUP	pH 1.5
20B	9A DUP	pH 7.0
Reagent Blank		pH 7.0

Table 1. Results of Bioaccessibility Testing - El Paso Residential Soils

Sample ID	Total Sample As (mg/g)	Stomach Phase			% Relative Bioaccessibility	Dietary Phase			% Relative Bioaccessibility	Absolute Bioaccessibility		
		As (ug/g) in Stomach	As (ug/g) in Stomach	As (ug/g) in Stomach		As (ug/g) in Intestine	As (ug/g) in Intestine	As (ug/g) in Intestine		% Relative Bioaccessibility	% Relative Bioaccessibility	% Absolute Bioaccessibility
1A	93	82	8.20	8.20	8.82	4.41	4.41	4.41	5.16	5.16	5.16	5.16
1B	67	100	10.00	10.00	11.42	5.81	5.81	5.81	8.35	8.35	8.35	8.35
1C	110	82	8.20	8.20	12.24	6.12	6.12	6.12	6.12	6.12	6.12	6.12
2A	67	100	10.00	10.00	11.42	5.81	5.81	5.81	8.35	8.35	8.35	8.35
2B	67	100	10.00	10.00	11.42	5.81	5.81	5.81	8.35	8.35	8.35	8.35
2C	67	100	10.00	10.00	11.42	5.81	5.81	5.81	8.35	8.35	8.35	8.35
3A	49	49	4.90	4.90	6.12	3.06	3.06	3.06	3.06	3.06	3.06	3.06
3B	49	49	4.90	4.90	6.12	3.06	3.06	3.06	3.06	3.06	3.06	3.06
3C	49	49	4.90	4.90	6.12	3.06	3.06	3.06	3.06	3.06	3.06	3.06
4A	41	41	4.10	4.10	5.16	2.58	2.58	2.58	2.58	2.58	2.58	2.58
4B	41	41	4.10	4.10	5.16	2.58	2.58	2.58	2.58	2.58	2.58	2.58
4C	41	41	4.10	4.10	5.16	2.58	2.58	2.58	2.58	2.58	2.58	2.58
5A	110	110	11.00	11.00	11.42	5.81	5.81	5.81	8.35	8.35	8.35	8.35
5B	110	110	11.00	11.00	11.42	5.81	5.81	5.81	8.35	8.35	8.35	8.35
5C	110	110	11.00	11.00	11.42	5.81	5.81	5.81	8.35	8.35	8.35	8.35
6A	61	61	6.10	6.10	6.12	3.06	3.06	3.06	3.06	3.06	3.06	3.06
6B	61	61	6.10	6.10	6.12	3.06	3.06	3.06	3.06	3.06	3.06	3.06
6C	61	61	6.10	6.10	6.12	3.06	3.06	3.06	3.06	3.06	3.06	3.06
7A	40	40	4.00	4.00	5.16	2.58	2.58	2.58	2.58	2.58	2.58	2.58
7B	40	40	4.00	4.00	5.16	2.58	2.58	2.58	2.58	2.58	2.58	2.58
7C	40	40	4.00	4.00	5.16	2.58	2.58	2.58	2.58	2.58	2.58	2.58
8A	100	100	10.00	10.00	11.42	5.81	5.81	5.81	8.35	8.35	8.35	8.35
8B	100	100	10.00	10.00	11.42	5.81	5.81	5.81	8.35	8.35	8.35	8.35
8C	100	100	10.00	10.00	11.42	5.81	5.81	5.81	8.35	8.35	8.35	8.35
9A	130	130	13.00	13.00	11.42	5.81	5.81	5.81	8.35	8.35	8.35	8.35
9B	130	130	13.00	13.00	11.42	5.81	5.81	5.81	8.35	8.35	8.35	8.35
9C	130	130	13.00	13.00	11.42	5.81	5.81	5.81	8.35	8.35	8.35	8.35
10A	75	75	7.50	7.50	6.12	3.06	3.06	3.06	3.06	3.06	3.06	3.06
10B	75	75	7.50	7.50	6.12	3.06	3.06	3.06	3.06	3.06	3.06	3.06
10C	75	75	7.50	7.50	6.12	3.06	3.06	3.06	3.06	3.06	3.06	3.06
11A	61	61	6.10	6.10	6.12	3.06	3.06	3.06	3.06	3.06	3.06	3.06
11B	61	61	6.10	6.10	6.12	3.06	3.06	3.06	3.06	3.06	3.06	3.06
11C	61	61	6.10	6.10	6.12	3.06	3.06	3.06	3.06	3.06	3.06	3.06
12A	160	160	16.00	16.00	11.42	5.81	5.81	5.81	8.35	8.35	8.35	8.35
12B	160	160	16.00	16.00	11.42	5.81	5.81	5.81	8.35	8.35	8.35	8.35
12C	160	160	16.00	16.00	11.42	5.81	5.81	5.81	8.35	8.35	8.35	8.35
13A	87	87	8.70	8.70	6.12	3.06	3.06	3.06	3.06	3.06	3.06	3.06
13B	87	87	8.70	8.70	6.12	3.06	3.06	3.06	3.06	3.06	3.06	3.06
13C	87	87	8.70	8.70	6.12	3.06	3.06	3.06	3.06	3.06	3.06	3.06
14A	159	159	15.90	15.90	11.42	5.81	5.81	5.81	8.35	8.35	8.35	8.35
14B	159	159	15.90	15.90	11.42	5.81	5.81	5.81	8.35	8.35	8.35	8.35
14C	159	159	15.90	15.90	11.42	5.81	5.81	5.81	8.35	8.35	8.35	8.35
15A	200	200	20.00	20.00	11.42	5.81	5.81	5.81	8.35	8.35	8.35	8.35
15B	200	200	20.00	20.00	11.42	5.81	5.81	5.81	8.35	8.35	8.35	8.35
15C	200	200	20.00	20.00	11.42	5.81	5.81	5.81	8.35	8.35	8.35	8.35
16A	140	140	14.00	14.00	11.42	5.81	5.81	5.81	8.35	8.35	8.35	8.35
16B	140	140	14.00	14.00	11.42	5.81	5.81	5.81	8.35	8.35	8.35	8.35
16C	140	140	14.00	14.00	11.42	5.81	5.81	5.81	8.35	8.35	8.35	8.35
17A	94	94	9.40	9.40	6.12	3.06	3.06	3.06	3.06	3.06	3.06	3.06
17B	94	94	9.40	9.40	6.12	3.06	3.06	3.06	3.06	3.06	3.06	3.06
17C	94	94	9.40	9.40	6.12	3.06	3.06	3.06	3.06	3.06	3.06	3.06
18A	230	230	23.00	23.00	11.42	5.81	5.81	5.81	8.35	8.35	8.35	8.35
18B	230	230	23.00	23.00	11.42	5.81	5.81	5.81	8.35	8.35	8.35	8.35
18C	230	230	23.00	23.00	11.42	5.81	5.81	5.81	8.35	8.35	8.35	8.35
19A	100	100	10.00	10.00	11.42	5.81	5.81	5.81	8.35	8.35	8.35	8.35
19B	100	100	10.00	10.00	11.42	5.81	5.81	5.81	8.35	8.35	8.35	8.35
19C	100	100	10.00	10.00	11.42	5.81	5.81	5.81	8.35	8.35	8.35	8.35
20A	184	184	18.40	18.40	11.42	5.81	5.81	5.81	8.35	8.35	8.35	8.35
20B	184	184	18.40	18.40	11.42	5.81	5.81	5.81	8.35	8.35	8.35	8.35
20C	184	184	18.40	18.40	11.42	5.81	5.81	5.81	8.35	8.35	8.35	8.35
21A	189	189	18.90	18.90	11.42	5.81	5.81	5.81	8.35	8.35	8.35	8.35
21B	189	189	18.90	18.90	11.42	5.81	5.81	5.81	8.35	8.35	8.35	8.35
21C	189	189	18.90	18.90	11.42	5.81	5.81	5.81	8.35	8.35	8.35	8.35
22A	54	54	5.40	5.40	6.12	3.06	3.06	3.06	3.06	3.06	3.06	3.06
22B	54	54	5.40	5.40	6.12	3.06	3.06	3.06	3.06	3.06	3.06	3.06
22C	54	54	5.40	5.40	6.12	3.06	3.06	3.06	3.06	3.06	3.06	3.06
23A	45	45	4.50	4.50	6.12	3.06	3.06	3.06	3.06	3.06	3.06	3.06
23B	45	45	4.50	4.50	6.12	3.06	3.06	3.06	3.06	3.06	3.06	3.06
23C	45	45	4.50	4.50	6.12	3.06	3.06	3.06	3.06	3.06	3.06	3.06

Bioaccessibility results

Table 1. Results of Bioaccessability Testing - El Paso Residential Soils

Sample ID	Total Simple As (mg/dl)	Stomach Phase			Intestinal Phase			% Relative Bioaccessibility	% Absolute Bioaccessibility
		As (μg/g) in Stomach	As (μg/g) in Stomach	% Relative Bioaccessibility	As (μg/g) in Intestine	As (μg/g) in Intestine			
1A	78	62	8.20	8.62	4.41	6.6	7.10	3.55	
21A	35								
21C	58								
21A1	100	31.0	31.00	31.00	15.50	15	16.00	7.20	
21A2	61								
21B	39								
21C	37								
25A	130	18.0	18.00	19.00	9.50	14	14.00	7.00	
25B1	65								
25B2	92								
25C	41								
25A	100								
25B	63								
25C	32								
27A	69	15.0	15.00	21.74	10.57	12	17.08	8.70	
27B	33								
27C	21								
28A	81	16.0	16.00	18.75	8.89	12	14.81	7.41	
28B	57								
28C	61								
29A	294								
29B	37								
29C	45								
29C	51								
30A	24	20	3.00	12.50	6.25	23	2.3	9.58	
30B	13								
30C	22								
31A	22								
31B	43								
31C	31								
31A	23	57	3.70	13.20	8.14	41	4.4	12.57	
32B	63								
32C	67								
31A	43								
31B	53								
31C	31								
32A	20	60	6.00	20.00	16.00	48	4.8	16.00	
32B	90								
32C	54								
33A	26								
33B	42								
33C	18								

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Table 1. Results of Bioassessability Testing - El Paso Residential Soils

Sample ID	Stomach Phase		Intestinal Phase		Relative Bioassessability		Absolute Bioassessability	
	Total Sample As (mg/kg)	As (µg/g) in Stomach	Total Sample As (mg/kg)	As (µg/g) in Intestine	As (µg/g) in Intestine	% Relative Bioassessability	% Absolute Bioassessability	% Absolute Bioassessability
1A	63	82	63	66	66	7.10	3.65	3.65
Table 2. Summary Results of Bioassessability Testing - El Paso Residential Soils								
Sample ID	Stomach Phase		Intestinal Phase		Relative Bioassessability		Absolute Bioassessability	
	Total Sample As (mg/kg)	As (µg/g) in Stomach	Total Sample As (mg/kg)	As (µg/g) in Intestine	As (µg/g) in Intestine	% Relative Bioassessability	% Absolute Bioassessability	% Absolute Bioassessability
1A	63	82	63	66	66	7.10	3.65	3.65
2A	110	120	110	110	110	12.22	6.22	6.22
3A	57	82	57	66	66	7.33	3.83	3.83
6C	40	20	40	18	18	2.00	1.00	1.00
9A	132	69	132	52	52	5.78	2.98	2.98
11A	163	160	163	110	110	12.22	6.22	6.22
15A	103	86	103	63	63	6.94	3.54	3.54
17A	64	77	64	62	62	6.78	3.48	3.48
18A	230	200	230	168	168	18.56	9.56	9.56
18A1	72	160	72	62	62	6.78	3.48	3.48
18A2	170	160	170	168	168	18.56	9.56	9.56
24A1	100	100	100	148	148	16.22	8.22	8.22
25A	100	100	100	148	148	16.22	8.22	8.22
27A	69	160	69	128	128	14.00	7.00	7.00
28A	81	160	81	128	128	14.00	7.00	7.00
30A	30	30	30	23	23	2.56	1.28	1.28
32A	34	37	34	44	44	4.89	2.44	2.44
34A	30	60	30	48	48	5.22	2.61	2.61
Low						2.00	1.00	1.00
High						31.00	15.50	15.50
Mean						13.66	6.83	6.83

Table 1.

