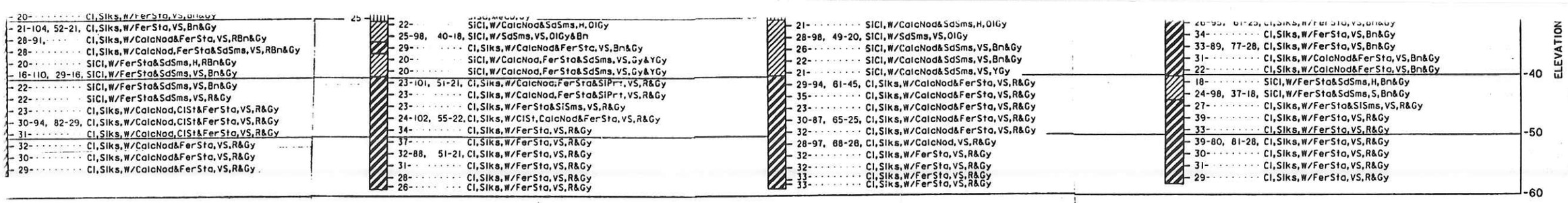
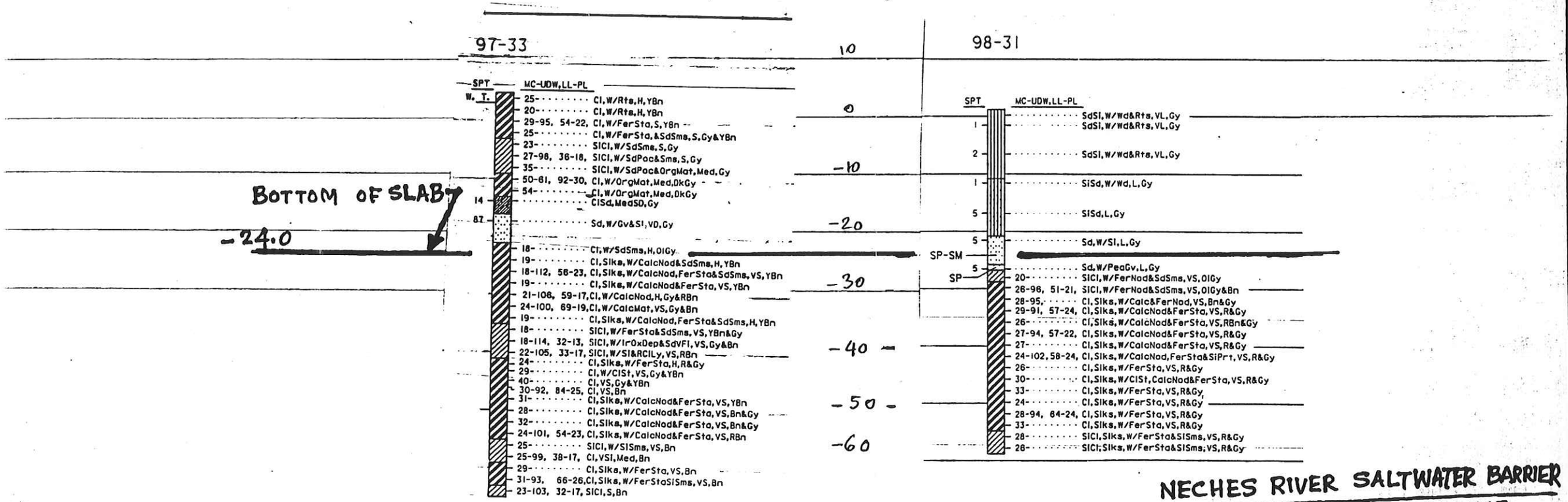




