

## 8. 自然条件調査結果等

### 水産施設

- (1) 陸上地形調査および海底地形調査(グレンヴィル水産施設)
- (2) 地質調査(グレンヴィル水産施設)
- (3) 潮位調和解析(グレンヴィル水産施設)
- (4) 波浪推算(グレンヴィル水産施設)
- (5) 水質調査、底質調査(グレンヴィル水産施設)

### 道路

- (6) 地形測量(グランドエタン道路)
- (7) 地質調査(グランドエタン道路)
- (8) 交通量調査(グランドエタン道路)

**水産施設（１）～（５）**

**（１）陸上地形調査および海底地形調査**

**（グレンヴィル水産施設）**



**CRC OVERSEAS CO-OPERATION INC.**

**PROPOSED FISH MARKET, GRENVILLE, GRENADA**

**TOPOGRAPHIC SURVEY FOR FISHERIES FACILITIES IN GRENVILLE**

**WORKING METHOD**

The land topographic survey works were sub-contracted to a local company. The company used a Sokkisha SDM5 optical theodolite with Electronic Distance Measuring (EDM) attachment.

Horizontal control was based on site control stations with assumed co-ordinates.

The data submitted by the local company was based on an assumed datum, and processed at LYP's Port of Spain Head Office. The X, Y, Z co-ordinates of the survey points were plotted and AutoCAD software with Eagle Point digital terrain modelling software used to generate the contours.

**WORKING SCHEDULE**

Field Work :	Start - July 3, 2001 End - July 3, 2001
Data Processing:	Start - July 30, 2001 End - August 15, 2001
Final Report:	Submitted - August 28, 2001

### EQUIPMENT LIST

The following equipment was used:

- Sokkisha SDM5 optical theodolite with Electronic Distance Measuring (EDM) attachment.
  
- Accessories (survey) – tapes, pegs, spray paint, cutlasses, hammer, etc.

### STAFFING

One surveyor and two labourers (chainmen) were involved in the topographic survey.

-oo0oo-

**CRC OVERSEAS CO-OPERATION INC.**

**PROPOSED FISH MARKET, GRENVILLE, GRENADA**

**BATHYMETRIC SURVEY**

**WORKING METHOD**

Lee Young & Partners used a Continuous Recording Raytheon DE719C Fathometer for the bathymetric survey. The fathometer was able to give a permanent echo sounder recording of the seabed profile along the path of the survey vessel. Horizontal control for the bathymetric survey was provided by Lee Young & Partners' Trimble GPS Total Station 5700. Vertical control was provided through periodic readings at the site tide gauge.

At Lee Young & Partners' Port of Spain Head Office, the fathometer tape recordings were sampled and the spot heights at selected points plotted along the vessel path, adjusted for tide. This data was then entered onto a spreadsheet along with its corresponding X and Y co-ordinates acquired from the GPS total station. The X, Y and Z co-ordinates were then plotted in AutoCAD and this data processed, using the AutoCAD and Eagle Point Software.

**WORKING SCHEDULE**

Field Work :           Start - July 11, 2001  
                              End - July 11, 2001

Data Processing:       Start - July 30, 2001  
                              End - August 15, 2001

Final Report:           Submitted - August 28, 2001

## EQUIPMENT LIST

The following equipment was used:

- Raytheon DE 719C Fathometer (Echo Sounder)
- Trimble GPS Total Station 5700.
- Tapes for tide measurements.

## STAFFING

- 1 Surveyor for GPS Equipment
- 1 Surveyor for Echo Sounder
- 1 Technician for tide measurements

-oo0oo-

1. The original full-size plot of this drawing is recent for an A1-sized sheet of paper. The drawing border lines would be 563 mm x 803 mm when the sheet is plotted full size. The scale in the title block refers to the full sized plot scale only. If this drawing is plotted on a 11" x 17" sheet it is a reduction of 50% approximately.
2. Do not scale from this drawing, use figured dimensions only.
3. All dimensions are in metres unless otherwise stated.
4. Land contours are at 0.2m intervals.
5. Sea contours are at 0.5m intervals.
6. Site coordinate system is based on an assumed datum.
7. Cadastral boundary is approximate and was "best fitted" into the drawing.

LEGEND

- S.T. SEPTIC TANK
- TREE CROP
- INTERMEDIATE CONTOURS
- INDEX CONTOURS
- WATER SAMPLE
- CONTROL STATION

REVISION B:

1. The Cadastral boundary was changed on the northern end next to the existing wall, from 116.13 to 116.83
2. The drawing has been revised to reflect the change in BM elevation from 0.9m MSL to 0.942m MSL.

REVISION C:

1. The Cadastral boundary was revised
2. Coastline position was revised.

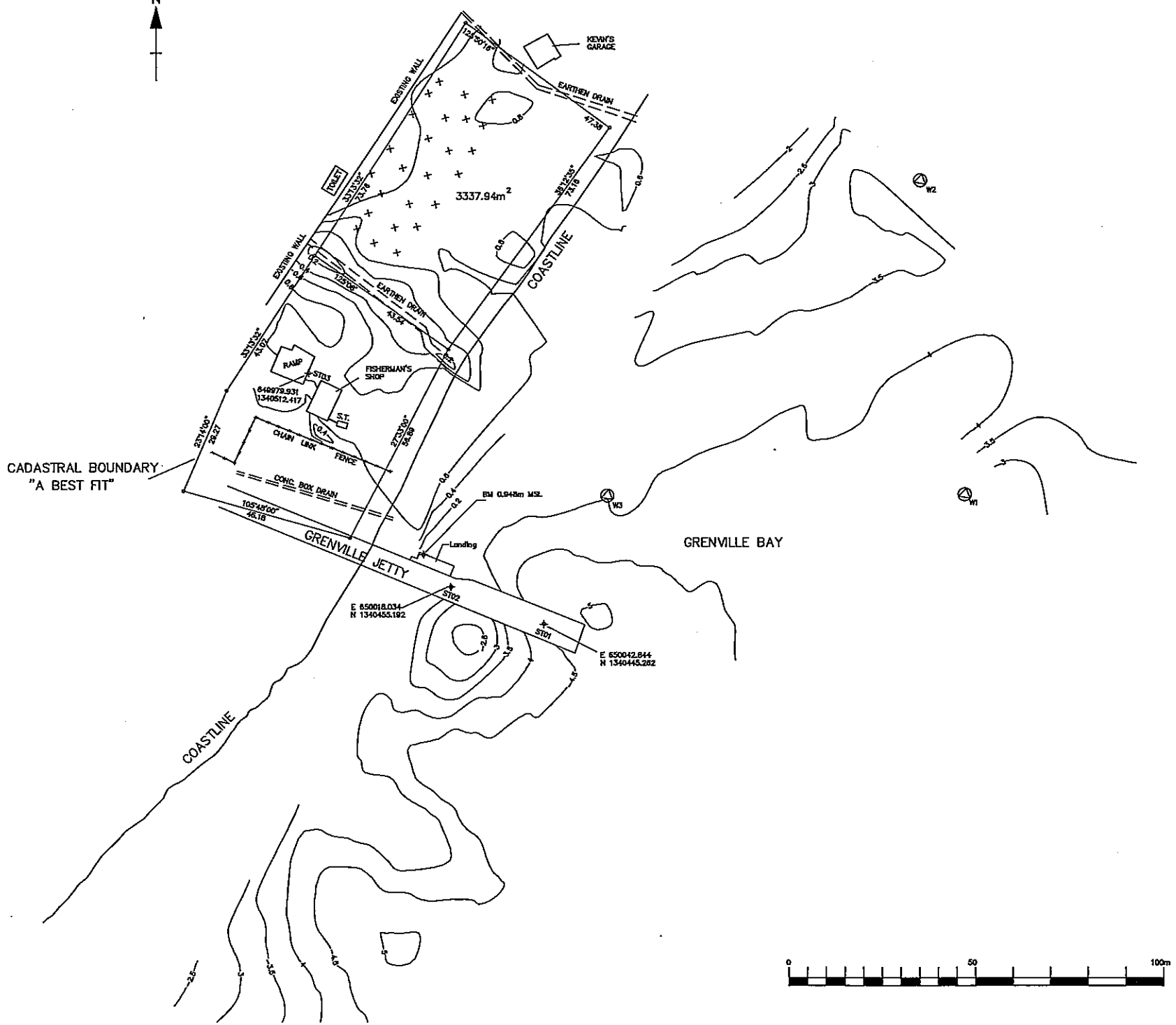
Issue	Date	Description	Drawn	Checked
C	29/06/01	THIRD ISSUE		
B	23/06/01	SECOND ISSUE		
A	14/06/01	PRELIMINARY ISSUE		

CRC OVERSEAS COOPERATION

JOB TITLE  
PROPOSED FISH MARKET FOR GRENVILLE

Drawn Title	Drawn No.
TOPOGRAPHIC/BATHYMETRIC SURVEY	20
Scale	Job No.
1:500	W749

LEE YOUNG & PARTNERS  
CONSULTING ENGINEERS & PROJECT MANAGERS  
PO BOX 5744, TORBAY, NZ



CADASTRAL BOUNDARY  
"A BEST FIT"

GRENVILLE BAY

GRENVILLE JETTY

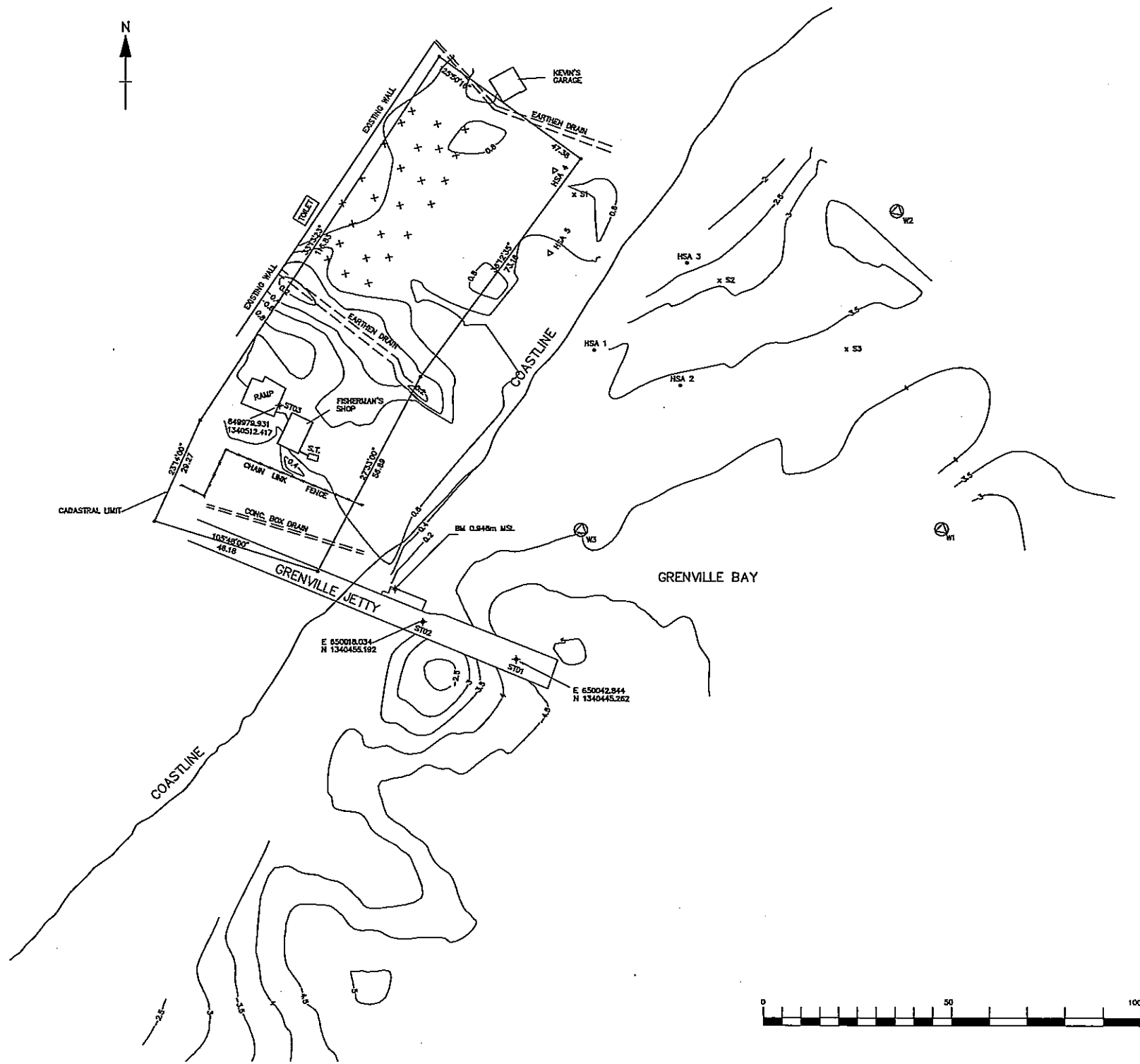
COASTLINE



## **(2) 地質調査(グレンヴィル水産施設)**

サイトにおける現況調査を行った結果、各地点のボーリング柱状図を次ページ以降に示す。棧橋(海上部 3箇所)、魚市場(陸上部 2箇所)計 5箇所についてボーリング調査を行った。





