

**Final General Reevaluation Report
and
Final Environmental Impact Statement**

on

Hurricane Protection and Beach Erosion Control

**WEST ONSLOW BEACH AND NEW RIVER INLET
(TOPSAIL BEACH), NORTH CAROLINA**

Appendix S -

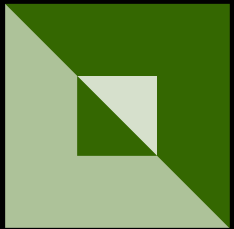
**Topsail Beach
Benthic Community Characterization Survey**

Appendix S -

Topsail Beach

Benthic Community Characterization Survey

The following pages contain the technical memorandum prepared by Dail Cordy and Associates, Inc., Environmental Consultants under contract to the U.S. Army Corps of Engineers, Wilmington District. The technical memorandum describes the benthic study of the Topsail Beach offshore borrow sites. The study also includes 4 additional appendices, which are included in the CDROM version of the Final GRR and Final EIS, but are not in the printed version.



Technical Memorandum

Topsail Beach Benthic Community Characterization Survey Pender County, NC

Final

May 2007

Prepared for:
U.S. Army Corps of Engineers
Wilmington District
P.O. Box 1890
Wilmington, NC 28402

Prepared by:



DIAL CORDY
AND ASSOCIATES INC
Environmental Consultants

**Topsail Beach Benthic Community
Characterization Survey
Pender County, NC**

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1.0 INTRODUCTION

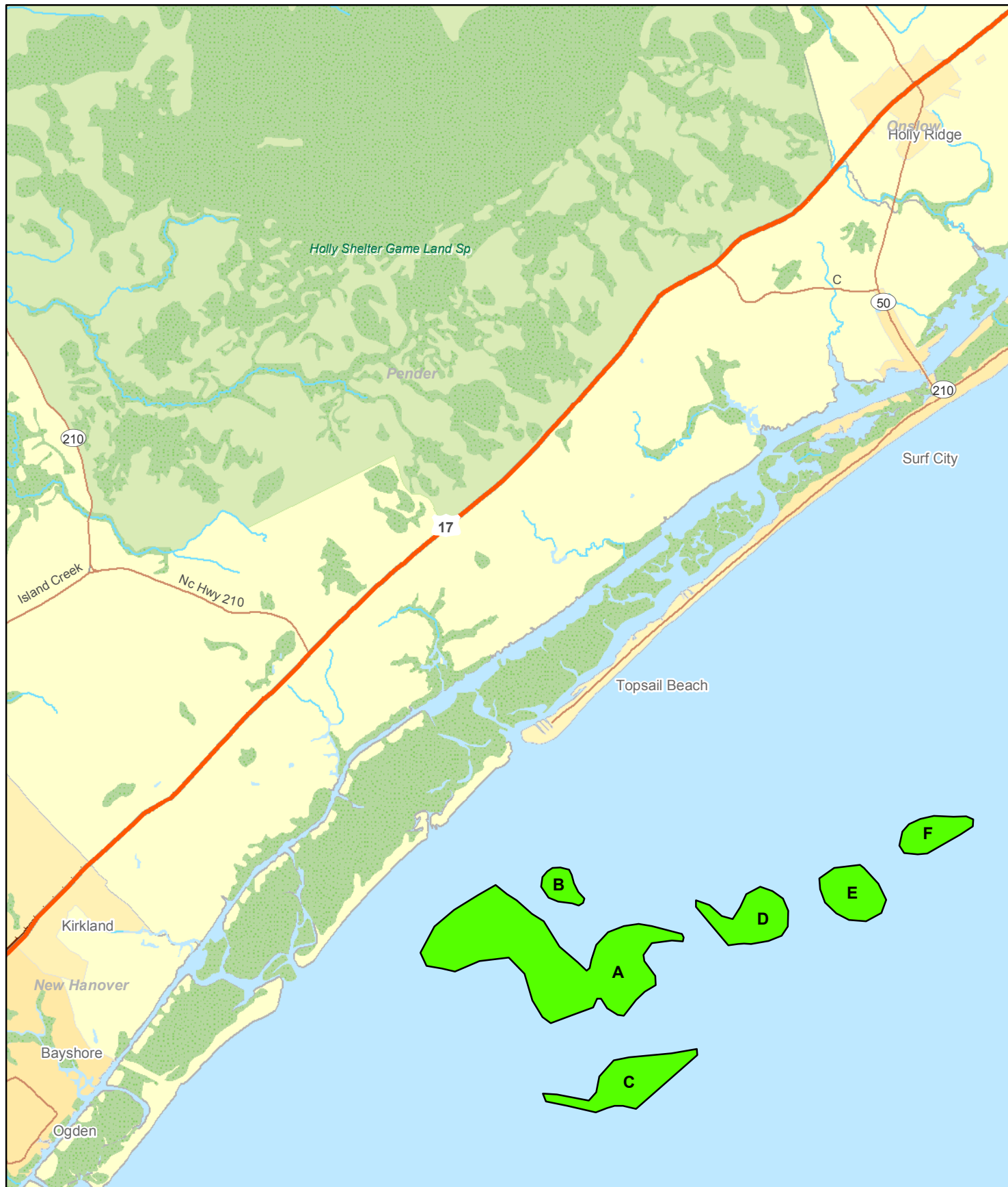
Dial Cordy and Associates Inc. (DC&A) was contracted (Contract DACW W912HN-05-D-0014) by the Wilmington District, Corps of Engineers, to conduct a characterization of the benthic community occurring within six proposed sand borrow sites selected for the proposed Shore Protection Project at Topsail Beach (Figure 1). The initial construction of the berm and dune project, extending along approximately five miles of oceanfront will require 3.2 million cubic yards of beach quality sand. The objectives of the study were to determine through benthic sampling the invertebrate abundance, species composition, and biomass within each of the borrow sites; and to perform a qualitative comparison of survey results to the results of other pertinent benthic studies completed along the coasts of North and South Carolina.

2.0 METHODS

Benthic infaunal samples were collected from three to five random locations within each of the six sand borrow sites shown in Figure 2. Five samples were taken at Borrow Site A, three samples at Borrow Site B, and four samples at each of Borrow Sites C, D, E and F. The borrow areas are located 3.0 to 5.5 miles off the south end of Topsail Island in the Atlantic Ocean. A total of 24 benthic samples were collected, along with one separate sediment sample per station (12 samples) for grain-size analysis. Coordinates for each of the 24 sampling stations are listed in Table 1.

Sampling was first attempted using a standard ponar grab on 13 November 2006; however, adequate bottom penetration was not achieved after 14 attempts within three of the six borrow areas. A Shipek grab (0.04 m²) was used on November 28th and 29th to collect the benthic and sediment samples within each of the six borrow areas. Station positions were recorded using a Trimble GEO XT and real time positions were displayed on-board using a Hypach Navigation System. This allowed the boat operator to select stations throughout each of the borrow areas. To standardize samples, only grabs that collected full samples were saved for analysis. Faunal samples were sieved through a 0.5 mm sieve after collection, preserved in 10% buffered formalin, and subsequently transferred to 50% isopropanol once received by Barry Vittor and Associates Inc., prior to sorting and identification. Samples were sorted and all fauna identified to the lowest practical identification level possible. Wet weight biomass for the major taxa found in each sample was also performed following sample processing.

Grain-size analysis of the 12 sediment samples collected was completed using sieve sizes ranging from 4.75 mm (U.S. Standard Sieve No. 4) to 63 micron (U.S. Standard Sieve 230). A Data Quality Control Report summarizing the field activities for each survey day is provided in Appendix A.



Legend

Topsail Beach Borrow Sites



0 2 4 6 8 Miles

Location of Borrow Sites off Topsail Beach

Topsail Beach Benthic Community
Characterization Survey, Pender County, NC

Scale: 1 inch = 2 miles

Date: April 2007

Drawn By: MR

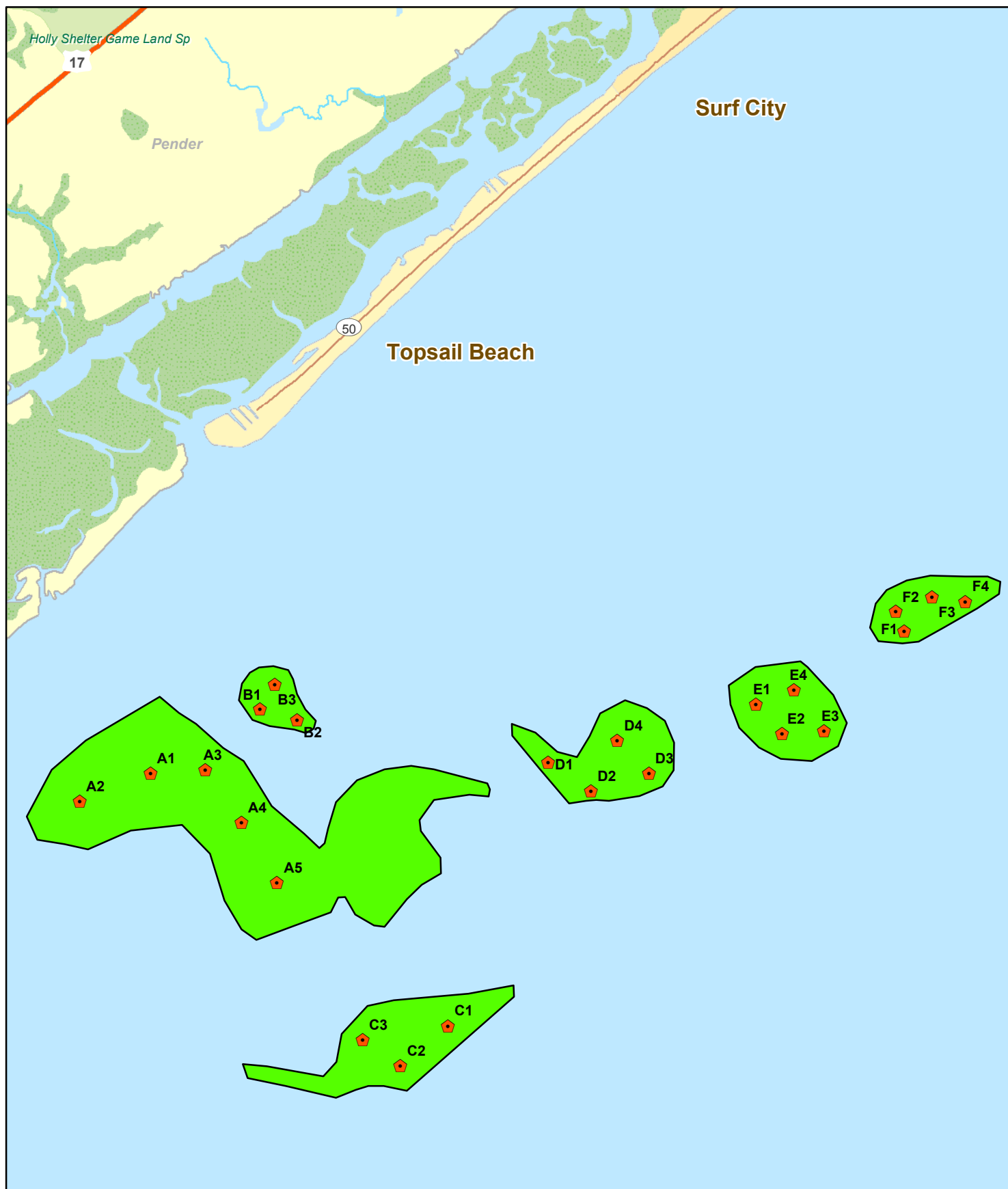
Approved By: SD



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Figure 1



Legend



Benthic Sampling Station



Topsail Beach Borrow Sites



0 6,000 12,000 18,000 24,000 Feet

Location of Benthic Sampling Stations off Topsail Beach

Topsail Beach Benthic Community
Characterization Survey, Pender County, NC

Scale: 1 inch = 6,000 feet

Drawn By: MR

Date: April 2007

Approved By: SD



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Figure 2

Table 1. Depths and location coordinates for benthic sampling stations off Topsail Beach, NC.

Borrow Site Station	Depth (m)	Station Coordinates	
A1	13.7	34°18'16.072"	77°39'47.647"
A2	13.3	34°18'02.486"	77°40'21.868"
A3	13.3	34°18'18.236"	77°39'14.008"
A4	14.2	34°17'54.945"	77°38'53.466"
A5	15.1	34°17'28.093"	77°38'33.163"
B1	12.2	34°18'46.266"	77°38'44.909"
B2	13.5	34°18'41.749"	77°38'24.575"
B3	13.2	34°18'57.558"	77°38'37.370"
C1	14.1	34°16'25.432"	77°36'58.081"
C2	14.9	34°16'06.703"	77°37'23.427"
C3	14.6	34°16'18.018"	77°37'44.459"
C4	15.2	34°15'57.406"	77°38'16.160"
D1	14.2	34°18'25.705"	77°36'07.197"
D2	15.3	34°18'13.213"	77°35'43.565"
D3	14.9	34°18'21.953"	77°35'12.038"
D4	14.3	34°18'36.383"	77°35'29.818"
E1	15.7	34°18'54.333"	77°34'14.820"
E2	15.4	34°18'41.374"	77°34'00.078"
E3	14.7	34°18'43.009"	77°33'37.360"
E4	15.3	34°19'01.135"	77°33'54.375"
F1	15.8	34°19'29.216"	77°32'55.069"
F2	15.4	34°19'37.710"	77°32'59.961"
F3	15.5	34°19'44.872"	77°32'40.239"
F4	14.7	34°19'43.171"	77°32'22.118"

3.0 RESULTS

The following results include a review of data pertaining to sediment grain-size analysis, faunal composition, species richness, diversity indices, faunal abundance, and biomass. A sediment analysis report prepared by Dr. Wayne Isfording is provided in Appendix B. Appendix C contains individual data summary reports for each sampling station and Appendix D includes the biomass data for all sampling stations and other supporting tables.

3.1 Sediment Grain-size Analysis

Results of the sediment grain-size analysis are summarized in Table 2 for each sampling station. The mean percent sand for Sites A, B, C, D, E, and F were 99.31%, 98.09%, 99.78%, 99.24%, 99.81%, and 99.84; respectively. The mean percent silt-clay fraction was 0.94%, 1.91%, 0.21%, 0.76%, 0.19%, and 0.16% for Sites A through F; respectively. The highest silt-clay content was recorded for Station B-2, with 5.31%; however, the fine fraction left was considered coarse silt rather than clay. The median particle size and sorting

Table 2. Sediment analysis results for benthic sampling stations off Topsail Beach, NC.

Station	% Sand	% Silt + Clay	USACE Description	Median Particle Size (phi)	Sorting Coefficient
A1	98.73	1.27	Sand	2.515	0.454
A2	99.00	1.00	Sand	2.496	0.470
A3	99.22	0.78	Sand	2.476	0.433
A4	99.72	0.28	Sand	2.470	0.504
A5	99.89	0.11	Sand	2.436	0.497
B1	100.00	0.00	Sand	*	*
B2	94.69	5.31	Sand	2.449	0.609
B3	99.59	0.41	Sand	*	*
C1	99.92	0.08	Sand	2.413	0.488
C2	99.82	0.18	Sand	2.445	0.436
C3	99.78	0.22	Sand	2.465	0.429
C4	99.57	0.43	Sand	2.469	0.415
D1	99.86	0.14	Sand	2.268	0.708
D2	99.84	0.16	Sand	2.412	0.505
D3	99.94	0.06	Sand	2.358	0.643
D4	99.61	0.39	Sand	1.885	0.726
E1	97.57	2.43	Sand	2.344	0.627
E2	99.82	0.18	Sand	2.271	0.693
E3	99.95	0.05	Sand	1.679	0.663
E4	99.82	0.18	Sand	1.798	0.711
F1	99.67	0.33	Sand	2.217	0.714
F2	99.78	0.22	Sand	*	0.934
F3	99.85	0.15	Sand	2.375	0.571
F4	99.91	0.09	Sand	2.339	0.618

* Insufficient data for any statistical calculations (See Appendix B).

coefficient for Sites A and E varied little between sampling stations (Table 2), while these parameters varied more between sampling stations at Sites C and D. Median particle size (ϕ) and sorting coefficients for Stations B-1, B-3, and F-2 could not be statistically calculated due to insufficient data (See Appendix B).

3.2 Faunal Composition

A total of 104 taxa were collected from the 24 samples collected within the six proposed borrow sites (Table 3). Of the taxa collected, the dominant faunal groups included polychaetes (43), crustaceans (26), mollusks (24), and echinoderms (6). Major taxa composition within each of the six borrow sites are illustrated in Figure 3 and Table 4. As shown, polychaetes were the major component of the benthos within all borrow sites; except for Site C, where crustaceans were more prevalent. The taxa within Site D were generally distributed evenly between polychaetes, mollusks, and crustaceans. Other, less frequently occurring faunal groups, included rhynchocoela (ribbon worms) that occurred within all five borrow sites, ranging from 2.6% to 4.8% of the total taxa collected; and echinoderms, which occurred within four of the five borrow sites, ranging from 3.8% to 14.3% of the total taxa collected. The total number of taxa collected within all of the samples taken at each borrow site ranged from a low of 21 taxa at Site C ($n=4$) to a high of 39 taxa at Sites B ($n=3$), E ($n=4$), and F ($n=4$) (Table 4).

Based on the total count of individuals collected per taxa within each borrow site, polychaetes were the dominant taxa at Sites A, B, D, and F. Polychaetes comprised greater than 30% of the total count (Table 4, Figure 3). Mollusks were the dominant taxa at Site E (44.6%) and secondary dominant taxa at Sites A (37.5%), B (15.4%), D (31.7%), and E (44.6%). The distribution of the total number of individuals within all Site F samples were fairly evenly distributed between the three most abundant taxa groups (polychaetes, mollusks, and crustaceans).

3.3 Species Richness

The mean number of species present within the six borrow sites ranged from a low of 7.8 within Site C to a high of 16.7 within Site B. The mean number of species present within Sites A (8.4) and D (8) were similar to Site C, while the mean number of species within Site E (15.8) was more similar to the mean number of species present within Site B. The mean number of species within Site F was 12.3 (Figure 4, Table 5). The total number of taxa collected within Sites C and D was also lower than observed within the other four sites (Table 4).

3.4 Diversity Indices

Diversity indices were calculated for each sample collected within the borrow sites (Table 5). Mean Shannon Wiener indices and Pielou Evenness values for the six borrow sites are illustrated on Figure 5. Diversity values expressed as one of the three diversity indices were consistently higher at Sites B, E, and F. High Evenness (J') and Equitability (e) values for samples collected within the six borrow sites indicate that within each station, the abundance was evenly distributed among the taxa collected. Evenness values were greater than 0.90 at all but two of the 24 stations. Mean evenness values for the six sites ranged from 0.91 at Site E to 0.96 at Sites A and D. Variability in the evenness values within each site was highest at Site F (Figure 5).

Table 3. Taxonomic species list for benthic sampling stations off Topsail Beach, NC.

ANNELIDA

CLASS OLIGOCHAETA
 Order TUBIFICIDA
 FAMILY ENCHYTRAEIDAE
 Enchytraeidae (LPIL)
 FAMILY TUBIFICIDAE
 Tubificidae (LPIL)
 CLASS POLYCHAETA
 Order CAPITELLIDA
 FAMILY CAPITELLIDAE
 Capitellidae (LPIL)
 Mediomastus (LPIL)
 Mediomastus californiensis
 FAMILY MALDANIDAE
 Maldanidae (LPIL)
 Order EUNICIDA
 FAMILY DORVILLEIDAE
 Schistomeringos pectinata
 FAMILY LUMBRINERIDAE
 Lumbrineris latreilli
 FAMILY OENONIDAE
 Arabella multidentata
 FAMILY ONUPHIDAE
 Onuphidae (LPIL)
 Order OPHELIIDA
 FAMILY OPHELIIDAE
 Opheliidae (LPIL)
 Armandia (LPIL)
 Armandia maculata
 Ophelia denticulata
 Order ORBINIIDA
 FAMILY PARAONIDAE
 Aricidea (LPIL)
 Aricidea catherinae
 Aricidea suecica
 Aricidea wassi
 Cirrophorus (LPIL)
 Order OWENIIDA
 FAMILY OWENIIDAE
 Owenia fusiformis
 Order PHYLLODOCIDA
 FAMILY CHRYSOPETALIDAE
 Bhawania heteroseta
 FAMILY GLYCERIDAE
 Glyceridae (LPIL)
 FAMILY GONIADIDAE
 Goniada littorea
 Goniadides carolinae
 FAMILY HESIONIDAE
 Microphthalmus (LPIL)
 FAMILY NEPHTYIDAE
 Aglaophamus verilli
 Nephtys picta
 Nephtys simoni
 FAMILY NEREIDAE
 Nereididae (LPIL)
 Ceratocephale oculata
 FAMILY PHYLLODOCIDAE
 Eumida sanguinea
 FAMILY PILARGIIDAE
 Ancistrosyllis (LPIL)
 Ancistrosyllis hartmanae
 Sigambra tentaculata

Order SPIONIDA
 FAMILY CHAETOPTERIDAE
 Spiochaetopterus oculatus
 FAMILY CIRRATULIDAE
 Cirratulidae (LPIL)
 Cauleriella sp. J
 FAMILY MAGELONIDAE
 Magelona (LPIL)
 Magelona papillicornis
 Magelona pettiboneae
 FAMILY SPIONIDAE
 Spionidae (LPIL)
 Paraprionospio pinnata
 Spiophanes bombyx
 Order TERESELLIDA
 FAMILY PECTINARIIDAE
 Pectinaria gouldii
 FAMILY TERESELLIDAE
 Terebellidae (LPIL)

ARTHROPODA

CLASS MALACOSTRACA
 Order AMPHIPODA
 Amphipoda (LPIL)
 FAMILY AORIDAE
 Rildardanus laminosa
 Unciola serrata
 FAMILY HAUSTORIIDAE
 Acanthohaustorius intermedius
 FAMILY ISAEIDAE
 Microprotopus raneyi
 FAMILY MELITIDAE
 Maera caroliniana
 FAMILY OEDICEROTIDAE
 Oedicerotidae (LPIL)
 Americhelidium americanum
 FAMILY PHOXOCEPHALIDAE
 Metharpinia floridana
 Rhepoxynius hudsoni
 FAMILY PLATYISCHNOPIDAE
 Eudevenopus honduranus
 FAMILY SYNOPIDAE
 Metatiron (LPIL)
 Metatiron triocellatus
 Order CUMACEA
 FAMILY DIASTYLIDAE
 Oxyurostylis (LPIL)
 Order DECAPODA
 FAMILY PAGURIDAE
 Pagurus (LPIL)
 FAMILY PASIPHAEDAE
 Leptochela serratorbita
 FAMILY PINNOTHERIDAE
 Dissodactylus mellitae
 CLASS OSTRACODA
 Order MYODOCOPINA
 FAMILY PHILOMEDIDAE
 Philomedidae (LPIL)
 Harbansus paucichelatus
 FAMILY SARSIELLIDAE
 Eusarsiella (LPIL)
 Eusarsiella radiicosta
 Eusarsiella texana

Table 3. (concluded)

Order PODOCOPIDA <i>Podocopida (LPIL)</i>	Order NEOGASTROPODA
BRYOZOA	FAMILY OLIVIDAE
<i>Bryozoa (LPIL)</i>	<i>Olivella dealbata</i>
CHORDATA	<i>Oliva sayana</i>
CLASS LEPTOCARDIA	FAMILY TURRIDAE
Order AMPHIOXI	<i>Kurtziella atrostyla</i>
FAMILY BRANCHIOSTOMIDAE	Order PYRAMIDELLOIDA
<i>Branchiostoma (LPIL)</i>	FAMILY PYRAMIDELLIDAE
CNIDARIA	<i>Odostomia weberi</i>
CLASS HYDROZOA	<i>Turbonilla (LPIL)</i>
<i>Hydrozoa (LPIL)</i>	PHORONIDA
ECHINODERMATA	FAMILY PHORONIDAE
<i>Echinodermata (LPIL)</i>	<i>Phoronis (LPIL)</i>
CLASS ECHINOIDEA	PLATYHELMINTHES
<i>Echinoidea (LPIL)</i>	CLASS TURBELLARIA
Order CLYPEASTEROIDA	<i>Turbellaria (LPIL)</i>
FAMILY MELLITIDAE	RHYNCHOCOELA
<i>Mellitidae (LPIL)</i>	<i>Rhynchocoela (LPIL)</i>
<i>Mellita isometra</i>	SIPUNCULA
CLASS OPHIUROIDEA	FAMILY ASPIDOSIPHONIDAE
<i>Ophiuroidea (LPIL)</i>	<i>Aspidosiphon albus</i>
Order OPHIURIDA	
FAMILY AMPHIURIDAE	
<i>Amphiuridae (LPIL)</i>	
MOLLUSCA	
CLASS BIVALVIA	
<i>Bivalvia (LPIL)</i>	
Order OSTREOIDA	
FAMILY ANOMIIDAE	
<i>Anomia simplex</i>	
Order VENEROIDA	
FAMILY CRASSATELLIDAE	
<i>Crassinella dupliniana</i>	
<i>Crassinella lunulata</i>	
FAMILY LUCINIDAE	
<i>Lucinidae (LPIL)</i>	
<i>Lucina (LPIL)</i>	
<i>Lucina multilineata</i>	
FAMILY MESODESMATIDAE	
<i>Ervilia concentrica</i>	
FAMILY MONTACUTIDAE	
<i>Montacutidae (LPIL)</i>	
FAMILY SEMELIDAE	
<i>Semelidae (LPIL)</i>	
FAMILY TELLINIDAE	
<i>Strigilla mirabilis</i>	
<i>Tellina (LPIL)</i>	
<i>Tellina iris</i>	
CLASS GASTROPODA	
Order CEPHALASPIDEA	
FAMILY SCAPHANDRIDAE	
<i>Acteocina canaliculata</i>	
<i>Cylichna alba</i>	
Order MESOGASTROPODA	
FAMILY CAECIDAE	
<i>Caecum pulchellum</i>	
FAMILY EULIMIDAE	
<i>Strombiformis bilineatus</i>	
FAMILY NATICIDAE	
<i>Tectonatica pusilla</i>	

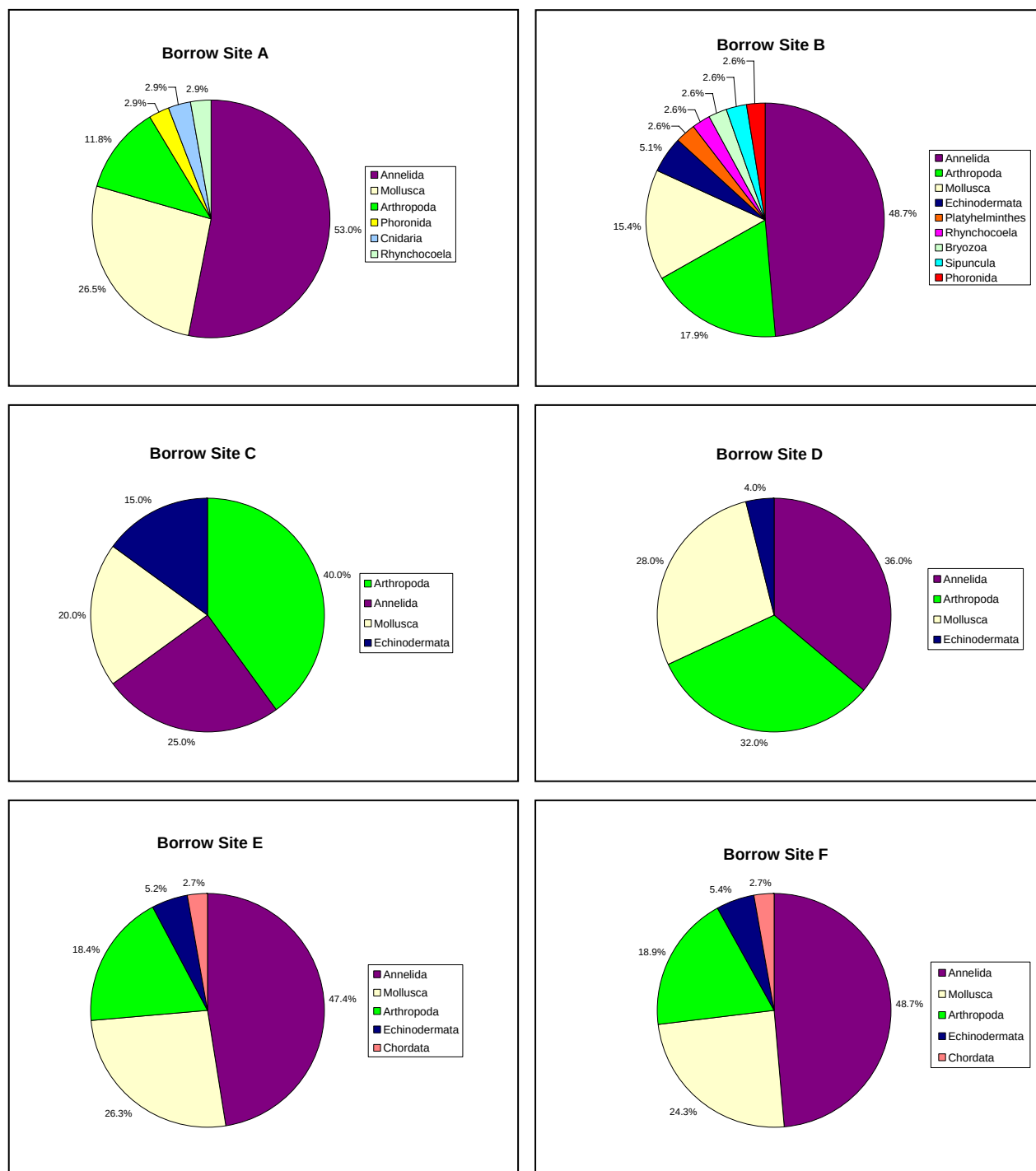


Figure 3. Relative composition of major taxa for borrow sites off Topsail Beach, NC.

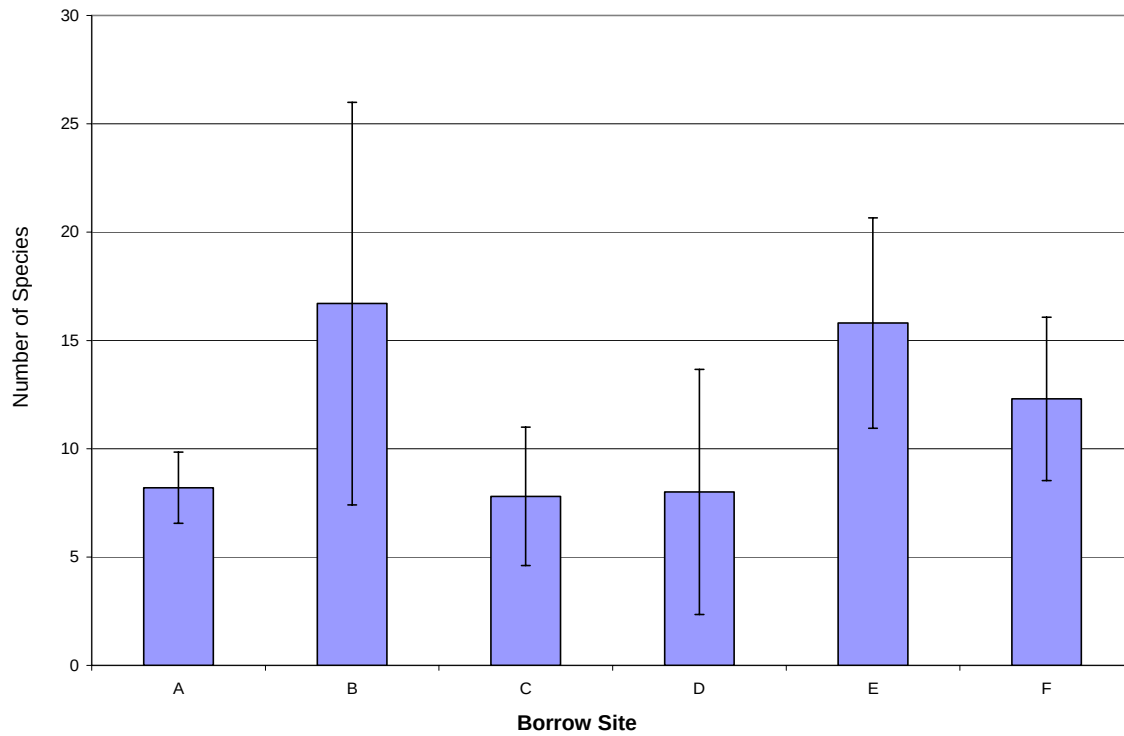
Table 4. Comparison of major taxa occurrences and relative abundances for borrow sites off Topsail Beach, NC.

