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April 18, 1994

Mr. Gene McLoughlin, P.E.
MDWASA
P.O. Box 330316
Miami, Florida 33233-0316

Dear Mr. McLoughlin,

The purpose of this letter report is to describe the procedures used and the results obtained from quantitative hydraulic analysis of a potential monitoring zone within the Floridan Aquifer system penetrated by Injection well I-15. The straddle packer test and subsequent hydraulic analysis were conducted in the zone of the aquifer between 1530 and 1560 feet below land surface (BLS).

METHOD

A straddle packer was used to isolate the test zone for drawdown and recovery tests. The formation tested is under artesian pressure, and was allowed to free flow during the drawdown portion of the test. Discharge was maintained at a constant rate by continuously opening a valve on the well head. Water level changes were measured in the drill stem with a pressure transducer and recorded on a Hermit 1000-C data logger. Prior to testing, the well was developed by pumping the formation fluid until the specific conductance stabilized. Specific conductance readings taken during the test are included in Appendix I. The well was then allowed to recover from development before performing the test.

BACKGROUND

A 12 1/4 inch pilot hole was drilled below casing to a depth of 1900 feet below land surface. A suite of geophysical logs were run and, together with the borehole cutting samples, the test zone was selected by the WASA project hydrogeologist. The zone was selected between 1530-1560 feet below land surface. The zone was isolated with an inflatable 30 foot straddle packer with 10 feet of perforated pipe, open to the formation, between the two packer elements.

The packer assembly was lowered on the drill stem into the original pilot hole to the tested interval of 1530-1560 feet B.L.S. The packer elements were then inflated. After more than six hours of free flow, a constant specific conductance of 14,000 umhos was reached. The well was allowed to recover to its initial antecedent conditions and then allowed to flow for 1 hour while drawdown data was recorded. Recovery data were recorded until formation water level had again reached antecedent conditions. Background, drawdown and recovery water level data is graphed on Figure 1. The test was run at a flow rate of 130.4 gpm, and is analyzed as follows. Raw data are presented in Appendix II.

