BORING LOG NO. 09-B100

CLIENT:	USACE Galveston District Galveston, Texas	PROJECT:	TO-0012 Pipeline Dredging, Cedar Bayou & Anahuac Channel, Volume II
BORING LOCATION:	N: 689623.44 E: 3279826.068	SITE:	Atkinson Island PA16 Texas

Approx. Surface Elevation: 8.2 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: FAT CLAY gray and brown, very soft to stiff, with broken shell and sand seams, wet, very high plasticity	1	CH	SS	7	0			37		70	22	48	88			
		3		SS	7	5			31								
		5		SS	8	9			33								
	0.2 / 8.0	7		SS	10	10			51								
	FILL: SILTY SAND gray, very loose to loose, fine grain, with broken shell, clay pockets and scattered organic matter, wet, none to slight plasticity	9	SM	SS	11	6			21				NP	17			
		11		SS	9	9			44								
	-5.3 / 13.5	13		SS	10	3			26								
	FAT CLAY gray and dark gray, soft to medium stiff, with scattered shell, wet, very high plasticity	15	CH	SS	8	4			54								
		17		SS	6	6			74								
		19		SS	12	3			70								
		21		SS	12	3			60		105	30	75	88			
		23		SS	10	3			59								
	-17.8 / 26.0	25		SS	12	3			70								

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 4 feet; wet rotary thereafter.**

WATER LEVEL OBSERVATIONS			
▽ 3 ft	WS	▼ 3 ft	at 5 min
▽ 3 ft	at 10 min	▼ 3 ft	at 5 min

Terracon

DATE DRILLED	Page 1 of 2
4/12/2010	09-B100
PROJECT NUMBER 92105186-B	EXHIBIT A-

BORING LOG NO. 09-B100

CLIENT:	USACE Galveston District Galveston, Texas	PROJECT:	TO-0012 Pipeline Dredging, Cedar Bayou & Anahuac Channel, Volume II
BORING LOCATION:	N: 689623.44 E: 3279826.068	SITE:	Atkinson Island PA16 Texas

Approx. Surface Elevation: 8.2 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
	SILTY SAND gray, very loose to loose, fine grain, with broken shell and clay pockets, wet, slight plasticity	27	SM	SS	12	5			31								
		28															
		29		SS	9	4			25					20			
		30															
		31		SS	9	5			26								
	-23.8 32.0	32															
	CLAYEY SAND gray, loose, fine grain, with shell and clay pockets, wet, medium to high plasticity	33	SC	SS	10	6			32								
	-25.8 34.0	34															
	SILTY SAND gray, very loose to medium dense, fine grain, with broken shell, wet, none to slight plasticity	35	SM	SS	8	9			23				NP	25			
		36															
		37		SS	7	9			24								
	- with clay 38 to 42 feet	38															
		39		SS	8	3			25								
		40															
		41		SS	8	3			23					22			
		42															
	- with 6 inches thick shell layer at 43 feet	43		SS	6	13			25					20			
	-35.8 44.0	44															
	CLAYEY SAND gray, medium dense, fine grain, with broken shell, wet, slight plasticity	45	SC	SS	10	22			23								
		46															
		47		SS	10	14			23		25	15	10	34			
		48															
		49		SS	8	11			24								
	-41.8 50.0	50															
	Boring terminated at 50 feet.																

