FALL 2005 INNER SANTA CRUZ HARBOR

DREDGE DISPOSAL MONITORING PROGRAM

Prepared for:

Santa Cruz Port District
135 5th Avenue
Santa Cruz, CA 95062

Prepared by:

Sea Engineering, Inc
200 Washington Street, Suite 210
Santa Cruz, CA, 95060
(831) 421-0871

May 12, 2006

EXECUTIVE SUMMARY

Sea Engineering, Inc (SEI) designed and conducted the monitoring program for the fall 2005 inner Santa Cruz Harbor dredging cycle. Inner Santa Cruz Harbor dredging took place between October 12th and October 31st, 2005 between the hours of 6 and 10 pm. An estimated 6,596 CY (5,044 m^3) of sediment composed of approximately 31% sand and 69% silt and clay was placed 50 meters offshore of Twin Lakes Beach. This report presents the fall 2005 monitoring program results and conclusions of all data collected before, during and after dredging took place. These data sets include:

- Beach and offshore sediment sampling
- Water quality measurements
- Beach monitoring observations
- SCUBA diver observations
- Nearshore waves and currents
- Multibeam bathymetry surveys, including GIS based benthic habitat maps
- Numerical modeling

The fall 2005 monitoring program detailed in this report is the third in a series of inner Santa Cruz Harbor dredge monitoring programs spanning over the past five years. The first monitoring program was conducted in the winter of 2001 and the second in the winter of 2005. A comparison of the three monitoring programs is included in this report.
The two winter and one fall 2005 monitoring programs describe two distinct climates in the Santa Cruz Bight, one dominated by high-energy winter storm conditions and the other dominated by low-energy summer conditions.

Despite the drastic differences in the wave and current energy between the fall and winter monitoring programs, the outcome was the same for all three: no significant changes in sediment sample mean grain-size or silt and clay percentage beyond the range of normal background conditions.

Strong evidence collected in three monitoring programs over the past 4.5 years indicates that the Santa Cruz Bight is a high-energy coastline that does not support the deposition of silt and clay sized particles. The evidence includes:

- The absence of increasing or relatively high silt and clay percentages in sediment samples collected in either summer or winter months
- Wide spread shifts in the spatial distribution of benthic habitats, including migrating scour features
- The possibility of a net sediment deficit in the local system
- And sediment bed shear stress calculations indicating that the deposition of particles < 63 µm is unlikely even under low wave conditions

The results indicate that local wave and current energy are more than capable of efficiently transporting not only silt and clay sediment away from the SCH, but sand-sized material as well. This implies that the Santa Cruz Bight could accommodate a larger volume of inner SCH dredge sediment than is currently permitted.

ACKNOWLEDGEMENTS

This report was prepared by Steve Watt, Dr. Craig Jones, and Jason Magalen of Sea Engineering, Inc. with funding from the California Department of Boating and Waterways and the Santa Cruz Port District. Sea Engineering, Inc. would like to thank the Santa Cruz Port District and Harbor Patrol for their help and patience with this project, specifically Port Director Brian Foss, Environmental Quality Manager Alan Romero, Dredging Operations Captain Jim Riley Jr., Harbor Patrol Officer Chuck Izenstark, and Harbormaster Larry White. SEI would also like to thank Kevin Tweed of Bay Marine Services and Jim Christmann of Monterey Bay Canyon Research Vessels, Inc.

Inner Santa Cruz Harbor Dredge Monitoring

Points of contact:

Comments, corrections, or inquiries should be addressed as follows:

Brian Foss
Port Director
Santa Cruz Port District
135 Fifth Avenue
Santa Cruz, CA 95062
Tel: (831) 475-6161
FAX: (831) 475-9558

Alan Romero
Environmental Quality Manager
Santa Cruz Port District
135 Fifth Avenue
Santa Cruz, CA 95062
Tel: (831) 475-6161
FAX: (831) 475-9558

Steve Watt
Marine Geologist
Sea Engineering, Inc.
200 Washington Street, Suite 210
Santa Cruz, CA 95060
Tel: (831) 421-0871
FAX: (831) 421-0875

Craig Jones, PhD
Ocean Engineer
Sea Engineering, Inc.
200 Washington Street, Suite 210
Santa Cruz, CA 95060
Tel: (831) 421-0871
FAX: (831) 421-0875

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1. INTRODUCTION

The Santa Cruz Harbor (SCH), located in the Santa Cruz Bight in northern Monterey Bay, CA, is subject to sediment accumulation in two locations which require dredging, the harbor entrance channel and inner harbor boat slips and waterways. The entrance channel sediment is permitted for surf-zone disposal because of the high sand content (> 80%). High concentrations of silt and clay in the inner harbor sediments have been restricted from surf-zone disposal in the past according to Environmental Protection Agency (EPA) Region IX standards for grain-size disposal (Foss, 1999). This measure is referred to as the "80/20 guideline", which states that dredged (non-toxic) sediment released into the surf-zone must contain at least 80% sand. The concern is that silt and clay sediment may disturb the local wildlife and be retained on local beaches and in nearshore benthic habitats, potentially changing the existing sedimentary conditions and sediment transport properties in the Santa Cruz Bight.

Between October 12 and October 31, 2005 the SCH continued their ongoing effort to maintain and clear the inner harbor of non-contaminated, mixed sand, silt, and clay sediment. This task was accomplished by hydraulically dredging the sediment and piping it offshore of Twin Lakes Beach. Two other similar inner harbor dredging efforts have already occurred, one in the winter of 2001 (Watt, 2003; Watt and Greene, 2003) and the second in the winter of 2005 (Sea Engineering, Inc., 2005). Monitoring programs were performed to determine if the mixed-grained sediment piped offshore was deposited on local beaches or in the nearshore habitats of the Santa Cruz Bight. The results of both the winter 2001 and winter 2005 monitoring programs indicated that beach and offshore sedimentary conditions near SCH were not significantly altered or impacted by the addition of fine-grained sediment from the inner harbor (Watt, 2003; Watt & Greene, 2003; Sea Engineering, Inc, 2005).

Sea Engineering, Inc (SEI) designed and conducted the monitoring program for the fall 2005 inner SCH dredging cycle. This report presents the monitoring program results and conclusions of all data collected before, during and after dredging took place. These data sets include:

- Beach and offshore sediment sampling
- Water quality measurements
- Beach monitoring observations
- SCUBA diver observations
- Nearshore waves and currents
- Numerical modeling calculations
- Multibeam bathymetry surveys, including GIS based benthic habitat maps

In addition to the results of the fall 2005 monitoring program, a comparison will be made between the fall 2005 monitoring program and similar monitoring programs conducted in the winters of 2001 and 2005.

1.1 Local Setting

To monitor an experimental dredging event in an open coastal system such as the Santa Cruz Bight (Figure 1), it is important to understand existing sediment sources, sediment sinks and the forces that drive sediment transport rates. SCH resides within the Santa Cruz Littoral Cell which extends from the Golden Gate Bridge in San Francisco southward to Monterey submarine canyon (Best and Griggs, 1991). The majority of sediment enters the littoral cell through major rivers and local tributaries during winter rainstorms occurring primarily from November to March (Best and Griggs, 1991). While the absolute values for sediment sources, sediment sinks, and sediment transport rates are not fully understood, researchers agree that there is a net deficit of sand in the system (Arnal et al., 1973; Oradiwe, 1986; Best and Griggs, 1991; Eittreim et al., 2002a).

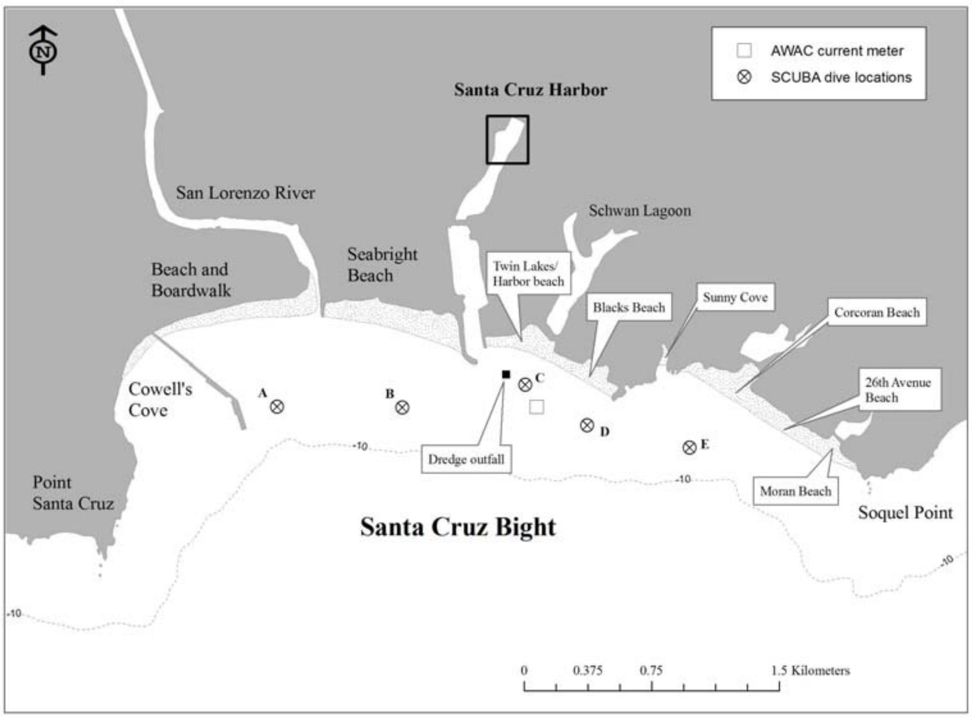


Figure 1. Illustration of the Santa Cruz Harbor, local beaches and offshore regions studied within the Santa Cruz Bight. Major geographic points, rivers, beaches, lagoons, SCUBA dive locations (lettered A-E), current meter (white box), and inner SCH dredging sites (black outline) and dredge outfall are indicated.

Sediments entering the coastal ocean are sorted by the forces of waves and currents based on differences in grain-size, density, and shape (Bascom, 1951). Best and Griggs (1991) determined that sediment in the Santa Cruz Littoral Cell is sorted into two basic categories at a cut-off grain-diameter of 180 µm. Sediments with diameters larger than 180 µm are categorized as littoral sand and sediments with diameters smaller than 180 µm are categorized as fine-sediment. According to the Wentworth classification scale, silt and sand are differentiated at a diameter of 63 µm.

Sediments larger than 180 µm travel in littoral drift or are deposited on beaches in the Santa Cruz Littoral Cell (Best and Griggs, 1991). Best and Griggs (1991) and Eittreim et al (2002) estimate that an average 262,000 CY (200,000 m^3) of sand are transported southeastward past the SCH every year in littoral drift.

Sediments finer than 180 µm either bypass the inner continental shelf in a river flood plume, or are winnowed from the seafloor shortly after deposition by wave or current processes. Fine-grained sediments are transported offshore to the continental shelf where they have deposited in abundance along a midshelf mudbelt (Greene, 1977; Best and Griggs, 1991; Lewis et al., 2002; Edwards, 2002). The mudbelt extends from south of Santa Cruz to north of Half Moon Bay and is up to 30 meters thick on the continental shelf offshore of the San Lorenzo River (Figure 2). The estimated rate of silt and clay accumulation offshore of the San Lorenzo River along the mudbelt is 2.3 mm per year (Lewis et al., 2002).

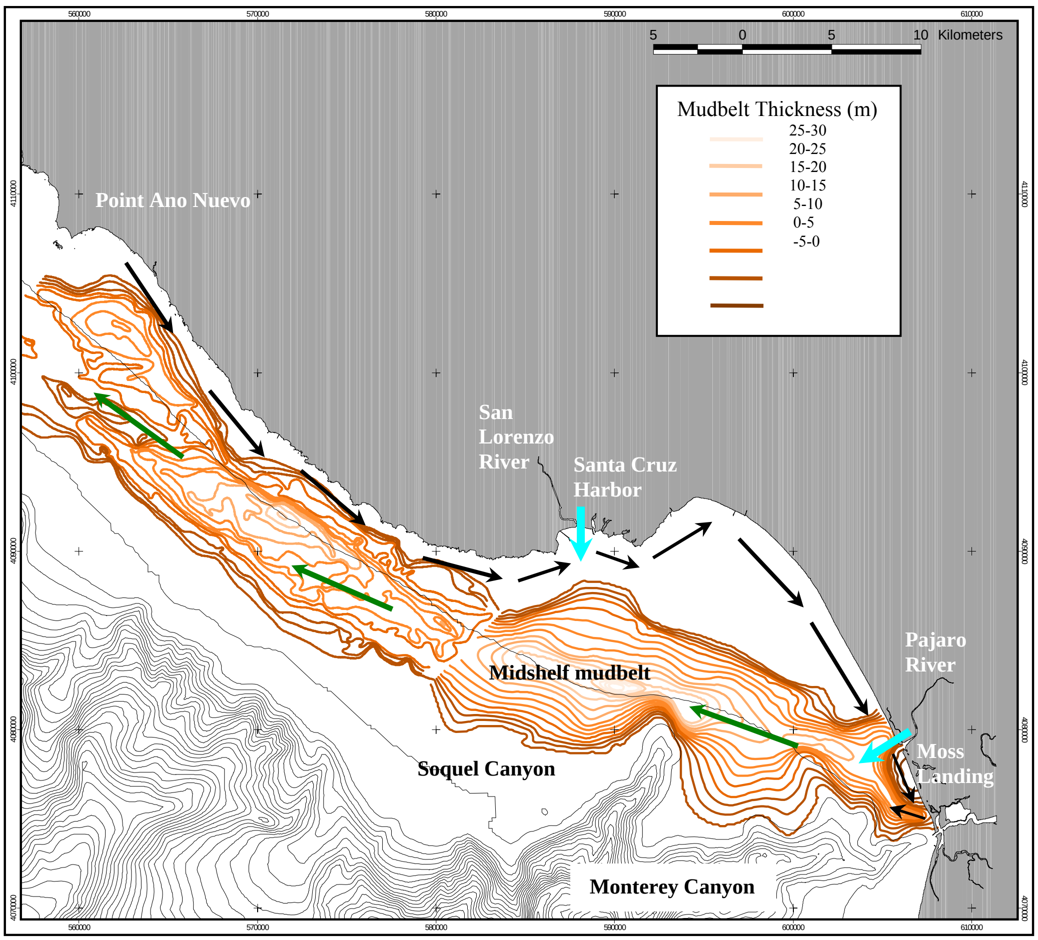


Figure 2. This figure illustrates a conceptual model of sediment transport and accumulation for the northern Monterey Bay shelf from Point Ano Nuevo to Monterey Canyon modified after Eittreim et al. (2002). Orange to brown lines represent the general outline and sediment isopachs (meters of sediment thickness) along the midshelf mudbelt. Green arrows indicate the direction of silt and clay transport along the mudbelt. Blue arrows show discharge of sediment from the San Lorenzo and Pajaro Rivers. Black arrows indicate the direction of littoral drift. Arrows do not indicate transport rates or sediment discharge magnitudes. Black lines are 50 meter bathymetry contours. This figure was reproduced using GIS data from Wong and Eittreim (2002).

2. METHODS

The design of the fall 2005 monitoring program follows the same basic structure used in the previous winter 2001 and winter 2005 monitoring programs; a three phase approach over time to 1) establish a baseline of existing sedimentary conditions before dredging begins, 2) monitor any potential immediate impacts during dredging, and 3) document the sedimentary conditions after harbor dredging was completed.

To accomplish these tasks, a variety of data sets were collected to monitor the dredging event before, during and after dredging took place. Waves and currents were recorded near the dredge outfall, local beaches and locations on the seafloor offshore were visually documented and sampled to track potential changes in sediment grain-size, seawater turbidity measurements were recorded offshore, two separate multibeam surveys were conducted and used to produce benthic habitat maps offshore of the SCH before and after dredging, and a numerical model was developed to approximate the sediment transport regime offshore of the Santa Cruz Bight while dredging occurred.

2.1 Waves and currents

Nearshore sediment transport in the northern Monterey Bay is driven by waves and wave induced currents (Best and Griggs, 1991; Breaker and Broenkow, 1994; Xu, 1999; Xu et al. 2002). To understand waves and currents during the monitoring program, water surface elevation and vertical current profiles were measured offshore of the SCH just east of the dredge outfall (Figure 1). A Nortek Acoustic Wave and Current (AWAC) profiler was deployed from the RV *Shana Rae* on 10/07/2005 and was recovered on 11/07/2005. These data were not only useful in describing the oceanographic climate offshore of SCH during the monitoring program but were used for development and verification of a preliminary sediment transport model described in section 2.6.

2.1.1 AWAC set-up

The AWAC was deployed on a bottom-mounted frame ~ 7 m below Mean Lower Low Water (MLLW). The instruments three transducers pointed upwards and were situated 0.95 m above the seafloor. The profiler measured the currents in the water column in user-specified bins (described below). The AWAC also had the ability to track the water surface elevation variation with the Acoustic Surface Tracking system (AST). This system transmitted a short acoustic pulse and measured the reflected signal from the air-water interface. The maximum output rate for current measurements was 1 Hz. The output rate of the AST was 2 Hz.

During this deployment, current data were collected in 3-minute bursts, with a new burst interval beginning every 5 minutes. Current profile data were time averaged after each 3 minute burst and recorded. A schematic of the instrument deployment is shown in Figure 3.

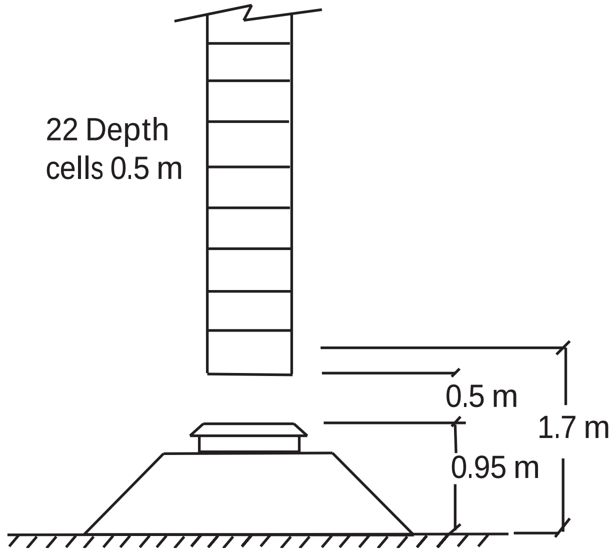


Figure 3. AWAC deployment schematic.

The user-defined specifications for the AWAC system profile bins, as used, are listed in Table 1. The profile was separated into 22 bins of 0.5 m height each. The profiler requires a separation distance between transducers and the first bin, a blanking distance, to be specified. This separation allows the system to recover after transmitting a pulse. The blanking distance used for this project was 0.5 meters.

Parameter	Value
Sampling interval	180 seconds
Number of cells	22 cells
Vertical cell size	0.5 meters
Blanking distance	0.5 meters

Table 1. AWAC current meter settings

Water surface elevation measurements were time-averaged over a 17 minute burst. Wave heights were determined through a combination of AST water surface measurements, orbital velocity measurements and pressure measurements. The higher sampling rate of the AST (compared the rate used to measure currents) enhanced predictions of wave heights that might otherwise be lost. Details of the measured wave parameters and the instrument sampling parameters are listed in Table 2. The burst interval is defined as the period between successive bursts.

Instrument	Sample Frequency	Burst Length	Burst Interval	Wave parameters
AWAC	1 Hz	3 min	5 min	Current velocity, temperature, pressure, instrument orientation
AWAC-AST	2 Hz	17 min	60 min	Wave height, wave period, wave direction

Table 2. Summary of instrument sampling parameters

Eastings and Northings (ENU) were used as the coordinate system for this project. This directs the v-velocity component towards true North (0º) and the u-velocity component towards the east (90º). The directions were corrected for magnetic declination (a value of 14.5°, determined from the NOAA National Geophysical Data Center for the SCH location) during post-processing. For the remainder of this report, current directions denote the direction towards which flows are traveling and wave directions denote the direction from which waves are approaching.

2.1.2 Data processing and quality control

The current meter data was processed by Nortek AWAC-AST software. Current magnitudes and directions were analyzed as depth averaged velocities, computed from the v (northward directed) and u (eastward directed) components. Depth-averaging the currents provided a broader perspective of the mean flows in the region.

Wave statistics were extracted from the raw data using Nortek WaveExtract software. Parameters such as significant wave heights, wave periods and directional and frequency spectra were output by the program. The directional spectrum was computed through a Maximum Likelihood Method (MLM) (Nortek AS, 2004). This method incorporates the three spatially separated velocity measurements (from the three beams of the AWAC) as well as the AST measurement to determine a wave direction for each wave frequency.

2.2 Beach monitoring and sediment sampling

2.2.1 Beach monitoring

During the dredging period from October 12th to November 1st, local beaches from the east jetty at Harbor Beach to Moran Beach were monitored twice daily to identify any potential immediate impacts that upper harbor dredging may have caused (Figure 1). A transect parallel to the shoreline was walked along the high tide berm beginning at 5:00 pm before dredging activity began and again at 7:00 am the following morning.

SEI beach monitoring personnel observed, logged, and photographed any potential notable phenomena deposited on beaches or close to shore such as organic debris, inorganic debris, and distressed wildlife. Any significant impacts observed by the SEI monitor were immediately reported to the Port District's Environmental Quality Manager who determined if dredging operations should be shut down.

2.2.1 Sediment sampling

Three sediment sampling events were conducted on the beach and offshore of the SCH over the monitoring period from October 4th to November 14th, 2005. Each of the three events consisted of fourteen offshore sediment samples and eight beach sediment samples, for a total of 22 samples per event and 66 samples overall (Figure 4).

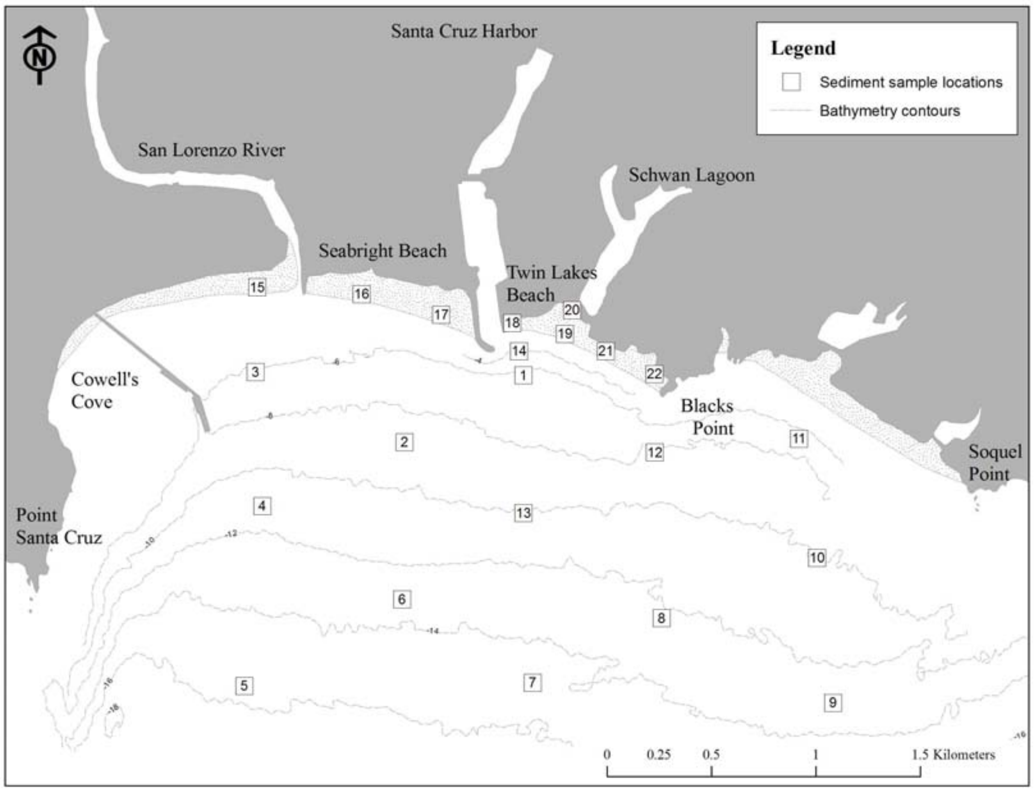


Figure 4. Sediment samples collected within the Santa Cruz Bight during the fall 2005 monitoring program are numbered in this map. Seawater turbidity measurements were collected concurrently at all offshore sampling locations (sample locations 1 through 14).

Beach sample collection

With the exception of sediment sample 20 near Schwan Lagoon, beach sediment samples were collected along, or slightly above, the high tide berms of beaches from the San Lorenzo River mouth to Blacks Point (Figure 4). The high tide berm was sampled because it is the most likely place for sediment to deposit on beaches during the monitoring period (Bascom, 1951). Sample sites were relocated to the position of the high tide berm for each individual day of sampling. The greatest number of beach sediment samples were located on Twin Lakes Beach because of the proximity to the dredge outfall. Changes in beach morphology or any other potential notable phenomena visibly deposited on beaches or close to shore were observed, logged, and photographed.

Offshore sample collection

Offshore sample locations were selected based on the results of the winter 2001 and winter 2005 monitoring programs (Watt, 2003; Watt & Greene, 2003; SEI, 2005). Exposed rock outcrops mapped in 2001 were avoided to increase the likelihood of retrieving sediment samples. GPS was used to locate the pre-determined offshore sample locations aboard the Port District's Harbor Patrol Vessel HP1 and SEI's RV *Eileen*. A petite ponar grab sampler was hand-deployed from the vessel to obtain surficial seafloor sediment samples. In order to compensate for the impossibility of resampling an exact location on the seafloor, designated sample locations were occupied and position coordinates recorded as soon as possible after the sediment grab sampler reached the seafloor.

Sediment sample processing and analysis

Sediment samples were processed by SEI using a Beckman Coulter LS 13320 laser particle analyzer. The instrument detects particles ranging from 0.04 to 2000 μm in diameter (clay to very-coarse-sand) and calculates a volume sediment distribution from the laser diffraction pattern of sediment particles. The laser diffraction technology utilized by the Beckman Coulter LS 13320 provides a state of the science estimation of grain-size distribution and an increased sensitivity to silt and clay sized particles critical to this study (compared to sieving methods). This study focuses on the mean grain diameter and the percentage of silt and clay present in each individual sediment sample.

If there were lasting sedimentary changes due to the addition of fine-grained sediment, grain-size analyses would indicate decreases in sediment sample mean grain-size and increases in silt and clay percentages over time. Changing or recurring sediment parameters on the seafloor can also provide clues about the environments in which they are deposited. Exposure to wave or current energy, dispersal of sediment from local sources, and water depth are a few of the factors which dictate the range of sediment sizes that may be deposited in a particular area. For example, non-cohesive, small diameter particles (such as silt and clay) are more easily transported by wave and current energy than larger sand-sized particles (Folk, 1974). Therefore, high percentages of silt and clay would not be expected in beach or near surf-zone sediment samples. Furthermore, identifying the locations of recurring, relatively high silt and clay percentages could indicate a sedimentary environment less exposed to wave or current energy.

2.3 Observational SCUBA diving

SEI SCUBA divers, aboard either the RV *Shana Rae* or SEI's RV *Eileen*, occupied and visually documented five offshore locations before, during, and after dredging (Figure 1). The SCUBA divers observed, logged, and photographed any notable phenomena visible in the water column or on the seafloor including organic debris, inorganic debris, and distressed wildlife. SCUBA diver observations were also used to verify seafloor substrate types when producing benthic habitat maps and compared with seawater turbidity measurements.

2.4 Seawater turbidity

An YSI 6920 Environmental Monitoring System manufactured by YSI Incorporated was used to record turbidity in the Santa Cruz Bight over the monitoring period. The YSI 6920 was calibrated and deployed according to the manufacturer's specifications to ensure data quality and accuracy. Turbidity measurements (in nephelometric turbidity units or NTU) were collected concurrently at all offshore sediment sampling locations before, during, and after dredging (Figure 4). Real-time turbidity measurements were recorded near the sea surface and at 1 meter depth intervals until reaching the seafloor at each sample location.

2.5 Multibeam bathymetry surveys and benthic habitat mapping

2.5.1. Multibeam bathymetry surveys

Two separate multibeam bathymetry surveys were conducted in the Santa Cruz Bight before and after inner SCH dredging for two specific purposes, 1) to identify and map the benthic habitats in the Santa Cruz Bight and resolve any changes that may have occurred due to harbor dredging 2) to provide detailed bathymetric data for input into a numerical model. The before dredging survey was conducted aboard SEI's RV *Eileen* and the after dredging survey aboard the RV *Otter*. Both vessels were equipped with a pole mounted Kongsberg SIMRAD EM 3002 shallow water multibeam echo sounder. The 300 kHz EM 3002 is ideal for shallow water conditions (1-150 meter depth range) with a depth resolution of 1 cm in ideal flat water conditions. With a ping rate of 40 Hz and a maximum of 254 soundings per ping, dense seafloor coverage is achieved allowing complex underwater features to be mapped in high resolution and with precision. In addition to bathymetric soundings, the EM 3002 provides an acoustic backscatter image of the seafloor. Backscatter imagery is similar to imagery produced by side-scan sonar, highlighting changes in sediment texture and rock outcrops on the seafloor. Differential GPS (DGPS) vessel positioning for both before and after dredging multibeam surveys were obtained using a Trimble AG DGPS. Vessel motion data (heave, pitch, and roll) during the before dredging survey were acquired for each depth sounding using a TSS DMS05 dynamic motion sensor. Vessel heading was acquired using a TSS Meridian Gyrocompass. In the second survey, heave, pitch, roll and heading were all acquired using an F-180 CodaOctopus. The velocity of sound in seawater was measured at least twice during a typical day of surveying using either a Sea-Bird SBE 19 CTD or an Odom Digibar Pro. The speed of sound in seawater, raw multibeam echo sounder depths, vessel motion, vessel heading, and DGPS data were logged and synchronized using Kongsberg's Seafloor Information System (SIS) hydrographic surveying software.

The planned survey area covers ~ 7 km^2 from Point Santa Cruz to Soquel Point (Figure 5). The bathymetric multibeam data were edited line-by-line using CarisHIPS 5.4® to produce WGS 84, UTM Zone 10 geo-referenced artificial sun-shaded images and 1-meter resolution XYZ ASCII text files in northings, eastings, and depth values in meters below MLLW. The ASCII text files were gridded using nearest neighbor statistics to 2-meter pixel size using ArcGIS 9.1®. The 2-m grids were used to create bathymetric contours, sun-shaded imagery, and to produce maps for visual interpretation and presentation. Acoustic backscatter data were processed to 25 cm and 50 cm resolution using CarisSIPS 5.4®. The final geo-referenced seafloor mosaics (WGS 84, UTM Zone 10) were exported to ArcGIS 9.1® to produce maps for visual interpretation and presentation.

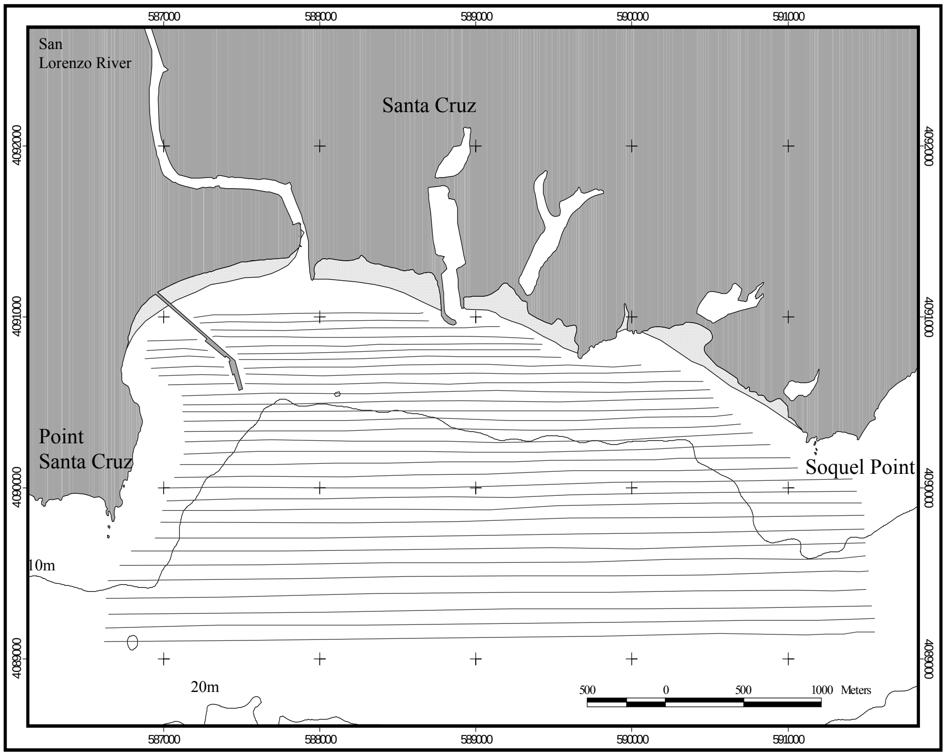


Figure 5. Planned track lines for multibeam bathymetry surveys conducted before and after dredging.

2.5.2 Benthic habitat mapping and sediment shift map

Artificially sun-shaded multibeam bathymetry and acoustic backscatter imagery, physical quantitative sediment sample data, and SCUBA diver observations were used to visually classify the seafloor imagery into two separate benthic habitat polygon layers in GIS, one representing the before dredging seafloor and one representing the after dredging seafloor. An area analysis calculated the area (m^2) and percent cover of each benthic habitat type mapped for each survey in the Santa Cruz Bight.

Before and after dredging benthic habitat maps were compared to one another to quantify changes in sediment distribution on the seafloor surface that occurred between the times of two surveys using the Spatial Analyst extension in ArcView9.1®. To compare the two separate habitat maps in GIS, each habitat type was assigned a unique numeric code to represent a specific before or after dredging habitat type. Before and after dredging benthic habitat polygon layers were converted to separate 2-m resolution raster images based on the numeric codes specific to each before and after dredging habitat type. These two numerical habitat rasters were added together using the ArcGIS raster calculator resulting in a new raster containing new numeric values indicating where habitats have changed or stayed the same over the time between the two surveys. Depending on the change in habitat types between the two surveys, erosion or deposition was inferred. For example, if a rocky habitat in the before dredging survey shifted to a sandy habitat in the after dredging survey, it is assumed that sand was deposited over the exposed bedrock during the time between the two surveys. Using this methodology, a sediment shift map was produced to highlight and quantify areas of erosion and deposition of sediment that occurred between the two multibeam surveys.

When comparing two different interpretations of seafloor imagery it is extremely important to know as much as possible about the multibeam data: how it was collected, what type of system was used, under what oceanographic conditions, how it was processed, how it was gridded and to what resolution, and the direction of artificial sun illumination. Preferably, all of these parameters would be identical between the two different surveys to provide the best possible accuracy for a sediment shift area estimate. The seafloor imagery interpreted in this study meets those criteria with the added bonus of having the same interpreter for both sets of data. However, even under the most desirable circumstances, a reasonable amount of error must be assumed when visually interpreting seafloor imagery. After considering DGPS positional accuracy, multibeam image resolution, and human interpretation errors, any polygon in the sediment shift map that had an area of 10 m^2 or less, was not counted as a sediment shift and was included in the "no habitat change" category.

2.6 Preliminary numerical modeling

Sediment plume transport and mixing in coastal waters is a complex process that depends on the characteristics of the discharge outlet, as well as those of the ambient receiving waters. The discharge of a dredge plume in the SCH region is transported and dispersed due to coastal waves and currents. Sediments discharged from the dredge will remain available for transport due to currents as long as the bottom shear stress due to waves and currents in the area remains high enough to keep the sediments resuspended. When the shear stress drops below the critical shear stress for any given sediment, the sediment will begin to deposit to the sediment bed.

The goal of the numerical modeling was to evaluate the potential for deposition of fine material (< 63 μm) introduced to the coastal region through the SCH dredge discharge. Circulation and mixing in the SCH region are controlled by a combination of winds, tides and waves. During large wave events, the wave effects can dominate the nearshore currents and mixing. The modeling approach was structured to capture complex wave induced currents and mixing, as well as tide and wind-driven currents. The approach required the use and integration of both a wave model, and a transport/circulation model. The final model results were used to determine the transport characteristics of a nearshore plume wave and calculate bottom shear stresses throughout the region to determine the potential for sediment deposition.

2.6.1 Wave Model

The wave model REF/DIF, developed at the Center for Applied Coastal Research at the University of Delaware, is a wave propagation model that is used to calculate the change in wave characteristics due to refraction and diffraction as the wave progresses from deepwater to the shoreline. REF/DIF calculates zones of wave breaking, wave heights, wave direction, and wave energy dissipation. These are then used to drive nearshore mixing and transport in the hydrodynamic model.

2.6.2 Hydrodynamic Model

The hydrodynamic model used, EFDC (Environmental Fluid Dynamics Code), is an EPA approved, state of the science, three dimensional hydrodynamic model developed at the Virginia Institute of Marine Science by John Hamrick (1996) to simulate hydrodynamics and water quality in rivers, lakes, estuaries, and coastal regions. The EPA describes the model as "one of the most widely used and technically defensible hydrodynamic models in the world." This model was selected because it has the following capabilities:

- The model is 3-dimensional, which allows for the simulation of variations in current structure in the vertical as well as horizontal.
- It allows input of nearshore wave radiation stresses and wave energy dissipation for simulation of surf zone circulation and transport.
- The model incorporates complex bathymetry.
- The model allows input of time varying flows, winds, water levels, and discharges.
- Discharges are easily input and configured to represent multiple dredge discharge configurations.

To accurately model the transport of sediments in the coastal environment, it is critical to describe both the transport and the bottom shear stress. Currents are responsible for overall transport. The advective transport flux (q) can be quantitatively calculated by the mass concentration, C, of the substance of interest multiplied by the velocity, u, yielding q = uC. The advective flux generally accounts for the majority of transport in coastal systems. The nearshore currents move masses around much more rapidly than diffusive processes. In the SCH region, EFDC handles advective transport through the water column velocities. These velocities are a result of tidal forces, wave forces, and wind.

Diffusive transport is due to molecular and turbulent transport processes. The molecular component is dispersion of a dissolved mass caused by the random motion of molecules in the water. The turbulent component of diffusion is the dispersion of mass due to the random motions in the fluid associated with turbulent flow. In coastal systems, turbulent diffusion generally exceeds molecular diffusion rates by many orders of magnitude.

When described mathematically in one dimension, the summation of the advective and diffusive components of mass transport into a mass flux (i.e. transport, q) term is

$$q = uC - K\frac{\partial C}{\partial x}$$

The second term is where the diffusive transport is quantified and K is the coefficient of turbulent diffusivity. The determination of K is a key component of mass transport and must be considered carefully. The diffusivity must be described in both the vertical and horizontal directions.

Turbulent eddies are responsible for mixing fluid in the horizontal. Larger eddies can mix more fluid. In general, the horizontal diffusivity (KH) responsible for the dispersion of freshwater and/or sediments, is proportional to the velocity in the fluid and the physical size of the eddies. EFDC uses the Smagorinsky (1963) method to calculate the horizontal diffusivity. The magnitude of the diffusivity in the model is proportional to the horizontal current shear. The Smagorinsky model has been well validated in coastal modeling studies over the past three decades. In addition to the diffusivity due to the current shear, wave dissipation plays a role in KH. As waves move into shallow water regions, they disperse energy in the form of turbulence. This can be calculated as the wave dissipation. The dissipation of wave energy through the generation of turbulence increases as the wave shoals and is at a maximum as the wave breaks. This dissipation is calculated in the REF/DIF model and used as an input to EFDC. The wave dissipation acts as another source of turbulence and is hence added to the KH determined from the currents in the Smagorinsky model.

Vertical mixing is the product of not only current gradients in the vertical, but also buoyancy gradients. EFDC implements the Mellor and Yamada (1982) second moment turbulence closure model in the vertical that has been well validated for coastal ocean applications. The model as implemented in EFDC has been improved and further validated by Galperin et al. (1988). The Mellor and Yamada model relates vertical turbulent diffusivity to turbulent intensity, turbulent length scale, and the Richardson number (a measure of the buoyancy effects in the flow). Once the vertical diffusivity has been calculated through the Mellor and Yamada model, the wave dissipation from the REF/DIF model is added in as a source of turbulence. The wave dissipation has a much larger relative effect in the vertical than the horizontal mixing and is responsible for significant vertical mixing.

Bottom shear stress, τ_b, is produced at the sediment bed as a result of friction between moving water and a solid bottom boundary. Shear stress is denoted as force per unit area (i.e., dynes/cm^2). It has been studied in detail for currents and waves, and can be defined and quantified mathematically given sufficient information about the hydrodynamics of the system. Shear stress is responsible for the initiation of sediment transport (i.e., erosion) and the ability of the flow to keep sediments in suspension. The calculation of shear stress in areas such as the SCH region where waves play a large role are outlined in more detail in Christoffersen et al. (1985), and Grant et al. (1979). The wave and current generated bottom shear stresses are calculated in this effort using the Christoffersen et al. (1985) formulation.

The overall modeling approach has limitations which include:

- It is a simplification of a turbulent, chaotic nearshore process.
- Waves are approximated by a single period
- Salinity and temperature gradients are not included at the offshore boundaries.
- No offshore boundary measurements of currents are available for incorporation into the model.

Even though the above limitations are considered when assessing the results, this methodology produces good approximations of transport due to the dominant nearshore processes in the region (i.e. waves and tides). These results are used to develop qualitative conclusions about the transport of dredge plumes in the region whose validity are based on quantification of the dominant processes.

2.6.3 Model setup and inputs

Model Domain and Grid

Both EFDC and REF/DIF require input of the regional coastal bathymetry. The bathymetry used for the model in the project area is derived from high-resolution multibeam bathymetric data described in detail in section 3.5. Bathymetry is represented in the numerical model through the creation of a grid and the specification of depth at each grid point. The model grid dimensions are a tradeoff between desired resolution and computer computation capability. Figure 6 shows the EFDC model grid and a color-coded representation of bathymetry overlain on the model grid. The grid cell size is 50 meters on a side, and the overall grid dimensions are 152 grid cells in the alongshore direction (Point Santa Cruz to Soquel Point) and 182 in the onshore-offshore direction (7,500 meters by 5,000 meters). The grid extends 4,000 meters to the west and 3,600 meters to the east of the dredge discharge site. Vertical variability in the water is modeled by dividing the water column into five layers whose thickness is a percentage of the total water depth, as shown in Table 3 below. Figure 7 shows the depth variable vertical model grid along a cross-shore section from the SCH to the offshore boundary.

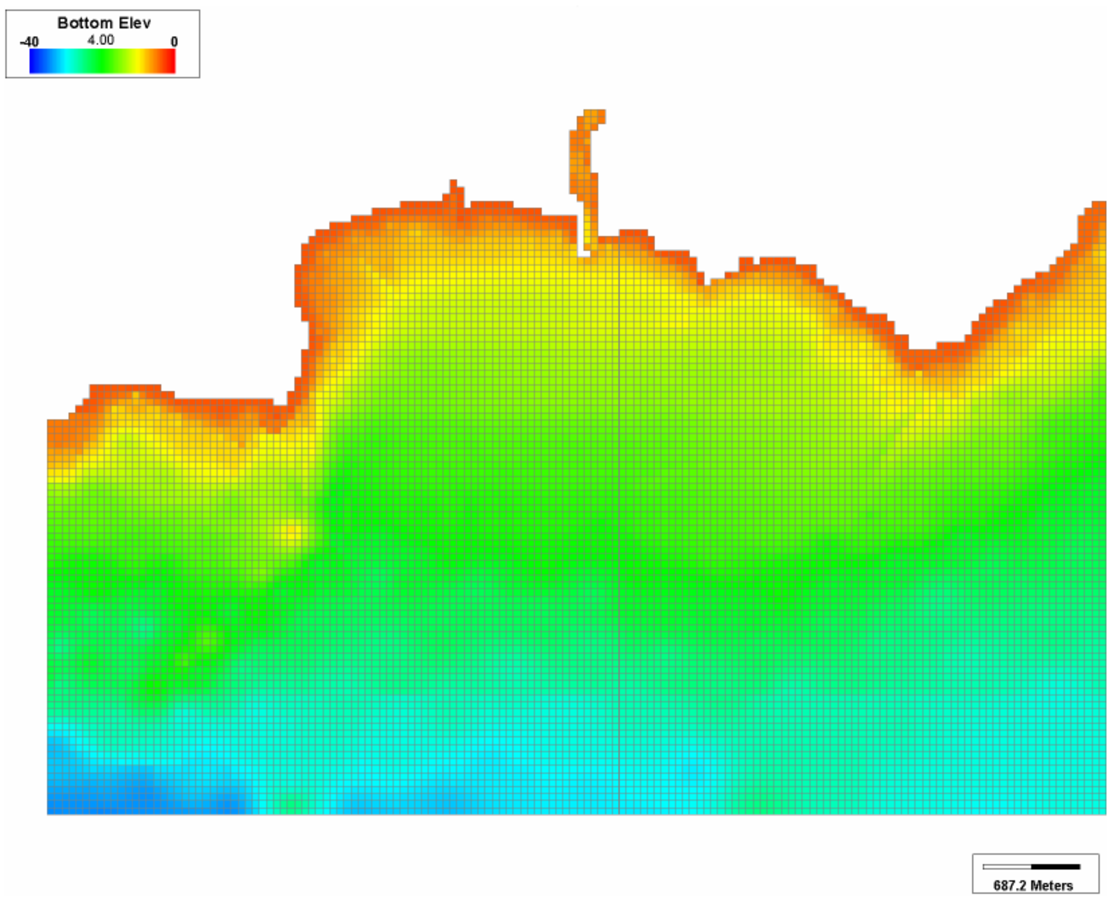


Figure 6. Model grid and color-coded bathymetry

Layer	Thickness (percentage of total depth)
5 (surface)	20.0
4	20.0
3	20.0
2	20.0
1 (bottom)	20.0

Table 3. Thickness of vertical grid elements

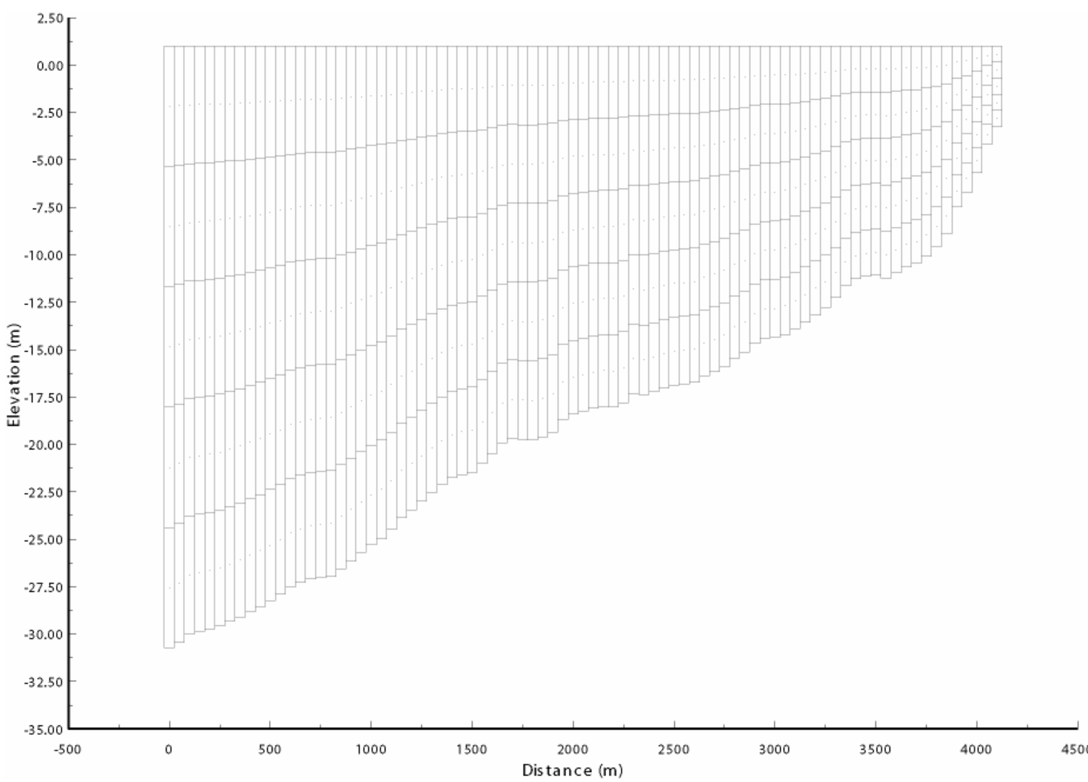


Figure 7. Vertical cross-section of model grid from the SCH (right) to the southern offshore boundary (left).

Water Level

The tidal water level variations corresponding to the conditions measured in October and November 2005 were used as model boundary conditions. The water level was applied along the east boundary of the grid. The tidal water level variations were determined from the NOAA CO-OPS values for tides in the Santa Cruz region. Additionally, from the CO-OPS tidal information and the measured currents information (section 3.1) tidal propagation along the Santa Cruz coast was determined to typically be from east to west; therefore a tidal lag time was applied to the water levels along the west model boundary.

The tidal lag time can be calculated as the time for the tide to travel along the model domain. The tidal speed is equivalent to the shallow water wave speed for the region. Using the average model domain depth, h, of 15 m the tide speed, c, can be calculated from:

$$c = \sqrt{gh}$$

The shallow water wave speed equation yields a speed of 12 m/s. The tide moving at 12 m/s from east to west takes approximately 10 minutes. This tidal lag was applied to the tidal water level data along the west model boundary to drive alongshore tidal flow in the region. Figure 8 shows the tides for the east and west boundary for the months of October and November 2005.

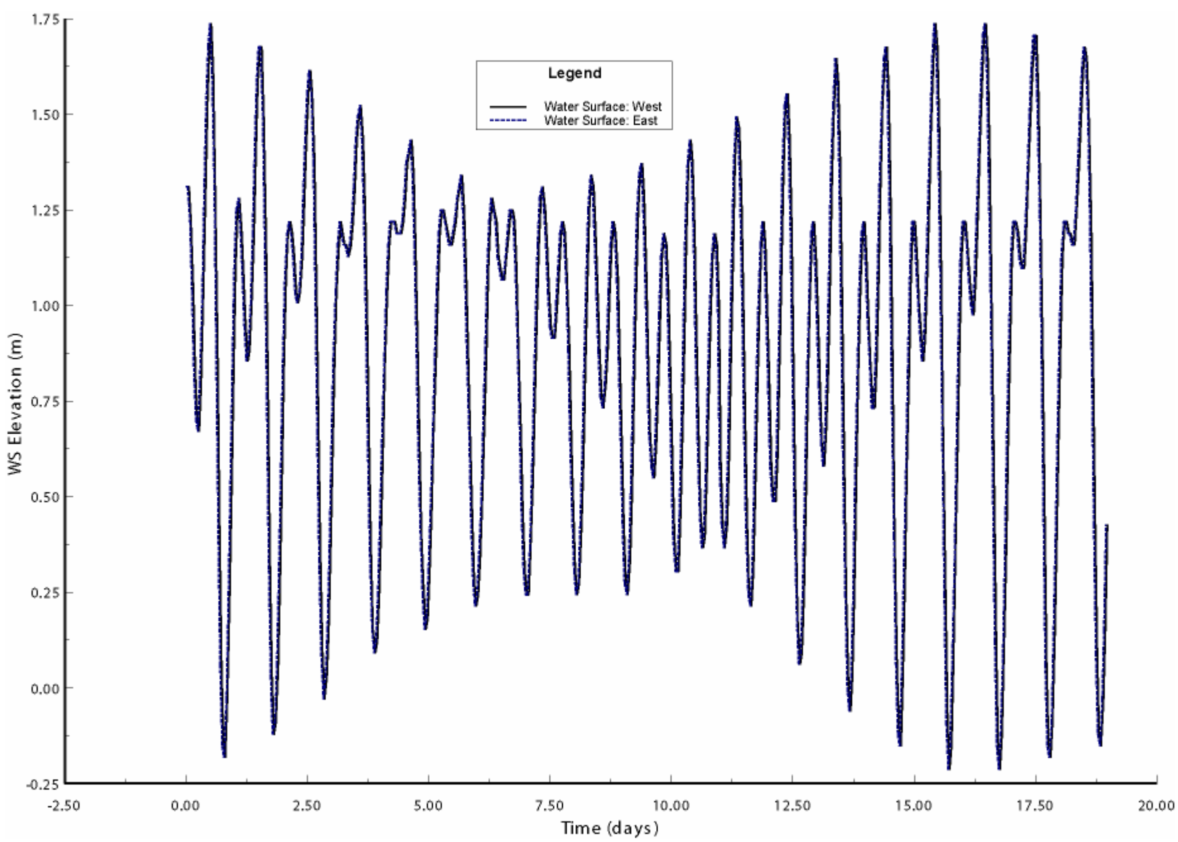


Figure 8. Tidal water levels from October 19th (day 0) through November 6th (day 18), 2005 applied at west and east offshore boundaries.

Wind

Wind conditions over the model region were assumed to be equivalent to the conditions measured at the NOAA NDBC buoy # 46042. The wind conditions at the buoy are presented in section 3.1. The hourly measured wind speed and direction from the buoy was applied over the entire model domain for the month of October.

Waves

Waves are an important factor driving nearshore currents in the SCH region. In this modeling analysis, therefore, great effort was focused on incorporating the effects of waves into the EFDC transport model. This was accomplished by utilizing the wave model REF/DIF to transform the prevailing deep-water waves as they move into the nearshore waters at the project site. REF/DIF computes the nearshore wave direction, wave height, radiation stresses, and energy dissipation at each grid point in the model area. These parameters are then input into EFDC to drive nearshore currents and mixing.

Dredge Discharge

The dredge discharge scenarios were developed from the actual dredging operations at SCH during October 2005 – and included the following characteristics:

- Dredging occurred between 6 pm and 10 pm on any given day.
- The discharge rate was assumed to be at the maximum possible rate of 1 m^3/s (15,000 gpm).
- The material released from the discharge was at a concentration of 10,000 mg/L.

The discharge characteristics represent the approximate maximum for dredging discharge, meaning that any given dredging event is generally releasing less material into the nearshore.

Total suspended sediment (TSS) loads were approximated by a neutrally buoyant dye discharged at the rate and concentration listed above. Since the dye is neutrally buoyant, it will reflect the maximum transport extents for the dredge material in the 48 hour period simulated in the model.

To evaluate the maximum potential for the deposition of the fine dredge material in any location of plume transport, the silt particle size diameter is assumed to be coarse silt at 63 μm. The corresponding settling velocity for a particle of that diameter is 0.21 cm/s. The critical shear stress for a coarse silt particle is approximately 1 $dyne/cm^2$ (Gelfenbaum and Smith, 1986). Therefore, a coarse silt particle would not be expected to deposit onto the sediment bed at any shear stress greater than 1 $dyne/cm^2$.

3. RESULTS

Inner SCH dredging took place between October 12th and October 31st, 2005 between the hours of 6 and 10 pm. The harbor dredging logs estimate that 6,596 CY (5,044 m^3) of sediment were removed from locations S-2, 6, 7, 8, 9, and 10 in the inner harbor (Figure 9). Grain-size results from sediment cores collected in the locations above indicate that the inner harbor has wide ranging differences in sedimentary composition. Location S-2 was composed of 67.0% sand and 33% silt and clay, while location S-10 was composed of 5.2% sand and 94.8 % silt and clay (RHE, Inc., 2005). Based on the percentages listed in Table 4, 2,034 CY (1,555 m^3) of the dredged harbor sediment was composed of sand (30.8 %) and 4,563 CY (3,488 m^3) was composed of silt and clay (69.2%). The sediment was placed ~ 50 meters offshore of Twin Lakes Beach (see Figure 1).

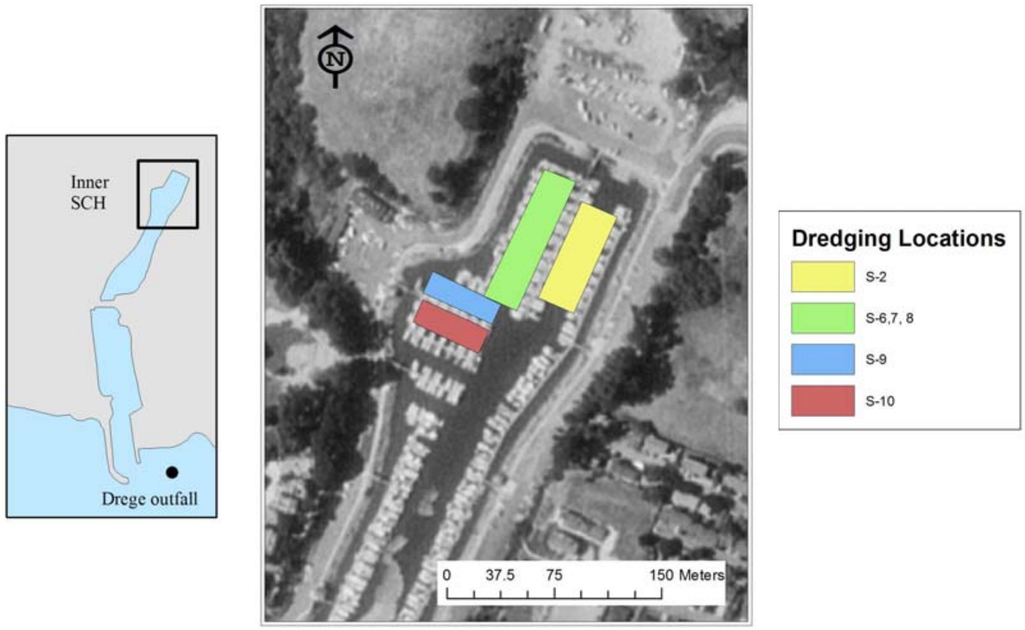


Figure 9. This figure illustrates the dredging areas in the inner SCH during the fall 2005 monitoring program.

Location	Total Volume Dredged		Sand composition		Silt & Clay composition		% Sand	% Silt & Clay
	CY	m^3	CY	m^3	CY	m^3		
S-2	1,479	1,131	991	758	488	373	67.0	33.0
S-6,7,8	3,150	2,408	905	692	2,245	1,716	28.7	71.3
S-9	910	696	83	63	827	632	9.1	90.9
S-10	1,058	809	55	42	1,003	767	5.2	94.8
Totals	**6,596**	**5,044**	**2,034**	**1,555**	**4,563**	**3,488**	**30.8**	**69.2**

Table 4. This table quantifies volumes and sediment compositions of the areas dredged in the inner SCH over the fall 2005 monitoring program (RHE, Inc., 2005).

3.1 Waves and currents

Water surface elevation and vertical current profiles were measured near the SCH during the fall of 2005 monitoring program using a Nortek Acoustic Wave and Current (AWAC) profiler. The AWAC profiler was deployed from 10/07/2005 and was recovered on 11/07/2005. During the period of deployment, the AWAC successfully recorded wave and current data from 10/17/2005 to 11/07/2005. Due to an installation error AWAC wave and current data from 10/7 to 10/16 were not recorded.

3.1.1 Data quality control

The data were processed with Nortek's AWAC WaveExtract and AWAC AST applications and output as ASCII files for further analysis in MatLab ®. The AWAC recorded the pitch, roll and heading of the instrument so that any orientation variations during deployment were accounted for in the post-processing. Figure 10 (top) shows the time evolution of the instrument orientation. During an earlier portion of the deployment (10/24-10/25), the instrument experienced reorientation. However, the pitch, roll and heading values remained relatively constant for the remainder of the experiment. Moreover, any orientation variations are accounted for when the data is post-processed provided the instrument was not tilted at an angle larger than 10º. As seen in Figure 10, the pitch and roll values never exceeded 10º, therefore we can assume that the post-processing accurately accounted for the instrument orientation.

Another measure of whether the instrument was functioning correctly is through beam amplitude analysis. The beam amplitude is a measure of the signal strength measured by the transducers. The measurable range of the signal strength is 0-255, with increasing beam amplitude corresponding to increasing signal strength. Figure 10 (bottom) shows typical beam amplitude values for the three directional signals (x, y and z). The beam amplitudes showed degradation in signal strength with increasing transducer-cell distance in the water column. In other words, the acoustic signals backscattered from distant cells were weaker than those measured from cells in proximity to the transducers. Acoustic signal strengths will attenuate over time and distance.

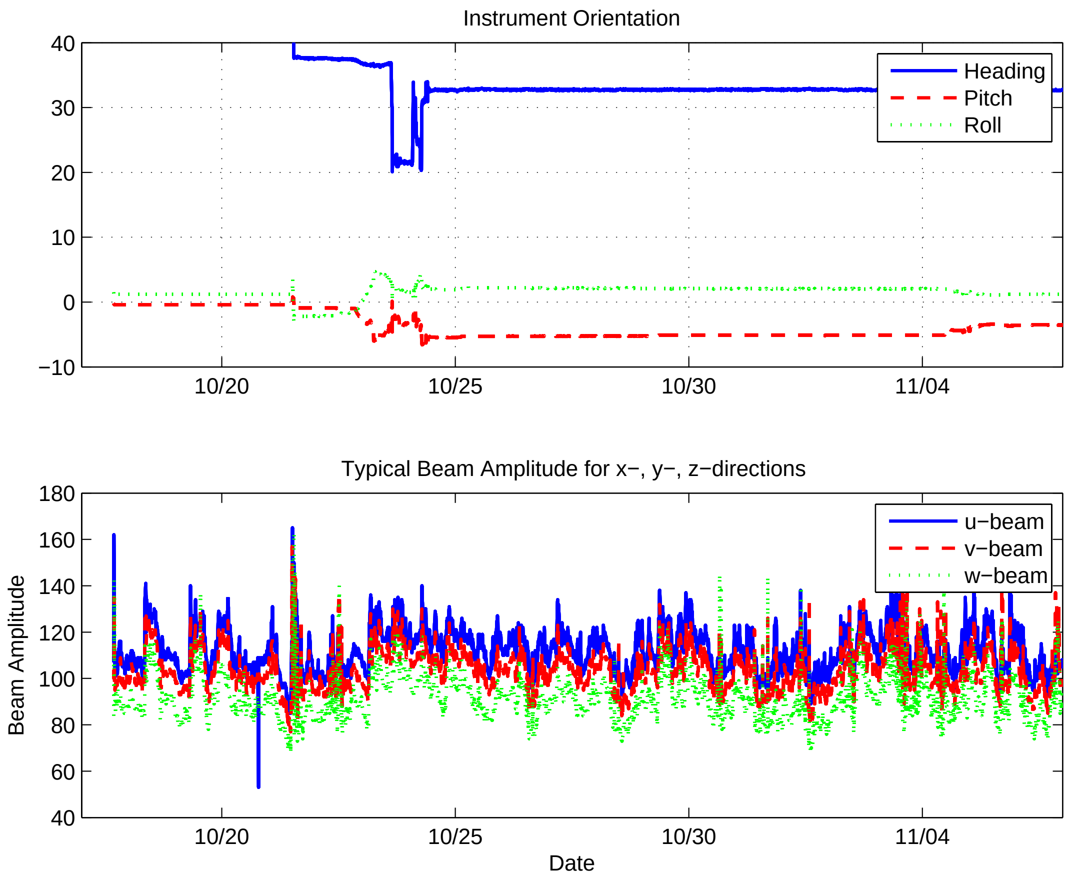


Figure 10. (top) Time evolution of instrument pitch, roll and heading. (bottom) Typical beam amplitude measurements for three velocity directions (u, v and w).

The beam amplitude for the lower cells in the water column was frequently greater than values of 50-60 counts. For the cells higher in the water column, the minimum signal strengths decreased to 20-30 counts. For comparison, the value of signal strength in open air is approximately 15-30 counts, representing the noise floor of the instrument. Therefore, velocities from cells higher in the water column needed to be interpreted with care.

3.1.2 Processed waves and currents

Wave conditions measured by the NOAA NDBC buoy #46042 and by the AWAC near SCH are plotted for comparison in Figure 11. Consistent with Xu (1999), the wave heights measured by the NDBC buoy were greater than the wave heights observed near SCH (Figure 11-second subplot). Trends at the two locations were similar, however. When the wave heights increased at the buoy, the wave heights at the Santa Cruz Harbor reflected this change, but in a smaller magnitude. The offshore wave height was typically a factor of two (or more) larger than the wave height measured by the AWAC.

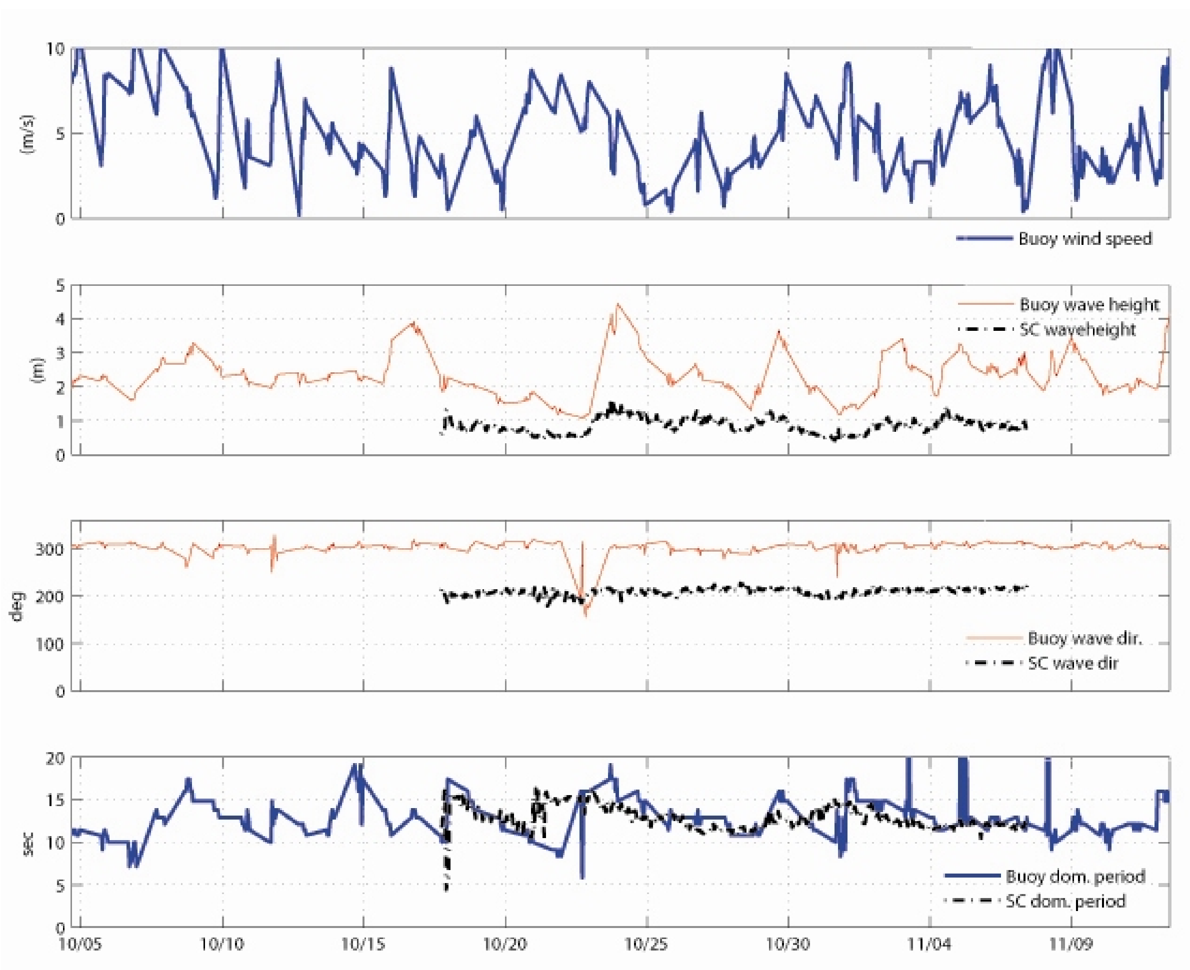


Figure 11. Wind speed (top), wave heights (second), wind and wave directions (third) and dominant and average wave periods, measured by buoy #46042 and the AWAC.