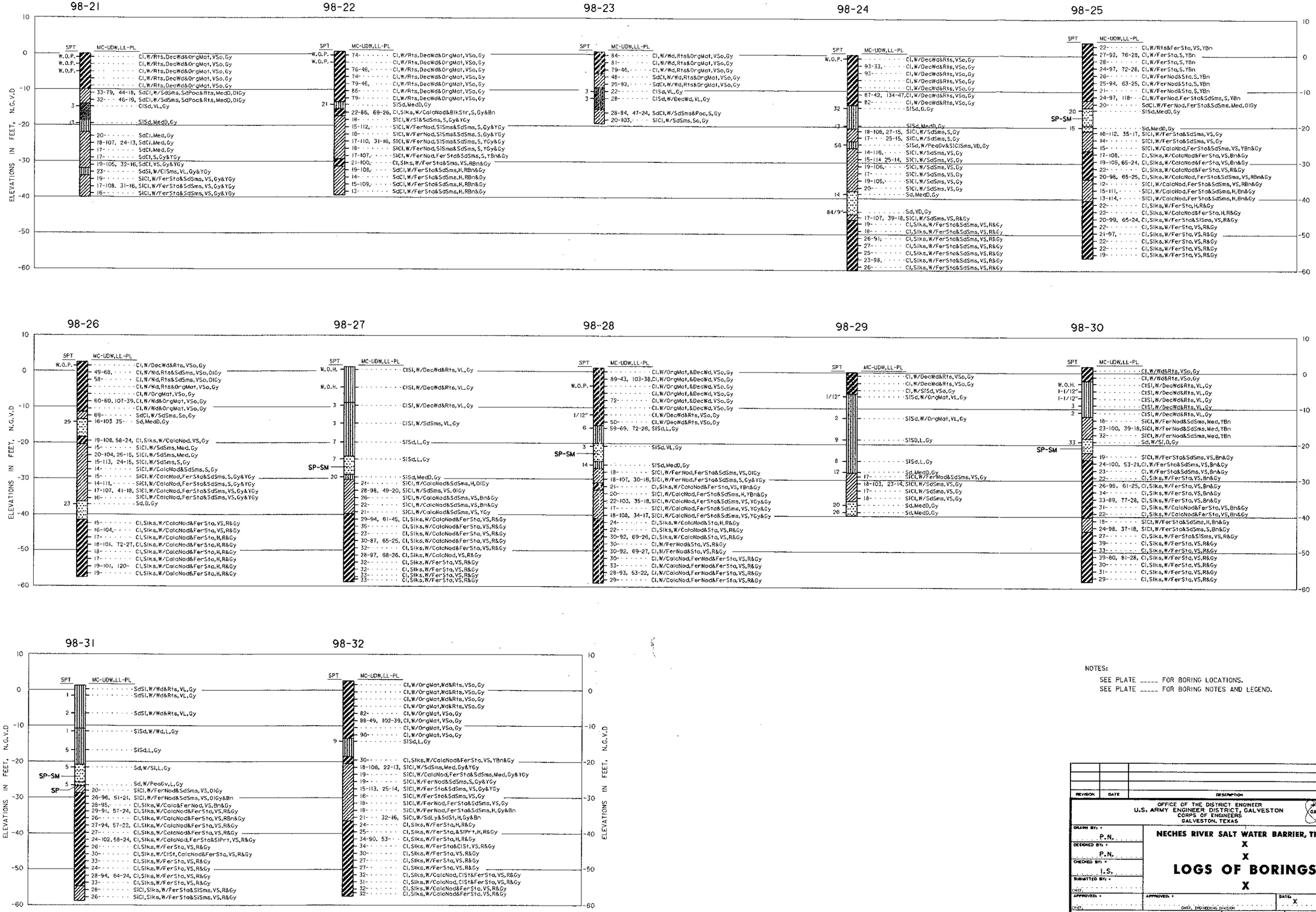
NECHES RIVER SALTWATER BARRIER

TAINTER GATE STRUCTURE

SOIL PROFILE

SUMMARY OF UNCONFINED COMPRESSION TEST RESULTS
NECHES RIVER SALT WATER BARRIER
BEAUMONT, TEXAS
TABLE-

BORING NO.	DEPTH (FT.)	DENSITY DATA Moisture Cont. %	DENSITY DATA Dry Wt (pcf)	MECHANICAL ANALYSIS Gvl.	MECHANICAL ANALYSIS Sand	MECHANICAL ANALYSIS Fine	ATTERBURG LIMITS L.L.	ATTERBURG LIMITS P.L.	% STRAIN @ MAX. STRESS	UNCON. COMP. STR (pcf)	CLASSIFICATION
98-21	24-26	18.2	106.6	0	18	82	24.0	13.0	3.9	630	Sandy Clay, Medium stiff, Gray
98-21	30-32	18.9	105.0	0	16	84	32.0	16.0	4.6	2090	Sandy Clay, Very stiff, Gray & yellowish gray
98-22	24-26	16.9	110.0	0	16	84	31.0	16.0	6	1980	Silty Clay, W / silt & sand seams,Very stiff, Gray & yellowish gray
98-23	16-18	27.9	84.9	0	14	86	47.0	24.0	4.3	1270	Silty Clay, W / sand seams & sand pockets, Stiff, Gray
98-24	10-12	41.7	77.8	0	1	99	134.0	47.0	3.6	90	Clay, W / decayed wood & roots, Very soft, Gray
98-24	28-30	14.7	114.1	0	8	92	25.0	14.0	10.5	2170	Silty Clay, W / sand seams, Very stiff, Gray
98-24	44.5-46	17.0	107.0	0	12	88	39.0	18.0	7.5	2000	Silty Clay, W / sand seams, Very stiff, Red & Gray
98-25	32-34	19.0	104.8	-	-	-	65.0	24.0	3.2	2220	Clay, W / calc nod & fer stains, slks, Very stiff, Brown & gray
98-25	40-42	15.3	111.4	-	-	-	-	-	3.4	3660	Clay, W / calc nod, fer stains, & sd sms, Very stiff, Reddish brown & gray
98-26	25-27	19.5	104.4	0	2	98	25.0	15.0	5	560	Silty Clay, W / sand seams, Medium stiff, Gray
98-26	35-37	16.8	106.6	0	7	93	41.0	18.0	4	2010	Silty Clay, W / sand seams, stiff, Gray
98-35	6.5-8	17.5	111.7	-	-	-	33.0	17.0	6.8	1370	Silty Clay, Stiff, Gray
98-40	14-16	76.4	43.9	-	-	-	-	-	2.1	70	Clay, W / decayed wood roots & organic material, Very soft, Gray
98-40	22-24	20.5	102.2	0	3	97	47.0	20.0	3.6	2030	Silty Clay, W / sand seams, Very stiff, Olive gray
98-40	32-34	25.5	94.5	-	-	-	-	-	3.3	2190	Clay, W / fer stains, slks,Very stiff, Reddish brown & gray
98-42	14-16	37.6	81.0	0	4	95	63.0	25.0	2.5	1060	Clay, W / fer nod & fer stains, Stiff,Yellowish brown



NOTES:

SEE PLATE _____ FOR BORING LOCATIONS.

