

(3) 潮流調査

Current (Circulation) studies

1. Dieppe Bay Results

Figure 1 shows the location of the 15-day current meter mooring at Dieppe Bay, St. Kitts. The current meter record is shown as 4 plots:

- Figure 2: The North and East Component Plot
- Figure 3: The Current Speed and Current Direction Time Series
- Figure 4: The Temperature, Salinity and Depth Time Series
- Figure 5: The Occurrence Bar Plot

Figure 1: Location of current stations at Dieppe Bay

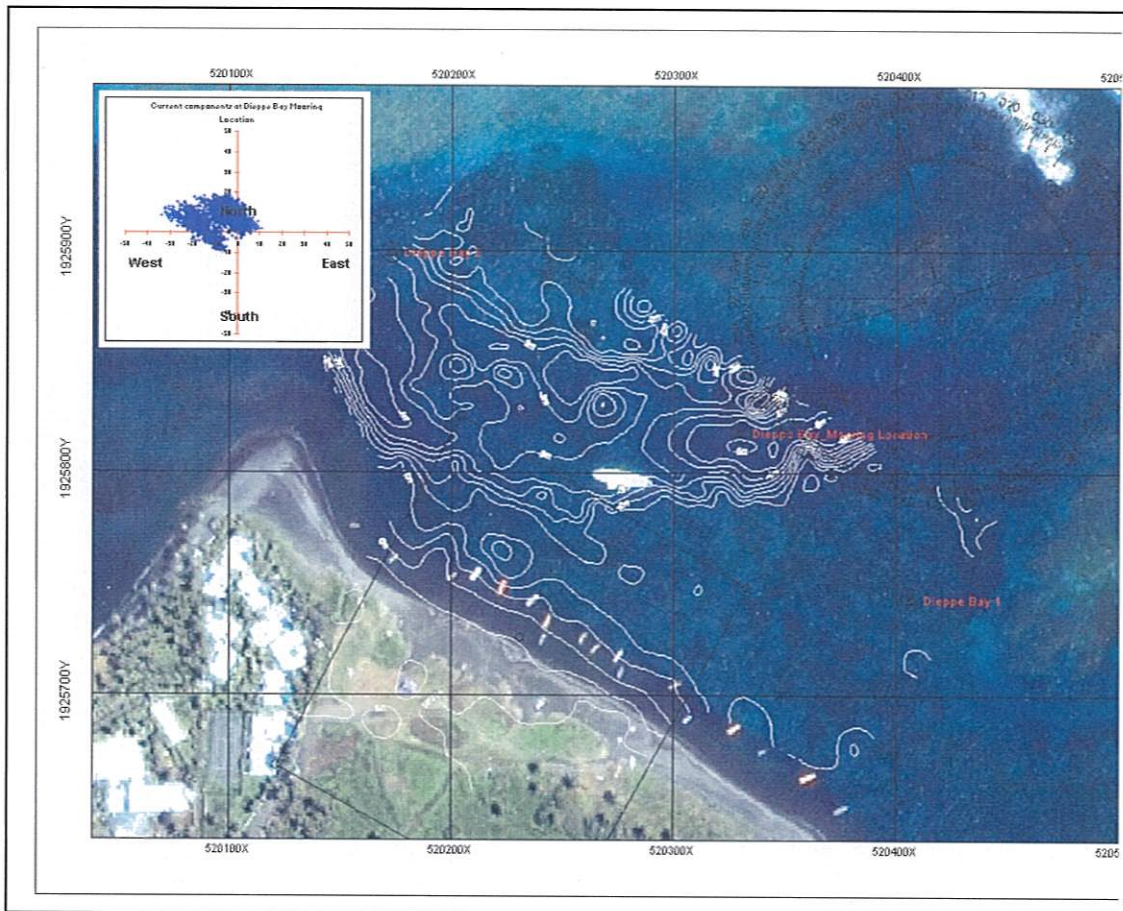


Figure 2: East and North component Plot of current at Dieppe Bay (30 Sep - 15 Oct 2004)

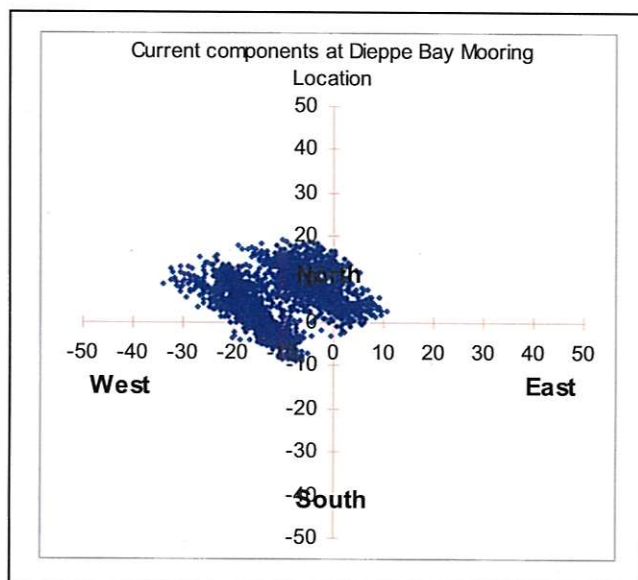


Figure 3: Time Series of Current Speed and Direction at Dieppe bay (30 Sept - 15 Oct 2004)