Site	Cnidaria	Rhynchozoela	Annelida	Mollusca	Platyhelminthes	Arthropoda	Bryozoa	Sipuncula	Phoronida	Echinodermata	Chordata	Total Per Site
Borrow Site A (n=5)												
Total # Taxa	1	1	18	9		4			1			34
Taxa % Total	2.9%	2.9%	52.9%	26.5%		11.8%			2.9%			
Total # Ind.	1	1	27	21		5			1			56
Ind. % Total	1.8%	1.8%	48.2%	37.5%		8.9%			1.8%			
Borrow Site B (n=3)												
Total # Taxa		1	19	6	1	7	1	1	1	2		39
Taxa % Total		2.6%	48.7%	15.4%	2.6%	17.9%	2.6%	2.6%	2.6%	5.1%		
Total # Ind.		3	44	16	4	9	1	1	1	9		88
Ind. % Total		3.4%	50.0%	18.2%	4.5%	10.2%	1.1%	1.1%	1.1%	10.2%		
Borrow Site C (n=4)												
Total # Taxa		1	5	4		8				3		21
Taxa % Total		4.8%	23.8%	19.0%		38.1%				14.3%		
Total # Ind.		1	12	16		20				6		55
Ind. % Total		1.8%	21.8%	29.1%		36.4%				10.9%		

Table 4. (concluded)

Site	Cnidaria	Rhynchozoela	Annelida	Mollusca	Platyhelminthes	Arthropoda	Bryozoa	Sipuncula	Phoronida	Echinodermata	Chordata	Total Per Site
Borrow Site D (n=4)												
Total # Taxa		1	9	7		8				1		26
Taxa % Total		3.8%	34.6%	26.9%		30.8%				3.8%		
Total # Ind.		1	15	13		11				1		41
Ind. % Total		2.4%	36.6%	31.7%		26.8%				2.4%		
Borrow Site E (n=4)												
Total # Taxa		1	18	10		7				2	1	39
Taxa % Total		2.6%	46.2%	25.6%		17.9%				5.1%	2.6%	
Total # Ind.		4	31	50		23				2	2	112
Ind. % Total		3.6%	27.7%	44.6%		20.5%				1.8%	1.8%	
Borrow Site F (n=4)												
Total # Taxa		1	18	9	1	7				2	1	39
Taxa % Total		2.6%	46.2%	23.1%	2.6%	17.9%				5.1%	2.6%	
Total # Ind.		3	23	21	1	21				4	3	76
Ind. % Total		3.9%	30.3%	27.6%	1.3%	27.6%				5.3%	3.9%	

Mean Number of Species (± 1 SD)



Mean Density (± 1 SD)

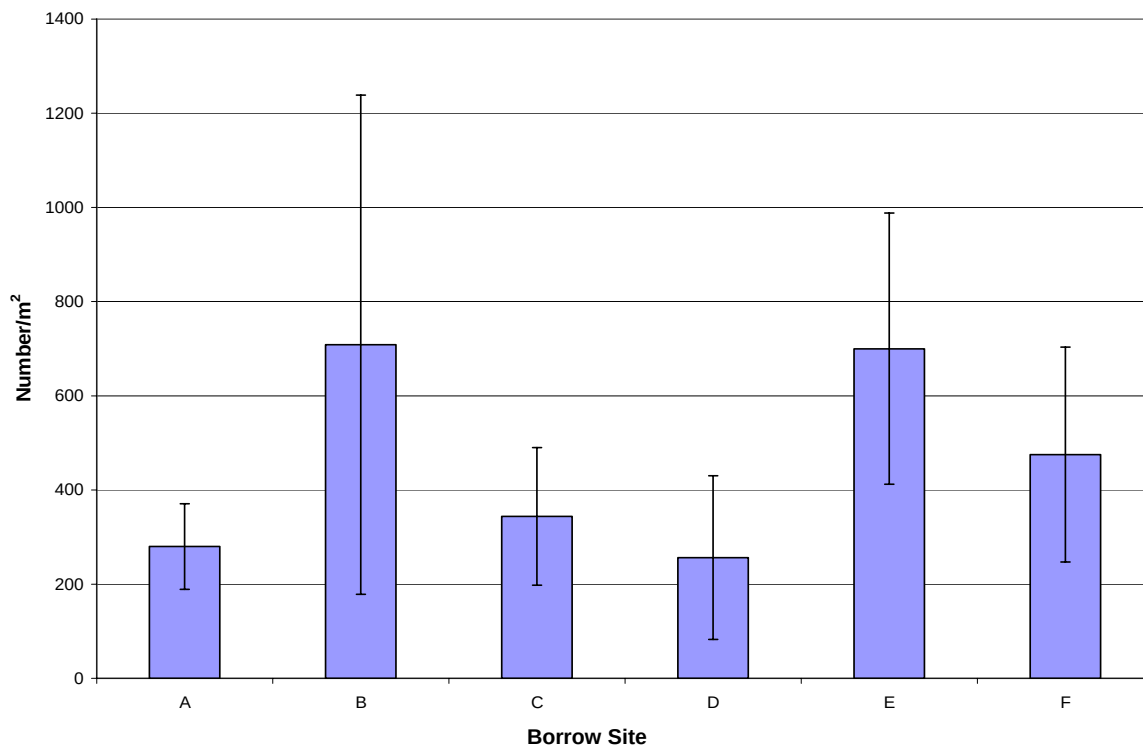
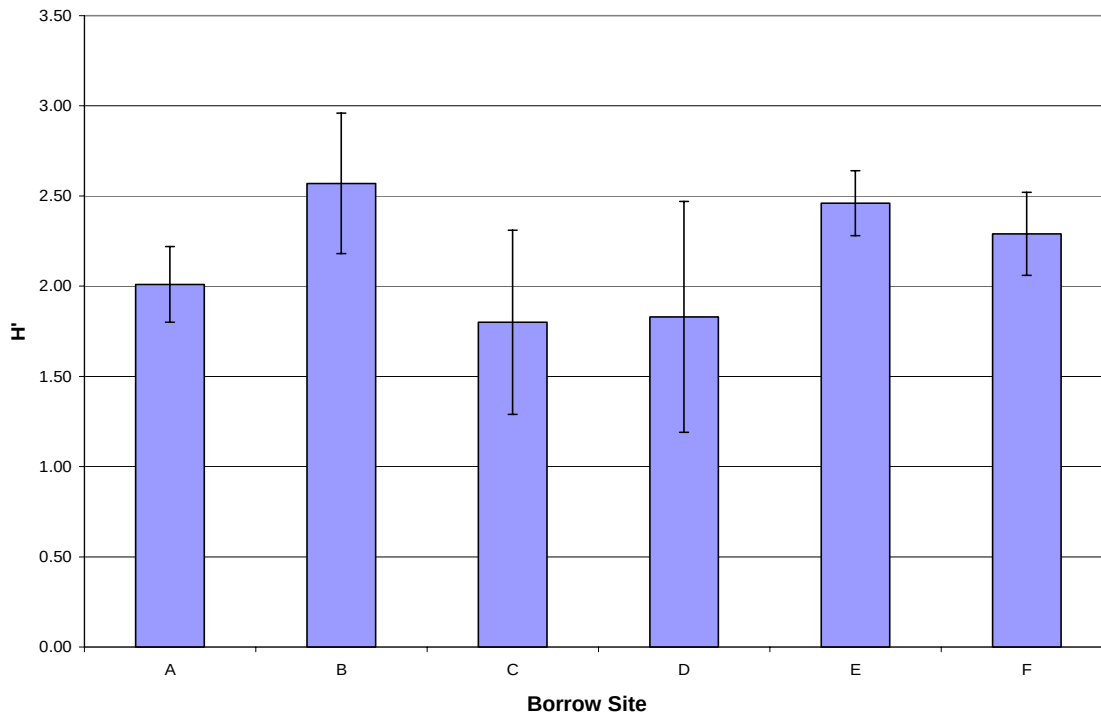


Figure 4. Mean number of species and density within borrow sites off Topsail Beach, NC.

Table 5. Summary of community parameters for benthic sampling stations off Topsail Beach, NC.

Station	Total No. Taxa	Total No. Individuals	Density (nos/m ²)	H' Shannon (log e)	d Diversity (log 2)	1/S Simpson Diversity	J' Pielou Evenness	D Margalef Richness	e Equitability
A1	6	7	175.0	1.75	2.52	21.00	0.98	2.57	1.33
A2	10	17	425.0	2.18	3.15	13.60	0.95	3.18	1.25
A3	9	10	250.0	2.16	3.12	45.00	0.98	3.47	1.37
A4	9	11	275.0	2.15	3.10	27.50	0.98	3.34	1.34
A5	7	11	275.0	1.80	2.59	9.17	0.92	2.50	1.20
B1	14	25	625.0	2.53	3.65	20.00	0.96	4.04	1.29
B2	9	9	225.0	2.20	3.17		1.00	3.64	1.41
B3	27	51	1275.0	2.98	4.29	19.92	0.90	6.61	1.06
C1	3	5	125.0	1.05	1.52	5.00	0.96	1.24	1.29
C2	9	17	425.0	2.04	2.94	10.46	0.93	2.82	1.20
C3	9	16	400.0	1.98	2.85	8.57	0.90	2.89	1.12
C4	10	17	425.0	2.15	3.10	12.36	0.93	3.18	1.21
D1	4	4	100.0	1.39	2.00		1.00	2.16	1.37
D2	8	10	250.0	1.97	2.85	15.00	0.95	3.04	1.26
D3	4	7	175.0	1.28	1.84	5.25	0.92	1.54	1.22
D4	16	20	500.0	2.67	3.85	31.67	0.96	5.01	1.30
E1	11	15	375.0	2.27	3.27	17.50	0.95	3.69	1.25
E2	13	26	650.0	2.34	3.38	11.21	0.91	3.68	1.14
E3	22	43	1075.0	2.64	3.82	10.38	0.86	5.58	0.92
E4	17	28	700.0	2.58	3.72	14.00	0.91	4.80	1.12
F1	9	9	225.0	2.20	3.17		1.00	3.64	1.41
F2	16	24	600.0	2.64	3.80	23.00	0.95	4.72	1.26
F3	9	14	350.0	2.14	3.09	18.20	0.98	3.03	1.34
F4	15	29	725.0	2.20	3.17	5.88	0.81	4.16	0.85

Mean Shannon Wiener Index (H')



Mean Pielou Evenness (J)

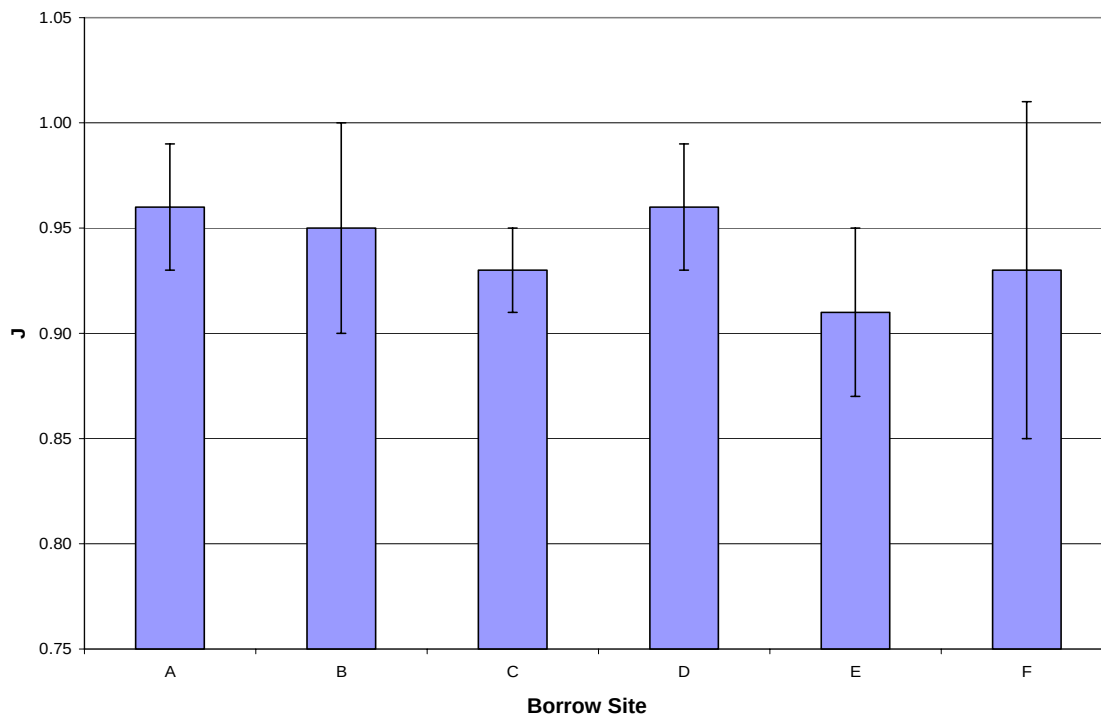


Figure 5. Mean Shannon Wiener index (H') and Pielou Evenness value for borrow sites off Topsail Beach, NC.

3.5 Faunal Abundance

The total count and density of the benthic community collected at each station within the six borrow sites is provided in Table 5. The abundance and density for each species occurrence is provided in Tables D-1 and D-2 (Appendix D). A total of 425 individuals were collected during the study, ranging from a mean density of 256 individuals/m² within Site D to 708 individuals/m² at Site B (Figure 4). Variability in the density within each borrow site was highest at Site B, which ranged from 225 individuals/m² to 1,275 individuals/m² (n=3); followed by Site E, where density ranged from 375 individuals/m² to 1,075 individuals/m² (n=4). Mean density at Sites A, C, and D were all low compared to the mean density at Sites B, E, and F.

The ten most abundant species were: the polychaetes *Magelona papillicornis*, *Goniada littorea*, and *Goniadides carolinae*; the amphipod *Eudovenopus honduranus*; the bivalves *Crassinella lunicata*, *Lucinidae*(LPIL), and *Tellina* (LPIL); the gastropod *Caecum pulchellum*; the echinoderm *Ophiuroidea* (LPIL); and the ribbon worm *Rhynchocoela* (LPIL). These ten species together comprised 47.4% of the benthic infauna collected (Table 6). Other species found within at least two of the sites, and comprising about 2% of the total abundance included: the polychaetes *Onuphidae* (LPIL), *Armandia maculata*, *Bhawania heteroseta*, and *Spionidae* (LPIL); the bivalve *Crassinella dupliniana*; and the gastropods *Acteocina canaliculata* and *Cylichna alba*. Of the balance of species remaining, 79 species each comprised less than 1% of the total abundance.

3.6 Biomass

The biomass for major faunal groups collected at all sampling stations is summarized in Table D-3 of Appendix D, while the mean biomass (g/m²) for major faunal groups within each site is provided in Table 7. Mean biomass was lowest at Site A (36.69 g/m²) and Site D (41.59 g/m²); similar between Sites B (69.53 g/m²), Site E (59.08 g/m²), and Site F (57.85 g/m²); and highest at Site C (182.61 g/m²). Site C is skewed higher due to the occurrence of brittle stars (*Ophiuroidea*), which weigh more than other taxa present. Excluding this epibenthic taxa, the mean biomass for Site C would be 44.88 g/m².

Table 6. Total abundance and percent composition for taxa collected at borrow sites off Topsail Beach, NC.

Species	Total Count Per Site						% of Total
	A	B	C	D	E	F	
<i>Enchytraeidae</i> (LPIL)		2					0.48
<i>Tubificidae</i> (LPIL)		1					0.24
<i>Capitellidae</i> (LPIL)	1						0.24
<i>Mediomastus</i> (LPIL)		4			1		1.20
<i>Mediomastus californiensis</i>	1						0.24
<i>Maldanidae</i> (LPIL)					1		0.24
<i>Schistomeringos pectinata</i>		1					0.24
<i>Lumbrineris latreilli</i>				1		1	0.48
<i>Arabella multidentata</i>					1		0.24
<i>Onuphidae</i> (LPIL)	1	1	2	1		2	1.67
<i>Opheliidae</i> (LPIL)					2	1	0.72
<i>Armandia</i> (LPIL)					1		0.24
<i>Armandia maculata</i>	1	1	3		2		1.67
<i>Ophelia denticulata</i>						1	0.24
<i>Aricidea</i> (LPIL)				1	1		0.48
<i>Aricidea catherinae</i>	1	1					0.48
<i>Aricidea suecica</i>					1		0.24
<i>Aricidea wassi</i>				1	3		0.96
<i>Cirrophorus</i> (LPIL)		1			1		0.48
<i>Owenia fusiformis</i>	1			1			0.48
<i>Bhawania heteroseta</i>		7				1	1.91
<i>Glyceridae</i> (LPIL)	2	1	1		1		1.20
<i>Goniada littorea</i>	1		5	4	4	2	3.83
<i>Goniadides carolinae</i>		9				2	2.63
<i>Microphthalmus</i> (LPIL)						1	0.24
<i>Aglaophamus verrilli</i>	1						0.24
<i>Nephtys picta</i>						2	0.48
<i>Nephtys simoni</i>						1	0.24
<i>Nereididae</i> (LPIL)		1					0.24
<i>Ceratocephale oculata</i>					1	2	0.72
<i>Eumida sanguinea</i>		1					0.24
<i>Ancistrosyllis</i> (LPIL)		1			1		0.48
<i>Ancistrosyllis hartmanae</i>		1			1		0.48
<i>Sigambra tentaculata</i>	1						0.24
<i>Spiochaetopterus oculatus</i>	1		1				0.48
<i>Cirratulidae</i> (LPIL)		2				1	0.72
<i>Caulleriella</i> sp. J	4	1				1	1.44
<i>Magelona</i> (LPIL)	3						0.72

Table 6. (continued)

Species	Total Count Per Site						
	A	B	C	D	E	F	% of Total
<i>Magelona papillicornis</i>	3			4	7	2	3.83
<i>Magelona pettiboneae</i>						1	0.24
<i>Spionidae</i> (LPIL)	1	4		1	1	1	1.91
<i>Paraprionospio pinnata</i>	1				1	1	0.72
<i>Spiophanes bombyx</i>				1			0.24
<i>Pectinaria gouldii</i>	1						0.24
<i>Terebellidae</i> (LPIL)		1					0.24
Amphipoda (LPIL)			1	1			0.48
<i>Rildardanus laminosa</i>		1					0.24
<i>Unciola serrata</i>		1					0.24
<i>Acanthohaustorius intermedius</i>						2	0.48
<i>Microprotopus raneyi</i>		2					0.48
<i>Maera caroliniana</i>		2				1	0.72
<i>Oedicerotidae</i> (LPIL)		1					0.24
<i>Americhelidium americanum</i>				1	1		0.48
<i>Metharpinia floridana</i>					1		0.24
<i>Rhepoxynius hudsoni</i>			2	1	1	1	1.20
<i>Eudevenopus honduranus</i>			10	4	17	14	10.77
<i>Metatiron</i> (LPIL)		1					0.24
<i>Metatiron triocellatus</i>		1					0.24
<i>Oxyurostylis</i> (LPIL)				1	1	1	0.72
<i>Pagurus</i> (LPIL)		1			1		0.48
<i>Leptochela serratorbita</i>							
<i>Dissodactylus mellitae</i>			2				0.48
<i>Philomedidae</i> (LPIL)					1		0.24
<i>Harbansus paucichelatus</i>					1		0.24
<i>Eusarsiella</i> (LPIL)	1						0.24
<i>Eusarsiella radiicosta</i>						1	0.24
<i>Eusarsiella texana</i>	1		2	1	1	1	1.44
<i>Podocopida</i> (LPIL)			1				0.24
<i>Bryozoa</i> (LPIL)		1					0.24
<i>Branchiostoma</i> (LPIL)					2	3	1.20
<i>Hydrozoa</i> (LPIL)	1						0.24
<i>Echinodermata</i> (LPIL)					1		0.24
<i>Echinoidea</i> (LPIL)			2				0.48
<i>Mellitidae</i> (LPIL)						2	0.48
<i>Mellita isometra</i>			1				0.24
<i>Ophiuroidea</i> (LPIL)		8	3	1	1	2	3.59
<i>Amphiuridae</i> (LPIL)		1					0.24
<i>Bivalvia</i> (LPIL)	2	1					0.72

Table 6. (concluded)

Species	Total Count Per Site						
	A	B	C	D	E	F	% of Total
<i>Anomia simplex</i>						1	0.24
<i>Crassinella dupliniana</i>					4	4	1.91
<i>Crassinella lunulata</i>		10	2	3			3.59
<i>Lucinidae (LPIL)</i>	2			1	3	3	2.15
<i>Lucina (LPIL)</i>				1			0.24
<i>Lucina multilineata</i>		1			3		0.96
<i>Ervilia concentrica</i>	1			1		1	0.72
<i>Montacutidae (LPIL)</i>					1		0.24
<i>Semelidae (LPIL)</i>		1					0.24
<i>Strigilla mirabilis</i>					2		0.48
<i>Tellina (LPIL)</i>	5	1	9	1	3		4.54
<i>Tellina iris</i>	1						0.24
<i>Acteocina canaliculata</i>	1		1	1	4	1	1.91
<i>Cylichna alba</i>	5		2	1			1.91
<i>Caecum pulchellum</i>		1	4	7	24	3	9.33
<i>Strombiformis bilineatus</i>					2		0.48
<i>Tectonatica pusilla</i>		1			2		0.72
<i>Oliva sayana</i>	3						0.72
<i>Olivella dealbata</i>						2	0.48
<i>Kurtziella atrostyla</i>						1	0.24
<i>Odostomia weberi</i>	1						0.24
<i>Turbonilla (LPIL)</i>						1	0.24
<i>Phoronis (LPIL)</i>	1	1					0.48
<i>Turbellaria (LPIL)</i>		4				1	1.20
<i>Rhynchocoela (LPIL)</i>	1	3	1	1	4	3	3.11
<i>Aspidosiphon albus</i>		1					0.24

Table 7. Mean biomass of major taxa at borrow sites off Topsail Beach, NC.

Borrow Site A	
Faunal Group	gm/m²
Annelida	14.3835
Mollusca	14.0410
Arthropoda	5.5235
Echinodermata	0.0000
Other Taxa	2.7450
Total	36.6930

Borrow Site D	
Faunal Group	gm/m²
Annelida	14.1350
Mollusca	13.7320
Arthropoda	6.8550
Echinodermat a	3.4325
Other Taxa	3.4325
Total	41.5881

Borrow Site B	
Faunal Group	gm/m²
Annelida	13.9200
Mollusca	13.7866
Arthropoda	13.9208
Echinodermata	13.9516
Other Taxa	13.9500
Total	69.5291

Borrow Site E	
Faunal Group	gm/m²
Annelida	14.0706
Mollusca	13.8350
Arthropoda	14.0100
Echinodermat a	6.8643
Other Taxa	10.2950
Total	59.0750

Borrow Site C	
Faunal Group	gm/m²
Annelida	13.8419
Mollusca	13.7693
Arthropoda	13.8356
Echinodermata	137.7275
Other Taxa	3.4350
Total	182.6093

Borrow Site F	
Faunal Group	gm/m²
Annelida	15.0306
Mollusca	13.9231
Arthropoda	13.8325
Echinodermata	3.4350
Other Taxa	11.6306
Total	57.8518

4.0 DISCUSSION

In comparison to the results of baseline sampling performed for the Kure Beach restoration project (Posey and Alphin 2000, 2002) and for the Dare County beach shoreline protection project (Versar 2006), the benthic community found offshore of Topsail Beach was less diverse and abundant. Since the Topsail Beach benthic sampling in this survey was only performed in late fall/early winter, comparisons to other surveys should focus on the same seasonal time frame.

Baseline sampling performed off Kure Beach in October 1995 found 44 and 76 taxa, and faunal densities of 1,007 individuals/m² and 923 individuals/m², respectively, for the borrow and control sites (Posey and Alphin 2000). The number of total taxa occurring within each proposed borrow site off Topsail Beach ranged from 21 to 39 taxa, while mean density by site ranged from 280 individuals/m² to 708 individuals/m². Posey and Alphin (2000) reported 600 total taxa collected from the year long study, as compared to the 104 total taxa collected for the one-time sampling performed for the Topsail Beach study. However, the Kure Beach study was more extensive in that it involved five sampling periods, replicate samples at each location, and covered a variety of benthic substrates (some adjacent to hard bottom communities). All of these factors would be expected to yield a more diverse benthic community. The community studied off Kure Beach was dominated by polychaetes, with 29 taxa comprising at least 5% of the individuals sampled from a single sampling event. Off Topsail Beach, polychaetes dominated the community, comprising over 30% of the relative abundance at four of the six borrow sites.

Seasonal pre-construction benthic community sampling was performed within the proposed north borrow site and reference site for the Dare County shoreline protection project (Versar 2006). Sampling included benthic grabs at ten stations within each of the two sites during the four seasons from spring 2004 through winter 2005. A total of 168 taxa were collected during the study, with polychaetes being the dominant taxa group in occurrence and biomass, especially during the fall and winter. The mean number of taxa present in the fall at the proposed north borrow site was 16 (range of 8 to 26 taxa) and 8 (range of 6 to 11 taxa) in the winter. This is not too different than what was found in the six Topsail Beach borrow sites, where the mean number of species across the six borrow sites ranged from 8 to 17. However, the species richness in the Dare County reference site was significantly greater than the species richness found off Topsail Beach or in the Dare County proposed north borrow site. Mean faunal density in the fall at the Dare County proposed north borrow site (1,555 individuals/m²) was slightly higher than the mean density within the Topsail Beach borrow sites (Figure 4, Table 5), while the mean density at the reference site (8,696 individuals/m²) was significantly greater. Mean faunal density in the winter was exceptionally higher off Dare County than observed off Topsail Beach, with mean densities of 11,460 individuals/m² and 1,398 individuals/m² for the reference and borrow sites, respectively. The mean biomass of fall samples was 0.28 g/m² and 2.23 g/m² for the borrow and reference sites, respectively; as compared to a much higher mean biomass range of 37 g/m² to 182 g/m² for the six Topsail Beach borrow sites. This comparison also held true for the winter mean biomass values from Dare County.

In summary, the benthic community found within the six proposed borrow sites off Topsail Beach is similar in composition and taxa dominance to those described in other studies along the North Carolina and South Carolina coasts (Byrnes et al. 2003; Versar 2002, 2006; and

Posey and Alphin 2000, 2002). However, the number of species present and abundance were noticeably lower off Topsail Beach than found off Kure Beach (Posey and Alphin 2000) or Dare County (Versar 2006). It is likely that the differences between the benthic community off Topsail Beach, as reported here, and the two referenced studies are due to the more extensive sampling effort associated with baseline monitoring programs, as compared to a less intensive sampling regime for a general characterization study (e.g. ten sampling stations per site off Dare County as compared to three to five stations per site for this study)

5.0 LITERATURE CITED

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APPENDIX A

Data Quality Control Report

Table A-1. Data Quality Control Report

Date: 13 Nov 06

Wind speed/direction (estimated): NW @ 10-12 knots

Wave height (estimated): 1' swells within 2 miles of shore. Beyond 2 miles, 2', steep and building slightly throughout the day.

Water temperature: 60.9°F

Vessel: F/V Emma K

Personnel on board: Capt. Jeff Coward, Duke Hunsaker

Sampling Equipment employed: Trimble GEO XT handheld gps (sub-meter accuracy)
SI-TEX CVS106 (120 kHz)
Standard Ponar grab

Sample Site	Time	Depth (m)	Sample Coordinates	Sediment Sample	Benthic sample?
F1	10:30	16.3		No	No
F1	10:40	16.3		No	No
F1	11:00	16.3		No	No
F1	11:25	16.3		No	No
F1	11:50	16.3		No	No
B1	12:15	13.4		No	No
B1	12:30	13.4		No	No
B1	12:50	13.4		No	No
B1	1:00	13.4		No	No
B1	1:20	13.4		No	No
B1	1:35	13.4		No	No
B1	1:45	13.4		No	No
B1	2:00	13.4		No	No
B1	2:20	13.4		No	No

Comments: Pot hauler works well in calm water, but sheaves aren't grooved deep enough. When trying to pull the sampler up in rolling sea, the line jumps off the pulley. To avoid injury and/or damage to the vessel, it was necessary to pull the ponar by hand all day. While we have listed 14 sampling attempts, there were numerous drops in between in which misfires occurred or the ponar did not fire. When the ponar did fire properly, it was unable to penetrate the substrate. Only a light dusting of sand was retrieved with each grab. Not enough substrate for analysis. GPS points not taken, since no samples were obtained at the sites. Crossed the bar around 3:00pm. Off water at 3:45pm.

Table A-1. (continued)**Date:** 28 Nov 06**Wind speed/direction (estimated):** NE @ 10 knots**Wave height (estimated):** 2-3' swells within 2.5 miles of shore. Beyond 2.5 miles, 3-4' rolling swells**Water temperature:** 58.9°F**Vessel:** F/V Emma K**Personnel on board:** Capt. Jeff Coward, Duke Hunsaker, Ryan Lewis**Sampling Equipment employed:** Trimble GEO XT handheld gps (sub-meter accuracy)
SI-TEX CVS106 (120 kHz)
Wildco Shipek grab sampler
Plastic jars/labels prepared for each station

Sample Site	Time	Depth (m)	Sample Coordinates	Sediment Sample	Benthic sample?
A1	8:40	13.7	34°18'16.072"	Yes	Yes
			77°39'47.647"	Yes	Yes
A2	9:05	13.3	34°18'02.486"	Yes	Yes
			77°40'21.868"	Yes	Yes
A3	9:30	13.3	34°18'18.236"	Yes	Yes
			77°39'14.008"	Yes	Yes
A4	9:55	14.2	34°17'54.945"	Yes	Yes
			77°38'53.466"	Yes	Yes
A5	10:30	15.1	34°17'28.093"	Yes	Yes
			77°38'33.163"	Yes	Yes
D1	11:15	14.2	34°18'25.705"	Yes	Yes
			77°36'07.197"	Yes	Yes
D2	11:40	15.3	34°18'13.213"	Yes	Yes
			77°35'43.565"	Yes	Yes
D3	12:00	14.9	34°18'21.953"	Yes	Yes
			77°35'12.038"	Yes	Yes
D4	12:35	14.3	34°18'36.383"	Yes	Yes
			77°35'29.818"	Yes	Yes
E1	1:00	15.7	34°18'54.333"	Yes	Yes
			77°34'14.820"	Yes	Yes
E2	1:25	15.4	34°18'41.374"	Yes	Yes
			77°34'00.078"	Yes	Yes
E3	1:45	14.7	34°18'43.009"	Yes	Yes
			77°33'37.360"	Yes	Yes
E4	2:10	15.3	34°19'01.135"	Yes	Yes
			77°33'54.375"	Yes	Yes
F1	2:40	15.8	34°19'29.216"	Yes	Yes
			77°32'55.069"	Yes	Yes
F2	3:15	15.4	34°19'37.710"	Yes	Yes
			77°32'59.961"	Yes	Yes
F3	3:40	15.5	34°19'44.872"	Yes	Yes
			77°32'40.239"	Yes	Yes
F4	4:15	14.7	34°19'43.171"	Yes	Yes
			77°32'22.118"	Yes	Yes

Comments: Ponar replaced with Wildco Shipek grab sampler. Shipek grab very effective. Sampling went very smoothly. Crossed the bar approximately 5:00pm. Off water at 5:45pm.

Table A-1. (concluded)

Date: 29 Nov 06

Wind speed/direction (estimated): ENE @ 5-10 knots

Wave height (estimated): 2' swells within 2 miles of shore. Beyond 2 miles, 3' swells with occasional 4' swell. Sea slightly confused.

Water temperature: 59.2°F

Vessel: F/V Emma K

Personnel on board: Capt. Jeff Coward, Duke Hunsaker, Ryan Lewis

Sampling Equipment employed: Trimble GEO XT handheld gps (sub-meter accuracy)
SI-TEX CVS106 (120 kHz)
Wildco Shipek grab sampler

Sample Site	Time	Depth (m)	Sample Coordinates	Sediment Sample	Benthic sample?
B1	9:30	12.2	34°18'46.266"	Yes	Yes
			77°38'44.909"	Yes	Yes
B2	10:00	13.5	34°18'41.749"	Yes	Yes
			77°38'24.575"	Yes	Yes
B3	10:20	13.2	34°18'57.558"	Yes	Yes
			77°38'37.370"	Yes	Yes
C1	10:55	14.1	34°16'25.432"	Yes	Yes
			77°36'58.081"	Yes	Yes
C2	11:20	14.9	34°16'06.703"	Yes	Yes
			77°37'23.427"	Yes	Yes
C3	11:40	14.6	34°16'18.018"	Yes	Yes
			77°37'44.459"	Yes	Yes
C4	11:55	15.2	34°15'57.406"	Yes	Yes
			77°38'16.160"	Yes	Yes

Comments: Sampling went smoothly. No problems. Crossed the bar at approximately 1:00pm. Off water at 1:45pm.

APPENDIX B

Sediment Analysis Report

=====

TIERRA CONSULTING
SEDPET III: SEDIMENTARY PETROLOGY ANALYSIS PROGRAM

=====

ANALYSIS OF SAMPLE: A-1

PAN=0.52=1.09%
BVA-DIAL CORDY 2-26-07

SIEVE ANALYSIS

=====

SAMPLE WEIGHT = 47.33

SIEVE SIZE (MICRONS)	SIEVE SIZE (PHI)	SIEVE WT (GRAMS)	WEIGHT PERCENT RETAINED	CUMULATIVE PERCENT THROUGH	CUMULATIVE PERCENT RETAINED
1000.00	.00	.54	1.14	98.86	1.14
500.00	1.00	.63	1.33	97.53	2.47
250.00	2.00	4.23	8.94	88.59	11.41
125.00	3.00	35.47	74.94	13.65	86.35
62.50	4.00	5.86	12.38	1.27	98.73

=====

TEXTURAL CLASSIFICATION AND PHI PERCENTILES SAMPLE A-1

=====

SIZE CLASSIFICATION USED: STANDARD GEOLOGICAL SOILS CLASSIFICATION

GRAVEL/SAND CUTOFF 2000.00 MICRONS
SAND/SILT CUTOFF 62.50 MICRONS
SILT/CLAY CUTOFF 4.00 MICRONS

PERCENT GRAVEL .00
PERCENT SAND 98.73

PERCENT SILT AND CLAY 1.27

=====

TEXTURAL DESCRIPTIONS

FOLK'S: SAND
SHEPARD'S: SAND
TREFETHEN'S: SAND
U.S. ARMY CORPS OF ENGINEERS: SAND
U.S. BUREAU OF SOILS: SAND

=====

PHI PERCENTILES

PHI(05)	1.28	PHI	410.98	MICRONS
PHI(16)	2.06	PHI	239.61	MICRONS
PHI(25)	2.18	PHI	220.47	MICRONS
PHI(50)	2.51	PHI	174.96	MICRONS
PHI(75)	2.85	PHI	138.84	MICRONS
PHI(84)	2.97	PHI	127.75	MICRONS
PHI(95)	3.70	PHI	77.02	MICRONS

=====

EXTRAPOLATION OF DATA TO CUMULATIVE 99.5% RETAINED.

