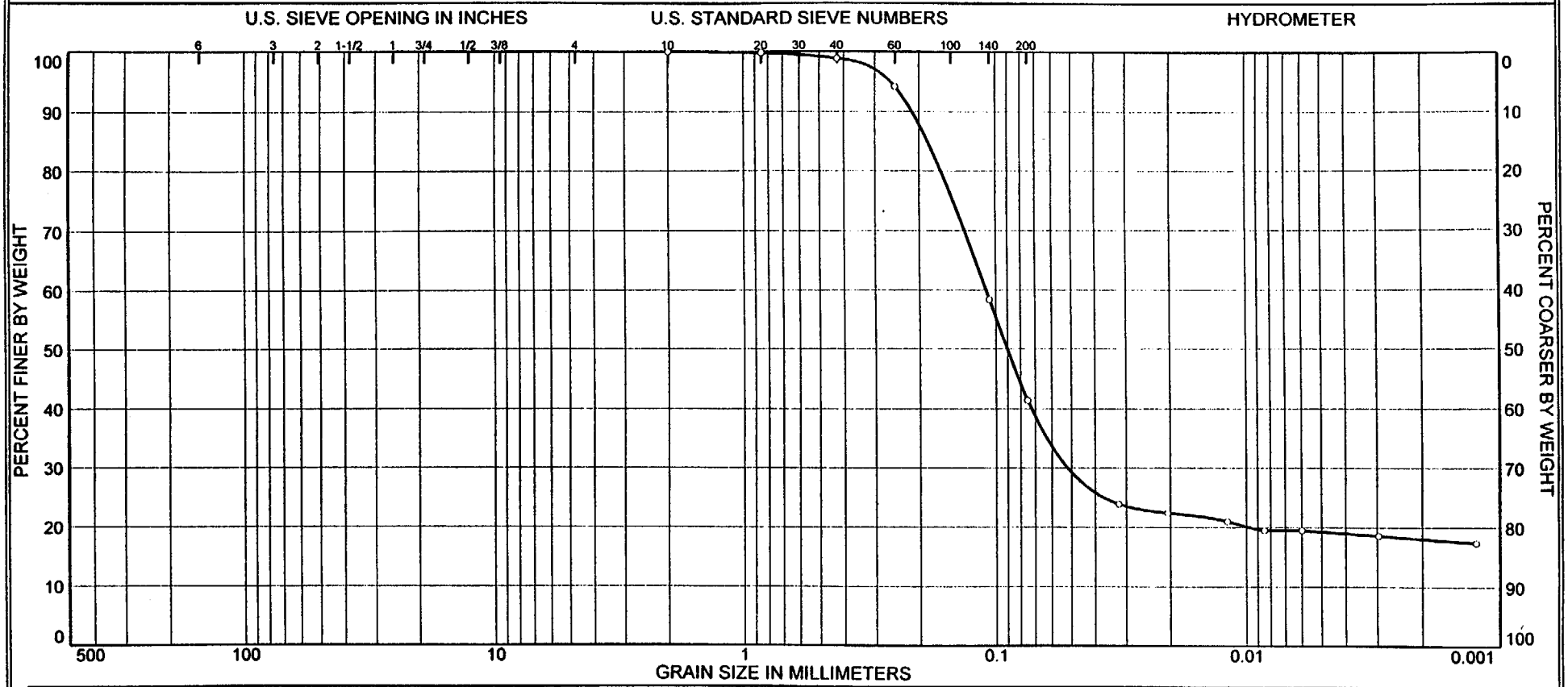
Grain Size & Atter[illegible] Limits Summary

Project: MOX Fuel Fabrication Facility **LAW Project No:** 50160-0-3963

Source of Sample	Sample No.	Depth	Material Description	Sand (%)	Silt (%)	Clay (%)	Fines (%)	Natural Moisture (%)	LL	PL	PI
Boring BH-9	3	14-15'	Red Brown Silty sand	68.4			31.6	15.2			
	5	24-25'	Red Brown Silty sand	81.3			18.1	8			
	7	33.5-34.5'	Tan Poorly graded sand with silt	94.2			5.8	5.1			
	12 (composite)	61.5-62.7'	silt	94.5			5.5				
	13	66.5-67.5'	silt	89.4			10.6	24.3			
	14	71.5-72.5'	Brown Silty sand	82.3	3.9	13.8	17.7	29.2	52	30	22
	17 (composite)	86.5-87.5'	Brown Silty sand	86.6			13.4				
	19	96.5-97.5'	Tan Brown Poorly graded sand with silt	92.5			7.5				
	24-1	122-123'	Tan Sandy silt	42.4			53.1				
	25	126-127.5'	Tan Brown Clayey sand	61.1			38.7		50	23	27

Particle Size Distribution Report ASTM D422/D1140



	% COBBLES	% GRAVEL		% SAND			% FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.0	0.0	1.1	57.5	22.1	19.3

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○	Boring BH-8	27	136-137.5	8/17/00	SC	Brown Clayey sand	35.4	56	26

Client Duke Cogema Stone & Webster (DCS)

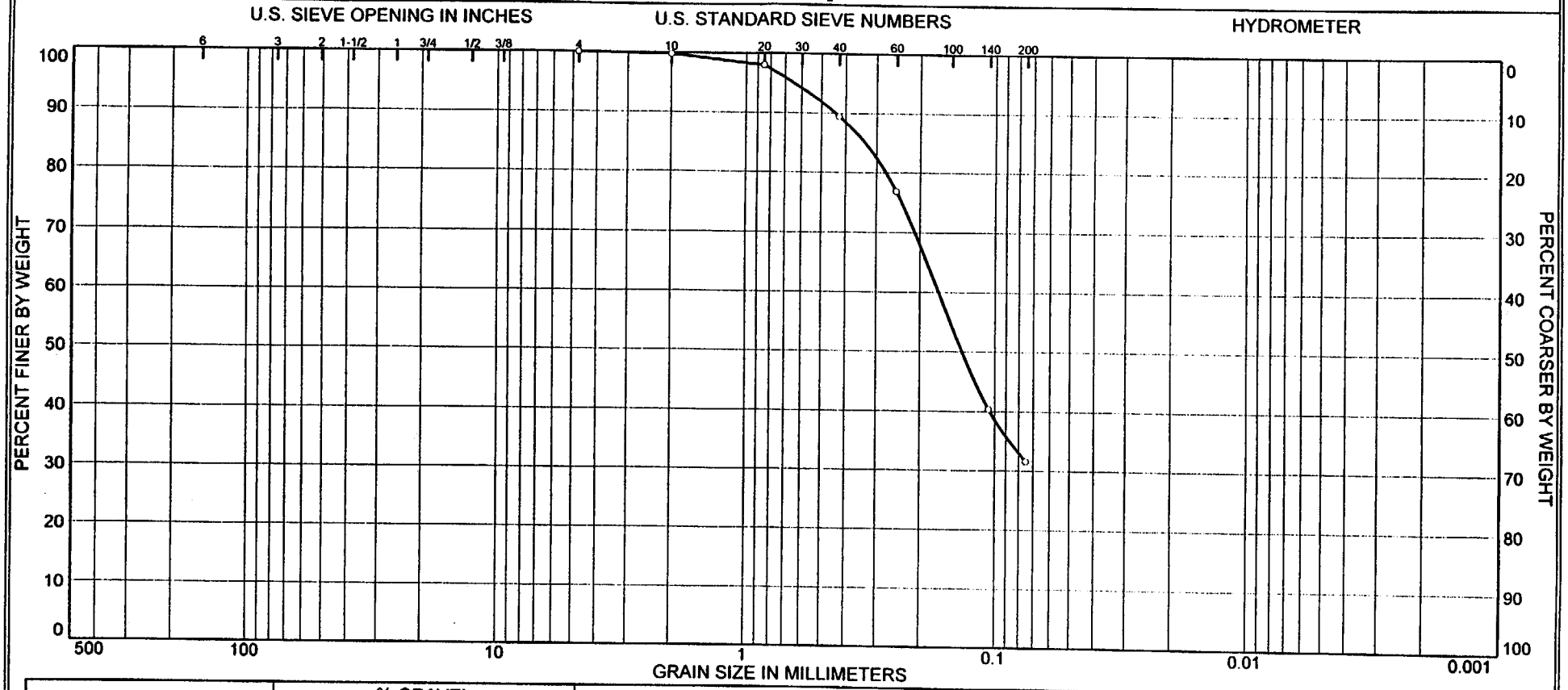
Project MOX Fuel Fabrication Facility

Project No. 50160-0-3963 Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

○ Tested by: SC/WFL Reviewed by: HJ

Particle Size Distribution Report ASTM D422/D1140



% COBBLES	% GRAVEL		% SAND			% FINES	
	COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
0.0	0.0	0.0	0.2	10.3	57.9	31.6	

SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
Boring BH-9	3	14-15 Ft.	8/17/00		Red Brown Silty sand	15.2		

Client Duke Cogema Stone & Webster (DCS)

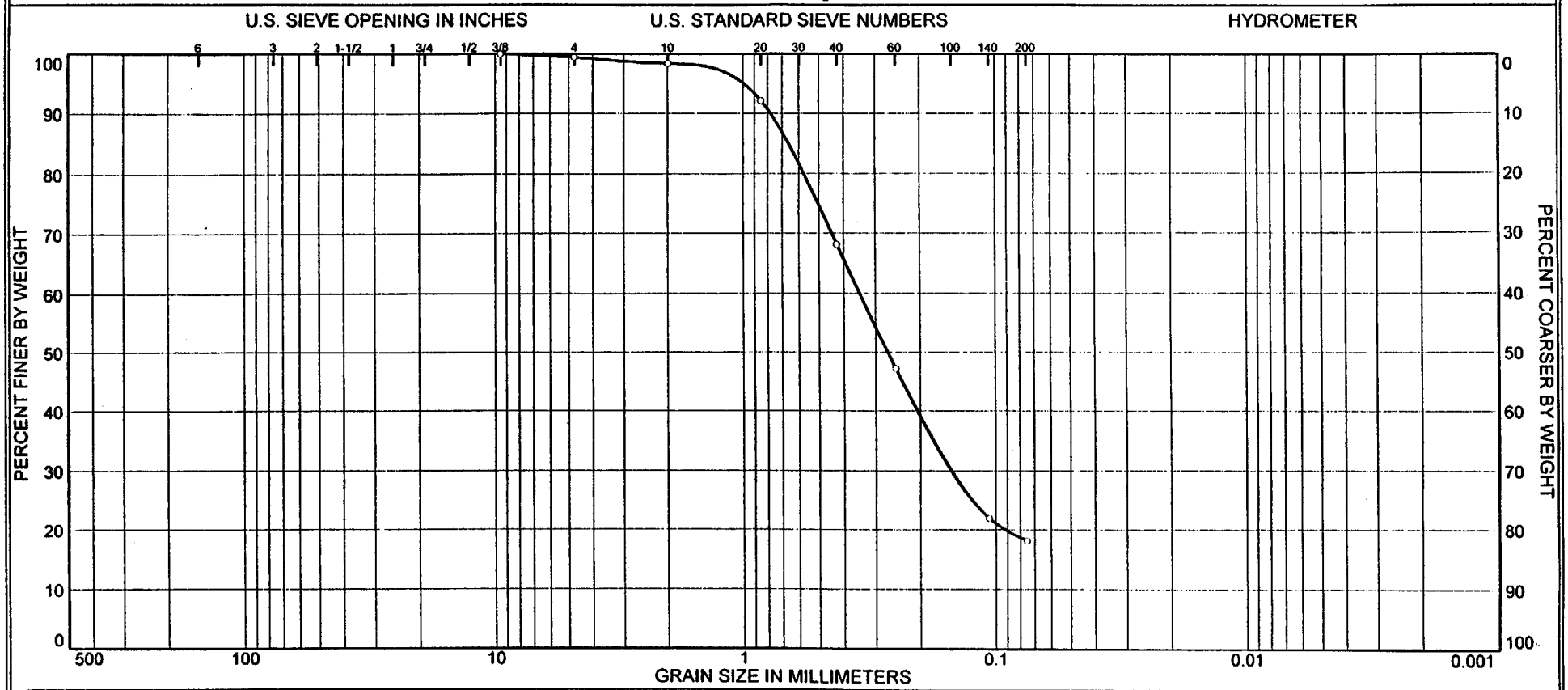
Project MOX Fuel Fabrication Facility

Project No. 50160-0-3963 | Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

○ Tested by: SC Reviewed by: HJ

Particle Size Distribution Report ASTM D422/D1140



	% COBBLES	% GRAVEL		% SAND			% FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.6	1.0	30.3	50.0	18.1	

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○	Boring BH-9	5	24-25 Ft.	8/17/00		Red Brown Silty sand	8.0		

Client Duke Cogema Stone & Webster (DCS)

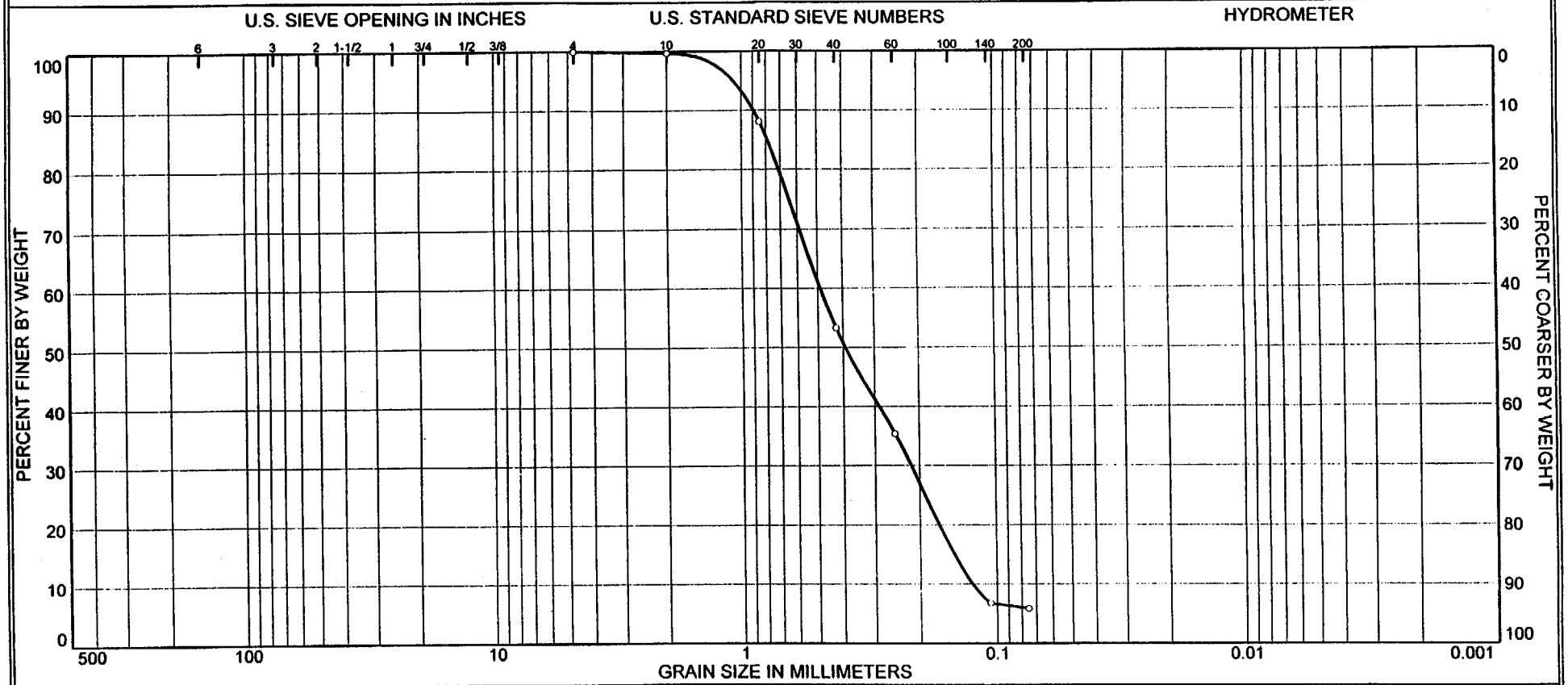
Project MOX Fuel Fabrication Facility

Project No. 50160-0-3963 Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

○ Tested by: WFL Reviewed by: HJ

Particle Size Distribution Report ASTM D422/D1140



	% COBBLES	% GRAVEL		% SAND			% FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.0	0.3	46.4	47.5	5.8	

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○	Boring BH-9	7	33.5-34.5 Ft.	8/17/00		Tan Poorly graded sand with silt	5.1		

Client Duke Cogema Stone & Webster (DCS)

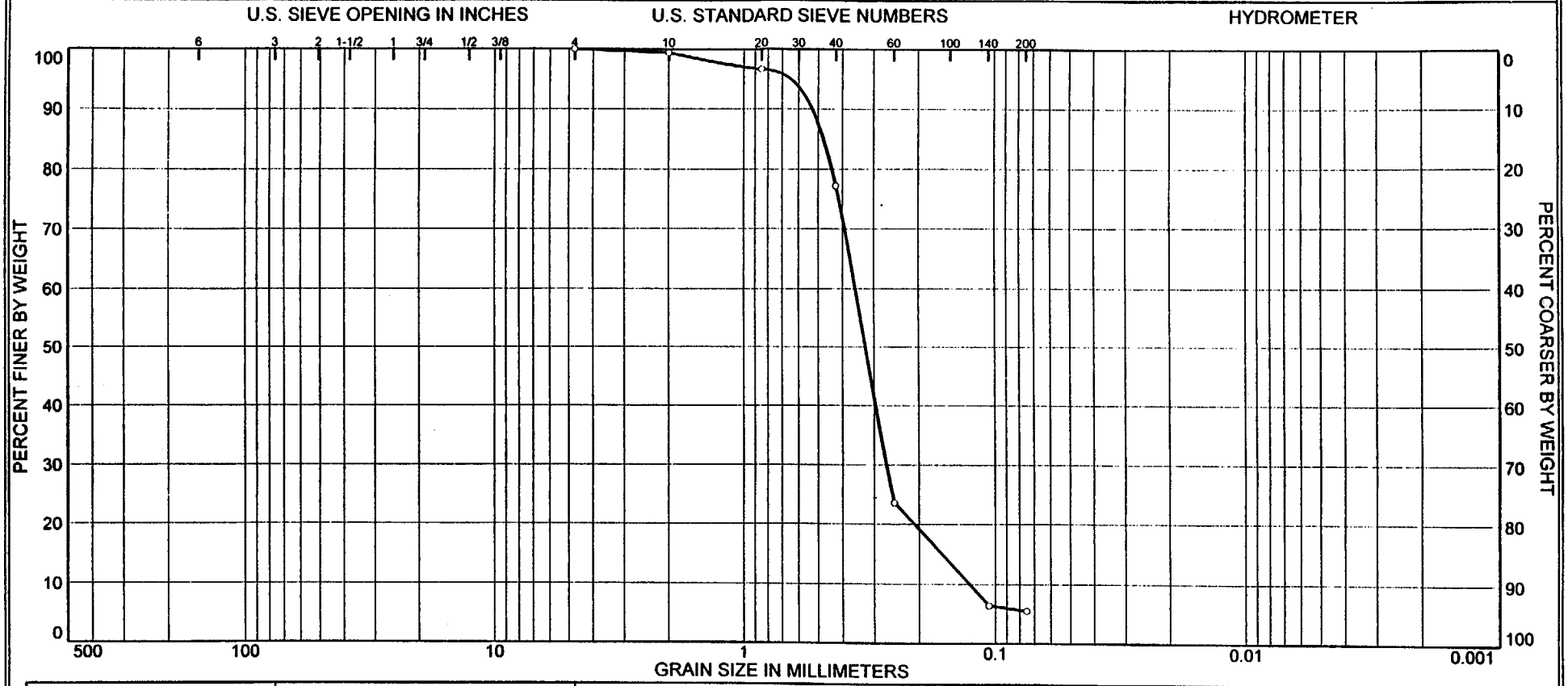
Project MOX Fuel Fabrication Facility

Project No. 50160-0-3963 | Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

○ Tested by: WFL Reviewed by: HJ

Particle Size Distribution Report ASTM D422/D1140



	% COBBLES	% GRAVEL		% SAND			% FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.0	0.6	22.2	71.7	5.5	

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○	Boring BH-9	12 (composite)	61.5-62.7'	8/17/00		Brown Poorly graded sand with silt			

Client Duke Cogema Stone & Webster (DCS)

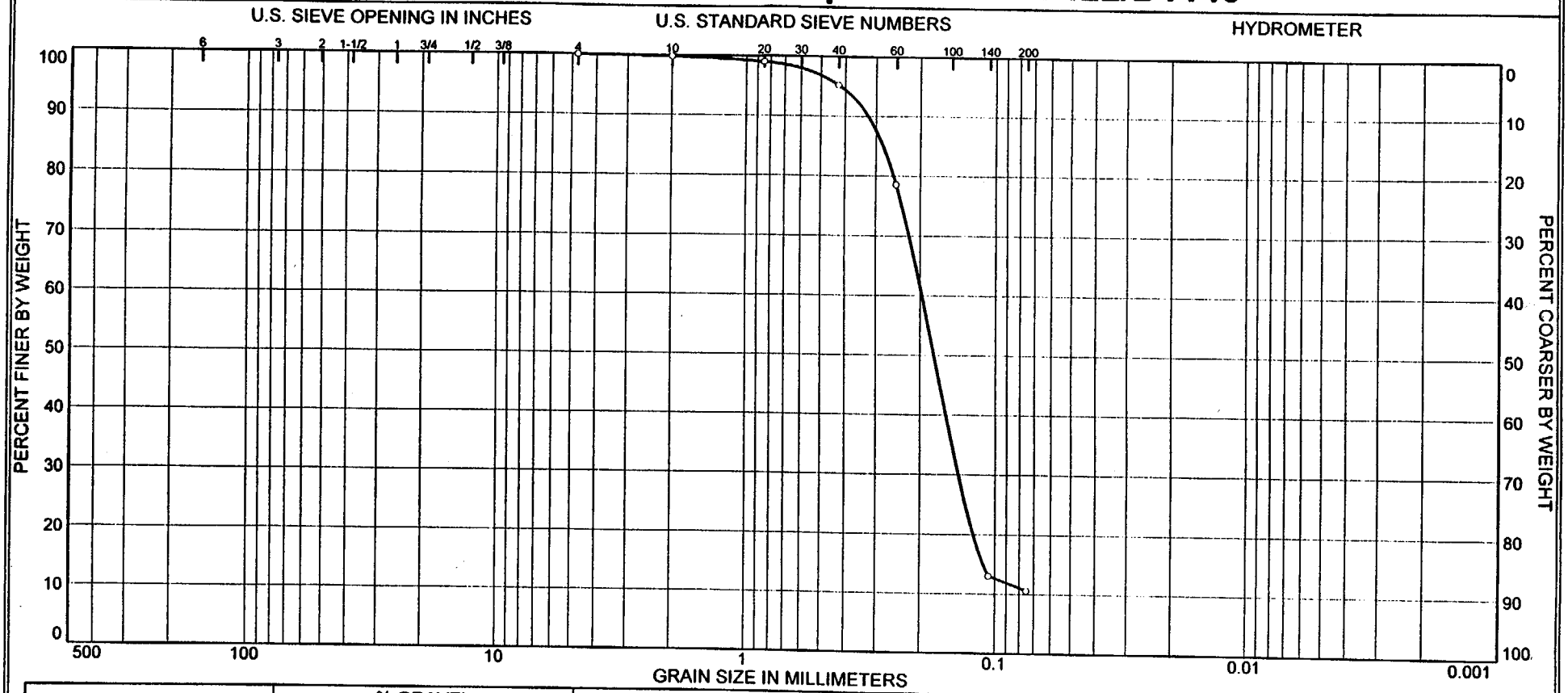
Project MOX Fuel Fabrication Facility

Project No. 50160-0-3963 Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

○ Tested by: WFL Reviewed by: HJ

Particle Size Distribution Report ASTM D422/D1140



	% COBBLES	% GRAVEL		% SAND			% FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.0	0.2	4.6	84.6	10.6	

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○	Boring BH-9	13	66.5-67.5'	8/17/00		Brown Poorly graded sand with silt	24.3		

Client Duke Cogema Stone & Webster (DCS)

Project MOX Fuel Fabrication Facility

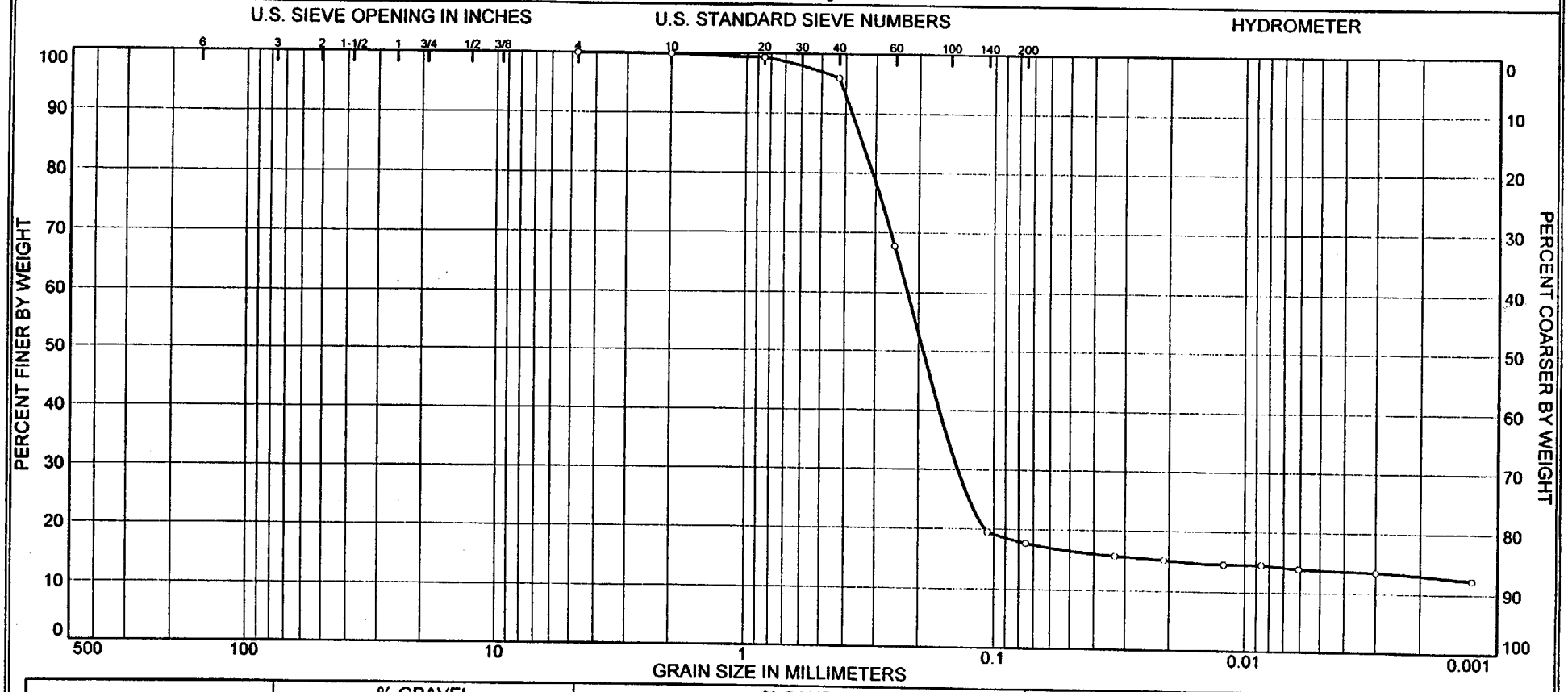
Project No. 50160-0-3963 | Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

○ Tested by: WFL Reviewed by: HJ

160 091

Particle Size Distribution Report ASTM D422/D1140



	% COBBLES	% GRAVEL		% SAND			% FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.0	0.1	4.0	78.2	3.9	13.8

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○	Boring BH-9	14	71.5-72.5'	8/22/00	SM	Brown Silty sand	29.2	52	30

Client Duke Cogema Stone & Webster (DCS)

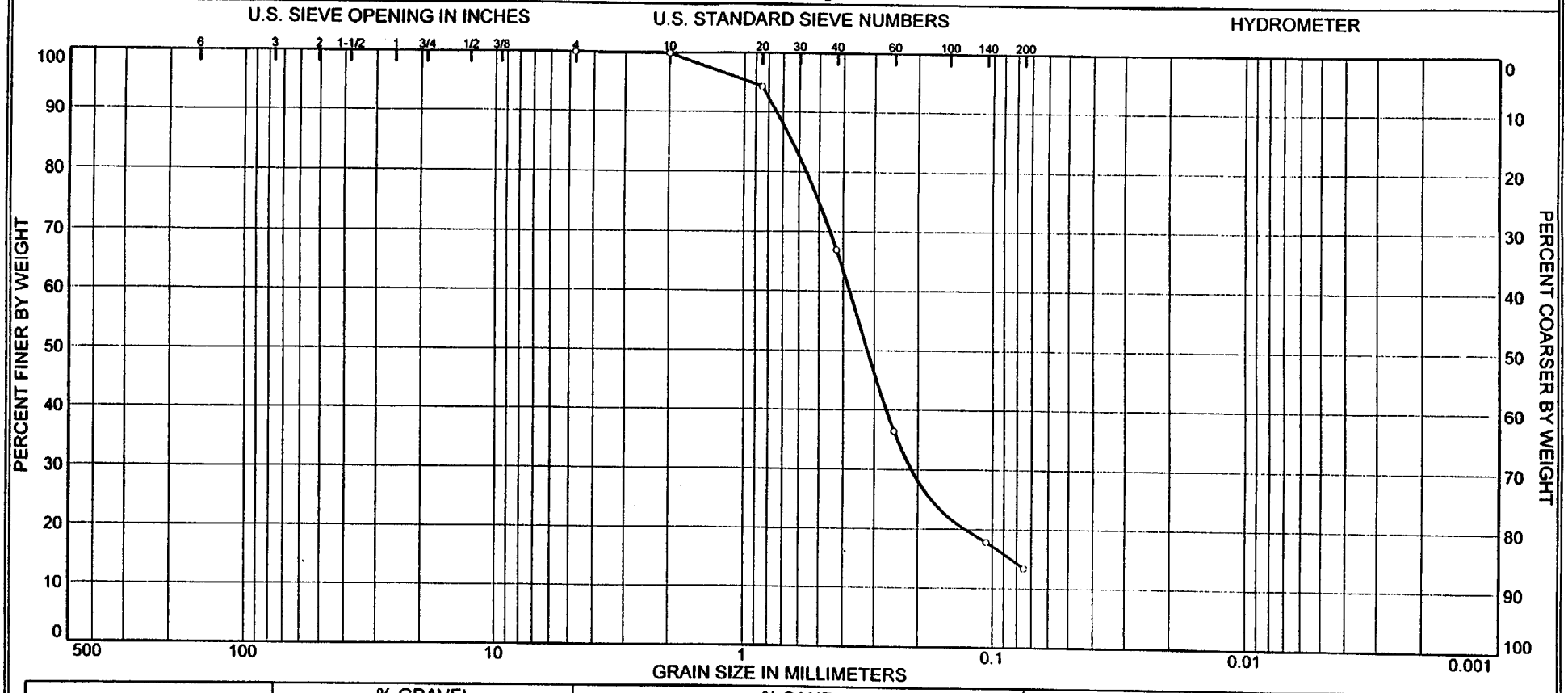
Project MOX Fuel Fabrication Facility

Project No. 50160-0-3963 | Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

○ Tested by: WFL/JTM Reviewed by: HJ

Particle Size Distribution Report ASTM D422/D1140



	% COBBLES	% GRAVEL		% SAND			% FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.0	0.1	33.0	53.5	13.4	

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○	Boring BH-9	17 (composite)	86.5-87.5'	8/17/00		Brown Silty sand			

Client Duke Cogema Stone & Webster (DCS)

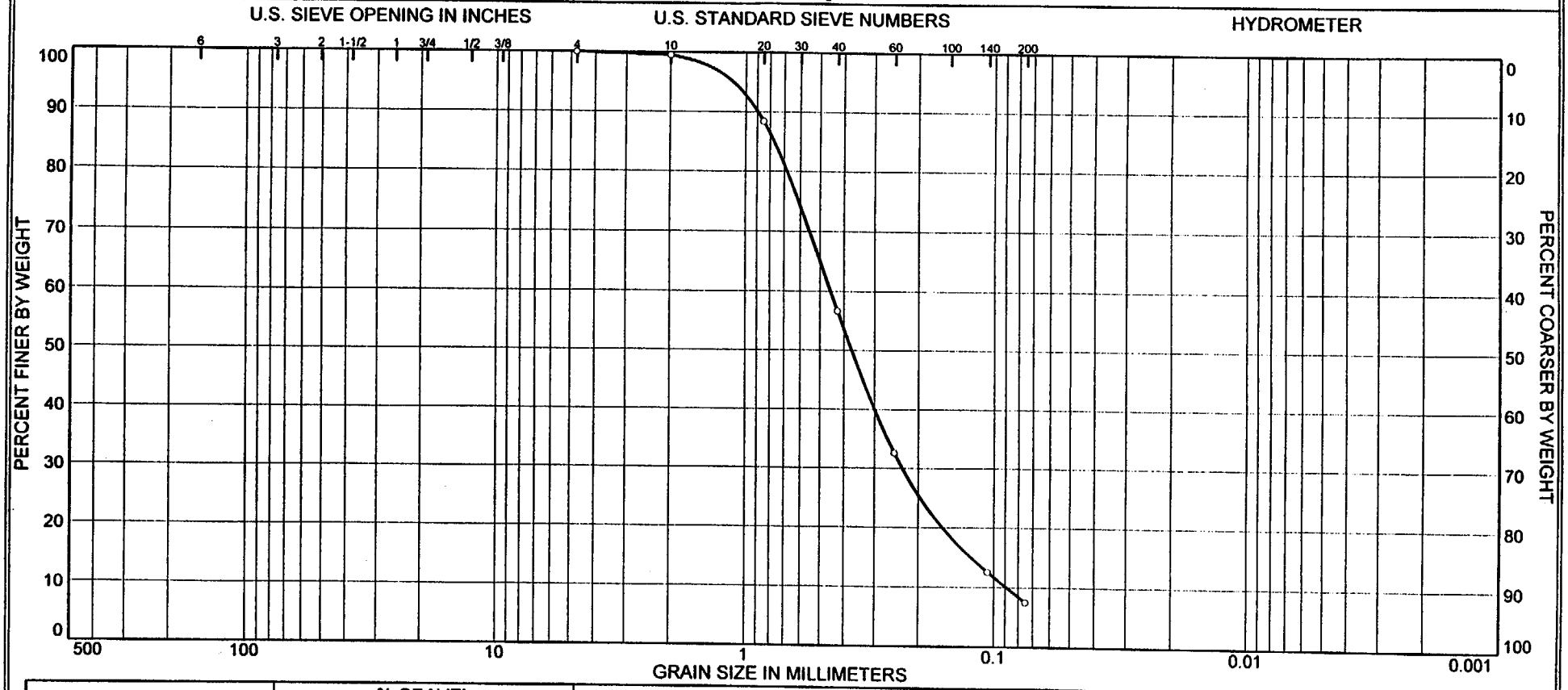
Project MOX Fuel Fabrication Facility

Project No. 50160-0-3963 | Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

○ Tested by: WFL Reviewed by: HJ

Particle Size Distribution Report ASTM D422/D1140



	% COBBLES	% GRAVEL		% SAND			% FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.0	0.5	42.8	49.2	7.5	

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○	Boring BH-9	19	96.5-97.5'	8/17/00		Tan Brown Poorly graded sand with silt			

Client Duke Cogema Stone & Webster (DCS)

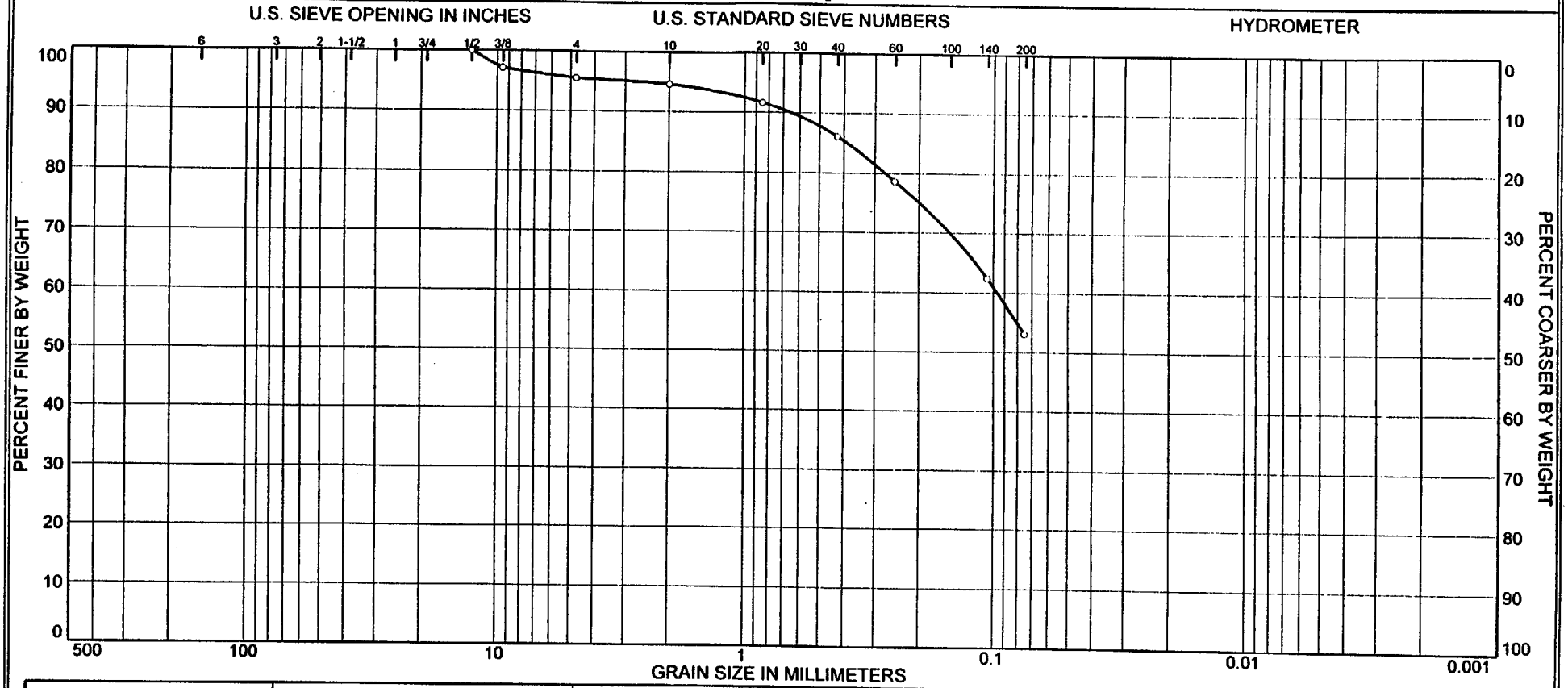
Project MOX Fuel Fabrication Facility

Project No. 50160-0-3963 | Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

○ Tested by: WFL Reviewed by: HJ

Particle Size Distribution Report ASTM D422/D1140



	% COBBLES	% GRAVEL		% SAND			% FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	4.5	0.9	8.5	33.0	53.1	

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○	Boring BH-9	24-1	122-123 Ft.	8/17/00		Tan Sandy silt			

Client Duke Cogema Stone & Webster (DCS)

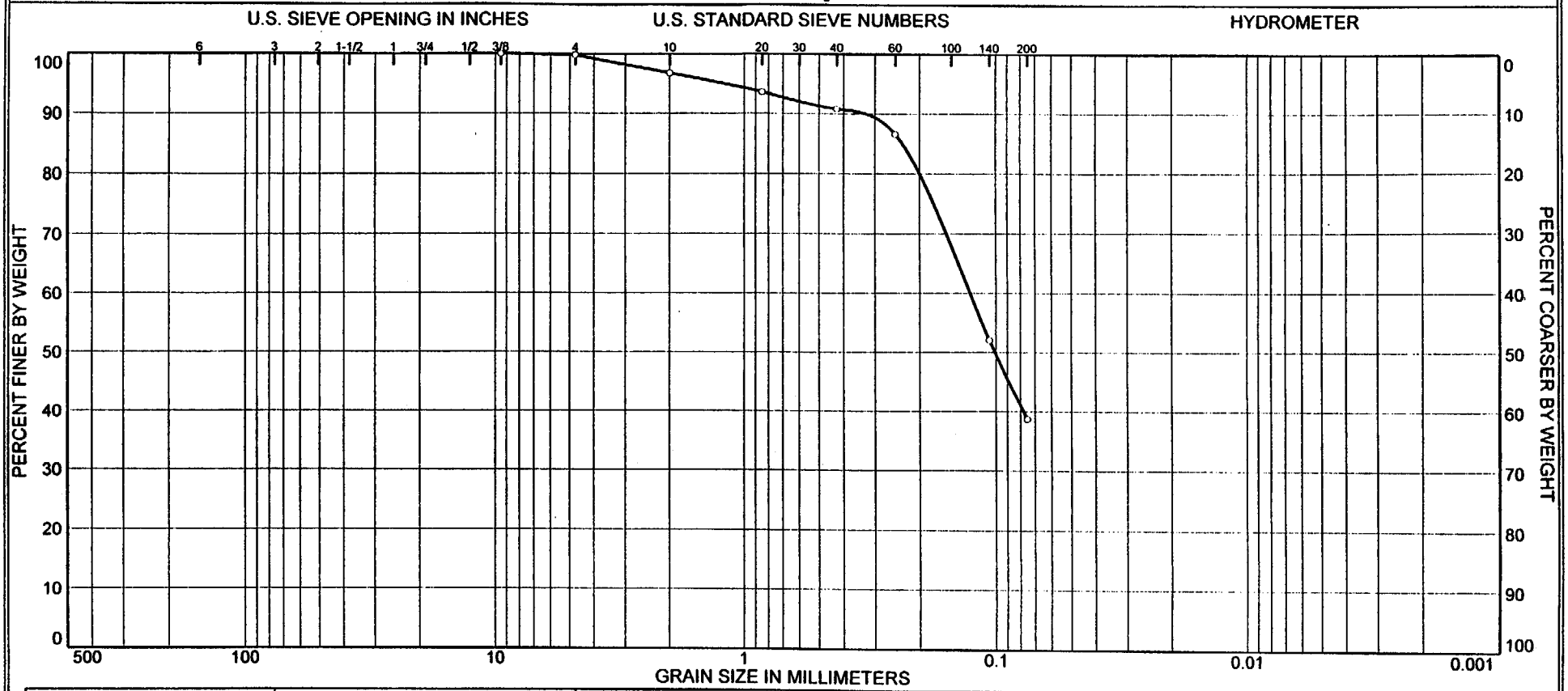
Project MOX Fuel Fabrication Facility

Project No. 50160-0-3963 | Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

○ Tested by: WFL Reviewed by: HJ

Particle Size Distribution Report ASTM D422/D1140



	% COBBLES	% GRAVEL		% SAND			% FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.2	3.0	6.0	52.1	38.7	

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○	Boring BH-9	25	126-127.5'	8/17/00	SC	Tan Brown Clayey sand		50	23

Client Duke Cogema Stone & Webster (DCS)

Project MOX Fuel Fabrication Facility

Project No. 50160-0-3963 | Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

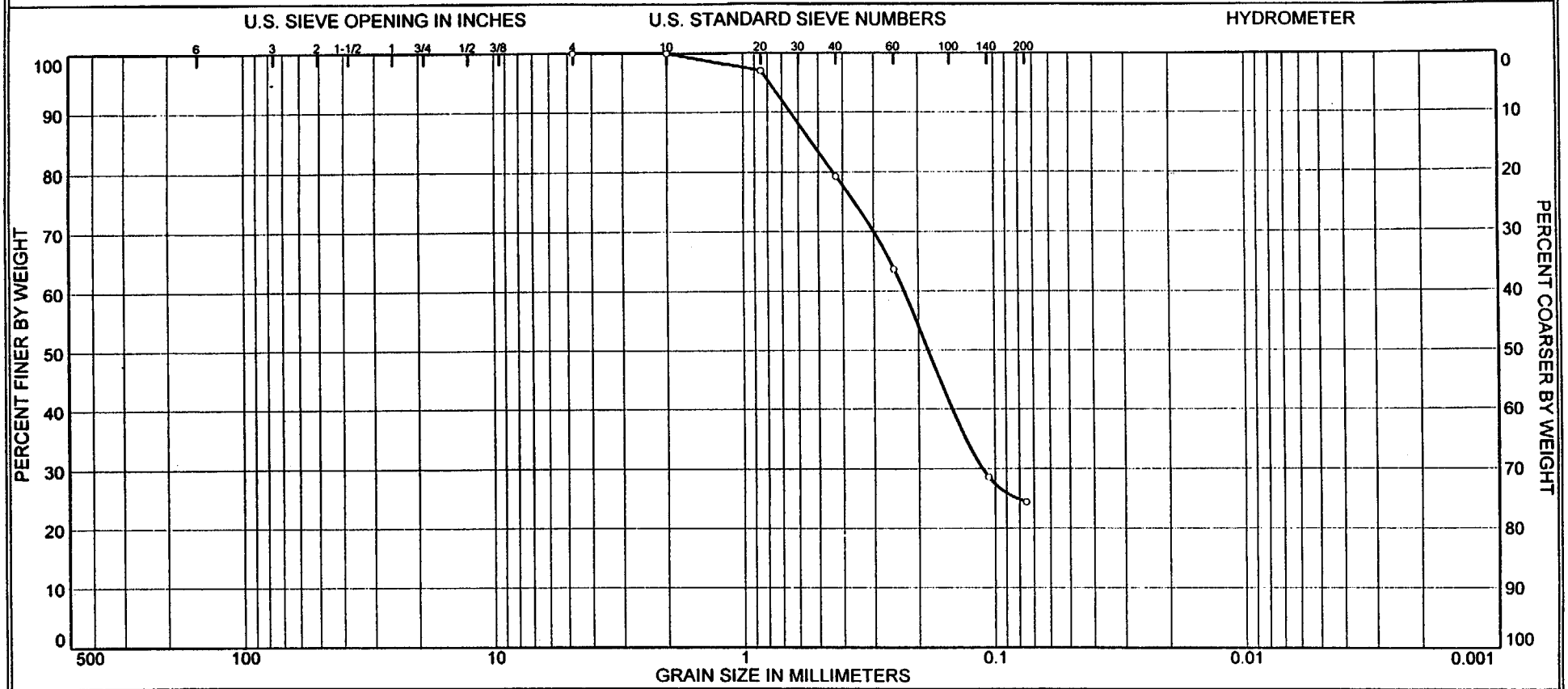
○ Tested by: WFL Reviewed by: HJ

Grain Size & Atter[illegible]g Limits Summary

Project: MOX Fuel Fabrication Facility **LAW Project No:** 50160-0-3963

Source of Sample	Sample No.	Depth	Material Description	Sand (%)	Silt (%)	Clay (%)	Fines (%)	Natural Moisture (%)	LL	PL	PI
Boring BH-10	2	13-14'	Red Brown Silty sand	75.6			24.4	14.4			
	5	28-29'	Tan Silty sand	83.7			16.3	18.5			
	7	38-39'	Red Brown Poorly graded sand with silt	90.9			9.1				
	9	48-49'	Red Brown Silty sand	87.3			12.7				
	10	53-54'	Red Brown Poorly graded sand with silt	91.4			7.5	23			
	13	68-68.8'	Red Brown Silty sand	86.9			13.1				
	14A	72.3-72.8'	Red Brown Poorly graded sand with silt	92.7			7.3				
	15	78-79'	Brown Poorly graded sand with silt	94			6				
	17 (17-1)	88-88.4'	Tan Brown Well-graded sand with silt	93.6			6.4	16.3			
	19	98-99.5'	Brown Clayey sand	62	15.6	22.4	38	28.5	83	23	60
	21A	106-107'	Tan Brown Silty sand	85.1			14.9	23.2			
	24	124.5-125'	Tan Silty sand	82.4	4.1	13.5	17.6	32.8	43	28	15
	26B (top)	135-137'	Brown Clayey sand	53.3	19.4	27.3	46.7		69	24	45
	26B (retest)	135-136.5'	Tan Brown Silty sand	84.6			15.4		45	22	23
	29	148.5-149.5'	Gray Black Poorly graded sand with silt	93.5			6.4	22.6			

Particle Size Distribution Report ASTM D422/D1140



	% COBBLES	% GRAVEL		% SAND			% FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.0	0.0	20.7	54.9	24.4	

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○	Boring BH-10	2	13-14'	8/23/00		Red Brown Silty sand	14.4		

Client Duke Cogema Stone & Webster (DCS)

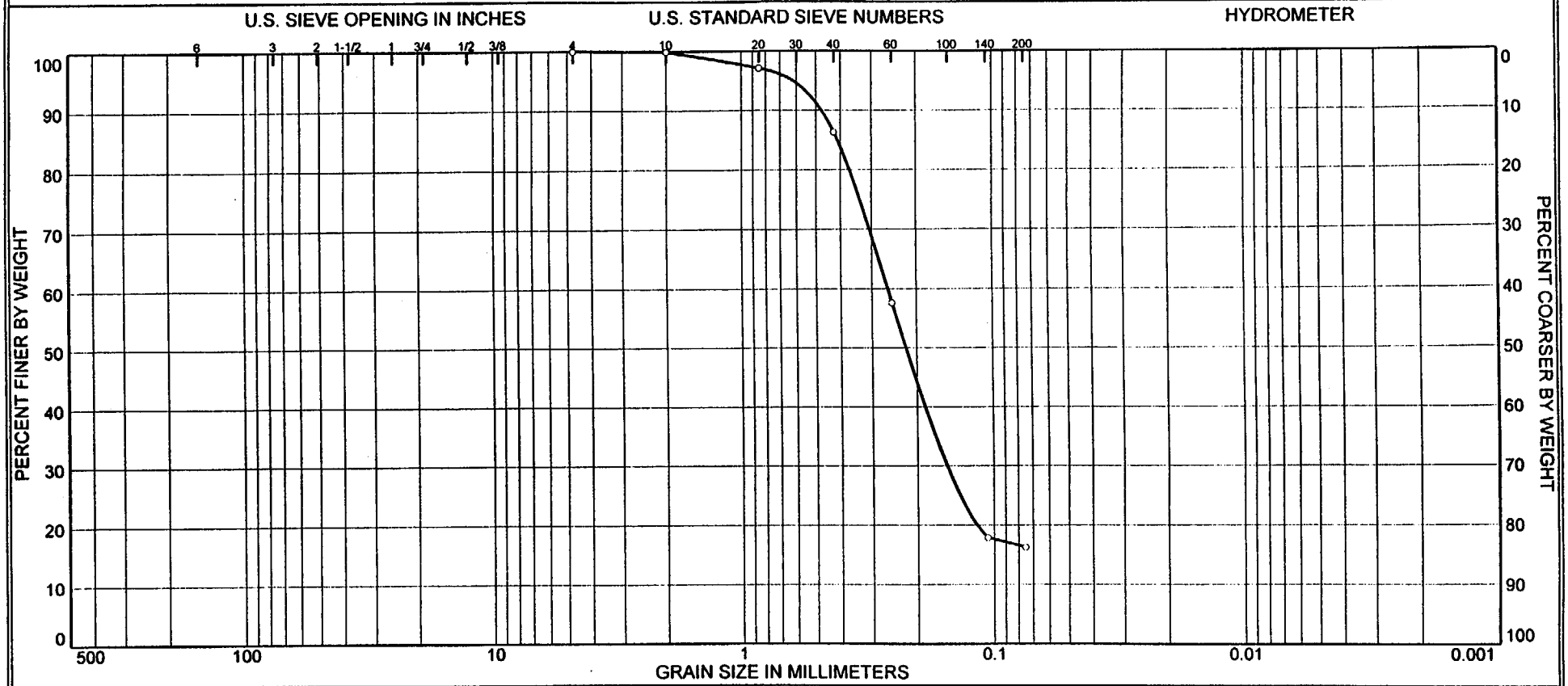
Project MOX Fuel Fabrication Facility

Project No. 50160-0-3963 | Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

○ Tested by: WFL Reviewed by: HJ

Particle Size Distribution Report ASTM D422/D1140



	% COBBLES	% GRAVEL		% SAND			% FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.0	0.1	13.6	70.0	16.3	

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○	Boring BH-10	5	28-29'	8/23/00		Tan Silty sand	18.5		

Client Duke Cogema Stone & Webster (DCS)

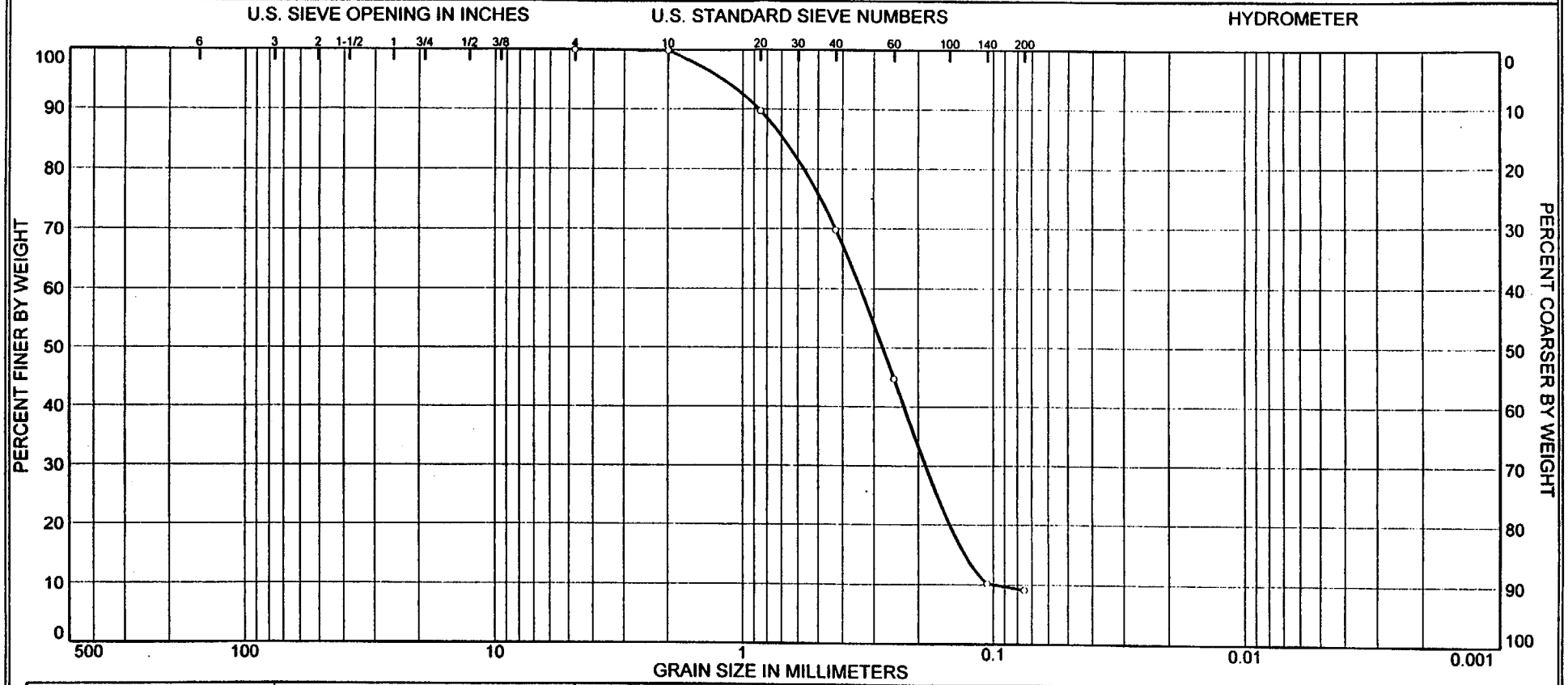
Project MOX Fuel Fabrication Facility

Project No. 50160-0-3963 | Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

○ Tested by: WFL Reviewed by: HJ

Particle Size Distribution Report ASTM D422/D1140



	% COBBLES	% GRAVEL		% SAND			% FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.0	0.1	30.1	60.7	9.1	

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○	Boring BH-10	7	38-39'	8/23/00		Red Brown Poorly graded sand with silt			

Client Duke Cogema Stone & Webster (DCS)

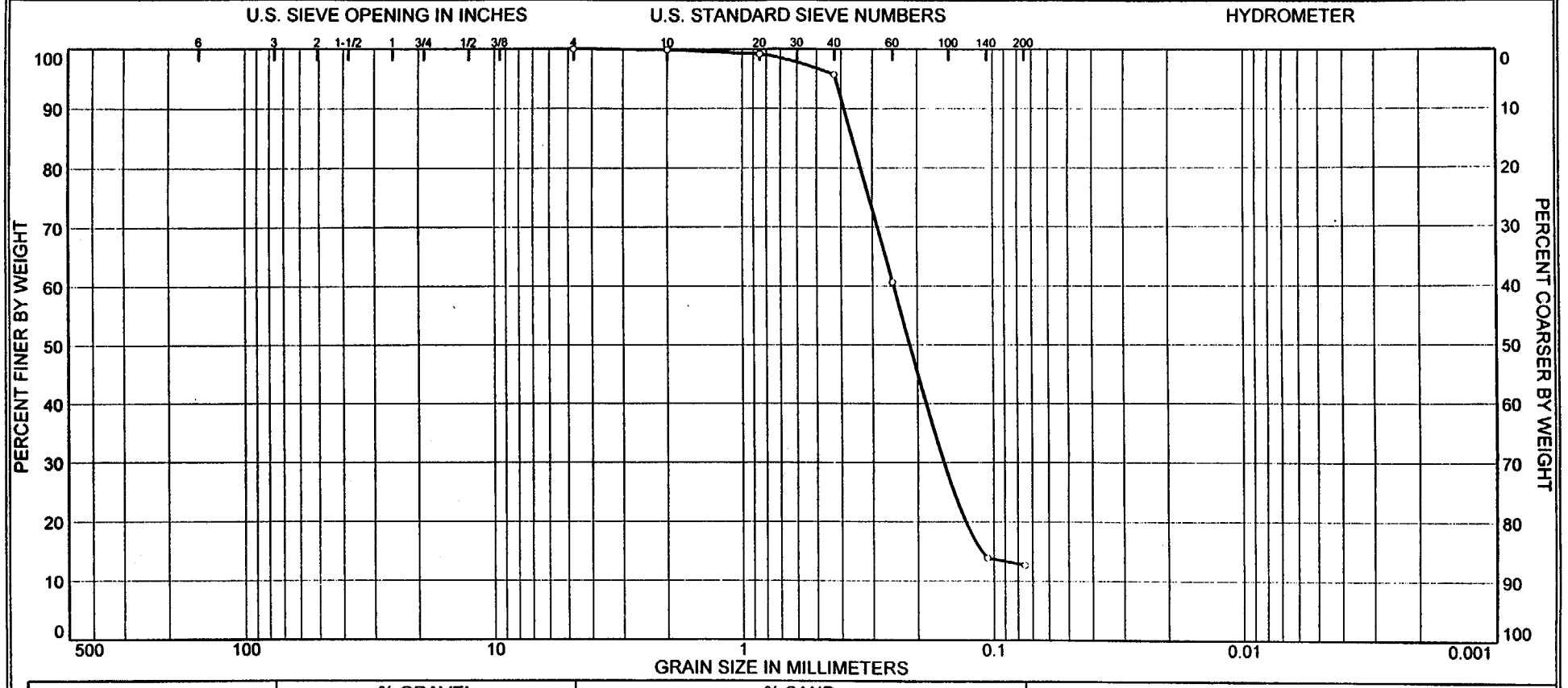
Project MOX Fuel Fabrication Facility

Project No. 50160-0-3963 | Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

○ Tested by: WFL Reviewed by: HJ

Particle Size Distribution Report ASTM D422/D1140



	% COBBLES	% GRAVEL		% SAND			% FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.0	0.1	4.2	83.0	12.7	

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○	Boring BH-10	9	48-49'	8/23/00		Red Brown Silty sand			

Client Duke Cogema Stone & Webster (DCS)

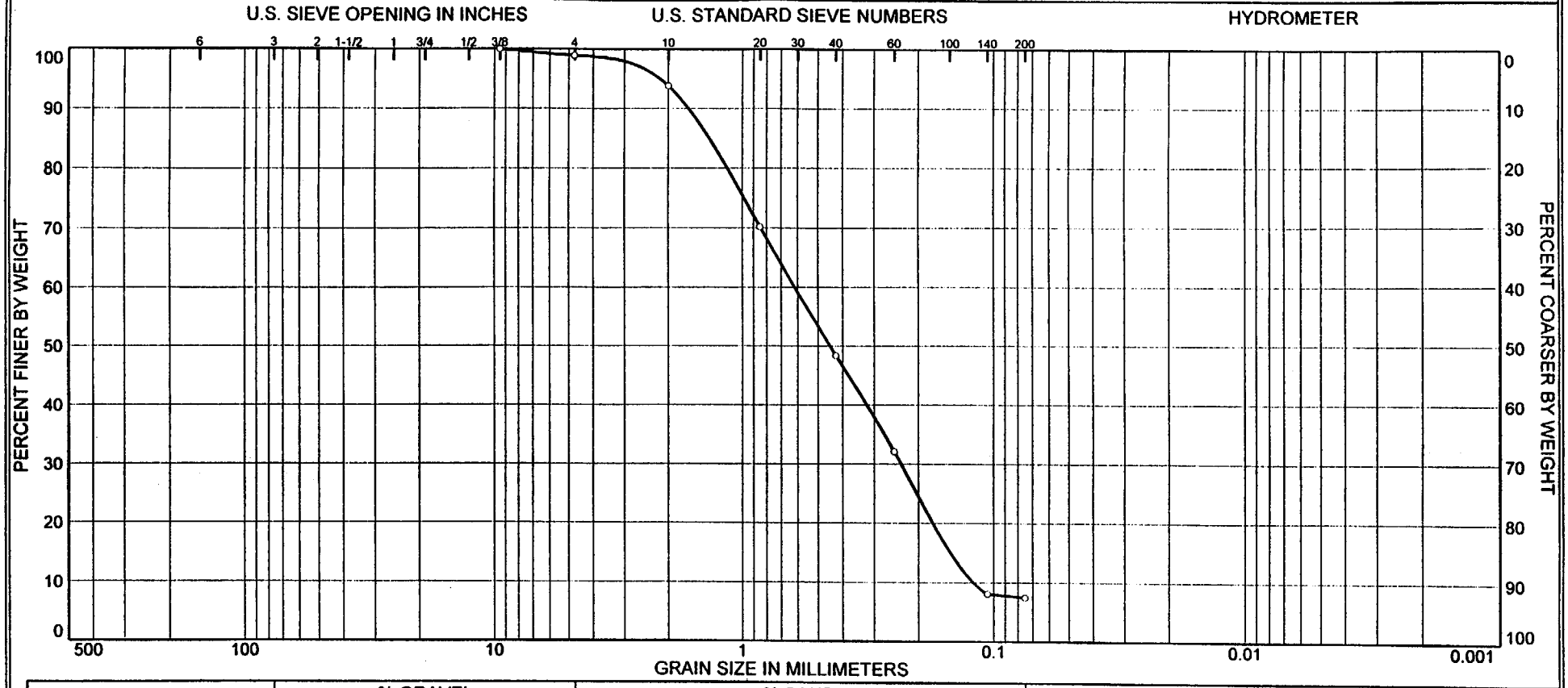
Project MOX Fuel Fabrication Facility

Project No. 50160-0-3963 | Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

○ Tested by: WFL Reviewed by: HJ

Particle Size Distribution Report ASTM D422/D1140



	% COBBLES	% GRAVEL		% SAND			% FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	1.1	5.1	45.4	40.9	7.5	

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○	Boring BH-10	10	53-54'	8/23/00		Red Brown Poorly graded sand with silt	23.0		

Client Duke Cogema Stone & Webster (DCS)

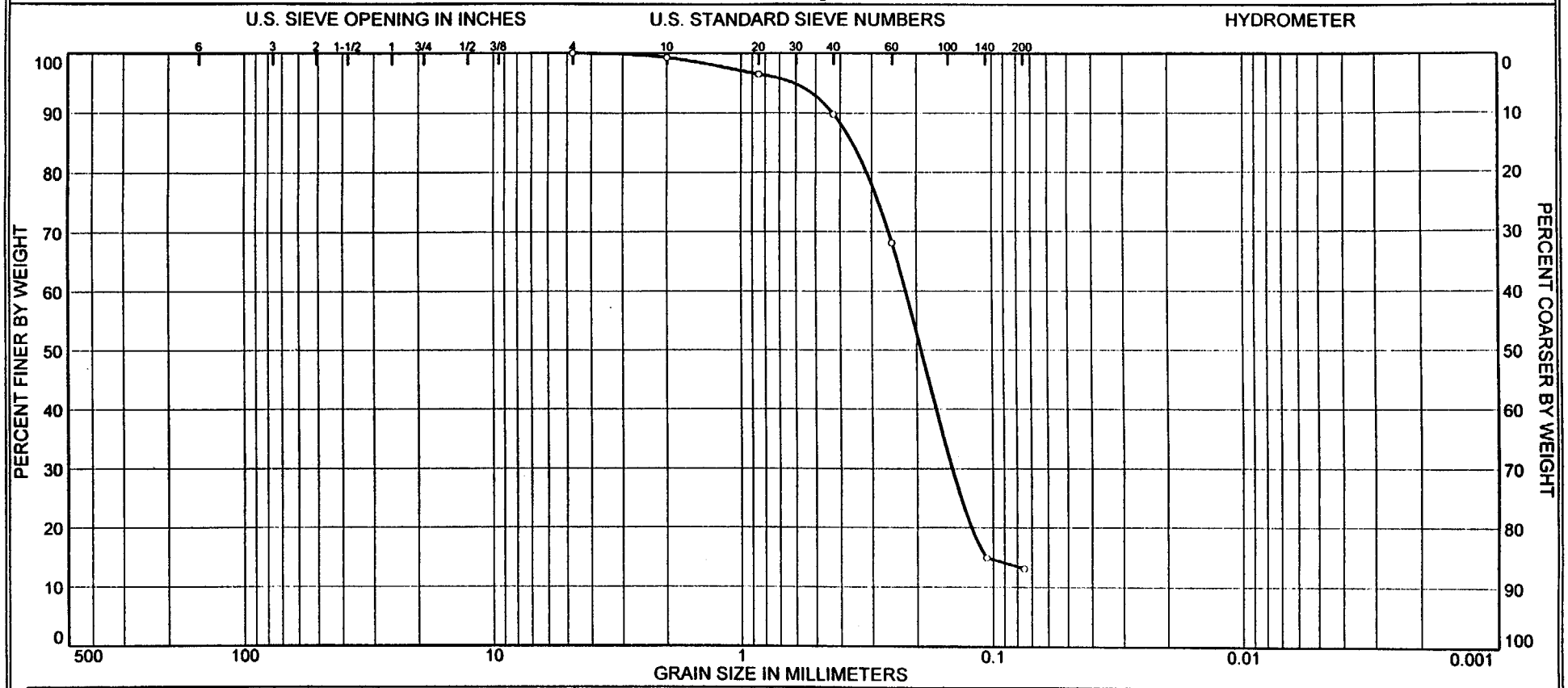
Project MOX Fuel Fabrication Facility

Project No. 50160-0-3963 | Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

○ Tested by: WFL Reviewed by: HJ

Particle Size Distribution Report ASTM D422/D1140



	% COBBLES	% GRAVEL		% SAND			% FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.0	0.7	9.5	76.7	13.1	

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○	Boring BH-10	13	68-68.8'	8/23/00		Red Brown Silty sand			

Client Duke Cogema Stone & Webster (DCS)

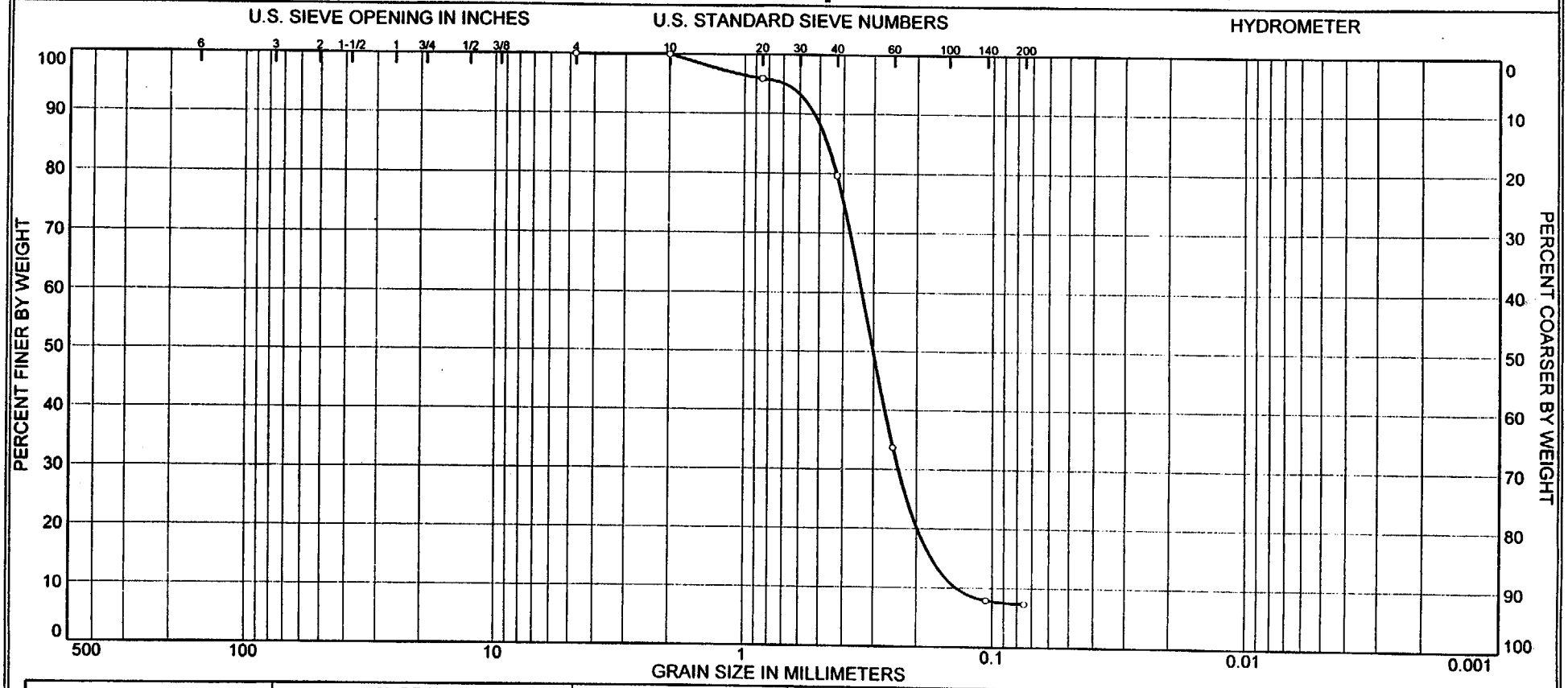
Project MOX Fuel Fabrication Facility

Project No. 50160-0-3963 | Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

○ Tested by: WFL Reviewed by: HJ

Particle Size Distribution Report ASTM D422/D1140



	% COBBLES	% GRAVEL		% SAND			% FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.0	0.0	20.3	72.4	7.3	

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○	Boring BH-10	14A	72.3-72.8'	8/23/00		Red Brown Poorly graded sand with silt			

Client Duke Cogema Stone & Webster (DCS)

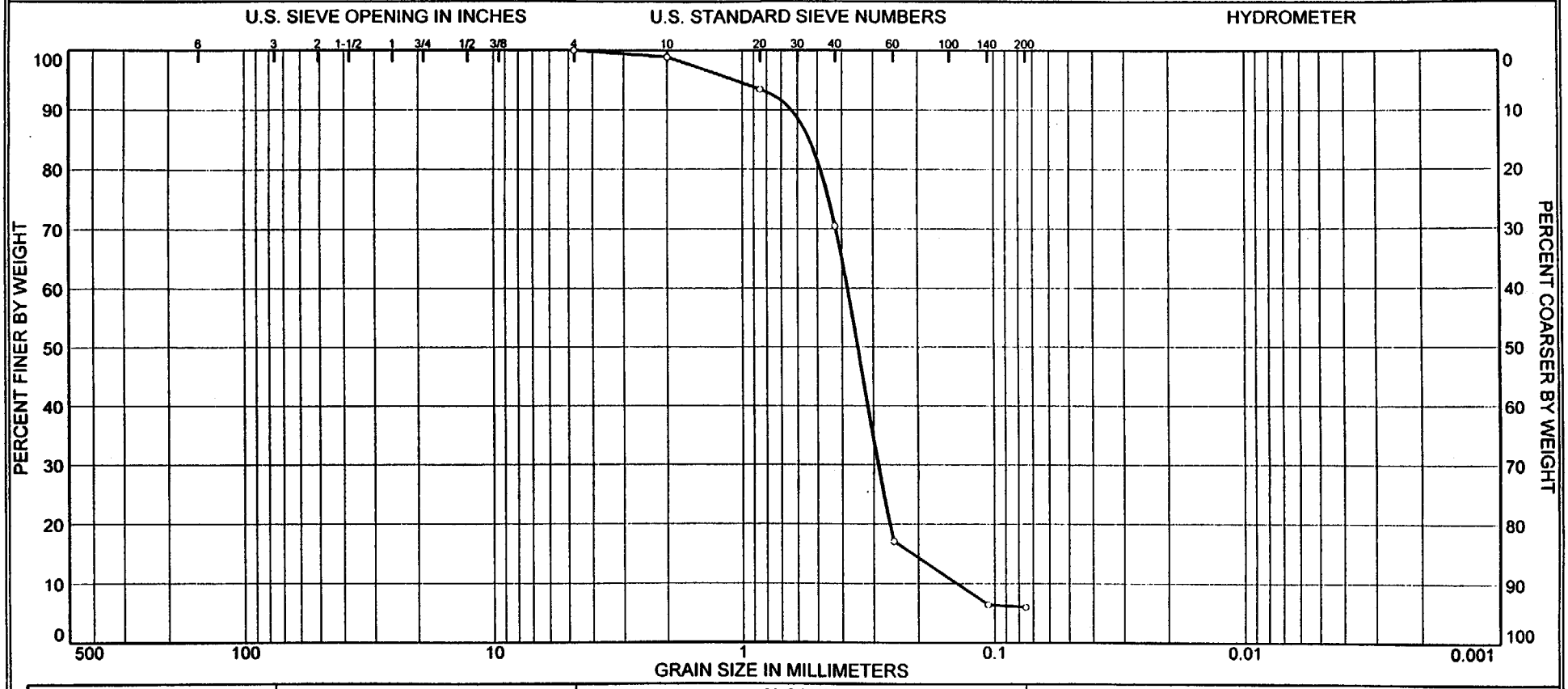
Project MOX Fuel Fabrication Facility

Project No. 50160-0-3963 | Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

○ Tested by: WFL Reviewed by: HJ

Particle Size Distribution Report ASTM D422/D1140



	% COBBLES	% GRAVEL		% SAND			% FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.0	1.1	28.4	64.5	6.0	

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○	Boring BH-10	15	78-79'	8/23/00		Brown Poorly graded sand with silt			

Client Duke Cogema Stone & Webster (DCS)

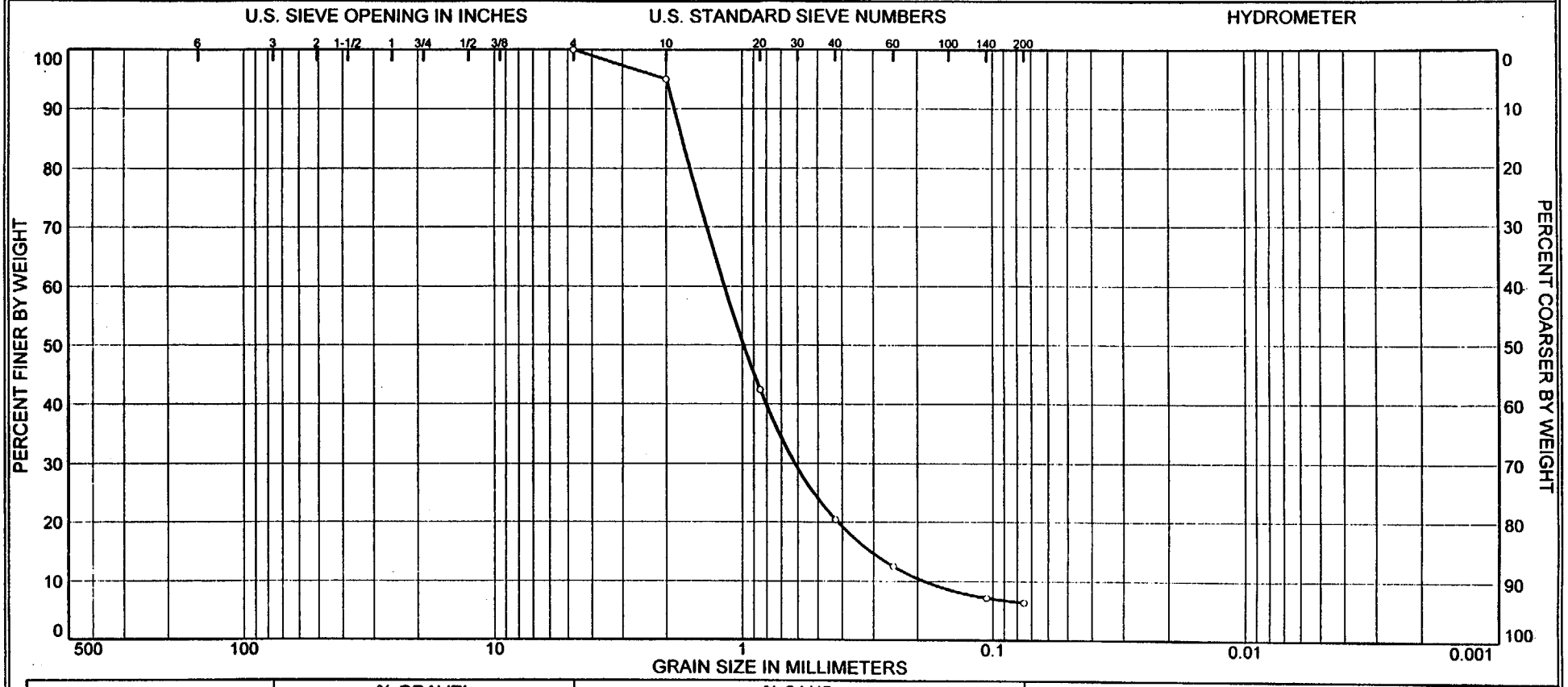
Project MOX Fuel Fabrication Facility

Project No. 50160-0-3963 | Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

○ Tested by: WFL Reviewed by: HJ

Particle Size Distribution Report ASTM D422/D1140



	% COBBLES	% GRAVEL		% SAND			% FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.0	5.0	74.6	14.0	6.4	

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○	Boring BH-10	17 (17-1)	88-88.4'	9/7/00		Tan Brown Well-graded sand with silt	16.3		

Client Duke Cogema Stone & Webster (DCS)

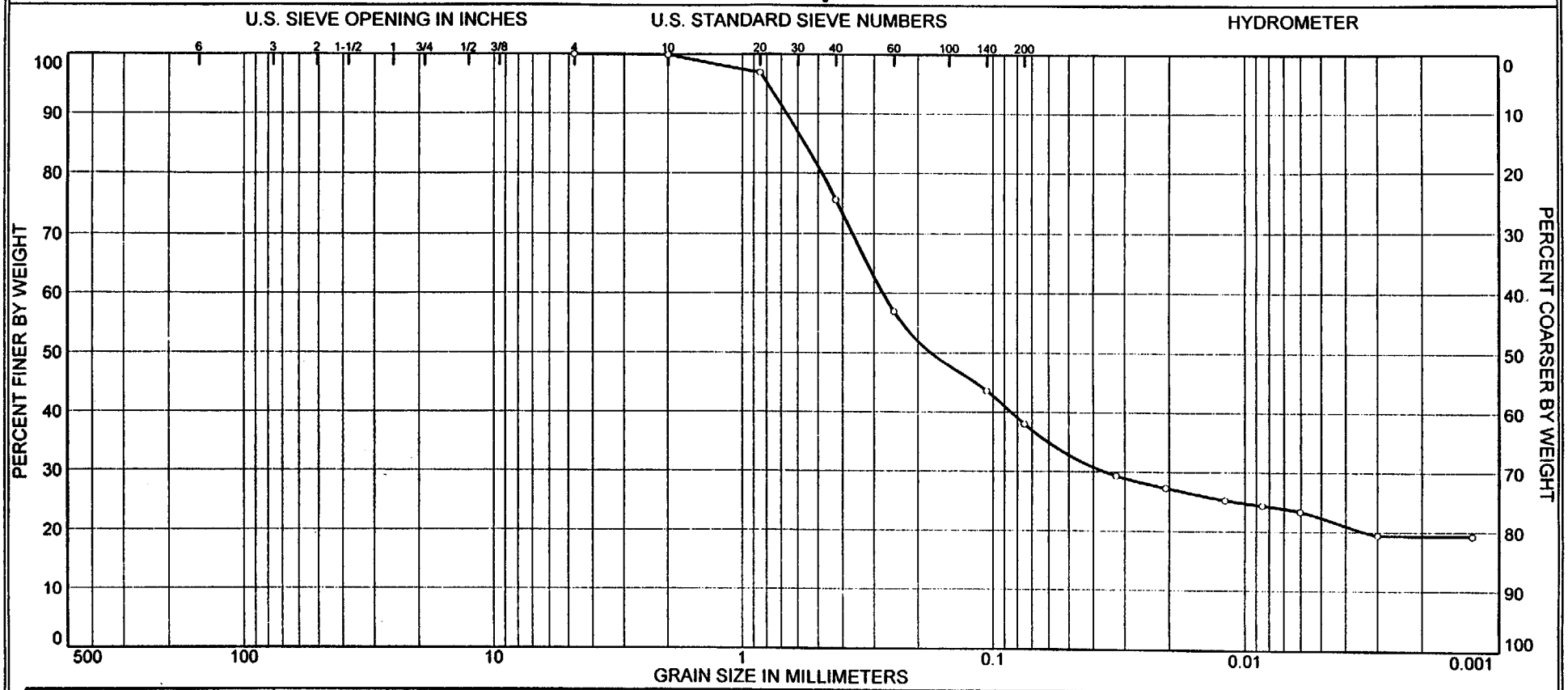
Project MOX Fuel Fabrication Facility

Project No. 50160-0-3963 | Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

○ Tested by: WFL Reviewed by: HJ

Particle Size Distribution Report ASTM D422/D1140



	% COBBLES	% GRAVEL		% SAND			% FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.0	0.1	24.3	37.6	15.6	22.4

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○	Boring BH-10	19	98-99.5'	8/31/00	SC	Brown Clayey sand	28.5	83	23

Client Duke Cogema Stone & Webster (DCS)

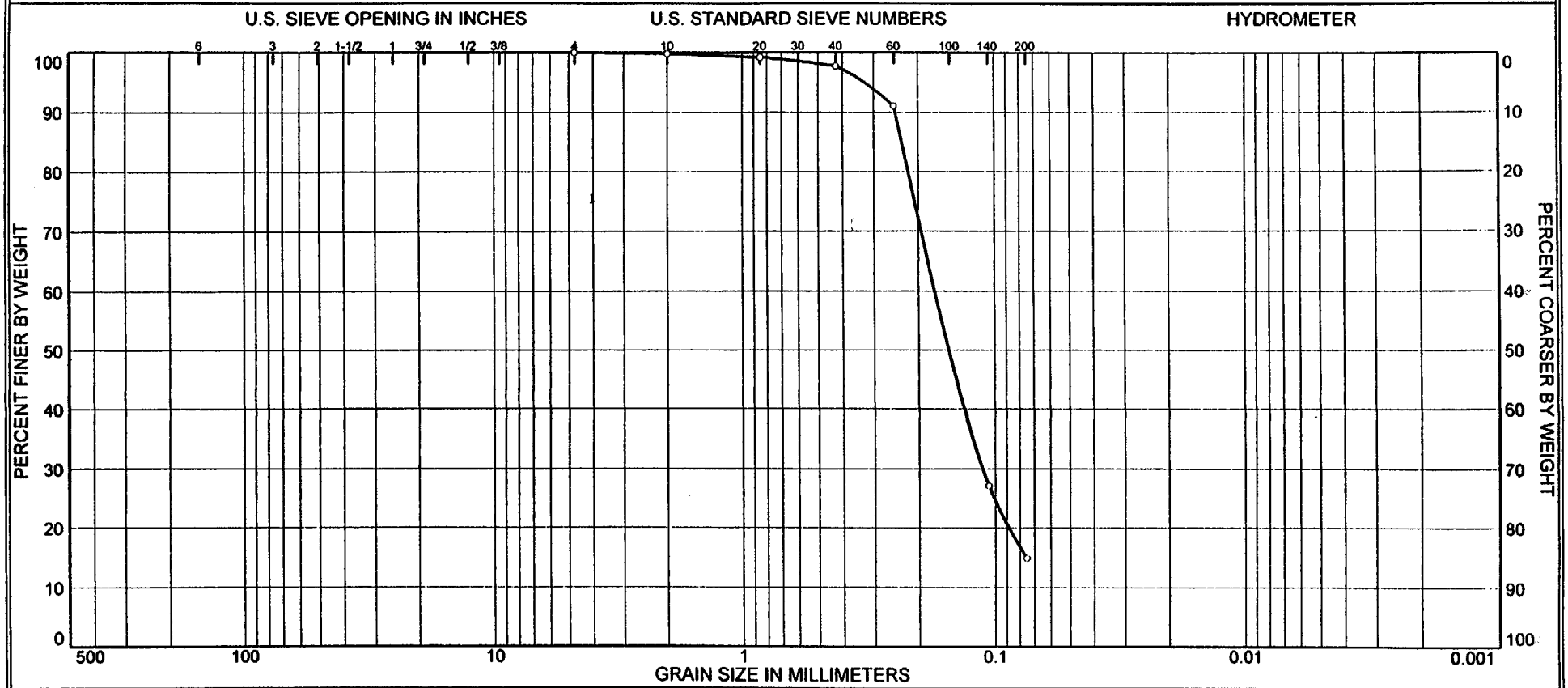
Project MOX Fuel Fabrication Facility

Project No. 50160-0-3963 | Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

○ Tested by: WFL/SC Reviewed by: HJ

Particle Size Distribution Report ASTM D422/D1140



	% COBBLES	% GRAVEL		% SAND			% FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.0	0.2	2.1	82.8	14.9	

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○	Boring BH-10	21A	106-107'	8/23/00		Tan Brown Silty sand	23.2		

Client Duke Cogema Stone & Webster (DCS)

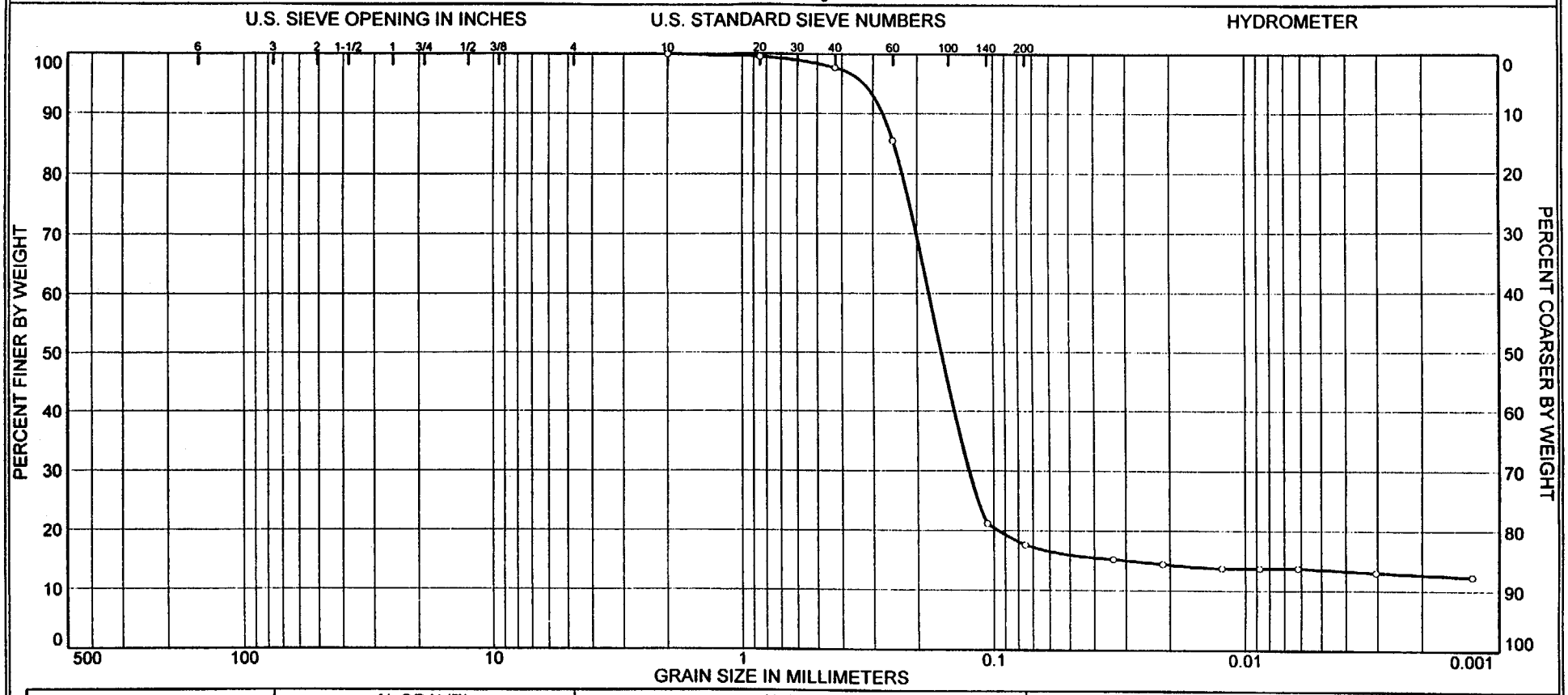
Project MOX Fuel Fabrication Facility

Project No. 50160-0-3963 | Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

○ Tested by: WFL Reviewed by: HJ

Particle Size Distribution Report ASTM D422/D1140



	% COBBLES	% GRAVEL		% SAND			% FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.0	0.0	2.3	80.1	4.1	13.5

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○	Boring BH-10	24	124.5-125'	8/22/00	SM	Tan Silty sand	32.8	43	28

Client Duke Cogema Stone & Webster (DCS)

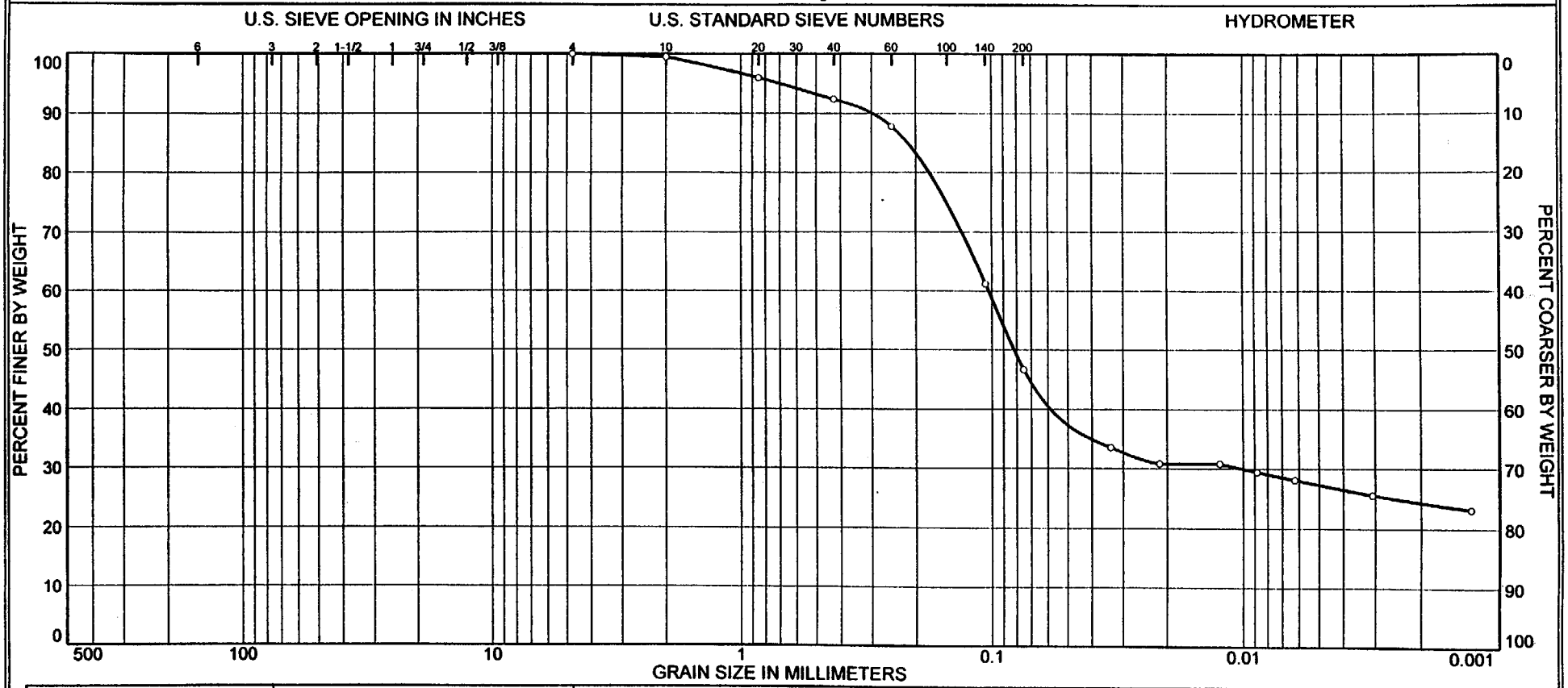
Project MOX Fuel Fabrication Facility

Project No. 50160-0-3963 | Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

○ Tested by: JTM/WFL Reviewed by: HJ

Particle Size Distribution Report ASTM D422/D1140



	% COBBLES	% GRAVEL		% SAND			% FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.0	0.5	7.1	45.7	19.4	27.3

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○	Boring BH-10	26B (top)	135-137'	9/28/00	SC	Brown Clayey sand		69	24

Client Duke Cogema Stone & Webster (DCS)

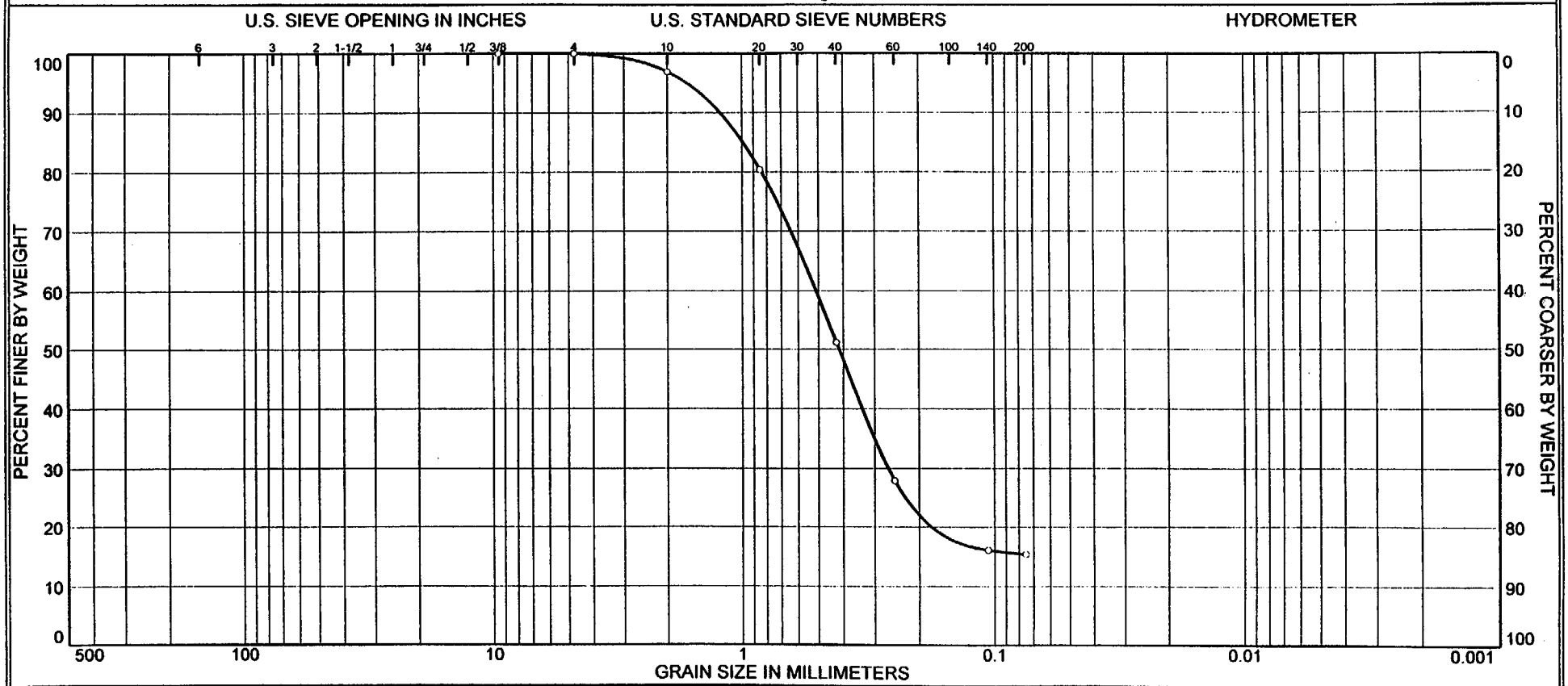
Project MOX Fuel Fabrication Facility

Project No. 5016003963 Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

○ Tested by: WFL/SC Reviewed by: HJ

Particle Size Distribution Report ASTM D422/D1140



	% COBBLES	% GRAVEL		% SAND			% FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.0	3.1	45.7	35.8	15.4	

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○	Boring BH-10	26B Retest	135-136.5'	11/20/00	SM	Tan Brown Silty sand		45	22

Client Duke Cogema Stone & Webster (DCS)

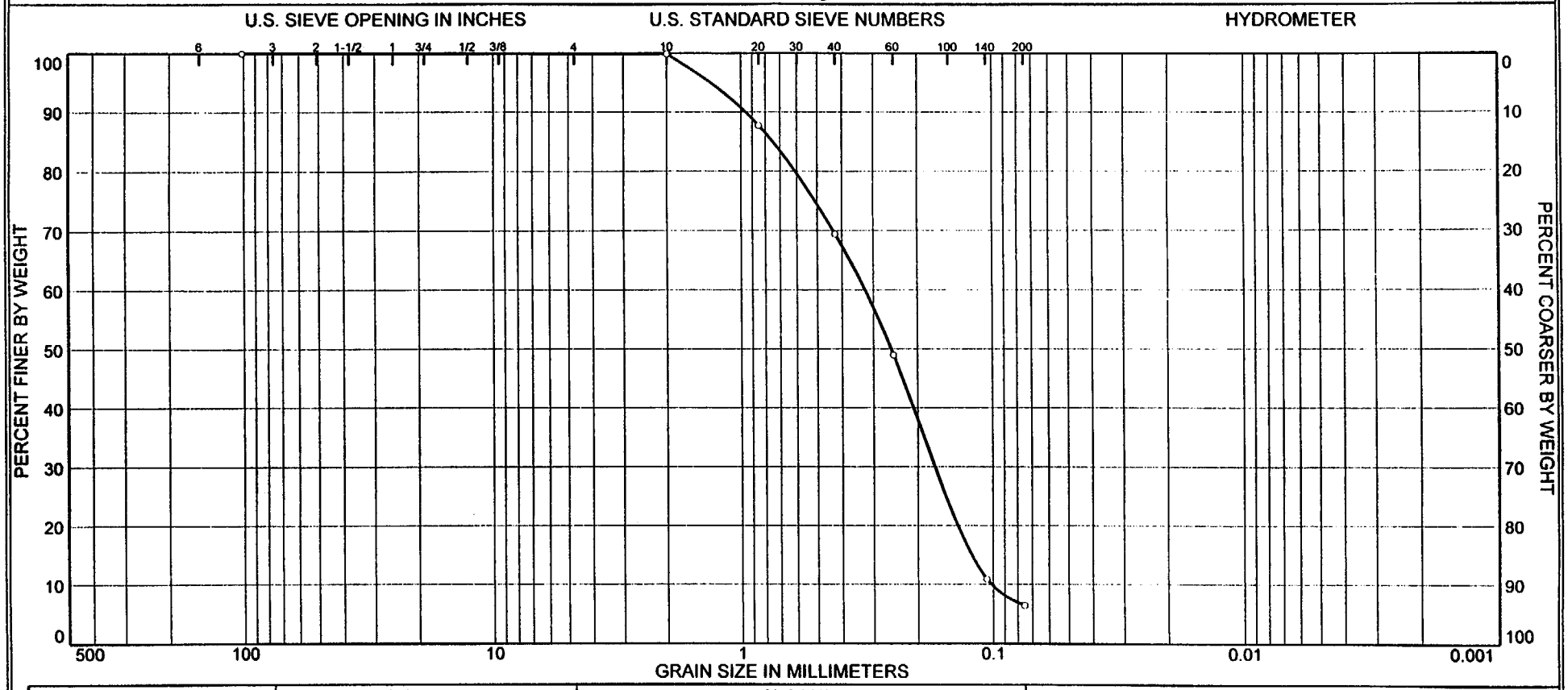
Project MOX Fuel Fabrication Facility

Project No. 5016003963 Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

○ Tested by: SC Reviewed by: HJ

Particle Size Distribution Report ASTM D422/D1140



	% COBBLES	% GRAVEL		% SAND			% FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.1	0.0	30.5	63.0	6.4	

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○	Boring BH-10	29	148.5-149.5'	8/23/00		Gray Black Poorly graded sand with silt	22.6		

Client Duke Cogema Stone & Webster (DCS)

Project MOX Fuel Fabrication Facility

Project No. 50160-0-3963 | Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

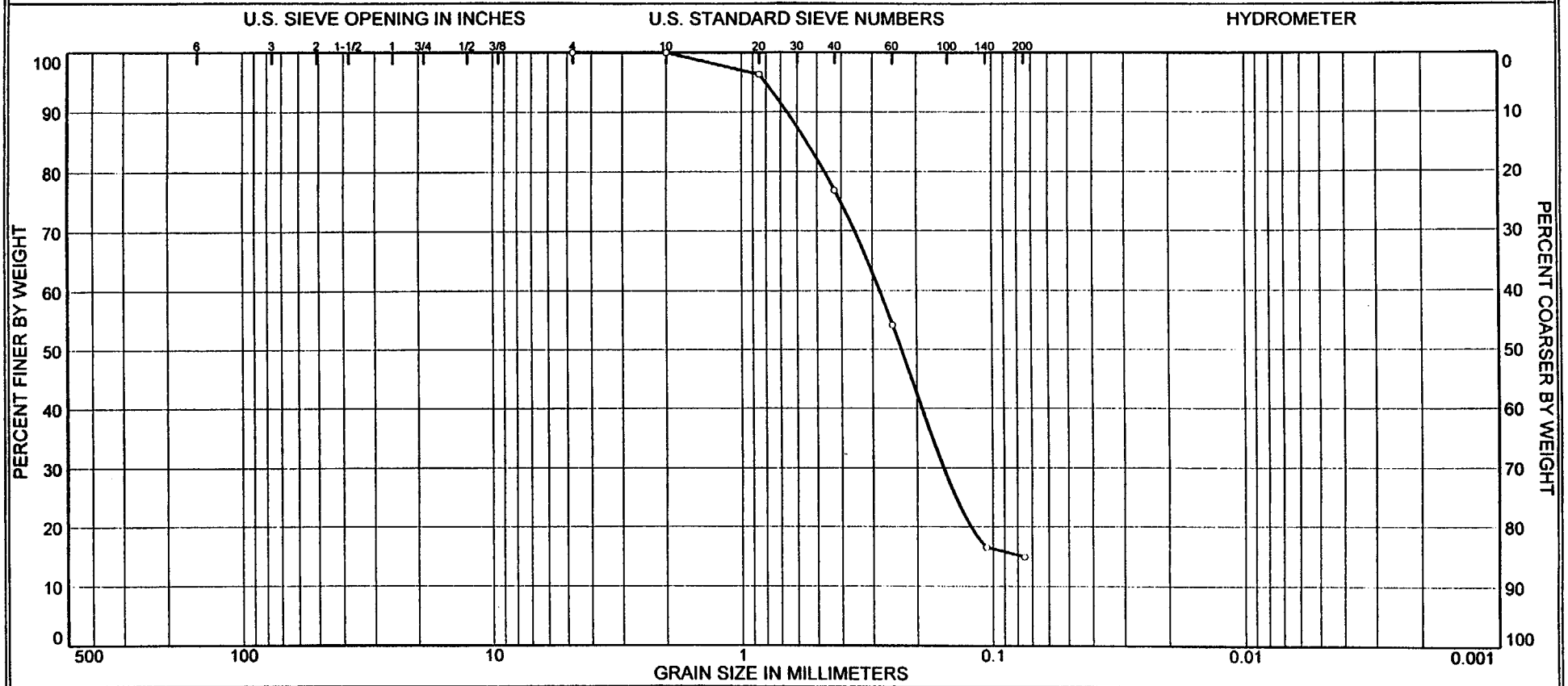
○ Tested by: WFL Reviewed by: HJ

Grain Size & Atter[illegible] Limits Summary

Project: MOX Fuel Fabrication Facility **LAW Project No:** 50160-0-3963

Source of Sample	Sample No.	Depth	Material Description	Sand (%)	Silt (%)	Clay (%)	Fines (%)	Natural Moisture (%)	LL	PL	PI
Boring BH-11	1	43.5-44'	Tan Silty sand	85.1			14.9	11.3			
	3	53-53.8'	Red Brown Poorly graded sand with silt	93.7			6.3	16.2			
	5	63-64'	Tan Brown Well-graded sand with silt	93.1			6.9	13.5			
	7A	73-74'	Tan Poorly graded sand with silt	90.4			9.6	20.2			
	7B (top)	74.5-75.5'	Light Brown Clayey sand	81.8	3.9	10.7	14.6		59	23	36
	8B (bottom)	82-84'	Tan Clayey sand	66.9	5.4	27.7	33.1		118	38	80
	8B (top)	82-84'	Light Brown Clayey sand	71.6	5.6	21.6	27.2		54	20	34
	9A	90-91.8'	Brown Silty sand	83.4			12.1				
	10	98-99.5'	Tan Clayey sand	72.6	5.7	21.7	27.4	37.6	86	34	52
	13	113.5-114.5'	Tan Silty sand	77.1	8.6	14.3	22.9	27.8			
	14	118.5-119.5'	Tan Brown Poorly graded sand with silt	88.9			9.6	30.8			
	15	123-124'	Tan Brown Poorly graded sand with silt	94.5			5.5	22.3			
	17	133-134'	Brown Poorly graded sand with silt	93.9			6.1	24.1			
	19	143-144.5'	Brown Clayey sand	77.6	4.2	18.2	22.4	31.7	51	27	24
	21A	153-154.5'	Tan Sandy silt	34.9	51.1	14	65.1	32.7	39	28	11
	21B (top)	154-156.5'	Tan Fat clay with sand	23.7	22.4	53.9	76.3		83	27	56

Particle Size Distribution Report ASTM D422/D1140



	% COBBLES	% GRAVEL		% SAND			% FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.0	0.0	23.1	62.0	14.9	

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○	Boring BH-11	1	43.5-44'	8/25/00		Tan Silty sand	11.3		

Client Duke Cogema Stone & Webster (DCS)

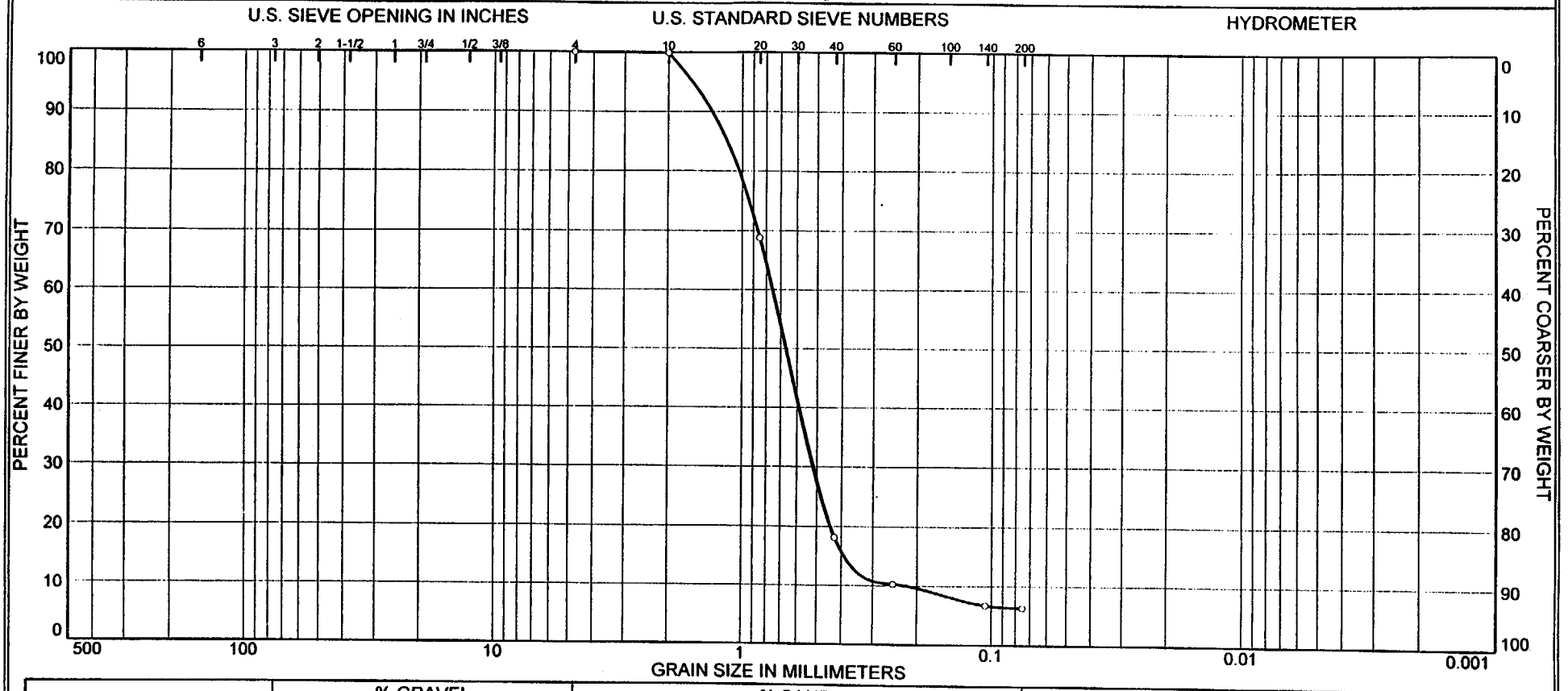
Project MOX Fuel Fabrication Facility

Project No. 50160-0-3963 | Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

○ Tested by: WFL Reviewed by: HJ

Particle Size Distribution Report ASTM D422/D1140



	% COBBLES	% GRAVEL		% SAND			% FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.0	0.1	81.7	11.9	6.3	

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○	Boring BH-11	3	53-53.8'	8/25/00		Red Brown Poorly graded sand with silt	16.2		

Client Duke Cogema Stone & Webster (DCS)

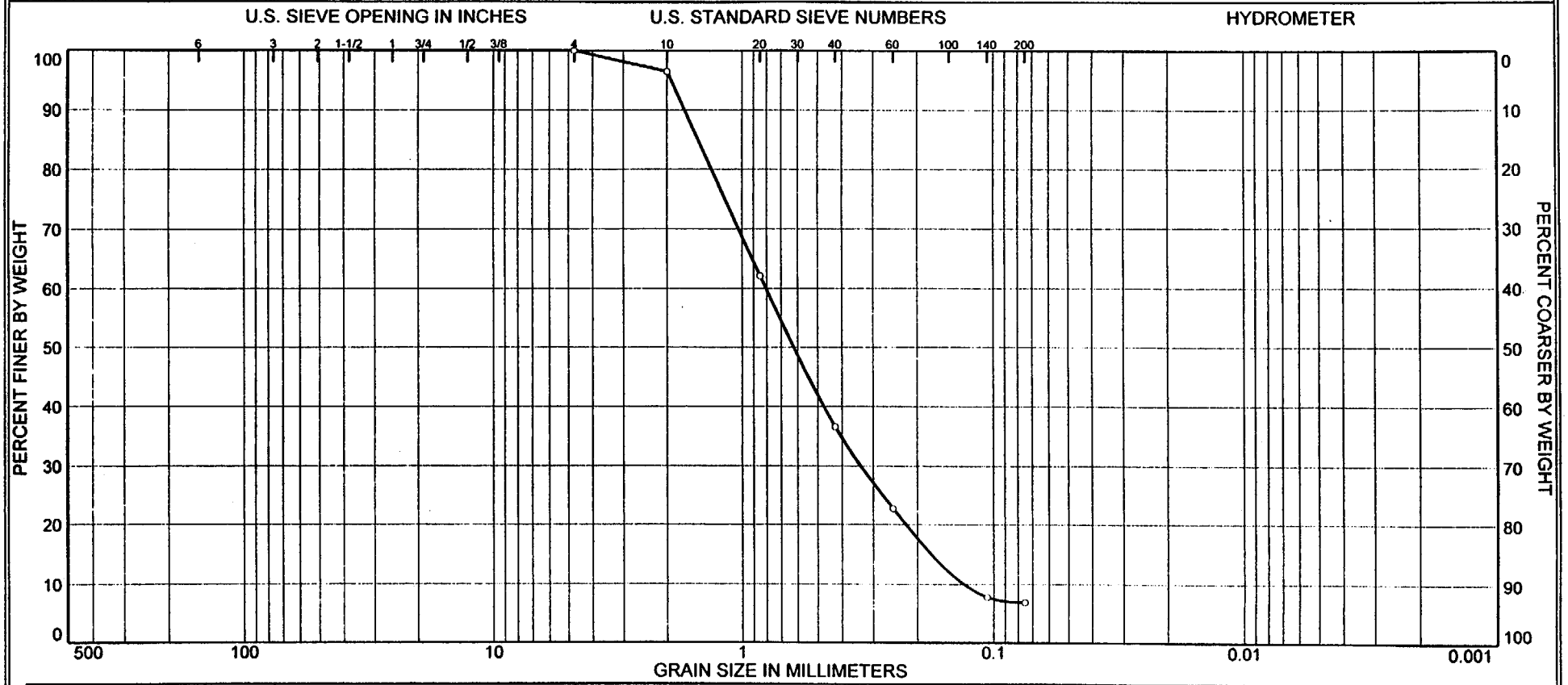
Project MOX Fuel Fabrication Facility

Project No. 50160-0-3963 | Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

○ Tested by: WFL Reviewed by: HJ

Particle Size Distribution Report ASTM D422/D1140



	% COBBLES	% GRAVEL		% SAND			% FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.0	3.5	59.9	29.7	6.9	

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○	Boring BH-11	5	63-64'	8/25/00		Tan Brown Well-graded sand with silt	13.5		

Client Duke Cogema Stone & Webster (DCS)

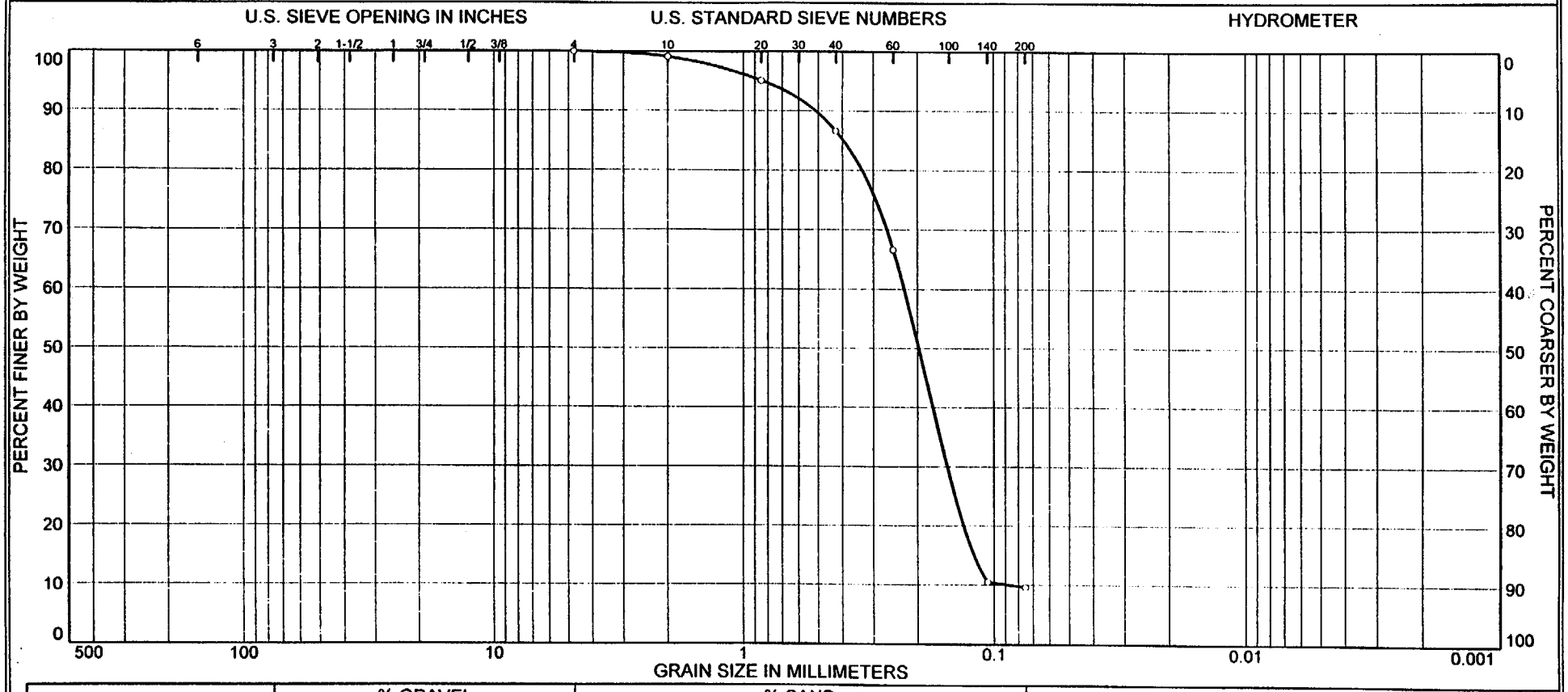
Project MOX Fuel Fabrication Facility

Project No. 50160-0-3963 | Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

○ Tested by: WFL Reviewed by: HJ

Particle Size Distribution Report ASTM D422/D1140



	% COBBLES	% GRAVEL		% SAND			% FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.0	0.9	12.5	77.0	9.6	

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○	Boring BH-11	7A	73-74'	8/25/00		Tan Poorly graded sand with silt	20.2		

Client Duke Cogema Stone & Webster (DCS)

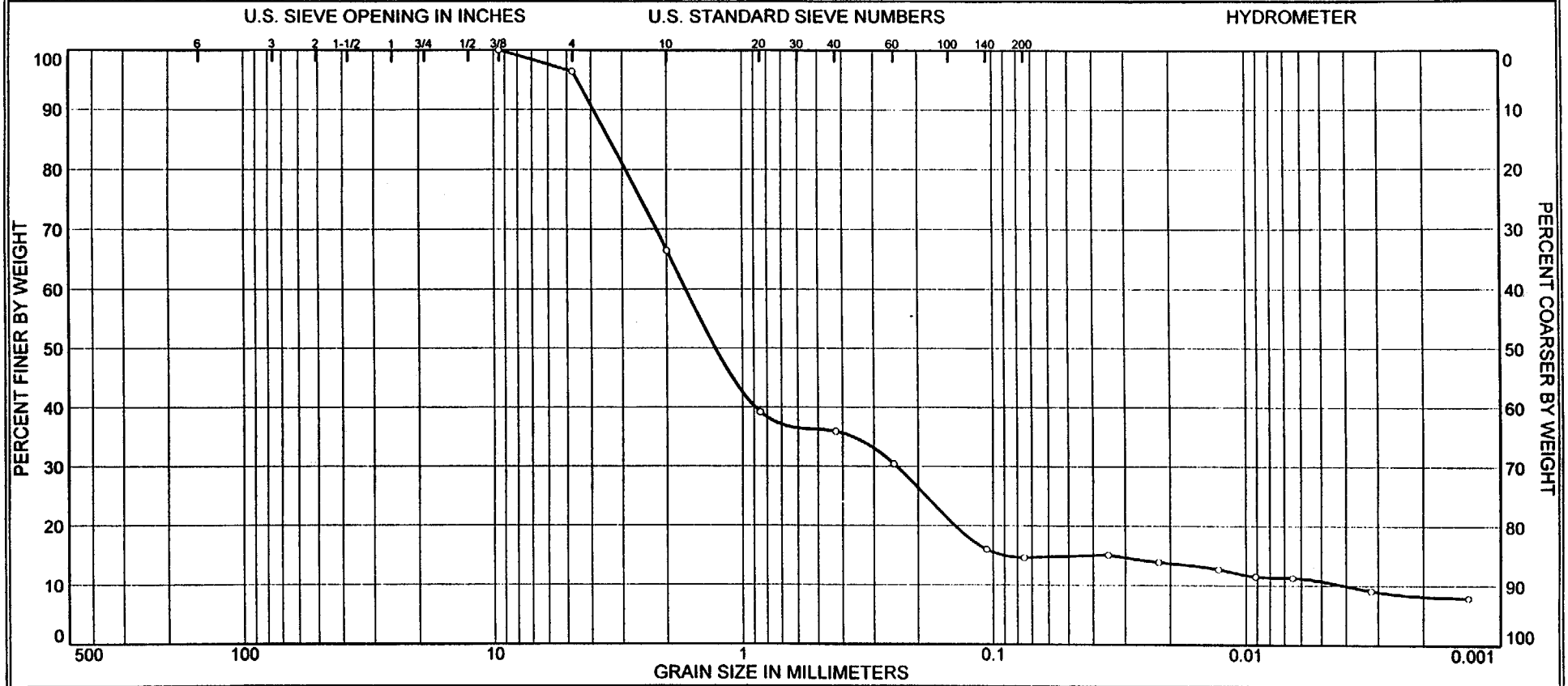
Project MOX Fuel Fabrication Facility

Project No. 50160-0-3963 | Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

○ Tested by: WFL Reviewed HJ

Particle Size Distribution Report ASTM D422/D1140



	% COBBLES	% GRAVEL		% SAND			% FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	3.6	29.9	30.6	21.3	3.9	10.7

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○	Boring BH-11	7B (Top)	74.5-75.5'	9/29/00	SC	Light Brown Clayey sand		59	23

Client Duke Cogema Stone & Webster (DCS)

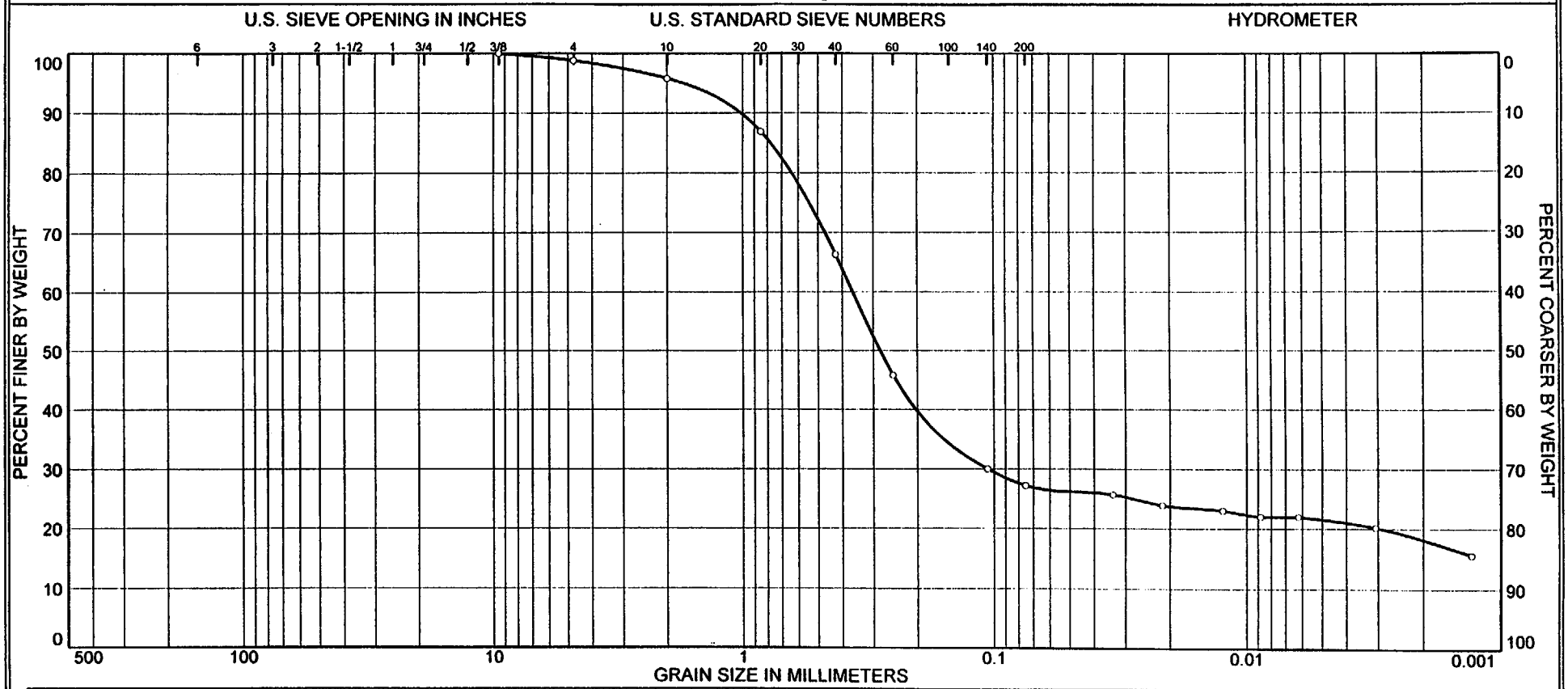
Project MOX Fuel Fabrication Facility

Project No. 5016003963 | Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

○ Tested by: WFL/SC Reviewed by:HJ

Particle Size Distribution Report ASTM D422/D1140



	% COBBLES	% GRAVEL		% SAND			% FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	1.2	3.0	29.5	39.1	5.6	21.6

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○	Boring BH-11	8B (Top)	82-84'	10/9/00	SC	Light Brown Clayey sand		54	20

Client Duke Cogema Stone & Webster (DCS)

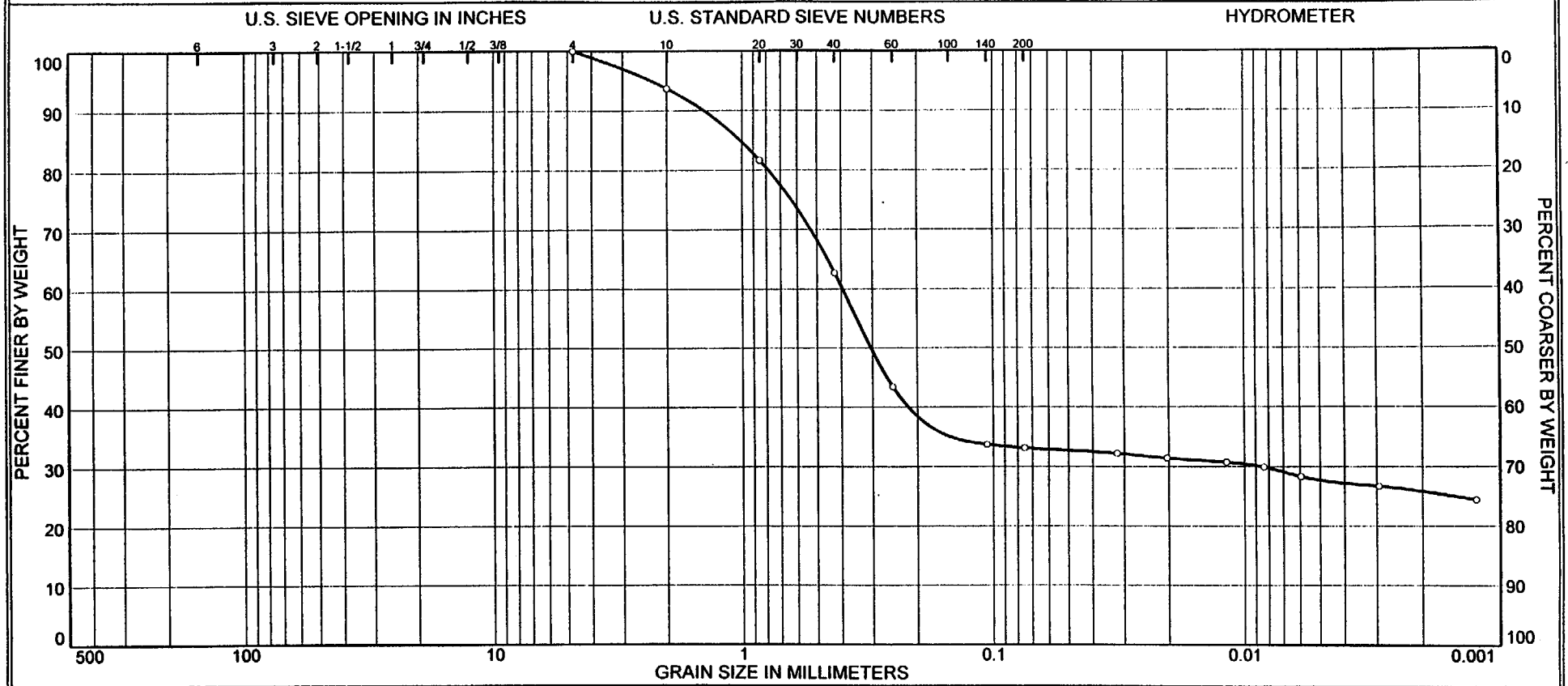
Project MOX Fuel Fabrication Facility

Project No. 5016003963 | Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

○ Tested by: WFL/SC Reviewed by: HJ

Particle Size Distribution Report ASTM D422/D1140



	% COBBLES	% GRAVEL		% SAND			% FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.0	6.3	31.0	29.6	5.4	27.7

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○	Boring BH-11	8B (Bottom)	82-84'	10/9/00	SC	Tan Clayey sand		118	38

Client Duke Cogema Stone & Webster (DCS)

