REPORT OF THE
GEOTECHNICAL INVESTIGATION

SAN CARLOS FLUME
TAMPA, FLORIDA

Driggers Engineering Services Incorporated

DRIGGERS ENGINEERING SERVICES INCORPORATED
Geotechnical Engineering & Construction Materials Testing

February 8, 2013

City of Tampa - Stormwater Department
306 E. Jackson Street, 6N
Tampa, Florida 33602

Attention: Ms. Barbara Graves
Utility Coordinator

RE: Report of the Geotechnical Investigation
San Carlos Flume Evaluation
Manhattan to Hesperides
Tampa, Florida
Work Order No. 9
Our File: DES 137123

Dear Barbara:

Pursuant to your request and authorization, **DRIGGERS ENGINEERING SERVICES, INC.** has completed the requested geotechnical investigation for the subject project. Presented herein are the results of our studies.

PROJECT DESCRIPTION

The existing flume is an approximately 620 foot long, 4 foot deep concrete lined open ditch between South Manhattan Avenue and South Hesperides Street. It is located behind residential properties along San Carlos Street and San Jose Street. We understand that it was originally constructed in the 1920s or 1930s. The concrete ditch bottom visually appears to be in relatively good condition. However, many of the wall panels show evidence of patching, deflection and possible undermining, with some of the deflection being caused by large trees at the top of the bank. The limits of the drainage easement coincide with the top of the side wall panels, leaving no room for maintenance. No weep holes were noticed in the wall panels, suggesting that the ditch may not be providing local drawdown of groundwater levels along its length.

We understand that it is planned to replace the open ditch with a pipe or box culvert which would tie into existing structures at Manhattan and Hesperides. With only the top of ditch width as the easement, the construction would likely proceed from one end to the other, working on top of the completed pipe or culvert. It is contemplated to remove the side panels; trim or remove trees and vegetation; and leave the bottom concrete slab in place. The new pipe or culvert would be set on the existing concrete bottom slab, thus raising the invert elevation only slightly. Backfill would be placed around and above the new drainage structures to match grades at the adjacent properties.

FIELD INVESTIGATION PROGRAM

To examine the condition of the bottom slab and the underlying soils, seven (7) cores were obtained from the concrete slab utilizing a diamond tipped core barrel. A hand auger classification boring was advanced through each core hole to a maximum depth of 3.2 feet below the ditch bottom. Since there was a small amount of water flowing through the flume, a short piece of casing was used to help minimize water infiltration into the boreholes.

The approximate core and boring locations are illustrated on Plate I in the report attachments. Logs of the borings are presented in the attachments indicating concrete thickness and visual soil descriptions and estimated Unified Soil Classifications with depth.

LABORATORY TESTING PROGRAM

A limited laboratory testing program was also undertaken to aid in soil classification and characterizing the engineering properties of the subsurface soils. Our laboratory tests included grainsize analyses on representative soil samples. In addition, recovered cores which met minimum length to diameter ratio requirements were tested in the laboratory for compressive strength. The results of our laboratory tests are included in the report attachments.

GENERALIZED SUBSURFACE CONDITIONS

CONCRETE DITCH BOTTOM - The concrete ditch bottom ranged in thickness from about 3-1/4 to 7 inches at the core locations. The concrete aggregate typically consisted of a rounded quartz river rock. Core # 7 had a piece of rusted reinforcing steel at the bottom of the core as well as about 1-3/4 inches of a grout topping above the concrete. Compressive strength tests of cores 1, 3 and 4, which were suitable for testing, indicate compressive strengths in the range of 3,150 to 4,190 psi, with an average of 3,813 psi.

SUBSURFACE CONDITIONS - The exploratory borings have identified a 2-3/4 to 19 inch thick layer of river rock gravel with occasional concrete fragments immediately below the bottom slab. There were no voids evident below the slab at the core locations. Soils typically consisted of fine sands comprising the SP Unified classification. Clayey sands with a classification of SC were penetrated at depths of about 2 and 2.7 feet at locations HA-1 and HA-3, respectively. Clayey sands were present immediately below the gravel layer at location HA-6 and at about 2.2 and 2 feet at locations HA-1 and HA-7, respectively. Refusal to hand auger penetration was encountered at depths of 1.5 feet in boring HA-6 and 2.9 feet in boring HA-7, presumably on limestone.

