THE CONTENTS OF THIS SECTION ARE
THE HIGHEST QUALITY AVAILABLE

INITIAL [illegible] DATE 3/18/02

Appendix A

Neutron Probe Data

Appendix A
Neutron Probe Data

INTRODUCTION

This appendix presents the neutron probe data, neutron probe calibration and infiltration and recharge calculations. The raw data for the five neutron probe monitoring locations are given in Tables A-1 through A-5. The calibration and infiltration estimates are described below.

Neutron Probe Calibration

To quantify the amount of water movement that occurred at the Neutron Access tube (NAT) locations, the neutron moisture probe raw data (counts) must be correlated to moisture contents. Two calibration curves were established based on two basic soil types present at the landfills. A calibration curve for each of these two types of soil must be developed because of the different character of sand and clay. Water is bound up in the structure of most clay minerals and can cause an elevated neutron count throughout the moisture content curve while the minerals that form sand and gravel deposits do not retain water in their mineral structures.

For an ideal calibration curve, soil samples are collected and neutron probe readings are made at the same locations and depths. The water content of the soil samples is measured, and a relationship between the neutron moisture probe counts and water content for that location is established. This was not done at the CFA landfills because the NATs were driven instead of drilled. For the CFA landfills, the counts from the neutron moisture probe were calibrated to samples from adjacent boreholes in Landfill II and Landfill III.

The calibration for sand and gravel is given in Figure A-1 and the clay calibration is in Figure A-2. The curve for the sand and gravel calibration was forced through zero. Two moisture content determinations per sample were made for several sample depths. The two moisture content measurements were averaged for the purposes of plotting the data. The scatter about the best-fit line for the sand and gravel calibration is probably due to natural variability of the soil or sample disturbance.

Because the clay calibration contains only three points, the slope of the line could change if more data were available and may approach the slope of the line for the sand and gravel calibration. Additional uncertainty over the slope of the clay calibration line exists because the LF2-04 data point is based on a neutron probe reading taken at 22 feet, but the moisture content was determined for a clay sample at 25 feet. This point was used because of the consistent lithology (clay) between 22 and 25 feet. If only the two data points with matching NAT readings and lithology are used for the clay calibration, then a slope of only 0.00056 and a y-intercept of 12 is obtained. This is a significant departure from the calibration used here and its effect would be to decrease moisture content determinations and reduce recharge estimates. The limited number of data points available to calibrate neutron probe readings with moisture contents make both calibration curves rough estimates at best. The calibration equations for sand and gravel and clay used to determine moisture content (MC) from neutron probe data are:

Sand and Gravel

$$MC = 0.000808 * counts$$

Clay

$$MC = 0.00166 * counts + 4.74$$

The mass water content was converted to a volumetric water content by multiplying the mass water contents by the soil bulk density. An average bulk density of 1.98 g/cm^3 was used to convert mass water contents to volumetric water contents for sand and gravel soils and 1.69 g/cm^3 for clay dominant soils. These bulk density numbers are based on samples collected from the boreholes adjacent to the NAT tubes (Ansley, et al. 1988). The equations to calculate volumetric water content (Vol) are:

$$Vol = MC*1.98, \quad \textit{for Sand and Gravel, and}$$

$$Vol = MC * 1.69, \quad \textit{for Clay}$$

The calibration curves were assigned to one foot increments of the NATs based on lithology logs for boreholes drilled next to the NATs located off the landfills (Table A-6). For the NATs located on the landfills, one foot increments with count rates less than 5500 were assigned the sand and gravel calibration curve, and over 5500 assigned the clay calibration.

Infiltration and Recharge Estimate Procedure

Infiltration is defined here as how much water moved into the soil column. Recharge is defined as how much water moved below the rooting zone or evapotranspiration depth and into the underlying formation presumably in route to the aquifer. Drainage refers to water moving out of a 1 ft layer, either downward or upward. Decreasing moisture contents at the NAT locations can be due to evapotranspiration (ET) or to drainage of water downward and out of the profile. The effective depth of ET is variable and depends on the rooting depth of plants as well as meteorological conditions. During the winter, when temperatures are low and plants are dormant, ET is negligible (Anderson et al., 1993). Evapotranspiration increases as temperatures rise and plants become active in the late spring and early summer.

The ET depths for the five NAT locations were estimated based on the amount of drainage occurring at 1 ft increments (Tables A-7 through A-11). The drainage from one layer to the next within the ET zone should steadily decrease until the zero flux boundary is reached. The depth at which drainage becomes nearly constant is assumed to be the ET depth. Based on the drainage plots, an ET depth of 3.5 to 4 ft (1.2 m) is probable. These ET depths are less than the estimated rooting depth of 63 in. (1.6 m) for crested wheatgrass probably because the covers were planted with seed rather than transplanted (Anderson et al., 1993).

The change in storage was calculated based on the net change in volumetric moisture contents for the same depth between monitoring dates. This difference was multiplied by 12 in. to yield an equivalent

depth of water over a 12 in. thickness. These differences were then totaled over the soil profile, the thickness of which depended on the ET depth assigned to that NAT location. The monthly change is storage is calculated for a 1 ft layer and for the soil column as follows:

One foot layer

$$\Delta Volumetric\ water\ content = (Vol_{april} - Vol_{march})* 12\ in.$$

Soil Column

$$\Delta Volumetric\ water\ content = \Sigma\ \Delta\ Volumetric\ water\ contents\ for\ each\ one\ foot\ layer.$$

A one-year cycle from August 1997 through August 1998 was chosen for total drainage and drainage below ET depth estimates because it is the only complete year of data. Tables A-7 through A-11 shows the results of the change in storage calculations for this period. All numbers are in inches of water and represent the estimated change in stored water over the neutron tube depth for the specified month. Negative changes in storage for a 1-ft layer indicate water drainage out of a soil layer. Drainage out of a 1 ft layer can be either up or down. Similarly, a negative change in storage for the whole soil profile indicates a net decrease in storage. Conversely, positive changes in storage indicate a net increase in water content.

Measurements were taken monthly at the NAT locations and some infiltration or drainage may have been missed by not monitoring often enough during the late winter and spring. These assumptions affect the drainage estimates.

Infiltration, Recharge, and Drainage Estimates Using NAT Data

Three approaches were used to estimate infiltration and recharge. One approach to estimate infiltration and recharge was to sum the change in storage during the spring recharge event. Because evapotranspiration greatly exceeds available rainfall on a yearly basis, recharge is more likely to occur in the spring. Many studies have reported that snowmelt is a major contributor to infiltration at the landfills (Ansley et al 1988 and Keck et al. 1995). The second approach was to estimate recharge based on the available precipitation, and the third method was to examine the drainage out of each layer and the soil column.

Infiltration and Recharge Estimates Based on the Spring 1998 Infiltration Event.

Tables A-7 through A-11 show a distinct infiltration event occurring the in the spring of 1998. The amount of water infiltrating into the soil column at each NAT location is calculated by subtracting the March reading from the April reading for each 1 ft interval and then summing the increases in storage. Two NATs, LF2-07 and LF3-05, are located through the landfill covers. Recharge below the rooting depth at LF2-07 and LF3-05 was estimated to be 2.27 and 0.11 in., respectively, during the spring infiltration event. Recharge from the three remaining NAT locations, adjacent to the native soil covers, was 2.43 in. at LF2-03, 1.96 in. at LF2-04, and 1.84 in. at LF3-03. LF3-03 shows a large change in counts at the bottom of the NAT, but much smaller changes above the bottom of the NAT. This may be caused by perching of water at the soil/basalt contact near the bottom of the tube. The infiltration data for the Spring of 1998 is summarized on Table A-12.

The data in Tables A-13 through A-17 do not show a distinct infiltration event for the spring of 1997. The data for three NAT tubes indicate that a minor recharge event may have occurred in January of 1997. However, two probe locations, LF2-04 and LF 2-07 do not have data from December of 1996 for comparison. Consequently, no recharge is apparent in 1997 for LF2-04 and LF2-07.

Infiltration and Recharge Estimate for the Spring of 1998 Based on a Water Balance Approach (Available Precipitation)

Infiltration and recharge was estimated based on the available water from precipitation. The site received 9.53 inches of precipitation over the year and 3.36 inches in the period from December 97 till April 98. The distribution of precipitation over the year is shown in Table A-18. These estimates are based on partitioning the water into the soil column based on the percentage of counts within the rooting zone and below the rooting zone. The calculation assumes all the precipitation moves into the column over a one month period from March to April in 1998. A distinct recharge event was not evident in 1997. The recharge based on water balance is calculated as follows:

$$rech\arg e = \left(\sum_{5}^{total_depth} \Delta counts \Big/ \sum_{1}^{total_depth} \Delta counts \right) x_precipitation$$

This method does not use a calibration to calculate changes in moisture content. Recharge is calculated based on the increase in counts below 6 feet divided by the increase in counts over the whole soil column and then multipling that percentage by the available precipitation. This approach assumes that all the available precipation infiltrates within a short period, none of the precipation evaporates, and no ponding of water occurs at the locations.

Recharge estimates range from 0.16 inches for LF3-05 to 2.57 inches for LF2-04 (Table A-19). A distinct infiltration event was not evident in 1997 (Tables A-13 through A-17), so a recharge calculation was not performed for that year.

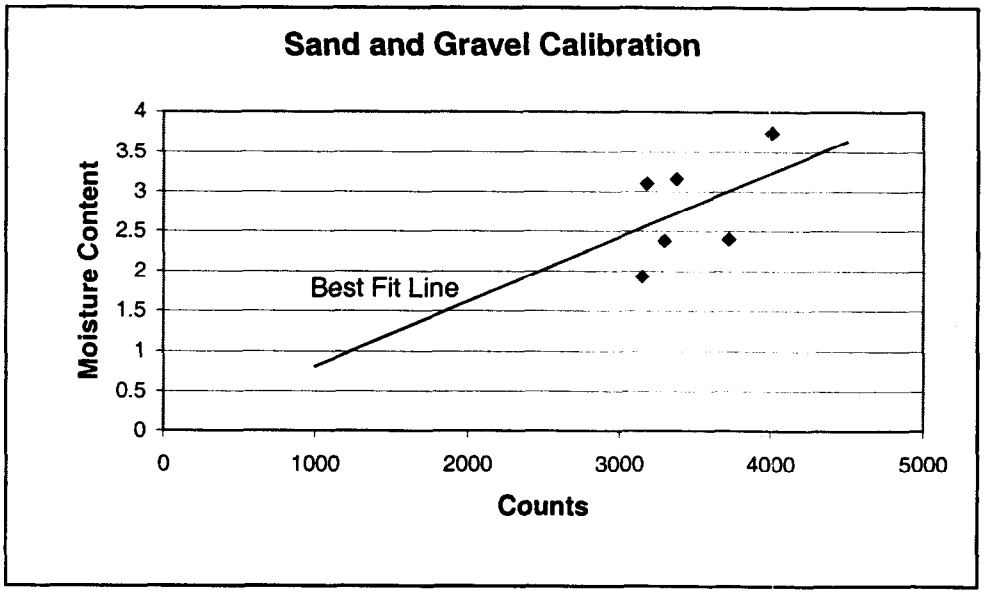
Drainage Estimates

The total amount of drainage (outflow) from each one foot layer in the soil column was calculated by summing the negative changes in storage for each layer from August 97 to August 98. The negative changes in storage were summed for all layers in the column to calculate total drainage and for all layers below the rooting depth to calculate drainage below the rooting depth. The results for these calculations are in Tables A-7 through A-11.

Total drainage estimates range from 5.79 inches for LF2-04 to 7.48 inches for LF2-07. Drainage below the ET depth ranges from 2.17 inches for LF3-05 to 3.08 inches for LF2-07. Some of the drainage for LF2-07 and probably most, if not all, of the drainage for LF3-05 are accounted for by losses in storage as indicated on Tables A-7 and A-11. Both LF2-07 and LF3-05 are located on the Landfill covers. LF3-05 showed decreasing moisture contents over time for the whole soil column.

Figure A-1 Neutron Probe Sand and Gravel Calibration

Location	Depth (feet)	Counts	Moisture Content
LF2-03/2-01	5	3150	1.93
LF2-03/2-01	10	3725	2.4
LF2-03/2-01	15	3300	2.38
LF3-03/3-02	5	3181	3.1
LF3-03/3-02	10	3378	3.16
LF3-03/3-02	15	4009	3.74



SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.908238
R Square	0.824896
Adjusted R Square	0.658229
Standard Error	0.50802
Observations	7

Best Fit Line

y=0.000808x+0

x=counts	mx+b =y
1000	0.81
2000	1.62
4500	3.64

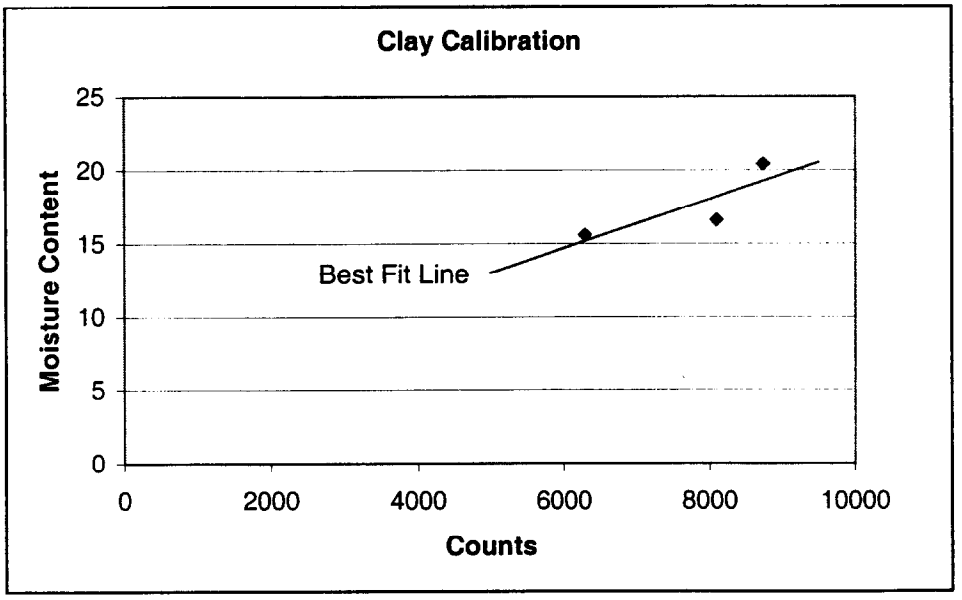
ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	7.294834901	7.294835	28.26528	0.003149152
Residual	6	1.548507956	0.258085		
Total	7	8.843342857			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0	#N/A	#N/A	#N/A	#N/A	#N/A
X Variable 1	0.000808	5.97484E-05	13.52123	1.01E-05	0.000661672	0.00095407

Figure A-2 Neutron Probe Clay Calibration

Location	Depth (feet)	Counts	Moisture Content
LF2-03/2-01	20	8094	16.6
LF2-4/2-02	20	6294	15.6
LF2-4/2-02	22	8734	20.4



SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.829415
R Square	0.687929
Adjusted R Square	0.375858
Standard Error	2.000708
Observations	3

Best Fit Line

y=0.00166x+4.74

x=counts	mx+b =y
5000	13.04
7000	16.36
9500	20.51

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	8.823834277	8.823834	2.204398	0.377348133
Residual	1	4.002832389	4.002832		
Total	2	12.82666667			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	4.737003	8.695736294	0.54475	0.682452	-105.7523297	115.226335
X Variable 1	0.00166	0.001118243	1.484721	0.377348	-0.012548289	0.01586885

Table A-1 Neutron Probe Measurments for Access Tube # LF2-03

Depth (ft)	Date 7/26/96	8/29/96	10/2/96	11/4/96	12/11/96	1/16/97	2/13/97	3/24/97	4/24/97	5/27/97	6/23/97	7/21/97	8/28/97
1	280		342	372	788	833	482	422	520	335	402	303	239
2	3404	3353	3354	3294	4888	6984	8235	7191	7000	5980	6004	3946	3347
3	3118	3160	2992	2999	3124	4402	6548	7903	8135	7052	7224	5168	3962
4	3422	3255	3268	3201	3284	4298	3811	4018	4315	4113	4000	3844	3617
5	3372	3281	3316	3297	3284	4153	3752	3704	4053	3757	3818	3523	3419
6	3503	3356	3329	3354	3408	3869	3757	3694	3939	3854	3592	3650	3495
7	3899	4625	4293	4438	4668	5030	3423	3457	3426	3457	3417	3333	3388
8	4048	3738	3640	3719	3640	3798	5780	5693	5516	5798	5577	5583	5655
9	3729	3678	3874	3779	3780	3773	3972	3985	3949	3903	3995	3937	3824
10	3630	3624	3425	3587	3576	3528	3795	3786	3795	3872	3788	3849	3876
11	4294	4526	4404	4435	4580	4595	3843	3817	3957	4015	3933	4041	4136
12	4520	4300	4293	4307	4488	4416	4549	4601	4584	4711	4651	4723	4709
13	3678	3720	3629	3745	4016	3690	3756	3737	3607	3667	3697	3789	3642
14	3742	3757	3738	3687	4088	3828	3597	3523	3508	3659	3542	3653	3585
15	4101	4056	4051	4094	4032	3770	4009	3850	4024	3921	4060	4057	3987
16	4377	4336	4304	4166	4184	4193	4163	4259	4218	4188	4224	4111	4234
17	3702	3627	3665	3733	3416	3759	3659	3739	3610	3713	3742	3652	3622
18	3469	3531	3494	3568	3392	3579	3398	3410	3434	3441	3483	3574	3300
19	4777	4770	4681	4701	4924	4777	4861	4910	4954	5048	4939	4898	4977
20	3434	3441	3489	3597	3572	3619	3727	3594	3602	3618	3643	3608	3638
21	8154	8060	8110	8076	8328	8025	8157	8084	8069	7980	8068	7881	8084
22	7810	7837	7586	7692	7776	7822	7665	7837	7849	8012	7786	7666	7886
23	9623	9558	9491	9610	9788	8723	9554	9630	9575	9520	9555	9598	9463

Depth (ft)	9/25/97	12/4/97	1/8/98	2/5/98	3/11/98	4/9/98	5/7/98	6/11/98	7/15/98	8/12/98	9/24/98
1	258	502	1366	2018	7226	410	372	348	265	243	300
2	3278	4818	5045	6093	5618	6913	6230	5073	3194	3054	3569
3	3891	4916	4998	5363	6277	8263	7584	6288	3764	3713	3590
4	3562	3576	3547	3441	3470	4361	4024	3909	3721	3544	3473
5	3501	3405	3359	3313	3262	4057	3769	3660	3574	3486	3374
6	3448	3420	3324	3277	3349	4014	3825	3689	3641	3608	3415
7	3399	3279	3421	3329	3288	3546	3484	3510	3429	3493	3317
8	5510	5355	5343	5321	5333	6345	6057	5982	5810	5806	5642
9	3787	3785	3891	3855	3816	4289	3977	3982	3831	3875	3827
10	3870	3844	3771	3766	3855	4143	3900	3961	3896	3820	3787
11	4133	4076	4064	3933	3933	4430	4271	4184	4137	4204	4154
12	4733	4622	4727	4660	4648	5042	5020	4846	4887	4842	4740
13	3782	3795	3807	3719	3798	4050	3981	3794	3805	3838	3816
14	3608	3623	3664	3658	3551	4114	3964	3879	3748	3764	3880
15	3995	4074	4018	4027	3945	4695	4290	4347	4362	4322	4270
16	4240	4171	4248	4321	4151	4784	4661	4661	4523	4432	4393
17	3735	3684	3578	3662	3711	4163	4040	3983	3842	3848	3894
18	3478	3538	3448	3547	3518	3868	3889	3777	3635	3708	3755
19	4946	4902	4897	4895	4972	6217	5743	5571	5510	5505	5503
20	3699	3618	3610	3618	3643	4917	4478	4276	4210	4056	3935
21	8073	7880	8029	8079	8201	8857	8691	8433	8268	8318	8175
22	7853	7861	7830	7812	7744	8240	8461	8300	8266	8175	8127
23	9392	9547	9442	9646	9750	10174	10152	10135	10120	9942	9858

Table A-2 Neutron Probe Measurements for Access Tube # LF2-04

Depth (ft)	Date 1/15/97	2/13/97	3/24/97	4/24/97	5/27/97	6/23/97	7/21/97	8/28/97	9/25/97	12/4/97	1/8/98
0	3133	2664	1569	1864	976	1256	1008	863	1046	1660	2678
1	4271	5627	4942	4934	3486	3601	3252	3002	3039	3249	5438
2	4302	4142	4114	4109	3760	3595	3498	3347	3149	3166	3789
3	4111	4184	4175	4238	4134	3944	3874	3683	3574	3474	3509
4	4292	4164	4092	4001	4109	3937	3849	3709	3599	3662	3611
5	4808	4109	3967	4214	4083	3979	3821	3756	3841	3817	3701
6	4281	4392	4355	4160	4177	4196	4078	3977	3884	3762	3978
7	4375	3974	3942	3962	3927	3891	3897	3712	3743	3696	3589
8	4376	4362	4148	4302	4108	4156	4210	4065	4069	3949	3843
9	4902	4909	4749	4818	4703	4374	4823	4661	4760	4699	4602
10	5312	5285	4512	4994	4845	4755	4740	4690	4679	4652	4666
11	4718	4911	4958	4530	4539	4486	4469	4481	4420	4468	4549
12	4639	4330	4507	4109	4110	4008	4026	4105	4017	3898	3852
13	4634	4495	4500	4398	4390	4211	4325	4403	4204	4160	4174
14	4980	4615	4214	4468	4421	4380	4400	4405	4387	4343	4305
15	4485	4143	4414	3988	3928	3987	3911	3980	4007	3859	3941
16	4352	4175	4112	3907	3856	4018	3944	4025	3867	3875	3907
17	4077	3998	4352	3946	3843	3911	3881	3926	3810	3877	3828
18	4421	4005	3587	3858	3810	3849	3862	3802	3683	3543	3760
19	4423	4319	4031	3997	4151	4003	4017	3997	3876	3795	3824
20	6526	6575	4903	6603	6413	6339	6233	6491	6337	6299	6284
21	6756	7164	6517	7207	7125	7243	7139	7009	6955	7077	6997
22	8732		9086	9057	9028	8950	8780	8858	8934	8775	8698

Depth (ft)	Date 2/5/98	3/11/98	4/9/98	5/7/98	6/11/98	7/15/98	8/12/98	9/24/98
0	4730	8917	1878	1217	1161	916	983	1262
1	5546	4735	4836	3790	3653	3139	3024	3049
2	3573	3739	4327	3848	3876	3529	3415	3131
3	3598	3585	4441	4262	4124	3989	3807	3603
4	3527	3628	4552	4279	3997	3735	3600	3610
5	3750	3814	4318	4190	4189	3956	3841	3803
6	3867	3975	4594	4379	4204	4136	4115	4030
7	3692	3667	4317	4071	4000	3904	3867	3651
8	4013	4159	4763	4373	4256	4248	4081	4013
9	4497	4884	5042	4828	4889	4739	4846	4747
10	4590	4973	5433	5340	5060	4992	4932	4750
11	4299	4764	4969	4778	4586	4631	4587	4375
12	3910	3989	4413	4354	4127	4082	4097	4020
13	4281	4181	4713	4428	4430	4358	4304	4312
14	4397	4355	4745	4741	4505	4385	4538	4375
15	3741	3870	4154	4181	3930	4078	3827	3977
16	3755	3913	4180	3968	4123	3942	3996	3922
17	3746	3898	4065	3842	3901	3859	3892	3749
18	3571	3733	4170	3945	3958	3856	3763	3647
19	3710	3722	4382	4155	4199	3991	3917	3920
20	6319	6276	6754	6597	6307	6454	6443	6407
21	6917	6886	7639	7494	7165	7053	7261	7114
22	8991	8841	9270	9171	9113	8989	9073	9019

Table A-3 Neutron Probe Measurements for Access Tube # LF2-07

Depth (ft)	DATE 1/15/97	2/13/97	3/24/97	4/24/97	5/27/97	6/23/97	7/21/97	8/28/97	9/25/97	12/4/97	1/8/98
	97	77	65	57	44	80	55	73	64	72	62
0	8101	2173	357	906	447	525	409	323	386	798	1276
1	9159	8915	7848	7553	6638	7193	5939	4939	4582	4386	6386
2	5672	6504	7737	6628	6370	6340	5610	5093	4807	4613	4711
3	6329	5532	6955	5517	5246	5268	5241	4900	4694	4591	4570
4	7047	6510	5439	6525	6474	6457	6461	6444	6387	6200	6006
5	6328	6887	6433	6713	6826	6882	6851	6561	6552	6518	6401
6	6138	6132	6832	5889	5949	6028	6019	5941	5887	5945	5922
7	8860	6430	6132	6170	5996	6224	6156	6119	5975	5950	6006
8	5928	13462	6218	13495	13566	13472	13543	13522	13419	13373	13449
9	7950	5789	5514	5479	5271	5250	5218	5219	5157	5166	5008
10	6140	6453	6287	6218	6165	6066	6084	6170	6203	6153	6029
11	7478	7175	7279	7093	7036	7133	7243	7198	7156	7276	7151
12	6477	6054	6106	5887	5967	5826	5772	5692	5849	5921	5734
13	6448	6119	5890	5960	5782	5869	5567	5610	5607	5575	5557
14	7415	7197	7206	7286	6939	7116	6887	7066	6665	6769	6743
15	8226	8166	8186	8039	8194	8113	8011	8278	8033	8215	8228
16	11058	10965	10903	11101	10789	10573	10761	10746	10697	10718	10586
17	14500	13680	13467	13641	13483	13345	13268	13339	13440	13301	13323
18	8263	8485	8324	8413	8272	8307	8316	8340	8295	8377	8554

Depth (ft)	DATE 2/5/98	3/11/98	4/9/98	5/7/98	6/11/98	7/15/98	8/12/98	9/24/98
	94	175	79	79	62	76	55	72
0	4209	9187	612	454	440	388	356	395
1	6398	5708	7614	6717	6665	6316	5,137	6182
2	4842	4994	6973	6249	5892	5869	5,076	5451
3	4634	4583	6372	6094	5920	5790	5,476	5363
4	6007	5928	6673	6684	6528	6491	6,488	6494
5	6411	6405	6907	6937	6761	6751	6,726	6647
6	5830	6035	6496	6359	6271	6171	6,154	6255
7	5944	5904	6540	6321	6241	6135	6,276	6014
8	13273	13326	13489	13364	13179	13546	13,447	13191
9	5082	5080	6210	5809	5503	5500	5,387	5272
10	6023	5893	6627	6288	6346	6176	6,241	5985
11	7140	6961	7199	7265	7104	7185	7,154	7049
12	5737	5680	6123	6002	6063	5983	5,191	5920
13	5490	5446	6504	6213	5921	5823	5,781	5811
14	6900	6694	7393	7307	7083	7007	7,000	7050
15	8131	8209	8249	8222	8344	8270	8,135	8163
16	10443	10487	10776	10842	10867	10808	10,742	10858
17	13231	13111	13629	13581	13702	13420	13,865	13550
18	8437	8294	8325	8394	8395	8458	8,366	8284

Table A-4 Neutron Probe Measurements for Access Tube # LF3-03

Depth (ft)	Date 7/26/96	8/29/96	10/2/96	11/4/96	12/11/96	1/15/97	2/13/97	3/24/97	4/24/97	5/27/97	6/23/97	7/21/97	8/28/97	9/25/97	12/4/97	1/8/98
					56	85	94	60	58	54	66	38	46	37	65	80
			106[a]	1194[a]	5856	4627	6400	194	219	160	156	147	140	135	279	392
0.5	949[a]	485[a]	2811	3593	4976	5606	6353	9001	8728	7102	7833	4797	4063	1456	5599	7125
1.5	6260	5546	5612	5774	5816	7508	7149	5809	5542	5267	5302	4616	4013	3905	4132	4335
2.5	3790	3767	3689	3615	3356	4617	5078	8039	8152	8143	8159	7986	6823	6440	6503	6441
3.5	3663	3653	3528	3589	3444	4416	4127	3942	3977	4068	3923	3967	3774	3647	3573	3518
4.5	3537	3457	3322	3375	3312	3838	3728	3801	3897	3694	3768	3734	3616	3615	3433	3441
5.5	3685	3579	3675	3666	3536	4125	3663	3594	3527	3531	3438	3379	3407	3410	3360	3215
6.5	3807	3444	3486	3516	3368	3784	3612	3748	3709	3618	3623	3611	3721	3542	3582	3355
7.5	4127	4136	4005	3946	4024	4284	4108	3742	3845	3735	3726	3820	3691	3596	3607	3527
8.5	4396	4417	4478	4480	4324	4793	4852	4083	4026	3957	3999	4012	3873	3866	3881	3833
9.5	3791	4049	4070	4021	4088	4351	4125	4335	4301	4256	4159	4274	4340	4374	4067	4172
10.5	4050	3798	3688	3528	3516	4034	3910	3792	3623	3708	3622	3691	3559	3593	3666	3689
11.5	5190	4134	4193	4098	4168	4265	4628	4005	3943	3918	3840	3926	3946	3970	3781	3881
12.5	4157	4361	4272	4301	4252	4453	4137	4994	4917	4853	4803	4840	4956	4897	4993	4815
13.5	4170	4300	4406	3720	4244	4902	4601	4267	4339	4322	4247	4241	4252	4253	4137	4290
14.5	3820	3768	3738	3953	3752	3944	3886	3822	3831	3795	3809	3770	3895	3742	3922	3859
15.5	4132	3979	3921	3928	4048	4089	4132	3901	4110	3901	4014	3908	3868	3942	3888	3851
16.5	3867	3974	3925	3672	3648	4178	3999	4032	4145	3949	3756	4032	3972	3976	3969	3986
17.5	4046	3782	3712	4198	4028	3713	3985	3855	3660	3789	4133	3773	3803	3707	3652	3688
18.5	4150	4097	4121	4629	4484	5393	6078	4272	4201	4141	4628	3960	4060	4180	4070	4019
19.5			4501					5045	4887	4511	4588	4668	4509	4495	4511	4485