INSUFFICIENT DATA TO PERFORM EXTRAPOLATION

INTERPOLATED PHI PERCENTILES

SAMPLE A-1

PHI	MICRONS	MM	PCT. RET	PCT. FINER
.00	1000.00	.1000E+01	1.14	98.86
.25	840.90	.8409E+00	1.47	98.53
.50	707.11	.7071E+00	1.81	98.19
.75	594.60	.5946E+00	2.14	97.86
1.00	500.00	.5000E+00	2.47	97.53
1.25	420.45	.4204E+00	4.71	95.29
1.50	353.55	.3536E+00	6.94	93.06
1.75	297.30	.2973E+00	9.17	90.83
2.00	250.00	.2500E+00	11.41	88.59
2.25	210.22	.2102E+00	30.14	69.86
2.50	176.78	.1768E+00	48.88	51.12
2.75	148.65	.1487E+00	67.62	32.38
3.00	125.00	.1250E+00	86.35	13.65
3.25	105.11	.1051E+00	89.45	10.55
3.50	88.39	.8839E-01	92.54	7.46
3.75	74.33	.7433E-01	95.64	4.36
4.00	62.50	.6250E-01	98.73	1.27

STATISTICS AND ENGINEERING PARAMETERS

SAMPLE A-1

=====

INMAN'S STATISTICS:

MEDIAN	2.515	PHI	174.955	MICRONS
MEAN	2.515	PHI	174.955	MICRONS
STANDARD DEVIATION	.454	WELL SORTED		
SKEWNESS	.000	NEAR-SYMMETRICAL		
KURTOSIS	1.662	VERY LEPTOKURTIC		

=====

FOLK'S STATISTICS:

MEAN 2.515 PHI 174.955 MICRONS
 STANDARD DEVIATION .593 MODERATELY WELL SORTED
 SKEWNESS -.010 NEAR-SYMMETRICAL
 KURTOSIS 1.484 LEPTOKURTIC

MOMENT MEASURES:

INSUFFICIENT DATA FOR MOMENT MEASURES

ENGINEERING PARAMETERS:

D60 2.382 PHI 191.909 MICRONS
 D30 2.782 PHI 145.409 MICRONS
 D10 3.295 PHI 101.905 MICRONS
 COEF. OF UNIFORMITY 1.883
 COEF. OF CURVATURE 1.081

TIERRA CONSULTING
 SEDPET III: SEDIMENTARY PETROLOGY ANALYSIS PROGRAM

ANALYSIS OF SAMPLE: A-2

PAN=0.26=0.60%
 BVA-DIAL CORDY 2-26-07

SIEVE ANALYSIS

SAMPLE WEIGHT = 42.99

SIEVE SIZE (MICRONS)	SIEVE SIZE (PHI)	SIEVE WT (GRAMS)	WEIGHT PERCENT RETAINED	CUMULATIVE PERCENT THROUGH	CUMULATIVE PERCENT RETAINED
1000.00	.00	.18	.42	99.58	.42
500.00	1.00	.73	1.70	97.88	2.12
250.00	2.00	5.17	12.03	85.86	14.14
125.00	3.00	31.07	72.27	13.58	86.42
62.50	4.00	5.41	12.58	1.00	99.00

TEXTURAL CLASSIFICATION AND PHI PERCENTILES

SAMPLE A-2

SIZE CLASSIFICATION USED: STANDARD GEOLOGICAL SOILS CLASSIFICATION

GRAVEL/SAND CUTOFF 2000.00 MICRONS
SAND/SILT CUTOFF 62.50 MICRONS
SILT/CLAY CUTOFF 4.00 MICRONS

PERCENT GRAVEL .00
PERCENT SAND 99.00

PERCENT SILT AND CLAY 1.00

TEXTURAL DESCRIPTIONS

FOLK'S: SAND
SHEPARD'S: SAND
TREFETHEN'S: SAND
U.S. ARMY CORPS OF ENGINEERS: SAND
U.S. BUREAU OF SOILS: SAND

PHI PERCENTILES

PHI(05) 1.24 PHI 423.45 MICRONS
PHI(16) 2.03 PHI 245.59 MICRONS
PHI(25) 2.15 PHI 225.28 MICRONS
PHI(50) 2.50 PHI 177.25 MICRONS
PHI(75) 2.84 PHI 139.46 MICRONS
PHI(84) 2.97 PHI 127.93 MICRONS
PHI(95) 3.68 PHI 77.90 MICRONS

EXTRAPOLATION OF DATA TO CUMULATIVE 99.5% RETAINED.

INSUFFICIENT DATA TO PERFORM EXTRAPOLATION

INTERPOLATED PHI PERCENTILES

SAMPLE A-2

PHI	MICRONS	MM	PCT. RET	PCT. FINER
.00	1000.00	.1000E+01	.42	99.58
.25	840.90	.8409E+00	.84	99.16
.50	707.11	.7071E+00	1.27	98.73
.75	594.60	.5946E+00	1.69	98.31
1.00	500.00	.5000E+00	2.12	97.88
1.25	420.45	.4204E+00	5.12	94.88
1.50	353.55	.3536E+00	8.13	91.87
1.75	297.30	.2973E+00	11.14	88.86

2.00	250.00	.2500E+00	14.14	85.86
2.25	210.22	.2102E+00	32.21	67.79
2.50	176.78	.1768E+00	50.28	49.72
2.75	148.65	.1487E+00	68.35	31.65
3.00	125.00	.1250E+00	86.42	13.58
3.25	105.11	.1051E+00	89.56	10.44
3.50	88.39	.8839E-01	92.71	7.29
3.75	74.33	.7433E-01	95.85	4.15
4.00	62.50	.6250E-01	99.00	1.00

=====

STATISTICS AND ENGINEERING PARAMETERS

=====

SAMPLE A-2

INMAN'S STATISTICS:

MEDIAN	2.496	PHI	177.251	MICRONS
MEAN	2.496	PHI	177.251	MICRONS
STANDARD DEVIATION	.470	WELL SORTED		
SKEWNESS	.000	NEAR-SYMMETRICAL		
KURTOSIS	1.596	VERY LEPTOKURTIC		

=====

FOLK'S STATISTICS:

MEAN	2.496	PHI	177.251	MICRONS
STANDARD DEVIATION	.605	MODERATELY WELL SORTED		
SKEWNESS	-.014	NEAR-SYMMETRICAL		
KURTOSIS	1.447	LEPTOKURTIC		

=====

MOMENT MEASURES:

INSUFFICIENT DATA FOR MOMENT MEASURES

=====

ENGINEERING PARAMETERS:

D60	2.358	PHI	195.092	MICRONS
D30	2.773	PHI	146.313	MICRONS
D10	3.285	PHI	102.604	MICRONS
COEF. OF UNIFORMITY	1.901			
COEF. OF CURVATURE	1.069			

=====

TIERRA CONSULTING

SEDPET III: SEDIMENTARY PETROLOGY ANALYSIS PROGRAM

=====

ANALYSIS OF SAMPLE: A-3

PAN=.30=.6%

BVA DIAL CORDY 2-26-07

SIEVE ANALYSIS

=====

SAMPLE WEIGHT = 47.21

SIEVE SIZE (MICRONS)	SIEVE SIZE (PHI)	SIEVE WT (GRAMS)	WEIGHT PERCENT RETAINED	CUMULATIVE PERCENT THROUGH	CUMULATIVE PERCENT RETAINED
1000.00	.00	.11	.23	99.77	.23
500.00	1.00	1.15	2.44	97.33	2.67
250.00	2.00	4.71	9.98	87.35	12.65
125.00	3.00	37.05	78.48	8.88	91.12
62.50	4.00	3.82	8.09	.78	99.22

TEXTURAL CLASSIFICATION AND PHI PERCENTILES

SAMPLE A-3

SIZE CLASSIFICATION USED: STANDARD GEOLOGICAL SOILS CLASSIFICATION

GRAVEL/SAND CUTOFF 2000.00 MICRONS
 SAND/SILT CUTOFF 62.50 MICRONS
 SILT/CLAY CUTOFF 4.00 MICRONS

PERCENT GRAVEL .00
 PERCENT SAND 99.22

PERCENT SILT AND CLAY .78

TEXTURAL DESCRIPTIONS

FOLK'S: SAND
 SHEPARD'S: SAND
 TREFETHEN'S: SAND
 U.S. ARMY CORPS OF ENGINEERS: SAND
 U.S. BUREAU OF SOILS: SAND

PHI PERCENTILES

PHI(05)	1.23	PHI	425.24	MICRONS
PHI(16)	2.04	PHI	242.70	MICRONS
PHI(25)	2.16	PHI	224.16	MICRONS
PHI(50)	2.48	PHI	179.74	MICRONS
PHI(75)	2.79	PHI	144.13	MICRONS
PHI(84)	2.91	PHI	133.12	MICRONS
PHI(95)	3.48	PHI	89.69	MICRONS

EXTRAPOLATION OF DATA TO CUMULATIVE 99.5% RETAINED.

INSUFFICIENT DATA TO PERFORM EXTRAPOLATION

INTERPOLATED PHI PERCENTILES	SAMPLE A-3
------------------------------	------------

PHI	MICRONS	MM	PCT. RET	PCT. FINER
.00	1000.00	.1000E+01	.23	99.77
.25	840.90	.8409E+00	.84	99.16
.50	707.11	.7071E+00	1.45	98.55
.75	594.60	.5946E+00	2.06	97.94
1.00	500.00	.5000E+00	2.67	97.33
1.25	420.45	.4204E+00	5.16	94.84
1.50	353.55	.3536E+00	7.66	92.34
1.75	297.30	.2973E+00	10.15	89.85
2.00	250.00	.2500E+00	12.65	87.35
2.25	210.22	.2102E+00	32.27	67.73
2.50	176.78	.1768E+00	51.89	48.11
2.75	148.65	.1487E+00	71.50	28.50
3.00	125.00	.1250E+00	91.12	8.88
3.25	105.11	.1051E+00	93.15	6.85
3.50	88.39	.8839E-01	95.17	4.83
3.75	74.33	.7433E-01	97.19	2.81
4.00	62.50	.6250E-01	99.22	.78

STATISTICS AND ENGINEERING PARAMETERS	SAMPLE A-3
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INMAN'S STATISTICS:

MEDIAN	2.476 PHI	179.745 MICRONS
MEAN	2.476 PHI	179.745 MICRONS
STANDARD DEVIATION	.433 WELL SORTED	
SKEWNESS	.000 NEAR-SYMMETRICAL	
KURTOSIS	1.591 VERY LEPTOKURTIC	

FOLK'S STATISTICS:

MEAN	2.476 PHI	179.745 MICRONS
STANDARD DEVIATION	.557 MODERATELY WELL SORTED	
SKEWNESS	-.053 NEAR-SYMMETRICAL	
KURTOSIS	1.444 LEPTOKURTIC	

MOMENT MEASURES:

INSUFFICIENT DATA FOR MOMENT MEASURES

ENGINEERING PARAMETERS:

D60	2.349 PHI	196.342 MICRONS
D30	2.731 PHI	150.640 MICRONS
D10	2.986 PHI	126.248 MICRONS

COEF. OF UNIFORMITY 1.555
COEF. OF CURVATURE .915

=====

TIERRA CONSULTING
SEDPET III: SEDIMENTARY PETROLOGY ANALYSIS PROGRAM

=====

ANALYSIS OF SAMPLE: A-4

PAN=0.07=.16%
BVA-DIAL CORDY 2-26-07

SIEVE ANALYSIS

=====

SAMPLE WEIGHT = 42.79

SIEVE SIZE (MICRONS)	SIEVE SIZE (PHI)	SIEVE WT (GRAMS)	WEIGHT PERCENT RETAINED	CUMULATIVE PERCENT THROUGH	CUMULATIVE PERCENT RETAINED
1000.00	.00	.30	.70	99.30	.70
500.00	1.00	1.52	3.55	95.75	4.25
250.00	2.00	5.33	12.46	83.29	16.71
125.00	3.00	30.28	70.76	12.53	87.47
62.50	4.00	5.24	12.25	.28	99.72

=====

TEXTURAL CLASSIFICATION AND PHI PERCENTILES SAMPLE A-4

=====

SIZE CLASSIFICATION USED: STANDARD GEOLOGICAL SOILS CLASSIFICATION

GRAVEL/SAND CUTOFF 2000.00 MICRONS
SAND/SILT CUTOFF 62.50 MICRONS
SILT/CLAY CUTOFF 4.00 MICRONS

PERCENT GRAVEL .00
PERCENT SAND 99.72

PERCENT SILT AND CLAY .28

=====

TEXTURAL DESCRIPTIONS

FOLK'S: SAND
SHEPARD'S: SAND
TREFETHEN'S: SAND
U.S. ARMY CORPS OF ENGINEERS: SAND
U.S. BUREAU OF SOILS: SAND

=====

PHI PERCENTILES

PHI(05)	1.06	PHI	479.65	MICRONS
PHI(16)	1.94	PHI	260.07	MICRONS
PHI(25)	2.12	PHI	230.50	MICRONS
PHI(50)	2.47	PHI	180.44	MICRONS
PHI(75)	2.82	PHI	141.24	MICRONS
PHI(84)	2.95	PHI	129.33	MICRONS
PHI(95)	3.61	PHI	81.64	MICRONS

=====

EXTRAPOLATION OF DATA TO CUMULATIVE 99.5% RETAINED.

***OVER 99.5% SAMPLE ACCOUNTED FOR BY INPUT DATA - NO EXTRAPOLATION REQUIRED.

INTERPOLATED PHI PERCENTILES

SAMPLE A-4

PHI	MICRONS	MM	PCT. RET	PCT. FINER
.00	1000.00	.1000E+01	.70	99.30
.25	840.90	.8409E+00	1.59	98.41
.50	707.11	.7071E+00	2.48	97.52
.75	594.60	.5946E+00	3.37	96.63
1.00	500.00	.5000E+00	4.25	95.75
1.25	420.45	.4204E+00	7.37	92.63
1.50	353.55	.3536E+00	10.48	89.52
1.75	297.30	.2973E+00	13.60	86.40
2.00	250.00	.2500E+00	16.71	83.29
2.25	210.22	.2102E+00	34.40	65.60
2.50	176.78	.1768E+00	52.09	47.91
2.75	148.65	.1487E+00	69.78	30.22
3.00	125.00	.1250E+00	87.47	12.53
3.25	105.11	.1051E+00	90.54	9.46
3.50	88.39	.8839E-01	93.60	6.40
3.75	74.33	.7433E-01	96.66	3.34
4.00	62.50	.6250E-01	99.72	.28

STATISTICS AND ENGINEERING PARAMETERS

SAMPLE A-4

INMAN'S STATISTICS:

MEDIAN	2.470	PHI	180.436	MICRONS
MEAN	2.447	PHI	183.395	MICRONS
STANDARD DEVIATION	.504	MODERATELY WELL SORTED		
SKEWNESS	-.047	NEAR-SYMMETRICAL		
KURTOSIS	1.535	VERY LEPTOKURTIC		

FOLK'S STATISTICS:

MEAN	2.455	PHI	182.403	MICRONS
STANDARD DEVIATION	.639	MODERATELY WELL SORTED		
SKEWNESS	-.075	NEAR-SYMMETRICAL		
KURTOSIS	1.482	LEPTOKURTIC		

=====

MOMENT MEASURES:

MEAN 2.399 PHI 189.621 MICRONS
SECOND MOMENT .443
STANDARD DEVIATION .666 MODERATELY WELL SORTED
THIRD MOMENT -.340
SKEWNESS -1.152 STRONGLY COARSE-SKEWED
FOURTH MOMENT 1.218
KURTOSIS 2.066 VERY LEPTOKURTIC

=====

ENGINEERING PARAMETERS:

D60 2.329 PHI 199.004 MICRONS
D30 2.753 PHI 148.335 MICRONS
D10 3.206 PHI 108.345 MICRONS
COEF. OF UNIFORMITY 1.837
COEF. OF CURVATURE 1.021

=====

TIERRA CONSULTING
SEDPET III: SEDIMENTARY PETROLOGY ANALYSIS PROGRAM

=====

ANALYSIS OF SAMPLE: A-5

PAN=0.05=.11%

BVA DIAL CORDY 2-26-07

SIEVE ANALYSIS

=====

SAMPLE WEIGHT = 45.18

SIEVE SIZE (MICRONS)	SIEVE SIZE (PHI)	SIEVE WT (GRAMS)	WEIGHT PERCENT RETAINED	CUMULATIVE PERCENT THROUGH	CUMULATIVE PERCENT RETAINED
1000.00	.00	.17	.38	99.62	.38
500.00	1.00	.49	1.08	98.54	1.46
250.00	2.00	7.30	16.16	82.38	17.62
125.00	3.00	33.57	74.30	8.08	91.92
62.50	4.00	3.60	7.97	.11	99.89

TEXTURAL CLASSIFICATION AND PHI PERCENTILES

SAMPLE A-5

SIZE CLASSIFICATION USED: STANDARD GEOLOGICAL SOILS CLASSIFICATION

GRAVEL/SAND CUTOFF 2000.00 MICRONS
SAND/SILT CUTOFF 62.50 MICRONS
SILT/CLAY CUTOFF 4.00 MICRONS

PERCENT GRAVEL .00
PERCENT SAND 99.89

PERCENT SILT AND CLAY .11

TEXTURAL DESCRIPTIONS

FOLK'S: SAND
SHEPARD'S: SAND
TREFETHEN'S: SAND
U.S. ARMY CORPS OF ENGINEERS: SAND
U.S. BUREAU OF SOILS: SAND

PHI PERCENTILES

PHI(05) 1.22 PHI 429.57 MICRONS
PHI(16) 1.90 PHI 267.97 MICRONS
PHI(25) 2.10 PHI 233.36 MICRONS
PHI(50) 2.44 PHI 184.82 MICRONS
PHI(75) 2.77 PHI 146.37 MICRONS
PHI(84) 2.89 PHI 134.59 MICRONS
PHI(95) 3.39 PHI 95.63 MICRONS

EXTRAPOLATION OF DATA TO CUMULATIVE 99.5% RETAINED.

***OVER 99.5% SAMPLE ACCOUNTED FOR BY INPUT DATA - NO EXTRAPOLATION REQUIRED.

INTERPOLATED PHI PERCENTILES

SAMPLE A-5

PHI	MICRONS	MM	PCT. RET	PCT. FINER
.00	1000.00	.1000E+01	.38	99.62
.25	840.90	.8409E+00	.65	99.35
.50	707.11	.7071E+00	.92	99.08
.75	594.60	.5946E+00	1.19	98.81
1.00	500.00	.5000E+00	1.46	98.54
1.25	420.45	.4204E+00	5.50	94.50
1.50	353.55	.3536E+00	9.54	90.46
1.75	297.30	.2973E+00	13.58	86.42
2.00	250.00	.2500E+00	17.62	82.38

2.25	210.22	.2102E+00	36.19	63.81
2.50	176.78	.1768E+00	54.77	45.23
2.75	148.65	.1487E+00	73.35	26.65
3.00	125.00	.1250E+00	91.92	8.08
3.25	105.11	.1051E+00	93.91	6.09
3.50	88.39	.8839E-01	95.91	4.09
3.75	74.33	.7433E-01	97.90	2.10
4.00	62.50	.6250E-01	99.89	.11

=====

STATISTICS AND ENGINEERING PARAMETERS

=====

SAMPLE A-5

INMAN'S STATISTICS:

MEDIAN	2.436	PHI	184.820	MICRONS
MEAN	2.397	PHI	189.910	MICRONS
STANDARD DEVIATION	.497	WELL SORTED		
SKEWNESS	-.079	NEAR-SYMMETRICAL		
KURTOSIS	1.181	LEPTOKURTIC		

=====

FOLK'S STATISTICS:

MEAN	2.410	PHI	188.198	MICRONS
STANDARD DEVIATION	.577	MODERATELY WELL SORTED		
SKEWNESS	-.101	COARSE-SKEWED		
KURTOSIS	1.320	LEPTOKURTIC		

=====

MOMENT MEASURES:

MEAN	2.382	PHI	191.795	MICRONS
SECOND MOMENT	.305			
STANDARD DEVIATION	.553	MODERATELY WELL SORTED		
THIRD MOMENT	-.161			
SKEWNESS	-.954	STRONGLY COARSE-SKEWED		
FOURTH MOMENT	.618			
KURTOSIS	2.211	VERY LEPTOKURTIC		

=====

ENGINEERING PARAMETERS:

D60	2.301	PHI	202.891	MICRONS
D30	2.705	PHI	153.363	MICRONS
D10	2.974	PHI	127.260	MICRONS
COEF. OF UNIFORMITY	1.594			
COEF. OF CURVATURE	.911			

=====

TIERRA CONSULTING

SEDPET III: SEDIMENTARY PETROLOGY ANALYSIS PROGRAM

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TIERRA CONSULTING
SEDPET III: SEDIMENTARY PETROLOGY ANALYSIS PROGRAM

ANALYSIS OF SAMPLE: B-1

PAN=0.00
BVA DIAL CORDY 2-26-07

SIEVE ANALYSIS
=====

SAMPLE WEIGHT = 48.25

SIEVE SIZE (MICRONS)	SIEVE SIZE (PHI)	SIEVE WT (GRAMS)	WEIGHT PERCENT RETAINED	CUMULATIVE PERCENT THROUGH	CUMULATIVE PERCENT RETAINED
1000.00	.00	24.92	51.65	48.35	51.65
500.00	1.00	8.30	17.20	31.15	68.85
250.00	2.00	9.19	19.05	12.10	87.90
125.00	3.00	5.56	11.52	.58	99.42
62.50	4.00	.43	.89	-.31	100.31

* ***ERROR*** ***ERROR*** CUMULATIVE PERCENT RETAINED GREATER THAN 100% *
*

=====

TEXTURAL CLASSIFICATION AND PHI PERCENTILES SAMPLE B-1

=====

SIZE CLASSIFICATION USED: STANDARD GEOLOGICAL SOILS CLASSIFICATION

GRAVEL/SAND CUTOFF 2000.00 MICRONS
SAND/SILT CUTOFF 62.50 MICRONS
SILT/CLAY CUTOFF 4.00 MICRONS

PERCENT GRAVEL .00
PERCENT SAND 100.31

PERCENT SILT AND CLAY -.31

=====

TEXTURAL DESCRIPTIONS

FOLK'S: SAND
SHEPARD'S: SAND
TREFETHEN'S: SAND
U.S. ARMY CORPS OF ENGINEERS: SAND
U.S. BUREAU OF SOILS: SAND

=====

PHI PERCENTILES

PHI(75) 1.32 PHI 399.73 MICRONS
 PHI(84) 1.80 PHI 288.09 MICRONS
 PHI(95) 2.62 PHI 163.07 MICRONS

=====

EXTRAPOLATION OF DATA TO CUMULATIVE 99.5% RETAINED.

***OVER 99.5% SAMPLE ACCOUNTED FOR BY INPUT DATA - NO EXTRAPOLATION REQUIRED.

===== INTERPOLATED PHI PERCENTILES

SAMPLE B-1

PHI	MICRONS	MM	PCT. RET	PCT. FINER
.00	1000.00	.1000E+01	51.65	48.35
.25	840.90	.8409E+00	55.95	44.05
.50	707.11	.7071E+00	60.25	39.75
.75	594.60	.5946E+00	64.55	35.45
1.00	500.00	.5000E+00	68.85	31.15
1.25	420.45	.4204E+00	73.61	26.39
1.50	353.55	.3536E+00	78.37	21.63
1.75	297.30	.2973E+00	83.13	16.87
2.00	250.00	.2500E+00	87.90	12.10
2.25	210.22	.2102E+00	90.78	9.22
2.50	176.78	.1768E+00	93.66	6.34
2.75	148.65	.1487E+00	96.54	3.46
3.00	125.00	.1250E+00	99.42	.58
3.25	105.11	.1051E+00	99.64	.36
3.50	88.39	.8839E-01	99.87	.13
3.75	74.33	.7433E-01	100.09	-.09
4.00	62.50	.6250E-01	100.31	-.31

===== STATISTICS AND ENGINEERING PARAMETERS

SAMPLE B-1

=====

INSUFFICIENT DATA FOR ANY STATISTICAL CALCULATIONS

=====

ENGINEERING PARAMETERS:

D60 IS NOT CALCULATED--FIRST SIEVE RETAINS OVER 40%
 D30 1.060 PHI 479.502 MICRONS
 D10 2.183 PHI 220.285 MICRONS
 COEF. OF UNIFORMITY IS NOT CALCULATED
 COEF. OF CURVATURE IS NOT CALCULATED

=====

TIERRA CONSULTING
SEDPET III: SEDIMENTARY PETROLOGY ANALYSIS PROGRAM

=====

ANALYSIS OF SAMPLE: B-2

PAN=.05=.10%
BVA-DIAL CORDY 2-26-07

SIEVE ANALYSIS

SAMPLE WEIGHT = 49.36

SIEVE SIZE (MICRONS)	SIEVE SIZE (PHI)	SIEVE WT (GRAMS)	WEIGHT PERCENT RETAINED	CUMULATIVE PERCENT THROUGH	CUMULATIVE PERCENT RETAINED
1000.00	.00	.55	1.11	98.89	1.11
500.00	1.00	1.62	3.28	95.60	4.40
250.00	2.00	7.73	15.66	79.94	20.06
125.00	3.00	32.93	66.71	13.23	86.77
62.50	4.00	3.91	7.92	5.31	94.69

=====

TEXTURAL CLASSIFICATION AND PHI PERCENTILES SAMPLE B-2

=====

SIZE CLASSIFICATION USED: STANDARD GEOLOGICAL SOILS CLASSIFICATION

GRAVEL/SAND CUTOFF 2000.00 MICRONS
SAND/SILT CUTOFF 62.50 MICRONS
SILT/CLAY CUTOFF 4.00 MICRONS

PERCENT GRAVEL .00
PERCENT SAND 94.69
PERCENT SILT AND CLAY 5.31

=====

TEXTURAL DESCRIPTIONS

FOLK'S: SAND
SHEPARD'S: SAND
TREFETHEN'S: SAND
U.S. ARMY CORPS OF ENGINEERS: SAND
U.S. BUREAU OF SOILS: SAND

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PHI PERCENTILES

PHI(05)	1.04	PHI	486.82	MICRONS
PHI(16)	1.74	PHI	299.17	MICRONS
PHI(25)	2.07	PHI	237.48	MICRONS
PHI(50)	2.45	PHI	183.16	MICRONS
PHI(75)	2.82	PHI	141.26	MICRONS
PHI(84)	2.96	PHI	128.65	MICRONS

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EXTRAPOLATION OF DATA TO CUMULATIVE 99.5% RETAINED.

INSUFFICIENT DATA TO PERFORM EXTRAPOLATION

INTERPOLATED PHI PERCENTILES

SAMPLE B-2

PHI	MICRONS	MM	PCT. RET	PCT. FINER
.00	1000.00	.1000E+01	1.11	98.89
.25	840.90	.8409E+00	1.93	98.07
.50	707.11	.7071E+00	2.76	97.24
.75	594.60	.5946E+00	3.58	96.42
1.00	500.00	.5000E+00	4.40	95.60
1.25	420.45	.4204E+00	8.31	91.69
1.50	353.55	.3536E+00	12.23	87.77
1.75	297.30	.2973E+00	16.14	83.86
2.00	250.00	.2500E+00	20.06	79.94
2.25	210.22	.2102E+00	36.74	63.26
2.50	176.78	.1768E+00	53.41	46.59
2.75	148.65	.1487E+00	70.09	29.91
3.00	125.00	.1250E+00	86.77	13.23
3.25	105.11	.1051E+00	88.75	11.25
3.50	88.39	.8839E-01	90.73	9.27
3.75	74.33	.7433E-01	92.71	7.29
4.00	62.50	.6250E-01	94.69	5.31

STATISTICS AND ENGINEERING PARAMETERS

SAMPLE B-2

INMAN'S STATISTICS:

MEDIAN	2.449	PHI	183.159	MICRONS
MEAN	2.350	PHI	196.185	MICRONS
STANDARD DEVIATION	.609	MODERATELY WELL SORTED		
SKEWNESS	-.163	COARSE-SKEWED		

FOLK'S STATISTICS:

MEAN	2.383	PHI	191.743	MICRONS
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MOMENT MEASURES:

INSUFFICIENT DATA FOR MOMENT MEASURES

ENGINEERING PARAMETERS:

D60	2.299 PHI	203.213 MICRONS
D30	2.749 PHI	148.793 MICRONS
D10	3.408 PHI	94.230 MICRONS
COEF. OF UNIFORMITY	2.157	
COEF. OF CURVATURE	1.156	

TIERRA CONSULTING
SEDPET III: SEDIMENTARY PETROLOGY ANALYSIS PROGRAM

ANALYSIS OF SAMPLE: B-3

PAN=0.11=0.25%
BVA DIAL CORDY 2-26-07

SIEVE ANALYSIS

SAMPLE WEIGHT = 43.90

SIEVE SIZE (MICRONS)	SIEVE SIZE (PHI)	SIEVE WT (GRAMS)	WEIGHT PERCENT RETAINED	CUMULATIVE PERCENT THROUGH	CUMULATIVE PERCENT RETAINED
1000.00	.00	27.79	63.30	36.70	63.30
500.00	1.00	9.11	20.75	15.95	84.05
250.00	2.00	3.80	8.66	7.29	92.71
125.00	3.00	2.70	6.15	1.14	98.86
62.50	4.00	.32	.73	.41	99.59

TEXTURAL CLASSIFICATION AND PHI PERCENTILES SAMPLE B-3

SIZE CLASSIFICATION USED: STANDARD GEOLOGICAL SOILS CLASSIFICATION

GRAVEL/SAND CUTOFF	2000.00 MICRONS
SAND/SILT CUTOFF	62.50 MICRONS
SILT/CLAY CUTOFF	4.00 MICRONS

PERCENT GRAVEL	.00
PERCENT SAND	99.59

PERCENT SILT AND CLAY	.41
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TEXTURAL DESCRIPTIONS

FOLK'S: SAND
 SHEPARD'S: SAND
 TREFETHEN'S: SAND
 U.S. ARMY CORPS OF ENGINEERS: SAND
 U.S. BUREAU OF SOILS: SAND

PHI PERCENTILES

PHI(75) .56 PHI 676.58 MICRONS
 PHI(84) 1.00 PHI 500.91 MICRONS
 PHI(95) 2.37 PHI 193.15 MICRONS

EXTRAPOLATION OF DATA TO CUMULATIVE 99.5% RETAINED.

***OVER 99.5% SAMPLE ACCOUNTED FOR BY INPUT DATA - NO EXTRAPOLATION REQUIRED.

INTERPOLATED PHI PERCENTILES

SAMPLE B-3

PHI	MICRONS	MM	PCT. RET	PCT. FINER
.00	1000.00	.1000E+01	63.30	36.70
.25	840.90	.8409E+00	68.49	31.51
.50	707.11	.7071E+00	73.68	26.32
.75	594.60	.5946E+00	78.87	21.13
1.00	500.00	.5000E+00	84.05	15.95
1.25	420.45	.4204E+00	86.22	13.78
1.50	353.55	.3536E+00	88.38	11.62
1.75	297.30	.2973E+00	90.55	9.45
2.00	250.00	.2500E+00	92.71	7.29
2.25	210.22	.2102E+00	94.25	5.75
2.50	176.78	.1768E+00	95.79	4.21
2.75	148.65	.1487E+00	97.32	2.68
3.00	125.00	.1250E+00	98.86	1.14
3.25	105.11	.1051E+00	99.04	.96
3.50	88.39	.8839E-01	99.23	.77
3.75	74.33	.7433E-01	99.41	.59
4.00	62.50	.6250E-01	99.59	.41

STATISTICS AND ENGINEERING PARAMETERS

SAMPLE B-3

INSUFFICIENT DATA FOR ANY STATISTICAL CALCULATIONS

ENGINEERING PARAMETERS:

D60 IS NOT CALCULATED--FIRST SIEVE RETAINS OVER 40%
 D30 .323 PHI 799.560 MICRONS
 D10 1.687 PHI 310.606 MICRONS
 COEF. OF UNIFORMITY IS NOT CALCULATED
 COEF. OF CURVATURE IS NOT CALCULATED

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TIERRA CONSULTING
SEDPET III: SEDIMENTARY PETROLOGY ANALYSIS PROGRAM

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ANALYSIS OF SAMPLE: C-3

PAN=.08=.17%
BVA- DIAL CORDY 2-26-07

SIEVE ANALYSIS

SAMPLE WEIGHT = 44.59

SIEVE SIZE (MICRONS)	SIEVE SIZE (PHI)	SIEVE WT (GRAMS)	WEIGHT PERCENT RETAINED	CUMULATIVE PERCENT THROUGH	CUMULATIVE PERCENT RETAINED
1000.00	.00	.02	.04	99.96	.04
500.00	1.00	.28	.63	99.33	.67
250.00	2.00	5.58	12.51	86.81	13.19
125.00	3.00	35.30	79.17	7.65	92.35
62.50	4.00	3.31	7.42	.22	99.78

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TEXTURAL CLASSIFICATION AND PHI PERCENTILES SAMPLE C-3

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SIZE CLASSIFICATION USED: STANDARD GEOLOGICAL SOILS CLASSIFICATION

GRAVEL/SAND CUTOFF 2000.00 MICRONS
SAND/SILT CUTOFF 62.50 MICRONS
SILT/CLAY CUTOFF 4.00 MICRONS

PERCENT GRAVEL .00
PERCENT SAND 99.78

PERCENT SILT AND CLAY .22

=====

TEXTURAL DESCRIPTIONS

FOLK'S: SAND
SHEPARD'S: SAND
TREFETHEN'S: SAND
U.S. ARMY CORPS OF ENGINEERS: SAND
U.S. BUREAU OF SOILS: SAND

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PHI PERCENTILES

PHI(05)	1.35	PHI	393.44	MICRONS
PHI(16)	2.04	PHI	243.92	MICRONS
PHI(25)	2.15	PHI	225.43	MICRONS
PHI(50)	2.47	PHI	181.12	MICRONS
PHI(75)	2.78	PHI	145.51	MICRONS
PHI(84)	2.89	PHI	134.48	MICRONS
PHI(95)	3.36	PHI	97.62	MICRONS

=====

EXTRAPOLATION OF DATA TO CUMULATIVE 99.5% RETAINED.

***OVER 99.5% SAMPLE ACCOUNTED FOR BY INPUT DATA - NO EXTRAPOLATION REQUIRED.

INTERPOLATED PHI PERCENTILES

SAMPLE C-3

PHI	MICRONS	MM	PCT. RET	PCT. FINER
.00	1000.00	.1000E+01	.04	99.96
.25	840.90	.8409E+00	.20	99.80
.50	707.11	.7071E+00	.36	99.64
.75	594.60	.5946E+00	.52	99.48
1.00	500.00	.5000E+00	.67	99.33
1.25	420.45	.4204E+00	3.80	96.20
1.50	353.55	.3536E+00	6.93	93.07
1.75	297.30	.2973E+00	10.06	89.94
2.00	250.00	.2500E+00	13.19	86.81
2.25	210.22	.2102E+00	32.98	67.02
2.50	176.78	.1768E+00	52.77	47.23
2.75	148.65	.1487E+00	72.56	27.44
3.00	125.00	.1250E+00	92.35	7.65
3.25	105.11	.1051E+00	94.21	5.79
3.50	88.39	.8839E-01	96.06	3.94
3.75	74.33	.7433E-01	97.92	2.08
4.00	62.50	.6250E-01	99.78	.22

STATISTICS AND ENGINEERING PARAMETERS

SAMPLE C-3

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INMAN'S STATISTICS:

MEDIAN	2.465	PHI	181.116	MICRONS
MEAN	2.465	PHI	181.116	MICRONS
STANDARD DEVIATION	.429	WELL SORTED		
SKEWNESS	.000	NEAR-SYMMETRICAL		
KURTOSIS	1.341	LEPTOKURTIC		

=====

FOLK'S STATISTICS:

MEAN 2.465 PHI 181.116 MICRONS
 STANDARD DEVIATION .519 MODERATELY WELL SORTED
 SKEWNESS -.057 NEAR-SYMMETRICAL
 KURTOSIS 1.305 LEPTOKURTIC

MOMENT MEASURES:

MEAN 2.430 PHI 185.619 MICRONS
 SECOND MOMENT .224
 STANDARD DEVIATION .474 WELL SORTED
 THIRD MOMENT -.066
 SKEWNESS -.617 STRONGLY COARSE-SKEWED
 FOURTH MOMENT .311
 KURTOSIS 2.060 VERY LEPTOKURTIC

ENGINEERING PARAMETERS:

D60 2.339 PHI 197.689 MICRONS
 D30 2.718 PHI 152.022 MICRONS
 D10 2.970 PHI 127.601 MICRONS
 COEF. OF UNIFORMITY 1.549
 COEF. OF CURVATURE .916

TIERRA CONSULTING
 SEDPET III: SEDIMENTARY PETROLOGY ANALYSIS PROGRAM

ANALYSIS OF SAMPLE: C-4

PAN=.06=.12%
 BVA- DIAL CORDY 2-26-07

SIEVE ANALYSIS

SAMPLE WEIGHT = 48.86

SIEVE SIZE (MICRONS)	SIEVE SIZE (PHI)	SIEVE WT (GRAMS)	WEIGHT PERCENT RETAINED	CUMULATIVE PERCENT THROUGH	CUMULATIVE PERCENT RETAINED
1000.00	.00	.06	.12	99.88	.12
500.00	1.00	1.00	2.05	97.83	2.17
250.00	2.00	4.59	9.39	88.44	11.56
125.00	3.00	40.06	81.99	6.45	93.55
62.50	4.00	2.94	6.02	.43	99.57

TEXTURAL CLASSIFICATION AND PHI PERCENTILES

SAMPLE C-4

SIZE CLASSIFICATION USED: STANDARD GEOLOGICAL SOILS CLASSIFICATION

GRAVEL/SAND CUTOFF 2000.00 MICRONS
SAND/SILT CUTOFF 62.50 MICRONS
SILT/CLAY CUTOFF 4.00 MICRONS

PERCENT GRAVEL .00
PERCENT SAND 99.57
PERCENT SILT AND CLAY .43

TEXTURAL DESCRIPTIONS

FOLK'S: SAND
SHEPARD'S: SAND
TREFETHEN'S: SAND
U.S. ARMY CORPS OF ENGINEERS: SAND
U.S. BUREAU OF SOILS: SAND

PHI PERCENTILES

PHI(05) 1.30 PHI 405.76 MICRONS
PHI(16) 2.05 PHI 240.80 MICRONS
PHI(25) 2.16 PHI 223.16 MICRONS
PHI(50) 2.47 PHI 180.64 MICRONS
PHI(75) 2.77 PHI 146.23 MICRONS
PHI(84) 2.88 PHI 135.51 MICRONS
PHI(95) 3.24 PHI 105.81 MICRONS

EXTRAPOLATION OF DATA TO CUMULATIVE 99.5% RETAINED.