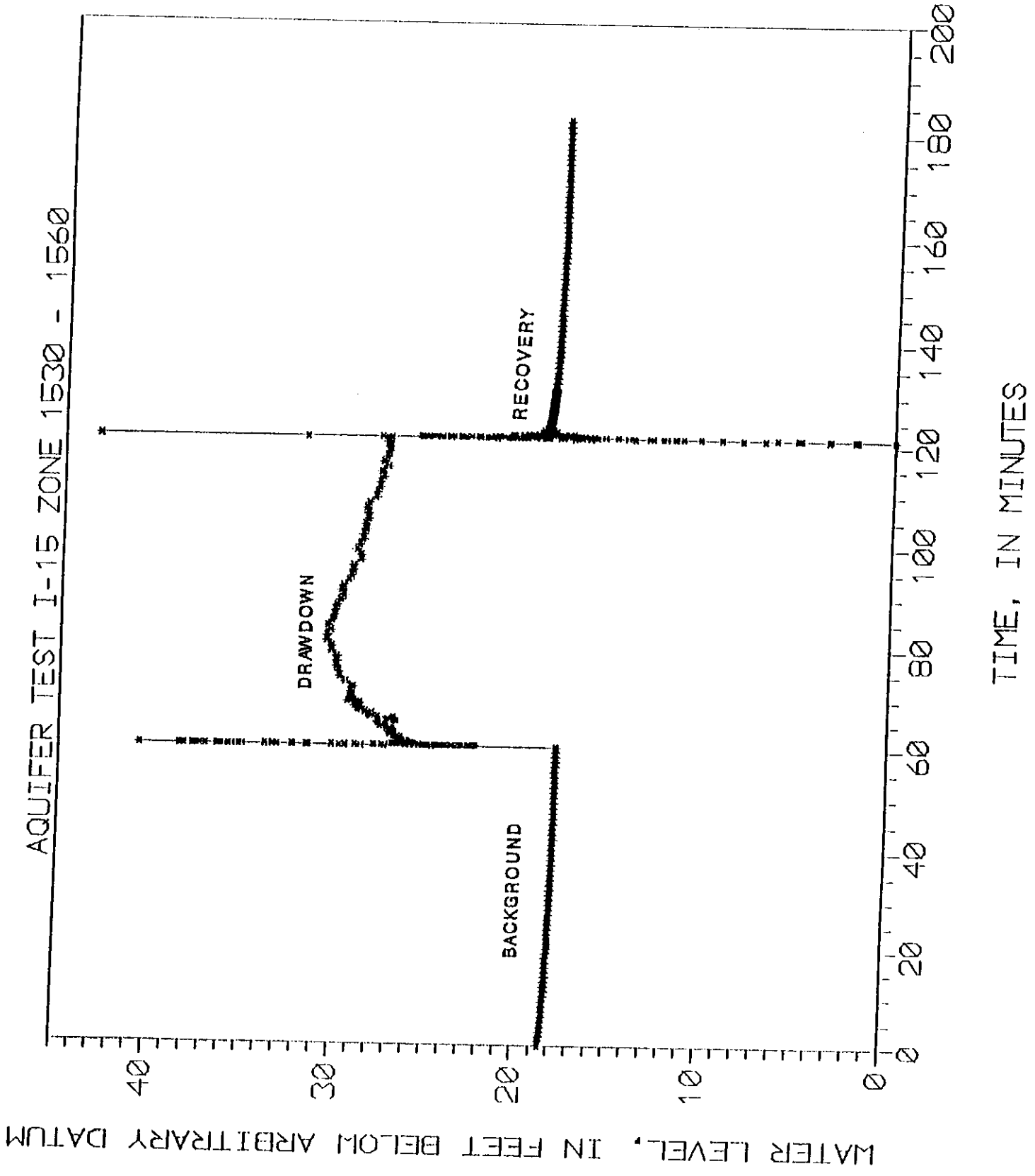

Figure 1.-- Background, drawdown and recovery data from I-15, from 1530 to 1560 zone, arbitrary datum.

DATA ANALYSIS

Three methods of data analysis were tested for this zone. The theis curve analysis method yielded no data matches with any appropriate curves. The Theis Recovery method was tested but due to large amounts of surging after the well was closed, this data was not useable. This surging resulted from the water over recovering then stabilizing in the stand pipe. This rebounding is typical in high permeability formations. Only the Cooper-Jacob analysis method of drawdown was used for the test analysis to calculate the transmissivity for the packer setting between 1530 and 1560 feet below land surface.

1. Cooper-Jacob Analysis

The Cooper-Jacob method (figure 2) (Todd, 1980 p. 129) was used to compute a transmissivity value. The equation is as follows:

$$T = \frac{(2.3)(Q)}{(4)(\pi)(\Delta s_t)}$$

where

Q= discharge in cubic feet per day

s_t= drawdown over one log cycle of time

The data were plotted on semi-log paper (s verses log t) and a straight line is fitted to the data.

