FINAL MONITORING REPORT

DREDGING AND RECLAMATION PROGRAMME
IN
KINGSTON HARBOUR

November 29, 2002

Prepared for:
The Port Authority of Jamaica

Prepared by:

1.0 BACKGROUND

Dredging on this programme by the Leoanardo Da Vinci was completed on 10th July 2002. Dredging by the Christoforo Colombo was completed on 26th July 2002.

This report presents findings of monitoring exercises carried out at least three weeks after the completion of the dredging as required by the approved monitoring programme.

2.0 WATER QUALITY

This report is based primarily on fieldwork carried out on September 2, 2002. Comparison is also made with data collected for the EIA, and during monitoring of the dredge.

The objective was to provide measurements of TSS (total suspended solids) and turbidity at sites that were monitored during dredging associated with the KCT3 Kingston Harbour Port Development Programme.

2.1 METHODOLOGY

2.1.1 Field Work

Monitoring was carried out at, Rackham's Cay, in the channel, and in Hunt's Bay. These sites were reached by Fisher's canoe from Harbour Head Fishing Beach.
Exact sampling locations were determined by GPS based on positions established during dredge monitoring operations. These samples were labelled KTP/PDM 1 – KTP/PDM PDM 5 (Table 1).

Table 1: Post Dredge Monitoring At Kingston Wharves
Water Quality Sampling Sites July 8, 2002

STATION NO	DESCRIPTION	N COORD.	W COORD.
KTP/PDM 1	Rackhams Cay - Restoration Area	17° 55.427'	76° 50.319'
KTP/PDM 2	Channel Near Port Royal	17° 56.638'	76° 51.299'
KTP/PDM 3	Channel - Near Greenwich Beach	17° 57.147'	76° 51.197'
KTP/PDM 4	Hunts Bay - Fishing Area	17° 58.673'	76° 51.005'
KTP/PDM 5	Hunts Bay - Bund Near Causeway Bridge	17° 58.923'	76° 50.538'

Sub-surface samples were collected using a Van Dorn type sampler. Samples were designated T (surface), M (middle depth) and B (bottom depth). Sampling was carried out between 0915 and 1227 hours.

2.1.2 Sample Analysis

Samples were analysed by the Geological Survey Division laboratory in accordance with Standard Methods for the Analysis of Water and Waste Water to determine TSS and turbidity.

TSS was determined by filtration of a known sample volume through a dried, pre weighed filter. After filtration, the filter was dried and re-weighed. TSS in mg/l is obtained through a determination of the weight difference of the filter before and after filtration.

Turbidity was performed using the colorimetric method and reported in FAU (formazin attenuated units). FAU incorporates a correction for colour and thus gives a more realistic determination of turbidity.

2.2 OBSERVATION AND RESULTS

2.2.1 General Observations

Sampling was carried out during sunny conditions. There was a strong southerly wind accompanied by a choppy sea state.

2.2.2 Laboratory Results

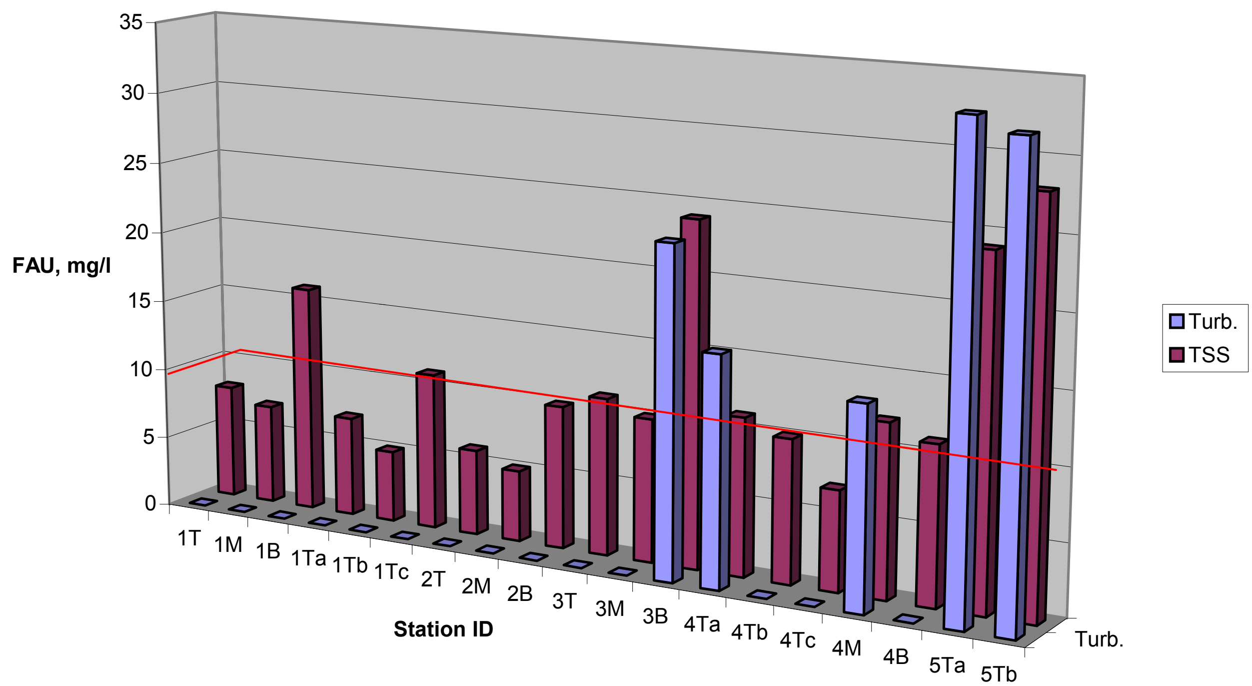
Results of laboratory analyses are presented numerically in Table 2, and graphically in Figure 2. Figure 3 is a graphical comparison of pre dredge (1), dredge (2) and post dredge TSS values.