**NOTES**

1. Do not scale from this drawing, use figured dimensions only.
2. All dimensions are in metres unless otherwise stated.
3. Land contours are at 0.2m intervals.
4. Sea contours are at 0.5m intervals.
5. Site coordinate system is based on an assumed datum.

**LEGEND**

- S.T. SEPTIC TANK
- [Symbol] TREE CANOPY
- INTERMEDIATE CONTOURS
- INDEX CONTOURS
- [Symbol] WATER SAMPLE
- [Symbol] CONTROL STATION
- MARINE BOREHOLES
- x SEDIMENT SAMPLES
- △ LAND BOREHOLES

**REVISIONS:**

1. The Cadastral boundary was changed on the northern and west to the existing wall, from 116.13 to 116.83
2. The drawing has been revised to reflect the change in BM from 0.9m MSL to 0.948m MSL.

REV	DATE	DESCRIPTION	BY	CHK

**CRC OVERSEAS COOPERATION**

**JOB TITLE**  
**PROPOSED FISH MARKET FOR GRENVILLE**

<b>DWG. TITLE</b> SEDIMENT SAMPLING AND SOIL CONDITION SURVEY LOCATIONS	<b>DRAW. No.</b> 1
<b>SCALE</b> 1:500	<b>JOB No.</b> W749

**LEE YOUNG & PARTNERS**  
 CONSULTING ENGINEERS & PROJECT MANAGERS  
 PORT OF SPAIN, TORBOLAN BL.





**LEE YOUNG & PARTNERS - GEOTECHNICAL DEPARTMENT**  
**BOREHOLE TEST RECORD**

JOB No. W 749 BORING No. HSA 2 SHEET 1 OF 2  
 PROJECT Proposed Fish Market, Grenville DATE STARTED July 25, 2001 LOCATION Grenville (Marine)  
 TYPE BORING Hollow Stem Auger DATE COMPLETED July 25, 2001 GROUND ELEVATION \_\_\_\_\_

DEPTH (m)	TYPE	SAMPLE NUMBER	SOIL PROFILE			S.P.T. VALUE* (BLOWS/300mm)	MOISTURE CONTENT (%)	BULK UNIT WT. (kN/m <sup>3</sup> )	SHEAR STRENGTH kN/m <sup>2</sup> WATER CONTENT % STD. PENETRATION TEST* N-VALUE (BLOW/300mm) C <sub>u</sub> (kN/m <sup>2</sup> ) & φ	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	CONSOLIDATION TEST	SPECIFIC GRAVITY	SIEVE (W & D)	C <sub>u</sub> (kN/m <sup>2</sup> )	TRIAxIAL ↓ DEGREES	UNCONFINED COMPRESSION C <sub>u</sub> TEST (kN/m <sup>2</sup> )	DRY UNIT WEIGHT	SHEAR VANE (kN/m <sup>2</sup> )
			STRATIGRAPHIC PLOT	SOIL	% FINES															
0																				
1																				
2																				
3																				
4		1																		
5		2				5														
6		3				2														
7		4				3														
8		5				4														
9		6				5														
10		7				51														
		8				52														

SOIL CLASSIFICATION AS PER ASTM D 2487-93  
 WATER DEPTH N/A HOURS AFTER DRILLING  
 POCKET PEN (kN/m<sup>2</sup>) & Q<sub>u</sub>  
 DRILLER M. Lalla  
 WATER ENCOUNTERED \_\_\_\_\_

**LEGEND**

	MADE GROUND		GRAVEL		SAND		UNCEMENTED CALCAREOUS MATTER		LOAM		SCHIST
			SILT		CLAY		PEAT		LIMESTONE		HARD SHALE

	STANDARD SPILT SPOON (DISTURBED)	<table border="1"> <tr> <td>PLASTIC LIMIT</td> <td>LIQUID LIMIT</td> </tr> </table>	PLASTIC LIMIT	LIQUID LIMIT		POCKET PENETROMETER
PLASTIC LIMIT	LIQUID LIMIT					
	UNDISTURBED (SHELBY)	X NATURAL WATER CONTENT, W		UNCONFINED COMPRESSION TEST		
	UNDISTURBED (NO RECOVERY)	△ N - VALUE (S.P.T.)		TRIAxIAL TEST		
	AUGER	φ (Angle of Internal Friction)		VANE SHEAR TEST		
	DIAMOND CORE	W = Wet Sieve		C <sub>u</sub> (kN/m <sup>2</sup> )		
		D = Dry Sieve		C <sub>u</sub> (Unconfined Compression Strength)		
				HAMMER WEIGHT - 140lb DROP - 30		

**LEE YOUNG & PARTNERS - GEOTECHNICAL DEPARTMENT**  
**BOREHOLE TEST RECORD**

JOB No. W 749 BORING No. HSA 2 SHEET 2 OF 2  
 PROJECT Proposed Fish Market, Grenville DATE STARTED July 25, 2001 LOCATION Grenville (Marine)  
 TYPE BORING Hollow Stem Auger DATE COMPLETED July 25, 2001 GROUND ELEVATION \_\_\_\_\_

DEPTH (m)	SAMPLE NUMBER	SOIL PROFILE			S.P.T. VALUE* (BLOWS/300mm)	MOISTURE CONTENT (%)	BULK UNIT WT. (kN/m <sup>3</sup> )	SHEAR STRENGTH kN/m <sup>2</sup>	WATER CONTENT %	STD. PENETRATION TEST* N-VALUE (BLOW/300mm)	C <sub>u</sub> (kN/m <sup>2</sup> ) & φ	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	CONSOLIDATION TEST	SPECIFIC GRAVITY	SIEVE (W & D)		TRIAXIAL		DRY UNIT WEIGHT	SHEAR VANE (kN/m <sup>2</sup> )	
		TYPE	STRATIGRAPHIC PLOT	SOIL													% FINES	% COARSE	C <sub>c</sub> (kN/m <sup>2</sup> )	φ DEGREES			UNCONFINED COMPRESSION TEST (kN/m <sup>2</sup> )
11	9																						
12	10			SP					53														
13	11								51														
14									53														
14																							
15																							
16																							
17																							
18																							
19																							
20																							
21																							

SOIL CLASSIFICATION AS PER ASTM D 2487-93  
 WATER DEPTH N/A HOURS AFTER DRILLING  
 POCKET PEN (kN/m<sup>2</sup>) & Q<sub>u</sub> DRILLER M. Lalla  
 WATER ENCOUNTERED \_\_\_\_\_

**LEGEND**

	MADE GROUT		GRAVEL		SAND		UNCEMENTED CALCAREOUS MATTER		LOAM		SCHIST
			SILT		CLAY		PEAT		LIMESTONE		HARD SHALE

	STANDARD SPLT SPOON (DISTURBED)		PLASTIC LIMIT		LIQUID LIMIT		POCKET PENETROMETER
	UNDISTURBED (SHELBY)	X	NATURAL WATER CONTENT, W		N - VALUE (S.P.T.)		UNCONFINED COMPRESSION TEST
	UNDISTURBED (NO RECOVERY)		φ (Angle of Internal Friction)		C <sub>u</sub> (kN/m <sup>2</sup> )		TRIAXIAL TEST
	AUGER	W	= Wet Sieve		Q <sub>u</sub> (Unconfined Compression Strength)		VANE SHEAR TEST
	DIAMOND CORE	D	= Dry Sieve		HAMMER WEIGHT - 140lb DROP - 30		



**LEE YOUNG & PARTNERS - GEOTECHNICAL DEPARTMENT**  
**BOREHOLE TEST RECORD**

JOB No. W 749 BORING No. HSA 3 SHEET 2 OF 2  
 PROJECT Proposed Fish Market, Greenville DATE STARTED July 28, 2001 LOCATION Greenville (Marine)  
 TYPE BORING Hollow Stem Auger DATE COMPLETED July 28, 2001 GROUND ELEVATION \_\_\_\_\_

DEPTH (m)	SAMPLE		SOIL PROFILE				S.P.T. VALUE (BLOWS/300mm)	MOISTURE CONTENT (%)	BULK UNIT WT. (kN/m <sup>3</sup> )	SHEAR STRENGTH kN/m <sup>2</sup> WATER CONTENT % STD. PENETRATION TEST* N-VALUE (BLOW/300mm) C <sub>u</sub> (kN/m <sup>2</sup> ) & φ	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	CONSOLIDATION TEST	SPECIFIC GRAVITY	SIEVE (W & D)	C <sub>u</sub> (kN/m <sup>2</sup> )	φ DEGREES	UNCONFINED COMPRESSION TEST (kN/m <sup>2</sup> )	DRY UNIT WEIGHT	SHEAR VANE (kN/m <sup>2</sup> )
	TYPE	NUMBER	STRATIGRAPHIC PLOT	SOIL	% FINES	% COARSE															
11																					
12	X	8					48														
13	X	9					30														
14	X	10					56														
15	X	11					50														
16	X	12					50														
17	X	13					50														
18	X	14					52														
19		15															99				
20																					
21																					

SOIL CLASSIFICATION AS PER ASTM D 2487-93  
 WATER DEPTH N/A HOURS AFTER DRILLING  
 POCKET PEN (kN/m<sup>2</sup>) & Q<sub>v</sub>  
 DRILLER M. Lalla  
 WATER ENCOUNTERED \_\_\_\_\_

**LEGEND**

	MADE GROUND		GRAVEL		SAND		UNCEMENTED CALCAREOUS MATTER		LOAM		SCHIST
	UNDISTURBED (SHELBY)		SILT		CLAY		PEAT		LIMESTONE		HARD SHALE

	STANDARD SPILT SPOON (DISTURBED)	<table border="1"> <tr> <td>PLASTIC LIMIT</td> <td>LIQUID LIMIT</td> </tr> </table>	PLASTIC LIMIT	LIQUID LIMIT		POCKET PENETROMETER
PLASTIC LIMIT	LIQUID LIMIT					
	UNDISTURBED (SHELBY)	X NATURAL WATER CONTENT, W		UNCONFINED COMPRESSION TEST		
	UNDISTURBED (NO RECOVERY)	△ N - VALUE (S.P.T.)		TRIAXIAL TEST		
	AUGER	φ (Angle of Internal Friction)		VANE SHEAR TEST		
	DIAMOND CORE	W = Wet Sieve		C <sub>u</sub> (kN/m <sup>2</sup> )		
		D = Dry Sieve		Q <sub>v</sub> (Unconfined Compression Strength)		
				*HAMMER WEIGHT - 140lb DROP - 30		