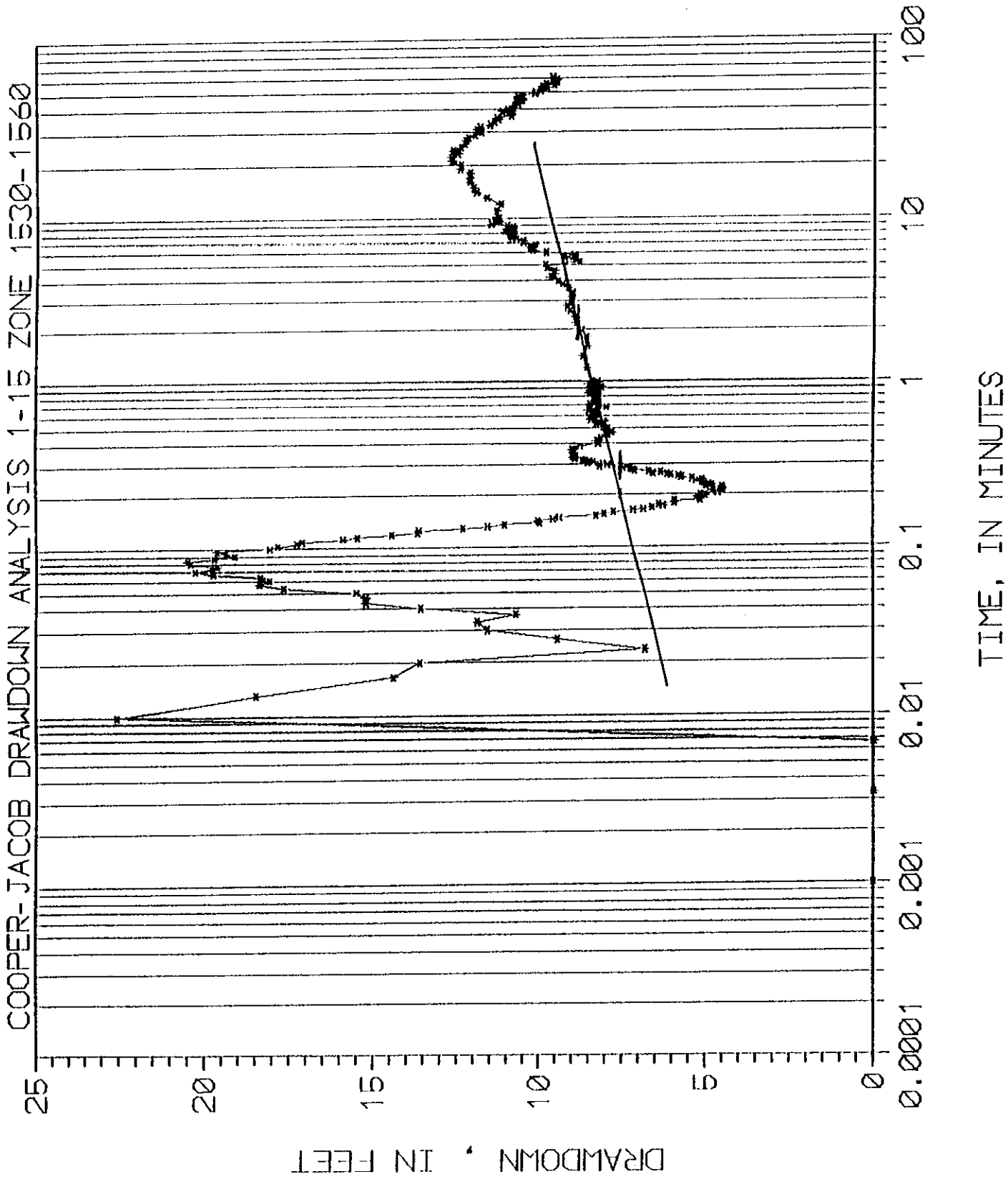

Figure 2.-- Cooper-Jacob Drawdown Analysis I-15, zone 1530 to 1560

Using the observed drawdown over a single log cycle, (s), the transmissivity can be determined from the equation given by Todd (1980, p. 130) as:

$$T = \frac{2.3\ (25100\ ft^3/day)}{(4)\ (3.1416)\ (1.25 ft)}$$

$$T = 3677\ ft^2/D$$

Using a unit thickness of 30 ft., the horizontal hydraulic conductivity is:

$$K = 122.5\ ft/D$$

$$K = 4.3 \times 10^{-2}\ cm/sec.$$

This hydraulic conductivity is similar to the hydraulic conductivity in I-14, zone 1510-1540, which was 3.2×10^{-2} cm/sec.

If you have any questions or comments please feel free to contact me or Leo Swayze.

Sincerely,

Edmand B. Workman, P.G.

EBW/na

#145
4/15/94

Appendix I

Specific Conductance Stabilization Data

Packer Test (I-15)
Zone 1530-1560

TIME	TEMP ^{0}C	CONDUCTIVITY umhos
11:20	23	13,100
11:30	23	14,000
11:45	24	14,000
12:00	24	13,800
12:15	22.5	14,000
12:30	23	14,100
12:45	25	15,000
1:00	25	15,000
1:15	25	15,000
1:30	25.5	15,000
1:45	25.5	15,000
2:00	25.5	14,900
2:15	25.5	14,900
2:30	25.5	14,900
2:45	25.5	14,800
3:00	25.5	14,800
3:15	25.5	14,500
3:30	25.5	14,800
3:45	25.5	14,800
4:00	25.5	14,500
4:15	25	14,500
4:30	25	14,500
4:45	25	14,500
5:00	25	14,500
5:15	25	14,500
5:30	25	14,500
5:45	25	14,500
6:00	25	14,500
6:15	25	14,200
6:30	25	14,200
6:45	24	14,000

SE1000C
Environmental Logger
04/04 15:50

Unit# 01513 Test 0

Setups:	INPUT 1
Type	Level (F)
Mode	TOC
I.D.	00000
Reference	0.000
Linearity	0.280
Scale factor	29.990
Offset	0.120
Delay mSEC	50.000