Table 2: Post-Dredge Monitoring Kingston Harbour - August 29, 2002
Comparison of TSS values

Station ID	Description	Depth (M)	NTU	TSS
1T	Rackhams Cay - Restoration Area	0.5	<14	8
1M		2.0	<14	7
1B		4.5	<14	16
1Ta	Channel Near Port Royal	0.5	<14	7
1Tb		0.5	<14	<5
1Tc		0.5	<14	11
2T	Channel Near Port Royal	0.5	<14	6
2M		7.0	<14	<5
2B		14.0	<14	10
3T	Channel - Near Ft. Augusta	0.5	<14	11
3M		7.0	<14	10
3B		14.0	23.0	24
4Ta	Hunts Bay - Fishing Area	0.5	16.0	11
4Tb		0.5	<14	10
4Tc		0.5	<14	7
4M		1.0	14.0	12
4B		2.0	<14	11
5Ta	Hunts Bay - Near Bund	0.5	33.0	24
5Tb		0.5	32.0	28

Turbidity readings for most of the samples collected for the post dredge monitoring exercise were below the quoted test detection limit of 14FAU. The exceptions s were 3B - Channel H2 (23FAU), 4Ta - one of the Hunt's Bay replicates (16FAU), and the duplicates collected at 5Ta and 5Tb – the bund near the Causeway Bridge (33 and 32FAU).