Depth (ft)	Date 2/5/98	3/11/98	4/9/98	5/7/98	6/11/98	7/15/98	8/12/98	9/24/98
	82	115	65	56	49	50	62	49
	1040	6228	204	196	180	113	102	140
0.5	8282	7690	8502	7171	6493	3976	4437	6168
1.5	4287	4279	5958	5634	5327	4236	4223	4047
2.5	6331	6374	8279	8070	8069	7568	7012	5992
3.5	3489	3585	4277	4173	4215	3933	3842	3771
4.5	3363	3453	4195	4099	3895	3903	3727	3578
5.5	3280	3253	3779	3661	3545	3638	3478	3412
6.5	3519	3386	3933	3787	3812	3652	3669	3650
7.5	3498	3441	3912	3905	3878	3801	3710	3725
8.5	3813	3824	4009	3961	3968	4049	3920	3846
9.5	4105	3983	4440	4265	4225	4190	4247	4400
10.5	3486	3512	3850	3765	3649	3689	3747	3739
11.5	3774	3808	4041	4010	4040	4028	3973	3966
12.5	4885	4866	5002	4923	4873	5019	4806	4864
13.5	4141	4157	4661	4440	4329	4297	4336	4243
14.5	3747	3689	4027	3896	3878	3846	3760	3779
15.5	4013	3877	3985	3931	4005	3992	3939	3910
16.5	3969	3973	3985	4145	4147	4094	4092	4033
17.5	3695	3761	3710	3832	3814	3890	3726	3787
18.5	4041	4004	5795	5261	4545	4304	4239	4262
19.5	4418	4534	7765	7407	6192	5354	4797	4716

Table A-5 Neutron Probe Measurements for Access Tube # LF3-05

Depth (ft) \ Date	7/26/96	8/29/96	10/2/96	11/4/96	12/11/96	1/15/97	2/13/97	3/24/97	4/24/97	5/27/97	6/23/97	7/21/97	8/28/97	9/25/97	12/4/97	1/8/98
					108	106	78	72	80	78	86	75	64	86	97	95
0			1901	2097	7868	9465	7048	4077	4047	2639	2761	1735	1229	1467	2614	4949
1		178	5680	5311	4960	5966	7659	7329	6400	6048	5934	4528	3797	3676	3697	3823
2	3960	4490	5042	4983	4736	5517	4341	4414	4502	4455	4479	3920	3422	3431	3444	3530
3	5582	5993	5846	5066	5956	5402	5293	5231	5275	5284	5213	5224	4558	4658	4784	4796
4	6929	6759	6894	6722	6860	7119	6634	6784	6606	6781	6779	6814	6705	6575	6609	6511
5	3869	4078	4217	4117	3948	4332	6774	6597	6537	6570	6570	6528	6394	6253	6036	6109
6	4041	3795	3591	3552	3464	4390	3678	3624	3701	3582	3588	3543	3524	3450	3461	3354
7	3495	3318	3192	3188	3116	3559	3947	3596	3515	3546	3489	3471	3418	3412	3235	3293
8	3827	3414	3379	3284	3552	3768	3481	3449	3425	3320	3215	3477	3284	3201	3141	3108
9	3621	3528	3625	3491	3404	3798	4044	3794	3633	3558	3484	3429	3378	3413	3437	3368
10	4320	3740	3557	3595	3688	3477	3394	3307	3343	3230	3288	3184	3193	3138	3182	3142
11	4349	4488	4240	4288	4352	4302	4223	4062	4054	4134	4068	4090	3998	4063	4047	3848
12	4912	4657	4301	4265	4208	4328	3953	3971	4059	4039	4102	4240	4016	3977	3923	3979
13	3958	3933	3963	3767	3800	3693	3927	3919	3943	3892	3853	3779	3935	3935	3829	3819
14	4499	4508	4254	4241	3916	4182	4006	3958	3911	3925	3963	3889	3938	3974	3931	3912
15	4952	4535	4523	4278	4164	4271	4441	4133	4015	4024	4138	4111	4032	4028	3985	3985
16	4382	4440	4485	4405	4360	4356	4457	4551	4328	4310	4273	4312	4254	4355	4308	4327
17	4470	4368	4453	4331	4504	4347	4457	4557	4526	4463	4455	4460	4343	4344	4298	4373
18	5490	4713	4435	4395	4468	4364	4307	4231	4185	4295	4211	4247	4226	4204	4162	4267
19	6863	5049	4753	4759	4680	4710	4894	4827	4812	4641	4790	4629	4779	4654	4719	4642
20	3861	4527	4763	4654	4452	4593	4416	4458	4418	4275	4424	4315	4587	4335	4377	4394
21	10161	7022	6177	6208	6108	6343	6474	6487	6545	6372	6562	6528	6711	6318	6401	6482
22	10576	10359	10595	10543	10352	10475	10662	10325	10511	10292	10513	10422	10314	10445	10395	10321
23	8683	9619	9747	9687	10076	9871	9688	9681	9411	10341	9381	9540	9342	9522	9493	9500
24	8304	8442	8451	8517	8272	8471	8429	8438	8733	8474	8550	8726	8547	8637	8695	8806

Depth (ft) \ Date	2/5/98	3/11/98	4/9/98	5/7/98	6/11/98	7/15/98	8/12/98	9/24/98
	128	376	86	64	83	54	75	57
0	7771	10494	3486	2518	2786	1542	1218	1940
1	3974	3977	6633	5924	5910	5411	4300	3804
2	3504	3539	4686	4403	4346	3912	3426	3519
3	4787	4576	5442	5134	4945	4914	4592	4484
4	6698	6476	6829	6685	6784	6669	6599	6616
5	6158	5969	6300	6134	6199	6170	6227	5843
6	3370	3255	3530	3463	3394	3379	3373	3304
7	3230	3172	3247	3322	3403	3334	3231	3294
8	3062	3095	2963	3019	3130	3012	3059	3097
9	3284	3247	3229	3296	3314	3302	3257	3285
10	3183	3086	3003	3068	3187	3060	3255	3081
11	3999	3988	3925	4021	3909	3983	3908	4023
12	3893	3971	3911	3964	3973	4058	3914	3947
13	3832	3881	3889	3856	3861	3981	3789	3859
14	4026	3871	3832	3984	3983	3955	3838	3935
15	3996	4026	4066	4020	4054	4017	4020	3854
16	4269	4288	4255	4149	4286	4362	4196	4238
17	4363	4266	4298	4233	4446	4221	4267	4319
18	4196	4080	4166	4116	4169	4111	4220	4164
19	4732	4719	4586	4576	4655	4617	4743	4636
20	4312	4444	4293	4344	4412	4295	4232	4291
21	6474	6456	6487	6547	6588	6633	6604	6435
22	10475	10203	10444	10352	10284	10630	10489	10587
23	9466	9496	9316	9298	9413	9437	9344	9367
24	8623	8727	8756	8776	8715	8892	8857	8916

Table A-6 Layer Classification for Neutron Probe Measurements

LF2-07 Depth/ Type[1] (feet)		LF2-04 Depth/ Type (feet)		LF2-03 Depth/ Type (feet)		LF3-05 Depth/ Type (feet)		LF3-03 Depth/ Type (feet)	
0	S					0	S		
1	C	1	S	1	S	1	S	0.5	C
2	S	2	S	2	S	2	S	1.5	S
3	S	3	S	3	S	3	S	2.5	C
4	C	4	S	4	S	4	C	3.5	S
5	C	5	S	5	S	5	C	4.5	S
6	C	6	S	6	S	6	S	5.5	S
7	C	7	S	7	S	7	S	6.5	S
8	C	8	S	8	S	8	S	7.5	S
9	S	9	S	9	S	9	S	8.5	S
10	C	10	S	10	S	10	S	9.5	S
11	C	11	S	11	S	11	S	10.5	S
12	C	12	S	12	S	12	S	11.5	S
13	S	13	S	13	S	13	S	12.5	S
14	C	14	S	14	S	14	S	13.5	S
15	C	15	S	15	S	15	S	14.5	S
16	C	16	S	16	S	16	S	15.5	S
17	C	17	S	17	S	17	S	16.5	S
18	C	18	S	18	S	18	S	17.5	S
		19	S	19	S	19	S	18.5	S
		20	C	20	S	20	S	19.5	S
		21	C	21	C	21	C		
		22	C	22	C	22	C		
				23	C	23	C		
						24	C		

1) **Type is either S =Sand and Gravel; or C = Clay**

Table A-7 One Year Drainage Measurments for Access Tube # LF2-03

Depth (ft)	07/21/97	08/28/97		09/25/97		12/4/97		1/8/98		2/5/98		3/11/98		4/9/98		5/7/98		6/11/98	
1	303	239	-0.01	258	0.00	502	0.05	1366	0.17	2018	0.13	7226	1.00	410	-1.31	372	-0.01	348	0.00
2	3946	3347	-0.11	3278	-0.01	4818	0.30	5045	0.04	6093	0.20	5618	-0.09	6913	0.25	6230	-0.13	5073	-0.22
3	5168	3962	-0.23	3891	-0.01	4916	0.20	4998	0.02	5363	0.07	6277	0.18	8263	0.38	7584	-0.13	6288	-0.25
4	3844	3617	-0.04	3562	-0.01	3576	0.00	3547	-0.01	3441	-0.02	3470	0.01	4361	0.17	4024	-0.06	3909	-0.02
5	3523	3419	-0.02	3501	0.02	3405	-0.02	3359	-0.01	3313	-0.01	3262	-0.01	4057	0.15	3769	-0.06	3660	-0.02
6	3650	3495	-0.03	3448	-0.01	3420	-0.01	3324	-0.02	3277	-0.01	3349	0.01	4014	0.13	3825	-0.04	3689	-0.03
7	3333	3388	0.01	3399	0.00	3279	-0.02	3421	0.03	3329	-0.02	3288	-0.01	3546	0.05	3484	-0.01	3510	0.00
8	5583	5655	0.02	5510	-0.04	5355	-0.04	5343	0.00	5321	-0.01	5333	0.00	6345	0.26	6057	-0.08	5982	-0.02
9	3937	3824	-0.02	3787	-0.01	3785	0.00	3891	0.02	3855	-0.01	3816	-0.01	4289	0.09	3977	-0.06	3982	0.00
10	3849	3876	0.01	3870	0.00	3844	0.00	3771	-0.01	3766	0.00	3855	0.02	4143	0.06	3900	-0.05	3961	0.01
11	4041	4136	0.02	4133	0.00	4076	-0.01	4064	0.00	3933	-0.03	3933	0.00	4430	0.10	4271	-0.03	4184	-0.02
12	4723	4709	0.00	4733	0.00	4622	-0.02	4727	0.02	4660	-0.01	4648	0.00	5042	0.08	5020	0.00	4846	-0.03
13	3789	3642	-0.03	3782	0.03	3795	0.00	3807	0.00	3719	-0.02	3798	0.02	4050	0.05	3981	-0.01	3794	-0.04
14	3653	3585	-0.01	3608	0.00	3623	0.00	3664	0.01	3658	0.00	3551	-0.02	4114	0.11	3964	-0.03	3879	-0.02
15	4057	3987	-0.01	3995	0.00	4074	0.02	4018	-0.01	4027	0.00	3945	-0.02	4695	0.14	4290	-0.08	4347	0.01
16	4111	4234	0.02	4240	0.00	4171	-0.01	4248	0.01	4321	0.01	4151	-0.03	4784	0.12	4661	-0.02	4661	0.00
17	3652	3622	-0.01	3735	0.02	3684	-0.01	3578	-0.02	3662	0.02	3711	0.01	4163	0.09	4040	-0.02	3983	-0.01
18	3574	3300	-0.05	3478	0.03	3538	0.01	3448	-0.02	3547	0.02	3518	-0.01	3868	0.07	3889	0.00	3777	-0.02
19	4898	4977	0.02	4946	-0.01	4902	-0.01	4897	0.00	4895	0.00	4972	0.01	6217	0.24	5743	-0.09	5571	-0.03
20	3608	3638	0.01	3699	0.01	3618	-0.02	3610	0.00	3618	0.00	3643	0.00	4917	0.24	4478	-0.08	4276	-0.04
21	7881	8084	0.07	8073	0.00	7880	-0.06	8029	0.05	8079	0.02	8201	0.04	8857	0.22	8691	-0.06	8433	-0.09
22	7666	7886	0.07	7853	-0.01	7861	0.00	7830	-0.01	7812	-0.01	7744	-0.02	8240	0.17	8461	0.07	8300	-0.05
23	9598	9463	-0.05	9392	-0.02	9547	0.05	9442	-0.04	9646	0.07	9750	0.04	10174	0.14	10152	-0.01	10135	-0.01
			-0.40		-0.01		0.39		0.22		0.40		1.12		1.99		-0.98		-0.89

Depth (ft)	Change in storage	Sum of Drainage (-) over year)
1	-0.01	-1.35
2	-0.17	-0.95
3	-0.28	-1.11
4	-0.06	-0.24
5	-0.01	-0.18
6	-0.01	-0.15
7	0.03	-0.08
8	0.06	-0.23
9	-0.01	-0.13
10	-0.01	-0.09
11	0.03	-0.10
12	0.02	-0.09
13	0.01	-0.09
14	0.02	-0.11
15	0.05	-0.13
16	0.06	-0.11
17	0.04	-0.10
18	0.03	-0.12
19	0.20	-0.15
20	0.09	-0.18
21	0.15	-0.27
22	0.17	-0.15
23	0.12	-0.18

Total Change in Storage	0.52	
Total Change in Storage below 4 ft	1.04	
Total Drainage (sum of drainage)		-6.28
Total Drainage below ET depth (4 ft)		-2.63

Net Drainage over one year

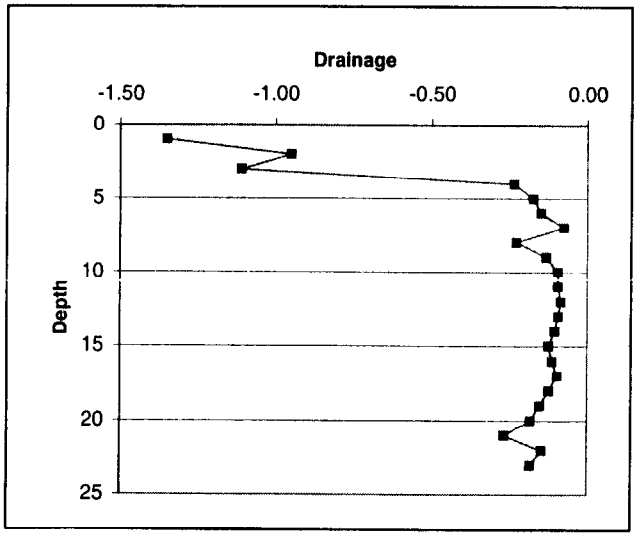


Table A-8 Drainage Calculations for Access Tube # LF2-04

Depth (ft)	7/21/97	8/28/97		9/25/97		12/4/97		1/8/98		2/5/98		3/11/98		4/9/98		5/7/98		6/11/98		7/15/98
										Date										
0	1008	863	-0.03	1046	0.04	1660	0.12	2678	0.20	4730	0.39	8917	0.80	1878	-1.35	1217	-0.13	1161	-0.01	916
1	3252	3002	-0.05	3039	0.01	3249	0.04	5438	0.42	5546	0.02	4735	-0.16	4836	0.02	3790	-0.20	3653	-0.03	3139
2	3498	3347	-0.03	3149	-0.04	3166	0.00	3789	0.12	3573	-0.04	3739	0.03	4327	0.11	3848	-0.09	3876	0.01	3529
3	3874	3683	-0.04	3574	-0.02	3474	-0.02	3509	0.01	3598	0.02	3585	0.00	4441	0.16	4262	-0.03	4124	-0.03	3989
4	3849	3709	-0.03	3599	-0.02	3662	0.01	3611	-0.01	3527	-0.02	3628	0.02	4552	0.18	4279	-0.05	3997	-0.05	3735
5	3821	3756	-0.01	3841	0.02	3817	0.00	3701	-0.02	3750	0.01	3814	0.01	4318	0.10	4190	-0.02	4189	0.00	3956
6	4078	3977	-0.02	3884	-0.02	3762	-0.02	3978	0.04	3867	-0.02	3975	0.02	4594	0.12	4379	-0.04	4204	-0.03	4136
7	3897	3712	-0.04	3743	0.01	3696	-0.01	3589	-0.02	3692	0.02	3667	0.00	4317	0.12	4071	-0.05	4000	-0.01	3904
8	4210	4065	-0.03	4069	0.00	3949	-0.02	3843	-0.02	4013	0.03	4159	0.03	4763	0.12	4373	-0.07	4256	-0.02	4248
9	4823	4661	-0.03	4760	0.02	4699	-0.01	4602	-0.02	4497	-0.02	4884	0.07	5042	0.03	4828	-0.04	4889	0.01	4739
10	4740	4690	-0.01	4679	0.00	4652	-0.01	4666	0.00	4590	-0.01	4973	0.07	5433	0.09	5340	-0.02	5060	-0.05	4992
11	4469	4481	0.00	4420	-0.01	4468	0.01	4549	0.02	4299	-0.05	4764	0.09	4969	0.04	4778	-0.04	4586	-0.04	4631
12	4026	4105	0.02	4017	-0.02	3898	-0.02	3852	-0.01	3910	0.01	3989	0.02	4413	0.08	4354	-0.01	4127	-0.04	4082
13	4325	4403	0.01	4204	-0.04	4160	-0.01	4174	0.00	4281	0.02	4181	-0.02	4713	0.10	4428	-0.05	4430	0.00	4358
14	4400	4405	0.00	4387	0.00	4343	-0.01	4305	-0.01	4397	0.02	4355	-0.01	4745	0.07	4741	0.00	4505	-0.05	4385
15	3911	3980	0.01	4007	0.01	3859	-0.03	3941	0.02	3741	-0.04	3870	0.02	4154	0.05	4181	0.01	3930	-0.05	4078
16	3944	4025	0.02	3867	-0.03	3875	0.00	3907	0.01	3755	-0.03	3913	0.03	4180	0.05	3968	-0.04	4123	0.03	3942
17	3881	3926	0.01	3810	-0.02	3877	0.01	3828	-0.01	3746	-0.02	3898	0.03	4065	0.03	3842	-0.04	3901	0.01	3859
18	3862	3802	-0.01	3683	-0.02	3543	-0.03	3760	0.04	3571	-0.04	3733	0.03	4170	0.08	3945	-0.04	3958	0.00	3856
19	4017	3997	0.00	3876	-0.02	3795	-0.02	3824	0.01	3710	-0.02	3722	0.00	4382	0.13	4155	-0.04	4199	0.01	3991
20	6233	6491	0.09	6337	-0.05	6299	-0.01	6284	-0.01	6319	0.01	6276	-0.01	6754	0.16	6597	-0.05	6307	-0.10	6454
21	7139	7009	-0.04	6955	-0.02	7077	0.04	6997	-0.03	6917	-0.03	6886	-0.01	7639	0.25	7494	-0.05	7165	-0.11	7053
22	8780	8858	0.03	8934	0.03	8775	-0.05	8698	-0.03	8991	0.10	8841	-0.05	9270	0.14	9171	-0.03	9113	-0.02	8989
Sum			-0.15		-0.26		-0.15		0.50		-0.07		0.22		2.25		-1.03		-0.56	

Depth (ft)	Change in storage	Sum of Drainage (-) over year)
0	0.00	-1.56
1	-0.04	-0.55
2	-0.02	-0.29
3	-0.01	-0.20
4	-0.05	-0.26
5	0.00	-0.13
6	0.01	-0.17
7	-0.01	-0.16
8	-0.02	-0.20
9	0.00	-0.15
10	0.04	-0.13
11	0.02	-0.14
12	0.01	-0.11
13	0.00	-0.14
14	0.03	-0.10
15	-0.02	-0.13
16	0.01	-0.13
17	0.00	-0.10
18	-0.02	-0.18
19	-0.02	-0.16
20	0.07	-0.24
21	0.04	-0.32
22	0.10	-0.22

Total Change in Storage	0.12	
Total Change in Storage below 4 ft	0.25	
Total Drainage (sum of drainage)		-5.79
Total Drainage below ET Depth (4 ft)		-2.93

Net Drainage over one year

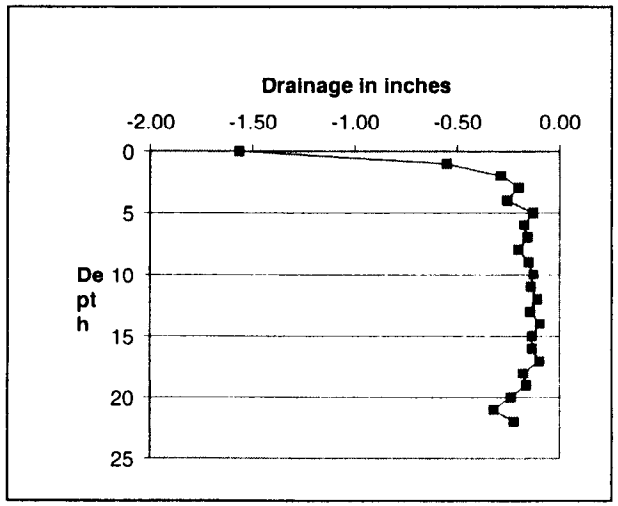


Table A-9 Drainage Calculations for Access Tube # LF2-07

Depth (ft)	7/21/97	8/28/97		9/25/97		12/4/97		1/8/98		2/5/98		3/11/98		4/9/98		5/7/98		6/11/98		7/15/98
										DATE										
	55	73		64		72		62		94		175		79		79		62		76
0	409	323	-0.02	386	0.01	798	0.08	1276	0.09	4209	0.56	9187	0.96	612	-1.65	454	-0.03	440	0.00	388
1	5939	4939	-0.34	4582	-0.12	4386	-0.07	6386	0.67	6398	0.00	5708	-0.23	7614	0.64	6717	-0.30	6665	-0.02	6316
2	5610	5093	-0.10	4807	-0.05	4613	-0.04	4711	0.02	4842	0.03	4994	0.03	6973	0.38	6249	-0.14	5892	-0.07	5869
3	5241	4900	-0.07	4694	-0.04	4591	-0.02	4570	0.00	4634	0.01	4583	-0.01	6372	0.34	6094	-0.05	5920	-0.03	5790
4	6461	6444	-0.01	6387	-0.02	6200	-0.06	6006	-0.07	6007	0.00	5928	-0.03	6673	0.25	6684	0.00	6528	-0.05	6491
5	6851	6561	-0.10	6552	0.00	6518	-0.01	6401	-0.04	6411	0.00	6405	0.00	6907	0.17	6937	0.01	6761	-0.06	6751
6	6019	5941	-0.03	5887	-0.02	5945	0.02	5922	-0.01	5830	-0.03	6035	0.07	6496	0.16	6359	-0.05	6271	-0.03	6171
7	6156	6119	-0.01	5975	-0.05	5950	-0.01	6006	0.02	5944	-0.02	5904	-0.01	6540	0.21	6321	-0.07	6241	-0.03	6135
8	13543	13522	-0.01	13419	-0.03	13373	-0.02	13449	0.03	13273	-0.06	13326	0.02	13489	0.05	13364	-0.04	13179	-0.06	13546
9	5218	5219	0.00	5157	-0.01	5166	0.00	5008	-0.03	5082	0.01	5080	0.00	6210	0.22	5809	-0.08	5503	-0.06	5500
10	6084	6170	0.03	6203	0.01	6153	-0.02	6029	-0.04	6023	0.00	5893	-0.04	6627	0.25	6288	-0.11	6346	0.02	6176
11	7243	7198	-0.02	7156	-0.01	7276	0.04	7151	-0.04	7140	0.00	6961	-0.06	7199	0.08	7265	0.02	7104	-0.05	7185
12	5772	5692	-0.02	5849	0.03	5921	0.01	5734	-0.04	5737	0.00	5680	-0.01	6123	0.09	6002	-0.02	6063	0.01	5983
13	5567	5610	0.01	5607	0.00	5575	-0.01	5557	0.00	5490	-0.01	5446	-0.01	6504	0.20	6213	-0.06	5921	-0.06	5823
14	6887	7066	0.06	6665	-0.13	6769	0.04	6743	-0.01	6900	0.05	6694	-0.07	7393	0.24	7307	-0.03	7083	-0.08	7007
15	8011	8278	0.09	8033	-0.08	8215	0.06	8228	0.00	8131	-0.03	8209	0.03	8249	0.01	8222	-0.01	8344	0.04	8270
16	10761	10746	-0.01	10697	-0.02	10718	0.01	10586	-0.04	10443	-0.05	10487	0.01	10776	0.10	10842	0.02	10867	0.01	10808
17	13268	13339	0.02	13440	0.03	13301	-0.05	13323	0.01	13231	-0.03	13111	-0.04	13629	0.17	13581	-0.02	13702	0.04	13420
18	8316	8340	0.01	8295	-0.02	8377	0.03	8554	0.06	8437	-0.04	8294	-0.05	8325	0.01	8394	0.02	8395	0.00	8458
			-0.47		-0.54		-0.08		0.48		-0.17		-0.41		3.57		-0.90		-0.47	

Depth (ft)	Change in storage	Sum of Drainage (-) over year)
0		-1.71
1	-0.27	-1.59
2	-0.10	-0.55
3	0.05	-0.31
4	0.01	-0.25
5	-0.04	-0.22
6	0.05	-0.20
7	0.04	-0.24
8	-0.03	-0.25
9	0.03	-0.20
10	0.05	-0.28
11	-0.03	-0.20
12	-0.11	-0.25
13	0.04	-0.17
14	0.04	-0.35
15	0.04	-0.19
16	-0.01	-0.16
17	0.20	-0.23
18	0.02	-0.13

Total Change in Storage	-0.03	
Total Change in Storage below 4 ft	0.29	
Total Drainage (sum of drainage)		-7.48
Total Drainage below ET depth (4 ft)		-3.08

Net Drainage over one year

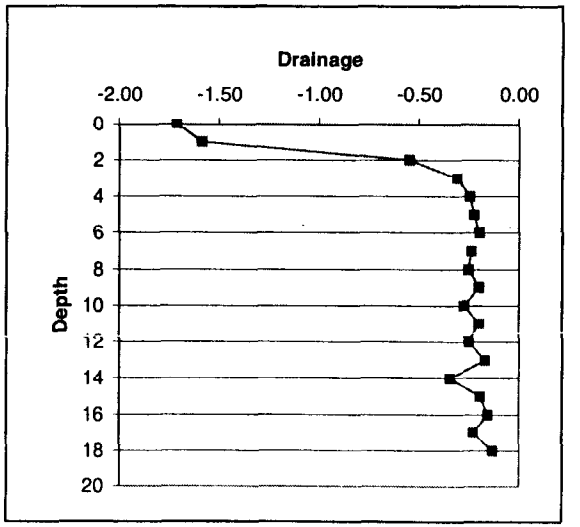


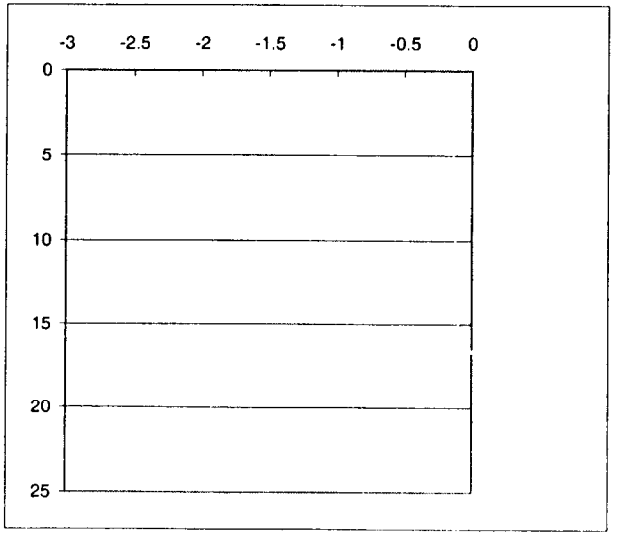
Table A-10 Drainage Calculations for Access Tube # LF3-03