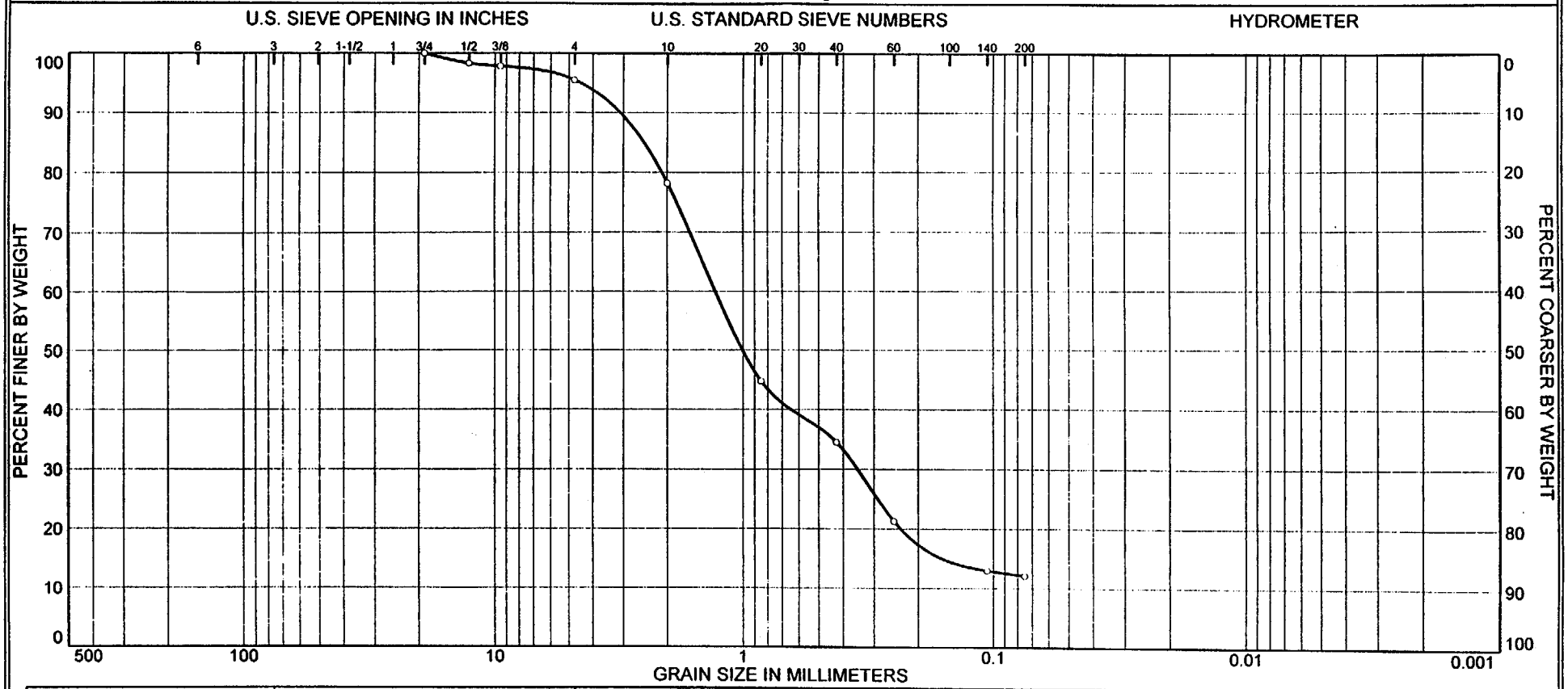
Project MOX Fuel Fabrication Facility

Project No. 5016003963 | Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

○ Tested by: WFL/SC Reviewed by: HJ

Particle Size Distribution Report ASTM D422/D1140



	% COBBLES	% GRAVEL		% SAND			% FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	4.5	17.3	43.7	22.4	12.1	

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○	Boring BH-11	9A	90-91.8'	8/25/00		Brown Silty sand			

Client Duke Cogema Stone & Webster (DCS)

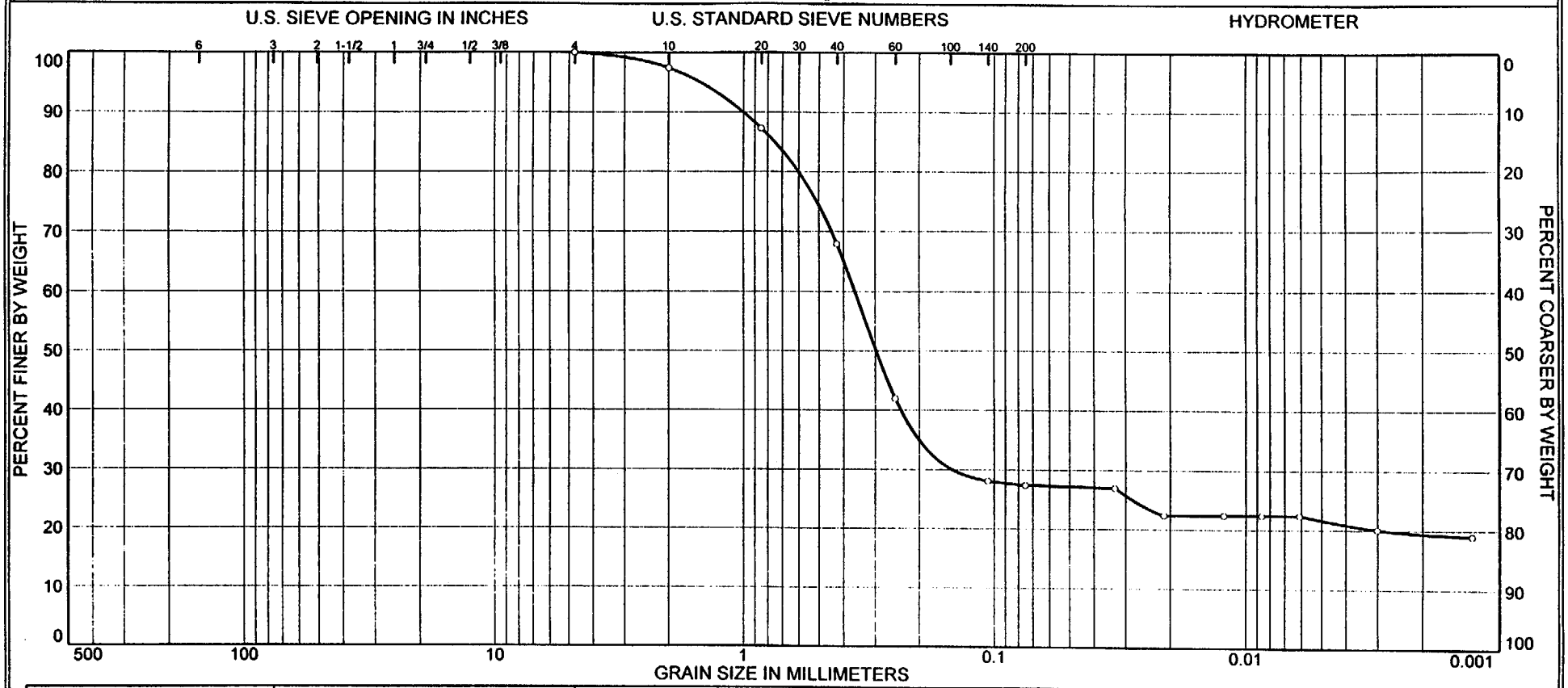
Project MOX Fuel Fabrication Facility

Project No. 50160-0-3963 | Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

○ Tested by: WFL Reviewed by: HJ

Particle Size Distribution Report ASTM D422/D1140



	% COBBLES	% GRAVEL		% SAND			% FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.0	2.6	29.5	40.5	5.7	21.7

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○	Boring BH-11	10	98-99.5'	8/29/00	SC	Tan Clayey sand	37.6	86	34

Client Duke Cogema Stone & Webster (DCS)

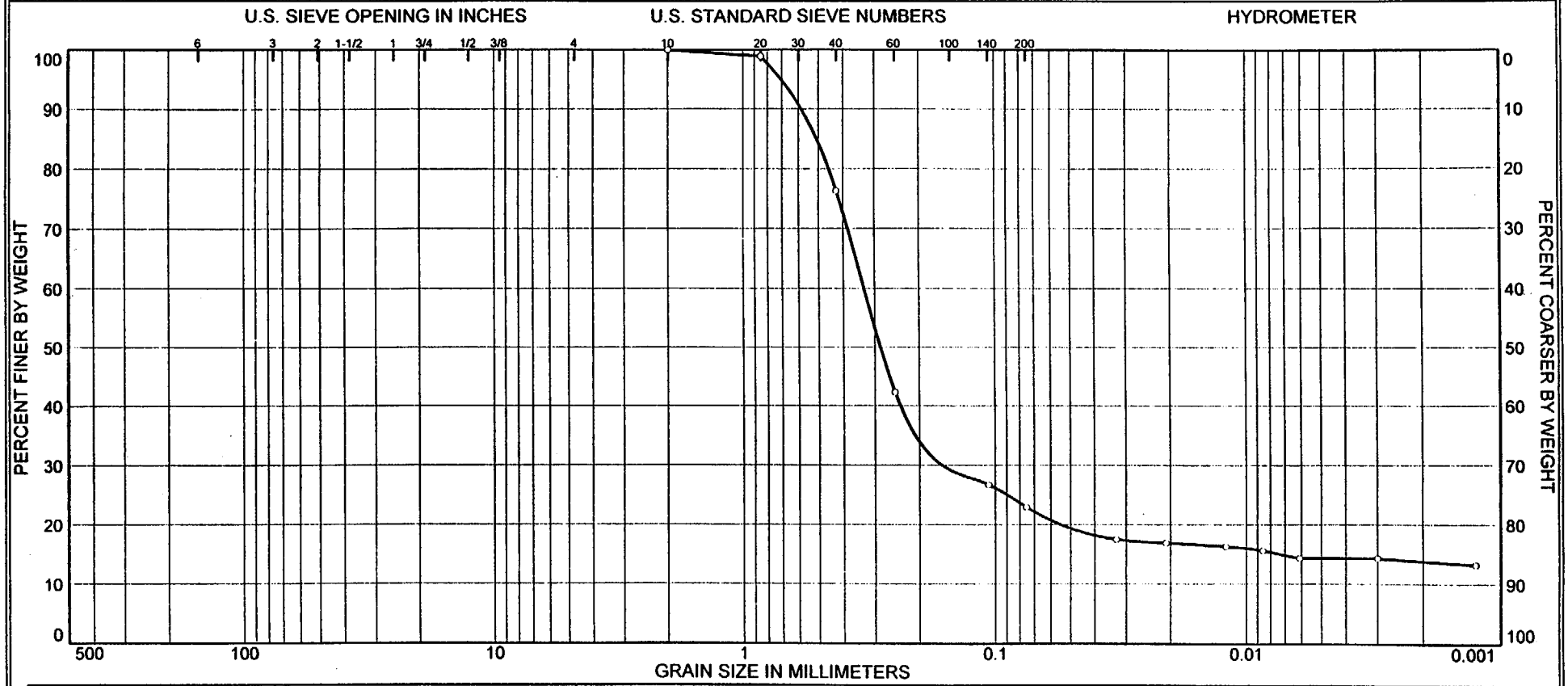
Project MOX Fuel Fabrication Facility

Project No. 50160-0-3963 | Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

○ Tested by: SC/WFL Reviewed by: HJ

Particle Size Distribution Report ASTM D422/D1140



	% COBBLES	% GRAVEL		% SAND			% FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.0	0.0	23.7	53.4	8.6	14.3

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○	Boring BH-11	13	113.5-114.5	8/17/00		Tan Silty sand	27.8		

Client Duke Cogema Stone & Webster (DCS)

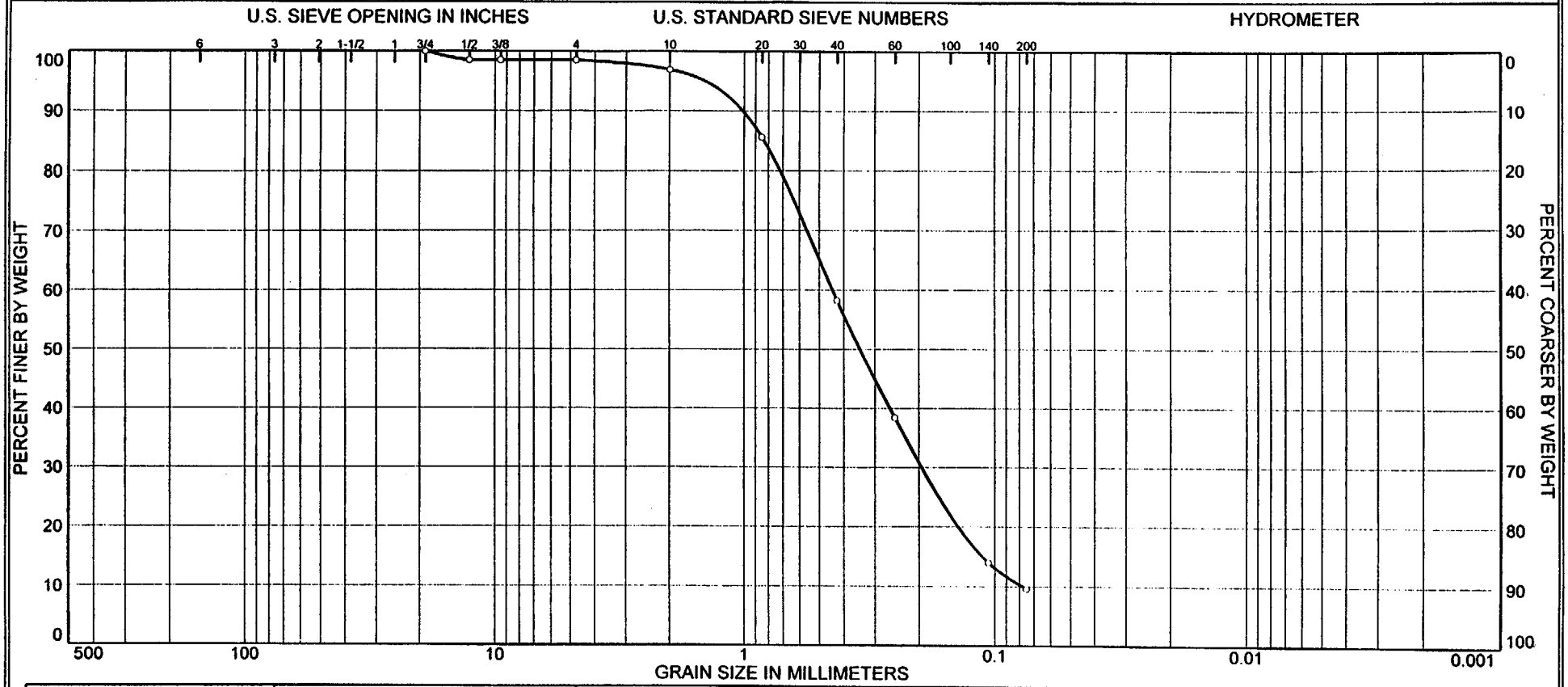
Project MOX Fuel Fabrication Facility

Project No. 50160-0-3963 | Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

○ Tested by: SC/WFL Reviewed by: HJ

Particle Size Distribution Report ASTM D422/D1140



	% COBBLES	% GRAVEL		% SAND			% FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	1.5	1.6	38.7	48.6	9.6	

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○	Boring BH-11	14	118.5-119.5	8/25/00		Tan Brown Poorly graded sand with silt	30.8		

Client Duke Cogema Stone & Webster (DCS)

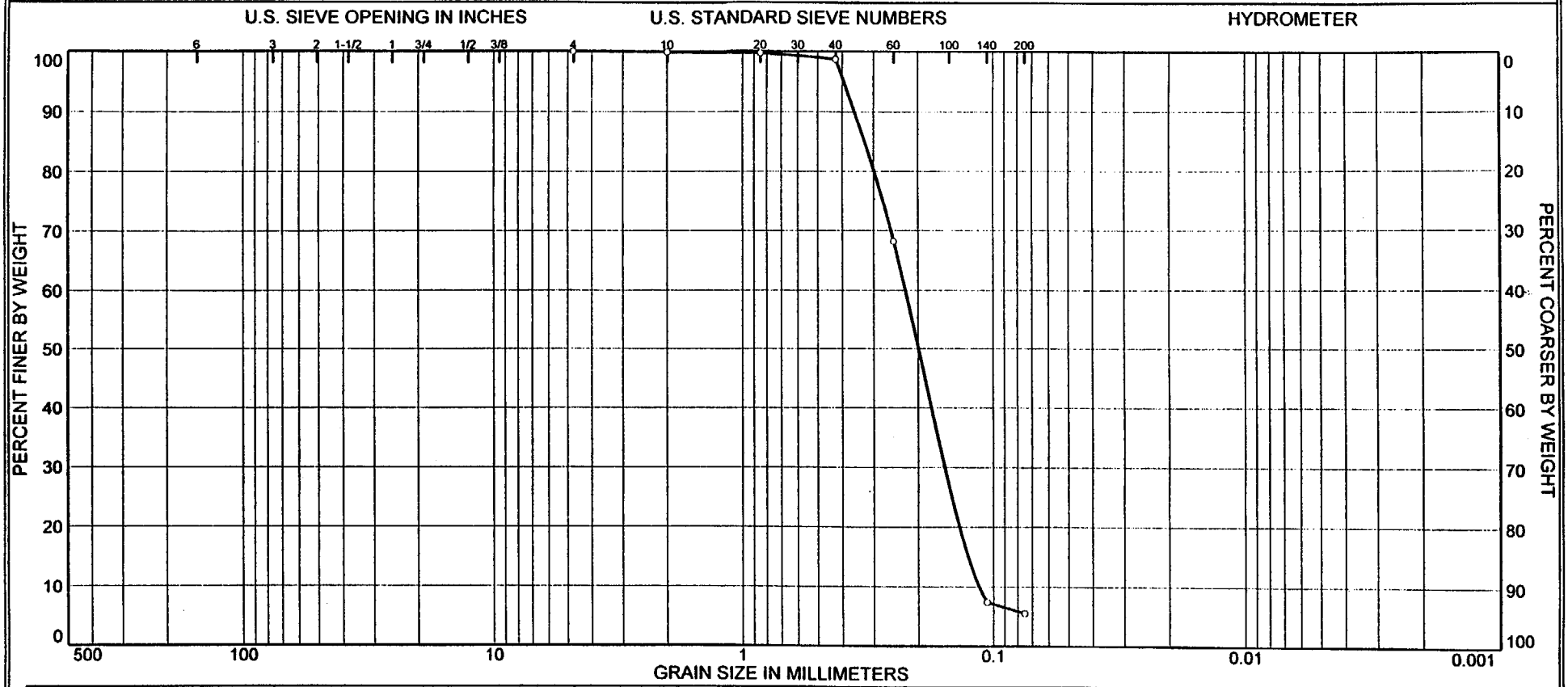
Project MOX Fuel Fabrication Facility

Project No. 50160-0-3963 | Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

○ Tested by: WFL Reviewed by: HJ

Particle Size Distribution Report ASTM D422/D1140



	% COBBLES	% GRAVEL		% SAND			% FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.0	0.1	1.2	93.2	5.5	

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○	Boring BH-11	15	123-124'	8/25/00		Tan Brown Poorly graded sand with silt	22.3		

Client Duke Cogema Stone & Webster (DCS)

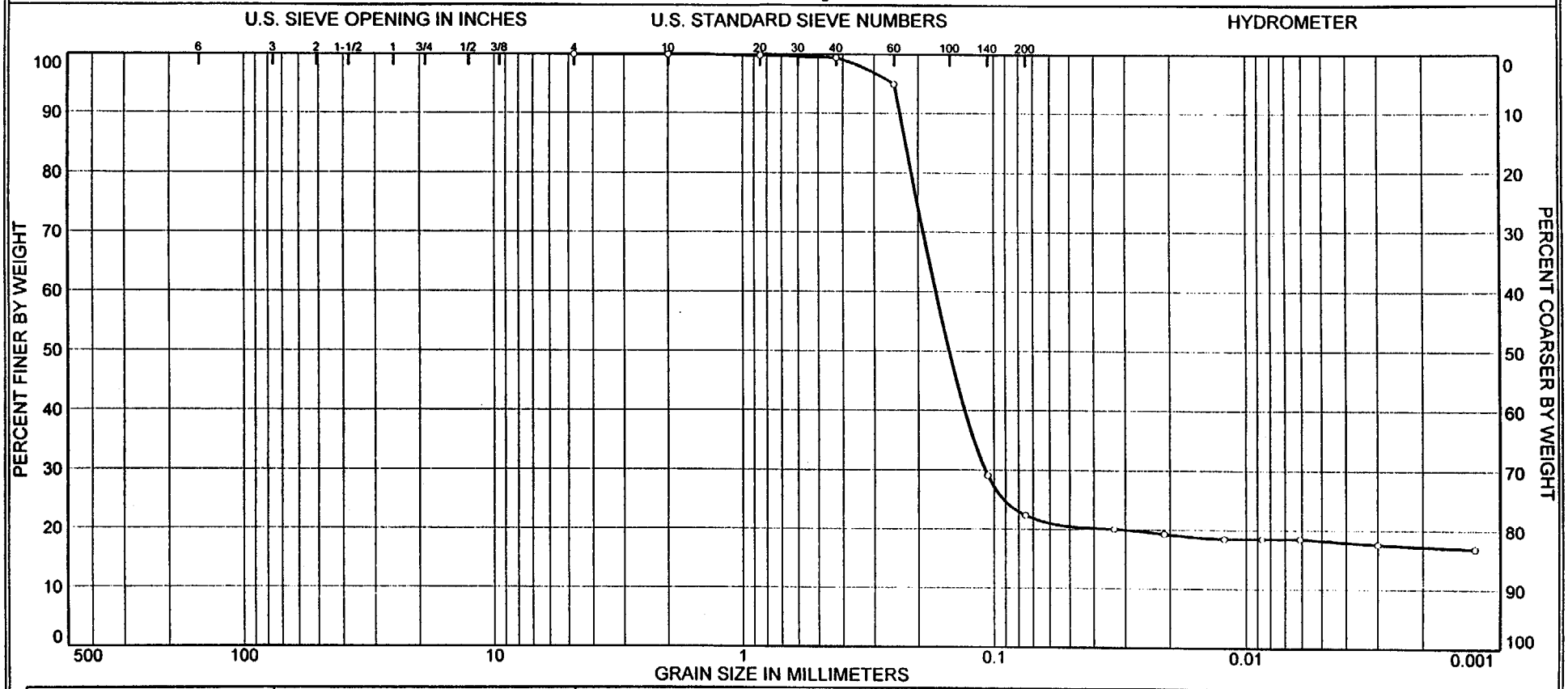
Project MOX Fuel Fabrication Facility

Project No. 50160-0-3963 Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

○ Tested by: WFL Reviewed by: HJ

Particle Size Distribution Report ASTM D422/D1140



	% COBBLES	% GRAVEL		% SAND			% FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.0	0.0	0.6	77.0	4.2	18.2

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○	Boring BH-11	19	143-144.5'	8/23/00	SC	Brown Clayey sand	31.7	51	27

Client Duke Cogema Stone & Webster (DCS)

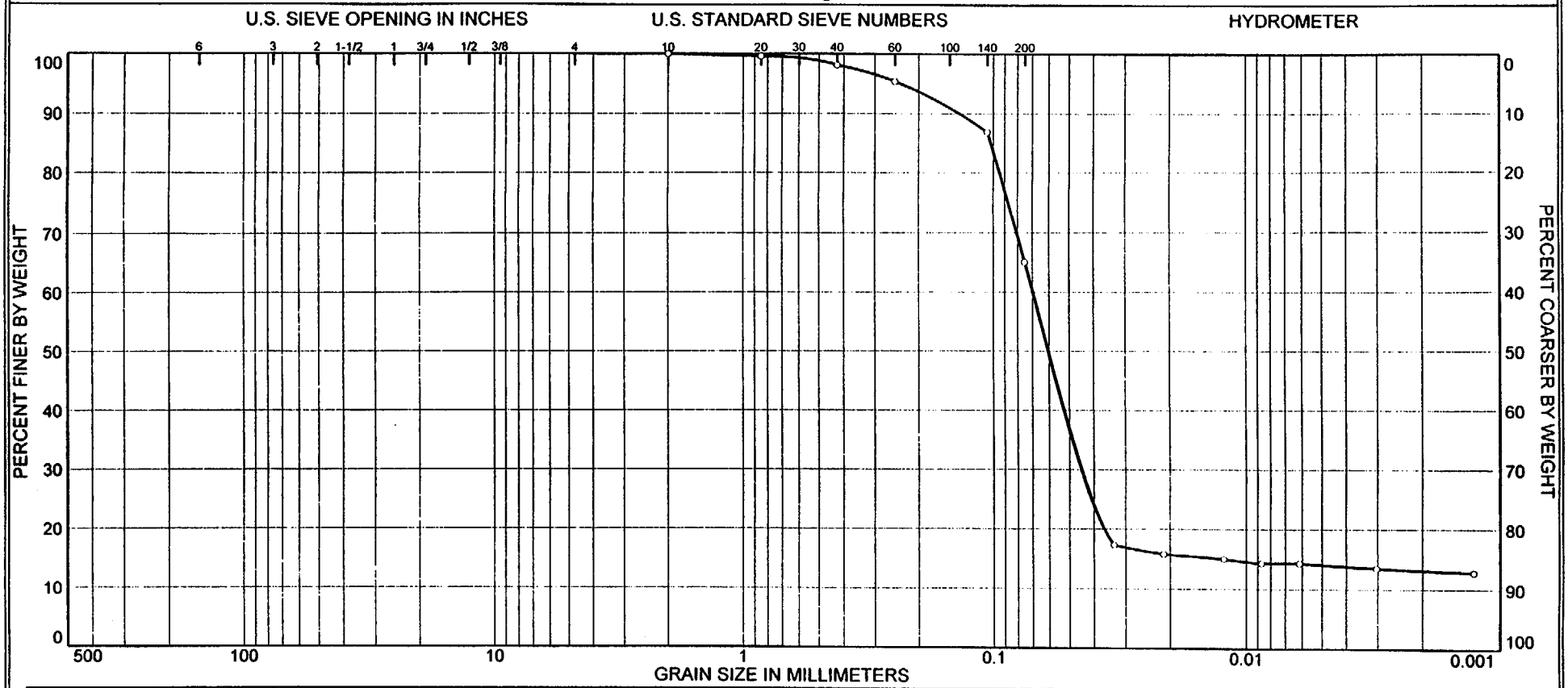
Project MOX Fuel Fabrication Facility

Project No. 50160-0-3963 | Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

○ Tested by: WFL/JTM/SC Reviewed by: HJ

Particle Size Distribution Report ASTM D422/D1140



	% COBBLES	% GRAVEL		% SAND			% FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.0	0.0	1.9	33.0	51.1	14.0

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○	Boring BH-11	21A	153-154.5'	8/29/00	ML	Tan Sandy silt	32.7	39	28

Client Duke Cogema Stone & Webster (DCS)

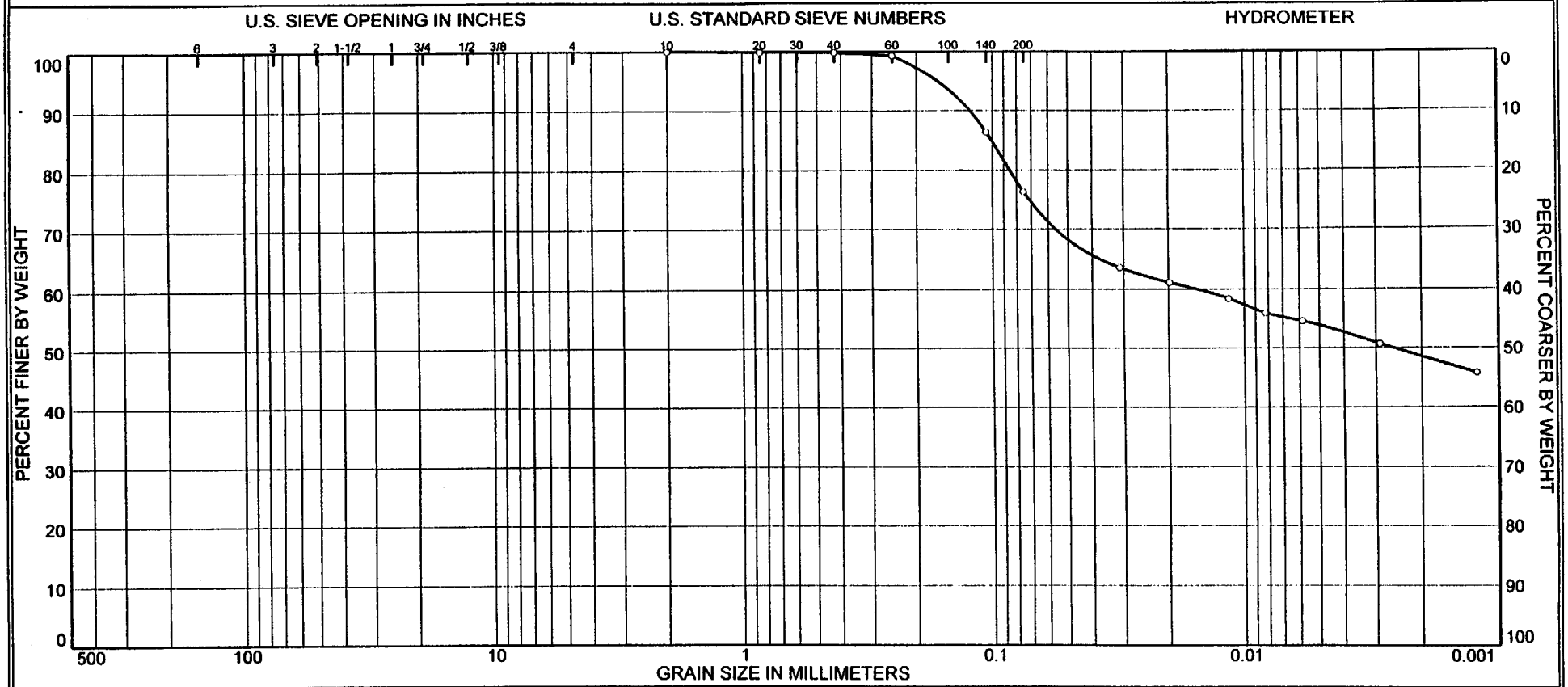
Project MOX Fuel Fabrication Facility

Project No. 50160-0-3963 | Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

○ Tested by: JTM/SC Reviewed by: HJ

Particle Size Distribution Report ASTM D422/D1140



	% COBBLES	% GRAVEL		% SAND			% FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.0	0.0	0.2	23.5	22.4	53.9

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○	Boring BH-11	21B (top)	154-156.5'	10/9/00	CH	Tan Fat clay with sand		83	27

Client Duke Cogema Stone & Webster (DCS)

Project MOX Fuel Fabrication Facility

Project No. 5016003963 | Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

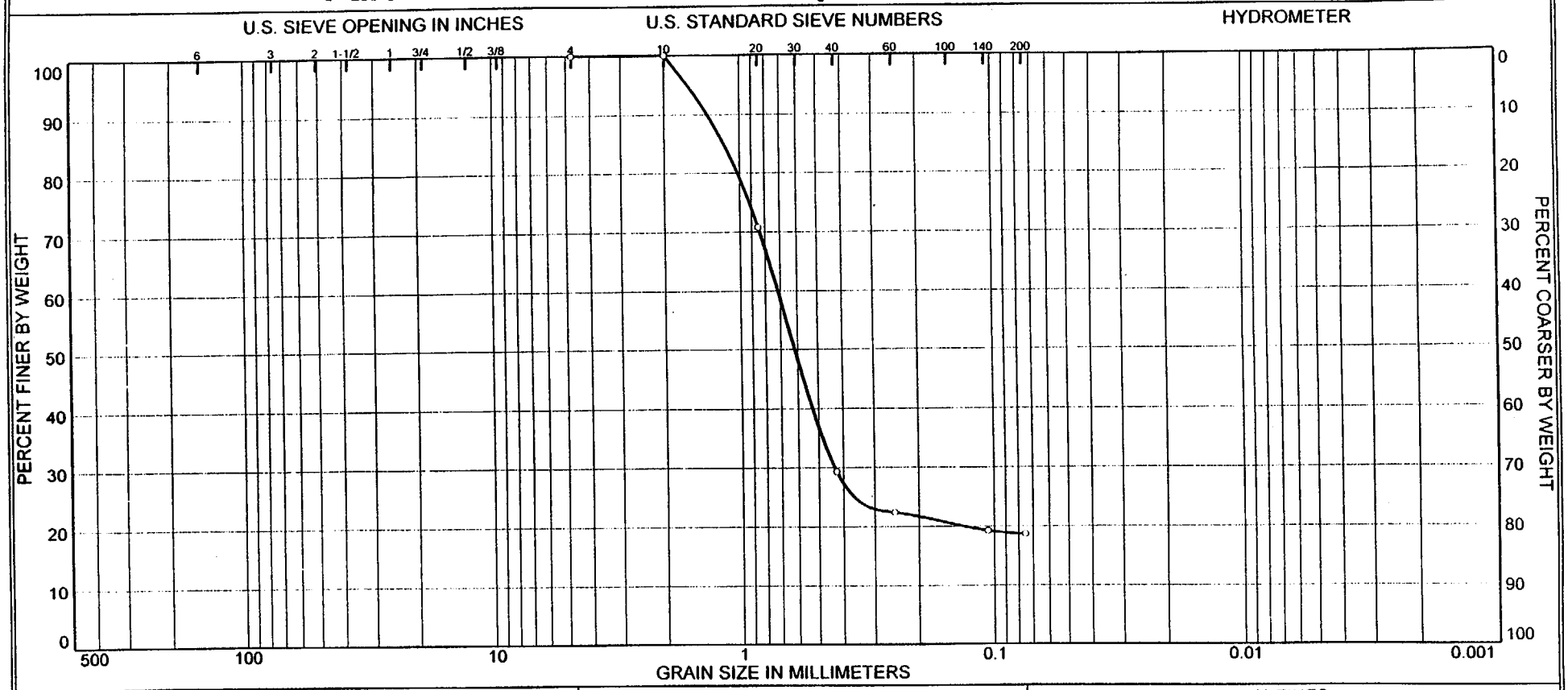
○ Tested by: WFL/SC Reviewed by: HJ

Grain Size & Atte[illegible]g Limits Summary

Project: MOX Fuel Fabrication Facility **LAW Project No:** 50160-0-3963

Source of Sample	Sample No.	Depth	Material Description	Sand (%)	Silt (%)	Clay (%)	Fines (%)	Natural Moisture (%)	LL	PL	PI
Boring BH-12	2	48-49'	Red Brown & Purple Silty sand	81.3			18.7	17.6			
	3	53-54'	Red Brown Silty sand	80.8	4	15.2	19.2	18			
	5	63-64'	Red Brown & Tan Silty sand	87.5			12.5	19.9			
	7	74-74.5'	Red Brown Poorly graded sand with silt	89.9			9.8	19.2			
	9	83-83.8'	Brown Poorly graded sand with	90			10	23.2			
	10A	88-89.7'	Tan Silty sand	77.6	5.5	16.9	22.4	36.4			
	10B (top)	90-91.5'	Brown Silty sand	85.2	2.5	12.3	14.8		41	29	12
	11	98-99.5'	Brown Poorly graded sand with	94.1			5.9	23.1			
	12A	103.5-104'	Tan Silty sand	76.7	2.8	20.5	23.3	39.5	109	67	42
	12B	104.5-106.8'	Light Yellow Tan Clayey sand	81.4	4.5	14.1	18.6		59	28	31
	13	108-109.5'	Tan Silty sand	79	6.3	14.7	21	31	62	35	27
	14	113-115'	Tan Brown Sandy fat clay	47.2	6.5	46.3	52.8	45.3	79	26	53
	16	123-124.2'	Tan Brown Poorly graded sand with silt	93.4			6.6	22.6			
	18A	133.3-133.8'	Brown Poorly graded sand with silt	90.6			9.4	25.3			
	19 (top)	138-140'	Yellow Clayey sand	82	2.8	15.2	18		44	26	18
	20	144-144.5'	Brown Sandy fat clay	40.4	40.4	19.2	59.6	34.8	57	27	30
	21-2	149-149.5'	Tan Brown Silty sand	66.1	18	15.9	33.9	27.5			

Particle Size Distribution Report ASTM D422/D1140



	% COBBLES	% GRAVEL		% SAND			% FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.0	0.0	70.7	10.6	18.7	

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○	Boring BH-12	2	48-49'	825/00		Red Brown & Purple Silty sand	17.6		

Client Duke Cogema Stone & Webster (DCS)

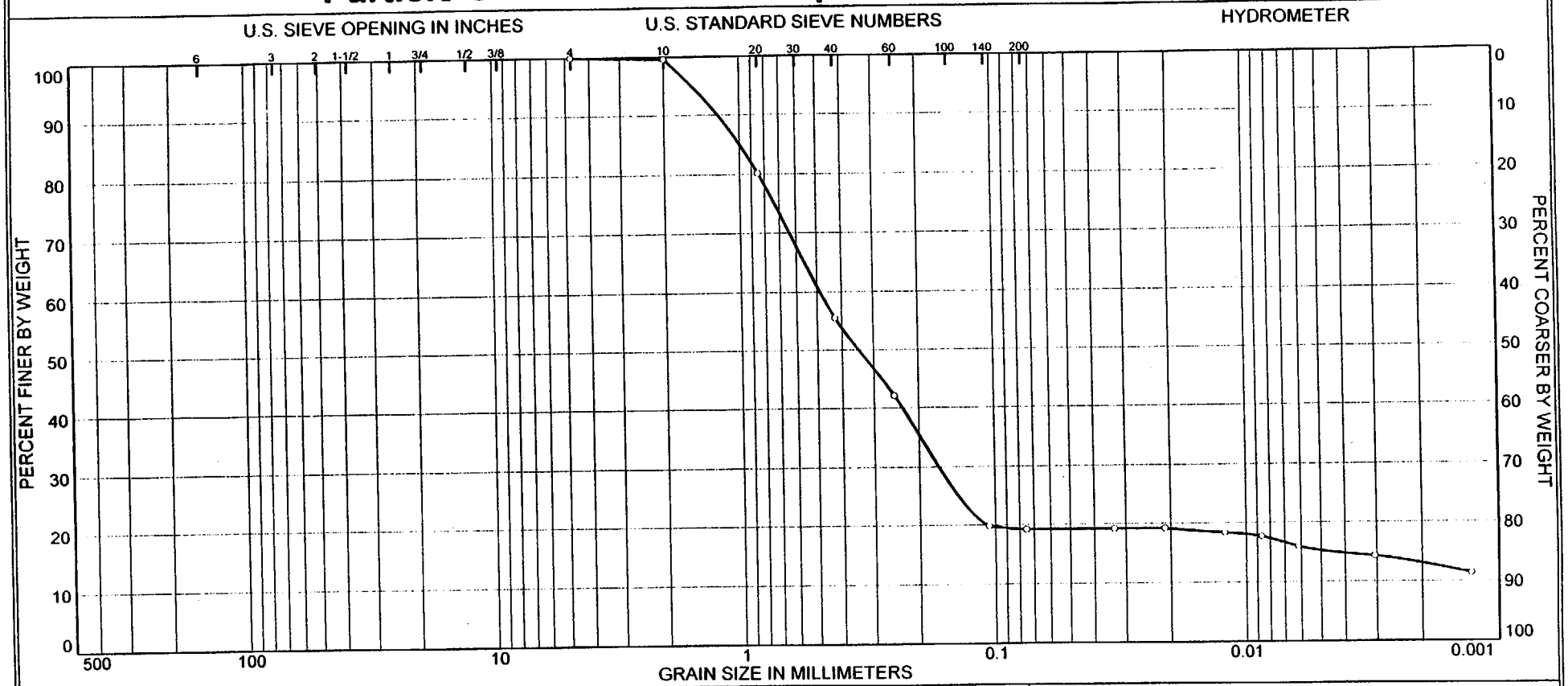
Project MOX Fuel Fabrication Facility

Project No. 50160-0-3963 | Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

○ Tested by: WFL Reviewed by: HJ

Particle Size Distribution Report ASTM D422/D1140



	% COBBLES	% GRAVEL		% SAND			% FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.0	0.4	44.0	36.4	4.0	15.2

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○	Boring BH-12	3	53-54'	8/25/00		Red Brown Silty sand	18.0		

Client Duke Cogema Stone & Webster (DCS)

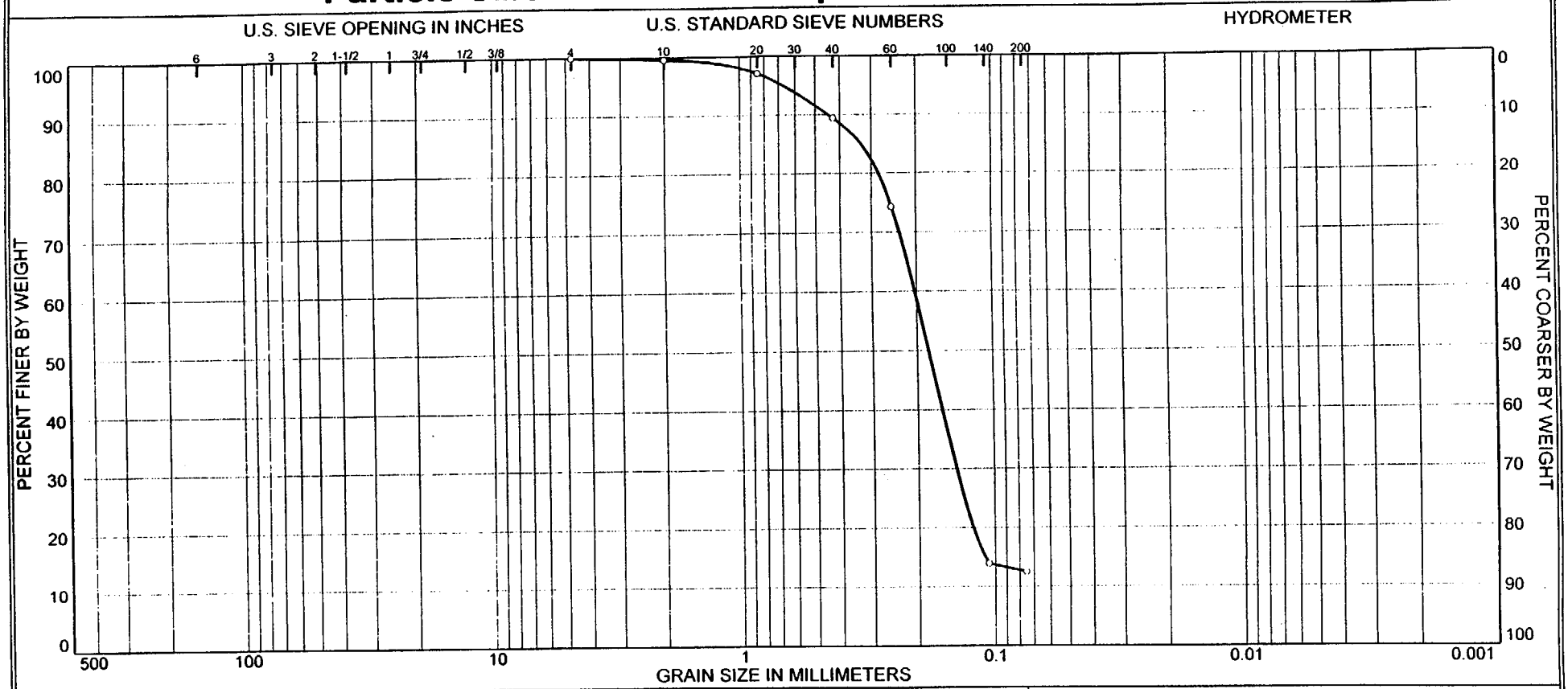
Project MOX Fuel Fabrication Facility

Project No. 50160-0-3963 | Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

○ Tested by: SC Reviewed by: HJ

Particle Size Distribution Report ASTM D422/D1140



	% COBBLES	% GRAVEL		% SAND			% FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.0	0.4	10.2	76.9	12.5	

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○	Boring BH-12	5	63-64'	8/25/00		Red Brown & Tan Silty sand	19.9		

Client Duke Cogema Stone & Webster (DCS)

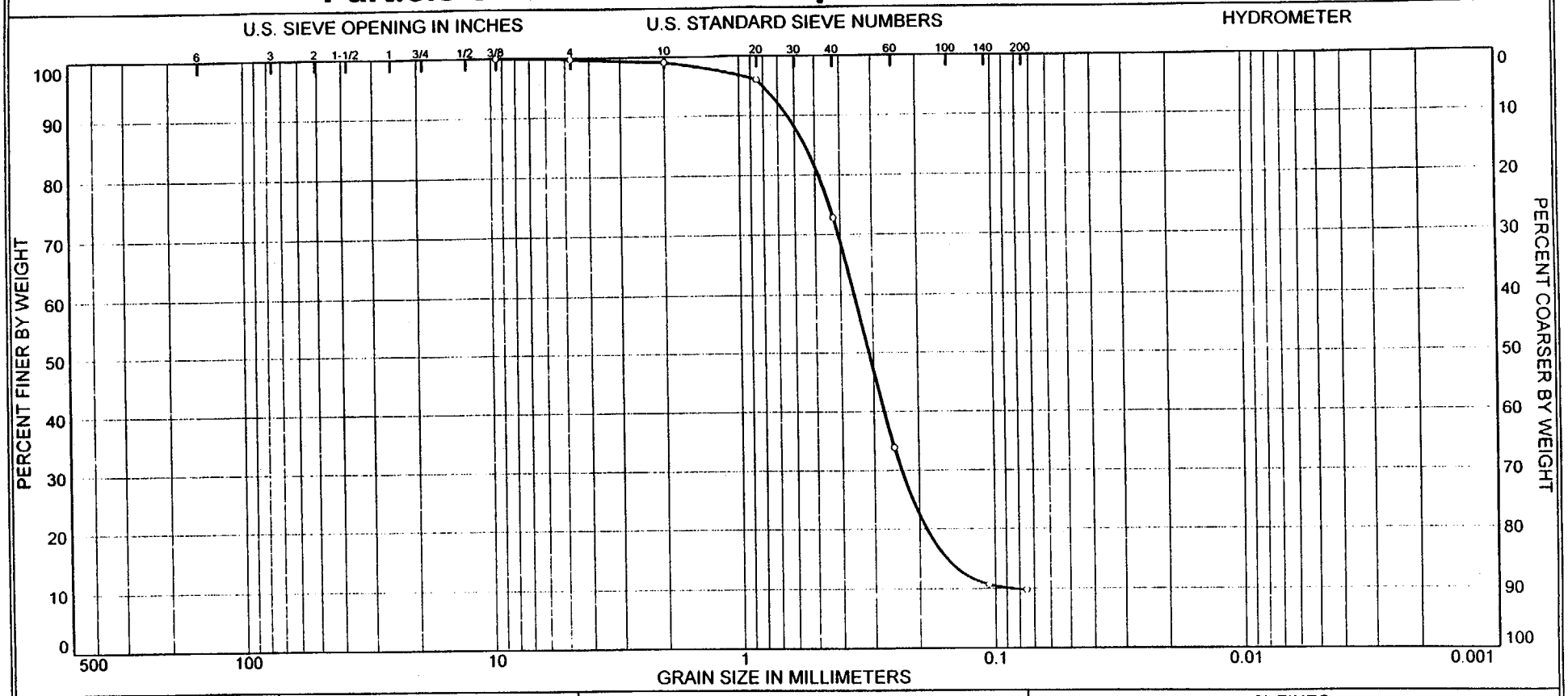
Project MOX Fuel Fabrication Facility

Project No. 50160-0-3963 | Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

○ Tested by: WFL Reviewed by: HJ

Particle Size Distribution Report ASTM D422/D1140



	% COBBLES	% GRAVEL		% SAND			% FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.3	0.6	26.3	63.0	9.8	

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○	Boring BH-12	7	74-74.5'	8/25/00		Red Brown Poorly graded sand with silt	19.2		

Client Duke Cogema Stone & Webster (DCS)

Project MOX Fuel Fabrication Facility

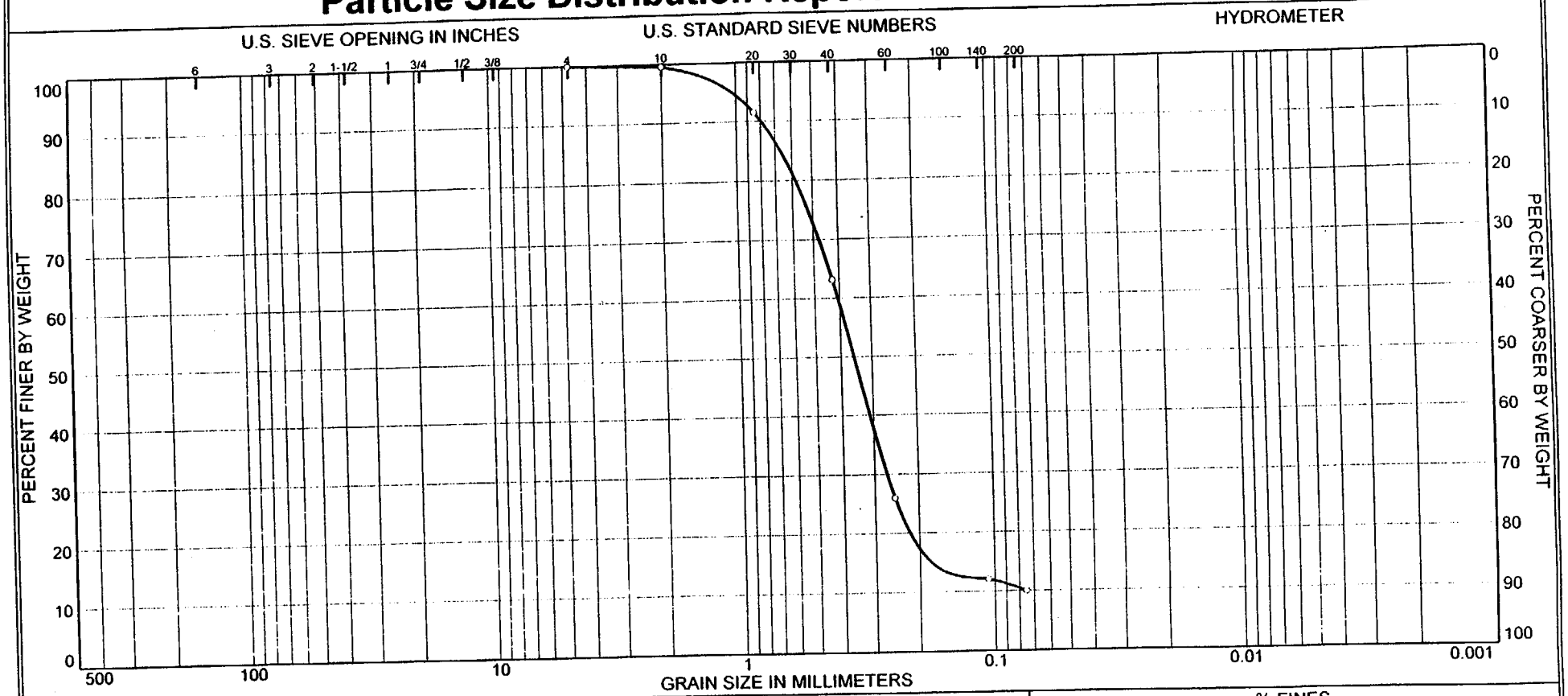
Project No. 50160-0-3963 | Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

○ Tested by: WFL Reviewed by: HJ

202

Particle Size Distribution Report ASTM D422/D1140



% COBBLES	% GRAVEL		% SAND			% FINES	
	COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
0.0	0.0	0.0	0.4	36.5	53.1	10.0	

SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
Boring BH-12	9	83-83.8'	8/25/00		Brown Poorly graded sand with silt	23.2		

Client Duke Cogema Stone & Webster (DCS)

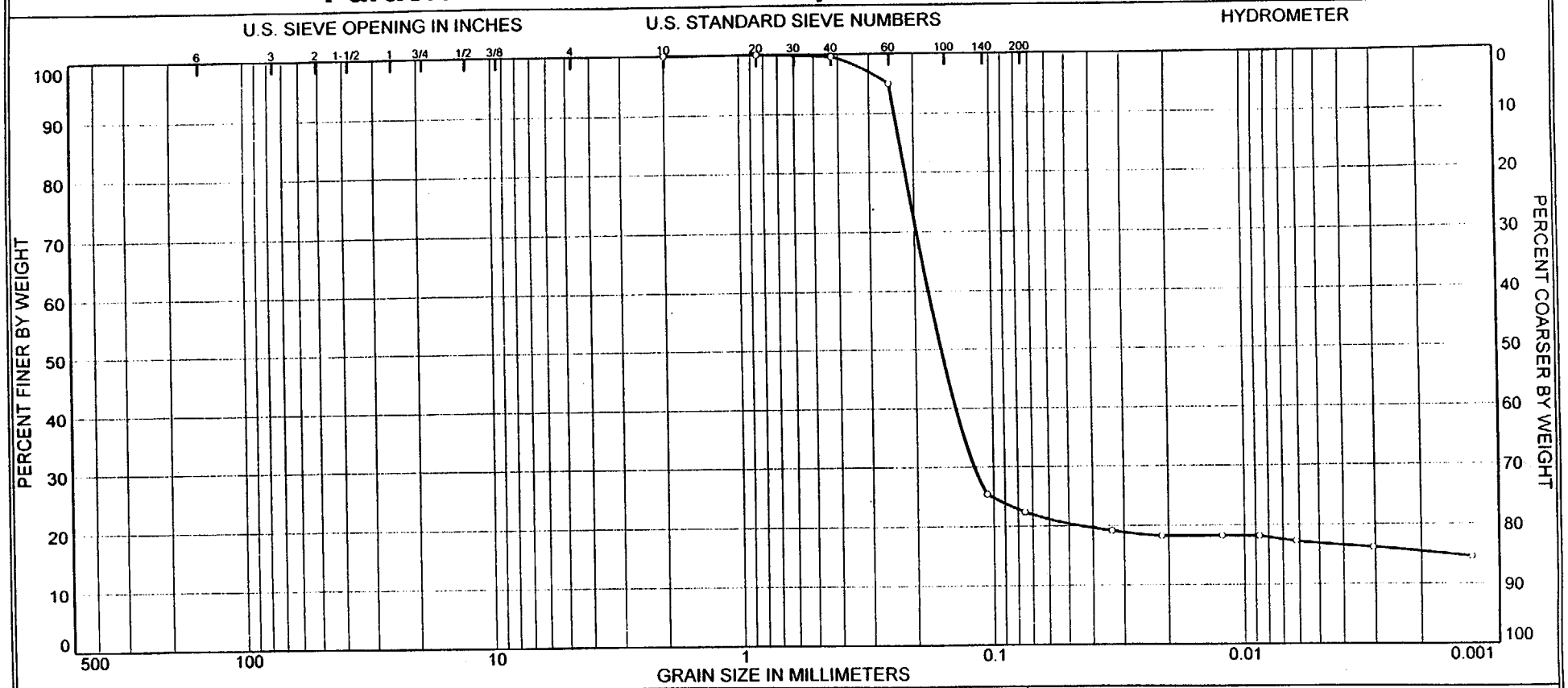
Project MOX Fuel Fabrication Facility

Project No. 50160-0-3963 | Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

Tested by: WFL Reviewed by: HJ

Particle Size Distribution Report ASTM D422/D1140



	% COBBLES	% GRAVEL		% SAND			% FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.0	0.0	0.4	77.2	5.5	16.9

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○	Boring BH-12	10A	88-89.7'	8/25/00		Tan Silty sand	36.4		

Client Duke Cogema Stone & Webster (DCS)

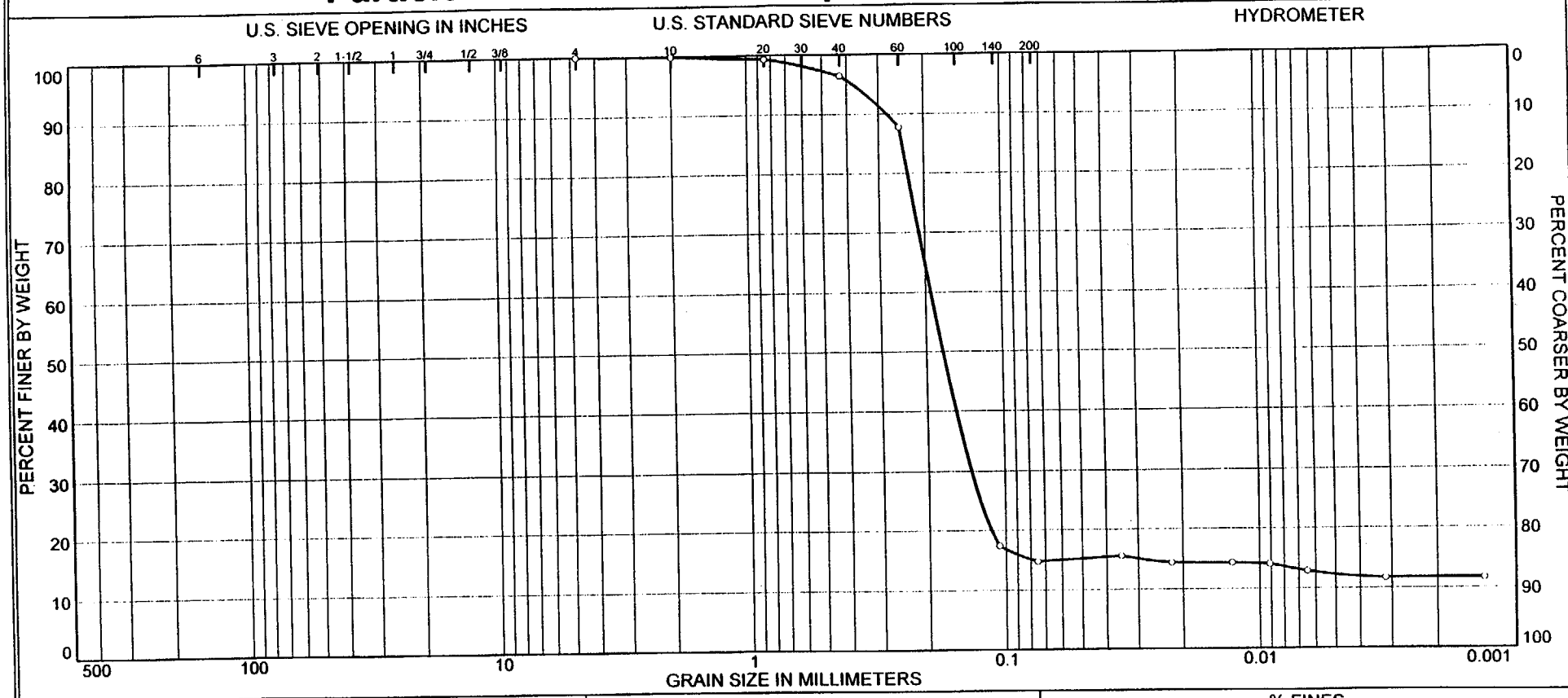
Project MOX Fuel Fabrication Facility

Project No. 50160-0-3963 | Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

○ Tested by: SC Reviewed by: HJ

Particle Size Distribution Report ASTM D422/D1140



% COBBLES	% GRAVEL		% SAND			% FINES	
	COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
0.0	0.0	0.0	0.1	3.5	81.6	2.5	12.3

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○	Boring BH-12	10B (Top)	90-91.5'	9/29/00	SM	Brown Silty sand		41	29

Client Duke Cogema Stone & Webster (DCS)

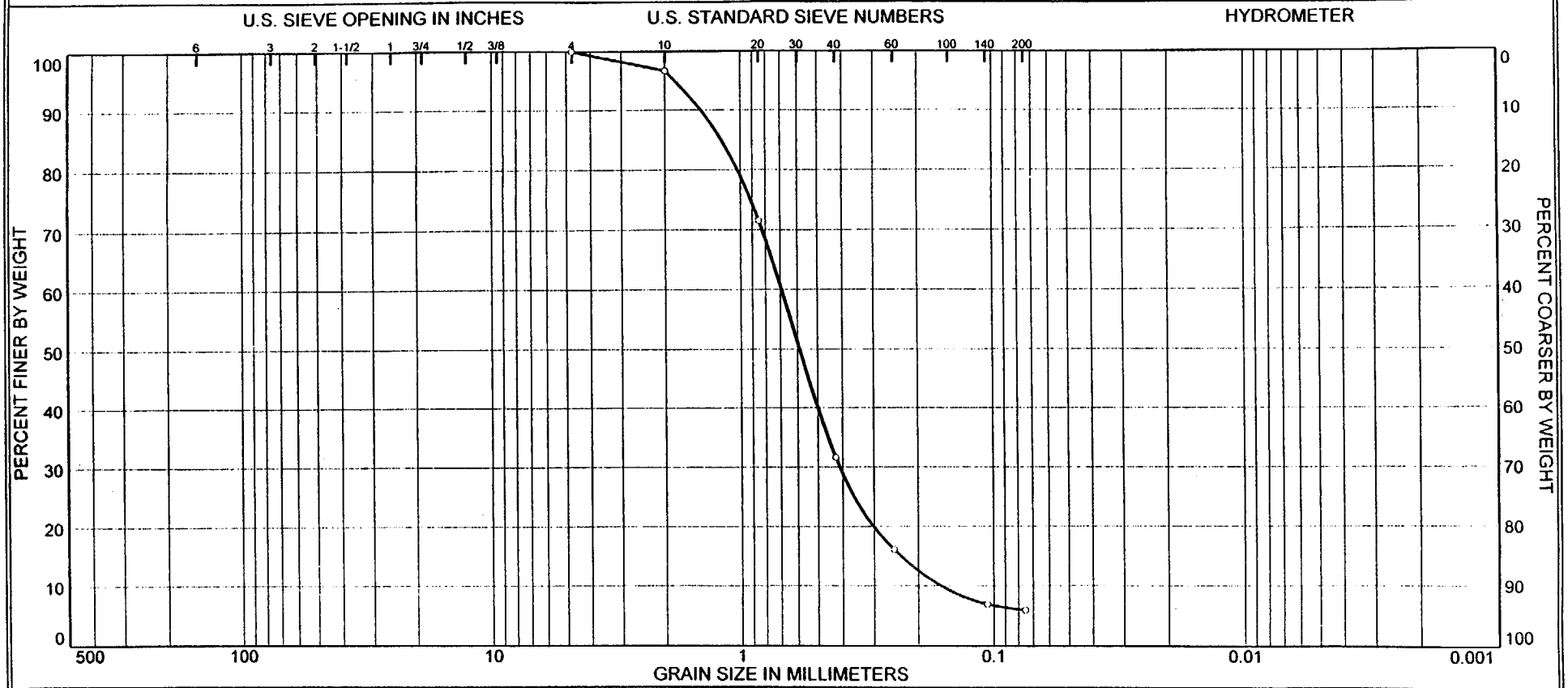
Project MOX Fuel Fabrication Facility

Project No. 5016003963 | Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

○ Tested by: WFL/SC Reviewed by: HJ

Particle Size Distribution Report ASTM D422/D1140



% COBBLES	% GRAVEL		% SAND			% FINES	
	COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
0.0	0.0	0.0	3.3	65.1	25.7	5.9	

SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
Boring BH-12	11	98-99.5'	8/25/00		Brown Poorly graded sand with silt	23.1		

Client Duke Cogema Stone & Webster (DCS)

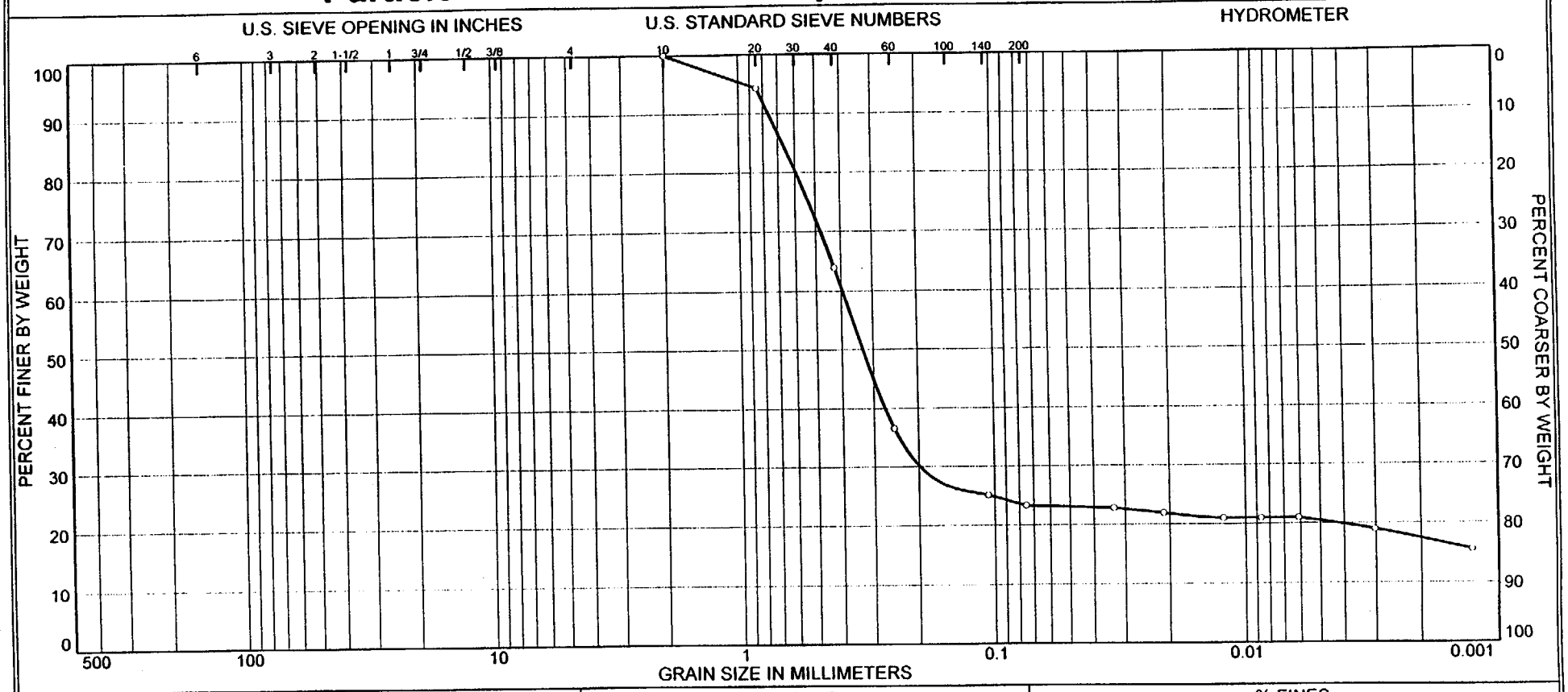
Project MOX Fuel Fabrication Facility

Project No. 50160-0-3963 | Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

○ Tested by: WFL Reviewed by: HJ

Particle Size Distribution Report ASTM D422/D1140



	% COBBLES	% GRAVEL		% SAND			% FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.0	0.0	36.0	40.7	2.8	20.5

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○	Boring BH-12	12A	103.5-104'	8/23/00	SM	Tan Silty sand	39.5	109	67

Client Duke Cogema Stone & Webster (DCS)

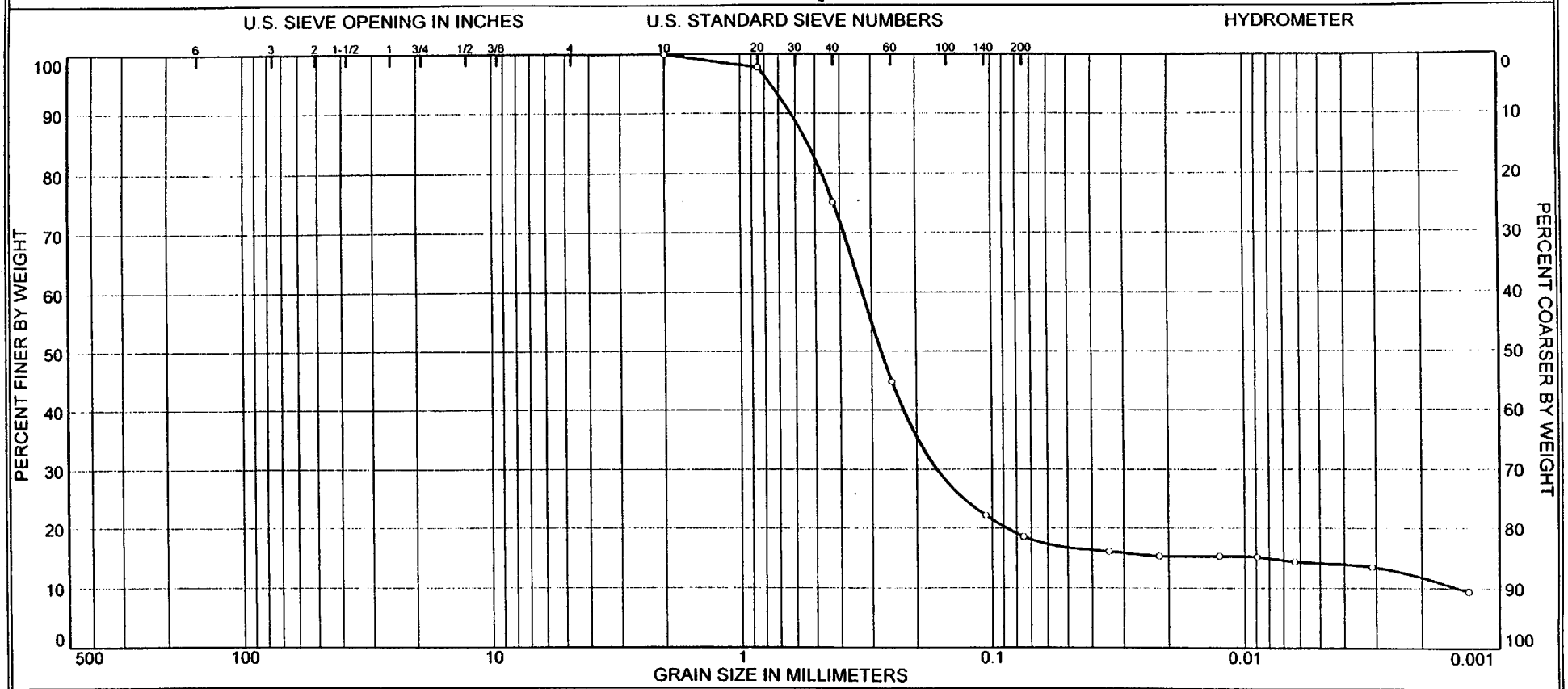
Project MOX Fuel Fabrication Facility

Project No. 50160-0-3963 | Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

○ Tested by: JTM/WFL Reviewed by: HJ

Particle Size Distribution Report ASTM D422/D1140



	% COBBLES	% GRAVEL		% SAND			% FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.0	0.0	24.8	56.6	4.5	14.1

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○	Boring BH-12	12B	104.5-106.8'	10/9/00	SC	Light Yellow Tan Clayey sand		59	28

Client Duke Cogema Stone & Webster (DCS)

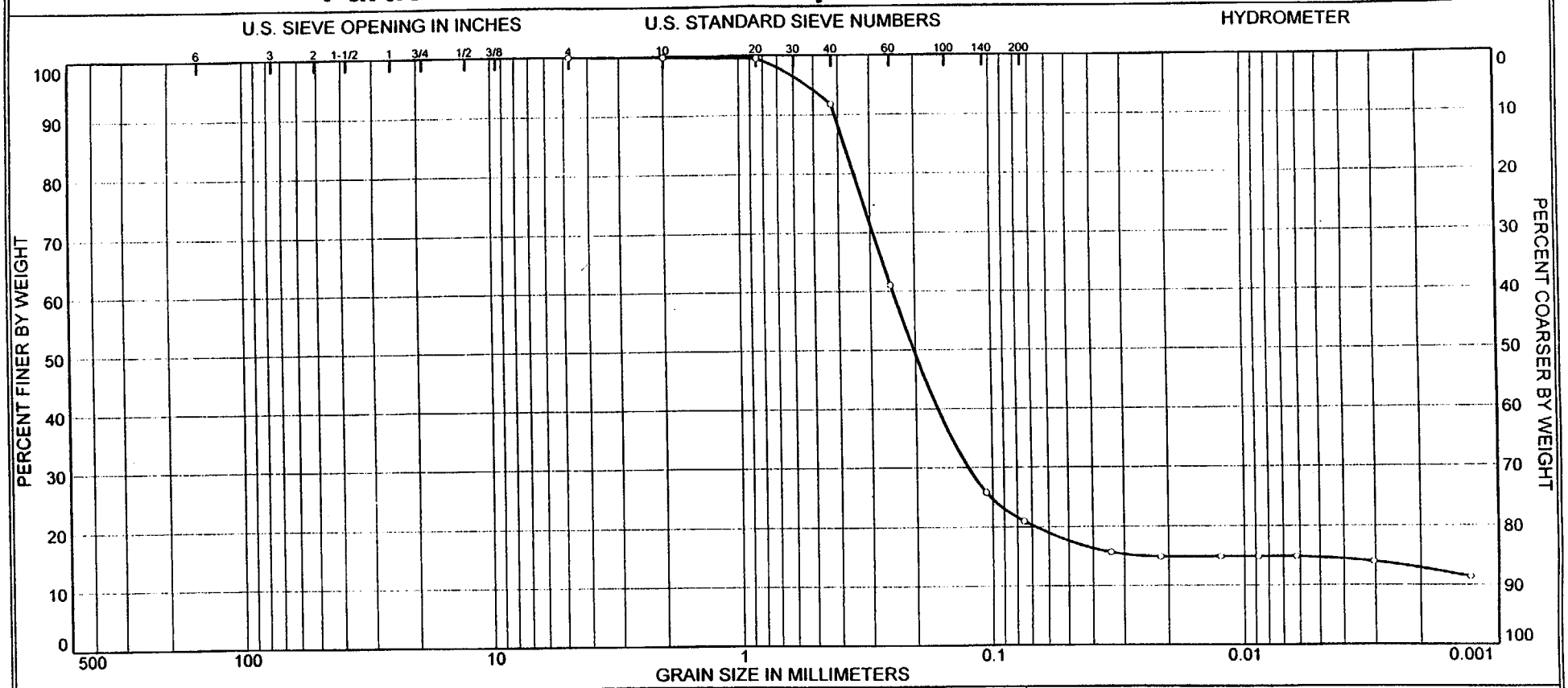
Project MOX Fuel Fabrication Facility

Project No. 5016003963 | Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

○ Tested by: WFL/SC Reviewed by: HJ

Particle Size Distribution Report ASTM D422/D1140



	% COBBLES	% GRAVEL		% SAND			% FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.0	0.1	8.1	70.8	6.3	14.7

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○	Boring BH-12	13	108-109.5'	8/23/00	SM	Tan Silty sand	31.0	62	35

Client Duke Cogema Stone & Webster (DCS)

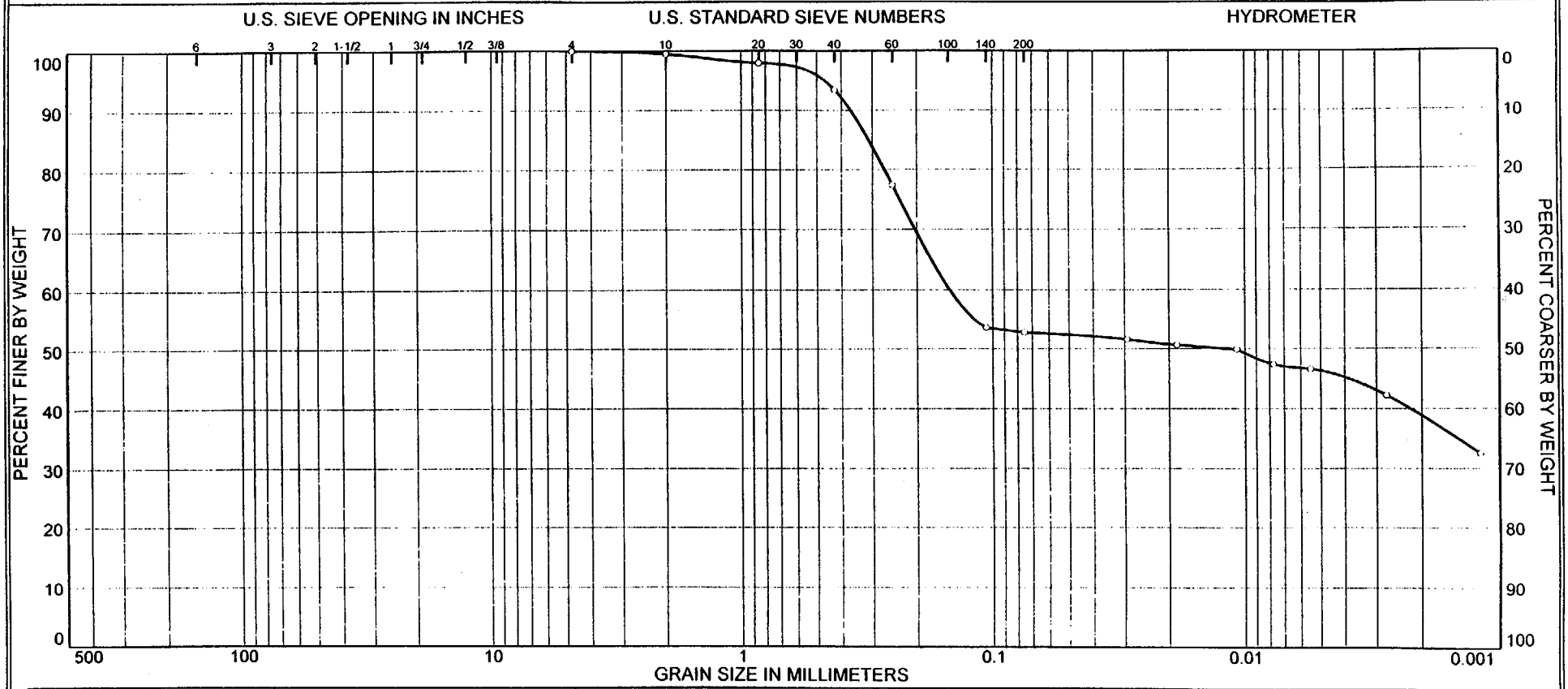
Project MOX Fuel Fabrication Facility

Project No. 50160-0-3963 | Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

○ Tested by: WFL/JTM Reviewed by: HJ

Particle Size Distribution Report ASTM D422/D1140



	% COBBLES	% GRAVEL		% SAND			% FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.0	0.5	6.1	40.6	6.5	46.3

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○	Boring BH-12	14	113-115'	8/25/00	CH	Tan Brown Sandy fat clay	45.3	79	26

Client Duke Cogema Stone & Webster (DCS)

Project MOX Fuel Fabrication Facility

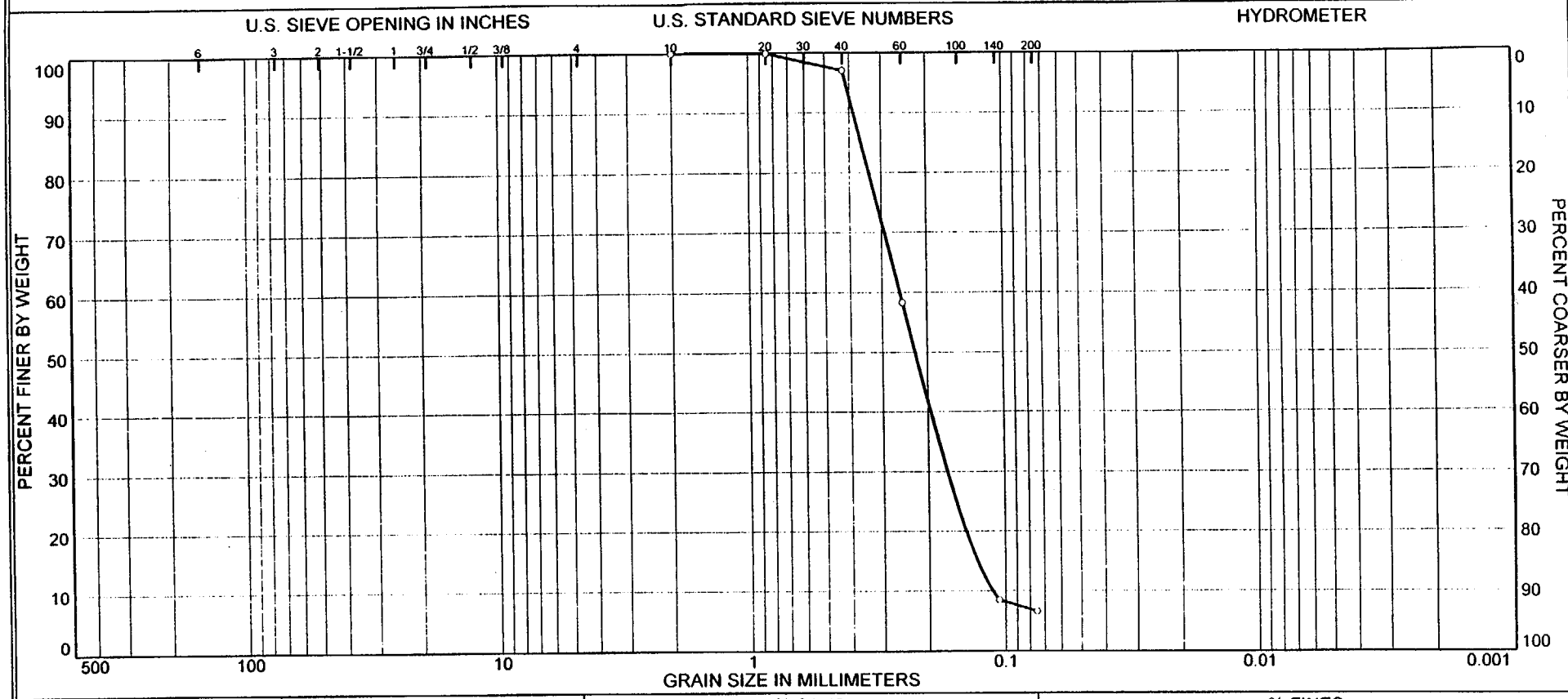
Project No. 50160-0-3963 | Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

○ Tested by: JTM/SC Reviewed by: HJ

2.10

Particle Size Distribution Report ASTM D422/D1140



	% COBBLES	% GRAVEL		% SAND			% FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.0	0.0	3.0	90.4	6.6	

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○	Boring BH-12	16	123-124.2'	8/23/00		Tan Brown Poorly graded sand with silt	22.6		

Client Duke Cogema Stone & Webster (DCS)

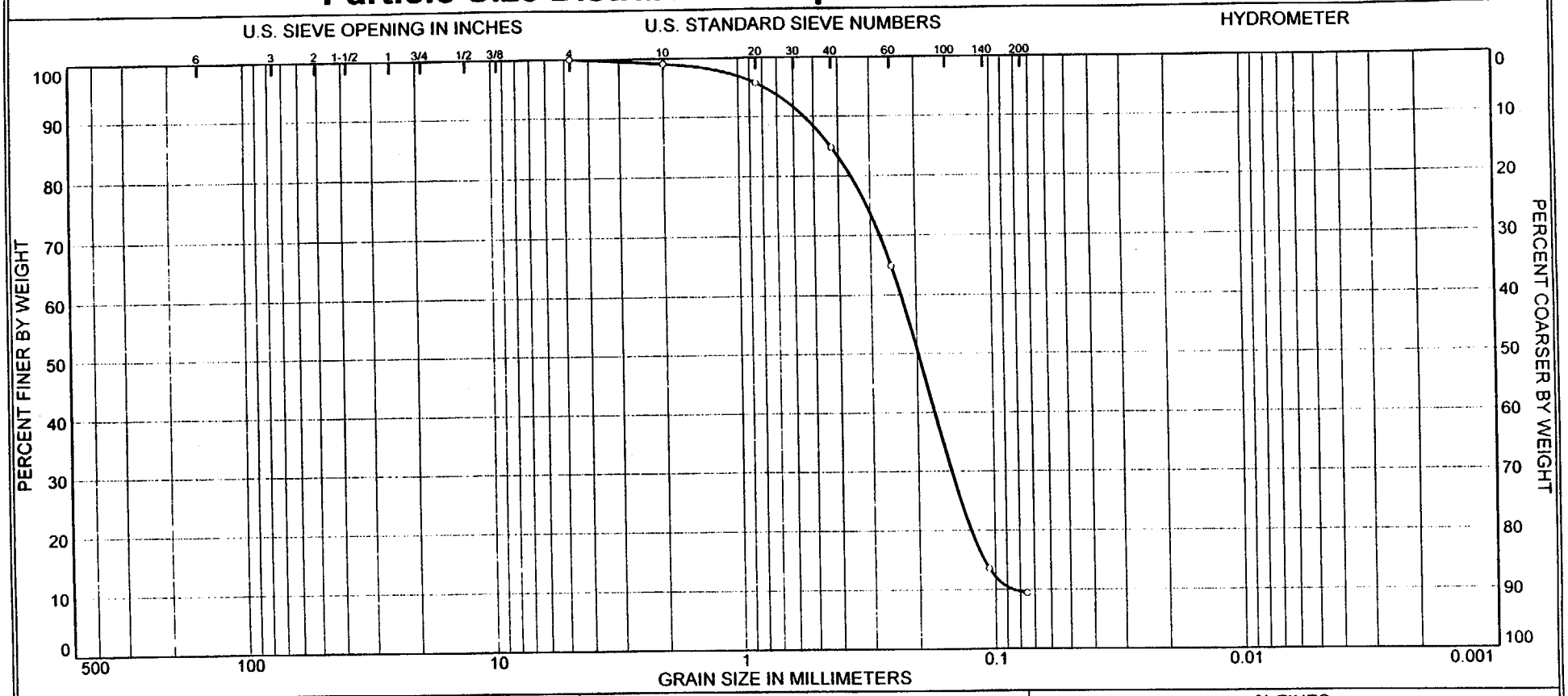
Project MOX Fuel Fabrication Facility

Project No. 50160-0-3963 | Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

○ Tested by: WFL Reviewed by: HJ

Particle Size Distribution Report ASTM D422/D1140



% COBBLES	% GRAVEL		% SAND			% FINES	
	COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
0.0	0.0	0.0	0.9	14.3	75.4	9.4	

SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
Boring BH-12	18A	133.3-133.8	8/25/00		Brown Poorly graded sand with silt	25.3		

Client Duke Cogema Stone & Webster (DCS)

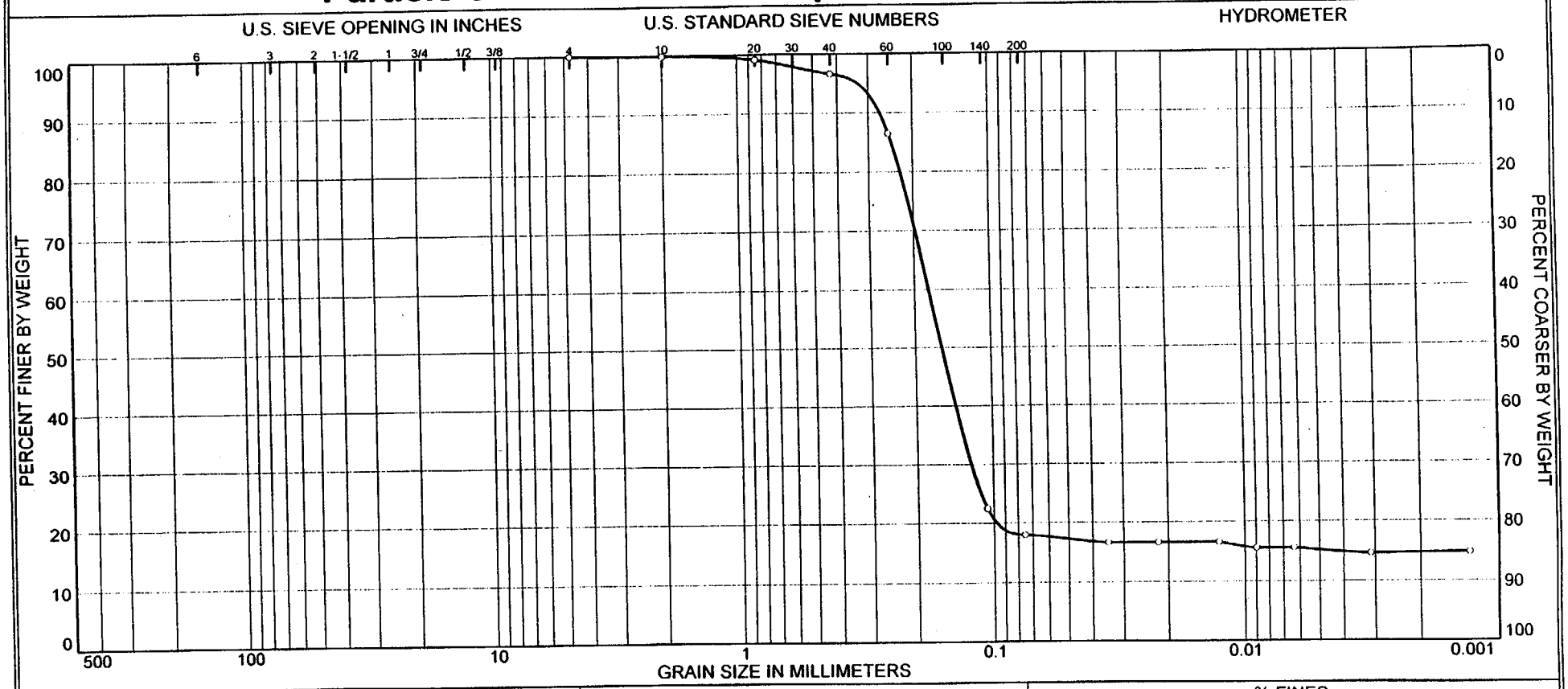
Project MOX Fuel Fabrication Facility

Project No. 50160-0-3963 | Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

Tested by: WFL Reviewed by: HJ

Particle Size Distribution Report ASTM D422/D1140



% COBBLES	% GRAVEL		% SAND			% FINES	
	COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
0.0	0.0	0.0	0.1	3.3	78.6	2.8	15.2

SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
Boring BH-12	19 (top)	138-140'	9/28/00	SC	Yellow Clayey sand		44	26

Client Duke Cogema Stone & Webster (DCS)

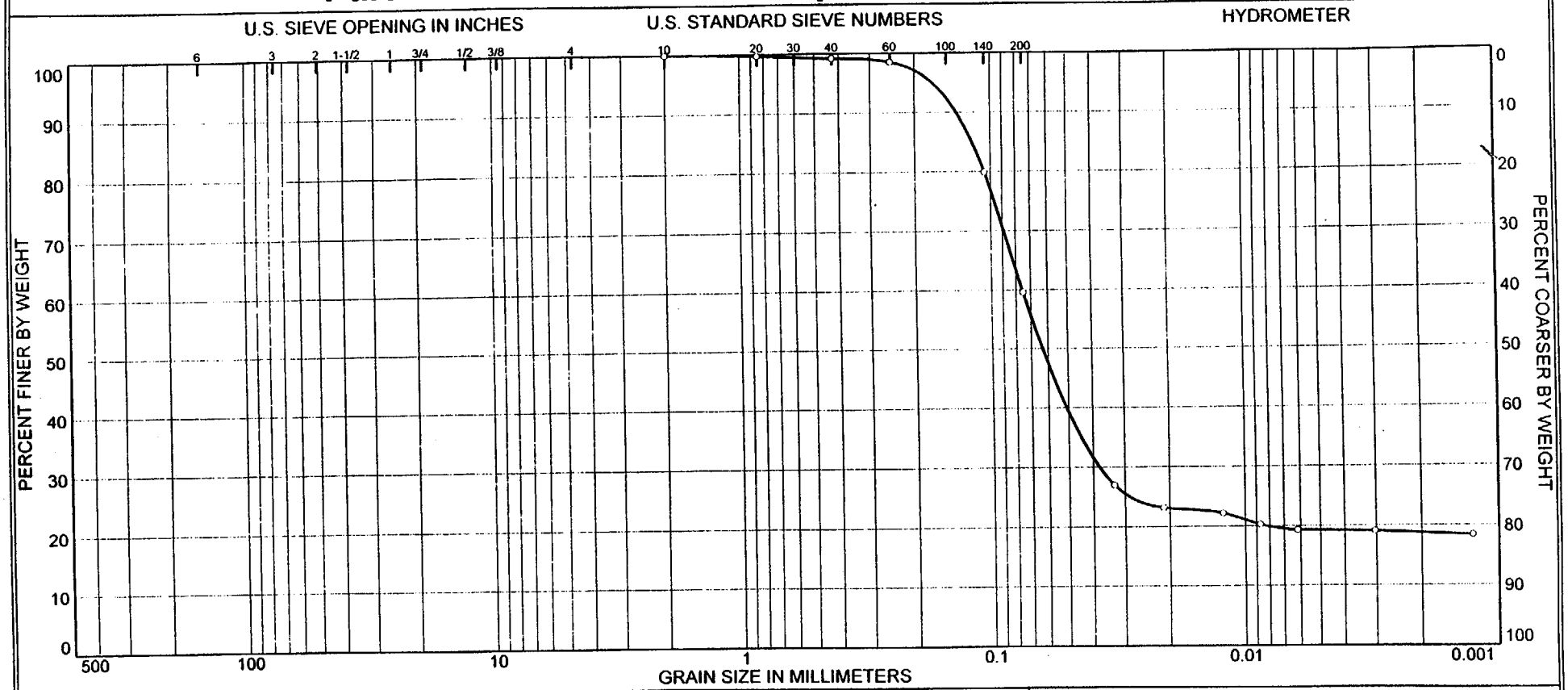
Project MOX Fuel Fabrication Facility

Project No. 5016003963 | Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

○ Tested by: WFL/SC REviewed by: HJ

Particle Size Distribution Report ASTM D422/D1140



% COBBLES	% GRAVEL		% SAND			% FINES	
	COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
0.0	0.0	0.0	0.0	0.8	39.6	40.4	19.2

SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
Boring BH-12	20	144-144.5'	8/22/00	CH	Brown Sandy fat clay	34.8	57	27

Client Duke Cogema Stone & Webster (DCS)

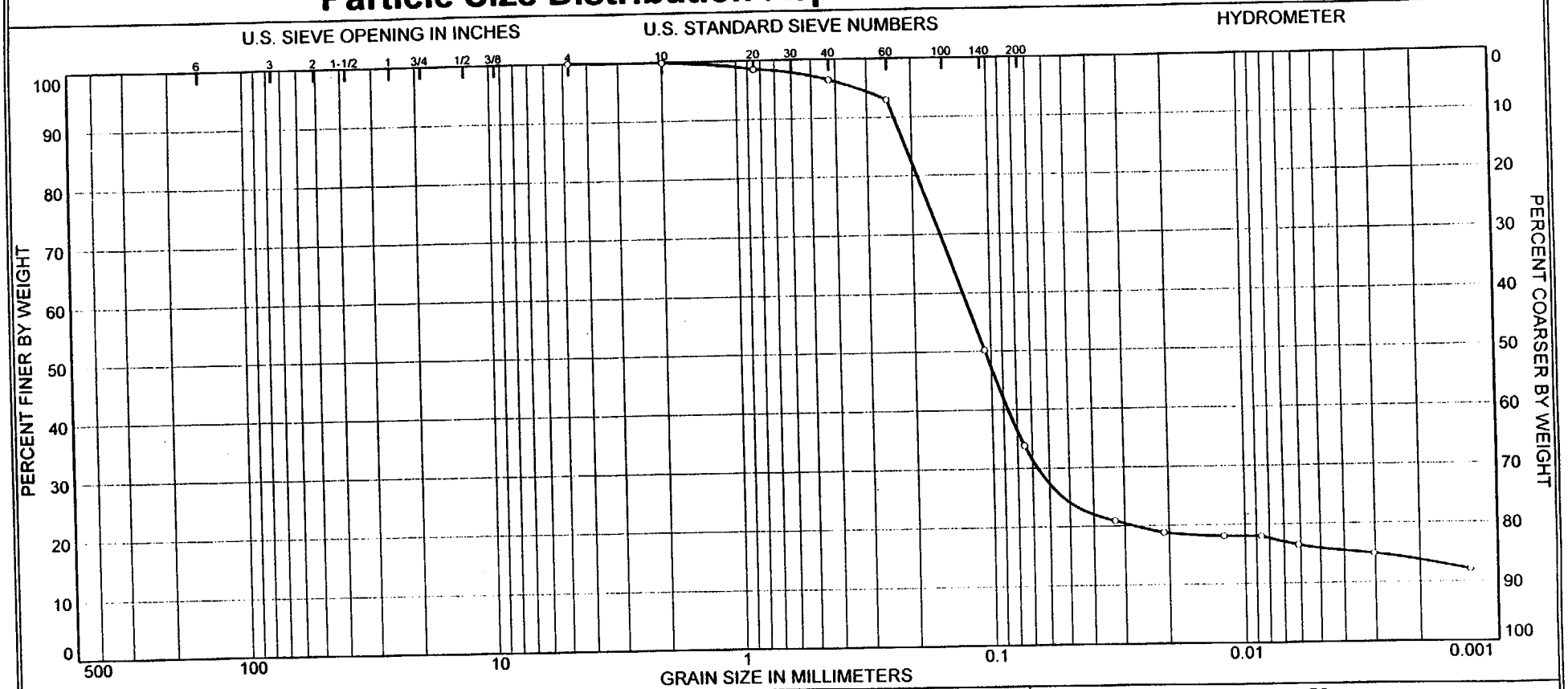
Project MOX Fuel Fabrication Facility

Project No. 50160-0-3963 | Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

○ Tested by: JTM/SC/WFL Reviewed by: HJ

Particle Size Distribution Report ASTM D422/D1140



% COBBLES	% GRAVEL		% SAND			% FINES	
	COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
0.0	0.0	0.0	0.1	3.4	62.6	18.0	15.9

SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
Boring BH-12	21-2	149-149.5'	8/25/00		Tan Brown Silty sand	27.5		

Client Duke Cogema Stone & Webster (DCS)

Project MOX Fuel Fabrication Facility

Project No. 50160-0-3963 | Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

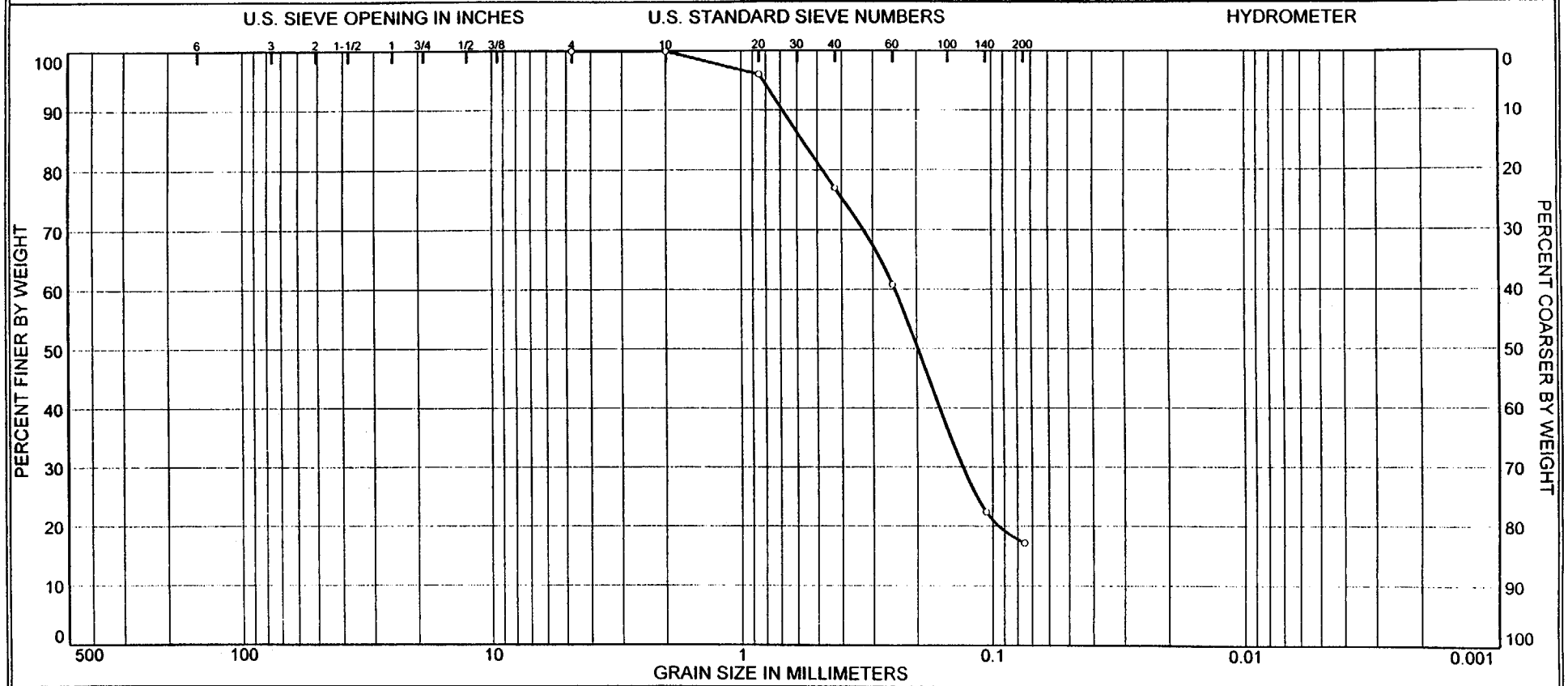
Tested by: SC Reviewed by: HJ

Grain Size & Atte[illegible]g Limits Summary

Project: **MOX Fuel Fabrication Facility** **LAW Project No:** **50160-0-3963**

Source of Sample	Sample No.	Depth	Material Description	Sand (%)	Silt (%)	Clay (%)	Fines (%)	Natural Moisture (%)	LL	PL	PI
Boring BH-13	2	18-19'	Tan Brown Silty sand	82.8			17.2	14.8			
	4	28-29.4'	Tan Brown Silty sand	83.1			16.9	13.1			
	6	38-39.2'	Brown Silty sand	85.2			14.8	14.8			
	8	48-49'	Red Brown Poorly graded sand with silt	94			6	12.9			
	10	58-59'	Red Brown Poorly graded sand with silt	92.5			6.9	14.9			
	12A	68-69'	Brown						64	22	42
	12A	68-70'	Brown Silty sand	74.4	6.5	19.1	25.6	28.7			
	12B (top)	70-71.2'	Tan Clayey sand	74.3	5.9	19.8	25.7		39	23	16
	14	78-79.5'	Tan Silty sand	86.2			13.8	26.7			
	15A	83-84.5'	Tan Silty sand	60.9	7.8	31.3	39.1	42.8	94	52	42
	15B bot	85-87'	Tan Poorly graded sand with silt	90.6	2.2	7.2	9.4		52	31	21
	17	93-94.6'	Tan Silty sand	79.2	5.9	14.9	20.8	34.4			
	18B Bot	100-101.2'	Yellow Brown Clayey sand	79.4	2.2	14.7	16.9		50	27	23
	20-2	108.5-109.5'	Tan Brown Poorly graded sand with silt	93.7			6.3	23.2			
	23A	123.5-124'	Tan Brown Clayey sand	75.5	4.7	19.8	24.5	35.5	55	26	29
	23B	125-127'	Yellow Clayey sand	75	4.1	20.9	25		62	26	36
	25	133.5-134'	Brown Sandy fat clay	42.3	38.5	19.2	57.7	27.1	52	23	29
	29	153-154'	Gray Black Poorly graded sand with silt	92.1			7.9	25.9			

Particle Size Distribution Report ASTM D422/D1140



	% COBBLES	% GRAVEL		% SAND			% FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.0	0.0	23.0	59.8	17.2	

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○	Boring BH-13	2	18-19'	8/25/00		Tan Brown Silty sand	14.8		

Client Duke Cogema Stone & Webster (DCS)

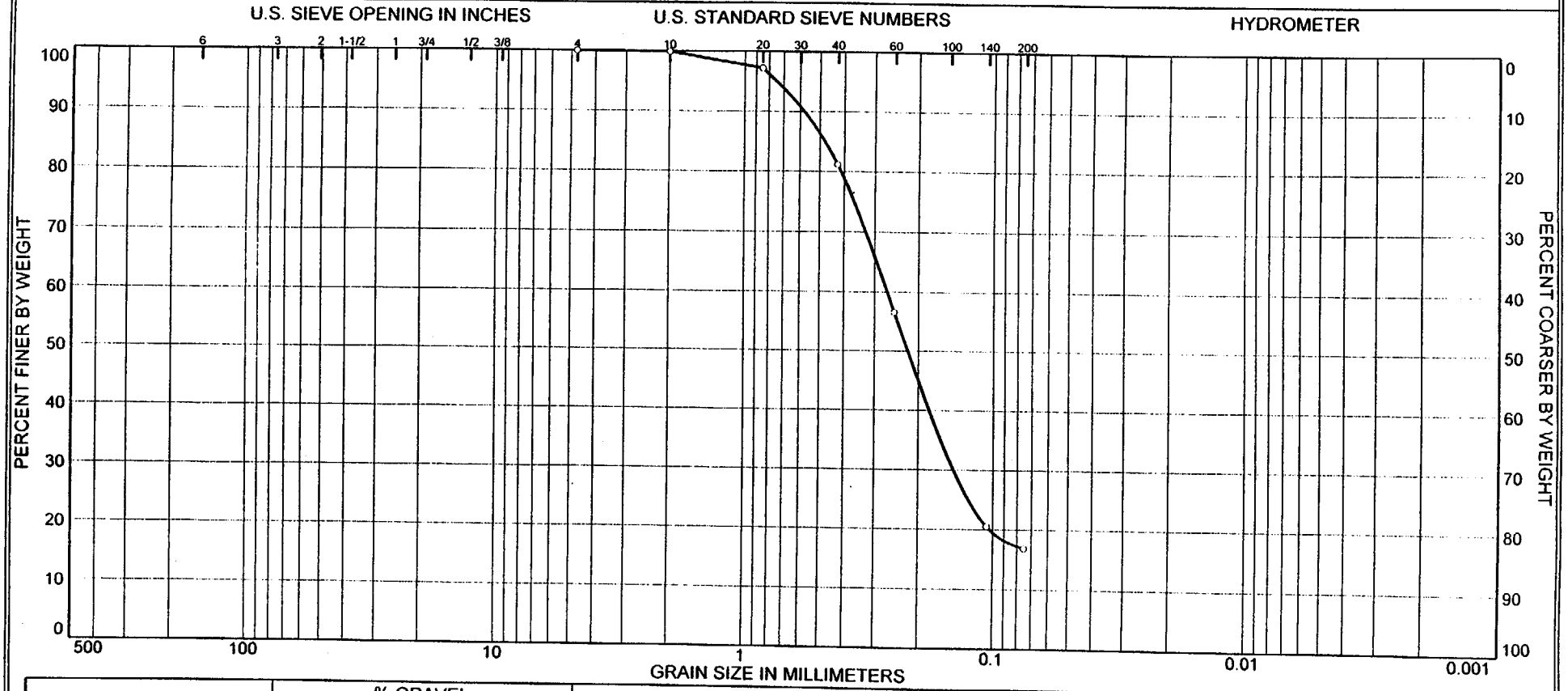
Project MOX Fuel Fabrication Facility

Project No. 50160-0-3963 | Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

○ Tested by: WFL Reviewed by: HJ

Particle Size Distribution Report ASTM D422/D1140



% COBBLES	% GRAVEL		% SAND			% FINES	
	COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
0.0	0.0	0.0	0.1	18.7	64.3	16.9	

SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
Boring BH-13	4	28-29.4'	8/28/00		Tan Brown Silty sand	13.1		

Client Duke Cogema Stone & Webster (DCS)

Project MOX Fuel Fabrication Facility

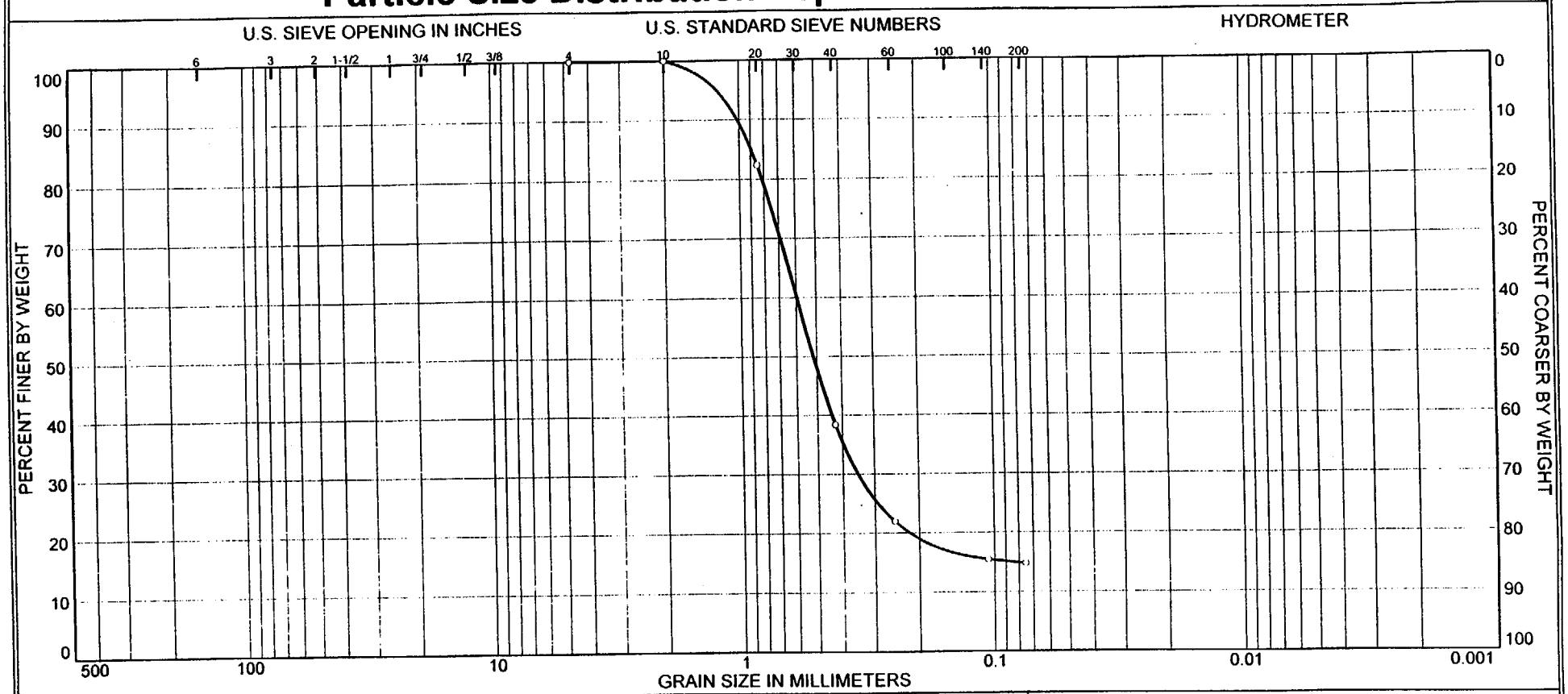
Project No. 50160-0-3963 | Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

○ Tested by: WFL Reviewed by: HJ

2118

Particle Size Distribution Report ASTM D422/D1140



	% COBBLES	% GRAVEL		% SAND			% FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.0	0.0	61.6	23.6	14.8	

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○	Boring BH-13	6	38-39.2'	8/25/00		Brown Silty sand	14.8		

Client Duke Cogema Stone & Webster (DCS)

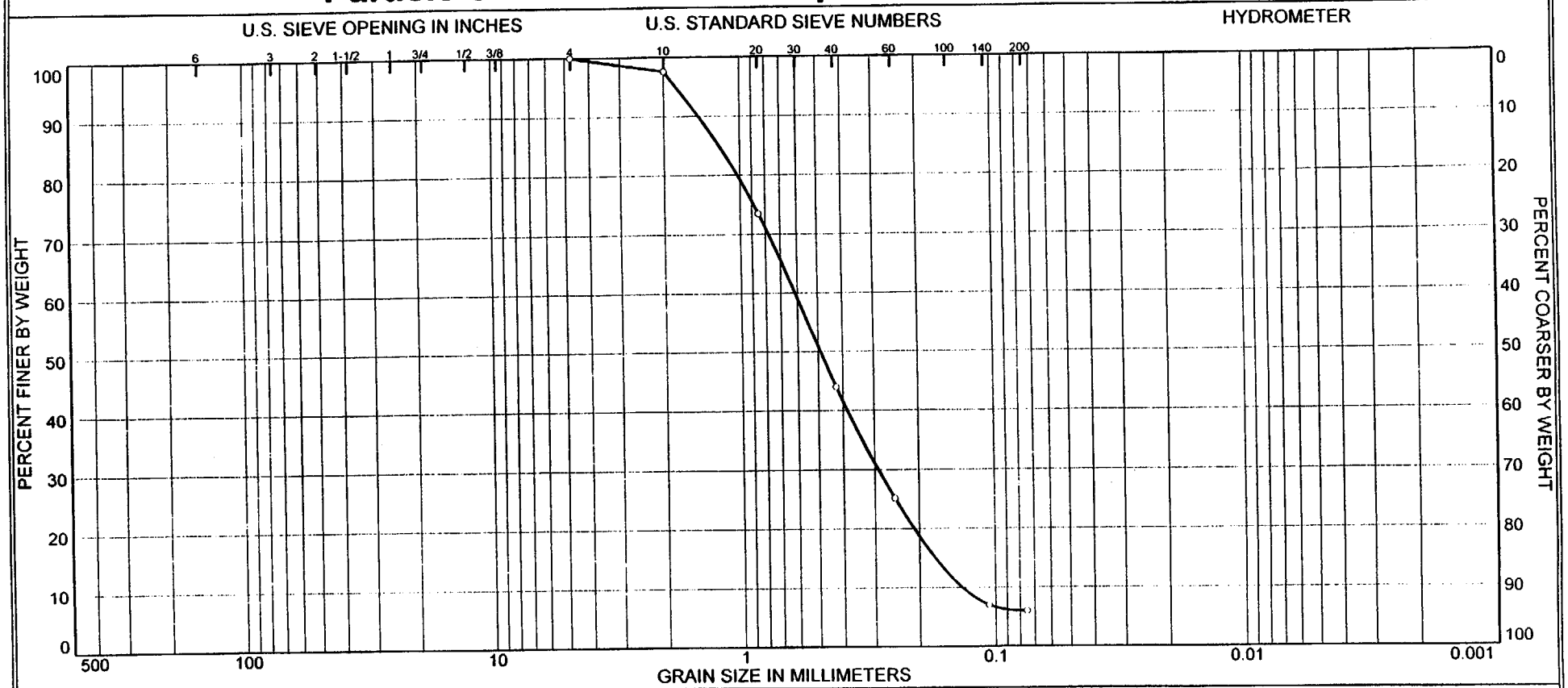
Project MOX Fuel Fabrication Facility

Project No. 50160-0-3963 | Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

○ Tested by: WFL Reviewed by: HJ

Particle Size Distribution Report ASTM D422/D1140



	% COBBLES	% GRAVEL		% SAND			% FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.0	2.4	53.6	38.0	6.0	

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○	Boring BH-13	8	48-49'	8/25/00		Red Brown Poorly graded sand with silt	12.9		

Client Duke Cogema Stone & Webster (DCS)

Project MOX Fuel Fabrication Facility

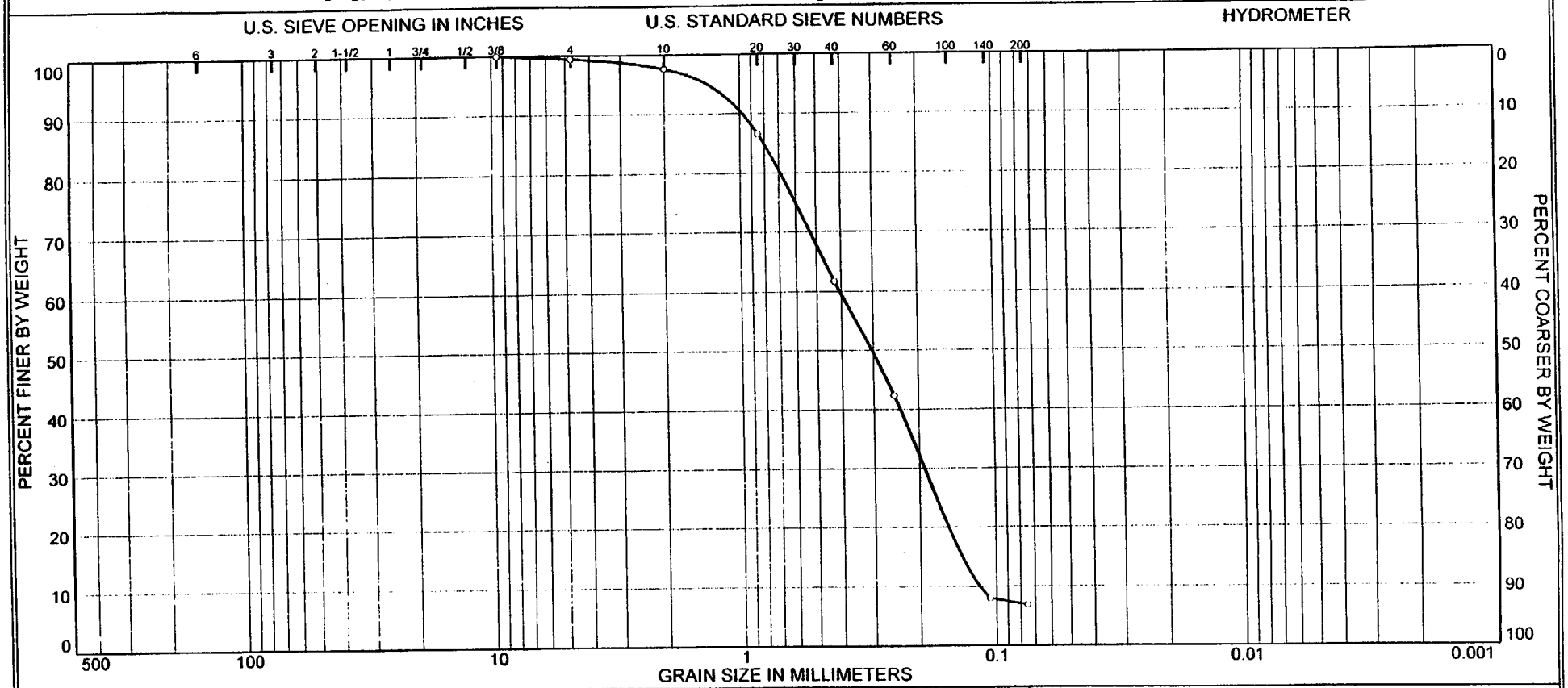
Project No. 50160-0-3963 | Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

○ Tested by: WFL Reviewed by: HJ

220

Particle Size Distribution Report ASTM D422/D1140



	% COBBLES	% GRAVEL		% SAND			% FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.6	1.8	35.9	54.8	6.9	

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○	Boring BH-13	10	58-59'	8/25/00		Red Brown Poorly graded sand with silt	14.9		

Client Duke Cogema Stone & Webster (DCS)

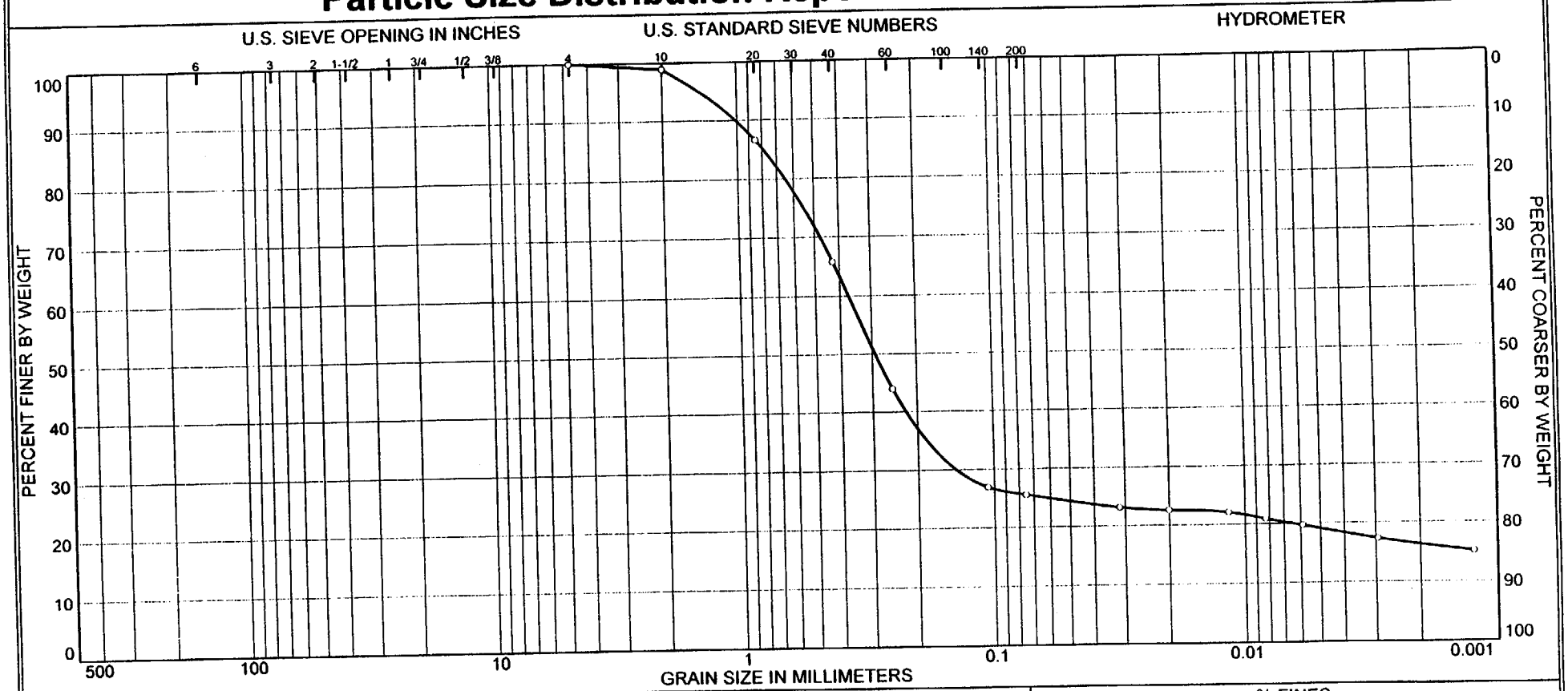
Project MOX Fuel Fabrication Facility

Project No. 50160-0-3963 | Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

○ Tested by: WFL Reviewed by: HJ

Particle Size Distribution Report ASTM D422/D1140



% COBBLES	% GRAVEL		% SAND			% FINES	
	COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
0.0	0.0	0.0	1.1	33.1	40.2	6.5	19.1

SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
Boring BH-13	12A	68-70'	8/23/00		Brown Silty sand	28.7		

Client Duke Cogema Stone & Webster (DCS)

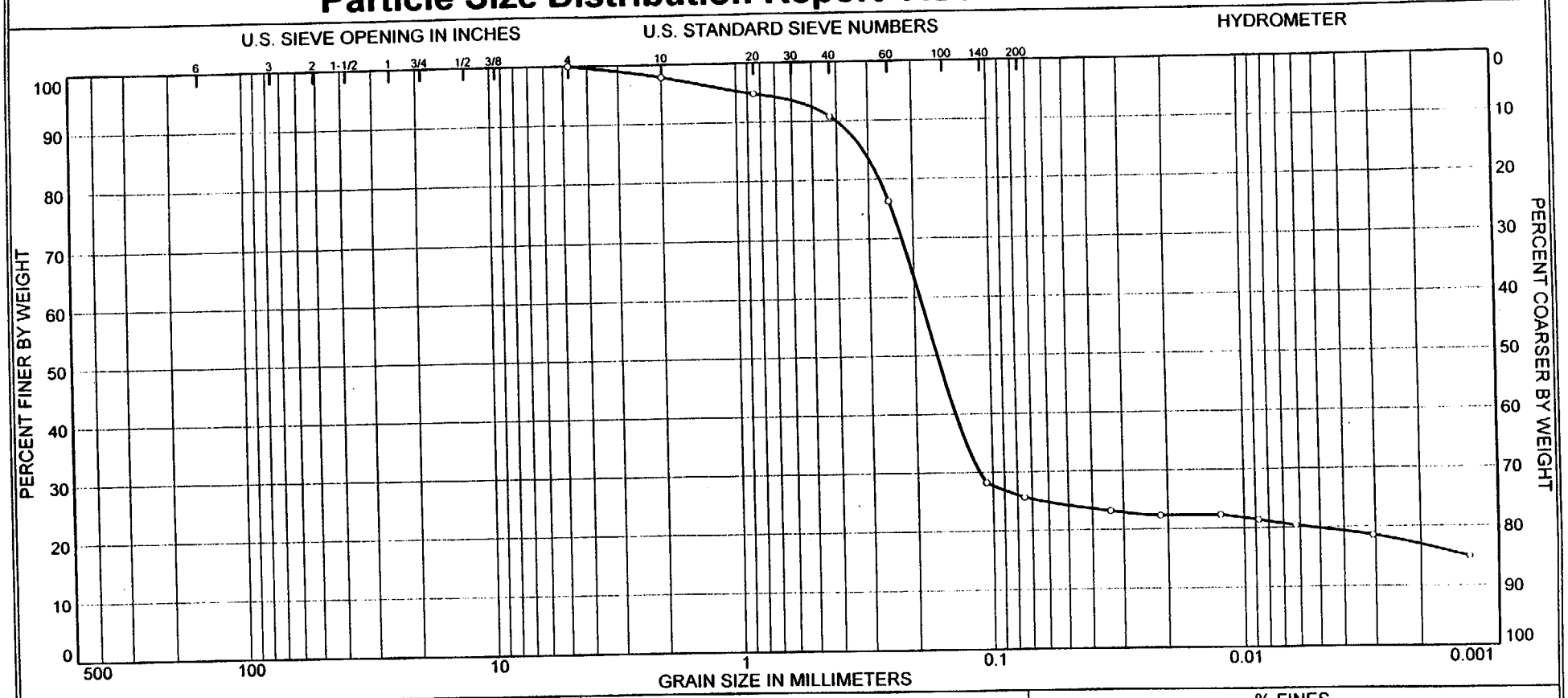
Project MOX Fuel Fabrication Facility

Project No. 50160-0-3963 | Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

○ Tested by: SC Reviewed by: HJ

Particle Size Distribution Report ASTM D422/D1140



	% COBBLES	% GRAVEL		% SAND			% FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.0	2.1	7.1	65.1	5.9	19.8

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○	Boring BH-13	12B (top)	70-71.2'	9/28/00	SC	Tan Clayey sand		39	23

Client Duke Cogema Stone & Webster (DCS)

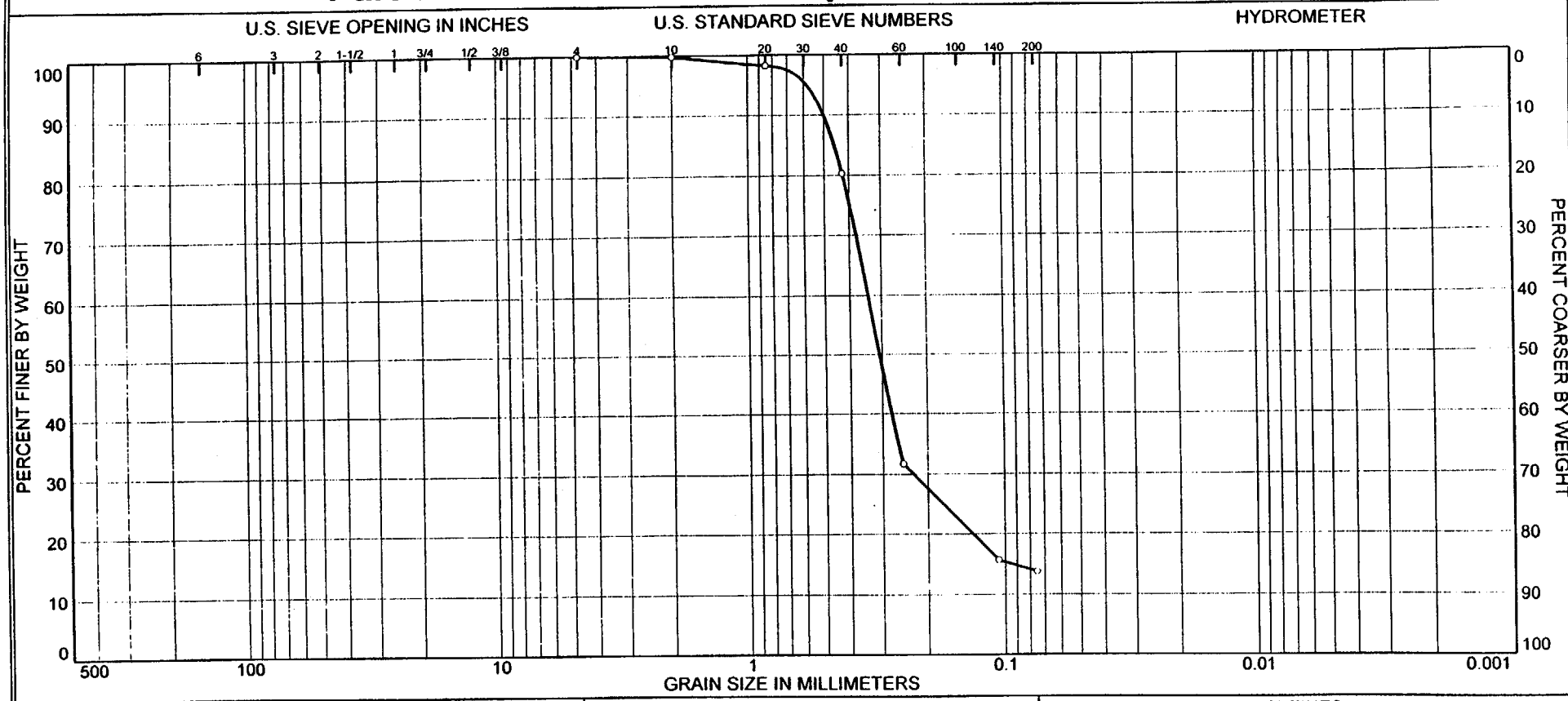
Project MOX Fuel Fabrication Facility

Project No. 5016003963 | Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

○ Tested by: WFL/SC Reviewed by: HJ

Particle Size Distribution Report ASTM D422/D1140



	% COBBLES	% GRAVEL		% SAND			% FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.0	0.2	19.4	66.6	13.8	

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○	Boring BH-13	14	78-79.5'	8/25/00		Tan Silty sand	26.7		

Client Duke Cogema Stone & Webster (DCS)