Figure 2 Post Dredge Monitoring Turbidity and TSS Levels

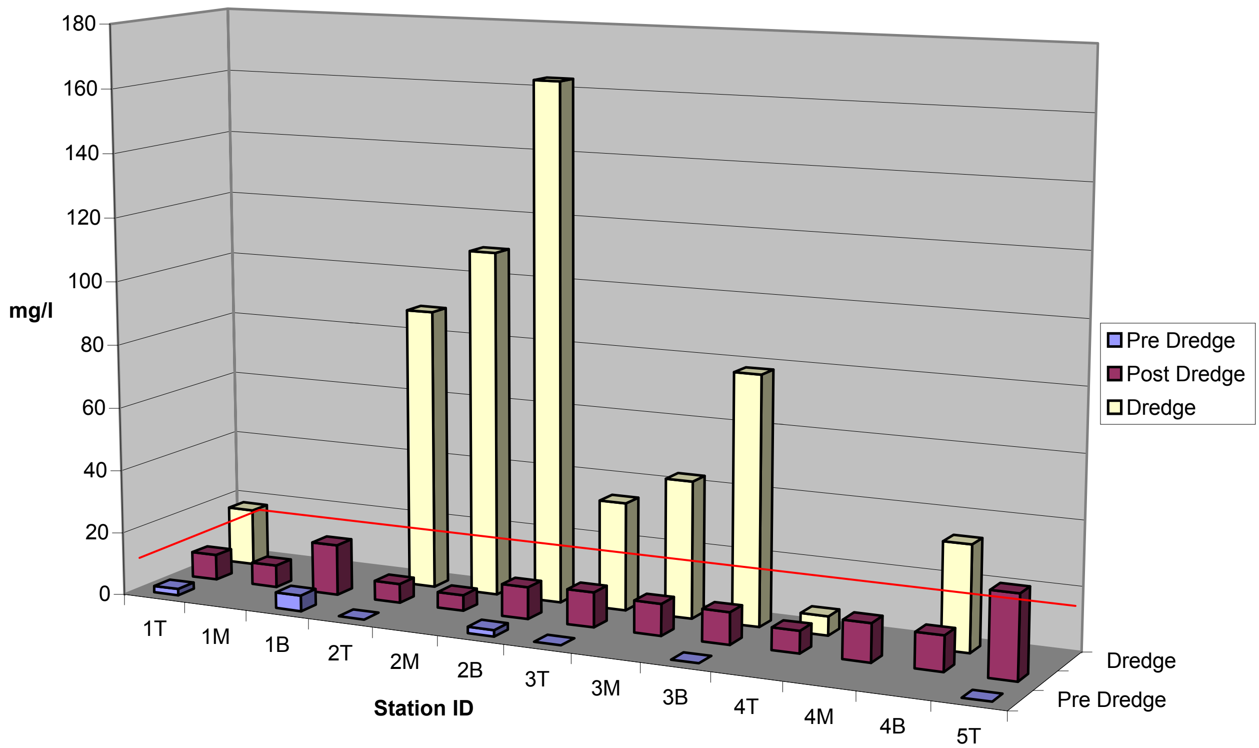


Proposed Coral Reef Standard

The range for TSS in all the samples collected was determined to be <5mg/l to 28mg/l. The lowest value was determined in one of the replicate surface samples from Rackham's Cay, while the highest value was determined in one of the duplicates taken in Hunts Bay at the bund near the causeway. Apart from the samples collected at the bund (Station 5), the surface sample in Hunts Bay fishing area (3T), and one of the Rackham's Cay replicates all other surface samples were less than the 10mg/l proposed for waters over coral reefs. The Hunts Bay (3T) sample, as well as the Rackham's Cay replicate were only marginally above the proposed standard being 11mg/l. Other samples which exceeded the proposed standard were those collected from the Station 1B, 3B, 4M and 4B. These levels were 16mg/l, 24mg/l, 12mg/l, and 11mg/l respectively.

TSS levels were generally consistent with the low turbidity readings determined (Figure 2). Correlation between turbidity and TSS was fair (Figure 4) having a correlation coefficient of .823389

Figure 3 Comparison of TSS Levels - Before, During, and After Dredging



Proposed Coral Reef Standard

2.3 CONCLUSION/ENVIRONMENTAL IMPACT

Post dredge turbidity and TSS readings suggest a near return to pre dredge conditions. The slightly increased TSS levels observed in some samples were likely associated with the choppy sea state that prevailed during the post dredge sampling exercise.

3.0 MARINE BIOLOGY

Dredging activity on the north (ship channel) side of Rackham's Cay took place over the period recorded as June 8-15; June 17-18; June 20 – 23 & June 24 – 27, 2002. Prior to the start of dredging activities mitigation required by National Environmental and Planning Agency (NEPA) stipulated the removal of 60,000 pieces of select scleractinian coral, gorgonians and urchins (***Tripneustes & Diadema spp.***) from the area to be affected by dredging activities to a nearby recipient site.

3.1 METHODOLOGY

Aerial photography - consisted of over flights of Rackham's Cay and adjacent Cays (Gun Cay, West Middle Shoal, Drunkenman's Cay) at approximately weekly intervals with photographs being taken at altitudes of between 600 to 1500 ft. to determine the extent and direction of movement of the sediment plume.

Sediment traps - were also deployed so as to determine the actual amount of sediment being liberated to and moved laterally by the water column by the actual dredging in contrast to the amount of sediment being resuspended from bottom sediments by wave action. Straight sided plastic jars (10cm high & 8.3cm dia.) were secured to reference stakes at 50cm & 10 cm above the substrate at the desired locations. After a selected number of days the jars were capped underwater and returned to the Laboratory. Foreign objects were removed from the jars, the samples filtered, rinsed and dried to constant weight at 70°C as per formula: (wt of sediment/ #of days deployed)x 3.142 x (radius of collecting jar) ^{2}

Sedimentation rates were calculated as gm of sediment per sq. cm per day. By collecting samples both at and above the substrate, the sediment being stirred up from and transported along the bottom (the "bedload" component) as well as the sediment that is arriving onsite as suspended in the water column (the "settling" component) can be calculated. Statistical analyses were then used to identify significant differences between these components of suspended solids in the water column.

Post Dredge Dives - consisted of scuba dives to perform a visual examination of the status (general health – mortality & bleaching, and level of sediment accumulated on them) of corals immediately adjacent the dredging area as well as those in the relocation area.

3.2 RESULTS

Aerial photography – of the dredge site at Rackham's Cay indicated that plumes of sediment were being moved in several directions by the prevailing winds and currents. Sediment plumes therefore obscured all of the water immediately around Rackham's Cay – despite the presence of a sediment curtain located on its eastern side (Photos #1, #2) between the dredge and the coral relocation sites. Sediment plumes were also observed moving North East towards Gun Cay and West towards West Middle Shoal, and southwards down the South Channel. (see Photo's # 3,#4, #5).

Sediment traps – were installed during the period of active dredging around Rackham's Cay (Photo #6); at Gun Cay; in between the dredging and spoil disposal sites at West Middle Shoal and at Drunkenman's Cay as a background/control site. (see Fig. #1). Amounts of sediment settling out on the substrate were found to be uniformly low at all sampling sites.

At Drunkenman's Cay the Settling Component Sedimentation Rate ranged between 0.0007 and 0.0071 g/sq. cm/day while the Bedload Component Sedimentation Rate ranged between 0.0088 and 0.0228 g/sq. cm/day.

The means of the Settling Component showed no statistical difference between the samples for the duration of the study.