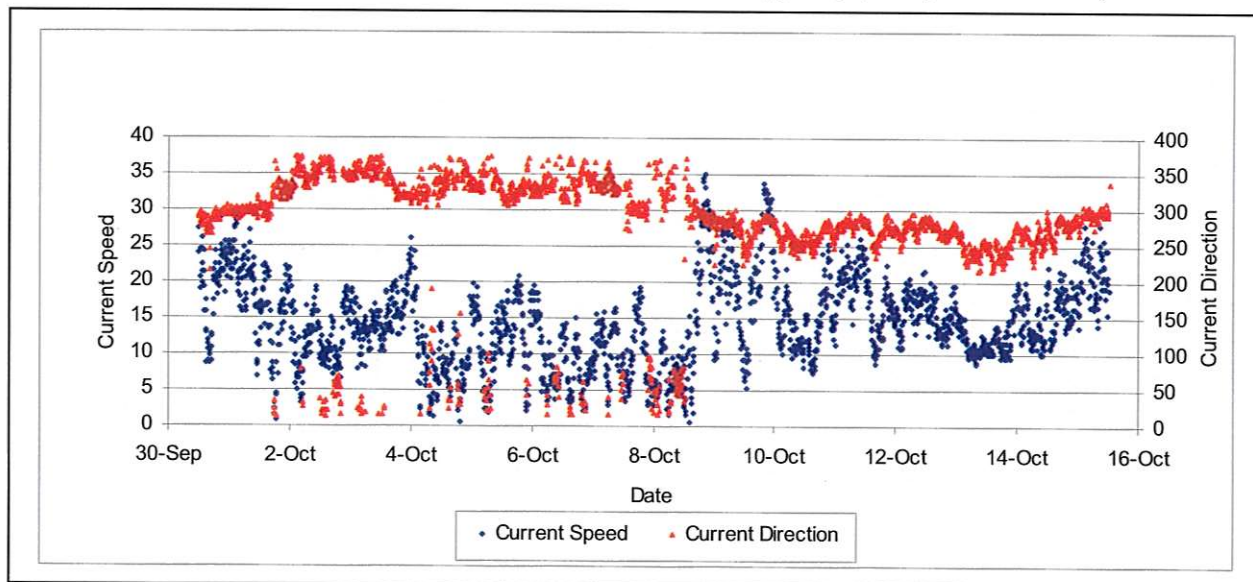


Figure 4: Time Series of Temperature, Salinity and Depth (Tide) at Dieppe bay (30 Sept - 15 Oct 2004)

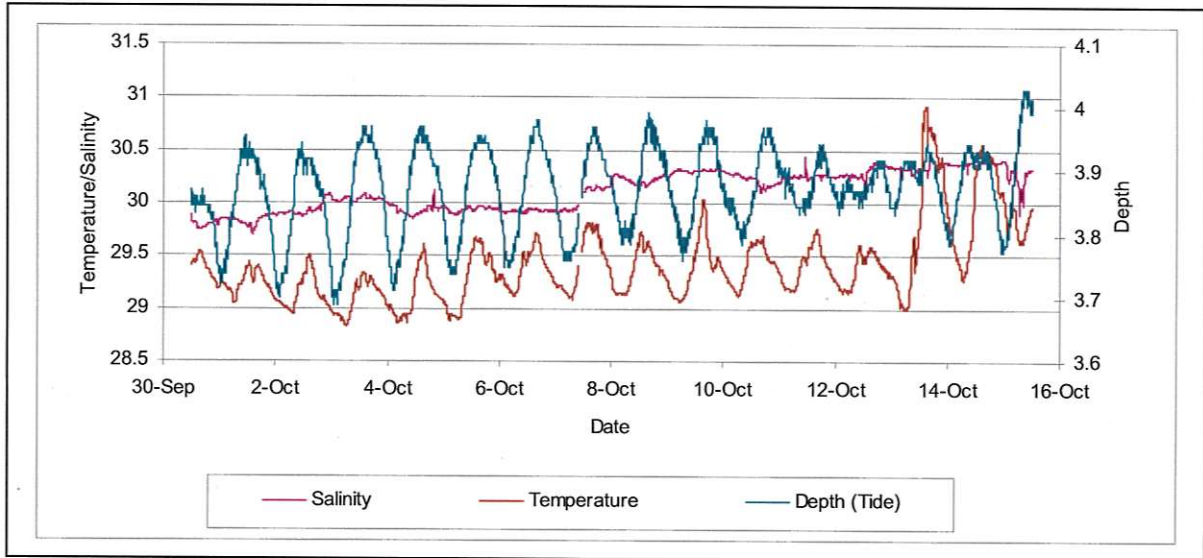
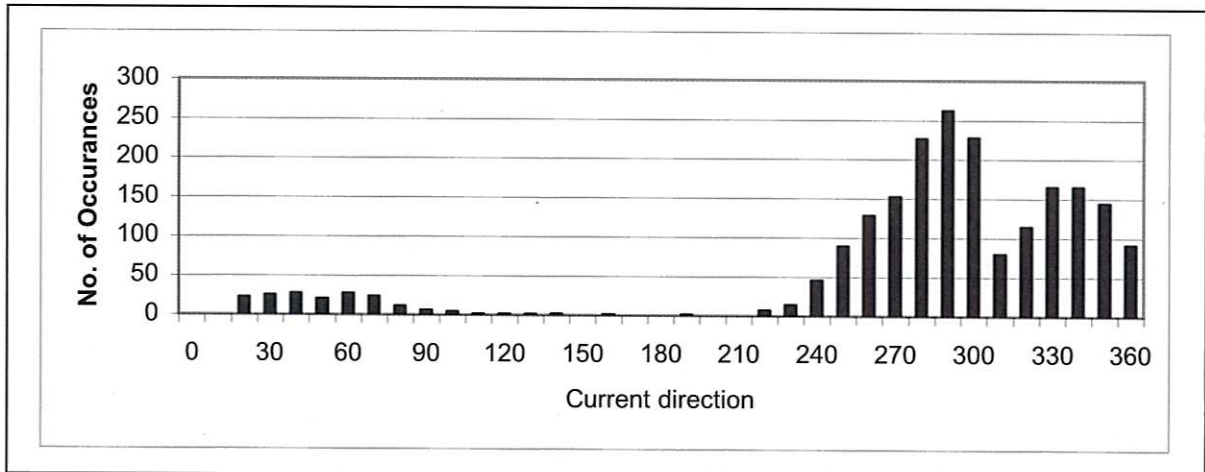


Figure 5: No. of Occurrences binned by Current Direction



2. Circulation at Dieppe Bay

Circulation at Dieppe Bay appears driven by tidal and residual flow through the channel feature between the barrier reef and the shoreline. Currents are almost persistently to the west or northwest at nearly all stages of the tide. Only small flows (usually less than 15cms^{-1}) were recorded towards the northeast) The maximum speed encountered was 35 cms^{-1} (on the rising tide at Springs on 9th October) The direction of flow was 290° True.