Depth (ft)	7/21/97	8/28/97		9/25/97		12/4/97		1/8/98		2/5/98		3/11/98		4/9/98		5/7/98		6/11/98		7/15/98
	38	46		37		65		80		82		115		65		56		49		50
	147	140		135		279		392		1040		6228		204		196		180		113
0.5	4797	4063	-0.25	1456	-0.88	5599	1.39	7125	0.51	8282	0.39	7690	-0.20	8502	0.27	7171	-0.45	6493	-0.23	3976
1.5	4616	4013	-0.12	3905	-0.02	4132	0.04	4335	0.04	4287	-0.01	4279	0.00	5958	0.32	5634	-0.06	5327	-0.06	4236
2.5	7986	6823	-0.39	6440	-0.13	6503	0.02	6441	-0.02	6331	-0.04	6374	0.01	8279	0.64	8070	-0.07	8069	0.00	7568
3.5	3967	3774	-0.04	3647	-0.02	3573	-0.01	3518	-0.01	3489	-0.01	3585	0.02	4277	0.13	4173	-0.02	4215	0.01	3933
4.5	3734	3616	-0.02	3615	0.00	3433	-0.03	3441	0.00	3363	-0.01	3453	0.02	4195	0.14	4099	-0.02	3895	-0.04	3903
5.5	3379	3407	0.01	3410	0.00	3360	-0.01	3215	-0.03	3280	0.01	3253	-0.01	3779	0.10	3661	-0.02	3545	-0.02	3638
6.5	3611	3721	0.02	3542	-0.03	3582	0.01	3355	-0.04	3519	0.03	3386	-0.03	3933	0.11	3787	-0.03	3812	0.00	3652
7.5	3820	3691	-0.02	3596	-0.02	3607	0.00	3527	-0.02	3498	-0.01	3441	-0.01	3912	0.09	3905	0.00	3878	-0.01	3801
8.5	4012	3873	-0.03	3866	0.00	3881	0.00	3833	-0.01	3813	0.00	3824	0.00	4009	0.04	3961	-0.01	3968	0.00	4049
9.5	4274	4340	0.01	4374	0.01	4067	-0.06	4172	0.02	4105	-0.01	3983	-0.02	4440	0.09	4265	-0.03	4225	-0.01	4190
10.5	3691	3559	-0.03	3593	0.01	3666	0.01	3689	0.00	3486	-0.04	3512	0.00	3850	0.06	3765	-0.02	3649	-0.02	3689
11.5	3926	3946	0.00	3970	0.00	3781	-0.04	3881	0.02	3774	-0.02	3808	0.01	4041	0.04	4010	-0.01	4040	0.01	4028
12.5	4840	4956	0.02	4897	-0.01	4993	0.02	4815	-0.03	4885	0.01	4866	0.00	5002	0.03	4923	-0.02	4873	-0.01	5019
13.5	4241	4252	0.00	4253	0.00	4137	-0.02	4290	0.03	4141	-0.03	4157	0.00	4661	0.10	4440	-0.04	4329	-0.02	4297
14.5	3770	3895	0.02	3742	-0.03	3922	0.03	3859	-0.01	3747	-0.02	3689	-0.01	4027	0.06	3896	-0.03	3878	0.00	3846
15.5	3908	3868	-0.01	3942	0.01	3888	-0.01	3851	-0.01	4013	0.03	3877	-0.03	3985	0.02	3931	-0.01	4005	0.01	3992
16.5	4032	3972	-0.01	3976	0.00	3969	0.00	3986	0.00	3969	0.00	3973	0.00	3985	0.00	4145	0.03	4147	0.00	4094
17.5	3773	3803	0.01	3707	-0.02	3652	-0.01	3688	0.01	3695	0.00	3761	0.01	3710	-0.01	3832	0.02	3814	0.00	3890
18.5	3960	4060	0.02	4180	0.02	4070	-0.02	4019	-0.01	4041	0.00	4004	-0.01	5795	0.34	5261	-0.10	4545	-0.14	4304
19.5	4668	4509	-0.03	4495	0.00	4511	0.00	4485	0.00	4418	-0.01	4534	0.02	7765	0.62	7407	-0.07	6192	-0.23	5354
Sum			-0.82		-1.11		1.32		0.44		0.27		-0.21		3.21		-0.95		-0.76	

Depth (ft)	Change in storage	Sum of Drainage (-) over year)
0.5	-0.12	-2.8477
1.5	-0.08	-0.4803
2.5	-0.33	-1.0049
3.5	-0.02	-0.1833
4.5	0.00	-0.1641
5.5	0.02	-0.1183
6.5	0.01	-0.1622
7.5	-0.02	-0.1137
8.5	-0.02	-0.0751
9.5	-0.01	-0.1432
10.5	0.01	-0.1029
11.5	0.01	-0.0756
12.5	-0.01	-0.1148
13.5	0.02	-0.1208
14.5	0.00	-0.1254
15.5	0.01	-0.0743
16.5	0.01	-0.0267
17.5	-0.01	-0.0737
18.5	0.05	-0.3367
19.5	0.02	-0.6209

Total Change in Storage	-0.45	
Total Change in Storage below 3.5 ft	0.10	
Total Drainage (sum of drainage)		-6.96
Total Drainage below ET Depth (3.5 ft)		-2.45

Net Outflow by One foot Layer over one year period



Tab[illegible] Drain[illegible] Calculation[illegible] for Access [illegible] # LF3[illegible]

Depth (ft)	7/21/97	8/28/97		9/25/97		12/4/97		1/8/98		2/5/98		3/11/98		4/9/98		5/7/98		6/11/98		7/15/98
	75	64		86		97		95		128		376		86		64		83		54
0	1735	1229	-0.14	1467	0.05	2614	0.27	4949	0.56	7771	0.68	10494	0.66	3486	-1.74	2518	-0.25	2786	0.05	1542
1	4528	3797	-0.19	3676	-0.03	3697	0.01	3823	0.03	3974	0.04	3977	0.00	6633	0.69	5924	-0.19	5910	0.00	5411
2	3920	3422	-0.10	3431	0.00	3444	0.00	3530	0.02	3504	0.00	3539	0.01	4686	0.22	4403	-0.05	4346	-0.01	3912
3	5224	4558	-0.13	4658	0.02	4784	0.02	4796	0.00	4787	0.00	4576	-0.04	5442	0.17	5134	-0.06	4945	-0.04	4914
4	6814	6705	-0.04	6575	-0.04	6609	0.01	6511	-0.03	6698	0.06	6476	-0.07	6829	0.12	6685	-0.05	6784	0.03	6669
5	6528	6394	-0.05	6253	-0.05	6036	-0.07	6109	0.02	6158	0.02	5969	-0.06	6300	0.11	6134	-0.06	6199	0.02	6170
6	3543	3524	0.00	3450	-0.01	3461	0.00	3354	-0.02	3370	0.00	3255	-0.02	3530	0.05	3463	-0.01	3394	-0.01	3379
7	3471	3418	-0.01	3412	0.00	3235	-0.03	3293	0.01	3230	-0.01	3172	-0.01	3247	0.01	3322	0.01	3403	0.02	3334
8	3477	3284	-0.04	3201	-0.02	3141	-0.01	3108	-0.01	3062	-0.01	3095	0.01	2963	-0.03	3019	0.01	3130	0.02	3012
9	3429	3378	-0.01	3413	0.01	3437	0.00	3368	-0.01	3284	-0.02	3247	-0.01	3229	0.00	3296	0.01	3314	0.00	3302
10	3184	3193	0.00	3138	-0.01	3182	0.01	3142	-0.01	3183	0.01	3086	-0.02	3003	-0.02	3068	0.01	3187	0.02	3080
11	4090	3998	-0.02	4063	0.01	4047	0.00	3848	-0.04	3999	0.03	3988	0.00	3925	-0.01	4021	0.02	3909	-0.02	3983
12	4240	4016	-0.04	3977	-0.01	3923	-0.01	3979	0.01	3893	-0.02	3971	0.01	3911	-0.01	3964	0.01	3973	0.00	4058
13	3779	3935	0.03	3935	0.00	3829	-0.02	3819	0.00	3832	0.00	3881	0.01	3889	0.00	3856	-0.01	3861	0.00	3981
14	3889	3938	0.01	3974	0.01	3931	-0.01	3912	0.00	4026	0.02	3871	-0.03	3832	-0.01	3984	0.03	3983	0.00	3955
15	4111	4032	-0.02	4028	0.00	3985	-0.01	3985	0.00	3996	0.00	4026	0.01	4066	0.01	4020	-0.01	4054	0.01	4017
16	4312	4254	-0.01	4355	0.02	4308	-0.01	4327	0.00	4269	-0.01	4288	0.00	4255	-0.01	4149	-0.02	4286	0.03	4362
17	4460	4343	-0.02	4344	0.00	4298	-0.01	4373	0.01	4363	0.00	4266	-0.02	4298	0.01	4233	-0.01	4446	0.04	4221
18	4247	4226	0.00	4204	0.00	4162	-0.01	4267	0.02	4196	-0.01	4080	-0.02	4166	0.02	4116	-0.01	4169	0.01	4111
19	4629	4779	0.03	4654	-0.02	4719	0.01	4642	-0.01	4732	0.02	4719	0.00	4586	-0.03	4576	0.00	4655	0.02	4617
20	4315	4587	0.05	4335	-0.05	4377	0.01	4394	0.00	4312	-0.02	4444	0.03	4293	-0.03	4344	0.01	4412	0.01	4295
21	6528	6711	0.06	6318	-0.13	6401	0.03	6482	0.03	6474	0.00	6456	-0.01	6487	0.01	6547	0.02	6588	0.01	6633
22	10422	10314	-0.04	10445	0.04	10395	-0.02	10321	-0.02	10475	0.05	10203	-0.09	10444	0.08	10352	-0.03	10284	-0.02	10630
23	9540	9342	-0.07	9522	0.06	9493	-0.01	9500	0.00	9466	-0.01	9496	0.01	9316	-0.06	9298	-0.01	9413	0.04	9437
24	8726	8547	-0.06	8637	0.03	8695	0.02	8806	0.04	8623	-0.06	8727	0.04	8756	0.01	8776	0.01	8715	-0.02	8892
			-0.36		-0.15		-0.10		-0.01		0.04		-0.30		0.40		-0.13		0.17	

Depth (ft)	Change in storage	Sum of Drainage (-) over year)
0	-0.26	-2.54
1	-0.06	-0.83
2	-0.09	-0.34
3	-0.12	-0.17
4	-0.07	-0.30
5	-0.10	-0.16
6	-0.03	-0.09
7	-0.05	-0.10
8	-0.08	-0.13
9	-0.03	-0.06
10	0.01	-0.04
11	-0.03	-0.11
12	-0.06	-0.12
13	0.00	-0.07
14	-0.01	-0.08
15	-0.02	-0.04
16	-0.02	-0.09
17	-0.04	-0.10
18	-0.01	-0.05
19	0.02	-0.05
20	-0.02	-0.13
21	0.03	-0.15
22	0.02	-0.27
23	-0.07	-0.19
24	0.04	-0.15

Total Change in Storage	-1.04	
Total Change in Storage below 4 ft	-0.43	
Total Drainage (sum of drainage)		**-6.36**
Total Drainage below 4 ft		-2.17

Net drainage (sum of -) by depth over one year

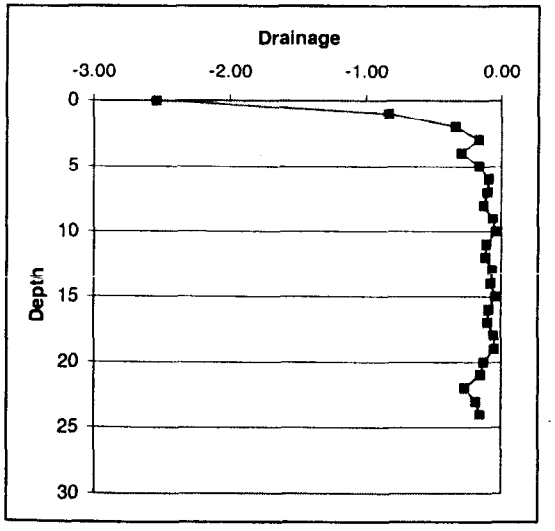


Table A-12 Infiltration and Recharge Estimates for Spring 1998

LF2-03

Depth (feet)	3/11/98	4/9/98	Change in Storage
1	7226	410	-1.31
2	5618	6913	0.25
3	6277	8263	0.38
4	3470	4361	0.17
5	3262	4057	0.15
6	3349	4014	0.13
7	3288	3546	0.05
8	5333	6345	0.19
9	3816	4289	0.09
10	3855	4143	0.06
11	3933	4430	0.10
12	4648	5042	0.08
13	3798	4050	0.05
14	3551	4114	0.11
15	3945	4695	0.14
16	4151	4784	0.12
17	3711	4163	0.09
18	3518	3868	0.07
19	4972	6217	0.24
20	3643	4917	0.24
21	8201	8857	0.22
22	7744	8240	0.17
23	9750	10174	0.14

LF2-4

Depth (feet)	3/11/98	4/9/98	Change in Storage
	8917	1878	
1	4735	4836	0.02
2	3739	4327	0.11
3	3585	4441	0.16
4	3628	4552	0.18
5	3814	4318	0.10
6	3975	4594	0.12
7	3667	4317	0.12
8	4159	4763	0.12
9	4884	5042	0.03
10	4973	5433	0.09
11	4764	4969	0.04
12	3989	4413	0.08
13	4181	4713	0.10
14	4355	4745	0.07
15	3870	4154	0.05
16	3913	4180	0.05
17	3898	4065	0.03
18	3733	4170	0.08
19	3722	4382	0.13
20	6276	6754	0.16
21	6886	7639	0.25
22	8841	9270	0.14

LF2-07

Depth (feet)	3/11/98	4/9/98	Change in Storage
	175	79	
0	9187	612	-1.65
1	5708	7614	0.64
2	4994	6973	0.38
3	4583	6372	0.34
4	5928	6673	0.25
5	6405	6907	0.17
6	6035	6496	0.16
7	5904	6540	0.21
8	13326	13489	0.05
9	5080	6210	0.22
10	5893	6627	0.25
11	6961	7199	0.08
12	5680	6123	0.15
13	5446	6504	0.20
14	6694	7393	0.24
15	8209	8249	0.01
16	10487	10776	0.10
17	13111	13629	0.17
18	8294	8325	0.01

LF3-03

Depth (feet)	3/11/98	4/9/98	Change in Storage
	115	65	
	6228	204	
0.5	7690	8502	0.27
1.5	4279	5958	0.32
2.5	6374	8279	0.64
3.5	3585	4277	0.13
4.5	3453	4195	0.14
5.5	3253	3779	0.10
6.5	3386	3933	0.11
7.5	3441	3912	0.09
8.5	3824	4009	0.04
9.5	3983	4440	0.09
10.5	3512	3850	0.06
11.5	3808	4041	0.04
12.5	4866	5002	0.03
13.5	4157	4661	0.10
14.5	3689	4027	0.06
15.5	3877	3985	0.02
16.5	3973	3985	0.00
17.5	3761	3710	-0.01
18.5	4004	5795	0.34
19.5	4534	7765	0.62

LF3-05

Depth (feet)	3/11/98	4/9/98	Change in Storage
	376	86	
0	10494	3486	-1.35
1	3977	6633	0.51
2	3539	4686	0.22
3	4576	5442	0.17
4	6476	6829	0.12
5	5969	6300	0.11
6	3255	3530	0.05
7	3172	3247	0.01
8	3095	2963	-0.03
9	3247	3229	0.00
10	3086	3003	-0.02
11	3988	3925	-0.01
12	3971	3911	-0.01
13	3881	3889	0.00
14	3871	3832	-0.01
15	4026	4066	0.01
16	4288	4255	-0.01
17	4266	4298	0.01
18	4080	4166	0.02
19	4719	4586	-0.03
20	4444	4293	-0.03
21	6456	6487	0.01
22	10203	10444	0.08
23	9496	9316	-0.06
24	8727	8756	0.01

	LF2-03	LF2-4	LF2-07	LF3-03	LF3-05
Recharge below ET depth (inches)	2.43	1.96	2.27	1.84	0.11
Total Infiltration (inches)	3.23	2.25	3.64	3.21	1.13

Table A-13 Infiltration and Recharge Assessment for LF2-03 in the Spring of 1997.

Depth (ft)	11/4/96	12/11/96		1/15/97		2/13/97		3/24/97		4/24/97	
1	372	788	0.08	833	0.01	482	-0.07	422	-0.01	520	0.02
2	3294	4888	0.31	6984	0.40	8235	0.24	7191	-0.20	7000	-0.04
3	2999	3124	0.02	4402	0.25	6548	0.41	7903	0.26	8135	0.04
4	3201	3284	0.02	4298	0.19	3811	-0.09	4018	0.04	4315	0.06
5	3297	3284	0.00	4153	0.17	3752	-0.08	3704	-0.01	4053	0.07
6	3354	3408	0.01	3869	0.09	3757	-0.02	3694	-0.01	3939	0.05
7	4438	4668	0.04	5030	0.07	3423	-0.31	3457	0.01	3426	-0.01
8	3719	3640	-0.02	3798	0.04	5780	*	5693	-0.02	5516	-0.05
9	3779	3780	0.00	3773	0.00	3972	0.04	3985	0.00	3949	-0.01
10	3587	3576	0.00	3528	-0.01	3795	0.05	3786	0.00	3795	0.00
11	4435	4580	0.03	4595	0.00	3843	-0.14	3817	0.00	3957	0.03
12	4307	4488	0.03	4416	-0.01	4549	0.03	4601	0.01	4584	0.00
13	3745	4016	0.05	3690	-0.06	3756	0.01	3737	0.00	3607	-0.02
14	3687	4088	0.08	3828	-0.05	3597	-0.04	3523	-0.01	3508	0.00
15	4094	4032	-0.01	3770	-0.05	4009	0.05	3850	-0.03	4024	0.03
16	4166	4184	0.00	4193	0.00	4163	-0.01	4259	0.02	4218	-0.01
17	3733	3416	-0.06	3759	0.07	3659	-0.02	3739	0.02	3610	-0.02
18	3568	3392	-0.03	3579	0.04	3398	-0.03	3410	0.00	3434	0.00
19	4701	4924	0.04	4777	-0.03	4861	0.02	4910	0.01	4954	0.01
20	3597	3572	0.00	3619	0.01	3727	0.02	3594	-0.03	3602	0.00
21	8076	8328	0.08	8025	-0.10	8157	0.04	8084	-0.02	8069	-0.01
22	7692	7776	0.03	7822	0.02	7665	-0.05	7837	0.06	7849	0.00
23	9610	9788	0.06	8723	-0.36	9554	0.28	9630	0.03	9575	-0.02
Change in Storage			0.75		0.67		0.32		0.09		0.13
Change in Storage below 4 feet			0.33		-0.18		-0.17		0.00		0.05

*Note: this measurement was excluded because the point marked a data shift to a higher base level for all subsequent readings.

Table A-14 Infiltration and Recharge Assessment for LF2-04 in the Spring of 1997.

Depth (ft)	1/15/97	2/13/97		3/24/97		4/24/97		5/27/97	
				Date					
0	3133	2664	-0.09	1569	-0.21	1864	0.06	976	-0.17
1	4271	5627	0.26	4942	-0.13	4934	0.00	3486	-0.28
2	4302	4142	-0.03	4114	-0.01	4109	0.00	3760	-0.07
3	4111	4184	0.01	4175	0.00	4238	0.01	4134	-0.02
4	4292	4164	-0.02	4092	-0.01	4001	-0.02	4109	0.02
5	4808	4109	-0.13	3967	-0.03	4214	0.05	4083	-0.03
6	4281	4392	0.02	4355	-0.01	4160	-0.04	4177	0.00
7	4375	3974	-0.08	3942	-0.01	3962	0.00	3927	-0.01
8	4376	4362	0.00	4148	-0.04	4302	0.03	4108	-0.04
9	4902	4909	0.00	4749	-0.03	4818	0.01	4703	-0.02
10	5312	5285	-0.01	4512	-0.15	4994	0.09	4845	-0.03
11	4718	4911	0.04	4958	0.01	4530	-0.08	4539	0.00
12	4639	4330	-0.06	4507	0.03	4109	-0.08	4110	0.00
13	4634	4495	-0.03	4500	0.00	4398	-0.02	4390	0.00
14	4980	4615	-0.07	4214	-0.08	4468	0.05	4421	-0.01
15	4485	4143	-0.07	4414	0.05	3988	-0.08	3928	-0.01
16	4352	4175	-0.03	4112	-0.01	3907	-0.04	3856	-0.01
17	4077	3998	-0.02	4352	0.07	3946	-0.08	3843	-0.02
18	4421	4005	-0.08	3587	-0.08	3858	0.05	3810	-0.01
19	4423	4319	-0.02	4031	-0.06	3997	-0.01	4151	0.03
20	6526	6575	0.02	4903	*	6603	*	6413	-0.06
21	6756	7164	0.14	6517	-0.22	7207	0.23	7125	-0.03
22	8732			9086	0.12	9057	-0.01	9028	-0.01
Change in Storage			-0.16		-0.57		0.08		-0.59
Change in Storage below 4 feet			-0.38		-0.42		0.09		-0.25

Note: some measurements were excluded because of inconsistencies with the data

Table A-15 Infiltration and Recharge Assessment for LF2-07 in the Spring of 1997.

Depth (ft)	DATE 1/15/97	2/13/97		3/24/97		4/24/97		5/27/97	
	97	77		65		57		44	
0	8101	2173	-1.14	357	-0.35	906	0.11	447	-0.09
1	9159	8915	-0.08	7848	-0.36	7553	-0.10	6638	-0.31
2	5672	6504	0.16	7737	0.24	6628	-0.21	6370	-0.05
3	6329	5532	-0.15	6955	0.27	5517	-0.28	5246	-0.05
4	7047	6510	-0.18	5439	-0.36	6525	0.37	6474	-0.02
5	6328	6887	0.19	6433	-0.15	6713	0.09	6826	0.04
6	6138	6132	0.00	6832	0.24	5889	-0.32	5949	0.02
7	8860	6430	-0.82	6132	-0.10	6170	0.01	5996	-0.06
8	5928	13462	*	6218	*	13495	*	13566	0.02
9	7950	5789	-0.41	5514	-0.05	5479	-0.01	5271	-0.04
10	6140	6453	0.11	6287	-0.06	6218	-0.02	6165	-0.02
11	7478	7175	-0.10	7279	0.04	7093	-0.06	7036	-0.02
12	6477	6054	-0.08	6106	0.01	5887	-0.04	5967	0.02
13	6448	6119	-0.06	5890	-0.04	5960	0.01	5782	-0.03
14	7415	7197	-0.07	7206	0.00	7286	0.03	6939	-0.12
15	8226	8166	-0.02	8186	0.01	8039	-0.05	8194	0.05
16	11058	10965	-0.03	10903	-0.02	11101	0.07	10789	-0.11
17	14500	13680	-0.28	13467	-0.07	13641	0.06	13483	-0.05
18	8263	8485	0.07	8324	-0.05	8413	0.03	8272	-0.05
Change in Storage			-2.91		-0.82		-0.32		-0.86
Change in Storage below 4 feet			-1.51		-0.26		-0.20		-0.34

Note: some measurements were excluded because of inconsistencies with the data

Table A-16 Infiltration and Recharge Assessment for LF3-03 in the Spring of 1997.

Depth (ft)	11/4/96	12/11/96		1/15/97		2/13/97		3/24/97		4/24/97	
		56		85		94		60		58	
	1194	5856		4627		6400		194		219	
0.5	3593	4976	0.47	5606	0.21	6353	0.25	9001	0.89	8728	-0.09
1.5	5774	5816	0.01	7508	0.32	7149	-0.07	5809	-0.26	5542	-0.05
2.5	3615	3356	-0.09	4617	0.42	5078	0.16	8039	1.00	8152	0.04
3.5	3589	3444	-0.03	4416	0.19	4127	-0.06	3942	-0.04	3977	0.01
4.5	3375	3312	-0.01	3838	0.10	3728	-0.02	3801	0.01	3897	0.02
5.5	3666	3536	-0.02	4125	0.11	3663	-0.09	3594	-0.01	3527	-0.01
6.5	3516	3368	-0.03	3784	0.08	3612	-0.03	3748	0.03	3709	-0.01
7.5	3946	4024	0.01	4284	0.05	4108	-0.03	3742	-0.07	3845	0.02
8.5	4480	4324	-0.03	4793	0.09	4852	0.01	4083	-0.15	4026	-0.01
9.5	4021	4088	0.01	4351	0.05	4125	-0.04	4335	0.04	4301	-0.01
10.5	3528	3516	0.00	4034	0.10	3910	-0.02	3792	-0.02	3623	-0.03
11.5	4098	4168	0.01	4265	0.02	4628	0.07	4005	-0.12	3943	-0.01
12.5	4301	4252	-0.01	4453	0.04	4137	-0.06	4994	0.16	4917	-0.01
13.5	3720	4244	0.10	4902	0.13	4601	-0.06	4267	-0.06	4339	0.01
14.5	3953	3752	-0.04	3944	0.04	3886	-0.01	3822	-0.01	3831	0.00
15.5	3928	4048	0.02	4089	0.01	4132	0.01	3901	-0.04	4110	0.04
16.5	3672	3648	0.00	4178	0.10	3999	-0.03	4032	0.01	4145	0.02
17.5	4198	4028	-0.03	3713	-0.06	3985	0.05	3855	-0.02	3660	-0.04
18.5	4629	4484	-0.03	5393	0.17	6078	0.13	4272	-0.35	4201	-0.01
19.5								5045		4887	-0.03
Change in Storage			0.31		2.18		0.15		0.98		-0.16
Change in Storage below 3.5 feet			-0.05		1.03		-0.13		-0.61		-0.06

Note: some measurements were excluded because of inconsistencies with the data

Table A-17 Infiltration and Recharge Assessment for LF3-05 in the Spring of 1997.

Depth (ft)	11/4/96	12/11/96		1/15/97		2/13/97		3/24/97		4/24/97	
		108		106		78		72		80	
0	2097	7868	1.41	9465	0.38	7048	-0.61	4077	-0.75	4047	-0.02
1	5311	4960	-0.09	5966	0.26	7659	0.44	7329	-0.09	6400	-0.24
2	4983	4736	-0.05	5517	0.15	4341	-0.23	4414	0.01	4502	0.02
3	5066	5956	0.17	5402	-0.11	5293	-0.02	5231	-0.01	5275	0.01
4	6722	6860	0.05	7119	0.09	6634	-0.16	6784	0.05	6606	-0.06
5	4117	3948	-0.06	4332	0.13	6774	*	6597	-0.06	6537	-0.02
6	3552	3464	-0.02	4390	0.18	3678	-0.14	3624	-0.01	3701	0.01
7	3188	3116	-0.01	3559	0.09	3947	0.07	3596	-0.07	3515	-0.02
8	3284	3552	0.05	3768	0.04	3481	-0.06	3449	-0.01	3425	0.00
9	3491	3404	-0.02	3798	0.08	4044	0.05	3794	-0.05	3633	-0.03
10	3595	3688	0.02	3477	-0.04	3394	-0.02	3307	-0.02	3343	0.01
11	4288	4352	0.01	4302	-0.01	4223	-0.02	4062	-0.03	4054	0.00
12	4265	4208	-0.01	4328	0.02	3953	-0.07	3971	0.00	4059	0.02
13	3767	3800	0.01	3693	-0.02	3927	0.04	3919	0.00	3943	0.00
14	4241	3916	-0.06	4182	0.05	4006	-0.03	3958	-0.01	3911	-0.01
15	4278	4164	-0.02	4271	0.02	4441	0.03	4133	-0.06	4015	-0.02
16	4405	4360	-0.01	4356	0.00	4457	0.02	4551	0.02	4328	-0.04
17	4331	4504	0.03	4347	-0.03	4457	0.02	4557	0.02	4526	-0.01
18	4395	4468	0.01	4364	-0.02	4307	-0.01	4231	-0.01	4185	-0.01
19	4759	4680	-0.02	4710	0.01	4894	0.04	4827	-0.01	4812	0.00
20	4654	4452	-0.04	4593	0.03	4416	-0.03	4458	0.01	4418	-0.01
21	6208	6108	-0.03	6343	0.08	6474	0.04	6487	0.00	6545	0.02
22	10543	10352	-0.06	10475	0.04	10662	0.06	10325	-0.11	10511	0.06
23	9687	10076	0.13	9871	-0.07	9688	-0.06	9681	0.00	9411	-0.09
24	8517	8272	-0.08	8471	0.07	8429	-0.01	8438	0.00	8733	0.10
Change in Storage			1.31		1.41		-0.64		-1.18		-0.34
Change in Storage below ET depth			-0.18		0.63		-0.07		-0.35		-0.10

Table A-18 Precipitation Summary for One-year period of Neutron Probe Monitoring

Date	Precipitation
8/28/97	0.81
9/25/97	0.68
12/4/97	0.4
1/8/98	0.33
2/5/98	0.7
3/11/98	1.27
4/9/98	0.66
5/7/98	0.54
6/11/98	1.83
7/15/98	1.61
8/12/98	0.7
Total Precipitation	9.53

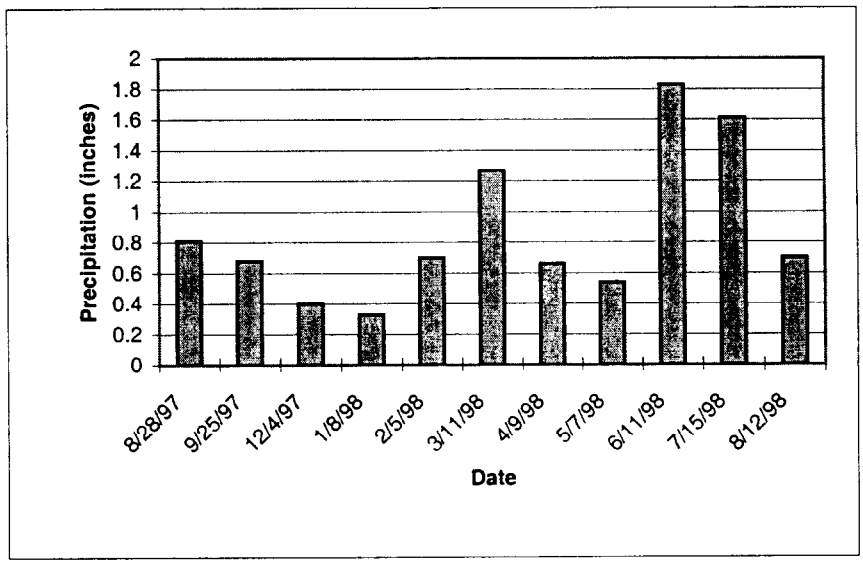


Table A-19 Infiltration Estimates for the Spring of 1998 using a Water Balance Approach

LF2-03

Depth (feet)	Date 3/11/98	4/9/98	Change in Counts
1	7226	410	-6816
2	5618	6913	1295
3	6277	8263	1986
4	3470	4361	891
5	3262	4057	795
6	3349	4014	665
7	3288	3546	258
8	5333	6345	1012
9	3816	4289	473
10	3855	4143	288
11	3933	4430	497
12	4648	5042	394
13	3798	4050	252
14	3551	4114	563
15	3945	4695	750
16	4151	4784	633
17	3711	4163	452
18	3518	3868	350
19	4972	6217	1245
20	3643	4917	1274
21	8201	8857	656
22	7744	8240	496
23	9750	10174	424

