

APPENDIX C

INDEX AND PROCTOR TEST RESULTS

APPENDIX C-1
LAB SUMMARY SHEETS



SHEPHERD MILLER

INCORPORATED

CLIENT Exxon Mobil JOB NO. 180548-2 PAGE 1 OF 2

PROJECT Highland DATE 11 Mar 02 DATE CHECKED 3 Apr 02

DETAIL Tailings Basin COMPUTED BY CLS CHECKED BY CLS

CQA LABORATORY TEST RESULTS SUMMARY

SAMPLE DATE	SAMPLE NUMBER OR LOCATION	TEST LAB ^a	NAT. M.C. (%) ^b	STD. PROCTOR TEST		ATTENBERG LIMITS			FRACTION PASSING No. 200 SIEVE (%)	COMMENT
				MAX. DRY UNIT WT. (pcf)	OPT. M.C. (%)	LL (%)	PL (%)	PI (%)		
24 OCT 00	North stockpile	SG	4.6	102	17	35	17	18	65	Stockpile samples
	South stockpile	SG	4.2	105	16	32	16	17	51	
27 OCT 00	Borrow area - top	SG	9.0	111	16	30	16	14	41	Middle Dump
	" - slope	"	10.3	107	20	NP	NP	NP	46	Non-plastic
04 NOV 00	" - north	"	-	102	21	32	16	16	56	
	" - south	"	-	103	20	33	16	17	57	
	" - NE	"	11.5	104	20	28	23	5	49	PI < 8
	" - SE	"	8.7	99	21	32	17	15	62	
06 NOV 00	" - NE	SM	-	104	20	43	23	20	61	Retest of 4 Nov
	" - SE	SM	-	104	20	42	20	22	70	Retest of 4 Nov
09 APR 01	Borrow area - mid	SG	17.8	105	19	42	17	25	67	Non-plastic
	" - low	"	18.3	106	19	40	16	24	45	
	" - E1	"	11.7	112	15	NP	NP	NP	34	
	" - E2	"	15.6	105	19	29	21	8	53	
	" - SA	"	11.9	107	18	34	13	16	53	
13 APR 01	" - SI	"	11.5	106	19	34	16	13	63	
30 OCT 00	2, Q+100, 11+100	SM	-	-	-	46	18	28	74	Sand cone test samples ↓
	4, Q+100, 13	"	-	-	-	42	19	23	67	
	6, R, 13	"	-	-	-	40	20	20	67	
	9, R, 11	"	-	-	-	43	18	25	71	
04 NOV 00	1, Q+100, 10+100	SG	-	-	-	43	18	25	69	
	4, Q+100, 12	"	-	-	-	41	16	25	70	
	10, Q, 12+100	"	-	-	-	42	18	24	63	
	12, R, 15	"	-	-	-	42	19	23	75	
16 APR 01	1, R+100, 16	"	-	-	-	34	15	19	51	
	4, R+100, 13	"	-	-	-	34	15	19	47	
	12, S+100, 15+100	"	-	-	-	40	15	25	52	

SG - Smith Geotechnical, SM - Shepherd Miller ^bNAT. M.C. - Natural moisture content



SHEPHERDMILLER
INCORPORATED

CLIENT _____ JOB NO. _____ PAGE 2 OF 2
PROJECT _____ DATE _____ DATE CHECKED _____
DETAIL _____ COMPUTED BY _____ CHECKED BY _____

CQA LABORATORY TEST RESULTS SUMMARY

SAMPLE DATE	SAMPLE NUMBER OR LOCATION	TEST LAE	NAT. M.C. (%)	STD. PROCTOR TEST		ATTERBERG LIMITS			FRACTION PASSING No. 200 SIEVE (%)	COMMENT
				MAX DRY UNIT WT (pcf)	OPT. M.C. (%)	LL (%)	PL (%)	PI (%)		
17 APR 01	5, S+100, 15	59	—	—	—	39	17	22	58	Sand cone test samples ↓
	7, Q, 12		—	—	—	41	17	24	62	
	11, S, 15		—	—	—	36	15	21	46	
19 APR 01	1, S, 10+100		—	—	—	37	15	22	64	
	8, S, 15+100		—	—	—	37	18	19	60	
	10, S+100, 15		—	—	—	37	14	23	67	
20 APR 01	4, R+100, 13+100		—	—	—	32	17	15	55	
	6, R+100, 15+100		—	—	—	36	17	19	63	
	12, R, 15		—	—	—	41	17	24	63	
01 MAY 01	2, P+136, 12+040		—	—	—	41	19	22	59	
	3, P+140, 11		—	—	—	37	21	16	60	
04 MAY 01	1, P+130, 14		—	—	—	44	24	20	60	
	7, P+175, 9+095		—	—	—	40	19	21	69	
08 MAY 01	15, O+100, 12+075		—	—	—	41	20	21	59	
	3, O+120, 12+110		—	—	—	45	17	28	71	
	6, P+035, 14+070		—	—	—	40	17	23	65	
10 MAY 01	9, N+025, 13+045		—	—	—	39	17	22	57	
	5, O+110, 10+160		—	—	—	43	21	22	62	
	6, O+042, 11+160		—	—	—	36	19	17	54	
15 MAY 01	8, N+050, 11+125		—	—	—	37	19	18	67	
	2, O+140, 10+155		—	—	—	35	18	17	53	
	5, M+145, 9+165		—	—	—	37	20	17	64	
17 MAY 01	8, L+030, 12+160		—	—	—	38	22	16	57	
	1, L+110, 13+130		—	—	—	41	24	17	89	
	6, M+170, 9+130		—	—	—	36	20	16	55	
22 MAY 01	10, M+050, 11+055		—	—	—	33	19	14	58	
	1, L+180, 11+005		—	—	—	40	18	22	83	
	7, L+075, 14+075		—	—	—	36	20	16	60	
	10, P+130, 14+150		—	—	—	34	23	11	50	
	13, P+035, 13+040		—	—	—	38	24	14	59	
	16, P+075, 16+010		—	—	—	32	18	14	80	

SMITH GEOTECHNICAL

SUMMARY OF LABORATORY TEST RESULTS

JOB NAME:

SMI # 100548-3,
Highland

JOB NUMBER: 00.084T

Date: December 2, 2000

Sample	Sample Type	Moisture (%)	Atterbergs LL / PL*	Proctor Max DD(pcf) / w(%)	% Passing No. 200 Sieve
North Stockpile	Bucket	4.6	35 / 17	101.8 / 16.6	65
South Stockpile	Bucket	4.2	33 / 16	104.5 / 15.2	51
Borrow Area-Top	Bucket	9.0	30 / 16	111.3 / 16.4	41
Borrow Area-Slope	Bucket	10.3	N.P.	106.5 / 19.6	46
Borrow Area-North	Bucket		32 / 16	101.5 / 21.0	56
Borrow Area-South	Bucket		33 / 16	102.5 / 20.0	57
BA-NE	Bucket	11.5	28 / 23	103.5 / 19.5	49
BA-SE	Bucket	8.7	32 / 17	99.0 / 21.0	62
Test 1	Bag	17.6	43 / 18		69
Test 2	Bag	16.0			
Test 3	Bag	21.0			
Test 4	Bag	17.1	41 / 16		70
Test 5	Bag	17.6			
Test 6	Bag	15.5			
Test 7	Bag	16.7			
Test 8	Bag	19.3			
Test 9	Bag	20.2			
Test 10	Bag	16.2	42 / 18		63
Test 11	Bag	14.5			
Test 12	Bag	17.1	42 / 19		75
Test 13	Bag	16.5			
Test 14	Bag	17.6			
Test 15	Bag	16.6			
Test 16	Bag	17.7			

*LL = Liquid Limit PL = Plastic Limit

N.P. = Non-Plastic

SMITH GEOTECHNICAL

SUMMARY OF LABORATORY TEST RESULTSJOB NAME:

SMI # 100548-2

JOB NUMBER: 01.026TDate: April 12, 2001

Sample	Sample Type	Moisture (%)	Atterbergs LL / PL*	Proctor Max DD(pcf) / w(%)	% Passing No. 200 Sieve
BA MID	Bucket	17.8	42 / 17	105.2 / 19.0	67
BA LOW	Bucket	18.3	40 / 16	106.2 / 18.4	45
BA E1	Bucket	11.7	N/P	112.2 / 14.5	34
BA E2	Bucket	15.6	29 / 21	105.0 / 18.2	53
04/16/01 Test 1	Bag	12.7	34 / 15		51
04/16/01 Test 4	Bag	12.8	34 / 15		47
04/16/01 Test 12	Bag	13.1	40 / 15		52
04/17/01 Test 5	Bag	16.7	39 / 17		58
04/17/01 Test 7	Bag	20.1	41 / 17		62
04/17/01 Test 11	Bag	17.5	36 / 15		46
BA SA	Bucket	11.9	34 / 18	107.0 / 17.6	53
BA SI	Bucket	11.5	34 / 16	105.3 / 18.2	63
4/19/01 Test 1	Bag	15.8	37 / 15		64
4/19/01 Test 8	Bag	11.7	37 / 18		60
4/19/01 Test 10	Bag	12.3	37 / 14		67
4/20/01 Test 4	Bag	12.8	32 / 17		55
4/20/01 Test 6	Bag	15.0	36 / 17		63
4/20/01 Test 12	Bag	16.5	41 / 17		63
5/01/01 Test 2	Bag	15.6	41 / 19		59
5/01/01 Test 3	Bag	16.3	37 / 21		60
5/04/01 Test 1	Bag	18.1	44 / 24		60
5/04/01 Test 7	Bag	18.3	40 / 19		69
5/04/01 Test 15	Bag	18.0	41 / 20		59

*LL = Liquid Limit PL = Plastic Limit

N.P. = Non-Plastic

TO: CLINT STRACHAN
FROM: JOSH WHITNEY
DATE: JUNE 27, 2001
PROJECT: 100548

SUBJECT: Sample results for Atterberg Limits and No. 200 sieve wash

SAMPLE ID	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	AMOUNT FINER THAN NO. 200 SIEVE
5/8/01 - 3	45.4	17.3	28.1	71.3
5/8/01 - 6	40.3	17.2	23.1	65.4
5/8/01 - 9	39.3	17.6	21.8	57.0
5/10/01 - 5	42.7	20.4	22.3	62.4
5/10/01 - 6	36.1	19.3	16.8	53.8
5/10/01 - 8	36.9	18.9	18.0	67.1
5/15/01 - 2	35.0	17.5	17.4	53.2
5/15/01 - 5	37.1	20.1	17.0	64.0
5/15/01 - 8	38.1	21.7	16.5	56.8
5/17/01 - 1	41.1	24.2	17.0	89.1
5/17/01 - 6	35.7	20.1	15.6	55.0
5/17/01 - 10	33.1	19.3	13.9	58.3
5/22/01 - 1	39.7	18.3	21.4	82.7
5/22/01 - 7	36.4	20.5	15.8	59.6
5/22/01 - 10	34.2	22.6	11.6	50.4
5/22/01 - 13	37.7	23.5	14.2	58.5
5/22/01 - 16	32.2	18.5	13.8	79.6

APPENDIX C-2

FRACTION PASSING NO. 200 SIEVE

Amount Passing the No. 200 Sieve

Shepherd Miller, Inc

Sample Information

Date	20-Nov-00
Project	Highland - Exxon
Job Number	100548-03
Sample Location	NE side on Main Borrow Area
Sample Identification	
Sample Type	Surface Grab Sample
Soil Description	med brn sandy CLAY w/ shale
Tested By	GVH

Results

Preparation Method Used (A or B)	A
Approximate Washing Time (min)	20
Initial Dry Mass of Soil (g)	115.6
Dry Mass of Soil After Washing (g)	44.9
Mass of Drying Pan (g)	13.7

Amount Finer than No. 200 Sieve (%)	61.2
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Amount Passing the No. 200 Sieve

Shepherd Miller, Inc

Sample Information

Date	13-Dec-00
Project	Highland
Job Number	100548-3
Sample Location	Sandcone Test
Sample Identification	sampled by CLS on Oct. 30; #4
Sample Type	Baggie
Soil Description	greyish brn sandy clay w/ shale frag
Tested By	GVH

Preparation

Deflocculation Agent Used (yes or no)	No
Type of Deflocculation Agent	N/A
Deflocculation Soaking Time (hours)	N/A

Measurements prior to washing

Drying Pan Identification	B
Drying Pan Mass (g)	13.8
Initial Dry Mass of Soil + Pan (g)	156.2

Measurements after washing

Approximate Washing Time (min)	25
Drying Pan Identification	B
Drying Pan Mass (g)	13.8
Dry Mass of Washed Sample + Pan (g)	61.1

Results

Amount Finer than No. 200 Sieve (%)	66.8
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Amount Passing the No. 200 Sieve

Shepherd Miller, Inc

Sample Information

Date	15-Dec-00
Project	Highland
Job Number	100548-3
Sample Location	Sandcone Test
Sample Identification	sampled by CLS on Oct. 30; #2
Sample Type	Baggie
Soil Description	med brn sandy CLAY
Tested By	GVH

Preparation

Deflocculation Agent Used (yes or no)	No
Type of Deflocculation Agent	N/A
Deflocculation Soaking Time (hours)	N/A

Measurements prior to washing

Drying Pan Identification	E
Drying Pan Mass (g)	13.8
Initial Dry Mass of Soil + Pan (g)	157.7

Measurements after washing

Approximate Washing Time (min)	25
Drying Pan Identification	E
Drying Pan Mass (g)	13.8
Dry Mass of Washed Sample + Pan (g)	51.6

Results

Amount Finer than No. 200 Sieve (%)	73.7
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Amount Passing the No. 200 Sieve

Shepherd Miller, Inc

Sample Information

Date	15-Dec-00
Project	Highland
Job Number	100548-3
Sample Location	Sandcone Test
Sample Identification	sampled by CLS on Oct. 30; #6
Sample Type	Baggie
Soil Description	lite brn sandy CLAY
Tested By	GVH

Preparation

Deflocculation Agent Used (yes or no)	No
Type of Deflocculation Agent	N/A
Deflocculation Soaking Time (hours)	N/A

Measurements prior to washing

Drying Pan Identification	H
Drying Pan Mass (g)	13.7
Initial Dry Mass of Soil + Pan (g)	129.6

Measurements after washing

Approximate Washing Time (min)	30
Drying Pan Identification	B
Drying Pan Mass (g)	13.8
Dry Mass of Washed Sample + Pan (g)	51.7

Results

Amount Finer than No. 200 Sieve (%)	67.3
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Amount Passing the No. 200 Sieve

Shepherd Miller, Inc

Sample Information

Date	17-Dec-00
Project	Highland
Job Number	100548-3
Sample Location	Sandcone Test
Sample Identification	sampled by CLS on Oct. 30; #9
Sample Type	Baggie
Soil Description	med brn sandy CLAY w/ shale frag
Tested By	GVH

Preparation

Deflocculation Agent Used (yes or no)	No
Type of Deflocculation Agent	N/A
Deflocculation Soaking Time (hours)	N/A

Measurements prior to washing

Drying Pan Identification	A
Drying Pan Mass (g)	13.8
Initial Dry Mass of Soil + Pan (g)	131.8

Measurements after washing

Approximate Washing Time (min)	20
Drying Pan Identification	G
Drying Pan Mass (g)	13.7
Dry Mass of Washed Sample + Pan (g)	47.8

Results

Amount Finer than No. 200 Sieve (%)	71.1
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APPENDIX C-3
ATTERBERG LIMITS

Atterberg Limits Test Form

Shepherd Miller, Inc.

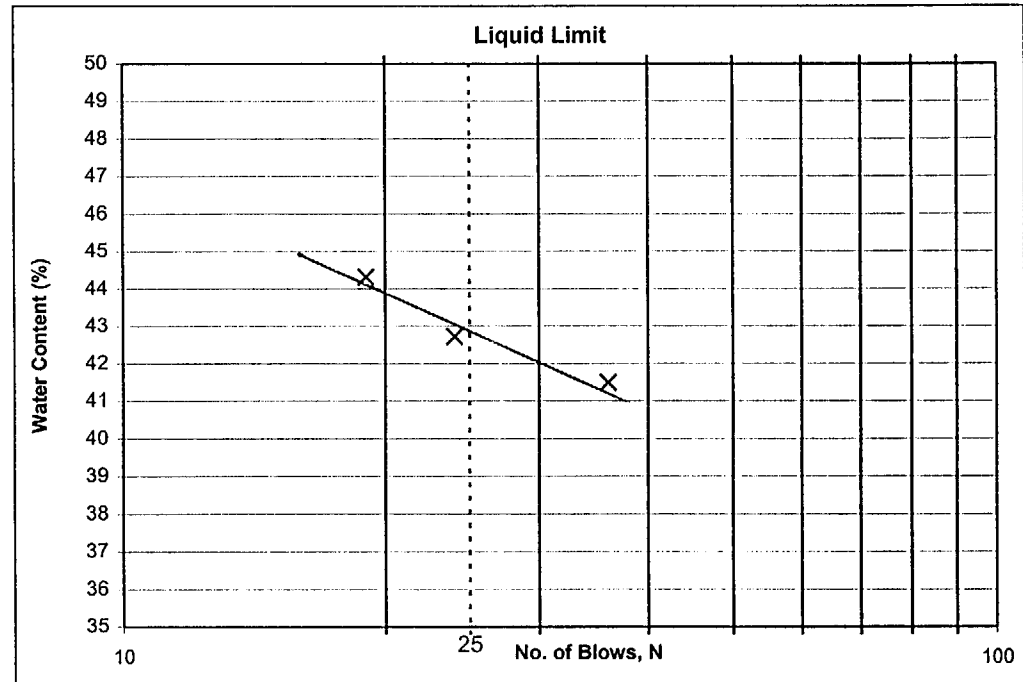
Date	17-Nov-00
Project	Highland
Job Number	100548-3
Sample Location	NE side of main borrow area
Sample Identification	
Soil Description	med brn sandy CLAY w/shale
Sample Type	Bucket Grab Sample
Tested By	GVH
Preparation (Wet or Dry)	Wet

Liquid Limit Determination

Can Number	A5	A3	A6
Mass of can (g)	10.90	10.93	10.95
Mass of wet soil + can (g)	28.70	44.27	44.59
Mass of dry soil + can(g)	23.48	34.29	34.26
Water content (%)	41.5	42.7	44.3
No. of blows, N	36	24	19

Plastic Limit Determination

Can Number	A11/L1	A12/L2
Mass of can (g)	15.41	15.47
Mass of wet soil + can (g)	23.13	21.71
Mass of dry soil + can(g)	21.66	20.58
Water content (%)	23.5	22.1



Results

Liquid Limit	43
Plastic Limit	23
Plasticity Index	20

Atterberg Limits Test Form

Shepherd Miller, Inc.

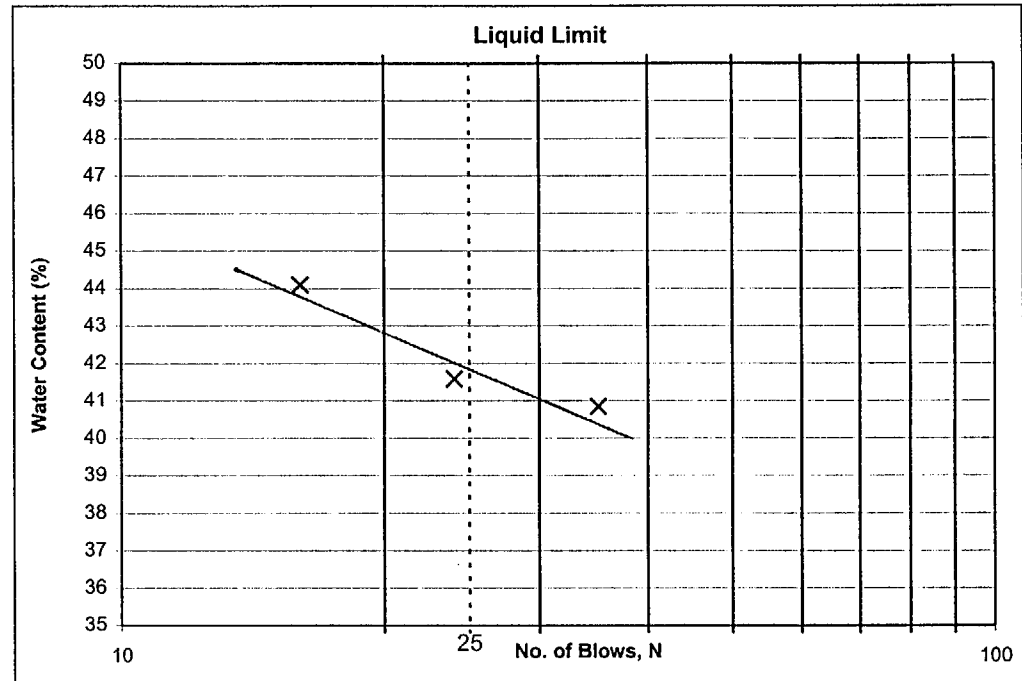
Date	21-Nov-00
Project	Highland
Job Number	100548-3
Sample Location	SE side of main borrow area
Sample Identification	
Soil Description	med brn sandy lean CLAY
Sample Type	Bucket Grab Sample
Tested By	GVH
Preparation (Wet or Dry)	Wet

Liquid Limit Determination

Can Number	A6	A5	A12
Mass of can (g)	10.95	10.90	11.04
Mass of wet soil + can (g)	33.64	35.96	35.97
Mass of dry soil + can(g)	27.06	28.60	28.34
Water content (%)	40.8	41.6	44.1
No. of blows, N	35	24	16

Plastic Limit Determination

Can Number	A11/L2	A4/L3
Mass of can (g)	15.46	15.48
Mass of wet soil + can (g)	25.81	23.04
Mass of dry soil + can(g)	24.05	21.81
Water content (%)	20.49	19.43



Results

Liquid Limit	42
Plastic Limit	20
Plasticity Index	22

Atterberg Limits Test Form

Shepherd Miller, Inc.

shaded cells are calculated - DO NOT CHANGE THEM

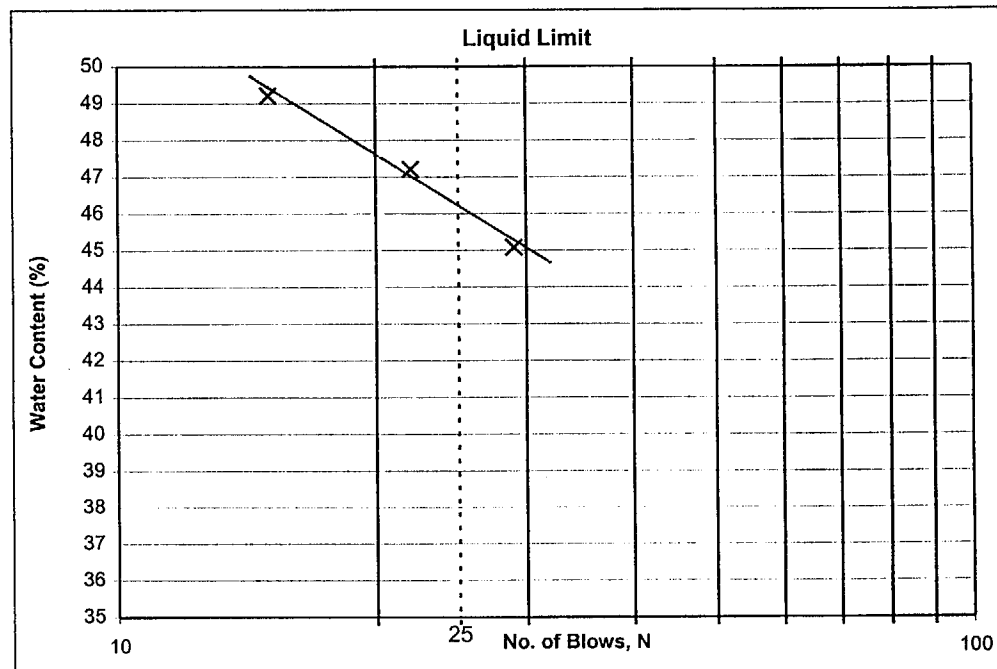
Date	14-Dec-00
Project	Highland
Job Number	100548-3
Sample Location	Sandcone Test
Sample Identification	sampled by CLS on Oct 30; #2
Soil Description	med brn sandy CLAY
Sample Type	Baggie
Tested By	GVH
Preparation (Wet or Dry)	Wet Sieve

Liquid Limit Determination

No. of blows, N	29	22	15
Can Number	A3	A6	A10
Mass of can (g)	10.92	10.95	11.01
Mass of wet soil + can (g)	30.23	30.22	34.63
Mass of dry soil + can(g)	24.23	24.04	26.84
Water content (%)	45.1	47.2	49.2

Plastic Limit Determination

Can Number	A8	A5
Mass of can (g)	15.43	15.20
Mass of wet soil + can (g)	21.35	21.04
Mass of dry soil + can(g)	20.43	20.14
Water content (%)	18.4	18.2



Results

Liquid Limit	46
Plastic Limit	18
Plasticity Index	28

Atterberg Limits Test Form

Shepherd Miller, Inc.

shaded cells are calculated - DO NOT CHANGE THEM

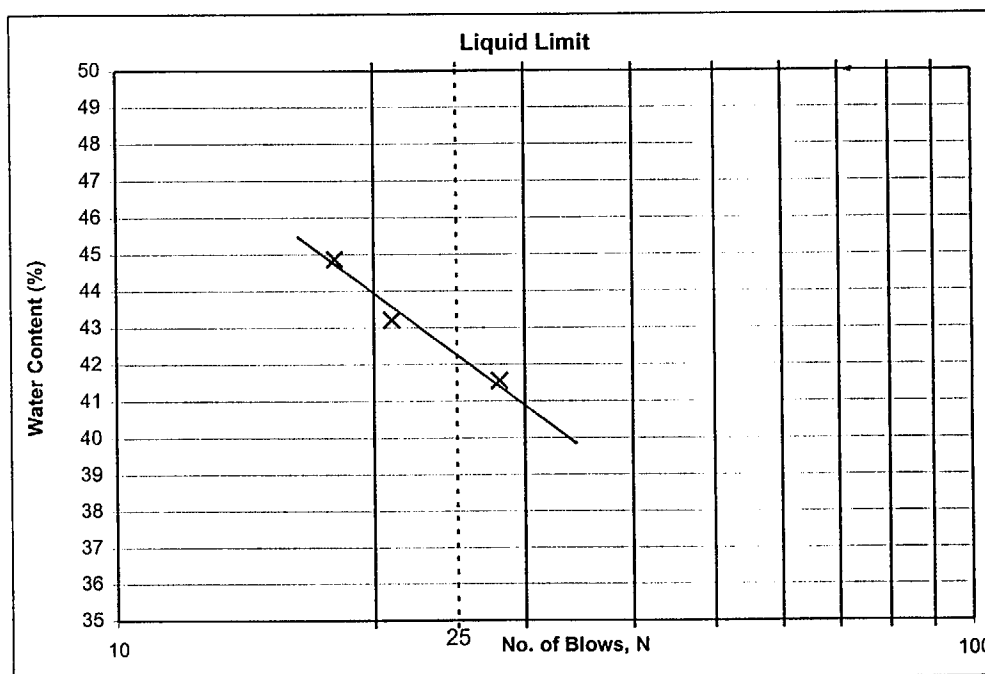
Date	18-Dec-00
Project	Highland
Job Number	100548-3
Sample Location	Sandcone Test
Sample Identification	sampled by CLS on Oct 30; #4
Soil Description	greyish brn sandy CLAY
Sample Type	Baggie
Tested By	GVH
Preparation (Wet or Dry)	Wet Sieve

Liquid Limit Determination

No. of blows, N	28	21	18
Can Number	A4	A11	A12
Mass of can (g)	11.13	11.04	11.04
Mass of wet soil + can (g)	24.62	31.09	28.12
Mass of dry soil + can(g)	20.66	25.04	22.83
Water content (%)	41.6	43.2	44.9

Plastic Limit Determination

Can Number	A7	A9
Mass of can (g)	15.42	15.49
Mass of wet soil + can (g)	21.51	22.00
Mass of dry soil + can(g)	20.56	20.93
Water content (%)	18.5	19.7



Results

Liquid Limit	42
Plastic Limit	19
Plasticity Index	23

Atterberg Limits Test Form

Shepherd Miller, Inc.

shaded cells are calculated - DO NOT CHANGE THEM

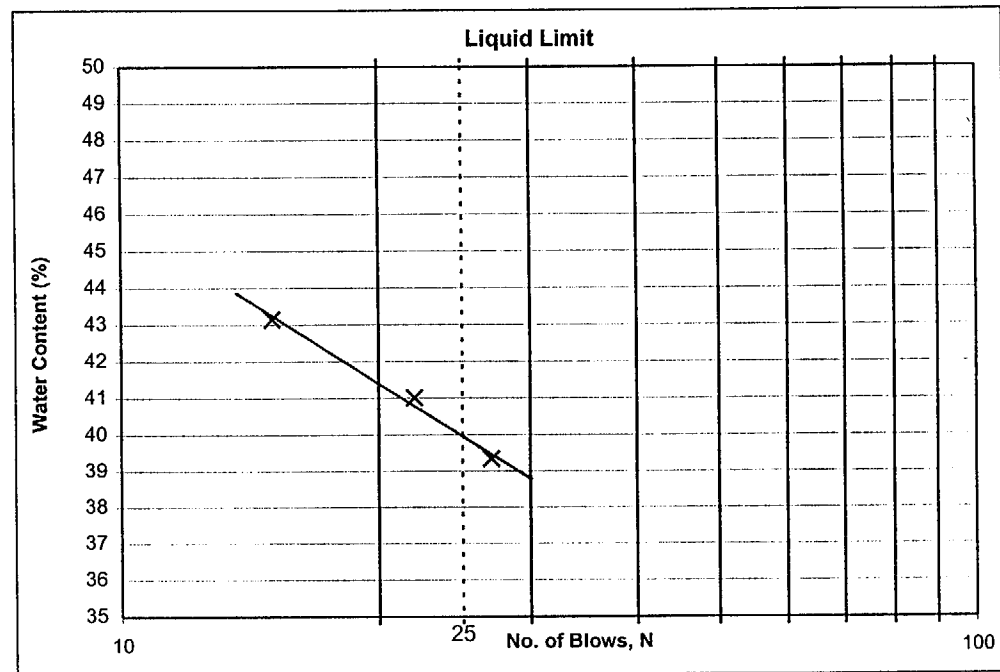
Date	18-Dec-00
Project	Highland
Job Number	100548-3
Sample Location	Sandcone Test
Sample Identification	sampled by CLS on Oct 30; #6
Soil Description	lite brn sandy CLAY
Sample Type	Baggie
Tested By	GVH
Preparation (Wet or Dry)	Wet Sieve

Liquid Limit Determination

No. of blows, N	27	22	15
Can Number	A9	A10	A6
Mass of can (g)	15.49	15.36	15.35
Mass of wet soil + can (g)	30.33	34.89	34.69
Mass of dry soil + can(g)	26.14	29.21	28.86
Water content (%)	39.3	41.0	43.2

Plastic Limit Determination

Can Number	A8	A5
Mass of can (g)	15.44	15.20
Mass of wet soil + can (g)	21.47	21.58
Mass of dry soil + can(g)	20.51	20.50
Water content (%)	18.9	20.4



Results

Liquid Limit	40
Plastic Limit	20
Plasticity Index	20

Atterberg Limits Test Form

Shepherd Miller, Inc.

shaded cells are calculated - DO NOT CHANGE THEM

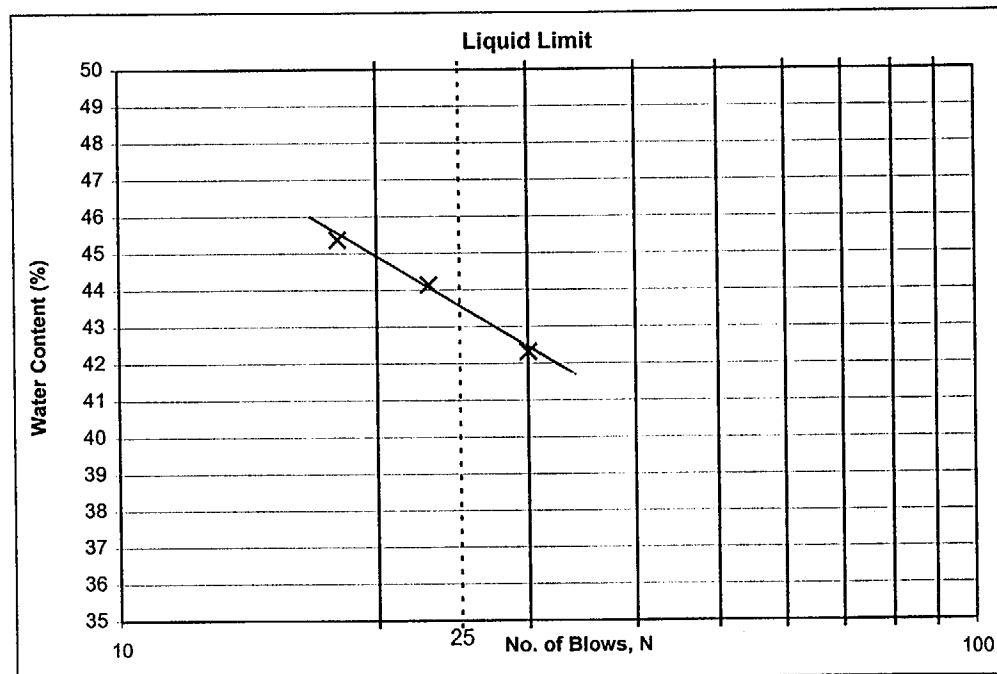
Date	19-Dec-00
Project	Highland
Job Number	100548-3
Sample Location	Sandcone Test
Sample Identification	by CLS on Oct 30, 00; #9
Soil Description	med brn silty CLAY w/shale
Sample Type	Baggie
Tested By	GVH
Preparation (Wet or Dry)	Wet Sieve

Liquid Limit Determination

No. of blows, N	30	23	18
Can Number	A12	A3	A7
Mass of can (g)	15.41	15.26	15.43
Mass of wet soil + can (g)	29.67	38.51	33.79
Mass of dry soil + can(g)	25.43	31.39	28.06
Water content (%)	42.3	44.1	45.4

Plastic Limit Determination

Can Number	A1	A2
Mass of can (g)	15.42	15.43
Mass of wet soil + can (g)	21.43	21.81
Mass of dry soil + can(g)	20.51	20.82
Water content (%)	18.1	18.4



Results

Liquid Limit	43
Plastic Limit	18
Plasticity Index	25

APPENDIX C-4
STANDARD PROCTOR TESTS

MOISTURE-DENSITY RELATIONSHIP

Test Method ASTM D-698 Method A

Job No 00.084T Date 10/26/00

Project SMI 100548-3 Highland

Source of Material North Stockpile

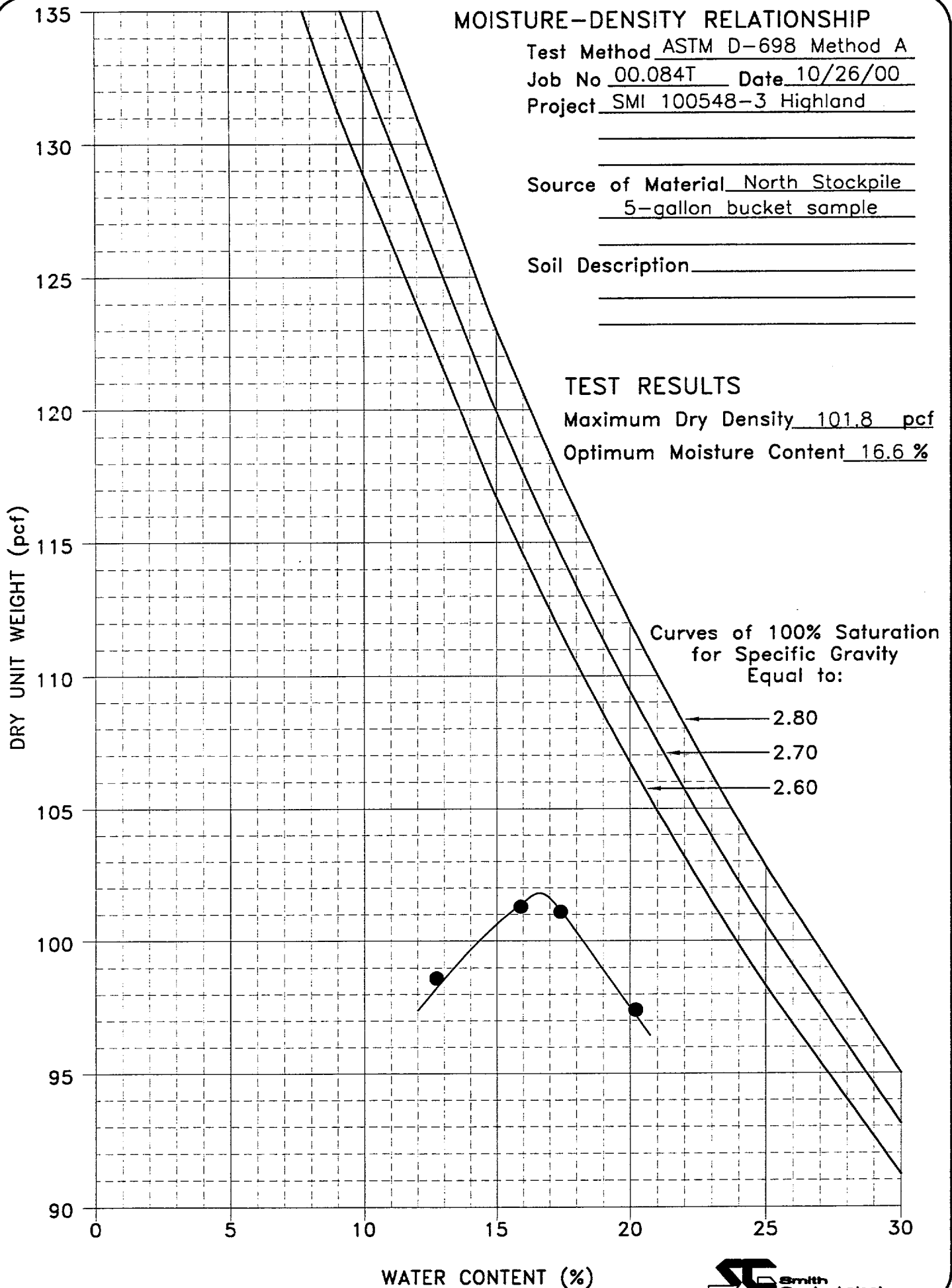
5-gallon bucket sample

Soil Description _____

TEST RESULTS

Maximum Dry Density 101.8 pcf

Optimum Moisture Content 16.6 %



MOISTURE-DENSITY RELATIONSHIP

Test Method ASTM D-698 Method A

Job No 00.084T Date 10/26/00

Project SMI 100548-3 Highland

Source of Material South Stockpile
5-gallon bucket sample

Soil Description _____

TEST RESULTS

Maximum Dry Density 104.5 pcf

Optimum Moisture Content 15.2 %

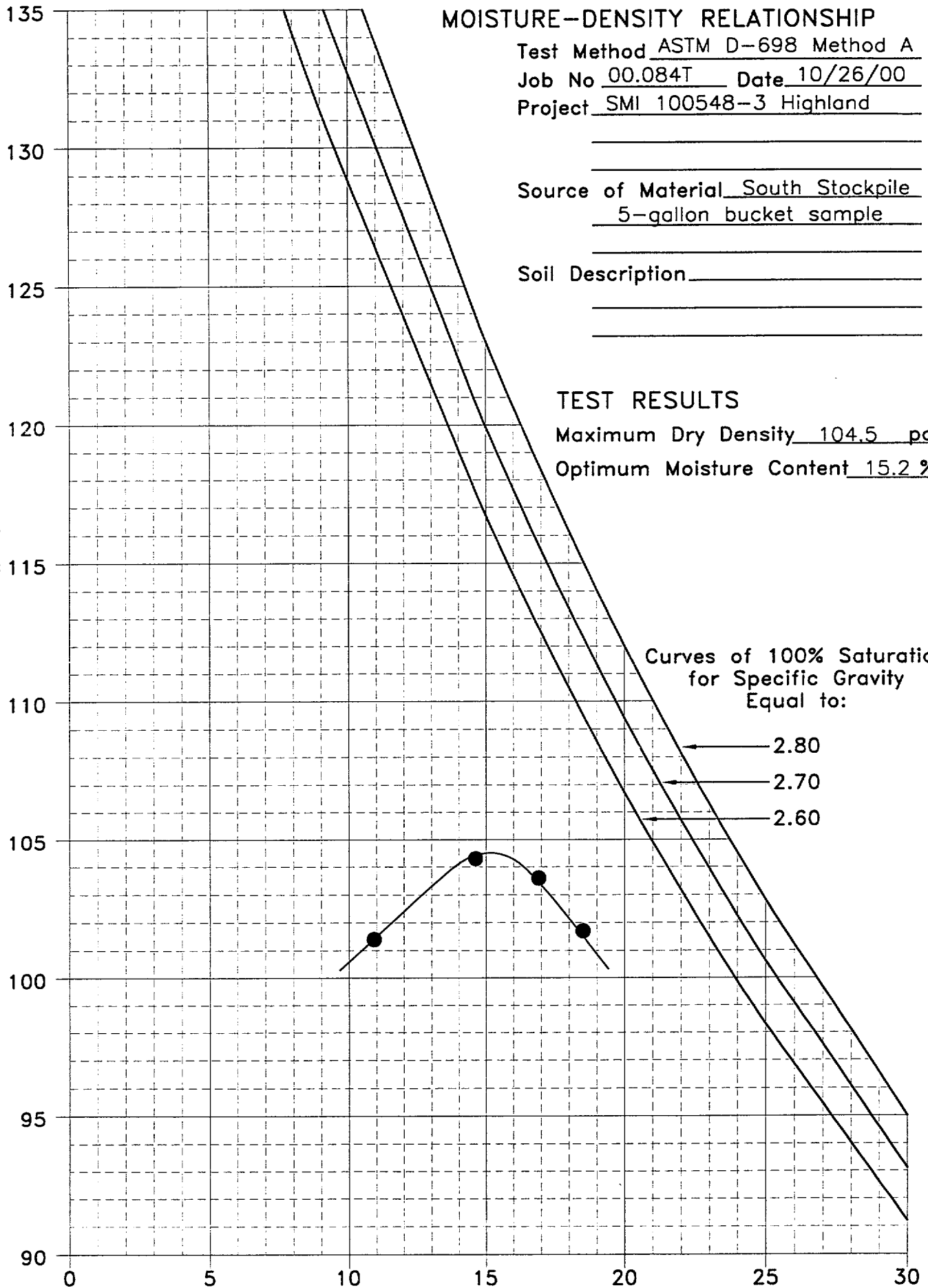
DRY UNIT WEIGHT (pcf)