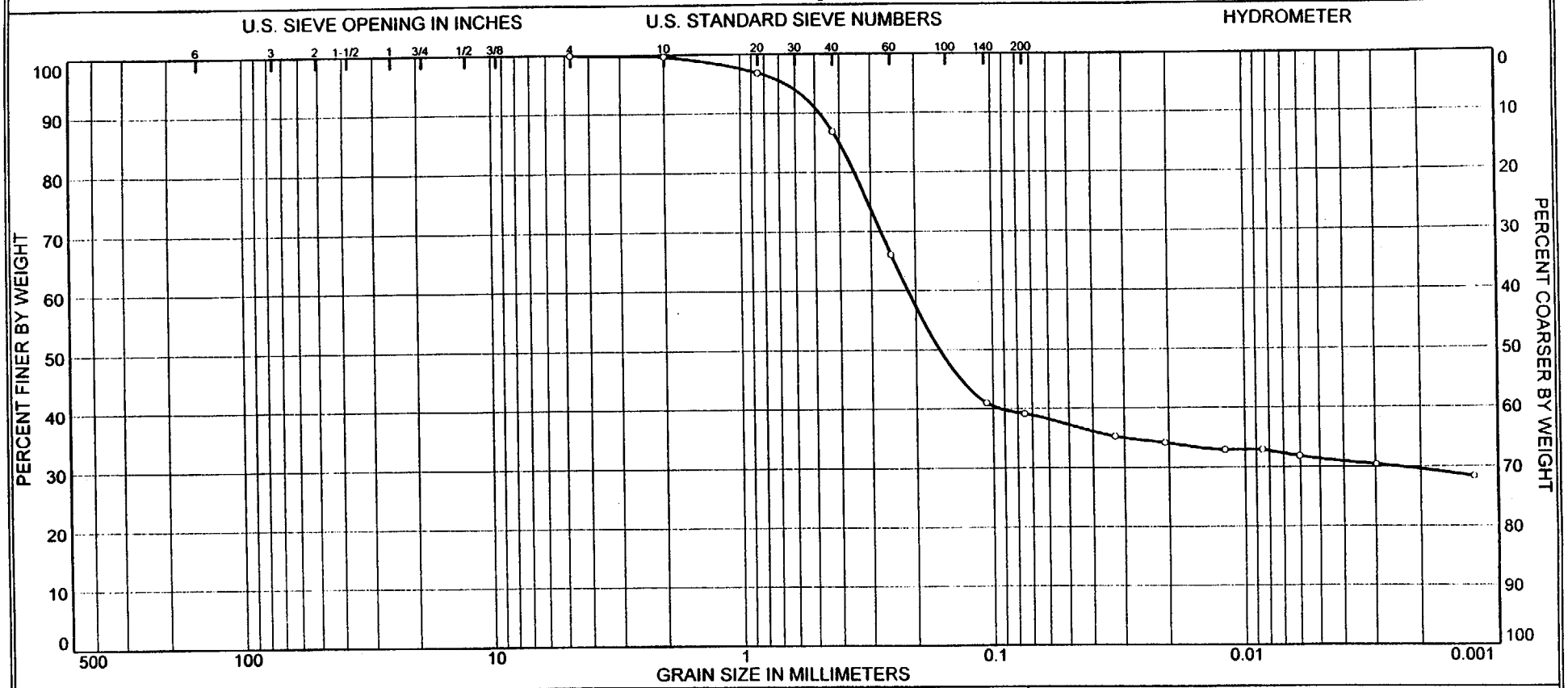
Project MOX Fuel Fabrication Facility

Project No. 50160-0-3963 | Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

○ Tested by: WFL Reviewed by: HJ

Particle Size Distribution Report ASTM D422/D1140



% COBBLES	% GRAVEL		% SAND			% FINES	
	COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
0.0	0.0	0.0	0.3	12.8	47.8	7.8	31.3

SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
Boring BH-13	15A	83-84.5'	8/22/00	SM	Tan Silty sand	42.8	94	52

Client Duke Cogema Stone & Webster (DCS)

Project MOX Fuel Fabrication Facility

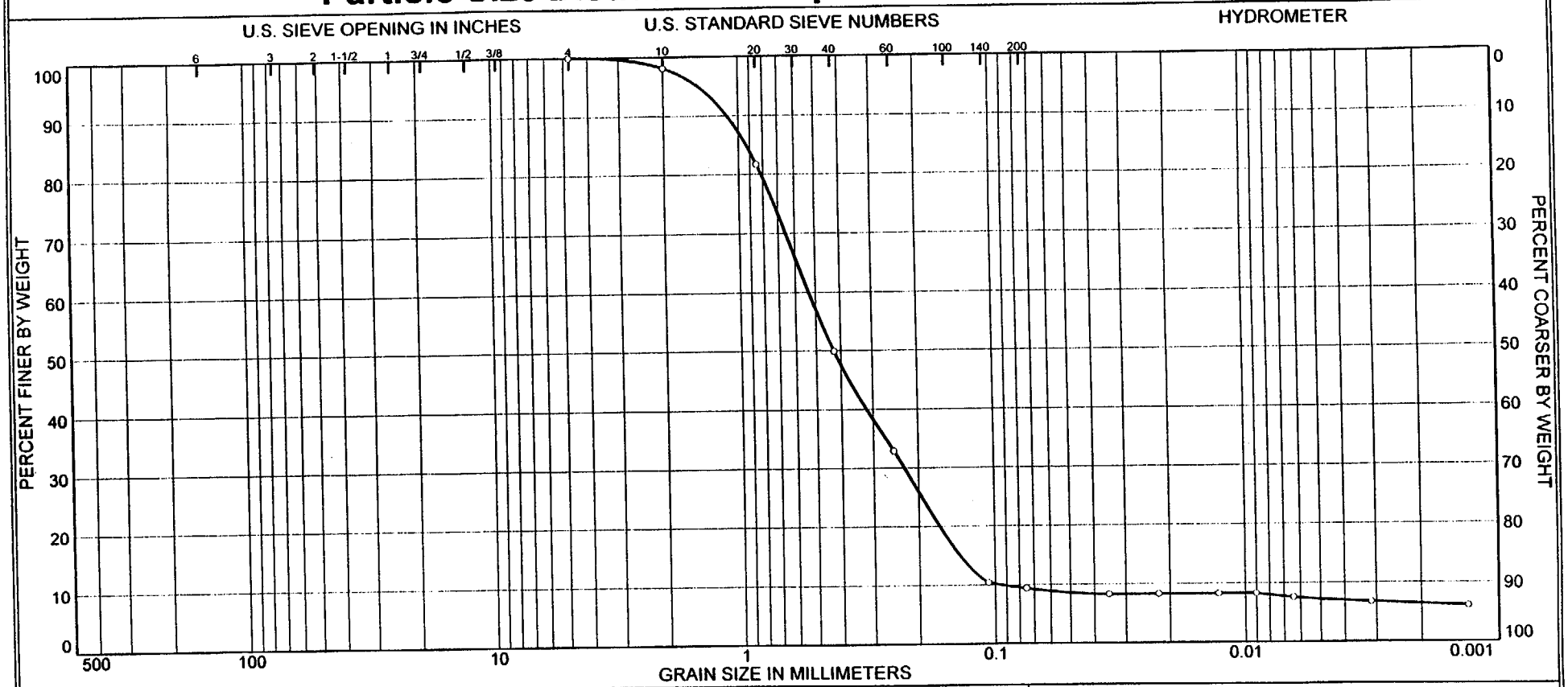
Project No. 50160-0-3963 | Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

○ Tested by: JTM/SC Reviewed by:HJ

225

Particle Size Distribution Report ASTM D422/D1140



% COBBLES	% GRAVEL		% SAND			% FINES	
	COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
0.0	0.0	0.0	1.9	48.2	40.5	2.2	7.2

SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
Boring BH-13	15B bot	85-87'	9/25/00	SP-SM	Tan Poorly graded sand with silt		52	31

Client Duke Cogema Stone & Webster (DCS)

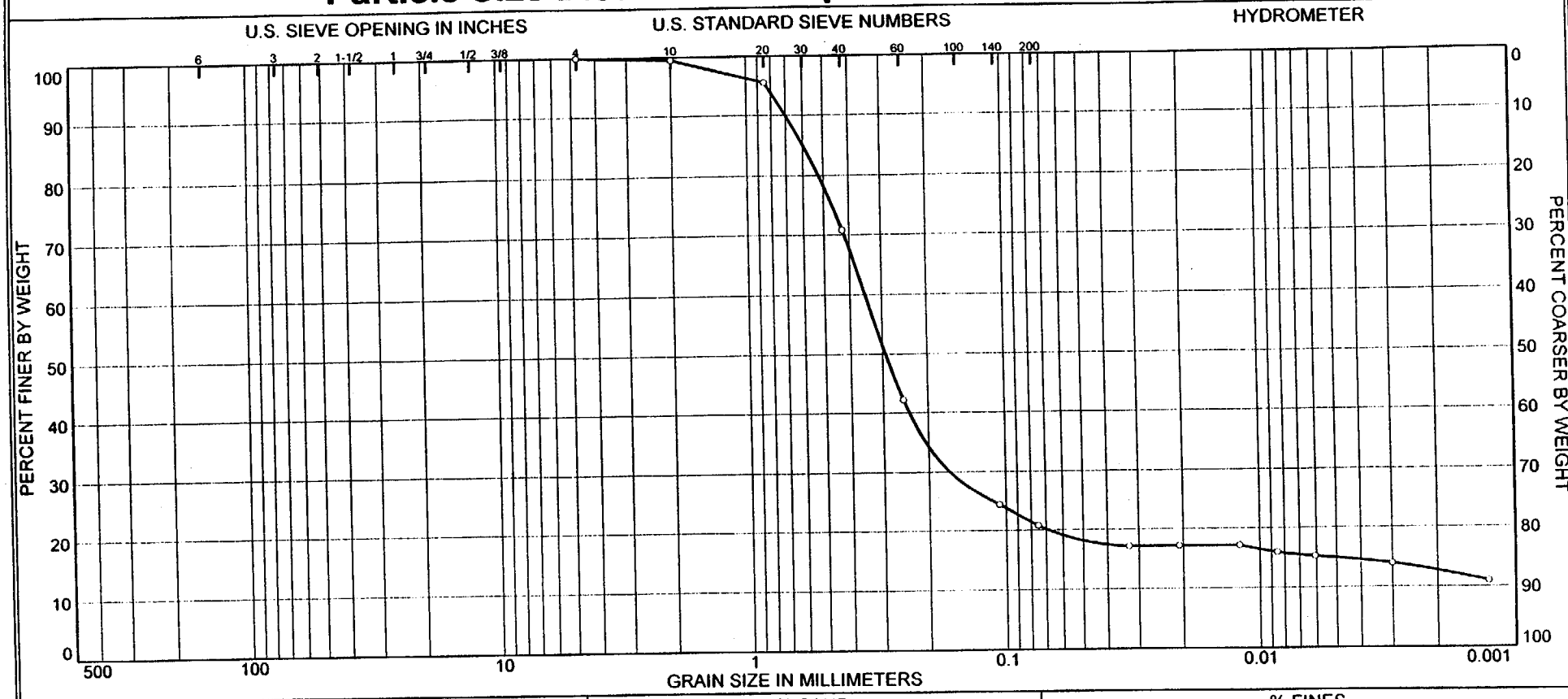
Project MOX Fuel Fabrication Facility

Project No. 5016003963 | Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

TGested by: SC/WFL Reviewed by: HJ

Particle Size Distribution Report ASTM D422/D1140



% COBBLES	% GRAVEL		% SAND			% FINES	
	COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
0.0	0.0	0.0	0.5	28.7	50.0	5.9	14.9

SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
Boring BH-13	17	93-94.6'	8/25/00		Tan Silty sand	34.4		

Client Duke Cogema Stone & Webster (DCS)

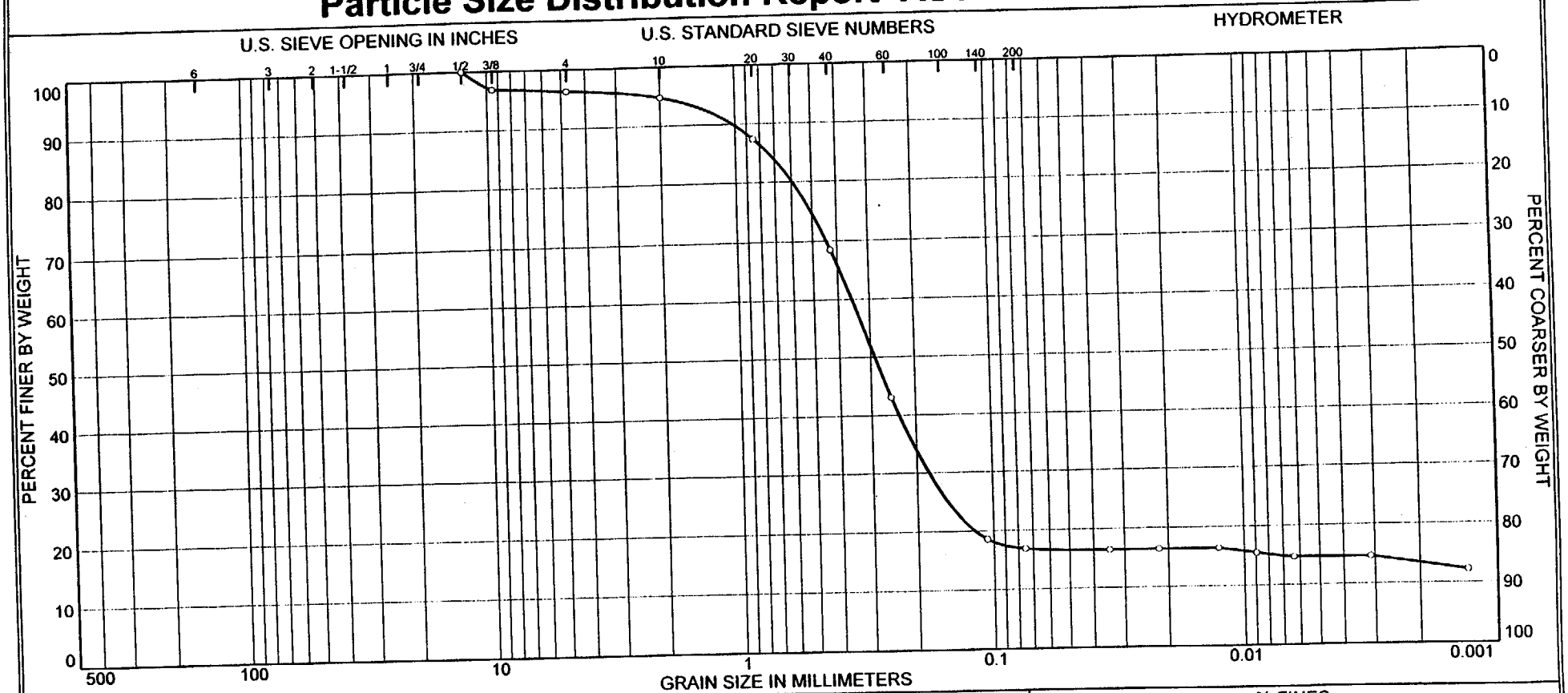
Project MOX Fuel Fabrication Facility

Project No. 50160-0-3963 | Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

Tested by: SC Reviewed by: HJ

Particle Size Distribution Report ASTM D422/D1140



% COBBLES	% GRAVEL		% SAND			% FINES	
	COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
0.0	0.0	3.7	1.5	26.3	51.6	2.2	14.7

SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
Boring BH-13	18B Bot	100-101.2'	9/28/00	SC	Yellow Brown Clayey sand		50	27

Client Duke Cogema Stone & Webster (DCS)

Project MOX Fuel Fabrication Facility

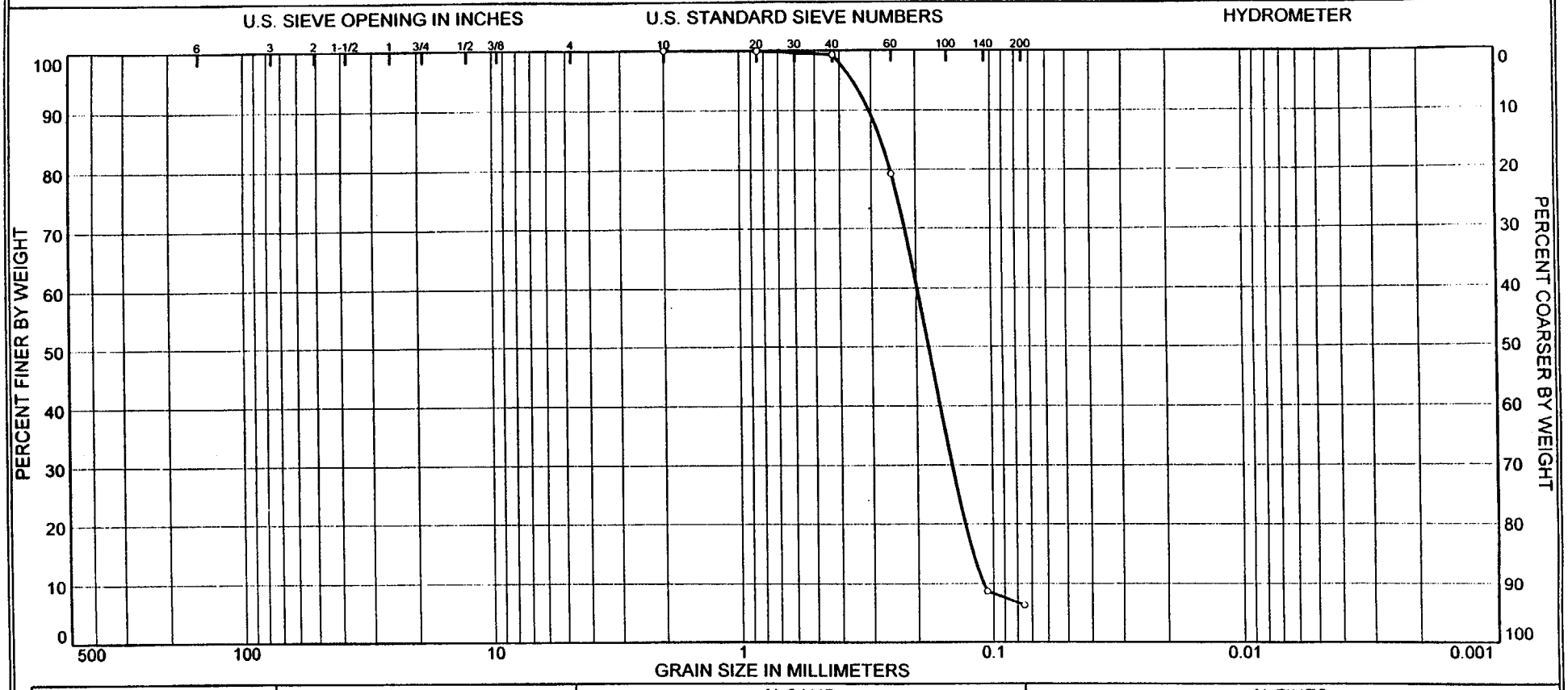
Project No. 5016003963 | Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

○ Tested by: WFL/SC Reviewed by: HJ

228

Particle Size Distribution Report ASTM D422/D1140



	% COBBLES	% GRAVEL		% SAND			% FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.0	0.0	0.7	93.0	6.3	

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○	Boring BH-13	20-2	108.5-109.5'	8/25/00		Tan Brown Poorly graded sand with silt	23.2		

Client Duke Cogema Stone & Webster (DCS)

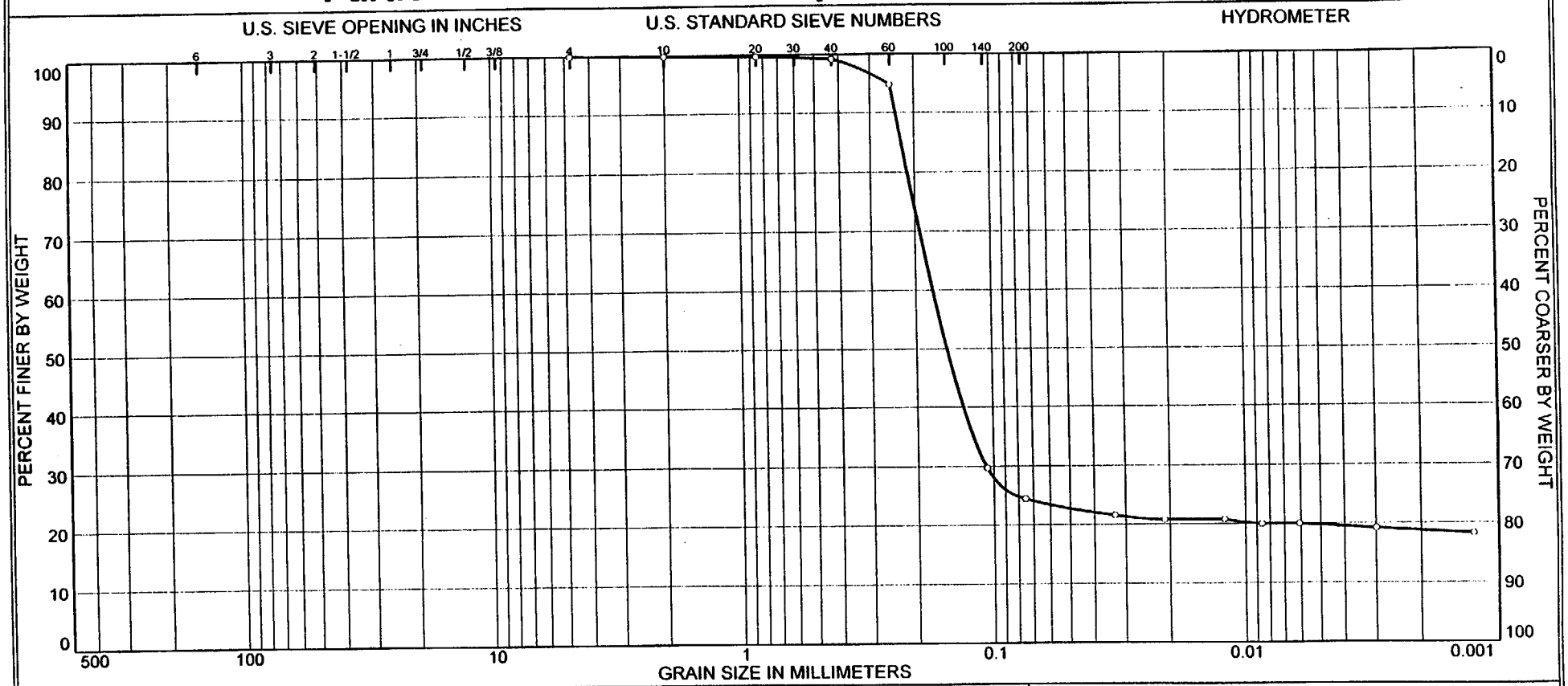
Project MOX Fuel Fabrication Facility

Project No. 50160-0-3963 | Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

○ Tested by: WFL Reviewed by: HJ

Particle Size Distribution Report ASTM D422/D1140



	% COBBLES	% GRAVEL		% SAND			% FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.0	0.1	0.7	74.7	4.7	19.8

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○	Boring BH-13	23A	123.5-124'	8/22/00	SC	Tan Brown Clayey sand	35.5	55	26

Client Duke Cogema Stone & Webster (DCS)

Project MOX Fuel Fabrication Facility

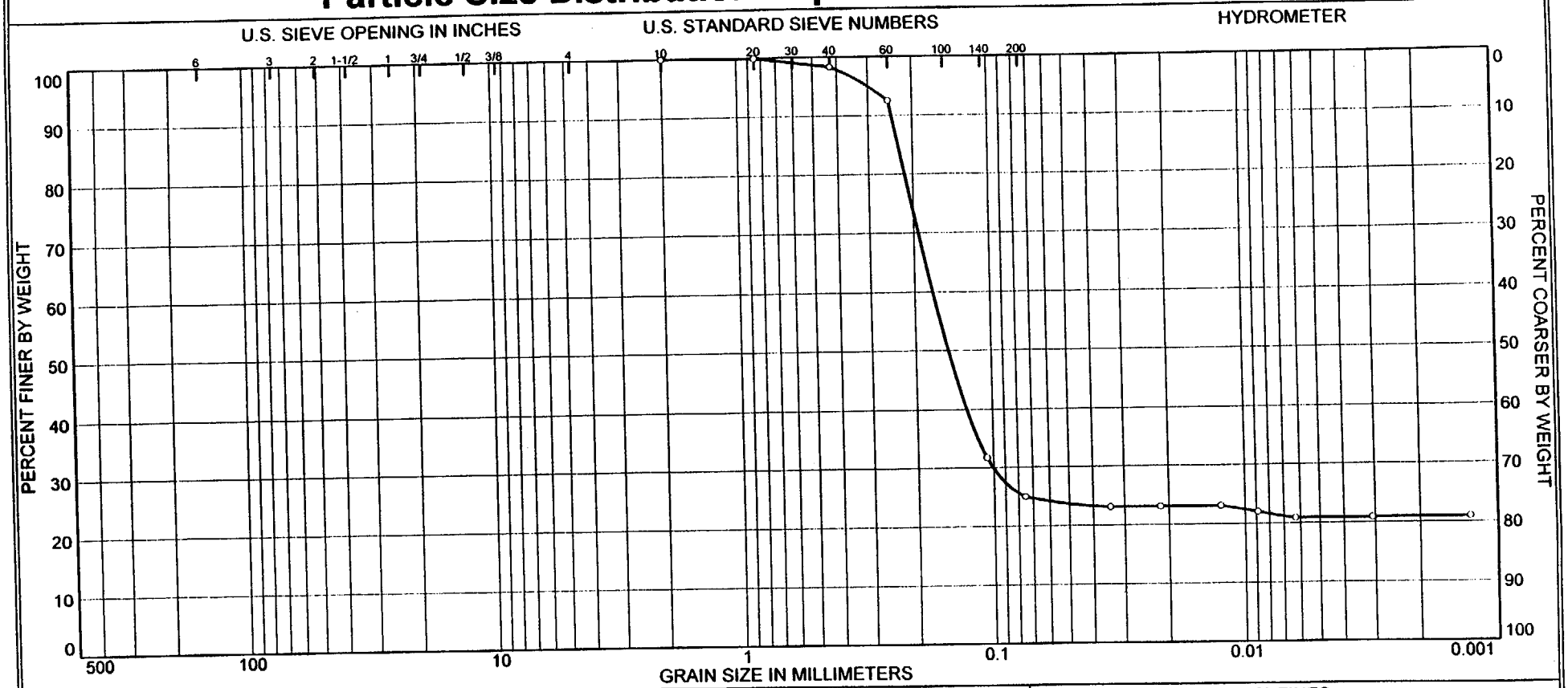
Project No. 50160-0-3963 Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

○ Tested by: SC/WFL/JTM Reviewed by: HJ

230

Particle Size Distribution Report ASTM D422/D1140



% COBBLES	% GRAVEL		% SAND			% FINES	
	COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
0.0	0.0	0.0	0.0	1.7	73.3	4.1	20.9

SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
Boring BH-13	23B	125-127'	9/28/00	SC	Yellow Clayey sand		62	26

Client Duke Cogema Stone & Webster (DCS)

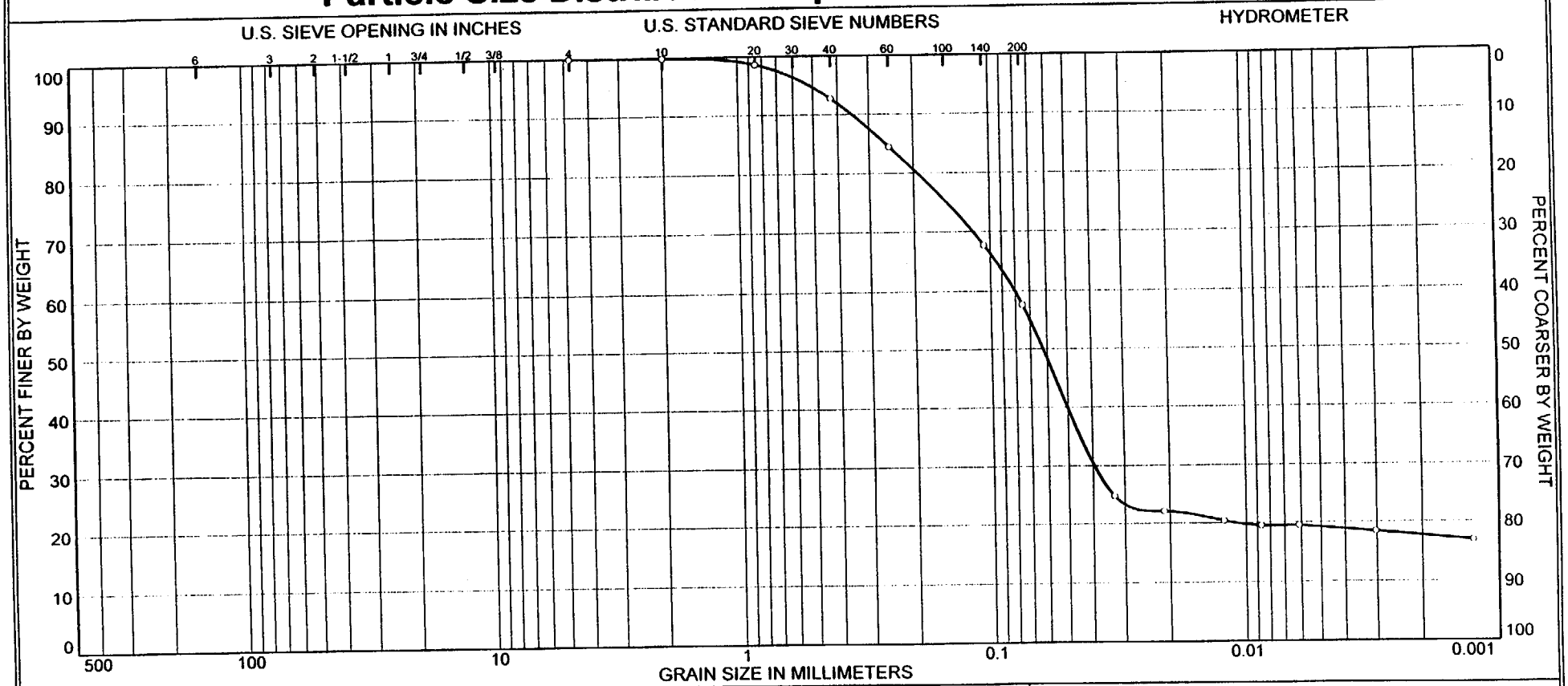
Project MOX Fuel Fabrication Facility

Project No. 5016003963 | Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

○ Tested by: WFL/SC Reviewed by: HJ

Particle Size Distribution Report ASTM D422/D1140



	% COBBLES	% GRAVEL		% SAND			% FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.0	0.1	7.2	35.0	38.5	19.2

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○	Boring BH-13	25	133.5-134'	8/23/00	CH	Brown Sandy fat clay	27.1	52	23

Client Duke Cogema Stone & Webster (DCS)

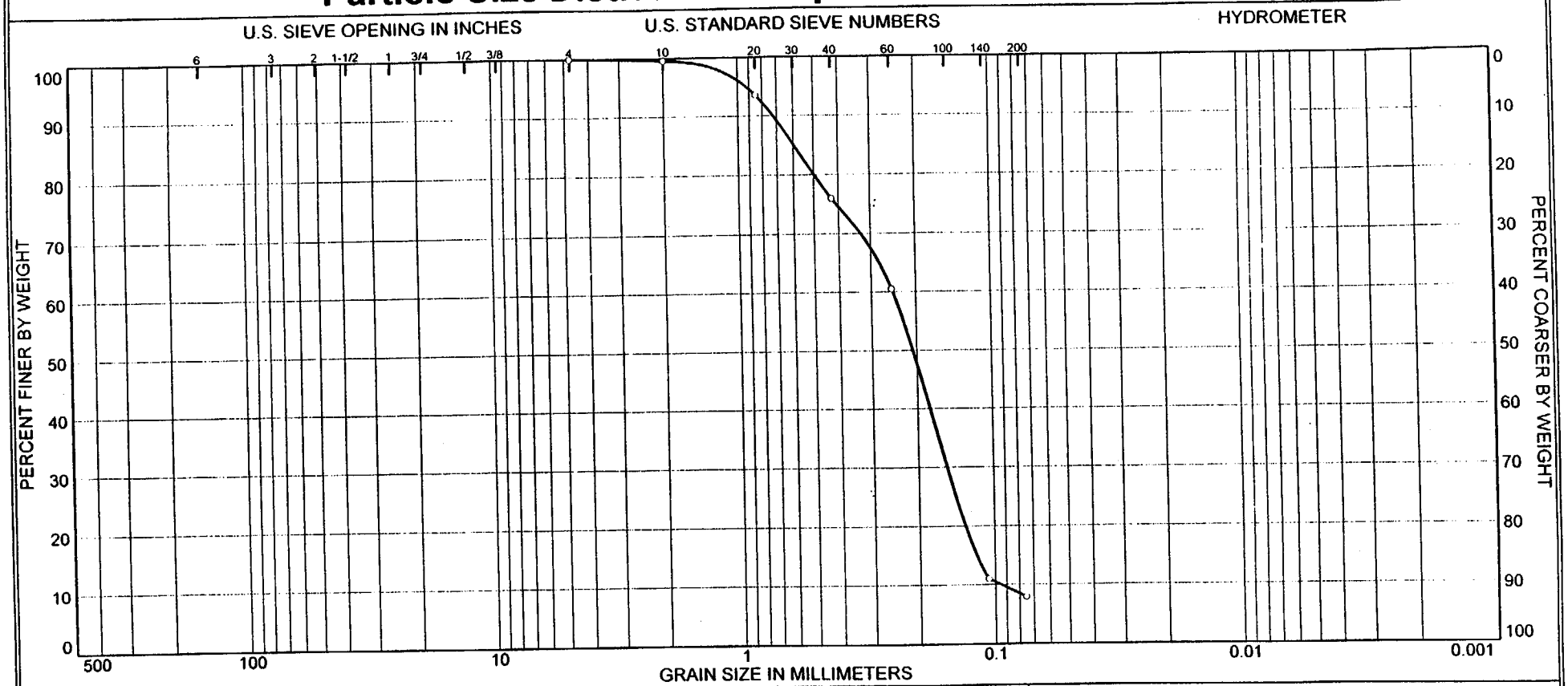
Project MOX Fuel Fabrication Facility

Project No. 50160-0-3963 Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

○ Tested by: WFL/SC Reviewed by: HJ

Particle Size Distribution Report ASTM D422/D1140



% COBBLES	% GRAVEL		% SAND			% FINES	
	COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
0.0	0.0	0.0	0.4	23.6	68.1	7.9	

SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
Boring BH-13	29	153-154'	8/17/00		Gray Black Poorly graded sand with silt	25.9		

Client Duke Cogema Stone & Webster (DCS)

Project MOX Fuel Fabrication Facility

Project No. 50160-0-3963 | Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

Tested by: WFL Reviewed by: HJ

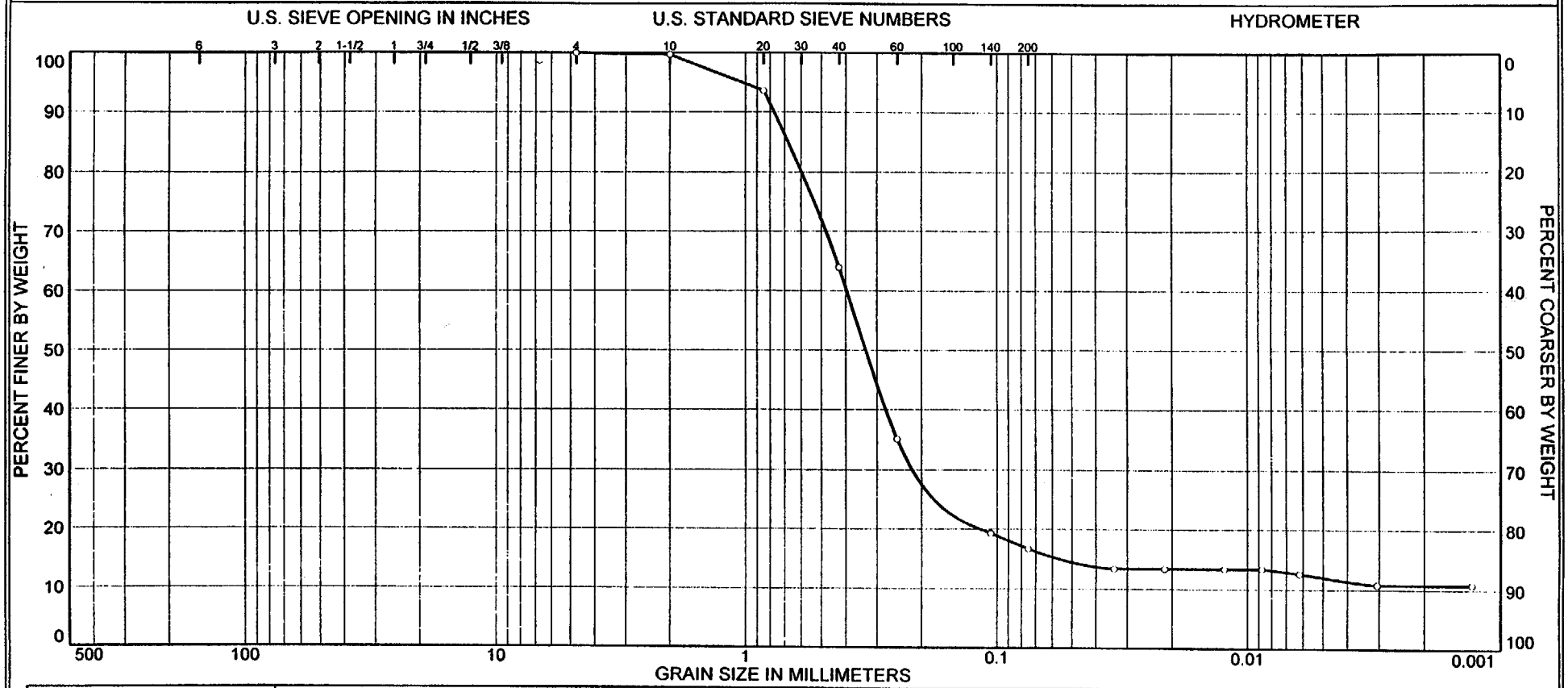
Grain Size & Atter[illegible]g Limits Summary

Project: MOX Fuel Fabrication Facility **LAW Project No:** 50160-0-3963

Source of Sample	Sample No.	Depth	Material Description	Sand (%)	Silt (%)	Clay (%)	Fines (%)	Natural Moisture (%)	LL	PL	PI
Boring CPT-10	10-1 (Tube)	65-67'	Brown Clayey sand	83.3	4.7	12	16.7	27.2	94	34	60
	26B	135-137									
Boring CPT-14											
	14-1 (Tube)	65-67'	Red Brown Clayey sand	73.2	11.4	15.4	26.8	27.2	63	23	40
	14-2 (Tube)	92-93'	Tan Brown Clayey sand	83.4	5	11.6	16.6	29	67	24	43
Boring CPT-22											
	22 (Tube)	128-130'	Brown Clayey sand	77.1	1.9	21	22.9	31.8	70	27	43
Boring CPT-29											
	29-1	68-70'	Tan Brown Silty sand	80.3	4.9	14.8	19.7	28.7	70	41	29
Boring CPT-37											
	37-1 (Tube)	58-60'	Brown Clayey sand	65.1	5.9	29	34.9	32.4	97	38	59
	37-2 (Tube)	67-69'	Tan Brown Clayey sand	77.5	5.5	17	22.5	31.1	47	23	24
	37-3 (Tube)	112-114'	Tan Brown Poorly graded sand	96.4	1.1	2.5	3.6	25.3	NV	NP	NP
Boring CPT-39											
	39 (Tube)	102-104'	Brown Clayey sand	76.4	4.1	19.5	23.6	32.5	61	26	35
Boring CPT-46											
	46-1 (Tube)	131-133'	Tan Brown Clayey sand	77.7	3.1	19.2	22.3	35.5	57	27	30
	46-2 (Tube)	140-142'	Tan Brown Sandy silt	35.4	58.4	6.2	64.6	39.5	NV	NP	NP

234

Particle Size Distribution Report ASTM D422/D1140



	% COBBLES	% GRAVEL		% SAND			% FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.0	0.3	35.8	47.2	4.7	12.0

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○	Boring CPT-10	10-1 (Tube)	65-67'	9/1/00	SC	Brown Clayey sand	27.2	94	34

Client Duke Cogema Stone & Webster (DCS)

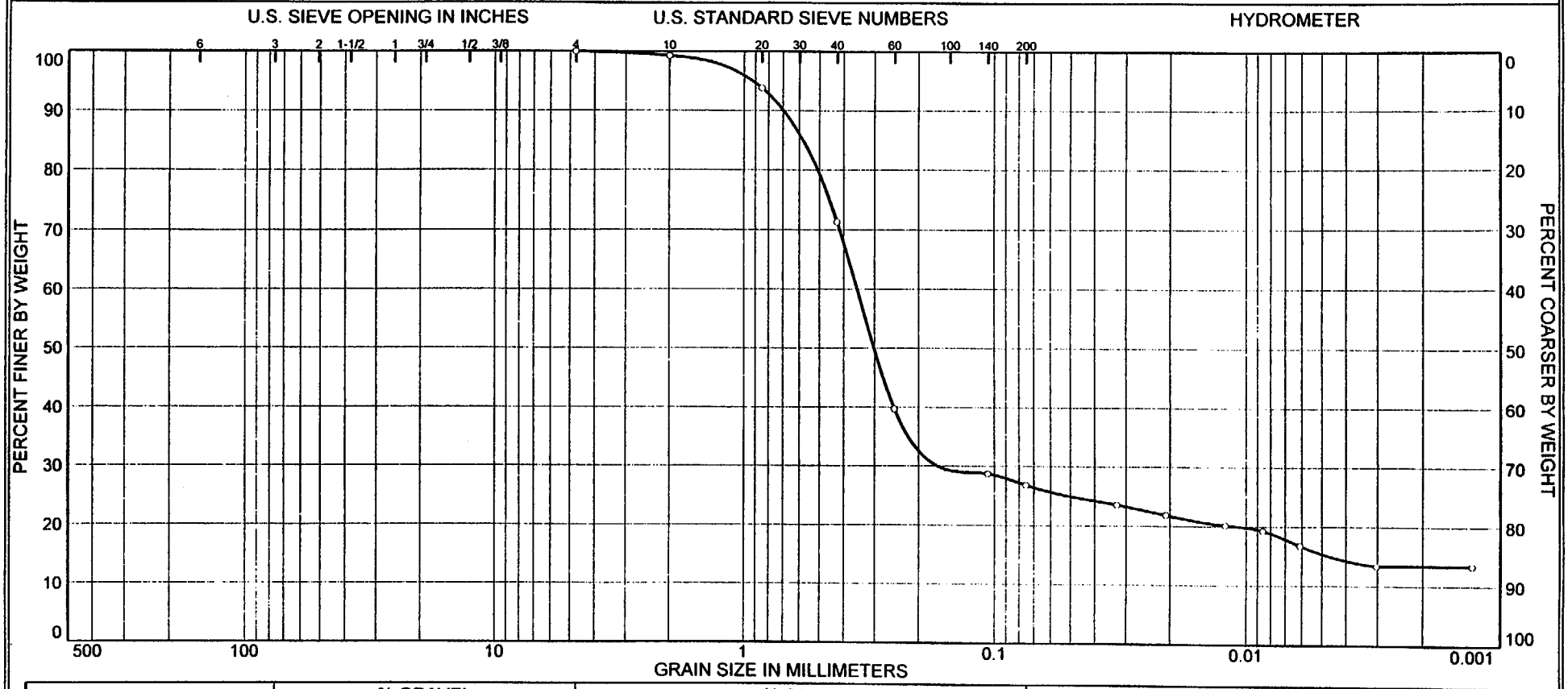
Project MOX Fuel Fabrication Facility

Project No. 5016003963 | Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

○ Tested by: SC/WFL Reviewed by: HJ

Particle Size Distribution Report ASTM D422/D1140



	% COBBLES	% GRAVEL		% SAND			% FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.0	0.7	28.0	44.5	11.4	15.4

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○	Boring CPT-14	14-1 (Tube)	65-67'	8/31/00	SC	Red Brown Clayey sand	27.2	63	23

Client Duke Cogema Stone & Webster (DCS)

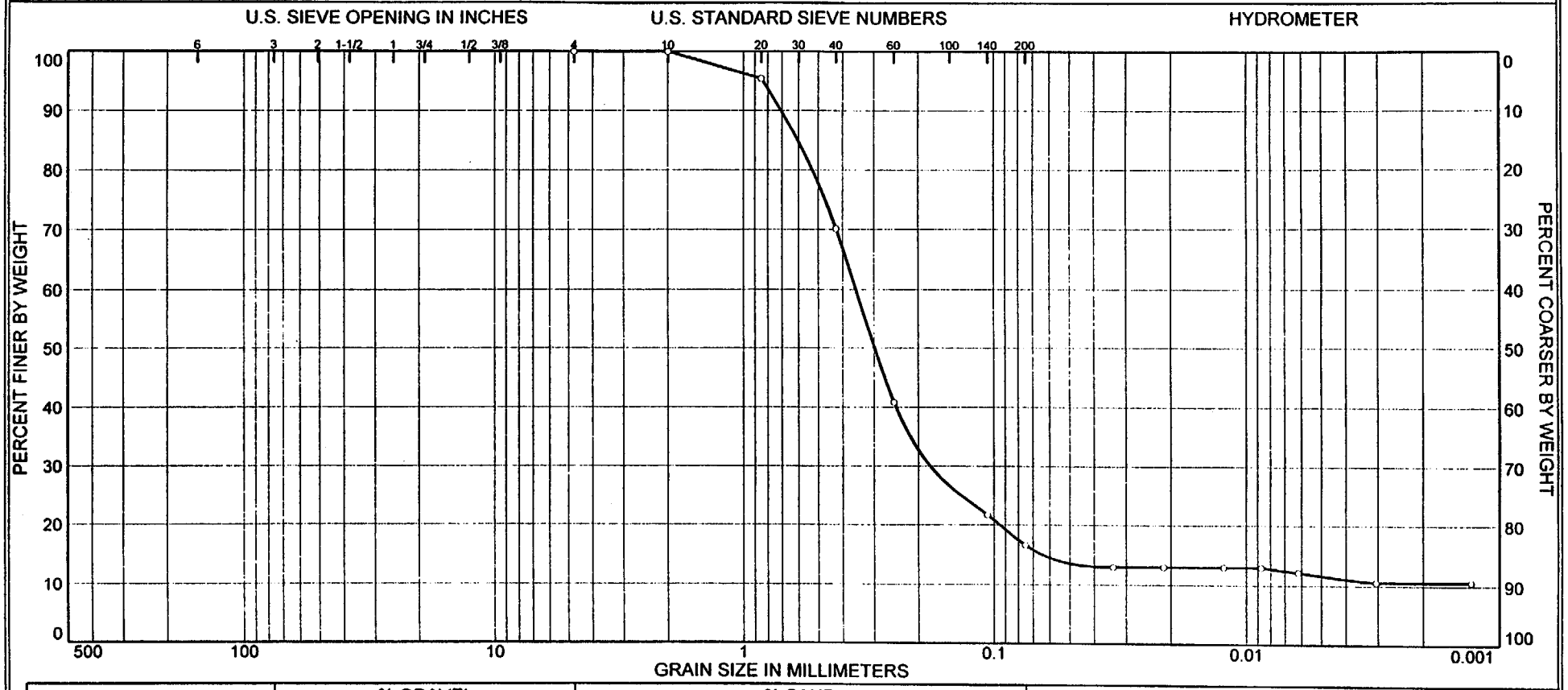
Project MOX Fuel Fabrication Facility

Project No. 5016003963 | Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

○ Tested by: WFL/SC Reviewed by: HJ

Particle Size Distribution Report ASTM D422/D1140



	% COBBLES	% GRAVEL		% SAND			% FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.0	0.0	29.9	53.5	5.0	11.6

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○	Boring CPT-14	14-2 (Tube)	92-93'	8/31/00	SC	Tan Brown Clayey sand	29.0	67	24

Client Duke Cogema Stone & Webster (DCS)

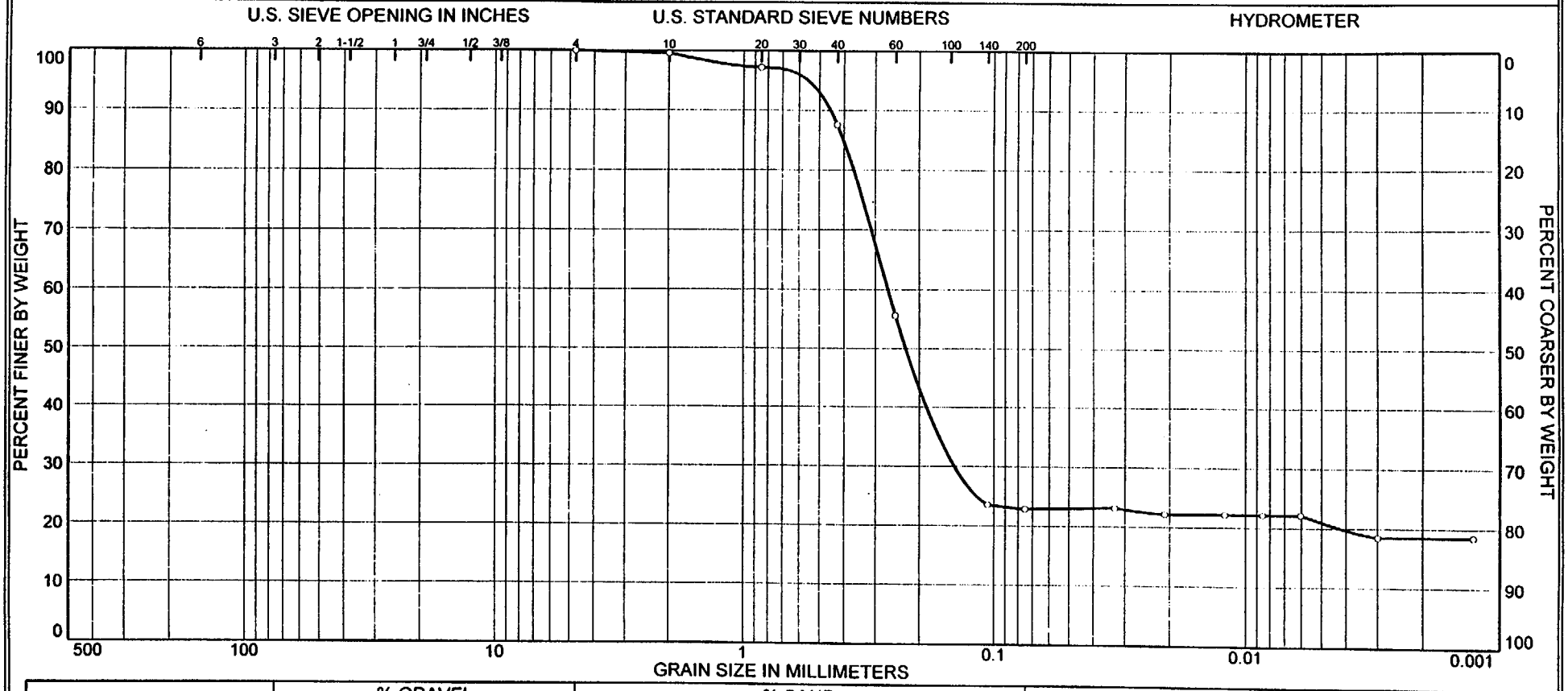
Project MOX Fuel Fabrication Facility

Project No. 5016003963 | Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

○ Tested by: SC/WFL/JTM Reviewed by: HJ

Particle Size Distribution Report ASTM D422/D1140



	% COBBLES	% GRAVEL		% SAND			% FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.0	0.4	12.0	64.7	1.9	21.0

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○	Boring CPT-22	22 (Tube)	128-130'	8/31/00	SC	Brown Clayey sand	31.8	70	27

Client Duke Cogema Stone & Webster (DCS)

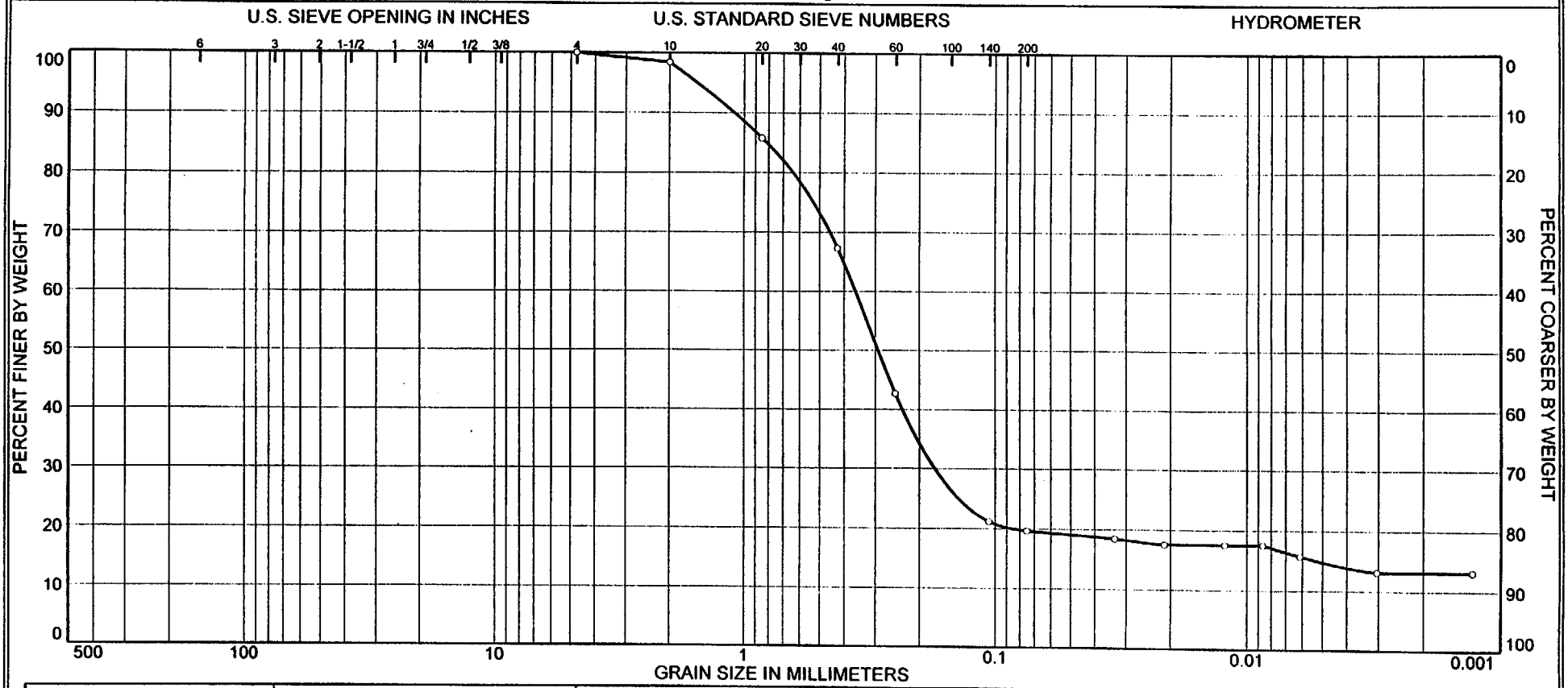
Project MOX Fuel Fabrication Facility

Project No. 5016003963 | Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

○ Tested by: WFL/SC Reviewed by: HJ

Particle Size Distribution Report ASTM D422/D1140



	% COBBLES	% GRAVEL		% SAND			% FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.0	1.6	31.1	47.6	4.9	14.8

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○	Boring CPT-29	29-1	68-70'	8/31/00	SM	Tan Brown Silty sand	28.7	70	41

Client Duke Cogema Stone & Webster (DCS)

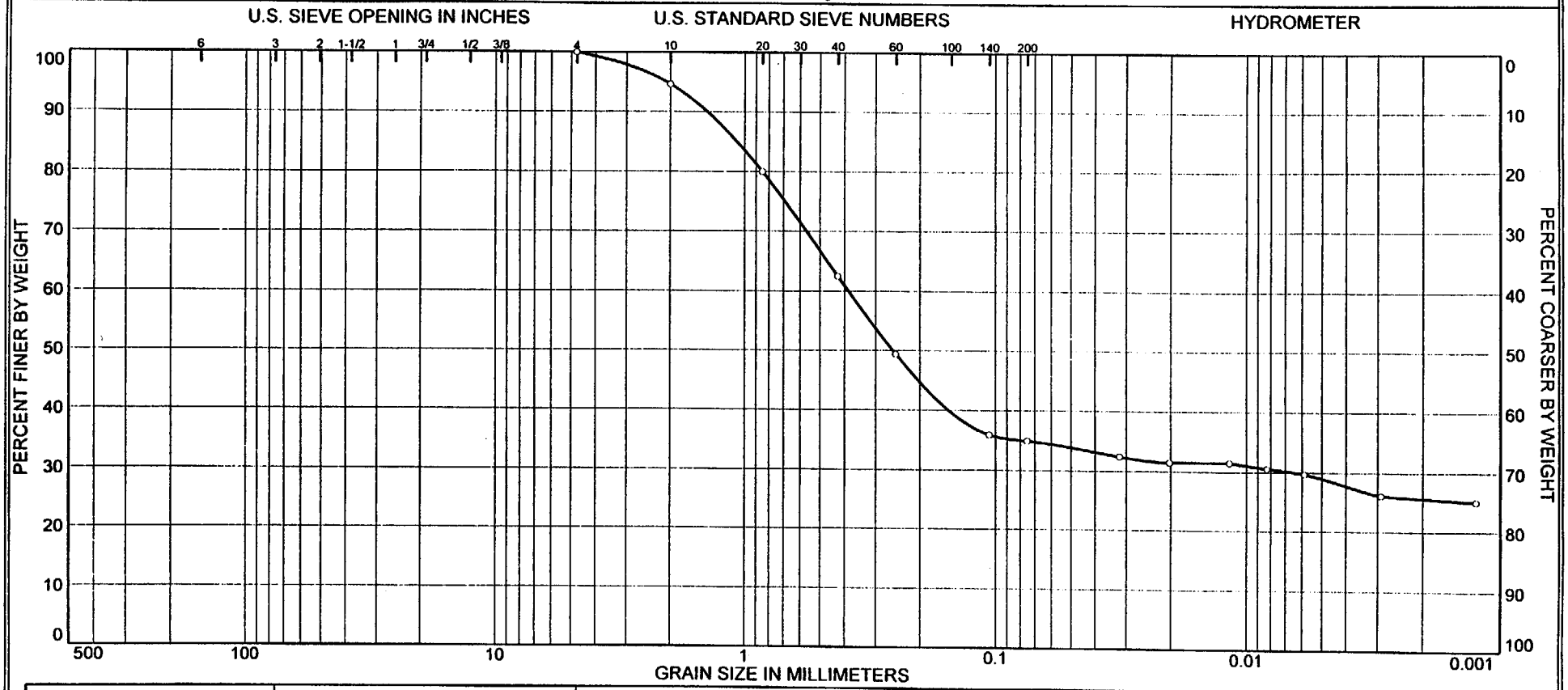
Project MOX Fuel Fabrication Facility

Project No. 5016003963 | Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

○ Tested by: WFL/SC Reviewed by: HJ

Particle Size Distribution Report ASTM D422/D1140



	% COBBLES	% GRAVEL		% SAND			% FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.0	5.4	32.1	27.6	5.9	29.0

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○	Boring CPT-37	37-1 (Tube)	58-60'	8/31/00	SC	Brown Clayey sand	32.4	97	38

Client Duke Cogema Stone & Webster (DCS)

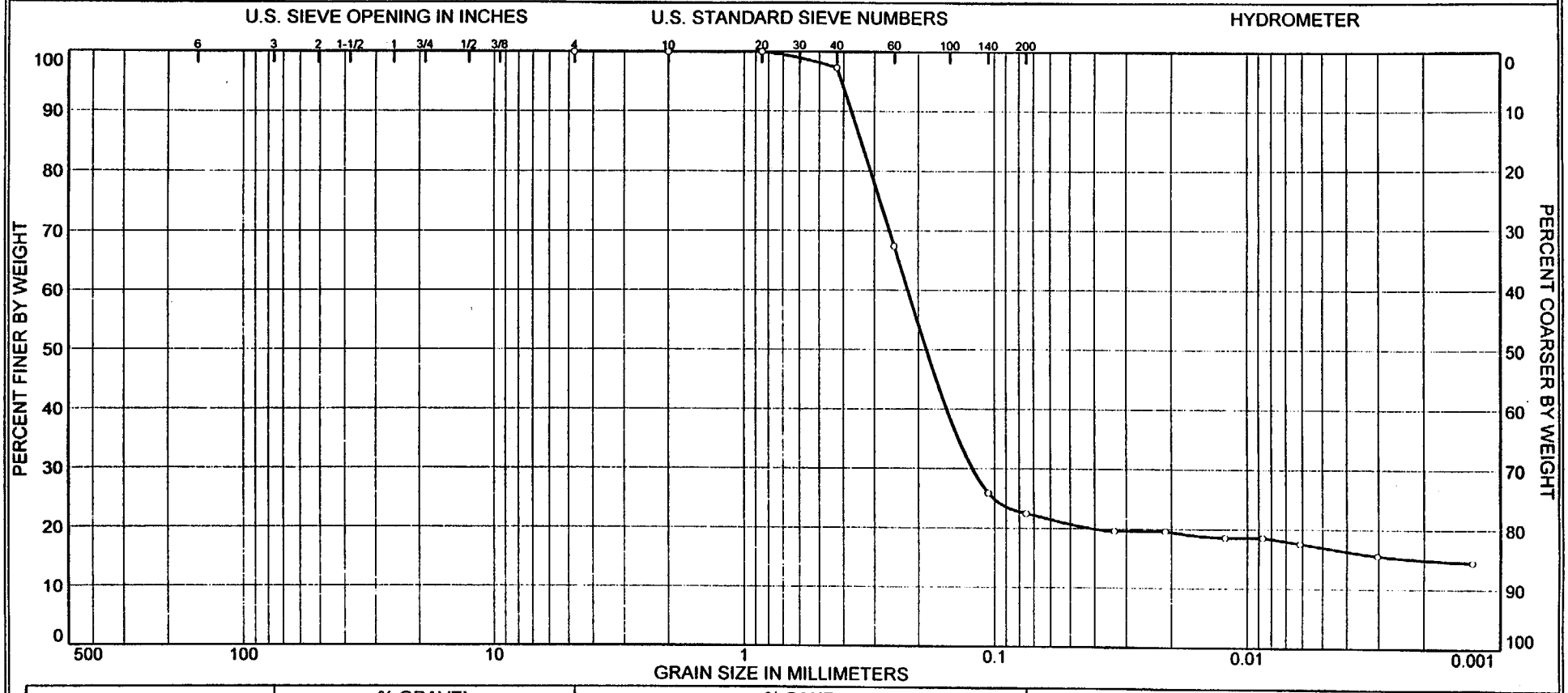
Project MOX Fuel Fabrication Facility

Project No. 5016003963 | Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

○ Tested by: WFL/SC Reviewed by: HJ

Particle Size Distribution Report ASTM D422/D1140



	% COBBLES	% GRAVEL		% SAND			% FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.0	0.0	2.7	74.8	5.5	17.0

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○	Boring CPT-37	37-2 (Tube)	67-69'	8/31/00	SC	Tan Brown Clayey sand	31.1	47	23

Client Duke Cogema Stone & Webster (DCS)

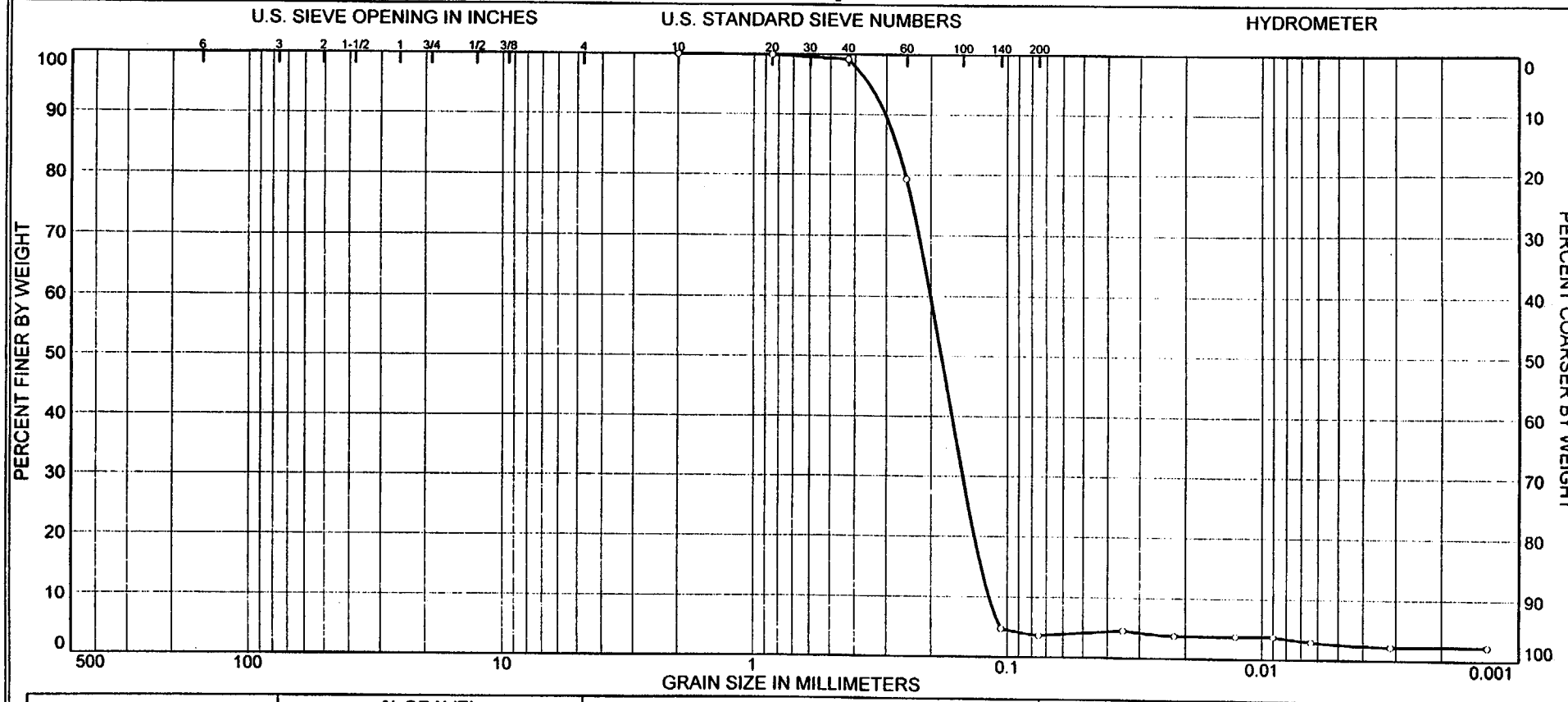
Project MOX Fuel Fabrication Facility

Project No. 5016003963 Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

○ Tested by: SC/WFL Reviewed by: HJ

Particle Size Distribution Report ASTM D422/D1140



	% COBBLES	% GRAVEL		% SAND			% FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.0	0.0	0.8	95.6	1.1	2.5

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○	Boring CPT-37	37-3 (Tube)	112-114'	8/31/00	SP	Tan Brown Poorly graded sand	25.3	NV	NP

Client Duke Cogema Stone & Webster (DCS)

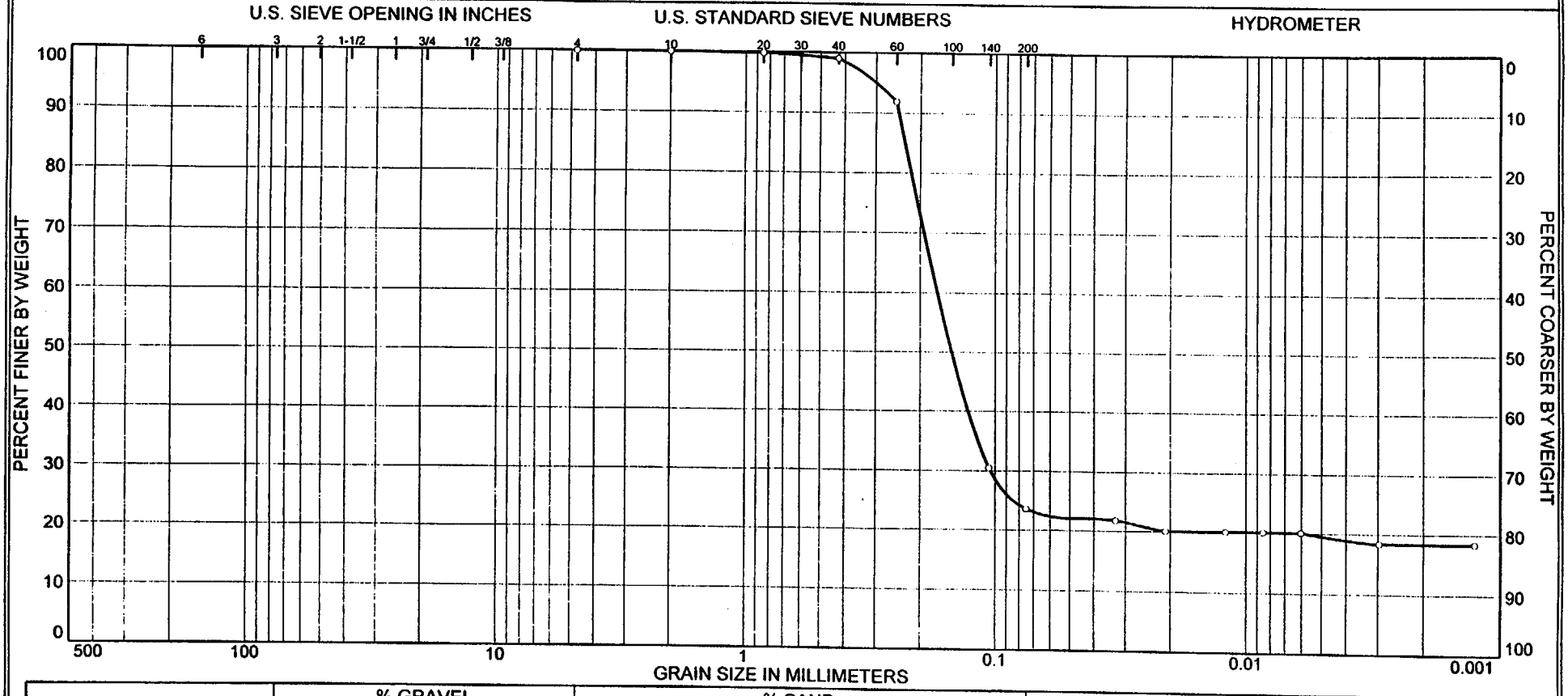
Project MOX Fuel Fabrication Facility

Project No. 5016003963 | Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

○ Tested by: SC/WFL Reviewed by: HJ

Particle Size Distribution Report ASTM D422/D1140



	% COBBLES	% GRAVEL		% SAND			% FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.0	0.0	1.0	75.4	4.1	19.5

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○	Boring CPT-39	39 (Tube)	102-104'	9/1/00	SC	Brown Clayey sand	32.5	61	26

Client Duke Cogema Stone & Webster (DCS)

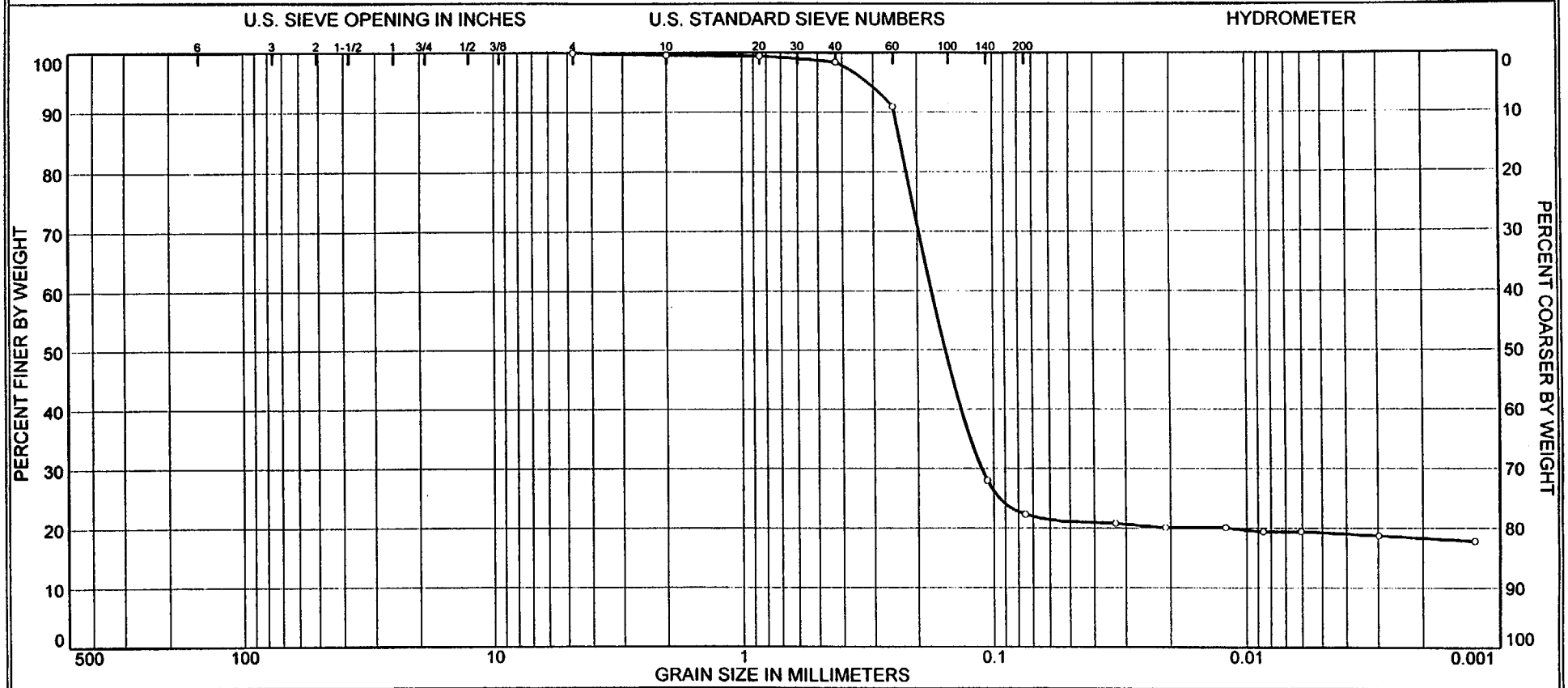
Project MOX Fuel Fabrication Facility

Project No. 5016003963 Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

○ Tested by: SC/WFL Reviewed by: HJ

Particle Size Distribution Report ASTM D422/D1140



	% COBBLES	% GRAVEL		% SAND			% FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.0	0.4	1.2	76.1	3.1	19.2

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○	Boring CPT-46	46-1 (Tube)	131-133'	9/1/00	SC	Tan Brown Clayey sand	35.5	57	27

Client Duke Cogema Stone & Webster (DCS)

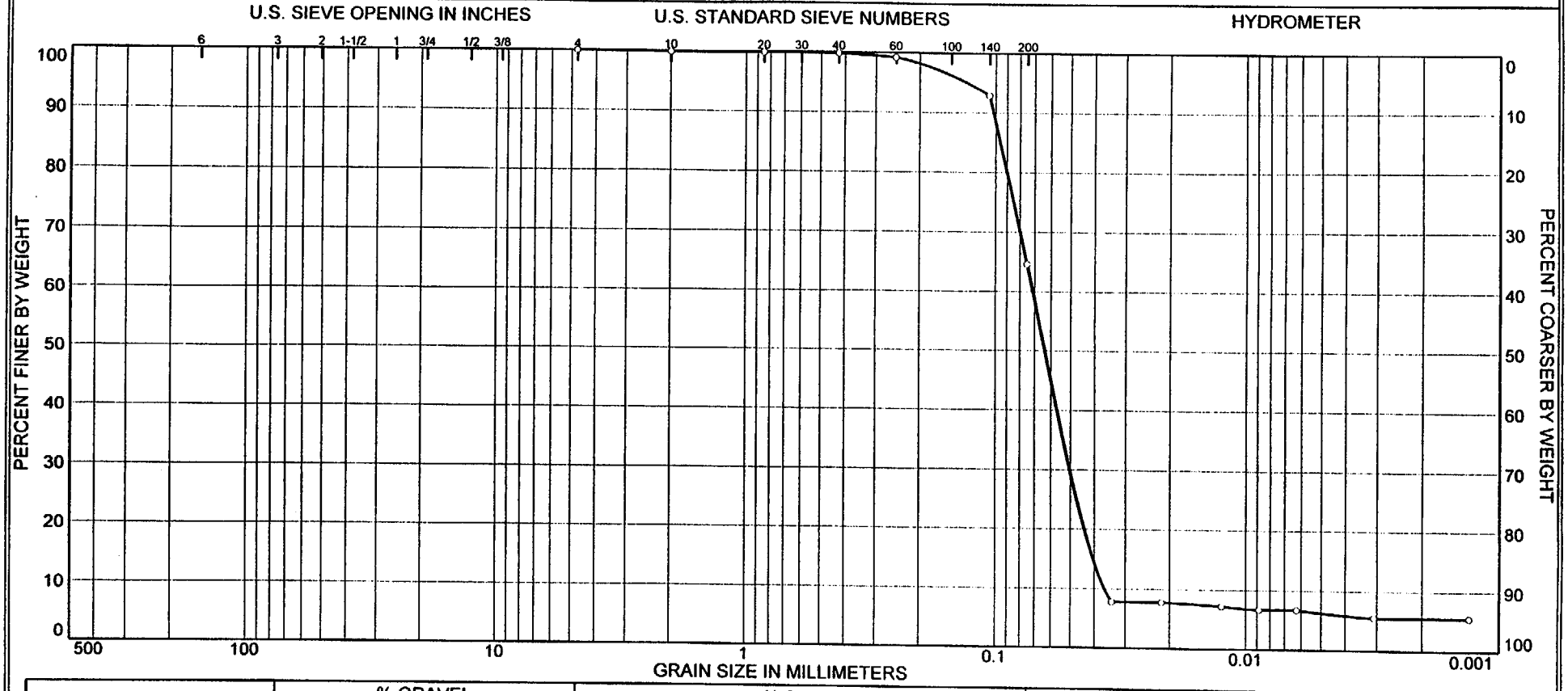
Project MOX Fuel Fabrication Facility

Project No. 5016003963 | Plate

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

○ Tested by: SC/WFL Reviewed by: HJ

Particle Size Distribution Report ASTM D422/D1140



	% COBBLES	% GRAVEL		% SAND			% FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.0	0.1	0.1	35.2	58.4	6.2

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○	Boring CPT-46	46-2 (Tube)	140-142'	8/31/00	ML	Tan Brown Sandy silt	39.5	NV	NP

Client Duke Cogema Stone & Webster (DCS)

Project MOX Fuel Fabrication Facility

Project No. 5016003963 | Plate

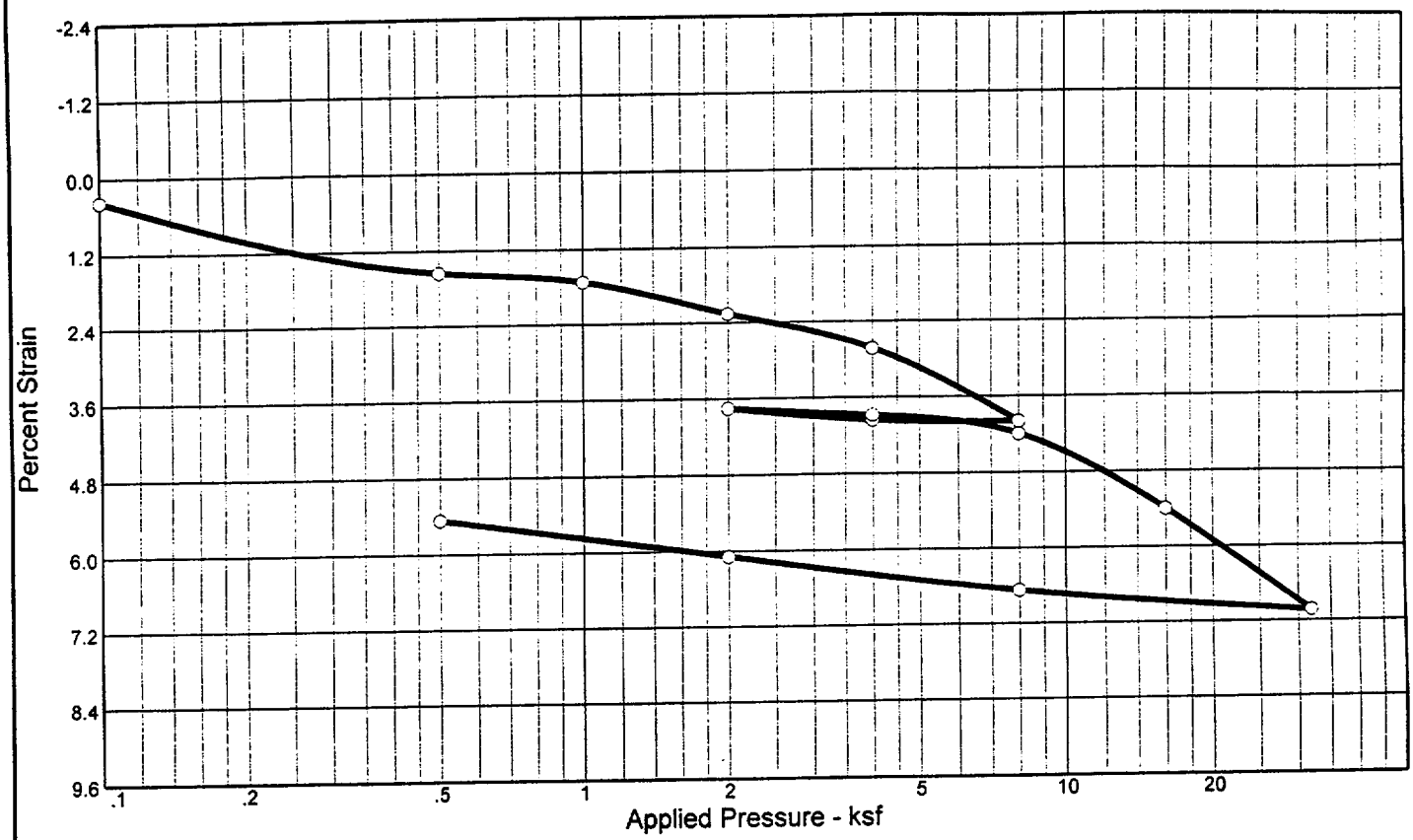
LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

○ Tested by: SC/WFL Reviewed by: HJ

ONE DIMENSIONAL

CONSOLIDATION TESTS

CONSOLIDATION TEST REPORT ASTM D2435-96 Test Method B



Coefficients of Consolidation

No.	Load (ksf)	C_v (ft.^{2}/day)	No.	Load (ksf)	C_v (ft.^{2}/day)	No.	Load (ksf)	C_v (ft.^{2}/day)
1	0.10	0.07	11	16.00	0.82			
2	0.50	0.21	12	32.00	0.66			
3	1.00	1.51	13	8.00	1.91			
4	2.00	0.21	14	2.00	1.39			
5	4.00	0.46	15	0.50	0.71			
6	8.00	0.80						
7	4.00	3.33						
8	2.00	0.79						
9	4.00	0.43						
10	8.00	0.39						

Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	P_c (ksf)	C_c	Initial Void Ratio
Saturation	Moisture							
72.0 %	19.6 %	97.2	43	23	2.7	5.02		0.734

MATERIAL DESCRIPTION	USCS	AASHTO
Brown Clayey sand	SC	A-2-7(1)

Project No. 5016003963 **Client:** Duke Cogema Stone & Webster (DCS)

Project: MOX Fuel Fabrication Facility

Source: Boring BH-1 **Sample No.:** 12B (Ud) **Elev./Depth:** 62-64'

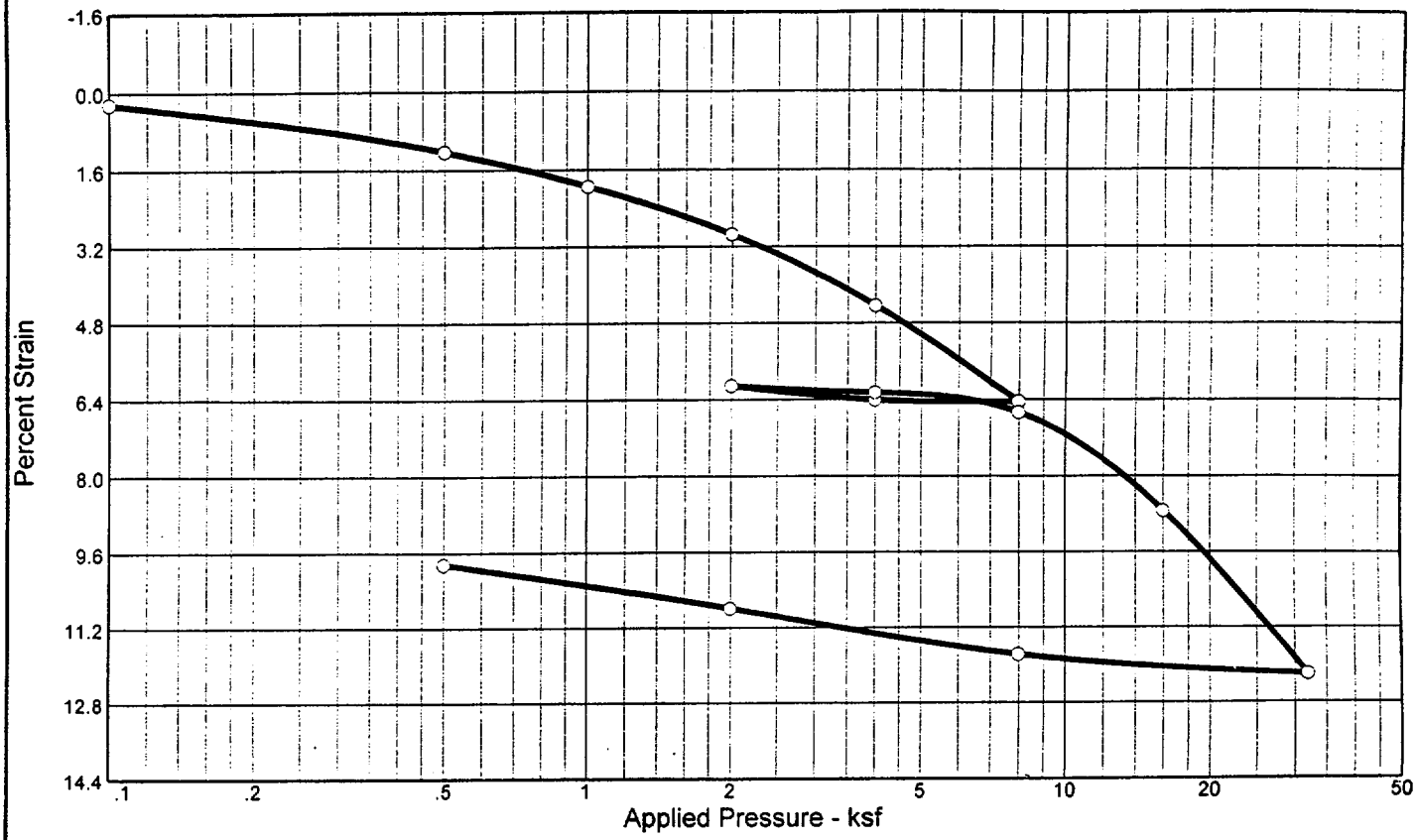
Remarks:
Tested by: JTM Reviewed by: HJ

CONSOLIDATION TEST REPORT ASTM D2435-96 Test Method B

LAW ENGINEERING & ENVIRONMENTAL SERVICES, INC.

Plate B

CONSOLIDATION TEST REPORT ASTM D2435-96 Test Method A



Coefficients of Consolidation								
No.	Load (ksf)	C_v (ft.2/day)	No.	Load (ksf)	C_v (ft.2/day)	No.	Load (ksf)	C_v (ft.2/day)
1	0.10	0.36	11	16.00	1.41			
2	0.50	1.40	12	32.00	0.72			
3	1.00	0.44	13	8.00	1.33			
4	2.00	0.85	14	2.00	0.40			
5	4.00	0.91	15	0.50	0.31			
6	8.00	0.84						
7	4.00	0.78						
8	2.00	0.77						
9	4.00	1.39						
10	8.00	0.70						

Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	P_c (ksf)	C_c	Initial Void Ratio
Saturation	Moisture							
91.8 %	27.0 %	94.0	43	23	2.7	16.71	0.21	0.794

MATERIAL DESCRIPTION	USCS	AASHTO
Brown Clayey sand	SC	A-2-7(1)

Project No. 5016003963 **Client:** Duke Cogema Stone & Webster (DCS)

Project: MOX Fuel Fabrication Facility

Source: Boring BH-1 **Sample No.:** 12B (Ud) **Elev./Depth:** 62-64'

CONSOLIDATION TEST REPORT ASTM D2435-96 Test Method A

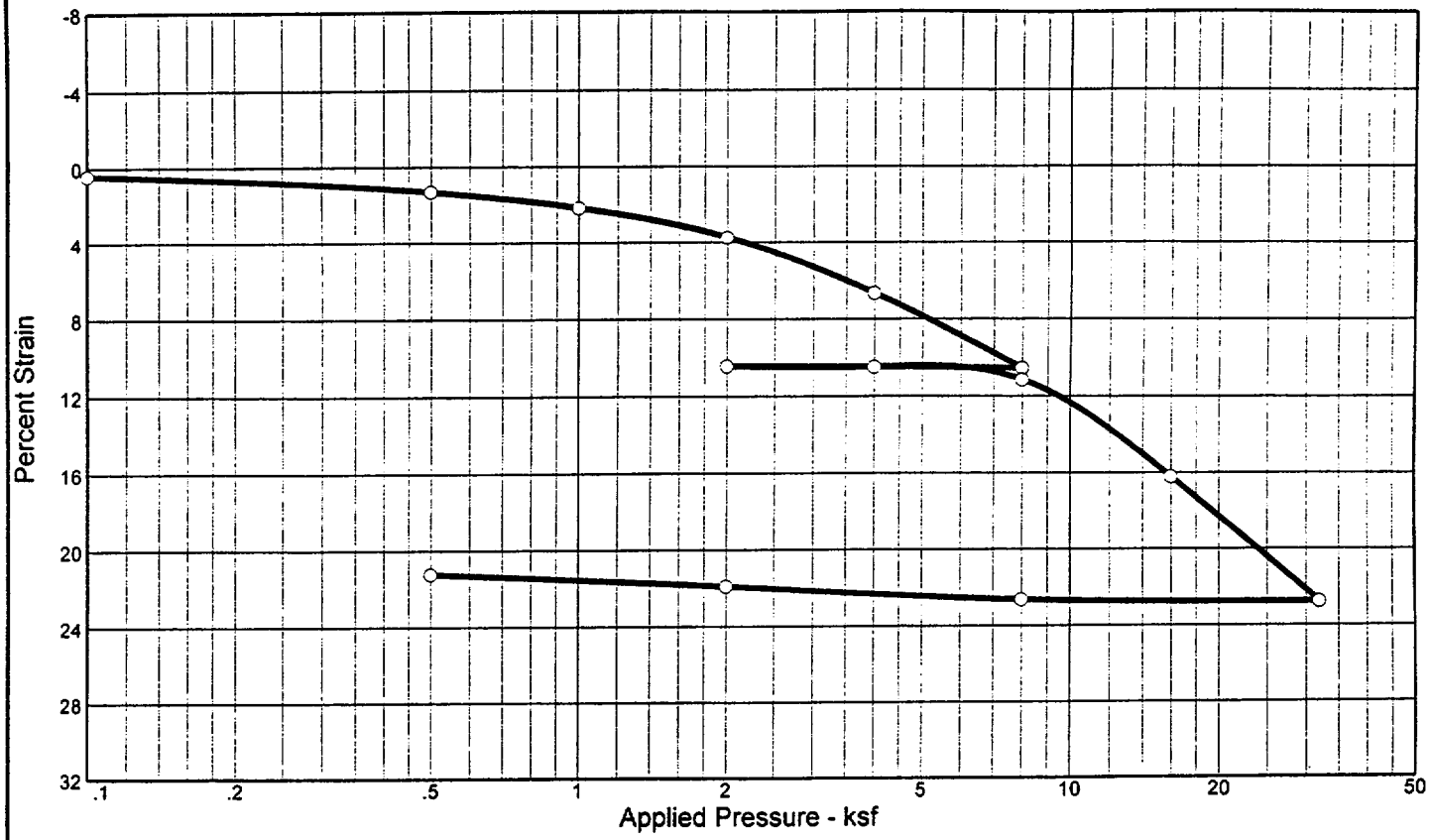
LAW ENGINEERING & ENVIRONMENTAL SERVICES, INC.

Remarks:

Tested by: JTM Reviewed by: HJ

Plate

CONSOLIDATION TEST REPORT ASTM D2435-96 Test Method B



Coefficients of Consolidation

No.	Load (ksf)	C_v (ft.2/day)	No.	Load (ksf)	C_v (ft.2/day)	No.	Load (ksf)	C_v (ft.2/day)
1	0.10	4.07	11	16.00	1.59			
2	0.50	0.22	12	32.00	0.23			
3	1.00	0.78	13	8.00	3.51			
4	2.00	0.41	14	2.00	1.70			
5	4.00	2.82	15	0.50	1.00			
6	8.00	1.54						
7	4.00	0.96						
8	2.00	0.62						
9	4.00	1.16						
10	8.00	0.12						

Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	P_c (ksf)	C_c	Initial Void Ratio
Saturation	Moisture							
65.4 %	51.5 %	53.9	86	34	2.7	5.06	0.68	2.126

MATERIAL DESCRIPTION	USCS	AASHTO
Tan Brown Silty sand	SM	A-2-7(0)

Project No. 5016003963 **Client:** Duke Cogema Stone & Webster (DCS)

Project: MOX Fuel Fabrication Facility

Source: Boring BH-1 **Sample No.:** 17B (Ud) **Elev./Depth:** 90-92'

CONSOLIDATION TEST REPORT ASTM D2435-96 Test Method B

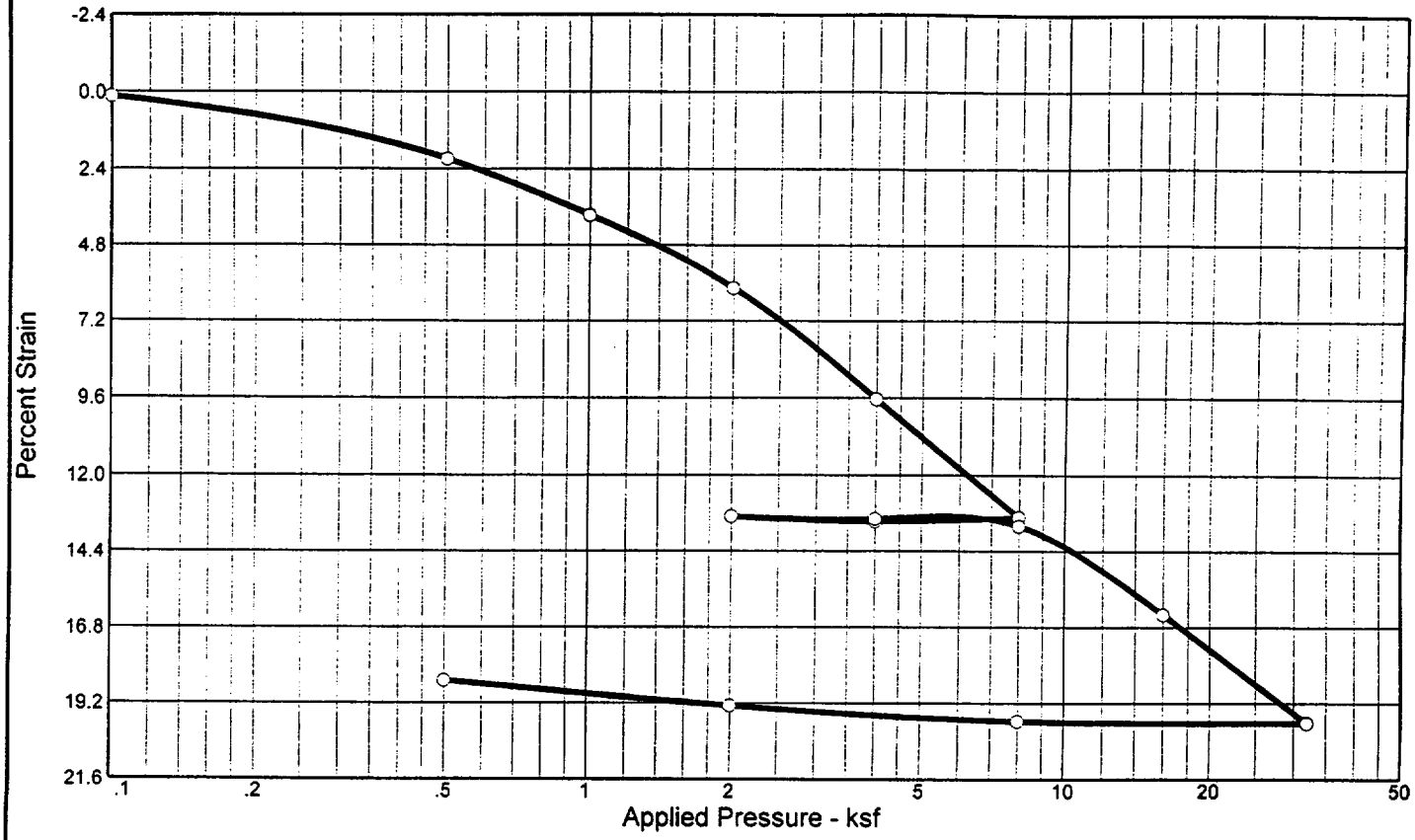
LAW ENGINEERING & ENVIRONMENTAL SERVICES, INC.

Remarks:

Tested by: JTM Reviewed by: HJ

Plate

CONSOLIDATION TEST REPORT ASTM D2435-96 Test Method B



Coefficients of Consolidation								
No.	Load (ksf)	C_v (ft.2/day)	No.	Load (ksf)	C_v (ft.2/day)	No.	Load (ksf)	C_v (ft.2/day)
1	0.10	1.80	11	16.00	0.67			
2	0.50	0.87	12	32.00	0.54			
3	1.00	1.87	13	8.00	4.13			
4	2.00	1.42	14	2.00	0.92			
5	4.00	1.27	15	0.50	0.50			
6	8.00	1.14						
7	4.00	4.80						
8	2.00	2.11						
9	4.00	4.81						
10	8.00	0.28						

Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	P_c (ksf)	C_c	Initial Void Ratio
Saturation	Moisture							
96.4 %	35.3 %	84.4	89	58	2.7		0.23	0.989

MATERIAL DESCRIPTION	USCS	AASHTO
Tan Brown Clayey sand	SC	A-2-7(1)

Project No. 5016003963 **Client:** Duke Cogema Stone & Webster (DCS)

Project: MOX Fuel Fabrication Facility

Source: Boring BH-2 **Sample No.:** 15 **Elev./Depth:** 70-72'

Remarks:

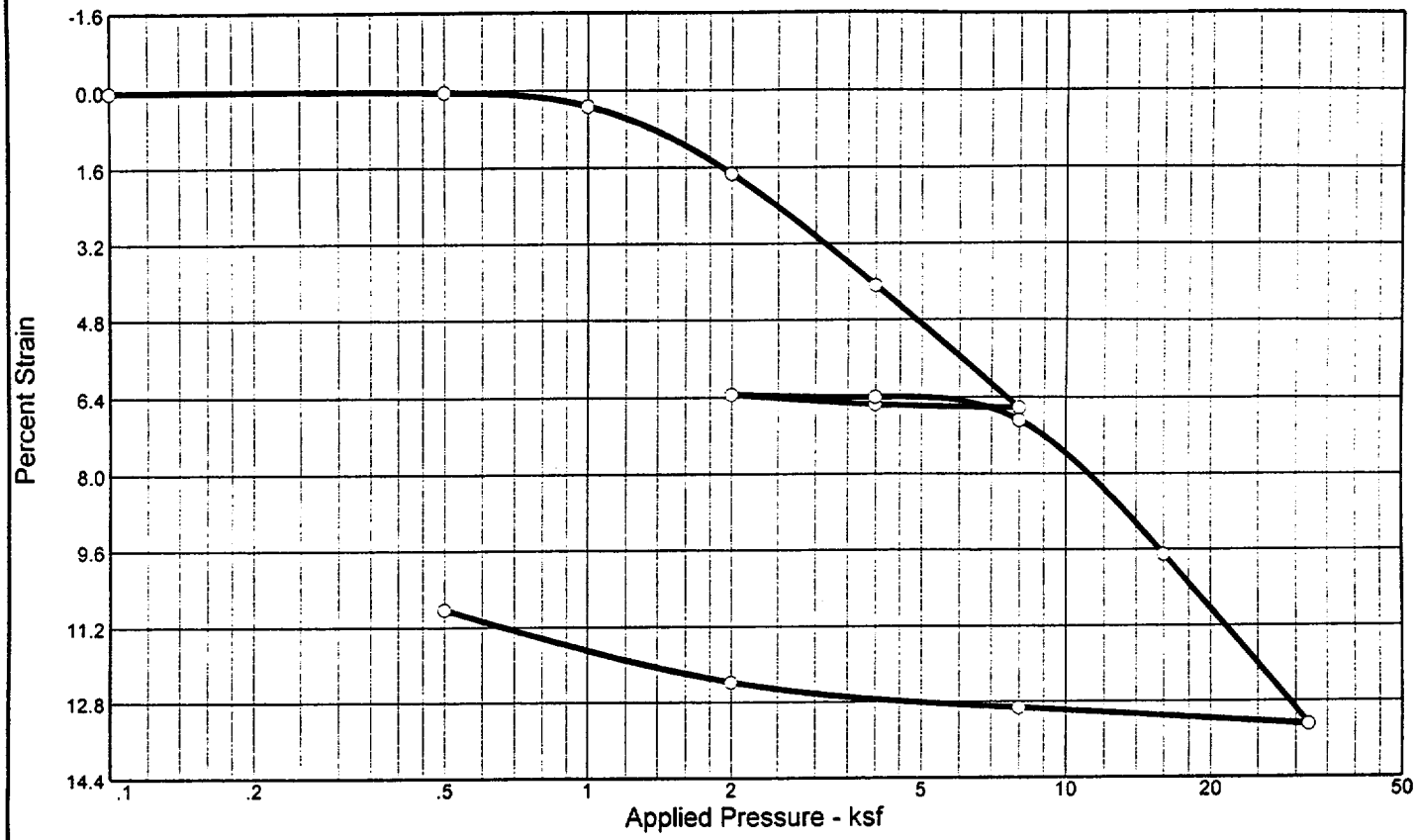
Tested by: JTM Reviewed by: HJ

CONSOLIDATION TEST REPORT ASTM D2435-96 Test Method B

LAW ENGINEERING & ENVIRONMENTAL SERVICES, INC.

Plate

CONSOLIDATION TEST REPORT ASTM D2435-96 Test Method B



Coefficients of Consolidation

No.	Load (ksf)	C_v (ft.2/day)	No.	Load (ksf)	C_v (ft.2/day)	No.	Load (ksf)	C_v (ft.2/day)
1	0.10	3.24	11	16.00	0.36			
2	0.50	2.75	12	32.00	0.24			
3	1.00	0.97	13	8.00	0.59			
4	2.00	0.98	14	2.00	0.31			
5	4.00	0.28	15	0.50	0.08			
6	8.00	0.39						
7	4.00	4.33						
8	2.00	2.61						
9	4.00	1.48						
10	8.00	0.43						

Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	P_c (ksf)	C_c	Initial Void Ratio
Saturation	Moisture							
95.6 %	34.9 %	84.9	59	30	2.7		0.24	0.985

MATERIAL DESCRIPTION	USCS	AASHTO
Tan Clayey sand	SC	A-2-7(2)

Project No. 5016003963 **Client:** Duke Cogema Stone & Webster (DCS)

Project: MOX Fuel Fabrication Facility

Source: Boring BH-2 **Sample No.:** 21 (top) **Elev./Depth:** 96-98'

Remarks:

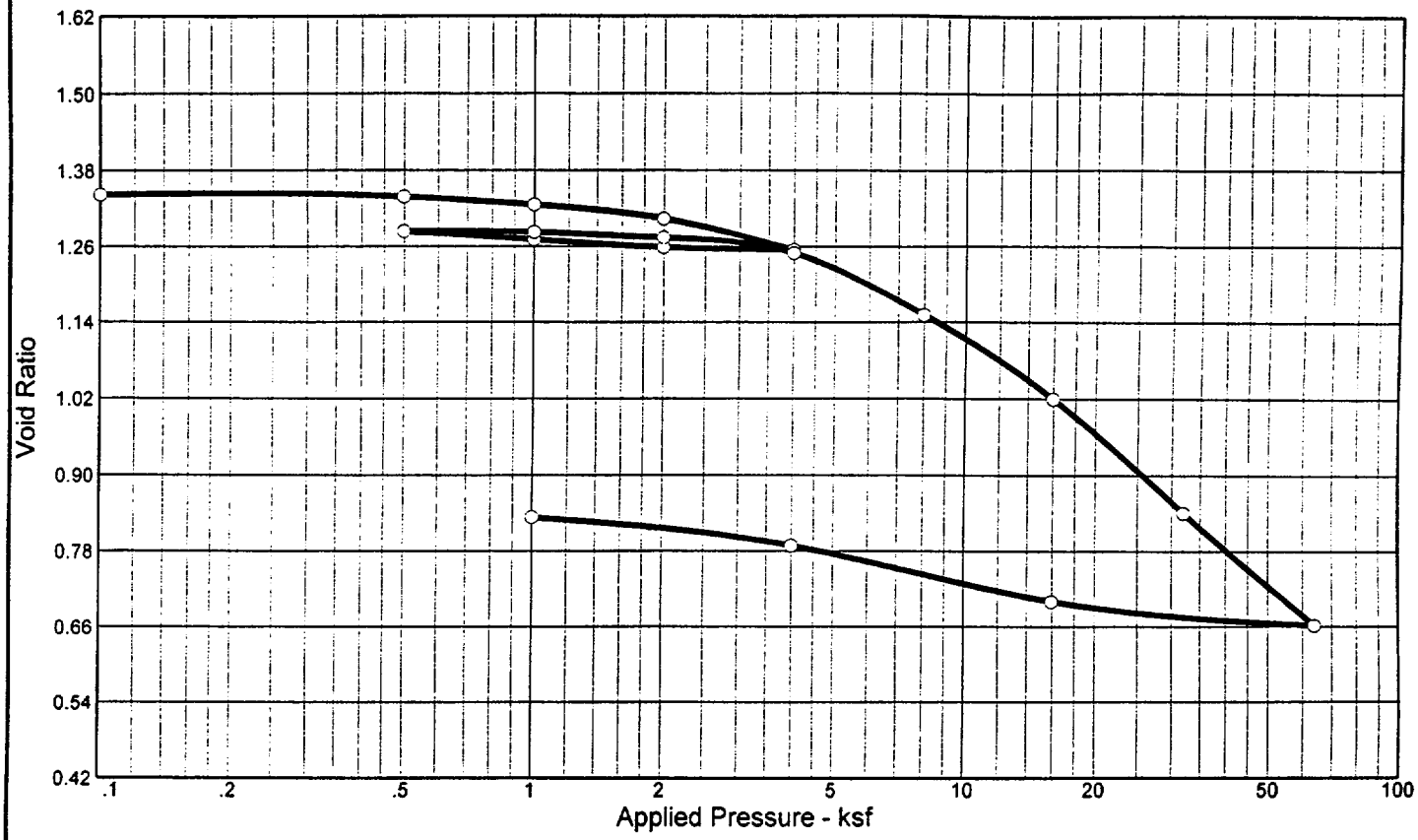
Tested by: JTM Reviewed by: HJ

CONSOLIDATION TEST REPORT ASTM D2435-96 Test Method B

LAW ENGINEERING & ENVIRONMENTAL SERVICES, INC.

Plate

CONSOLIDATION TEST REPORT ASTM D2435-96 Test Method B



Coefficients of Consolidation								
No.	Load (ksf)	C_v (ft.2/day)	No.	Load (ksf)	C_v (ft.2/day)	No.	Load (ksf)	C_v (ft.2/day)
1	0.10	0.78	11	4.00	0.61			
2	0.50	2.78	12	8.00	0.13			
3	1.00	0.37	13	16.00	0.09			
4	2.00	0.36	14	32.00	0.03			
5	4.00	0.43	15	64.00	0.02			
6	2.00	2.19	16	16.00	0.05			
7	1.00	0.67	17	4.00	0.01			
8	0.50	0.39	18	1.00	0.06			
9	1.00	3.05						
10	2.00	0.78						

Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	P_c (ksf)	C_c	Initial Void Ratio
Saturation	Moisture							
88.6 %	44.1 %	72.0	148	101	2.7	7.19	0.59	1.342

MATERIAL DESCRIPTION	USCS	AASHTO
Tan Fat clay	CH	A-7-5(106)

Project No. 5016003963 **Client:** Duke Cogema Stone & Webster (DCS)

Project: MOX Fuel Fabrication Facility

Source: Boring BH-3 **Sample No.:** 10B (TOP) **Elev./Depth:** 50-52'

CONSOLIDATION TEST REPORT ASTM D2435-96 Test Method B

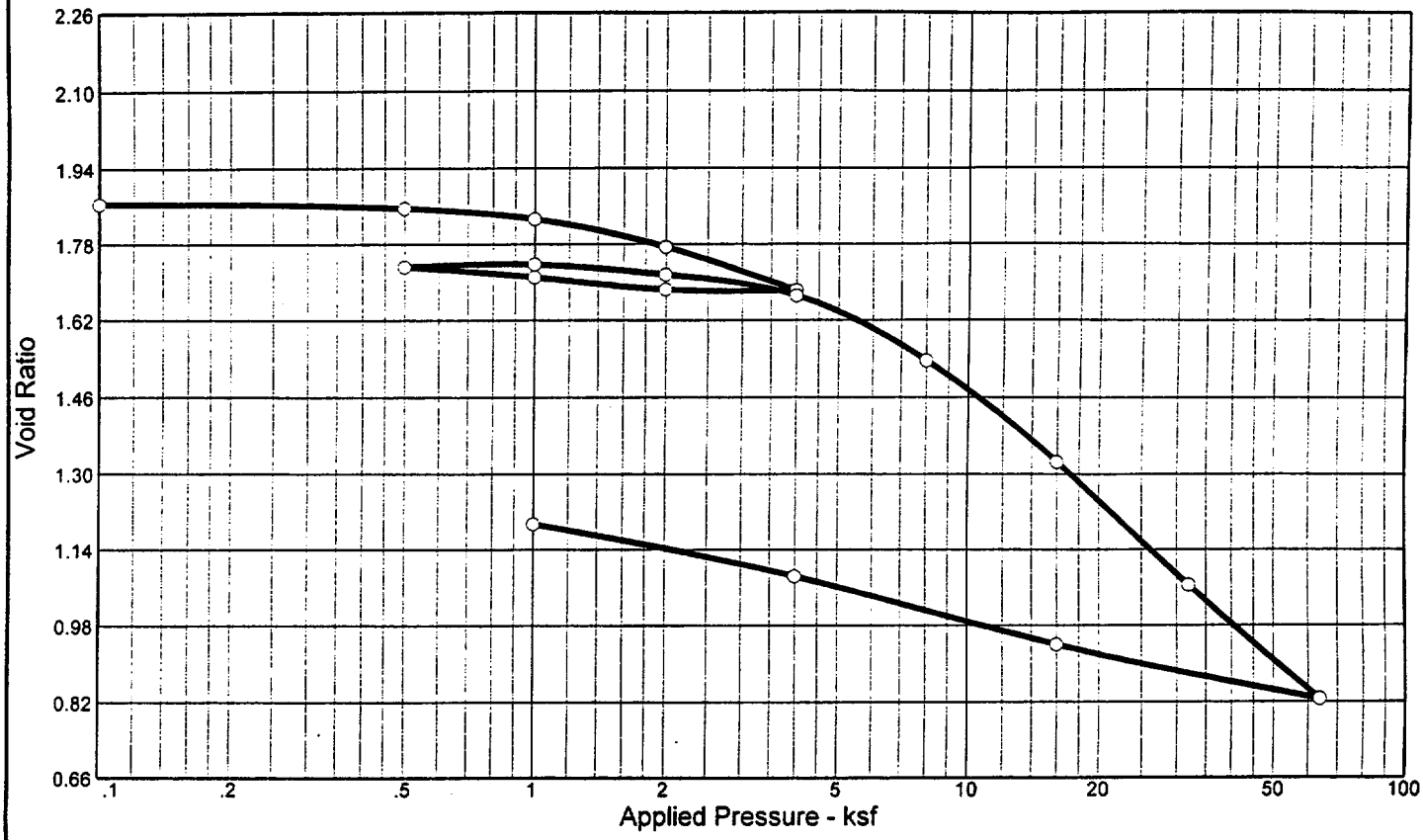
LAW ENGINEERING & ENVIRONMENTAL SERVICES, INC.

Remarks:

Tested by: JTM Reviewed by:

Plate

CONSOLIDATION TEST REPORT ASTM D2435-96 Test Method B



Coefficients of Consolidation								
No.	Load (ksf)	C_v (ft.2/day)	No.	Load (ksf)	C_v (ft.2/day)	No.	Load (ksf)	C_v (ft.2/day)
1	0.10	0.78	11	4.00	0.18			
2	0.50	3.00	12	8.00	0.09			
3	1.00	0.77	13	16.00	0.01			
4	2.00	0.28	14	32.00	0.01			
5	4.00	0.23	15	64.00	0.01			
6	2.00	0.37	16	16.00	0.01			
7	1.00	0.18	17	4.00	0.00			
8	0.50	0.15	18	1.00	0.00			
9	1.00	0.99						
10	2.00	0.21						

Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	P_c (ksf)	C_c	Initial Void Ratio
Saturation	Moisture							
96.0 %	66.3 %	58.8	175	93	2.7	5.61	0.79	1.865

MATERIAL DESCRIPTION	USCS	AASHTO
Tan Elastic silt	MH	A-7-5(110)

Project No. 5016003963 **Client:** Duke Cogema Stone & Webster (DCS)

Project: MOX Fuel Fabrication Facility

Source: Boring BH-3 **Sample No.:** 10B bot **Elev./Depth:** 50-52'

Remarks:

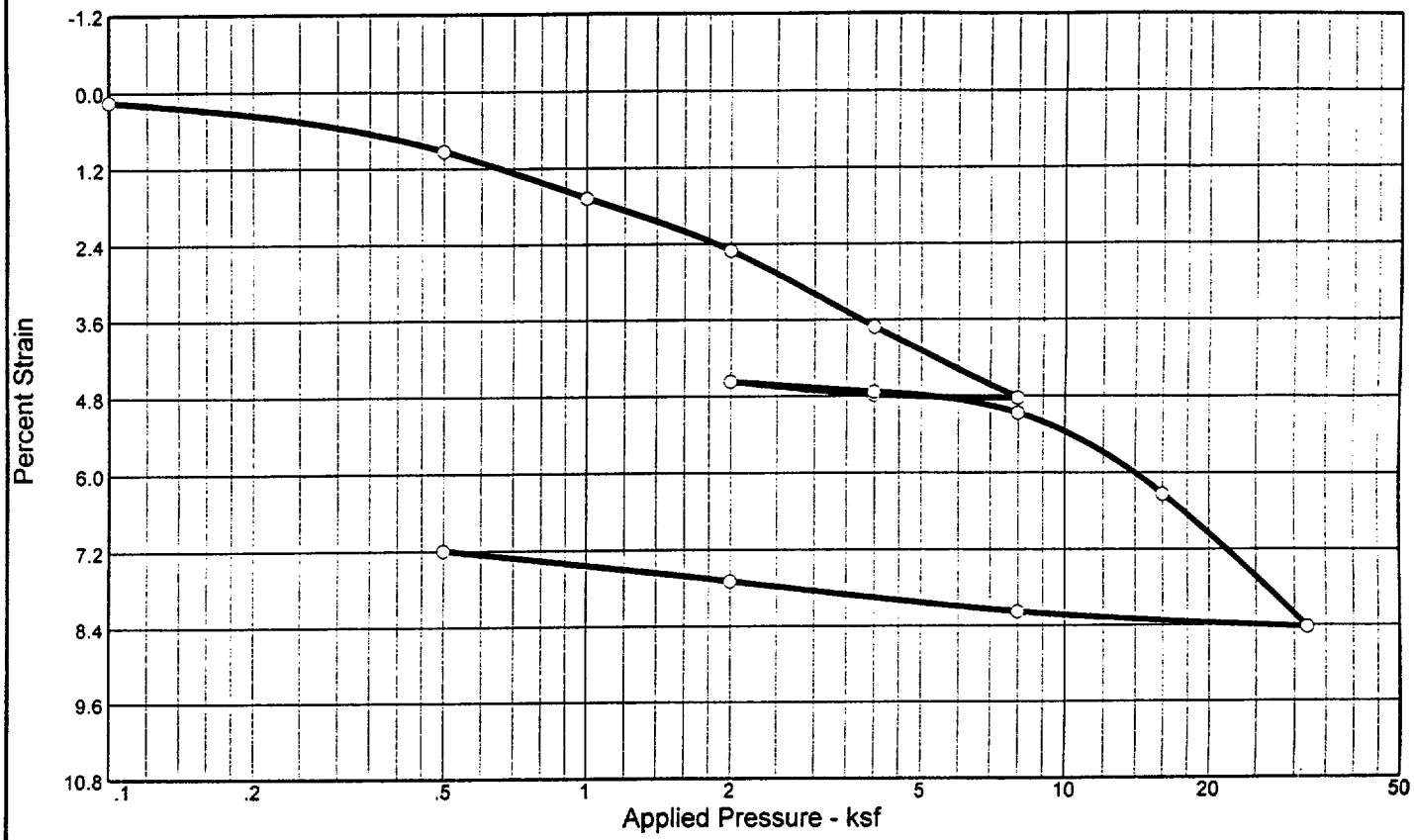
Tested by: JTM Reviewed by: HJ

CONSOLIDATION TEST REPORT ASTM D2435-96 Test Method B

LAW ENGINEERING & ENVIRONMENTAL SERVICES, INC.

Plate

CONSOLIDATION TEST REPORT ASTM D2435-96 Test Method B



Coefficients of Consolidation								
No.	Load (ksf)	C_v (ft.2/day)	No.	Load (ksf)	C_v (ft.2/day)	No.	Load (ksf)	C_v (ft.2/day)
1	0.10	0.17	11	16.00	0.71			
2	0.50	0.40	12	32.00	0.35			
3	1.00	0.17	13	8.00	1.54			
4	2.00	0.34	14	2.00	2.81			
5	4.00	0.13	15	0.50	0.76			
6	8.00	0.40						
7	4.00	3.27						
8	2.00	0.22						
9	4.00	1.65						
10	8.00	0.16						

Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	P_c (ksf)	C_c	Initial Void Ratio
Saturation	Moisture							
91.0 %	24.4 %	97.8	101	75	2.7	6.27	0.12	0.724

MATERIAL DESCRIPTION	USCS	AASHTO
Tan Poorly graded sand with clay	SP-SC	A-2-7(0)

Project No. 5016003963 **Client:** Duke Cogema Stone & Webster (DCS)

Project: MOX Fuel Fabrication Facility

Source: Boring BH-3 **Sample No.:** 15B (TOP) **Elev./Depth:** 75-77'

CONSOLIDATION TEST REPORT ASTM D2435-96 Test Method B

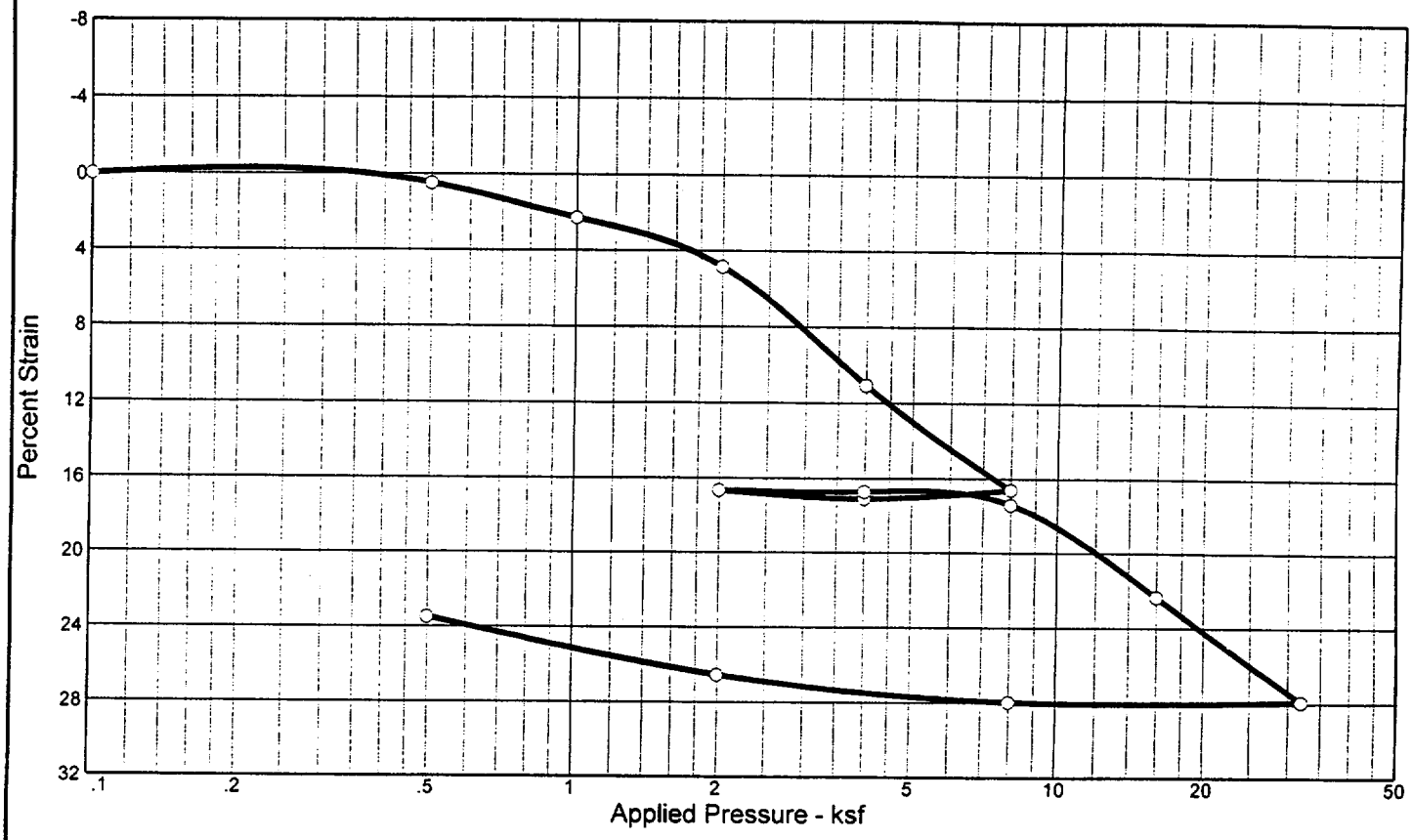
LAW ENGINEERING & ENVIRONMENTAL SERVICES, INC.

Remarks:

Tested by: JTM Reviewed by: HJ

Plate

CONSOLIDATION TEST REPORT ASTM D2435-96 Test Method A



Coefficients of Consolidation								
No.	Load (ksf)	C_v (ft.2/day)	No.	Load (ksf)	C_v (ft.2/day)	No.	Load (ksf)	C_v (ft.2/day)
2	0.50	0.19	12	32.00	0.09			
3	1.00	0.13	13	8.00	0.22			
4	2.00	0.16	14	2.00	0.06			
5	4.00	0.07	15	0.50	0.01			
6	8.00	0.12						
7	4.00	0.70						
8	2.00	0.24						
9	4.00	4.24						
10	8.00	0.28						
11	16.00	0.11						

Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	P_c (ksf)	C_c	Initial Void Ratio
Saturation	Moisture							
99.5 %	49.8 %	71.7	98	62	2.7	1.33	0.44	1.352

MATERIAL DESCRIPTION	USCS	AASHTO
Brown Clayey sand	SC	A-7-5(14)

Project No. 5016003963 **Client:** Duke Cogema Stone & Webster (DCS)

Project: MOX Fuel Fabrication Facility

Source: Boring BH-3 **Sample No.:** 17B (top) **Elev./Depth:** 88-90'

CONSOLIDATION TEST REPORT ASTM D2435-96 Test Method A

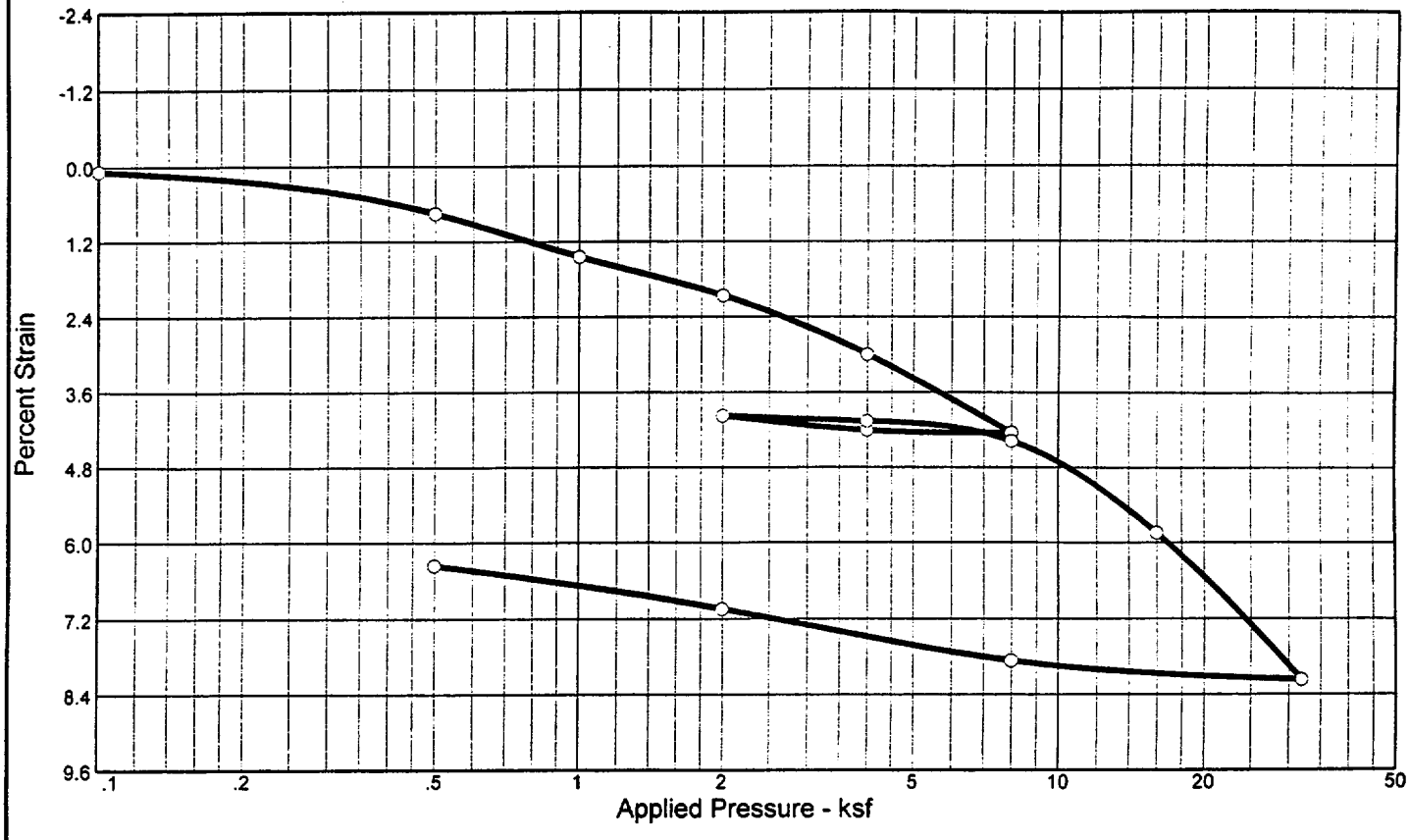
LAW ENGINEERING & ENVIRONMENTAL SERVICES, INC.