Figure 5- the 'occurrence bar graph,' shows the numbers of records binned by flow direction. The bias is clearly for flow towards the west or west-northwest.

The time series of water temperature and salinity over the observation period show a well-defined correlation between water temperature and tidal state. This mechanism is not explained by the record but may be related to water flow over the shallow tidal flat into the deep channel where the meter was located.

The circulation mechanism appears capable of transport large sediment loads across the sites. Such loads may be deposited in any dredged channels causing high levels of siltation.

3. Old Road Results

Figure 6 shows the location of the 15-day current meter mooring at Old Road, St. Kitts. The current meter record is shown as 4 plots:

- Figure 7: The North and East Component Plot
- Figure 8: The Current Speed and Current Direction Time Series
- Figure 9: The Temperature, Salinity and Depth Time Series
- Figure 10: The Occurrence Bar Plot

Figure67: Location of current stations at Old Road

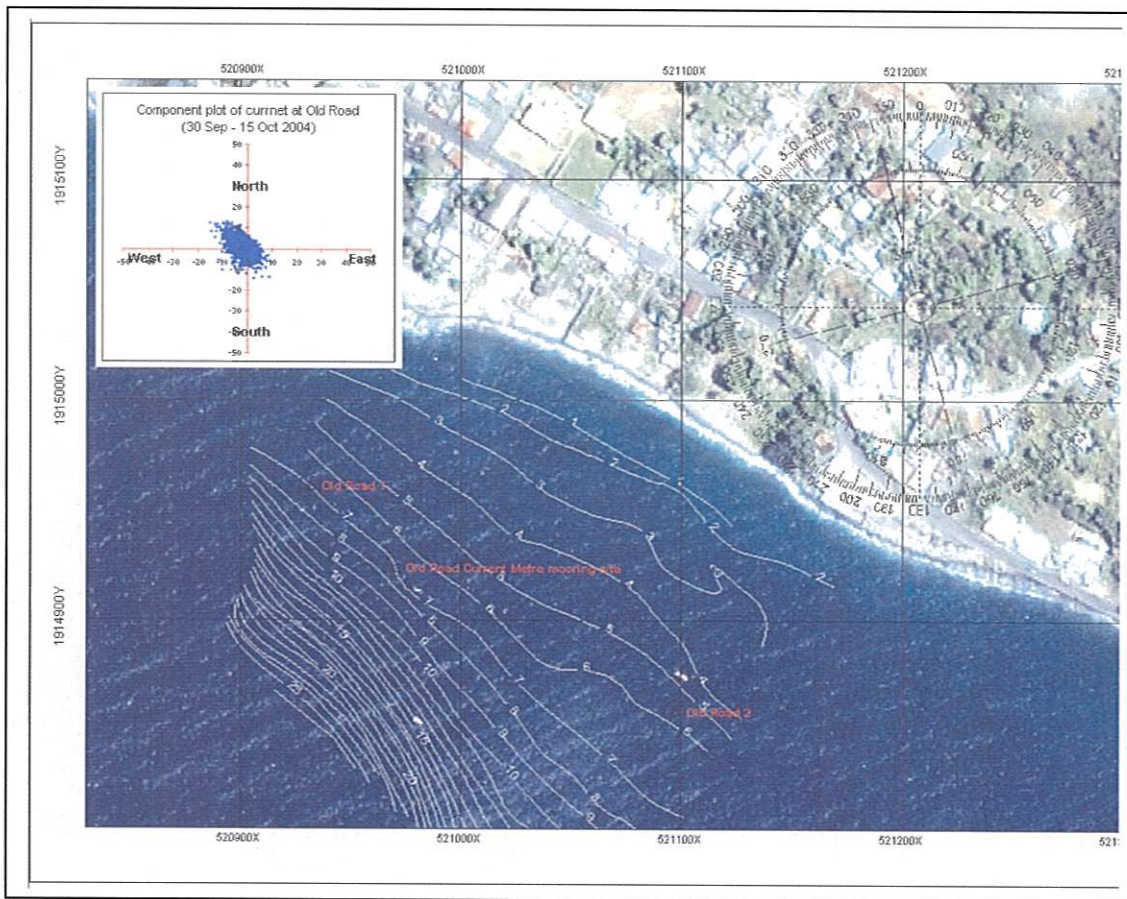


Figure 7: East and North component Plot of current at Old Road (30 Sep - 15 Oct 2004)

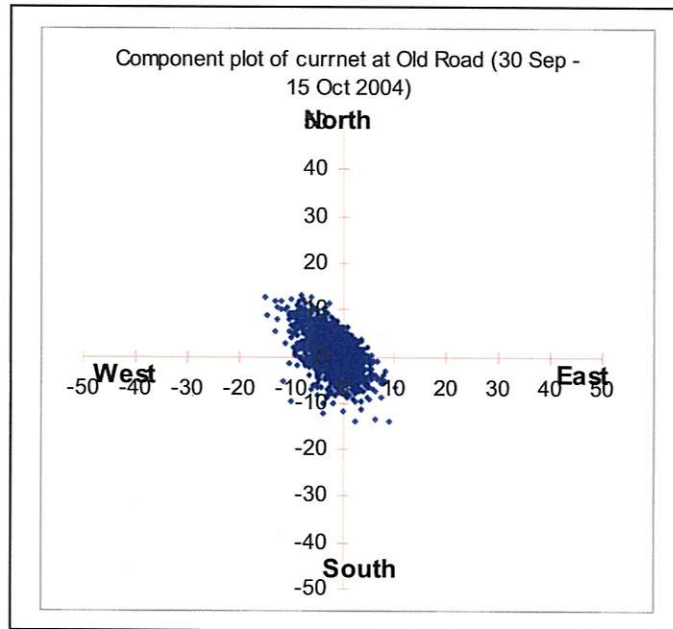


Figure 8: Time Series of Current Speed and Direction at Old Road (30 Sep - 15 Oct 2004)

