AD-A076 098 WOODWARD-CLYDE CONSULTANTS CHICAGO IL F/G 13/2
RESULTS AND INTERPRETATION OF ROCK ANCHOR TEST PROGRAM, EXISTIN--ETC(U)
JUL 79 J PEREZ , R A FASANO DACW43-78-C-0005
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1 OF 3
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LEVEL II

PHASE IV REPORT

VOLUME VA

APPENDICES A THROUGH E

RESULTS AND INTERPRETATION OF ROCK ANCHOR TEST PROGRAM

EXISTING LOCKS AND DAM NO. 26
MISSISSIPPI RIVER, ALTON, ILLINOIS

Prepared for

United States Army
Corps of Engineers
...Serving the Army
...Serving the Nation

St. Louis District

By

Woodward-Clyde Consultants
Chicago, Illinois

15 July 1979

Contract No. DACW43-78-C-0005

Y7C825

PHASE IV REPORT

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APPENDICES A THROUGH E

(6)

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By (9) Final rept.,

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Woodward-Clyde Consultants

Chicago, Illinois

(11) 15 July 1979

(12) 198

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(15) Y7C825

APPROVED FOR PUBLIC RELEASE - DISTRIBUTION UNLIMITED

411445

Unclassified
SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) FOUNDATION INVESTIGATION AND TEST PROGRAM, LOCKS AND DAM 26, MISSISSIPPI RIVER, ALTON, ILLINOIS Volume V A AD76097		5. TYPE OF REPORT & PERIOD COVERED Final report 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Jean-Yves Perez Ralph A. Fasano		8. CONTRACT OR GRANT NUMBER(s) DACW43-78-C-0005
9. PERFORMING ORGANIZATION NAME AND ADDRESS Woodward-Clyde Consultants 11 East Adams Street Chicago, IL 60603		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS U. S. Army Engineer District, St. Louis 210 North 12th Street St. Louis, MO 63101		12. REPORT DATE June 1979 13. NUMBER OF PAGES 188
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) Unclassified 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

Vol I Overview of Foundation Investigation and Test Program
Vol II Results and Interpretation of Chemical Grouting Test Program
Vol IIA Appendices A through G, Results and Interpretation of Chemical Grouting Test Program
Vol III Results and Interpretation of Pile Driving Effects Test Program
Vol IIIA Appendices H through T, Results and Interpretation of Pile Driving Effects Test Program
Vol IV Results and Interpretation of Drilled-In Pile Test Program
Vol IVA Appendices A through E, Results and Interpretation of Drilled-In Pile Test Program
Vol V Results and Interpretation of Rock Anchor Test Program
Vol VA Appendices A through E, Results and Interpretation of Rock Anchor Test Program

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Lock and Dam No. 26, Mississippi River
Chemical grout test
Rock anchor test
Drilled-in pile test
Pile driving effects test
Timber piles
Alluvial sands
Benoto method
Instrumentation of tests
Vibrational effects on structures

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

A series of tests examining various foundation systems and construction techniques were conducted on Ellis Island near Locks and Dam No. 26 in alluvial sand deposits underlain by glacial deposits and limestone. The chemical grout test consisted of grouting the upper 20 feet of the alluvial sand by injecting a number of different silicate and cement-bentonite grout types, while varying the grouting method, hole spacing, and injecting rates. Heave, lateral displacement, and pore pressure were monitored during grout injection. The in situ properties of the sand were measured before and after grouting by standard

CONT

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CONT

20. penetration tests, static cone penetration tests, pressuremeter tests, bore hole permeability tests, and shear wave velocity tests. Concurrently laboratory tests were conducted to investigate the strength and creep behavior of the grouted sand. After completion of grouting, the site was excavated to examine and evaluate the grouted sand. In the rock anchor test, inclined rock anchors were installed in limestone through 130 feet of alluvial and glacial deposits using a pneumatic down-the-hole hammer with an offset reamer. Load tests were conducted on three instrumentated rock anchors and the feasibility of installation of the rock anchors was determined by evaluating loss of ground during installation, performance of the installation equipment, and rate of installation. The drilled-in pile test consisted of installation of large diameter high capacity pipe piles by the Benoto method. The feasibility of installing these piles was determined by evaluating loss of ground during installation, performance of the Benoto equipment, and rate of installation. In the pile driving effects test, pile founded monoliths were constructed, supported on either one, eight or twelve timber piles jetted and driven in alluvial sand to a depth of 35 feet. After applying lateral and vertical load to the monoliths, steel piles were driven at varying distances from the monoliths while monitoring movement of the monolith and supporting piles; shear, moment, and axial load in the timber piles; and pore pressure, movement, and particle velocity, in the soil. Parameters examined were pile type being driven (sheet, pipe, or H-pile), pile driving hammer (diesel, air-steam, or vibratory), distance of driven piles from monolith, driving of multiple piles at the same distance from the monolith, load level applied to the monolith, and soil properties (grouted and ungrouted). Vertical and lateral load tests were conducted on each pile founded monolith. Tests were also conducted to assess what effect grouted soil has on piles. Piles were driven in both grouted and ungrouted sand to examine driving characteristics and lateral load tests were conducted on H and pipe piles in both grouted and ungrouted sand.

RESULTS AND INTERPRETATION OF ROCK ANCHOR TEST PROGRAM

VOLUME VA

Appendix A	**ANCHOR LOAD TEST DATA SHEETS**
Appendix B	**DRILLING PRODUCTION LOGS**
Appendix C	**GROUND INSTRUMENTATION DATA SHEETS**
Appendix D	**INCLINOMETER PROFILES**
Appendix E	**QUANTITY OF CUTTINGS DATA SHEETS**

PHASE IV REPORT

VOLUME VA

RESULTS AND INTERPRETATION OF ROCK ANCHOR TEST PROGRAM

APPENDIX A

ANCHOR LOAD TEST DATA SHEETS

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WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
ROCK ANCHOR TEST PROGRAM

ROCK ANCHOR LOAD TEST
ANCHOR NO. RP-1

Date	Time	Load Increment (kips)	JACK		LOAD CELL			ELONGATION			
								PISTON		CALIPER	
			Pressure (lb/in.²)	Load (kips)	Reading	Δ Reading	Load (kips)	Reading	Displ (in.)	Reading	Displ (in.)
1978 20 Dec	1006	0	0	0	+0000			0.00			
	1007	30		30	—			seating			
	1009	10		10	250	250	initial 20	0.60	0.00	0.434	0.000
	1011	80	not recorded	80	542	542	40	1.92	1.32	1.006 / 2.413	0.[illegible]72 / — ①
	1026	80		80	530	530	40	1.92	1.32	1.007 / 2.414	[illegible] / 0.001
	1031	80		80	524	524	40	1.92	1.32	1.009 / 2.415	[illegible] / 0.002
	1032	10		10	250	250	20	0.60	0.00	0.703	0.269
	1035	80		80	535	535	40	1.92	1.32	1.050	0.616
	1045	160		160	854	854	70	3.96	1.36	2.289	1.855
	1048	10		10	270	270	20	0.72	0.12	1.178	0.744

Remarks = ① lower number indicates [illegible] reading for creep measurements

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
ROCK ANCHOR TEST PROGRAM

ROCK ANCHOR LOAD TEST
ANCHOR NO. RP-1

Date	Time	Load Increment (kips)	JACK		LOAD CELL			ELONGATION			
								PISTON		CALIPER	
			Pressure (lb/in²)	Load (kips)	Reading	Δ Reading	Load (kips)	Reading	Displ (in.)	Reading	Displ (in.)
20 Dec	1115	10		10	269	269	20	0.72	0.12	1.144	0.710
	1124	80		80	640	640	45	2.40	1.80	1.733	1.299
	1126	160		160	872	872	75	4.32	3.72	2.616	2.182
										2.545	—
	1130	160		160	868	868	75	4.26	3.66	2.616	2.182
										2.547	0.002
	1134	160	not recorded	160	876	876	75	4.38	3.78	2.682	2.248
										2.587	0.042
	1138	160		160	873	873	75	4.38	3.78	2.683	2.249
										2.587	0.042
	1142	160		160	870	870	75	4.38	3.78	2.685	2.251
										2.587	0.042
	1145	10		10	464	464	35	1.32	0.72	1.631	1.197
	1248	10		10	464	464	35	1.32	0.72	1.635	1.201
	1250	80		80	620	620	45	2.34	1.74	1.950	1.516

Remarks =

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
ROCK ANCHOR TEST PROGRAM

ROCK ANCHOR LOAD TEST
ANCHOR NO. RP-1

Date	Time	Load Increment (kips)	JACK		LOAD CELL			ELONGATION			
								PISTON		CALIPER	
			Pressure (lb/in²)	Load (kips)	Reading	Δ Reading	Load (kips)	Reading	Displ (in.)	Reading	Displ (in.)
20 Dec	1253	160		160	888	888	75	4.50	3.90	2.850	2.416
	1300	240		240	1108	1108	105	6.54	5.94	3.737 2.301	3.303 —
	1304	240		240	1089	1089	100	6.48	5.88	3.737 2.305	3.303 0.004
	1308	240		240	1084	1084	100	6.48	5.88	3.738 2.307	3.304 0.006
	1312	240		240	1082	1082	100	6.51	5.91	3.738 2.308	3.304 0.007
	1316	240		240	1081	1081	100	6.51	5.91	3.738 2.309	3.304 0.008
	1320	240		240	1080	1080	100	6.51	5.91	3.738 2.310	3.304 0.009
	1326	10		10	444	444	35	1.38	0.78	1.882	1.448
	1327	80		80	590	590	45	2.49	1.89	2.165	1.731
	1330	160		160	858	858	70	4.65	4.05	3.150	2.716

Remarks =

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
ROCK ANCHOR TEST PROGRAM

ROCK ANCHOR LOAD TEST
ANCHOR NO. RP-1

Date	Time	Load Increment (kips)	JACK		LOAD CELL			ELONGATION			
								PISTON		CALIPER	
			Pressure (lb/in²)	Load (kips)	Reading	Δ Reading	Load (kips)	Reading	Displ (in.)	Reading	Displ (in)
20 Dec	1332	240		240	1092	1092	100	6.60	6.00	3.850	3.416
	1337	320		320	1318	1318	130	9.30	8.70	5.020 1.179	4.586 —
	1341	320		320	1300	1300	130	9.33	8.73	5.020 1.181	4.586 0.002
	1346	320	not recorded	320	1294	1294	130	9.33	8.73	5.020 1.185	4.586 0.006
	1350	320		320	1290	1290	130	9.33	8.73	5.020 1.185	4.586 0.006
	1354	320		320	1286	1286	125	9.33	8.73	5.020 1.187	4.586 0.008
	1358	320		320	1284	1284	125	9.33	8.73	5.020 1.188	4.586 0.009
	1402	10		10	324	324	25	1.32	0.72	2.092	1.658
	1409	80		80	472	472	35	2.82	2.22	2.502	2.068
	1410	160		160	716	716	55	4.83	4.23	3.371	2.937

Remarks =

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
ROCK ANCHOR TEST PROGRAM

ROCK ANCHOR LOAD TEST
ANCHOR NO. RP-1

Date	Time	Load Increment (kips)	JACK		LOAD CELL			ELONGATION			
								PISTON		CALIPER	
			Pressure (lb/in²)	Load (kips)	Reading	Δ Reading	Load (kips)	Reading	Displ (in.)	Reading	Displ (in)
20 Dec	1412	240		240	960	960	85	6.32	5.12	4.164	3.730
	1414	320		320	1258	1258	125	9.06	8.46	4.994	4.560
	1415	400		400	1424	1424	145	11.37	10.77	6.150 1.912	5.716 —
	1419	400	not recorded	400	1383	1383	140	11.37	10.77	6.150 1.913	5.716 0.001
	1423	400		400	1374	1374	140	11.37	10.77	6.150 1.914	5.716 0.002
	1427	400		400	1369	1369	140	11.37	10.77	6.150 1.916	5.716 0.004
	1430	400		400	1398	1398	140	11.88	11.28	6.384 1.722	5.950 — ①
	1435	400		400	1380	1380	140	11.88	11.28	6.384 1.722	5.950 0.000
	1444	10		10	274	274	20	1.62	1.02	2.900	2.466
	1448	80		80	327	327	25	2.52	2.22	3.666	3.226

Remarks = ① reset load to zero

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
ROCK ANCHOR TEST PROGRAM

ROCK ANCHOR LOAD TEST
ANCHOR NO.

Date	Time	Load Increment (kips)	JACK		LOAD CELL			ELONGATION			
								PISTON		CALIPER	
			Pressure (lb/in²)	Load (kips)	Reading	Δ Reading	Load (kips)	Reading	Displ (in.)	Reading	Displ (in.)
20 Dec	1451	80		80	340	340	25	3.00	2.40	3. 224	2. 790
	1515	re setting		—	513	513	40	3.60	3.00	—	—
	1521	lock off		0	512	512	40	—	—	0. 271	—
	1524	lift off		—	337	337	25	① 5.40	3.70	0. 440	—
	1526	160	not recorded	160	577	577	40	5.79	4.09	1. 365	2. 937 ②
	1528	240		240	792	792	65	7.20	5.50	2. 176	3. 748
	1530	320		320	1095	1095	100	9.46	6.76	3. 435	5. 007
	1532	400		400	1401	1401	140	12.45	10.75	4. 560	6. 132
	1535	480		480	1466	1466	150	14.10	12.40	5.146 1.591	6.718 —
	1539	450		480	1413	1413	145	14.10	12.40	5.146 1.589	6.718 -0. 002

1.572

Remarks = ① after re setting
= ② decreased from last lock increment

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
ROCK ANCHOR TEST PROGRAM

P. ___ of 2

ROCK ANCHOR LOAD TEST
ANCHOR NO. [illegible]-1

Date	Time	Load Increment (kips)	JACK		LOAD CELL			ELONGATION			
								PISTON		CALIPER	
			Pressure (lb/in²)	Load (kips)	Reading	Δ Reading	Load (kips)	Reading	Displ (in.)	Reading	Displ (in.)
20 Dec	1541	480		480	1428	1428	145	14.58	12.88	5.300 1.583	6.922 -0.[illegible]
	1543	480		480	[illegible]17	[illegible]	145	[illegible]	[illegible]	[illegible]	[illegible]
	1547	480		480	1403	1403	140	14.58	12.88	5.350 1.583	6.922 -0.[illegible]
	1549	480	not recorded	480	[illegible]12	[illegible]13	145	15.00	[illegible]	5.716 1.068	7.255 —
	1555	480		480	1395	1395	140	[illegible]	13.30	[illegible]	[illegible]
	1600	480		480	1386	1386	140	[illegible]	13.30	5.716 1.066	7.288 -0.[illegible]
	1605	480		480	[illegible]370	1379	140	[illegible]	13.30	5.716 1.065	7.288 -0.[illegible]
	1612	400		400	[illegible]263	1263	130	13.80	12.10	5.[illegible]1	6.[illegible]993
	1614	320		320	[illegible]066	1066	100	11.52	9.82	4.[illegible]696	6.[illegible]17
	1615	240		240	795	[illegible]83	60	8.76	[illegible]7.06	3.[illegible]14	5.[illegible]856

(1)

Remarks = 0 reset load on jack

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
ROCK ANCHOR TEST PROGRAM

ROCK ANCHOR LOAD TEST
ANCHOR NO. RP-1

Date	Time	Load Increment (kips)	JACK		LOAD CELL			ELONGATION			
								PISTON		CALIPER	
			Pressure (lb/in²)	Load (kips)	Reading	Δ Reading	Load (kips)	Reading	Displ (in.)	Reading	Displ (in.)
20 Dec	1616	160		160	567	567	40	7.14	5.44	2.706	4.278
	1618	80		80	385	385	30	4.26	2.56	1.869	3.441
	1622	160		160	538	538	40	7.12	5.42	2.365	3.937
	1630	240		240	671	671	50	7.56	5.86	2.843	4.415
	1631	320		320	925	925	80	9.99	8.29	3.803	5.375
	1633	400	30 sec. dead	400	1260	1260	125	12.57	10.87	5.011	6.583
	1639	400		400	1354	1354	135	13.59	12.19	5.530	7.102
	1658	400		400	1350	1350	135	13.86	12.16	5.541	7.113
	Jack off lock off for hold at 400 k;										
	but chair + shims are unstable + kick										
	out; dial test										

Remarks =

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
ROCK ANCHOR TEST PROGRAM

ROCK ANCHOR LOAD TEST
ANCHOR NO. RP-1

Date	Time	Load Increment (kips)	JACK		LOAD CELL			ELONGATION			
								PISTON		CALIPER	
			Pressure (lb/in²)	Load (kips)	Reading	Δ Reading	Load (kips)	Reading	Displ (in.)	Reading	Displ (in.)
1978 21 Dec	1320	0	0	0	+ 1080	—	0	0.00	—		
	1321	80		75 ①	1542	462	35	2.40	2.40		
	1322	160		150	1893	813	65	4.38	4.38		
	1324	240		226	2180	1100	100	6.72	6.72		
	1326	320	not recorded	301	2400	1320	130	9.03	9.03		
	1327	400		376	2515	1435	150	11.34	11.34		
	1331	400		376	2550	1470	155	—			
	1333	400		376	2570	1490	155	12.12	12.12	②	
	1337	400		376	2570	1490	155	12.12	12.12		
	1341	400		376	2553	1473	155	12.12	12.12		

Remarks ① Test load applied by the jack was reduced to account for 1 broken cable of anchor tendon; jack load = 16/17 load increment

② Limit of jack piston

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
ROCK ANCHOR TEST PROGRAM

ROCK ANCHOR LOAD TEST
ANCHOR NO. RP-1

	Date	Time	Load Increment (kips)	JACK		LOAD CELL # 61378-2			ELONGATION			
									PISTON		CALIPER	
				Pressure (lb/in^2)	Load (kips)	Reading	Δ Reading	Load (kips)	Reading	Displ (in.)	Reading	Displ (in.)
1978	21 Dec	1345	lock off		0	2944	1764	200	resetting			
		1347	lift off			2555	1475	155	jack		piston	
		1351	"	not recorded		2529	1449	150	① 6.27	12.66		
		1354	400		376	2596	1515	160	6.87	13.26		
		1356	400		376	2632	1552	165	7.49	13.88		
		1407	400		376	2535	1455	150				
		1408	lock off		0	2830	1750	195				
		1410	long-term monitoring	withdraw piston		2980	1900	② 384.0				
		1412				2980	1900	384.0				
		1414				2980	1900	384.0				

Remarks ① After reset of jack piston
② Load on anchor during long-term monitoring is based on mean trend of load cell reading vs. jack load

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
ROCK ANCHOR TEST PROGRAM

ROCK ANCHOR LOAD TEST
ANCHOR NO. RP-1

Date	Time	Load Increment (kips)	JACK		LOAD CELL			ELONGATION			
								PISTON		CALIPER	
			Pressure (lb/in²)	Load (kips)	Reading	Δ Reading	Load (kips)	Reading	Displ (in.)	Reading	Displ (in.)
1978 21 Dec	1418				2979	1899	383.7				
	1420				2979	1899	383.7				
	1430				2979	1899	383.7				
	1440	long-term monitoring			2979	1899	383.7				
	1450				2977	1897	383.2				
	1500				2976	1896	382.8				
	1530				2975	1895	382.6				
	1630				2974	1894	382.1				
	1730				2971	1891	381.1				

Remarks =

WOODWARD-CLYDE CONSULTANTS
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ROCK ANCHOR TEST PROGRAM

ROCK ANCHOR LOAD TEST
ANCHOR NO. RP-1

	Date	Time	Load Increment (kips)	JACK		LOAD CELL			ELONGATION			
									PISTON		CALIPER	
				Pressure (lb/in²)	Load (kips)	Reading	Δ Reading	Load (kips)	Reading	Displ (in.)	Reading	Displ (in.)
1978	21 Dec	1810				2970	1890	380.8				
		1910				2968	1888	380.2				
		2010				2968	1888	380.2				
		2110	long-term monitoring			2966	1886	379.5				
		2210				2965	1885	379.2				
		2310				2965	1885	379.2				
	22 Dec	0010				2964	1884	378.9				
		0400				2960	1880	377.6				
		0800				2960	1880	377.6				
		1200				2960	1880	377.6				

Remarks =

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
ROCK ANCHOR TEST PROGRAM

ROCK ANCHOR LOAD TEST
ANCHOR NO. RP-1

1978

Date	Time	~~Load Increment (kips)~~ Air-Temp (°F)	JACK		LOAD CELL			ELONGATION			
								PISTON		CALIPER	
			Pressure (lb/in.^{2})	Load (kips)	Reading	Δ Reading	Load (kips)	Reading	Displ (in.)	Reading	Displ (in.)
22 Dec	1525	32			2967	1887	379.8				
23 Dec	1000	–			2966	1886	379.5				
24 Dec	1400	–			2950	1870	374.4				
26 Dec	1630	–			2944	1864	372.5				
27 Dec	1545	40			2948	1868	373.8				
28 Dec	1330	32			2943	1863	372.2				
30 Dec	1000	27			2940	1860	371.2				

Remarks ___

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
ROCK ANCHOR TEST PROGRAM

ROCK ANCHOR LOAD TEST
ANCHOR NO. RP-1

Date	Air Temp (°F) ~~Time~~	Load Increment (kips)	JACK		LOAD CELL			ELONGATION			
								PISTON		CALIPER	
			Pressure (lb/in^2)	Load (kips)	Reading	Δ Reading	Load (kips)	Reading	Displ (in.)	Reading	Displ (in)
1979 8 Jan	15				2911	1831	361.9				
9 Jan	27				2969	1889	380.5				
10 Jan	22				2918	1838	364.2				
15 Jan	—				2918	1838	364.2				
27 Jan	30				2936	1856	369.9				
30 Jan	29				2904	1824	359.7				
7 Feb	15				2894	1814	356.5				
12 Feb	25				2904	1824	359.7				
3 Mar	50				2920	1840	364.8				

Remarks =

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
ROCK ANCHOR TEST PROGRAM

ROCK ANCHOR LOAD TEST
ANCHOR NO. RD-1

Date	Time	Load Increment (kips)	JACK Pressure (lb/in²)	JACK Load (kips)	LOAD CELL #61378-1 Reading	Δ Reading	Load (kips)	ELONGATION PISTON Reading	PISTON Displ. (in.)	CALIPER Reading	CALIPER Displ. (in.)	ANCHOR ZONE STRAIN — TELLTALES (in.) 1 Rdg.	1 Displ. (in.)	2 Rdg.	2 Displ. (in.)	3 Rdg.	3 Displ. (in.)	4 Rdg.	4 Displ. (in.)	STRAIN GAGES (με) 1 Rdg.	1 Strain	2 Rdg.	2 Strain	3 Rdg.	3 Strain	4 Rdg.	4 Strain
2 Feb	1400	0	0	0	+ 1093	—	0	1.30	—	0.894	—	2.814	—	2.861	—	2.904	—	2.798	—	-10 390	—	-11 246	—	-13 258	—	-5 296	—
	1415	10	890	100	1160	67	③10/45	1.52	0.22	1.032	.138																
	1428	80	725	85	1610	517	80/275	3.06	1.76	1.940	1.046																
	1433	"	"	"	1620	527	85/280	3.06	1.76	1.926	1.032																
	1444	10	150	15	1162	69	10/45	2.21	0.91	1.205	0.311	2.812		2.925		2.910		2.973									
	1449	80	650	75	1661	568	90/295	3.12	1.82	1.975	1.081	2.765		2.916		2.956		2.835		-10 400	-10	-11 255	-9	-13 246	12	-5 296	0
	1455	160	2400	295	2099	1006	160/430	6.40	5.10	5.150	4.256	①		①		2.277		1.590		-10 400	-10	-11 255	-9	-13 292	-24	-5 336	-40
	1500	80	400	45	1608	515	80/275	3.28	1.98	2.224	1.330	—		—		2.894		2.460		-10 401	-1	-11 258	-12	-13 294	-36	-5 353	-57
	1505	0	0	0	1106	13	0/5	2.09	0.79	1.034	0.140																

Remarks: Load cell readout: Terrametrics P-350A #9663
balanced at meter +1000, ch 9
g.f. 2, half bridge
Strain gage readout: Vishay P-350A #21900
balanced at meter +0000, 350Ω calibrator #2C086
bal. pot. 5.45, g.f. 2, quarter bridge

① telltales #1 + #2 bind on stressing head + break at rod joint decide to discontinue test

② load in upper box is based on Terrametrics calibration
" " lower " " " " U of I "

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
ROCK ANCHOR TEST PROGRAM

ROCK ANCHOR LOAD TEST
ANCHOR NO. RD-1

Date	Time	Load Increment (kips)	JACK		LOAD CELL			ELONGATION				ANCHOR ZONE STRAIN													
								PISTON		CALIPER		TELLTALES (in.)								STRAIN GAGES (με)					
												1		2		3		4		1		2		3	
			Pressure (lb/in²)	Load (kips)	Reading	Reading	Load (kips)	Reading	Displ (in.)	Reading	Displ (in.)	Rdg.	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Strain	Rdg.	Strain	Rdg.	Strain
2 Feb	1630	0	0	0	1105	—	—	2.06	—	0.938	—	2.831		2.831		2.879		2.514		-10 391	—	-11 247	—	-13 260	—
	1640	80	400	40	1603	498	③ 80 270	3.05	0.99	1.916	0.978	2.833		2.835		2.896		2.518		-10 392	-1	-11 248	-1	-13 280	-20
	② 1659	160	2900	360	2080	975	155 425	8.86	6.80	7.567	6.629	— ①		— ①		2.388		— ①		-10 392	-1	-11 250	-3	-13 266	-6
	1708	—	1550	190	1936	831	130 380	6.41	4.35	5.228	4.291	—		—		2.445		—		-10 397	-5	-11 252	-5	-13 300	-40
	1712	0	0	0	1168	63	10 45	2.23	0.17	1.070	0.132	—		—		2.911		—		-10 397	-5	-11 253	-6	-13 290	-30

Date	Time	Load Increment (kips)	Jack Pressure (lb/in²)	Jack Load (kips)	Load Cell Reading	Load Cell Reading	Load Cell Load (kips)	Elongation Piston Reading	Elongation Piston Displ (in.)	Elongation Caliper Reading	Elongation Caliper Displ (in.)	Anchor Zone Strain — Telltales (in.) 1 Rdg.	1 Displ. (in.)	2 Rdg.	2 Displ. (in.)	3 Rdg.	3 Displ. (in.)	4 Rdg.	4 Displ. (in.)	Strain Gages (με) 1 Rdg.	1 Strain	2 Rdg.	2 Strain	3 Rdg.	3 Strain	4 Rdg.	4 Strain

Remarks ① telltale rods 1 & 3 bind on stressing head & break at rod joint;
telltale rod 2 is pulled free accidentally
② load calculated from jack pressure doesn't match load cell,
decide to discontinue test
③ load in upper box based on Terrametrics calibration
" " lower " " " U of I "

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
ROCK ANCHOR TEST PROGRAM

ROCK ANCHOR LOAD TEST
ANCHOR NO. RD-1

Date	Time	Load (increment) (kips)	JACK Pressure (lb/in²)	JACK Load (kips)	LOAD CELL #61378-1 Reading	LOAD CELL Δ Reading	LOAD CELL Load (kips)	ELONGATION PISTON Reading	ELONGATION PISTON Displ. (in.)	ELONGATION CALIPER Reading	ELONGATION CALIPER Displ. (in.)	ANCHOR ZONE STRAIN — TELLTALES (in.) 1 Rdg.	1 Displ. (in.)	2 Rdg.	2 Displ. (in.)	3 Rdg.	3 Displ. (in.)	4 Rdg.	4 Displ. (in.)	STRAIN GAGES (με) 1 Rdg.	1 Strain	2 Rdg.	2 Strain	3 Rdg.	3 Strain	4 Rdg.	4 Strain
7 Feb	1355	0	0	0	+ 1093	—	0													-10 352	—	-11 217	—	-13 188	—	-5 224	—
①	1356	"Zero"	200	20	1181	88	15	1.56	—	1.908	—	2. 456	—	2. 485	—	2. 895	—	2. 496	—					①			
Initial	1940	"Zero"	150	15	1165	72	15	1.42	0.00	1.793	0.000	2. 426	—	2. 478	—	2. 869	—	2. 466	—	-10 352	—	-11 204	—	-13 186	—	-5 210	—
	1950	80	725	80	1452	359	55	2.63	1.21	2.807	1.014																
	1952	"	710	80	1446	353	55			2.807	1.014																
	1954	"	710	80	1443	350	55			2.808	1.015																
	1956	"	710	80	1442	349	55	2.62	1.20	2.808	1.015	2. 448	-0. 022	2. 480	-0. 002	2. 772	+0. 097	2. 454	+0. 012	-10 357	- 5	-11 208	-4	-13 197	-11	-5 216	-6
	1959	160	1375	160	1461	768	120	4.12	2.70	4.255	2.462																
	2001	"	1350	160	1853	760	120			4.265	2.472																
	2003	"	1350	160	1848	755	120			4.275	2.482																
	2005	"	1350	160	1844	751	120			4.273	2.480																

Remarks: Seating to 300 psi, release to 200 psi & take initial readings

① Strain gage #3 shorts, relay start of test to Fix

Strain gage readout # 21900, meter +0000
bal pot 5.50, 350 Ω calibrator # 20086
gage factor 2, quarter bridge
Load cell readout # 9663, meter +1000
ch 9, half bridge

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WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
ROCK ANCHOR TEST PROGRAM

ROCK ANCHOR LOAD TEST
ANCHOR NO.

Date	Time	Load Increment (kips)	JACK		LOAD CELL			ELONGATION				ANCHOR ZONE STRAIN													
								PISTON		CALIPER		TELLTALES (in.)								STRAIN GAGES (με)					
												1		2		3		4		1		2		3	
			Pressure (lb/in²)	Load (kips)	Reading	Δ Reading	Load (kips)	Reading	Displ. (in.)	Reading	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Strain	Rdg.	Strain	Rdg.	Strain
7 Feb	2007	160	1325	160	1840	747	120			4.269	2.476														
	2009	"	1325	160	1838	745	120			4.265	2.472														
	2011	"	1325	160	1838	745	120	4.11	2.69	4.268	2.475	2.435	-0.009	2.434	0.044	2.648	0.221	2.430	0.036	-10 367	-15	-11 219	-15	-13 217	-31
	2017	zero	210	20	1270	177	30	1.83	0.41	2.705	0.412														
	2019	80	725	80	1526	433	70	2.84	1.42	3.007	1.284														
	2021	160	1350	160	1867	774	130	4.14	2.72	4.239	2.446														
	2022	240	1950	240	2236	1143	180	5.51	4.09	5.603	3.810														
	2025	"	1925	240	" ①	"	"	5.51	4.09	5.606	3.813														
	2027	"	1900	235	"	"	"	5.53	4.11	5.626	3.833														
	2029	"	1925	240	"	"	"	5.53	4.11	5.623	3.830														
	2031	"	1910	235	"	"	"	5.53	4.11	5.624	3.831														

Remarks ① load maintained as per load cell reading using hand pump

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
ROCK ANCHOR TEST PROGRAM

ROCK ANCHOR LOAD TEST
ANCHOR NO. RD-1

Date	Time	Load Increment (kips)	JACK		LOAD CELL			ELONGATION				ANCHOR ZONE STRAIN													
								PISTON		CALIPER		TELLTALES (in.)								STRAIN GAGES (με)							
												1		2		3		4		1		2		3		4	
			Pressure (lb/in²)	Load (kips)	Reading	Δ Reading	Load (kips)	Reading	Displ (in.)	Reading	Displ (in.)	Rdg.	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Strain	Rdg.	Strain	Rdg.	Strain	Rdg.	Strain
7 Feb	2033	240	1910	235	2236	1143	180	5.53	4.11	5.625	3.832	2.418	0.008	2.417	0.061	2.651	0.218	2.378	0.088	-10 370	-18	-11 222	-18	-13 215	-29	-5 251	-41
	2039	zero	210	20	1320	227	35	1.96	0.54	2.270	0.477																
	2043	80	725	80	1582	489	80	2.87	1.45	2.982	1.189																
	2044	160	1350	160	1916	823	130	4.20	2.78	4.267	2.476																
	2047	240	1950	240	2226	1133	180	5.48	4.06	5.489	3.696																
	2054	320	2525	315	2606	1513	240	7.01	5.59	6.956	5.163																
	2056	"	2550	320	"	"	"	7.01	5.59	6.961	5.168																
	2058	"	2525	315	"	"	"	7.01	5.59	6.969	5.176																
	2105	"	2520	315	"	"	"	7.01	5.59	6.953	5.160																
	2110	"	2520	315	"	"	"	7.01	5.59	6.965	5.172																
	2115	"	2520	315	"	"	"	7.01	5.59	6.969	5.176																

Remarks

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
ROCK ANCHOR TEST PROGRAM

ROCK ANCHOR LOAD TEST
ANCHOR NO. RD-1

Date	Time	Load Increment (kips)	JACK		LOAD CELL			ELONGATION				ANCHOR ZONE STRAIN													
								PISTON		CALIPER		TELLTALES (in.)								STRAIN GAGES (με)					
												1		2		3		4		1		2		3	
			Pressure (lb/in²)	Load (kips)	Reading	Δ Reading	Load (kips)	Reading	Displ (in.)	Reading	Displ (in.)	Rdg.	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Strain	Rdg.	Strain	Rdg.	Strain
7 Feb	2117	320	2525	315	2606	1513	240	7.01	5.59	6.966	5.173														
	2119	"	2525	315	"	"	"	7.01	5.59	6.969	5.176	2.493	-0.067	2.465	0.013	2.672	0.197	2.465	0.001	-10 380	-28	-11 231	-27	-13 236	-50
	2125	Zero	210	20	1320	227	35	1.95	0.53	2.255	0.462														
	2129	80	700	80	1585	492	80	2.90	1.48	2.991	1.198														
	2131	160	1350	160	1978	885	140	4.42	3.00	4.466	2.673														
	2133	240	1975	240	2300	1207	190	5.74	4.32	5.740	3.947														
	2135	320	2550	320	2621	1528	245	7.07	5.65	7.040	5.247														
	2137	400	3175	400	2963	1870	305	8.50	7.08	8.425	6.632														
	2139	"	3125	390	"	"	"	8.51	7.09	8.430	6.637														
	2143	"	3125	390	"	"	"	8.50	7.08	8.442	6.649														
	2145	"	3125	390	"	"	"	8.51	7.08	8.440	6.647														

4								
Rdg.	Strain	Rdg.	Strain	Rdg.	Strain	Rdg.	Strain
-5 268	-58							

Remarks

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
ROCK ANCHOR TEST PROGRAM

ROCK ANCHOR LOAD TEST
ANCHOR NO. RD-1

	Date	Time	Load Increment (kips)	JACK		LOAD CELL			ELONGATION				ANCHOR ZONE STRAIN													
									PISTON		CALIPER		TELLTALES (in.)								STRAIN GAGES (με)							
													1		2		3		4		1		2		3		4	
				Pressure (lb/in²)	Load (kips)	Reading	Δ Reading	Load (kips)	Reading	Displ (in.)	Reading	Displ (in.)	Rdg.	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Strain	Rdg.	Strain	Rdg.	Strain	Rdg.	Strain
	7 Feb	2149	400	3125	390	+2960	1967	305	8.49	7.07	8.444	6.651	2.501	-0.075	2.398	0.080	2.633	0.236	2.514	-0.048	-10 382	-30	-11 235	-31	-13 253	-67	-5 272	-62
		2200	"	3150	395	"	"	"	8.49	7.07	8.450	6.657																
		2230	"	3150	395	"	"	"	8.50	7.08	8.544	6.751																
		2300	"	3150	395	"	"	"	8.50	7.08	8.555	6.762																
		2330	"	3125	390	"	"	"	8.51	7.09	8.540	6.747																
		2400	"	3125	390	"	"	"	8.51	7.09	8.508	6.715																
40°	8 Feb	0100	"	3125	390	"	"	"	8.51	7.09	8.530	6.737																
32°		0200	"	3125	390	"	"	"	8.51	7.09	8.545	6.752																
28°	①	0300	"	3150	395	"	"	"	8.50	7.08	8.545	6.752																
25°	②	0600	"	3150	395	"	"	"	8.52	7.10	8.560	6.767																
29°		0900	"	3125	390	"	"	"	8.53	7.11	③ 8.830	6.767	③	see	next	page												

Remarks ① Power to one heater off at 0230
② Power to other heater off at 0430
③ Telltale readout head binding, change wire hanger
caliper reading changes +0.270"