Sample ID	Total Sample Pb (mg/kg)	Stomach Phase Pb (ppb) in Stomach	Pb (ppb) in Stomach Q2	Relative Bioaccessibility 24.24	Absolute Bioaccessibility 12.12
1A	150				
1B	210				
1C	450	1170	110	23.73	14.88
2A	378				
2B	388				
2C	468	560	65	34.74	17.37
3A	190				
3B	270				
3C	216				
4A	270				
4B	270				
4C	281				
5A	281				
5B	281				
5C	303				
6A	220	120	12	10.50	8.45
6B	220				
6C	11				
7A	702				
7B	150				
7C	220				
8A	360				
8B	350	910	51	16.05	8.03
9A	350				
9B	120				
9C	280				
10A	180				
10B	450				
10C	200	1500	120	21.56	10.52
11A	200				
11B	180				
11C	540				
12A	180				
12B	150				
12C	340				
13A	170				
13B	80				
13C	430				
14A	370				
14B	320				
14C	240				
15A	370				
15B	210				
15C	420				
16A	410	930	93	22.14	11.07
16B	156				
16C	156				
17A	180	129	72	21.63	12.41
17B	200				
17C	76	120	160	23.00	12.50
18A	610	1900			
18B	760				
18C	670	800	85	24.57	12.28
19A	130				
19B	130				
19C	280				
20A	280				
20B	130				
20C	79				
21A	180				
21B	150				
21C	130				
22A	240				
22B	189				
22C	129				

Absolute Bioaccessibility

Bioassay Results

Table 1.

Sample ID	Total Sample P (mg/kg)	Strength P <sub>172</sub> P <sub>172</sub> (µg/g) in Stomach mg	P <sub>172</sub> (µg/g) in Stomach mg	%Relative Bioaccessibility 24.24	%Relative Bioaccessibility 12.12
1A	320				
20A	230				
21C	220				
24A1	610	1601	160	26.52	13.11
24A2	670				
24B	160				
24C	160	3000	300	44.12	22.06
25A	880				
25B1	880				
25B2	520				
25C	770				
26A	140				
26B	220				
26C	330	840	88	26.67	13.33
27A	330				
27B	298				
27C	337	943	94	24.74	12.37
28A	476				
28B	350				
28C	201				
28A	401				
28B	570				
28C	130	260	29	22.31	11.15
29A	100				
29B	120				
29C	200				
30A	240				
30B	180				
30C	200				
31A	180				
31B	200				
31C	450	400	43	21.60	10.75
32A	480				
32B	330				
32C	330				
33A	230				
33B	160				
33C	170				
34A	550				
34B	350				
34C	150				
35A	210				
35B	316				
35C	1528				

Biskabay results.xls

Table 1.

Sample ID	Total Sample Pb (ppb)	Stomach Phase		Stomach Phase	Pb (ug/g) in Stomach	Pb (ug/g) in Stomach	% Relative Bioaccessibility	% Absolute Bioaccessibility
		Pb (ug/L) in Stomach	Pb (ug/L) in Stomach					
1A	330	800	80	80	24.24	12.12	12.12	12.12
2A	330	1100	110	110	33.74	14.56	14.56	14.56
3A	330	160	60	60	18.18	8.45	8.45	8.45
4A	330	120	12	12	15.79	8.45	8.45	8.45
5A	360	510	61	61	15.05	8.45	8.45	8.45
6A	750	1500	150	150	21.05	10.53	10.53	10.53
7A	420	830	83	83	22.14	11.07	11.07	11.07
8A	290	720	72	72	24.83	12.41	12.41	12.41
9A	180	160	160	160	25.03	12.59	12.59	12.59
10A	350	860	86	86	24.87	12.41	12.41	12.41
11A	350	1600	160	160	28.83	13.11	13.11	13.11
12A	610	1600	160	160	44.12	22.06	22.06	22.06
13A	680	2000	200	200	44.12	22.06	22.06	22.06
14A	330	830	83	83	26.67	13.33	13.33	13.33
15A	330	940	94	94	26.71	13.35	13.35	13.35
16A	330	940	94	94	26.71	13.35	13.35	13.35
17A	330	940	94	94	26.71	13.35	13.35	13.35
18A	330	940	94	94	26.71	13.35	13.35	13.35
19A	330	940	94	94	26.71	13.35	13.35	13.35
20A	330	940	94	94	26.71	13.35	13.35	13.35
21A	330	940	94	94	26.71	13.35	13.35	13.35
22A	330	940	94	94	26.71	13.35	13.35	13.35
23A	330	940	94	94	26.71	13.35	13.35	13.35
24A	330	940	94	94	26.71	13.35	13.35	13.35
25A	330	940	94	94	26.71	13.35	13.35	13.35
26A	330	940	94	94	26.71	13.35	13.35	13.35
27A	330	940	94	94	26.71	13.35	13.35	13.35
28A	330	940	94	94	26.71	13.35	13.35	13.35
29A	330	940	94	94	26.71	13.35	13.35	13.35
30A	330	940	94	94	26.71	13.35	13.35	13.35
31A	330	940	94	94	26.71	13.35	13.35	13.35
32A	330	940	94	94	26.71	13.35	13.35	13.35
33A	330	940	94	94	26.71	13.35	13.35	13.35
34A	330	940	94	94	26.71	13.35	13.35	13.35
35A	330	940	94	94	26.71	13.35	13.35	13.35
36A	330	940	94	94	26.71	13.35	13.35	13.35
37A	330	940	94	94	26.71	13.35	13.35	13.35
38A	330	940	94	94	26.71	13.35	13.35	13.35
39A	330	940	94	94	26.71	13.35	13.35	13.35
40A	330	940	94	94	26.71	13.35	13.35	13.35
41A	330	940	94	94	26.71	13.35	13.35	13.35
42A	330	940	94	94	26.71	13.35	13.35	13.35
43A	330	940	94	94	26.71	13.35	13.35	13.35
44A	330	940	94	94	26.71	13.35	13.35	13.35
45A	330	940	94	94	26.71	13.35	13.35	13.35
46A	330	940	94	94	26.71	13.35	13.35	13.35
47A	330	940	94	94	26.71	13.35	13.35	13.35
48A	330	940	94	94	26.71	13.35	13.35	13.35
49A	330	940	94	94	26.71	13.35	13.35	13.35
50A	330	940	94	94	26.71	13.35	13.35	13.35
51A	330	940	94	94	26.71	13.35	13.35	13.35
52A	330	940	94	94	26.71	13.35	13.35	13.35
53A	330	940	94	94	26.71	13.35	13.35	13.35
54A	330	940	94	94	26.71	13.35	13.35	13.35
55A	330	940	94	94	26.71	13.35	13.35	13.35
56A	330	940	94	94	26.71	13.35	13.35	13.35
57A	330	940	94	94	26.71	13.35	13.35	13.35
58A	330	940	94	94	26.71	13.35	13.35	13.35
59A	330	940	94	94	26.71	13.35	13.35	13.35
60A	330	940	94	94	26.71	13.35	13.35	13.35
61A	330	940	94	94	26.71	13.35	13.35	13.35
62A	330	940	94	94	26.71	13.35	13.35	13.35
63A	330	940	94	94	26.71	13.35	13.35	13.35
64A	330	940	94	94	26.71	13.35	13.35	13.35
65A	330	940	94	94	26.71	13.35	13.35	13.35
66A	330	940	94	94	26.71	13.35	13.35	13.35
67A	330	940	94	94	26.71	13.35	13.35	13.35
68A	330	940	94	94	26.71	13.35	13.35	13.35
69A	330	940	94	94	26.71	13.35	13.35	13.35
70A	330	940	94	94	26.71	13.35	13.35	13.35
71A	330	940	94	94	26.71	13.35	13.35	13.35
72A	330	940	94	94	26.71	13.35	13.35	13.35
73A	330	940	94	94	26.71	13.35	13.35	13.35
74A	330	940	94	94	26.71	13.35	13.35	13.35
75A	330	940	94	94	26.71	13.35	13.35	13.35
76A	330	940	94	94	26.71	13.35	13.35	13.35
77A	330	940	94	94	26.71	13.35	13.35	13.35
78A	330	940	94	94	26.71	13.35	13.35	13.35
79A	330	940	94	94	26.71	13.35	13.35	13.35
80A	330	940	94	94	26.71	13.35	13.35	13.35
81A	330	940	94	94	26.71	13.35	13.35	13.35
82A	330	940	94	94	26.71	13.35	13.35	13.35
83A	330	940	94	94	26.71	13.35	13.35	13.35
84A	330	940	94	94	26.71	13.35	13.35	13.35
85A	330	940	94	94	26.71	13.35	13.35	13.35
86A	330	940	94	94	26.71	13.35	13.35	13.35
87A	330	940	94	94	26.71	13.35	13.35	13.35
88A	330	940	94	94	26.71	13.35	13.35	13.35
89A	330	940	94	94	26.71	13.35	13.35	13.35
90A	330	940	94	94	26.71	13.35	13.35	13.35
91A	330	940	94	94	26.71	13.35	13.35	13.35
92A	330	940	94	94	26.71	13.35	13.35	13.35
93A	330	940	94	94	26.71	13.35	13.35	13.35
94A	330	940	94	94	26.71	13.35	13.35	13.35
95A	330	940	94	94	26.71	13.35	13.35	13.35
96A	330	940	94	94	26.71	13.35	13.35	13.35
97A	330	940	94	94	26.71	13.35	13.35	13.35
98A	330	940	94	94	26.71	13.35	13.35	13.35
99A	330	940	94	94	26.71	13.35	13.35	13.35
100A	330	940	94	94	26.71	13.35	13.35	13.35

BIOASSAY RESULTS

Page 8



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1 (1)

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## **APPENDIX D**

### **PHASE IV BORING LOGS AND MONITORING WELL COMPLETION DETAILS**



**HYDROMETRICS INC.**  
Consulting Scientists and Engineers  
El Paso, Texas

EP-133

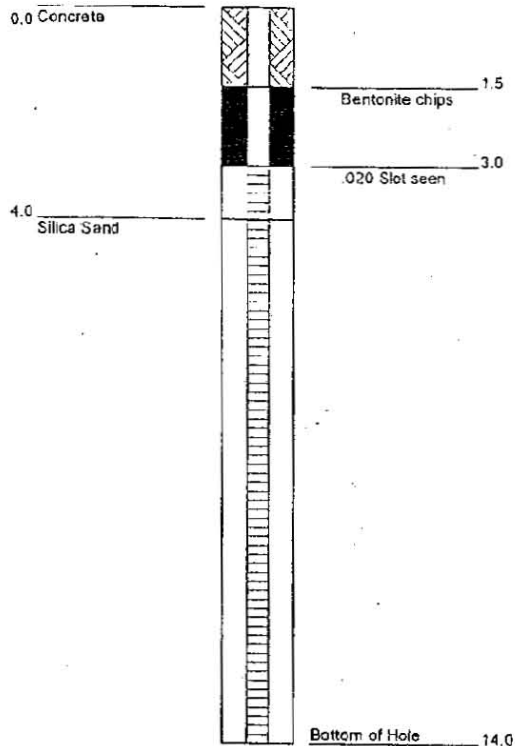
Hole Name: EP-133

Date Hole Started:

Date Hole Finished:

## Well Construction Diagram

## Geological Description



0.0 - 3.0'	Very fine, well sorted silty SAND, no odor, medium brown, some dark brown clay lenses. Alluvium.
3.0 - 4.0'	Very fine silty SAND, some clay, no odor, dark brown to nearly black. Alluvium.
5.0 - 8.0'	Clean SAND, fine grained, grayish brown, saturated, no odor. Alluvium.