**LEE YOUNG & PARTNERS - GEOTECHNICAL DEPARTMENT**  
**BOREHOLE TEST RECORD**

JOB No. W 749 BORING No. HSA 4 SHEET 1 OF 2  
 PROJECT Proposed Fish Market, Greenville DATE STARTED July 16, 2001 LOCATION Greenville (Land)  
 TYPE BORING Hollow Stem Auger DATE COMPLETED July 16, 2001 GROUND ELEVATION \_\_\_\_\_

DEPTH (m)	SAMPLE NUMBER	SOIL PROFILE		S.P.T. VALUE (BLOWS/300mm)	MOISTURE CONTENT (%)	BULK UNIT WT. (kN/m <sup>3</sup> )	SHEAR STRENGTH kN/m <sup>2</sup> WATER CONTENT % STD. PENETRATION TEST N-VALUE (BLOW/300mm) C <sub>u</sub> (kN/m <sup>2</sup> ) & φ	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	CONSOLIDATION TEST	SPECIFIC GRAVITY	SIEVE (W & D)	C <sub>c</sub> (kN/m <sup>2</sup> )	φ DEGREES	UNCONFINED COMPRESSION C <sub>u</sub> TEST (kN/m <sup>2</sup> )	DRY UNIT WEIGHT	SHEAR VANE (kN/m <sup>2</sup> )	
		STRATIGRAPHIC PLOT	DESCRIPTION																
0																			
1	1	MH	LIGHT GREY MOIST VERY SOFT STRATIFIED ELASTIC SILT																
2	2																		
3	3																		
4	4																		
5	5																		
6	6	CL	DARK BROWN MOIST SOFT STRATIFIED LEAN CLAY																
7	7		LIGHT GREY MOIST SOFT STRATIFIED SILT WITH LOW ELASTICITY																
8	8	ML																	
9	9																		
10	10																		
10		CH																	

SOIL CLASSIFICATION AS PER ASTM D 2487-93  
 WATER DEPTH \_\_\_ HOURS AFTER DRILLING  
 POCKET PEN (kN/m<sup>2</sup>) & Q<sub>u</sub> \_\_\_\_\_  
 DRILLER M. LALLA  
 WATER ENCOUNTERED 3m

**LEGEND**

	MADE GROUND		GRAVEL		SAND		UNCEMENTED CALCAREOUS MATTER		LOAM		SCHIST
	SILT		CLAY		PEAT		LIMESTONE		HARD SHALE		

	STANDARD SPLIT SPOON (DISTURBED)	<table border="1"> <tr> <td>PLASTIC LIMIT</td> <td>LIQUID LIMIT</td> </tr> </table>	PLASTIC LIMIT	LIQUID LIMIT		POCKET PENETROMETER
PLASTIC LIMIT	LIQUID LIMIT					
	UNDISTURBED (SHELBY)	X NATURAL WATER CONTENT, W		UNCONFINED COMPRESSION TEST		
	UNDISTURBED (NO RECOVERY)	△ N - VALUE (S.P.T.)		TRIAxIAL TEST		
	AUGER	φ (Angle of Internal Friction)		VANE SHEAR TEST		
	DIAMOND CORE	W = Wet Sieve		C <sub>u</sub> (kN/m <sup>2</sup> )		
		D = Dry Sieve		Q <sub>u</sub> (Unconfined Compression Strength)		
				*HAMMER WEIGHT - 140lb DROP - 30		



**LEE YOUNG & PARTNERS - GEOTECHNICAL DEPARTMENT**  
**BOREHOLE TEST RECORD**

JOB No. W 749  
PROJECT Proposed Fish Market, Grenville  
TYPE BORING Hollow Stem Auger

BORING No. HSA 4  
DATE STARTED July 16, 2001  
DATE COMPLETED July 16, 2001

SHEET 2 OF 2  
LOCATION Grenville (Land)  
GROUND ELEVATION \_\_\_\_\_

DEPTH (m)	SAMPLE TYPE	SAMPLE NUMBER	SOIL PROFILE			S.P.T. VALUE (BLOW/300mm)	MOISTURE CONTENT (%)	BULK UNIT WT. (kN/m <sup>3</sup> )	SHEAR STRENGTH kN/m <sup>2</sup> WATER CONTENT % STD. PENETRATION TEST N-VALUE (BLOW/300mm) C <sub>u</sub> (kN/m <sup>2</sup> ) & φ	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	CONSOLIDATION TEST	SPECIFIC GRAVITY	SIEVE (M & D)	C <sub>u</sub> (kN/m <sup>2</sup> )	DEGREES	UNCONFINED COMPRESSION TEST (kN/m <sup>2</sup> )	DRY UNIT WEIGHT	SHEAR VANE (kN/m <sup>2</sup> )																
			STRATIGRAPHIC ZONE	SOIL	% FINES																% COARSE	DESCRIPTION														
11	X	11	CH			15																														
12	X	12	CH			21																														
13	X	13	CH			25																														
14	X	14	MH			38																														
15	X	15																			50															
16	X	16																			63															
17	X	17	MH			39																														
18			END OF BOREHOLE																																	

SOIL CLASSIFICATION AS PER ASTM D 2487-93  
WATER DEPTH \_\_\_\_\_ HOURS AFTER DRILLING  
POCKET PEN (kN/m<sup>2</sup>) & Q<sub>u</sub> \_\_\_\_\_  
DRILLER M I A I A  
WATER ENCOUNTERED 3m

**LEGEND**

	MADE GROUND		GRAVEL		SAND		UNCEMENTED CALCAREOUS MATTER		LOAM		SCHIST
	UNDISTURBED (SHELBY)		SILT		CLAY		PEAT		LIMESTONE		HARD SHALE

	STANDARD SPILT SPOON (DISTURBED)		PLASTIC LIMIT		LIQUID LIMIT		POCKET PENETROMETER
	UNDISTURBED (SHELBY)	X	NATURAL WATER CONTENT, W		N - VALUE (S.P.T.)		TRIAXIAL TEST
	UNDISTURBED (NO RECOVERY)		φ (Angle of Internal Friction)		W = Wet Sieve		VANE SHEAR TEST
	AUGER	D	D = Dry Sieve		C <sub>u</sub> (kN/m <sup>2</sup> )		Q <sub>u</sub> (Unconfined Compression Strength)
	DIAMOND CORE						HAMMER WEIGHT - 140lb DROP - 30

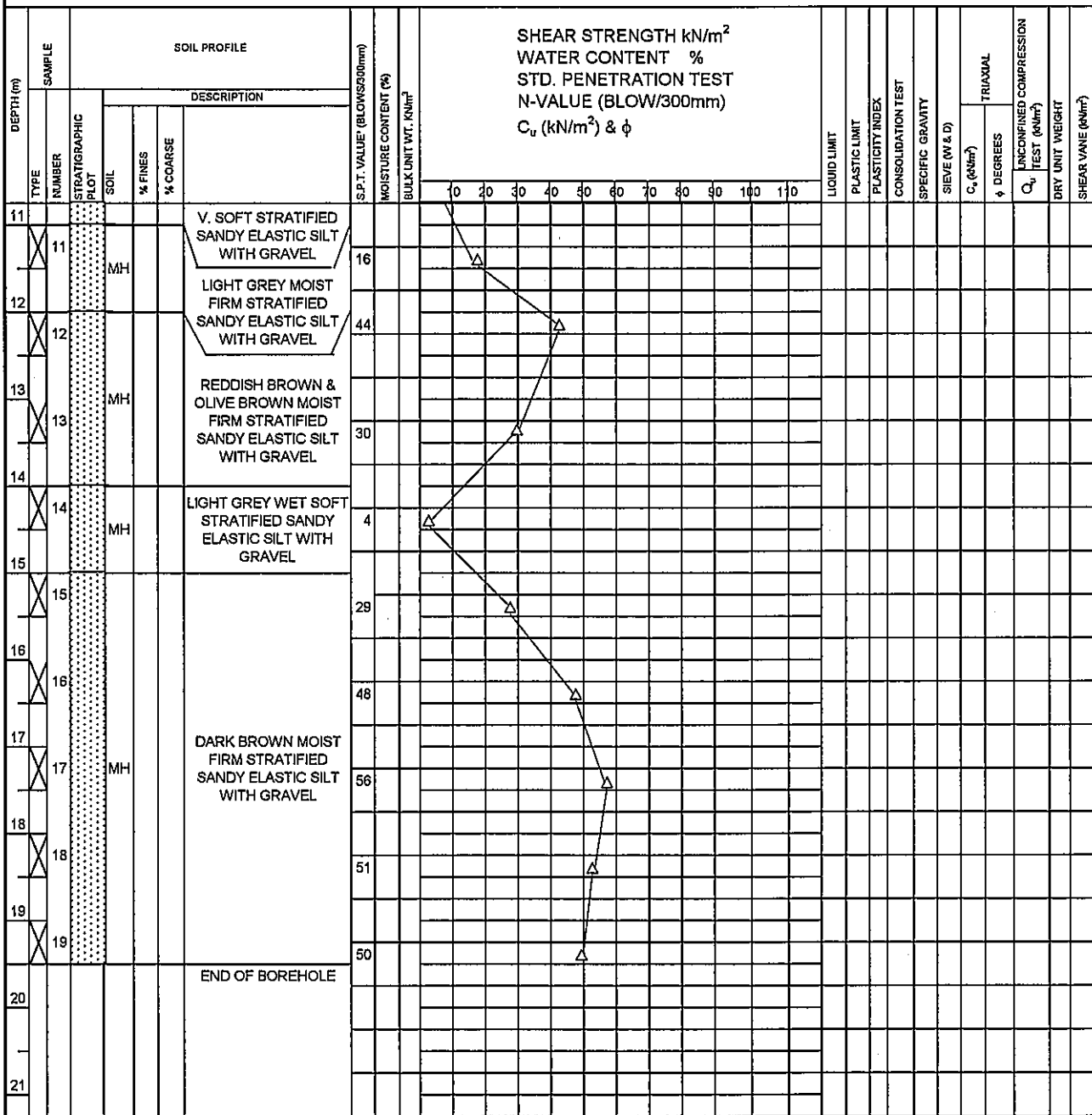


**LEE YOUNG & PARTNERS - GEOTECHNICAL DEPARTMENT**  
**BOREHOLE TEST RECORD**

JOB No. W 749  
PROJECT Proposed Fish Market, Grenville  
TYPE BORING Hollow Stem Auger

BORING No. HSA 5  
DATE STARTED July 17, 2001  
DATE COMPLETED July 17, 2001

SHEET 2 OF 2  
LOCATION Grenville (Land)  
GROUND ELEVATION \_\_\_\_\_



SOIL CLASSIFICATION AS PER ASTM D 2487-93  
WATER DEPTH \_\_\_\_\_ HOURS AFTER DRILLING  
POCKET PEN (kN/m<sup>2</sup>) & Q<sub>u</sub> \_\_\_\_\_  
DRILLER M I A I A  
WATER ENCOUNTERED 3m

**LEGEND**

	MADE GROUND		GRAVEL		SAND		UNCEMENTED CALCAREOUS MATTER		LOAM		SCHIST
	UNDISTURBED (SHELBY)		SILT		CLAY		PEAT		LIMESTONE		HARD SHALE