As mentioned, there was a small mount of flow in the ditch at the time of our field investigation in late January of 2013. There no weep holes noticed in the wall panels and no seepage was noticed between the panels.

GEOTECHNICAL EVALUATION AND RECOMMENDATIONS

The existing bottom slab appears suitable for support of a concrete pipe or box culvert. Construction may require temporarily diverting the water to allow placement of the new pipe or box structure segments as well as the placement and compaction of backfill soils.

Backfill soils placed to develop proposed grades should be inorganic, clean to slightly silty fine sands, free of unsuitable debris. Soils with a Unified Soil Classification of SP to SP-SM would certainly be considered suitable. The backfill should be placed in lift thicknesses not exceeding 9 inches with each lift compacted to a density of no less than 95% of the Modified Proctor maximum dry density. Thinner lifts may be required depending upon compactor size and performance. Moisture content within the fill soil should be controlled to within $\pm$2% of optimum as established in ASTM D-1557 to help ensure development of both density and stability during compaction operations.

If groundwater drawdown along the flume is not a concern and new underdrain piping is not provided, we suggest utilization of a lean concrete or "flowable fill" conforming with Florida Department of Transportation Standard Specification Section 121 at least within the lower portion of the backfill against the pipe or box structures where access by compaction equipment would be difficult.

ADDITIONAL GEOTECHNICAL COMMENTS

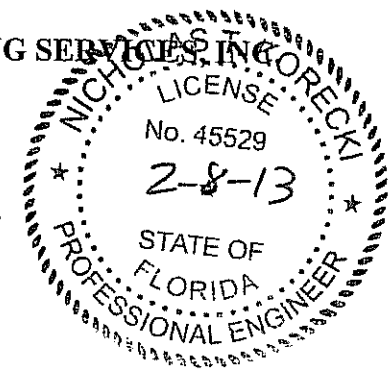
As previously mentioned, no weep holes were noticed in the side wall panels, suggesting that the ditch may not be providing drawdown of groundwater levels along its length. Should groundwater drawdown be a design concern, underdrain piping along the new culvert or pipe, tied into the downstream structure, would be necessary to provide or maintain groundwater drawdown. We would suggest an underdrain detail generally conforming with a Type II underdrain of FDOT Design Standard 286. A woven filter fabric is suggested around the aggregate to help minimize the potential for clogging.

DRIGGERS ENGINEERING SERVICES, INC. appreciates the opportunity to assist you on this project. If you have any questions concerning our findings, please contact the undersigned at your convenience.

Respectfully submitted,
DRIGGERS ENGINEERING SERVICES, INC.

Nicholas T Korecki

Nicholas T. Korecki, P.E.
Senior Geotechnical Engineer
FL Registration No. 45529



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Copies submitted: (3)