SEE PLATE _____ FOR BORING NOTES AND LEGEND.

REVISION	DATE	DESCRIPTION	BY

OFFICE OF THE DISTRICT ENGINEER
U.S. ARMY ENGINEER DISTRICT, GALVESTON
CORPS OF ENGINEERS
GALVESTON, TEXAS

DRAWN BY: * P.N.
DESIGNED BY: * P.N.
CHECKED BY: * I.S.
SUBMITTED BY: *
CHIEF,
APPROVED: *
CHIEF,
APPROVED: *
CHIEF, ENGINEERING DIVISION
DATE: X
SPEC. DATE:

NECHES RIVER SALT WATER BARRIER, TEXAS
X
X
LOGS OF BORINGS
X

* AS REQUIRED BY ENGINEER CIRCULAR NO. 1110-1-8152 !

SCALE: AS SHOWN

Prepared under the direction of
Nicholas J. Buechler, Lt. Col. (P), C.E.,
District Engineer

DRAWING NUMBER X
SHEET X OF X FILE NO. X

EXHIBIT

DESIGN FILE: ¢DESIGN¢SPECIFICATION¢ CREATED BY: ¢USERNAME¢ ON: ¢¢DATE¢¢ AT: ¢TIME¢

...\user\p_parm\netch\bore2_98.dgn Apr. 06, 1999 12:52:38

DESIGN FILE: DGNSPECIFICATION$$$

HP 12x53 Batter 1H : 2V

Prepared by: Ishaq Syed 9 Oct. 1998

PILE CAPACITY TABLE

Elevation	Depth Below Top of Pile (Ft)	Capacity Mode	BORING Nos.					
			98-30	98-31		98-27	98-39	97-33
			Ultimate Pile Capacity in Tons					
-30	8	Compression	2.2	2		**4.1**		1.9
		Tension	0.6	0.6		**0.43**		0.48
-40	18	Compression	7.8	7.9		**13.71**		13.58
		Tension	3.6	3.7		**4.06**		4.28
-50	28	Compression	14.4	13.5		**14.93**		15.4
		Tension	8.3	7.4		**7.88**		8.76
-60	38	Compression	19.7	24.4		**20.23**		21.11
		Tension	12	12.2		**11.7**		12.91
-70	48	Compression	25.4	26.8		**25.8**		26.88
		Tension	16	17		**15.6**		17.06
-80	58	Compression	31	32.4		**30.8**		32.64
		Tension	20	21		**19.2**		21.21

CASE B

Borings Nos. 98-30 and 98-31 are located on the east end of the Tainter Gate structure, and 98-39 and 97-33 are located on the west side of the structure.

SOIL TYPE	Material Strata			
	98-30	98-31	98-39	97-33
CH, SIK, V/S	El. -24 to -40 = 16'	El -24 to -55 = 31'	El. -24 to -34 = 10'	El. -24 to -3 = 10'
CL, V/S	El. -40 to -44 = 4'	El. -55 to 65 = 10'	El. -34 to -44 = 10'	El. -34 to -4 = 8'
CH, SIK, V/S	El. -44 to 60 = 16'	—	El -44 to -60 16'	El. -42 to -60 18'

HP 12x53 Batter 1H : 2V (Adopted)

Prepared by: Ishaq Syed 9 Oct. 1998

PILE CAPACITY TABLE

Elevation	Depth Below Top of Pile (Ft)	Capacity Mode	BORING Nos.					
			98-30	98-31		98-27	98-39	97-33
			Ultimate Pile Capacity in Tons					
-30	8	Compression	2.2	2		**4.1**		1.9
		Tension	0.6	0.6		**0.43**		0.48
-40	18	Compression	7.8	7.9		**13.71**		13.58
		Tension	3.6	3.7		**4.06**		4.28
-50	28	Compression	14.4	13.5		**14.93**		15.4
		Tension	8.3	7.4		**7.88**		8.76
-60	38	Compression	19.7	24.4		**20.23**		21.11
		Tension	12	12.2		**11.7**		12.91
-70	48	Compression	25.4	26.8		**25.8**		26.88
		Tension	16	17		**15.6**		17.06
-80	58	Compression	31	32.4		**30.8**		32.64
		Tension	20	21		**19.2**		21.21