LF2-4

Depth (feet)	Date 3/11/98	4/9/98	Change in Counts
0	8917	1878	
1	4735	4836	101
2	3739	4327	588
3	3585	4441	856
4	3628	4552	924
5	3814	4318	504
6	3975	4594	619
7	3667	4317	650
8	4159	4763	604
9	4884	5042	158
10	4973	5433	460
11	4764	4969	205
12	3989	4413	424
13	4181	4713	532
14	4355	4745	390
15	3870	4154	284
16	3913	4180	267
17	3898	4065	167
18	3733	4170	437
19	3722	4382	660
20	6276	6754	478
21	6886	7639	753
22	8841	9270	429

LF2-07

Depth (feet)	Date 3/11/98	4/9/98	Change in Counts
	175	79	
0	9187	612	-8575
1	5708	7614	1906
2	4994	6973	1979
3	4583	6372	1789
4	5928	6673	745
5	6405	6907	502
6	6035	6496	461
7	5904	6540	636
8	13326	13489	163
9	5080	6210	1130
10	5893	6627	734
11	6961	7199	238
12	5680	6123	443
13	5446	6504	1058
14	6694	7393	699
15	8209	8249	40
16	10487	10776	289
17	13111	13629	518
18	8294	8325	31

LF3-03

Depth (feet)	Date 3/11/98	4/9/98	Change in Counts
	115	65	
	6228	204	
0.5	7690	8502	812
1.5	4279	5958	1679
2.5	6374	8279	1905
3.5	3585	4277	692
4.5	3453	4195	742
5.5	3253	3779	526
6.5	3386	3933	547
7.5	3441	3912	471
8.5	3824	4009	185
9.5	3983	4440	457
10.5	3512	3850	338
11.5	3808	4041	233
12.5	4866	5002	136
13.5	4157	4661	504
14.5	3689	4027	338
15.5	3877	3985	108
16.5	3973	3985	12
17.5	3761	3710	-51
18.5	4004	5795	1791
19.5	4534	7765	3231

LF3-05

Depth (feet)	Date 3/11/98	4/9/98	Change in Counts
	376	86	
0	10494	3486	-7008
1	3977	6633	2656
2	3539	4686	1147
3	4576	5442	866
4	6476	6829	353
5	5969	6300	331
6	3255	3530	275
7	3172	3247	75
8	3095	2963	-132
9	3247	3229	-18
10	3086	3003	-83
11	3988	3925	-63
12	3971	3911	-60
13	3881	3889	8
14	3871	3832	-39
15	4026	4066	40
16	4288	4255	-33
17	4266	4298	32
18	4080	4166	86
19	4719	4586	-133
20	4444	4293	-151
21	6456	6487	31
22	10203	10444	241
23	9496	9316	-180
24	8727	8756	29

	LF2-03	LF2-4	LF2-07	LF3-03	LF3-05
Total increase in Counts	15649	10490	13361	14656	5278
Total increase in Counts below ET	11477	8021	6942	9568	256
Total Infiltration = 3.36 inches					
Recharge below ET depth (inches)	2.46	2.57	1.75	2.19	0.16

Appendix B

Soil Gas Probe Installation Diagrams

WELL NAME: GSP1-1A(CFA-GAS-VA-04) Easting: 292438.02 Driller: Alfred High Date: 1/7/97

Facility: CFA Northing: 683536.22 Geologist: Erick Neher Water Level: NA

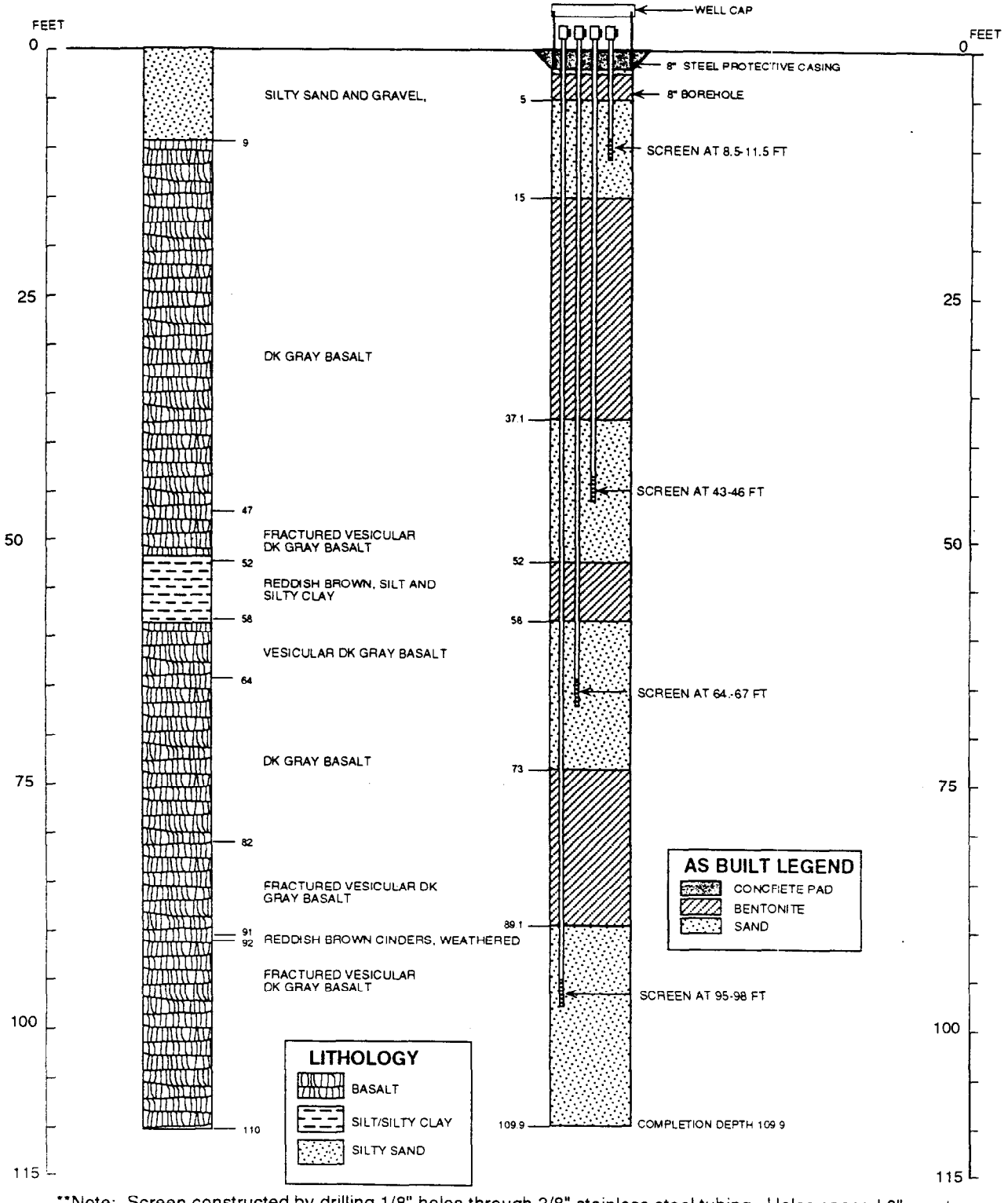
Well Type: gas sampling Longitude: 1125657.97 Drill Method: direct air rotary

Well Status active Latitude: 433222.67 Drill Fluid: air Water Level Date: NA

Year Drilled: 1996 Completion Depth: 109.9 Land Surface: 4937.38 Water Level Access: NA

Total Depth 110

* NOTE Easting/Northing and Elevation relative to NAD27/NGVD29

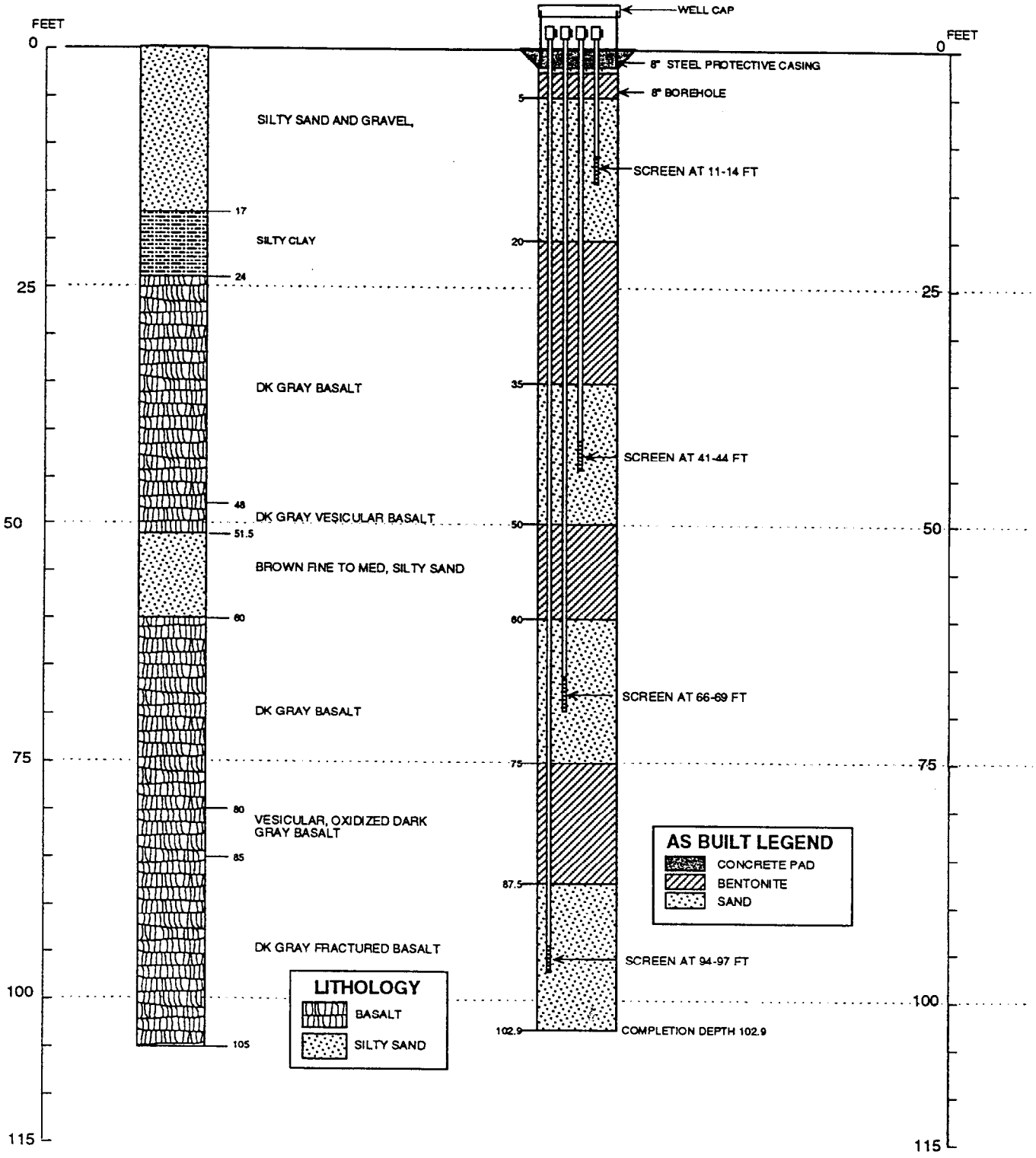


**Note: Screen constructed by drilling 1/8" holes through 3/8" stainless steel tubing. Holes spaced 6" apart over 3 ft screened section.

Figure B-1. Soil gas sampling schematic for location GSP1-1.

WELL NAME:	GSP2-1(CFA-GAS-VA-05)	Easting:	294688.85	Driller:	Alfred High	Date:	1/8/97
Facility:	CFA	Northing:	682849.49	Geologist:	Erick Neher	Water Level:	NA
Well Type:	gas sampling	Longitude:	1125627.33	Drill Method:	direct air rotary	Water Level Date:	NA
Well Status	active	Latitude:	433216.09	Drill Fluid:	air	Water Level Access:	NA
Year Drilled:	1996	Completion Depth:	102.9	Land Surface:	4930.63		
Total Depth	105						

* NOTE Easting/Northing and Elevation relative to NAD27/NGVD29

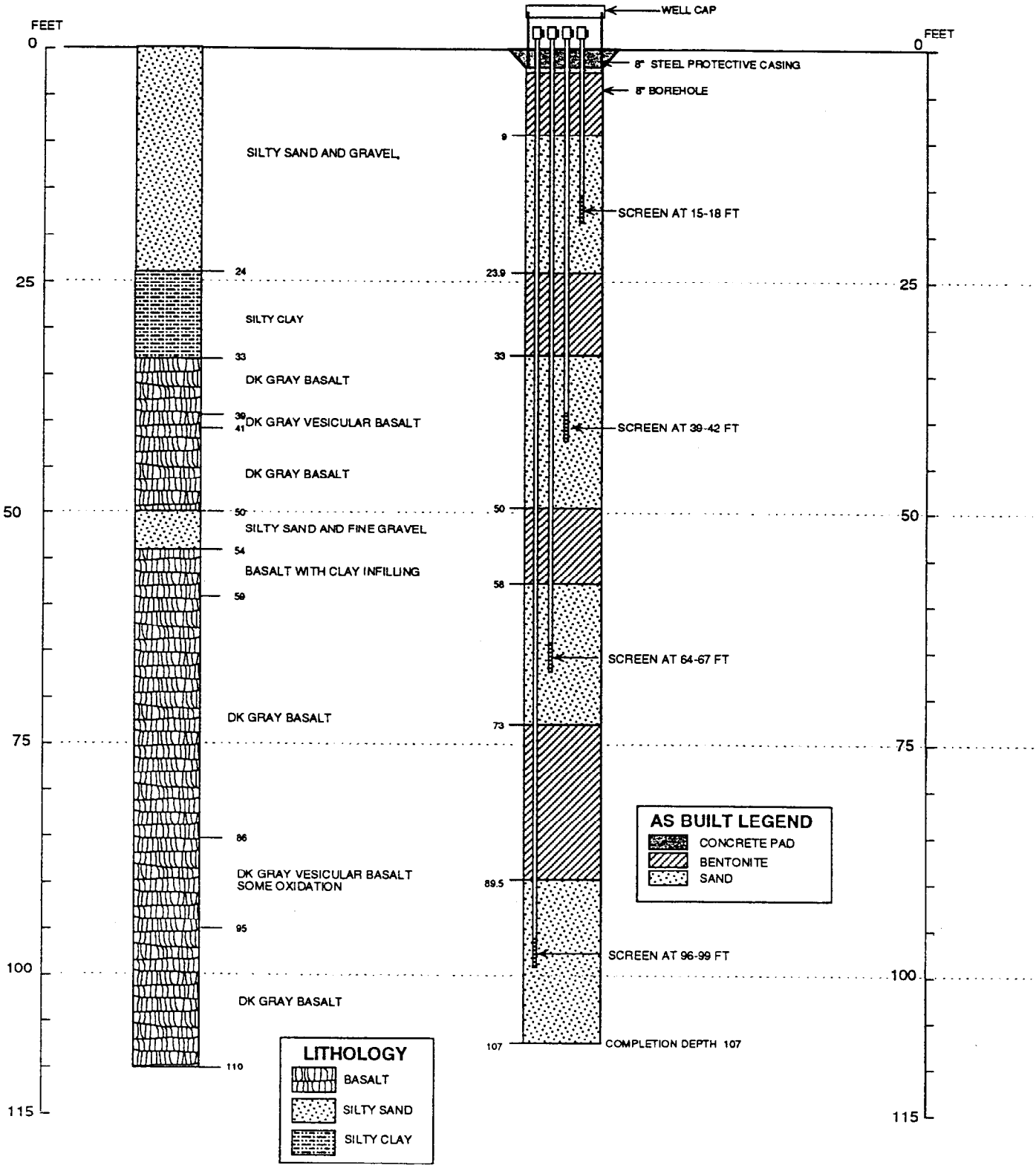


**Note: Screen constructed by drilling 1/8" holes through 3/8" stainless steel tubing. Holes spaced 6" apart over 3 ft screened section.

Figure B-2. Soil gas sampling schematic for location GSP2-1.

WELL NAME:	GSP2-2(CFA-GAS-VA-06)	Easting: 294128.07	Driller: Alfred High	Date:	[illegible]
Facility:	CFA	Northing: 683639.07	Geologist: Erick Neher	Water Level:	NA
Well Type:	gas sampling	Longitude: 1125635.04	Drill Method: direct air rotary	Water Level Date:	NA
Well Status	active	Latitude: 433223.84	Drill Fluid: air	Water Level Access:	NA
Year Drilled:	1996	Completion Depth: 107	Land Surface: 4933.51		
Total Depth	110				

* NOTE Easting/Northing and Elevation relative to NAD27/NGVD29



**Note: Screen constructed by drilling 1/8" holes through 3/8" stainless steel tubing. Holes spaced 6" apart over 3 ft screened section.

Figure B-3. Soil gas sampling schematic for location GSP2-2.

WELL NAME: GSP3-1(CFA-GAS-VA-07) Easting: 291968.15 Driller: Alfred High Date: 1/9/97

Facility: CFA Northing: 683893.79 Geologist: Erick Neher Water Level: NA

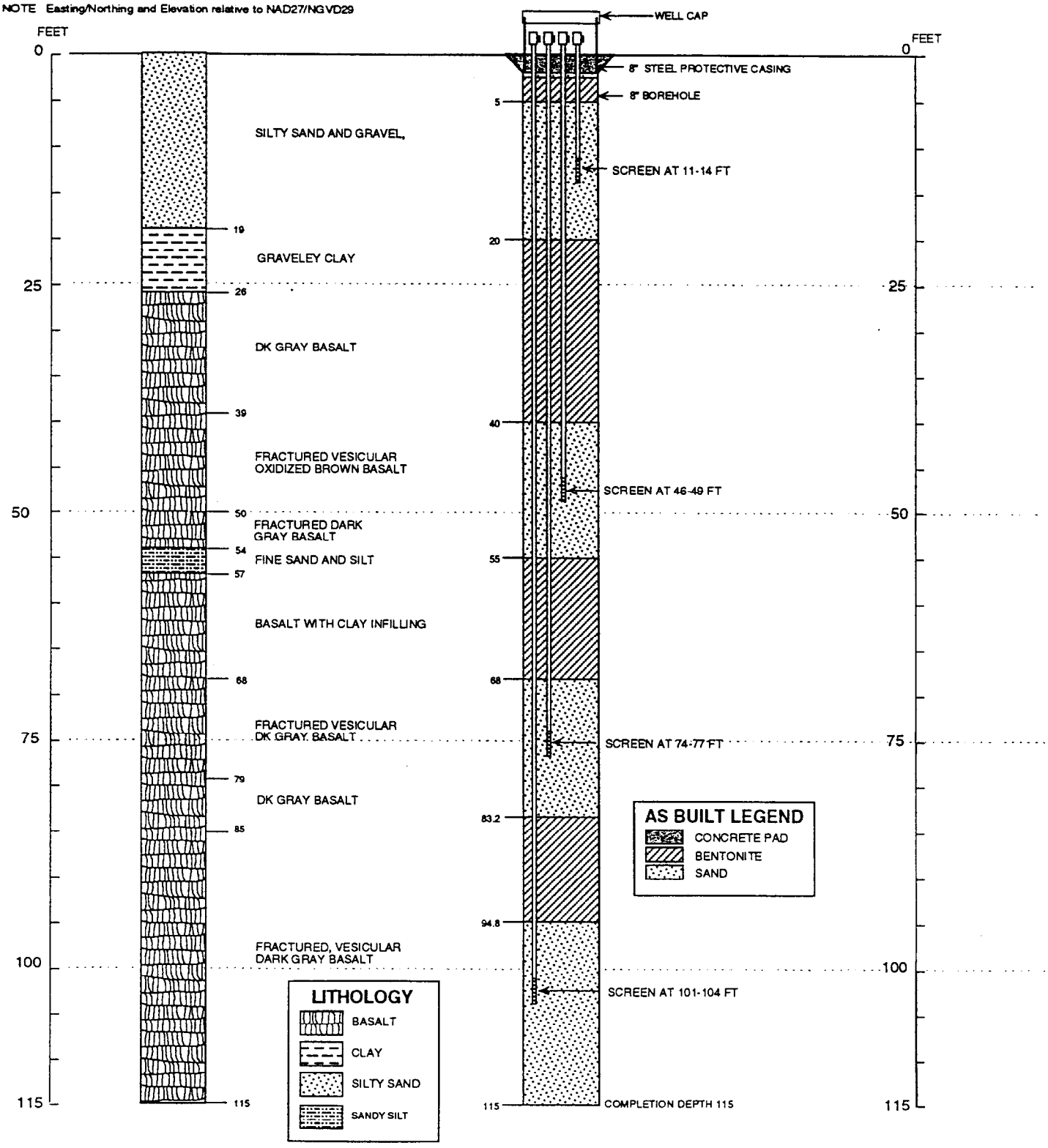
Well Type: gas sampling Longitude: 1125704.40 Drill Method: direct air rotary

Well Status: active Latitude: 433226.15 Drill Fluid: air Water Level Date: NA

Year Drilled: 1996 Completion Depth: 115 Land Surface: 4939.04 Water Level Access: NA

Total Depth: 115

* NOTE Easting/Northing and Elevation relative to NAD27/NGVD29



**Note: Screen constructed by drilling 1/8" holes through 3/8" stainless steel tubing. Holes spaced 6" apart over 3 ft screened section.

Figure B-4. Soil gas sampling schematic for location GSP3-1.

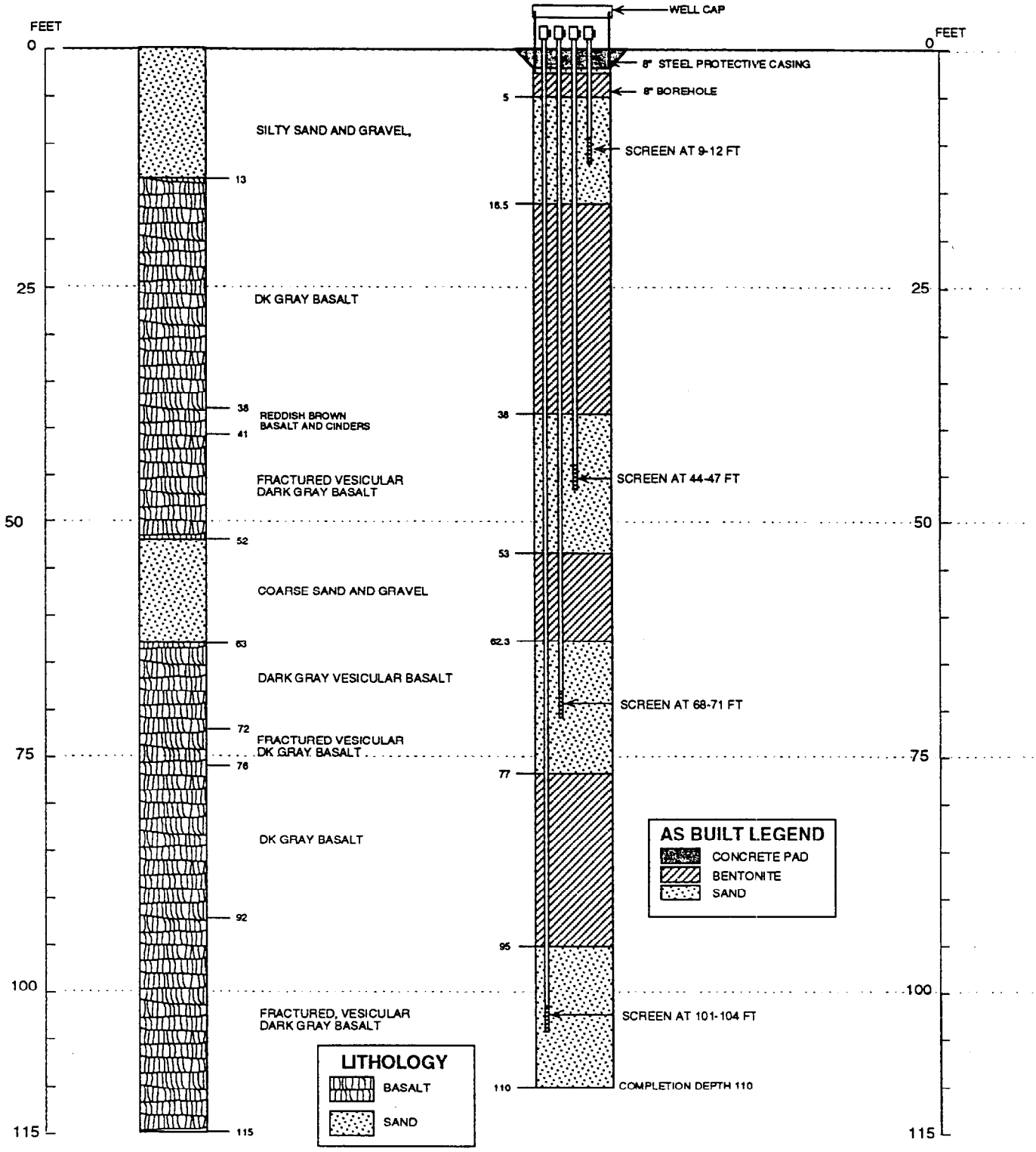
WELL NAME: GSP3-2(CFA-GAS-VA-08)
Facility: CFA
Well Type: gas sampling
Well Status: active
Year Drilled: 1996
Total Depth: 115

Easting: 292096.75
Northing: 684927.13
Longitude: 1125702.78
Latitude: 433236.37
Completion Depth: 110

Driller: Alfred High
Geologist: Erick Neher
Drill Method: direct air rotary
Drill Fluid: air
Land Surface: 4937.42

Date: 1/9/97
Water Level: NA
Water Level Date: NA
Water Level Access: NA

* NOTE Easting/Northing and Elevation relative to NAD27/NGVD29



**Note: Screen constructed by drilling 1/8" holes through 3/8" stainless steel tubing. Holes spaced 6" apart over 3 ft screened section.

Figure B-5. Soil gas sampling schematic for location GSP3-2.

Appendix C

Section 4 Figures

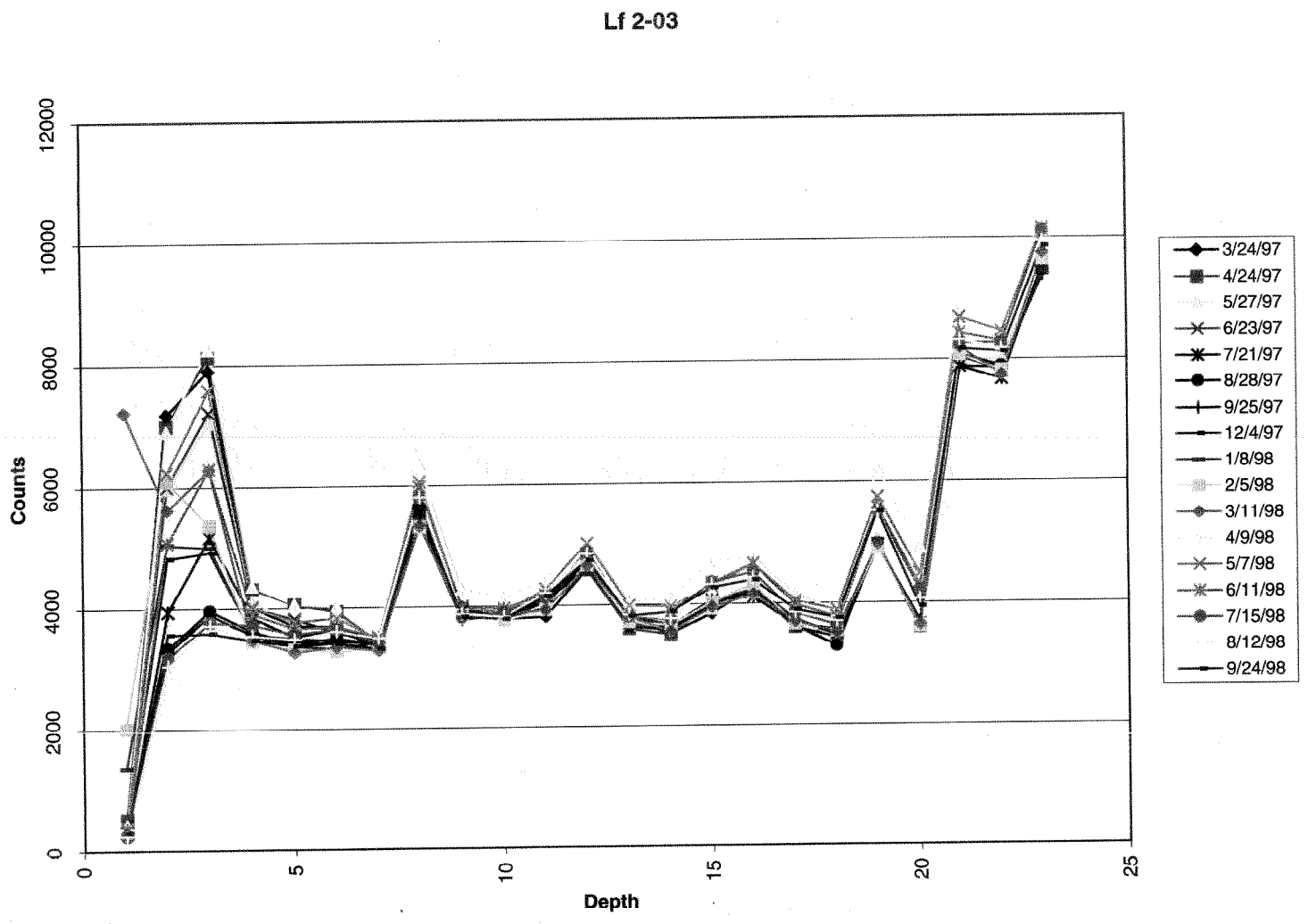


Figure C-1. CPN log for LF 2-03.