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
ROCK ANCHOR TEST PROGRAM

ROCK ANCHOR LOAD TEST
ANCHOR NO. RD-1

Date	Time	Load Increment (kips)	JACK		LOAD CELL			ELONGATION				ANCHOR ZONE STRAIN													
								PISTON		CALIPER		TELLTALES (in.)								STRAIN GAGES (με)					
												1		2		3		4		1		2		3		4	
			Pressure (lb/in²)	Load (kips)	Reading	Δ Reading	Load (kips)	Reading	Displ (in.)	Reading	Displ (in.)	Rdg.	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Strain	Rdg.	Strain	Rdg.	Strain	Rdg.	Strain
8 Feb	1200	400	3110	390	2952	1867	305	8.54	7.12	8.822	6.759			see ② previous page											
	1334	"	2975	370	2936	1843	300	8.51	7.09	8.811	6.748	2.378	-0.075	2.358	+0.080	2.588	+0.236	2.396	-0.048	-10 378	-26	-11 228	-24	-13 222	-36	-5 270	-60 ①
	1348	zero	210	25	1314	221	35	2.06	0.64	2.585	0.522																
	1363	80	775	85	1585	492	80	2.09	1.57	3.315	1.252																
	1354	160	1390	165	1978	885	140	4.52	3.10	4.800	2.737																
	1356	240	1960	240	2300	1207	190	5.87	4.45	6.126 ② (1.656)	4.063 (-)																
	1359	320	2525	315	2621	1528	245	7.18	5.76	7.420 (0.269)	5.357 (1.387)																
	1402	400	3125	395	2960	1867	300	8.58	7.16	8.806	6.743																
	1404	480	3625	485	3332	2239	370	10.13	8.71	10.307	8.244																
	1406	"	3800	480	3342	2249	370	10.16	8.74	10.320	8.257																
	1408	"	3790	480	"	"	"	10.16	8.74	10.313 (0.975)	8.250 (-)																

Remarks ② dial gage set on jack piston for creep readings in ( ), decreasing dial gage reading indicates elongation creep, e.g. 2.378 - x + (-0.075) #1

① rebalance strain gage readout bal pot 5.55
" load cell " ch 9, +1000, half bridge

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
ROCK ANCHOR TEST PROGRAM

ROCK ANCHOR LOAD TEST
ANCHOR NO. RD-1

Date	Time	Load Increment (kips)	JACK		LOAD CELL			ELONGATION				ANCHOR ZONE STRAIN													
								PISTON		CALIPER		TELLTALES (in.)								STRAIN GAGES (με)					
												1		2		3		4		1		2		3		4	
			Pressure (lb/in²)	Load (kips)	Reading	Δ Reading	Load (kips)	Reading	Displ (in.)	Reading	Displ (in.)	Rdg.	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Strain	Rdg.	Strain	Rdg.	Strain	Rdg.	Strain
9 Feb	1410	480	3790	480	3342	2249	370	10.16	8.74	10.320 (0.974)	8.257 (0.001)														
	1413	"	3790	480	"	"	"	10.16	8.74	10.327 (0.974)	8.264 (0.001)														
	1415	"	3790	480	"	"	"	10.16	8.74	10.316 (0.974)	8.253 (0.001)														
	1417	"	3790	480	"	"	"	10.16	8.74	10.325 (0.973)	8.262 (0.002)														
	1419	"	3790	480	"	"	"	10.17	8.75	10.327 (0.973)	8.264 (0.002)	2.458	-0.155	2.363	0.075	2.585	0.239	2.479	-0.131	-10	-37	-11	-36	-13	-48	-5	-81
	1429	"zero"	200	20	1285	192	30	2.01	0.59	2.606	0.543														
	1452	400	3150	395	2960	1867	300	8.71	7.29	8.942	6.879														
			start to place wedges to lock off at bottom + reset piston																						

Remarks

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WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
ROCK ANCHOR TEST PROGRAM

ROCK ANCHOR LOAD TEST
ANCHOR NO. RD-1

Date	Time	Load Increment (kips)	JACK		LOAD CELL			ELONGATION				ANCHOR ZONE STRAIN															
								PISTON		CALIPER		TELLTALES (in.)								STRAIN GAGES (με)							
												1		2		3		4		1		2		3		4	
			Pressure (lb/in²)	Load (kips)	Reading	Δ Reading	Load (kips)	Reading	Displ. (in.)	Reading	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Strain	Rdg.	Strain	Rdg.	Strain	Rdg.	Strain
10 Feb	1345	400	3150	395	2845	1752	280	8.88	7.46	8.945	6.882																
	1400	lock off	0	0	1125	32	50	7.50	6.08	—	[5.502]	/															
				reset	piston																						
①	1600	lock off	0	0	1090	0	0	1.79	6.08	2.189	[5.502]	2.570	-0.267	2.370	0.068	2.615	0.209	2.541	-0.193	-10	369	-11	215	-13	194	-5	264
	1615	lift off	2600	320	2592	1499	240	—	—	—	—										-16		-11		-8		-54
	1617	—	3150	395	2877	1784	290	2.96	7.25	2.963	6.276	remove some wedges															②
	1650	400	3275	410	2960	1867	300	3.22	7.51	3.223	6.536																
	1653	480	3810	480	3285	2192	360	4.48	8.77	4.474	7.787																
	1657	400	3190	400	2960	1867	300	3.91	8.20	4.134	7.447																
	1659	480	3825	485	3290	2197	360	4.53	8.92	4.556	7.969																
	1701	560	4425	560	3640	2547	430	5.87	10.16	5.564	9.177																

Remarks ① new initial readings for piston + caliper

② rebalance strain gage readout
bal pot 5.37
rebalance load cell readout
ch 9, +1000, half bridge

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
ROCK ANCHOR TEST PROGRAM

ROCK ANCHOR LOAD TEST
ANCHOR NO. RD-1

Date	Time	Load Increment (kips)	JACK		LOAD CELL			ELONGATION				ANCHOR ZONE STRAIN															
								PISTON		CALIPER		TELLTALES (in.)								STRAIN GAGES (με)							
												1		2		3		4		1		2		3		4	
			Pressure (lb/in²)	Load (kips)	Reading	Δ Reading	Load (kips)	Reading	Displ (in.)	Reading	Displ (in.)	Rdg.	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Strain	Rdg.	Strain	Rdg.	Strain	Rdg.	Strain
10 Feb	1703	560	4425	560	3640	2547	430	5.87	10.16	5.830 (0.977)	9.143 (-)																
	1707	"	4410	560	"	"	"	5.88	10.17	5.877 (0.964)	9.190 (0.013)																
	1712	"	4375	555	3650	2557	430	5.91	10.20	5.879 (0.930)	9.192 (0.034)																
	1715	"	4375	555	3640	2547	430	5.91	10.20	5.868 (0.931)	9.181 (0.033)																
	1720	"	4350	550	"	"	"	5.90	10.20	5.866 (0.932)	9.179 (0.032)	2.453	-0.150	2.304	0.134	2.555	0.269	2.482	-0.134	-10 365	-13	-11 214	-10	-13 175	+11	-5 276	-66
	1726	640	5025	640	4053	2960	510	7.48	11.77	7.405 (0.326)	10.718 (0.051)																
	1728	"	5000	635	"	"	"	7.47	11.76	7.395 (0.333)	10.708 (0.031)																
	1731	"	5000	635	"	"	"	7.49	11.78	7.390 (0.328)	10.703 (0.049)																
	1737	"	5000	635	"	"	"	7.49	11.78	7.406 (0.326)	10.719 (0.051)																
	1739	"	5000	635	"	"	"	7.49	11.78	7.407 (0.326)	10.720 (0.051)																
	1742	"	5000	635	"	"	"	7.48	11.77	7.390 (0.317)	10.703 (0.060)																

Remarks

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
ROCK ANCHOR TEST PROGRAM

ROCK ANCHOR LOAD TEST
ANCHOR NO. RD-1

Date	Time	Load Increment (kips)	JACK		LOAD CELL			ELONGATION				ANCHOR ZONE STRAIN													
								PISTON		CALIPER		TELLTALES (in.)								STRAIN GAGES (με)							
												1		2		3		4		1		2		3		4	
			Pressure (lb/in²)	Load (kips)	Reading	Reading	Load (kips)	Reading	Displ (in.)	Reading	Displ (in.)	Rdg.	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Strain	Rdg.	Strain	Rdg.	Strain	Rdg.	Strain
10 Feb	1748	640	5000	635	+4053	2960	510	7.48	11.77	7.420 (6.323)	10.733 (0.054)	2. 476	-0. 173	2. 290	0. 148	2. 608	0. 216	2. 483	-0. 135	-10 381	-29	-11 228	-24	-13 166	+20	-5 299	-89
	1754	400	3075	385	2960	1867	300	4.15	8.44	4. 655	7.968																
①	1905	400	3050	380	2960	1867	300	4.12	8.41	4. 538	7.851																
	1908	480	3800	480	3342	2249	370	5.03	9.32	4. 998	8.311																
	1910	560	4425	560	3640	2547	430	6.05	10.34	6. 032	9.345																
	1912	640	5025	640	4053	2960	510	7.53	11.82	7. 490	10.803																
	1915	"	4975	630	"	"	"	7.52	11.81	7. 465	10.778									-10 390	-38	-11 236	-32	-13 174	+12	-5 312	-102
	1917	720	5700	720	4500	3407	620	9.19	13.48	9.119 (1.518)	12.432 (-)																
	1922	"	5600	710	"	"	"	9.20	13.49	9.125 (1.511)	12.438 (0.007)																
	1926	"	5675	720	"	"	"	9.20	13.49	9.083 (1.513)	12.396 (0.005)																
	1932	"	5700	720	"	"	"	9.20	13.49	9.130 (1.512)	12.443 (0.006)																

Remarks ① break for dinner

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
ROCK ANCHOR TEST PROGRAM

ROCK ANCHOR LOAD TEST
ANCHOR NO. RD-1

Date	Time	Load Increment (kips)	JACK		LOAD CELL			ELONGATION				ANCHOR ZONE STRAIN														
								PISTON		CALIPER		TELLTALES (In.)								STRAIN GAGES (με)							
												1		2		3		4		1		2		3		4	
			Pressure (lb/in²)	Load (kips)	Reading	Δ Reading	Load (kips)	Reading	Displ. (in.)	Reading	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Strain	Rdg.	Strain	Rdg.	Strain	Rdg.	Strain
10 Feb	1938	720	5625	715	4500	3407	620	9.20	13.49	9.115 (1.512)	12.428 (0.006)	2.411	-0.108	2.277	0.161	2.596	0.228	2.462	-0.114								
			—		—			—	—	9.352 (1.588)	12.428 (0.006)	2.347	-0.108	2.227	0.161	2.593	0.228	2.409	-0.114								
	1948	"	5650	720	"	"	"	9.21	13.50	9.353 (1.586)	12.429 (0.008)																
	1951	"	5700	725	"	"	"	9.20	13.49	9.351 (1.583)	12.427 (0.011)																
	1955	"	5690	725	"	"	"	9.22	13.51	9.359 (1.585)	12.435 (0.009)																
	2000	"	5700	725	"	"	"	9.22	13.51	9.350 (1.584)	12.426 (0.010)																
	2004	400	3025	380	2960	1867	300	4.08	8.37	4.782	7.858																
	2006	440	3300	465	3342	2249	370	5.03	9.32	5.178	8.254																
	2007	560	4250	535	3640	2547	430	6.12	10.41	6.237	9.313																
	2009	640	4875	620	4053	2960	510	7.66	11.95	7.759	10.835																
	2012	720	5650	720	4500	3407	620	9.28	13.57	9.353	12.429	2.748	-0.509	2.273	0.115	2.800	0.021	2.474	-0.199	-10 378	-26	-11 224	-20	-13 137	+49	-5 307	-97

① reset

Remarks ① Tendons approach bottom of telltale readout head.
reset by raising head relative to reference telltale
e.g. 2.347 - x + (-0.108) #1

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
ROCK ANCHOR TEST PROGRAM

ROCK ANCHOR LOAD TEST
ANCHOR NO. RD-1

Date	Time	Load Increment (kips)	JACK		LOAD CELL			ELONGATION				ANCHOR ZONE STRAIN													
								PISTON		CALIPER		TELLTALES (in.)								STRAIN GAGES (με)							
												1		2		3		4		1		2		3		4	
			Pressure (lb/in²)	Load (kips)	Reading	Δ Reading	Load (kips)	Reading	Displ. (in.)	Reading	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Strain	Rdg.	Strain	Rdg.	Strain	Rdg.	Strain
10 Feb	2018	800	6310	800	+ 4968	3875	730	10.90	15.19	10.938	14.014														
	2021	"	6300	800	"	"	"	10.90	15.19	10.935 (1.648)	14.011 (-)														
	2023	"	6275	795	"	"	"	10.92	15.21	10.924 (1.641)	14.000 (0.007)														
	2027	"	6310	800	"	"	"	10.93	15.22	10.935 (1.639)	14.011 (0.009)														
	2029	"	6275	795	"	"	"	10.94	15.23	10.930 (1.640)	14.006 (0.008)														
	2039	"	6275	795	"	"	"	10.94	15.23	10.930 (1.640)	14.006 (0.008)														
	2046	"	6290	800	"	"	"	10.96	15.25	10.933 (1.636)	14.009 (0.012)	2.431	-0.192	2.302	0.086	2.781	0.040	2.512	-0.217	-10 374	-22	-11 220	-16	-12 660	+526	-5 308	-98
	2100	"	6290	800	"	"	"	10.97	15.26	10.982	14.058														
	2200	"	6275	795	"	"	"	10.98	15.27	11.093	14.169														
	2300	"	6300	800	"	"	"	11.02	15.31	11.122	14.198														
11 Feb	0000	"	6310	800	"	"	"	11.05	15.34	11.165	14.241									-10.333	+19	-11 177	+27	-12 552	+634	-5 266	-56

Remarks

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WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
ROCK ANCHOR TEST PROGRAM

ROCK ANCHOR LOAD TEST
ANCHOR NO. RD-1

Date	Time	Load Increment (kips)	JACK		LOAD CELL			ELONGATION				ANCHOR ZONE STRAIN															
								PISTON		CALIPER		TELLTALES (in.)								STRAIN GAGES (με)							
												1		2		3		4		1		2		3		4	
			Pressure (lb/in²)	Load (kips)	Reading	Reading	Load (kips)	Reading	Displ. (in.)	Reading	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Strain	Rdg.	Strain	Rdg.	Strain	Rdg.	Strain
11 Feb	0300	800	6350	805	+ 4968	3875	730	11.05	15.34	11. 183	14.259									-10. 376	-24	-11. 223	-19	-12. 552	+634	-5. 310	-100
	0600	900	6300	800	"	"	"	11.08	15.37	11. 228	14.304									-10. 353	-1	-11. 198	+6	-12. 539	+647	-5. 289	-79
	0657	400	2800	350	+ 2960	1867	300	4.03	8.32	4. 740	7.816									-10. 361	-9	-11. 208	-4	-12. 539	+647	-5. 275	-65
12 Feb	0900	400	2875	360	2960	1867	300	3.50	7.79	4. 220	7.296	①															
	0915	400	3225	405	3109	2016	325	3.76	8.05	4. 337	7.413	②															
		lock off	0	0	1082	0	0	9.82	—	—	—	insert wedges in anchor head, release pressure on jack, remove wedges from stressing head, raise piston & reinsert wedges in stressing head															
		lift off	2675	330	—			10.21	③ (6.98)	—	—																
	1546	400	3250	405	2960	1867	300	11.28	8.05	—	—	remove wedges from anchor head															
	1551	0	0	0	1092	0	0	3.31	0.08	—	—									-10 423	-71	-11 262	-58	-12 660	+526	-5 298	-88

Remarks ① load set based on load cell
② load set based on jack pressure
③ elongation at lift off backfigured from elongation at next 400 k increment

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
ROCK ANCHOR TEST PROGRAM

ROCK ANCHOR LOAD TEST
ANCHOR NO. RD-2

Date	Time	Load Increment (kips)	JACK Pressure (lb/in²)	JACK Load (kips)	LOAD CELL #61375-1 Reading	Δ Reading	Load (kips)	ELONGATION PISTON Reading	PISTON Displ. (in.)	CALIPER Reading	CALIPER Displ. (in.)	ANCHOR ZONE STRAIN — TELLTALES (in.) 1 Rdg.	1 Displ. (in.)	2 Rdg.	2 Displ. (in.)	3 Rdg.	3 Displ. (in.)	4 Rdg.	4 Displ. (in.)	STRAIN GAGES (με) 1 Rdg.	1 Strain	2 Rdg.	2 Strain	3 Rdg.	3 Strain	4 Rdg.	4 Strain
14 Feb	2128	0	0	0	(1093)	—	0	1.26	—	0.763	—									-23		- 3		-9		-13	
																				321	—	651	—	227	—	359	—
	2139	seating	375	40	(170) ②	77	15	2.43	—	1.540	—	2.		2.		2.		2.		-23		-3		-9		-13	
												197	—	330	—	755	—	481	—	314	—	649	—	231	—	362	—
15 Feb	0856	"zero"	200	20	1148	55	10	2.31	0.00	1.998	0.000	2.		2.		2.		2.		-24		-3		-9		-13	
												213	—	328	—	779	—	499	—	373	—	664	—	248	—	380	—
	0858	80	1150	130	1605	512	80	4.85	2.54	4.291 / (1.943)	2.293 / (-)																
	0900	"	1175	135	"	"	"	4.85	2.54	(1.947)	(0.000)																
	0902	"	1190	140	"	"	"	4.84	2.53	(1.943)	(0.000)																
	0904	"	1190	140	"	"	"	4.84	2.53	4.291 / (1.943)	2.293 / (0.000)	1.	0.	1.	0.	2.	-0.	2.	-0.	-24		-3		-9		-13	
												391	822	537	791	814	035	531	032	550	-177	622	42	250	-2	382	-2
	0910	"zero"	225	25	1148	55	10	2.45	0.14	2.167	0.169																
	0912	80	1190	140	1605	512	80	4.79	2.48	4.219	2.221																
	0914	160	2075	255	2107	1014	160	7.12	4.81	6.469 / (1.819)	4.471 / (-)																
	0916	"	2075	255	"	"	"	7.13	4.92	(1.500)	(0.010)																

Remarks: Seating to 375 psi, release to 200 psi & take initial readings

N.B.: 1 strand was broken during installation, this is a 24-strand anchor

① Strain gage readout # 21300, meter +0000
bal pot 5.52, 350 Ω calibrator # 20086
gage factor 2, quarter bridge

② Load cell readout # 2663, meter +1000
ch 2, half bridge

VSL jack eff area 127.6 in²

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
ROCK ANCHOR TEST PROGRAM

ROCK ANCHOR LOAD TEST
ANCHOR NO. RD-2

Date	Time	Load Increment (kips)	JACK		LOAD CELL			ELONGATION				ANCHOR ZONE STRAIN													
								PISTON		CALIPER		TELLTALES (in.)								STRAIN GAGES (με)					
												1		2		3		4		1		2		3		4	
			Pressure (lb/in²)	Load (kips)	Reading	Reading	Load (kips)	Reading	Displ. (in.)	Reading	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Strain	Rdg.	Strain	Rdg.	Strain	Rdg.	Strain
15 Feb	0918	160	2025	250	2107	1014	160	7.13	4.82	(1.808)	(0.011)														
	0920	"	2010	245	"	"	"	7.14	4.83	(1.788)	(0.031)														
	0924	"	2050	250	"	"	"	7.15	4.84	(1.787)	(0.032)														
	0926	"	2050	250	"	"	"	7.16	4.85	(1.786)	(0.033)														
	0929	"	2075	255	"	"	"	7.15	4.84	(1.786)	(0.033)														
	0930	"	2050	250	"	"	"	7.14	4.83	6.502 (1.785)	4.509 (0.034)	0.695	1.528	1.049	1.279	2.772	-0.093	2.591	-0.092	-24 706	-333	-3 485	179	-9 251	-3	-13 393	-3
	0935	Zero	190	20	1148	55	10	2.51	0.20	2.185	0.187														
	0939	80	1190	140	1605	512	80	4.66	2.35	4.049	2.051														
	0939	160	2050	250	2107	1014	160	7.03	4.72	6.290	4.292														
	0944	320	2575	320	2460	1367	220	8.82	6.51	(1.885)	6.071 (-)														
	0949	"	2550	315	"	"	220	8.82	6.51	(1.884)	6.072 (0.001)														

Remarks _____

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
ROCK ANCHOR TEST PROGRAM

ROCK ANCHOR LOAD TEST
ANCHOR NO. RD-2

Date	Time	Load Increment (kips)	JACK		LOAD CELL			ELONGATION				ANCHOR ZONE STRAIN													
								PISTON		CALIPER		TELLTALES (in.)								STRAIN GAGES (με)					
												1		2		3		4		1		2		3	
			Pressure (lb/in²)	Load (kips)	Reading	Δ Reading	Load (kips)	Reading	Displ (in.)	Reading	Displ (in.)	Rdg.	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Strain	Rdg.	Strain	Rdg.	Strain
15 Feb	0950	320	2650	330	2460	1367	220	8.81	6.50	(1.888)	(-0.003)														
	0954	"	2590	320	"	"	220	8.81	6.50	(1.887)	(0.002)														
	0958	"	2675	330	"	"	220	8.80	6.49	(1.887) (1.069)	(-0.002) 6.071	0. 661	1. 552	2. 752	1. 576	2. 963	-0. 184	2. 685	-0. 186	-2.1 766	-593	-3 175	489	-9 218	0	-13 382	-2
	1015	Zero	100	10	1148	55	10	2.49	0.18	2.195	0.167														
	1020	80	1050	120	1605	512	80	4.67	2.36	4.120	2.122														
	1022	160	2000	245	2107	1014	160	7.04	4.73	6.410	4.442														
	1023	320	2700	335	2460	1367	220	8.76	6.45	8.037	6.039														
	1026	400	3175	395	2710	1617	260	9.98	7.67	7.218 (1.918)	7.212 (-)														
	1032	"	3075	385	"	"	"	10.02	7.71	(1.886)	(0.032)														
	1034	"	3200	400	"	"	"	10.01	7.70	(1.892)	(0.026)														
	1036	"	3200	400	"	"	"	10.00	7.69	(1.892)	(0.026)														

Remarks

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WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
ROCK ANCHOR TEST PROGRAM

ROCK ANCHOR LOAD TEST
ANCHOR NO.

Date	Time	Load Increment (kips)	JACK		LOAD CELL			ELONGATION				ANCHOR ZONE STRAIN															
								PISTON		CALIPER		TELLTALES (in.)								STRAIN GAGES (με)							
												1		2		3		4		1		2		3		4	
			Pressure (lb/in²)	Load (kips)	Reading	Reading	Load (kips)	Reading	Displ. (in.)	Reading	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Strain	Rdg.	Strain	Rdg.	Strain	Rdg.	Strain
15 FEB.	1038	400	3190	395	2710	1617	260	10.00	7.69	(1.893)	(0.027)																
	1040	"	3190	395	"	"	"	10.00	7.69	(1.893)	(0.027)																
	1042	"	3150	395	"	"	"	10.01	7.70	(1.893)	(0.027)																
	1044	"	3125	390	"	"	"	10.01	7.70	(1.893)	(0.027)																
Temp = 45°	1046	"	3150	395	"	"	"	10.01	7.70	(1.892)	(0.028)																
	1048	"	3125	390	"	"	"	10.00	7.69	(1.893)	(0.027)																
	1051	"	3125	390	"	"	"	10.01	7.70	(1.896)	(0.024)																
	1053	"	3050	380	"	"	"	10.00	7.69	(1.899)	(0.021)																
	1055	"	3100	390	"	"	"	10.00	7.69	(1.899)	(0.021)																
	1057	"	3000	375	"	"	"	10.00	7.69	9.223 (1.894)	7.225 (0.021)	0.510	1.703	①	(1.576)	①	(-0.184)	2.835	-0.336	-25 168	-795	-2 912	752	-9 249	-1	-13 382	-2
	1105	"	3125	390	"	"	"	9.97	7.66	(1.916)	(0.002)																

Remarks ① TELLTALES CANNOT BE READ DUE TO INSUFFICIENT TRAVEL OF DIAL GAGE

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WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
ROCK ANCHOR TEST PROGRAM

ROCK ANCHOR LOAD TEST
ANCHOR NO. RD-2

Date	Time	Load increment (kips)	JACK		LOAD CELL			ELONGATION				ANCHOR ZONE STRAIN													
								PISTON		CALIPER		TELLTALES (in.)								STRAIN GAGES (με)					
												1		2		3		4		1		2		3		4	
			Pressure (lb/in²)	Load (kips)	Reading	Δ Reading	Load (kips)	Reading	Displ (in.)	Reading	Displ (in.)	Rdg.	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Strain	Rdg.	Strain	Rdg.	Strain	Rdg.	Strain
15 FEB	1110	400	3150	395	2710	1617	260	9.98	7.67	(1.904)	(0.014)														
	1123	"	3150	395	"	"	"	9.97	7.66	(1.913)	(0.005)														
	1145	"	3150	395	"	"	"	9.97	7.66	(1.917)	(0.001)														
	1300	"	3150	395	"	"	"	9.96	7.65	(1.909)	(0.009)														
	1400	"	3200	400	"	"	"	9.96	7.65	(1.877)	(0.041)														
	1500	"	3175	395	"	"	"	9.98	7.67	(1.847)	(0.071)														
	1600	"	3200	400	"	"	"	9.97	7.66	(1.811)	(0.107)	0.511	1.702	—		—		2.764	-0.265						
	1800	"	3150	395	"	"	"	9.99	7.68	(1.768)	(0.149)	0.513 / 1.830	1.700	— / 0.872	(1.576)	— / 0.971	(-0.184)	2.744 / 1.301	-0.245	①					
	2100	"	3150	395	"	"	"	9.98	7.67	(1.732)	(0.186)			①		①									
16 Feb	0000	"	3200	400	"	"	"	10.00	7.69	(1.690)	(0.228)														
	0300	"	3200	400	"	"	"	10.05	7.74	(1.662)	(0.256)														

Remarks ① reference head reset & another dial gage with a longer stem used, new dial gage has decreasing readings for extension, which is opposite from old dial gage; e.g. 1.301 + (-0.245) for #4

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
ROCK ANCHOR TEST PROGRAM

ROCK ANCHOR LOAD TEST
ANCHOR NO. RD-2

Date	Time	Load Increment (kips)	JACK		LOAD CELL			ELONGATION				ANCHOR ZONE STRAIN													
								PISTON		CALIPER		TELLTALES (in.)								STRAIN GAGES (με)					
												1		2		3		4		1		2		3	
			Pressure* (lb/in²)	Load (kips)	Reading	Reading	Load (kips)	Reading	Displ. (in.)	Reading	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Strain	Rdg.	Strain	Rdg.	Strain
16 Feb	0800	400	3100	390	+ 2710	1617	260	10.00	7.69	9.350 (1.678)	7.252 (0.242)	3.531	1.701	0.920	1.624	1.039	-0.116	1.365	-0.181	-26.047	-1674	-2.891	773	-7.319	-69	-13.453	-73
	0900	"	3150	395	"	"	"	9.98	7.67	(1.672)	(0.244)																
	1130	"	3150	395	"	"	"	10.04	7.73	(1.605)	(0.313)	3.530	1.700	0.595	1.299	1.075	-0.080	1.415	-0.131	-26.171	-1798	-2.782	882	-9.201	47	-13.331	49
	1411	"	350	395	"	"	"	10.00	7.69	9.353 (1.628)	7.355 (0.290)	3.530	1.700	0.947	1.651	1.084	-0.071	1.405	-0.141	-26.396	-2023	-2.870	794	-9.298	-50	-13.430	-50
	1420	2e$_v$	200	20	1165	72	15	2.62	0.31	2.255	0.257	3.943	2.113	0.985	1.689	1.266	0.051	1.441	-0.105	-25.724	-1351	-3.307	357	-9.306	-58	-13.435	-55
	1503	400	3150	395	+ 2710	1617	260	7.91	7.60	9.190	7.192																
			insert wedges in anchor-head																								
	1621	400	3100	390	+ 2710	1617	260	9.92	7.61	9.340	7.342	top wedges in anchor head															
		lock off	lower piston to approx 1", seat wedges in stressing head																								
	1638	lift off	2650	325	+ 2472	1379	220	0.86	(6.60)①	0.590	—																
	1702	400	3050	380	+ 2710	1617	260	1.87	7.61	1.435	7.342																

Remarks ① Elongation at lift off back figured from elongation at next 400k increment

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
ROCK ANCHOR TEST PROGRAM

ROCK ANCHOR LOAD TEST
ANCHOR NO. RD-2

Date	Time	Load Increment (kips)	JACK		LOAD CELL			ELONGATION				ANCHOR ZONE STRAIN															
								PISTON		CALIPER		TELLTALES (in.)								STRAIN GAGES (με)							
												1		2		3		4		1		2		3		4	
			Pressure (lb/in²)	Load (kips)	Reading	Δ Reading	Load (kips)	Reading	Displ. (in.)	Reading	Displ (in.)	Rdg.	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Strain	Rdg.	Strain	Rdg.	Strain	Rdg.	Strain
16 Feb	1725	400	3050	380	2710	1617	260	1.88	7.62	1.431	7.338																
	1728	480	3825	480	3135	2042	335	3.80	9.54	3.253	9.160																
	1730	"	3850	485	"	"	"	3.81	9.55	(0.358)	(-)																
	1732	"	3810	480	"	"	"	3.82	9.56	(0.356)	(0.002)																
	1734	"	3850	485	"	"	"	3.83	9.57	(0.355)	(0.003)																
	1737	"	3810	480	"	"	"	3.83	9.57	(0.352)	(0.006)																
	1739	"	3810	480	"	"	"	3.83	9.57	3.260 (8.351)	9.167 (0.007)	3.531	1.701	1.086	1.790	1.169	0.014	1.537	-0.009	-26 584	-2211	-2 505	1159	-9 234	14	-13 365	15
	1743	400	3000	375	2780	1617	260	2.25	7.99	1.991	7.998																
	1745	480	3825	480	3135	2042	335	3.82	9.56	3.330	9.237																
	1747	560	4425	560	3450	2357	370	5.27	11.01	4.702	10.609																
	1749	"	4400	"	"	"	"	5.28	11.02	(4.297)	(-)																

Remarks

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WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
ROCK ANCHOR TEST PROGRAM

ROCK ANCHOR LOAD TEST
ANCHOR NO. RO-2

Date	Time	Load Increment (kips)	JACK		LOAD CELL			ELONGATION				ANCHOR ZONE STRAIN															
								PISTON		CALIPER		TELLTALES (in.)								STRAIN GAGES (με)							
												1		2		3		4		1		2		3		4	
			Pressure (lb/in²)	Load (kips)	Reading	Δ Reading	Load (kips)	Reading	Displ (in.)	Reading	Displ (in.)	Rdg.	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Strain	Rdg.	Strain	Rdg.	Strain	Rdg.	Strain
16 Feb	1753	560	4400	560	3450	2357	390	5.30	11.04	(1.291)	(0.006)																
	1757	"	4400	"	"	"	"	5.31	11.05	(1.298)	(0.009)																
	1759	"	4400	"	"	"	"	5.31	11.05	4.709 (1.286)	10.616 (0.011)	3.531	1.701	1.071	1.775	1.202	0.047	1.520	-0.026	-26 635	-2262	-2 214	1450	-9 234	14	-13 369	16
	1802	400	2975	370	2710	1617	260	2.30	8.04	1.932	7.839																
	1805	490	3625	480	3135	2042	330	3.92	9.66	3.346	9.253																
	1807	560	4375	555	3450	2357	390	5.29	11.03	4.697	10.604																
	1809	640	5025	635	3798	2705	465	6.96	12.70	6.357	12.264																
	1811	"	5010	635	"	"	"	6.96	12.70	(1.952)	(-)																
	1813	"	5025	635	"	"	"	6.97	12.71	(1.945)	(0.007)																
	1815	"	5050	640	"	"	"	6.97	12.71	(1.942)	(0.010)																
	1817	"	5075	645	"	"	"	6.98	12.72	(1.936)	(0.016)																

Remarks

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
ROCK ANCHOR TEST PROGRAM

ROCK ANCHOR LOAD TEST
ANCHOR NO. RD-2

Date	Time	Load Increment (kips)	JACK		LOAD CELL			ELONGATION				ANCHOR ZONE STRAIN													
								PISTON		CALIPER		TELLTALES (in.)								STRAIN GAGES (με)					
												1		2		3		4		1		2		3		4	
			Pressure (lb/in²)	Load (kips)	Reading	Δ Reading	Load (kips)	Reading	Displ (in.)	Reading	Displ (in.)	Rdg.	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Strain	Rdg.	Strain	Rdg.	Strain	Rdg.	Strain
16 Feb	1819	640	5025	635	3798	2705	465	—	—	—	—														
Light wind	1826	"	5000	635	"	"	"	7.00	12.74	(1.993)	(0.019)														
	1828	"	4980	635	"	"	"	6.99	12.73	(1.989)	(0.023)														
	1830	"	4990	635	"	"	"	6.99	12.73	6.364	12.275	3.532	1.702	1.122	1.826	1.091	-0.064	1.520	-0.026	-26	-2489	-1	1945	-9	34	-13	31
	1835	400	2950	370	2710	1617	260	2.32	8.06	2.009	7.916														
	1838	480	3800	480	3135	2042	330	3.95	969	3.383	9.290														
	1839	560	4375	555	3450	2357	390	5.35	11.09	4.757	10.464														
	1842	640	5050	640	3798	2705	465	6.98	12.72	6.365	12.272														
	1844	720	5675	720	4147	3054	545	8.66	14.39	8.013	13.920														
	1846	"	5650	715	"	"	"	8.68	14.42	(1.668)	(-)														
	1848	"	"	"	"	"	"	8.69	14.43	(1.661)	(0.007)														

Remarks

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
ROCK ANCHOR TEST PROGRAM

ROCK ANCHOR LOAD TEST
ANCHOR NO. RD-2

Date	Time	Load Increment (kips)	JACK		LOAD CELL			ELONGATION				ANCHOR ZONE STRAIN													
								PISTON		CALIPER		TELLTALES (in.)								STRAIN GAGES (με)					
												1		2		3		4		1		2		3		4	
			Pressure (lb/in²)	Load (kips)	Reading	Δ Reading	Load (kips)	Reading	Displ. (in.)	Reading	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Strain	Rdg.	Strain	Rdg.	Strain	Rdg.	Strain
16 FEB	1850	720	8650	715	4147	3054	545	8.69	14.43	(1.656)	(0.012)														
	1852	"	"	"	"	"	"	8.69	14.43	(1.660)	(0.008)														
	1854		"	"	"	"	"	8.71	14.45	(1.654)	(0.014)														
	1856	"	"	"	"	"	"	8.71	14.45	(1.653)	(0.015)														
	1858	"	5625	715	"	"	"	8.71	14.45	8.026	13.933	3.531	1.701	1.051	1.755	1.046	-0.109	1.495	-0.051	-27 591	-3218	-1 160	2504	-9 202	46	-13 379	42
	1904	480	2900	360	+ 2710	1617	260	2.32	8.06	2.021	7.928														
	1907	480	3750	475	+ 3135	2042	330	3.99	9.73	3.445	9.352														
	1909	560	4350	550	3450	2357	390	5.42	11.16	4.855	10.762														
	1911	640	5010	635	+ 3798	2705	465	7.04	12.78	6.442	12.349														
	1913	720	5625	715	4147	3054	545	8.69	14.43	8.041	13.948														
	1916	800	6325	800	4550	3407	625	10.44	16.18	9.717	15.624														

Remarks

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
ROCK ANCHOR TEST PROGRAM

ROCK ANCHOR LOAD TEST
ANCHOR NO. RD-2

Date	Time	Load Increment (kips)	JACK		LOAD CELL			ELONGATION				ANCHOR ZONE STRAIN															
								PISTON		CALIPER		TELLTALES (in.)								STRAIN GAGES (με)							
												1		2		3		4		1		2		3		4	
			Pressure (lb/in²)	Load (kips)	Reading	Δ Reading	Load (kips)	Reading	Displ. (in.)	Reading	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Strain	Rdg.	Strain	Rdg.	Strain	Rdg.	Strain
16 Feb	1918	800	6325	800	4500	3407	625	10.50	16.24	(1.636)	(-)																
	1920	"	6300	800	"	"	"	10.50	16.24	(1.612)	(0.024)																
	1922	"	6300	800	"	"	"	10.51	16.25	(1.606)	(0.030)																
	1924	"	6325	800	"	"	"	10.52	16.26	(1.598)	(0.038)																
	1926	"	6310	810	"	"	"	10.54	16.28	(1.581)	(0.055)																
	1928	"	6300	800	"	"	"	10.54	16.28	(1.579)	(0.057)																
	1930	"	6275	795	"	"	"	10.55	16.29	9.791	15.698	3.	1.	0.	1.	0.	-0.	1.	-0.	-28		-1		-9		-13	
										(1.578)	(0.058)	531	701	924	628	983	172	417	129	545	-4172	012	2652	232	16	380	0
	1934	400	2950	370	2710	1617	260	2.29	8.03	2.020	7.927	2.	0.	0.	1.	1.	-0.	1.	-0.	-27		-1		-9		-13	
												000	170	991	695	112	043	450	096	932	-3559	810	1924	242	6	386	-6
	2215	400	2855	355	2700	1613	260	2.28	8.02	1.900	7.807																
	2221	lock off	0	0	1110	17	0	0.68	6.42	0.795	6.702									-28		-2		-9		-13	
																				710	-1337	084	1580	262	-14	407	-27
	2255	re set	0	0	1082	-11	0	8.80	6.42	8.751	6.702																

Remarks

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
ROCK ANCHOR TEST PROGRAM

ROCK ANCHOR LOAD TEST
ANCHOR NO. RD-2

Date	Time	Load Increment (kips)	JACK		LOAD CELL			ELONGATION				ANCHOR ZONE STRAIN													
								PISTON		CALIPER		TELLTALES (in.)								STRAIN GAGES (με)							
												1		2		3		4		1		2		3		4	
			Pressure (lb/in²)	Load (kips)	Reading	Reading	Load (kips)	Reading	Displ. (in.)	Reading	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Displ. (in.)	Rdg.	Strain	Rdg.	Strain	Rdg.	Strain	Rdg.	Strain
16 Feb	2256	lift off ①	2750	340	2507	1414	225	9.37	6.99	8.874	6.825														
	2258	400	3100	390	2710	1617	260	10.25	7.87	9.621	7.572	2.222	0.392	1.022	1.726	1.247	0.092	1.584	0.038	-28 996	-4623	-2 027	1637	-9 213	35	-13 358	22
	2322	"To"	100	10	1148	55	10	2.62	0.24	2.257	0.208	1.987	0.157	0.954	1.658	1.208	0.053	1.438	-0.108	-28 796	-4423	-3 094	570	-9 206	42	-13 356	24
	2325	0	0	0	1100	7	0	2.04	-0.34	2.035	-0.014	1.941	0.111	0.940	1.644	1.114	-0.041	1.380	-0.166	-28 752	-4379	-3 136	528	-9 206	42	-13 358	22

Remarks ① Ironworker assisting with test was not sure whether initial lift-off occurred earlier than when he noted it.