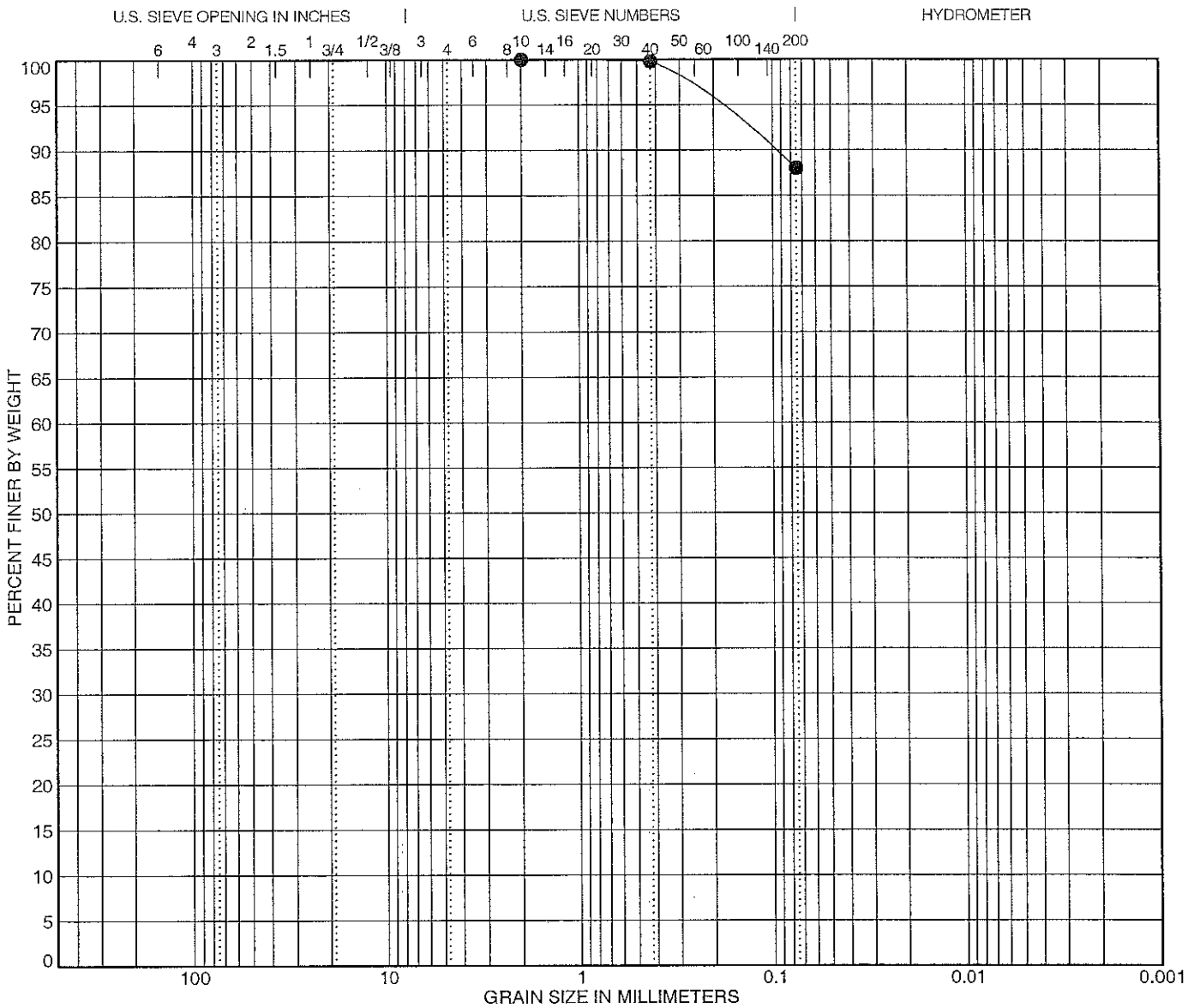
STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES. IN SITU, THE TRANSITION BETWEEN STRATA MAY BE MORE GRADUAL.

REMARKS: Dry augered to 4 feet; wet rotary thereafter.

WATER LEVEL OBSERVATIONS			
▽ 3 ft	WS	▼ 3 ft	at 5 min
▼ 3 ft	at 10 min	▼ 3 ft	at 5 min

Terracon

DATE DRILLED	Page 2 of 2
4/12/2010	09-B100
PROJECT NUMBER 92105186-B	EXHIBIT A-



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	09-B100	0.5	**FAT CLAY(CH)**	**70**	**22**	**48**		

D100	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
2				**0.0**	**12.0**	**88.0**	