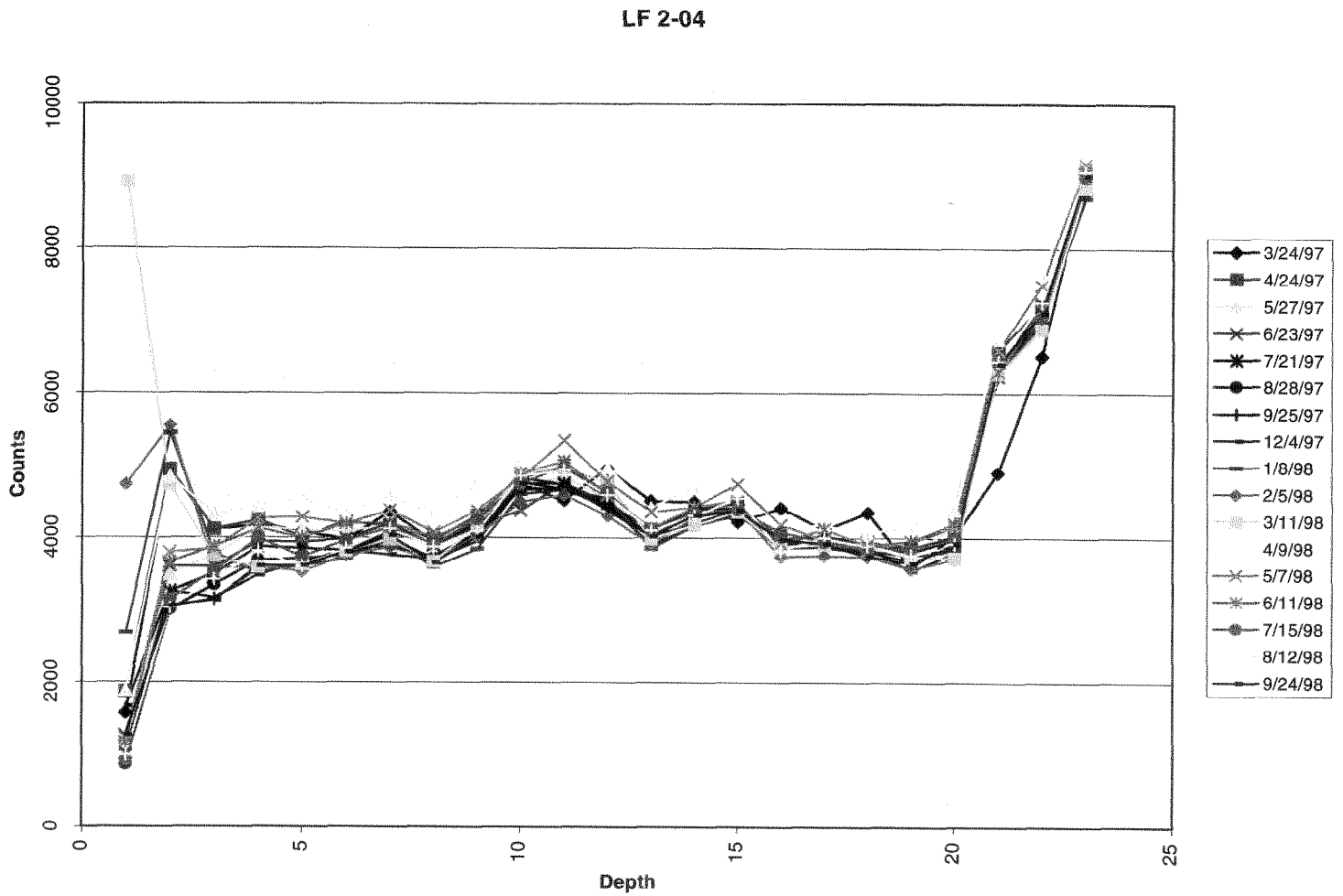


Figure C-2. CPN log for LF 2-04.

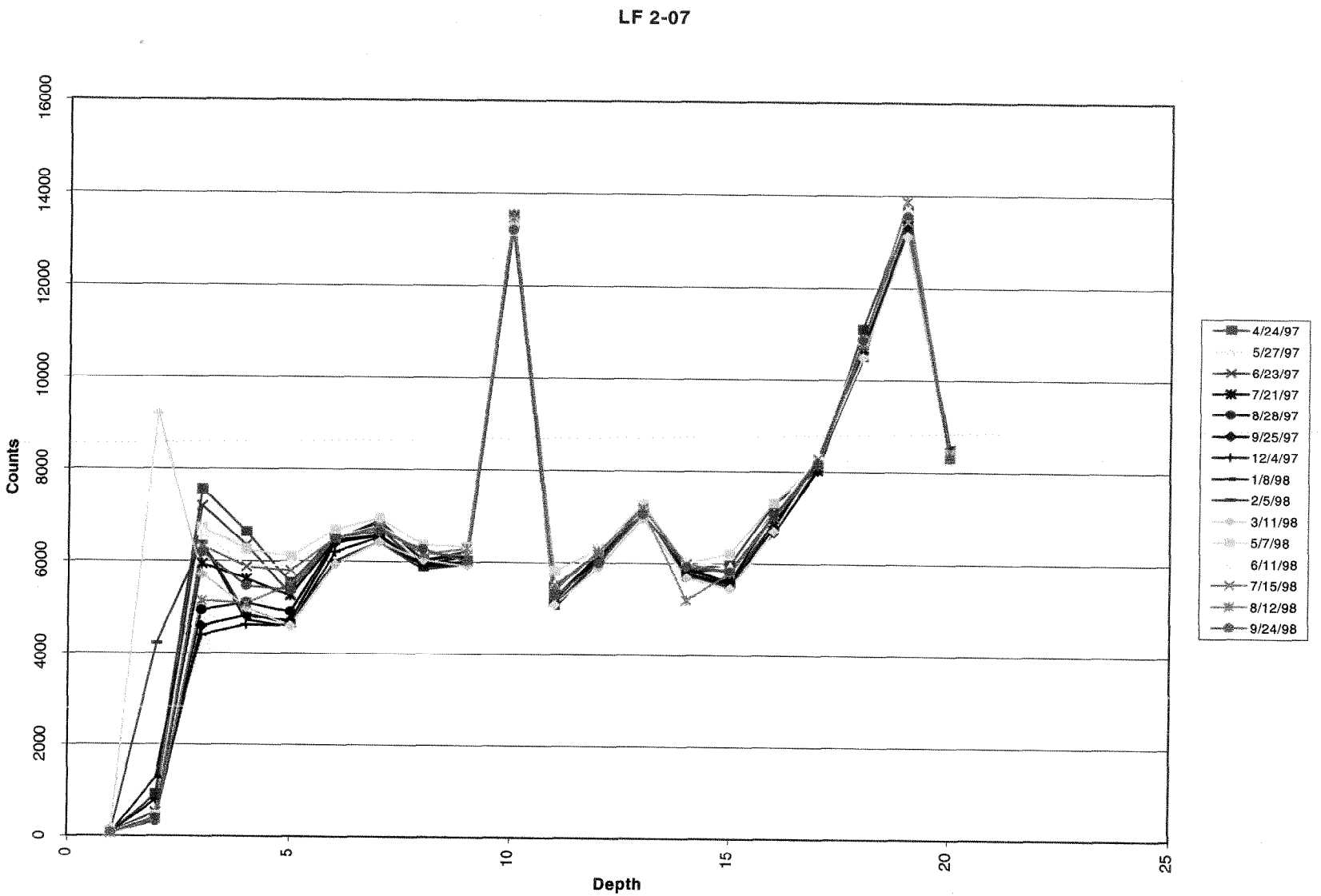


Figure C-3. CPN log for LF 2-07.

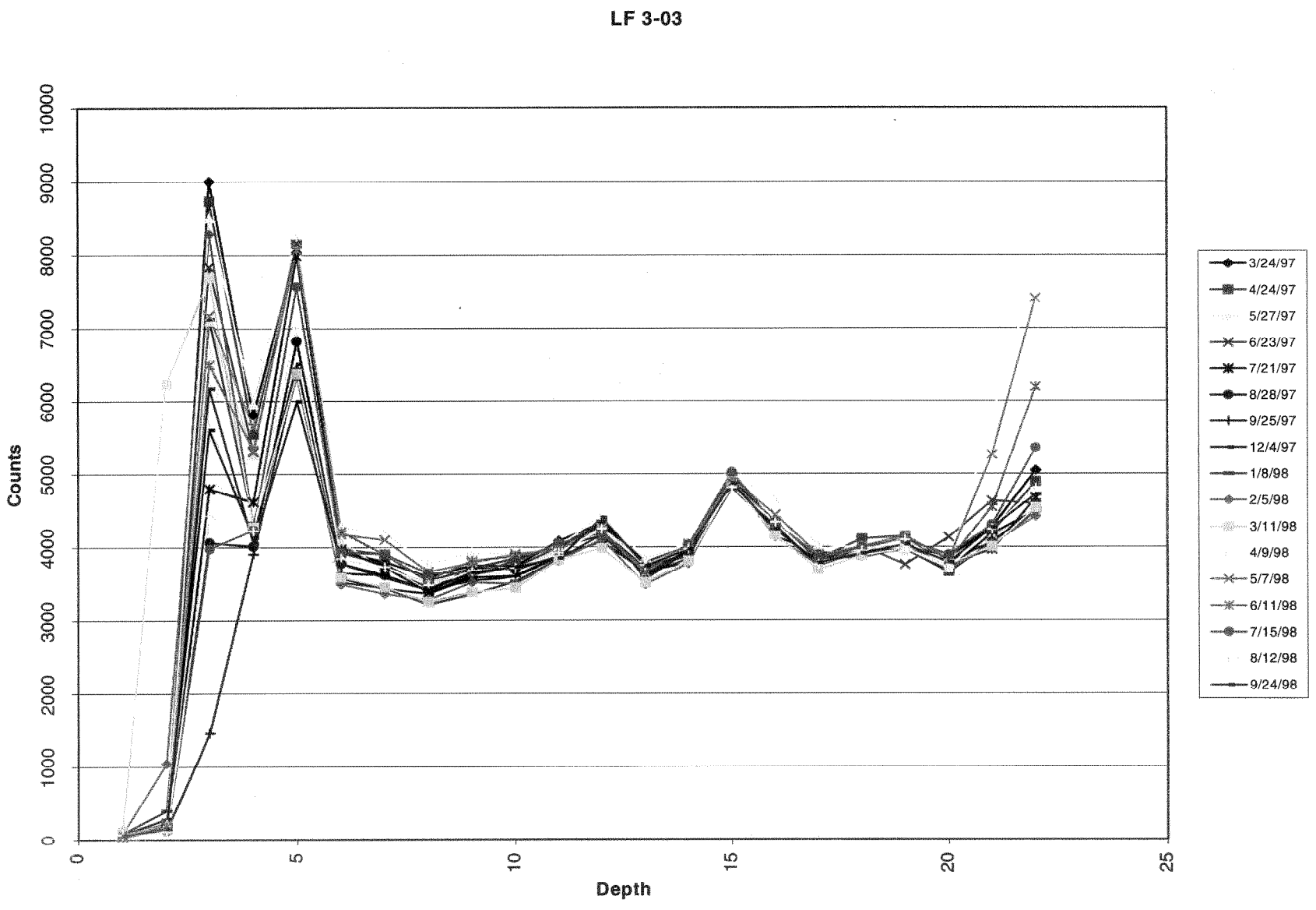


Figure C-4. CPN log for LF 3-03.

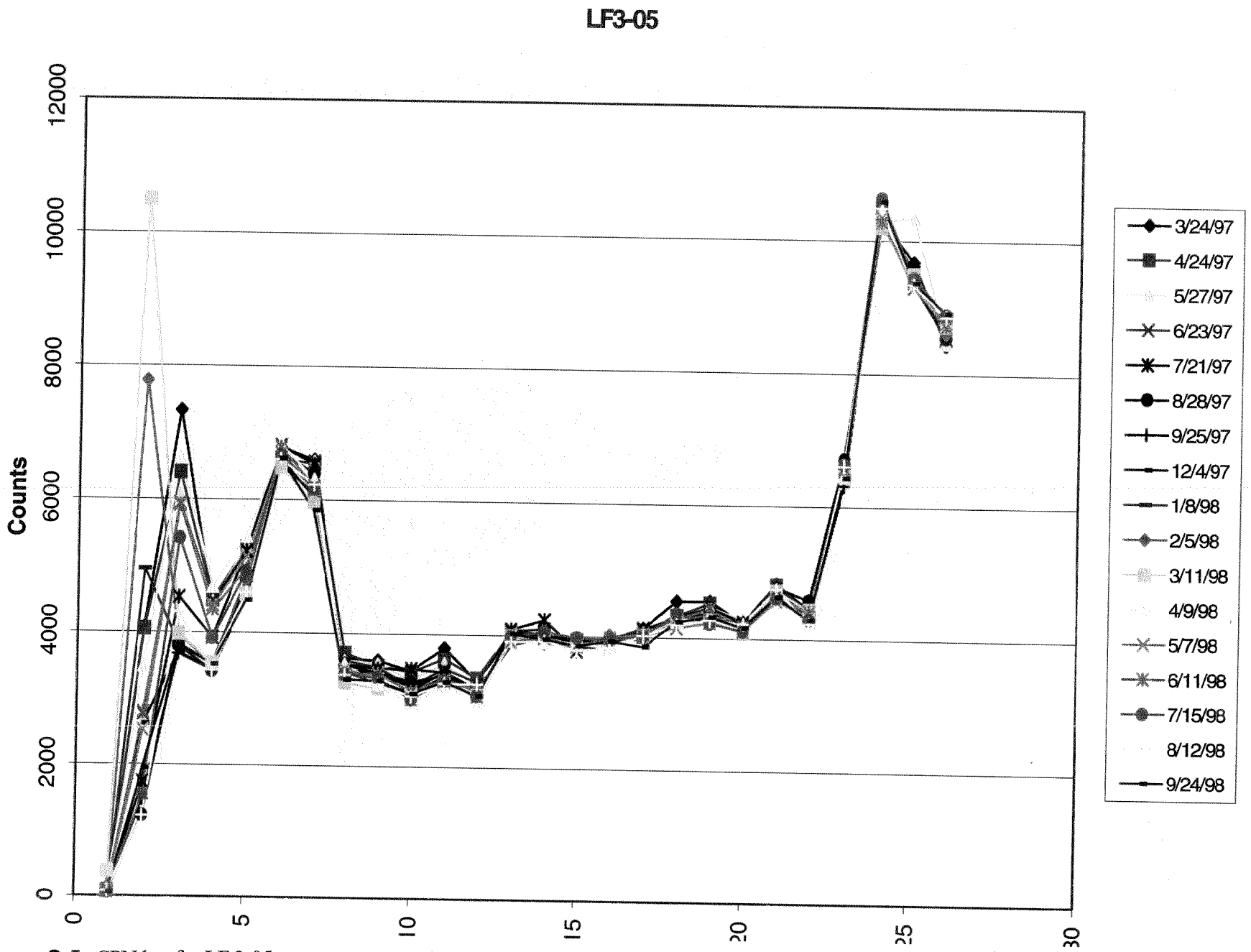


Figure C-5. CPN log for LF 3-05.

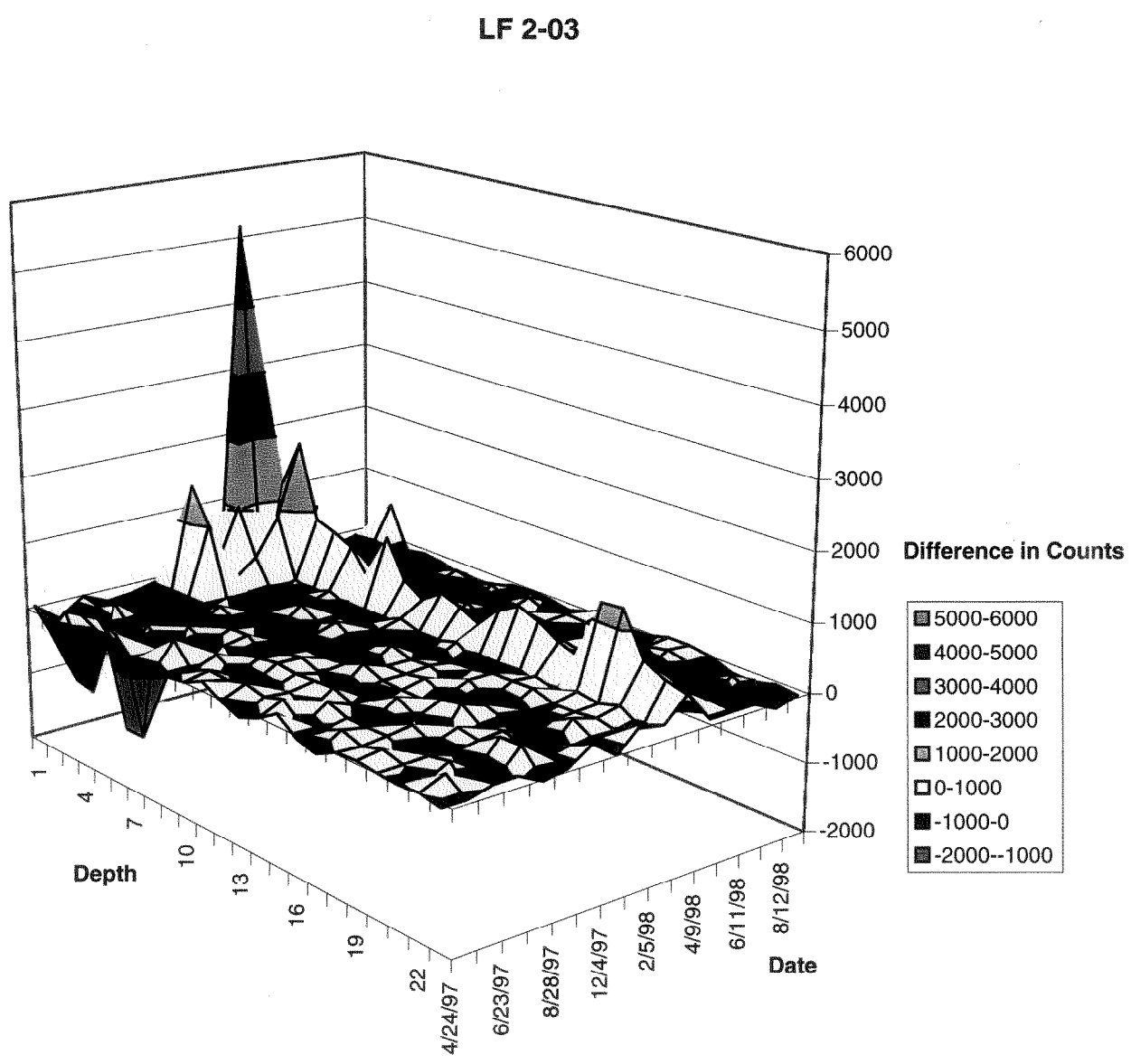


Figure C-6. Three-dimensional plot of LF 2-03 showing the difference in counts from month to month.

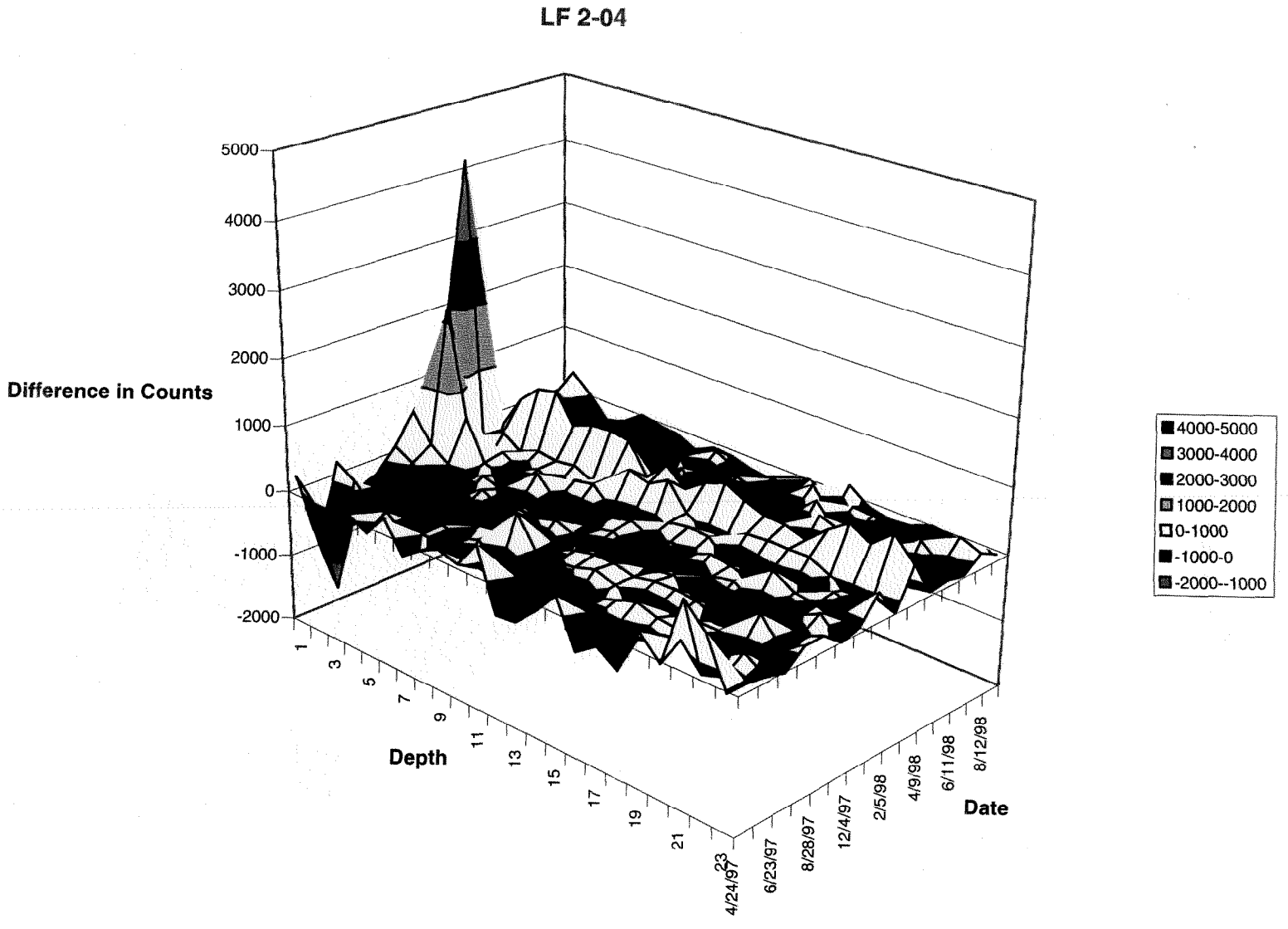


Figure C-7. Three-dimensional plot of LF 2-04 showing the difference in counts from month to month.

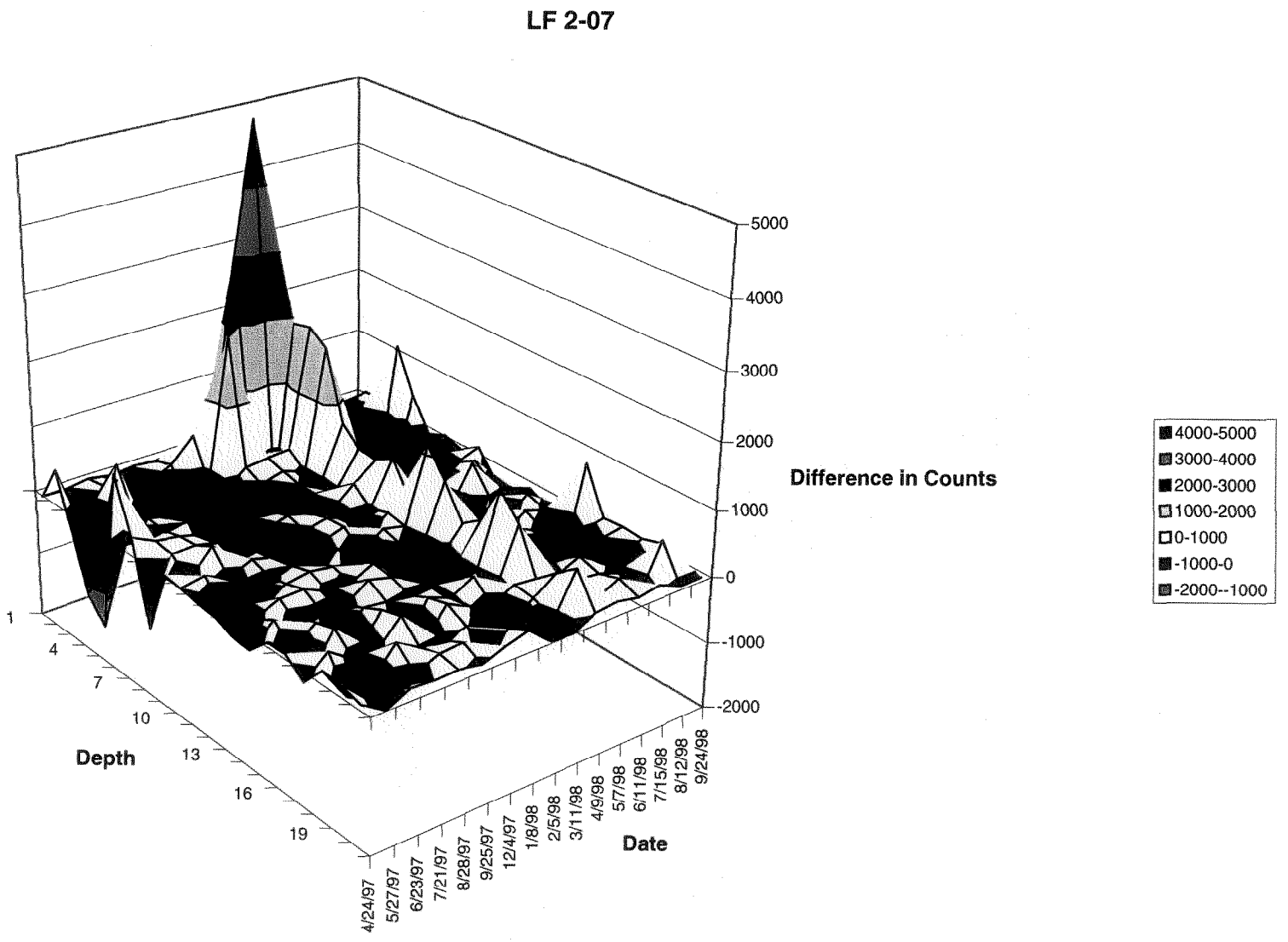


Figure C-8. Three-dimensional plot of LF 2-07 showing the difference in counts from month to month.

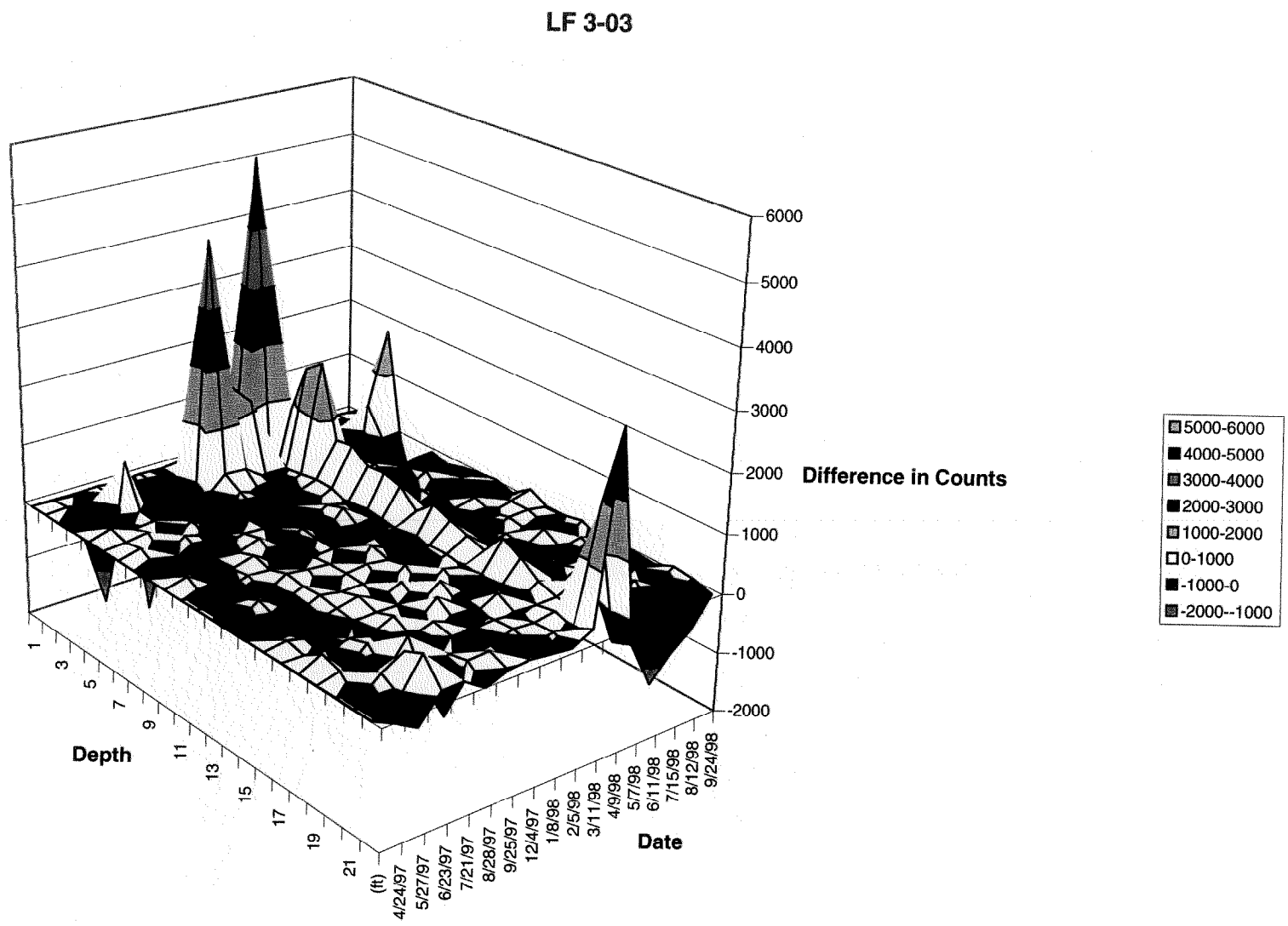


Figure C-9. Three-dimensional plot of LF 3-03 showing the difference in counts from month to month.