Curves of 100% Saturation
for Specific Gravity
Equal to:

2.80

2.70

2.60



WATER CONTENT (%)

MOISTURE-DENSITY RELATIONSHIP

Test Method ASTM D-698 Method A

Job No 00.084T Date 10/26/00

Project SMI 100548-3 Highland

Source of Material Borrow Area-Top
5-gallon bucket sample

Soil Description _____

TEST RESULTS

Maximum Dry Density 111.3 pcf

Optimum Moisture Content 16.4 %

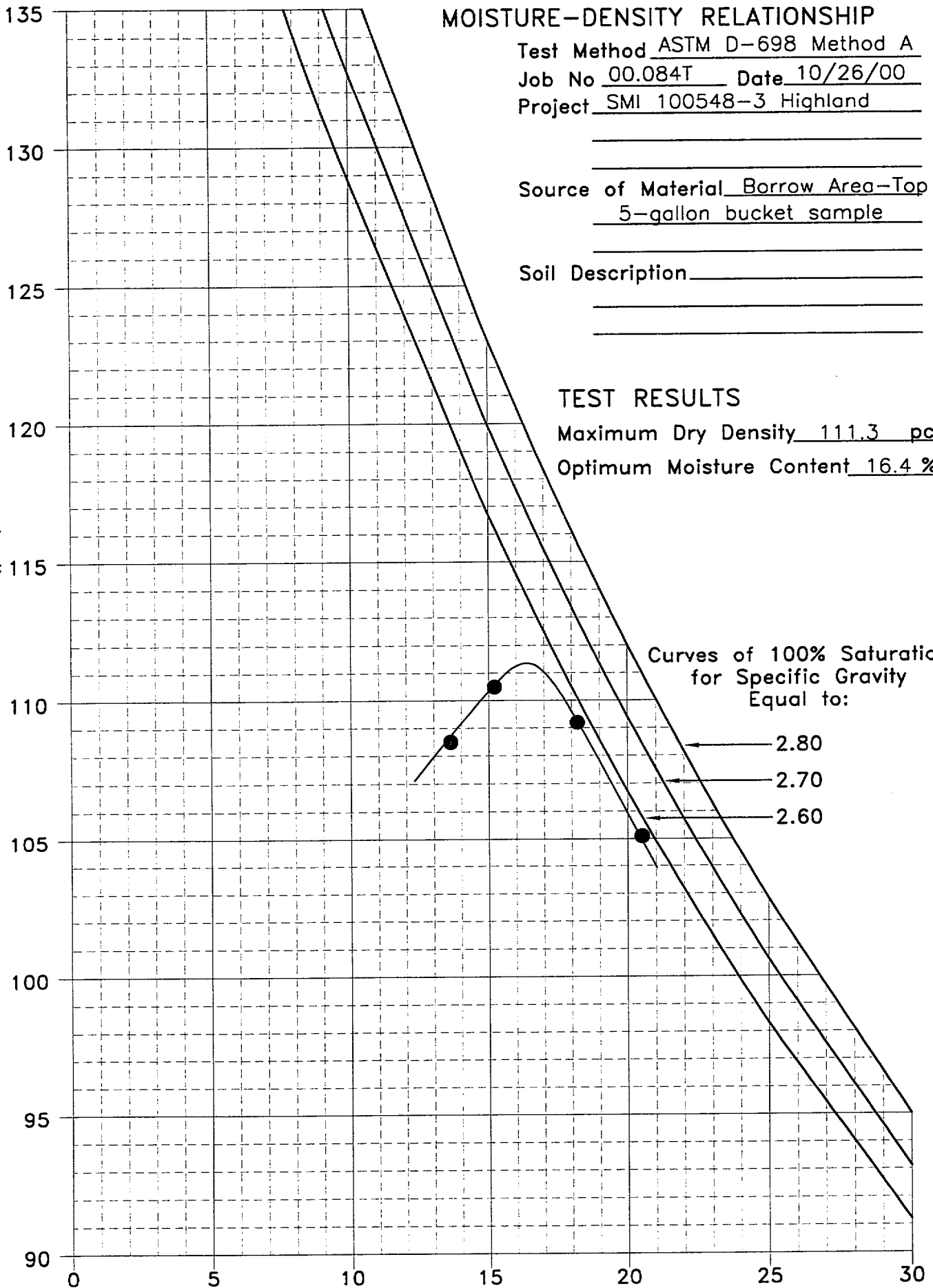
DRY UNIT WEIGHT (pcf)

Curves of 100% Saturation
for Specific Gravity
Equal to:

2.80

2.70

2.60



WATER CONTENT (%)

MOISTURE-DENSITY RELATIONSHIP

Test Method ASTM D-698 Method A

Job No 00.084T Date 10/26/00

Project SMI 100548-3 Highland

Source of Material Borrow Area-Slope
5-gallon bucket sample

Soil Description _____

TEST RESULTS

Maximum Dry Density 106.5 pcf

Optimum Moisture Content 19.6 %

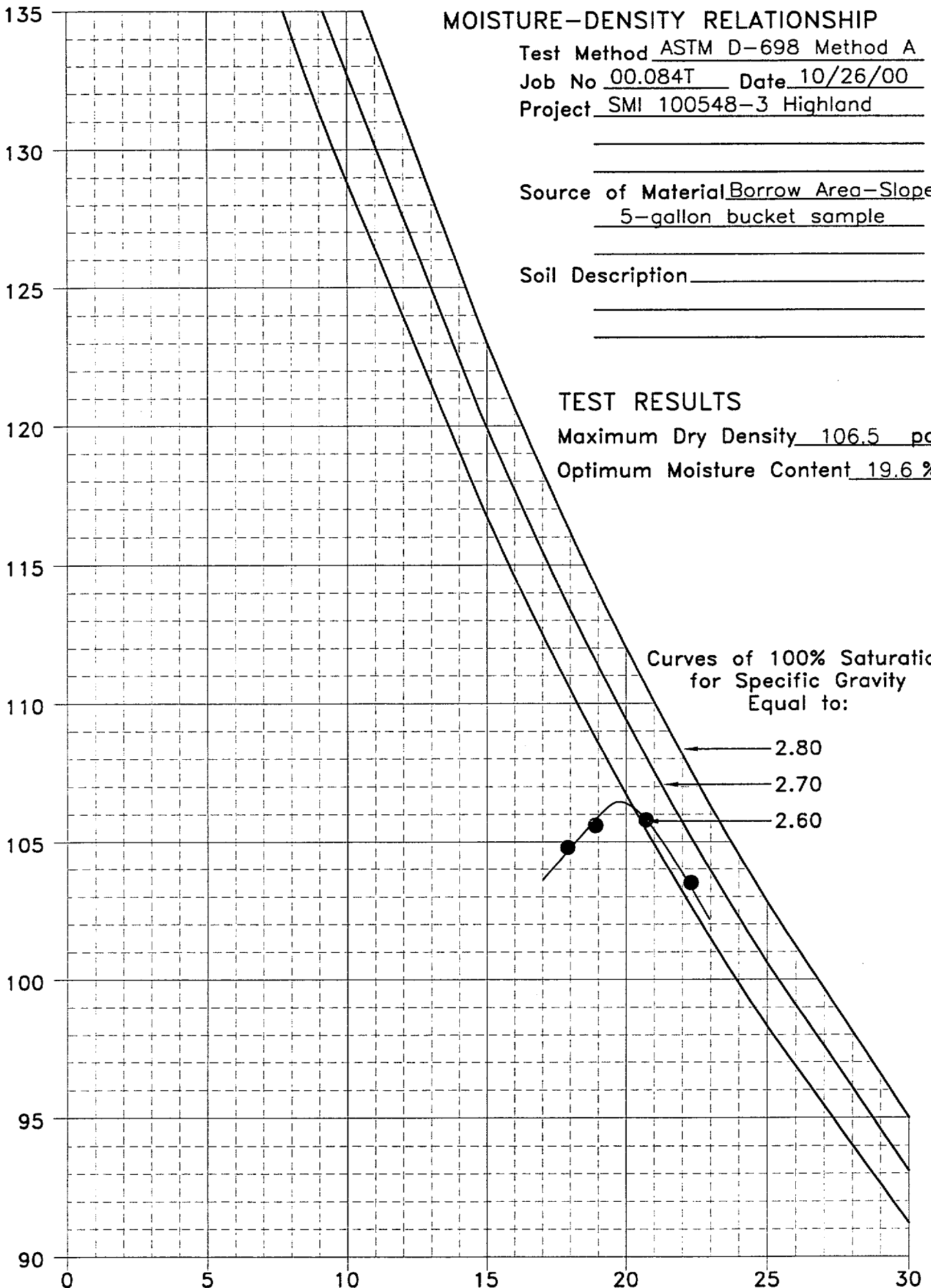
DRY UNIT WEIGHT (pcf)

Curves of 100% Saturation
for Specific Gravity
Equal to:

2.80

2.70

2.60



WATER CONTENT (%)

MOISTURE-DENSITY RELATIONSHIP

Test Method ASTM D-698 Method A

Job No 00.084T Date 11/5/00

Project SMI 100548-3 Highland

Source of Material Borrow Area-North
5-gallon bucket sample

Soil Description SILT with SAND
vf. gr., trace gravel, GRAY

TEST RESULTS

Maximum Dry Density 101.5 pcf

Optimum Moisture Content 21.0 %

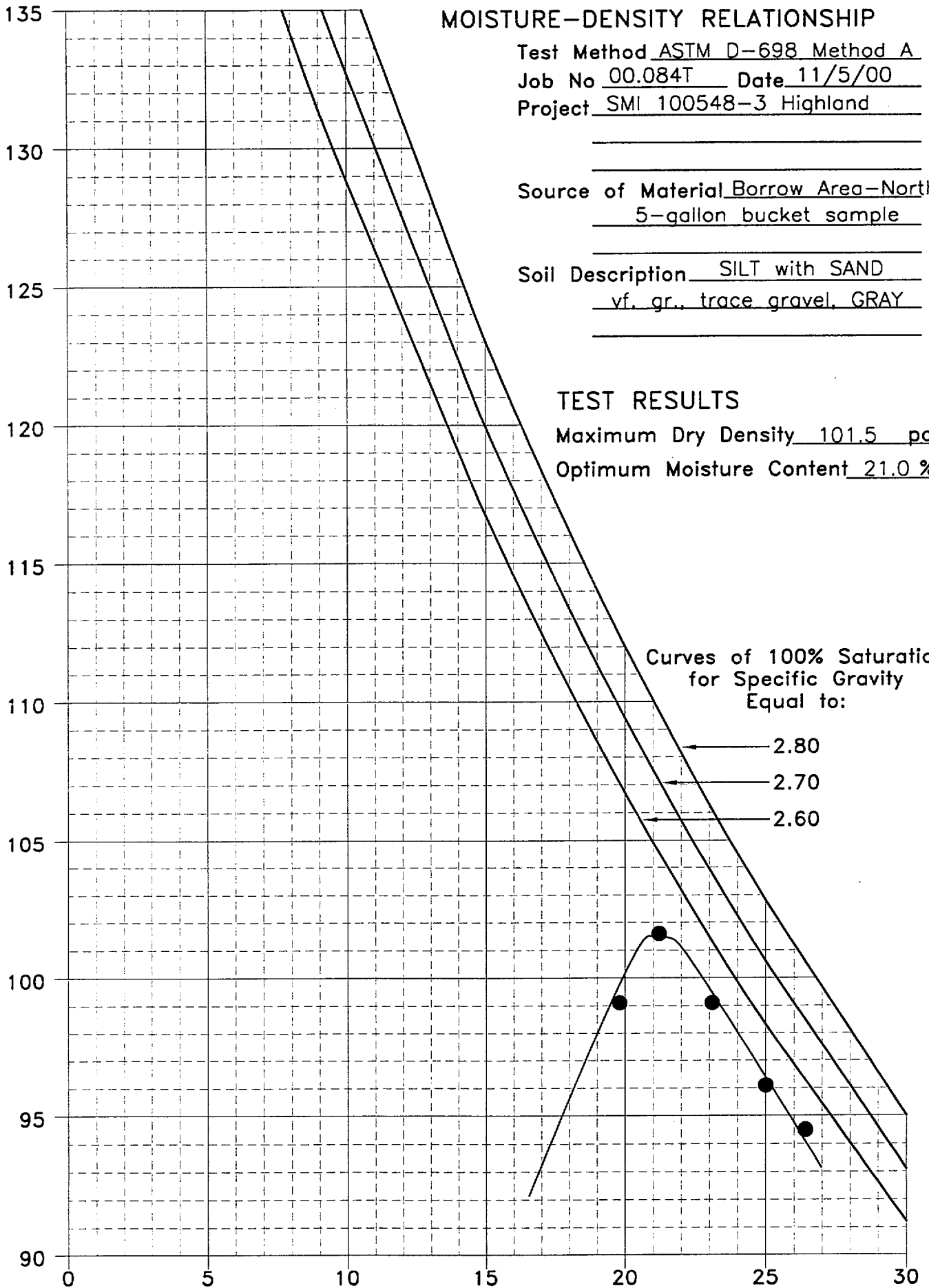
DRY UNIT WEIGHT (pcf)

Curves of 100% Saturation
for Specific Gravity
Equal to:

2.80

2.70

2.60



WATER CONTENT (%)

MOISTURE-DENSITY RELATIONSHIP

Test Method ASTM D-698 Method A

Job No 00.084T Date 10/26/00

Project SMI 100548-3 Highland

Source of Material Borrow Area-South
5-gallon bucket sample

Soil Description SILT with SAND
vf. gr., trace gravel, GRAY

TEST RESULTS

Maximum Dry Density 102.5 pcf

Optimum Moisture Content 20.0 %

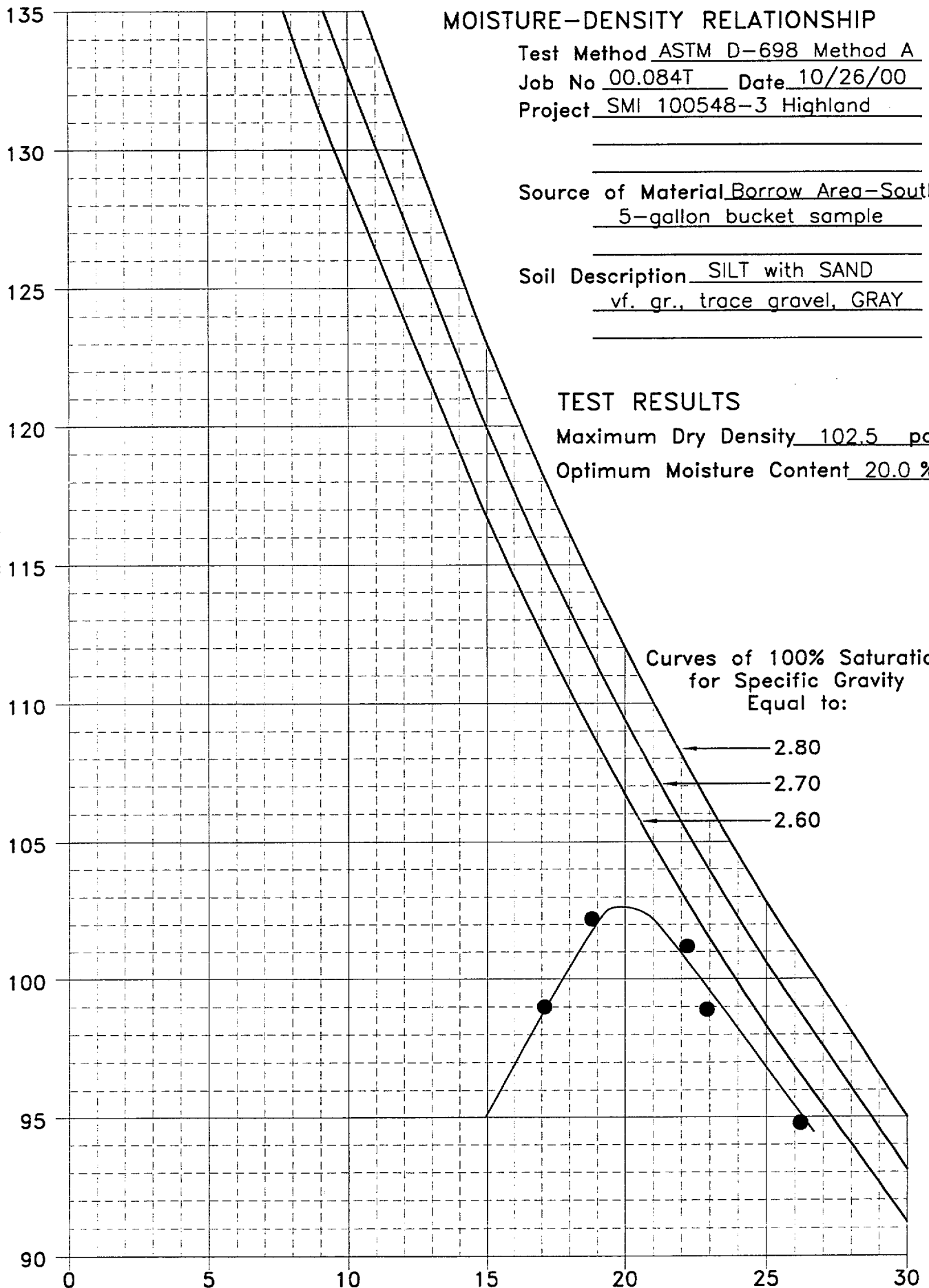
DRY UNIT WEIGHT (pcf)

Curves of 100% Saturation
for Specific Gravity
Equal to:

2.80

2.70

2.60



WATER CONTENT (%)

MOISTURE-DENSITY RELATIONSHIP

Test Method ASTM D-698A

Job No 00.085T Date 12/5/00

Project SMI 100711

Source of Material _____

BA-NE

delivered to Lab

Soil Description SILTY CLAY

gray

TEST RESULTS

Maximum Dry Density 103.5 pcf

Optimum Moisture Content 19.5 %

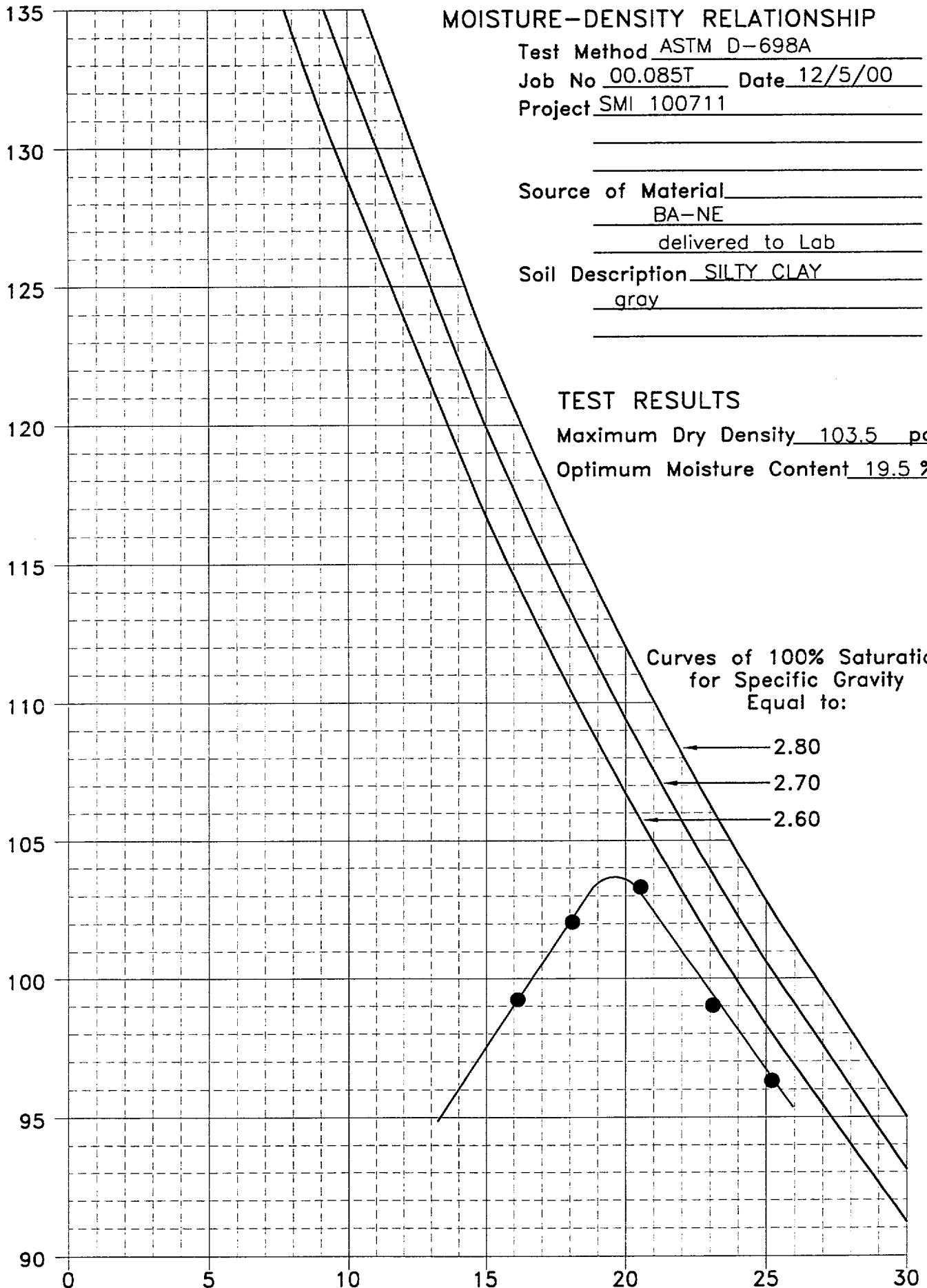
DRY UNIT WEIGHT (pcf)

Curves of 100% Saturation
for Specific Gravity
Equal to:

2.80

2.70

2.60



WATER CONTENT (%)

MOISTURE-DENSITY RELATIONSHIP

Test Method ASTM D-698A

Job No 00.085T Date 12/5/00

Project SMI 100711

Source of Material _____

BA-SE

delivered to Lab

Soil Description SILTY CLAY

gray

TEST RESULTS

Maximum Dry Density 99.0 pcf

Optimum Moisture Content 21.0 %

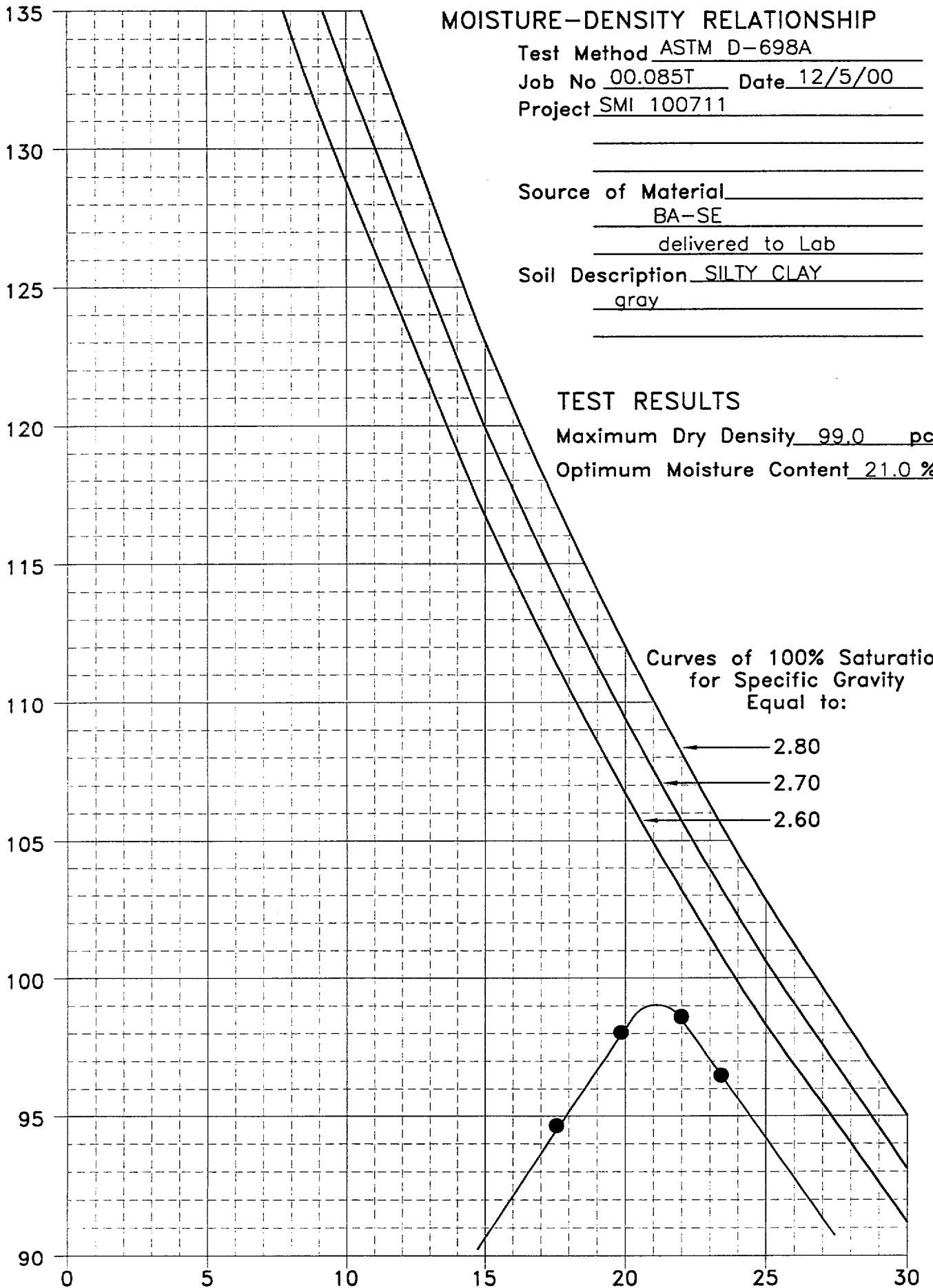
DRY UNIT WEIGHT (pcf)

Curves of 100% Saturation
for Specific Gravity
Equal to:

2.80

2.70

2.60



WATER CONTENT (%)

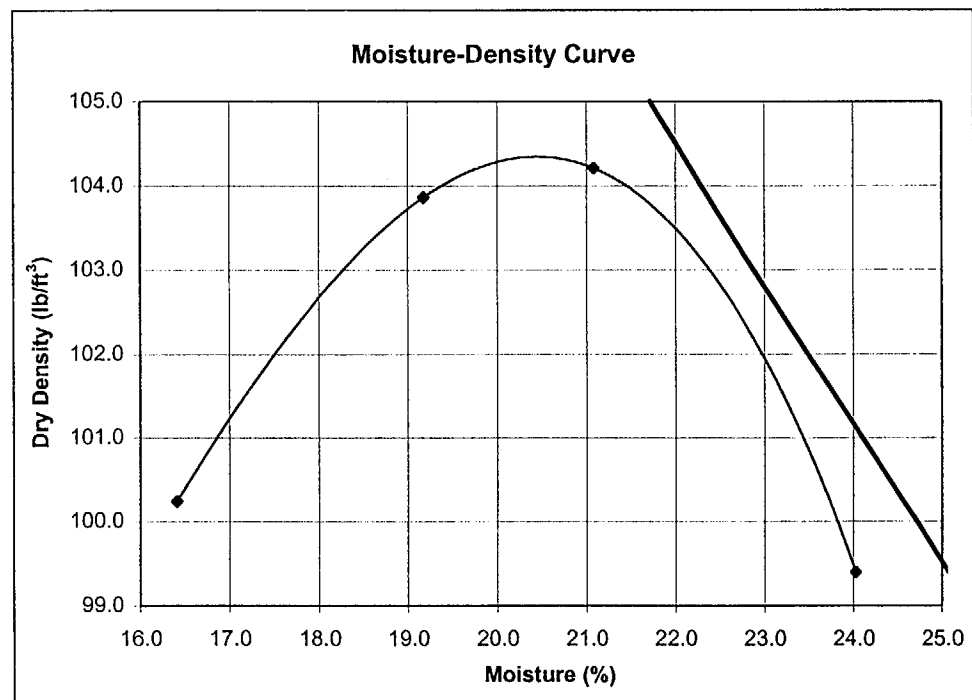
Compaction Test Form

Shepherd Miller, Inc

Okay to change shaded cells

Date	20-Nov-00
Project	Highland - Exxon
Job Number	100548-03
Sample Location	SE side on Main Borrow Area
Sample Identification	
Sample Type	Surface Grab Sample
Soil Description	med brn sandy lean CLAY
Tested By	GVH
Rock Correction?	Not Required

Proctor Method	Standard
Procedure (A,B, or C)	A
Mold Weight (g)	2080.4
Mold Diameter (in)	3.992
Mold Height (in)	4.585
Mold Volume (ft ³)	0.03321



Laboratory Testing Determinations

Target Water Content	0	+2	+4	-2	
Mass of soil + mold (g)	3945.0	3981.1	3937.5	3838.2	
Drying Pan Identification	E	A	I	G	
Mass of pan for drying (g)	13.8	13.7	13.5	13.8	
Mass of wet soil + pan (g)	247.5	213.6	280.9	286.9	
Mass of dry soil + pan (g)	209.9	178.8	229.1	248.4	

Calculated Density and Moisture Content

Moist Unit Weight (lb/ft ³)	123.8	126.2	123.3	116.7	N/A
Dry Unit Weight (lb/ft ³)	103.9	104.2	99.4	100.2	N/A
Moisture Content (%)	19.2	21.1	24.0	16.4	N/A

Max Dry Density: 104.3

Optimum Moisture: 20.3

Zero Air-Voids Data

Dry Unit Weight (lb/ft ³)	105	104	103	99
Corresponding Moisture (%)	21.7	22.3	22.9	25.3

Specific Gravity = 2.65
(assumed)

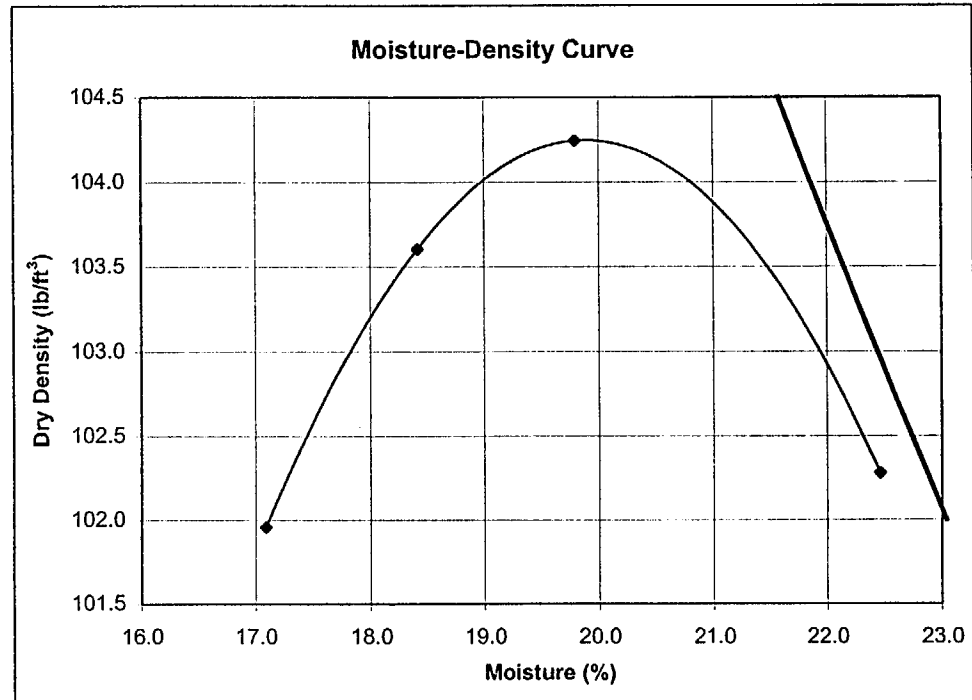
Compaction Test Form

Shepherd Miller, Inc

Okay to change shaded cells

Date	14-Nov-00
Project	Highland - Exxon
Job Number	100548-03
Sample Location	NE side on Main Borrow Area
Sample Identification	
Sample Type	Surface Grab Sample
Soil Description	med brn sandy Clay w/shale
Tested By	GVH
Rock Correction?	Not Required

Proctor Method	Standard
Procedure (A,B, or C)	A
Mold Weight (g)	2080.4
Mold Diameter (in)	3.992
Mold Height (in)	4.585
Mold Volume (ft ³)	0.03321



Laboratory Testing Determinations

Target Water Content	+2	-2	+4	0	
Mass of soil + mold (g)	3961.6	3878.7	3967.2	3928.4	
Drying Pan Identification	A	B	E	D	
Mass of pan for drying (g)	13.7	13.7	13.6	13.7	
Mass of wet soil + pan (g)	297.5	379.6	342.9	312.8	
Mass of dry soil + pan (g)	250.6	326.2	282.5	266.3	

Calculated Density and Moisture Content

Moist Unit Weight (lb/ft ³)	124.9	119.4	125.3	122.7	N/A
Dry Unit Weight (lb/ft ³)	104.2	102.0	102.3	103.6	N/A
Moisture Content (%)	19.8	17.1	22.5	18.4	N/A

Max Dry Density: 104.2

Optimum Moisture: 19.9

Zero Air-Voids Data

Dry Unit Weight (lb/ft ³)	104.5	104	103	102
Corresponding Moisture (%)	21.6	21.9	22.4	23.0

Specific Gravity = 2.62
(assumed)

MOISTURE-DENSITY RELATIONSHIP

Test Method ASTM D-698A

Job No 01.026T Date 04/13/01

Project SMI 100548-2

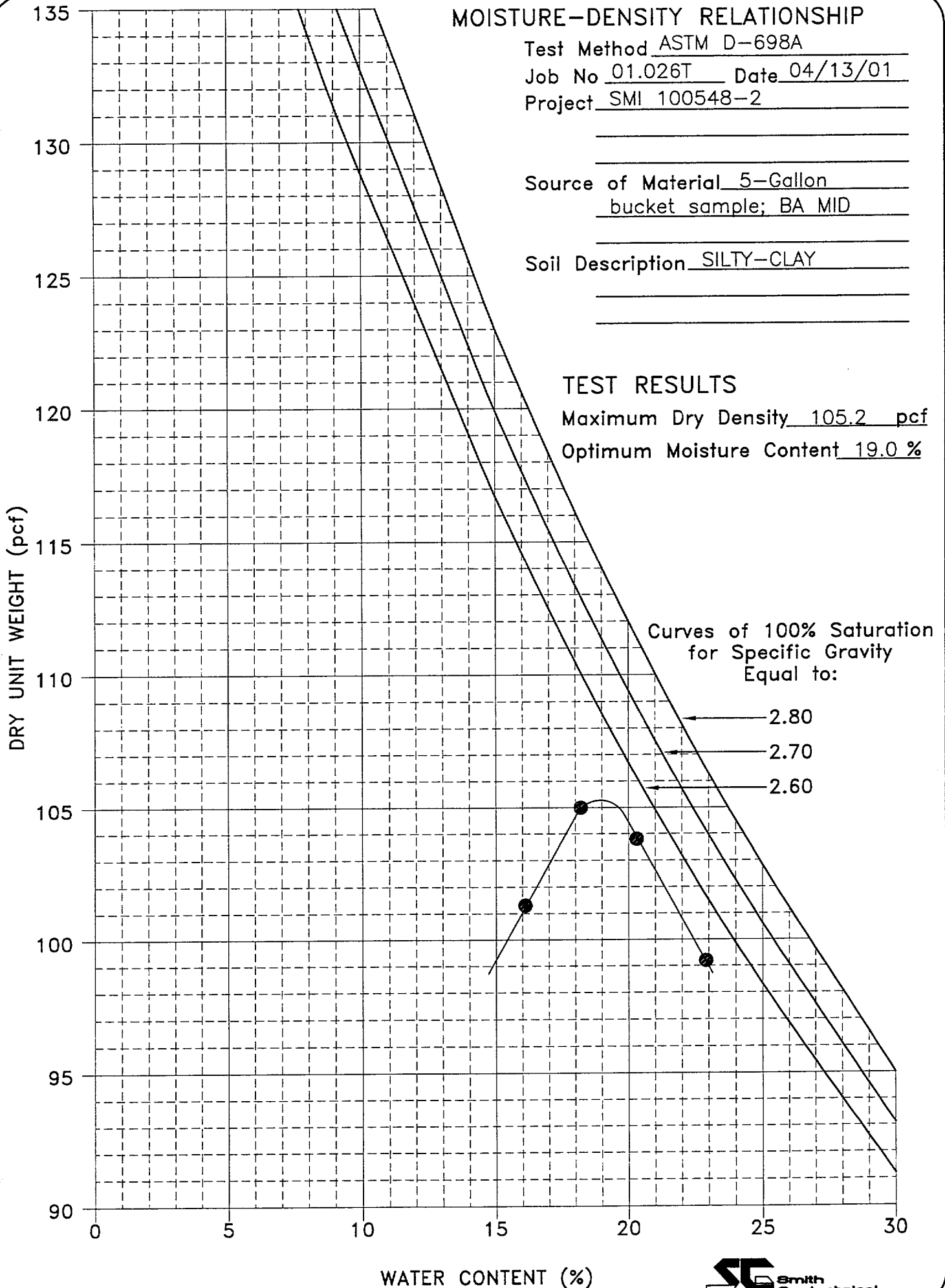
Source of Material 5-Gallon
bucket sample; BA MID