Step 0 04/02 21:09:49

Elapsed Time	INPUT 1
0.0000	18.462
1.0000	18.472
2.0000	18.443
3.0000	18.405
4.0000	18.375
5.0000	18.375
6.0000	18.328
7.0000	18.318
8.0000	18.318
9.0000	18.328
10.0000	18.261
11.0000	18.261
12.0000	18.251
13.0000	18.241
14.0000	18.212
15.0000	18.232
16.0000	18.212
17.0000	18.222
18.0000	18.212
19.0000	18.184
20.0000	18.145
21.0000	18.136
22.0000	18.145
23.0000	18.165
24.0000	18.155
25.0000	18.136
26.0000	18.145
27.0000	18.126
28.0000	18.136
29.0000	18.097
30.0000	18.117
31.0000	18.107
32.0000	18.088
33.0000	18.088
34.0000	18.097
35.0000	18.068
36.0000	18.078

Appendix II
Raw Aquifer Test Data

37.0000	18.059
38.0000	18.088
39.0000	18.039
40.0000	18.068
41.0000	18.068
42.0000	18.011
43.0000	18.049
44.0000	18.068
45.0000	18.011
46.0000	18.021
47.0000	18.039
48.0000	18.021
49.0000	18.011
50.0000	18.021
51.0000	18.021
52.0000	18.039
53.0000	17.992
54.0000	18.039
55.0000	18.049
56.0000	18.011
57.0000	18.001
58.0000	18.011
59.0000	18.001
60.0000	17.992

SE1000C
Environmental Logger
04/04 15:53

Unit# 01513 Test 1

Setups:	INPUT 1
Type	Level (F)
Mode	TOC
I.D.	00000
Reference	0.000
Linearity	0.280
Scale factor	29.990
Offset	0.120
Delay mSEC	50.000

Step 0 04/02 22:12:32

Elapsed Time	INPUT 1
0.0000	18.030
0.0033	18.021
0.0066	18.021
0.0100	40.599
0.0133	36.501
0.0166	32.399
0.0200	31.595
0.0233	24.814
0.0266	27.449
0.0300	29.575
0.0333	29.882
0.0366	28.704
0.0400	31.566
0.0433	33.231
0.0466	33.231
0.0500	33.509
0.0533	35.660
0.0566	36.386
0.0600	36.071
0.0633	36.348
0.0666	37.743
0.0700	38.269
0.0733	37.772
0.0766	37.629
0.0800	38.403
0.0833	38.488
0.0866	37.715
0.0900	37.103
0.0933	37.390
0.0966	37.638
0.1000	36.062
0.1033	35.832
0.1066	35.278
0.1100	35.115
0.1133	33.891
0.1166	33.461
0.1200	32.428

0.1233	31.662
0.1266	31.614
0.1300	30.294
0.1333	29.556
0.1366	29.039
0.1400	27.986
0.1433	28.043
0.1466	27.584
0.1500	27.392
0.1533	26.290
0.1566	26.041
0.1600	25.753
0.1633	25.169
0.1666	24.862
0.1700	24.594
0.1733	24.277
0.1766	24.392
0.1800	23.932
0.1833	23.922
0.1866	23.155
0.1900	23.174
0.1933	23.232
0.1966	23.011
0.2000	23.145
0.2033	22.637
0.2066	22.685
0.2100	22.772
0.2133	22.522
0.2166	22.483
0.2200	22.512
0.2233	22.982
0.2266	22.829
0.2300	22.906
0.2333	23.097
0.2366	23.097
0.2400	23.280
0.2433	23.097
0.2466	23.395
0.2500	23.730
0.2533	23.711
0.2566	23.807
0.2600	24.047
0.2633	24.143
0.2666	24.565
0.2700	24.354
0.2733	24.699
0.2766	25.130
0.2800	25.197
0.2833	25.255
0.2866	25.379
0.2900	25.542
0.2933	26.175
0.2966	25.820
0.3000	25.964
0.3033	26.079
0.3066	26.539
0.3100	26.366
0.3133	26.491
0.3166	26.616
0.3200	26.702