PHASE IV REPORT

VOLUME VA

RESULTS AND INTERPRETATION OF ROCK ANCHOR TEST PROGRAM

APPENDIX B

DRILLING PRODUCTION LOGS

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ROCK ANCHOR TEST
DRILLING PRODUCTION LOG
ANCHOR RP-1

DATE	DESCRIPTION OF ACTIVITY	COMPLETED DEPTH ft
27 Nov	start drilling first section of casing; hammer plugs at 40 ft; pull hammer and casing for repair	0
28 Nov	restart drilling; complete third section on day shift and fifth section on night shift; weld sixth section	120
29 Nov	continue drilling; complete eighth section seating casing 3 ft into rock; pull ODEX tools from hole	182
30 Nov	insert rock bit; cut 5-in.-dia socket into rock for 15 ft plus 3 ft extra for reference telltale; rate of drilling rock averaged 0.1 ft/min	200
1 Dec	install anchor tendon and grout; start to pull casing	
2 Dec	complete pulling casing; move drill rig to next hole	

Note: The above drilling production sequence was taken from Daily Field Reports. The field log forms were not used for this anchor hole

ROCK ANCHOR TEST LOG

Anchor No. RD-1 | Batter 45° | Supervisors 1

Date 1/10/79 | G.S. Elev ± 420.6 | Operators 1 oiler 1, Welder: 2

Observer D. T. TSO | Weather SNOWING | Laborers 2

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
0	7:00 to 10:00					▲ Crew stood by for casing shoe to be checked by X-Ray. (See shift report).
19'6"	10:00 to 11:00	Grey clayey silt	Gage not working.	Down the hole DOEx bit w/ reamer & hammer.	0.2 ft/min	▲ This 19'6" was through 50' ft predrilled hole.
19'6"	11:30 to 17:30					▲ Setting up the 2nd section on rig. Beveling & welding on progress.
						productive time 7½ hrs

B-2

ROCK ANCHOR [illegible]ST LOG

Anchor No. RD-1 | Batter 45° | Supervisors 1

Date 1/11/12/79 | G.S. Elev 420.6 ± | Operators 1-1 driller {2 welders = NOT 2100 2300}

Observer L Isette | Weather Snowing 0°F | Laborers 3

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
19'6" TIP END	day Shift			Down The Hole apex bit with Reamer and Hammer		on 1/10/79 Predrilled To 50 FT between 0400 hrs and 0700 hrs. I LEFT site 0400 hrs They were still setting up Rig down L. I.
44'6" TIP END	1945 hrs	Gray To brown fine To med sand w/Trace silt.	gage Not working	11	1945 hrs To 2020 hrs	went very good. Beveling Top end casing in ground at 2330 hrs. Start Setting 3rd Sec for welding at 0010 hrs. complete welding and grinding at 0400 hrs
69'6" TIP END	0505 hrs	Gray To brown fine To med sand w/Trace silt.	gage NOT working	11	0505 hrs To 0523 hrs	3rd Sec went down easy air Pressure gage not working figure air Pressure approx 100-120 PSI
					0.7 Ft/min	productive time 10 hrs
					1.4 Ft/min	

B-3

ROCK ANCHOR TEST LOG

Anchor No. RD-1 | Batter 45° | Supervisors _____

Date 1/12/79 | G.S. Elev ± | Operators _____

Observer D.T. Tso | Weather _____ | Laborers _____

	Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
7'6" stick up	69'6"	7:00 s 11:40	/	/	/	/	▲ 7:00 ~ 11:40 Welding and grinding the 4th section of casing.
	~~89'6"~~	11:50 s 12:30	/	/	/	/	▲ Lunch break.
	69'6"	12:30 s 14:00	/	/	/	/ (-1½ hrs)	▲ Crew stood by for the welding to be checked by X-Ray. ▲ X-Ray showed the welding is OK but lacking of penetration due to the insufficient gap.
7'6" stick up	94'6" ~~95'6"~~	14:00 s 14:45	Gray fine to coarse SAND graded w/ fine gravel. trace lignite med. gravel.	170 psi		0.8 ft/min	▲ Drilling started at 14:15 and completed at 14:45.
	"	14:45 s 15:10	/	/	/	/	▲ To disconnect the discharge hose from the crane so that it could work for DP test.
	"	15:10 s 17:30	/	/	/	/	▲ Crane broke down at DP test area due to a worn-out polly. ~~It~~ The polly was replaced at 17:20.
					productive time 6 hrs	(-2½ hrs)	so no work was done between 15:10 to 17:30 (Crane is needed to set up the 5th section.)

ROCK ANCHOR ...ST LOG

Anchor No. RD-1 | Batter 45° | Supervisors 1

Date 1/12/13/79 | G.S. Elev 422.6 ± | Operators 1+1 oiler 2 welders

Observer L Isetts | Weather Cloudy + Rain 30°26° | Laborers 3

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
						1445hr To 1900hr crane used [illegible]
7'6" stick up 94'6" Tip End	1900hr	Gray fine To coarse SAND graded w/ fine gravel. Trace Lignite w/ Trace silt.			14:15 day To shift 14:45	1900hr setting up for 5th sec bevleing welding grinding finish at 2300hr weld Looks Real good.
7'3" stick up 119'9"	0102hr	Gray fine To coarse Sand w/ fine To medium Gravel w/ Lignite Particle. Trace silt	approx 120	ODEX Bit And Reamer	0102 hr To 0130 hr.	went down easy - head was Trying To come off [illegible] approx 106 ft had a very heavy water return Threw discharge Line To depth of 119'6"
7'3" stick up 144'9"	0510hr	Gray Fine Gravel To fine/med Sand To Lignite Pebbles - deposits.	approx 120	〃	0510 hr To 0615 hr	fine gravel To approx 131'9" Then To fine To med SAND To 141'9" Then Lignite Pebbles To 144'9" Very hard Drilling for last 3 ft Water return [illegible] at This Point.
					→ 0.9 ft/min	productive time 10 hrs
					→ 0.4 ft/min	

B-5

ROCK ANCHOR TEST LOG

Anchor No. RD-1. Batter 45° Supervisors

Date 1/13/79 G.S. Elev ± 422.6 Operators

Observer D.T. Tso Weather SNOWING Laborers

	Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
	144'9"	7:00 ∫ 11:50					▲ 7:00 – 11:50 Welding + grinding the 7th section.
		11:50 ∫ 12:30					▲ Lunch break.
		12:30 ∫ 13:00					▲ To get ready for drilling.
		13:00 ∫ 13:25					▲ Blowing the line.
7'1" stick up	144'9" ∫ 167'11"	13:25 ∫ 14:00	Gray med. to coarse SAND, trace fine gravel, lignite.	120	QDEX bit + reamer	0.7 ft/min	▲ To drill the 7th section
		14:00 ∫ 17:25					▲ To set up the 8th section ▲ Welding and grinding finished at 17:00
	167'11" ∫ 184'7"	17:25 ∫ 18:00	Gray fine to coarse SAND graded w/ fine gravel. trace lignite	120	"	0.5 ft/min (1st 4' into rock)	▲ Bottom of the hole is at 184'7" ▲ Casing was sit into bedrock for ~4'.
			Limestone bedrock at 180'7"				productive time 11 hrs

B-6

Rock Anchor Test Log RD-1

shift	work performed	remarks
13/14 Jan	pull drillrods 1930 to 2345	productive time 4.25 hrs
14 Jan	Sunday	
15 Jan	no work at site	

ROCK ANCHOR TEST LOG

Anchor No. RD-1 | Batter 45° | Supervisors _____

Date 1/16/79 | G.S. Elev ± 422.6 | Operators _____

Observer R.L. MOBERLY | Weather COLD; PL. CLOUDY | Laborers _____

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
184'7"	7:00 / 9:20					REMOVING LAST 2 SECTIONS OF DRILL ROD.
	9:20 / 10:00					CHANGE BITS; SWITCHED TO 6" DIA
	10:00 / 11:40					LOWER DRILL TOOLS INTO HOLE. @135' IN HOLE
	11:40 / 12:40					LUNCH
184'7"	12:40 / 1:45					LOWER REMAINDER OF TOOLS IN HOLE. SET UP TO START ROCK DRILLING
202'7"	1:50 / 2:35	LIMESTONE - may be weathered BETWEEN 198'-201'	200 psi	6" DIA. CROSS BIT	45 min/18' 0.4'/min	DRILL ROCK "SOCKET" 18'6" FROM BOTTOM OF HOLE (184'7") DRILL FLUID TURNED BROWN FROM 198' to 201'
	2:35 / 3:00					FLUSH HOLE - CLEAN WATER RAN FOR 10 min
	3:00 / 5:[illegible]	Bottom of Hole - 202.6'		production	time 11 hrs	EXTRACT RODS & BIT [illegible]

B-8

ROCK ANCHOR TEST LOG

Anchor No. RD-1 Batter _____ Supervisors _____

Date 1/17-79 G.S. Elev _____ Operators _____

Observer NONE Weather _____ Laborers _____

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
						~~[illegible]~~ NO WORK

B-9

ROCK ANCHOR TEST LOG

Anchor No. RD-1 Batter _____ Supervisors _____

Date 1-17-79 G.S. Elev _____ Operators _____

Observer R.L. McBeth Weather _____ Laborers _____

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
	1130 to 2300	(less ½ hr dinner)				INSTALLING ANCHOR
						productive time 11 hrs

B-10

ROCK ANCHOR TEST LOG

Anchor No. 1 RO-1 Batter _____ Supervisors _____

Date 1-18-79 G.S. Elev _____ Operators _____

Observer R.L. Mosley Weather _____ Laborers _____

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
	7:00 / 11:30					PREPERATION FOR & INJECTION OF PRIMARY GROUT.
	11:30 / 12:15					LUNCH
	12:15 / 1:00					PREPERATION FOR PULLING 1ST CASING
	1:00 / 2:30					PULLED 1ST CASING
	2:30 / 3:30					CUT & REMOVE 2ND CASING
	3:30 / 4:30					PULLED 2ND CASING
	4:30 / 6:35					CUT & BEGAN TO REMOVE 2ND CASING
	6:35					LEFT FOR SHIFT CHANGE productive time 11 hrs

B-11

ROCK ANCHOR TEST LOG

Anchor No. RD-1 (Pulling)　　Batter 45°　　Supervisors ______

Date 1/18~1/19/79　　G.S. Elev ± 420.6　　Operators ______

Observer D.T. Tso　　Weather Freezing Rain　　Laborers ______

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
	19:55 ~ 20:15	} 2.3 hrs				△ 7:55 started to mix grout. Welder was welding hooks on the upper part.
	20:15 ~ 20:25					△ Tried to pump secondary grout into casing but failed. There might be some bent on grout hose and the trapped air was resisting pumping.
	20:25 ~ 22:15					△ Grout was injected into casing from the top. It took about 90 gals. of grout to fill up the annular space between casing + sheath.
	22:15 ~ 23:40					△ No work was done. △ 11:00~11:40 Lunch break.
	23:40 ~ 1:20	} 1.7 hrs				△ To pull up a 25' Aeclum and leave it on the head of the rig. [illegible] knocked off at 1:20 due [illegible] conditions. [illegible] time 1.0 hrs

ROCK ANCHOR TEST LOG

Anchor No. RD-1 (pulling casing) Batter _____ Supervisors 1/2

Date 1-19-99 G.S. Elev _____ Operators 1 op. 1 oiler

Observer R.L. MOBERLY Weather _____ Laborers 2

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
	7:00 / 9:30					NO ACTIVITY DUE TO ICE ON EQUIPMENT.
	9:30 / 10:30					REMOVING ICE FROM RIG
	10:30 / 11:35					Removing 3rd CASING
	11:35 / 12:15					LUNCH
	12:15 / 2:30					PREPERATION FOR PULLING 4th CASING & Rilling
	2:30 / 3:50					SHOVING CASING CLEAN W/ CONCRETE PAD
	3:50 / 4:10					BREAK DOWN RIG & MOVED OFF HOLE
						production time 5 hrs

B-13

ROCK ANCHOR TEST LOG

Anchor No. RD-2 Batter 45° Supervisors

Date 1-17-79 G.S. Elev ≈ 422.6 Operators

Observer R L MOBERLY Weather PC. CLOUDY Laborers

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
0 / 20.0		PREVIOUSLY DRILLED				THIS PORTION OF HOLE COMPLETED ON NIGHT SHIFT W/O WGC INSPECTION HOLE REDRILLED TO 50' ±
20.0'	7:00 A / 7:45 A					SHIFT CHANGE FUEL RIG & EQUIPMENT
20.0'	7:45 A / 10:15 A					REPAIR HYD. HOSE & AIR COUPLER
20.0'	10:15 A / 1:00 P					WELD 2nd CASING PERIODIC DELAYS CAUSED BY USE OF CHERRY PICKER FOR INSTALLATION OF RD-1 ANCHOR
20.0'	4:00 PM / 5:30 P					STAND BY - WAITING FOR CHERRY PICKER
20.0' / 45.0	5:30 P / 5:50		120-250	OPEN BIT 168mm.	20' IN 1.25 F/min	DRILLING 2nd CASING
45.0'	5:30 / [illegible]					STAND-BY - WAITING FOR CHERRY PICKER - CONCRETE WAS PLACED UNTIL AM INSTALLATION OF RD-1 ANCHOR

ROCK ANCHOR TEST LOG

Anchor No. RD-2 | Batter 45° | Supervisors 1

Date 1-17/18-79 | G.S. Elev ± 420.6 | Operators 1 Oiler, 1 welder 2 Crane operator 1

Observer J. Keck | Weather clear, damp, cold | Laborers 3, Carpenters 2

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
45.0' to 70.0'	06:21 to 06:37	Sand		Odex Bit	15 minutes 1.7 Ft/min	Slight grinding noise was heard at sight sites as weld when drilling started

B-15

ROCK ANCHOR TEST LOG

Anchor No. RD-2 Batter 45° Supervisors

Date 1-18-79 G.S. Elev 420.6 ± Operators

Observer R.L Weather HAZY - COLD 15°± Laborers

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
70.0'	7:00 / 8:00					SHIFT CHANGE - PUT EQUIPMENT & PREPARE 4TH PIECE of CASING
70.0'	8:00 / 12:00±					SET & WELD 4TH CASING
70.0'	12:00± / 12:45±					LUNCH
70.0'	12:45± / 3:00 P					WELD 4TH CASING
70.0'	3:00 / 3:20					RIG STAND BY FOR X-RAY of 4TH WELD
70'	3:20 / 5:00					COULD NOT GET CIRCULATION (SEE DAILY REPORT)
70'	5:30 / 6:00					CUTTING 4TH CASING OFF BIT & RODS COULD NOT BE REMOVED STARTED REAMING REMAINING CASING
	6:00 / 6:35					PULL 3RD CASING

B-16

ROCK ANCHOR TEST LOG

Anchor No. RD-2 | Batter 45° | Supervisors

Date 1/18 ~ 1/19/79 | G.S. Elev ± 420.6 | Operators

Observer D. T. Tso | Weather Freezing Rain | Laborers

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
	7:00 s 7:40					@ 7:40 3rd casing was pulled out and cut from 2nd section. ~ 8:00 Freezing rain started
1	7:40 s 8:30					8:30 2nd section was pulled out and cut from 1st section.
	8:30 s 9:25					9:25 1st section was pulled out.
	9:25 s 11:00					9:25 ~ 10:10 To take bit & reamer off from drilling rod. Fine to med. sand, trace fine gravel jammed up between rod & casing. 10:10 ~ 11:00 To separate reamer from bit, same material jammed between. they were then cleaned up
	11:00 s 11:40					Lunch break.
	11:40 s 7:00					No work was done because of the hazardous working condition. (slippery everywhere).

ROCK ANCHOR TEST LOG

Anchor No. RD-2 Batter _____ Supervisors 1/2

Date 1-19-79 G.S. Elev _____ Operators 1

Observer R. MOBERLY Weather _____ Laborers 3

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
0	7:00 A / 8:00					DOWN DUE TO ICE ON COMP Bit & CASING out of Hole & CLEANED ON NIGHT SHIFT
	8:00 / 9:30					REMOVING ICE FROM RIG
	9:30 / 11:35					ATTEMPTING to Get HAMMER WORKING - PROBABLY PLUGGED W/ SAND NOT COMPLETELY CLEANED DURING NIGHT SHIFT
	11:35 A / 12:15 P.					LUNCH
	12:15 / 4:00					CLEANING HAMMER & CASING
0 / 20'	4:00 P / 4:10	OPEN HOLE	0	ODEX 165 mm	1Dmin 2.0 FT/min	STARTED 12" CASING INTO HOLE CASING LENGTH 27.0'.
20'	4:10 / 6:35				in predrilled clay	PREPERATION of 2nd CASING FOR WELDING
20'	6:35					LEFT RIG FOR SHIFT CHANGE

B-18

ROCK ANCHOR TEST LOG

Anchor No. RD-2 Batter 45° Supervisors 1

Date 1/19~1/20/79 G.S. Elev _____ Operators 1 Oiler: 1

Observer D. T. Tso Weather _____ Laborers 6 Welder: 2

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
	19:00 ∫ 19:30					▲ SHIFT CHANGE.
	19:30 ∫ 22:35					▲ Welding and grinding of 2nd section ▲ Preparation for drilling.
20' to bottom of bit 54'6"	22:35 ∫ 23:05	Grey fine to med. SAND. trace coarse sand	0	ODEX 165 bit.	30 min 1.15 ft/min in predrilled sand	▲ Advancing the casing from 20' to 54'6" ▲ Casing was driven in by hammer very easily. Not much of cuttings came out but blow was good.
	23:05 ∫ 23:45					▲ Lunch break.
	23:45 ∫ 1:10					▲ Loading the 3rd section of casing ▲ Preparation for welding.
	1:10 ∫ 3:00					▲ Welding + grinding of the 3rd section.
	3:00 ∫ 3:40					▲ Lunch break.

ROCK ANCHOR TEST LOG

Anchor No. RD-2. Batter _____ Supervisors _____

Date 1/19 ~ 1/20/79 G.S. Elev _____ Operators _____

Observer D.T. Tso Weather _____ Laborers _____

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
54.5' to bottom of bit	3:40 ~ 4:08					▲ Preparation for drilling.
75'	4:08 ~ 4:37	Grey med. to coarse SAND. trace fine gravel, lignite.	Gage was broken	ODEX 165 bit	29 min 0.6 ft/min in gravel filled sand	▲ Drilling the 3rd section. ▲ Blow as good Normal amount of cuttings.
"	4:37 ~ 6:05					▲ Loading 4th section of the casing onto the rig and setting up. ▲
"	6:05 ~ 6:35					▲ Welded line up the casing and point welded it.

B-20

ROCK ANCHOR TEST LOG

Anchor No. RD-2 | Batter 45° | Supervisors BRYAN

Date 1-20-79 | G.S. Elev 420 | Operators

Observer R. L. MOBERLY | Weather HAZY 35° | Laborers

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
70.5'	7:00A / 9:45			ODEX 165		WELDING 4TH CASING
	9:45 / 10:15	(- 1/2 hr)				WAITING FOR WELDING SHED TO BE MOVED
70.5 / 95.0	10:15 / 11:00±				45min 0.5 ft/min	DRILL 4th SECTION OF CASING
	11:00 / 11:45					PREPERATION OF 5TH CASING
	11:45 / 12:30P					LUNCH
	12:30 / 3:35					WELDING 5th CASING
	3:35 / 4:00	(- 1/2 hr)				WAITING TO MOVE SHED
	4:00 / 4:15		250		15 min see next pg.	DRILL 5TH CASING (ONLY 10')

B-21

ROCK ANCHOR TEST LOG

Anchor No. RD-2
Date 1-20-79
Observer RL MOBERLY

Batter
G.S. Elev
Weather

Supervisors
Operators
Laborers

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
	4:15 – 4:55	(~0.7hr)				LABOR DISPUTE ABOUT WHO MOVES SHED. CARP. (WON)
to 119'7"	4:55 – 5:10	GRAY, FINE TO MED SAND W/ SOME GRAVEL	250	ODEX 165	15 min (1.88'/min)	DRILL 5TH CASING (LAST 10') ROTATION 26 RPM
	5:10 – 6:00				total 30 min for 24.6 Ft 0.8 Ft/min	PREPARE 6TH CASING
	6:00 – 6:35					PARTIALLY WELD 6TH CASING
	6:35					LEFT RIG FOR SHIFT CHANGE

ROCK ANCHOR TEST LOG

Anchor No. RO-2 Batter 45° Supervisors _____

Date 1/20 ~ 1/21/79 G.S. Elev _____ Operators _____

Observer D.T.TSO Weather _____ Laborers _____

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
	19:00 ∫ 19:30					▲ SHIFT CHANGE.
1	19:30 ∫ 20:40					▲ WELDING & GRINDING THE 6TH SECTION OF CASING.
	20:40 ∫ 21:05	(-½ hr)				▲ WAITING FOR CARPENTERS TO MOVE AWAY THE SHED USED IN WELDING
119.6 to 144.5'	21:05 ∫ 22:45	GREY FINE TO COARSE SAND GRADED WITH FINE GRAVEL, TRACE MED. GRAVEL, LIGNITE.		ODEX 165 BIT	40 min (1hr less due to equip pblms)	▲ DRILLING THE 6TH SECTION. ▲ THE FLUSHING HEAD WAS BLOWN OFF DURING DRILLING. LABORERS
					0.6 ft/min	SPENT HALF HOUR TO PUT IT BACK. IT WAS HARD TO HOLD IT ON POSITION, THE OPERATOR HAD THE
						WELDER TO WELD A HOOK ON THE R.C. BLOCK SO THAT THE HEAD COULD BE TIED TO THE HOOK W/OUT
						BEING BLOWN OFF DURING DRILLING. THE WELDING SPENT ANOTHER HALF HOUR

ROCK ANCHOR TEST LOG

Anchor No. RD-2 | Batter _____ | Supervisors _____

Date 1-20-21-79 | G.S. Elev _____ | Operators _____

Observer D.T. TSO | Weather _____ | Laborers _____

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
144.5	22:55 S 23:35					▲ LUNCH BREAK. ▲ DURING BREAK, THE RIG KEPT THE BLOWING. AT ABOUT 23:30, THE
1						FLUSHED OUT MATERIAL CHANGED TO MED. TO COARSE SAND, GRADED WITH FINE TO MED. GRAVEL, TRACE LIGNITE.
	23:35 S 3:00					▲ LOADED THE 7TH SECTION OF CASING TO THE RIG. ▲ WELDED + GRINDED THE 7TH SECTION
	3:00 S 3:40					▲ LUNCH BREAK.
144.5 to 169.5'	3:40 S 6:10				150 min 0.2 ft/min	▲ DRILLED THE 7TH SECTION INTO GROUND
	6:10 S 6:20					▲ LABORERS TOOK HEAD FROM THE LAST PIECE OF CASING SO THAT A HOSE COULD BE INSERTED IN
						TO INFILL WATER.

ROCK ANCHOR TEST LOG

Anchor No. RD-2 | Batter _____ | Supervisors _____

Date 1-22-79 | G.S. Elev _____ | Operators _____

Observer R.L. McBERLY | Weather CLEAR - RELATIVE MOIST + 30° | Laborers _____

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
170'0"	7:00A to 8:00					SHIFT CHANGE, FUEL, WARM UP EQUIPMENT etc
	8:00 to 9:00					FLUSHING HOLE - PREPAIR TO CASING
	9:00 to 11'45					GETTING & WELDING TO CASING
	11:45 to 12:30P					LUNCH
	12:30 to 1:00					SETTING UP TO START DRILLING
170'0" 175'6"	1:00 to 1:06±	MED TO COARSE SAND W/ GRAVEL	250±	ODEX 165	13 min / 8'	Top of Rock = 175'6"
175'6" to 178'0"	1:06± to 1:13	Limestone	"	"	16'/min	
178'0"	1:13 to 6:00					CUT OFF EXCESSIVE CASING & REMOVE DRILL RODS & PUT 6" ROCK PLUG ON TOP

B-25

ROCK ANCHOR TEST LOG

Anchor No. RD-2 Batter _____ Supervisors _____

Date 1-22-79 G.S. Elev _____ Operators _____

Observer R.L. MOISEEVV Weather _____ Laborers _____

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
178' 0"	6:00 / 6:35					LOWER DRILL RODS W/6" BIT
	6:35P					LEFT RIG FOR SHIFT CHANGE

B-26

ROCK ANCHOR TEST LOG

Anchor No. RD-2 Batter _____ Supervisors _____

Date 1/22~1/23/79 G.S. Elev _____ Operators 1, aler:1

Observer D.T. Bo. Weather _____ Laborers 3

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
190'	19:00 ~ 21:07					▲ Adding rods to lower down bit to the bottom of the hole.
	21:07 ~ 23:57				(-1hr)	▲ Preparation for drilling. ▲ 21:17~22:12 cherry picker was not available, crew stood by.
						▲ 23:00 ~ 23:40 Lunch break.
191'9" B.o.H.	23:57 ~ 0:27	Limestone				▲ Drilling the rock socket. 0~1 ft 23:57 ~ 0:00. 1~1.9 ft 0:00 ~ 0:02 1.9~3.05 ft 0:02 ~ 0:03 3.05~4.05 ft 0:03 ~ 0:04 4.05~5.05 ft 0:04 ~ 0:06 5.05~6.05 ft 0:06 ~ 0:08 6.05~7.05 ft 0:11 ~ 0:13 7.05~8.05 ft 0:13 ~ 0:15 8.05~9.05 ft 0:15 ~ 0:17 9.05~10.05 ft 0:17 ~ 0:19 10.05~11.05 ft 0:19 ~ 0:20.5 11.05~12.05 ft 0:20.5 ~ 0:22.5 12.05~13.05 ft 0:22.5 ~ 0:24.5 13.05~13.9 ft 0:24.5 ~ 0:26.5
				27 min for 13.9' 0.5 ft/min	0:08~0:11 stopped to foot mark the rod	

ROCK ANCHOR TEST LOG

Anchor No. RD-2 | Batter _____ | Supervisors _____

Date 1/22-1/23/79 | G.S. Elev _____ | Operators 1, Oiler: 1

Observer D.T. Bo. | Weather _____ | Laborers 3.

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
	0:27 ↓ 1:00					▲ Flushing clean the hole. Very clean water came out from 0:40.
	1:00 ↓ 5:30					▲ Extracting rods + bit. ▲ 3:00 – 3:40 Coffee break. ▲ Rig was pulled away from the hole @ 5:30.

B-28

ROCK ANCHOR TEST LOG

Anchor No. RD-2 Batter _____ Supervisors _____

Date 1-23-79 G.S. Elev _____ Operators _____

Observer R. MOBERLY Weather RAIN CHANGING TO SNOW 30° ± Laborers _____

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
191'9"	7:00 A. / 9:00					SHIFT CHANGE - FUEL & SETTING UP ON HOLE OIL FLOATING ON top of WATER
	9:00 / 11:35					ON ARRIVAL WANTED TO RE-FLUSH HOLE & SOCKET LOWER RODS INTO HOLE
	11:35 / 12:25±					LUNCH
	12:25 P. / 1:30					SETTING RODS & PREPARING TO FLUSH
	1:30 / 2:20					FLUSHING HOLE - CONSIDERABLE ROCK DRILL OIL HYDRAULIC OIL CAME OUT FOR 1ST 5 MIN. 45 MIN of FLUSHING PRODUCED CLEAN WATER
	2:20 / 3:15					PULLING RODS
	3:15 / 6:35					STAND-BY.

ROCK ANCHOR TEST LOG

Anchor No. RO-2 Batter _____ Supervisors _____

Date 1-25-79 G.S. Elev _____ Operators _____

Observer R.L. MOBELLY Weather 10° AM 25° PM Laborers _____

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
191'9"	7:00A / 11:35					RIG BROKE DOWN. REPAIR ON RELIEF VALVE.
	11:35 / 12:45P					LUNCH
	12:45 / 1:30					REPAIRS
	1:30 / 6:30					RIG MOVED OFF HOLE STAND-BY

B-30

ROCK ANCHOR TEST LOG

Anchor No. ~~RD-2~~ RD-2 Batter _____ Supervisors _____

Date 1-26-79 G.S. Elev _____ Operators _____

Observer R. LIMOBERRY Weather _____ Laborers _____

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
19'9"	7:00 / 8:30	(-1½ hrs)				STAND BY
	8:30 / 11:35					INSTALLING ANCHOR
	11:35 / 12:35	5.75 hrs				LUNCH
	12:35 / 3:15					INSTALLING ANCHOR
	3:15 / 5:30					SET RIG BACK OVER HOLE - SET UP GROUT PLANT
	5:30 / 6:00					FLUSH TUBING - ≈ 50 GAL WATER PUMPED
	6:00 / 6:20					GROUTING ~~AT~~
	6:20 / 6:25					REPAIR FUEL FILTER

ROCK ANCHOR TEST LOG

Anchor No. 1

Batter _____

Supervisors _____

Date _____

G.S. Elev _____

Operators _____

Observer _____

Weather _____

Laborers _____

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
191'9"	6:26 / 6:35					GROUTING - TOOK GROUT TAKE BEFOR WATER CAME OUT TOP OF CASING ± 60-70 GAL.
	6:35 / 6:50					PREPARE RIG FOR PULLING CASING
	6:50					SHIFT CHANGE

B-32

2nd SHIFT

ROCK ANCHOR TEST LOG

Anchor No. RO-2 | Batter 45° | Supervisors 1

Date 1/26~1/27/79 | G.S. Elev | Operators 1. Diler: 1. Welder: 2

Observer D.T. Tso | Weather SNOW | Laborers 3

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
	19:00 ~ 21:45					▲ First section of casing was pulled up and cut. ▲ One tendon seemed to be ripped off.
	21:45 ~ 22:55					▲ Welding hooks to the casing. ▲ Extracted casing 2nd section of casing off the hole. (24.8')
	22:55 ~ 23:40					▲ Lunch break.
	23:40 ~ 2:25					▲ Weld Cut the 2nd section. ▲ Welded hooks on 3rd section. ▲ Extracted 3rd section. (23.3').
						▲ Half hour was spent to shift grinding saw to compressed-air powered saw. Some oil + water from the compressor of the rig stopped the saw. Welders changed back to grinding saw.
	2:25 ~ 2:55					▲ Cut the 3rd section

ROCK ANCHOR TEST LOG

Anchor No. RD-2 Batter _____ Supervisors _____

Date 1/26 ~ 1/27/79 G.S. Elev _____ Operators _____

Observer D.T. Tso - Weather _____ Laborers _____

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
	3:50 ∫ 3:40					▲ Coffee break.
	3:40 ∫ 4:15					▲ Welded hooks to the 4th section. ▲ Extracted 4th section. (24.8')
	4:45 ∫ 6:35					▲ Cut the 4th section. ▲ Welded 5th section hooks to 5th section. ▲ Extracted 5th section.
						▲ Partly cut 5th section w/ torch. ▲ Crew knocked off at 6:35.

ROCK ANCHOR TEST LOG

Anchor No. RD-2 Batter _____ Supervisors _____

Date 1-27-79 G.S. Elev _____ Operators _____

Observer L. MOSELEY Weather SNOW 25° Laborers _____

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
	7:00 A 1 7:30					SHIFT CHANGE & FUEL EQUIP
	7:30 1 9:35					PULLING REMAING CASING
						RIG ON STAND-BY.

B-35

1ST shift

LOCKS AND DAM NO. 26
GENERAL TESTING PROGRAM
DAILY REPORT

DATE: 12/28/78 REPORT PREPARED BY: D.T. Tso

SUMMARY OF ACTIVITIES: Rock Anchor Test - Drilling Effects RA-I1
Odex 115

7:00 ~ 8:40 Advanced casing to 56' (including 2 ft in shoe).

8:40 ~ 10:45 WCC took ground instrument measurement. Crew + rig standing by

10:45 ~ 11:05 Drilling operation resumed.

11:05 ~ 11:45 WCC took G.I measurement. Crew + rig standing by.

11:45 ~ 12:30 Lunch break.

12:30 ~ 13:00 Casing broke at 13:00

13:00 ~ 18:05 Pulling out of the casing on progress.

5½ hrs production

SIGNED: David Tso

SHIFT #2

LOCKS AND DAM NO. 26
GENERAL TESTING PROGRAM
DAILY REPORT

DATE: 12-28/29-78 REPORT PREPARED BY: L Isette

SUMMARY OF ACTIVITIES: Drilling Effects Test - RA-I1

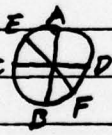
1900 hrs - 2130 hrs casing out of RA-I1 ---

2130 hrs - 2200 hrs - break

2200 hrs - 2400 hrs They had to cut casing to Relase from Bit. measurments of Bit. guide 4.925

2400 - 0030 hrs Lunch break

I made measurments of male end of casing but will have to be measured with different set of calipers. Readings on the one I did were



AB = 5.506
CD = 5.507
EF = 5.506
} ave 5.5 in.

0030 hrs - 0130 hrs made measurments of Bit guide and they Reassembled.

0130 hrs - 0300 hrs Reset First sec in RA-I1 and set up second sec.

0300 hrs - 0330 hrs. Break

SIGNED: L Isette

SHIFT #2

2 of 2

LOCKS AND DAM NO. 26
GENERAL TESTING PROGRAM
DAILY REPORT

DATE: 12-28/78 /29 REPORT PREPARED BY: L Isetts

SUMMARY OF ACTIVITIES:

0330 hrs - 0430 hrs when inserting 2nd sec at approx depth of 33 FT. Heave point next to slab started to bubbel around it and water started Flowing out. also North - West side of slab bubbling up in 2 spots approx 2 FT apart. Just at edge of slab. 1st sec going down did not show no Fine Sand second sec started showing some fine sand at approx 25 FT.

0430 - 0600 hrs Trying To figer way To Hold casing. nothing done.

0600 hrs. - 0630 hrs Sled tool in casing and set on rig. for 3rd sec. still has to be put To gether

0630 - 0700 hrs Stop because it started rainning quit rainning 8 min Later.