**HYDROMETRICS INC.**  
Consulting Scientists and Engineers  
El Paso, Texas

EP-134

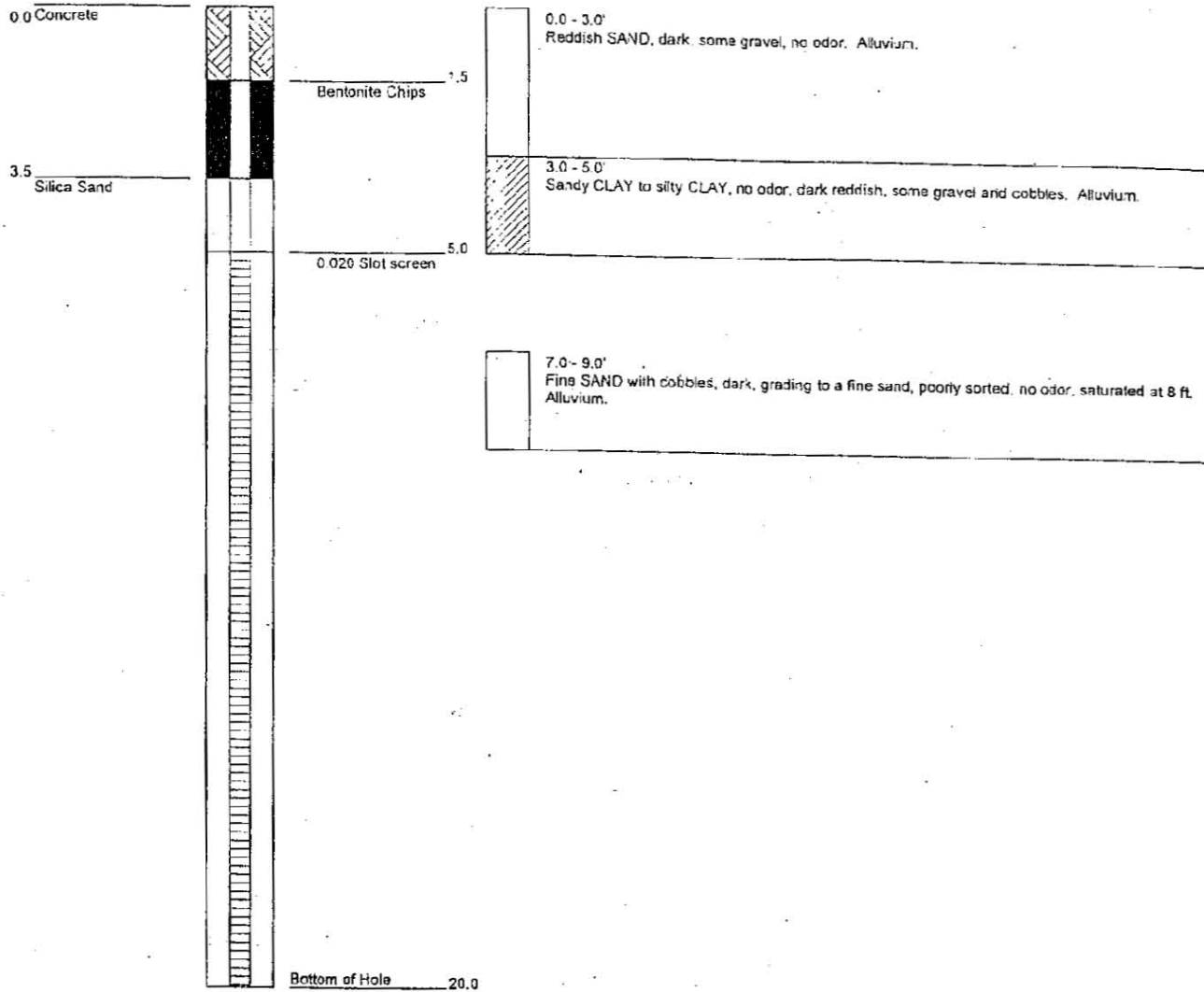
Hole Name: EP-134

Date Hole Started:

Date Hole Finished:

## Well Construction Diagram

## Geological Description





**HYDROMETRICS INC.**  
Consulting Scientists and Engineers  
El Paso, Texas

EP-135

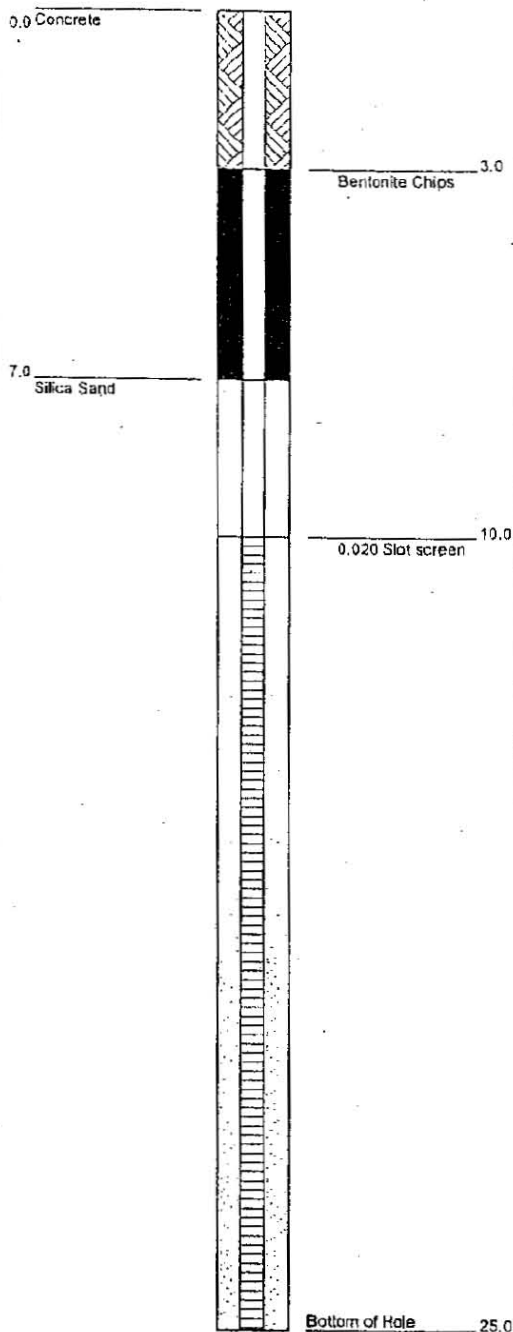
Hole Name: EP-135

Date Hole Started:

Date Hole Finished:

## Well Construction Diagram

## Geological Description

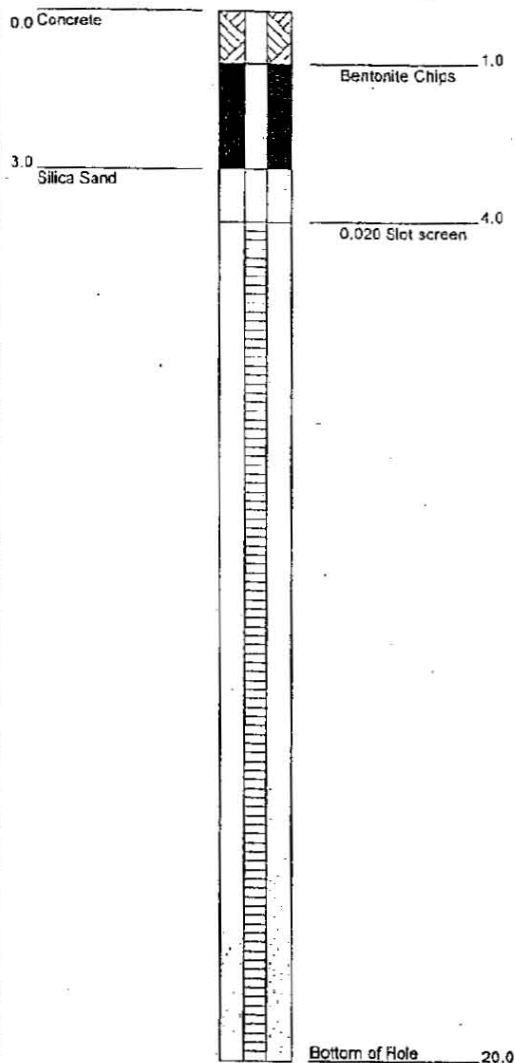


0.0 - 0.5'	Gravel, some slag, debris. Fill.
0.5 - 4.0'	Silty SAND, medium brown, no odor. Alluvium.
4.0 - 7.0'	SAND, fine to medium grained, silty, some gravel, poorly sorted, moist, no odor, medium brown. Alluvium.
7.0 - 8.0'	CLAY, highly plastic, medium brown, no odor, moist. Alluvium.
8.0 - 15.0'	SAND, fine to medium grained, silty, medium yellowish brown, no odor, moist. Alluvium.



## Well Construction Diagram

## Geological Description



0.0 - 3.0'	Very fine silty sand, medium brown, earthy smell, no hydrocarbon odor, some clay lenses.
3.0 - 4.0'	Silty sand, medium brown to black, the black material is fine sand, no odor, earthy smell, moist.
4.0 - 5.0'	Fine sand, dark gray, slight HC odor, saturated.
7.0 - 9.0'	Fine sand, medium brown, no odor, clean, alluvium.
9.0 - 15.0'	Fine sand, medium brown, no odor.
15.0 - 20.0'	Dark colored, silty sand, no odor.



**HYDROMETRICS INC.**  
Consulting Scientists and Engineers  
El Paso, Texas

EP-137

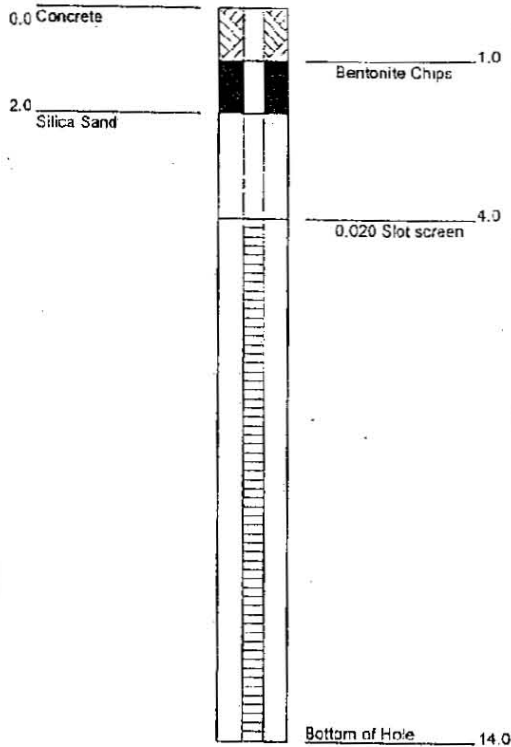
Hole Name: EP-137

Date Hole Started:

Date Hole Finished:

## Well Construction Diagram

## Geological Description



0.0 - 2.0'

Fine silty sand, no odor, few cobbles, dark brown, alluvium.

2.0 - 5.0'

Very fine silty sand, dark brown, some very fine black sand, some silt, no odor, few clay lenses.

7.0 - 8.0'

Clean sand, medium grained, no odor, saturated, medium brown, well sorted.

