BORING LOG NO. 09-B104

CLIENT:	USACE Galveston District Galveston, Texas	PROJECT:	TO-0012 Pipeline Dredging, Cedar Bayou & Anahuac Channel, Volume II
BORING LOCATION:	N: 699113.784 E: 3280678.777	SITE:	Atkinson Island PA16 Texas

Approx. Surface Elevation: 13.0 feet

Graphic Log	DESCRIPTION	DEPTH, FEET	USCS SYMBOL	TYPE	RECOVERY, IN	SPT, BLOWS/FT	CALIBRATED HAND PENETROM., TSF	TORVANE, TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX	MINUS #200 SIEVE, %	COMPRESSIVE STRENGTH, TSF	FAILURE STRAIN, %	CONFINING PRESSURE, PSI
	FILL: SILTY SAND light brown and brown, loose to medium dense, fine grain, with shell, dry, none to slight plasticity		SM														
		1		SS	8	25			3					27			
		2															
		3		SS	6	9			8								
	9.0 — 4.0	4															
	FIIL: CLAYEY SAND light brown and brown, medium dense to dense, fine grain, with shell, wet, medium plasticity		SC														
		5		SS	10	15			19		38	19	19	49			
		6															
		7		SS	10	45			20								
	5.0 — 8.0	8															
	FILL: SANDY FAT CLAY light gray and dark gray, very soft to stiff, with sand seams and layers, wet, high plasticity		CH														
		9		SS	10	8			26		52	19	33	62			
		10															
		11		SS	6	4			34								
		12															
		13		SS	12	2			28								
		14															
		15		SS	12	3			41		50	17	33	53			
	-3.0 — 16.0	16															
	FAT CLAY dark gray, very soft to medium stiff, with sand seams, wet, very high plasticity - 6 inches thick sand layer at 19.5 feet		CH														
		17		SS	10	2			51								
		18															
		19		SS	11	20			43								
		20															
		21		SS	12	0			49								
		22															
		23		SS	8	0			45		82	24	58	88			
		24															
		25		SS	12	6			48								
	-13.0 — 26.0	26															

Continued Next Page

STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES. IN SITU, THE TRANSITION BETWEEN STRATA MAY BE MORE GRADUAL.

REMARKS: Dry augered to 6 feet; wet rotary thereafter.

WATER LEVEL OBSERVATIONS			
▽ 5 ft	WS	▼ 5 ft	at 5 min
▼ 5 ft	at 10 min	▼ 5 ft	at 5 min

Terracon

DATE DRILLED	4/9/2010
PROJECT NUMBER	92105186-B

09-B104

EXHIBIT A-

BORING LOG NO. 09-B104

CLIENT:	USACE Galveston District Galveston, Texas	PROJECT:	TO-0012 Pipeline Dredging, Cedar Bayou & Anahuac Channel, Volume II
BORING LOCATION:	N: 699113.784 E: 3280678.777	SITE:	Atkinson Island PA16 Texas

Approx. Surface Elevation: 13.0 feet

Graphic Log	DESCRIPTION	DEPTH, FEET	USCS SYMBOL	SAMPLES: TYPE	RECOVERY, IN	SPT, BLOWS/FT	CALIBRATED HAND PENETROM., TSF	TORVANE, TSF	TESTS: MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX	MINUS #200 SIEVE, %	COMPRESSIVE STRENGTH, TSF	FAILURE STRAIN, %	CONFINING PRESSURE, PSI
	CLAYEY SAND gray and light gray, very loose to medium dense, fine grain, with shell and interbedded clay seams and layers, wet, slight to high plasticity		SC														
		27		SS	8	4			22								
		28															
		29		SS	10	7			19		42	18	24	14			
		30															
		31		SS	9	5			19								
		32															
		33		SS	10	10			21								
		34															
		35		SS	10	16											
		36															
		37		SS	7	4			22					24			
		38															
		39		SS	7	8			22								
		40															
		41		SS	7	5			23								
		42															
		43		SS	7	8			23								
		44															
		45		SS	6	7			18		25	17	8	18			
		46															
		47		SS	6	10			23								
		48															
	-37.0 50.0	49		SS	6	8			20								
	Boring terminated at 50 feet.	50															