	STANDARD SPLT SPOON (DISTURBED)	<table border="1"> <tr> <td>PLASTIC LIMIT</td> <td>LIQUID LIMIT</td> </tr> </table>	PLASTIC LIMIT	LIQUID LIMIT		POCKET PENETROMETER
PLASTIC LIMIT	LIQUID LIMIT					
	UNDISTURBED (SHELBY)	X	NATURAL WATER CONTENT, W		UNCONFINED COMPRESSION TEST	
	UNDISTURBED (NO RECOVERY)	△	N - VALUE (S.P.T.)		TRIAxIAL TEST	
	AUGER	○	φ (Angle of Internal Friction)		VANE SHEAR TEST	
	DIAMOND CORE	W	= Wet Sieve		C <sub>v</sub> (kN/m <sup>2</sup> )	
		D	= Dry Sieve		Q <sub>u</sub> (Unconfined Compression Strength)	
					'HAMMER WEIGHT - 140lb DROP - 30	

### **(3) 潮位調和解析**

**(グレンヴィル水産施設)**

## 潮汐調和解析

### 1. 解析目的

Grenville計画地点では、近傍のSt. George's、 HarbourやPrickly Bay地点と比較してやや潮位変動が大きいと思われるため、潮位観測結果から調和解析により調和定数を求め工食用基準面（CDL）及び潮汐の概要を把握するものである。

### 2. 調査地点

Grenville地点の潮位観測位置は、北緯 $12^{\circ} 07' 20''$ 、西経 $61^{\circ} 37' 16''$ であり、近傍の既存測定地点をふくめ図1-1と図1-2に示した。

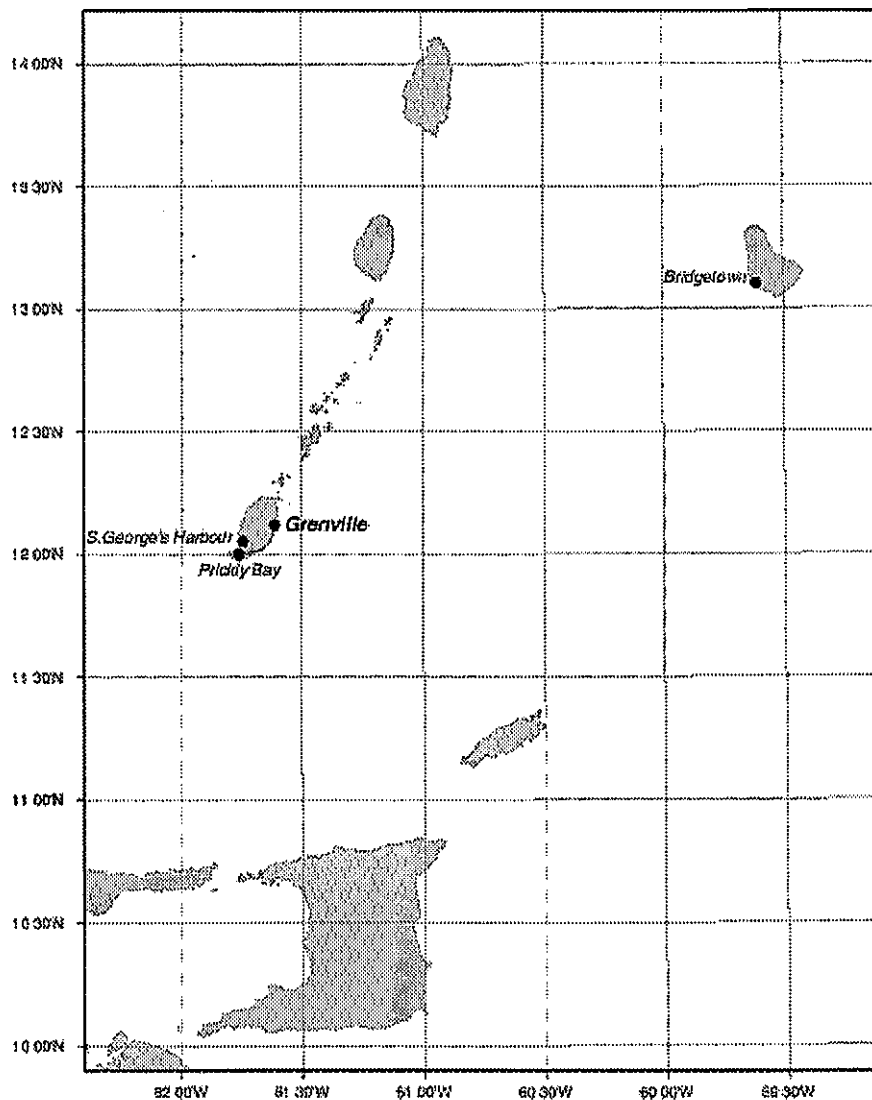


図1-1 Grenville潮位測定地点と近傍の既存潮位測定地点

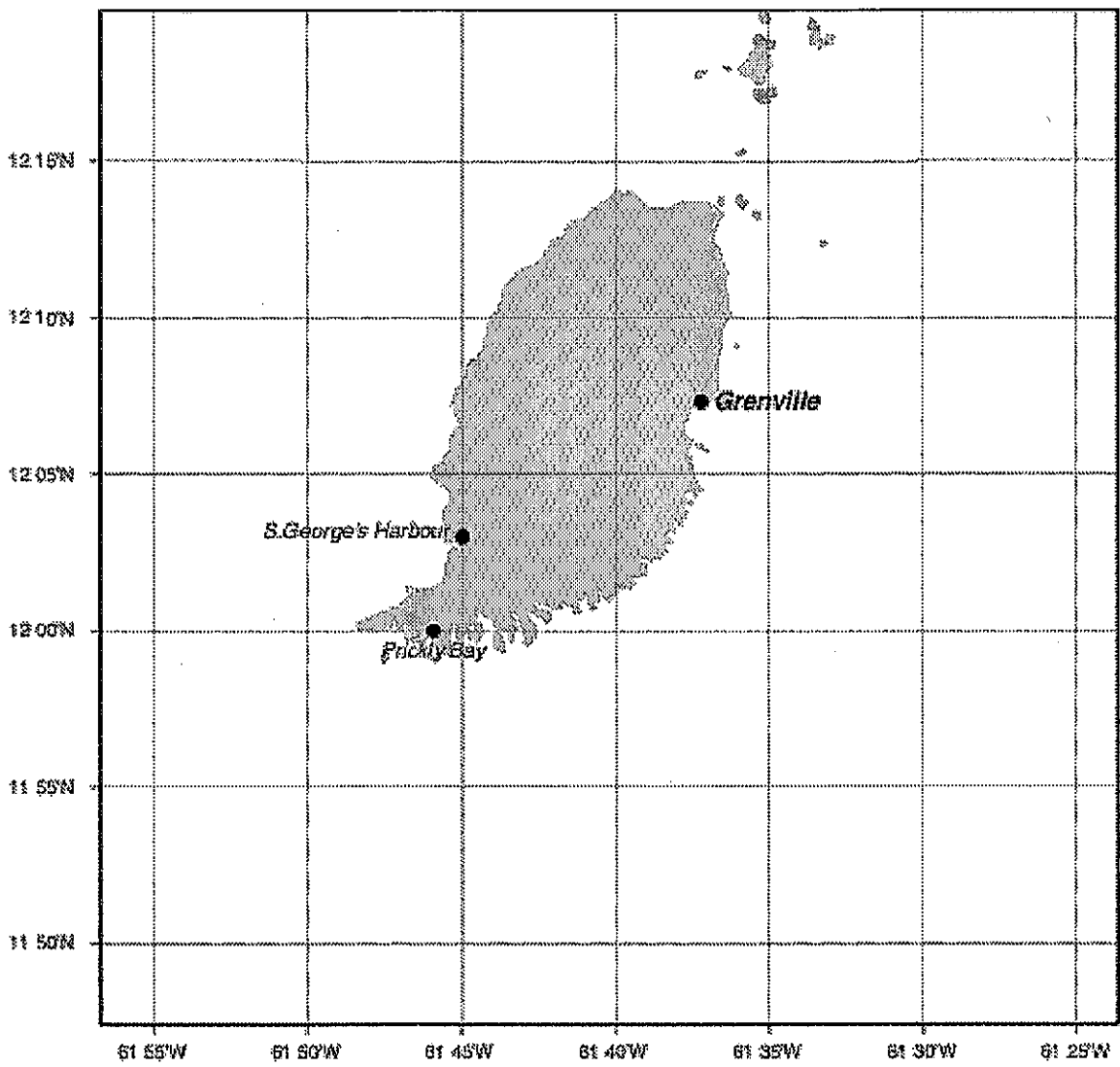


図1-2 Grenville潮位測定地点と近傍の既存測定地点

### 3. 調和分解結果

#### (1) 観測データ

15昼夜の観測データを経時変化図として図3-1に示した。

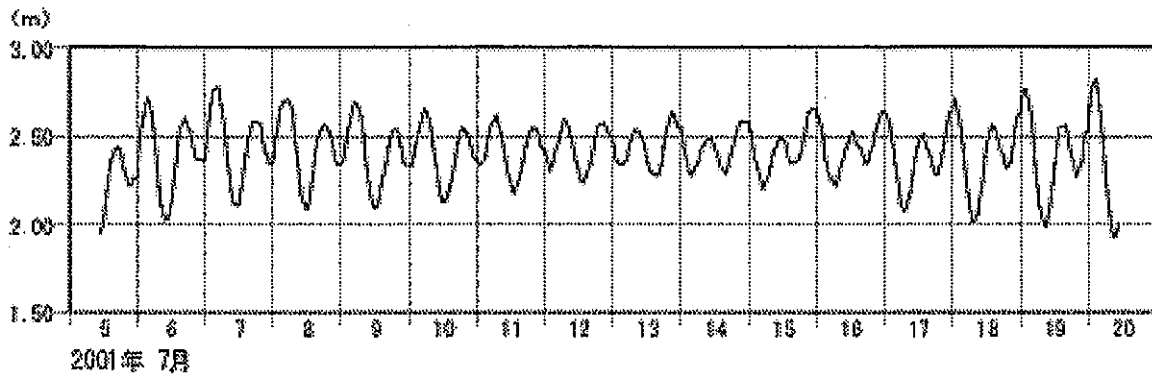


図3-1 Grenville観測地点の調和分解に用いた潮位データ  
(2001年7月5日11時～7月20日11時)

(2) 調和定数

調和分解により求めた調和定数を表3-1及び主要四分潮を表3-2に示した。

表3-1 15日間調和分解結果

\*\*\* TIME AND LOCATION OF OBSERVATION \*\*\*

Station : (GRENVILLE )  
 Longitude(W) : ( 61 37 16)  
 Latitude(N) : ( 12 7 20)  
 DATA Span : (FROM 2001 7/ 5 11: 0 TO 2001 7/20 11: 0) 15DAYS  
 DATA Number : ( 361)  
 DATA Interval : ( 60) MINUTES

\*\*\* HARMONIC CONSTANTS \*\*\*

KIGO	VO+U	LARGE. F	COS. P	SIN. P	R	ZETA	H	KAPPA	[H]	[KAPPA]
K1	175.57	0.9963	0.1073	0.0177	0.11	9.36	0.11	184.94	0.08	177.
O1	337.29	0.9943	-0.0753	-0.0134	0.08	190.07	0.08	167.36	0.08	167.
P1									0.03	177.
Q1	103.89	0.9943	0.0151	0.0166	0.02	47.64	0.02	151.54	0.02	152.
M2	148.79	0.9962	0.1192	-0.1766	0.21	304.03	0.21	92.82	0.21	93.
S2	326.76	1.0000	-0.0509	0.0168	0.05	161.73	0.05	128.49	0.07	120.
N2	275.39	0.9962	-0.0467	0.0244	0.05	152.45	0.05	67.85	0.05	68.
K2									0.02	120.
M4	297.58	0.9925	0.0011	0.0018	0.00	59.38	0.00	356.96	0.00	357.
MS4	115.55	0.9962	0.0015	0.0028	0.00	62.59	0.00	178.14	0.00	178.
STED			2.4121	0.0000			2.41		2.41	