Boring # 98-31

Long Term
HP 12x53, Batter 1H:2V

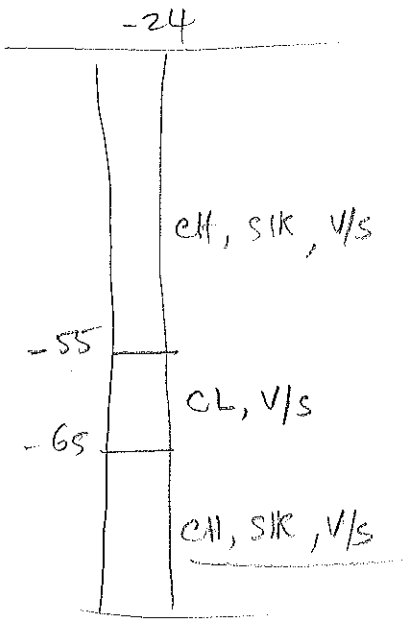
PILE CAPACITY **ENTER ALL RED VALUES**

If pile is round 0, if square 1	1	
Pile Diameter	12.045	inches, BUTT
	11.78	inches, TIP
Assume Pile Length	68	feet
Top Surface Elev	-24	feet
Batter	63.4	degrees
Water Elev.	2	
Unit weight of Pile	62.4	pcf

Dc = # * B	=	15

Critical Depth Elevation	=	-39
Tip Elevation	=	-85

	Stratum Number	Bouyant Density pcf	Strength Prop Delta Fric, Ang. phi*delt	Strata Cohesion psf	Adhesion Reduction Factor	Coef Ear Prs. Kc	Coef Ear. Prs. Kt	Terzaghi Nc	Terzaghi Nq	Bottom Elev. -24
Clay CH	1	57	13.3	0	0	1.25	0.9	9	7.5	-25
V/stiff	1	57	13.3	0	0	1.25	0.9	9	7.5	-26
	1	57	13.3	0	0	1.25	0.9	9	7.5	-27
	1	57	13.3	0	0	1.25	0.9	9	7.5	-28
	1	57	13.3	0	0	1.25	0.9	9	7.5	-29
	1	57	13.3	0	0	1.25	0.9	9	7.5	-30
	1	57	13.3	0	0	1.25	0.9	9	7.5	-31
	1	57	13.3	0	0	1.25	0.9	9	7.5	-32
	1	57	13.3	0	0.5	1.25	0.9	9	7.5	-33
	1	57	13.3	0	0.5	1.25	0.9	9	7.5	-34
	1	57	13.3	0	0.5	1.25	0.9	9	7.5	-35
	1	57	13.3	0	0.5	1.25	0.9	9	7.5	-36
	1	57	13.3	0	0.5	1.25	0.9	9	7.5	-37
	1	57	13.3	0	0.5	1.25	0.9	9	7.5	-38
	1	57	13.3	0	0.5	1.25	0.9	9	7.5	-39
	1	57	13.3	0	0.5	1.25	0.9	9	7.5	-40



	1	57	13.3	0	0.5	1.25	0.9	9	7.5	-41
	1	57	13.3	0	0.5	1.25	0.9	9	7.5	-42
	1	57	13.3	0	0.5	1.25	0.9	9	7.5	-43
	1	57	13.3	0	0.5	1.25	0.9	9	7.5	-44
	1	57	13.3	0	0.5	1.25	0.9	9	7.5	-45
	1	57	13.3	0	0.5	1.25	0.9	9	7.5	-46
	1	57	13.3	0	0.5	1.25	0.9	9	7.5	-47
	1	57	13.3	0	0.5	1.25	0.9	9	7.5	-48
	1	57	13.3	0	0.5	1.25	0.9	9	7.5	-49
	1	57	13.3	0	0.5	1.25	0.9	9	7.5	-50
	1	57	13.3	0	0.5	1.25	0.9	9	7.5	-51
	1	57	13.3	0	0.5	1.25	0.9	9	7.5	-52
	1	57	13.3	0	0.5	1.25	0.9	9	7.5	-53
	1	57	13.3	0	0.5	1.25	0.9	9	7.5	-54
	1	57	13.3	0	0.5	1.25	0.9	9	7.5	-55
Clay CL	2	62	18.2	0	0.5	1.25	0.9	9	18	-56
V/stiff	2	62	18.2	0	0.5	1.25	0.9	9	18	-57
	2	62	18.2	0	0.5	1.25	0.9	9	18	-58
	2	62	18.2	0	0.5	1.25	0.9	9	18	-59
	2	62	18.2	0	0.5	1.25	0.9	9	18	-60
	2	62	18.2	0	0.5	1.25	0.9	9	18	-61
	2	62	18.2	0	0.5	1.25	0.9	9	18	-62
	2	62	18.2	0	0.5	1.25	0.9	9	18	-63
	2	62	18.2	0	0.5	1.25	0.9	9	18	-64
	2	62	18.2	0	0.5	1.25	0.9	9	18	-65
Ctt	3	57	13.3	0	0.5	1.25	0.9	9	7.5	-66
V/S	3	57	13.3	0	0.5	1.25	0.9	9	7.5	-67
	3	57	13.3	0	0.5	1.25	0.9	9	7.5	-68
	3	57	13.3	0	0.5	1.25	0.9	9	7.5	-69
	3	57	13.3	0	0.5	1.25	0.9	9	7.5	-70
	3	57	13.3	0	0.5	1.25	0.9	9	7.5	-71
	3	57	13.3	0	0.5	1.25	0.9	9	7.5	-72
	3	57	13.3	0	0.5	1.25	0.9	9	7.5	-73
	3	57	13.3	0	0.5	1.25	0.9	9	7.5	-74