[illegible]



EP133

Project Information		Construction Information																																																			
Client	Asarco Inc.	Well_Surf_Detl	Stick up																																																		
Name	Phase IV RT	Surface_Casing_Ht	3.66																																																		
County	El Paso	Riser_Height																																																			
State	TX	Well_Desc	4" Sch 40 PVC																																																		
Property Owner	EBMC	Well_Interval	0 - 14																																																		
<b>Point Identifying Information</b> PointID EP133 Property Owner EBMC Legal_Description Descriptive_Location Samp_Numb_Prefix Hole_Title HoleDepth 14' Elevation North = t		Surf_Casing_Desc	Sch 40 PVC																																																		
		Surf_Casing_Int	4-14"																																																		
		Screen_Desc	.020 Slot Screen																																																		
		Screen_Int	4-14"																																																		
		Sand_Pack_Desc	Silica Sand																																																		
		Sand_Pack_Int	3 - 14'																																																		
		Annular_Seal_Desc	Bentonite Chips																																																		
		Annular_Seal_Int	1.5' - 3'																																																		
		Surf_Seal_Desc	Concrete																																																		
		Surf_Seal_Int	0 - 1.5'																																																		
		Development_Desc																																																			
		Development_Int																																																			
		Water_Samples_Desc																																																			
		Water_Samples_Int																																																			
		Boring_Samples_Desc																																																			
		Boring_Samples_Int																																																			
		Remarks																																																			
<b>Drilling Information</b> Date_Started 10/28/02 Date_Finished Recorded_By A. Muñoz Drilling_Company Raba Kistner Driller Manny Duenez Drilling_Method HSH Drilling_Fluids None Purpose Install Monitor Well Target_Aquifer Shallow alluvial Hole_Dia 10"		<b>Well Diagram Information</b> <table border="1"> <thead> <tr> <th></th> <th>Top</th> <th>Bot.</th> <th>Graphic</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>Surface Seal</td> <td>0</td> <td>1.5</td> <td>R</td> <td>CMNT11</td> </tr> <tr> <td>Annular Seal</td> <td>1.5</td> <td>3</td> <td>R</td> <td>BENT11</td> </tr> <tr> <td></td> <td></td> <td></td> <td>R</td> <td></td> </tr> <tr> <td>Filter Pack</td> <td>3</td> <td>14</td> <td>R</td> <td>FILT11 Silica Sand</td> </tr> <tr> <td></td> <td></td> <td></td> <td>R</td> <td></td> </tr> <tr> <td>Screen</td> <td>4</td> <td>14</td> <td>L</td> <td>SLOT11</td> </tr> <tr> <td></td> <td></td> <td></td> <td>L</td> <td></td> </tr> <tr> <td>Backfill</td> <td></td> <td></td> <td>R</td> <td>SLUF11</td> </tr> <tr> <td>Bottom Cap</td> <td></td> <td></td> <td></td> <td>PCAP11 (None Needed)</td> </tr> </tbody> </table>			Top	Bot.	Graphic	Description	Surface Seal	0	1.5	R	CMNT11	Annular Seal	1.5	3	R	BENT11				R		Filter Pack	3	14	R	FILT11 Silica Sand				R		Screen	4	14	L	SLOT11				L		Backfill			R	SLUF11	Bottom Cap				PCAP11 (None Needed)
	Top	Bot.	Graphic	Description																																																	
Surface Seal	0	1.5	R	CMNT11																																																	
Annular Seal	1.5	3	R	BENT11																																																	
			R																																																		
Filter Pack	3	14	R	FILT11 Silica Sand																																																	
			R																																																		
Screen	4	14	L	SLOT11																																																	
			L																																																		
Backfill			R	SLUF11																																																	
Bottom Cap				PCAP11 (None Needed)																																																	
<b>Measuring Information</b> Datum Static_Water_Level 8.3 Static_Water_Date MP_Description MP_Height																																																					

# HYDROMETRICS, INC.

Test Log Field Form: Graphical Logs

Well/Boring Name: EP 135-

Page 1 of 1

## Sample Collection Log

## Geological Log

Depth	Length	Number	Date	Time	Sample Type	Blow Count	Recovery (in feet)	Notes	Top Depth	Bot. Depth	Hatching	Material Name	Unit Name
0-1	1	A	10/29	1515	SS	N/A	1		0.5				Fill
1-2	1	B		1520			1		Description			Gravel, some slag, debris	
2-3	1	C		1522			1						
3-4	1	D		1525			1		.5	4		Silty Sand	Yellow, tan
4-5	1	E		1530			1		Description			Fine Sand, silt, med brown, no odor	
7-9	1	F		1535			1						
13-15	1	G		1540			1		4	7	SP	Silty Sand w/ gravel	Yellow, tan
									Description			Fine to med sand, some gravel silty, poorly sorted, moist, no odor, med brown	
									7	8		Clay	Yellow, tan
									Description			Med Brown, clay, highly plastic, no odor, moist	
									8	15	SP	Silty Sand	
									Description			Fine to med silty sand, med brown, no odor, moist	

## HYDROMETRICS, INC.

## Test Log Field Form: Graphical Logs

Well/Boring Name:

EP 136

Page 1 of

## Sample Collection Log

## Geological Log

Depth	Length	Number	Date	Time	Sample Type	Blow Count	Recovery (in feet)	Notes	Top Depth	Bot. Depth	Hatching	Material Name	Unit Name
0-1	1	A	10/18	0840	SS		1		0	3		Silty SAND	Alluvium
1-2	1	B		0845					Description	Silty SAND, med. Brown, Earthy smelly, no HC odor, some clay lenses			
2-3	1	C		0850									
3-4	1	D		0855					3	4		Silty Sand	Alluvium
4-5	1	E		0900					Description	Silty Sand, med. Brown to Black, Black material is fine sand, no odor, earthy smelly, very moist			
7-8	1	F		0905					4	5		Sand	Alluvium
									Description	Fine Sand, dark gray, slight HC odor, saturated, water level $\pm$ 6 ft			
									7	9		Sand	Alluvium
									Description	Fine Sand, med. Brown, no odor, clean sand			
									9	15			
									Description	Fine Silty med brown no odor			

## HYDROMETRICS, INC.

Test Log Field Form: Graphical Logs

Sample Collection Log

Well/Boring Name: E-136

Page 1 of 1

## Geological Log

Depth		Length	Number	Date	Time	Sample Type	Blow Count	Recovery (in feet)	Notes	Tip Bot.		Depth	Hauling	Material Name	Unit Name
										15	20				
										Description dark - silty sand no color					
										Description					
										Description					
										Description					
										Description					
										Description					

## HYDROMETRICS, INC.

Test Log Field Form: Graphical Logs

Sample Collection Log

Well/Boring Name:

EP137

Page 1 of

## Geological Log

Depth	Length	Number	Date	Time	Sample Type	Blow Count	Recovery (in feet)	Notes	Top Box			Material Name	Unit Name
									Depth	Depth	Hatching		
0-1	1 ft	A	10/28	9:30	SS		1		0	2	SW	Silty Sand	Alluvium
1-2	1	B	10/28	9:33	SS		5		Description: Sand (fine) NO odor some coarse dark Brown				
2-3	1	C		9:35	SS		1						
3-4	1	D		9:40	SS		1		2	5	SW	Silty Sand	Alluvium
4-5	1	E		9:45	SS		1		Description: VF Sand dark Brown, some VF Black sand some silt no odor, clay lenses (min)				
7-8	1	F		9:50	SS		1						
									7	8	SW	Sand	Alluvium
									Description: Clean Sand medium fine NO odor secured med Brown med silica				
									Description: Alluvial Refuse @ 15 ft				
									Description:				

### Sample Collection Log

Page 1 of 1

# Geological Log

Depth		Length	Number	Date	Time	Sample Type	Blow Count	Recovery (in feet)	Notes	Top Box	Depth	Hatching	Material Name	Unit Name
0-1	1	A	10/30	505	SS	N/A				0	1.5	SS	Silty sand	F. 11
1-2	1	B		1505						Description	Silty Fine sand, yellow, fine brown rock, dry nodules			
2-3	1	C		1510										
3-4	1	D		1510						1.5	5		Silty sand	Alluvium
4-5	1	E		1515						Description	Fine sand, silty, some green, med brown nodules			
										Description				
										Description				
										Description				
										Description				

## HYDROMETRICS, INC.

Test Log Field Form: Graphical Logs

Sample Collection Log

Well/Boring Name:

12HS-13

Page 1 of 1

## (Geological Log)

Depth	Length	Number	Date	Time	Sample Type	Blow Count	Recovery (in feet)	Notes	Top Depth	Bot. Depth	Hatching	Material Name	Unit Name
0-1	1	A	10/30		SS		1		0	1.5		Soft Sand	Fill
1-2	1	B	10/30				1		Description: Silty Sand, fine sand, some pebbles				
2-3							0						
3-4							0		1.5	5.5		Soft Sand	Fill
4-5	1	C					1		Description: Reddish-brown, fine sand, slight HC with some black w/ HC @ 4.5				
7-9	1	D					1						
10-11	1	E					1		5.5	7		Sandy Clay	Fill
15-17	1	F					1		Description: Sandy Clayey silt, black from HC sand				
20-21	1	G					1						
									7	18		Clay	Fill
									Description: Clay, light plastic, moist, some silt, fine sand, silt, some HC @ 15 ft				
									18	20		Sand	Fill
									Description: Very fine sand, silty, medium, med-coarse sand, no gravel				

20.5 - 21

Sandy Clay

Fill



## HYDROMETRICS, INC.

Test Log Field Form: Graphical Logs

Well/Boring Name:

BH 5-12

Page 1 of

## Sample Collection Log

## Geological Log

Depth	Length	Number	Date	Time	Sample Type	Blow Count	Recovery (in feet)	Notes	Top Bot.		Hatching	Material Name	Unit Name
									Depth	Depth			
01	1	A	10/30		SS	N/A	1		0	4		Silty Sand	Fillman
1-2	1	B				1	1		Description			Wet Brown. Fine sand w/ silt No color water @ 4 ft	
0-3	1	C				1	1						
3-4	1	D				1	1						
									Description				
									Description				
									Description				
									Description				
									Description				





## HYDROMETRICS, INC.

Test Log Field Form: Graphical Logs

Well/Boring Name: 3012

Page 1 of 1

## Sample Collection Log

## Geological Log

Depth	Length	Number	Date	Time	Sample Type	Blow Count	Recovery (in feet)	Notes	Top			Material Name	Unit Name
									Depth	Depth	Hatching		
0-1	1	A	10/30	1635	SS	N/A	1		1	2.5		Silty Sand	F-11
1-2	1	B		1638	SS	1	1		Description: Silty sand, mixed brown, no visible coarse gravel, debris, fracture zone				
2-3	1	C		1642	SS	1	1						
3-4	1	D		1646	SS	1	1		2.5			Silty Sand	F-11
4-5	1	E		1650	SS	1	1		Description: Silty Sand, mixed brown, no visible coarse gravel				
									Notes: Sample 60 cm				
									Description				
									Description				
									Description				
									Description				

## HYDROMETRICS, INC.

Test Log Field Form: Graphical Logs

Well/Logging Name: *IS1116 #4*  
(BHS-9) Page 1 of 1

## Sample Collection Log

## Geological Log

Depth	Length	Number	Date	Time	Sample		Recovery (in feet)	Notes	Top		Hatching	Material Name	Unit Name
					Type	Blow Count			Depth	Bed			
0-1	1	A	10/30	1610	SS	N/A	1		0	2		Silty Sand	F.11
1-2	1	B		1610			1		Description: Silty Sand w/ dec. s. s. & gravel				
2-3	1	C		1615			1						
3-4	1	D		1615			1		2	5		Silty Sand	12/1/16, 17/16
4-5	1	E		1620			1		Description: Silty Sand w/ silt, med. brown, no gravel				
									Description				
									Description				
									Description				
									Description				
									Description				

## HYDROMETRICS, INC.

Test Log Field Form: Graphical Logs

Well/Boring Name:

B4 S-3 43

Page 1 of

## Sample Collection Log

## Geological Log

Depth	Length	Number	Date	Time	Sample Type	Blow Count	Recovery (in feet)	Notes	Top		Brd.	Depth	Hatching	Material Name	Unit Name
									Depth	Top					
0-1	1	A	19/30	1550	SS	NA	1		0	1				Silty SAND	F-11
1-2	1	B	1	1550			1		Description					Silty Sand, green, Fractured dark med brown, bit. nodules	
2-3	1	C	1	1555			1								
3-4	1	D	1	1555			1			4				Silty Sand	11/100, 400
4-5	1	E	1	1600			1		Description					Sand w/ bit med brown no nodules	
										4	5			Silty Sand	11/100, 400
									Description					Same as above, slightly coarser	
									Description						
									Description						

## HYDROMETRICS, INC.

Test Log Field Form: Graphical Logs

Well/Boring Name: IB MC

Page 1 of 2

## Sample Collection Log

## Geological Log

Depth	Length	Number	Date	Time	Sample Type	Blow Count	Recovery (in feet)	Notes	Top		Hatching	Material Name	Unit Name
									Depth	Box			
0-1	1	A	10/2	1530	SS	N/A	1		0	1-5		Silty sand	F-11
1-2	1	B		1530		1	1		Description			fine grained silty sand, fractured necks, yellow	
2-3	1	C		1535		1	1						
3-4	1	D		1535		1	1					Silty sand	fine grained
4-5	1	E		1540		1	1		Description			fine grained silty sand, fractured necks, yellow	
									Description				
									Description				
									Description				
									Description				





This form must be completed and filed with the department and owner within 60 days upon completion of the well.