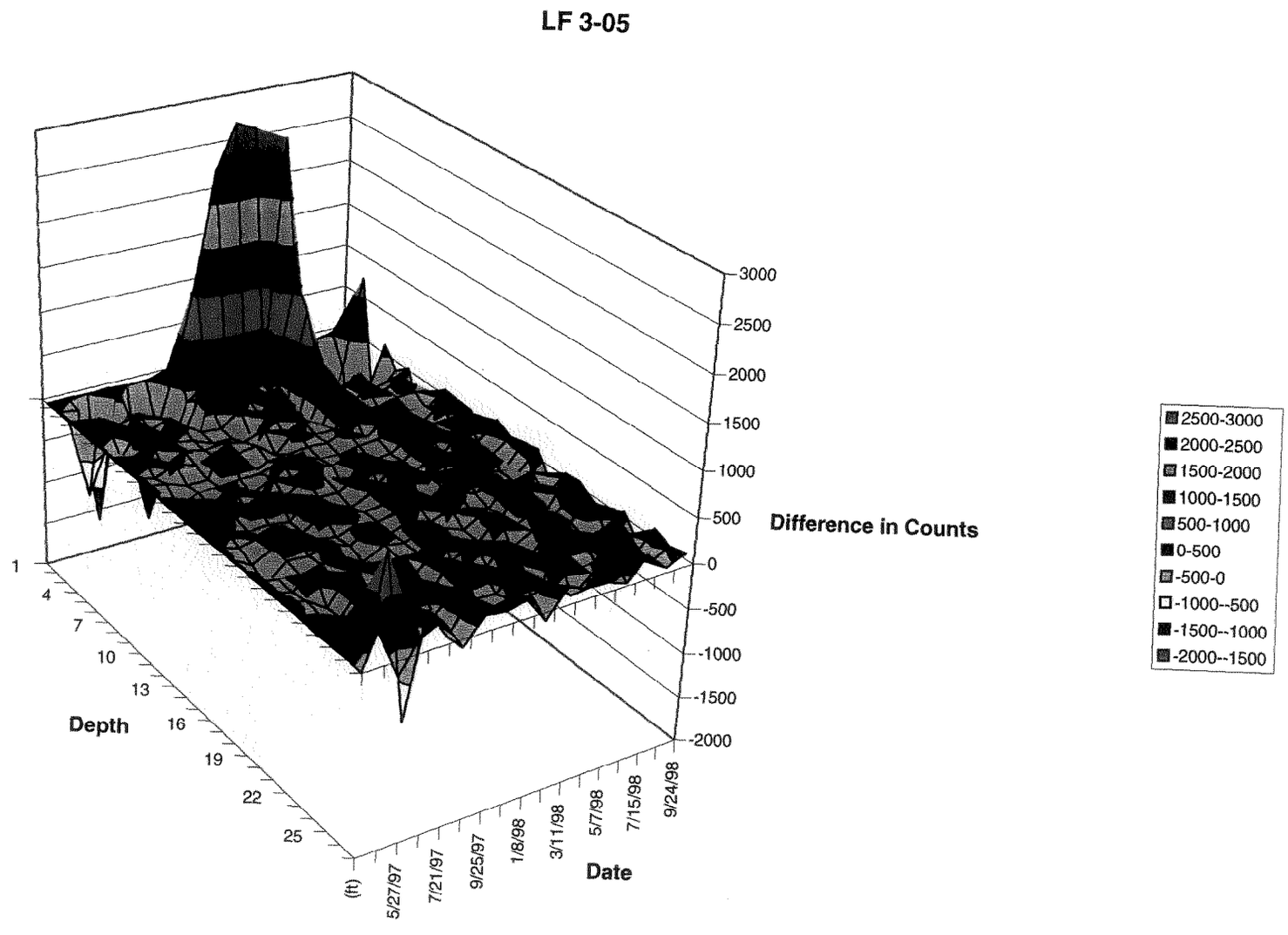


Figure C-10. Three-dimensional plot of LF 3-05 showing the difference in counts from month to month.

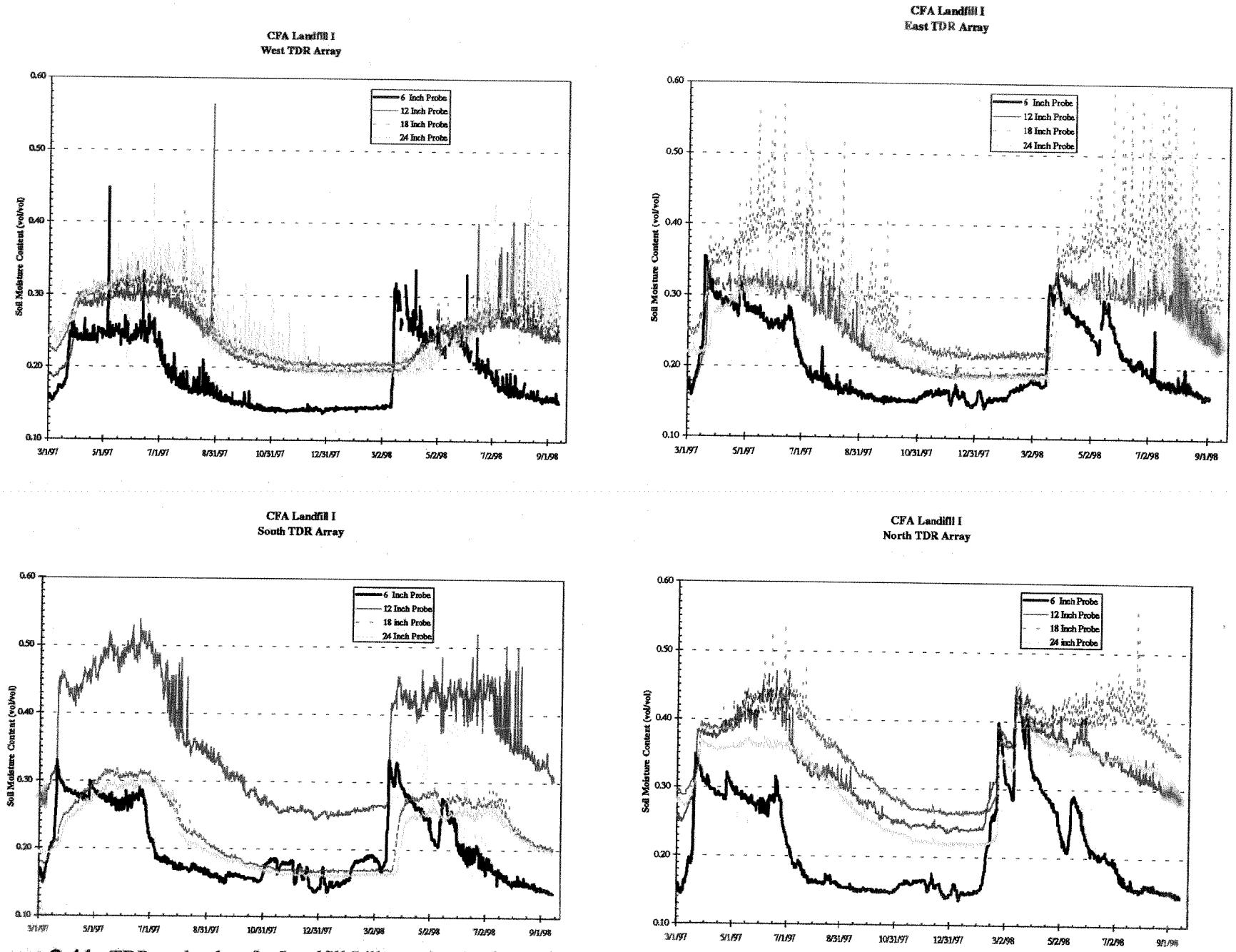


Figure C-11. TDR probe data for Landfill I illustrating north, south, east, and west arrays.

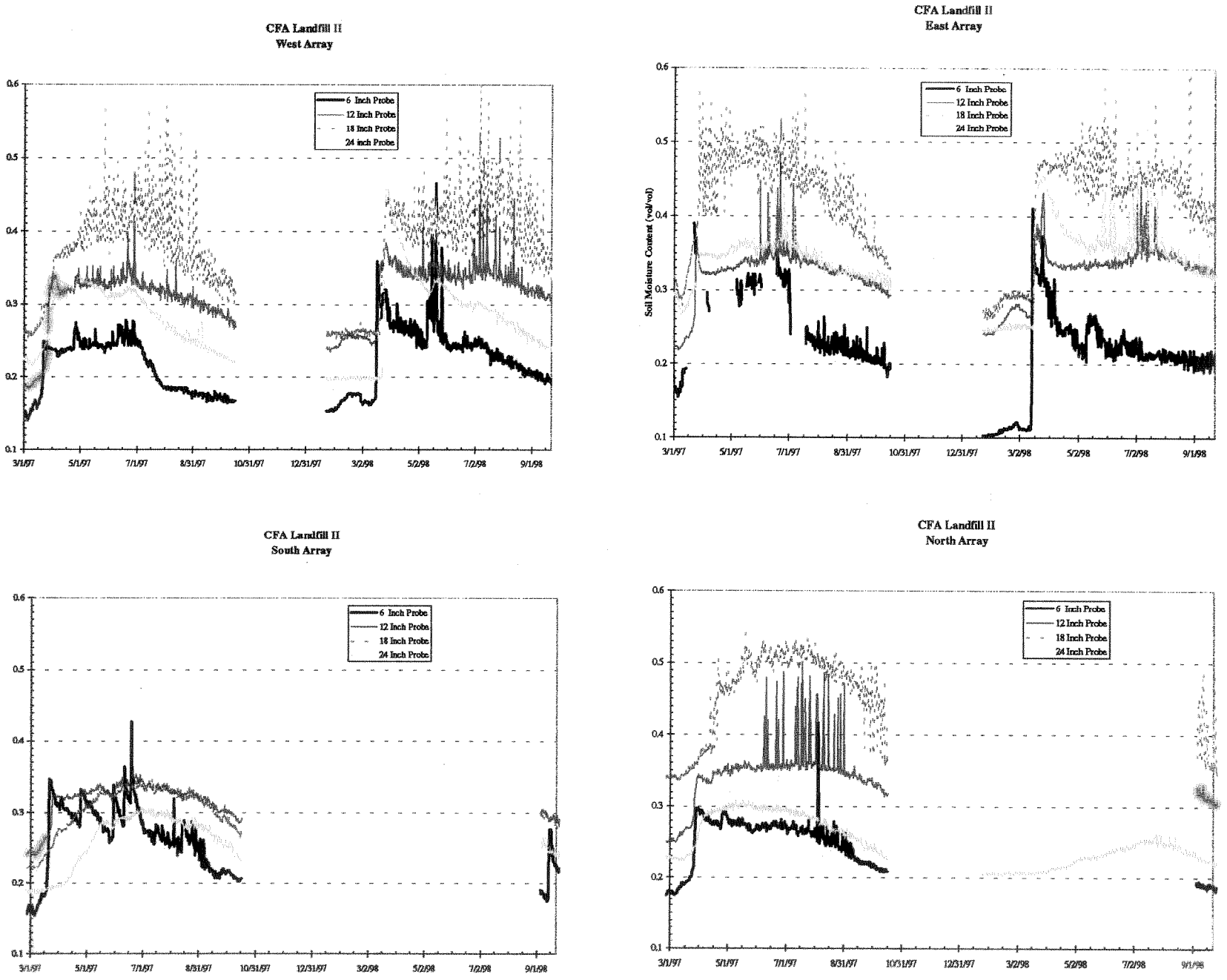


Figure C-12. TDR probe data for Landfill II illustrating north, south, east, and west arrays.

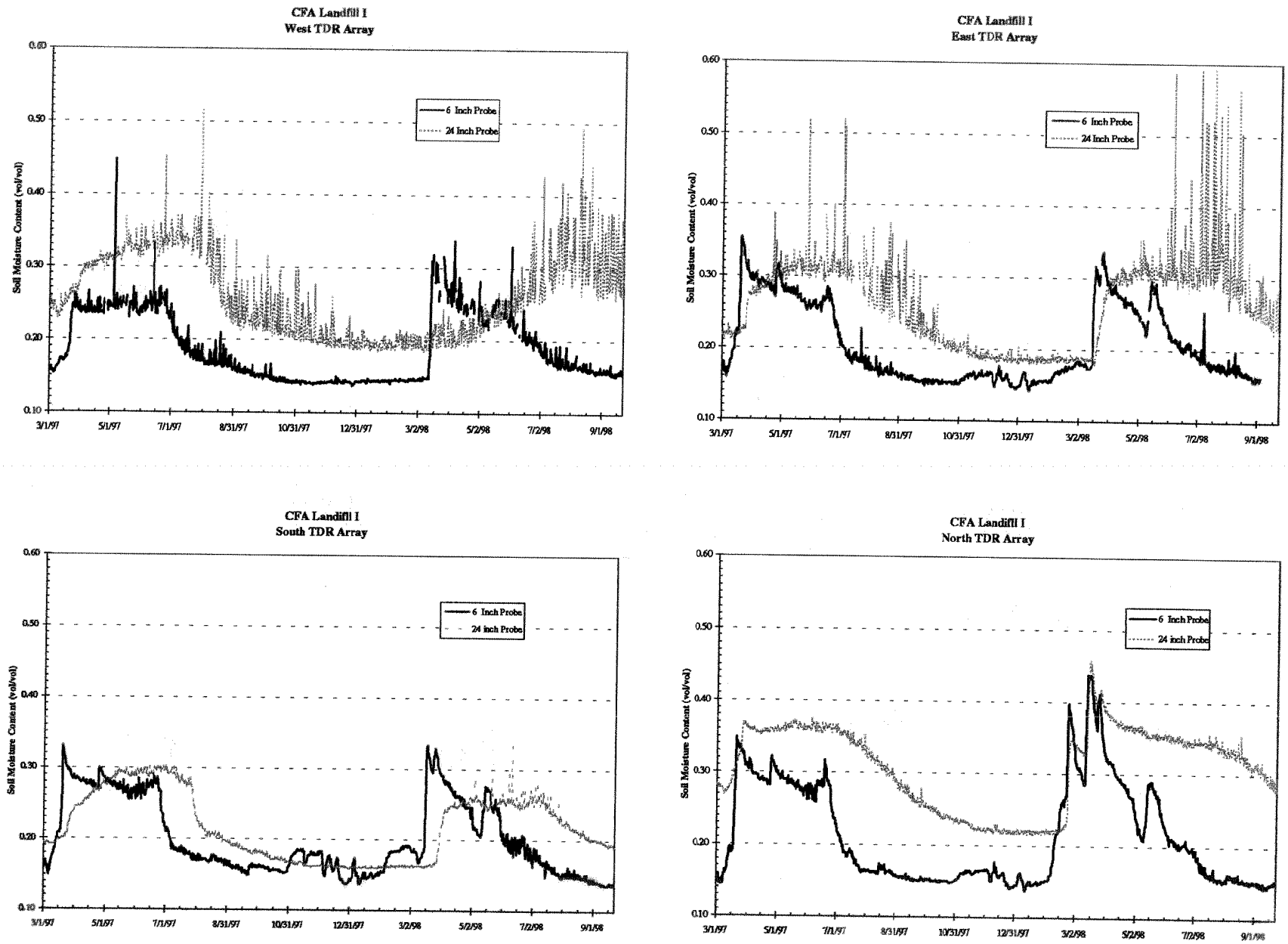


Figure C-13. TDR probe data for the 6-in. and 24-in. depths at Landfill I.

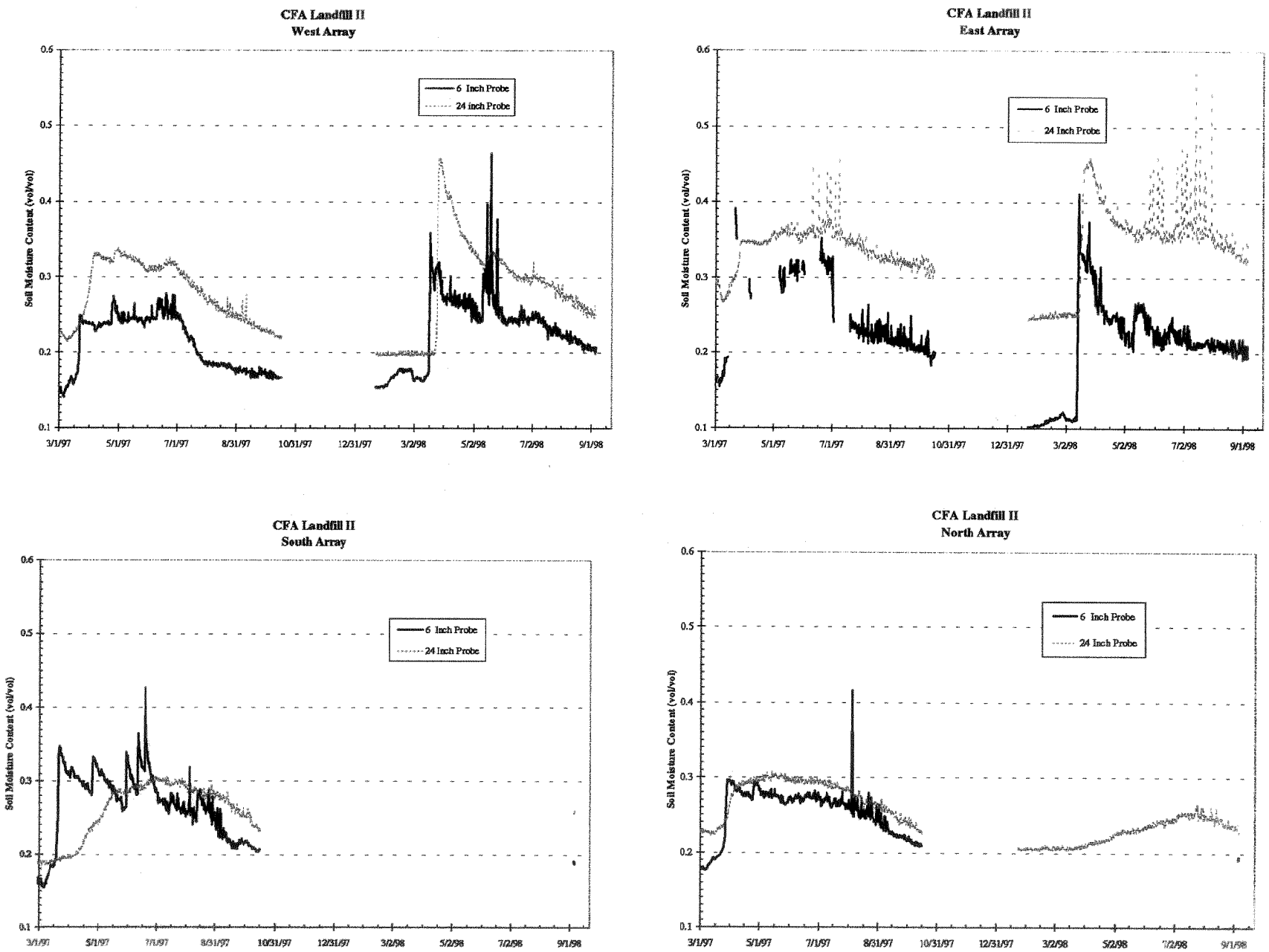


Figure C-14. TDR probe data for the 6-in. and 24-in. depths at Landfill II.

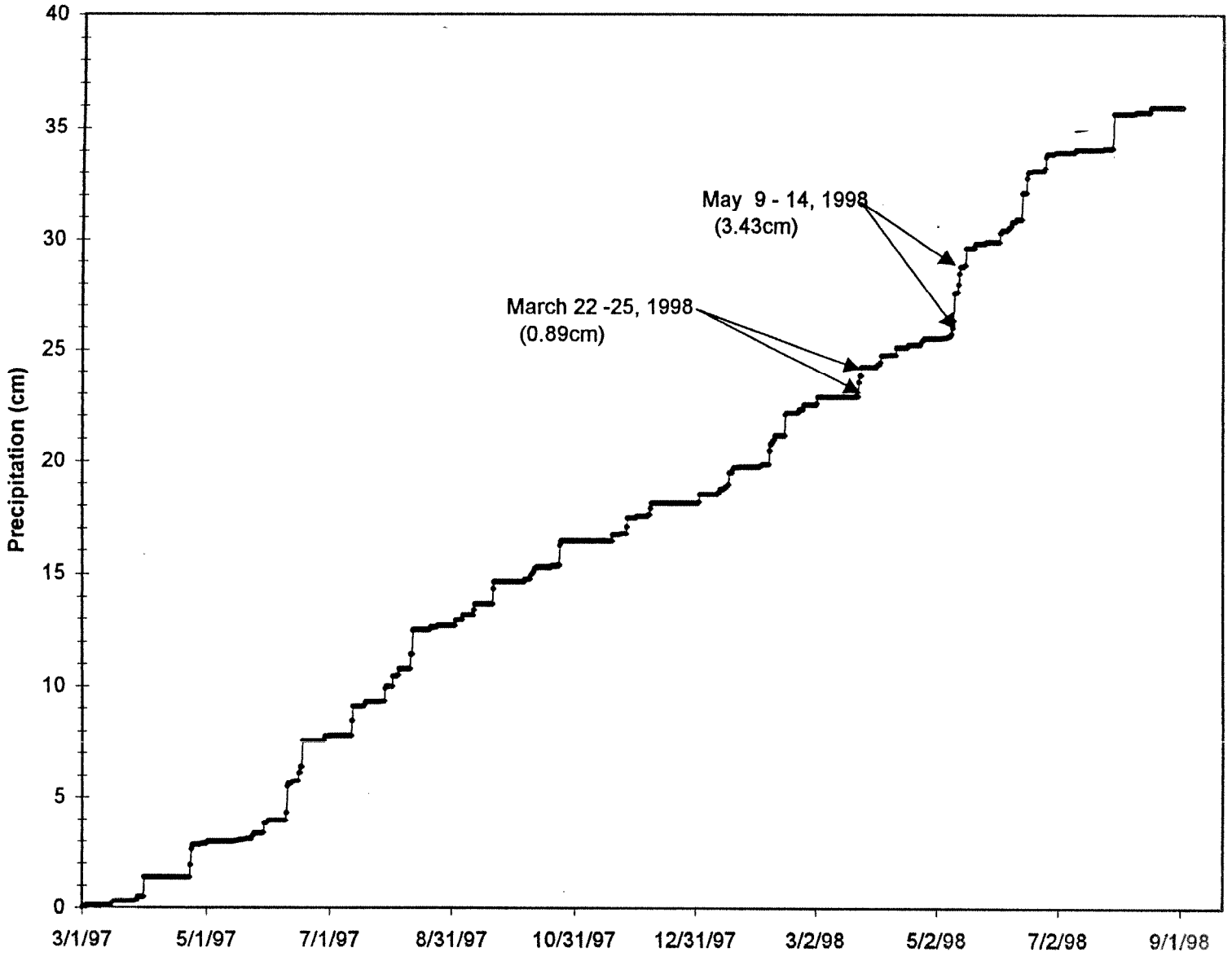


Figure C-15. Cumulative precipitation at the CFA Weather Station for the monitoring period.

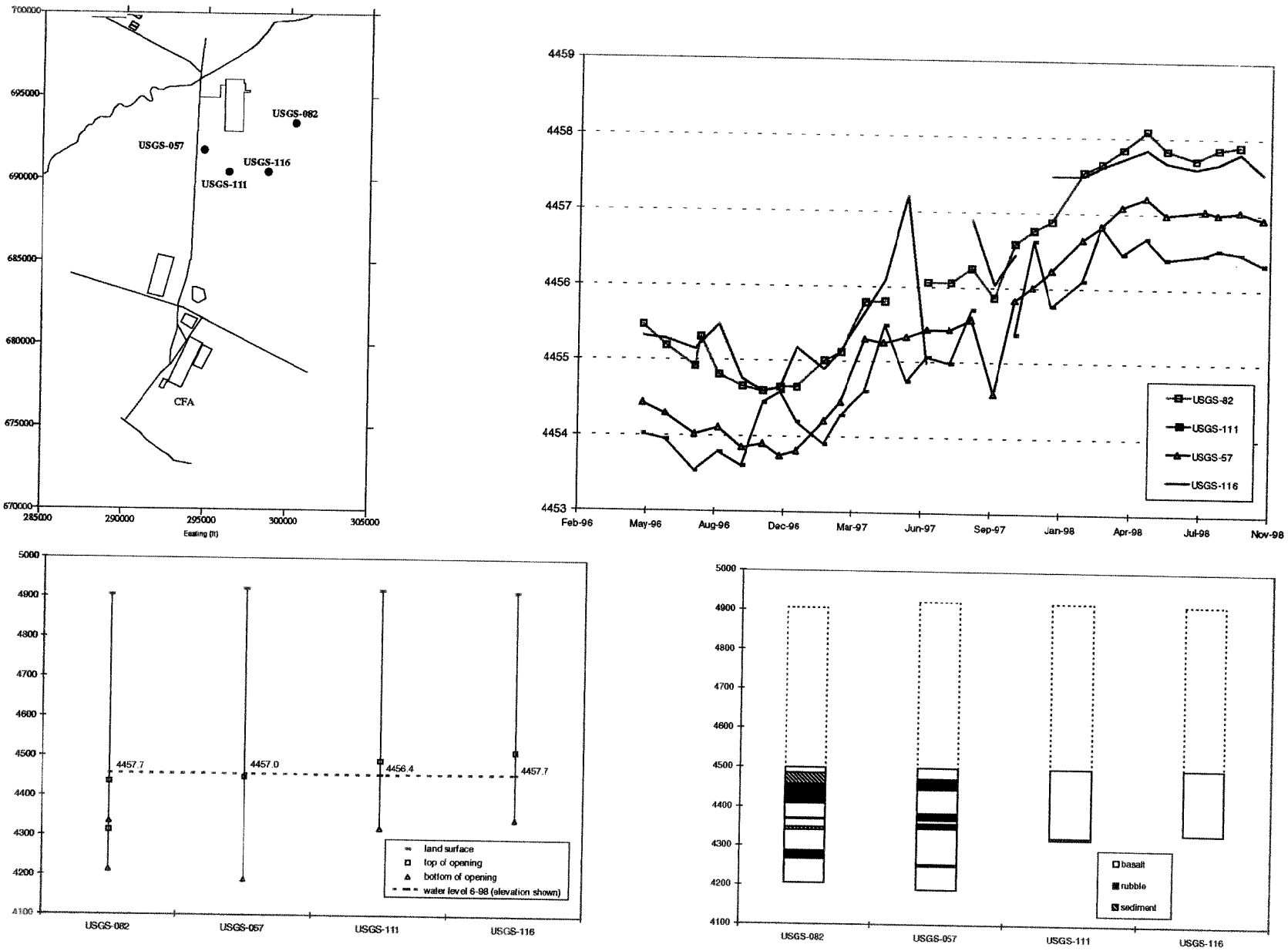


Figure C-16. Location, hydrograph, construction detail, and lithology diagrams for the first group of CFA wells.