Pile Capacity		Skin	Tip	Total
Compresion (lbs)	=	64258	6180	70437
Compresion (ton)	=	32.13	3.09	35.22
Tension (lbs)	=	46266		46266
Tension (ton)	=	23.13		23.13

Construction condition - Batter; 1H:2V

Weight of pile lbs	Dc Equiv. Bottom -24	Dist. From pile tip L	Average Pile Dia. inches	Pile Length in Sublayer	Total Surface in sub layer (ft^2)	Tip Area (ft^2)	Cohesionless Calculations: stress at bottom 0	stress for skin friction w/ Dc 0	avg-stress psf w/Dc	avg - su psf	comp. fs=kcsu	tension fs=ktSu
0	-25	60.5	12.02	1.12	4.48	0.96	57	57	28.5	7	8	6
0	-26	59.5	12.01	1.12	4.48	0.96	114	114	85.5	20	25	18
0	-27	58.5	12.01	1.12	4.48	0.96	171	171	142.5	34	42	30
0	-28	57.5	12.00	1.12	4.48	0.96	228	228	199.5	47	59	42
0	-29	56.5	12.00	1.12	4.47	0.96	285	285	256.5	61	76	55
0	-30	55.5	12.00	1.12	4.47	0.96	342	342	313.5	74	93	67
0	-31	54.5	11.99	1.12	4.47	0.96	399	399	370.5	88	109	79
0	-32	53.5	11.99	1.12	4.47	0.96	456	456	427.5	101	126	91
0	-33	52.5	11.98	1.12	4.47	0.96	513	513	484.5	115	143	103
0	-34	51.5	11.98	1.12	4.47	0.96	570	570	541.5	128	160	115
0	-35	50.5	11.98	1.12	4.46	0.96	627	627	598.5	141	177	127
0	-36	49.5	11.97	1.12	4.46	0.96	684	684	655.5	155	194	139
0	-37	48.5	11.97	1.12	4.46	0.96	741	741	712.5	168	211	152
0	-38	47.5	11.97	1.12	4.46	0.96	798	798	769.5	182	227	164
0	-39	46.5	11.96	1.12	4.46	0.96	855	855	826.5	195	244	176
0	-39	45.5	11.96	1.12	4.46	0.96	912	855	855	202	253	182

0	-39	44.5	11.95	1.12	4.46	0.96	969	855	855	202	253	182
0	-39	43.5	11.95	1.12	4.45	0.96	1026	855	855	202	253	182
0	-39	42.5	11.95	1.12	4.45	0.96	1083	855	855	202	253	182
0	-39	41.5	11.94	1.12	4.45	0.96	1140	855	855	202	253	182
0	-39	40.5	11.94	1.12	4.45	0.96	1197	855	855	202	253	182
0	-39	39.5	11.93	1.12	4.45	0.96	1254	855	855	202	253	182
0	-39	38.5	11.93	1.12	4.45	0.96	1311	855	855	202	253	182
0	-39	37.5	11.93	1.12	4.45	0.96	1368	855	855	202	253	182
0	-39	36.5	11.92	1.12	4.44	0.96	1425	855	855	202	253	182
0	-39	35.5	11.92	1.12	4.44	0.96	1482	855	855	202	253	182
0	-39	34.5	11.91	1.12	4.44	0.96	1539	855	855	202	253	182
0	-39	33.5	11.91	1.12	4.44	0.96	1596	855	855	202	253	182
0	-39	32.5	11.91	1.12	4.44	0.96	1653	855	855	202	253	182
0	-39	31.5	11.90	1.12	4.44	0.96	1710	855	855	202	253	182
0	-39	30.5	11.90	1.12	4.44	0.96	1767	855	855	202	253	182
0	-39	29.5	11.89	1.12	4.43	0.96	1829	855	855	281	351	253
0	-39	28.5	11.89	1.12	4.43	0.96	1891	855	855	281	351	253
0	-39	27.5	11.89	1.12	4.43	0.96	1953	855	855	281	351	253
0	-39	26.5	11.88	1.12	4.43	0.96	2015	855	855	281	351	253
0	-39	25.5	11.88	1.12	4.43	0.96	2077	855	855	281	351	253
0	-39	24.5	11.88	1.12	4.43	0.96	2139	855	855	281	351	253
0	-39	23.5	11.87	1.12	4.43	0.96	2201	855	855	281	351	253
0	-39	22.5	11.87	1.12	4.42	0.96	2263	855	855	281	351	253
0	-39	21.5	11.86	1.12	4.42	0.96	2325	855	855	281	351	253
0	-39	20.5	11.86	1.12	4.42	0.96	2387	855	855	281	351	253
0	-39	19.5	11.86	1.12	4.42	0.96	2444	855	855	202	253	182
0	-39	18.5	11.85	1.12	4.42	0.96	2501	855	855	202	253	182
0	-39	17.5	11.85	1.12	4.42	0.96	2558	855	855	202	253	182
0	-39	16.5	11.84	1.12	4.42	0.96	2615	855	855	202	253	182
0	-39	15.5	11.84	1.12	4.41	0.96	2672	855	855	202	253	182
0	-39	14.5	11.84	1.12	4.41	0.96	2729	855	855	202	253	182
0	-39	13.5	11.83	1.12	4.41	0.96	2786	855	855	202	253	182
0	-39	12.5	11.83	1.12	4.41	0.96	2843	855	855	202	253	182
0	-39	11.5	11.82	1.12	4.41	0.96	2900	855	855	202	253	182