### A. WELL IDENTIFICATION AND LOCATION DATA

Attention Owner:  
Confidentiality Privilege Notice  
on reverse side of owner's copy.

**Texas Department of License and Regulation**  
Water Well Driller/Pump Installer Program  
P.O. Box 12157 Austin, Texas 78711 (512)463-7880 FAX (512)463-8616  
Toll free (800)803-9202  
Email address: water.well@license.state.tx.us

This form must be completed  
and filed with the department  
and owner within 60 days  
upon completion of the well.

**WELL REPORT**

**A. WELL IDENTIFICATION AND LOCATION DATA**

**1) OWNER**

Name	Address	City	State	Zip
------	---------	------	-------	-----

**2) WELL LOCATION**

County	Physical Address	City	State	Zip
--------	------------------	------	-------	-----

**3) Type of Work**

☐ New Well ☐ Reconditioning  
☐ Replacement ☐ Deepening

**4) Proposed Use (check)** ☐ Monitor ☐ Environmental Soil Boring ☐ Domestic  
☐ Industrial ☐ Irrigation ☐ Injection ☐ Public Supply ☐ De-watering ☐ Testwell  
☐ Rig Supply If Public Supply well, were plans submitted? ☐ Yes ☐ No

**5)** N↑

**6) Drilling Date**

Started / /

Completed / /

**Diameter of Hole**

Dia. (in.)	From (ft)	To (ft)

**7) Drilling Method (check)**

☐ Driven  
☐ Air Rotary ☐ Mud Rotary ☐ Bored  
☐ Air Hammer ☐ Cable Tool ☐ Jetted  
☐ Other

**From (ft) To (ft) Description and color of formation material**


**8) Borehole Completion** ☐ Open Hole ☐ Straight Wall  
☐ Under-reamed ☐ Gravel Packed ☐ Other  
If Gravel Packed give the interval from ft. to ft.

**Casing, Blank Pipe, and Well Screen Data**

Dia. (in.)	New Or Used	Steel, Plastic, etc. Perf., Slotted, etc. Screen Mfg., if commercial	Setting (ft)		Gage Casing Screen
			From	To	
4"		Plastic riser	1	4	
4"		Plastic screen	1	14	

(Use reverse side of Well Owner's copy, if necessary)

**13) Plugged**

☐ Well plugged within 48 hours

Casing left in well: Cement/Bentonite placed in well:

From (ft)	To (ft)	From (ft)	To (ft)	Sacks used

**14) Type Pump**

☐ Turbine ☐ Jet ☐ Submersible ☐ Cylinder  
☐ Other

Depth to pump bowls, cylinder, jet etc. ft.

**15) Water Test**

Typetest ☐ Pump ☐ Bailer ☐ Jetted ☐ Estimated  
Yield: gpm with ft. drawdown after hrs

**16) Water Quality**

Did you knowingly penetrate a strata which contain undesirable constituents.  
☐ YES ☒ NO If yes, did you submit a REPORT OF UNDESIRABLE WATER  
Type of water Depth of Strata  
Was a chemical analysis made ☐ Yes ☐ No

**9) Cementing Data**

Cementing from ft. to ft. # of sacks used  
ft. to ft. # of sacks used

Method Used  
Cementing By  
Distance to septic system field or other concentrated contamination ft.  
Method of verification of above distance  
Bentonite Seal (if concrete)

**10) Surface Completion**

☐ Specified Surface Slab Installed  
☐ Specified Surface Sleeve Installed  
☐ Pileless Adapter Used  
☐ Approved Alternative Procedure Used

**11) Water Level**

Static level ft. below Date / /  
Artesian Flow gpm. Date / /

**12) Packers** N/A Type Depth

Company or individual's Name (type or print)

Manuel Duenez

Lic. No. 2914M

Address 7002 Commerce

City El Paso

State TX

Zip 79915

Signature

Manuel Duenez 11 29 102

Signature



Attention Owner:  
Confidentiality Privilege Notice  
on reverse side of owner's copy.

**Texas Department of License and Regulation**  
Water Well Driller/Pump Installer Program  
P.O. Box 12157 Austin, Texas 78711 (512)463-7880 FAX (512)463-8616  
Toll free (800)803-9202  
Email address: water.well@license.state.tx.us

This form must be completed  
and filed with the department  
and owner within 60 days  
upon completion of the well.

**WELL REPORT**

**A. WELL IDENTIFICATION AND LOCATION DATA**

**1) OWNER**

Name	Address	City	State	Zip
------	---------	------	-------	-----

**2) WELL LOCATION**

County	Physical Address	City	State	Zip
--------	------------------	------	-------	-----

**3) Type of Work**

☐ New Well ☐ Reconditioning  
☐ Replacement ☐ Deepening

**4) Proposed Use (check)** ☐ Monitor ☐ Environmental Soil Boring ☐ Domestic  
☐ Industrial ☐ Irrigation ☐ Injection ☐ Public Supply ☐ De-watering ☐ Testwell  
☐ Rig Supply If Public Supply well, were plans submitted? ☐ Yes ☐ No

**5)** NT

**6) Drilling Date**

Started    /    /     
Completed    /    /   

**Diameter of Hole**

Dia. (in.)	From (ft)	To (ft)

**7) Drilling Method (check)**

☐ Driven  
☐ Air Rotary ☐ Mud Rotary ☐ Bored  
☐ Air Hammer ☐ Cable Tool ☐ Jetted  
☐ Other   

**From (ft) To (ft) Description and color of formation material**


**8) Borehole Completion** ☐ Open Hole ☐ Straight Wall  
☐ Under-reamed ☐ Gravel Packed ☐ Other  
If Gravel Packed give the interval from    ft. to    ft.

**Casing, Blank Pipe, and Well Screen Data**

Dia. (in.)	New Or Used	Steel, Plastic, etc. Perf., Slotted, etc. Screen Mfg., if commercial	Setting (ft)		Cage Casing Screen
			From	To	

(Use reverse side of Well Owner's copy, if necessary)

**13) Plugged**

☐ Well plugged within 48 hours

Casing left in well: Cement/Bentonite placed in well:

From (ft)	To (ft)	From (ft)	To (ft)	Sacks used

**14) Type Pump**

☐ Turbine ☐ Jet ☐ Submersible ☐ Cylinder  
☐ Other   

Depth to pump bowls, cylinder, jet etc.    ft.

**15) Water Test**

Typetest ☐ Pump ☐ Bailer ☐ Jetted ☐ Estimated  
Yield:    gpm with    ft. drawdown after    hrs.

**16) Water Quality**

Did you knowingly penetrate a strata which contain undesirable constituents.  
☐ YES ☒ NO If yes, did you submit a REPORT OF UNDESIRABLE WATER  
Type of water    Depth of Strata     
Was a chemical analysis made ☐ Yes ☐ No

**9) Cementing Data**

Cementing from    ft. to    ft. # of sacks used     
   ft. to    ft. # of sacks used   

Method Used   

Cementing By   

Distance to septic system field or other concentrated contamination    ft.

Method of verification of above distance  
bentonite seal 3-4 conductance 5-7

**10) Surface Completion**

☒ Specified Surface Slab Installed  
☐ Specified Surface Sleeve Installed  
☐ Pitless Adapter Used  
☐ Approved Alternative Procedure Used

**11) Water Level**

Static level    ft. below Date    /    /     
Artesian Flow    gpm. Date    /    /   

**12) Packers** N/A Type    Depth   

Company or individual's Name (type or print)

Manuel Duenas

Lic. No. 291421

Address 7002 Commerce

City El Paso

State TX

Zip 79915

Signature

Manuel Duenas

11/29/02

Signature

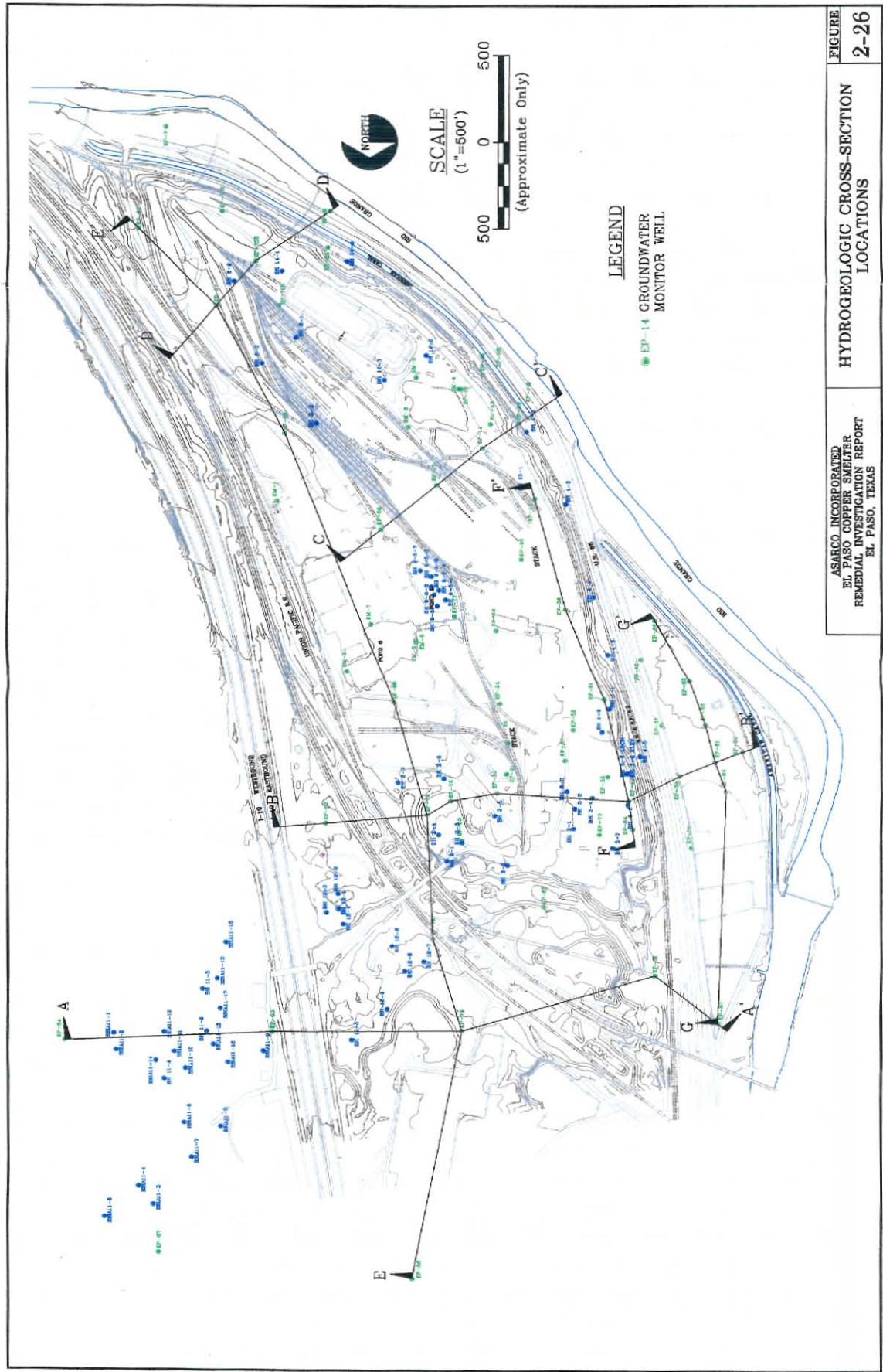
This form must be completed and filed with the department and owner within 60 days upon completion of the well.