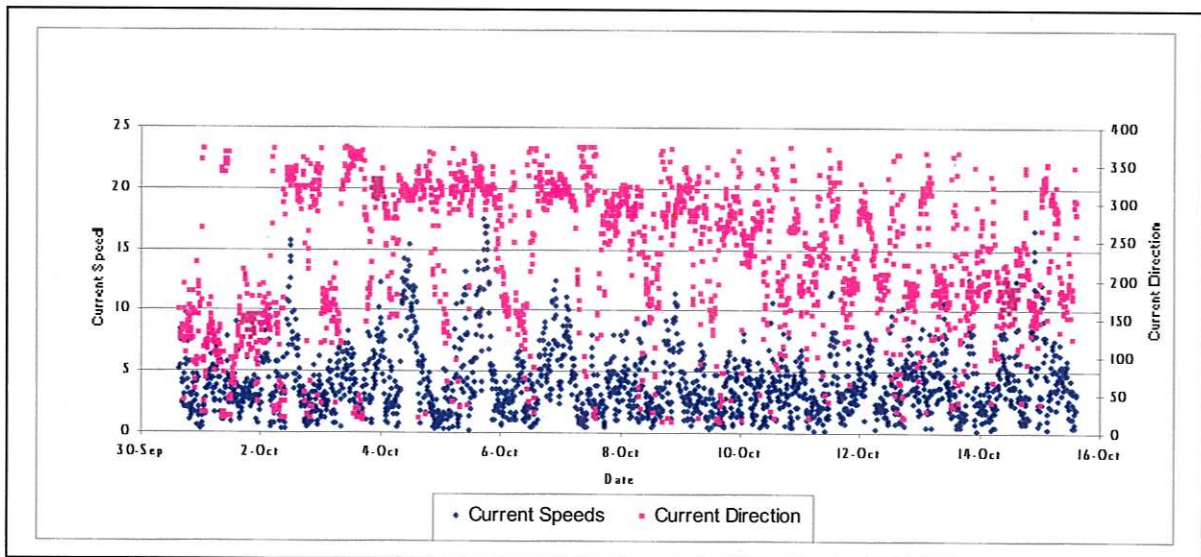


Figure 9: Time Series of Temperature, Salinity and Depth (Tide) at Dieppe bay (30 Sept - 15 Oct 2004)

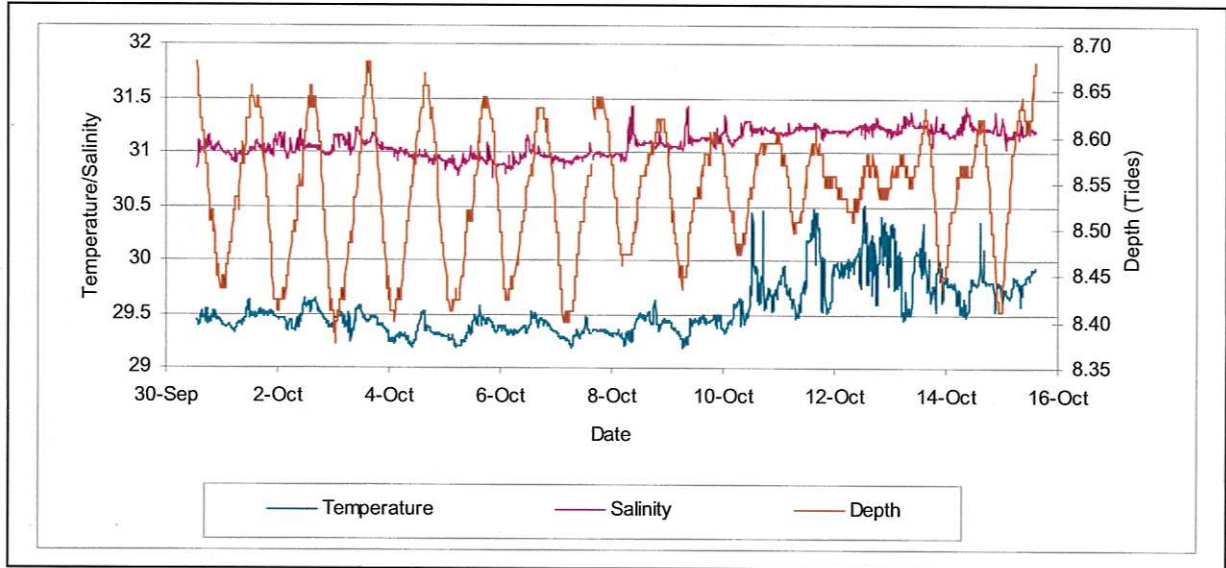
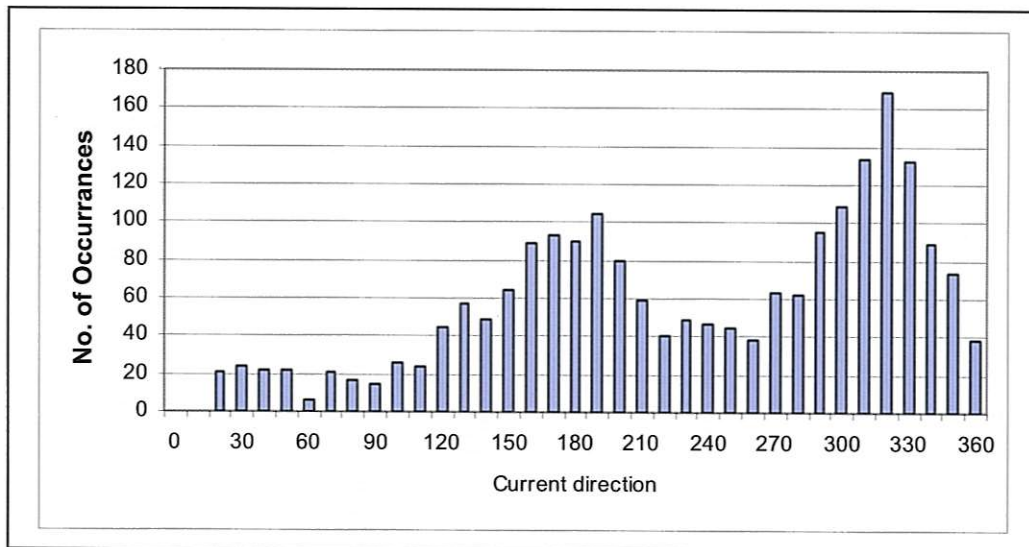


Figure 10: No. of Occurrences binned by Current Direction



4. Circulation at Old Road

Circulation at the Old Road site is strongly tidal with flow towards the southeast on the falling tide at usually less than 15 cms^{-1} and towards the northwest on the rising tide at usually less than 20 cms^{-1} . The flow appears parallel to the shoreline but may be influenced by the density effect of nearby river and streams.