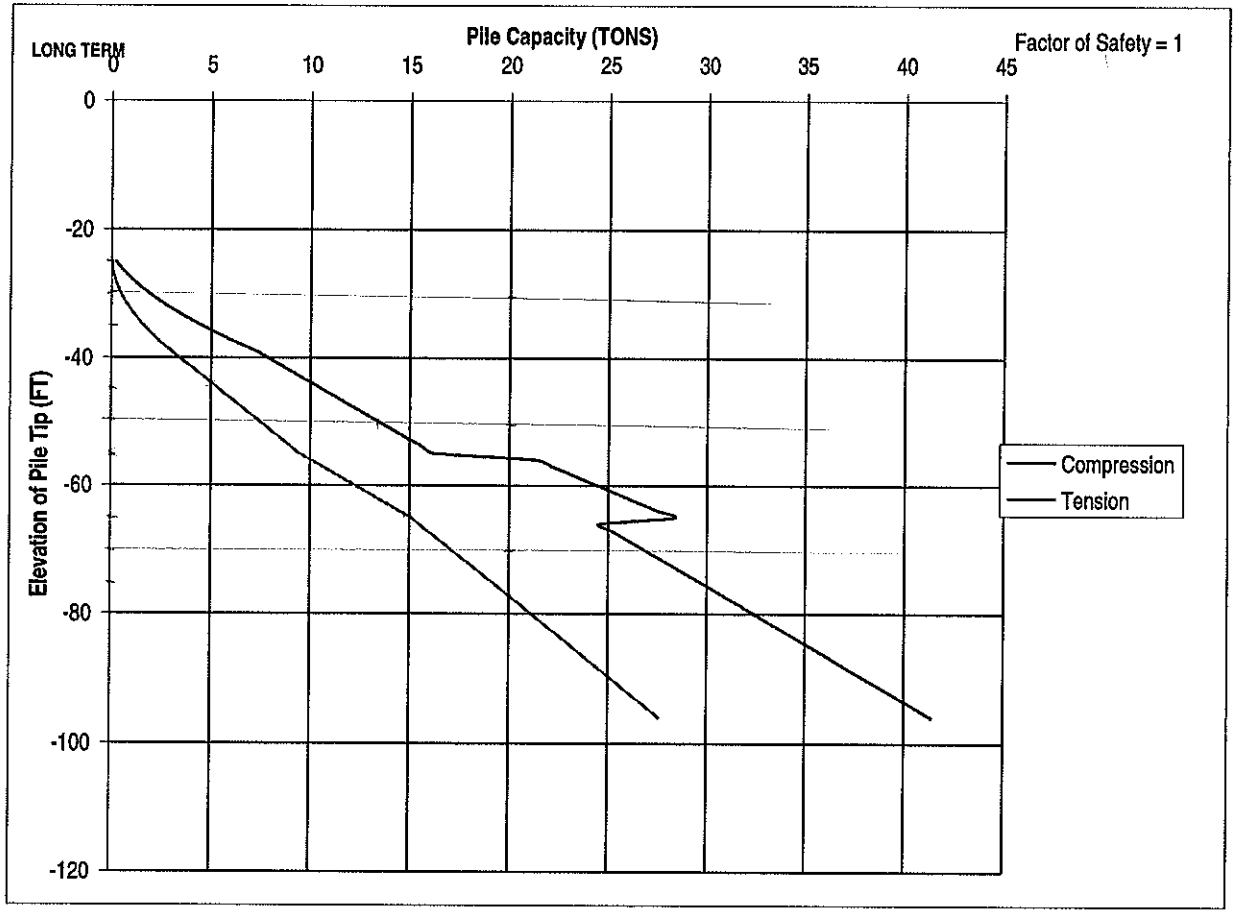
Pile Capacity		Skin	Tip	Pile Weight	Total
Compresion (lbs)	=	64258	6179.53	0	70437
Compresion (ton)	=	32.13	3.09	0.00	35.22
Tension (lbs)	=	46266		0	46266
Tension (ton)	=	23.13		0.00	23.13