### A.7 WELL IDENTIFICATION AND LOCATION DATA



## **APPENDIX E**

**GEOLOGICAL CROSS SECTIONS (PHASE I RI FIGURES  
2-26 THROUGH 2-33 AND PHASE III RI FIGURE 2-4 AND  
EXHIBITS 2 AND 3)**



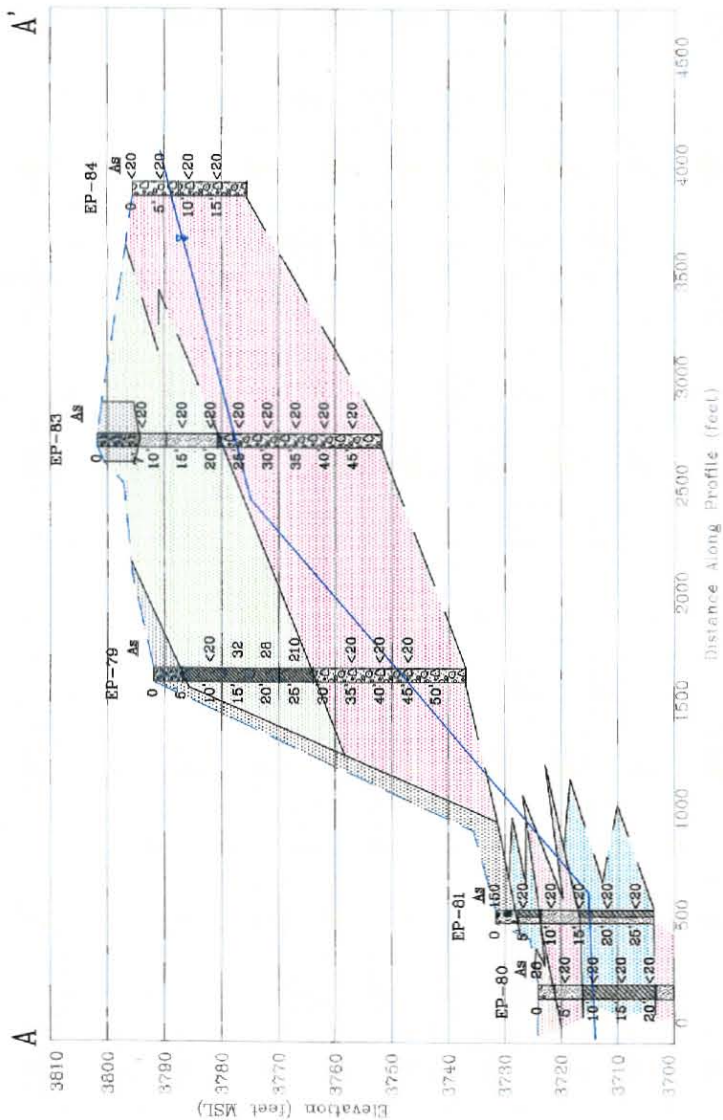
ASARCO INCORPORATED  
EL PASO COPPER SMELTER  
REMEDIAL INVESTIGATION REPORT  
EL PASO, TEXAS

HYDROGEOLOGIC CROSS-SECTION  
LOCATIONS

FIGURE  
2-26

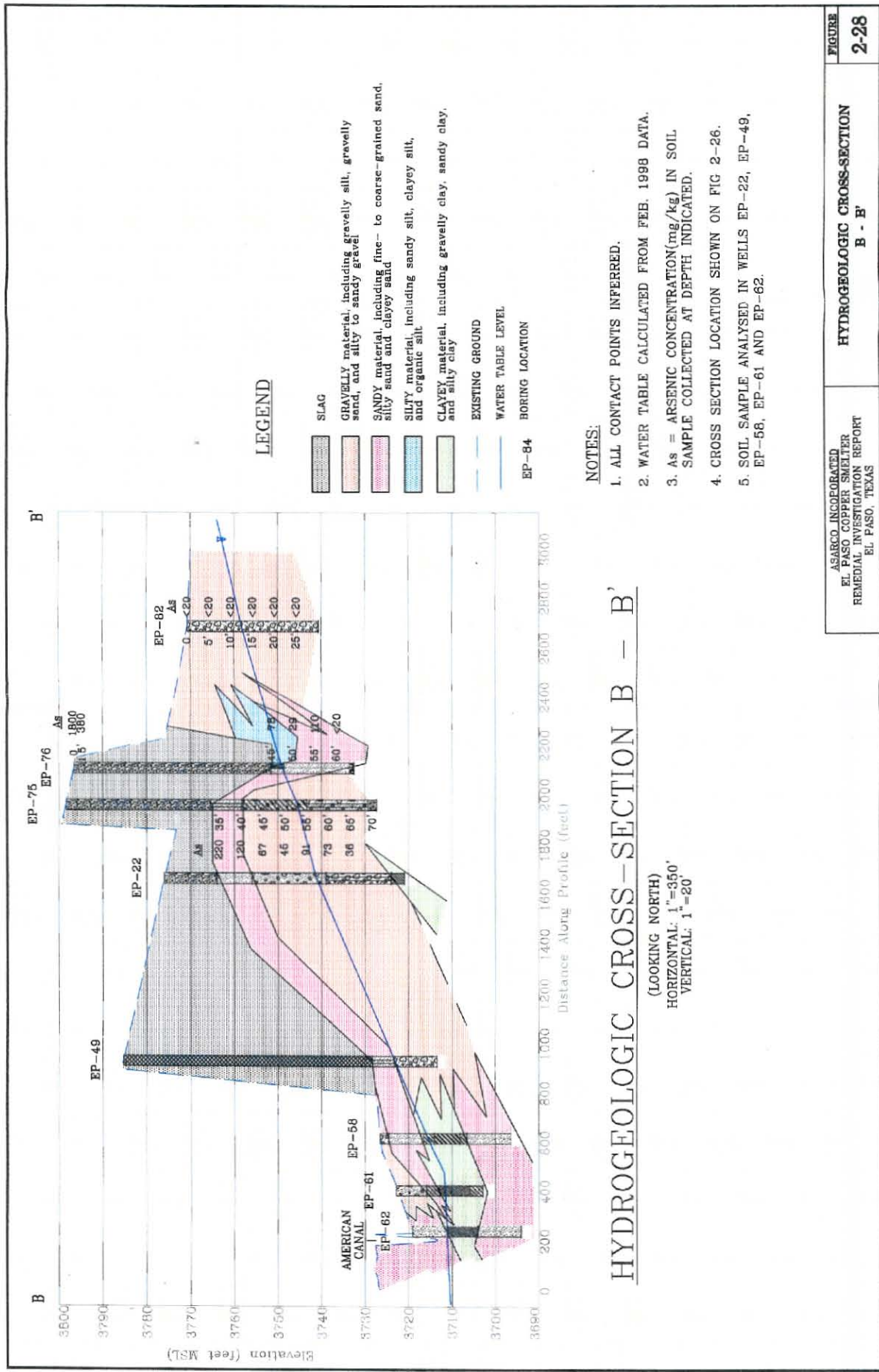
HydroMetrics, Inc. Consulting Scientists, Engineers and Contractors

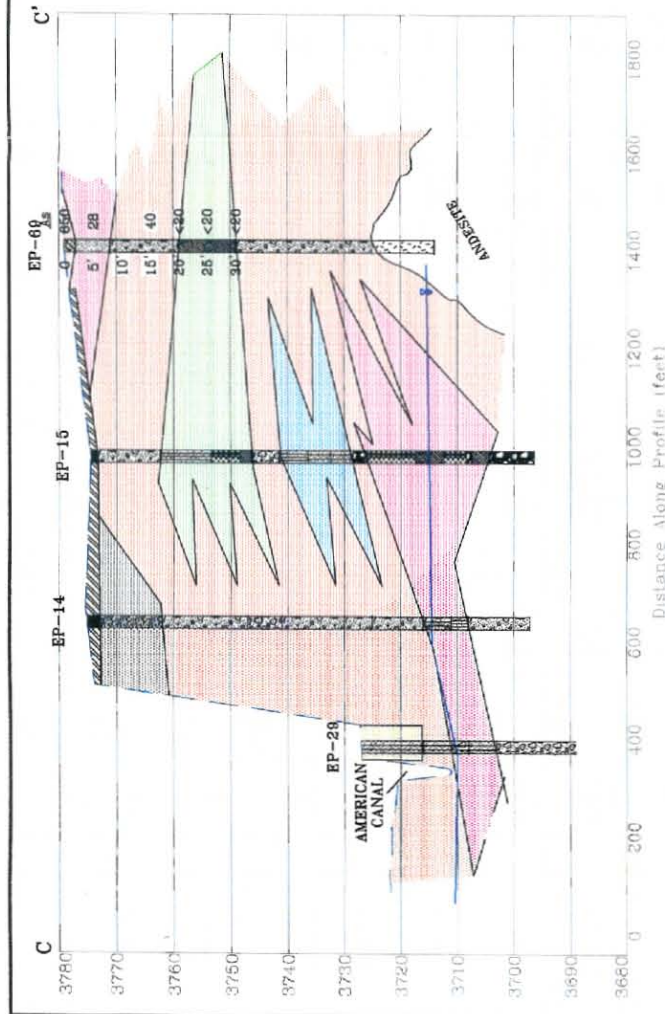




## HYDROGEOLOGIC CROSS-SECTION A - A'

(LOOKING NORTH)  
HORIZONTAL: 1"=500'  
VERTICAL: 1"=20'





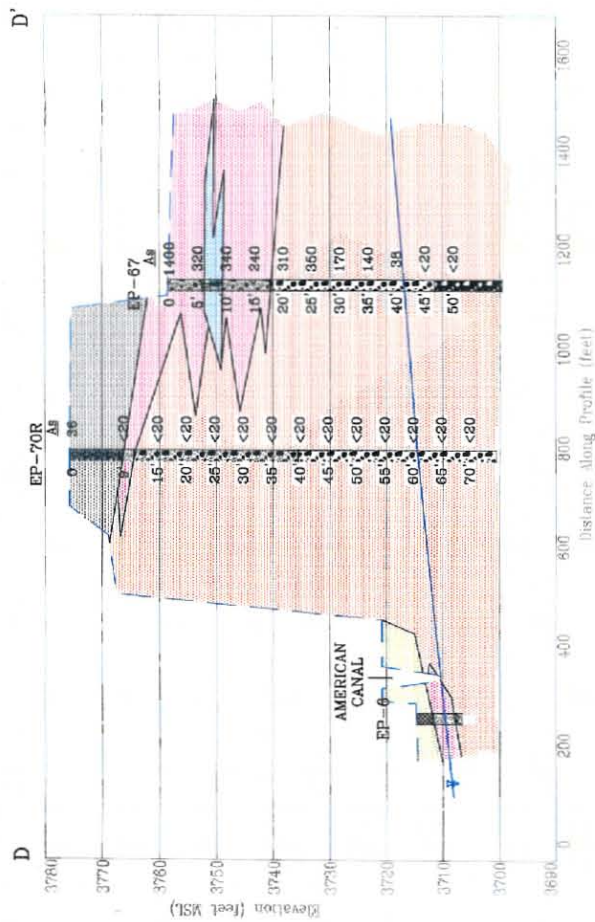
# HYDROGEOLOGIC CROSS-SECTION C - C'

(LOOKING NORTH)  
 HORIZONTAL: 1"=230'  
 VERTICAL: 1"=20'