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				**99.8**					**88**

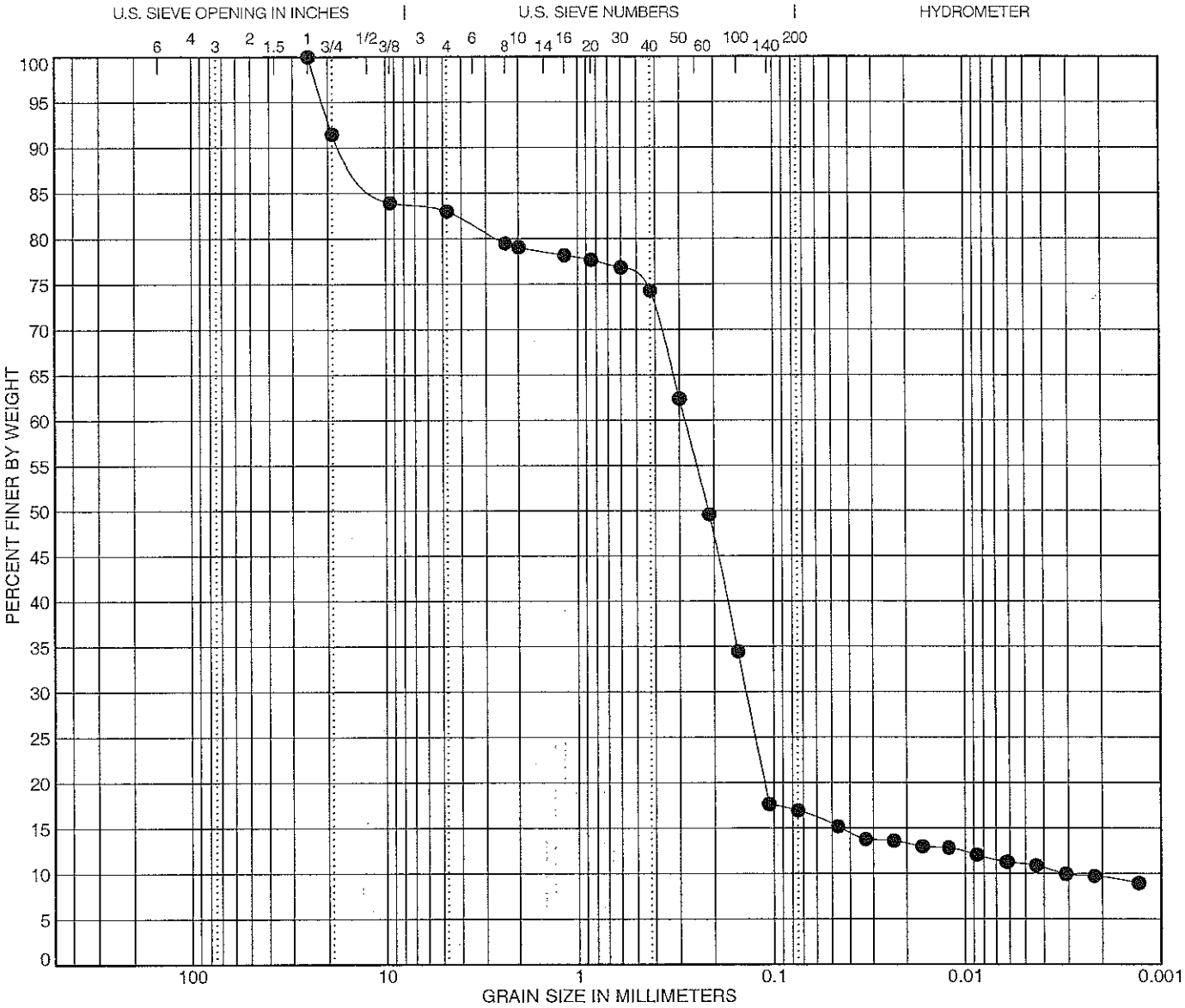
GRAIN SIZE DISTRIBUTION

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
a



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	**09-B100**	**8.5**					**21.02**	**88.78**

D100	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
25	**0.214**	**0.137**	**0.003**	**17.0**	**66.1**	**7.4**	**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	**91.5**	**83.9**	**83**	**79.5**	**79**	**78.2**	**77.6**	**76.8**	**74.3**	**62.4**	**49.6**	**34.4**	**17.6**	**16.9**