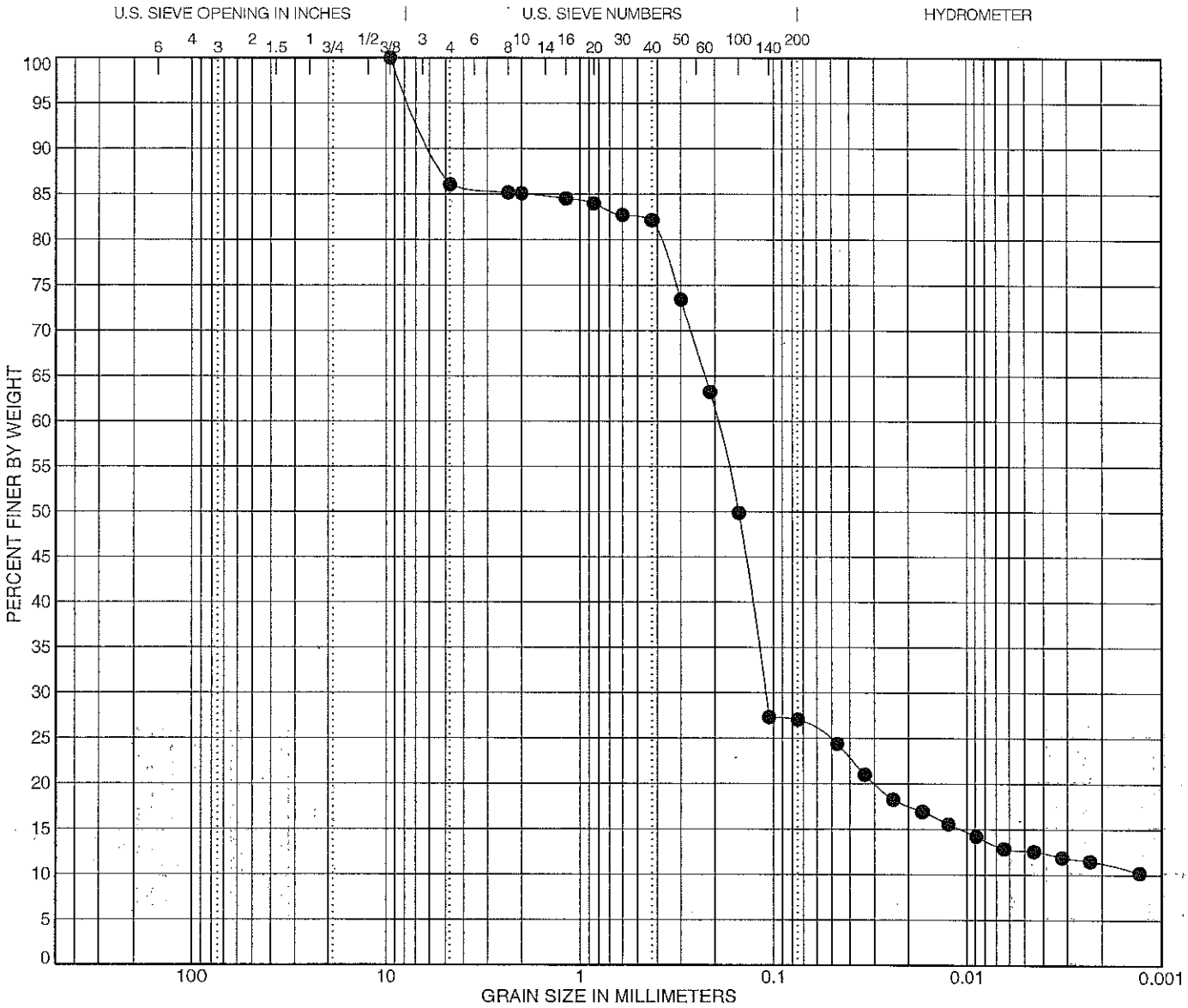
STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES. IN SITU, THE TRANSITION BETWEEN STRATA MAY BE MORE GRADUAL.

REMARKS: **Dry augered to 6 feet; wet rotary thereafter.**

WATER LEVEL OBSERVATIONS			
▽ 5 ft	WS	▼ 5 ft	at 5 min
▼ 5 ft	at 10 min	▼ 5 ft	at 5 min

Terracon

DATE DRILLED	Page 2 of 2
4/9/2010	09-B104
PROJECT NUMBER	EXHIBIT A-
92105186-B	



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	**09-B104**	**0.5**						

D100	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
9.5	**0.151**	**0.11**		**13.9**	**59.0**	**15.9**	**11.2**

Percent Passing the Indicated Sieve

2"	1-1/2"	1"	3/4"	3/8"	#4	#8	#10	#16	#20	#30	#40	#50	#70	#100	#140	#200
				100	**86.1**	**85.2**	**85.1**	**84.5**	**84**	**82.7**	**82.1**	**73.4**	**63.2**	**49.9**	**27.3**	**27**