0.3233	26.932
0.3266	26.913
0.3300	26.989
0.3333	26.922
0.3500	26.970
0.3666	27.009
0.3833	26.779
0.4000	26.223
0.4166	26.271
0.4333	26.146
0.4500	25.936
0.4666	25.820
0.4833	25.993
0.5000	25.945
0.5166	26.089
0.5333	26.290
0.5500	26.060
0.5666	26.443
0.5833	26.405
0.6000	26.213
0.6166	26.271
0.6333	26.357
0.6500	26.520
0.6666	26.271
0.6833	25.993
0.7000	26.213
0.7166	26.472
0.7333	26.309
0.7500	26.348
0.7666	26.204
0.7833	26.319
0.8000	26.252
0.8166	26.280
0.8333	26.501
0.8500	26.261
0.8666	26.482
0.8833	26.261
0.9000	26.136
0.9166	26.146
0.9333	26.405
0.9500	26.520
0.9666	26.309
0.9833	26.252
1.0000	26.434
1.2000	26.568
1.4000	26.702
1.6000	26.577
1.8000	26.606
2.0000	26.750
2.2000	26.913
2.4000	26.932
2.6000	27.105
2.8000	27.181
3.0000	27.037
3.2000	27.037
3.4000	27.028
3.6000	27.152
3.8000	27.315
4.0000	27.468
4.2000	27.689

4.4000	27.593
4.6000	27.564
4.8000	27.794
5.0000	27.842
5.2000	26.827
5.4000	26.942
5.6000	27.267
5.8000	26.970
6.0000	27.823
6.2000	28.235
6.4000	28.264
6.6000	28.311
6.8000	28.158
7.0000	28.522
7.2000	28.513
7.4000	28.723
7.6000	28.876
7.8000	28.915
8.0000	28.771
8.2000	29.068
8.4000	28.991
8.6000	28.829
8.8000	28.829
9.0000	29.001
9.2000	29.470
9.4000	29.240
9.6000	29.240
9.8000	29.384
10.0000	29.250
11.0000	29.327
12.0000	29.192
13.0000	29.605
14.0000	29.920
15.0000	29.987
16.0000	30.131
17.0000	30.121
18.0000	30.102
19.0000	30.409
20.0000	30.389
21.0000	30.657
22.0000	30.667
23.0000	30.466
24.0000	30.628
25.0000	30.389
26.0000	30.274
27.0000	30.226
28.0000	30.160
29.0000	29.958
30.0000	29.767
31.0000	29.901
32.0000	29.805
33.0000	29.518
34.0000	29.374
35.0000	29.278
36.0000	29.307
37.0000	28.886
38.0000	28.886
39.0000	29.145
40.0000	28.982
41.0000	28.819

42.0000	28.800
43.0000	28.666
44.0000	28.733
45.0000	28.541
46.0000	28.551
47.0000	28.666
48.0000	28.532
49.0000	28.168
50.0000	28.139
51.0000	27.986
52.0000	27.986
53.0000	27.784
54.0000	27.929
55.0000	27.564
56.0000	27.813
57.0000	27.622
58.0000	27.526
59.0000	27.497
60.0000	27.603
61.0000	27.612

SE1000C
Environmental Logger
04/04 15:58

Unit# 01513 Test 2

Setups:	INPUT 1
Type	Level (F)
Mode	TOC
I.D.	00000
Reference	0.000
Linearity	0.280
Scale factor	29.990
Offset	0.120
Delay mSEC	50.000

Step 0 04/02 23:15:17

Elapsed Time	INPUT 1
0.0000	27.631
0.0033	27.421
0.0066	0.000
0.0100	16.551
0.0133	14.129
0.0166	8.212
0.0200	0.000
0.0233	3.558
0.0266	7.018
0.0300	0.000
0.0333	31.930
0.0366	0.000
0.0400	2.006
0.0433	2.141
0.0466	43.128
0.0500	0.000
0.0533	0.000
0.0566	17.415
0.0600	21.688
0.0633	13.100
0.0666	3.482
0.0700	23.558
0.0733	0.000
0.0766	25.485
0.0800	12.561
0.0833	16.186
0.0866	0.000
0.0900	27.919
0.0933	20.613
0.0966	5.236
0.1000	9.367
0.1033	18.030
0.1066	22.042
0.1100	5.187
0.1133	18.980
0.1166	6.353
0.1200	17.358