2½ hrs production

SIGNED: Lee Isetts

LOCKS AND DAM NO. 26
GENERAL TESTING PROGRAM
DAILY REPORT

DATE: 12-29/30-78 REPORT PREPARED BY: L Isetts

SUMMARY OF ACTIVITIES: Rock Anchor Test RA I-1
1900hrs - 1930 hrs advanced hole 90ft To 100 ft by
Pushing and rotating casing and rods. at
1930 hrs, Rick-ICOS said That They were at a
100 FT and was waiting for are test To be done
We finished Instrumentation at 2100 hrs. Foreman
Rick-ICOS was having steel welded To casing
To see if They could Free rods up finished
at 2215 hrs. it advanced approx 2 Feet and
Lodge up agian. and started Plugging bad.
hammer had started working when it was
advancing that 2 Ft, after removing steel
from casing. start advancing hole hammer
started working and then something Lodged
and plug up again. at 2345 hrs. Foreman had
welder, weld some more steel To casing and
Tried To break Rods Loose from casing at
This Time it bent steel and broke weld when
continuing. it would move approx 1½" in both
derections Then Lodge. The foreman Rick
from ICOS stated That he was going To
Repeat This. That he was not pulling no
Rods, start welding more steel on casing

SIGNED: Lee Isetts

see page-2

LOCKS AND DAM NO. 26
GENERAL TESTING PROGRAM
DAILY REPORT

DATE: 12-29/30-78 REPORT PREPARED BY: L Isett

SUMMARY OF ACTIVITIES: Rock Anchor Test RA I-1 at 0015 hrs. Finished at 0100 hrs. rotating back and Forth with apprer 35,000 Pounds Torque on Rods and casing. Foreman had opperaters Keep This up for apprer 45 minutes gage may not be completley accurate. appearance of sterss on Rods and casing shows alot of bending action Visually when presure is being applied. stoped at 0445 hrs for brake. returned from brake at 0215 hrs. Forman Rick Forcos at 0215 hrs had iorn being cut off casing To Pull Rods and casing. started Pulling Rods and casing at - 0245 hrs. First sec Removed by 0530 hrs = 26 FT Sec. Rock From Cos stated They were having Lunch Tonight from 0330 hrs To 0400 hrs. 2nd sec Pulled And was working on cutting it Still have some To go STOP 0645 hrs = 30 FT sec.

(2 hrs)

[Note: Work at RA-I1 stopped at this point until 19 Jan 79] RT

SIGNED: L Isett

ROCK ANCHOR TEST LOG

Anchor No. RA I-1 | Batter _____ | Supervisors _____

Date 1/19-1/20/79 | G.S. Elev _____ | Operators _____

Observer O.T. TSO | Weather _____ | Laborers _____

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
		[Restarting ODEX 115	hole with tools] RCT			▲ Setting up the rig. Welding the drilling shoe to the 1st section. ▲ No drilling.
						6 hrs production

B-41

ROCK ANCHOR TEST LOG

Anchor No. RA-I-1 | Batter 45° | Supervisors BRMAN

Date 1-20-79 | G.S. Elev | Operators 1½ 1 on RIG ½ on C. PIERCE

Observer P.L. MOBERLY | Weather HAZY 35° | Laborers 2

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
0	7:00A / 9:30					ALLIGN RIG ON HOLE
	9:30 / 10:00					WAITING FOR WOOD SHED FOR DRILLER
	10:00 / 11:45					CLEANING RIG & WAITING FOR SHED
	11:45 / 12:30					LUNCH
	12:30 / 2:15					WAITING FOR SHED
	2:15 / 2:30					INSTALLATION of WOOD SHED
	2:30 / 4:00					CARPENTERS LAID OFF WAITING FOR SHED
	4:00 / 4:45					CARPENTERS Completed (ALMOST) SHED

ROCK ANCHOR TEST LOG

Anchor No. RA-I1 Batter _____ Supervisors _____

Date 1-20-79 G.S. Elev _____ Operators _____

Observer L McBeen Weather _____ Laborers _____

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
	4:45 / 5:15					WAITING (?)
0 / 50'	5:15 / 6:10			7⅞" TRI-CONE ROLLER BIT		STARTED REAMING (PRE-DRILLING HOLE)
	6:10 / 6:35					TRIED TO BREAK OFF BIT DIDN'T COME
	6:35					LEFT RIG FOR SHIFT CHANGE
						4 hrs production

ROCK ANCHOR TEST LOG

Anchor No. RA-I1 Batter _____ Supervisors _____

Date 1-20/21-79 G.S. Elev _____ Operators _____

Observer DT T30 Weather _____ Laborers _____

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
0	7:00 P					DT. T30 TAKING GROUND INSTRUMENTATION READING & WAS NOT AVAILABLE FOR OBSERVATIONS
1	1					
14'9"	7:00 A					
						10 Lbs proof

ROCK ANCHOR TEST LOG

Anchor No. RA-I1 Batter _____ Supervisors _____

Date 1-22-79 G.S. Elev _____ Operators _____

Observer R.L. MOBERLY Weather _____ Laborers _____

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
14'9"	7:00 / 8:00					SHIFT CHANGE, FUEL, WARM UP EQUIP.
	8:00 / 10:30					WAITING FOR NEW WELDING EQUIP - OLD ONE WOULDN'T WORK
	10:30 / 11:45					SETTING 2ND CASING & WELDING
	11:45 / 12:30					LUNCH
	12:30 / 2:00					WELDING 2ND CASING
	2:00 / 2:15					GETTING READING TO DRILL
14'9" / 34'9"	2:15 / 2:27	NO CUTTING ARE-DRILLED H/E	150# psi	ODEX 115	20' / 12 min 1.7 FT/min	DRILL 2ND CASING
34'9"	2:27 / 4:40					PREPARING 3RD CASING SETTING & WELDING

B4S

ROCK ANCHOR TEST LOG

Anchor No. RAI1 Batter _____ Supervisors _____

Date 1-22-79 G.S. Elev _____ Operators _____

Observer R.L. MOSELY Weather _____ Laborers _____

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
34'9"	4:40 / 4:46					Setting up to drill 3rd CASING
34'9" / 54'6"	4:46 / 4:54	NO CUTTINGS PRE-DRILLED HOLE	150-150	ODEX 115	19'9"/8min 2.5'/min	Drill 3rd CASING
54'6"	4:54 / 6:35					PREPARING TO CASING & LINE UP
	6:35 (18:35)					LEFT FOR SHIFT CHANGE
						8½ hrs prod

B-46

AD-A076 098 WOODWARD-CLYDE CONSULTANTS CHICAGO IL F/G 13/2
RESULTS AND INTERPRETATION OF ROCK ANCHOR TEST PROGRAM. EXISTIN--ETC(U)
JUL 79 J PEREZ , R A FASANO DACW43-78-C-0005
UNCLASSIFIED NL

2 OF 3
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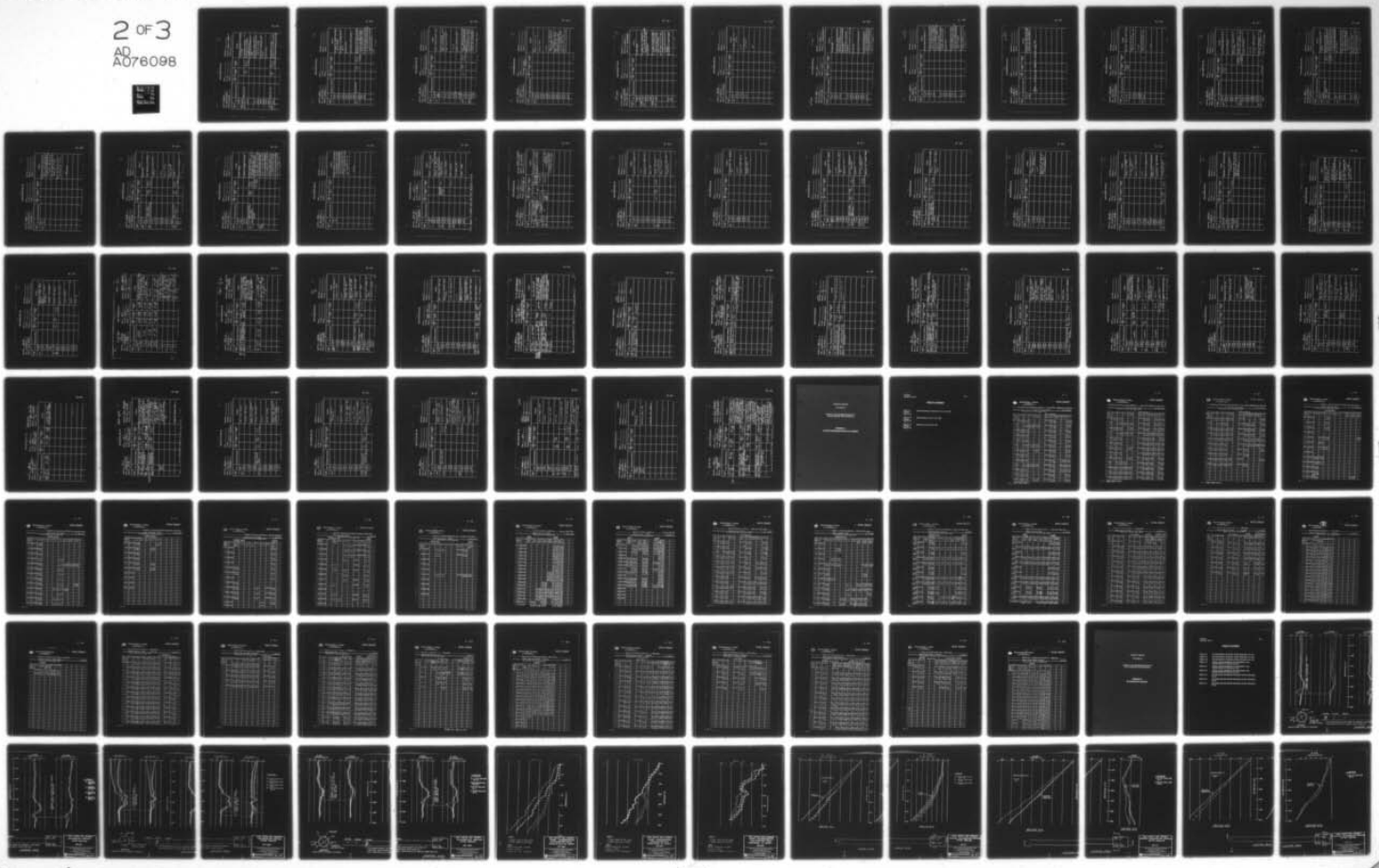

ROCK ANCHOR TEST LOG

Anchor No. RALI1 Batter _____ Supervisors _____

Date 1/22 ~ 1/23/79 G.S. Elev _____ Operators 1. Oiler: 1 Welder: 2

Observer D.T. Tso Weather _____ Laborers 3

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
54'-6" to	19:00 ∫ 20:12					▲ Welding + grinding the 4th section of casing.
66'7"	20:12 ∫ 21:17	Gray fine SAND.		ODEX 115	35 min 12.1 ft 0.3 ft/min	▲ Preparation for drilling. ▲ Drilling started @ 20:42 finished @ 21:17
						▲ Hammer was not activated to strike. ▲ Very few cuttings came out.
	21:17 ∫ 22:08					▲ Loading the 5th section and lined up for welding.
	22:08 ∫ 23:00					▲ Welding + grinding the 5th section.
	23:00 ∫ 23:40					▲ Lunch break.
to 94'4"	23:40 ∫ 0:22	Gray fine SAND.		ODEX 115	42 min 27.7 ft 0.7 ft/min	▲ Preparation for drilling. ▲ Drilled the 5th section into ground. ▲ No hammer driving. Very few cuttings.

ROCK ANCHOR TEST LOG

Anchor No. RA11 Batter _____ Supervisors _____

Date 1/22~1/23 G.S. Elev _____ Operators _____

Observer D.T.Tso Weather _____ Laborers _____

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
	0:22 ∫ 1:47					▲ Loaded 6th section and lined up for welding.
	1:47 ∫ 3:00					▲ Welding + grinding the 6th section.
	2:00 ∫ 3:40					▲ Coffee break.
	3:40 ∫ 4:30					▲ Preparation for drilling.
to 114'	4:30 ∫ 5:40	Grey fine SAND.		ODEX 115	70 min 19.7 ft 0.3 ft/min	▲ Drilled the 6th section into ground ▲ Operation was stopped off and on to tighten the loosen connection between flushing head + casing.
	5:40 ∫ 6:30					▲ To disconnect the rod and hand so that 7th section can be loaded on. Much difficulty was encountered because another connection on the hand got disconnected first. always
						11 hrs.

B-48

ROCK ANCHOR TEST LOG

Anchor No. RA-I1 Batter _____ Supervisors _____

Date 1-23-79 G.S. Elev _____ Operators _____

Observer R.L. MOBERLY Weather RAIN CHANGING to SNOW Laborers _____

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
114'	7:00A ! 7:30					SHIFT CHANGE, PUBL ETC
	7:30 ! 11:00					WELDING 7" CASING GROUND INSTRUMENTATION READING TAKEN DURING THIS PERIOD
	11:00 ! 11:35					DOWN DUE to RAIN
	11:35 ! 12:25P					LUNCH
	12:25P ! 1:09					GOING READY to DRILL
129 ±	1:09 ! 1:18		175	DOWN 115'	9 min 1.7 ft/min	DRILL 13' 15" of 7" CASING PROVIDING U. LINE CLEARANCE HAMMER COULD NOT JUNCTION
139'0"	1:18 ! 5:00				—	SHOVED, DRILLED ON 7" CASING to DEPTH & TRYING to BREAK HAMMER FREE INSIDE CASING
	5:00 ! 6:30 6:40					DOWN 200s OUT of HOLE CLEAN UP FOR SHIFT-CHANGE

11 hrs

B-49

ROCK ANCHOR TEST LOG

Anchor No. RA-I1 Batter _____ Supervisors _____

Date 1-25-79 G.S. Elev _____ Operators _____

Observer R.L. MOBERLY Weather Cold 10°AM 25°PM Laborers _____

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
133'0"	7:00A / 8:15					SE START & WARM UP
	8:15 / 11:35					pulling RODS.
	11:35 / 12:45P					LUNCH
	12:45 / 2:45					BREAKING OFF HAMMER & BIT & INSTALL DIFFERENT HAMMER
	2:45 / 4:30					GOING BACK IN Hole - BENT 20' of RODS. ICOS DECIDED to SWITCH RIGS
	4:30 / 5:00					pull RIG OFF Hole After pulling up BENT RODS
	5:00 / 6:35					Set ICOS RIG ON Hole
					≈1½ hrs	

B-50

2nd SHIFT.

ROCK ANCHOR TEST LOG

Anchor No. RA11 | Batter | Supervisors 1

Date 1/25 – 1/26/79 | G.S. Elev | Operators 1. Oiler: 1

Observer D.T. Tso | Weather | Laborers 3. Crane Operator: 1.

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
	19:00 s 19:30					▲ Shift change.
rod @ 110'	19:30 s 23:00					▲ Loading rods + lowering the bit. It went down very smoothly. Stopped at 110 ft. for break.
	23:00 s 23:40					▲ Lunch break.
rod @ 115'	23:40 s 4:00					▲ To change the ~~oil~~ fuel filter. Tried to fix up some trouble of the oil system (see shift report) but failed.
						▲ Rod stopped at ~115 ft and wouldn't go down any further. It looked like the rod hit on something.
	4:00 s 7:00					▲ Stood by for further decision.
						Otherwise good.

B-15

ROCK ANCHOR TEST LOG

Anchor No. RA-IL Batter _____ Supervisors _____

Date 1-26-79 G.S. Elev _____ Operators _____

Observer R.L. MOBERLY Weather _____ Laborers _____

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
133'0"	7:00 / 11:35					RIG BROKEN DOWN. NO DRILLING
	11:35 / 12:35					LUNCH
	12:35 / 6:45					RIG BROKE DOWN - NO DRILLING
						0

B-52

2nd SHIFT

ROCK ANCHOR TEST LOG

Anchor No. RA11 Batter 45° Supervisors

Date 2/1 ~ 2/2 G.S. Elev Operators 1. Oiler: 1

Observer D. T. TJO Weather ~13° F Laborers 3 Chicago picker operator: 1

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
	19:00 | 19:30					▲ Shift change.
	19:30 | 22:20					▲ Moved shed, generator from DP test area to RA test area. ▲ hooked up all the heaters used for rig
						▲ Crew looked for all the tools necessary for operation. ▲ Set up end table and prepared for pulling rods.
	22:20 | 23:00					▲ Pulled two sections of rod off the casing
	23:00 | 23:40					▲ Lunch break.
	23:40 | 0:05					▲ Pulled the 3rd + 4th sections off.
	0:05 | 0:40					▲ Wrench used for disconnect rods "sweater" and the adjusting screw got frozen. Laborers brought in torch to thaw out the ice but it got frozen again right away. Crew could not break connection between 5th [illegible]

B-153

ROCK ANCHOR TEST LOG

Anchor No. 1 RA-I 1 Batter _____ Supervisors _____

Date 2-1/2-79 G.S. Elev _____ Operators _____

Observer D.T TSO Weather _____ Laborers _____

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
	0:40 ↓ 1:00					▲ Crew broke for warm up.
	1:00 ↓ 2:00					▲ Welder was called in to use the cutting torch to thaw the ice on wrench and heat up the female end of the connecting rod.
						▲ 1:05~1:30 cherry picker screwed up its cable wrap. 25 min. in getting it straight. ▲ Bit was out @ 2:00.
	2:00 ↓ 3:00					▲ Disconnect ODEX bit and changed to an ordinary bit (w/out reamer)
	3:00 ↓ 3:40					▲ Coffee break.
	3:40 ↓ 4:10					▲ Tested the hammer + bit. Air came out from the bit was little. Also the hammer was not working. ICOS superintendent thought that sand must have plugged inside of the hammer.
	4:10 ↓ 5:40					▲ Hammer was brought into trailer and took part. Small amount of sand + ice was found plugged inside. ▲ cleaned up the hole.

B-54

ROCK ANCHOR TEST LOG

Anchor No. RA-12 Batter _____ Supervisors _____

Date 2-1/2-79 G.S. Elev _____ Operators _____

Observer DTBO Weather _____ Laborers _____

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
	5:40 ↓ 6:40					▲ Put the parts back into the hammer ▲ Hammer + bit were connected to the rod and tested. Air blow seemed OK
		[Note: Drilling with ODEX 115 discontinued] RT				

B-55

ROCK ANCHOR TEST LOG

Anchor No. RA-I1 Batter 45° Supervisors _____

Date 2-6-79 G.S. Elev _____ Operators _____

Observer R.L. MOBERLY Weather _____ Laborers _____

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
0	7:40	—	—	165mm ODex		SET RIG BACK UP ON HOLE
	7:40 / 11:45					SET UP & DRILL IN PREVIOUSLY ADVANCED HOLE
	11:45 / 12:30					LUNCH
70'±	12:30 / 6:45				—	DRILL & WELD CASING IN PREVIOUSLY ADVANCED HOLE
						11 hrs

B-56

ROCK ANCHOR TEST LOG

Anchor No. RA-I 1 | Batter _____ | Supervisors _____

Date 2-7-79. | G.S. Elev _____ | Operators _____

Observer R.L. MOBERLY | Weather _____ | Laborers _____

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
70'±	7:00 A to 7:30			165 mm DOCK		SHIFT CHANGE start up at ...
	7:30 to 10:00					WELDING 4th CASING
	10:00 to 11:00					WAITING FOR WELDING SHED to be MOVED
to 95'±	11:00 to 11:15±				15min 1.7 Ft/min in predrilled zone	DRILLING 4th CASING (IN PREVIOUSLY ADVANCED HOLE)
	11:15 to 11:45					LOADING 5TH CASING
	11:45 to 12:30					LUNCH
	12:30 to 5:45					WELDING 5TH CASING
to 105'	5:45 to 6:00 2:00 6:45			10 hrs	—	DRILLING 5TH CASING (IN PREVIOUSLY ADVANCED HOLE) GETTING NEXT CASING PREPARED

B-57

ROCK ANCHOR TEST LOG

Anchor No. RA I/ Batter _____ Supervisors _____

Date 2/7 ~ 2/8/79 G.S. Elev _____ Operators _____

Observer D.T. Tso Weather _____ Laborers _____

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
105'	19:15 ↓ 22:05					Welding + grinding the 6th section.
125'	22:05 ↓ 23:20	Grey fine to med. SAND.			75 min 20 ft 0.3 ft/min in predrilled sand	Preparation for drilling. 22:25 discharge head blew off. The laborers had to use hammer to keep on punching on top of the head so that it would follow the casing. It reduced the operation drastically.
125'	23:30 ↓ 0:10					Lunch break.
	0:10 ↓ 1:50					Some cracks found on top of the head caused by hammer punching. Welder filled these cracks and put another piece of steel to reinforce that area.
	1:50 ↓ 3:50					Loaded the 7th section. Welded + grinded the 7th section.
135	3:50 ↓ 6:30				—	Preparation for drilling. Drilling started at 4:05. Head was blown off right away.

ROCK ANCHOR TEST LOG

Anchor No. RA1 | Batter | Supervisors
Date 2/7 ~ 2/8/71 | G.S. Elev | Operators
Observer D T Tso. | Weather | Laborers

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
135	3:50) 6:30					▲ Crew spent about 20 mins to work on the head but failed. Then they decided to hold the head w/ cable and hook the other end on a shackle. After that was done and drilling resumed, the shackle broke. (~ 6:10).
						▲ It needs welder to fix it. Crew knocked off at 6:30.
						4½ hrs

B-59

ROCK ANCHOR TEST LOG

Anchor No. RA-I1 Batter _____ Supervisors _____

Date 2-8-79 G.S. Elev _____ Operators _____

Observer R.MOSELEY Weather SNOWS 12° Laborers _____

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
115'±	7:00 A / 8:30					REPAIR HOSE
to 141'	8:30 / 9:15	GRAY, MED to COARSE SAND w/ some FINE to MED. GRAVEL		ODEX 165	45 min 6 ft 0.1 ft/min	DRILL REMAINDER of 6" CASING
	9:15 / 11:45					SETTING & WELDING 7" CASING
	11:45 / 12:30					LUNCH
	12:30 P / 4:30					WELDING 7" CASING
	4:30 / 5:30					BLOWING out HOLE & SET up to DRILL
to 166'	5:30 / 6:00	GRAY, FINE to COARSE SAND w/ some GRAVEL		165 ODEX	30 min 25 ft 0.8 ft/min	DRILLING
	6:00 / 6:30					PREPARATION of 5" CASING

11 hrs

B-60

ROCK ANCHOR TEST LOG

Anchor No. RA11 Batter _____ Supervisors _____

Date 2/8 ~ 2/9/79 G.S. Elev _____ Operators _____

Observer D.T. Tso Weather _____ Laborers _____

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
166'	19:00 ↓ 19:40					▲ shift change.
	21:00 ↓ 22:40					▲ Welding + grinding 8th section.
to 176'	0:10 ↓ 1:30	Grey fine to coarse SAND, graded w/ fine to med. gravel.		ODEX 165	80 min 10 ft includes	▲ Drilling started at 0:10. ▲ while casing had ~20.0 ft stick-up, the flushing water turned clearer than before. Cutting mostly fine to
		Limestone.			2 ft weathed 3 ft sound rock	med. gravel. graded w/ fine to coarse sand. There were some limestone chips
top of rock 173(?)						but due to the mixed med. size gravels, it was not sured that the ~~bit hit the bedrock.~~ The operator
						said it seemed to be in bedrock now.
						It drilled another 3.0 ft and I
						could still catch gravel + sand
						w/ a bucket from the cutting. By
						~~that time drilling turned to be very~~
						hard. I had the operator drilled
						another 2' to sit the casing.

B-61

ROCK ANCHOR TEST LOG

Anchor No. RA11 Batter _____ Supervisors _____

Date 2/8 - 2/9/78 G.S. Elev _____ Operators _____

Observer D.T. Bo Weather _____ Laborers _____

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
	1:30 ↓ 1:45					After casing was sit into bedrock, ICOS superintendent told me they would pulled the last section of rod up and shut off the operation because of the extremely cold weather. (−5°F. Wind chill was −30°F). Crew knocked off at 1:45.
						6 hrs

B-62

ROCK ANCHOR TEST LOG

Anchor No. RA-I2 Batter 45° Supervisors _____

Date 2-13-14-79 G.S. Elev ≈ 422 Operators _____

Observer L. ISETTS * Weather _____ Laborers _____

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
0	1900 / 1930					SHIFT CHANGE. FUEL ETC
	1930 / 0235					SET UP ON HOLE LOCATION CHECK W/ LEVEL / ELEV = 2445 ± 0030 ±
0.0 / 20 ±	0235 / 0300			TRI-CONE ROLLER BIT & AIR	25 min	PRE-DRILLING (7⅞" TRI-CONE)
	0300 / 0330					COFFEE BREAK
20 ± / 42 ±	0330 / 0410			11	40 min	PRE-DRILLING
	0410 / 0530					PULL RODS & BIT
	0530 / 0645					CLEAN AREA

* LOG PREPARED BY R. MOSELEY FROM DAILY FIELD REPORT OF L. ISETTS

ROCK ANCHOR TEST LOG

Anchor No. RA-I2 | Batter 45-0 | Supervisors BRAIN MAHAR

Date 2/14/79 | G.S. Elev ~ 422 | Operators 2, IOILER

Observer R. Q. | Weather Partly Cloudy ~ 50° | Laborers 3

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
0-42 "	0100 To 0700	Brown to Gray silty Clay to ~24' CL Below 24' Gray fine to medium sand trace silt SP	170	Tricone	See Lee Dsetts report 2/14	Drilled By 9" Tricone bit Air was med as a drilling medium.
0-0 ft, 17-2	11 To 11:30	Mixture of Clay & Sand	120	predrilling	10 MINS *	
17'-2" ft 46'	17:15 To 11:35	11	120 to 150, and 200		15 MINS *	@ 44' the air pressure is 200 psi.
						* next 2 time intervals in holding the pipe

B-64

ROCK ANCHOR TEST LOG

Anchor No. RA-12 | Batter _____ | Supervisors _____

Date 2-14/15-79 | G.S. Elev _____ | Operators _____

Observer L. ISELIS | Weather _____ | Laborers _____

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
43½'	7:00 PM / 11:45					MODIFICATIONS to CUTTINGS BIN
	11:45 / 12:30					LUNCH
	12:30 / 3:30 PM					MODIFICATIONS to CUTTINGS BIN
	3:30 / 3:45					BLOWING HOLE
to 146'	3:45 / 5:00 PM		120 #	ODEX 165 mm	50 mins	DRILLING 3rd CASING in predrilled hole
	6:00 / 5:45					BLOWING & CLEANING
	5:45 / 7:00					CLEAN CUTTINGS FROM HOLE & TARP to LAB

B-65

ROCK ANCHOR TEST LOG

Anchor No. PA-I2 Batter _____ Supervisors _____

Date 2-15-79 G.S. Elev _____ Operators _____

Observer L.G. Weather _____ Laborers _____

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
46'	7:00 / 11:45					MODIFICATION TO CUTTING BIN.
	11:45 / 12:30					LUNCH
	12:30 / 4:30±					WELDING 3rd CASING
	4:30 / 6:45					MODIFICATIONS TO CUTTING BIN

B-66

ROCK ANCHOR TEST LOG

Anchor No. RA-I2 | Batter _____ | Supervisors _____

Date 2-15/16-79 | G.S. Elev _____ | Operators _____

Observer L. Eggers | Weather _____ | Laborers _____

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
46'	1900 / 2345					MODIFICATIONS TO CUTTING BIT
	2345 / 0030					LUNCH
	0030 / 0330					MODIFICATIONS TO CUTTING BIT
	0330 / 0345					BLOWING OUT.
46' / 58±	0345 / 0410	SAND, V. FINE GRAINED SILTY SAND w/trace FINE to MED. GRAVEL	120 – 250	ODEX RC 6mm	25 min 0.5 ft/min	DRILLING & CASING (PARTIALLY)
	0410 / 0415					REPAIRS "
58± / 63±	0415 / 0425	"			10 min 0.5 ft/min	DRILLING & CASING (PARTIALLY)
	0425 / 0445					REPAIRS TO DRILLING HEAD

ROCK ANCHOR TEST LOG

Anchor No. RA-I2 | Batter _____ | Supervisors _____

Date 2-15/16-79 | G.S. Elev _____ | Operators _____

Observer L. Iseth's | Weather _____ | Laborers _____

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
63I / N'	0445 / 0500	GRAY, FINE TO V. FINE, GRAINED SILTY SAND w/ GL FINE to MED GRAVEL	120 - 250	ODEX 165mm	15 MIN 0.5 ft/min	DRILLING REMAINS OF 8" CASING
71'	0500 / 0700	"				REMOVING CUTTING FROM HOSE

B-68

ROCK ANCHOR TEST LOG

Anchor No. RA-I2 Batter ______ Supervisors ______

Date 2-16-79 G.S. Elev ______ Operators ______

Observer R. Q. Weather ______ Laborers ______

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
71'	0930 / 1145					WEIGH CUTTINGS & WELD CASING (4±) (24'10" LONG)
	1145 / 12:30					LUNCH
71'	12:30 / 6:45					MODIFICATION TO EQUIP TO WEIGH CUTTINGS, BIN & CLEANING AIR HOSE (NO PRODUCTION)

ROCK ANCHOR TEST LOG

Anchor No. RA-12 Batter _____ Supervisors _____

Date 2-16/17-79 G.S. Elev _____ Operators _____

Observer L. Isaacs Weather _____ Laborers _____

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
71'	9:00A / 9:30					BLOWING MATERIAL TO CLEAN OUT HOLE.
	9:30 / 9:45					WEIGHING MATERIAL (626#)
	9:45 / 10:50					HOOKING UP CUTTINGS BIN.
	10:50 / 11:30					LUNCH
	11:30A / 11:45					HOOKING UP CUTTINGS BIN
	11:45A / 2:45A					HAMMER PLUGGED - CLEANING & BLOWING.
	2:45 / 3:35					PREPARATION FOR DRILLING
71' / 75±	3:35 / 3:45		120 – 250	ODEX 165	10 MIN 0.4 ft/...	DRILLING 4½ CASING (PARTIALLY)

OL-B

ROCK ANCHOR TEST LOG

Anchor No. RA-I2   Batter ______   Supervisors ______

Date 2-16/17-79   G.S. Elev ______   Operators ______

Observer L.I   Weather ______   Laborers ______

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
75±	3:45A / 4:30					REPAIRS to DRILLING MEAN
75± / 92±	4:30 / 5:30A		120-250	ODEX 165 mm	60 min 0.3 ft/min	DRILLING 4 1/2 CASING (PARTIALLY)
92±	5:30 / 6:45					CUTTINGS BIN BLEW its LID, 9000± # CUTTING WENT ON GROUND, LOW AIR BLOWIN

ROCK ANCHOR TEST LOG

Anchor No. RA-I2 Batter _____ Supervisors _____

Date 2-17-79 G.S. Elev _____ Operators _____

Observer R. MOSELEY / R. O / L.I. Weather COLD Laborers _____

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
92'±	0700 / 1145					WELDING CUTTING SPILLED OUT OF BIN @ 92' LOW AIR BLOWING
	11:45 / 12:30					LUNCH LOW AIR BLOWING RA TOOL OVER FOR RM
96'	12:30 / 2:45P					COMPLETED DRILLING & BLOWING 4TH CASING
	2:45 / 5:15					PREPARATION & WELDING 5TH CASING LT TOOL OVER FOR RD
96' / 121'	5:15 / 6:45			00 EX 165 mm.	120 mm 0.2 ft/min	DRILLING 5TH CASING (@ 5500 - 6000#)
	6:45					SHIFT CHANG

ROCK ANCHOR TEST LOG

Anchor No. RA-I2 Batter _____ Supervisors _____

Date 2-17/18-79 G.S. Elev _____ Operators _____

Observer Lee Isaacs Weather _____ Laborers _____

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
121'	7:45P / 7:15					BLOWING W/ LOW AIR PRESSURE DURING SHIFT CHANGE
	7:15 / 12:60A					PREPERATION & WELDING 6TH CASING
	12:60 / 1:40					PREPARATION FOR DRILLING
121' to 146'	1:40 / 2:00		125-250	ODEX 165	20 min 1.25 ft/min	DRILLING 6TH CASING
	2:00 / 2:45					BLOWING (LOW AIR)
	2:45 / 3:15					WEIGH CUTTINGS.
	3:15 / 3:45					BREAK
	3:45 / 5:00					CLEAN UP.

SHEET 1 of 2

morning Shift

ROCK ANCHOR TEST LOG

Anchor No. RA.I.2 Batter 45° Supervisors BRAIN MAHAR

Date 2/12/79 G.S. Elev ~422 Operators 2 1 WELDER

Observer R.Q Weather ~ 35° Laborers 4

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
145-10"	07.00 To 11:30	N/A	N/A	N/A	N/A	Loading + welding + Grinding 7th Segment of 25' long
"	11.30 To 12:00	N/A	N/A	N/A	N/A	X-Ray for the 7th section casing weld taken
"	12:00 To 12:30	N A	N/A	N/A	N/A	Lunch
	12:30 To 16:05	N/A	N/A	N/A	N/A	Removing wooden Chadel and
"						modifying the cutting Bin (A trapezoidal
"						Bin is being modified connecting the
"						line to the Bin The Bin was covered
"						by Plywood sheets

B-74

SHEET 2 of 2

ROCK ANCHOR TEST LOG

Anchor No. RA I-2 | Batter 45° | Supervisors BRAIN. MAHAR

Date 2/19/79 | G.S. Elev ~ 422 | Operators 2, 1 WELDER

Observer R.Q | Weather ~ 35° | Laborers 4

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
146 / 145-10" To 166'-8" / 167	16:05 To 16:35	Gray fine to medium SAND trace salt, some fine Gravel	120 To 210	ODEX BIT (16") + HAMMER	16 * MINS 1.3 CF/min	* Remaining time 14 MINS is for flushing the cuttings. Air pressure = 120 PSI for flushing The cutting 225 PSI for drilling + hammering operation
	16:05 To 19:00	N/A	N/A	N/A	N/A	Installation of 8th Segment of Casing in progress

S7-8

ROCK ANCHOR TEST LOG

179.0
2/9
6 9

Anchor No. PA-I2 Batter ______ Supervisors ______

Date 2-19/20-79 G.S. Elev ______ Operators ______

Observer R. Escotts Weather ______ Laborers ______

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
166.5	7:00 – 11:45					WELDING 8" CASING WEIGHING CUTTINGS
	11:45 – 12:30					LUNCH
	12:30 – 1:15					PREPARATION OF CASING & PREP TO DRILL.
	1:15 – 4:55					Attempting to get AIR Blowing THROUGH RODS.
166.5 – 176.9	5:05 – 5:20	SAND & GRAVEL	125 – 250	ODEX 165	15 min 0.7 ft/min	DRILLING PARTIAL 8" CASING
176.9 – 179.0	5:20 – 5:40	T.O. ROCK – 176.9' LIMESTONE		ODEX 165	20 min	DRILLING ROCK
[illegible] – 179	5:40 – 5:45					CLEAN OUT CUTTINGS IN HOLE
	5:45 – 6:45					WEIGHING CUTTINGS

ROCK ANCHOR TEST LOG

Anchor No. AA-I-2 Batter _____ Supervisors _____

Date 2-20-79 G.S. Elev _____ Operators _____

Observer R. MOBERLY Weather MILD - AM RAIN - 1:00 - 3:00 PM Laborers _____

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
179.0'	7:00A / 7:30					SHIFT CHANGE, FUEL etc
	7:30 / 8:45					REMOVING EXCESS RODS & CASING
	8:45 / 11:45					PULLING RODS, HAMMER & BIT
	11:45 / 12:30P					LUNCH
	12:30 / 1:30					ATTEMPTING TO DISCONNECT B.F. BROKE WRENCH
	1:30 / 2:45					WAITING FOR SUPERVISOR - CLEANED DRILLING AREA WHILE WAITING
	2:45 / 3:14					GOING BACK DOWN HOLE
179.0' / 199.0'	5:14 / 5:57	Limestone	125-250	6" DIA. ROCK BIT & ROC HAMMER	27 MIN / 20' = 0.7'/MIN	DRILLING ROCK SOCKET 16 MIN FOR CHANGE IN MUDGE

B-77

ROCK ANCHOR TEST LOG

Anchor No. RE-1 | Batter 45° | Supervisors Rick Bowman

Date 2-22-23-79 | G.S. Elev 422 ± | Operators 2 1 oiler

Observer L.I. RQ | Weather Light Showers To Heavy Rain - Intense Fog. approx 35° | Laborers 3

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
0'0" To 19'2"	day shift	see day Report	"	"	"	see day Report
19'2" To 32'0" (Casing Drive Predrill)	0015 hrs To 0015 30 min	see day Report	**125 To *225	ODEX BIT	~30 sec	This area To 32'0" was Predrilled we are setting casing To this depth now.
32'0" To 45'11"	0050 hrs To 100 hrs	Light Gray Fine SAND w/ Trace SILT SP"	**125 To *225	ODEX BIT	3 min 4.6 Ft/min	went very smooth very good control. matl has grouting effect To it. (slightly)
45'11" To 71'-5"	0620 To 0635	"	"	"	4 min 6.4 Ft/min	went very smooth.