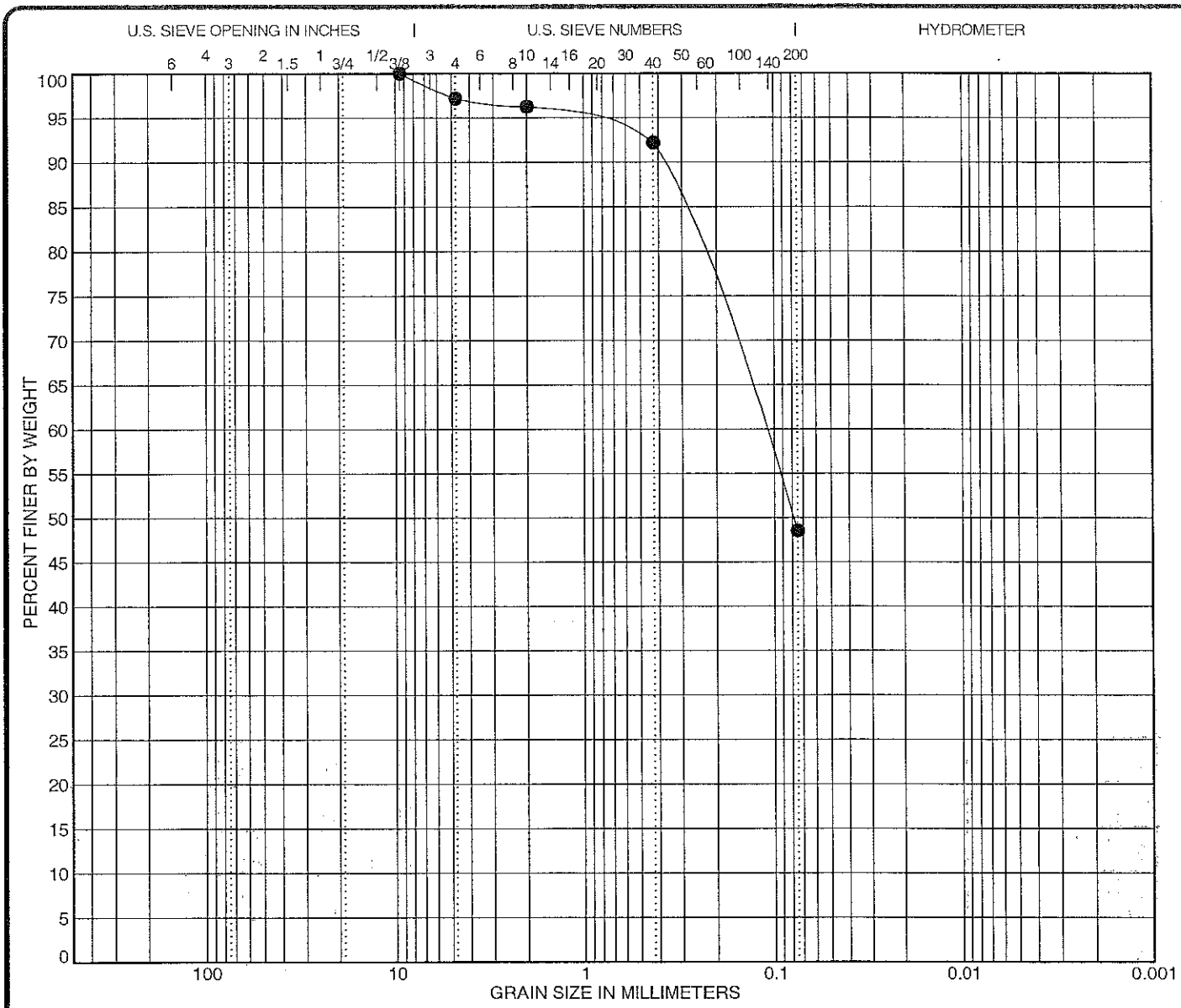
GRAIN SIZE DISTRIBUTION

TO-0012 Pipeline Dredging, Cedar Bayou & Anahuac Channel, Volume II
, Texas
Project Number 92105186-B

Terracon

Terracon Consultants, Inc.
11555 Clay Road, Suite 100
Houston, Texas 77043
Telephone: 713-690-8989
Fax: 713-690-8787

EXHIBIT ?



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	**09-B104**	**4.5**	**CLAYEY SAND(SC)**	**38**	**19**	**19**		

D100	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
9.5	**0.08**			**2.8**	**48.6**	**48.5**	

Percent Passing the Indicated Sieve

2"	1-1/2"	1"	3/4"	3/8"	#4	#8	#10	#16	#20	#30	#40	#50	#70	#100	#140	#200
				100	**97.2**		**96.2**				**92.2**					**48.5**

GRAIN SIZE DISTRIBUTION

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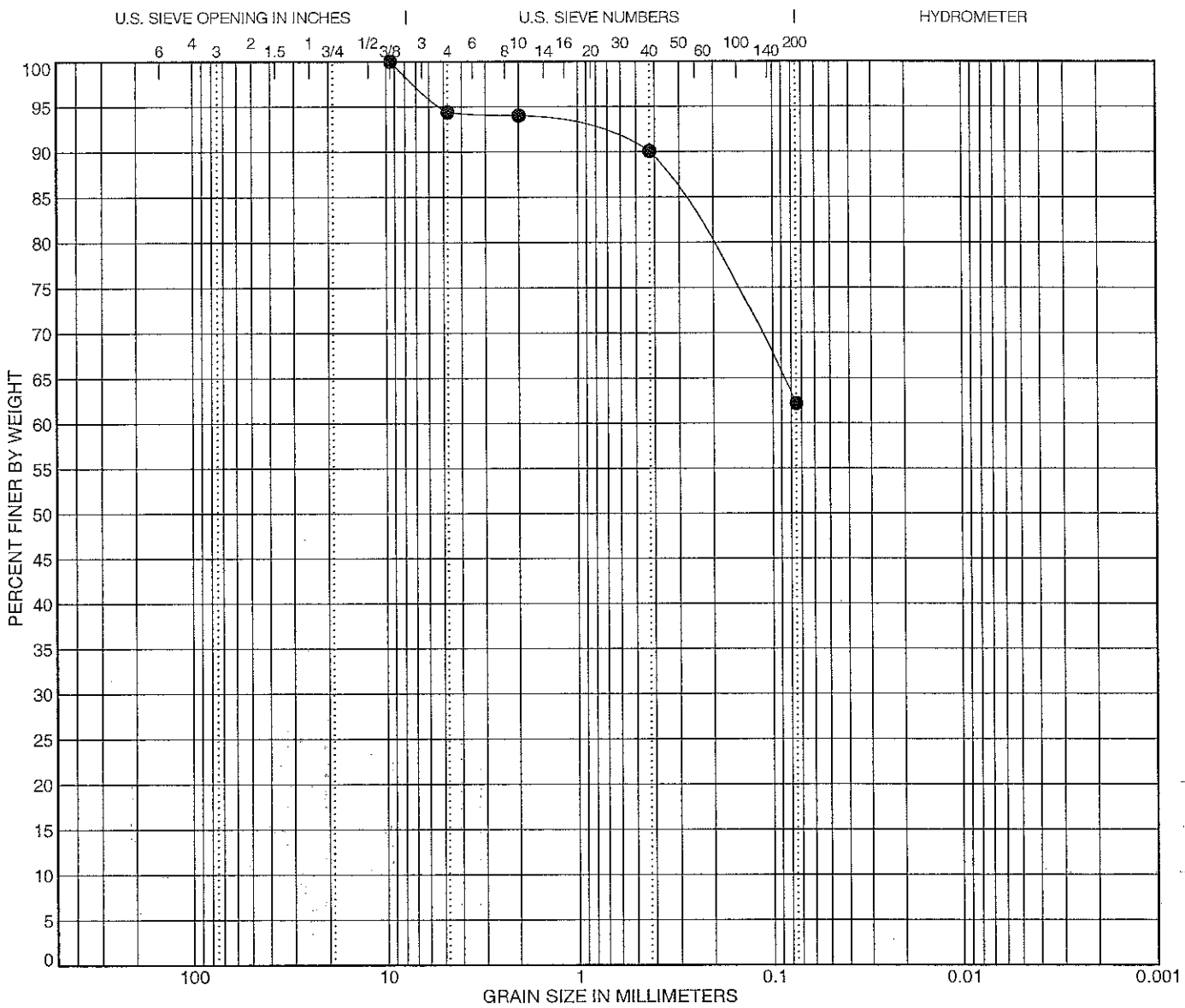