0.1233	14.494
0.1266	18.232
0.1300	5.052
0.1333	11.936
0.1366	22.138
0.1400	12.388
0.1433	11.878
0.1466	10.512
0.1500	22.244
0.1533	11.465
0.1566	19.307
0.1600	13.302
0.1633	17.175
0.1666	16.407
0.1700	21.994
0.1733	17.022
0.1766	13.100
0.1800	22.215
0.1833	21.016
0.1866	20.171
0.1900	14.177
0.1933	24.785
0.1966	20.238
0.2000	22.608
0.2033	18.827
0.2066	23.491
0.2100	21.668
0.2133	24.450
0.2166	23.385
0.2200	20.919
0.2233	24.181
0.2266	25.399
0.2300	25.667
0.2333	20.036
0.2366	25.715
0.2400	25.351
0.2433	25.840
0.2466	21.313
0.2500	24.977
0.2533	24.613
0.2566	25.063
0.2600	23.567
0.2633	22.733
0.2666	23.673
0.2700	24.056
0.2733	24.881
0.2766	20.594
0.2800	22.618
0.2833	23.059
0.2866	24.268
0.2900	19.806
0.2933	21.169
0.2966	21.668
0.3000	22.061
0.3033	20.142
0.3066	19.355
0.3100	20.018
0.3133	19.662
0.3166	20.526
0.3200	17.761

0.3233	18.174
0.3266	17.992
0.3300	19.893
0.3333	16.868
0.3500	15.744
0.3666	15.080
0.3833	16.272
0.4000	16.589
0.4166	16.368
0.4333	17.512
0.4500	18.856
0.4666	20.929
0.4833	21.524
0.5000	21.831
0.5166	21.515
0.5333	21.620
0.5500	20.785
0.5666	19.701
0.5833	18.251
0.6000	17.540
0.6166	17.069
0.6333	16.906
0.6500	16.877
0.6666	17.185
0.6833	17.886
0.7000	18.779
0.7166	19.662
0.7333	20.248
0.7500	20.670
0.7666	20.824
0.7833	20.718
0.8000	20.238
0.8166	19.576
0.8333	18.904
0.8500	18.299
0.8666	17.809
0.8833	17.512
0.9000	17.473
0.9166	17.694
0.9333	18.039
0.9500	18.597
0.9666	19.125
0.9833	19.643
1.0000	19.989
1.2000	19.442
1.4000	18.500
1.6000	18.443
1.8000	18.875
2.0000	19.125
2.2000	18.942
2.4000	18.702
2.6000	18.712
2.8000	18.827
3.0000	18.846
3.2000	18.788
3.4000	18.721
3.6000	18.731
3.8000	18.731
4.0000	18.760
4.2000	18.750

4.4000	18.721
4.6000	18.693
4.8000	18.702
5.0000	18.664
5.2000	18.693
5.4000	18.673
5.6000	18.683
5.8000	18.654
6.0000	18.635
6.2000	18.654
6.4000	18.635
6.6000	18.635
6.8000	18.644
7.0000	18.625
7.2000	18.616
7.4000	18.616
7.6000	18.616
7.8000	18.597
8.0000	18.597
8.2000	18.606
8.4000	18.587
8.6000	18.587
8.8000	18.568
9.0000	18.568
9.2000	18.587
9.4000	18.558
9.6000	18.568
9.8000	18.558
10.0000	18.558
11.0000	18.510
12.0000	18.500
13.0000	18.481
14.0000	18.443
15.0000	18.462
16.0000	18.405
17.0000	18.405
18.0000	18.395
19.0000	18.405
20.0000	18.366
21.0000	18.347
22.0000	18.357
23.0000	18.337
24.0000	18.357
25.0000	18.357
26.0000	18.318
27.0000	18.308
28.0000	18.328
29.0000	18.308
30.0000	18.280
31.0000	18.289
32.0000	18.289
33.0000	18.270
34.0000	18.261
35.0000	18.251
36.0000	18.241
37.0000	18.232
38.0000	18.241
39.0000	18.174
40.0000	18.222
41.0000	18.184

42.0000	18.241
43.0000	18.212
44.0000	18.193
45.0000	18.193
46.0000	18.222
47.0000	18.203
48.0000	18.174
49.0000	18.184
50.0000	18.174
51.0000	18.203
52.0000	18.174
53.0000	18.184
54.0000	18.203
55.0000	18.165
56.0000	18.203
57.0000	18.165
58.0000	18.165
59.0000	18.155
60.0000	18.203
61.0000	18.165