** Air Pressure Flushing * Air Pressure Drilling Casing

B-78

ROCK ANCHOR TEST LOG

Anchor No. RE-1 | Batter 45° | Supervisors 1 (WCC)

Date 2-23-79 | G.S. Elev 420 ± | Operators 2

Observer J. Kerr | Weather ~~Sunny, warm turning~~ cold. | Laborers 3

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
71.5' to 96'-7"	16:14 to 16:19	Fine to coarse sand with trace to some fine to coarse gravel	110 to 250	ODEX 165	5 minutes 5 ft/min	

B-79

SHIFT #2

ROCK ANCHOR TEST LOG (DRILLING EFFECTS)

SHEET 1/1

Anchor No. RE-1 | Batter 45° | Supervisors RICK BOREMAN

Date 2/23, 2/24 | G.S. Elev ~422 | Operators 2 OPER, 1 OILER

Observer R.G./R.I | Weather Partly cloudy 35°-45° | Laborers 3

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
96'-7" To 120-8"	0105 0135	Gray fine to medium SAND, trace silt	120* to 222**	ODEX BIT	4 Mins 15 Sec	Remaining time spent in holding the hose and unhooking the bar at the casing head
					5.7 ft/min	

* for removing the cuttings

** for hammering the casing

B-80

ROCK ANCHOR TEST LOG

Anchor No. RE-1 | Batter _____ | Supervisors WCC 1

Date 2-24-79 | G.S. Elev _____ | Operators 3

Observer J. Kerr | Weather Clear and cool | Laborers 4

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
— to 145'0"	08:13 to 08:32 and 08:43-44	Light brown, wet med. sand with a trace of G. sand and a trace to some f. sand and fine gravel	110 to 230	ODEX 165	10 min 1.4 Ft/min	Trouble getting flow started
145'0" to 166'11"	14:07 to 14:19	Light brown, wet med. sand with some f. sand and some fine gravel.	110 to 230	ODEX 165	12 min 1.9 Ft/min	Noticable change in material.

B-81

ROCK ANCHOR TEST LOG

Anchor No. RE-1　　Batter 45°　　Supervisors Rick BOREMAN

Date 2/24, 2/25/79　　G.S. Elev 420 ±　　Operators 2, 1 OILER

Observer R.Q　　Weather Partly cloudy 30°　　Laborers 3

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
166'-6" To 176'-8"	22^40 To 22^55	Gray fine to coarse SAND trace silt, trace to some fine gravel "SP"	120 * To 230 **	ODEX BIT	6.8 ft/sec 1 MIN 30 SEC ⊛	⊛ Remaining time for straightening hole
176'-8" To 178'-8"	22^55 To 23^00	~~Limestone Bedrock~~ boulders	120 To 230	ODEX BIT	~ 1 MIN ⊛ 2 ft/min	⊛ Remaining time for straightening hole

* Air pressure for flushing the cuttings, ** Air pressure for hammering mechanism

ROCK ANCHOR TEST LOG

Anchor No. RE-1 Batter _____ Supervisors _____

Date 2-26-79 G.S. Elev _____ Operators _____

Observer RL. MOBERLY Weather 20° AM 35° PM Laborers _____

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
178'8"	0700 / 0800	—	—	—	—	SHIFT CHANGE, FUEL EQUIP THAW OUT FROST IN COMPRESSOR
	0800 / 0930	—	—	—	—	LOWER RODS (W/ROCK BIT) INTO HOLE
	0930 / 1045	—	—	—	—	WAITING FOR CHERRY PICKER TO COME, NEEDED TO ADD RODS
	1045 / 1125					ADD DRILL RODS & PREPARE TO DRILL BIT ONLY WENT TO 178'7"
	1125 / 1145					REPAIR HOSE
	1145 / 1245					LUNCH
	1245 / 1313					REPAIR HOSE
to 182'2	1313 / 1327	SAND, GRAVEL, COBBLES W/OCCASIONAL LIMESTONE	120 - 250	6" ROCK BIT	14 min	DRILLING ROCK SOCKET

B-83

ROCK ANCHOR TEST LOG

Anchor No. RE-1 Batter _____ Supervisors _____

Date 2-26-79 G.S. Elev _____ Operators _____

Observer R.L. MOBERLY Weather _____ Laborers _____

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
182±	1327 / 1354					STAND BY WHILE DISCUSSING WHY SO MUCH SAND & GRAVEL IN HOLE. ALSO RODS UP 10'± & SAND & GRAVEL CAME BACK IN TO 173'±
to 194'6"	1354 / 1418	LIMESTONE	125-250	6" OVER ROCK BIT	24 min	DRILLING
	1418 / 1443					BLOWING, CLEANING & ADDING DRILL ROD.
to 201	1443 / 1508	LIMESTONE	125-250	"	25 min	DRILLING
	1508 / 1540					WATER COMING OUT RACE INCLOMETER — DISCUSSION CONCERNING WHY.
to 207'8"	1540 / 1558	LIMESTONE	"	"	18 min	DRILLING
	1558 / 1835				totals 67 min for 25.7 Ft 0.4 Ft/min rock	PULLING RODS MEASURED HOLE AFTER RODS PULLED > 196' LEFT RIG FOR SHIFT CHANGE

B-84

ROCK ANCHOR TEST LOG

Anchor No. RE-1 Batter _____ Supervisors _____

Date 2-27-79 G.S. Elev _____ Operators _____

Observer R.L. Mobley Weather _____ Laborers _____

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
207'8"	0000 to 0730					START CHANGE, Fuel etc
	0730 to 1135					Attempting to Remove Bit
	1135 to 1230					LUNCH
	1230 to 1300					MIXING GROUT
	1300 to 1500					GROUTING - 9275# CAL GROUT PUMPED WHEN FLOW WAS NOTED OUT TOP OF HOLE
	1500 to 1850					ALIGNED CASING W/PERIODIC GROUTING PERIODS

B-85

ROCK ANCHOR TEST LOG

Anchor No. RE-2 Batter 45° Supervisors _____

Date 2-28-79 G.S. Elev _____ Operators _____

Observer R L. MOBERLY Weather 20°-35° ↓ mist Laborers _____

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
0	0700 / 1100					STAND BY WHILE WCC TOOK INCLOMETER READINGS IN RE-1
0 / 40'±	1100 / 1145	CLAY	120	7⅞" TRI-CONE Roller B.I.T & AIR	45'± mn	PRE DRILLING IN CLAY RIG IS NOT LINED UP CORRECTLY
	1230 / 1800					pull RODS & BIT
	1300 / 1400					Set up RIG "CORRECTLY" ON Hole
	1400 / 1530		120	7⅞ TRI-CONE Roller B.I.T		RE-PRE-DRILL
0 / 20'±	1530 / 1625					SET & LOWERED 1ST CASING
	1625 / 1845					PREPARATION & WELDING 2ND CASING
						SHIFT CHANGE productive time 7 hrs

ROCK ANCHOR TEST LOG

Sheet 1 of 2

Anchor No. RE-2 | Batter 45° | Supervisors RICK BOLCHAN

Date 2/28, 3/1/79 | G.S. Elev 422+ | Operators 2, 1 OILER

Observer R.B | Weather SHOWERS, 38° | Laborers 3

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
N/A	19-0" To 21-05"	N/A		N/A	N/A	working + branding 2nd segment 7" CASING

B-87

Sheet 27/2

ROCK ANCHOR TEST LOG

Anchor No. RE-2
Date 2/28, 3/1/79
Observer R. Q

Batter 45°
G.S. Elev 422±
Weather Showers 38°

Supervisors RICK BOREHAN
Operators 2 1 OILER
Laborers 3

	Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
	20'3 To 45-1"	2105 to 2125	*Gray silty clay (CL) to ~35 ft. from 35'-45'-1" Gray to brown fine to medium SAND, trace silt "SP"	120**to 220***	ODEX BIT	~4 MIN*** 6.3 Ft/min	*predrilled depth to ~40ft. ***remaining time straightening the hore, and
	N/A	21 25 To 0210		N/A	N/A	N/A	interruption during drilling operation → welding 3rd segment 26'6" long
3/1/79	45'-1" to 70'-2"	0210 0230	Gray fine to medium SAND trace silt "SP"	120** 220***	ODEX BIT	~3 MIN*** 8.4 Ft/min	Easy + smooth drilling. Very las amount of
							water came out as compared to water @ a greater depth.
	" "	0230 to 7:00					welding + grinding 4th section of casing 26' long
							productive time 12hs

**120 to flush air cutting ***220 for hammering mechanisme

ROCK ANCHOR TEST LOG

Anchor No. RE-2 | Batter _____ | Supervisors _____

Date 3-1-79 | G.S. Elev _____ | Operators _____

Observer R. MOSSELY | Weather 35°-40° mild, cloudy | Laborers _____

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
70'2"	0700 / 0730					SHIFT CHANGE, FUEL etc
	0730 / 0758					PREPERATION FOR DRILLING
	0758 / 0805					TURNED AIR ON - CUTTING (AIR) STARTED COMING @ 0805
95'4"	0805 / 0810	GRAY, FINE-MED SAND w/ TRACE of GRAVEL	120 — 220	165 mm ODEX	5 min 5.0 ft/min	DRILLING 4TH CASING
	0810 / 0812					BLOWING
	0812 / 0845					WEIGHING CUTTINGS
	0845 / 1000					CHERRY PICKER sent to PILE DRIVING AREA - DRILLING OPERATIONS HALTED.
	1000 / 1030					WEIGHING CUTTINGS

B-89

ROCK ANCHOR TEST LOG

Anchor No. RE-2 Batter _____ Supervisors _____

Date 3-1-79 G.S. Elev _____ Operators _____

Observer _____ Weather _____ Laborers _____

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
0 / 95'4"	1030 / 1145					PREP. & WELDING 5TH CASING
	1145 / 1230					CONT'd
	1230 / 1300					WELDING 5TH CASING
	1300 / 1400					WAITING FOR TESTING LAB to X-RAY WELD
	1400 / 1430					X-RAY 5TH WELD
	1438 / 1454					BLOWING AIR - NO RETURN UNTIL 1454
95'4" / 102±	1454 / 1457	BROWNISH GRAY, FINE SAND w/ some SILT (SP-SM)	120 / 220	165mm ODEX	3min 2.2 FT/min	DRILLING 5TH CASING
	1457 / 1510					REPAIR DRILLING HEAD cut cutting Loss = 100#

B-90

ROCK ANCHOR TEST LOG

Anchor No. RE-2 | Batter _____ | Supervisors _____

Date 3-1-79 | G.S. Elev _____ | Operators _____

Observer _____ | Weather _____ | Laborers _____

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
102±	1510 ' 1525					TURNED ON AIR. NO RETURN UNTIL 1525
112±	1525 ' 1529	FINE, GRADATION GRAY SAND w/ some SILT			4 min 2.5 ft/min	DRILLING 5" CASING
	1529 ' 1558					REPAIR DRILL HEAD est. cutting cost = 75± #
	1558 ' 1740					TURNED ON AIR - NO RETURN UNTIL 17:10. HAD to BURN Hole IN CASING & FILL W/ WATER
119'6"	1740 ' 1743				3 min 2.5 ft/min	DRILLING REMAING PORTION of 5" CASING
	1743 ' 1755					BLOWING
	1755 ' 1845					WEIGHING & MEASURING CUTTINGS
						productive time 6 hrs

B-91

ROCK ANCHOR TEST LOG

Anchor No. RT-2 | Batter 45° | WCC 1
Date 3-2-79 | G.S. Elev | Supervisors 1
Observer J. Kerr | Weather overcast and cool changing to partly sunny and cooler | Oilers 1 | Operators 2 | Welders 1 | Laborers 3

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
	07:00 to 11:30					See R Moberly report
	11:30 to 12:30					Lunch
	12:30 to 13:15					Delay soft pick
169-6" to	13:17 to 13:21		110 230	Odex 165		Drilling
↓	13:21 to 14:15				↓	Fixing discharge hood
176.3"	14:25 to 14:27		110 230	Odex 165	6 min 1.1 ft/min	Drilling until rock stuck
	14:45					rod broke free and dropped to is at 176'3"
176'-3" to 181'-3"	15:08 to 15:22	limestone	300	Odex 165	14 min for 5ft	Drilling rock socket.

ROCK ANCHOR TEST LOG

2 of 3

Anchor No. RE-2 | Batter | Supervisors

Date 3-2-79 | G.S. Elev | Operators

Observer J. Kerr | Weather | Laborers

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
	15:22 to 15:48					Flushing
	15:48 to 18:30					Breaking down rod
						productive time 4½ hrs

B-93

SHIFT #2

ROCK ANCHOR TEST LOG

Anchor No. RE-2 | Batter ~45° | Supervisors RICK BOREMAN

Date 3/1, 3/2/79 | G.S. Elev 422± | Operators 2 OPER, 1 OILER

Observer R.G. | Weather Partly cloudy ~35° | Laborers 3

Depth ft	Time	Description of Material	Air Pressure psi	Excavation Tools	Excavation Time	Remarks
119'-6"	1900 to 0001	N/A	N/A	N/A	N/A	Welding and grinding 6th segment of casing and
3/2 →						loading unloading Shaeff removing material from hole and weighing
119-6" to 144'-6"	0001 to 0110	Gray fine to medium SAND, trace silt, trace fine gravel (SP)	*120 **230	ODEX BIT	9 MINS *** 2.8 ft/min	remaining time spent in straightening the hole
3	0110 To 0545	N/A	N/A	N/A	N/A	weigh cuttings from 119'-6" to 144'-6" and loading, installing
						welding + grinding 7th Section of casing (23-4" length)
144'-6" 169'-6"	0545 0625	Gray fine to Course SAND, trace silt, trace to some fine gravel SP	*120 **230	ODEX BIT	12 MINS 2.1 ft/min	Easy + smooth drilling, lots of water discharge into Bin, during the first 10 ft drilling
				productive time 10½ hrs		wet sand slurry shooting out from 3D-2 ~15' high discharge

* Air pressure for flushing cuttings ** Air pressure for [illegible] + drilling

B-94

PHASE IV REPORT

VOLUME VA

RESULTS AND INTERPRETATION OF ROCK ANCHOR TEST PROGRAM

APPENDIX C

GROUND INSTRUMENTATION DATA SHEETS

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Woodward-Clyde Consultants
Consulting Engineers
Geologists and Environmental Scientists

DATA SHEET

Ground Instrumentation - Surface Reference Points

Rock Anchor Test

Elevation & Change (Ft)

start RA-I1

Date	11 Oct 78	20 Oct 78	21 Oct '78	26 Oct 78		Initial	28 Dec '78	28 Dec '78	29 Dec '78	18 JAN 79
Time				08.00		Depth	60 ft	80 ft	100 ft	
No.										
RA-P1	420.523	420.518				420.520	420.495			420.488
	0.000	- 0.005					-0.025			- 0.168
										- 0.32
R2		420.703	420.709	420.708		420.705	420.679			420.668
		0.000	+ 0.005	0.000			- 0.026			- 0.037
R3	420.642	420.638				420.640	420.601			420.592
	0.000	- 0.005					- 0.039			- 0.048
R4	420.298	420.293				420.296	420.273			420.264
	0.000	- 0.005					-0.025			-0.032
P5	420.392	420.388				420.390	420.367			420.359
		- 0.005					- 0.023			- 0.031
R6		420.408	420.408	420.408		420.408	420.383			420.374
		0.000	0.000	0.000			-0.025			-0.034
P7	420.638	420.628		420.628		420.628	420.589			420.577
	0.000	- 0.010		- 0.010			-0.039			- 0.051
R8	420.878	420.873				420.876	420.833			420.823
	0.000	- 0.005					- 0.043			- 0.053
P9	420.563	420.558				420.560	420.532		420.53	420.506
	0.000	- 0.005					-0.028		- 0.03	-0.054
R10		420.676	420.683	420.678		420.680	420.647		420.64	420.634
		0.000	+ 0.005	0.000			-0.033		-0.04	- 0.046
P11	420.778	420.773				420.776	420.739		420.73	420.715
	0.000	- 0.005					-0.042		-0.05	- 0.061
P12	420.348	420.343				420.346	420.320			420.310
	0.000	- 0.005					- 0.026			- 0.036
P13	421.083	421.073		421.068		421.070	421.033			421.019
	0.000	- 0.010		-0.015			-0.037			-0.052

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DATA SHEET

Ground Instrumentation - Surface Reference Points

Rock Anchor Test

Elevation & Change (ft)

start RA-II

Date	11 Oct 78	20 Oct 78	21 Oct 78	26 Oct 78		28 Dec 78	6 Dec 78	29 Dec 78	18 Jan 79
Time				0800		Initial	60ft	80ft	100ft	
No						Depth				
RA-R14	420.521	420.513				420.518	420.482		420.47	420.4[illegible]
	0.000	- 0.010					-0.035		-0.05	- 0.050
R15		420.633	420.628	420.678		420.683	420.647		420.64	420.[illegible]
		0.000	+ 0.005	- 0.005			-0.036		-0.04	- 0.050
R16	420.823	420.813		420.808		420.810	420.768		420.76	420.754
	0.000	- 0.010		-0.015			-0.042		-0.05	-0.056
R17		420.623	420.628	420.623		420.628	420.582	420.582	420.57	420561
		0.000	- 0.005	- 0.010			- 0.034	- 0.034	- 0.06	- 0.067
R18	420.498	420.493				420.496	420.456	420.458		420.442
	0.000	- 0.005					-0.040	- 0.038		-0.054
R19	420.453	420.443				420.448	420.404	420.404	420.40	420.393
	0.000	- 0.010					- 0.044	- 0.044	- 0.05	- 0.065
R20	420.528	420.518		420.508		420.513	420.470	420.470	420.46	420.446
	0.000	- 0.010		- 0.020			- 0.043	- 0.043	- 0.05	- 0.067
R21	421.698	420.688				421.693	420.638	420.638	420.62	420.617
	0.000	- 0.010					-0.055	- 0.055	- 0.07	- 0.076
R22	421.128	421.113		421.113		421.113	421.080	421.084		421.064
	0.000	- 0.010		- 0.010			-0.033	- 0.029		0.049
R23		420.473	420.473			420.473	420.432	420.432		420.412
		0.000	0.000				-0.040	- 0.041		- 0.061
R24	420.398	420.473	420.388	420 383		420.386	420.348	420.350		420.326
	0.000	+0.125	- 0.010	- 0.015			-0.038	- 0.036		-0.052
R25	420.442	420.513	420.433	420.428		420.430	420.329	420.392		420.374
	0.000	+ 0.070	- 0.010	- 0.015			-0.101	-0.038		- 0.056
R26	420.748	420.808	420.738	420.738		420.738	420.702	420.703		420.683
	0.000	+ 0.060	- 0.010	-0.010			-0.036	- 0.035		-0.055

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Consulting Engineers, Geologists and Environmental Scientists

DATA SHEET

Ground Instrumentation - Surface Reference Points

Rock Anchor Test

Elevation & Change (Ft)

start RA-II

Date	11 Oct '78	20 Oct '78	21 Oct '78	26 Oct 78		Initial	28 Dec '78	29 Dec '78	29 Dec 78	15 JAN '79
Time				0800		Depth	60ft	80ft	100ft	
No.										
RA-R27	420.463	420.353	420.358	420.353		420.359				420.300
	0.000	-0.110	-0.105	-0.110						-0.050
R28		420.443	420.468			420.466	420.425	420.428		420.410
		0.000	+0.005				-0.041	-0.038		-0.056
R29	420.973	420.023	420.928	420.933		420.928	420.908	420.887		420.899
	0.000	-0.050	-0.045	-0.040			-0.020	-0.041		-0.029
R30	420.418	420.518	420.408	420.408		420.408	420.382	420.384		420.373
	0.000	+0.100	-0.010	-0.010			-0.026	-0.024		-0.035
R31	420.468	420.453	420.453	420.453		420.453	420.417	420.421	420.41	420.406
	0.000	-0.015	-0.015	-0.015			-0.036	-0.032	-0.04	-0.047
R32	420.748	420.728	420.743			420.746	420.710	420.714	420.70	420.701
	0.000	-0.020	-0.005				-0.036	-0.032	-0.05	-0.045
R33	420.563	420.553	420.553			420.553	420.515			420.516
	0.000	-0.010	0.010				-0.038			-0.037
R34	420.803	420.798	420.803			420.801	420.763			—
	0.000	-0.005	0.000				-0.038			
R35	420.408	420.543	420.403	420.398		420.403				420.380
	0.000	+0.135	-0.005	-0.010						-0.023
R36	420.713	420.678	420.683	420.678		420.680	420.651			—
	0.000	-0.035	-0.030	-0.035			-0.029			

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DATA SHEET

GROUND INSTRUMENTATION (Surface Ref Pts)

ROCK ANCHOR TEST

Elevation & Change (Ft)

				complete RA-I1	start RA-I2					
DATE	Initial	23 JAN 79	4 FEB 79	8 Feb 79	14 Feb 79	15 Feb 79	16 Feb 79	17 Feb 79	17 Feb 79	18 Feb 79
DEPTH		114 ft.	140 ft.	166 ft	46 ft.	71 ft.		10 ft	125 ft	150 ft
No.								RA I2	RA I2	RA I2
RA-R1	420.520			420.388						
				-0.132						
R-2	420.705			420.664						
				-0.041						
R-3	420.640			420.585						
				-0055						
R-4	420.296									
R-5	420.390		420.367	420.348						419.959
			-0.023	-0.042						-0.431
R-6	420.408		420.373							
			-0.035							
R-7	420.628		420.572	420.567						
			-0.056	-0.061						
R-8	420.876									
R-9	420.560	420.527	420.920							
		-0.033	0.360?							
R-10	420.680	420.635	420.633							
		-0.045	-0.047							
R-11	420.776	420.722								
		-0.054								
R-12	420.346	420.393								
		+0.047								
R-13	421.070	420.016							420.973	
		-0.054							-0.097	

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DATA SHEET

GROUND INSTRUMENTATION (Surface Ref Pts)

ROCK ANCHOR TEST

Elevation & Change (ft)

complete RA-I1 | start RA-I2

DATE	Initial	23JAN79	4 FEB 79	8 Feb 79	14 Feb 79	15 Feb 79	16 Feb 79	17 Feb 79	17 Feb 79
DEPTH		114 ft.	140 ft	166 ft	46 ft	71 ft	check	100 ft	125 ft
No									
RA-R14	420.518	420.468							
		-0.050							
R15	420.653	420.632							
		-0.051							
R16	420.810	420.750							
		-0.060							
R17	420.628	420.559				420.502			
		-0.069				-0.126			
R18	420.496	420440				420.401	420.403	420.399	420.398
		-0.056				-0.095	-0.093	-0.097	-0.098
R19	420.448	420.376				420.325			
		-0.072				-0.125			
R20	420.513	420.439				420.337			
		-0.074				-0.176			
R21	421.693	420.610				420.554			
		-0.083				-0.139			
R22	421.113	421.059				421.030			421.018
		-0.054				-0.083			-0.095
R23	420.473	420.401			420.360	420.349	420.350		
		-0.072			-0.113	-0.124	-0.125		
R24	420.386	420.326				420.294			
		-0.060				-0.092			
R25	420.430	420.365			420.337	420.324			
		-0.065			-0.093	-0.106			
R26	420.738	420.678			420.662	420.653			
		-0.060			-0.076	-0.085			

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DATA SHEET

GROUND INSTRUMENTATION (Surface Ref. Pts)

ROCK ANCHOR TEST

Elevation & Change (ft)

				complete RA-I1	start RA-I2				
DATE	Initial	23 JAN 79	4 FEB 79	8 FEB 79	14 FEB 79	15 FEB 79			
DEPTH		114 ft.	140 ft	166 ft	46 ft	71 ft			
No.									
RA-R27	420.354	420.314				420.298			
		-0.040				-0.056			
R28	420.466	420.404			420.386				
		-0.062			-0.080				
R29	420.928	420.895							
		-0.033							
R30	420.408	420.364							
		-0.044							
R31	420.453	420.399			420.396				
		-0.054			-0.057				
R32	420.746	420.694			420.700				
		-0.052			-0.046				
R33	420.553								
R34	420.801								
R35	420.403								
R36	420.680								

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DATA SHEET

GROUND INSTRUMENTATION -(Surface Ref. Pts)

ROCK ANCHOR TEST

Elevation & Change (ft)

Date	Initial	complete RA-12 19 Feb 79	start RE-1 23 Feb 79	23 Feb 79	23 Feb 79	28 Feb 79	28 Feb 79	28 Feb 79	complete RE-1 28 Feb 79
Depth		166 ft	2' ft	45 ft	9.6 ft		120 ft	150	176
No.		RA12		RE1	RE1				RE1
RA-R1	420.520								420.462
									-0.058
R2	420.705								421.032
									+0.327
R3	420.640								420.557
									-0.083
R4	420.296								420.219
									-0.079
R5	420.390	420.336							420.308
		-0.054							-0.028
R6	420.408	420.306							420.294
		-0.102							-0.112
R7	420.628								420.511
									-0.117
R8	420.876	420.772							
		-0.104							
R9	420.560	420.458				420.442		420.442	420.431
		-0.102				-.118			-0.129
R10	420.680	420.567				420.555		420.555	420.542
		-0.113				-.125			-0.138
R11	420.776	420.672				420.651		420.651	420.641
		-0.104				-.125			-0.135
R-12	420.346						420.235		420.226
									-0.130
R-13	421.070						420.941		

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DATA SHEET

GROUND INSTRUMENTATION - (Surface Ref. Pts)

ROCK ANCHOR TEST

Elevation & Change (Ft)

Date	Initial	complete RA-12 19 Feb 79	start RE-1 22 Feb 79	23 Feb 79	22 Feb 79	22 Feb 79	23 Feb 79	23 Feb 79	complete RE-1 26 Feb 79
Depth	1		71 ft	45 ft	96 ft		120 ft	150 ft	17 m
No.			RE 1						RE 1
RA-R14	420.518				420.365	420.362	420.358	420.362	420.252
					-.153	-.155			-0.166
R15	420.683				420.515	420.471	420.509	420.471	420.562
					-.168	-.212			-0.121
R16	420.810				420.637	420.635	420.635	420.635	420.626
					-.173	-.175			-0.184
R17	420.628				420.419		420.426		420.417
					-.209				-0.211
R18	420.496		420.351				420.376		420.253
			-.115						-0.123
R19	420.448		420.306		420.297		420.279		420.271
			-.142		-.169				-0.177
R20	420.513				420.310				420.303
					-.203				-0.211
R21	421.693				420.476		420.481		420.480
					-.217				-0.213
R22	421.113		420.996				420.995		420.990
			-.117						-0.123
R23	420.473								
R24	420.386		420.281				420.280		420.277
			-.105						-0.109
R25	420.430		420.301	420.303			420.301		420.309
			-.129	-.127					-0.121
R26	420.738								

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DATA SHEET

GROUND INSTRUMENTATION (Surface Ref. Pt)

ROCK ANCHORS TEST

			Elevation & Change (ft)						
		complete RA-I2	start RE-1						complete RE-1
Date	Initial	19 Feb 79	22 Feb 79	23 Feb 79	22 Feb 79	22 Feb 79	23 Feb 79 120 ft	23 Feb 79	26 Feb 79 176 ft
Depth No									RE1
RA-R27	420.354		420.298	420.298			420.246	420.246	
			-.056	-.061				-0.052	
R28	420.466		420.368				420.359	420.363	
			-.098					-0.103	
R29	420.928								
R30	420.408								
R31	420.453								
R32	420.746		420.689	420.685			420.698	[illegible]	420.692
			-.057	-.061				[illegible]	-0.054
R33	420.553								
R34	420.801								
R35	420.403								
R36	420.680								

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DATA SHEET

Ground Instrumentation — Surface Ref Pts.

Rock Anchor Test — p. 4A of 4

Elevation & Change (ft)

Date	Initial	start RE-2 2/28/79	3/1/79	3/1/79	3/1/79	3/1/79	complete RE-2 3/2/79	3/5/79
Depth		45 ft	70 ft	100 ft	120 ft	145 ft	176 ft	After
No		RE2	RE2	RE2	RE2	RE2	RE2	Drilling Activities
RA R1	420.510						420.456	420.457
							-0.064	-0.063
R2	420.705						420.628	420.631
							-0.077	-0.074
R3	420.690						420.551	420.553
							-0.089	-0.087
R4	420.296						420.208	420.209
							-0.088	-0.087
R5	420.390						420.299	420.298
							-0.091	-0.092
R6	420.408						420.291	420.285
							-0.117	-0.123
R7	420.628						420.500	420.499
							-0.128	-0.129
R8	420.876						420.752	420.754
							-0.124	-0.122
R9	420.560					420.417	420.418	420.416
						-0.143	-0.142	-0.144
R10	420.680					420.523	420.521	420.518
						-0.157	-0.159	-0.162
R11	420.776					420.621	420.621	420.618
						-0.155	-0.155	-0.158
R12	420.396				420.218		420.216	420.213
					-0.128		-0.130	-0.133
R13	421.070				420.924		420.921	420.922
					-0.146		-0.149	-0.148
R14	420.518			420.348	420.341	420.337	420.337	420.337
				-0.190	-0.179	-0.181	-0.181	-0.181
R15	420.683			420.497	420.488	420.483	420.484	420.484
				-0.186	-0.195	-0.200	-0.199	-0.199
R16	420.810			420.622	420.613	420.610	420.610	420.610
				-0.188	-0.197	-0.208	-0.200	-0.200
R17	420.628			420.414	420.403		420.403	420.400
				-0.214	-0.225		-0.225	-0.228
R18	420.996		420.370		420.363		420.364	420.363
			-0.126		-0.133		-0.132	-0.133
R19	420.448		420.245	420.245	420.257		420.257	420.253
			-0.183	-0.193	-0.191		-0.191	-0.195

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DATA SHEET

Ground Instrumentation. Surface Ref Pt

Rock Anchor Test. p. 4B of 4

Elevation & Change (ft)

Date	Initial	start RE-2 3/28/79	3/1/79	3/1/79	3/1/79	complete RE-2 3/3/79	3/5/79
Depth		45 ft	70 ft	100 ft	120 ft	176 ft	After Drilling Activities
No		RE2		RE2	RE2	RE2	
PA-R20	420.513		420.297	420.296	420.287	420.286	420.283
			-0.216	-0.217	-0.226	-0.227	-0.230
R21	421.693		420.475	420.473	420.465	420.462	420.458
			-0.218	-.220	-0.228	-0.231	-0.235
R22	421.113		420.987		420.977	420.979	420.978
			-0.126		-0.136	-0.134	-0.155
R23	420.423		—		—		420.225
							-0.198
R24	420.386	420.272	420.273		420.265		420.267
		-0.114	0.113		-0.121		0.119
R25	420.430	420.292	420.289		420.280	420.282	420.279
		-0.138	-0.141		-0.150	-0.148	-0.151
R26	420.738	420.621	420.621		420.611		420.607
		-0.117	0.117		-0.127		-0.131
R27	420.354		420.294		420.292	420.294	420.297
			-0.060		-0.062	-0.060	-0.057
R28	420.466	420.355	420.355		420.348		420.345
		-0.111	-0.111		-0.118		-0.121
R29	420.928	—	—		—		420.829
							-0.044
R30	420.408	420.362	420.364		420.358		419.963
		-0.036	-0.034		-0.050		0.445
R31	420.453	420.376	420.376		420.370		420.374
		-0.077	-0.077		-0.083		-0.079
R32	420.746	420.685	420.687		420.680	420.683	420.684
		-0.061	-0.059		-0.066	-0.063	-0.062
R33	420.553						
R34	420.801						
R35	420.403						
R36	420.680						

Woodward-Clyde Consultants
Consulting Engineers
Geologists and Environmental Scientists

DATA SHEET

Ground Instrumentation - Borros Points

Rock Anchor Test

Elevation & Change (Ft)

start RA-I1

Date	11 Oct '78	20 Oct '78	26 Oct '78		Initial	28 Dec '78	29 Dec 78	29 Dec 78	18 JAN 79	
Time			08.00		Depth	60 ft	80 ft	100 ft		
No										
PA-H1	420.849	420.853			420.850	420.849			420.846	
	0.000	+0.005				-0.001			-0.004	
					3					
H2	421.058	421.063			421.066	421.063			421.064	-
	0.000	+0.005				+0.003			+0.004	1
H3		420.973	420.973		420.973	420.968			420.965	
		0.000	0.000			-0.005			-0.008	
H4	420.718	420.718	420.718		420.718	420.719			420.717	
	0.000	0.000	0.000			+0.001			-0.001	
H5	421.168	421.168	421.168		421.168	421.169		421.171	421.166	
	0.000	0.000	0.000			+0.001		+0.003	-0.002	
H6	420.708	420.708	420.708		420.708	420.704		420.705	420.699	
	0.000	0.000	0.000			-0.004		-0.003	-0.009	
H7	421.643	421.653	421.653		421.653	421.692			421.636	
	0.000	+0.010	+0.010			-0.009			-0.017	
H8	420.838	420.833			420.836	420.838		420.835	420.832	
	0.000	-0.005				+0.002		-0.001	-0.004	
H9	421.213	421.208			421.210	421.194	421.194	421.190	421.180	
	0.000	-0.005				-0.016	-0.016	-0.020	-0.030	
H10	421.103	421.098	421.098		421.100	421.085	421.086		421.075	
	0.000	-0.005	-0.005			-0.015	-0.014		-0.025	
H11	421.528	421.523			421.526	421.510	421.513		421.502	
	0.000	-0.005				-0.016	-0.013		-0.024	
H12	421.008	421.003			421.006	420.987	420.981	420.980	420.984	
	0.000	-0.005				-.019	-0.025	-0.026	-0.022	
									-0.022	
H13	420.878	420.878	420.868		420.871	420.871	420.872	420.872	420.870	
	0.000	+0.010	0.000			.000	+0.001	+0.001	-0.001	

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DATA SHEET

GROUND INSTRUMENTATION - Borros Points

ROCK ANCHOR TEST

Elevation & Change (ft)

DATE	Initial	23JAN'79	3 FEB 79	complete RA-H1 8Feb 79	start RA-H2 14 Feb 79	15Feb 79	16 Feb'79	17Feb'79	17Feb'79	18 Feb'79
DEPTH		114Ft.	140 ft	166ft	46 ft.	71 ft	Check	10ft	125ft	150 ft
No								RAI2	RAI2	RAI2
RA-H1	420.850									
H2	421.063			421.066						
				+0.003						
H3	420.973									
H4	420.718		420.714	420.713						
			-0.004	-0.005						
H5	421.168	421.165	421.163	421.117					421.108	421.083
		-0.003	-0.005	-0.048	?				-0.060	-0.082
H6	420.708	420.700								
		-0.008								
H7	421.653	421.636							421.603	
		-0.017							-0.050	
H8	420836	420.929	420.831							
		-0.007	-0.005							
H9	421.210	421.176				421.119		421.077	421.058	420.307
		-0.034				-0.091		-0.133	-0.152	-0.903 ?
H10	421.100	421.074				421.045	421.049	421.045	420.398	420.483
		-0.026				-0.055	-0.051	-0.055	-0.702	-0.617
H11	421.526	421.499				421.476				420.370
		-0.027				-0.050				1.156
H12	421.006	420.953			420.918	420.901	420.903	420.891	420.888	
		-0.053			-0.088	-0.105	-0.103	-0.115	-0.118	
H13	420.871	420.865			420.834		420.878	420.873	420.873	
		-0.006			0.003		-.002	+0.002	+0.002	

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DATA SHEET

GROUND INSTRUMENTATION - Borros Points

ROCK ANCHOR TEST

Elevation & Change (ft)

			complete RA-I2	start RE-1					complete RE-1
Date	Initial	19 Feb 79	20 Feb 79	22 Feb 79	23 Feb 79	22 Feb 79	23 Feb 79	24 Feb 79	26 Feb 79
Depth		166 ft	179 ft	2[illegible] ft	-56 ft	96 ft	150 ft	120 Again	176 ft
No		RAI2	RAI2	RE1	RE1	RE1	REJ	RE1	RE1
RA-H1	420.850		420.822						420.819
(395)			-0.028						-0.031
H2	421.063		421.049	421.054	-20.053	421.042	421.048	421.053	421.052
(305)			-0.014	-.009	-.010	-.014	-.015	-0.010	-0.011
H3	420.973		420.937						420.934
(395)			-0.036						-0.034
H4	420.718	420.680	420.657	420.659	420.649	420.655	420.656	420.658	420.614
(385)		-0.038	-0.061	-.059	-.069	-.063	-.004	-0.060	-0.104
H5	421.168	421.077	421.074	421.073	421.072	421.069	421.044	421.061	421.031
(345)		-0.091	-0.094	-.093	-.094	-.097	-.124	-0.107	-0.137
H6	420.708		420.637						420.614
(395)			-0.071						-0.094
H7	421.653		421.573						421.585
(395)			-0.080						-0.068
H8	420.836	420.758	420.749	420.753	420.749	420.744	420.720	420.730	420.724
(365)		-0.078	-0.087	-.083	-.087	-.092	-.116	-0.106	-0.112
H9	421.210	421.047	421.058	421.034	421.033	421.030	421.016	421.025	421.018
(395)		-0.163	-0.152	-.176	-.177	-.180	-.194	-0.185	-0.192
H10	421.100		421.038	421.036				421.030	421.038
(395)			-0.062	-.064				-0.070	-0.062
H11	421.526		421.457	421.452				421.452	421.451
(395)			-0.069	-.074				-0.074	-0.075
H12	421.006		420.873		420.868	420.864	420.845	420.861	420.858
(395)			-0.133		-.138	-.142	-.161	-0.145	-0.148
H13	420.871		420.868	420.874	420.868	420.871	420.858	420.858	420.845
(395)			-0.003	.003	-.003	.000	+.000	-0.013	+.000