Dominant wave directions at the NDBC buoy typically approached the NDBC buoy from a northwesterly direction (third subplot). Wave directions observed near the SCH, however, predominantly approached from a southwesterly direction. This is probably due to the refraction of the dominant waves into the Santa Cruz region of Monterey Bay.
The bottom plot in Figure 11 shows the dominant wave periods measured at the NDBC buoy as well as SCH. Aside from slight differences in magnitude, the periods measured at SCH were of the same order as the periods measured at the buoy (~ 10-16 seconds). Correspondingly, the average periods (not shown in the figure) measured at both locations were of the same order of magnitude (4-12 seconds). The mean wave periods measured near SCH, however, were typically smaller (4-9 seconds) than those measured at the offshore buoy.

While the AWAC was deployed, the wind magnitudes at the NDBC buoy were between 1 and 8 m/s. Several larger events are noticeable in the top plot of Figure 11 in which increased wind speeds persisted for several days. The wind direction approached the buoy during this time period from a northwesterly direction, typically. Wind was not measured at the SCH location, so comparisons could not be made to wind speeds at the NDBC buoy.

Current magnitudes and directions were time-averaged hourly so that the low frequency signals (tides) could easily be viewed. Figure 12 displays the hourly averaged current magnitudes (top), directions (middle) and the tidal signal (bottom). The pressure signal is used to represent the varying water depth above the AWAC. The pressure can be interpreted as the water depth above the instrument. Combined with the current magnitude and direction, we were able to observe the trends of the currents with ebbing and flooding tides.

By separating the deployment period into distinct phases based on types of tide, the effect of the tides on the currents becomes evident. During the larger, spring tides of the deployment period (roughly 10/17-10/25 and 11/03-11/07), the largest current magnitudes were observed (see arrows on Figure 12). Also during this time, the ebb tides were predominantly directed towards the east (~ 70º) while the flood tides were directed westward in the area of study (~ 250º).

On the other hand, during the neap tides (10/25 – 11/02, approximately), the current magnitudes were smaller and the current direction as a result of flooding or ebbing tide was more difficult to ascertain. The mean current velocities due to the tides are smaller during the neap tides. Therefore, the dominant flow mechanism may not be the tidal shift, but, rather, the wind and wave driven circulation.

Wave statistics measured by the AWAC at SCH are shown in Figure 13. The top plot displays a closer look at the significant wave height and the maximum wave heights observed during the deployment. Significant wave height fluctuated between 0.5 and 1.5 meters. Maximum wave heights were observed between 10/23/2005 and 10/30/2005, and, at times, were larger than 2.0 meters. The mean significant wave height for the deployment duration was 0.85 meters.

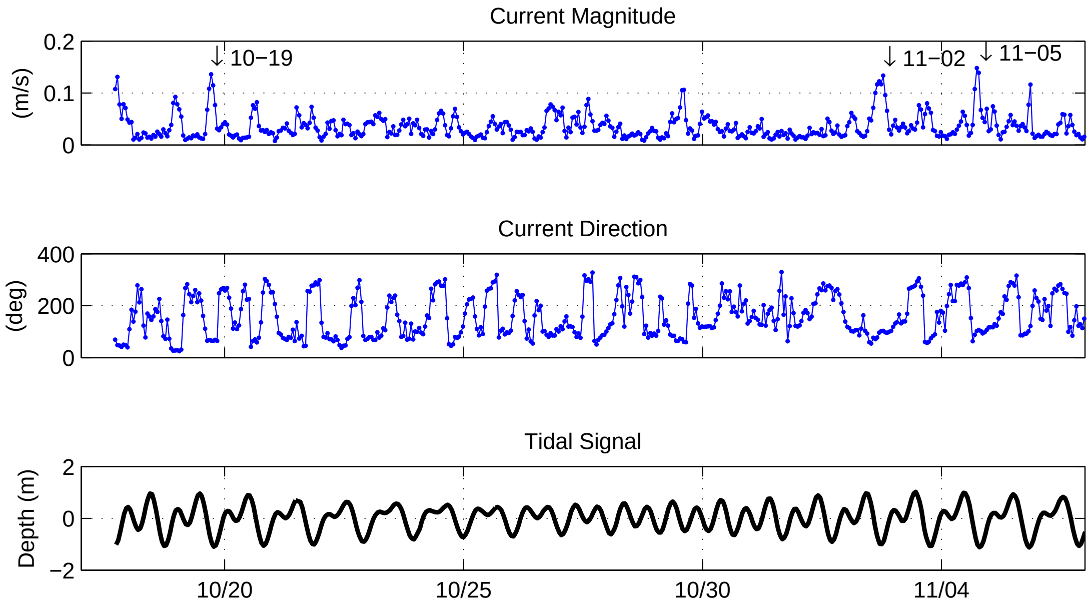


Figure 12. Current directions (top), magnitudes (second) and tidal signal (dashed).

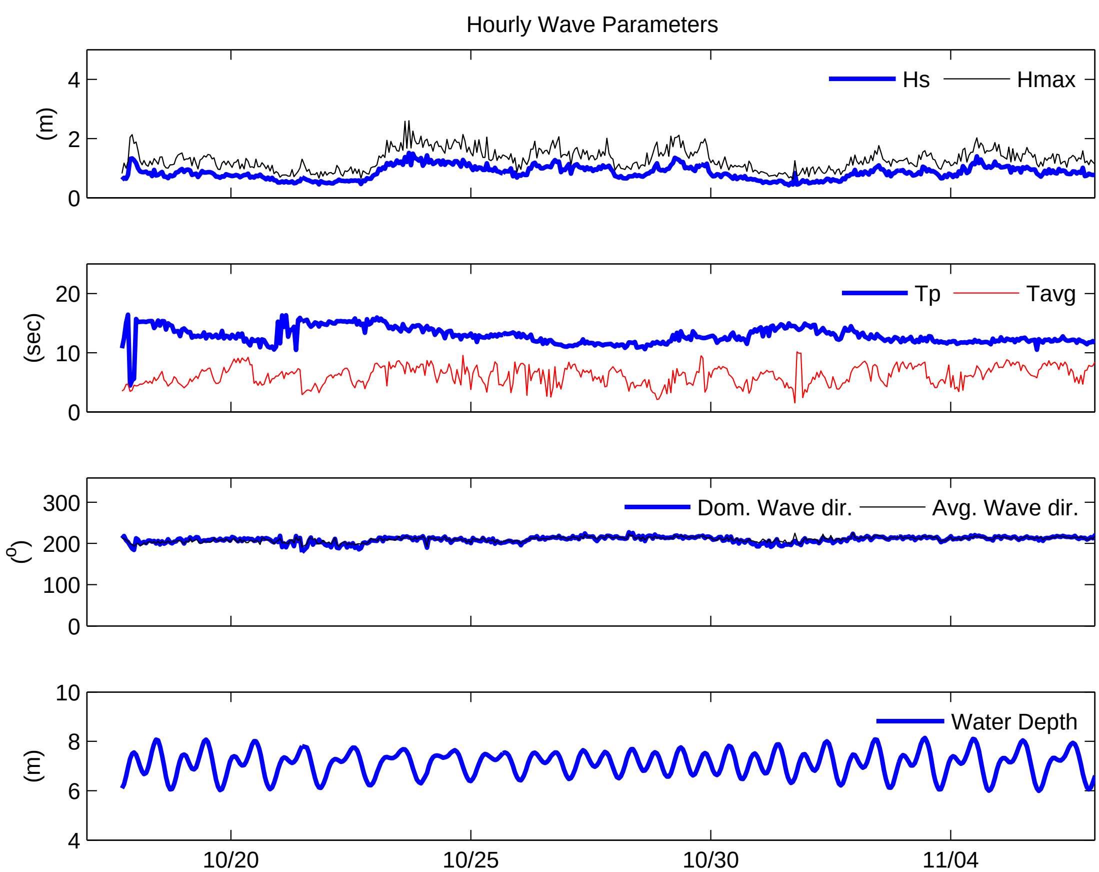


Figure 13. Wave parameters: (top) Significant height, maximum wave height, (second) peak and average period, (third) dominant and average wave direction and (bottom) water depth (tidal signal).

The peak wave period varied slightly during the deployment, fluctuating between 11 and 16 seconds, approximately. The mean value during deployment was 13 seconds.

The wave directions observed at this site were consistent throughout deployment, approaching the SCH from approximately 210º from true north. The mean wave direction during deployment was 209º from true north. Additionally, the sea temperature fluctuated between 11 and 14 ºC, appearing to vary with the tidal signal to some extent. The mean temperature during deployment was 12.8 ºC.

Wave statistics were also averaged daily for easy observation, and are shown in Table 5. The current parameters presented in the table (Uc, Udir) correspond to depth-averaged current magnitudes and directions. The temperature is sea temperature as measured by the AWAC.

Month	Day	Hs (m)	Hmax (m)	Tp (sec)	Wdir (º)	Uc (m/s)	Udir (º)	Temp (ºC)
10	17	0.9	2.1	10.0	201.0	0.083	50.1	12.7
10	18	0.8	1.9	14.7	204.7	0.027	141.5	12.3
10	19	0.8	1.5	12.9	208.8	0.042	163.1	12.7
10	20	0.7	1.3	12.1	209.5	0.030	184.5	12.7
10	21	0.5	1.3	14.5	202.1	0.035	149.7	12.8
10	22	0.6	1.1	15.1	196.9	0.029	113.9	12.9
10	23	1.2	2.6	14.6	212.2	0.039	122.3	13.1
10	24	1.2	2.1	13.3	209.2	0.036	157.8	13.4
10	25	0.9	2.1	12.9	205.5	0.028	174.9	13.1
10	26	1.0	2.1	12.0	211.1	0.035	141.9	13.0
10	27	1.0	2.0	11.4	214.7	0.044	144.2	12.7
10	28	0.8	1.9	11.3	215.8	0.023	190.5	12.9
10	29	1.1	2.1	12.5	215.5	0.039	131.9	13.2
10	30	0.7	1.4	12.6	207.0	0.032	180.7	12.8
10	31	0.5	1.3	14.2	199.7	0.022	165.7	12.7
11	1	0.6	1.4	13.6	207.6	0.023	215.0	12.7
11	2	0.9	1.8	12.6	213.5	0.058	98.2	12.9
11	3	0.8	1.6	12.1	212.4	0.041	172.3	12.6
11	4	1.0	2.0	11.8	214.0	0.047	185.7	12.4
11	5	1.0	1.8	12.1	213.1	0.040	182.4	12.4
11	6	0.9	1.6	12.0	214.6	0.028	187.4	12.5
11	7	0.8	1.7	11.8	216.7	0.022	185.7	12.5

Table 5. Daily-averaged wave statistics observed by the AWAC

3.2 Beach monitoring and sediment sampling

3.2.1 Beach monitoring

Beach monitors for the fall 2005 monitoring program observed and recorded changes in beach morphology and identified any potential irregular deposits on the shoreline such as organic debris, inorganic debris, and distressed wildlife. Local beaches were monitored in two different ways; 1) beaches were monitored concurrently with beach sediment sampling events on beaches spanning from the San Lorenzo River mouth to Blacks Point before (October 4th), during (October 27th) and after dredging (November 8th) and 2) beach monitoring also occurred while dredging took place from October 12th to November 1st. Beaches from the east jetty at Twin Lakes Beach to Moran Beach were monitored twice daily. Over 1,100 digital images were recorded during beach monitoring.

On the first morning following dredging (the morning of October 13th) a small silt and clay deposit was observed around the base of the dredge pipe near the east jetty (Figure 14). Minor holes in the pipe allowed a small amount of silt and clay to leak onto Twin Lakes Beach. The Port District's Environmental Quality Manager was immediately notified and the pipe was repaired before the beginning of the next dredging cycle. The deposit was less than 0.5 cm thick, about 1 m long and 30 cm wide. Other minor leaks of smaller magnitude occurred on the evenings of October 14th and October 20th. The holes were repaired after each leak the following morning. No other evidence of silt and clay deposits of any type were observed on Santa Cruz Bight beaches at any other time during the monitoring period. Additionally, no evidence of a dredge plume offshore was visible from the beach, jetty or nearby cliffs during the times of beach monitoring.

Figure 14. On the morning of October 13th a small amount of silt and clay leaked from the dredge pipe onto Twin lakes Beach. The deposit is approximate 3 feet long and 1 foot wide and less than 0.5 cm thick.

Stream flow at the San Lorenzo River (the most significant contributor of silt and clay to the Santa Cruz Bight during the winter) was never more than a thin, shallow stream meandering westward up Beach and Boardwalk Beach (Figure 15). No significant amount of sediment was input by the San Lorenzo River during the monitoring period. Coastal lagoons (Schwan, Corcoran, and Moran Lake) remained ponded behind summer beach berms. This implies that potential increases in silt and clay concentration in sediments over the monitoring period would likely be a result of harbor dredging and not the San Lorenzo River.

Major changes in beach morphology did not occur at any Santa Cruz Bight beaches monitored from the San Lorenzo River to Moran Beach over the monitoring period. Lack of high surf or rainfall preserved the beach morphologies in summer profile, meaning beaches were consistently wide, cuspate, and gently sloping near the waters edge (Figures 16- 21).

Watt (2003), Watt and Greene (2003), and SEI (2005) used remnant pier pilings on the eastern end of Twin Lakes Beach as an indicator for sediment deposition and erosion. In the winter the pilings are in the wave swash zone and can extend upward over a meter from the sand. After the summer beaches have rebuilt, the pilings are completely covered over by beach sand. During the entire fall 2005 monitoring program the pilings remained completely buried in sand and were never exposed on Twin Lakes Beach (Figure 22).

Before dredging (10-4-2005) High tide

During dredging (10-27-2005) High tide

After dredging (11-8-2005) Medium tide

Figure 15. These photographs were recorded before, during and after dredging had taken place at the San Lorenzo River mouth. The point of view is to the west across the San Lorenzo River towards the Beach and Boardwalk. The river did not exit at the usual mouth along the outcrop point and has meandered westward. Depending on tide, the river is either dammed or barely connected to the ocean. No major morphological changes occurred at this beach over the monitoring period.

Before dredging (10-4-2005)

High tide

During dredging (10-27-2005)

High tide

After dredging (11-8-2005)

Medium tide

Figure 16. These photographs were recorded before, during and after dredging had taken place at Seabright Beach. The point of view from the photographs on the left is eastward from the San Lorenzo River. The photographs on the right were taken in approximately the middle of Seabright Beach looking eastward to the west jetty at the Santa Cruz Harbor. No major morphological changes occurred at this beach over the monitoring period.

Before dredging (10-4-2005) High tide

During dredging (10-27-2005) High tide

After dredging (11-8-2005) Medium tide

Figure 17. These photographs were recorded before, during and after dredging had taken place at Twin Lakes Beach. The point of view is to the west from the middle of Twin Lakes Beach to the east harbor jetty. The dredge outfall pipe is visible in each image. No major morphological changes occurred at this beach over the monitoring period.

Before dredging (10-4-2005) High tide

During dredging (10-27-2005) High tide

After dredging (11-8-2005) Medium tide

Figure 18. These photographs were recorded before, during and after dredging had taken place at Blacks Point. The point of view is eastward from the middle of Twin Lakes Beach to Blacks Point. No major morphological changes occurred at this beach over the monitoring period.

Evening of October 21st High tide

Morning of October 24th. Medium tide

Evening of October 28th Medium tide

Figure 19. These photographs were recorded between October 12th and October 31st 2005 and represent typical conditions at Sunny Cove Beach while dredging occurred. No major morphological changes occurred at this beach over the monitoring period.

Evening October 13th High tide

Morning November 1st High tide

Evening October 17th Low tide

Evening October 25th High tide

Figure 20. These photographs were recorded between October 12th and October 31st 2005 and represent typical conditions at Corcoran Beach while dredging occurred. No major morphological changes occurred at this beach over the monitoring period.

Evening of October 15th — Low tide

Morning of October 15th — Medium tide

Evening of October 25th — High tide

Morning of November 1st — High tide

Figure 21. These photographs were recorded between October 12th and October 31st 2005 and represent typical conditions at 26th Avenue and Moran Beaches while dredging occurred. No major morphological changes occurred at these beaches over the monitoring period.

Before dredging (10-4-2005) During dredging (10-27-2005) After dredging (11-8-2005)

Figure 22. Remnant pier pilings used to indicate erosion and deposition on Twin Lakes Beach in previous monitoring programs remained completely buried in sand during the entire fall 2005 monitoring program. The perspective of these photographs is eastward towards the Santa Cruz Harbor.

3.2.2 Beach sediment samples

A complete copy of SEI's grain-size results are provided in Appendix A. Beach sediment samples were collected before dredging began on October 4th, during dredging on October 27th, and after dredging November 8th. Like beach morphology, beach sediment sample statistics remained consistent over the fall 2005 monitoring program. Every beach sediment sample collected between the San Lorenzo River and Blacks Point during the 2005 monitoring program had a mean grain diameters between 346-612 µm (medium- to coarse-sand) and the samples were composed of 99% sand or greater. Only trace amounts of silt and clay sediment were detected on these beaches over the monitoring period (Figures 23 and 24).

3.2.3 Offshore sediment samples

Offshore sediment samples were collected before dredging began on October 11th, during dredging on October 27th, and after dredging on November 7th. Offshore sediment sample statistics had a broader range of mean grain-sizes and silt and clay percentages than beach sediment samples. Offshore sample means ranged from 86 to 780 µm (very-fine to coarse-sand) and silt and clay percentages ranged from 0.7 to 41.8% (Table 6). Figure 23 maps the locations and color-coded Wentworth classifications of mean grain-size for all samples collected in the fall 2005 monitoring program. In general, mean grain-size decreases with increasing distance away from the shoreline and with increasing water depth. An exception to this generality occurred offshore at sample location 8 prior to dredging where coarse-sand was sampled away from the shoreline in the deeper waters of the eastern Santa Cruz Bight. This sample was the coarsest sediment sample mapped during the fall 2005 monitoring period (780 µm sample mean).

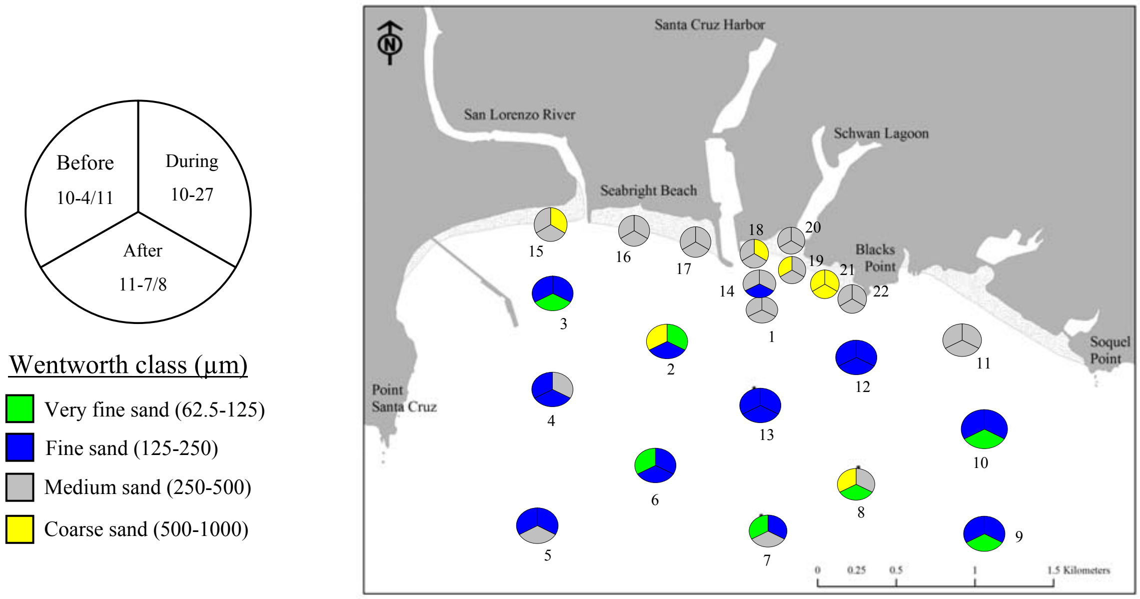


Figure 23. This map shows the Wentworth classification of sediment sample mean grain diameters collected from October 4th through November 8th, 2005. The three sections of each pie chart represent a separate sampling time before, during, and after dredging. The sections of the pie charts are color coded to indicate the Wentworth size class for each sample at each location.

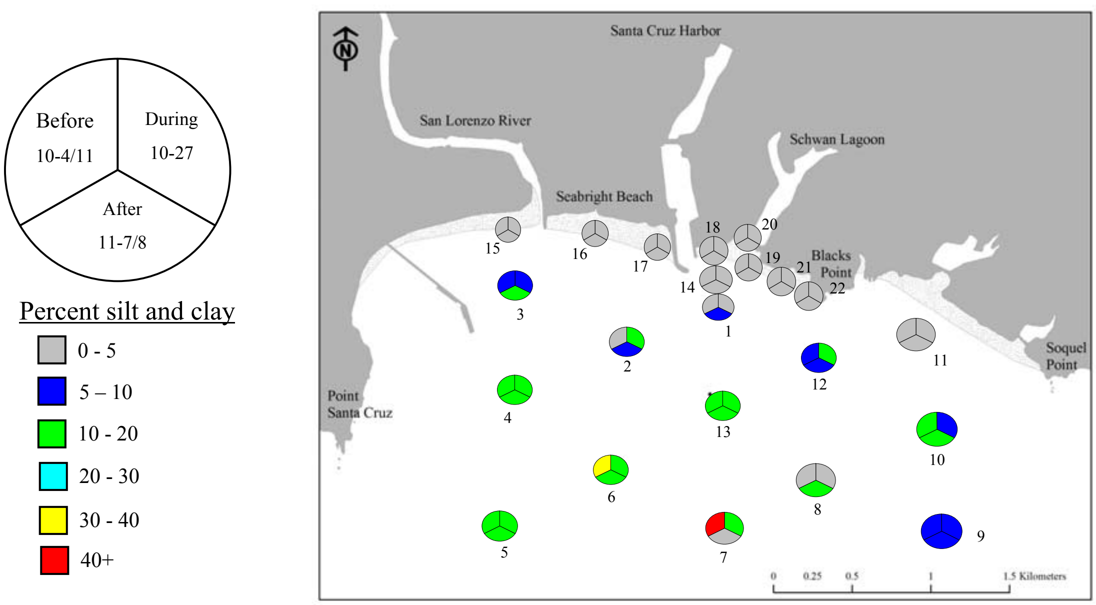


Figure 24. This map displays the percentage of silt and clay present in the same sediment samples collected from October 4th to November 8th, 2005. The three sections of the each pie chart represent a separate sampling time before, during, and after dredging. The sections of the pie charts are color coded to indicate the percentage of silt and clay of each sample at each location.

Offshore sample	Dredging phase	Mean (micron)	Class	% Sand	% Silt & clay
1	Before	328	Medium sand	96.8	3.2
	During	303	Medium sand	97.6	2.4
	After	255	Medium sand	94.4	5.6
2	Before	541	Coarse sand	95.6	4.5
	During	105	Very fine sand	81.5	18.5
	After	231	Fine sand	91.7	8.3
3	Before	197	Fine sand	94.0	6.0
	During	208	Fine sand	91.3	8.7
	After	112	Very fine sand	82.9	17.1
4	Before	220	Fine sand	81.3	18.7
	During	278	Medium sand	81.8	18.2
	After	225	Fine sand	81.9	18.1
5	Before	232	Fine sand	87.0	13.0
	During	181	Fine sand	89.1	10.9
	After	252	Medium sand	85.3	14.7
6	Before	108	Very fine sand	63.1	36.9
	During	172	Fine sand	87.8	12.2
	After	244	Fine sand	83.9	16.1
7	Before	86	Very fine sand	58.2	41.8
	During	229	Fine sand	85.1	14.9
	After	486	Medium sand	98.6	1.4
8	Before	780	Coarse sand	97.8	2.2
	During	392	Medium sand	98.1	1.9
	After	119	Very fine sand	89.1	10.9
9	Before	141	Fine sand	93.3	6.8
	During	169	Fine sand	93.3	6.7
	After	110	Very fine sand	92.9	7.1
10	Before	163	Fine sand	86.4	13.6
	During	211	Fine sand	93.0	7.0
	After	98	Very fine sand	83.4	16.6
11	Before	280	Medium sand	97.9	2.1
	During	351	Medium sand	99.3	0.7
	After	279	Medium sand	97.8	2.2
12	Before	148	Fine sand	94.9	5.1
	During	158	Fine sand	88.6	11.4
	After	219	Fine sand	94.6	5.4
13	Before	217	Fine sand	88.1	11.9
	During	201	Fine sand	84.8	15.2
	After	193	Fine sand	82.5	17.5
14	Before	380	Medium sand	98.8	1.2
	During	285	Medium sand	98.2	1.8
	After	225	Fine sand	95.9	4.1

Table 6. Sample mean grain-size (µm) and composition (percent) of each offshore sediment sample collected during the fall 2005 monitoring program are listed above. Every beach sample was between 346-612 µm (medium-to coarse sand) and composed of 99% sand or greater. See Figure 4 for sediment sample locations.

Sediment sample silt and clay percentages are mapped in Figure 24. Silt and clay percentages increase with increasing distance away from the shoreline and with increasing water depth. The two samples with the highest silt and clay percentages (6 and 7) were both collected before dredging took place. The highest silt and clay percentage was collected before dredging began at sample location 7 (41.8%). This sample had the highest silt and clay concentration of any sediment sample in either the winter 2001 or winter 2005 monitoring programs as well. Sample 7's silt and clay concentration decreased over the monitoring period from 14.9% during dredging to 1.4% after dredging. The next highest silt and clay concentration (36.9%) was recorded prior to dredging at sample location 6. Sample 6's silt and clay concentration decreased to 16.1% after dredging. Sediment samples containing over 20% silt and clay in the study area were rare, representing only 2 out of a 66 sediment samples collected (3%). No sediment samples were collected with a silt and clay concentration over 19% while dredging occurred or following dredging.

3.3 Observational SCUBA diving

Observational SCUBA dives were performed by SEI divers at five shallow (6-8 m deep) offshore locations spanning from the Santa Cruz Wharf to offshore of Corcoran Beach (Figure 1). Before dredging dives were performed on October 7th 2005, while dredging occurred on October 21st 2005, and after dredging had ceased on November 7th 2005. Wind and wave conditions were mild with moderate swell surge near the seafloor during all observational SCUBA dives. On the sea surface the water had a reddish brown tint, usually a sign of an algal bloom. The potential bloom was noted on all dive days. Visibility was poor in the algal bloom, cleared slightly at about ~3-m water depth and then decreased with increasing water depth. At the seafloor, visibility ranged from 0 to 3 meters. Due to restrictions in visibility, observations of the seafloor were limited to a small field of view (~ 2 m^2).

Observations of the seafloor were consistent throughout the monitoring program. Examples of the seafloor at the five dive locations are shown in Figure 25. There was no evidence of consolidated silt and clay deposits on the seafloor before, during or after dredging. At the base of the AWAC current meter, a significant number of golf balls were observed. The balls were generally old, faded, and worn. Suspended sand, silt and clay particles were highest in concentration near the seafloor and were commonly suspended 1-3 meters above the seafloor at all dive locations throughout the monitoring program. At locations A, B, C, and E the seafloor was sandy with the presence of occasional small-scale sand ripples (< 5 cm in height). Observations of shell particles, broken off kelp strands, and other organic detritus were common in these locations. Location D contained sandy areas adjacent to exposed, low-relief (< 1.5 m) sedimentary rock outcrops. The outcrops were sometimes covered by loose or lightly suspended sediment and detritus and were often encrusted with kelp or other marine invertebrates. The exposed sedimentary rocks were extensively altered and eroded by burrowing marine invertebrates and kelp holdfasts. The rocks were friable and appeared to be dissolving to some extent in the seawater, contributing to the poor visibility conditions.

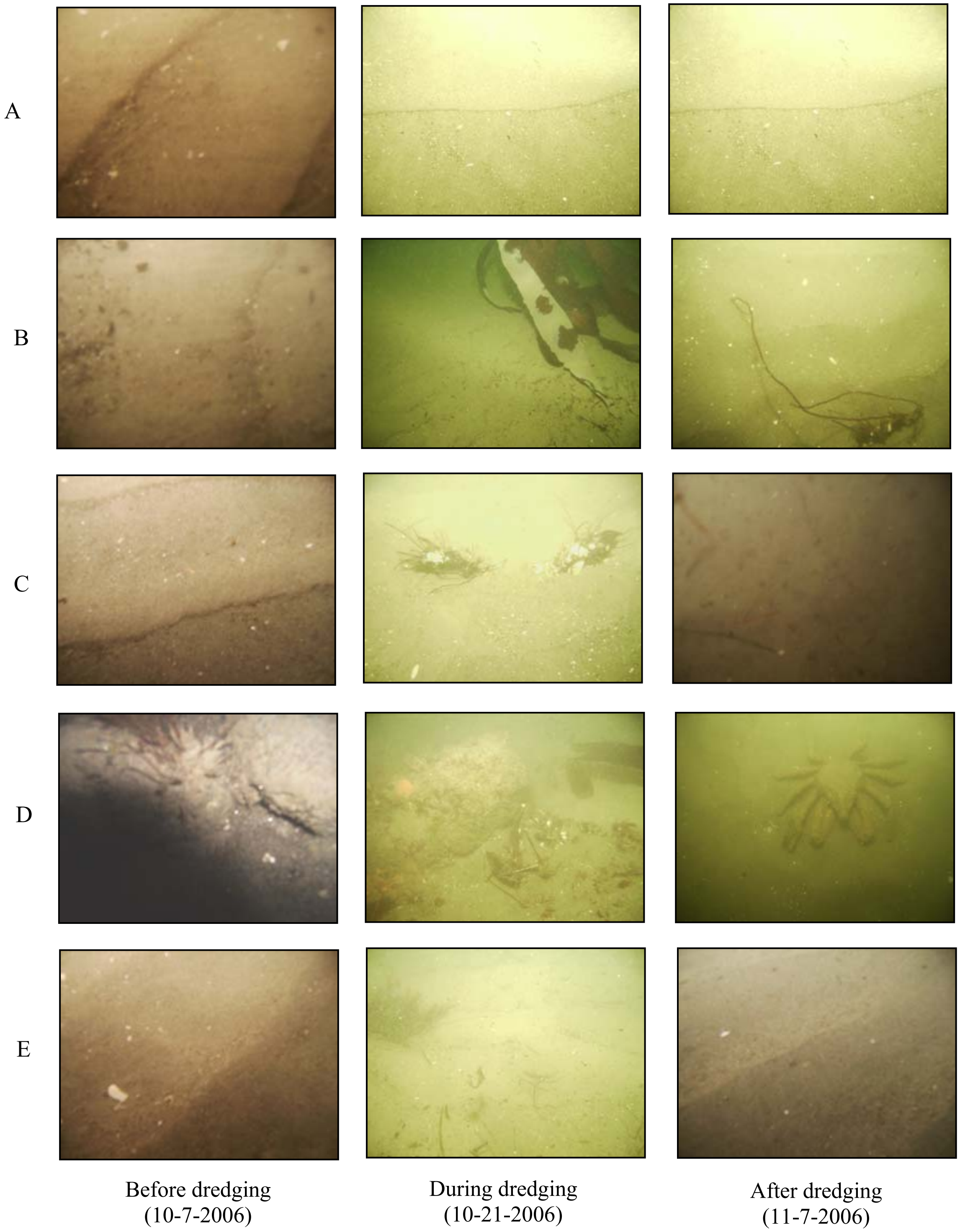


Figure 25. Examples images of the seafloor recorded at five locations in the Santa Cruz Bight before, during, and after dredging had taken place. Station locations are indicated at left. See Figure 1 for SCUBA station locations.

3.4 Seawater Turbidity

Turbidity measurements (in nephelometric turbidity units or NTU) were recorded concurrently at all offshore sediment sampling locations before dredging began on October 11th, during dredging on October 27th, and after dredging on November 7th (Figure 4). Real-time turbidity measurements were logged near the sea surface and at 1 meter depth intervals until reaching the seafloor at each sample location. Figure 26 displays turbidity (NTU) vs. depth (m) for all sample locations for each phase of the monitoring program.

Overall, turbidity in the Santa Cruz Bight increased with increasing water depth during the monitoring program. However, a turbidity spike was present at ~ 1-3 meters water depth at many sample locations over the monitoring period. The spike was probably caused by an algal bloom noted by SEI SCUBA divers during observational dives. A turbidity signature caused by inner harbor dredging or from the San Lorenzo River could not be differentiated from normal background turbidity conditions at the times of sampling. Turbidity values were highest near the seafloor where sediments were continually resuspended by wave and current activity, matching SCUBA diver observations. The highest turbidity was measured at sample location 11 (11.5 NTU) near the seafloor offshore of Corcoran Beach one week after dredging had ceased. The highest turbidity measured while dredging occurred was at sample location 8 (9 NTU) two meters below the sea surface and near the seafloor about one kilometer offshore of Blacks Point. For comparison, turbidity measurements recorded by SEI using the same instrument and the same calibration methods in the San Francisco Bay are typically over 20 NTU and can increase to well over 100 NTU during stormy weather.

3.5 Multibeam bathymetry surveys and benthic habitat mapping

The before dredging multibeam survey began on October 7 and was successfully completed on October 11, 2005. Figures 27 and 28 display processed multibeam bathymetry and backscatter imagery. The survey spans from roughly 3 to 18 meters below MLLW and covers about 7 km^2. Four benthic habitat types were identified and classified by visually interpreting multibeam and backscatter imagery. The habitat classifications were verified using sediment sample data (section 3.2) and SCUBA diver observations (section 3.3). Figure 29 displays multibeam bathymetry and backscatter imagery examples and descriptions of the four benthic habitat types. The Santa Cruz Bight seafloor has previously been described in detail in Watt (2003) and Watt and Greene (2003).

The Santa Cruz Bight seafloor is mostly flat sand (~ 49%) in the very-fine to medium-sand range (Figure 30). Sand has deposited in wide flat expanses and may fill shallow, ancient, eroded, river channels formed during times of lower sea level (Anima et al., 2002). The largest sand patch is in the protected waters of Cowell's Cove. A unique patch of sand waves were imaged near the San Lorenzo River mouth that were likely formed by alternating tidal flow between the river mouth and the ocean before the river was sealed by the building summer sand berm (Figure 31). Coarse sediment or flat to low-relief bedrock exposed in the axis of current and wave induced scours or depressions comprise about 5% of the surveyed seafloor. The most impressive scour features are located offshore east of Point Santa Cruz. Patchy, mixed-sediment covered rock subcrops account for ~ 29% of the survey area. Low-relief, exposed, eroded and locally fractured rock outcrops comprise 19% of the seafloor. Kelp forests were often associated with exposed rock outcrop habitats with the densest forest located on the exposed rock outcrops offshore of Soquel Point.

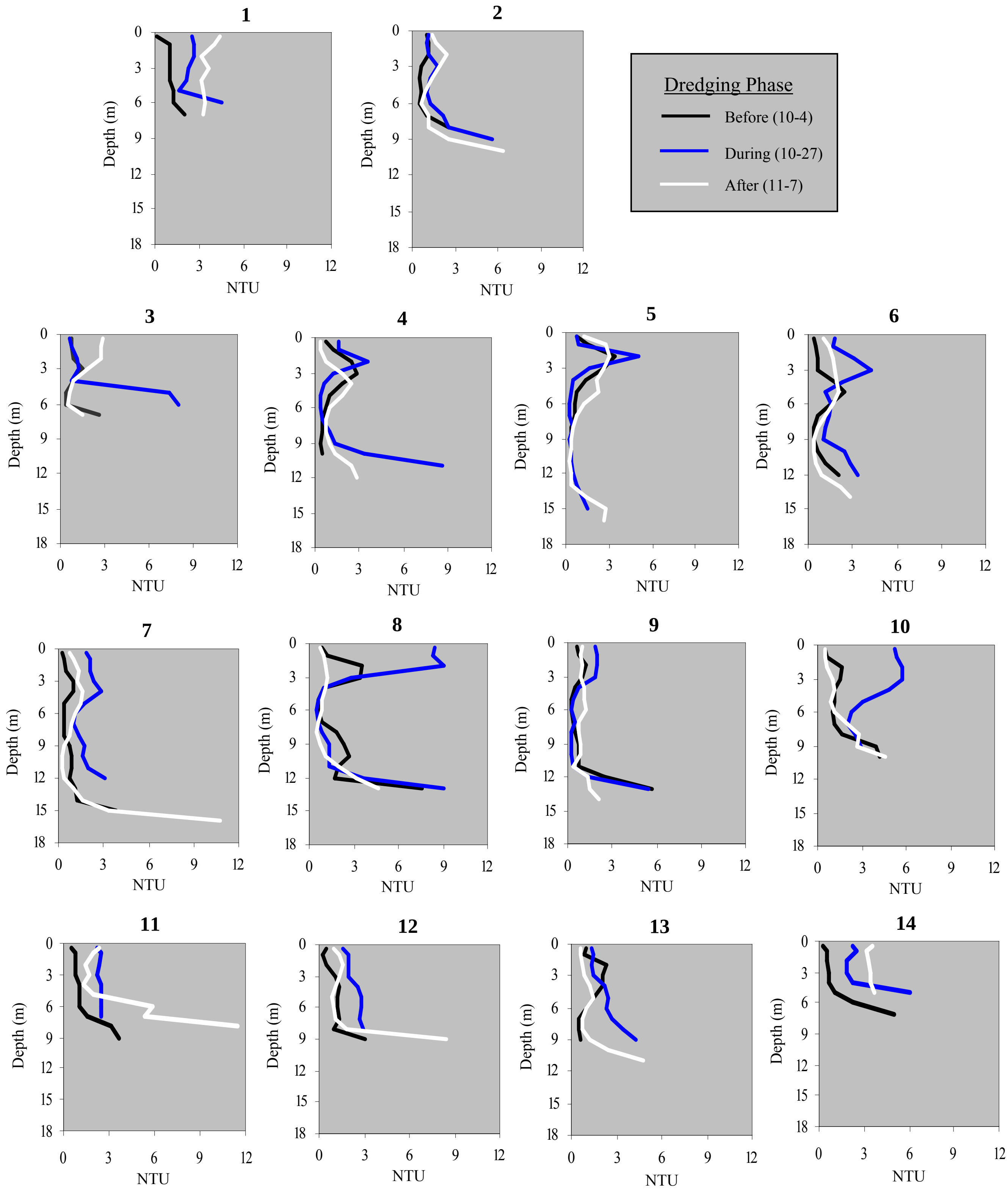


Figure 26. The above graphs plot turbidity (NTU) vs. depth (m) for water quality measurements recorded before, during and after dredging at 14 offshore sample locations (see Figure 4). Sample locations are noted above each graph. Turbidity measurements taken before dredging are represented by the black line, during dredging by the blue line, and after dredging by the white line.

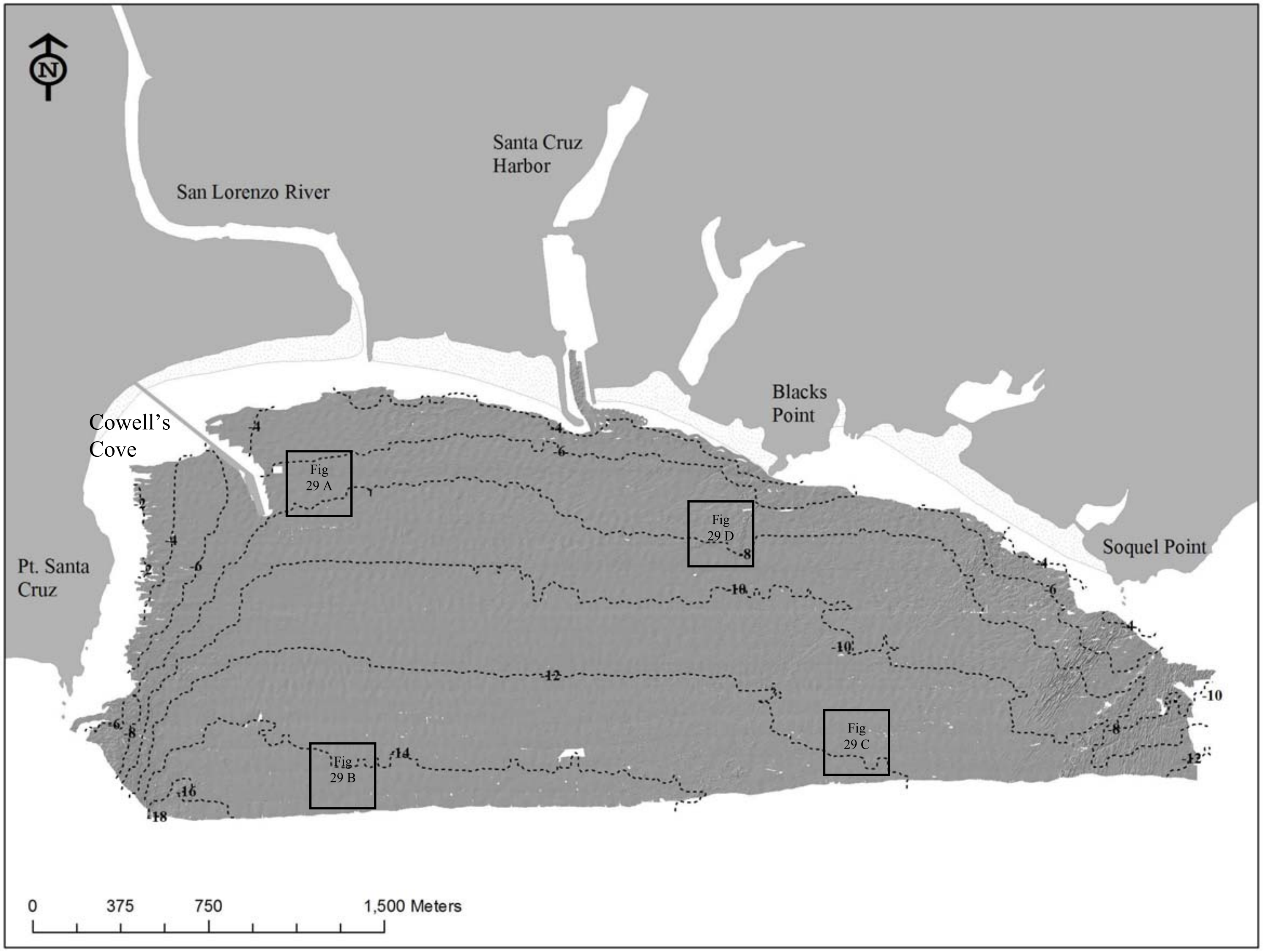


Figure 27. This figure shows the before dredging multibeam bathymetry image of the seafloor surface offshore of SCH. This survey was completed on October 11, 2005, one month before the after dredging survey. Bathymetry contours are in meters below MLLW. The black boxes mark the locations of four benthic habitat examples described in Figure 29.

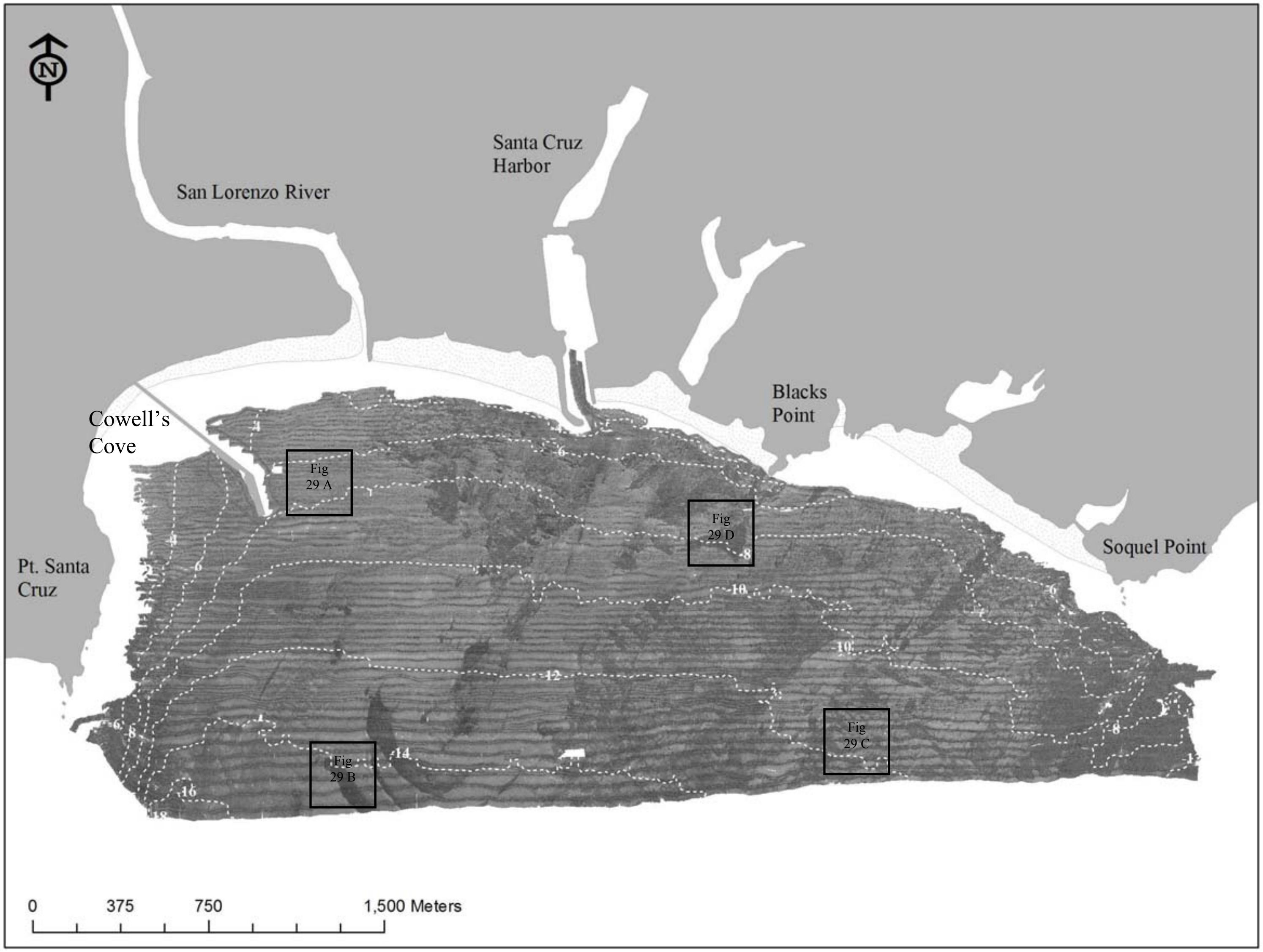
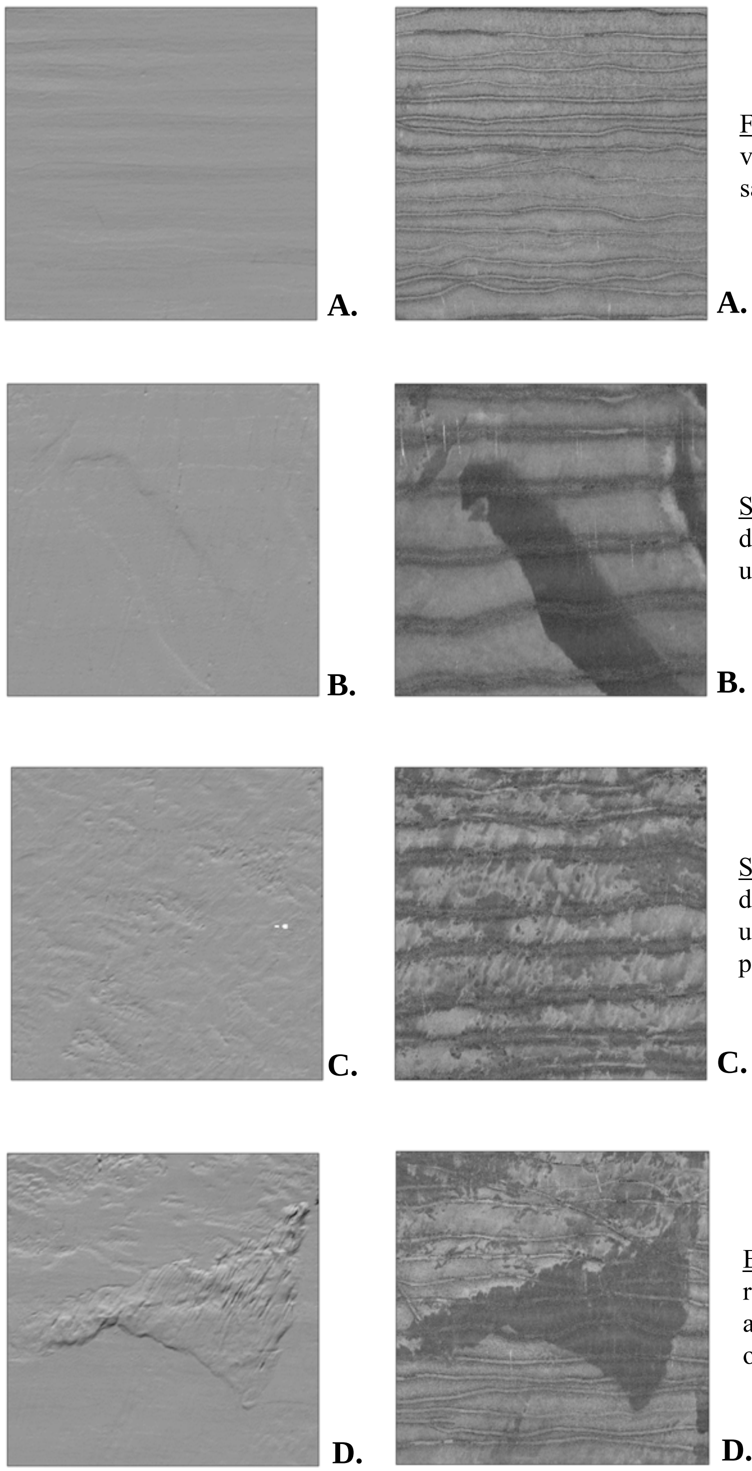


Figure 28. This figure shows the before dredging backscatter image of the seafloor surface offshore of SCH. This survey was completed on October 11, 2005, one month before the after dredging survey. Bathymetry contours are in meters below MLLW. The black boxes mark the locations of four benthic habitat examples described in Figure 29.

Multibeam examples | Backscatter examples | Habitat descriptions



<u>Flat sand</u> - Flat, unconsolidated sediment ranging from very-fine-sand to medium-sand with occasional coarse sand, pebbles and shell fragments.

<u>Scours and depressions</u> - Scours or sedimentary depressions revealing flat exposed bedrock or unconsolidated coarse sediment.

<u>Sediment covered subcrop</u> - Patchy rock outcrops draped in most areas by an estimated 0-15 cm of unconsolidated, very-fine-sand to very-coarse-sand, pebbles, and shell fragments. Highly variable.

<u>Exposed rock outcrops</u> - Flat to low-relief (2 m) exposed rock outcrops and boulders. Some have fractures, folds and faults. Patchy kelp forests are associated with most outcrops.

Figure 29. The four benthic habitats identified within the study area using multibeam and backscatter imagery. Each image is 300 x 300 m. See Figures 27 and 28 for location of these features within the Santa Cruz Bight.

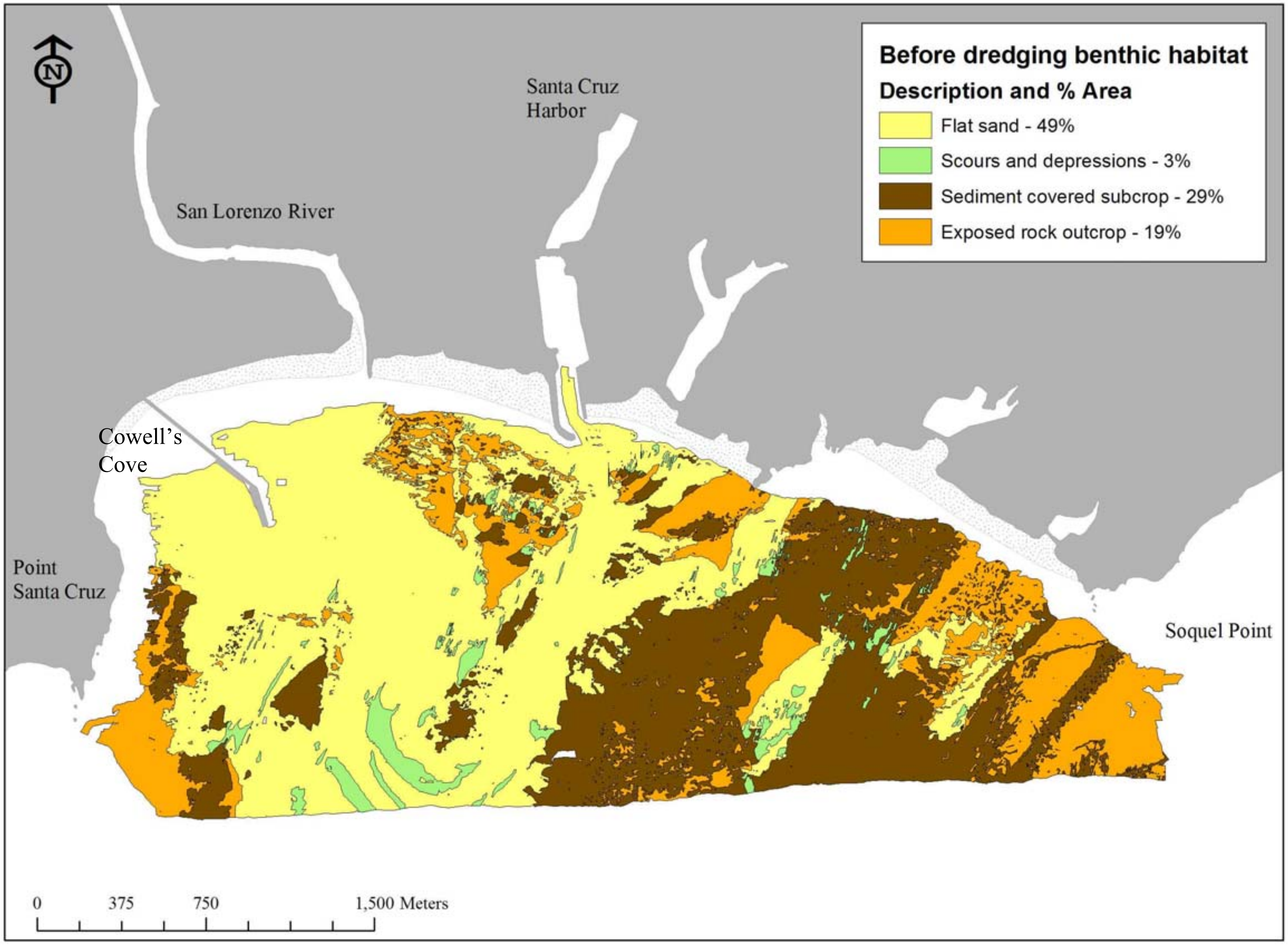


Figure 30. This benthic habitat map was produced in GIS by visually interpreting multibeam bathymetry and backscatter imagery collected before dredging took place offshore of SCH (see Figures 27, 28, and 29). The interpreted habitats were verified using offshore sediment samples (section 3.2) and SCUBA diver observations (section 3.3).

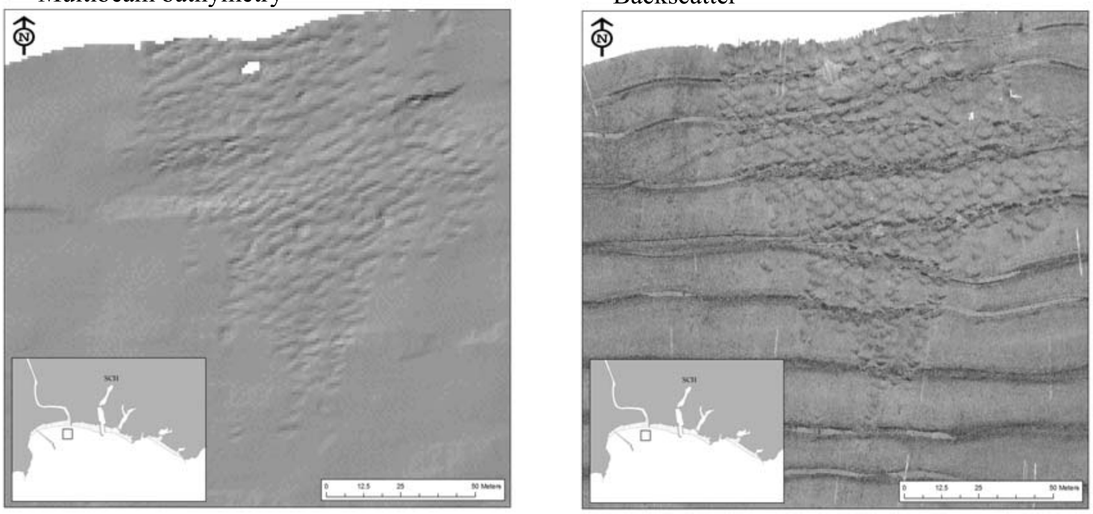


Figure 31. Sand waves imaged offshore of the San Lorenzo River mouth before dredging occurred.

After dredging multibeam bathymetry and backscatter images are displayed in Figures 32 and 33. The after dredging survey began on November 10th and was completed on November 14th, 2005, a month after the before dredging survey was completed. The after dredging seafloor conditions are very similar to the conditions imaged before dredging (Figure 34). The after dredging seafloor was composed of 43% flat sand, 4% scours and depressions, 35% mixed-sediment covered rock subcrop, and 18% rock outcrop. These benthic habitats were identified and mapped in the same general locations and with similar spatial distributions as those identified before dredging. The after dredging multibeam and backscatter images did not contain any bathymetric or textural evidence of a harbor dredge deposit near the outfall. It is possible that sedimentary mounds may have been produced by the deposition of sediment from inner harbor dredging that were transported away by wave and current activity prior to the after dredging survey.

Using the Spatial Analyst extension in ArcGIS 9.1 ®, the before and after benthic habitat interpretations were compared and analyzed to produce the sediment shift map shown in Figure 35. The sediment shift map highlights and quantifies areas in the Santa Cruz Bight where habitat types changed over the monitoring period. Habitat changes are indicated as areas of sediment erosion, deposition, or no habitat changes.

The GIS sediment shift area analysis indicated that approximately 89% (~ 5,240,000 m^2) of the Santa Cruz Bight seafloor habitats had not changed, 5% (300,000 m^2) had undergone sediment deposition, and 6% (355,000 m^2) had been eroded of sediment in the month between the two surveys. Any polygon in the sediment shift map that had an area of 10 m^2 or less was included in the “no habitat change” category. Polygons that were less than 10 m^2 accounted for only 0.4 % of the total area of the sediment shift map. In general, areas of sediment erosion and deposition identified in the map occurred in nearly equal spatial proportion throughout the Santa Cruz Bight. Grain-size analyses (section 3.2) indicate that areas of deposition were composed of sand sized sediment not silt and clay.

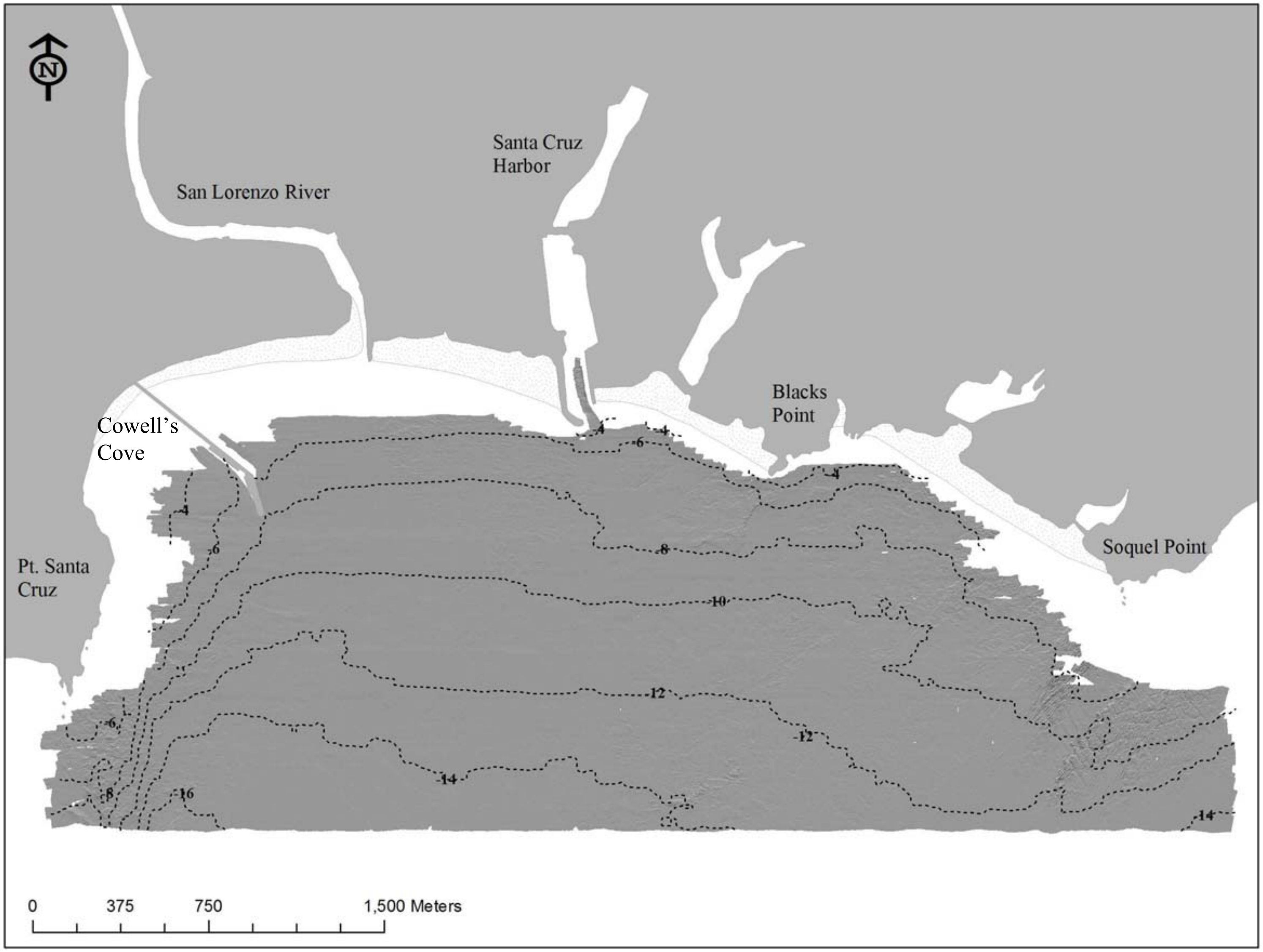


Figure 32. This figure shows the after dredging multibeam bathymetry image of the seafloor surface offshore of SCH. This survey was completed on November 14th, 2005, one month after the after dredging survey. Bathymetry contours are in meters below MLLW.

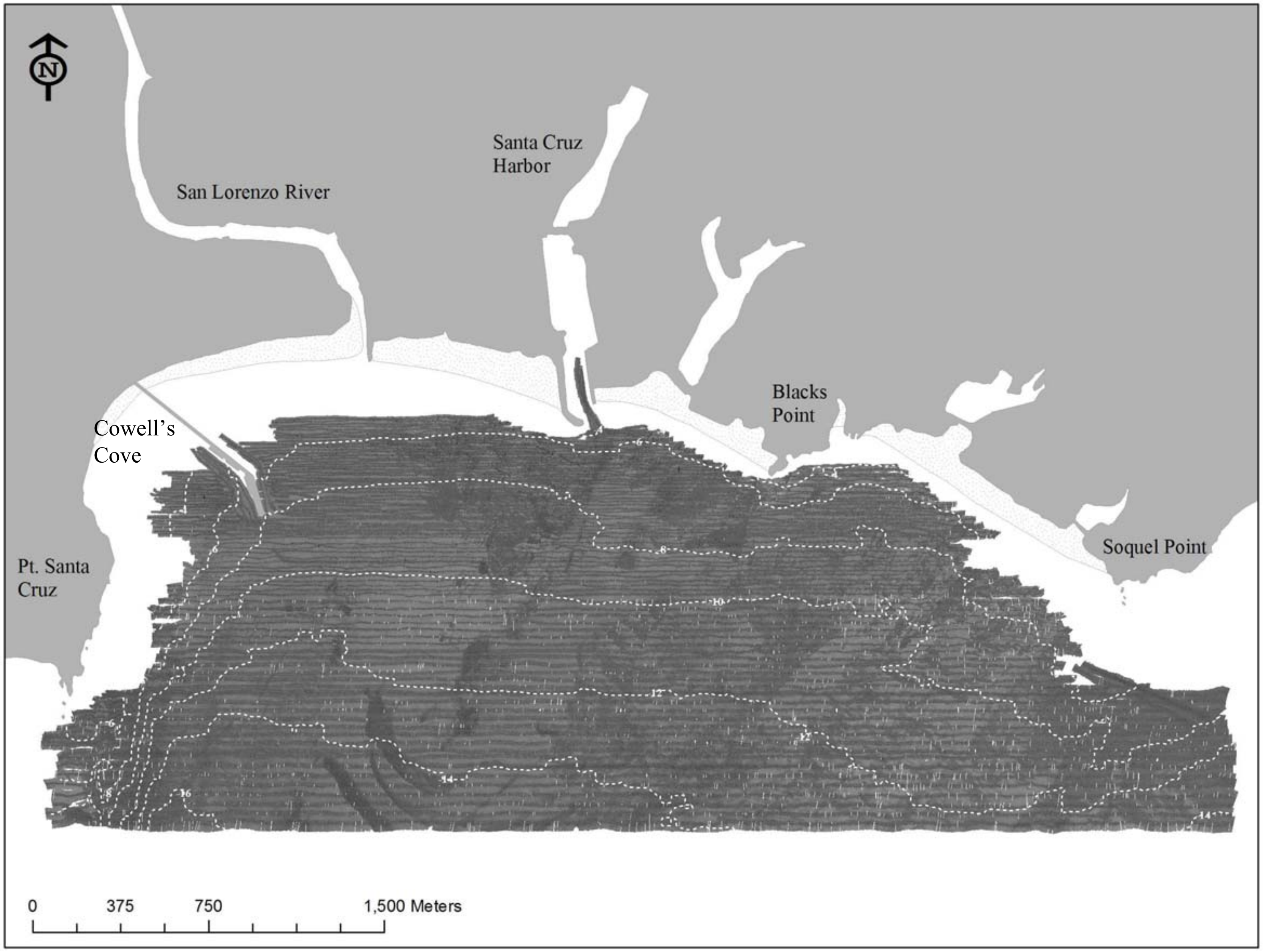


Figure 33. This figure shows the after dredging backscatter image of the seafloor surface offshore of SCH. This survey was completed on November 14th, 2005, one month after the after dredging survey. Bathymetry contours are in meters below MLLW.