The means of the Bedload Component showed no statistical difference between the samples for the duration of the study. There was however a statistical difference between the means of the Settling and Bedload Sedimentation Rates which indicated that the wave action was stirring up bottom sediments in this area and thus adding to any possible stress from sediments that corals and other flora/fauna may have been experiencing in this area. Since the sediments appeared to originate from the bottom sediments, this stress was not directly attributable to the dredging activities and was assumed to be the norm for the area.

At West Middle Shoal the Settling Component Sedimentation Rate ranged between 0.0036 and 0.0126 g/sq. cm/day while the Bedload Component Sedimentation Rate ranged between 0.0038 and 0.0358 g/sq. cm/day.

The means of the Settling Component showed no statistical difference between the samples for the duration of the study.

The means of the Bedload Component showed no statistical difference between the samples for the duration of the study. As with the site at Rackham's Cay there was a significant statistical difference between the means of the Settling and Bedload Sedimentation Rates which indicated that the wave action was stirring up bottom sediments in this area and thus adding to the sediment load in the water column. This situation was also assumed to be the norm for the area.

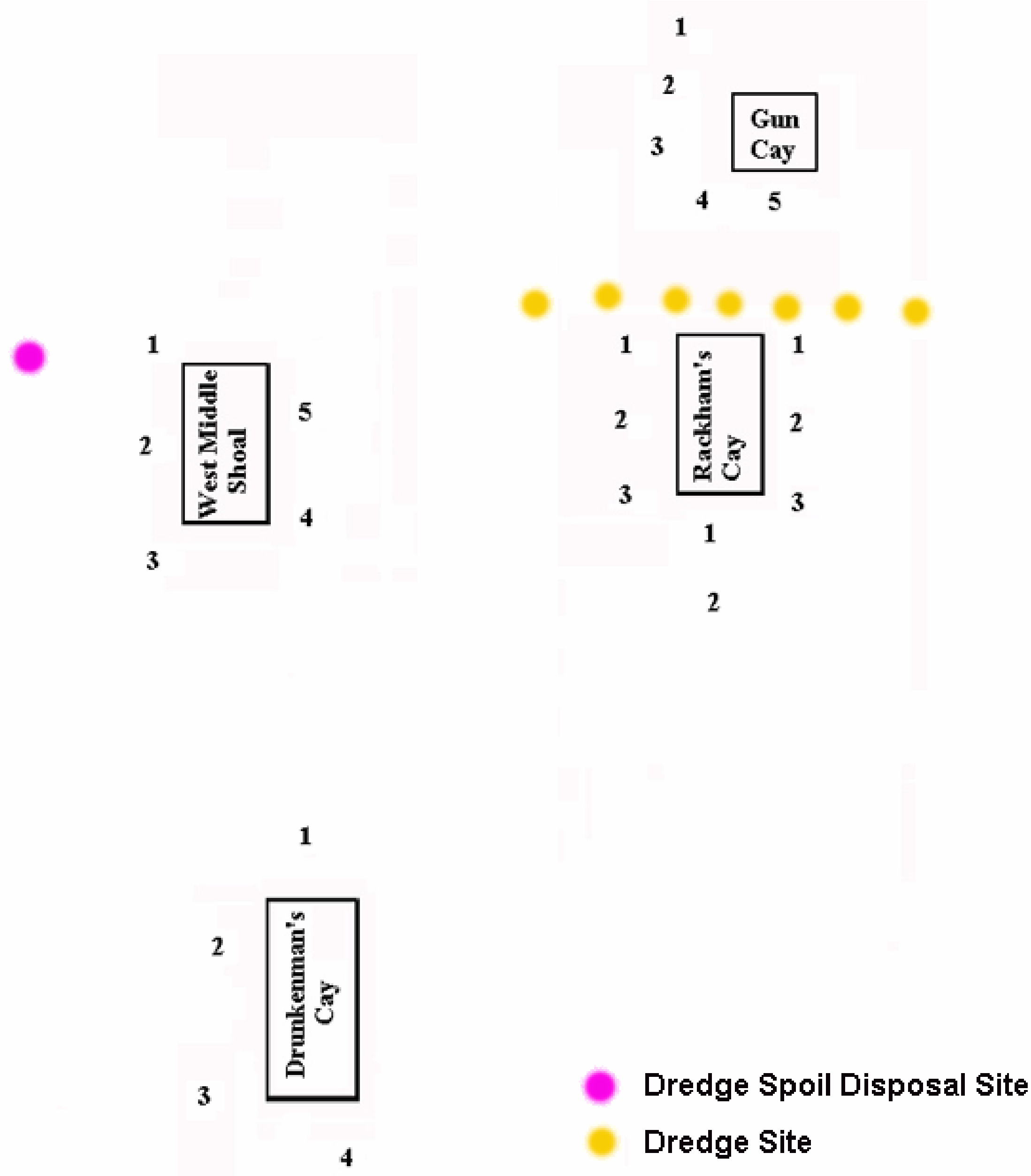


Fig #1 - Relative Positions of Sediment Traps

(diagram not to scale)

At Gun Cay the Settling Component Sedimentation Rate ranged between 0.0008 and 0.0151 g/sq. cm/day while the Bedload Component Sedimentation Rate ranged between 0.0091 and 0.0581 g/sq. cm/day.