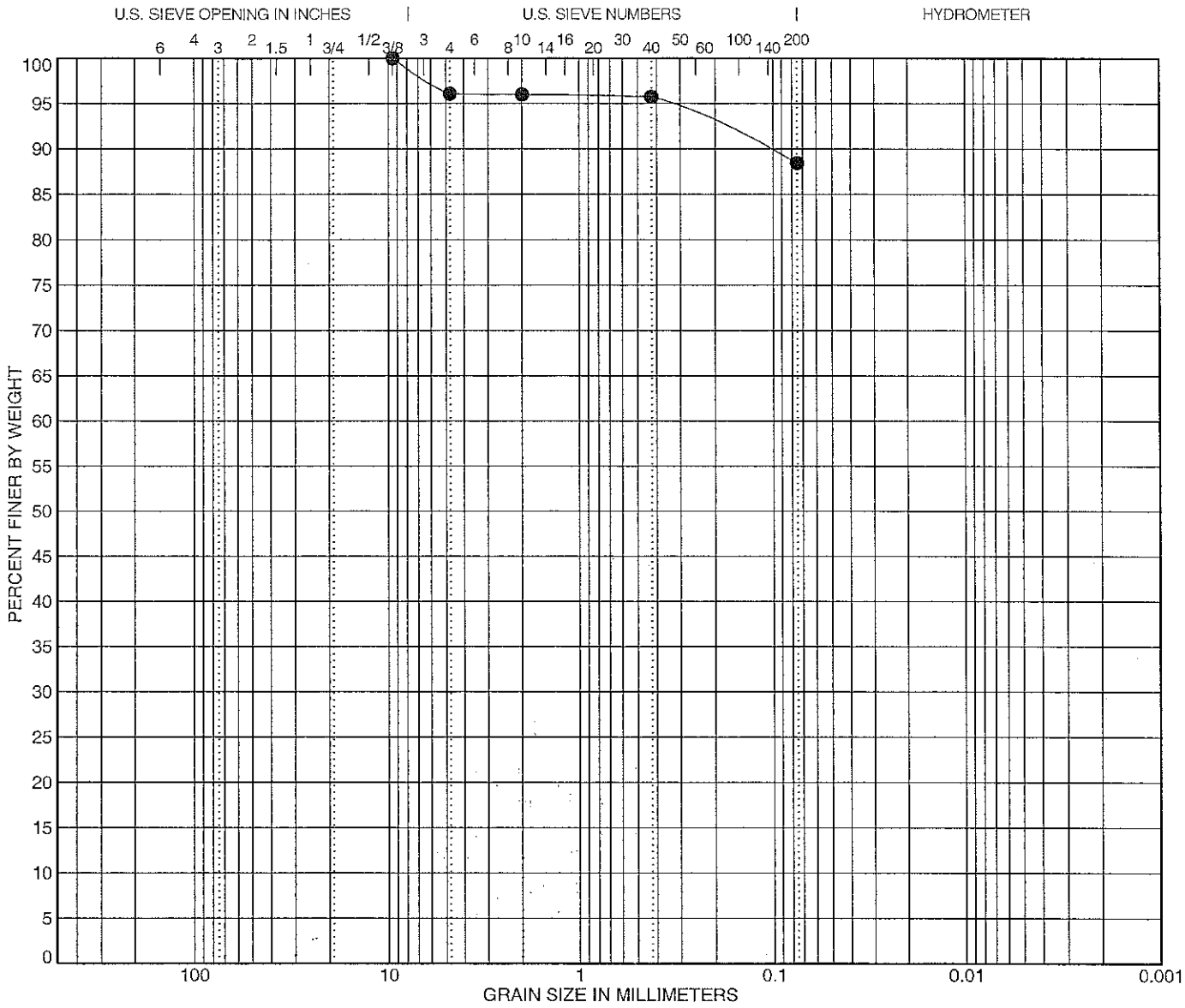
GRAIN SIZE DISTRIBUTION

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 b



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	**09-B100**	**20.5**	**FAT CLAY(CH)**	**105**	**30**	**75**		

D100	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
9.5				**3.9**	**7.6**	**88.4**	

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	**96.1**		**96**				**95.7**					**88.4**

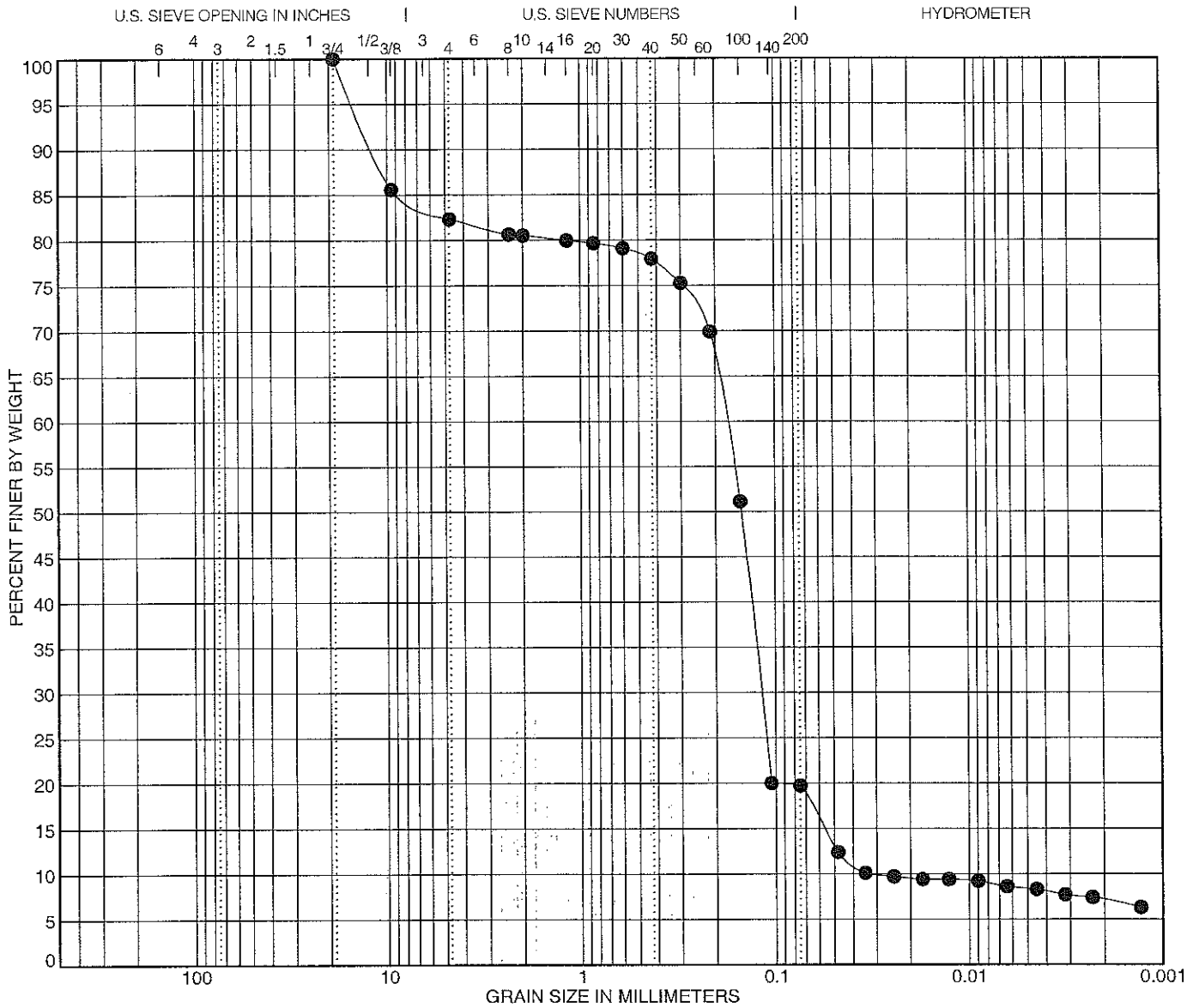
GRAIN SIZE DISTRIBUTION

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 C



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	**09-B100**	**28.5**					**2.51**	**5.58**