APPENDIX

PLATE I - CORE & BORING LOCATION PLAN

HAND AUGER BORING LOGS

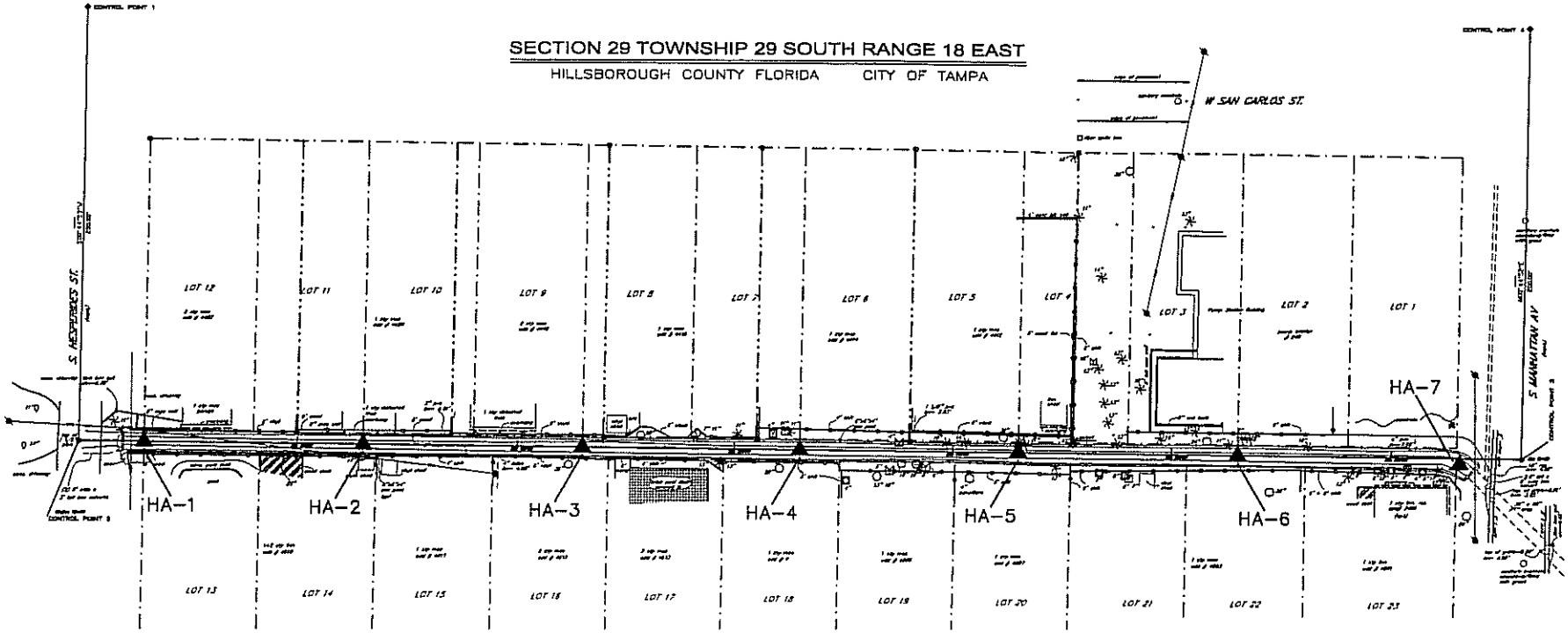
SUMMARY OF LABORATORY TEST RESULTS

GRAINSIZE ANALYSIS

PLATE I - CORE & BORING LOCATION PLAN

SECTION 29 TOWNSHIP 29 SOUTH RANGE 18 EAST

HILLSBOROUGH COUNTY FLORIDA CITY OF TAMPA



LEGEND:

▲ CONCRETE CORE/HAND AUGER BORING LOCATION

N

0 25 50 100

SCALE IN FEET

CAD / ENGINEER	SHEET TITLE	PROJECT NO.	DATE
R.D.B. / N.T.K.	BORING LOCATION PLAN	DES 137123	1/29/13
PREPARED BY	PROJECT NAME	CAD FILE NAME	SHEET NO.
DRIGGERS ENGINEERING SERVICES, INCORPORATED	WEST SAN CARLOS STREET FLUME EVALUATION TAMPA, FLORIDA	N:\ACLTWIN\ PLATE1\137123	PLATE 1

HAND AUGER BORING LOGS

DRIGGERS ENGINEERING SERVICES INCORPORATED

CONCRETE CORE/HAND AUGER BORING LOG

PROJECT: West San Carlos Street Flume Evaluation Tampa, Florida Project No.: DES 137123	**CLIENT:** City of Tampa - Stormwater Department
TECHNICIAN: J.R./M.F.	**WATER TABLE:** +0.02' / **DATE:** 1/28/13
LOCATION: See Plate 1	**DATE:** 1/28/13 / **COMPLETION DEPTH:** 2.5' *
	TEST NUMBER: HA-1

ELEV. (FT)	DESCRIPTION	DEPTH (FT)	SYMBOL	REMARKS
	5.45" Concrete	0		
	3.0" Gravel			
	Gravel with brown Fine SAND	1		
	Light brown Fine SAND (SP)			
	Light gray clayey Fine SAND (SC)	2		
	Light gray to light green sandy CLAY (CH)			* Encountered refusal at depth 2.5' (possible LIMESTONE layer).
		3		
		4		
		5		
		6		
		7		