***OVER 99.5% SAMPLE ACCOUNTED FOR BY INPUT DATA - NO EXTRAPOLATION REQUIRED.

INTERPOLATED PHI PERCENTILES

SAMPLE C-4

PHI	MICRONS	MM	PCT. RET	PCT. FINER
.00	1000.00	.1000E+01	.12	99.88
.25	840.90	.8409E+00	.63	99.37
.50	707.11	.7071E+00	1.15	98.85
.75	594.60	.5946E+00	1.66	98.34
1.00	500.00	.5000E+00	2.17	97.83
1.25	420.45	.4204E+00	4.52	95.48
1.50	353.55	.3536E+00	6.87	93.13
1.75	297.30	.2973E+00	9.22	90.78
2.00	250.00	.2500E+00	11.56	88.44
2.25	210.22	.2102E+00	32.06	67.94
2.50	176.78	.1768E+00	52.56	47.44

2.75	148.65	.1487E+00	73.06	26.94
3.00	125.00	.1250E+00	93.55	6.45
3.25	105.11	.1051E+00	95.06	4.94
3.50	88.39	.8839E-01	96.56	3.44
3.75	74.33	.7433E-01	98.07	1.93
4.00	62.50	.6250E-01	99.57	.43

STATISTICS AND ENGINEERING PARAMETERS

SAMPLE C-4

INMAN'S STATISTICS:

MEDIAN	2.469 PHI	180.642 MICRONS
MEAN	2.469 PHI	180.642 MICRONS
STANDARD DEVIATION	.415 WELL SORTED	
SKEWNESS	.000 NEAR-SYMMETRICAL	
KURTOSIS	1.338 LEPTOKURTIC	

FOLK'S STATISTICS:

MEAN	2.469 PHI	180.642 MICRONS
STANDARD DEVIATION	.501 MODERATELY WELL SORTED	
SKEWNESS	-.102 COARSE-SKEWED	
KURTOSIS	1.303 LEPTOKURTIC	

MOMENT MEASURES:

MEAN	2.411 PHI	188.043 MICRONS
SECOND MOMENT	.241	
STANDARD DEVIATION	.491 WELL SORTED	
THIRD MOMENT	-.166	
SKEWNESS	-1.401 STRONGLY COARSE-SKEWED	
FOURTH MOMENT	.510	
KURTOSIS	2.930 VERY LEPTOKURTIC	

ENGINEERING PARAMETERS:

D60	2.347 PHI	196.578 MICRONS
D30	2.713 PHI	152.541 MICRONS
D10	2.957 PHI	128.812 MICRONS
COEF. OF UNIFORMITY	1.526	
COEF. OF CURVATURE	.919	

TIERRA CONSULTING
SEDPET III: SEDIMENTARY PETROLOGY ANALYSIS PROGRAM

ANALYSIS OF SAMPLE: C1

PAN=.03=.06%
BVA DIAL CORDY 2-26-07

SIEVE ANALYSIS

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SAMPLE WEIGHT = 48.84

SIEVE SIZE (MICRONS)	SIEVE SIZE (PHI)	SIEVE WT (GRAMS)	WEIGHT PERCENT RETAINED	CUMULATIVE PERCENT THROUGH	CUMULATIVE PERCENT RETAINED
500.00	1.00	1.12	2.29	97.71	2.29
250.00	2.00	7.65	15.66	82.04	17.96
125.00	3.00	37.92	77.64	4.40	95.60
62.50	4.00	2.11	4.32	.08	99.92

TEXTURAL CLASSIFICATION AND PHI PERCENTILES SAMPLE C1

SIZE CLASSIFICATION USED: STANDARD GEOLOGICAL SOILS CLASSIFICATION

GRAVEL/SAND CUTOFF 2000.00 MICRONS
 SAND/SILT CUTOFF 62.50 MICRONS
 SILT/CLAY CUTOFF 4.00 MICRONS

PERCENT GRAVEL .00
 PERCENT SAND 99.92

PERCENT SILT AND CLAY .08

TEXTURAL DESCRIPTIONS

FOLK'S: SAND
 SHEPARD'S: SAND
 TREFETHEN'S: SAND
 U.S. ARMY CORPS OF ENGINEERS: SAND
 U.S. BUREAU OF SOILS: SAND

PHI PERCENTILES

PHI(05)	1.17 PHI	443.56 MICRONS
PHI(16)	1.88 PHI	272.61 MICRONS
PHI(25)	2.09 PHI	234.76 MICRONS
PHI(50)	2.41 PHI	187.80 MICRONS
PHI(75)	2.73 PHI	150.24 MICRONS
PHI(84)	2.85 PHI	138.64 MICRONS
PHI(95)	2.99 PHI	125.67 MICRONS

EXTRAPOLATION OF DATA TO CUMULATIVE 99.5% RETAINED.

***OVER 99.5% SAMPLE ACCOUNTED FOR BY INPUT DATA - NO EXTRAPOLATION REQUIRED.

INTERPOLATED PHI PERCENTILES	SAMPLE C1
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PHI	MICRONS	MM	PCT. RET	PCT. FINER
1.00	500.00	.5000E+00	2.29	97.71
1.25	420.45	.4204E+00	6.21	93.79
1.50	353.55	.3536E+00	10.12	89.88
1.75	297.30	.2973E+00	14.04	85.96
2.00	250.00	.2500E+00	17.96	82.04
2.25	210.22	.2102E+00	37.37	62.63
2.50	176.78	.1768E+00	56.78	43.22
2.75	148.65	.1487E+00	76.19	23.81
3.00	125.00	.1250E+00	95.60	4.40
3.25	105.11	.1051E+00	96.68	3.32
3.50	88.39	.8839E-01	97.76	2.24
3.75	74.33	.7433E-01	98.84	1.16
4.00	62.50	.6250E-01	99.92	.08

STATISTICS AND ENGINEERING PARAMETERS	SAMPLE C1
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INMAN'S STATISTICS:

MEDIAN	2.413 PHI	187.803 MICRONS
MEAN	2.363 PHI	194.406 MICRONS
STANDARD DEVIATION	.488 WELL SORTED	
SKEWNESS	-.102 COARSE-SKEWED	
KURTOSIS	.865 PLATYKURTIC	

FOLK'S STATISTICS:

MEAN	2.379 PHI	192.180 MICRONS
STANDARD DEVIATION	.520 MODERATELY WELL SORTED	
SKEWNESS	-.233 COARSE-SKEWED	
KURTOSIS	1.158 LEPTOKURTIC	

MOMENT MEASURES:

MEAN	2.339 PHI	197.694 MICRONS
SECOND MOMENT	.266	
STANDARD DEVIATION	.516 MODERATELY WELL SORTED	
THIRD MOMENT	-.164	
SKEWNESS	-1.194 STRONGLY COARSE-SKEWED	
FOURTH MOMENT	.419	
KURTOSIS	1.970 VERY LEPTOKURTIC	

ENGINEERING PARAMETERS:

D60	2.284 PHI	205.340 MICRONS
D30	2.670 PHI	157.093 MICRONS
D10	2.928 PHI	131.406 MICRONS
COEF. OF UNIFORMITY	1.563	
COEF. OF CURVATURE	.915	

TIERRA CONSULTING
SEDPET III: SEDIMENTARY PETROLOGY ANALYSIS PROGRAM

ANALYSIS OF SAMPLE: C-2

PAN=0.06g=.12%
BVA DIAL CORDY 2-26-07

SIEVE ANALYSIS

SAMPLE WEIGHT = 49.58

SIEVE SIZE (MICRONS)	SIEVE SIZE (PHI)	SIEVE WT (GRAMS)	WEIGHT PERCENT RETAINED	CUMULATIVE PERCENT THROUGH	CUMULATIVE PERCENT RETAINED
1000.00	.00	.07	.14	99.86	.14
500.00	1.00	.75	1.51	98.35	1.65
250.00	2.00	6.78	13.67	84.67	15.33
125.00	3.00	38.64	77.93	6.74	93.26
62.50	4.00	3.25	6.56	.18	99.82

TEXTURAL CLASSIFICATION AND PHI PERCENTILES SAMPLE C-2

SIZE CLASSIFICATION USED: STANDARD GEOLOGICAL SOILS CLASSIFICATION

GRAVEL/SAND CUTOFF	2000.00 MICRONS
SAND/SILT CUTOFF	62.50 MICRONS
SILT/CLAY CUTOFF	4.00 MICRONS

PERCENT GRAVEL	.00
PERCENT SAND	99.82

PERCENT SILT AND CLAY	.18
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TEXTURAL DESCRIPTIONS

FOLK'S: SAND
 SHEPARD'S: SAND
 TREFETHEN'S: SAND
 U.S. ARMY CORPS OF ENGINEERS: SAND
 U.S. BUREAU OF SOILS: SAND

PHI PERCENTILES

PHI(05)	1.24	PHI	422.00	MICRONS
PHI(16)	2.01	PHI	248.51	MICRONS
PHI(25)	2.12	PHI	229.39	MICRONS
PHI(50)	2.44	PHI	183.66	MICRONS
PHI(75)	2.77	PHI	147.05	MICRONS
PHI(84)	2.88	PHI	135.73	MICRONS
PHI(95)	3.26	PHI	104.03	MICRONS

EXTRAPOLATION OF DATA TO CUMULATIVE 99.5% RETAINED.

***OVER 99.5% SAMPLE ACCOUNTED FOR BY INPUT DATA - NO EXTRAPOLATION REQUIRED.

INTERPOLATED PHI PERCENTILES

SAMPLE C-2

PHI	MICRONS	MM	PCT. RET	PCT. FINER
.00	1000.00	.1000E+01	.14	99.86
.25	840.90	.8409E+00	.52	99.48
.50	707.11	.7071E+00	.90	99.10
.75	594.60	.5946E+00	1.28	98.72
1.00	500.00	.5000E+00	1.65	98.35
1.25	420.45	.4204E+00	5.07	94.93
1.50	353.55	.3536E+00	8.49	91.51
1.75	297.30	.2973E+00	11.91	88.09
2.00	250.00	.2500E+00	15.33	84.67
2.25	210.22	.2102E+00	34.81	65.19
2.50	176.78	.1768E+00	54.30	45.70
2.75	148.65	.1487E+00	73.78	26.22
3.00	125.00	.1250E+00	93.26	6.74
3.25	105.11	.1051E+00	94.90	5.10
3.50	88.39	.8839E-01	96.54	3.46
3.75	74.33	.7433E-01	98.18	1.82
4.00	62.50	.6250E-01	99.82	.18

STATISTICS AND ENGINEERING PARAMETERS

SAMPLE C-2

INMAN'S STATISTICS:

MEDIAN	2.445	PHI	183.662	MICRONS
MEAN	2.445	PHI	183.662	MICRONS
STANDARD DEVIATION	.436	WELL SORTED		
SKEWNESS	.000	NEAR-SYMMETRICAL		
KURTOSIS	1.315	LEPTOKURTIC		

FOLK'S STATISTICS:

MEAN	2.445	PHI	183.662	MICRONS
STANDARD DEVIATION	.524	MODERATELY WELL SORTED		
SKEWNESS	-.094	NEAR-SYMMETRICAL		
KURTOSIS	1.291	LEPTOKURTIC		

MOMENT MEASURES:

MEAN	2.390	PHI	190.812	MICRONS
SECOND MOMENT	.264			
STANDARD DEVIATION	.514	MODERATELY WELL SORTED		
THIRD MOMENT	-.142			
SKEWNESS	-1.043	STRONGLY COARSE-SKEWED		
FOURTH MOMENT	.477			
KURTOSIS	2.274	VERY LEPTOKURTIC		

ENGINEERING PARAMETERS:

D60	2.317	PHI	200.745	MICRONS
D30	2.702	PHI	153.733	MICRONS
D10	2.958	PHI	128.681	MICRONS
COEF. OF UNIFORMITY	1.560			
COEF. OF CURVATURE	.915			

TIERRA CONSULTING
SEDPET III: SEDIMENTARY PETROLOGY ANALYSIS PROGRAM

ANALYSIS OF SAMPLE: D-1

PAN=0.05=<5%
BVA DIAL CORDY 2-26-07

SIEVE ANALYSIS

=====

SAMPLE WEIGHT = 49.48

SIEVE SIZE (MICRONS)	SIEVE SIZE (PHI)	SIEVE WT (GRAMS)	WEIGHT PERCENT RETAINED	CUMULATIVE PERCENT THROUGH	CUMULATIVE PERCENT RETAINED
1000.00	.00	.21	.42	99.58	.42
500.00	1.00	2.48	5.01	94.56	5.44
250.00	2.00	13.61	27.51	67.06	32.94
125.00	3.00	31.55	63.76	3.29	96.71
62.50	4.00	1.56	3.15	.14	99.86

=====

TEXTURAL CLASSIFICATION AND PHI PERCENTILES

SAMPLE D-1

=====

SIZE CLASSIFICATION USED: STANDARD GEOLOGICAL SOILS CLASSIFICATION

GRAVEL/SAND CUTOFF 2000.00 MICRONS
 SAND/SILT CUTOFF 62.50 MICRONS
 SILT/CLAY CUTOFF 4.00 MICRONS

PERCENT GRAVEL .00
 PERCENT SAND 99.86

PERCENT SILT AND CLAY .14

=====

TEXTURAL DESCRIPTIONS

FOLK'S: SAND
 SHEPARD'S: SAND
 TREFETHEN'S: SAND
 U.S. ARMY CORPS OF ENGINEERS: SAND
 U.S. BUREAU OF SOILS: SAND

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PHI PERCENTILES

PHI(05)	.91	PHI	531.12	MICRONS
PHI(16)	1.38	PHI	383.14	MICRONS
PHI(25)	1.71	PHI	305.40	MICRONS
PHI(50)	2.27	PHI	207.69	MICRONS
PHI(75)	2.66	PHI	158.26	MICRONS
PHI(84)	2.80	PHI	143.51	MICRONS
PHI(95)	2.97	PHI	127.34	MICRONS

=====

EXTRAPOLATION OF DATA TO CUMULATIVE 99.5% RETAINED.

***OVER 99.5% SAMPLE ACCOUNTED FOR BY INPUT DATA - NO EXTRAPOLATION REQUIRED.

INTERPOLATED PHI PERCENTILES	SAMPLE D-1
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PHI	MICRONS	MM	PCT. RET	PCT. FINER
.00	1000.00	.1000E+01	.42	99.58
.25	840.90	.8409E+00	1.68	98.32
.50	707.11	.7071E+00	2.93	97.07
.75	594.60	.5946E+00	4.18	95.82
1.00	500.00	.5000E+00	5.44	94.56
1.25	420.45	.4204E+00	12.31	87.69
1.50	353.55	.3536E+00	19.19	80.81
1.75	297.30	.2973E+00	26.07	73.93
2.00	250.00	.2500E+00	32.94	67.06
2.25	210.22	.2102E+00	48.88	51.12
2.50	176.78	.1768E+00	64.82	35.18
2.75	148.65	.1487E+00	80.76	19.24
3.00	125.00	.1250E+00	96.71	3.29
3.25	105.11	.1051E+00	97.49	2.51
3.50	88.39	.8839E-01	98.28	1.72
3.75	74.33	.7433E-01	99.07	.93
4.00	62.50	.6250E-01	99.86	.14

STATISTICS AND ENGINEERING PARAMETERS	SAMPLE D-1
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INMAN'S STATISTICS:

MEDIAN	2.268 PHI	207.688 MICRONS
MEAN	2.092 PHI	234.492 MICRONS
STANDARD DEVIATION	.708	MODERATELY WELL SORTED
SKEWNESS	-.247	COARSE-SKEWED
KURTOSIS	.454	VERY PLATYKURTIC

FOLK'S STATISTICS:

MEAN	2.151 PHI	225.194 MICRONS
STANDARD DEVIATION	.666	MODERATELY WELL SORTED
SKEWNESS	-.281	COARSE-SKEWED
KURTOSIS	.890	PLATYKURTIC

MOMENT MEASURES:

MEAN	2.140 PHI	226.887 MICRONS
SECOND MOMENT	.418	
STANDARD DEVIATION	.647	MODERATELY WELL SORTED
THIRD MOMENT	-.262	
SKEWNESS	-.970	STRONGLY COARSE-SKEWED
FOURTH MOMENT	.733	
KURTOSIS	1.399	LEPTOKURTIC

ENGINEERING PARAMETERS:

D60	2.111 PHI	231.538 MICRONS
D30	2.581 PHI	167.105 MICRONS
D10	2.895 PHI	134.452 MICRONS
COEF. OF UNIFORMITY	1.722	
COEF. OF CURVATURE	.897	

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TIERRA CONSULTING
SEDPET III: SEDIMENTARY PETROLOGY ANALYSIS PROGRAM

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ANALYSIS OF SAMPLE: D-2

PAN=.07=.1%
BVA-DIAL CORDY 2-26-07

SIEVE ANALYSIS

=====

SAMPLE WEIGHT = 44.00

SIEVE SIZE (MICRONS)	SIEVE SIZE (PHI)	SIEVE WT (GRAMS)	WEIGHT PERCENT RETAINED	CUMULATIVE PERCENT THROUGH	CUMULATIVE PERCENT RETAINED
1000.00	.00	.16	.36	99.64	.36
500.00	1.00	.89	2.02	97.61	2.39
250.00	2.00	7.08	16.09	81.52	18.48
125.00	3.00	33.69	76.57	4.95	95.05
62.50	4.00	2.11	4.80	.16	99.84

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TEXTURAL CLASSIFICATION AND PHI PERCENTILES SAMPLE D-2

=====

SIZE CLASSIFICATION USED: STANDARD GEOLOGICAL SOILS CLASSIFICATION

GRAVEL/SAND CUTOFF	2000.00 MICRONS
SAND/SILT CUTOFF	62.50 MICRONS
SILT/CLAY CUTOFF	4.00 MICRONS

PERCENT GRAVEL	.00
PERCENT SAND	99.84
PERCENT SILT AND CLAY	.16

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TEXTURAL DESCRIPTIONS

FOLK'S: SAND
 SHEPARD'S: SAND
 TREFETHEN'S: SAND
 U.S. ARMY CORPS OF ENGINEERS: SAND
 U.S. BUREAU OF SOILS: SAND

PHI PERCENTILES

PHI(05)	1.16	PHI	446.76	MICRONS
PHI(16)	1.85	PHI	278.15	MICRONS
PHI(25)	2.09	PHI	235.67	MICRONS
PHI(50)	2.41	PHI	187.93	MICRONS
PHI(75)	2.74	PHI	149.87	MICRONS
PHI(84)	2.86	PHI	138.15	MICRONS
PHI(95)	3.00	PHI	125.05	MICRONS

EXTRAPOLATION OF DATA TO CUMULATIVE 99.5% RETAINED.

***OVER 99.5% SAMPLE ACCOUNTED FOR BY INPUT DATA - NO EXTRAPOLATION REQUIRED.

INTERPOLATED PHI PERCENTILES

SAMPLE D-2

PHI	MICRONS	MM	PCT. RET	PCT. FINER
.00	1000.00	.1000E+01	.36	99.64
.25	840.90	.8409E+00	.87	99.13
.50	707.11	.7071E+00	1.38	98.63
.75	594.60	.5946E+00	1.88	98.12
1.00	500.00	.5000E+00	2.39	97.61
1.25	420.45	.4204E+00	6.41	93.59
1.50	353.55	.3536E+00	10.43	89.57
1.75	297.30	.2973E+00	14.45	85.55
2.00	250.00	.2500E+00	18.48	81.52
2.25	210.22	.2102E+00	37.62	62.38
2.50	176.78	.1768E+00	56.76	43.24
2.75	148.65	.1487E+00	75.90	24.10
3.00	125.00	.1250E+00	95.05	4.95
3.25	105.11	.1051E+00	96.24	3.76
3.50	88.39	.8839E-01	97.44	2.56
3.75	74.33	.7433E-01	98.64	1.36
4.00	62.50	.6250E-01	99.84	.16

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STATISTICS AND ENGINEERING PARAMETERS

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SAMPLE D-2

INMAN'S STATISTICS:

MEDIAN	2.412	PHI	187.935	MICRONS
MEAN	2.351	PHI	196.024	MICRONS
STANDARD DEVIATION	.505	MODERATELY WELL SORTED		
SKEWNESS	-.120	COARSE-SKEWED		
KURTOSIS	.819	PLATYKURTIC		

=====

FOLK'S STATISTICS:

MEAN	2.371	PHI	193.290	MICRONS
STANDARD DEVIATION	.531	MODERATELY WELL SORTED		
SKEWNESS	-.240	COARSE-SKEWED		
KURTOSIS	1.153	LEPTOKURTIC		

=====

MOMENT MEASURES:

MEAN	2.332	PHI	198.649	MICRONS
SECOND MOMENT	.295			
STANDARD DEVIATION	.544	MODERATELY WELL SORTED		
THIRD MOMENT	-.219			
SKEWNESS	-1.366	STRONGLY COARSE-SKEWED		
FOURTH MOMENT	.628			
KURTOSIS	2.400	VERY LEPTOKURTIC		

=====

ENGINEERING PARAMETERS:

D60	2.281	PHI	205.742	MICRONS
D30	2.673	PHI	156.811	MICRONS
D10	2.934	PHI	130.842	MICRONS
COEF. OF UNIFORMITY	1.572			
COEF. OF CURVATURE	.913			

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TIERRA CONSULTING

SEDPET III: SEDIMENTARY PETROLOGY ANALYSIS PROGRAM

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ANALYSIS OF SAMPLE: D-3

PAN=0.02=.04%

BVA-DIAL CORDY 2-26-07

SIEVE ANALYSIS
=====

SAMPLE WEIGHT = 47.34

SIEVE SIZE (MICRONS)	SIEVE SIZE (PHI)	SIEVE WT (GRAMS)	WEIGHT PERCENT RETAINED	CUMULATIVE PERCENT THROUGH	CUMULATIVE PERCENT RETAINED
1000.00	.00	.82	1.73	98.27	1.73
500.00	1.00	1.87	3.95	94.32	5.68
250.00	2.00	8.89	18.78	75.54	24.46
125.00	3.00	33.77	71.34	4.20	95.80
62.50	4.00	1.96	4.14	.06	99.94

=====

TEXTURAL CLASSIFICATION AND PHI PERCENTILES SAMPLE D-3

=====

SIZE CLASSIFICATION USED: STANDARD GEOLOGICAL SOILS CLASSIFICATION

GRAVEL/SAND CUTOFF 2000.00 MICRONS
SAND/SILT CUTOFF 62.50 MICRONS
SILT/CLAY CUTOFF 4.00 MICRONS

PERCENT GRAVEL .00
PERCENT SAND 99.94

PERCENT SILT AND CLAY .06

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TEXTURAL DESCRIPTIONS

FOLK'S: SAND
SHEPARD'S: SAND
TREFETHEN'S: SAND
U.S. ARMY CORPS OF ENGINEERS: SAND
U.S. BUREAU OF SOILS: SAND

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PHI PERCENTILES

PHI(05)	.83	PHI	563.59	MICRONS
PHI(16)	1.55	PHI	341.65	MICRONS
PHI(25)	2.01	PHI	248.69	MICRONS
PHI(50)	2.36	PHI	195.06	MICRONS
PHI(75)	2.71	PHI	152.99	MICRONS
PHI(84)	2.83	PHI	140.18	MICRONS
PHI(95)	2.99	PHI	125.97	MICRONS

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EXTRAPOLATION OF DATA TO CUMULATIVE 99.5% RETAINED.

***OVER 99.5% SAMPLE ACCOUNTED FOR BY INPUT DATA - NO EXTRAPOLATION REQUIRED.

INTERPOLATED PHI PERCENTILES				SAMPLE D-3
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PHI	MICRONS	MM	PCT. RET	PCT. FINER
.00	1000.00	.1000E+01	1.73	98.27
.25	840.90	.8409E+00	2.72	97.28
.50	707.11	.7071E+00	3.71	96.29
.75	594.60	.5946E+00	4.69	95.31
1.00	500.00	.5000E+00	5.68	94.32
1.25	420.45	.4204E+00	10.38	89.62
1.50	353.55	.3536E+00	15.07	84.93
1.75	297.30	.2973E+00	19.77	80.23
2.00	250.00	.2500E+00	24.46	75.54
2.25	210.22	.2102E+00	42.30	57.70
2.50	176.78	.1768E+00	60.13	39.87
2.75	148.65	.1487E+00	77.96	22.04
3.00	125.00	.1250E+00	95.80	4.20
3.25	105.11	.1051E+00	96.83	3.17
3.50	88.39	.8839E-01	97.87	2.13
3.75	74.33	.7433E-01	98.90	1.10
4.00	62.50	.6250E-01	99.94	.06

STATISTICS AND ENGINEERING PARAMETERS		SAMPLE D-3
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INMAN'S STATISTICS:

MEDIAN	2.358 PHI	195.060 MICRONS
MEAN	2.192 PHI	218.843 MICRONS
STANDARD DEVIATION	.643	MODERATELY WELL SORTED
SKEWNESS	-.258	COARSE-SKEWED
KURTOSIS	.682	PLATYKURTIC

FOLK'S STATISTICS:

MEAN	2.247 PHI	210.610 MICRONS
STANDARD DEVIATION	.649	MODERATELY WELL SORTED
SKEWNESS	-.337	STRONGLY COARSE-SKEWED
KURTOSIS	1.264	LEPTOKURTIC

MOMENT MEASURES:

MEAN	2.221 PHI	214.484 MICRONS
SECOND MOMENT	.466	
STANDARD DEVIATION	.683	MODERATELY WELL SORTED
THIRD MOMENT	-.519	
SKEWNESS	-1.630	STRONGLY COARSE-SKEWED
FOURTH MOMENT	1.462	
KURTOSIS	2.243	VERY LEPTOKURTIC

ENGINEERING PARAMETERS:

D60	2.218 PHI	214.965 MICRONS
D30	2.638 PHI	160.609 MICRONS
D10	2.919 PHI	132.242 MICRONS
COEF. OF UNIFORMITY	1.626	
COEF. OF CURVATURE	.907	

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TIERRA CONSULTING

SEDPET III: SEDIMENTARY PETROLOGY ANALYSIS PROGRAM

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ANALYSIS OF SAMPLE: D-4

PAN=.01=.02%

BVA-DIAL CORDY 2-26-07

SIEVE ANALYSIS

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SAMPLE WEIGHT = 44.00

SIEVE SIZE (MICRONS)	SIEVE SIZE (PHI)	SIEVE WT (GRAMS)	WEIGHT PERCENT RETAINED	CUMULATIVE PERCENT THROUGH	CUMULATIVE PERCENT RETAINED
1000.00	.00	.13	.30	99.70	.30
500.00	1.00	1.84	4.18	95.52	4.48
250.00	2.00	22.62	51.41	44.11	55.89
125.00	3.00	18.28	41.55	2.57	97.43
62.50	4.00	.96	2.18	.39	99.61

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TEXTURAL CLASSIFICATION AND PHI PERCENTILES SAMPLE D-4

=====

SIZE CLASSIFICATION USED: STANDARD GEOLOGICAL SOILS CLASSIFICATION

GRAVEL/SAND CUTOFF	2000.00 MICRONS
SAND/SILT CUTOFF	62.50 MICRONS
SILT/CLAY CUTOFF	4.00 MICRONS

PERCENT GRAVEL	.00
PERCENT SAND	99.61

PERCENT SILT AND CLAY	.39
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TEXTURAL DESCRIPTIONS

FOLK'S: SAND
 SHEPARD'S: SAND
 TREFETHEN'S: SAND
 U.S. ARMY CORPS OF ENGINEERS: SAND
 U.S. BUREAU OF SOILS: SAND

PHI PERCENTILES

PHI(05)	1.01	PHI	496.49	MICRONS
PHI(16)	1.22	PHI	428.05	MICRONS
PHI(25)	1.40	PHI	379.14	MICRONS
PHI(50)	1.89	PHI	270.65	MICRONS
PHI(75)	2.46	PHI	181.74	MICRONS
PHI(84)	2.68	PHI	156.40	MICRONS
PHI(95)	2.94	PHI	130.18	MICRONS

EXTRAPOLATION OF DATA TO CUMULATIVE 99.5% RETAINED.

***OVER 99.5% SAMPLE ACCOUNTED FOR BY INPUT DATA - NO EXTRAPOLATION REQUIRED.

INTERPOLATED PHI PERCENTILES

SAMPLE D-4

PHI	MICRONS	MM	PCT. RET	PCT. FINER
.00	1000.00	.1000E+01	.30	99.70
.25	840.90	.8409E+00	1.34	98.66
.50	707.11	.7071E+00	2.39	97.61
.75	594.60	.5946E+00	3.43	96.57
1.00	500.00	.5000E+00	4.48	95.52
1.25	420.45	.4204E+00	17.33	82.67
1.50	353.55	.3536E+00	30.18	69.82
1.75	297.30	.2973E+00	43.03	56.97
2.00	250.00	.2500E+00	55.89	44.11
2.25	210.22	.2102E+00	66.27	33.73
2.50	176.78	.1768E+00	76.66	23.34
2.75	148.65	.1487E+00	87.05	12.95
3.00	125.00	.1250E+00	97.43	2.57
3.25	105.11	.1051E+00	97.98	2.02
3.50	88.39	.8839E-01	98.52	1.48
3.75	74.33	.7433E-01	99.07	.93
4.00	62.50	.6250E-01	99.61	.39

STATISTICS AND ENGINEERING PARAMETERS

SAMPLE D-4

INMAN'S STATISTICS:

MEDIAN	1.885	PHI	270.650	MICRONS
MEAN	1.950	PHI	258.741	MICRONS

STANDARD DEVIATION .726 MODERATELY SORTED
 SKEWNESS .089 NEAR-SYMMETRICAL
 KURTOSIS .330 VERY PLATYKURTIC

=====

FOLK'S STATISTICS:

MEAN 1.929 PHI 262.652 MICRONS
 STANDARD DEVIATION .656 MODERATELY WELL SORTED
 SKEWNESS .091 NEAR-SYMMETRICAL
 KURTOSIS .746 PLATYKURTIC

=====

MOMENT MEASURES:

MEAN 1.906 PHI 266.911 MICRONS
 SECOND MOMENT .387
 STANDARD DEVIATION .622 MODERATELY WELL SORTED
 THIRD MOMENT -.016
 SKEWNESS -.066 NEAR-SYMMETRICAL
 FOURTH MOMENT .469
 KURTOSIS 1.046 MESOKURTIC

=====

ENGINEERING PARAMETERS:

D60 1.691 PHI 309.716 MICRONS
 D30 2.340 PHI 197.549 MICRONS
 D10 2.821 PHI 141.501 MICRONS
 COEF. OF UNIFORMITY 2.189
 COEF. OF CURVATURE .890

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TIERRA CONSULTING
 SEDPET III: SEDIMENTARY PETROLOGY ANALYSIS PROGRAM

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ANALYSIS OF SAMPLE: E-1

PAN=1.15=2.34%
 BVA- DIAL CORDY 2-26-07

SIEVE ANALYSIS

=====

SAMPLE WEIGHT = 48.95

SIEVE SIZE (MICRONS)	SIEVE SIZE (PHI)	SIEVE WT (GRAMS)	WEIGHT PERCENT RETAINED	CUMULATIVE PERCENT THROUGH	CUMULATIVE PERCENT RETAINED
1000.00	.00	.26	.53	99.47	.53
500.00	1.00	.89	1.82	97.65	2.35
250.00	2.00	11.58	23.66	73.99	26.01
125.00	3.00	34.19	69.85	4.15	95.85
62.50	4.00	.84	1.72	2.43	97.57

TEXTURAL CLASSIFICATION AND PHI PERCENTILES

SAMPLE E-1

SIZE CLASSIFICATION USED: STANDARD GEOLOGICAL SOILS CLASSIFICATION

GRAVEL/SAND CUTOFF 2000.00 MICRONS
SAND/SILT CUTOFF 62.50 MICRONS
SILT/CLAY CUTOFF 4.00 MICRONS

PERCENT GRAVEL .00
PERCENT SAND 97.57

PERCENT SILT AND CLAY 2.43

TEXTURAL DESCRIPTIONS

FOLK'S: SAND
SHEPARD'S: SAND
TREFETHEN'S: SAND
U.S. ARMY CORPS OF ENGINEERS: SAND
U.S. BUREAU OF SOILS: SAND

PHI PERCENTILES

PHI(05) 1.11 PHI 462.64 MICRONS
PHI(16) 1.58 PHI 335.17 MICRONS
PHI(25) 1.96 PHI 257.48 MICRONS
PHI(50) 2.34 PHI 197.03 MICRONS
PHI(75) 2.70 PHI 153.74 MICRONS
PHI(84) 2.83 PHI 140.60 MICRONS
PHI(95) 2.99 PHI 126.06 MICRONS

EXTRAPOLATION OF DATA TO CUMULATIVE 99.5% RETAINED.