D100	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
19	**0.148**	**0.119**	**0.032**	**17.7**	**62.6**	**12.6**	**7.1**

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	**85.6**	**82.3**	**80.6**	**80.5**	**79.9**	**79.7**	**79.1**	**77.9**	**75.3**	**69.9**	**51.1**	**20**	**19.7**

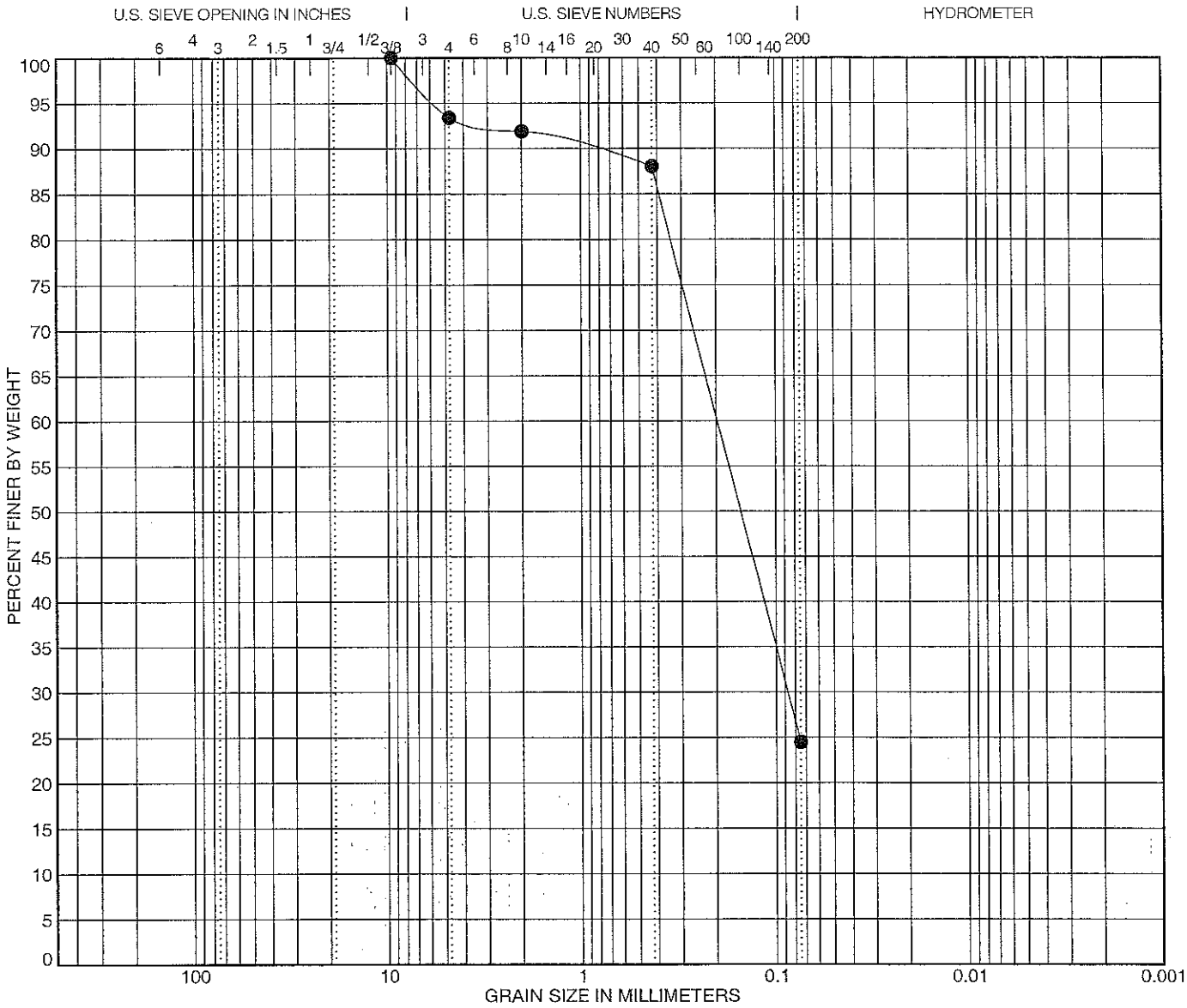
GRAIN SIZE DISTRIBUTION

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 d



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	LL	PL	PI	Cc	Cu
● 09-B100	34.5						

D100	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
9.5	0.151	0.087		6.6	68.9	24.5	