Remarks:

Tested by; JTM Reviewed by: HJ

Plate

CONSOLIDATION TEST REPORT ASTM D2435-96 Test Method B



Coefficients of Consolidation								
No.	Load (ksf)	C_v (ft.^{2}/day)	No.	Load (ksf)	C_v (ft.^{2}/day)	No.	Load (ksf)	C_v (ft.^{2}/day)
1	0.10	6.41	11	16.00	0.63			
2	0.50	2.11	12	32.00	0.58			
3	1.00	0.43	13	8.00	2.36			
4	2.00	0.90	14	2.00	0.75			
5	4.00	1.69	15	0.50	1.35			
6	8.00	0.72						
7	4.00	2.58						
8	2.00	1.99						
9	4.00	5.90						
10	8.00	1.21						

Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	P_c (ksf)	C_c	Initial Void Ratio
Saturation	Moisture							
88.1 %	29.3 %	88.8	43	12	2.7	16.62	0.15	0.897

MATERIAL DESCRIPTION	USCS	AASHTO
Brown Silty sand	SM	A-2-7(0)

Project No. 5016003963 **Client:** Duke Cogema Stone & Webster (DCS)

Project: MOX Fuel Fabrication Facility

Source: Boring BH-3 **Sample No.:** 17B Bot **Elev./Depth:** 88-90'

Remarks:

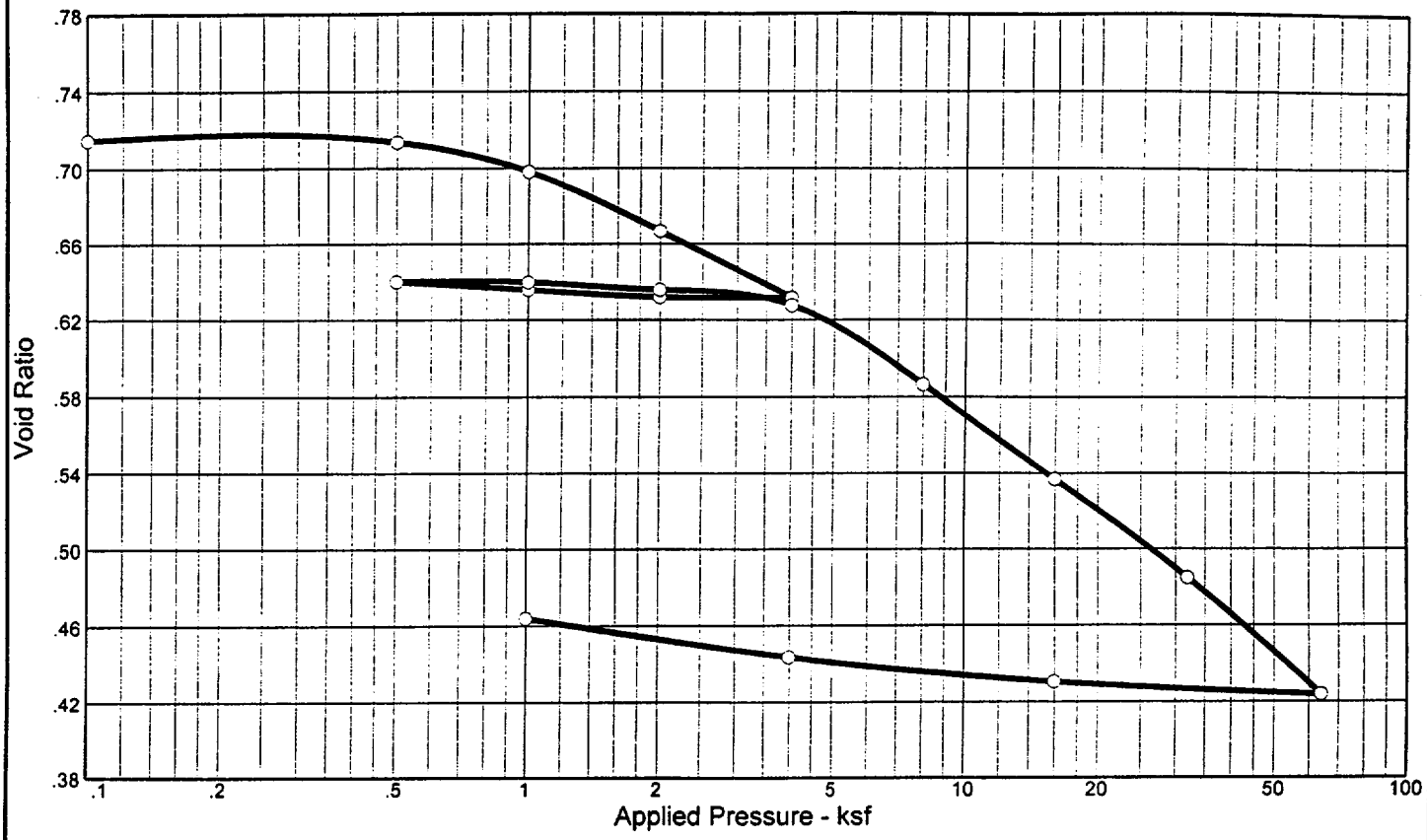
Tested by: JTM Reviewed by: HJ

CONSOLIDATION TEST REPORT ASTM D2435-96 Test Method B

LAW ENGINEERING & ENVIRONMENTAL SERVICES, INC.

Plate

CONSOLIDATION TEST REPORT ASTM D2435-96 Test Method B



Coefficients of Consolidation								
No.	Load (ksf)	C_v (ft.2/day)	No.	Load (ksf)	C_v (ft.2/day)	No.	Load (ksf)	C_v (ft.2/day)
1	0.10	0.41	11	4.00	0.28			
2	0.50	0.57	12	8.00	0.82			
3	1.00	1.58	13	16.00	0.73			
4	2.00	0.32	14	32.00	0.78			
5	4.00	1.01	15	64.00	0.24			
6	2.00	5.50	16	16.00	2.31			
7	1.00	1.57	17	4.00	0.90			
8	0.50	0.62	18	1.00	0.15			
9	1.00	1.44						
10	2.00	2.92						

Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	P_c (ksf)	C_c	Initial Void Ratio
Saturation	Moisture							
82.2 %	21.8 %	98.3	112	64	2.7	3.78	0.20	0.715

MATERIAL DESCRIPTION	USCS	AASHTO
Yellowish Tan Silty sand	SM	A-2-7(3)

Project No. 5016003963 **Client:** Duke Cogema Stone & Webster (DCS)

Project: MOX Fuel Fabrication Facility

Source: Boring BH-5 **Sample No.:** 8 (top) **Elev./Depth:** 38-39.8'

Remarks:

Tested by: JTM Reviewed by: HJ

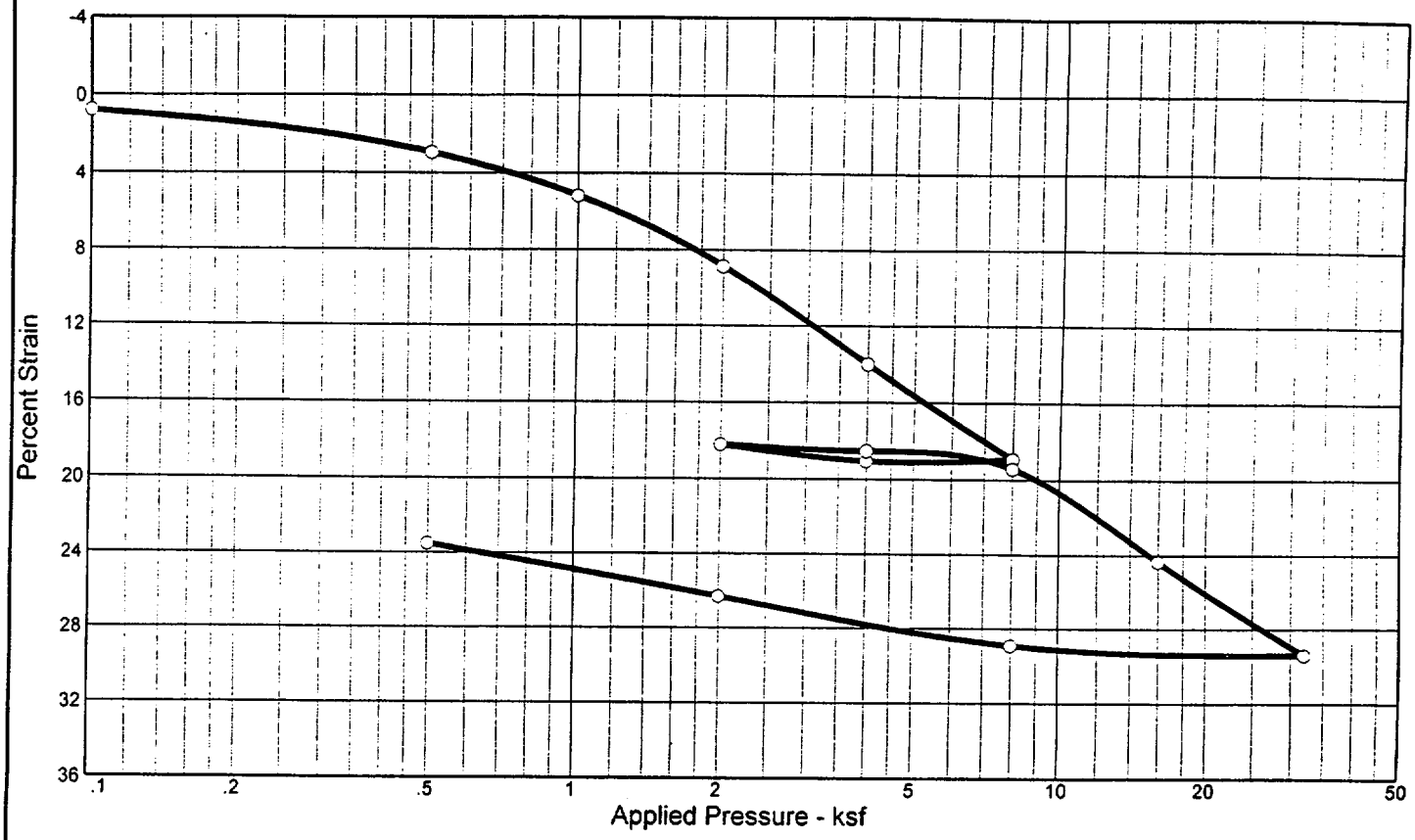
Represents Soft Material

CONSOLIDATION TEST REPORT ASTM D2435-96 Test Method B

LAW ENGINEERING & ENVIRONMENTAL SERVICES, INC.

Plate

CONSOLIDATION TEST REPORT ASTM D2435-96 Test Method A



Coefficients of Consolidation								
No.	Load (ksf)	C_v (ft.2/day)	No.	Load (ksf)	C_v (ft.2/day)	No.	Load (ksf)	C_v (ft.2/day)
1	0.10	0.08	11	16.00	0.06			
2	0.50	0.10	12	32.00	0.07			
3	1.00	0.09	13	8.00	0.23			
4	2.00	0.08	14	2.00	0.05			
5	4.00	0.06	15	0.50	0.02			
6	8.00	0.06						
7	4.00	0.48						
8	2.00	0.13						
9	4.00	0.29						
10	8.00	0.25						

Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	P_c (ksf)	C_c	Initial Void Ratio
Saturation	Moisture							
105.3 %	46.0 %	77.3	78	53	2.7	2.28	0.38	1.180

MATERIAL DESCRIPTION	USCS	AASHTO
Red Brown Sandy fat clay	CH	A-7-6(36)

Project No. 5016003963 **Client:** Duke Cogema Stone & Webster (DCS)

Project: MOX Fuel Fabrication Facility

Source: Boring BH-5 **Sample No.:** 14 (Top) **Elev./Depth:** 65-66.5'

Remarks:

Tested by: JTM Reviewed by: HJ

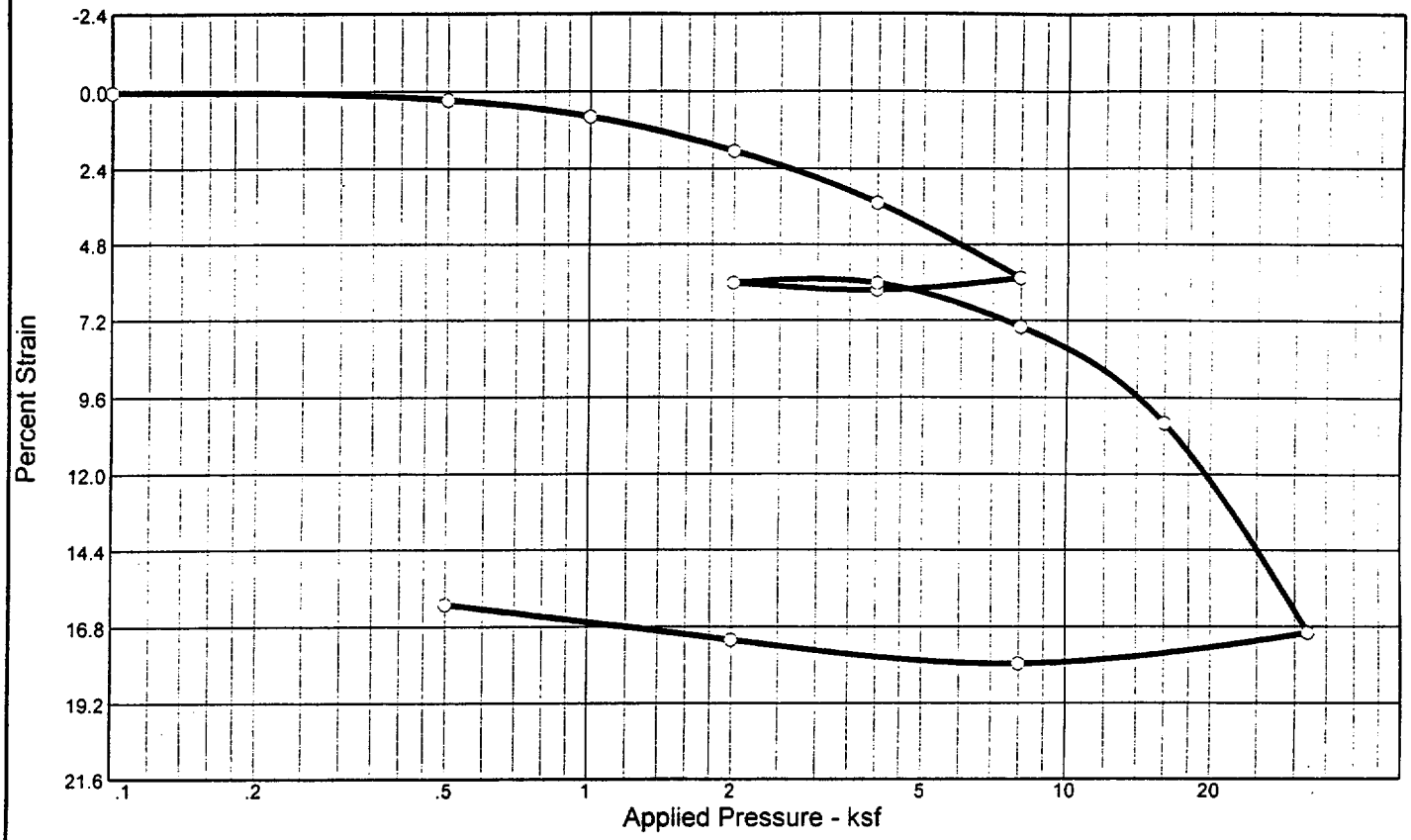
Not Representative of unit.

CONSOLIDATION TEST REPORT ASTM D2435-96 Test Method A

LAW ENGINEERING & ENVIRONMENTAL SERVICES, INC.

Plate

CONSOLIDATION TEST REPORT ASTM D2435-96 Test Method A



Coefficients of Consolidation								
No.	Load (ksf)	C_v (ft.2/day)	No.	Load (ksf)	C_v (ft.2/day)	No.	Load (ksf)	C_v (ft.2/day)
1	0.10	1.52	11	16.00	0.70			
2	0.50	1.63	12	32.00	0.59			
3	1.00	1.62	13	8.00	0.31			
4	2.00	1.60	14	2.00	0.35			
5	4.00	1.55	15	0.50	0.14			
6	8.00	1.43						
7	4.00	1.49						
8	2.00	1.37						
9	4.00	3.04						
10	8.00	0.75						

Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	P_c (ksf)	C_c	Initial Void Ratio
Saturation	Moisture							
94.5 %	47.1 %	71.9	67	35	2.7	11.52	0.53	1.345

MATERIAL DESCRIPTION	USCS	AASHTO
Tan Clayey sand	SC	A-2-7(2)

Project No. 5016003963 **Client:** Duke Cogema Stone & Webster (DCS)

Project: MOX Fuel Fabrication Facility

Source: Boring BH-5 **Sample No.:** 22 (top)(consol **Elev./Depth:** 100-102'

CONSOLIDATION TEST REPORT ASTM D2435-96 Test Method A

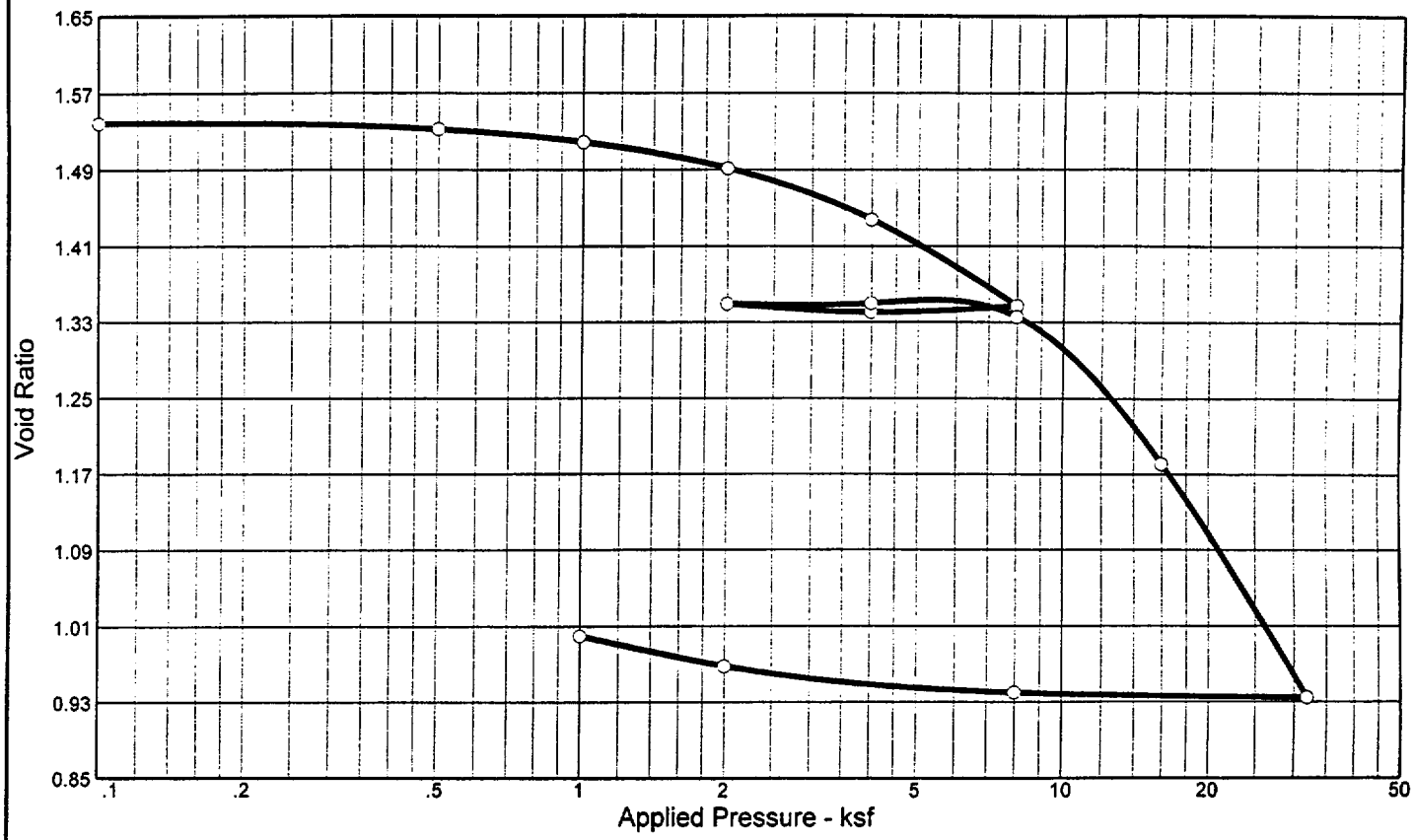
LAW ENGINEERING & ENVIRONMENTAL SERVICES, INC.

Remarks:

Tested by: JTM Reviewed by: HJ

Plate

CONSOLIDATION TEST REPORT ASTM D2435-96 Test Method B



Coefficients of Consolidation								
No.	Load (ksf)	C_v (ft.^{2}/day)	No.	Load (ksf)	C_v (ft.^{2}/day)	No.	Load (ksf)	C_v (ft.^{2}/day)
1	0.10	0.72	11	16.00	0.32			
2	0.50	1.35	12	32.00	0.11			
3	1.00	0.31	13	8.00	0.47			
4	2.00	0.86	14	2.00	0.12			
5	4.00	0.24	15	1.00	0.04			
6	8.00	0.24						
7	4.00	2.37						
8	2.00	0.36						
9	4.00	1.21						
10	8.00	0.61						

Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	P_c (ksf)	C_c	Initial Void Ratio
Saturation	Moisture							
95.3 %	54.5 %	66.2			2.7	11.20	0.83	1.545

MATERIAL DESCRIPTION	USCS	AASHTO

Project No. 5016003963 **Client:** Duke Cogema Stone & Webster (DCS)

Project: MOX Fuel Fabrication Facility

Source: Boring BH-5 **Sample No.:** 22 (Ud top) **Elev./Depth:** 100-102'

CONSOLIDATION TEST REPORT ASTM D2435-96 Test Method B

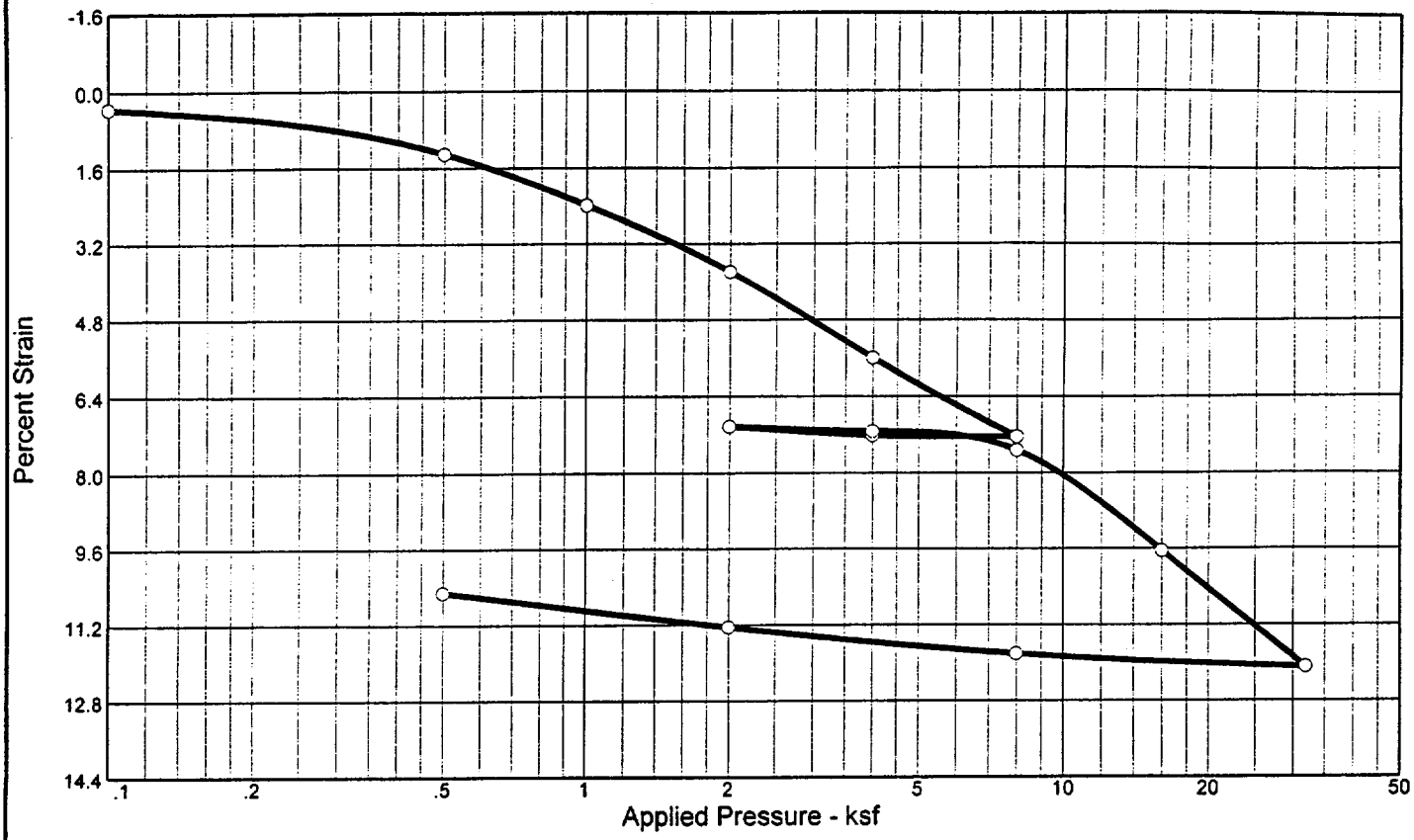
LAW ENGINEERING & ENVIRONMENTAL SERVICES, INC.

Remarks:

Tested by: JTM Reviewed by: HJ

Plate

CONSOLIDATION TEST REPORT ASTM D2435-96 Test Method B



Coefficients of Consolidation

No.	Load (ksf)	C_v (ft.2/day)	No.	Load (ksf)	C_v (ft.2/day)	No.	Load (ksf)	C_v (ft.2/day)
1	0.10	0.88	11	16.00	0.89			
2	0.50	0.95	12	32.00	0.87			
3	1.00	0.36	13	8.00	2.52			
4	2.00	1.63	14	2.00	2.52			
5	4.00	0.56	15	0.50	3.25			
6	8.00	1.39						
7	4.00	1.31						
8	2.00	5.25						
9	4.00	2.79						
10	8.00	1.88						

Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	P_c (ksf)	C_c	Initial Void Ratio
Saturation	Moisture							
95.5 %	32.5 %	87.8	67	35	2.7	8.08	0.16	0.919

MATERIAL DESCRIPTION	USCS	AASHTO
Tan Clayey sand	SC	A-2-7(2)

Project No. 5016003963 **Client:** Duke Cogema Stone & Webster (DCS)

Project: MOX Fuel Fabrication Facility

Source: Boring BH-5 **Sample No.:** 22 Bottom **Elev./Depth:** 100-102'

Remarks:

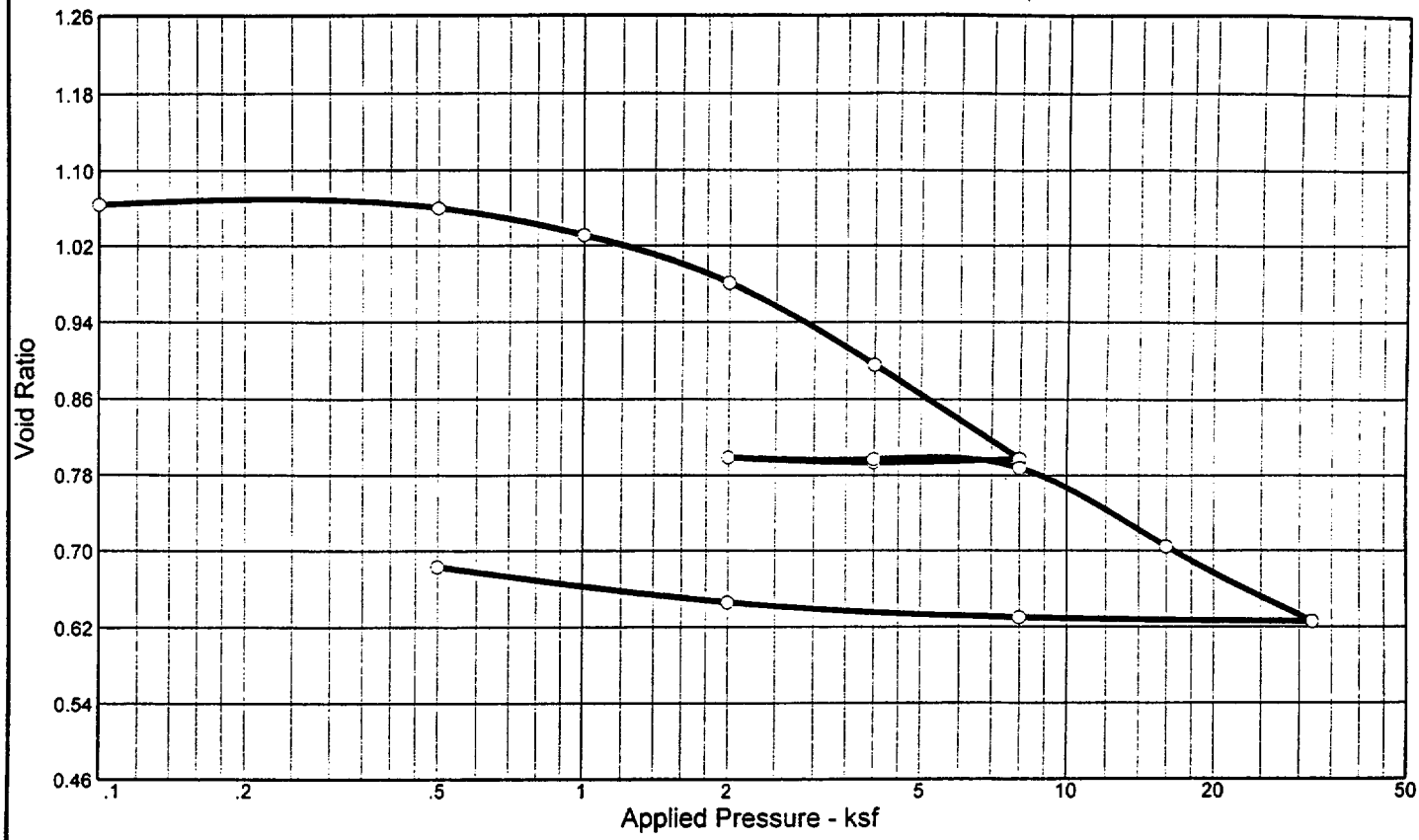
Tested by: JTM Reviewed by: HJ

CONSOLIDATION TEST REPORT ASTM D2435-96 Test Method B

LAW ENGINEERING & ENVIRONMENTAL SERVICES, INC.

Plate

CONSOLIDATION TEST REPORT ASTM D2435-96 Test Method B



Coefficients of Consolidation								
No.	Load (ksf)	C_v (ft.^{2}/day)	No.	Load (ksf)	C_v (ft.^{2}/day)	No.	Load (ksf)	C_v (ft.^{2}/day)
1	0.10	0.72	11	16.00	0.07			
2	0.50	0.31	12	32.00	0.08			
3	1.00	0.09	13	8.00	3.79			
4	2.00	0.13	14	2.00	0.09			
5	4.00	0.11	15	0.50	0.02			
6	8.00	0.10						
7	4.00	2.12						
8	2.00	0.40						
9	4.00	0.91						
10	8.00	0.22						

Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	P_c (ksf)	C_c	Initial Void Ratio
Saturation	Moisture							
99.7 %	39.3 %	81.7	61	36	2.7	2.00	0.30	1.064

MATERIAL DESCRIPTION	USCS	AASHTO
Tan Sandy fat clay	CH	A-7-6(18)

Project No. 5016003963 **Client:** Duke Cogema Stone & Webster (DCS)

Project: MOX Fuel Fabrication Facility

Source: Boring BH-5 **Sample No.:** 29 (top) **Elev./Depth:** 130-132'

CONSOLIDATION TEST REPORT ASTM D2435-96 Test Method B

LAW ENGINEERING & ENVIRONMENTAL SERVICES, INC.

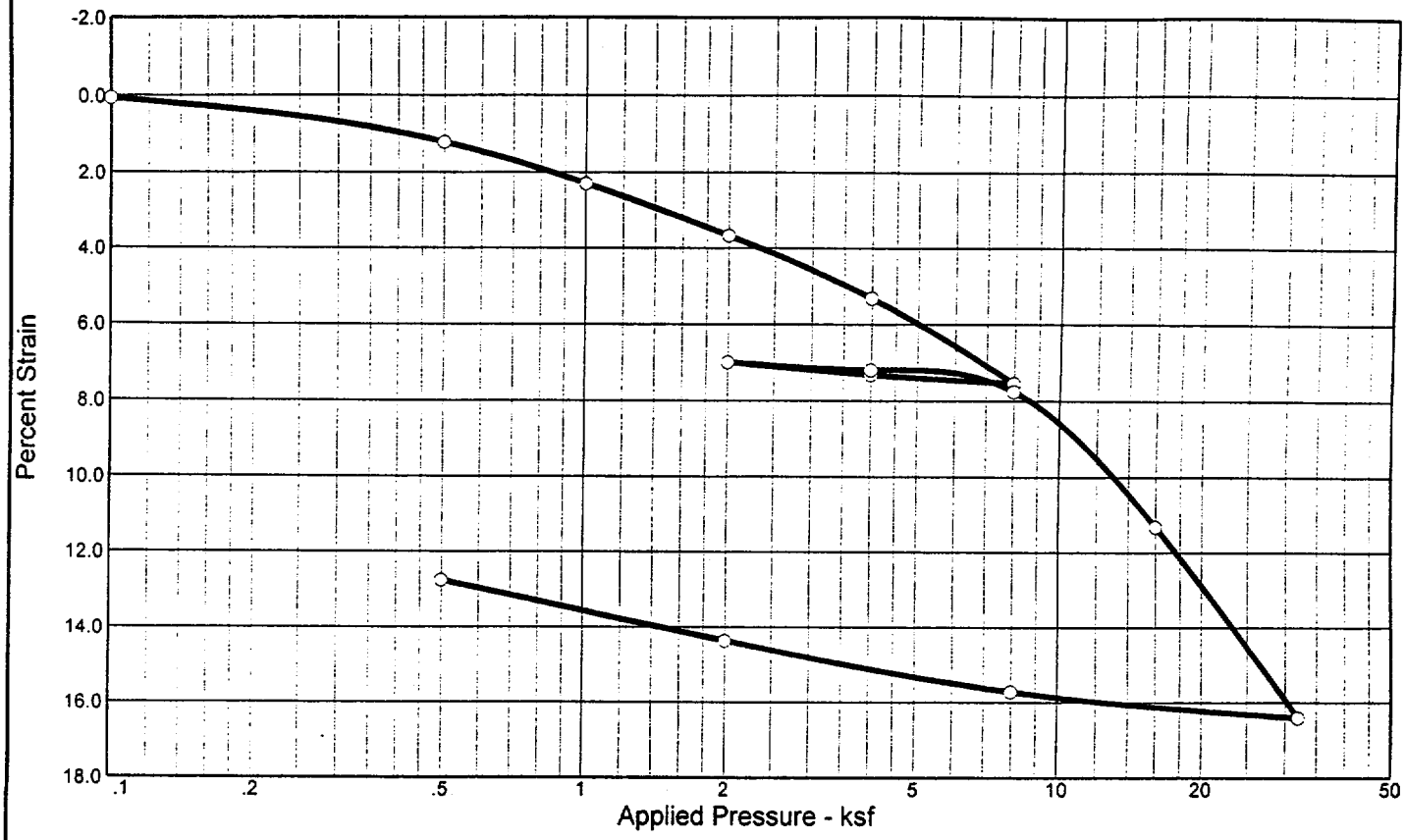
Remarks:

Tested by: JTM Reviewed by: HJ

Not representative of unit.

Plate

CONSOLIDATION TEST REPORT ASTM D2435-96 Test Method A



Coefficients of Consolidation								
No.	Load (ksf)	C_v (ft.2/day)	No.	Load (ksf)	C_v (ft.2/day)	No.	Load (ksf)	C_v (ft.2/day)
1	0.10	1.83	11	16.00	0.63			
2	0.50	0.80	12	32.00	0.52			
3	1.00	0.74	13	8.00	0.55			
4	2.00	0.77	14	2.00	0.13			
5	4.00	0.77	15	0.50	0.06			
6	8.00	0.70						
7	4.00	0.73						
8	2.00	1.31						
9	4.00	2.40						
10	8.00	1.35						

Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	P_c (ksf)	C_c	Initial Void Ratio
Saturation	Moisture							
92.8 %	37.0 %	81.2	58	32	2.7	10.52	0.35	1.076

MATERIAL DESCRIPTION	USCS	AASHTO
Tan Brown Clayey sand	SC	A-2-7(2)

Project No. 5016003963 **Client:** Duke Cogema Stone & Webster (DCS)

Project: MOX Fuel Fabrication Facility

Source: Boring BH-6 **Sample No.:** 13B (consol **Elev./Depth:** 77.5-79.0'

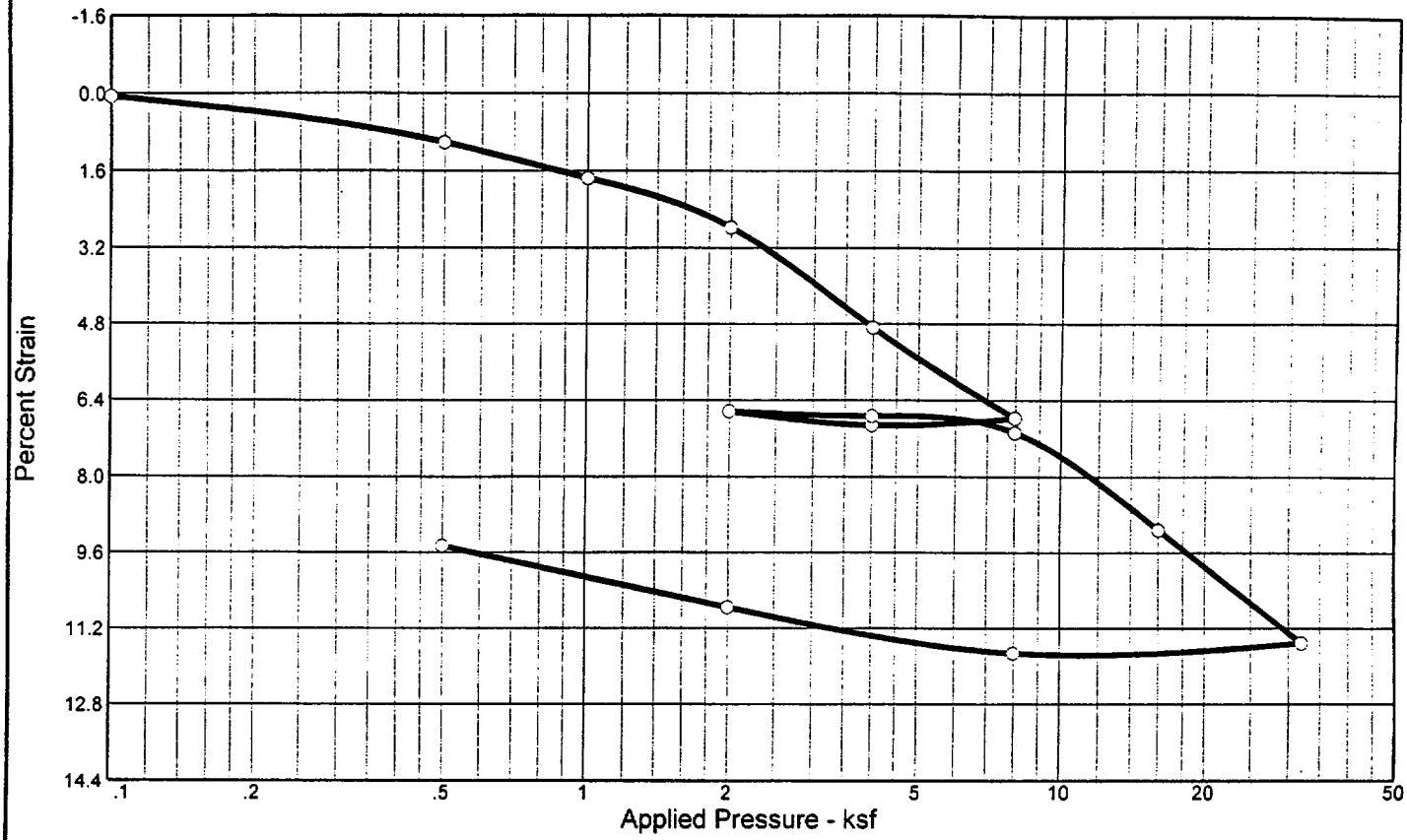
Remarks:
Tested by: JTM Reviewed by: HJ

CONSOLIDATION TEST REPORT ASTM D2435-96 Test Method A

LAW ENGINEERING & ENVIRONMENTAL SERVICES, INC.

Plate

CONSOLIDATION TEST REPORT ASTM D2435-96 Test Method B



Coefficients of Consolidation								
No.	Load (ksf)	C_v (ft.2/day)	No.	Load (ksf)	C_v (ft.2/day)	No.	Load (ksf)	C_v (ft.2/day)
1	0.10	5.87	11	16.00	1.19			
2	0.50	0.76	12	32.00	1.10			
3	1.00	1.16	13	8.00	1.88			
4	2.00	0.79	14	2.00	0.30			
5	4.00	3.21	15	0.50	0.11			
6	8.00	2.02						
7	4.00	4.87						
8	2.00	0.95						
9	4.00	5.11						
10	8.00	1.44						

Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	P_c (ksf)	C_c	Initial Void Ratio
Saturation	Moisture							
93.2 %	32.6 %	86.7	58	32	2.7	2.88	0.15	0.944

MATERIAL DESCRIPTION	USCS	AASHTO
Tan Brown Clayey sand	SC	A-2-7(2)

Project No. 5016003963 **Client:** Duke Cogema Stone & Webster (DCS)

Project: MOX Fuel Fabrication Facility

Source: Boring BH-6 **Sample No.:** 13B (consol **Elev./Depth:** 77.5-79.0'

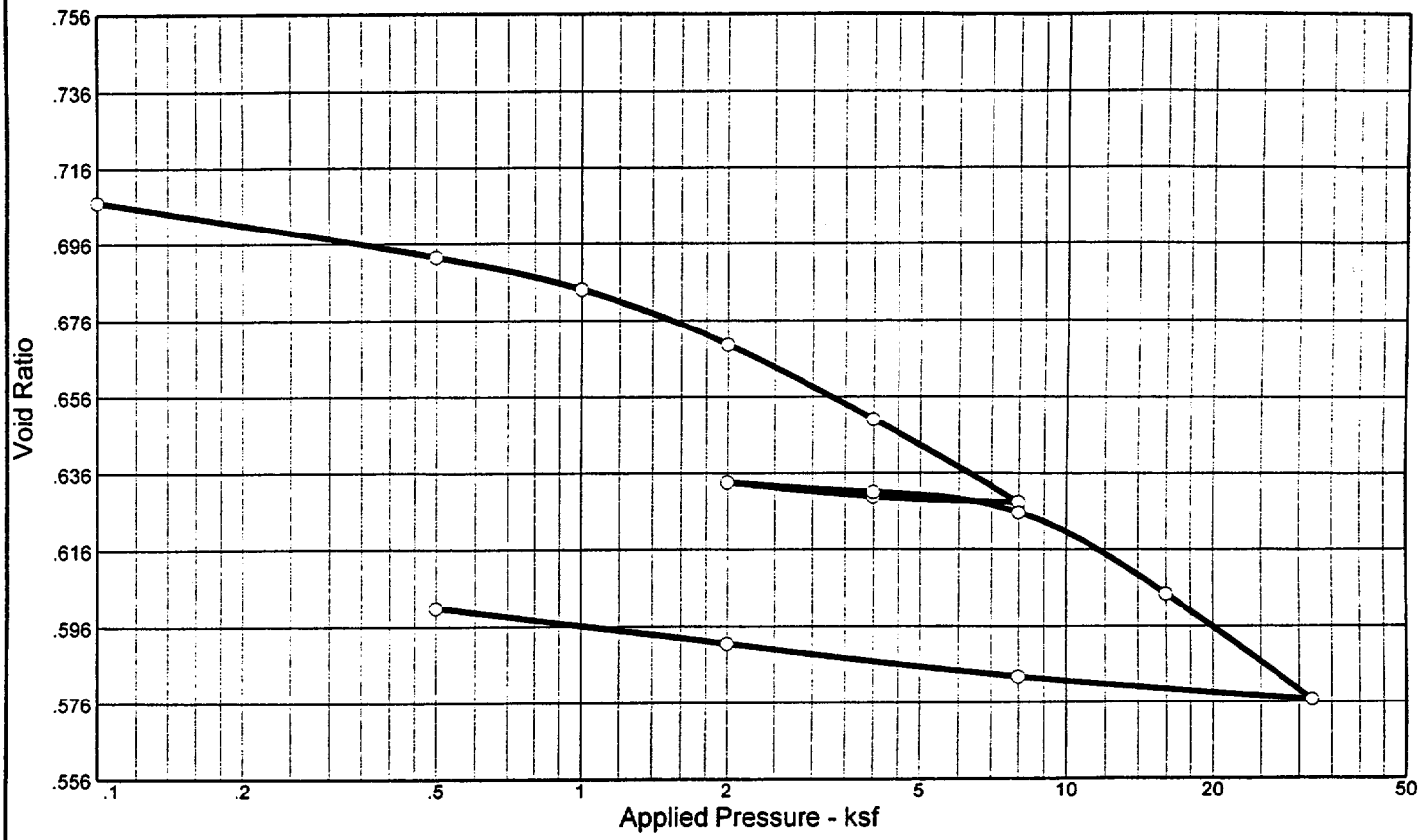
Remarks:
Tested by: JTM Reviewed by: HJ

CONSOLIDATION TEST REPORT ASTM D2435-96 Test Method B

LAW ENGINEERING & ENVIRONMENTAL SERVICES, INC.

Plate

CONSOLIDATION TEST REPORT ASTM D2435-96 Test Method B



Coefficients of Consolidation

No.	Load (ksf)	C_v (ft.2/day)	No.	Load (ksf)	C_v (ft.2/day)	No.	Load (ksf)	C_v (ft.2/day)
1	0.10	0.40	11	16.00	0.64			
2	0.50	0.20	12	32.00	0.43			
3	1.00	0.42	13	8.00	0.73			
4	2.00	0.82	14	2.00	1.36			
5	4.00	0.65	15	0.50	1.48			
6	8.00	0.39						
7	4.00	0.77						
8	2.00	0.64						
9	4.00	3.28						
10	8.00	0.98						

Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	P_c (ksf)	C_c	Initial Void Ratio
Saturation	Moisture							
71.8 %	18.9 %	98.5	51	28	2.7	2.74	0.09	0.712

MATERIAL DESCRIPTION	USCS	AASHTO
Tan Poorly graded sand with clay	SP-SC	A-2-7(0)

Project No. 5016003963 **Client:** Duke Cogema Stone & Webster (DCS)

Project: MOX Fuel Fabrication Facility

Source: Boring BH-6 **Sample No.:** 17B Bot **Elev./Depth:** 98-100'

Remarks:

Tested by: JTM Reviewed by: HJ

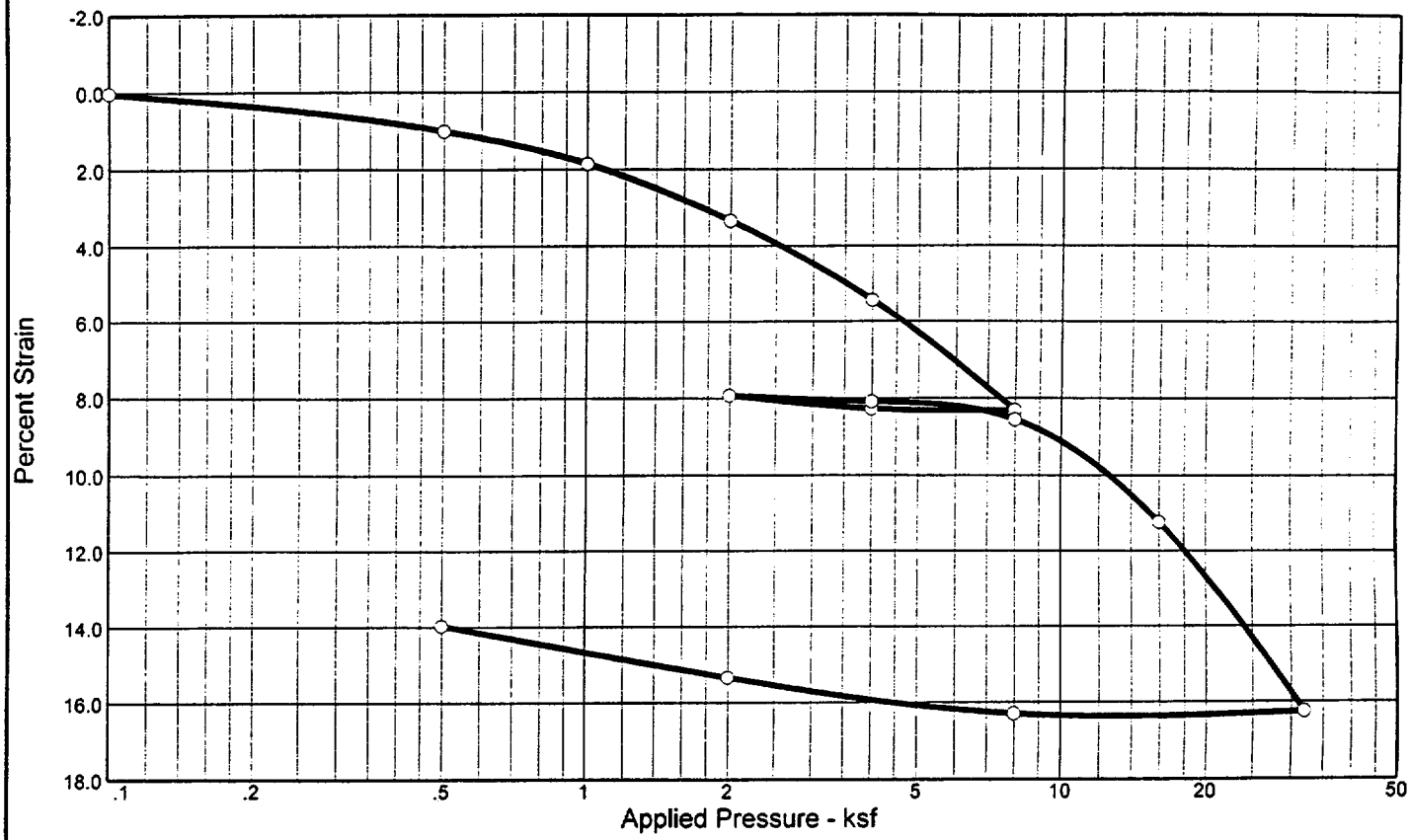
Soft Zone Sample

CONSOLIDATION TEST REPORT ASTM D2435-96 Test Method B

LAW ENGINEERING & ENVIRONMENTAL SERVICES, INC.

Plate

CONSOLIDATION TEST REPORT ASTM D2435-96 Test Method B



Coefficients of Consolidation

No.	Load (ksf)	C_v (ft.2/day)	No.	Load (ksf)	C_v (ft.2/day)	No.	Load (ksf)	C_v (ft.2/day)
1	0.10	1.84	11	16.00	1.05			
2	0.50	0.15	12	32.00	0.32			
3	1.00	0.23	13	8.00	0.46			
4	2.00	0.22	14	2.00	0.24			
5	4.00	0.16	15	0.50	0.06			
6	8.00	0.17						
7	4.00	2.34						
8	2.00	0.89						
9	4.00	0.76						
10	8.00	0.30						

Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	P_c (ksf)	C_c	Initial Void Ratio
Saturation	Moisture							
94.2 %	38.2 %	80.4	57	35	2.7	16.84	0.36	1.096

MATERIAL DESCRIPTION	USCS	AASHTO
Tan Clayey sand	SC	A-7-6(12)

Project No. 5016003963 **Client:** Duke Cogema Stone & Webster (DCS)

Project: MOX Fuel Fabrication Facility

Source: Boring BH-6 **Sample No.:** 18B Bot. **Elev./Depth:** 103-105'

CONSOLIDATION TEST REPORT ASTM D2435-96 Test Method B

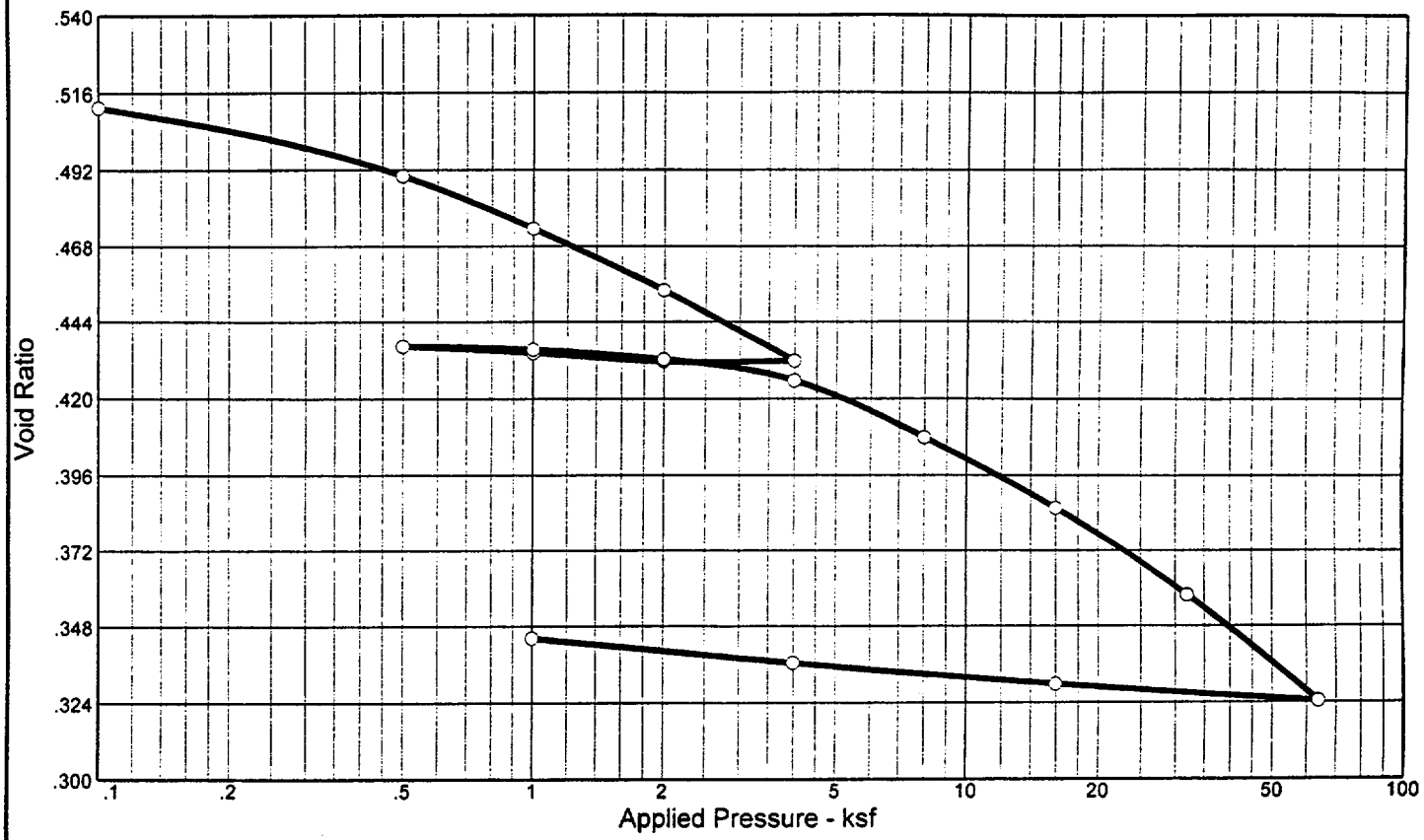
LAW ENGINEERING & ENVIRONMENTAL SERVICES, INC.

Remarks:

Tested by: JTM Reviewed by: HJ

Plate

CONSOLIDATION TEST REPORT ASTM D2435-96 Test Method B



Coefficients of Consolidation

No.	Load (ksf)	C_v (ft.2/day)	No.	Load (ksf)	C_v (ft.2/day)	No.	Load (ksf)	C_v (ft.2/day)
1	0.10	0.19	11	4.00	0.16			
2	0.50	0.29	12	8.00	0.23			
3	1.00	0.21	13	16.00	0.32			
4	2.00	0.25	14	32.00	0.41			
5	4.00	0.35	15	64.00	0.38			
6	2.00	0.20	16	16.00	1.20			
7	1.00	0.77	17	4.00	0.99			
8	0.50	0.92	18	1.00	2.53			
9	1.00	0.09						
10	2.00	1.37						

Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	P_c (ksf)	C_c	Initial Void Ratio
Saturation	Moisture							
104.0 %	20.1 %	110.8	31	11	2.7	19.64	0.11	0.521

MATERIAL DESCRIPTION	USCS	AASHTO
Tan Clayey sand	SC	A-2-6(0)

Project No. 5016003963 **Client:** Duke Cogema Stone & Webster (DCS)

Project: MOX Fuel Fabrication Facility

Source: Boring BH-7 **Sample No.:** 6B (top) **Elev./Depth:** 30-31.6'

CONSOLIDATION TEST REPORT ASTM D2435-96 Test Method B

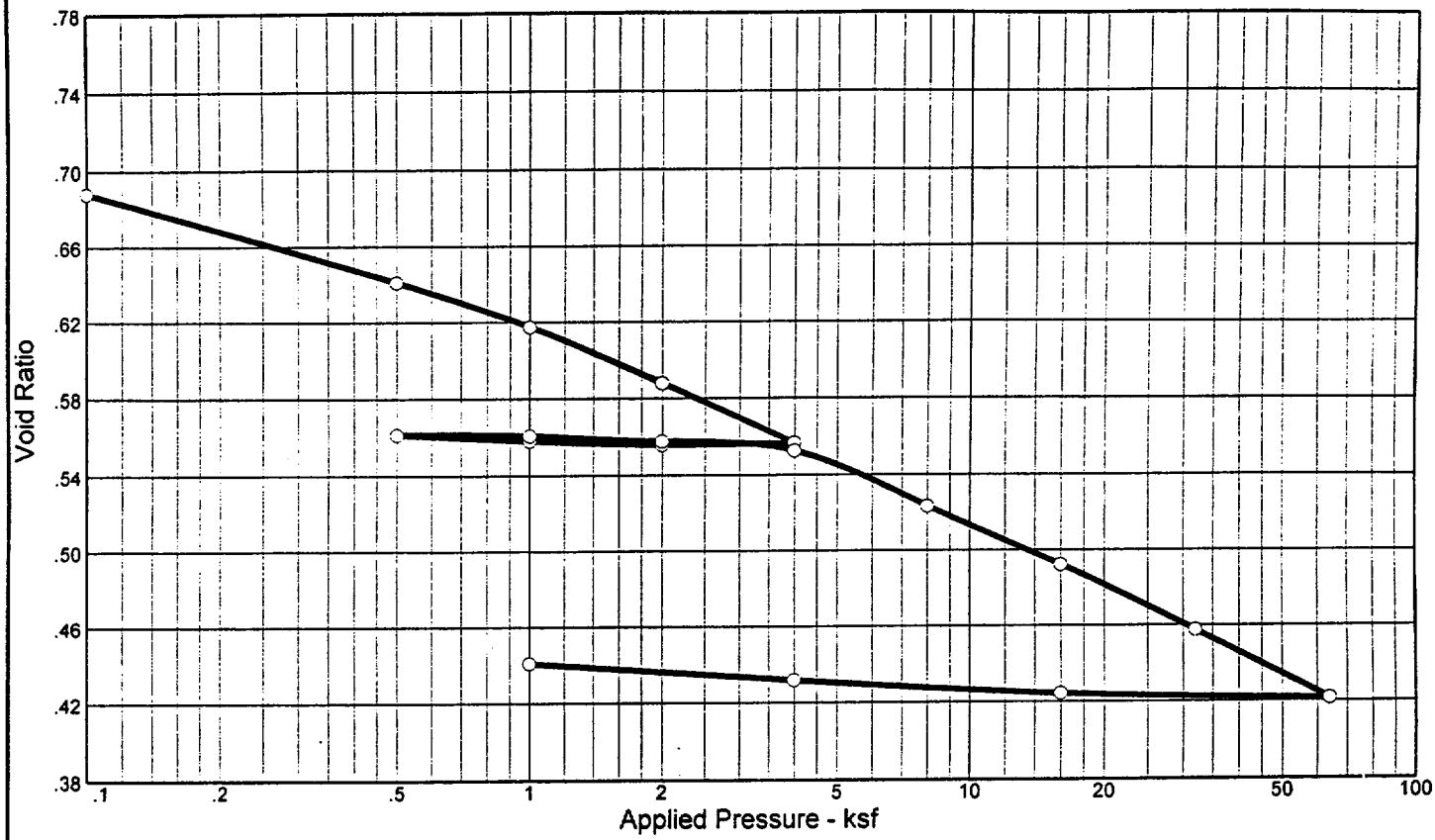
LAW ENGINEERING & ENVIRONMENTAL SERVICES, INC.

Remarks:

Tested by: JTM Reviewed by: HJ

Plate

CONSOLIDATION TEST REPORT ASTM D2435-96 Test Method B



Coefficients of Consolidation								
No.	Load (ksf)	C_v (ft.2/day)	No.	Load (ksf)	C_v (ft.2/day)	No.	Load (ksf)	C_v (ft.2/day)
1	0.10	0.55	11	4.00	0.61			
2	0.50	0.19	12	8.00	0.24			
3	1.00	0.44	13	16.00	0.36			
4	2.00	0.30	14	32.00	0.15			
5	4.00	0.62	15	64.00	0.46			
6	2.00	1.39	16	16.00	3.53			
7	1.00	2.75	17	4.00	3.56			
8	0.50	0.73	18	1.00	1.00			
9	1.00	5.47						
10	2.00	0.72						

Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	P_c (ksf)	C_c	Initial Void Ratio
Saturation	Moisture							
102.5 %	26.2 %	99.8	36	17	2.7		0.12	0.690

MATERIAL DESCRIPTION	USCS	AASHTO
Tan Clayey sand	SC	A-2-6(0)

Project No. 5016003963 **Client:** Duke Cogema Stone & Webster (DCS)

Project: MOX Fuel Fabrication Facility

Source: Boring BH-7 **Sample No.:** 8B (top) **Elev./Depth:** 40-41.2'

CONSOLIDATION TEST REPORT ASTM D2435-96 Test Method B

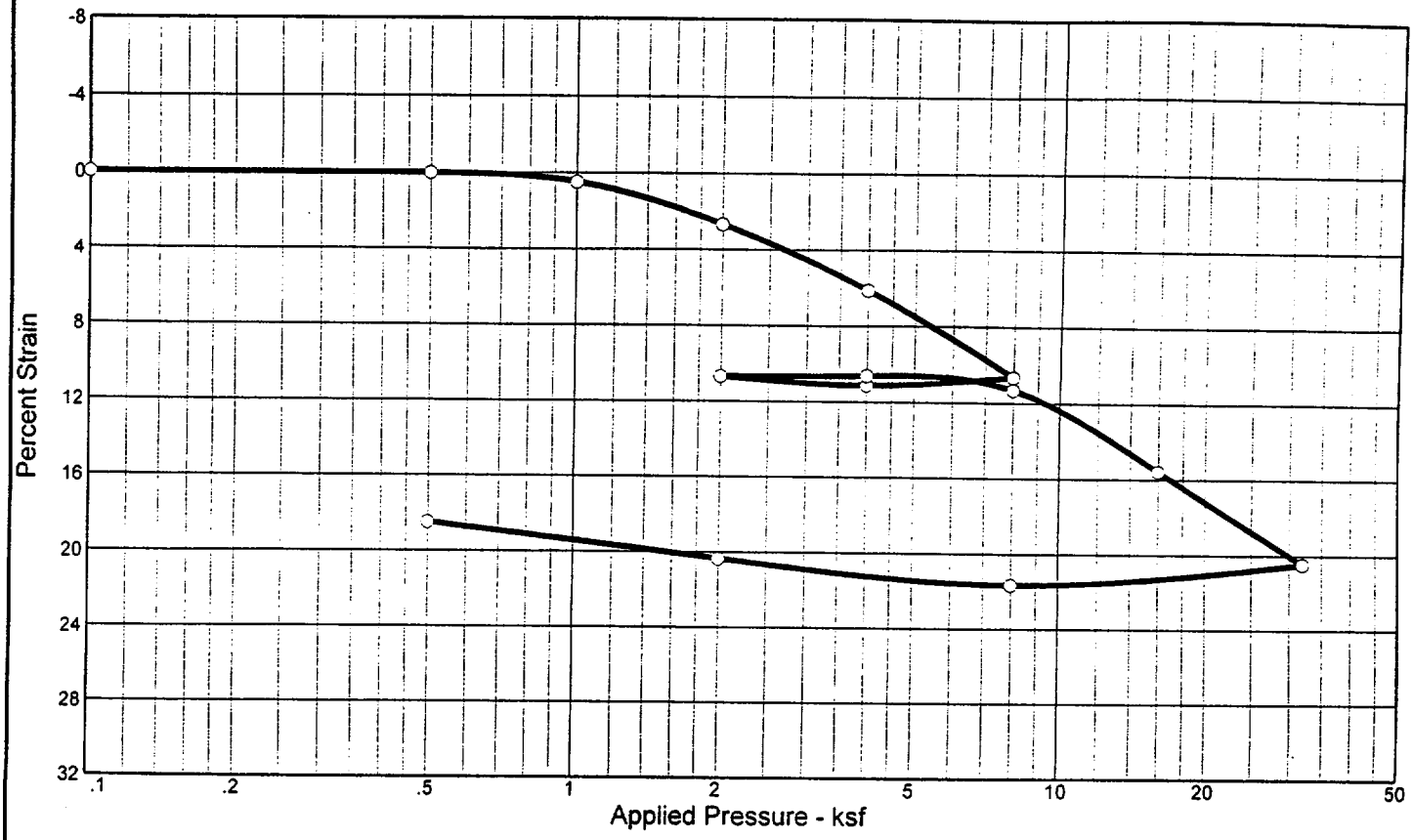
LAW ENGINEERING & ENVIRONMENTAL SERVICES, INC.

Remarks:

Tested by: JTM Reviewed by: HJ

Plate

CONSOLIDATION TEST REPORT ASTM D2435-96 Test Method A



Coefficients of Consolidation

No.	Load (ksf)	C_v (ft.2/day)	No.	Load (ksf)	C_v (ft.2/day)	No.	Load (ksf)	C_v (ft.2/day)
1	0.10	9.35	11	16.00	0.49			
2	0.50	0.33	12	32.00	0.44			
3	1.00	1.53	13	8.00	0.51			
4	2.00	0.83	14	2.00	0.95			
5	4.00	0.72	15	0.50	1.10			
6	8.00	0.65						
7	4.00	1.22						
8	2.00	0.64						
9	4.00	1.37						
10	8.00	0.68						

Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	P_c (ksf)	C_c	Initial Void Ratio
Saturation	Moisture							
89.4 %	45.9 %	70.6	109	41	2.7	2.12	0.41	1.386

MATERIAL DESCRIPTION	USCS	AASHTO
Tan Silty sand	SM	A-7-5(16)

Project No. 5016003963 **Client:** Duke Cogema Stone & Webster (DCS)

Project: MOX Fuel Fabrication Facility

Source: Boring BH-7 **Sample No.:** 14B (Top) **Elev./Depth:**

CONSOLIDATION TEST REPORT ASTM D2435-96 Test Method A

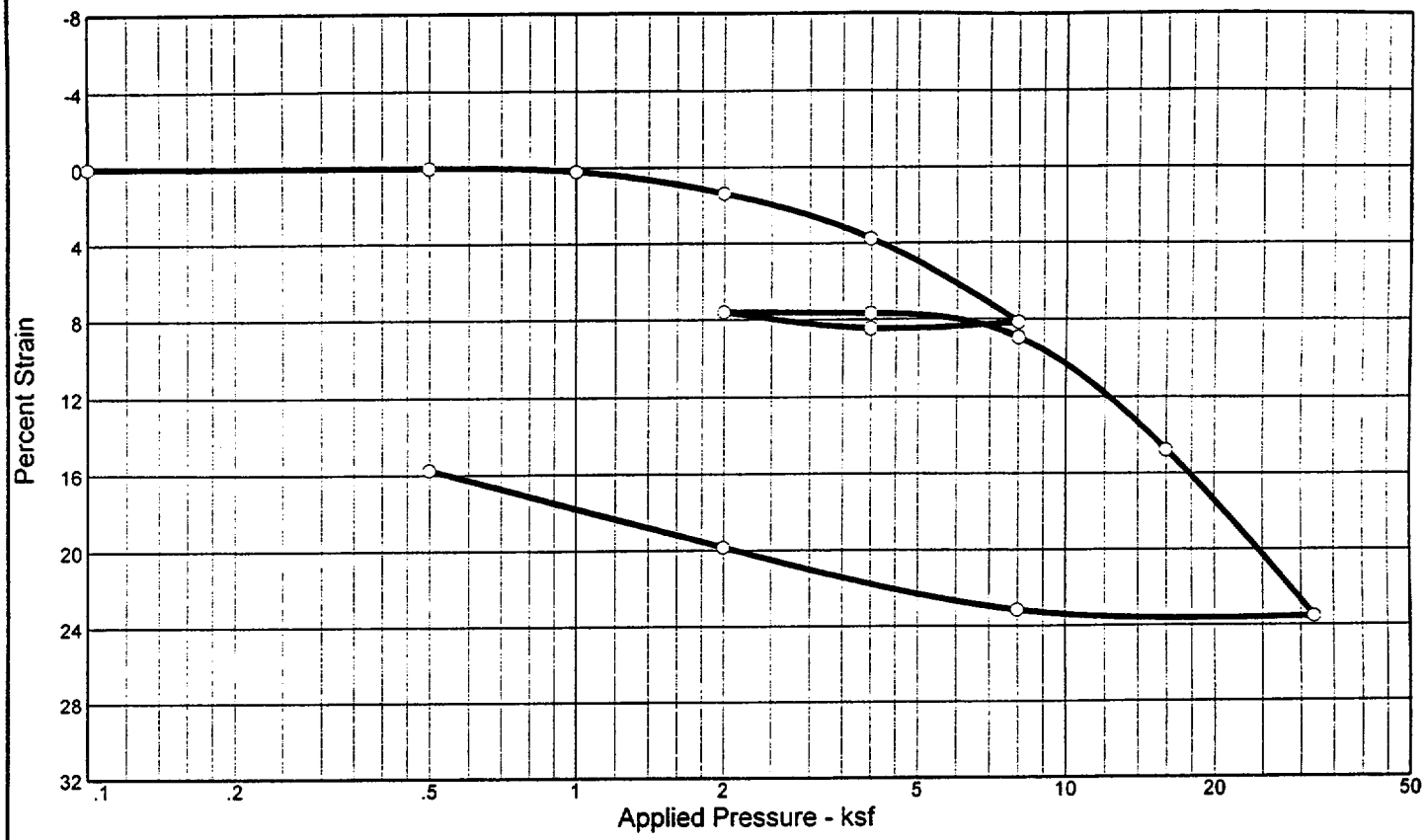
LAW ENGINEERING & ENVIRONMENTAL SERVICES, INC.

Remarks:

Tested by; JTM Reviewed by: HJ

Plate

CONSOLIDATION TEST REPORT ASTM D2435-96 Test Method B



Coefficients of Consolidation

No.	Load (ksf)	C_v (ft.2/day)	No.	Load (ksf)	C_v (ft.2/day)	No.	Load (ksf)	C_v (ft.2/day)
1	0.10	0.92	11	16.00	0.06			
2	0.50	1.52	12	32.00	0.02			
3	1.00	3.21	13	8.00	0.10			
4	2.00	1.50	14	2.00	0.02			
5	4.00	0.75	15	0.50	0.01			
6	8.00	0.18						
7	4.00	0.59						
8	2.00	0.25						
9	4.00	1.28						
10	8.00	0.31						

Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	P_c (ksf)	C_c	Initial Void Ratio
Saturation	Moisture							
92.6 %	54.5 %	65.1	93	50	2.7	7.80	0.76	1.588

MATERIAL DESCRIPTION	USCS	AASHTO
Tan Sandy elastic silt	MH	A-7-5(37)

Project No. 5016003963 **Client:** Duke Cogema Stone & Webster (DCS)

Project: MOX Fuel Fabrication Facility

Source: Boring BH-7 **Sample No.:** 20B Bot **Elev./Depth:** 100-102'

CONSOLIDATION TEST REPORT ASTM D2435-96 Test Method B

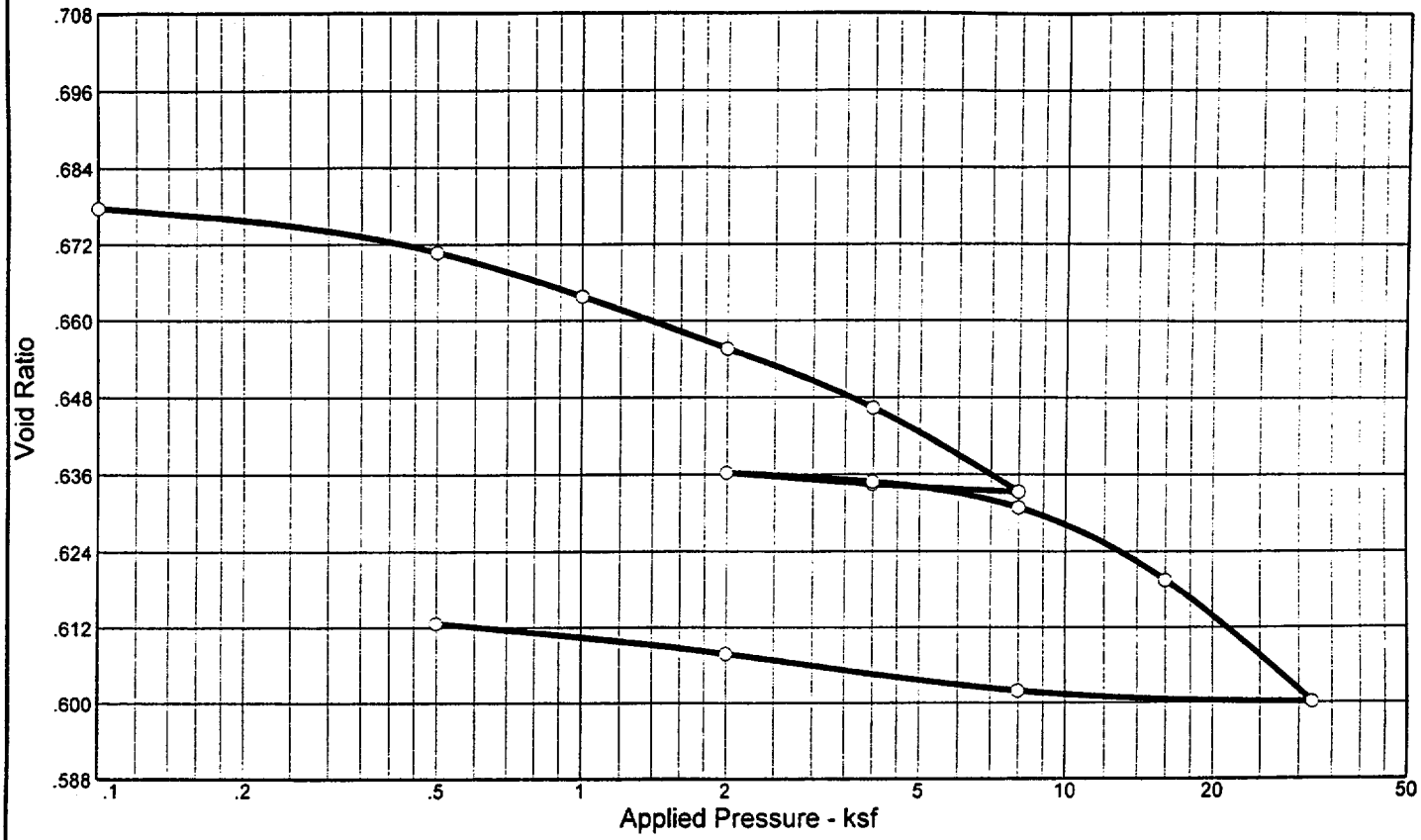
LAW ENGINEERING & ENVIRONMENTAL SERVICES, INC.

Remarks:

Tested by: JTM Reviewed by: by HJ

Plate

CONSOLIDATION TEST REPORT ASTM D2435-96 Test Method B



Coefficients of Consolidation								
No.	Load (ksf)	C_v (ft.2/day)	No.	Load (ksf)	C_v (ft.2/day)	No.	Load (ksf)	C_v (ft.2/day)
2	0.50	0.76	12	32.00	1.34			
3	1.00	2.49	13	8.00	0.16			
4	2.00	0.76	14	2.00	1.55			
5	4.00	2.95	15	0.50	2.57			
6	8.00	1.56						
7	4.00	5.34						
8	2.00	0.67						
9	4.00	0.87						
10	8.00	0.77						
11	16.00	1.57						

Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	P_c (ksf)	C_c	Initial Void Ratio
Saturation	Moisture							
71.7 %	18.0 %	100.5	45	23	2.7	16.83	0.07	0.678

MATERIAL DESCRIPTION	USCS	AASHTO
Tan Brown Silty sand	SM	A-2-4(0)

Project No. 5016003963 **Client:** Duke Cogema Stone & Webster (DCS)

Project: MOX Fuel Fabrication Facility

Source: Boring BH-10 **Sample No.:** 26B Retest **Elev./Depth:** 135-136.5'

Remarks:

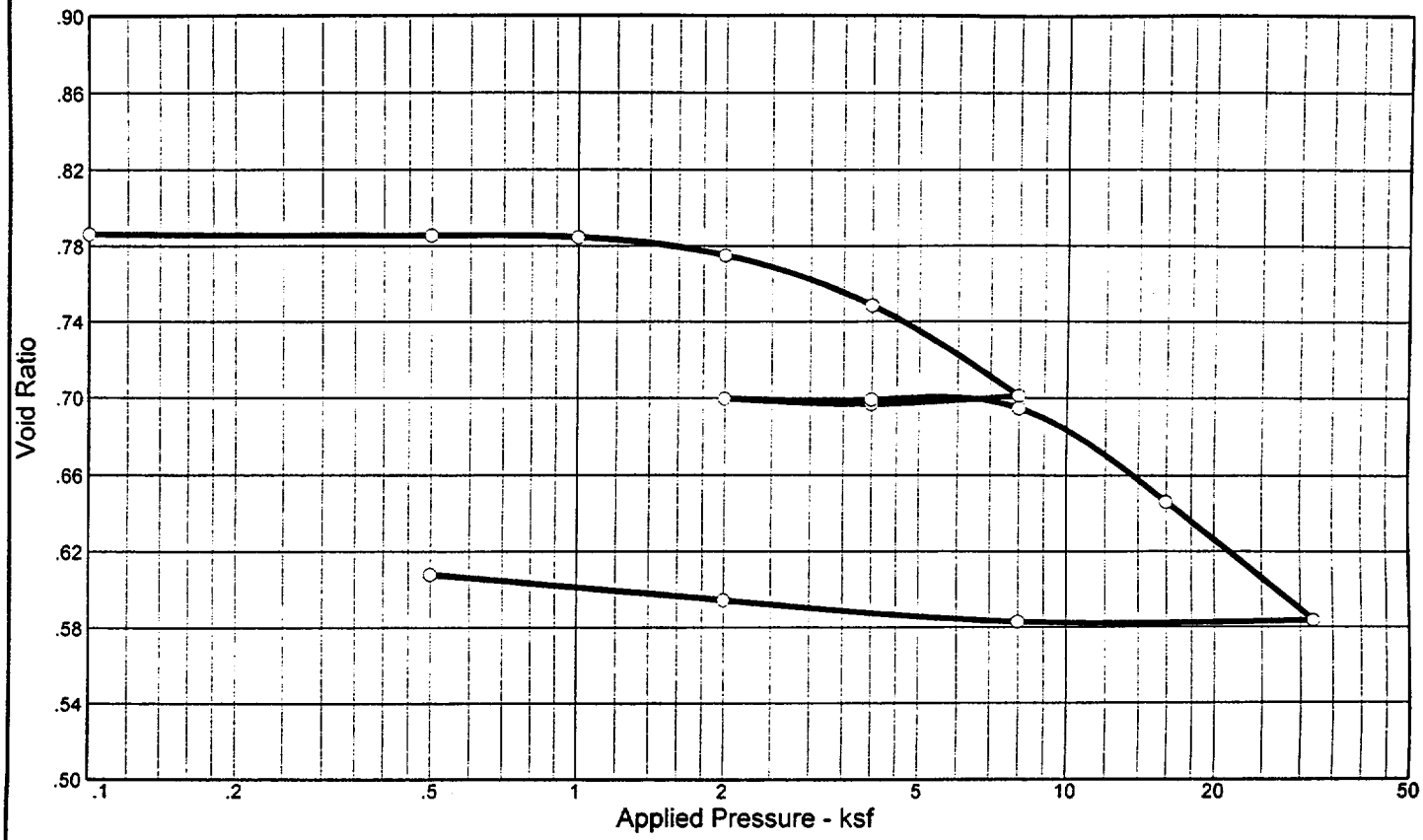
Tested by: JTM Reviewed by: HJ

CONSOLIDATION TEST REPORT ASTM D2435-96 Test Method B

LAW ENGINEERING & ENVIRONMENTAL SERVICES, INC.

Plate 271

CONSOLIDATION TEST REPORT ASTM D2435-96 Test Method B



Coefficients of Consolidation								
No.	Load (ksf)	C_v (ft.2/day)	No.	Load (ksf)	C_v (ft.2/day)	No.	Load (ksf)	C_v (ft.2/day)
1	0.10	16.03	11	16.00	1.17			
2	0.50	0.82	12	32.00	1.22			
3	1.00	0.32	13	8.00	4.61			
4	2.00	0.75	14	2.00	1.12			
5	4.00	0.74	15	0.50	0.30			
6	8.00	1.10						
7	4.00	4.48						
8	2.00	1.09						
9	4.00	1.85						
10	8.00	2.53						

Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	P_c (ksf)	C_c	Initial Void Ratio
Saturation	Moisture							
92.0 %	26.8 %	93.6	59	36	2.7	5.09	0.21	0.786

MATERIAL DESCRIPTION	USCS	AASHTO
Light Brown Clayey sand	SC	A-2-7(0)

Project No. 5016003963 **Client:** Duke Cogema Stone & Webster (DCS)

Project: MOX Fuel Fabrication Facility

Source: Boring BH-11 **Sample No.:** 7B (Top) **Elev./Depth:** 74.5-75.5'

CONSOLIDATION TEST REPORT ASTM D2435-96 Test Method B

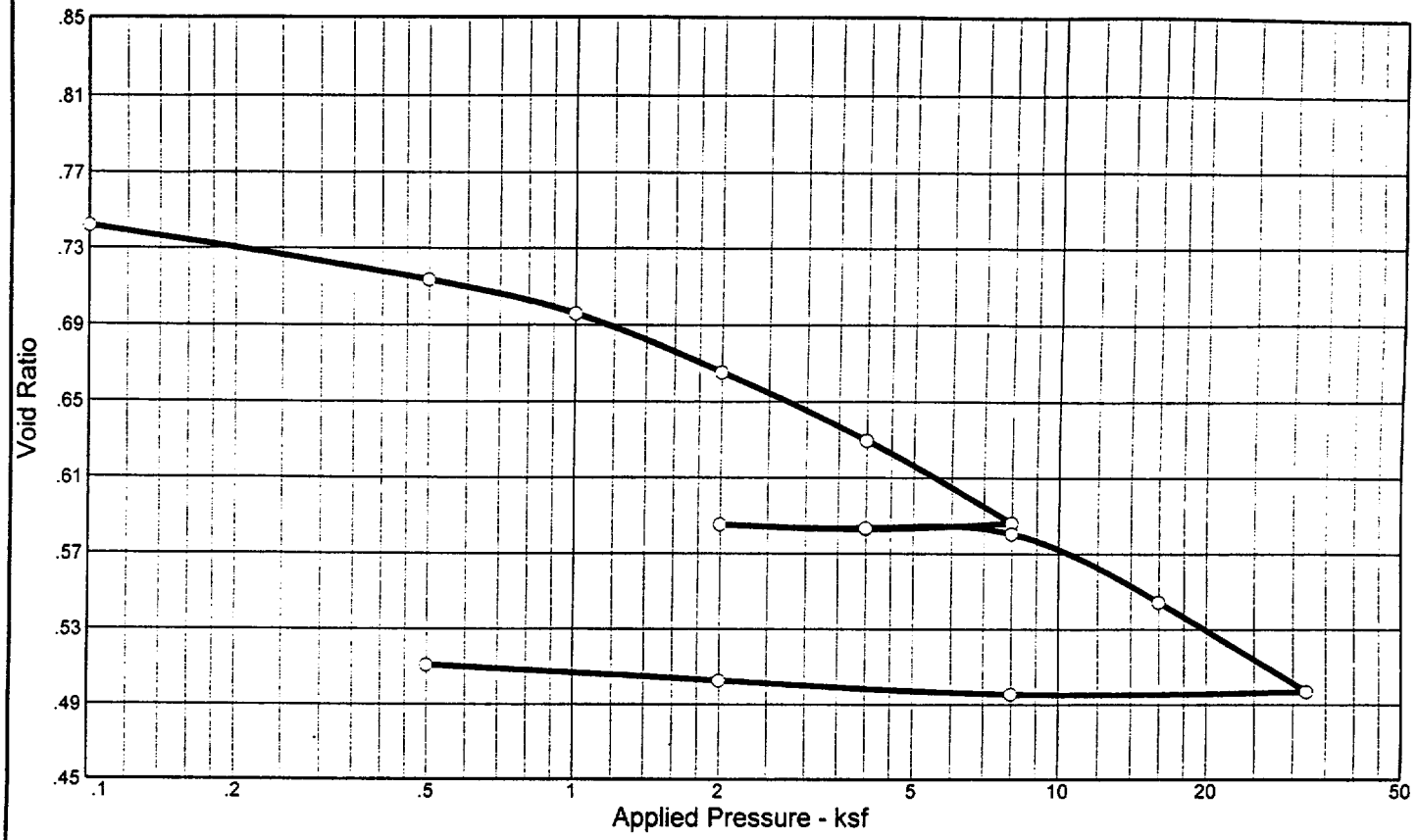
LAW ENGINEERING & ENVIRONMENTAL SERVICES, INC.

Remarks:

Tested by: JTM Reviewed by: HJ

Plate

CONSOLIDATION TEST REPORT ASTM D2435-96 Test Method A



Coefficients of Consolidation								
No.	Load (ksf)	C_v (ft.2/day)	No.	Load (ksf)	C_v (ft.2/day)	No.	Load (ksf)	C_v (ft.2/day)
1	0.10	0.36	11	16.00	1.33			
2	0.50	0.61	12	32.00	2.30			
3	1.00	0.38	13	8.00	2.35			
4	2.00	0.68	14	2.00	2.23			
5	4.00	1.21	15	0.50	0.61			
6	8.00	1.31						
7	4.00	1.29						
8	2.00	1.26						
9	4.00	0.05						
10	8.00	0.69						

Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	P_c (ksf)	C_c	Initial Void Ratio
Saturation	Moisture							
103.9 %	28.9 %	96.2	54	34	2.7			0.752

MATERIAL DESCRIPTION	USCS	AASHTO
Light Brown Clayey sand	SC	A-2-7(3)

Project No. 5016003963 **Client:** Duke Cogema Stone & Webster (DCS)

Project: MOX Fuel Fabrication Facility

Source: Boring BH-11 **Sample No.:** 8B (Top) **Elev./Depth:** 82-84'

CONSOLIDATION TEST REPORT ASTM D2435-96 Test Method A

LAW ENGINEERING & ENVIRONMENTAL SERVICES, INC.

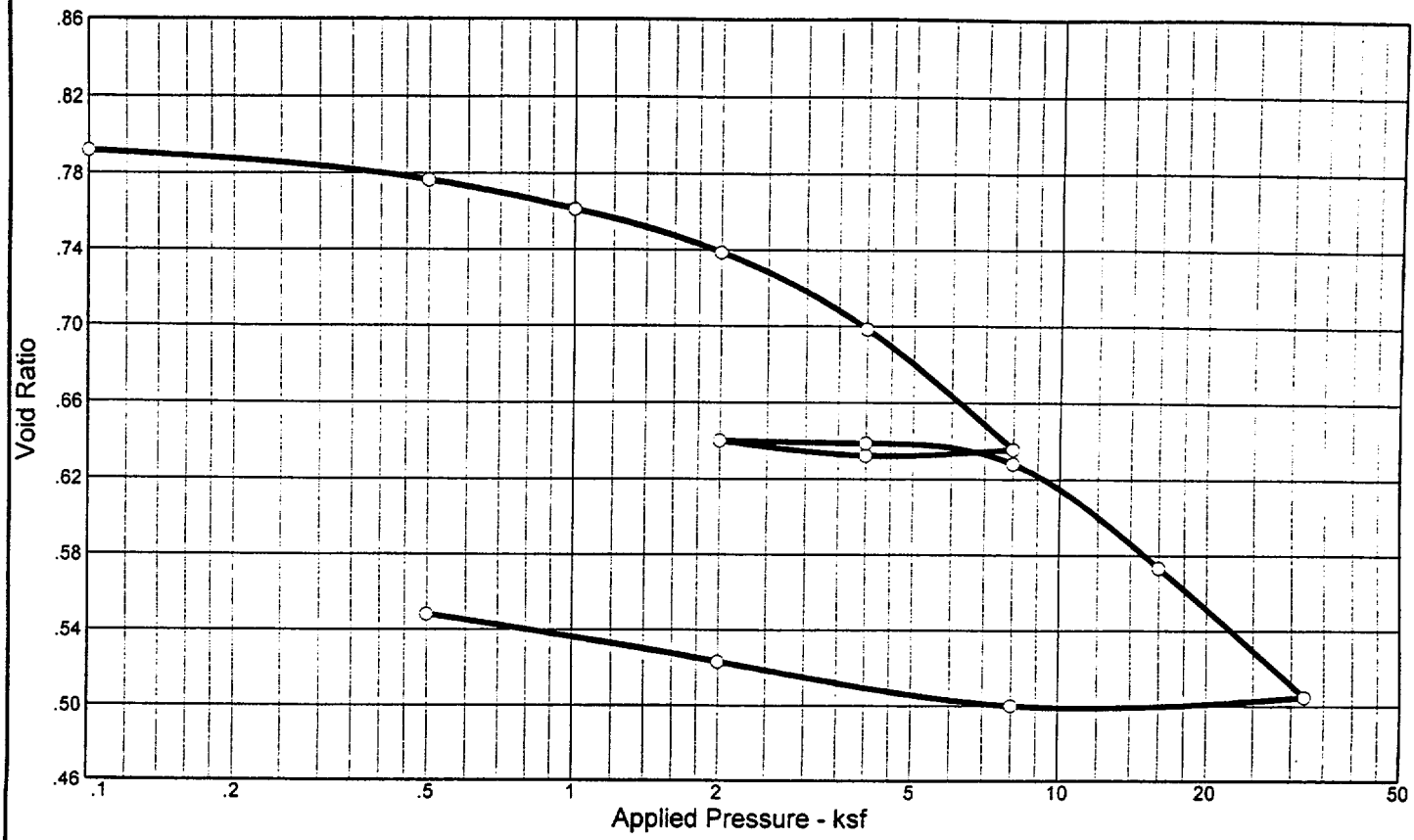
Remarks:

Tested by: JTM Reviewed by: HJ

Considered Disturbed Sample

Plate 273

CONSOLIDATION TEST REPORT ASTM D2435-96 Test Method A



Coefficients of Consolidation								
No.	Load (ksf)	C_v (ft.2/day)	No.	Load (ksf)	C_v (ft.2/day)	No.	Load (ksf)	C_v (ft.2/day)
1	0.10	0.41	11	16.00	1.24			
2	0.50	0.79	12	32.00	0.25			
3	1.00	0.74	13	8.00	1.10			
4	2.00	0.74	14	2.00	0.28			
5	4.00	0.71	15	0.50	0.07			
6	8.00	0.69						
7	4.00	1.27						
8	2.00	0.34						
9	4.00	1.27						
10	8.00	1.31						

Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	P_c (ksf)	C_c	Initial Void Ratio
Saturation	Moisture							
94.4 %	27.7 %	94.0	118	80	2.7	6.81	0.27	0.792

MATERIAL DESCRIPTION	USCS	AASHTO
Tan Clayey sand	SC	A-2-7(13)

Project No. 5016003963 **Client:** Duke Cogema Stone & Webster (DCS)

Project: MOX Fuel Fabrication Facility

Source: Boring BH-11 **Sample No.:** 8B (Bottom) **Elev./Depth:** 82-84'

CONSOLIDATION TEST REPORT ASTM D2435-96 Test Method A

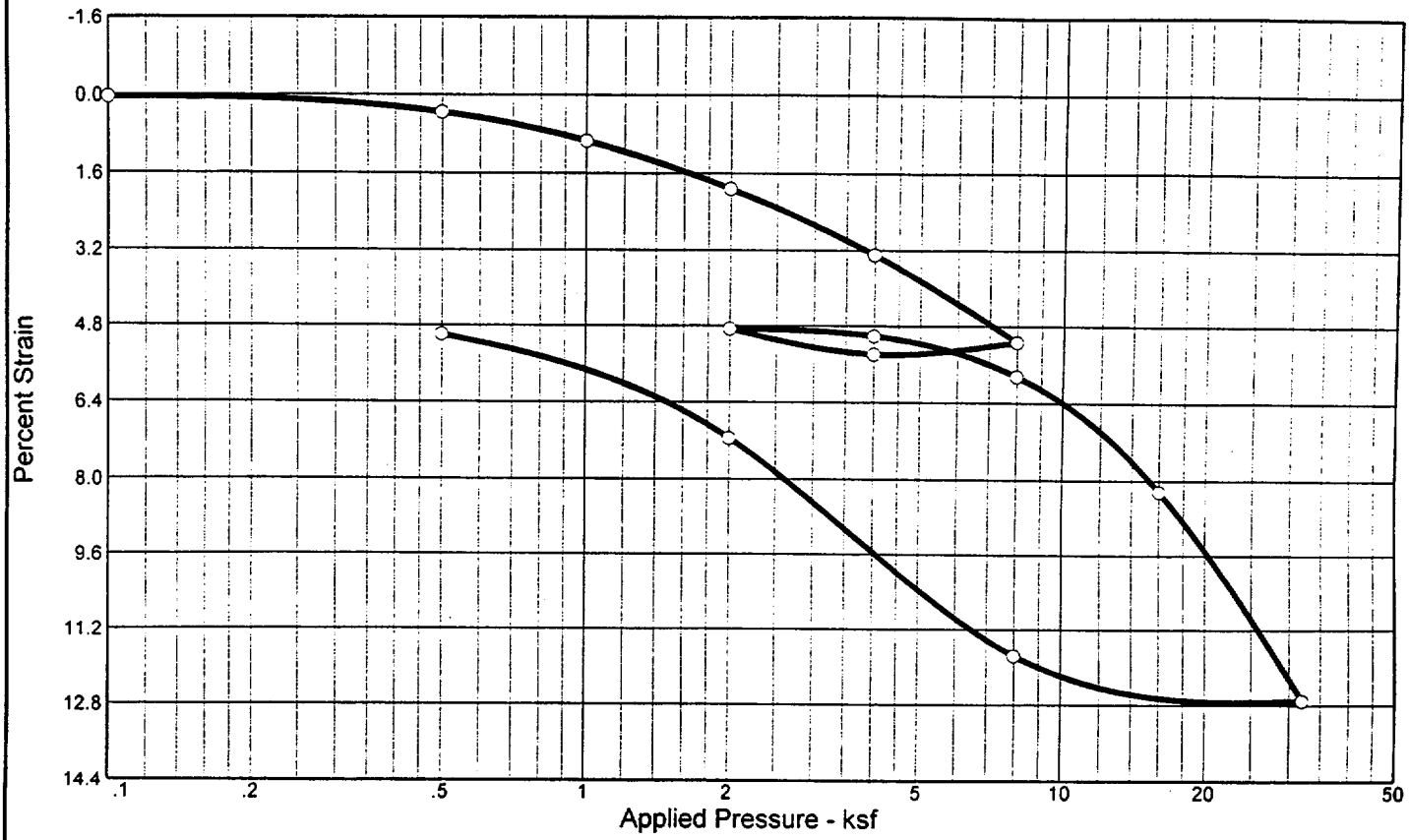
LAW ENGINEERING & ENVIRONMENTAL SERVICES, INC.

Remarks:

Tested by: JTM Reviewed by: HJ

Plate

CONSOLIDATION TEST REPORT ASTM D2435-96 Test Method A



Coefficients of Consolidation								
No.	Load (ksf)	C_v (ft.2/day)	No.	Load (ksf)	C_v (ft.2/day)	No.	Load (ksf)	C_v (ft.2/day)
1	0.10	6.41	11	16.00	0.30			
2	0.50	1.61	12	32.00	0.07			
3	1.00	0.82	13	8.00	0.03			
4	2.00	0.84	14	2.00	0.55			
5	4.00	0.68	15	0.50	0.18			
6	8.00	1.31						
7	4.00	0.16						
8	2.00	0.42						
9	4.00	0.27						
10	8.00	0.34						

Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	P_c (ksf)	C_c	Initial Void Ratio
Saturation	Moisture							
90.7 %	36.6 %	80.7	83	56	2.7	16.36	0.35	1.088

MATERIAL DESCRIPTION	USCS	AASHTO
Tan Fat clay with sand	CH	A-7-6(45)

Project No. 5016003963 **Client:** Duke Cogema Stone & Webster (DCS)

Project: MOX Fuel Fabrication Facility

Source: Boring BH-11 **Sample No.:** 21B (top) **Elev./Depth:** 154-156.5'

CONSOLIDATION TEST REPORT ASTM D2435-96 Test Method A

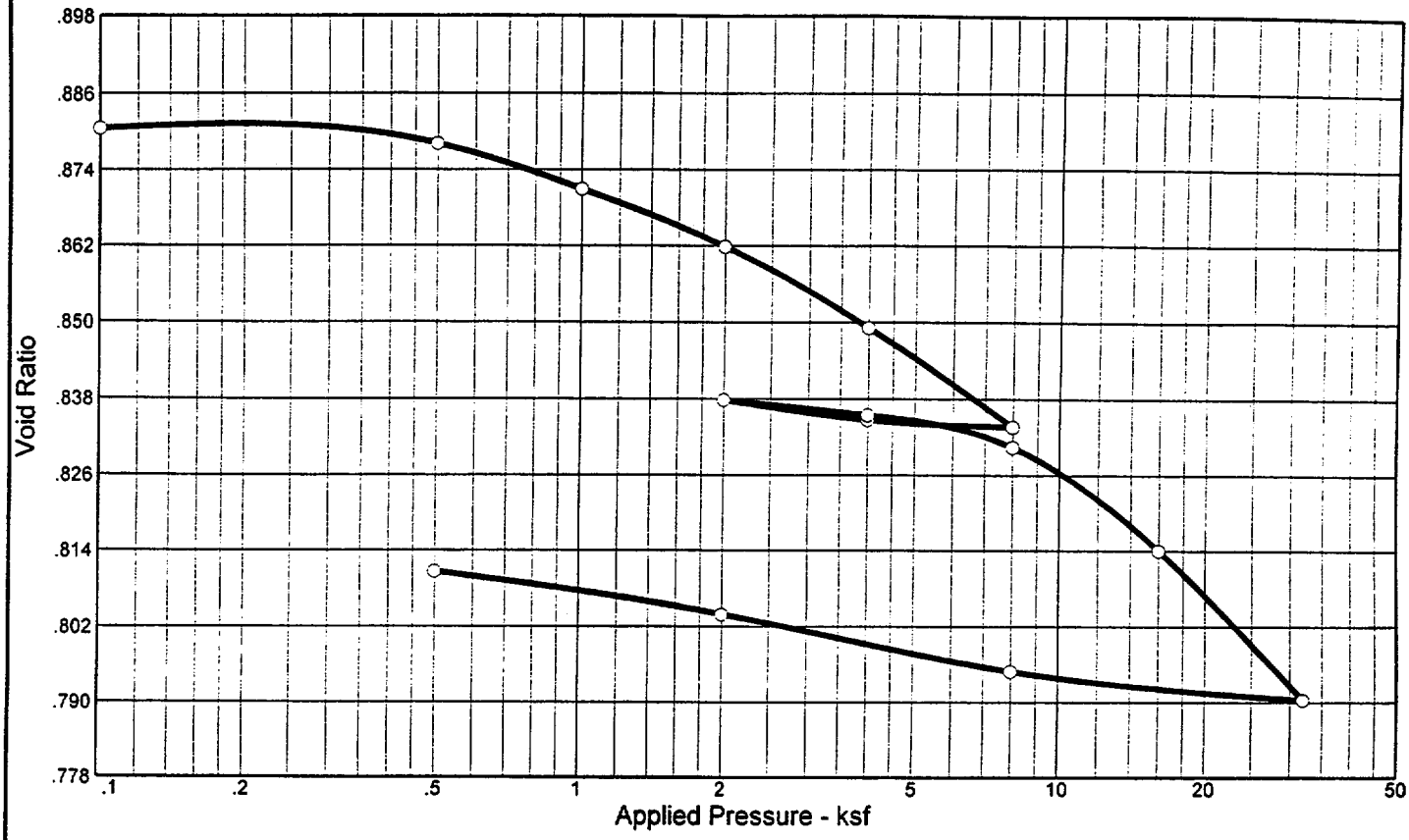
LAW ENGINEERING & ENVIRONMENTAL SERVICES, INC.

Remarks:

Tested by: JTM Reviewed by: HJ

Plate

CONSOLIDATION TEST REPORT ASTM D2435-96 Test Method B



Coefficients of Consolidation								
No.	Load (ksf)	C_v (ft.^{2}/day)	No.	Load (ksf)	C_v (ft.^{2}/day)	No.	Load (ksf)	C_v (ft.^{2}/day)
1	0.10	9.56	11	16.00	0.84			
2	0.50	5.86	12	32.00	1.22			
3	1.00	0.44	13	8.00	5.84			
4	2.00	1.60	14	2.00	0.79			
5	4.00	0.76	15	0.50	2.58			
6	8.00	0.77						
7	4.00	3.08						
8	2.00	0.85						
9	4.00	1.46						
10	8.00	2.64						

Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	P_c (ksf)	C_c	Initial Void Ratio
Saturation	Moisture							
92.8 %	30.3 %	89.6	41	12	2.7	3.11	0.08	0.881

MATERIAL DESCRIPTION	USCS	AASHTO
Brown Silty sand	SM	A-2-7(0)

Project No. 5016003963 **Client:** Duke Cogema Stone & Webster (DCS)

Project: MOX Fuel Fabrication Facility

Source: Boring BH-12 **Sample No.:** 10B (Top) **Elev./Depth:** 90-91.5'

CONSOLIDATION TEST REPORT ASTM D2435-96 Test Method B

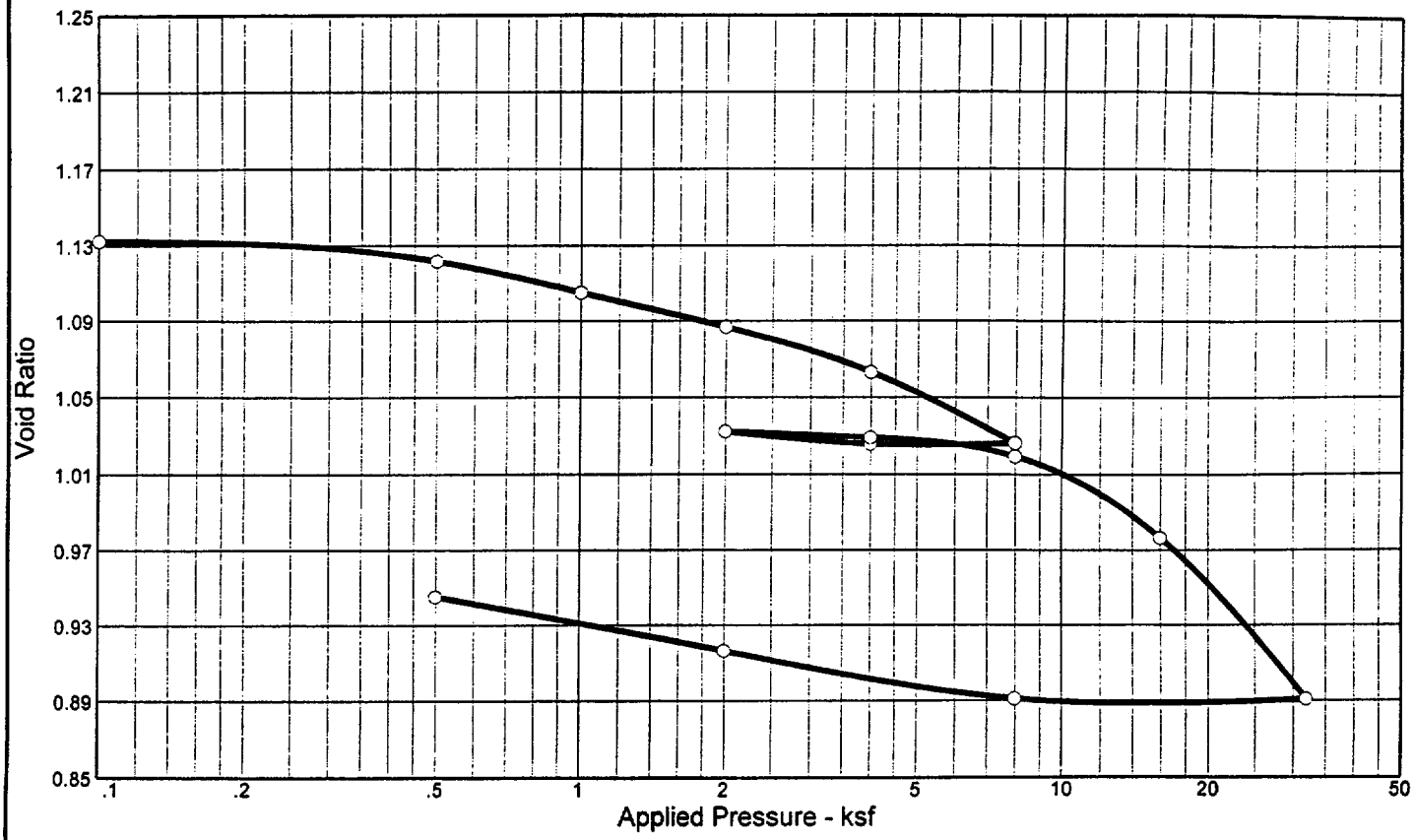
LAW ENGINEERING & ENVIRONMENTAL SERVICES, INC.

Remarks:

Tested by: JTM Reviewed by: HJ

Plate

CONSOLIDATION TEST REPORT ASTM D2435-96 Test Method B



Coefficients of Consolidation

No.	Load (ksf)	C_v (ft.2/day)	No.	Load (ksf)	C_v (ft.2/day)	No.	Load (ksf)	C_v (ft.2/day)
1	0.10	12.00	11	16.00	2.36			
2	0.50	2.77	12	32.00	1.26			
3	1.00	0.83	13	8.00	3.46			
4	2.00	1.55	14	2.00	1.26			
5	4.00	1.50	15	0.50	0.69			
6	8.00	0.79						
7	4.00	4.48						
8	2.00	5.33						
9	4.00	0.33						
10	8.00	2.50						

Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	P_c (ksf)	C_c	Initial Void Ratio
Saturation	Moisture							
88.0 %	36.9 %	79.0	59	31	2.7	16.49	0.29	1.132

MATERIAL DESCRIPTION	USCS	AASHTO
Light Yellow Tan Clayey sand	SC	A-2-7(1)

Project No. 5016003963 **Client:** Duke Cogema Stone & Webster (DCS)

Project: MOX Fuel Fabrication Facility

Source: Boring BH-12 **Sample No.:** 12B **Elev./Depth:** 104.5-106.8'

CONSOLIDATION TEST REPORT ASTM D2435-96 Test Method B

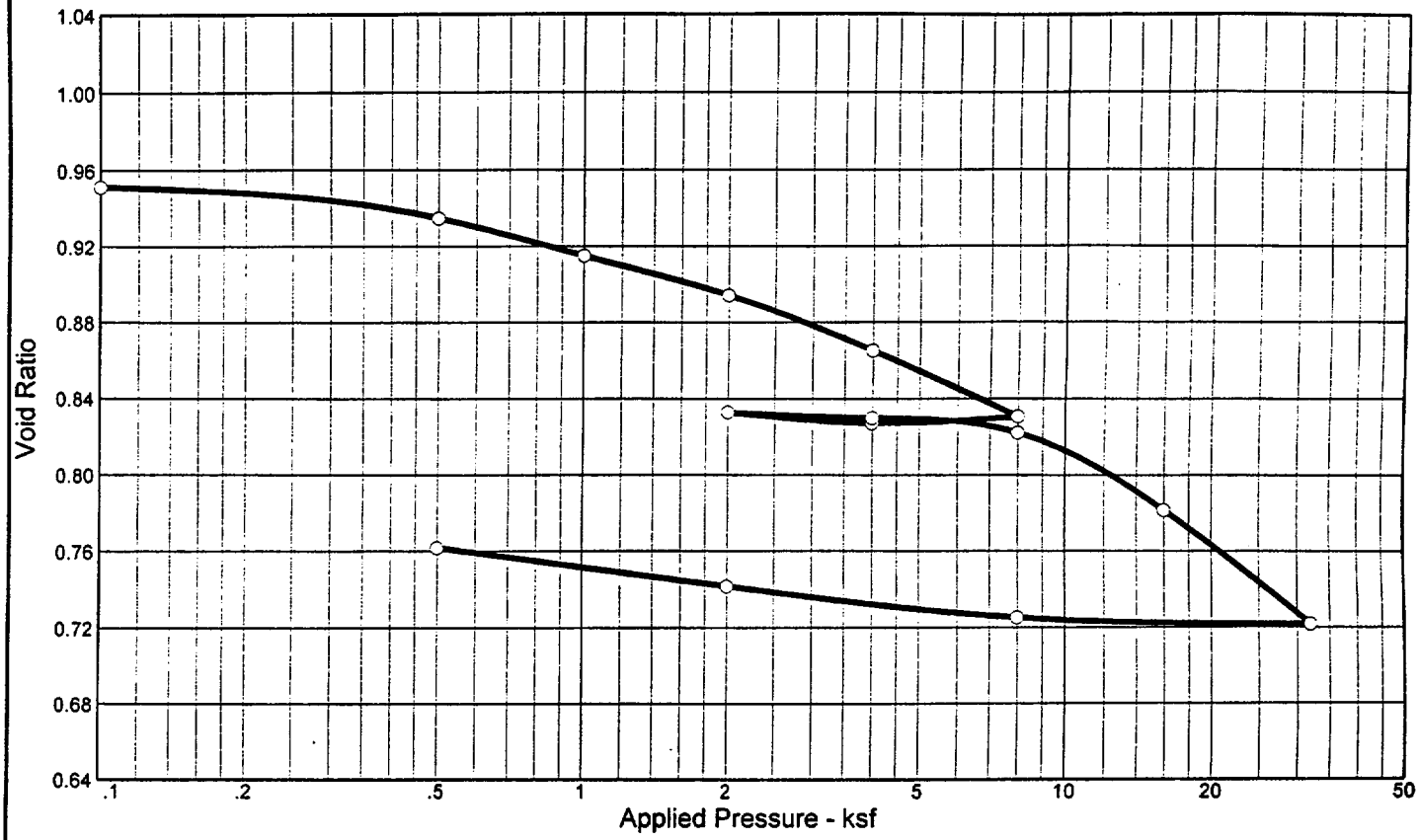
LAW ENGINEERING & ENVIRONMENTAL SERVICES, INC.

Remarks:

Tested by: JTM Reviewed by: HJ

Plate

CONSOLIDATION TEST REPORT ASTM D2435-96 Test Method B



Coefficients of Consolidation

No.	Load (ksf)	C_v (ft.2/day)	No.	Load (ksf)	C_v (ft.2/day)	No.	Load (ksf)	C_v (ft.2/day)
1	0.10	0.31	11	16.00	0.78			
2	0.50	0.43	12	32.00	0.71			
3	1.00	0.24	13	8.00	1.23			
4	2.00	0.84	14	2.00	0.58			
5	4.00	0.82	15	0.50	0.34			
6	8.00	0.82						
7	4.00	0.58						
8	2.00	0.42						
9	4.00	0.91						
10	8.00	1.38						

Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	P_c (ksf)	C_c	Initial Void Ratio
Saturation	Moisture							
88.9 %	31.4 %	86.3	44	18	2.7	9.96	0.20	0.953

MATERIAL DESCRIPTION	USCS	AASHTO
Yellow Clayey sand	SC	A-2-7(0)

Project No. 5016003963 **Client:** Duke Cogema Stone & Webster (DCS)

Project: MOX Fuel Fabrication Facility

Source: Boring BH-12 **Sample No.:** 19 (top) **Elev./Depth:** 138-140'

CONSOLIDATION TEST REPORT ASTM D2435-96 Test Method B

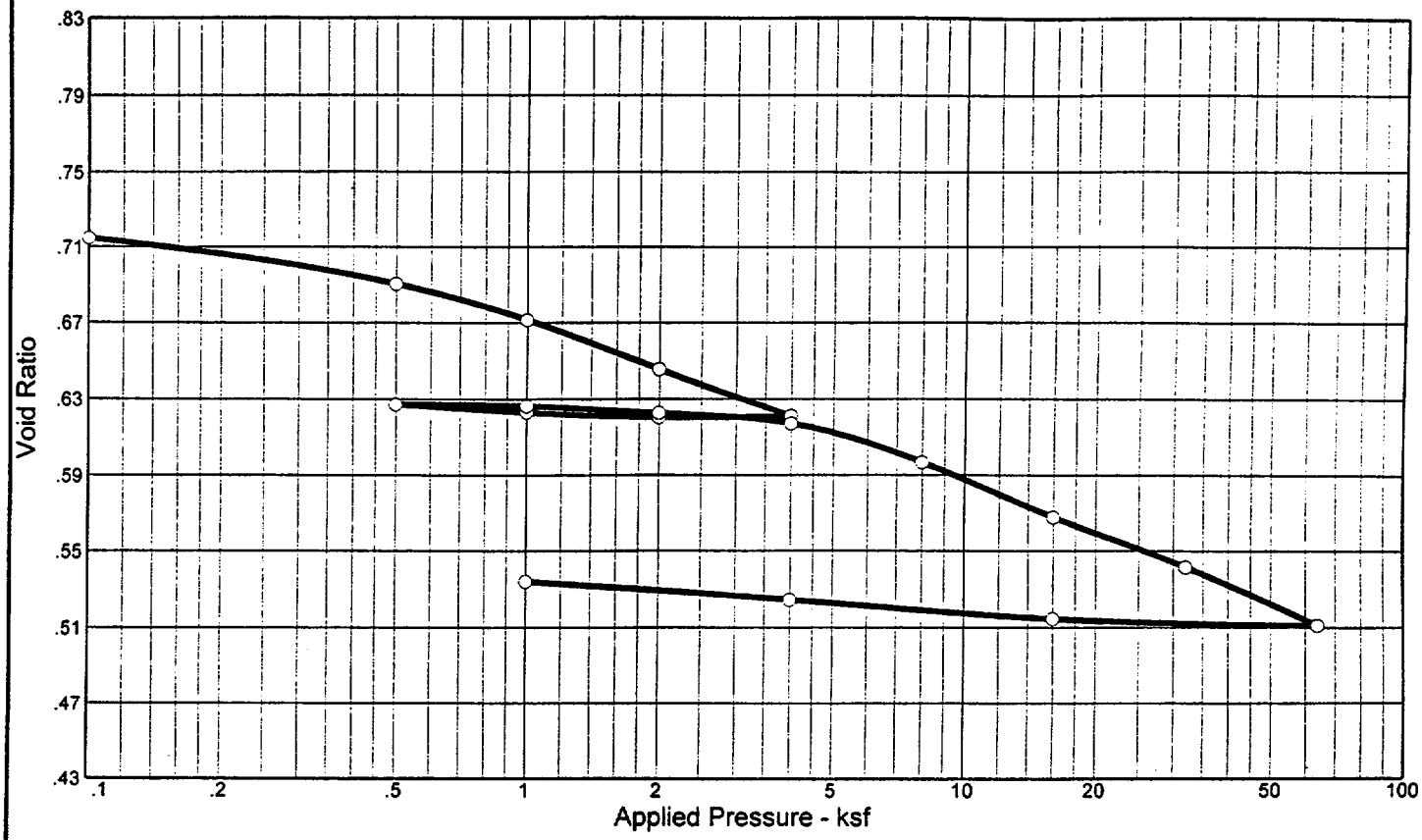
LAW ENGINEERING & ENVIRONMENTAL SERVICES, INC.

Remarks:

Tested by: JTM Reviewed by: HJ

Plate

CONSOLIDATION TEST REPORT ASTM D2435-96 Test Method B



Coefficients of Consolidation								
No.	Load (ksf)	C_v (ft.^{2}/day)	No.	Load (ksf)	C_v (ft.^{2}/day)	No.	Load (ksf)	C_v (ft.^{2}/day)
1	0.10	0.11	11	4.00	1.50			
2	0.50	5.19	12	8.00	2.61			
3	1.00	1.49	13	16.00	1.23			
4	2.00	1.52	14	32.00	0.69			
5	4.00	0.80	15	64.00	1.19			
6	2.00	0.72	16	16.00	2.17			
7	1.00	2.87	17	4.00	2.19			
8	0.50	0.35	18	1.00	3.92			
9	1.00	5.70						
10	2.00	0.60						

Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	P_c (ksf)	C_c	Initial Void Ratio
Saturation	Moisture							
75.1 %	20.2 %	97.7	39	16	2.7			0.725

MATERIAL DESCRIPTION	USCS	AASHTO
Tan Clayey sand	SC	A-2-6(1)

Project No. 5016003963 **Client:** Duke Cogema Stone & Webster (DCS)

Project: MOX Fuel Fabrication Facility

Source: Boring BH-13 **Sample No.:** 12B (top) **Elev./Depth:** 70-71.2'

CONSOLIDATION TEST REPORT ASTM D2435-96 Test Method B

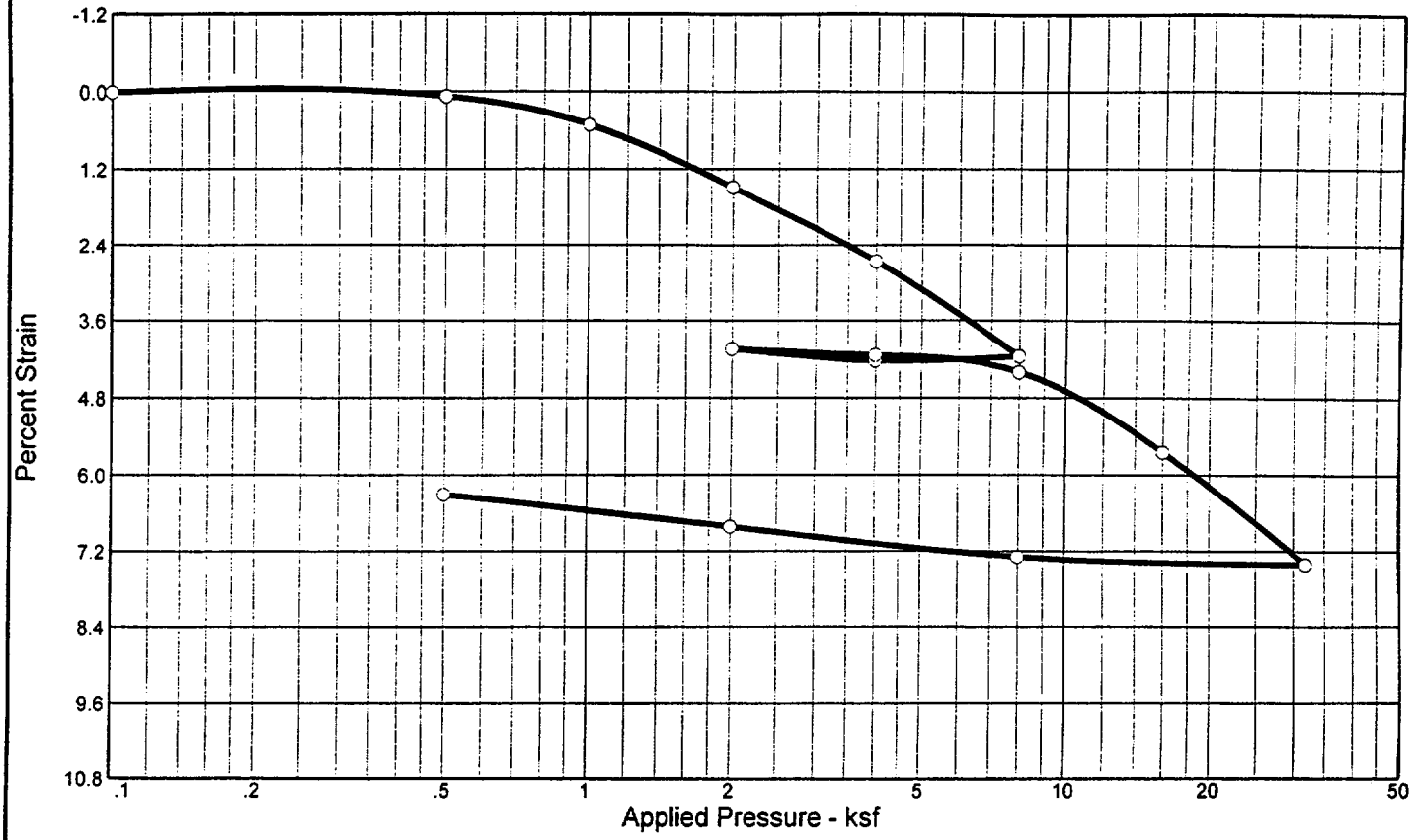
LAW ENGINEERING & ENVIRONMENTAL SERVICES, INC.

Remarks:

Tested by: JTM Reviewed by: HJ

Plate

CONSOLIDATION TEST REPORT ASTM D2435-96 Test Method B



Coefficients of Consolidation								
No.	Load (ksf)	C_v (ft.^{2}/day)	No.	Load (ksf)	C_v (ft.^{2}/day)	No.	Load (ksf)	C_v (ft.^{2}/day)
1	0.10	16.03	11	16.00	0.73			
2	0.50	2.81	12	32.00	1.40			
3	1.00	3.02	13	8.00	1.02			
4	2.00	2.95	14	2.00	2.05			
5	4.00	2.88	15	0.50	5.89			
6	8.00	1.48						
7	4.00	5.88						
8	2.00	0.77						
9	4.00	5.89						
10	8.00	0.67						

Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	P_c (ksf)	C_c	Initial Void Ratio
Saturation	Moisture							
81.1 %	21.8 %	97.6	52	21	2.7	2.71	0.10	0.727

MATERIAL DESCRIPTION	USCS	AASHTO
Tan Poorly graded sand with silt	SP-SM	A-2-7(0)

Project No. 5016003963 **Client:** Duke Cogema Stone & Webster (DCS)

Project: MOX Fuel Fabrication Facility

Source: Boring BH-13 **Sample No.:** 15B bot **Elev./Depth:** 85-87'

CONSOLIDATION TEST REPORT ASTM D2435-96 Test Method B

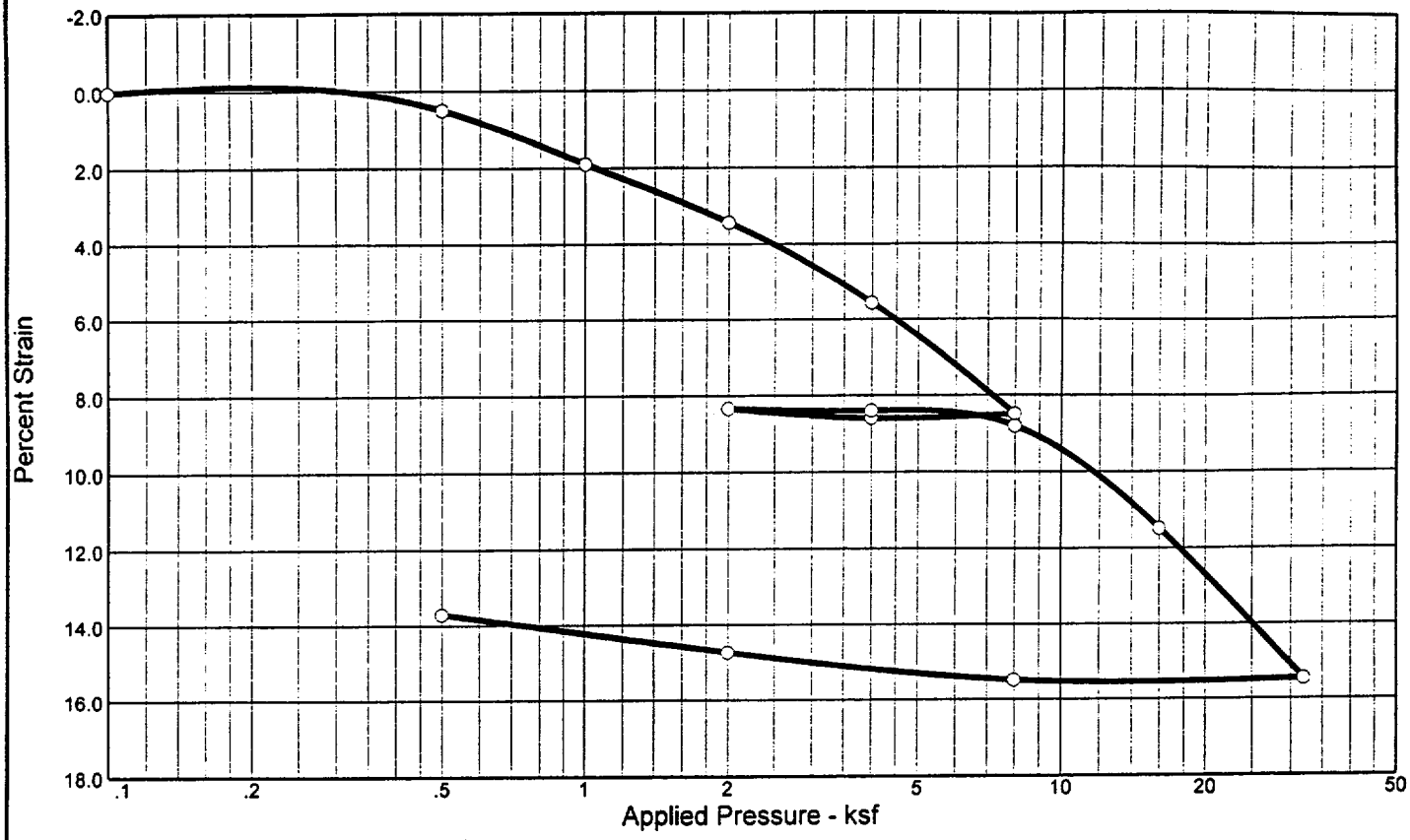
LAW ENGINEERING & ENVIRONMENTAL SERVICES, INC.

Remarks:

Tested by: JTM Reviewed by: HJ

Plate

CONSOLIDATION TEST REPORT ASTM D2435-96 Test Method B



Coefficients of Consolidation								
No.	Load (ksf)	C_v (ft.2/day)	No.	Load (ksf)	C_v (ft.2/day)	No.	Load (ksf)	C_v (ft.2/day)
1	0.10	0.41	11	16.00	2.36			
2	0.50	2.77	12	32.00	2.26			
3	1.00	1.54	13	8.00	2.45			
4	2.00	0.76	14	2.00	1.18			
5	4.00	1.46	15	0.50	0.59			
6	8.00	2.54						
7	4.00	5.35						
8	2.00	2.36						
9	4.00	5.38						
10	8.00	1.29						

Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	P_c (ksf)	C_c	Initial Void Ratio
Saturation	Moisture							
77.3 %	28.0 %	85.3	50	23	2.7	3.12	0.26	0.977

MATERIAL DESCRIPTION	USCS	AASHTO
Yellow Brown Clayey sand	SC	A-2-7(0)

Project No. 5016003963 **Client:** Duke Cogema Stone & Webster (DCS)

Project: MOX Fuel Fabrication Facility

Source: Boring BH-13 **Sample No.:** 18B Bot **Elev./Depth:** 100-101.2'

CONSOLIDATION TEST REPORT ASTM D2435-96 Test Method B

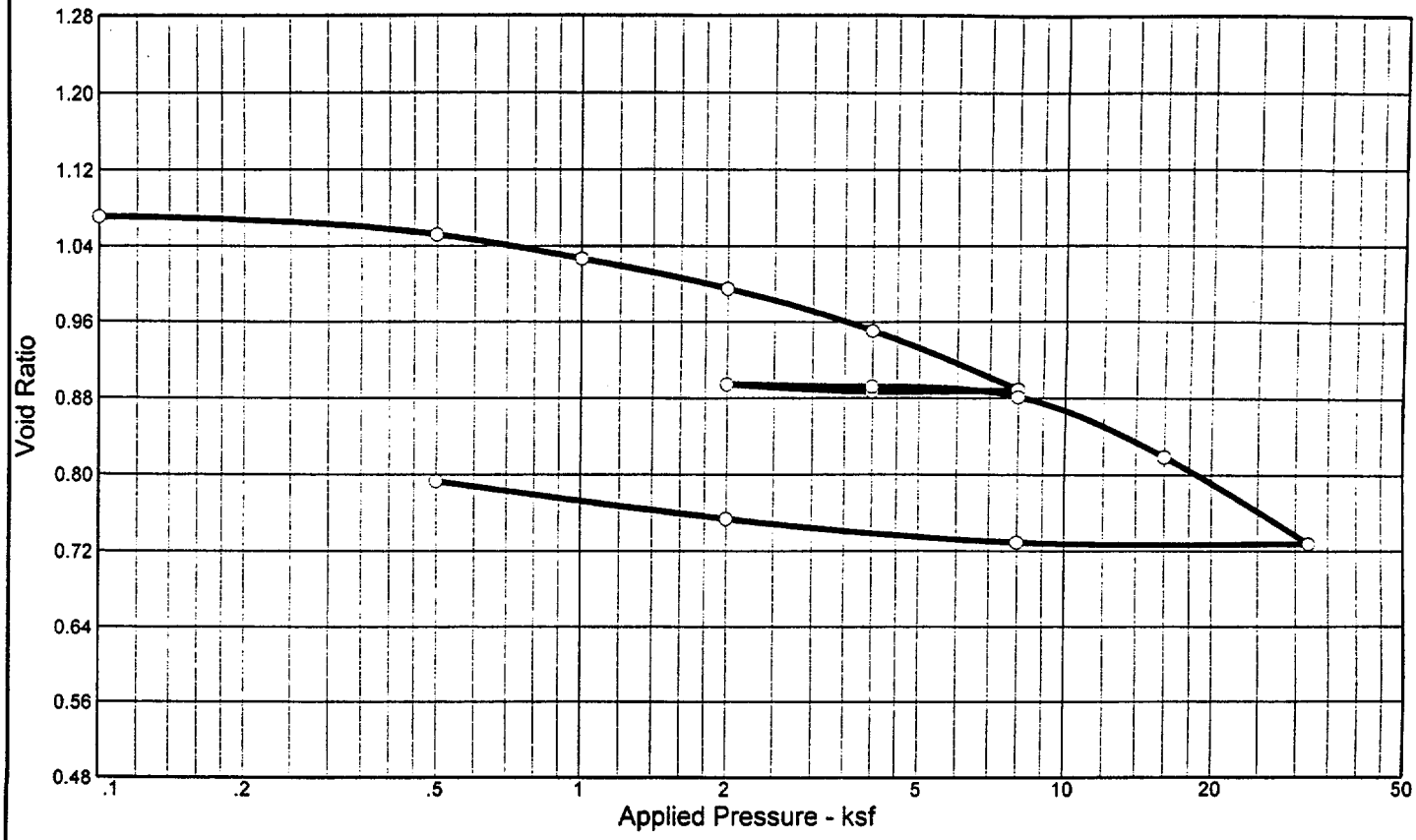
LAW ENGINEERING & ENVIRONMENTAL SERVICES, INC.