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	**09-B104**	**8.5**	**SANDY FAT CLAY(CH)**	**52**	**19**	**33**		

D100	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
9.5				**5.6**	**32.2**	**62.2**	

Percent Passing the Indicated Sieve

2"	1-1/2"	1"	3/4"	3/8"	#4	#8	#10	#16	#20	#30	#40	#50	#70	#100	#140	#200
				100	**94.4**		**94**				**90.1**					**62.2**

GRAIN SIZE DISTRIBUTION

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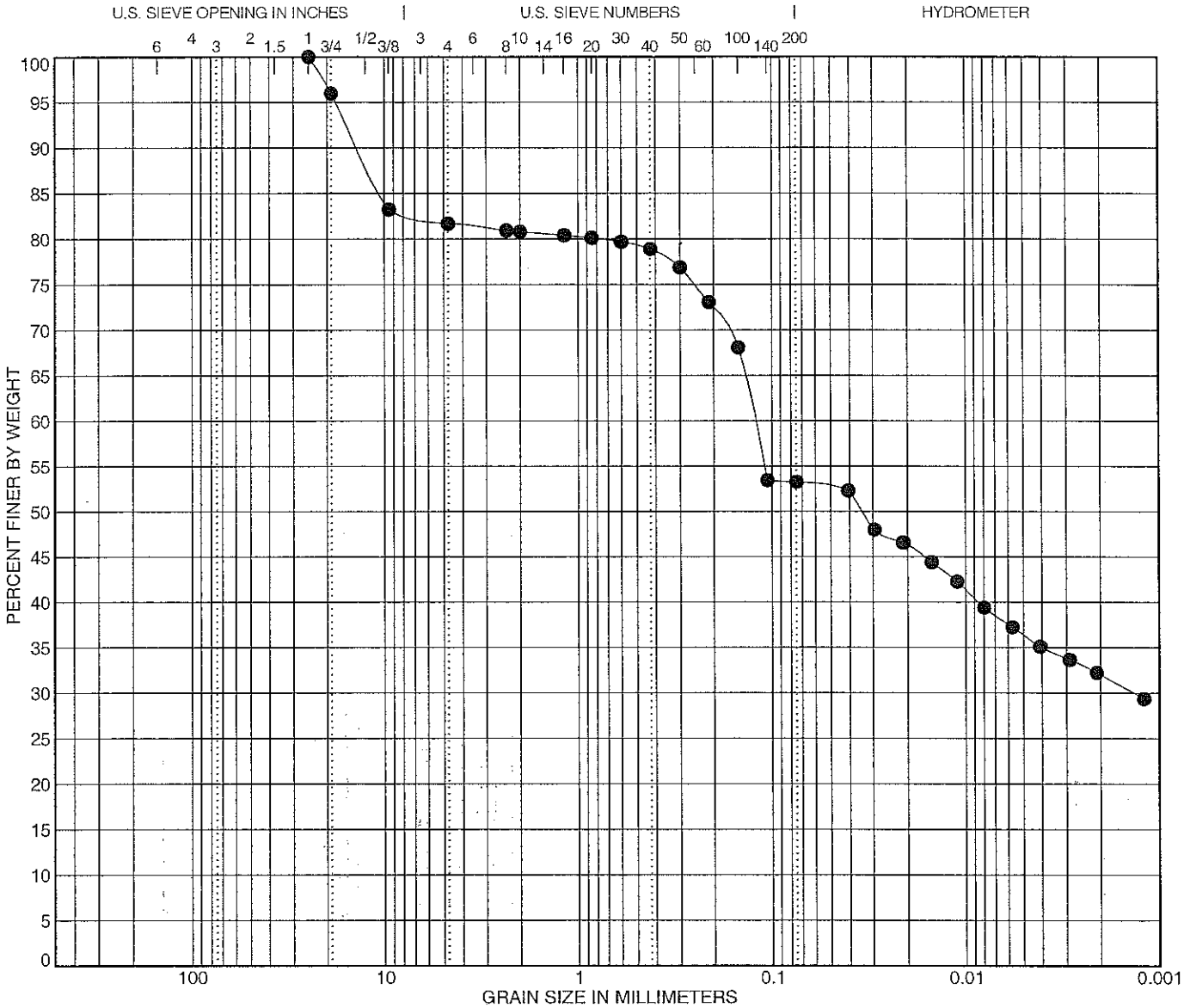

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	**09-B104**	**14.5**	**SANDY FAT CLAY with GRAVEL(CH)**	**50**	**17**	**33**		

D100	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
25	**0.034**	**0.001**		**18.3**	**28.4**	**21.3**	**32.0**