Soil Description SILTY-CLAY

TEST RESULTS

Maximum Dry Density 105.2 pcf

Optimum Moisture Content 19.0 %



MOISTURE-DENSITY RELATIONSHIP

Test Method ASTM D-698A

Job No 01.026T Date 04/13/01

Project SMI 100548-2

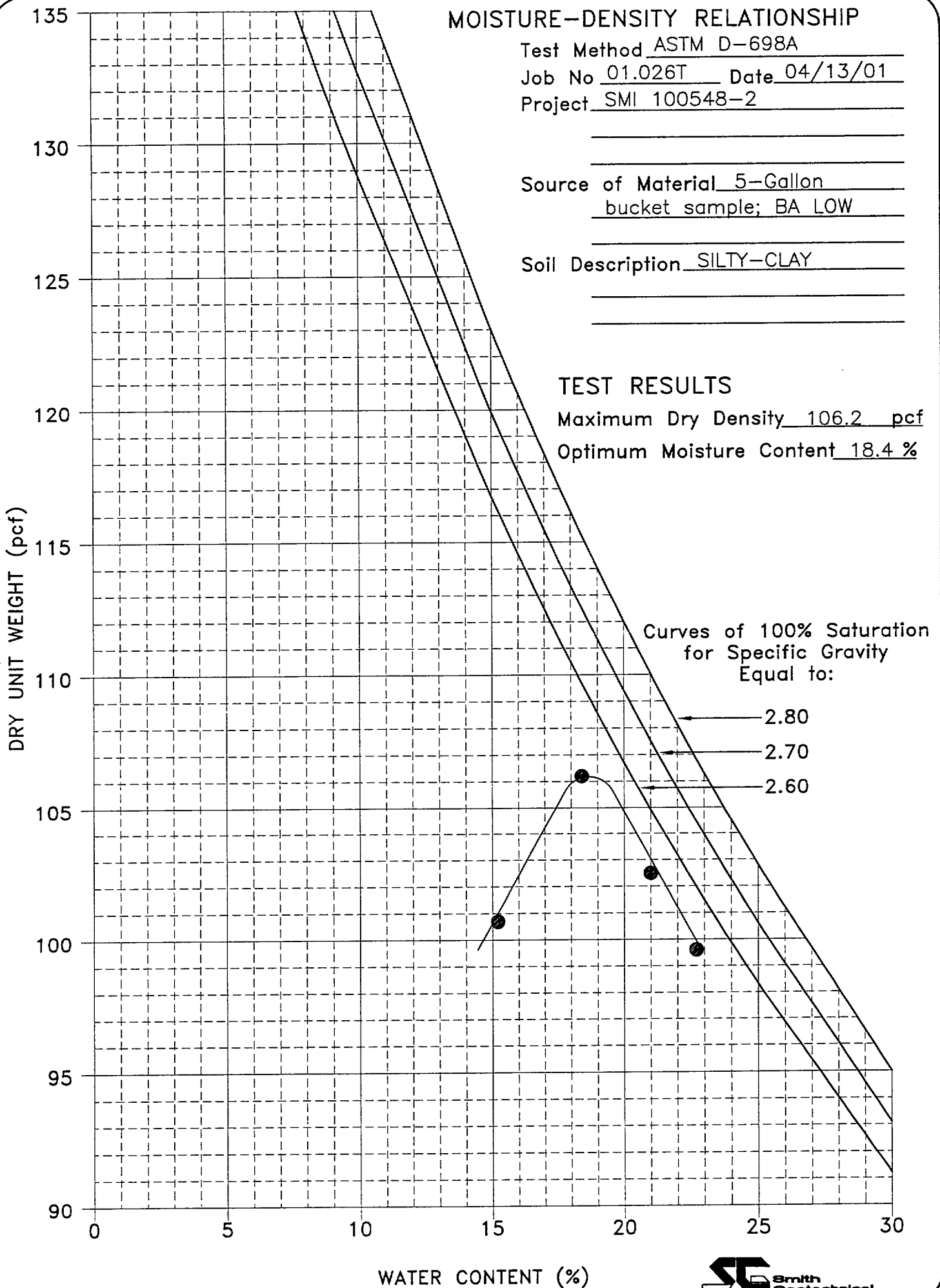
Source of Material 5-Gallon
bucket sample; BA LOW

Soil Description SILTY-CLAY

TEST RESULTS

Maximum Dry Density 106.2 pcf

Optimum Moisture Content 18.4 %



MOISTURE-DENSITY RELATIONSHIP

Test Method ASTM D-698A

Job No 01.026T Date 04/19/01

Project SMI 100548-2

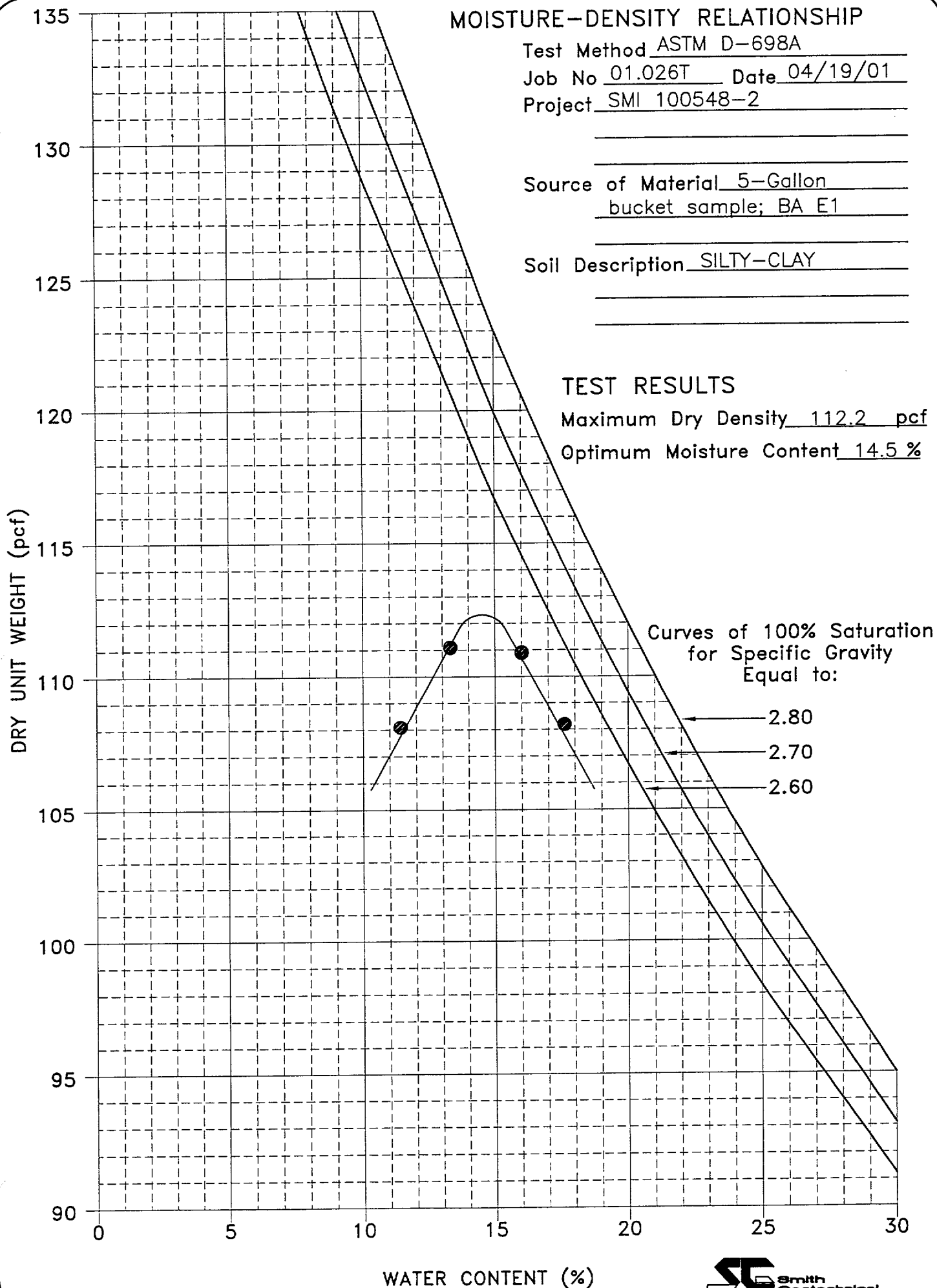
Source of Material 5-Gallon
bucket sample; BA E1

Soil Description SILTY-CLAY

TEST RESULTS

Maximum Dry Density 112.2 pcf

Optimum Moisture Content 14.5 %



MOISTURE-DENSITY RELATIONSHIP

Test Method ASTM D-698A

Job No 01.026T Date 04/19/01

Project SMI 100548-2

Source of Material 5-Gallon
bucket sample; BA E2

Soil Description SILTY-CLAY

TEST RESULTS

Maximum Dry Density 105.0 pcf

Optimum Moisture Content 18.2 %

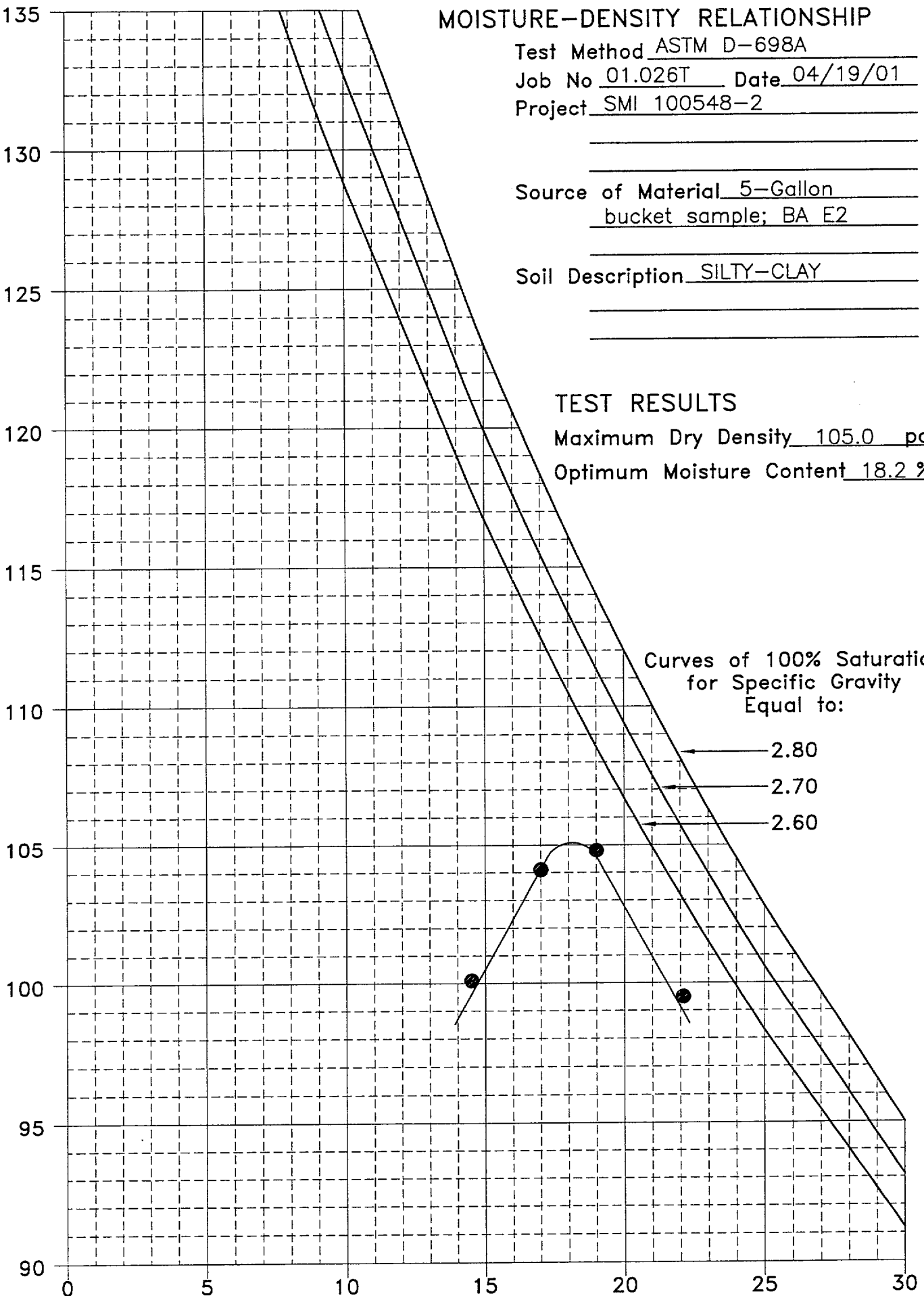
DRY UNIT WEIGHT (pcf)

Curves of 100% Saturation
for Specific Gravity
Equal to:

2.80

2.70

2.60



WATER CONTENT (%)

MOISTURE-DENSITY RELATIONSHIP

Test Method ASTM D-698A

Job No 01.026T Date 04/23/01

Project SMI 100548-2

Source of Material 5-Gallon
bucket sample; BA SA

Soil Description SILTY-CLAY

TEST RESULTS

Maximum Dry Density 107.0 pcf

Optimum Moisture Content 17.6 %

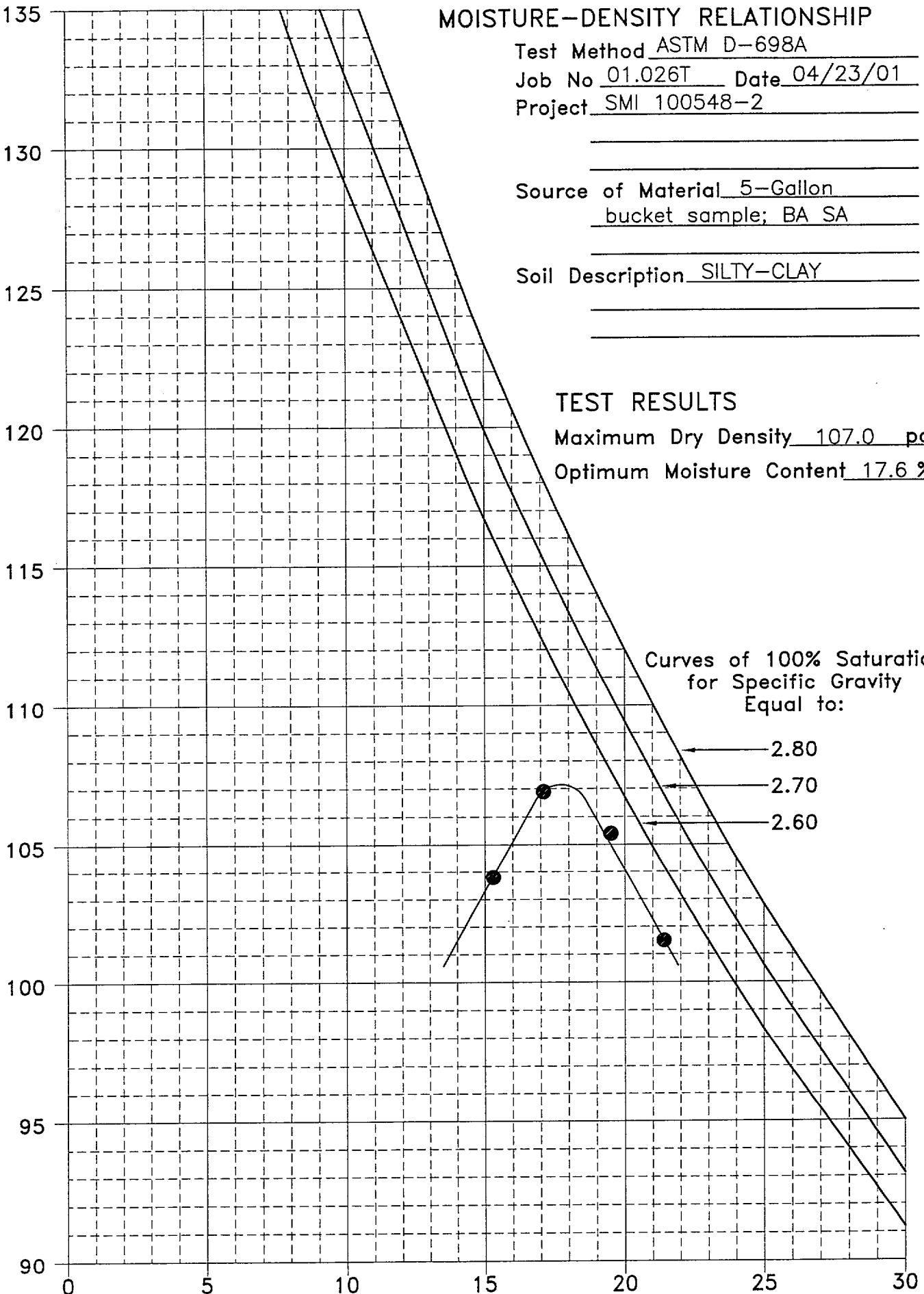
DRY UNIT WEIGHT (pcf)

Curves of 100% Saturation
for Specific Gravity
Equal to:

2.80

2.70

2.60



WATER CONTENT (%)

MOISTURE-DENSITY RELATIONSHIP

Test Method ASTM D-698A

Job No 01.026T Date 04/23/01

Project SMI 100548-2

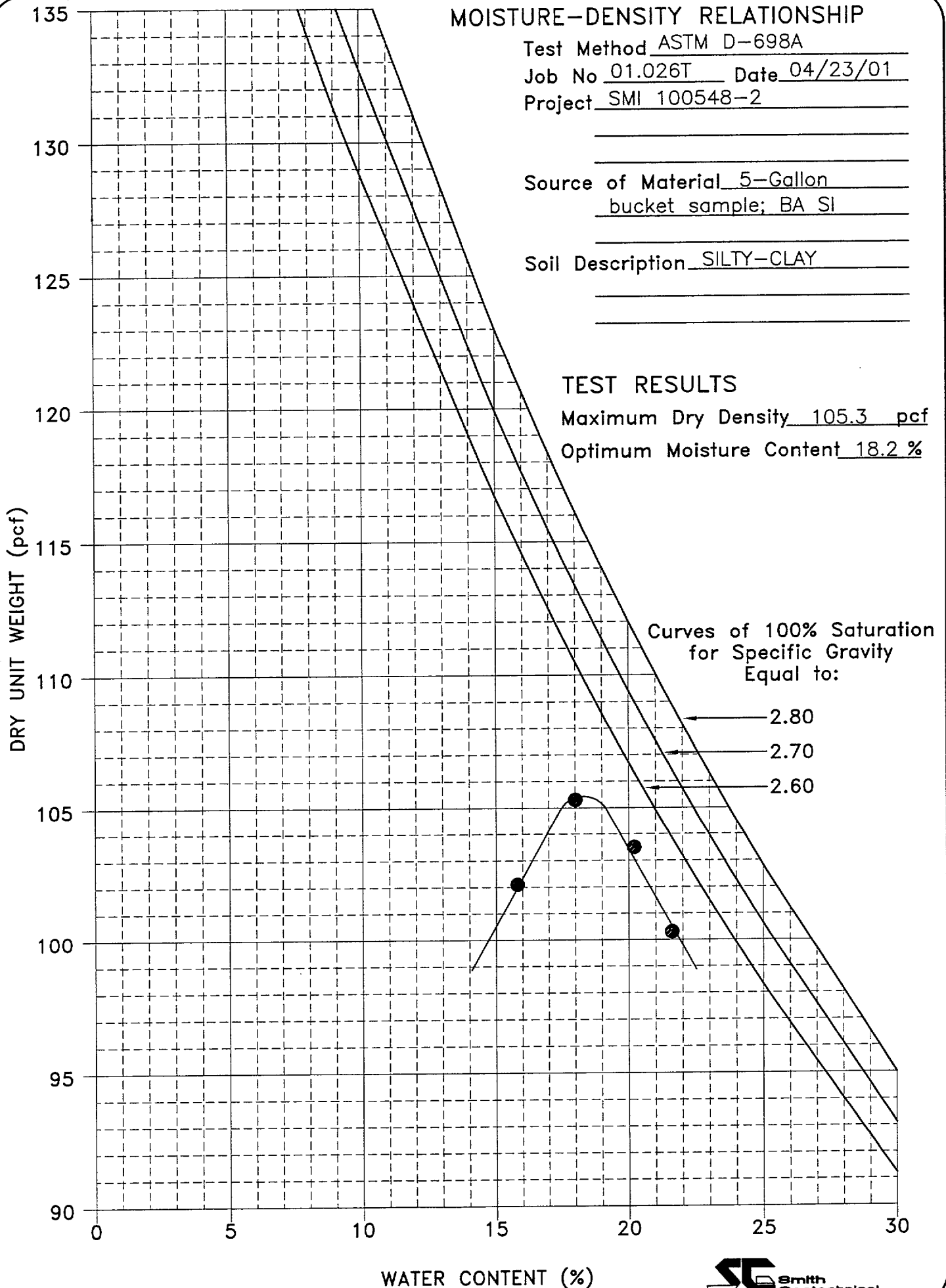
Source of Material 5-Gallon
bucket sample; BA SI

Soil Description SILTY-CLAY

TEST RESULTS

Maximum Dry Density 105.3 pcf

Optimum Moisture Content 18.2 %



Water Content Test Form

Shepherd Miller, Inc

Sample Information

Date	11-Dec-00
Project	Highland
Job Number	100548-3
Sample Type	Baggie From Sandcone
Sample Comments	sampled by CLS on Oct 30, 00
Tested By	GVH

Test Data

Sample Identification	Test #2	Test #7	Test #1	Test #4	Test #10	Test #9	Test #3	Test #5	Test #8	Test #6
Drying Pan Identification	I	D	C	B	G	A	J	L	K	H
Mass of Drying Pan (g)	13.5	13.7	13.8	13.8	13.8	13.8	13.7	13.8	13.4	13.8
Moist Mass of Soil & Pan (g)	301.2	302.9	309.1	317.4	301.0	302.8	304.8	291.1	314.8	279.5
Dry Mass of Soil & Pan (g)	257.3	259.1	262.9	275.1	258.9	255.1	262.5	253.5	264.2	240.3
Water Content (%)	18.0	17.8	18.5	16.2	17.2	19.8	17.0	15.7	20.2	17.3

Water Content Test Form

Shepherd Miller, Inc

Sample Information

Date	14-Dec-00
Project	Highland
Job Number	100548-3
Sample Type	Sandcone Baggies
Sample Comments	sampled by GVH on Oct 31,00
Tested By	GVH

Test Data

Sample Identification	Test #5	Test #4	Test #2	Test #3	Test #1
Drying Pan Identification	L	J	G	K	C
Mass of Drying Pan (g)	13.8	13.8	13.8	13.4	13.7
Moist Mass of Soil & Pan (g)	268.9	292.6	311.2	273.2	307.1
Dry Mass of Soil & Pan (g)	235.5	255.4	260.4	226.9	255.7
Water Content (%)	15.1	15.4	20.6	21.7	21.2

APPENDIX D

FIELD COMPACTION TEST RESULTS

APPENDIX D-1
SAND CONE TESTS

SHEPHERD MILLER
INCORPORATED

CLIENT

JOB NO. 100548-2

PAGE

OF

6

PROJECT

DATE 29 MAR 02

DATE CHECKED

DETAIL

COMPUTED BY CLS

CHECKED BY _____

TEST DATE	TEST NO.	TEST LOCATION	MATERIAL	FIELD D.D. (pcf)	FIELD W.C. (%)	MAX. D.D. (pcf)	OPT W.C. (%)	COMPACTION (%)
24 OCT 00	1	Q, 13+100	RF	109.2	7.6	107	18	102.1
	2	Q, 14+100		98.0	9.6	105	19	93.3
	3	P+100, 14+100		95.2	15.6	104	20	71.5
	4	P+50, 13+100		106.9	11.7	107	18	77.9
	5	P+100, 12+100		101.7	13.0	105	19	76.7
	6	Q+50, 12+50		107.5	3.6	107	18	100.5
	7	Q+100, 11		103.2	11.0	107	18	101.1
	8	Q+100, 12	✓	100.3	16.3	105	19	95.5
30 OCT 00	1	Q+100, 11	RB	97.6	19.5	104	20	92.8
	2	Q+100, 11+100		96.1	13.0	104	23	92.4
	3	Q+100, 12		102.0	17.0	107	18	95.3
	4	Q+100, 13		100.3	16.2	104	20	96.4
	5	Q+100, 13+100		92.2	15.7	104	20	83.7
	6	R, 13		100.6	17.3	105	19	95.8
	7	R, 12		99.5	17.3	104	20	95.7
	8	R, 11+100		101.3	20.2	104	20	97.4
	9	R, 11		95.9	19.8	104	20	93.1
	10	Q+100, 13+100	✓	99.2	17.2	104	20	95.4
31 OCT 01	1	Q+100, 12+100	RB	97.8	21.2	102	21	95.9
	2	Q+100, 10+100		100.9	20.6	104	20	97.0
	3	Q, 10		92.5	21.7	102	21	90.7
	4	P+150, 10+100		93.8	15.4	104	20	90.2
	5	Q, 11+100	✓	96.1	15.1	104	20	92.4
4 NOV 00	1	Q+100, 10+100	RB	99.8	17.6	105	19	95.1
	2	Q+100, 10		93.5	16.0	105	19	93.1
	3	Q+100, 11+100		99.8	21.0	102	21	88.1
	4	Q+100, 12		101.5	17.1	105	19	96.6
	5	Q+100, 13		102.6	17.6	105	19	97.7
	6	Q, 10+100		100.8	15.5	105	19	96.0
	7	Q, 11		97.6	16.7	105	19	92.3
	8	Q+100, 11+100		92.5	19.3	102	21	90.7
	9	Q, 12		97.4	20.2	102	21	95.5
	10	Q, 12+100		108.4	16.2	107	18	96.6
	11	Q, 13		102.1	14.5	107	18	95.4
	12	R, 15		99.8	17.1	105	19	95.1
	13	R, 14		92.1	16.5	105	19	87.7
	14	R, 14		94.2	17.6	105	19	87.7
	15	R, 13		90.1	16.6	105	19	85.7
	16	R, 12	✓	94.5	17.7	105	19	90.0



SHEPHERD MILLER
INCORPORATED

CLIENT _____ JOB NO. 100543-2 PAGE 2 OF 6

PROJECT _____ DATE 29 MAR 02 DATE CHECKED _____

DETAIL _____ COMPUTED BY CLS CHECKED BY _____

TEST DATE	TEST NO.	TEST LOCATION	MATERIAL	FIELD D.D. (pcf)	FIELD W.C. (%)	MAX. D.D. (pcf)	OPT. W.C. (%)	COMPACTION (%)	
6 NOV 00	1	P+150, 11	RB	95.7	15.2	104	20	92.0	fail
	2	N, 13	↓	89.3	15.7	↓	↓	85.9	↓
	3	O, 12	↓	98.5	19.3	↓	↓	74.7	↓
	4	P+150, 10	↓	91.9	15.7	↓	↓	88.4	↓
9 APR 01	1	Q+100, 10	RB	96.7	22.4	102	21	94.8	fail
	2	Q+100, 11	↓	94.9	22.8	102	21	73.0	fail
	3	Q+100, 12	↓	99.5	19.5	104	20	95.7	↓
	4	Q+100, 13	↓	101.0	22.7	102	21	99.1	↓
	5	Q+100, 14	↓	97.7	21.4	102	21	95.8	↓
	6	Q+100, 15	↓	102.7	20.6	104	20	98.8	↓
	7	Q+100, 16	↓	100.9	22.5	102	21	98.9	↓
	8	R+50, 14	↓	100.0	19.1	104	20	96.2	↓
10 APR 01	1	P+150, 10	RB	95.8	21.5	104	20	92.1	fail
	2	P+150, 10+100	↓	95.8	18.8	↓	↓	92.1	fail
	3	P+150, 11	↓	99.7	18.3	↓	↓	95.8	↓
	4	P+150, 11+100	↓	98.9	18.2	↓	↓	95.0	↓
	5	P+150, 13	↓	97.7	17.4	↓	↓	93.9	fail
	6	P+150, 14	↓	102.0	17.2	105	19	97.1	↓
	7	P+150, 15	↓	101.4	20.0	105	19	96.5	↓
	8	R+50, 13+100	↓	100.6	18.8	104	20	96.7	↓
13 APR 01	1	Q+100, 10	RB	103.0	19.6	104	20	99.0	↓
	2	Q+100, 11	↓	100.3	20.1	104	20	96.4	↓
	3	Q+100, 12	↓	95.9	21.6	104	20	92.2	fail
	4	R, 12	↓	103.8	19.4	104	20	99.8	↓
	5	R, 13	↓	111.6	19.4	105	19	106.2	high
	6	R, 14	↓	102.7	20.8	104	20	98.7	↓
	7	Q+100, 15	↓	100.6	16.2	107	18	94.0	fail
	8	Q+100, 16	↓	104.0	16.3	107	18	97.2	↓
16 APR 01	1	R+100, 16	RB	106.7	14.3	111	16	96.1	↓
	2	R+100, 15	↓	106.8	10.3	111	16	96.2	dry
	3	R+100, 14	↓	108.8	16.5	111	16	98.0	↓
	4	R+100, 13	↓	114.5	11.7	117	13	97.9	↓
	5	Q+100, 12 (retest)	↓	103.1	13.0	107	18	96.4	dry
	6	Q+100, 12+100 (retest)	↓	106.4	13.9	107	18	99.4	dry
	7	S, 13+100	↓	106.3	16.4	107	18	99.3	↓
	8	S, 14+100	↓	104.1	16.7	107	18	97.3	↓
	9	S, 15	↓	97.8	13.5	107	18	91.4	fail
	10	S, 15 (retest)	↓	101.3	10.6	107	18	94.6	fail
	11	S, 15+100	↓	93.4	18.4	107	18	87.3	fail
	12	S+100, 15+100	↓	104.5	12.4	107	18	97.7	dry

lab weights



SHEPHERD MILLER
INCORPORATED

CLIENT _____

JOB NO. 100548-2 PAGE 3 OF 6

PROJECT _____

DATE 29 MAR 02 DATE CHECKED _____

DETAIL _____

COMPUTED BY CLS CHECKED BY _____

TEST DATE	TEST NO.	TEST LOCATION	MATERIAL	FIELD D.D. (pcf)	FIELD W.C. (%)	MAX. D.D. (pcf)	OPT. W.C. (%)	COMPACTION (%)
17 APR 01	1	P, 12+150	RF	100.3	19.0	105	19	95.5
	2	O+100, 12+150		106.1	16.5	111	16	95.6
	3	O, 12+150		106.0	16.0	111	16	95.5
	4	N+100, 12+150	↓	97.7	20.7	102	21	95.8
	5	S+100, 15	RB	103.0	18.3	107	18	96.3
	6	Q, 11		97.1	22.9	100	22	97.1
	7	Q, 12		95.9	20.9	104	20	92.2 fail
	8	Q, 12 (retest)		106.9	20.9	104	20	102.8
	9	Q, 11		109.7	17.1	111	16	98.3
	10	S, 15+100 (retest)		100.2	15.7	107	18	93.6 fail
	11	S, 15 (retest)		100.5	19.4	105	19	95.7
	12	S, 15+100 (retest)	↓	106.5	17.4	107	18	99.5
19 APR 01	1	S, 10+100	RB	93.9	18.6	104	20	90.3 fail
	2	S, 10+100		103.6	12.9	107	18	96.8 dry
	3	S, 11		100.5	17.7	105	19	95.7
	4	S, 13		97.5	15.4	105	19	92.9 fail
	5	S, 13 (retest)		101.3	16.3	105	19	96.5 dry
	6	S, 14		102.0	17.6	107	18	95.3
	7	S, 15		102.2	15.5	107	18	95.5 dry
	8	S, 15+100		115.0	13.6	117	13	93.3
	9	S+100, 15+100		98.8	15.7	111	16	89.0 fail
	10	S+100, 15		111.3	14.7	111	16	100.3
	11	S+100, 15+100 (retest)		107.9	13.5	111	16	97.2 dry
	12	S, 12	↓	100.4	15.1	105	19	95.6 dry
20 APR 01	1	R+100, 10+100	RB	104.6	19.1	105	19	99.6
	2	R+100, 11+100		103.9	17.7	105	19	98.9
	3	R+100, 12+100		104.8	16.7	107	18	97.9
	4	R+100, 13+100		110.5	14.6	111	16	99.6
	5	R+100, 15		99.5	15.0	111	16	99.6 fail
	6	R+100, 15+100		107.2	15.9	111	16	96.6
	7	R, 10		109.5	18.9	107	18	102.3
	8	R, 11		104.3	17.2	107	18	97.5
	9	R, 12		102.4	13.9	107	18	95.7 dry
	10	R, 12+100		104.8	16.8	107	18	97.9
	11	R, 13+100		108.8	16.7	111	16	98.0
	12	R, 15	↓	102.3	18.1	107	18	95.6



SHEPHERDMILLER
INCORPORATED

CLIENT _____ JOB NO. 100548-2 PAGE 4 OF 6

PROJECT _____ DATE 29 MAR 02 DATE CHECKED _____

DETAIL _____ COMPUTED BY CLS CHECKED BY _____

TEST DATE	TEST NO.	TEST LOCATION	MATERIAL	FIELD D.D. (pcf)	FIELD W.C. (%)	MAX. D.D. (pcf)	OPT. W.C. (%)	COMPACTION (%)
1 MAY 01	1	P+130, 14	RB	30.1	18.6	104	20	77.0
	2	P+136, 12+040	↓	110.7	17.8	107	18	103.5
	3	P+140, 11	↓	103.2	16.7	107	18	96.4
	4	P+135, 10+080	↓	105.2	18.7	107	18	98.3
	5	Q+015, 9+100	↓	107.3	19.6	107	18	100.3
	6	Q+010, 10+085	↓	106.2	19.4	107	18	99.3
	7	Q+015, 11+020	↓	105.7	19.4	107	18	98.7
	8	Q+020, 12+040	↓	106.4	18.0	107	18	99.4
	9	Q+020, 13+105	↓	105.1	17.9	107	18	98.2
	10	Q+010, 14+100	↓	106.2	17.5	107	18	99.2
4 MAY 01	1	P+130, 14 (retest)	RB	102.3	18.6	107	18	96.1
	2	P+115, 15+015	↓	105.0	17.9	107	18	98.1
	3	P+145, 14	↓	109.8	18.9	107	18	102.6
	4	P+130, 13	↓	108.7	19.3	107	18	101.6
	5	P+160, 11+195	↓	103.1	21.3	104	20	99.1
	6	P+160, 10+170	↓	108.2	19.8	107	18	101.1
	7	P+175, 9+095	↓	106.6	17.3	107	18	99.6
	8	O+175, 11+170	RF	108.1	16.7	111	16	97.3
	9	P+095, 9+157	RB	104.2	19.6	104	20	100.2
	10	P+015, 11	RF	106.8	18.8	107	18	99.8
	11	P+080, 12+005	RB	103.1	19.4	104	20	99.1
	12	O+150, 12+145	↓	105.1	18.2	107	18	98.2
	13	O+035, 12+145	↓	105.6	19.3	107	18	98.7
	14	O, 12+070	↓	102.7	19.1	107	18	95.9
	15	O+100, 12+075	↓	106.7	18.3	107	18	99.8
8 MAY 01	1	O+100, 11+015	RB	105.0	17.7	107	18	98.1
	2	N+170, 11+115	↓	101.3	18.7	104	20	97.4
	3	O+120, 12+110	↓	106.5	19.7	104	20	102.4
	4	N+010, 12+185	↓	100.2	18.4	104	20	96.3
	5	P+035, 13+140	↓	103.7	20.4	104	20	99.7
	6	P+035, 14+070	↓	109.4	16.6	111	16	98.6
	7	O+070, 13+050	↓	103.6	17.7	107	18	101.6
	8	N+175, 13+050	↓	99.3	17.3	107	18	92.8
	9	N+025, 13+045	↓	107.4	17.1	107	18	100.4
	10	M+150, 13+010	↓	106.4	16.9	107	18	99.4
	11	N+030, 12+065	↓	99.7	18.1	105	19	95.0



SHEPHERD MILLER
INCORPORATED

CLIENT _____

JOB NO. 100548-2 PAGE 5 OF 6

PROJECT _____

DATE 30 MAR 02 DATE CHECKED _____

DETAIL _____

COMPUTED BY CLS CHECKED BY _____

TEST DATE	TEST NO.	TEST LOCATION	MATERIAL	FIELD D.D. (pcf)	FIELD W.C. (%)	MAX. D.D. (pcf)	OPT. W.C. (%)	COMPACTION (%)
10 MAY 01	1	N+150, 11+075	RB	103.2	19.7	104	20	99.2
	2	M+170, 11+085		103.5	21.6	104	20	99.5
	3	M+150, 11+165		105.1	17.3	107	18	98.2
	4	O+010, 10+170		100.9	17.7	105	19	96.0
	5	O+110, 10+160		99.9	20.3	104	20	96.0
	6	O+042, 11+160		105.7	17.2	107	18	98.7
	7	O+115, 11+165		105.6	13.2	107	18	98.7
	8	N+050, 11+125		110.0	14.1	111	16	99.1
	9	O+130, 12+120		108.3	19.0	107	18	101.2
	10	N+150, 12+065		102.7	13.0	107	18	95.9
	11	N+040, 12+045		106.4	16.7	107	18	99.5
	12	M+140, 12+065		105.7	17.0	107	18	98.3
	13	N+090, 12+185		109.7	16.1	111	16	98.8
	14	O+035, 10+120		107.3	14.7	111	16	96.7
	15	N+175, 10+130	✓	103.0	19.3	107	18	101.9
15 MAY 01	1	O+050, 11+060	RB	107.2	16.3	111	16	96.6
	2A	O+140, 10+150		112.5	17.0	111	16	101.3
	3	N+150, 10+145		106.8	16.6	111	16	96.2
	4	N+050, 11+035		110.2	15.3	111	16	99.3
	5	M+145, 9+165		102.0	17.2	107	18	95.3
	6	N+050, 10+035		102.6	15.1	111	16	92.4
	7	L+035, 13+150		102.1	15.4	111	16	92.0
	8	L+030, 12+160	✓	96.4	19.5	104	20	92.7
17 MAY 01	1	L+110, 13+130	RB	106.4	17.5	107	18	99.4
	2	L+115, 13+040		103.1	16.7	107	18	96.4
	3	O+160, 9+125		105.8	14.5	111	16	95.3
	4	N+165, 9+155		102.0	14.7	111	16	91.9
	5	M+165, 9+140		95.4	13.4	111	16	85.9
	6	M+170, 9+130		100.9	15.7	111	16	90.9
	7	O+045, 10+065		107.9	16.0	111	16	97.2
	8	M+075, 10+075		103.5	17.5	107	18	96.7
	9	M+165, 10+150		110.0	16.6	111	16	99.2
	10	M+050, 11+055		106.8	15.5	111	16	96.2
	11	M+075, 12+050		100.5	13.7	111	16	90.5
	12	M+070, 12+045 (retest)		109.6	13.7	111	16	98.7
	13	M+015, 13+035		104.3	15.0	107	18	97.9
	14	M+020, 14+035		110.0	18.0	107	18	102.8
	15	L+135, 14+130		106.8	16.4	107	18	99.8
	16	L+155, 13+155	✓	105.2	18.0	107	18	98.3

dry

fail
fail
fail

fail
fail
fail

fail
dry
dry



SHEPHERD MILLER
INCORPORATED

CLIENT _____ JOB NO. 100543-2 PAGE 6 OF 6
PROJECT _____ DATE 30 MAR 02 DATE CHECKED _____
DETAIL _____ COMPUTED BY CLS CHECKED BY _____

TEST DATE	TEST NO.	TEST LOCATION	MATERIAL	FIELD D.D.(pcf)	FIELD W.C.(%)	MAX. D.D.(pcf)	OPT. W.C.(%)	COMPACTION (%)
22 MAY 01	1	L+130, 11+005	RB	105.6	17.1	107	18	98.7
	2	L+160, 11+155		103.1	18.2	107	18	96.4
	3	L+135, 12+140		106.2	16.6	107	18	99.3
	4	L+045, 12+035		101.8	15.8	107	18	95.1 dry
	5	L+065, 13+030		99.1	17.6	107	18	92.6 fail
	6	L+010, 13+155		110.3	14.0	111	16	99.4
	7	L+075, 14+075		103.1	17.0	107	18	96.3
	8	P+135, 13+150		107.9	13.9	111	16	97.2 dry
	9	P+160, 14+100		107.3	11.0	111	16	96.7 dry
	10	P+130, 14+150		115.5	15.0	111	16	104.0
	11	P+015, 12+055		107.4	16.1	111	16	96.7
	12	P+015, 12+055		105.7	18.7	107	18	93.8
	13	P+035, 13+040		107.3	18.1	107	18	100.3
	14	P+035, 14+055		105.6	17.7	107	18	93.7
	15	P+070, 15+050		103.6	18.7	107	18	102.4
	16	P+075, 16+010		110.1	17.3	107	18	102.9