表3-2 主要四分潮調和定数 (Grenville)

分潮	振幅 (m)	遅角 (°)
M <sub>2</sub>	0.21	93
S <sub>2</sub>	0.07	120
K <sub>1</sub>	0.08	177
O <sub>1</sub>	0.08	167
四分潮の和	0.44	-



調和分解結果を既存の調和定数と比較すると表3-3のようであり、島の西側と東側では、東側の方が潮位変化が大きく、やや離れた東側に位置するBridgetownではもう少し大きな値となっており、ほぼ妥当な結果と考えられる。(図1-1の測定地点位置図参照)

表3-3 近傍の既存調和定数との比較

	M.L. Z <sub>0</sub>	M2 K° H(m)	S2 K° H(m)	K1 K° H(m)	O1 K° H(m)
Bridgetown	0.73	107 0.24	127 0.08	177 0.09	173 0.07
St. George s Harbour	0.61	079 0.06	105 0.01	181 0.09	178 0.06
Prickly Bay	0.5	091 0.13	109 0.05	178 0.07	176 0.06
Grenville	-	093 0.21	120 0.07	177 0.08	167 0.08

平均水面は長周期の変動を伴っているため、近傍の観測地点Bridgetownの測定データを基に検討を行った。Bridgetownの測定データは観測期間が3期間に分かれており、観測基準面がそれぞれ異なるため、観測期間別の平均水面からの月平均偏差を求め表3-4に示した。また各期間のデータから比較的連続する一年間のデータによる調和分解を行った（表3-8A, B, C参照）。調和定数の長周期成分Sa, Ssa, Mm, MSf, Mf分潮を用い月平均偏差を求め算定結果を表3-5に示した。

実測の偏差と長周期成分から求めた偏差を比較すると、期間Aは比較的平均的な値と思われるが、期間Bは1991の大きな偏差の影響があると思われる。一方期間Cは観測期間が年の前半に偏っているため長周期成分はその影響を受けた結果偏った偏差が算定された。

この結果から月別変動に平均的に対応すると思われる期間Aから求めた長周期成分による偏差を月平均値の変動として採用した。この結果の精度は高くないのでcm単位にし、表3-6を月変動分とした。

表3-4 Bridgetownにおける月別平均水面の偏差

期間Aの月平均値の偏差 (cm)

	1	2	3	4	5	6	7	8	9	10	11	12
1968	-	-	-	-	-	-	-	-	-	-	-4.1	-7.9
1969	-5.0	-3.0	2.3	1.6	2.8	16.9	6.9	10.5	4.2	6.1	-4.0	-8.0
1970	-17.8	-	-	-	-	-	-	-	-	-	-	-

期間Bの月平均値の偏差 (cm)

	1	2	3	4	5	6	7	8	9	10	11	12
1990	-	-	-	-	1.3	-2.6	-	-6.4	-7.0	-10.1	-10.8	-10.8
1991	-19.3	-15.9	-1.9	-3.1	7.2	13.1	24.5	40.5	-	-	-	-

期間Cの月平均値の偏差 (cm)

	1	2	3	4	5	6	7	8	9	10	11	12
1993	-	-2.6	-2.7	0.0	8.2	7.7	8.4	-	-	-	-	-
1994	-	-6.6	-4.6	-	-	-	-	-	-	-	-	-
1995	-9.0	-7.9	-2.3	4.0	12.0	4.4	-	-	-	-	-0.2	-1.2
1996	-	-8.7	-	-	-	-	-	-	-	-	-	-

表3-5 長周期成分により求めた月別平均水面の偏差

期間ABCから求めた長周期成分による月平均値の偏差 (cm)

	1	2	3	4	5	6	7	8	9	10	11	12
A	-8.7	-5.7	-1.7	1.7	4.0	6.0	7.4	7.2	4.4	-0.4	-5.6	-9.0
B	-11.1	-11.1	-7.4	2.1	13.2	19.7	17.4	7.7	-2.8	-8.7	-10.0	-10.2
C	-4.7	-6.2	-1.7	6.0	10.9	8.7	1.0	-5.7	-6.3	-2.2	0.9	-0.8

表3-6 月別平均水面の偏差 (cm)

月	1	2	3	4	5	6	7	8	9	10	11	12
偏差	-9	-6	-2	+2	+4	+6	+7	+7	+4	0	-6	-9

以上の月平均水面の偏差とGrenvilleの観測期間の平均水面からM. S. Lを求め表3-7に示した。

表3-7 Grnvilleの平均水面 (M. S. L)

観測期間2001年7月5日11時～7月20日11時 観測基準面上 (m)

15昼夜の平均	7月の偏差	平均水面 (M. S. L)
2.41	+0.07	2.34



(4) 潮汐の概要

潮汐の概要と工事前基準面 (C. D. L) 及び平均海面 (M. S. L) を図3-3に示した。

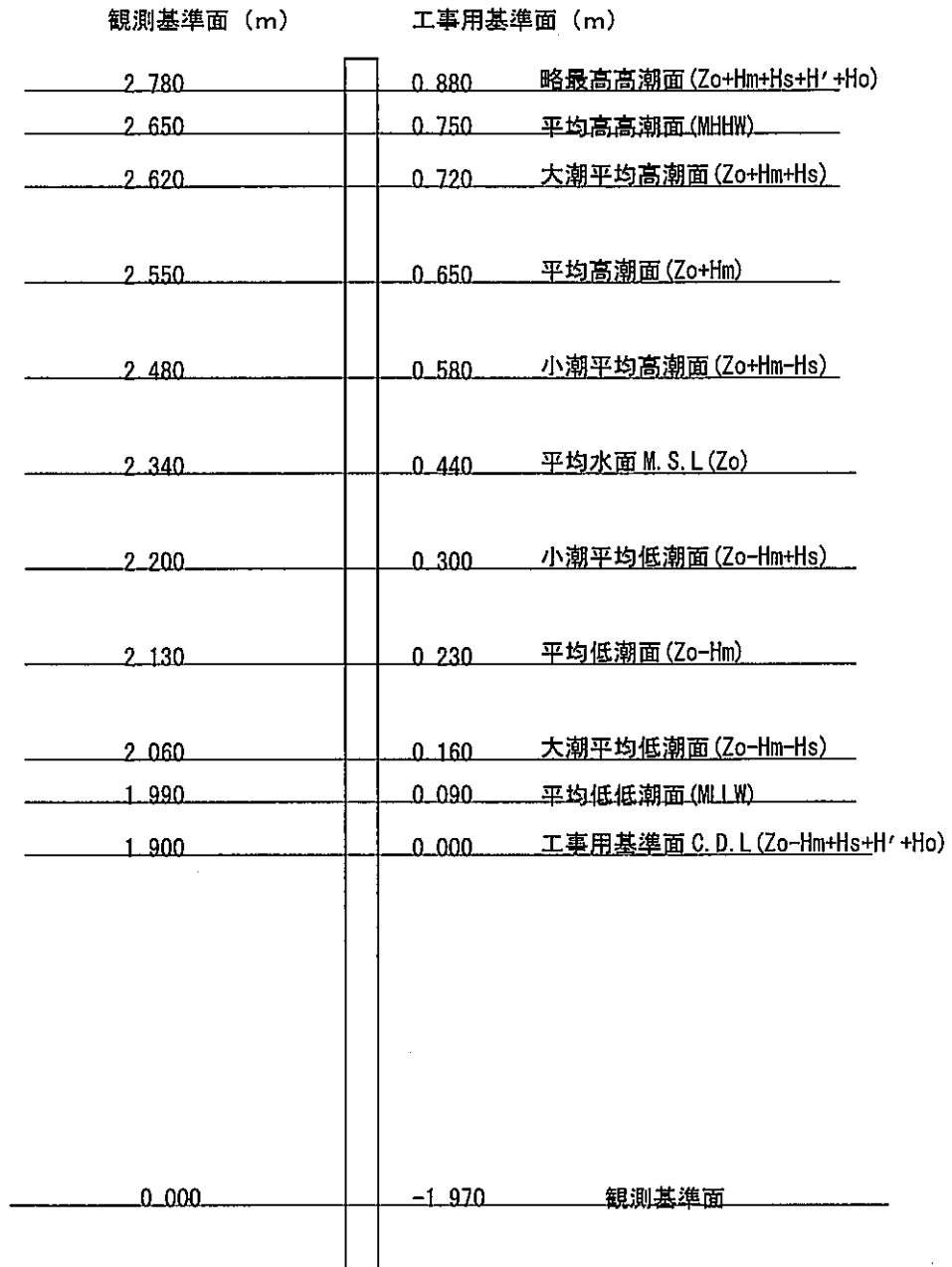


図3-3 Grenvilleにおける潮汐の概要

Grenvilleの潮型は日周潮と半日周潮の割合から混合潮型に分類される。

$$\text{1日2回潮型} \quad (K1+O1)/(M2+S2) < 0.25$$

$$\text{混合潮型} \quad 0.25 \leq (K1+O1)/(M2+S2) < 1.50$$

$$\text{1日1回潮型} \quad 1.50 \leq (K1+O1)/(M2+S2)$$

$$(K1+O1)/(M2+S2) = (0.08+0.08)/(0.21+0.07) = 0.57$$

このため日潮不等がやや大きく回帰潮の平均高高潮面(MHHW)、平均低低潮面(MLLW)および平均高高潮間隔、平均低低潮間隔を次式から求めた。時刻  $t$  は0~25時の範囲とした。