Percent Passing the Indicated Sieve

2"	1-1/2"	1"	3/4"	3/8"	#4	#8	#10	#16	#20	#30	#40	#50	#70	#100	#140	#200
		100	**96**	**83.2**	**81.7**	**80.9**	**80.8**	**80.4**	**80.1**	**79.7**	**78.9**	**76.9**	**73**	**68.1**	**53.4**	**53.3**

GRAIN SIZE DISTRIBUTION

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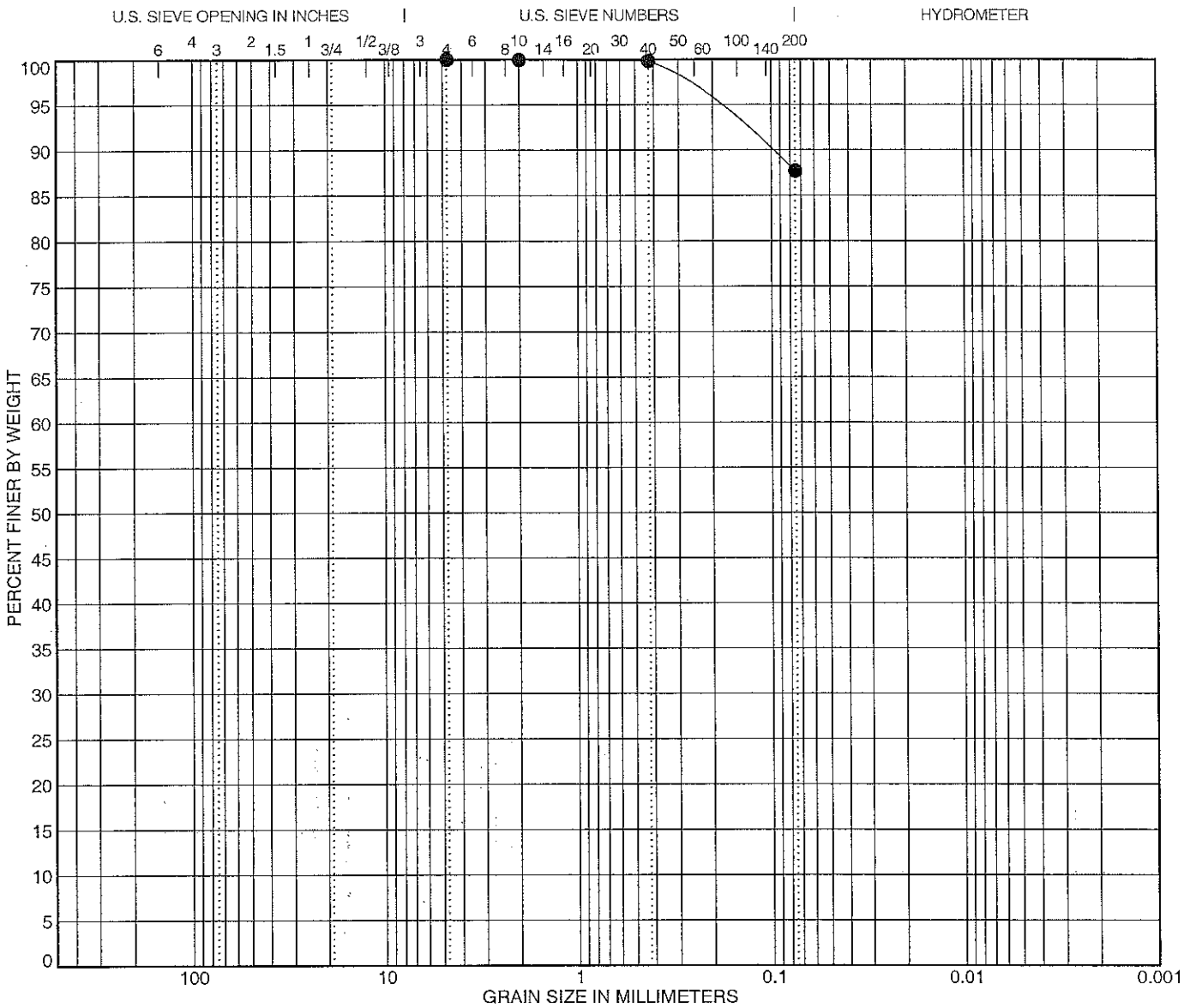

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	**09-B104**	**22.5**	**FAT CLAY(CH)**	**82**	**24**	**58**		

D100	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
4.75				**0.0**	**12.3**	**87.7**	

Percent Passing the Indicated Sieve

2"	1-1/2"	1"	3/4"	3/8"	#4	#8	#10	#16	#20	#30	#40	#50	#70	#100	#140	#200
					100		**99.9**				**99.8**					**87.7**