As at Dieppe Bay, the time series of water temperature and salinity show strong correlation between water temperature and tidal state. Here too, the phenomenon is not fully explained by the record.

The circulation mechanism at Old Road appears weak and not sufficient to transport high loads of course material. The effect of extreme conditions, swell wave and or string winds is not examined.

Single Point current measurements

Single point current speed and direction measurements were carried out using a third S4 current meter from a small boat. Some difficulties were experienced while conducting these measurements. In the shallow water conditions at Dieppe Bay, the drift of the boat as function of the wind was sometimes a problem. Often the boat had to be anchored to manage the measurements. The measured data were recorded manually and entered into an EXCEL spread sheet for post processing and analysis. These data are supplied on the project CD.

Table 1: Single Point current meter and hydrographic measurements

Date	Site
Dieppe Bay	29, 30 September and 1,6,7,8,9,13,14,15 October 2004
Sandy Point	29, 30 September and 1,6,7,8,9,13,14,15 October 2004

Sea water Sampling Data measurements

The Seawater was sampled using a YSI 63/50 Probe. Measurement of salinity, pH, temperature and suspended solids were taken each time the single current measurements were taken.

(4) 底質調査

Marine Sediment Samples

1. Sampling methodology

Marine Sediment Samples were taken at each of the three survey-sites, on 8th October 2004. The samples were taken by a diver (using SCUBA) and with an 8cm diameter plastic tube that was manually pushed into the seabed. The samples were recovered and stored on plastic ZIPLOC bags for delivery to the analytical laboratory.

2. Sample Positions

GPS co-ordinates were taken for each of the marine sediment sample locations and listed below in Table 1

Table 1: Single Point Current meter and hydrographic measurements

Date	Sample Positions
Dieppe Bay_1	E 520301 N 1925713
Dieppe Bay_2	E 520209 N 1925787
Sandy Point_1	E 515038 N 1920060
Sandy Point_2	E 515141 N 1920010
Old Road_1	E 520975 N 1914980
Old Road_2	E 521091 N 1914888

3. General Site Notes

The following notes were taken during the sampling at each site.

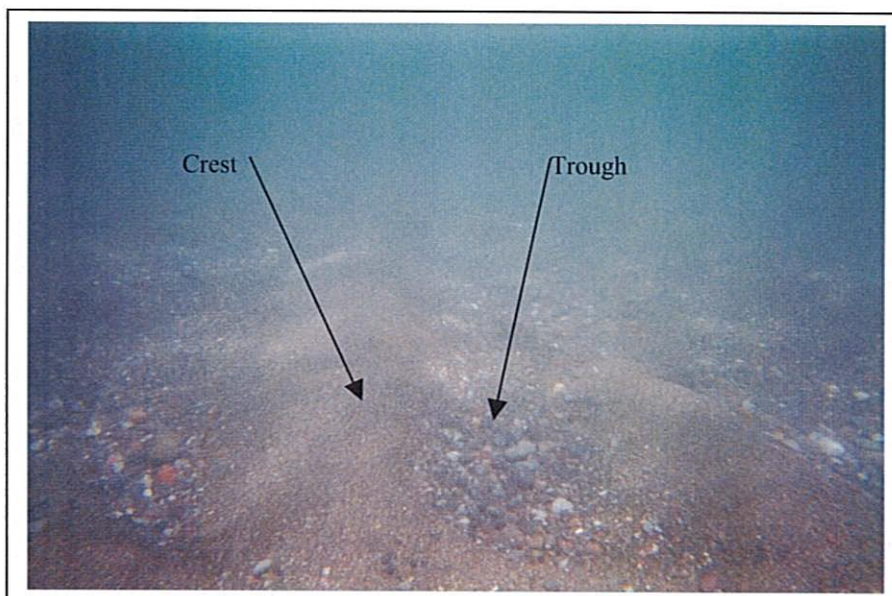
Dieppe Bay

At Dieppe Bay, two samples were taken – Dieppe Bay_1 was taken in about 2m of water in sandy area in-between areas of sea grass beds, Dieppe Bay_2 was also taken in about 2m of water in an area where these were small rocks and broken coral.

Sandy Point

The Sandy Point Samples were both taken in about 3.5m of water. At both sites the seabed appeared to be dominated by sand waves with larger sizes deposited at the wave trough with finer grain sizes at the wave crests. The photograph in Figure 6 shows the seabed at the Sandy Point Site.