INSUFFICIENT DATA TO PERFORM EXTRAPOLATION

INTERPOLATED PHI PERCENTILES

SAMPLE E-1

PHI	MICRONS	MM	PCT. RET	PCT. FINER
.00	1000.00	.1000E+01	.53	99.47
.25	840.90	.8409E+00	.99	99.01
.50	707.11	.7071E+00	1.44	98.56
.75	594.60	.5946E+00	1.89	98.11
1.00	500.00	.5000E+00	2.35	97.65
1.25	420.45	.4204E+00	8.26	91.74
1.50	353.55	.3536E+00	14.18	85.82
1.75	297.30	.2973E+00	20.09	79.91
2.00	250.00	.2500E+00	26.01	73.99
2.25	210.22	.2102E+00	43.47	56.53

2.50	176.78	.1768E+00	60.93	39.07
2.75	148.65	.1487E+00	78.39	21.61
3.00	125.00	.1250E+00	95.85	4.15
3.25	105.11	.1051E+00	96.28	3.72
3.50	88.39	.8839E-01	96.71	3.29
3.75	74.33	.7433E-01	97.14	2.86
4.00	62.50	.6250E-01	97.57	2.43

=====

STATISTICS AND ENGINEERING PARAMETERS

=====

SAMPLE E-1

INMAN'S STATISTICS:

MEDIAN	2.344	PHI	197.029	MICRONS
MEAN	2.204	PHI	217.085	MICRONS
STANDARD DEVIATION	.627	MODERATELY WELL SORTED		
SKEWNESS	-.223	COARSE-SKEWED		
KURTOSIS	.497	VERY PLATYKURTIC		

=====

FOLK'S STATISTICS:

MEAN	2.250	PHI	210.183	MICRONS
STANDARD DEVIATION	.598	MODERATELY WELL SORTED		
SKEWNESS	-.268	COARSE-SKEWED		
KURTOSIS	1.033	MESOKURTIC		

=====

MOMENT MEASURES:

INSUFFICIENT DATA FOR MOMENT MEASURES

=====

ENGINEERING PARAMETERS:

D60	2.200	PHI	217.585	MICRONS
D30	2.630	PHI	161.559	MICRONS
D10	2.916	PHI	132.475	MICRONS
COEF. OF UNIFORMITY	1.642			
COEF. OF CURVATURE	.906			

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TIERRA CONSULTING

SEDPET III: SEDIMENTARY PETROLOGY ANALYSIS PROGRAM

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ANALYSIS OF SAMPLE: E-2

PAN=.05=.1%

BVA- DIAL CORDY 2-26-07

SIEVE ANALYSIS

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SAMPLE WEIGHT = 49.98

SIEVE SIZE (MICRONS)	SIEVE SIZE (PHI)	SIEVE WT (GRAMS)	WEIGHT PERCENT RETAINED	CUMULATIVE PERCENT THROUGH	CUMULATIVE PERCENT RETAINED
1000.00	.00	.16	.32	99.68	.32
500.00	1.00	2.15	4.30	95.38	4.62
250.00	2.00	13.90	27.81	67.57	32.43
125.00	3.00	32.44	64.91	2.66	97.34
62.50	4.00	1.24	2.48	.18	99.82

=====

TEXTURAL CLASSIFICATION AND PHI PERCENTILES SAMPLE E-2

=====

SIZE CLASSIFICATION USED: STANDARD GEOLOGICAL SOILS CLASSIFICATION

GRAVEL/SAND CUTOFF 2000.00 MICRONS
SAND/SILT CUTOFF 62.50 MICRONS
SILT/CLAY CUTOFF 4.00 MICRONS

PERCENT GRAVEL .00
PERCENT SAND 99.82
PERCENT SILT AND CLAY .18

=====

TEXTURAL DESCRIPTIONS

FOLK'S: SAND
SHEPARD'S: SAND
TREFETHEN'S: SAND
U.S. ARMY CORPS OF ENGINEERS: SAND
U.S. BUREAU OF SOILS: SAND

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PHI PERCENTILES

PHI(05)	1.01 PHI	495.31 MICRONS
PHI(16)	1.41 PHI	376.54 MICRONS
PHI(25)	1.73 PHI	300.88 MICRONS
PHI(50)	2.27 PHI	207.24 MICRONS
PHI(75)	2.66 PHI	158.68 MICRONS
PHI(84)	2.79 PHI	144.14 MICRONS
PHI(95)	2.96 PHI	128.16 MICRONS

=====

EXTRAPOLATION OF DATA TO CUMULATIVE 99.5% RETAINED.

***OVER 99.5% SAMPLE ACCOUNTED FOR BY INPUT DATA - NO EXTRAPOLATION REQUIRED.

INTERPOLATED PHI PERCENTILES	SAMPLE E-2
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PHI	MICRONS	MM	PCT. RET	PCT. FINER
.00	1000.00	.1000E+01	.32	99.68
.25	840.90	.8409E+00	1.40	98.60
.50	707.11	.7071E+00	2.47	97.53
.75	594.60	.5946E+00	3.55	96.45
1.00	500.00	.5000E+00	4.62	95.38
1.25	420.45	.4204E+00	11.57	88.43
1.50	353.55	.3536E+00	18.53	81.47
1.75	297.30	.2973E+00	25.48	74.52
2.00	250.00	.2500E+00	32.43	67.57
2.25	210.22	.2102E+00	48.66	51.34
2.50	176.78	.1768E+00	64.89	35.11
2.75	148.65	.1487E+00	81.11	18.89
3.00	125.00	.1250E+00	97.34	2.66
3.25	105.11	.1051E+00	97.96	2.04
3.50	88.39	.8839E-01	98.58	1.42
3.75	74.33	.7433E-01	99.20	.80
4.00	62.50	.6250E-01	99.82	.18

STATISTICS AND ENGINEERING PARAMETERS	SAMPLE E-2
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INMAN'S STATISTICS:

MEDIAN	2.271 PHI	207.236 MICRONS
MEAN	2.102 PHI	232.967 MICRONS
STANDARD DEVIATION	.693	MODERATELY WELL SORTED
SKEWNESS	-.244	COARSE-SKEWED
KURTOSIS	.408	VERY PLATYKURTIC

FOLK'S STATISTICS:

MEAN	2.158 PHI	224.053 MICRONS
STANDARD DEVIATION	.642	MODERATELY WELL SORTED
SKEWNESS	-.266	COARSE-SKEWED
KURTOSIS	.866	PLATYKURTIC

MOMENT MEASURES:

MEAN	2.147 PHI	225.851 MICRONS
SECOND MOMENT	.382	
STANDARD DEVIATION	.618	MODERATELY WELL SORTED
THIRD MOMENT	-.236	
SKEWNESS	-1.002	STRONGLY COARSE-SKEWED
FOURTH MOMENT	.615	
KURTOSIS	1.407	LEPTOKURTIC

ENGINEERING PARAMETERS:

D60	2.117 PHI	230.592 MICRONS
D30	2.579 PHI	167.381 MICRONS
D10	2.887 PHI	135.191 MICRONS
COEF. OF UNIFORMITY	1.706	
COEF. OF CURVATURE	.899	

=====

TIERRA CONSULTING

SEDPET III: SEDIMENTARY PETROLOGY ANALYSIS PROGRAM

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ANALYSIS OF SAMPLE: E-3

PAN=.02=.04%

BVA-DIAL CORDY 2-26-07

SIEVE ANALYSIS

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SAMPLE WEIGHT = 43.54

SIEVE SIZE (MICRONS)	SIEVE SIZE (PHI)	SIEVE WT (GRAMS)	WEIGHT PERCENT RETAINED	CUMULATIVE PERCENT THROUGH	CUMULATIVE PERCENT RETAINED
1000.00	.00	.01	.02	99.98	.02
500.00	1.00	2.86	6.57	93.41	6.59
250.00	2.00	27.82	63.90	29.51	70.49
125.00	3.00	12.44	28.57	.94	99.06
62.50	4.00	.39	.90	.05	99.95

=====

TEXTURAL CLASSIFICATION AND PHI PERCENTILES SAMPLE E-3

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SIZE CLASSIFICATION USED: STANDARD GEOLOGICAL SOILS CLASSIFICATION

GRAVEL/SAND CUTOFF	2000.00 MICRONS
SAND/SILT CUTOFF	62.50 MICRONS
SILT/CLAY CUTOFF	4.00 MICRONS

PERCENT GRAVEL	.00
PERCENT SAND	99.95

PERCENT SILT AND CLAY .05

=====

TEXTURAL DESCRIPTIONS

FOLK'S: SAND
SHEPARD'S: SAND
TREFETHEN'S: SAND
U.S. ARMY CORPS OF ENGINEERS: SAND
U.S. BUREAU OF SOILS: SAND

PHI PERCENTILES

PHI(05)	.76	PHI	591.44	MICRONS
PHI(16)	1.15	PHI	451.49	MICRONS
PHI(25)	1.29	PHI	409.49	MICRONS
PHI(50)	1.68	PHI	312.22	MICRONS
PHI(75)	2.16	PHI	224.07	MICRONS
PHI(84)	2.47	PHI	180.12	MICRONS
PHI(95)	2.86	PHI	137.93	MICRONS

EXTRAPOLATION OF DATA TO CUMULATIVE 99.5% RETAINED.

***OVER 99.5% SAMPLE ACCOUNTED FOR BY INPUT DATA - NO EXTRAPOLATION REQUIRED.

INTERPOLATED PHI PERCENTILES

SAMPLE E-3

PHI	MICRONS	MM	PCT. RET	PCT. FINER
.00	1000.00	.1000E+01	.02	99.98
.25	840.90	.8409E+00	1.67	98.33
.50	707.11	.7071E+00	3.31	96.69
.75	594.60	.5946E+00	4.95	95.05
1.00	500.00	.5000E+00	6.59	93.41
1.25	420.45	.4204E+00	22.57	77.43
1.50	353.55	.3536E+00	38.54	61.46
1.75	297.30	.2973E+00	54.51	45.49
2.00	250.00	.2500E+00	70.49	29.51
2.25	210.22	.2102E+00	77.63	22.37
2.50	176.78	.1768E+00	84.77	15.23
2.75	148.65	.1487E+00	91.92	8.08
3.00	125.00	.1250E+00	99.06	.94
3.25	105.11	.1051E+00	99.28	.72
3.50	88.39	.8839E-01	99.51	.49
3.75	74.33	.7433E-01	99.73	.27
4.00	62.50	.6250E-01	99.95	.05

STATISTICS AND ENGINEERING PARAMETERS

SAMPLE E-3

INMAN'S STATISTICS:

MEDIAN	1.679	PHI	312.220	MICRONS
MEAN	1.810	PHI	285.171	MICRONS
STANDARD DEVIATION	.663	MODERATELY WELL SORTED		
SKEWNESS	.197	FINE-SKEWED		
KURTOSIS	.584	VERY PLATYKURTIC		

FOLK'S STATISTICS:

MEAN 1.767 PHI 293.916 MICRONS
 STANDARD DEVIATION .650 MODERATELY WELL SORTED
 SKEWNESS .160 FINE-SKEWED
 KURTOSIS .990 MESOKURTIC

MOMENT MEASURES:

MEAN 1.737 PHI 300.036 MICRONS
 SECOND MOMENT .332
 STANDARD DEVIATION .576 MODERATELY WELL SORTED
 THIRD MOMENT .041
 SKEWNESS .214 FINE-SKEWED
 FOURTH MOMENT .345
 KURTOSIS 1.045 MESOKURTIC

ENGINEERING PARAMETERS:

D60 1.523 PHI 347.995 MICRONS
 D30 1.992 PHI 251.324 MICRONS
 D10 2.683 PHI 155.722 MICRONS
 COEF. OF UNIFORMITY 2.235
 COEF. OF CURVATURE 1.166

TIERRA CONSULTING
 SEDPET III: SEDIMENTARY PETROLOGY ANALYSIS PROGRAM

ANALYSIS OF SAMPLE: E-4

PAN=.02=.04%
 BVA DIAL CORDY 2-26-07

SIEVE ANALYSIS

SAMPLE WEIGHT = 48.72

SIEVE SIZE (MICRONS)	SIEVE SIZE (PHI)	SIEVE WT (GRAMS)	WEIGHT PERCENT RETAINED	CUMULATIVE PERCENT THROUGH	CUMULATIVE PERCENT RETAINED
1000.00	.00	.06	.12	99.88	.12
500.00	1.00	2.71	5.56	94.31	5.69
250.00	2.00	27.05	55.52	38.79	61.21
125.00	3.00	18.26	37.48	1.31	98.69
62.50	4.00	.55	1.13	.18	99.82

TEXTURAL CLASSIFICATION AND PHI PERCENTILES

SAMPLE E-4

SIZE CLASSIFICATION USED: STANDARD GEOLOGICAL SOILS CLASSIFICATION

GRAVEL/SAND CUTOFF 2000.00 MICRONS
SAND/SILT CUTOFF 62.50 MICRONS
SILT/CLAY CUTOFF 4.00 MICRONS

PERCENT GRAVEL .00
PERCENT SAND 99.82
PERCENT SILT AND CLAY .18

TEXTURAL DESCRIPTIONS

FOLK'S: SAND
SHEPARD'S: SAND
TREFETHEN'S: SAND
U.S. ARMY CORPS OF ENGINEERS: SAND
U.S. BUREAU OF SOILS: SAND

PHI PERCENTILES

PHI(05) .88 PHI 544.59 MICRONS
PHI(16) 1.19 PHI 439.59 MICRONS
PHI(25) 1.35 PHI 392.87 MICRONS
PHI(50) 1.80 PHI 287.54 MICRONS
PHI(75) 2.37 PHI 193.71 MICRONS
PHI(84) 2.61 PHI 164.01 MICRONS
PHI(95) 2.90 PHI 133.82 MICRONS

EXTRAPOLATION OF DATA TO CUMULATIVE 99.5% RETAINED.

***OVER 99.5% SAMPLE ACCOUNTED FOR BY INPUT DATA - NO EXTRAPOLATION REQUIRED.

INTERPOLATED PHI PERCENTILES

SAMPLE E-4

PHI	MICRONS	MM	PCT. RET	PCT. FINER
.00	1000.00	.1000E+01	.12	99.88
.25	840.90	.8409E+00	1.51	98.49
.50	707.11	.7071E+00	2.90	97.10
.75	594.60	.5946E+00	4.29	95.71
1.00	500.00	.5000E+00	5.69	94.31
1.25	420.45	.4204E+00	19.57	80.43
1.50	353.55	.3536E+00	33.45	66.55
1.75	297.30	.2973E+00	47.33	52.67
2.00	250.00	.2500E+00	61.21	38.79
2.25	210.22	.2102E+00	70.58	29.42
2.50	176.78	.1768E+00	79.95	20.05
2.75	148.65	.1487E+00	89.32	10.68
3.00	125.00	.1250E+00	98.69	1.31

3.25	105.11	.1051E+00	98.97	1.03
3.50	88.39	.8839E-01	99.25	.75
3.75	74.33	.7433E-01	99.53	.47
4.00	62.50	.6250E-01	99.82	.18

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STATISTICS AND ENGINEERING PARAMETERS

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SAMPLE E-4

INMAN'S STATISTICS:

MEDIAN	1.798 PHI	287.543 MICRONS
MEAN	1.897 PHI	268.508 MICRONS
STANDARD DEVIATION	.711	MODERATELY SORTED
SKEWNESS	.139	FINE-SKEWED
KURTOSIS	.424	VERY PLATYKURTIC

=====

FOLK'S STATISTICS:

MEAN	1.864 PHI	274.709 MICRONS
STANDARD DEVIATION	.662	MODERATELY WELL SORTED
SKEWNESS	.114	FINE-SKEWED
KURTOSIS	.813	PLATYKURTIC

=====

MOMENT MEASURES:

MEAN	1.837 PHI	279.997 MICRONS
SECOND MOMENT	.365	
STANDARD DEVIATION	.604	MODERATELY WELL SORTED
THIRD MOMENT	-.008	
SKEWNESS	-.037	NEAR-SYMMETRICAL
FOURTH MOMENT	.380	
KURTOSIS	.951	MESOKURTIC

=====

ENGINEERING PARAMETERS:

D60	1.618 PHI	325.778 MICRONS
D30	2.235 PHI	212.479 MICRONS
D10	2.768 PHI	146.784 MICRONS
COEF. OF UNIFORMITY	2.219	
COEF. OF CURVATURE	.944	

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TIERRA CONSULTING

SEDPET III: SEDIMENTARY PETROLOGY ANALYSIS PROGRAM

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ANALYSIS OF SAMPLE: F-1

PAN=0.10=.2%

BVA DIAL CORDY 2-26-07

SIEVE ANALYSIS

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SAMPLE WEIGHT = 44.93

SIEVE SIZE (MICRONS)	SIEVE SIZE (PHI)	SIEVE WT (GRAMS)	WEIGHT PERCENT RETAINED	CUMULATIVE PERCENT THROUGH	CUMULATIVE PERCENT RETAINED
1000.00	.00	.13	.29	99.71	.29
500.00	1.00	2.16	4.81	94.90	5.10
250.00	2.00	14.22	31.65	63.25	36.75
125.00	3.00	27.48	61.16	2.09	97.91
62.50	4.00	.79	1.76	.33	99.67

=====

TEXTURAL CLASSIFICATION AND PHI PERCENTILES SAMPLE F-1

=====

SIZE CLASSIFICATION USED: STANDARD GEOLOGICAL SOILS CLASSIFICATION

GRAVEL/SAND CUTOFF 2000.00 MICRONS
 SAND/SILT CUTOFF 62.50 MICRONS
 SILT/CLAY CUTOFF 4.00 MICRONS

PERCENT GRAVEL .00
 PERCENT SAND 99.67

PERCENT SILT AND CLAY .33

=====

TEXTURAL DESCRIPTIONS

FOLK'S: SAND
 SHEPARD'S: SAND
 TREFETHEN'S: SAND
 U.S. ARMY CORPS OF ENGINEERS: SAND
 U.S. BUREAU OF SOILS: SAND

=====

PHI PERCENTILES

PHI(05)	.98	PHI	507.03	MICRONS
PHI(16)	1.34	PHI	393.79	MICRONS
PHI(25)	1.63	PHI	323.34	MICRONS
PHI(50)	2.22	PHI	215.13	MICRONS
PHI(75)	2.63	PHI	162.05	MICRONS
PHI(84)	2.77	PHI	146.34	MICRONS
PHI(95)	2.95	PHI	129.19	MICRONS

=====

EXTRAPOLATION OF DATA TO CUMULATIVE 99.5% RETAINED.

***OVER 99.5% SAMPLE ACCOUNTED FOR BY INPUT DATA - NO EXTRAPOLATION REQUIRED.

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INTERPOLATED PHI PERCENTILES	SAMPLE F-1
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PHI	MICRONS	MM	PCT. RET	PCT. FINER
.00	1000.00	.1000E+01	.29	99.71
.25	840.90	.8409E+00	1.49	98.51
.50	707.11	.7071E+00	2.69	97.31
.75	594.60	.5946E+00	3.89	96.11
1.00	500.00	.5000E+00	5.10	94.90
1.25	420.45	.4204E+00	13.01	86.99
1.50	353.55	.3536E+00	20.92	79.08
1.75	297.30	.2973E+00	28.83	71.17
2.00	250.00	.2500E+00	36.75	63.25
2.25	210.22	.2102E+00	52.04	47.96
2.50	176.78	.1768E+00	67.33	32.67
2.75	148.65	.1487E+00	82.62	17.38
3.00	125.00	.1250E+00	97.91	2.09
3.25	105.11	.1051E+00	98.35	1.65
3.50	88.39	.8839E-01	98.79	1.21
3.75	74.33	.7433E-01	99.23	.77
4.00	62.50	.6250E-01	99.67	.33

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STATISTICS AND ENGINEERING PARAMETERS	SAMPLE F-1
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INMAN'S STATISTICS:

MEDIAN	2.217 PHI	215.132 MICRONS
MEAN	2.059 PHI	240.057 MICRONS
STANDARD DEVIATION	.714	MODERATELY SORTED
SKEWNESS	-.221	COARSE-SKEWED
KURTOSIS	.381	VERY PLATYKURTIC

FOLK'S STATISTICS:

MEAN	2.111 PHI	231.443 MICRONS
STANDARD DEVIATION	.656	MODERATELY WELL SORTED
SKEWNESS	-.238	COARSE-SKEWED
KURTOSIS	.811	PLATYKURTIC

MOMENT MEASURES:

MEAN	2.088 PHI	235.220 MICRONS
SECOND MOMENT	.389	
STANDARD DEVIATION	.624	MODERATELY WELL SORTED
THIRD MOMENT	-.215	
SKEWNESS	-.885	STRONGLY COARSE-SKEWED
FOURTH MOMENT	.561	
KURTOSIS	1.236	LEPTOKURTIC

=====

ENGINEERING PARAMETERS:

D60	2.053 PHI	240.949 MICRONS
D30	2.544 PHI	171.502 MICRONS
D10	2.871 PHI	136.720 MICRONS
COEF. OF UNIFORMITY	1.762	
COEF. OF CURVATURE	.893	

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TIERRA CONSULTING
SEDPET III: SEDIMENTARY PETROLOGY ANALYSIS PROGRAM

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ANALYSIS OF SAMPLE: F-2

PAN=.05=.11%
BVA DIAL CORDY 2-26-07

SIEVE ANALYSIS

SAMPLE WEIGHT = 44.73

SIEVE SIZE (MICRONS)	SIEVE SIZE (PHI)	SIEVE WT (GRAMS)	WEIGHT PERCENT RETAINED	CUMULATIVE PERCENT THROUGH	CUMULATIVE PERCENT RETAINED
1000.00	.00	9.78	21.86	78.14	21.86
500.00	1.00	19.82	44.31	33.83	66.17
250.00	2.00	9.72	21.73	12.09	87.91
125.00	3.00	5.13	11.47	.63	99.37
62.50	4.00	.18	.40	.22	99.78

=====

TEXTURAL CLASSIFICATION AND PHI PERCENTILES SAMPLE F-2

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SIZE CLASSIFICATION USED: STANDARD GEOLOGICAL SOILS CLASSIFICATION

GRAVEL/SAND CUTOFF	2000.00 MICRONS
SAND/SILT CUTOFF	62.50 MICRONS
SILT/CLAY CUTOFF	4.00 MICRONS

PERCENT GRAVEL	.00
PERCENT SAND	99.78
PERCENT SILT AND CLAY	.22

=====

TEXTURAL DESCRIPTIONS

FOLK'S: SAND
SHEPARD'S: SAND
TREFETHEN'S: SAND
U.S. ARMY CORPS OF ENGINEERS: SAND
U.S. BUREAU OF SOILS: SAND

PHI PERCENTILES

PHI(25)	.07	PHI	952.14	MICRONS
PHI(50)	.63	PHI	643.96	MICRONS
PHI(75)	1.41	PHI	377.32	MICRONS
PHI(84)	1.82	PHI	283.16	MICRONS
PHI(95)	2.62	PHI	162.82	MICRONS

EXTRAPOLATION OF DATA TO CUMULATIVE 99.5% RETAINED.

***OVER 99.5% SAMPLE ACCOUNTED FOR BY INPUT DATA - NO EXTRAPOLATION REQUIRED.

INTERPOLATED PHI PERCENTILES

SAMPLE F-2

PHI	MICRONS	MM	PCT. RET	PCT. FINER
.00	1000.00	.1000E+01	21.86	78.14
.25	840.90	.8409E+00	32.94	67.06
.50	707.11	.7071E+00	44.02	55.98
.75	594.60	.5946E+00	55.10	44.90
1.00	500.00	.5000E+00	66.17	33.83
1.25	420.45	.4204E+00	71.61	28.39
1.50	353.55	.3536E+00	77.04	22.96
1.75	297.30	.2973E+00	82.47	17.53
2.00	250.00	.2500E+00	87.91	12.09
2.25	210.22	.2102E+00	90.77	9.23
2.50	176.78	.1768E+00	93.64	6.36
2.75	148.65	.1487E+00	96.51	3.49
3.00	125.00	.1250E+00	99.37	.63
3.25	105.11	.1051E+00	99.47	.53
3.50	88.39	.8839E-01	99.58	.42
3.75	74.33	.7433E-01	99.68	.32
4.00	62.50	.6250E-01	99.78	.22

STATISTICS AND ENGINEERING PARAMETERS

SAMPLE F-2

INMAN'S STATISTICS:

MEDIAN	.635	PHI	643.957	MICRONS
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FOLK'S STATISTICS:

INSUFFICIENT DATA FOR FOLK'S STATISTICS

MOMENT MEASURES:

WARNING ACCURACY OF MOMENT MEASURES MAY BE
ADVERSELY AFFECTED BY THE LARGE AMOUNT OF
MATERIAL RETAINED IN THE FIRST SIEVE **

MEAN	.739	PHI	599.159	MICRONS
SECOND MOMENT	.873			
STANDARD DEVIATION	.934	MODERATELY SORTED		
THIRD MOMENT	.385			
SKEWNESS	.472	STRONGLY FINE-SKEWED		
FOURTH MOMENT	1.926			
KURTOSIS	.842	PLATYKURTIC		

ENGINEERING PARAMETERS:

D60	.409	PHI	752.997	MICRONS
D30	1.176	PHI	442.568	MICRONS
D10	2.183	PHI	220.271	MICRONS
COEF. OF UNIFORMITY	3.419			
COEF. OF CURVATURE	1.181			

TIERRA CONSULTING
SEDPET III: SEDIMENTARY PETROLOGY ANALYSIS PROGRAM

ANALYSIS OF SAMPLE: F-3

PAN=0.04=.08%

SIEVE ANALYSIS

SAMPLE WEIGHT = 46.34

SIEVE SIZE (MICRONS)	SIEVE SIZE (PHI)	SIEVE WT (GRAMS)	WEIGHT PERCENT RETAINED	CUMULATIVE PERCENT THROUGH	CUMULATIVE PERCENT RETAINED
1000.00	.00	.19	.41	99.59	.41
500.00	1.00	1.43	3.09	96.50	3.50
250.00	2.00	8.47	18.28	78.23	21.77
125.00	3.00	34.92	75.36	2.87	97.13
62.50	4.00	1.26	2.72	.15	99.85

TEXTURAL CLASSIFICATION AND PHI PERCENTILES

SAMPLE F-3

SIZE CLASSIFICATION USED: STANDARD GEOLOGICAL SOILS CLASSIFICATION

GRAVEL/SAND CUTOFF 2000.00 MICRONS
SAND/SILT CUTOFF 62.50 MICRONS
SILT/CLAY CUTOFF 4.00 MICRONS

PERCENT GRAVEL .00
PERCENT SAND 99.85

PERCENT SILT AND CLAY .15

TEXTURAL DESCRIPTIONS

FOLK'S: SAND
SHEPARD'S: SAND
TREFETHEN'S: SAND
U.S. ARMY CORPS OF ENGINEERS: SAND
U.S. BUREAU OF SOILS: SAND

PHI PERCENTILES

PHI(05) 1.08 PHI 472.28 MICRONS
PHI(16) 1.68 PHI 311.20 MICRONS
PHI(25) 2.04 PHI 242.69 MICRONS
PHI(50) 2.37 PHI 192.83 MICRONS
PHI(75) 2.71 PHI 153.22 MICRONS
PHI(84) 2.83 PHI 141.05 MICRONS
PHI(95) 2.97 PHI 127.47 MICRONS

EXTRAPOLATION OF DATA TO CUMULATIVE 99.5% RETAINED.

***OVER 99.5% SAMPLE ACCOUNTED FOR BY INPUT DATA - NO EXTRAPOLATION REQUIRED.

INTERPOLATED PHI PERCENTILES

SAMPLE F-3

PHI	MICRONS	MM	PCT. RET	PCT. FINER
.00	1000.00	.1000E+01	.41	99.59
.25	840.90	.8409E+00	1.18	98.82
.50	707.11	.7071E+00	1.95	98.05
.75	594.60	.5946E+00	2.72	97.28
1.00	500.00	.5000E+00	3.50	96.50
1.25	420.45	.4204E+00	8.07	91.93
1.50	353.55	.3536E+00	12.63	87.37

1.75	297.30	.2973E+00	17.20	82.80
2.00	250.00	.2500E+00	21.77	78.23
2.25	210.22	.2102E+00	40.61	59.39
2.50	176.78	.1768E+00	59.45	40.55
2.75	148.65	.1487E+00	78.29	21.71
3.00	125.00	.1250E+00	97.13	2.87
3.25	105.11	.1051E+00	97.81	2.19
3.50	88.39	.8839E-01	98.49	1.51
3.75	74.33	.7433E-01	99.17	.83
4.00	62.50	.6250E-01	99.85	.15

=====

STATISTICS AND ENGINEERING PARAMETERS

=====

SAMPLE F-3

INMAN'S STATISTICS:

MEDIAN	2.375	PHI	192.834	MICRONS
MEAN	2.255	PHI	209.506	MICRONS
STANDARD DEVIATION	.571	MODERATELY WELL SORTED		
SKEWNESS	-.210	COARSE-SKEWED		
KURTOSIS	.655	VERY PLATYKURTIC		

=====

FOLK'S STATISTICS:

MEAN	2.295	PHI	203.794	MICRONS
STANDARD DEVIATION	.572	MODERATELY WELL SORTED		
SKEWNESS	-.289	COARSE-SKEWED		
KURTOSIS	1.167	LEPTOKURTIC		

=====

MOMENT MEASURES:

MEAN	2.267	PHI	207.817	MICRONS
SECOND MOMENT	.318			
STANDARD DEVIATION	.563	MODERATELY WELL SORTED		
THIRD MOMENT	-.279			
SKEWNESS	-1.558	STRONGLY COARSE-SKEWED		
FOURTH MOMENT	.669			
KURTOSIS	2.212	VERY LEPTOKURTIC		

=====

ENGINEERING PARAMETERS:

D60	2.242	PHI	211.413	MICRONS
D30	2.640	PHI	160.431	MICRONS
D10	2.905	PHI	133.473	MICRONS
COEF. OF UNIFORMITY	1.584			
COEF. OF CURVATURE	.912			

=====

TIERRA CONSULTING

SEDPET III: SEDIMENTARY PETROLOGY ANALYSIS PROGRAM

=====

ANALYSIS OF SAMPLE: F-4

PAN=.03=.06%

BVA-DIAL CORDY 2-26-07

SIEVE ANALYSIS

=====

SAMPLE WEIGHT = 44.28

SIEVE SIZE (MICRONS)	SIEVE SIZE (PHI)	SIEVE WT (GRAMS)	WEIGHT PERCENT RETAINED	CUMULATIVE PERCENT THROUGH	CUMULATIVE PERCENT RETAINED
1000.00	.00	.13	.29	99.71	.29
500.00	1.00	1.41	3.18	96.52	3.48
250.00	2.00	9.70	21.91	74.62	25.38
125.00	3.00	32.14	72.58	2.03	97.97
62.50	4.00	.86	1.94	.09	99.91

=====

TEXTURAL CLASSIFICATION AND PHI PERCENTILES SAMPLE F-4

=====

SIZE CLASSIFICATION USED: STANDARD GEOLOGICAL SOILS CLASSIFICATION

GRAVEL/SAND CUTOFF 2000.00 MICRONS
 SAND/SILT CUTOFF 62.50 MICRONS
 SILT/CLAY CUTOFF 4.00 MICRONS

PERCENT GRAVEL .00
 PERCENT SAND 99.91

PERCENT SILT AND CLAY .09

=====

TEXTURAL DESCRIPTIONS

FOLK'S: SAND
 SHEPARD'S: SAND
 TREFETHEN'S: SAND
 U.S. ARMY CORPS OF ENGINEERS: SAND
 U.S. BUREAU OF SOILS: SAND

=====

PHI PERCENTILES

PHI(05)	1.07 PHI	476.49 MICRONS
PHI(16)	1.57 PHI	336.43 MICRONS
PHI(25)	1.98 PHI	253.06 MICRONS
PHI(50)	2.34 PHI	197.63 MICRONS
PHI(75)	2.68 PHI	155.66 MICRONS

PHI(84)	2.81 PHI	142.84 MICRONS
PHI(95)	2.96 PHI	128.59 MICRONS

=====

EXTRAPOLATION OF DATA TO CUMULATIVE 99.5% RETAINED.