DRIGGERS ENGINEERING SERVICES INCORPORATED

CONCRETE CORE/HAND AUGER BORING LOG

PROJECT: West San Carlos Street Flume Evaluation Tampa, Florida Project No.: DES 137123	**CLIENT:** City of Tampa - Stormwater Department
TECHNICIAN: J.R./M.F.	**WATER TABLE:** +0.08' / **DATE:** 1/28/13
LOCATION: See Plate I	**DATE:** 1/28/13 / **COMPLETION DEPTH:** 2.9'
	TEST NUMBER: HA-2

ELEV. (FT)	DESCRIPTION	DEPTH (FT)	SYMBOL	REMARKS
	4.86" Concrete	0		
	19.5" Gravel	1		
	Brown Fine SAND with gravel (SP)	2		
	Light brown Fine SAND (SP)	3		
		4		
		5		
		6		
		7		

DRIGGERS ENGINEERING SERVICES INCORPORATED

CONCRETE CORE/HAND AUGER BORING LOG

PROJECT: West San Carlos Street Flume Evaluation Tampa, Florida Project No.: DES 137123	**CLIENT:** City of Tampa - Stormwater Department
TECHNICIAN: J.R./M.F.	**WATER TABLE:** +0.02' — **DATE:** 1/28/13
LOCATION: See Plate I	**DATE:** 1/28/13 — **COMPLETION DEPTH:** 3.0'
	TEST NUMBER: HA-3

ELEV. (FT)	DESCRIPTION	DEPTH (FT)	SYMBOL	REMARKS
	5.81" Concrete	0		
	7.0" Gravel	1		
	Light brown Fine SAND (SP)	2		
	Light gray clayey Fine SAND (SC)	3		
		4		
		5		
		6		
		7		

DRIGGERS ENGINEERING SERVICES INCORPORATED

CONCRETE CORE/HAND AUGER BORING LOG

PROJECT: West San Carlos Street Flume Evaluation Tampa, Florida Project No.: DES 137123	**CLIENT:** City of Tampa - Stormwater Department
WATER TABLE: +0.04'	**DATE:** 1/28/13
TECHNICIAN: J.R./M.F.	**DATE:** 1/28/13
COMPLETION DEPTH: 3.0'	
LOCATION: See Plate I	**TEST NUMBER:** HA-4

ELEV. (FT)	DESCRIPTION	DEPTH (FT)	SYMBOL	REMARKS
	4.42" Concrete	0		
	7.88" Gravel with dark gray Fine SAND	1		
	Light brown Fine SAND (SP)	2		
		3		
		4		
		5		
		6		
		7		

DRIGGERS ENGINEERING SERVICES INCORPORATED

CONCRETE CORE/HAND AUGER BORING LOG

PROJECT: West San Carlos Street Flume Evaluation Tampa, Florida Project No.: DES 137123	**CLIENT:** City of Tampa - Stormwater Department
TECHNICIAN: J.R./M.F.	**WATER TABLE:** +0.58' — **DATE:** 1/28/13
LOCATION: See Plate I	**DATE:** 1/28/13 — **COMPLETION DEPTH:** 3.2'
	TEST NUMBER: HA-5

ELEV. (FT)	DESCRIPTION	DEPTH (FT)	SYMBOL	REMARKS
	3.28" Concrete	0		
	6.0" Gravel			
	Light brown Fine SAND (SP)	1		
		2		
		3		
		4		
		5		
		6		
		7		

DRIGGERS ENGINEERING SERVICES INCORPORATED

CONCRETE CORE/HAND AUGER BORING LOG

PROJECT: West San Carlos Street Flume Evaluation Tampa, Florida Project No.: DES 137123	**CLIENT:** City of Tampa - Stormwater Department
TECHNICIAN: J.R./M.F.	**WATER TABLE:** +0.46' / **DATE:** 1/28/13
LOCATION: See Plate I	**DATE:** 1/28/13 / **COMPLETION DEPTH:** 1.5' *
	TEST NUMBER: HA-6

ELEV. (FT)	DESCRIPTION	DEPTH (FT)	SYMBOL	REMARKS
	4.47" Concrete	0		
	2.75" Gravel and Concrete Fragments			
	Light gray clayey Fine SAND (SC)	1		
	Cream colored weathered LIMESTONE			* Could not penetrate below depth 1.5' due to LIMESTONE.
		2		
		3		
		4		
		5		
		6		
		7		