Figure 1: Seabed at Sandy Point showing sand waves



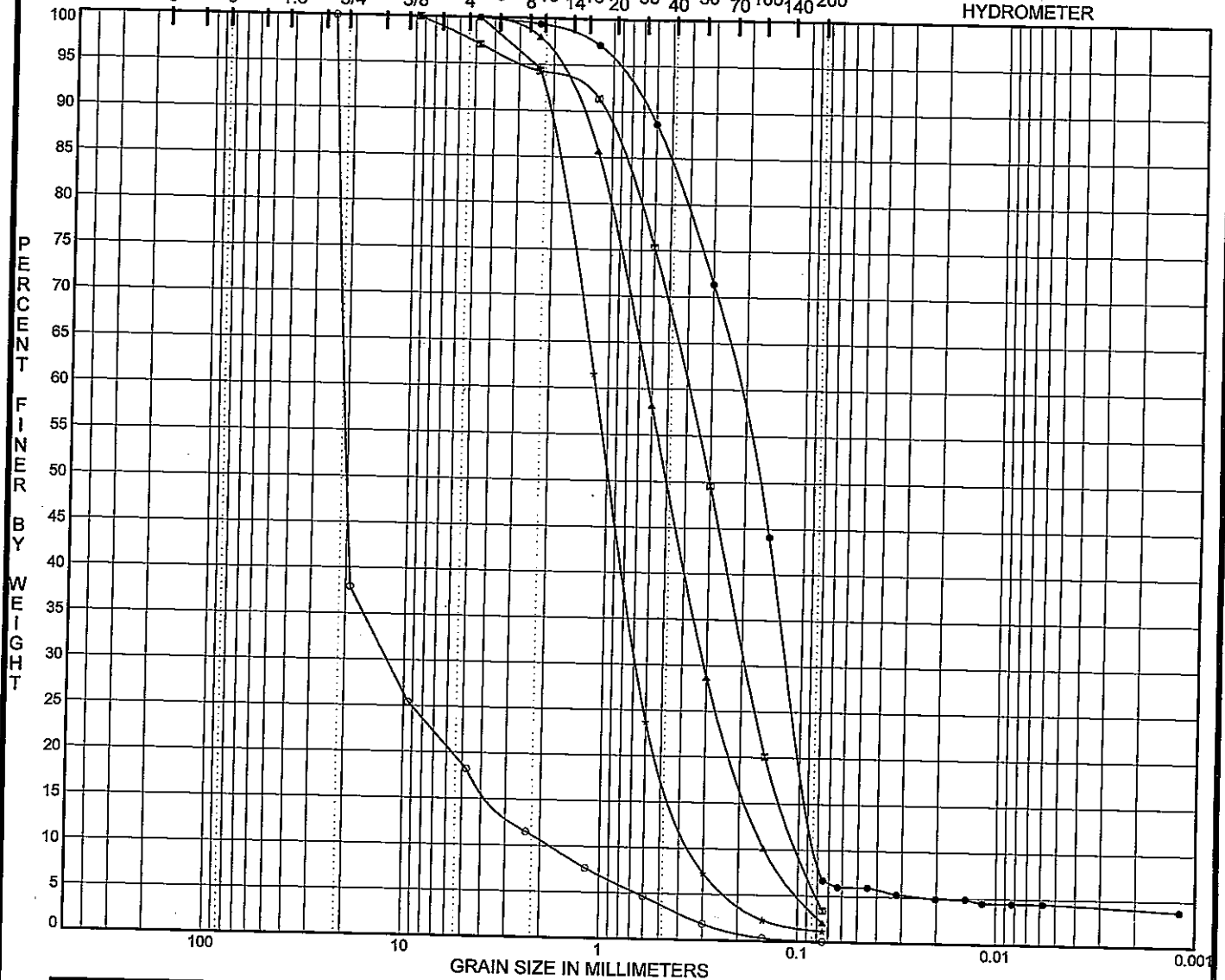
Old Road

Two samples were taken at Old Road. Both samples were taken in about 3m of water. At the Old Road Site, the presence of large boulders dominates the nearshore seabed topography (< than 15m from the shore). The samples were taken immediately seaward of the boulders.

U.S. SIEVE OPENING IN INCHES

U.S. SIEVE NUMBERS

ENCLOSURE No. 2
HYDROMETER



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample Id.	Depth, m	Classification				MC%	LL	PL	PI	Cc	Cu
● D 1	0.0									0.75	2.8
☒ D 2	0.0	POORLY GRADED SAND SP								0.91	4.0
▲ OR 1	0.0	POORLY GRADED SAND SP								1.03	4.2
* OR 2	0.0	POORLY GRADED SAND SP								1.17	3.4
○ R 1/1+2	0.0	POORLY GRADED GRAVEL with SAND GP								3.97	11.6
Sample Id.	Depth, m	D100	D60	D50	D30	%Gravel	%Sand	%Silt	%Clay		
● D 1	0.0	4.75	0.22	0.174	0.116	0.0	93.3	2.7	4.0		
☒ D 2	0.0	9.50	0.40	0.303	0.189	2.9	93.7	3.4			
▲ OR 1	0.0	4.75	0.63	0.495	0.309	0.0	97.9	2.1			
* OR 2	0.0	4.75	1.15	0.961	0.672	0.0	98.8	1.2			
○ R 1/1+2	0.0	25.00	20.95	20.042	12.243	81.8	18.2	0.1			