ABBREVIATIONS:

D.D. - dry density
W.C. - water content

MAX. - maximum
OPT. - optimum

RF - random fill
RB - random barrier

high* - test rejected, value is above zero air voids curve line



SHEPHERD MILLER
INCORPORATED

Project: HIGHLAND 100548-3
Area: _____
Tested By: CLS & GVH
Date: 27 OCT 00

SAND CONE TEST FORM

PAGE 1 OF 2

Visual Description of Soil: grayish brown Sandy silty clay
Material Type: random fill LIFT 0
Location of Sample: South end of fill placement area

Laboratory Data from Field Test

Test No.	1	2	3	4
Moisture Can No.	(bag)	(bag)	(bag)	(bag)
Wt. of can lb	0.02	0.02	0.02	0.02
Wt. of can + wet soil	3.13	2.33	2.55	2.67
Wt. of can + dry soil	(see			→
Wt. of water ↓	m.c. sheet)			
Water content, %	7.6	9.6	15.6	11.7 (lab test)

Field Data

Test No.	1	2	3	4
Unit wt. of sand g/L	93.6			→
Wt. of jug + cone before use lb	15.26	14.87	10.33	15.19
Wt. of jug + cone after use	9.04	9.16	4.53	2.41
Wt. of sand used (hole + cone)	6.22	5.71	5.85	5.73
Wt. of sand in cone	3.70			→
Wt. of sand in hole ↓	2.52	2.01	2.15	2.03
Volume of hole ft ³	0.0269	0.0215	0.0230	0.0232
Wt. of soil lb	3.16	2.31	2.53	2.65

Test Results

Test No.	1	2	3	4
Wet Density (pcf)	117.5	107.4	110.0	119.4
Dry Density (pcf)	109.2	98.0	95.2	106.9
Moisture Content (%)	7.6	9.6	15.6	11.7

Notes: Location Q, 13+1 Q, 14+1 P+1, 14+1 P+1.5, 13+1

Maximum dry density (pcf) 107 105 104 107
Optimum w.c. (%) 18 19 20 18
Compaction (%) 102.1 93.3 91.5 99.9

PASS / FAIL

P

P

P

PFile: SAND-C.DWG



SHEPHERD MILLER
INCORPORATED

Project: HIGHLAND 100548-3
Area: _____
Tested By: CLS & GWH
Date: 27 OCT 00

SAND CONE TEST FORM

PAGE 2 OF 2

Visual Description of Soil: grayish brown Sandy Silty clay
Material Type: random fill LIFT 0
Location of Sample: South end of fill placement area

Laboratory Data from Field Test

Test No.	5	6	7	8
Moisture Can No.	(bag)	(bag)	(bag)	(heavy bag)
Wt. of can lb	0.02	0.02	0.02	0.08
Wt. of can + wet soil	3.73	3.82	3.19	2.82
Wt. of can + dry soil	(see m. c. sheet) →			
Wt. of water				
Water content, %	18.0	9.6	11.0	16.3 (lab test)

Field Data

Test No.	5	6	7	8
Unit wt. of sand pcf	93.6			→
Wt. of jug + cone before use lb	13.75	13.65	14.93	12.83
Wt. of jug + cone after use	7.16	6.93	8.66	4.93
Wt. of sand used (hole + cone)	6.59	6.72	6.17	5.90
Wt. of sand in cone	3.70			→
Wt. of sand in hole	2.89	3.02	2.47	2.20
Volume of hole ft ³	0.0309	0.0323	0.0264	0.0235
Wt. of soil lb	3.71	3.30	3.17	2.74

Test Results

Test No.	5	6	7	8
Wet Density (pcf)	120.1	117.3	120.1	116.6
Dry Density (pcf)	101.7	107.5	103.2	100.3
Moisture Content (%)	18.0	9.6	11.0	16.3

Notes: Location P+1, 12+1 Q+0.5, 12+0.5 Q+1, 11 Q+1, 12
Maximum dry density (pcf) 105 107 107 105
Optimum w.c. (%) 17 13 13 19
Compaction (%) 96.9 100.5 101.1 95.5

PASS/ FAIL

P

P

P

P File: SAND-C.DWG



SHEPHERD MILLER
INCORPORATED

Project: HIGHLAND
Area: _____
Tested By: CLS
Date: 30 OCT 00

SAND CONE TEST FORM

PAGE 1 of 3

Visual Description of Soil: grayish brown silty clay
Material Type: cover LIFT 1
Location of Sample: South end of fill area

Laboratory Data from Field Test	Q+1, 11	Q+1, 11+1	Q+1, 12	Q+1, 13
Test No.	1	2	3	4
Moisture Can No.	bag			→
Wt. of can	0.02			→
Wt. of can + wet soil	2.74	2.65	3.04	2.65
Wt. of can + dry soil				
Wt. of water				
Water content, %				

Field Data

Test No.	1	2	3	4
Unit wt. of sand	93.6			→
Wt. of jug + cone before use	15.23	13.47	13.12	12.53
Wt. of jug + cone after use	9.33	7.60	7.05	6.70
Wt. of sand used (hole + cone)	5.90	5.87	6.07	5.83
Wt. of sand in cone	3.70			→
Wt. of sand in hole	2.20	2.17	2.37	2.13
Volume of hole	0.0235	0.0232	0.0253	0.0228
Wt. of soil (wet)	2.72	2.63	3.02	2.65

Test Results

Test No.	1	2	3	4
Wet Density (pcf)	115.7	113.4	119.3	116.5
Dry Density (pcf)	97.6	96.1	102.0	100.3
Moisture Content (%)	✓ 18.5	✓ 18.0	✓ 17.0	✓ 16.2

Notes: Max d.d (pcf) 104 104 107 104
Opt WC (%) 20 20 18 20
Compaction (%) 93.8 92.4 95.3 96.4
(dry)
PASS/FAIL F F P P



SHEPHERD MILLER
INCORPORATED

Project: HIGHLAND
Area: _____
Tested By: CLS
Date: 30 OCT 00

SAND CONE TEST FORM

PAGE 2 OF 3

Visual Description of Soil: grayish brown silty clay
Material Type: cover LIFT 1
Location of Sample: South end of fill area

Laboratory Data from Field Test Q+1, 13+1 R, 13 R, 12 R, 11+1

Test No.	5	6	7	8
Moisture Can No.	bag			
Wt. of can	0.02			
Wt. of can + wet soil	2.63	2.78	2.40	3.09
Wt. of can + dry soil				
Wt. of water				
Water content, %				

Field Data

Test No.	5	6	7	8
Unit wt. of sand	93.6			
Wt. of jug + cone before use	11.65	14.25	13.28	12.90
Wt. of jug + cone after use	5.66	8.36	7.68	6.84
Wt. of sand used (hole + cone)	5.99	5.89	5.60	6.06
Wt. of sand in cone	3.70			
Wt. of sand in hole	2.29	2.19	1.90	2.36
Volume of hole	0.0245	0.0234	0.203	0.0252
Wt. of soil	2.61	2.76	2.33	3.07

14.82

Test Results

Test No.	5	6	7	8
Wet Density (pcf)	106.7	118.0	117.2	121.5
Dry Density (pcf)	92.2	100.6	99.5	101.3
Moisture Content (%)	~ 15.7	~ 17.3	~ 17.8	~ 20.2

Notes: Max dd 104 105 104 104
Opt mc 20 19 20 20
Compaction (%) 88.7 95.8 95.7 97.4

(dry)

PASS/FAIL

F

P

P

P



SHEPHERD MILLER
INCORPORATED

Project: HIGHLAND
Area: _____
Tested By: CUS
Date: 30 OCT 00

SAND CONE TEST FORM

PAGE 3 of 3

Visual Description of Soil: _____

Material Type: cover LIFT 2

Location of Sample: _____

Laboratory Data from Field Test R,11 Q+1, 13+1 (RT#5)

Test No.	<u>9</u>	<u>10</u>
Moisture Can No.	<u>bag</u>	<u>bag</u>
Wt. of can	<u>0.02</u>	<u>0.02</u>
Wt. of can + wet soil	<u>2.72</u>	<u>2.48</u>
Wt. of can + dry soil		
Wt. of water		
Water content, %		

Field Data

Test No.	<u>9</u>	<u>10</u>
Unit wt. of sand	<u>93.6</u>	<u>→</u>
Wt. of jug + cone before use	<u>14.82</u>	<u>14.35</u>
Wt. of jug + cone after use	<u>8.94</u>	<u>8.67</u>
Wt. of sand used (hole + cone)	<u>5.90</u>	<u>5.68</u>
Wt. of sand in cone	<u>3.70</u>	<u>3.70</u>
Wt. of sand in hole	<u>2.20</u>	<u>1.98</u>
Volume of hole	<u>0.0235</u>	<u>0.0212</u>
Wt. of soil	<u>2.70</u>	<u>2.46</u>

Test Results

Test No.	<u>9</u>	<u>10</u>
Wet Density (pcf)	<u>114.9</u>	<u>116.3</u>
Dry Density (pcf)	<u>95.9</u>	<u>99.2</u>
Moisture Content (%)	<u>~ 19.8</u>	<u>~ 17.2</u>

Notes: max d.d. (pcf) 104 104
opt m.c. (%) 20 20
compaction (%) 92.2 95.4

PASS/FAIL

F

P



SHEPHERD MILLER
INCORPORATED

Project: HIGHLAND 100548-2
Area: TAILINGS BASIN FILL AREA
Tested By: GVH | Checked
Date: 31 OCT 2002 | by CLS

SAND CONE TEST FORM

PAGE 1 of 1

Visual Description of Soil: Grayish brown silty CLAY w little gravel

Material Type: COVER

Location of Sample: South side of fill area

Location of test

Q+1, 12+1

Laboratory Data from Field Test

Q+1, 10+1

Q, 10

PA1.5, 10+1

Q, 11+1

Test No.	1	2	3	4	5
Moisture Can No. (bag)					
Wt. of bag bag (lb)	0.02				→
Wt. of can + wet soil (lb)	2.57	2.99	2.62	2.24	2.49
Wt. of can + dry wet soil (g)					
Wt. of water " (lb)					
Wt. of water Wet soil (lb)	2.55	2.97	2.60	2.22	2.47

Field
lab
"

Field Data

Test No.	1	2	3	4	5
Unit wt. of sand (pcf)	93.6				→
Wt. of jug + cone before use (lb)	14.17	12.85	11.63	10.19	9.05
Wt. of jug + cone after use (lb)	8.46	6.87	5.77	4.57	3.26
Wt. of sand used (hole + cone) (lb)	5.71	5.98	5.86	5.62	5.79
Wt. of sand in cone (lb)	3.70				→
Wt. of sand in hole (lb)	2.01	2.28	2.16	1.92	2.09
Volume of hole (ft ³)	0.0215	0.0244	0.0231	0.0205	0.0223
Wt. of soil (wet) (lb)	2.55	2.97	2.60	2.22	2.47

Test Results

Test No.	1	2	3	4	5
Wet Density (pcf)	118.6	121.7	112.6	108.2	110.6
Dry Density (pcf)	97.8	100.2	92.5	93.8	96.1
Moisture Content (%)	21.2	20.6	21.7	15.4	15.1

Lab
Value

Notes:

Maximum dry density (pcf) 102 104 102 104 104

Optimum water content (%) 21 20 21 20 20

Compaction (%) 95.9 97.0 90.7 90.2 92.4

PASS/FAIL

P

P

F

F

File: SAND-C.DWG

F

**SHEPHERD MILLER**

INCORPORATED

Project: HIGHLAND 100548-3

Area: _____

Tested By: CLSDate: 4 NOV 00**SAND CONE TEST FORM**

PAGE 1 of 4

Visual Description of Soil: grayish brown silty CLAY w GRAVEL piecesMaterial Type: COVER LIFT 4

Location of Sample: _____

Laboratory Data from Q+100, 10+100 Field Test Q+100, 10 Q+100, 11+100 Q+100, 12

Test No.	1	2	3	4
Moisture Can No.	<u>ban</u>			
Wt. of can	<u>0.52</u>			
Wt. of can + wet soil <u>lb</u>	<u>2.44</u>	<u>2.50</u>	<u>2.41</u>	<u>2.28</u>
Wt. of can + dry soil				
Wt. of water				
Water content, %				

Field Data

Test No.				
Unit wt. of sand <u>lb</u>	<u>73.6</u>			
Wt. of jug + cone before use	<u>14.08</u>	<u>12.71</u>	<u>11.23</u>	<u>13.65</u>
Wt. of jug + cone after use	<u>8.45</u>	<u>6.98</u>	<u>5.52</u>	<u>8.17</u>
Wt. of sand used (hole + cone)	<u>5.63</u>	<u>5.73</u>	<u>5.76</u>	<u>5.48</u>
Wt. of sand in cone	<u>3.70</u>	<u>3.70</u>	<u>3.70</u>	<u>3.70</u>
Wt. of sand in hole	<u>1.93</u>	<u>2.03</u>	<u>2.06</u>	<u>1.78</u>
Volume of hole <u>ft³</u>	<u>0.0206</u>	<u>0.0217</u>	<u>0.0220</u>	<u>0.0190</u>
Wt. of soil	<u>2.42</u>	<u>2.48</u>	<u>2.39</u>	<u>2.26</u>

Test Results

Test No.				
Wet Density (pcf)	<u>117.4</u>	<u>114.3</u>	<u>103.6</u>	<u>118.8</u>
Dry Density (pcf)	<u>99.8</u>	<u>98.5</u>	<u>89.8</u>	<u>101.5</u>
Moisture Content (%)	<u>~ 17.6</u>	<u>~ 16.0</u>	<u>~ 21.0</u>	<u>~ 17.1</u>

Notes: Opt WC (%) 19 19 21 19Max dd (pcf) 105 105 102 105Compaction (%) 95.1 93.4 88.0 96.6PASS/FAIL P F F P



SHEPHERD MILLER
INCORPORATED

Project: HIGHLAND
Area: _____
Tested By: CLS
Date: 4/11/00

SAND CONE TEST FORM

PAGE 2 OF 4

Visual Description of Soil: _____
Material Type: _____
Location of Sample: _____

CONVERT

LIFT 4

Laboratory Data from Field Test				
Test No.	5	6	7	8
Moisture Can No. <u>Bag</u>				
Wt. of can bag (lb)	0.02			
Wt. of can + wet soil (lb)	2.65	2.98	3.22	2.84
Wt. of can + dry soil				
Wt. of water				
Water content, %				

Field Data

Test No.				
Unit wt. of sand				
Wt. of jug + cone before use	12.78	11.81	13.02	13.17
Wt. of jug + cone after use	7.04	5.73	6.69	7.08
Wt. of sand used (hole + cone)	5.74	6.08	6.33	6.09
Wt. of sand in cone	3.70	3.70	3.70	3.70
Wt. of sand in hole	2.04	2.38	2.63	2.39
Volume of hole	0.0218	0.0254	0.0281	0.0255
Wt. of soil	2.63	2.96	3.20	2.82

Test Results

Test No.				
Wet Density (pcf)	120.7	116.4	113.9	110.4
Dry Density (pcf)	102.6	100.8	97.6	92.5
Moisture Content (%)	~17.6	~15.5	~16.7	~19.3

Notes: Opt wc (%) 19 19 19 21
Max dcl (pcf) 105 105 105 102
Compaction (%) 97.7 96.0 92.3 90.7
PASS / FAIL P P F F



SHEPHERD MILLER
INCORPORATED

Project: HIGHLAND
Area: _____
Tested By: ELB
Date: 4 NOV 00

SAND CONE TEST FORM

PAGE 3 of 4

Visual Description of Soil: _____
Material Type: COVER
Location of Sample: LIFT 4

Laboratory Data from Field Test ^{Q, 12} ^{Q, 12+100} ^{Q, 13} ^{R, 15 (LIFT 5)}

Test No.	9	10	11	12
Moisture Can No.				
Wt. of can (lb)	0.02			
Wt. of can + wet soil (lb)	3.41	3.19	3.33	3.18
Wt. of can + dry soil				
Wt. of water				
Water content, %				

Field Data

Test No.				
Unit wt. of sand pcf	93.6			
Wt. of jug + cone before use lb	14.94	13.17	11.16	13.44 12.15
Wt. of jug + cone after use	8.53	7.00	4.81	7.21
Wt. of sand used (hole + cone)	6.41	6.17	6.35	6.23
Wt. of sand in cone	3.70	3.70	3.70	3.70
Wt. of sand in hole ✓	2.71	2.47	2.65	2.53
Volume of hole ft ³	0.0290	0.0264	0.0283	0.0270
Wt. of soil lb	3.39	3.17	3.31	3.16

Test Results

Test No.				
Wet Density (pcf)	117.1	120.1	116.9	116.9
Dry Density (pcf)	97.4	103.4	102.1	99.8
Moisture Content (%)	~ 20.2	~ 16.2	~ 14.5	~ 17.1

Notes: opt WC 21 18 18 19
Max dd 102 107 107 105
Compaction 95.5 96.6 95.4 95.1

PASS / FAIL

P

P

P

P File: SAND-C.DWG



SHEPHERD MILLER
INCORPORATED

Project: HIGHLAND
Area: _____
Tested By: CLS
Date: 4 NOV 00

SAND CONE TEST FORM

PAGE 4 of 4

Visual Description of Soil: _____
Material Type: COVER
Location of Sample: LIFT 5

Laboratory Data from Field Test				
Test No.	R ₁₄ 13	R ₁₄ 14	R ₁₃ 15	R ₁₂ 16
Moisture Can No.				
Wt. of can	0.02	0.02	0.02	0.02
Wt. of can + wet soil	2.76	3.05	3.16	2.29
Wt. of can + dry soil				
Wt. of water				
Water content, %				

Field Data

Test No.				
Unit wt. of sand	93.6			
Wt. of jug + cone before use	12.15	12.96	13.60	14.49
Wt. of jug + cone after use	6.06	6.70	7.10	8.88
Wt. of sand used (hole + cone)	6.09	6.26	6.50	5.61
Wt. of sand in cone	3.70	3.70	3.70	3.70
Wt. of sand in hole	2.39	2.56	2.80	1.91
Volume of hole	0.0255	0.0274	0.0299	0.0204
Wt. of soil	2.74	3.03	3.14	2.27

Test Results

Test No.				
Wet Density (pcf)	107.3	110.8	105.0	111.2
Dry Density (pcf)	92.1	94.2	90.1	94.5
Moisture Content (%)	~ 15.5	~ 17.6	~ 16.6	~ 17.7

Notes: Opt MC (%) 19 19 19 19
Max dd (pcf) 105 105 105 105
Compaction (%) 87.7 89.7 85.7 90.0
(dry) Re-test
4 13

PASS/FAIL

F

F

F

F File: SAND-C.DWG



SHEPHERD MILLER
INCORPORATED

Project: HIGHLAND

Area: _____

Tested By: GREG VAN HEEL

Date: MONDAY NOV 6, 2000

SAND CONE TEST FORM

PAGE 1 of 1

Visual Description of Soil: _____

Material Type: COVER FILL

Location of Sample: _____

Laboratory Data from Field Test

Test No.	1	2	3	4
Moisture Can No.				
Wt. of can	2.02			
Wt. of can + wet soil	2.87	2.87	3.02	2.44
Wt. of can + dry soil				
Wt. of water				
Water content, %				

Field Data

Test No.	1	2	3	4
Unit wt. of sand	93.6			
Wt. of jug + cone before use	13.12	11.87	10.86	9.49
Wt. of jug + cone after use	7.00	5.57	4.77	3.66
Wt. of sand used (hole + cone)	6.12	6.30	6.09	5.83
Wt. of sand in cone	3.70	3.70	3.70	3.70
Wt. of sand in hole	2.42	2.60	2.39	2.13
Volume of hole	0.0259	0.0278	0.0255	0.0228
Wt. of soil	2.85	2.87	3.00	2.42

Test Results

Test No.	1	2	3	4
Wet Density (pcf)	110.2	103.3	117.5	106.3
Dry Density (pcf)	95.7	89.3	98.5	91.9
Moisture Content (%)	15.2	15.7	19.3	15.7

Notes:

γ_{max}	104 pcf	104	104	104
$w_{LC opt}$	20%	20%	20%	20%
γ_{comp}	92.0	85.9	94.7	88.4
PASS/FAIL	F	F	F	F



SHEPHERD MILLER
INCORPORATED

Project: Highland

Area: _____

Tested By: Clint Strachan

Date: 9 Apr 01

SAND CONE TEST FORM

Page 1 of 2

Visual Description of Soil: brown clayey SILT w tan & dk gray

Material Type: COVERFILL

Location of Sample: reworked area from Nov 2000

Laboratory Data from Field Test ^{Q+100, 10}				
Test No.	1	2	3	4
Moisture Can No.	<u>2600</u>			
Wt. of can ^{lb}	<u>0.02</u>	<u>0.02</u>	<u>0.02</u>	<u>0.02</u>
Wt. of can + wet soil ^{lb}	<u>3.68</u>	<u>3.31</u>	<u>3.77</u>	<u>4.14</u>
Wt. of can + dry soil				
Wt. of water				
Water content, %				

Field Data

Test No.	1	2	3	4
Unit wt. of sand ^{pcf}	<u>96.7</u>			
Wt. of jug + cone before use ^{lb}	<u>11.20</u>	<u>12.74</u>	<u>11.16</u>	<u>13.22</u>
Wt. of jug + cone after use	<u>7.78</u>	<u>6.18</u>	<u>4.28</u>	<u>6.18</u>
Wt. of sand used (hole + cone)	<u>6.82</u>	<u>6.56</u>	<u>6.98</u>	<u>7.04</u>
Wt. of sand in cone	<u>3.83</u>	<u>3.83</u>	<u>3.83</u>	<u>3.93</u>
Wt. of sand in hole	<u>2.99</u>	<u>2.73</u>	<u>3.05</u>	<u>3.21</u>
Volume of hole ^{ft³}	<u>0.0309</u>	<u>0.0282</u>	<u>0.0315</u>	<u>0.0332</u>
Wt. of soil (wet) ^{lb}	<u>3.66</u>	<u>3.29</u>	<u>3.75</u>	<u>4.12</u>

Test Results

Test No.	1	2	3	4
Wet Density (pcf)	<u>118.4</u>	<u>116.5</u>	<u>118.9</u>	<u>124.1</u>
Dry Density (pcf)	<u>96.7</u>	<u>94.9</u>	<u>99.5</u>	<u>101.1</u>
Moisture Content (%)	<u>22.4</u>	<u>22.8</u>	<u>19.5</u>	<u>22.7</u>

Notes: Max. dry density (pcf) 102 102 104 102

Opt. m.c. (%) 21 21 20 21

Compaction (%) 94.8 93.0 95.7 99.1

PASS/FAIL

F

F

P

P File: SAND-C.DWG

SAND CONE TEST FORM

Page 2 of 2

Visual Description of Soil: SAME AS PAGE 1
Material Type: _____
Location of Sample: _____

Laboratory Data from Field Test ^{Q+100, 14} ^{Q+100, 15} ^{Q+100, 16} ^{R+50, 14}

Test No.	5	6	7	8
Moisture Can No.	(log)			
Wt. of can lb	0.02	0.02	0.02	0.02
Wt. of can + wet soil lb	3.01	3.99	3.74	4.22
Wt. of can + dry soil				
Wt. of water				
Water content, %				

Field Data

Test No.	5	6	7	8
Unit wt. of sand pcf	96.7			
Wt. of jug + cone before use lb	11.81	12.84	13.62	12.17
Wt. of jug + cone after use	4.89	5.91	6.88	4.93
Wt. of sand used (hole + cone)	6.92	6.93	6.74	7.24
Wt. of sand in cone	3.83	3.83	3.93	3.83
Wt. of sand in hole ✓	3.09	3.10	2.91	3.41
Volume of hole ft ³	0.03195	0.03206	0.0301	0.03326
Wt. of soil lb	3.79	3.97	3.72	4.20

Test Results

Test No.	5	6	7	8
Wet Density (pcf)	113.6	123.8	123.6	119.1
Dry Density (pcf)	97.7	102.7	100.9	100.0
Moisture Content (%) ✓	21.4	20.6	22.5	19.1

Notes: Max d_d (pcf) 102 104 102 104

opt mc (%) 21 20 21 20

Compaction (%) 95.8 98.8 98.9 96.2

PASS/FAIL

P

P

P

P File: SAND-C.DWG



SHEPHERD MILLER
INCORPORATED

Project: HIGHLAND
Area: _____
Tested By: CLINT STRACHAN
Date: 10 April

30f

SAND CONE TEST FORM

Page 142

Visual Description of Soil: brown clayey SILT w tan gray, & dk gray GRAVEL
Material Type: COVER
Location of Sample: _____

Laboratory Data from Field Test		P+150, 10	P+150, 10+100	P+150, 11	P+150, 11+100
Test No.		1	2	3	4
Moisture Can No.		Bag			
Wt. of can	lb	0.02			
Wt. of can + wet soil	lb	3.50	3.61	3.35	3.08
Wt. of can + dry soil					
Wt. of water					
Water content, %					

Field Data

Test No.		1	2	3	4
Unit wt. of sand	pcf	96.7			
Wt. of jug + cone before use	lb	13.61	12.53	13.18	13.35
Wt. of jug + cone after use	lb	6.89	5.65	6.62	6.99
Wt. of sand used (hole + cone)	lb	6.72	6.88	6.56	6.36
Wt. of sand in cone	lb	3.83			
Wt. of sand in hole	lb	2.89	3.05	2.73	2.53
Volume of hole	ft ³	0.0299	0.0315	0.0282	0.0262
Wt. of soil	lb	3.48	3.59	3.33	3.06

14.12

Test Results

Test No.		1	2	3	4
Wet Density (pcf)		116.4	113.8	117.95	116.9
Dry Density (pcf)		95.8	95.8	99.7	98.9
Moisture Content (%)		21.5	18.8	18.3	18.2

Notes: Max dd 104
Opt mc 20

Compaction (%) 92.1 92.1 95.3 95.0

PASS/FAIL

F

F

P

P File: SAND-C.DWG



SHEPHERD MILLER
INCORPORATED

Project: HIGHLAND
Area: _____
Tested By: CLS
Date: 10 Apr 01

SAND CONE TEST FORM

Page 2 of 2

Visual Description of Soil: SAME AS PAGE 1
Material Type: _____
Location of Sample: _____

Laboratory Data from Field Test P+150, 13 P+150, 14 P+150, 15 R+50, 13+100

Test No.	5	6	7	8
Moisture Can No.				
Wt. of can	0.02			
Wt. of can + wet soil	3.53	3.31	3.32	3.35
Wt. of can + dry soil				
Wt. of water				
Water content, %				

Field Data

Test No.	5	6	7	8
Unit wt. of sand	96.7			
Wt. of jug + cone before use	14.12	12.83	12.65	12.91
Wt. of jug + cone after use	7.33	7.40	5.30	5.98
Wt. of sand used (hole + cone)	6.79	6.49	7.35	6.93
Wt. of sand in cone	3.83			
Wt. of sand in hole	2.96	2.66	3.02	2.97
Volume of hole	0.0306	0.0275	0.0312	0.0300
Wt. of soil	3.51	3.29	3.60	3.65

Test Results

Test No.	5	6	7	8
Wet Density (pcf)	114.7	119.6	121.7	119.5
Dry Density (pcf)	97.7	102.0	101.4	100.6
Moisture Content (%)	~ 17.4	~ 17.2	~ 20.0	~ 18.3

Notes: Max dd (pcf) 104

Opt mc (%) 20

Compaction (%)

93.9 98.1 97.5 96.7

PASS/FAIL

F

P

P

P File: SAND-C.DWG

SAND CONE TEST FORM

Page 1 of 2

Visual Description of Soil: tanish brown clayey SILT with dk gray and gray GRAVEL

Material Type: COVER FILL

Location of Sample: _____

Location of test Q+100, 10 Q+100, 11 Q+100, 12 R, 12
Laboratory Data from Field Test

Test No.	1	2	3	4
Moisture Can No.				
Wt. of can	0.02			
Wt. of can + wet soil (lb)	3.30	3.31	3.71	3.17
Wt. of can + dry soil	(1457.0g)	(1503.4g)	(1666.2g)	(1436.4g)
Wt. of water	(3.21 lb)	(3.31 lb)	(3.67 lb)	(3.17 lb)
Water content, %	(0.973)	(1.000)	(0.999)	(1.000)

field wt (lb)
lab wt (g)
" (lb)
lab/field ratio

Field Data

Laboratory sample weights measured due to high winds on site 13 April (checking field measurements)

Test No.	1	2	3	4
Unit wt. of sand (pcf)	96.0			
Wt. of jug + cone before use (lb)	15.16	13.39	11.69	12.37
Wt. of jug + cone after use (lb)	8.91	7.01	4.92	6.17
Wt. of sand used (hole + cone) (lb)	6.25	6.38	6.77	6.20
Wt. of sand in cone (lb)	3.75			
Wt. of sand in hole (lb)	2.49	2.62	3.01	2.44
Volume of hole (ft ³)	0.0259	0.0273	0.0313	0.0254
Wt. of soil (wet) (lb)	3.28	3.29	3.69	3.15

-13.25

lab wt

Test Results

Test No.	1	2	3	4
Wet Density (pcf)	126.5 123.2	120.5	117.7 116.6	123.9
Dry Density (pcf)	105.8 103.0	100.3	96.8 95.9	103.8
Moisture Content (%)	~ 19.6	~ 20.1	~ 21.6	~ 19.4

Notes:

Maximum dry density (pcf) 104 104 104 104
Optimum water content (%) 20 20 20 20
Compaction (%) 101.7 | 99.0 96.5 93.1 | 92.2 99.8

PASS/FAIL

P

P

F

P File: SAND-C.DWG

SAND CONE TEST FORM

Page 2 of 2

Visual Description of Soil: SAME AS PAGE 1
Material Type: _____
Location of Sample: _____

Location of test R, 13 R, 14 Q+100, 15 Q+100, 16
Laboratory Data from Field Test

Test No.	5	6	7	8
Moisture Can No.				
Wt. of can	0.02			
Wt. of can + wet soil (lb)	3.92	3.20	3.14	3.02
Wt. of can + dry soil	(1753.8 g)	(1436.1 g)	(1394.3 g)	(1347.0 g)
Wt. of water	(3.87 lb)	(3.17 lb)	(3.07 lb)	(2.97 lb)
Water content, %	(0.987)	(0.971)	(0.978)	(0.983)

field wt (lb)
lab wt (g)
lab wt (lb)
lab/field ratio

Field Data Laboratory sample weights measured due to high winds on site 13 April

Test No.	5	6	7	8
Unit wt. of sand (pcf)	96.0			
Wt. of jug + cone before use (lb)	13.25	13.44	13.39	14.32
Wt. of jug + cone after use (lb)	6.72	7.24	7.62	8.22
Wt. of sand used (hole + cone) (lb)	6.53	6.20	6.27	6.10
Wt. of sand in cone (lb)	3.76			
Wt. of sand in hole (lb)	2.77	2.44	2.51	2.34
Volume of hole (ft ³)	0.0289	0.0254	0.0261	0.0244
Wt. of soil (wet) (lb)	3.90	3.18	3.12	3.00

Test Results 3.85 3.15 3.05 2.95
lab lab lab lab

Test No.	5	6	7	8
Wet Density (pcf)	135.2 133.2	125.1 124.0	119.3 116.9	123.1 120.1
Dry Density (pcf)	113.2 111.6	103.6 102.7	102.7 100.6	105.8 104.0
Moisture Content (%)	19.4	20.5	16.2	16.3

Notes: (high density)
Maximum dry density (pcf) 107 104 107 107
Optimum water content (%) 18 20 18 18
Compaction (%) 105.8 | 104.3 99.6 | 93.7 96.0 | 94.0 101.8 | 97.2

PASS / FAIL

P

P

F

P

File: SAND-C.DWG



SHEPHERD MILLER
INCORPORATED

Project: HIGHLAND 100548-2
Area: TAILINGS BASIN FILL AREA
Tested By: CLS
Date: 16 APR 01

SAND CONE TEST FORM

PAGE 1 of 3

Visual Description of Soil: tan sandy, clayey, SILT w dk gray & brown gravel pieces
Material Type: COVETZ * Sandstone material
Location of Sample: _____

Location of test

Laboratory Data from Field Test R+100, 16 * R+100, 15 * R+100, 14 * R+100, 13 *

Test No.	1	2	3	4
Moisture Can No.				
Wt. of can bag (lb)	0.02			
Wt. of can + wet soil (lb)	2.93	3.32	3.11	3.31
Wt. of can + dry soil (g)	1330.2	1513.6	1415.4	1509.8
Wt. of water (lb)	2.93	3.34	3.12	3.33
Water content, %	1.000	1.006	1.003	1.006

} field weight
} lab weight
lab/field ratio

bag weights checked in lab with field weights.

Field Data

Test No.	1	2	3	4
Unit wt. of sand (pcf)	36.0			
Wt. of jug + cone before use (lb)	14.37	13.07	13.37	11.84
Wt. of jug + cone after use (lb)	8.32	6.62	7.27	5.61
Wt. of sand used (hole + cone) (lb)	6.05	6.45	6.10	6.23
Wt. of sand in cone (lb)	3.76			
Wt. of sand in hole (lb)	2.29	2.69	2.34	2.47
Volume of hole (ft ³)	0.0239	0.0230	0.0244	0.0257
Wt. of soil (wet) (lb)	2.91	3.30	3.09	3.29

13.46

Test Results

Test No.	1	2	3	4
Wet Density (pcf)	122.0	117.8	126.3	127.9
Dry Density (pcf)	106.7	106.8	108.8	114.5
Moisture Content (%)	~ 14.3	~ 10.3	~ 16.5	~ 11.7

(12.7)

(dry)

(12.8)
(dry)

Notes:

Maximum dry density (pcf)	111	111	111	117
Optimum water content (%)	16	16	16	13
Compaction (%)	96.1	96.2	98.0	97.9

PASS/FAIL

P

P

P

P File: SAND-C.DWG

SAND CONE TEST FORM

PAGE 2 of 3

Visual Description of Soil: AS ABOVE
Material Type: _____
Location of Sample: _____

Location of test Q+100, 12 Q+100, 12+100 S, 13+100 S, 14+100
Laboratory Data from Field Test

Test No.	5	6	7	8
Moisture Can No.				
Wt. of can (lb)	0.02			
Wt. of can + wet soil (lb)	3.42	3.34	3.82	2.97
Wt. of can + wet dry soil (g)	1554.9	1517.0	1729.3	1338.1
Wt. of water (lb)	3.43	3.34	3.81	2.95
Water content, %	1.003	1.000	0.997	0.993

field
lab
lab
lab/field

Field Data

Test No.	5	6	7	8
Unit wt. of sand (pcf)	96.0			
Wt. of jug + cone before use (lb)	12.46	12.17	12.67	13.30
Wt. of jug + cone after use (lb)	5.70	5.78	5.96	7.21
Wt. of sand used (hole + cone) (lb)	6.56	6.39	6.71	6.09
Wt. of sand in cone (lb)	3.76			
Wt. of sand in hole (lb)	2.80	2.63	2.95	2.33
Volume of hole (ft ³)	0.0212	0.0274	0.0307	0.0243
Wt. of soil (wet) (lb)	3.40	3.32	3.80	2.95

14.56

Test Results

Test No.	5	6	7	8
Wet Density (pcf)	116.6	121.2	123.7	121.5
Dry Density (pcf)	103.1	106.4	106.3	104.1
Moisture Content (%)	~ 13.0	~ 13.9	~ 16.4	~ 16.7

Notes:

Retest of
penetrated area

Retest of
penetrated area

Maximum dry density (pcf) 107 107 107 107
Optimum water content (%) 18 18 18 18
Compaction (%) (dry) (dry)
96.4 99.4 99.3 97.3

PASS/FAIL

P

P

P



SHEPHERD MILLER
INCORPORATED

Project: HIGHLAND 100548-2
Area: TAILINGS BASIN FILL AREA
Tested By: CLS
Date: 6 APR 01

SAND CONE TEST FORM

PAGE 3 of 3

Visual Description of Soil: AS ABOVE
Material Type: _____
Location of Sample: _____

Location of test S, 15 S, 15 S, 15 + 100 S + 100, 15 + 100
Laboratory Data from Field Test

Test No.	9	10	11	12
Moisture Can No.				
Wt. of can (lb)	0.02			
Wt. of can + wet soil (lb)	2.83	2.54	2.67	3.13
Wt. of can + wet soil (g)	1284.1	1164.2	1214.3	1417.7
Wt. of water (lb)	2.83	2.57	2.68	3.13
Water content, %	1.000	1.010	1.003	1.000

field
lab
lab
lab

Field Data

Test No.	9	10	11	12
Unit wt. of sand (pcf)	96.0			
Wt. of jug + cone before use (lb)	14.56	13.53	12.86	11.99
Wt. of jug + cone after use (lb)	8.37	7.61	6.80	5.69
Wt. of sand used (hole + cone) (lb)	6.19	5.92	6.06	6.30
Wt. of sand in cone (lb)	3.76			
Wt. of sand in hole (lb)	2.43	2.16	2.30	2.54
Volume of hole (ft ³)	0.0253	0.0225	0.0240	0.0265
Wt. of soil (wet) (lb)	2.81	2.52	2.65	3.11

Test Results

Test No.	9	10	11	12
Wet Density (pcf)	111.0	112.0	110.6	117.5
Dry Density (pcf)	97.8	101.3	93.4	104.5
Moisture Content (%)	~ 13.5	~ 10.6	~ 18.4	~ 12.4

Notes:

Maximum dry density (pcf) 107 107 107 107
Optimum water content (%) 13 13 13 13
Compaction (%) 91.4 94.6 87.3 97.7

PASS/FAIL

F

F

F

P

File: SAND-C.DWG



SHEPHERD MILLER
INCORPORATED

Project: HIGHLAND 100548-2
Area: THINGS BASIN FILL AREA
Tested By: OLS
Date: 17 APR 01

SAND CONE TEST FORM

PAGE 1 of 3

Visual Description of Soil: grayish brown clayey SILT with gravel-sized pieces
Material Type: RANDOM FILL
Location of Sample: _____

Location of test P 12+150 0+100, 0, 12+150 N+100,
Laboratory Data from Field Test 12+150 12+250

Test No.	1	2	3	4
Moisture Can No.				
Wt. of dry bag (lb)	0.02			
Wt. of can + wet soil (lb)	2.72	2.80	2.57	2.93
Wt. of can + wet dry soil (g)	1234.7	1263.1	1177.0	1333.4
Wt. of water (lb)	2.72	2.80	2.59	2.95
Water content, %	1.000	1.000	1.008	1.007

field
lab
lab
lab/field

Field sample weights checked in lab.