		Cohesionless			Cohesive		
Stratum Number	Bottom Elevation -24	Qskin Comp. lbs	Qskin Tension lbs	End Bearing lbs	Qskin lbs	End Bearing lbs	End Bearing lbs
1	-25	38	27	411.9687	0	0	0
1	-26	113	81	823.9374	0	0	0
1	-27	188	136	1235.906	0	0	0
1	-28	264	190	1647.875	0	0	0
1	-29	339	244	2059.843	0	0	0
1	-30	414	298	2471.812	0	0	0
1	-31	489	352	2883.781	0	0	0
1	-32	565	406	3295.75	0	0	0
1	-33	640	461	3707.718	0	0	0
1	-34	715	515	4119.687	0	0	0
1	-35	790	569	4531.656	0	0	0
1	-36	865	622	4943.624	0	0	0
1	-37	939	676	5355.593	0	0	0
1	-38	1014	730	5767.562	0	0	0
1	-39	1089	784	6179.53	0	0	0
1	-40	1126	811	6179.53	0	0	0

Pile Length	Capacity Comp	Tension	Pile tip Elev
	35.22	23.13	-85
1	0.224684	0.013463	-25
2	0.486558	0.053704	-26
3	0.785691	0.120772	-27
4	1.122085	0.214666	-28
5	1.121627	0.214337	-28
6	1.495149	0.334963	-29
7	1.905928	0.482416	-30
8	2.353966	0.656694	-31
9	2.839262	0.857799	-32
10	3.361818	1.085731	-33
11	3.921634	1.340489	-34
12	4.518708	1.622074	-35
13	5.153043	1.930486	-36
14	5.824636	2.265725	-37
15	5.823181	2.264677	-37
16	6.5319	2.626646	-38

1	-41	1126	811	6179.53	0	0	0	17	7.277878	3.015441	-39
1	-42	1125	810	6179.53	0	0	0	18	7.836628	3.417742	-40
1	-43	1125	810	6179.53	0	0	0	19	8.395613	3.82021	-41
1	-44	1125	810	6179.53	0	0	0	20	8.954797	4.222823	-42
1	-45	1124	810	6179.53	0	0	0	21	9.514151	4.625558	-43
1	-46	1124	809	6179.53	0	0	0	22	10.07365	5.028399	-44
1	-47	1124	809	6179.53	0	0	0	23	10.63328	5.431333	-45
1	-48	1123	809	6179.53	0	0	0	24	10.63101	5.429696	-45
1	-49	1123	808	6179.53	0	0	0	25	11.19064	5.832631	-46
1	-50	1123	808	6179.53	0	0	0	26	11.75038	6.235641	-47
1	-51	1122	808	6179.53	0	0	0	27	12.31021	6.638718	-48
1	-52	1122	808	6179.53	0	0	0	28	12.87012	7.041853	-49
1	-53	1121	807	6179.53	0	0	0	29	13.4301	7.445041	-50
1	-54	1121	807	6179.53	0	0	0	30	13.99015	7.848277	-51
1	-55	1121	807	6179.53	0	0	0	31	14.55026	8.251556	-52
2	-56	1558	1122	14830.87	0	0	0	32	15.11042	8.654874	-53
2	-57	1558	1122	14830.87	0	0	0	33	15.67064	9.058227	-54
2	-58	1557	1121	14830.87	0	0	0	34	15.66772	9.056124	-54
2	-59	1557	1121	14830.87	0	0	0	35	16.2279	9.459456	-55
2	-60	1556	1120	14830.87	0	0	0	36	21.33069	10.01898	-56
2	-61	1556	1120	14830.87	0	0	0	37	22.10797	10.57862	-57
2	-62	1555	1120	14830.87	0	0	0	38	22.88541	11.13838	-58
2	-63	1555	1119	14830.87	0	0	0	39	23.66299	11.69824	-59
2	-64	1554	1119	14830.87	0	0	0	40	24.4407	12.25819	-60
2	-65	1554	1119	14830.87	0	0	0	41	25.21854	12.81824	-61
3	-66	1117	804	6179.53	0	0	0	42	25.99649	13.37836	-62
3	-67	1116	804	6179.53	0	0	0	43	25.99315	13.37595	-62
3	-68	1116	803	6179.53	0	0	0	44	26.77113	13.9361	-63
3	-69	1116	803	6179.53	0	0	0	45	27.54922	14.49632	-64
3	-70	1115	803	6179.53	0	0	0	46	28.3274	15.05661	-65
3	-71	1115	803	6179.53	0	0	0	47	24.56312	15.46082	-66
3	-72	1114	802	6179.53	0	0	0	48	25.1245	15.86501	-67
3	-73	1114	802	6179.53	0	0	0	49	25.68586	16.26919	-68
3	-74	1114	802	6179.53	0	0	0	50	26.24721	16.67336	-69

98-31


LONG TERM
Pile Capacity (TONS)
Factor of Safety = 1
0
5
10
15
20
25
30
35
40
45
0
-20
-40
-60
-80
-100
-120
Elevation of Pile Tip (FT)
Compression
Tension

Mark, 27 ~~20~~ August 1998

The soil parameters were determined for the northeast and southeast walls, at the Neches River Saltwater Barrier structure, based on the boring logs and laboratory testing. These two locations are separated by about 100 feet but there is a noticeable difference in the soil strata and the strength. The thickness of cohesionless material on the southeast side is less than the thickness on the northeast side. Also, sand layer dips deeper westward.