PROJECT Soil Inv. for Fishing Facility St. Kitts

JOB NO. GA 04 376
DATE December 2004

GRADATION CURVES

Geotech Associates Ltd.
Tunapuna

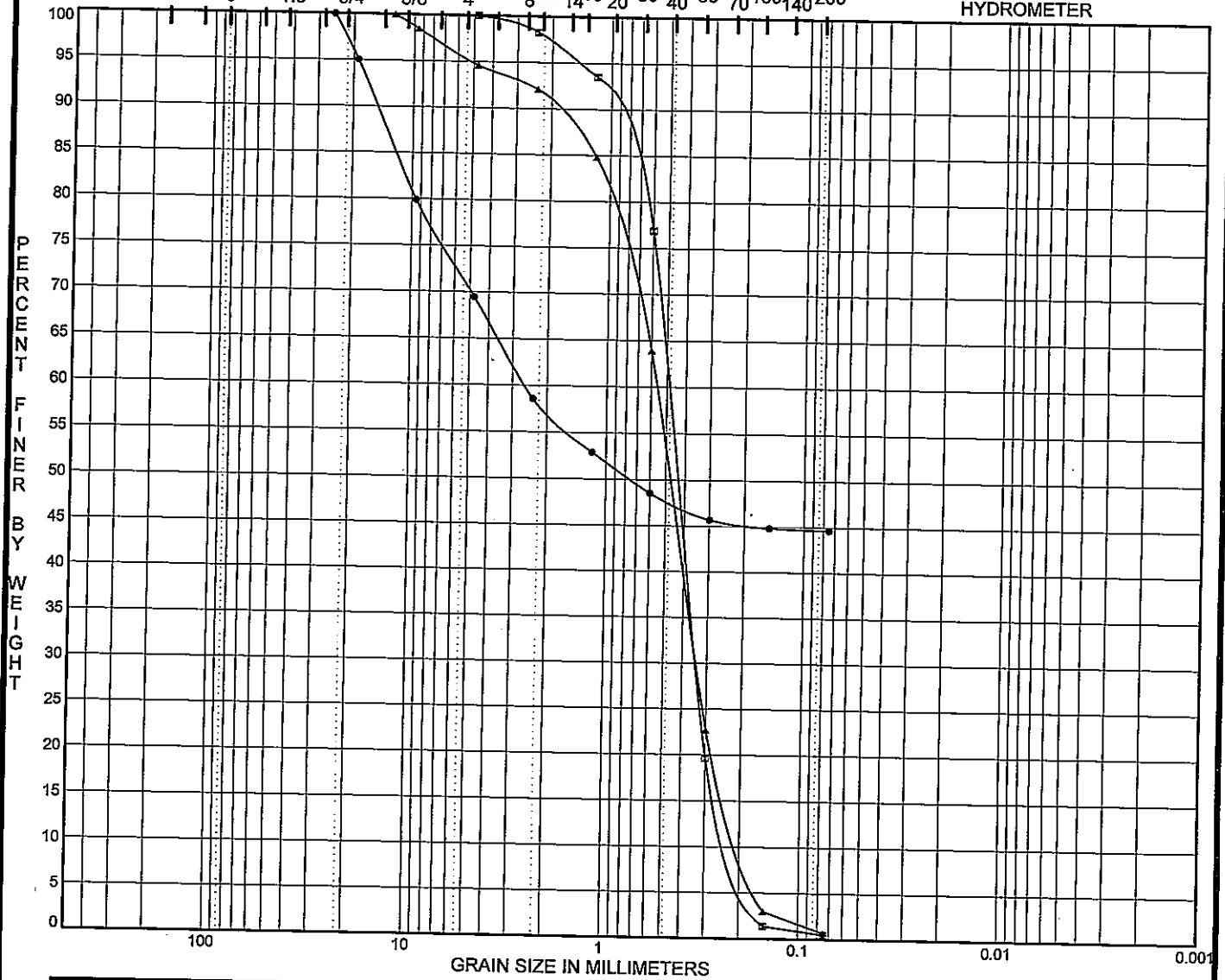


*GRSL-2, 04376.GPJ, 04/12/2

U.S. SIEVE OPENING IN INCHES

U.S. SIEVE NUMBERS

ENCLOSURE No. 3
HYDROMETER



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample Id.	Depth,m	Classification				MC%	LL	PL	PI	Cc	Cu
● R 2/1+2+3	0.0										
☒ SP 1	0.0	POORLY GRADED SAND SP								1.14	2.3
▲ SP 2	0.0	POORLY GRADED SAND SP								1.07	2.9
Sample Id.	Depth,m	D100	D60	D50	D30	%Gravel	%Sand	%Silt	%Clay		
● R 2/1+2+3	0.0	25.00	2.59	0.753		30.5	24.8	44.7			
☒ SP 1	0.0	4.75	0.49	0.433	0.340	0.0	99.5	0.5			
▲ SP 2	0.0	12.50	0.56	0.475	0.339	5.4	93.9	0.7			

PROJECT Soil Inv. for Fishing Facility - St. Kitts

JOB NO. GA 04 376
DATE December 2004

GRADATION CURVES

Geotech Associates Ltd.
Tunapuna



*GRSZL-2 04376.GPJ 04/12/2



**DETERMINATION OF SPECIFIC GRAVITY
(FINE AGGREGATES)**

PROJECT No. GA 04 376 **PROJECT NAME:** Soil Inv. for Fisheries Dev. Project

SOURCE St. Kitts **SPECIMEN ID.** Dieppe #1

MATERIAL DESCRIPTION _____

TESTED BY A.G.

CHECKED BY A. Budhram

TEST No.		1	2
BOTTLE No.		F	C
Wt. BOTTLE + WATER + SOIL = W_{bws}	g	653.6	660.2
TEMPERATURE, (T_w)	°C	30	30
Wt. BOTTLE + WATER = W_{bwc} (From calibrated curve)	g	637.6	644.3
Wt. OF EVAP. OF DISH + DRY SOIL	g		
Wt. OF EVAP. OF DISH	g		
Wt. OVEN DRY SOIL = W_s	g	25.0	25.0
SG of Water at T_w		0.9974	0.9974
G_s		2.771	2.740

REMARKS

AVERAGE SPECIFIC GRAVITY (G_s) = 2.756



**DETERMINATION OF SPECIFIC GRAVITY
(FINE AGGREGATES)**

PROJECT No. GA 04 376 PROJECT NAME: Soil Inv. for Fisheries Dev. Project

SOURCE St. Kitts SPECIMEN ID. Dieppe #2

MATERIAL DESCRIPTION _____

TESTED BY A.G.

CHECKED BY A. Budhram

TEST No.		1	2
BOTTLE No.		E	IA
Wt. BOTTLE + WATER + SOIL = W_{bws}	g	656.6	651.1
TEMPERATURE, (T_w)	°C	30	30
Wt. BOTTLE + WATER = W_{bwc} (From calibrated curve)	g	640.4	635.0
Wt. OF EVAP. OF DISH + DRY SOIL	g		
Wt. OF EVAP. OF DISH	g		
Wt. OVEN DRY SOIL = W_s	g	25.0	25.0
SG of Water at T_w		0.9974	0.9974
G_s		2.834	2.802

REMARKS

AVERAGE SPECIFIC GRAVITY (G_s) = 2.818



**DETERMINATION OF SPECIFIC GRAVITY
(FINE AGGREGATES)**

PROJECT No. GA 04 376 PROJECT NAME: Soil Inv. for Fisheries Dev. Project

SOURCE St. Kitts SPECIMEN ID. Old Road #1

MATERIAL DESCRIPTION _____

TESTED BY A.G.