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DATA SHEET

GROUND INSTRUMENTATION · Borros Points

ROCK ANCHOR TEST

Elevation & Change (ft)

Date	Initial	start RE-2 28 Feb'79	1 Mar'79	1 Mar 79	1 Mar'79	2 Mar'79	complete RE-2 3 Mar'79	5 Mar 79
Depth		45 ft	70 ft	100 ft	120 ft	145 ft	Final	After drilling
No.		RE 2	RE 2	RE 2	RE 2	RE 2	RE 2	
RA H1	420.850						420.813	420.814
(395)							-0.037	-0.036
H2	421.063	421.047	421.052	421.049	421.048	421.045	421.044	421.048
(305)		-0.016	-0.011	-0.014	-0.015	-0.018	-0.019	-0.015
H3	420.973						420.928	420.930
(395)							-0.045	-0.043
H4	420.718	420.610	420.617	420.614	420.611	420.608	420.568	420.562
(325)		-0.108	-0.101	-0.104	-0.107	-0.110	-0.150	-0.156
H5	421.168	421.029	421.032	421.030	421.012	420.962	420.957	420.948
(345)		-0.139	-0.136	-0.138	-0.156	-0.206	-0.211	0.220
H6	420.708						420.606	420.604
(395)							-0.102	-0.104
H7	421.653						421.551	421.551
(395)							-0.102	-0.102
H8	420.836	420.719	420.721	420.717	420.681	420.676	420.676	420.677
(365)		-0.117	-0.115	-0.119	-0.155	-0.160	-0.160	-0.159
H9	421.210	421.013	421.015	421.013	421.002	420.999	420.999	421.001
(395)		-0.197	-0.195	-0.197	-0.208	-0.211	-0.211	-0.209
H10	421.100		421.024		421.019		421.021	421.021
(395)			-0.076		-0.081		-0.079	-0.079
H11	421.526		421.447		421.438		421.441	421.441
(395)			0.079		-0.088		-0.085	-0.085
H12	421.006	420.850	420.850	420.846	420.838	420.836	420.837	420.833
(395)		-0.156	-0.156	-0.160	-0.168	-0.170	-0.169	-0.173
H13	420.871	420.875	420.875		420.871	420.872	420.879	420.878
		+.004	+.004		0.000	+.001	+0.008	+0.007

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DATA SHEET

Ground Instrumentation - Sondex

Rock Anchor Test - RA 3D1

Elevation & Change (Ft)

				start RA-I1			complete RA-I1		complete RA-I2	complete RE-1
Date	12 Oct 78	20 Oct 78		Initial	29 Dec 78	29 Dec 78	9 Feb 79	8 Feb 79	20 Feb 79	25 Feb 79
time							Final	166 ft	179 ft	176 ft
Top of							RA-I1	RA I1	RA I2	RE1
Casing	421.31	421.31		421.31	421.31		421.31	421.31		421.36
							0.00	0.00		.05
	415.68	415.68		415.68	415.65	415.63	415.59	415.61	415.65	415.63
		0.00			-0.03	-0.05	-.09	-.07	-0.03	-.05
	405.97	405.97		405.97	405.96	405.95	405.89	405.91	405.96	405.94
		0.00			-0.01	-0.02	-.08	-.06	-0.01	-.02
	396.49	396.50		396.50	396.47	396.46	396.38	396.41	396.45	396.45
		+0.01			-0.03	-0.04	-.12	-.09	-0.05	-.05
	386.74	386.75		386.74	386.75	386.73	386.69	386.68	386.73	386.72
		+0.01			+0.01	-0.01	-.05	-.06	-0.01	-.02
	376.44	376.44		376.44	376.43	376.42	376.37	376.38	376.43	376.42
		0.00			-0.01	-0.02	-.07	-.06	-0.01	-.02
	366.66	366.69		366.68	366.68	366.67	366.61	366.61	366.66	366.65
		+0.03			+0.00	-0.01	-.07	-.07	-0.02	-.01
	356.34	356.33		356.34	356.33		356.23	356.28	356.31	356.30
		0.01			-0.01		-.06	-.06	-0.03	-.04
	346.59	346.60		346.60	346.59		346.52	346.53	346.54	346.55
		-0.01			-0.01		-.08	-.07	-0.06	-.09
	336.63	336.63		336.63	336.63		336.56	336.57	336.57	336.49
		0.00			0.00		-.07	-.06	-0.06	-.14
	331.87	331.86		331.86	331.86		331.80	331.81	331.8	331.77
		0.01			0.00		-.06	-.05	-0.06	-.09
	326.88	326.89		326.88	326.89		326.82	326.83	326.83	326.80
		-0.01			+0.01		-.06	-.05	-0.05	-.08
	321.81	321.82		321.82	321.81		321.75	321.77	321.76	321.7
		-0.01			-0.01		-.04	-.05	-0.06	-.09

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DATA SHEET

1. Ground Instrumentation - Sondex

Rock Anchor Test - RA 3D1

Elevation & Change (Ft)

				start RA-I1			complete RA-I1		complete RA-I2	complete RE-1
Date	12 Oct'78	20 Oct'78		Initial	28 Dec'78	29 Dec'78	9 Feb'79	8 Feb'79	20 Feb.79	25 Feb.79
Time							Final	RAI1	RAI2	RE1
Top of casing	421.31	421.31								
	316.52	316.53		316.52	316.53		316.49	316.48	316.46	316.44
		-0.01			+0.01		-.03	-.04	-0.06	-.08
	311.70	311.72		311.71	311.71		311.68	311.67	311.67	311.66
		-0.02			0.00		-.03	-.04	-0.04	-.05
	306.80	306.82		306.81	306.81		306.76	306.62	306.84	306.84
		-0.02			0.00		-.05	-.19	+0.03	.03
	301.88	301.90		301.89	301.89		301.84	301.82	301.92	301.91
		-0.02			0.00		-.05	-.07	+0.03	.02
	296.33	296.34		296.34	296.29		296.24		296.28	296.27
		-0.01			-0.05		-.10		-0.06	-.05
	291.28	291.28		291.28	291.21		291.14		291.18	291.16
		0.00			-0.07		-.14		-0.10	-.12
	286.20	286.21		286.20	286.07		286.07		286.11	286.10
		-0.01			-0.13		-.13		-0.09	-.10

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DATA SHEET

Ground Instrumentation + Sondex

Rock Anchor Test - RA3D1

Elevation & Change (Ft)

Date	Initial	2 Feb. 89 complete RE-2	5 Feb. 89 after drilling activities	6 March 89	6 March 89					
Depth Top of Casing	421.31	421.31	421.31	421.31	421.31					
		.00	.00							
	415.68	415.70	415.53	415.48	415.54					
		.02	-.15	-0.20	-0.14					
	405.97	405.83	405.91	405.85	405.91					
		-.14	-.06	-0.12	-0.06					
	396.50	396.48	396.39	396.44	396.41					
		-.02	-.11	-0.06	-0.09					
	386.74	386.61	386.68	386.72	386.69					
		-.13	-.06	-0.02	-0.05					
	376.44	376.31	376.38	376.41	376.39					
		-.13	-.08	-0.03	-0.05					
	366.68	366.68	366.60	366.65	366.62					
		.00	-.08	-0.03	-0.06					
	356.34	356.18	356.25	356.29	356.26					
		-.16	-.09	-0.05	-0.08					
	346.60	346.38	346.44	346.40	346.46					
		-.22	-.16	-0.20	-0.14					
	336.63	336.39	336.45	336.51	336.47					
		-.24	-.18	-0.12	-0.16					
	331.86	331.62	331.69	331.72	331.70					
		-.24	-.17	-0.14	-0.16					
	326.88	326.78	326.70	326.74	326.71					
		-.10	-.18	-0.14	-0.17					
	321.82	321.71	321.69	321.58	321.64					
		-.11	-.13	-0.24	-0.18					
	316.52	316.42	316.35	316.36	316.35					
		-.10	-.19	-0.16	-0.17					
	311.71	311.50	311.57	311.51	311.58					
		-.21	-.14	-0.20	-0.13					
	306.81	306.71	306.78	306.69	306.79					
		-.10	-.03	-0.18	-0.02					
	301.89	301.94	301.87	301.79	301.89					
		.05	-.02	-0.10	-0.01					
	296.34	296.28	296.22	296.21	296.22					
		-.06	-.12	-0.13	-0.12					

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DATA SHEET

Ground Instrumentation - Sondex

Rock Anchor Test - RA3D1

Elevation & Change (ft)

complete RE-2

Date	Initial	2 March 79	5 March 79	6 March 79	@ 1535 6 March 79				
Depth		176 Ft	after drilling activities						
Hole No.									
	291.28	291.04	291.10	291.04	291.11				
		-.24	-.18	-0.24	-0.17				
	286.20	285.99	286.04	285.76	286.05				
		-.23	-.16	-0.44	-0.15				

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DATA SHEET

Ground Instrumentation - Sondex

Rock Anchor Test - RA3D2 p.1A of 3

Elevation & Change (Ft)

Corrections on 24 Oct 78 start RA-I1

Date	12 Oct'78	20 Oct'78	24 Oct'78	25 Oct 78	25 Oct 78	24 Oct 78		Initial	28 Dec 78	26 Dec 78
Time				16 45	1650					
Top of Casing	421.21	421.21	421.22	421.22	421.22	421.22		421.22	421.22	421.22
		0.00	+0.01	+0.01	+0.01	+0.01			.00	.00
	413.94	413.87	413.94	413.95	413.95	413.94		413.94	413.88	413.89
		-0.07	0.00	+0.01	+0.01	0.00			-.06	-0.05
	403.97	403.99	403.97	403.97	403.98	403.97		403.98	403.88	403.90
		+0.02	0.00	0.00	+0.01	0.00			-.09	-0.09
	393.99	393.91	393.97	393.99	393.99	393.97		393.98	393.92	393.92
		-0.08	-0.02	0.00	0.00	-0.02			-.06	-.06
	384.06	383.98	384.04	384.07	384.07	384.04		384.06	384.02	384.03
		-0.08	-0.02	+0.01	+0.01	-0.02			-.04	-.03
	374.04	373.94	374.04	374.04	374.04	374.04		374.04	374.02	374.03
		-0.10	0.00	0.00	0.00	0.00			-.02	-.04
	364.01	363.95	364.02	364.02	364.03	364.02		364.02	363.97	363.98
		-0.06	+0.01	+0.01	+0.02	+0.01			-.05	-.04
	354.03	353.97	354.04	354.04	354.05	354.04		354.04	353.98	
		-0.06	+0.01	+0.01	+0.02	+0.01			-.06	
	344.07	344.00	344.06	344.08	344.09	344.06		344.07	344.02	
		-0.07	-0.01	+0.01	+0.02	-0.01			-.04	
	339.09	339.02	339.05	340.00	339.09	339.05		339.08	339.04	
		-0.07	-0.04	+0.01	0.00	-0.04			-.04	
	334.07	334.00	334.00	334.08	334.07	334.07		334.07	334.01	
		-0.07	-0.07	+0.01	0.00	0.00			-.06	
	329.07	329.00	329.06	329.08	329.08	329.06		329.07	329.02	
		-0.07	-0.01	+0.01	+0.01	-0.01			-.05	
	324.06	323.99	323.92	324.06	324.06	324.03		324.05	323.99	
		-0.07	-0.14	0.00	0.00	+0.03			-.06	

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DATA SHEET

Ground Instrumentation - Sondex

Rock Anchor Test - RA3D2

Elevation & Change (ft)

Corrections on 24 Oct 78 start RA-I2

Date	12 Oct'78	20 Oct'78	24 Oct '78	25 Oct 78	25 Oct 78	24 Oct 78		Initial	28 Dec 78	29 Dec 78
Time				1645	1650					
Top of Casing		421.213	421.22	421.22	421.22	421.22				
	319.04	318.98	318.93	319.05	319.05	319.05		319.05	319.00	
		-0.06	-0.11	+0.01	+0.01	+0.01			-.05	
	314.12	313.92	314.04	314.13	314.12	314.10		314.12	314.06	
		-0.20	-0.08	+0.01	0.00	-0.02			-.06	
	309.05	308.87	309.04	309.07	309.07	309.04		309.05	309.00	
		-0.18	-0.01	+0.02	+0.02	-0.01			-.05	
	304.11	303.93	304.09	304.12	304.12	304.05		304.11	304.05	
		-0.18	-0.02	+0.01	+0.01	+0.06			-.06	
	299.10	299.03	298.98	299.10	299.10	299.08		299.10	298.99	
		-0.07	-0.12	0.00	0.00	-0.02			-.11	

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DATA SHEET

Ground Investigation - Sondex

Rock Anchor Test - RA3D2

Elevation & Change (Ft)

				complete RA-I		start RA-I2		complete RA-I2	complete RE-1
Date	Initial	23JAN79	8FEB79	8 Feb 79	9 Feb 79	17Feb79	18 Feb 79	20Feb79	25 Feb
		114Ft.	discontinuous core			125ft	130(146ft	179 ft	179 ft
Type Dr.			115	166Ft	Final.	RAI2	RAI2	RAI2	RE1
Ground	421.32	421.22	421.22	421.22	421.22	421.27	421.27		421.27
		0.00	0.00	—	—	0.05			
	413.94	413.84	413.83	413.85	413.84	413.89	413.90	413.89	413.87
		-0.10	-0.11	-.09	-.10	-0.05	-0.04	-0.05	-.02
	403.98	403.85	403.83	403.86	403.81	403.90	403.91	403.9	403.90
		-0.13	-0.15	-.12	-.17	-0.08	-0.07	-0.08	-.07
	393.98	393.88	393.85	393.88	393.78	393.98	393.98	393.91	393.91
		-0.10	-0.13	-.10	-.20	-0.06	-0.06	-0.07	-.07
	383.06	383.99	383.85	383.99	383.87	384.02	384.03	384.02	384.01
		-0.07	-0.21	-.07	-.19	-0.04	-0.03	-0.04	-.05
	374.00	373.99	373.95	373.99	373.90	374.03	374.03	374.01	374.00
		-0.05	-0.09	-.05	-.14	-0.01	-0.01	-0.03	-.04
	364.02	363.90	363.90	363.93	363.86	363.95	363.93	363.92	363.89
		-0.12	-0.12	-.09	-.16	-0.07	-0.09	-0.10	-.12
	354.04	353.96	353.91	353.93	353.88	353.96	353.92	353.89	353.85
		-0.09	-0.13	-.11	-.16	-0.08	-0.12	-0.15	-.19
	344.02	344.01	343.95	343.96	343.89	344.01	343.94	343.93	343.85
		-0.06	-0.12	-.011	-.18	-0.06	-0.13	-0.14	-.19
	334.05	339.00	338.97	338.98	338.91	339.02	338.96	338.95	338.89
		-0.08	-0.11	-.10	-.17	-0.06	-0.12	-0.13	-.19
	324.07	333.99	333.89	334.01	333.97	334.07	334.07	334.08	334.02
		-0.08	-0.18	-.06	-.10	-0.02	0.00	+0.01	-.07
	329.02		328.96		329.00	329.07	329.08	329.09	329.06
			-0.11		-.07	-0.01	+0.01	+0.02	-.01
	324.05		323.94		329.06	324.05	324.08	324.09	324.09
			-0.11		-.09	0.00	+ 0.03	+0.04	.04

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DATA SHEET

GROUND INSTRUMENTATION - Sondex

Rock Anchor Test - RG302

Elevation & Change (Ft)

				complete RA-I1			start RA-I2	complete RA-I2	complete RE-1
DATE	[illegible]	23JAN79	2FEB79	8 Feb 79	9 Feb 79		18 Feb 79	20 Feb 79	25 Feb 79
TIME		1114	discontinue ODEX 116	166 Ft	Final			179 ft	196 ft
TOP OF CASING									
	310.05	1	318.95	318.98	318.96		319.086	319.09	319.10
			-0.10	-.07	-.09		+0.03	+0.04	.05
	314.12			314.04	313.92	314.01	314.186	314.15	314.16
				-.08	-.20	-0.11	+0.01	+0.03	.04
	309.05			308.99	308.97			309.09	309.09
				-.06	-.08			+0.04	.04
	304.11			304.02	303.97			304.13	304.13
				-.09	-.14			+0.02	.02
	299.10				298.95			299.12	299.12
					-.15			+0.02	.02

WCC 1-8

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DATA SHEET

Ground Instrumentation - Sondex

Rock Anchor Test - RA3D2

Elevation & Change (Ft)

complete RE-2

Date	Initial		2 March 79	2 March 79	5 March 79	6 March 79	@1330 hrs 6 March 79
Depth		RE1	144 ft	176 ft			final
- No.		150 ft	RE2				
Top of Casing	421.22	421.27	421.27	421.22	421.22	421.22	421.22
		.05	.05	.00	.00	0.00	
	413.94	413.92	413.89	413.75	413.80	413.77	413.83
		-.02	-.05	-.19	-.14	- 0.17	- 0.11
	403.98	403.93	403.89	403.76	403.83	403.78	403.84
		-.05	-.09	-.22	-.15	- 0.20	- 0.14
	393.98	393.85	393.91	393.92	393.84	393.90	393.86
		-.13	-.07	-.06	-.12	- 0.08	- 0.12
	384.06	383.95	384.01	384.02	383.93	383.99	?383.95
		-.11	-.05	-.04	-.13	- 0.07	- 0.11
	374.04	373.95	374.00	373.87	373.92	373.89	373.93
		-.09	-.04	-.17	-.12	- 0.15	?0.11
	364.02	363.85	363.88	363.74	363.80	363.86	?363.81
		-.17	-.14	-.27	-.22	- 0.16	- 0.21
	354.04	353.82	353.82	353.65	353.71	353.70	353.75
		-.22	-.22	-.36	-.33	- 0.34	- 0.29
	344.07	343.84	343.81	343.77	343.69	343.74	343.71
		-.23	-.27	-.30	-.38	- 0.33	- 0.36
	339.08	338.95	338.79	338.61	338.67	338.70	338.68
		-.13	-.29	-.47	-.41	- 0.38	?- 0.40
	334.07	334.08	333.93	333.84	333.77	333.81	333.77
		.01	-.14	-.21	-.30	- 0.26	?- 0.30
	329.07	329.11	328.99	320.95	328.86	328.89	328.86
		.04	-.08	.86	-.21	- 0.18	?- 0.21
	324.05	324.03	324.07	323.87	323.91	323.88	323.93
		-.02	.02	-.18	-.14	- 0.17	- 0.12
	319.05	319.12	319.10	318.95	318.80	318.89	?318.86
		.07	.05	-.10	-.25	- 0.16	- 0.19
	314.12	314.18	314.27				
		.06	.15				
	309.05	309.10					
		.05					
	304.11	304.14					
		.03					
	299.10	299.06					
		-.04					

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DATA SHEET

Ground Instrumentation - Sondex

Rock Anchor Test - RA3D3 p. 1A of 3

Elevation & Change (Ft)

start RA-I1

Date	12 Oct 78	20 Oct 78		INITIAL	20 DEC 78	24 DEC 78	29 Dec 78	23 JAN 79	2 FEB 79	8 FEB 79
Time					60 ft	80 ft Depth	100 ft Depth	114 Ft.	discontinue ODEX 115	6 PM
Top of										
Casing	421.61	421.62		421.62	421.62	421.62		421.62	421.62	421.62
		+0.01			.00	.00		0.00	0.00	.01
	418.14	418.13		418.14	418.05	418.05	418.06	418.03	418.01	418.05
		- .01			-.09	-.09	-0.08	-0.11	-0.13	-.09
	408.29	408.28		408.28	408.23	408.22	408.22	408.19	408.16	408.20
		0.00			-.05	-.06	-0.06	-0.09	-0.12	-.08
	398.36	398.36		398.36	398.31	398.32	398.32	398.28	398.26	398.28
		0.00			-.05	-.04	-0.04	-0.08	-0.10	-.08
	388.68	388.67		388.65	388.63	388.63	388.63	388.60	388.59	388.60
		-0.01			-.05	-.05	-0.05	-0.08	-0.09	-.08
	378.81	378.79		378.80	378.76	378.73	378.77	378.74	378.72	378.73
		-0.02			-.04	-.07	-0.03	-0.06	-0.08	-.07
	373.16	373.16		373.16	373.11	373.11	373.12	373.08	373.06	373.09
		0.00			-.05	-.05	-0.04	-0.08	-0.10	-.07
	369.74	369.75		369.75	369.69	369.69	369.70	369.66	369.65	369.64
		+0.01			-.06	-.06	-0.05	-0.09	-.10	-.11
	365.49	365.50		365.50	365.45	365.45	365.45	365.41	365.39	365.42
		+0.01			-.05	-.05	-0.05	-0.09	-0.11	-.08
	356.40	356.40		356.40	356.35		356.35	356.32	356.28	356.32
		0.00			-.05		-0.05	-0.08	-0.12	-.08
	353.68	353.58		353.63	353.62		353.62	353.60	353.58	353.61
		-0.10			-.01		-0.01	-0.03	-.05	-.02
	350.48	350.47		350.48	350.43		350.43	350.40	350.37	350.42
		-0.01			-.05		-0.05	-0.08	-0.11	-.06
	346.44	346.43		346.44	346.37		346.38	346.35	346.33	346.35
		-0.01			-.07		-0.06	-0.09	-0.11	-.06

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DATA SHEET

Ground Instrumentation - Sondex

Rock Anchor Test - RA3D3

Elevation & Change (Ft)

start RA-I1

Date	12 Oct 78	20 Oct '78		INITIAL	28 DEC 78	29 DEC 78	23 JAN 79	2 FEB 79	
Time							114 Ft.	discontinue ODEX 118	
Top of Casing	421.61	421.62		421.62	421.62	421.62	421.62		
	335.52	335.53		335.53	335 47	*	335.44	335.43	335.48
		+0.01			-.06		-.09	-.10	-.05
	331.76	331.77		331.77	331.72		331.69	331.65	331.74
		+0.01			-.05		-0.07	-0.11	-.03
	328.00	328.01		328.01	327.96			327.90	327.96
		+0.01			-.05			-.11	-.05
	323.52	325.51		323.52	323.47			323.40	323.49
		-0.01			-.05			-0.12	-.03
	313.69	313.69		313.69	313.62				313.69
		0.00			-.07				-.06

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DATA SHEET

GROUND INSTRUMENTATION - Sondex

Rock Anchor Test - RA303

				Elevation & Change (Ft)						
		complete RA-E1	start RA-I2				complete RA-I2	start RE-1	complete RE-1	
DATE	INITIAL	9 Feb 79		17 Feb 79	17 Feb 79	18 Feb 79	19 Feb 79	24 Feb 79	25 Feb 79	24 Feb 79
TIME				100 ft	125 ft	150 (46) ft	175 ft	120 ft	176 ft	150 ft
TOP OF				RAI2	RAI2	RAI2	RAI2	RE1	RE1	RE-1
CASING	421.62	421.62		421.62			421.62	421.59	421.59	421.59
		—						-.03	-.03	-.03
	418.14	418.01		418.02	418.02	418.02	418.01	417.97	417.97	417.99
		-.13		-0.12	-0.12	-0.12	-0.13	-.17	-.17	-.15
	408.28	408.18		408.18	408.18	408.18	408.17	408.13	408.13	408.05
		-.10		-0.10	-0.10	-0.10	-0.11	-.14	-.14	-.20
	398.36	398.26		398.26	398.26	398.26	398.26	398.22	398.22	398.17
		-.10		-0.10	-0.10	-0.10	-0.10	-.14	-.14	-.19
	388.68	388.58		388.58	388.59	388.58	388.58	388.53	388.54	388.56
		-.10		-0.10	-0.09	-0.10	-0.10	-.15	-.14	-.12
	378.80	378.73		378.72	378.72	378.72	378.71	378.66	378.66	378.63
		-.07		-0.08	-0.08	-0.08	-0.09	-.14	-.14	-.12
	373.16	373.06		373.06	373.06	373.04	373.06	373.00	372.99	373.01
		-.10		-0.10	-0.10	-0.12	-0.10	-.16	-.17	-.15
	369.75	369.65		369.66	369.63	369.62	369.64	369.57	369.56	369.59
		-.10		-0.11 -0.09	-0.12	-0.13	-0.11	-.18	-.19	-.16
	365.50	365.40		365.40	365.40	365.38	365.39	365.33	365.32	365.32
		-.10		-0.10	-0.10	-0.12	-0.11	-.17	-.18	-.13
	356.40	356.31		365.34	356.32	356.32	356.33	356.25	356.24	356.26
		-.09		-0.06	-0.08	-0.08	-0.07	-.15	-.16	-.14
	353.63	353.59		353.62	353.60	353.60	353.63	353.54	353.53	353.52
		-.04		-0.01	-0.03	-0.03	0.00	-.09	-.10	-.06
	350.48	350.41		350.44	350.44	350.44	350.47	350.39	350.39	350.39
		-.07		-0.04	-0.04	-0.04	-0.01	-.09	-.09	-.09
	346.44	346.35			346.41	346.42	346.43	346.39	346.39	346.33
		-.09			-0.03	-0.02	-0.01	-.05	-.05	-.11

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DATA SHEET

- GROUND INSTRUMENTATION - Sondex

Rock Anchor Test - RA 903

Elevation & Change (ft)

		complete RA-I1	start RA-I2				complete RA-I2	start RE-1	complete RE-1	
DATE	INITIAL	9 Feb 79			17 Feb 79	18 Feb 79	19 Feb 79	21 Feb 79	25 Feb 79	24 Feb 79
TIME					125 ft	150 (max) ft	179 ft	120 ft	196 ft	150 ft
TOP OF CASING	421.62	421.62								
	335.59	335.49			335.53	335.53	335.56	335.52	335.54	335.[illegible]
		-.05			0.00	0.00	+0.03	-.01	.01	-.0[illegible]
	331.77	331.72			331.76	331.76	331.8	331.77	331.77	331.[illegible]
		-.05			-0.01	-0.01	+0.03	0.00	0	-.06
	328.01	327.96			328.00	328.02	328.03		328.01	327.[illegible]
		-.05			-0.01	+ 0.01	+0.02		0	-.0[illegible]
	323.52	323.48			323.52	323.52	323.54		323.52	323.44
		-.04			0.00	0.00	+0.02		0	-.08
	313.69	313.64				313.68	313.7		313.68	313.6[illegible]
		-.05				- 0.01	+0.01		-.01	.00

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DATA SHEET

Ground Instrumentation - Sondex

Rock Anchor Test - RA3D3

Elevation & Change (ft)

Date	Initial	1 March 79	2 March 79	7 March 79 complete RE 2	8 March 79	6 March 79	@ 1315 hr 6 March 79			
Depth		119 ft	144 ft	176 ft						
No.		RE 2	RE 2							
Top of Casing	421.62	421.59	421.59	421.54	421.54	421.54	421.54			
		-.03	-.02	-.08	-.08		-.08			
	418.14	417.97	418.00	-13.87	417.91	417.89	417.94			
		-.17	-.14	-.27	-.23	-0.25	-0.30			
	408.28	408.13	408.14	408.03	408.07	408.04	408.10			
		-.15	-.14	-.25	-.21	-0.24	-0.18			
	398.36	398.22	398.23	398.13	398.17	398.20	?398.18			
		-.14	-.13	-.23	-.19	-0.16	-0.18			
	388.68	388.53	388.54	388.45	388.47	388.51	?388.50			
		-.15	-.14	-.13	-.21	-0.17	?0.18			
	378.80	378.64	378.65	378.55	378.58	378.61	378.59			
		-.16	-.15	-.25	-.22	-0.19	-0.21			
	373.16	372.95	372.95	372.85	372.87	372.91	?372.90			
		-.21	-.21	-.31	-.29	-0.25	-0.26			
	369.75	369.51	369.50	369.39	369.42	369.46	?369.45			
		-.24	-.25	-.36	-.33	-0.29	-0.30			
	365.50	365.25	365.23	365.23	365.15	365.14	365.18			
		-.25	-.27	-.27	-.35	-0.36	-0.32			
	356.40	356.18	356.11	356.01	356.03	356.06	?356.06			
		-.22	-.29	-.39	-.37	-0.34	-0.34			
	353.63	353.47	353.42	353.33	353.34	353.37	353.36			
		-.16	-.21	-.30	-.29	-0.26	-0.27			
	350.48	350.34	350.29	350.28	350.20	350.23	350.23			
		-.14	-.19	-.20	-.28	-0.25	-0.25			
	346.44	346.36	346.33	346.32	346.24	346.22	346.27			
		-.08	-.11	-.12	-.20	-0.22	-0.17			
	335.53	335.56	335.55	335.55	335.47	335.45	335.51			
		.03	.02	.02	-.06	-0.08	-0.02			
	331.77	331.79	331.81	331.94	331.71	331.74	331.77			
		.02	.04	-.03	-.06	-0.03	0.00			
	328.01		328.05	328.04	329.99	327.95	328.01			
			.04	.03	-.02	-.06	0.00			
	323.52		323.56	323.47	323.47	323.49	323.52			
			.04	-.05	-.05	-0.03	0.00			
	313.69		313.72	313.62	313.66	313.69	313.67			
			.03	-.07	-.03	0.00	-0.02			

PHASE IV REPORT

VOLUME VA

RESULTS AND INTERPRETATION OF ROCK ANCHOR TEST PROGRAM

APPENDIX D

INCLINOMETER PROFILES

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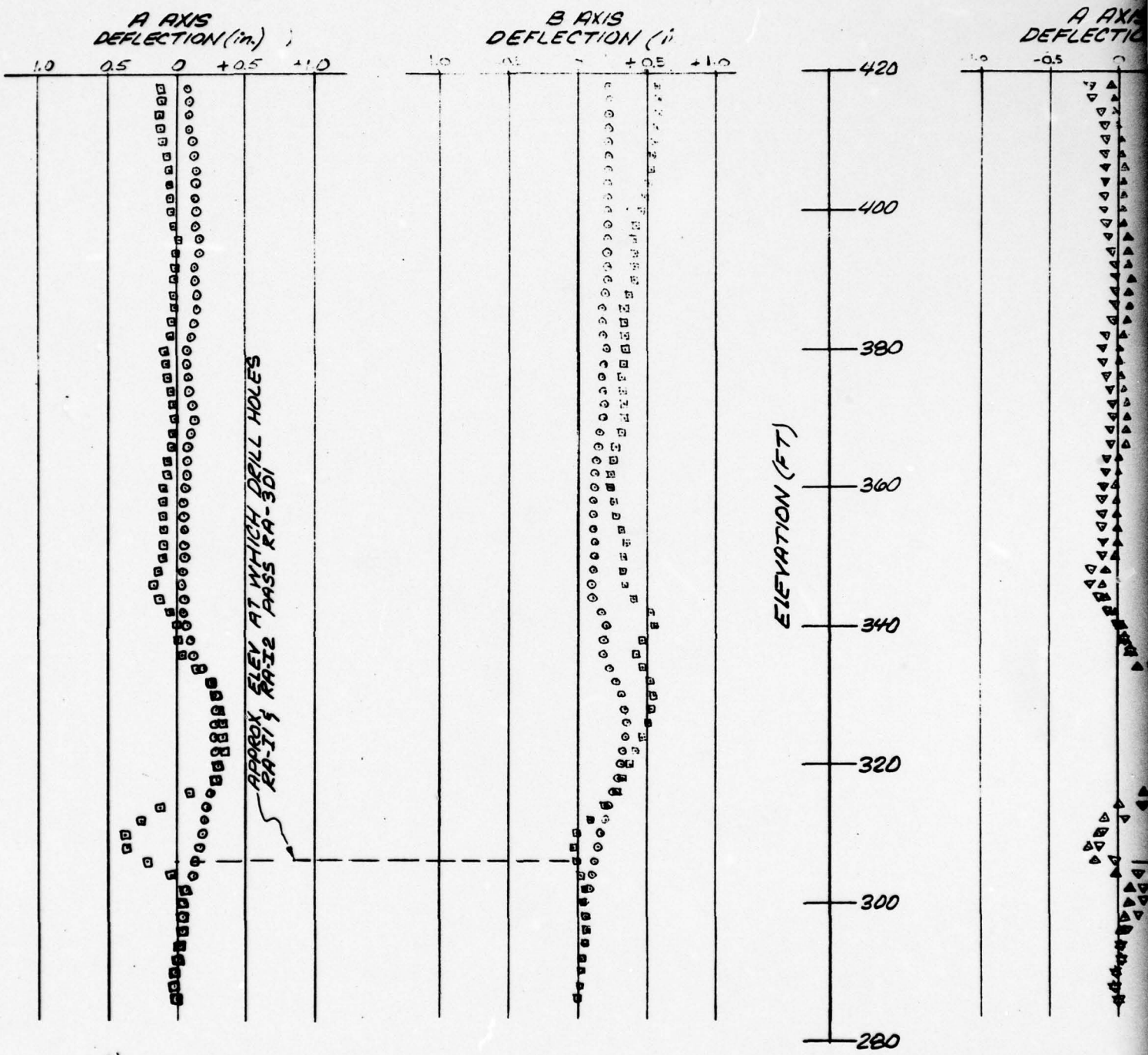
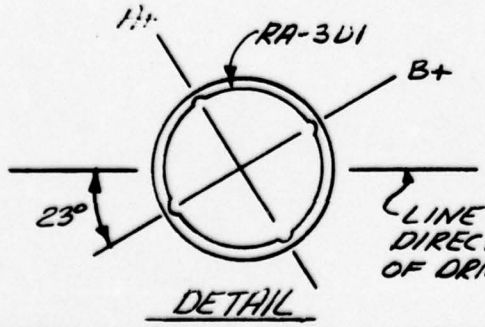
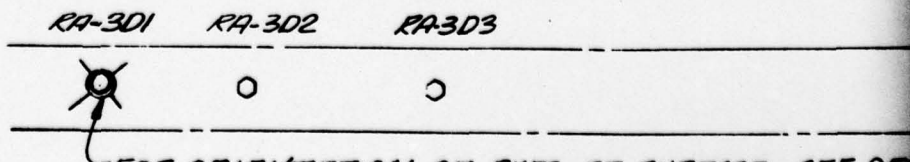