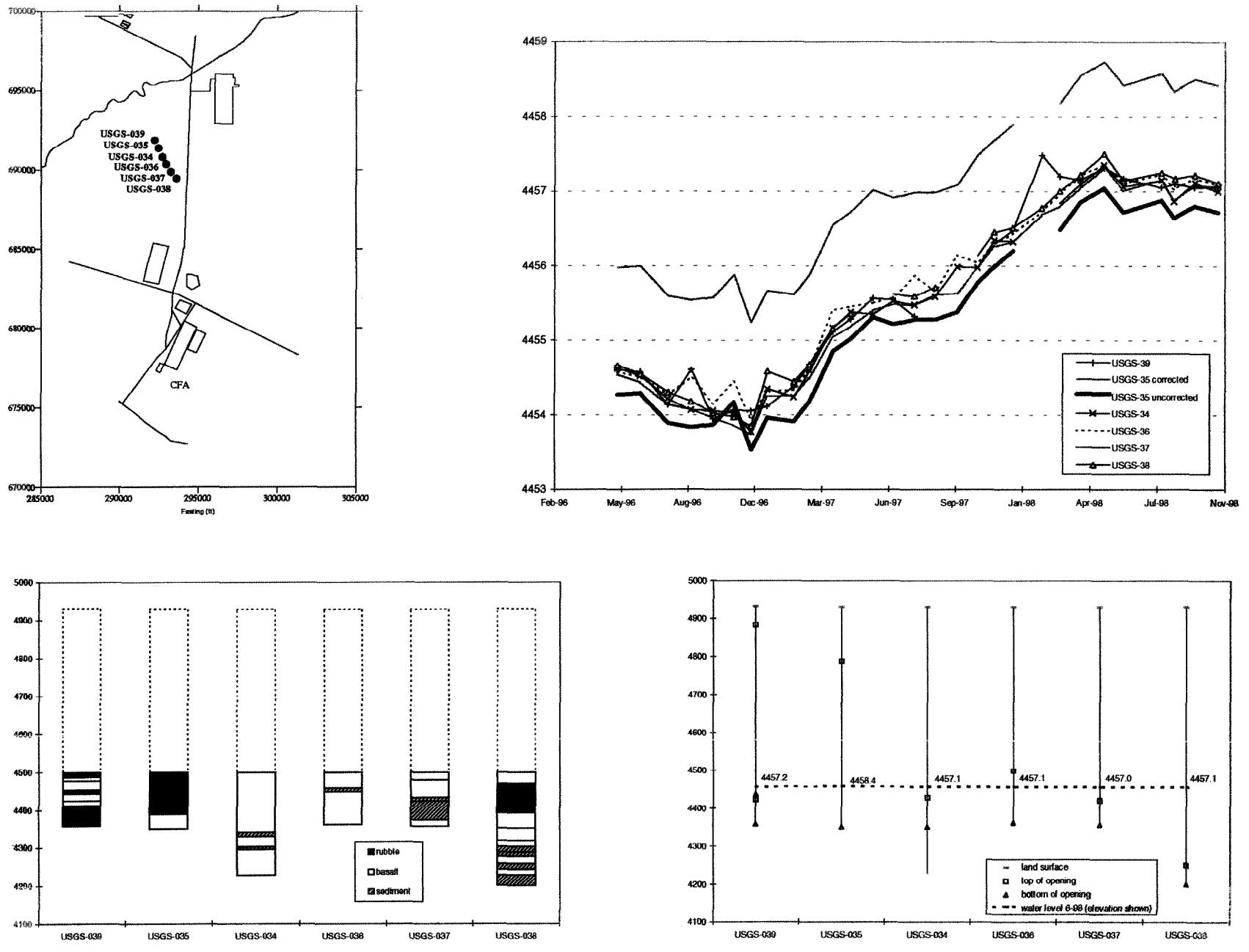


Figure C-17. Location, hydrograph, construction detail, and lithology diagrams for second group CFA wells.

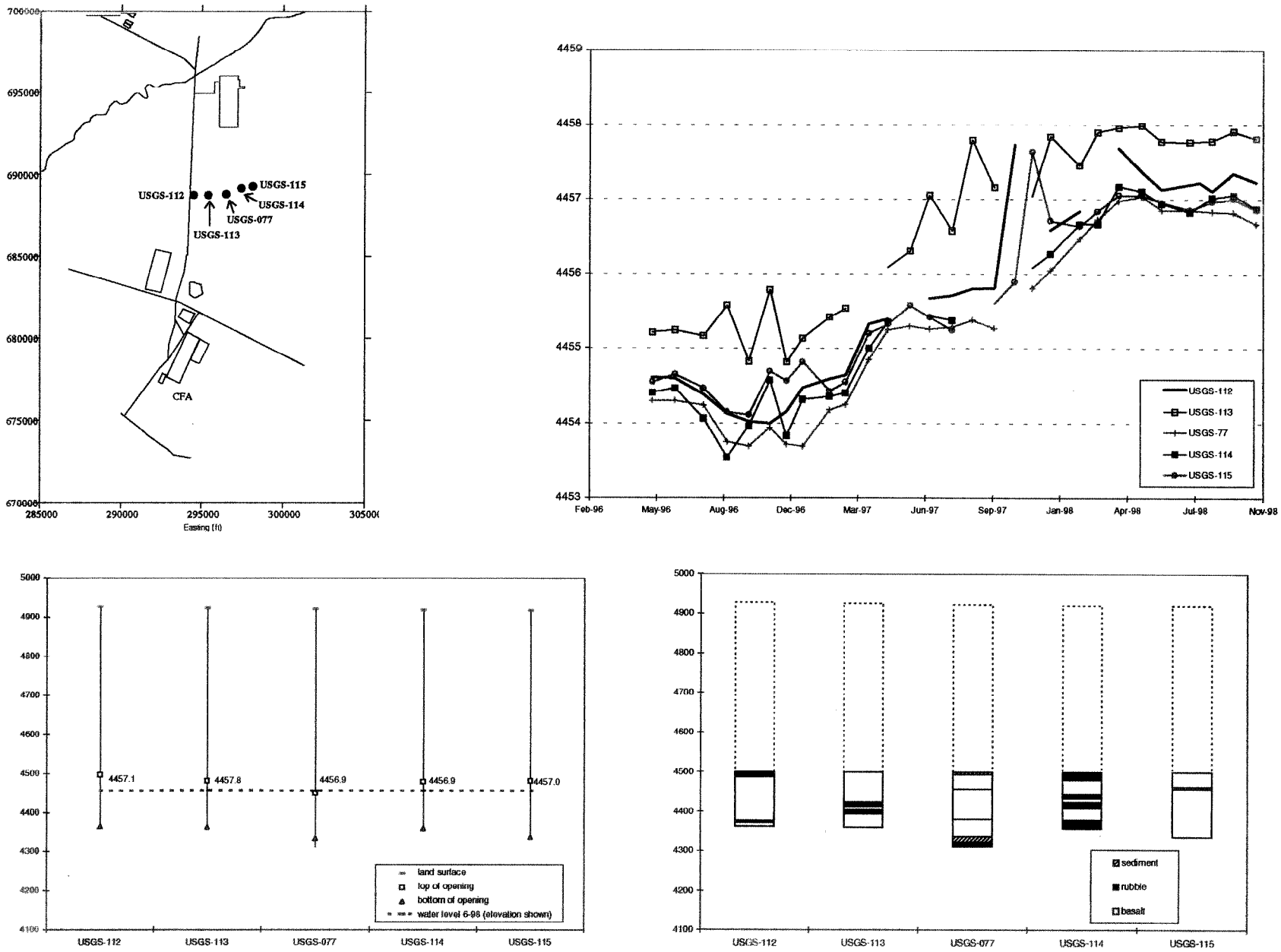


Figure 18. Location, hydrograph, construction detail, and lithology diagrams for third group CFA well.

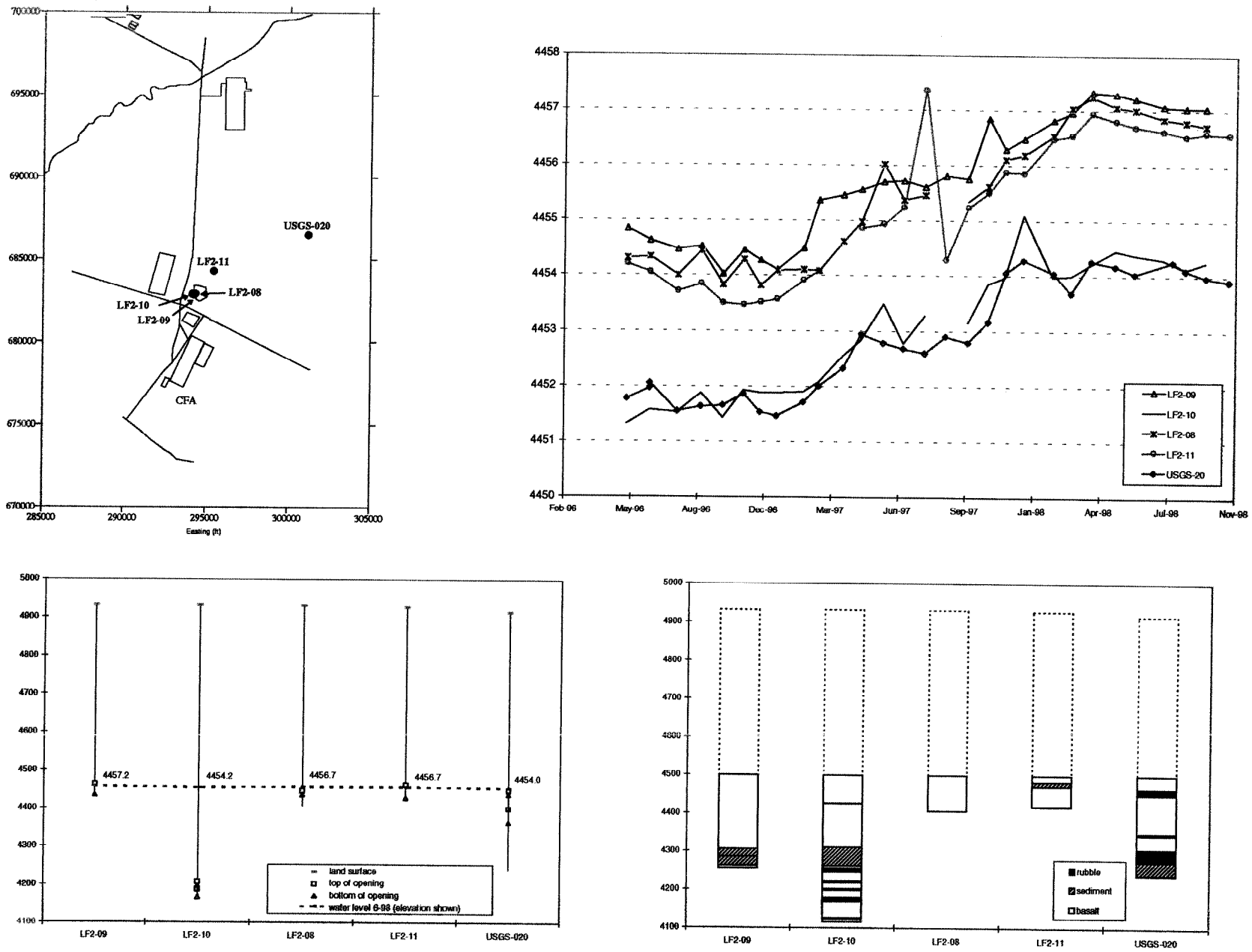


Figure C-19. Location, hydrograph, construction detail, and lithology diagrams for fourth group of CFA wells.

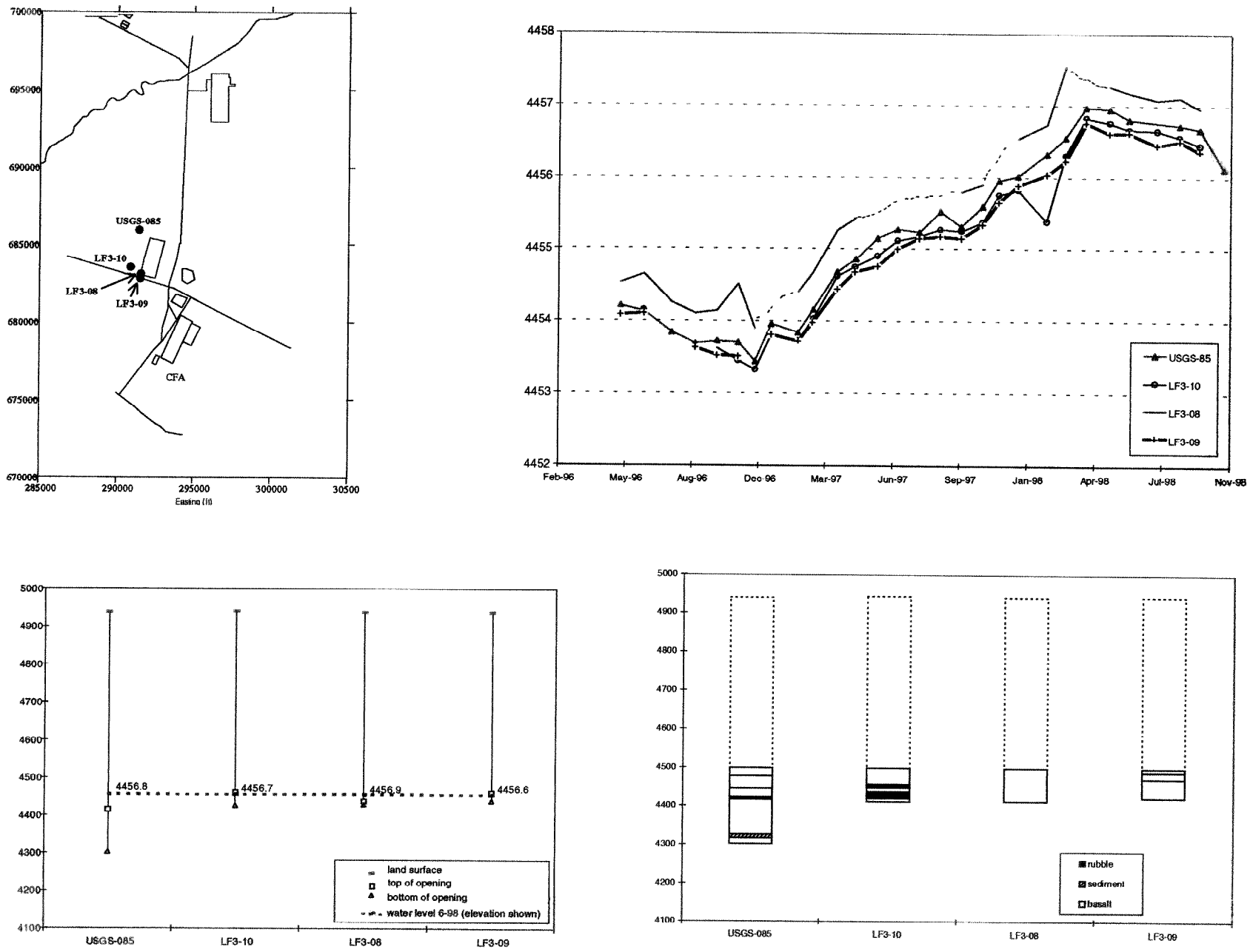


Figure C-20. Location, hydrograph, construction detail, and lithology diagrams for fifth group CFA wells.

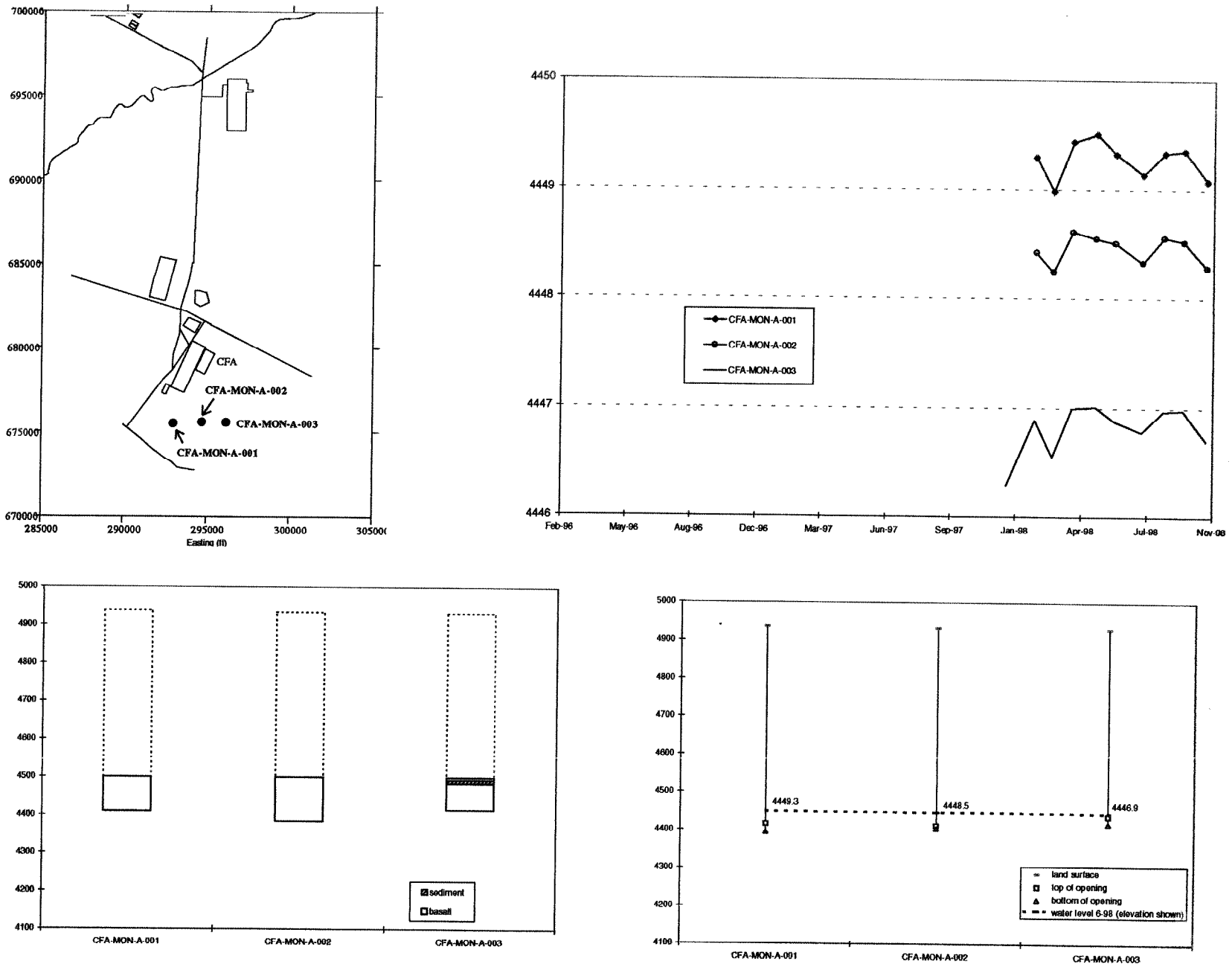


Figure C-21. Location, hydrograph, construction detail, and lithology diagrams for sixth group CFA wells.

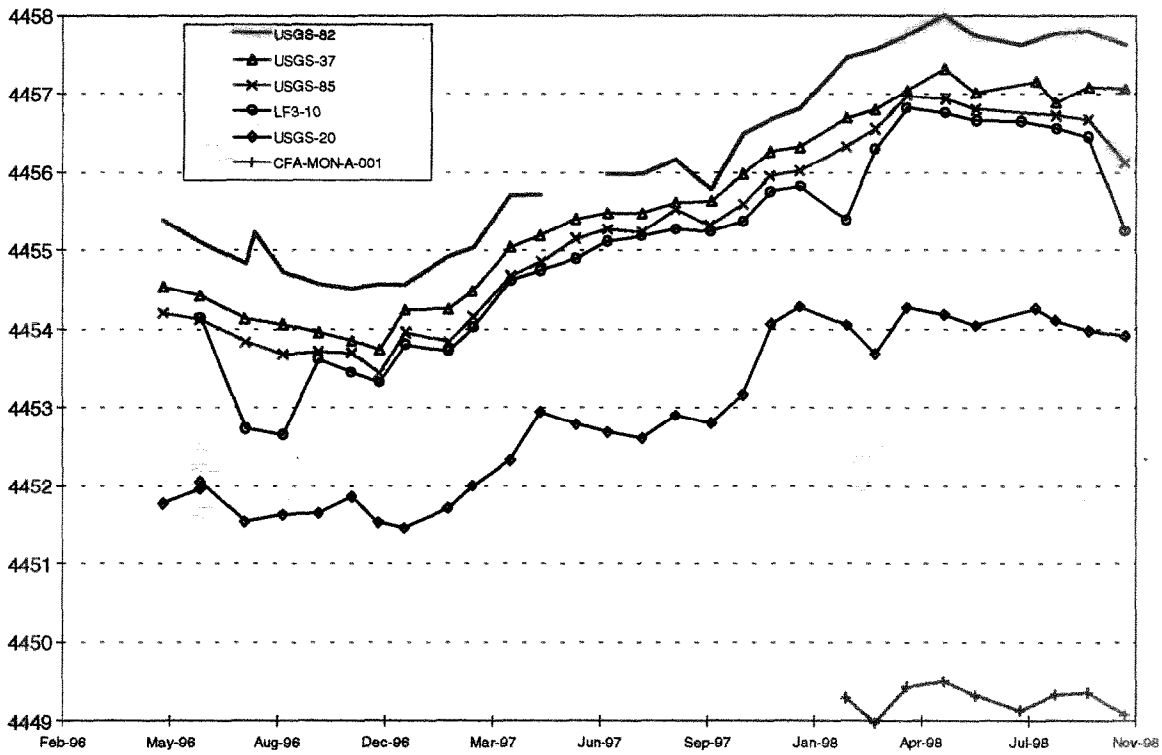


Figure C-22. Perimeter-well hydrographs.

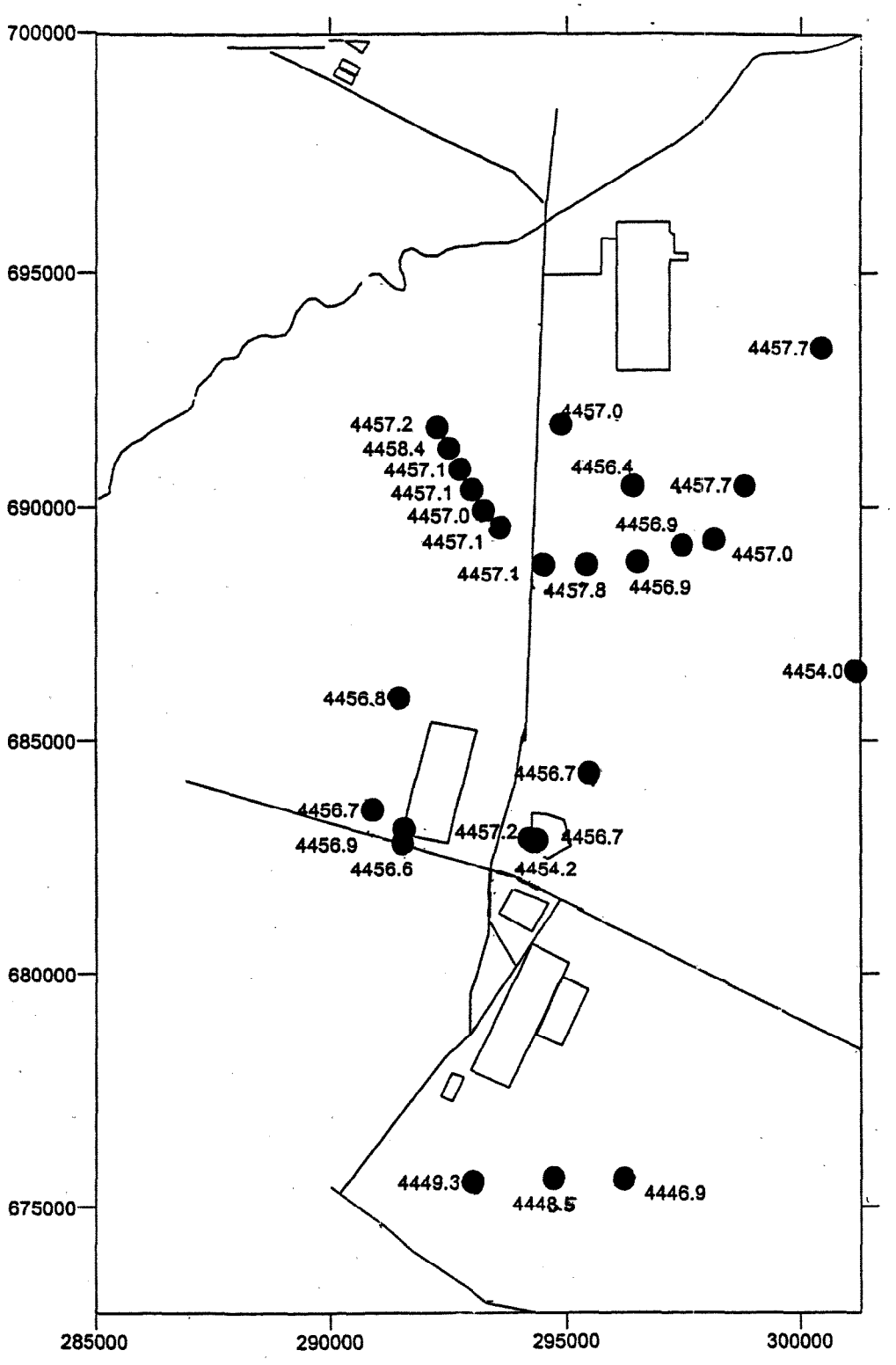


Figure C-23. Water Level elevations – June 1998.

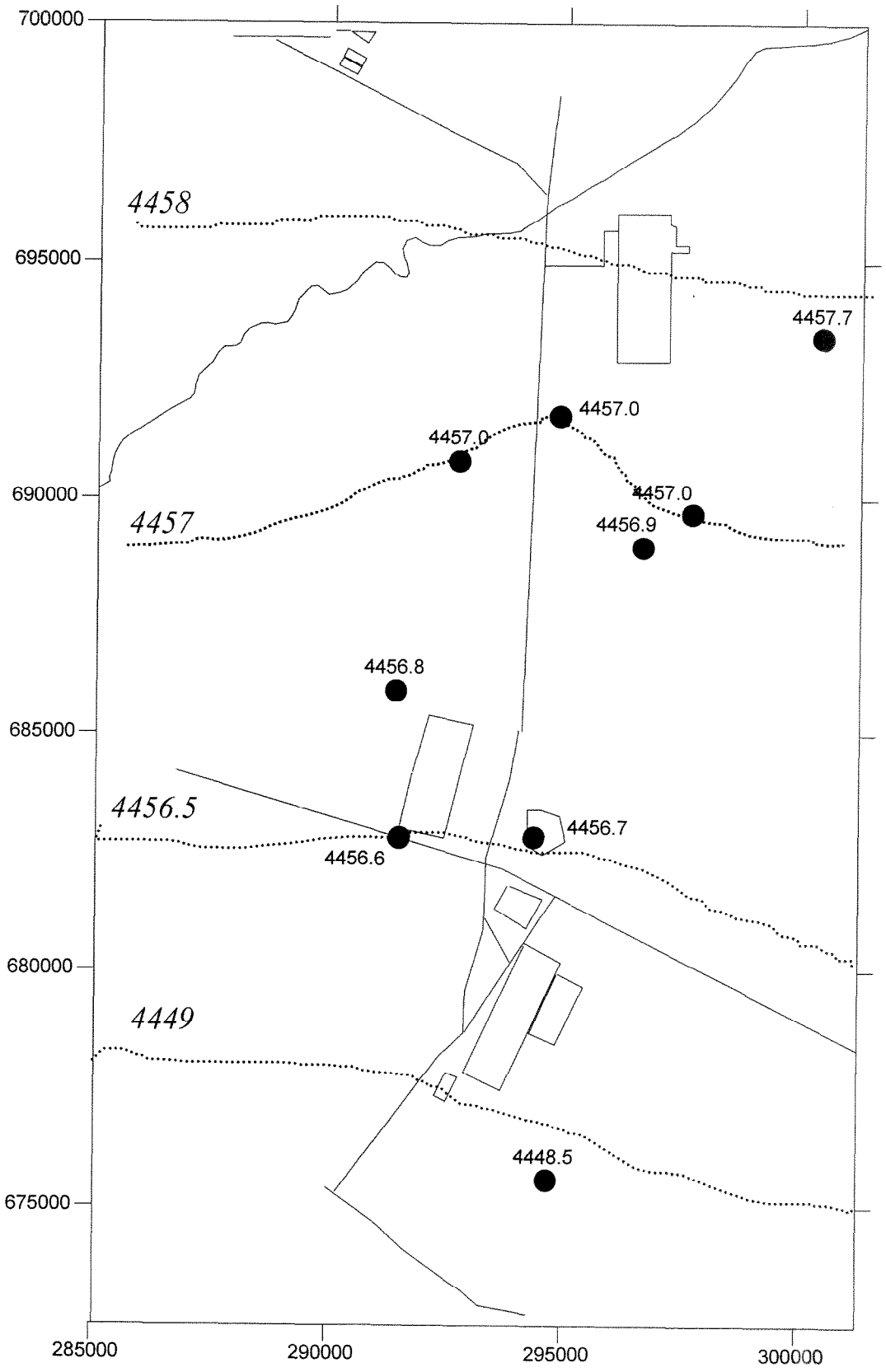


Figure C-24. Water Level Contour plot using selected water table elevations.

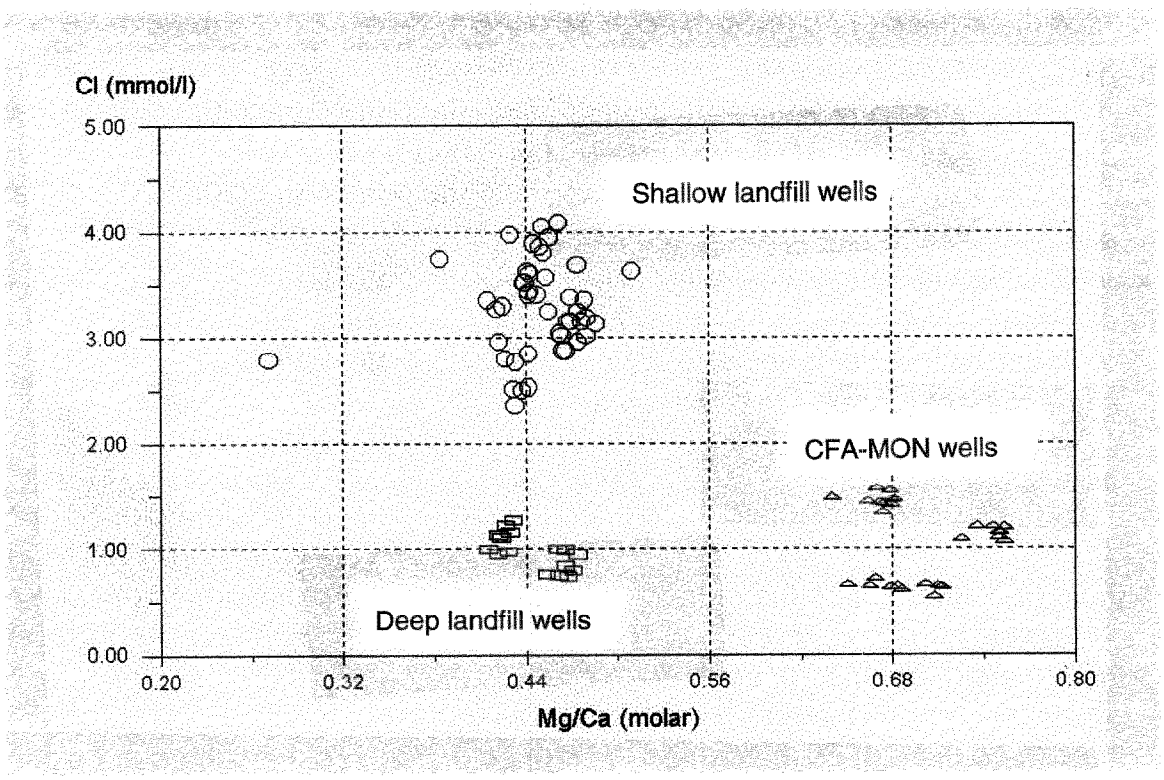


Figure C-25. Plot of chemical composition of CFA monitoring wells.