The means of the Settling Component showed no statistical difference between the samples for the duration of the study. The means of the Bedload Component showed no statistical difference between the samples for the duration of the study. As with the West Middle Shoal site there was a significant statistical difference between the means of the Settling and Bedload Sedimentation Rates which indicated that the wave action was stirring up bottom sediments in this area and thus adding to the sediment load in the water column. This situation was also assumed to be the norm for the area.

At Rackham's Cay the Settling Component and Bedload Sedimentation Rates ranged between 0.0001 and 0.0176 g/sq. cm/day.

The means of the Settling Component showed no statistical difference between the samples for the duration of the study. The means of the Bedload Component showed no statistical difference between the samples for the duration of the study. Unlike other sites however, there was no significant statistical difference between the means of the Settling and Bedload Sedimentation Rates. This indicated that the activity of the dredge in the vicinity was having an impact on the amount of sediment arriving onsite via the water column. This situation was NOT assumed to be the norm for the area.

Post Dredge Dives – were carried out to gain a visual impression of the condition of the reef subsequent to the cessation of dredging activities. Immediately after dredging had ceased, some impacts were noted among some of the corals adjacent to the dredge site and at the relocation site. In particular the smaller massive corals were covered with a light layer of fine sediments. This material was easily dislodged by fanning the coral and it is presumed that the normal ciliary action of coral to clear their surfaces of particulate matter settling out of the water column would have been able to deal with these quantities of sediments. Several of the large transplanted colonies of ***Acropora palmata*** were found to be experiencing almost 100% bleaching of their surface area. This bleaching was not maintained and within a few weeks after the cessation of dredging they had regained their normal pigmentation. The basic visual impression of the relocation site and the substrate immediately adjacent the dredge site was that the flora and fauna were in relatively good health.

3.3 CONCLUSION

It is felt that some short term impacts were sustained to the reef at Rackham's Cay due to the dredging activity. However, the long term impact to adjacent areas and the coral relocation site from dredging does not appear to be significant.

4.0 REFERENCES

1. Phase 1- Environmental Impact Assessment Kingston Container Terminal Gordon Cay-Western Extension Prepared By: P. M. Carroll For: T.E.M.N. Ltd. January 22, 2001.
2. Monitoring Reports Dredging And Reclamation Programme In Kingston Harbour (January through July 2002), Water Quality, Prepared By: Paul M. Carroll For: T.E.M.N. Limited March 22, 2000

Appendix 1

Photographs

APPENDIX 2

Sedimentation Data (Marine Biology)

Site	***Set Date***	***Pull Date***	***Location***	***Dry Weight***	***Interval (days)***	***Sed'n Rate (g/sq. cm/day)***	***Bedload component***	***Settling component***
Drunkenman's Cay	18 06 02	25 06 02	1T	9.7	7	0.0068		0.0068
			1B	14	7	0.0098	0.0098	
			2T	10.5	7	0.0074		0.0074
			2B	17	7	0.0119	0.0119	
			3T	10.1	7	0.0071		0.0071
			3B	32.5	7	0.0228	0.0228	
			4T	8	7	0.0056		0.0056
			4B	12.5	7	0.0088	0.0088	
	25 06 02	02 07 02	1T	1	7	0.0007		0.0007
			1B	14.5	7	0.0102	0.0102	
			2T	9	7	0.0063		0.0063
			2B	22	7	0.0154	0.0154	
			3T	lost				
			3B	lost				
			4T	7.5	7	0.0053		0.0053
			4B	16	7	0.0112	0.0112	

Comparison of Bedload Components from 1st & 2nd sampling periods		
t-Test: Two-Sample Assuming Unequal Variances		
	Variable 1	***Variable 2***
Mean	0.013325	0.012266666666666
Variance	4.156916666E-05	7.61333333333E-06
Observations	4	3
Pearson Correlation	0.8757807593006	
Pooled Variance	4.213125E-05	
Df	6	
T	0.8987456026100	
P(T<=t) one-tail	0.2017060048967	
T Critical one-tail	1.9431802800435	
t < Tc		
cannot reject Ho		
i.e. there is no difference between means of samples		

Comparison of Settling Components from 1st & 2nd sampling periods		
t-Test: Two-Sample Assuming Unequal Variances		
	Variable 1	***Variable 2***
Mean	0.006725	0.0041
Variance	6.225000000E-07	8.92E-06
Observations	4	3
Pearson Correlation	-0.021919426151	
Pooled Variance	5.385833333E-06	
df	3	
t	2.224238774212	
P(T<=t) one-tail	0.056299057156	
T Critical one-tail	2.353363434397	
t < Tc		
cannot reject Ho		
i.e. there is no difference between means of samples		