GRAIN SIZE DISTRIBUTION

TO-0012 Pipeline Dredging, Cedar Bayou & Anahuac Channel, Volume II
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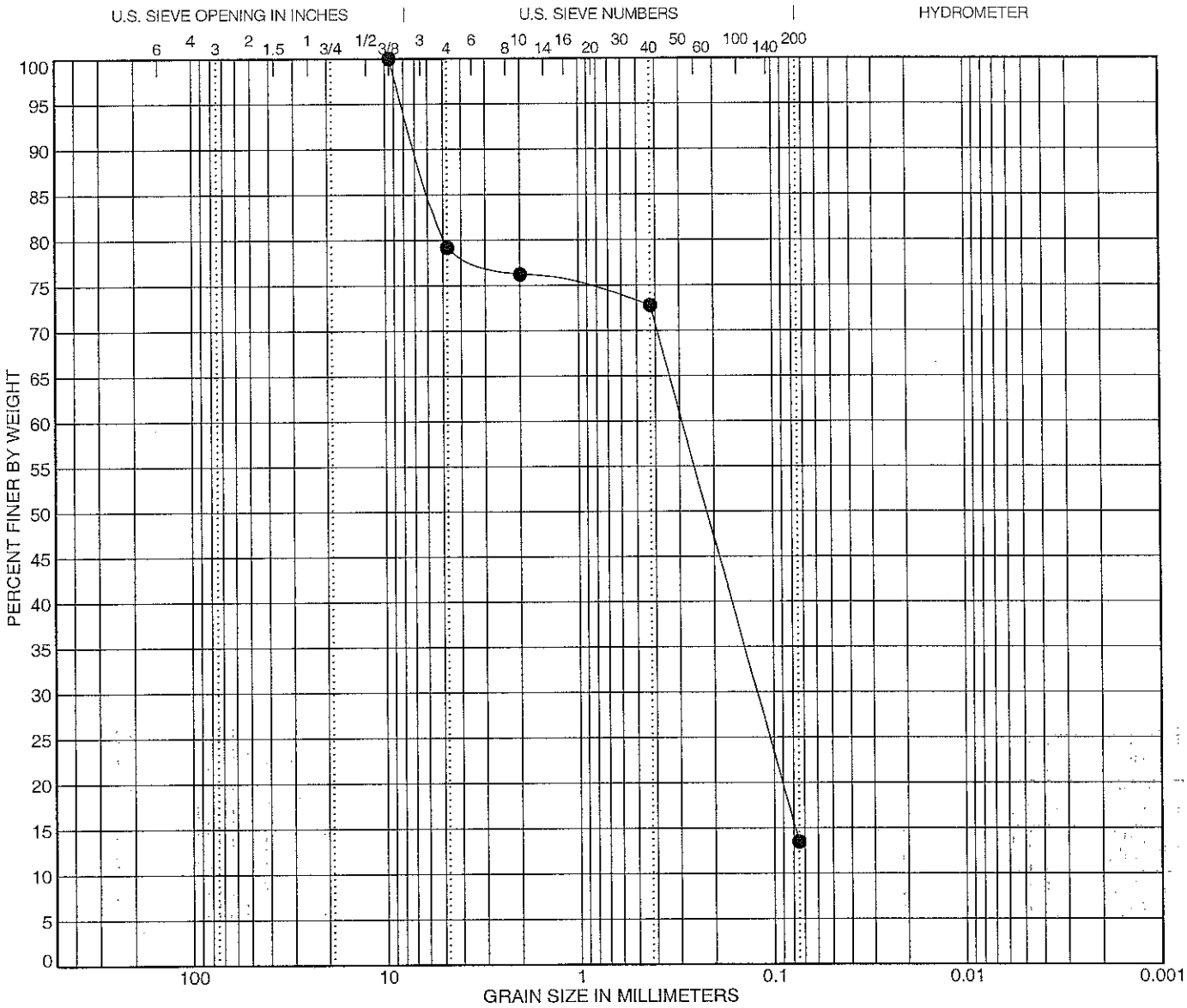

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	**09-B104**	**28.5**	**CLAYEY SAND with GRAVEL(SC)**	**42**	**18**	**24**		

D100	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
9.5	**0.218**	**0.122**		**20.8**	**65.7**	**13.5**	

Percent Passing the Indicated Sieve

2"	1-1/2"	1"	3/4"	3/8"	#4	#8	#10	#16	#20	#30	#40	#50	#70	#100	#140	#200
				100	**79.2**		**76.2**				**72.8**					**13.5**

GRAIN SIZE DISTRIBUTION

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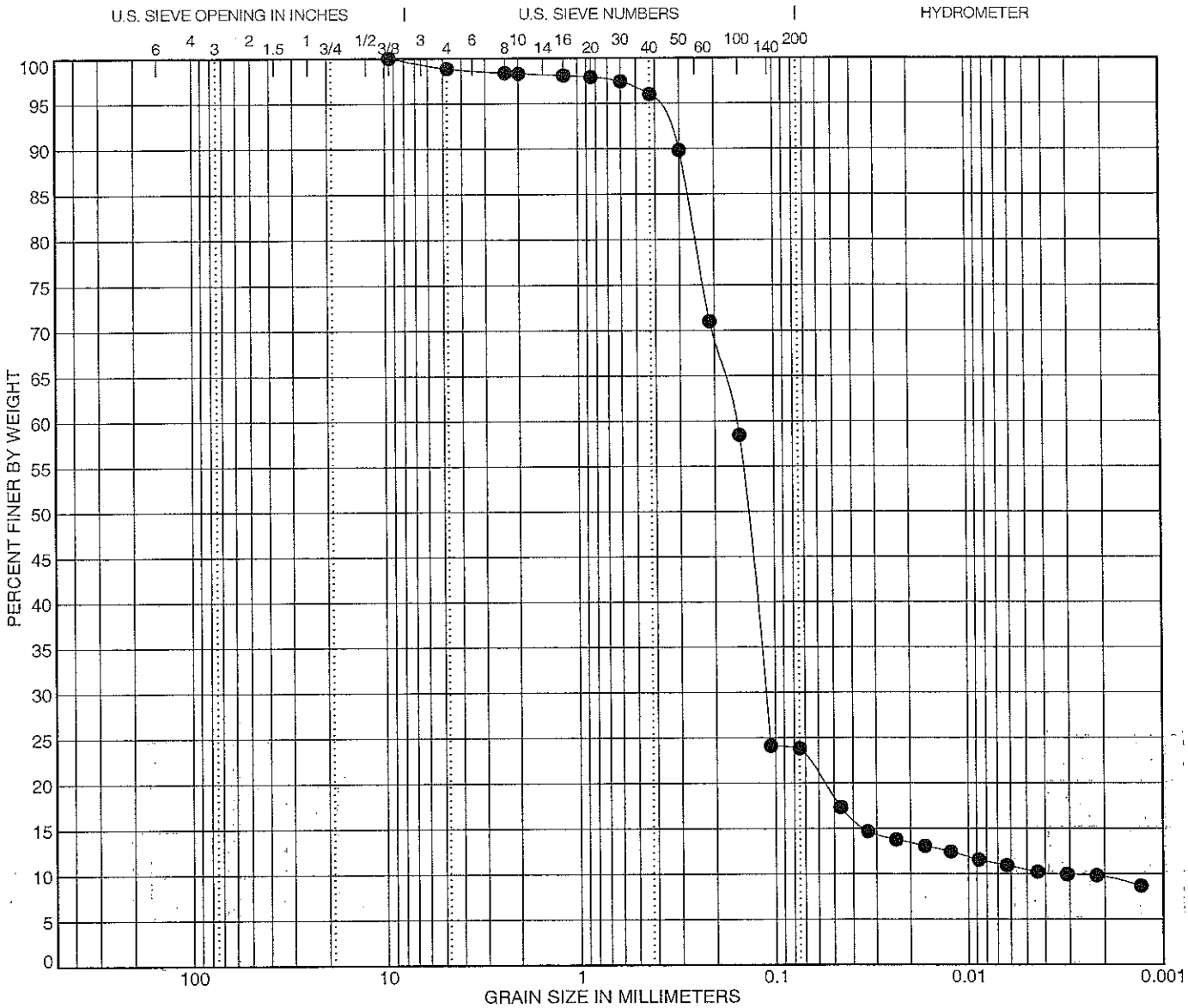