DRIGGERS ENGINEERING SERVICES INCORPORATED

CONCRETE CORE/HAND AUGER BORING LOG

PROJECT: West San Carlos Street Flume Evaluation Tampa, Florida Project No.: DES 137123	**CLIENT:** City of Tampa - Stormwater Department
TECHNICIAN: J.R./M.F.	**WATER TABLE:** +0.67' / **DATE:** 1/28/13
LOCATION: See Plate I	**DATE:** 1/28/13 / **COMPLETION DEPTH:** 2.9' *
	TEST NUMBER: HA-7

ELEV. (FT)	DESCRIPTION	DEPTH (FT)	SYMBOL	REMARKS
	1.79" Grout	0		
	5.31" Concrete			
	8.13" Gravel and Concrete Fragments	1		
	Very light brown Fine SAND (SP)	2		
	Light gray sandy CLAY (CH)			
	Cream colored weathered LIMESTONE	3		* Could not penetrate below depth 2.9' due to LIMESTONE.
		4		
		5		
		6		
		7		

SUMMARY OF LABORATORY TEST RESULTS

SUMMARY OF LABORATORY TEST RESULTS

BORING NO.	DEPTH (ft)	DESCRIPTION	W %	Y_d (pcf)	G_s	ATTERBERG LIMITS			P.P. (tsf)	U.C.	CON.	G.S.	ORG. (%)	pH	Cl. (ppm)	SO_4 (ppm)	RES. (ohm-cm)
						LL	PL	SL									
HA-1	2.0-2.5	Light gray clayey Fine SAND	26.4			39	14					** 27.3					
HA-3	0.9-2.8	Light brown Fine SAND										*					
HA-6	0.8-1.3	Light gray clayey Fine SAND	25.5			29	16					** 15.9					

W % = Water Content
Y_d (pcf) = Dry Density
G_s = Specific Gravity
LL = Liquid Limit
PL = Plastic Limit
SL = Shrinkage Limit
P.P. (tsf) = Pocket Penetrometer
U.C. = Unconfined Compression

Con. = Consolidation Test
G.S. (+1) = Grainsize Analysis (Hydrometer)
ORG. (%) = Organic Content
Cl. (ppm) = Total Chloride
SO_4 (ppm) = Total Sulfate
RES. (ohm-cm) = Lab Resistivity
* = See Test Curves
** = Percent Passing No. 200 Sieve

CLIENT: City of Tampa - Stormwater Department

PROJECT: West San Carlos Street Flume Evaluation, Tampa, Florida

FILE: DES 137123

CONCRETE CORE COMPRESSION TEST RESULTS

CLIENT:	City of Tampa	**FILE NO:**	DES 137123	**DATA SHEET PAGE:**	1 of 1
PROJECT:	San Carlos Flume Evaluation, Tampa	**REPORT NO:**		**LABORATORY TECHNICIAN:**	A.W.

LOCATION	SAMPLE #	SAMPLE LENGTH (in)	TRIMMED LENGTH (in)	CAPPED LENGTH (in)	DIAMETER (in)	AREA (sq. in.)	L/D	STRENGTH REDUCTION FACTOR (%)	TOTAL LOAD (lbs)	COMPRESSIVE STRENGTH (psi)	COMPRESSION STRENGTH* CORRECTED	REMARKS
	1	5.45	4.33	4.44	3.75	11.04	1.18	.91	38160	3460	3150	
	2	4.86			3.75							Core Not Testable - Big Piece Missing
	3	5.81	4.31	4.60	3.75	11.04	1.23	.93	48665	4410	4100	
	4	4.42	3.68	3.86	3.75	11.04	1.03	.87	53115	4810	4190	
	5	3.28			3.75							Too short to test
	6	4.47	3.11		3.75							Too short to test
	7	7.10	1.81	2.65	3.75	11.04	.71*	.87	67825	6140	5340*	#4 Rebar @ bottom of the core. 1.79" grout at top of concrete.
	8											
	9											
	10											