Comparison of Bedload vs. Settling Components from 1st & 2nd sampling periods		
t-Test: Two-Sample Assuming Unequal Variances		
	Variable 1	***Variable 2***
Mean	0.0128714285714	0.0056
Variance	2.364238095E-05	5.25333333E-06
Observations	7	7
Pearson Correlation	0.3711824569278	
Pooled Variance	1.444785714E-05	
Df	9	
T	3.5789204486261	
P(T<=t) one-tail	0.0029703856621	
T Critical one-tail	1.8331129315801	
t > Tc		
So reject Ho		
i.e. there is a difference between means of samples		

Site	Set Date	Pull Date	Location	Dry Weight	Interval (days)	Sed'n Rate (g/sq. cm/day)	Bedload component	Settling component
West Middle Shoal	14 06 02	20 06 02	1T	10	6	0.008		0.008
			1B	23	6	0.0184	0.0184	
			2T	missed				
			2B	missed				
			3T	8.5	6	0.0068		0.0068
			3B	27	6	0.0216	0.0216	
			4T	lost				
			4B	lost				
			5T	lost				
			5B	lost				
	20 06 02	25 06 02	1T	6	5	0.0054		0.0054
			1B	12.5	5	0.0113	0.0113	
			2T	9	11	0.0036		0.0036
			2B	9.5	11	0.0038	0.0038	
			3T	14	5	0.0126		0.0126
			3B	39.8	5	0.0358	0.0358	
			4T	lost				
			4B	lost				
			5T	lost				
			5B	lost				
	25 06 02	02 07 02	1T	16.5	7	0.0116		0.0116
			1B	21.5	7	0.0151	0.0151	
			2T	lost	7			
			2B	lost	7			
			3T	13.5	7	0.0095		0.0095
			3B	32.6	7	0.0228	0.0228	
			4T	lost				
			4B	lost				
			5T	lost				
			5B	lost				

Comparison of Bedload Components from 1st & 2nd sampling periods		
t-Test: Two-Sample Assuming Unequal Variances		
	Variable 1	***Variable 2***
Mean	0.02	0.016966666666666
Variance	5.120000000E-06	0.000280083333333
Observations	2	3
Pearson Correlation	NA	
Pooled Variance	0.0001884288888	
Df	2	
T	0.3097155689074	
P(T<=t) one-tail	0.3930341113192	
T Critical one-tail	2.9199855798292	
t < Tc		
so cannot reject Ho		
i.e. there is no difference between means of samples		

Comparison of Bedload Components from 1st & 3rd sampling periods		
t-Test: Two-Sample Assuming Unequal Variances		
	Variable 1	***Variable 2***
Mean	0.02	0.01895
Variance	5.120000000E-06	2.9645E-05
Observations	2	2
Pearson Correlation	1	
Pooled Variance	1.73825E-05	
Df	1	
t	0.2518449112872	
P(T<=t) one-tail	0.421468400853829	
T Critical one-tail	6.3137515122627	
t < Tc		
so cannot reject Ho		
i.e. there is no difference between means of samples		

Comparison of Bedload Components from 2nd & 3rd sampling periods		
t-Test: Two-Sample Assuming Unequal Variances		
	Variable 1	***Variable 2***
Mean	0.0169666666666	0.01895
Variance	0.0002800833333	2.9645E-05
Observations	3	2
Pearson Correlation	-1	
Pooled Variance	0.0002073033333	
Df	4	
t	0.3686078538659	
P(T<=t) one-tail	0.3655501668955	
T Critical one-tail	2.1318467860385	
t < Tc		
so cannot reject Ho		
i.e. there is no difference between means of samples		

Comparison of Settlement Components from 1st & 2nd sampling periods		
t-Test: Two-Sample Assuming Unequal Variances		
	Variable 1	***Variable 2***
Mean	0.0074	0.0072
Variance	7.199999999E-07	2.268E-05
Observations	2	3
Pearson Correlation	1	
Pooled Variance	2.064666666E-05	
Df	4	
T	-0.6109537212156	
P(T<=t) one-tail	0.287121575056	
T Critical one-tail	2.1318467860385	
t < Tc		
so cannot reject Ho		
i.e. there is no difference between means of samples		

Comparison of Settlement Components from 1st & 3rd sampling periods		
t-Test: Two-Sample Assuming Unequal Variances		
	Variable 1	***Variable 2***
Mean	0.0074	0.01055
Variance	7.199999999E-07	2.20499999999E-06
Observations	2	2
Pearson Correlation	1	
Pooled Variance	1.462499999E-06	
Df	2	
t	-2.6047294263734	
P(T<=t) one-tail	0.0605886759004	
T Critical one-tail	2.9199855798292	
t < Tc		
so cannot reject Ho		
i.e. there is no difference between means of samples		

Comparison of Settlement Components from 2nd & 3rd sampling periods		
t-Test: Two-Sample Assuming Unequal Variances		
	Variable 1	***Variable 2***
Mean	0.0072	0.01055
Variance	2.268E-05	2.20499999999E-06
Observations	3	2
Pearson Correlation	1	
Pooled Variance	3.044166666E-05	
Df	4	
T	0.0369964596082	
P(T<=t) one-tail	0.4861302823586	
T Critical one-tail	2.1318467860385	
t < Tc		
so cannot reject Ho		
i.e. there is no difference between means of samples		