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	93.4		91.9				88					24.5

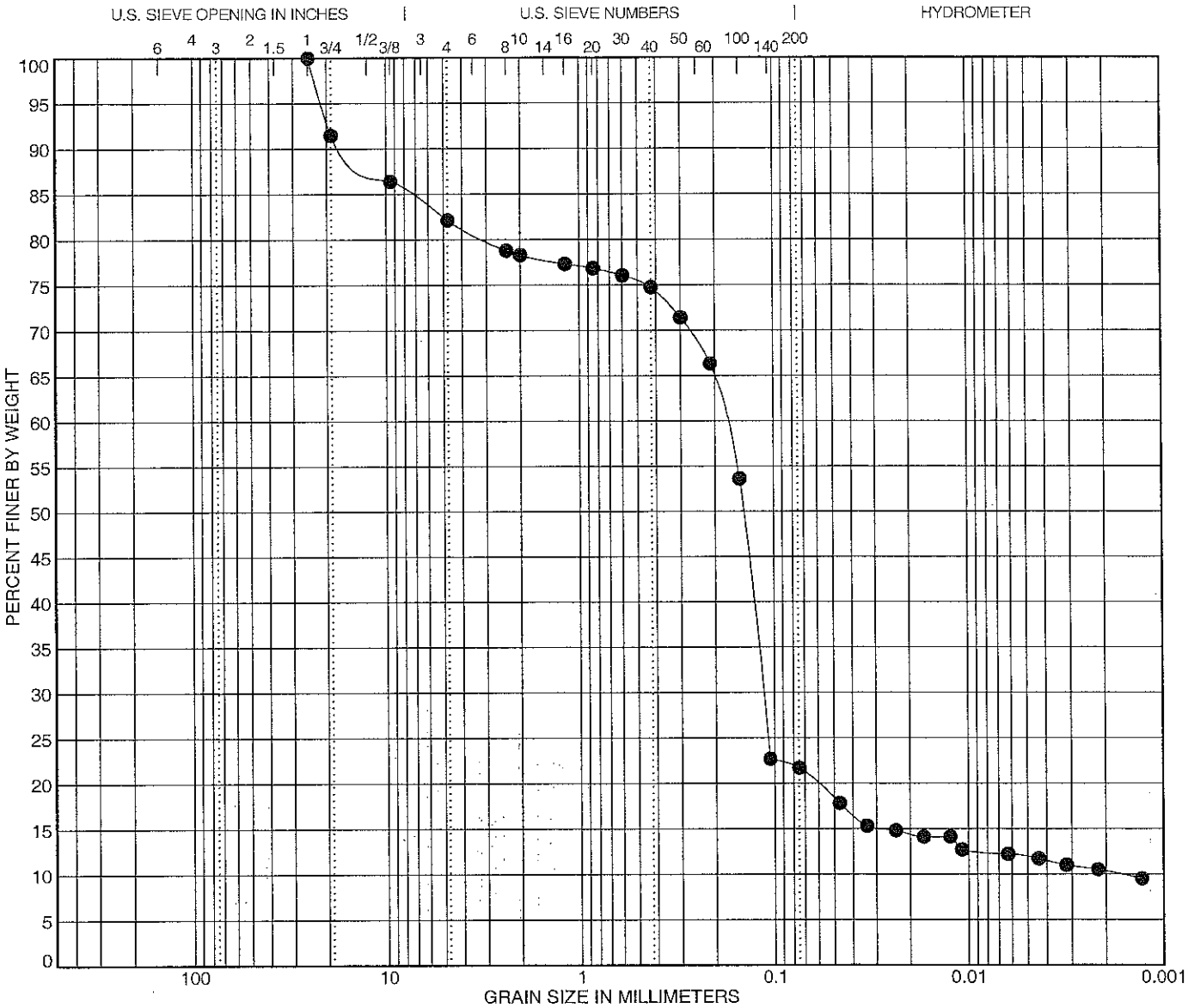
GRAIN SIZE DISTRIBUTION

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
e



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	LL	PL	PI	Cc	Cu
● 09-B100	40.5					43.87	105.57

D100	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
25	0.144	0.115	0.002	17.9	60.4	11.4	10.3

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	91.4	86.4	82.1	78.8	78.3	77.3	76.8	76	74.7	71.4	66.3	53.6	22.7	21.7