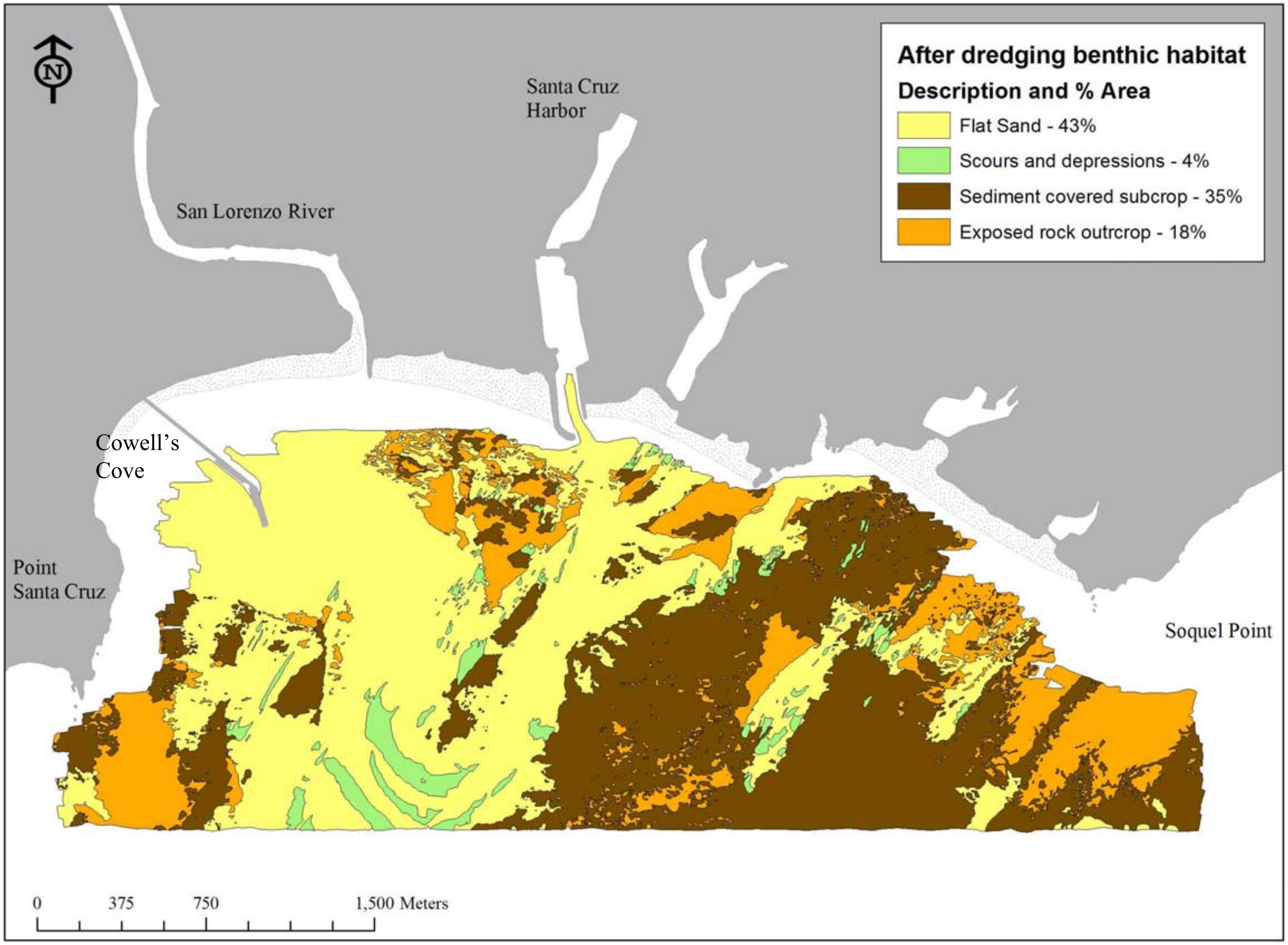


Figure 34. This benthic habitat map was produced in GIS by visually interpreting multibeam bathymetry and backscatter imagery collected after dredging was completed offshore of SCH (see Figures 32 and 33). The habitats were verified using offshore sediment samples (section 3.2) and SCUBA diver observations (section 3.3).

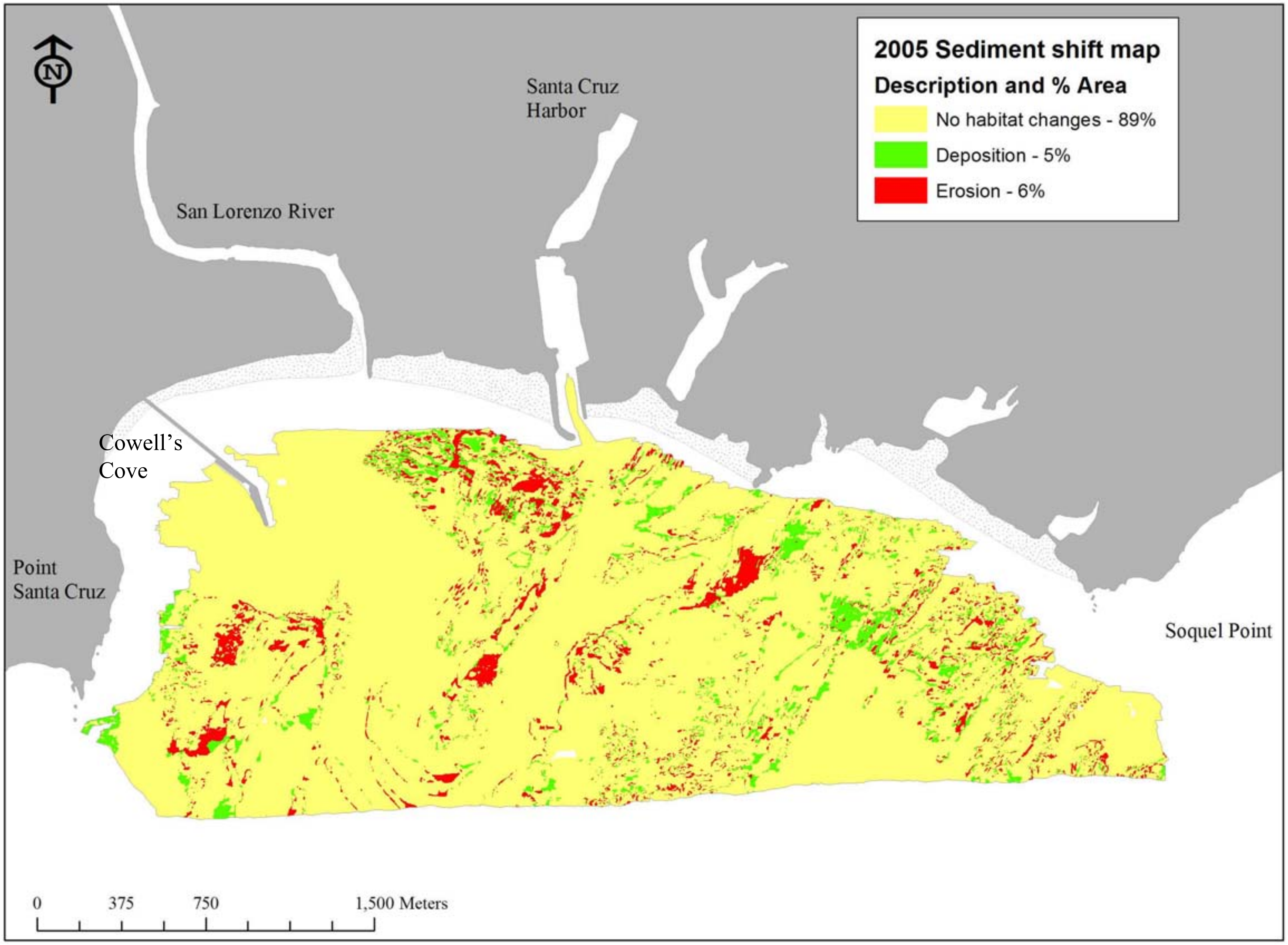


Figure 35. This figure indicates surficial changes that occurred in the spatial distribution of benthic habitats mapped before dredging on October 11th and after dredging on November 14th, 2005 offshore of SCH (see Figures 31 and 34). Red areas highlight areas of sediment erosion (6% of the mapped seafloor), green areas sediment deposition (5% of the mapped seafloor) , and yellow areas indicate areas of where habitats had not changed (89% of the mapped seafloor).

3.6 Preliminary numerical modeling

3.6.1 Model Verification

The first phase of modeling analyses is verifying that the model is both working correctly and also reasonably simulating the natural processes occurring at the site. As mentioned previously, EFDC has been successfully used previously to simulate circulation and transport in a multitude of environments, including the Chesapeake Bay, the Florida Everglades, the James and York River Estuaries, the Potomac River, San Francisco Bay, and Puget Sound. It has been calibrated and verified with extensive field data sets (Tetra Tech, 2002; www.epa.gov/athens/ research/modeling/efdc.html).

To ensure that the model closely simulated currents in the project area, actual currents measured by the AWAC were compared with those modeled during the two model cases set up using the wave, tide, and wind boundary conditions outlined in the previous section. The project site is partially sheltered from west to northwest prevailing offshore swell in the fall and winter seasons (Xu, 1999). Section 3.1 details the measured wave climate in the SCH region. During the measurement period in October 2005, the maximum daily average swell height was 1.2 m and the minimum was 0.5 m. Two model runs were conducted over 48 hour periods to simulate the range of conditions during the measurement period. The smallest swell height is the "Small Swell" model and represents the period from October 20th – 21st, 2005. The maximum swell height is the "Moderate Swell" model and represents the period from October 23rd – 24th, 2005. The average wave conditions for each model case are summarized in Table 7. REF/DIF model was run to calculate the average wave field through the model domain from the conditions reported in section 2.6. These results were incorporated into the EFDC model for the time period of interest with the actual tide and winds applied to the domain.

The current velocity results are shown in Figures 36 and 37, which plots current meter data with the model generated data at the meter location. Table 8 also compares results from the wave meter and the wave model predictions at the meter location. Figures 38 and 39 show modeled wave heights throughout the region for both model cases.

The results show that the model reproduces the overall current and wave conditions for both cases. The maximum currents during each period were predicted by the model to within 10%. The small swell case shows a temporal lead in the modeled tidal current maximums, but the duration and magnitude of the maximum currents are consistent. The noise in the current measurements in the moderate swell case allows only current magnitudes to be compared. The model accurately reproduces the maximum current envelope. Additionally, the wave heights and directions are accurately reproduced at the meter location. The model reproduction of the current and wave magnitude measured at the meter location gives confidence that the model behavior is reliable for qualitative assessment of plume behavior.

Model Case	Wave Height (m)	Dominant Period (sec.)	Direction	Date
Small Swell	0.6	13.2	205	10/20/2005 - 10/21/2005
Moderate Swell	1.2	13.9	210	10/23/2005 - 10/24/2005

Table 7. Average wave conditions for model cases

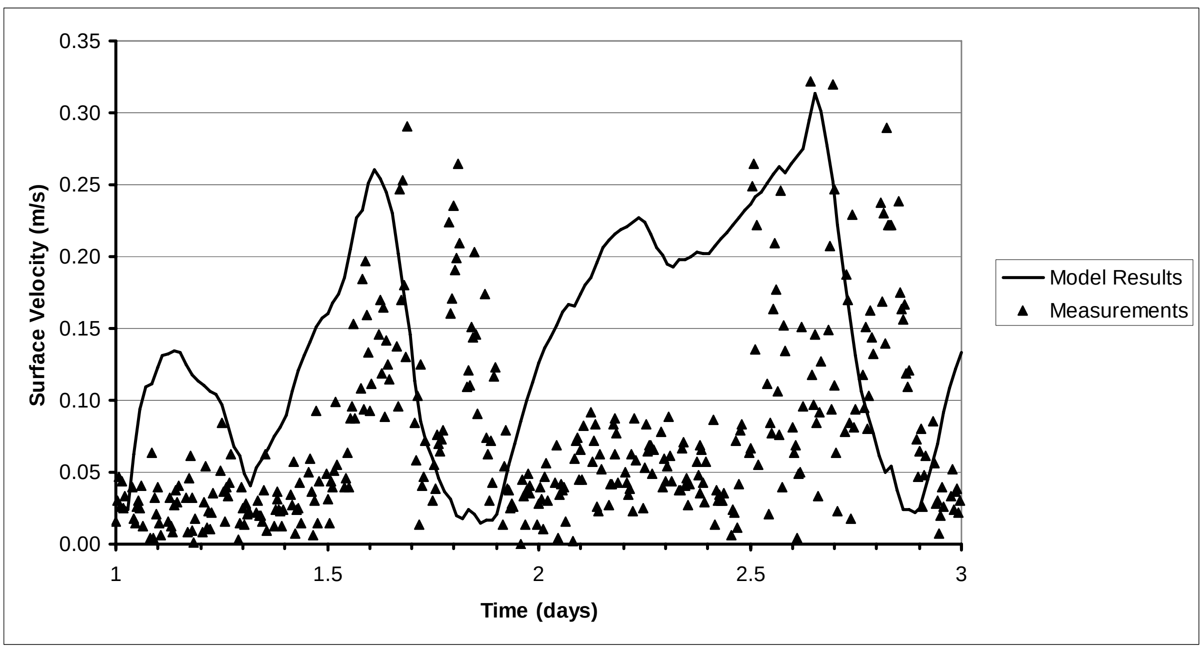


Figure 36. Surface velocity comparison for small swell period (Oct. 20-21, 2005).

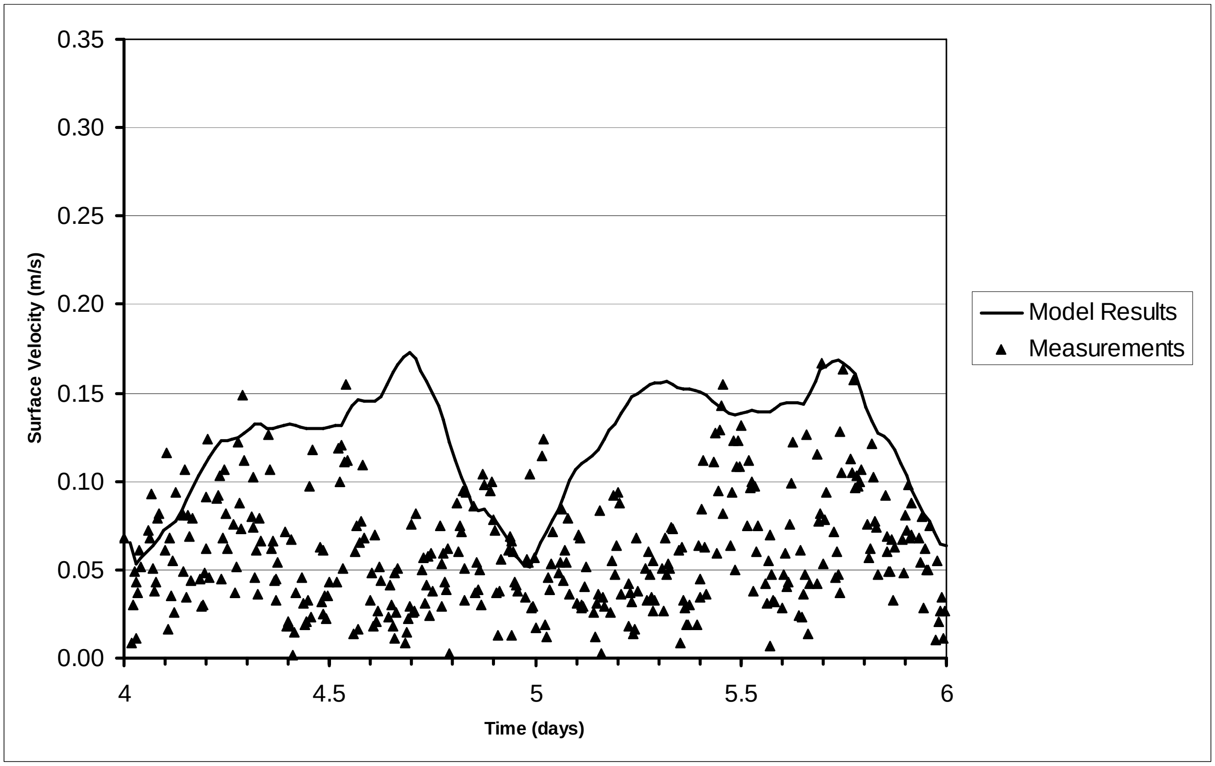


Figure 37. Surface velocity comparison for moderate swell period (Oct. 23-24, 2005)

Model Case	Measured Wave Height (m)	Modeled Wave Height (m)	Measured Direction (degrees)	Modeled Direction (degrees)
Small Swell	0.60	0.62	205	210
Moderate Swell	1.20	1.21	210	210

Table 8. Average measured and modeled wave condition comparison for model cases

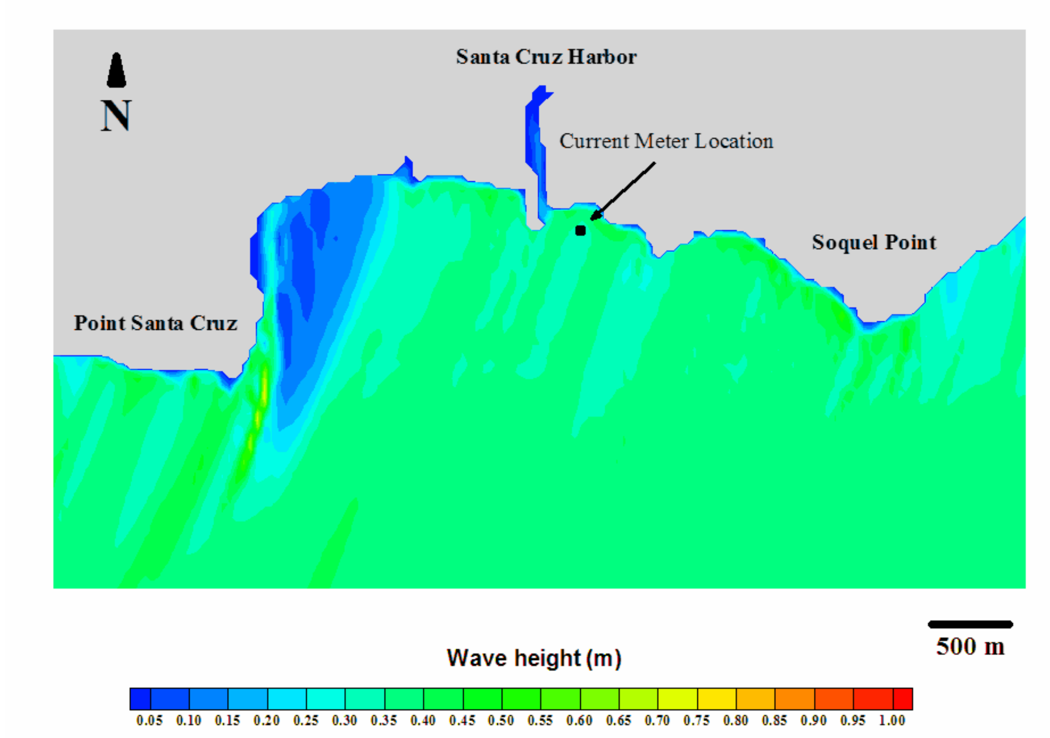


Figure 38. Wave height contours for small swell period (Oct. 20-21, 2005). Note the protected area inside of Point Santa Cruz.

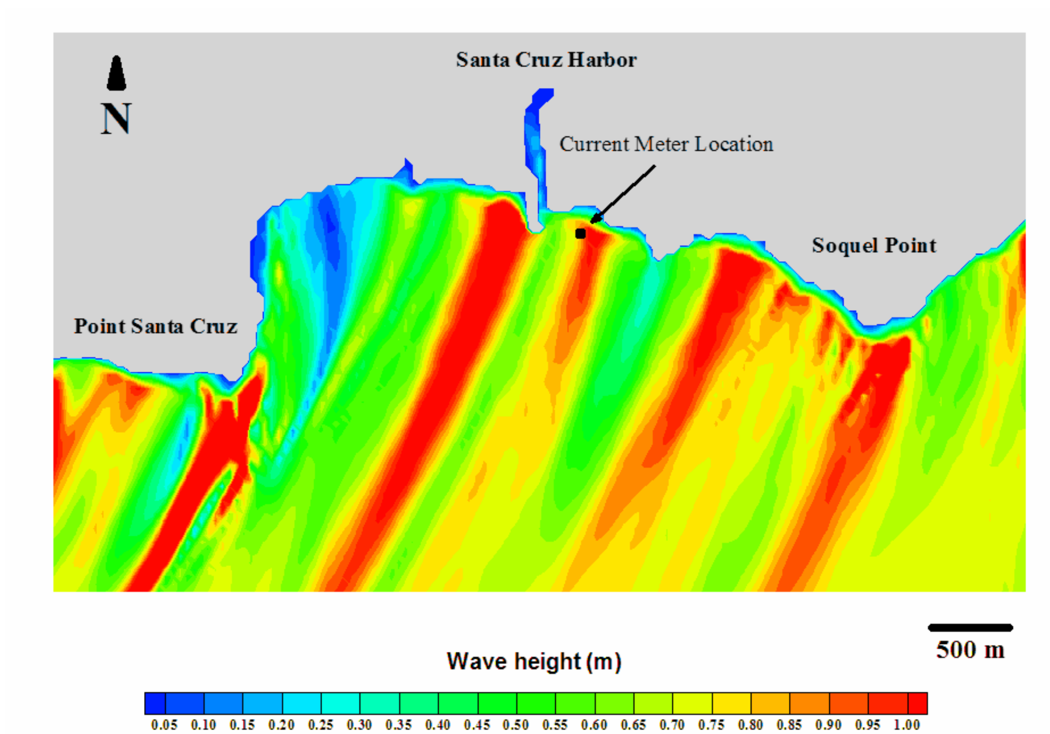


Figure 39. Wave height contours for moderate swell period (Oct. 23-24, 2005).

3.6.2 Model results

Two model runs were completed using data from the time periods listed in Table 7. The cases were run for a time period of 48 hours with a dredge event commencing at 6 pm on the first day and ceasing at 10 pm on the same day. At every time step for the specified duration of the model run, EFDC calculates currents and water column properties at each model grid point. These values are output at specified times of interest during the model run.

Run 1 – Small Swell Case – October 20th-21st, 2005

Run 1 encompasses the period of dredging with the lowest swell and large tides. The measured currents were the highest of the instrument deployment period (Figure 36). The wave model results and measurements are summarized in Table 8.

Figure 40 shows a snapshot of velocity vectors and shear stress contours ($dynes/cm^2$) during the maximum modeled values at 8:10 pm on October 21st. Figure 41 shows the same parameters during the minimum modeled values at 8:40 pm on October 20th. The darkest blue regions in the color contours represent the area of shear stresses equal to or below 1 $dynes/cm^2$ where coarse silt sediments would begin to settle out. It is important to note that the dark blue region at the shoreline interface is a modeling artifact at the boundary due to interpolation. The figures illustrate that the only large regions where deposition of coarse silt could occur are either at the offshore boundary or inside the SCH.

Figure 42 shows the initial pulse of dye release used to represent the dredge discharge. The figure shows a snapshot at 8:40 pm which is 2.3 hours after dredging discharge has begun. Figure 43 shows a snapshot of the discharge plume transport 12 hours after dredging has ceased. The plume is transported past Soquel Point and is dispersing offshore. The east flow of the plume is consistent with observed alongshore transport in the Santa Cruz region. Additional material is also transported back into the harbor due to tidal motion over the discharge period. Comparison of Figures 40 and 41 with Figures 42 and 43 shows that there is no probability of coarse silt deposition in the nearshore regions of plume transport during this time period. By the end of the 48 hour model run the dye levels had been diluted to very low levels (< 1 mg/L).

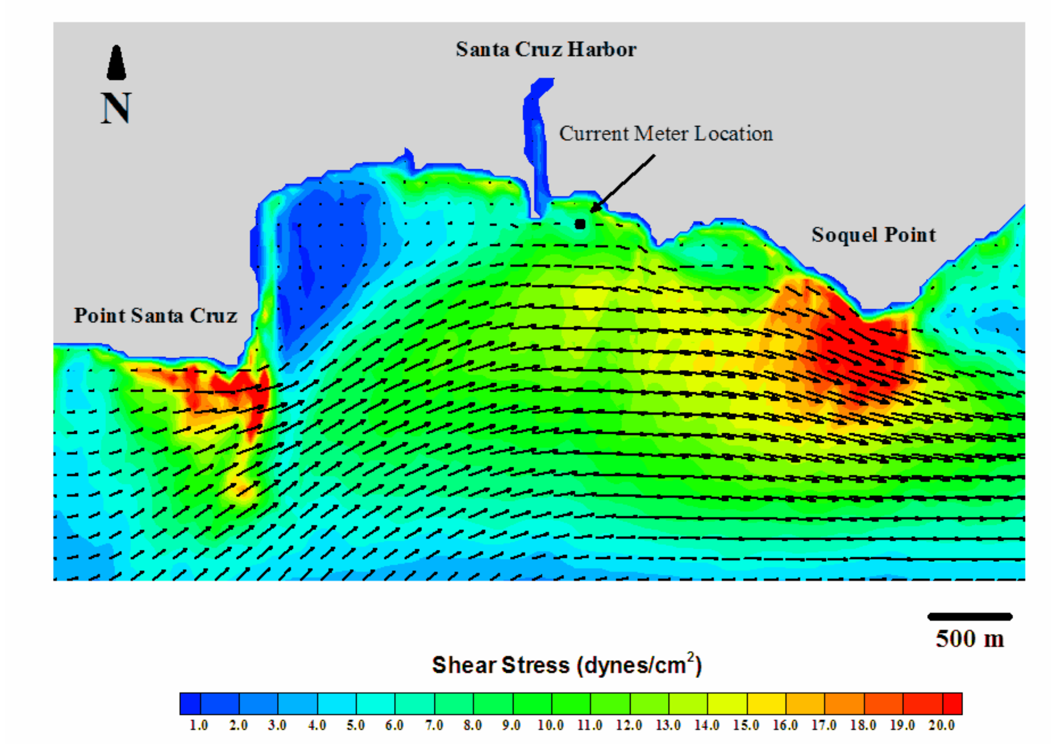


Figure 40. Average velocity vectors and bottom shear stress at 8:10 pm on October 21st, 2005.

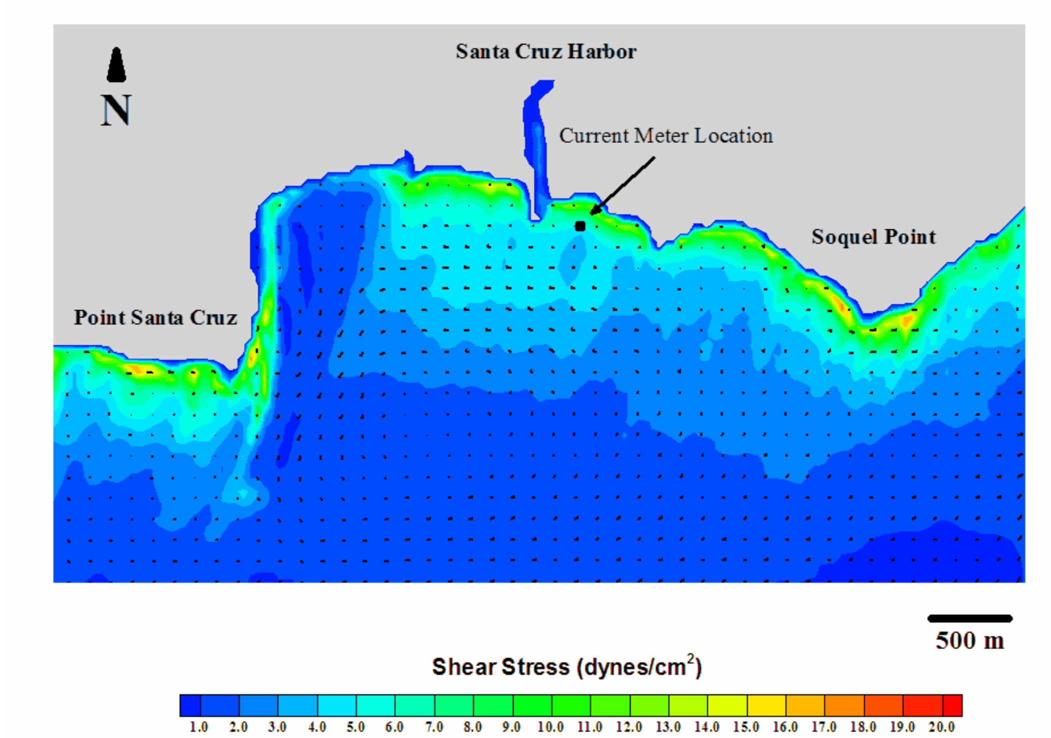


Figure 41. **Average velocity vectors and bottom shear stress at 8:40 pm on October 20th, 2005.**

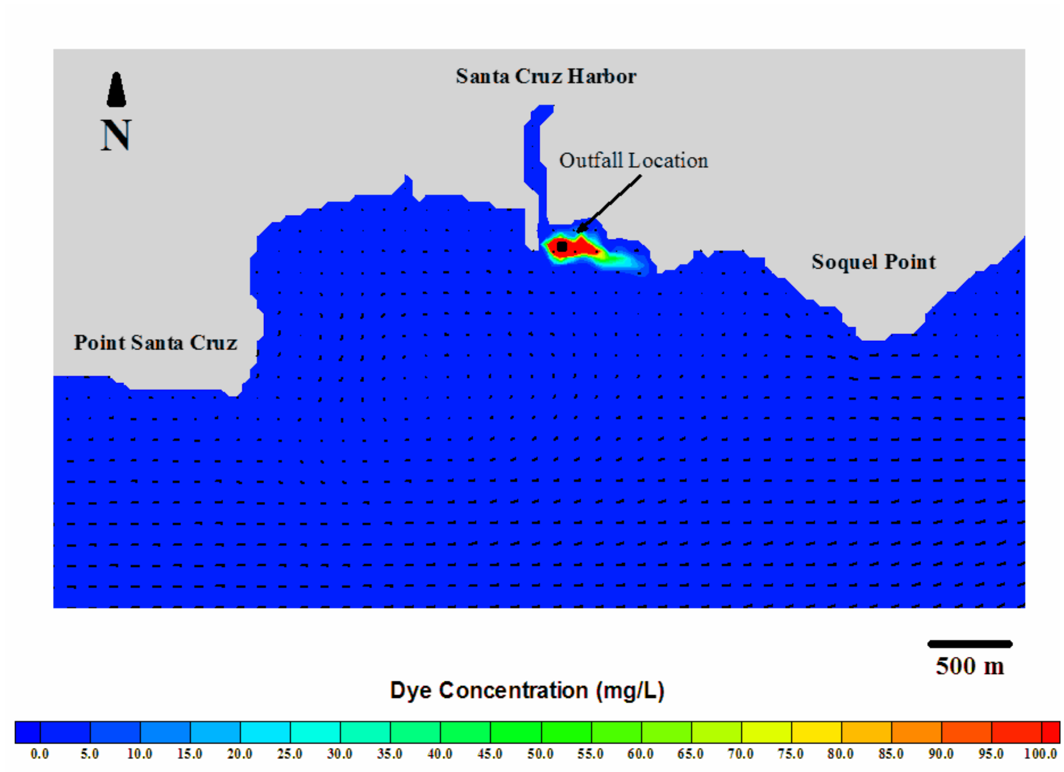


Figure 42. Average velocity vectors and dye concentrations at 8:40 pm on October 20th, 2005.

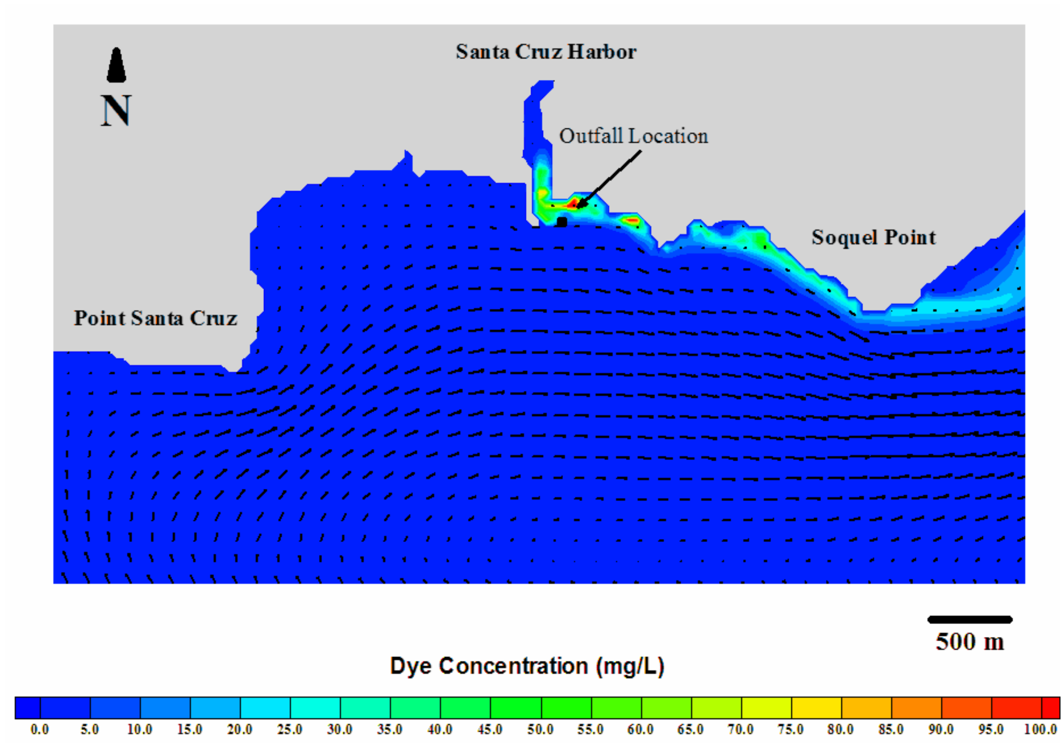


Figure 43. Average velocity vectors and dye concentrations at 6:00 am on October 21st, 2005.

Run 2 – Moderate Swell Case – October 23rd-24th, 2005

Run 2 simulates a 48 hour period of moderate swell. The measured currents were some of the lowest during the instrument deployment (Figure 37). The wave model results and measurements are summarized in Table 8.

Figure 44 shows a snapshot of velocity vectors and shear stress contours ($dynes/cm^2$) during the maximum modeled values at 6:15 pm on October 23rd. Figure 45 shows the same parameters during the minimum modeled values at 2:25 am on October 24th. The darkest blue regions in the color contours represent the area of shear stresses equal to or below 1 $dynes/cm^2$ where coarse silt sediments would begin to settle out. The figures illustrate even larger overall bottom shear stress levels throughout the region than the small swell case due to the large wave activity in the area.

Figure 46 shows the initial pulse of dye release used to represent the dredge discharge. The figure shows a snapshot at 8:40 pm which is 2.3 hours after dredging discharge has begun. Figure 47 shows a snapshot of the discharge plume transport 12 hours after dredging has ceased. The plume is transported past Soquel Point and is dispersing offshore similar to the small swell case. The eastward flow of the plume is consistent with observed alongshore transport in the Santa Cruz region. The overall plume concentrations are lower in Figure 47 than the concentrations seen in the small swell case indicating a higher transport and dispersion rate for the larger swell. Additional material is still transported back into the harbor due to tidal motion over the discharge period. Comparison of Figures 44 and 45 with Figures 46 and 47 shows that there is no probability of coarse silt deposition in the nearshore regions of plume transport during this time period. By the end of the 48 hour model run the dye levels had been diluted to very low levels (< 1 mg/L).

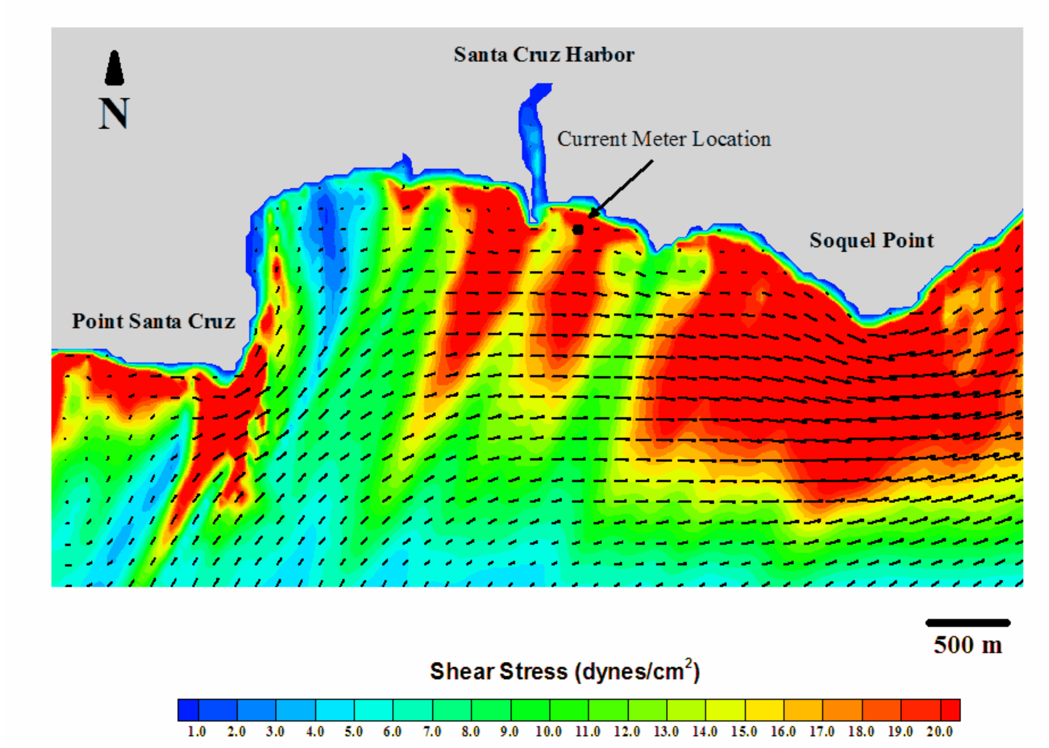


Figure 44. Average velocity vectors and bottom shear stress at 6:15 pm on October 23rd, 2005

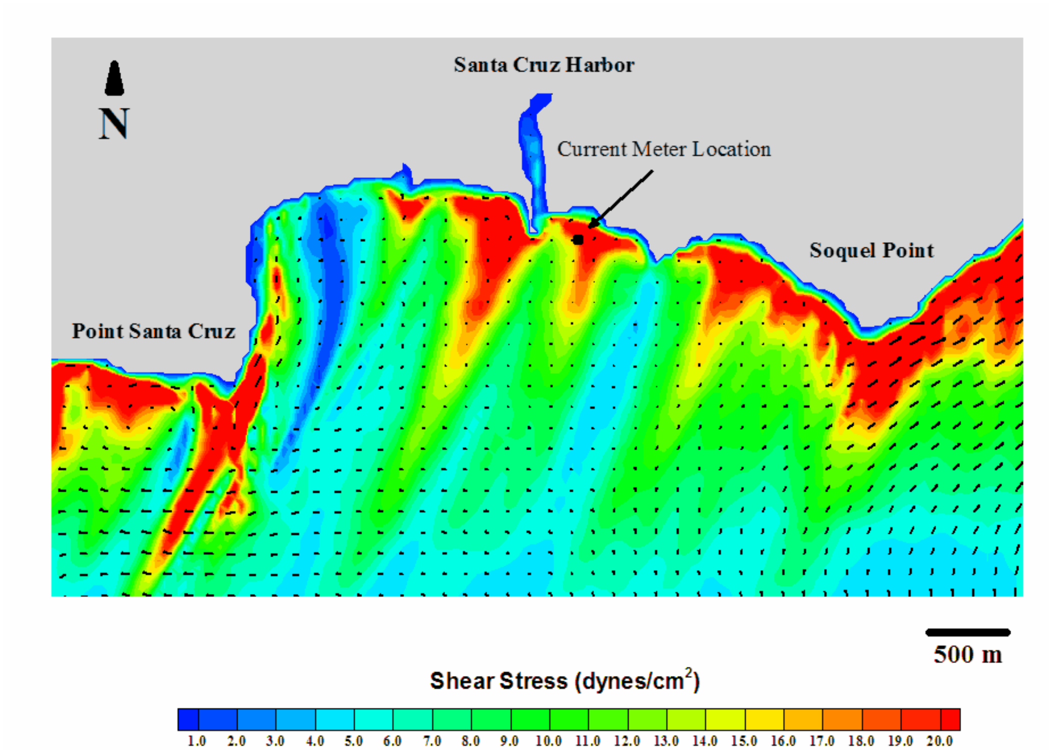


Figure 45. Average velocity vectors and bottom shear stress at 2:25 am on October 24th, 2005

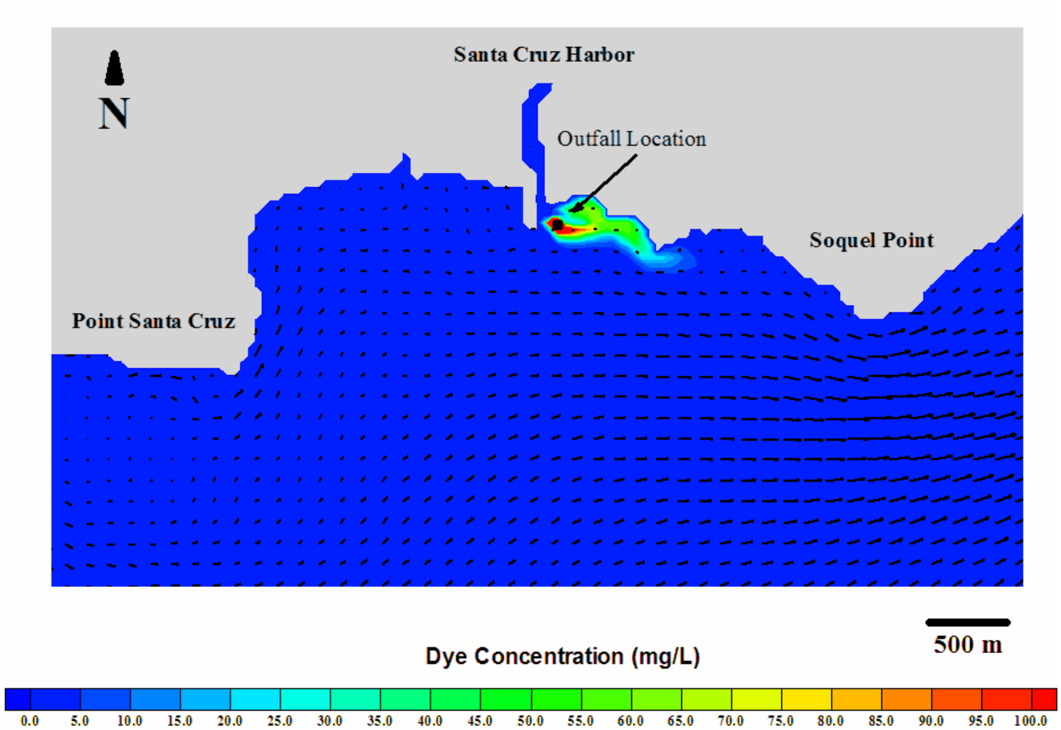


Figure 46. Average velocity vectors and dye concentrations at 8:40 pm on October 23rd, 2005

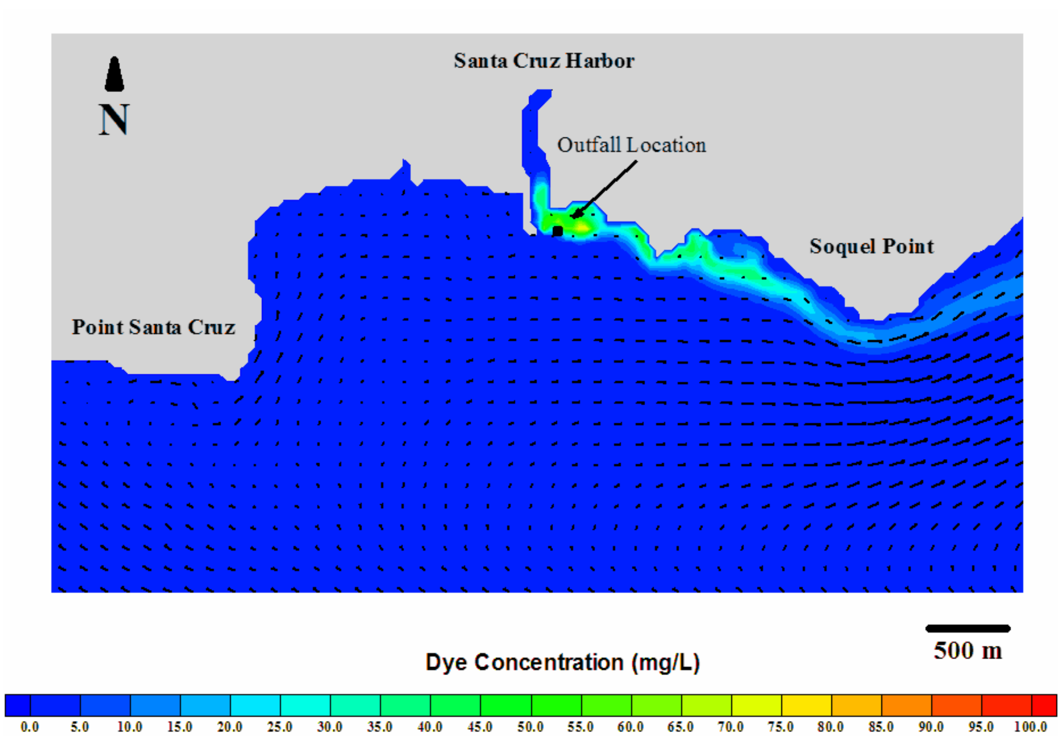


Figure 47. Average velocity vectors and dye concentrations at 6:00 am on October 24th, 2005

The two model runs bracketed the range of conditions measured at the site. The modeling results show that the site is characterized by eastward transport and high nearshore shear stresses. In general, the plume generated at the dredge discharge site hugs the shoreline, and is transported to the east. Once the plume reaches Soquel point it is calculated to detach from the shoreline and disperse into the offshore region. The overall transport direction appears to be independent of where on the tidal cycle the discharge occurs. Generally, during ebb tide, currents strongly flow to the east, while during flood tide, lower currents flow to the west. The current meter data indicated that flow currents flowing to the west are generally lower than the ebb flows to the east. Thus, the bulk of the discharge plume transport is to the east. Additionally, wave action from the northwest to southwest will set up additional nearshore flow to the east. The predominantly easterly direction of longshore transport is observed under prevailing conditions at the SCH (personal communication with SCH Staff).

Perfectly calm conditions are rare at the SCH. The small swell case, with wave heights in the 0.6 m range, is consistent with the predominant summer low-energy conditions. The small swell case shows that significant regions of shear stress greater than 1 dynes/cm^2 are present in the region even during low energy time periods. These results are consistent with extensive nearshore sandy regions mapped in Cowell's Cove in section 3.5 and little or no silt present even in the deeper offshore sediments in section 3.1.

The worst-case conditions measured at the site were modeled in the moderate swell case. Under these conditions, the plume is still calculated to hug the shoreline to the east of the SCH until reaching Soquel Point. The overall shear stresses in the nearshore region are in excess of 1 dynes/cm^2 and it is unlikely that any fine sediment could deposit or accumulate along the Santa Cruz coast. Extreme wave conditions not modeled here will produce even larger shear stresses and present even less likelihood of fine sediment deposition.

4.0 MONITORING PROGRAM COMPARISON

The fall 2005 monitoring program described in this document is the third in a series of inner SCH dredge monitoring programs spanning over the past five years. The first monitoring program was conducted by researchers from Moss Landing Marine Laboratories (MLML) and occurred from March 28th to March 30th 2001 (Watt, 2003; Watt and Greene, 2003). The second inner harbor dredge monitoring program was conducted by SEI and occurred February 15th to April 7th, 2005 (SEI, 2005). Monitoring program dredge volumes and sedimentary compositions are compared in Table 9.

The three monitoring programs all shared the same basic structure: a three phase approach over time to 1) establish a baseline of existing sedimentary conditions in the Santa Cruz Bight before dredging begins, 2) monitor any potential immediate impacts during dredging, and 3) document the sedimentary conditions after harbor dredging was completed.

Monitoring program	Total volume		Sand composition			Silt and clay composition		
	CY	m^3	CY	m^3	%	CY	m^3	%
Winter 2001	3,000	2,294	1,200	917	40	1,800	1,376	60
Winter 2005	7,050	5,392	5,623	4,300	80	1,428	1,091	20
Fall 2005	6,596	5,044	2,034	1,555	31	4,563	3,488	69
5-year total	**16,646**	**12,730**	**8,857**	**6,772**	**53%**	**7,791**	**5,955**	**47%**

Table 9. Comparison of dredging volumes and sedimentary composition of the three inner SCH dredge monitoring programs over the last 5 years.

The outcome of all the three monitoring programs was the same; no significant evidence of silt and clay sediment deposition occurred on any beaches or in the Santa Cruz Bight.

The level of monitoring effort was not always the same. The monitoring effort was greatest for the initial winter 2001 monitoring program (Watt, 2003; and Watt and Greene, 2003) and the fall 2005 monitoring program described in this document. These two monitoring programs included extensive beach and offshore sediment sample analyses, a summation of oceanographic conditions, beach monitoring, SCUBA dives, seawater turbidity measurements, and before and after dredging multibeam bathymetry surveys. This fall's 2005 monitoring effort also included the installation of an offshore wave and current meter and numerical modeling. The winter 2005 monitoring program only required beach and offshore sediment sampling and a summation of oceanographic conditions (SEI, 2005). For this section comparisons will be made between seasonal weather and oceanographic patterns, beach and offshore sediment sampling, and benthic habitat maps produced using the winter 2001 and fall 2005 benthic habitat maps.

The two winter and fall 2005 monitoring programs describe two distinct climates in the Santa Cruz Bight. One is dominated by high-energy winter storm conditions and the other dominated by low-energy summer like conditions. In general, the two winter monitoring programs both experienced episodic high-energy storms that produced strong winds, high surf, heavy rainfall and significant inputs of silt and clay sediment from the San Lorenzo River. During the winter storms, conditions were ideal for sediment transport. Conversely, the fall 2005 monitoring program occurred during mild, dry summer conditions that lacked strong winds, high surf, any rainfall, or sedimentary inputs other than those contributed by inner SCH dredging. The lack of high-energy conditions provided potentially ideal conditions for silt and clay sediment to deposit (Figure 48).

This photograph of the San Lorenzo River mouth was taken during the initial 2001 inner SCH dredge monitoring program on February 20, 2001. This image clearly illustrates high-energy winter storm conditions. The perspective of this photo is westward towards the Beach and Boardwalk.

This photo of the San Lorenzo River mouth was taken during the fall 2005 inner SCH monitoring program on October 27, 2005. This image illustrates typical low-energy summer like conditions. The perspective of this photo is westward towards the Beach and Boardwalk.

Figure 48. The above images illustrate the drastic difference between high-energy winter storm conditions and low-energy summer conditions at the San Lorenzo River 1 kilometer west of the SCH.

Despite the drastic difference in the sediment transport conditions between the fall 2005 monitoring program and the two winter monitoring programs, silt and clay released during inner SCH dredging did not cause significant changes in sediment sample mean grain-size or silt and clay percentage beyond the range of normal background conditions for any monitoring program. The range of grain-size parameters from sediment samples collected during the three monitoring programs are listed in Table 10.

Grain-size parameters	Fall 2005	Winter 2005	Winter 2001
Mean grain size (µm)			
Before dredging	86-780 µm	82-433 µm	90-530 µm
During dredging	105-392 µm	82-485 µm	80-560 µm
After dredging	98-486 µm	77-444 µm	70-530 µm
Wentworth classification			
Before dredging	very-fine to coarse-sand	very-fine to medium-sand	very-fine to coarse-sand
During dredging	very-fine to coarse-sand	very-fine to medium-sand	very-fine to coarse-sand
After dredging	very-fine to coarse-sand	very-fine to medium-sand	very-fine to coarse-sand
Percent silt and clay			
Before dredging	0-42 %	0-30 %	0-26 %
During dredging	0-19 %	0-31 %	0-25 %
After dredging	0-19 %	0-35 %	0-26 %

Table 10. Comparison of grain–size analyses of sediment samples collected for the three inner SCH dredge monitoring programs over the last 5 years.

The highest silt and clay percentages in sediment samples occurred in the same general locations for all three monitoring programs. The locations most often sampled with relatively high silt and clay percentages were positioned in deeper waters (~ 15 m) directly offshore of the San Lorenzo River.

Benthic habitat maps like those found in Figures 30 and 34 were produced for the winter 2001 monitoring program (Watt, 2003; Watt and Greene, 2003). Table 11 shows a comparison of the percent area for each benthic habitat type covered in the after dredging winter 2001 and after dredging fall 2005 monitoring program benthic habitat maps. Only areas in the Santa Cruz Bight covered by both maps were used to compute the percentages in Table 11.

Benthic Habitat	% area in Winter 2001	% area in Fall 2005	% Difference
Flat sand	50.8	45.3	+5.5
Exposed rock outcrop	16.7	13.8	+2.9
Scours and depressions	3.1	3.9	-0.9
Sediment covered subcrop	29.4	37.0	-7.6

Table 11. Comparison of 4.5 years of change in the percent areas of benthic habitat types between the winter 2001 and fall 2005 benthic habitat maps.

The table indicates that the percent areas of benthic habitats in the Santa Cruz Bight over the past 4.5 years are variable by as much as 7.6%. Changes between winter 2001 and fall 2005 habitats are a function of many factors including changes in seasonal weather patterns and oceanographic conditions which control regional sediment inputs and sediment transport rates.

Another sediment shift map was produced like the one in Figure 35 by comparing the winter 2001 and the fall 2005 benthic habitat maps (Figure 49). This comparison evaluated sediment shift patterns that have occurred over a roughly 4.5 year period.

The 2001-2005 sediment shift map indicates that the spatial distribution of 69% of the benthic habitats had remained unchanged, a 20% difference from the fall 2005 sediment shift map (89% unchanged - see Figure 35). The Santa Cruz Bight has also undergone more areal erosion (17%) than areal deposition (14%) over the past 4.5 years. Using the SCH as a central divide between the western and eastern sections of the Santa Cruz Bight, shows that 71% of the total areal erosion took place in the eastern Santa Cruz Bight while 69% of the total areal deposition occurred in the western Santa Cruz Bight. Large scour features in the southwest corner of the Bight appear to have migrated northeasterly by more than 100 meters, an average rate of over 20 meters per year. This implies that net sediment transport is traveling from west to east around Point Santa Cruz. The indication of a higher percentage of areal erosion in general in the Bight suggests that the amount of sediment (sand, silt and clay) entering the Santa Cruz Bight from the west (or from the San Lorenzo River) is less than the amount being transported out of the Santa Cruz Bight to the east, a net sediment deficit in this localized system.

5.0 DISCUSSION

Inner SCH maintenance dredging occurred in the evenings from October 12th to October 31st 2005. Dredge volume calculations estimate that 6,596 CY (5,044 m^3) of sediment was removed from the inner harbor (RHE, Inc., 2005) and placed ~50 meters offshore of Twin Lakes Beach near the seafloor. Approximately 31% of the material was composed of sand and 69% composed of silt and clay

Wave conditions during the fall 2005 monitoring program were milder than those occurring in the previous monitoring programs conducted in the winters of 2001 and 2005. No high-energy winter storms occurred in the Monterey Bay during the fall 2005 monitoring program. Only three swells produced wave heights over 3m offshore of Monterey Bay during the monitoring period, two while dredging occurred and the largest after dredging took place.

Mild surf during the fall 2005 monitoring period was not of sufficient magnitude to significantly alter beach morphology, indicating that sediment transport rates in the Santa Cruz Bight littoral zone during the monitoring program were low. Low-energy conditions provided the best possible opportunity for silt and clay sediments to be deposited on the beaches or offshore of the SCH. Stream flow (and therefore sediment input) to the Santa Cruz Bight from all local rivers, lakes and lagoons, including the San Lorenzo River, were insignificant. The lack of sediment input from the San Lorenzo River implies that any potential increases in silt and clay concentration sampled in sediments during or after dredging would likely have been the result of harbor dredging and not the San Lorenzo River.

Beach sediment samples collected from the San Lorenzo River mouth to Blacks Point were composed of > 99% sand throughout the fall 2005 monitoring program. Samples indicate that silt and clay sediments were not deposited on these beaches at any time during the monitoring period. The ranges of grain-size parameters in offshore sediment samples were more variable than beach sediment sample parameters. Sediment samples containing over 20% silt and clay concentrations were rare (~ 3%) and were collected only from sample locations 6 and 7 offshore before dredging took place. Sample locations 6 and 7 are likely locations for silt and clay to deposit in the Santa Cruz Bight because they are positioned in deeper waters (~ 15 m) away from the shoreline, shallow water wave influence, and directly offshore of the San Lorenzo River. These areas also had the highest silt and clay concentrations during the winter 2001 and winter 2005 monitoring programs (Watt, 2003; Watt and Greene, 2003; SEI, 2005).

No evidence of consolidated silt or clay deposits were observed during SCUBA dives. The seafloors observed at the five dive locations were generally sandy or contained eroded, low-relief sedimentary rock outcrops encrusted with marine invertebrates and/or kelp holdfasts. Diving visibility was poor near the sea surface due to algal bloom and was worse near the seafloor due to resuspended sediments. Resuspended sand, silt and clay sediments were common near the seafloor and in the water column throughout the monitoring program.

SCUBA diver observations compliment turbidity profiles from 14 sample locations offshore of SCH. Turbidity values were highest near the seafloor. The highest recorded seafloor turbidity value was 11.5 NTU offshore of Corcoran Beach a week after dredging had ceased. Many sample locations had a distinct turbidity spike ~1-3 meters below the sea surface,

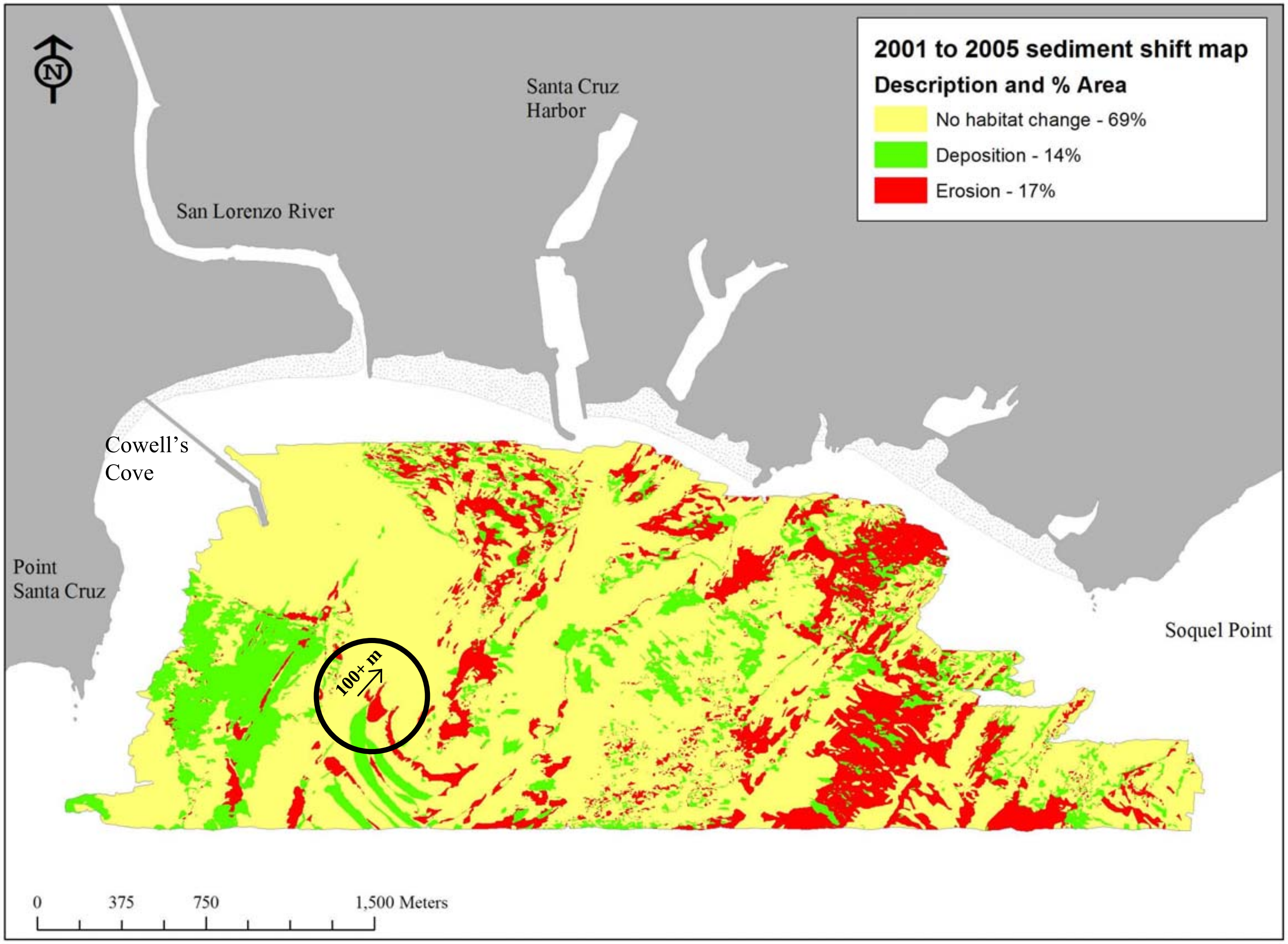


Figure 49. This figure indicates surficial changes that occurred in the spatial distribution of benthic habitats mapped after dredging occurred during the winter 2001 monitoring program on April 11th, 2001 and after dredging occurred on November 14th during the fall 2005 monitoring program, a time span of ~4.5 years. The black circle indicates where scour depression may have migrated northeastward over 100 meters.

probably due to the algal bloom noted during observational SCUBA dives. In general, turbidity offshore of SCH was low for the entire monitoring program. A turbidity signature caused by inner SCH dredging could not be differentiated from normal background turbidity conditions.

Benthic habitats were mapped before and after dredging with nearly identical spatial geometries and spatial distributions. Two notable bathymetric features imaged on the Santa Cruz Bight seafloor may play significant roles in trapping, diverting, or enhancing sediment transport (Watt, 2003). Ledges and low-lying troughs present in the exposed, fractured, and eroded bedrock of the Pleasure Point fault offshore of Soquel Point (Figure 48), may trap and partially obstruct sediment transport downcoast around Soquel Point (Watt, 2003). Another bathymetric feature which may affect sediment transport is the irregularly shaped rock outcrop shelf extending southwestward offshore of Blacks Point (Figure 50). The ledge is ~ 2 m above the surrounding flat sandy seafloor and may act as an obstruction to predominantly southeastward traveling littoral drift from Twin Lakes Beach or may impact nearshore currents. The densest kelp forests found in the Santa Cruz Bight are associated with the above two bathymetric features which may also affect sediment transport in these areas.

A comparison of the fall 2005 before and after dredging benthic habitat maps indicate that 89% of the habitats offshore of SCH did not change over the monitoring period. A nearly equal amount of areal sedimentary erosion (6%) and deposition (5%) were mapped over the course of the monitoring period. Stability in the spatial distribution of offshore benthic habitats is another indication that sediment transport conditions in the Santa Cruz Bight were low or episodic during the fall 2005 monitoring program.

The numerical modeling runs indicate the shear stresses and direction of sediment transport while dredging occurred during the fall 2005 monitoring program. The two model runs were executed for the region offshore of SCH incorporating Nortek AWAC wave and current meter data and high-resolution multibeam bathymetry to develop and verify the models. The two runs represented the lowest and highest energy wave and current conditions measured while dredging occurred between October 12th and October 31st. In addition, a release of dye was used to approximate dredge material dispersal offshore under inner SCH dredge conditions. The small swell case conditions are representative of the low-energy summer like conditions that dominated the monitoring period. The worst swell case conditions are representative of the highest swell conditions encountered while dredging occurred.

The spatial distribution of benthic habitats offshore of SCH and the results of numerical modeling support one another. Large expanses of flat sand occur in Cowell's Cove corresponding with low shear stresses predicted by the numerical model in this area. Areas of exposed rock outcrops corresponded with areas where shear stresses were the largest, around Point Santa Cruz, Soquel Point and nearshore. The numerical modeling results show that the Santa Cruz Bight was characterized by eastward sediment transport during dredging. Additional wave-energy would significantly increase nearshore flow to the east. Net eastward sediment transport is also implied by the winter 2001- fall 2005 sediment shift map over the past 4.5 years. Extreme winter wave conditions not modeled here would produce larger shear stresses and present less likelihood of fine sediment deposition. The model results indicate that even under low swell conditions, silt and clay sediment is unlikely to deposit in the Santa Cruz Bight and predicts that a plume generated at the discharge site would travel eastward along the shoreline until reaching Soquel Point where it detaches from the shoreline and disperses into the offshore region. By the end of the 48 hour model run, modeled dye levels released at 10,000 mg/L had been diluted to less than 1 mg/L.