Comparison of Bedload vs. Settling Components from 1st , 2nd & 3rd sampling periods		
t-Test: Two-Sample Assuming Unequal Variances		
	Variable 1	***Variable 2***
Mean	0.0184	0.00821428571428572
Variance	0.0001011366666666	1.06014285714E-05
Observations	7	7
Pearson Correlation	0.781915814075438	
Pooled Variance	5.586904761904E-05	
Df	7	
T	2.54941113266873	
P(T<=t) one-tail	0.0190681877403795	
T Critical one-tail	1.89457860357215	
t > Tc		
So reject Ho		
i.e. there is a difference between means of samples		

ite	Set Date	Pull Date	Location	Dry Weight	Interval (days)	Sed'n Rate (g/sq. cm/day)	Bedload component	Settling component
Rackhams	11 06 02	21 06 02	South 1T	7.2	10	0.0036		0.0036
Cay			1B	8.5	10	0.0043	0.0043	
			2T	4.5	10	0.0023		0.0023
			2B	13.7	10	0.0069	0.0069	
			West 1T	lost				
			1B	lost				
			2T	8	10	0.004		0.004
			2B	19.5	10	0.0098	0.0098	
			3T	0.1	10	0.0001		0.0001
			3B	0.1	10	0.0001	0.0001	
	21 06 02	25 06 02	South 1T	7.5	4	0.009		0.009
			1B	9	4	0.0108	0.0108	
			2T	lost				
			2B	lost				
			East 1T	lost				
			1B	lost				
			2T	lost				
			2B	lost				
			3T	lost				
			3B	lost				
		26 06 02	West 1T	12.5	5	0.0113		0.0113
			1B	19.5	5	0.0176	0.0176	
			2T	19.5	5	0.0176		0.0176
			2B	12	5	0.0108	0.0108	
			3T	12.5	5	0.0113		0.0113
			3B	12.3	5	0.0111	0.0111	
	25 06 02	2 07 02	East 1T	11	7	0.0077		0.0077
			1B	16.5	7	0.0116	0.0116	
			2T	9.5	7	0.0067		0.0067
			2B	13.5	7	0.0095	0.0095	
			3T	3.5	7	0.0025		0.0025
			3B	11	7	0.0077	0.0077	
			West 1T	10	7	0.007		0.007
			1B	13.5	7	0.0095	0.0095	
			2T	14	7	0.0098		0.0098
			2B	13	7	0.0091	0.0091	
			3T	9	7	0.0063		0.0063
			3B	10.5	7	0.0074	0.0074	
			South 1T	9.5	7	0.0067		0.0067
			1B	15	7	0.0105	0.0105	
			2T	9	7	0.0063		0.0063
			2B	11.5	7	0.0081	0.0081	

Comparison of Bedload Components from 1st & 2nd sampling periods

t-Test: Two-Sample Assuming Unequal Variances		
	Variable 1	***Variable 2***
Mean	0.0025	0.0123
Variance	3.086666666E-06	1.366E-05
Observations	4	4
Pearson Correlation	0.3552340801477	
Pooled Variance	8.373333333E-06	
Df	4	
T	-4.7895188115154	
P(T<=t) one-tail	0.0043573134456	
T Critical one-tail	2.1318467860385	
t < Tc		
so cannot reject Ho		
i.e. there is no difference between means of samples		

Comparison of Bedload Components from 1st & 3rd sampling periods

t-Test: Two-Sample Assuming Unequal Variances		
	Variable 1	***Variable 2***
Mean	0.005275	0.009175
Variance	1.694916666E-05	2.04785714285E-06
Observations	4	8
Pearson Correlation	- 0.51755297515	
Pooled Variance	8.630982142E-06	
Df	9	
T	-4.450528520646	
P(T<=t) one-tail	0.000799487597	
T Critical one-tail	1.8331129315801	
t < Tc		
so cannot reject Ho		
i.e. there is no difference between means of samples		

Comparison of Bedload Components from 2nd & 3rd sampling periods

t-Test: Two-Sample Assuming Unequal Variances		
	Variable 1	***Variable 2***
Mean	0.012575	0.009175
Variance	1.12425E-05	2.04785714285E-06
Observations	4	8
Pearson Correlation	-0.0331998734647	
Pooled Variance	2.6023125E-05	
Df	8	
T	-1.1320673489044	
P(T<=t) one-tail	0.1451975685864	
T Critical one-tail	1.8595480370611	
t < Tc		
so cannot reject Ho		
i.e. there is no difference between means of samples		

Comparison of Settlement Components from 1st & 2nd sampling periods		
t-Test: Two-Sample Assuming Unequal Variances		
	Variable 1	*Variable 2*
Mean	0.0025	0.0123
Variance	3.086666666E-06	1.366E-05
Observations	4	4
Pearson Correlation	0.3552340801477	
Pooled Variance	8.373333333E-06	
Df	4	
T	-4.7895188115154	
P(T<=t) one-tail	0.0043573134456	
T Critical one-tail	2.1318467860385	
t < Tc		
so cannot reject Ho		
i.e. there is no difference between means of samples		