$$h(t) = Hm \cos(29t - Km) + (H' + Ho) \cos(14.5t - (K' + Ko)/2)$$

$$\text{平均高高潮面(MHHW)} : +0.31(\text{m})$$

$$\text{平均低低潮面(MLLW)} : -0.35(\text{m})$$

$$\text{平均高高潮間隔} : 15\text{時}$$

$$\text{平均低低潮間隔} : 22\text{時}$$

#### **(4) 波浪推算**

**(グレンヴィル水産施設)**

## 波浪推算

### 1. 調査目的

本調査はグレナダ国グレンヴィル港の栈橋施設整備にかかる設計波浪を把握するため、波浪推算による沖波確率波の算定さらに対象地点までの波浪変形計算を行うものである。

グレンヴィル港の位置を図1-1に示した。

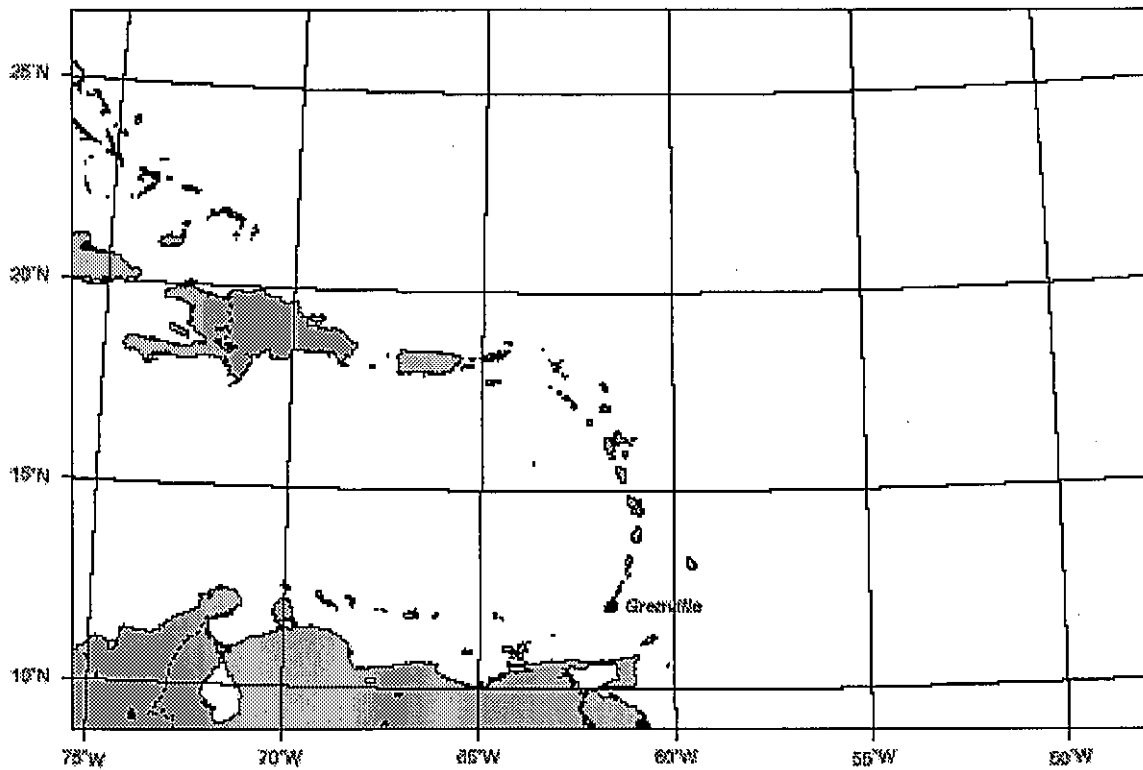


図1-1 グレンヴィル港位置図



## 2. 調査の手順

本調査の調査手順を以下に示した。

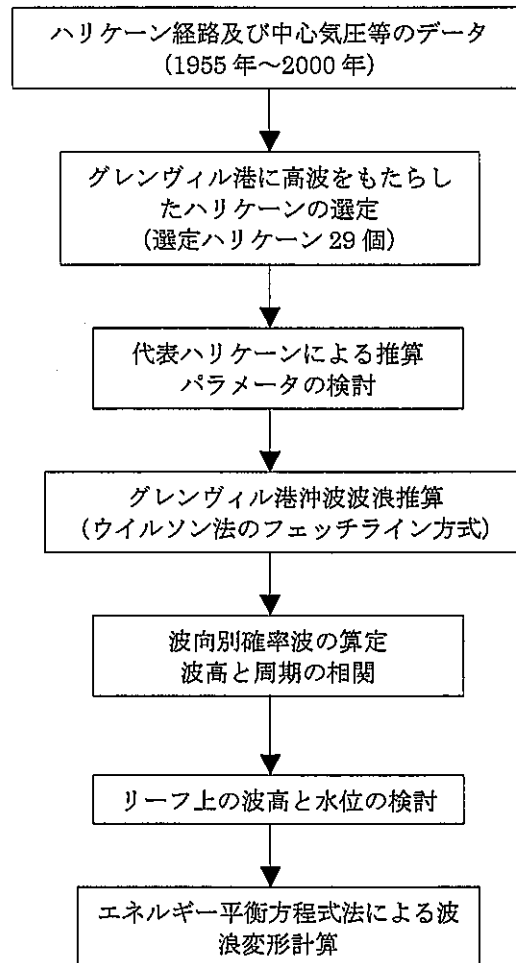


図2-1 調査手順

### 3. 選択したハリケーン

グレンヴィル港周辺を通過したハリケーンを *National Oceanic & Atmospheric Administration (NOAA)* の *National Hurricane Center (NHC)* からハリケーン経路図およびハリケーン位置と中心気圧データを基に、1955年から2000年の46年間で高波をもたらしたと考えられるものを選択し表3-1に示し、波浪推算に用いるものとした。

推算に使用する気圧分布のパラメータは天気図から読み取り推算データを作成した。使用した天気図はアメリカの *Daily Series Synoptic Weather Maps Northern Hemisphere Sea Level* 及びドイツの (*Täglicher Wetterbericht*) *Europäischer Wetterkarte* などを用いた。

表3-1 グレンヴィル港周辺を通過した選定ハリケーン

年	ハリケーン No	Nickname	推算期間(年月日時)
1955	5510	JANET	1955.09.21.18-09.25.12
1956	5603	BETSY	1956.08.09.12-08.12.12
1963	6307	FLORA	1963.09.28.12-10.02.12
1964	6405	CLEO	1964.08.20.18-08.23.12
1966	6606	FAITH	1966.08.24.12-08.27.12
1966	6609	INEZ	1966.09.25.12-09.28.18
1970	7005	DOROTHY	1970.08.19.12-08.23.00
1973	7304	CHRISTINE	1973.09.02.00-09.04.00
1974	7404	ALMA	1974.08.13.18-08.15.00
1978	7804	CORA	1978.08.10.00-08.12.00
1979	7904	DAVID	1979.08.28.00-09.01.00
1979	7906	FREDERIC	1979.09.01.18-09.05.00
1980	8001	ALLEN	1980.08.03.00-08.06.00
1986	8604	DANIELLE	1986.09.07.12-09.09.18
1987	8706	EMILY	1987.09.20.12-09.23.00
1988	8808	GILBERT	1988.09.08.18-09.12.00
1988	8811	JOAN	1988.10.13.00-10.17.00
1989	8908	HUGO	1989.09.15.00-09.19.18
1990	9007	GUSTAV	1990.08.25.18-08.29.00
1993	9302	BRET	1993.08.06.06-08.08.12
1995	9509	IRIS	1995.08.23.12-08.28.12
1995	9512	LUIS	1995.09.03.00-09.06.12
1995	9513	MERILYN	1995.09.13.06-09.16.00
1996	9602	BERTHA	1996.09.06.12-09.10.12
1996	9608	HORTENSE	1966.09.06.12-09.10.12
1997	9706	ERIKA	1997.09.04.12-09.09.00
1998	9807	GEORGES	1998.09.18.18-09.23.00
1999	9910	JOSE	1999.10.18.12-10.22.18
2000	0010	JOYCE	2000.09.27.18-10.02.06

#### 4. 計算結果

エネルギー平衡方程式による計算は、再現期間50年のNE, ENE, E, ESEの4波向とし、波浪諸元を表4-1に示した。

表4-1 沖波波浪諸元

沖波向	波高(m)	周期(s)	Smax
NE	4.9	15.3	75
ENE	4.1	13.5	75
E	4.2	8.0	10
ESE	4.2	8.0	10

波浪変形計算結果は、平均波向分布図、波高分布図として各領域について作成し資料編に示した。ここではその中から小領域の計画地点付近の波向と波高分布図を作成した。

これらの結果から栈橋付近（図4-1）の代表点の波向と波高を表4-2に示した。

図4-1 計画栈橋付近の代表地点

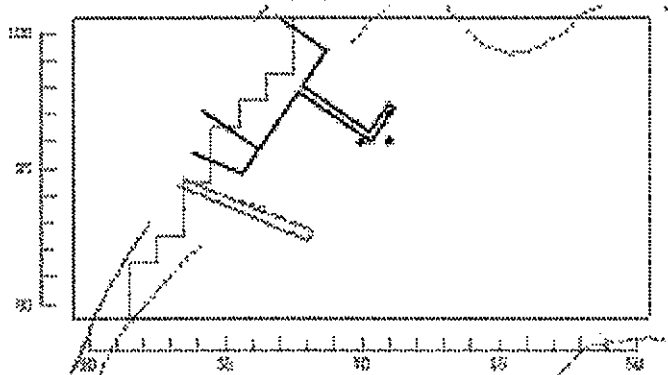
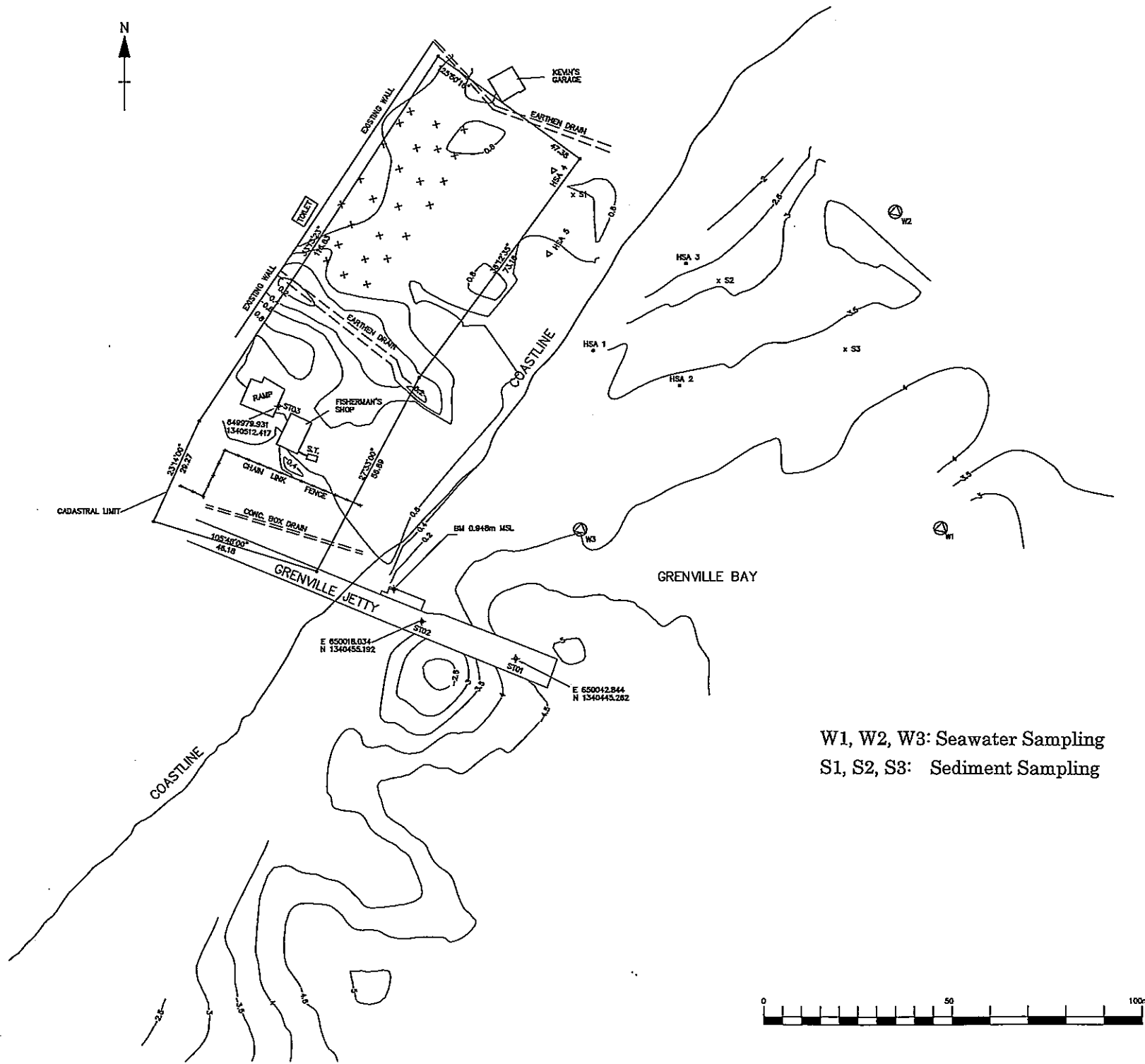


表4-2 計画栈橋先端付近代表点の波向と波高

沖波 波向	波高 (m)	周期 (s)	格子 (40, 96)		格子 (41, 96)		格子 (41, 97)	
			波向(度)	波高(m)	波向(度)	波高cm)	波向(度)	波高(m)
NE	4.9	15.3	131	0.38	128	0.35	131	0.33
ENE	4.1	13.5	131	0.37	127	0.35	130	0.33
E	4.2	8.0	131	0.34	127	0.33	131	0.30
ESE	4.2	8.0	134	0.35	128	0.34	131	0.31

**(5) 水質調査、底質調査**  
**(グレンヴィル水産施設)**



**NOTES**

1. Do not scale from this drawing, use figured dimensions only.
2. All dimensions are in metres unless otherwise stated.
3. Land contours are at 0.2m intervals.
4. Sea contours are at 0.5m intervals.
5. Site coordinate system is based on an assumed datum.