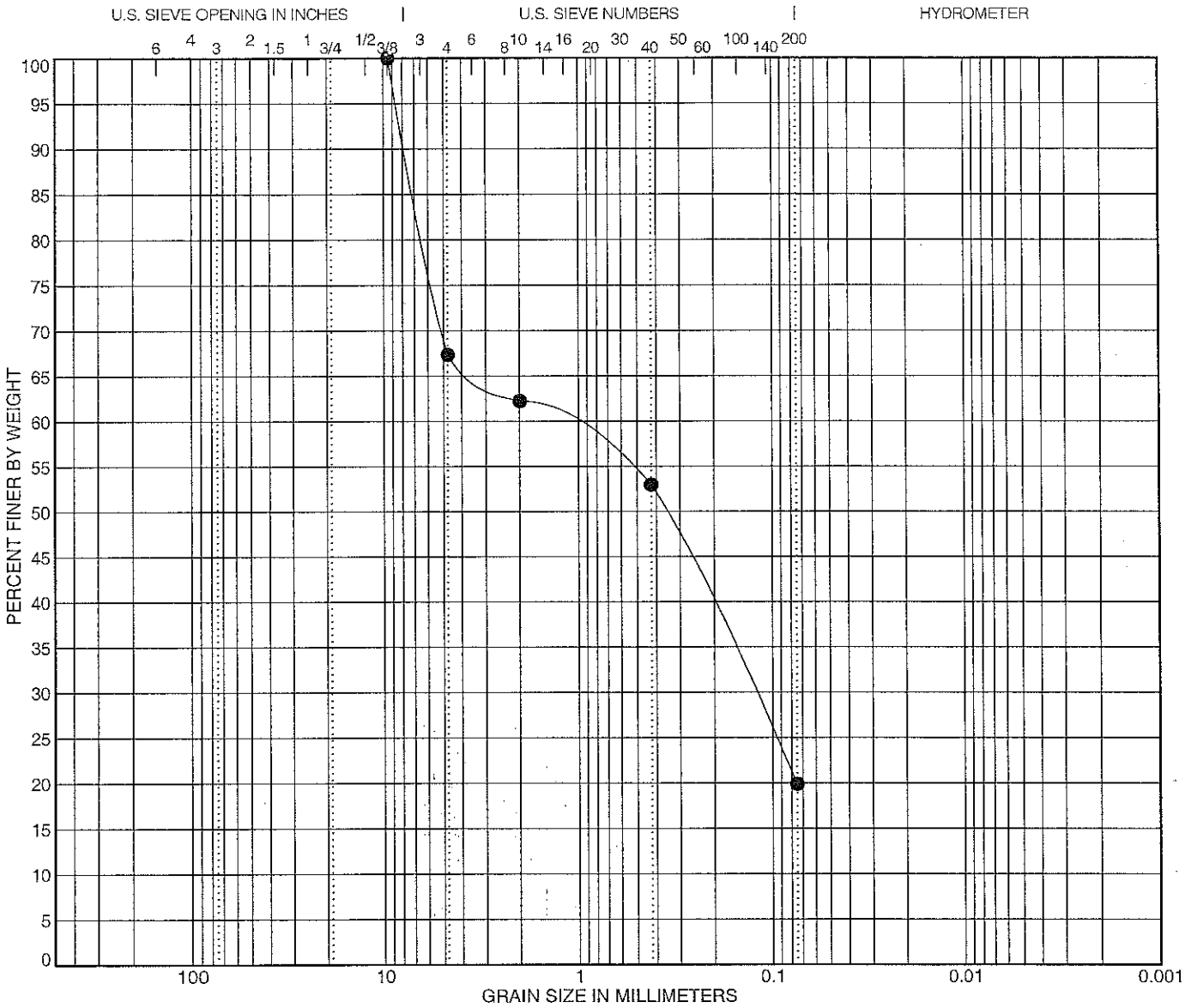
GRAIN SIZE DISTRIBUTION

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
f



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	**09-B100**	**42.5**						

D100	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
9.5	**0.364**	**0.127**		**32.7**	**47.4**	**19.9**	

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	**67.3**		**62.2**				**53**					**19.9**