Field Data

Test No.	1	2	3	4
Unit wt. of sand (pcf)	96.0			
Wt. of jug + cone before use (lb)	12.22	12.42	12.44	12.83
Wt. of jug + cone after use (lb)	6.29	7.50	6.69	6.70
Wt. of sand used (hole + cone) (lb)	5.93	5.92	5.75	6.13
Wt. of sand in cone (lb)	3.76			
Wt. of sand in hole (lb)	2.17	2.16	1.99	2.37
Volume of hole (ft ³)	0.0226	0.0225	0.0207	0.0247
Wt. of soil (wet) (lb)	2.70	2.78	2.55	2.91

12.84

Test Results

Test No.	1	2	3	4
Wet Density (pcf)	119.4	123.6	123.0	117.3
Dry Density (pcf)	100.3	106.1	106.0	97.7
Moisture Content (%)	~ 19.0	~ 16.5	~ 16.0	~ 20.7

Notes:

Maximum dry density (pcf) 105 111 111 102
Optimum water content (%) 19 16 16 21
Compaction (%) 95.5 95.6 95.5 95.8

PASS/FAIL

P

P

P

P

File: SAND-C.DWG

SAND CONE TEST FORM

PAGE 3 OF 3

Visual Description of Soil: AS ABOVE
Material Type: COVER
Location of Sample: * Sandier material

Location of test Q 11
Laboratory Data from Field Test S, 15+100 S, 15 S, 15+100

Test No.	9	10	11	12
Moisture Can No.				
Wt. of can <u>baa</u> (u)	0.02			
Wt. of can + wet soil (lb)	3.03	2.75	3.77	2.22
Wt. of can + wet <u>dry</u> soil (g)	1334.1	1250.0	1715.6	1015.8
Wt. of water (lb)	3.05	2.76	3.75	2.24
Water content, %	1.007	1.002	1.003	1.009

field
lab
lab
lab/field

Field Data

Test No.	9	10	11	12
Unit wt. of sand (pcf)	36.0			
Wt. of jug + cone before use (lb)	12.60	13.46	12.87	10.68
Wt. of jug + cone after use (lb)	6.58	7.44	6.11	5.23
Wt. of sand used (hole + cone) (lb)	6.02	6.02	6.76	5.45
Wt. of sand in cone (lb)	3.76			
Wt. of sand in hole (lb)	2.26	2.26	3.00	1.69
Volume of hole (ft ³)	0.0235	0.0235	0.0313	0.0176
Wt. of soil (wet) (lb)	3.01	2.73	3.75	2.20

Test Results

Test No.	9	10	11	12
Wet Density (pcf)	127.9	115.76	120.0	125.0
Dry Density (pcf)	109.7	100.2	100.5	106.5
Moisture Content (%)	~ 17.1	~ 15.7	~ 19.4 (17.5)	~ 17.4

Notes:

Maximum dry density (pcf) 111 Retest of test on 16 Apr 107 Retest of test on 16 Apr 105 Retest of 10 107
Optimum water content (%) 16 18 19 18
Compaction (%) 98.3 93.6 95.7 99.5

PASS/FAIL

P

F

P

P File: SAND-C.DWG

SAND CONE TEST FORM

PAGE 2 of 3

Visual Description of Soil: _____

Material Type: COVER

Location of Sample: _____

Location of test S+100, 15
Laboratory Data from Field Test

Test No.	5	6	7	8
Moisture Can No.				
Wt. of can bag (lb)	0.02			
Wt. of can + wet soil (lb)	2.42	2.84	2.76	3.05
Wt. of can + dry wet soil (g)	1093.6	1283.0	1248.6	1388.4
Wt. of water (lb)	2.41	2.83	2.75	3.06
Water content, %	0.996	0.996	0.997	1.004

field
lab
lab
lab/field

Field Data

Test No.	5	6	7	8
Unit wt. of sand (pcf)	96.0			
Wt. of jug + cone before use (lb)	12.94	11.94	13.74	12.72
Wt. of jug + cone after use (lb)	7.19	5.31	7.71	6.71
Wt. of sand used (hole + cone) (lb)	5.65	6.03	6.03	6.01
Wt. of sand in cone (lb)	3.76			
Wt. of sand in hole (lb)	1.89	2.27	2.27	2.25
Volume of hole (ft ³)	0.0197	0.0236	0.0236	0.0234
Wt. of soil (wet) (lb)	2.40	2.82	2.74	3.03

Test Results

Test No.	5	6	7	8
Wet Density (pcf)	121.9	119.3	115.9	129.3
Dry Density (pcf)	103.0	97.1	95.9	106.9
Moisture Content (%)	~ 18.3 (16.7)	~ 22.9	~ 20.9 (20.1)	~ 20.9

Notes:

Maximum dry density (pcf)	107	100	104	104
Optimum water content (%)	18	22	20	20
Compaction (%)	96.3	97.1	92.2	102.8

PASS/FAIL

P

P

F

P File: SAND-C.DWG



SHEPHERD MILLER
INCORPORATED

Project: HIGHLAND 100548-2
Area: TAILINGS BASIN FILL AREA
Tested By: CLS
Date: 19 APR 01

SAND CONE TEST FORM

PAGE 1 of 3

Visual Description of Soil: grayish brown silty CLAY w dk gray and gray GRAVEL pieces
Material Type: cover, final lift
Location of Sample: _____

Location of test

Laboratory Data from Field Test

Test No.	1	2	3	4
Moisture Can No. Bag				
Wt. of can bag (lb)	0.02			
Wt. of can + wet soil (lb)	2.77	1.97	2.83	2.54
Wt. of can + dry wet soil (lb)	1256.6	901.8	1284.4	1160.9
Wt. of water (lb)	2.77	1.99	2.83	2.56
Water content, %				

Field Data

Test No.	1	2	3	4
Unit wt. of sand (pcf)	96.0			
Wt. of jug + cone before use (lb)	14.26	13.27	12.35	13.04
Wt. of jug + cone after use (lb)	8.13	7.91	6.31	7.13
Wt. of sand used (hole + cone) (lb)	6.13	5.36	6.04	5.91
Wt. of sand in cone (lb)	3.76			
Wt. of sand in hole (lb)	2.37	1.60	2.28	2.15
Volume of hole (ft ³)	0.0247	0.0167	0.0238	0.0224
Wt. of soil (wet) (lb)	2.75	1.95	2.81	2.52

Rest of 1

Test Results

Test No.	1	2	3	4
Wet Density (pcf)	111.4	117.0	118.3	112.5
Dry Density (pcf)	93.9	103.6	100.5	97.5
Moisture Content (%)	~ 18.6	~ 12.9	~ 17.7	~ 15.4

(15.8)

(dry)

(dry)

Notes:

Maximum dry density (pcf) 104 107 105 105
Optimum water content (%) 20 18 19 19
Compaction (%) 90.3 96.8 95.7 92.9

PASS/FAIL

F

P

P

F

File: SAND-C.DWG



SHEPHERD MILLER
INCORPORATED

Project: HIGHLAND 100548-2
Area: TAILINGS BASIN FILL AREA
Tested By: CLS
Date: 19 APR 01

SAND CONE TEST FORM

PAGE 2 of 3

Visual Description of Soil: AS ABOVE

Material Type: COVER, final lift

Location of Sample: _____

Location of test

Laboratory Data from Field Test

Test No.	5	6	7	8
Moisture Can No.				
Wt. of can bag (lb)	0.02			
Wt. of can + wet soil (lb)	3.10	3.03	2.96	2.62
Wt. of can + wet dry soil (g)	1412.6	1378.8	1353.8	1187.3
Wt. of water " (lb)	3.11	3.04	2.98	2.62
Water content, %				

field
lab
lab

Field Data

Test No.	5	6	7	8
Unit wt. of sand (pcf)	96.0			
Wt. of jug + cone before use (lb)	12.11	12.83	13.21	12.09
Wt. of jug + cone after use (lb)	5.85	6.71	7.06	6.42
Wt. of sand used (hole + cone) (lb)	6.26	6.17	6.15	5.67
Wt. of sand in cone (lb)	3.76			
Wt. of sand in hole (lb)	2.50	2.41	2.39	1.91
Volume of hole (ft ³)	0.0260	0.0251	0.0249	0.0199
Wt. of soil (wet) (lb)	3.03	3.01	2.94	2.60

12.47

Test Results

Test No.	5	6	7	8
Wet Density (pcf)	113.3	117.9	118.1	130.7
Dry Density (pcf)	101.3	102.0	102.2	115.0
Moisture Content (%)	~ 16.8	~ 17.6	~ 15.5	~ 13.6 (11.7)

Notes:

Maximum dry density (pcf)	105	107	107	117
Optimum water content (%)	19	18	18	13
Compaction (%)	96.5	95.3	95.5	98.3

PASS / FAIL

P

P

P

P File: SAND-C.DWG



SHEPHERD MILLER
INCORPORATED

Project: HIGHLAND 100548-2
Area: TAILINGS BASIN FILL AREA
Tested By: CLS
Date: 19 APR 201

SAND CONE TEST FORM

PAGE 3 OF 3

Visual Description of Soil: AS ABOVE

Material Type: COVER, final lift

Location of Sample: _____

Location of test

S+100, 15+100

S+100, 15

S+100, 15+100

S 12

Laboratory Data from Field Test

Test No.	9	10	11	12
Moisture Can No.				
Wt. of can bag (lb)	0.02	0.02	0.02	0.02
Wt. of can + wet soil (lb)	3.21	2.60	2.47	2.68
Wt. of can + ^{wet} dry soil (g)	1476.0	1184.8	1133.7	1219.4
Wt. of water " (lb)	3.25	2.61	2.50	2.69
Water content, %				

Field Data

Test No.	9	10	11	12
Unit wt. of sand (pcf)	96.0			
Wt. of jug + cone before use (lb)	12.47	12.29	12.16	12.33
Wt. of jug + cone after use (lb)	6.03	6.59	6.48	6.41
Wt. of sand used (hole + cone) (lb)	6.44	5.70	5.68	5.97
Wt. of sand in cone (lb)	3.76			
Wt. of sand in hole (lb)	2.68	1.94	1.92	2.21
Volume of hole (ft ³)	0.0279	0.0202	0.0200	0.0230
Wt. of soil (wet) (lb)	3.19	2.59	2.45	2.66

Test Results

Check of test 9

Test No.	9	10	11	12
Wet Density (pcf)	114.3	127.7	122.5	115.5
Dry Density (pcf)	98.8	111.3	107.9	100.4
Moisture Content (%)	~ 15.7	~ 14.7	~ 13.5	~ 15.1

Notes:

Maximum dry density (pcf)	111	111	111	105
Optimum water content (%)	16	16	16	19
Compaction (%)	35.0	100.3	97.2	95.6

PASS/FAIL

P

P

P File: SAND-C.DWG

SAND CONE TEST FORM

PAGE 1 of 3

Visual Description of Soil: grayish brown clayey SILT to Silty CLAY w dk gray & green
Material Type: COVER, final lift gravel-sized pieces
Location of Sample: _____

Location of test R+100, 10+100
Laboratory Data from Field Test

Test No.	1	2	3	4
Moisture Can No.				
Wt. of can lb (lb)	0.02			
Wt. of can + wet soil (lb)	1.94	2.11	1.97	1.83
Wt. of can + wet soil (g)	877.5	963.6	895.4	852.5
Wt. of water (lb)	1.93	2.12	1.97	1.83
Water content, %				

field
lab

Field Data

Test No.				
Unit wt. of sand (pcf)	96.0			
Wt. of jug + cone before use (lb)	14.24	13.46	12.77	11.92
Wt. of jug + cone after use (lb)	9.00	8.06	7.43	6.75
Wt. of sand used (hole + cone) (lb)	5.24	5.40	5.29	5.17
Wt. of sand in cone (lb)	3.76			
Wt. of sand in hole (lb)	1.48	1.64	1.53	1.41
Volume of hole (ft ³)	0.0154	0.0171	0.0159	0.0147
Wt. of soil (wet) (lb)	1.92	2.09	1.95	1.86

12.92

Test Results

Test No.	1	2	3	4
Wet Density (pcf)	124.5	122.3	122.4	126.6
Dry Density (pcf)	104.6	103.9	104.8	110.5
Moisture Content (%)	~ 19.1	~ 17.7	~ 16.7	~ 14.6

(12.8)

Notes:

Maximum dry density (pcf) 105 105 107 111
Optimum water content (%) 19 19 18 16
Compaction (%) 99.6 98.9 97.9 99.6

PASS/FAIL

P

P

P

P File: SAND-C.DWG



SHEPHERD MILLER
INCORPORATED

Project: HIGHLAND 100548-2
Area: TAILINGS BASIN FILL AREA
Tested By: CLS
Date: 20APR01

SAND CONE TEST FORM

PAGE 2 of 3

Visual Description of Soil: AS ABOVE

Material Type: COVER, final lift

Location of Sample: _____

Location of test

Laboratory Data from Field Test

R+100, 15

R, 10

R, 11

Test No.	5	6	7	8
Moisture Can No.				
Wt. of can bag (lb)	0.02			
Wt. of can + wet soil (lb)	2.13	1.87	1.81	1.93
Wt. of can + wet soil (g)	969.0	856.4	829.2	878.2
Wt. of water " (lb)	2.14	1.89	1.83	1.94
Water content, %				

field
lab

Field Data

Test No.				
Unit wt. of sand (pcf)	96.0			
Wt. of jug + cone before use (lb)	12.92	11.95	10.95	12.51
Wt. of jug + cone after use (lb)	7.39	6.76	5.87	7.25
Wt. of sand used (hole + cone) (lb)	5.53	5.19	5.08	5.26
Wt. of sand in cone (lb)	3.76			
Wt. of sand in hole (lb)	1.77	1.43	1.32	1.50
Volume of hole (ft ³)	0.0184	0.0149	0.0133	0.0156
Wt. of soil (wet) (lb)	2.11	1.85	1.79	1.91

11.67

check of 5

Test Results

Test No.	5	6	7	8
Wet Density (pcf)	114.4	124.2	130.2	122.2
Dry Density (pcf)	99.5	107.2	109.5	104.3
Moisture Content (%)	~ 15.0	~ 15.9	~ 18.9	~ 17.2

(15.0)

Notes:

Maximum dry density (pcf) 111 111 107 107
Optimum water content (%) 16 16 18 18
Compaction (%) 89.6 96.6 102.3 97.5

PASS/FAIL

F

P

P

P

File: SAND-C.DWG

SAND CONE TEST FORM

PAGE 3 OF 3

Visual Description of Soil: AS ABOVE
Material Type: COVER final lift
Location of Sample: _____

Location of test

Laboratory Data from Field Test R, 12 R, 12+100 R, 13+100 R, 15

Test No.	9	10	11	12
Moisture Can No.				
Wt. of can bag (lb)	0.02	0.02	0.02	0.02
Wt. of can + wet soil (lb)	2.17	1.83	1.86	2.94
Wt. of can + dry wet soil (g)	993.5	827.0	842.5	1344.7
Wt. of water (lb)	2.19	1.82	1.86	2.96
Water content, %				

field
lab

Field Data

Test No.				
Unit wt. of sand (pcf)	98.0			
Wt. of jug + cone before use (lb)	11.67	11.79	11.59	9.58
Wt. of jug + cone after use (lb)	6.14	6.61	6.44	3.80
Wt. of sand used (hole + cone) (lb)	5.53	5.18	5.15	6.08
Wt. of sand in cone (lb)	3.76			
Wt. of sand in hole (lb)	1.77	1.42	1.39	2.32
Volume of hole (ft ³)	0.0184	0.0148	0.0145	0.0242
Wt. of soil (Wet) (lb)	2.15	1.81	1.84	2.92

Test Results

Sandier material check of 9

Test No.	9	10	11	12
Wet Density (pcf)	116.6	122.4	127.0	120.8
Dry Density (pcf)	102.4	104.8	108.8	102.3
Moisture Content (%)	~ 13.9	~ 16.8	~ 16.7	~ 18.1

(dry)

(16.5)

Notes:

Maximum dry density (pcf)	107	107	111	107
Optimum water content (%)	18	18	16	18
Compaction (%)	95.7	97.9	98.0	95.6

PASS/FAIL

P

P

P

P File: SAND-C.DWG

SAND CONE TEST FORM

PAGE 1 OF 1

Visual Description of Soil: _____
Material Type: CONGR BORROW MATERIAL
Location of Sample: BORROW AREA

Location of test

Laboratory Data from Field Test

Test No.	1	2	1	2
Moisture Can No.			A1	A2
Wt. of can bag (lb)	0.02	0.02	11.05 g	11.01 g can
Wt. of can + wet soil (lb)	5.18	4.27	57.21 g	64.01 g wet field
Wt. of can + wet dry soil (g)	2342.3	1933.6	49.07 g	54.92 g dry lab
Wt. of water " (lb)			8.14 g	9.09 g water "
Water content %			38.02 g	43.91 g dry soil
			21.4	20.7 % mc

Field Data

Test No.	1	2		
Unit wt. of sand (pcf)	96.0	96.0		
Wt. of jug + cone before use (lb)	13.13	12.25		
Wt. of jug + cone after use (lb)	5.31	5.31		
Wt. of sand used (hole + cone) (lb)	7.82	6.94		
Wt. of sand in cone (lb)	3.76	3.76		
Wt. of sand in hole (lb)	4.06	3.18		
Volume of hole (ft ³)	0.0423	0.0331		
Wt. of soil (wet) (lb)	5.16	4.25		

Test Results

Test No.	1	2		
Wet Density (pcf)	122.0	128.3		
Dry Density (pcf)	100.5	106.3		
Moisture Content (%)	21.4	20.7		

Notes:

Maximum dry density (pcf)

Optimum water content (%)

Compaction (%)

rock in sand
cone sample

PASS / FAIL

SAND CONE TEST FORM

PAGE 1 of 3

Visual Description of Soil: _____
Material Type: COVER
Location of Sample: _____

Location of test

Laboratory Data from Field Test

Test No.	#1 P+130 1400 (2.1)	#2 P+130 12+4-0	#3 P+140 11+00	#4 P+125 10+80
Moisture Can No.	A-11	A-10	B-10	A-7
Wt. of bag (lb)	0.02	0.02	0.02	0.02
Wt. of can + wet soil (lb)	4.52	4.95	5.03	5.36
Wt. of can + wet soil (g)	43.75	54.69	40.37	55.91
Wt. of water + dry (g)	38.63	48.08	36.19	48.86
Water content Nt of Can (g)	11.04	11.02	11.16	11.07

Field
lab
"

Field Data

Test No.				
Unit wt. of sand (pcf)	96	96	96	96
Wt. of jug + cone before use (lb)	14.64	13.53	12.38	15.08
Wt. of jug + cone after use (lb)	6.33	6.14	4.83	7.21
Wt. of sand used (hole + cone) (lb)	8.31	7.39	7.75	7.87
Wt. of sand in cone (lb)	3.76	3.76	3.76	3.76
Wt. of sand in hole (lb)	4.55	3.63	3.99	4.11
Volume of hole (ft ³)	0.0474	0.0378	0.416	0.0428
Wt. of soil (Wet) (lb)	4.50	4.93	5.01	5.34

Test Results

Test No.	#1	#2	#3	#4
Wet Density (pcf)	94.94	130.4	120.4	124.77
Dry Density (pcf)	80.08	110.66	103.17	105.15
Moisture Content (%)	18.56	17.84 (15.6)	16.70 (16.3)	18.66

lab

Notes:

Maximum dry density (pcf) 104

Optimum water content (%) 20

Compaction (%) 91

Bad Test ??

very tight
well compacted
maybe dry.

107

18

103.5

Apparent tight
but soft
+ some
same clay
stone frag.

107

18

96.4

- Multiple
clay stone
Fragments
- well compacted
- no voids

107/18

93.3

PASS/FAIL

F

P

P

P File: SAND-C.DWG

SAND CONE TEST FORM

PAGE 2 of 3

Visual Description of Soil: _____
Material Type: COVER
Location of Sample: _____

Location of test

Laboratory Data from Field Test @ grade @ grade @ grade @ grade

Test No.	#5 ⁹⁺¹⁰⁰ 9+15	#6 ⁹⁺¹⁰ 10+85	#7 ⁹⁺¹⁵ 11+020	#8 ⁹⁺²⁰ 12+040
Moisture Can No.	B-9	A-3	A-12	B-7
Wt. of can bag (lb)	0.02	0.02	0.02	0.02
Wt. of can + wet soil (lb)	5.46	5.45	5.04	5.00
Wt. of can + wet soil (g)	56.09	51.34	48.20	51.18
Wt. of water can + dry (lb)	48.72	44.78	42.16	45.08
Wt. of water can + dry (g)	11.10	10.93	11.05	11.12

field
lab
"

Wt of water (g)

Field Data

Test No.	#1			
Unit wt. of sand (pcf)	96			
Wt. of jug + cone before use (lb)	14.04	12.70	14.23	13.48
Wt. of jug + cone after use (lb)	6.21	4.83	6.70	5.91
Wt. of sand used (hole + cone) (lb)	7.83	7.87	7.58	7.57
Wt. of sand in cone (lb)	3.76	3.76	3.76	3.76
Wt. of sand in hole (lb)	4.07	4.11	3.82	3.81
Volume of hole (ft ³)	0.0424	0.0428	0.0398	0.0397
Wt. of soil (wet) (lb)	5.44	5.43	5.02	4.98

Test Results

Test No.	#5	#6	#7	#8
Wet Density (pcf)	128.31	126.83	126.16	125.48
Dry Density (pcf)	107.29	106.24	105.65	106.38
Moisture Content (%)	19.59	19.38	19.41	17.96

Notes:

Maximum dry density (pcf) 107 → Firm - very hard to excav.
Optimum water content (%) 18 → Soft on surface - Rts in area.
Compaction (%) 100.3 Bottom 1/2 hole v. Firm wettest sample 99.3 98.7
Some as #6 drier
Soft upper portion - softer than #7 dense lower part of hole moisture between sample 6 + 7 99.4

PASS/FAIL

P

P

P

P

File: SAND-C.DWG

SAND CONE TEST FORM

PAGE 3 of 3

Visual Description of Soil: _____
Material Type: COVER
Location of Sample: _____

Location of test

Laboratory Data from Field Test @ grade @ grade

Test No.	#9 ^{Q+20} 13+105	#10 ^{Q+10} 14+100	^{Q+5 Q+50} 14+100 to 16+00 @ grade
Moisture Can No.	B-11	B-8	
Wt. of can jug (lb)	0.02	0.02	This area in traffic pattern - not tested
Wt. of can + wet soil (lb)	4.02	4.40	
Wt. of can + ^{wet} dry soil (g)	46.08	51.23	
Wt. of water Wt. Can + dry soil (g)	40.77	45.25	
Wt. of water Wt. of Can (g)	11.09	11.10	
Wt. of water (g)			

Field
lab

Field Data

Test No.			
Unit wt. of sand (pcf)	96	96	
Wt. of jug + cone before use (lb)	11.11	14.01	
Wt. of jug + cone after use (lb)	4.25	6.88	
Wt. of sand used (hole + cone) (lb)	6.86	7.13	
Wt. of sand in cone (lb)	3.76	3.76	
Wt. of sand in hole (lb)	3.10	3.37	
Volume of hole (ft ³)	0.323	0.0351	
Wt. of soil (wet) (lb)	4.00	4.38	

Test Results

Test No.	#9	#10	
Wet Density (pcf)	123.87	124.77	
Dry Density (pcf)	105.07	106.18	
Moisture Content (%)	17.89	17.51	

Notes:

Maximum dry density (pcf) ^{Very Dense w/ Rk fragments} drier material
Optimum water content (%) 107
Compaction (%) 98.2

Maximum dry density (pcf) ^{Very Dense w/ Rk fragments} dry as #9
Optimum water content (%) 18
Compaction (%) 99.2

PASS/FAIL

P

P

SAND CONE TEST FORM

PAGE 1 of 4

Visual Description of Soil: _____
Material Type: COVER
Location of Sample: _____

Location of test P+130, 14
Laboratory Data from Field Test - "C" @ grade @ grade @ grade @ grade

Test No.	#1 / Retest 5.11.01 #1	#2 P+115 13+015	#3 P+145 14+000	#4 P+180 13+000
Moisture Can No.	78	A9	A1	A2
Wt. of can bag (lb)	0.02	0.02	0.02	0.02
Wt. of can + wet soil (lb)	5.89	4.34	4.51	5.48
Wt. of can + wet soil (g)	27.34	48.02	46.40	47.79
Wt. of water can + dry (g)	23.26	42.42	40.77	41.83
Water content Wt. of Can (g)	1.30	11.17	11.04	11.00
Moisture (%)	4.08	5.60	5.63	5.96

Field
Tag
"

Field Data

Test No.	#1	#2	#3	#4
Unit wt. of sand (pcf)	96	96	96	
Wt. of jug + cone before use (lb)	15.17	12.88	11.44	10.03
Wt. of jug + cone after use (lb)	6.77	5.87	4.38	2.23
Wt. of sand used (hole + cone) (lb)	8.38	7.11	7.06	7.80
Wt. of sand in cone (lb)	3.76	3.76	3.76	3.76
Wt. of sand in hole (lb)	4.62	3.35	3.30	4.04
Volume of hole (#3)	0.0481	0.0349	0.0344	0.0421
Wt. of soil (wet) (lb)	5.87	4.32	4.49	5.46

Test Results

Test No.	#1 (Retest)	#2	#3	#4
Wet Density (pcf)	121.97	123.80	130.61	129.74
Dry Density (pcf)	102.86	104.99	109.81	108.72
Moisture Content (%)	18.58	17.32	18.94	19.33

Notes:

Maximum dry density (pcf) 107 → *very hard w/ Rk fragments*
Optimum water content (%) 18 → *Top surface wet from weather top 1" softer than rest of hole (sur face rebound?)*
Compaction (%) 96.1 *Very Dense w/ consist. moisture - Not "wet" @ surface*
Bottom of hole softer than upper - less Rk fragments slight increase in moisture?

PASS/FAIL

MDD, OWC

P

107, 18

P

107, 18

P

107, 18

P

107, 18

File: SAND-C.DWG



SHEPHERD MILLER
INCORPORATED

Project: HIGHLAND 100548-2
Area: TAILINGS BASIN FILL AREA
Tested By: _____
Date: _____

SAND CONE TEST FORM

PAGE 2 of 4

Visual Description of Soil: _____

Material Type: _____

Location of Sample: _____

Location of test

Laboratory Data from Field Test @ grade @ grade @ grade ± 3.8 below grade top of Random F. 11??

Test No.	#5 $P=160$ 11+195	#6 $P=160$ 10+170	#7 $P=175$ 9+095	#8 $P=175$ 11+170
Moisture Can No.	A8	B5	B1	B-2
Wt. of can jug (lb)	5.02	0.02	0.02	0.02
Wt. of can + wet soil (lb)	4.54	4.70	5.18	4.24
Wt. of can + wet soil (g)	38.28	48.65	42.58	59.24
Wt. of water can + dry (lb)	33.52	42.43	37.94	52.37
Water content Wt of Can (g)	11.15	11.08	11.16	11.16
Moisture (%)	4.76	6.22	4.64	6.87

Field Data

Test No.	#5	#6	#7	#8
Unit wt. of sand (pcf)	96	96	96	96
Wt. of jug + cone before use (lb)	15.43	14.30	13.42	12.23
Wt. of jug + cone after use (lb)	8.20	7.07	5.73	4.26
Wt. of sand used (hole + cone) (lb)	7.23	7.23	7.69	6.97
Wt. of sand in cone (lb)	3.76	3.76	3.76	3.76
Wt. of sand in hole (lb)	3.47	3.47	3.93	3.21
Volume of hole (ft ³)	0.0361	0.0361	0.0413	0.0334
Wt. of soil (Wet) (lb)	4.52	4.68	5.16	4.22

Test Results

Test No.	#5	#6	#7	#8
Wet Density (pcf)	125.05	129.64	125.07	126.06
Dry Density (pcf)	103.11	108.18	106.62	108.05
Moisture Content (%)	21.28	19.84	17.33	16.67

Notes:

Maximum dry density (pcf) ± 2 -soft
Optimum water content (%) hole dense.
Compaction (%) well compacted

upper 1/2"
Similar to
Rest of
hole

Material slightly drier
and denser
- RK frag (12")
in side
of hole

same @
#5

Drier
Mat'X ??
RK fragments
 ± 1 " in
soil matrix

PASS/FAIL
MOD, OWC

P
104,20

P
107,18

P
107,18

P
111,16

File: SAND-C.DWG

SAND CONE TEST FORM

PAGE 3 of 4

Visual Description of Soil: _____
Material Type: RANDOM
Location of Sample: FILL

Location of test

Laboratory Data from Field Test @ grade @ grade @ grade -6" below grade

Test No.	#9 <u>P+093</u> <u>9+197</u>	#10 <u>P+015</u> <u>11+000</u>	#11 <u>P+080</u> <u>12+005</u>	#12 <u>0+100</u> <u>12+145</u>
Moisture Can No.	B-6	B-12	A-6	B-3
Wt. of can bag (lb)	0.02	0.02	0.02	0.02
Wt. of can + wet soil (lb)	4.89	3.72	4.22	4.60
Wt. of can + <u>wet</u> soil (g)	43.25	57.64	54.45	43.08
Wt. of water can + dry (g)	37.98	50.26	47.37	38.16
Water content Wt of Can (g)	11.10	11.09	10.95	11.12
Moisture (%)	5.27	7.38	7.08	4.92

Field Data

Test No.	#9	#10	#11	#12
Unit wt. of sand (pcf)	96	96	96	96
Wt. of jug + cone before use (lb)	13.82	12.27	11.17	15.26
Wt. of jug + cone after use (lb)	6.29	5.71	4.12	7.96
Wt. of sand used (hole + cone) (lb)	7.51	6.56	7.05	7.30
Wt. of sand in cone (lb)	3.76	3.76	3.76	3.76
Wt. of sand in hole (lb)	3.75	2.80	3.29	3.54
Volume of hole (ft ³)	0.0391	0.0292	0.0343	0.0369
Wt. of soil (wet) (lb)	4.87	3.70	4.22	4.58

Test Results

Test No.	#9	#10	#11	#12
Wet Density (pcf)	124.67	126.86	123.14	124.20
Dry Density (pcf)	104.23	106.75	103.10	105.08
Moisture Content (%)	19.61	18.84	19.44	18.20

Notes:

Maximum dry density (pcf)

Optimum water content (%)

Compaction (%)

Dense w/
some RK
fragment.

Smaller Hole
V. stiff
drier
Hard to
excavate.

Top wet from
weather -
softer
Lower portion
of Hole
lighter

Softer w/
sandstone
RK (+2") in
side of hole

100.2

99.8

drier 99.1

98.2

PASS/FAIL
MDD, ONK

P
104, 20

P
107, 18

P
104, 20

P
107, 18

File: SAND-C.DWG

SAND CONE TEST FORM

PAGE 4 of 4

Visual Description of Soil: _____
Material Type: _____
Location of Sample: _____

Location of test

Laboratory Data from Field Test ^{-1 ft below grade} ^{-1' below grade} ^{-1 ft below grade}

Test No.	#13 ⁰⁺⁰³⁵ 12+145	#14 ⁰⁺⁵⁰⁰ 12+090	#15 ¹²⁺⁰⁷⁵ 0+100	
Moisture Can No.	B-4	A-4	A-5	
Wt. of can bag (lb)	0.02	0.02	0.02	
Wt. of can + wet soil (lb)	4.30	3.61	3.86	
Wt. of can + wet soil (g)	43.47	44.46	52.12	
Wt. of water can't dry (g)	38.23	39.29	45.75	
Water content Wt of Can (g)	11.11	11.15	10.90	
Moisture (%)	5.24	5.17	6.37	

Field Data

Test No.	#13	#14	#15	
Unit wt. of sand (pcf)	96	96	96	
Wt. of jug + cone before use (lb)	14.10	12.54	11.32	
Wt. of jug + cone after use (lb)	7.08	5.96	4.64	
Wt. of sand used (hole + cone) (lb)	7.02	6.58	6.68	
Wt. of sand in cone (lb)	3.76	3.76	3.76	
Wt. of sand in hole (lb)	3.26	2.82	2.92	
Volume of hole (ft ³)	0.0340	0.0294	0.0304	
Wt. of soil (wet) (lb)	4.28	3.59	3.84	

Test Results

Test No.	#13	#14	#15	
Wet Density (pcf)	126.04	122.22	126.25	
Dry Density (pcf)	105.63	102.66	106.74	
Moisture Content (%)	19.32	19.05	18.23	

Notes:

Maximum dry density (pcf)

Optimum water content (%)

Compaction (%)

Shallow
Hole - RK
in bottom

PASS / FAIL
MDD, OWC

98.7
P
107, 18

95.9
P
107, 18

99.8
P
107, 18

SAND CONE TEST FORM

PAGE 1 of 3

Visual Description of Soil: _____

Material Type: _____

Location of Sample: _____

Location of Test

Laboratory Data from Field Test ^{-1/4" hole} ^{table bag?} ^{on 15' diff?} @ grade @ grade @ grade

Test No.	#1 ⁰⁺¹⁵⁰ 11+015	#2 ^{N+170} 11+115	#3 ⁰⁺¹²⁰ 12+110	#4 ^{N+010} 12+185
Moisture Can No.				
Wt. of can bag (lb)	0.02	0.02	0.02	0.02
Wt. of can + wet soil (lb)	4.00	4.44	4.51	5.15
Wt. of can + wet soil (g)	B12 45.37g	A6 39.58g	A2 41.56g	B4 35.59g
Wt. of water " (lb)	B12 40.26g	A6 35.07g	A2 36.52g	B4 31.61g
Wt. of water Wt of can	11.09g	10.96g	11.00g	11.12g

field
lab
"

Field Data

Test No.				
Unit wt. of sand (pcf)	96	96	96	96
Wt. of jug + cone before use (lb)	15.56	14.55	12.95	11.44
Wt. of jug + cone after use (lb)	8.71	7.26	5.81	3.63
Wt. of sand used (hole + cone) (lb)	6.85	7.29	7.14	7.81
Wt. of sand in cone (lb)	3.76	3.74	3.76	3.76
Wt. of sand in hole (lb)	3.09	3.53	3.38	4.15
Volume of hole (ft ³)	0.0322	0.0368	0.0352	0.0432
Wt. of soil (wet) (lb)	3.98	4.42	4.49	5.13

Test Results

Test No.	#1	#2	#3	#4
Wet Density (pcf)	123.65	120.20	127.53	118.67
Dry Density (pcf)	105.0	101.3	106.5	100.2
Moisture Content (%)	17.7	18.7	19.7	18.4

Notes:

Maximum dry density (pcf)	Drier Mat'l "Blasty" excavation Dense Soil	2-2" RK frag. in sample Softer Excav. typical bottom moist	Similar to #2 - no rock frag - slightly more stiff	Similar Mat'l to #3 but softer and more moist.
Optimum water content (%)	Hand digging (DK GRAYMIL)			
Compaction (%)				(P)

PASS/FAIL	98.1 (P)	97.4 (P)	102.4 (P)	96.3
MOD, OMC	107, 18	104, 20	104, 20	104, 20

File: SAND-C.DWG

SAND CONE TEST FORM

PAGE 2 of 3

Visual Description of Soil: _____

Material Type: _____

Location of Sample: _____

Location of test @ grade Area Ripped - to be re-tested - see notes
Laboratory Data from Field Test @ grade @ grade @ grade @ grade

Test No.	#5 P+035 13+140	#6 P+035 14+070	#7 0+070 13+050	#8 P+175 13+050
Moisture Can No.				
Wt. of bag (lb)	0.02	0.02	0.02	0.02
Wt. of can + wet soil (lb)	4.65	3.57	4.96	4.65
Wt. of can + wet soil (g)	B2 34.79g	A8 40.25g	A5 42.21g	A4 38.55g
Wt. of water " (lb)	B2 30.78g	A8 36.10g	A5 37.50g	A4 34.41g
Water content % of can	11.17g	11.15g	10.90g	11.15g

Field
lab
"

Field Data

Test No.	#5	#6	#7	#8
Unit wt. of sand (pcf)	96	96	96	96
Wt. of jug + cone before use (lb)	15.06	13.75	12.95	12.03
Wt. of jug + cone after use (lb)	7.74	7.32	5.47	4.47
Wt. of sand used (hole + cone) (lb)	7.32	6.43	7.47	7.56
Wt. of sand in cone (lb)	3.76	3.76	3.76	3.76
Wt. of sand in hole (lb)	3.56	2.67	3.71	3.80
Volume of hole (ft ³)	0.0371	0.0278	0.0386	0.0396
Wt. of soil (wet) (lb)	4.63	3.55	4.94	4.63

Test Results

Test No.	#5	#6	#7	#8
Wet Density (pcf)	124.85	127.64	127.32	116.97
Dry Density (pcf)	103.7	109.4	108.6	99.3
Moisture Content (%)	20.4	16.6	17.7	17.8

Notes:

Maximum dry density (pcf) 103.7 Sample in Pumped area - Don't OK but bottom of hole wet and soft.
Optimum water content (%) 20.4
Compaction (%) 99.7

Hole very dense - stiff material drier than avg. bottom of hole slightly more moist.
- Moist
- Soft
- excavation

PASS/FAIL
MDD, ONK

P
104, 20

P 98.6
111, 16

101.6
107, 18

92.8
107, 18

F File: SAND-C.DWG

SAND CONE TEST FORM

PAGE 3 of 3

Visual Description of Soil: _____
Material Type: _____
Location of Sample: _____

Location of test

Laboratory Data from Field Test *made @ grade*

Test No.	#9 <i>N+025</i> 13+045	#10 <i>M+150</i> 13+010	#11 <i>P+030</i> 12+065	
Moisture Can No.				
Wt. of can bag (lb)	0.02	0.02	0.02	
Wt. of can + wet soil (lb)	5.01	4.80	4.14	
Wt. of can + dry ^{wet} soil (g)	B3 39.45g	A1 35.52g	A9 33.00g	
Wt. of water " (lb)	B3 35.31g	A1 31.99g	A9 29.16g	
Water content wt of can	11.12g	11.06g	11.17g	

field
lab
"

Field Data

Test No.	#9	#10	#11	
Unit wt. of sand (pcf)	96	96	96	
Wt. of jug + cone before use (lb)	11.21	15.85	14.54	
Wt. of jug + cone after use (lb)	3.64	8.40	7.42	
Wt. of sand used (hole + cone) (lb)	7.57	7.45	7.12	
Wt. of sand in cone (lb)	3.76	3.76	3.76	
Wt. of sand in hole (lb)	3.81	3.69	3.36	
Volume of hole (ft ³)	0.0397	0.0384	0.035	
Wt. of soil (wet) (lb)	4.99	4.78	4.12	

Test Results

Test No.	#9	#10	#11	
Wet Density (pcf)	125.73	124.36	117.71	
Dry Density (pcf)	107.4	106.4	99.7	
Moisture Content (%)	17.1	16.9	18.1	

Notes:

Maximum dry density (pcf)

Optimum water content (%)

Compaction (%)

Soft wet mat 1'

Same as #9 Bottom of hole @ 5' to 11' ground surface

Soft, wet Surface @ Base of compaction foot

100.4

99.4

95.9

PASS/FAIL
MOD, OMC

P
107, 18

P
107, 18

P
105, 19

SAND CONE TEST FORM

PAGE 1 of 4

Visual Description of Soil: _____
Material Type: COVER
Location of Sample: _____

Location of test

Laboratory Data from Field Test - 11 ft -14 B.G. @ grade -2.0 ft B.G.

Test No.	#1 <u>N+150</u> <u>11+075</u>	#2 <u>M+170</u> <u>11+085</u>	#3 <u>M+150</u> <u>11+165</u>	#4 <u>O+010</u> <u>10+170</u>
Moisture Can No.	B1	B2	B3	B4
Wt. of can bag (lb)	0.02	0.02	0.02	0.02
Wt. of can + wet soil (lb)	4.78	4.70	4.0	3.62
Wt. of can + wet dry soil (g)	47.79	41.51	44.51	48.15
Wt. of water dry (lb)	41.76	36.12	39.59	42.57
Water content Torrance (g)	11.16	11.16	11.12	11.11
Moisture (g)	6.03	5.39	4.92	5.58

field lab

Field Data

Test No.	#1	#2	#3	#4
Unit wt. of sand (pcf)	96	96	96	96
Wt. of jug + cone before use (lb)	12.90	11.72	14.68	13.74
Wt. of jug + cone after use (lb)	5.44	4.39	7.82	7.07
Wt. of sand used (hole + cone) (lb)	7.46	7.33	6.86	6.67
Wt. of sand in cone (lb)	3.76	3.76	3.76	3.76
Wt. of sand in hole (lb)	3.70	3.57	3.10	2.91
Volume of hole (ft ³)	0.0385	0.0372	0.0323	0.0303
Wt. of soil (wet) (lb)	4.76	4.68	3.98	3.60

Test Results

Test No.	#1	#2	#3	#4
Wet Density (pcf)	123.50	125.84	123.25	118.76
Dry Density (pcf)	103.17	103.49	105.09	100.87
Moisture Content (%)	19.71	21.59	17.28	17.74

Notes:

Maximum dry density (pcf)

Optimum water content (%)

Compaction (%)

stiff
- good moisture

softer
wetter
material

very stiff
avg. moist.
small
hole

#4 in work area
soil hard Break
smaller hole due
to time available.