Remarks:

Tested by: JTM Reviewed by: HJ

Plate

CONSOLIDATION TEST REPORT ASTM D2435-96 Test Method B



Coefficients of Consolidation								
No.	Load (ksf)	C_v (ft.2/day)	No.	Load (ksf)	C_v (ft.2/day)	No.	Load (ksf)	C_v (ft.2/day)
1	0.10	0.89	11	16.00	0.62			
2	0.50	0.72	12	32.00	0.33			
3	1.00	0.46	13	8.00	0.55			
4	2.00	0.76	14	2.00	0.14			
5	4.00	1.60	15	0.50	0.04			
6	8.00	0.41						
7	4.00	0.79						
8	2.00	0.41						
9	4.00	0.79						
10	8.00	0.78						

Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	P_c (ksf)	C_c	Initial Void Ratio
Saturation	Moisture							
89.3 %	35.5 %	81.3	62	36	2.7	7.12	0.31	1.073

MATERIAL DESCRIPTION	USCS	AASHTO
Yellow Clayey sand	SC	A-2-7(3)

Project No. 5016003963 **Client:** Duke Cogema Stone & Webster (DCS)

Project: MOX Fuel Fabrication Facility

Source: Boring BH-13 **Sample No.:** 23B **Elev./Depth:** 125-127'

Remarks:

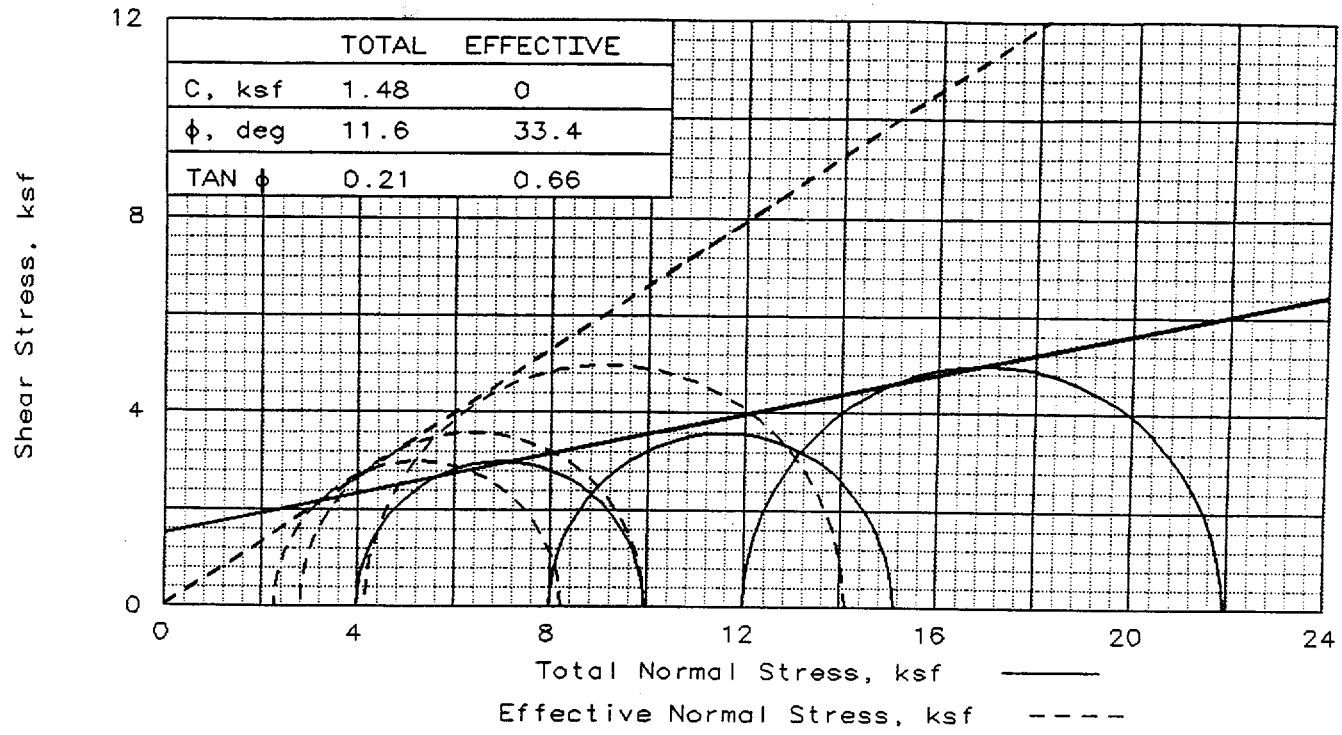
Tested by: JTM Reviewed by: HJ

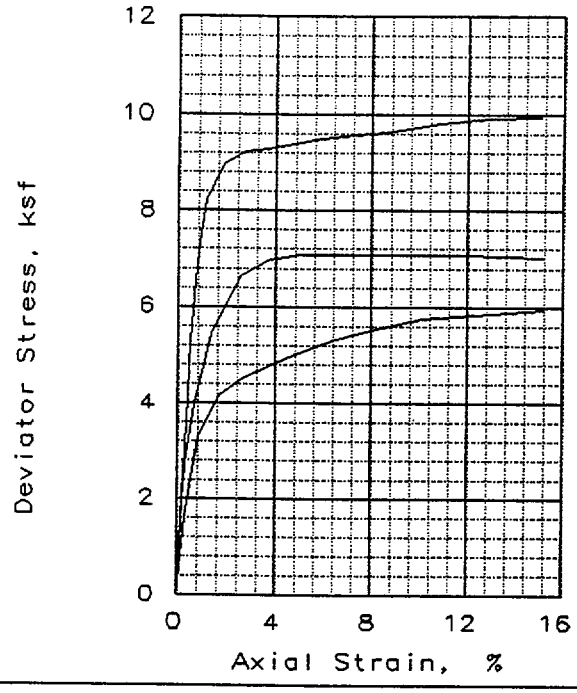
CONSOLIDATION TEST REPORT ASTM D2435-96 Test Method B

LAW ENGINEERING & ENVIRONMENTAL SERVICES, INC.

Plate

TRIAXIAL SHEAR TESTS





SAMPLE NO.:		1	2	3
INITIAL	WATER CONTENT, %	24.7	20.1	22.5
	DRY DENSITY, pcf	96.4	102.7	96.5
	SATURATION, %	89.3	84.5	81.3
	VOID RATIO	0.748	0.641	0.747
	DIAMETER, in	2.85	2.85	2.86
	HEIGHT, in	5.99	5.97	5.99
AT TEST	WATER CONTENT, %	25.5	22.5	24.5
	DRY DENSITY, pcf	99.8	104.8	101.4
	SATURATION, %	100.0	99.7	100.0
	VOID RATIO	0.689	0.608	0.663
	DIAMETER, in	2.82	2.83	2.81
	HEIGHT, in	5.91	5.93	5.89
Strain rate, %/min		0.10	0.10	0.10
BACK PRESSURE, ksf		2.9	3.0	3.0
CELL PRESSURE, ksf		10.9	7.0	15.0
FAIL. STRESS, ksf		7.1	5.9	9.9
TOTAL PORE PR., ksf		8.1	4.7	10.8
ULT. STRESS, ksf				
TOTAL PORE PR., ksf				
$\bar{\sigma}_1$ FAILURE, ksf		10.0	8.2	14.1
$\bar{\sigma}_3$ FAILURE, ksf		2.8	2.3	4.2

TYPE OF TEST:
CU with Pore Pressures
SAMPLE TYPE: Ud
DESCRIPTION: Tan Brown Clayey Sand
LL= 43 PL= 20 PI= 23
SPECIFIC GRAVITY= 2.7
REMARKS: Tested by: DMJ

Reviewed by: HS

Fig. No.: _____

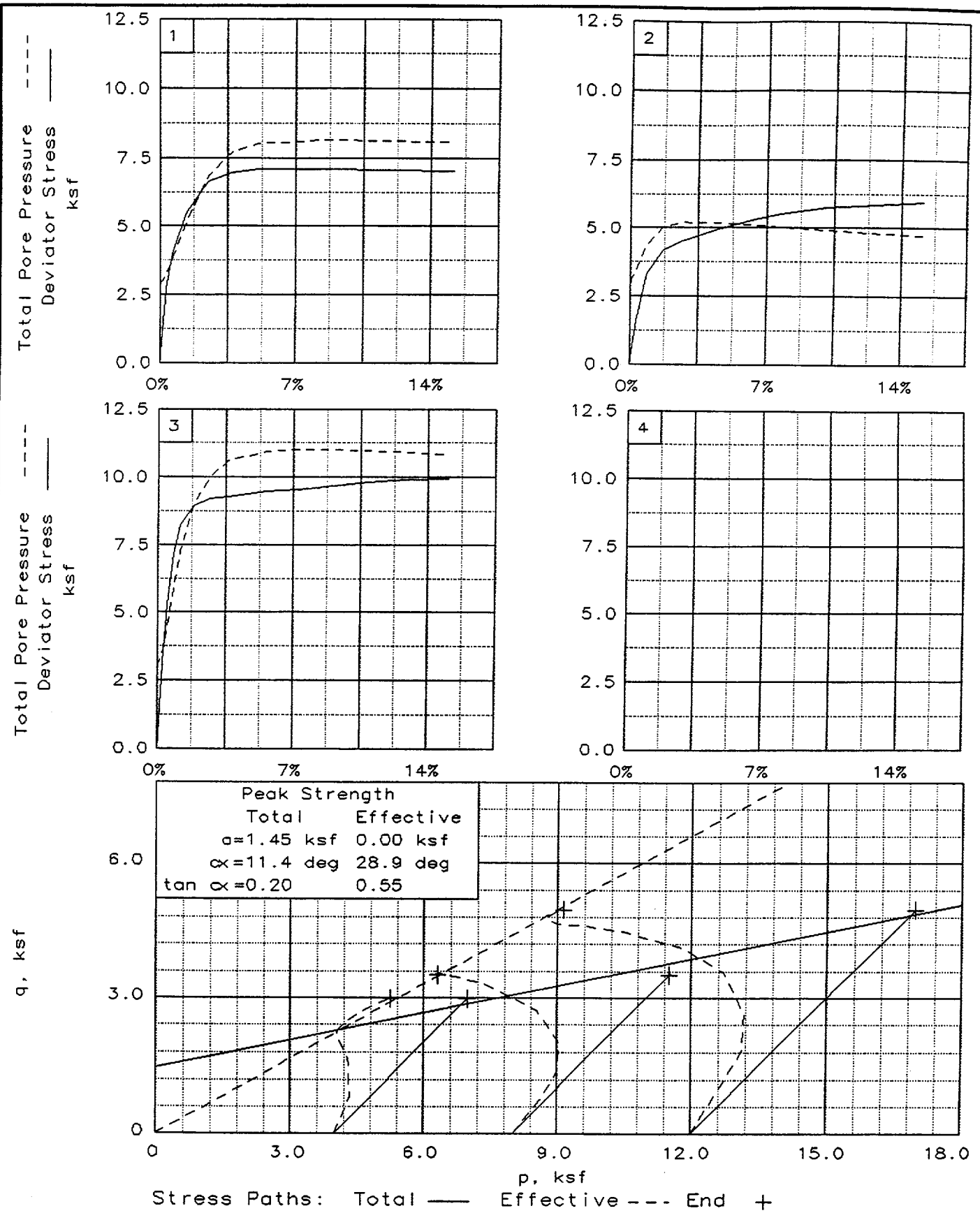
CLIENT: Duke Cogema Stone & Webster

PROJECT: MOX Fuel Fabrication Facility

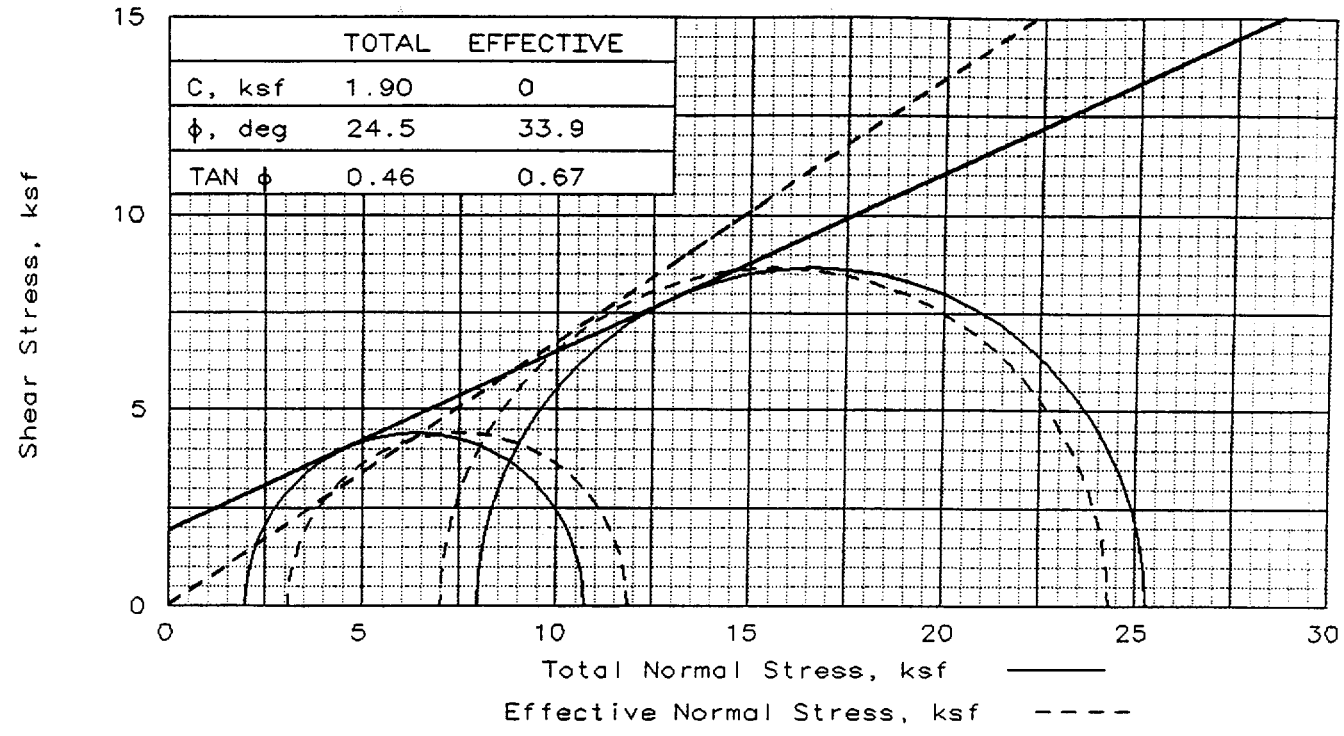
SAMPLE LOCATION: BH-1 Ud-12B @ 62-64'

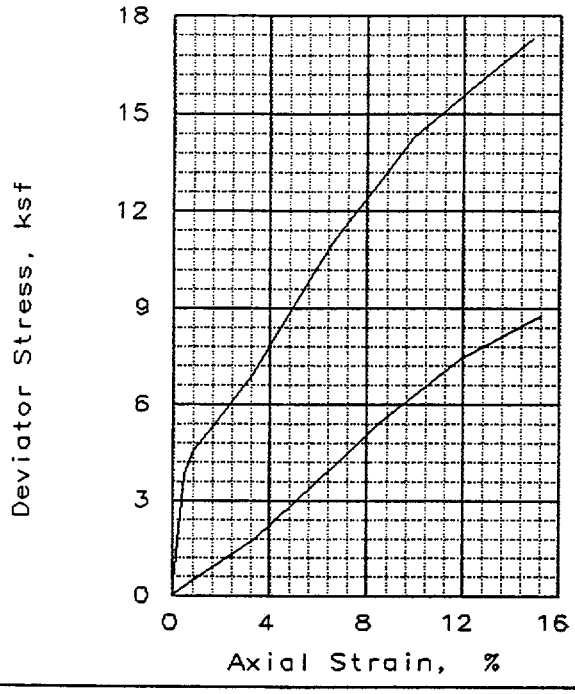
PROJ. NO.: 50160-0-3963 DATE: Dec.22,2000

TRIAXIAL SHEAR TEST REPORT
LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.



Client: Duke Cogema Stone & Webster
Project: MOX Fuel Fabrication Facility
Location: BH-1 Ud-12B @ 62-64'
File: 3963 Project No.: 50160-0-3963 Fig. No.: ____





SAMPLE NO.:		1	2
INITIAL	WATER CONTENT, %	5.7	5.6
	DRY DENSITY, pcf	100.8	96.4
	SATURATION, %	23.0	20.3
	VOID RATIO	0.672	0.749
	DIAMETER, in	2.83	2.87
	HEIGHT, in	5.98	6.10
AT TEST	WATER CONTENT, %	23.3	26.1
	DRY DENSITY, pcf	103.5	98.8
	SATURATION, %	100.0	99.9
	VOID RATIO	0.629	0.707
	DIAMETER, in	2.81	2.85
	HEIGHT, in	5.90	6.05
Strain rate, %/min		0.10	0.10
BACK PRESSURE, ksf		5.7	5.8
CELL PRESSURE, ksf		7.7	13.8
FAIL. STRESS, ksf		8.8	17.3
TOTAL PORE PR., ksf		4.6	6.8
ULT. STRESS, ksf			
TOTAL PORE PR., ksf			
$\bar{\sigma}_1$ FAILURE, ksf		11.9	24.3
$\bar{\sigma}_3$ FAILURE, ksf		3.1	7.0

TYPE OF TEST:
CU with Pore Pressures
SAMPLE TYPE: Ud
DESCRIPTION: Tan Brown Clayey Sand

SPECIFIC GRAVITY= 2.7
REMARKS: Tested by: DMJ

Reviewed by: HJ

Fig. No.: _____

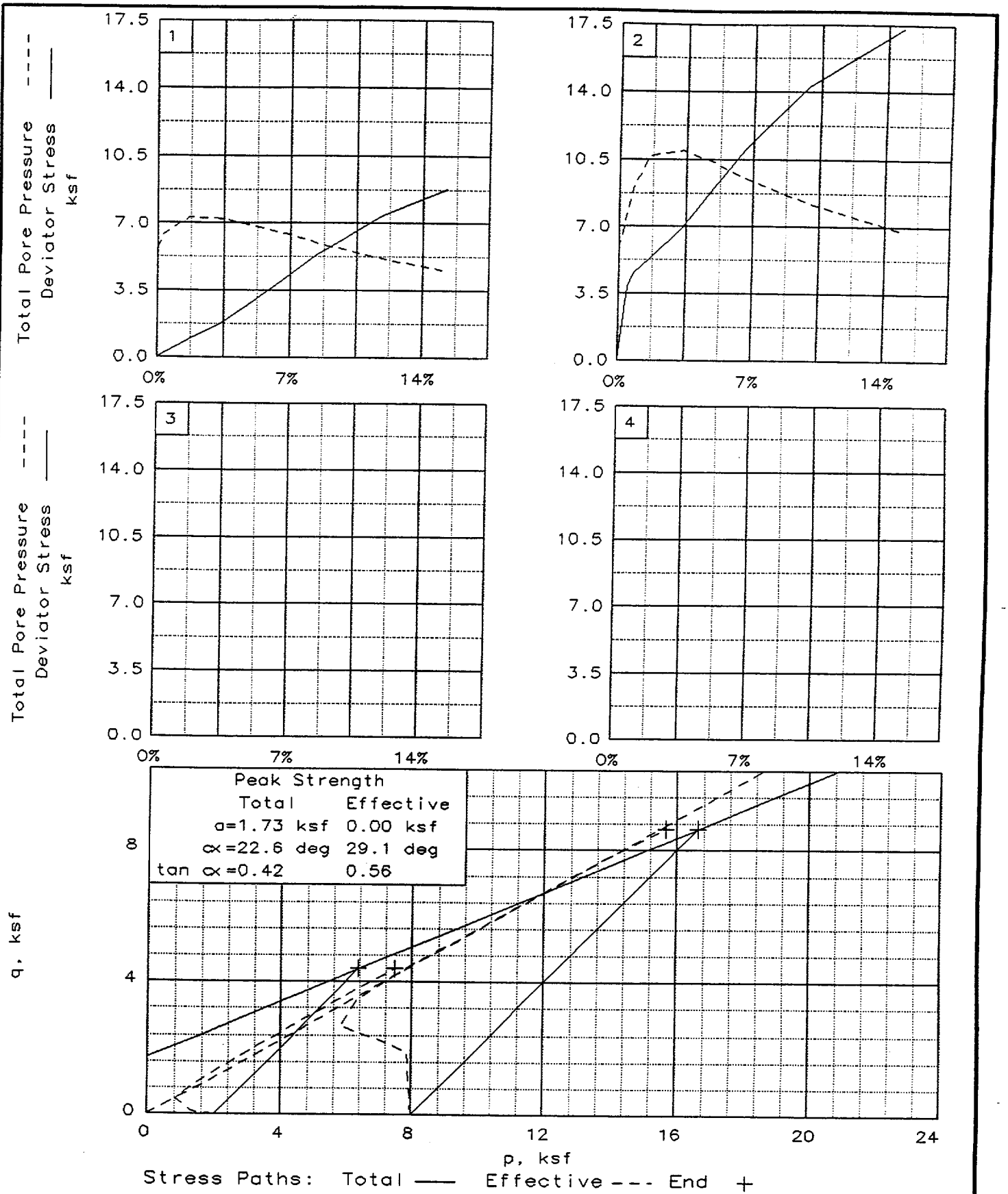
CLIENT: Duke Cogema Stone & Webster

PROJECT: MOX Fuel Fabricarion Facility

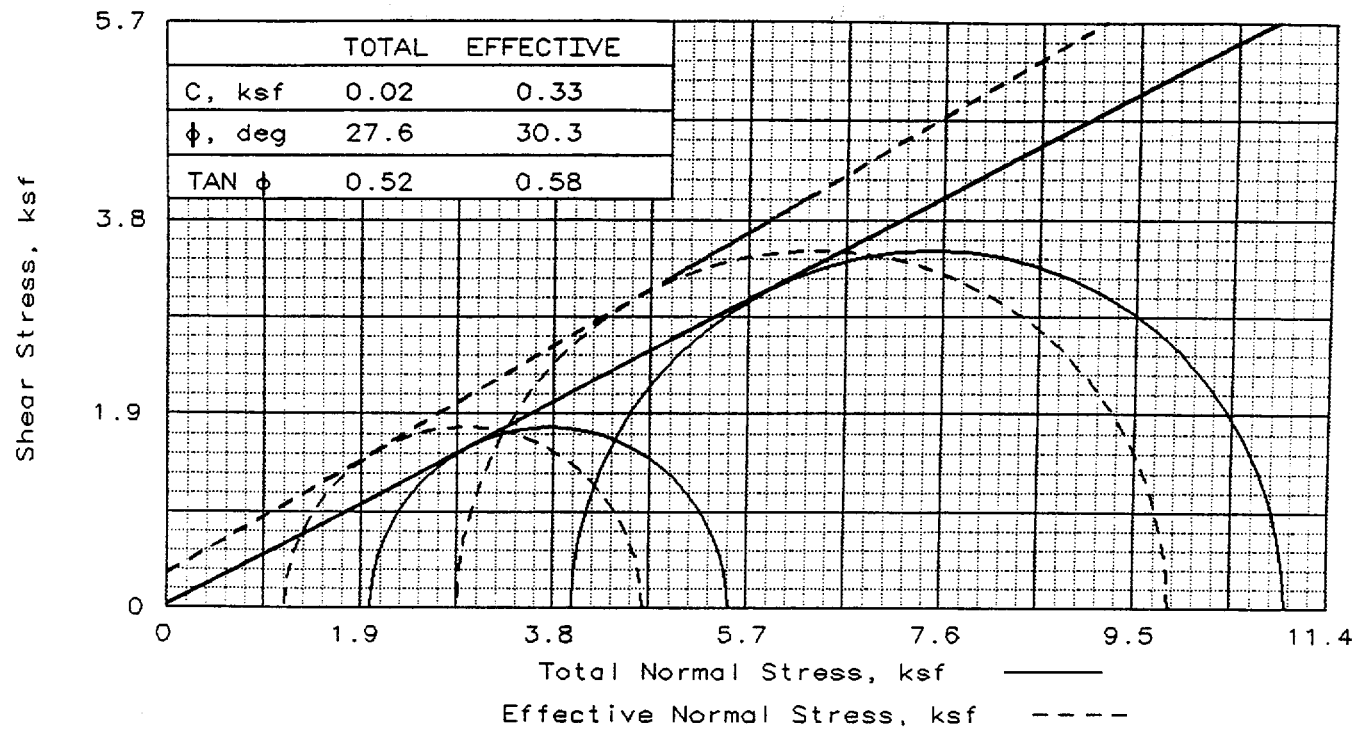
SAMPLE LOCATION: BH-2 Ud-5B @ 24-26'

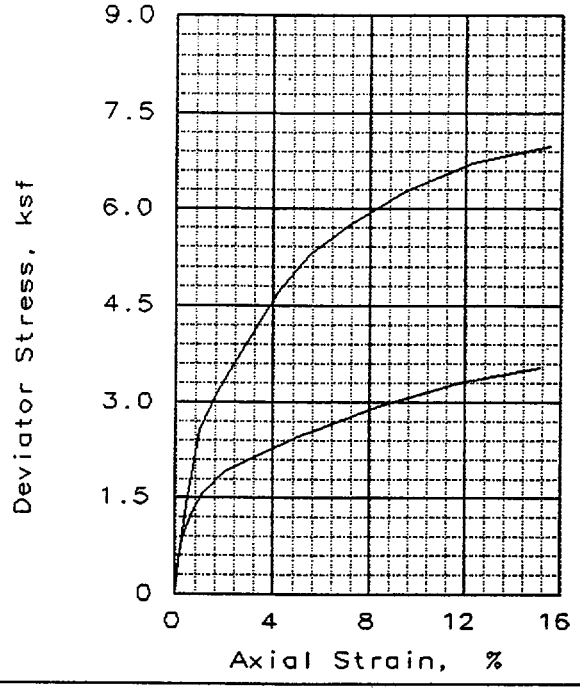
PROJ. NO.: 50160-0-3963 DATE: Dec.22,2000

TRIAXIAL SHEAR TEST REPORT
LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.



Client: Duke Cogema Stone & Webster
Project: MOX Fuel Fabricarion Facility
Location: BH-2 Ud-5B @ 24-26'
File: 3963F Project No.: 50160-0-3963 Fig. No.: ____





SAMPLE NO.:		1	2
INITIAL	WATER CONTENT, %	20.4	20.7
	DRY DENSITY, pcf	99.5	101.1
	SATURATION, %	79.3	83.7
	VOID RATIO	0.693	0.666
	DIAMETER, in	2.87	2.87
	HEIGHT, in	5.97	5.98
AT TEST	WATER CONTENT, %	25.3	23.5
	DRY DENSITY, pcf	100.1	103.2
	SATURATION, %	100.0	100.0
	VOID RATIO	0.684	0.634
	DIAMETER, in	2.86	2.85
	HEIGHT, in	5.95	5.94
Strain rate, %/min		0.10	0.10
BACK PRESSURE, ksf		2.71	2.94
CELL PRESSURE, ksf		4.71	6.94
FAIL. STRESS, ksf		3.53	6.99
TOTAL PORE PR., ksf		3.54	4.08
ULT. STRESS, ksf			
TOTAL PORE PR., ksf			
$\bar{\sigma}_1$ FAILURE, ksf		4.70	9.85
$\bar{\sigma}_3$ FAILURE, ksf		1.16	2.86

TYPE OF TEST:
CU with Pore Pressures
SAMPLE TYPE: Ud
DESCRIPTION: Tan Brown Clayey Sand
LL= 112 PL= 48 PI= 64
SPECIFIC GRAVITY= 2.7
REMARKS: Tested by: DMS

Reviewed by: HJ

Fig. No.: _____

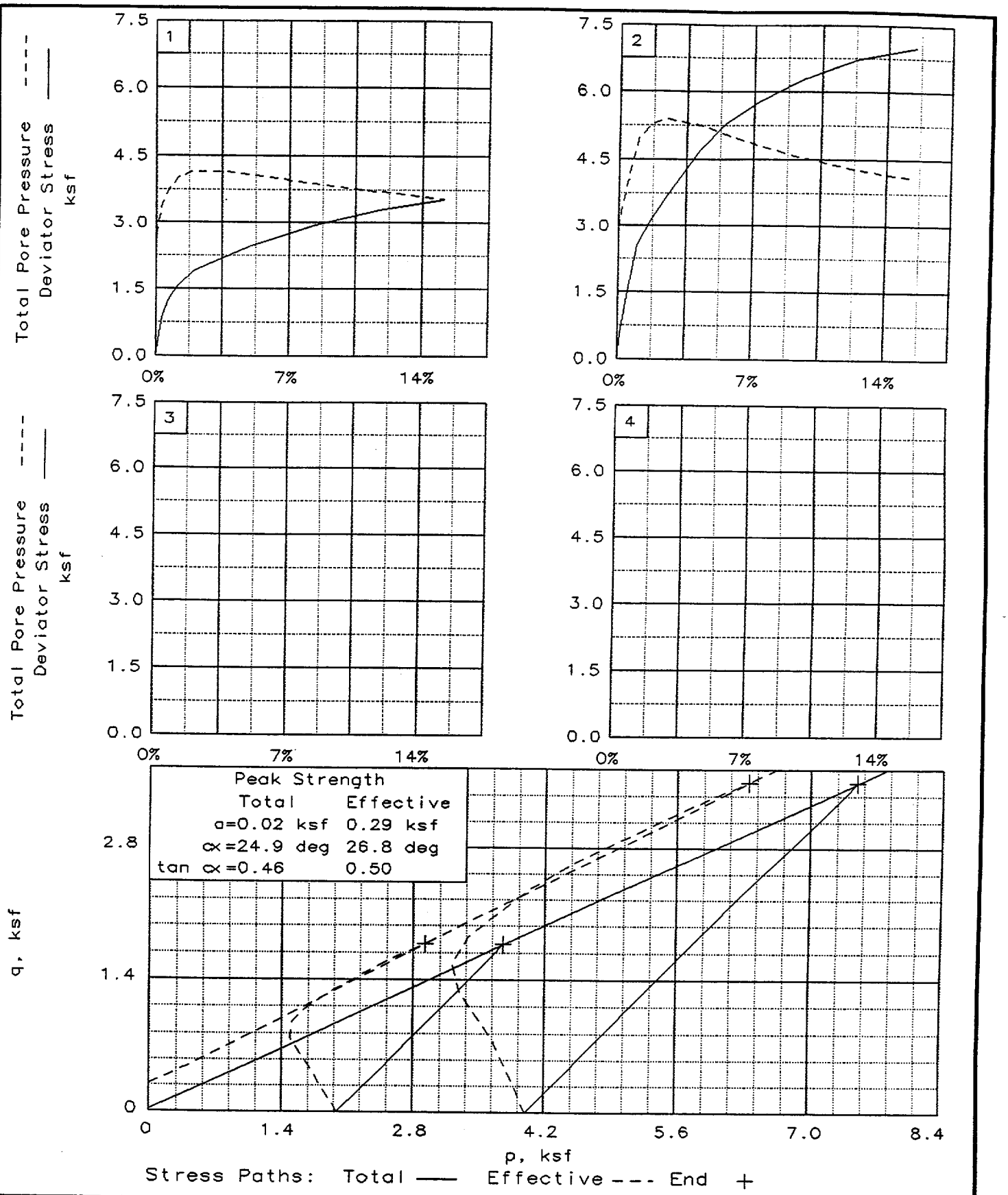
CLIENT: Duke Cogema Stone & Webster

PROJECT: MOX Fuel Fabricarion Facility

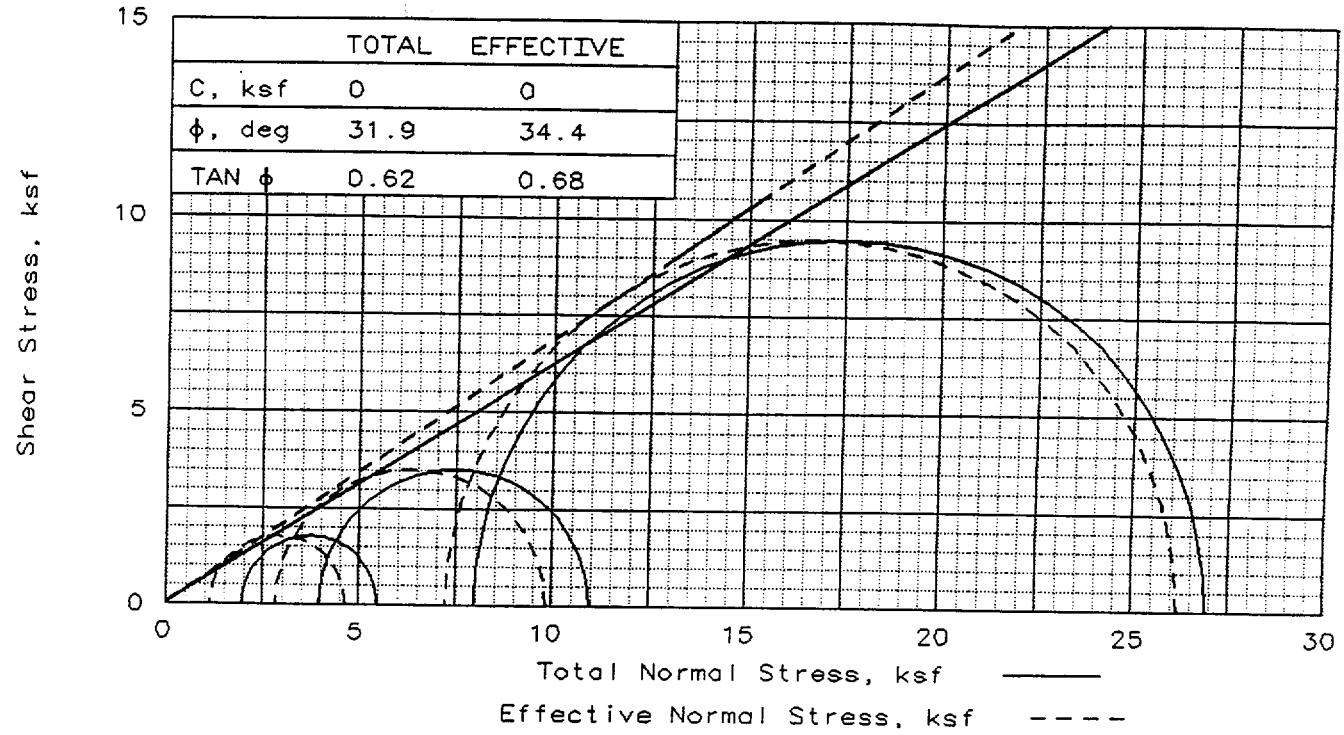
SAMPLE LOCATION: BH-5 Ud-8 @ 38.0-39.1'

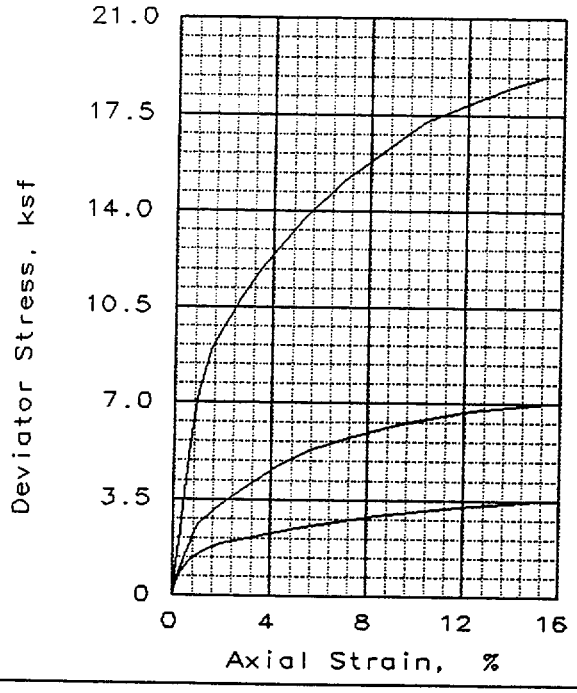
PROJ. NO.: 50160-0-3963 DATE: Dec.22,2000

TRIAXIAL SHEAR TEST REPORT
LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.



Client: Duke Cogema Stone & Webster
Project: MOX Fuel Fabricarion Facility
Location: BH-5 Ud-8 @ 38.0-39.1'
File: 3963A Project No.: 50160-0-3963 Fig. No.: ____





SAMPLE NO.:		1	2	3
INITIAL	WATER CONTENT, %	20.4	20.7	18.0
	DRY DENSITY, pcf	99.5	101.2	101.3
	SATURATION, %	79.3	83.8	73.0
	VOID RATIO	0.693	0.666	0.665
	DIAMETER, in	2.87	2.87	2.87
	HEIGHT, in	5.97	5.98	6.00
AT TEST	WATER CONTENT, %	25.8	23.5	23.0
	DRY DENSITY, pcf	99.3	103.2	104.0
	SATURATION, %	100.0	100.0	100.0
	VOID RATIO	0.697	0.634	0.620
	DIAMETER, in	2.87	2.85	2.85
	HEIGHT, in	5.95	5.94	5.94
Strain rate, %/min		0.10	0.10	0.10
BACK PRESSURE, ksf		2.7	2.9	2.9
CELL PRESSURE, ksf		4.7	6.9	10.9
FAIL. STRESS, ksf		3.5	7.0	18.9
TOTAL PORE PR., ksf		3.5	4.1	3.6
ULT. STRESS, ksf				
TOTAL PORE PR., ksf				
$\bar{\sigma}_1$ FAILURE, ksf		4.7	9.9	26.2
$\bar{\sigma}_3$ FAILURE, ksf		1.2	2.9	7.3

TYPE OF TEST:
CU with Pore Pressures
SAMPLE TYPE: Ud
DESCRIPTION: Tan Brown Clayey Sand
LL= 112 PL= 48 PI= 64
SPECIFIC GRAVITY= 2.7
REMARKS: Tested by: DMJ

Reviewed by: HJ

Fig. No.: _____

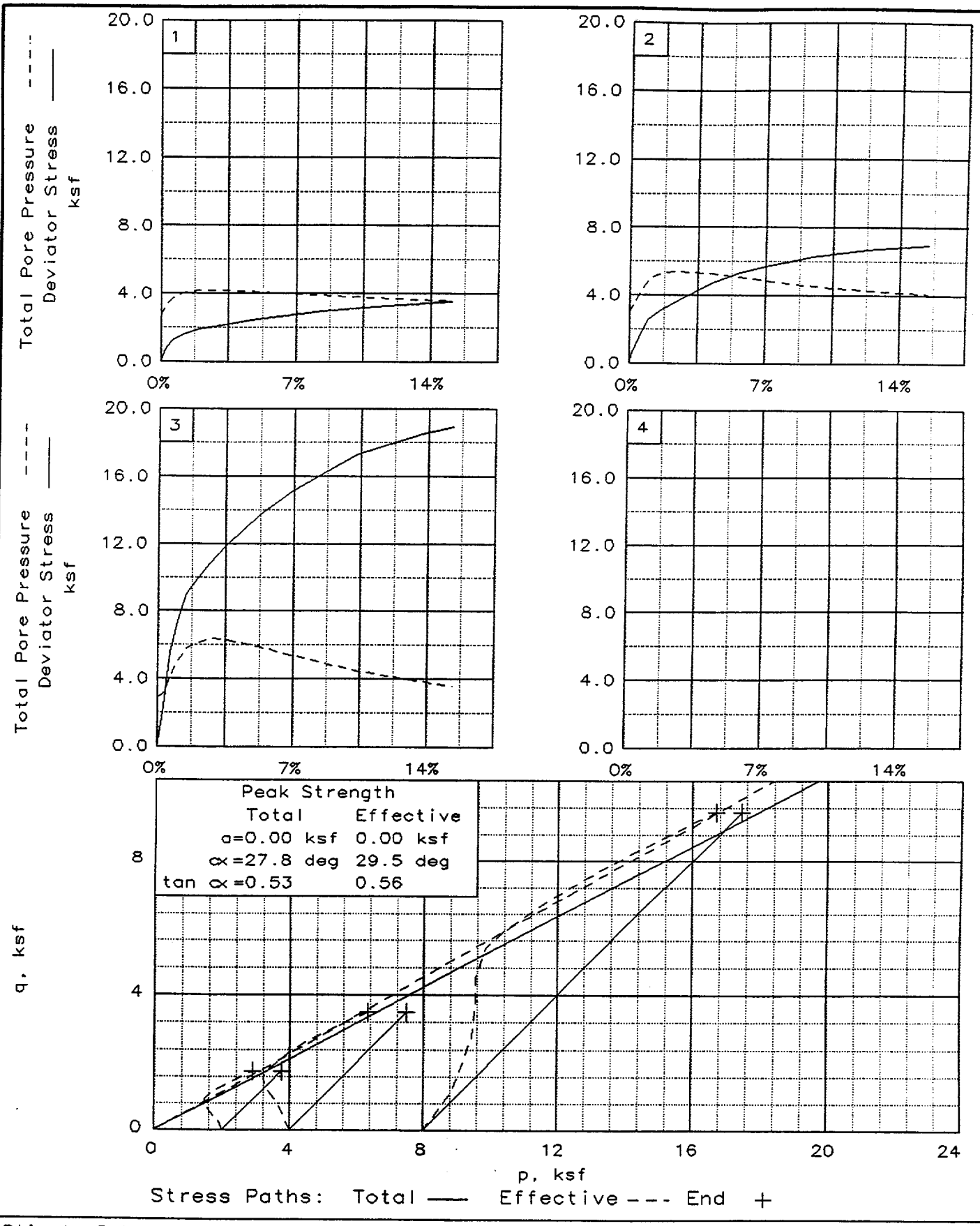
CLIENT: Duke Cogema Stone & Webster

PROJECT: MOX Fuel Fabricarion Facility

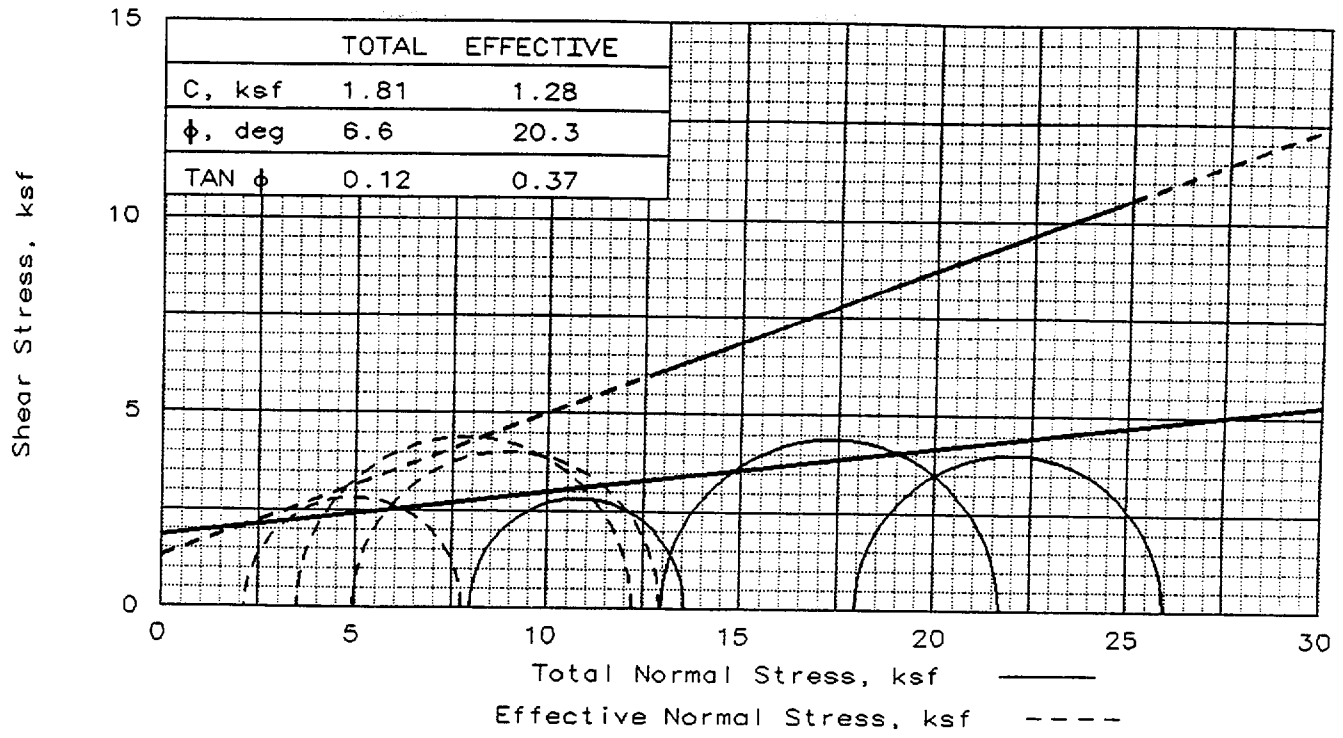
SAMPLE LOCATION: BH-5 Ud-8 @ 38.0-39.1'

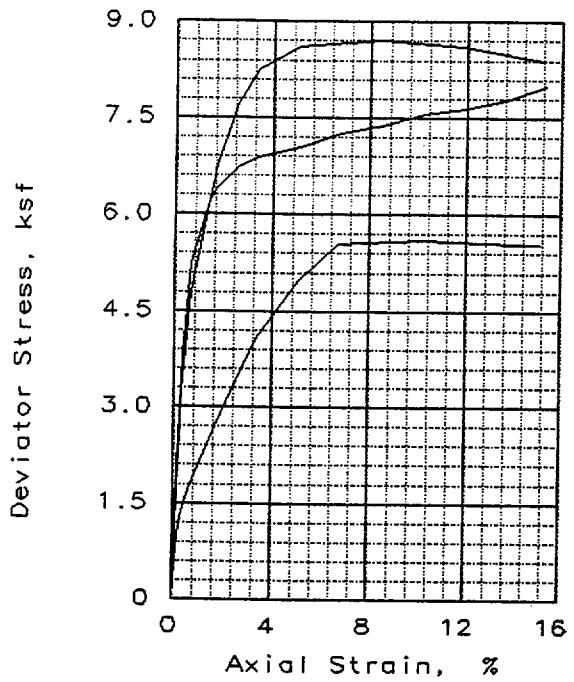
PROJ. NO.: 50160-0-3963 DATE: Dec.22,2000

TRIAXIAL SHEAR TEST REPORT
LAW ENGINEERING
AND ENVIRONMENTAL SERVICES, INC.



Client: Duke Cogema Stone & Webster
Project: MOX Fuel Fabricarion Facility
Location: BH-5 Ud-8 @ 38.0-39.1'
File: 3963AA Project No.: 50160-0-3963 Fig. No.: ____





SAMPLE NO.:		1	2	3
INITIAL	WATER CONTENT, %	27.8	26.8	28.5
	DRY DENSITY, pcf	94.6	96.6	89.3
	SATURATION, %	96.1	97.1	86.6
	VOID RATIO	0.782	0.745	0.888
	DIAMETER, in	2.87	2.87	2.88
	HEIGHT, in	5.98	5.98	5.97
AT TEST	WATER CONTENT, %	28.6	26.1	29.6
	DRY DENSITY, pcf	95.1	98.9	93.7
	SATURATION, %	100.0	100.0	100.0
	VOID RATIO	0.772	0.704	0.799
	DIAMETER, in	2.87	2.85	2.83
	HEIGHT, in	5.94	5.92	5.87
Strain rate, %/min		0.10	0.10	0.10
BACK PRESSURE, ksf		4.3	4.4	4.5
CELL PRESSURE, ksf		12.3	17.4	22.5
FAIL. STRESS, ksf		5.6	8.7	8.0
TOTAL PORE PR., ksf		10.2	13.9	17.6
ULT. STRESS, ksf				
TOTAL PORE PR., ksf				
$\bar{\sigma}_1$ FAILURE, ksf		7.8	12.2	13.0
$\bar{\sigma}_3$ FAILURE, ksf		2.2	3.5	5.0

TYPE OF TEST:
CU with Pore Pressures
SAMPLE TYPE: Ud
DESCRIPTION: Tan Brown Clayey Sand
LL= 61 PL= 25 PI= 36
SPECIFIC GRAVITY= 2.7
REMARKS: Tested by: MM

Reviewed by: HJ

Fig. No.: _____

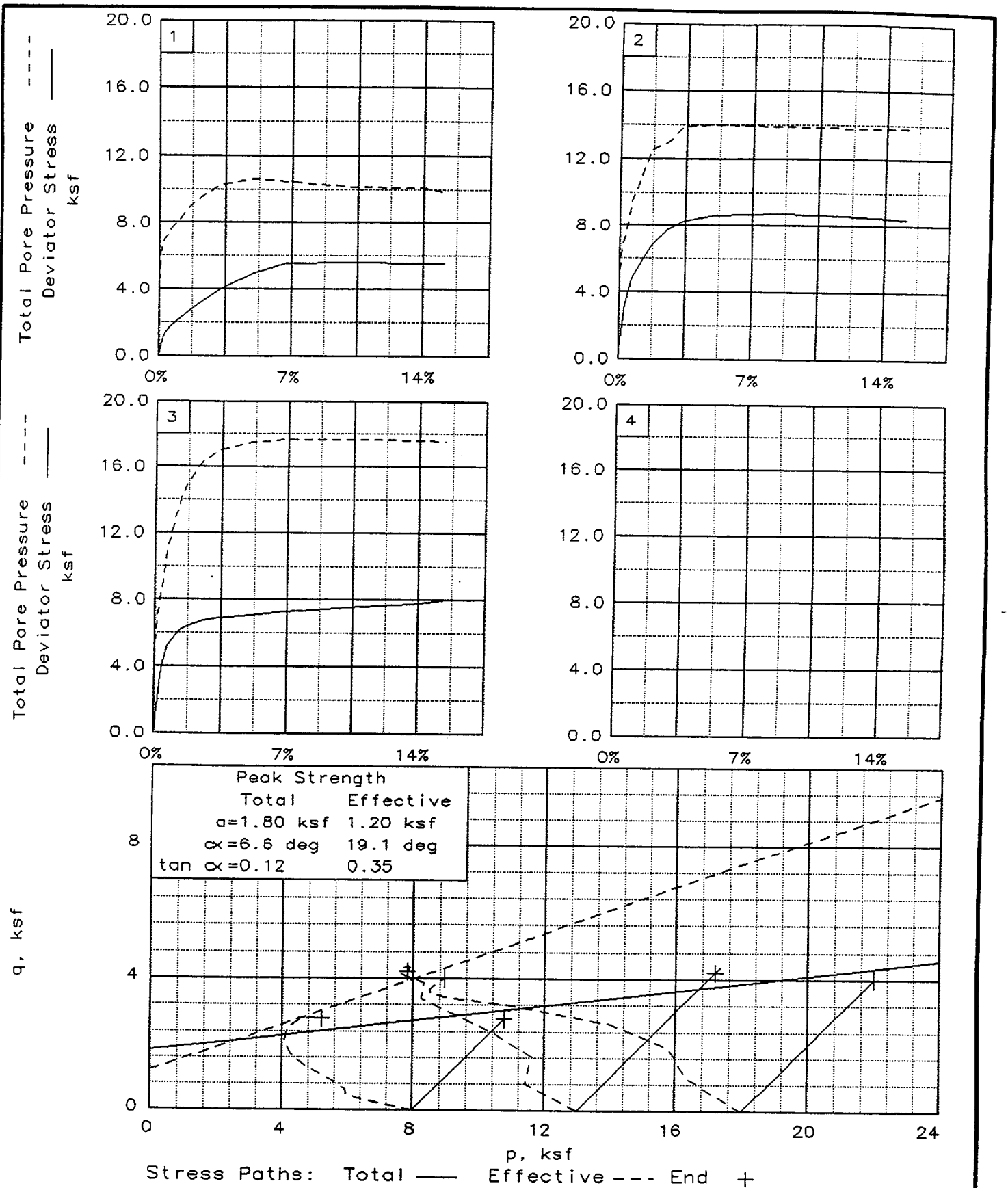
CLIENT: Duke Cogema Stone & Webster

PROJECT: MOX Fuel Fabrication Facility

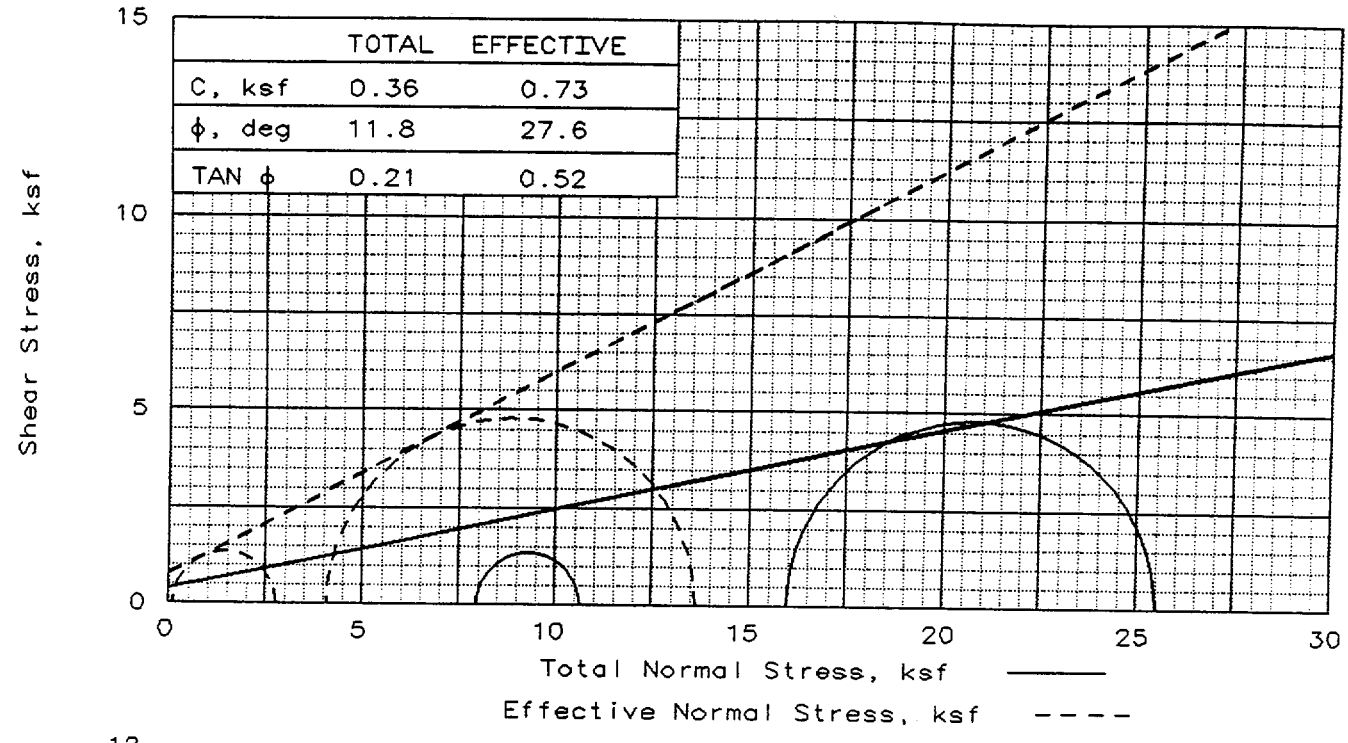
SAMPLE LOCATION: BH-5
Ud-29 @ 130-132'

PROJ. NO.: 50160-0-3963.01 DATE: Dec. 22,2000

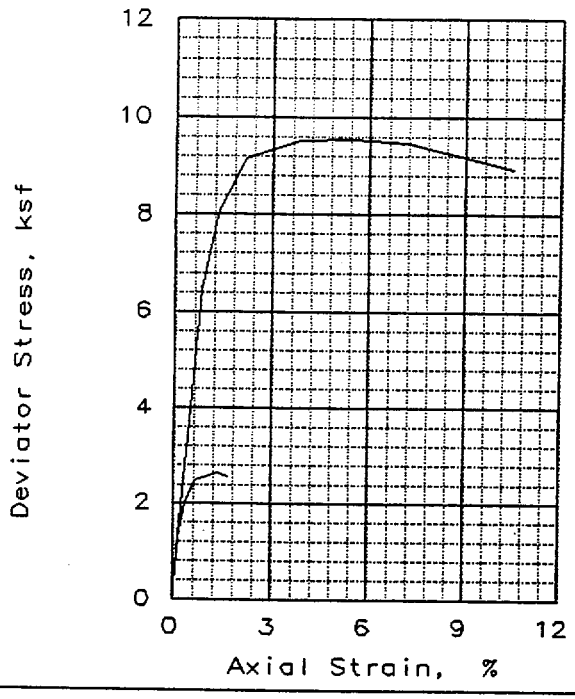
TRIAXIAL SHEAR TEST REPORT
LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.



Client: Duke Cogema Stone & Webster
Project: MOX Fuel Fabrication Facility
Location: BH-5 Ud-29 @ 130-132'
File: 3963BB Project No.: 50160-0-3963.01 Fig. No.: ____



	TOTAL	EFFECTIVE
C, ksf	0.36	0.73
ϕ, deg	11.8	27.6
TAN ϕ	0.21	0.52



SAMPLE NO.:		1	2
INITIAL	WATER CONTENT, %	43.5	37.9
	DRY DENSITY, pcf	75.3	80.8
	SATURATION, %	94.7	94.2
	VOID RATIO	1.239	1.087
	DIAMETER, in	2.85	2.87
	HEIGHT, in	5.96	5.99
AT TEST	WATER CONTENT, %	43.9	40.6
	DRY DENSITY, pcf	77.1	80.4
	SATURATION, %	100.0	100.0
	VOID RATIO	1.185	1.097
	DIAMETER, in	2.83	2.88
	HEIGHT, in	5.91	5.99
Strain rate, %/min		0.10	0.10
BACK PRESSURE, ksf		4.6	3.0
CELL PRESSURE, ksf		12.6	19.0
FAIL. STRESS, ksf		2.7	9.5
TOTAL PORE PR., ksf		12.4	14.9
ULT. STRESS, ksf			
TOTAL PORE PR., ksf			
$\bar{\sigma}_1$ FAILURE, ksf		2.8	13.7
$\bar{\sigma}_3$ FAILURE, ksf		0.1	4.1

TYPE OF TEST:
CU with Pore Pressures
SAMPLE TYPE: Ud
DESCRIPTION: Tan Brown Clayey Sand
LL= 57 PL= 22 PI= 35
SPECIFIC GRAVITY= 2.7
REMARKS: Tested by: DMS

Reviewed by: HJ

Fig. No.: _____

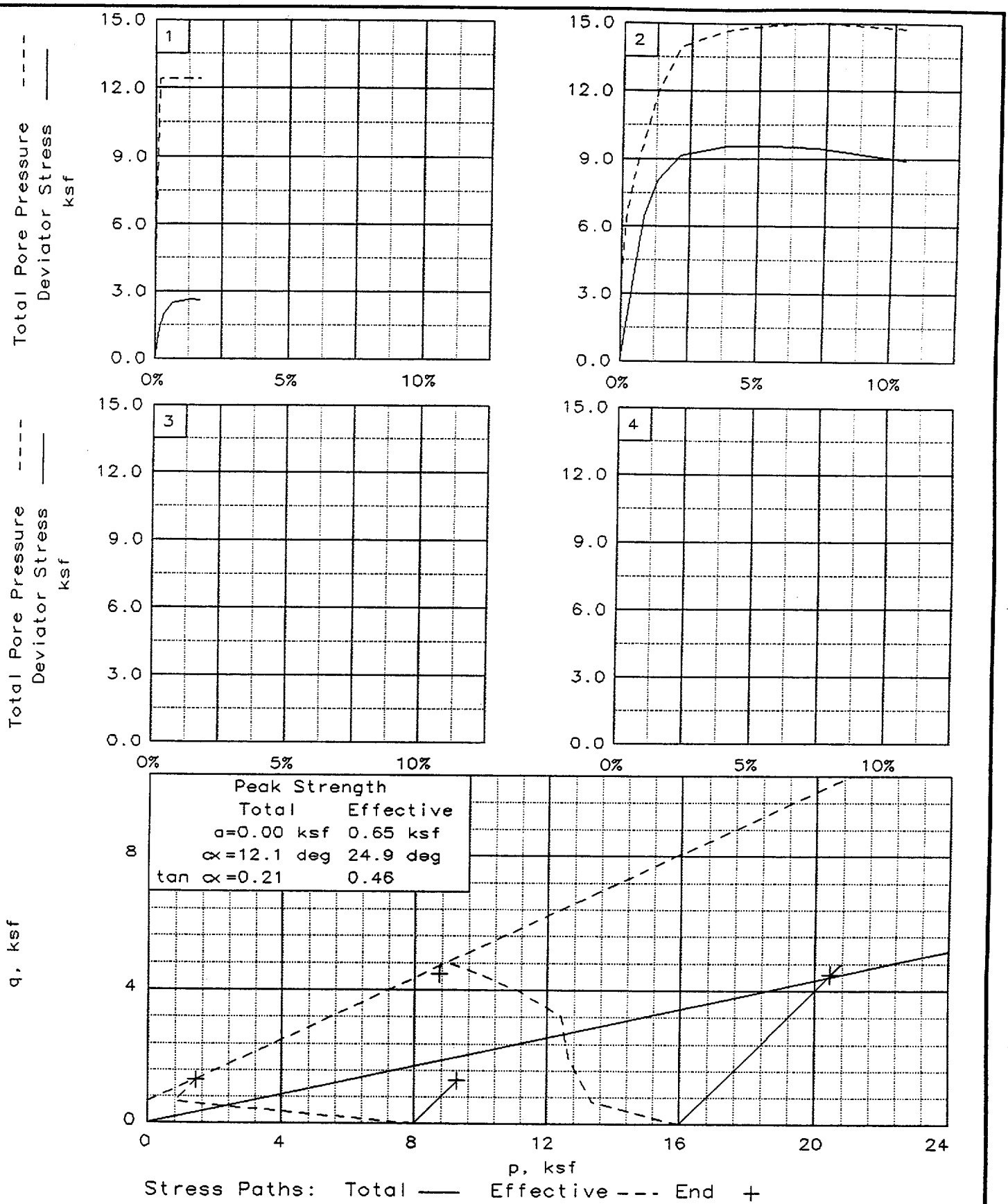
CLIENT: Duke Cogema Stone & Webster

PROJECT: MOX Fuel Fabrication Facility

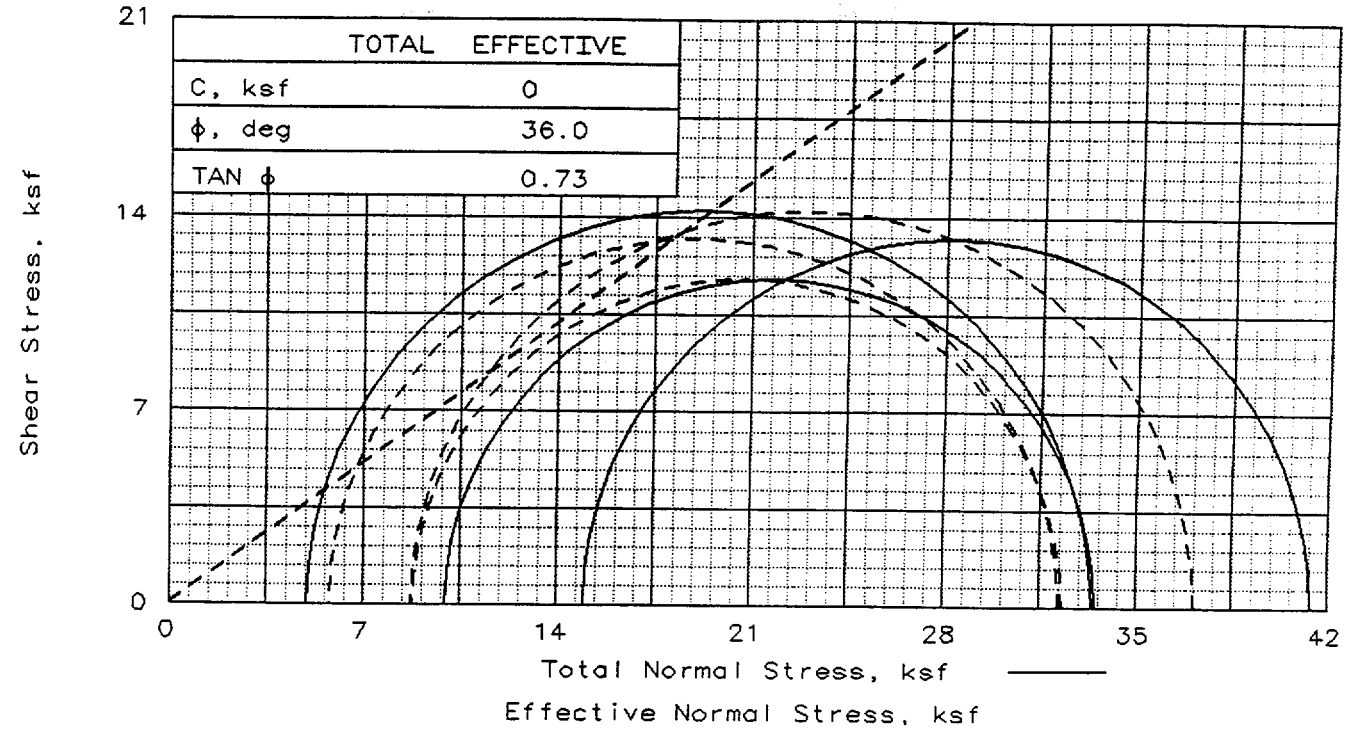
SAMPLE LOCATION: BH-6 Ud 18B @ 103-105'

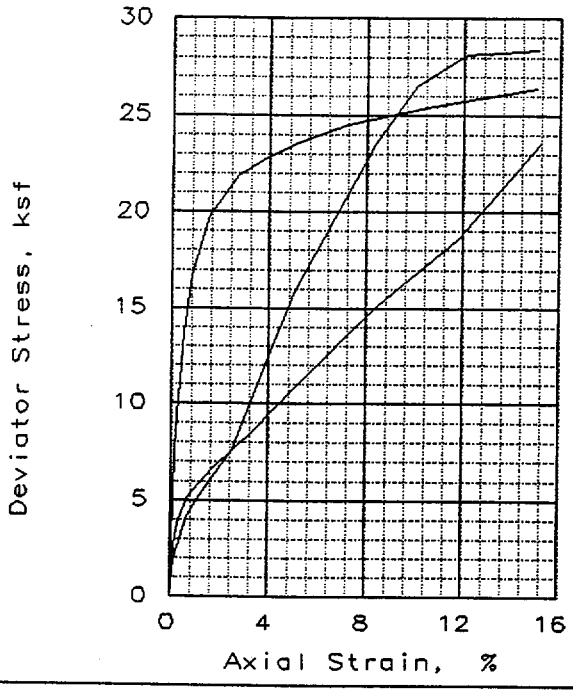
PROJ. NO.: 50160-0-3963 DATE: Jan.2,2000

TRIAXIAL SHEAR TEST REPORT
LAW ENGINEERING
AND ENVIRONMENTAL SERVICES, INC.



Client: Duke Cogema Stone & Webster
Project: MOX Fuel Fabrication Facility
Location: BH-6 Ud 18B @ 103-105'
File: 3963 Project No.: 50160-0-3963 Fig. No.: ____





SAMPLE NO.:		1	2	3
INITIAL	WATER CONTENT, %	12.3	18.4	14.6
	DRY DENSITY, pcf	101.1	103.9	103.3
	SATURATION, %	49.7	80.1	62.3
	VOID RATIO	0.668	0.622	0.632
	DIAMETER, in	2.88	2.87	2.86
	HEIGHT, in	5.99	6.00	5.98
AT TEST	WATER CONTENT, %	23.4	21.8	21.8
	DRY DENSITY, pcf	103.3	106.0	106.1
	SATURATION, %	100.0	100.0	100.0
	VOID RATIO	0.632	0.590	0.588
	DIAMETER, in	2.87	2.85	2.83
	HEIGHT, in	5.92	5.96	5.92
Strain rate, %/min		0.10	0.10	0.10
BACK PRESSURE, ksf		2.9	4.3	4.4
CELL PRESSURE, ksf		17.9	9.3	14.4
FAIL. STRESS, ksf		26.4	28.4	23.5
TOTAL PORE PR., ksf		12.1	0.6	5.5
ULT. STRESS, ksf				
TOTAL PORE PR., ksf				
$\bar{\sigma}_1$ FAILURE, ksf		32.2	37.1	32.3
$\bar{\sigma}_3$ FAILURE, ksf		5.8	8.8	8.8

TYPE OF TEST:
CU with Pore Pressures
SAMPLE TYPE: Ud
DESCRIPTION: Tan Brown Clayey Sand

SPECIFIC GRAVITY= 2.7
REMARKS: Tested by: DMJ

Reviewed by: HJ

Fig. No.: _____

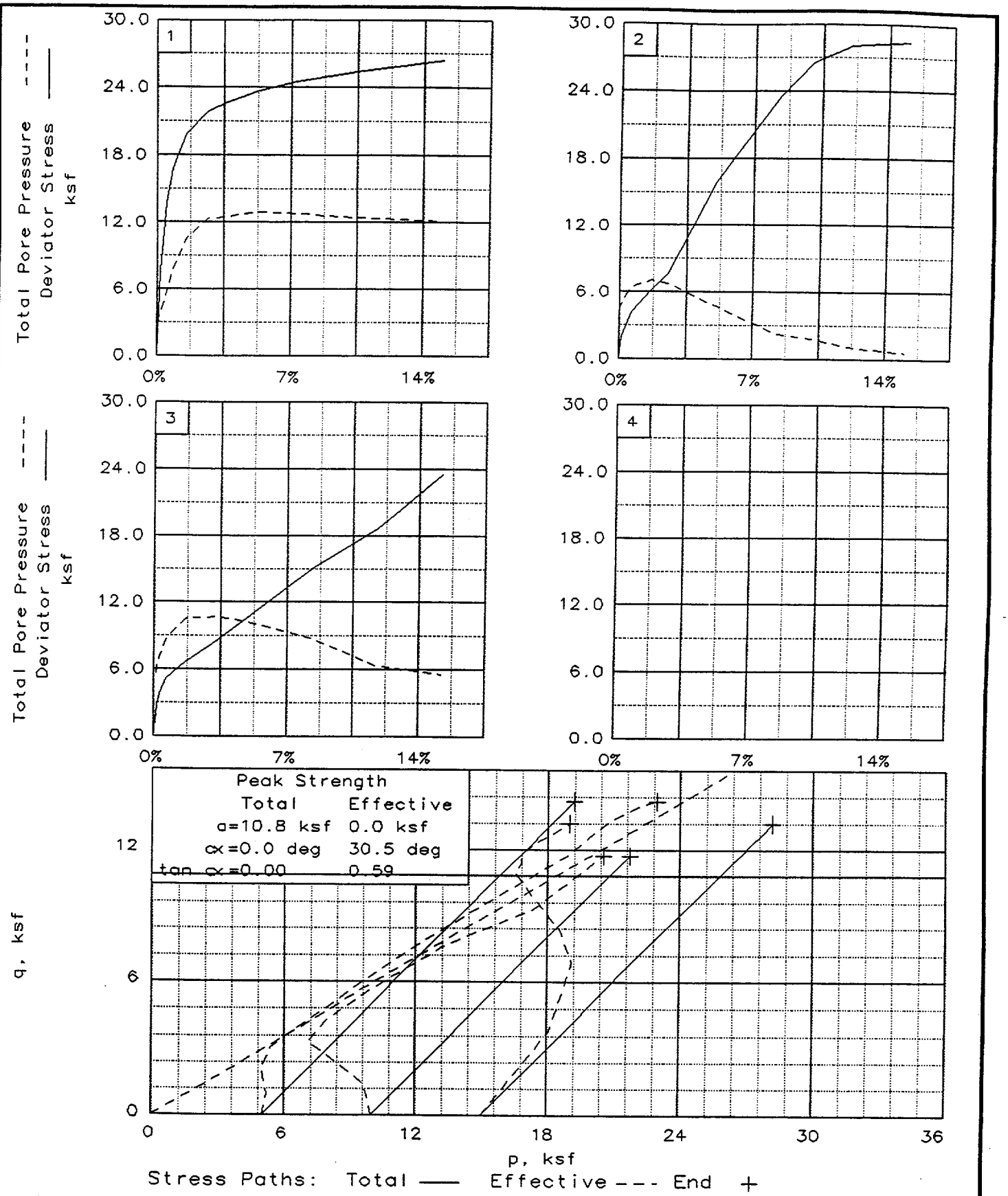
CLIENT: Duke Cogema Stone & Webster

PROJECT: MOX Fuel Fabricarion Facility

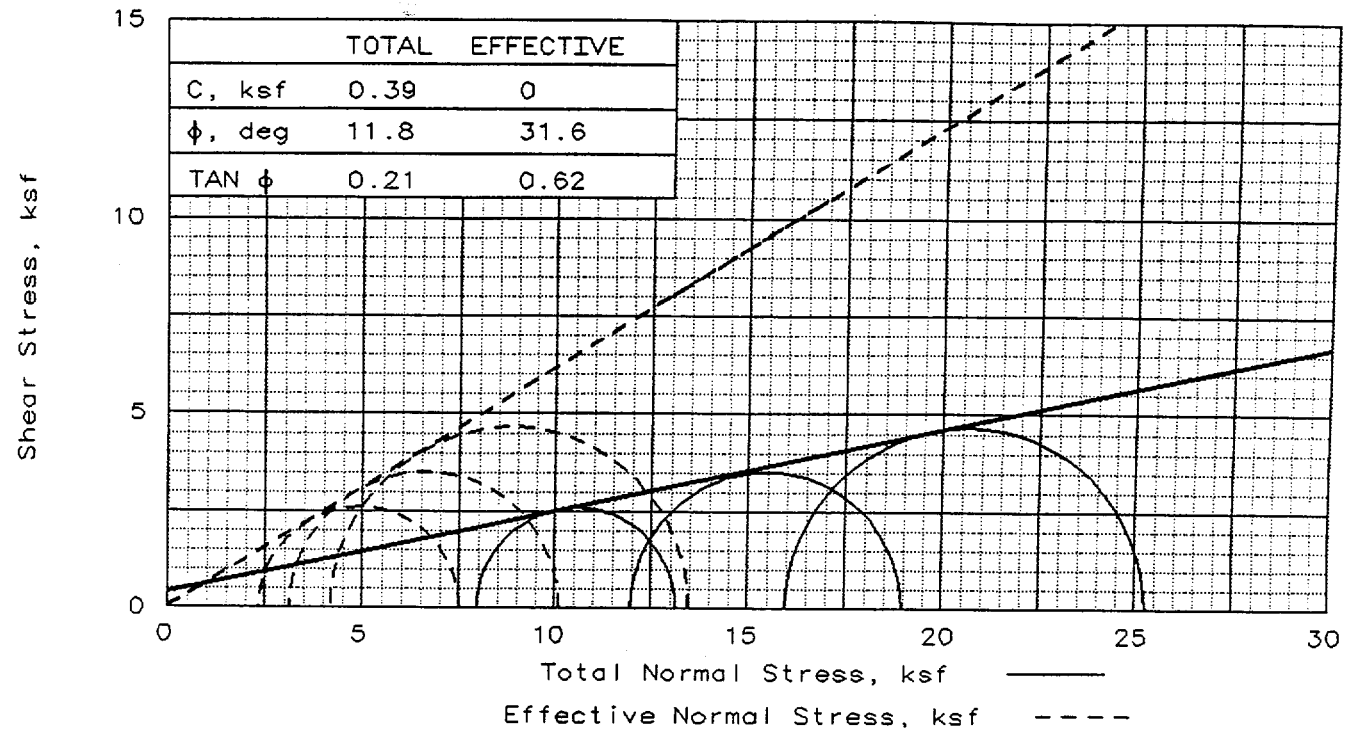
SAMPLE LOCATION: BH-6 Ud-7A 43-45.5'

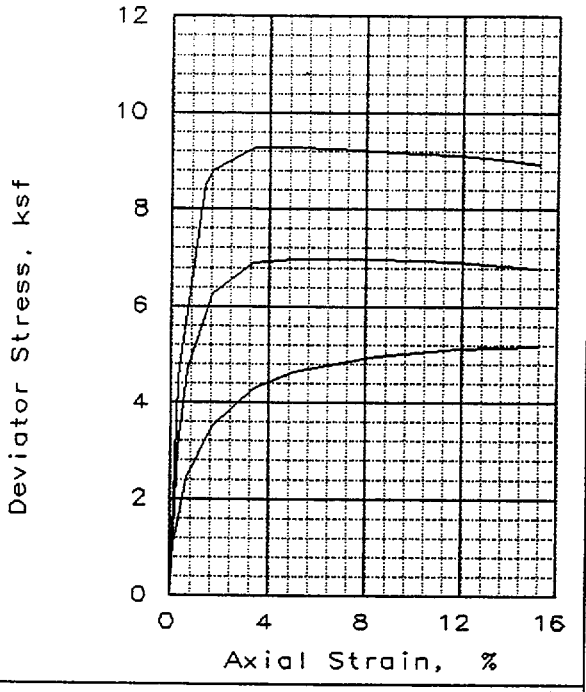
PROJ. NO.: 50160-0-3963 DATE: Dec.22,2000

TRIAXIAL SHEAR TEST REPORT
LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.



Client: Duke Cogema Stone & Webster
Project: MOX Fuel Fabricarion Facility
Location: BH-6 Ud-7A 43-45.5'
File: 3963D Project No.: 50160-0-3963 Fig. No.: ____





SAMPLE NO.:		1	2	3
INITIAL	WATER CONTENT, %	33.3	33.6	34.7
	DRY DENSITY, pcf	84.4	86.0	85.2
	SATURATION, %	90.1	94.5	95.8
	VOID RATIO	0.997	0.960	0.978
	DIAMETER, in	2.86	2.84	2.85
	HEIGHT, in	5.97	5.97	5.97
AT TEST	WATER CONTENT, %	34.6	35.8	36.3
	DRY DENSITY, pcf	87.2	85.7	85.2
	SATURATION, %	100.0	100.0	100.0
	VOID RATIO	0.934	0.967	0.979
	DIAMETER, in	2.83	2.84	2.86
	HEIGHT, in	5.91	5.97	5.92
Strain rate, %/min		0.10	0.10	0.10
BACK PRESSURE, ksf		4.3	4.5	4.8
CELL PRESSURE, ksf		20.3	16.5	12.8
FAIL. STRESS, ksf		9.3	7.0	5.2
TOTAL PORE PR., ksf		16.1	13.3	10.4
ULT. STRESS, ksf				
TOTAL PORE PR., ksf				
$\bar{\sigma}_1$ FAILURE, ksf		13.5	10.1	7.5
$\bar{\sigma}_3$ FAILURE, ksf		4.2	3.2	2.4

TYPE OF TEST:
CU with Pore Pressures
SAMPLE TYPE: Ud
DESCRIPTION: Tan Brown Clayey Sand
LL= 58 PL= 26 PI= 32
SPECIFIC GRAVITY= 2.7
REMARKS: Tested by: DNJ

Reviewed by: MJ

Fig. No.: _____

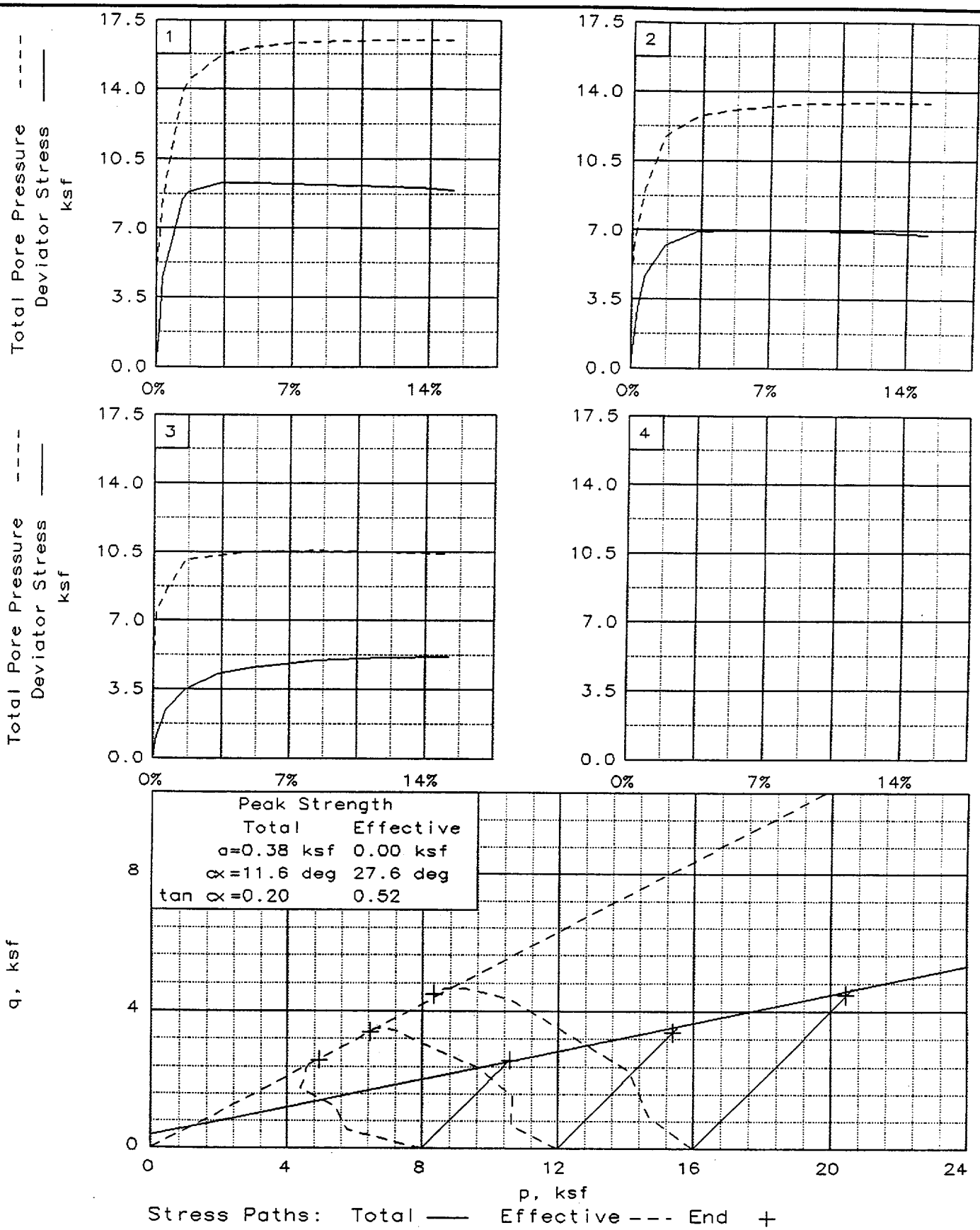
CLIENT: Duke Cogema Stone & Webster

PROJECT: MOX Fuel Fabricarion Facility

SAMPLE LOCATION: BH-6 Ud-13B 77.5-80'

PROJ. NO.: 50160-0-3963 DATE: Dec.22,2000

TRIAXIAL SHEAR TEST REPORT
LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

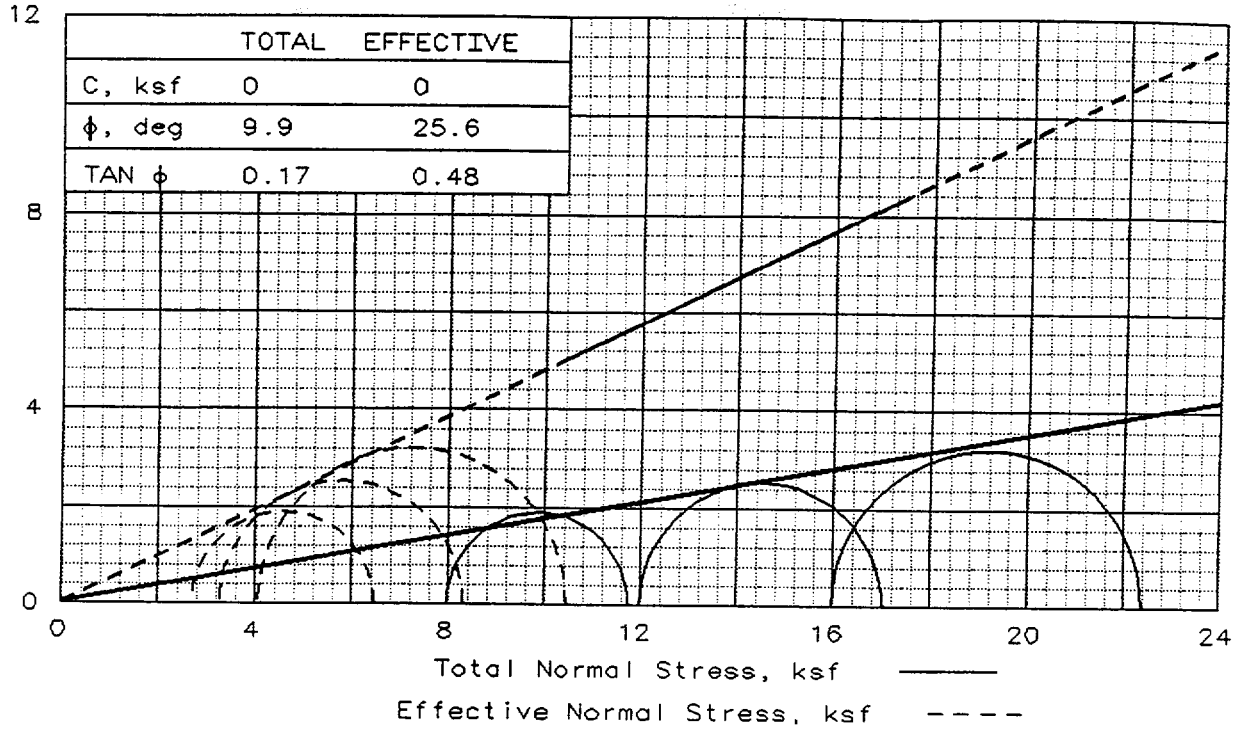


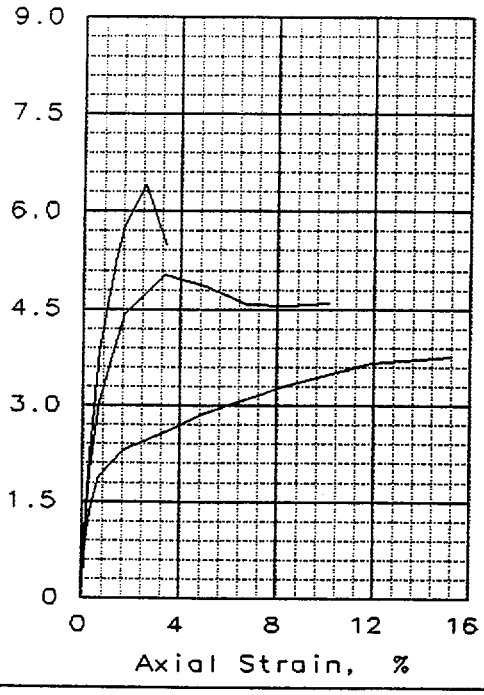
Client: Duke Cogema Stone & Webster

Project: MOX Fuel Fabricarion Facility

Location: BH-6 Ud-13B 77.5-80'

File: 3963C Project No.: 50160-0-3963 Fig. No.: ____





SAMPLE NO.:		1	2	3
INITIAL	WATER CONTENT, %	27.2	38.3	46.9
	DRY DENSITY, pcf	91.5	77.9	69.8
	SATURATION, %	87.2	89.1	89.6
	VOID RATIO	0.842	1.163	1.415
	DIAMETER, in	2.86	2.87	2.87
	HEIGHT, in	5.97	5.98	5.97
AT TEST	WATER CONTENT, %	28.8	41.0	29.1
	DRY DENSITY, pcf	94.8	80.0	73.8
	SATURATION, %	100.0	100.0	61.2
	VOID RATIO	0.778	1.106	1.284
	DIAMETER, in	2.82	2.85	2.82
	HEIGHT, in	5.90	5.92	5.86
Strain rate, %/min		0.10	0.10	0.10
BACK PRESSURE, ksf		3.9	4.2	3.2
CELL PRESSURE, ksf		11.9	16.2	19.2
FAIL. STRESS, ksf		3.8	5.0	6.4
TOTAL PORE PR., ksf		9.2	12.9	15.1
ULT. STRESS, ksf				
TOTAL PORE PR., ksf				
$\bar{\sigma}_1$ FAILURE, ksf		6.5	8.3	10.5
$\bar{\sigma}_3$ FAILURE, ksf		2.7	3.3	4.1

TYPE OF TEST:
CU with Pore Pressures
SAMPLE TYPE: Ud
DESCRIPTION: Tan Brown Clayey Sand
LL= 93 PL= 43 PI= 50
SPECIFIC GRAVITY= 2.7
REMARKS: Tested by: DMJ

Reviewed by: HS

Fig. No.: _____

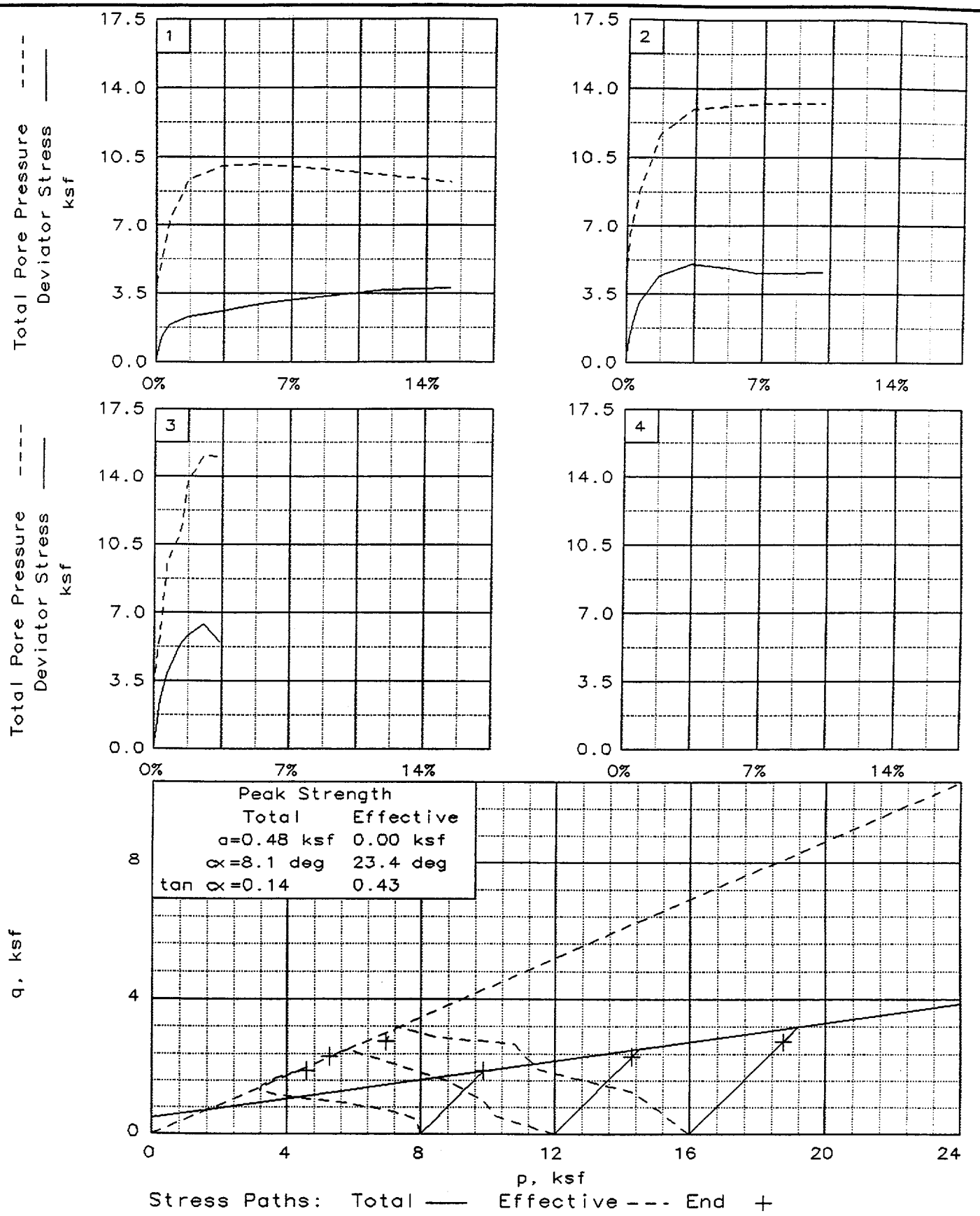
CLIENT: Duke Cogema Stone & Webster

PROJECT: MOX Fuel Fabricarion Facility

SAMPLE LOCATION: BH-7 Ud-20B @ 100-102'

PROJ. NO.: 50160-0-3963 DATE: Dec.22,2000

TRIAXIAL SHEAR TEST REPORT
LAW ENGINEERING
AND ENVIRONMENTAL SERVICES, INC.



Client: Duke Cogema Stone & Webster

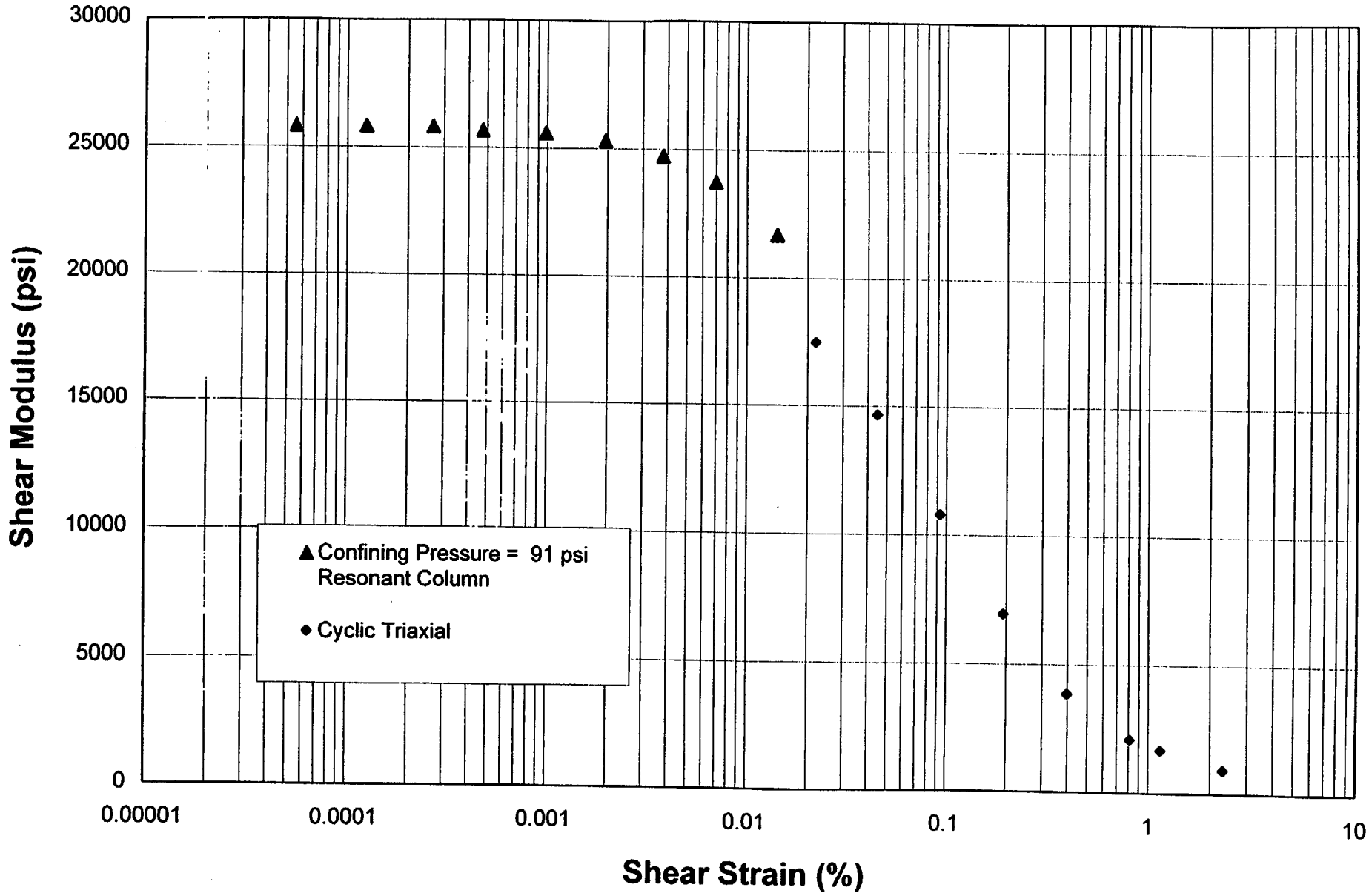
Project: MOX Fuel Fabricarion Facility

Location: BH-7 Ud-20B @ 100-102'

File: 3963E Project No.: 50160-0-3963 Fig. No.: ____

RESONANT COLUMN AND

CYCLIC TRIAXIAL TESTS



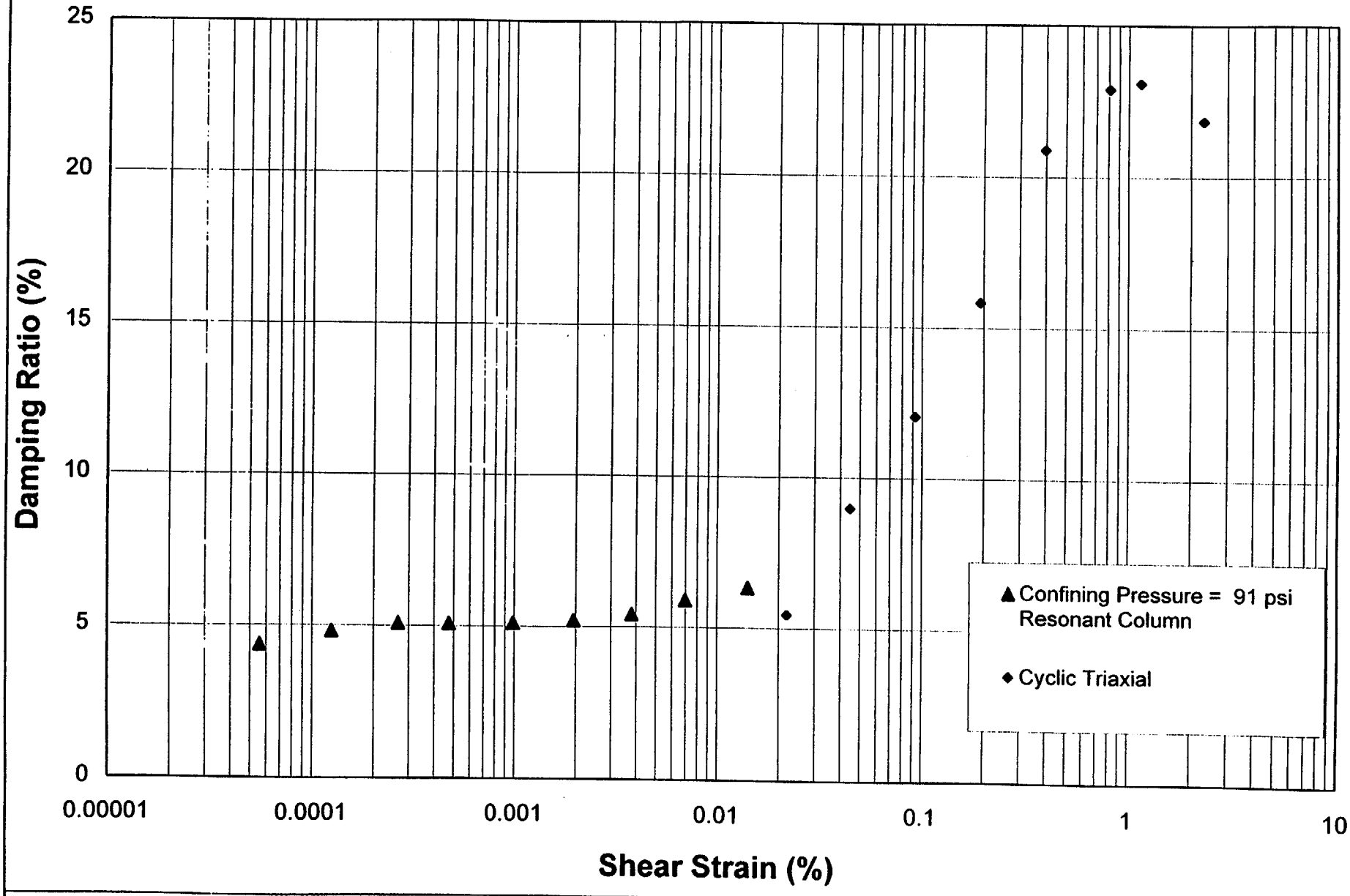
Shear Modulus vs. Shear Strain
BH-2 15 70 - 72 feet

LAW
LAWGIBB Group Member

MOX

Project No.: 50160-0-3963

Date: 11/17/00



Damping Ratio vs. Shear Strain **BH-2 15 70 - 72 feet**	**LAW** **LAWGIBB Group Member**	**MOX** Project No.: 50160-0-3963 Date: 11/17/00

LAW

LAWGIBB Group Member

RESONANT COLUMN TEST (ASTM D4015-87)

Project No.:	50160-0-3963	Project Name:	MOX
Tested By:	HJ & JW	Boring No.:	BH-2
Test Date:	11/17/00	Sample No.:	15
Reviewed By:	JW	Depth:	70 - 72 feet
Reviewed Date:	11/20/00	Sample Description:	Light tan clayey sand

Initial Specimen Data

Labels	Values	Units	Description
	Masses		
M_{scb}	1158.83	g	*Mass of soil and container before*
M_{sca}	0.00	g	*Mass of soil and container after*
M_{ds}	1158.83	g	*M_{scb} - M_{sca} =mass of soil*
	Diameters		
D_t	72.3	mm	*Diameter near top of specimen*
D_m	72.4	mm	*Diameter near middle of specimen*
D_b	72.4	mm	*Diameter near bottom of specimen*
T_{mem}	0.0	mm	*Single thickness of membrane*
D_{net}	72.3	mm	*$(D_t + D_m + D_b)/3 - 2*T_{mem}$*
	Lengths		
L_{cbp}	220.8	mm	*Length between chamber bottom & top of top platen*
L_{tp}	21.6	mm	*Length of top platen*
L_{bp}	46.6	mm	*Length of bottom platen*
L_{net}	152.6	mm	*Length of Specimen $= L_{cbp} - L_{tp} - L_{bp}$*
	Volume		
V	627292	mm^3	*$D^2_{net} * Pi * L_{net}/4$*

Labels	Values	Units	Description
	Mass Density and Unit Weight		
Rho	1847	kg/m^3	*Mass density of specimen $M_s * V * 10^6$*
U_{wt}	18.1	kN/m^3	*Unit weight of specimen = Rho*9.806/1000*
	Moisture Content		
No.	BC-2		*Container number*
M_{wscb}	1241.18	g	*Mass of wet soil + container*
M_{wsca}	950.05	g	*Mass of dry soil + container*
M_{wat}	291.13	g	*Mass of water = M_{wscb} - M_{wsca}*
M_{cont}	82.35	g	*Mass of container.*
mc	33.6	%	*$M_{wat}/(M_{wsca} - M_{cont}) * 100\%$*
Rho_d	1383	kg/m^3	*Dry mass density = Rho/(1+mc)*
G_s	2.65		*Specific gravity (estimated)*
e	0.92		*Void Ratio, $[1000*G_s)]/Rho_d$-1*
S_r	97.1	%	*Degree of Saturation = $mc*G_s/e$*
J	7.6E-04	$kg-m^2$	*Polar mass moment of inertia $= (M_s/1000)*(D_{net}/1000)^2/8$*

Conditions After Saturation			
CL_s	0.0	mm	*Change in length*
L_s	152.61	mm	*Length after saturation, $L - CL_s$*
A_s	4110	mm^2	*Area of specimen*
V_s	627292	mm^3	*Volume after saturation, $A_s * L_s$*
B	0.95		*B Value*

Conditions After Consolidation			
CL_c	2.7	mm	*Change in length*
L_d	149.9	mm	*Length after consolidation, L_s-CL_c*
CV_c	45390	mm^3	*Change in volume*
V_c	581902	mm^3	*Volume, V_s - CV_c*
S_r	100.0	%	*Degree of Saturation, $mc*G_s/e$*
e	0.78		*Void Ratio, $[1000*G_s]/Rho_d$-1*
mc	29.3	%	*Moisture Content*
Rho_d	1491	kg/m^3	*Dry mass density, $Rho_d * V/V_c$*

LAW

LAWGIBB Group Member

RESONANT COLUMN TEST (ASTM D4015-87)

Project No.:	50160-0-3963	Project Name:	MOX
Tested By:	HJ & JW	Boring No.:	BH-2
Test Date:	11/17/00	Sample No.:	15
Reviewed By:	JW	Depth:	70 - 72 feet
Reviewed Date:	11/20/00	Sample Description:	Light tan clayey sand

Apparatus Information

Apparatus Description	Typical Long-Tor
Apparatus Serial No.	556G0001
Platen Diameter, mm	72.4

Apparatus Calibration Factors			
M_A	0.3044	kg	*Top Platen Mass*
LCFA	N/A	$[m/V_{rms}]*[Hz^2]$	*Longitudinal Vibration Calibration Factor*
ADCL	N/A	kg-Hz	*Longitudinal Apparatus Damping Coefficient*
FCF	N/A	N/V_{rms}	*Force Calibration Factor*
J_A	0.0032	$kg-m^2$	*Platen Polar Mass Momment of Inertia*
RCFA	4.42	$[Rad/V_{rms}]*[Hz^2]$	*Rotational Vibration Calibration Factor*
ADCT	0.00139	$Hz-kg-m^2$	*Torsional Apparatus Damping Coefficient*
TCF	0.069	$N-m/V_{rms}$	*Torque Calibration Factor*
FOT	0	Hz	*Apparatus Resonant Frequency*

Ancillary System Calibration Factors			
LCCF	-0.635	mm/unit	*Length change calibration factor (+ means*
			specimen length increase for increase values)
BCF	-0.34	mL/unit	*Burette calibration factor (+ means specimen*
			volume increase for increase values.)
CPCF	6.89	kPa/unit	*Cell pressure calibration factor*
PPCF	6.89	kPa/unit	*Pore Pressure calibration factor*
ALCF	1	kN/unit	*Axial load calibration factor*
			(+ means compression of specimen.)
Ancillary System Initial Conditions			
ILR	7.51	units	*Initial length reading before testing*
IBR	38.5	units	*Initial burette reading before testing*
RPF	P		*P or F. "P" for resonant period input, and*
			"F" for resonant frequency input.

LAW

LAWGIBB Group Member

RESONANT COLUMN TEST (ASTM D4015-87)

INPUT DATA

Project No.:	50160-0-3963	Project Name:	MOX
Tested By:	HJ & JW	Boring No:	BH-2
Test Date:	11/17/00	Sample No.:	15
Reviewed By:	JW	Depth:	70 - 72 feet
Reviewed Date	11/20/00	Sample Description:	Light tan clayey sand

Total Number of Data Sets 9

Line No.	Elapsed Time [second]	Cell Pressure [unit]	Pore Pressure [unit]	Axial Load [unit]	Burette Reading [unit]	Length Reading [unit]	Longitudinal or Torsional	Force or Torque Reading [V_{rms}]	Transducer Reading [V_{rms}]	Resonant Period [msec]
1	34	111.0	19.5	0	38.5	7.51	T	0.013	0.017	6.881
2	61	111.0	19.5	0	38.5	7.51	T	0.032	0.038	6.881
3	97	111.0	19.7	0	38.5	7.51	T	0.072	0.081	6.882
4	138	111.0	19.8	0	38.5	7.51	T	0.128	0.144	6.900
5	180	111.0	19.8	0	38.5	7.51	T	0.266	0.298	6.911
6	206	111.0	19.9	0	38.5	7.51	T	0.531	0.584	6.949
7	237	111.0	19.9	0	38.5	7.51	T	1.051	1.111	7.029
8	270	111.0	20.0	0	38.5	7.51	T	2.020	1.960	7.176
9	306	111.0	20.1	0	38.5	7.51	T	4.000	3.62	7.506

LAW

LAWGIBB Group Member

RESONANT COLUMN TEST (ASTM D4015-87)

TEST RESULTS SUMMARY

Project No.:	50160-0-3963	Project Name:	MOX
Tested By:	HJ & JW	Boring No:	BH-2
Test Date:	11/17/00	Sample No.:	15
Reviewed By:	JW	Depth:	70 - 72 feet
Reviewed Date:	11/20/00	Sample Description:	Light tan clayey sand

Line No.	Effective Confining Stress [kPa]	Principal Stress Ratio	Void Ratio e	Longitudinal or Torsional	No. of Vibration Cycles	Shear Modulus G [Mpa]	Shear Modulus G [psi]	Shear Strain Amplitude [%]	Damping Ratio [%]
1	630.44	1.00	0.777	T	4941	177.92	25823	0.00006	4.38
2	630.44	1.00	0.777	T	3924	177.92	25823	0.00012	4.83
3	629.06	1.00	0.777	T	5231	177.87	25816	0.00027	5.10
4	628.37	1.00	0.777	T	5942	176.94	25681	0.00047	5.10
5	628.37	1.00	0.777	T	6077	176.38	25599	0.00098	5.12
6	627.68	1.00	0.777	T	3742	174.46	25320	0.00195	5.21
7	627.68	1.00	0.777	T	4410	170.51	24747	0.00379	5.43
8	626.99	1.00	0.777	T	4599	163.59	23744	0.00697	5.91
9	626.30	1.00	0.777	T	4796	149.52	21702	0.01409	6.34

LAWGIBB GROUP

CYCLIC TRIAXIAL PROPERTIES TEST

(ASTM D 3999-91)

Project No.:	50160-0-3963	Project Name:	Mox
Tested By:	JW & HJ	Boring No.:	BH-2
Test Date:	11/17/00	Sample No.:	15
Reviewed By:	JW	Depth:	70 - 72 feet
Review Date:	11/20/00	Sample Description:	Light tan clayey sand

SPECIMEN DATA

Initial Conditions of Specimen

Diameters, in.		Area , sq. in.	• 6.38
Top	2.850	Volume, cubic in.	38.31
Middle	2.848	Mass of Specimen, grams	1152.46
Bottom	2.850		
Average	2.849	Moisture Content	
Membrane Thickness, in.	0.000	Pan No.	T-12
Net Diameter, in.	2.849	Wet Mass + Pan, grams	1205.06
		Dry Mass + Pan, grams	896.84
Length, in.		Container Mass, grams	52.60
Location 1	6.009	Moisture Content, %	36.5
Location 2	6.009		
Location 3	6.008	Density, pcf	114.4
Average	6.009	Dry Density, pcf	83.8
Length of Top Platen	0.000	Specific Gravity	2.65
Length of Bottom Platen	0.000	Degree of Saturation, %	99.3
Length of Specimen, in	6.009	Void Ratio	0.974

Conditions of Specimen After Saturation and Consolidation

After Saturation		After Consolidation	
Change in Length, in.	0.000	Change in Length, in.	0.168
Length, in.	6.009	Length, in.	5.840
Area, sq. in.	6.38	Change in Volume, cc	47.30
Volume, cubic in.	38.31	Volume, cubic in.	35.43
Back Pressure, psi	15.0	Area, sq. in.	6.07
B Value	0.97	Effe. Consoli.. Stress, psi	91.0
		Moisture Content, %	31.2
		Dry Density, pcf	90.6
		Void Ratio	0.825
		Degree of Saturation, %	100.0

LAWGIBB GROUP

CYCLIC TRIAXIAL PROPERTIES TEST

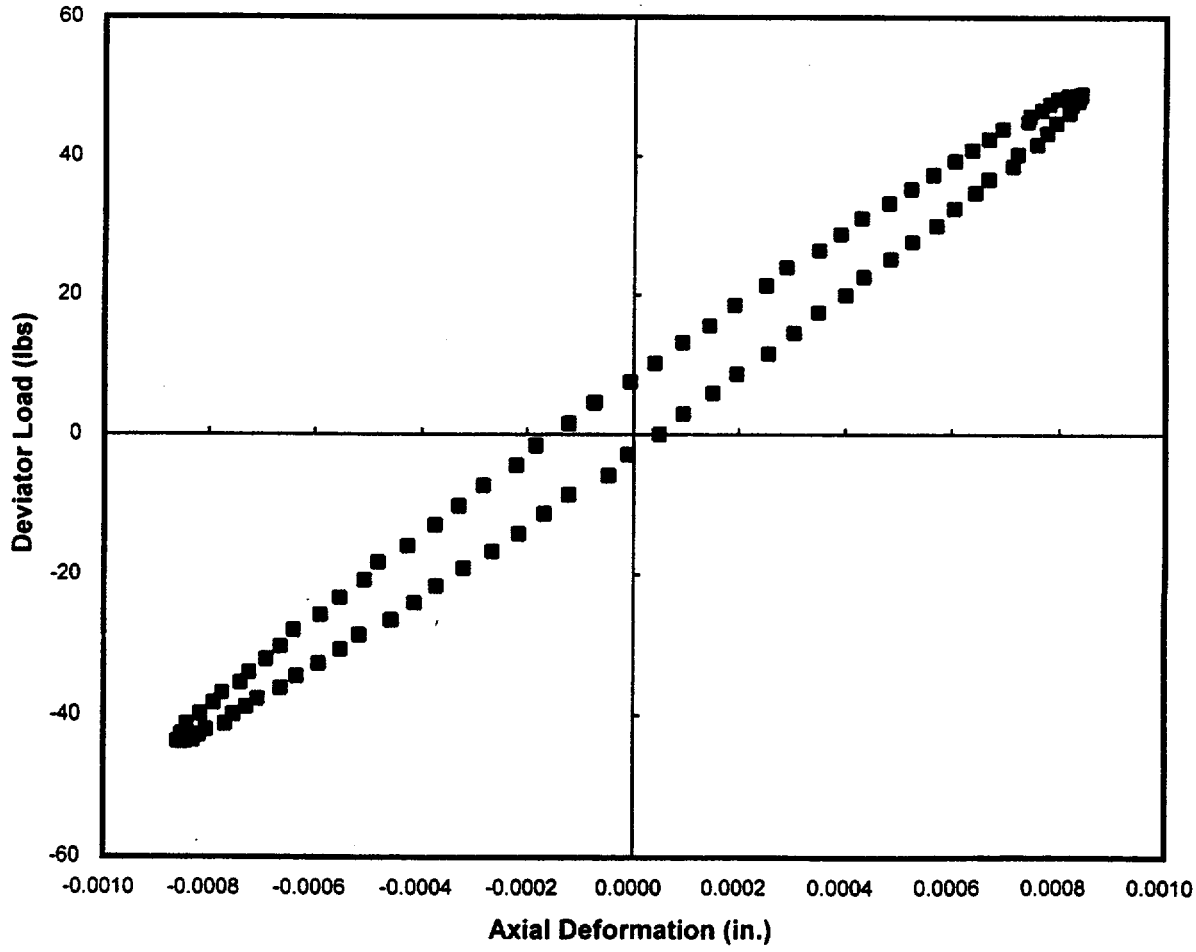
(ASTM D 3999-91)

Project No.:	50160-0-3963	Project Name:	Mox
Tested By:	JW & HJ	Boring No.:	BH-2
Test Date:	11/17/00	Sample No.:	15
Reviewed By:	JW	Depth:	70 - 72 feet
Review Date:	11/20/00	Sample Description:	Light tan clayey sand

Area, A_c (in^2)	Length, H_c (in)	Effective Consoli. Stress, σ_c (psi)	Cyclic Load, P_c (lbs)	Cyclic Deviator Stress, σ_d (psi)
6.07	5.84	91.0	46.32	7.6

Double Amplitude Load LD_A (lbs)	Double Ampli. Deformation SD_A (in.)	Young's Modulus E (psi)	Single Ampliti. Axial Strain ε (%)	Area of Hysteresis Loop A_L, (lb-in)	Area of Triangle A_T, (lb-in)	Damping Ratio D (%)
92.6	0.0017	52444	0.015	0.014	0.020	5.5

Hysteresis Loop @ 10th Cycle, Deformation Stage 1



LAWGIBB GROUP

CYCLIC TRIAXIAL PROPERTIES TEST

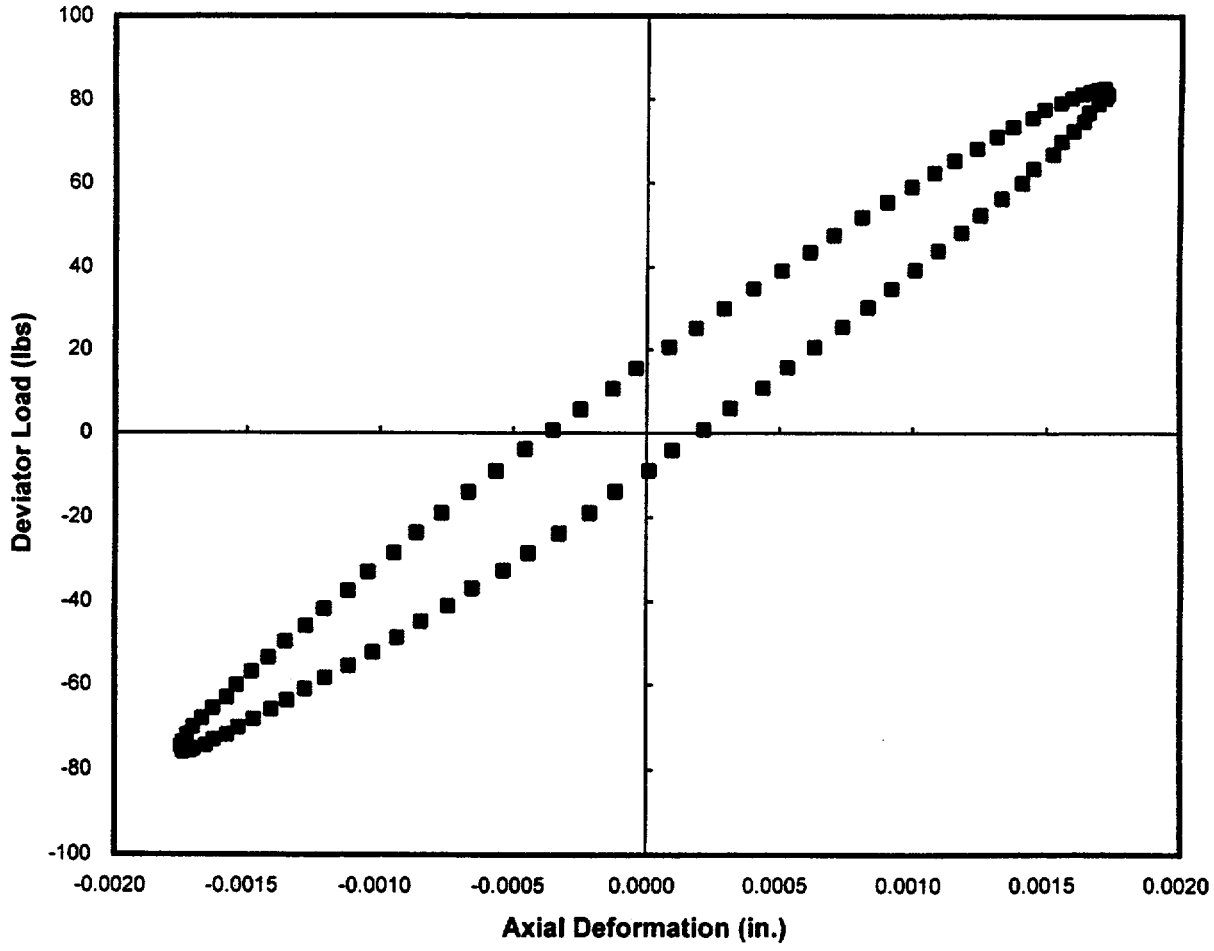
(ASTM D 3999-91)

Project No.:	50160-0-3963	Project Name:	Mox
Tested By:	JW & HJ	Boring No.:	BH-2
Test Date:	11/17/00	Sample No.:	15
Reviewed By:	JW	Depth:	70 - 72 feet
Review Date:	11/20/00	Sample Description:	Light tan clayey sand

Area, A_c (in^2)	Length, H_c (in)	Effective Consoli. Stress, σ_c (psi)	Cyclic Load, P_c (lbs)	Cyclic Deviator Stress, σ_d (psi)
6.07	5.84	91.0	79.25	13.1

Double Amplitude Load LD_A (lbs)	Double Ampli. Deformation SD_A (in.)	Young's Modulus E (psi)	Single Ampliti. Axial Strain ε (%)	Area of Hysteresis Loop A_L, (lb-in)	Area of Triangle A_T, (lb-in)	Damping Ratio D (%)
158.5	0.0035	43982	0.030	0.078	0.069	9.0

Hysteresis Loop @ 10th Cycle, Deformation Stage 2



LAWGIBB GROUP

CYCLIC TRIAXIAL PROPERTIES TEST

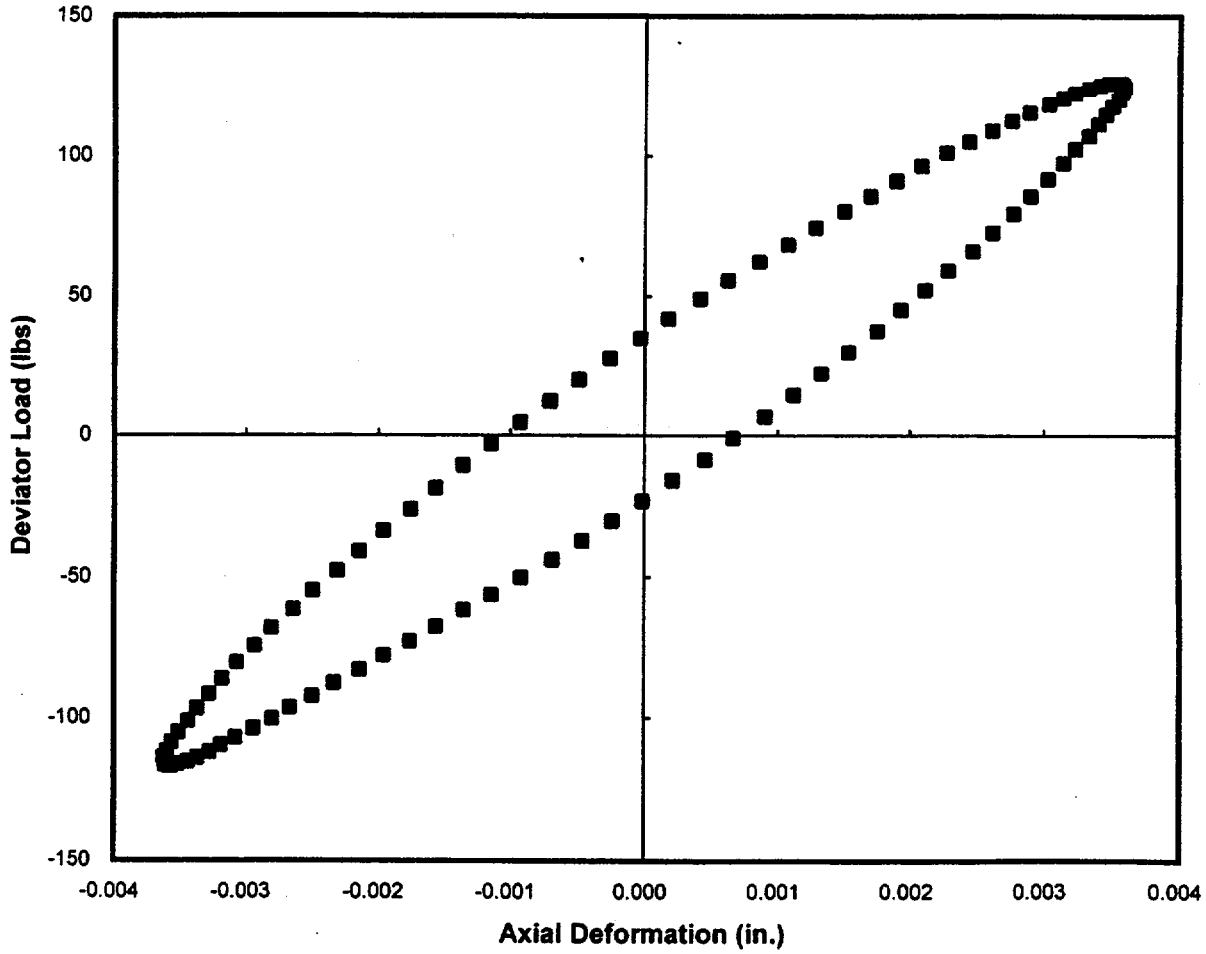
(ASTM D 3999-91)

Project No.:	50160-0-3963	Project Name:	Mox
Tested By:	JW & HJ	Boring No.:	BH-2
Test Date:	11/17/00	Sample No.:	15
Reviewed By:	JW	Depth:	70 - 72 feet
Review Date:	11/20/00	Sample Description:	Light tan clayey sand

Area, A_c (in^2)	Length, H_c (in)	Effective Consoli Stress, σ_c (psi)	Cyclic Load, P_c (lbs)	Cyclic Deviator Stress, σ_d (psi)
6.07	5.84	91.0	121.26	20.0

Double Amplitude Load LD_A (lbs)	Double Ampli. Deformation SD_A (in.)	Young's Modulus E (psi)	Single Ampliti. Axial Strain ε (%)	Area of Hysteresis Loop A_L, (lb-in)	Area of Triangle A_T, (lb-in)	Damping Ratio D (%)
242.5	0.0072	32386	0.062	0.330	0.219	12.0

Hysteresis Loop @ 10th Cycle, Deformation Stage 3



LAWGIBB GROUP

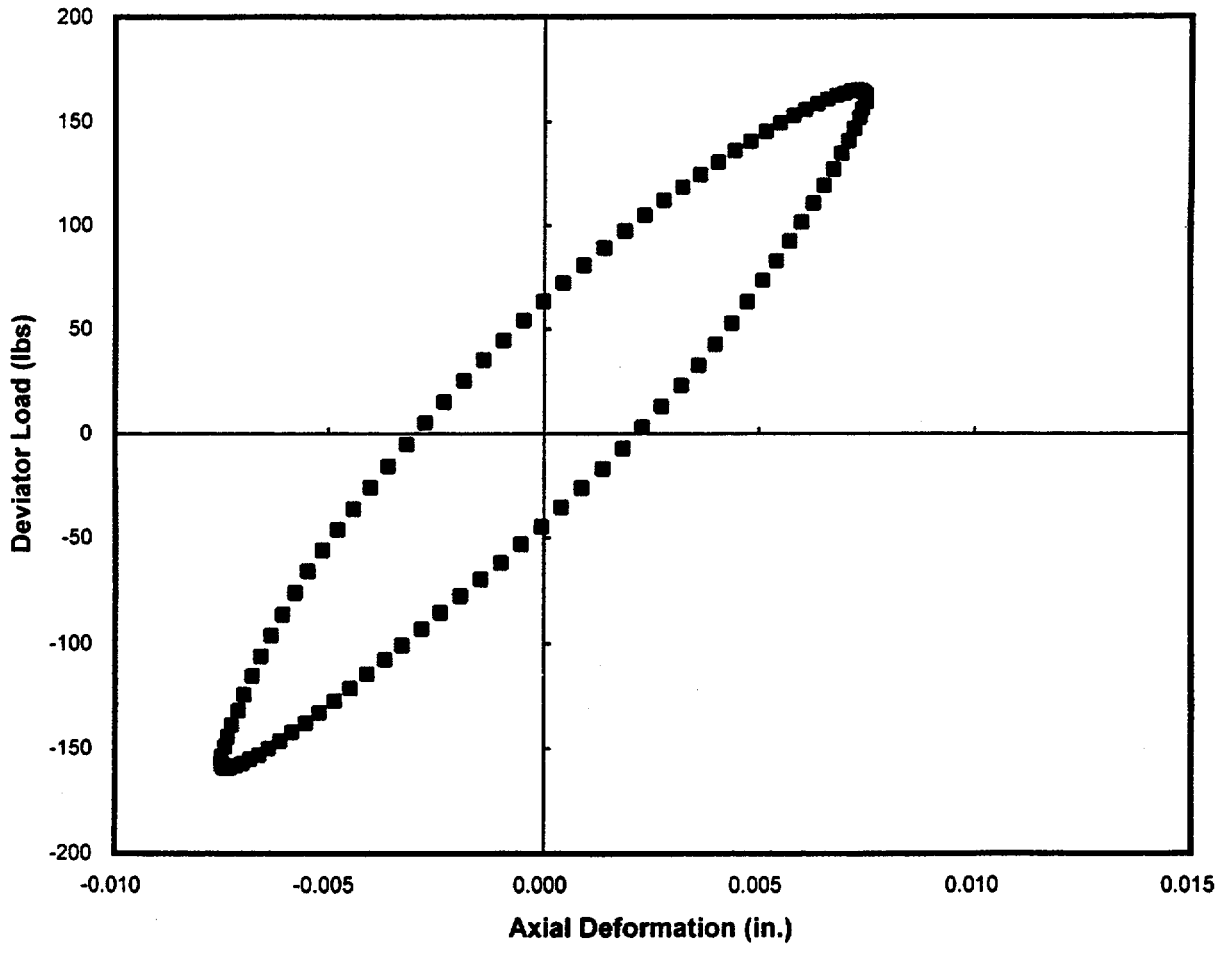
CYCLIC TRIAXIAL PROPERTIES TEST
(ASTM D 3999-91)

Project No.:	50160-0-3963	Project Name:	Mox
Tested By:	JW & HJ	Boring No.:	BH-2
Test Date:	11/17/00	Sample No.:	15
Reviewed By:	JW	Depth:	70 - 72 feet
Review Date:	11/20/00	Sample Description:	Light tan clayey sand

Area, A_c (in^2)	Length, H_c (in)	Effective Consoli. Stress, σ_c (psi)	Cyclic Load, P_c (lbs)	Cyclic Deviator Stress, σ_d (psi)
6.07	5.84	91.0	162.22	26.7

Double Amplitude Load LD_A (lbs)	Double Ampli. Deformation SD_A (in.)	Young's Modulus E (psi)	Single Ampliti. Axial Strain ε (%)	Area of Hysteresis Loop A_L, (lb-in)	Area of Triangle A_T, (lb-in)	Damping Ratio D (%)
324.4	0.0150	20872	0.128	1.208	0.607	15.8