***OVER 99.5% SAMPLE ACCOUNTED FOR BY INPUT DATA - NO EXTRAPOLATION REQUIRED.

=====

INTERPOLATED PHI PERCENTILES

SAMPLE F-4

PHI	MICRONS	MM	PCT. RET	PCT. FINER
.00	1000.00	.1000E+01	.29	99.71
.25	840.90	.8409E+00	1.09	98.91
.50	707.11	.7071E+00	1.89	98.11
.75	594.60	.5946E+00	2.68	97.32
1.00	500.00	.5000E+00	3.48	96.52
1.25	420.45	.4204E+00	8.95	91.05
1.50	353.55	.3536E+00	14.43	85.57
1.75	297.30	.2973E+00	19.91	80.09
2.00	250.00	.2500E+00	25.38	74.62
2.25	210.22	.2102E+00	43.53	56.47
2.50	176.78	.1768E+00	61.68	38.32
2.75	148.65	.1487E+00	79.82	20.18
3.00	125.00	.1250E+00	97.97	2.03
3.25	105.11	.1051E+00	98.45	1.55
3.50	88.39	.8839E-01	98.94	1.06
3.75	74.33	.7433E-01	99.42	.58
4.00	62.50	.6250E-01	99.91	.09

=====

STATISTICS AND ENGINEERING PARAMETERS

SAMPLE F-4

=====

INMAN'S STATISTICS:

MEDIAN	2.339 PHI	197.628 MICRONS
MEAN	2.190 PHI	219.213 MICRONS
STANDARD DEVIATION	.618	MODERATELY WELL SORTED
SKEWNESS	-.242	COARSE-SKEWED
KURTOSIS	.529	VERY PLATYKURTIC

=====

FOLK'S STATISTICS:

MEAN	2.239 PHI	211.768 MICRONS
STANDARD DEVIATION	.595	MODERATELY WELL SORTED
SKEWNESS	-.293	COARSE-SKEWED
KURTOSIS	1.105	MESOKURTIC

=====

MOMENT MEASURES:

MEAN	2.226 PHI	213.808 MICRONS
SECOND MOMENT	.318	
STANDARD DEVIATION	.564	MODERATELY WELL SORTED
THIRD MOMENT	-.252	
SKEWNESS	-1.402	STRONGLY COARSE-SKEWED
FOURTH MOMENT	.560	
KURTOSIS	1.846	VERY LEPTOKURTIC

=====

ENGINEERING PARAMETERS:

D60	2.201 PHI	217.431 MICRONS
D30	2.615 PHI	163.268 MICRONS
D10	2.890 PHI	134.882 MICRONS
COEF. OF UNIFORMITY	1.612	
COEF. OF CURVATURE	.909	

=====

APPENDIX C

Station Data Summary Report

Station Data Summary Report

Station A1

Client: Wilmington District, USACE
Project: Topsail Benthic Survey
Location: Topsail Beach
Sample Date: 28-29 Nov 06

Page 1

Station: A1
Sample Type: Macrofauna
Replicates: 1
Sample Area: 0.0400

TAXON	Rep 1		Station		
	Count	Density	Total	Percent	Mean Density
Annelida					
Polychaeta					
Oweniida					
Oweniidae					
Owenia fusiformis	1	25	1	14.3	25
Spionida					
Chaetopteridae					
Spiochaetopterus oculatus	1	25	1	14.3	25
Cirratulidae					
Cautleriella sp. J	1	25	1	14.3	25
Magelonidae					
Magelona (LPIL)	2	50	2	28.6	50
Terebellida					
Pectinariidae					
Pectinaria gouldii	1	25	1	14.3	25
Mollusca					
Bivalvia					
Bivalvia (LPIL)	1	25	1	14.3	25

Note: LPIL designates the LOWEST PRACTICAL IDENTIFICATION LEVEL

Station Data Summary Report

Station A1

Page 2

Client: Wilmington District, USACE

Project: Topsail Benthic Survey

Location: Topsail Beach

Sample Date: 28-29 Nov 06

Station: A1

Sample Type: Macrofauna

Replicates: 1

Sample Area: 0.0400

DATA SUMMARY

FAUNAL PARAMETERS	Station	Rep 1	Mean	Std Dev
Total Taxa	6	6	6	0
Total Individuals	7	7	7	0
Density (nos/sq.m.)		175	175	0

FAUNAL INDICES

Species Diversity (Shannon; log base e)	H' =	1.75
Species Diversity (Shannon; log base 2)	d =	2.52
Species Diversity (Shannon; log base 10)	H =	0.76
Species Diversity (Simpson; 1/S)	1/S =	21
Species Evenness (Pielou)	J' =	0.98
Species Richness (Margalef)	D =	2.57
Equitability Index (Lloyd & Ghelardi)	e =	1.33

MAJOR TAXONOMIC GROUPS	Total No. Taxa	Taxa % Total	Total No. Individuals	Individuals % Total
Annelida	5	83.3	6	85.7
Mollusca	1	16.6	1	14.2
TOTALS	6		7	

Station Data Summary Report

Station A2

Client: Wilmington District, USACE
Project: Topsail Benthic Survey
Location: Topsail Beach
Sample Date: 28-29 Nov 06

Page 2

Station: A2
Sample Type: Macrofauna
Replicates: 1
Sample Area: 0.0400

TAXON	Rep 1		Station		
	Count	Density	Total	Percent	Mean Density
Annelida					
Polychaeta					
Capitellida					
Capitellidae					
Capitellidae (LPIL)	1	25	1	5.9	25
Opheliida					
Opheliidae					
Armandia maculata	1	25	1	5.9	25
Phyllodocida					
Glyceridae					
Glyceridae (LPIL)	2	50	2	11.8	50
Nephtyidae					
Aglaophamus verrilli	1	25	1	5.9	25
Spionida					
Cirratulidae					
Caulleriella sp. J	2	50	2	11.8	50
Magelonidae					
Magelona (LPIL)	1	25	1	5.9	25
Mollusca					
Bivalvia					
Veneroida					
Lucinidae					
Lucinidae (LPIL)	2	50	2	11.8	50
Tellinidae					
Tellina (LPIL)	2	50	2	11.8	50
Tellina iris	1	25	1	5.9	25

Station Data Summary Report

Station A2

Client: Wilmington District, USACE
Project: Topsail Benthic Survey
Location: Topsail Beach
Sample Date: 28-29 Nov 06

Page 2

Station: A2
Sample Type: Macrofauna
Replicates: 1
Sample Area: 0.0400

TAXON	Rep 1		Station		
	Count	Density	Total	Percent	Mean Density
Gastropoda					
Cephalaspidea					
Scaphandridae					
Cylichna alba	4	100	4	23.5	100

Note: LPIL designates the LOWEST PRACTICAL IDENTIFICATION LEVEL

Station Data Summary Report

Station A2

Page 3

Client: Wilmington District, USACE

Project: Topsail Benthic Survey

Location: Topsail Beach

Sample Date: 28-29 Nov 06

Station: A2

Sample Type: Macrofauna

Replicates: 1

Sample Area: 0.0400

DATA SUMMARY

FAUNAL PARAMETERS	Station	Rep 1	Mean	Std Dev
Total Taxa	10	10	10	0
Total Individuals	17	17	17	0
Density (nos/sq.m.)		425	425	0

FAUNAL INDICES

Species Diversity (Shannon; log base e)	H' =	2.18
Species Diversity (Shannon; log base 2)	d =	3.15
Species Diversity (Shannon; log base 10)	H =	0.95
Species Diversity (Simpson; 1/S)	1/S =	13.6
Species Evenness (Pielou)	J' =	0.95
Species Richness (Margalef)	D =	3.18
Equitability Index (Lloyd & Ghelardi)	e =	1.25

MAJOR TAXONOMIC GROUPS	Total No. Taxa	Taxa % Total	Total No. Individuals	Individuals % Total
Annelida	6	60	8	47
Mollusca	4	40	9	52.9
TOTALS	10		17	

Station Data Summary Report

Station A3

Client: Wilmington District, USACE
Project: Topsail Benthic Survey
Location: Topsail Beach
Sample Date: 28-29 Nov 06

Page 1

Station: A3
Sample Type: Macrofauna
Replicates: 1
Sample Area: 0.0400

TAXON	Rep 1		Station		
	Count	Density	Total	Percent	Mean Density
Annelida					
Polychaeta					
Spionida					
Magelonidae					
Magelona papillicornis	2	50	2	20	50
Spionidae					
Paraprionospio pinnata	1	25	1	10	25
Spionidae (LPIL)	1	25	1	10	25
Arthropoda					
Ostracoda					
Myodocopina					
Sarsiellidae					
Eusarsiella (LPIL)	1	25	1	10	25
Cnidaria					
Hydrozoa					
Hydrozoa (LPIL)	1	25	1	10	25
Mollusca					
Gastropoda					
Cephalaspidea					
Scaphandridae					
Acteocina canaliculata	1	25	1	10	25
Cylichna alba	1	25	1	10	25

Station Data Summary Report

Client: Wilmington District, USACE
Project: Topsail Benthic Survey
Location: Topsail Beach
Sample Date: 28-29 Nov 06

Station A3

Page 1

Station: A3
Sample Type: Macrofauna
Replicates: 1
Sample Area: 0.0400

TAXON

	Rep 1		Station		
	Count	Density	Total	Percent	Mean Density
Phoronida					
Phoronidae					
Phoronis (LPIL)	1	25	1	10	25
Rhynchocoela					
Rhynchocoela (LPIL)	1	25	1	10	25

Note:

LPIL designates the LOWEST PRACTICAL IDENTIFICATION LEVEL

Station Data Summary Report

Station A3

Page 3

Client: Wilmington District, USACE
Project: Topsail Benthic Survey
Location: Topsail Beach
Sample Date: 28-29 Nov 06

Station: A3
Sample Type: Macrofauna
Replicates: 1
Sample Area: 0.0400

DATA SUMMARY

FAUNAL PARAMETERS	Station	Rep 1	Mean	Std Dev
Total Taxa	9	9	9	0
Total Individuals	10	10	10	0
Density (nos/sq.m.)		250	250	0

FAUNAL INDICES

Species Diversity (Shannon; log base e)	H' =	2.16
Species Diversity (Shannon; log base 2)	d =	3.12
Species Diversity (Shannon; log base 10)	H =	0.94
Species Diversity (Simpson; 1/S)	1/S =	45
Species Evenness (Pielou)	J' =	0.98
Species Richness (Margalef)	D =	3.47
Equitability Index (Lloyd & Ghelardi)	e =	1.37

MAJOR TAXONOMIC GROUPS	Total No. Taxa	Taxa % Total	Total No. Individuals	Individuals % Total
Cnidaria	1	11.1	1	10
Rhynchocoela	1	11.1	1	10
Annelida	3	33.3	4	40
Mollusca	2	22.2	2	20
Arthropoda	1	11.1	1	10
Phoronida	1	11.1	1	10
TOTALS	9		10	

Station Data Summary Report

Station A4

Client: Wilmington District, USACE

Project: Topsail Benthic Survey

Location: Topsail Beach

Sample Date: 28-29 Nov 06

Page 1

Station: A4

Sample Type: Macrofauna

Replicates: 1

Sample Area: 0.0400

TAXON	Rep 1		Station		
	Count	Density	Total	Percent	Mean Density
Annelida					
Polychaeta					
Capitellida					
Capitellidae					
Mediomastus californiensis	1	25	1	9.1	25
Eunicida					
Onuphidae					
Onuphidae (LPIL)	1	25	1	9.1	25
Phyllodocida					
Goniadidae					
Goniada littorea	1	25	1	9.1	25
Spionida					
Cirratulidae					
Caulleriella sp. J	1	25	1	9.1	25
Arthropoda					
Malacostraca					
Amphipoda					
Platyischnopidae					
Eudevenopus honduranus	1	25	1	9.1	25
Synopiidae					
Synopiidae (LPIL)	2	50	2	18.2	50
Mollusca					
Bivalvia					
Bivalvia (LPIL)	1	25	1	9.1	25

Station Data Summary Report

Station A4

Client: Wilmington District, USACE
Project: Topsail Benthic Survey
Location: Topsail Beach
Sample Date: 28-29 Nov 06

Page 1

Station: A4
Sample Type: Macrofauna
Replicates: 1
Sample Area: 0.0400

TAXON	Rep 1		Station		
	Count	Density	Total	Percent	Mean Density
Veneroida					
Mesodesmatidae					
Ervilia concentrica	1	25	1	9.1	25
Gastropoda					
Neogastropoda					
Olividae					
Oliva sayana	2	50	2	18.2	50

Note: LPIL designates the LOWEST PRACTICAL IDENTIFICATION LEVEL

Station Data Summary Report**Station A4**

Page 3

Client: Wilmington District, USACE

Project: Topsail Benthic Survey

Location: Topsail Beach

Sample Date: 28-29 Nov 06

Station: A4

Sample Type: Macrofauna

Replicates: 1

Sample Area: 0.0400

DATA SUMMARY

FAUNAL PARAMETERS	Station	Rep 1	Mean	Std Dev
Total Taxa	9	9	9	0
Total Individuals	11	11	11	0
Density (nos/sq.m.)		275	275	0

FAUNAL INDICES

Species Diversity (Shannon; log base e)	H' =	2.15
Species Diversity (Shannon; log base 2)	d =	3.1
Species Diversity (Shannon; log base 10)	H =	0.93
Species Diversity (Simpson; 1/S)	1/S =	27.5
Species Evenness (Pielou)	J' =	0.98
Species Richness (Margalef)	D =	3.34
Equitability Index (Lloyd & Ghelardi)	e =	1.34

MAJOR TAXONOMIC GROUPS	Total No. Taxa	Taxa % Total	Total No. Individuals	Individuals % Total
Annelida	4	44.4	4	36.3
Mollusca	3	33.3	4	36.3
Arthropoda	2	22.2	3	27.2
TOTALS	9		11	

Station Data Summary Report

Station A5

Client: Wilmington District, USACE
Project: Topsail Benthic Survey
Location: Topsail Beach
Sample Date: 28-29 Nov 06

Page 1

Station: A5
Sample Type: Macrofauna
Replicates: 1
Sample Area: 0.0400

TAXON	Rep 1		Station		
	Count	Density	Total	Percent	Mean Density
Annelida					
Polychaeta					
Orbiniida					
Paraonidae					
Aricidea catherinae	1	25	1	9.1	25
Phyllodocida					
Pilargiidae					
Sigambra tentaculata	1	25	1	9.1	25
Spionida					
Magelonidae					
Magelona papillicornis	3	75	3	27.3	75
Arthropoda					
Ostracoda					
Myodocopina					
Sarsiellidae					
Eusarsiella texana	1	25	1	9.1	25
Mollusca					
Bivalvia					
Veneroida					
Tellinidae					
Tellina (LPIL)	3	75	3	27.3	75
Gastropoda					
Neogastropoda					
Olividae					
Oliva sayana	1	25	1	9.1	25

Station Data Summary Report

Station A5

Client: Wilmington District, USACE
Project: Topsail Benthic Survey
Location: Topsail Beach
Sample Date: 28-29 Nov 06

Page 1

Station: A5
Sample Type: Macrofauna
Replicates: 1
Sample Area: 0.0400

TAXON	Rep 1		Station		
	Count	Density	Total	Percent	Mean Density
Pyramidelloida					
Pyramidellidae					
Odostomia weberi	1	25	1	9.1	25

Note: LPIL designates the LOWEST PRACTICAL IDENTIFICATION LEVEL

Station Data Summary Report

Station A5

Page 3

Client: Wilmington District, USACE

Project: Topsail Benthic Survey

Location: Topsail Beach

Sample Date: 28-29 Nov 06

Station: A5

Sample Type: Macrofauna

Replicates: 1

Sample Area: 0.0400

DATA SUMMARY

FAUNAL PARAMETERS	Station	Rep 1	Mean	Std Dev
Total Taxa	7	7	7	0
Total Individuals	11	11	11	0
Density (nos/sq.m.)		275	275	0

FAUNAL INDICES

Species Diversity (Shannon; log base e)	H' =	1.8
Species Diversity (Shannon; log base 2)	d =	2.59
Species Diversity (Shannon; log base 10)	H =	0.78
Species Diversity (Simpson; 1/S)	1/S =	9.17
Species Evenness (Pielou)	J' =	0.92
Species Richness (Margalef)	D =	2.5
Equitability Index (Lloyd & Ghelardi)	e =	1.2

MAJOR TAXONOMIC GROUPS	Total No. Taxa	Taxa % Total	Total No. Individuals	Individuals % Total
Annelida	3	42.8	5	45.4
Mollusca	3	42.8	5	45.4
Arthropoda	1	14.2	1	9
TOTALS	7		11	

Station Data Summary Report

Station B1

Client: Wilmington District, USACE

Project: Topsail Benthic Survey

Location: Topsail Beach

Sample Date: 28-29 Nov 06

Page 1

Station: B7

Sample Type: Macrofauna

Replicates: 1

Sample Area: 0.0400

TAXON	Rep 1		Station		
	Count	Density	Total	Percent	Mean Density
Annelida					
Polychaeta					
Capitellida					
Capitellidae					
Mediomastus (LPIL)	3	75	3	12	75
Eunicida					
Dorvilleidae					
Schistomeringos pectinata	1	25	1	4	25
Phyllodocida					
Chrysopetalidae					
Bhawania heteroseta	2	50	2	8	50
Goniadidae					
Goniadides carolinae	2	50	2	8	50
Spionida					
Cirratulidae					
Cirratulidae (LPIL)	1	25	1	4	25
Arthropoda					
Malacostraca					
Amphipoda					
Aoridae					
Rildardanus laminosa	1	25	1	4	25
Melitidae					
Maera caroliniana	2	50	2	8	50
Synopiidae					
Metatiron triocellatus	1	25	1	4	25

Station Data Summary Report

Station B1

Client: Wilmington District, USACE
Project: Topsail Benthic Survey
Location: Topsail Beach
Sample Date: 28-29 Nov 06

Page 1

Station: B7
Sample Type: Macrofauna
Replicates: 1
Sample Area: 0.0400

TAXON	Rep 1		Station		
	Count	Density	Total	Percent	Mean Density
Echinodermata					
Ophiuroidea					
Ophiuroidea (LPIL)	2	50	2	8	50
Ophiurida					
Amphiuridae					
Amphiuridae (LPIL)	1	25	1	4	25
Mollusca					
Bivalvia					
Veneroida					
Crassatellidae					
Crassinella lunulata	4	100	4	16	100
Gastropoda					
Mesogastropoda					
Caecidae					
Caecum pulchellum	1	25	1	4	25
Platyhelminthes					
Turbellaria					
Turbellaria (LPIL)	2	50	2	8	50
Rhynchocoela					
Rhynchocoela (LPIL)	2	50	2	8	50

Note: LPIL designates the LOWEST PRACTICAL IDENTIFICATION LEVEL

Station Data Summary Report

Station B1

Page 3

Client: Wilmington District, USACE

Project: Topsail Benthic Survey

Location: Topsail Beach

Sample Date: 28-29 Nov 06

Station: B7

Sample Type: Macrofauna

Replicates: 1

Sample Area: 0.0400

DATA SUMMARY

FAUNAL PARAMETERS	Station	Rep 1	Mean	Std Dev
Total Taxa	14	14	14	0
Total Individuals	25	25	25	0
Density (nos/sq.m.)		625	625	0

FAUNAL INDICES

Species Diversity (Shannon; log base e)	H' =	2.53
Species Diversity (Shannon; log base 2)	d =	3.65
Species Diversity (Shannon; log base 10)	H =	1.1
Species Diversity (Simpson; 1/S)	1/S =	20
Species Evenness (Pielou)	J' =	0.96
Species Richness (Margalef)	D =	4.04
Equitability Index (Lloyd & Ghelardi)	e =	1.29

MAJOR TAXONOMIC GROUPS

	Total No. Taxa	Taxa % Total	Total No. Individuals	Individuals % Total
Platyhelminthes	1	7.1	2	8
Rhynchocoela	1	7.1	2	8
Annelida	5	35.7	9	36
Mollusca	2	14.2	5	20
Arthropoda	3	21.4	4	16
Echinodermata	2	14.2	3	12
TOTALS	14		25	

Station Data Summary Report

Station B2

Client: Wilmington District, USACE
Project: Topsail Benthic Survey
Location: Topsail Beach
Sample Date: 28-29 Nov 06

Page 1

Station: B2
Sample Type: Macrofauna
Replicates: 1
Sample Area: 0.0400

TAXON	Rep 1		Station		
	Count	Density	Total	Percent	Mean Density
Annelida					
Polychaeta					
Capitellida					
Capitellidae					
Mediomastus (LPIL)	1	25	1	11.1	25
Spionida					
Cirratulidae					
Caulleriella sp. J	1	25	1	11.1	25
Arthropoda					
Malacostraca					
Amphipoda					
Synopiidae					
Metatiron (LPIL)	1	25	1	11.1	25
Echinodermata					
Ophiuroidea					
Ophiuroidea (LPIL)	1	25	1	11.1	25
Mollusca					
Bivalvia					
Veneroida					
Lucinidae					
Lucina multilineata	1	25	1	11.1	25
Tellinidae					
Tellina (LPIL)	1	25	1	11.1	25

Station Data Summary Report

Station B2

Client: Wilmington District, USACE
Project: Topsail Benthic Survey
Location: Topsail Beach
Sample Date: 28-29 Nov 06

Page 1

Station: B2
Sample Type: Macrofauna
Replicates: 1
Sample Area: 0.0400

TAXON	Rep 1		Station		
	Count	Density	Total	Percent	Mean Density
Platyhelminthes					
Turbellaria					
Turbellaria (LPIL)	1	25	1	11.1	25
Rhynchocoela					
Rhynchocoela (LPIL)	1	25	1	11.1	25
Sipuncula					
Aspidosiphonidae					
Aspidosiphon albus	1	25	1	11.1	25

Note: LPIL designates the LOWEST PRACTICAL IDENTIFICATION LEVEL

Station Data Summary Report

Station B2

Page 3

Client: Wilmington District, USACE
Project: Topsail Benthic Survey
Location: Topsail Beach
Sample Date: 28-29 Nov 06

Station: B2
Sample Type: Macrofauna
Replicates: 1
Sample Area: 0.0400

DATA SUMMARY

FAUNAL PARAMETERS	Station	Rep 1	Mean	Std Dev
Total Taxa	9	9	9	0
Total Individuals	9	9	9	0
Density (nos/sq.m.)		225	225	0

FAUNAL INDICES

Species Diversity (Shannon; log base e)	H' =	2.2
Species Diversity (Shannon; log base 2)	d =	3.17
Species Diversity (Shannon; log base 10)	H =	0.95
Species Diversity (Simpson; 1/S)	1/S =	
Species Evenness (Pielou)	J' =	1
Species Richness (Margalef)	D =	3.64
Equitability Index (Lloyd & Ghelardi)	e =	1.41

MAJOR TAXONOMIC GROUPS	Total No. Taxa	Taxa % Total	Total No. Individuals	Individuals % Total
Platyhelminthes	1	11.1	1	11.1
Rhynchocoela	1	11.1	1	11.1
Annelida	2	22.2	2	22.2
Mollusca	2	22.2	2	22.2
Sipuncula	1	11.1	1	11.1
Arthropoda	1	11.1	1	11.1
Echinodermata	1	11.1	1	11.1
TOTALS	9		9	

Station Data Summary Report

Station B3

Client: Wilmington District, USACE

Project: Topsail Benthic Survey

Location:

Sample Date: 28-29 Nov 06

Page 1

Station: B3

Sample Type: Macrofauna

Replicates: 1

Sample Area: 0.0400

TAXON	Rep 1		Station		
	Count	Density	Total	Percent	Mean Density
Annelida					
Oligochaeta					
Tubificida					
Enchytraeidae					
Enchytraeidae (LPIL)	2	50	2	3.9	50
Tubificidae					
Tubificidae (LPIL)	1	25	1	2	25
Polychaeta					
Eunicida					
Onuphidae					
Onuphidae (LPIL)	1	25	1	2	25
Opheliida					
Opheliidae					
Armandia maculata	1	25	1	2	25
Orbiniida					
Paraonidae					
Aricidea catherinae	1	25	1	2	25
Cirrophorus (LPIL)	1	25	1	2	25
Phyllodocida					
Chrysopetalidae					
Bhawania heteroseta	5	125	5	9.8	125
Glyceridae					
Glyceridae (LPIL)	1	25	1	2	25
Goniadidae					
Goniadides carolinae	7	175	7	13.7	175
Nereidae					
Nereididae (LPIL)	1	25	1	2	25

Station Data Summary Report

Station B3

Client: Wilmington District, USACE

Project: Topsail Benthic Survey

Location: Topsail Beach

Sample Date: 28-29 Nov 06

Page 1

Station: B3

Sample Type: Macrofauna

Replicates: 1

Sample Area: 0.0400

TAXON	Rep 1		Station		
	Count	Density	Total	Percent	Mean Density
Phyllodocidae					
Eumida sanguinea	1	25	1	2	25
Pilargiidae					
Ancistrosyllis (LPIL)	1	25	1	2	25
Ancistrosyllis hartmanae	1	25	1	2	25
Spionida					
Cirratulidae					
Cirratulidae (LPIL)	1	25	1	2	25
Spionidae					
Spionidae (LPIL)	4	100	4	7.8	100
Terebellida					
Terebellidae					
Terebellidae (LPIL)	1	25	1	2	25
Arthropoda					
Malacostraca					
Amphipoda					
Aoridae					
Unciola serrata	1	25	1	2	25
Isaeidae					
Microprotopus raneyi	2	50	2	3.9	50
Decapoda					
Paguridae					
Paguridae (LPIL)	1	25	1	2	25
Bryozoa					
Bryozoa (LPIL)	1	25	1	2	25

Station Data Summary Report

Station B3

Client: Wilmington District, USACE

Project: Topsail Benthic Survey

Location: Topsail Beach

Sample Date: 28-29 Nov 06

Page 1

Station: B3

Sample Type: Macrofauna

Replicates: 1

Sample Area: 0.0400

TAXON	Rep 1		Station		
	Count	Density	Total	Percent	Mean Density
Echinodermata					
Ophiuroidea					
Ophiuroidea (LPIL)	5	125	5	9.8	125
Mollusca					
Bivalvia					
Bivalvia (LPIL)	1	25	1	2	25
Veneroida					
Crassatellidae					
Crassinella lunulata	6	150	6	11.8	150
Semelidae					
Semelidae (LPIL)	1	25	1	2	25
Gastropoda					
Mesogastropoda					
Naticidae					
Tectonatica pusilla	1	25	1	2	25
Phoronida					
Phoronidae					
Phoronis (LPIL)	1	25	1	2	25
Platyhelminthes					
Turbellaria					
Turbellaria (LPIL)	1	25	1	2	25

Note: LPIL designates the LOWEST PRACTICAL IDENTIFICATION LEVEL

Station Data Summary Report

Station B3

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Client: Wilmington District, USACE

Project: Topsail Benthic Survey

Location: Topsail Beach

Sample Date: 28-29 Nov 06

Station: B3

Sample Type: Macrofauna

Replicates: 1

Sample Area: 0.0400

DATA SUMMARY

FAUNAL PARAMETERS	Station	Rep 1	Mean	Std Dev
Total Taxa	27	27	27	0
Total Individuals	51	51	51	0
Density (nos/sq.m.)		1275	1275	0

FAUNAL INDICES

Species Diversity (Shannon; log base e)	H' =	2.98
Species Diversity (Shannon; log base 2)	d =	4.29
Species Diversity (Shannon; log base 10)	H =	1.29
Species Diversity (Simpson; 1/S)	1/S =	19.92
Species Evenness (Pielou)	J' =	0.9
Species Richness (Margalef)	D =	6.61
Equitability Index (Lloyd & Ghelardi)	e =	1.06

MAJOR TAXONOMIC GROUPS

	Total No. Taxa	Taxa % Total	Total No. Individuals	Individuals % Total
Platyhelminthes	1	3.7	1	1.9
Annelida	16	59.2	30	58.8
Mollusca	4	14.8	9	17.6
Arthropoda	3	11.1	4	7.8
Phoronida	1	3.7	1	1.9
Bryozoa	1	3.7	1	1.9
Echinodermata	1	3.7	5	9.8
TOTALS	27		51	

Station Data Summary Report

Station C1

Client: Wilmington District, USACE
Project: Topsail Benthic Survey
Location: Topsail Beach
Sample Date: 28-29 Nov 06

Page 1

Station: C1
Sample Type: Macrofauna
Replicates: 1
Sample Area: 0.0400

TAXON	Rep 1		Station		
	Count	Density	Total	Percent	Mean Density
Annelida					
Polychaeta					
Phyllodocida					
Goniadidae					
Goniada littorea	2	50	2	40	50
Arthropoda					
Malacostraca					
Amphipoda					
Phoxocephalidae					
Rhepoxynius hudsoni	2	50	2	40	50
Mollusca					
Gastropoda					
Cephalaspidea					
Scaphandridae					
Cylichna alba	1	25	1	20	25

Note: LPIL designates the LOWEST PRACTICAL IDENTIFICATION LEVEL

Station Data Summary Report

Station C1

Page 2

Client: Wilmington District, USACE

Project: Topsail Benthic Survey

Location: Topsail Beach

Sample Date: 28-29 Nov 06

Station: C1

Sample Type: Macrofauna

Replicates: 1

Sample Area: 0.0400

DATA SUMMARY

FAUNAL PARAMETERS	Station	Rep 1	Mean	Std Dev
Total Taxa	3	3	3	0
Total Individuals	5	5	5	0
Density (nos/sq.m.)		125	125	0

FAUNAL INDICES

Species Diversity (Shannon; log base e)	H' =	1.05
Species Diversity (Shannon; log base 2)	d =	1.52
Species Diversity (Shannon; log base 10)	H =	0.46
Species Diversity (Simpson; 1/S)	1/S =	5
Species Evenness (Pielou)	J' =	0.96
Species Richness (Margalef)	D =	1.24
Equitability Index (Lloyd & Ghelardi)	e =	1.29

MAJOR TAXONOMIC GROUPS

	Total No. Taxa	Taxa % Total	Total No. Individuals	Individuals % Total
Annelida	1	33.3	2	40
Mollusca	1	33.3	1	20
Arthropoda	1	33.3	2	40
TOTALS	3		5	

Station Data Summary Report

Station C2

Client: Wilmington District, USACE
Project: Topsail Benthic Survey
Location: Topsail Beach
Sample Date: 28-29 Nov 06

Page 1

Station: C2
Sample Type: Macrofauna
Replicates: 1
Sample Area: 0.0400

TAXON	Rep 1		Station		
	Count	Density	Total	Percent	Mean Density
Annelida					
Polychaeta					
Phyllodocida					
Goniadidae					
Goniada littorea	3	75	3	17.6	75
Arthropoda					
Malacostraca					
Amphipoda					
Amphipoda (LPIL)	1	25	1	5.9	25
Oedicerotidae					
Oedicerotidae (LPIL)	1	25	1	5.9	25
Platyischnopidae					
Eudevenopus honduranus	3	75	3	17.6	75
Decapoda					
Pasiphaeidae					
Leptochela serratorbita	1	25	1	5.9	25
Ostracoda					
Myodocopina					
Sarsiellidae					
Eusarsiella texana	1	25	1	5.9	25
Echinodermata					
Ophiuroidea					
Ophiuroidea (LPIL)	2	50	2	11.8	50

Station Data Summary Report

Station C2

Client: Wilmington District, USACE
Project: Topsail Benthic Survey
Location: Topsail Beach
Sample Date: 28-29 Nov 06

Page 1

Station: C2
Sample Type: Macrofauna
Replicates: 1
Sample Area: 0.0400

TAXON	Rep 1		Station		
	Count	Density	Total	Percent	Mean Density
Annelida					
Mollusca					
Bivalvia					
Veneroida					
Tellinidae					
Tellina (LPIL)	4	100	4	23.5	100
Gastropoda					
Mesogastropoda					
Caecidae					
Caecum pulchellum	1	25	1	5.9	25

Note: LPIL designates the LOWEST PRACTICAL IDENTIFICATION LEVEL

Station Data Summary Report

Station C2

Page 3

Client: Wilmington District, USACE
Project: Topsail Benthic Survey
Location: Topsail Beach
Sample Date: 28-29 Nov 06

Station: C2
Sample Type: Macrofauna
Replicates: 1
Sample Area: 0.0400

DATA SUMMARY

FAUNAL PARAMETERS	Station	Rep 1	Mean	Std Dev
Total Taxa	9	9	9	0
Total Individuals	17	17	17	0
Density (nos/sq.m.)		425	425	0

FAUNAL INDICES

Species Diversity (Shannon; log base e)	H' =	2.04
Species Diversity (Shannon; log base 2)	d =	2.94
Species Diversity (Shannon; log base 10)	H =	0.88
Species Diversity (Simpson; 1/S)	1/S =	10.46
Species Evenness (Pielou)	J' =	0.93
Species Richness (Margalef)	D =	2.82
Equitability Index (Lloyd & Ghelardi)	e =	1.2

MAJOR TAXONOMIC GROUPS

	Total No.	Taxa	Total No.	Individuals
	Taxa	% Total	Individuals	% Total
Annelida	1	11.1	3	17.6
Mollusca	2	22.2	5	29.4
Arthropoda	5	55.5	7	41.1
Echinodermata	1	11.1	2	11.7
TOTALS	9		17	

Station Data Summary Report

Station C3

Client: Wilmington District, USACE
Project: Topsail Benthic Survey
Location: Topsail Beach
Sample Date: 28-29 Nov 06

Page 1

Station: C3
Sample Type: Macrofauna
Replicates: 1
Sample Area: 0.0400

TAXON	Rep 1		Station		
	Count	Density	Total	Percent	Mean Density
Annelida					
Polychaeta					
Eunicida					
Onuphidae					
Onuphidae (LPIL)	1	25	1	6.3	25
Phyllodocida					
Glyceridae					
Glyceridae (LPIL)	1	25	1	6.3	25
Arthropoda					
Malacostraca					
Amphipoda					
Platyschnopidae					
Eudevenopus honduranus	3	75	3	18.8	75
Echinodermata					
Echinoidea					
Echinoidea (LPIL)	2	50	2	12.5	50
Ophiuroidea					
Ophiuroidea (LPIL)	1	25	1	6.3	25
Mollusca					
Bivalvia					
Veneroida					
Tellinidae					
Tellina (LPIL)	5	125	5	31.3	125

Station Data Summary Report

Station C3

Client: Wilmington District, USACE

Project: Topsail Benthic Survey

Location: Topsail Beach

Sample Date: 28-29 Nov 06

Page 1

Station: C3

Sample Type: Macrofauna

Replicates: 1

Sample Area: 0.0400

TAXON

Rep 1

Station

	Count	Density	Total	Percent	Mean Density
Gastropoda					
Cephalaspidea					
Scaphandridae					
Acteocina canaliculata	1	25	1	6.3	25
Mesogastropoda					
Caecidae					
Caecum pulchellum	1	25	1	6.3	25
Rhynchocoela					
Rhynchocoela (LPIL)	1	25	1	6.3	25

Note: LPIL designates the LOWEST PRACTICAL IDENTIFICATION LEVEL

Station Data Summary Report

Station C3

Page 3

Client: Wilmington District, USACE
Project: Topsail Benthic Survey
Location: Topsail Beach
Sample Date: 28-29 Nov 06

Station: C3
Sample Type: Macrofauna
Replicates: 1
Sample Area: 0.0400

DATA SUMMARY

FAUNAL PARAMETERS	Station	Rep 1	Mean	Std Dev
Total Taxa	9	9	9	0
Total Individuals	16	16	16	0
Density (nos/sq.m.)		400	400	0

FAUNAL INDICES

Species Diversity (Shannon; log base e)	H' =	1.98
Species Diversity (Shannon; log base 2)	d =	2.85
Species Diversity (Shannon; log base 10)	H =	0.86
Species Diversity (Simpson; 1/S)	1/S =	8.57
Species Evenness (Pielou)	J' =	0.9
Species Richness (Margalef)	D =	2.89
Equitability Index (Lloyd & Ghelardi)	e =	1.12

MAJOR TAXONOMIC GROUPS

	Total No. Taxa	Taxa % Total	Total No. Individuals	Individuals % Total
Rhynchocoela	1	11.1	1	6.2
Annelida	2	22.2	2	12.5
Mollusca	3	33.3	7	43.7
Arthropoda	1	11.1	3	18.7
Echinodermata	2	22.2	3	18.7
TOTALS	9		16	

Station Data Summary Report

Station C4

Client: Wilmington District, USACE

Page 1

Station: C4

Project: Topsail Benthic Survey

Sample Type: Macrofauna

Location: Topsail Beach

Replicates: 1

Sample Date: 28-29 Nov 06

Sample Area: 0.0400

TAXON	Rep 1		Station		
	Count	Density	Total	Percent	Mean Density
Annelida					
Polychaeta					
Eunicida					
Onuphidae					
Onuphidae (LPIL)	1	25	1	5.9	25
Opheliida					
Opheliidae					
Armandia maculata	3	75	3	17.6	75
Spionida					
Chaetopteridae					
Spiochaetopterus oculatus	1	25	1	5.9	25
Arthropoda					
Malacostraca					
Amphipoda					
Platyischnopidae					
Eudevenopus honduranus	4	100	4	23.5	100
Decapoda					
Pinnotheridae					
Dissodactylus mellitae	2	50	2	11.8	50
Ostracoda					
Myodocopina					
Sarsiellidae					
Eusarsiella texana	1	25	1	5.9	25
Podocopida					
Podocopida (LPIL)	1	25	1	5.9	25

Station Data Summary Report

Station C4

Client: Wilmington District, USACE

Project: Topsail Benthic Survey

Location: Topsail Beach

Sample Date: 28-29 Nov 06

Page 1

Station: C4

Sample Type: Macrofauna

Replicates: 1

Sample Area: 0.0400

TAXON

Rep 1

Station

	Count	Density	Total	Percent	Mean Density
Echinodermata					
Echinoidea					
Clypeasteroida					
Mellitidae					
Mellita isometra	1	25	1	5.9	25
Mollusca					
Gastropoda					
Cephalaspidea					
Scaphandridae					
Cylichna alba	1	25	1	5.9	25
Mesogastropoda					
Caecidae					
Caecum pulchellum	2	50	2	11.8	50