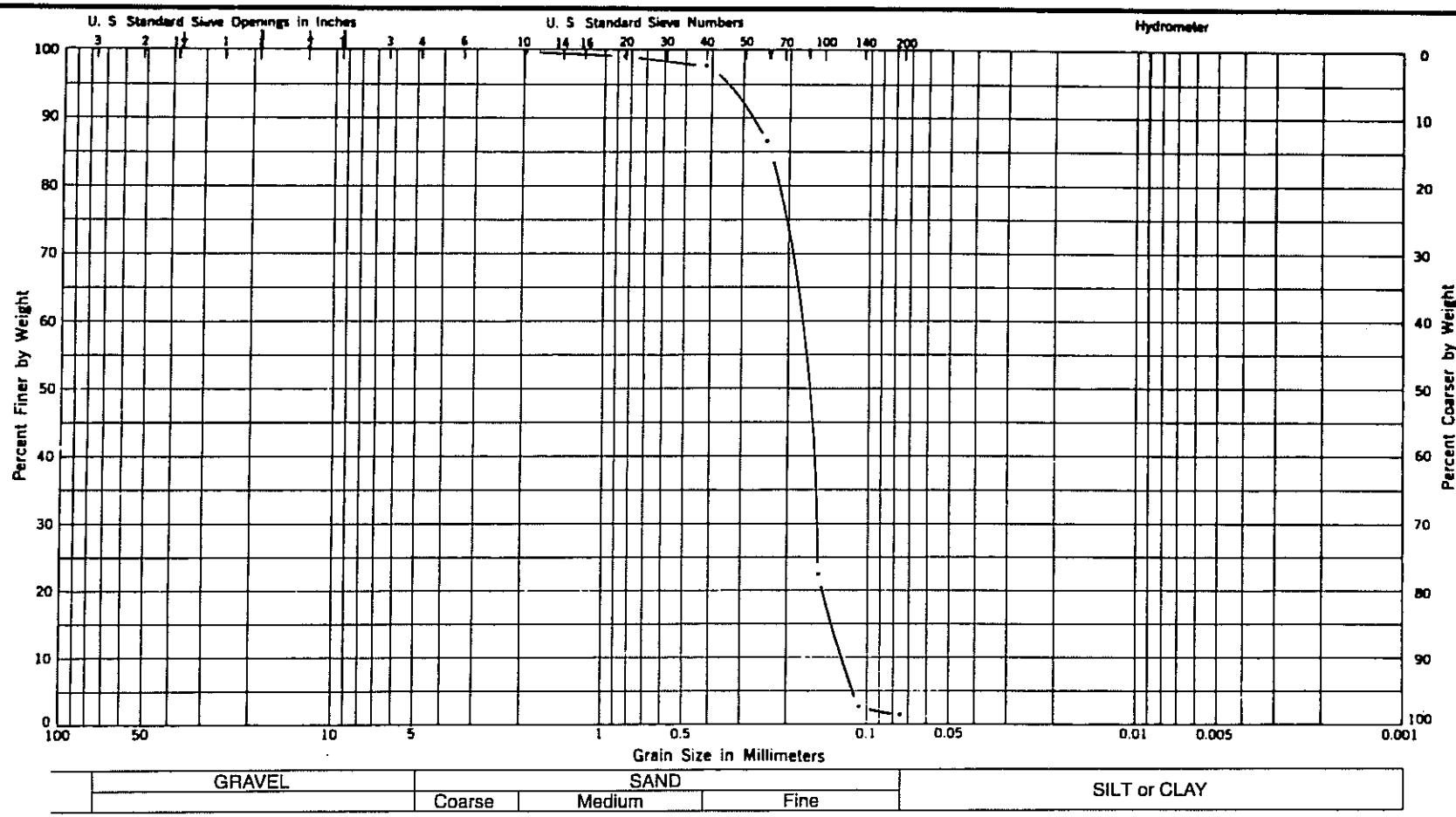
NOTES:

Average Compressive Strength: **3813 psi** - (excluding core #7)

* L/D Ratio is less than 1.0. Compressive strength for information only

GRAINSIZE ANALYSIS

DRIGGERS ENGINEERING SERVICES, INC.



Number	Depth	Natural Moisture	L.L.	P.L.	P.I.	Classification
HA-3	0.9' - 2.8'					Light brown Fine SAND

CLIENT: City of Tampa - Stormwater Department

PROJECT: West San Carlos Street
Flume Evaluation, Tampa, Florida

FILE: DES 137123