Hysteresis Loop @ 10th Cycle, Deformation Stage 4



LAWGIBB GROUP

CYCLIC TRIAXIAL PROPERTIES TEST

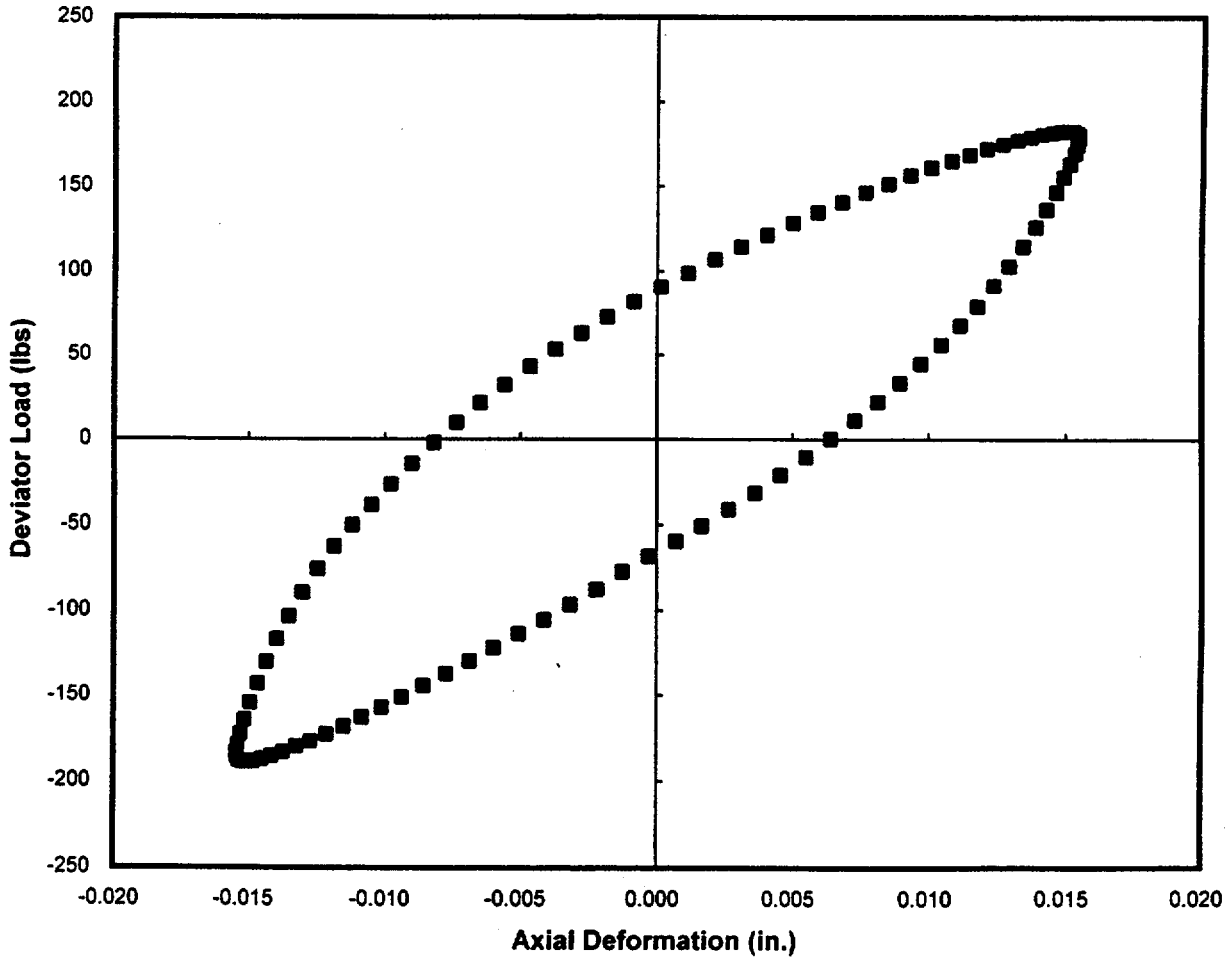
(ASTM D 3999-91)

Project No.:	50160-0-3963	Project Name:	Mox
Tested By:	JW & HJ	Boring No.:	BH-2
Test Date:	11/17/00	Sample No.:	15
Reviewed By:	[illegible]	Depth:	70 - 72 feet
Review Date:	11/20/00	Sample Description:	Light tan clayey sand

Area, A_c (in^2)	Length, H_c (in)	Effective Consoli. Stress, σ_c (psi)	Cyclic Load, P_c (lbs)	Cyclic Deviator Stress, σ_d (psi)
6.07	5.84	91.0	185.80	30.6

Double Amplitude Load LD_A (lbs)	Double Ampli. Deformation SD_A (in.)	Young's Modulus E (psi)	Single Ampliti. Axial Strain ε (%)	Area of Hysteresis Loop A_L, (lb-in)	Area of Triangle A_T, (lb-in)	Damping Ratio D (%)
371.6	0.0309	11580	0.265	3.766	1.435	20.9

Hysteresis Loop @ 10th Cycle, Deformation Stage 5



LAWGIBB GROUP

CYCLIC TRIAXIAL PROPERTIES TEST

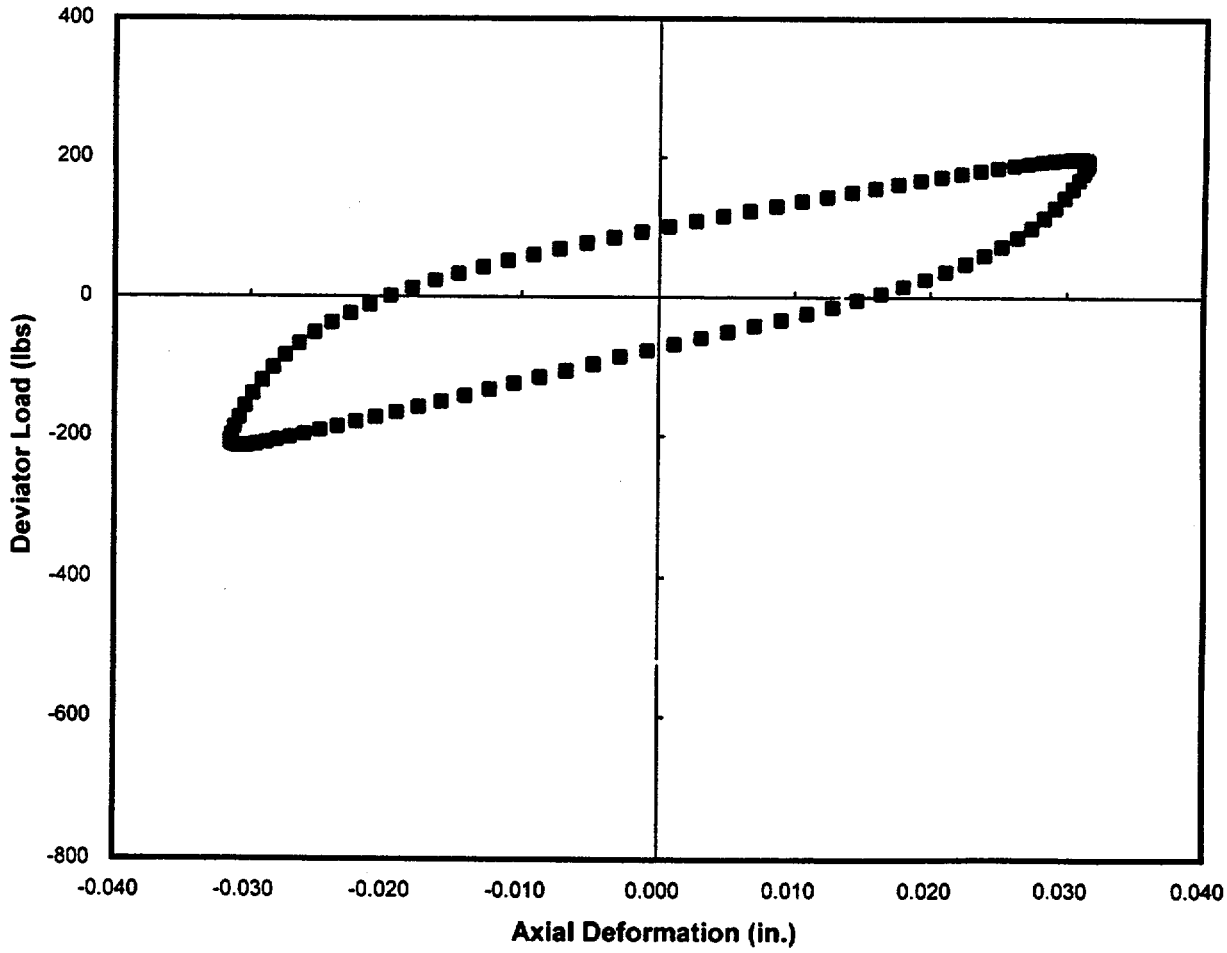
(ASTM D 3999-91)

Project No.:	50160-0-3963	Project Name:	Mox
Tested By:	JW & HJ	Boring No.:	BH-2
Test Date:	11/17/00	Sample No.:	15
Reviewed By:	JW	Depth:	70 - 72 feet
Review Date:	11/20/00	Sample Description:	Light tan clayey sand

Area, A_c (in^2)	Length, H_c (in)	Effective Consoli. Stress, σ_c (psi)	Cyclic Load, P_c (lbs)	Cyclic Deviator Stress, σ_d (psi)
6.07	5.84	91.0	206.29	34.0

Double Amplitude Load LD_A (lbs)	Double Ampli. Deformation SD_A (in.)	Young's Modulus E (psi)	Single Ampliti. Axial Strain ε (%)	Area of Hysteresis Loop A_L, (lb-in)	Area of Triangle A_T, (lb-in)	Damping Ratio D (%)
412.6	0.0629	6315	0.538	9.332	3.244	22.9

Hysteresis Loop @ 10th Cycle, Deformation Stage 6



LAWGIBB GROUP

CYCLIC TRIAXIAL PROPERTIES TEST

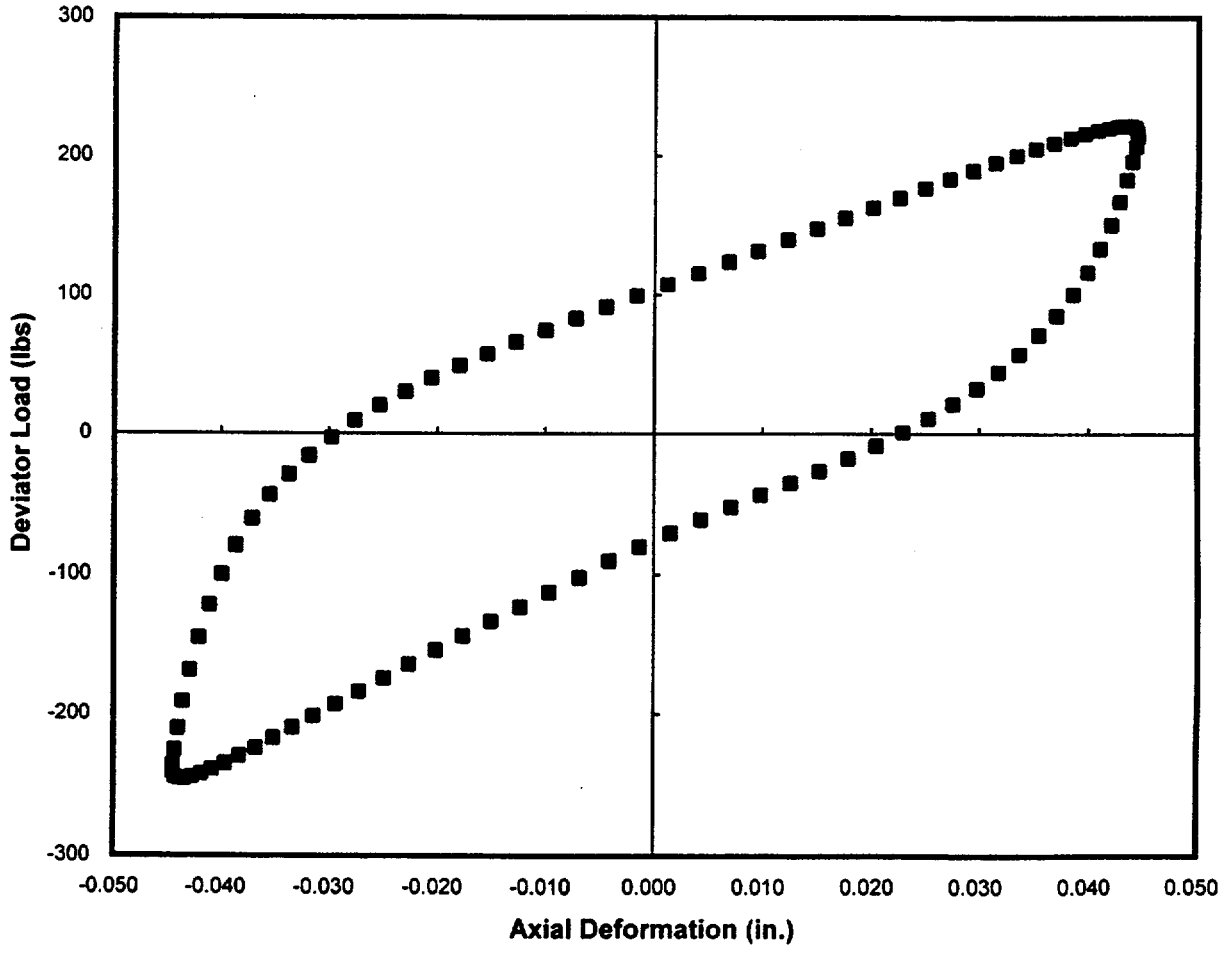
(ASTM D 3999-91)

Project No.:	50160-0-3963	Project Name:	Mox
Tested By:	JW & HJ	Boring No.:	BH-2
Test Date:	11/17/00	Sample No.:	15
Reviewed By:	JW	Depth:	70 - 72 feet
Review Date:	4/20/01	Sample Description:	Light tan clayey sand

Area, A_c (in^2)	Length, H_c (in)	Effective Consoli. Stress, σ_c (psi)	Cyclic Load, P_c (lbs)	Cyclic Deviator Stress, σ_d (psi)
6.07	5.84	91.0	233.99	38.6

Double Amplitude Load LD_A (lbs)	Double Ampli. Deformation SD_A (in.)	Young's Modulus E (psi)	Single Ampliti. Axial Strain ε (%)	Area of Hysteresis Loop A_L, (lb-in)	Area of Triangle A_T, (lb-in)	Damping Ratio D (%)
468.0	0.0888	5072	0.761	15.080	5.197	23.1

Hysteresis Loop @ 10th Cycle, Deformation Stage 7



LAWGIBB GROUP

CYCLIC TRIAXIAL PROPERTIES TEST

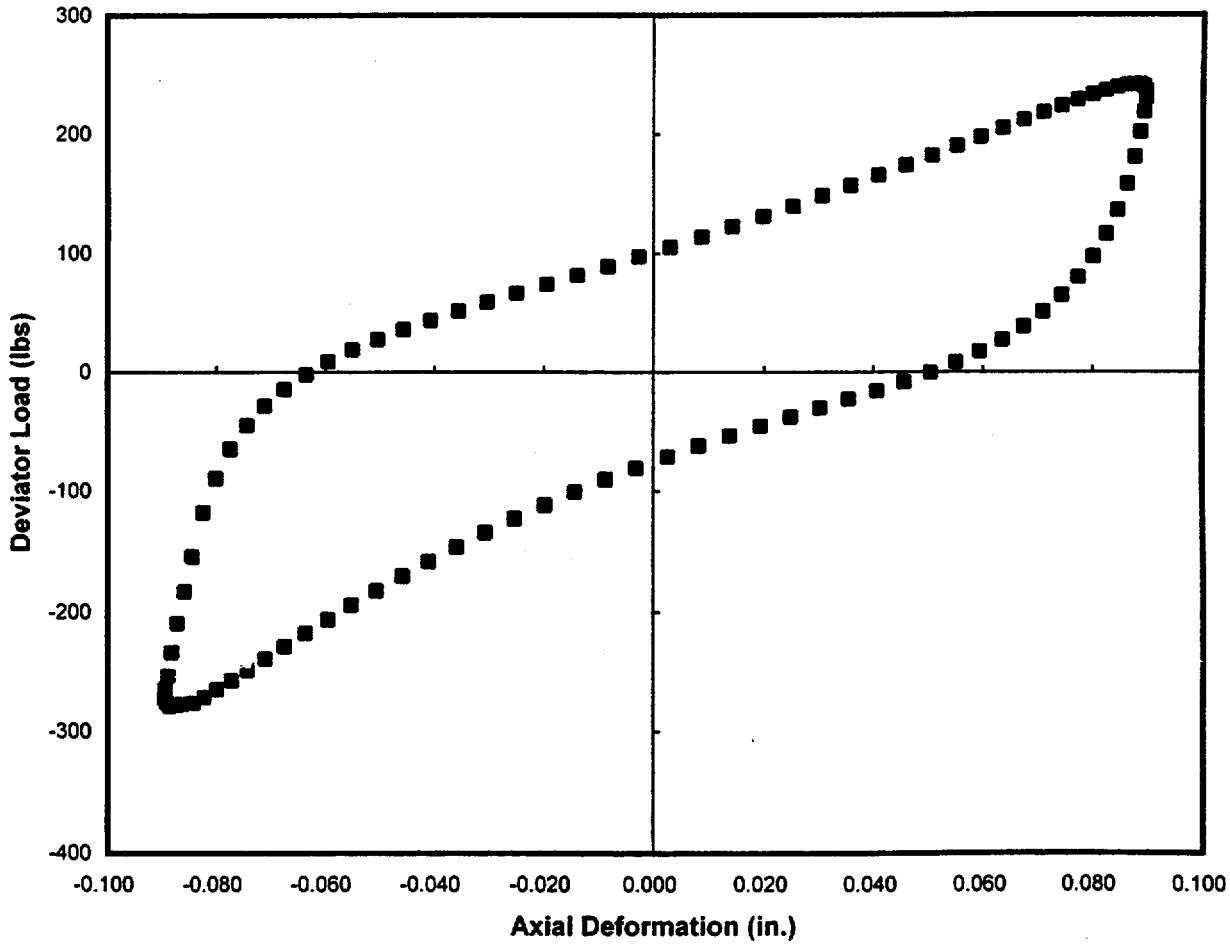
(ASTM D 3999-91)

Project No.:	50160-0-3963	Project Name:	Mox
Tested By:	JW & HJ	Boring No.:	BH-2
Test Date:	11/17/00	Sample No.:	15
Reviewed By:	JW	Depth:	70 - 72 feet
Review Date:	11/20/00	Sample Description:	Light tan clayey sand

Area, A_c (in^2)	Length, H_c (in)	Effective Consoli. Stress, σ_c (psi)	Cyclic Load, P_c (lbs)	Cyclic Deviator Stress, σ_d (psi)
6.07	5.84	91.0	260.39	42.9

Double Amplitude Load LD_A (lbs)	Double Ampli. Deformation SD_A (in.)	Young's Modulus E (psi)	Single Ampliti. Axial Strain ε (%)	Area of Hysteresis Loop A_L, (lb-in)	Area of Triangle A_T, (lb-in)	Damping Ratio D (%)
520.8	0.1791	2800	1.533	31.998	11.659	21.8

Hysteresis Loop @ 10th Cycle, Deformation Stage 8



LAWGIBB GROUP

CYCLIC TRIAXIAL PROPERTIES TEST

(ASTM D 3999-91)

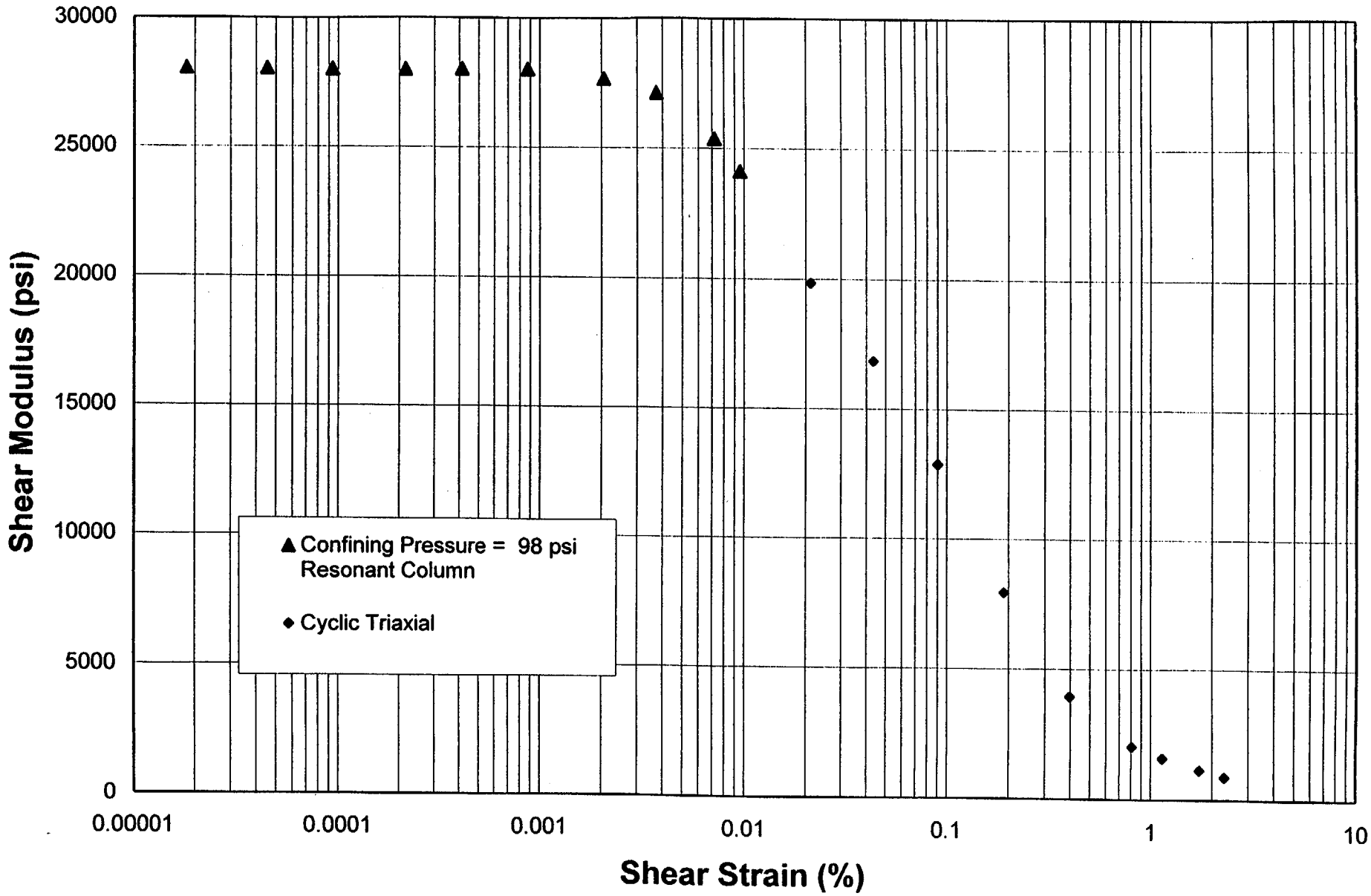
Project No.:	50160-0-3963	Project Name:	Mox
Tested By:	JW & HJ	Boring No.:	BH-2
Test Date:	11/17/00	Sample No.:	15
Reviewed By:	JW	Depth:	70 - 72 feet
Review Date:	11/20/00	Sample Description:	Light tan clayey sand

Effective Consolidation Stress 91 psi

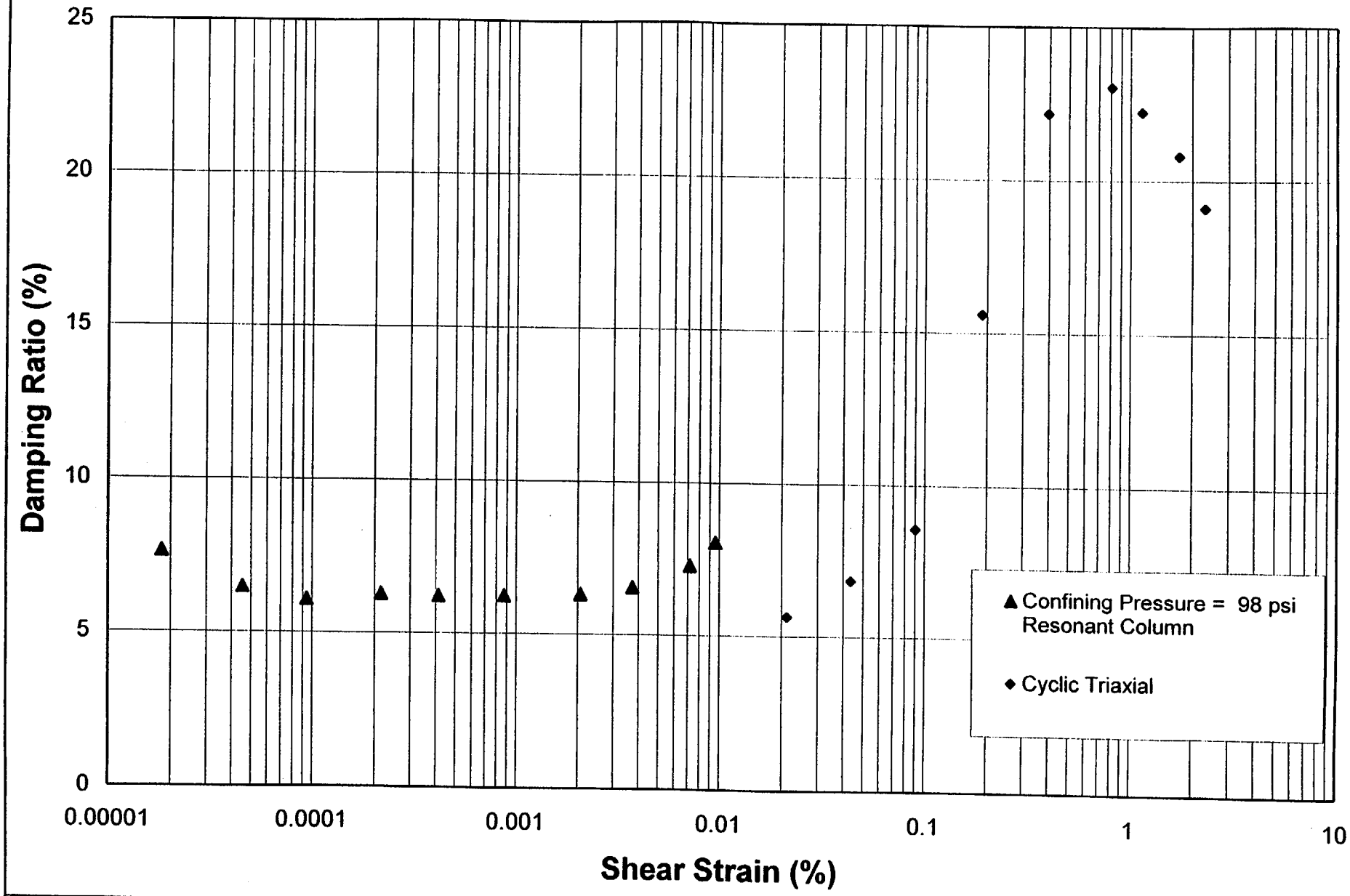
Deformation Stage No.	Cyclic Stress (psi)	Axial Strain ε (%)	Young's Modulus E, (psi)	Damping Ratio D, (%)	Shear* Modulus G, (psi)	Shear* Strain γ (%)
1	7.6	0.015	52444	5.46	17481	0.022
2	13.1	0.030	43982	8.98	14661	0.045
3	20.0	0.062	32386	12.02	10795	0.093
4	26.7	0.128	20872	15.84	6957	0.192
5	30.6	0.265	11580	20.88	3860	0.397
6	34.0	0.538	6315	22.89	2105	0.808
7	38.6	0.761	5072	23.09	1691	1.141
8	42.9	1.533	2800	21.84	933	2.300

* Calculated based on assumed Poisson's Ratio value, 0.5.

All calculations are based on 10th cycle.



Shear Modulus vs. Shear Strain **BH-2 21 96 - 98 feet**	**LAW** **LAWGIBB Group Member**	**MOX**	
		Project No.: 50160-0-3963	Date: 11/21/00



Damping Ratio vs. Shear Strain

BH-2 21 96 - 98 feet

LAW

LAWGIBB Group Member

MOX

Project No.: 50160-0-3963

Date: 11/21/00

LAW
LAWGIBB Group Member

RESONANT COLUMN TEST (ASTM D4015-87)

Project No.:	50160-0-3963	Project Name:	MOX
Tested By:	HJ & JW	Boring No.:	BH-2
Test Date:	11/21/00	Sample No.:	21
Reviewed By:	JW	Depth:	96 - 98 feet
Reviewed Date:	11/22/00	Sample Description:	Tan brown clayey sand

Initial Specimen Data

Labels	Values	Units	Description
	Masses		
M_{scb}	1179.40	g	*Mass of soil and container before*
M_{sca}	0.00	g	*Mass of soil and container after*
M_{ds}	1179.40	g	*M_{scb} - M_{sca} =mass of soil*
	Diameters		
D_t	72.8	mm	*Diameter near top of specimen*
D_m	72.8	mm	*Diameter near middle of specimen*
D_b	72.8	mm	*Diameter near bottom of specimen*
T_{mem}	0.0	mm	*Single thickness of membrane*
D_{net}	72.8	mm	*$(D_t + D_m + D_b)/3 - 2*T_{mem}$*
	Lengths		
L_{cbp}	220.7	mm	*Length between chamber bottom & top of top platen*
L_{tp}	21.6	mm	*Length of top platen*
L_{bp}	46.6	mm	*Length of bottom platen*
L_{net}	152.5	mm	*Length of Specimen $= L_{cbp} - L_{tp} - L_{bp}$*
	Volume		
V	634223	mm^3	*$D^2_{net} * Pi * L_{net}/4$*

Labels	Values	Units	Description
	Mass Density and Unit Weight		
Rho	1860	kg/m^3	*Mass density of specimen $M_s * V * 10^6$*
U_{wt}	18.2	kN/m^3	*Unit weight of specimen = Rho*9.806/1000*
	Moisture Content		
No.	AB-28		*Container number*
M_{wscb}	1262.68	g	*Mass of wet soil + container*
M_{wsca}	973.72	g	*Mass of dry soil + container*
M_{wat}	288.96	g	*Mass of water = M_{wscb} - M_{wsca}*
M_{cont}	83.28	g	*Mass of container.*
mc	32.5	%	*$M_{wat}/(M_{wsca} - M_{cont}) * 100\%$*
Rho_d	1404	kg/m^3	*Dry mass density = Rho/(1+mc)*
G_s	2.65		*Specific gravity (estimated)*
e	0.89		*Void Ratio, $[1000*G_s)]/Rho_d - 1$*
S_r	96.9	%	*Degree of Saturation = $mc*G_s/e$*
J	7.8E-04	$kg\text{-}m^2$	*Polar mass moment of inertia $= (M_s/1000)*(D_{net}/1000)^2/8$*

Conditions After Saturation			
CL_s	0.0	mm	*Change in length*
L_s	152.52	mm	*Length after saturation, $L - CL_s$*
A_s	4158	mm^2	*Area of specimen*
V_s	634223	mm^3	*Volume after saturation, $A_s * L_s$*
B	0.98		*B Value*

Conditions After Consolidation			
CL_c	3.4	mm	*Change in length*
L_d	149.1	mm	*Length after consolidation, $L_s - CL_c$*
CV_c	23426	mm^3	*Change in volume*
V_c	610797	mm^3	*Volume, $V_s - CV_c$*
S_r	100.0	%	*Degree of Saturation, $mc*G_s/e$*
e	0.82		*Void Ratio, $[1000*G_s]/Rho_d - 1$*
mc	30.9	%	*Moisture Content*
Rho_d	1458	kg/m^3	*Dry mass density, $Rho_d * V/V_c$*

LAW
LAWGIBB Group Member

RESONANT COLUMN TEST (ASTM D4015-87)

Project No.:	50160-0-3963	Project Name:	MOX
Tested By:	HJ & JW	Boring No.:	BH-2
Test Date:	11/21/00	Sample No.:	21
Reviewed By:	JW	Depth:	96 - 98 feet
Reviewed Date:	11/22/00	Sample Description:	Tan brown clayey sand

Apparatus Information

Apparatus Description	Typical Long-Tor
Apparatus Serial No.	556G0001
Platen Diameter, mm	72.4

Apparatus Calibration Factors			
M_A	0.3044	kg	*Top Platen Mass*
LCFA	N/A	$[m/V_{rms}]*[Hz^2]$	*Longitudinal Vibration Calibration Factor*
ADCL	N/A	kg-Hz	*Longitudinal Apparatus Damping Coefficient*
FCF	N/A	N/V_{rms}	*Force Calibration Factor*
J_A	0.0032	$kg-m^2$	*Platen Polar Mass Momment of Inertia*
RCFA	4.42	$[Rad/V_{rms}]*[Hz^2]$	*Rotational Vibration Calibration Factor*
ADCT	0.00139	$Hz-kg-m^2$	*Torsional Apparatus Damping Coefficient*
TCF	0.069	$N-m/V_{rms}$	*Torque Calibration Factor*
FOT	0	Hz	*Apparatus Resonant Frequency*

Ancillary System Calibration Factors			
LCCF	-0.635	mm/unit	*Length change calibration factor (+ means*
			specimen length increase for increase values)
BCF	-0.34	mL/unit	*Burette calibration factor (+ means specimen*
			volume increase for increase values.)
CPCF	6.89	kPa/unit	*Cell pressure calibration factor*
PPCF	6.89	kPa/unit	*Pore Pressure calibration factor*
ALCF	1	kN/unit	*Axial load calibration factor*
			(+ means compression of specimen.)
Ancillary System Initial Conditions			
ILR	19	units	*Initial length reading before testing*
IBR	7.33	units	*Initial burette reading before testing*
RPF	P		*P or F. "P" for resonant period input, and*
			"F" for resonant frequency input.

LAW
LAWGIBB Group Member

RESONANT COLUMN TEST (ASTM D4015-87)

INPUT DATA

Project No.:	50160-0-3963	Project Name:	MOX
Tested By:	HJ & JW	Boring No:	BH-2
Test Date:	11/21/00	Sample No.:	21
Reviewed By:	JW	Depth:	96 - 98 feet
Reviewed Date	11/22/00	Sample Description:	Tan brown clayey sand

Total Number of Data Sets 10

Line No.	Elapsed Time [second]	Cell Pressure [unit]	Pore Pressure [unit]	Axial Load [unit]	Burette Reading [unit]	Length Reading [unit]	Longitudinal or Torsional	Force or Torque Reading [V_{rms}]	Transducer Reading [V_{rms}]	Resonant Period [msec]
1	28	118.0	20.0	0	19.0	7.33	T	0.008	0.006	6.765
2	54	118.0	20.0	0	19.0	7.33	T	0.017	0.015	6.765
3	99	118.0	20.0	0	19.0	7.33	T	0.033	0.031	6.768
4	162	118.0	20.0	0	19.0	7.36	T	0.078	0.071	6.768
5	205	118.0	20.0	0	19.0	7.35	T	0.148	0.136	6.765
6	250	118.0	20.0	0	19.0	7.36	T	0.314	0.288	6.766
7	286	118.0	20.0	0	19.0	7.36	T	0.740	0.671	6.810
8	313	118.0	20.0	0	19.0	7.36	T	1.365	1.191	6.876
9	360	118.0	20.0	0	19.0	8.36	T	2.750	2.16	7.068
10	393	118.0	20.0	0	19.0	9.36	T	3.870	2.75	7.207

LAW
LAWGIBB Group Member

RESONANT COLUMN TEST (ASTM D4015-87)

TEST RESULTS SUMMARY

Project No.:	50160-0-3963	Project Name:	MOX
Tested By:	HJ & JW	Boring No:	BH-2
Test Date:	11/21/00	Sample No.:	21
Reviewed By:	JW	Depth:	96 - 98 feet
Reviewed Date:	11/22/00	Sample Description:	Tan brown clayey sand

Line No.	Effective Confining Stress [kPa]	Principal Stress Ratio	Void Ratio e	Longitudinal or Torsional	No. of Vibration Cycles	Shear Modulus G [Mpa]	Shear Modulus G [psi]	Shear Strain Amplitude [%]	Damping Ratio [%]
1	675.22	1.00	0.806	T	4139	193.26	28050	0.00002	7.64
2	675.22	1.00	0.806	T	3843	193.26	28050	0.00005	6.49
3	675.22	1.00	0.806	T	6649	193.09	28025	0.00009	6.09
4	675.22	1.00	0.806	T	9309	193.02	28015	0.00022	6.29
5	675.22	1.00	0.806	T	6356	193.22	28043	0.00041	6.23
6	675.22	1.00	0.806	T	6651	193.14	28031	0.00087	6.24
7	675.22	1.00	0.806	T	5286	190.65	27670	0.00206	6.31
8	675.22	1.00	0.806	T	3927	187.01	27142	0.00372	6.56
9	675.22	1.00	0.806	T	6650	174.90	25384	0.00718	7.29
10	675.22	1.00	0.806	T	4579	166.23	24126	0.00956	8.06

LAWGIBB GROUP

CYCLIC TRIAXIAL PROPERTIES TEST

(ASTM D 3999-91)

Project No.:	50160-0-3963	Project Name:	Mox
Tested By:	JW & HJ	Boring No.:	BH-2
Test Date:	11/21/00	Sample No.:	21
Reviewed By:	JW	Depth:	96 - 98 feet
Review Date:	11/22/00	Sample Description:	Tan brown clayey sand

SPECIMEN DATA

Initial Conditions of Specimen

Diameters, in.		Area , sq. in.	6.41
Top	2.856	Volume, cubic in.	38.49
Middle	2.858	Mass of Specimen, grams	1192.94
Bottom	2.858		
Average	2.857	Moisture Content	
Membrane Thickness, in.	0.000	Pan No.	AB-1
Net Diameter, in.	2.857	Wet Mass + Pan, grams	1277.94
		Dry Mass + Pan, grams	992.89
Length, in.		Container Mass, grams	85.00
Location 1	6.002	Moisture Content, %	31.4
Location 2	6.002		
Location 3	6.002	Density, pcf	117.8
Average	6.002	Dry Density, pcf	89.7
Length of Top Platen	0.000	Specific Gravity	2.65
Length of Bottom Platen	0.000	Degree of Saturation, %	98.6
Length of Specimen, in	6.002	Void Ratio	0.844

Conditions of Specimen After Saturation and Consolidation

After Saturation		After Consolidation	
Change in Length, in.	0.000	Change in Length, in.	0.143
Length, in.	6.002	Length, in.	5.859
Area, sq. in.	6.41	Change in Volume, cc	32.10
Volume, cubic in.	38.49	Volume, cubic in.	36.53
Back Pressure, psi	15.7	Area, sq. in.	6.23
B Value	0.96	Effe. Consoli.. Stress, psi	98.0
		Moisture Content, %	28.3
		Dry Density, pcf	94.5
		Void Ratio	0.750
		Degree of Saturation, %	100.0

LAWGIBB GROUP

CYCLIC TRIAXIAL PROPERTIES TEST

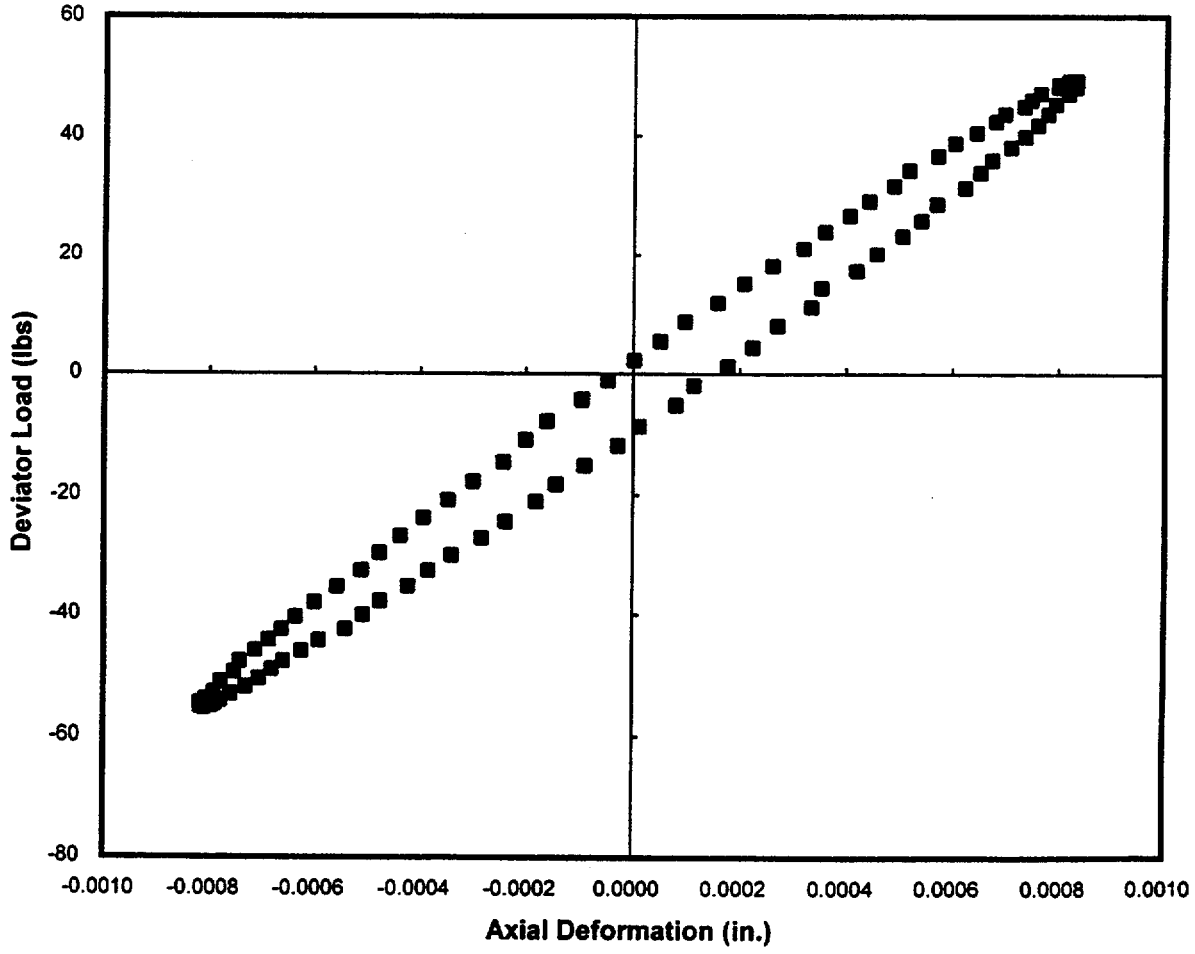
(ASTM D 3999-91)

Project No.:	50160-0-3963	Project Name:	Mox
Tested By:	JW & HJ	Boring No.:	BH-2
Test Date:	11/21/00	Sample No.:	21
Reviewed By:		Depth:	96 - 98 feet
Review Date:		Sample Description:	Tan brown clayey sand

Area, A_c (in^2)	Length, H_c (in)	Effective Consoli. Stress, σ_c (psi)	Cyclic Load, P_c (lbs)	Cyclic Deviator Stress, σ_d (psi)
6.23	5.86	98.0	52.28	8.4

Double Amplitude Load LD_A (lbs)	Double Ampli. Deformation SD_A (in.)	Young's Modulus E (psi)	Single Ampliti. Axial Strain ε (%)	Area of Hysteresis Loop A_L, (lb-in)	Area of Triangle A_T, (lb-in)	Damping Ratio D (%)
104.6	0.0016	59569	0.014	0.015	0.022	5.6

Hysteresis Loop @ 10th Cycle, Deformation Stage 1



LAWGIBB GROUP

CYCLIC TRIAXIAL PROPERTIES TEST

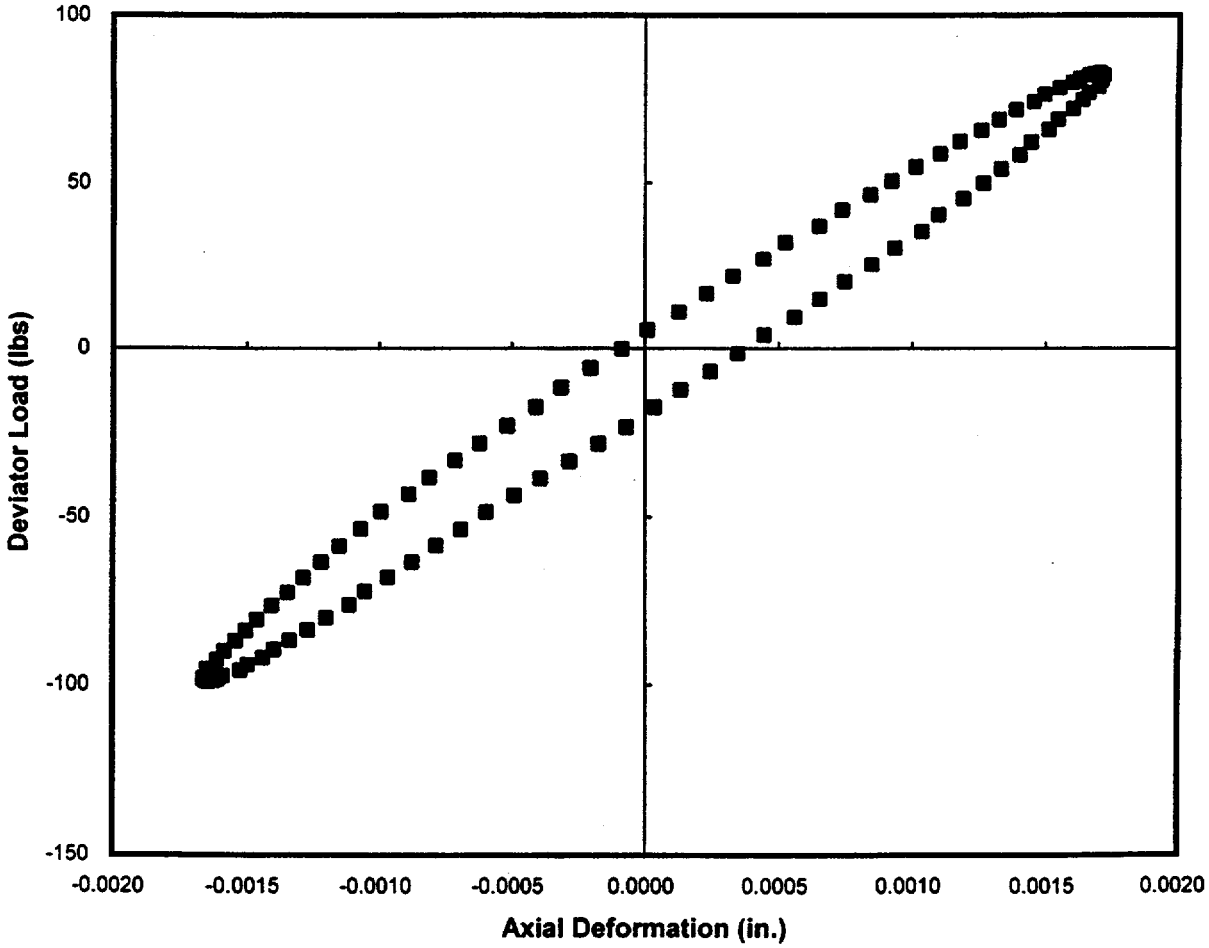
(ASTM D 3999-91)

Project No.:	50160-0-3963	Project Name:	Mox
Tested By:	JW & HJ	Boring No.:	BH-2
Test Date:	11/21/00	Sample No.:	21
Reviewed By:		Depth:	96 - 98 feet
Review Date:		Sample Description:	Tan brown clayey sand

Area, A_c (in^2)	Length, H_c (in)	Effective Consoli. Stress, σ_c (psi)	Cyclic Load, P_c (lbs)	Cyclic Deviator Stress, σ_d (psi)
6.23	5.86	98.0	90.95	14.6

Double Amplitude Load LD_A (lbs)	Double Ampli. Deformation SD_A (in.)	Young's Modulus E (psi)	Single Ampliti. Axial Strain ε (%)	Area of Hysteresis Loop A_L, (lb-in)	Area of Triangle A_T, (lb-in)	Damping Ratio D (%)
181.9	0.0034	50534	0.029	0.066	0.077	6.8

Hysteresis Loop @ 10th Cycle, Deformation Stage 2



LAWGIBB GROUP

CYCLIC TRIAXIAL PROPERTIES TEST

(ASTM D 3999-91)

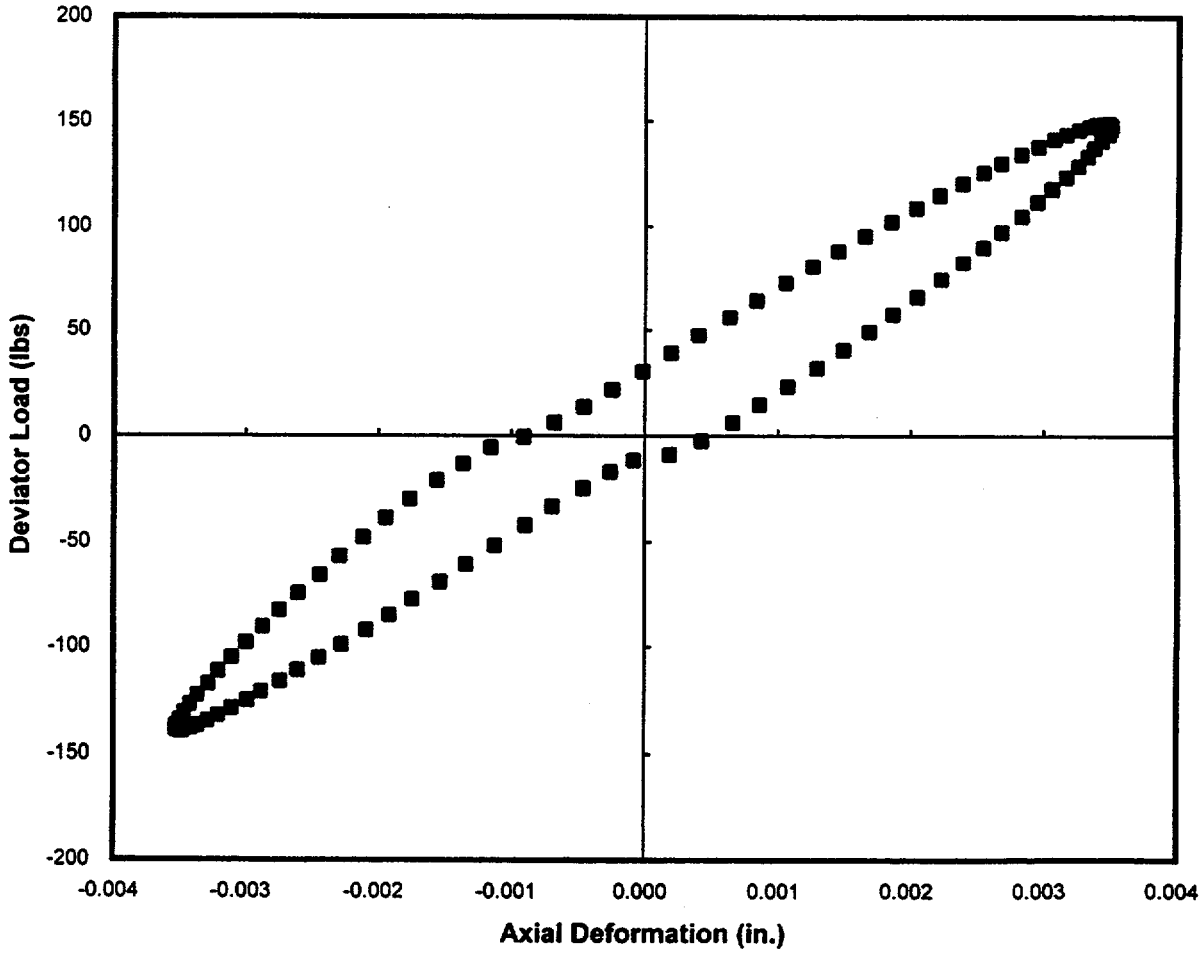
Project No.: 50160-0-3963
Tested By: JW & HJ
Test Date: 11/21/00
Reviewed By:
Review Date:

Project Name: Mox
Boring No.: BH-2
Sample No.: 21
Depth: 96 - 98 feet
Sample Description: Tan brown clayey sand

Area, A_c (in^2)	Length, H_c (in)	Effective Consoli Stress, σ_c (psi)	Cyclic Load, P_c (lbs)	Cyclic Deviator Stress, σ_d (psi)
6.23	5.86	98.0	144.34	23.2

Double Amplitude Load LD_A (lbs)	Double Ampli. Deformation SD_A (in.)	Young's Modulus E (psi)	Single Ampliti. Axial Strain ε (%)	Area of Hysteresis Loop A_L, (lb-in)	Area of Triangle A_T, (lb-in)	Damping Ratio D (%)
288.7	0.0070	38588	0.060	0.273	0.254	8.6

Hysteresis Loop @ 10th Cycle, Deformation Stage 3



LAWGIBB GROUP

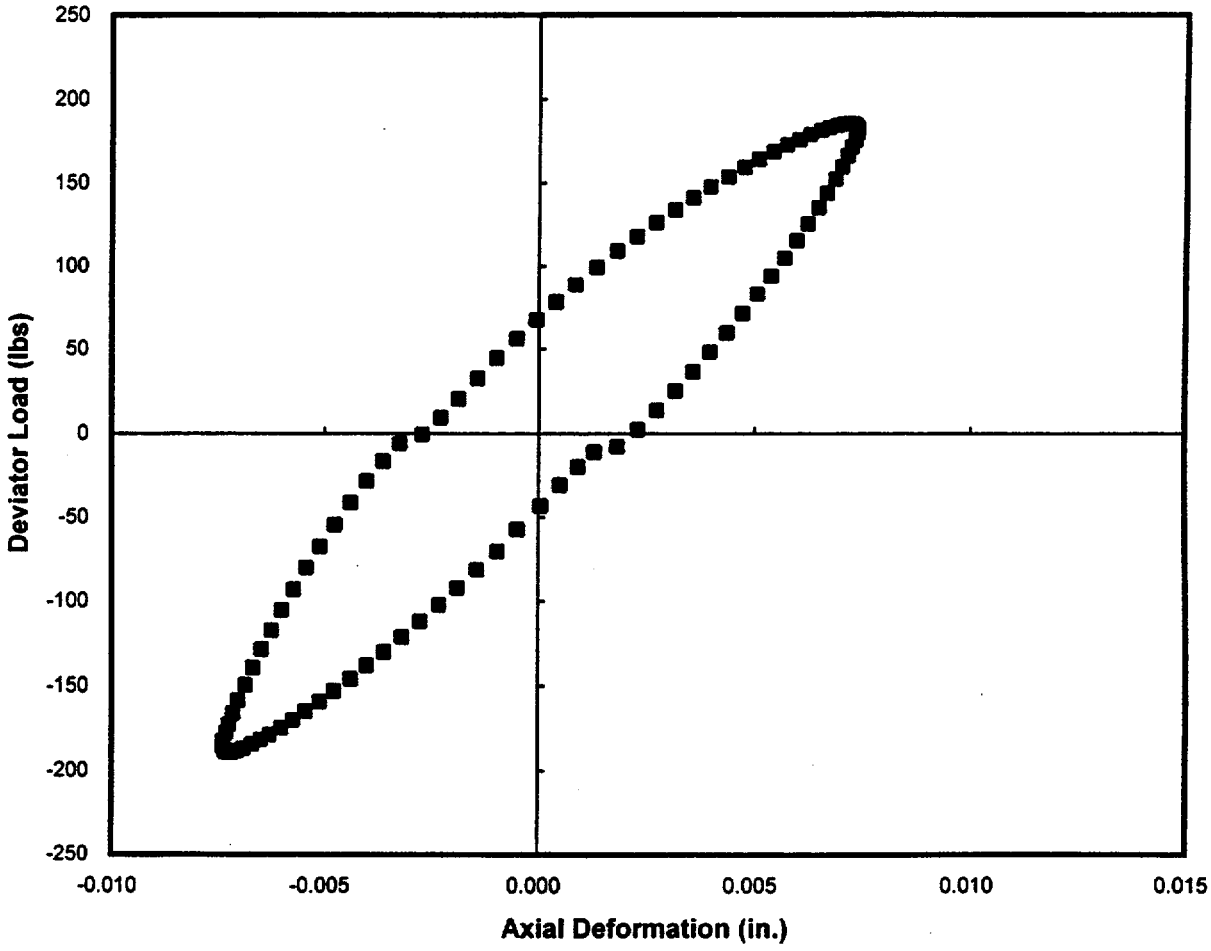
CYCLIC TRIAXIAL PROPERTIES TEST
(ASTM D 3999-91)

Project No.:	50160-0-3963	Project Name:	Mox
Tested By:	JW & HJ	Boring No.:	BH-2
Test Date:	11/21/00	Sample No.:	21
Reviewed By:		Depth:	96 - 98 feet
Review Date:		Sample Description:	Tan brown clayey sand

Area, A_c (in^2)	Length, H_c (in)	Effective Consoli. Stress, σ_c (psi)	Cyclic Load, P_c (lbs)	Cyclic Deviator Stress, σ_d (psi)
6.23	5.86	98.0	187.16	30.0

Double Amplitude Load LD_A (lbs)	Double Ampli. Deformation SD_A (in.)	Young's Modulus E (psi)	Single Ampliti. Axial Strain ε (%)	Area of Hysteresis Loop A_L, (lb-in)	Area of Triangle A_T, (lb-in)	Damping Ratio D (%)
374.3	0.0148	23807	0.126	1.356	0.691	15.6

Hysteresis Loop @ 10th Cycle, Deformation Stage 4



LAWGIBB GROUP

CYCLIC TRIAXIAL PROPERTIES TEST

(ASTM D 3999-91)

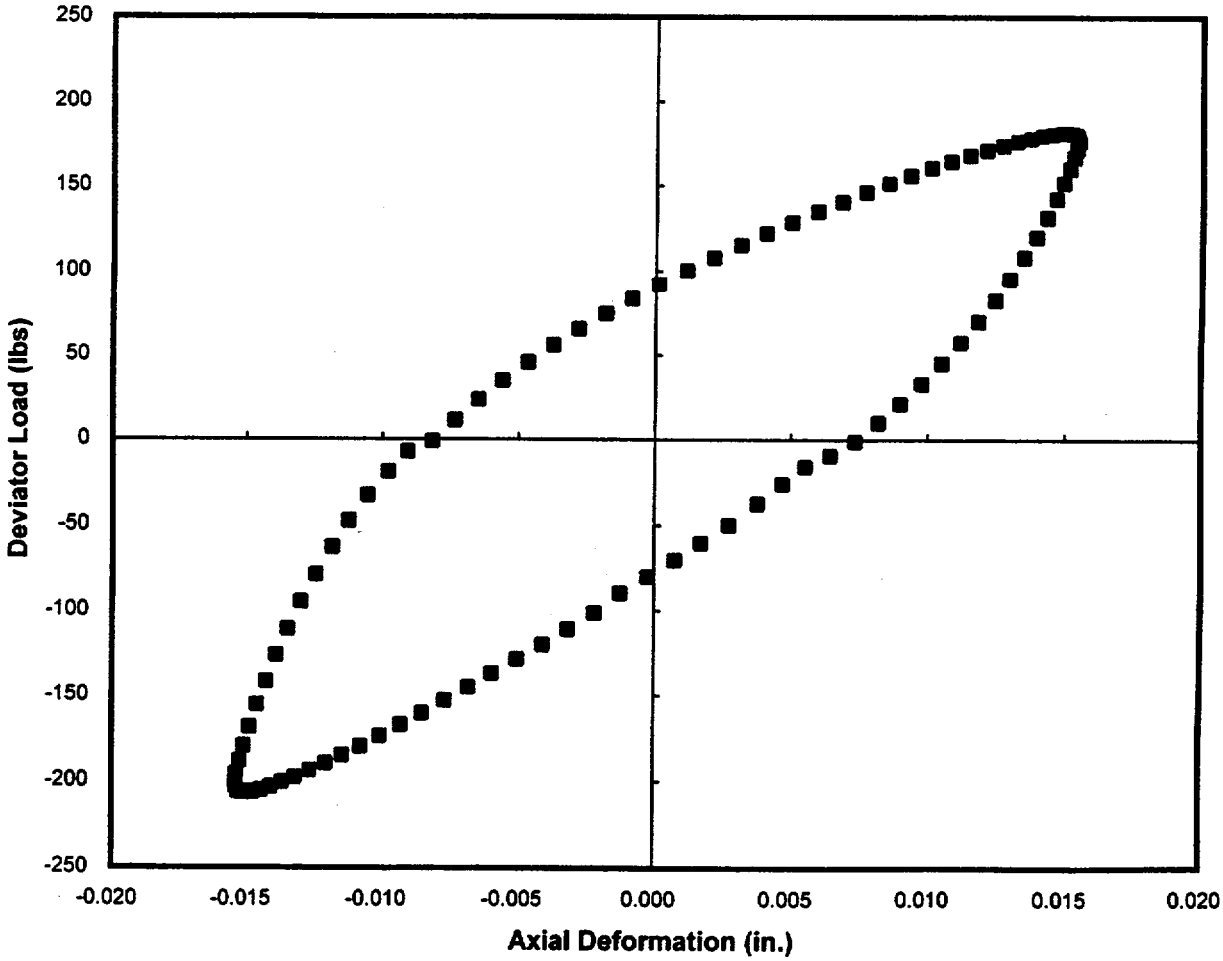
Project No.: 50160-0-3963
Tested By: JW & HJ
Test Date: 11/21/00
Reviewed By:
Review Date:

Project Name: Mox
Boring No.: BH-2
Sample No.: 21
Depth: 96 - 98 feet
Sample Description: Tan brown clayey sand

Area, A_c (in^2)	Length, H_c (in)	Effective Consoli. Stress, σ_c (psi)	Cyclic Load, P_c (lbs)	Cyclic Deviator Stress, σ_d (psi)
6.23	5.86	98.0	193.80	31.1

Double Amplitude Load LD_A (lbs)	Double Ampli. Deformation SD_A (in.)	Young's Modulus E (psi)	Single Ampliti. Axial Strain ε (%)	Area of Hysteresis Loop A_L, (lb-in)	Area of Triangle A_T, (lb-in)	Damping Ratio D (%)
387.6	0.0309	11805	0.263	4.163	1.495	22.2

Hysteresis Loop @ 10th Cycle, Deformation Stage 5



LAWGIBB GROUP

CYCLIC TRIAXIAL PROPERTIES TEST

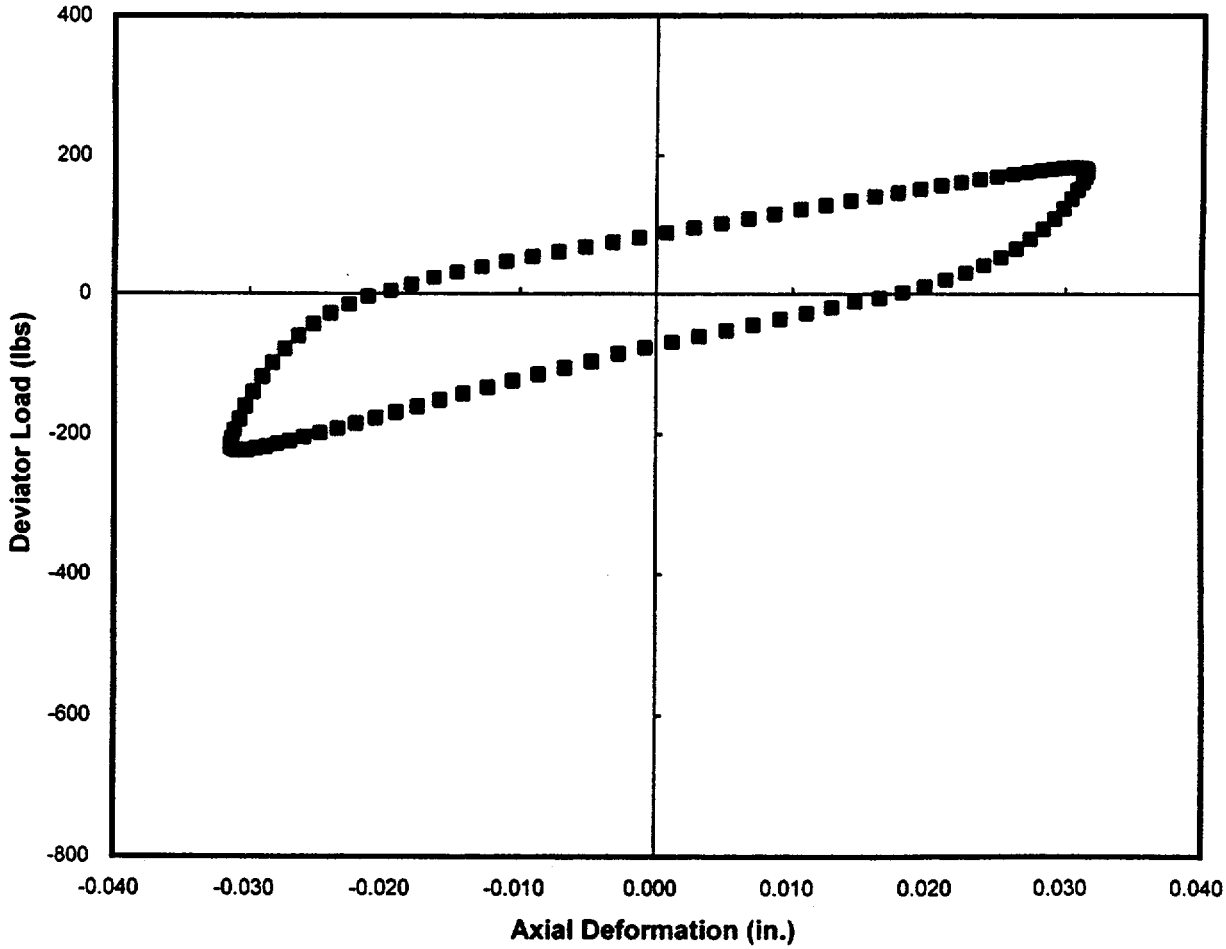
(ASTM D 3999-91)

Project No.:	50160-0-3963	Project Name:	Mox
Tested By:	JW & HJ	Boring No.:	BH-2
Test Date:	11/21/00	Sample No.:	21
Reviewed By:		Depth:	96 - 98 feet
Review Date:		Sample Description:	Tan brown clayey sand

Area, A_c (in^2)	Length, H_c (in)	Effective Consoli. Stress, σ_c (psi)	Cyclic Load, P_c (lbs)	Cyclic Deviator Stress, σ_d (psi)
6.23	5.86	98.0	203.08	32.6

Double Amplitude Load LD_A (lbs)	Double Ampli. Deformation SD_A (in.)	Young's Modulus E (psi)	Single Ampliti. Axial Strain ε (%)	Area of Hysteresis Loop A_L, (lb-in)	Area of Triangle A_T, (lb-in)	Damping Ratio D (%)
406.2	0.0629	6064	0.537	9.247	3.195	23.0

Hysteresis Loop @ 10th Cycle, Deformation Stage 6



LAWGIBB GROUP

CYCLIC TRIAXIAL PROPERTIES TEST

(ASTM D 3999-91)

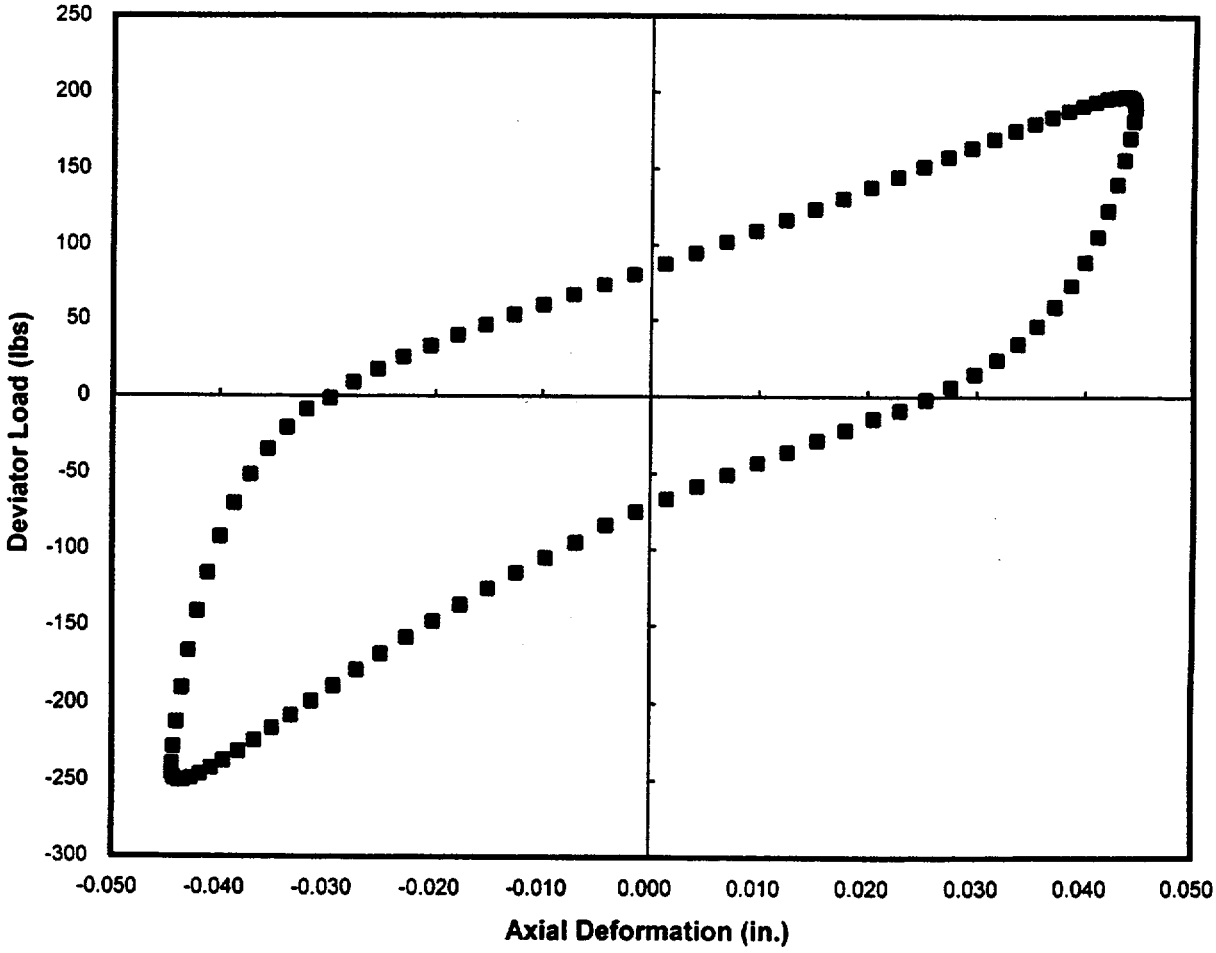
Project No.: 50160-0-3963
Tested By: JW & HJ
Test Date: 11/21/00
Reviewed By:
Review Date:

Project Name: Mox
Boring No.: BH-2
Sample No.: 21
Depth: 96 - 98 feet
Sample Description: Tan brown clayey sand

Area, A_c (in^2)	Length, H_c (in)	Effective Consoli. Stress, σ_c (psi)	Cyclic Load, P_c (lbs)	Cyclic Deviator Stress, σ_d (psi)
6.23	5.86	98.0	224.06	35.9

Double Amplitude Load LD_A (lbs)	Double Ampli. Deformation SD_A (in.)	Young's Modulus E (psi)	Single Ampliti. Axial Strain ε (%)	Area of Hysteresis Loop A_L, (lb-in)	Area of Triangle A_T, (lb-in)	Damping Ratio D (%)
448.1	0.0889	4736	0.759	13.905	4.981	22.2

Hysteresis Loop @ 10th Cycle, Deformation Stage 7



LAWGIBB GROUP

CYCLIC TRIAXIAL PROPERTIES TEST

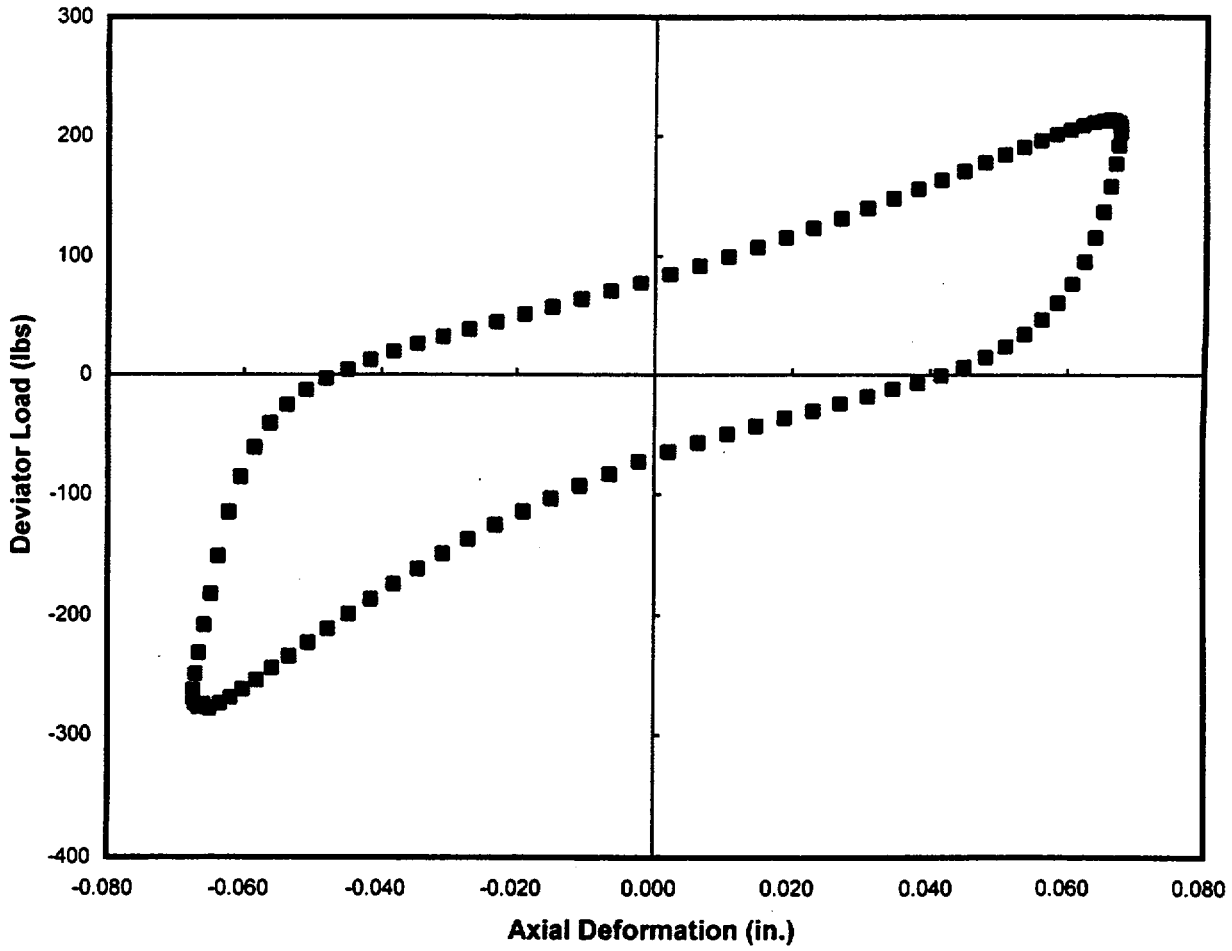
(ASTM D 3999-91)

Project No.:	50160-0-3963	Project Name:	Mox
Tested By:	JW & HJ	Boring No.:	BH-2
Test Date:	11/21/00	Sample No.:	21
Reviewed By:		Depth:	96 - 98 feet
Review Date:		Sample Description:	Tan brown clayey sand

Area, A_c (in^2)	Length, H_c (in)	Effective Consoli. Stress, σ_c (psi)	Cyclic Load, P_c (lbs)	Cyclic Deviator Stress, σ_d (psi)
6.23	5.86	98.0	245.96	39.5

Double Amplitude Load LD_A (lbs)	Double Ampli. Deformation SD_A (in.)	Young's Modulus E (psi)	Single Ampliti. Axial Strain ε (%)	Area of Hysteresis Loop A_L, (lb-in)	Area of Triangle A_T, (lb-in)	Damping Ratio D (%)
491.9	0.1350	3425	1.152	21.698	8.300	20.8

Hysteresis Loop @ 10th Cycle, Deformation Stage 8



LAWGIBB GROUP

CYCLIC TRIAXIAL PROPERTIES TEST

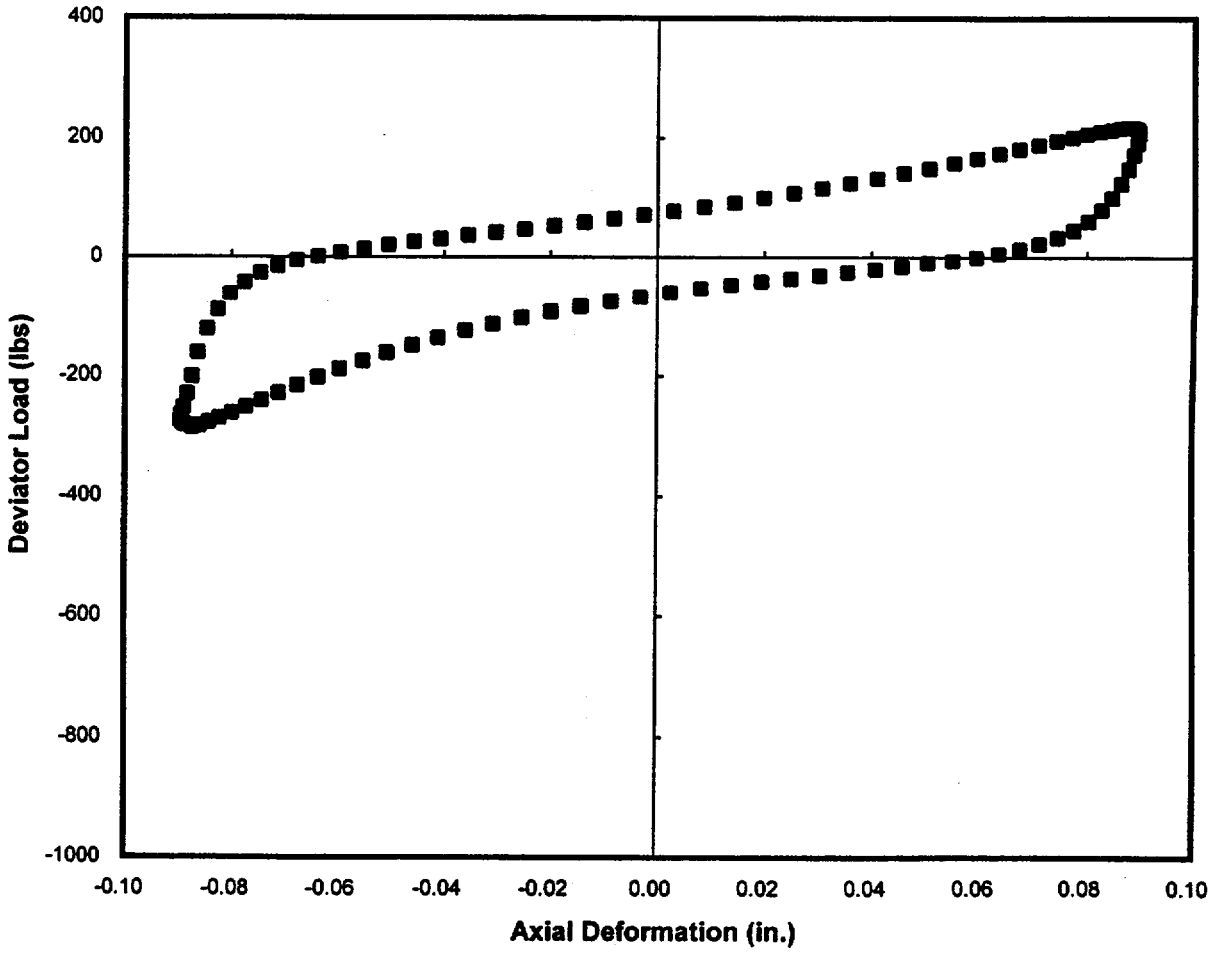
(ASTM D 3999-91)

Project No.:	50160-0-3963	Project Name:	Mox
Tested By:	JW & HJ	Boring No.:	BH-2
Test Date:	11/21/00	Sample No.:	21
Reviewed By:		Depth:	96 - 98 feet
Review Date:		Sample Description:	Tan brown clayey sand

Area, A_c (in^2)	Length, H_c (in)	Effective Consoli. Stress, σ_c (psi)	Cyclic Load, P_c (lbs)	Cyclic Deviator Stress, σ_d (psi)
6.23	5.86	98.0	251.39	40.3

Double Amplitude Load LD_A (lbs)	Double Ampli. Deformation SD_A (in.)	Young's Modulus E (psi)	Single Ampliti. Axial Strain ε (%)	Area of Hysteresis Loop A_L, (lb-in)	Area of Triangle A_T, (lb-in)	Damping Ratio D (%)
502.8	0.1792	2637	1.529	27.048	11.260	19.1

Hysteresis Loop @ 10th Cycle, Deformation Stage 9



LAWGIBB GROUP

CYCLIC TRIAXIAL PROPERTIES TEST

(ASTM D 3999-91)

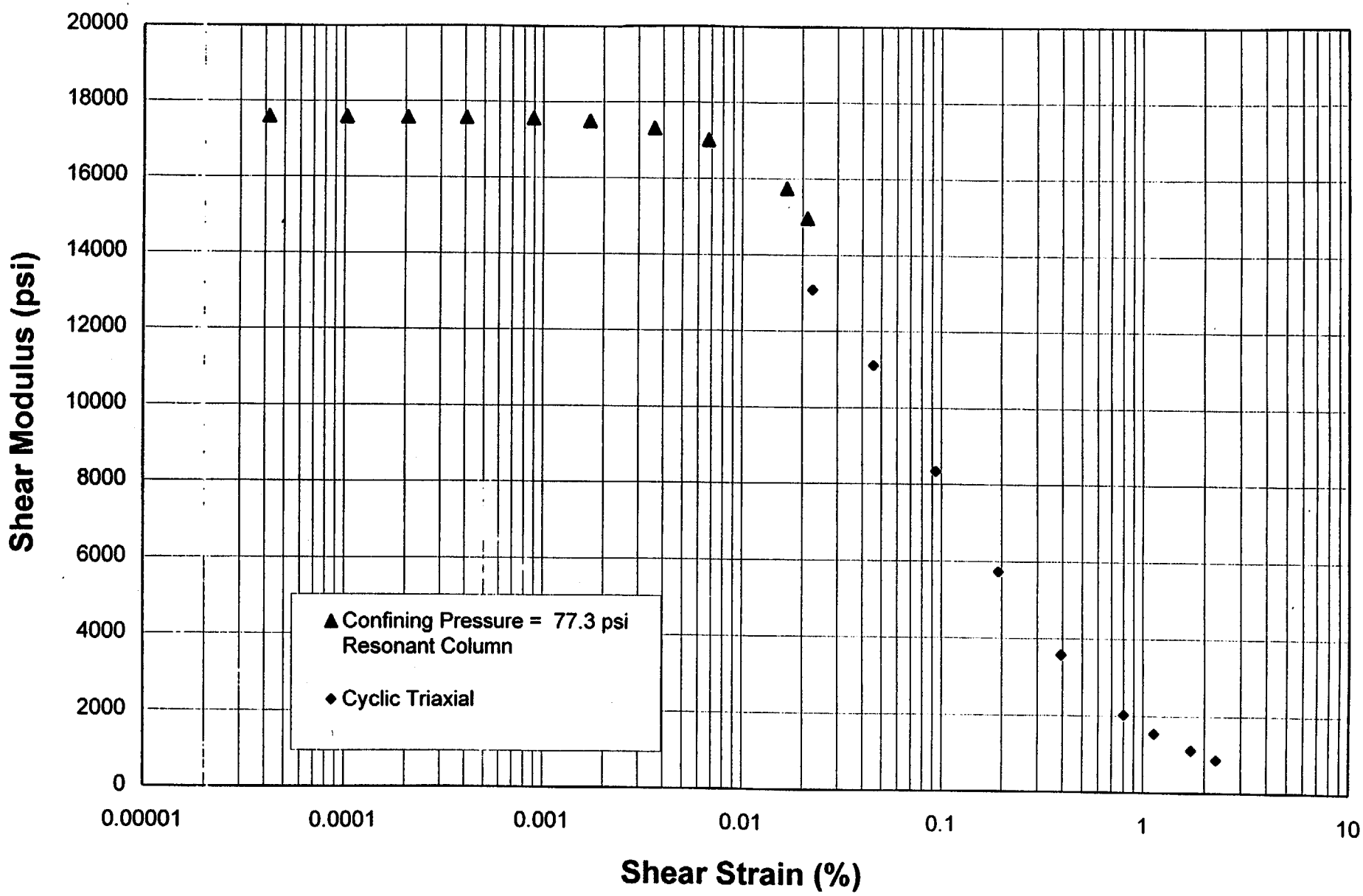
Project No.:	50160-0-3963	Project Name:	Mox
Tested By:	JW & HJ	Boring No.:	BH-2
Test Date:	11/21/00	Sample No.:	21
Reviewed By:		Depth:	96 - 98 feet
Review Date:		Sample Description:	Tan brown clayey sand

Effective Consolidation Stress 98 psi

Deformation Stage No.	Cyclic Stress (psi)	Axial Strain ε (%)	Young's Modulus E, (psi)	Damping Ratio D, (%)	Shear* Modulus G, (psi)	Shear* Strain γ (%)
1	8.4	0.014	59569	5.65	19856	0.021
2	14.6	0.029	50534	6.84	16845	0.043
3	23.2	0.060	38588	8.57	12863	0.090
4	30.0	0.126	23807	15.61	7936	0.189
5	31.1	0.263	11805	22.16	3935	0.395
6	32.6	0.537	6064	23.03	2021	0.806
7	35.9	0.759	4736	22.22	1579	1.138
8	39.5	1.152	3425	20.80	1142	1.728
9	40.3	1.529	2637	19.12	879	2.293

* Calculated based on assumed Poisson's Ratio value, 0.5.

All calculations are based on 10th cycle.



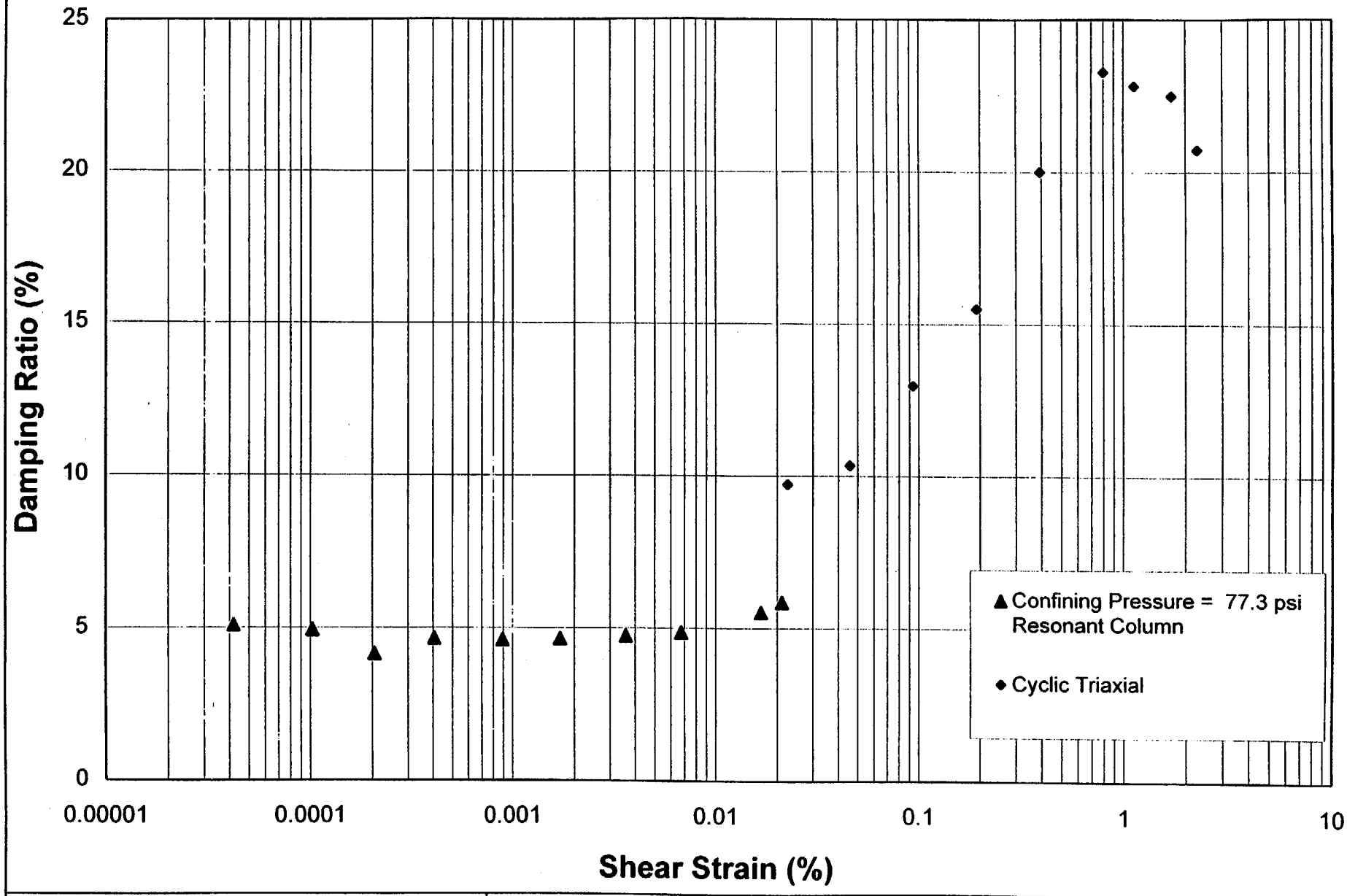
Shear Modulus vs. Shear Strain
BH-3 10B 50 - 52 ft

LAW
LAWGIBB Group Member

MOX

Project No.: 50160-0-3963

Date: 11/27/00



Damping Ratio vs. Shear Strain **BH-3 10B 50 - 52 ft**	**LAW** **LAWGIBB Group Member**	**MOX** Project No.: 50160-0-3963 Date: 11/27/00

LAW

LAWGIBB Group Member

RESONANT COLUMN TEST (ASTM D4015-87)

Project No.:	50160-0-3963	Project Name:	MOX
Tested By:	HJ & JW	Boring No.:	BH-3
Test Date:	11/27/00	Sample No.:	10B
Reviewed By:	JW	Depth:	50 - 52 ft
Reviewed Date:	11/28/00	Sample Description:	Tan fat clay and elastic silt

Initial Specimen Data

Labels	Values	Units	Description
			Masses
M_{scb}	1108.51	g	*Mass of soil and container before*
M_{sca}	0.00	g	*Mass of soil and container after*
M_{ds}	1108.51	g	*M_{scb} - M_{sca} =mass of soil*
			Diameters
D_t	72.7	mm	*Diameter near top of specimen*
D_m	72.7	mm	*Diameter near middle of specimen*
D_b	72.8	mm	*Diameter near bottom of specimen*
T_{mem}	0.0	mm	*Single thickness of membrane*
D_{net}	72.7	mm	*$(D_t + D_m + D_b)/3 - 2*T_{mem}$*
			Lengths
L_{cbp}	220.7	mm	*Length between chamber bottom & top of top platen*
L_{tp}	21.6	mm	*Length of top platen*
L_{bp}	46.6	mm	*Length of bottom platen*
L_{net}	152.5	mm	*Length of Specimen = $L_{cbp} - L_{tp} - L_{bp}$*
			Volume
V	633716	mm^3	*$D^2_{net}*Pi*L_{net}/4$*

Labels	Values	Units	Description
			Mass Density and Unit Weight
Rho	1749	kg/m^3	*Mass density of specimen M_s*V*10^6*
U_{wt}	17.2	kN/m^3	*Unit weight of specimen = Rho*9.806/1000*
			Moisture Content
No.	K-14		*Container number*
M_{wscb}	1160.21	g	*Mass of wet soil + container*
M_{wsca}	854.06	g	*Mass of dry soil + container*
M_{wat}	306.15	g	*Mass of water = $M_{wscb} - M_{wsca}$*
M_{cont}	51.70	g	*Mass of container.*
mc	38.2	%	*$M_{wat}/(M_{wsca} - M_{cont})*100\%$*
Rho_d	1266	kg/m^3	*Dry mass density = Rho/(1+mc)*
G_s	2.65		*Specific gravity (estimated)*
e	1.09		*Void Ratio, $[1000*G_s)]/Rho_d-1$*
S_r	92.5	%	*Degree of Saturation = $mc*G_s/e$*
J	7.3E-04	$kg-m^2$	*Polar mass moment of inertia = $(M_s/1000)*(D_{net}/1000)^2/8$*

Conditions After Saturation			
CL_s	0.0	mm	*Change in length*
L_s	152.51	mm	*Length after saturation, $L - CL_s$*
A_s	4155	mm^2	*Area of specimen*
V_s	633716	mm^3	*Volume after saturation, $A_s * L_s$*
B	0.96		*B Value*

Conditions After Consolidation			
CL_c	2.3	mm	*Change in length*
L_d	150.2	mm	*Length after consolidation, L_s-CL_c*
CV_c	38250	mm^3	*Change in volume*
V_c	595466	mm^3	*Volume, $V_s - CV_c$*
S_r	100.0	%	*Degree of Saturation, $mc*G_s/e$*
e	0.97		*Void Ratio, $[1000*G_s]/Rho_d-1$*
mc	36.5	%	*Moisture Content*
Rho_d	1347	kg/m^3	*Dry mass density, Rho_d*V/V_c*

LAW

LAWGIBB Group Member

RESONANT COLUMN TEST (ASTM D4015-87)

Project No.:	50160-0-3963	Project Name:	MOX
Tested By:	HJ & JW	Boring No.:	BH-3
Test Date:	11/27/00	Sample No.:	10B
Reviewed By:	JW	Depth:	50 - 52 ft
Reviewed Date:	11/28/00	Sample Description:	Tan fat clay and elastic silt

Apparatus Information

Apparatus Description	Typical Long-Tor
Apparatus Serial No.	556G0001
Platen Diameter, mm	72.4

Apparatus Calibration Factors			
M_A	0.3044	kg	*Top Platen Mass*
LCFA	N/A	$[m/V_{rms}]*[Hz^2]$	*Longitudinal Vibration Calibration Factor*
ADCL	N/A	kg-Hz	*Longitudinal Apparatus Damping Coefficient*
FCF	N/A	N/V_{rms}	*Force Calibration Factor*
J_A	0.0032	$kg\text{-}m^2$	*Platen Polar Mass Momment of Inertia*
RCFA	4.42	$[Rad/V_{rms}]*[Hz^2]$	*Rotational Vibration Calibration Factor*
ADCT	0.00139	$Hz\text{-}kg\text{-}m^2$	*Torsional Apparatus Damping Coefficient*
TCF	0.069	$N\text{-}m/V_{rms}$	*Torque Calibration Factor*
FOT	0	Hz	*Apparatus Resonant Frequency*

Ancillary System Calibration Factors			
LCCF	-0.635	mm/unit	*Length change calibration factor (+ means specimen length increase for increase values)*
BCF	-0.34	mL/unit	*Burette calibration factor (+ means specimen volume increase for increase values.)*
CPCF	6.89	kPa/unit	*Cell pressure calibration factor*
PPCF	6.89	kPa/unit	*Pore Pressure calibration factor*
ALCF	1	kN/unit	*Axial load calibration factor (+ means compression of specimen.)*
Ancillary System Initial Conditions			
ILR	9.71	units	*Initial length reading before testing*
IBR	22	units	*Initial burette reading before testing*
RPF	P		*P or F. "P" for resonant period input, and "F" for resonant frequency input.*

LAW

LAWGIBB Group Member

RESONANT COLUMN TEST (ASTM D4015-87)

INPUT DATA

Project No.:	50160-0-3963	Project Name:	MOX
Tested By:	HJ & JW	Boring No:	BH-3
Test Date:	11/27/00	Sample No.:	10B
Reviewed By:	JW	Depth:	50 - 52 ft
Reviewed Date	11/28/00	Sample Description:	Tan fat clay and elastic silt

Total Number of Data Sets 10

Line No.	Elapsed Time [second]	Cell Pressure [unit]	Pore Pressure [unit]	Axial Load [unit]	Burette Reading [unit]	Length Reading [unit]	Longitudinal or Torsional	Force or Torque Reading [V_{rms}]	Transducer Reading [V_{rms}]	Resonant Period [msec]
1	38	102.0	24.7	0	22.0	9.71	T	0.008	0.009	8.166
2	63	102.0	24.7	0	22.0	9.71	T	0.019	0.022	8.166
3	97	102.0	24.7	0	22.0	9.71	T	0.032	0.044	8.169
4	127	102.0	24.7	0	22.0	9.71	T	0.071	0.087	8.170
5	165	102.0	24.7	0	22.0	9.71	T	0.154	0.191	8.172
6	197	102.0	24.7	0	22.0	9.71	T	0.297	0.365	8.189
7	238	102.0	25.7	0	22.0	9.71	T	0.632	0.761	8.232
8	282	102.0	25.9	0	22.0	9.71	T	1.193	1.403	8.303
9	328	102.0	26.1	0	22.0	9.71	T	3.100	3.21	8.633
10	356	102.0	26.2	0	22.0	10.71	T	3.970	3.88	8.802

LAW

LAWGIBB Group Member

RESONANT COLUMN TEST (ASTM D4015-87)

TEST RESULTS SUMMARY

Project No.:	50160-0-3963	Project Name:	MOX
Tested By:	HJ & JW	Boring No:	BH-3
Test Date:	11/27/00	Sample No.:	10B
Reviewed By:	JW	Depth:	50 - 52 ft
Reviewed Date:	11/28/00	Sample Description:	Tan fat clay and elastic silt

Line No.	Effective Confining Stress [kPa]	Principal Stress Ratio	Void Ratio e	Longitudinal or Torsional	No. of Vibration Cycles	Shear Modulus G [Mpa]	Shear Modulus G [psi]	Shear Strain Amplitude [%]	Damping Ratio [%]
1	532.60	1.00	0.967	T	4653	121.24	17596	0.00004	5.09
2	532.60	1.00	0.967	T	3061	121.24	17596	0.00010	4.95
3	532.60	1.00	0.967	T	4162	121.15	17583	0.00020	4.16
4	532.60	1.00	0.967	T	3672	121.12	17579	0.00040	4.67
5	532.60	1.00	0.967	T	4650	121.06	17570	0.00089	4.62
6	532.60	1.00	0.967	T	3908	120.56	17498	0.00171	4.66
7	525.71	1.00	0.967	T	4981	119.30	17315	0.00359	4.76
8	524.33	1.00	0.967	T	5299	117.27	17020	0.00674	4.87
9	522.95	1.00	0.967	T	5328	108.48	15744	0.01668	5.53
10	522.26	1.00	0.967	T	3181	103.07	14959	0.02109	5.86

LAWGIBB GROUP

CYCLIC TRIAXIAL PROPERTIES TEST

(ASTM D 3999-91)

Project No.:	50160-0-3963	Project Name:	Mox
Tested By:	JW & HJ	Boring No.:	BH-3
Test Date:	11/27/00	Sample No.:	10B
Reviewed By:	JW	Depth:	50 - 52 feet
Review Date:	11/28/00	Sample Description:	Tan fat clay and elastic silt

SPECIMEN DATA

Initial Conditions of Specimen

Diameters, in.		Area , sq. in.	6.44
Top	2.862	Volume, cubic in.	38.68
Middle	2.864	Mass of Specimen, grams	1092.79
Bottom	2.862		
Average	2.863	Moisture Content	
Membrane Thickness, in.	0.000	Pan No.	N-18
Net Diameter, in.	2.863	Wet Mass + Pan, grams	1141.65
		Dry Mass + Pan, grams	868.71
Length, in.		Container Mass, grams	48.86
Location 1	6.010	Moisture Content, %	33.3
Location 2	6.009		
Location 3	6.010	Density, pcf	107.4
Average	6.010	Dry Density, pcf	80.6
Length of Top Platen	0.000	Specific Gravity	2.65
Length of Bottom Platen	0.000	Degree of Saturation, %	83.8
Length of Specimen, in	6.010	Void Ratio	1.052

Conditions of Specimen After Saturation and Consolidation

After Saturation		After Consolidation	
Change in Length, in.	0.000	Change in Length, in.	0.100
Length, in.	6.010	Length, in.	5.910
Area, sq. in.	6.44	Change in Volume, cc	26.70
Volume, cubic in.	38.68	Volume, cubic in.	37.05
Back Pressure, psi	20.0	Area, sq. in.	6.27
B Value	0.96	Effe. Consoli.. Stress, psi	77.0
		Moisture Content, %	36.4
		Dry Density, pcf	84.1
		Void Ratio	0.966
		Degree of Saturation, %	100.0

LAWGIBB GROUP

CYCLIC TRIAXIAL PROPERTIES TEST

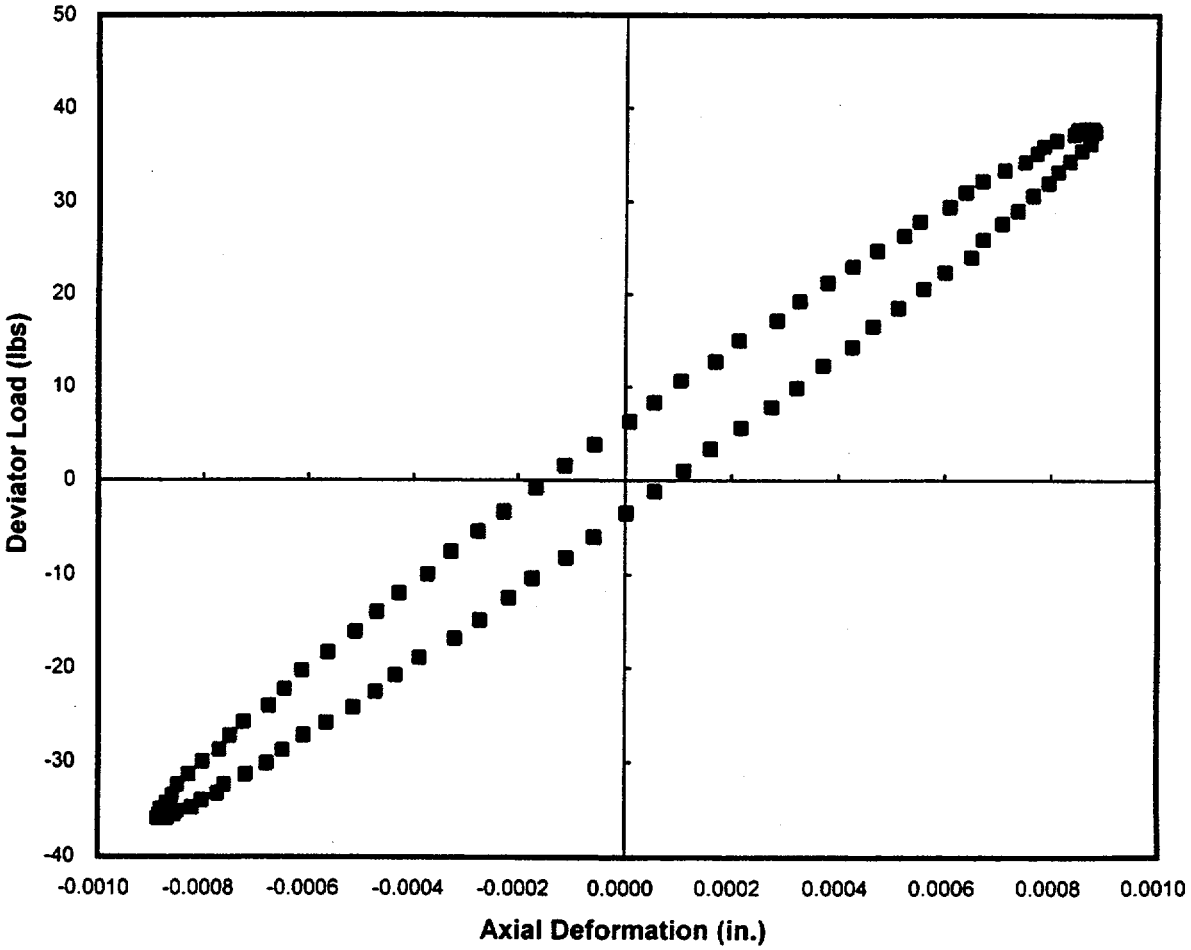
(ASTM D 3999-91)

Project No.:	50160-0-3963	Project Name:	Mox
Tested By:	JW & HJ	Boring No.:	BH-3
Test Date:	11/27/00	Sample No.:	10B
Reviewed By:		Depth:	50 - 52 feet
Review Date:		Sample Description:	Tan fat clay and elastic silt

Area, A_c (in^2)	Length, H_c (in)	Effective Consoli. Stress, σ_c (psi)	Cyclic Load, P_c (lbs)	Cyclic Deviator Stress, σ_d (psi)
6.27	5.91	77.0	36.87	5.9

Double Amplitude Load LD_A (lbs)	Double Ampli. Deformation SD_A (in.)	Young's Modulus E (psi)	Single Ampliti. Axial Strain ε (%)	Area of Hysteresis Loop A_L, (lb-in)	Area of Triangle A_T, (lb-in)	Damping Ratio D (%)
73.7	0.0018	39275	0.015	0.020	0.016	9.7

Hysteresis Loop @ 10th Cycle, Deformation Stage 1



LAWGIBB GROUP

CYCLIC TRIAXIAL PROPERTIES TEST

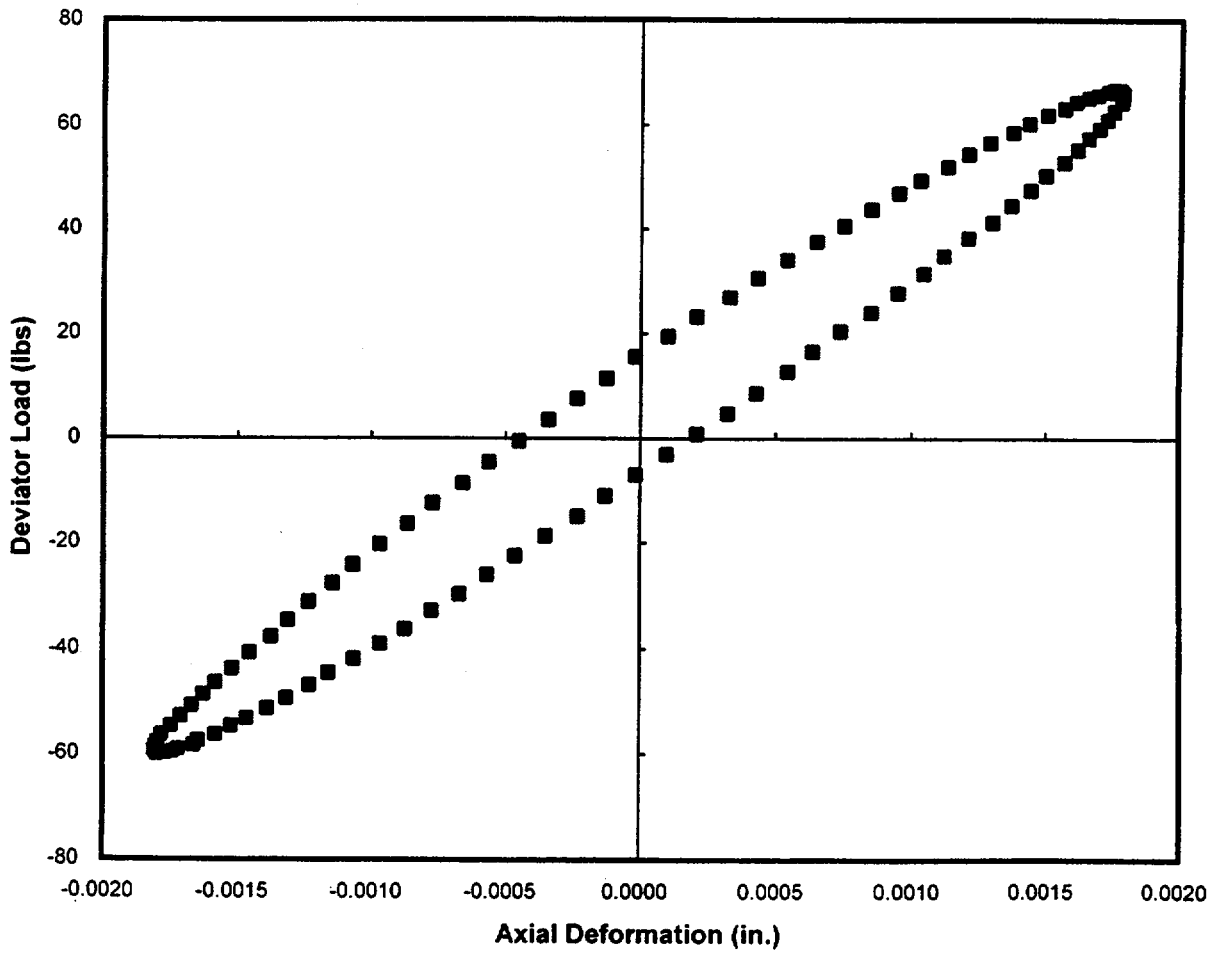
(ASTM D 3999-91)

Project No.:	50160-0-3963	Project Name:	Mox
Tested By:	JW & HJ	Boring No.:	BH-3
Test Date:	11/27/00	Sample No.:	10B
Reviewed By:		Depth:	50 - 52 feet
Review Date:		Sample Description:	Tan fat clay and elastic silt

Area, A_c (in^2)	Length, H_c (in)	Effective Consoli. Stress, σ_c (psi)	Cyclic Load, P_c (lbs)	Cyclic Deviator Stress, σ_d (psi)
6.27	5.91	77.0	63.38	10.1

Double Amplitude Load LD_A (lbs)	Double Ampli. Deformation SD_A (in.)	Young's Modulus E (psi)	Single Ampliti. Axial Strain ε (%)	Area of Hysteresis Loop A_L, (lb-in)	Area of Triangle A_T, (lb-in)	Damping Ratio D (%)
126.8	0.0036	33308	0.030	0.074	0.057	10.3

Hysteresis Loop @ 10th Cycle, Deformation Stage 2



LAWGIBB GROUP

CYCLIC TRIAXIAL PROPERTIES TEST

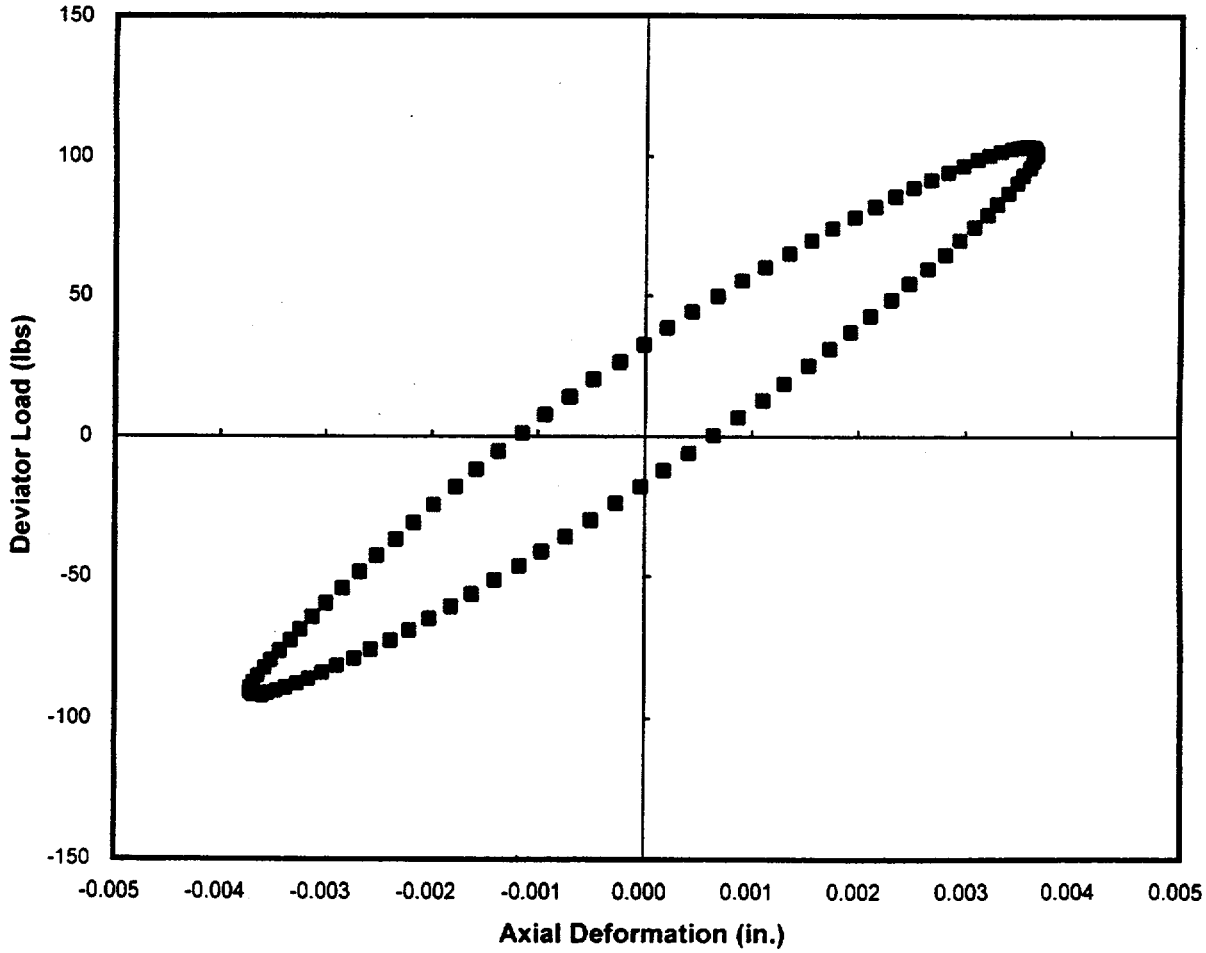
(ASTM D 3999-91)

Project No.:	50160-0-3963	Project Name:	Mox
Tested By:	JW & HJ	Boring No.:	BH-3
Test Date:	11/27/00	Sample No.:	10B
Reviewed By:		Depth:	50 - 52 feet
Review Date:		Sample Description:	Tan fat clay and elastic silt

Area, A_c (in^2)	Length, H_c (in)	Effective Consoli Stress, σ_c (psi)	Cyclic Load, P_c (lbs)	Cyclic Deviator Stress, σ_d (psi)
6.27	5.91	77.0	97.87	15.6

Double Amplitude Load LD_A (lbs)	Double Ampli. Deformation SD_A (in.)	Young's Modulus E (psi)	Single Ampliti. Axial Strain ε (%)	Area of Hysteresis Loop A_L, (lb-in)	Area of Triangle A_T, (lb-in)	Damping Ratio D (%)
195.7	0.0074	25028	0.062	0.294	0.180	12.9

Hysteresis Loop @ 10th Cycle, Deformation Stage 3



LAWGIBB GROUP

CYCLIC TRIAXIAL PROPERTIES TEST

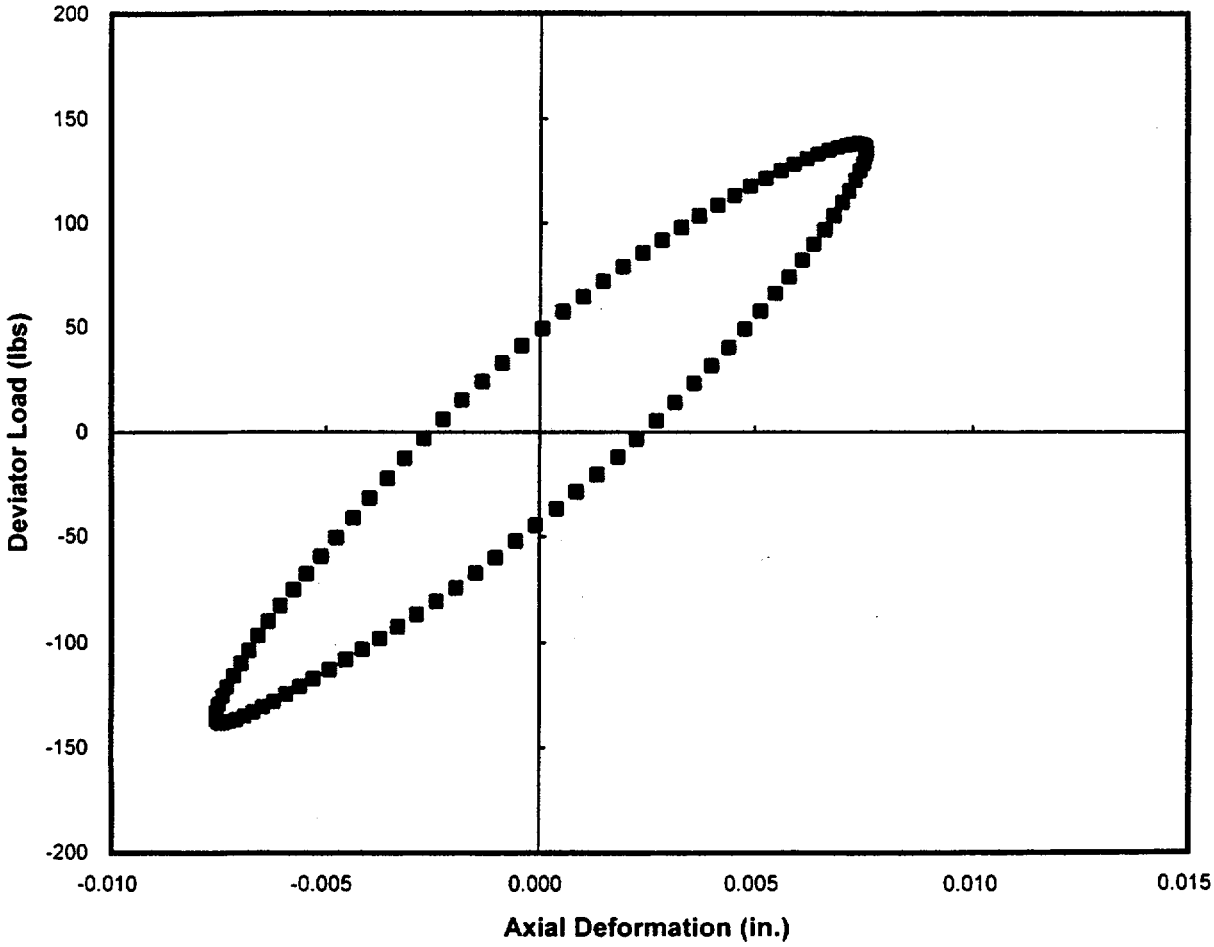
(ASTM D 3999-91)

Project No.:	50160-0-3963	Project Name:	Mox
Tested By:	JW & HJ	Boring No.:	BH-3
Test Date:	11/27/00	Sample No.:	10B
Reviewed By:		Depth:	50 - 52 feet
Review Date:		Sample Description:	Tan fat clay and elastic silt

Area, A_c (in^2)	Length, H_c (in)	Effective Consoli. Stress, σ_c (psi)	Cyclic Load, P_c (lbs)	Cyclic Deviator Stress, σ_d (psi)
6.27	5.91	77.0	138.21	22.0

Double Amplitude Load LD_A (lbs)	Double Ampli. Deformation SD_A (in.)	Young's Modulus E (psi)	Single Ampliti. Axial Strain ε (%)	Area of Hysteresis Loop A_L, (lb-in)	Area of Triangle A_T, (lb-in)	Damping Ratio D (%)
276.4	0.0151	17218	0.128	1.019	0.523	15.5

Hysteresis Loop @ 10th Cycle, Deformation Stage 4



LAWGIBB GROUP

CYCLIC TRIAXIAL PROPERTIES TEST

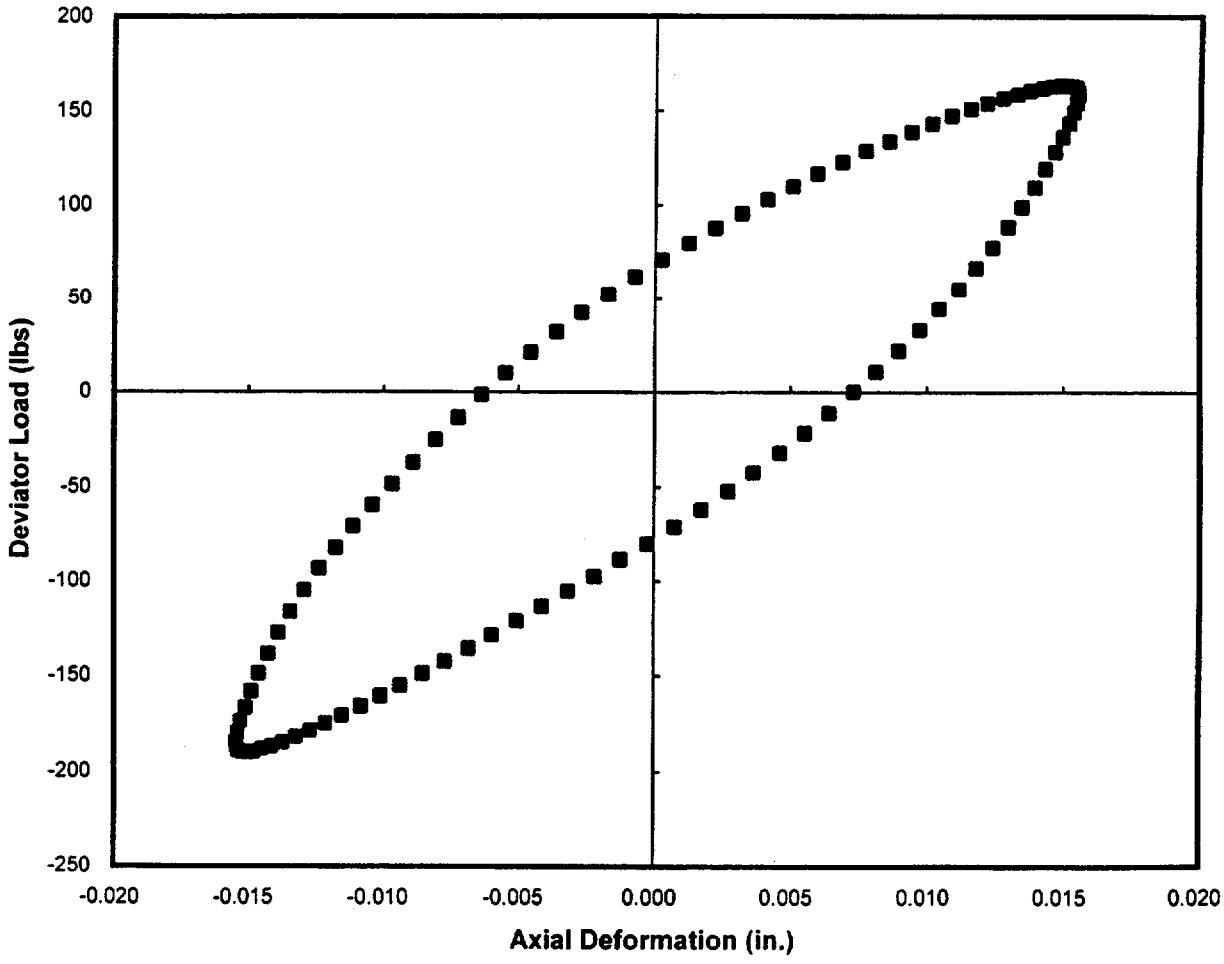
(ASTM D 3999-91)

Project No.:	50160-0-3963	Project Name:	Mox
Tested By:	JW & HJ	Boring No.:	BH-3
Test Date:	11/27/00	Sample No.:	10B
Reviewed By:		Depth:	50 - 52 feet
Review Date:		Sample Description:	Tan fat clay and elastic silt

Area, A_c (in^2)	Length, H_c (in)	Effective Consoli. Stress, σ_c (psi)	Cyclic Load, P_c (lbs)	Cyclic Deviator Stress, σ_d (psi)
6.27	5.91	77.0	176.67	28.2

Double Amplitude Load LD_A (lbs)	Double Ampli. Deformation SD_A (in.)	Young's Modulus E (psi)	Single Ampliti. Axial Strain ε (%)	Area of Hysteresis Loop A_L, (lb-in)	Area of Triangle A_T, (lb-in)	Damping Ratio D (%)
353.3	0.0309	10769	0.262	3.435	1.366	20.0

Hysteresis Loop @ 10th Cycle, Deformation Stage 5



LAWGIBB GROUP

CYCLIC TRIAXIAL PROPERTIES TEST

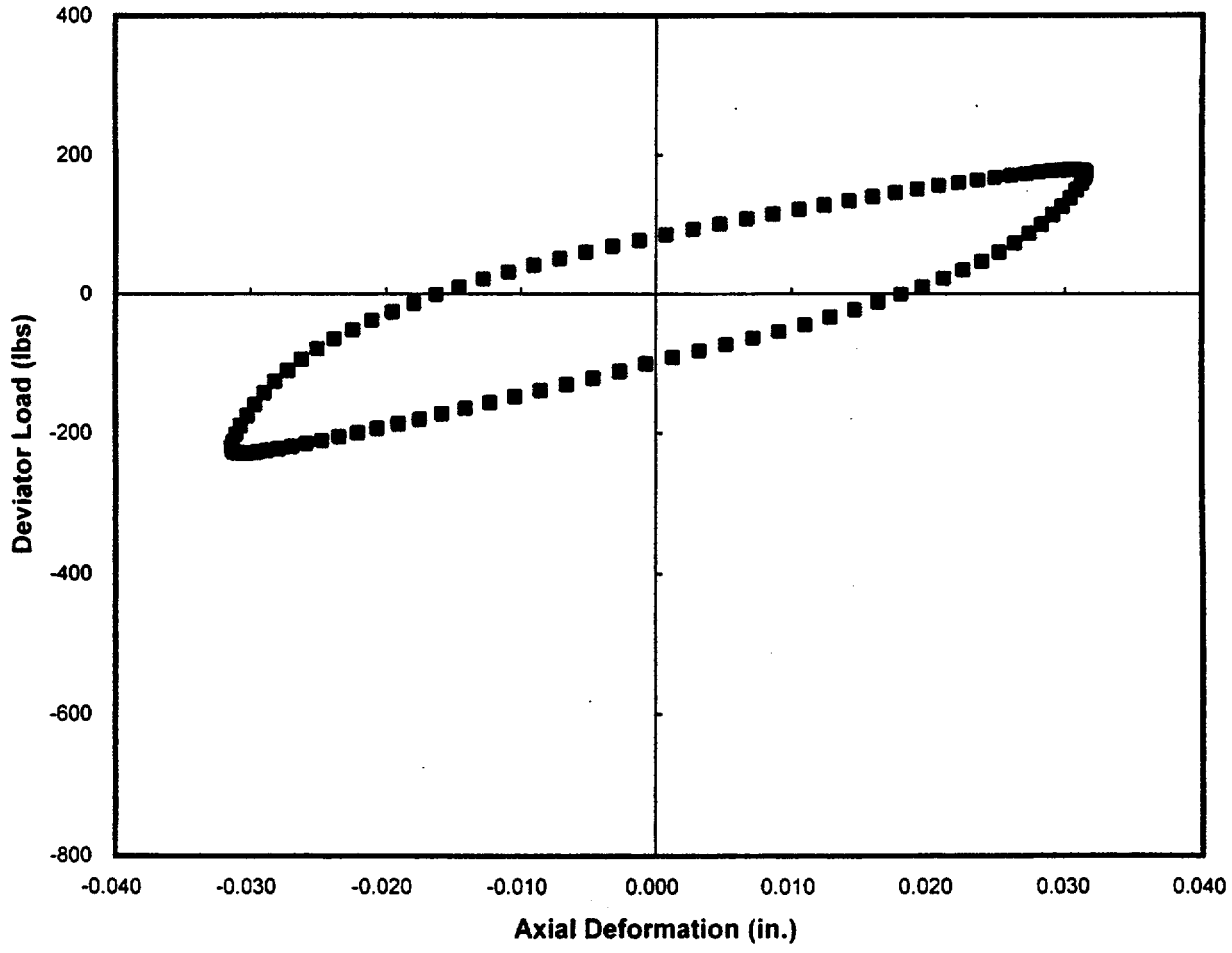
(ASTM D 3999-91)

Project No.:	50160-0-3963	Project Name:	Mox
Tested By:	JW & HJ	Boring No.:	BH-3
Test Date:	11/27/00	Sample No.:	10B
Reviewed By:		Depth:	50 - 52 feet
Review Date:		Sample Description:	Tan fat clay and elastic silt

Area, A_c (in^2)	Length, H_c (in)	Effective Consoli. Stress, σ_c (psi)	Cyclic Load, P_c (lbs)	Cyclic Deviator Stress, σ_d (psi)
6.27	5.91	77.0	203.45	32.5

Double Amplitude Load LD_A (lbs)	Double Ampli. Deformation SD_A (in.)	Young's Modulus E (psi)	Single Ampliti. Axial Strain ε (%)	Area of Hysteresis Loop A_L, (lb-in)	Area of Triangle A_T, (lb-in)	Damping Ratio D (%)
406.9	0.0629	6096	0.532	9.361	3.201	23.3

Hysteresis Loop @ 10th Cycle, Deformation Stage 6



LAWGIBB GROUP

CYCLIC TRIAXIAL PROPERTIES TEST

(ASTM D 3999-91)