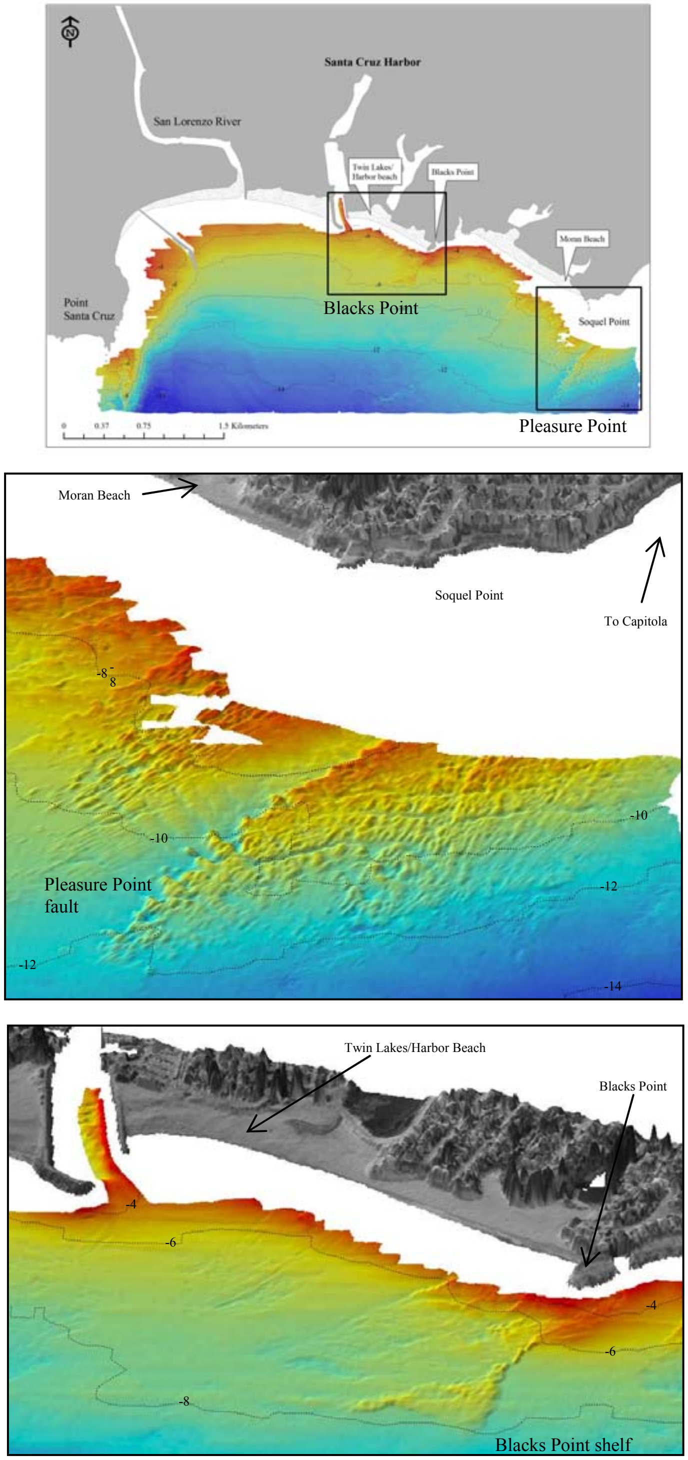


Figure 50. Two bathymetric features in the Santa Cruz Bight may potentially divert, trap, or enhance sediment transport downcoast from the SCH. The top figure indicates where the Pleasure Point fault (middle) and a shelf offshore of Blacks Point (bottom) are located in relation to SCH. Bathymetry contours are displayed in meters below MLLW.

Comparisons between winter 2001 and fall 2005 benthic habitat maps indicate that the Santa Cruz Bight has undergone more areal erosion than deposition over the past 4.5 years. This implies that the amount of sediment entering the Bight may be less than the amount being transported out of the Bight, a net sediment deficit in this localized system. This suggests that local wave and current energy are more than capable of efficiently transporting sand, silt, and clay sediment way from the SCH. This assessment is in agreement with research indicating a net deficit of sand in the larger Santa Cruz Littoral Cell (section 1.1) (Arnal et al., 1973; Oradiwe, 1986; Best and Griggs, 1991; Eittreim et al., 2002a).

6.0 CONCLUSIONS

The fall 2005 monitoring program is the third in a series of inner SCH dredge monitoring programs spanning over the past five years. The first monitoring program was conducted in the winter of 2001 and the second in the winter of 2005. The winter and fall 2005 monitoring programs describe two distinct climates in the Santa Cruz Bight, one dominated by high-energy winter storm conditions and the other dominated by low-energy summer like conditions. Despite the drastic differences in available wave and current energy between the fall and winter monitoring programs, the outcome was the same: no significant changes in sediment sample mean grain-size or silt and clay percentage beyond the range of normal background conditions.

A lack of high-energy storm conditions during the fall 2005 monitoring program provided potentially ideal conditions for silt and clay particle deposition. Stable beach morphologies and persistent spatial distributions of offshore benthic habitats indicate that wave and current energy were not of sufficient magnitude to transport or erode large amounts of sand during the fall 2005 monitoring program. However, grain-size analyses and numerical sediment transport modeling indicate that the episodic, low-energy summer wave and current energy were sufficient to transport silt and clay sediment to the east and outside of the Santa Cruz Bight.

The analysis of sediment samples collected on the beaches and nearshore benthic habitats in the Santa Cruz Bight indicate that silt and clay released from the harbor into the surf-zone did not cause any significant changes in sediment sample mean grain-size or silt and clay percentage beyond the range of normal background conditions. Silt and clay was not deposited on beaches between the San Lorenzo River mouth and Blacks Point, which were composed of > 99% sand throughout the fall 2005, winter 2005, and winter 2001 monitoring programs. No sediment samples were collected with a silt and clay concentration over ~ 19% during or after dredging.

Offshore silt and clay percentages where relatively high before dredging took place in two sample locations directly offshore of the San Lorenzo River, away from wave activity, in the deepest location sampled (the most likely spot for silt and clay to deposit). Silt and clay compositions in these areas were also relatively high in the winter 2001 and the winter 2005 monitoring programs. The recurring presence of relatively high silt and clay percentages and the results of numerical modeling indicate that this area may be a component of a larger sediment transport pathway linking terrestrially supplied silt and clay to the abundant silt and clay deposits found on the northern Monterey Bay midshelf mudbelt (see Figure 2).

SEI SCUBA diver observations and turbidity profiles from 14 sample locations offshore of SCH indicate that a turbidity signature caused by inner SCH dredging could not be differentiated from normal background turbidity conditions at the times of sampling. Turbidity was greatest near the seafloor due to resuspension of sediments by waves and currents and near the sea surface due to an algal bloom.

Shear stress predictions and transport directions from numerical modeling are consistent with the spatial distributions and sediment shifts of benthic habitats in the Santa Cruz Bight. Numerical modeling predictions of low shear stresses correspond to locations of large sand deposits while predictions of high shear stress correspond to locations of exposed rock outcrops. The model indicates an eastward direction of sediment transport while dredging occurred and the winter 2001 – fall 2005 sediment shift map indicates net eastward transport over a 4.5 year period.

Even under low swell conditions, the numerical model predicts that silt and clay sediment is unlikely to deposit offshore of the SCH. This is also supported by the winter 2001 – fall 2005 sediment shift map which suggests a net sediment deficit in this localized system. These data suggest that wave and current energy in the Santa Cruz Bight are more than capable of efficiently transporting sand, silt, and clay eastward and outside of the SCH. The only regions where silt and clay might deposit are inside the protected waters of the SCH or offshore along the midshelf mudbelt where silt and clay has deposited in abundance.

A variety of data sets collected during three monitoring programs over the past 4.5 years provides strong evidence that the Santa Cruz Bight is a high-energy coastline that does not support the deposition of silt and clay sized particles. The evidence includes:

- The absence of increasing or relatively high silt and clay percentages in sediment samples collected in either summer or winter months
- Wide spread shifts in the spatial distribution of benthic habitats, including migrating scour features
- The possibility of a net sediment deficit in the local system
- Sediment bed shear stress calculations indicating that the deposition of particles < 63 μm is unlikely even under low wave conditions

The results show that local wave and current energy are effectively transporting not only silt and clay sediment away from the SCH, but sand-sized material as well. This implies that the Santa Cruz Bight could accommodate a larger volume of inner SCH dredge sediment than is currently permitted.

REFERENCES

Anima, R., Eittreim, S.L., Edwards, B.D., Stevenson, A.J. (2002). Nearshore morphology and late Quaternary geologic framework of the northern Monterey Bay Marine Sanctuary, California. Mar. Geol. vol. 181, pp. 35-54.

Arnal, R.E., Dittmer, E., Shumaker, E., 1973. Sand transport studies in Monterey Bay, California. Moss Landing Marine Labs Technical Publication 73-5, 71pp.

Bascom, W.N., 1951, The Relationship Between Sand-Size and Beach-Face Slope, Transactions American Geophysical Union, 32: 866-874.

Best, T. and Griggs, G.B., 1991, A sediment budget for the Santa Cruz littoral cell, California. Shoreline to Abyss S.E.P.M. Special Publication No. 46.

Breaker, L.C., Broenkow, W.W., 1994. The Circulation of Monterey Bay and related processes. Ocean Mar. Biol. Annu. Rev 32, 1-64.

Christoffersen, J., and Jonsson, I., 1985. Bed friction and dissipation in a combined current and wave motion, Ocean Engr., 17(4):479-494.

Folk, R.L., 1974, Petrology of Sedimentary Rocks, Hemphill Pub. Co., Austin Texas, 182pp.

Foss, B, 1999, Impact of Santa Cruz Harbor Dredging Disposal Sediment on Kelp Forest at Twin Lakes Beach, Santa Cruz Port District Report to CDF&G, MBNMS, U.S. Army Corp of Engineers, CARWQCB, and California Coastal Commission.

Edwards, B.D. (2002). Variations in sediment texture on the northern Monterey Bay National Marine Sanctuary continental shelf. Mar. Geol. vol. 181, pp. 83-100.

Eittreim, S.L., Xu, J.P., Noble, M., Edwards, B.D., (2002). Towards a sediment budget for the northern Monterey Bay continental shelf. Mar. Geol. vol.181, pp. 235-248.

Galperin, B., L.H. Kantha, S. Hassid and A. Rosati, A Quasi-equilibrium Turbulent Energy Model for Geophysical Flows, J. Atmosph. Sci., 45, 55-62, 1988.

Gelfenbaum, G. and J. D. Smith (1986) Experimental evaluation of a generalized suspended-sediment transport theory. In: Shelf Sands and Sandstones, Memoir II, R. J. Knight and J. R. McClean, eds. Canadian Society of Petroleum Geologists, Calgary, pp. 133-144.

Grant, W. D., and Madsen, O. S. (1979). “Combined wave and current interaction with a rough bottom,” J. Geophys. Res. 84(C4), 1797-1808.

Greene, H.G., 1977. Geology of the Monterey Bay region. US Geological Survey Open-File Report OF 77-718, 347 pp.

Hamrich, 1992. A Three-Dimensional Environmental Fluid Dynamics Code: Theoretical and Computation Aspects. The College of William and Mary, Virginia Institute of Marine Science. Special Report 317, 66 pp.

Lewis, R.C., Coale, K.H., Edwards, B.D., Marot, M., Douglas, J.N., Burton, E.J., 2002. Accumulation rate and mixing of shelf sediments in the Monterey Bay National Marine Sanctuary. Mar Geol. vol. 181, pp. 157-169.

Mellor, G.L. and T. Yamada, Development of a Turbulence Closure Model for Geophysical Fluid Problems, Rev. Geophys. Space Phys., 20, 851-875, 1982.

Nortek AS, 2004. AWAC - Acoustic wave and current meter user guide, September, 2004. Doc. No: N3000-126, Revision D. Nortek AS, Vangkroken 2, NO-1351RUD, Norway.

Oradiwe, E.N., 1986, Sediment Budget for Monterey Bay. M.S. thesis, U.S. Naval Post Graduate School, Monterey California, 101 pp.

Red Hill Environmental, Incorporated, 2005. 2005-2006 North Harbor Dredging Project dredged sediment volume and sand content calculations. Prepared by Red Hill Environmental, Inc., for the Port District of the Santa Cruz Small Craft Harbor.

Sea Engineering, Inc., 2005. 2005 Santa Cruz Harbor Dredge Disposal Monitoring Results. Prepared by Sea Engineering, Inc. 200 Washington Street, Suite 210, Santa Cruz, CA, 95060. Prepared for the Port District of the Santa Cruz Small Craft Harbor, 68 pp.

Smagorinsky, J., "General Circulation Experiments with the Primitive Equations, I. The Basic Experiment," Mon. Weather Rev., 91, 99-164. 1963.

Watt, S.G., Greene, H.G., 2003. Monitoring of upper Santa Cruz Harbor mixed sand and mud sediment released into the nearshore area of Santa Cruz, California. Center for Habitat Studies, Moss Landing Marine Laboratories. Prepared for the Port District of the Santa Cruz Small Craft Harbor, 117 pp.

Watt, S.G., 2003. Monitoring harbor dredging and sedimentary changes in coastal habitats of the Santa Cruz Bight, California. California State University, Monterey Bay. Masters Thesis, 95 pp.

Wong, F.L. and Eittreim, S.L., (2002) Continental shelf GIS for the Monterey Bay National Marine Sanctuary. Mar. Geol. vol. 181, pp. 317-321.

Xu, J.P. 1999. Local wave climate and long-term bed shear stress characteristics in Monterey Bay, CA. Mar. Geol. vol. 159, pp. 341-343.

Xu, J.P., Noble, M., Eittreim, S.L., (2002). Suspended sediment transport on the continental shelf near Davenport, California. Mar. Geol. vol. 181, pp. 171-193.

Appendix A

Sediment sample grain-size results

LS Particle Size Analyzer

Santa Cruz Harbor Sediment Monitoring (Fall 2005)

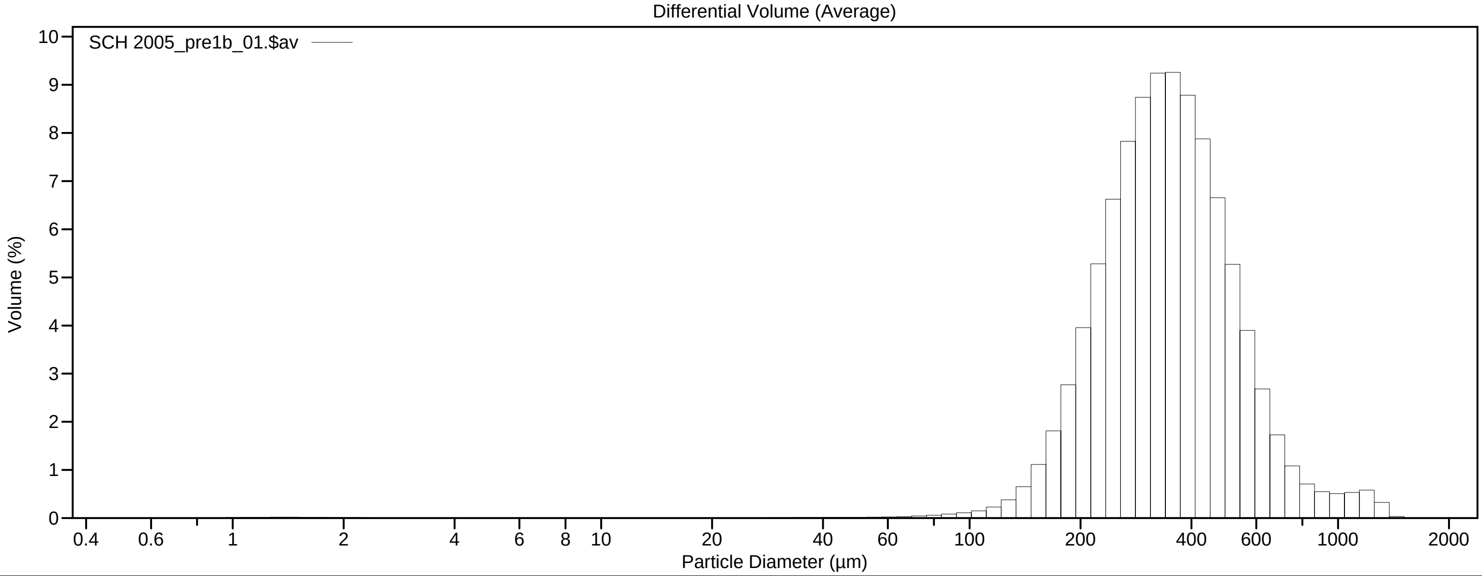
File name:	C:\LS13320\SCH-2005-6-grain-size\Beach-samples\SCH 2005_pre1b_01.$av SCH 2005_pre1b_01.$av
Sample ID:	pre1b
Comment 1:	Collected 10-4-05
Comment 2:	Pre-dredging
Optical model:	Fraunhofer.rf780z

Volume Statistics (Arithmetic) SCH 2005_pre1b_01.$av

Calculations from 0.375 µm to 2000 µm

Volume:	100%		
Mean:	377.0 µm	S.D.:	179.5 µm
Median:	341.6 µm	Variance:	32211 μm^2
Mean/Median ratio:	1.104	Skewness:	1.928 Right skewed
Mode:	356.1 µm	Kurtosis:	5.969 Leptokurtic

d_{10}: 204.6 µm d_{50}: 341.6 µm d_{90}: 577.7 µm



SCH 2005_pre1b_01.$av

Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %
0.375	0	7.422	0.19	146.8	2.15
0.412	0	8.148	0.20	161.2	3.26
0.452	0	8.944	0.20	176.9	5.08
0.496	0	9.819	0.21	194.2	7.85
0.545	0	10.78	0.21	213.2	11.8
0.598	0	11.83	0.22	234.1	17.1
0.657	0	12.99	0.23	256.9	23.7
0.721	0	14.26	0.23	282.1	31.5
0.791	0.00018	15.65	0.24	309.6	40.3
0.869	0.0026	17.18	0.24	339.9	49.5
0.954	0.0099	18.86	0.25	373.1	58.8
1.047	0.022	20.71	0.25	409.6	67.6
1.149	0.037	22.73	0.26	449.7	75.4
1.261	0.054	24.95	0.27	493.6	82.1
1.385	0.072	27.39	0.27	541.9	87.4
1.520	0.091	30.07	0.28	594.9	91.3
1.669	0.11	33.01	0.29	653.0	93.9
1.832	0.12	36.24	0.30	716.9	95.7
2.011	0.14	39.78	0.32	787.0	96.8
2.208	0.15	43.67	0.34	863.9	97.5
2.423	0.16	47.94	0.35	948.3	98.0
2.660	0.17	52.63	0.37	1041	98.5
2.920	0.17	57.77	0.39	1143	99.1
3.206	0.17	63.42	0.41	1255	99.6
3.519	0.18	69.62	0.44	1377	99.97
3.863	0.18	76.43	0.49	1512	100
4.241	0.18	83.90	0.55	1660	100
4.656	0.18	92.10	0.63	1822	100
5.111	0.18	101.1	0.74	2000	100
5.610	0.18	111.0	0.89		
6.159	0.18	121.8	1.12		
6.761	0.19	133.8	1.50		

LS Particle Size Analyzer

Santa Cruz Harbor Sediment Monitoring (Fall 2005)

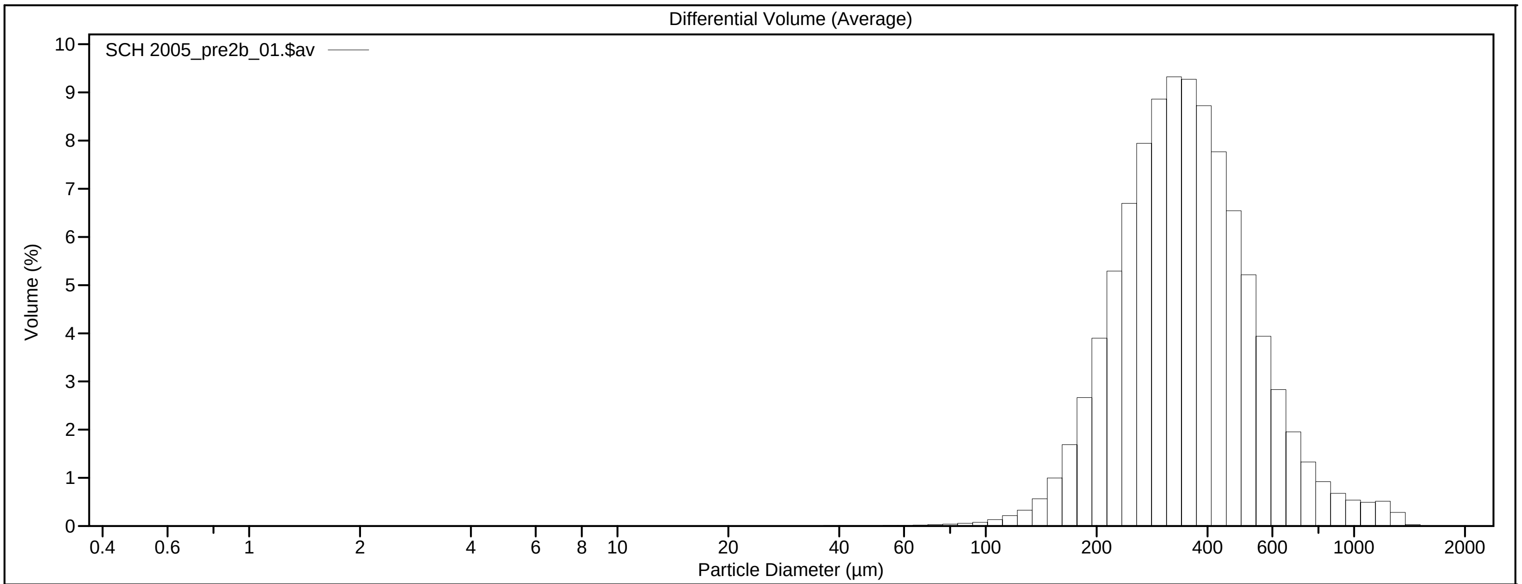
File name:	C:\LS13320\SCH-2005-6-grain-size\Beach-samples\SCH 2005_pre2b_01.$av SCH 2005_pre2b_01.$av
Sample ID:	pre2b
Comment 1:	collected 10-4-05
Comment 2:	Pre-dredging
Optical model:	Fraunhofer.rf780z

Volume Statistics (Arithmetic) SCH 2005_pre2b_01.$av

Calculations from 0.375 µm to 2000 µm

Volume:	100%		
Mean:	381.5 µm	S.D.:	178.7 µm
Median:	343.6 µm	Variance:	31939 μm^2
Mean/Median ratio:	1.110	Skewness:	1.868 Right skewed
Mode:	324.4 µm	Kurtosis:	5.360 Leptokurtic

d_{10}: 209.1 µm d_{50}: 343.6 µm d_{90}: 589.1 µm



SCH 2005_pre2b_01.$av

Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %
0.375	0	7.422	0.0044	146.8	1.60
0.412	0	8.148	0.0066	161.2	2.60
0.452	0	8.944	0.0093	176.9	4.29
0.496	0	9.819	0.012	194.2	6.95
0.545	0	10.78	0.015	213.2	10.8
0.598	0	11.83	0.018	234.1	16.1
0.657	0	12.99	0.021	256.9	22.8
0.721	0	14.26	0.025	282.1	30.8
0.791	0	15.65	0.028	309.6	39.6
0.869	0	17.18	0.031	339.9	49.0
0.954	0	18.86	0.034	373.1	58.2
1.047	0	20.71	0.037	409.6	67.0
1.149	0	22.73	0.041	449.7	74.7
1.261	0	24.95	0.045	493.6	81.3
1.385	0	27.39	0.050	541.9	86.5
1.520	0	30.07	0.056	594.9	90.4
1.669	0	33.01	0.062	653.0	93.3
1.832	0	36.24	0.069	716.9	95.2
2.011	0	39.78	0.078	787.0	96.5
2.208	0	43.67	0.088	863.9	97.5
2.423	0	47.94	0.099	948.3	98.1
2.660	0	52.63	0.11	1041	98.7
2.920	0	57.77	0.12	1143	99.2
3.206	0	63.42	0.14	1255	99.7
3.519	0	69.62	0.16	1377	99.97
3.863	0	76.43	0.19	1512	100
4.241	0	83.90	0.23	1660	100
4.656	0.000004	92.10	0.28	1822	100
5.111	0.000081	101.1	0.36	2000	100
5.610	0.00045	111.0	0.49		
6.159	0.0013	121.8	0.71		
6.761	0.0026	133.8	1.04		

LS Particle Size Analyzer

Santa Cruz Harbor Sediment Monitoring (Fall 2005)

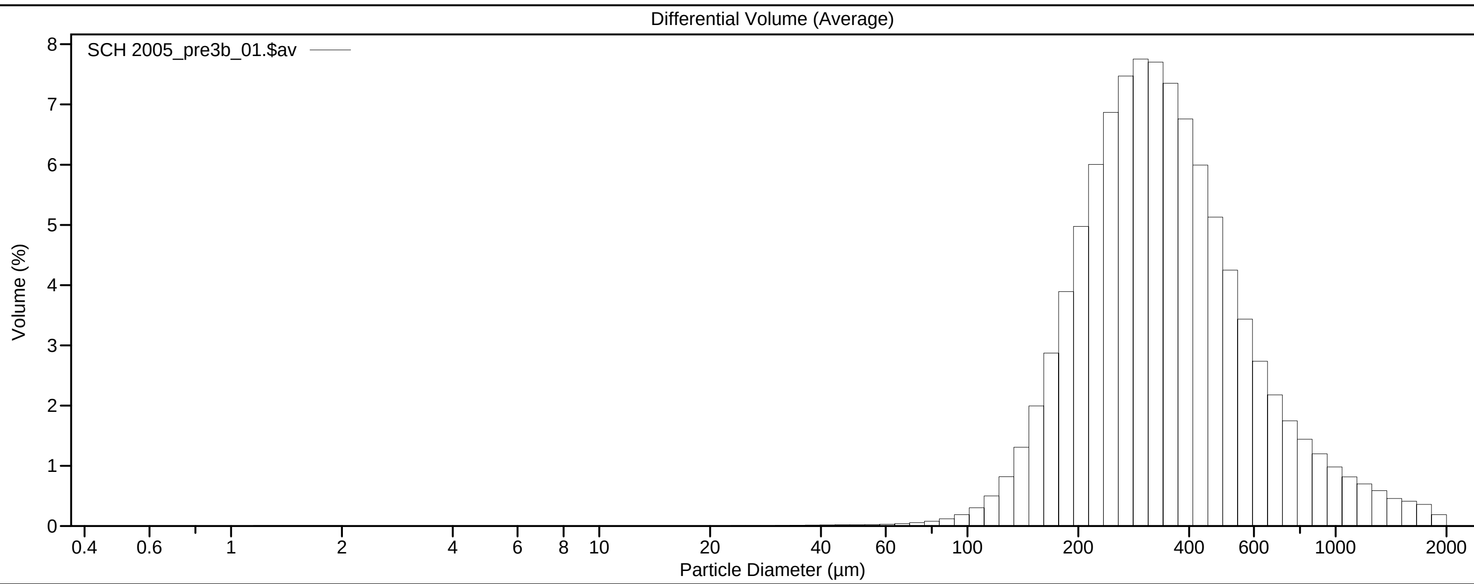
File name:	C:\LS13320\SCH-2005-6-grain-size\Beach-samples\SCH 2005_pre3b_01.$av
	SCH 2005_pre3b_01.$av
Sample ID:	pre3b
Comment 1:	Collected 10-4-05
Comment 2:	pre-dredging
Optical model:	Fraunhofer.rf780z

Volume Statistics (Arithmetic) SCH 2005_pre3b_01.$av

Calculations from 0.375 µm to 2000 µm

Volume:	100%		
Mean:	397.4 µm	S.D.:	258.4 µm
Median:	327.1 µm	Variance:	66786 $µm^2$
Mean/Median ratio:	1.215	Skewness:	2.418 Right skewed
Mode:	295.5 µm	Kurtosis:	7.715 Leptokurtic

d_{10}: 183.1 µm d_{50}: 327.1 µm d_{90}: 684.4 µm



SCH 2005_pre3b_01.$av

Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %
0.375	0	7.422	0.090	146.8	3.74
0.412	0	8.148	0.094	161.2	5.73
0.452	0	8.944	0.098	176.9	8.60
0.496	0	9.819	0.10	194.2	12.5
0.545	0	10.78	0.11	213.2	17.5
0.598	0	11.83	0.11	234.1	23.5
0.657	0	12.99	0.12	256.9	30.3
0.721	0	14.26	0.12	282.1	37.8
0.791	0.000075	15.65	0.13	309.6	45.6
0.869	0.0011	17.18	0.13	339.9	53.3
0.954	0.0041	18.86	0.14	373.1	60.6
1.047	0.0090	20.71	0.14	409.6	67.4
1.149	0.015	22.73	0.15	449.7	73.4
1.261	0.023	24.95	0.16	493.6	78.5
1.385	0.031	27.39	0.16	541.9	82.8
1.520	0.039	30.07	0.17	594.9	86.2
1.669	0.047	33.01	0.18	653.0	88.9
1.832	0.054	36.24	0.20	716.9	91.1
2.011	0.061	39.78	0.21	787.0	92.9
2.208	0.067	43.67	0.23	863.9	94.3
2.423	0.072	47.94	0.25	948.3	95.5
2.660	0.076	52.63	0.27	1041	96.5
2.920	0.079	57.77	0.30	1143	97.3
3.206	0.081	63.42	0.33	1255	98.0
3.519	0.082	69.62	0.37	1377	98.6
3.863	0.083	76.43	0.42	1512	99.0
4.241	0.083	83.90	0.50	1660	99.5
4.656	0.083	92.10	0.62	1822	99.8
5.111	0.084	101.1	0.81	2000	100
5.610	0.084	111.0	1.11		
6.159	0.086	121.8	1.61		
6.761	0.088	133.8	2.43		

LS Particle Size Analyzer

Santa Cruz Harbor Sediment Monitoring (Fall 2005)

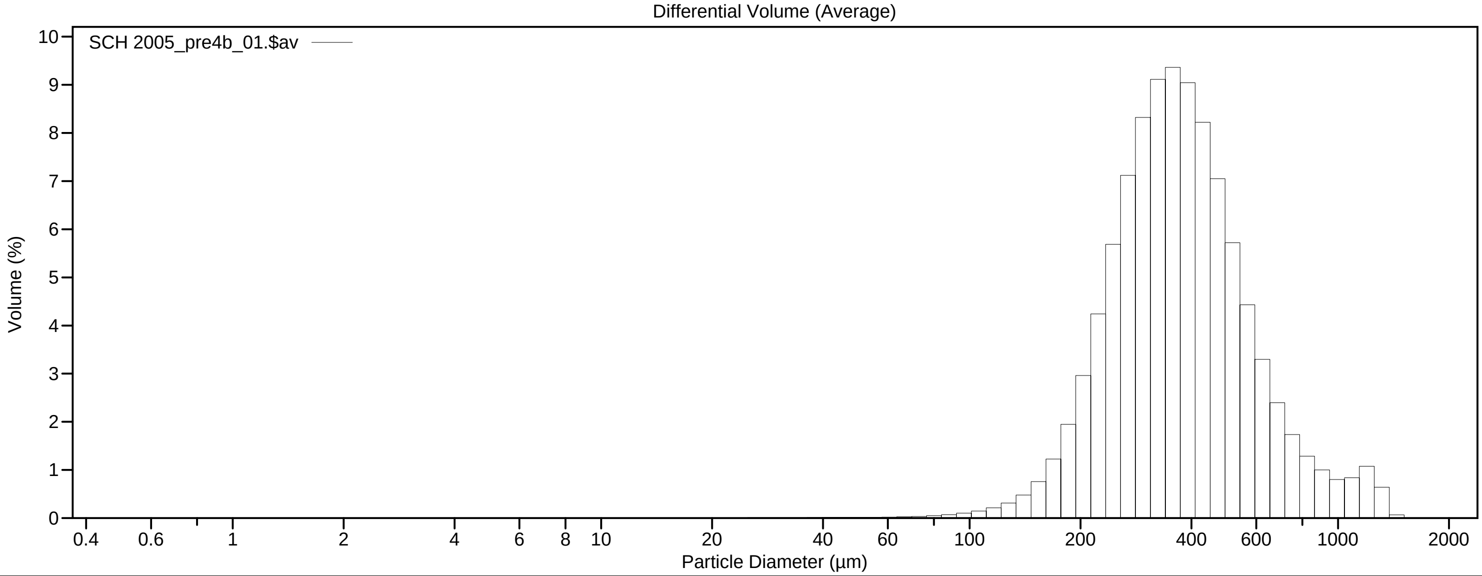
File name: C:\LS13320\SCH-2005-6-grain-size\Beach-samples\SCH 2005_pre4b_01.$av
SCH 2005_pre4b_01.$av
Sample ID: pre4b
Comment 1: Collected 10-4-05
Comment 2: Pre-dredging
Optical model: Fraunhofer.rf780z

Volume Statistics (Arithmetic) SCH 2005_pre4b_01.$av

Calculations from 0.375 µm to 2000 µm

Volume:	100%		
Mean:	412.4 µm	S.D.:	206.7 µm
Median:	364.7 µm	Variance:	42735 µm^2
Mean/Median ratio:	1.131	Skewness:	1.853 Right skewed
Mode:	356.1 µm	Kurtosis:	4.487 Leptokurtic

d_{10}: 220.4 µm d_{50}: 364.7 µm d_{90}: 650.2 µm



SCH 2005_pre4b_01.$av

Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %
0.375	0	7.422	0.017	146.8	1.65
0.412	0	8.148	0.022	161.2	2.41
0.452	0	8.944	0.027	176.9	3.64
0.496	0	9.819	0.031	194.2	5.58
0.545	0	10.78	0.034	213.2	8.55
0.598	0	11.83	0.038	234.1	12.8
0.657	0	12.99	0.041	256.9	18.5
0.721	0	14.26	0.044	282.1	25.6
0.791	0	15.65	0.048	309.6	33.9
0.869	0	17.18	0.052	339.9	43.0
0.954	0	18.86	0.058	373.1	52.4
1.047	0	20.71	0.065	409.6	61.4
1.149	0	22.73	0.072	449.7	69.7
1.261	0	24.95	0.080	493.6	76.7
1.385	0	27.39	0.089	541.9	82.4
1.520	0	30.07	0.098	594.9	86.9
1.669	0	33.01	0.11	653.0	90.2
1.832	0	36.24	0.12	716.9	92.6
2.011	0	39.78	0.13	787.0	94.3
2.208	0	43.67	0.15	863.9	95.6
2.423	0	47.94	0.17	948.3	96.6
2.660	0	52.63	0.18	1041	97.4
2.920	0	57.77	0.20	1143	98.2
3.206	0	63.42	0.22	1255	99.3
3.519	0	69.62	0.25	1377	99.9
3.863	0.000006	76.43	0.28	1512	100
4.241	0.00012	83.90	0.33	1660	100
4.656	0.00078	92.10	0.40	1822	100
5.111	0.0024	101.1	0.50	2000	100
5.610	0.0050	111.0	0.65		
6.159	0.0085	121.8	0.86		
6.761	0.013	133.8	1.17		

LS Particle Size Analyzer

Santa Cruz Harbor Sediment Monitoring (Fall 2005)

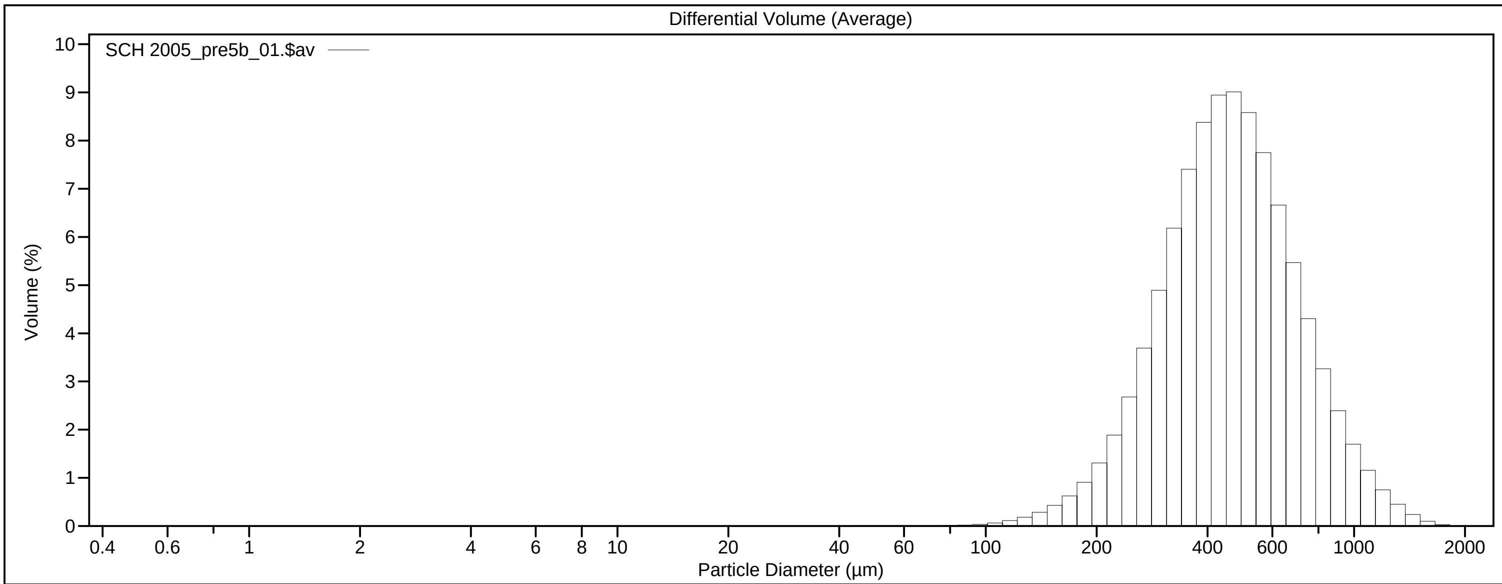
File name:	C:\LS13320\SCH-2005-6-grain-size\Beach-samples\SCH 2005_pre5b_01.$av
	SCH 2005_pre5b_01.$av
Sample ID:	pre5b
Comment 1:	collected 10-4-05
Comment 2:	Pre-dredging
Optical model:	Fraunhofer.rf780z

Volume Statistics (Arithmetic) SCH 2005_pre5b_01.$av

Calculations from 0.375 µm to 2000 µm

Volume:	100%		
Mean:	500.4 µm	S.D.:	220.2 µm
Median:	458.7 µm	Variance:	48481 µm²
Mean/Median ratio:	1.091	Skewness:	1.232 Right skewed
Mode:	471.1 µm	Kurtosis:	2.274 Leptokurtic

d_{10}: 266.2 µm d_{50}: 458.7 µm d_{90}: 788.8 µm



SCH 2005_pre5b_01.$av

Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %
0.375	0	7.422	0	146.8	0.81
0.412	0	8.148	0	161.2	1.24
0.452	0	8.944	0	176.9	1.86
0.496	0	9.819	0	194.2	2.77
0.545	0	10.78	0.00019	213.2	4.08
0.598	0	11.83	0.0019	234.1	5.97
0.657	0	12.99	0.0049	256.9	8.65
0.721	0	14.26	0.0077	282.1	12.3
0.791	0	15.65	0.010	309.6	17.2
0.869	0	17.18	0.012	339.9	23.4
0.954	0	18.86	0.013	373.1	30.8
1.047	0	20.71	0.014	409.6	39.2
1.149	0	22.73	0.015	449.7	48.1
1.261	0	24.95	0.016	493.6	57.2
1.385	0	27.39	0.018	541.9	65.7
1.520	0	30.07	0.021	594.9	73.5
1.669	0	33.01	0.025	653.0	80.1
1.832	0	36.24	0.029	716.9	85.6
2.011	0	39.78	0.034	787.0	89.9
2.208	0	43.67	0.041	863.9	93.2
2.423	0	47.94	0.050	948.3	95.6
2.660	0	52.63	0.059	1041	97.3
2.920	0	57.77	0.070	1143	98.4
3.206	0	63.42	0.080	1255	99.2
3.519	0	69.62	0.090	1377	99.6
3.863	0	76.43	0.10	1512	99.9
4.241	0	83.90	0.11	1660	99.97
4.656	0	92.10	0.13	1822	99.998
5.111	0	101.1	0.17	2000	100
5.610	0	111.0	0.23		
6.159	0	121.8	0.34		
6.761	0	133.8	0.52		

LS Particle Size Analyzer

Santa Cruz Harbor Sediment Monitoring (Fall 2005)

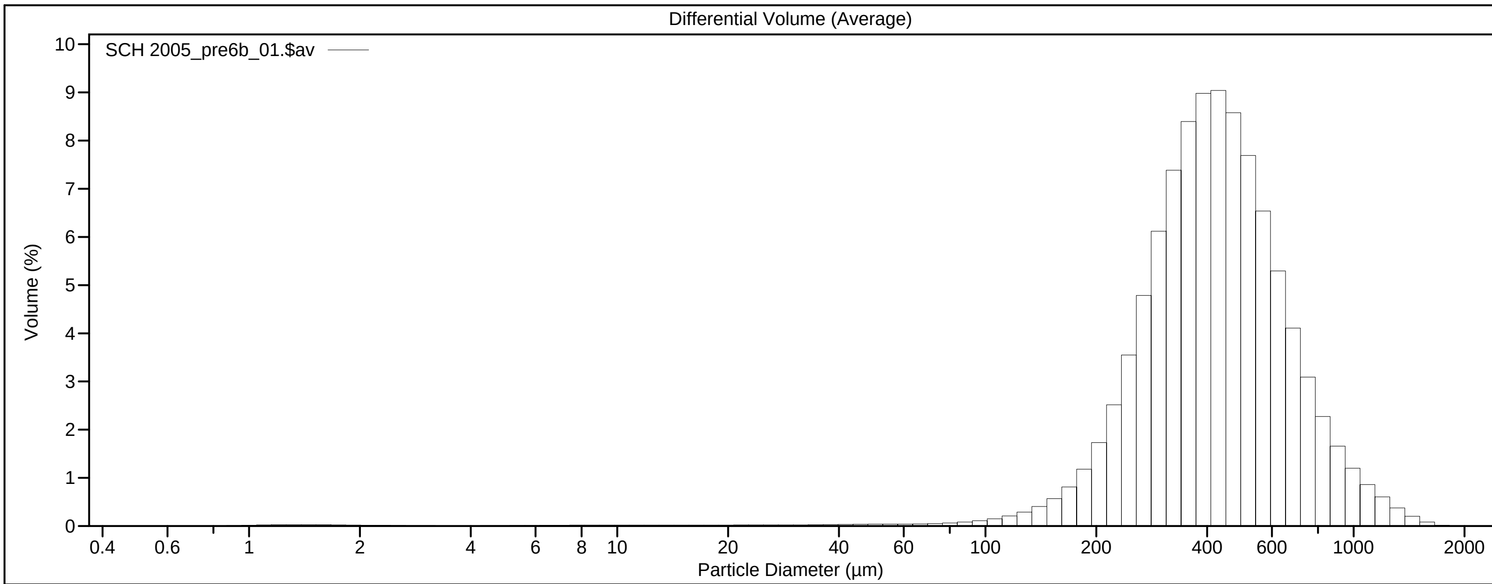
File name:	C:\LS13320\SCH-2005-6-grain-size\Beach-samples\SCH 2005_pre6b_01.$av
	SCH 2005_pre6b_01.$av
Sample ID:	pre6b
Comment 1:	Collected 10-4-05
Comment 2:	Pre-dredging
Optical model:	Fraunhofer.rf780z

Volume Statistics (Arithmetic) SCH 2005_pre6b_01.$av

Calculations from 0.375 µm to 2000 µm

Volume:	100%		
Mean:	456.3 µm	S.D.:	213.6 µm
Median:	416.8 µm	Variance:	45608 µm^2
Mean/Median ratio:	1.095	Skewness:	1.335 Right skewed
Mode:	429.2 µm	Kurtosis:	3.058 Leptokurtic

d_{10}: 239.5 µm d_{50}: 416.8 µm d_{90}: 725.3 µm



SCH 2005_pre6b_01.$av

Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %
0.375	0	7.422	0.37	146.8	2.36
0.412	0	8.148	0.39	161.2	2.92
0.452	0	8.944	0.41	176.9	3.73
0.496	0	9.819	0.43	194.2	4.91
0.545	0	10.78	0.45	213.2	6.64
0.598	0	11.83	0.47	234.1	9.16
0.657	0	12.99	0.49	256.9	12.7
0.721	0	14.26	0.51	282.1	17.5
0.791	0.00027	15.65	0.53	309.6	23.6
0.869	0.0039	17.18	0.55	339.9	31.0
0.954	0.015	18.86	0.57	373.1	39.4
1.047	0.032	20.71	0.59	409.6	48.4
1.149	0.055	22.73	0.62	449.7	57.4
1.261	0.080	24.95	0.64	493.6	66.0
1.385	0.11	27.39	0.66	541.9	73.7
1.520	0.13	30.07	0.68	594.9	80.2
1.669	0.16	33.01	0.71	653.0	85.5
1.832	0.19	36.24	0.73	716.9	89.6
2.011	0.21	39.78	0.76	787.0	92.7
2.208	0.22	43.67	0.80	863.9	95.0
2.423	0.24	47.94	0.83	948.3	96.7
2.660	0.25	52.63	0.87	1041	97.9
2.920	0.26	57.77	0.91	1143	98.7
3.206	0.27	63.42	0.95	1255	99.3
3.519	0.28	69.62	1.00	1377	99.7
3.863	0.29	76.43	1.05	1512	99.9
4.241	0.29	83.90	1.11	1660	99.98
4.656	0.30	92.10	1.19	1822	99.999
5.111	0.31	101.1	1.30	2000	100
5.610	0.33	111.0	1.45		
6.159	0.34	121.8	1.66		
6.761	0.36	133.8	1.95		

LS Particle Size Analyzer

Santa Cruz Harbor Sediment Monitoring (Fall 2005)

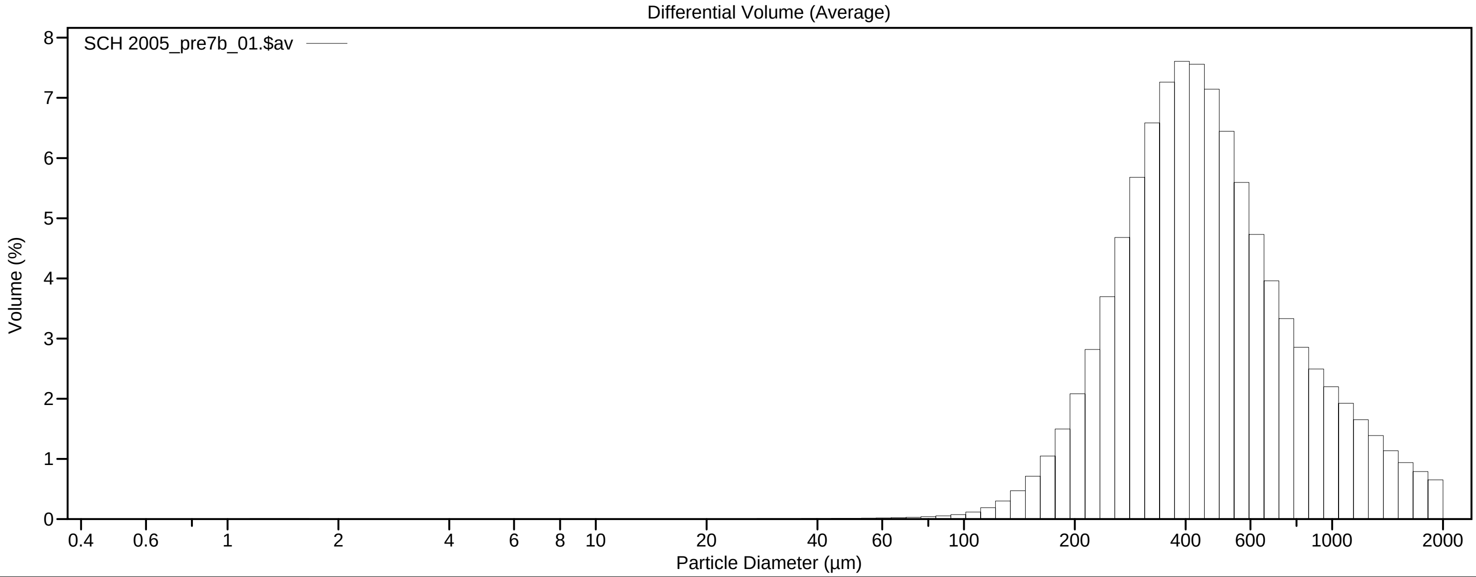
File name:	C:\LS13320\SCH-2005-6-grain-size\Beach-samples\SCH 2005_pre7b_01.$av
	SCH 2005_pre7b_01.$av
Sample ID:	pre7b
Comment 1:	Collected 10-4-05
Comment 2:	During dredging
Optical model:	Fraunhofer.rf780z

Volume Statistics (Arithmetic) SCH 2005_pre7b_01.$av

Calculations from 0.375 µm to 2000 µm

Volume:	100%		
Mean:	530.4 µm	S.D.:	328.8 µm
Median:	435.0 µm	Variance:	108.1e3 µm^2
Mean/Median ratio:	1.219	Skewness:	1.755 Right skewed
Mode:	391.0 µm	Kurtosis:	3.365 Leptokurtic

d_{10}: 235.9 µm d_{50}: 435.0 µm d_{90}: 977.0 µm



SCH 2005_pre7b_01.$av

Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %
0.375	0	7.422	0.076	146.8	1.54
0.412	0	8.148	0.080	161.2	2.25
0.452	0	8.944	0.084	176.9	3.30
0.496	0	9.819	0.088	194.2	4.80
0.545	0	10.78	0.093	213.2	6.88
0.598	0	11.83	0.097	234.1	9.70
0.657	0	12.99	0.10	256.9	13.4
0.721	0	14.26	0.10	282.1	18.1
0.791	0.000072	15.65	0.11	309.6	23.8
0.869	0.0010	17.18	0.11	339.9	30.3
0.954	0.0039	18.86	0.12	373.1	37.6
1.047	0.0086	20.71	0.12	409.6	45.2
1.149	0.014	22.73	0.13	449.7	52.8
1.261	0.021	24.95	0.13	493.6	59.9
1.385	0.028	27.39	0.14	541.9	66.4
1.520	0.035	30.07	0.15	594.9	72.0
1.669	0.042	33.01	0.15	653.0	76.7
1.832	0.048	36.24	0.16	716.9	80.6
2.011	0.053	39.78	0.17	787.0	84.0
2.208	0.058	43.67	0.18	863.9	86.8
2.423	0.061	47.94	0.20	948.3	89.3
2.660	0.063	52.63	0.21	1041	91.5
2.920	0.064	57.77	0.22	1143	93.4
3.206	0.065	63.42	0.24	1255	95.1
3.519	0.066	69.62	0.27	1377	96.5
3.863	0.066	76.43	0.30	1512	97.6
4.241	0.066	83.90	0.34	1660	98.6
4.656	0.066	92.10	0.39	1822	99.3
5.111	0.067	101.1	0.46	2000	100
5.610	0.068	111.0	0.58		
6.159	0.070	121.8	0.77		
6.761	0.073	133.8	1.07		

LS Particle Size Analyzer

Santa Cruz Harbor Sediment Monitoring (Fall 2005)

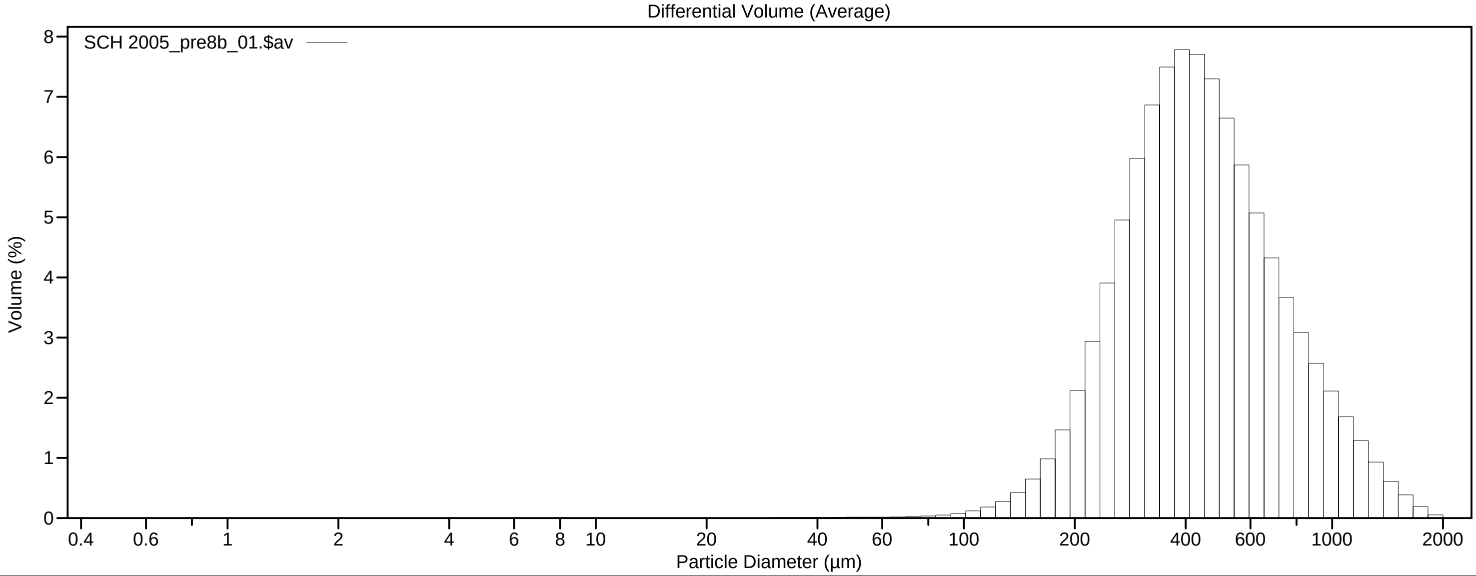
File name:	C:\LS13320\SCH-2005-6-grain-size\Beach-samples\SCH 2005_pre8b_01.$av
	SCH 2005_pre8b_01.$av
Sample ID:	pre8b
Comment 1:	Collected 10-4-05
Comment 2:	Pre-dredging
Optical model:	Fraunhofer.rf780z

Volume Statistics (Arithmetic) SCH 2005_pre8b_01.$av

Calculations from 0.375 µm to 2000 µm

Volume:	100%		
Mean:	496.6 µm	S.D.:	268.2 µm
Median:	427.8 µm	Variance:	71948 µm^2
Mean/Median ratio:	1.161	Skewness:	1.527 Right skewed
Mode:	391.0 µm	Kurtosis:	2.873 Leptokurtic

d_{10}: 236.8 µm d_{50}: 427.8 µm d_{90}: 859.6 µm



SCH 2005_pre8b_01.$av

Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %
0.375	0	7.422	0.0073	146.8	1.38
0.412	0	8.148	0.011	161.2	2.02
0.452	0	8.944	0.014	176.9	3.01
0.496	0	9.819	0.018	194.2	4.48
0.545	0	10.78	0.023	213.2	6.59
0.598	0	11.83	0.027	234.1	9.53
0.657	0	12.99	0.031	256.9	13.4
0.721	0	14.26	0.035	282.1	18.4
0.791	0	15.65	0.038	309.6	24.4
0.869	0	17.18	0.042	339.9	31.2
0.954	0	18.86	0.045	373.1	38.7
1.047	0	20.71	0.049	409.6	46.5
1.149	0	22.73	0.054	449.7	54.2
1.261	0	24.95	0.059	493.6	61.5
1.385	0	27.39	0.065	541.9	68.2
1.520	0	30.07	0.072	594.9	74.0
1.669	0	33.01	0.079	653.0	79.1
1.832	0	36.24	0.088	716.9	83.4
2.011	0	39.78	0.098	787.0	87.1
2.208	0	43.67	0.11	863.9	90.2
2.423	0	47.94	0.12	948.3	92.7
2.660	0	52.63	0.14	1041	94.9
2.920	0	57.77	0.15	1143	96.5
3.206	0	63.42	0.17	1255	97.8
3.519	0	69.62	0.19	1377	98.8
3.863	0	76.43	0.21	1512	99.4
4.241	0	83.90	0.25	1660	99.8
4.656	0.000015	92.10	0.30	1822	99.9
5.111	0.00024	101.1	0.37	2000	100
5.610	0.0010	111.0	0.49		
6.159	0.0024	121.8	0.68		
6.761	0.0045	133.8	0.95		

LS Particle Size Analyzer

Santa Cruz Harbor Sediment Monitoring (Fall 2005)

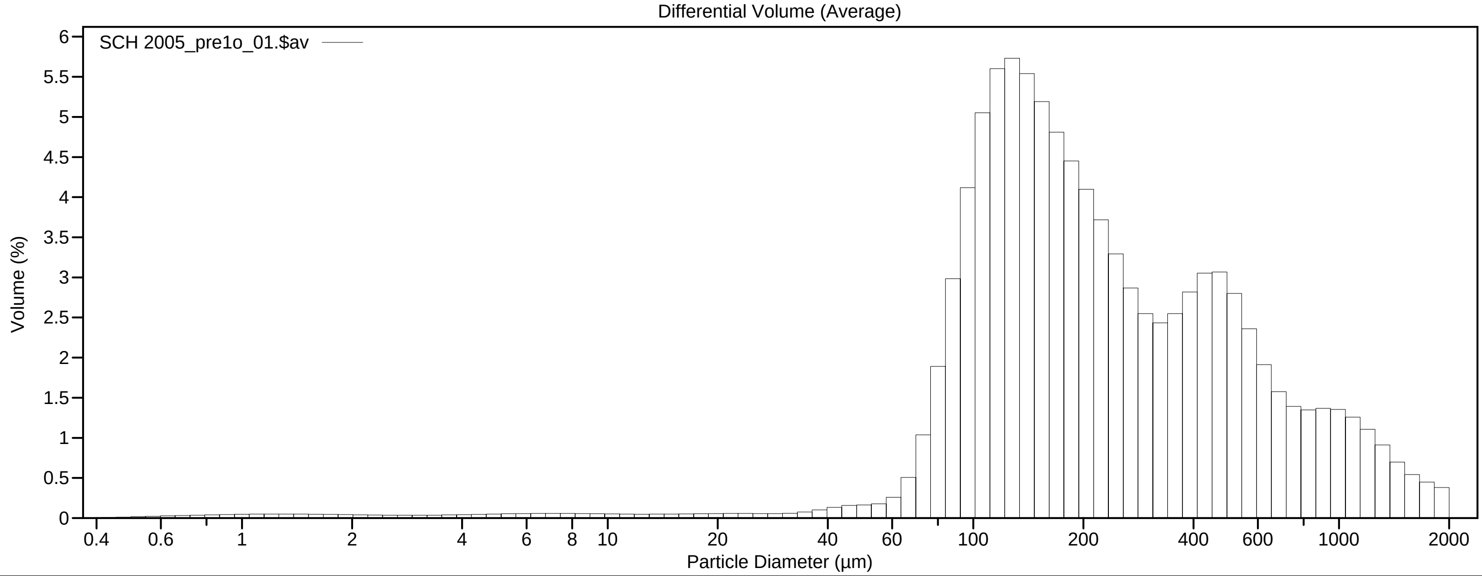
File name:	C:\LS13320\SCH-2005-6-grain-size\Offshore-samples\SCH 2005_pre1o_01.$av
	SCH 2005_pre1o_01.$av
Sample ID:	pre1off
Comment 1:	Collected 10-11-05
Comment 2:	Pre-dredging
Optical model:	Fraunhofer.rf780z

Volume Statistics (Arithmetic) SCH 2005_pre1o_01.$av

Calculations from 0.375 µm to 2000 µm

Volume:	100%		
Mean:	327.5 µm	S.D.:	327.4 µm
Median:	193.9 µm	Variance:	107.2e3 µm^2
Mean/Median ratio:	1.689	Skewness:	2.166 Right skewed
Mode:	127.7 µm	Kurtosis:	5.043 Leptokurtic

d_{10}: 92.97 µm d_{50}: 193.9 µm d_{90}: 757.7 µm



SCH 2005_pre1o_01.$av

Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %
0.375	0	7.422	1.25	146.8	35.6
0.412	0.0037	8.148	1.31	161.2	40.8
0.452	0.011	8.944	1.36	176.9	45.6
0.496	0.023	9.819	1.42	194.2	50.1
0.545	0.040	10.78	1.47	213.2	54.2
0.598	0.062	11.83	1.52	234.1	57.9
0.657	0.089	12.99	1.57	256.9	61.2
0.721	0.12	14.26	1.61	282.1	64.1
0.791	0.16	15.65	1.67	309.6	66.6
0.869	0.20	17.18	1.72	339.9	69.1
0.954	0.24	18.86	1.77	373.1	71.6
1.047	0.29	20.71	1.83	409.6	74.4
1.149	0.34	22.73	1.89	449.7	77.5
1.261	0.39	24.95	1.94	493.6	80.5
1.385	0.44	27.39	2.00	541.9	83.3
1.520	0.49	30.07	2.06	594.9	85.7
1.669	0.54	33.01	2.12	653.0	87.6
1.832	0.58	36.24	2.19	716.9	89.2
2.011	0.63	39.78	2.29	787.0	90.6
2.208	0.67	43.67	2.43	863.9	91.9
2.423	0.70	47.94	2.58	948.3	93.3
2.660	0.74	52.63	2.75	1041	94.7
2.920	0.77	57.77	2.92	1143	95.9
3.206	0.81	63.42	3.18	1255	97.0
3.519	0.85	69.62	3.69	1377	97.9
3.863	0.89	76.43	4.73	1512	98.6
4.241	0.93	83.90	6.62	1660	99.2
4.656	0.97	92.10	9.60	1822	99.6
5.111	1.02	101.1	13.7	2000	100
5.610	1.08	111.0	18.8		
6.159	1.13	121.8	24.4		
6.761	1.19	133.8	30.1		

LS Particle Size Analyzer

Santa Cruz Harbor Sediment Monitoring (Fall 2005)

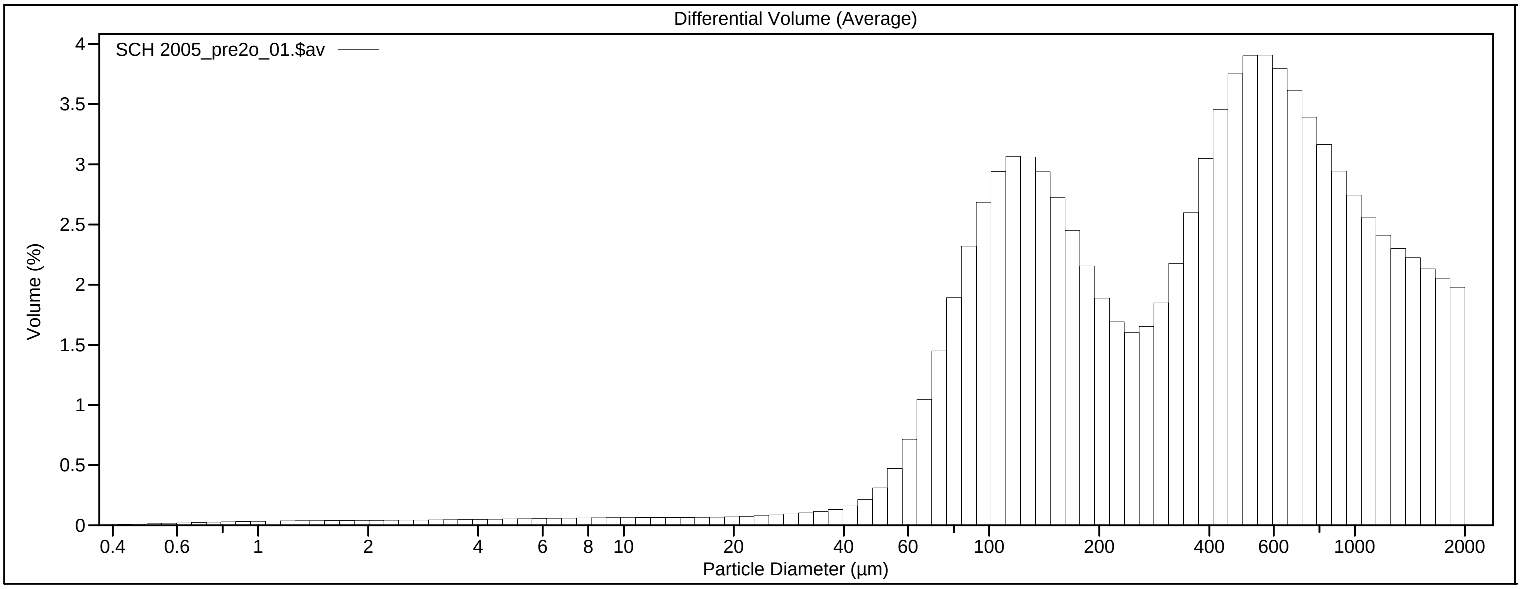
File name:	C:\LS13320\SCH-2005-6-grain-size\Offshore-samples\SCH 2005_pre2o_01.$av SCH 2005_pre2o_01.$av
Sample ID:	pre2off
Comment 1:	Collected 10-11-05
Comment 2:	Pre-Dredging
Optical model:	Fraunhofer.rf780z

Volume Statistics (Arithmetic) SCH 2005_pre2o_01.$av

Calculations from 0.375 µm to 2000 µm

Volume:	100%		
Mean:	540.9 µm	S.D.:	476.9 µm
Median:	413.4 µm	Variance:	227.5e3 µm^2
Mean/Median ratio:	1.309	Skewness:	1.132 Right skewed
Mode:	567.8 µm	Kurtosis:	0.508 Leptokurtic

d_{10}: 88.00 µm d_{50}: 413.4 µm d_{90}: 1291 µm



SCH 2005_pre2o_01.$av

Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %
0.375	0	7.422	1.18	146.8	25.8
0.412	0.0036	8.148	1.24	161.2	28.6
0.452	0.010	8.944	1.30	176.9	31.0
0.496	0.020	9.819	1.37	194.2	33.2
0.545	0.033	10.78	1.43	213.2	35.1
0.598	0.051	11.83	1.50	234.1	36.8
0.657	0.071	12.99	1.56	256.9	38.4
0.721	0.095	14.26	1.63	282.1	40.0
0.791	0.12	15.65	1.69	309.6	41.9
0.869	0.15	17.18	1.76	339.9	44.0
0.954	0.18	18.86	1.83	373.1	46.6
1.047	0.22	20.71	1.90	409.6	49.7
1.149	0.25	22.73	1.97	449.7	53.1
1.261	0.29	24.95	2.05	493.6	56.9
1.385	0.33	27.39	2.14	541.9	60.8
1.520	0.36	30.07	2.23	594.9	64.7
1.669	0.40	33.01	2.33	653.0	68.5
1.832	0.44	36.24	2.45	716.9	72.1
2.011	0.49	39.78	2.58	787.0	75.5
2.208	0.53	43.67	2.74	863.9	78.7
2.423	0.57	47.94	2.95	948.3	81.6
2.660	0.61	52.63	3.27	1041	84.4
2.920	0.66	57.77	3.74	1143	86.9
3.206	0.70	63.42	4.45	1255	89.3
3.519	0.75	69.62	5.50	1377	91.6
3.863	0.80	76.43	6.95	1512	93.8
4.241	0.85	83.90	8.84	1660	96.0
4.656	0.90	92.10	11.2	1822	98.0
5.111	0.95	101.1	13.8	2000	100
5.610	1.00	111.0	16.8		
6.159	1.06	121.8	19.8		
6.761	1.12	133.8	22.9		