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	**09-B104**	**36.5**					**24.19**	**46.83**

D100	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
9.5	**0.138**	**0.113**	**0.003**	**1.2**	**75.0**	**14.2**	**9.6**

Percent Passing the Indicated Sieve

2"	1-1/2"	1"	3/4"	3/8"	#4	#8	#10	#16	#20	#30	#40	#50	#70	#100	#140	#200
				100	**98.8**	**98.4**	**98.3**	**98.1**	**97.9**	**97.4**	**96**	**89.8**	**71**	**58.4**	**24.1**	**23.8**

GRAIN SIZE DISTRIBUTION

TO-0012 Pipeline Dredging, Cedar Bayou & Anahuac Channel, Volume II
, Texas
Project Number 92105186-B

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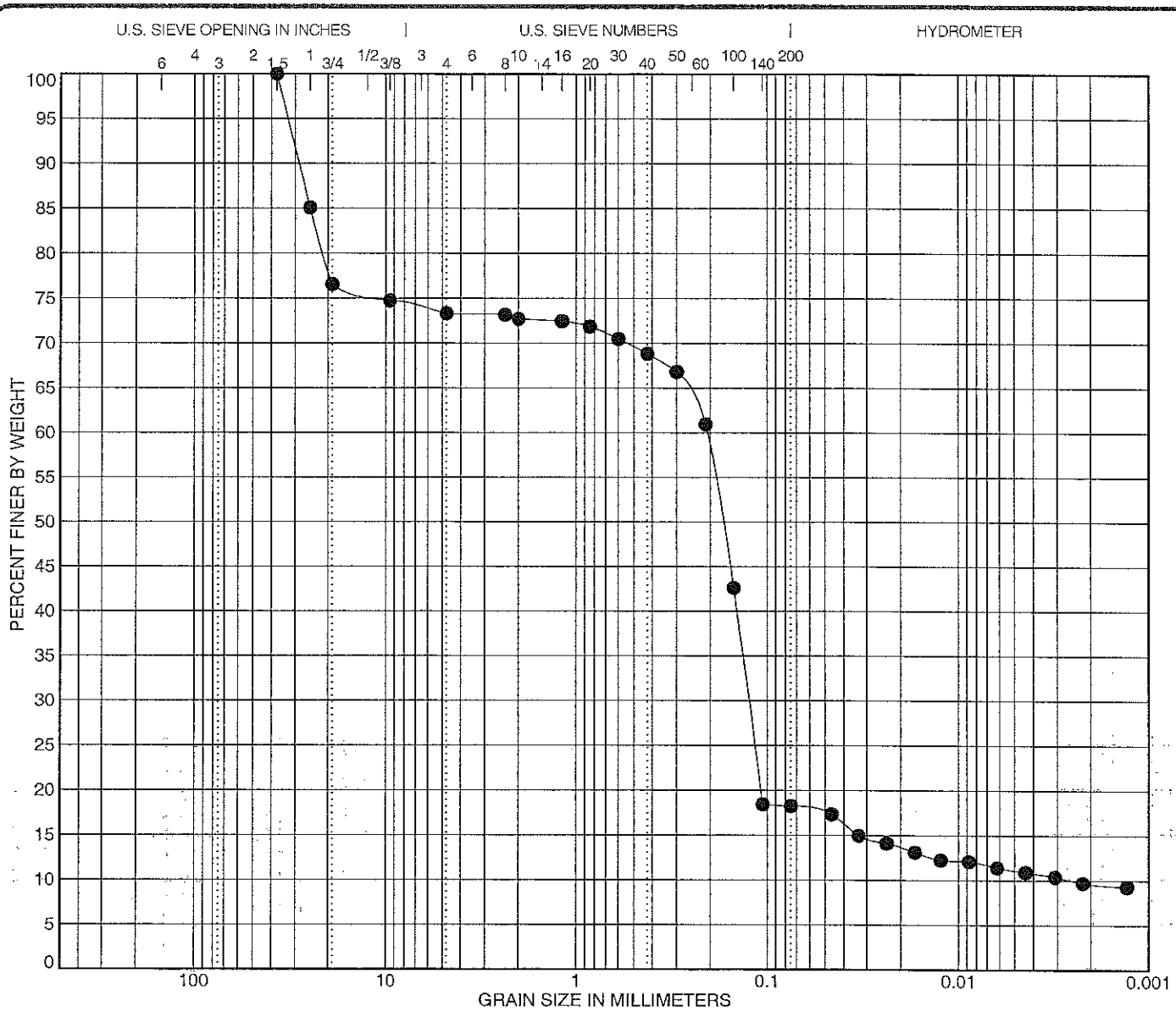