PASS/FAIL
MDD, OMC

99.2
P
104, 20

99.5
P
104, 20

98.2
P
107, 13

97.0
P
105, 19

File: SAND-C.DWG

SAND CONE TEST FORM

PAGE 2 of 4

Visual Description of Soil: _____

Material Type: _____

Location of Sample: _____

Location of test

Laboratory Data from Field Test -24 -1ft B.G. @ grade -1ft B.G.				
Test No.	#5 0+110 10+160	#6 0+042 11+160	#7 0+115 11+165	#8 N+050 11+125
Moisture Can No.	B5	B6	B7	B8
Wt. of can bag (lb)	0.02	0.02	0.02	0.02
Wt. of can + wet soil (lb)	3.78	3.80	5.00	4.36
Wt. of can + wet soil (g)	45.37	48.04	45.11	47.84
Wt. of water dry (lb)	39.45	42.61	39.88	43.30
Wt. of water dry (g)	11.08	11.09	11.12	11.09
Moisture (g)	5.92	5.43	5.23	4.54

Field
lab
"

Field Data

Test No.	#5	#6	#7	#8
Unit wt. of sand (pcf)	96	96	96	96
Wt. of jug + cone before use (lb)	12.28	11.11	13.25	12.03
Wt. of jug + cone after use (lb)	5.53	4.42	5.66	4.95
Wt. of sand used (hole + cone) (lb)	6.75	6.69	7.59	7.08
Wt. of sand in cone (lb)	3.76	3.76	3.76	3.76
Wt. of sand in hole (lb)	2.99	2.93	3.83	3.32
Volume of hole (ft ³)	0.0311	0.0305	0.0399	0.0346
Wt. of soil (wet) (lb)	3.76	3.78	4.98	4.34

Test Results

Test No.	#5	#6	#7	#8
Wet Density (pcf)	120.72	123.85	124.83	123.49
Dry Density (pcf)	99.88	105.65	105.62	110.0
Moisture Content (%)	20.87	17.23	18.18	14.10

Notes: #5 - small hole - work area over lunch (time)

Very Stiff Hand Excav.

'Sandier material

Maximum dry density (pcf)

Optimum water content (%)

Compaction (%)

[DRY]

PASS/FAIL

MDD, OMC

96.0

P
104, 20

98.7

P
107, 18

98.7

P
107, 18

99.1

P File: SAND-C.DWG
111, 16

SAND CONE TEST FORM

PAGE 3 of 4

Visual Description of Soil: _____

Material Type: _____

Location of Sample: _____

Location of test

Laboratory Data from Field Test @ grade @ grade @ grade -1 ft Below GRADE

Test No.	#9 0+120 12+120	#10 N+150 12+065	#11 N+040 12+045	#12 M+140 12+065
Moisture Can No.	39	310	311	312
Wt. of can bag (lb)	0.02	0.02	0.02	0.02
Wt. of can + wet soil (lb)	4.06	3.62	4.29	4.89
Wt. of can + wet soil (g)	44.41	53.33	45.42	45.10
Wt. of water dry (lb)	39.09	48.49	40.50	40.16
Water content Moisture (g)	11.10	11.15	11.08	11.09
	3.32	4.84	4.92	4.94

field lab

Field Data

Test No.	#9	#10	#11	#12
Unit wt. of sand (pcf)	96	96	96	96
Wt. of jug + cone before use (lb)	14.76	13.94	12.89	11.96
Wt. of jug + cone after use (lb)	7.99	7.20	5.83	4.42
Wt. of sand used (hole + cone) (lb)	6.77	6.74	7.06	7.54
Wt. of sand in cone (lb)	3.76	3.76	3.76	3.76
Wt. of sand in hole (lb)	3.01	2.98	3.30	3.78
Volume of hole (#3)	0.0314	0.031	0.0344	0.0394
Wt. of soil (wet) (lb)	4.04	3.60	4.27	4.87

Test Results

Test No.	#9	#10	#11	#12
Wet Density (pcf)	128.85	115.97	124.22	123.68
Dry Density (pcf)	108.27	102.66	106.42	105.72
Moisture Content (%)	19.01	12.96	16.72	17.00

Notes:

Maximum dry density (pcf)

Optimum water content (%)

Compaction (%)

RK in sample
- Side of hole
(see notes)

V. St. Fl. Dry
RK in bottom of
hole

[Dry]

PASS/FAIL
MOD, OMC

101.2
P
107, 18

95.9
P
107, 18

91.5
P
107, 13

98.8
P
107, 18

File: SAND-C.DWG

SAND CONE TEST FORM

PAGE 4 of 4

Visual Description of Soil: _____

Material Type: _____

Location of Sample: _____

Location of test
Laboratory Data from Field Test @ grade

Test No.	#13 N+090 12+185	#14 0+85 10+120	#15 N+175 10+130	
Moisture Can No.	A1	A2	A3	
Wt. of can bag (lb)	0.02	0.02	0.02	
Wt. of can + wet soil (lb)	4.32	4.38	4.48	
Wt. of can + wet dry soil (g)	49.21	45.13	37.92	
Wt. of water dry (lb)	43.91	40.76	33.74	
Water content true (g)	11.04	11.00	10.93	
Moisture (g)	5.30	4.37	4.18	

Field
lab
"

Field Data

Test No.	#13	#14	#15	
Unit wt. of sand (pcf)	96			
Wt. of jug + cone before use (lb)	11.08	14.56	13.04	
Wt. of jug + cone after use (lb)	4.08	7.38	5.96	
Wt. of sand used (hole + cone) (lb)	7.00	7.16	7.08	
Wt. of sand in cone (lb)	3.76	3.76	3.76	
Wt. of sand in hole (lb)	3.24	3.40	3.32	
Volume of hole (ft ³)	0.0338	0.0354	0.0346	
Wt. of soil (wet) (lb)	4.30	4.36	4.46	

Test Results

Test No.	#13	#14	#15	
Wet Density (pcf)	127.41	123.10	128.96	
Dry Density (pcf)	109.72	107.34	108.99	
Moisture Content (%)	16.12	14.68	18.33	

(See Notes)

Notes:

Maximum dry density (pcf)

Optimum water content (%)

Compaction (%)

98.8 96.7 101.9

PASS/FAIL
MDD, OMC

P
111, 16

P
111, 16

P
107, 18



SHEPHERD MILLER

INCORPORATED

Project: HIGHLAND 100548-2

Area: TAILINGS BASIN FILL AREA

Tested By: Don Paulter

Date: May 15, 2007

SAND CONE TEST FORM

PAGE 1 of 3

Visual Description of Soil: _____

Material Type: COVER

Location of Sample: _____

Location of test

Laboratory Data from Field Test at grade esgrade

Test No.	1	2	2A	3
	<u>0+050</u> <u>11+060</u>	<u>20+140</u> <u>10+155</u>	<u>0+140</u> <u>10+150</u>	<u>N+150</u> <u>10+145</u>
Moisture Can No.	<u>B1</u>		<u>B2</u>	<u>B3</u>
Wt. of bag <u>bag</u> (lb)	<u>0.02</u>	<u>0.02</u>	<u>0.02</u>	<u>0.02</u>
Wt. of can + wet soil (lb)	<u>4.64</u>	<u>4.75</u>	<u>4.30</u>	<u>4.69</u>
Wt. of can + wet <u>wet</u> soil (g)	<u>47.77</u>		<u>49.98</u>	<u>49.90</u>
Wt. of water <u>dry</u> (g)	<u>42.65</u>		<u>44.33</u>	<u>44.37</u>
Water content <u>Wt. of water</u> (g)	<u>11.16</u>		<u>11.16</u>	<u>11.12</u>

Field
lab
"

Field Data

Test No.	#1	#2	#2A	#3
Unit wt. of sand (pcf)	<u>96</u>	<u>76</u>		
Wt. of jug + cone before use (lb)	<u>14.84</u>	<u>12.85</u>	<u>15.41</u>	<u>13.52</u>
Wt. of jug + cone after use (lb)	<u>7.52</u>	<u>5.03</u>	<u>8.49</u>	<u>6.16</u>
Wt. of sand used (hole + cone) (lb)	<u>7.32</u>	<u>7.82</u>	<u>6.92</u>	<u>7.36</u>
Wt. of sand in cone (lb)	<u>3.76</u>	<u>3.76</u>	<u>3.76</u>	<u>3.76</u>
Wt. of sand in hole (lb)	<u>3.56</u>	<u>4.06</u>	<u>3.12</u>	<u>3.60</u>
Volume of hole (ft ³)	<u>0.371</u>	<u>0.0423</u>	<u>0.0325</u>	<u>0.0375</u>
Wt. of soil (Wet) (lb)	<u>4.62</u>	<u>4.73</u>	<u>4.28</u>	<u>4.67</u>

Test Invalid
Sand Cone Funnel Stuck
open

Test Results

Test No.	#1	Sample	#2A	#3
Wet Density (pcf)	<u>124.58</u>	<u>Saved</u>	<u>131.69</u>	<u>124.53</u>
Dry Density (pcf)	<u>107.2</u>		<u>112.5</u>	<u>106.8</u>
Moisture Content (%)	<u>16.3</u>		<u>17.0</u>	<u>16.6</u>

Notes:

Maximum dry density (pcf) 111

111

111

Optimum water content (%) 16

16

16

Compaction (%) 96.6

101.3

96.2

PASS/FAIL

P

P

P

File: SAND-C.DWG

SAND CONE TEST FORM

PAGE 2 of 3

Visual Description of Soil: _____

Material Type: _____

Location of Sample: _____

Location of test

Laboratory Data from Field Test @ grade @ grade @ grade -16 ft B.G.

Test No.	#4 N+050 11+035	#5 M+145 9+165	#6 N+050 10+035	#7 L+035 13+150
Moisture Can No.	B4	B5	B6	B7
Wt. of can bag (lb)	0.02	0.02	0.02	0.02
Wt. of can + wet soil (lb)	4.35	4.23	3.76	4.92
Wt. of can + wet soil (g)	39.18	39.99	55.51	50.88
Wt. of water dry (g)	35.36	35.75	49.68	45.57
Water content (g)	11.11	11.08	11.09	11.12

field
lab
"

Field Data

Test No.				
Unit wt. of sand (pcf)	96			
Wt. of jug + cone before use (lb)	12.14	11.36	14.74	13.77
Wt. of jug + cone after use (lb)	5.12	4.22	7.94	6.02
Wt. of sand used (hole + cone) (lb)	7.02	7.14	6.80	7.75
Wt. of sand in cone (lb)	3.76	3.76	3.76	3.76
Wt. of sand in hole (lb)	3.26	3.38	3.04	3.99
Volume of hole (ft ³)	0.0340	0.0352	0.0317	0.0416
Wt. of soil (wet) (lb)	4.33	4.21	3.74	4.90

Test Results

Test No.	#4	#5	#6	#7
Wet Density (pcf)	127.51	117.57	118.10	117.89
Dry Density (pcf)	110.2	102.0	102.6	102.1
Moisture Content (%)	15.8	17.2	15.1	15.4

Notes:

Maximum dry density (pcf)	111	107	111	111
Optimum water content (%)	16	18	16	16
Compaction (%)	99.3	95.3	92.4	92.0

HEAVY WET
clay in sample

Rock in side
of hole

PASS/FAIL

P

P

F

F File: SAND-C.DWG



SHEPHERD MILLER
INCORPORATED

Project: HIGHLAND 100548-2
Area: TAILINGS BASIN FILL AREA
Tested By: _____
Date: _____

SAND CONE TEST FORM

PAGE 3 of 3

Visual Description of Soil: _____

Material Type: _____

Location of Sample: _____

Location of test -1st B.G.
Laboratory Data from Field Test

Test No.	#8	2+030			
Moisture Can No.	88	12+160			
Wt. of can <u>bag</u> (lb)	0.02				
Wt. of can + wet soil (lb)	4.70				
Wt. of can + wet <u>wet</u> soil (g)	49.79				
Wt. of water <u>dry</u> (g)	43.49				
Water content <u>tare</u> (g)	11.10				

field
lab
"

Field Data

Test No.	#8			
Unit wt. of sand (pcf)	96			
Wt. of jug + cone before use (lb)	11.24			
Wt. of jug + cone after use (lb)	3.58			
Wt. of sand used (hole + cone) (lb)	7.66			
Wt. of sand in cone (lb)	3.76			
Wt. of sand in hole (lb)	3.90			
Volume of hole (ft ³)	0.0406			
Wt. of soil (wet) (lb)	4.68			

Test Results

Test No.	#8			
Wet Density (pcf)	115.20			
Dry Density (pcf)	96.4			
Moisture Content (%)	19.5			

Notes:

Maximum dry density (pcf) 104

Optimum water content (%) 20

Compaction (%) 92.7

PASS/FAIL

F

File: SAND-C.DWG

SAND CONE TEST FORM

PAGE 1 of 4

Visual Description of Soil: _____

Material Type: COVER

Location of Sample: _____

Location of test

Laboratory Data from Field Test-1st BG -0.54 BG @ grade

Test No.	#1 L+110 12+120	#2 L+115 12+040	#3 0+160 9+125	#4 N+165 9+155
Moisture Can No.	A1	A2	A3	A4
Wt. of can bag (lb)	0.02	0.02	0.02	0.02
Wt. of can + wet soil (lb)	3.68	4.07	4.26	4.36
Wt. of can + wet soil (g)	46.64	47.52	53.38	50.58
Wt. of water dry (lb)	41.33	42.29	48.02	45.52
Water content Tare (g)	11.05	11.00	10.93	11.14
dry soil (g)	5.31	5.23	5.36	5.06

field
lab
"

Field Data

Test No.	#1	#2	#3	#4
Unit wt. of sand (pcf)	96	96	96	96
Wt. of jug + cone before use (lb)	15.34	14.26	13.34	11.27
Wt. of jug + cone after use (lb)	8.77	7.27	6.22	3.95
Wt. of sand used (hole + cone) (lb)	6.57	6.99	7.12	7.32
Wt. of sand in cone (lb)	3.76	3.76	3.76	3.76
Wt. of sand in hole (lb)	2.81	3.23	3.36	3.56
Volume of hole (ft ³)	0.0293	0.0336	0.0350	0.0371
Wt. of soil (wet) (lb)	3.66	4.05	4.24	4.34

Test Results

Test No.	#1	#2	#3	#4
Wet Density (pcf)	125.04	120.37	121.14	117.03
Dry Density (pcf)	106.38	103.13	105.8	102.0
Moisture Content (%)	17.5	16.7	14.5	14.7

Notes:

Maximum dry density (pcf) 107

Optimum water content (%) 18

Compaction (%)

Very stiff
small hole

Rk in Bottom
Hard SS(?)
no very friable
smaller hole

107

18

99.4

107

18

96.4

111

16

95.3

111

16

91.9

PASS/FAIL

P

P

P

F File: SAND-C.DWG

SAND CONE TEST FORM

PAGE 2 of 1

Visual Description of Soil: _____

Material Type: _____

Location of Sample: _____

Location of test

Laboratory Data from Field Test @ grade (see note) #5 @ grade below #5 @ grade @ grade

Test No.	#5 M+165 9+140	#6 M+170 9+130	#7 0+095 10+065	#8 M+075 10+075
Moisture Can No.	A5	A6	A7	A8
Wt. of can bag (lb)	0.02	0.02	0.02	0.02
Wt. of can + wet soil (lb)	5.17	4.53	4.18	4.16
Wt. of can + wet soil (g)	47.37	55.05	52.20	43.91
Wt. of water dry (lb)	43.07	49.08	46.52	39.04
Water content (%)	10.89	10.96	11.06	11.15

field
lab
"

Field Data Dry soil (g) 4.30 5.57 5.63 4.37

Test No.	#5	#6	#7	#8
Unit wt. of sand (pcf)	96	96		
Wt. of jug + cone before use (lb)	15.58	13.58	12.41	11.77
Wt. of jug + cone after use (lb)	7.25	6.11	5.46	4.74
Wt. of sand used (hole + cone) (lb)	8.33	7.47	6.95	7.03
Wt. of sand in cone (lb)	3.76	3.76	3.76	3.76
Wt. of sand in hole (lb)	4.57	3.71	3.19	3.27
Volume of hole (ft ³)	0.0476	0.0386	0.0332	0.0341
Wt. of soil (wet) (lb)	5.15	4.51	4.16	4.14

Test Results

Test No.	#5	#6	#7	#8
Wet Density (pcf)	108.18	116.70	125.19	121.54
Dry Density (pcf)	95.43	100.89	107.9	103.5
Moisture Content (%)	13.4	15.7	16.0	17.5

Notes:

(see Notes)
Test Not Rep.
Bottom more stiff

Retest of #5

Maximum dry density (pcf)	107	107	107	107
Optimum water content (%)	13	13	13	13
Compaction (%)	89.2	94.3	97.2	96.7

PASS/FAIL

F

F

P

P

File: SAND-C.DWG

SAND CONE TEST FORM

PAGE 3 of 4

Visual Description of Soil: _____

Material Type: _____

Location of Sample: _____

Location of test

Test No.	#9 ^{M+165} 10+150 @ grade	#10 ^{M+050} 11+055 @ grade	#11 ^{M+075} 12+050 @ grade	#12 ^{M+070} 12+045 @ grade
Moisture Can No.	A9	A10	A11	A12
Wt. of can ^{jug} (lb)	0.02	0.02	0.02	0.02
Wt. of can + wet soil (lb)	4.03	4.04	4.15	3.27
Wt. of can + ^{wet} soil (g)	51.49	54.95	52.71	56.00
Wt. of water: ^{dry} (g)	45.76	49.07	47.68	50.58
Water content: ^{Tare} (g)	11.17	11.03	11.03	11.04
Dry Soil (g)	5.73	5.83	5.03	5.42

Field lab
"

Field Data

Test No.				
Unit wt. of sand (pcf)	96	96	96	
Wt. of jug + cone before use (lb)	15.49	14.75	12.47	13.64
Wt. of jug + cone after use (lb)	8.73	7.86	5.24	7.38
Wt. of sand used (hole + cone) (lb)	6.76	6.89	7.23	5.26
Wt. of sand in cone (lb)	3.76	3.76	3.76	3.76
Wt. of sand in hole (lb)	3.00	3.13	3.47	2.50
Volume of hole (ft ³)	0.0313	0.0326	0.0361	0.0260
Wt. of soil (wet) (lb)	4.01	4.02	4.13	3.25

Test Results

Test No.	#9	#10	#11	#12
Wet Density (pcf)	128.32	123.30	114.26	124.60
Dry Density (pcf)	110.0	106.8	100.47	109.58
Moisture Content (%)	16.6	15.5	13.7	13.7

Notes:	#9 sandy mat 1/2	Test for 32 ft sub- excavated soft material & replacement fill (see notes)	BAD TEST? Mat'l - very firm	#11 RETEST very stiff small hole
Maximum dry density (pcf)				
Optimum water content (%)	11, 16	11, 16	11, 16	11, 16
Compaction (%)	99.2	96.2	90.5	(dry) 98.1

PASS/FAIL

P

P

F

P

File: SAND-C.DWG



SHEPHERD MILLER
INCORPORATED

Project: HIGHLAND 100548-2
Area: TAILINGS BASIN FILL AREA
Tested By: D. Positor
Date: May 17 2001

SAND CONE TEST FORM

PAGE 4 of 4

Visual Description of Soil: _____

Material Type: _____

Location of Sample: _____

Location of Test

Laboratory Data from Field Test *@ grade* *@ grade* *@ grade*

Test No.	#13 <i>m+0.15</i> <i>13+0.35</i>	#14 <i>m+0.20</i> <i>14+0.35</i>	#15 <i>L+1.35</i> <i>14+1.35</i>	#16 <i>L+1.55</i> <i>13+1.55</i>
Moisture Can No.	B9	B10	B11	B12
Wt. of can bag (lb)	0.02	0.02	0.02	0.02
Wt. of can + wet soil (lb)	3.91	4.32	4.10	4.69
Wt. of can + wet soil (g)	45.14	48.73	49.42	43.98
Wt. of water dry (lb)	40.70	43.00	44.01	38.95
Water content Tare (g)	11.09	11.16	11.07	11.08
Dry soil (g)	4.44	5.73	5.41	5.03

field
lab
"

Field Data

Test No.	#13	#14	#15	#16
Unit wt. of sand (pcf)	96	96	96	96
Wt. of jug + cone before use (lb)	12.00	10.92	13.88	12.37 (?)
Wt. of jug + cone after use (lb)	5.14	3.98	6.97	5.00
Wt. of sand used (hole + cone) (lb)	6.86	6.94	6.91	7.37
Wt. of sand in cone (lb)	3.76	3.76	3.76	3.76
Wt. of sand in hole (lb)	3.10	3.18	3.15	3.61
Volume of hole (ft ³)	0.0323	0.0331	0.0328	0.0376
Wt. of soil (Wet) (lb)	3.89	4.30	4.08	4.67

Test Results

Test No.	#13	#14	#15	#16
Wet Density (pcf)	120.46	129.81	124.34	124.19
Dry Density (pcf)	104.75	110.01	106.8	105.2
Moisture Content (%)	15.0	18.0	16.4	18.0

#13+14 more clayey mat'l.

Notes:

Maximum dry density (pcf) 107 107 107 107
Optimum water content (%) 18 18 18 18
Compaction (%) (dry) 97.9 102.3 99.8 98.3

PASS/FAIL

P

P

P

P

File: SAND-C.DWG

SAND CONE TEST FORM

PAGE 1 of 4

Visual Description of Soil: _____

Material Type: COVER

Location of Sample: _____

Location of test

Laboratory Data from Field Test @ grade @ grade @ grade @ grade

Test No.	#1 <u>4+180</u> <u>11+005</u>	#2 <u>4+160</u> <u>11+155</u>	#3 <u>4+125</u> <u>12+140</u>	#4 <u>4+045</u> <u>12+035</u>
Moisture Can No.				
Wt. of can bag (lb)	0.02	0.02	0.02	0.02
Wt. of can + wet soil (lb)	3.87	4.44	4.38	4.71
Wt. of can + wet soil (g)	58.31	54.67	52.54	57.55
Wt. of water Can Wt (lb)	A1 11.05	A2 11.01	A3 10.93	A4 11.15
Water content Dry wt (g)	51.42	47.94	46.62	51.23
Water wt (g)	6.89	6.73	5.92	6.32

field
lab
"

Field Data

Test No.	#1	#2	#3	#4
Unit wt. of sand (pcf)	96			
Wt. of jug + cone before use (lb)	15.58	14.39	12.76	11.72
Wt. of jug + cone after use (lb)	8.83	7.15	5.52	4.24
Wt. of sand used (hole + cone) (lb)	6.75	7.24	7.14	7.58
Wt. of sand in cone (lb)	3.76	3.76	3.76	3.76
Wt. of sand in hole (lb)	2.99	3.48	3.38	3.82
Volume of hole (ft ³)	0.311	0.0363	0.0352	0.0398
Wt. of soil (wet) (lb)	3.85	4.42	4.36	4.69

Test Results

Test No.	#1	#2	#3	#4
Wet Density (pcf)	123.61	121.93	123.83	117.86
Dry Density (pcf)	105.59	103.14	106.21	101.81
Moisture Content (%)	17.07	18.22	16.58	15.77

Notes:

Maximum dry density (pcf)	107	107	107	(dry) 107
Optimum water content (%)	18	18	18	18
Compaction (%)	93.7	96.4	99.3	95.1

PASS/FAIL

P

P

P

P File: SAND-C.DWG

SAND CONE TEST FORM

PAGE 2 of 4

Visual Description of Soil: _____

Material Type: _____

Location of Sample: _____

Location of test

Laboratory Data from Field Test *@grade* *-16" below grade* *@grade* *@grade*

Test No.	#5 <i>L+065 13+030</i>	#6 <i>L+010 13+155</i>	#7 <i>L+075 14+075</i>	#8 <i>P+185 12+150</i>
Moisture Can No.	Double bagged			
Wt. of can bag (lb)	0.04	0.02	0.02	0.02
Wt. of can + wet soil (lb)	4.80	4.24	5.21	4.45
Wt. of can + wet soil (g)	54.53	59.64	59.72	57.38
Wt. of water Can't (g)	A5 10.90	A6 10.95	A7 11.07	A8 11.14
Wt. of water Dry wt (g)	48.00	53.65	52.64	51.75
Water (g)	6.53	5.99	7.08	5.63

field lab
"

Field Data

Test No.	#5	#6	#7	#8
Unit wt. of sand (pcf)	96			
Wt. of jug + cone before use (lb)	13.95	12.31	10.89	13.85
Wt. of jug + cone after use (lb)	6.27	5.33	3.00	6.63
Wt. of sand used (hole + cone) (lb)	7.68	6.98	7.89	7.22
Wt. of sand in cone (lb)	3.76	3.76	3.76	3.76
Wt. of sand in hole (lb)	3.92	3.22	4.13	3.46
Volume of hole (ft ³)	0.408	0.035	0.0430	0.0360
Wt. of soil (wet) (lb)	4.76	4.22	5.19	4.43

Test Results

Test No.	#5	#6	#7	#8
Wet Density (pcf)	116.57 (?)	125.81	120.64	122.91
Dry Density (pcf)	99.12	110.33	103.08	107.94
Moisture Content (%)	17.60	14.03	17.03	13.86

Notes:

Maximum dry density (pcf)	104	111	107	111
Optimum water content (%)	20	16	18	16
Compaction (%)	95.3	92.4	96.3	(dry) 97.2

PASS/FAIL

F

P

P

P

File: SAND-C.DWG

SAND CONE TEST FORM

PAGE 3 of 4

Visual Description of Soil: _____

Material Type: _____

Location of Sample: _____

Location of test

Laboratory Data from Field Test ^{@ grade}

Test No.	#9 ^{P+160} 14+000	#10 ^{P+130} 14+150	#11 ^{P+175} 15+145	#12 ^{P+015} 12+055
Moisture Can No.	0			
Wt. of can bag (lb)	0.02	0.02	0.02	0.02
Wt. of can + wet soil (lb)	2.44	5.00	4.02	4.32
Wt. of can + ^{wet} soil (g)	65.03	57.19	57.60	55.13
Wt. of water Can wt (lb)	A9 11.18	A10 11.02	A11 11.04	A12 11.05
Water content Dry Wt (g)	59.70	51.17	51.14	48.13
Water (g)	5.33	6.02	6.46	6.95

field
lab
"

Field Data

Test No.	#9	#10	#11	#12
Unit wt. of sand (pcf)				
Wt. of jug + cone before use (lb)	12.43	13.81	12.16	13.70
Wt. of jug + cone after use (lb)	6.72	6.45	5.32	6.65
Wt. of sand used (hole + cone) (lb)	5.71	7.36	6.84	7.05
Wt. of sand in cone (lb)	3.76	3.76	3.76	3.76
Wt. of sand in hole (lb)	1.95	3.60	3.08	3.29
Volume of hole (ft ³)	0.0203	0.0375	0.0321	0.0343
Wt. of soil (Wet) (lb)	2.42	4.98	4.00	4.30

Test Results

Test No.	#9	#10	#11	#12
Wet Density (pcf)	119.14	132.80	124.67	125.47
Dry Density (pcf)	107.34	115.49	107.37	105.69
Moisture Content (%)	10.99	14.99	16.11	18.72

* Very Hard - Dry Cement Like (see notes) very stiff

Notes:

Maximum dry density (pcf) 111 111 111 107

Optimum water content (%) 16 16 16 18

Compaction (%) (dry) 96.7 104.0 96.7 98.8

PASS/FAIL

P

P

P

P

File: SAND-C.DWG

SAND CONE TEST FORM

PAGE 4 of 4

Visual Description of Soil: _____

Material Type: _____

Location of Sample: _____

Location of test

Laboratory Data from Field Test @ grade @ grade @ grade

Test No.	#13 P+035 13+040	#14 P+085 14+055	#15 P+070 15+050	#16 P+075 16+010
Moisture Can No.				
Wt. of can bag (lb)	0.02	0.02	0.02	0.02
Wt. of can + wet soil (lb)	4.52	4.67	4.30	5.04
Wt. of can + wet soil (g)	57.57	57.21	60.81	51.66
Wt. of water Can't wt (g)	B1 11.17	B2 11.17	B3 11.12	B4 11.12
Water content Dry wt (g)	50.47	50.28	53.00	45.67
Water (g)	7.10	6.93	7.81	5.99

field
lab
"

Field Data

Test No.	#13	#14	#15	#16
Unit wt. of sand (pcf)	96	96	96	96
Wt. of jug + cone before use (lb)	11.90	13.83	11.49	13.77
Wt. of jug + cone after use (lb)	4.83	6.58	4.57	6.28
Wt. of sand used (hole + cone) (lb)	7.17	7.25	6.92	7.49
Wt. of sand in cone (lb)	3.76	3.76	3.76	3.76
Wt. of sand in hole (lb)	3.41	3.59	3.16	3.73
Volume of hole (ft ³)	0.0355	0.0374	0.0329	0.0389
Wt. of soil (wet) (lb)	4.50	4.65	4.28	5.02

Test Results

Test No.	#13	#14	#15	#16
Wet Density (pcf)	126.69	124.34	130.02 (?)	129.20
Dry Density (pcf)	107.30	105.62	109.53	110.11
Moisture Content (%)	18.07	17.72	18.65	17.34

Notes:

	Bottom of hole soft + increase... moisture	same as #13	Sample softer and incr. moisture	Similar to #15
Maximum dry density (pcf)	107	107	107	107
Optimum water content (%)	18	18	18	18
Compaction (%)	100.3	93.7	102.4	102.9

PASS/FAIL

P

P

P

P

File: SAND-C.DWG

APPENDIX D-2
MOISTURE CONTENT TESTS



SHEPHERDMILLER

INCORPORATED

CLIENT _____ JOB NO. _____ PAGE _____ OF _____
 PROJECT 100543-3 DATE 28 OCT 00 DATE CHECKED 29 OCT 00
 DETAIL HIGHLAND COMPUTED BY CLS CHECKED BY CLS

MICROWAVE SAMPLE DRYING

10/27 TEST SAMPLE	1	2	3	4	5	6	7	8
Wet weight (g)	1430	1065	1156	1209	1699	1733	1442	1267
Wet weight (g) + bag	1439	1074	1165	1218	1708	1742	1451	1276
(lb)	3.17	2.37	2.57	2.68	3.76	3.84	3.20	2.81
[Wet wt (g) (lb)]	[3.18]	[2.33]	[2.55]	[2.67]	[3.73]	[3.82]	[3.19]	[2.82]
Bag weight (g)	9	9	9	9	9	9	9	35
Pan weight (g)	164	197	197	164	197	164	197	164
Pan + Wet weight (g)	1603	1261	1352	1406	863*	1928	1639	1403
Wet weight (g)	1430	1064	1155	1242	666*	1764	1442	1239
Pan + Dry weight (g)	1574	1255	1340	1398	510	1893	1636	1396
	→ 1492	1213	1309	1377	796	1889	1626	1382
		1196	1280	1326	776	1843	1614	1377
		1185	1258	1317	→ 761	1839	1611	1361
		1181	1234	1301		1819	1538	1339
		1177	1223	1297		1813	1534	1326
		1174	1200	1285		1808	1513	1320
		1171	→ 1197	1277		1781	→ 1496	1312
		→ 1169		1264		1777		1300
				1249		1774		1260
				→ 1246		→ 1753		→ 1253
Wet wt (g)	1430	1065	1156	1209	666	1742	1442	1267
Dry wt (g)	1328	972	1000	1082	564	1581	1299	1089
Water wt (g)	102	93	156	127	132	153	143	178
Water content (%)	7.6	9.6	15.6	11.1	13.0	9.6	11.0	16.3

* split of sample



CLIENT EXXON JOB NO. 100548 PAGE 1 OF 1
PROJECT HIGHLAND DATE Nov 8, 00 DATE CHECKED _____
DETAIL _____ COMPUTED BY GVH CHECKED BY _____

DETERMINE MOISTURE CONTENTS FOR NOV. 6TH
SANDCONE TESTS

<u>SAMPLE</u>	<u>CONTAINER</u> <u>WT. (g)</u>	<u>MOIST TOTAL</u> <u>WT. (g)</u>	<u>DRY TOTAL</u> <u>WT. (g)</u>	<u>RATIO</u>	<u>MOISTURE</u> <u>CONTENT</u>
1	135.7	209.4	199.7	$\frac{9.7}{64}$	15.2%
2	129.7	205.6	195.3	$\frac{10.3}{65.6}$	15.7%
3	130.0	190.7	180.9	$\frac{9.8}{50.9}$	19.3%
4	134.9	208.0	198.1	$\frac{9.9}{63.2}$	15.7%

ABOVE SAMPLES WERE OVEN DRIED 24 hrs. IN PYREX BOWLS

<u>CHECKS</u>					
1.1	20.9	18.5	$\frac{2.4}{17.4}$	13.8%	
4 METAL CUP IN OVEN					
1 CERAMIC CUP IN MICROWAVE	153.8	211.0	203.7	$\frac{7.3}{49.9}$	14.6%

Shepherd Miller, Inc

Project: Highland

Client: Exxon

Project No: 100548

Contractor: Carr Construction

Test Counter	Date	Daily Test No.	Tested By	Area of Test	Test Grid Location	Lift No. or Elev.	Test Results		
							Wet Density	Moisture Content	Dry Density
							(lb/ft ³)	(%)	(lb/ft ³)
1	27-Oct-00	1	CLS/GVH	Random Fill	Q, 13+100	0	117.5	7.6	109.2
2	27-Oct-00	2	CLS/GVH	Random Fill	Q, 14+100	0	107.4	9.6	98.0
3	27-Oct-00	3	CLS/GVH	Random Fill	P+100, 14+100	0	110.0	15.6	95.2
4	27-Oct-00	4	CLS/GVH	Random Fill	P+150, 13+100	0	119.4	11.7	106.9
5	27-Oct-00	5	CLS/GVH	Random Fill	P+100, 12+100	0	120.1	18.0	101.8
6	27-Oct-00	6	CLS/GVH	Random Fill	Q+50, 12+50	0	117.8	9.6	107.5
7	27-Oct-00	7	CLS/GVH	Random Fill	Q+100, 11	0	120.1	11.0	108.2
8	27-Oct-00	8	CLS/GVH	Random Fill	Q+100, 12	0	116.6	16.3	100.3
9	30-Oct-00	1	CLS	Cover	Q+100, 11	1	115.7	18.5	97.6
10	30-Oct-00	2	CLS	Cover	Q+100, 11+100	1	113.4	18.0	96.1
11	30-Oct-00	3	CLS	Cover	Q+100, 12	1	119.3	17.0	102.0
12	30-Oct-00	4	CLS	Cover	Q+100, 13	1	116.5	16.2	100.3
13	30-Oct-00	5	CLS	Cover	Q+100, 13+100	1	106.7	15.7	92.2
14	30-Oct-00	6	CLS	Cover	R, 13	1	118.0	17.3	100.6
15	30-Oct-00	7	CLS	Cover	R, 12	1	117.2	17.8	99.5
16	30-Oct-00	8	CLS	Cover	R, 11+100	1	121.8	20.2	101.3
17	30-Oct-00	9	CLS	Cover	R, 11	2	114.9	19.8	95.9
18	30-Oct-00	10	CLS	Cover	Q+100, 13+100	2	116.3	17.2	99.2
19	31-Oct-00	1	GVH	Cover	Q+100, 12+100	3	118.6	21.2	97.9
20	31-Oct-00	2	GVH	Cover	Q+100, 10+100	3	121.7	20.6	100.9
21	31-Oct-00	3	GVH	Cover	Q, 10	2	112.6	21.7	92.5
22	31-Oct-00	4	GVH	Cover	P+150, 10+100	1	108.3	15.4	93.8
23	31-Oct-00	5	GVH	Cover	Q, 11+100	2	110.8	15.1	96.3
24	4-Nov-00	1	CLS	Cover	Q+100, 10+100	4	117.4	17.6	99.8
25	4-Nov-00	2	CLS	Cover	Q+100, 10	4	114.3	16.0	98.5
26	4-Nov-00	3	CLS	Cover	Q+100, 11+100	4	108.6	21.0	89.8
27	4-Nov-00	4	CLS	Cover	Q+100, 12	4	118.8	17.1	101.5
28	4-Nov-00	5	CLS	Cover	Q+100, 13	4	120.7	17.6	102.6
29	4-Nov-00	6	CLS	Cover	Q, 10+100	4	116.4	15.5	100.8
30	4-Nov-00	7	CLS	Cover	Q, 11	4	113.9	16.7	97.6
31	4-Nov-00	8	CLS	Cover	Q+100, 11+100	4	110.4	19.3	92.5
32	4-Nov-00	9	CLS	Cover	Q, 12	4	117.0	20.2	97.3
33	4-Nov-00	10	CLS	Cover	Q, 12+100	4	120.1	16.2	103.4
34	4-Nov-00	11	CLS	Cover	Q, 13	4	116.9	14.5	102.1
35	4-Nov-00	12	CLS	Cover	R, 15	5	116.9	17.1	99.8
36	4-Nov-00	13	CLS	Cover	R, 14	5	107.3	16.5	92.1
37	4-Nov-00	14	CLS	Cover	R, 14	5	110.8	17.6	94.2
38	4-Nov-00	15	CLS	Cover	R, 13	5	105.0	16.6	90.1
39	4-Nov-00	16	CLS	Cover	R, 12	5	111.2	17.7	94.5
40	6-Nov-00	1	GVH	Cover	P+150, 11	3, 1' BFC	110.2	15.2	95.7
41	6-Nov-00	2	GVH	Cover	N, 13	1, 6" BFC	103.3	15.7	89.3
42	6-Nov-00	3	GVH	Cover	O, 12	2, 2' BFC	117.5	19.3	98.5
43	6-Nov-00	4	GVH	Cover	P+150, 10	6" BFC	106.3	15.7	91.9

SUMMARY OF LABORATORY TEST RESULTS

JOB NAME: SMI # 100548-3,
Highland

JOB NUMBER: 00.084T

Date: December 2, 2000

Sample	Sample Type	Moisture (%)	Atterbergs LL / PL*	Proctor Max DD(pcf) / w(%)	% Passing No. 200 Sieve
North Stockpile	Bucket	4.6	35 / 17	101.8 / 16.6	65
South Stockpile	Bucket	4.2	33 / 16	104.5 / 15.2	51
Borrow Area-Top	Bucket	9.0	30 / 16	111.3 / 16.4	41
Borrow Area-Slope	Bucket	10.3	N.P.	106.5 / 19.6	46
Borrow Area-North	Bucket		32 / 16	101.5 / 21.0	56
Borrow Area-South	Bucket		33 / 16	102.5 / 20.0	57
BA-NE	Bucket	11.5	28 / 23	103.5 / 19.5	49
BA-SE	Bucket	8.7	32 / 17	99.0 / 21.0	62
Test 1	Bag	17.6	43 / 18		69
Test 2	Bag	16.0			
Test 3	Bag	21.0			
Test 4	Bag	17.1	41 / 16		70
Test 5	Bag	17.6			
Test 6	Bag	15.5	<div style="text-align: center;"> SAMPLES COLLECTED 4 NOV 2000 </div>		
Test 7	Bag	16.7			
Test 8	Bag	19.3			
Test 9	Bag	20.2			
Test 10	Bag	16.2	42 / 18		63
Test 11	Bag	14.5			
Test 12	Bag	17.1	42 / 19		75
Test 13	Bag	16.5			
Test 14	Bag	17.6			
Test 15	Bag	16.6			
Test 16	Bag	17.7			

*LL = Liquid Limit PL = Plastic Limit
N.P. = Non-Plastic



SHEPHERD MILLER
INCORPORATED

CLIENT _____ JOB NO. 100548 PAGE 1 OF 1
PROJECT _____ DATE 10 APR 01 DATE CHECKED _____
DETAIL _____ COMPUTED BY CLS CHECKED BY _____

MOISTURE CONTENT MEASUREMENTS

SAMPLE / TEST	DISH	DISH WT (g)	WET SOIL & DISH (g)	DRY SOIL & DISH (g)	MOISTURE WT (g)	DRY SOIL WT (g)	W (%)
09 APR 01 1	A3	11.04	47.99	41.22 (41.26)	6.77 (6.73)	30.18 (30.22)	22.4 (22.3)
2	A12	11.04	46.90	40.25	6.65	29.21	22.8
3	A1	10.93	47.58	41.61	5.97	30.68	19.5
4	A8	11.14	47.95	41.13	6.82	29.99	22.7
5	A5	10.90	49.57	42.75	6.82	31.85	21.4
6	A9	11.17	51.95	44.99	6.96	33.82	20.6
7	A7	11.07	45.75	39.37	6.38	23.30	22.5
8	A10	11.02	51.70	45.19	6.51	34.17	19.1
10 APR 01 1	78	1.30	35.53	29.48	6.05	23.18	21.5
2	82	1.28	38.69	32.78	5.91	31.50	18.8
3	76	1.29	32.07	27.30	4.77	26.01	18.3
4	69	1.29	36.25	30.87	5.38	29.58	18.2
5	53	1.28	35.15	30.12	5.03	23.84	17.4
6	66	1.28	39.29	33.72	5.57	32.44	17.2
7	63	1.30	40.04	33.59	6.45	32.29	20.0
8	74	1.28	42.85	36.28	6.57	35.00	18.8