LS Particle Size Analyzer

Santa Cruz Harbor Sediment Monitoring (Fall 2005)

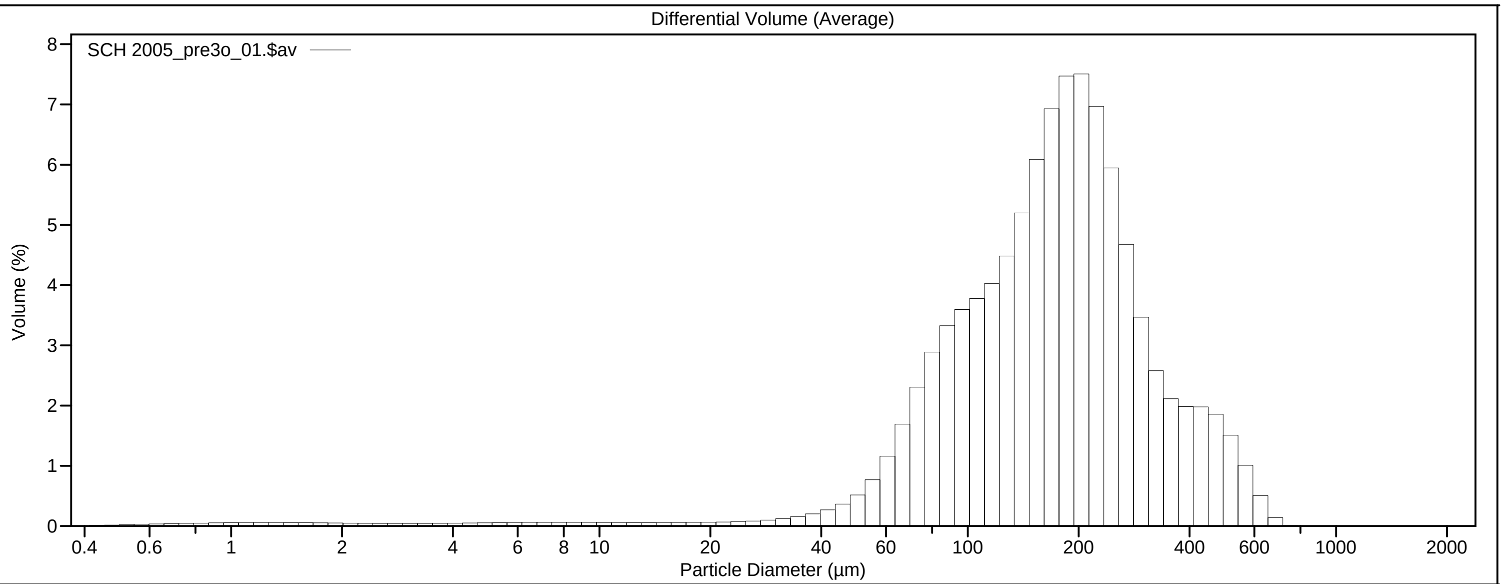
File name:	C:\LS13320\SCH-2005-6-grain-size\Offshore-samples\SCH 2005_pre3o_01.$av SCH 2005_pre3o_01.$av
Sample ID:	pre3off
Comment 1:	Collected 10-11-05
Comment 2:	Pre-dredging
Optical model:	Fraunhofer.rf780z

Volume Statistics (Arithmetic) SCH 2005_pre3o_01.$av

Calculations from 0.375 µm to 2000 µm

Volume:	100%		
Mean:	197.0 µm	S.D.:	117.0 µm
Median:	176.3 µm	Variance:	13688 µm^2
Mean/Median ratio:	1.117	Skewness:	1.240 Right skewed
Mode:	203.5 µm	Kurtosis:	1.777 Leptokurtic

d_{10}: 76.48 µm d_{50}: 176.3 µm d_{90}: 357.2 µm



SCH 2005_pre3o_01.$av

Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %
0.375	0	7.422	1.44	146.8	37.3
0.412	0.0049	8.148	1.51	161.2	43.4
0.452	0.014	8.944	1.57	176.9	50.3
0.496	0.030	9.819	1.63	194.2	57.8
0.545	0.053	10.78	1.69	213.2	65.3
0.598	0.081	11.83	1.74	234.1	72.2
0.657	0.11	12.99	1.80	256.9	78.2
0.721	0.15	14.26	1.86	282.1	82.9
0.791	0.20	15.65	1.91	309.6	86.3
0.869	0.25	17.18	1.97	339.9	88.9
0.954	0.30	18.86	2.04	373.1	91.0
1.047	0.36	20.71	2.10	409.6	93.0
1.149	0.41	22.73	2.17	449.7	95.0
1.261	0.47	24.95	2.24	493.6	96.8
1.385	0.53	27.39	2.32	541.9	98.3
1.520	0.59	30.07	2.42	594.9	99.3
1.669	0.64	33.01	2.55	653.0	99.9
1.832	0.69	36.24	2.70	716.9	99.99
2.011	0.74	39.78	2.90	787.0	100
2.208	0.79	43.67	3.17	863.9	100
2.423	0.84	47.94	3.53	948.3	100
2.660	0.88	52.63	4.05	1041	100
2.920	0.92	57.77	4.82	1143	100
3.206	0.97	63.42	5.98	1255	100
3.519	1.01	69.62	7.67	1377	100
3.863	1.05	76.43	9.98	1512	100
4.241	1.10	83.90	12.9	1660	100
4.656	1.15	92.10	16.2	1822	100
5.111	1.20	101.1	19.8	2000	100
5.610	1.26	111.0	23.6		
6.159	1.32	121.8	27.6		
6.761	1.38	133.8	32.1		

LS Particle Size Analyzer

Santa Cruz Harbor Sediment Monitoring (Fall 2005)

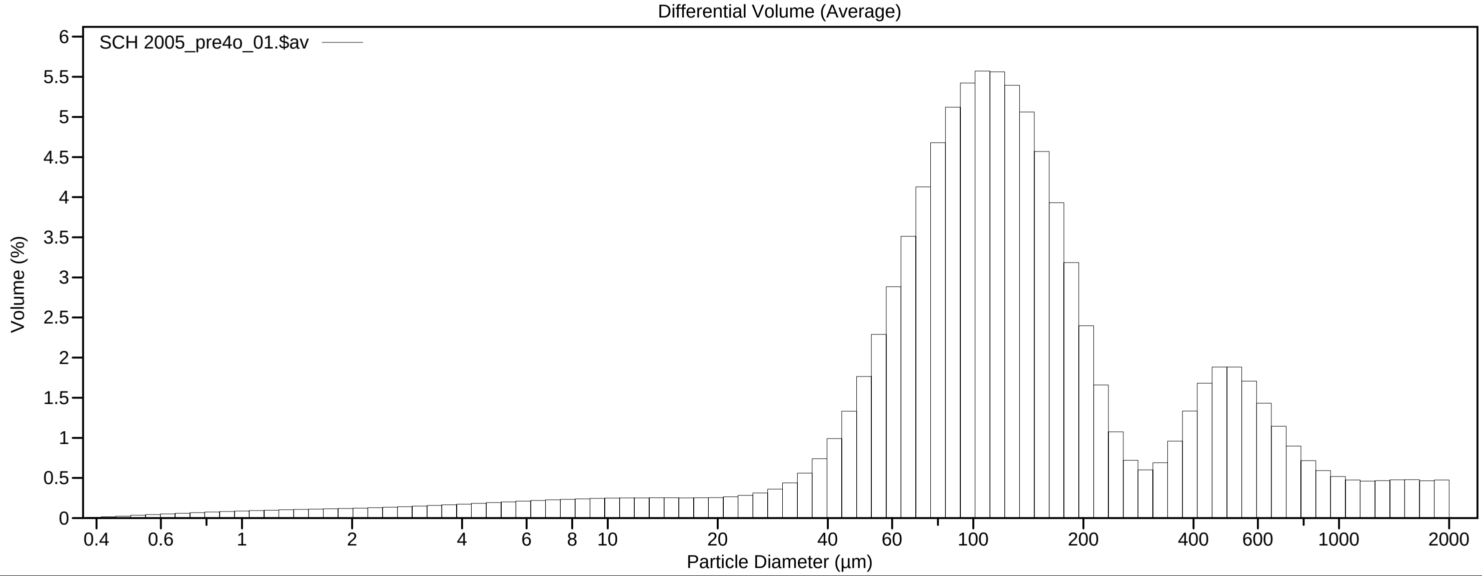
File name:	C:\LS13320\SCH-2005-6-grain-size\Offshore-samples\SCH 2005_pre4o_01.$av
	SCH 2005_pre4o_01.$av
Sample ID:	pre4off
Comment 1:	Collected 10-11-05
Comment 2:	Pre-dredging
Optical model:	Fraunhofer.rf780z

Volume Statistics (Arithmetic) SCH 2005_pre4o_01.$av

Calculations from 0.375 µm to 2000 µm

Volume:	100%		
Mean:	220.7 µm	S.D.:	299.0 µm
Median:	116.6 µm	Variance:	89408 µm^2
Mean/Median ratio:	1.892	Skewness:	3.080 Right skewed
Mode:	105.9 µm	Kurtosis:	10.83 Leptokurtic

d_{10}: 42.07 µm d_{50}: 116.6 µm d_{90}: 551.3 µm



SCH 2005_pre4o_01.$av

Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %
0.375	0	7.422	3.72	146.8	63.1
0.412	0.0093	8.148	3.95	161.2	67.7
0.452	0.026	8.944	4.19	176.9	71.6
0.496	0.050	9.819	4.44	194.2	74.8
0.545	0.086	10.78	4.69	213.2	77.2
0.598	0.13	11.83	4.94	234.1	78.9
0.657	0.18	12.99	5.19	256.9	79.9
0.721	0.24	14.26	5.44	282.1	80.7
0.791	0.31	15.65	5.70	309.6	81.3
0.869	0.39	17.18	5.95	339.9	82.0
0.954	0.47	18.86	6.20	373.1	82.9
1.047	0.56	20.71	6.46	409.6	84.3
1.149	0.65	22.73	6.72	449.7	85.9
1.261	0.75	24.95	7.00	493.6	87.8
1.385	0.85	27.39	7.32	541.9	89.7
1.520	0.96	30.07	7.68	594.9	91.4
1.669	1.07	33.01	8.12	653.0	92.8
1.832	1.19	36.24	8.68	716.9	94.0
2.011	1.31	39.78	9.42	787.0	94.9
2.208	1.43	43.67	10.4	863.9	95.6
2.423	1.56	47.94	11.7	948.3	96.2
2.660	1.70	52.63	13.5	1041	96.7
2.920	1.84	57.77	15.8	1143	97.2
3.206	1.99	63.42	18.7	1255	97.6
3.519	2.14	69.62	22.2	1377	98.1
3.863	2.31	76.43	26.3	1512	98.6
4.241	2.48	83.90	31.0	1660	99.1
4.656	2.67	92.10	36.1	1822	99.5
5.111	2.86	101.1	41.5	2000	100
5.610	3.06	111.0	47.1		
6.159	3.27	121.8	52.7		
6.761	3.49	133.8	58.1		

LS Particle Size Analyzer

Santa Cruz Harbor Sediment Monitoring (Fall 2005)

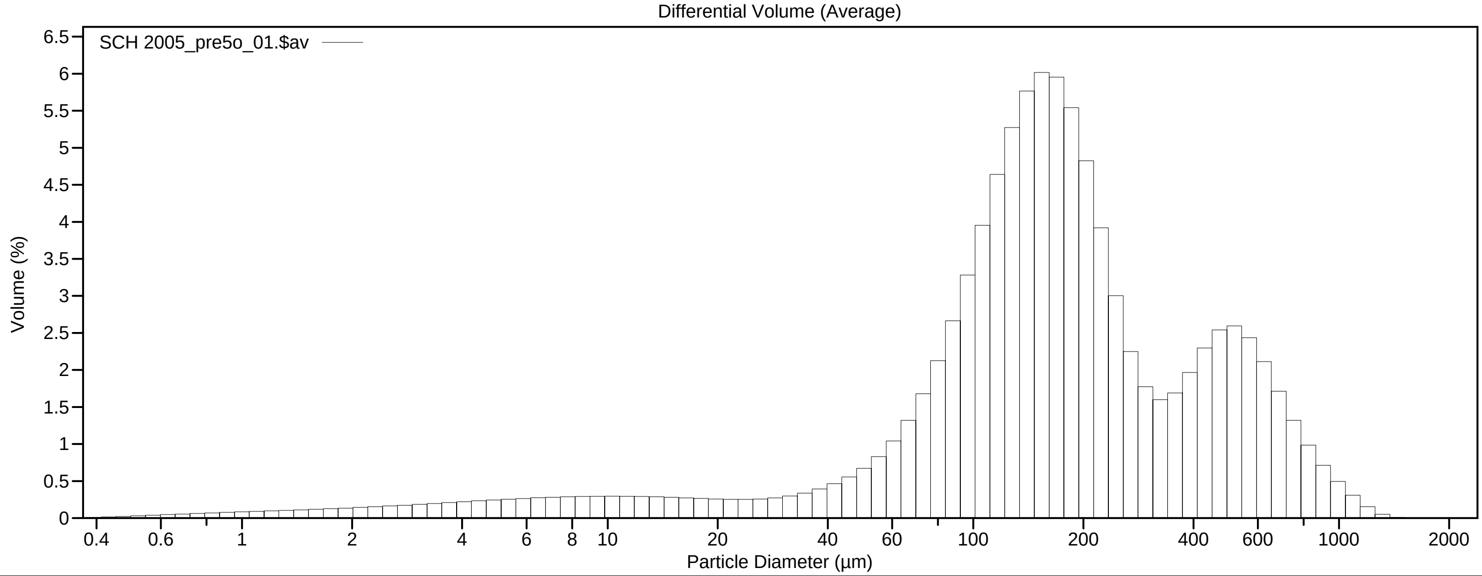
File name:	C:\LS13320\SCH-2005-6-grain-size\Offshore-samples\SCH 2005_pre5o_01.$av SCH 2005_pre5o_01.$av
Sample ID:	pre5off
Comment 1:	Collected 10-11-05
Comment 2:	Pre-dredging
Optical model:	Fraunhofer.rf780z

Volume Statistics (Arithmetic) SCH 2005_pre5o_01.$av

Calculations from 0.375 µm to 2000 µm

Volume:	100%		
Mean:	231.9 µm	S.D.:	209.2 µm
Median:	161.8 µm	Variance:	43759 μm^2
Mean/Median ratio:	1.433	Skewness:	1.703 Right skewed
Mode:	153.8 µm	Kurtosis:	2.971 Leptokurtic

d_{10}: 44.20 µm d_{50}: 161.8 µm d_{90}: 548.4 µm



SCH 2005_pre5o_01.$av

Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %
0.375	0	7.422	4.29	146.8	43.7
0.412	0.0082	8.148	4.57	161.2	49.8
0.452	0.023	8.944	4.87	176.9	55.7
0.496	0.044	9.819	5.16	194.2	61.2
0.545	0.076	10.78	5.46	213.2	66.1
0.598	0.11	11.83	5.75	234.1	70.0
0.657	0.16	12.99	6.04	256.9	73.0
0.721	0.22	14.26	6.33	282.1	75.2
0.791	0.28	15.65	6.61	309.6	77.0
0.869	0.35	17.18	6.88	339.9	78.6
0.954	0.43	18.86	7.15	373.1	80.3
1.047	0.51	20.71	7.41	409.6	82.3
1.149	0.60	22.73	7.66	449.7	84.6
1.261	0.70	24.95	7.91	493.6	87.1
1.385	0.80	27.39	8.17	541.9	89.7
1.520	0.91	30.07	8.44	594.9	92.1
1.669	1.03	33.01	8.74	653.0	94.3
1.832	1.16	36.24	9.07	716.9	96.0
2.011	1.29	39.78	9.47	787.0	97.3
2.208	1.44	43.67	9.93	863.9	98.3
2.423	1.59	47.94	10.5	948.3	99.0
2.660	1.75	52.63	11.2	1041	99.5
2.920	1.93	57.77	12.0	1143	99.8
3.206	2.11	63.42	13.0	1255	99.9
3.519	2.31	69.62	14.3	1377	99.99
3.863	2.52	76.43	16.0	1512	99.999
4.241	2.74	83.90	18.2	1660	100
4.656	2.97	92.10	20.8	1822	100
5.111	3.21	101.1	24.1	2000	100
5.610	3.47	111.0	28.1		
6.159	3.73	121.8	32.7		
6.761	4.01	133.8	38.0		

LS Particle Size Analyzer

Santa Cruz Harbor Sediment Monitoring (Fall 2005)

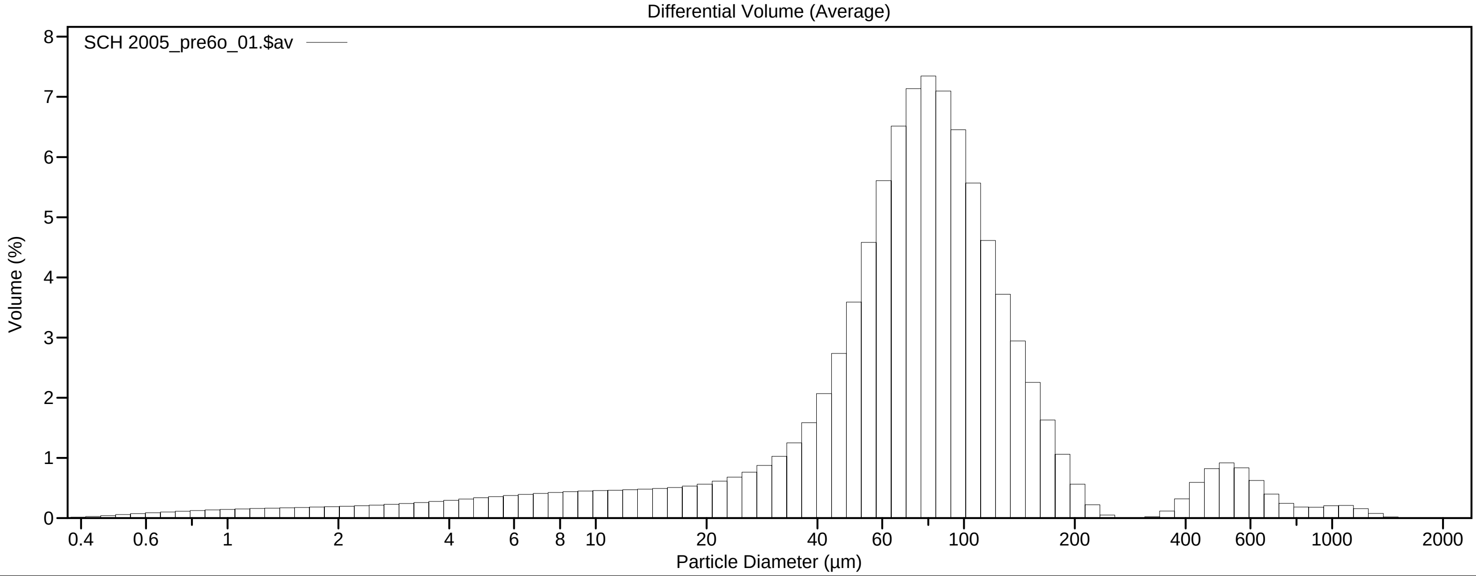
File name:	C:\LS13320\SCH-2005-6-grain-size\Offshore-samples\SCH 2005_pre6o_01.$av
	SCH 2005_pre6o_01.$av
Sample ID:	pre6off
Comment 1:	Collected 10-11-05
Comment 2:	Pre dredging
Optical model:	Fraunhofer.rf780z

Volume Statistics (Arithmetic) SCH 2005_pre6o_01.$av

Calculations from 0.375 µm to 2000 µm

Volume:	100%		
Mean:	107.6 µm	S.D.:	145.5 µm
Median:	75.90 µm	Variance:	21164 µm^2
Mean/Median ratio:	1.418	Skewness:	4.271 Right skewed
Mode:	80.07 µm	Kurtosis:	21.92 Leptokurtic

d_{10}: 15.93 µm d_{50}: 75.90 µm d_{90}: 157.7 µm



SCH 2005_pre6o_01.$av

Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %
0.375	0	7.422	6.23	146.8	88.3
0.412	0.016	8.148	6.66	161.2	90.5
0.452	0.044	8.944	7.10	176.9	92.2
0.496	0.085	9.819	7.54	194.2	93.2
0.545	0.14	10.78	8.00	213.2	93.8
0.598	0.22	11.83	8.46	234.1	94.0
0.657	0.31	12.99	8.93	256.9	94.1
0.721	0.41	14.26	9.42	282.1	94.1
0.791	0.52	15.65	9.91	309.6	94.1
0.869	0.65	17.18	10.4	339.9	94.1
0.954	0.78	18.86	10.9	373.1	94.2
1.047	0.93	20.71	11.5	409.6	94.5
1.149	1.08	22.73	12.1	449.7	95.1
1.261	1.24	24.95	12.8	493.6	95.9
1.385	1.40	27.39	13.6	541.9	96.9
1.520	1.57	30.07	14.4	594.9	97.7
1.669	1.75	33.01	15.5	653.0	98.3
1.832	1.93	36.24	16.7	716.9	98.7
2.011	2.12	39.78	18.3	787.0	99.0
2.208	2.32	43.67	20.4	863.9	99.1
2.423	2.53	47.94	23.1	948.3	99.3
2.660	2.74	52.63	26.7	1041	99.5
2.920	2.97	57.77	31.3	1143	99.7
3.206	3.21	63.42	36.9	1255	99.9
3.519	3.47	69.62	43.4	1377	99.98
3.863	3.75	76.43	50.5	1512	99.998
4.241	4.04	83.90	57.9	1660	100
4.656	4.36	92.10	65.0	1822	100
5.111	4.70	101.1	71.4	2000	100
5.610	5.05	111.0	77.0		
6.159	5.43	121.8	81.6		
6.761	5.82	133.8	85.3		

LS Particle Size Analyzer

Santa Cruz Harbor Sediment Monitoring (Fall 2005)

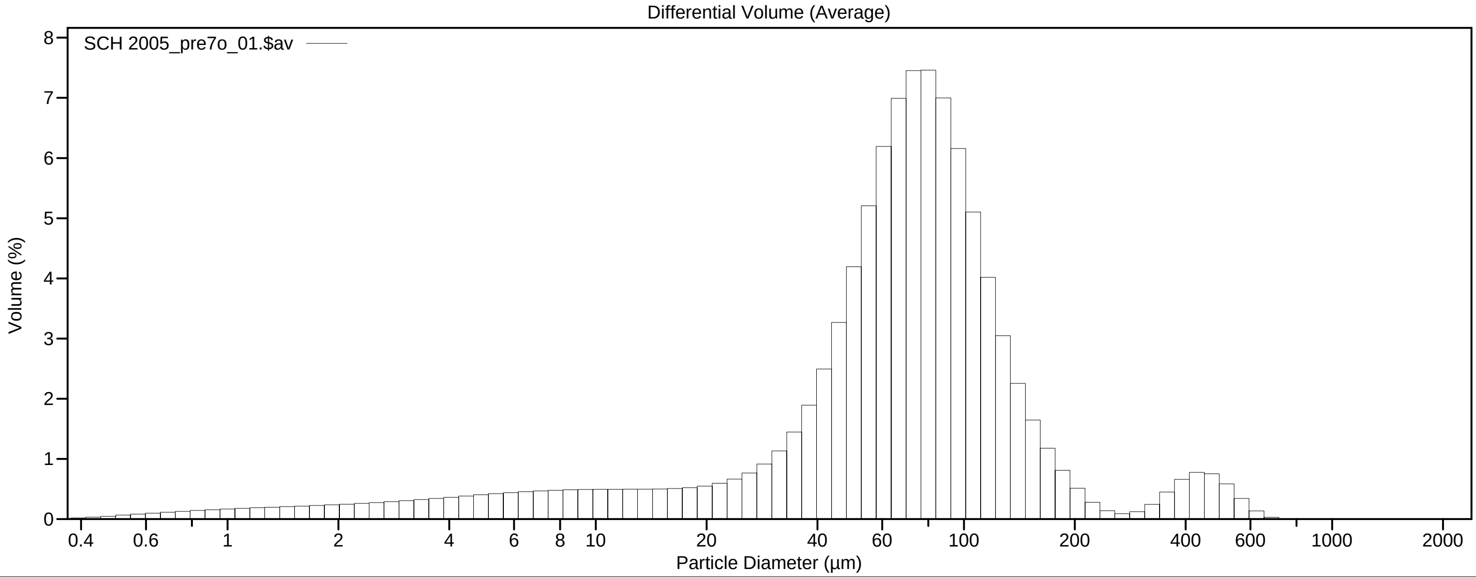
File name:	C:\LS13320\SCH-2005-6-grain-size\Offshore-samples\SCH 2005_pre7o_01.$av
	SCH 2005_pre7o_01.$av
Sample ID:	pre7off
Comment 1:	Collected 10-11-05
Comment 2:	Pre-dredging
Optical model:	Fraunhofer.rf780z

Volume Statistics (Arithmetic) SCH 2005_pre7o_01.$av

Calculations from 0.375 µm to 2000 µm

Volume:	100%		
Mean:	86.37 µm	S.D.:	86.53 µm
Median:	70.76 µm	Variance:	7488 $µm^2$
Mean/Median ratio:	1.221	Skewness:	3.335 Right skewed
Mode:	80.07 µm	Kurtosis:	13.39 Leptokurtic

d_{10}: 12.02 µm d_{50}: 70.76 µm d_{90}: 139.6 µm



SCH 2005_pre7o_01.$av

Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %
0.375	0	7.422	7.47	146.8	91.2
0.412	0.017	8.148	7.95	161.2	92.9
0.452	0.048	8.944	8.44	176.9	94.1
0.496	0.094	9.819	8.93	194.2	94.9
0.545	0.16	10.78	9.42	213.2	95.4
0.598	0.24	11.83	9.92	234.1	95.7
0.657	0.34	12.99	10.4	256.9	95.8
0.721	0.45	14.26	10.9	282.1	95.9
0.791	0.58	15.65	11.4	309.6	96.0
0.869	0.72	17.18	11.9	339.9	96.3
0.954	0.88	18.86	12.4	373.1	96.7
1.047	1.05	20.71	13.0	409.6	97.4
1.149	1.22	22.73	13.6	449.7	98.2
1.261	1.41	24.95	14.2	493.6	98.9
1.385	1.61	27.39	15.0	541.9	99.5
1.520	1.82	30.07	15.9	594.9	99.8
1.669	2.03	33.01	17.1	653.0	99.97
1.832	2.26	36.24	18.5	716.9	99.997
2.011	2.49	39.78	20.4	787.0	100
2.208	2.74	43.67	22.9	863.9	100
2.423	3.00	47.94	26.2	948.3	100
2.660	3.28	52.63	30.4	1041	100
2.920	3.56	57.77	35.6	1143	100
3.206	3.87	63.42	41.8	1255	100
3.519	4.19	69.62	48.7	1377	100
3.863	4.54	76.43	56.2	1512	100
4.241	4.90	83.90	63.7	1660	100
4.656	5.28	92.10	70.7	1822	100
5.111	5.69	101.1	76.8	2000	100
5.610	6.11	111.0	81.9		
6.159	6.55	121.8	85.9		
6.761	7.00	133.8	89.0		

LS Particle Size Analyzer

Santa Cruz Harbor Sediment Monitoring (Fall 2005)

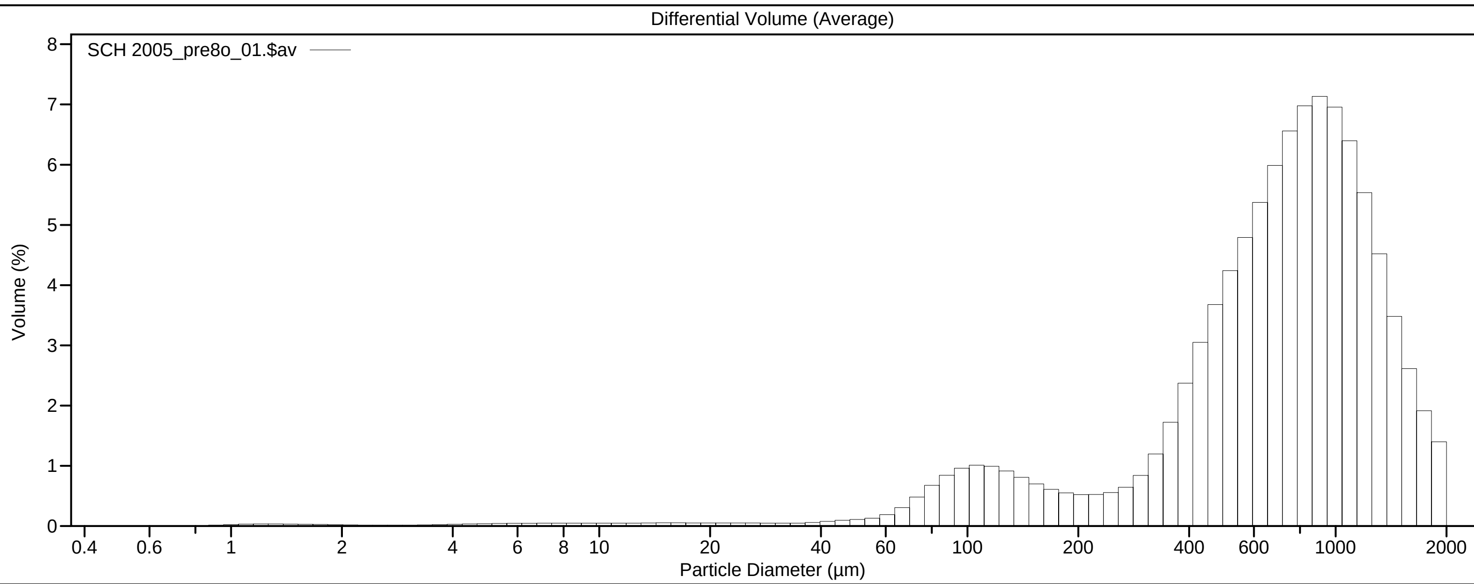
File name:	C:\LS13320\SCH-2005-6-grain-size\Offshore-samples\SCH 2005_pre8o_01.$av SCH 2005_pre8o_01.$av
Sample ID:	pre8off
Comment 1:	Collected 10-11-05
Comment 2:	Pre-dredging
Optical model:	Fraunhofer.rf780z

Volume Statistics (Arithmetic) SCH 2005_pre8o_01.$av

Calculations from 0.375 µm to 2000 µm

Volume:	100%		
Mean:	779.7 µm	S.D.:	429.1 µm
Median:	754.2 µm	Variance:	184.1e3 µm^2
Mean/Median ratio:	1.034	Skewness:	0.342 Right skewed
Mode:	905.1 µm	Kurtosis:	-0.278 Platykurtic

d_{10}: 165.1 µm d_{50}: 754.2 µm d_{90}: 1361 µm



SCH 2005_pre8o_01.$av

Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %
0.375	0	7.422	0.66	146.8	9.15
0.412	0	8.148	0.71	161.2	9.85
0.452	0	8.944	0.75	176.9	10.5
0.496	0	9.819	0.80	194.2	11.0
0.545	0	10.78	0.85	213.2	11.5
0.598	0	11.83	0.89	234.1	12.1
0.657	0	12.99	0.94	256.9	12.6
0.721	0	14.26	0.99	282.1	13.3
0.791	0.00041	15.65	1.05	309.6	14.1
0.869	0.0058	17.18	1.10	339.9	15.3
0.954	0.022	18.86	1.15	373.1	17.0
1.047	0.047	20.71	1.20	409.6	19.4
1.149	0.077	22.73	1.25	449.7	22.4
1.261	0.11	24.95	1.30	493.6	26.1
1.385	0.15	27.39	1.35	541.9	30.4
1.520	0.18	30.07	1.40	594.9	35.1
1.669	0.21	33.01	1.45	653.0	40.5
1.832	0.23	36.24	1.50	716.9	46.5
2.011	0.25	39.78	1.56	787.0	53.1
2.208	0.27	43.67	1.63	863.9	60.0
2.423	0.29	47.94	1.73	948.3	67.2
2.660	0.30	52.63	1.84	1041	74.1
2.920	0.32	57.77	1.97	1143	80.5
3.206	0.34	63.42	2.16	1255	86.1
3.519	0.36	69.62	2.46	1377	90.6
3.863	0.38	76.43	2.94	1512	94.1
4.241	0.41	83.90	3.62	1660	96.7
4.656	0.44	92.10	4.46	1822	98.6
5.111	0.48	101.1	5.42	2000	100
5.610	0.52	111.0	6.43		
6.159	0.57	121.8	7.43		
6.761	0.61	133.8	8.34		

LS Particle Size Analyzer

Santa Cruz Harbor Sediment Monitoring (Fall 2005)

File name:	C:\LS13320\SCH-2005-6-grain-size\Offshore-samples\SCH 2005_pre9o_01.$av
	SCH 2005_pre9o_01.$av
Sample ID:	pre9off
Comment 1:	Collected 10-11-05
Comment 2:	Pre-dredging
Optical model:	Fraunhofer.rf780z

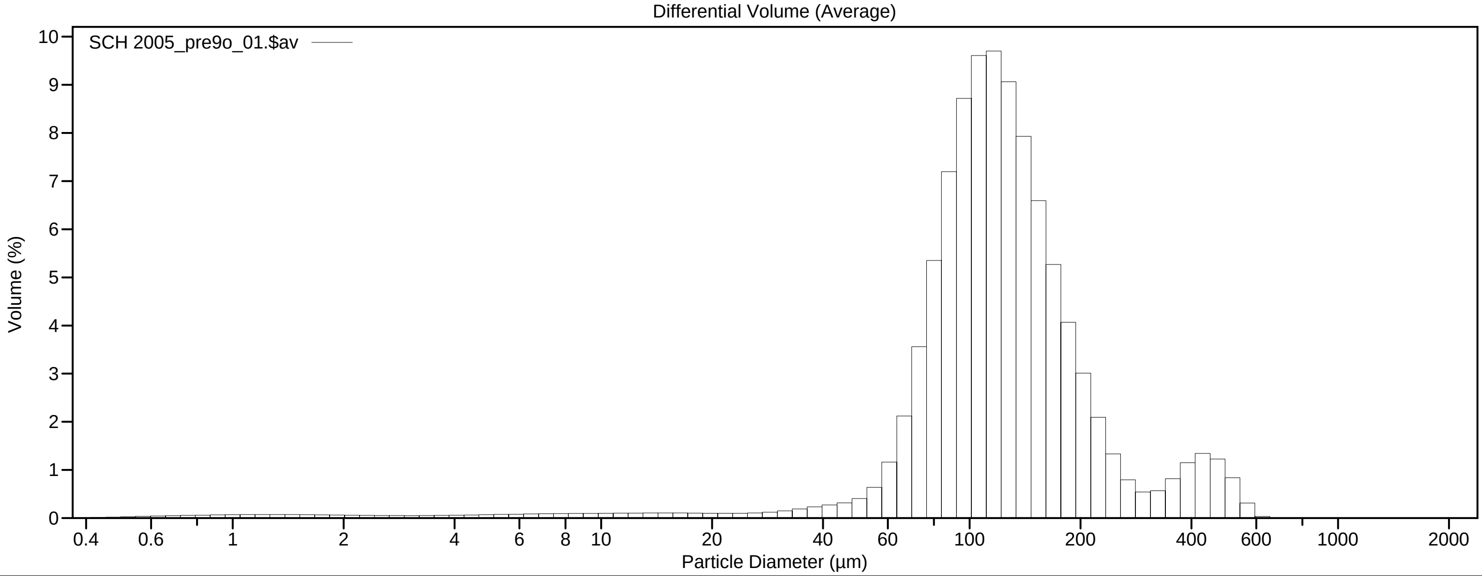
Volume Statistics (Arithmetic)   SCH 2005_pre9o_01.$av

Calculations from 0.375 µm to 2000 µm

Volume:	100%		
Mean:	140.7 µm	S.D.:	91.05 µm
Median:	118.5 µm	Variance:	8291 µm^2
Mean/Median ratio:	1.188	Skewness:	2.264 Right skewed
Mode:	116.3 µm	Kurtosis:	6.074 Leptokurtic

d_{10}: 71.77 µm d_{50}: 118.5 µm d_{90}: 223.7 µm

Differential Volume (Average)



SCH 2005_pre9o_01.$av

Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %
0.375	0	7.422	1.84	146.8	70.0
0.412	0.0062	8.148	1.93	161.2	76.6
0.452	0.018	8.944	2.03	176.9	81.9
0.496	0.038	9.819	2.13	194.2	85.9
0.545	0.066	10.78	2.23	213.2	88.9
0.598	0.10	11.83	2.33	234.1	91.0
0.657	0.14	12.99	2.43	256.9	92.4
0.721	0.19	14.26	2.54	282.1	93.2
0.791	0.25	15.65	2.64	309.6	93.7
0.869	0.31	17.18	2.75	339.9	94.3
0.954	0.38	18.86	2.86	373.1	95.1
1.047	0.45	20.71	2.96	409.6	96.2
1.149	0.52	22.73	3.06	449.7	97.6
1.261	0.59	24.95	3.15	493.6	98.8
1.385	0.67	27.39	3.26	541.9	99.7
1.520	0.74	30.07	3.38	594.9	99.97
1.669	0.81	33.01	3.53	653.0	100
1.832	0.87	36.24	3.72	716.9	100
2.011	0.94	39.78	3.96	787.0	100
2.208	0.99	43.67	4.23	863.9	100
2.423	1.05	47.94	4.55	948.3	100
2.660	1.10	52.63	4.95	1041	100
2.920	1.16	57.77	5.59	1143	100
3.206	1.21	63.42	6.75	1255	100
3.519	1.26	69.62	8.87	1377	100
3.863	1.32	76.43	12.4	1512	100
4.241	1.37	83.90	17.8	1660	100
4.656	1.44	92.10	25.0	1822	100
5.111	1.51	101.1	33.7	2000	100
5.610	1.58	111.0	43.3		
6.159	1.66	121.8	53.0		
6.761	1.75	133.8	62.1		

LS Particle Size Analyzer

Santa Cruz Harbor Sediment Monitoring (Fall 2005)

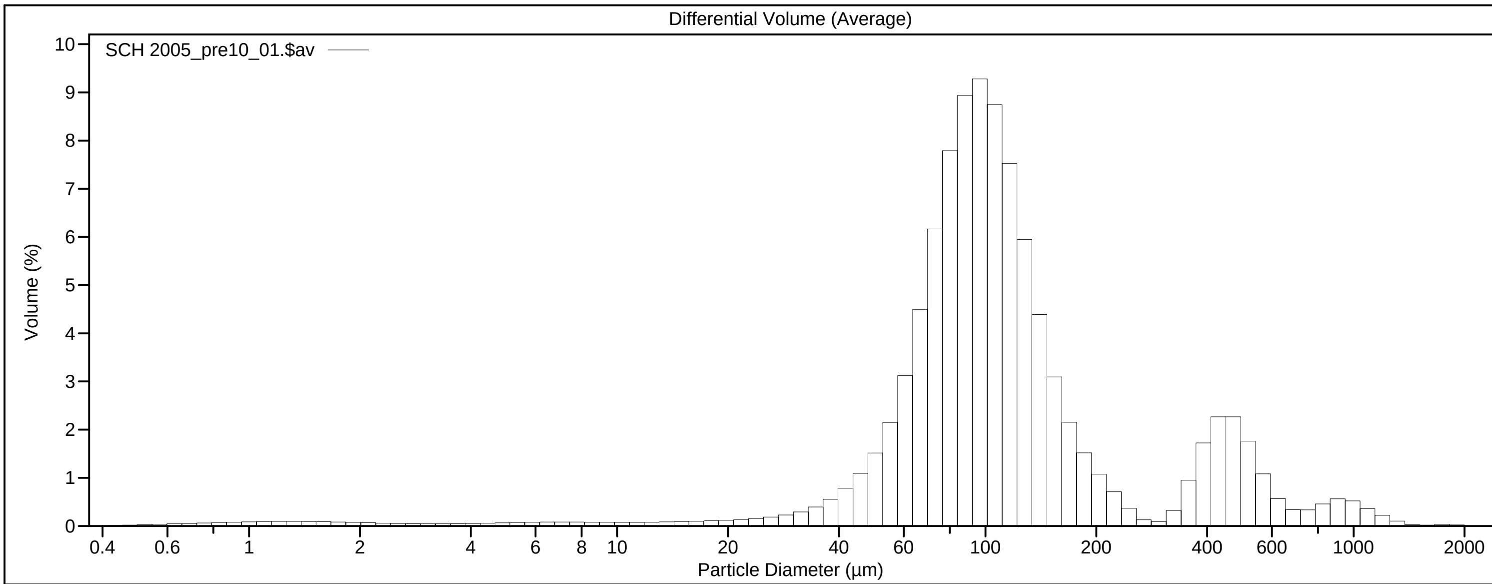
File name:	C:\LS13320\SCH-2005-6-grain-size\Offshore-samples\SCH 2005_pre10_01.$av
	SCH 2005_pre10_01.$av
Sample ID:	pre10off
Comment 1:	Collected 10-11-05
Comment 2:	Pre-dredging
Optical model:	Fraunhofer.rf780z

Volume Statistics (Arithmetic) SCH 2005_pre10_01.$av

Calculations from 0.375 µm to 2000 µm

Volume:	100%		
Mean:	163.3 µm	S.D.:	188.4 µm
Median:	100.8 µm	Variance:	35503 µm^2
Mean/Median ratio:	1.620	Skewness:	3.193 Right skewed
Mode:	96.49 µm	Kurtosis:	12.74 Leptokurtic

d_{10}: 56.61 µm d_{50}: 100.8 µm d_{90}: 426.7 µm



SCH 2005_pre10_01.$av

Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %
0.375	0	7.422	2.00	146.8	76.9
0.412	0.0058	8.148	2.08	161.2	80.0
0.452	0.017	8.944	2.16	176.9	82.1
0.496	0.036	9.819	2.24	194.2	83.7
0.545	0.064	10.78	2.32	213.2	84.7
0.598	0.100	11.83	2.40	234.1	85.4
0.657	0.14	12.99	2.48	256.9	85.8
0.721	0.20	14.26	2.56	282.1	85.9
0.791	0.26	15.65	2.66	309.6	86.0
0.869	0.33	17.18	2.76	339.9	86.4
0.954	0.41	18.86	2.87	373.1	87.3
1.047	0.50	20.71	2.99	409.6	89.0
1.149	0.59	22.73	3.12	449.7	91.3
1.261	0.69	24.95	3.28	493.6	93.6
1.385	0.78	27.39	3.47	541.9	95.3
1.520	0.88	30.07	3.70	594.9	96.4
1.669	0.97	33.01	3.99	653.0	97.0
1.832	1.05	36.24	4.38	716.9	97.3
2.011	1.13	39.78	4.94	787.0	97.7
2.208	1.20	43.67	5.73	863.9	98.1
2.423	1.26	47.94	6.82	948.3	98.7
2.660	1.31	52.63	8.34	1041	99.2
2.920	1.36	57.77	10.5	1143	99.6
3.206	1.40	63.42	13.6	1255	99.8
3.519	1.45	69.62	18.1	1377	99.9
3.863	1.50	76.43	24.3	1512	99.9
4.241	1.55	83.90	32.1	1660	99.9
4.656	1.61	92.10	41.0	1822	99.98
5.111	1.68	101.1	50.3	2000	100
5.610	1.75	111.0	59.0		
6.159	1.83	121.8	66.6		
6.761	1.92	133.8	72.5		

LS Particle Size Analyzer

Santa Cruz Harbor Sediment Monitoring (Fall 2005)

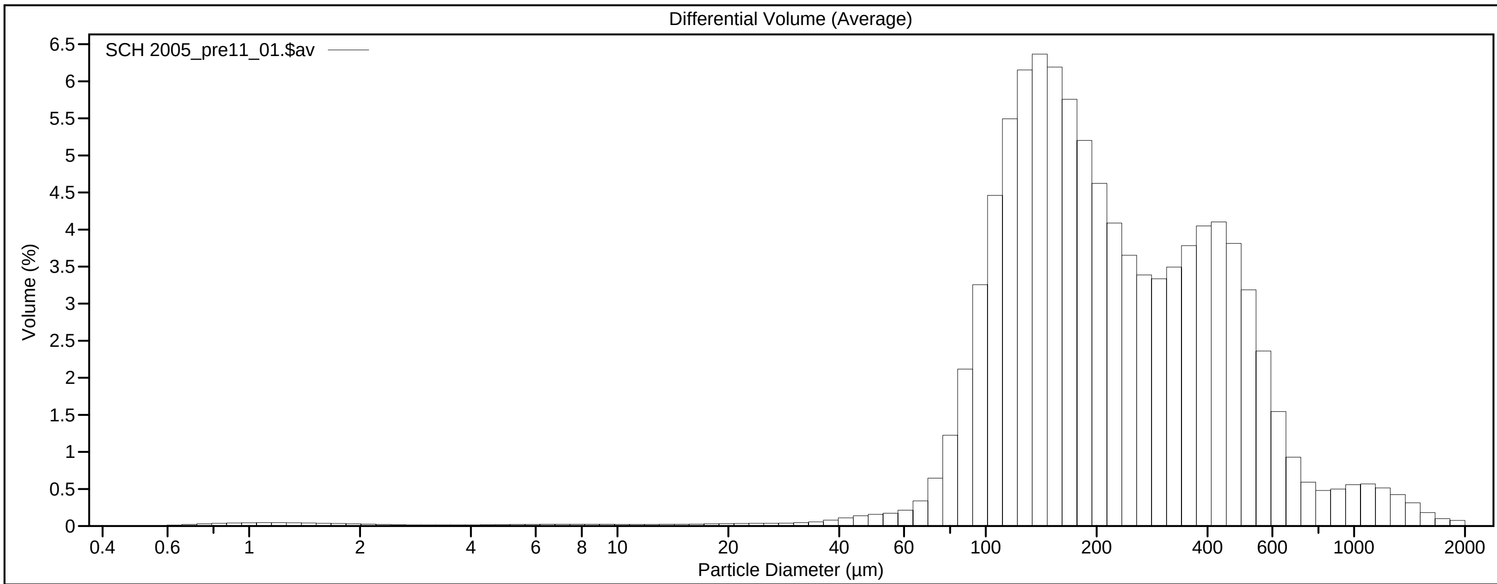
File name:	C:\LS13320\SCH-2005-6-grain-size\Offshore-samples\SCH 2005_pre11_01.$av
	SCH 2005_pre11_01.$av
Sample ID:	pre11off
Comment 1:	Collected 10-11-05
Comment 2:	Pre-dredging
Optical model:	Fraunhofer.rf780z

Volume Statistics (Arithmetic) SCH 2005_pre11_01.$av

Calculations from 0.375 µm to 2000 µm

Volume:	100%		
Mean:	279.5 µm	S.D.:	232.4 µm
Median:	196.9 µm	Variance:	54014 μm^2
Mean/Median ratio:	1.419	Skewness:	2.576 Right skewed
Mode:	140.1 µm	Kurtosis:	9.290 Leptokurtic

d_{10}: 101.7 µm d_{50}: 196.9 µm d_{90}: 528.8 µm



SCH 2005_pre11_01.$av

Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %
0.375	0	7.422	0.73	146.8	32.2
0.412	0	8.148	0.76	161.2	38.4
0.452	0	8.944	0.78	176.9	44.1
0.496	0	9.819	0.81	194.2	49.3
0.545	0.00032	10.78	0.83	213.2	54.0
0.598	0.0047	11.83	0.85	234.1	58.1
0.657	0.018	12.99	0.87	256.9	61.7
0.721	0.040	14.26	0.90	282.1	65.1
0.791	0.069	15.65	0.92	309.6	68.4
0.869	0.10	17.18	0.95	339.9	71.9
0.954	0.15	18.86	0.98	373.1	75.7
1.047	0.19	20.71	1.01	409.6	79.8
1.149	0.23	22.73	1.05	449.7	83.9
1.261	0.28	24.95	1.08	493.6	87.7
1.385	0.32	27.39	1.12	541.9	90.9
1.520	0.36	30.07	1.16	594.9	93.2
1.669	0.40	33.01	1.20	653.0	94.8
1.832	0.44	36.24	1.26	716.9	95.7
2.011	0.47	39.78	1.34	787.0	96.3
2.208	0.49	43.67	1.45	863.9	96.8
2.423	0.51	47.94	1.59	948.3	97.3
2.660	0.53	52.63	1.75	1041	97.8
2.920	0.55	57.77	1.92	1143	98.4
3.206	0.56	63.42	2.13	1255	98.9
3.519	0.58	69.62	2.47	1377	99.3
3.863	0.59	76.43	3.12	1512	99.6
4.241	0.61	83.90	4.34	1660	99.8
4.656	0.62	92.10	6.46	1822	99.9
5.111	0.64	101.1	9.72	2000	100
5.610	0.66	111.0	14.2		
6.159	0.69	121.8	19.7		
6.761	0.71	133.8	25.8		

LS Particle Size Analyzer

Santa Cruz Harbor Sediment Monitoring (Fall 2005)

File name:	C:\LS13320\SCH-2005-6-grain-size\Offshore-samples\SCH 2005_pre12_01.$av SCH 2005_pre12_01.$av
Sample ID:	pre12off
Comment 1:	Collected 10-11-05
Comment 2:	Pre-dredging
Optical model:	Fraunhofer.rf780z

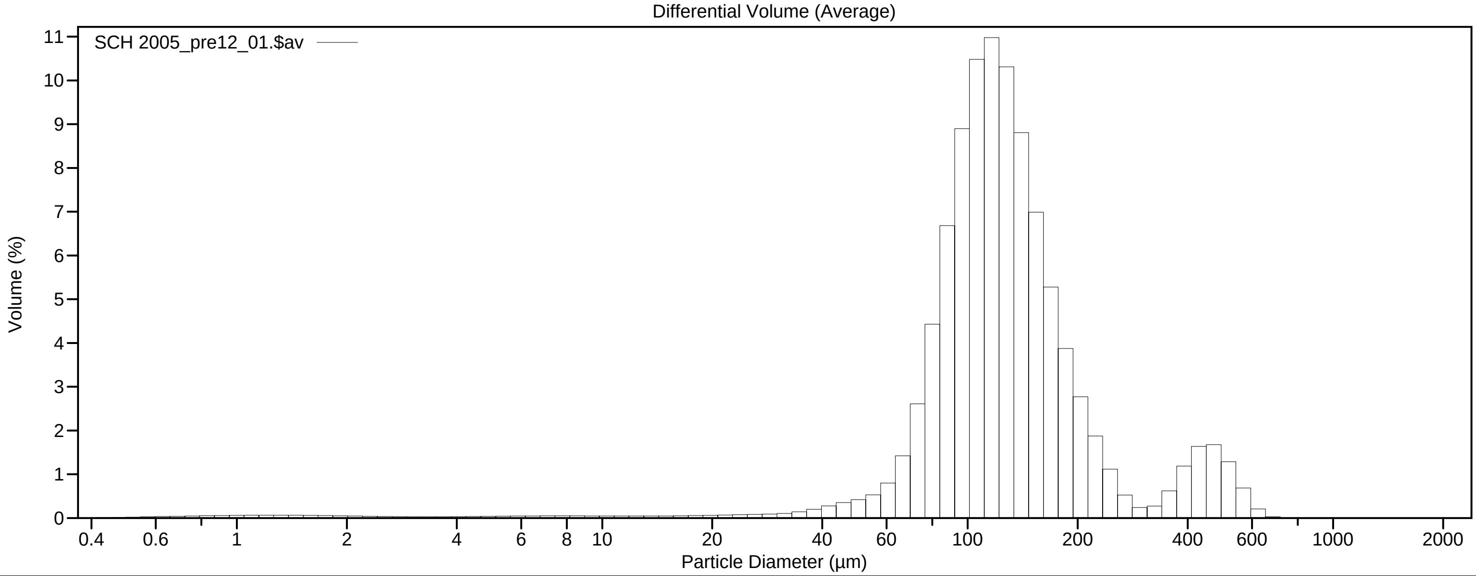
Volume Statistics (Arithmetic) SCH 2005_pre12_01.$av

Calculations from 0.375 µm to 2000 µm

Volume:	100%		
Mean:	148.1 µm	S.D.:	100.6 µm
Median:	121.3 µm	Variance:	10111 µm^2
Mean/Median ratio:	1.222	Skewness:	2.434 Right skewed
Mode:	116.3 µm	Kurtosis:	6.223 Leptokurtic

d_{10}: 77.91 µm d_{50}: 121.3 µm d_{90}: 228.5 µm

Differential Volume (Average)



SCH 2005_pre12_01.$av

Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %
0.375	0	7.422	1.37	146.8	69.7
0.412	0.0049	8.148	1.42	161.2	76.7
0.452	0.014	8.944	1.47	176.9	82.0
0.496	0.030	9.819	1.52	194.2	85.9
0.545	0.053	10.78	1.57	213.2	88.6
0.598	0.082	11.83	1.62	234.1	90.5
0.657	0.12	12.99	1.66	256.9	91.6
0.721	0.16	14.26	1.71	282.1	92.1
0.791	0.21	15.65	1.76	309.6	92.4
0.869	0.26	17.18	1.81	339.9	92.7
0.954	0.32	18.86	1.87	373.1	93.3
1.047	0.38	20.71	1.93	409.6	94.5
1.149	0.45	22.73	2.00	449.7	96.1
1.261	0.52	24.95	2.07	493.6	97.8
1.385	0.58	27.39	2.16	541.9	99.1
1.520	0.65	30.07	2.25	594.9	99.8
1.669	0.71	33.01	2.36	653.0	99.97
1.832	0.77	36.24	2.50	716.9	99.999
2.011	0.82	39.78	2.70	787.0	100
2.208	0.87	43.67	2.98	863.9	100
2.423	0.91	47.94	3.33	948.3	100
2.660	0.95	52.63	3.75	1041	100
2.920	0.98	57.77	4.28	1143	100
3.206	1.01	63.42	5.09	1255	100
3.519	1.04	69.62	6.51	1377	100
3.863	1.07	76.43	9.12	1512	100
4.241	1.11	83.90	13.5	1660	100
4.656	1.14	92.10	20.2	1822	100
5.111	1.18	101.1	29.1	2000	100
5.610	1.23	111.0	39.6		
6.159	1.27	121.8	50.6		
6.761	1.32	133.8	60.9		

LS Particle Size Analyzer

Santa Cruz Harbor Sediment Monitoring (Fall 2005)

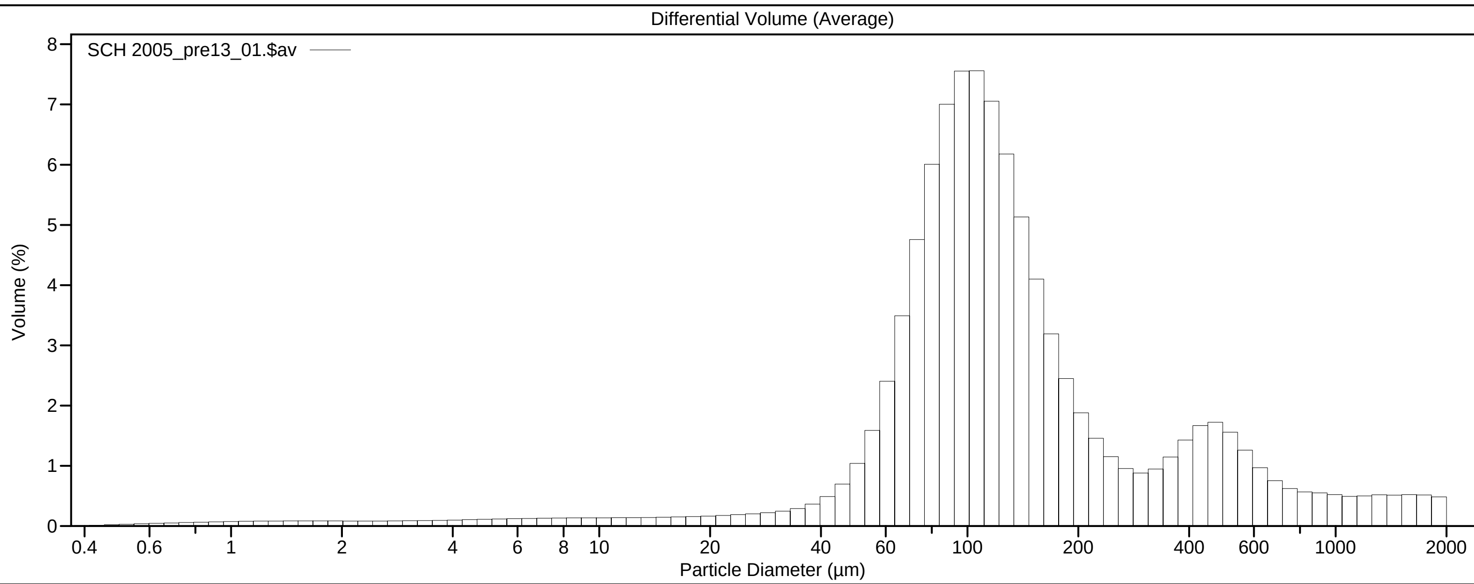
File name:	C:\LS13320\SCH-2005-6-grain-size\Offshore-samples\SCH 2005_pre13_01.$av
	SCH 2005_pre13_01.$av
Sample ID:	pre13off
Comment 1:	Collected 10-11-05
Comment 2:	Pre-dredging
Optical model:	Fraunhofer.rf780z

Volume Statistics (Arithmetic) SCH 2005_pre13_01.$av

Calculations from 0.375 µm to 2000 µm

Volume:	100%		
Mean:	216.7 µm	S.D.:	297.4 µm
Median:	113.6 µm	Variance:	88443 µm^2
Mean/Median ratio:	1.908	Skewness:	3.305 Right skewed
Mode:	105.9 µm	Kurtosis:	12.07 Leptokurtic

d_{10}: 58.85 µm d_{50}: 113.6 µm d_{90}: 504.2 µm



SCH 2005_pre13_01.$av

Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %
0.375	0	7.422	2.47	146.8	66.7
0.412	0.0073	8.148	2.60	161.2	70.8
0.452	0.021	8.944	2.74	176.9	74.0
0.496	0.041	9.819	2.87	194.2	76.4
0.545	0.071	10.78	3.01	213.2	78.3
0.598	0.11	11.83	3.15	234.1	79.8
0.657	0.15	12.99	3.28	256.9	80.9
0.721	0.20	14.26	3.43	282.1	81.9
0.791	0.26	15.65	3.57	309.6	82.8
0.869	0.33	17.18	3.72	339.9	83.7
0.954	0.40	18.86	3.88	373.1	84.8
1.047	0.47	20.71	4.04	409.6	86.3
1.149	0.55	22.73	4.22	449.7	87.9
1.261	0.63	24.95	4.41	493.6	89.7
1.385	0.72	27.39	4.61	541.9	91.2
1.520	0.80	30.07	4.83	594.9	92.5
1.669	0.88	33.01	5.08	653.0	93.4
1.832	0.97	36.24	5.36	716.9	94.2
2.011	1.05	39.78	5.73	787.0	94.8
2.208	1.14	43.67	6.22	863.9	95.4
2.423	1.22	47.94	6.91	948.3	95.9
2.660	1.30	52.63	7.95	1041	96.5
2.920	1.39	57.77	9.54	1143	96.9
3.206	1.47	63.42	11.9	1255	97.4
3.519	1.57	69.62	15.4	1377	98.0
3.863	1.66	76.43	20.2	1512	98.5
4.241	1.76	83.90	26.2	1660	99.0
4.656	1.86	92.10	33.2	1822	99.5
5.111	1.97	101.1	40.8	2000	100
5.610	2.09	111.0	48.3		
6.159	2.21	121.8	55.4		
6.761	2.34	133.8	61.6		

LS Particle Size Analyzer

Santa Cruz Harbor Sediment Monitoring (Fall 2005)

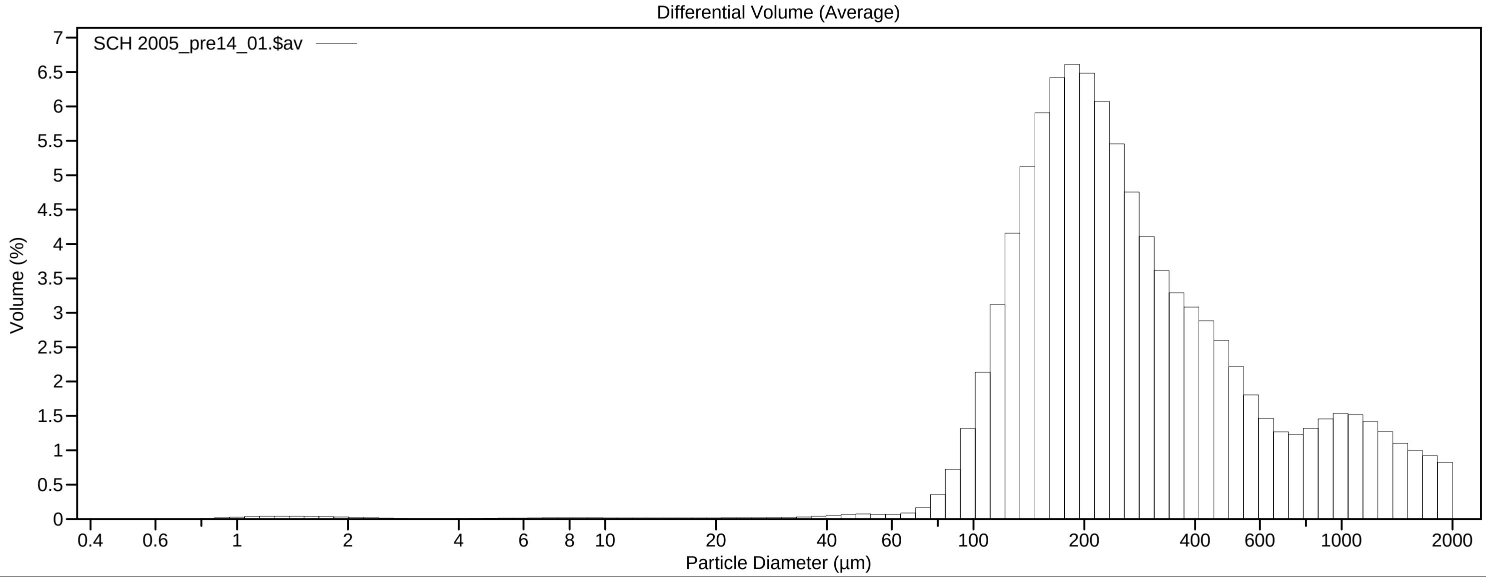
File name:	C:\LS13320\SCH-2005-6-grain-size\Offshore-samples\SCH 2005_pre14_01.$av SCH 2005_pre14_01.$av
Sample ID:	pre14off
Comment 1:	Collected 10-11-05
Comment 2:	Pre-dredging
Optical model:	Fraunhofer.rf780z

Volume Statistics (Arithmetic) SCH 2005_pre14_01.$av

Calculations from 0.375 µm to 2000 µm

Volume:	100%		
Mean:	380.2 µm	S.D.:	368.7 µm
Median:	234.6 µm	Variance:	136.0e3 µm^2
Mean/Median ratio:	1.620	Skewness:	2.170 Right skewed
Mode:	185.4 µm	Kurtosis:	4.418 Leptokurtic

d_{10}: 124.5 µm d_{50}: 234.6 µm d_{90}: 924.3 µm



SCH 2005_pre14_01.$av

Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %
0.375	0	7.422	0.50	146.8	18.4
0.412	0	8.148	0.51	161.2	24.3
0.452	0	8.944	0.53	176.9	30.7
0.496	0	9.819	0.55	194.2	37.3
0.545	0	10.78	0.57	213.2	43.8
0.598	0	11.83	0.58	234.1	49.9
0.657	0	12.99	0.60	256.9	55.3
0.721	0	14.26	0.61	282.1	60.1
0.791	0.00045	15.65	0.63	309.6	64.2
0.869	0.0064	17.18	0.65	339.9	67.8
0.954	0.024	18.86	0.66	373.1	71.1
1.047	0.053	20.71	0.68	409.6	74.2
1.149	0.089	22.73	0.70	449.7	77.1
1.261	0.13	24.95	0.72	493.6	79.7
1.385	0.17	27.39	0.74	541.9	81.9
1.520	0.22	30.07	0.76	594.9	83.7
1.669	0.25	33.01	0.78	653.0	85.1
1.832	0.29	36.24	0.81	716.9	86.4
2.011	0.32	39.78	0.85	787.0	87.6
2.208	0.34	43.67	0.91	863.9	89.0
2.423	0.36	47.94	0.97	948.3	90.4
2.660	0.38	52.63	1.05	1041	91.9
2.920	0.39	57.77	1.12	1143	93.5
3.206	0.40	63.42	1.19	1255	94.9
3.519	0.40	69.62	1.27	1377	96.2
3.863	0.41	76.43	1.44	1512	97.3
4.241	0.41	83.90	1.79	1660	98.3
4.656	0.42	92.10	2.52	1822	99.2
5.111	0.43	101.1	3.83	2000	100
5.610	0.45	111.0	5.97		
6.159	0.46	121.8	9.09		
6.761	0.48	133.8	13.2		

LS Particle Size Analyzer

Santa Cruz Harbor Sediment Monitoring (Fall 2005)