**LEGEND**

- S.T. SEPTIC TANK
- [Symbol] TREE CANOPY
- INTERMEDIATE CONTOURS
- INDEX CONTOURS
- [Symbol] WATER SAMPLE
- [Symbol] CONTROL STATION
- MARINE BOREHOLES
- x SEDIMENT SAMPLES
- △ LAND BOREHOLES

**REVISIONS:**

1. The Cadastral boundary was changed on the northern and west to the existing wall, from 116.13 to 116.83
2. The drawing has been revised to reflect the change in BM from 0.9m MSL to 0.948m MSL.

W1, W2, W3: Seawater Sampling  
 S1, S2, S3: Sediment Sampling

REV	DATE	DESCRIPTION	BY	CHECKED
1				

**CRC OVERSEAS COOPERATION**

**JOB TITLE  
 PROPOSED FISH MARKET FOR GRENVILLE**

DWG. TITLE	DWG. No.
SEDIMENT SAMPLING AND SOIL CONDITION SURVEY LOCATIONS	1

SCALE	JOB No.
1:500	W749

**LEE YOUNG & PARTNERS**  
 CONSULTING ENGINEERS & PROJECT MANAGERS  
 PORT OF SPAIN, TRINIDAD T.T.

# LEE YOUNG & PARTNERS

## CRC OVERSEAS CO-OPERATION INC.

### PROPOSED FISH MARKET, GRENVILLE, GRENADA

#### SEA WATER ANALYSIS

##### EQUIPMENT LIST

The YSI 63 pH and Temperature Meter (Data logs 60 data sets and automatically compensates pH measurements for temperature) was used to measure pH and temperature.

##### RESULTS

Location	Time	pH	Temperature	BOD <sub>5</sub> (mg O <sub>2</sub> /L)	COD (mg O <sub>2</sub> /L)
W1	July 3, 2:45 p.m.	7.96	30.3	4.08	5998
W2	July 3, 2:50 p.m.	8.04	30.4	2.74	7798
W3	July 3, 2:55 p.m.	8.04	30.1	<DL	5236
W1	July 4, 9:07 a.m.	7.94	28.0	<DL	7656
W2	July 4, 9:10 a.m.	7.96	28.0	<DL	6610
W3	July 4, 9:05 a.m.	7.88	28.2	2.00	3165

The above table presents the results from the tests performed.

The bathymetric survey report includes a map which identifies the location of the samples corresponding to their identification number.

The analytical data sheet and quality control data sheets as well as photographs illustrating the general area where sampling wads done are attached.

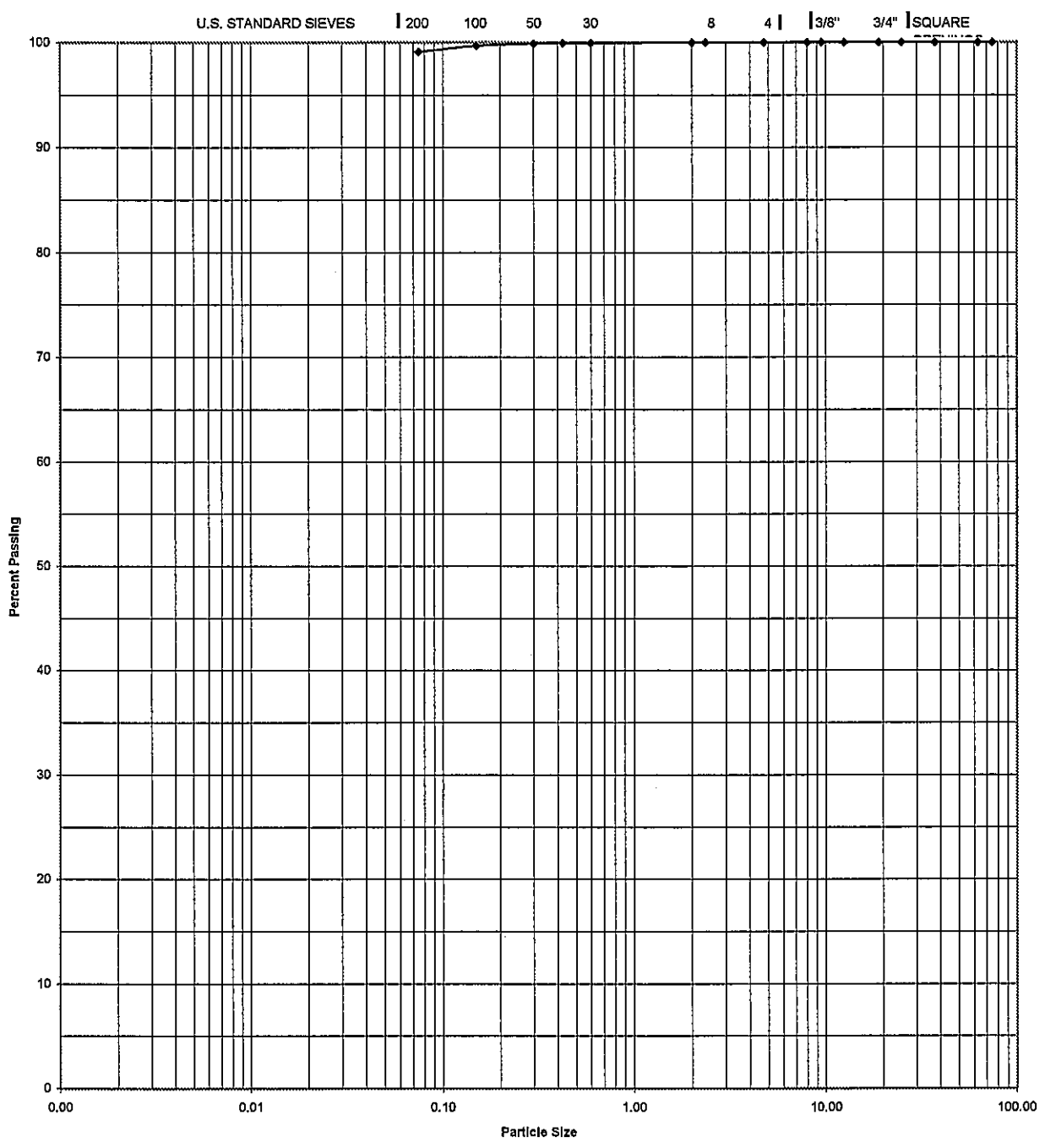
# LEE YOUNG & PARTNERS

Client Name: Lee Young and Partners.  
Sample Receive Date: 4/07/01  
Sample Matrix: Water  
Project number: 033-005

## ANALYTICAL DATA SHEET

Table 1. Results of analyses performed on samples

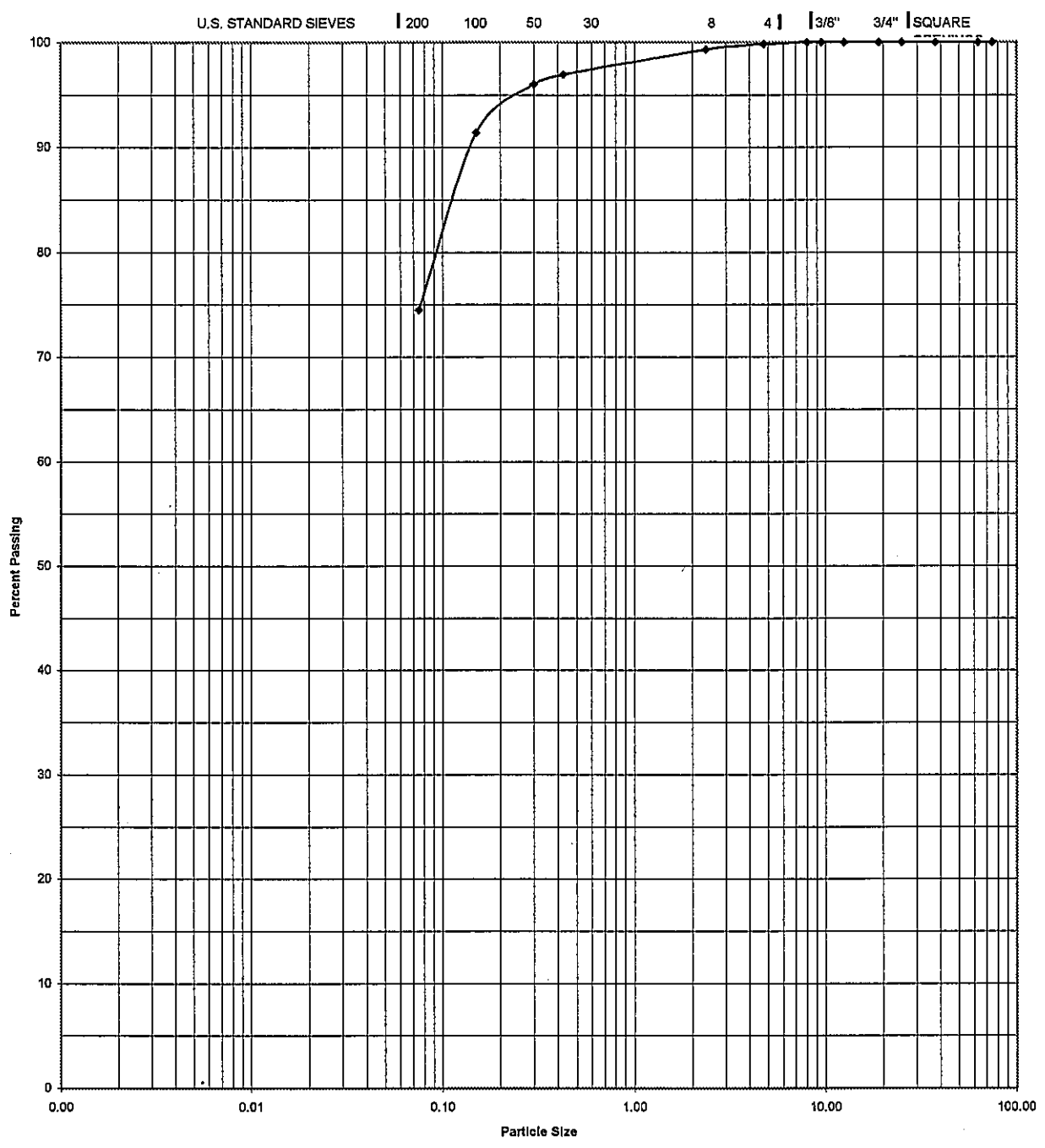
Sample Date	Sample Description	Sample Reference number	Biochemical Oxygen Demand (mg O <sub>2</sub> /L)	Chemical Oxygen Demand (mg O <sub>2</sub> /L)
3/07/01	W1	033-005-1	4.08	5998
3/07/01	W2	033-005-2	2.74	7798
3/07/01	W3	033-005-3	<DL	5236
4/07/01	W1	033-005-4	<DL	7656
4/07/01	W2	033-005-5	<DL	6610
4/07/01	W3	033-006-6	2.00	3165



Date 03-Aug-01  
 Job Name Proposed Fish Market, Grenville  
 Job Number W749  
 Job Location Grenville, Grenada  
 Tested by: A.P.