Hefty 1-gallon plastic bag - $9.36 \text{ g} / 454 = 0.02 \text{ lb}$



SHEPHERD MILLER
INCORPORATED

CLIENT _____ JOB NO. 100548 PAGE 1 OF 1
PROJECT _____ DATE 13 APR 01 DATE CHECKED _____
DETAIL _____ COMPUTED BY CLS CHECKED BY _____

MOISTURE CONTENT MEASUREMENTS

SAMPLE / TEST	DISH	DISH WT(g)	WET SOIL +DISH(g)	DRY SOIL +DISH(g)	MOISTURE WT(g)	DRY SOIL WT(g)	WT (%)
13 APR 01 1	A1	11.05	51.30	44.69	6.61	33.64	19.6
2	A2	11.00	49.36	42.95	6.41	31.95	20.1
3	A7	11.07	50.21	43.25	6.96	32.18	21.6
4	A4	11.15	53.43	46.56	6.87	35.41	19.4
5	A10	11.02	55.91	48.61	7.30	37.59	19.4
6	76	1.30	42.63	35.52	7.11	34.22	20.8
7	68	1.29	40.29	34.84	5.45	33.55	16.2
8	75	1.29	41.73	36.06	5.67	34.77	16.3



SHEPHERD MILLER
INCORPORATED

CLIENT _____

JOB NO. 100548

PAGE 1

OF 1

PROJECT _____

DATE _____

DATE CHECKED _____

DETAIL _____

COMPUTED BY _____

CHECKED BY _____

MOISTURE CONTENT MEASUREMENTS

SAMPLE/TEST	DISH	DISH WT.(g)	WET SOIL +DISH(g)	DRY SOIL +DISH(g)	MOISTURE WT (g)	DRY SOIL WT (g)	W (%)
16 APR 01	1	10	4.34	20.62	18.58	14.24	14.3
	2	5	4.33	23.22	21.45	17.12	10.3
	3	7	4.36	20.92	18.58	14.22	16.5
	4	9	4.33	24.32	22.23	17.90	11.7
	5	A4	11.15	57.40	52.07	40.92	13.0
	6	1	4.38	24.92	22.42	18.04	13.9
	7	8	4.29	26.27	23.17	18.88	16.4
	8	4	4.23	23.39	20.65	16.37	16.7
	9	2	4.43	25.23	22.75	18.32	13.5
	10	3	4.33	25.87	23.31	19.48	10.6
	11	12	4.36	24.60	21.45	17.09	18.4
	12	53	1.28	38.88	34.74	33.46	12.4
17 APR 01	1	66	1.28	39.19	33.13	31.85	19.0
	2	82	1.29	42.63	37.52	36.33	16.5
	3	74	1.29	38.64	32.48	32.19	16.0
	4	78	1.30	42.49	36.26	34.96	20.7
	5	68	1.29	43.78	37.21	35.92	18.3
	6	A1	11.04	50.79	43.38	32.34	22.9
	7	A2	11.00	52.05	44.94	33.94	20.9
	8	76	1.30	44.35	36.91	35.61	20.9
	9	75	1.37	39.61	34.02	32.65	17.1
	10	A10	11.02	59.03	52.53	41.51	15.7
	11	A11	11.04	52.98	46.18	35.14	19.4
	12	A7	11.07	55.21	48.67	37.60	17.4



SHEPHERD MILLER
INCORPORATED

CLIENT _____ JOB NO. 100548 PAGE 1 OF 1
PROJECT _____ DATE 21 APR 01 DATE CHECKED _____
DETAIL _____ COMPUTED BY CLS CHECKED BY _____

MOISTURE CONTENT MEASUREMENTS

SAMPLE / TEST	DISH	DISH WT(g)	WET SOIL +DISH(g)	DRY SOIL +DISH(g)	MOISTURE WT(g)	DRY SOIL WT(g)	W (%)	
19 APR 01 TEST 1	63	1.29	39.87	33.82	6.05	32.53	18.6	
2	69	1.28	47.08	41.83	5.25	40.55	12.9	
3	82	1.28	43.19	36.88	6.31	35.60	17.7	
4	74	1.29	48.02	41.80	6.22	40.51	15.4	
5	76	1.30	38.52	33.18	5.34	31.88	16.8	
6	75	1.29	49.09	41.95	7.14	40.66	17.6	
7	68	1.29	38.52	33.53	4.99	32.24	15.5	
8	66	1.28	42.77	37.79	4.98	36.51	13.6	*
9	53	1.28	42.47	36.91	5.58	35.63	15.7	
10	78	1.30	40.04	35.08	4.96	33.78	14.7	*
11	7	4.35	27.16	24.46	2.70	20.11	13.4	
12	10	4.35	20.24	18.15	2.09	13.80	15.1	
20 APR 01 TEST 1	A1	11.04	54.97	47.31	7.06	36.87	19.1	
2	A10	11.02	58.72	51.54	7.18	40.52	17.7	
3	A7	11.07	54.03	47.88	6.15	36.81	16.7	
4	A4	11.15	60.13	53.95	6.23	42.80	14.6	
5	A11	11.04	58.95	52.71	6.24	41.67	15.0	
6	A6	10.95	59.39	52.75	6.64	41.80	15.9	
7	A5	10.90	56.43	49.18	7.25	38.28	18.9	
8	A8	11.15	64.22	56.43	7.79	45.28	17.2	
9	A3	10.94	61.87	55.64	6.23	44.70	13.9	
10	A9	11.18	57.15	50.54	6.61	39.36	16.8	
11	A2	11.00	59.05	52.19	6.86	41.19	16.7	
12	A12	11.04	53.21	50.97	7.24	39.93	18.1	

* hole in bag



SHEPHERDMILLER
INCORPORATED

CLIENT _____ JOB NO. 100548-2 PAGE 1 OF 1
PROJECT _____ DATE 12 MAR 02 DATE CHECKED _____
DETAIL _____ COMPUTED BY CLB CHECKED BY _____

CHECK OF MOISTURE CONTENT MEASUREMENTS FROM MAY 01 & 04, 2001 SAMPLES

SAMPLE / TEST	DISH	DISH WT(g)	WET SOIL ± DISH(g)	DRY SOIL ± DISH(g)	MOISTURE WT(g)	DRY SOIL WT(g)	W (%)
01 MAY 01 1	A11	11.04	43.75	38.63	5.12	27.59	18.56
2	A10	11.02	54.69	48.08	6.61	37.06	17.34
3	B10	11.16	40.37	36.19	4.18	25.03	16.70
4	A7	11.07	55.91	48.86	7.05	37.19	18.66
5	B9	11.10	56.09	48.72	7.37	37.62	19.59
6	A3	10.93	51.34	44.78	6.56	33.85	19.38
7	A12	11.05	43.20	42.16	6.04	31.11	19.41
8	B7	11.12	51.13	45.08	6.10	33.96	17.96
9	B11	11.09	46.03	40.77	5.31	29.63	17.89
10	B8	11.10	51.23	45.25	5.98	34.15	17.51
04 MAY 01 1	T8	1.30	27.34	23.26	4.08	21.96	18.58
2	A9	11.17	48.02	42.42	5.60	31.25	17.92
3	A1	11.04	46.40	40.77	5.63	29.73	18.94
4	A2	11.00	47.79	41.83	5.96	30.83	19.33
5	A8	11.15	38.28	33.52	4.76	22.37	21.28
6	B5	11.08	48.65	42.43	6.22	31.35	19.84
7	B1	11.16	42.53	37.94	4.64	26.78	17.33
8	B2	11.16	59.24	52.37	6.87	41.21	16.67
9	B6	11.10	43.25	37.98	5.27	26.83	19.61
10	B12	11.09	57.64	50.26	7.38	39.17	18.84
11	A6	10.95	54.45	47.37	7.08	36.42	19.44
12	B3	11.12	43.08	38.16	4.92	27.04	18.20
13	B4	11.11	43.47	38.23	5.24	27.12	19.32
14	A4	11.15	44.46	38.29	5.17	27.14	19.05
15	A5	10.90	52.12	45.75	6.37	34.85	18.28

May 8, 2001 samples

Drying Can No.	B12	A6	A2	B4	B2	A8	A5	A4	B3	A1	A9
Mass of can (g)	11.09	10.96	11.00	11.12	11.17	11.15	10.90	11.15	11.12	11.06	11.17
Mass of wet soil + can (g)	45.37	39.58	41.56	35.39	34.79	40.25	42.21	38.55	39.45	35.52	33.00
Mass of dry soil + can (g)	40.21	35.07	36.52	31.61	30.78	36.10	37.50	34.41	35.31	31.99	29.66
Water content (%)	17.7	18.7	19.7	18.4	20.4	16.6	17.7	17.8	17.1	16.9	18.1
Wet Density	123.7	120.2	127.5	118.7	124.9	127.6	127.8	117.0	125.7	124.4	117.7
Dry Density	105.0	101.3	106.5	100.2	103.7	109.4	108.6	99.3	107.4	106.4	99.7

Test

1 2 3 4 5 6 7 8 9 10 11

Mass of dry soil (g) 29.12
Mass of water (g) 5.16



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CLIENT _____ JOB NO. 100548-2 PAGE _____ OF _____
PROJECT _____ DATE 12 MAR 02 DATE CHECKED _____
DETAIL _____ COMPUTED BY CLS CHECKED BY _____

CHECK OF MOISTURE CONTENT MEASUREMENTS FROM MAY 10, 2001 SAMPLES

SAMPLE / TEST		DISH	DISH WT (g)	WET SOIL ± DISH (g)	DRY SOIL ± DISH (g)	MOISTURE WT (g)	DRY SOIL WT (g)	W (%)
10 MAY 01	1	B1	11.16	47.79	41.76	6.03	30.60	19.71
	2	B2	11.16	41.51	36.12	5.39	24.96	21.59
	3	B3	11.12	44.51	39.59	4.92	23.47	17.23
	4	B4	11.11	43.15	42.57	5.58	31.46	17.74
	5	B5	11.08	45.37	39.45	5.92	28.37	20.87
	6	B6	11.09	48.04	42.61	5.43	31.52	17.23
	7	B7	11.12	45.11	39.88	5.23	23.76	18.18
	8	B8	11.09	47.84	43.30	4.54	32.21	14.10
	9	B9	11.10	44.41	39.09	5.32	27.99	19.01
	10	B10	11.15	53.33	48.49	4.84	37.34	12.96
	11	B11	11.08	45.42	40.50	4.92	29.42	16.72
	12	B12	11.09	45.10	40.16	4.94	29.07	16.99
	13	A1	11.04	49.21	43.91	5.30	32.87	16.12
	14	A2	11.00	45.13	40.76	4.37	29.76	14.63
	15	A3	10.93	37.92	33.74	4.18	22.81	18.33

May 15, 2001 Samples

Drying Can No.	B1	B2	B3	B4	B5	B6	B7	B8
Mass of can (g)	11.16	11.16	11.12	11.11	11.08	11.09	11.12	11.10
Mass of wet soil + can (g)	47.77	49.98	49.90	39.18	39.99	55.51	50.88	49.79
Mass of dry soil + can (g)	42.65	44.33	44.37	35.36	35.75	49.68	45.57	43.49
Water content (%)	16.3	17.0	16.6	15.8	17.2	15.1	15.4	19.5
Wet Density	124.6	131.7	124.5	127.5	119.6	118.1	117.9	115.2
Dry Density	107.2	112.5	106.8	110.2	102.0	102.6	102.1	96.4

Test

1

2A

3

4

5

6

7

8



SHEPHERD MILLER
INCORPORATED

CLIENT _____ JOB NO. 100548-2 PAGE _____ OF _____
PROJECT _____ DATE 12 MAR 02 DATE CHECKED _____
DETAIL _____ COMPUTED BY CLS CHECKED BY _____

CHECK OF MOISTURE CONTENT MEASUREMENTS FROM MAY 17 & 22, 2001 SAMPLES

SAMPLE / TEST	DISH	DISH WT(g)	WET SOIL & DISH(g)	DRY SOIL & DISH(g)	MOISTURE WT(g)	DRY SOIL WT(g)	W (%)
17 MAY 01	1 A1	11.05	46.64	41.33	5.31	30.28	17.54
	2 A2	11.00	47.52	42.29	5.23	31.29	16.71
	3 A3	10.93	53.38	48.02	5.36	37.09	14.45
	4 A4	11.14	50.58	45.52	5.06	34.38	14.72
	5 A5	10.99	47.37	43.07	4.30	32.18	13.36
	6 A6	10.96	55.05	49.08	5.97	38.12	15.66
	7 A7	11.06	52.20	46.52	5.68	35.46	16.02
	8 A8	11.15	43.31	39.04	4.37	27.89	17.46
	9 A9	11.17	51.49	45.76	5.73	34.59	16.57
	10 A10	11.03	54.95	49.07	5.88	38.04	15.46
	11 A11	11.03	52.71	47.68	5.03	36.65	13.72
	12 A12	11.04	56.00	50.58	5.42	39.54	13.71
	13 B9	11.09	45.14	40.70	4.44	29.61	14.99
	14 B10	11.16	48.73	43.00	5.73	31.84	18.00
	15 B11	11.07	49.42	44.01	5.41	32.94	16.42
	16 B12	11.08	43.98	38.95	5.03	27.87	18.05
22 MAY 01	1 A1	11.05	58.31	51.42	6.89	40.37	17.07
	2 A2	11.01	54.67	47.94	6.73	36.93	18.22
	3 A3	10.93	52.54	46.62	5.92	35.69	16.59
	4 A4	11.15	57.55	51.23	6.32	40.08	15.77
	5 A5	10.90	54.53	48.00	6.53	37.10	17.60
	6 A6	10.95	59.64	53.65	5.99	42.70	14.03
	7 A7	11.07	57.92	52.64	7.08	41.57	17.03
	8 A8	11.14	57.38	51.75	5.63	40.61	13.86
	9 A9	11.18	65.03	59.70	5.33	48.52	10.99
	10 A10	11.02	57.19	51.17	6.02	40.15	15.00
	11 A11	11.04	57.60	51.14	6.46	40.10	16.11
	12 A12	11.05	55.13	48.18	6.95	37.13	18.72
	13 B1	11.17	57.57	50.47	7.10	39.30	18.07
	14 B2	11.17	57.21	50.28	6.93	39.11	17.72
	15 B3	11.12	60.81	53.00	7.81	41.88	18.65
	16 B4	11.12	51.66	45.67	5.99	34.55	17.34

APPENDIX D-3
SAND CALIBRATION TESTS

SAND CONE CALIBRATION

Cone No. *Bobby*
Type of Sand: Ottawa 16-30

Calibration By: *J. Coleman*

Date: *10-Aug-00*

Calibration of Cone and Template: Total No. of Trials (recommend 3 minimum): **5**

Trial	Units	1	2	3	4	5	avg.
Initial Wieght (W_i)	<i>grams</i>	7008.6	5327.6	6262.3	4569.5	5249	
Final Weight (W_f)	<i>grams</i>	5327.6	3640.7	4578.9	2888.7	3564.8	
$W_c (=W_i - W_f)$	<i>grams</i>	1681	1678.2	1683.4	1680.8	1684.2	1681.5

Sand Density Calibration: Total No. of Trials (recommend 3 minimum): **5**

Trial	Units	1	2	3	4	5	avg.
Initial Wieght (W_i)	<i>grams</i>	6562.4	6268.1	6535.6	6996.6	7076.8	
Final Weight (W_f)	<i>grams</i>	1690.4	1401.2	1704.6	2101.6	2216.9	
W_c (from above)	<i>grams</i>	1681.5	1681.5	1681.5	1681.5	1681.5	
$W_s (= W_i - W_f - W_c)$	<i>grams</i>	3190.5	3185.4	3149.5	3213.5	3178.4	
Mold Volume	<i>ft.³</i>	0.075	0.075	0.075	0.075	0.075	
Sand Density	<i>pcf</i>	93.78	93.63	92.58	94.46	93.43	93.58



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CLIENT _____ JOB NO. 100548-2 PAGE _____ OF _____
PROJECT _____ DATE 9 Apr 01 DATE CHECKED _____
DETAIL _____ COMPUTED BY CLS CHECKED BY _____

SAND CONE CALIBRATION - density of new sand

Weight of 6" Proctor mold 6585 g

Weight of mold + sand

trial 1	9875 g
2	9870 g
3	9835 g

Weight of sand

trial 1	3290 g	} 3292 g average
2	3285 g	
3	3300 g	

$$3292 \text{ g sand} \times \frac{1 \text{ lb}}{454 \text{ g}} = 7.25 \text{ lb sand}$$

$$\gamma = \frac{7.25 \text{ lb}}{0.075 \text{ ft}^3} = 96.67 \text{ pcf}$$

$$\text{Weight of sand in cone (10 Aug 00 calibration)} = 1681.5 \text{ g} = 3.70 \text{ lb}$$

$$\begin{aligned} \text{Volume of sand in cone (10 Aug 00 calibration)} &= 3.70 \text{ lb} / 93.6 \text{ lb/ft}^3 \\ &= 0.0396 \text{ ft}^3 \end{aligned}$$

$$\begin{aligned} \text{Weight of sand in cone (9 Apr 01 sand density)} &= 96.67 \text{ lb/ft}^3 \cdot 0.0396 \text{ ft}^3 \\ &= 3.83 \text{ lb} \end{aligned}$$



SHEPHERD MILLER
INCORPORATED

CLIENT _____ JOB NO. 100548-2 PAGE _____ OF _____

PROJECT _____ DATE 12 Apr 01 DATE CHECKED _____

DETAIL _____ COMPUTED BY CLS CHECKED BY _____

SAND CONE CALIBRATION - density of new sand

I. SAND CONE DENSITY

Weight of 6" dia Proctor mold = 14.51 lb

Weight of filled Proctor mold

① 21.72 lb

② 21.69 lb

③ 21.73 lb

Weight of sand in Proctor mold

① 21.72 - 14.51 = 7.21 lb

② 21.69 - 14.51 = 7.18 lb

③ 21.73 - 14.51 = 7.22 lb

① Weight of cone + jug

14.98
7.78
<hr/> 7.20 lb

AVERAGE 7.20 lb

$$\gamma = \frac{7.20 \text{ lb}}{0.075 \text{ ft}^3} = 96.0 \text{ pcf}$$

II Weight of Sand in cone

AVERAGE 3.76 lb

Weight of cone + jug (initial)

15.28 lb

11.51 lb

7.78 lb

(final)

11.51 lb

7.78 lb

4.01 lb

Weight of sand in cone

3.77 lb

3.75 lb

3.77 lb

$$\text{Volume of Sand in cone} = 3.76 / 96.0 = 0.0392 \text{ ft}^3$$

SAND CONE CALIBRATION

Cone No. Bobby

Calibration By: M.Davis Date: 11-May-01

Type of Sand:

Calibration of Cone and Template: Total No. of Trials (recommend 3 minimum): 3

Trial	Units	1	2	3	4	5	avg.
Initial Wiegth (Wi)	lbs	14.98	11.57	8.15			
Final Weight (Wf)	lbs	11.57	8.15	4.75			
Wc (=Wi - Wf)	lbs	3.41	3.42	3.40			3.41

Sand Density Calibration: Total No. of Trials (recommend 3 minimum): 3

Trial	Units	1	2	3	4	5	avg.
Initial Wiegth (Wi)	lbs	13.49	14.12	14.42			
Final Weight (Wf)	lbs	2.9	3.55	3.82			
Wc (from above)	lbs	3.41	3.41	3.41			
Ws (= Wi - Wf - Wc)	lbs	7.18	7.16	7.19			
Mold Volume	ft.3	0.075	0.075	0.075			
Sand Density	pcf	95.73	95.47	95.87			95.69

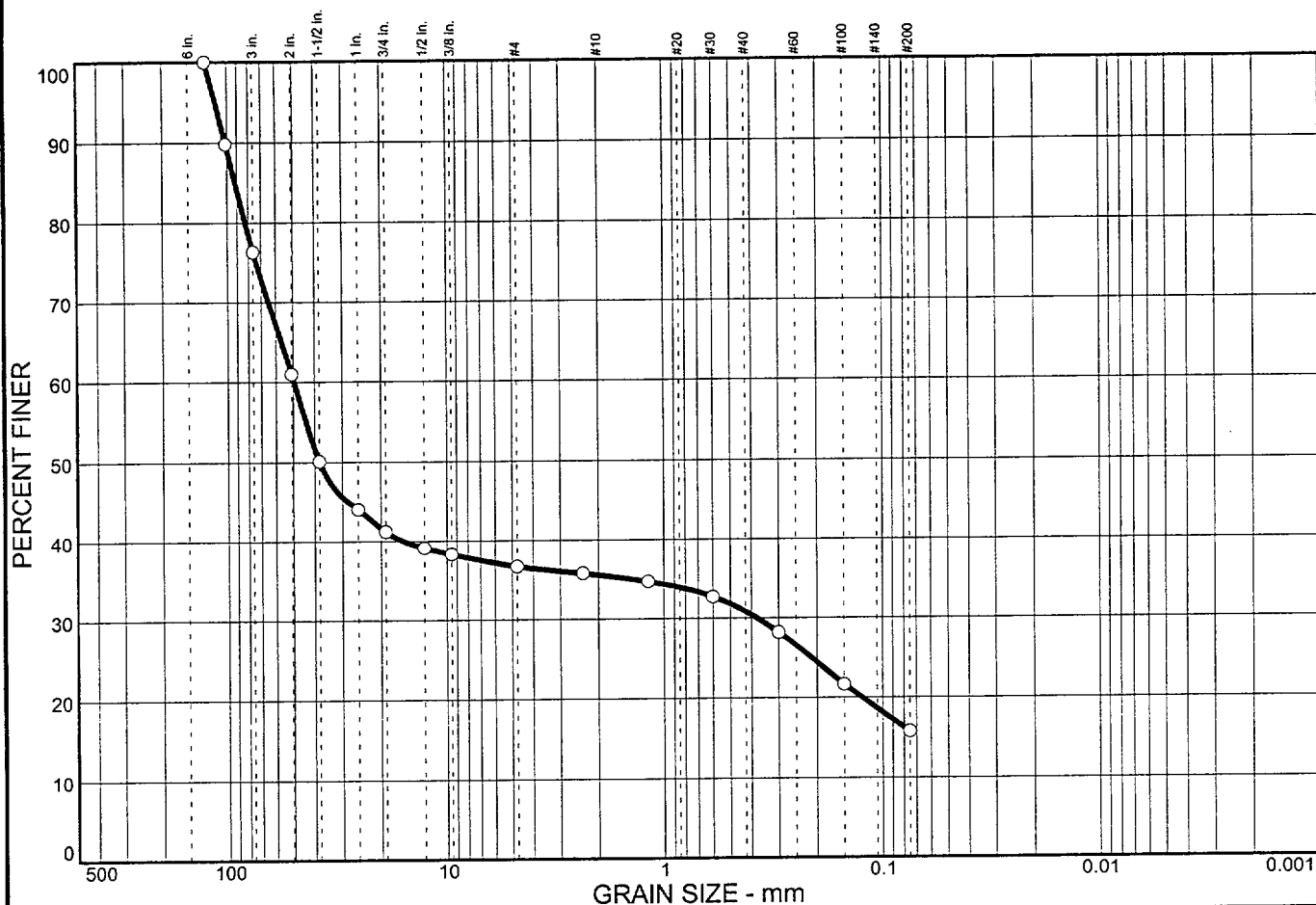
APPENDIX E

EROSION PROTECTION MATERIAL TEST RESULTS

APPENDIX E-1

PARTICLE-SIZE DISTRIBUTION

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
23.7	39.6	20.9	15.8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
5 in.	100.0		
4 in.	89.8		
3 in.	76.3		
2 in.	61.0		
1.5 in.	50.1		
1 in.	44.0		
.75 in.	41.2		
.5 in.	39.1		
.375 in.	38.3		
#4	36.7		
#8	35.8		
#16	34.7		
#30	32.7		
#50	28.2		
#100	21.7		
#200	15.8		

Soil Description

Atterberg Limits

PL= LL= PI=

Coefficients

D₈₅= 92.0 D₆₀= 49.5 D₅₀= 38.0
D₃₀= 0.378 D₁₅= D₁₀=
C_u= C_c=

Classification

USCS= AASHTO=

Remarks

* (no specification provided)

Sample No.: 1
Location:

Source of Sample: LFCT 3

Date: 09/14/01
Elev./Depth:

**SMITH
GEOTECHNICAL**

Client: Shepherd Miller, Inc.

Project: SMI 100548

Project No: 01.026T

Figure

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
16.6	42.3	24.9	16.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
5 in.	100.0		
4 in.	87.1		
3 in.	83.4		
2 in.	69.1		
1.5 in.	55.3		
1 in.	46.5		
.75 in.	45.2		
.5 in.	43.4		
.375 in.	42.6		
#4	41.1		
#8	39.7		
#16	38.3		
#30	36.1		
#50	30.6		
#100	24.3		
#200	16.2		

* (no specification provided)

Soil Description

Atterberg Limits
 PL= LL= PI=

Coefficients
 D₈₅= 92.9 D₆₀= 42.4 D₅₀= 32.1
 D₃₀= 0.280 D₁₅= D₁₀=
 C_u= C_c=

Classification
 USCS= AASHTO=

Remarks

Sample No.: 1
Location:

Source of Sample: LFCT 4

Date: 09/14/01
Elev./Depth:

**SMITH
GEOTECHNICAL**

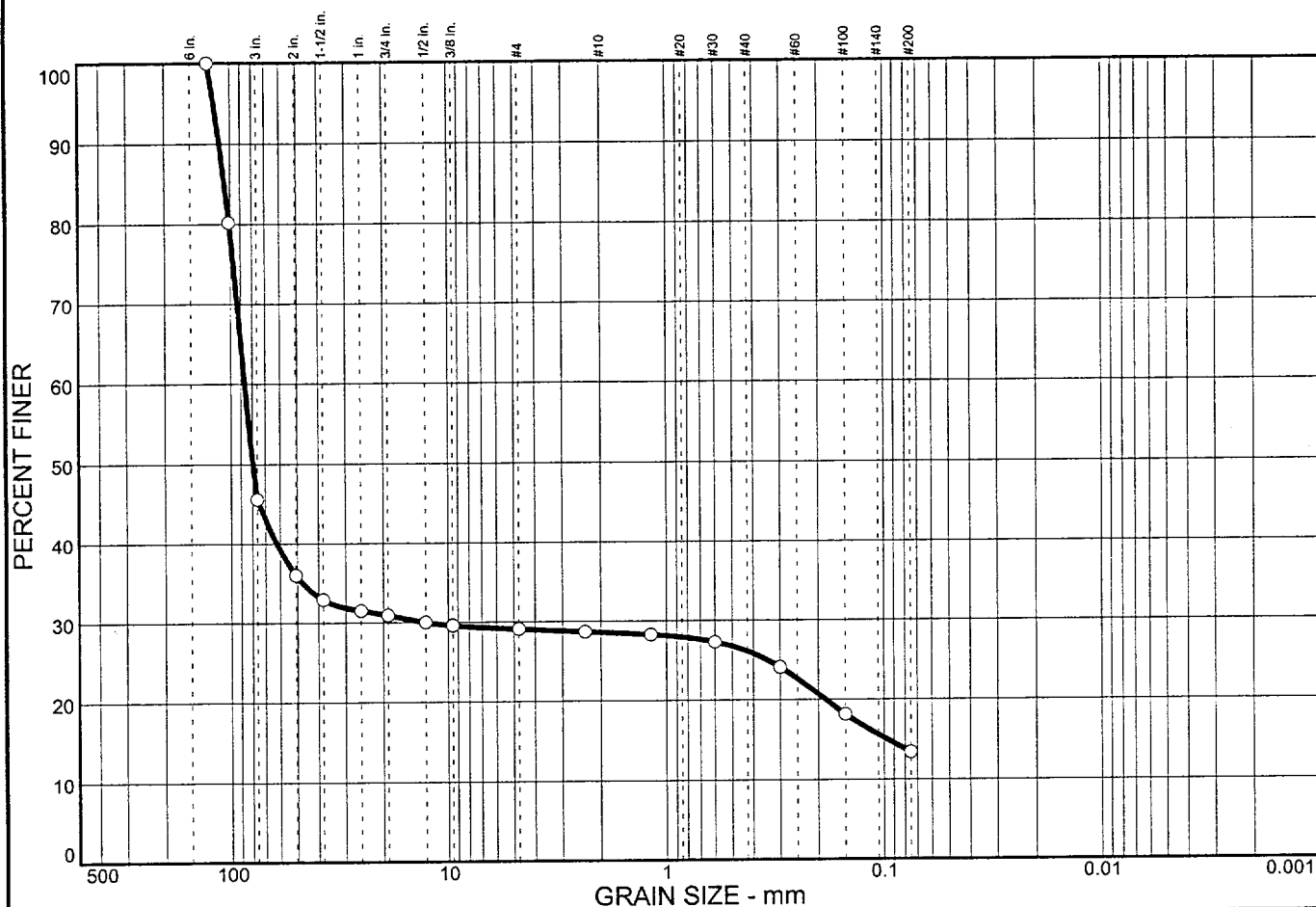
Client: Shepherd Miller, Inc.

Project: SMI 100548

Project No: 01.026T

Figure

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
54.4	16.5	15.7	13.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
5 in.	100.0		
4 in.	80.2		
3 in.	45.6		
2 in.	36.0		
1.5 in.	32.9		
1 in.	31.5		
.75 in.	30.9		
.5 in.	30.0		
.375 in.	29.6		
#4	29.1		
#8	28.7		
#16	28.3		
#30	27.3		
#50	24.1		
#100	18.2		
#200	13.4		

* (no specification provided)

Soil Description

Atterberg Limits
 PL= LL= PI=

Coefficients
 D₈₅= 106.3 D₆₀= 86.7 D₅₀= 79.7
 D₃₀= 12.7 D₁₅= 0.0964 D₁₀=
 C_u= C_c=

Classification
 USCS= AASHTO=

Remarks

Sample No.: 1
Location:

Source of Sample: LFCT 6

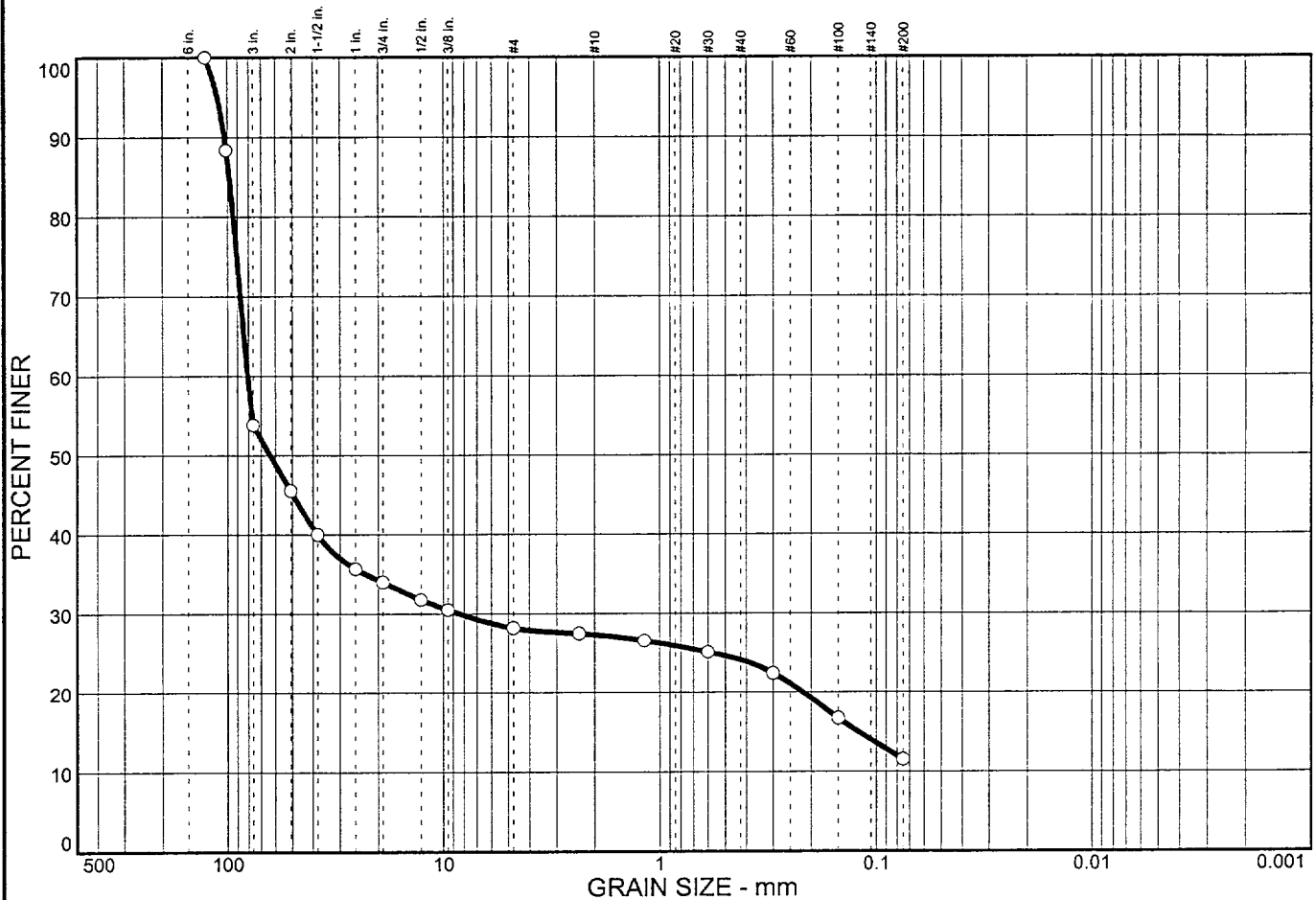
Date: 09/14/01
Elev./Depth:

**SMITH
GEOTECHNICAL**

Client: Shepherd Miller, Inc.
Project: SMI 100548
Project No: 01.026T

Figure

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
46.2	25.6	16.7	11.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
5 in.	100.0		
4 in.	88.3		
3 in.	53.8		
2 in.	45.5		
1.5 in.	40.0		
1 in.	35.7		
.75 in.	34.0		
.5 in.	31.8		
.375 in.	30.5		
#4	28.2		
#8	27.5		
#16	26.6		
#30	25.1		
#50	22.4		
#100	16.7		
#200	11.5		

* (no specification provided)

Soil Description

Atterberg Limits
 PL= LL= PI=

Coefficients
 D₈₅= 98.4 D₆₀= 80.8 D₅₀= 63.5
 D₃₀= 8.43 D₁₅= 0.121 D₁₀=
 C_u= C_c=

Classification
 USCS= AASHTO=

Remarks

Sample No.: 1
Location:

Source of Sample: LFCT 7

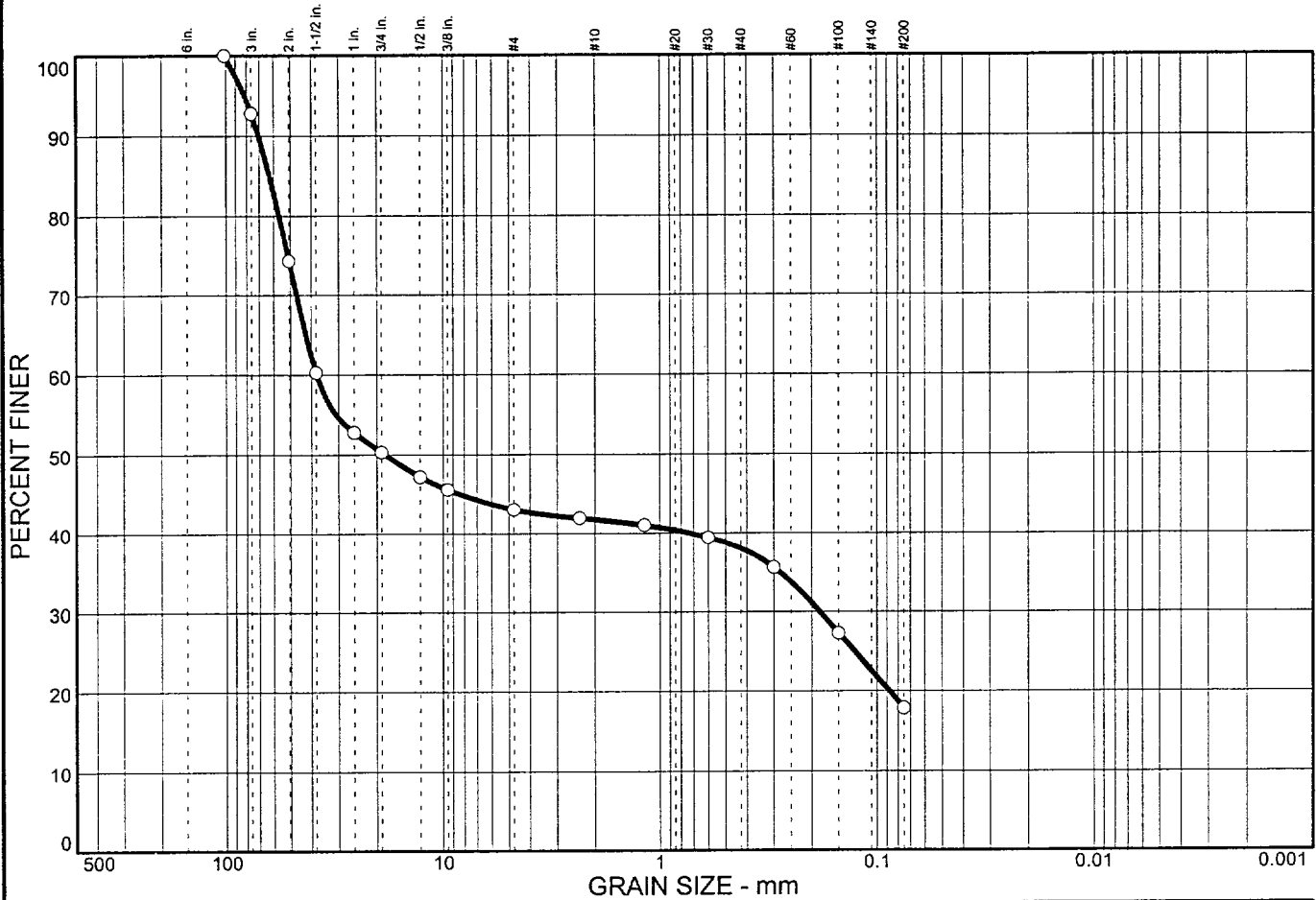
Date: 09/14/01
Elev./Depth:

**SMITH
GEOTECHNICAL**

Client: Shepherd Miller, Inc.
Project: SMI 100548
Project No: 01.026T

Figure

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
7.2	49.8	25.1	17.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
4 in.	100.0		
3 in.	92.8		
2 in.	74.3		
1.5 in.	60.3		
1 in.	52.8		
.75 in.	50.3		
.5 in.	47.2		
.375 in.	45.6		
#4	43.0		
#8	41.9		
#16	41.0		
#30	39.4		
#50	35.6		
#100	27.3		
#200	17.9		

* (no specification provided)

Soil Description

Atterberg Limits
 PL= LL= PI=

Coefficients
 D₈₅= 62.8 D₆₀= 37.8 D₅₀= 18.4
 D₃₀= 0.184 D₁₅= D₁₀=
 C_u= C_c=

Classification
 USCS= AASHTO=

Remarks

Sample No.: 1
Location:

Source of Sample: LFCT 8

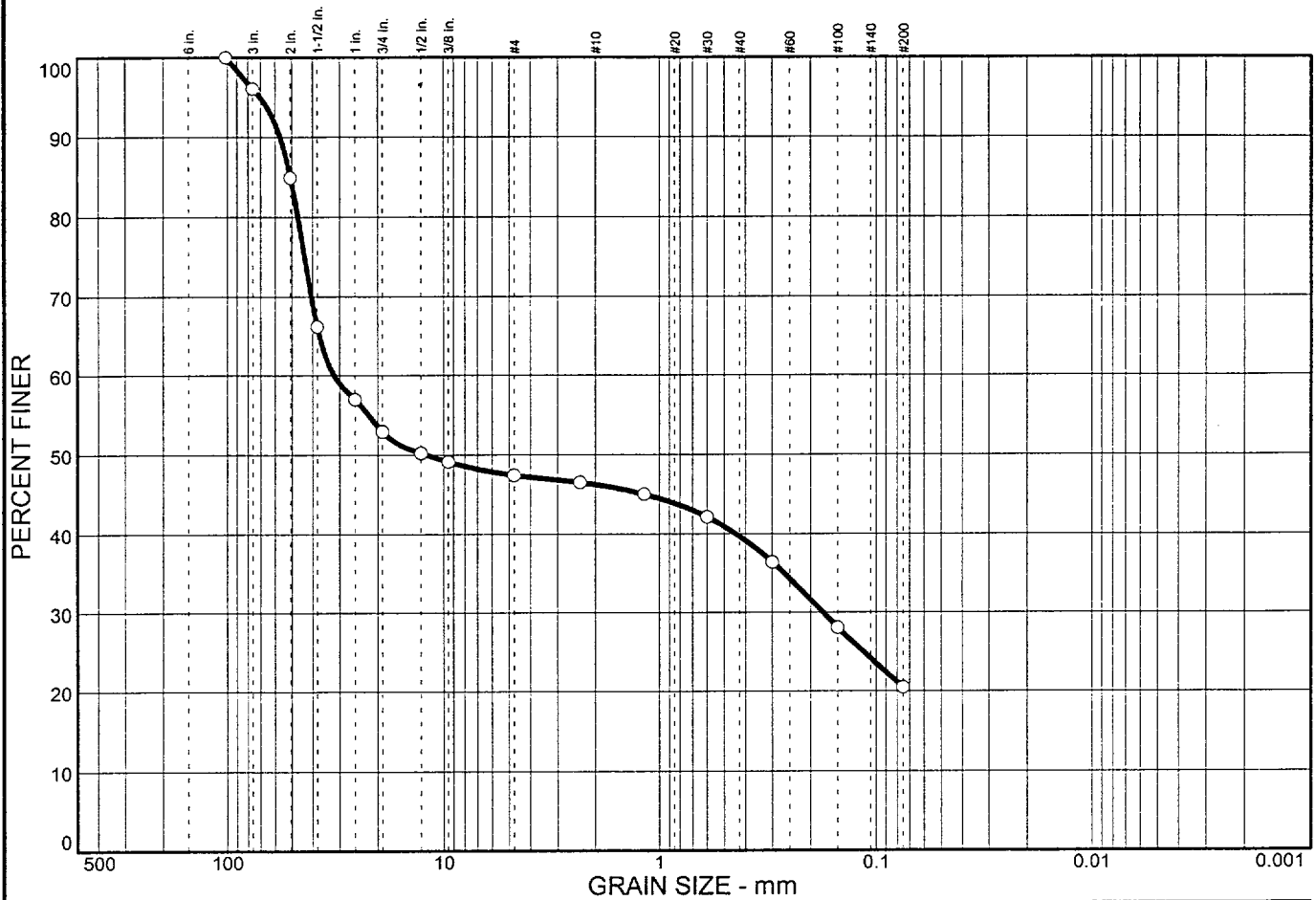
Date: 09/14/01
Elev./Depth:

**SMITH
GEOTECHNICAL**

Client: Shepherd Miller, Inc.
Project: SMI 100548
Project No: 01.026T

Figure

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
3.9	48.7	26.9	20.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
4 in.	100.0		
3 in.	96.1		
2 in.	84.9		
1.5 in.	66.2		
1 in.	57.0		
.75 in.	52.9		
.5 in.	50.2		
.375 in.	49.1		
#4	47.4		
#8	46.5		
#16	45.0		
#30	42.1		
#50	36.4		
#100	28.1		
#200	20.5		

* (no specification provided)

Soil Description

Atterberg Limits
 PL= LL= PI=

Coefficients
 D₈₅= 50.9 D₆₀= 31.8 D₅₀= 12.1
 D₃₀= 0.175 D₁₅= D₁₀=
 C_u= C_c=

Classification
 USCS= AASHTO=

Remarks

Sample No.: 1
Location:

Source of Sample: LFCT 9

Date: 09/14/01
Elev./Depth:

**SMITH
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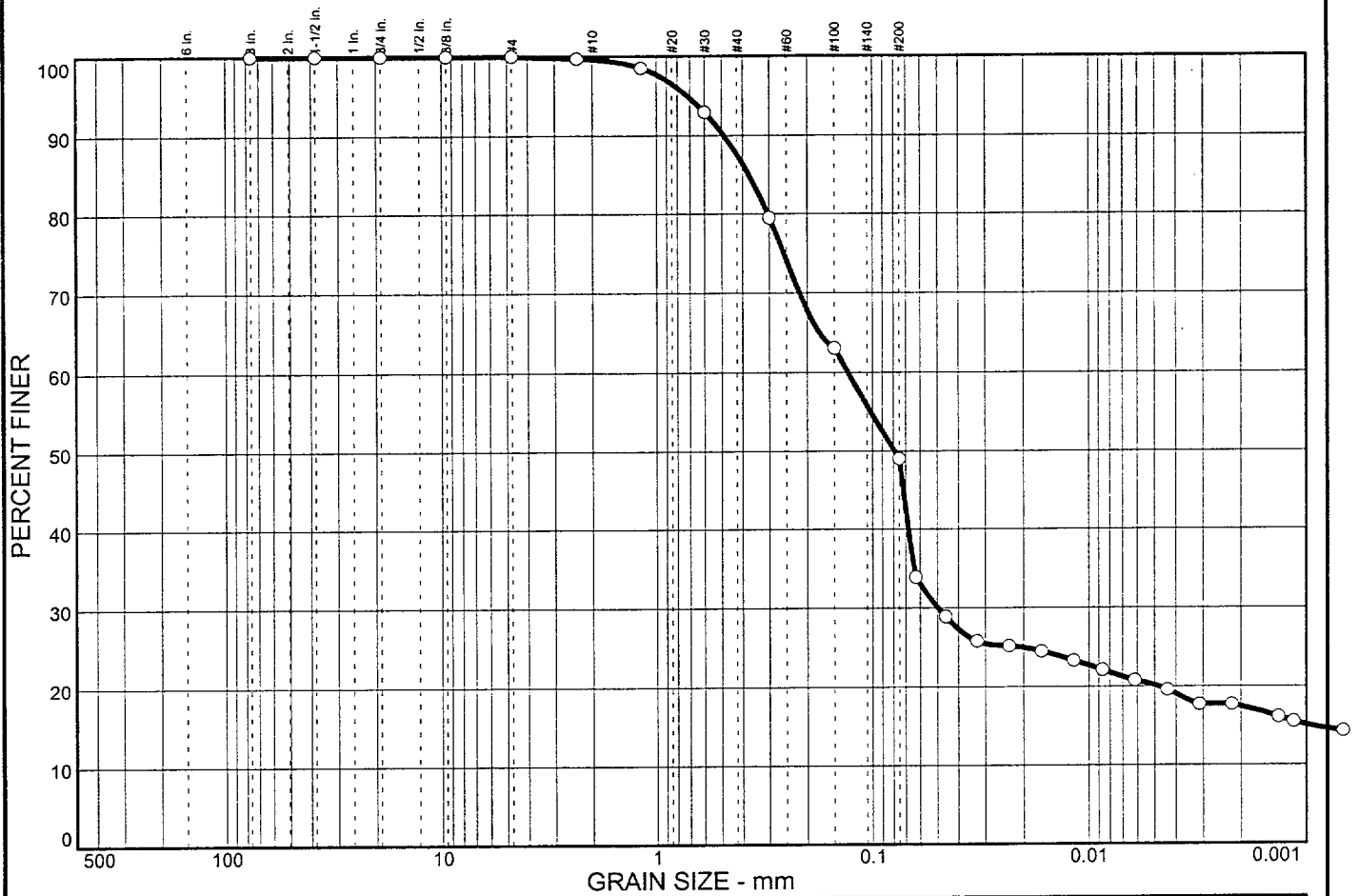
Client: Shepherd Miller, Inc.

Project: SMI 100548

Project No: 01.026T

Figure

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	51.0	28.8	20.2

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3 in.	100.0		
1.5 in.	100.0		
.75 in.	100.0		
.375 in.	100.0		
#4	100.0		
#8	99.7		
#16	98.5		
#30	92.9		
#50	79.5		
#100	63.1		
#200	49.0		

* (no specification provided)

Soil Description

Atterberg Limits
 PL= LL= PI=

Coefficients
 D₈₅= 0.375 D₆₀= 0.130 D₅₀= 0.0791
 D₃₀= 0.0496 D₁₅= 0.0010 D₁₀=
 C_u= C_c=

Classification
 USCS= AASHTO=

Remarks

Sample No.: 1
Location:

Source of Sample: U.A.F.

Date: 09/10/01
Elev./Depth:

**SMITH
GEOTECHNICAL**

Client: SMI
Project: SMI 100548
Project No: 01.026T

Figure

APPENDIX E-2
ROCK DURABILITY

DURABILITY TEST ANALYSIS

HIGHLAND RECLAMATION PROJECT TAILINGS BASIN
LOW-FLOW CHANNEL ROCK

SAMPLE NAME

LFCT 3 & 4

SAMPLE DATE

Aug-01

ROCK TYPE

IGNEOUS

TEST AND METHOD	ASTM METHOD	TEST VALUE	SCORE(a)	WEIGHTING FACTOR(b)	TOTAL VALUE(c)	MAXIMUM VALUE
Specific gravity	C-127	2.76	10	9	90	90
Absorbtion (%)	C-127	0.4	8.5	2	17	20
Sodium sulfate soundness (% loss)	C-88	0	10	11	110	110
Schmidt hammer rebound (%)	C-805	27	3.5	3	10.5	30
LA abrasion (100 revolutions) (% loss)	C-535	not tested	0	1	0	0
TOTAL					227.5	250
ROCK QUALITY (%)					91.0	

(a) Interpolated from Table D-1 of NRC (1990)

(b) From Table D-1 of NRC (1990) and DuPuy (1965), for rock type listed above

(c) Product of score and weighting factor

DURABILITY TEST ANALYSIS

HIGHLAND RECLAMATION PROJECT TAILINGS BASIN
LOW-FLOW CHANNEL ROCK

SAMPLE NAME

LFCT 6 & 7

SAMPLE DATE

Aug-01

ROCK TYPE

IGNEOUS

TEST AND METHOD	ASTM METHOD	TEST VALUE	SCORE(a)	WEIGHTING FACTOR(b)	TOTAL VALUE(c)	MAXIMUM VALUE
Specific gravity	C-127	2.7	9	9	81	90
Absorbtion (%)	C-127	0.4	8.5	2	17	20
Sodium sulfate soundness (% loss)	C-88	0	10	11	110	110
Schmidt hammer rebound (%)	C-805	35	4.5	3	13.5	30
LA abrasion (100 revolutions) (% loss)	C-535	not tested	0	1	0	0
TOTAL					221.5	250
ROCK QUALITY (%)					88.6	

(a) Interpolated from Table D-1 of NRC (1990)

(b) From Table D-1 of NRC (1990) and DuPuy (1965), for rock type listed above

(c) Product of score and weighting factor

DURABILITY TEST ANALYSIS

HIGHLAND RECLAMATION PROJECT TAILINGS BASIN

LOW-FLOW CHANNEL ROCK

SAMPLE NAME

LFCT 8 & 9

SAMPLE DATE

Aug-01

ROCK TYPE

IGNEOUS

TEST AND METHOD	ASTM METHOD	TEST VALUE	SCORE(a)	WEIGHTING FACTOR(b)	TOTAL VALUE(c)	MAXIMUM VALUE
Specific gravity	C-127	2.68	8.6	9	77.4	90
Absorbtion (%)	C-127	0.7	6.8	2	13.6	20
Sodium sulfate soundness (% loss)	C-88	0	10	11	110	110
Schmidt hammer rebound (%)	C-805	30	3.8	3	11.4	30
LA abrasion (100 revolutions) (% loss)	C-535	not tested	0	1	0	0
TOTAL					212.4	250
ROCK QUALITY (%)					85.0	

(a) Interpolated from Table D-1 of NRC (1990)

(b) From Table D-1 of NRC (1990) and DuPuy (1965), for rock type listed above

(c) Product of score and weighting factor

Physical Properties of Aggregates

301 North Howes
Fort Collins, Colorado 80521
(970) 484 - 0359
(970) 484 - 0454

Client Name: Shepard Miller Inc.
Address: 3801 Automation Way, STE 100
Fort Collins, CO 80525

Attn: Clint Strachan

Project Name: Durability Testing

Location: SMI Project No.100548

Project No.: 20016335 Date of Report: 24-Oct-01

Sample I.D.# or Description:
LFCT-3 & LFCT-4

Aggregate Source:
Not Reported

Aggregate Type:
Coarse Aggregate

Sampled By: Client Date: Not Reported

Submitted By: Client Date: 19-Sep-01

Reviewed By: Mike L. Walker

Sieve Analysis, ASTM C136				Test Standards are ASTM unless otherwise indicated			
Sieve Size	X Passing Retained	Specification		Test	Standard	Results	Specification
	% Accumulative	Min.	Max.				
6"				Fineness Modulus	C125		
5"				Dry Rodded Unit Wt, pcf	C29		
4"				Lightweight Pieces, %	C123		
3"	100			Clay Lumps & Friable, %	C142		
2"	75			Organic Impurities	C40		
1-1/2"	38			Sand Equivalent Value	C2419		
1"	8			LA Abrasion, % Grade	C131		
3/4"				Soundness-Mg, %loss	C88		
1/2"				Soundness-Na, %loss	C88	0	
3/8"				Fractured Face, % by Wt.			
#4				One or more			
#8				Two or more			
#10				Liquid Limit	D4318		
#16				Plasticity Index	D4318		
#20				Schmidt Hammer Rebound	C805	27	
#30							
#40							
#50							
#80							
#100							
#200							
				Specific Gravity	Absorption, %	C127	0.4
					Bulk (Dry)	C127	2.76
					Bulk (SSD)	C127	2.78
					Apparent	C127	2.80

Comments: Soundness test is a composite sample of LFCT-3, LFCT-4, LFCT-6, LFCT-7, LFCT-8 & LFCT-9

Copies to:

Physical Properties of Aggregates

301 North Howes
Fort Collins, Colorado 80521
(970) 484 - 0359
(970) 484 - 0454

Client Name: Shepard Miller Inc.
Address: 3801 Automation Way, STE 100
Fort Collins, CO 80525

Project No.: 20016335 Date of Report: 24-Oct-01

Sample I.D.# or Description:
LFCT-8 & LFCT-9

Attn: Clint Strachan

Project Name: Durability Testing

Aggregate Source:

Location: SMI Project No.100548

Not Reported

Aggregate Type:

Sampled By: Client Date: Not Reported

Coarse Aggregate

Submitted By: Client Date: 19-Sep-01

Reviewed By: Mike L. Walker

Sieve Analysis, ASTM C136					Test Standards are ASTM unless otherwise indicated				
Sieve Size	X	Passing Retained	Specification		Test	Standard	Results	Specifi- cation	
			Min.	Max.					
		% Accumulative							
6"					Fineness Modulus	C125			
5"					Dry Rodded Unit Wt, pcf	C29			
4"					Lightweight Pieces, %	C123			
3"		100			Clay Lumps & Friable, %	C142			
2"		80			Organic Impurities	C40			
1-1/2"		37			Sand Equivalent Value	C2419			
1"		11			LA Abrasion, % Grade	C131			
3/4"					Soundness-Mg, %loss	C88			
1/2"					Soundness-Na, %loss	C88	0		
3/8"					Fractured Face, % by Wt.				
#4					One or more				
#8					Two or more				
#10					Liquid Limit	D4318			
#16					Plasticity Index	D4318			
#20					Schmidt Hammer Rebound	C805	30		
#30									
#40									
#50									
#80									
#100									
#200									
					Specific Gravity	Absorption, %	C127	0.7	
						Bulk (Dry)	C127	2.68	
						Bulk (SSD)	C127	2.70	
						Apparent	C127	2.73	

Comments: Soundness test is a composite sample of LFCT-3, LFCT-4, LFCT-6, LFCT-7, LFCT-8 & LFCT-9

Copies to:

Physical Properties of Aggregates

301 North Howes
Fort Collins, Colorado 80521
(970) 484 - 0359
(970) 484 - 0454

Client Name: Shepard Miller Inc.
Address: 3801 Automation Way, Ste. 100
Fort Collins, CO 80525

Project No.: 20016335 Date of Report: 23-Nov-01

Sample I.D.# or Description:

Attn: Clint Strachan

Project Name: Durability Testing

Aggregate Source:

Location: Lysite

Lysite Pit (potential additional source)

Aggregate Type:

Sampled By: Client Date: Not Reported

Coarse Aggregate

Submitted By: Client Date: 5-Nov-01

Reviewed By: Mike L. Walker

Sieve Analysis, ASTM C136				Test Standards are ASTM unless otherwise indicated			
Sieve Size	X Passing Retained	Specification		Test	Standard	Results	Specifi- cation
		Min.	Max.				
	% Accumulative						
6"				Fineness Modulus	C125		
5"				Dry Rodded Unit Wt, pcf	C29		
4"				Lightweight Pieces, %	C123		
3"	100			Clay Lumps & Friable, %	C142		
2-1/2"	73			Organic Impurities	C40		
2"	52			Sand Equivalent Value	C2419		
1-1/2"	29			LA Abrasion, % (100 Rev) Grade 1	C535	3.9	
1"	15			Soundness-Mg, %loss	C88		
3/4"	11			Soundness-Na, %loss	C88	0	
1/2"	7.5			Fractured Face, % by Wt.			
3/8"				One or more			
#4				Two or more			
#8				Liquid Limit	D4316		
#10				Plasticity Index	D4318		
#16				Schmidt Hammer Rebound	C805	18	
#20							
#30							
#40							
#50							
#80							
#100							
#200							
				Absorption, %	C127	1.7	
				Bulk (Dry)	C127	2.50	
				Bulk (SSD)	C127	2.54	
				Apparent	C127	2.61	

Comments:

Copies to:

Physical Properties of Aggregates

301 North Howes
Fort Collins, Colorado 80521
(970) 484 - 0359
(970) 484 - 0454

Client Name: Shepard Miller Inc.
Address: 3801 Automation Way, Ste. 100
Fort Collins, CO 80525

Project No.: 20016335 Date of Report: 23-Nov-01
Sample I.D.# or Description:

Attn: Clint Strachan
Project Name: Durability Testing
Location: Arlington

Aggregate Source:
Arlington Pit (potential additional source)
Aggregate Type:

Sampled By: Client Date: Not Reported
Submitted By: Client Date: 5-Nov-01

Coarse Aggregate
Reviewed By: Mike L. Walker

Sieve Analysis, ASTM C136				Test Standards are ASTM unless otherwise indicated			
Sieve Size	X Passing Retained % Accumulative	Specification		Test	Standard	Results	Specifi- cation
		Min.	Max.				
6"				Fineness Modulus	C125		
5"				Dry Rodded Unit Wt, pcf	C29		
4"				Lightweight Pieces, %	C123		
3"	100			Clay Lumps & Friable, %	C142		
2-1/2"	48			Organic Impurities	C40		
2"	26			Sand Equivalent Value	C2419		
1-1/2"	13			LA Abrasion, % (100 Rev) Grade 1	C535	1.7	
1"	7			Soundness-Mg, %loss	C88		
3/4"	5			Soundness-Na, %loss	C88	0	
1/2"	2.9			Fractured Face, % by Wt.			
3/8"				One or more			
#4				Two or more			
#8				Liquid Limit	D4318		
#10				Plasticity Index	D4318		
#16				Schmidt Hammer Rebound	C805	22	
#20							
#30							
#40							
#50							
#80							
#100							
#200							
				Absorption, %	C127	0.8	
				Bulk (Dry)	C127	2.82	
				Bulk (SSD)	C127	2.84	
				Apparent	C127	2.88	

Comments:

Copies to:

APPENDIX F

TECHNICAL SPECIFICATIONS AND VOLUME ESTIMATES

APPENDIX F-1
TECHNICAL SPECIFICATIONS

TECHNICAL SPECIFICATIONS

(ATTACHMENT B TO CONTRACTOR'S WORK PLAN)

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B.1 SPECIAL PROVISIONS

B.1.1 Scope of Document

The technical specifications provided herein comprise the Specifications for completion of the soil cover over the tailings basin at the reclaimed Highland uranium mill site in Converse County, Wyoming. These Specifications form part of the overall contract for cover completion conducted by contractors selected by and under contract with ExxonMobil. The work described in these Specifications also refers to an associated construction drawing (Drawing 1)

B.1.2 Definitions

For these Specifications, Owner is referred to as ExxonMobil, with overall responsibility for site reclamation.

The Contractor is defined as the group selected by ExxonMobil and responsible for conducting the work tasks outlined in Specification Section B.1.3 under the direction of and under contract with ExxonMobil.

The Field Engineer is defined as the person appointed by ExxonMobil responsible for inspection and quality assurance (QA) testing to ensure that earthmoving operations are conducted as outlined in these Specifications.

The Professional Engineer is defined as a Professional Engineer appointed by ExxonMobil with current registration in Wyoming responsible for ensuring that construction work, inspection and QA testing are conducted according to these Specifications and the intent of the design.

B.1.3 Scope of Work

The work outlined in these Specifications consists of execution of the following tasks associated with completion of the cover over the tailings basin.

- a. Preparation of site areas within the footprint of the area of fill placement, as well as stockpile areas, borrow areas, and haul roads. Preparation may include removal of vegetation; and stripping, salvaging, and stockpiling of topsoil.
- b. Placement and compaction of random fill in designated areas of the tailings basin.
- c. Placement and compaction of cover soils in designated areas of the tailings basin.
- d. Shaping of the reach of low-flow channel through the designated area of the tailings basin, and placement of low-flow channel rock in the reach of low-flow channel.
- e. Placement of topsoil over the cover soils and other areas of disturbance from earthmoving operations.

Revegetation of areas of disturbance is not part of the scope of work outlined in these specifications.

B.1.4 Applicable Regulations and Standards

The work shall conform to applicable regulations, and shall be conducted according to applicable Nuclear Regulatory Commission guidelines for uranium tailings reclamation.

B.1.5 Inspection and Quality Assurance

On-site inspection of earthmoving construction and quality assurance (QA) testing outlined in these Specifications shall be conducted by the Field Engineer (and approved assistants as needed) while the work is in progress. The Field Engineer will be an independent representative of ExxonMobil, appointed by ExxonMobil. The inspection and QA testing conducted by the Field Engineer shall be under the supervision of a Professional Engineer registered in the State of Wyoming.

Documentation of work outlined above shall be recorded by the Field Engineer on a daily basis, as outlined in Specification Section B.1.6. Deviations from the Specifications shall be approved by the Field Engineer prior to initiation of such work.

B.1.6 Construction Documentation

Construction documentation shall be recorded by the Field Engineer on a daily basis, and shall include the items listed below.

- a. Work performed by the Contractor.
- b. QA testing and surveying work conducted.
- c. Discussions with ExxonMobil and the Contractor.
- d. Key decisions, important communications, design modifications, or deviations from specifications.
- e. General comments, including weather conditions, soil surface conditions, and visitors to the site.

A final construction report documenting the as-built conditions will be submitted to the Nuclear Regulatory Commission at the end of construction. This report will be prepared by the Field Engineer and shall include all design modifications or changes to the construction plans or specifications were made during construction.

B.1.7 Environmental Requirements

The Contractor shall store materials, confine equipment, and maintain construction operations according to applicable laws, ordinances, or permits for the project site. Fuel, lubricating oils, and chemicals shall be stored and dispensed in such a manner as to prevent or contain spills and prevent said liquids from reaching local streams or ground water. Used lubricating oils shall be disposed of or recycled at an appropriate facility.

The Contractor shall design, construct, and maintain all temporary diversion and protective works required to divert runoff around work areas. The Contractor shall furnish, install, maintain, and operate all equipment required to keep excavations and other work areas free from water in order to construct the facilities as specified.

The Contractor shall suspend earthmoving operations or implement necessary precautions in construction whenever, in the opinion of the Field Engineer, conditions for earthmoving are unsatisfactory. Such conditions may include rain, snow, wind, cold temperatures, or unacceptable subsoil bearing capacity conditions.

B.1.8 Construction Requirements

There are no facilities at the tailings basin. The nearest source of electricity is at the Power Resources Corporation facility. If needed, arrangements for power shall be made directly with Power Resources.

Non-potable water for soil compaction and dust control will be provided at the tailings basin by ExxonMobil. This water will be pumped from the Highland Reservoir to four storage tanks (16,800 gallons capacity each) at the tailings basin for Contractor use. The tank refill rate will be approximately 40 gpm.

B.2 SITE PREPARATION

This Specification Section describes the work related to preparation of work areas as well as areas within the footprint of soil storage areas and haul roads. This work includes removal of vegetation; and stripping, salvaging, and stockpiling of topsoil.

B.2.1 Materials Description

B.2.1.1 Topsoil

Topsoil shall consist of the surface and near-surface soils characterized by a darker color and higher organic matter content than the underlying soils and rock. Topsoil shall be excavated from Stockpiles 21 and 25 (see Drawing 1) and if necessary, salvaged from other designated areas of the Highland site. Topsoil shall be minus 12-inch size, and free from construction debris or rubbish.

B.2.1.2 Mulch

Mulch shall consist of residual native vegetation derived from site vegetation stripping operations. Mulch shall be free from construction debris or rubbish.

B.2.2 Work Description

B.2.2.1 Stripping

Stripping of vegetation shall be conducted in areas designated for construction as shown on Drawing 1. Stripping and grubbing shall not extend beyond 20 feet from the edge of facilities to be constructed, unless as shown on Drawing 1.

Stripped vegetation shall either be incorporated into topsoil (Specification Section B.2.1.1) or separated as mulch (Specification Section B.2.1.2). Alternative methods of on-site or off-site disposal of vegetation or burning of stripped vegetation shall be conducted only as approved by the Field Engineer.

B.2.2.2 Topsoil Salvaging

Where topsoil salvage is required, topsoil shall be excavated from work areas as shown on Drawing 1. Stripping of topsoil shall not extend beyond 10 feet from the edge of facilities to be constructed, unless shown on Drawing 1. The depth of excavation of topsoil shall be based on the presence of suitable topsoil and approved by the Field Engineer. Water shall be applied to the areas of excavation as needed for dust suppression.

B.2.2.3 Topsoil Placement

Topsoil (Specification Section B.2.1.1) shall be placed in designated areas of completed cover within the tailings basin. Topsoil shall be placed in one or more uncompacted lifts and smoothed to form a layer with a nominal thickness of 6 inches. Water shall be applied to the area of topsoil placement as necessary for dust suppression.

B.2.3 Performance Standards and Testing**B.2.3.1 General Requirements**

Stripping of vegetation shall not extend beyond 20 feet from the outer edge of facilities to be constructed, unless approved otherwise by the Field Engineer. Excavation of topsoil shall not extend beyond 10 feet from the outer edge of facilities to be constructed, unless approved otherwise by the Field Engineer.

B.2.3.2 Excavation Depths

The maximum depth of topsoil excavation shall be based on the presence of suitable topsoil, and as confirmed by the Field Engineer.

B.3 COVER COMPLETION

This Specification Section describes the work related to placement of random fill and cover soil for completion of the tailings basin cover.

B.3.1 Materials Description

B.3.1.1 Random Fill

Random fill shall consist of soils excavated from existing cover soil stockpiles or from the designated area on the Middle Dump (see Drawing 1).

B.3.1.2 Cover Soil

The material used for cover soil shall consist of soils excavated from existing cover soil stockpiles or from the designated area on the Middle Dump (see Drawing 1). Cover soil shall be minus 6-inch size and relatively free from organics, rubbish, or construction debris. Cover soil shall have a minimum fines fraction equivalent to 40 percent passing the No. 200 sieve, shall have a minimum plastic limit of 8, and shall have a minimum liquid limit of 25.

B.3.1.3 Topsoil

Material used for topsoil shall be soils as defined in Specification Section B.2.1.1.

B.3.2 Work Description

B.3.2.1 Random Fill Placement

Random fill (Specification Section B.3.1.1) shall be placed in horizontal lifts, with a maximum compacted thickness of twelve inches. Each lift shall be rolled or compacted by at least four passes with rubber-tired equipment or a sheepsfoot or tamping-foot roller.

The final or top random fill surface shall be compacted to at least 90 percent of the maximum dry density for the material, as determined by the Standard Proctor test. During compaction, the material shall be within 2 percent above to 4 percent below optimum moisture content for the material, as determined by the Standard Proctor test. If water addition is required to achieve this range of moisture contents, the added water shall be thoroughly mixed into the final lift prior to compaction. The final lift shall be rolled or compacted with rubber-tired equipment or a sheepsfoot or tamping-foot roller of sufficient weight and compaction effort to achieve the required compaction specifications.

B.3.2.2 Cover Soil Placement

Cover soil (Specification Section B.3.1.2) shall be placed in horizontal lifts, with a maximum compacted thickness of twelve inches.

Each lift of material shall be compacted to at least 95 percent of the maximum dry density for the material, as determined by the Standard Proctor test. During compaction, the material shall be within 2 percent above to 2 percent below optimum moisture content for the material, as determined by the Standard Proctor test. If water addition is required to achieve this range of moisture contents, the added water shall be thoroughly mixed into the material prior to compaction. Compaction of material shall be done with rubber-tired equipment or a sheepsfoot or tamping-foot roller of sufficient weight and compaction effort to achieve the required compaction specifications.

B.3.2.3 Topsoil Placement

Topsoil (Specification Section B.3.1.3) shall be placed in one or more lifts to form a continuous layer with a final thickness of a minimum of six inches. Topsoil shall not be placed on completed areas of the cover that will receive low-flow channel rock.

B.3.3 Performance Standards and Testing

The QA testing outlined in the paragraphs below will be conducted for ExxonMobil by the Field Engineer.

B.3.3.1 General Requirements

Constructed features shall be constructed to within 0.1 feet of the lines as shown on the Drawing, or as approved by the Field Engineer. Final slopes and grades outside of the low-flow channel shall be between 0.5 and 2.0 percent, with no areas of runoff concentration or abrupt changes in grade.

B.3.3.2 Cover Soil Testing

Checking of cover soil compaction shall consist of a minimum of one field density test per 1000 cubic yards of material compacted. Field density testing may be conducted with the sand cone test (ASTM D-1556) or a nuclear density gauge (ASTM D-3107 and D-2922). Calibration of the nuclear density gauge (if used) shall be by comparison with results from the sand cone test on the same material, at a frequency of one sand cone test per 10 nuclear density gauge tests, with a maximum of one sand cone test per day.

Field density tests shall be compared with Standard Proctor tests (ASTM D-698 Method A or C), which shall be conducted at a frequency of at least one test per 10,000 cubic yards of material compacted, or when material characteristics show significant variation.

Material index properties will consist of Atterberg limit (ASTM D-4318) and No. 200 sieve wash tests (ASTM D-1140), conducted at a frequency of one test per day of cover soil placement.

B.4 LOW-FLOW CHANNEL COMPLETION AND SITE RECLAMATION

This Specification Section describes the work related to completion of the reach of the low-flow channel through the area of the completed tailings basin cover (See Drawing 1).

B.4.1 Materials Description

B.4.1.1 On-Site Low-Flow Channel Rock

Low-flow channel rock shall be obtained from the designated stockpile shown on Drawing 1. This will be the primary source of low-flow channel rock.

B.4.1.2 Off-Site Low-Flow Channel Rock

If additional low-flow channel rock is required, rock shall be obtained from off-site. This rock shall be free from vegetative material, rubbish, or construction debris, and have the following particle-size distribution: (1) 100 percent finer than 8 inches, (2) 30 to 70 percent finer than 4 inches, (3) 10 to 30 percent finer than 2 inches, and up to 20 percent finer than one inch. This rock shall also meet Nuclear Regulatory Commission requirements for durability for "frequently saturated areas."

B.4.1.3 Topsoil

Material used for topsoil shall be soils as defined in Specification Section B.2.1.1.

B.4.2 Work Description

B.4.2.1 Channel Shaping

Prior to placement of low-flow channel rock, the compacted cover surface shall be shaped to the lines, grades, and dimensions shown on Drawing 1. Shaping shall be done by construction of the compacted cover to reach these dimensions, or excavating cover to create the low-flow channel dimensions.

B.4.2.2 Rock Placement

Low-flow channel rock (Specification Section B.4.1.1 or B.4.1.2) shall be placed in one or more lifts, with a nominal compacted thickness of six inches. The final surface shall be rolled with rubber-tired equipment to provide rock compaction and create a smooth surface.

B.4.2.3 Borrow Area Shaping

All excavated stockpiles and borrow areas utilized in this work plan shall be (upon completion of excavation) left or shaped with slopes no steeper than 3:1 (horizontal:vertical) with no areas of

runoff concentration or abrupt changes in grade. The final surfaces shall be covered with topsoil as described in Specification Section B.4.2.4.

B.4.2.4 Topsoil Placement

Where required, topsoil (Specification Section B.3.1.3) shall be placed in one or more lifts to form a continuous layer with a final thickness of a minimum of six inches. Topsoil shall not be placed on completed areas of the cover that will receive low-flow channel rock.

B.4.3 Performance Standards and Testing

The QA testing outlined in the paragraphs below will be conducted for ExxonMobil by the Field Engineer.

B.4.3.1 General Requirements

Constructed features shall be constructed to within 0.1 feet of the lines as shown on the Drawing, or as approved by the Field Engineer.

B.4.3.2 Low-Flow Channel Rock Testing

If off-site low-flow channel rock is imported, one test for particle-size distribution and durability shall be conducted on a representative sample of the material brought to the site. Particle-size distribution testing will be conducted using methods appropriate for rock of this size. Durability testing will include sodium sulfate soundness, L.A. abrasion, specific gravity, absorption, and petrographic analysis. Durability test results will be evaluated according to criteria in the Nuclear Regulatory Commission publication NUREG-4620.

APPENDIX F-2
VOLUME ESTIMATES

MEMORANDUM

TO: Mark Hoffman, ExxonMobil Environmental Remediation

FROM: Clint Strachan, Shepherd Miller, Inc.

DATE: June 22, 2001

COPY TO: Monte Carr, Carr Construction

SUBJECT: Highland Tailings Basin Fill Placement in spring 2001

This memorandum outlines the calculated volumes of fill materials excavated and placed in the Highland tailings basin this spring by Carr Construction. These volumes have been discussed by telephone with Monte Carr.

Volume calculations have been made based on survey work conducted by SMI before and after construction work in 2001. These volume calculations have been made for contractor payment support, and are outlined below.

Middle dump borrow area. The surveyed contours of the middle dump borrow area (the main borrow area used for cover material) were made before excavation in 2000, at the end of construction work in 2000 and after excavation and replacement of topsoil in 2001. The total volume of material removed from the borrow area was 159,235 cy. The volume of material removed in 2000 was approximately 65,181 cy, resulting in a volume removed in 2001 of approximately 94,054 cy.

Cover material stockpiles. The stockpiles of cover materials used in 2000 totaled 18,303 cy (6,879 cy in the north stockpile and 11,424 cy in the south stockpile).

Temporary topsoil stockpiles. Three temporary stockpiles were created in 2001 to store topsoil excavated from the edges of the fill area. The stockpiles were surveyed at the end of topsoil stripping and after final topsoil placement. The volume of temporarily-stored topsoil totaled 15,239 cy (5,855 cy in the southeast stockpile, 3389 cy in the east stockpile, and 6265 cy in the west stockpile).

Existing topsoil stockpiles. Topsoil from the two existing original topsoil stockpiles (created by Exxon during mining operations) was completely used to cover the fill area. These two stockpiles (No 21 and 25) were surveyed before construction in 2000 and after removal of topsoil in 2001. Stockpile 21 had an estimated volume of 4630 cy of material removed. Stockpile 25

was used for the last volume of topsoil placed over the fill area, had an estimated volume of 33,112 cy of material removed. The volume of material removed from these two stockpile areas totaled 37,742 cy.

Topsoil totals. The volume of topsoil placed in the fill area totaled 52,981 cy (37,724 cy from the existing topsoil stockpiles and 15,239 cy of salvaged topsoil). The area requiring topsoil placement is approximately 43.45 acres (35,050 cy at a thickness of six inches). A volume of 52,981 cy over 43.45 acres is equivalent to an average topsoil depth of approximately nine inches. The calculated thickness is more than the minimum thickness of six inches, but is most likely due to compaction of the topsoil during handling and placement stripping of more than six inches of soil during excavation.

Low-flow channel rock. The volume of on-site rock used to complete the low-flow channel was estimated from the placed dimensions of the low-flow channel. This on-site rock included rock stockpiled in 1989 plus a minor amount of rock salvaged by Carr Construction in 2000 during topsoil stripping. The length of replaced low-flow channel was 1,350 feet, with a channel width of 20 feet and rock depth of 0.5 feet, for an estimated rock volume of 500 cy.

Fill placement volumes. The required volume of fill was used as a check of the volumes excavated from the borrow areas, as well as to separate random fill volumes from cover material volumes. The placed fill volumes were calculated by comparing the difference between initial elevations prior to construction in 2000 and elevations at various periods during construction. Control points on a grid system with 100-foot spacing were used for fill volume calculation (as well as for construction grade control, and field test location).

The estimated fill volume in 2000 totaled 76,866 cy (45,337 cy random fill and 31,529 cy cover material). The total of 76,866 cy is nine percent less than the total volume excavated in 2000 from the Middle Dump borrow area and cover stockpiles (totaling 84,484 cy). The larger actual volume is most likely due to compaction and consolidation of the original materials in the fill area.

Field density measurements taken in the Middle Dump borrow area in April 2001 show that existing materials were near 95 percent of Standard Proctor dry density for the material. The compacted fill materials averaged roughly 98 percent of Standard Proctor dry density for the material.

The estimated fill requirement for 2000 and 2001 totaled 173,308 cy (46,837 cy random fill, 91,421 cy cover material, and 35,050 cy topsoil). The calculated volume of material actually placed in the fill area in 2000 and 2001 totaled 215,280 cy (18,303 cy from the cover material stockpiles, 159,235 cy from the Middle Dump borrow area, and 37,742 cy from the existing topsoil stockpiles). The actual volume of placed fill is approximately 19 percent higher than the estimated fill requirement, most likely due to consolidation and settlement of the original materials in the fill placement area and compaction of salvaged topsoil.

APPENDIX F-3

SEDIMENT RADIUM ANALYSIS



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ENERGY LABORATORIES, INC.

SHIPPING: 2393 SALT CREEK HIGHWAY • CASPER, WY 82601
MAILING: P.O. BOX 3258 • CASPER, WY 82602
E-mail: casper@energylab.com • FAX: (307) 234-1639
PHONE: (307) 235-0515 • TOLL FREE: (888) 235-0515

LABORATORY ANALYSIS REPORT

Client: SHEPHERD MILLER
Project: Exxon Mobil, Highland
Project Number:: 100548/3
Contact: Toby Wright
Sample Matrix: Solid, soil
Report Date: October 20, 2000

Laboratory ID	Sample Date	Sample ID	Radium-226, pCi/g	Radium Precision ±	Digestion
36308-1	09-19-00	North Evap Pond	1.27	0.12	-
36308-2	09-19-00	South Evap Pond	1.11	0.11	-

Quality Assurance Data		
Method	903.0	SW3050
Reporting Limit	0.01	-
Duplicate ¹	2.5	-
Spike ²	101	-
Batch ID	RA-244	-
Analyst	rs	rcb
Date Analyzed	10-10-00	09-28-00

NOTES:

- (1) These values are an assessment of analytical precision. The acceptance range is 0-20% for sample results above 10 times the reporting limit. This range is not applicable to samples with results below 10 times the reporting limit.
- (2) These values are an assessment of analytical accuracy. They are a percent recovery of the spike addition. ELI performs a matrix spike on 10 percent of all samples for each analytical method.

Report Approved By:

Reviewed By:

CATHY FORSTING
PROJECT MANAGER

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