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	LL	PL	PI	Cc	Cu
● 09-B104	44.5	**CLAYEY SAND with GRAVEL(SC)**	25	17	8	29.53	81.77

D100	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
37.5	0.172	0.125	0.003	26.7	55.0	8.6	9.6

Percent Passing the Indicated Sieve

2"	1-1/2"	1"	3/4"	3/8"	#4	#8	#10	#16	#20	#30	#40	#50	#70	#100	#140	#200
	100	85.1	76.5	74.7	73.3	73.2	72.7	72.4	71.8	70.5	68.8	66.8	60.9	42.6	18.4	18.2

GRAIN SIZE DISTRIBUTION

TO-0012 Pipeline Dredging, Cedar Bayou & Anahuac Channel, Volume II
, Texas
Project Number 92105186-B

Terracon

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Houston, Texas 77043
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Fax: 713-690-8787

EXHIBIT ?

Project name: TO-0012 Pipeline Dredging, Volume II, Atkinson Island, PA 16 | Client: USACE, Galveston District | Terracon Project # : 92105186-B

Boring	Depth	Field tests			Atterberg Limits			Grain Size Analysis														USCS Symbol (ASTM 2487)	Wc	γd
		PP	TV	SPTn	LL	PL	PI	Percent Pasing Sieve																
								3/4"	3/8"	4	8	10	16	20	30	40	50	70	100	140	200			
	ft	tsf	tsf	bl/ft	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%		%	pcf
09-B104	0-2			25					100	86	85	85	85	84	83	82	73	63	50	27	27	SM*	3	
	2-4			9																		SM**	8	
	4-6			15	38	19	19		100	97		96				92					49	SC	19	
	6-8			45																		SC**	20	
	8-10			8	52	19	33		100	94		94				90					62	CH	26	
	10-12			4																		CH**	34	
	12-14			2																		CH**	28	
	14-16			3	50	17	33	96	83	82	81	81	80	80	80	79	77	73	68	53	53	CH	41	
	16-18			2																		CH**	51	
	18-20			20																		CH**	43	
	20-22			0																		CH**	49	
	22-24			0	82	24	58			100		100				100					88	CH	45	
	24-26			6																		CH**	48	
	26-28			4																		SC**	22	
	28-30			7	42	18	24		100	79		76				73					14	SC	19	
	30-32			5																		SC**	19	
	32-34			10																		SC**	21	
	34-36			16																		SC**		
	36-38			4				100	100	99	98	98	98	98	97	96	90	71	58	24	24	SC*	22	
	38-40			8																		SC**	22	
	40-42			5																		SC**	23	
	42-44			8																		SC**	23	
	44-46			7	25	17	8	77	75	73	73	73	72	72	71	69	67	61	43	18	18	SC	18	
	46-48			10																		SC**	23	
	48-50			8																		SC**	20	
09-B105	0-2			10																		SM**	4	
	2-4			10								100				100					24	SM*	22	
	4-6			14																		CH**	35	
	6-8			8	84	25	59		100	98		97				96					83	CH	34	
	8-10			6																		SM**	30	
	10-12			8					100	100	100	100	99	99	99	97	91	81	66	37	36	SM*	25	
	12-14			4																		CH**	38	
	14-16			8	86	25	61		100	99		98				98					87	CH	38	
	16-18			6																		CH**	33	
	18-20			4						100	100	100	98	96	94	92	90	87	83	62	61	CH*	48	
	20-22			7																		CH**	65	
	22-24			7																		CH**	49	
	24-26			6																		CH**	78	
	26-28			5	63	20	43					100				100					97	CH	77	
	28-30			10																		CH**	71	
	30-32			8					100	88		85				82					27	SM*	28	
	32-34			9																		SM**	24	
	34-36			8	72	21	51			100		100				98					82	CH	65	
	36-38			13																		SC**	19	
	38-40			6																		SC**	21	
	40-42			6																		SC**	22	
	42-44			7	25	16	9		100	75		73				71					26	SC	21	
	44-46			18																		SC**	24	
	46-48			14																		SC**	24	
	48-50			11																		SC**	21	

Boring	Depth	Strength tests: Direct Shear Test					Unconfined Compression				UU Triaxial Test				CU Triaxial Test						
		C	φ	Wc	γd	Symbol	C	Wc	γd	Symbol	C	Wc	γd	Symbol	C	φ	c'	φ'	Wc	γd	Symbol
	ft	ksf	°	%	pcf		ksf	%	pcf		ksf	%	pcf		ksf	°	ksf	°	%	pcf	
09-B104	0-2																				
	2-4																				
	4-6																				
	6-8																				
	8-10																				
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	12-14																				
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