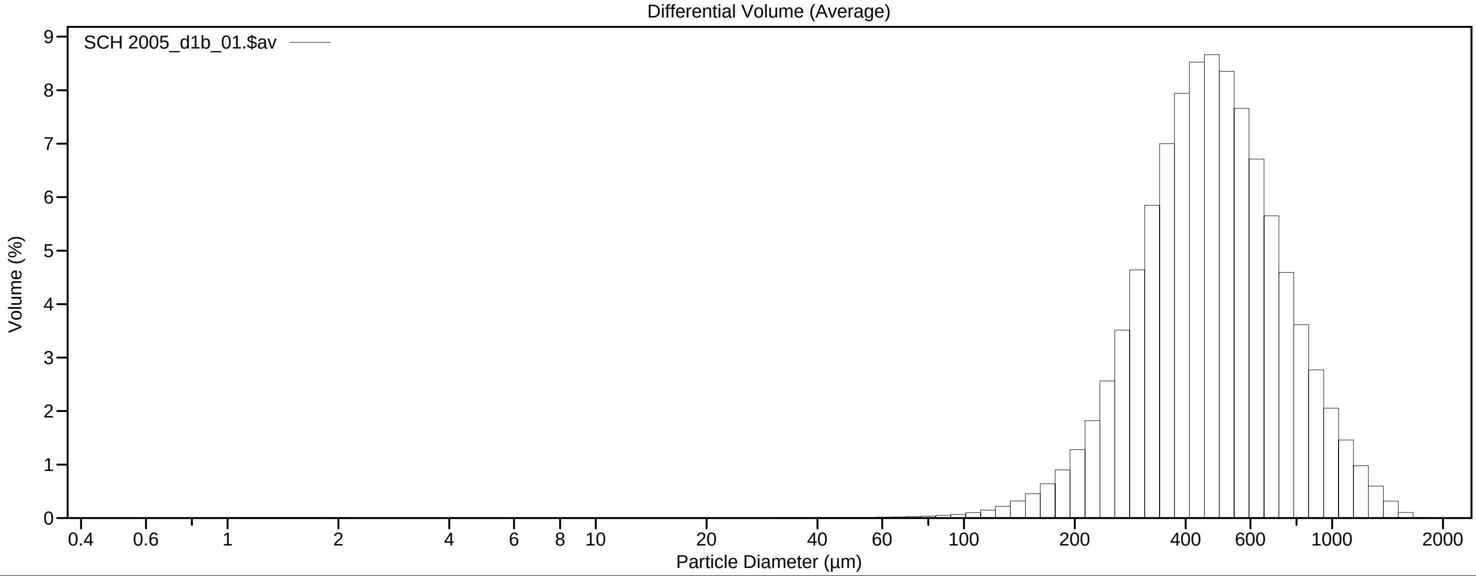
File name:	C:\LS13320\SCH-2005-6-grain-size\Beach-samples\SCH 2005_d1b_01.$av
	SCH 2005_d1b_01.$av
Sample ID:	d1b
Comment 1:	collected 10-27-05
Comment 2:	During dredging
Optical model:	Fraunhofer.rf780z

Volume Statistics (Arithmetic) SCH 2005_d1b_01.$av

Calculations from 0.375 µm to 2000 µm

Volume:	100%		
Mean:	512.1 µm	S.D.:	233.4 µm
Median:	467.6 µm	Variance:	54466 µm^2
Mean/Median ratio:	1.095	Skewness:	1.121 Right skewed
Mode:	471.1 µm	Kurtosis:	1.713 Leptokurtic

d_{10}: 264.2 µm d_{50}: 467.6 µm d_{90}: 827.5 µm



SCH 2005_d1b_01.$av

Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %
0.375	0	7.422	0.14	146.8	1.33
0.412	0	8.148	0.15	161.2	1.78
0.452	0	8.944	0.15	176.9	2.42
0.496	0	9.819	0.16	194.2	3.32
0.545	0	10.78	0.16	213.2	4.61
0.598	0	11.83	0.17	234.1	6.43
0.657	0	12.99	0.17	256.9	8.99
0.721	0	14.26	0.18	282.1	12.5
0.791	0.00014	15.65	0.18	309.6	17.1
0.869	0.0020	17.18	0.19	339.9	23.0
0.954	0.0075	18.86	0.20	373.1	30.0
1.047	0.016	20.71	0.20	409.6	37.9
1.149	0.028	22.73	0.21	449.7	46.5
1.261	0.041	24.95	0.22	493.6	55.1
1.385	0.054	27.39	0.22	541.9	63.5
1.520	0.068	30.07	0.23	594.9	71.1
1.669	0.081	33.01	0.24	653.0	77.9
1.832	0.092	36.24	0.25	716.9	83.5
2.011	0.10	39.78	0.26	787.0	88.1
2.208	0.11	43.67	0.27	863.9	91.7
2.423	0.12	47.94	0.28	948.3	94.5
2.660	0.12	52.63	0.30	1041	96.5
2.920	0.12	57.77	0.31	1143	98.0
3.206	0.13	63.42	0.33	1255	99.0
3.519	0.13	69.62	0.35	1377	99.6
3.863	0.13	76.43	0.38	1512	99.9
4.241	0.13	83.90	0.42	1660	99.99
4.656	0.13	92.10	0.47	1822	100
5.111	0.13	101.1	0.54	2000	100
5.610	0.13	111.0	0.64		
6.159	0.13	121.8	0.79		
6.761	0.14	133.8	1.01		

LS Particle Size Analyzer

Santa Cruz Harbor Sediment Monitoring (Fall 2005)

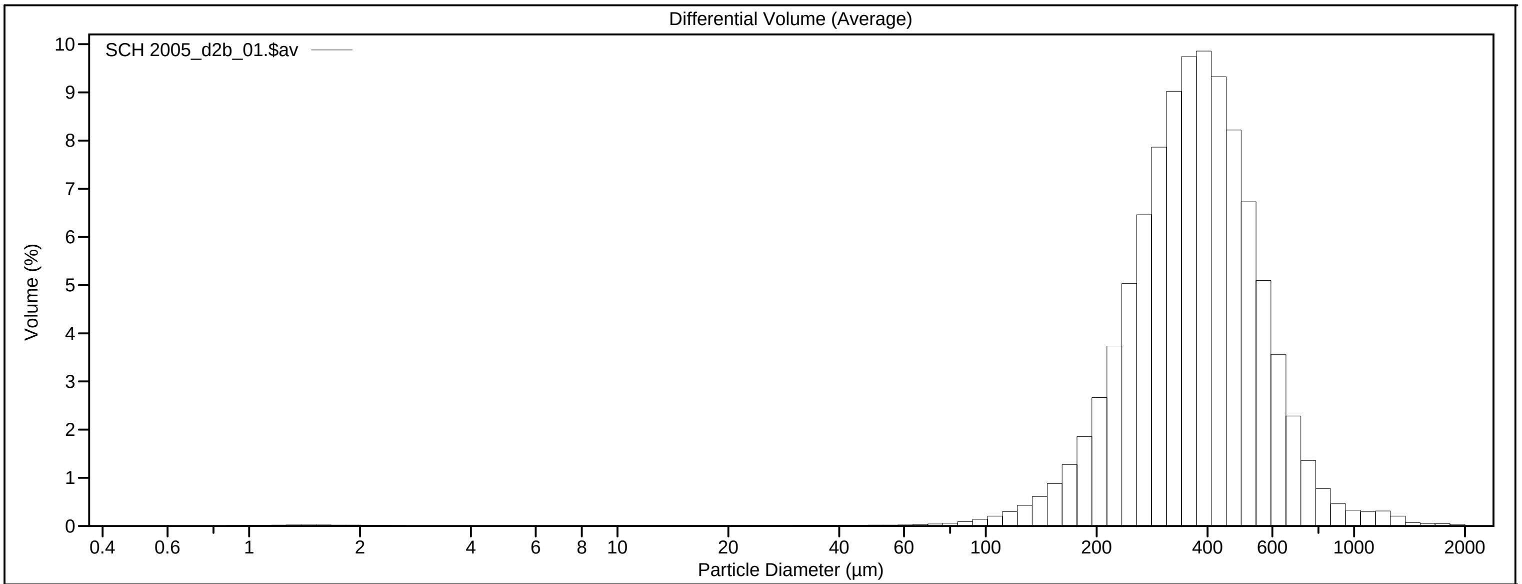
File name:	C:\LS13320\SCH-2005-6-grain-size\Beach-samples\SCH 2005_d2b_01.$av
	SCH 2005_d2b_01.$av
Sample ID:	d2b
Comment 1:	Collected 10-27-05
Comment 2:	During dredging
Optical model:	Fraunhofer.rf780z

Volume Statistics (Arithmetic) SCH 2005_d2b_01.$av

Calculations from 0.375 µm to 2000 µm

Volume:	100%		
Mean:	395.9 µm	S.D.:	174.7 µm
Median:	369.8 µm	Variance:	30526 µm^2
Mean/Median ratio:	1.071	Skewness:	1.899 Right skewed
Mode:	391.0 µm	Kurtosis:	8.324 Leptokurtic

d_{10}: 218.1 µm d_{50}: 369.8 µm d_{90}: 592.7 µm



SCH 2005_d2b_01.$av

Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %
0.375	0	7.422	0.25	146.8	2.44
0.412	0	8.148	0.25	161.2	3.32
0.452	0	8.944	0.26	176.9	4.60
0.496	0	9.819	0.27	194.2	6.46
0.545	0	10.78	0.28	213.2	9.12
0.598	0	11.83	0.29	234.1	12.9
0.657	0	12.99	0.30	256.9	17.9
0.721	0	14.26	0.31	282.1	24.4
0.791	0.00022	15.65	0.32	309.6	32.2
0.869	0.0031	17.18	0.33	339.9	41.2
0.954	0.012	18.86	0.34	373.1	51.0
1.047	0.026	20.71	0.35	409.6	60.8
1.149	0.044	22.73	0.37	449.7	70.2
1.261	0.065	24.95	0.38	493.6	78.4
1.385	0.087	27.39	0.39	541.9	85.1
1.520	0.11	30.07	0.40	594.9	90.2
1.669	0.13	33.01	0.41	653.0	93.8
1.832	0.15	36.24	0.42	716.9	96.1
2.011	0.17	39.78	0.44	787.0	97.4
2.208	0.19	43.67	0.45	863.9	98.2
2.423	0.20	47.94	0.47	948.3	98.7
2.660	0.21	52.63	0.49	1041	99.0
2.920	0.22	57.77	0.51	1143	99.3
3.206	0.23	63.42	0.53	1255	99.6
3.519	0.23	69.62	0.56	1377	99.8
3.863	0.23	76.43	0.61	1512	99.9
4.241	0.23	83.90	0.67	1660	99.9
4.656	0.23	92.10	0.76	1822	99.97
5.111	0.23	101.1	0.90	2000	100
5.610	0.24	111.0	1.10		
6.159	0.24	121.8	1.40		
6.761	0.24	133.8	1.83		

BECKMAN COULTER

LS Particle Size Analyzer

Santa Cruz Harbor Sediment Monitoring (Fall 2005)

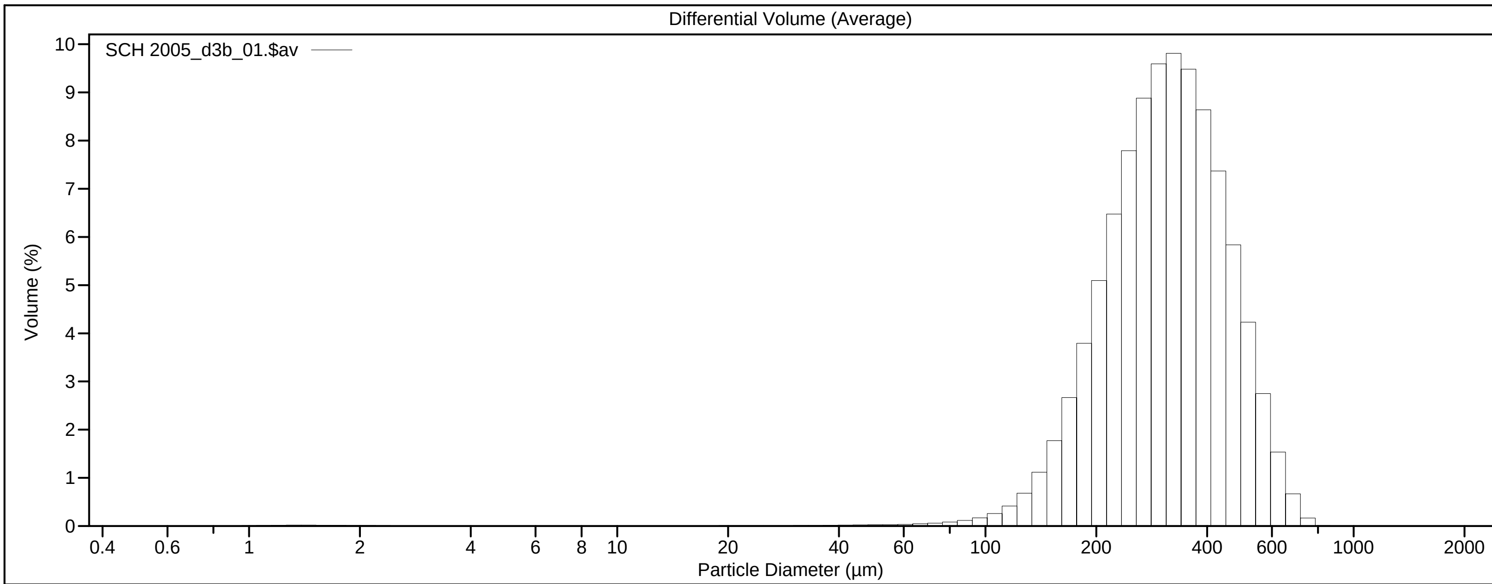
File name:	C:\LS13320\SCH-2005-6-grain-size\Beach-samples\SCH 2005_d3b_01.$av SCH 2005_d3b_01.$av
Sample ID:	d3b
Comment 1:	Collected 10-27-05
Comment 2:	During dredging
Optical model:	Fraunhofer.rf780z

Volume Statistics (Arithmetic) SCH 2005_d3b_01.$av

Calculations from 0.375 µm to 2000 µm

Volume:	100%		
Mean:	325.7 µm	S.D.:	118.8 µm
Median:	311.2 µm	Variance:	14107 µm^2
Mean/Median ratio:	1.046	Skewness:	0.548 Right skewed
Mode:	324.4 µm	Kurtosis:	0.235 Leptokurtic

d_{10}: 186.7 µm d_{50}: 311.2 µm d_{90}: 488.8 µm



SCH 2005_d3b_01.$av

Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %
0.375	0	7.422	0.20	146.8	3.43
0.412	0	8.148	0.20	161.2	5.20
0.452	0	8.944	0.21	176.9	7.87
0.496	0	9.819	0.21	194.2	11.7
0.545	0	10.78	0.22	213.2	16.8
0.598	0	11.83	0.22	234.1	23.2
0.657	0	12.99	0.23	256.9	31.0
0.721	0	14.26	0.24	282.1	39.9
0.791	0.00018	15.65	0.24	309.6	49.5
0.869	0.0025	17.18	0.25	339.9	59.3
0.954	0.0096	18.86	0.26	373.1	68.8
1.047	0.021	20.71	0.27	409.6	77.4
1.149	0.036	22.73	0.28	449.7	84.8
1.261	0.053	24.95	0.29	493.6	90.6
1.385	0.071	27.39	0.30	541.9	94.9
1.520	0.090	30.07	0.31	594.9	97.6
1.669	0.11	33.01	0.32	653.0	99.2
1.832	0.12	36.24	0.33	716.9	99.8
2.011	0.14	39.78	0.35	787.0	99.99
2.208	0.15	43.67	0.37	863.9	100
2.423	0.16	47.94	0.39	948.3	100
2.660	0.17	52.63	0.42	1041	100
2.920	0.18	57.77	0.45	1143	100
3.206	0.18	63.42	0.48	1255	100
3.519	0.18	69.62	0.53	1377	100
3.863	0.18	76.43	0.59	1512	100
4.241	0.18	83.90	0.67	1660	100
4.656	0.18	92.10	0.79	1822	100
5.111	0.19	101.1	0.96	2000	100
5.610	0.19	111.0	1.22		
6.159	0.19	121.8	1.63		
6.761	0.19	133.8	2.32		

LS Particle Size Analyzer

Santa Cruz Harbor Sediment Monitoring (Fall 2005)

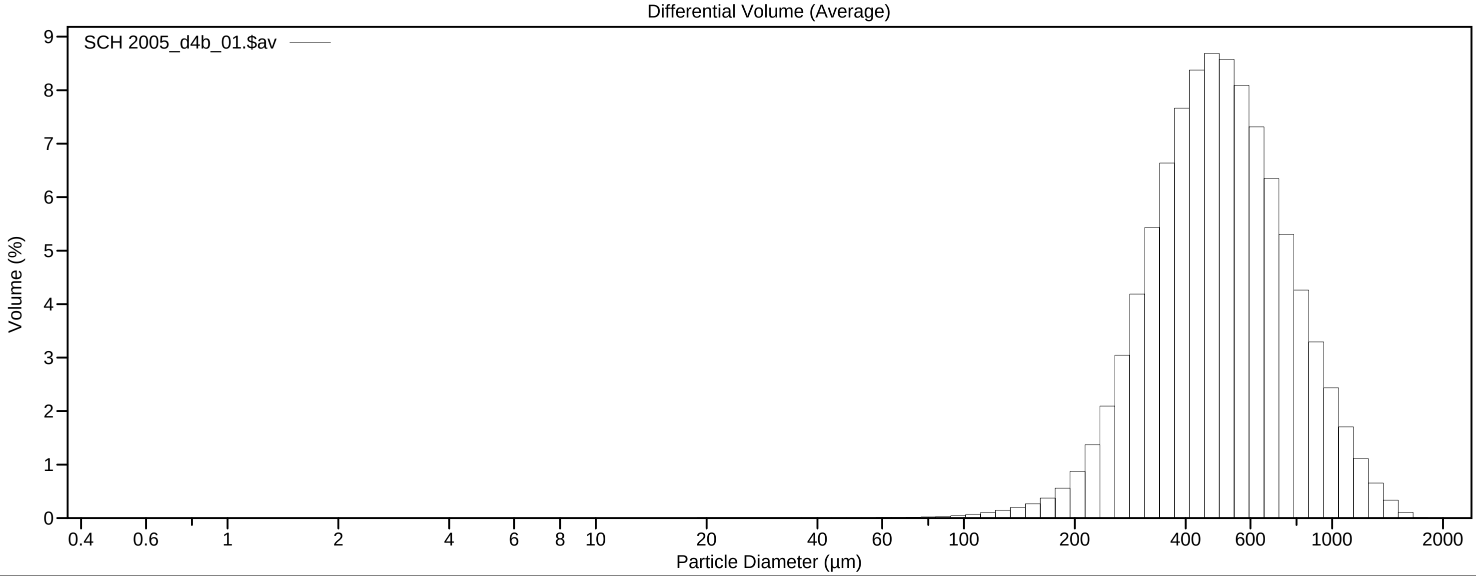
File name:	C:\LS13320\SCH-2005-6-grain-size\Beach-samples\SCH 2005_d4b_01.$av
	SCH 2005_d4b_01.$av
Sample ID:	d4b
Comment 1:	Collected 10-27-05
Comment 2:	During dredging
Optical model:	Fraunhofer.rf780z

Volume Statistics (Arithmetic) SCH 2005_d4b_01.$av

Calculations from 0.375 µm to 2000 µm

Volume:	100%		
Mean:	537.1 µm	S.D.:	235.2 µm
Median:	491.4 µm	Variance:	55330 µm^2
Mean/Median ratio:	1.093	Skewness:	1.053 Right skewed
Mode:	471.1 µm	Kurtosis:	1.398 Leptokurtic

d_{10}: 285.6 µm d_{50}: 491.4 µm d_{90}: 857.6 µm



SCH 2005_d4b_01.$av

Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %
0.375	0	7.422	0.068	146.8	0.88
0.412	0	8.148	0.072	161.2	1.15
0.452	0	8.944	0.077	176.9	1.52
0.496	0	9.819	0.082	194.2	2.08
0.545	0	10.78	0.088	213.2	2.96
0.598	0	11.83	0.094	234.1	4.33
0.657	0	12.99	0.10	256.9	6.42
0.721	0	14.26	0.11	282.1	9.46
0.791	0.000059	15.65	0.11	309.6	13.7
0.869	0.00085	17.18	0.12	339.9	19.1
0.954	0.0032	18.86	0.13	373.1	25.7
1.047	0.0071	20.71	0.14	409.6	33.4
1.149	0.012	22.73	0.14	449.7	41.8
1.261	0.018	24.95	0.15	493.6	50.5
1.385	0.024	27.39	0.16	541.9	59.0
1.520	0.030	30.07	0.17	594.9	67.1
1.669	0.036	33.01	0.17	653.0	74.4
1.832	0.042	36.24	0.18	716.9	80.8
2.011	0.046	39.78	0.19	787.0	86.1
2.208	0.050	43.67	0.20	863.9	90.3
2.423	0.054	47.94	0.21	948.3	93.6
2.660	0.056	52.63	0.22	1041	96.1
2.920	0.058	57.77	0.23	1143	97.8
3.206	0.059	63.42	0.24	1255	98.9
3.519	0.059	69.62	0.25	1377	99.5
3.863	0.060	76.43	0.27	1512	99.9
4.241	0.060	83.90	0.29	1660	99.99
4.656	0.060	92.10	0.32	1822	100
5.111	0.060	101.1	0.36	2000	100
5.610	0.061	111.0	0.44		
6.159	0.063	121.8	0.54		
6.761	0.065	133.8	0.69		

LS Particle Size Analyzer

Santa Cruz Harbor Sediment Monitoring (Fall 2005)

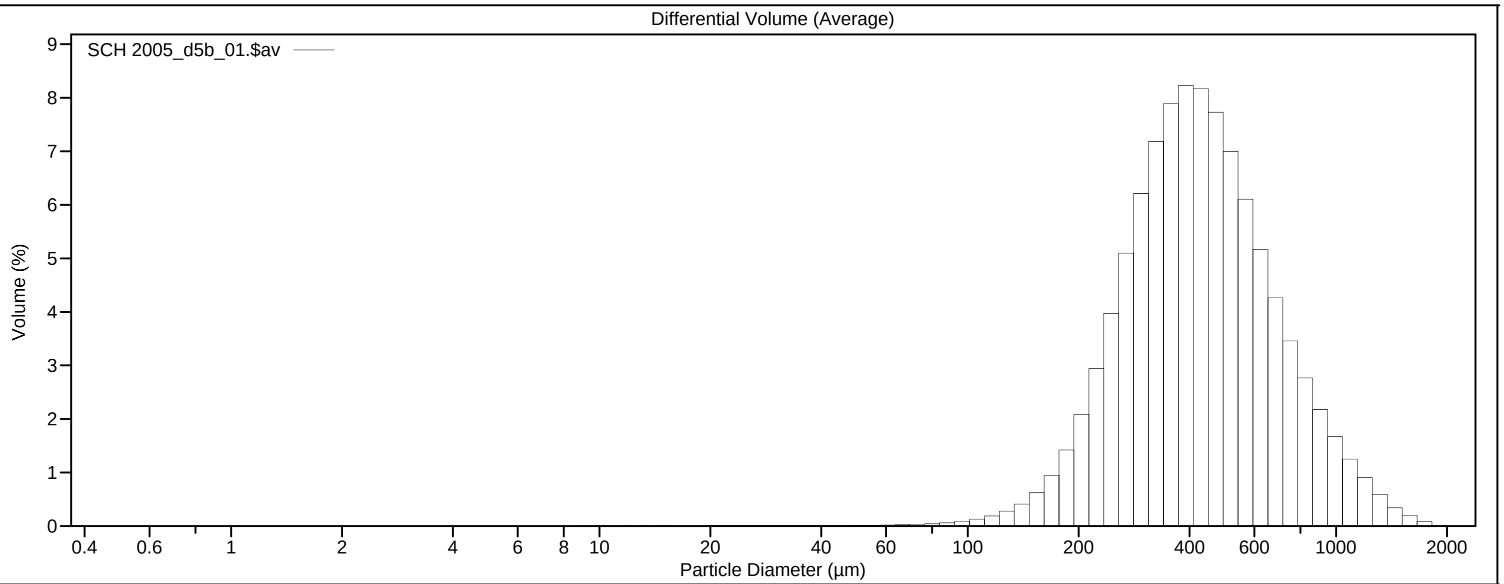
File name:	C:\LS13320\SCH-2005-6-grain-size\Beach-samples\SCH 2005_d5b_01.$av SCH 2005_d5b_01.$av
Sample ID:	d5b
Comment 1:	Collected 10-27-05
Comment 2:	During dredging
Optical model:	Fraunhofer.rf780z

Volume Statistics (Arithmetic) SCH 2005_d5b_01.$av

Calculations from 0.375 µm to 2000 µm

Volume:	100%		
Mean:	473.6 µm	S.D.:	238.6 µm
Median:	418.8 µm	Variance:	56922 μm^2
Mean/Median ratio:	1.131	Skewness:	1.481 Right skewed
Mode:	391.0 µm	Kurtosis:	3.035 Leptokurtic

d_{10}: 236.7 µm d_{50}: 418.8 µm d_{90}: 786.7 µm



SCH 2005_d5b_01.$av

Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %
0.375	0	7.422	0.020	146.8	1.52
0.412	0	8.148	0.027	161.2	2.14
0.452	0	8.944	0.034	176.9	3.09
0.496	0	9.819	0.042	194.2	4.51
0.545	0	10.78	0.050	213.2	6.60
0.598	0	11.83	0.058	234.1	9.54
0.657	0	12.99	0.066	256.9	13.5
0.721	0	14.26	0.074	282.1	18.6
0.791	0	15.65	0.082	309.6	24.8
0.869	0	17.18	0.091	339.9	32.0
0.954	0	18.86	0.10	373.1	39.9
1.047	0	20.71	0.11	409.6	48.1
1.149	0	22.73	0.12	449.7	56.3
1.261	0	24.95	0.13	493.6	64.0
1.385	0	27.39	0.14	541.9	71.0
1.520	0	30.07	0.15	594.9	77.1
1.669	0	33.01	0.17	653.0	82.3
1.832	0	36.24	0.18	716.9	86.6
2.011	0	39.78	0.19	787.0	90.0
2.208	0	43.67	0.20	863.9	92.8
2.423	0	47.94	0.22	948.3	95.0
2.660	0	52.63	0.23	1041	96.6
2.920	0	57.77	0.25	1143	97.9
3.206	0	63.42	0.26	1255	98.8
3.519	0	69.62	0.29	1377	99.4
3.863	0	76.43	0.32	1512	99.7
4.241	0.000040	83.90	0.36	1660	99.9
4.656	0.00055	92.10	0.42	1822	99.99
5.111	0.0021	101.1	0.51	2000	100
5.610	0.0048	111.0	0.64		
6.159	0.0087	121.8	0.83		
6.761	0.014	133.8	1.11		

LS Particle Size Analyzer

Santa Cruz Harbor Sediment Monitoring (Fall 2005)

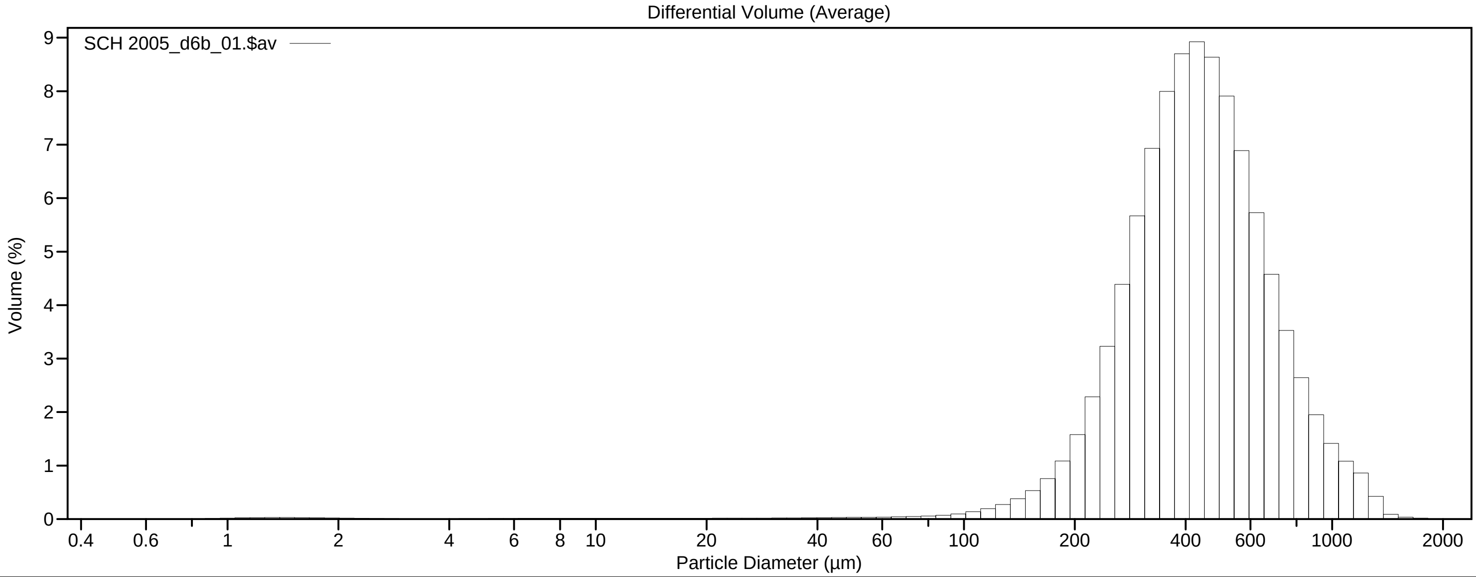
File name: C:\LS13320\SCH-2005-6-grain-size\Beach-samples\SCH 2005_d6b_01.$av
SCH 2005_d6b_01.$av
Sample ID: d6b
Comment 1: Collected 10-27-05
Comment 2: During dredging
Optical model: Fraunhofer.rf780z

Volume Statistics (Arithmetic) SCH 2005_d6b_01.$av

Calculations from 0.375 µm to 2000 µm

Volume:	100%		
Mean:	471.6 µm	S.D.:	218.1 µm
Median:	430.8 µm	Variance:	47585 µm^2
Mean/Median ratio:	1.095	Skewness:	1.184 Right skewed
Mode:	429.2 µm	Kurtosis:	2.161 Leptokurtic

d_{10}: 245.6 µm d_{50}: 430.8 µm d_{90}: 757.7 µm



SCH 2005_d6b_01.$av

Channel Diameter (Lower) µm	Cum. < Volume %
0.375	0
0.412	0
0.452	0
0.496	0
0.545	0
0.598	0
0.657	0
0.721	0
0.791	0.00030
0.869	0.0043
0.954	0.016
1.047	0.035
1.149	0.059
1.261	0.087
1.385	0.12
1.520	0.14
1.669	0.17
1.832	0.19
2.011	0.22
2.208	0.23
2.423	0.25
2.660	0.26
2.920	0.27
3.206	0.27
3.519	0.28
3.863	0.29
4.241	0.29
4.656	0.30
5.111	0.31
5.610	0.32
6.159	0.34
6.761	0.35

Channel Diameter (Lower) µm	Cum. < Volume %
7.422	0.37
8.148	0.38
8.944	0.40
9.819	0.41
10.78	0.43
11.83	0.44
12.99	0.46
14.26	0.47
15.65	0.48
17.18	0.50
18.86	0.51
20.71	0.53
22.73	0.55
24.95	0.56
27.39	0.58
30.07	0.60
33.01	0.62
36.24	0.64
39.78	0.67
43.67	0.69
47.94	0.72
52.63	0.75
57.77	0.79
63.42	0.82
69.62	0.87
76.43	0.91
83.90	0.97
92.10	1.04
101.1	1.14
111.0	1.27
121.8	1.47
133.8	1.74

Channel Diameter (Lower) µm	Cum. < Volume %
146.8	2.12
161.2	2.66
176.9	3.41
194.2	4.50
213.2	6.08
234.1	8.37
256.9	11.6
282.1	16.0
309.6	21.7
339.9	28.6
373.1	36.6
409.6	45.3
449.7	54.2
493.6	62.8
541.9	70.7
594.9	77.6
653.0	83.4
716.9	87.9
787.0	91.5
863.9	94.1
948.3	96.1
1041	97.5
1143	98.6
1255	99.4
1377	99.9
1512	99.9
1660	99.98
1822	99.998
2000	100

LS Particle Size Analyzer

Santa Cruz Harbor Sediment Monitoring (Fall 2005)

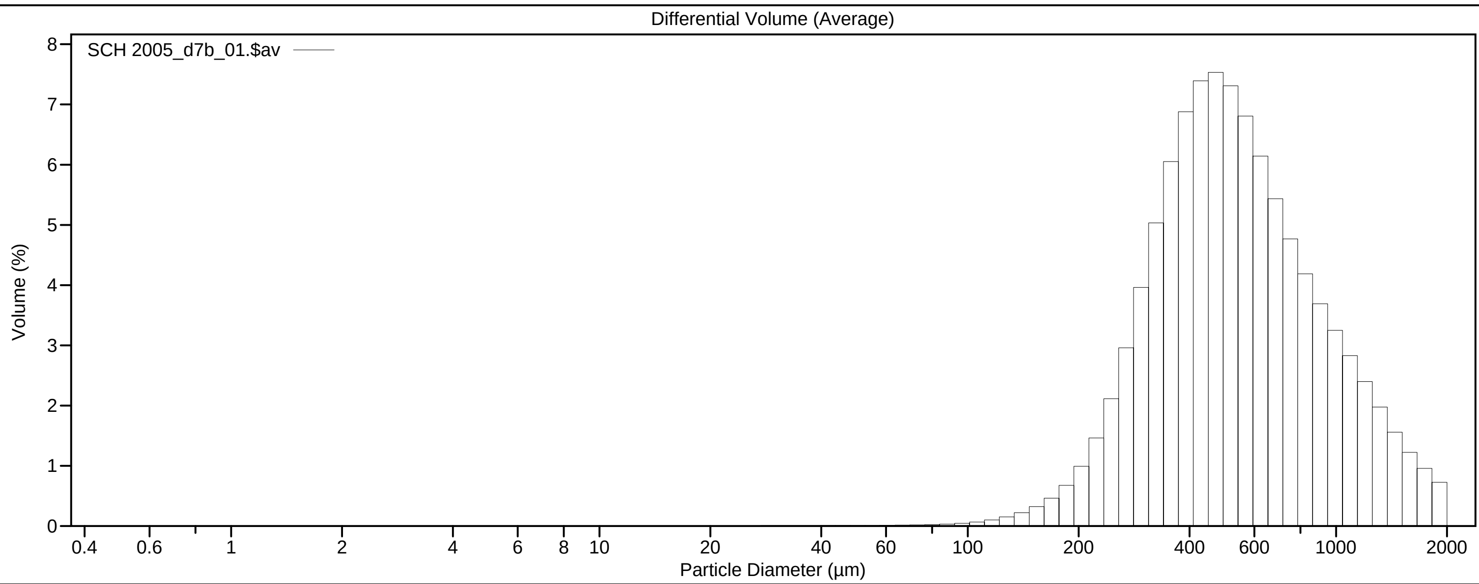
File name: C:\LS13320\SCH-2005-6-grain-size\Beach-samples\SCH 2005_d7b_01.$av
SCH 2005_d7b_01.$av
File ID: SCH 2005
Sample ID: d7b
Operator: swatt
Comment 1: 10-27-05
Comment 2: SCH dredge monitoring project
Optical model: Fraunhofer.rf780z
LS 13 320 SW Aqueous Liquid Module
Run length: 60 seconds
Pump speed: 86
Average of 3 files:
SCH 2005_d7b_01.$ls
SCH 2005_d7b_02.$ls
SCH 2005_d7b_03.$ls

Volume Statistics (Arithmetic) SCH 2005_d7b_01.$av

Calculations from 0.375 µm to 2000 µm

Volume: 100%
Mean: 611.5 µm S.D.: 343.2 µm
Median: 515.2 µm Variance: 117.8e3 $µm^2$
Mean/Median ratio: 1.187 Skewness: 1.405 Right skewed
Mode: 471.1 µm Kurtosis: 1.942 Leptokurtic

d_{10}: 282.9 µm d_{50}: 515.2 µm d_{90}: 1101 µm



SCH 2005_d7b_01.$av

Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %
0.375	0	2.660	0.054	18.86	0.11	133.8	0.67	948.3	85.1
0.412	0	2.920	0.055	20.71	0.11	146.8	0.89	1041	88.3
0.452	0	3.206	0.056	22.73	0.12	161.2	1.21	1143	91.2
0.496	0	3.519	0.057	24.95	0.12	176.9	1.68	1255	93.6
0.545	0	3.863	0.057	27.39	0.13	194.2	2.35	1377	95.5
0.598	0	4.241	0.057	30.07	0.14	213.2	3.34	1512	97.1
0.657	0	4.656	0.058	33.01	0.14	234.1	4.81	1660	98.3
0.721	0	5.111	0.059	36.24	0.15	256.9	6.92	1822	99.3
0.791	0.000062	5.610	0.060	39.78	0.16	282.1	9.88	2000	100
0.869	0.00088	6.159	0.063	43.67	0.17	309.6	13.8		
0.954	0.0033	6.761	0.066	47.94	0.18	339.9	18.9		
1.047	0.0073	7.422	0.069	52.63	0.19	373.1	24.9		
1.149	0.012	8.148	0.073	57.77	0.20	409.6	31.8		
1.261	0.018	8.944	0.077	63.42	0.21	449.7	39.2		
1.385	0.024	9.819	0.081	69.62	0.23	493.6	46.7		
1.520	0.030	10.78	0.085	76.43	0.25	541.9	54.0		
1.669	0.036	11.83	0.089	83.90	0.27	594.9	60.9		
1.832	0.041	12.99	0.093	92.10	0.31	653.0	67.0		
2.011	0.046	14.26	0.096	101.1	0.35	716.9	72.4		
2.208	0.049	15.65	0.100	111.0	0.42	787.0	77.2		
2.423	0.052	17.18	0.10	121.8	0.52	863.9	81.4		

LS Particle Size Analyzer

Santa Cruz Harbor Sediment Monitoring (Fall 2005)

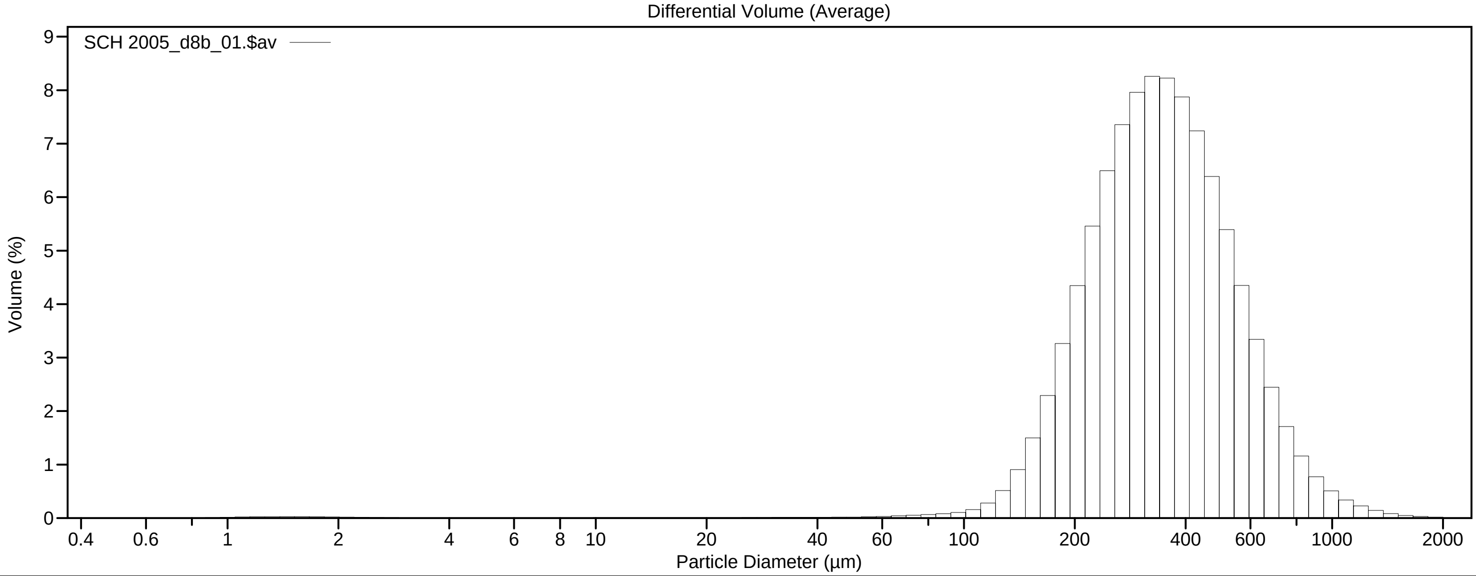
File name:	C:\LS13320\SCH-2005-6-grain-size\Beach-samples\SCH 2005_d8b_01.$av SCH 2005_d8b_01.$av
Sample ID:	d8b
Comment 1:	Collected 10-27-05
Comment 2:	During dredging
Optical model:	Fraunhofer.rf780z

Volume Statistics (Arithmetic) SCH 2005_d8b_01.$av

Calculations from 0.375 µm to 2000 µm

Volume:	100%		
Mean:	379.1 µm	S.D.:	184.8 µm
Median:	341.1 µm	Variance:	34159 µm^2
Mean/Median ratio:	1.111	Skewness:	1.699 Right skewed
Mode:	324.4 µm	Kurtosis:	5.573 Leptokurtic

d_{10}: 195.0 µm d_{50}: 341.1 µm d_{90}: 609.3 µm



SCH 2005_d8b_01.$av

Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %
0.375	0	7.422	0.28	146.8	2.77
0.412	0	8.148	0.28	161.2	4.27
0.452	0	8.944	0.29	176.9	6.56
0.496	0	9.819	0.30	194.2	9.83
0.545	0	10.78	0.31	213.2	14.2
0.598	0	11.83	0.31	234.1	19.6
0.657	0	12.99	0.32	256.9	26.1
0.721	0	14.26	0.33	282.1	33.5
0.791	0.00024	15.65	0.34	309.6	41.4
0.869	0.0034	17.18	0.35	339.9	49.7
0.954	0.013	18.86	0.36	373.1	57.9
1.047	0.028	20.71	0.37	409.6	65.8
1.149	0.048	22.73	0.38	449.7	73.0
1.261	0.072	24.95	0.39	493.6	79.4
1.385	0.097	27.39	0.40	541.9	84.8
1.520	0.12	30.07	0.41	594.9	89.2
1.669	0.15	33.01	0.43	653.0	92.5
1.832	0.17	36.24	0.44	716.9	95.0
2.011	0.19	39.78	0.46	787.0	96.7
2.208	0.21	43.67	0.47	863.9	97.8
2.423	0.23	47.94	0.49	948.3	98.6
2.660	0.24	52.63	0.51	1041	99.1
2.920	0.25	57.77	0.53	1143	99.5
3.206	0.26	63.42	0.56	1255	99.7
3.519	0.26	69.62	0.61	1377	99.8
3.863	0.26	76.43	0.66	1512	99.9
4.241	0.27	83.90	0.73	1660	99.95
4.656	0.27	92.10	0.81	1822	99.98
5.111	0.27	101.1	0.91	2000	100
5.610	0.27	111.0	1.07		
6.159	0.27	121.8	1.35		
6.761	0.27	133.8	1.87		

LS Particle Size Analyzer

Santa Cruz Harbor Sediment Monitoring (Fall 2005)

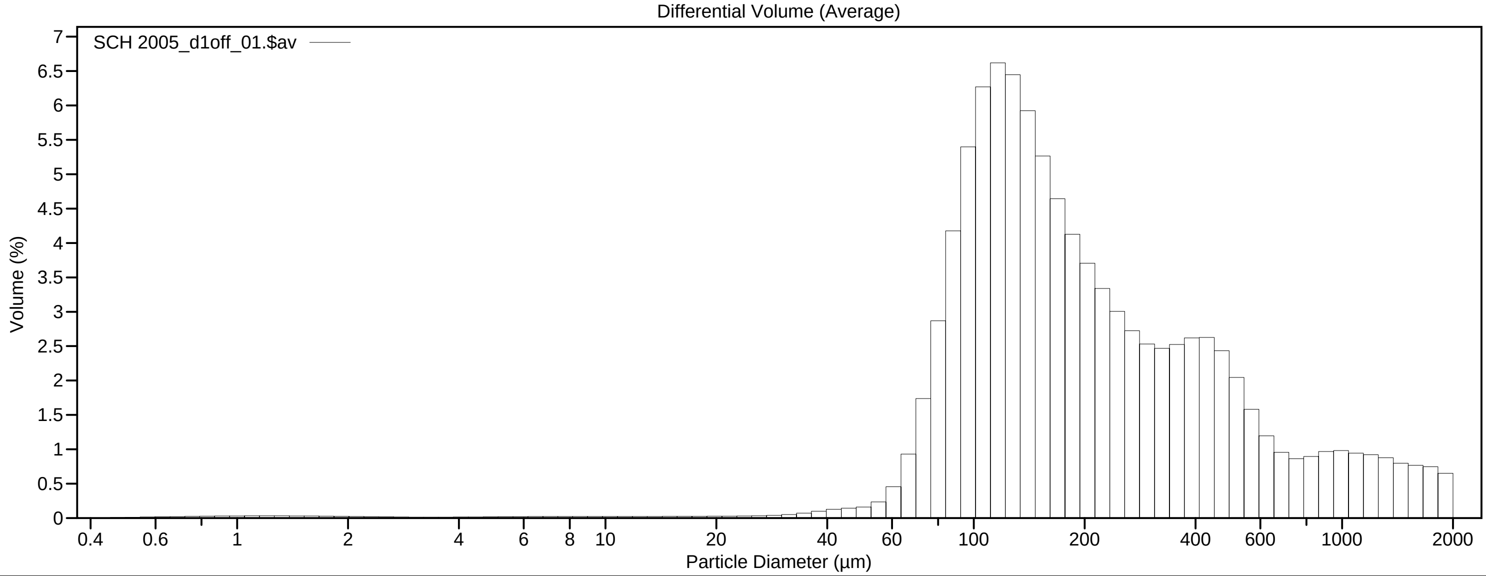
File name:	C:\LS13320\SCH-2005-6-grain-size\Offshore-samples\SCH 2005_d1off_01.$av SCH 2005_d1off_01.$av
Sample ID:	d1off
Comment 1:	Collected 10-27-05
Comment 2:	During dredging
Optical model:	Fraunhofer.rf780z

Volume Statistics (Arithmetic) SCH 2005_d1off_01.$av

Calculations from 0.375 µm to 2000 µm

Volume:	100%		
Mean:	303.4 µm	S.D.:	341.1 µm
Median:	167.8 µm	Variance:	116.3e3 µm^2
Mean/Median ratio:	1.808	Skewness:	2.579 Right skewed
Mode:	116.3 µm	Kurtosis:	6.879 Leptokurtic

d_{10}: 87.93 µm d_{50}: 167.8 µm d_{90}: 678.1 µm



SCH 2005_d1off_01.$av

Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %
0.375	0	7.422	0.66	146.8	42.8
0.412	0.0026	8.148	0.69	161.2	48.0
0.452	0.0076	8.944	0.71	176.9	52.7
0.496	0.016	9.819	0.73	194.2	56.8
0.545	0.028	10.78	0.76	213.2	60.5
0.598	0.043	11.83	0.78	234.1	63.9
0.657	0.062	12.99	0.81	256.9	66.9
0.721	0.083	14.26	0.83	282.1	69.6
0.791	0.11	15.65	0.86	309.6	72.1
0.869	0.13	17.18	0.88	339.9	74.6
0.954	0.16	18.86	0.91	373.1	77.1
1.047	0.19	20.71	0.93	409.6	79.7
1.149	0.23	22.73	0.96	449.7	82.4
1.261	0.26	24.95	0.99	493.6	84.8
1.385	0.29	27.39	1.03	541.9	86.8
1.520	0.32	30.07	1.07	594.9	88.4
1.669	0.35	33.01	1.12	653.0	89.6
1.832	0.38	36.24	1.19	716.9	90.6
2.011	0.40	39.78	1.29	787.0	91.4
2.208	0.43	43.67	1.41	863.9	92.3
2.423	0.45	47.94	1.56	948.3	93.3
2.660	0.47	52.63	1.72	1041	94.3
2.920	0.48	57.77	1.95	1143	95.2
3.206	0.50	63.42	2.41	1255	96.2
3.519	0.51	69.62	3.34	1377	97.0
3.863	0.52	76.43	5.08	1512	97.8
4.241	0.54	83.90	7.95	1660	98.6
4.656	0.56	92.10	12.1	1822	99.3
5.111	0.58	101.1	17.5	2000	100
5.610	0.60	111.0	23.8		
6.159	0.62	121.8	30.4		
6.761	0.64	133.8	36.9		

LS Particle Size Analyzer

Santa Cruz Harbor Sediment Monitoring (Fall 2005)

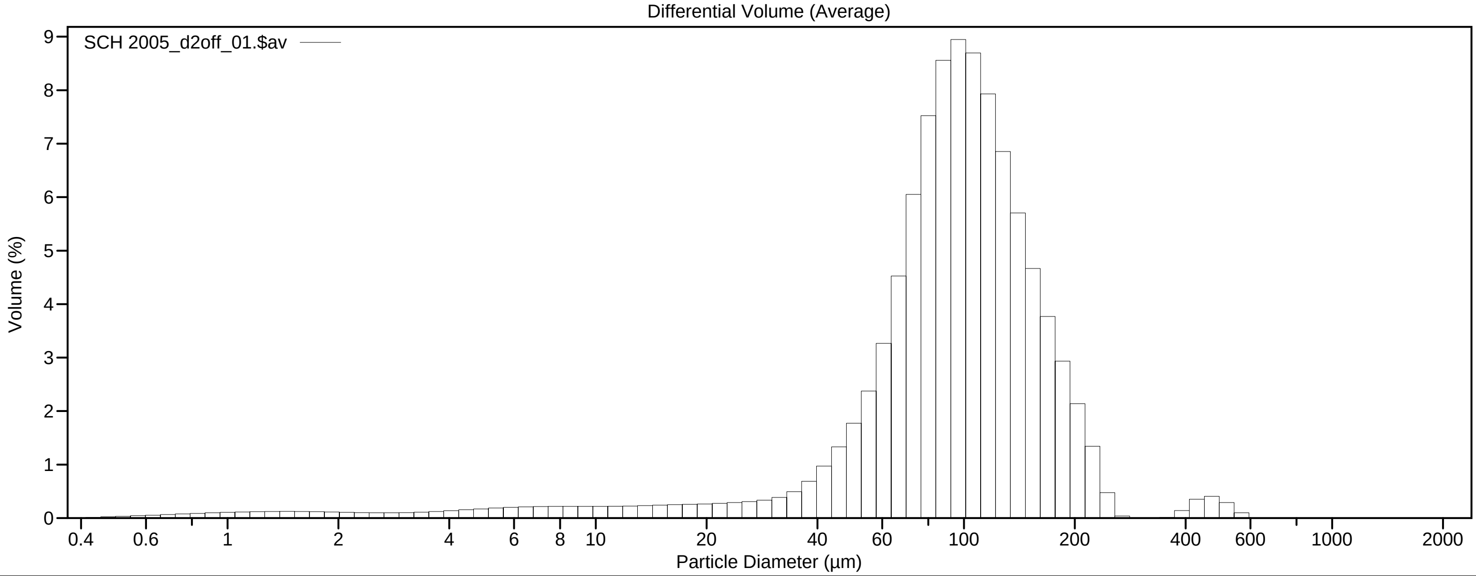
File name:	C:\LS13320\SCH-2005-6-grain-size\Offshore-samples\SCH 2005_d2off_01.$av SCH 2005_d2off_01.$av
Sample ID:	d2off
Comment 1:	Collected 10-27-05
Comment 2:	During dredging
Optical model:	Fraunhofer.rf780z

Volume Statistics (Arithmetic) SCH 2005_d2off_01.$av

Calculations from 0.375 µm to 2000 µm

Volume:	100%		
Mean:	105.0 µm	S.D.:	63.53 µm
Median:	96.93 µm	Variance:	4036 µm^2
Mean/Median ratio:	1.083	Skewness:	2.613 Right skewed
Mode:	96.49 µm	Kurtosis:	13.76 Leptokurtic

d_{10}: 44.37 µm d_{50}: 96.93 µm d_{90}: 169.6 µm



SCH 2005_d2off_01.$av

Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %
0.375	0	7.422	3.47	146.8	83.3
0.412	0.0070	8.148	3.69	161.2	88.0
0.452	0.020	8.944	3.91	176.9	91.8
0.496	0.044	9.819	4.13	194.2	94.7
0.545	0.077	10.78	4.34	213.2	96.8
0.598	0.12	11.83	4.56	234.1	98.2
0.657	0.17	12.99	4.79	256.9	98.7
0.721	0.24	14.26	5.02	282.1	98.7
0.791	0.32	15.65	5.27	309.6	98.7
0.869	0.40	17.18	5.52	339.9	98.7
0.954	0.50	18.86	5.77	373.1	98.7
1.047	0.61	20.71	6.04	409.6	98.8
1.149	0.72	22.73	6.31	449.7	99.2
1.261	0.85	24.95	6.60	493.6	99.6
1.385	0.97	27.39	6.91	541.9	99.9
1.520	1.09	30.07	7.24	594.9	99.99
1.669	1.22	33.01	7.63	653.0	100
1.832	1.33	36.24	8.12	716.9	100
2.011	1.45	39.78	8.81	787.0	100
2.208	1.56	43.67	9.78	863.9	100
2.423	1.66	47.94	11.1	948.3	100
2.660	1.76	52.63	12.9	1041	100
2.920	1.86	57.77	15.3	1143	100
3.206	1.96	63.42	18.5	1255	100
3.519	2.07	69.62	23.1	1377	100
3.863	2.19	76.43	29.1	1512	100
4.241	2.33	83.90	36.6	1660	100
4.656	2.48	92.10	45.2	1822	100
5.111	2.65	101.1	54.1	2000	100
5.610	2.84	111.0	62.8		
6.159	3.04	121.8	70.8		
6.761	3.25	133.8	77.6		

BECKMAN COULTER™

LS Particle Size Analyzer

Santa Cruz Harbor Sediment Monitoring (Fall 2005)

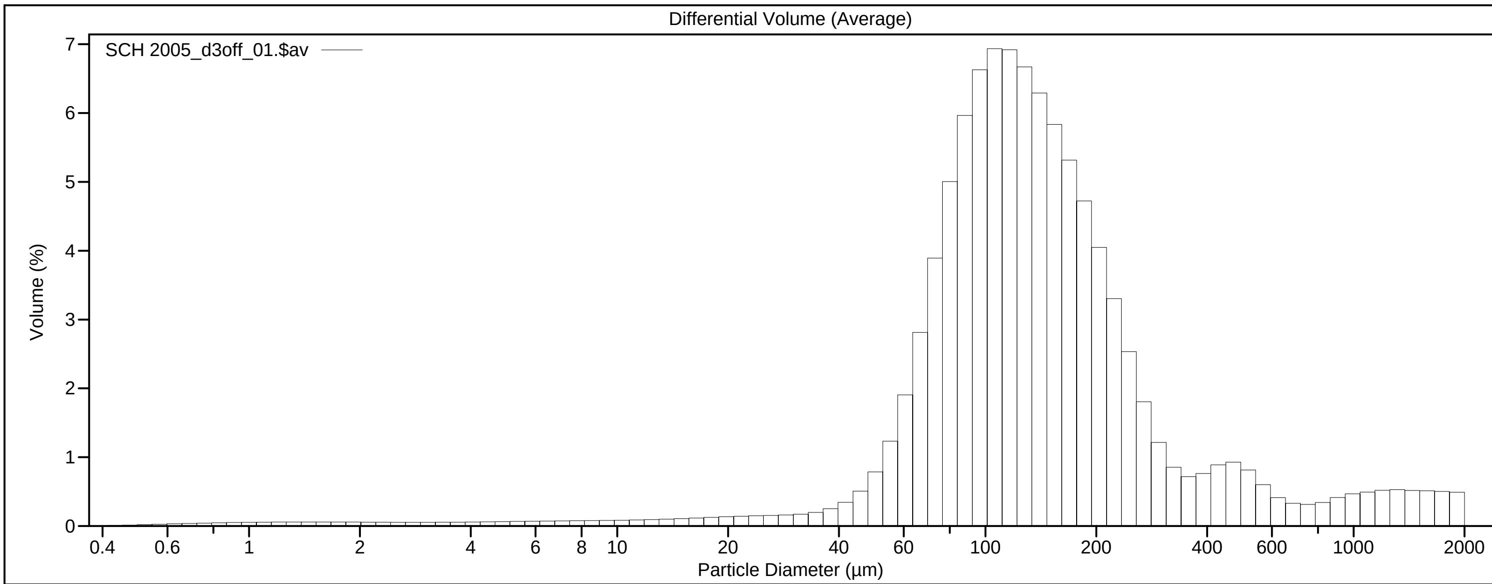
File name:	C:\LS13320\SCH-2005-6-grain-size\Offshore-samples\SCH 2005_d3off_01.$av
	SCH 2005_d3off_01.$av
Sample ID:	d3off
Comment 1:	Collected 10-27-05
Comment 2:	During dredging
Optical model:	Fraunhofer.rf780z

Volume Statistics (Arithmetic) SCH 2005_d3off_01.$av

Calculations from 0.375 µm to 2000 µm

Volume:	100%		
Mean:	207.9 µm	S.D.:	282.0 µm
Median:	127.5 µm	Variance:	79546 µm^2
Mean/Median ratio:	1.631	Skewness:	3.841 Right skewed
Mode:	105.9 µm	Kurtosis:	15.83 Leptokurtic

d_{10}: 66.30 µm d_{50}: 127.5 µm d_{90}: 365.5 µm



SCH 2005_d3off_01.$av

Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %
0.375	0	7.422	1.60	146.8	59.8
0.412	0.0052	8.148	1.68	161.2	65.6
0.452	0.015	8.944	1.76	176.9	71.0
0.496	0.030	9.819	1.84	194.2	75.7
0.545	0.051	10.78	1.92	213.2	79.7
0.598	0.077	11.83	2.01	234.1	83.0
0.657	0.11	12.99	2.10	256.9	85.6
0.721	0.15	14.26	2.20	282.1	87.4
0.791	0.19	15.65	2.31	309.6	88.6
0.869	0.24	17.18	2.43	339.9	89.4
0.954	0.29	18.86	2.56	373.1	90.2
1.047	0.34	20.71	2.69	409.6	90.9
1.149	0.39	22.73	2.83	449.7	91.8
1.261	0.45	24.95	2.98	493.6	92.7
1.385	0.51	27.39	3.13	541.9	93.6
1.520	0.57	30.07	3.29	594.9	94.2
1.669	0.63	33.01	3.47	653.0	94.6
1.832	0.69	36.24	3.66	716.9	94.9
2.011	0.75	39.78	3.92	787.0	95.2
2.208	0.80	43.67	4.26	863.9	95.6
2.423	0.86	47.94	4.77	948.3	96.0
2.660	0.91	52.63	5.55	1041	96.4
2.920	0.97	57.77	6.79	1143	96.9
3.206	1.02	63.42	8.69	1255	97.5
3.519	1.08	69.62	11.5	1377	98.0
3.863	1.13	76.43	15.4	1512	98.5
4.241	1.19	83.90	20.4	1660	99.0
4.656	1.25	92.10	26.4	1822	99.5
5.111	1.32	101.1	33.0	2000	100
5.610	1.38	111.0	39.9		
6.159	1.45	121.8	46.9		
6.761	1.52	133.8	53.5		

BECKMAN COULTER

LS Particle Size Analyzer

Santa Cruz Harbor Sediment Monitoring (Fall 2005)

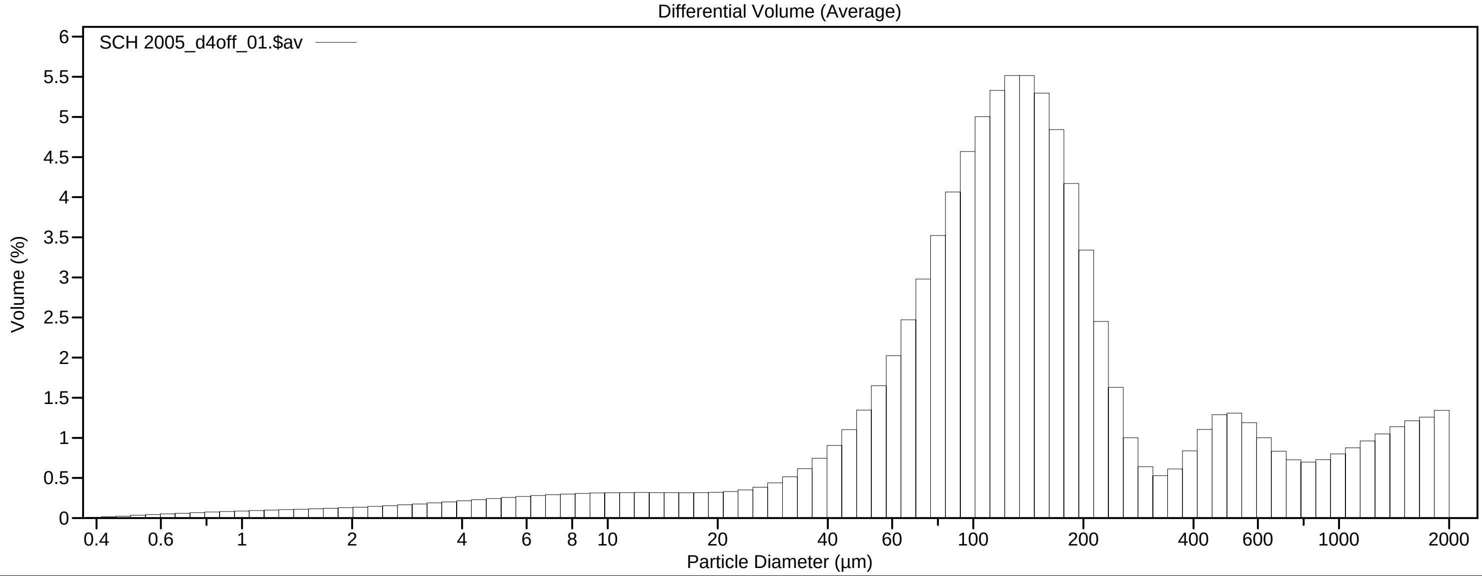
File name:	C:\LS13320\SCH-2005-6-grain-size\Offshore-samples\SCH 2005_d4off_01.$av SCH 2005_d4off_01.$av
Sample ID:	d4off
Comment 1:	Colleccted 10-27-05
Comment 2:	During dredging
Optical model:	Fraunhofer.rf780z

Volume Statistics (Arithmetic) SCH 2005_d4off_01.$av

Calculations from 0.375 µm to 2000 µm

Volume:	100%		
Mean:	278.3 µm	S.D.:	406.2 µm
Median:	130.3 µm	Variance:	165.0e3 µm^2
Mean/Median ratio:	2.137	Skewness:	2.525 Right skewed
Mode:	140.1 µm	Kurtosis:	5.707 Leptokurtic

d_{10}: 34.24 µm d_{50}: 130.3 µm d_{90}: 794.1 µm



SCH 2005_d4off_01.$av

Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %
0.375	0	7.422	4.28	146.8	57.1
0.412	0.0093	8.148	4.58	161.2	62.4
0.452	0.026	8.944	4.89	176.9	67.3
0.496	0.050	9.819	5.20	194.2	71.4
0.545	0.086	10.78	5.52	213.2	74.8
0.598	0.13	11.83	5.84	234.1	77.2
0.657	0.18	12.99	6.16	256.9	78.9
0.721	0.24	14.26	6.47	282.1	79.9
0.791	0.31	15.65	6.79	309.6	80.5
0.869	0.39	17.18	7.11	339.9	81.0
0.954	0.47	18.86	7.42	373.1	81.6
1.047	0.56	20.71	7.75	409.6	82.5
1.149	0.65	22.73	8.08	449.7	83.6
1.261	0.75	24.95	8.43	493.6	84.9
1.385	0.86	27.39	8.81	541.9	86.2
1.520	0.97	30.07	9.25	594.9	87.4
1.669	1.08	33.01	9.77	653.0	88.4
1.832	1.21	36.24	10.4	716.9	89.2
2.011	1.33	39.78	11.1	787.0	89.9
2.208	1.47	43.67	12.0	863.9	90.6
2.423	1.62	47.94	13.1	948.3	91.4
2.660	1.77	52.63	14.5	1041	92.2
2.920	1.93	57.77	16.1	1143	93.0
3.206	2.11	63.42	18.2	1255	94.0
3.519	2.30	69.62	20.6	1377	95.0
3.863	2.50	76.43	23.6	1512	96.2
4.241	2.72	83.90	27.1	1660	97.4
4.656	2.94	92.10	31.2	1822	98.7
5.111	3.19	101.1	35.8	2000	100
5.610	3.44	111.0	40.8		
6.159	3.71	121.8	46.1		
6.761	3.99	133.8	51.6		

LS Particle Size Analyzer

Santa Cruz Harbor Sediment Monitoring (Fall 2005)

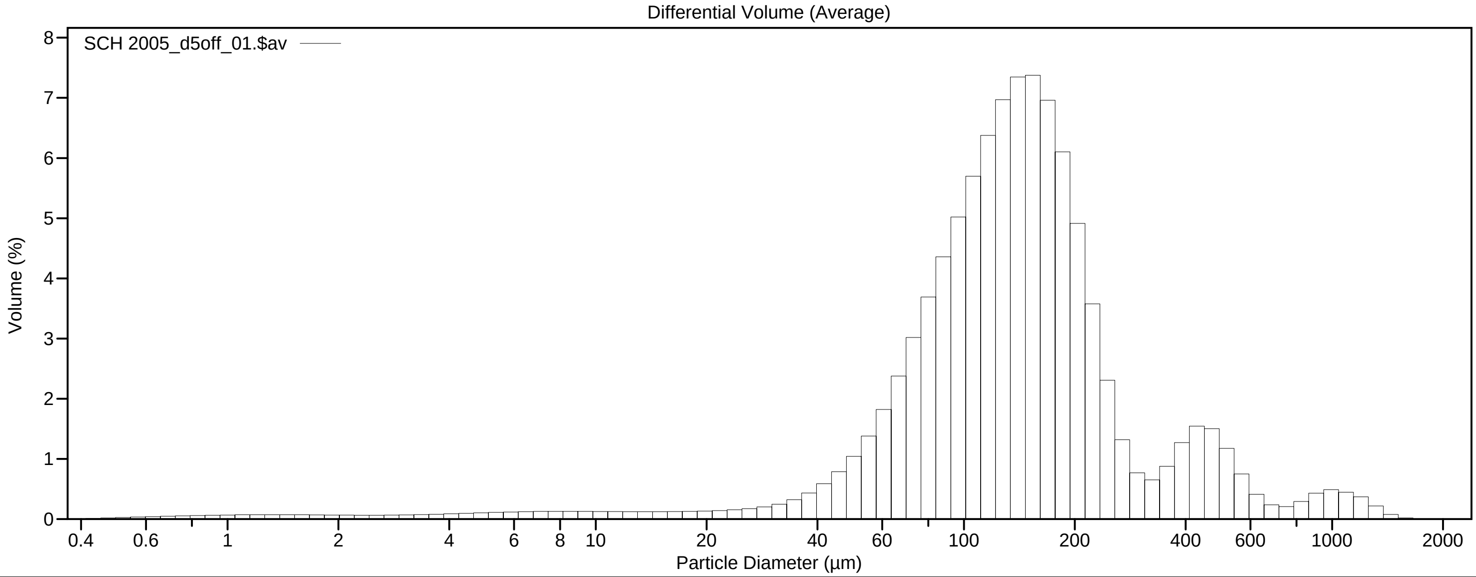
File name:	C:\LS13320\SCH-2005-6-grain-size\Offshore-samples\SCH 2005_d5off_01.$av SCH 2005_d5off_01.$av
Sample ID:	d5off
Comment 1:	Collected 10-27-05
Comment 2:	During dredging
Optical model:	Fraunhofer.rf780z