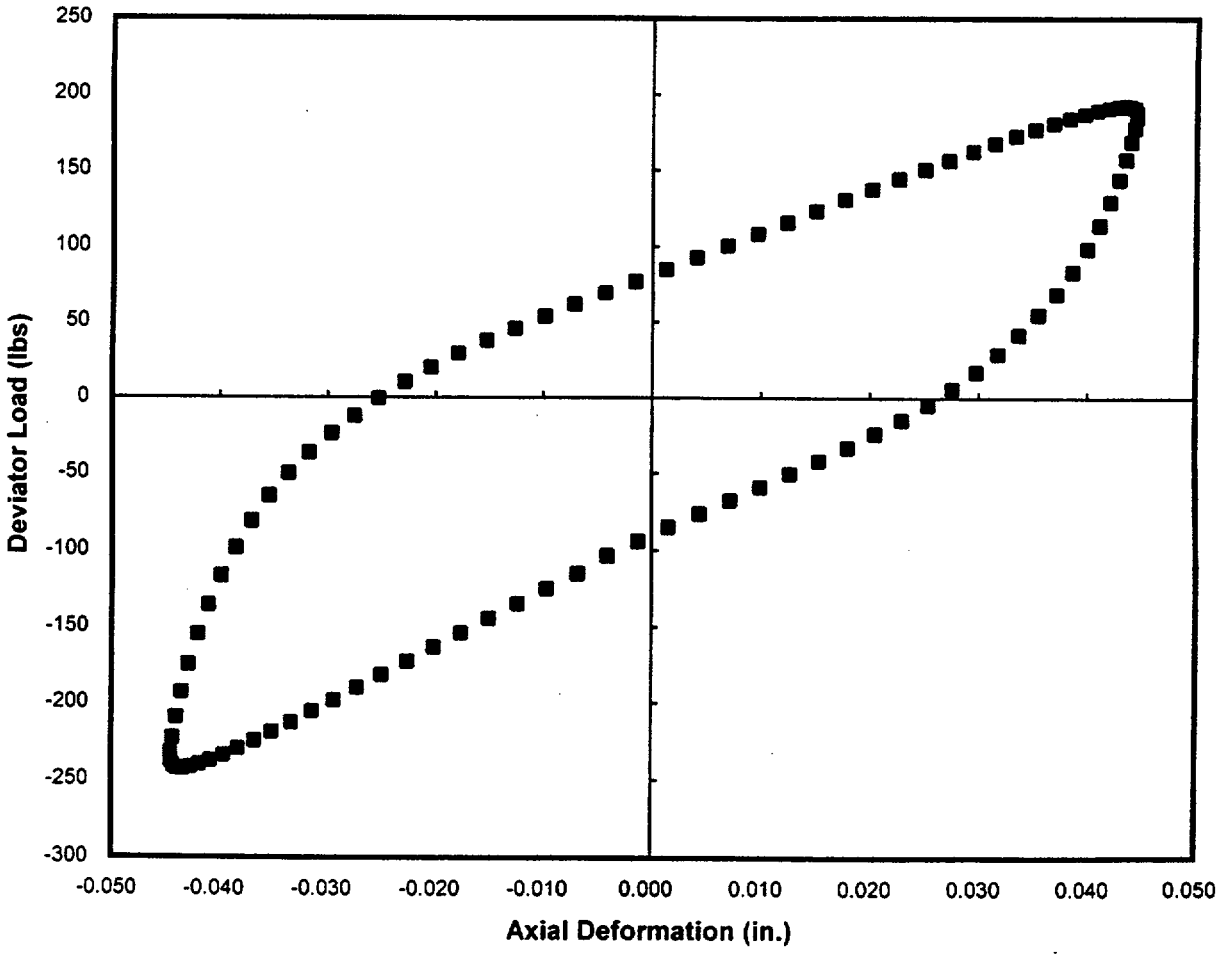
Project No.: 50160-0-3963
Tested By: JW & HJ
Test Date: 11/27/00
Reviewed By:
Review Date:

Project Name: Mox
Boring No.: BH-3
Sample No.: 10B
Depth: 50 - 52 feet
Sample Description: Tan fat clay and elastic silt

Area, A_c (in^2)	Length, H_c (in)	Effective Consoli. Stress, σ_c (psi)	Cyclic Load, P_c (lbs)	Cyclic Deviator Stress, σ_d (psi)
6.27	5.91	77.0	217.91	34.8

Double Amplitude Load LD_A (lbs)	Double Ampli. Deformation SD_A (in.)	Young's Modulus E (psi)	Single Ampliti. Axial Strain ε (%)	Area of Hysteresis Loop A_L, (lb-in)	Area of Triangle A_T, (lb-in)	Damping Ratio D (%)
435.8	0.0890	4619	0.753	13.892	4.847	22.8

Hysteresis Loop @ 10th Cycle, Deformation Stage 7



LAWGIBB GROUP

CYCLIC TRIAXIAL PROPERTIES TEST

(ASTM D 3999-91)

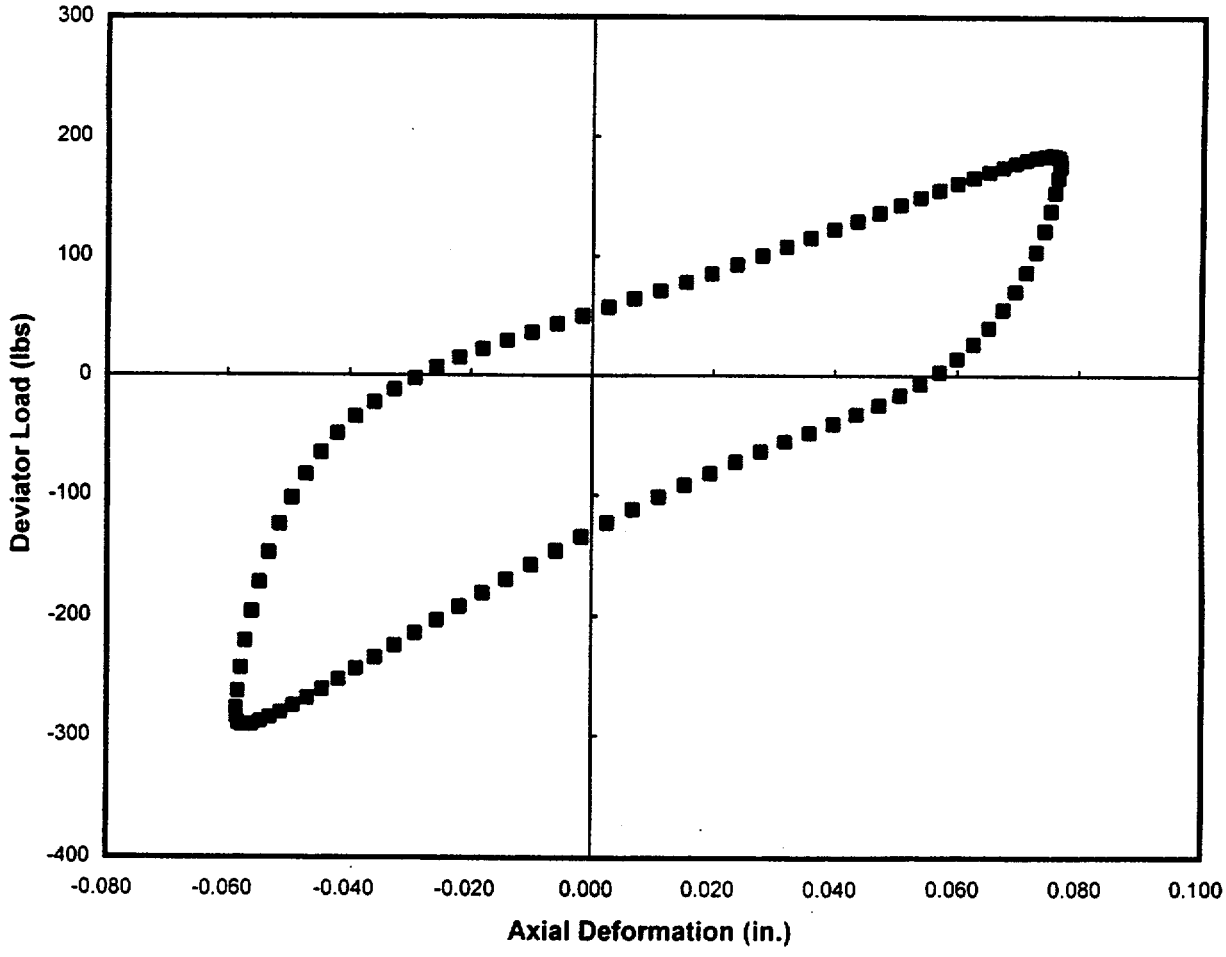
Project No.: 50160-0-3963
Tested By: JW & HJ
Test Date: 11/27/00
Reviewed By:
Review Date:

Project Name: Mox
Boring No.: BH-3
Sample No.: 10B
Depth: 50 - 52 feet
Sample Description: Tan fat clay and elastic silt

Area, A_c (in^2)	Length, H_c (in)	Effective Consoli. Stress, σ_c (psi)	Cyclic Load, P_c (lbs)	Cyclic Deviator Stress, σ_d (psi)
6.27	5.91	77.0	237.89	37.9

Double Amplitude Load LD_A (lbs)	Double Ampli. Deformation SD_A (in.)	Young's Modulus E (psi)	Single Ampliti. Axial Strain ε (%)	Area of Hysteresis Loop A_L, (lb-in)	Area of Triangle A_T, (lb-in)	Damping Ratio D (%)
475.8	0.1350	3322	1.142	22.695	8.031	22.5

Hysteresis Loop @ 10th Cycle, Deformation Stage 8



LAWGIBB GROUP

CYCLIC TRIAXIAL PROPERTIES TEST

(ASTM D 3999-91)

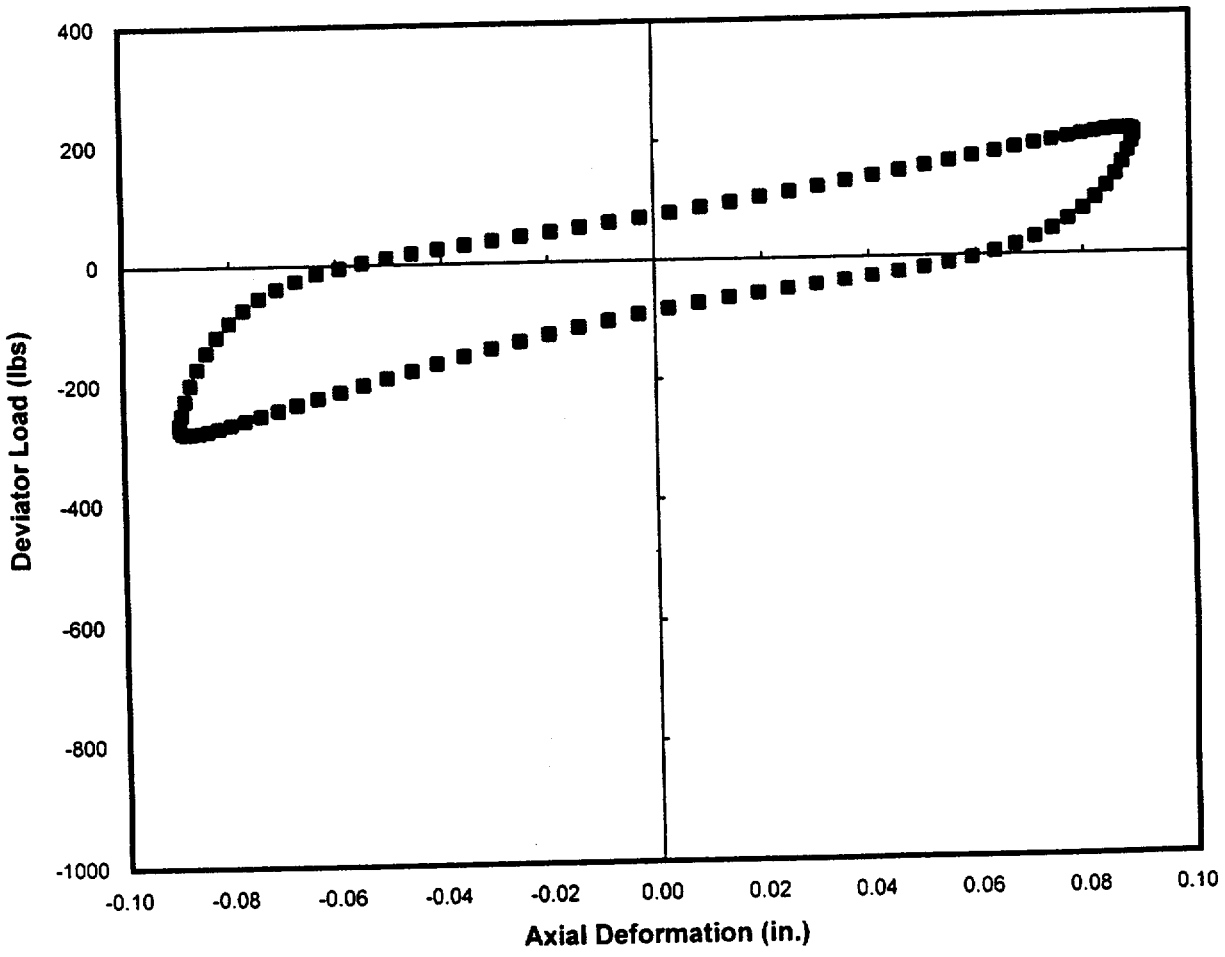
Project No.: 50160-0-3963
Tested By: JW & HJ
Test Date: 11/27/00
Reviewed By:
Review Date:

Project Name: Mox
Boring No.: BH-3
Sample No.: 10B
Depth: 50 - 52 feet
Sample Description: Tan fat clay and elastic silt

Area, A_c (in^2)	Length, H_c (in)	Effective Consoli. Stress, σ_c (psi)	Cyclic Load, P_c (lbs)	Cyclic Deviator Stress, σ_d (psi)
6.27	5.91	77.0	244.20	39.0

Double Amplitude Load LD_A (lbs)	Double Ampli. Deformation SD_A (in.)	Young's Modulus E (psi)	Single Ampliti. Axial Strain ε (%)	Area of Hysteresis Loop A_L, (lb-in)	Area of Triangle A_T, (lb-in)	Damping Ratio D (%)
488.4	0.1792	2570	1.516	28.478	10.940	20.7

Hysteresis Loop @ 10th Cycle, Deformation Stage 9



LAWGIBB GROUP

CYCLIC TRIAXIAL PROPERTIES TEST

(ASTM D 3999-91)

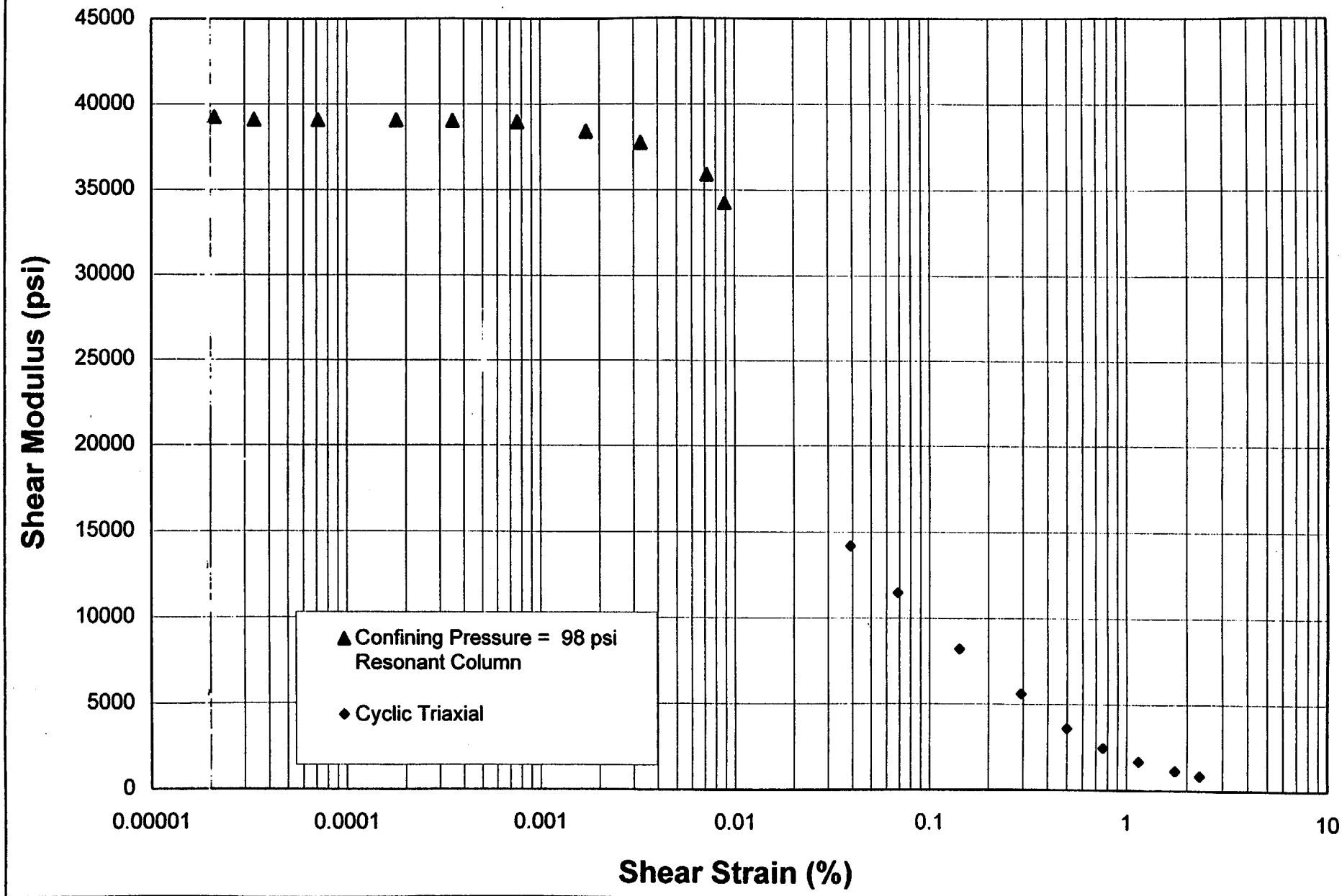
Project No.:	50160-0-3963	Project Name:	Mox
Tested By:	JW & HJ	Boring No.:	BH-3
Test Date:	11/27/00	Sample No.:	10B
Reviewed By:		Depth:	50 - 52 feet
Review Date:		Sample Description:	Tan fat clay and elastic silt

Effective Consolidation Stress 77 psi

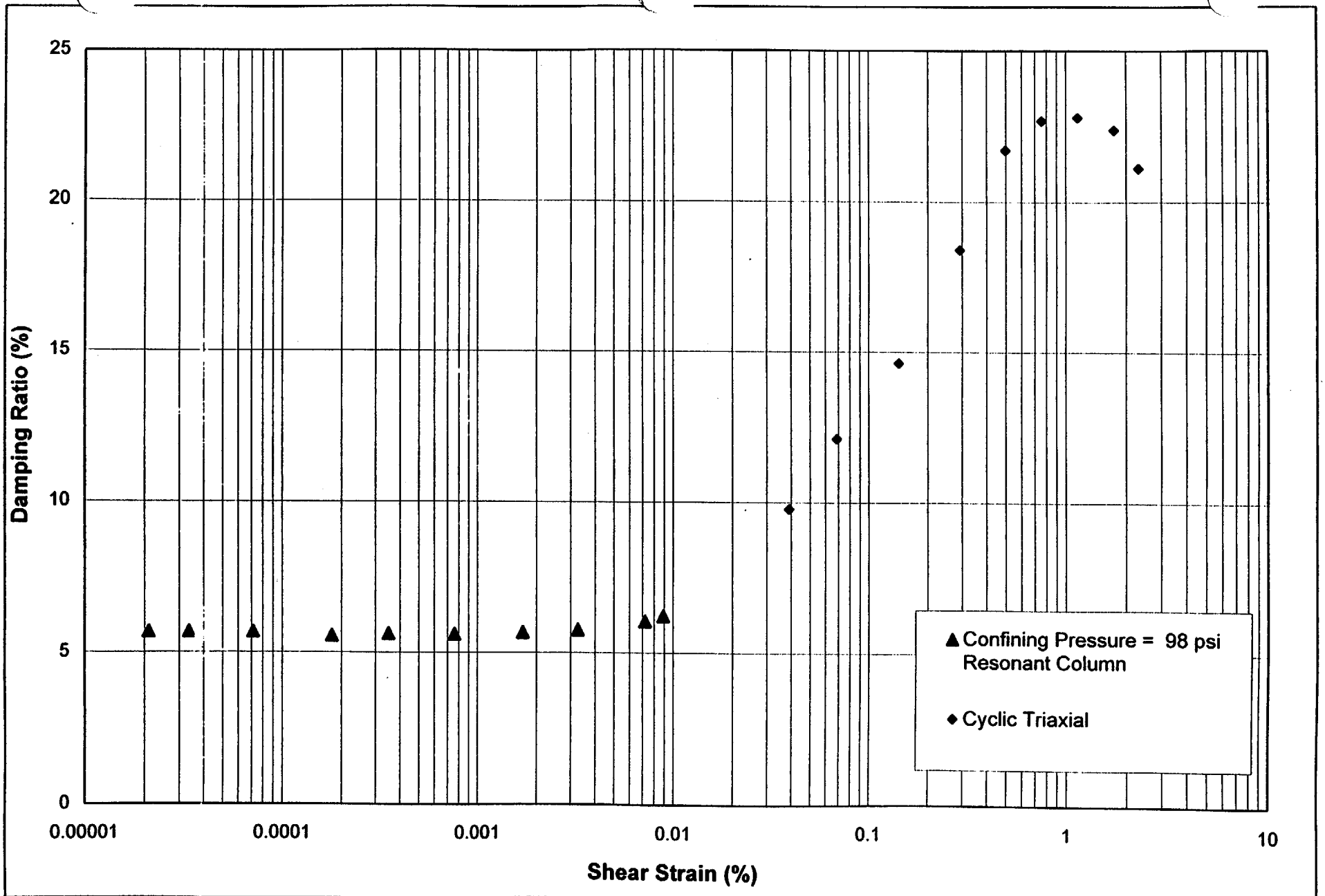
Deformation Stage No.	Cyclic Stress (psi)	Axial Strain ε (%)	Young's Modulus E, (psi)	Damping Ratio D, (%)	Shear* Modulus G, (psi)	Shear* Strain γ (%)
1	5.9	0.015	39275	9.72	13092	0.022
2	10.1	0.030	33308	10.34	11103	0.046
3	15.6	0.062	25028	12.95	8343	0.094
4	22.0	0.128	17218	15.50	5739	0.192
5	28.2	0.262	10769	20.01	3590	0.393
6	32.5	0.532	6096	23.27	2032	0.799
7	34.8	0.753	4619	22.81	1540	1.129
8	37.9	1.142	3322	22.49	1107	1.714
9	39.0	1.516	2570	20.72	857	2.274

* Calculated based on assumed Poisson's Ratio value, 0.5.

All calculations are based on 10th cycle.



Shear Modulus vs. Shear Strain **BH-6 17B 98 - 100 feet**	**LAW** **LAWGIBB Group Member**	**MOX** Project No.: 50160-0-3963 Date: 12/4/00



Damping Ratio vs. Shear Strain
BH-6 17B 98 - 100 feet

LAW
LAWGIBB Group Member

MOX

Project No.: 50160-0-3963

Date: 12/4/00

LAW

LAWGIBB Group Member

RESONANT COLUMN TEST (ASTM D4015-87)

Project No.:	50160-0-3963	Project Name:	MOX
Tested By:	HJ & JW	Boring No.:	BH-6
Test Date:	12/4/00	Sample No.:	17B
Reviewed By:	JW	Depth:	98 - 100 feet
Reviewed Date:	12/5/00	Sample Description:	Brown clayey sand

Initial Specimen Data

Labels	Values	Units	Description
			Masses
M_{scb}	1164.42	g	*Mass of soil and container before*
M_{sca}	0.00	g	*Mass of soil and container after*
M_{ds}	1164.42	g	*M_{scb} - M_{sca} =mass of soil*
			Diameters
D_t	72.8	mm	*Diameter near top of specimen*
D_m	72.8	mm	*Diameter near middle of specimen*
D_b	72.8	mm	*Diameter near bottom of specimen*
T_{mem}	0.0	mm	*Single thickness of membrane*
D_{net}	72.8	mm	*$(D_t + D_m + D_b)/3 - 2*T_{mem}$*
			Lengths
L_{cbp}	221.3	mm	*Length between chamber bottom & top of top platen*
L_{tp}	21.6	mm	*Length of top platen*
L_{bp}	46.6	mm	*Length of bottom platen*
L_{net}	153.2	mm	*Length of Specimen $= L_{cbp} - L_{tp} - L_{bp}$*
			Volume
V	637543	mm^3	*$D^2_{net}*Pi*L_{net}/4$*

Labels	Values	Units	Description
			Mass Density and Unit Weight
Rho	1826	kg/m^3	*Mass density of specimen M_s*V*10^6*
U_{wt}	17.9	kN/m^3	*Unit weight of specimen = Rho*9.806/1000*
			Moisture Content
No.	9		*Container number*
M_{wscb}	1248.31	g	*Mass of wet soil + container*
M_{wsca}	1056.36	g	*Mass of dry soil + container*
M_{wat}	191.95	g	*Mass of water = M_{wscb} - M_{wsca}*
M_{cont}	83.89	g	*Mass of container.*
mc	19.7	%	*$M_{wat}/(M_{wsca} - M_{cont})*100\%$*
Rho_d	1525	kg/m^3	*Dry mass density = Rho/(1+mc)*
G_s	2.65		*Specific gravity (estimated)*
e	0.74		*Void Ratio, $[1000*G_s)]/Rho_d$-1*
S_r	70.9	%	*Degree of Saturation = mc*G_s /e*
J	7.7E-04	$kg-m^2$	*Polar mass moment of inertia $= (M_s/1000)*(D_{net}/1000)^2/8$*

Conditions After Saturation			
CL_s	0.0	mm	*Change in length*
L_s	153.15	mm	*Length after saturation, L - CL_s*
A_s	4163	mm^2	*Area of specimen*
V_s	637543	mm^3	*Volume after saturation, $A_s * L_s$*
B	0.95		*B Value*

Conditions After Consolidation			
CL_c	3.4	mm	*Change in length*
L_d	149.8	mm	*Length after consolidation, L_s-CL_c*
CV_c	41922	mm^3	*Change in volume*
V_c	595621	mm^3	*Volume, V_s - CV_c*
S_r	100.0	%	*Degree of Saturation, mc*G_s /e*
e	0.62		*Void Ratio, $[1000*G_s]/Rho_d$-1*
mc	23.5	%	*Moisture Content*
Rho_d	1633	kg/m^3	*Dry mass density, Rho_d*V/V_c*

LAW

LAWGIBB Group Member

RESONANT COLUMN TEST (ASTM D4015-87)

Project No.:	50160-0-3963	Project Name:	MOX
Tested By:	HJ & JW	Boring No.:	BH-6
Test Date:	12/4/00	Sample No.:	17B
Reviewed By:	JW	Depth:	98 - 100 feet
Reviewed Date:	12/5/00	Sample Description:	Brown clayey sand

Apparatus Information

Apparatus Description	Typical Long-Tor
Apparatus Serial No.	556G0001
Platen Diameter, mm	72.4

Apparatus Calibration Factors			
M_A	0.3044	kg	*Top Platen Mass*
LCFA	N/A	$[m/V_{rms}]*[Hz^2]$	*Longitudinal Vibration Calibration Factor*
ADCL	N/A	kg-Hz	*Longitudinal Apparatus Damping Coefficient*
FCF	N/A	N/V_{rms}	*Force Calibration Factor*
J_A	0.0032	$kg\text{-}m^2$	*Platen Polar Mass Momment of Inertia*
RCFA	4.42	$[Rad/V_{rms}]*[Hz^2]$	*Rotational Vibration Calibration Factor*
ADCT	0.00139	$Hz\text{-}kg\text{-}m^2$	*Torsional Apparatus Damping Coefficient*
TCF	0.069	$N\text{-}m/V_{rms}$	*Torque Calibration Factor*
FOT	0	Hz	*Apparatus Resonant Frequency*

Ancillary System Calibration Factors			
LCCF	-0.635	mm/unit	*Length change calibration factor (+ means*
			specimen length increase for increase values)
BCF	-0.34	mL/unit	*Burette calibration factor (+ means specimen*
			volume increase for increase values.)
CPCF	6.89	kPa/unit	*Cell pressure calibration factor*
PPCF	6.89	kPa/unit	*Pore Pressure calibration factor*
ALCF	1	kN/unit	*Axial load calibration factor*
			(+ means compression of specimen.)
Ancillary System Initial Conditions			
ILR	0	units	*Initial length reading before testing*
IBR	17	units	*Initial burette reading before testing*
RPF	P		*P or F. "P" for resonant period input, and*
			"F" for resonant frequency input.

LAW

LAWGIBB Group Member

RESONANT COLUMN TEST (ASTM D4015-87)

INPUT DATA

Project No.:	50160-0-3963	Project Name:	MOX
Tested By:	HJ & JW	Boring No:	BH-6
Test Date:	12/4/00	Sample No.:	17B
Reviewed By:	JW	Depth:	98 - 100 feet
Reviewed Date	12/5/00	Sample Description:	Brown clayey sand

Total Number of Data Sets 10

Line No.	Elapsed Time [second]	Cell Pressure [unit]	Pore Pressure [unit]	Axial Load [unit]	Burette Reading [unit]	Length Reading [unit]	Longitudinal or Torsional	Force or Torque Reading [V_{rms}]	Transducer Reading [V_{rms}]	Resonant Period [msec]
1	39	118.0	19.5	0	17.0	0	T	0.010	0.010	5.466
2	85	118.0	19.8	0	17.0	0	T	0.016	0.016	5.476
3	140	118.0	20.2	0	17.0	0	T	0.034	0.034	5.477
4	202	118.0	20.4	0	17.0	0	T	0.083	0.085	5.479
5	239	118.0	20.5	0	17.0	0	T	0.164	0.166	5.481
6	281	118.0	20.6	0	17.0	0	T	0.356	0.361	5.485
7	319	118.0	20.6	0	17.0	0	T	0.796	0.798	5.524
8	359	118.0	20.7	0	17.0	0	T	1.523	1.503	5.571
9	409	118.0	20.9	0	17.0	0	T	3.350	3.15	5.713
10	491	118.0	21.0	0	17.0	0	T	4.060	3.71	5.851

LAW

LAWGIBB Group Member

RESONANT COLUMN TEST (ASTM D4015-87)

TEST RESULTS SUMMARY

Project No.:	50160-0-3963	Project Name:	MOX
Tested By:	HJ & JW	Boring No:	BH-6
Test Date:	12/4/00	Sample No.:	17B
Reviewed By:	JW	Depth:	98 - 100 feet
Reviewed Date:	12/5/00	Sample Description:	Brown clayey sand

Line No.	Effective Confining Stress [kPa]	Principal Stress Ratio	Void Ratio e	Longitudinal or Torsional	No. of Vibration Cycles	Shear Modulus G [Mpa]	Shear Modulus G [psi]	Shear Strain Amplitude [%]	Damping Ratio [%]
1	678.67	1.00	0.623	T	7135	270.53	39264	0.00002	5.70
2	676.60	1.00	0.623	T	8400	269.54	39121	0.00003	5.70
3	673.84	1.00	0.623	T	10042	269.44	39107	0.00007	5.70
4	672.46	1.00	0.623	T	11316	269.25	39078	0.00018	5.57
5	671.78	1.00	0.623	T	6751	269.05	39050	0.00035	5.63
6	671.09	1.00	0.623	T	7657	268.66	38993	0.00076	5.62
7	671.09	1.00	0.623	T	6879	264.88	38444	0.00170	5.69
8	670.40	1.00	0.623	T	7180	260.43	37798	0.00326	5.78
9	669.02	1.00	0.623	T	8752	247.64	35942	0.00720	6.06
10	668.33	1.00	0.623	T	14015	236.10	34267	0.00889	6.24

LAWGIBB GROUP

CYCLIC TRIAXIAL PROPERTIES TEST

(ASTM D 3999-91)

Project No.:	50160-0-3963	Project Name:	Mox
Tested By:	JW & HJ	Boring No.:	BH-6
Test Date:	12/1/00	Sample No.:	17B
Reviewed By:	JW	Depth:	98 - 100 feet
Review Date:	12/4/00	Sample Description:	Brown clayey sand

SPECIMEN DATA

Initial Conditions of Specimen

Diameters, in.		Area , sq. in.	6.50
Top	2.875	Volume, cubic in.	39.12
Middle	2.877	Mass of Specimen, grams	1169.39
Bottom	2.877		
Average	2.876	Moisture Content	
Membrane Thickness, in.	0.000	Pan No.	L-34
Net Diameter, in.	2.876	Wet Mass + Pan, grams	1262.22
		Dry Mass + Pan, grams	1005.29
Length, in.		Container Mass, grams	92.83
Location 1	6.022	Moisture Content, %	28.2
Location 2	6.019		
Location 3	6.021	Density, pcf	113.6
Average	6.021	Dry Density, pcf	88.7
Length of Top Platen	0.000	Specific Gravity	2.65
Length of Bottom Platen	0.000	Degree of Saturation, %	86.3
Length of Specimen, in	6.021	Void Ratio	0.865

Conditions of Specimen After Saturation and Consolidation

After Saturation		After Consolidation	
Change in Length, in.	0.000	Change in Length, in.	0.197
Length, in.	6.021	Length, in.	5.824
Area, sq. in.	6.50	Change in Volume, cc	20.50
Volume, cubic in.	39.12	Volume, cubic in.	37.87
Back Pressure, psi	15.0	Area, sq. in.	6.50
B Value	0.96	Effe. Consoli.. Stress, psi	98.0
		Moisture Content, %	30.4
		Dry Density, pcf	91.6
		Void Ratio	0.805
		Degree of Saturation, %	100.0

LAWGIBB GROUP

CYCLIC TRIAXIAL PROPERTIES TEST

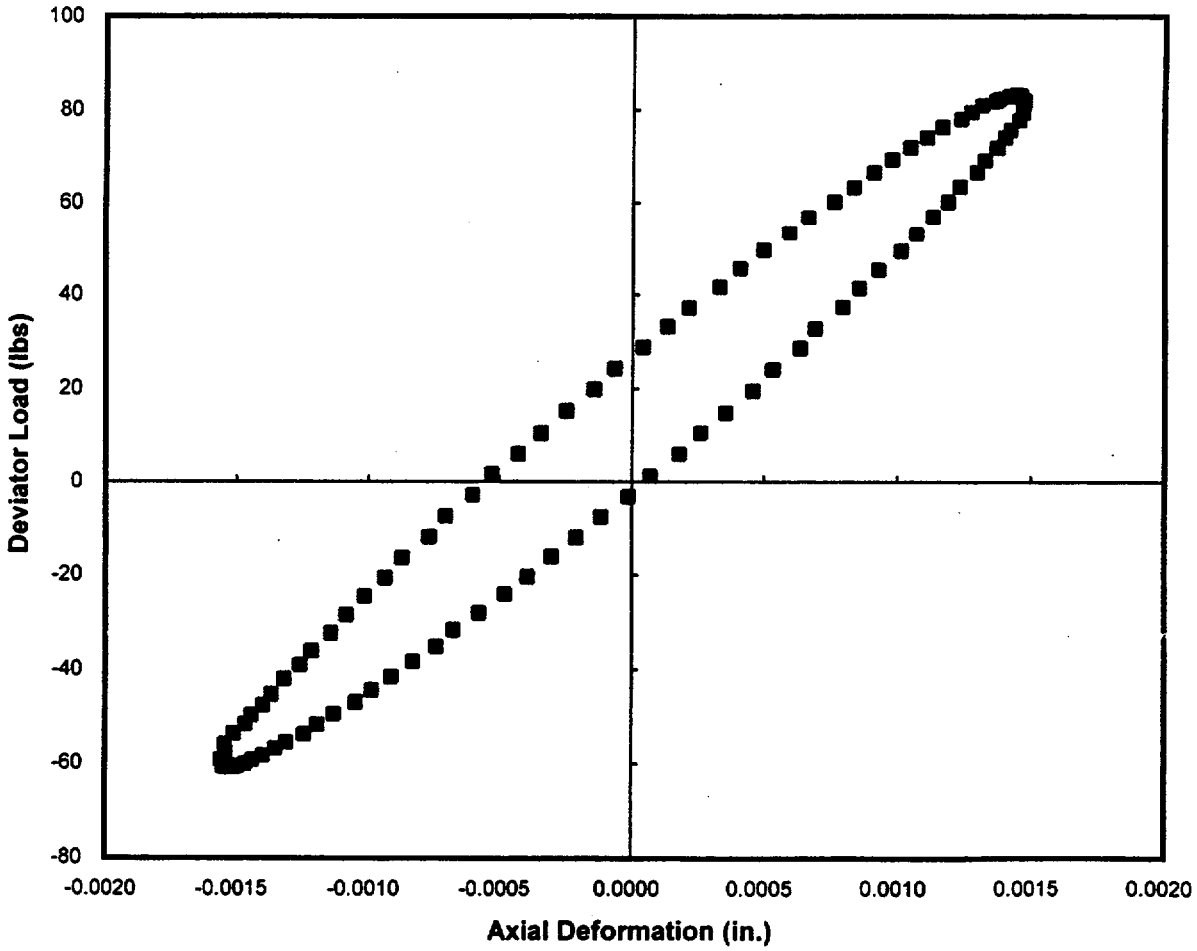
(ASTM D 3999-91)

Project No.:	50160-0-3963	Project Name:	Mox
Tested By:	JW & HJ	Boring No.:	BH-6
Test Date:	12/1/00	Sample No.:	17B
Reviewed By:		Depth:	98 - 100 feet
Review Date:		Sample Description:	Brown clayey sand

Area, A_c (in^2)	Length, H_c (in)	Effective Consoli. Stress, σ_c (psi)	Cyclic Load, P_c (lbs)	Cyclic Deviator Stress, σ_d (psi)
6.50	5.82	98.0	72.04	11.1

Double Amplitude Load LD_A (lbs)	Double Ampli. Deformation SD_A (in.)	Young's Modulus E (psi)	Single Ampliti. Axial Strain ε (%)	Area of Hysteresis Loop A_L, (lb-in)	Area of Triangle A_T, (lb-in)	Damping Ratio D (%)
144.1	0.0030	42635	0.026	0.067	0.055	9.8

Hysteresis Loop @ 10th Cycle, Deformation Stage 1



LAWGIBB GROUP

CYCLIC TRIAXIAL PROPERTIES TEST

(ASTM D 3999-91)

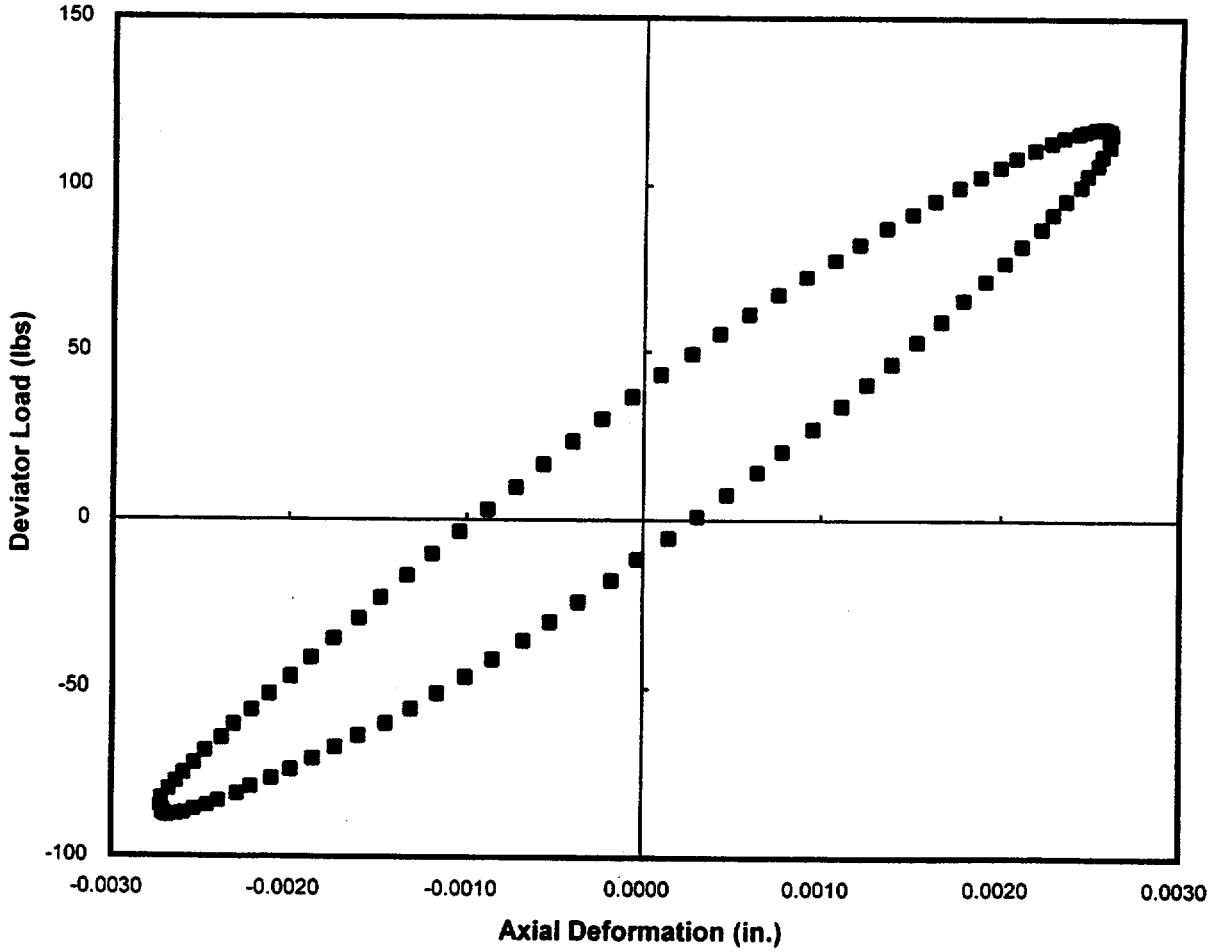
Project No.: 50160-0-3963
Tested By: JW & HJ
Test Date: 12/1/00
Reviewed By:
Review Date:

Project Name: Mox
Boring No.: BH-6
Sample No.: 17B
Depth: 98 - 100 feet
Sample Description: Brown clayey sand

Area, A_c (in^2)	Length, H_c (in)	Effective Consoli. Stress, σ_c (psi)	Cyclic Load, P_c (lbs)	Cyclic Deviator Stress, σ_d (psi)
6.50	5.82	98.0	102.62	15.8

Double Amplitude Load LD_A (lbs)	Double Ampli. Deformation SD_A (in.)	Young's Modulus E (psi)	Single Ampliti. Axial Strain ε (%)	Area of Hysteresis Loop A_L, (lb-in)	Area of Triangle A_T, (lb-in)	Damping Ratio D (%)
205.2	0.0053	34500	0.046	0.208	0.137	12.1

Hysteresis Loop @ 10th Cycle, Deformation Stage 2



LAWGIBB GROUP

CYCLIC TRIAXIAL PROPERTIES TEST

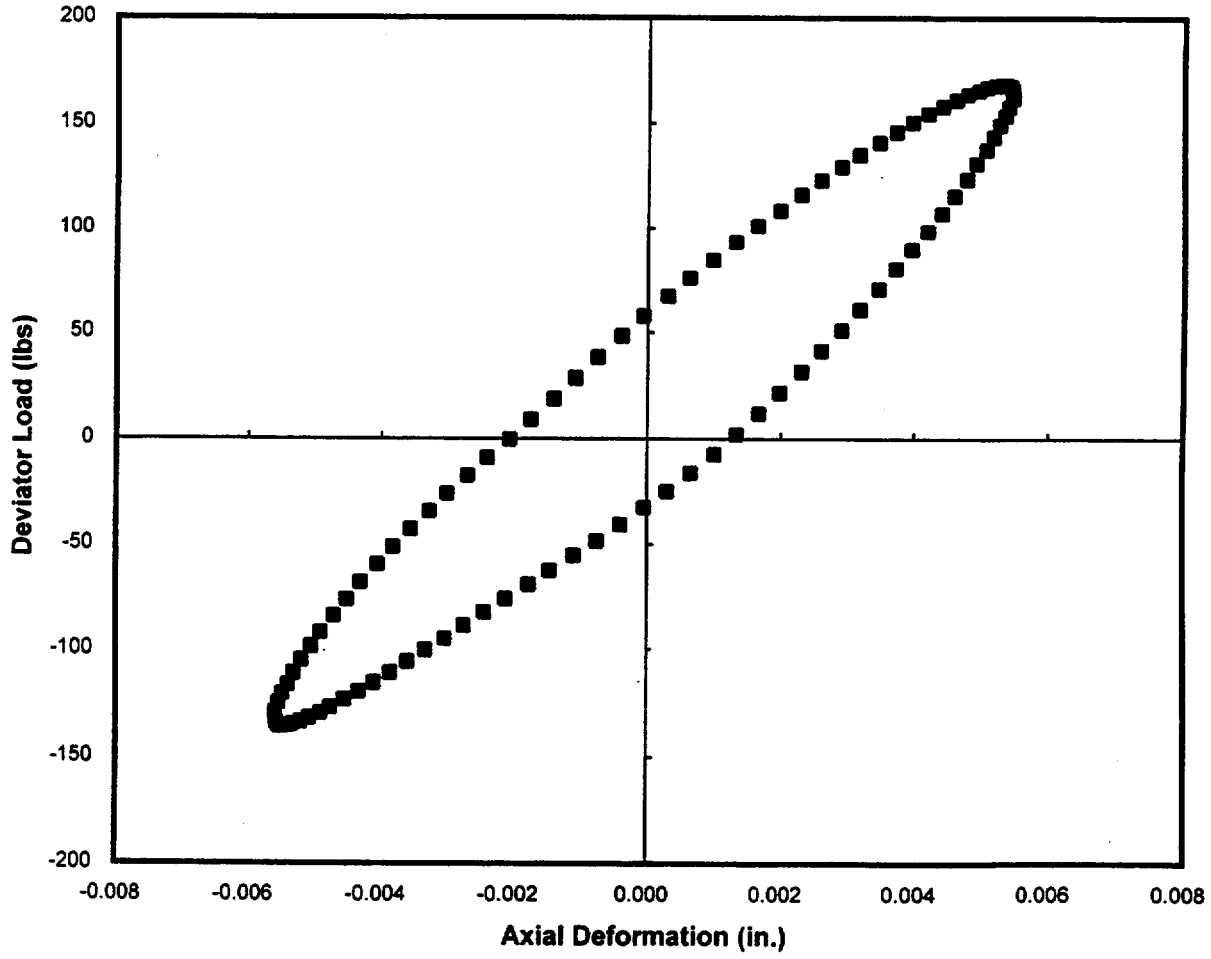
(ASTM D 3999-91)

Project No.:	50160-0-3963	Project Name:	Mox
Tested By:	JW & HJ	Boring No.:	BH-6
Test Date:	12/1/00	Sample No.:	17B
Reviewed By:		Depth:	98 - 100 feet
Review Date:		Sample Description:	Brown clayey sand

Area, A_c (in^2)	Length, H_c (in)	Effective Consoli Stress, σ_c (psi)	Cyclic Load, P_c (lbs)	Cyclic Deviator Stress, σ_d (psi)
6.50	5.82	98.0	151.95	23.4

Double Amplitude Load LD_A (lbs)	Double Ampli. Deformation SD_A (in.)	Young's Modulus E (psi)	Single Ampliti. Axial Strain ε (%)	Area of Hysteresis Loop A_L, (lb-in)	Area of Triangle A_T, (lb-in)	Damping Ratio D (%)
303.9	0.0110	24670	0.095	0.770	0.419	14.6

Hysteresis Loop @ 10th Cycle, Deformation Stage 3



LAWGIBB GROUP

CYCLIC TRIAXIAL PROPERTIES TEST
(ASTM D 3999-91)

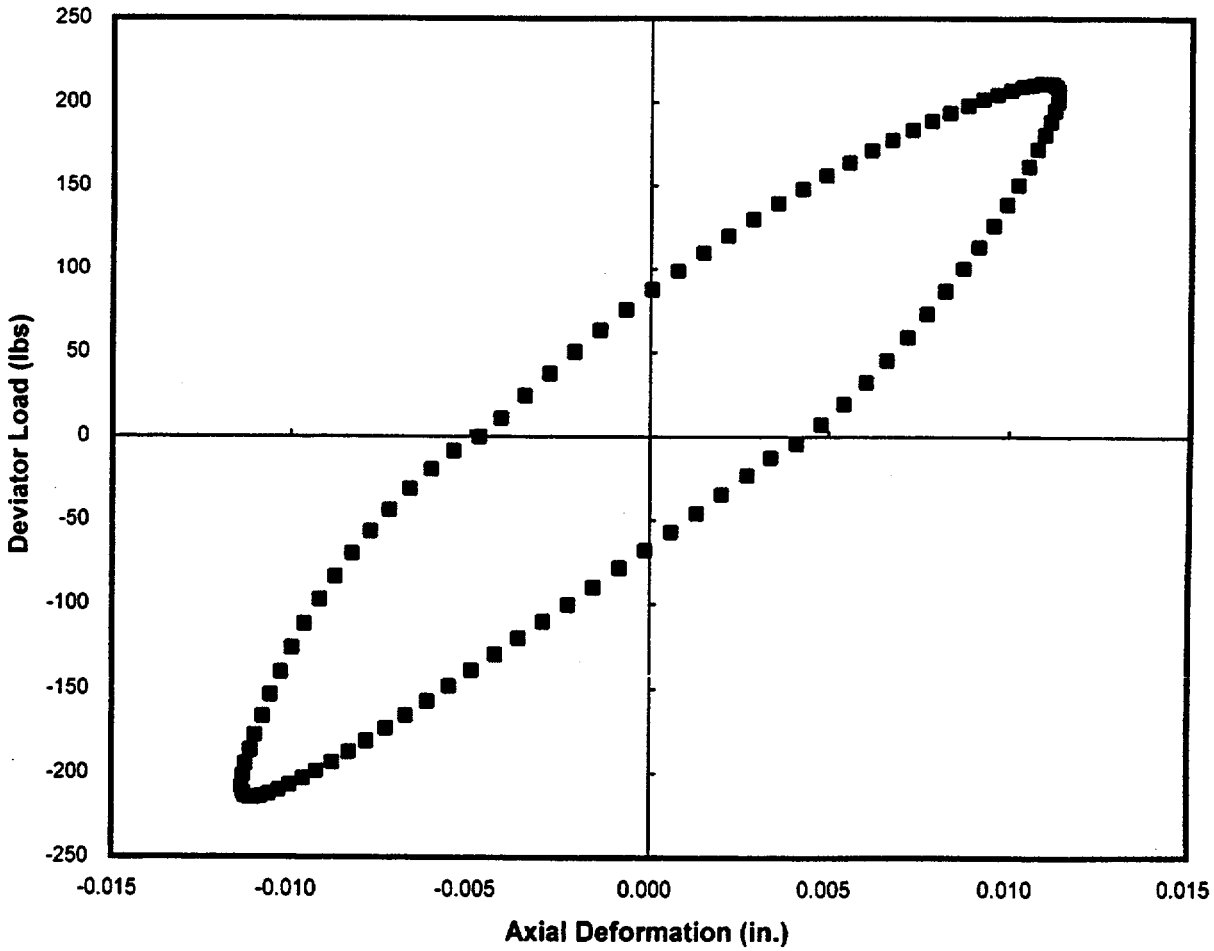
Project No.: 50160-0-3963
Tested By: JW & HJ
Test Date: 12/1/00
Reviewed By:
Review Date:

Project Name: Mox
Boring No.: BH-6
Sample No.: 17B
Depth: 98 - 100 feet
Sample Description: Brown clayey sand

Area, A_c (in^2)	Length, H_c (in)	Effective Consoli. Stress, σ_c (psi)	Cyclic Load, P_c (lbs)	Cyclic Deviator Stress, σ_d (psi)
6.50	5.82	98.0	212.81	32.7

Double Amplitude Load LD_A (lbs)	Double Ampli. Deformation SD_A (in.)	Young's Modulus E (psi)	Single Ampliti. Axial Strain ε (%)	Area of Hysteresis Loop A_L, (lb-in)	Area of Triangle A_T, (lb-in)	Damping Ratio D (%)
425.6	0.0226	16834	0.194	2.785	1.205	18.4

Hysteresis Loop @ 10th Cycle, Deformation Stage 4



LAWGIBB GROUP

CYCLIC TRIAXIAL PROPERTIES TEST

(ASTM D 3999-91)

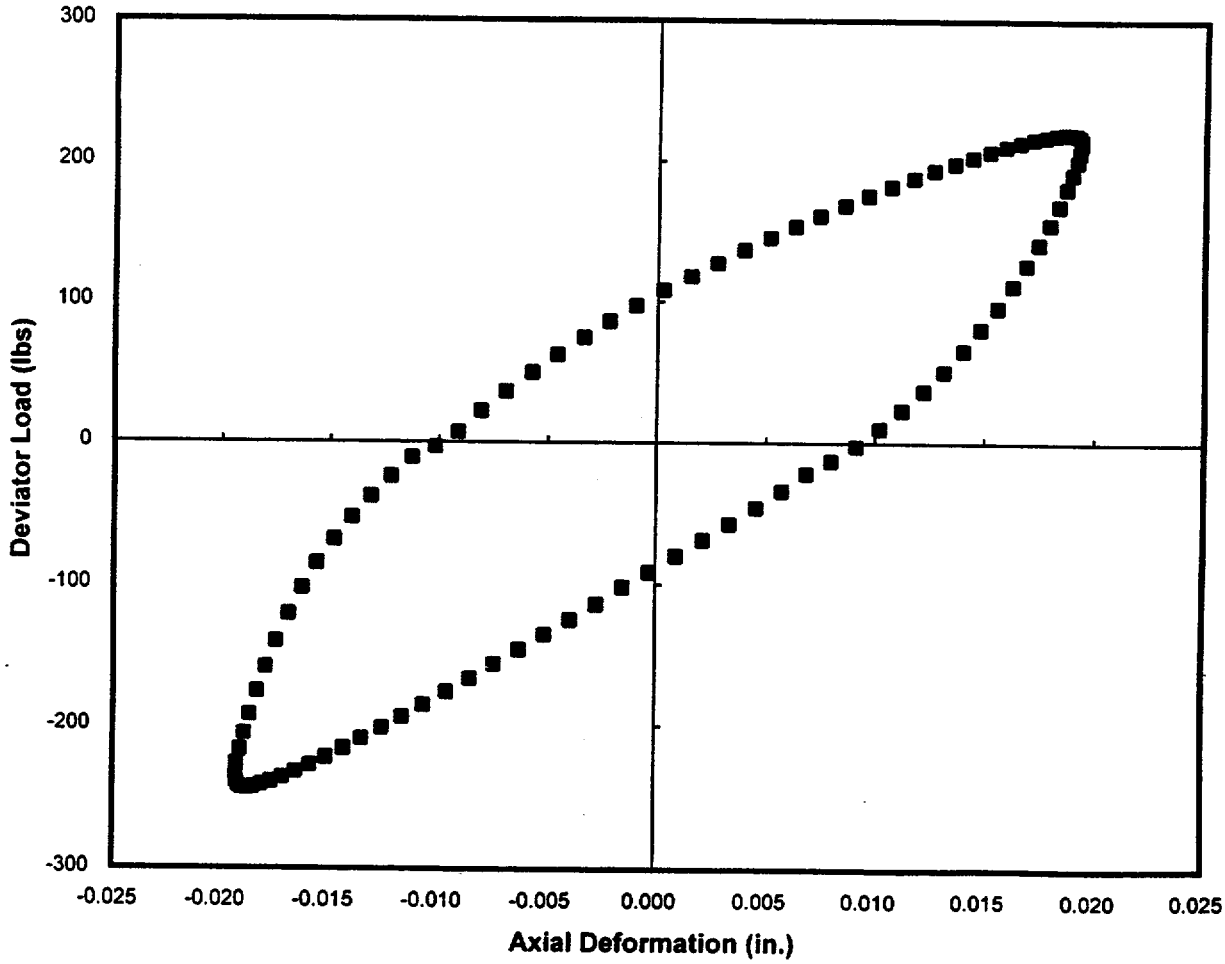
Project No.: 50160-0-3963
Tested By: JW & HJ
Test Date: 12/1/00
Reviewed By:
Review Date:

Project Name: Mox
Boring No.: BH-6
Sample No.: 17B
Depth: 98 - 100 feet
Sample Description: Brown clayey sand

Area, A_c (in^2)	Length, H_c (in)	Effective Consoli. Stress, σ_c (psi)	Cyclic Load, P_c (lbs)	Cyclic Deviator Stress, σ_d (psi)
6.50	5.82	98.0	232.09	35.7

Double Amplitude Load LD_A (lbs)	Double Ampli. Deformation SD_A (in.)	Young's Modulus E (psi)	Single Ampliti. Axial Strain ε (%)	Area of Hysteresis Loop A_L, (lb-in)	Area of Triangle A_T, (lb-in)	Damping Ratio D (%)
464.2	0.0386	10770	0.331	6.109	2.240	21.7

Hysteresis Loop @ 10th Cycle, Deformation Stage 5



LAWGIBB GROUP

CYCLIC TRIAXIAL PROPERTIES TEST

(ASTM D 3999-91)

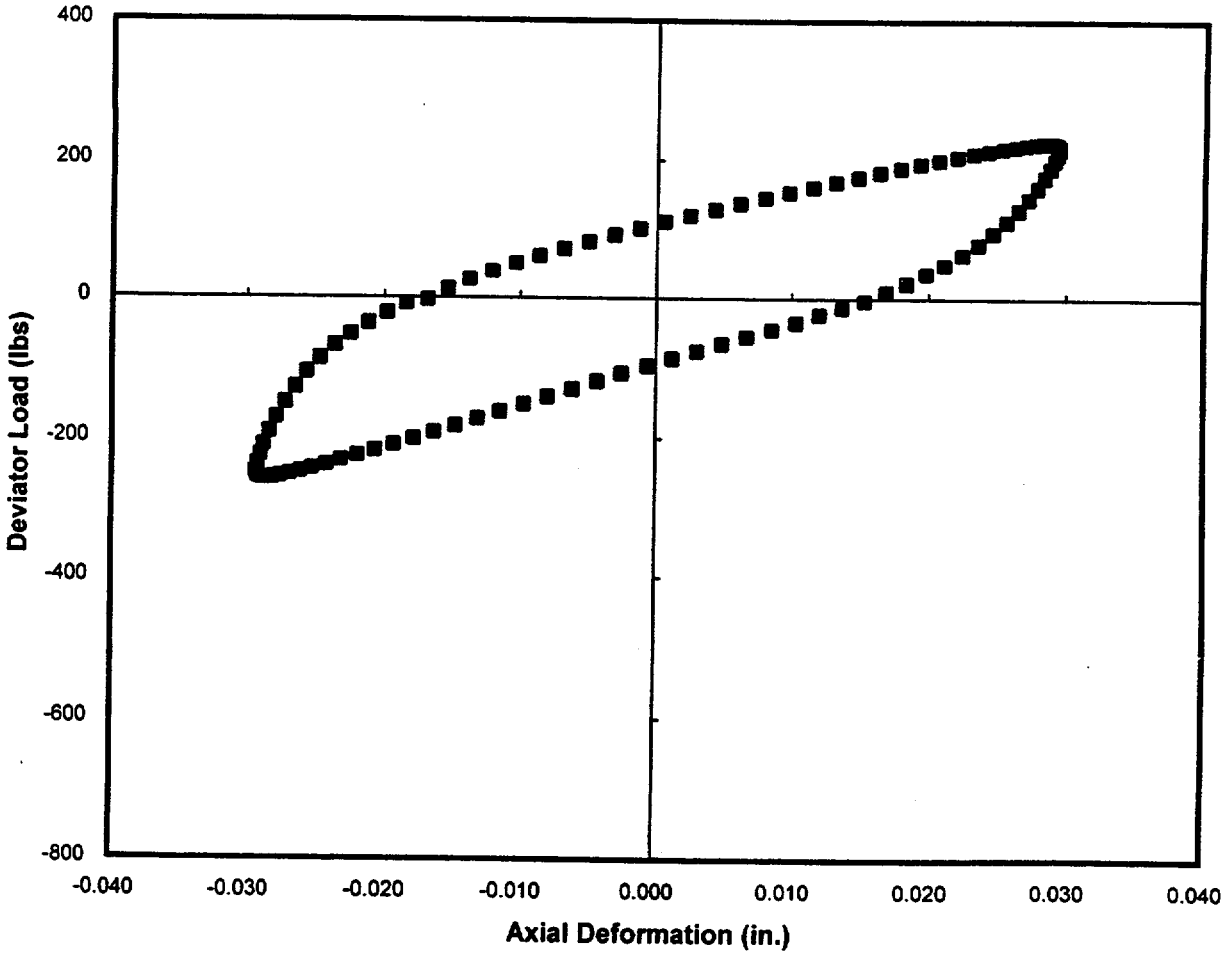
Project No.: 50160-0-3963
Tested By: JW & HJ
Test Date: 12/1/00
Reviewed By:
Review Date:

Project Name: Mox
Boring No.: BH-6
Sample No.: 17B
Depth: 98 - 100 feet
Sample Description: Brown clayey sand

Area, A_c (in^2)	Length, H_c (in)	Effective Consoli. Stress, σ_c (psi)	Cyclic Load, P_c (lbs)	Cyclic Deviator Stress, σ_d (psi)
6.50	5.82	98.0	241.78	37.2

Double Amplitude Load LD_A (lbs)	Double Ampli. Deformation SD_A (in.)	Young's Modulus E (psi)	Single Ampliti. Axial Strain ε (%)	Area of Hysteresis Loop A_L, (lb-in)	Area of Triangle A_T, (lb-in)	Damping Ratio D (%)
483.6	0.0587	7381	0.504	10.111	3.547	22.7

Hysteresis Loop @ 10th Cycle, Deformation Stage 6



LAWGIBB GROUP

CYCLIC TRIAXIAL PROPERTIES TEST

(ASTM D 3999-91)

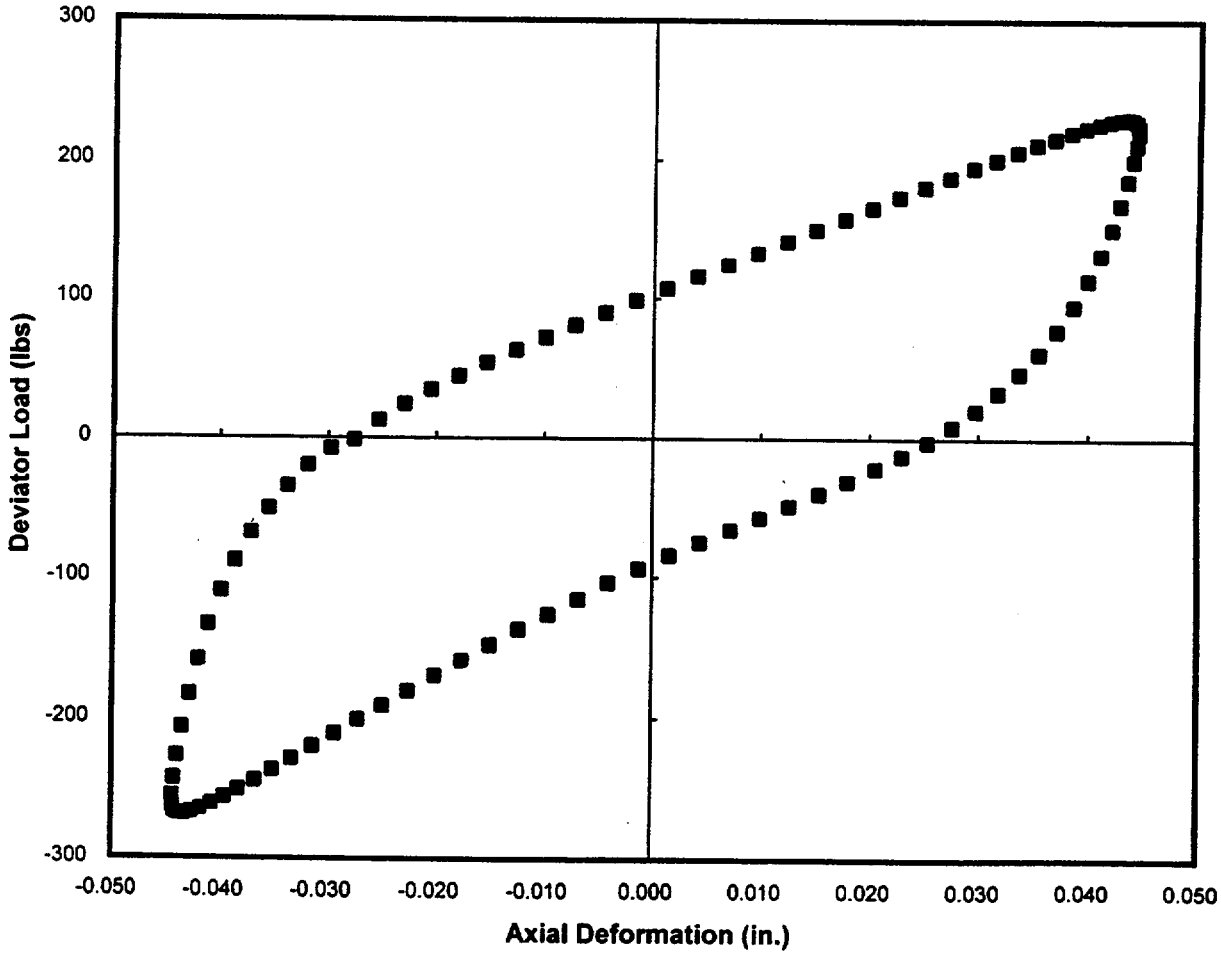
Project No.: 50160-0-3963
Tested By: JW & HJ
Test Date: 12/1/00
Reviewed By:
Review Date:

Project Name: Mox
Boring No.: BH-6
Sample No.: 17B
Depth: 98 - 100 feet
Sample Description: Brown clayey sand

Area, A_c (in^2)	Length, H_c (in)	Effective Consoli. Stress, σ_c (psi)	Cyclic Load, P_c (lbs)	Cyclic Deviator Stress, σ_d (psi)
6.50	5.82	98.0	249.47	38.4

Double Amplitude Load LD_A (lbs)	Double Ampli. Deformation SD_A (in.)	Young's Modulus E (psi)	Single Ampliti. Axial Strain ε (%)	Area of Hysteresis Loop A_L, (lb-in)	Area of Triangle A_T, (lb-in)	Damping Ratio D (%)
498.9	0.0888	5034	0.762	15.863	5.537	22.8

Hysteresis Loop @ 10th Cycle, Deformation Stage 7



LAWGIBB GROUP

CYCLIC TRIAXIAL PROPERTIES TEST

(ASTM D 3999-91)

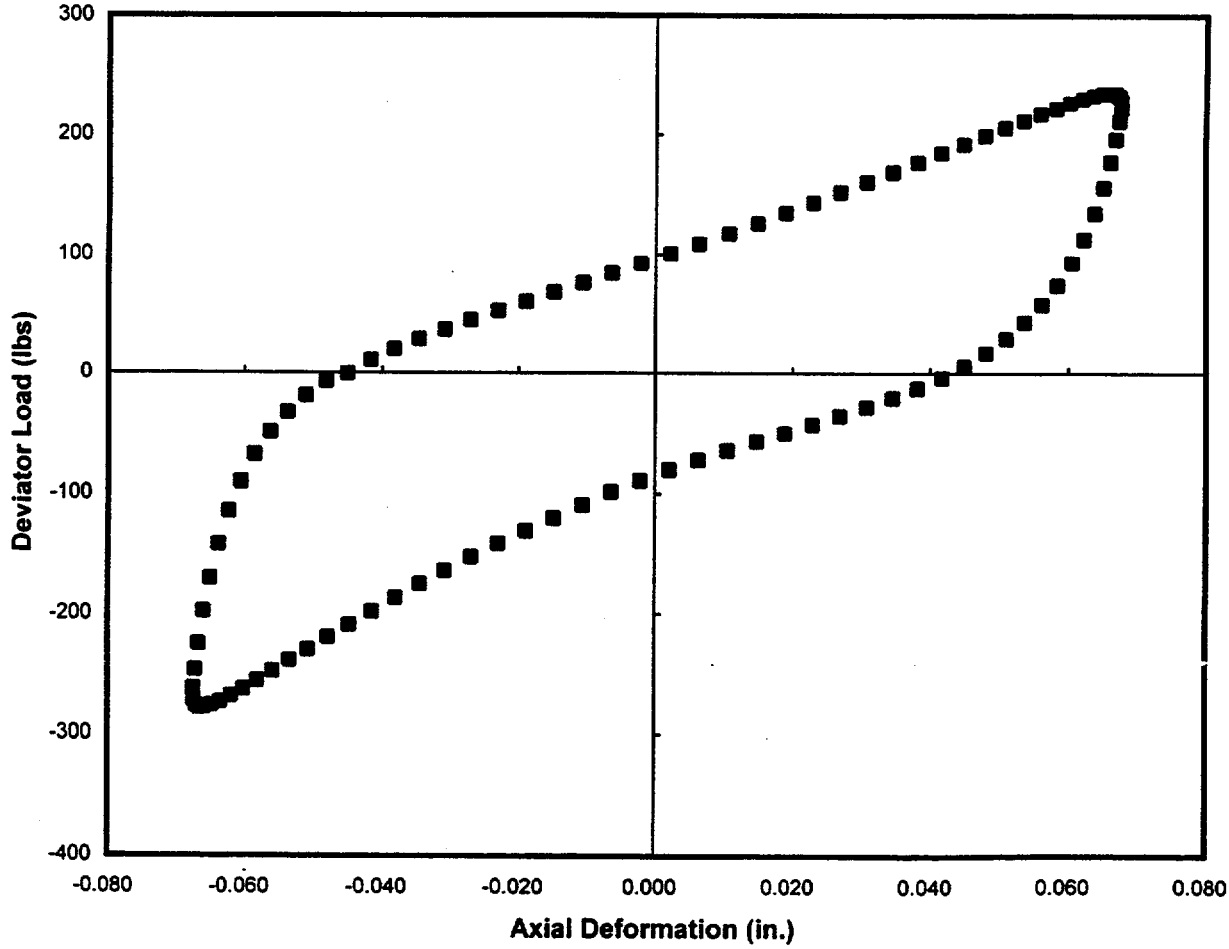
Project No.: 50160-0-3963
Tested By: JW & HJ
Test Date: 12/1/00
Reviewed By:
Review Date:

Project Name: Mox
Boring No.: BH-6
Sample No.: 17B
Depth: 98 - 100 feet
Sample Description: Brown clayey sand

Area, A_c (in^2)	Length, H_c (in)	Effective Consoli. Stress, σ_c (psi)	Cyclic Load, P_c (lbs)	Cyclic Deviator Stress, σ_d (psi)
6.50	5.82	98.0	256.54	39.5

Double Amplitude Load LD_A (lbs)	Double Ampli. Deformation SD_A (in.)	Young's Modulus E (psi)	Single Ampliti. Axial Strain ε (%)	Area of Hysteresis Loop A_L, (lb-in)	Area of Triangle A_T, (lb-in)	Damping Ratio D (%)
513.1	0.1349	3406	1.158	24.338	8.653	22.4

Hysteresis Loop @ 10th Cycle, Deformation Stage 8



LAWGIBB GROUP

CYCLIC TRIAXIAL PROPERTIES TEST

(ASTM D 3999-91)

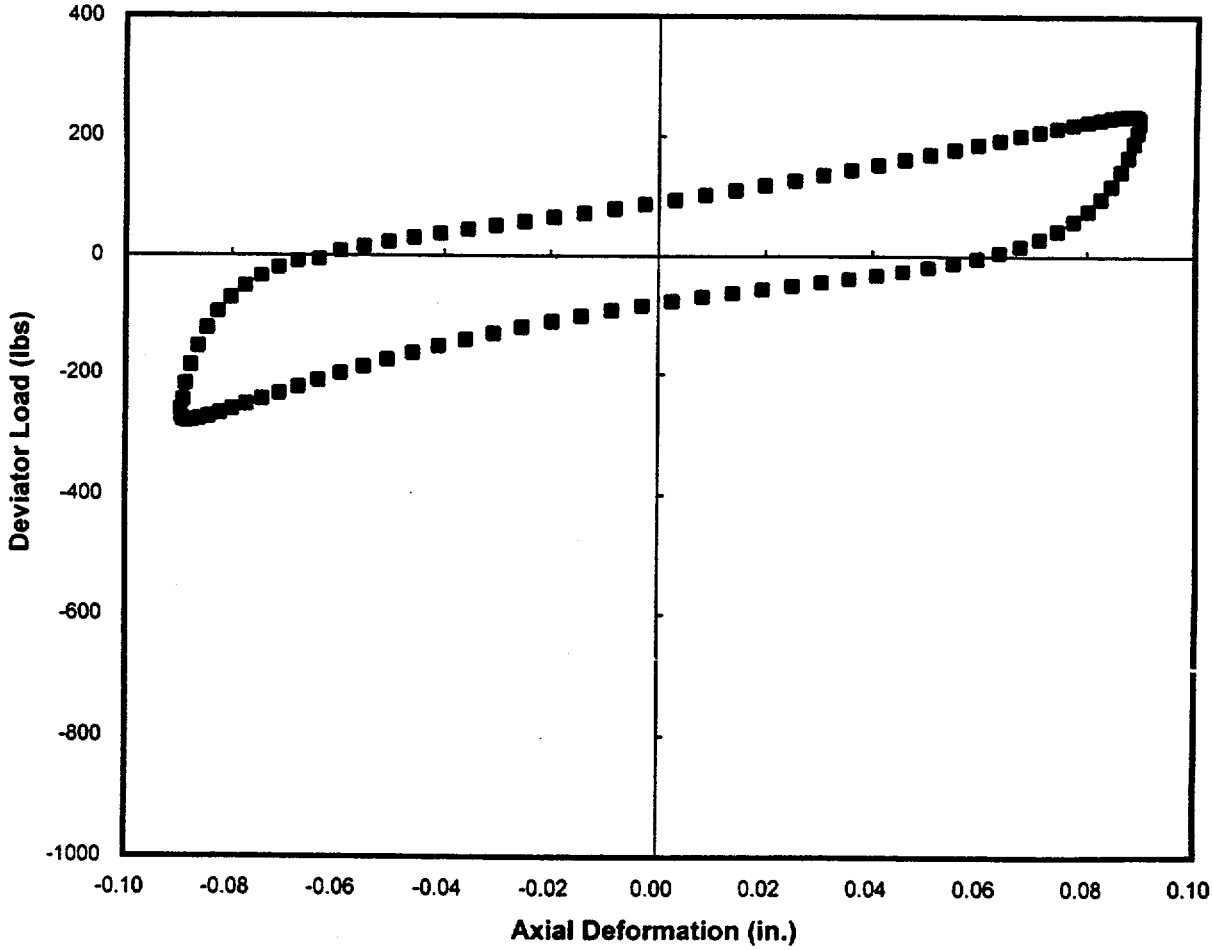
Project No.: 50160-0-3963
Tested By: JW & HJ
Test Date: 12/1/00
Reviewed By:
Review Date:

Project Name: Mox
Boring No.: BH-6
Sample No.: 17B
Depth: 98 - 100 feet
Sample Description: Brown clayey sand

Area, A_c (in^2)	Length, H_c (in)	Effective Consoli. Stress, σ_c (psi)	Cyclic Load, P_c (lbs)	Cyclic Deviator Stress, σ_d (psi)
6.50	5.82	98.0	256.02	39.4

Double Amplitude Load LD_A (lbs)	Double Ampli. Deformation SD_A (in.)	Young's Modulus E (psi)	Single Ampliti. Axial Strain ε (%)	Area of Hysteresis Loop A_L, (lb-in)	Area of Triangle A_T, (lb-in)	Damping Ratio D (%)
512.0	0.1791	2560	1.538	30.424	11.465	21.1

Hysteresis Loop @ 10th Cycle, Deformation Stage 9



LAWGIBB GROUP

CYCLIC TRIAXIAL PROPERTIES TEST

(ASTM D 3999-91)

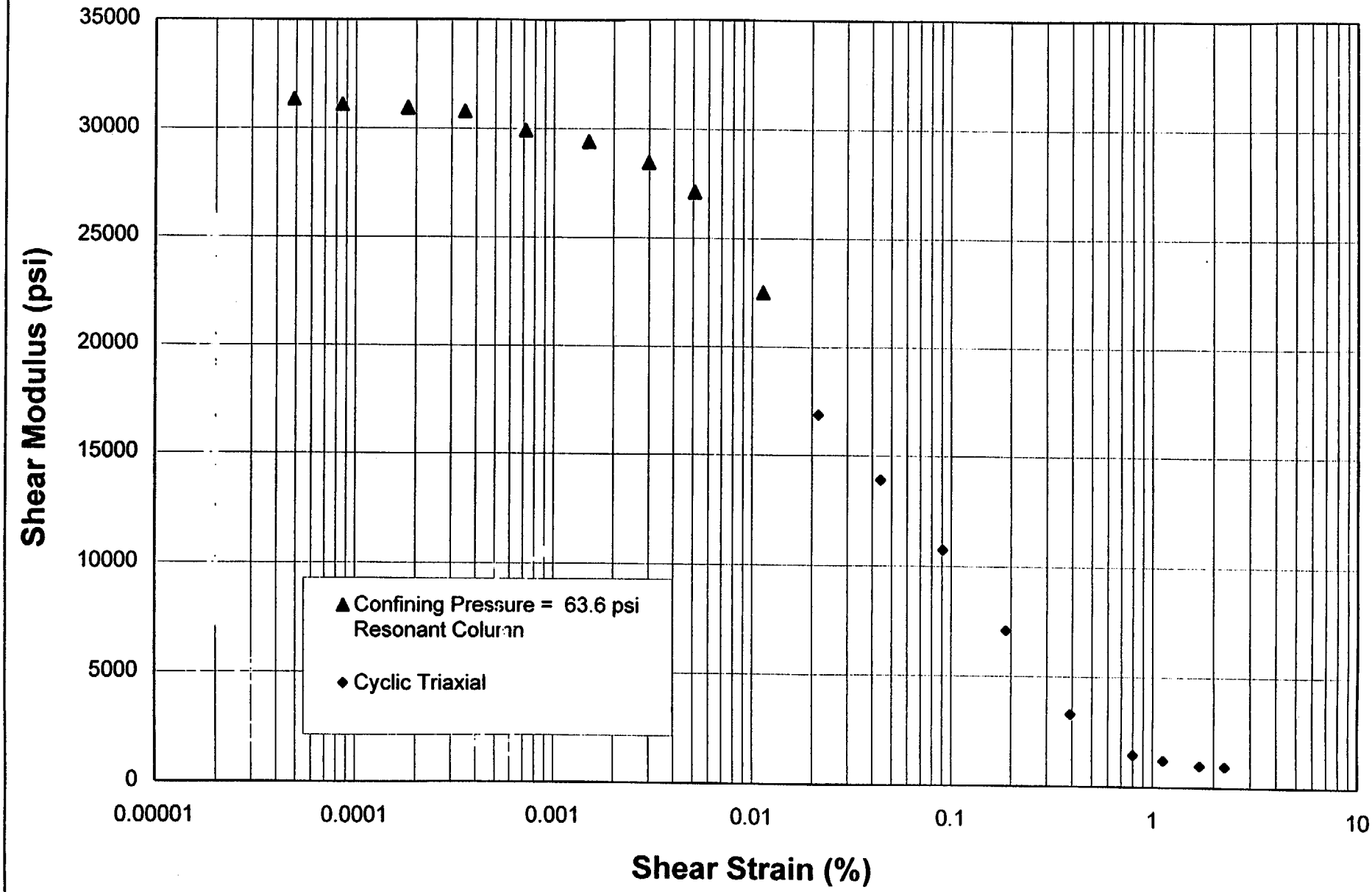
Project No.:	50160-0-3963	Project Name:	Mox
Tested By:	JW & HJ	Boring No.:	BH-6
Test Date:	12/1/00	Sample No.:	17B
Reviewed By:		Depth:	98 - 100 feet
Review Date:		Sample Description:	Brown clayey sand

Effective Consolidation Stress 98 psi

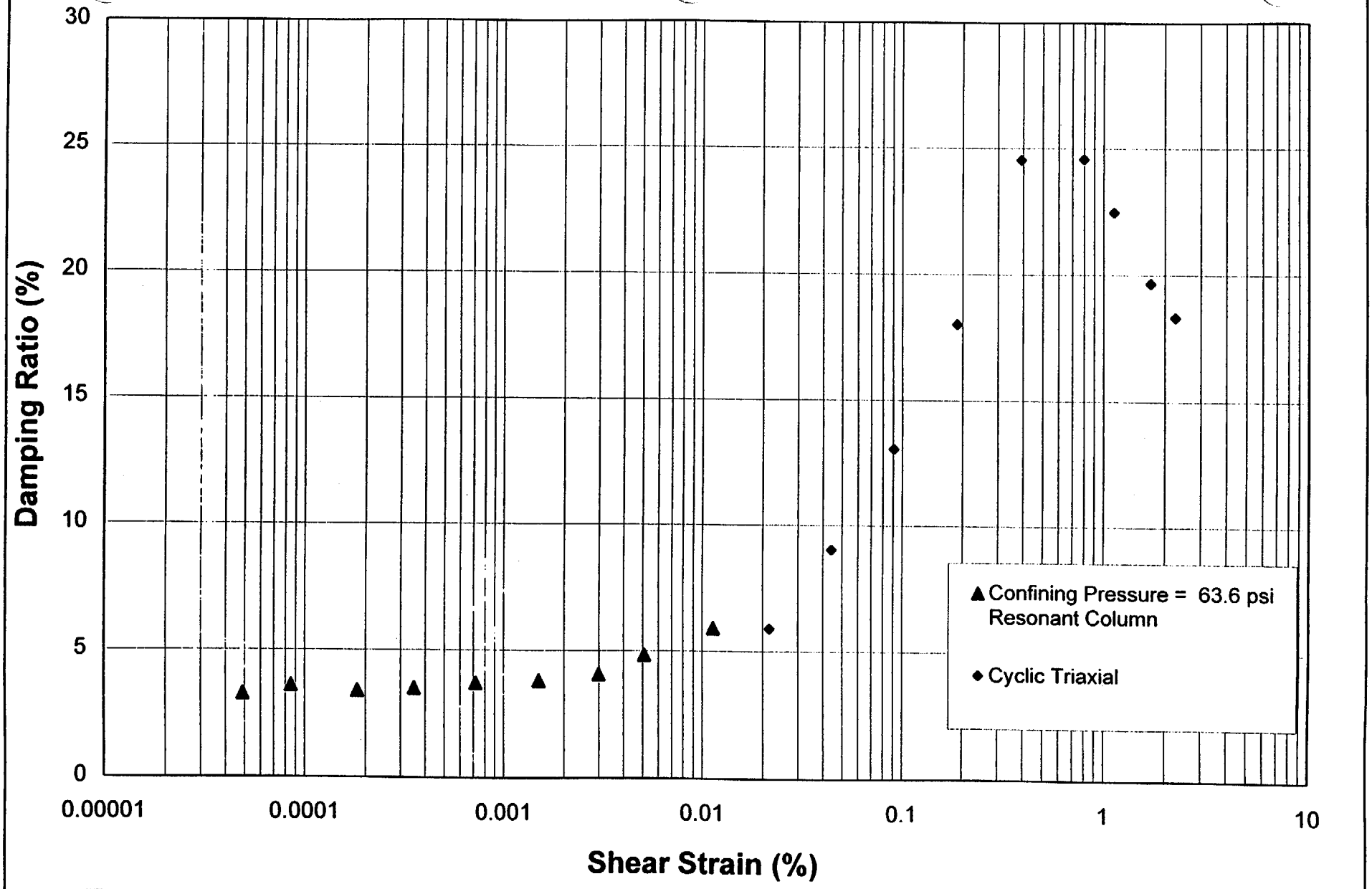
Deformation Stage No.	Cyclic Stress (psi)	Axial Strain ε (%)	Young's Modulus E, (psi)	Damping Ratio D, (%)	Shear* Modulus G, (psi)	Shear* Strain γ (%)
1	11.1	0.026	42635	9.78	14212	0.039
2	15.8	0.046	34500	12.10	11500	0.069
3	23.4	0.095	24670	14.62	8223	0.142
4	32.7	0.194	16834	18.39	5611	0.292
5	35.7	0.331	10770	21.71	3590	0.497
6	37.2	0.504	7381	22.69	2460	0.756
7	38.4	0.762	5034	22.80	1678	1.143
8	39.5	1.158	3406	22.38	1135	1.738
9	39.4	1.538	2560	21.12	853	2.307

* Calculated based on assumed Poisson's Ratio value, 0.5.

All calculations are based on 10th cycle.



Shear Modulus vs. Shear Strain **BH-10 6B 35 - 37.5 ft**	**LAW** **LAWGIBB Group Member**	**MOX** Project No.: 50160-0-3963 Date: 10/24/00



Damping Ratio vs. Shear Strain
BH-10 6B 35 - 37.5 ft

LAW
LAWGIBB Group Member

MOX

Project No.: 50160-0-3963

Date: 10/24/00

LAW

LAWGIBB Group Member

RESONANT COLUMN TEST (ASTM D4015-87)

Project No.:	50160-0-3963	Project Name:	MOX
Tested By:	HJ & JW	Boring No.:	BH-10
Test Date:	10/24/00	Sample No.:	6B
Reviewed By:	JW	Depth:	35 - 37.5 ft
Reviewed Date:	10/25/00	Sample Description:	Tan Brown & Purple Silty Sand

Initial Specimen Data

Labels	Values	Units	Description
Masses			
M_{scb}	1250.30	g	*Mass of soil and container before*
M_{sca}	0.00	g	*Mass of soil and container after*
M_{ds}	1250.30	g	*M_{scb} - M_{sca} =mass of soil*
Diameters			
D_t	72.9	mm	*Diameter near top of specimen*
D_m	72.6	mm	*Diameter near middle of specimen*
D_b	72.0	mm	*Diameter near bottom of specimen*
T_{mem}	0.0	mm	*Single thickness of membrane*
D_{net}	72.5	mm	*$(D_t + D_m + D_b)/3 - 2*T_{mem}$*
Lengths			
L_{cbp}	220.6	mm	*Length between chamber bottom & top of top platen*
L_{tp}	21.6	mm	*Length of top platen*
L_{bp}	46.6	mm	*Length of bottom platen*
L_{net}	152.4	mm	*Length of Specimen $= L_{cbp} - L_{tp} - L_{bp}$*
Volume			
V	629440	mm^3	*$D^2_{net}*Pi*L_{net}/4$*

Labels	Values	Units	Description
Mass Density and Unit Weight			
Rho	1986	kg/m^3	*Mass density of specimen M_s*V*10^6*
U_{wt}	19.5	kN/m^3	*Unit weight of specimen = Rho*9.806/1000*
Moisture Content			
No.	E-8		*Container number*
M_{wscb}	1326.90	g	*Mass of wet soil + container*
M_{wsca}	1136.50	g	*Mass of dry soil + container*
M_{wat}	190.4	g	*Mass of water = M_{wscb} - M_{wsca}*
M_{cont}	76.60	g	*Mass of container.*
mc	18.0	%	*$M_{wat}/(M_{wsca} - M_{cont})*100\%$*
Rho_d	1684	kg/m^3	*Dry mass density = Rho/(1+mc)*
G_s	2.65		*Specific gravity (estimated)*
e	0.57		*Void Ratio, $[1000*G_s)]/Rho_d$-1*
S_r	83.0	%	*Degree of Saturation = mc*G_s /e*
J	8.2E-04	$kg-m^2$	*Polar mass moment of inertia $= (M_s/1000)*(D_{net}/1000)^2/8$*

Conditions After Saturation			
CL_s	0.0	mm	*Change in length*
L_s	152.4	mm	*Length after saturation, L - CL_s*
A_s	4130	mm^2	*Area of specimen*
V_s	629440	mm^3	*Volume after saturation, $A_s * L_s$*
B	0.96		*B Value*

Conditions After Consolidation			
CL_c	1.3	mm	*Change in length*
L_d	151.1	mm	*Length after consolidation, L_s-CL_c*
CV_c	17340	mm^3	*Change in volume*
V_c	612100	mm^3	*Volume, V_s - CV_c*
S_r	100.0	%	*Degree of Saturation, mc*G_s /e*
e	0.53		*Void Ratio, $[1000*G_s]/Rho_d$-1*
mc	20.0	%	*Moisture Content*
Rho_d	1732	kg/m^3	*Dry mass density, Rho_d*V/V_c*

LAW
LAWGIBB Group Member

RESONANT COLUMN TEST (ASTM D4015-87)

Project No.:	50160-0-3963	Project Name:	MOX
Tested By:	HJ & JW	Boring No.:	BH-10
Test Date:	10/24/00	Sample No.:	6B
Reviewed By:	JW	Depth:	35 - 37.5 ft
Reviewed Date:	10/25/00	Sample Description:	Tan Brown & Purple Silty Sand

Apparatus Information

Apparatus Description	Typical Long-Tor
Apparatus Serial No.	556G0001
Platen Diameter, mm	72.4

Apparatus Calibration Factors			
M_A	0.3044	kg	*Top Platen Mass*
LCFA	N/A	$[m/V_{rms}]*[Hz^2]$	*Longitudinal Vibration Calibration Factor*
ADCL	N/A	kg-Hz	*Longitudinal Apparatus Damping Coefficient*
FCF	N/A	N/V_{rms}	*Force Calibration Factor*
J_A	0.0032	$kg\text{-}m^2$	*Platen Polar Mass Momment of Inertia*
RCFA	4.42	$[Rad/V_{rms}]*[Hz^2]$	*Rotational Vibration Calibration Factor*
ADCT	0.00139	$Hz\text{-}kg\text{-}m^2$	*Torsional Apparatus Damping Coefficient*
TCF	0.069	$N\text{-}m/V_{rms}$	*Torque Calibration Factor*
FOT	0	Hz	*Apparatus Resonant Frequency*

Ancillary System Calibration Factors			
LCCF	-0.635	mm/unit	*Length change calibration factor (+ means*
			specimen length increase for increase values)
BCF	-0.34	mL/unit	*Burette calibration factor (+ means specimen*
			volume increase for increase values.)
CPCF	6.89	kPa/unit	*Cell pressure calibration factor*
PPCF	6.89	kPa/unit	*Pore Pressure calibration factor*
ALCF	1	kN/unit	*Axial load calibration factor*
			(+ means compression of specimen.)
Ancillary System Initial Conditions			
ILR	2.612	units	*Initial length reading before testing*
IBR	14.5	units	*Initial burette reading before testing*
RPF	P		*P or F. "P" for resonant period input, and*
			"F" for resonant frequency input.

LAW

LAWGIBB Group Member

RESONANT COLUMN TEST (ASTM D4015-87)

INPUT DATA

Project No.:	50160-0-3963	Project Name:	MOX
Tested By:	HJ & JW	Boring No:	BH-10
Test Date:	10/24/00	Sample No.:	6B
Reviewed By:	JW	Depth:	35 - 37.5 ft
Reviewed Date	10/25/00	Sample Description:	Tan Brown & Purple Silty Sand

Total Number of Data Sets 9

Line No.	Elapsed Time [second]	Cell Pressure [unit]	Pore Pressure [unit]	Axial Load [unit]	Burette Reading [unit]	Length Reading [unit]	Longitudinal or Torsional	Force or Torque Reading [V_{rms}]	Transducer Reading [V_{rms}]	Resonant Period [msec]
1	21	100.0	36.4	0	14.5	2.612	T	0.011	0.019	6.052
2	56	100.0	36.4	0	14.5	2.612	T	0.021	0.033	6.076
3	101	100.0	36.4	0	14.5	2.612	T	0.042	0.070	6.090
4	138	100.0	36.4	0	14.5	2.612	T	0.083	0.134	6.106
5	169	100.0	36.4	0	14.5	2.613	T	0.175	0.267	6.194
6	195	100.0	36.4	0	14.5	2.613	T	0.368	0.547	6.249
7	226	100.0	36.4	0	14.5	2.613	T	0.760	1.057	6.351
8	259	100.0	36.4	0	14.5	2.613	T	1.470	1.717	6.504
9	304	100.0	36.7	0	14.5	2.625	T	3.310	3.17	7.139

LAW

LAWGIBB Group Member

RESONANT COLUMN TEST (ASTM D4015-87)

TEST RESULTS SUMMARY

Project No.:	50160-0-3963	Project Name:	MOX
Tested By:	HJ & JW	Boring No:	BH-10
Test Date:	10/24/00	Sample No.:	6B
Reviewed By:	JW	Depth:	35 - 37.5 ft
Reviewed Date:	10/25/00	Sample Description:	Tan Brown & Purple Silty Sand

Line No.	Effective Confining Stress [kPa]	Principal Stress Ratio	Void Ratio e	Longitudinal or Torsional	No. of Vibration Cycles	Shear Modulus G [Mpa]	Shear Modulus G [psi]	Shear Strain Amplitude [%]	Damping Ratio [%]
1	438.20	1.00	0.530	T	3536	216.00	31350	0.00005	3.27
2	438.20	1.00	0.530	T	5629	214.30	31103	0.00009	3.60
3	438.20	1.00	0.530	T	7389	213.32	30960	0.00018	3.39
4	438.20	1.00	0.530	T	6125	212.20	30798	0.00035	3.50
5	438.20	1.00	0.530	T	5005	206.21	29929	0.00072	3.71
6	438.20	1.00	0.530	T	4097	202.60	29404	0.00150	3.80
7	438.20	1.00	0.530	T	4944	196.14	28468	0.00299	4.07
8	438.20	1.00	0.530	T	5074	187.02	27144	0.00509	4.85
9	436.14	1.00	0.530	T	6303	155.21	22527	0.01131	5.91

LAWGIBB GROUP

CYCLIC TRIAXIAL PROPERTIES TEST

(ASTM D 3999-91)

Project No.:	50160-0-3963	Project Name:	Mox
Tested By:	JW & HJ	Boring No.:	BH-10
Test Date:	10/24/00	Sample No.:	6B
Reviewed By:	JW	Depth:	35 - 37.5 ft
Review Date:	10/25/00	Sample Description:	Tan brown & purple silty sand

SPECIMEN DATA

Initial Conditions of Specimen

Diameters, in.		Area , sq. in.	6.41
Top	2.842	Volume, cubic in.	38.44
Middle	2.871	Mass of Specimen, grams	1267.81
Bottom	2.855		
Average	2.856	Moisture Content	
Membrane Thickness, in.	0.000	Pan No.	X-25
Net Diameter, in.	2.856	Wet Mass + Pan, grams	1315.90
		Dry Mass + Pan, grams	1101.02
Length, in.		Container Mass, grams	48.10
Location 1	6.000	Moisture Content, %	20.4
Location 2	6.000		
Location 3	6.000	Density, pcf	125.4
Average	6.000	Dry Density, pcf	104.1
Length of Top Platen	0.000	Specific Gravity	2.65
Length of Bottom Platen	0.000	Degree of Saturation, %	92.0
Length of Specimen, in	6.000	Void Ratio	0.588

Conditions of Specimen After Saturation and Consolidation

After Saturation		After Consolidation	
Change in Length, in.	0.000	Change in Length, in.	0.032
Length, in.	6.000	Length, in.	5.968
Area, sq. in.	6.41	Change in Volume, cc	16.40
Volume, cubic in.	38.44	Volume, cubic in.	37.44
Back Pressure, psi	30.0	Area, sq in.	6.27
B Value	0.96	Effe. Consoli.. Stress, psi	63.0
		Moisture Content, %	20.6
		Dry Density, pcf	106.9
		Void Ratio	0.547
		Degree of Saturation, %	100.0

LAWGIBB GROUP

CYCLIC TRIAXIAL PROPERTIES TEST

(ASTM D 3999-91)

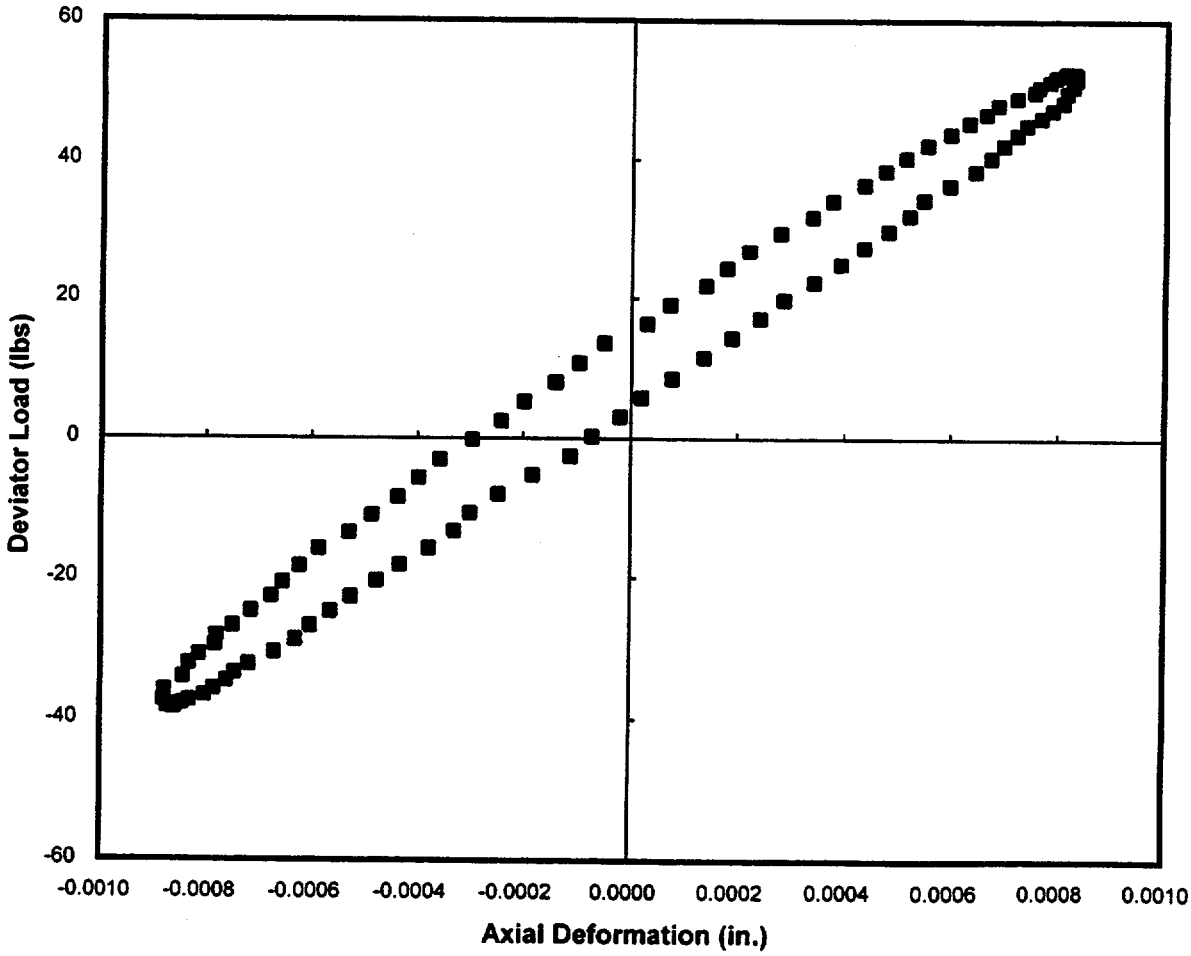
Project No.: 50160-0-3963
Tested By: JW & HJ
Test Date: 10/24/00
Reviewed By: JW
Review Date: 10/25/00

Project Name: Mox
Boring No.: BH-10
Sample No.: 6B
Depth: 35 - 37.5 ft
Sample Description: Tan brown & purple silty sand

Area, A_c (in^2)	Length, H_c (in)	Effective Consoli. Stress, σ_c (psi)	Cyclic Load, P_c (lbs)	Cyclic Deviator Stress, σ_d (psi)
6.27	5.97	63.0	45.47	7.2

Double Amplitude Load LD_A (lbs)	Double Ampli. Deformation SD_A (in.)	Young's Modulus E (psi)	Single Ampliti. Axial Strain ε (%)	Area of Hysteresis Loop A_L, (lb-in)	Area of Triangle A_T, (lb-in)	Damping Ratio D (%)
90.9	0.0017	50587	0.014	0.014	0.019	5.9

Hysteresis Loop @ 10th Cycle, Deformation Stage 1



LAWGIBB GROUP

CYCLIC TRIAXIAL PROPERTIES TEST

(ASTM D 3999-91)

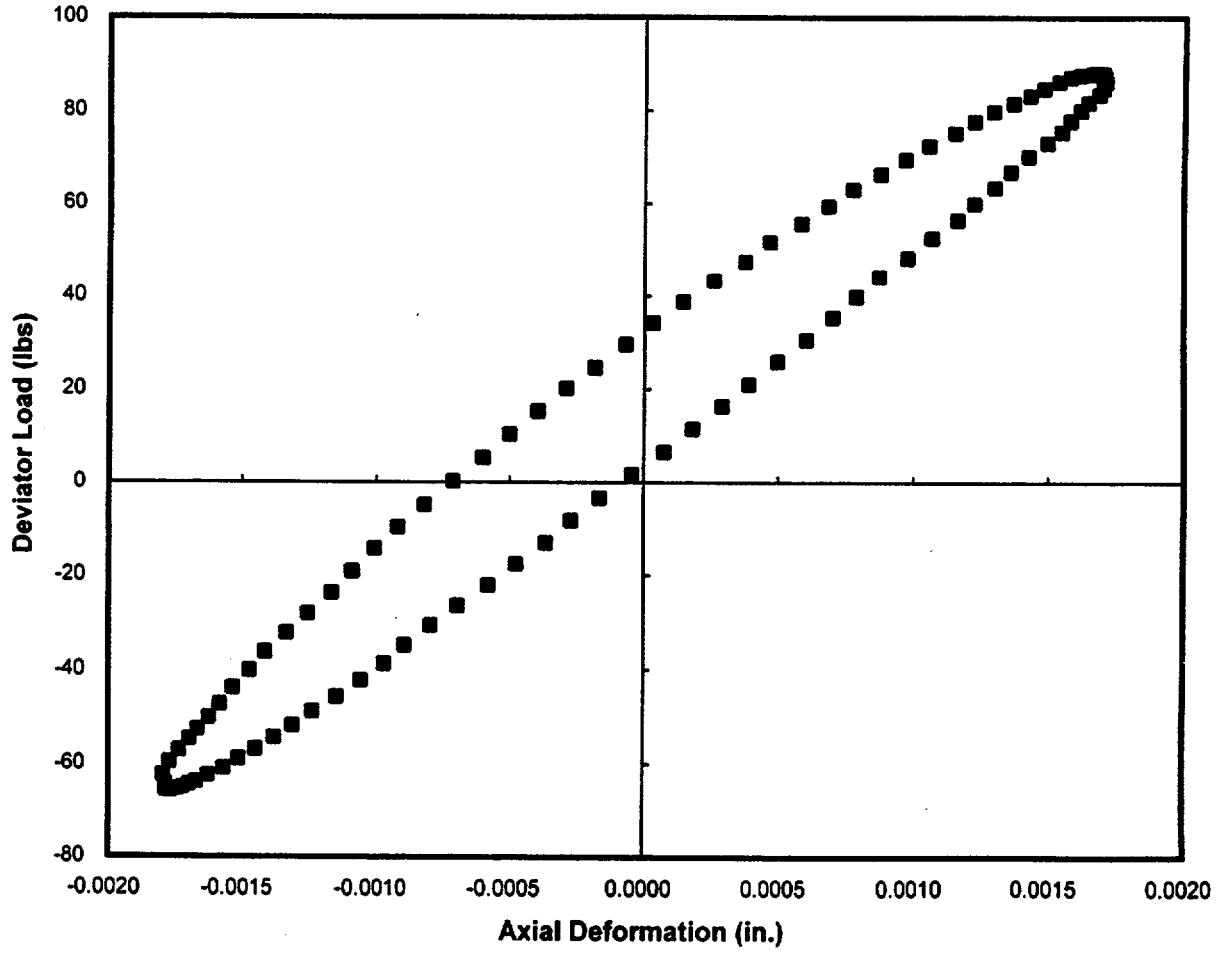
Project No.: 50160-0-3963
Tested By: JW & HJ
Test Date: 10/24/00
Reviewed By: JW
Review Date: 10/25/00

Project Name: Mox
Boring No.: BH-10
Sample No.: 6B
Depth: 35 - 37.5 ft
Sample Description: Tan brown & purple silty sand

Area, A_c (in^2)	Length, H_c (in)	Effective Consoli. Stress, σ_c (psi)	Cyclic Load, P_c (lbs)	Cyclic Deviator Stress, σ_d (psi)
6.27	5.97	63.0	76.81	12.2

Double Amplitude Load LD_A (lbs)	Double Ampli. Deformation SD_A (in.)	Young's Modulus E (psi)	Single Ampliti. Axial Strain ε (%)	Area of Hysteresis Loop A_L, (lb-in)	Area of Triangle A_T, (lb-in)	Damping Ratio D (%)
153.6	0.0035	41718	0.029	0.076	0.067	9.0

Hysteresis Loop @ 10th Cycle, Deformation Stage 2



LAWGIBB GROUP

CYCLIC TRIAXIAL PROPERTIES TEST

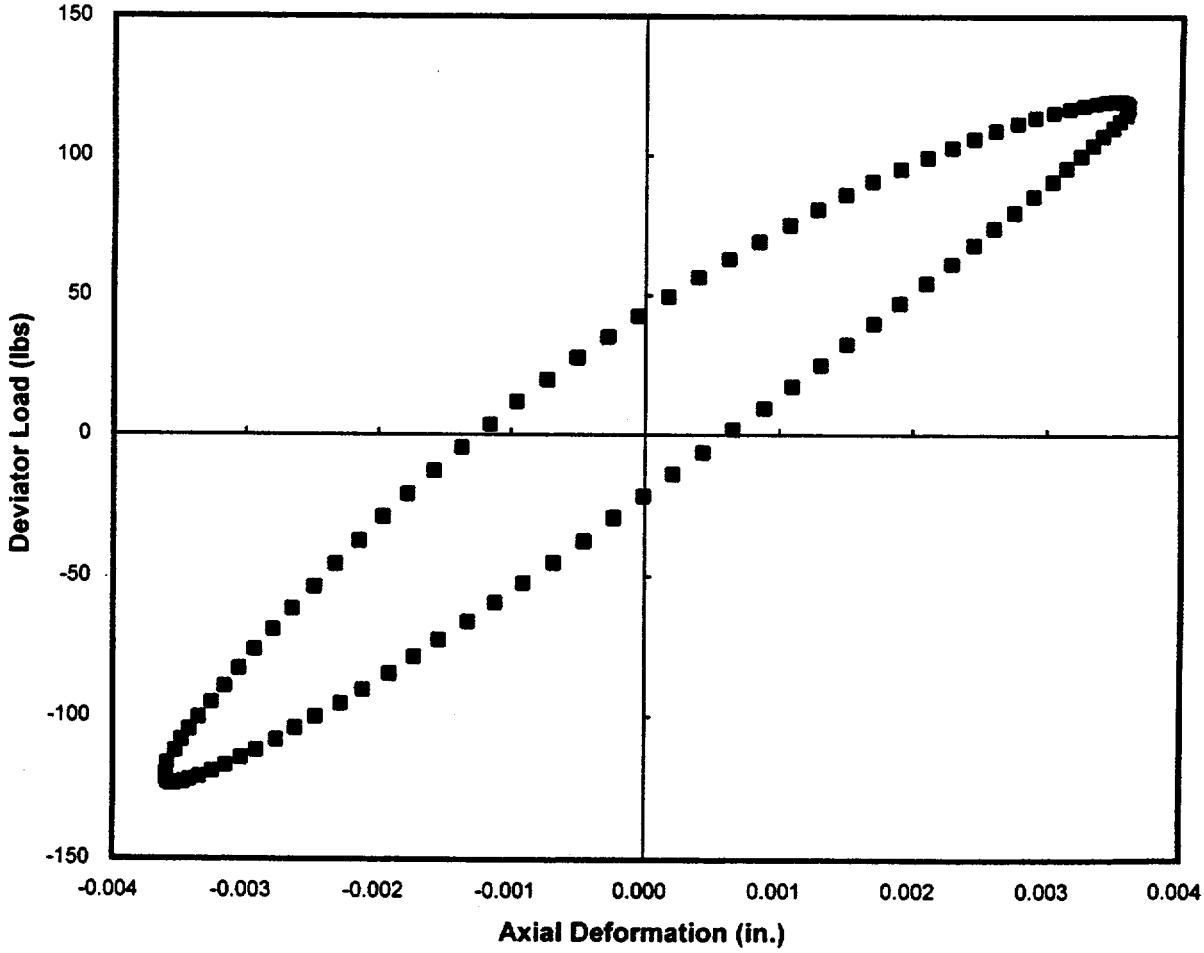
(ASTM D 3999-91)

Project No.:	50160-0-3963	Project Name:	Mox
Tested By:	JW & HJ	Boring No.:	BH-10
Test Date:	10/24/00	Sample No.:	6B
Reviewed By:	JW	Depth:	35 - 37.5 ft
Review Date:	10/25/00	Sample Description:	Tan brown & purple silty sand

Area, A_c (in^2)	Length, H_c (in)	Effective Consoli Stress, σ_c (psi)	Cyclic Load, P_c (lbs)	Cyclic Deviator Stress, σ_d (psi)
6.27	5.97	63.0	121.84	19.4

Double Amplitude Load LD_A (lbs)	Double Ampli. Deformation SD_A (in.)	Young's Modulus E (psi)	Single Ampliti. Axial Strain ε (%)	Area of Hysteresis Loop A_L, (lb-in)	Area of Triangle A_T, (lb-in)	Damping Ratio D (%)
243.7	0.0072	32211	0.060	0.359	0.219	13.0

Hysteresis Loop @ 10th Cycle, Deformation Stage 3



LAWGIBB GROUP

CYCLIC TRIAXIAL PROPERTIES TEST

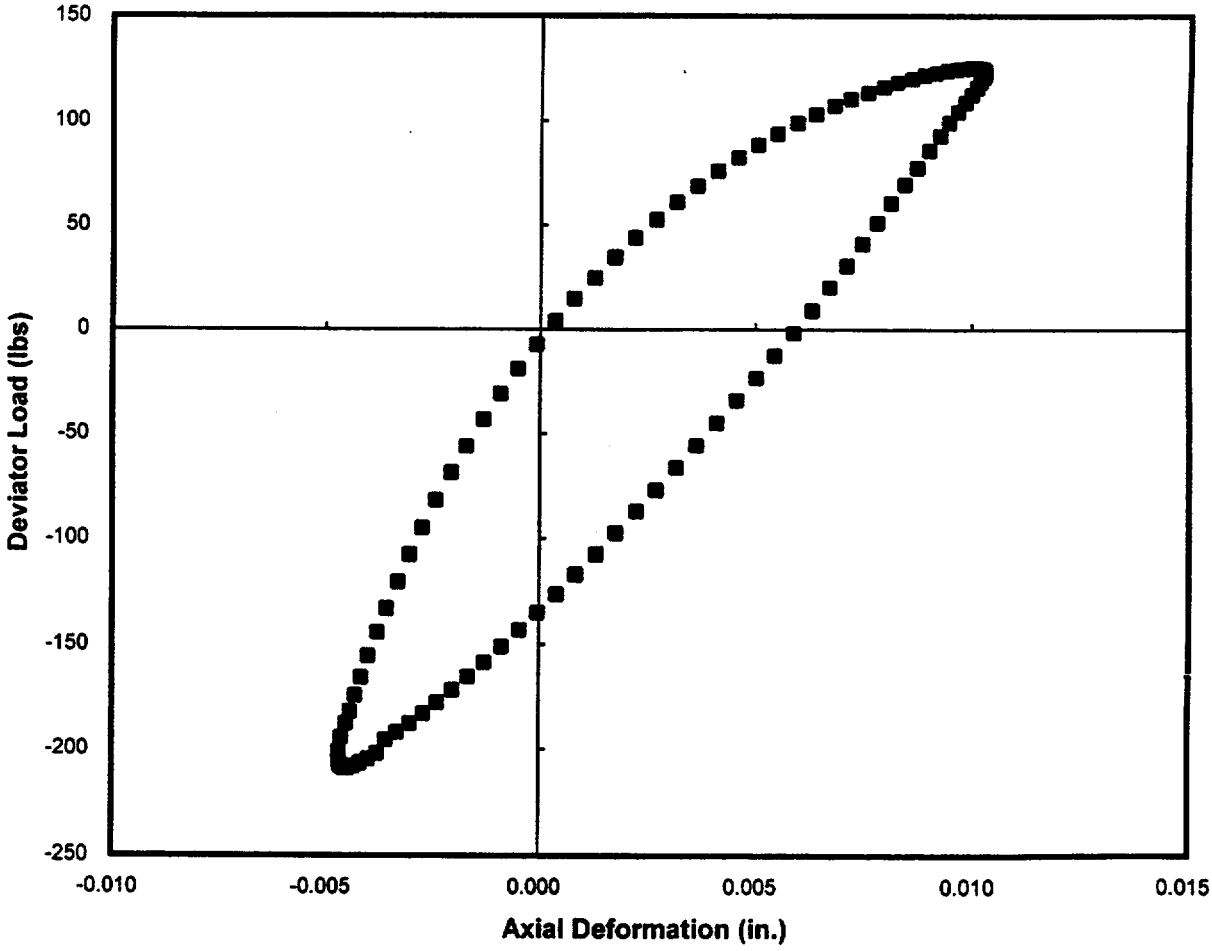
(ASTM D 3999-91)

Project No.:	50160-0-3963	Project Name:	Mox
Tested By:	JW & HJ	Boring No.:	BH-10
Test Date:	10/24/00	Sample No.:	6B
Reviewed By:	JW	Depth:	35 - 37.5 ft
Review Date:	11/27/00	Sample Description:	Tan brown & purple silty sand

Area, A_c (in^2)	Length, H_c (in)	Effective Consoli. Stress, σ_c (psi)	Cyclic Load, P_c (lbs)	Cyclic Deviator Stress, σ_d (psi)
6.27	5.97	63.0	167.22	26.7

Double Amplitude Load LD_A (lbs)	Double Ampli. Deformation SD_A (in.)	Young's Modulus E (psi)	Single Ampliti. Axial Strain ε (%)	Area of Hysteresis Loop A_L, (lb-in)	Area of Triangle A_T, (lb-in)	Damping Ratio D (%)
334.4	0.0149	21291	0.125	1.416	0.625	18.0

Hysteresis Loop @ 10th Cycle, Deformation Stage 4



LAWGIBB GROUP

CYCLIC TRIAXIAL PROPERTIES TEST

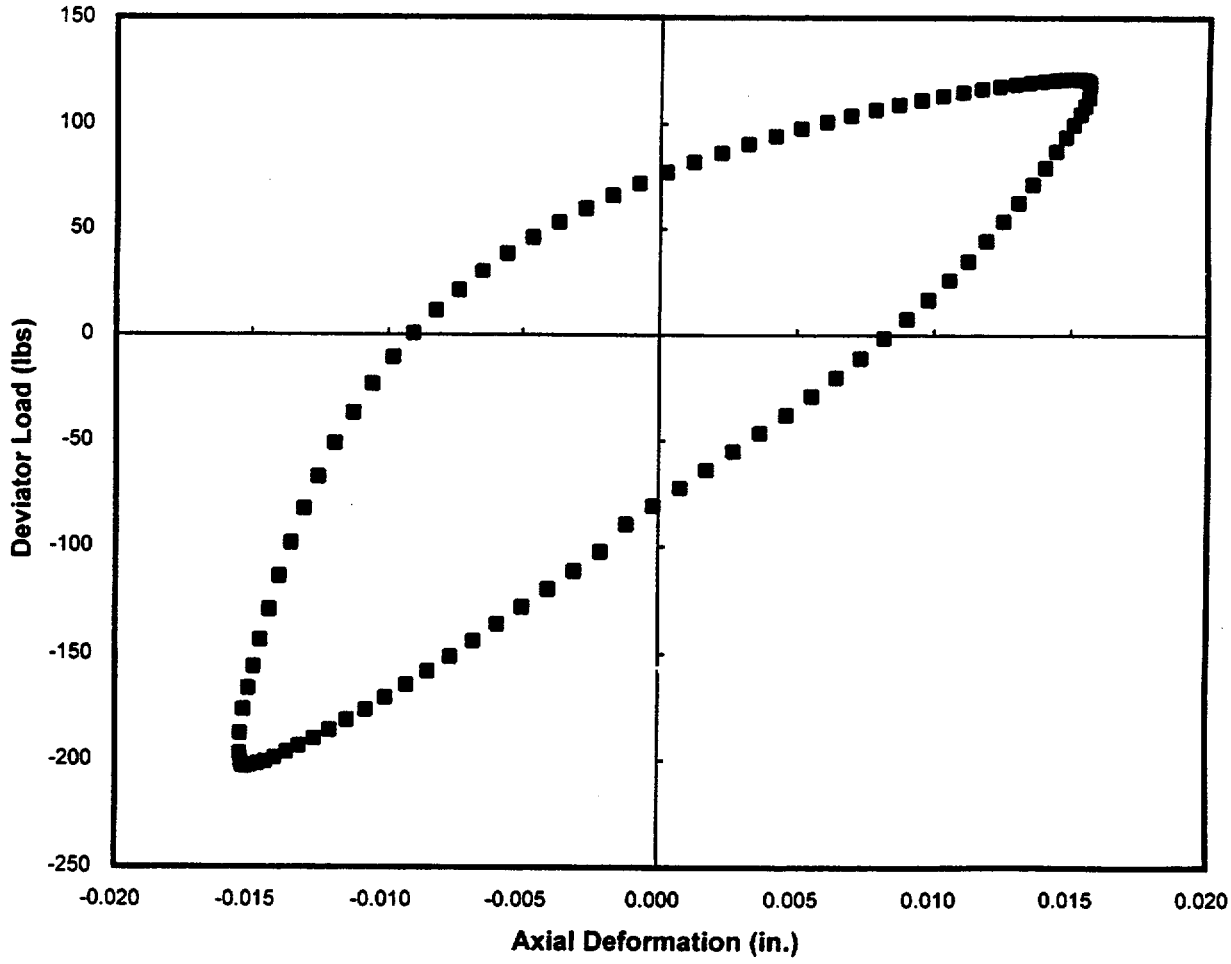
(ASTM D 3999-91)

Project No.:	50160-0-3963	Project Name:	Mox
Tested By:	JW & HJ	Boring No.:	BH-10
Test Date:	10/24/00	Sample No.:	6B
Reviewed By:	JW	Depth:	35 - 37.5 ft
Review Date:	10/25/00	Sample Description:	Tan brown & purple silty sand

Area, A_c (in^2)	Length, H_c (in)	Effective Consoli. Stress, σ_c (psi)	Cyclic Load, P_c (lbs)	Cyclic Deviator Stress, σ_d (psi)
6.27	5.97	63.0	162.15	25.8

Double Amplitude Load LD_A (lbs)	Double Ampli. Deformation SD_A (in.)	Young's Modulus E (psi)	Single Ampliti. Axial Strain ε (%)	Area of Hysteresis Loop A_L, (lb-in)	Area of Triangle A_T, (lb-in)	Damping Ratio D (%)
324.3	0.0311	9936	0.260	3.882	1.259	24.5

Hysteresis Loop @ 10th Cycle, Deformation Stage 5



LAWGIBB GROUP

CYCLIC TRIAXIAL PROPERTIES TEST

(ASTM D 3999-91)

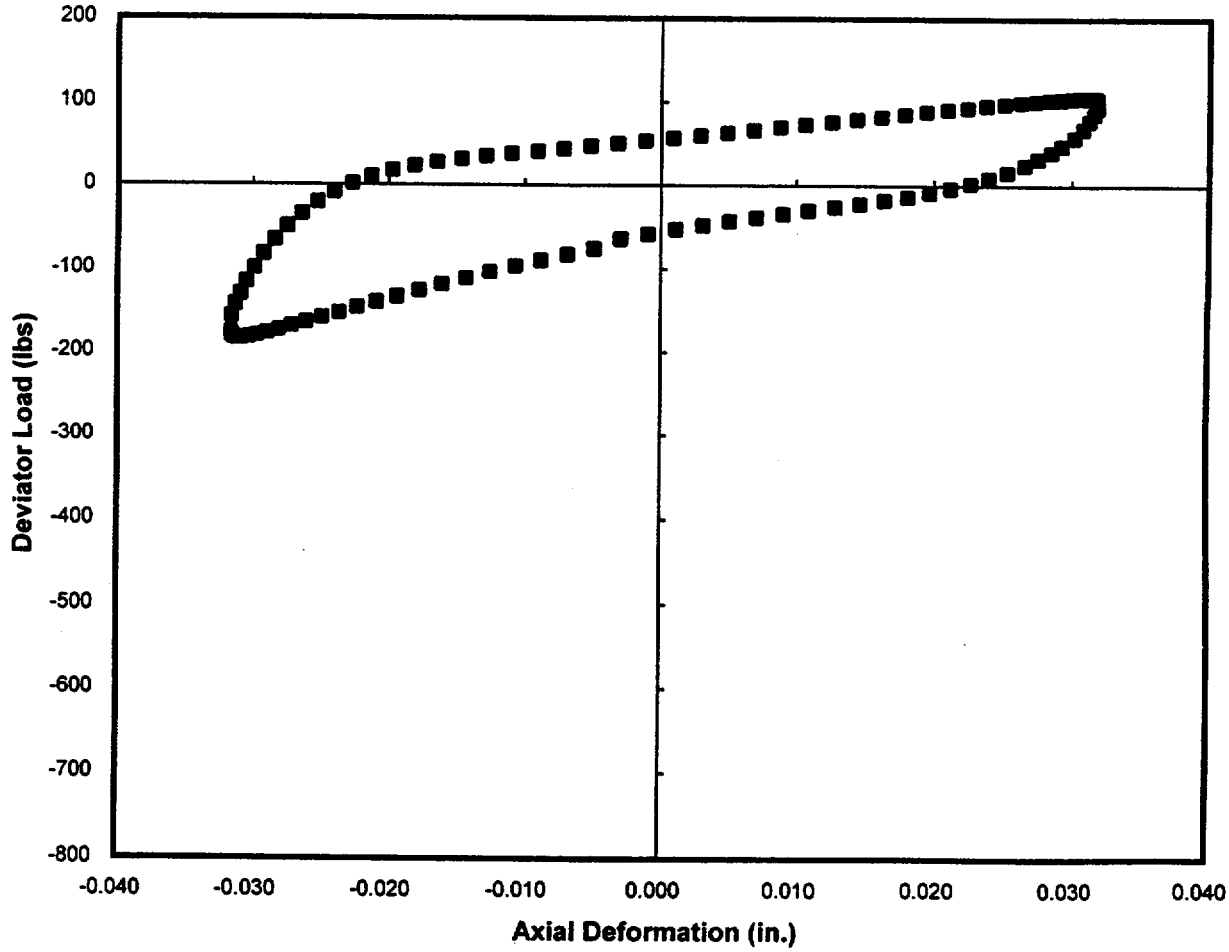
Project No.: 50160-0-3963
Tested By: JW & HJ
Test Date: 10/24/00
Reviewed By: JW
Review Date: 10/26/00

Project Name: Mox
Boring No.: BH-10
Sample No.: 6B
Depth: 35 - 37.5 ft
Sample Description: Tan brown & purple silty sand

Area, A_c (in^2)	Length, H_c (in)	Effective Consoli. Stress, σ_c (psi)	Cyclic Load, P_c (lbs)	Cyclic Deviator Stress, σ_d (psi)
6.27	5.97	63.0	144.93	23.1

Double Amplitude Load LD_A (lbs)	Double Ampli. Deformation SD_A (in.)	Young's Modulus E (psi)	Single Ampliti. Axial Strain ε (%)	Area of Hysteresis Loop A_L, (lb-in)	Area of Triangle A_T, (lb-in)	Damping Ratio D (%)
289.9	0.0634	4349	0.531	7.094	2.297	24.6

Hysteresis Loop @ 10th Cycle, Deformation Stage 6



LAWGIBB GROUP

CYCLIC TRIAXIAL PROPERTIES TEST

(ASTM D 3999-91)

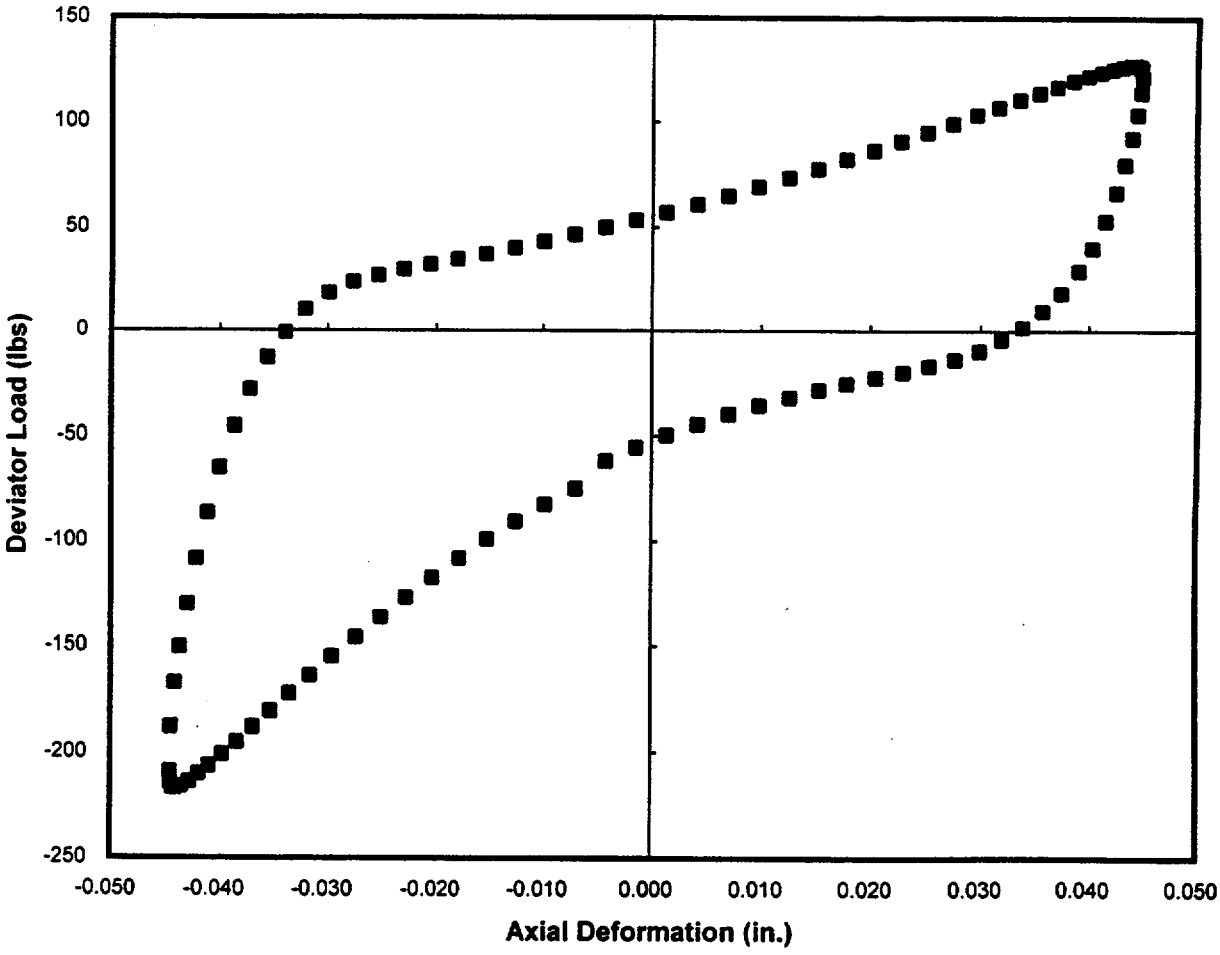
Project No.: 50160-0-3963
Tested By: JW & HJ
Test Date: 10/24/00
Reviewed By: JW
Review Date: 10/25/00

Project Name: Mox
Boring No.: BH-10
Sample No.: 6B
Depth: 35 - 37.5 ft
Sample Description: Tan brown & purple silty sand

Area, A_c (in^2)	Length, H_c (in)	Effective Consoli. Stress, σ_c (psi)	Cyclic Load, P_c (lbs)	Cyclic Deviator Stress, σ_d (psi)
6.27	5.97	63.0	172.04	27.4

Double Amplitude Load LD_A (lbs)	Double Ampli. Deformation SD_A (in.)	Young's Modulus E (psi)	Single Ampliti. Axial Strain ε (%)	Area of Hysteresis Loop A_L, (lb-in)	Area of Triangle A_T, (lb-in)	Damping Ratio D (%)
344.1	0.0894	3663	0.749	10.855	3.843	22.5

Hysteresis Loop @ 10th Cycle, Deformation Stage 7



LAWGIBB GROUP

CYCLIC TRIAXIAL PROPERTIES TEST

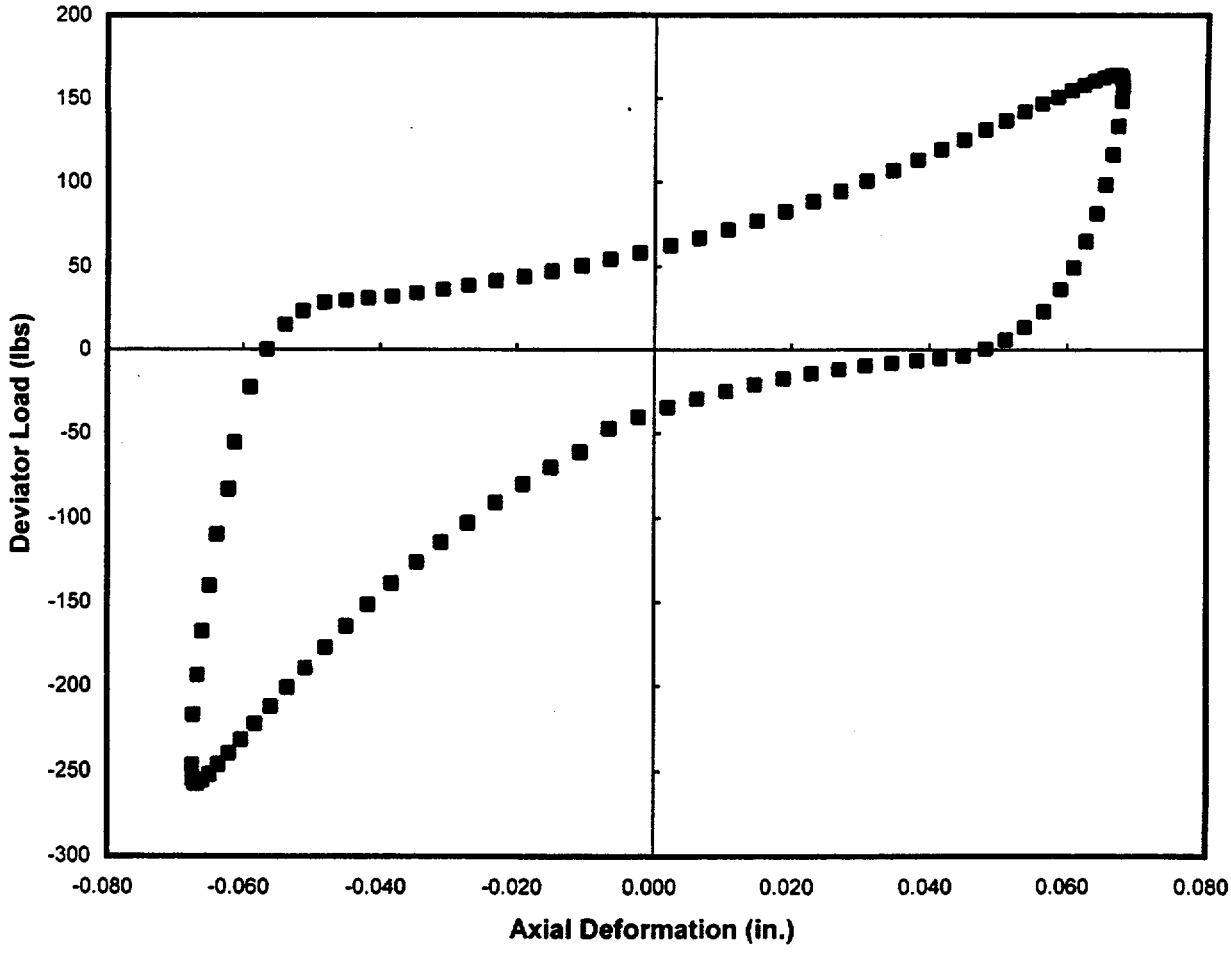
(ASTM D 3999-91)

Project No.:	50160-0-3963	Project Name:	Mox
Tested By:	JW & HJ	Boring No.:	BH-10
Test Date:	10/24/00	Sample No.:	6B
Reviewed By:	JW	Depth:	35 - 37.5 ft
Review Date:	10/25/00	Sample Description:	Tan brown & purple silty sand

Area, A_c (in^2)	Length, H_c (in)	Effective Consoli. Stress, σ_c (psi)	Cyclic Load, P_c (lbs)	Cyclic Deviator Stress, σ_d (psi)
6.27	5.97	63.0	210.73	33.6

Double Amplitude Load LD_A (lbs)	Double Ampli. Deformation SD_A (in.)	Young's Modulus E (psi)	Single Ampliti. Axial Strain ε (%)	Area of Hysteresis Loop A_L, (lb-in)	Area of Triangle A_T, (lb-in)	Damping Ratio D (%)
421.5	0.1353	2963	1.134	17.622	7.130	19.7

Hysteresis Loop @ 10th Cycle, Deformation Stage 8



LAWGIBB GROUP

CYCLIC TRIAXIAL PROPERTIES TEST

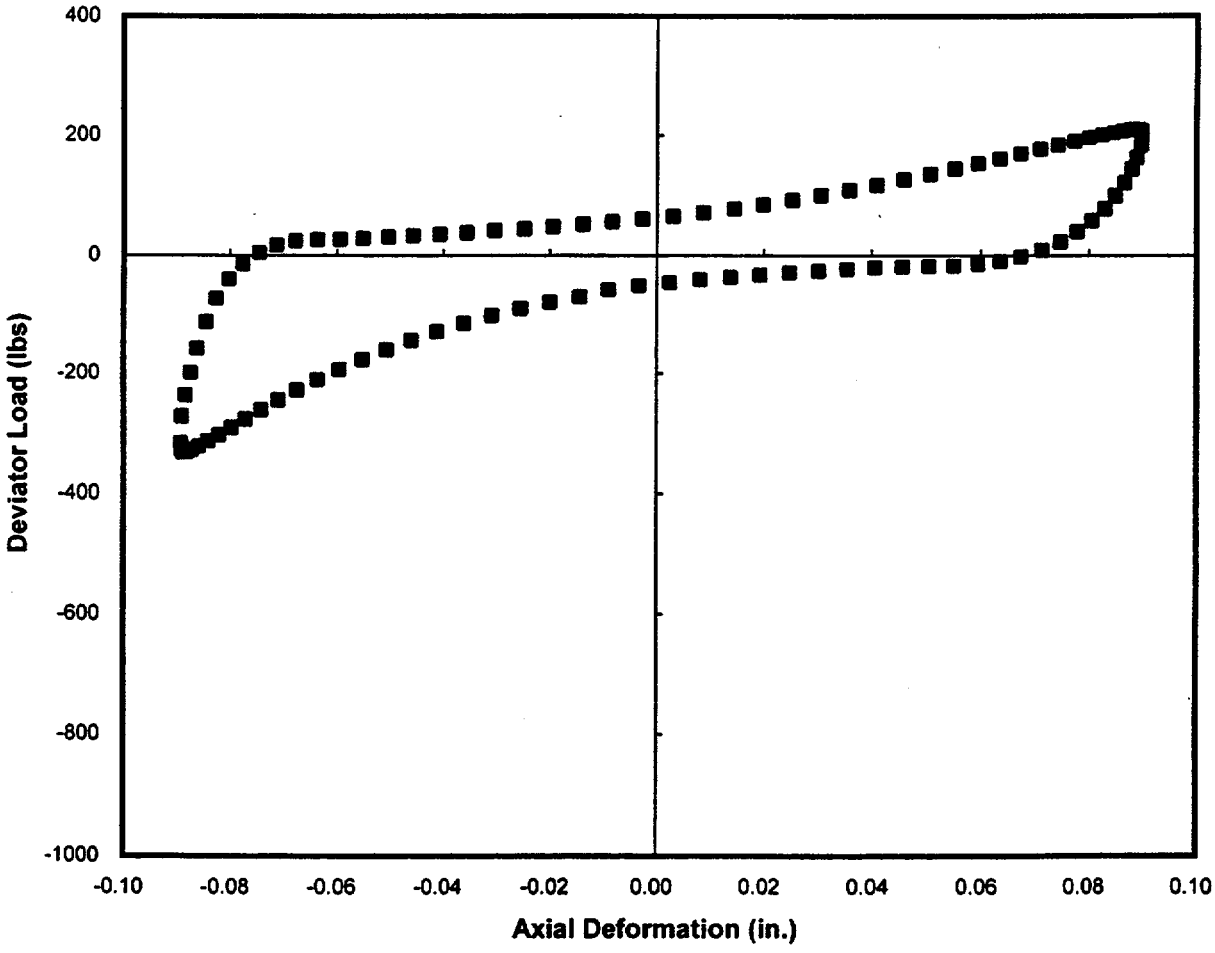
(ASTM D 3999-91)

Project No.:	50160-0-3963	Project Name:	Mox
Tested By:	JW & HJ	Boring No.:	BH-10
Test Date:	10/24/00	Sample No.:	6B
Reviewed By:	JW	Depth:	35 - 37.5 ft
Review Date:	10/25/01	Sample Description:	Tan brown & purple silty sand

Area, A_c (in^2)	Length, H_c (in)	Effective Consoli. Stress, σ_c (psi)	Cyclic Load, P_c (lbs)	Cyclic Deviator Stress, σ_d (psi)
6.27	5.97	63.0	270.70	43.2

Double Amplitude Load LD_A (lbs)	Double Ampli. Deformation SD_A (in.)	Young's Modulus E (psi)	Single Ampliti. Axial Strain ε (%)	Area of Hysteresis Loop A_L, (lb-in)	Area of Triangle A_T, (lb-in)	Damping Ratio D (%)
541.4	0.1791	2876	1.500	27.934	12.120	18.3

Hysteresis Loop @ 10th Cycle, Deformation Stage 9



LAWGIBB GROUP

CYCLIC TRIAXIAL PROPERTIES TEST

(ASTM D 3999-91)

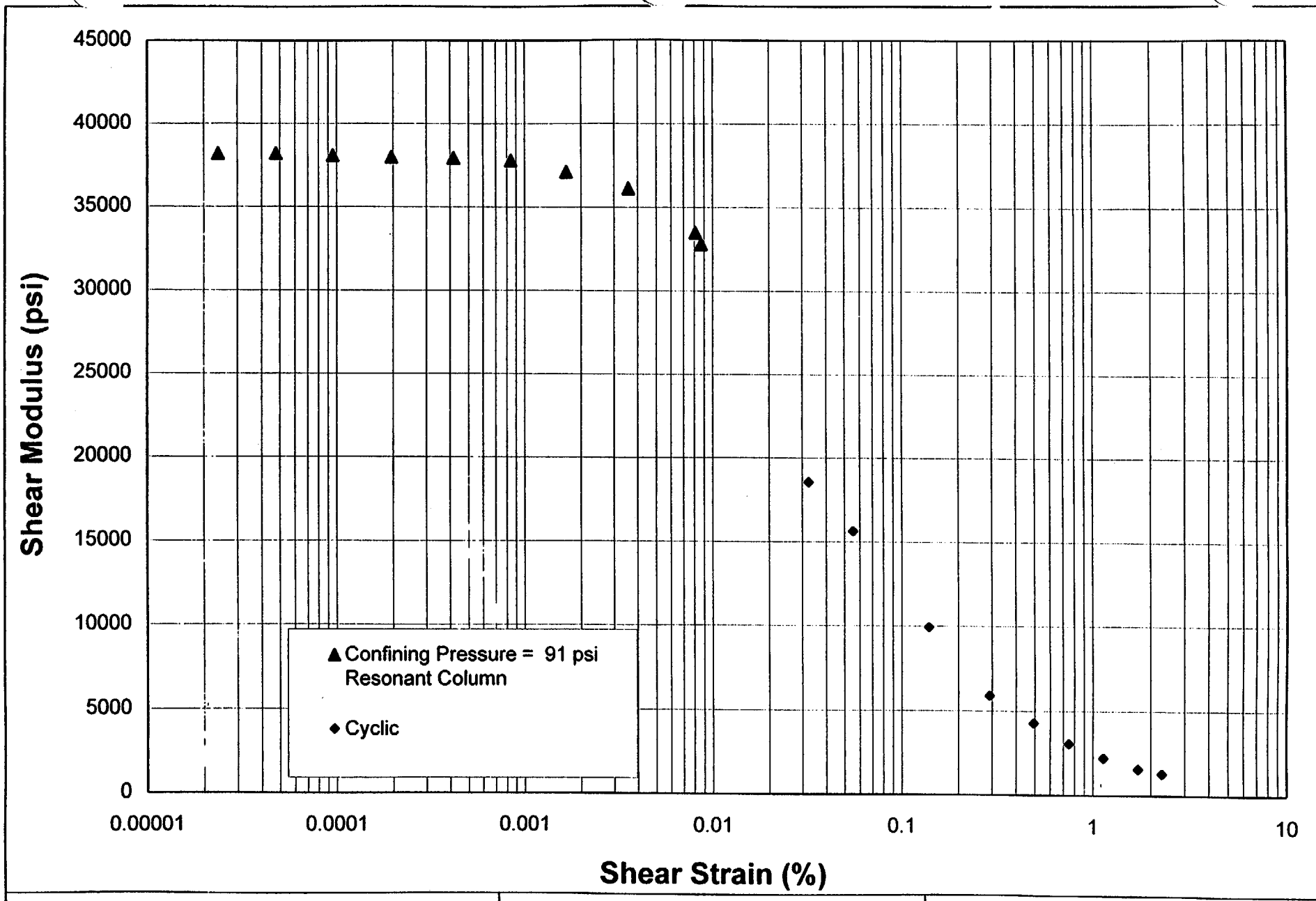
Project No.:	50160-0-3963	Project Name:	Mox
Tested By:	JW & HJ	Boring No.:	BH-10
Test Date:	10/24/00	Sample No.:	6B
Reviewed By:	JW	Depth:	35 - 37.5 ft
Review Date:	10/26/00	Sample Description:	Tan brown & purple silty sand

Effective Consolidation Stress 63 psi

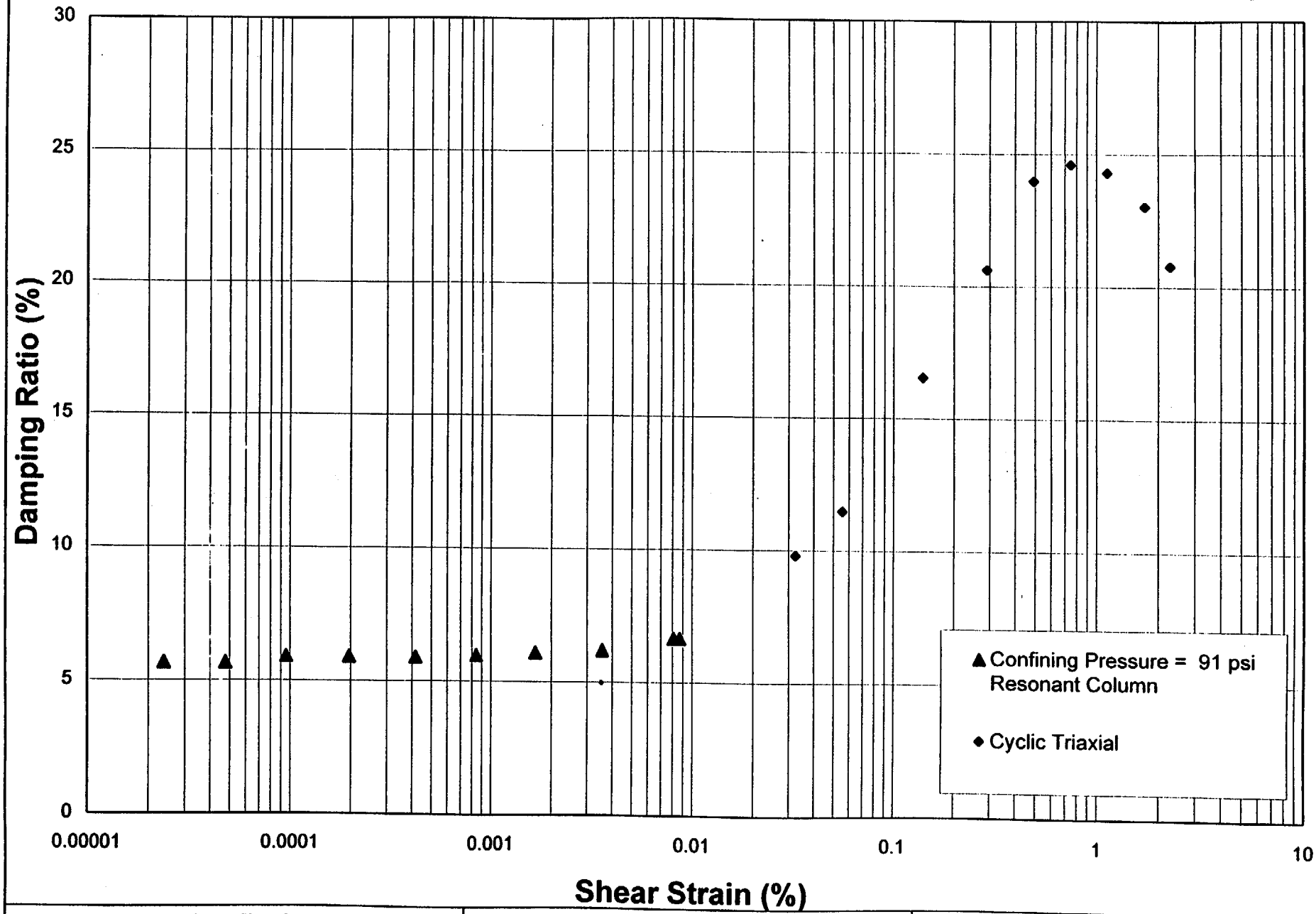
Deformation Stage No.	Cyclic Stress (psi)	Axial Strain ε (%)	Young's Modulus E, (psi)	Damping Ratio D, (%)	Shear* Modulus G, (psi)	Shear* Strain γ (%)
1	7.2	0.014	50587	5.90	16862	0.021
2	12.2	0.029	41718	9.03	13906	0.044
3	19.4	0.060	32211	13.04	10737	0.090
4	26.7	0.125	21291	18.04	7097	0.188
5	25.8	0.260	9936	24.54	3312	0.390
6	23.1	0.531	4349	24.57	1450	0.797
7	27.4	0.749	3663	22.48	1221	1.123
8	33.6	1.134	2963	19.67	988	1.701
9	43.2	1.500	2876	18.34	959	2.251

* Calculated based on assumed Poisson's Ratio value, 0.5.