Note: LPIL designates the LOWEST PRACTICAL IDENTIFICATION LEVEL

Station Data Summary Report

Station C4

Page 3

Client: Wilmington District, USACE
Project: Topsail Benthic Survey
Location: Topsail Beach
Sample Date: 28-29 Nov 06

Station: C4
Sample Type: Macrofauna
Replicates: 1
Sample Area: 0.0400

DATA SUMMARY

FAUNAL PARAMETERS	Station	Rep 1	Mean	Std Dev
Total Taxa	10	10	10	0
Total Individuals	17	17	17	0
Density (nos/sq.m.)		425	425	0

FAUNAL INDICES

Species Diversity (Shannon; log base e)	H' =	2.15
Species Diversity (Shannon; log base 2)	d =	3.1
Species Diversity (Shannon; log base 10)	H =	0.93
Species Diversity (Simpson; 1/S)	1/S =	12.36
Species Evenness (Pielou)	J' =	0.93
Species Richness (Margalef)	D =	3.18
Equitability Index (Lloyd & Ghelardi)	e =	1.21

MAJOR TAXONOMIC GROUPS

	Total No.	Taxa	Total No.	Individuals
	Taxa	% Total	Individuals	% Total
Annelida	3	30	5	29.4
Mollusca	2	20	3	17.6
Arthropoda	4	40	8	47
Echinodermata	1	10	1	5.8
TOTALS	10		17	

Station Data Summary Report

Station D1

Client: Wilmington District, USACE

Page 1

Station: D1

Project: Topsail Benthic Survey

Sample Type: Macrofauna

Location: Topsail Beach

Replicates: 1

Sample Date: 28-29 Nov 06

Sample Area: 0.0400

TAXON

Rep 1

Station

	Count	Density	Total	Percent	Mean Density
Annelida					
Polychaeta					
Oweniida					
Oweniidae					
Owenia fusiformis	1	25	1	25	25
Arthropoda					
Malacostraca					
Amphipoda					
Platyschnopidae					
Eudevenopus honduranus	1	25	1	25	25
Ostracoda					
Myodocopina					
Sarsiellidae					
Eusarsiella texana	1	25	1	25	25
Mollusca					
Gastropoda					
Cephalaspidea					
Scaphandridae					
Cylichna alba	1	25	1	25	25

Note: LPIL designates the LOWEST PRACTICAL IDENTIFICATION LEVEL

Station Data Summary Report**Station D1**

Page 2

Client: Wilmington District, USACE

Project: Topsail Benthic Survey

Location: Topsail Beach

Sample Date: 28-29 Nov 06

Station: D1

Sample Type: Macrofauna

Replicates: 1

Sample Area: 0.0400

DATA SUMMARY

FAUNAL PARAMETERS	Station	Rep 1	Mean	Std Dev
Total Taxa	4	4	4	0
Total Individuals	4	4	4	0
Density (nos/sq.m.)		100	100	0

FAUNAL INDICES

Species Diversity (Shannon; log base e)	H' =	1.39
Species Diversity (Shannon; log base 2)	d =	2
Species Diversity (Shannon; log base 10)	H =	0.6
Species Diversity (Simpson; 1/S)	1/S =	
Species Evenness (Pielou)	J' =	1
Species Richness (Margalef)	D =	2.16
Equitability Index (Lloyd & Ghelardi)	e =	1.37

MAJOR TAXONOMIC GROUPS	Total No. Taxa	Taxa % Total	Total No. Individuals	Individuals % Total
Annelida	1	25	1	25
Mollusca	1	25	1	25
Arthropoda	2	50	2	50
TOTALS	4		4	

Station Data Summary Report

Station D2

Client: Wilmington District, USACE

Project: Topsail Benthic Survey

Location: Topsail Beach

Sample Date: 28-29 Nov 06

Page 1

Station: D2

Sample Type: Macrofauna

Replicates: 1

Sample Area: 0.0400

TAXON	Rep 1		Station		
	Count	Density	Total	Percent	Mean Density
Annelida					
Polychaeta					
Eunicida					
Onuphidae					
Onuphidae (LPIL)	1	25	1	10	25
Phyllodocida					
Goniadidae					
Goniada littorea	1	25	1	10	25
Spionida					
Magelonidae					
Magelona papillicornis	3	75	3	30	75
Spionidae					
Spiophanes bombyx	1	25	1	10	25
Mollusca					
Bivalvia					
Veneroida					
Lucinidae					
Lucinidae (LPIL)	1	25	1	10	25
Mesodesmatidae					
Ervilia concentrica	1	25	1	10	25
Gastropoda					
Mesogastropoda					
Caecidae					
Caecum pulchellum	1	25	1	10	25

Station Data Summary Report

Station D2

Client: Wilmington District, USACE
Project: Topsail Benthic Survey
Location:
Sample Date: 28-29 Nov 06

Page 1

Station: D2
Sample Type: Macrofauna
Replicates: 1
Sample Area: 0.0400

TAXON	Rep 1		Station		
	Count	Density	Total	Percent	Mean Density
Rhynchocoela					
Rhynchocoela (LPIL)	1	25	1	10	25

Note: LPIL designates the LOWEST PRACTICAL IDENTIFICATION LEVEL

Station Data Summary Report

Station D2

Page 3

Client: Wilmington District, USACE

Project: Topsail Benthic Survey

Location: Topsail Beach

Sample Date: 28-29 Nov 06

Station: D2

Sample Type: Macrofauna

Replicates: 1

Sample Area: 0.0400

DATA SUMMARY

FAUNAL PARAMETERS	Station	Rep 1	Mean	Std Dev
Total Taxa	8	8	8	0
Total Individuals	10	10	10	0
Density (nos/sq.m.)		250	250	0

FAUNAL INDICES

Species Diversity (Shannon; log base e)	H' =	1.97
Species Diversity (Shannon; log base 2)	d =	2.85
Species Diversity (Shannon; log base 10)	H =	0.86
Species Diversity (Simpson; 1/S)	1/S =	15
Species Evenness (Pielou)	J' =	0.95
Species Richness (Margalef)	D =	3.04
Equitability Index (Lloyd & Ghelardi)	e =	1.26

MAJOR TAXONOMIC GROUPS

	Total No. Taxa	Taxa % Total	Total No. Individuals	Individuals % Total
Rhynchocoela	1	12.5	1	10
Annelida	4	50	6	60
Mollusca	3	37.5	3	30
TOTALS	8		10	

Station Data Summary Report

Station D3

Client: Wilmington District, USACE
Project: Topsail Benthic Survey
Location: Topsail Beach
Sample Date: 28-29 Nov 06

Page 1

Station: D3
Sample Type: Macrofauna
Replicates: 1
Sample Area: 0.0400

TAXON	Rep 1		Station		
	Count	Density	Total	Percent	Mean Density
Annelida					
Polychaeta					
Phyllodocida					
Goniadidae					
Goniada littorea	2	50	2	28.6	50
Spionida					
Spionidae					
Spionidae (LPIL)	1	25	1	14.3	25
Mollusca					
Gastropoda					
Cephalaspidea					
Scaphandridae					
Acteocina canaliculata	1	25	1	14.3	25
Mesogastropoda					
Caecidae					
Caecum pulchellum	3	75	3	42.9	75

Note: LPIL designates the LOWEST PRACTICAL IDENTIFICATION LEVEL

Station Data Summary Report

Station D3

Page 2

Client: Wilmington District, USACE

Project: Topsail Benthic Survey

Location: Topsail Beach

Sample Date: 28-29 Nov 06

Station: D3

Sample Type: Macrofauna

Replicates: 1

Sample Area: 0.0400

DATA SUMMARY

FAUNAL PARAMETERS	Station	Rep 1	Mean	Std Dev
Total Taxa	4	4	4	0
Total Individuals	7	7	7	0
Density (nos/sq.m.)		175	175	0

FAUNAL INDICES

Species Diversity (Shannon; log base e)	H' =	1.28
Species Diversity (Shannon; log base 2)	d =	1.84
Species Diversity (Shannon; log base 10)	H =	0.55
Species Diversity (Simpson; 1/S)	1/S =	5.25
Species Evenness (Pielou)	J' =	0.92
Species Richness (Margalef)	D =	1.54
Equitability Index (Lloyd & Ghelardi)	e =	1.22

MAJOR TAXONOMIC GROUPS	Total No. Taxa	Taxa % Total	Total No. Individuals	Individuals % Total
Annelida	2	50	3	42.8
Mollusca	2	50	4	57.1
TOTALS	4		7	

Station Data Summary Report

Station D4

Client: Wilmington District, USACE

Project: Topsail Benthic Survey

Location: Topsail Beach

Sample Date: 28-29 Nov 06

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Station: D4

Sample Type: Macrofauna

Replicates: 1

Sample Area: 0.0400

TAXON	Rep 1		Station		
	Count	Density	Total	Percent	Mean Density
Annelida					
Polychaeta					
Eunicida					
Lumbrineridae					
Lumbrineris latreilli	1	25	1	5	25
Orbiniida					
Paraonidae					
Aricidea (LPIL)	1	25	1	5	25
Aricidea wassi	1	25	1	5	25
Phyllodocida					
Goniadidae					
Goniada littorea	1	25	1	5	25
Spionida					
Magelonidae					
Magelona papillicornis	1	25	1	5	25
Arthropoda					
Malacostraca					
Amphipoda					
Amphipoda (LPIL)	1	25	1	5	25
Oedicerotidae					
Americhelidium americanum	1	25	1	5	25
Phoxocephalidae					
Rhepoxynius hudsoni	1	25	1	5	25
Platyischnopidae					
Eudevenopus honduranus	3	75	3	15	75

Station Data Summary Report

Station D4

Client: Wilmington District, USACE

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Station: D4

Project: Topsail Benthic Survey

Sample Type: Macrofauna

Location: Topsail Beach

Replicates: 1

Sample Date: 28-29 Nov 06

Sample Area: 0.0400

TAXON	Rep 1		Station		
	Count	Density	Total	Percent	Mean Density
Cumacea					
Diastylidae					
Oxyurostylis (LPIL)	1	25	1	5	25
Ostracoda					
Myodocopina					
Philomedidae					
Harbansus paucichelatus	1	25	1	5	25
Philomedidae (LPIL)	1	25	1	5	25
Echinodermata					
Ophiuroidea					
Ophiuroidea (LPIL)	1	25	1	5	25
Mollusca					
Bivalvia					
Veneroida					
Lucinidae					
Lucina (LPIL)	1	25	1	5	25
Tellinidae					
Tellina (LPIL)	1	25	1	5	25
Gastropoda					
Mesogastropoda					
Caecidae					
Caecum pulchellum	3	75	3	15	75

Note: LPIL designates the LOWEST PRACTICAL IDENTIFICATION LEVEL

Station Data Summary Report

Station D4

Page 2

Client: Wilmington District, USACE
Project: Topsail Benthic Survey
Location: Topsail Beach
Sample Date: 28-29 Nov 06

Station: D4
Sample Type: Macrofauna
Replicates: 1
Sample Area: 0.0400

DATA SUMMARY

FAUNAL PARAMETERS	Station	Rep 1	Mean	Std Dev
Total Taxa	16	16	16	0
Total Individuals	20	20	20	0
Density (nos/sq.m.)		500	500	0

FAUNAL INDICES

Species Diversity (Shannon; log base e)	H' =	2.67
Species Diversity (Shannon; log base 2)	d =	3.85
Species Diversity (Shannon; log base 10)	H =	1.16
Species Diversity (Simpson; 1/S)	1/S =	31.67
Species Evenness (Pielou)	J' =	0.96
Species Richness (Margalef)	D =	5.01
Equitability Index (Lloyd & Ghelardi)	e =	1.3

MAJOR TAXONOMIC GROUPS

	Total No. Taxa	Taxa % Total	Total No. Individuals	Individuals % Total
Annelida	5	31.2	5	25
Mollusca	3	18.7	5	25
Arthropoda	7	43.7	9	45
Echinodermata	1	6.2	1	5
TOTALS	16		20	

Station Data Summary Report

Station E1

Client: Wilmington District, USACE

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Station: E1

Project: Topsail Benthic Survey

Sample Type: Macrofauna

Location: Topsail Beach

Replicates: 1

Sample Date: 28-29 Nov 06

Sample Area: 0.0400

TAXON

Rep 1

Station

	Count	Density	Total	Percent	Mean Density
Annelida					
Polychaeta					
Orbiniida					
Paraonidae					
Aricidea wassi	1	25	1	6.7	25
Phyllodocida					
Glyceridae					
Glyceridae (LPIL)	1	25	1	6.7	25
Goniadidae					
Goniada littorea	3	75	3	20	75
Pilargiidae					
Ancistrosyllis (LPIL)	1	25	1	6.7	25
Spionida					
Magelonidae					
Magelona papillicornis	1	25	1	6.7	25
Spionidae					
Spionidae (LPIL)	1	25	1	6.7	25
Arthropoda					
Malacostraca					
Amphipoda					
Oedicerotidae					
Americhelidium americanum	1	25	1	6.7	25
Platyischnopidae					
Eudevenopus honduranus	1	25	1	6.7	25

Station Data Summary Report

Station E1

Client: Wilmington District, USACE

Project: Topsail Benthic Survey

Location:

Sample Date: 28-29 Nov 06

Page 1

Station: E1

Sample Type: Macrofauna

Replicates: 1

Sample Area: 0.0400

TAXON	Rep 1		Station		
	Count	Density	Total	Percent	Mean Density
Decapoda					
Paguridae					
Pagurus (LPIL)	1	25	1	6.7	25
Mollusca					
Bivalvia					
Veneroida					
Lucinidae					
Lucinidae (LPIL)	1	25	1	6.7	25
Gastropoda					
Mesogastropoda					
Caecidae					
Caecum pulchellum	3	75	3	20	75

Note: LPIL designates the LOWEST PRACTICAL IDENTIFICATION LEVEL

Station Data Summary Report

Station E1

Page 3

Client: Wilmington District, USACE

Project: Topsail Benthic Survey

Location: Topsail Beach

Sample Date: 28-29 Nov 06

Station: E1

Sample Type: Macrofauna

Replicates: 1

Sample Area: 0.0400

DATA SUMMARY

FAUNAL PARAMETERS	Station	Rep 1	Mean	Std Dev
Total Taxa	11	11	11	0
Total Individuals	15	15	15	0
Density (nos/sq.m.)		375	375	0

FAUNAL INDICES

Species Diversity (Shannon; log base e)	H' =	2.27
Species Diversity (Shannon; log base 2)	d =	3.27
Species Diversity (Shannon; log base 10)	H =	0.99
Species Diversity (Simpson; 1/S)	1/S =	17.5
Species Evenness (Pielou)	J' =	0.95
Species Richness (Margalef)	D =	3.69
Equitability Index (Lloyd & Ghelardi)	e =	1.25

MAJOR TAXONOMIC GROUPS

	Total No. Taxa	Taxa % Total	Total No. Individuals	Individuals % Total
Annelida	6	54.5	8	53.3
Mollusca	2	18.1	4	26.6
Arthropoda	3	27.2	3	20
TOTALS	11		15	

Station Data Summary Report

Station E2

Client: Wilmington District, USACE

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Station: E2

Project: Topsail Benthic Survey

Sample Type: Macrofauna

Location: Topsail Beach

Replicates: 1

Sample Date: 28-29 Nov 06

Sample Area: 0.0400

TAXON	Rep 1		Station		
	Count	Density	Total	Percent	Mean Density
Annelida					
Polychaeta					
Capitellida					
Capitellidae					
Mediomastus (LPIL)	1	25	1	3.8	25
Opheliida					
Opheliidae					
Opheliidae (LPIL)	1	25	1	3.8	25
Orbiniida					
Paraonidae					
Aricidea (LPIL)	1	25	1	3.8	25
Aricidea wassi	2	50	2	7.7	50
Spionida					
Magelonidae					
Magelona papillicornis	2	50	2	7.7	50
Arthropoda					
Malacostraca					
Amphipoda					
Platyischnopidae					
Eudevenopus honduranus	3	75	3	11.5	75
Echinodermata					
Ophiuroidea					
Ophiuroidea (LPIL)	1	25	1	3.8	25

Station Data Summary Report

Station E2

Client: Wilmington District, USACE
Project: Topsail Benthic Survey
Location:
Sample Date: 28-29 Nov 06

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Station: E2
Sample Type: Macrofauna
Replicates: 1
Sample Area: 0.0400

TAXON	Rep 1		Station		
	Count	Density	Total	Percent	Mean Density
Mollusca					
Bivalvia					
Veneroida					
Lucinidae					
Lucinidae (LPIL)	2	50	2	7.7	50
Tellinidae					
Tellina (LPIL)	1	25	1	3.8	25
Gastropoda					
Cephalaspidea					
Scaphandridae					
Acteocina canaliculata	2	50	2	7.7	50
Mesogastropoda					
Caecidae					
Caecum pulchellum	7	175	7	26.9	175
Eulimidae					
Strombiformis bilineatus	1	25	1	3.8	25
Rhynchocoela					
Rhynchocoela (LPIL)	2	50	2	7.7	50

Note: LPIL designates the LOWEST PRACTICAL IDENTIFICATION LEVEL

Station Data Summary Report

Station E2

Page 3

Client: Wilmington District, USACE
Project: Topsail Benthic Survey
Location: Topsail Beach
Sample Date: 28-29 Nov 06

Station: E2
Sample Type: Macrofauna
Replicates: 1
Sample Area: 0.0400

DATA SUMMARY

FAUNAL PARAMETERS	Station	Rep 1	Mean	Std Dev
Total Taxa	13	13	13	0
Total Individuals	26	26	26	0
Density (nos/sq.m.)		650	650	0

FAUNAL INDICES

Species Diversity (Shannon; log base e)	H' =	2.34
Species Diversity (Shannon; log base 2)	d =	3.38
Species Diversity (Shannon; log base 10)	H =	1.02
Species Diversity (Simpson; 1/S)	1/S =	11.21
Species Evenness (Pielou)	J' =	0.91
Species Richness (Margalef)	D =	3.68
Equitability Index (Lloyd & Ghelardi)	e =	1.14

MAJOR TAXONOMIC GROUPS

	Total No. Taxa	Taxa % Total	Total No. Individuals	Individuals % Total
Rhynchocoela	1	7.6	2	7.6
Annelida	5	38.4	7	26.9
Mollusca	5	38.4	13	50
Arthropoda	1	7.6	3	11.5
Echinodermata	1	7.6	1	3.8
TOTALS	13		26	

Station Data Summary Report

Station E3

Client: Wilmington District, USACE

Project: Topsail Benthic Survey

Location: Topsail Beach

Sample Date: 28-29 Nov 06

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Station: E3

Sample Type: Macrofauna

Replicates: 1

Sample Area: 0.0400

TAXON	Rep 1		Station		
	Count	Density	Total	Percent	Mean Density
Annelida					
Polychaeta					
Capitellida					
Maldanidae					
Maldanidae (LPIL)	1	25	1	2.3	25
Opheliida					
Opheliidae					
Armandia (LPIL)	1	25	1	2.3	25
Orbiniida					
Paraonidae					
Aricidea suecica	1	25	1	2.3	25
Cirrophorus (LPIL)	1	25	1	2.3	25
Phyllodocida					
Goniadidae					
Goniada littorea	1	25	1	2.3	25
Pilargiidae					
Ancistrosyllis hartmanae	1	25	1	2.3	25
Spionida					
Magelonidae					
Magelona papillicornis	2	50	2	4.7	50
Arthropoda					
Malacostraca					
Amphipoda					
Phoxocephalidae					
Metharpinia floridana	1	25	1	2.3	25

Station Data Summary Report

Station E3

Client: Wilmington District, USACE

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Station: E3

Project: Topsail Benthic Survey

Sample Type: Macrofauna

Location: Topsail Beach

Replicates: 1

Sample Date: 28-29 Nov 06

Sample Area: 0.0400

TAXON	Rep 1		Station		
	Count	Density	Total	Percent	Mean Density
Platyschnopidae					
Eudevenopus honduranus	6	150	6	14	150
Cumacea					
Diastylidae					
Oxyurostylis (LPIL)	1	25	1	2.3	25
Chordata					
Leptocardia					
Amphioxi					
Branchiostomidae					
Branchiostoma (LPIL)	2	50	2	4.7	50
Echinodermata					
Echinodermata (LPIL)	1	25	1	2.3	25
Mollusca					
Bivalvia					
Veneroida					
Crassatellidae					
Crassinella dupliniana	3	75	3	7	75
Crassinella lunulata	2	50	2	4.7	50
Montacutidae					
Montacutidae (LPIL)	1	25	1	2.3	25
Tellinidae					
Strigilla mirabilis	1	25	1	2.3	25
Tellina (LPIL)	1	25	1	2.3	25

Station Data Summary Report

Station E3

Client: Wilmington District, USACE
 Project: Topsail Benthic Survey
 Location: Topsail Beach
 Sample Date: 28-29 Nov 06

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Station: E3
 Sample Type: Macrofauna
 Replicates: 1
 Sample Area: 0.0400

TAXON	Rep 1		Station		
	Count	Density	Total	Percent	Mean Density
Gastropoda					
Cephalaspidea					
Scaphandridae					
Acteocina canaliculata	1	25	1	2.3	25
Mesogastropoda					
Caecidae					
Caecum pulchellum	12	300	12	27.9	300
Eulimidae					
Strombiformis bilineatus	1	25	1	2.3	25
Naticidae					
Tectonatica pusilla	1	25	1	2.3	25
Rhynchocoela					
Rhynchocoela (LPIL)	1	25	1	2.3	25

Note: LPIL designates the LOWEST PRACTICAL IDENTIFICATION LEVEL

Station Data Summary Report

Station E3

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Client: Wilmington District, USACE
Project: Topsail Benthic Survey
Location: Topsail Beach
Sample Date: 28-29 Nov 06

Station: E3
Sample Type: Macrofauna
Replicates: 1
Sample Area: 0.0400

DATA SUMMARY

FAUNAL PARAMETERS	Station	Rep 1	Mean	Std Dev
Total Taxa	22	22	22	0
Total Individuals	43	43	43	0
Density (nos/sq.m.)		1075	1075	0

FAUNAL INDICES

Species Diversity (Shannon; log base e)	H' =	2.64
Species Diversity (Shannon; log base 2)	d =	3.82
Species Diversity (Shannon; log base 10)	H =	1.15
Species Diversity (Simpson; 1/S)	1/S =	10.38
Species Evenness (Pielou)	J' =	0.86
Species Richness (Margalef)	D =	5.58
Equitability Index (Lloyd & Ghelardi)	e =	0.92

MAJOR TAXONOMIC GROUPS

	Total No. Taxa	Taxa % Total	Total No. Individuals	Individuals % Total
Rhynchocoela	1	4.5	1	2.3
Annelida	7	31.8	8	18.6
Mollusca	9	40.9	23	53.4
Arthropoda	3	13.6	8	18.6
Echinodermata	1	4.5	1	2.3
Chordata	1	4.5	2	4.6
TOTALS	22		43	

Station Data Summary Report

Station E4

Client: Wilmington District, USACE

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Station: E4

Project: Topsail Benthic Survey

Sample Type: Macrofauna

Location: Topsail Beach

Replicates: 1

Sample Date: 28-29 Nov 06

Sample Area: 0.0400

TAXON	Rep 1		Station		
	Count	Density	Total	Percent	Mean Density
Annelida					
Polychaeta					
Eunicida					
Oenonidae					
Arabella multidentata	1	25	1	3.6	25
Opheliida					
Opheliidae					
Armandia maculata	2	50	2	7.1	50
Opheliidae (LPIL)	1	25	1	3.6	25
Phyllodocida					
Nereidae					
Ceratocephale oculata	1	25	1	3.6	25
Spionida					
Magelonidae					
Magelona papillicornis	2	50	2	7.1	50
Spionidae					
Paraprionospio pinnata	1	25	1	3.6	25
Arthropoda					
Malacostraca					
Amphipoda					
Phoxocephalidae					
Rhepoxynius hudsoni	1	25	1	3.6	25
Platyischnopidae					
Eudevenopus honduranus	7	175	7	25	175

Station Data Summary Report

Station E4

Client: Wilmington District, USACE

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Station: E4

Project: Topsail Benthic Survey

Sample Type: Macrofauna

Location: Topsail Beach

Replicates: 1

Sample Date: 28-29 Nov 06

Sample Area: 0.0400

TAXON	Rep 1		Station		
	Count	Density	Total	Percent	Mean Density
Ostracoda					
Myodocopina					
Sarsiellidae					
Eusarsiella texana	1	25	1	3.6	25
Mollusca					
Bivalvia					
Veneroida					
Crassatellidae					
Crassinella dupliniana	1	25	1	3.6	25
Lucinidae					
Lucina multilineata	3	75	3	10.7	75
Tellinidae					
Strigilla mirabilis	1	25	1	3.6	25
Tellina (LPIL)	1	25	1	3.6	25
Gastropoda					
Cephalaspidea					
Scaphandridae					
Acteocina canaliculata	1	25	1	3.6	25
Mesogastropoda					
Caecidae					
Caecum pulchellum	2	50	2	7.1	50
Naticidae					
Tectonatica pusilla	1	25	1	3.6	25

Station Data Summary Report

Station E4

Client: Wilmington District, USACE
Project: Topsail Benthic Survey
Location: Topsail Beach
Sample Date: 28-29 Nov 06

Page 1

Station: E4
Sample Type: Macrofauna
Replicates: 1
Sample Area: 0.0400

TAXON	Rep 1		Station		
	Count	Density	Total	Percent	Mean Density
Rhynchocoela					
Rhynchocoela (LPIL)	1	25	1	3.6	25

Note: LPIL designates the LOWEST PRACTICAL IDENTIFICATION LEVEL

Station Data Summary Report

Station E4

Page 4

Client: Wilmington District, USACE
Project: Topsail Benthic Survey
Location: Topsail Beach
Sample Date: 28-29 Nov 06

Station: E4
Sample Type: Macrofauna
Replicates: 1
Sample Area: 0.0400

DATA SUMMARY

FAUNAL PARAMETERS	Station	Rep 1	Mean	Std Dev
Total Taxa	17	17	17	0
Total Individuals	28	28	28	0
Density (nos/sq.m.)		700	700	0

FAUNAL INDICES

Species Diversity (Shannon; log base e)	H' =	2.58
Species Diversity (Shannon; log base 2)	d =	3.72
Species Diversity (Shannon; log base 10)	H =	1.12
Species Diversity (Simpson; 1/S)	1/S =	14
Species Evenness (Pielou)	J' =	0.91
Species Richness (Margalef)	D =	4.8
Equitability Index (Lloyd & Ghelardi)	e =	1.12

MAJOR TAXONOMIC GROUPS

	Total No. Taxa	Taxa % Total	Total No. Individuals	Individuals % Total
Rhynchocoela	1	5.8	1	3.5
Annelida	6	35.2	8	28.5
Mollusca	7	41.1	10	35.7
Arthropoda	3	17.6	9	32.1
TOTALS	17		28	

Station Data Summary Report

Station F1

Client: Wilmington District, USACE

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Station: F1

Project: Topsail Benthic Survey

Sample Type: Macrofauna

Location: Topsail Beach

Replicates: 1

Sample Date: 28-29 Nov 06

Sample Area: 0.0400

TAXON	Rep 1		Station		
	Count	Density	Total	Percent	Mean Density
Annelida					
Polychaeta					
Opheliida					
Opheliidae					
Opheliidae (LPIL)	1	25	1	11.1	25
Spionida					
Cirratulidae					
Caulleriella sp. J	1	25	1	11.1	25
Magelonidae					
Magelona papillicornis	1	25	1	11.1	25
Magelona pettiboneae	1	25	1	11.1	25
Arthropoda					
Malacostraca					
Cumacea					
Diastylidae					
Oxyurostylis (LPIL)	1	25	1	11.1	25
Ostracoda					
Myodocopina					
Sarsiellidae					
Eusarsiella texana	1	25	1	11.1	25
Chordata					
Leptocardia					
Amphioxi					
Branchiostomidae					
Branchiostoma (LPIL)	1	25	1	11.1	25

Station Data Summary Report

Station F1

Client: Wilmington District, USACE
Project: Topsail Benthic Survey
Location: Topsail Beach
Sample Date: 28-29 Nov 06

Page 1

Station: F1
Sample Type: Macrofauna
Replicates: 1
Sample Area: 0.0400

TAXON	Rep 1		Station		
	Count	Density	Total	Percent	Mean Density
Mollusca					
Bivalvia					
Veneroida					
Crassatellidae					
Crassinella lunulata	1	25	1	11.1	25
Platyhelminthes					
Turbellaria					
Turbellaria (LPIL)	1	25	1	11.1	25

Note: LPIL designates the LOWEST PRACTICAL IDENTIFICATION LEVEL

Station Data Summary Report

Station F1

Page 3

Client: Wilmington District, USACE
Project: Topsail Benthic Survey
Location: Topsail Beach
Sample Date: 28-29 Nov 06

Station: F1
Sample Type: Macrofauna
Replicates: 1
Sample Area: 0.0400

DATA SUMMARY

FAUNAL PARAMETERS	Station	Rep 1	Mean	Std Dev
Total Taxa	9	9	9	0
Total Individuals	9	9	9	0
Density (nos/sq.m.)		225	225	0

FAUNAL INDICES

Species Diversity (Shannon; log base e)	H' =	2.2
Species Diversity (Shannon; log base 2)	d =	3.17
Species Diversity (Shannon; log base 10)	H =	0.95
Species Diversity (Simpson; 1/S)	1/S =	
Species Evenness (Pielou)	J' =	1
Species Richness (Margalef)	D =	3.64
Equitability Index (Lloyd & Ghelardi)	e =	1.41

MAJOR TAXONOMIC GROUPS

	Total No. Taxa	Taxa % Total	Total No. Individuals	Individuals % Total
Platyhelminthes	1	11.1	1	11.1
Annelida	4	44.4	4	44.4
Mollusca	1	11.1	1	11.1
Arthropoda	2	22.2	2	22.2
Chordata	1	11.1	1	11.1
TOTALS	9		9	

Station Data Summary Report

Station F2

Page 1

Client: Wilmington District, USACE

Project: Topsail Benthic Survey

Location: Topsail Beach

Sample Date: 28-29 Nov 06

Station: F2

Sample Type: Macrofauna

Replicates: 1

Sample Area: 0.0400

TAXON	Rep 1		Station		
	Count	Density	Total	Percent	Mean Density
Annelida					
Polychaeta					
Opheliida					
Opheliidae					
Ophelia denticulata	1	25	1	4.2	25
Phyllodocida					
Chrysopetalidae					
Bhawania heteroseta	1	25	1	4.2	25
Goniadidae					
Goniadides carolinae	2	50	2	8.3	50
Hesionidae					
Microphthalmus (LPIL)	1	25	1	4.2	25
Nephtyidae					
Nephtys simoni	1	25	1	4.2	25
Spionida					
Cirratulidae					
Cirratulidae (LPIL)	1	25	1	4.2	25
Arthropoda					
Malacostraca					
Amphipoda					
Melitidae					
Maera caroliniana	1	25	1	4.2	25

Station Data Summary Report

Station F2

Page 4

Client: Wilmington District, USACE
Project: Topsail Benthic Survey
Location: Topsail Beach
Sample Date: 28-29 Nov 06

Station: F2
Sample Type: Macrofauna
Replicates: 1
Sample Area: 0.0400

DATA SUMMARY

FAUNAL PARAMETERS	Station	Rep 1	Mean	Std Dev
Total Taxa	16	16	16	0
Total Individuals	24	24	24	0
Density (nos/sq.m.)		600	600	0

FAUNAL INDICES

Species Diversity (Shannon; log base e)	H' =	2.64
Species Diversity (Shannon; log base 2)	d =	3.8
Species Diversity (Shannon; log base 10)	H =	1.14
Species Diversity (Simpson; 1/S)	1/S =	23
Species Evenness (Pielou)	J' =	0.95
Species Richness (Margalef)	D =	4.72
Equitability Index (Lloyd & Ghelardi)	e =	1.26

MAJOR TAXONOMIC GROUPS

	Total No. Taxa	Taxa % Total	Total No. Individuals	Individuals % Total
Rhynchocoela	1	6.2	3	12.5
Annelida	6	37.5	7	29.1
Mollusca	7	43.7	11	45.8
Arthropoda	1	6.2	1	4.1
Chordata	1	6.2	2	8.3
TOTALS	16		24	

Station Data Summary Report

Station F2

Client: Wilmington District, USACE

Page 1

Station: F2

Project: Topsail Benthic Survey

Sample Type: Macrofauna

Location: Topsail Beach

Replicates: 1

Sample Date: 28-29 Nov 06

Sample Area: 0.0400

TAXON	Rep 1		Station		
	Count	Density	Total	Percent	Mean Density
Chordata					
Leptocardia					
Amphioxi					
Branchiostomidae					
Branchiostoma (LPIL)	2	50	2	8.3	50
Mollusca					
Bivalvia					
Bivalvia (LPIL)	1	25	1	4.2	25
Ostreoida					
Anomiidae					
Anomia simplex	1	25	1	4.2	25
Veneroida					
Crassatellidae					
Crassinella dupliniana	4	100	4	16.7	100
Crassinella lunulata	2	50	2	8.3	50
Gastropoda					
Cephalaspidea					
Scaphandridae					
Acteocina canaliculata	1	25	1	4.2	25
Mesogastropoda					
Caecidae					
Caecum pulchellum	1	25	1	4.2	25
Pyramidelloida					
Pyramidellidae					
Turbonilla (LPIL)	1	25	1	4.2	25

Station Data Summary Report

Station F2

Page 1

Client: Wilmington District, USACE

Project: Topsail Benthic Survey

Location: Topsail Beach

Sample Date: 28-29 Nov 06

Station: F2

Sample Type: Macrofauna

Replicates: 1

Sample Area: 0.0400

TAXON	Rep 1		Station		
	Count	Density	Total	Percent	Mean Density
Rhynchocoela					
Rhynchocoela (LPIL)	3	75	3	12.5	75

Note: LPIL designates the LOWEST PRACTICAL IDENTIFICATION LEVEL

Station Data Summary Report

Station F2

Page 4

Client: Wilmington District, USACE
Project: Topsail Benthic Survey
Location: Topsail Beach
Sample Date: 28-29 Nov 06

Station: F2
Sample Type: Macrofauna
Replicates: 1
Sample Area: 0.0400

DATA SUMMARY

FAUNAL PARAMETERS	Station	Rep 1	Mean	Std Dev
Total Taxa	16	16	16	0
Total Individuals	24	24	24	0
Density (nos/sq.m.)		600	600	0

FAUNAL INDICES

Species Diversity (Shannon; log base e)	H' =	2.64
Species Diversity (Shannon; log base 2)	d =	3.8
Species Diversity (Shannon; log base 10)	H =	1.14
Species Diversity (Simpson; 1/S)	1/S =	23
Species Evenness (Pielou)	J' =	0.95
Species Richness (Margalef)	D =	4.72
Equitability Index (Lloyd & Ghelardi)	e =	1.26