Because of the variation in the soil strata, I recommend adopting the same design for both walls using the worst foundation condition.

ISHAQ SYED

Prepared by: Syedi
11 August 1998

NECHES RIVER SALTWATER BARRIER
BEAUMONT, TEXAS

SOILS PARAMETERS AT NORTH EAST WING WALL

BORING No. 98-31

Layer No. 1, Elevation -20.0 to -27.0 NGVD: Sand w/Silt, Loose

	Short Term Shear Strength	Long Term Shear Strength
γ_{moist} = 110 pcf $\gamma_{bouyant}$ = 47 pcf	$\phi = 30^o$ c = 0 psf	$\phi = 30^o$ c = 0 psf

Pile Design Parameters (See EM 1110-2-2906 for definitions)
$\delta = 0.9\ \phi$ for concrete, 0.8 for timber $N_q = 24$
$K_c = 2.0$ $K_t = 0.67$

Layer No. 2, Elevation –27.0 to –31.0 NGVD: Clay, V/stiff

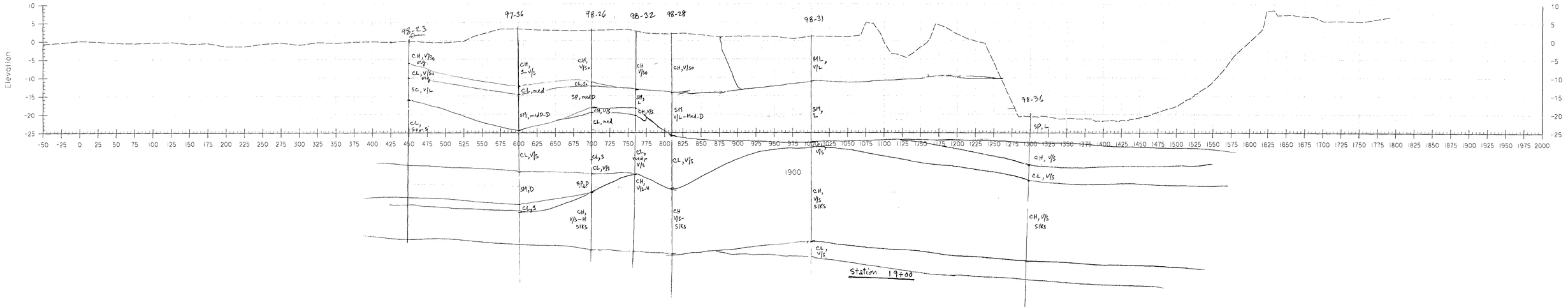
	Short Term Shear Strength	Long Term Shear Strength
γ_{moist} = 120 pcf $\gamma_{bouyant}$ = 57 pcf	$\phi = 0^o$ c = 2,100 psf	$\phi = 26^o$ c = 0 psf

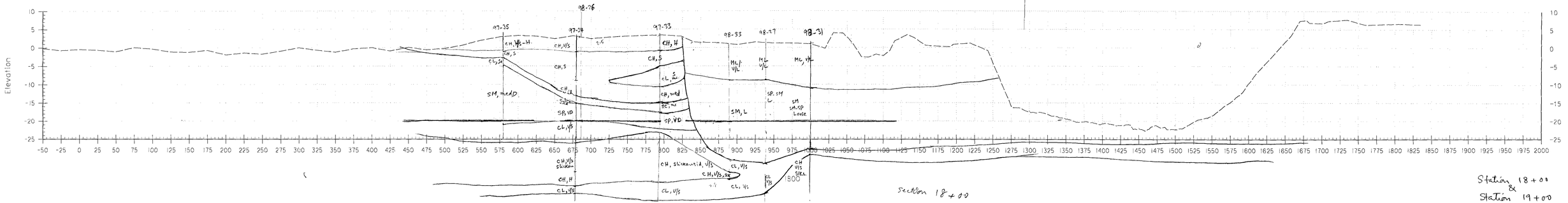
Pile Design Parameters (See EM 1110-2-2906 for definitions)
$\delta = 0.9\ \phi$ for concrete, 0.8 for timber $N_q = 18$
$K_c = 125$ $K_t = 0.9$ $\alpha = 0.5$

Layer No. 3, Elevation -31.0 to -60.0 NGVD: Clay, V/stiff, slikenside

	Short Term Shear Strength	Long Term Shear Strength
γ_{moist} = 120 pcf $\gamma_{bouyant}$ = 57pcf	$\phi = 0^o$ c = 1800 psf	$\phi = 17^o$ c = 0 psf

Pile Design Parameters (See EM 1110-2-2906 for definitions)
$\delta = 0.9\ \phi$ for concrete, 0.8 for timber $N_q = 6.0$
$K_c = 125$ $K_t = 0.9$ $\alpha = 0.5$





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Station 19+00