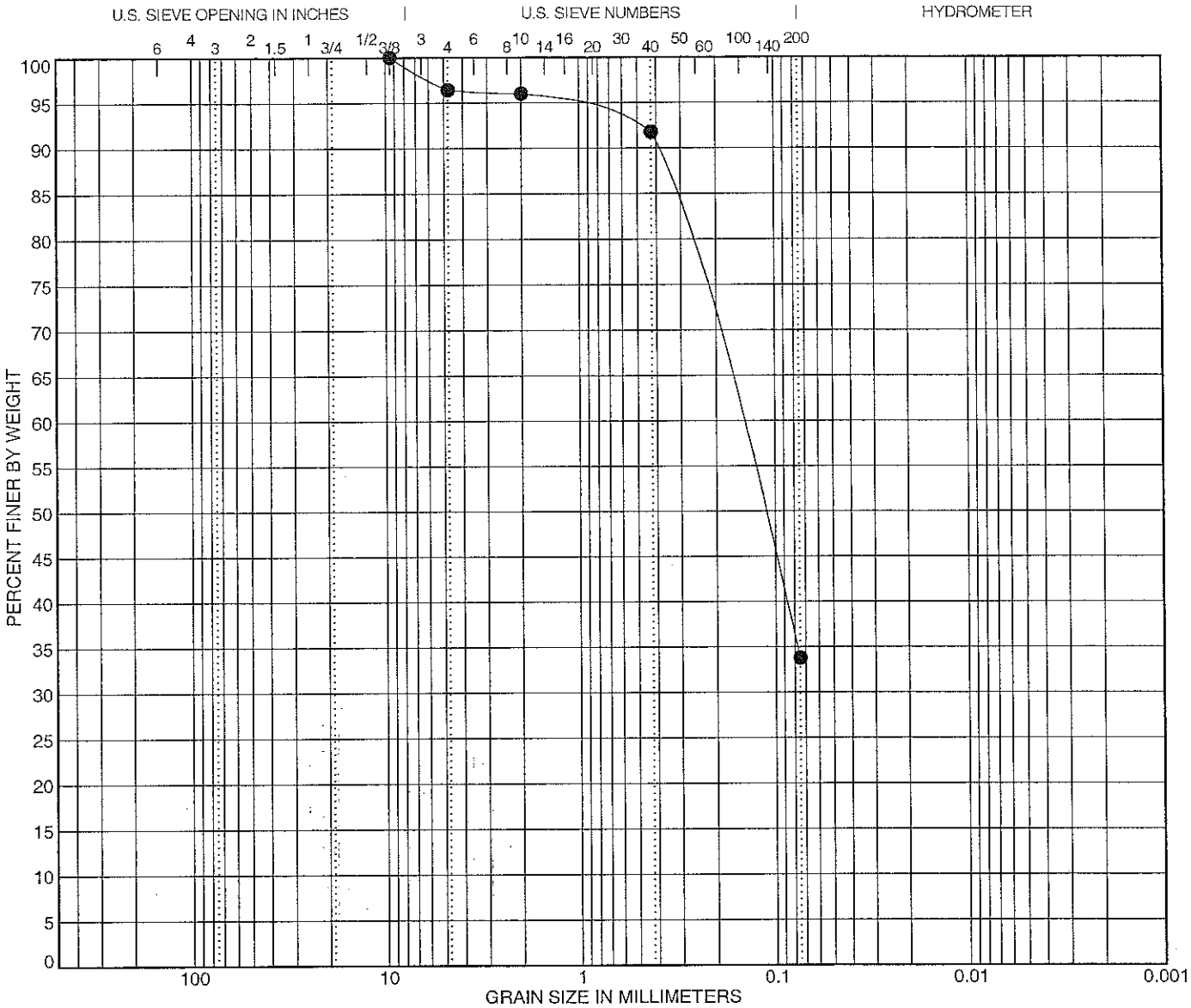
GRAIN SIZE DISTRIBUTION

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 g



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	**09-B100**	**46.5**	**CLAYEY SAND(SC)**	**25**	**15**	**10**		

D100	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
9.5	**0.122**			**3.6**	**62.7**	**33.8**	

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	**96.4**		**96**				**91.8**					**33.8**

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 h

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	γ_d	Strength tests																						
								Percent Pasing Sieve																	Direct Shear Test					Unconfined Compression				UU Triaxial Test				CU Triaxial Test						
		PP	TV	SPTn	LL	PL	PI	3/4"	3/8"	4	8	10	16	20	30	40	50	70	100	140	200				C	φ	Wc	γ_d	Symbol	C	Wc	γ_d	Symbol	C	Wc	γ_d	Symbol	C	φ	c'	φ'	Wc	γ_d	Symbol
	ft	tsf	tsf	bl/ft	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%		%	pcf	ksf	°	%	pcf		ksf	%	pcf		ksf	%	pcf		ksf	°	ksf	°	%	pcf	
09-B100	0-2			0	70	22	48					100				100					88	CH	37																						
	2-4			5																		CH**	31																						
	4-6			9																		CH**	33																						
	6-8			10																		CH**	51																						
	8-10			6	NP	NP	NP	92	84	83	80	79	78	78	77	74	62	50	34	18	17	SM	21																						
	10-12			9																		SM**	44																						
	12-14			3																		SM**	26																						
	14-16			4																		SM**	54																						
	16-18			6																		CH**	74																						
	18-20			3																		CH**	70																						
	20-22			3	105	30	75		100	96		96				96					88	CH	60																						
	22-24			3																		CH**	59																						
	24-26			3																		CH**	70																						
	26-28			5																		SM**	31																						
	28-30			4				100	86	82	81	81	80	80	79	78	75	70	51	20	20	SM*	25																						
	30-32			5																		SM**	26																						
	32-34			6																		SC**	32																						
	34-36			9	NP	NP	NP	100	100	93		92				88					25	SM	23																						
	36-38			9																		SM**	24																						
	38-40			3																		SM**	25																						
	40-42			3				91	86	82	79	78	77	77	76	75	71	66	54	23	22	SM*	23																						
	42-44			13					100	67		62				53					20	SM*	25																						
	44-46			22																		SC**	23																						
	46-48			14	25	15	10	100	100	96		96				92					34	SC	23																						
	48-50			11																		SC**	24																						
09-B101	0-2			0																		SC**	27																						
	2-4			0	50	16	34			100		100				94					23	SC	21																						
	4-6			0																		SC**	51																						
	6-8			10																		SC**	30																						
	8-10			3								100	100	100	100	99	97	88	69	33	32	SM*	28																						
	10-12			0																		CH**	38																						
	12-14			0						100		99				98					81	CH*	60																						
	14-16			19																		CH**	37																						
	16-18			15																		CH**	43																						
	18-20			5						100	100	100	99	99	99	98	92	81	58	31	31	SM*	34																						
	20-22			8																		SM**	24																						
	22-24			8	29	16	13		100	80		77				75					62	CL	25																						
	24-26			4																		CL**	34																						
	26-28			3																		CH**	32																						
	28-30			3					100	87		84				79					50	CH*	51																						
	30-32			6																		SM**	26																						
	32-34			4				93	87	84	82	82	81	81	80	80	77	74	57	40	40	SM*	21																						
	34-36			6																		SM**	39																						
	36-38			6	NP	NP	NP		100	72		67				62					17	SM	20																						
	38-40			6																		SM**	25																						
	40-42			5																		SM**	23																						
	42-44			5	29	14	15			100		100				97					44	SC	25																						
	44-46			7																		SC**	24																						
	46-48			10																		SC**	23																						
	48-50			11																		SC**	22																						