MAJOR TAXONOMIC GROUPS

	Total No. Taxa	Taxa % Total	Total No. Individuals	Individuals % Total
Rhynchocoela	1	6.2	3	12.5
Annelida	6	37.5	7	29.1
Mollusca	7	43.7	11	45.8
Arthropoda	1	6.2	1	4.1
Chordata	1	6.2	2	8.3
TOTALS	16		24	

Station Data Summary Report

Station F3

Client: Wilmington District, USACE
Project: Topsail Benthic Survey
Location: Topsail Beach
Sample Date: 28-29 Nov 06

Page 1

Station: F3
Sample Type: Macrofauna
Replicates: 1
Sample Area: 0.0400

TAXON	Rep 1		Station		
	Count	Density	Total	Percent	Mean Density
Annelida					
Polychaeta					
Eunicida					
Onuphidae					
Onuphidae (LPIL)	1	25	1	7.1	25
Phyllodocida					
Goniadidae					
Goniada littorea	1	25	1	7.1	25
Nereidae					
Ceratocephale oculata	1	25	1	7.1	25
Spionida					
Spionidae					
Paraprionospio pinnata	1	25	1	7.1	25
Arthropoda					
Malacostraca					
Amphipoda					
Platyischnopidae					
Eudevenopus honduranus	2	50	2	14.3	50
Echinodermata					
Ophiuroidea					
Ophiuroidea (LPIL)	2	50	2	14.3	50

Station Data Summary Report

Station F3

Client: Wilmington District, USACE
Project: Topsail Benthic Survey
Location: Topsail Beach
Sample Date: 28-29 Nov 06

Page 1

Station: F3
Sample Type: Macrofauna
Replicates: 1
Sample Area: 0.0400

TAXON	Rep 1		Station		
	Count	Density	Total	Percent	Mean Density
Mollusca					
Bivalvia					
Veneroida					
Lucinidae					
Lucinidae (LPIL)	2	50	2	14.3	50
Gastropoda					
Mesogastropoda					
Caecidae					
Caecum pulchellum	2	50	2	14.3	50
Neogastropoda					
Olividae					
Olivella dealbata	2	50	2	14.3	50

Note: LPIL designates the LOWEST PRACTICAL IDENTIFICATION LEVEL

Station Data Summary Report

Station F3

Page 3

Client: Wilmington District, USACE
Project: Topsail Benthic Survey
Location: Topsail Beach
Sample Date: 28-29 Nov 06

Station: F3
Sample Type: Macrofauna
Replicates: 1
Sample Area: 0.0400

DATA SUMMARY

FAUNAL PARAMETERS	Station	Rep 1	Mean	Std Dev
Total Taxa	9	9	9	0
Total Individuals	14	14	14	0
Density (nos/sq.m.)		350	350	0

FAUNAL INDICES

Species Diversity (Shannon; log base e)	H' =	2.14
Species Diversity (Shannon; log base 2)	d =	3.09
Species Diversity (Shannon; log base 10)	H =	0.93
Species Diversity (Simpson; 1/S)	1/S =	18.2
Species Evenness (Pielou)	J' =	0.98
Species Richness (Margalef)	D =	3.03
Equitability Index (Lloyd & Ghelardi)	e =	1.34

MAJOR TAXONOMIC GROUPS

	Total No. Taxa	Taxa % Total	Total No. Individuals	Individuals % Total
Annelida	4	44.4	4	28.5
Mollusca	3	33.3	6	42.8
Arthropoda	1	11.1	2	14.2
Echinodermata	1	11.1	2	14.2
TOTALS	9		14	

Station Data Summary Report

Station F4

Client: Wilmington District, USACE

Project: Topsail Benthic Survey

Location: Topsail Beach

Sample Date: 28-29 Nov 06

Page 1

Station: F4

Sample Type: Macrofauna

Replicates: 1

Sample Area: 0.0400

TAXON	Rep 1		Station		
	Count	Density	Total	Percent	Mean Density
Annelida					
Polychaeta					
Eunicida					
Lumbrineridae					
Lumbrineris latreilli	1	25	1	3.4	25
Oeonidae					
Arabella multidentata	1	25	1	3.4	25
Phyllodocida					
Goniadidae					
Goniada littorea	1	25	1	3.4	25
Nephtyidae					
Nephtys picta	2	50	2	6.9	50
Nereidae					
Ceratocephale oculata	1	25	1	3.4	25
Spionida					
Magelonidae					
Magelona papillicornis	1	25	1	3.4	25
Spionidae					
Spionidae (LPIL)	1	25	1	3.4	25
Arthropoda					
Malacostraca					
Amphipoda					
Haustoriidae					
Acanthohaustorius intermedius	2	50	2	6.9	50

Station Data Summary Report

Station F4

Client: Wilmington District, USACE

Project: Topsail Benthic Survey

Location: Topsail Beach

Sample Date: 28-29 Nov 06

Page 1

Station: F4

Sample Type: Macrofauna

Replicates: 1

Sample Area: 0.0400

TAXON	Rep 1		Station		
	Count	Density	Total	Percent	Mean Density
Phoxocephalidae					
Rhepoxynius hudsoni	1	25	1	3.4	25
Platyischnopidae					
Eudevenopus honduranus	12	300	12	41.4	300
Ostracoda					
Myodocopina					
Sarsiellidae					
Eusarsiella radiicosta	1	25	1	3.4	25
Echinodermata					
Echinoidea					
Clypeasteroidea					
Mellitidae					
Mellitidae (LPIL)	2	50	2	6.9	50
Mollusca					
Bivalvia					
Veneroidea					
Lucinidae					
Lucinidae (LPIL)	1	25	1	3.4	25
Mesodesmatidae					
Ervilia concentrica	1	25	1	3.4	25
Gastropoda					
Neogastropoda					
Turridae					
Kurtziella atrostyla	1	25	1	3.4	25

Note: LPIL designates the LOWEST PRACTICAL IDENTIFICATION LEVEL

Station Data Summary Report

Station F4

Page 3

Client: Wilmington District, USACE
Project: Topsail Benthic Survey
Location: Topsail Beach
Sample Date: 28-29 Nov 06

Station: F4
Sample Type: Macrofauna
Replicates: 1
Sample Area: 0.0400

DATA SUMMARY

FAUNAL PARAMETERS	Station	Rep 1	Mean	Std Dev
Total Taxa	15	15	15	0
Total Individuals	29	29	29	0
Density (nos/sq.m.)		725	725	0

FAUNAL INDICES

Species Diversity (Shannon; log base e)	H' =	2.2
Species Diversity (Shannon; log base 2)	d =	3.17
Species Diversity (Shannon; log base 10)	H =	0.95
Species Diversity (Simpson; 1/S)	1/S =	5.88
Species Evenness (Pielou)	J' =	0.81
Species Richness (Margalef)	D =	4.16
Equitability Index (Lloyd & Ghelardi)	e =	0.85

MAJOR TAXONOMIC GROUPS

	Total No. Taxa	Taxa % Total	Total No. Individuals	Individuals % Total
Annelida	7	46.6	8	27.5
Mollusca	3	20	3	10.3
Arthropoda	4	26.6	16	55.1
Echinodermata	1	6.6	2	6.8
TOTALS	15		29	

APPENDIX D

Supporting Data Tables

Table D-1. Species abundance and density at sampling stations within borrow sites A, B, and C off Topsail Beach, NC.

Species List	A1		A2		A3		A4		A5		Mean A		B1		B2		B3		Mean B		C1		C2		C3		C4		Mean C	
	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density
ANNELIDA																														
CLASS OLIGOCHAETA																														
Order TUBIFICIDA																														
FAMILY ENCHYTRAEIDAE																														
Enchytraeidae (LPIL)																	2	50	.67	16.67										
FAMILY TUBIFICIDAE																														
Tubificidae (LPIL)																	1	25	.33	8.33										
CLASS POLYCHAETA																														
Order CAPITELLIDA																														
FAMILY CAPITELLIDAE																														
Capitellidae (LPIL)			1	25							.20	5.00																		
Mediomastus (LPIL)													3	75	1	25			1.33	33.33										
Mediomastus californiensis							1	25			.20	5																		
FAMILY MALDANIDAE																														
Maldanidae (LPIL)																														
Order EUNICIDA																														
FAMILY DORVILLEIDAE																														
Schistomeringos pectinata													1	25					.33	8.33										
FAMILY LUMBRINERIDAE																														
Lumbrineris latreilli																														
FAMILY OENONIDAE																														
Arabella multidentata																														
FAMILY ONUPHIDAE																														
Onuphidae (LPIL)							1	25			.20	5.00					1	25	.33	8.33					1	25	1	25	.50	12.50
Order OPHELIIDA																														
FAMILY OPHELIIDAE																														
Opheiliidae (LPIL)																														
Armandia (LPIL)																														
Armandia maculata			1	25							.20	5.00					1	25	.33	8.33							3	75	.75	18.75
Opheia denticulata																														
Order ORBINIIDA																														
FAMILY PARAONIDAE																														
Aricidea (LPIL)																														
Aricidea catherinae									1	25	.20	5.00					1	25	.33	8.33										
Aricidea suecica																														
Aricidea wassi																														
Cirrophorus (LPIL)																	1	25	.33	8.33										

Table D-1. (continued)

Species List	A1		A2		A3		A4		A5		Mean A		B1		B2		B3		Mean B		C1		C2		C3		C4		Mean C	
	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density
Order OWENIIDAE																														
FAMILY OWENIIDAE																														
<i>Owenia fusiformis</i>	1	25									.20	5.00																		
Order PHYLLODOCIDA																														
FAMILY CHRYSOPETALIDAE																														
<i>Bhawania heteroseta</i>													2	50			5	125	2.33	58.33										
FAMILY GLYCERIDAE																														
<i>Glyceridae (LPIL)</i>			2	50							.40	10.00					1	25	.33	8.33					1	25			.25	6.25
FAMILY GONIADIDAE																														
<i>Goniada littorea</i>							1	25			.20	5.00									2	50	3	75					1.25	31.25
<i>Goniadides caroliniae</i>													2	50			7	175	3	75.00										
FAMILY HESIONIDAE																														
<i>Microphthalmus (LPIL)</i>																														
FAMILY NEPHTYIDAE																														
<i>Aglaophamus verrilli</i>			1	25							.20	5.00																		
<i>Nephtys picta</i>																														
<i>Nephtys simoni</i>																														
FAMILY NEREIDAE																														
<i>Nereididae (LPIL)</i>																	1	25	.33	8.33										
<i>Ceratocephale oculata</i>																														
FAMILY PHYLLODOCIDAE																														
<i>Eumida sanguinea</i>																	1	25	.33	8.33										
FAMILY PILARGIIDAE																														
<i>Ancistrosyllis (LPIL)</i>																	1	25	.33	8.33										
<i>Ancistrosyllis hartmanae</i>																	1	25	.33	8.33										
<i>Sigambra tentaculata</i>									1	25	.20	5.00																		
Order SPIONIDA																														
FAMILY CHAETOPTERIDAE																														
<i>Spiochaetopterus oculatus</i>	1	25									.20	5.00															1	25	.25	6.25
FAMILY CIRRATULIDAE																														
<i>Cirratulidae (LPIL)</i>													1	25			1	25	.67	16.67										
<i>Cauleriella sp. J</i>	1	25	2	50			1	25			.80	20.00			1	25			.33	8.33										
FAMILY MAGELONIDAE																														
<i>Magelona (LPIL)</i>	2	50	1	25							.60	15.00																		
<i>Magelona papillicornis</i>					2	50			3	75	1.00	25.00																		
<i>Magelona pettiboneae</i>																														
FAMILY SPIONIDAE																														
<i>Spionidae (LPIL)</i>					1	25					.20	5.00					4	100	1.33	33.33										
<i>Paraprionospio pinnata</i>					1	25					.20	5.00																		
<i>Spiophanes bombyx</i>																														

Table D-1. (continued)

Species List	A1		A2		A3		A4		A5		Mean A		B1		B2		B3		Mean B		C1		C2		C3		C4		Mean C	
	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density
Order TEREHELLIDA																														
FAMILY PECTINARIIDAE																														
<i>Pectinaria gouldii</i>	1	25									.20	5.00																		
FAMILY TEREHELLIDAE																														
<i>Terebellidae (LPIL)</i>																	1	25	.33	8.33										
ARTHROPODA																														
CLASS MALACOSTRACA																														
Order AMPHIPODA																														
Amphipoda (LPIL)																							1	25					.25	6.25
FAMILY AORIDAE																														
<i>Rildardanus laminosa</i>													1	25					.33	8.33										
<i>Unciola serrata</i>																	1	25	.33	8.33										
FAMILY HAUSTORIIDAE																														
<i>Acanthohaustorius intermedius</i>																														
FAMILY ISAEIDAE																														
<i>Microprotopus raneyi</i>																	2	50	.67	16.67										
FAMILY MELITIDAE																														
<i>Maera caroliniana</i>													2	50					.67	16.67										
FAMILY OEDICEROTIDAE																														
<i>Oedicerotidae (LPIL)</i>																							1	25					.25	6.25
<i>Americhelidium americanum</i>																														
FAMILY PHOXOCEPHALIDAE																														
<i>Metharpinia floridana</i>																														
<i>Rhepoxynius hudsoni</i>																					2	50							.50	12.50
FAMILY PLATYISCHNOPIDAE																														
<i>Eudevenopus honduranus</i>																							3	75	3	75	4	100	2.50	62.50
FAMILY SYNOPIIDAE																														
<i>Metatiron (LPIL)</i>																			.33	8.33										
<i>Metatiron triocellatus</i>													1	25					.33	8.33										
Order CUMACEA																														
FAMILY DIASTYLIDAE																														
<i>Oxyurostylis (LPIL)</i>																														
Order DECAPODA																														
FAMILY PAGURIDAE																														
<i>Pagurus (LPIL)</i>																			.33	8.33										
FAMILY PASIPHAIDAE																														
<i>Leptochela serratorbita</i>																														
FAMILY PINNOTHERIDAE																														
<i>Dissodactylus mellitae</i>																											2	50	.50	12.50

Table D-1. (continued)

Species List	A1		A2		A3		A4		A5		Mean A		B1		B2		B3		Mean B		C1		C2		C3		C4		Mean C	
	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density
CLASS OSTRACODA																														
Order MYODOCOPINA																														
FAMILY PHILOMEDIDAE																														
<i>Philomedidae (LPIL)</i>																														
<i>Harbansus paucichelatus</i>																														
FAMILY SARSIELLIDAE																														
<i>Eusarsiella (LPIL)</i>					1	25					.20	5.00																		
<i>Eusarsiella radiicosta</i>																														
<i>Eusarsiella texana</i>									1	25	.20	5.00											1	25			1	25	.50	12.50
Order PODOCOPIDA																														
<i>Podocopida (LPIL)</i>																										1	25	.25	6.25	
BRYOZOA																														
<i>Bryozoa (LPIL)</i>																	1	25	.33	8.33										
CHORDATA																														
CLASS LEPTOCARDIA																														
Order AMPHIOXI																														
FAMILY BRANCHIOSTOMIDAE																														
<i>Branchiostoma (LPIL)</i>																														
CNIDARIA																														
CLASS HYDROZOA																														
<i>Hydrozoa (LPIL)</i>					1	25					.20	5.00																		
ECHINODERMATA																														
<i>Echinodermata (LPIL)</i>																														
CLASS ECHINOIDEA																														
<i>Echinoidea (LPIL)</i>																									2	50			.50	12.50
Order CLYPEASTEROIDA																														
FAMILY MELLITIDAE																														
<i>Mellitidae (LPIL)</i>																														
<i>Mellita isometra</i>																											1	25	.25	6.25
CLASS OPHIUROIDEA																														
<i>Ophiuroidea (LPIL)</i>													2	50	1	25	5	125					2	50	1	25			.75	18.75
Order OPHIURIDA																														
FAMILY AMPHIURIDAE																														
<i>Amphiuridae (LPIL)</i>													1	25					.33	8.33										
MOLLUSCA																														
CLASS BIVALVIA																														
<i>Bivalvia (LPIL)</i>	1	25					1	25			.40	10.00					1	25	.33	8.33										
Order OSTREOIDA																														
FAMILY ANOMIIDAE																														
<i>Anomia simplex</i>																														

Table D-1. (continued)

Species List	A1		A2		A3		A4		A5		Mean A		B1		B2		B3		Mean B		C1		C2		C3		C4		Mean C	
	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density
Order VENEROIDA																														
FAMILY CRASSATELLIDAE																														
<i>Crassinella dupliniana</i>																														
<i>Crassinella lunulata</i>													4	100			6	150	3.33	83.33										
FAMILY LUCINIDAE																														
<i>Lucinidae (LPIL)</i>			2	50							.40	10.00																		
<i>Lucina (LPIL)</i>																														
<i>Lucina multilineata</i>															1	25			.33	8.33										
FAMILY MESODESMATIDAE																														
<i>Ervilia concentrica</i>							1	25			.20	5.00																		
FAMILY MONTACUTIDAE																														
<i>Montacutidae (LPIL)</i>																														
FAMILY SEMELIDAE																														
<i>Semelidae (LPIL)</i>																	1	25	.33	8.33										
FAMILY TELLINIDAE																														
<i>Strigilla mirabilis</i>																														
<i>Tellina (LPIL)</i>			2	50					3	75	1.0	25.00			1	25			.33	8.33			4	100	5	125			2.25	56.25
<i>Tellina iris</i>			1	25							.20	5.00																		
CLASS GASTROPODA																														
Order CEPHALASPIDEA																														
FAMILY SCAPHANDRIDAE																														
<i>Acteocina canaliculata</i>					1	25					.20	5.00													1	25			.25	6.25
<i>Cylichna alba</i>			4	100	1	25					1.0	25.00									1	25					1	25	.50	12.50
Order MESOGASTROPODA																														
FAMILY CAECIDAE																														
<i>Caecum pulchellum</i>													1	25					.33	8.33			1	25	1	25	2	50	1.00	25.00
FAMILY EULIMIDAE																														
<i>Strombiformis bilineatus</i>																														
FAMILY NATICIDAE																														
<i>Tectonatica pusilla</i>																	1	25	.33	8.33										
Order NEOGASTROPODA																														
FAMILY OLIVIDAE																														
<i>Oliva sayana</i>							2	50	1	75	.60	25.00																		
<i>Olivella dealbata</i>																														
FAMILY TURRIDAE																														
<i>Kurtziella atrostyla</i>																														
Order PYRAMIDELLOIDA																														
FAMILY PYRAMIDELLIDAE																														
<i>Odostomia weberi</i>									1	25	.20	5.00																		
<i>Turbonilla (LPIL)</i>																														

Table D-1. (concluded)

Species List	A1		A2		A3		A4		A5		Mean A		B1		B2		B3		Mean B		C1		C2		C3		C4		Mean C	
	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density
PHORONIDA																														
FAMILY PHORONIDAE																														
<i>Phoronis (LPIL)</i>					1	25					.20	5.00					1	25	.33	8.33										
PLATYHELMINTHES																														
CLASS TURBELLARIA																														
<i>Turbellaria (LPIL)</i>													2	50	1	25	1	25	1.33	33.33										
RHYNCHOCOELA																														
<i>Rhynchocoela (LPIL)</i>					1	25					.20	5.00	2	50	1	25			1.00	25.00					1	25			.25	6.25
SIPUNCULA																														
FAMILY ASPIDOSIPHONIDAE																														
<i>Aspidosiphon albus</i>															1	25			.33	8.33										

Table D-2. Species abundance and density at sampling stations within borrow sites D, E, and F off Topsail Beach, NC.

Species List	D1		D2		D3		D4		Mean D		E1		E2		E3		E4		Mean E		F1		F2		F3		F4		Mean F			
	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density		
ANNELIDA																																
CLASS OLIGOCHAETA																																
Order TUBIFICIDA																																
FAMILY ENCHYTRAEIDAE																																
Enchytraeidae (LPIL)																																
FAMILY TUBIFICIDAE																																
Tubificidae (LPIL)																																
CLASS POLYCHAETA																																
Order CAPITELLIDA																																
FAMILY CAPITELLIDAE																																
Capitellidae (LPIL)																																
Mediomastus (LPIL)													1	25					.25	6.25												
Mediomastus californiensis																																
FAMILY MALDANIDAE																																
Maldanidae (LPIL)															1	25			.25	6.25												
Order EUNICIDA																																
FAMILY DORVILLEIDAE																																
Schistomeringos pectinata																																
FAMILY LUMBRINERIDAE																																
Lumbrineris latreilli							1	25	.25	6.25																1	25	.25	6.25			
FAMILY OENONIDAE																																
Arabella multidentata																	1	25	.25	6.25												
FAMILY ONUPHIDAE																																
Onuphidae (LPIL)			1	25					.25	6.25															1	25	1	25	.50	12.50		
Order OPHELIIDA																																
FAMILY OPHELIIDAE																																
Opheliidae (LPIL)													1	25			1	25	.50	12.50	1	25							.25	6.25		
Armandia (LPIL)															1	25			.25	6.25												
Armandia maculata																	2	50	.50	12.50												
Ophelia denticulata																							1	25					.25	6.25		
Order ORBINIIDA																																
FAMILY PARAONIDAE																																
Aricidea (LPIL)							1	25	.25	6.25				1	25				.25	6.25												
Aricidea catherinae																																
Aricidea suecica																1	25		.25	6.25												
Aricidea wassi							1	25	.25	6.25		1	25	2	50																	
Cirrophorus (LPIL)																1	25		.25	6.25												
Order OWENIIDA																																
FAMILY OWENIIDAE																																
Owenia fusiformis	1	25																														

Table D-2. (continued)

Species List	D1		D2		D3		D4		Mean D		E1		E2		E3		E4		Mean E		F1		F2		F3		F4		Mean F		
	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	
Order PHYLLODOCIDA																															
FAMILY CHRYSOPETALIDAE																															
Bhawania heteroseta																								1	25				.25	6.25	
FAMILY GLYCERIDAE																															
Glyceridae (LPIL)											1	25							.25	6.25											
FAMILY GONIADIDAE																															
Goniada littorea			1	25	2	50	1	25	1.00	25.00	3	75			1	25			1.00	25.00					1	25	1	25	.50	12.50	
Goniadides carolinae																								2	50				.50	12.50	
FAMILY HESIONIDAE																															
Microphthalmus (LPIL)																								1	25				.25	6.25	
FAMILY NEPHTYIDAE																															
Aglaophamus verrilli																															
Nephtys picta																											2	50	.50	12.50	
Nephtys simoni																								1	25				.25	6.25	
FAMILY NEREIDAE																															
Nereididae (LPIL)																															
Ceratocephale oculata																	1	25	.25	6.25					1	25	1	25	.50	12.50	
FAMILY PHYLLODOCIDAE																															
Eumida sanguinea																															
FAMILY PILARGIIDAE																															
Ancistrosyllis (LPIL)											1	25							.25	6.25											
Ancistrosyllis hartmanae																1	25		.25	6.25											
Sigambra tentaculata																															
Order SPIONIDA																															
FAMILY CHAETOPTERIDAE																															
Spiochaetopterus oculatus																															
FAMILY CIRRATULIDAE																															
Cirratulidae (LPIL)																									1	25				.25	6.25
Cauleriella sp. J																								1	25				.25	6.25	
FAMILY MAGELONIDAE																															
Magelona (LPIL)																															
Magelona papillicornis			3	75			1	25	1.00	25.00	1	25	2	50	2	50	2	50	1.75	43.75	1	25					1	25	.50	12.50	
Magelona pettiboneae																								1	25				.25	6.25	
FAMILY SPIONIDAE																															
Spionidae (LPIL)					1	25			.25	6.25	1	25							.25	6.25							1	25	.25	6.25	
Paraprionospio pinnata																	1	25	.25	6.25					1	25			.25	6.25	
Spiophanes bombyx			1	25					.25	6.25																					
Order TERESELLIDA																															
FAMILY PECTINARIIDAE																															
Pectinaria gouldii																															
FAMILY TERESELLIDAE																															
Terebellidae (LPIL)																															

[illegible]

Table D-2. (continued)

Species List	D1		D2		D3		D4		Mean D		E1		E2		E3		E4		Mean E		F1		F2		F3		F4		Mean F	
	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density
Order PODOCOPIDA																														
<i>Podocopida (LPIL)</i>																														
BRYOZOA																														
<i>Bryozoa (LPIL)</i>																														
CHORDATA																														
CLASS LEPTOCARDIA																														
Order AMPHIOXI																														
FAMILY BRANCHIOSTOMIDAE																														
<i>Branchiostoma (LPIL)</i>															2	50			.50	12.50	1	25	2	50					.75	18.75
CNIDARIA																														
CLASS HYDROZOA																														
<i>Hydrozoa (LPIL)</i>																														
ECHINODERMATA																														
<i>Echinodermata (LPIL)</i>															1	25			.25	6.25										
CLASS ECHINOIDEA																														
<i>Echinoidea (LPIL)</i>																														
Order CLYPEASTEROIDA																														
FAMILY MELLITIDAE																														
<i>Mellitidae (LPIL)</i>																											2	50	.50	12.50
<i>Mellita isometra</i>																														
CLASS OPHIUROIDEA																														
<i>Ophiuroidea (LPIL)</i>							1	25	.25	6.25			1	25					.25	6.25					2	50			.50	12.50
Order OPHIURIDA																														
FAMILY AMPHIURIDAE																														
<i>Amphiuridae (LPIL)</i>																														
MOLLUSCA																														
CLASS BIVALVIA																														
<i>Bivalvia (LPIL)</i>																														
Order OSTREOIDA																														
FAMILY ANOMIIDAE																														
<i>Anomia simplex</i>																							1	25					.25	6.25
Order VENEROIDA																														
FAMILY CRASSATELLIDAE																														
<i>Crassinella dupliniana</i>															3	75	1	25	1.00	25.00			4	100					1.00	25.00
<i>Crassinella lunulata</i>															2	50			.50	12.50	1	25	2	50					.75	18.75
FAMILY LUCINIDAE																														
<i>Lucinidae (LPIL)</i>			1	25					.25	6.25	1	25	2	50					.75	18.75					2	50	1	25	.75	18.75
<i>Lucina (LPIL)</i>							1	25	.25	6.25																				
<i>Lucina multilineata</i>																	3	75	.75	18.75										
FAMILY MESODESMATIDAE																														
<i>Ervilia concentrica</i>			1	25					.25	6.25																	1	25	.25	6.25

Table D-2. (concluded)

Species List	D1		D2		D3		D4		Mean D		E1		E2		E3		E4		Mean E		F1		F2		F3		F4		Mean F	
	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density	Count	Density
FAMILY MONTACUTIDAE																														
Montacutidae (LPIL)															1	25			.25	6.25										
FAMILY SEMELIDAE																														
Semelidae (LPIL)																														
FAMILY TELLINIDAE																														
Strigilla mirabilis															1	25	1	25	.50	12.50										
Tellina (LPIL)							1	25	.25	6.25			1	25	1	25	1	25	.75	18.75										
Tellina iris																														
CLASS GASTROPODA																														
Order CEPHALASPIDEA																														
FAMILY SCAPHANDRIDAE																														
Acteocina canaliculata					1	25			.25	6.25			2	50	1	25	1	25	1.00	25.00			1	25					.25	6.25
Cylichna alba	1	25																												
Order MESOGASTROPODA																														
FAMILY CAECIDAE																														
Caecum pulchellum			1	25	3	75	3	75	1.75	43.75	3	75	7	175	12	300	2	50	6.00	150.00			1	25	2	50			.75	18.75
FAMILY EULIMIDAE																														
Strombiformis bilineatus													1	25	1	25			.50	12.50										
FAMILY NATICIDAE																														
Tectonatica pusilla															1	25	1	25	.50	12.50										
Order NEOGASTROPODA																														
FAMILY OLIVIDAE																														
Oliva sayana																														
Olivella dealbata																									2	50			.50	12.50
FAMILY TURRIDAE																														
Kurtziella atrostyla																											1	25	.25	6.25
Order PYRAMIDELLOIDA																														
FAMILY PYRAMIDELLIDAE																														
Odostomia weberi																														
Turbonilla (LPIL)																									1	25			.25	6.25
PHORONIDA																														
FAMILY PHORONIDAE																														
Phoronis (LPIL)																														
PLATYHELMINTHES																														
CLASS TURBELLARIA																														
Turbellaria (LPIL)																					1	25						.25	6.25	
RHYNCHOCOELA																														
Rhynchocoela (LPIL)			1	25					.25	6.25			2	50	1	25	1	25	1.00	25.00			3	75				.75	18.75	
SIPUNCULA																														
FAMILY ASPIDOSIPHONIDAE																														
Aspidosiphon albus																														

Table D-3. Biomass for major taxa groups from Topsail Beach, NC, benthic sampling stations.

Station: A1	gm/04 m ²	gm/m ²
Annelida	0.5556	13.89
Mollusca	0.5544	13.86
Arthropoda	0.0000	0
Echinodermata	0.0000	0
Other Taxa	0.0000	0
Total	1.1100	27.75

Station: B2	gm/04 m ²	gm/m ²
Annelida	0.5520	13.8
Mollusca	0.5520	13.8
Arthropoda	0.5481	13.7025
Echinodermata	0.5492	13.73
Other Taxa	0.5491	13.7275
Total	2.7504	68.76

Station: A2	gm/04 m ²	gm/m ²
Annelida	0.6517	16.2925
Mollusca	0.5792	14.48
Arthropoda	0.0000	0
Echinodermata	0.0000	0
Other Taxa	0.0000	0
Total	1.2309	30.7725

Station: B3	gm/04 m ²	gm/m ²
Annelida	0.5665	14.1625
Mollusca	0.5511	13.7775
Arthropoda	0.5513	13.7825
Echinodermata	0.5490	13.725
Other Taxa	0.5595	13.9875
Total	2.7774	69.435

Station: A3	gm/04 m ²	gm/m ²
Annelida	0.5557	13.8925
Mollusca	0.5512	13.78
Arthropoda	0.5484	13.71
Echinodermata	0.0000	0
Other Taxa	0.5490	13.725
Total	2.2043	55.1075

Station: C1	gm/04 m ²	gm/m ²
Annelida	0.5526	13.815
Mollusca	0.5490	13.725
Arthropoda	0.5520	13.8
Echinodermata	0.0000	0
Other Taxa	0.0000	0
Total	1.6536	41.34

Station: A4	gm/04 m ²	gm/m ²
Annelida	0.5620	14.05
Mollusca	0.5712	14.28
Arthropoda	0.5563	13.9075
Echinodermata	0.0000	0
Other Taxa	0.0000	0
Total	1.6895	42.2375

Station: C2	gm/04 m ²	gm/m ²
Annelida	0.5526	13.815
Mollusca	0.5490	13.725
Arthropoda	0.5520	13.8
Echinodermata	0.0000	0
Other Taxa	0.0000	0
Total	1.6536	41.34

Station: A5	gm/04 m ²	gm/m ²
Annelida	0.5517	13.7925
Mollusca	0.5522	13.805
Arthropoda	0.0000	0
Echinodermata	0.0000	0
Other Taxa	0.0000	0
Total	1.1039	27.5975

Station: C3	gm/04 m ²	gm/m ²
Annelida	0.5556	13.89
Mollusca	0.5555	13.8875
Arthropoda	0.5564	13.91
Echinodermata	0.5491	13.7275
Other Taxa	0.5496	13.74
Total	2.7662	69.155

Station: B1	gm/04 m ²	gm/m ²
Annelida	0.5519	13.7975
Mollusca	0.5513	13.7825
Arthropoda	0.5711	14.2775
Echinodermata	0.5760	14.4
Other Taxa	0.5654	14.135
Total	2.8157	70.3925

Station: C4	gm/04 m ²	gm/m ²
Annelida	0.5539	13.8475
Mollusca	0.5496	13.74
Arthropoda	0.5533	13.8325
Echinodermata	21.4873	537.1825
Other Taxa	0.0000	0
Total	23.1441	578.6025

Table D-3. (concluded)

Station: D1	gm/04 m ²	gm/m ²
Annelida	0.5556	13.89
Mollusca	0.5494	13.735
Arthropoda	0.5483	13.7075
Echinodermata	0.0000	0
Other Taxa	0.0000	0
Total	1.6533	41.3325

Station: D2	gm/04 m ²	gm/m ²
Annelida	0.5659	14.1475
Mollusca	0.5491	13.7275
Arthropoda	0.0000	0
Echinodermata	0.0000	0
Other Taxa	0.5492	13.73
Total	1.6642	41.605

Station: D3	gm/04 m ²	gm/m ²
Annelida	0.5658	14.145
Mollusca	0.5493	13.7325
Arthropoda	0.0000	0
Echinodermata	0.0000	0
Other Taxa	0.0000	0
Total	1.1151	27.8775

Station: D4	gm/04 m ²	gm/m ²
Annelida	0.5743	14.3575
Mollusca	0.5495	13.7375
Arthropoda	0.5485	13.7125
Echinodermata	0.5492	13.73
Other Taxa	0.0000	0
Total	2.2215	55.5375

Station: E1	gm/04 m ²	gm/m ²
Annelida	0.5722	14.305
Mollusca	0.5526	13.815
Arthropoda	0.5766	14.415
Echinodermata	0.0000	0
Other Taxa	0.0000	0
Total	1.7014	42.535

Station: F1	gm/04 m ²	gm/m ²
Annelida	0.5520	13.8
Mollusca	0.5513	13.7825
Arthropoda	0.5520	13.8
Echinodermata	0.0000	0
Other Taxa	0.5491	13.7275
Total	2.2044	55.11

Station: E2	gm/04 m ²	gm/m ²
Annelida	0.5546	13.865
Mollusca	0.5545	13.8625
Arthropoda	0.5563	13.9075
Echinodermata	0.5492	13.73
Other Taxa	0.5490	13.725
Total	2.7636	69.09

Station: E3	gm/04 m ²	gm/m ²
Annelida	0.5622	14.055
Mollusca	0.5522	13.805
Arthropoda	0.5563	13.9075
Echinodermata	0.5491	13.7275
Other Taxa	0.5490	13.725
Total	2.7688	69.22

Station: E4	gm/04 m ²	gm/m ²
Annelida	0.5623	14.0575
Mollusca	0.5543	13.8575
Arthropoda	0.5524	13.81
Echinodermata	0.0000	0
Other Taxa	0.5492	13.73
Total	2.2182	55.455

Station: F2	gm/04 m ²	gm/m ²
Annelida	0.6508	16.27
Mollusca	0.5512	13.78
Arthropoda	0.5561	13.9025
Echinodermata	0.0000	0
Other Taxa	0.6559	16.3975
Total	2.4140	60.35

Station: F3	gm/04 m ²	gm/m ²
Annelida	0.6508	16.27
Mollusca	0.5512	13.78
Arthropoda	0.5561	13.9025
Echinodermata	0.0000	0
Other Taxa	0.6559	16.3975
Total	2.4140	60.35

Station: F4	gm/04 m ²	gm/m ²
Annelida	0.5513	13.7825
Mollusca	0.5740	14.35
Arthropoda	0.5490	13.725
Echinodermata	0.5496	13.74
Other Taxa	0.0000	0
Total	2.2239	55.5975