All calculations are based on 10th cycle.



Shear Modulus vs. Shear Strain **BH-11 8B 82 - 84 feet**	**LAW** **LAWGIBB Group Member**	**MOX** Project No.: 50160-0-3963 Date: 12/6/00



Damping Ratio vs. Shear Strain
BH-11 SB 82 - 84 feet

LAW
LAWGIBB Group Member

MOX

Project No.: 50160-0-3963

Date: 12/6/00

LAW

LAWGIBB Group Member

RESONANT COLUMN TEST (ASTM D4015-87)

Project No.:	50160-0-3963	Project Name:	MOX
Tested By:	HJ & JW	Boring No.:	BH-11
Test Date:	12/6/00	Sample No.:	8B
Reviewed By:	JW	Depth:	82 - 84 feet
Reviewed Date:	12/7/00	Sample Description:	Brown clayey sand

Initial Specimen Data

Labels	Values	Units	Description
	Masses		
M_{scb}	1276.44	g	*Mass of soil and container before*
M_{sca}	0.00	g	*Mass of soil and container after*
M_{ds}	1276.44	g	*M_{scb} - M_{sca} =mass of soil*
	Diameters		
D_t	72.3	mm	*Diameter near top of specimen*
D_m	72.3	mm	*Diameter near middle of specimen*
D_b	73.4	mm	*Diameter near bottom of specimen*
T_{mem}	0.0	mm	*Single thickness of membrane*
D_{net}	72.7	mm	*$(D_t + D_m + D_b)/3 - 2*T_{mem}$*
	Lengths		
L_{cbp}	226.8	mm	*Length between chamber bottom & top of top platen*
L_{tp}	21.6	mm	*Length of top platen*
L_{bp}	46.6	mm	*Length of bottom platen*
L_{net}	158.6	mm	*Length of Specimen = $L_{cbp} - L_{tp} - L_{bp}$*
	Volume		
V	657792	mm^3	*$D^2_{net}*Pi*L_{net}/4$*

Labels	Values	Units	Description
	Mass Density and Unit Weight		
Rho	1940	kg/m^3	*Mass density of specimen M_s*V*10^6*
U_{wt}	19.0	kN/m^3	*Unit weight of specimen = Rho*9.806/1000*
	Moisture Content		
No.	C-33		*Container number*
M_{wscb}	1377.99	g	*Mass of wet soil + container*
M_{wsca}	1156.97	g	*Mass of dry soil + container*
M_{wat}	221.02	g	*Mass of water = $M_{wscb} - M_{wsca}$*
M_{cont}	101.55	g	*Mass of container.*
mc	20.9	%	*$M_{wat}/(M_{wsca} - M_{cont})*100\%$*
Rho_d	1604	kg/m^3	*Dry mass density = Rho/(1+mc)*
G_s	2.65		*Specific gravity (estimated)*
e	0.65		*Void Ratio, $[1000*G_s)]/Rho_d$-1*
S_r	85.2	%	*Degree of Saturation = $mc*G_s/e$*
J	8.4E-04	$kg-m^2$	*Polar mass moment of inertia = $(M_s/1000)*(D_{net}/1000)^2/8$*

Conditions After Saturation			
CL_s	0.0	mm	*Change in length*
L_s	158.58	mm	*Length after saturation, $L - CL_s$*
A_s	4148	mm^2	*Area of specimen*
V_s	657792	mm^3	*Volume after saturation, $A_s * L_s$*
B	0.95		*B Value*

Conditions After Consolidation			
CL_c	3.3	mm	*Change in length*
L_d	155.3	mm	*Length after consolidation, L_s-CL_c*
CV_c	40528	mm^3	*Change in volume*
V_c	617264	mm^3	*Volume, $V_s - CV_c$*
S_r	100.0	%	*Degree of Saturation, $mc*G_s/e$*
e	0.55		*Void Ratio, $[1000*G_s]/Rho_d$-1*
mc	20.7	%	*Moisture Content*
Rho_d	1710	kg/m^3	*Dry mass density, Rho_d*V/V_c*

LAW

LAWGIBB Group Member

RESONANT COLUMN TEST (ASTM D4015-87)

Project No.:	50160-0-3963	Project Name:	MOX
Tested By:	HJ & JW	Boring No.:	BH-11
Test Date:	12/6/00	Sample No.:	8B
Reviewed By:	JW	Depth:	82 - 84 feet
Reviewed Date:	12/7/00	Sample Description:	Brown clayey sand

Apparatus Information

Apparatus Description	Typical Long-Tor
Apparatus Serial No.	556G0001
Platen Diameter, mm	72.4

Apparatus Calibration Factors			
M_A	0.3044	kg	*Top Platen Mass*
LCFA	N/A	$[m/V_{rms}]*[Hz^2]$	*Longitudinal Vibration Calibration Factor*
ADCL	N/A	kg-Hz	*Longitudinal Apparatus Damping Coefficient*
FCF	N/A	N/V_{rms}	*Force Calibration Factor*
J_A	0.0032	$kg\text{-}m^2$	*Platen Polar Mass Momment of Inertia*
RCFA	4.42	$[Rad/V_{rms}]*[Hz^2]$	*Rotational Vibration Calibration Factor*
ADCT	0.00139	$Hz\text{-}kg\text{-}m^2$	*Torsional Apparatus Damping Coefficient*
TCF	0.069	$N\text{-}m/V_{rms}$	*Torque Calibration Factor*
FOT	0	Hz	*Apparatus Resonant Frequency*

Ancillary System Calibration Factors			
LCCF	-0.635	mm/unit	*Length change calibration factor (+ means*
			specimen length increase for increase values)
BCF	-0.34	mL/unit	*Burette calibration factor (+ means specimen*
			volume increase for increase values.)
CPCF	6.89	kPa/unit	*Cell pressure calibration factor*
PPCF	6.89	kPa/unit	*Pore Pressure calibration factor*
ALCF	1	kN/unit	*Axial load calibration factor*
			(+ means compression of specimen.)
Ancillary System Initial Conditions			
ILR	0	units	*Initial length reading before testing*
IBR	21.4	units	*Initial burette reading before testing*
RPF	P		*P or F. "P" for resonant period input, and*
			"F" for resonant frequency input.

LAW

LAWGIBB Group Member

RESONANT COLUMN TEST (ASTM D4015-87)

INPUT DATA

Project No.:	50160-0-3963	Project Name:	MOX
Tested By:	HJ & JW	Boring No:	BH-11
Test Date:	12/6/00	Sample No.:	8B
Reviewed By:	JW	Depth:	82 - 84 feet
Reviewed Date	12/7/00	Sample Description:	Brown clayey sand

Total Number of Data Sets 10

Line No.	Elapsed Time [second]	Cell Pressure [unit]	Pore Pressure [unit]	Axial Load [unit]	Burette Reading [unit]	Length Reading [unit]	Longitudinal or Torsional	Force or Torque Reading [V_{rms}]	Transducer Reading [V_{rms}]	Resonant Period [msec]
1	41	111.0	19.6	0	21.4	0	T	0.011	0.011	5.660
2	89	111.0	19.6	0	21.4	0	T	0.022	0.022	5.660
3	129	111.0	19.6	0	21.4	0	T	0.046	0.044	5.669
4	167	111.0	19.6	0	21.4	0	T	0.094	0.090	5.676
5	210	111.0	19.6	0	21.4	0	T	0.199	0.191	5.680
6	250	111.0	19.6	0	21.4	0	T	0.406	0.385	5.691
7	266	111.0	19.6	0	21.4	0	T	0.804	0.748	5.743
8	293	111.0	19.7	0	21.4	0	T	1.707	1.560	5.820
9	329	111.0	19.7	0	21.4	0	T	3.850	3.28	6.045
10	355	111.0	19.8	0	21.4	0	T	4.040	3.44	6.108

LAW

LAWGIBB Group Member

RESONANT COLUMN TEST (ASTM D4015-87)

TEST RESULTS SUMMARY

Project No.:	50160-0-3963	Project Name:	MOX
Tested By:	HJ & JW	Boring No:	BH-11
Test Date:	12/6/00	Sample No.:	8B
Reviewed By:	JW	Depth:	82 - 84 feet
Reviewed Date:	12/7/00	Sample Description:	Brown clayey sand

Line No.	Effective Confining Stress [kPa]	Principal Stress Ratio	Void Ratio e	Longitudinal or Torsional	No. of Vibration Cycles	Shear Modulus G [Mpa]	Shear Modulus G [psi]	Shear Strain Amplitude [%]	Damping Ratio [%]
1	629.75	1.00	0.550	T	7244	263.26	38209	0.00002	5.68
2	629.75	1.00	0.550	T	8481	263.26	38209	0.00005	5.68
3	629.75	1.00	0.550	T	7056	262.42	38088	0.00010	5.93
4	629.75	1.00	0.550	T	6695	261.78	37994	0.00020	5.93
5	629.75	1.00	0.550	T	7570	261.41	37940	0.00042	5.91
6	629.75	1.00	0.550	T	7029	260.40	37794	0.00084	5.99
7	629.75	1.00	0.550	T	2786	255.70	37112	0.00166	6.10
8	629.06	1.00	0.550	T	4639	248.98	36137	0.00357	6.21
9	629.06	1.00	0.550	T	5955	230.79	33497	0.00809	6.66
10	628.37	1.00	0.550	T	4257	226.06	32809	0.00866	6.67

LAWGIBB GROUP

CYCLIC TRIAXIAL PROPERTIES TEST

(ASTM D 3999-91)

Project No.:	50160-0-3963	Project Name:	Mox
Tested By:	JW & HJ	Boring No.:	BH-11
Test Date:	12/7/00	Sample No.:	8B
Reviewed By:	JW	Depth:	82 - 84 feet
Review Date:	12/8/00	Sample Description:	Brown clayey sand

SPECIMEN DATA

Initial Conditions of Specimen

Diameters, in.		Area , sq. in.	6.38
Top	2.850	Volume, cubic in.	38.12
Middle	2.848	Mass of Specimen, grams	1191.13
Bottom	2.850		
Average	2.849	Moisture Content	
Membrane Thickness, in.	0.000	Pan No.	AB-23
Net Diameter, in.	2.849	Wet Mass + Pan, grams	1274.91
		Dry Mass + Pan, grams	1037.08
Length, in.		Container Mass, grams	83.78
Location 1	5.979	Moisture Content, %	24.9
Location 2	5.978		
Location 3	5.980	Density, pcf	118.8
Average	5.979	Dry Density, pcf	95.1
Length of Top Platen	0.000	Specific Gravity	2.65
Length of Bottom Platen	0.000	Degree of Saturation, %	89.4
Length of Specimen, in	5.979	Void Ratio	0.740

Conditions of Specimen After Saturation and Consolidation

After Saturation		After Consolidation	
Change in Length, in.	0.000	Change in Length, in.	0.106
Length, in.	5.979	Length, in.	5.873
Area, sq. in.	6.38	Change in Volume, cc	43.80
Volume, cubic in.	38.12	Volume, cubic in.	35.45
Back Pressure, psi	20.0	Area, sq. in.	6.04
B Value	0.96	Effe. Consoli.. Stress, psi	91.0
		Moisture Content, %	23.3
		Dry Density, pcf	102.2
		Void Ratio	0.618
		Degree of Saturation, %	100.0

LAWGIBB GROUP

CYCLIC TRIAXIAL PROPERTIES TEST

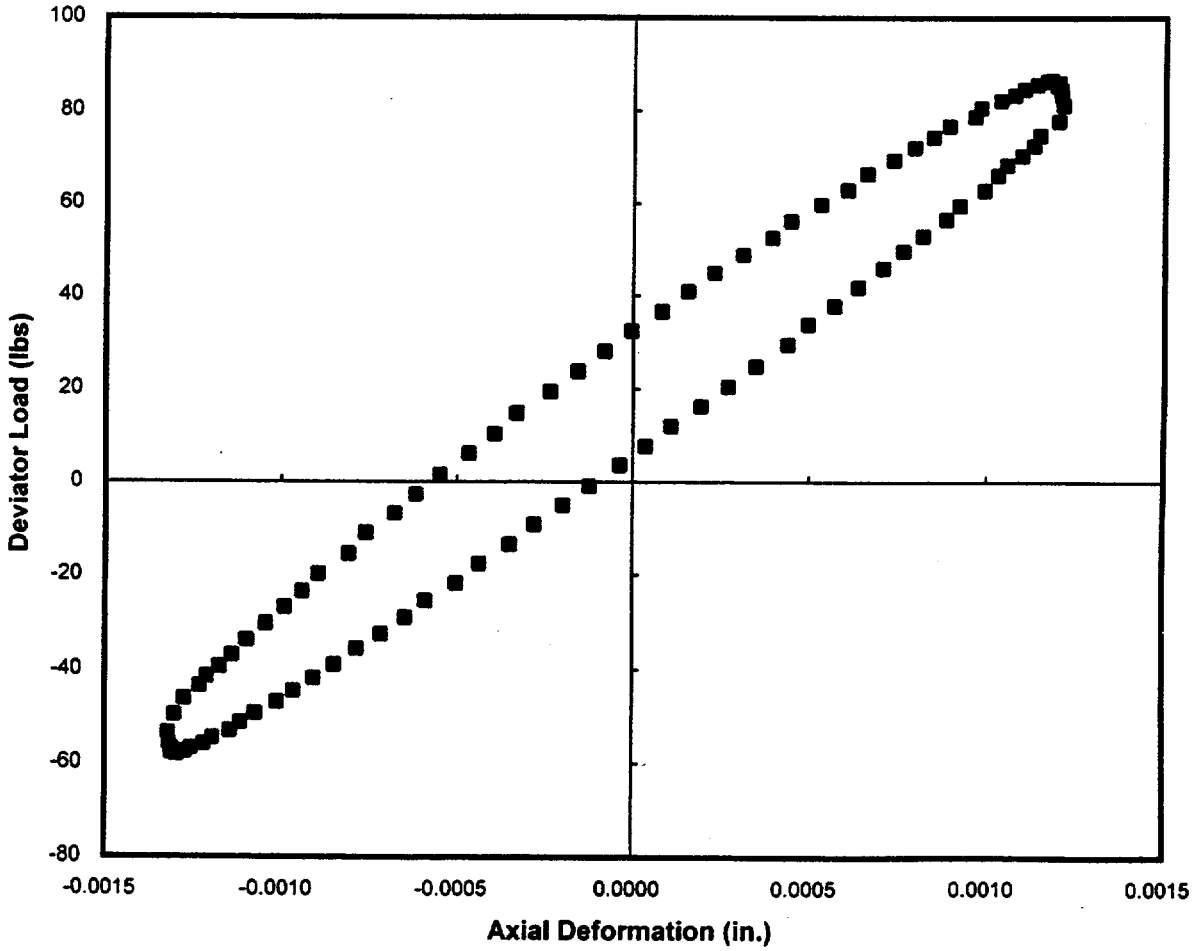
(ASTM D 3999-91)

Project No.:	50160-0-3963	Project Name:	Mox
Tested By:	JW & HJ	Boring No.:	BH-11
Test Date:	12/7/00	Sample No.:	8B
Reviewed By:		Depth:	82 - 84 feet
Review Date:		Sample Description:	Brown clayey sand

Area, A_c (in^2)	Length, H_c (in)	Effective Consoli. Stress, σ_c (psi)	Cyclic Load, P_c (lbs)	Cyclic Deviator Stress, σ_d (psi)
6.04	5.87	91.0	72.37	12.0

Double Amplitude Load LD_A (lbs)	Double Ampli. Deformation SD_A (in.)	Young's Modulus E (psi)	Single Ampliti. Axial Strain ε (%)	Area of Hysteresis Loop A_L, (lb-in)	Area of Triangle A_T, (lb-in)	Damping Ratio D (%)
144.7	0.0025	55668	0.022	0.056	0.046	9.8

Hysteresis Loop @ 10th Cycle, Deformation Stage 1



LAWGIBB GROUP

CYCLIC TRIAXIAL PROPERTIES TEST

(ASTM D 3999-91)

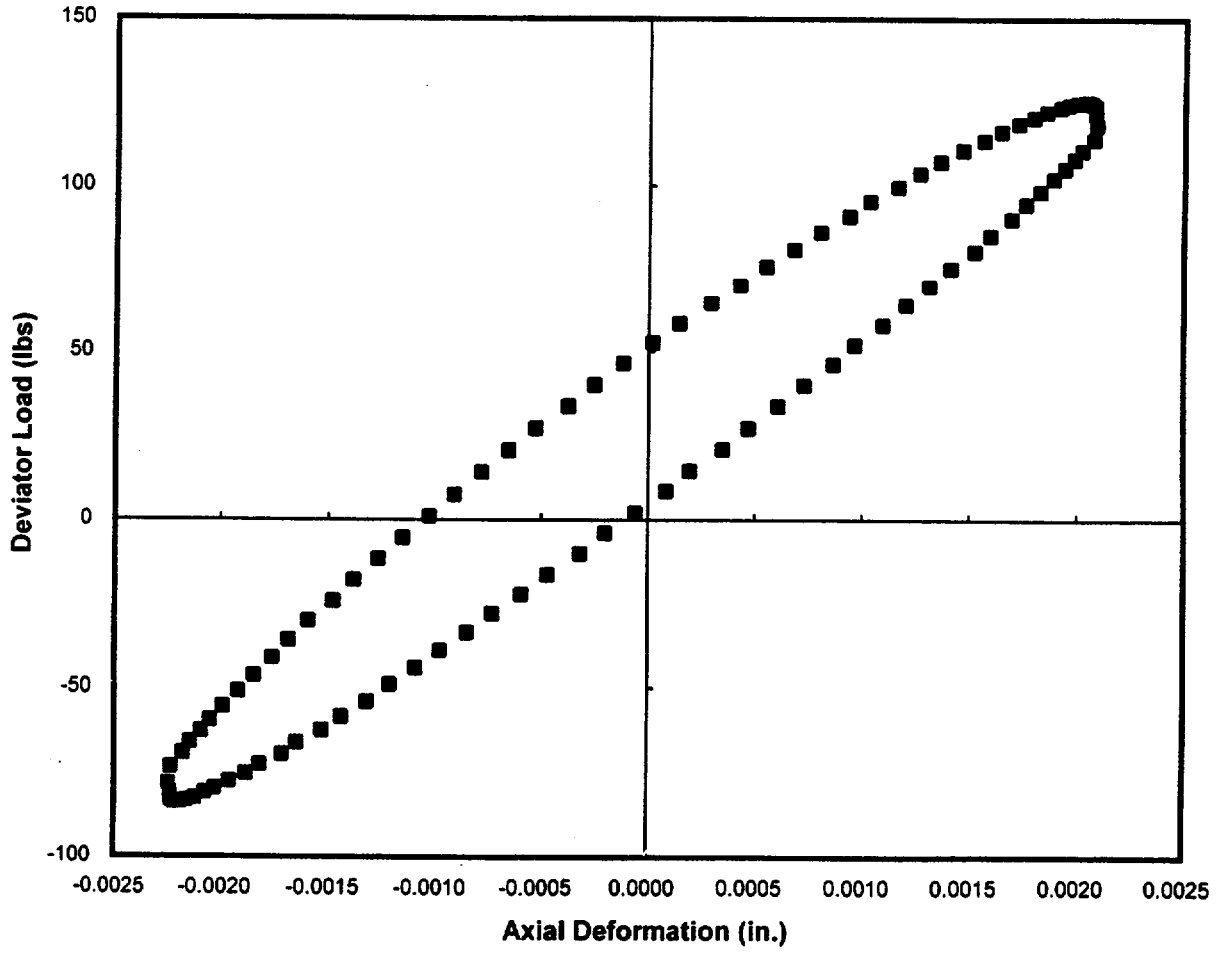
Project No.: 50160-0-3963
Tested By: JW & HJ
Test Date: 12/7/00
Reviewed By:
Review Date:

Project Name: Mox
Boring No.: BH-11
Sample No.: 8B
Depth: 82 - 84 feet
Sample Description: Brown clayey sand

Area, A_c (in^2)	Length, H_c (in)	Effective Consoli. Stress, σ_c (psi)	Cyclic Load, P_c (lbs)	Cyclic Deviator Stress, σ_d (psi)
6.04	5.87	91.0	104.39	17.3

Double Amplitude Load LD_A (lbs)	Double Ampli. Deformation SD_A (in.)	Young's Modulus E (psi)	Single Ampliti. Axial Strain ε (%)	Area of Hysteresis Loop A_L, (lb-in)	Area of Triangle A_T, (lb-in)	Damping Ratio D (%)
208.8	0.0043	46926	0.037	0.163	0.113	11.5

Hysteresis Loop @ 10th Cycle, Deformation Stage 2



LAWGIBB GROUP

CYCLIC TRIAXIAL PROPERTIES TEST

(ASTM D 3999-91)

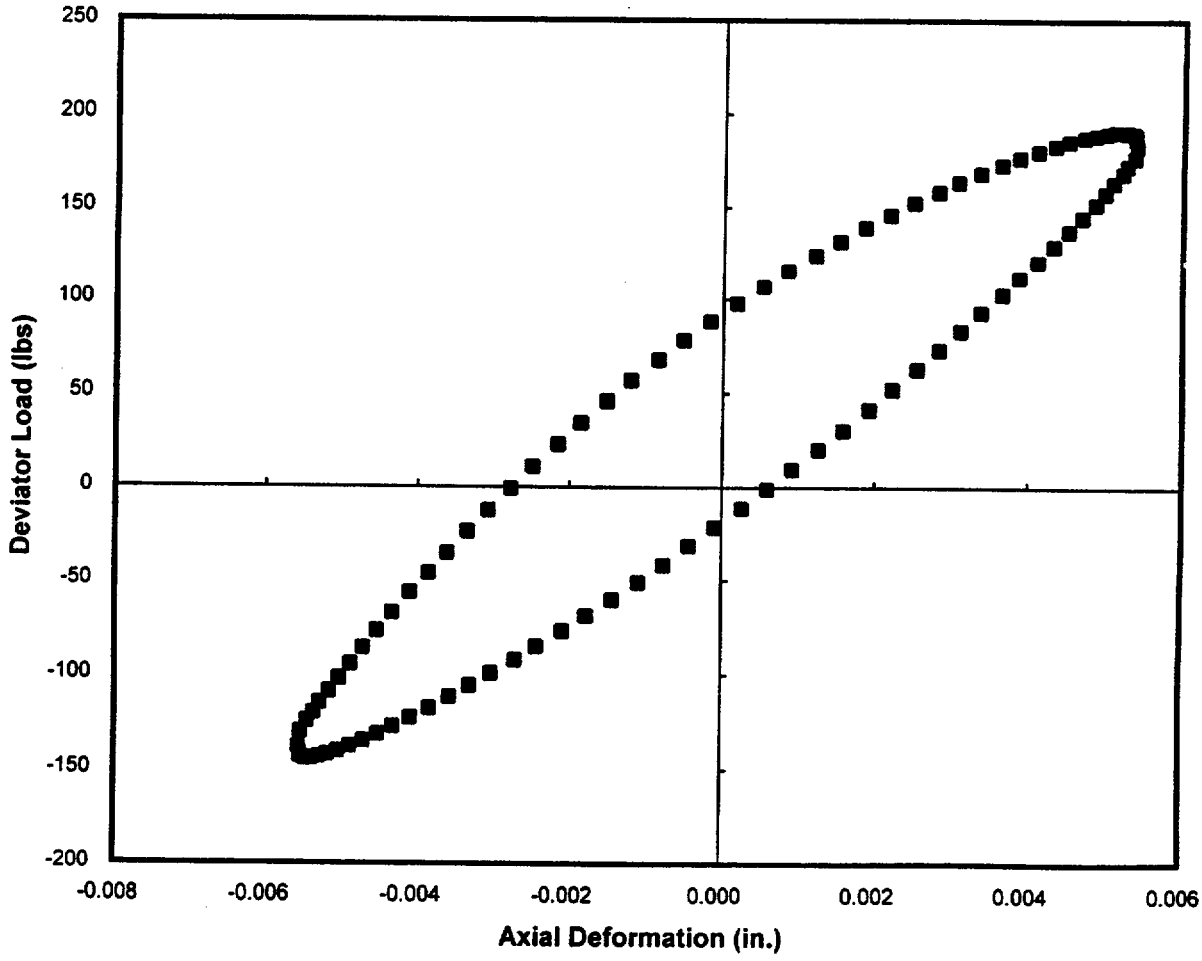
Project No.: 50160-0-3963
Tested By: JW & HJ
Test Date: 12/7/00
Reviewed By:
Review Date:

Project Name: Mox
Boring No.: BH-11
Sample No.: 8B
Depth: 82 - 84 feet
Sample Description: Brown clayey sand

Area, A_c (in^2)	Length, H_c (in)	Effective Consoli Stress, σ_c (psi)	Cyclic Load, P_c (lbs)	Cyclic Deviator Stress, σ_d (psi)
6.04	5.87	91.0	167.50	27.7

Double Amplitude Load LD_A (lbs)	Double Ampli. Deformation SD_A (in.)	Young's Modulus E (psi)	Single Ampliti. Axial Strain ε (%)	Area of Hysteresis Loop A_L, (lb-in)	Area of Triangle A_T, (lb-in)	Damping Ratio D (%)
335.0	0.0109	29791	0.093	0.952	0.458	16.5

Hysteresis Loop @ 10th Cycle, Deformation Stage 3



LAWGIBB GROUP

CYCLIC TRIAXIAL PROPERTIES TEST
(ASTM D 3999-91)

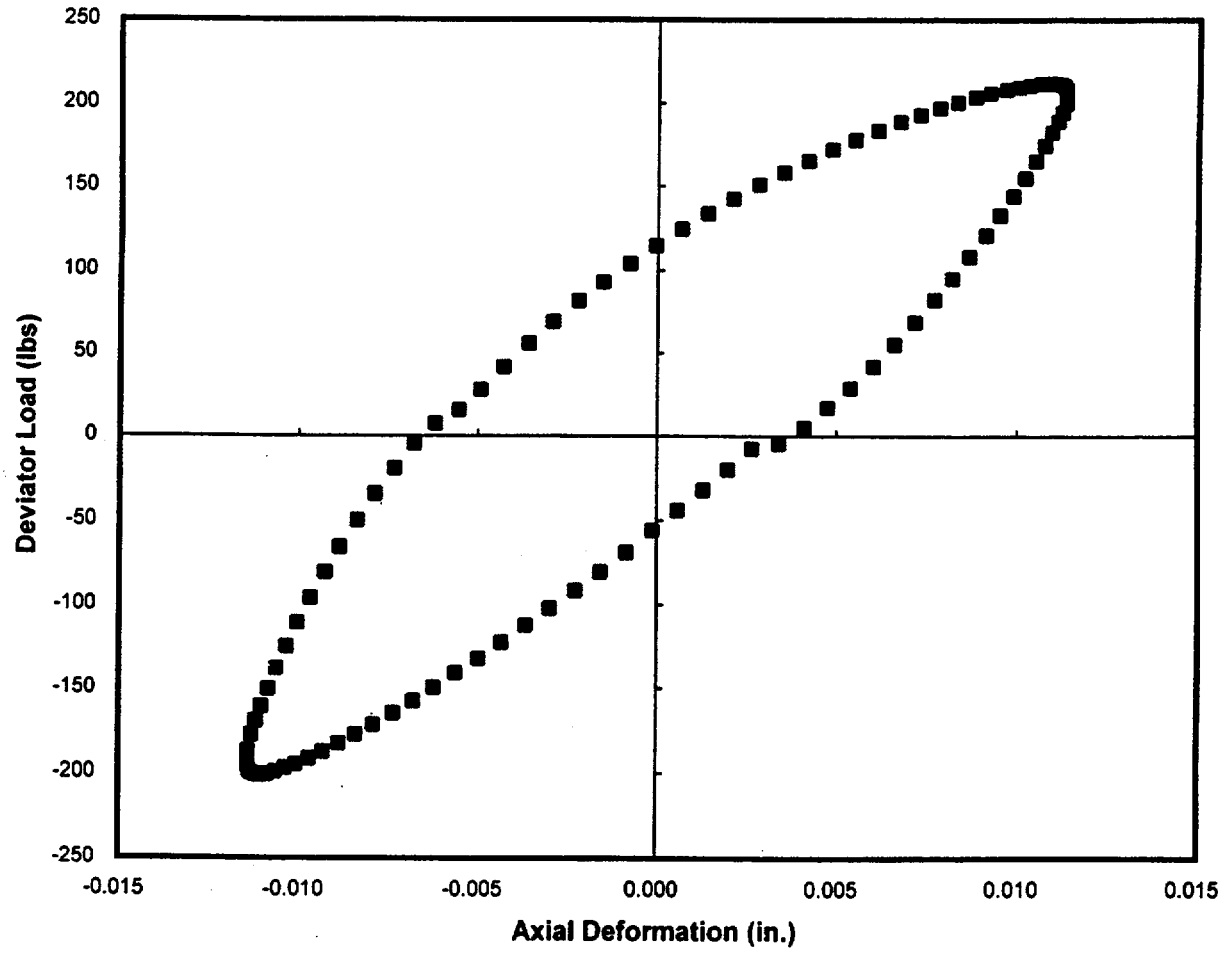
Project No.: 50160-0-3963
Tested By: JW & HJ
Test Date: 12/7/00
Reviewed By:
Review Date:

Project Name: Mox
Boring No.: BH-11
Sample No.: 8B
Depth: 82 - 84 feet
Sample Description: Brown clayey sand

Area, A_c (in^2)	Length, H_c (in)	Effective Consoli. Stress, σ_c (psi)	Cyclic Load, P_c (lbs)	Cyclic Deviator Stress, σ_d (psi)
6.04	5.87	91.0	206.56	34.2

Double Amplitude Load LD_A (lbs)	Double Ampli. Deformation SD_A (in.)	Young's Modulus E (psi)	Single Ampliti. Axial Strain ε (%)	Area of Hysteresis Loop A_L, (lb-in)	Area of Triangle A_T, (lb-in)	Damping Ratio D (%)
413.1	0.0227	17696	0.193	3.042	1.173	20.6

Hysteresis Loop @ 10th Cycle, Deformation Stage 4



LAWGIBB GROUP

CYCLIC TRIAXIAL PROPERTIES TEST

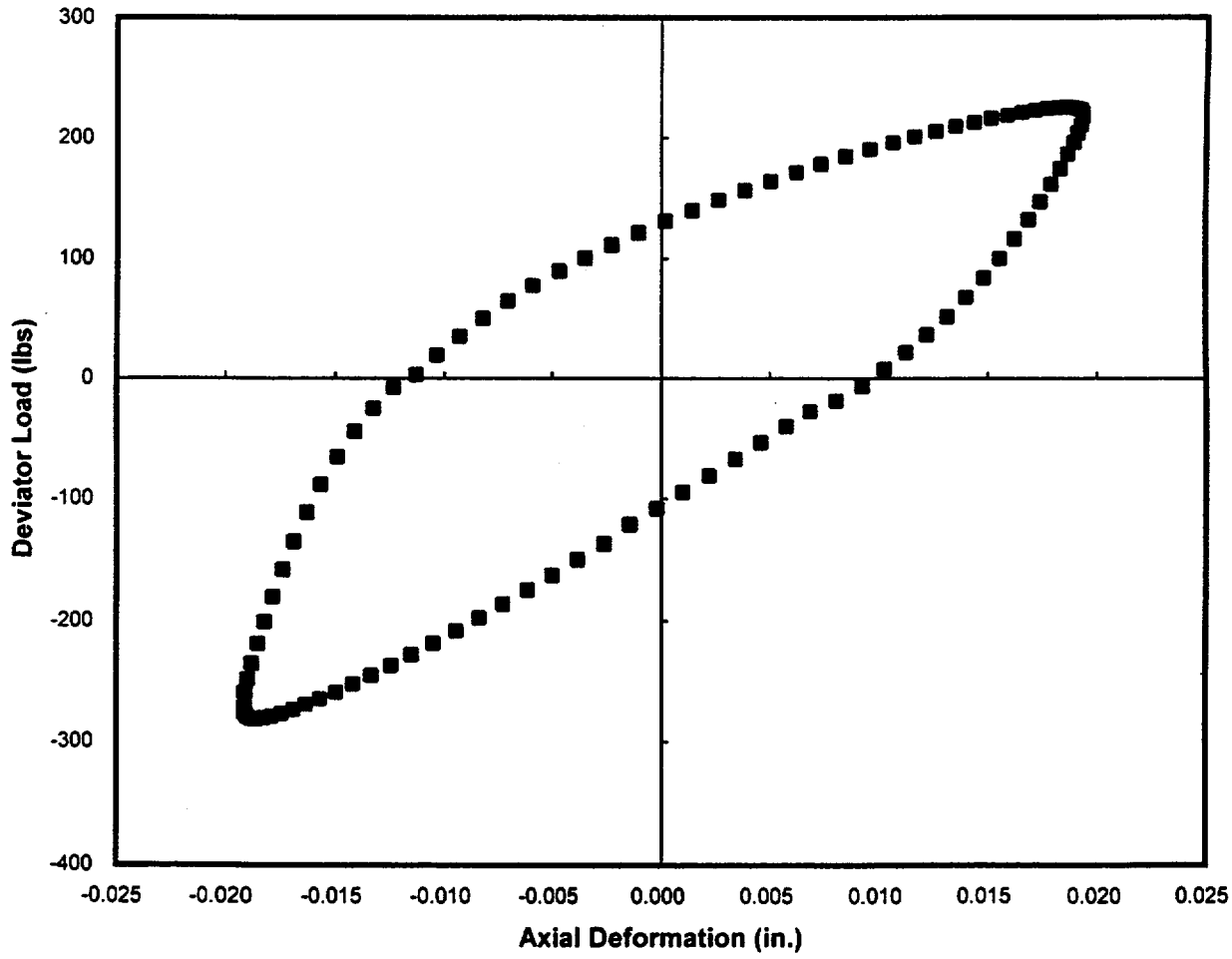
(ASTM D 3999-91)

Project No.:	50160-0-3963	Project Name:	Mox
Tested By:	JW & HJ	Boring No.:	BH-11
Test Date:	12/7/00	Sample No.:	8B
Reviewed By:		Depth:	82 - 84 feet
Review Date:		Sample Description:	Brown clayey sand

Area, A_c (in^2)	Length, H_c (in)	Effective Consoli. Stress, σ_c (psi)	Cyclic Load, P_c (lbs)	Cyclic Deviator Stress, σ_d (psi)
6.04	5.87	91.0	253.59	42.0

Double Amplitude Load LD_A (lbs)	Double Ampli. Deformation SD_A (in.)	Young's Modulus E (psi)	Single Ampliti. Axial Strain ε (%)	Area of Hysteresis Loop A_L, (lb-in)	Area of Triangle A_T, (lb-in)	Damping Ratio D (%)
507.2	0.0385	12825	0.328	7.354	2.439	24.0

Hysteresis Loop @ 10th Cycle, Deformation Stage 5



LAWGIBB GROUP

CYCLIC TRIAXIAL PROPERTIES TEST

(ASTM D 3999-91)

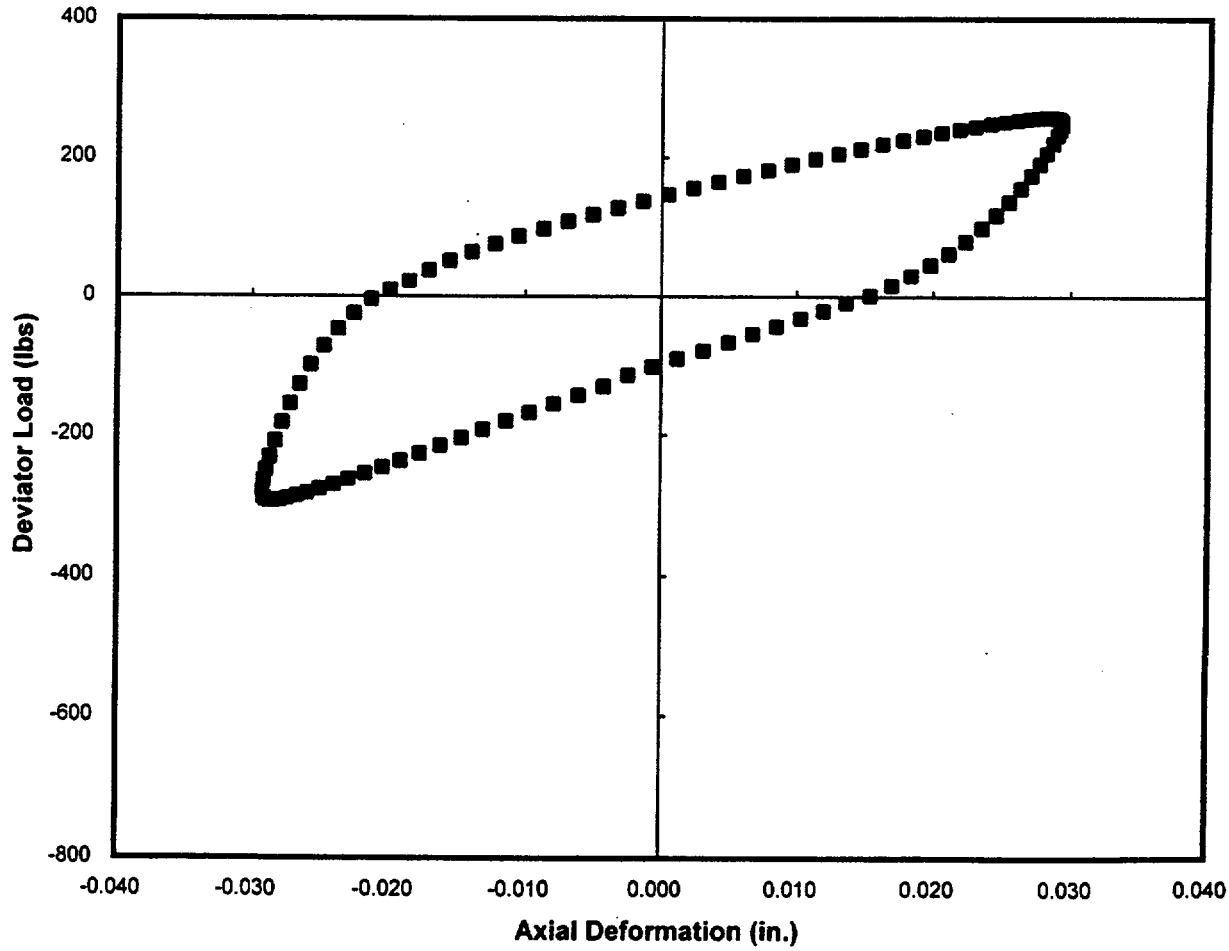
Project No.: 50160-0-3963
Tested By: JW & HJ
Test Date: 12/7/00
Reviewed By:
Review Date:

Project Name: Mox
Boring No.: BH-11
Sample No.: 8B
Depth: 82 - 84 feet
Sample Description: Brown clayey sand

Area, A_c (in^2)	Length, H_c (in)	Effective Consoli. Stress, σ_c (psi)	Cyclic Load, P_c (lbs)	Cyclic Deviator Stress, σ_d (psi)
6.04	5.87	91.0	275.58	45.7

Double Amplitude Load LD_A (lbs)	Double Ampli. Deformation SD_A (in.)	Young's Modulus E (psi)	Single Ampliti. Axial Strain ε (%)	Area of Hysteresis Loop A_L, (lb-in)	Area of Triangle A_T, (lb-in)	Damping Ratio D (%)
551.2	0.0584	9177	0.497	12.448	4.026	24.6

Hysteresis Loop @ 10th Cycle, Deformation Stage 6



LAWGIBB GROUP

CYCLIC TRIAXIAL PROPERTIES TEST

(ASTM D 3999-91)

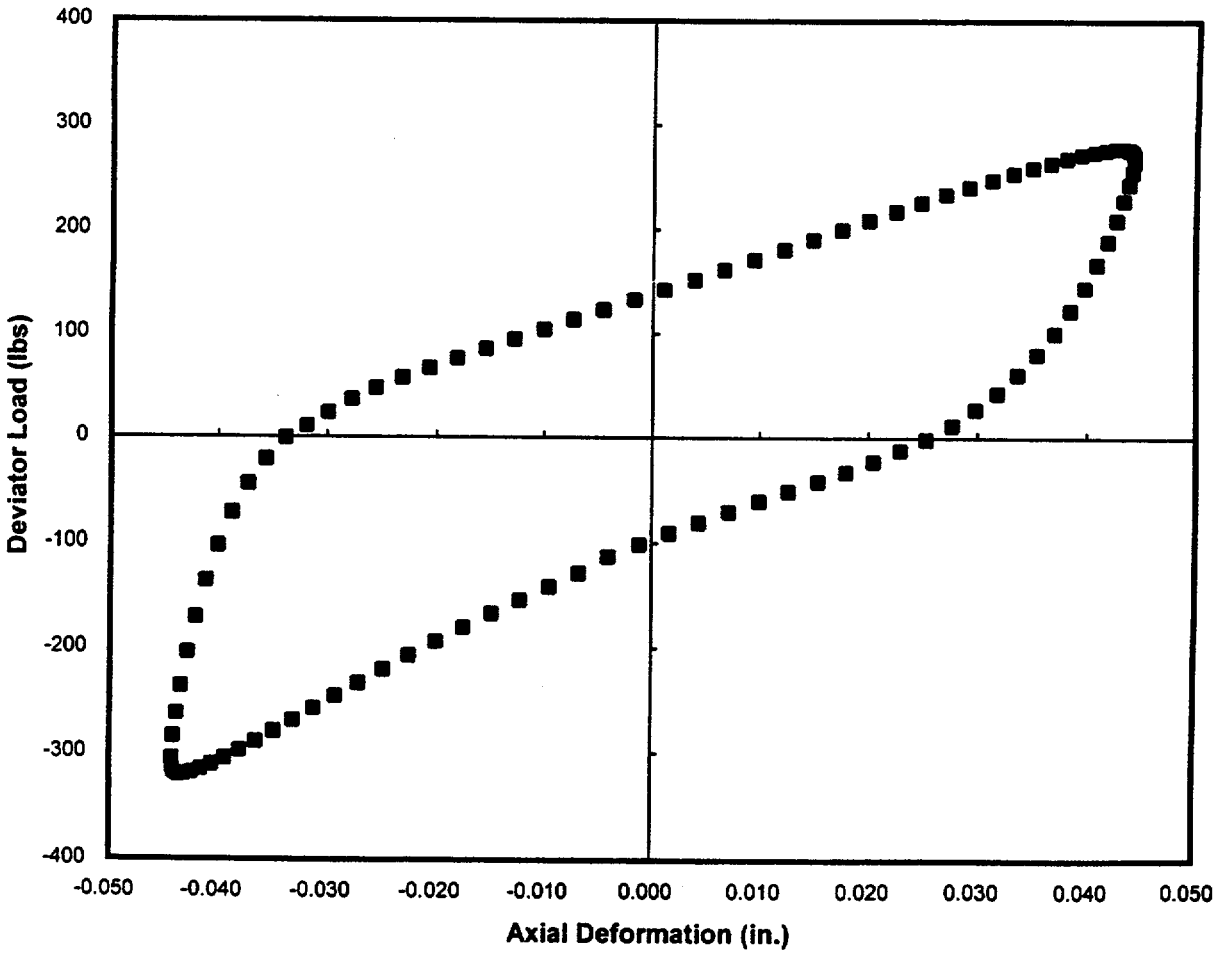
Project No.: 50160-0-3963
Tested By: JW & HJ
Test Date: 12/7/00
Reviewed By:
Review Date:

Project Name: Mox
Boring No.: BH-11
Sample No.: 8B
Depth: 82 - 84 feet
Sample Description: Brown clayey sand

Area, A_c (in^2)	Length, H_c (in)	Effective Consoli. Stress, σ_c (psi)	Cyclic Load, P_c (lbs)	Cyclic Deviator Stress, σ_d (psi)
6.04	5.87	91.0	299.32	49.6

Double Amplitude Load LD_A (lbs)	Double Ampli. Deformation SD_A (in.)	Young's Modulus E (psi)	Single Ampliti. Axial Strain ε (%)	Area of Hysteresis Loop A_L, (lb-in)	Area of Triangle A_T, (lb-in)	Damping Ratio D (%)
598.6	0.0885	6585	0.753	20.218	6.619	24.3

Hysteresis Loop @ 10th Cycle, Deformation Stage 7



LAWGIBB GROUP

CYCLIC TRIAXIAL PROPERTIES TEST

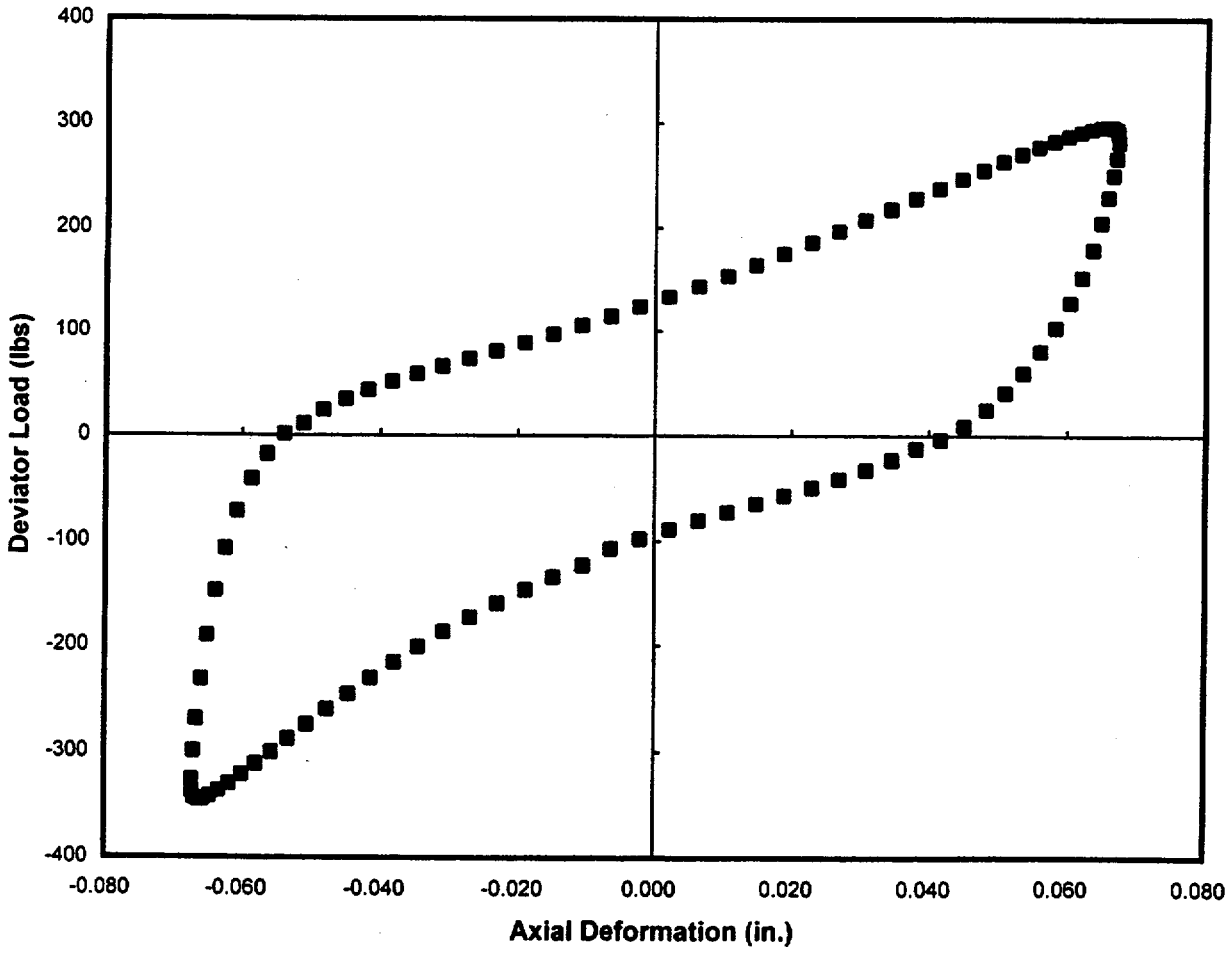
(ASTM D 3999-91)

Project No.:	50160-0-3963	Project Name:	Mox
Tested By:	JW & HJ	Boring No.:	BH-11
Test Date:	12/7/00	Sample No.:	8B
Reviewed By:		Depth:	82 - 84 feet
Review Date:		Sample Description:	Brown clayey sand

Area, A_c (in^2)	Length, H_c (in)	Effective Consoli. Stress, σ_c (psi)	Cyclic Load, P_c (lbs)	Cyclic Deviator Stress, σ_d (psi)
6.04	5.87	91.0	320.64	53.1

Double Amplitude Load LD_A (lbs)	Double Ampli. Deformation SD_A (in.)	Young's Modulus E (psi)	Single Ampliti. Axial Strain ε (%)	Area of Hysteresis Loop A_L, (lb-in)	Area of Triangle A_T, (lb-in)	Damping Ratio D (%)
641.3	0.1345	4638	1.145	31.224	10.783	23.0

Hysteresis Loop @ 10th Cycle, Deformation Stage 8



LAWGIBB GROUP

CYCLIC TRIAXIAL PROPERTIES TEST

(ASTM D 3999-91)

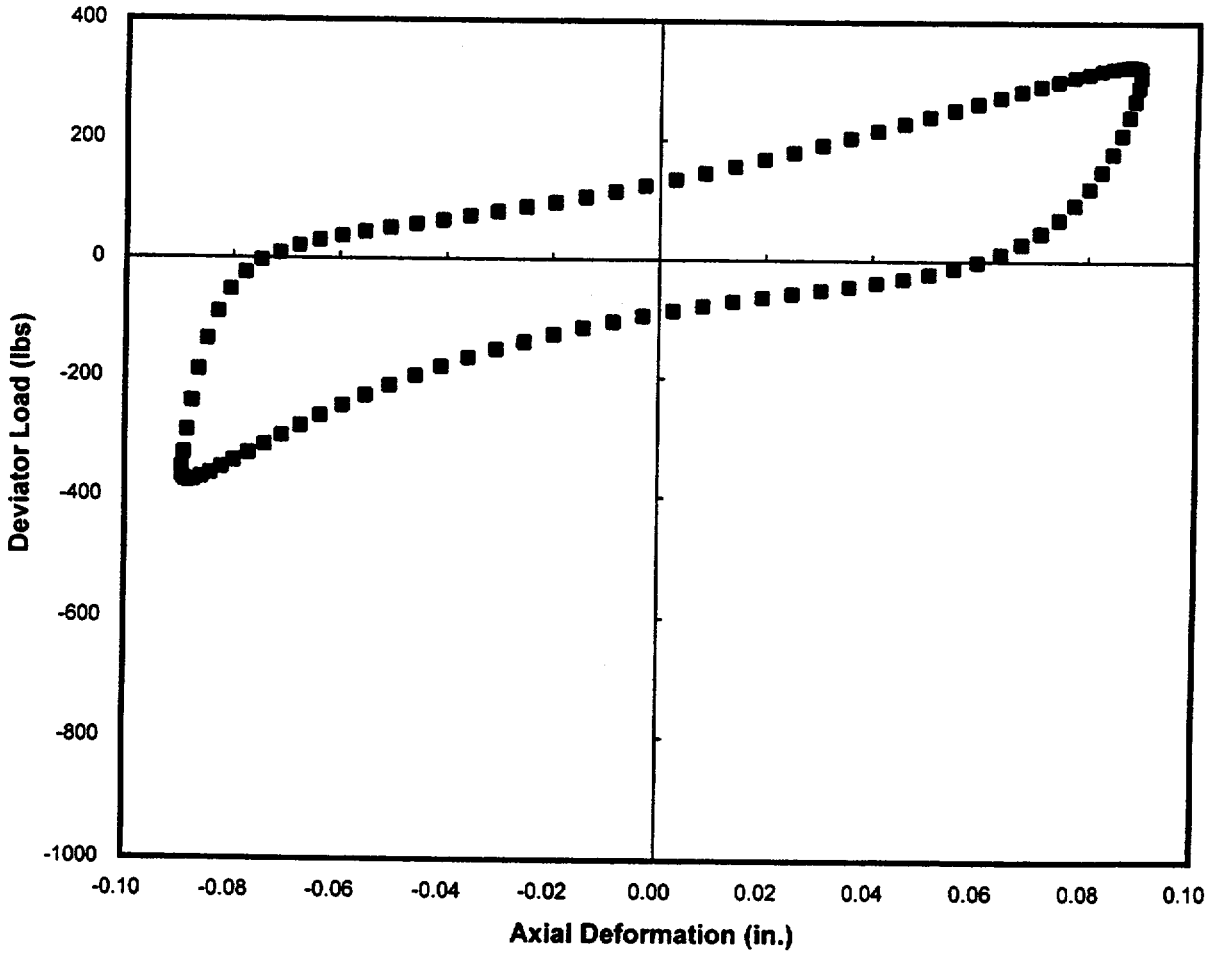
Project No.: 50160-0-3963
Tested By: JW & HJ
Test Date: 12/7/00
Reviewed By:
Review Date:

Project Name: Mox
Boring No.: BH-11
Sample No.: 8B
Depth: 82 - 84 feet
Sample Description: Brown clayey sand

Area, A_c (in^2)	Length, H_c (in)	Effective Consoli. Stress, σ_c (psi)	Cyclic Load, P_c (lbs)	Cyclic Deviator Stress, σ_d (psi)
6.04	5.87	91.0	351.03	58.2

Double Amplitude Load LD_A (lbs)	Double Ampli. Deformation SD_A (in.)	Young's Modulus E (psi)	Single Ampliti. Axial Strain ε (%)	Area of Hysteresis Loop A_L, (lb-in)	Area of Triangle A_T, (lb-in)	Damping Ratio D (%)
702.1	0.1785	3826	1.520	40.922	15.666	20.8

Hysteresis Loop @ 10th Cycle, Deformation Stage 9



LAWGIBB GROUP

CYCLIC TRIAXIAL PROPERTIES TEST

(ASTM D 3999-91)

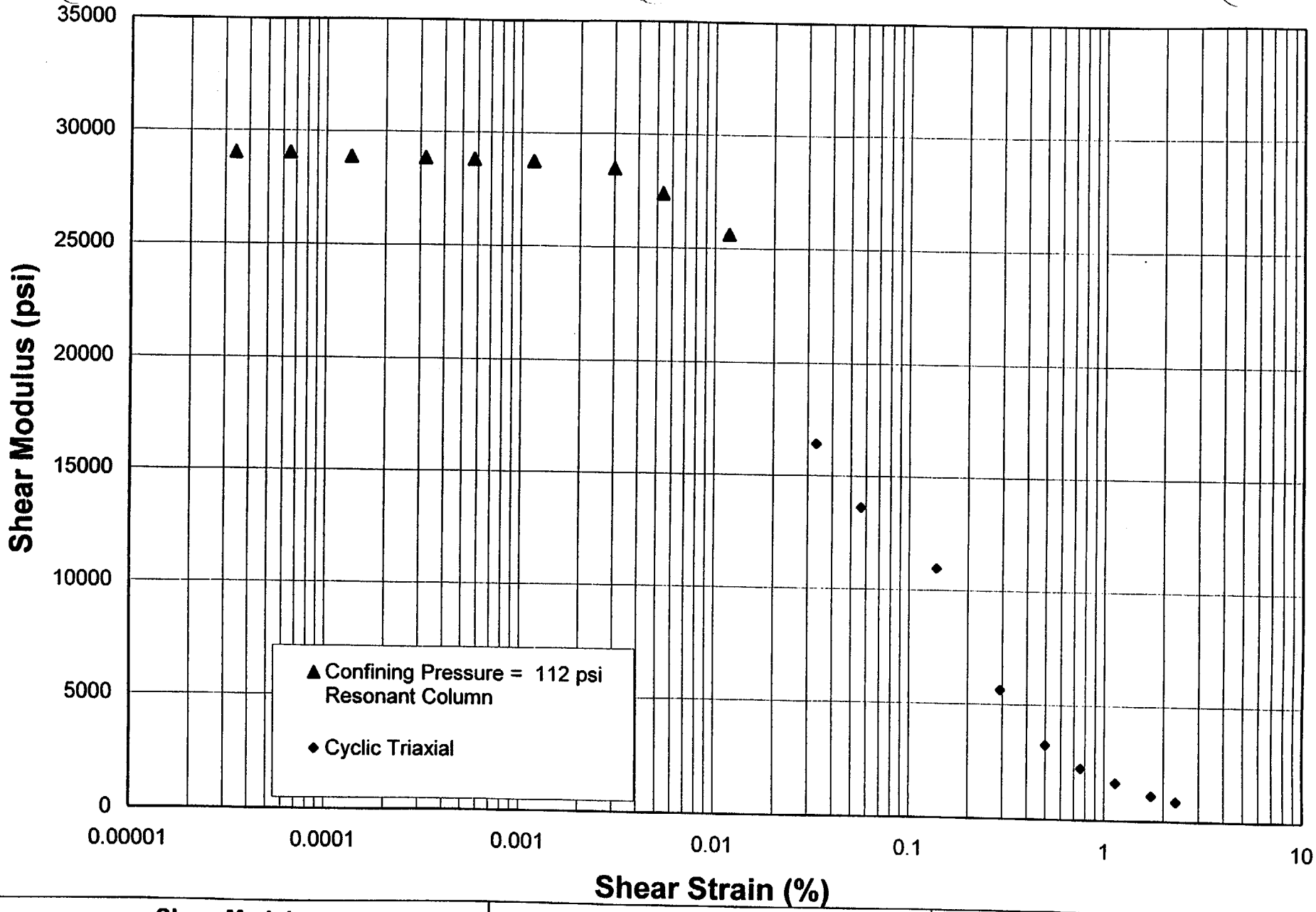
Project No.:	50160-0-3963	Project Name:	Mox
Tested By:	JW & HJ	Boring No.:	BH-11
Test Date:	12/7/00	Sample No.:	8B
Reviewed By:		Depth:	82 - 84 feet
Review Date:		Sample Description:	Brown clayey sand

Effective Consolidation Stress 91 psi

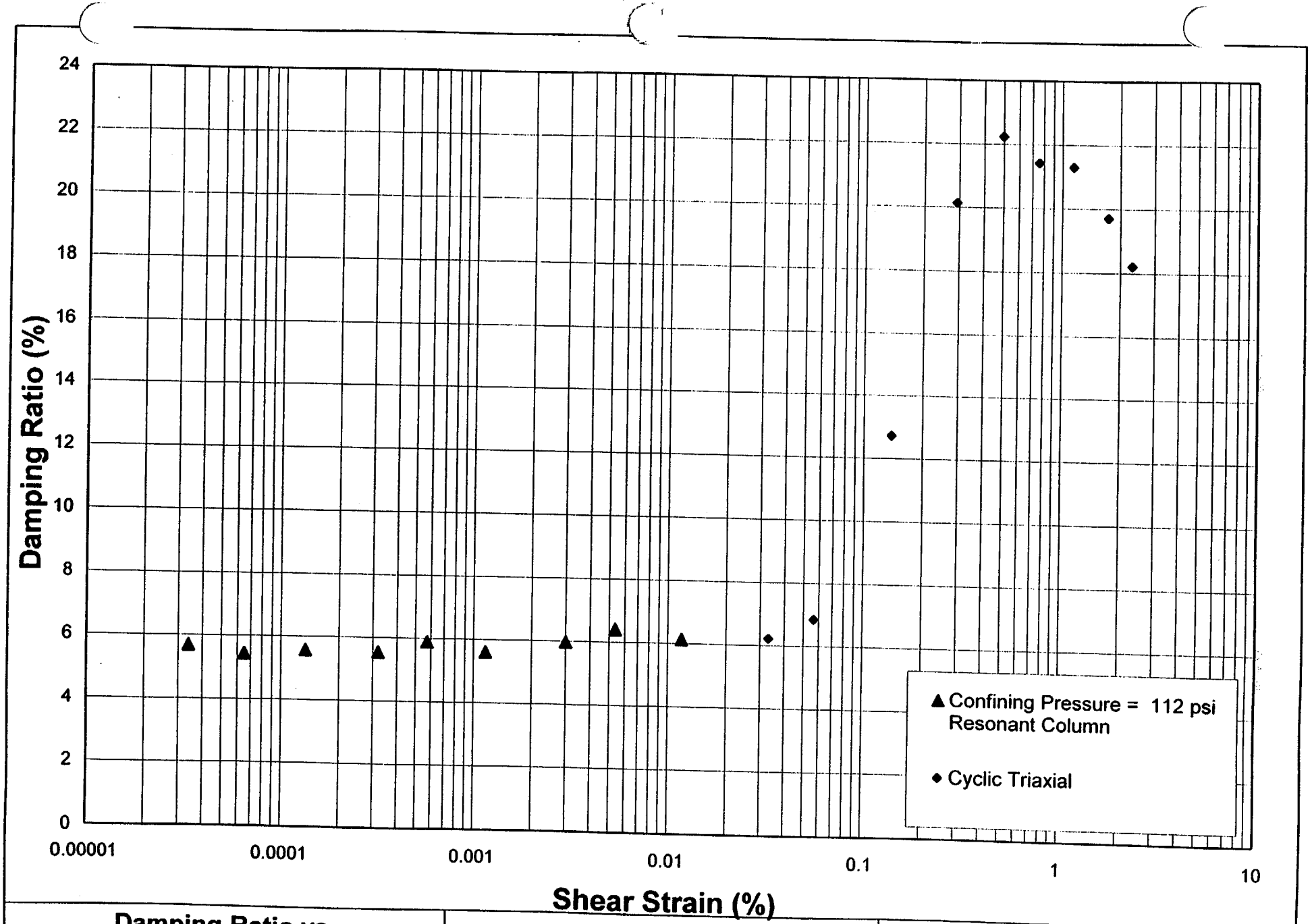
Deformation Stage No.	Cyclic Stress (psi)	Axial Strain ε (%)	Young's Modulus E, (psi)	Damping Ratio D, (%)	Shear* Modulus G, (psi)	Shear* Strain γ (%)
1	12.0	0.022	55668	9.81	18556	0.032
2	17.3	0.037	46926	11.49	15642	0.055
3	27.7	0.093	29791	16.54	9930	0.140
4	34.2	0.193	17696	20.64	5899	0.290
5	42.0	0.328	12825	23.99	4275	0.491
6	45.7	0.497	9177	24.61	3059	0.746
7	49.6	0.753	6585	24.31	2195	1.130
8	53.1	1.145	4638	23.04	1546	1.718
9	58.2	1.520	3826	20.79	1275	2.280

* Calculated based on assumed Poisson's Ratio value, 0.5.

All calculations are based on 10th cycle.



Shear Modulus vs. Shear Strain **BH-12 19 138 - 140 feet**	**LAW** **LAWGIBB Group Member**	**MOX**	
		Project No.: 50160-0-3963	Date: 12/12/00



Damping Ratio vs. Shear Strain
BH-12 19 138 - 140 feet

LAW
LAWGIBB Group Member

MOX

Project No.: 50160-0-3963

Date: 12/12/00

LAW
LAWGIBB Group Member

RESONANT COLUMN TEST (ASTM D4015-87)

Project No.:	50160-0-3963	Project Name:	MOX
Tested By:	HJ & JW	Boring No.:	BH-12
Test Date:	12/12/00	Sample No.:	19
Reviewed By:	JW	Depth:	138 - 140 feet
Reviewed Date:	12/13/00	Sample Description:	Tan clayey sand

Initial Specimen Data

Labels	Values	Units	Description
		Masses	
M_{scb}	1220.83	g	*Mass of soil and container before*
M_{sca}	0.00	g	*Mass of soil and container after*
M_{ds}	1220.83	g	*M_{scb} - M_{sca} =mass of soil*
		Diameters	
D_t	72.4	mm	*Diameter near top of specimen*
D_m	72.4	mm	*Diameter near middle of specimen*
D_b	72.4	mm	*Diameter near bottom of specimen*
T_{mem}	0.0	mm	*Single thickness of membrane*
D_{net}	72.4	mm	*$(D_t + D_m + D_b)/3 - 2*T_{mem}$*
		Lengths	
L_{cbp}	226.9	mm	*Length between chamber bottom & top of top platen*
L_{tp}	21.6	mm	*Length of top platen*
L_{bp}	46.6	mm	*Length of bottom platen*
L_{net}	158.7	mm	*Length of Specimen $= L_{cbp} - L_{tp} - L_{bp}$*
		Volume	
V	653990	mm^3	*$D^2_{net} * Pi * L_{net}/4$*

Labels	Values	Units	Description
		Mass Density and Unit Weight	
Rho	1867	kg/m^3	*Mass density of specimen $M_s * V * 10^6$*
U_{wt}	18.3	kN/m^3	*Unit weight of specimen = Rho*9.806/1000*
		Moisture Content	
No.	L-18		*Container number*
M_{wscb}	1311.80	g	*Mass of wet soil + container*
M_{wsca}	1018.57	g	*Mass of dry soil + container*
M_{wat}	293.23	g	*Mass of water = M_{wscb} - M_{wsca}*
M_{cont}	90.97	g	*Mass of container.*
mc	31.6	%	*$M_{wat}/(M_{wsca} - M_{cont})*100\%$*
Rho_d	1418	kg/m^3	*Dry mass density = Rho/(1+mc)*
G_s	2.65		*Specific gravity (estimated)*
e	0.87		*Void Ratio, $[1000*G_s)]/Rho_d - 1$*
S_r	96.5	%	*Degree of Saturation = $mc*G_s/e$*
J	8.0E-04	$kg-m^2$	*Polar mass moment of inertia $= (M_s/1000)*(D_{net}/1000)^2/8$*

Conditions After Saturation			
CL_s	0.0	mm	*Change in length*
L_s	158.71	mm	*Length after saturation, $L - CL_s$*
A_s	4121	mm^2	*Area of specimen*
V_s	653990	mm^3	*Volume after saturation, $A_s * L_s$*
B	0.95		*B Value*

Conditions After Consolidation			
CL_c	2.8	mm	*Change in length*
L_d	155.9	mm	*Length after consolidation, $L_s - CL_c$*
CV_c	34272	mm^3	*Change in volume*
V_c	619718	mm^3	*Volume, $V_s - CV_c$*
S_r	100.0	%	*Degree of Saturation, $mc*G_s/e$*
e	0.77		*Void Ratio, $[1000*G_s]/Rho_d - 1$*
mc	29.1	%	*Moisture Content*
Rho_d	1497	kg/m^3	*Dry mass density, $Rho_d * V/V_c$*

LAW
LAWGIBB Group Member

RESONANT COLUMN TEST (ASTM D4015-87)

Project No.:	50160-0-3963	Project Name:	MOX
Tested By:	HJ & JW	Boring No.:	BH-12
Test Date:	12/12/00	Sample No.:	19
Reviewed By:	JW	Depth:	138 - 140 feet
Reviewed Date:	12/13/00	Sample Description:	Tan clayey sand

Apparatus Information

Apparatus Description	Typical Long-Tor
Apparatus Serial No.	556G0001
Platen Diameter, mm	72.4

Apparatus Calibration Factors			
M_A	0.3044	kg	*Top Platen Mass*
LCFA	N/A	$[m/V_{rms}]*[Hz^2]$	*Longitudinal Vibration Calibration Factor*
ADCL	N/A	kg-Hz	*Longitudinal Apparatus Damping Coefficient*
FCF	N/A	N/V_{rms}	*Force Calibration Factor*
J_A	0.0032	$kg\text{-}m^2$	*Platen Polar Mass Momment of Inertia*
RCFA	4.42	$[Rad/V_{rms}]*[Hz^2]$	*Rotational Vibration Calibration Factor*
ADCT	0.00139	$Hz\text{-}kg\text{-}m^2$	*Torsional Apparatus Damping Coefficient*
TCF	0.069	$N\text{-}m/V_{rms}$	*Torque Calibration Factor*
FOT	0	Hz	*Apparatus Resonant Frequency*

Ancillary System Calibration Factors			
LCCF	-0.635	mm/unit	*Length change calibration factor (+ means*
			specimen length increase for increase values)
BCF	-0.34	mL/unit	*Burette calibration factor (+ means specimen*
			volume increase for increase values.)
CPCF	6.89	kPa/unit	*Cell pressure calibration factor*
PPCF	6.89	kPa/unit	*Pore Pressure calibration factor*
ALCF	1	kN/unit	*Axial load calibration factor*
			(+ means compression of specimen.)
Ancillary System Initial Conditions			
ILR	0	units	*Initial length reading before testing*
IBR	4	units	*Initial burette reading before testing*
RPF	P		*P or F. "P" for resonant period input, and*
			"F" for resonant frequency input.

LAW
LAWGIBB Group Member

RESONANT COLUMN TEST (ASTM D4015-87)

INPUT DATA

Project No.:	50160-0-3963	Project Name:	MOX
Tested By:	HJ & JW	Boring No:	BH-12
Test Date:	12/12/00	Sample No.:	19
Reviewed By:	JW	Depth:	138 - 140 feet
Reviewed Date	12/13/00	Sample Description:	Tan clayey sand

Total Number of Data Sets 9

Line No.	Elapsed Time [second]	Cell Pressure [unit]	Pore Pressure [unit]	Axial Load [unit]	Burette Reading [unit]	Length Reading [unit]	Longitudinal or Torsional	Force or Torque Reading [V_{rms}]	Transducer Reading [V_{rms}]	Resonant Period [msec]
1	37	127.0	14.6	0	4.0	0	T	0.012	0.012	6.487
2	88	127.0	14.6	0	4.0	0	T	0.022	0.023	6.487
3	125	127.0	14.6	0	4.0	0	T	0.046	0.047	6.505
4	166	127.0	14.6	0	4.0	0	T	0.109	0.112	6.508
5	209	127.0	14.8	0	4.0	0	T	0.208	0.201	6.514
6	268	127.0	14.8	0	4.0	0	T	0.398	0.404	6.520
7	303	127.0	14.9	0	4.0	0	T	1.089	1.040	6.552
8	340	127.0	14.9	0	4.0	0	T	2.010	1.790	6.678
9	376	127.0	14.9	0	4.0	0	T	3.960	3.68	6.904

LAW
LAWGIBB Group Member

RESONANT COLUMN TEST (ASTM D4015-87)

TEST RESULTS SUMMARY

Project No.:	50160-0-3963	Project Name:	MOX
Tested By:	HJ & JW	Boring No:	BH-12
Test Date:	12/12/00	Sample No.:	19
Reviewed By:	JW	Depth:	138 - 140 feet
Reviewed Date:	12/13/00	Sample Description:	Tan clayey sand

Line No.	Effective Confining Stress [kPa]	Principal Stress Ratio	Void Ratio e	Longitudinal or Torsional	No. of Vibration Cycles	Shear Modulus G [Mpa]	Shear Modulus G [psi]	Shear Strain Amplitude [%]	Damping Ratio [%]
1	774.44	1.00	0.770	T	5704	200.12	29046	0.00003	5.70
2	774.44	1.00	0.770	T	7862	200.12	29046	0.00007	5.45
3	774.44	1.00	0.770	T	5688	199.02	28885	0.00013	5.58
4	774.44	1.00	0.770	T	6300	198.84	28859	0.00032	5.55
5	773.06	1.00	0.770	T	6601	198.47	28805	0.00057	5.90
6	773.06	1.00	0.770	T	9049	198.12	28754	0.00115	5.62
7	772.37	1.00	0.770	T	5342	196.17	28472	0.00300	5.97
8	772.37	1.00	0.770	T	5541	188.84	27408	0.00536	6.40
9	772.37	1.00	0.770	T	5214	176.68	25643	0.01179	6.13

LAWGIBB GROUP

CYCLIC TRIAXIAL PROPERTIES TEST
(ASTM D 3999-91)

Project No.:	50160-0-3963	Project Name:	Mox
Tested By:	JW & HJ	Boring No.:	BH-12
Test Date:	12/11/00	Sample No.:	19
Reviewed By:	JW	Depth:	138 - 140 feet
Review Date:	12/12/00	Sample Description:	Tan clayey sand

SPECIMEN DATA

Initial Conditions of Specimen

Diameters, in.		Area , sq. in.	6.42
Top	2.858	Volume, cubic in.	38.34
Middle	2.858	Mass of Specimen, grams	1168.37
Bottom	2.859		
Average	2.858	Moisture Content	
Membrane Thickness, in.	0.000	Pan No.	X-31
Net Diameter, in.	2.858	Wet Mass + Pan, grams	1215.97
		Dry Mass + Pan, grams	939.59
Length, in.		Container Mass, grams	47.60
Location 1	5.975	Moisture Content, %	31.0
Location 2	5.977		
Location 3	5.975	Density, pcf	115.8
Average	5.976	Dry Density, pcf	88.4
Length of Top Platen	0.000	Specific Gravity	2.65
Length of Bottom Platen	0.000	Degree of Saturation, %	94.4
Length of Specimen, in	5.976	Void Ratio	0.870

Conditions of Specimen After Saturation and Consolidation

After Saturation		After Consolidation	
Change in Length, in.	0.000	Change in Length, in.	0.120
Length, in.	5.976	Length, in.	5.856
Area, sq. in.	6.42	Change in Volume, cc	38.10
Volume, cubic in.	38.34	Volume, cubic in.	36.02
Back Pressure, psi	15.0	Area, sq. in.	6.15
B Value	0.97	Effe. Consoli.. Stress, psi	112.0
		Moisture Content, %	28.6
		Dry Density, pcf	94.1
		Void Ratio	0.756
		Degree of Saturation, %	100.0

Data Reduction Based on Cycle No. 10

Number of Stages 9

LAWGIBB GROUP

CYCLIC TRIAXIAL PROPERTIES TEST

(ASTM D 3999-91)

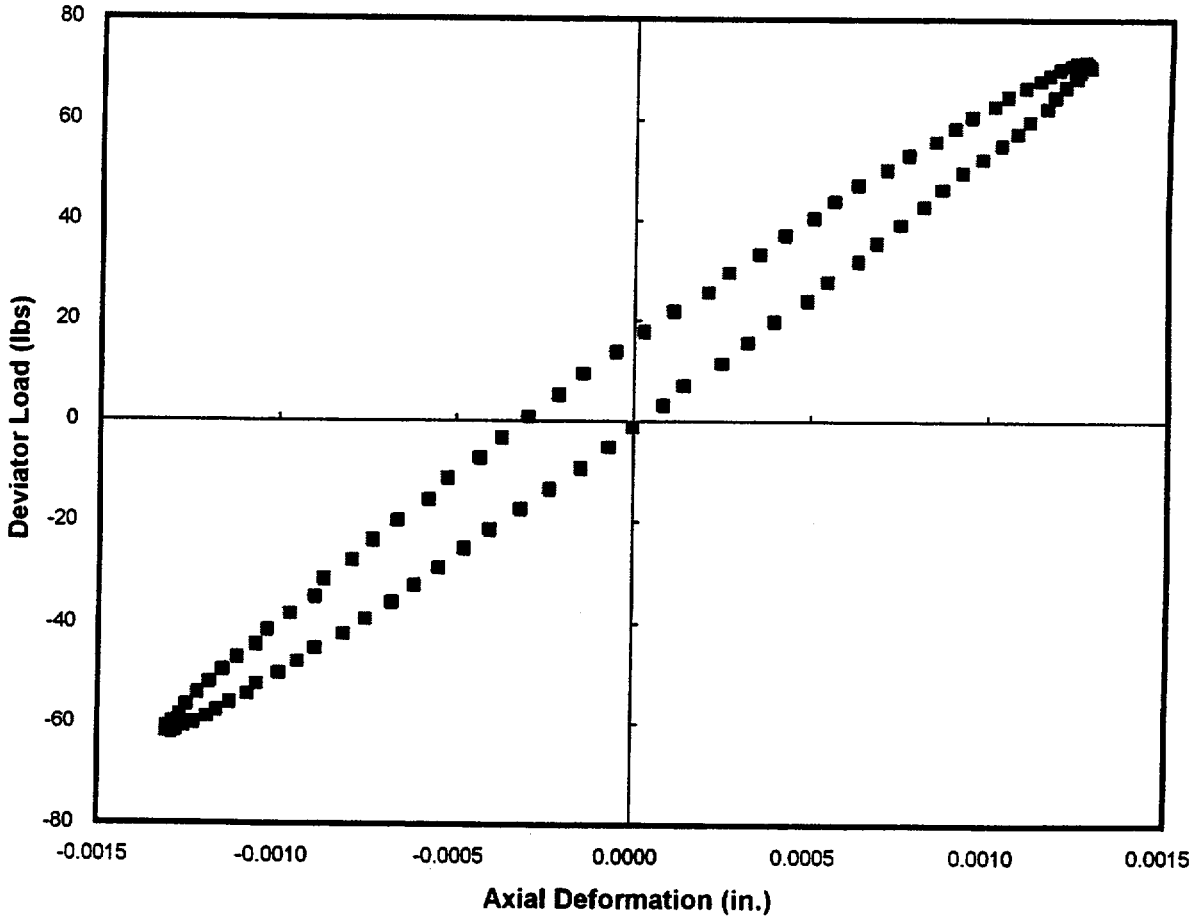
Project No.: 50160-0-3963
Tested By: JW & HJ
Test Date: 12/11/00
Reviewed By:
Review Date:

Project Name: Mox
Boring No.: BH-12
Sample No.: 19
Depth: 138 - 140 feet
Sample Description: Tan clayey sand

Area, A_c (in^2)	Length, H_c (in)	Effective Consoli. Stress, σ_c (psi)	Cyclic Load, P_c (lbs)	Cyclic Deviator Stress, σ_d (psi)
6.15	5.86	112.0	66.83	10.9

Double Amplitude Load LD_A (lbs)	Double Ampli. Deformation SD_A (in.)	Young's Modulus E (psi)	Single Ampliti. Axial Strain ε (%)	Area of Hysteresis Loop A_L, (lb-in)	Area of Triangle A_T, (lb-in)	Damping Ratio D (%)
133.7	0.0026	49246	0.022	0.034	0.043	6.2

Hysteresis Loop @ 10th Cycle, Deformation Stage 1



LAWGIBB GROUP

CYCLIC TRIAXIAL PROPERTIES TEST

(ASTM D 3999-91)

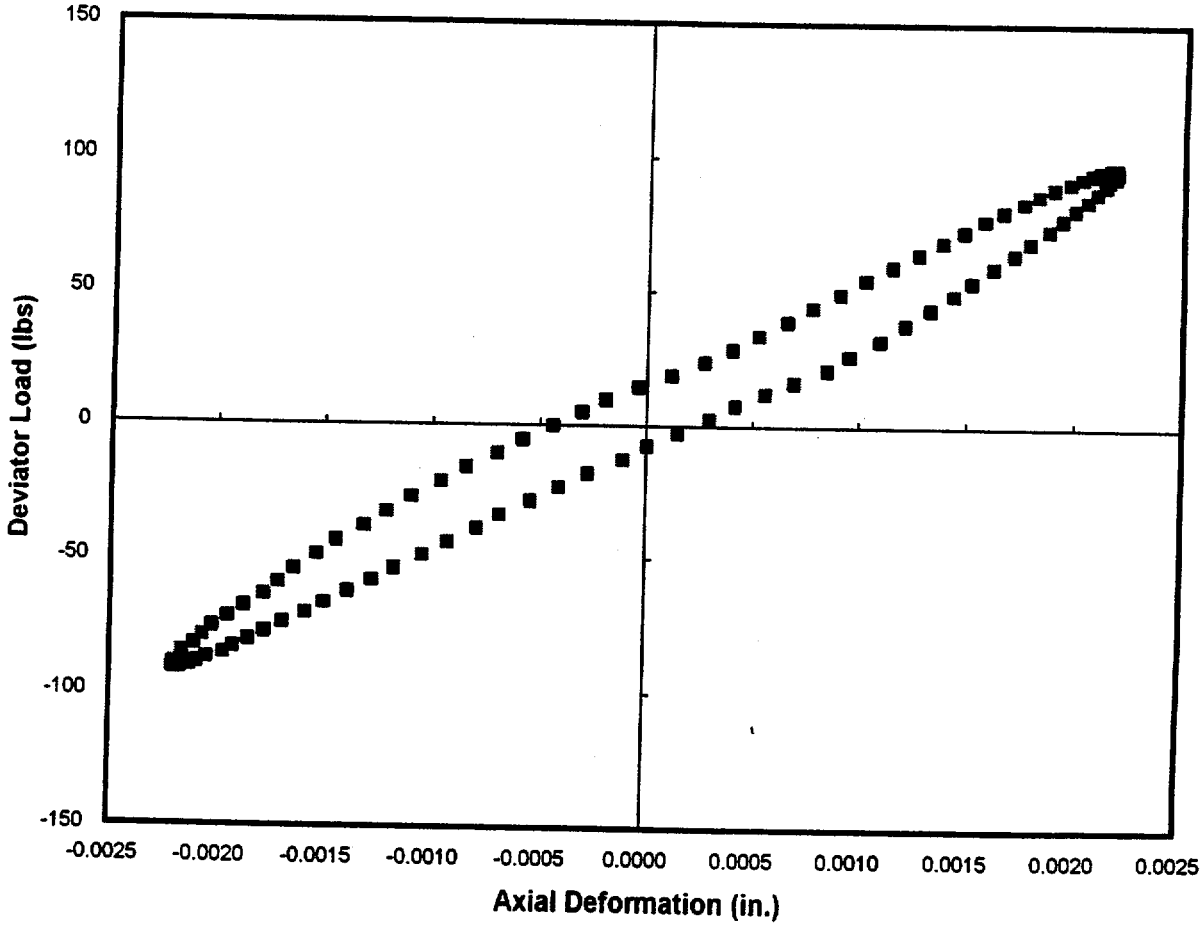
Project No.: 50160-0-3963
Tested By: JW & HJ
Test Date: 12/11/00
Reviewed By:
Review Date:

Project Name: Mox
Boring No.: BH-12
Sample No.: 19
Depth: 138 - 140 feet
Sample Description: Tan clayey sand

Area, A_c (in^2)	Length, H_c (in)	Effective Consoli. Stress, σ_c (psi)	Cyclic Load, P_c (lbs)	Cyclic Deviator Stress, σ_d (psi)
6.15	5.86	112.0	94.16	15.3

Double Amplitude Load LD_A (lbs)	Double Ampli. Deformation SD_A (in.)	Young's Modulus E (psi)	Single Ampliti. Axial Strain ε (%)	Area of Hysteresis Loop A_L, (lb-in)	Area of Triangle A_T, (lb-in)	Damping Ratio D (%)
188.3	0.0044	40805	0.038	0.089	0.103	6.8

Hysteresis Loop @ 10th Cycle, Deformation Stage 2



LAWGIBB GROUP

CYCLIC TRIAXIAL PROPERTIES TEST

(ASTM D 3999-91)

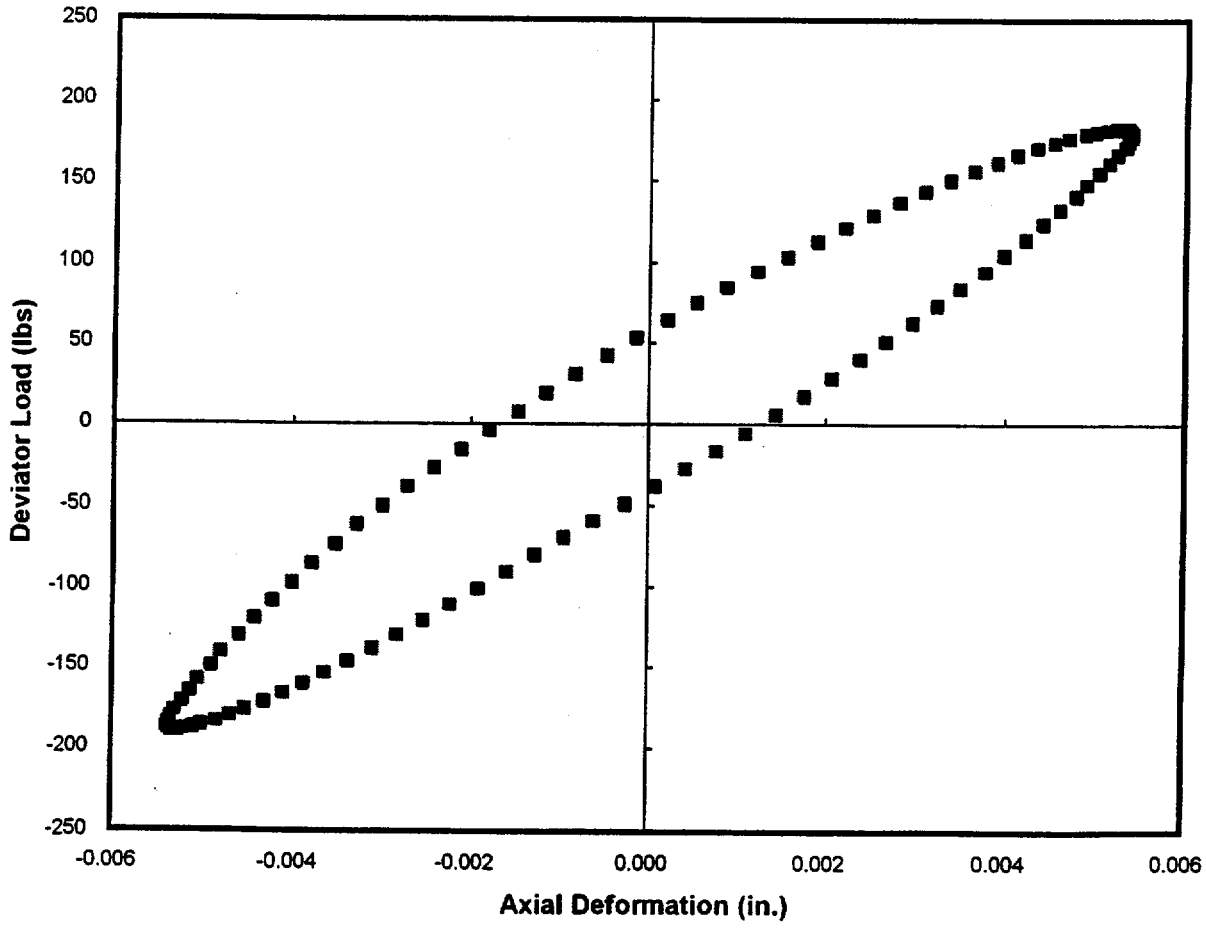
Project No.: 50160-0-3963
Tested By: JW & HJ
Test Date: 12/11/00
Reviewed By:
Review Date:

Project Name: Mox
Boring No.: BH-12
Sample No.: 19
Depth: 138 - 140 feet
Sample Description: Tan clayey sand

Area, A_c (in^2)	Length, H_c (in)	Effective Consoli. Stress, σ_c (psi)	Cyclic Load, P_c (lbs)	Cyclic Deviator Stress, σ_d (psi)
6.15	5.86	112.0	186.08	30.3

Double Amplitude Load LD_A (lbs)	Double Ampli. Deformation SD_A (in.)	Young's Modulus E (psi)	Single Ampliti. Axial Strain ε (%)	Area of Hysteresis Loop A_L, (lb-in)	Area of Triangle A_T, (lb-in)	Damping Ratio D (%)
372.2	0.0108	32841	0.092	0.803	0.502	12.7

Hysteresis Loop @ 10th Cycle, Deformation Stage 3



LAWGIBB GROUP

CYCLIC TRIAXIAL PROPERTIES TEST
(ASTM D 3999-91)

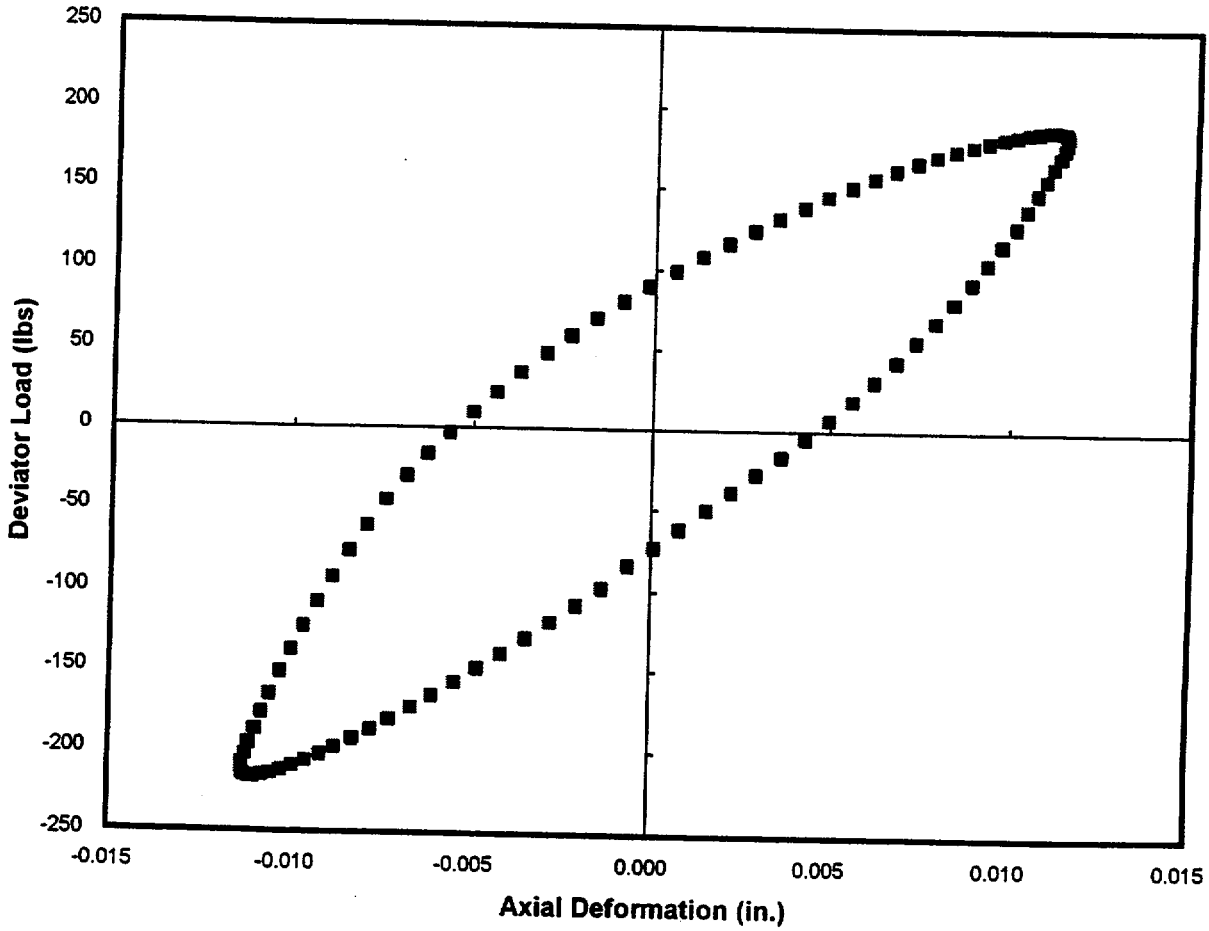
Project No.: 50160-0-3963
Tested By: JW & HJ
Test Date: 12/11/00
Reviewed By:
Review Date:

Project Name: Mox
Boring No.: BH-12
Sample No.: 19
Depth: 138 - 140 feet
Sample Description: Tan clayey sand

Area, A_c (in^2)	Length, H_c (in)	Effective Consoli. Stress, σ_c (psi)	Cyclic Load, P_c (lbs)	Cyclic Deviator Stress, σ_d (psi)
6.15	5.86	112.0	202.13	32.9

Double Amplitude Load LD_A (lbs)	Double Ampli. Deformation SD_A (in.)	Young's Modulus E (psi)	Single Ampliti. Axial Strain ε (%)	Area of Hysteresis Loop A_L, (lb-in)	Area of Triangle A_T, (lb-in)	Damping Ratio D (%)
404.3	0.0228	16910	0.194	2.910	1.150	20.1

Hysteresis Loop @ 10th Cycle, Deformation Stage 4



LAWGIBB GROUP

CYCLIC TRIAXIAL PROPERTIES TEST

(ASTM D 3999-91)

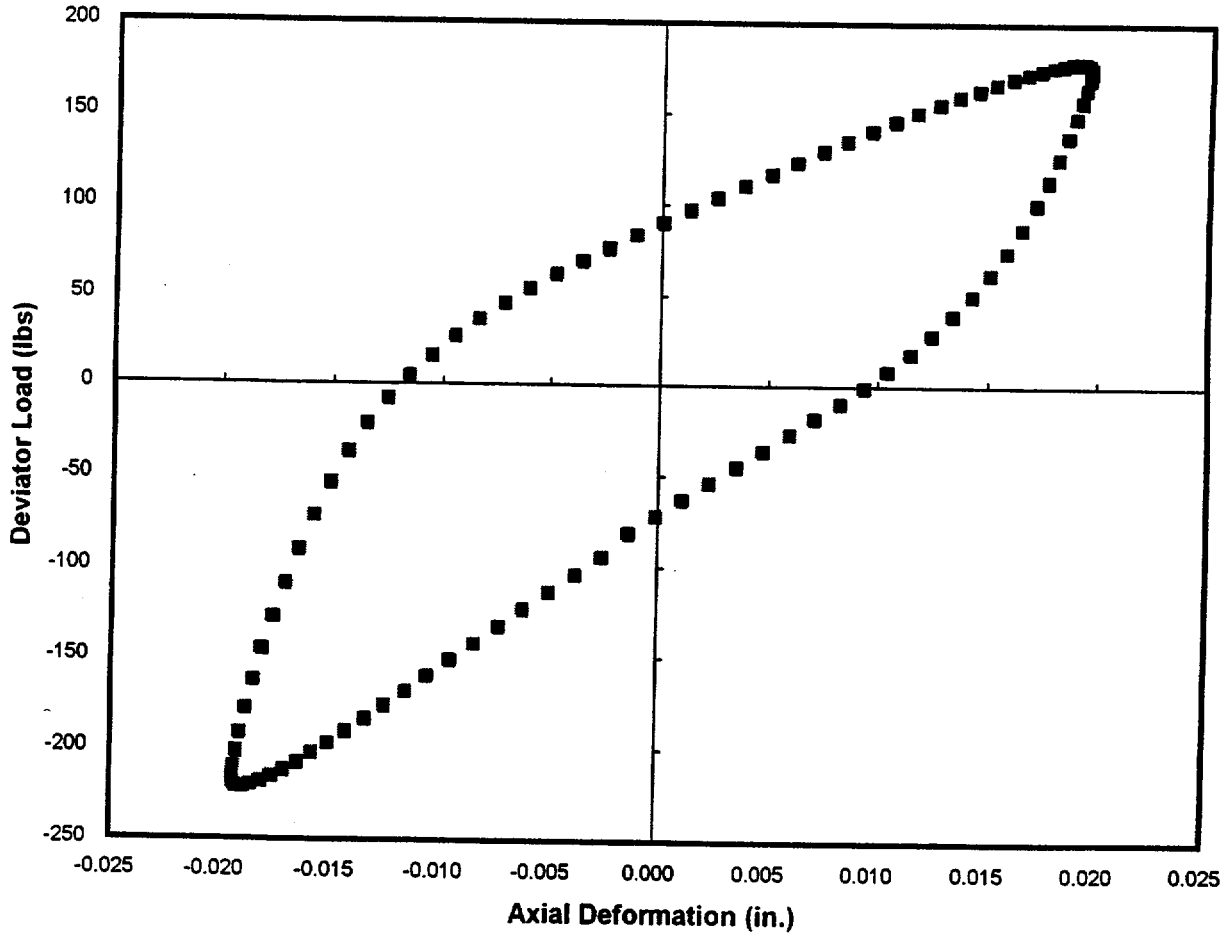
Project No.: 50160-0-3963
Tested By: JW & HJ
Test Date: 12/11/00
Reviewed By:
Review Date:

Project Name: Mox
Boring No.: BH-12
Sample No.: 19
Depth: 138 - 140 feet
Sample Description: Tan clayey sand

Area, A_c (in^2)	Length, H_c (in)	Effective Consoli. Stress, σ_c (psi)	Cyclic Load, P_c (lbs)	Cyclic Deviator Stress, σ_d (psi)
6.15	5.86	112.0	199.94	32.5

Double Amplitude Load LD_A (lbs)	Double Ampli. Deformation SD_A (in.)	Young's Modulus E (psi)	Single Ampliti. Axial Strain ε (%)	Area of Hysteresis Loop A_L, (lb-in)	Area of Triangle A_T, (lb-in)	Damping Ratio D (%)
399.9	0.0389	9783	0.332	5.436	1.945	22.2

Hysteresis Loop @ 10th Cycle, Deformation Stage 5



LAWGIBB GROUP

CYCLIC TRIAXIAL PROPERTIES TEST

(ASTM D 3999-91)

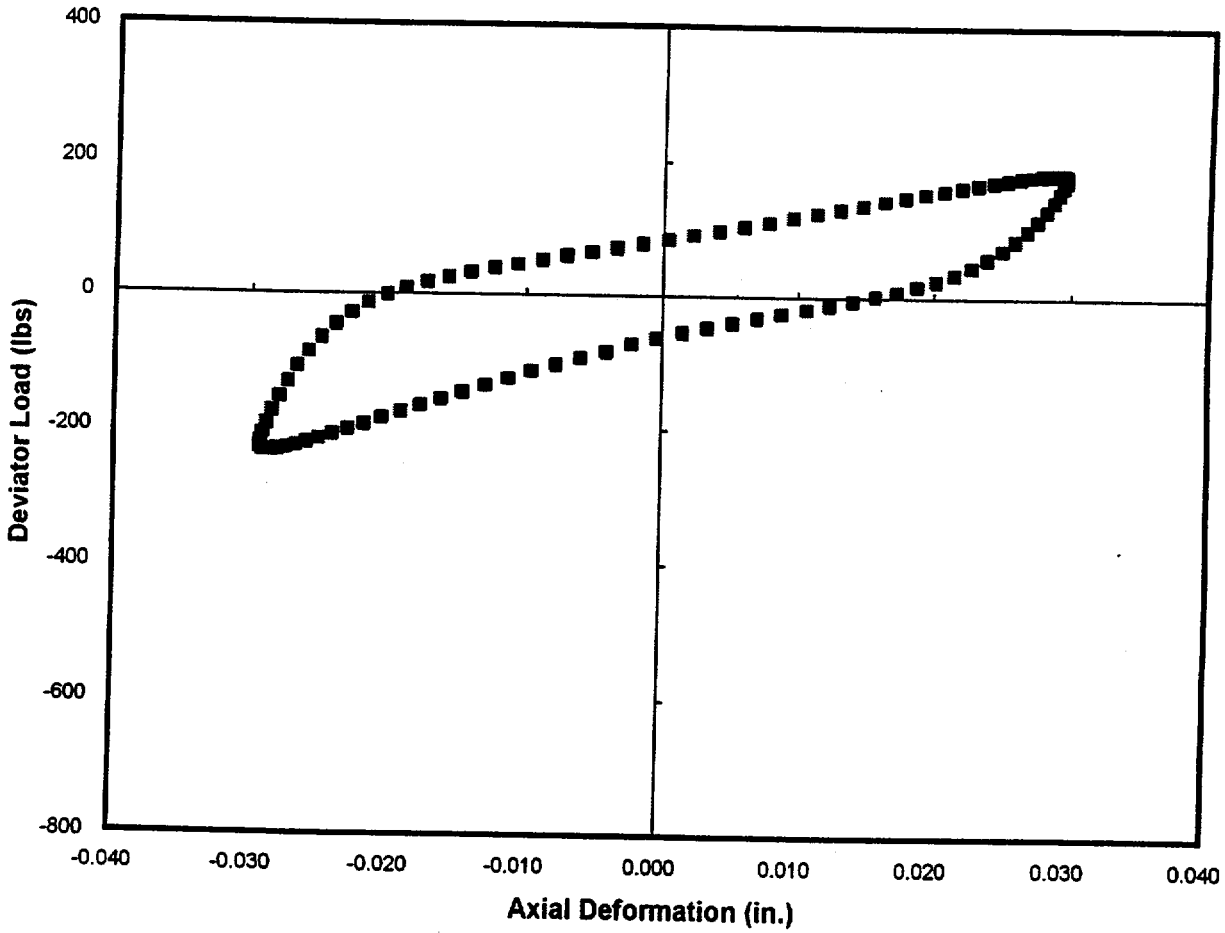
Project No.: 50160-0-3963
Tested By: JW & HJ
Test Date: 12/11/00
Reviewed By:
Review Date:

Project Name: Mox
Boring No.: BH-12
Sample No.: 19
Depth: 138 - 140 feet
Sample Description: Tan clayey sand

Area, A_c (in^2)	Length, H_c (in)	Effective Consoli. Stress, σ_c (psi)	Cyclic Load, P_c (lbs)	Cyclic Deviator Stress, σ_d (psi)
6.15	5.86	112.0	209.95	34.1

Double Amplitude Load LD_A (lbs)	Double Ampli. Deformation SD_A (in.)	Young's Modulus E (psi)	Single Ampliti. Axial Strain ε (%)	Area of Hysteresis Loop A_L, (lb-in)	Area of Triangle A_T, (lb-in)	Damping Ratio D (%)
419.9	0.0590	6777	0.504	8.334	3.096	21.4

Hysteresis Loop @ 10th Cycle, Deformation Stage 6



LAWGIBB GROUP

CYCLIC TRIAXIAL PROPERTIES TEST

(ASTM D 3999-91)

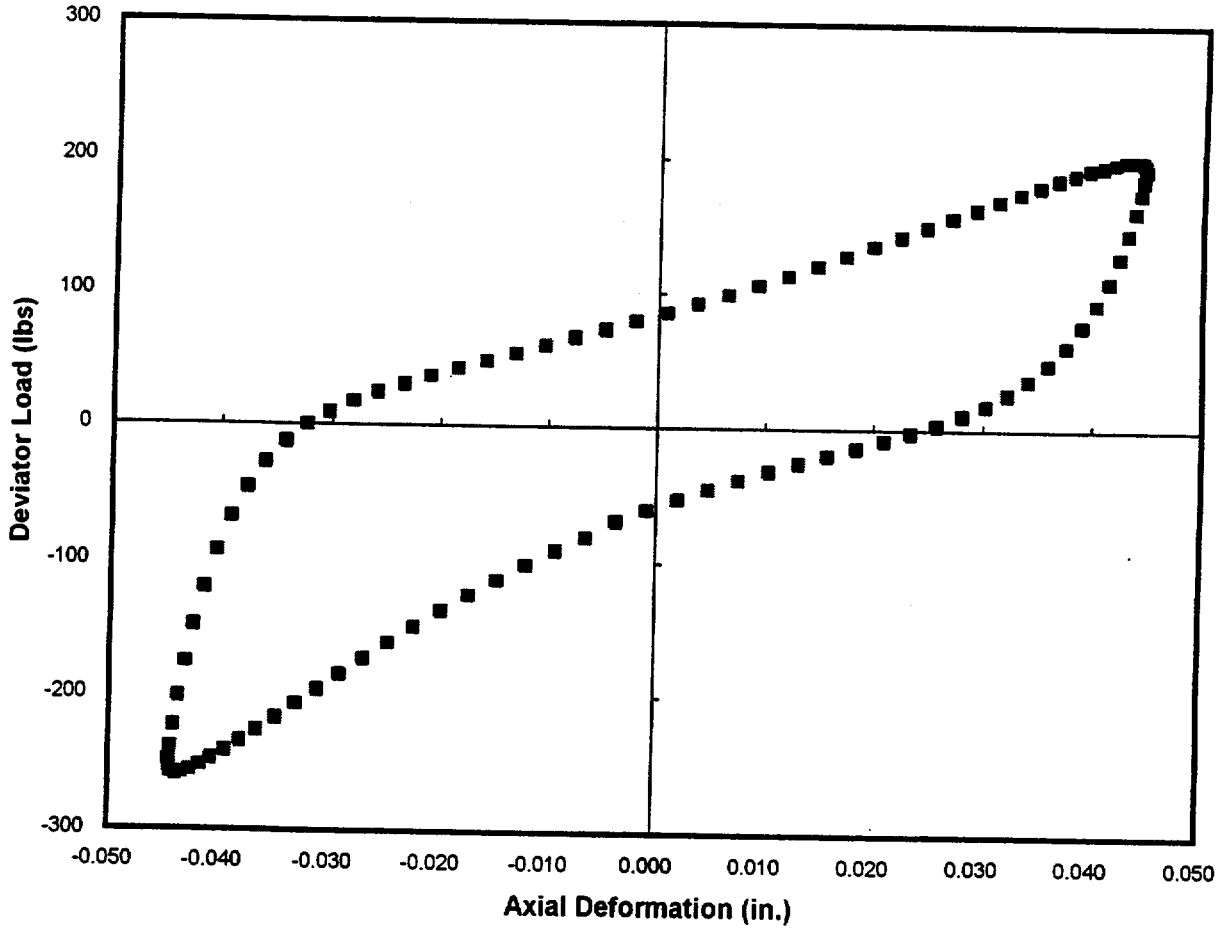
Project No.: 50160-0-3963
Tested By: JW & HJ
Test Date: 12/11/00
Reviewed By:
Review Date:

Project Name: Mox
Boring No.: BH-12
Sample No.: 19
Depth: 138 - 140 feet
Sample Description: Tan clayey sand

Area, A_c (in^2)	Length, H_c (in)	Effective Consoli. Stress, σ_c (psi)	Cyclic Load, P_c (lbs)	Cyclic Deviator Stress, σ_d (psi)
6.15	5.86	112.0	229.94	37.4

Double Amplitude Load LD_A (lbs)	Double Ampli. Deformation SD_A (in.)	Young's Modulus E (psi)	Single Ampliti. Axial Strain ε (%)	Area of Hysteresis Loop A_L, (lb-in)	Area of Triangle A_T, (lb-in)	Damping Ratio D (%)
459.9	0.0891	4914	0.761	13.706	5.121	21.3

Hysteresis Loop @ 10th Cycle, Deformation Stage 7



LAWGIBB GROUP

CYCLIC TRIAXIAL PROPERTIES TEST

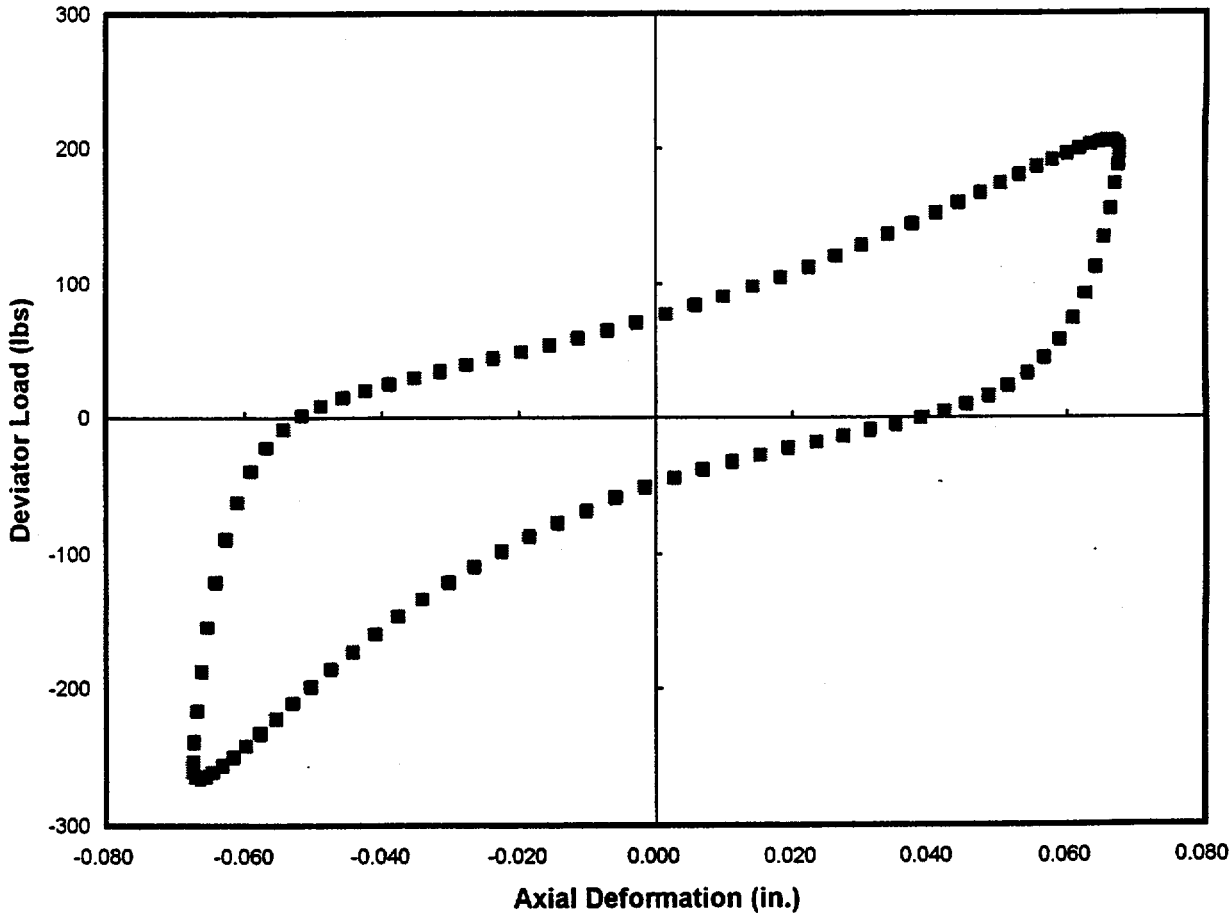
(ASTM D 3999-91)

Project No.:	50160-0-3963	Project Name:	Mox
Tested By:	JW & HJ	Boring No.:	BH-12
Test Date:	12/11/00	Sample No.:	19
Reviewed By:		Depth:	138 - 140 feet
Review Date:		Sample Description:	Tan clayey sand

Area, A_c (in^2)	Length, H_c (in)	Effective Consoli. Stress, σ_c (psi)	Cyclic Load, P_c (lbs)	Cyclic Deviator Stress, σ_d (psi)
6.15	5.86	112.0	235.12	38.2

Double Amplitude Load LD_A (lbs)	Double Ampli. Deformation SD_A (in.)	Young's Modulus E (psi)	Single Ampliti. Axial Strain ε (%)	Area of Hysteresis Loop A_L, (lb-in)	Area of Triangle A_T, (lb-in)	Damping Ratio D (%)
470.2	0.1353	3308	1.156	19.703	7.955	19.7

Hysteresis Loop @ 10th Cycle, Deformation Stage 8



LAWGIBB GROUP

CYCLIC TRIAXIAL PROPERTIES TEST

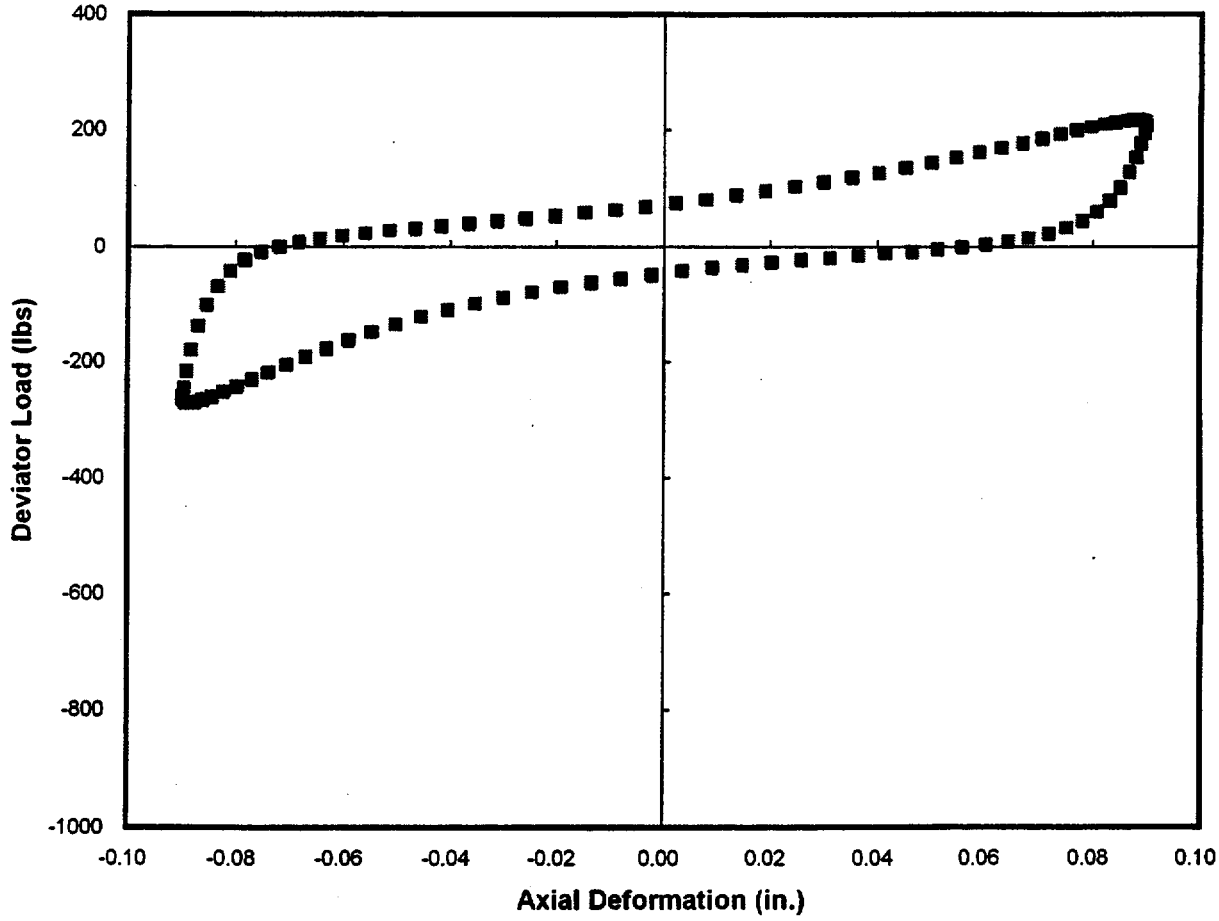
(ASTM D 3999-91)

Project No.:	50160-0-3963	Project Name:	Mox
Tested By:	JW & HJ	Boring No.:	BH-12
Test Date:	12/11/00	Sample No.:	19
Reviewed By:		Depth:	138 - 140 feet
Review Date:		Sample Description:	Tan clayey sand

Area, A_c (in^2)	Length, H_c (in)	Effective Consoli. Stress, σ_c (psi)	Cyclic Load, P_c (lbs)	Cyclic Deviator Stress, σ_d (psi)
6.15	5.86	112.0	244.34	39.7

Double Amplitude Load LD_A (lbs)	Double Ampli. Deformation SD_A (in.)	Young's Modulus E (psi)	Single Ampliti. Axial Strain ε (%)	Area of Hysteresis Loop A_L, (lb-in)	Area of Triangle A_T, (lb-in)	Damping Ratio D (%)
488.7	0.1796	2590	1.534	25.103	10.971	18.2

Hysteresis Loop @ 10th Cycle, Deformation Stage 9



LAWGIBB GROUP

CYCLIC TRIAXIAL PROPERTIES TEST

(ASTM D 3999-91)

Project No.:	50160-0-3963	Project Name:	Mox
Tested By:	JW & HJ	Boring No.:	BH-12
Test Date:	12/11/00	Sample No.:	19
Reviewed By:		Depth:	138 - 140 feet
Review Date:		Sample Description:	Tan clayey sand

Effective Consolidation Stress 112 psi

Deformation Stage No.	Cyclic Stress (psi)	Axial Strain ε (%)	Young's Modulus E, (psi)	Damping Ratio D, (%)	Shear* Modulus G, (psi)	Shear* Strain γ (%)
1	10.9	0.022	49246	6.22	16415	0.033
2	15.3	0.038	40805	6.85	13602	0.056
3	30.3	0.092	32841	12.73	10947	0.138
4	32.9	0.194	16910	20.14	5637	0.291
5	32.5	0.332	9783	22.24	3261	0.498
6	34.1	0.504	6777	21.42	2259	0.755
7	37.4	0.761	4914	21.30	1638	1.141
8	38.2	1.156	3308	19.71	1103	1.733
9	39.7	1.534	2590	18.21	863	2.300

* Calculated based on assumed Poisson's Ratio value, 0.5.

All calculations are based on 10th cycle.