Volume Statistics (Arithmetic) SCH 2005_d5off_01.$av

Calculations from 0.375 µm to 2000 µm

Volume:	100%		
Mean:	180.5 µm	S.D.:	178.5 µm
Median:	136.7 µm	Variance:	31868 µm^2
Mean/Median ratio:	1.320	Skewness:	3.476 Right skewed
Mode:	153.8 µm	Kurtosis:	15.09 Leptokurtic

d_{10}: 60.78 µm d_{50}: 136.7 µm d_{90}: 352.1 µm



SCH 2005_d5off_01.$av

Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %
0.375	0	7.422	2.17	146.8	55.7
0.412	0.0057	8.148	2.30	161.2	63.1
0.452	0.017	8.944	2.43	176.9	70.0
0.496	0.035	9.819	2.55	194.2	76.1
0.545	0.061	10.78	2.68	213.2	81.1
0.598	0.095	11.83	2.81	234.1	84.6
0.657	0.13	12.99	2.93	256.9	86.9
0.721	0.18	14.26	3.05	282.1	88.3
0.791	0.24	15.65	3.17	309.6	89.0
0.869	0.29	17.18	3.30	339.9	89.7
0.954	0.36	18.86	3.43	373.1	90.6
1.047	0.43	20.71	3.56	409.6	91.8
1.149	0.50	22.73	3.70	449.7	93.4
1.261	0.57	24.95	3.86	493.6	94.9
1.385	0.64	27.39	4.03	541.9	96.1
1.520	0.71	30.07	4.23	594.9	96.8
1.669	0.79	33.01	4.48	653.0	97.2
1.832	0.86	36.24	4.80	716.9	97.5
2.011	0.92	39.78	5.24	787.0	97.7
2.208	0.99	43.67	5.82	863.9	97.9
2.423	1.05	47.94	6.61	948.3	98.4
2.660	1.12	52.63	7.65	1041	98.9
2.920	1.18	57.77	9.03	1143	99.3
3.206	1.25	63.42	10.9	1255	99.7
3.519	1.33	69.62	13.2	1377	99.9
3.863	1.41	76.43	16.2	1512	99.98
4.241	1.49	83.90	19.9	1660	99.998
4.656	1.59	92.10	24.3	1822	100
5.111	1.69	101.1	29.3	2000	100
5.610	1.80	111.0	35.0		
6.159	1.92	121.8	41.4		
6.761	2.04	133.8	48.4		

LS Particle Size Analyzer

Santa Cruz Harbor Sediment Monitoring (Fall 2005)

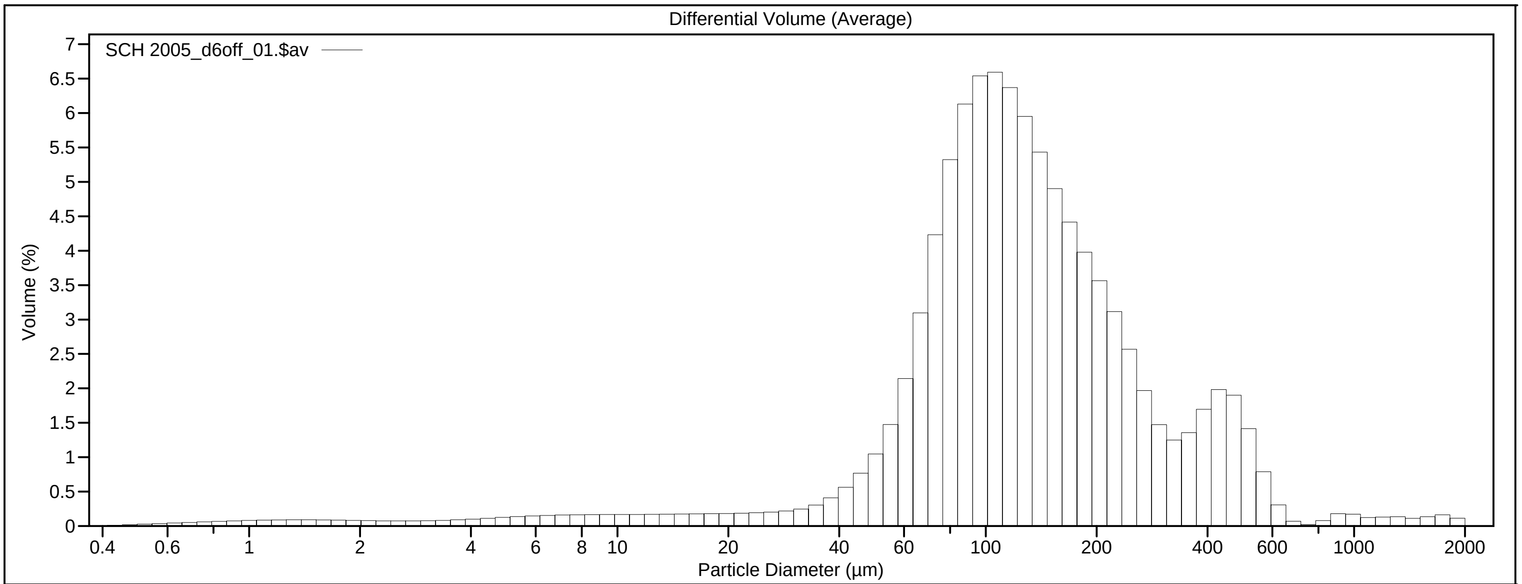
File name:	C:\LS13320\SCH-2005-6-grain-size\Offshore-samples\SCH 2005_d6off_01.$av
	SCH 2005_d6off_01.$av
Sample ID:	d6off
Comment 1:	Collected 10-27-05
Comment 2:	During dredging
Optical model:	Fraunhofer.rf780z

Volume Statistics (Arithmetic)   SCH 2005_d6off_01.$av

Calculations from 0.375 µm to 2000 µm

Volume:	100%		
Mean:	172.1 µm	S.D.:	180.8 µm
Median:	121.0 µm	Variance:	32693 µm^2
Mean/Median ratio:	1.422	Skewness:	4.515 Right skewed
Mode:	105.9 µm	Kurtosis:	30.20 Leptokurtic

d_{10}: 57.51 µm d_{50}: 121.0 µm d_{90}: 361.5 µm



SCH 2005_d6off_01.$av

Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %
0.375	0	7.422	2.57	146.8	61.9
0.412	0.0058	8.148	2.73	161.2	66.8
0.452	0.017	8.944	2.90	176.9	71.2
0.496	0.036	9.819	3.07	194.2	75.2
0.545	0.063	10.78	3.23	213.2	78.7
0.598	0.098	11.83	3.40	234.1	81.9
0.657	0.14	12.99	3.57	256.9	84.4
0.721	0.19	14.26	3.75	282.1	86.4
0.791	0.25	15.65	3.92	309.6	87.9
0.869	0.32	17.18	4.10	339.9	89.1
0.954	0.39	18.86	4.28	373.1	90.5
1.047	0.48	20.71	4.46	409.6	92.2
1.149	0.56	22.73	4.65	449.7	94.2
1.261	0.65	24.95	4.84	493.6	96.1
1.385	0.74	27.39	5.04	541.9	97.5
1.520	0.83	30.07	5.26	594.9	98.3
1.669	0.92	33.01	5.51	653.0	98.6
1.832	1.00	36.24	5.81	716.9	98.6
2.011	1.09	39.78	6.22	787.0	98.7
2.208	1.16	43.67	6.79	863.9	98.7
2.423	1.24	47.94	7.56	948.3	98.9
2.660	1.31	52.63	8.60	1041	99.1
2.920	1.39	57.77	10.1	1143	99.2
3.206	1.46	63.42	12.2	1255	99.3
3.519	1.55	69.62	15.3	1377	99.5
3.863	1.64	76.43	19.5	1512	99.6
4.241	1.74	83.90	24.9	1660	99.7
4.656	1.85	92.10	31.0	1822	99.9
5.111	1.97	101.1	37.5	2000	100
5.610	2.11	111.0	44.1		
6.159	2.26	121.8	50.5		
6.761	2.41	133.8	56.5		

LS Particle Size Analyzer

Santa Cruz Harbor Sediment Monitoring (Fall 2005)

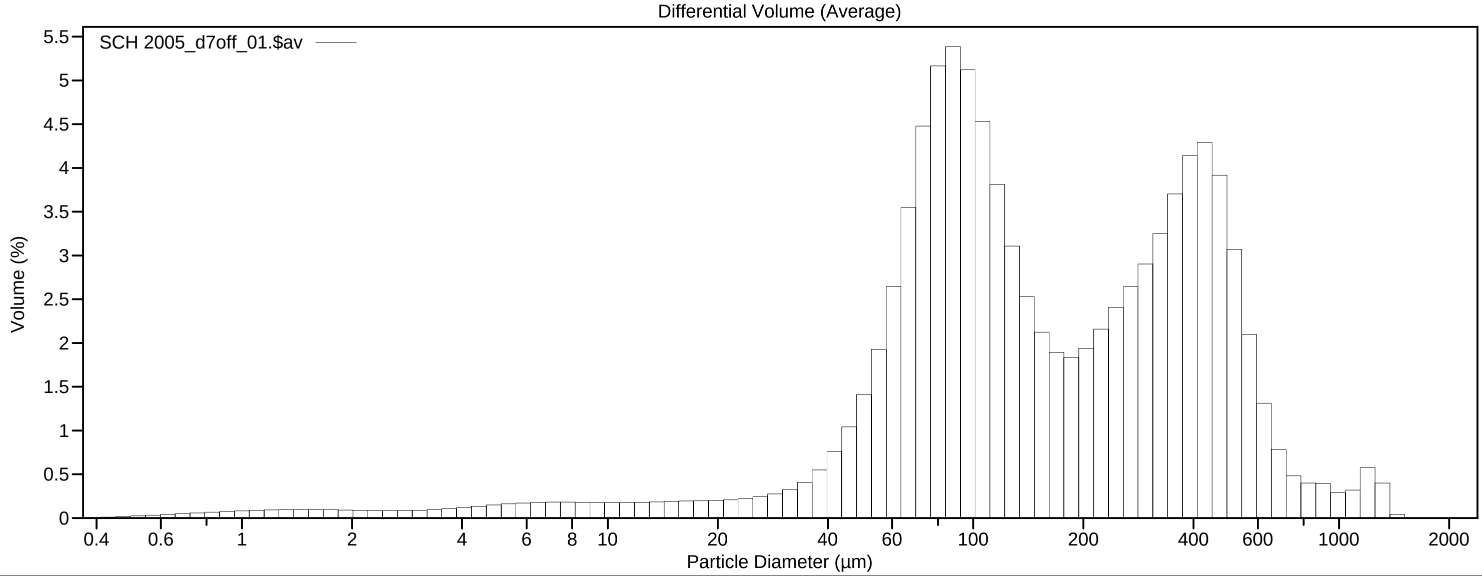
File name:	C:\LS13320\SCH-2005-6-grain-size\Offshore-samples\SCH 2005_d7off_01.$av SCH 2005_d7off_01.$av
Sample ID:	d7off
Comment 1:	Collected 10-27-05
Comment 2:	During dredging
Optical model:	Fraunhofer.rf780z

Volume Statistics (Arithmetic) SCH 2005_d7off_01.$av

Calculations from 0.375 µm to 2000 µm

Volume:	100%		
Mean:	229.4 µm	S.D.:	216.6 µm
Median:	133.4 µm	Variance:	46898 µm^2
Mean/Median ratio:	1.720	Skewness:	1.901 Right skewed
Mode:	87.90 µm	Kurtosis:	5.036 Leptokurtic

d_{10}: 51.43 µm d_{50}: 133.4 µm d_{90}: 496.3 µm



SCH 2005_d7off_01.$av

Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %
0.375	0	7.422	2.87	146.8	52.6
0.412	0.0053	8.148	3.05	161.2	54.7
0.452	0.016	8.944	3.23	176.9	56.6
0.496	0.033	9.819	3.41	194.2	58.5
0.545	0.058	10.78	3.59	213.2	60.4
0.598	0.092	11.83	3.76	234.1	62.6
0.657	0.13	12.99	3.94	256.9	65.0
0.721	0.18	14.26	4.13	282.1	67.6
0.791	0.24	15.65	4.32	309.6	70.5
0.869	0.31	17.18	4.51	339.9	73.8
0.954	0.39	18.86	4.71	373.1	77.5
1.047	0.47	20.71	4.91	409.6	81.6
1.149	0.56	22.73	5.12	449.7	85.9
1.261	0.65	24.95	5.34	493.6	89.8
1.385	0.75	27.39	5.59	541.9	92.9
1.520	0.85	30.07	5.86	594.9	95.0
1.669	0.94	33.01	6.19	653.0	96.3
1.832	1.04	36.24	6.59	716.9	97.1
2.011	1.13	39.78	7.14	787.0	97.6
2.208	1.22	43.67	7.90	863.9	98.0
2.423	1.30	47.94	8.95	948.3	98.4
2.660	1.39	52.63	10.4	1041	98.7
2.920	1.47	57.77	12.3	1143	99.0
3.206	1.56	63.42	14.9	1255	99.6
3.519	1.66	69.62	18.5	1377	99.96
3.863	1.77	76.43	23.0	1512	100
4.241	1.89	83.90	28.1	1660	100
4.656	2.03	92.10	33.5	1822	100
5.111	2.17	101.1	38.6	2000	100
5.610	2.34	111.0	43.2		
6.159	2.51	121.8	47.0		
6.761	2.69	133.8	50.1		

LS Particle Size Analyzer

Santa Cruz Harbor Sediment Monitoring (Fall 2005)

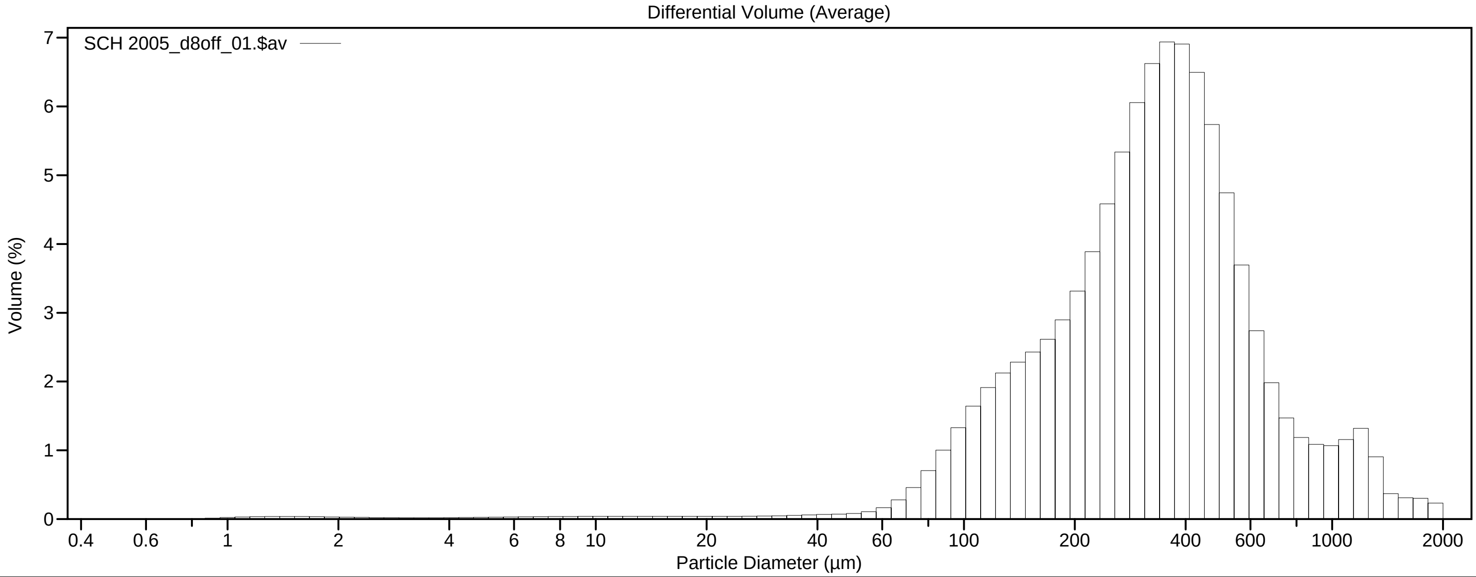
File name:	C:\LS13320\SCH-2005-6-grain-size\Offshore-samples\SCH 2005_d8off_01.$av SCH 2005_d8off_01.$av
Sample ID:	d8off
Comment 1:	Collected 10-27-05
Comment 2:	During dredging
Optical model:	Fraunhofer.rf780z

Volume Statistics (Arithmetic) SCH 2005_d8off_01.$av

Calculations from 0.375 µm to 2000 µm

Volume:	100%		
Mean:	391.8 µm	S.D.:	279.9 µm
Median:	333.7 µm	Variance:	78342 µm²
Mean/Median ratio:	1.174	Skewness:	2.027 Right skewed
Mode:	356.1 µm	Kurtosis:	5.543 Leptokurtic

d_{10}: 126.3 µm d_{50}: 333.7 µm d_{90}: 697.7 µm



SCH 2005_d8off_01.$av

Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %
0.375	0	7.422	0.63	146.8	13.6
0.412	0	8.148	0.66	161.2	16.0
0.452	0	8.944	0.70	176.9	18.7
0.496	0	9.819	0.74	194.2	21.6
0.545	0	10.78	0.78	213.2	24.9
0.598	0	11.83	0.82	234.1	28.8
0.657	0	12.99	0.86	256.9	33.3
0.721	0	14.26	0.90	282.1	38.7
0.791	0.00036	15.65	0.94	309.6	44.7
0.869	0.0052	17.18	0.98	339.9	51.4
0.954	0.020	18.86	1.02	373.1	58.3
1.047	0.043	20.71	1.06	409.6	65.2
1.149	0.073	22.73	1.10	449.7	71.7
1.261	0.11	24.95	1.14	493.6	77.4
1.385	0.14	27.39	1.18	541.9	82.2
1.520	0.18	30.07	1.22	594.9	85.9
1.669	0.22	33.01	1.27	653.0	88.6
1.832	0.25	36.24	1.32	716.9	90.6
2.011	0.28	39.78	1.38	787.0	92.1
2.208	0.31	43.67	1.45	863.9	93.3
2.423	0.34	47.94	1.52	948.3	94.3
2.660	0.36	52.63	1.60	1041	95.4
2.920	0.38	57.77	1.71	1143	96.6
3.206	0.40	63.42	1.88	1255	97.9
3.519	0.41	69.62	2.16	1377	98.8
3.863	0.43	76.43	2.61	1512	99.2
4.241	0.45	83.90	3.32	1660	99.5
4.656	0.48	92.10	4.32	1822	99.8
5.111	0.50	101.1	5.65	2000	100
5.610	0.53	111.0	7.29		
6.159	0.56	121.8	9.21		
6.761	0.59	133.8	11.3		

LS Particle Size Analyzer

Santa Cruz Harbor Sediment Monitoring (Fall 2005)

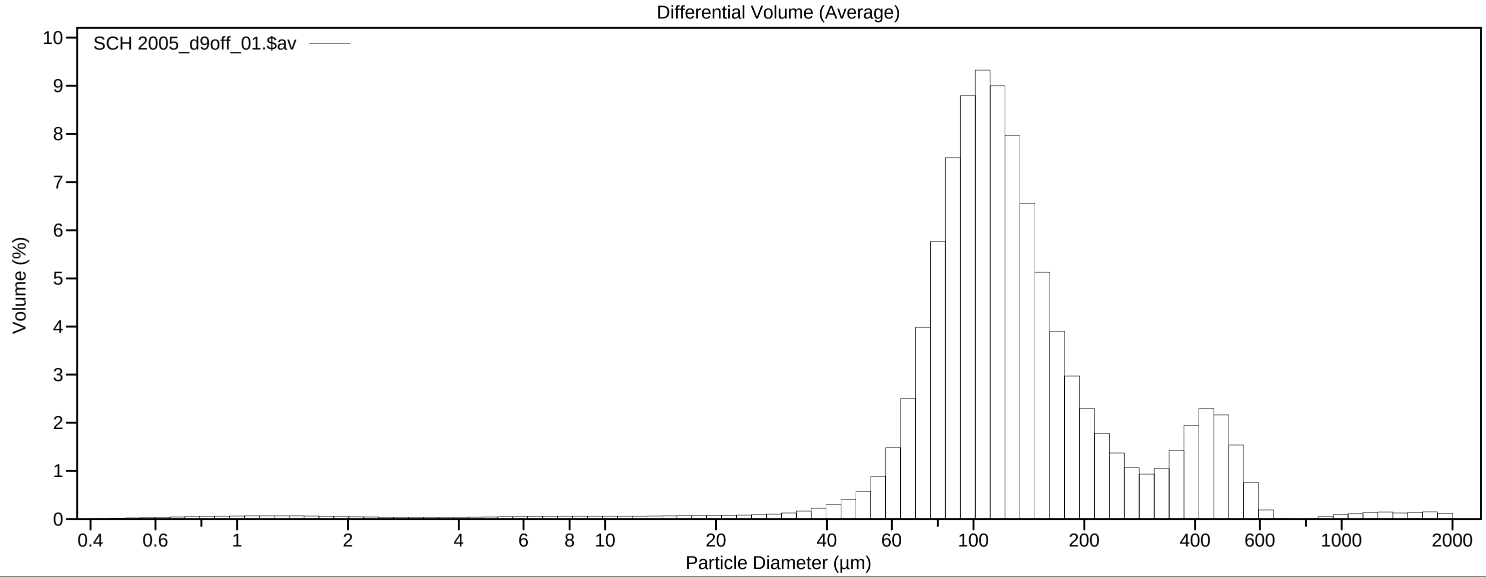
File name:	C:\LS13320\SCH-2005-6-grain-size\Offshore-samples\SCH 2005_d9off_01.$av SCH 2005_d9off_01.$av
Sample ID:	d9off
Comment 1:	Collected 10-27-05
Comment 2:	During dredging
Optical model:	Fraunhofer.rf780z

Volume Statistics (Arithmetic) SCH 2005_d9off_01.$av

Calculations from 0.375 µm to 2000 µm

Volume:	100%		
Mean:	168.8 µm	S.D.:	175.1 µm
Median:	117.6 µm	Variance:	30675 µm^2
Mean/Median ratio:	1.436	Skewness:	4.905 Right skewed
Mode:	105.9 µm	Kurtosis:	34.69 Leptokurtic

d_{10}: 71.02 µm d_{50}: 117.6 µm d_{90}: 372.8 µm



SCH 2005_d9off_01.$av

Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %
0.375	0	7.422	1.44	146.8	68.1
0.412	0.0053	8.148	1.50	161.2	73.2
0.452	0.015	8.944	1.56	176.9	77.1
0.496	0.033	9.819	1.62	194.2	80.1
0.545	0.057	10.78	1.68	213.2	82.4
0.598	0.088	11.83	1.74	234.1	84.2
0.657	0.13	12.99	1.80	256.9	85.5
0.721	0.17	14.26	1.86	282.1	86.6
0.791	0.22	15.65	1.93	309.6	87.5
0.869	0.28	17.18	2.00	339.9	88.6
0.954	0.34	18.86	2.07	373.1	90.0
1.047	0.40	20.71	2.14	409.6	92.0
1.149	0.47	22.73	2.22	449.7	94.3
1.261	0.54	24.95	2.31	493.6	96.4
1.385	0.60	27.39	2.40	541.9	98.0
1.520	0.67	30.07	2.50	594.9	98.7
1.669	0.73	33.01	2.63	653.0	98.9
1.832	0.79	36.24	2.79	716.9	98.9
2.011	0.84	39.78	3.02	787.0	98.9
2.208	0.89	43.67	3.33	863.9	98.9
2.423	0.93	47.94	3.73	948.3	99.0
2.660	0.97	52.63	4.31	1041	99.1
2.920	1.00	57.77	5.19	1143	99.2
3.206	1.04	63.42	6.67	1255	99.3
3.519	1.07	69.62	9.18	1377	99.5
3.863	1.10	76.43	13.2	1512	99.6
4.241	1.14	83.90	18.9	1660	99.7
4.656	1.18	92.10	26.4	1822	99.9
5.111	1.22	101.1	35.2	2000	100
5.610	1.27	111.0	44.6		
6.159	1.33	121.8	53.6		
6.761	1.38	133.8	61.5		

LS Particle Size Analyzer

Santa Cruz Harbor Sediment Monitoring (Fall 2005)

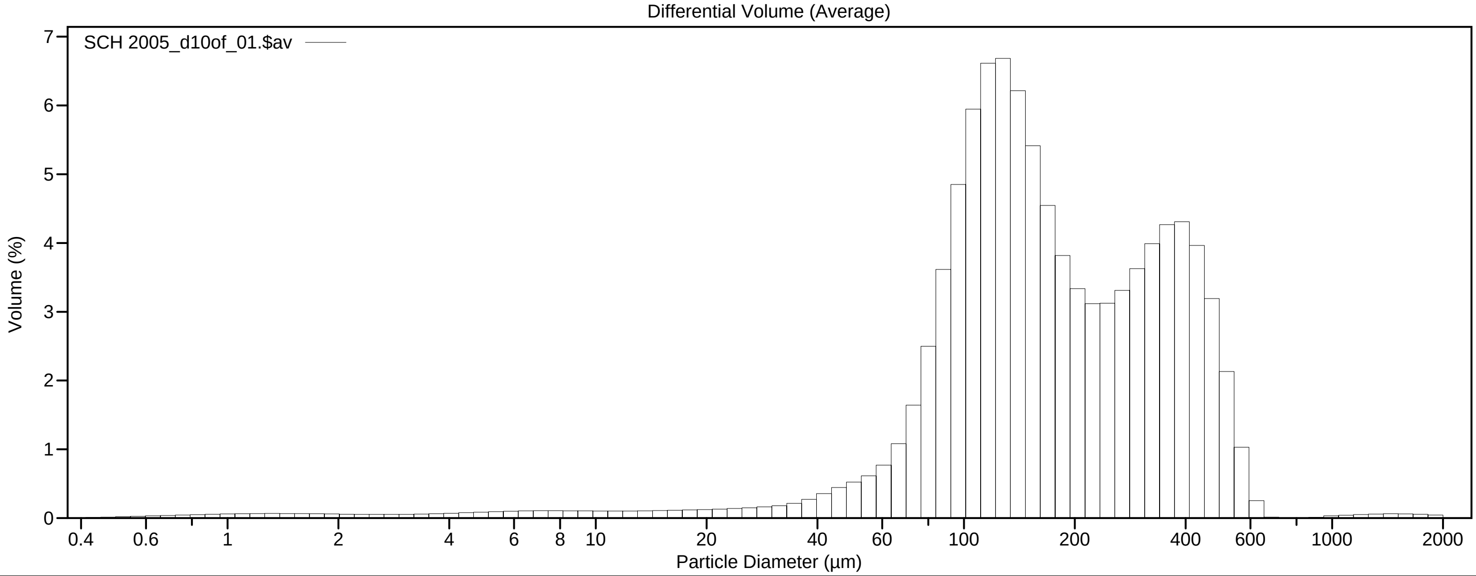
File name:	C:\LS13320\SCH-2005-6-grain-size\Offshore-samples\SCH 2005_d10of_01.$av
	SCH 2005_d10of_01.$av
Sample ID:	d10off
Comment 1:	Collected 10-27-05
Comment 2:	During dredging
Optical model:	Fraunhofer.rf780z

Volume Statistics (Arithmetic) SCH 2005_d10of_01.$av

Calculations from 0.375 µm to 2000 µm

Volume:	100%		
Mean:	210.7 µm	S.D.:	155.9 µm
Median:	157.1 µm	Variance:	24320 µm^2
Mean/Median ratio:	1.341	Skewness:	2.766 Right skewed
Mode:	127.7 µm	Kurtosis:	18.94 Leptokurtic

d_{10}: 77.31 µm d_{50}: 157.1 µm d_{90}: 419.8 µm



SCH 2005_d10of_01.$av

Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %
0.375	0	7.422	1.83	146.8	46.1
0.412	0.0043	8.148	1.94	161.2	51.5
0.452	0.013	8.944	2.04	176.9	56.1
0.496	0.027	9.819	2.15	194.2	59.9
0.545	0.047	10.78	2.25	213.2	63.2
0.598	0.073	11.83	2.35	234.1	66.4
0.657	0.11	12.99	2.45	256.9	69.5
0.721	0.14	14.26	2.56	282.1	72.8
0.791	0.19	15.65	2.67	309.6	76.4
0.869	0.24	17.18	2.78	339.9	80.4
0.954	0.29	18.86	2.90	373.1	84.7
1.047	0.35	20.71	3.02	409.6	89.0
1.149	0.42	22.73	3.15	449.7	93.0
1.261	0.48	24.95	3.29	493.6	96.2
1.385	0.55	27.39	3.44	541.9	98.3
1.520	0.61	30.07	3.61	594.9	99.3
1.669	0.68	33.01	3.79	653.0	99.6
1.832	0.74	36.24	4.00	716.9	99.6
2.011	0.80	39.78	4.27	787.0	99.6
2.208	0.86	43.67	4.63	863.9	99.6
2.423	0.91	47.94	5.07	948.3	99.6
2.660	0.96	52.63	5.60	1041	99.6
2.920	1.02	57.77	6.21	1143	99.7
3.206	1.07	63.42	6.98	1255	99.7
3.519	1.13	69.62	8.06	1377	99.8
3.863	1.19	76.43	9.70	1512	99.8
4.241	1.26	83.90	12.2	1660	99.9
4.656	1.34	92.10	15.8	1822	99.96
5.111	1.43	101.1	20.7	2000	100
5.610	1.52	111.0	26.6		
6.159	1.62	121.8	33.2		
6.761	1.73	133.8	39.9		

LS Particle Size Analyzer

Santa Cruz Harbor Sediment Monitoring (Fall 2005)

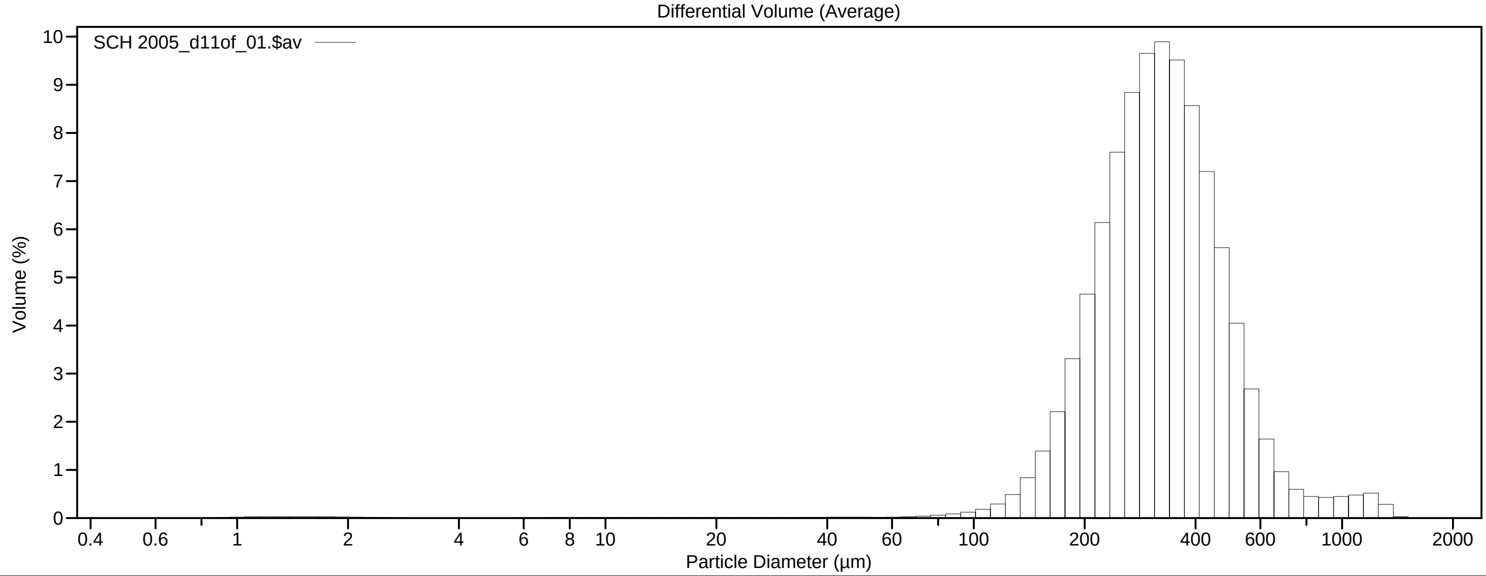
File name:	C:\LS13320\SCH-2005-6-grain-size\Offshore-samples\SCH 2005_d11of_01.$av
	SCH 2005_d11of_01.$av
Sample ID:	d11off
Comment 1:	Collected 10-27-05
Comment 2:	During dredging
Optical model:	Fraunhofer.rf780z

Volume Statistics (Arithmetic) SCH 2005_d11of_01.$av

Calculations from 0.375 µm to 2000 µm

Volume:	100%		
Mean:	350.9 µm	S.D.:	168.7 µm
Median:	320.0 µm	Variance:	28459 µm^2
Mean/Median ratio:	1.097	Skewness:	2.242 Right skewed
Mode:	324.4 µm	Kurtosis:	8.274 Leptokurtic

d_{10}: 195.3 µm d_{50}: 320.0 µm d_{90}: 524.4 µm



SCH 2005_d11of_01.$av

Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %
0.375	0	7.422	0.36	146.8	2.83
0.412	0	8.148	0.37	161.2	4.22
0.452	0	8.944	0.38	176.9	6.43
0.496	0	9.819	0.40	194.2	9.74
0.545	0	10.78	0.41	213.2	14.4
0.598	0	11.83	0.42	234.1	20.5
0.657	0	12.99	0.44	256.9	28.1
0.721	0	14.26	0.45	282.1	37.0
0.791	0.00031	15.65	0.46	309.6	46.6
0.869	0.0044	17.18	0.47	339.9	56.5
0.954	0.017	18.86	0.49	373.1	66.0
1.047	0.037	20.71	0.50	409.6	74.6
1.149	0.062	22.73	0.51	449.7	81.8
1.261	0.091	24.95	0.52	493.6	87.4
1.385	0.12	27.39	0.54	541.9	91.5
1.520	0.15	30.07	0.55	594.9	94.2
1.669	0.18	33.01	0.57	653.0	95.8
1.832	0.21	36.24	0.58	716.9	96.8
2.011	0.23	39.78	0.60	787.0	97.4
2.208	0.25	43.67	0.62	863.9	97.8
2.423	0.27	47.94	0.64	948.3	98.2
2.660	0.28	52.63	0.66	1041	98.7
2.920	0.29	57.77	0.67	1143	99.2
3.206	0.29	63.42	0.69	1255	99.7
3.519	0.30	69.62	0.72	1377	99.97
3.863	0.30	76.43	0.76	1512	100
4.241	0.31	83.90	0.82	1660	100
4.656	0.31	92.10	0.90	1822	100
5.111	0.32	101.1	1.03	2000	100
5.610	0.33	111.0	1.21		
6.159	0.34	121.8	1.50		
6.761	0.35	133.8	1.99		

LS Particle Size Analyzer

Santa Cruz Harbor Sediment Monitoring (Fall 2005)

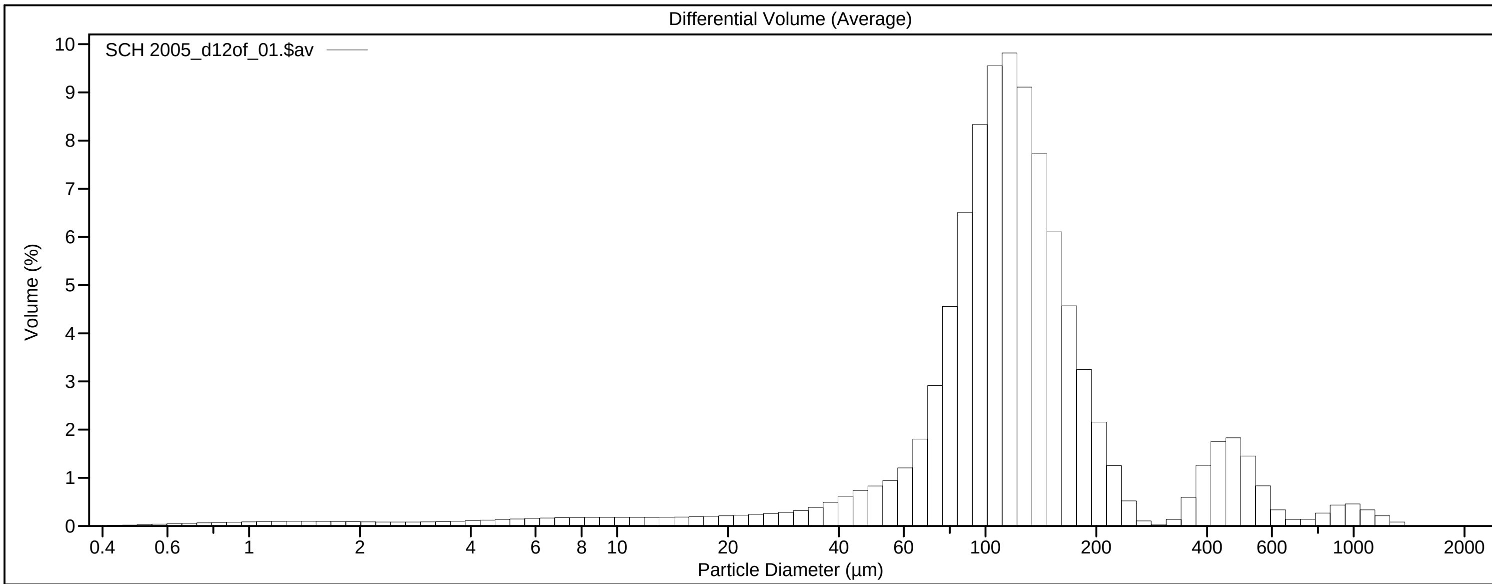
File name: C:\LS13320\SCH-2005-6-grain-size\Offshore-samples\SCH 2005_d12of_01.$av
SCH 2005_d12of_01.$av
Sample ID: d12off
Operator: swatt
Comment 1: Collected 10-27-05
Comment 2: During dredging
Optical model: Fraunhofer.rf780z
LS 13 320 SW Aqueous Liquid Module
Run length: 60 seconds
Pump speed: 86
Fluid: ,0
Average of 3 files:
SCH 2005_d12of_01.$ls
SCH 2005_d12of_02.$ls
SCH 2005_d12of_03.$ls

Volume Statistics (Arithmetic) SCH 2005_d12of_01.$av

Calculations from 0.375 µm to 2000 µm

Volume:	100%		
Mean:	158.1 µm	S.D.:	161.7 µm
Median:	116.4 µm	Variance:	26149 µm^2
Mean/Median ratio:	1.358	Skewness:	3.471 Right skewed
Mode:	116.3 µm	Kurtosis:	14.73 Leptokurtic

d_{10}: 56.60 µm d_{50}: 116.4 µm d_{90}: 347.7 µm



SCH 2005_d12of_01.$av

Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %
0.375	0	2.660	1.45	18.86	4.66	133.8	64.0	948.3	98.9
0.412	0.0065	2.920	1.53	20.71	4.87	146.8	71.7	1041	99.4
0.452	0.019	3.206	1.61	22.73	5.10	161.2	77.8	1143	99.7
0.496	0.040	3.519	1.71	24.95	5.34	176.9	82.4	1255	99.9
0.545	0.071	3.863	1.80	27.39	5.61	194.2	85.7	1377	99.99
0.598	0.11	4.241	1.91	30.07	5.89	213.2	87.8	1512	100
0.657	0.16	4.656	2.04	33.01	6.21	234.1	89.1	1660	100
0.721	0.21	5.111	2.17	36.24	6.59	256.9	89.6	1822	100
0.791	0.28	5.610	2.32	39.78	7.08	282.1	89.7	2000	100
0.869	0.35	6.159	2.48	43.67	7.70	309.6	89.7		
0.954	0.44	6.761	2.64	47.94	8.44	339.9	89.9		
1.047	0.52	7.422	2.82	52.63	9.27	373.1	90.5		
1.149	0.62	8.148	2.99	57.77	10.2	409.6	91.7		
1.261	0.71	8.944	3.17	63.42	11.4	449.7	93.5		
1.385	0.81	9.819	3.35	69.62	13.2	493.6	95.3		
1.520	0.91	10.78	3.53	76.43	16.1	541.9	96.8		
1.669	1.01	11.83	3.71	83.90	20.7	594.9	97.6		
1.832	1.10	12.99	3.89	92.10	27.2	653.0	97.9		
2.011	1.19	14.26	4.08	101.1	35.5	716.9	98.1		
2.208	1.28	15.65	4.26	111.0	45.1	787.0	98.2		
2.423	1.36	17.18	4.46	121.8	54.9	863.9	98.5		

LS Particle Size Analyzer

BECKMAN COULTER™

Santa Cruz Harbor Sediment Monitoring (Fall 2005)

File name:	C:\LS13320\SCH-2005-6-grain-size\Offshore-samples\SCH 2005_d13of_01.$av
	SCH 2005_d13of_01.$av
Sample ID:	d13off
Comment 1:	Collected 10-27-05
Comment 2:	During dredging
Optical model:	Fraunhofer.rf780z

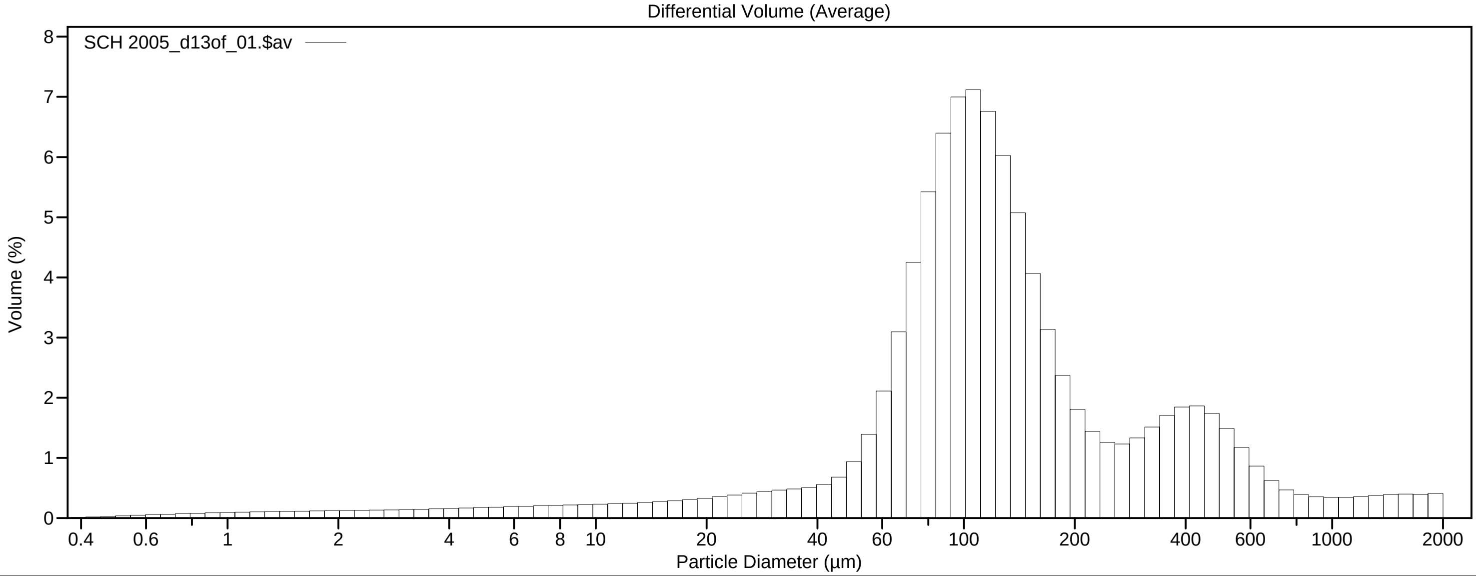
Volume Statistics (Arithmetic) SCH 2005_d13of_01.$av

Calculations from 0.375 µm to 2000 µm

Volume:	100%		
Mean:	201.1 µm	S.D.:	269.2 µm
Median:	113.5 µm	Variance:	72468 µm²
Mean/Median ratio:	1.772	Skewness:	3.610 Right skewed
Mode:	105.9 µm	Kurtosis:	15.45 Leptokurtic

d_{10}: 43.32 µm d_{50}: 113.5 µm d_{90}: 452.5 µm

Differential Volume (Average)



SCH 2005_d13of_01.$av

Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %
0.375	0	7.422	3.61	146.8	66.3
0.412	0.0099	8.148	3.82	161.2	70.4
0.452	0.027	8.944	4.04	176.9	73.5
0.496	0.054	9.819	4.26	194.2	75.9
0.545	0.091	10.78	4.49	213.2	77.7
0.598	0.14	11.83	4.73	234.1	79.1
0.657	0.19	12.99	4.98	256.9	80.4
0.721	0.26	14.26	5.24	282.1	81.6
0.791	0.33	15.65	5.51	309.6	83.0
0.869	0.41	17.18	5.80	339.9	84.5
0.954	0.50	18.86	6.11	373.1	86.2
1.047	0.59	20.71	6.44	409.6	88.0
1.149	0.69	22.73	6.79	449.7	89.9
1.261	0.80	24.95	7.18	493.6	91.6
1.385	0.91	27.39	7.59	541.9	93.1
1.520	1.02	30.07	8.03	594.9	94.3
1.669	1.13	33.01	8.50	653.0	95.2
1.832	1.25	36.24	8.98	716.9	95.8
2.011	1.37	39.78	9.49	787.0	96.2
2.208	1.50	43.67	10.1	863.9	96.6
2.423	1.63	47.94	10.7	948.3	97.0
2.660	1.76	52.63	11.7	1041	97.3
2.920	1.90	57.77	13.1	1143	97.7
3.206	2.04	63.42	15.2	1255	98.0
3.519	2.18	69.62	18.3	1377	98.4
3.863	2.34	76.43	22.5	1512	98.8
4.241	2.50	83.90	27.9	1660	99.2
4.656	2.67	92.10	34.3	1822	99.6
5.111	2.84	101.1	41.3	2000	100
5.610	3.02	111.0	48.5		
6.159	3.21	121.8	55.2		
6.761	3.41	133.8	61.2		

LS Particle Size Analyzer

Santa Cruz Harbor Sediment Monitoring (Fall 2005)

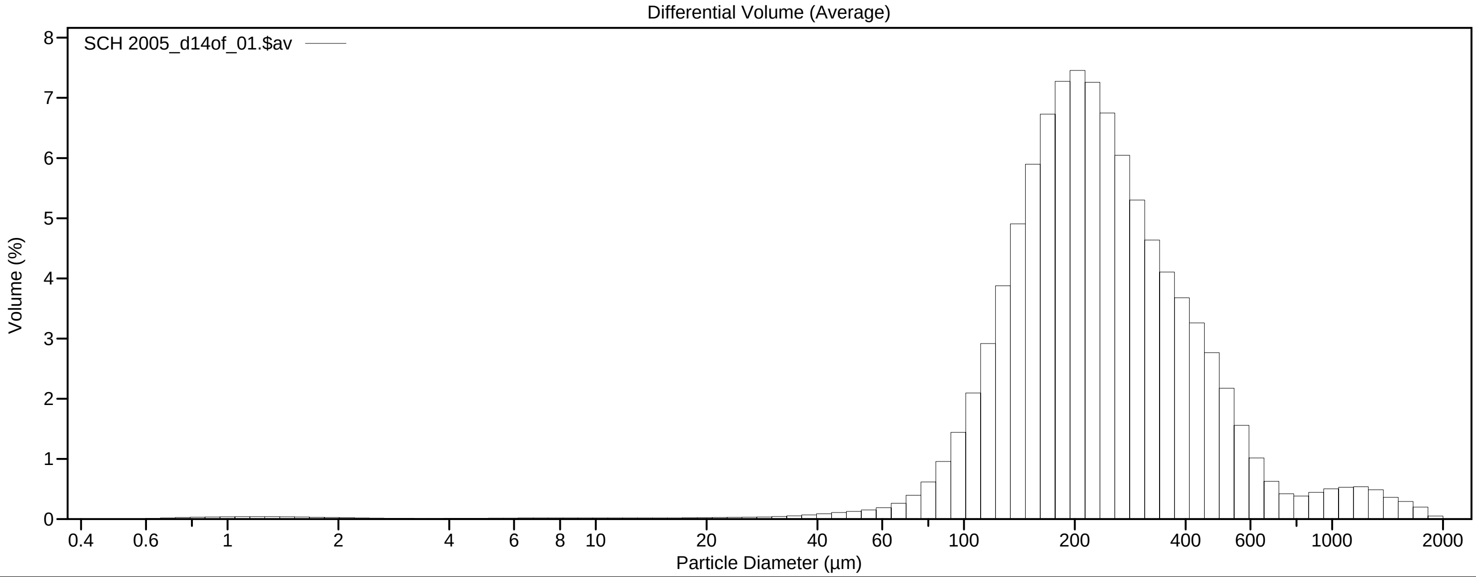
File name:	C:\LS13320\SCH-2005-6-grain-size\Offshore-samples\SCH 2005_d14of_01.$av SCH 2005_d14of_01.$av
Sample ID:	d14off
Comment 1:	Collected 10-27-05
Comment 2:	During dredging
Optical model:	Fraunhofer.rf780z

Volume Statistics (Arithmetic) SCH 2005_d14of_01.$av

Calculations from 0.375 µm to 2000 µm

Volume:	100%		
Mean:	284.9 µm	S.D.:	226.4 µm
Median:	222.9 µm	Variance:	51238 μm^2
Mean/Median ratio:	1.278	Skewness:	3.154 Right skewed
Mode:	203.5 µm	Kurtosis:	12.97 Leptokurtic

d_{10}: 120.1 µm d_{50}: 222.9 µm d_{90}: 487.0 µm



SCH 2005_d14of_01.$av

Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %
0.375	0	7.422	0.63	146.8	19.3
0.412	0	8.148	0.65	161.2	25.2
0.452	0	8.944	0.66	176.9	31.9
0.496	0	9.819	0.68	194.2	39.2
0.545	0.00028	10.78	0.70	213.2	46.6
0.598	0.0040	11.83	0.72	234.1	53.9
0.657	0.016	12.99	0.74	256.9	60.6
0.721	0.035	14.26	0.75	282.1	66.7
0.791	0.060	15.65	0.77	309.6	72.0
0.869	0.091	17.18	0.79	339.9	76.6
0.954	0.13	18.86	0.81	373.1	80.7
1.047	0.16	20.71	0.84	409.6	84.4
1.149	0.20	22.73	0.86	449.7	87.7
1.261	0.24	24.95	0.89	493.6	90.4
1.385	0.28	27.39	0.92	541.9	92.6
1.520	0.32	30.07	0.96	594.9	94.2
1.669	0.35	33.01	1.00	653.0	95.2
1.832	0.38	36.24	1.05	716.9	95.8
2.011	0.41	39.78	1.12	787.0	96.2
2.208	0.43	43.67	1.21	863.9	96.6
2.423	0.45	47.94	1.32	948.3	97.0
2.660	0.47	52.63	1.45	1041	97.5
2.920	0.48	57.77	1.60	1143	98.1
3.206	0.50	63.42	1.79	1255	98.6
3.519	0.51	69.62	2.05	1377	99.1
3.863	0.52	76.43	2.45	1512	99.5
4.241	0.53	83.90	3.06	1660	99.8
4.656	0.54	92.10	4.02	1822	99.9
5.111	0.56	101.1	5.46	2000	100
5.610	0.57	111.0	7.56		
6.159	0.59	121.8	10.5		
6.761	0.61	133.8	14.4		

LS Particle Size Analyzer

Santa Cruz Harbor Sediment Monitoring (Fall 2005)

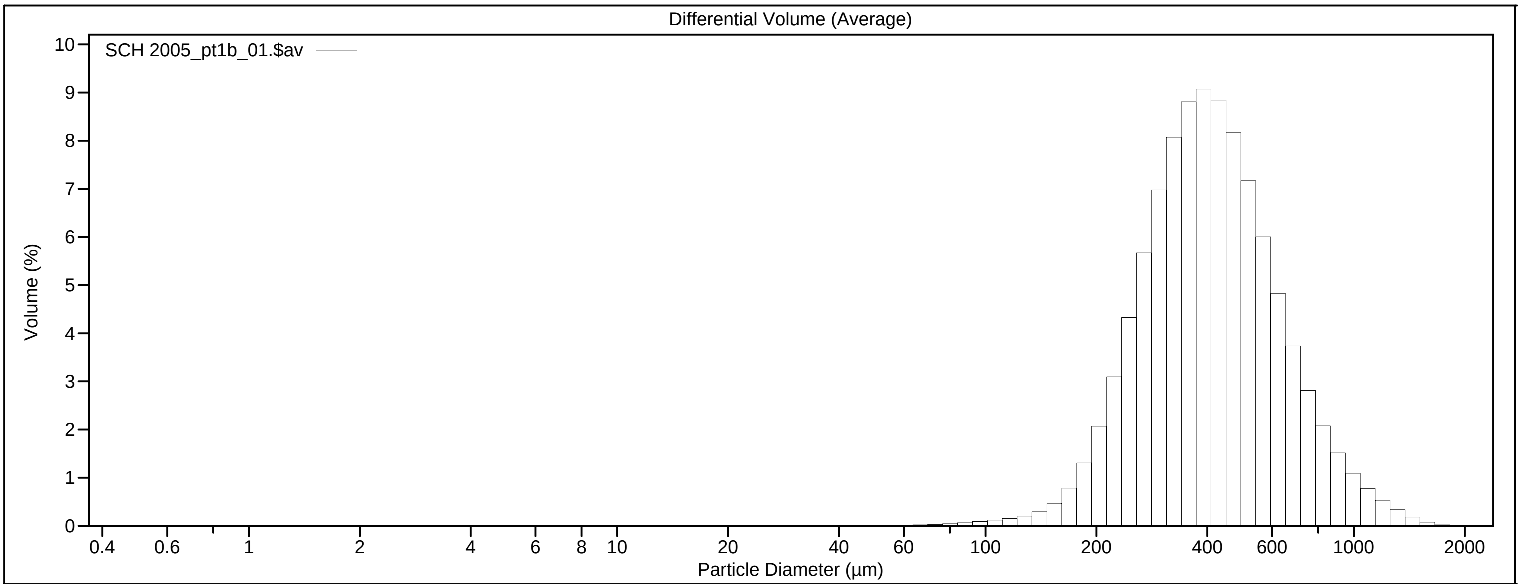
File name:	C:\LS13320\SCH-2005-6-grain-size\Beach-samples\SCH 2005_pt1b_01.$av
	SCH 2005_pt1b_01.$av
Sample ID:	pt1b
Comment 1:	Collected 11-08-05
Comment 2:	Post-dredging
Optical model:	Fraunhofer.rf780z

Volume Statistics (Arithmetic) SCH 2005_pt1b_01.$av

Calculations from 0.375 µm to 2000 µm

Volume:	100%		
Mean:	445.9 µm	S.D.:	205.6 µm
Median:	402.3 µm	Variance:	42258 $µm^2$
Mean/Median ratio:	1.109	Skewness:	1.532 Right skewed
Mode:	391.0 µm	Kurtosis:	3.618 Leptokurtic

d_{10}: 239.9 µm d_{50}: 402.3 µm d_{90}: 707.0 µm



SCH 2005_pt1b_01.$av

Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %
0.375	0	7.422	0.0029	146.8	1.17
0.412	0	8.148	0.0046	161.2	1.64
0.452	0	8.944	0.0068	176.9	2.43
0.496	0	9.819	0.0092	194.2	3.73
0.545	0	10.78	0.012	213.2	5.80
0.598	0	11.83	0.016	234.1	8.90
0.657	0	12.99	0.020	256.9	13.2
0.721	0	14.26	0.025	282.1	18.9
0.791	0	15.65	0.029	309.6	25.9
0.869	0	17.18	0.034	339.9	34.0
0.954	0	18.86	0.038	373.1	42.8
1.047	0	20.71	0.042	409.6	51.8
1.149	0	22.73	0.047	449.7	60.7
1.261	0	24.95	0.051	493.6	68.8
1.385	0	27.39	0.056	541.9	76.0
1.520	0	30.07	0.062	594.9	82.0
1.669	0	33.01	0.070	653.0	86.8
1.832	0	36.24	0.079	716.9	90.6
2.011	0	39.78	0.090	787.0	93.4
2.208	0	43.67	0.10	863.9	95.5
2.423	0	47.94	0.12	948.3	97.0
2.660	0	52.63	0.13	1041	98.1
2.920	0	57.77	0.15	1143	98.9
3.206	0	63.42	0.16	1255	99.4
3.519	0	69.62	0.18	1377	99.7
3.863	0	76.43	0.21	1512	99.9
4.241	0	83.90	0.25	1660	99.98
4.656	0.000001	92.10	0.31	1822	99.999
5.111	0.000029	101.1	0.40	2000	100
5.610	0.00021	111.0	0.52		
6.159	0.00069	121.8	0.68		
6.761	0.0016	133.8	0.88		

LS Particle Size Analyzer

Santa Cruz Harbor Sediment Monitoring (Fall 2005)

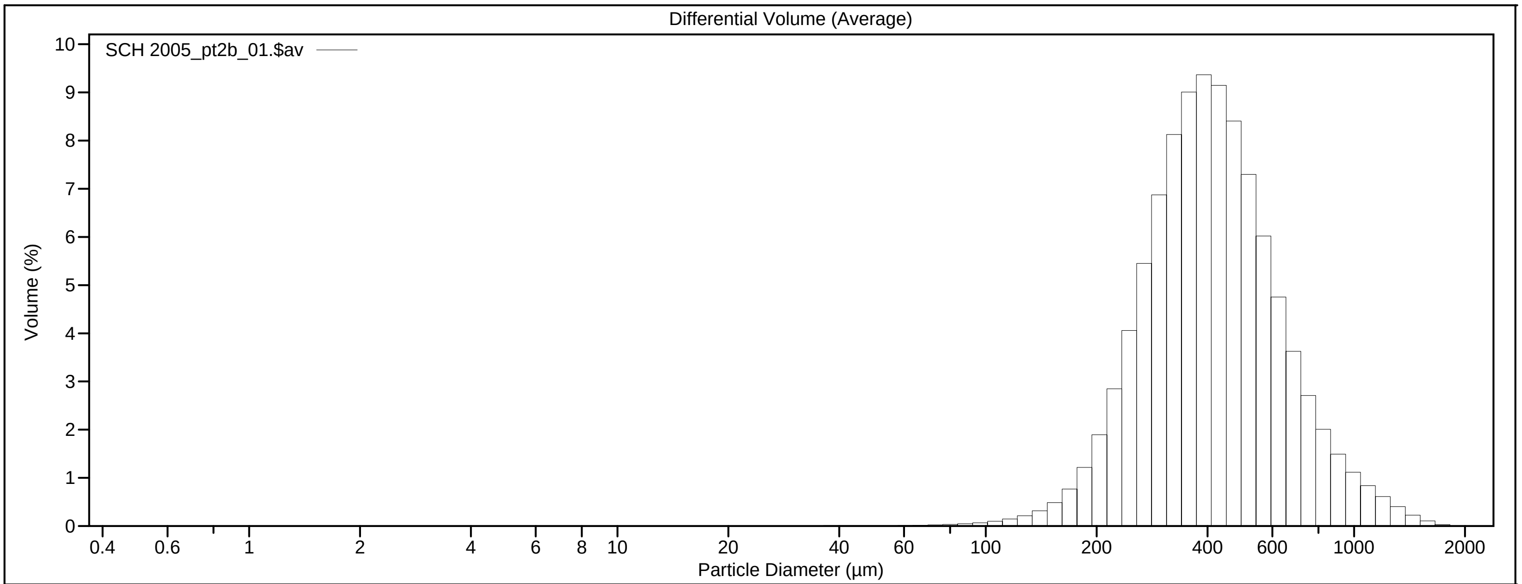
File name:	C:\LS13320\SCH-2005-6-grain-size\Beach-samples\SCH 2005_pt2b_01.$av
	SCH 2005_pt2b_01.$av
Sample ID:	pt2b
Comment 1:	Collected 11-08-05
Comment 2:	Post-dredging
Optical model:	Fraunhofer.rf780z

Volume Statistics (Arithmetic) SCH 2005_pt2b_01.$av

Calculations from 0.375 µm to 2000 µm

Volume:	100%		
Mean:	449.7 µm	S.D.:	209.0 µm
Median:	404.9 µm	Variance:	43665 μm^2
Mean/Median ratio:	1.111	Skewness:	1.638 Right skewed
Mode:	391.0 µm	Kurtosis:	4.109 Leptokurtic

d_{10}: 243.5 µm d_{50}: 404.9 µm d_{90}: 708.8 µm



SCH 2005_pt2b_01.$av

Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %
0.375	0	7.422	0.0088	146.8	1.11
0.412	0	8.148	0.012	161.2	1.60
0.452	0	8.944	0.015	176.9	2.36
0.496	0	9.819	0.019	194.2	3.58
0.545	0	10.78	0.022	213.2	5.47
0.598	0	11.83	0.025	234.1	8.32
0.657	0	12.99	0.028	256.9	12.4
0.721	0	14.26	0.031	282.1	17.8
0.791	0	15.65	0.034	309.6	24.7
0.869	0	17.18	0.037	339.9	32.8
0.954	0	18.86	0.040	373.1	41.8
1.047	0	20.71	0.044	409.6	51.2
1.149	0	22.73	0.049	449.7	60.4
1.261	0	24.95	0.054	493.6	68.8
1.385	0	27.39	0.060	541.9	76.1
1.520	0	30.07	0.067	594.9	82.1
1.669	0	33.01	0.074	653.0	86.8
1.832	0	36.24	0.082	716.9	90.5
2.011	0	39.78	0.091	787.0	93.2
2.208	0	43.67	0.10	863.9	95.2
2.423	0	47.94	0.11	948.3	96.7
2.660	0	52.63	0.12	1041	97.8
2.920	0	57.77	0.13	1143	98.6
3.206	0	63.42	0.15	1255	99.2
3.519	0	69.62	0.16	1377	99.6
3.863	0	76.43	0.19	1512	99.9
4.241	0.000001	83.90	0.22	1660	99.97
4.656	0.000067	92.10	0.27	1822	99.997
5.111	0.00056	101.1	0.34	2000	100
5.610	0.0017	111.0	0.43		
6.159	0.0035	121.8	0.58		
6.761	0.0059	133.8	0.79		

LS Particle Size Analyzer

Santa Cruz Harbor Sediment Monitoring (Fall 2005)

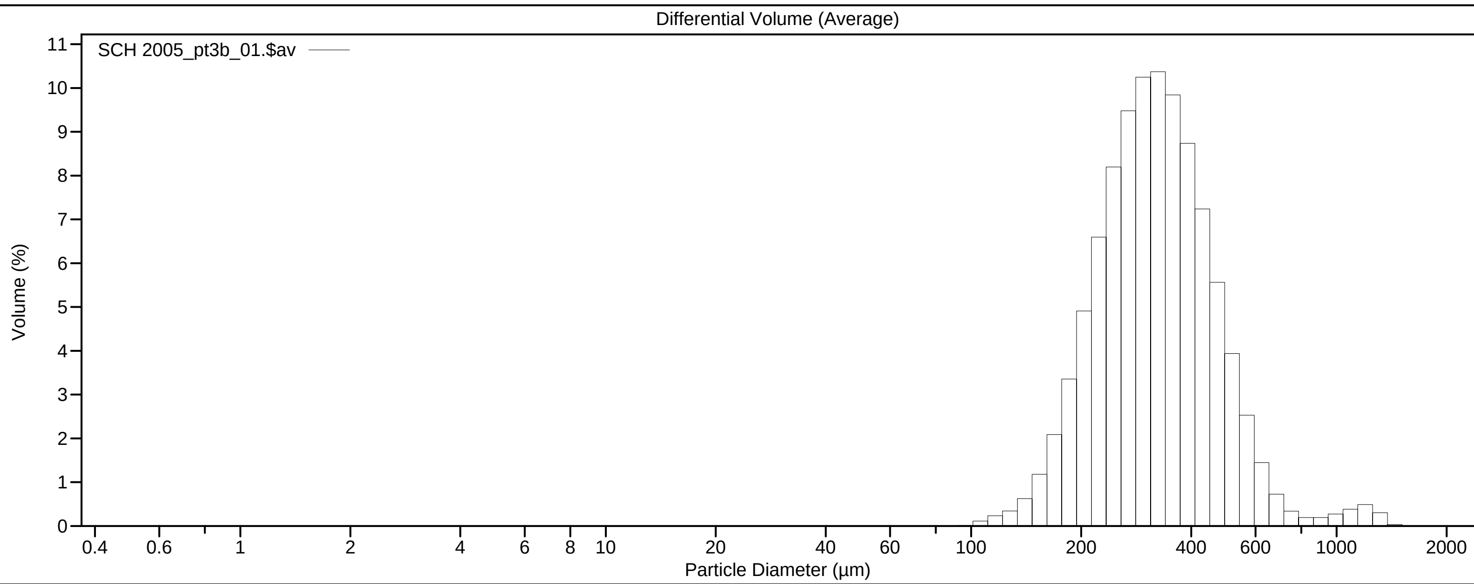
File name:	C:\LS13320\SCH-2005-6-grain-size\Beach-samples\SCH 2005_pt3b_01.$av SCH 2005_pt3b_01.$av
Sample ID:	pt3b
Comment 1:	Collected 11-08-05
Comment 2:	Post-dredging
Optical model:	Fraunhofer.rf780z