## NOTES:

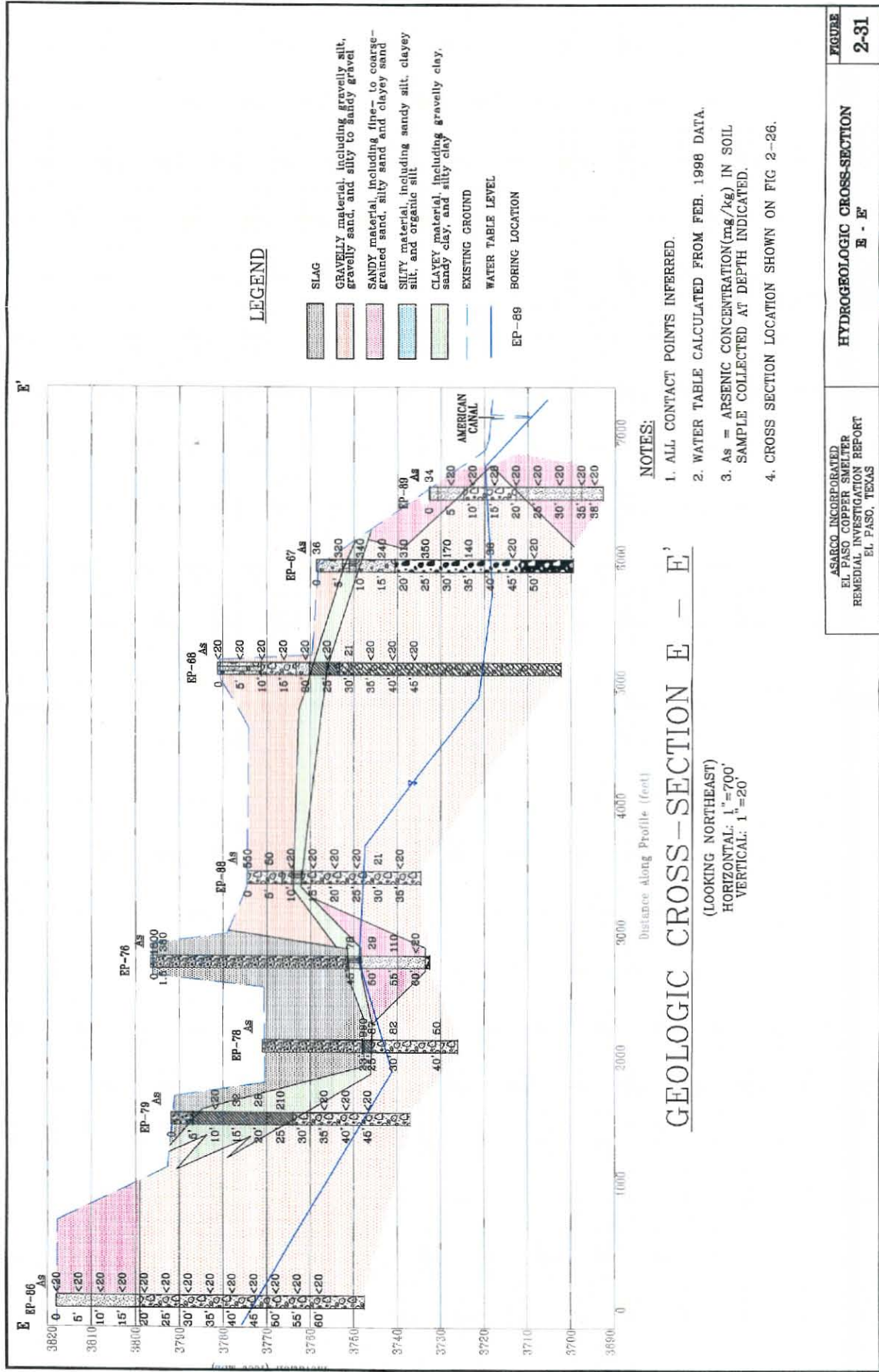
1. ALL CONTACT POINTS INFERRED.
2. WATER TABLE CALCULATED FROM FEB. 1998 DATA.
3. As = ARSENIC CONCENTRATION (mg/kg) IN SOIL SAMPLE COLLECTED AT DEPTH INDICATED.
4. WELL EP-69 ABANDONED DUE TO INSUFFICIENT WATER ENCOUNTERED IN WELL.
5. CROSS SECTION LOCATION SHOWN ON FIG 2-28.
6. NO SOIL SAMPLES ANALYZED IN WELLS EP-14, EP-16, AND EP-29.





## HYDROGEOLOGIC CROSS-SECTION D - D'

(LOOKING NORTH)  
HORIZONTAL: 1"=225'  
VERTICAL: 1"=20'



# LEGEND

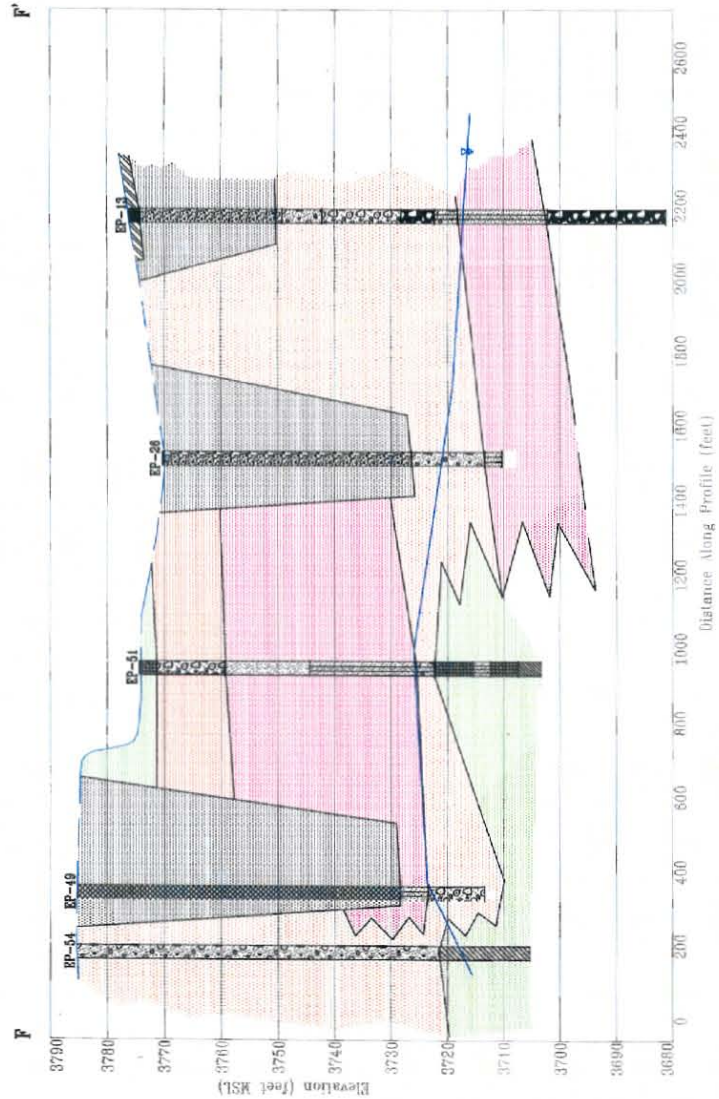
- SLAG
- GRAVELLY material, including gravelly silt, gravelly sand, and silty to sandy gravel
- SANDY material, including fine- to coarse-grained sand, silty sand and clayey sand
- SILTY material, including sandy silt, clayey silt, and organic silt
- CLAYEY material, including gravelly clay, sandy clay, and silty clay
- EXISTING GROUND
- WATER TABLE LEVEL
- BORING LOCATION

## NOTES:

- ALL CONTACT POINTS INFERRED.
- WATER TABLE CALCULATED FROM FEB. 1998 DATA.
- As = ARSENIC CONCENTRATION(mg/kg) IN SOIL SAMPLE COLLECTED AT DEPTH INDICATED.
- CROSS SECTION LOCATION SHOWN ON FIG 2-26.

## GEOLOGIC CROSS-SECTION E - E'

(LOOKING NORTHEAST)  
HORIZONTAL: 1"=700'  
VERTICAL: 1"=20'



# LEGEND

- ASPHALT
- SLAG
- GRAVELLY material, including gravely silt, gravely sand, and silty to sandy gravel
- SANDY material, including fine- to coarse-grained sand, silty sand and clayey sand
- SILTY material, including sandy silt, clayey silt, and organic silt
- CLAYEY material, including gravely clay, sandy clay, and silty clay
- EXISTING GROUND
- WATER TABLE LEVEL
- BORING LOCATION

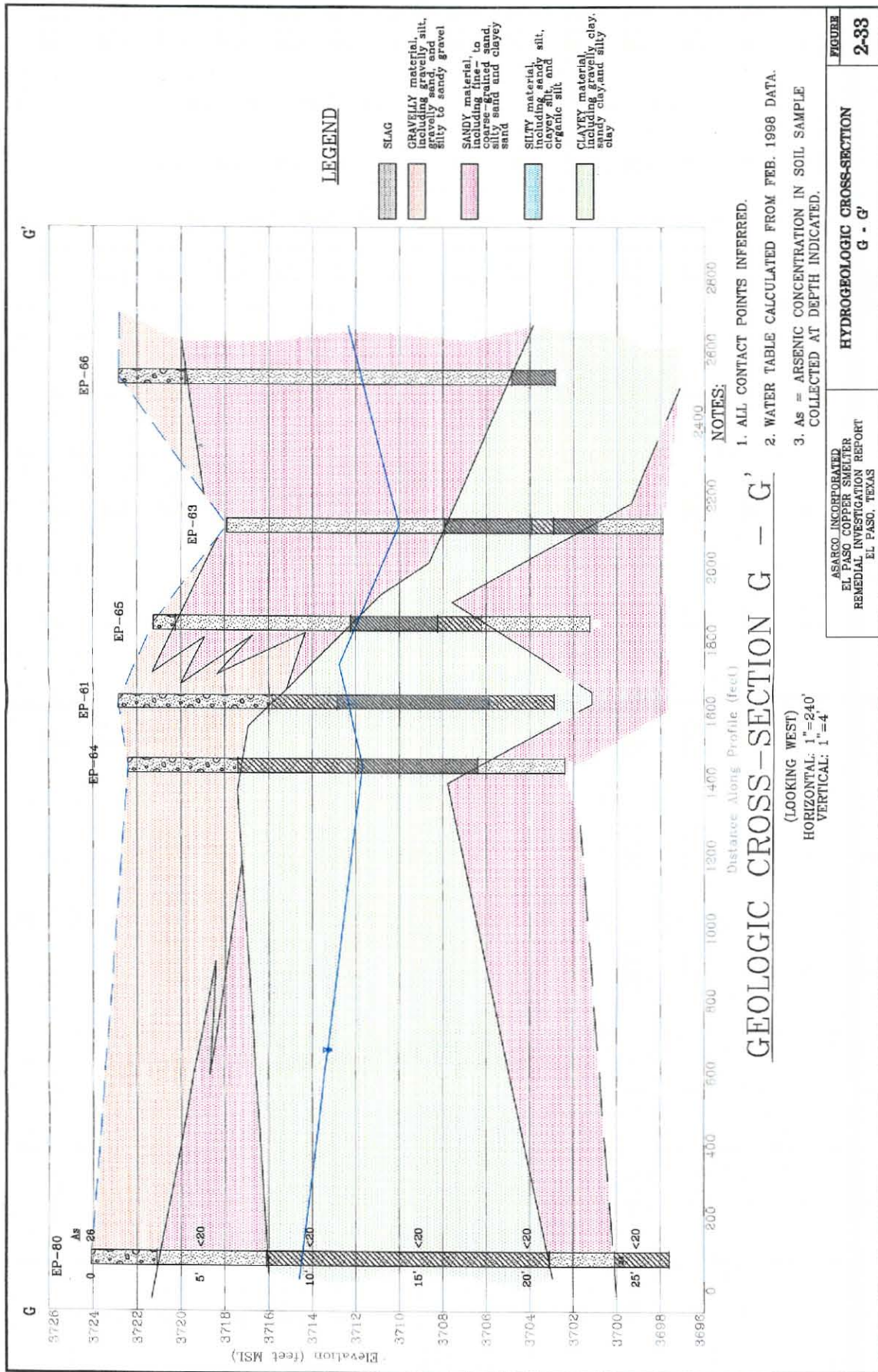
## NOTES:

1. ALL CONTACT POINTS INFERRED.
2. WATER TABLE CALCULATED FROM FEB. 1998 DATA.

## HYDROGEOLOGIC CROSS-SECTION F' - F'

(LOOKING WEST)  
HORIZONTAL: 1"=300'  
VERTICAL: 1"=20'



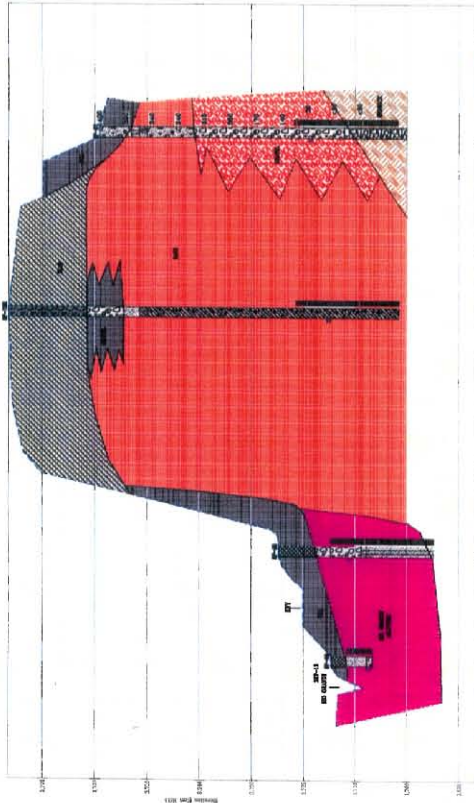






Phase III Remediation Investigation

D-D'



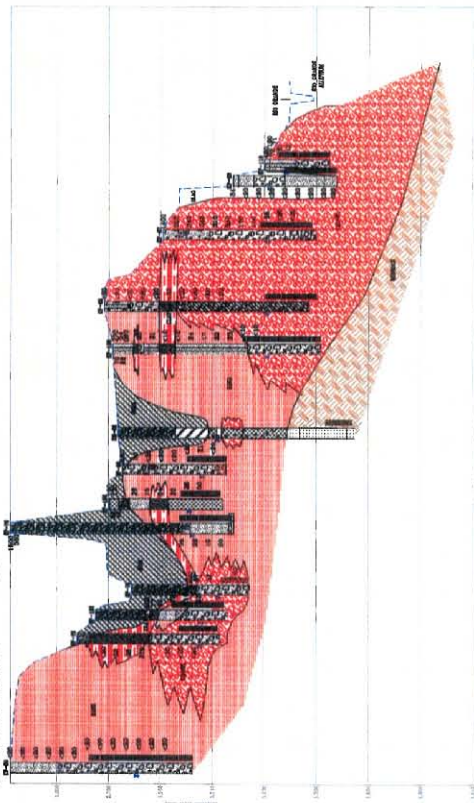
### HYDROGEOLOGIC CROSS-SECTION D - D'

(LOOSELY BASED ON)  
HYDROGEOLOGIC MAP  
VERTICAL SCALE 1"=20'

LEGEND

Phase III Remediation Investigation

D-D'

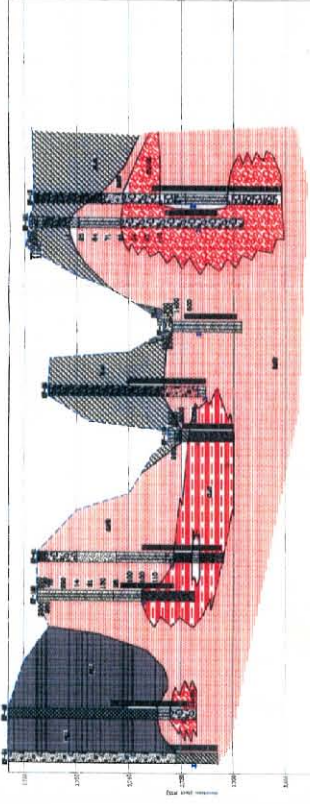


### HYDROGEOLOGIC CROSS-SECTION E - E'

(LOOSELY BASED ON)  
HYDROGEOLOGIC MAP  
VERTICAL SCALE 1"=20'

Phase III Remediation Investigation

F-F'

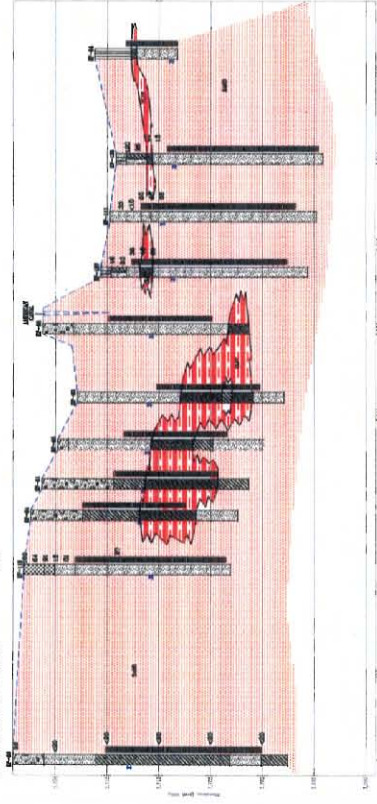


### HYDROGEOLOGIC CROSS-SECTION F - F'

(LOOSELY BASED ON)  
HYDROGEOLOGIC MAP  
VERTICAL SCALE 1"=20'

Phase III Remediation Investigation

G-G'



### HYDROGEOLOGIC CROSS-SECTION G - G'

(LOOSELY BASED ON)  
HYDROGEOLOGIC MAP  
VERTICAL SCALE 1"=20'

LEGEND

REL - sand and gravel  
REL - clay  
REL - silty clay  
REL - silty sand  
REL - sand  
REL - gravel  
REL - cobble  
REL - boulder  
REL - bedrock  
REL - unconsolidated  
REL - consolidated  
REL - metamorphic  
REL - igneous  
REL - sedimentary  
REL - volcanic  
REL - glacial  
REL - alluvial  
REL - fluvial  
REL - lacustrine  
REL - marine  
REL - other

REL - sand and gravel  
REL - clay  
REL - silty clay  
REL - silty sand  
REL - sand  
REL - gravel  
REL - cobble  
REL - boulder  
REL - bedrock  
REL - unconsolidated  
REL - consolidated  
REL - metamorphic  
REL - igneous  
REL - sedimentary  
REL - volcanic  
REL - glacial  
REL - alluvial  
REL - fluvial  
REL - lacustrine  
REL - marine  
REL - other

REL - sand and gravel  
REL - clay  
REL - silty clay  
REL - silty sand  
REL - sand  
REL - gravel  
REL - cobble  
REL - boulder  
REL - bedrock  
REL - unconsolidated  
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REL - glacial  
REL - alluvial  
REL - fluvial  
REL - lacustrine  
REL - marine  
REL - other

REL - sand and gravel  
REL - clay  
REL - silty clay  
REL - silty sand  
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REL - gravel  
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REL - other

REL - sand and gravel  
REL - clay  
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REL - silty sand  
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REL - gravel  
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REL - marine  
REL - other

	<b>Hydrogeologic, Inc.</b> 10000 N. Loop West, Suite 100 Houston, Texas 77040 Phone: (713) 861-1111 Fax: (713) 861-1112	<b>ASARCO INCORPORATED</b> EL PASO COPPER SMELTER PHASE III REMEDIAL INVESTIGATION EL PASO, TEXAS	<b>HYDROGEOLOGIC CROSS SECTIONS</b> D-D', E-E', F-F', G-G'	DRAWING FILE NUMBER LUG 12477601009 PROJECT NUMBER 3
	SCALE INFORMATION HORIZONTAL SCALE 1"=100' VERTICAL SCALE 1"=20' DATE 10/1/98			

visual  
observation  
cat I was  
is for design

**APPENDIX F**

**TCEQ LETTER APPROVING A SEMI-ANNUAL RI  
GROUNDWATER MONITORING AND SAMPLING  
PROGRAM**



Robert J. Huston, *Chairman*  
R. B. "Ralph" Marquez, *Commissioner*  
Kathleen Hartnett White, *Commissioner*  
Margaret Hoffman, *Executive Director*



## TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

*Protecting Texas by Reducing and Preventing Pollution*

May 19 2003

CERTIFIED MAIL#2442

RETURN RECEIPT REQUESTED

Mr. Lairy Johnson  
Environmental Manager  
ASARCO Incorporated-El Paso  
P. O. Box 1111  
El Paso, Texas 79999

Re: Comments to *ASARCO El Paso Copper Smelter Phase III Remedial Investigation Report* dated November 19, 2001  
TCEQ SWR No. 31235  
TCEQ Agreed Order Docket No. 96-0212-MLM-E  
EPA ID No. TXD990757668

Dear Mr. Johnson:

The Texas Commission on Environmental Quality (TCEQ) has reviewed the above referenced submittal dated November 19, 2001. Based on our review of the document and knowledge of the facility, the TCEQ has developed a list of the comments. Since ASARCO is currently investigating the site and proposing various corrective measure to ensure protection of human health and the environment the TCEQ did not review ASARCO's baseline risk assessment (BLRA) and will not provide comments concerning ASARCO's BLRA at this time. It is the understanding of the TCEQ that ASARCO will or has completed a Phase IV investigation. Below are general comments which should be address in the Phase IV Remedial Investigation Report.

1. In Table 1-1 ASARCO incorrectly list the Solid Waste Registration (SWR) number as a Permit number. An SWR number is not a permit number, please do not refer or list ASARCO's SWR number as a permit in the future.
2. On page 2-9 ASARCO stated Total Dissolve Solid (TDS) data for the ASARCO site. The TDS values which were given are from an 1982 document and not from actual sample values. Please note that the TCEQ will not allow any remedial decisions based on referenced values when site concentration can be easily collected.
3. ASARCO propose changes in the ground water sampling frequencies for the El Paso facility. ASARCO list procedures which describes sampling frequency determination for all the monitoring wells. The TCEQ does not agree or approve of the procedures at this time. The TCEQ will approve a semiannual ground water sampling program

Mr. Johnson  
Page 2  
May 19, 2003

which will include analyzing all the constituents and monitor wells. A modified sampling program may be proposed when all of ASARCO's Corrective Measures have been implemented.

4. In general the Corrective Measure Study is completed after the investigation, however, certain interim corrective measures maybe implemented during the investigation. It is possible for a given area that the Corrective Measure will change during the investigation phase. The TCEQ has commented on Corrective Measures with the development of the Area of Contamination (AOC) and will continue to assist ASARCO in selecting the appropriate Corrective Measure. Also, please note that medical monitoring of employees is not an institutional control and should not be proposed as such.

An original and one copy of the written response to these comments must be submitted to the TCEQ at the letterhead address using mail code number MC-127. These comments can be included in ASARCO's Phase IV Report. An additional copy should be submitted to the TCEQ Region 6 Office in El Paso. Your response to this letter and your Phase IV Investigation Report must be received on or before September 30, 2003. The facility name, location and identification number(s) in the TCEQ reference line above should be included in your response.

Please call me at (512) 239-2350 if you need additional information or wish to discuss these comments or the due date. Thank you for your cooperation in this matter.

Sincerely,



Brad Wilkinson, P. G.  
Team I, Corrective Action Section  
Remediation Division  
Texas Commission on Environmental Quality

BW/bw

cc: Mr. Don Robbins, Director of Environmental Services, ASARCO Incorporated-Arizona  
Ms. Terry Sykes, Senior Counsel, EPA Region 6, Legal RCRA Enforcement  
Branch-Dallas  
Waste Program Manager, TCEQ Region 6 Office, El Paso

## **APPENDIX G**

### **CUMULATIVE LIST OF SURFACE WATER AND GROUNDWATER QUALITY RESULTS (GENERAL CHEMISTRY)**