CHECKED BY A. Budhram

TEST No.		1	2
BOTTLE No.		M	G
Wt. BOTTLE + WATER + SOIL = W_{bws}	g	658.3	658.4
TEMPERATURE, (T_w)	°C	30	30
Wt. BOTTLE + WATER = W_{bwc} (From calibrated curve)	g	641.8	642.0
Wt. OF EVAP. OF DISH + DRY SOIL	g		
Wt. OF EVAP. OF DISH	g		
Wt. OVEN DRY SOIL = W_s	g	25.0	25.0
SG of Water at T_w		0.9974	0.9974
G_s		2.934	2.899

REMARKS

AVERAGE SPECIFIC GRAVITY (G_s) = 2.917



**DETERMINATION OF SPECIFIC GRAVITY
(FINE AGGREGATES)**

PROJECT No. GA 04 376 PROJECT NAME: Soil Inv. for Fisheries Dev. Project

SOURCE St. Kitts SPECIMEN ID. Old Road #2

MATERIAL DESCRIPTION _____

TESTED BY A.G.

CHECKED BY A. Budhram

TEST No.		1	2
BOTTLE No.		J	H
Wt. BOTTLE + WATER + SOIL = W_{bws}	g	653.6	657.1
TEMPERATURE, (T_w)	°C	30	30
Wt. BOTTLE + WATER = W_{bwc} (From calibrated curve)	g	637.5	640.9
Wt. OF EVAP. OF DISH + DRY SOIL	g		
Wt. OF EVAP. OF DISH	g		
Wt. OVEN DRY SOIL = W_s	g	25.0	25.0
SG of Water at T_w		0.9974	0.9974
G_s		2.802	2.834

REMARKS

AVERAGE SPECIFIC GRAVITY (G_s) = 2.818



**DETERMINATION OF SPECIFIC GRAVITY
(FINE AGGREGATES)**

PROJECT No. GA 04 376 PROJECT NAME: Soil Inv. for Fisheries Dev. Project

SOURCE St. Kitts SPECIMEN ID. Sandy Point #1

MATERIAL DESCRIPTION _____

TESTED BY A.G.

CHECKED BY A. Budhram

TEST No.		1	2
BOTTLE No.		D	A
Wt. BOTTLE + WATER + SOIL = W_{bws}	g	659.8	656.0
TEMPERATURE, (T_w)	°C	30	30
Wt. BOTTLE + WATER = W_{bwc} (From calibrated curve)	g	643.2	639.4
Wt. OF EVAP. OF DISH + DRY SOIL	g		
Wt. OF EVAP. OF DISH	g		
Wt. OVEN DRY SOIL = W_s	g	25.0	25.0
SG of Water at T_w		0.9974	0.9974
G_s		2.968	2.968

REMARKS

AVERAGE SPECIFIC GRAVITY (G_s) = 2.968



**DETERMINATION OF SPECIFIC GRAVITY
(FINE AGGREGATES)**

PROJECT No. GA 04 376 PROJECT NAME: Soil Inv. for Fisheries Dev. Project

SOURCE St. Kitts SPECIMEN ID. Sandy Point #2

MATERIAL DESCRIPTION _____

TESTED BY A.G.

CHECKED BY A. Budhram

TEST No.		1	2
BOTTLE No.		SA	GA
Wt. BOTTLE + WATER + SOIL = W_{bws}	g	642.1	658.4
TEMPERATURE, (T_w)	°C	30	30
Wt. BOTTLE + WATER = W_{bwc} (From calibrated curve)	g	625.6	642.0
Wt. OF EVAP. OF DISH + DRY SOIL	g		
Wt. OF EVAP. OF DISH	g		
Wt. OVEN DRY SOIL = W_s	g	25.0	25.0
SG of Water at T_w		0.9974	0.9974
G_s		2.934	2.899

REMARKS

AVERAGE SPECIFIC GRAVITY (G_s) = 2.917



**DETERMINATION OF SPECIFIC GRAVITY
(FINE AGGREGATES)**

PROJECT No. GA 04 376 PROJECT NAME: Soil Inv. for Fisheries Dev. Project

SOURCE St. Kitts SPECIMEN ID. River #1/1+2

MATERIAL DESCRIPTION _____

TESTED BY A.G.

CHECKED BY A. Budhram

TEST No.		1	2
BOTTLE No.		#574	#540
Wt. BOTTLE + WATER + SOIL = W_{bws}	g	657.4	657.7
TEMPERATURE, (T_w)	°C	29	29
Wt. BOTTLE + WATER = W_{bwc} (From calibrated curve)	g	640.8	641.1
Wt. OF EVAP. OF DISH + DRY SOIL	g		
Wt. OF EVAP. OF DISH	g		
Wt. OVEN DRY SOIL = W_s	g	25	25
SG of Water at T_w		0.9977	0.9977
G_s		2.969	2.969

REMARKS

AVERAGE SPECIFIC GRAVITY (G_s) = 2.969



**DETERMINATION OF SPECIFIC GRAVITY
(FINE AGGREGATES)**

PROJECT No. GA 04 376 PROJECT NAME: Soil Inv. for Fisheries Dev. Project

SOURCE St. Kitts SPECIMEN ID. River #2/1+2+3

MATERIAL DESCRIPTION _____

TESTED BY A.G. CHECKED BY A. Budhram

TEST No.		1	2
BOTTLE No.		#574	#540
Wt. BOTTLE + WATER + SOIL = W_{bws}	g	657.4	657.7
TEMPERATURE, (T_w)	°C	29	29
Wt. BOTTLE + WATER = W_{bwc} (From calibrated curve)	g	640.8	641.1
Wt. OF EVAP. OF DISH + DRY SOIL	g		
Wt. OF EVAP. OF DISH	g		
Wt. OVEN DRY SOIL = W_s	g	25	25
SG of Water at T_w		0.9977	0.9977
G_s		2.969	2.969

REMARKS

AVERAGE SPECIFIC GRAVITY (G_s) = 2.969