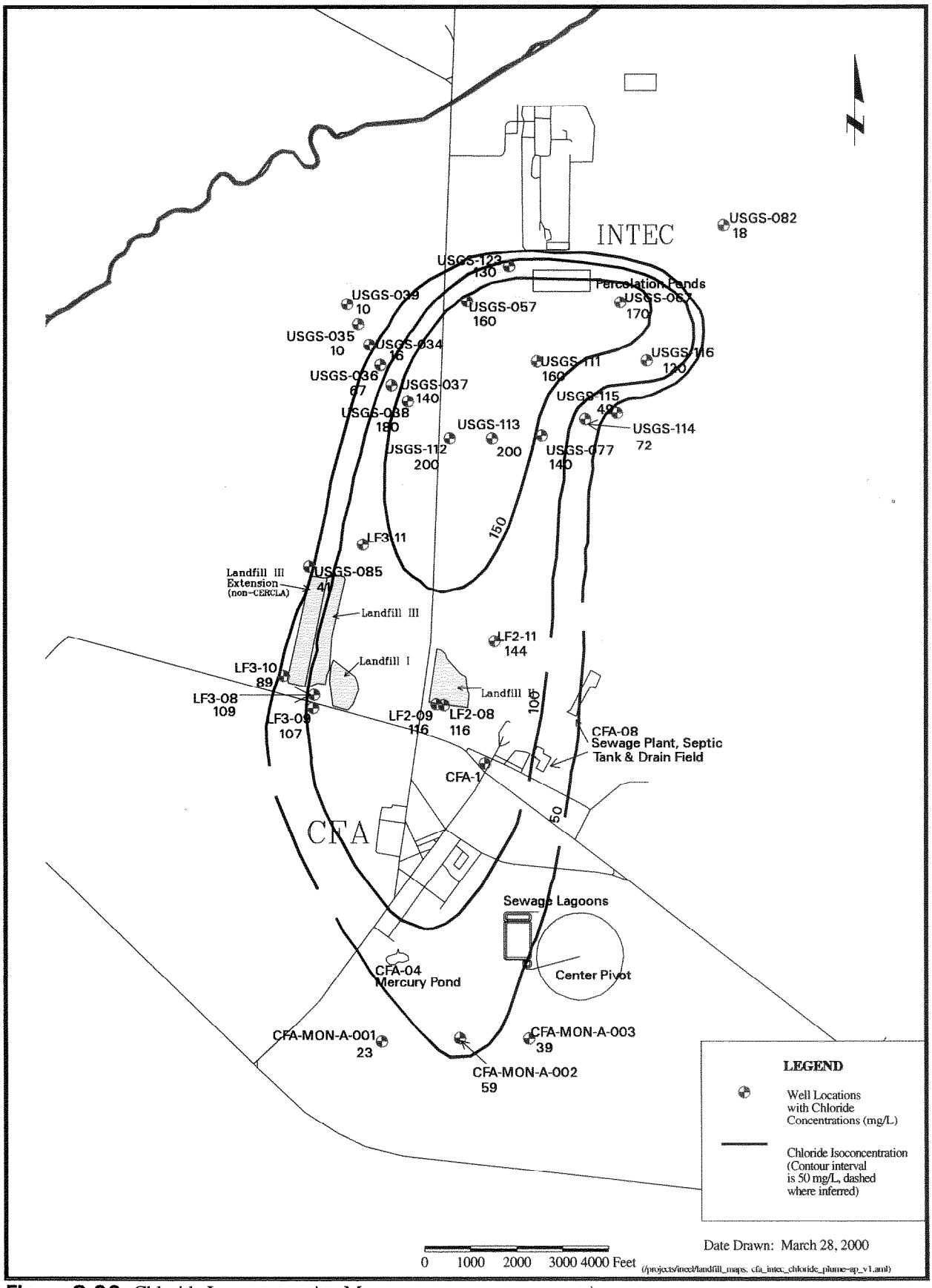
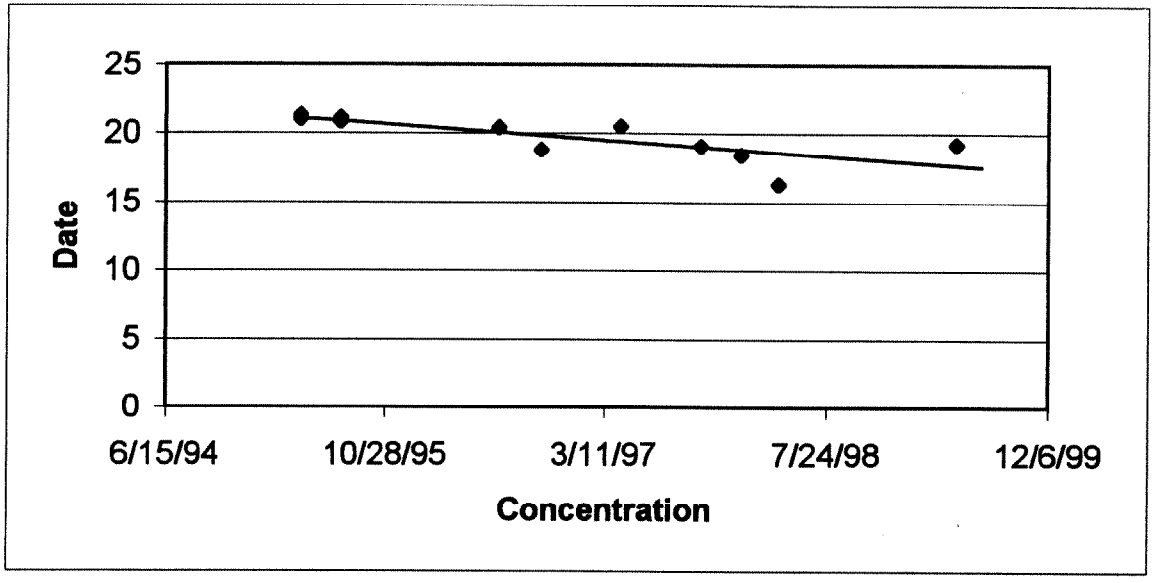


Figure C-26. Chloride Isoconcentration Map.

Sample Date	Concentration
5/12/99	19.2
4/8/98	16.3
1/13/98	18.4
10/14/97	19.1
4/16/97	20.5
10/17/96	18.8
7/12/96	20.4
7/12/96	20.4
7/19/95	21.1
7/19/95	20.8
4/17/95	21.3
4/17/95	21



SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.750386745
R Square	0.563080266
Adjusted R Square	0.519388293
Standard Error	1.016359917
Observations	12

Best Fit Line	
y = (-0.002277)x + 100.32	
date	concentration
5/1/95	21.07
3/11/97	19.52
7/7/99	17.59
1/1/05	13.03
1/1/09	9.70

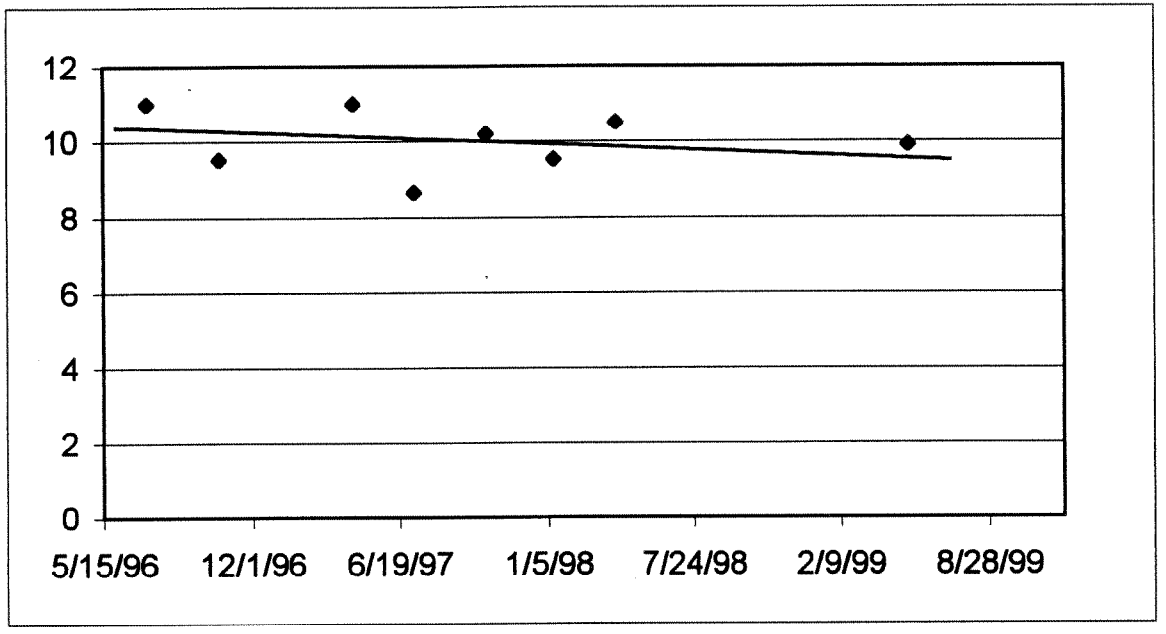
ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	13.3126252	13.31263	12.8875	0.004929784
Residual	10	10.3298748	1.032987		
Total	11	23.6425			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	100.3240185	22.43949377	4.470868	0.001196	50.32570191	150.322335
X Variable 1	-0.00227686	0.000634237	-3.589916	0.00493	-0.00369003	-0.00086369

Figure C-27. Analysis of nitrate trend in groundwater at CFA-MON-A-002.

Sample Date	Concentration
5/11/99	9.9
4/8/98	10.5
1/13/98	9.52
10/14/97	10.2
7/9/97	8.65
4/16/97	11
10/17/96	9.52
7/12/96	11
7/12/96	11



SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.31856712
R Square	0.10148501
Adjusted R Sq	-0.0268743
Standard Error	0.83242703
Observations	9

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.547856692	0.547857	0.790632	0.4034
Residual	7	4.850543308	0.692935		
Total	8	5.3984			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	37.85	31.16444764	1.214618	0.26389	-35.839	111.545
X Variable 1	-0.0007775	0.000874454	-0.889175	0.403429	-0.0028	0.0013

Best Fit Line

$y = (-0.00078)x + 37.85$

Date	Concentration
6/1/96	10.38
7/7/97	10.07
7/7/99	9.50
1/1/05	7.93
1/1/11	6.23

Figure C-28. Nitrate trend in groundwater at CFA-MON-A-003.

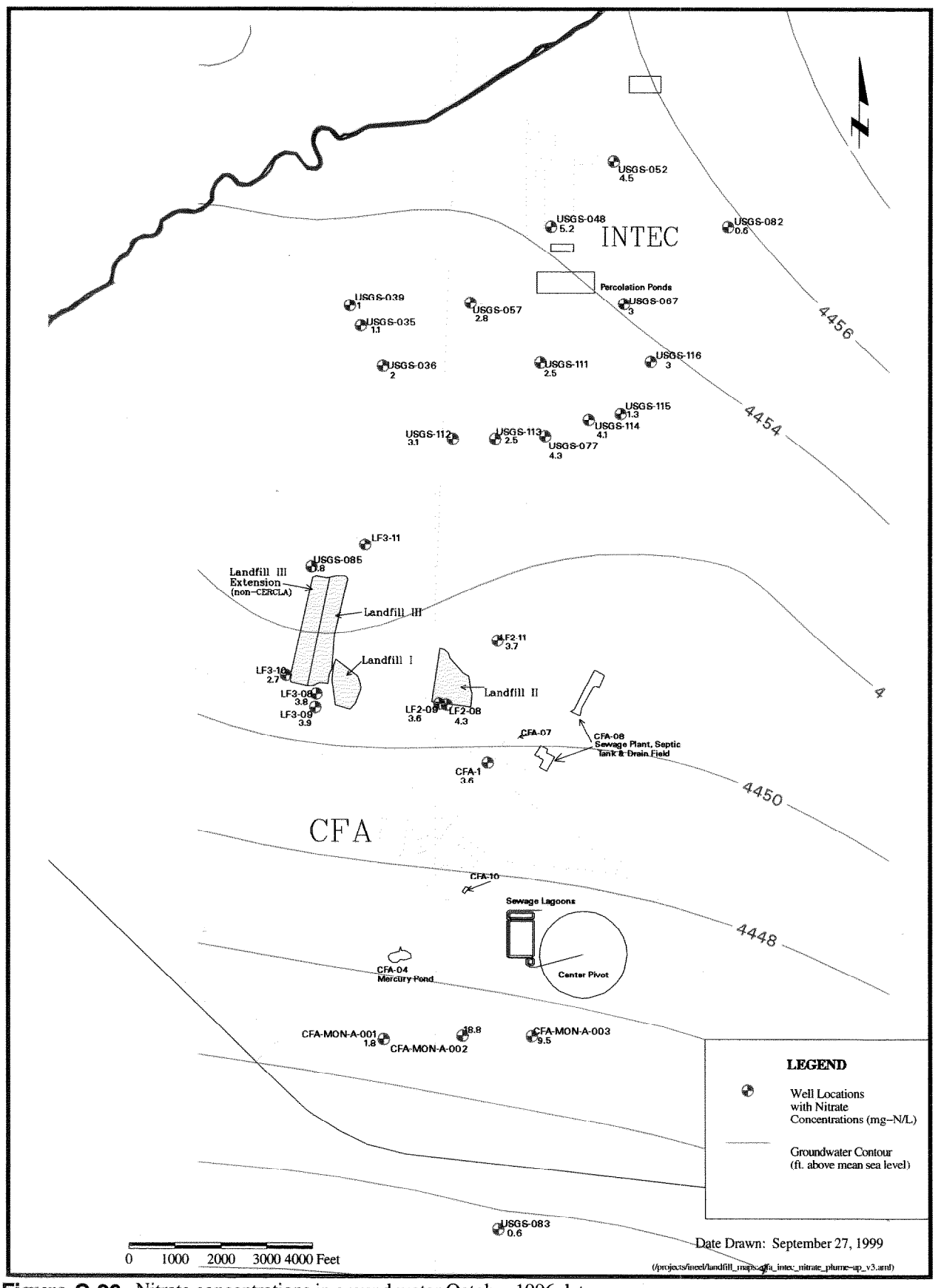
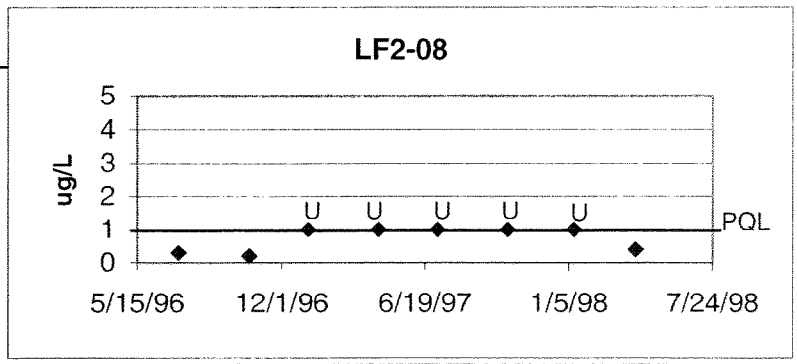
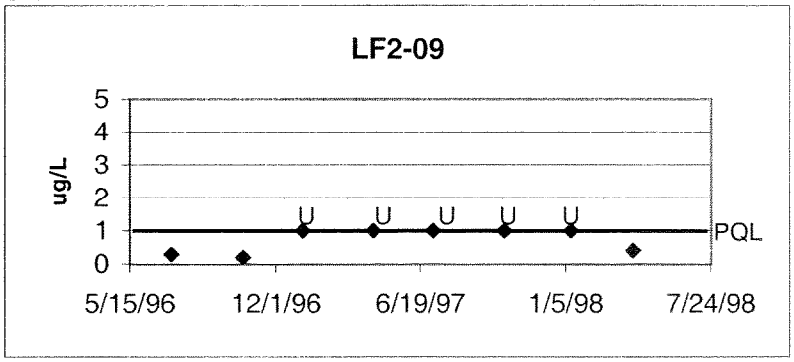
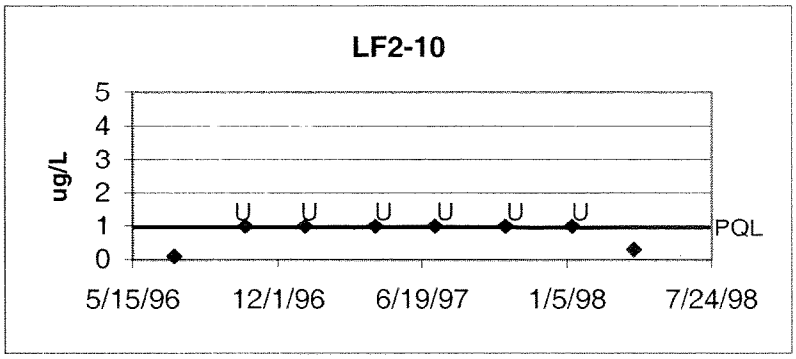


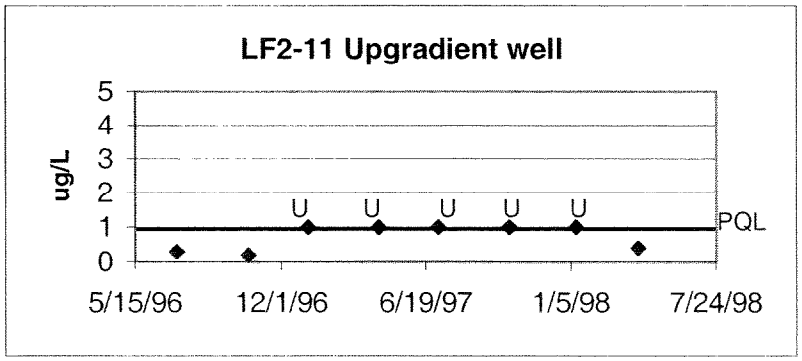
Figure C-29. Nitrate concentrations in ground water October 1996 data.

Well	Date	Concentration
LF2-08	7/11/96	0.3 J
	10/17/96	0.2 J
	1/7/97	1 U
	4/15/97	1 U
	7/7/97	1 U
	10/13/97	1 U
	1/12/98	1 U
	4/7/98	0.4 J
LF2-09	7/11/96	0.3 J
	10/17/96	0.2 J
	1/7/97	1 U
	4/15/97	1 U
	4/15/97	1 U
	7/7/97	1 U
	10/13/97	1 U
	1/12/98	1 U
	4/7/98	0.4 J
LF2-10	7/11/96	0.1 J
	10/17/96	1 U
	1/7/97	1 U
	4/15/97	1 U
	4/15/97	1 U
	7/7/97	1 U
	10/13/97	1 U
	1/12/98	1 U
	4/7/98	0.3 J
LF2-11	7/11/96	0.3 J
	10/17/96	0.2 J
	1/7/97	1 U
	4/15/97	1 U
	7/7/97	1 U
	10/13/97	1 U
	1/12/98	1 U
	4/7/98	0.4 J





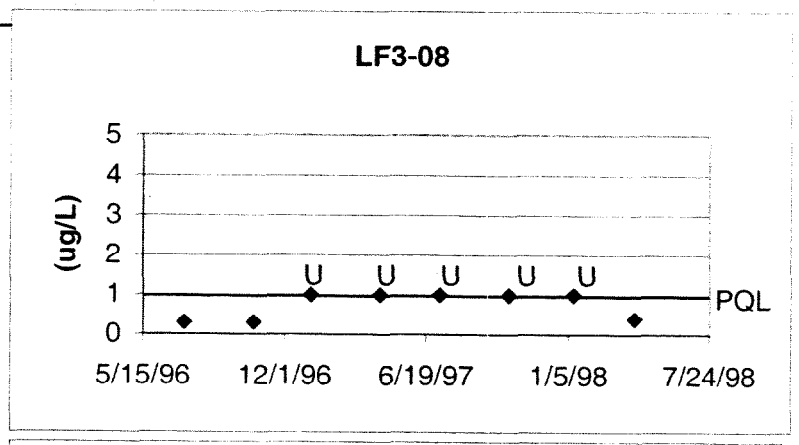


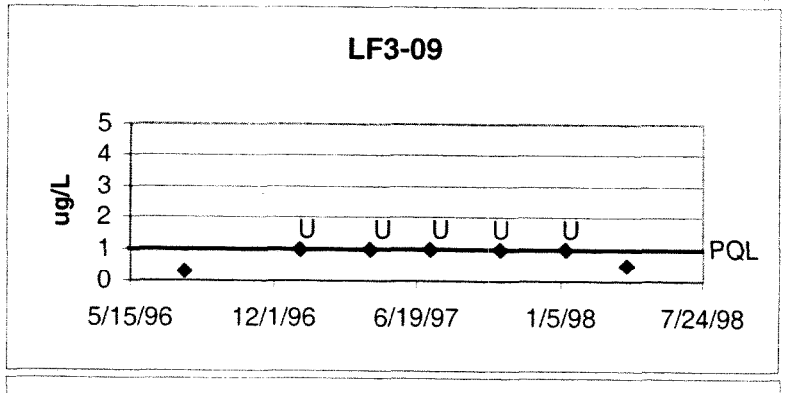


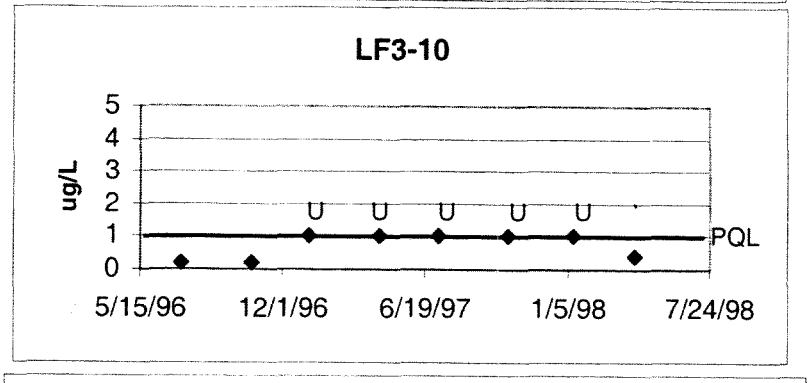
U - Undetected with a Practical Quantitation Limit (PQL) of 1 ug/L
J - Statistically estimated concentration; below PQL.

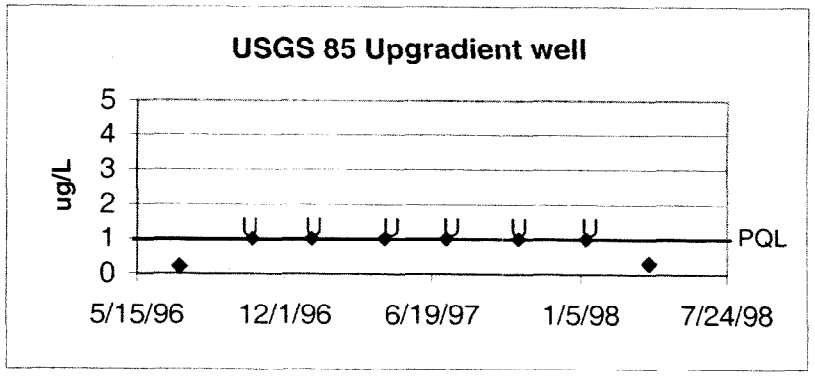
Figure C-30. Occurrence of 1,1,1-TCA in groundwater at CFA Landfill II.

Well	Date	Concentration
LF3-08	7/12/96	0.3 J
	7/12/96	0.3 J
	10/18/96	0.3 J
	10/18/96	0.3 J
	1/7/97	1 U
	1/7/97	1 U
	4/15/97	1 U
	4/15/97	1 U
	7/8/97	1 U
	7/8/97	1 U
	10/13/97	1 U
	10/13/97	1 U
	1/12/98	1 U
	4/8/98	0.4 J
	4/8/98	0.4 J
LF3-09	7/29/96	0.3 J
	1/7/97	1 U
	4/15/97	1 U
	7/8/97	1 U
	10/13/97	1 U
	1/12/98	1 U
	4/7/98	0.5 J
LF3-10	7/11/96	0.2 J
	10/18/96	0.2 J
	1/7/97	1 U
	4/16/97	1 U
	7/8/97	1 U
	10/13/97	1 U
	1/12/98	1 U
	4/8/98	0.4 J
USGS-85		
	7/11/96	0.2 J
	10/18/96	1 U
	1/7/97	1 U
	4/16/97	1 U
	7/8/97	1 U
	10/13/97	1 U
	1/12/98	1 U
	4/8/98	0.3 J



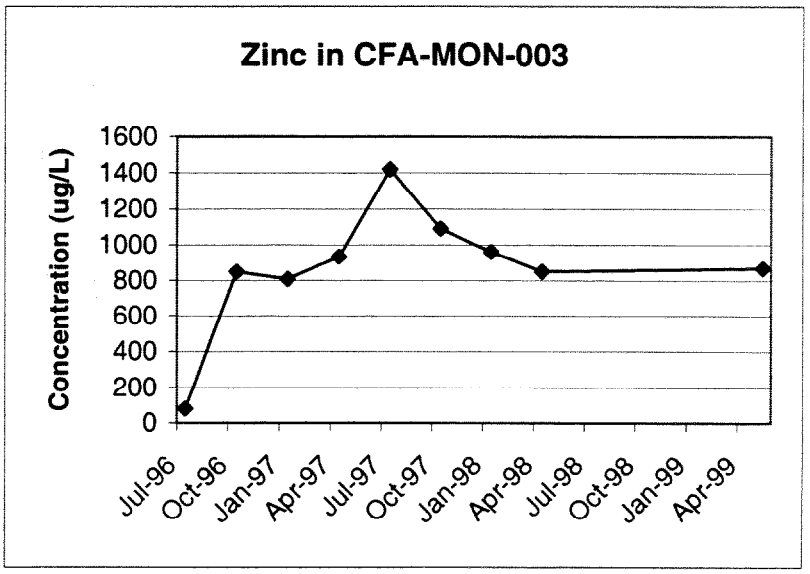


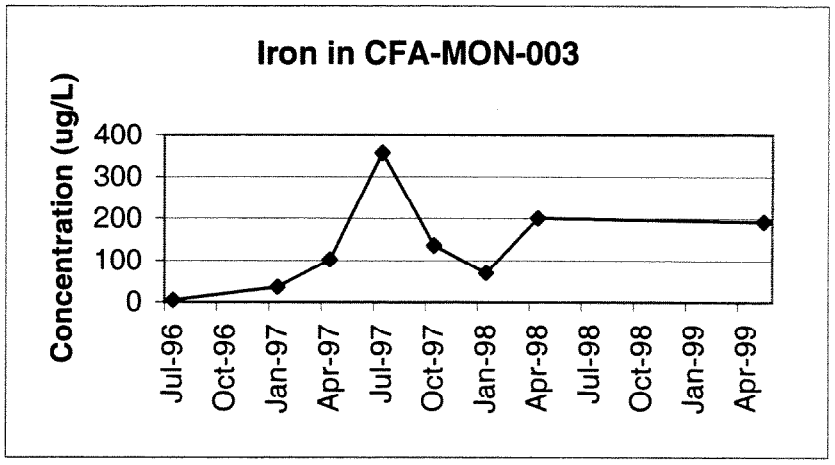




U - Undetected with a Practical Quantitation Limit (PQL) of 1 ug/L
J - Statistically estimated concentration; below PQL.

Figure C-31. Occurrence of 1,1,1-TCA in groundwater at CFA Landfill II.





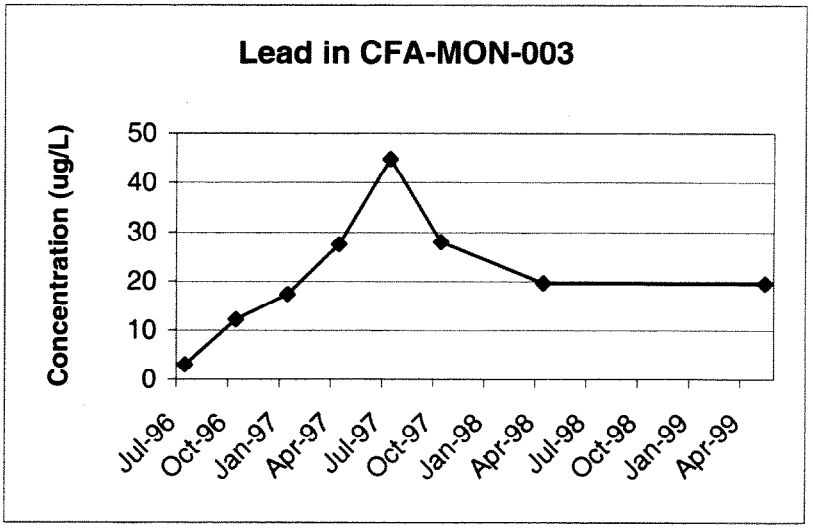


Figure C-32. Zinc, Iron, and Lead trends in CFA-MON-A-003.