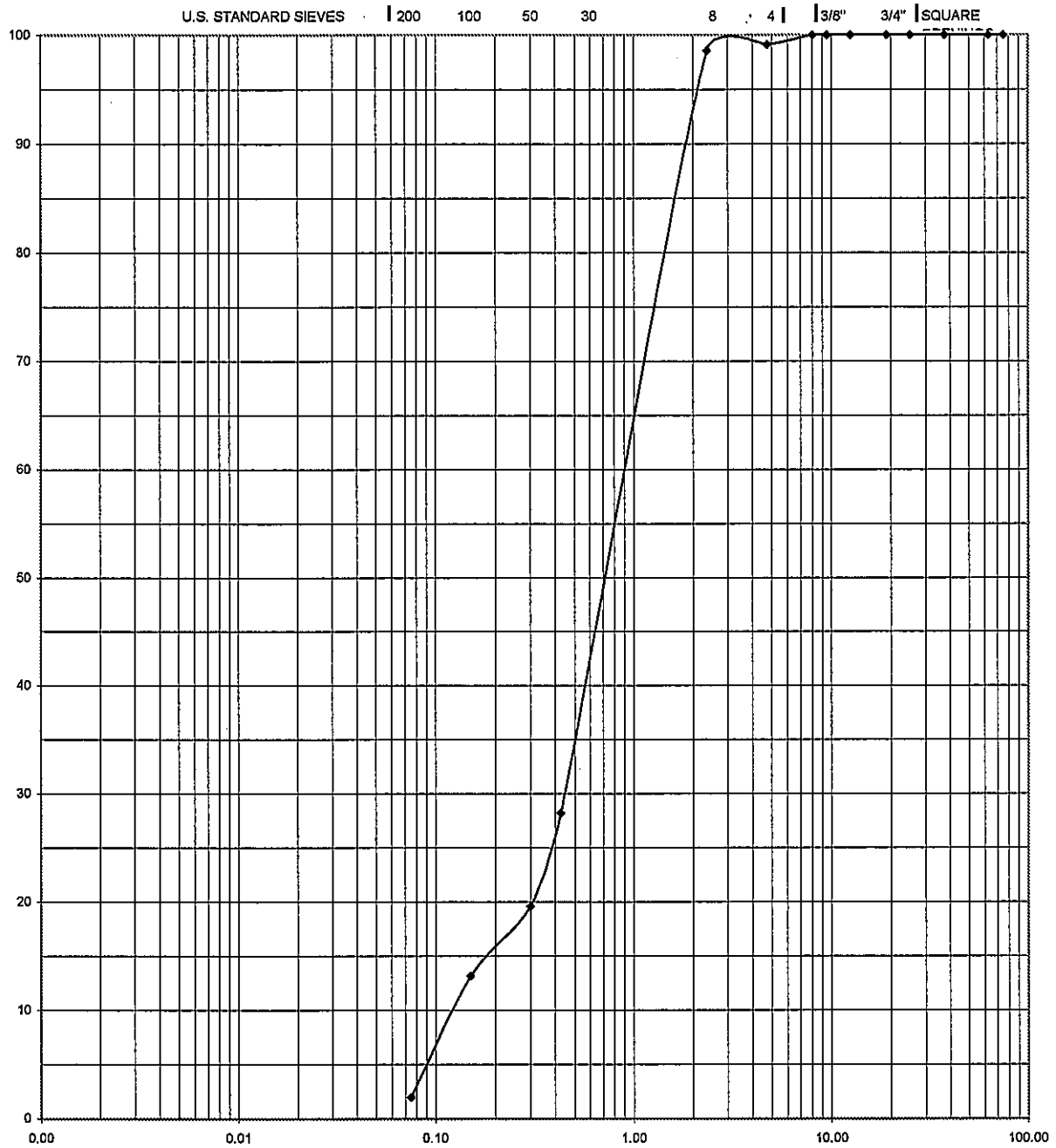
Boring no. Sediment Sample  
 Sample no. S1  
 Sample depth  
 Soil description





Date 04-Aug-01  
 Job Name Proposed Fish Market, Grenville  
 Job Number W749  
 Job Location Grenville, Grenada  
 Tested by: A.P.

Boring no. Sediment Sample  
 Sample no. S2  
 Sample depth  
 Soil description



Date 04-Aug-01  
 Job Name Proposed Fish Market, Grenville  
 Job Number W749  
 Job Location Grenville, Grenada  
 Tested by: A.P.

Boring no. Sediment Sample  
 Sample no. S3  
 Sample depth  
 Soil description

SPECIFIC GRAVITY TESTS ASTM D854M

PROJECT FISHERIES JOB No. \_\_\_\_\_  
 LOCATION OF PROJECT BOENVILLE  
 TEST HOLE No. 51 SAMPLE \_\_\_\_\_ DEPTH \_\_\_\_\_  
 DESCRIPTION OF SAMPLE \_\_\_\_\_  
 REMARKS \_\_\_\_\_

FLASK No.		<u>4</u>	<u>8</u>
THERMOMETER No.			
COHESIONLESS SOILS ONLY	WT. FLASK + DRY SOIL	<u>196.17</u>	<u>222.32</u>
	WT. FLASK	<u>171.17</u>	<u>197.32</u>
	WT. DRY SOIL, $W_s$	<u>25</u>	<u>25</u>
METHOD OF AIR REMOVAL		<u>BOILING</u>	<u>BOILING</u>
WT. FLASK + WATER + SOIL, $W_{dws}$		<u>681.71</u>	<u>710.47</u>
TEMP. OF SUSPENSION, $T^\circ C.$		<u>30</u>	<u>20</u>
WT. FLASK + WATER, $W_{bw}$		<u>666.25</u>	<u>695.05</u>
COHESIVE SOILS ONLY	EVAP. DISH No.		
	WT. DRY SOIL + TARE		
	WT. TARE		
	WT. DRY SOIL, $W_s$		
SPECIFIC GRAVITY, $G_s$		<u>2.45</u>	<u>2.61</u>
AVERAGE SPECIFIC GRAVITY		<u>2.53</u>	

FORMULA: 
$$G_s = \frac{W_s G_1}{W_s + W_{bw} - W_{dws}}$$

- WHERE
- $G_s$  = SPECIFIC GRAVITY OF SOILS
  - $W_s$  = WT. OF DRY SOIL
  - $W_{bw}$  = WT. OF FLASK + WATER AT  $T^\circ C.$   
(FROM CALIBRATION CURVE FOR FLASK)
  - $W_{dws}$  = WT. OF FLASK + WATER + SOIL AT  $T^\circ C.$
  - $G_1$  = SPECIFIC GRAVITY OF WATER AT  $T^\circ C.$

TESTED \_\_\_\_\_ DATE \_\_\_\_\_  
 COMPUTED \_\_\_\_\_ DATE \_\_\_\_\_  
 CHECKED \_\_\_\_\_ DATE \_\_\_\_\_

SOIL MECHANICS LABORATORY  
 LEE YOUNG & PARTNERS  
 CONSULTING ENGINEERS  
 PORT OF SPAIN  
 TRINIDAD

SPECIFIC GRAVITY TESTS ASTM D854M

PROJECT FISHERIES JOB No. \_\_\_\_\_  
 LOCATION OF PROJECT GREVILLE  
 TEST HOLE No. S2 SAMPLE \_\_\_\_\_ DEPTH \_\_\_\_\_  
 DESCRIPTION OF SAMPLE GREYISH GRAY - FINES  
 REMARKS \_\_\_\_\_

FLASK No.		9	10
THERMOMETER No.			
COHESIONLESS SOILS ONLY	WT. FLASK + DRY SOIL	199.11	213.80
	WT. FLASK	174.11	188.80
	WT. DRY SOIL, $W_s$	25	25
METHOD OF AIR REMOVAL		BOILING	BOILING
WT. FLASK + WATER + SOIL, $W_{bws}$		684.60	668.96
TEMP. OF SUSPENSION, $T^\circ C.$		30	20
WT. FLASK + WATER, $W_{bw}$		668.30	670.25
COHESIVE SOILS ONLY	EVAP. DISH No.		
	WT. DRY SOIL + TARE		
	WT. TARE		
	WT. DRY SOIL, $W_s$		
SPECIFIC GRAVITY, $G_s$		2.86	0.92
AVERAGE SPECIFIC GRAVITY		1.89	

FORMULA: 
$$G_s = \frac{W_s G_t}{W_s + W_{bw} - W_{bws}}$$

WHERE

- $G_s$  = SPECIFIC GRAVITY OF SOILS
- $W_s$  = WT. OF DRY SOIL
- $W_{bw}$  = WT. OF FLASK + WATER AT  $T^\circ C.$   
(FROM CALIBRATION CURVE FOR FLASK)
- $W_{bws}$  = WT. OF FLASK + WATER + SOIL AT  $T^\circ C.$
- $G_t$  = SPECIFIC GRAVITY OF WATER AT  $T^\circ C.$

TESTED _____ DATE _____	SOIL MECHANICS LABORATORY LEE YOUNG & PARTNERS CONSULTING ENGINEERS PORT OF SPAIN TRINIDAD
COMPUTED _____ DATE _____	
CHECKED _____ DATE _____	

SPECIFIC GRAVITY TESTS ASTM D854M

PROJECT FISHERIES JOB No. \_\_\_\_\_  
 LOCATION OF PROJECT GREENVILLE  
 TEST HOLE No. S3 SAMPLE \_\_\_\_\_ DEPTH \_\_\_\_\_  
 DESCRIPTION OF SAMPLE \_\_\_\_\_  
 REMARKS \_\_\_\_\_

FLASK No.		5	15
THERMOMETER No.			
COHESIONLESS SOILS ONLY	WT. FLASK + DRY SOIL	223.46	198.69
	WT. FLASK	198.46	173.69
	WT. DRY SOIL, $W_s$	25	25
METHOD OF AIR REMOVAL		BOILING	BOILING
WT. FLASK + WATER + SOIL, $W_{bws}$		708.93	684.52
TEMP. OF SUSPENSION, $T^\circ C.$		30	20
WT. FLASK + WATER, $W_{bw}$		693.45	671.25
COHESIVE SOILS ONLY	EVAP. DISH No.		
	WT. DRY SOIL + TARE		
	WT. TARE		
	WT. DRY SOIL, $W_s$		
SPECIFIC GRAVITY, $G_s$		2.61	2.88
AVERAGE SPECIFIC GRAVITY		2.745	

FORMULA: 
$$G_s = \frac{W_s G_t}{W_s + W_{bw} - W_{bws}}$$

WHERE

- $G_s$  = SPECIFIC GRAVITY OF SOILS
- $W_s$  = WT. OF DRY SOIL
- $W_{bw}$  = WT. OF FLASK + WATER AT  $T^\circ C.$   
(FROM CALIBRATION CURVE FOR FLASK)
- $W_{bws}$  = WT. OF FLASK + WATER + SOIL AT  $T^\circ C.$
- $G_t$  = SPECIFIC GRAVITY OF WATER AT  $T^\circ C.$

TESTED \_\_\_\_\_ DATE \_\_\_\_\_  
 COMPUTED \_\_\_\_\_ DATE \_\_\_\_\_  
 CHECKED \_\_\_\_\_ DATE \_\_\_\_\_

SOIL MECHANICS LABORATORY  
 LEE YOUNG & PARTNERS  
 CONSULTING ENGINEERS  
 PORT OF SPAIN  
 TRINIDAD