Comparison of Settlement Components from 1st & 3rd sampling periods		
t-Test: Two-Sample Assuming Unequal Variances		
	Variable 1	*Variable 2*
Mean	0.0025	0.006625
Variance	3.086666666E-06	4.08785714285E-06
Observations	4	8
Pearson Correlation	-0.4770926600822	
Pooled Variance	3.598214285E-06	
Df	14	
T	-5.6671531927568	
P(T<=t) one-tail	2.906408490E-05	
T Critical one-tail	1.7613101351834	
t < Tc		
so cannot reject Ho		
i.e. there is no difference between means of samples		

Comparison of Settlement Components from 2nd & 3rd sampling periods		
t-Test: Two-Sample Assuming Unequal Variances		
	Variable 1	*Variable 2*
Mean	0.0123	0.006625
Variance	1.366E-05	4.08785714285E-06
Observations	4	8
Pearson Correlation	-0.9906701222792	
Pooled Variance	2.658392857E-05	
Df	8	
T	-0.1842527695657	
P(T<=t) one-tail	0.4292000203084	
T Critical one-tail	1.8595480370611	
t < Tc		
so cannot reject Ho		
i.e. there is no difference between means of samples		

Comparison of Bedload vs. Settling Components from 1st , 2nd & 3rd sampling periods

t-Test: Two-Sample Assuming Unequal Variances		
	Variable 1	*Variable 2*
Mean	0.00905	0.0070125
Variance	1.3716E-05	1.82225E-05
Observations	16	16
Pearson Correlation	0.685833017081563	
Pooled Variance	1.596925E-05	
Df	29	
T	1.44211651697454	
P(T<=t) one-tail	0.0799915381093836	
T Critical one-tail	1.69912702432396	
t < Tc		
so cannot reject Ho		
i.e. there is no difference between means of samples		

Site	*Set Date*	*Pull Date*	*Location*	*Dry Weight*	*Interval (days)*	*Sed'n Rate (g/sq. cm/day)*	*Bedload component*	*Settling component*
Gun Cay	18 06 02	25 06 02	1T	21.5	7	0.0151		0.0151
			1B	38.5	7	0.027	0.027	
			2T	21	7	0.0147		0.0147
			2B	49	7	0.0343	0.0343	
			3T	13	7	0.0091		0.0091
			3B	15	7	0.0105	0.0105	
			4T	16.5	7	0.0116		0.0116
			4B	19.5	7	0.0137	0.0137	
			5T	1.2	7	0.0008		0.0008
			5B	13	7	0.0091	0.0091	
	25 06 02	02 07 02	1T	18	7	0.0126		0.0126
			1B	37	7	0.0259	0.0259	
			2T	16.5	7	0.0116		0.0116
			2B	83	7	0.0581	0.0581	
			3T	12.5	7	0.0088		0.0088
			3B	15.5	7	0.0109	0.0109	
			4T	11.5	7	0.0081		0.0081
			4B	20	7	0.014	0.014	
			5T	9	7	0.0063		0.0063
			5B	13.5	7	0.0095	0.0095	

Comparison of Bedload Components from 1st & 2nd sampling periods

t-Test: Two-Sample Assuming Unequal Variances		
	Variable 1	*Variable 2*
Mean	0.01892	0.02368
Variance	0.000124102	0.000411942
Observations	5	5
Pearson Correlation	0.9339768339492	
Pooled Variance	0.000268022	
Df	6	
t	-0.4597182398803	
P(T<=t) one-tail	0.3309525927521	
T Critical one-tail	1.9431802800435	
t < Tc		
cannot reject Ho		
i.e. there is no difference between means of samples		

Comparison of Settling Components from 1st & 2nd sampling periods

t-Test: Two-Sample Assuming Unequal Variances		
	Variable 1	*Variable 2*
Mean	0.01026	0.00948
Variance	3.3943E-05	6.677E-06
Observations	5	5
Pearson Correlation	0.889037597605	
Pooled Variance	2.031E-05	
df	6	
t	0.273658943092	
P(T<=t) one-tail	0.396761644826	
T Critical one-tail	1.943180280043	
t < Tc		
cannot reject Ho		
i.e. there is no difference between means of samples		

Comparison of Bedload vs. Settling Components from 1st & 2nd sampling periods

t-Test: Two-Sample Assuming Unequal Variances		
	Variable 1	*Variable 2*
Mean	0.0213	0.00987
Variance	0.0002445355555555	1.82223333333E-05
Observations	10	10
Pearson Correlation	0.567295791817554	
Pooled Variance	0.0001313789444444	
Df	10	
t	2.22981251398824	
P(T<=t) one-tail	0.0249291589766319	
T Critical one-tail	1.81246112048912	
t > Tc		
So reject Ho		
i.e. there is a difference between means of samples		