DETAIL

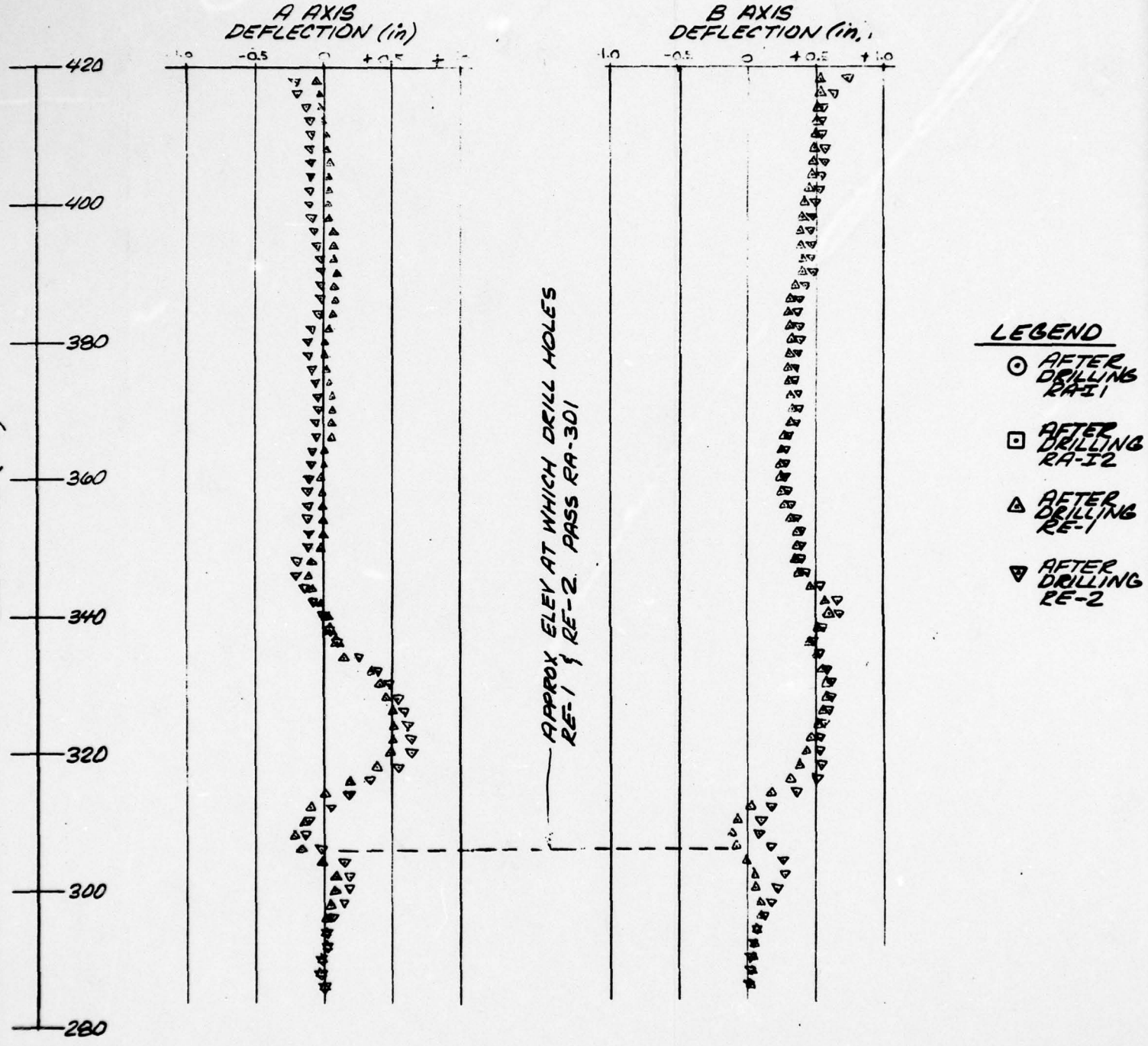
ORIENTATION OF AXES AT SURFACE



FOR ORIENTATION OF AXES AT SURFACE, SEE DE

FOR ORIENTATION AT DEPTH, SEE FIG 0.4

LOCATION PLA



RA303

RA-I1 RE-1

RA-I2 RE-2

OF AXES AT SURFACE, SEE DETAIL
AT DEPTH, SEE FIG 0.4

LOCATION PLAN

ROCK ANCHOR TEST PROGRAM

INCLINOMETER PROFILES
AFTER DRILLING

RA 301

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0005

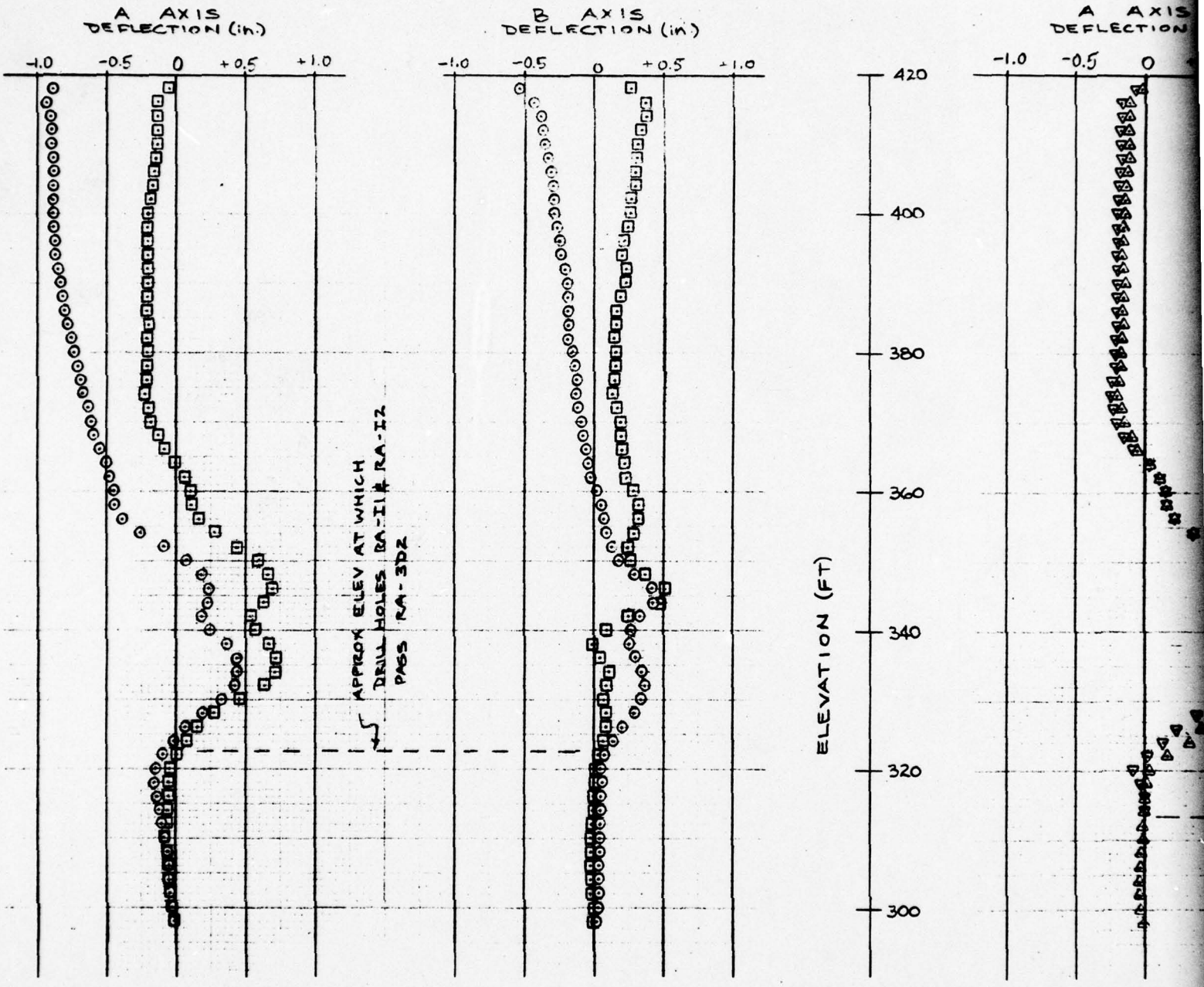
Woodward-Clyde Consultants

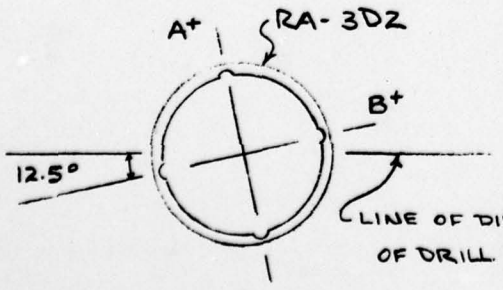
Y7C625 Phase II

Fig 0.1

1

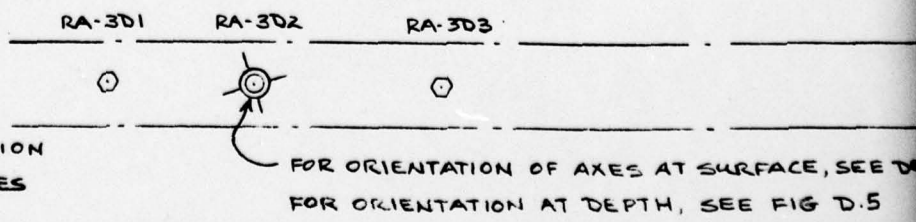
2



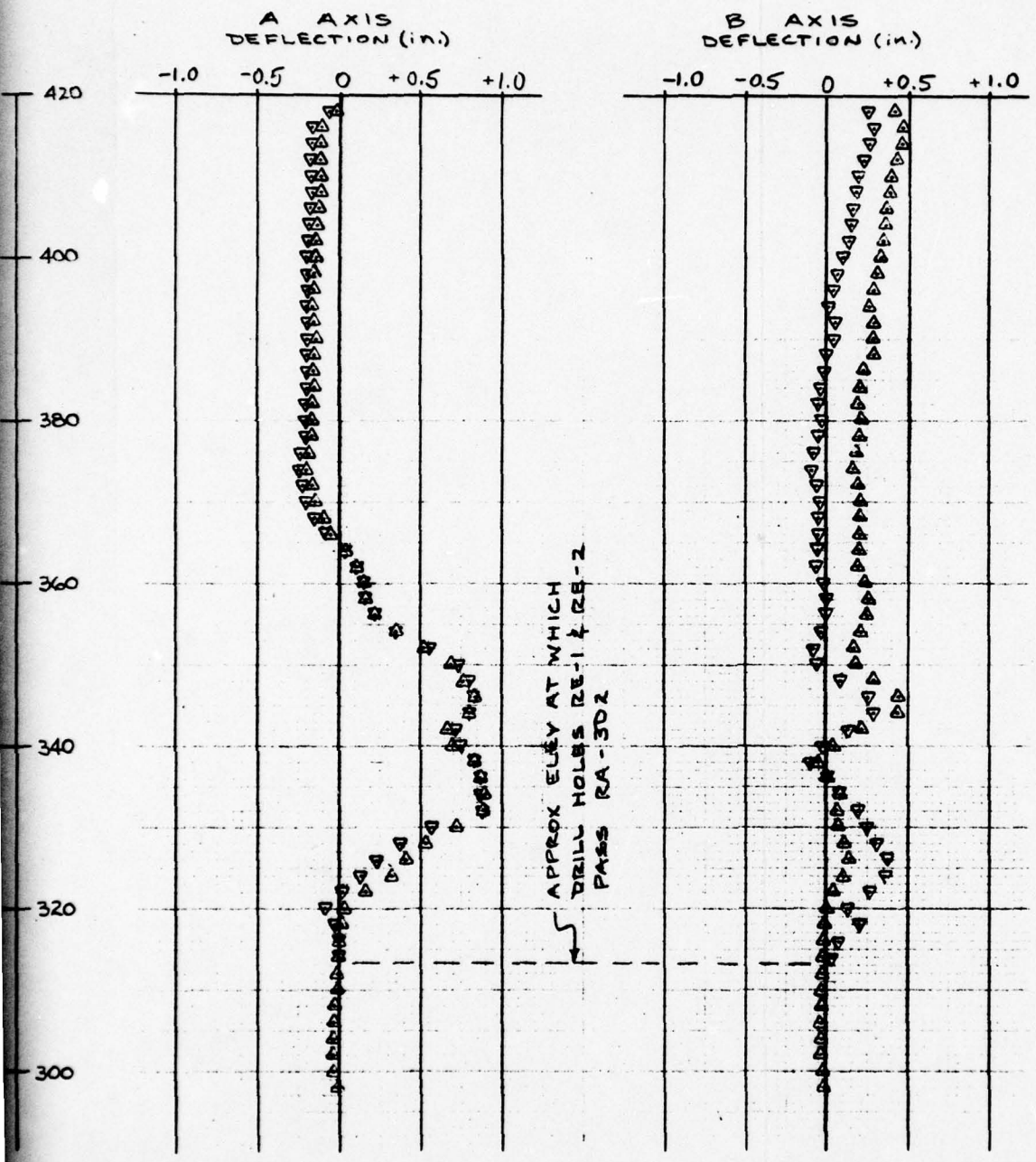


DETAIL

ORIENTATION OF AXES AT SURFACE

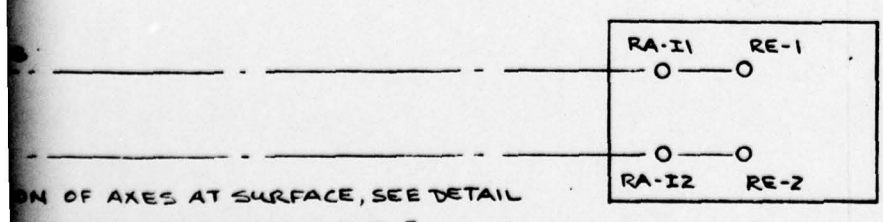


LOCATION P



LEGEND

- ⊙ AFTER DRILLING RA-I1
- ⊡ AFTER DRILLING RA-I2
- △ AFTER DRILLING RE-1
- ▽ AFTER DRILLING RE-2



ON OF AXES AT SURFACE, SEE DETAIL
ION AT DEPTH, SEE FIG D.5

LOCATION PLAN

ROCK ANCHOR TEST PROGRAM

INCLINOMETER PROFILES AFTER DRILLING

RA-3D2

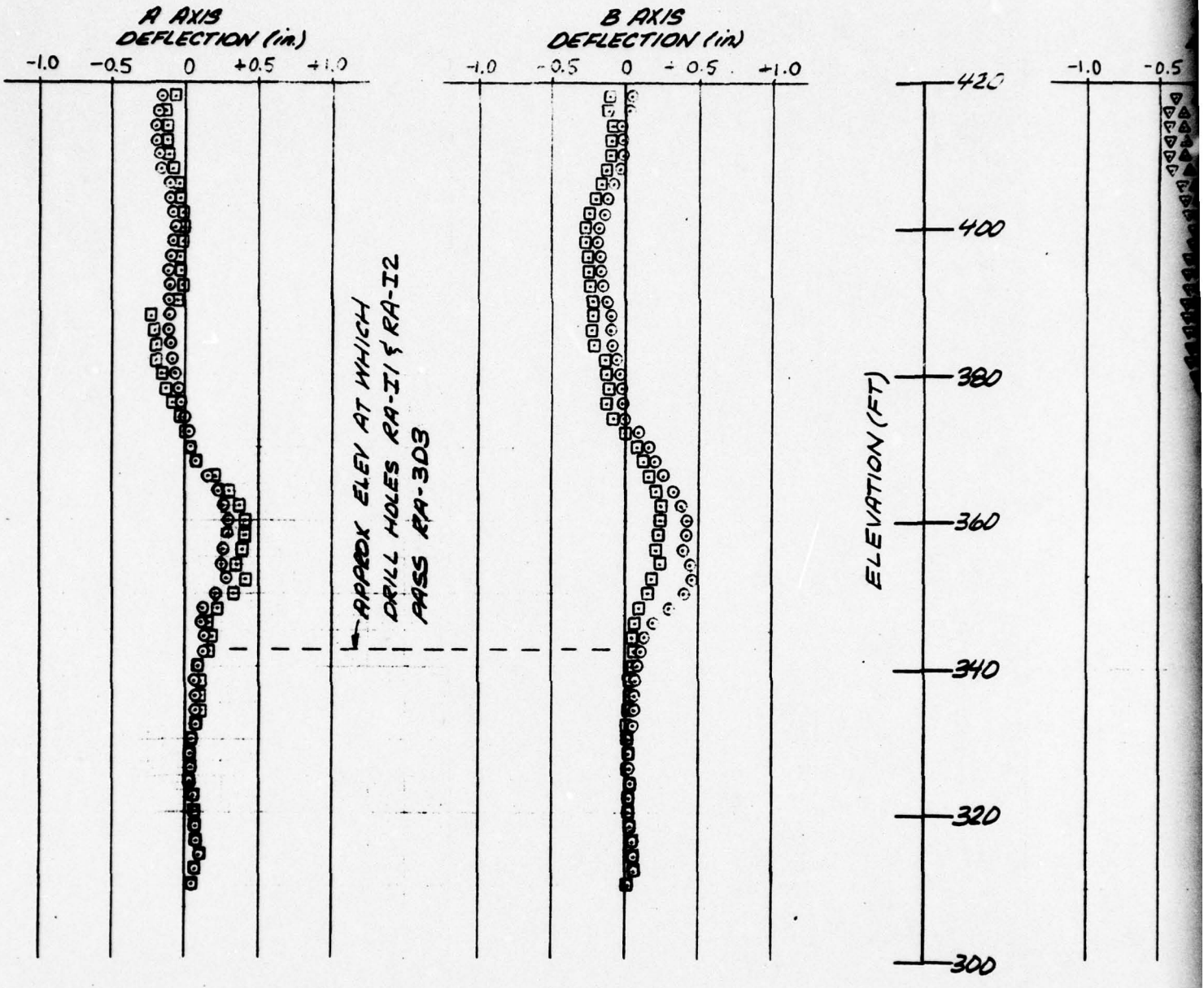
FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0008

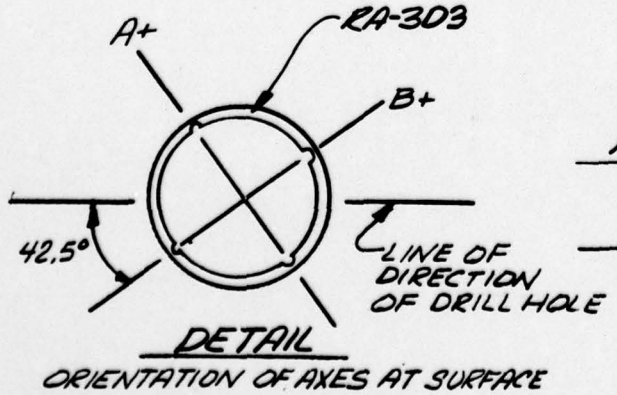
Woodward-Clyde Consultants

Y7C825 Phase IX

Fig D.2

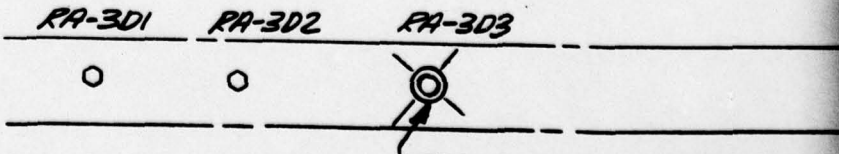
1 2



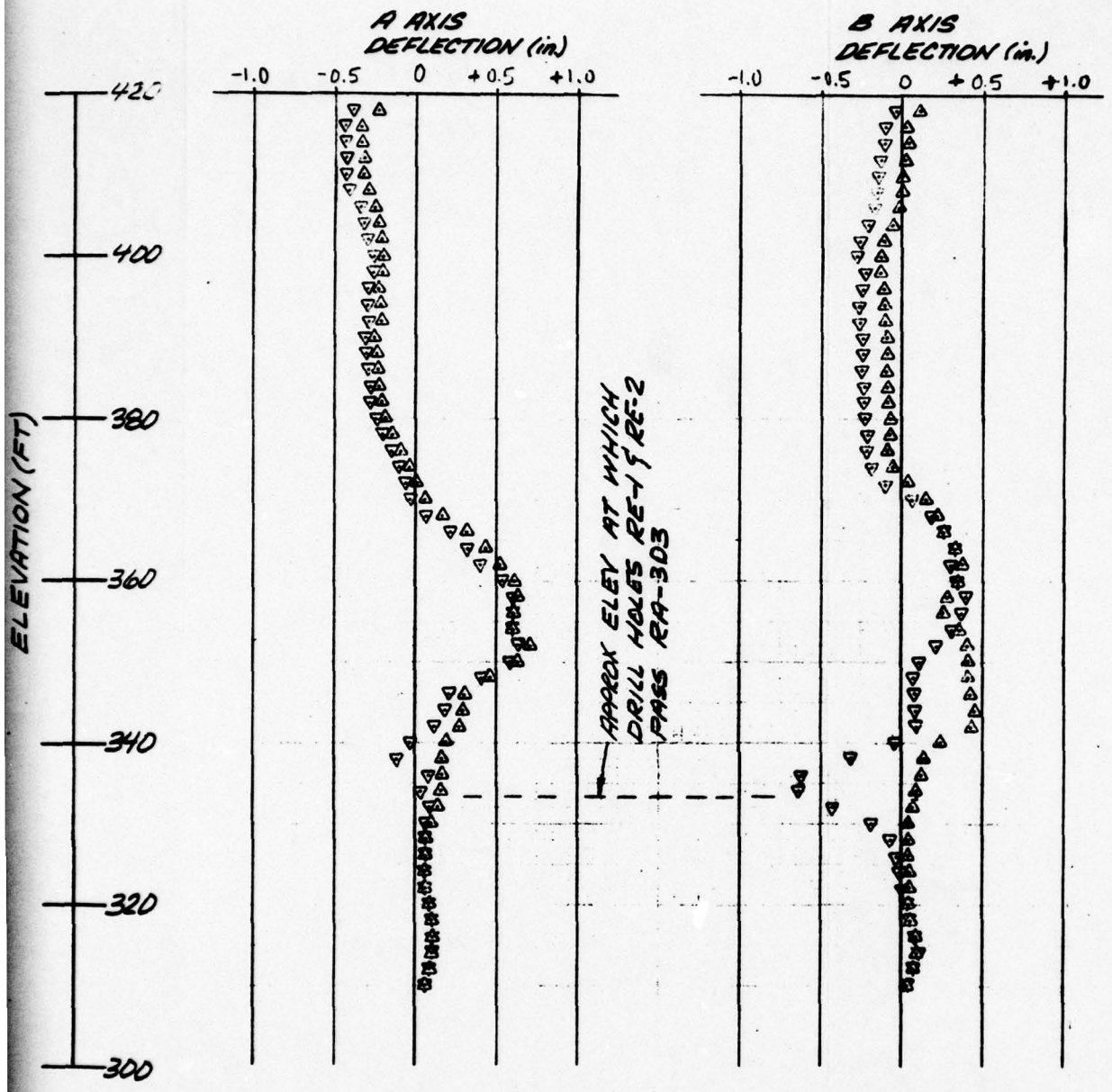


DETAIL

ORIENTATION OF AXES AT SURFACE

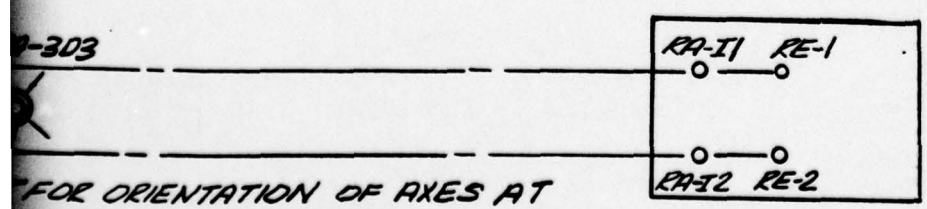


FOR ORIENTATION OF A
SURFACE, SEE DETAIL
FOR ORIENTATION AT DE



LEGEND

- ⊙ AFTER DRILLING RA-I1
- ⊡ AFTER DRILLING RA-I2
- △ AFTER DRILLING RE-1
- ▽ AFTER DRILLING RE-2



FOR ORIENTATION OF AXES AT SURFACE, SEE DETAIL
FOR ORIENTATION AT DEPTH, SEE FIG. D.6

LOCATION PLAN

1 2

ROCK ANCHOR TEST PROGRAM

INCLINOMETER PROFILES AFTER DRILLING

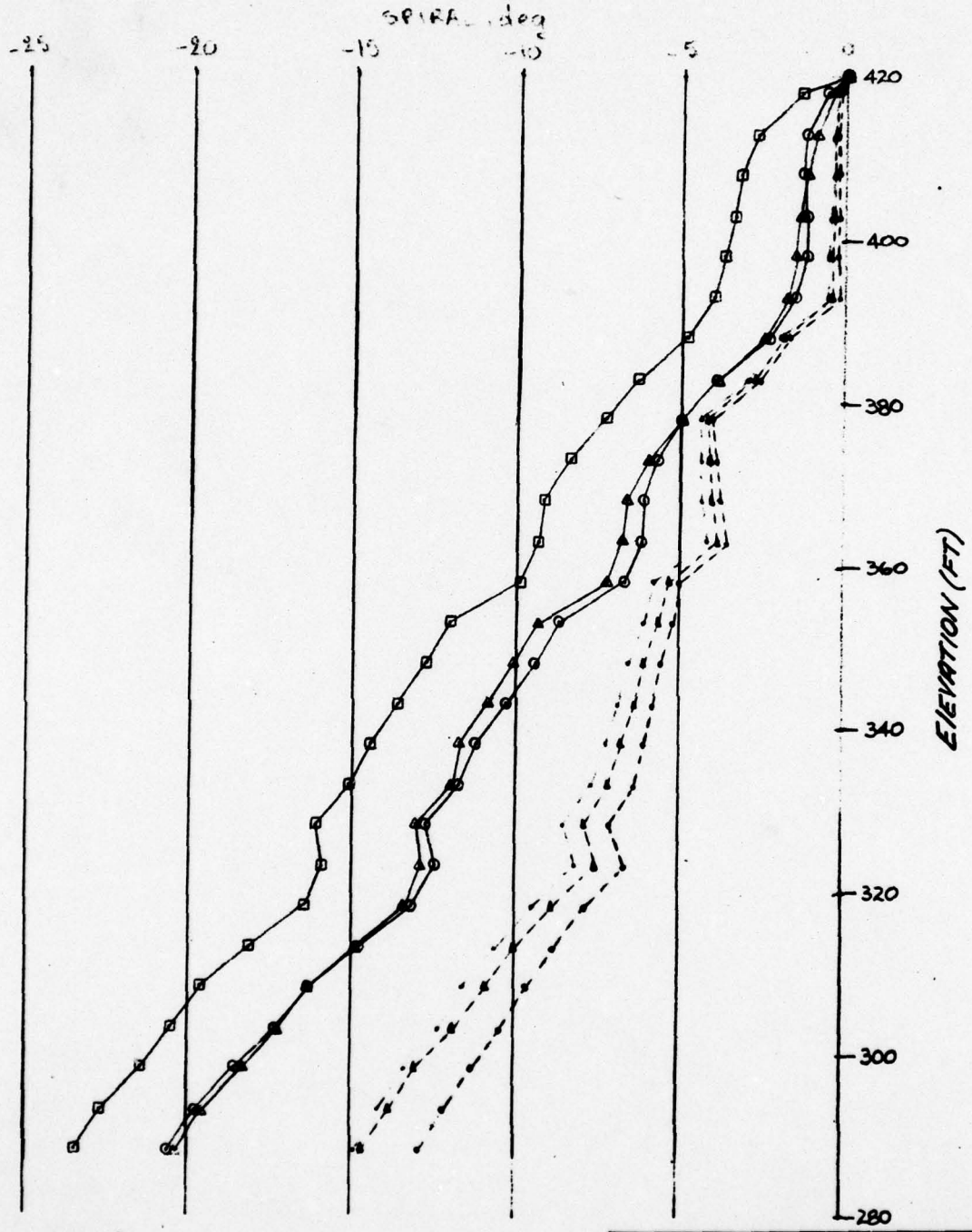
RA 303

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0005

Woodward-Clyde Consultants

Y7C625 Phase II

Fig. D.3



Legend:

___Torpedo lowered down the casing

- - -Torpedo pulled up the casing

Notes:

Positive measurement indicates clockwise rotation

Measurements made in A+ groove

ROCK ANCHOR TEST PROGRAM

SPIRAL MEASUREMENTS; INCLINOMETER AXIS ORIENTATION AT DEPTH

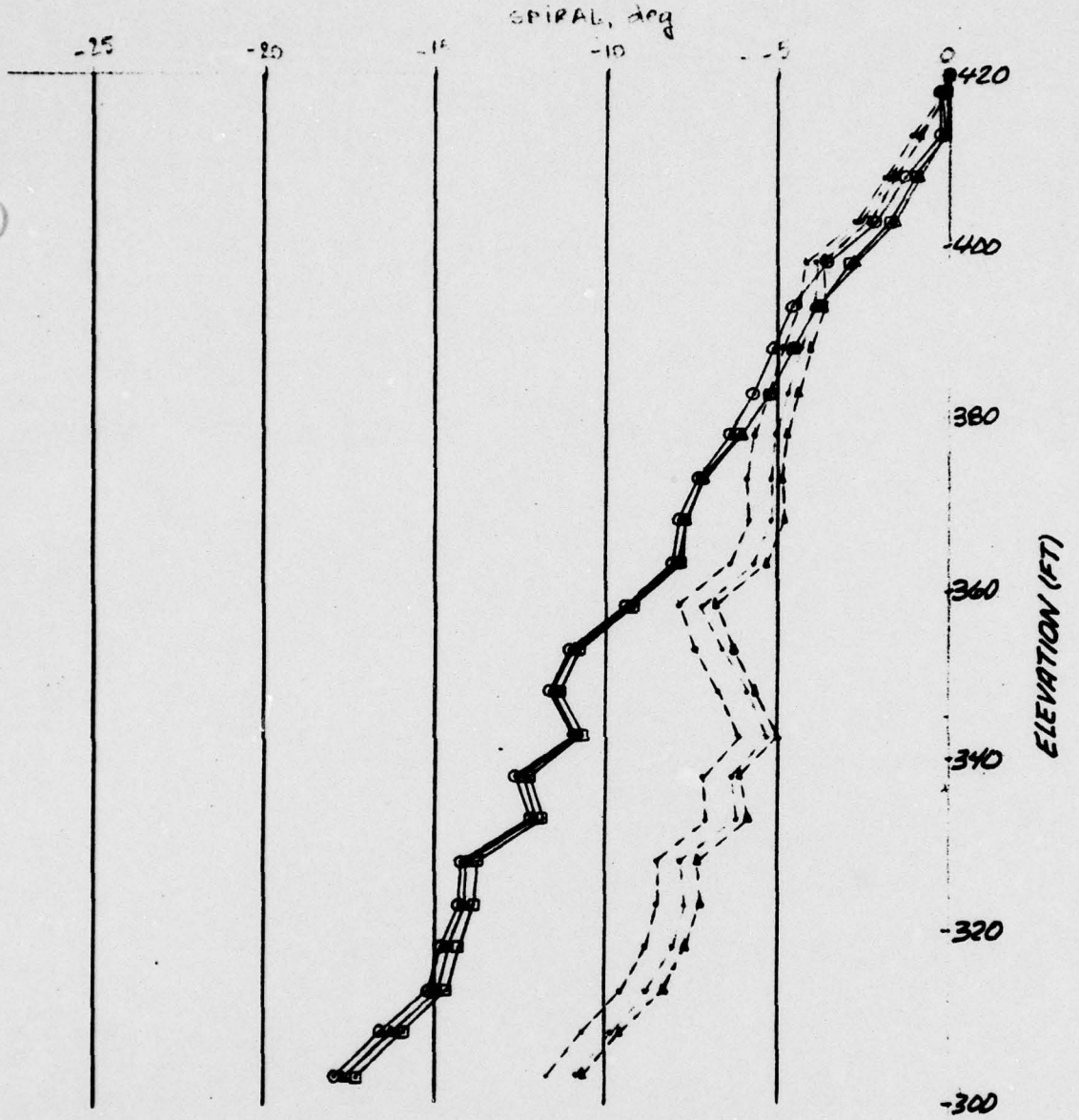
RA 3D1

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0005

Woodward-Clyde Consultants

Y7C025 Phase II

Fig. 0.4



Legend:

—Torpedo lowered down the casing
- - Torpedo pulled up the casing

Notes:

Positive measurement indicates clockwise rotation
Measurements made in A+ groove

ROCK ANCHOR TEST PROGRAM

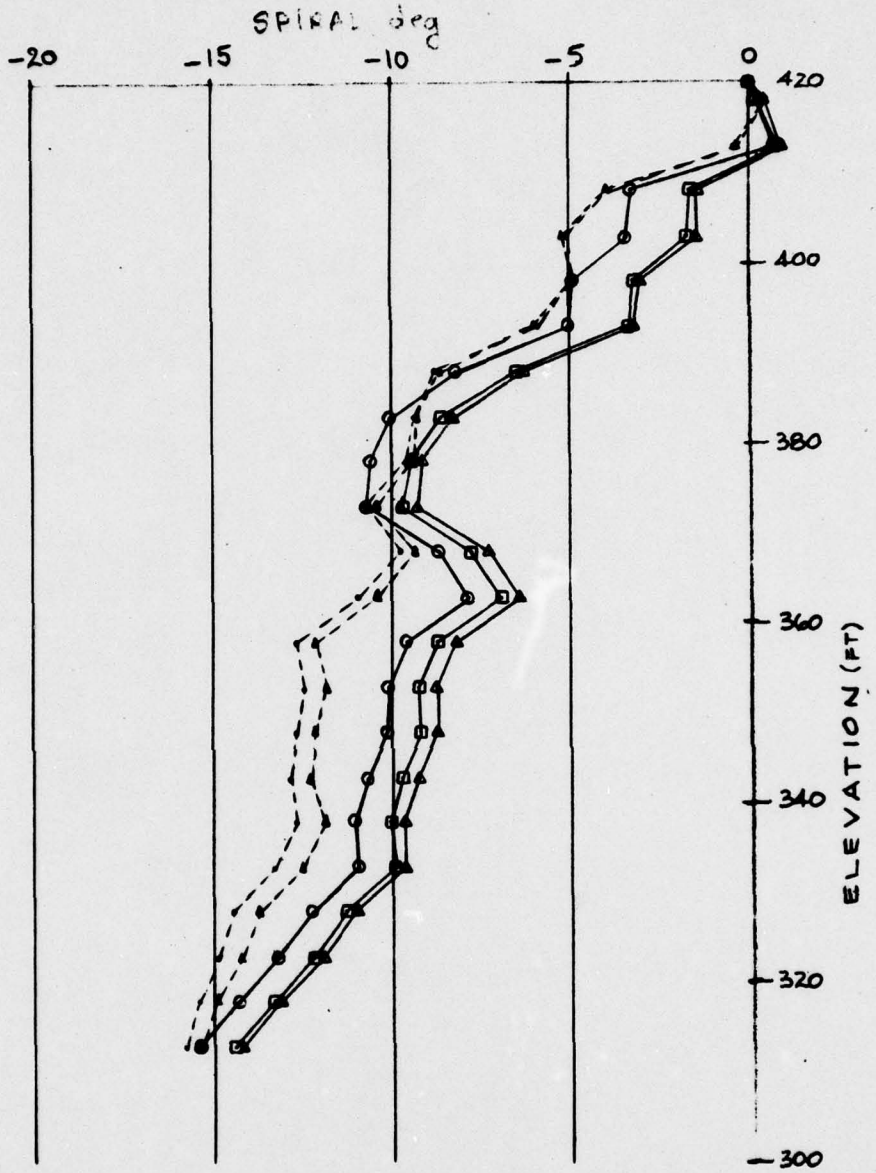
SPIRAL MEASUREMENTS; INCLINOMETER AXIS ORIENTATION AT DEPTH RA-302

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0008

Woodward-Clyde Consultants

Fig 0.5

V7C825 Phase IX



Legend:

—Torpedo lowered down the casing

- - -Torpedo pulled up the casing

Notes:

Positive measurement indicates clockwise rotation

Measurements made in A+ groove

ROCK ANCHOR TEST PROGRAM

SPIRAL MEASUREMENTS; INCLINOMETER AXIS ORIENTATION AT DEPTH

RA-303

FOUNDATION INVESTIGATION AND TEST PROGRAM

EXISTING LOCKS AND DAM No. 26

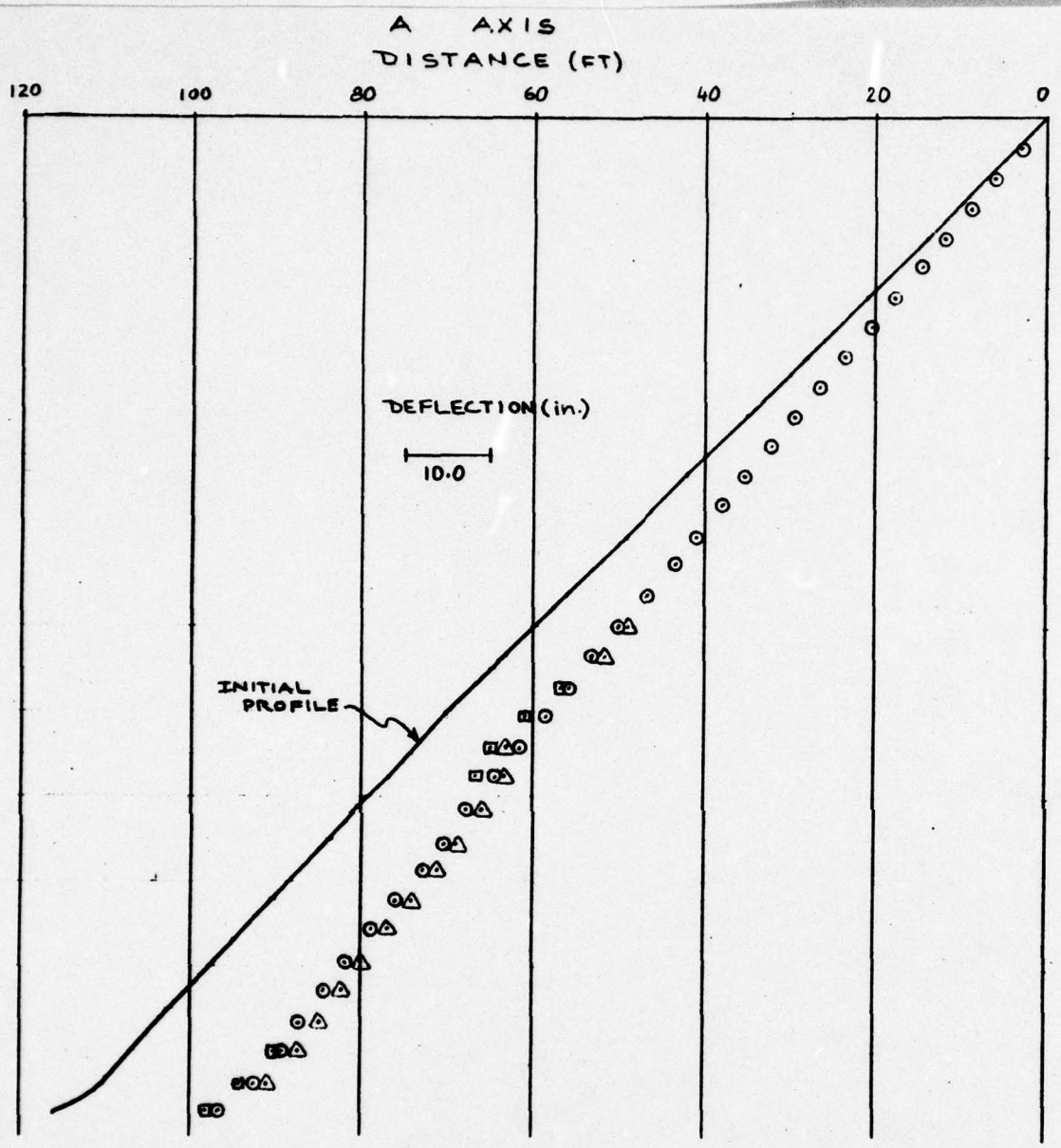
ST LOUIS DISTRICT, CORPS OF ENGINEERS.

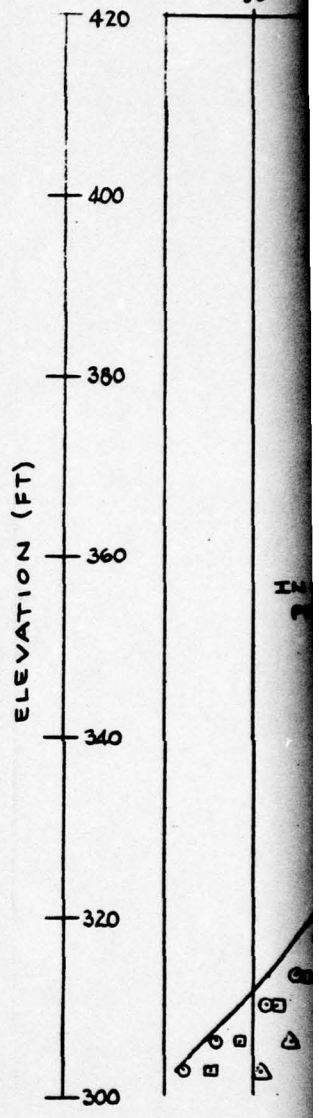
DACW43-78-C-0005

Woodward-Clyde Consultants

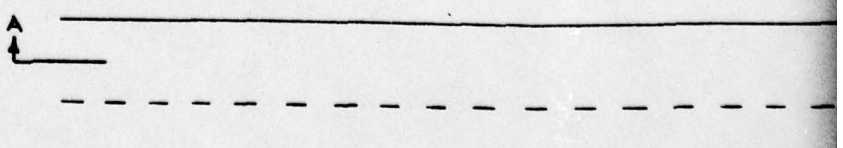
Y7C826 Phase IX

Fig. 06



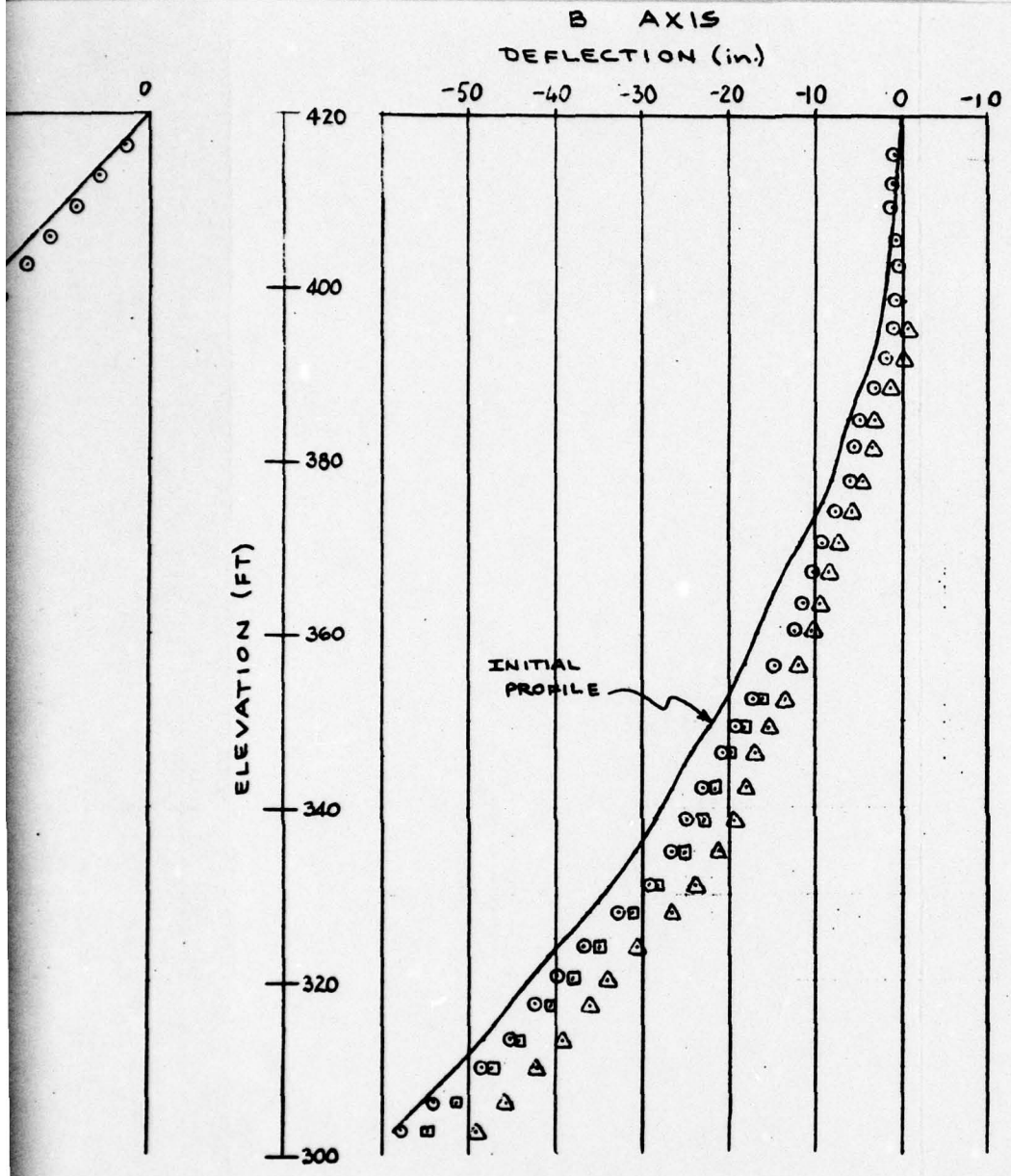


SECTION A-A



LOCATION PLAN

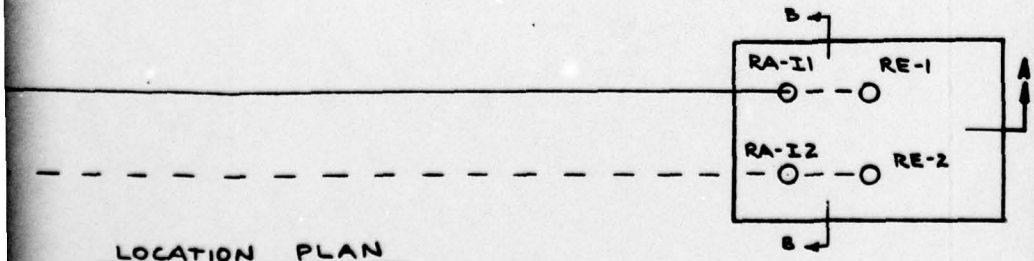
1



LEGEND

- ⊙ AFTER DRILLING RA-I2
- ⊡ AFTER DRILLING RE-1
- △ AFTER DRILLING RE-2

SECTION B-B



LOCATION PLAN

ROCK ANCHOR TEST PROGRAM

INCLINED INCLINOMETER PROFILES AFTER DRILLING

RA-I1

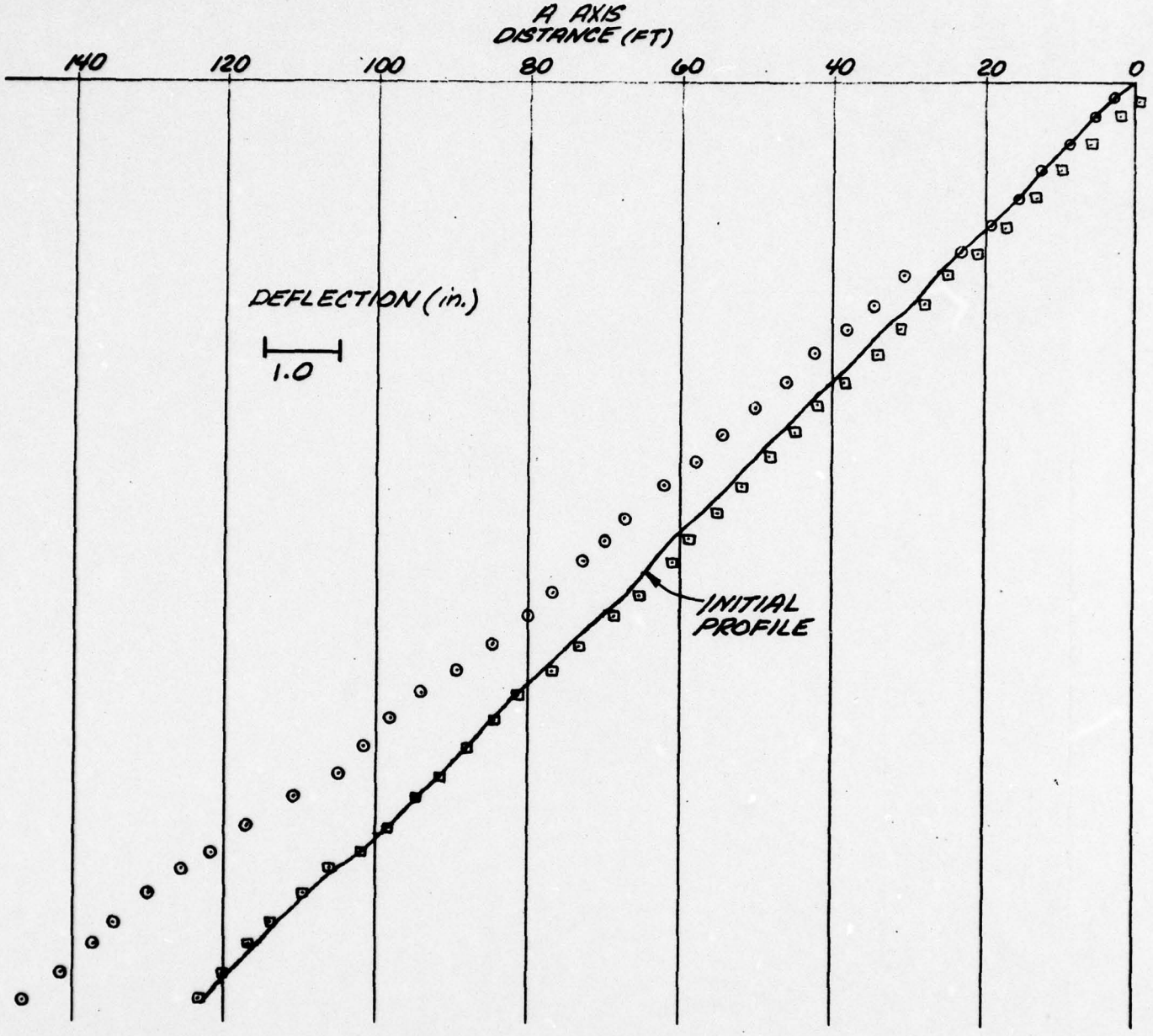
FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0005

Woodward-Clyde Consultants

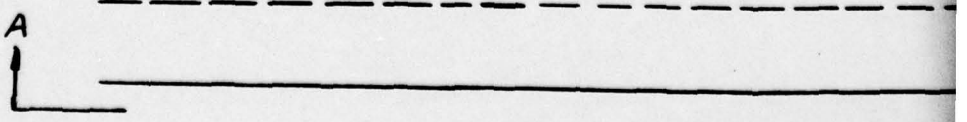
Y7C826 Phase II

Fig. D.7

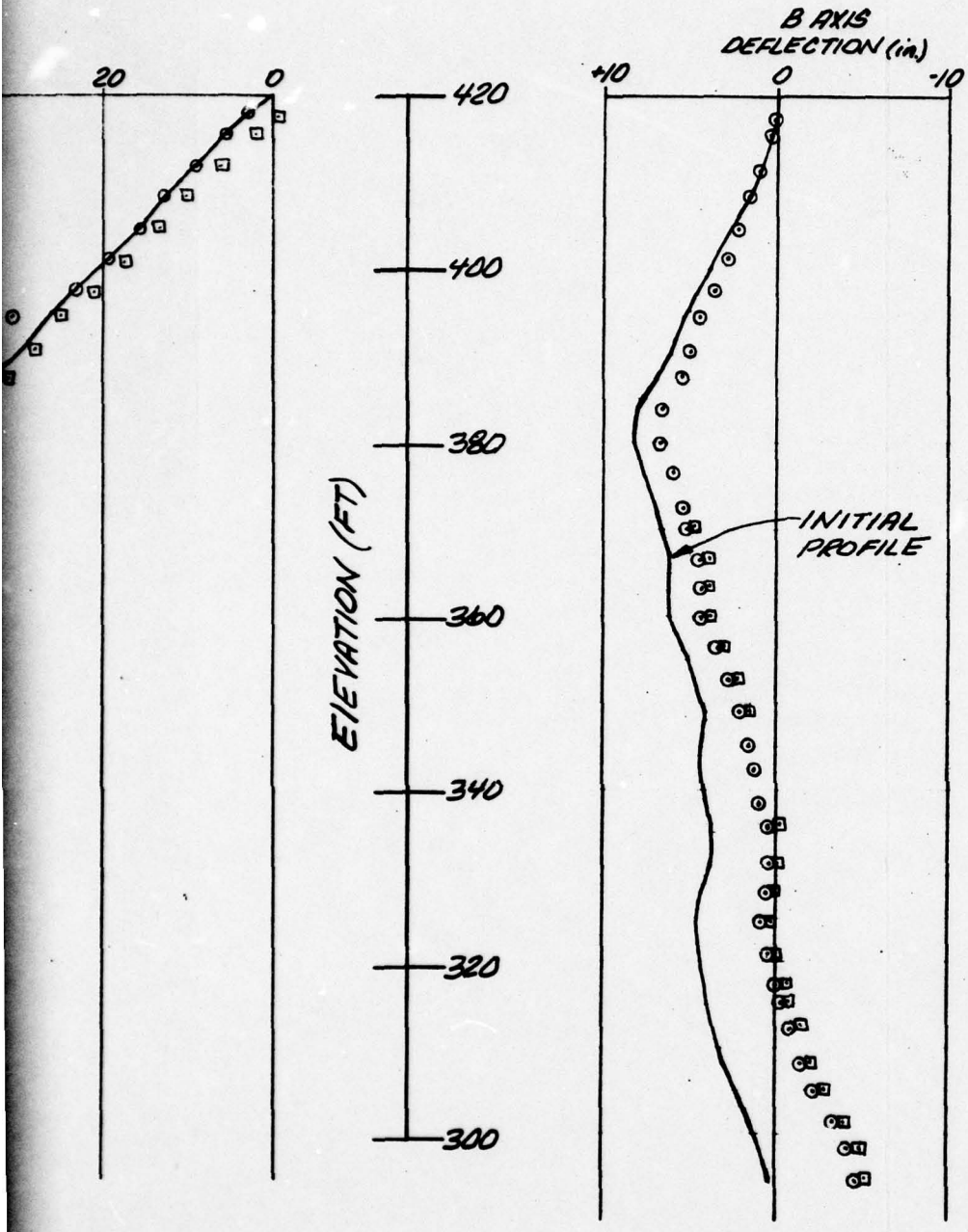
1 2



SECTION A-A



LOCATION P

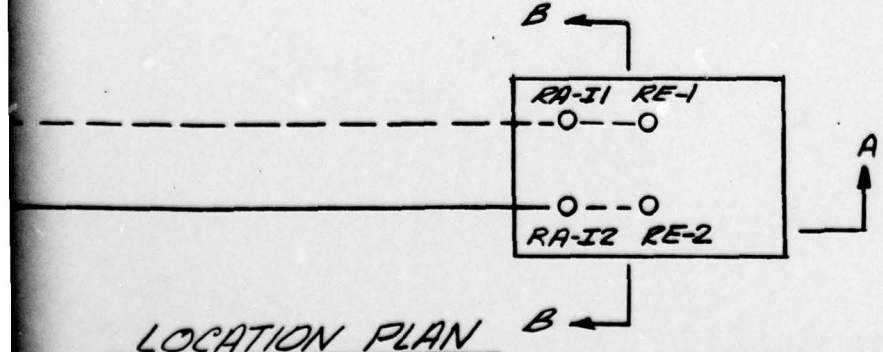


SECTION B-B

LEGEND

○ AFTER DRILLING RE-1

□ AFTER DRILLING RE-2



LOCATION PLAN

ROCK ANCHOR TEST PROGRAM

INCLINED INCLINOMETER PROFILES AFTER DRILLING

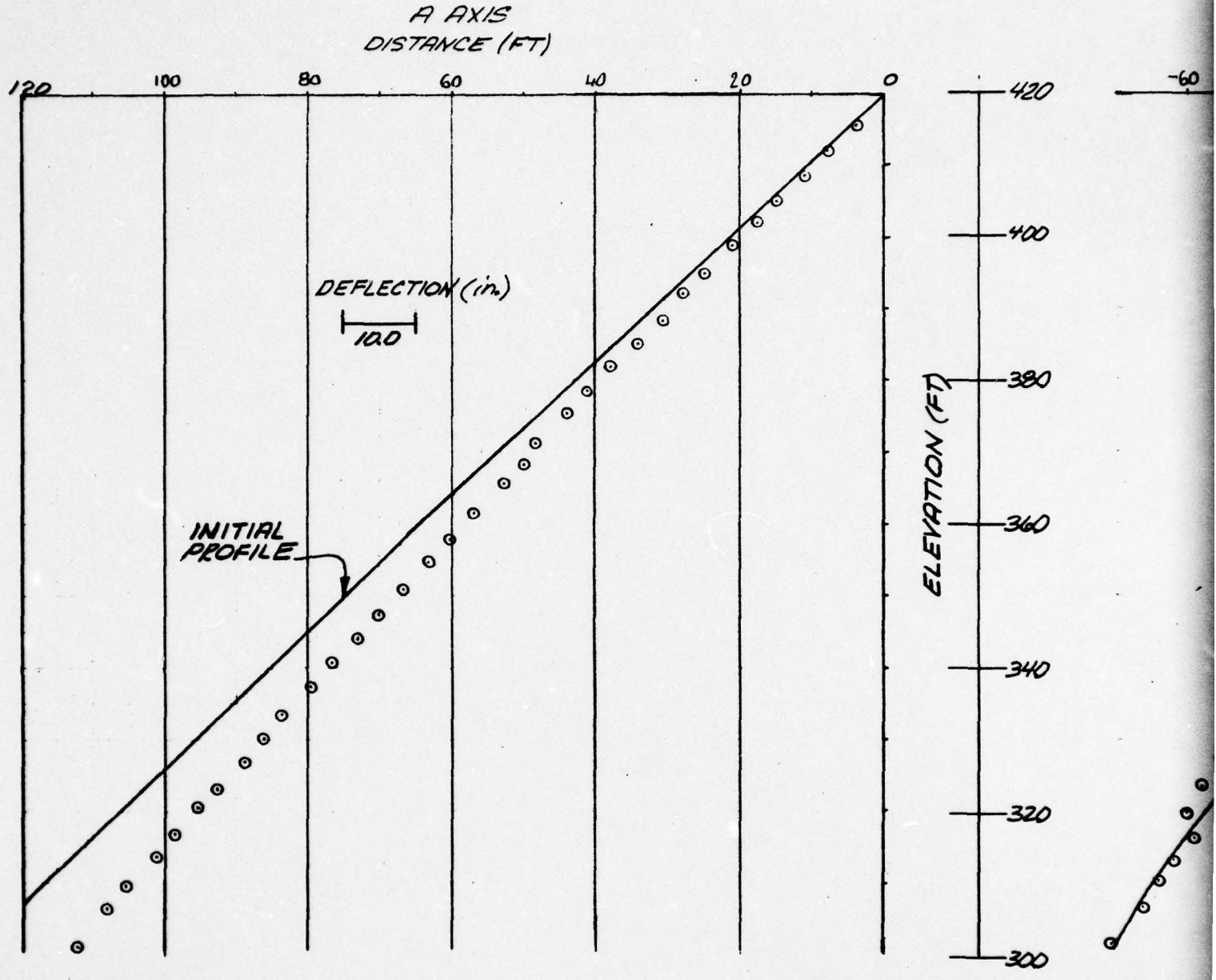
RA-I2

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0005

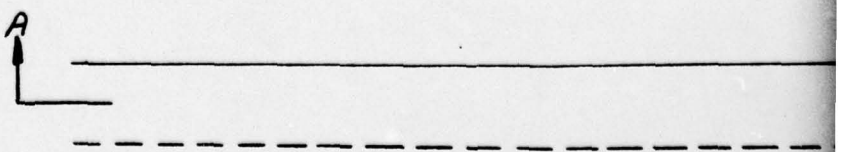
Woodward-Clyde Consultants

Fig. D.8

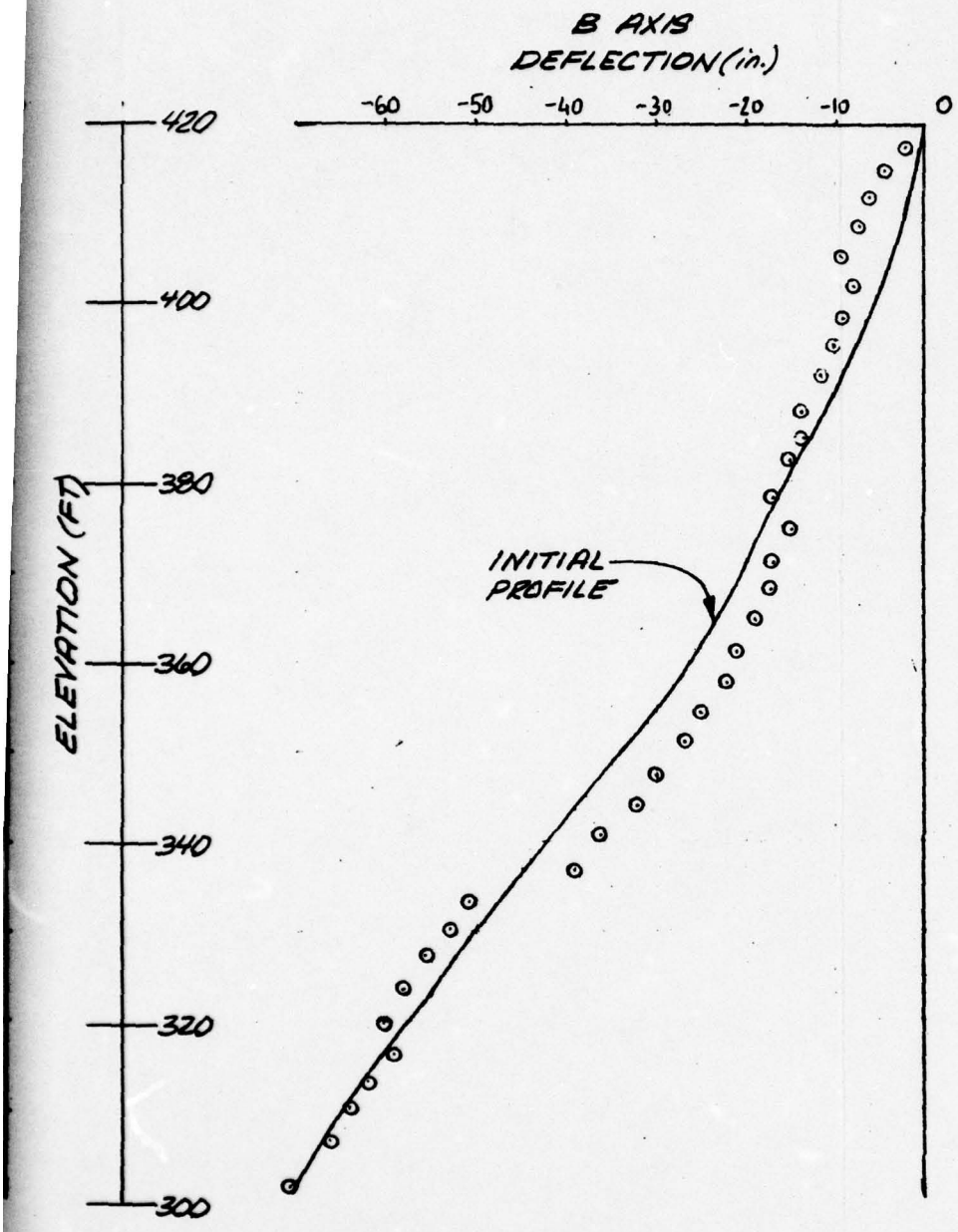
V7C825 Phase II



SECTION A-A



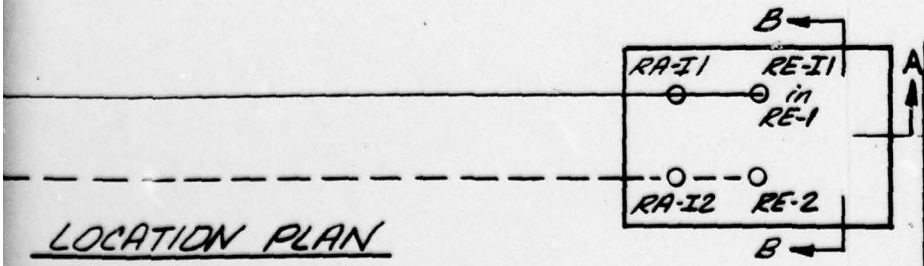
LOCATION PLAN



LEGEND

O AFTER DRILLING RE-2

SECTION B-B



LOCATION PLAN

ROCK ANCHOR TEST PROGRAM

INCLINED INCLINOMETER PROFILES AFTER DRILLING

RE-I1

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0005

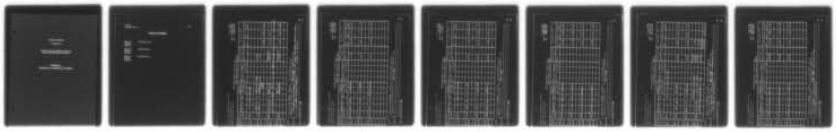
Woodward-Clyde Consultants

Fig. 0.9

V7C025 Phase II

AD-A076 098 WOODWARD-CLYDE CONSULTANTS CHICAGO IL F/G 13/2
RESULTS AND INTERPRETATION OF ROCK ANCHOR TEST PROGRAM. EXISTIN--ETC(U)
JUL 79 J PEREZ , R A FASANO DACW43-78-C-0005
UNCLASSIFIED NL

3 OF 3
AD
A076098



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DATE
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PHASE IV REPORT

VOLUME VA

RESULTS AND INTERPRETATION OF ROCK ANCHOR TEST PROGRAM

APPENDIX E

QUANTITY OF CUTTINGS DATA SHEETS

TABLE OF CONTENTS

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Page E-3 through Page E-4 — Drill Hole RE-1

Page E-5 through Page E-6 — Drill Hole RE-2

WOODWARD-CLYDE CONSULTANTS
LOCK & DAM No. 26
ROCK ANCHOR TEST

P. 1 of 3
Date 16/17 Mar
By RQ & LI

MEASUREMENT OF CUTTINGS
TEST DRILL HOLE No RA-I2

DRILLED DEPTH Ft.	DRY DENSITY Lb/Ft³	WEIGHT, Lb								WATER CONENT, %		VOLUME, Ft³		
		Cuttings + Bin	Bin	Est. Loss	Cuttings Wet	Cuttings Dry	Fines + Bag	Bag	Fines Wet	Fines Dry	Cuttings	Fines	Measured (1)	Theoretical (2)	Variation M/T
0	clay	no measurements													
46.0															
		269	0	0	269	223	hose				20.3				
46.0	105.0	3563	0	0	3563	3311	bin				7.6				
71.0						3534							33.66	9.85	3.42
71.0	105.0	9015	520	0	8495	7387					estimate ① 15.0		70.35	9.91	7.10
96.1		[at approx depth 90 Ft, estimate +9000 lb expelled during drilling interruption]													
96.1	105.0				② 5750	5000					estimate ① 15.0		47.6	9.85	4.83
121.1															

Notes.
1) Measured Volume(Ft^3) = (Dry wt. Cuttings + Dry wt. Fines) / Dry Density.
2) Theoretical Volume (Ft^3) = $\pi r^2 L$ = $\pi \left(\frac{8.5 \text{ in.}}{2}\right)^2 \frac{(L)}{144} \div 0.394 \text{ Ft}^2 \times L \text{ (Ft)}$

Remarks. ① material was frozen in the bin | ② weight estimated; material was frozen in the bin
no water content taken

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM No. 26
ROCK ANCHOR TEST

Date 18 to 20 Mar
By LI + RQ

MEASUREMENT OF CUTTINGS
TEST DRILL HOLE No RA-I2

DRILLED DEPTH Ft.	DRY DENSITY Lb/Ft³	WEIGHT, Lb									WATER CONENT, %		VOLUME, Ft³		
		Cuttings + Bin	Bin	Est. Loss	Cuttings		Fines + Bag	Bag	Fines		Cuttings	Fines	Measured (1)	Theoretical (2)	Variation M/T
					Wet	Dry			Wet	Dry					
121.1	105.0	6640	455	0	6185	5266					17.5		50.15	9.72	5.16
145.8															
145.8	105.0	6667	448	0	6219	5848					6.4		55.7	8.21	6.78
166.7															
166.7	105.0	3168	192	500	3476	3279					6.0		31.23	4.76	6.56
178.8															

Notes. 1) Measured Volume(ft^3) = (Dry wt. Cuttings + Dry wt. Fines) / Dry Density.
2) Theoretical Volume (ft^3) = $\pi r^2 L = \pi \left(\frac{8.5}{2} \text{ in.}\right)^2 \frac{(L)}{144} = 0.394 \text{ Ft}^2 \times L \text{ (Ft)}$

Remarks. _____

WCC, Y7C825 Phase, III

III-N

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
ROCK ANCHOR TESTS

Date 22/23 Mar
By RQ

MEASUREMENT OF CUTTINGS
TEST DRILL HOLE No RE-1

DRILLED DEPTH ft.	DRY DENSITY Lb/Ft3	WEIGHT, Lb									WATER CONENT, %		VOLUME, Ft3		
		Cuttings + Bin	Bin	Est. Loss	Cuttings		Fines + Bag	Bag	Fines		Cuttings	Fines	Measured (1)	Theoretical (2)	Variation M/T
					Wet	Dry			wet	Dry					
0															
32.0	clay	no	measurements												
32.0															
45.9	105.0	208	32	0	176	144					22.0		1.37	5.48	0.25
45.9															
71.4	105.0	1319	0	0	1319	1129					16.8		10.76	10.05	1.07
71.4															
96.6	105.0	2241	172	0	2069	1777					16.5		16.92	9.91	1.71

Notes. 1) Measured Volume(ft^3) = (Dry wt. Cuttings + Dry wt. Fines) / Dry Density.
2) Theoretical Volume (ft^3) = $\pi r^2 L = \pi \left(\frac{8.5}{2} \text{ in.}\right)^2 \frac{(L)}{144} = 0.394\ ft^2 \times L\ (ft)$

Remarks. _____

WCC, YTCB25 PHASE, IV

M-W

WOODWARD-CLYDE CONSULTANTS.
LOCKS AND DAM No. 26
ROCK ANCHOR TEST

Date 24/25 Mar
By RQ + RT

MEASUREMENT OF CUTTINGS
TEST DRILL HOLE No RE-1

DRILLED DEPTH Ft.	DRY DENSITY Lb/Ft3	WEIGHT, Lb									WATER CONENT, %		VOLUME, FT3		
		Cuttings + Bin	Bin	Est. Loss	Cuttings		Fines + Bag	Bag	Fines		Cuttings	Fines	Measured (1)	Theoretical (2)	Variation M/T
					Wet	Dry			Wet	Dry					
96.6															
120.7	105.0	direct volume measure											41.78	9.49	4.40
120.7															
145.0	105.0	direct volume measure											26.33	9.59	2.75
145.0															
166.5	105.0	direct volume measure											29.87	8.47	3.53
166.5															
176.7	105.0	direct volume measure											28.98	4.00	7.23

Notes. 1) Measured Volume(ft^3) = (Dry wt. Cuttings + Dry wt. Fines) / Dry Density.
2) Theoretical Volume (ft^3) = $\pi r^2 L = \pi \left(\frac{8.5}{2} \text{ in.}\right)^2 \frac{(L)}{144} = 0.394 \text{ Ft}^2 \times L \text{ (Ft)}$

Remarks. _____

WCC, Y7C825 Phase, IV

11-4

WOODWARD-CLYDE CONSULTANTS
LOCK AND DAM No. 26
ROCK ANCHOR TEST

P. 1 of 2
Date 1 Mar 79
By RQ & RM

MEASUREMENT OF CUTTINGS
TEST DRILL HOLE No RE-2

DRILLED DEPTH Ft.	DRY DENSITY Lb/Ft3	WEIGHT, Lb									WATER CONENT, %		VOLUME, Ft3		
		Cuttings + Bin	Bin	Est. Loss	Cuttings		Fines + Bag	Bag	Fines		Cuttings	Fines	Measured (1)	Theoretical (2)	Variation M/T
					Wet	Dry			Wet	Dry					
0															
45.1	clay			no	measurements										
45.1															
70.2	105.0	995	68	0	927	782					18.5		7.45	9.59	0.78
70.2															
95.3	105.0	2236	170	10	2076	1752					18.5		16.70	9.92	1.68
95.3				250	250	217	spilled				estimate 15.0		2.07		
119.5	105.0	49	34		15	14	hose				estimate 8.0		0.13		
		direct volume measure					bin				(12.9)		47.78		
													49.98	9.59	5.21

Notes.
1) Measured Volume(Ft^3) = (Dry wt. Cuttings + Dry wt. Fines) / Dry Density.
2) Theoretical Volume (Ft^3) = $\pi r^2 L = \pi \left(\frac{8.5 \text{ in.}}{2}\right)^2 \frac{(L)}{144} = 0.394 \text{ Ft}^2 \times L \text{ (Ft)}$

Remarks. (-) indicates water content for information only; not used in calculations

WCC, YTCB25 Phase, III

III-5

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM No 26
ROCK ANCHOR TEST

Date 2 Mar 79
By RQ + RM

MEASUREMENT OF CUTTINGS
TEST DRILL HOLE No RE-2

DRILLED DEPTH Ft.	DRY DENSITY Lb/Ft3	WEIGHT, Lb									WATER CONENT, %		VOLUME, FT3		
		Cuttings + Bin	Bin	Est. Loss	Cuttings		Fines + Bag	Bag	Fines		Cuttings	Fines	Measured (1)	Theoretical (2)	Variation M/T
					Wet	Dry			Wet	Dry					
119.5															
	105.0	direct volume measure									(15.5)		24.57	9.85	2.49
144.5															
144.5															
	105.0	direct volume measure									(13.4)		32.27	9.85	3.28
169.5															
169.5															
	105.0	direct volume measure									(11.9)		23.13	2.66	8.70
176.3															

Notes. 1) Measured Volume(ft^3) = (Dry wt. Cuttings + Dry wt. Fines) / Dry Density.

2) Theoretical Volume (ft^3) = $\pi r^2 L = \pi \left(\frac{8.5 \text{ in.}}{2}\right)^2 \frac{(L)}{144} = 0.394 \text{ ft}^2 \times L \text{ (ft)}$

Remarks. (-) indicates water content for information only; not used in calculations