Volume Statistics (Arithmetic) SCH 2005_pt3b_01.$av

Calculations from 0.375 µm to 2000 µm

Volume:	100%		
Mean:	346.0 µm	S.D.:	154.5 µm
Median:	317.3 µm	Variance:	23858 µm^2
Mean/Median ratio:	1.090	Skewness:	2.623 Right skewed
Mode:	324.4 µm	Kurtosis:	11.40 Leptokurtic

d_{10}: 202.1 µm d_{50}: 317.3 µm d_{90}: 504.1 µm



SCH 2005_pt3b_01.$av

Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %
0.375	0	7.422	0	146.8	1.33
0.412	0	8.148	0	161.2	2.51
0.452	0	8.944	0	176.9	4.60
0.496	0	9.819	0	194.2	7.96
0.545	0	10.78	0	213.2	12.9
0.598	0	11.83	0	234.1	19.5
0.657	0	12.99	0	256.9	27.7
0.721	0	14.26	0	282.1	37.1
0.791	0	15.65	0	309.6	47.4
0.869	0	17.18	0	339.9	57.8
0.954	0	18.86	0	373.1	67.6
1.047	0	20.71	0	409.6	76.3
1.149	0	22.73	0	449.7	83.6
1.261	0	24.95	0	493.6	89.1
1.385	0	27.39	0	541.9	93.1
1.520	0	30.07	0	594.9	95.6
1.669	0	33.01	0	653.0	97.1
1.832	0	36.24	0	716.9	97.8
2.011	0	39.78	0	787.0	98.1
2.208	0	43.67	0	863.9	98.3
2.423	0	47.94	0	948.3	98.5
2.660	0	52.63	0	1041	98.8
2.920	0	57.77	0	1143	99.2
3.206	0	63.42	0	1255	99.7
3.519	0	69.62	0	1377	99.97
3.863	0	76.43	0	1512	100
4.241	0	83.90	0	1660	100
4.656	0	92.10	0	1822	100
5.111	0	101.1	0.012	2000	100
5.610	0	111.0	0.12		
6.159	0	121.8	0.36		
6.761	0	133.8	0.70		

LS Particle Size Analyzer

Santa Cruz Harbor Sediment Monitoring (Fall 2005)

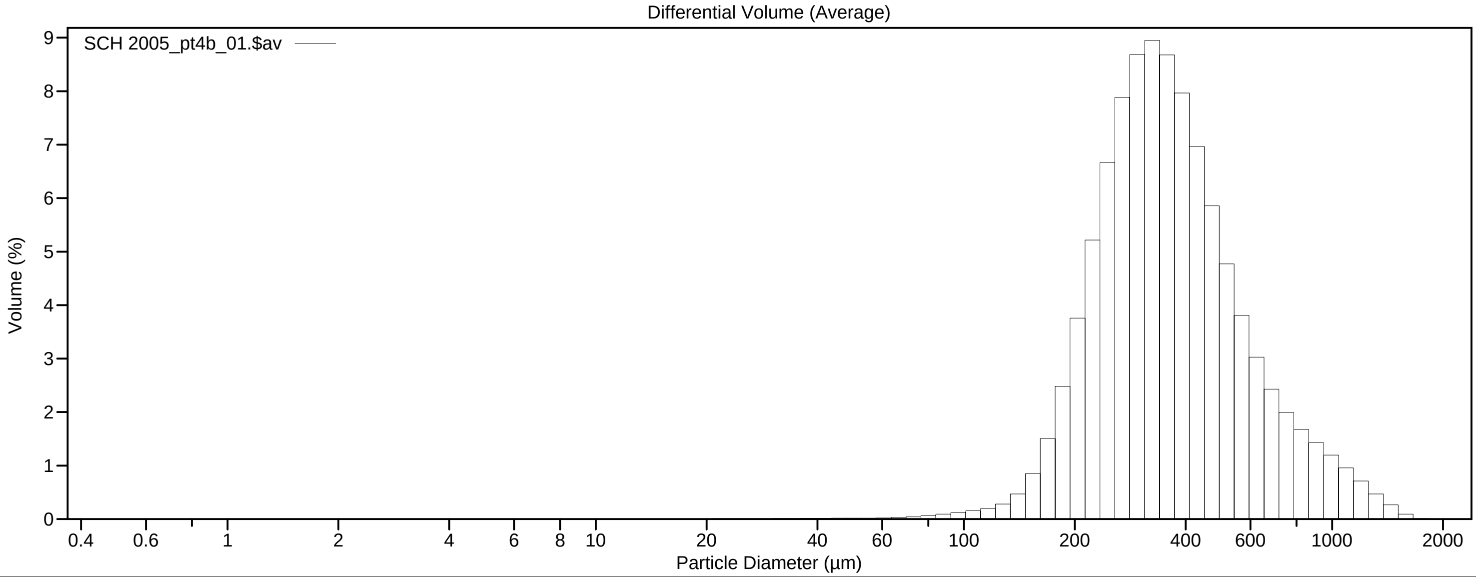
File name:	C:\LS13320\SCH-2005-6-grain-size\Beach-samples\SCH 2005_pt4b_01.$av SCH 2005_pt4b_01.$av
Sample ID:	pt4b
Comment 1:	Collected 11-08-05
Comment 2:	Post-dredging
Optical model:	Fraunhofer.rf780z

Volume Statistics (Arithmetic) SCH 2005_pt4b_01.$av

Calculations from 0.375 µm to 2000 µm

Volume:	100%		
Mean:	407.4 µm	S.D.:	218.7 µm
Median:	348.8 µm	Variance:	47813 $µm^2$
Mean/Median ratio:	1.168	Skewness:	1.871 Right skewed
Mode:	324.4 µm	Kurtosis:	4.423 Leptokurtic

d_{10}: 211.7 µm d_{50}: 348.8 µm d_{90}: 685.3 µm



SCH 2005_pt4b_01.$av

Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %
0.375	0	7.422	0.010	146.8	1.70
0.412	0	8.148	0.015	161.2	2.55
0.452	0	8.944	0.020	176.9	4.05
0.496	0	9.819	0.025	194.2	6.54
0.545	0	10.78	0.031	213.2	10.3
0.598	0	11.83	0.037	234.1	15.5
0.657	0	12.99	0.043	256.9	22.2
0.721	0	14.26	0.049	282.1	30.1
0.791	0	15.65	0.055	309.6	38.7
0.869	0	17.18	0.062	339.9	47.7
0.954	0	18.86	0.068	373.1	56.4
1.047	0	20.71	0.076	409.6	64.3
1.149	0	22.73	0.083	449.7	71.3
1.261	0	24.95	0.092	493.6	77.2
1.385	0	27.39	0.10	541.9	81.9
1.520	0	30.07	0.11	594.9	85.7
1.669	0	33.01	0.12	653.0	88.8
1.832	0	36.24	0.13	716.9	91.2
2.011	0	39.78	0.15	787.0	93.2
2.208	0	43.67	0.16	863.9	94.9
2.423	0	47.94	0.18	948.3	96.3
2.660	0	52.63	0.20	1041	97.5
2.920	0	57.77	0.22	1143	98.5
3.206	0	63.42	0.24	1255	99.2
3.519	0	69.62	0.27	1377	99.6
3.863	0	76.43	0.31	1512	99.9
4.241	0	83.90	0.38	1660	99.99
4.656	0.000027	92.10	0.47	1822	100
5.111	0.00039	101.1	0.60	2000	100
5.610	0.0015	111.0	0.75		
6.159	0.0035	121.8	0.95		
6.761	0.0064	133.8	1.23		

LS Particle Size Analyzer

Santa Cruz Harbor Sediment Monitoring (Fall 2005)

File name:	C:\LS13320\SCH-2005-6-grain-size\Beach-samples\SCH 2005_pt5b_01.$av SCH 2005_pt5b_01.$av
Sample ID:	pt5b
Comment 1:	Collected 11-08-05
Comment 2:	Post-dredging
Optical model:	Fraunhofer.rf780z

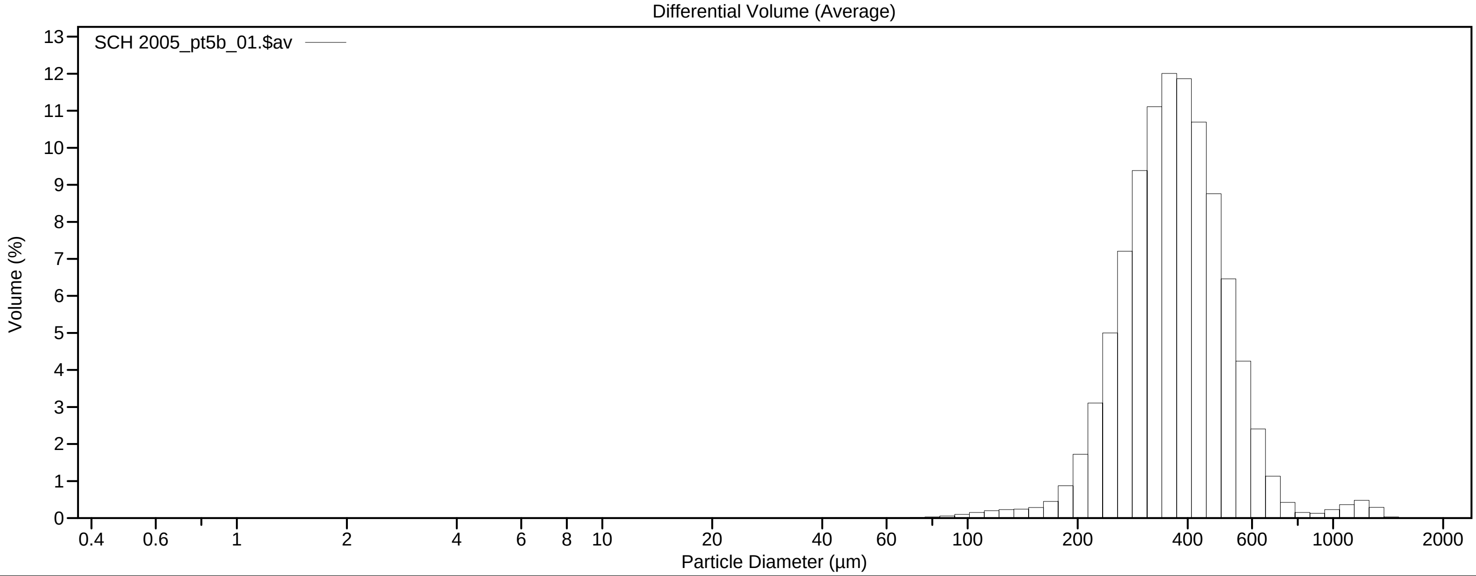
Volume Statistics (Arithmetic) SCH 2005_pt5b_01.$av

Calculations from 0.375 µm to 2000 µm

Volume:	100%		
Mean:	388.4 µm	S.D.:	147.9 µm
Median:	366.6 µm	Variance:	21881 μm^2
Mean/Median ratio:	1.059	Skewness:	2.302 Right skewed
Mode:	356.1 µm	Kurtosis:	10.38 Leptokurtic

d_{10}: 244.9 µm d_{50}: 366.6 µm d_{90}: 540.9 µm

Differential Volume (Average)



SCH 2005_pt5b_01.$av

Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %
0.375	0	7.422	0.0025	146.8	1.20
0.412	0	8.148	0.0041	161.2	1.48
0.452	0	8.944	0.0061	176.9	1.93
0.496	0	9.819	0.0086	194.2	2.81
0.545	0	10.78	0.011	213.2	4.53
0.598	0	11.83	0.015	234.1	7.64
0.657	0	12.99	0.018	256.9	12.6
0.721	0	14.26	0.022	282.1	19.8
0.791	0	15.65	0.027	309.6	29.2
0.869	0	17.18	0.031	339.9	40.3
0.954	0	18.86	0.035	373.1	52.3
1.047	0	20.71	0.040	409.6	64.2
1.149	0	22.73	0.044	449.7	74.9
1.261	0	24.95	0.048	493.6	83.7
1.385	0	27.39	0.052	541.9	90.1
1.520	0	30.07	0.058	594.9	94.4
1.669	0	33.01	0.064	653.0	96.8
1.832	0	36.24	0.072	716.9	97.9
2.011	0	39.78	0.083	787.0	98.3
2.208	0	43.67	0.096	863.9	98.5
2.423	0	47.94	0.11	948.3	98.6
2.660	0	52.63	0.13	1041	98.8
2.920	0	57.77	0.14	1143	99.2
3.206	0	63.42	0.15	1255	99.7
3.519	0	69.62	0.17	1377	99.97
3.863	0	76.43	0.19	1512	100
4.241	0	83.90	0.22	1660	100
4.656	0	92.10	0.27	1822	100
5.111	0.000013	101.1	0.37	2000	100
5.610	0.00016	111.0	0.53		
6.159	0.00059	121.8	0.72		
6.761	0.0014	133.8	0.95		

LS Particle Size Analyzer

Santa Cruz Harbor Sediment Monitoring (Fall 2005)

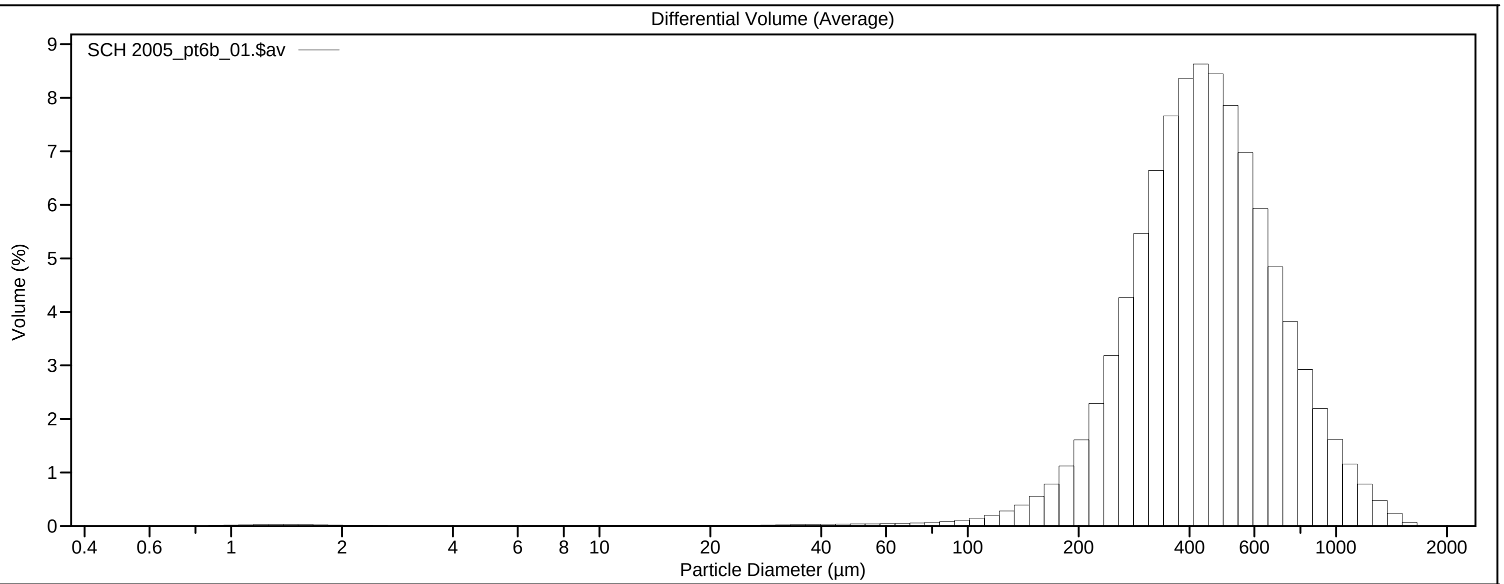
File name:	C:\LS13320\SCH-2005-6-grain-size\Beach-samples\SCH 2005_pt6b_01.$av SCH 2005_pt6b_01.$av
Sample ID:	pt6b
Comment 1:	Collected 11-08-05
Comment 2:	Post-dredging
Optical model:	Fraunhofer.rf780z

Volume Statistics (Arithmetic) SCH 2005_pt6b_01.$av

Calculations from 0.375 µm to 2000 µm

Volume:	100%		
Mean:	480.0 µm	S.D.:	225.3 µm
Median:	437.3 µm	Variance:	50750 $µm^2$
Mean/Median ratio:	1.098	Skewness:	1.174 Right skewed
Mode:	429.2 µm	Kurtosis:	2.049 Leptokurtic

d_{10}: 245.1 µm d_{50}: 437.3 µm d_{90}: 777.0 µm



SCH 2005_pt6b_01.$av

Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %
0.375	0	7.422	0.29	146.8	2.11
0.412	0	8.148	0.30	161.2	2.66
0.452	0	8.944	0.31	176.9	3.45
0.496	0	9.819	0.32	194.2	4.57
0.545	0	10.78	0.33	213.2	6.18
0.598	0	11.83	0.34	234.1	8.47
0.657	0	12.99	0.35	256.9	11.7
0.721	0	14.26	0.36	282.1	15.9
0.791	0.00027	15.65	0.37	309.6	21.4
0.869	0.0038	17.18	0.38	339.9	28.0
0.954	0.014	18.86	0.40	373.1	35.7
1.047	0.031	20.71	0.41	409.6	44.0
1.149	0.053	22.73	0.42	449.7	52.7
1.261	0.077	24.95	0.44	493.6	61.1
1.385	0.10	27.39	0.45	541.9	69.0
1.520	0.13	30.07	0.47	594.9	76.0
1.669	0.15	33.01	0.49	653.0	81.9
1.832	0.17	36.24	0.51	716.9	86.7
2.011	0.19	39.78	0.54	787.0	90.5
2.208	0.21	43.67	0.57	863.9	93.5
2.423	0.22	47.94	0.61	948.3	95.7
2.660	0.23	52.63	0.65	1041	97.3
2.920	0.23	57.77	0.69	1143	98.4
3.206	0.24	63.42	0.73	1255	99.2
3.519	0.24	69.62	0.78	1377	99.7
3.863	0.25	76.43	0.83	1512	99.9
4.241	0.25	83.90	0.90	1660	99.995
4.656	0.25	92.10	0.99	1822	100
5.111	0.26	101.1	1.09	2000	100
5.610	0.26	111.0	1.24		
6.159	0.27	121.8	1.44		
6.761	0.28	133.8	1.72		

LS Particle Size Analyzer

Santa Cruz Harbor Sediment Monitoring (Fall 2005)

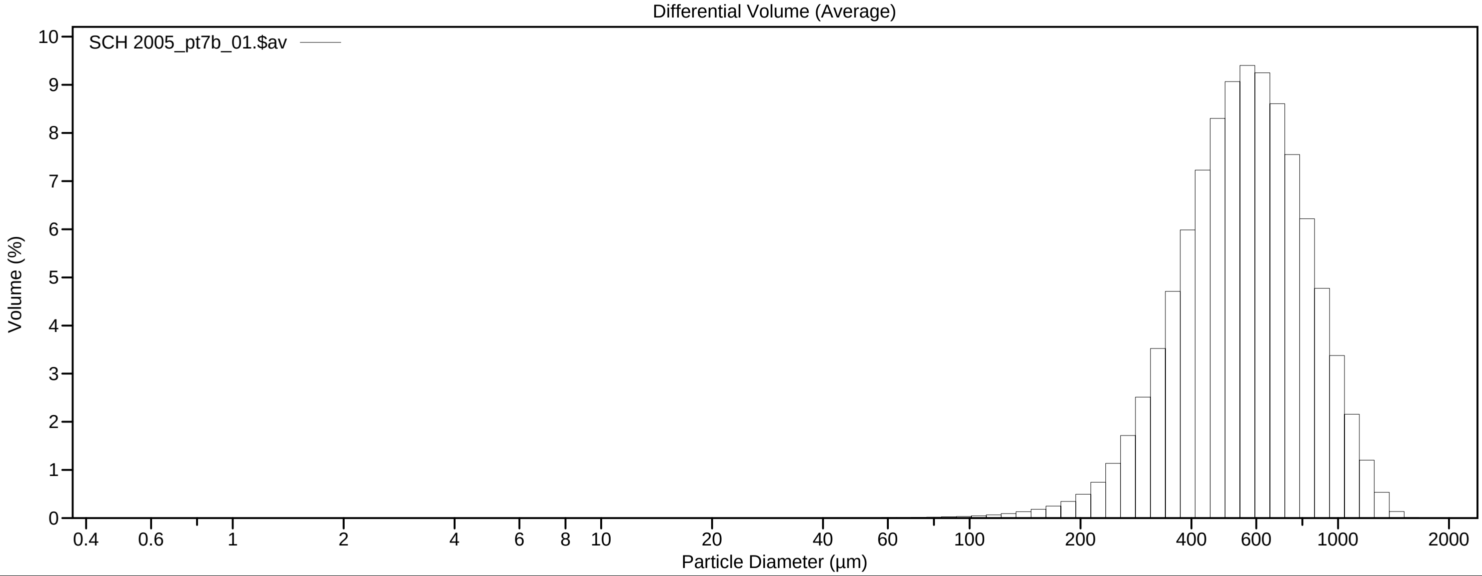
File name: C:\LS13320\SCH-2005-6-grain-size\Beach-samples\SCH 2005_pt7b_01.$av
SCH 2005_pt7b_01.$av
Sample ID: pt7b
Comment 1: Collected 11-08-05
Comment 2: Post-dredging
Optical model: Fraunhofer.rf780z

Volume Statistics (Arithmetic) SCH 2005_pt7b_01.$av

Calculations from 0.375 µm to 2000 µm

Volume:	100%		
Mean:	589.8 µm	S.D.:	225.9 µm
Median:	560.1 µm	Variance:	51023 µm^2
Mean/Median ratio:	1.053	Skewness:	0.651 Right skewed
Mode:	567.8 µm	Kurtosis:	0.357 Leptokurtic

d_{10}: 327.2 µm d_{50}: 560.1 µm d_{90}: 902.7 µm



SCH 2005_pt7b_01.$av

Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %
0.375	0	7.422	0.0037	146.8	0.58
0.412	0	8.148	0.0054	161.2	0.76
0.452	0	8.944	0.0074	176.9	1.01
0.496	0	9.819	0.0096	194.2	1.35
0.545	0	10.78	0.012	213.2	1.85
0.598	0	11.83	0.015	234.1	2.59
0.657	0	12.99	0.019	256.9	3.73
0.721	0	14.26	0.024	282.1	5.45
0.791	0	15.65	0.028	309.6	7.96
0.869	0	17.18	0.032	339.9	11.5
0.954	0	18.86	0.036	373.1	16.2
1.047	0	20.71	0.039	409.6	22.2
1.149	0	22.73	0.043	449.7	29.4
1.261	0	24.95	0.046	493.6	37.7
1.385	0	27.39	0.050	541.9	46.8
1.520	0	30.07	0.055	594.9	56.2
1.669	0	33.01	0.061	653.0	65.4
1.832	0	36.24	0.068	716.9	74.0
2.011	0	39.78	0.076	787.0	81.6
2.208	0	43.67	0.085	863.9	87.8
2.423	0	47.94	0.094	948.3	92.6
2.660	0	52.63	0.10	1041	96.0
2.920	0	57.77	0.11	1143	98.1
3.206	0	63.42	0.13	1255	99.3
3.519	0	69.62	0.14	1377	99.9
3.863	0	76.43	0.16	1512	99.99
4.241	0	83.90	0.18	1660	100
4.656	0.000007	92.10	0.20	1822	100
5.111	0.00012	101.1	0.24	2000	100
5.610	0.00052	111.0	0.28		
6.159	0.0012	121.8	0.35		
6.761	0.0023	133.8	0.44		

LS Particle Size Analyzer

Santa Cruz Harbor Sediment Monitoring (Fall 2005)

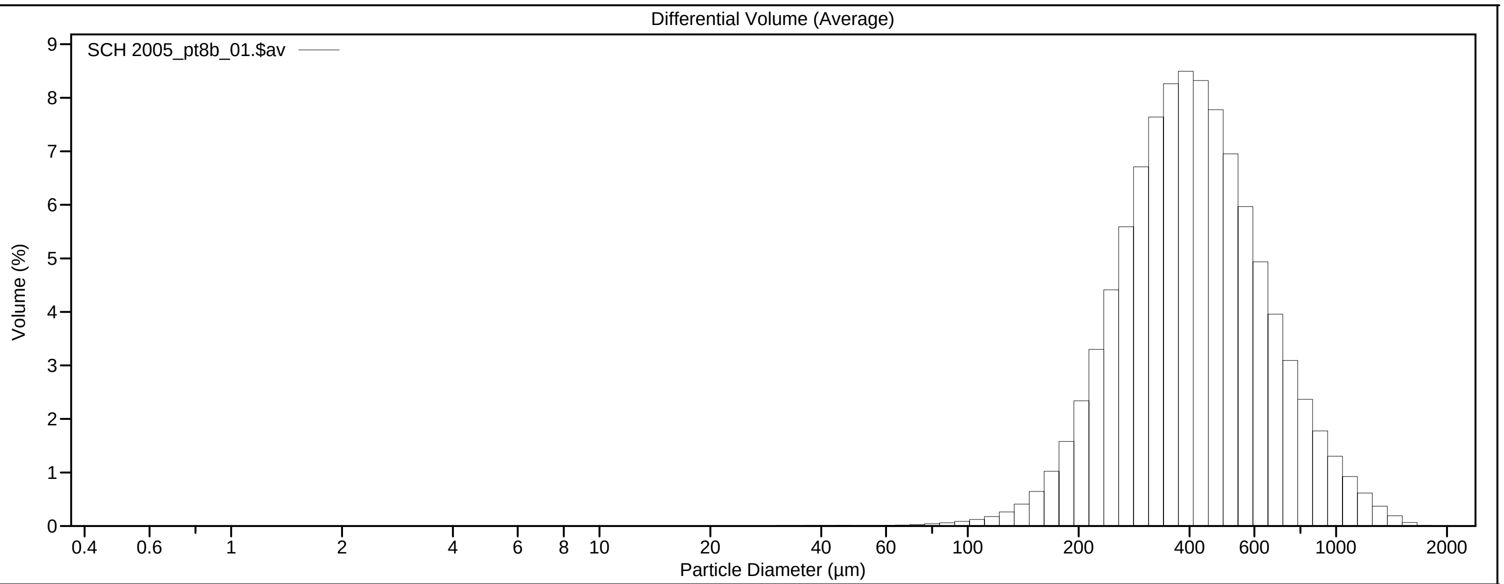
File name:	C:\LS13320\SCH-2005-6-grain-size\Beach-samples\SCH 2005_pt8b_01.$av
	SCH 2005_pt8b_01.$av
Sample ID:	pt8b
Comment 1:	Collected 11-08-05
Comment 2:	Post-dredging
Optical model:	Fraunhofer.rf780z

Volume Statistics (Arithmetic) SCH 2005_pt8b_01.$av

Calculations from 0.375 µm to 2000 µm

Volume:	100%		
Mean:	450.5 µm	S.D.:	214.7 µm
Median:	403.7 µm	Variance:	46101 µm^2
Mean/Median ratio:	1.116	Skewness:	1.404 Right skewed
Mode:	391.0 µm	Kurtosis:	2.763 Leptokurtic

d_{10}: 232.4 µm d_{50}: 403.7 µm d_{90}: 733.1 µm



SCH 2005_pt8b_01.$av

Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %
0.375	0	7.422	0.0044	146.8	1.37
0.412	0	8.148	0.0069	161.2	2.02
0.452	0	8.944	0.0099	176.9	3.04
0.496	0	9.819	0.013	194.2	4.62
0.545	0	10.78	0.017	213.2	6.96
0.598	0	11.83	0.021	234.1	10.3
0.657	0	12.99	0.026	256.9	14.7
0.721	0	14.26	0.030	282.1	20.3
0.791	0	15.65	0.034	309.6	27.0
0.869	0	17.18	0.038	339.9	34.6
0.954	0	18.86	0.043	373.1	42.9
1.047	0	20.71	0.047	409.6	51.4
1.149	0	22.73	0.051	449.7	59.7
1.261	0	24.95	0.055	493.6	67.5
1.385	0	27.39	0.061	541.9	74.4
1.520	0	30.07	0.067	594.9	80.4
1.669	0	33.01	0.075	653.0	85.3
1.832	0	36.24	0.085	716.9	89.3
2.011	0	39.78	0.097	787.0	92.4
2.208	0	43.67	0.11	863.9	94.7
2.423	0	47.94	0.12	948.3	96.5
2.660	0	52.63	0.14	1041	97.8
2.920	0	57.77	0.15	1143	98.7
3.206	0	63.42	0.17	1255	99.4
3.519	0	69.62	0.18	1377	99.7
3.863	0	76.43	0.21	1512	99.9
4.241	0	83.90	0.25	1660	99.99
4.656	0	92.10	0.31	1822	100
5.111	0.000023	101.1	0.40	2000	100
5.610	0.00030	111.0	0.52		
6.159	0.0011	121.8	0.70		
6.761	0.0025	133.8	0.96		

LS Particle Size Analyzer

Santa Cruz Harbor Sediment Monitoring (Fall 2005)

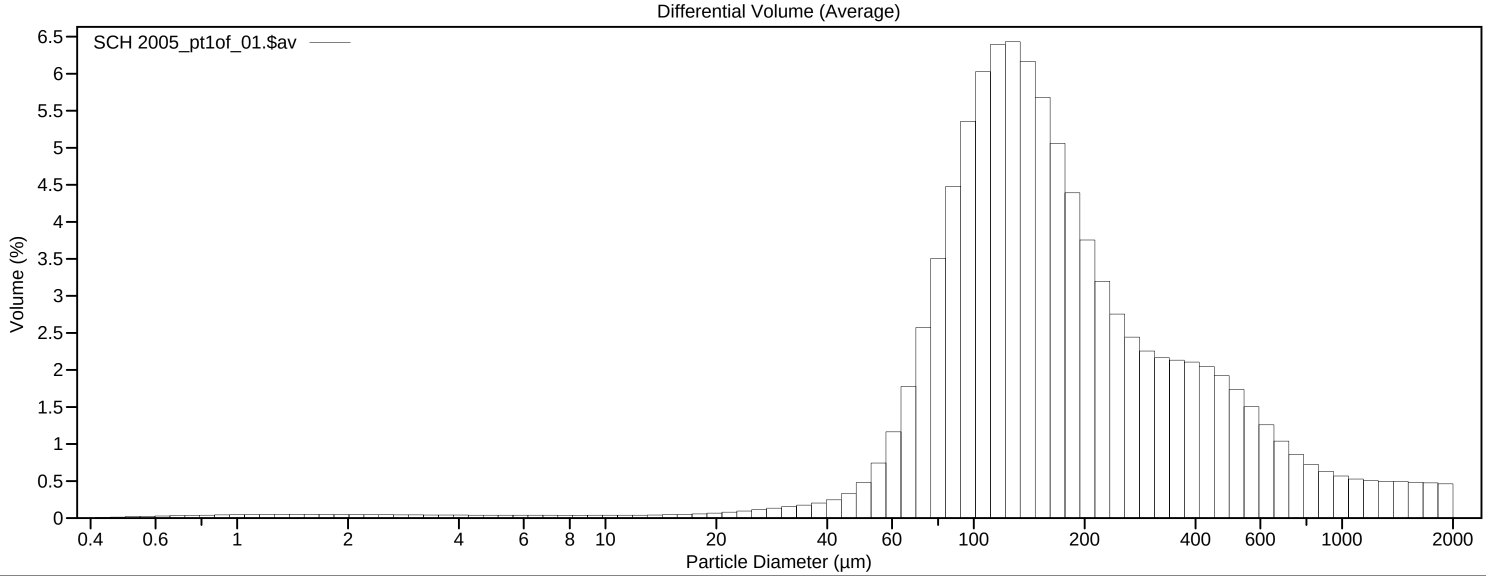
File name:	C:\LS13320\SCH-2005-6-grain-size\Offshore-samples\SCH 2005_pt1of_01.$av
	SCH 2005_pt1of_01.$av
Sample ID:	pt1off
Comment 1:	Collected 11-7-05
Comment 2:	Post-dredging
Optical model:	Fraunhofer.rf780z

Volume Statistics (Arithmetic) SCH 2005_pt1of_01.$av

Calculations from 0.375 µm to 2000 µm

Volume:	100%		
Mean:	254.9 µm	S.D.:	291.1 µm
Median:	151.0 µm	Variance:	84717 µm^2
Mean/Median ratio:	1.688	Skewness:	3.085 Right skewed
Mode:	127.7 µm	Kurtosis:	11.03 Leptokurtic

d_{10}: 76.49 µm d_{50}: 151.0 µm d_{90}: 542.6 µm



SCH 2005_pt1of_01.$av

Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %
0.375	0	7.422	1.21	146.8	48.3
0.412	0.0050	8.148	1.25	161.2	54.0
0.452	0.014	8.944	1.28	176.9	59.1
0.496	0.027	9.819	1.32	194.2	63.5
0.545	0.046	10.78	1.36	213.2	67.2
0.598	0.070	11.83	1.40	234.1	70.4
0.657	0.098	12.99	1.44	256.9	73.2
0.721	0.13	14.26	1.48	282.1	75.6
0.791	0.17	15.65	1.52	309.6	77.9
0.869	0.21	17.18	1.57	339.9	80.0
0.954	0.25	18.86	1.63	373.1	82.2
1.047	0.29	20.71	1.70	409.6	84.3
1.149	0.34	22.73	1.78	449.7	86.3
1.261	0.39	24.95	1.87	493.6	88.2
1.385	0.44	27.39	1.99	541.9	90.0
1.520	0.48	30.07	2.12	594.9	91.5
1.669	0.53	33.01	2.28	653.0	92.7
1.832	0.58	36.24	2.45	716.9	93.8
2.011	0.63	39.78	2.66	787.0	94.6
2.208	0.68	43.67	2.90	863.9	95.4
2.423	0.72	47.94	3.23	948.3	96.0
2.660	0.77	52.63	3.71	1041	96.6
2.920	0.81	57.77	4.46	1143	97.1
3.206	0.85	63.42	5.62	1255	97.6
3.519	0.90	69.62	7.40	1377	98.1
3.863	0.94	76.43	9.97	1512	98.6
4.241	0.98	83.90	13.5	1660	99.1
4.656	1.02	92.10	18.0	1822	99.5
5.111	1.05	101.1	23.3	2000	100
5.610	1.09	111.0	29.3		
6.159	1.13	121.8	35.7		
6.761	1.17	133.8	42.2		

LS Particle Size Analyzer

Santa Cruz Harbor Sediment Monitoring (Fall 2005)

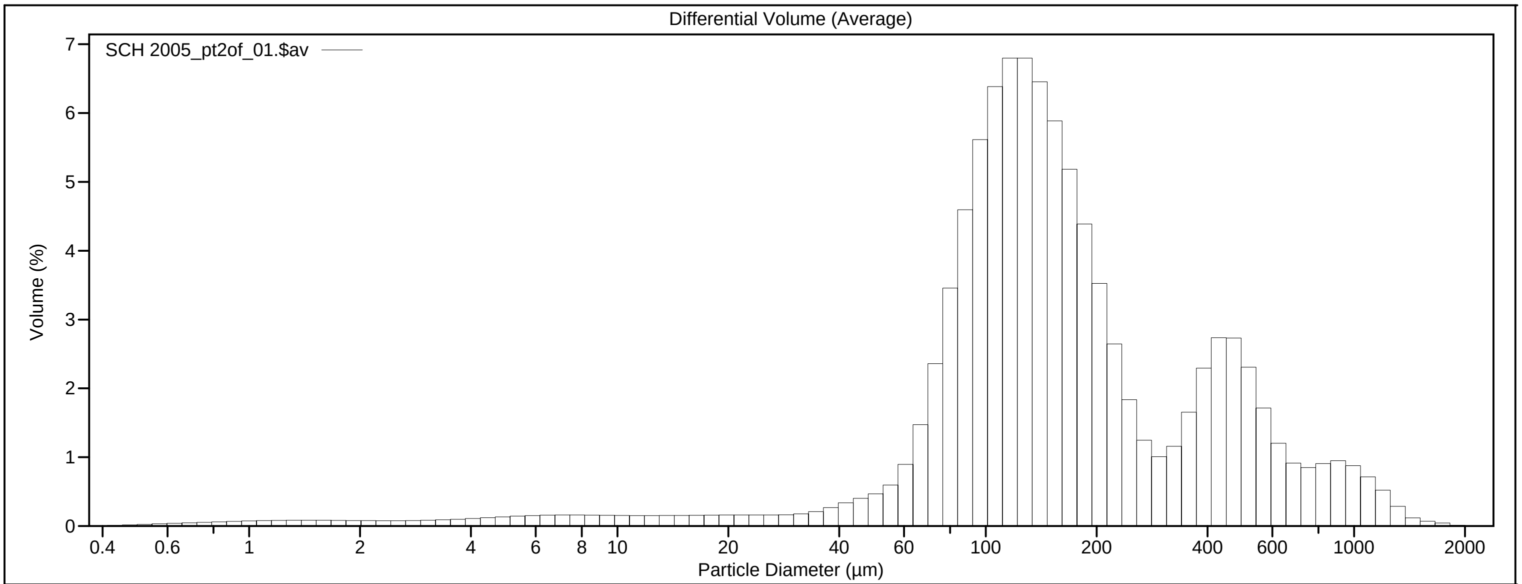
File name:	C:\LS13320\SCH-2005-6-grain-size\Offshore-samples\SCH 2005_pt2of_01.$av SCH 2005_pt2of_01.$av
Sample ID:	pt2off
Comment 1:	Collected 11-7-05
Comment 2:	Post-dredging
Optical model:	Fraunhofer.rf780z

Volume Statistics (Arithmetic) SCH 2005_pt2of_01.$av

Calculations from 0.375 µm to 2000 µm

Volume:	100%		
Mean:	230.8 µm	S.D.:	234.8 µm
Median:	142.3 µm	Variance:	55111 µm^2
Mean/Median ratio:	1.621	Skewness:	2.364 Right skewed
Mode:	127.7 µm	Kurtosis:	6.465 Leptokurtic

d_{10}: 70.34 µm d_{50}: 142.3 µm d_{90}: 524.8 µm



SCH 2005_pt2of_01.$av

Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %
0.375	0	7.422	2.56	146.8	52.2
0.412	0.0052	8.148	2.72	161.2	58.1
0.452	0.015	8.944	2.88	176.9	63.3
0.496	0.032	9.819	3.04	194.2	67.7
0.545	0.057	10.78	3.19	213.2	71.2
0.598	0.088	11.83	3.34	234.1	73.8
0.657	0.13	12.99	3.50	256.9	75.7
0.721	0.17	14.26	3.65	282.1	76.9
0.791	0.23	15.65	3.80	309.6	77.9
0.869	0.29	17.18	3.96	339.9	79.1
0.954	0.36	18.86	4.12	373.1	80.7
1.047	0.43	20.71	4.28	409.6	83.0
1.149	0.51	22.73	4.44	449.7	85.8
1.261	0.59	24.95	4.60	493.6	88.5
1.385	0.67	27.39	4.76	541.9	90.8
1.520	0.76	30.07	4.92	594.9	92.5
1.669	0.84	33.01	5.10	653.0	93.7
1.832	0.92	36.24	5.31	716.9	94.6
2.011	1.00	39.78	5.58	787.0	95.5
2.208	1.08	43.67	5.91	863.9	96.4
2.423	1.16	47.94	6.32	948.3	97.4
2.660	1.24	52.63	6.78	1041	98.2
2.920	1.31	57.77	7.38	1143	98.9
3.206	1.40	63.42	8.28	1255	99.5
3.519	1.49	69.62	9.75	1377	99.8
3.863	1.59	76.43	12.1	1512	99.9
4.241	1.69	83.90	15.6	1660	99.9
4.656	1.82	92.10	20.2	1822	99.99
5.111	1.95	101.1	25.8	2000	100
5.610	2.09	111.0	32.2		
6.159	2.24	121.8	39.0		
6.761	2.40	133.8	45.8		

LS Particle Size Analyzer

Santa Cruz Harbor Sediment Monitoring (Fall 2005)

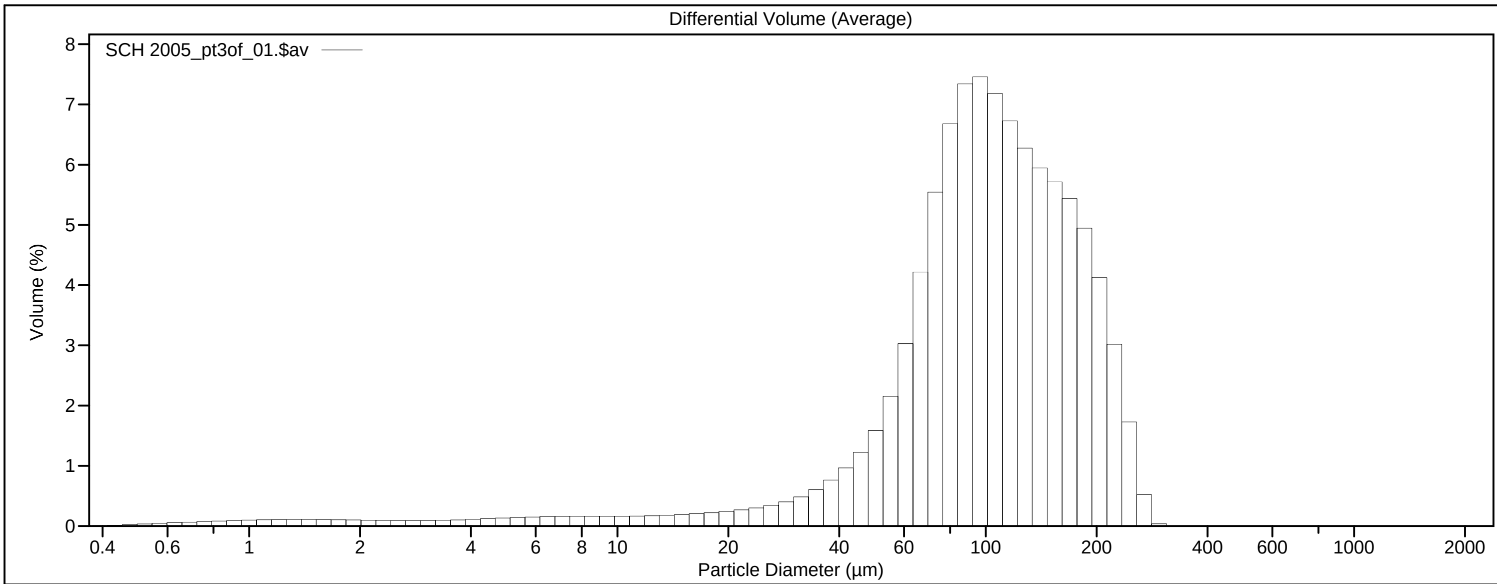
File name:	C:\LS13320\SCH-2005-6-grain-size\Offshore-samples\SCH 2005_pt3of_01.$av SCH 2005_pt3of_01.$av
Sample ID:	pt3off
Comment 1:	Collected 11-7-05
Comment 2:	Post-dredging
Optical model:	Fraunhofer.rf780z

Volume Statistics (Arithmetic) SCH 2005_pt3of_01.$av

Calculations from 0.375 µm to 2000 µm

Volume:	100%		
Mean:	111.8 µm	S.D.:	56.08 µm
Median:	103.4 µm	Variance:	3145 $µm^2$
Mean/Median ratio:	1.081	Skewness:	0.396 Right skewed
Mode:	96.49 µm	Kurtosis:	-0.178 Platykurtic

d_{10}: 46.77 µm d_{50}: 103.4 µm d_{90}: 192.2 µm



SCH 2005_pt3of_01.$av

Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %
0.375	0	7.422	2.96	146.8	74.5
0.412	0.0075	8.148	3.12	161.2	80.2
0.452	0.022	8.944	3.28	176.9	85.6
0.496	0.047	9.819	3.44	194.2	90.6
0.545	0.081	10.78	3.61	213.2	94.7
0.598	0.13	11.83	3.77	234.1	97.7
0.657	0.18	12.99	3.94	256.9	99.4
0.721	0.24	14.26	4.12	282.1	99.96
0.791	0.32	15.65	4.31	309.6	100
0.869	0.40	17.18	4.51	339.9	100
0.954	0.49	18.86	4.73	373.1	100
1.047	0.59	20.71	4.98	409.6	100
1.149	0.69	22.73	5.25	449.7	100
1.261	0.80	24.95	5.55	493.6	100
1.385	0.91	27.39	5.89	541.9	100
1.520	1.02	30.07	6.29	594.9	100
1.669	1.13	33.01	6.78	653.0	100
1.832	1.23	36.24	7.38	716.9	100
2.011	1.33	39.78	8.14	787.0	100
2.208	1.43	43.67	9.11	863.9	100
2.423	1.52	47.94	10.3	948.3	100
2.660	1.61	52.63	11.9	1041	100
2.920	1.70	57.77	14.1	1143	100
3.206	1.79	63.42	17.1	1255	100
3.519	1.88	69.62	21.3	1377	100
3.863	1.99	76.43	26.9	1512	100
4.241	2.10	83.90	33.5	1660	100
4.656	2.22	92.10	40.9	1822	100
5.111	2.35	101.1	48.3	2000	100
5.610	2.49	111.0	55.5		
6.159	2.64	121.8	62.3		
6.761	2.80	133.8	68.5		

LS Particle Size Analyzer

Santa Cruz Harbor Sediment Monitoring (Fall 2005)

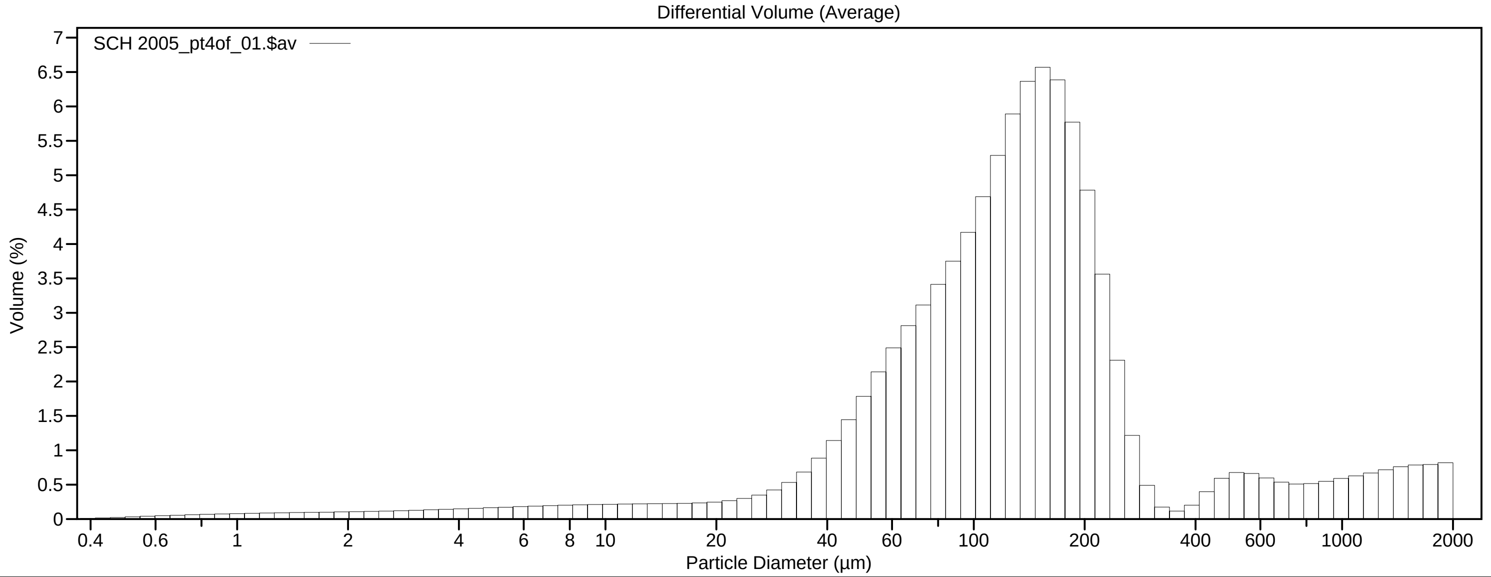
File name:	C:\LS13320\SCH-2005-6-grain-size\Offshore-samples\SCH 2005_pt4of_01.$av
	SCH 2005_pt4of_01.$av
Sample ID:	pt4off
Comment 1:	Collected 11-7-05
Comment 2:	Post-dredging
Optical model:	Fraunhofer.rf780z

Volume Statistics (Arithmetic) SCH 2005_pt4of_01.$av

Calculations from 0.375 µm to 2000 µm

Volume:	100%		
Mean:	224.7 µm	S.D.:	336.6 µm
Median:	131.2 µm	Variance:	113.3e3 µm^2
Mean/Median ratio:	1.712	Skewness:	3.287 Right skewed
Mode:	153.8 µm	Kurtosis:	10.72 Leptokurtic

d_{10}: 42.82 µm d_{50}: 131.2 µm d_{90}: 479.8 µm



SCH 2005_pt4of_01.$av

Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %
0.375	0	7.422	3.23	146.8	57.6
0.412	0.0086	8.148	3.44	161.2	64.2
0.452	0.024	8.944	3.64	176.9	70.6
0.496	0.046	9.819	3.85	194.2	76.3
0.545	0.079	10.78	4.07	213.2	81.1
0.598	0.12	11.83	4.29	234.1	84.7
0.657	0.17	12.99	4.51	256.9	87.0
0.721	0.22	14.26	4.73	282.1	88.2
0.791	0.29	15.65	4.95	309.6	88.7
0.869	0.35	17.18	5.18	339.9	88.9
0.954	0.43	18.86	5.42	373.1	89.0
1.047	0.51	20.71	5.66	409.6	89.2
1.149	0.59	22.73	5.93	449.7	89.6
1.261	0.68	24.95	6.23	493.6	90.2
1.385	0.77	27.39	6.58	541.9	90.9
1.520	0.87	30.07	7.00	594.9	91.5
1.669	0.96	33.01	7.54	653.0	92.1
1.832	1.06	36.24	8.22	716.9	92.7
2.011	1.17	39.78	9.11	787.0	93.2
2.208	1.28	43.67	10.3	863.9	93.7
2.423	1.39	47.94	11.7	948.3	94.2
2.660	1.50	52.63	13.5	1041	94.8
2.920	1.63	57.77	15.6	1143	95.5
3.206	1.75	63.42	18.1	1255	96.1
3.519	1.89	69.62	20.9	1377	96.8
3.863	2.03	76.43	24.0	1512	97.6
4.241	2.18	83.90	27.5	1660	98.4
4.656	2.33	92.10	31.2	1822	99.2
5.111	2.50	101.1	35.4	2000	100
5.610	2.67	111.0	40.1		
6.159	2.85	121.8	45.4		
6.761	3.04	133.8	51.2		

LS Particle Size Analyzer

Santa Cruz Harbor Sediment Monitoring (Fall 2005)

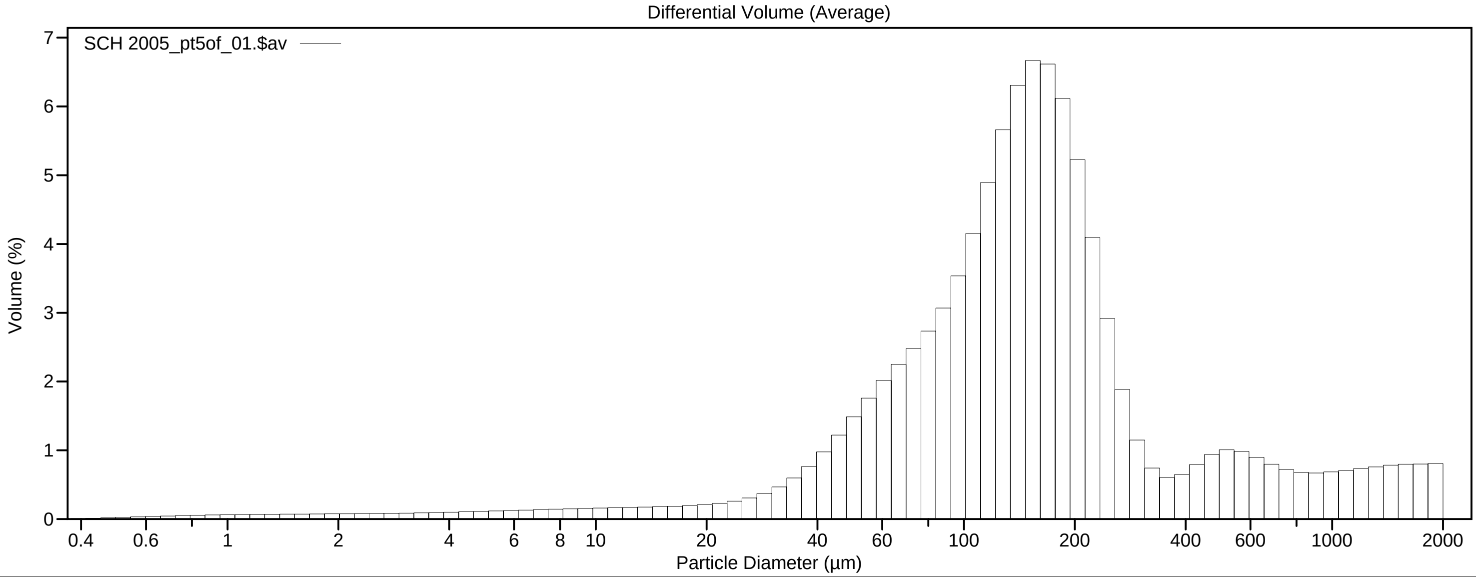
File name:	C:\LS13320\SCH-2005-6-grain-size\Offshore-samples\SCH 2005_pt5of_01.$av SCH 2005_pt5of_01.$av
Sample ID:	pt5off
Comment 1:	Collected 11-7-05
Comment 2:	Post-dredging
Optical model:	Fraunhofer.rf780z

Volume Statistics (Arithmetic) SCH 2005_pt5of_01.$av

Calculations from 0.375 µm to 2000 µm

Volume:	100%		
Mean:	251.5 µm	S.D.:	342.5 µm
Median:	147.3 µm	Variance:	117.3e3 μm^2
Mean/Median ratio:	1.707	Skewness:	3.003 Right skewed
Mode:	153.8 µm	Kurtosis:	9.054 Leptokurtic

d_{10}: 49.75 µm d_{50}: 147.3 µm d_{90}: 586.3 µm



SCH 2005_pt5of_01.$av

Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %
0.375	0	7.422	2.33	146.8	49.8
0.412	0.0070	8.148	2.48	161.2	56.4
0.452	0.020	8.944	2.63	176.9	63.1
0.496	0.038	9.819	2.78	194.2	69.2
0.545	0.065	10.78	2.94	213.2	74.4
0.598	0.098	11.83	3.11	234.1	78.5
0.657	0.14	12.99	3.28	256.9	81.4
0.721	0.18	14.26	3.45	282.1	83.3
0.791	0.23	15.65	3.63	309.6	84.4
0.869	0.29	17.18	3.82	339.9	85.2
0.954	0.35	18.86	4.02	373.1	85.8
1.047	0.41	20.71	4.23	409.6	86.4
1.149	0.48	22.73	4.46	449.7	87.2
1.261	0.55	24.95	4.72	493.6	88.2
1.385	0.62	27.39	5.02	541.9	89.2
1.520	0.69	30.07	5.40	594.9	90.2
1.669	0.76	33.01	5.86	653.0	91.1
1.832	0.83	36.24	6.46	716.9	91.9
2.011	0.91	39.78	7.23	787.0	92.6
2.208	0.99	43.67	8.20	863.9	93.3
2.423	1.07	47.94	9.42	948.3	93.9
2.660	1.15	52.63	10.9	1041	94.6
2.920	1.23	57.77	12.7	1143	95.3
3.206	1.32	63.42	14.7	1255	96.1
3.519	1.41	69.62	16.9	1377	96.8
3.863	1.51	76.43	19.4	1512	97.6
4.241	1.61	83.90	22.1	1660	98.4
4.656	1.71	92.10	25.2	1822	99.2
5.111	1.82	101.1	28.8	2000	100
5.610	1.94	111.0	32.9		
6.159	2.07	121.8	37.8		
6.761	2.20	133.8	43.5		

LS Particle Size Analyzer

Santa Cruz Harbor Sediment Monitoring (Fall 2005)

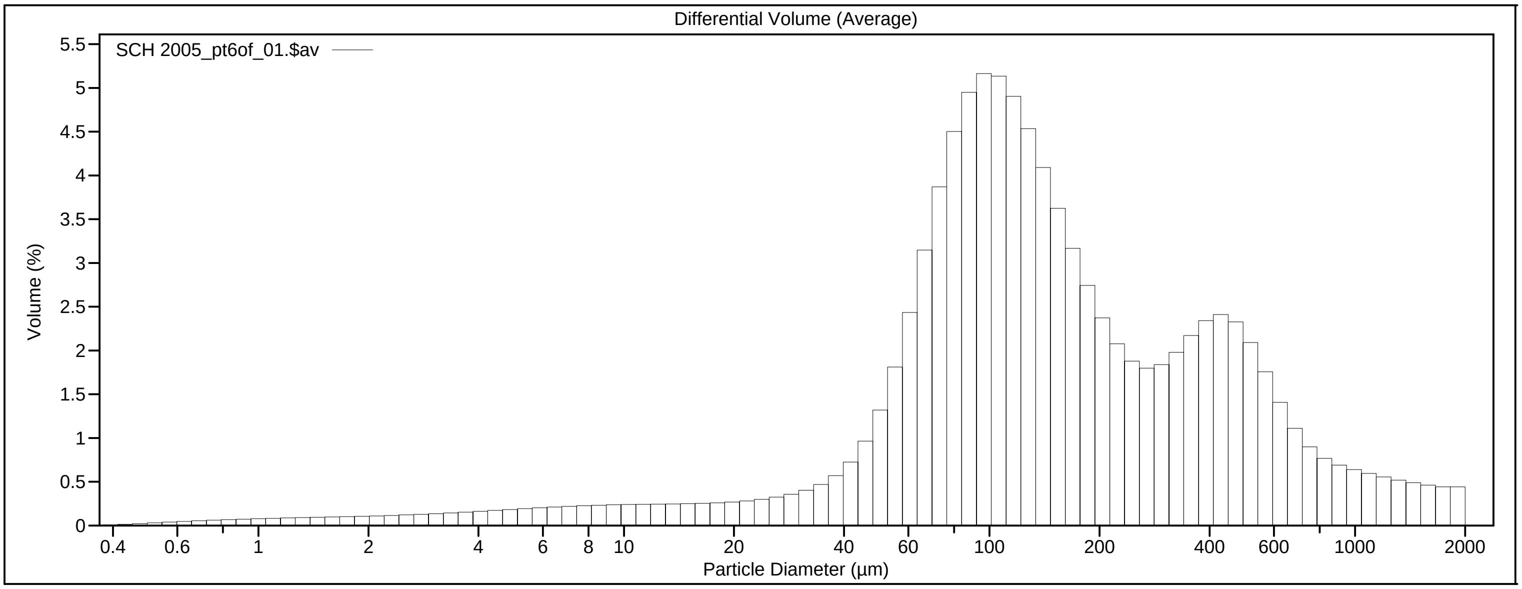
File name:	C:\LS13320\SCH-2005-6-grain-size\Offshore-samples\SCH 2005_pt6of_01.$av SCH 2005_pt6of_01.$av
Sample ID:	pt6off
Comment 1:	Collected 11-7-05
Comment 2:	Post-dredging
Optical model:	Fraunhofer.rf780z

Volume Statistics (Arithmetic) SCH 2005_pt6of_01.$av

Calculations from 0.375 µm to 2000 µm

Volume:	100%		
Mean:	244.1 µm	S.D.:	302.1 µm
Median:	127.7 µm	Variance:	91270 μm^2
Mean/Median ratio:	1.911	Skewness:	2.803 Right skewed
Mode:	96.49 µm	Kurtosis:	9.249 Leptokurtic

d_{10}: 45.62 µm d_{50}: 127.7 µm d_{90}: 565.5 µm



SCH 2005_pt6of_01.$av

Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %
0.375	0	7.422	3.42	146.8	56.4
0.412	0.0085	8.148	3.65	161.2	60.0
0.452	0.024	8.944	3.88	176.9	63.2
0.496	0.046	9.819	4.12	194.2	65.9
0.545	0.078	10.78	4.36	213.2	68.3
0.598	0.12	11.83	4.60	234.1	70.4
0.657	0.17	12.99	4.85	256.9	72.3
0.721	0.22	14.26	5.09	282.1	74.1
0.791	0.28	15.65	5.34	309.6	75.9
0.869	0.35	17.18	5.60	339.9	77.9
0.954	0.42	18.86	5.86	373.1	80.0
1.047	0.50	20.71	6.13	409.6	82.4
1.149	0.59	22.73	6.41	449.7	84.8
1.261	0.67	24.95	6.71	493.6	87.1
1.385	0.76	27.39	7.03	541.9	89.2
1.520	0.86	30.07	7.39	594.9	91.0
1.669	0.96	33.01	7.79	653.0	92.4
1.832	1.06	36.24	8.26	716.9	93.5
2.011	1.16	39.78	8.83	787.0	94.4
2.208	1.27	43.67	9.56	863.9	95.2
2.423	1.39	47.94	10.5	948.3	95.9
2.660	1.51	52.63	11.8	1041	96.5
2.920	1.64	57.77	13.7	1143	97.1
3.206	1.78	63.42	16.1	1255	97.6
3.519	1.92	69.62	19.2	1377	98.2
3.863	2.07	76.43	23.1	1512	98.7
4.241	2.24	83.90	27.6	1660	99.1
4.656	2.41	92.10	32.6	1822	99.6
5.111	2.59	101.1	37.7	2000	100
5.610	2.79	111.0	42.9		
6.159	2.99	121.8	47.8		
6.761	3.20	133.8	52.3		

LS Particle Size Analyzer

Santa Cruz Harbor Sediment Monitoring (Fall 2005)

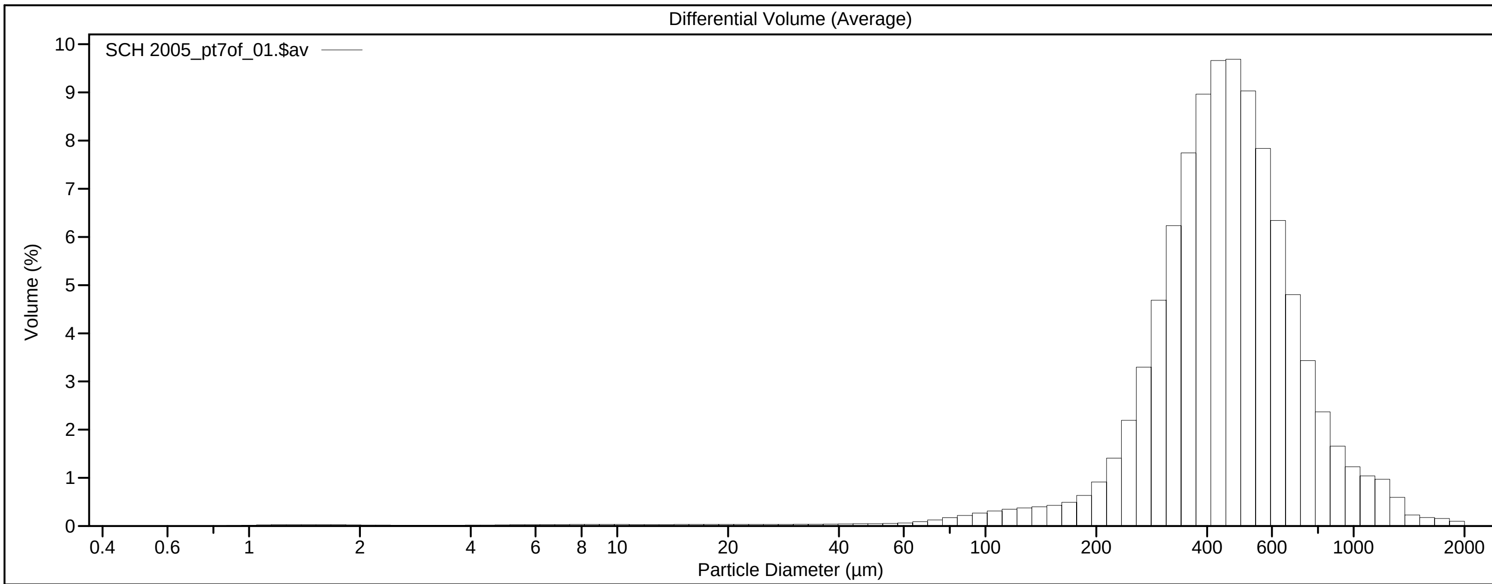
File name: C:\LS13320\SCH-2005-6-grain-size\Offshore-samples\SCH 2005_pt7of_01.$av
SCH 2005_pt7of_01.$av
Sample ID: pt7off
Comment 1: Collected 11-7-05
Comment 2: Post-dredging
Optical model: Fraunhofer.rf780z

Volume Statistics (Arithmetic) SCH 2005_pt7of_01.$av

Calculations from 0.375 µm to 2000 µm

Volume:	100%		
Mean:	486.2 µm	S.D.:	233.5 µm
Median:	448.3 µm	Variance:	54525 µm^2
Mean/Median ratio:	1.085	Skewness:	1.517 Right skewed
Mode:	471.1 µm	Kurtosis:	4.631 Leptokurtic

d_{10}: 258.9 µm d_{50}: 448.3 µm d_{90}: 756.9 µm



SCH 2005_pt7of_01.$av

Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %
0.375	0	7.422	0.51	146.8	3.68
0.412	0	8.148	0.54	161.2	4.11
0.452	0	8.944	0.58	176.9	4.60
0.496	0	9.819	0.61	194.2	5.23
0.545	0	10.78	0.64	213.2	6.15
0.598	0	11.83	0.67	234.1	7.55
0.657	0	12.99	0.70	256.9	9.75
0.721	0	14.26	0.74	282.1	13.0
0.791	0.00028	15.65	0.77	309.6	17.7
0.869	0.0039	17.18	0.80	339.9	24.0
0.954	0.015	18.86	0.83	373.1	31.7
1.047	0.033	20.71	0.87	409.6	40.7
1.149	0.055	22.73	0.90	449.7	50.3
1.261	0.081	24.95	0.93	493.6	60.0
1.385	0.11	27.39	0.97	541.9	69.1
1.520	0.14	30.07	1.00	594.9	76.9
1.669	0.16	33.01	1.04	653.0	83.2
1.832	0.19	36.24	1.07	716.9	88.0
2.011	0.21	39.78	1.11	787.0	91.5
2.208	0.23	43.67	1.16	863.9	93.8
2.423	0.25	47.94	1.21	948.3	95.5
2.660	0.27	52.63	1.25	1041	96.7
2.920	0.29	57.77	1.31	1143	97.8
3.206	0.30	63.42	1.37	1255	98.7
3.519	0.32	69.62	1.46	1377	99.3
3.863	0.34	76.43	1.59	1512	99.6
4.241	0.35	83.90	1.76	1660	99.7
4.656	0.38	92.10	1.98	1822	99.9
5.111	0.40	101.1	2.25	2000	100
5.610	0.43	111.0	2.56		
6.159	0.45	121.8	2.90		
6.761	0.48	133.8	3.28		

LS Particle Size Analyzer

Santa Cruz Harbor Sediment Monitoring (Fall 2005)

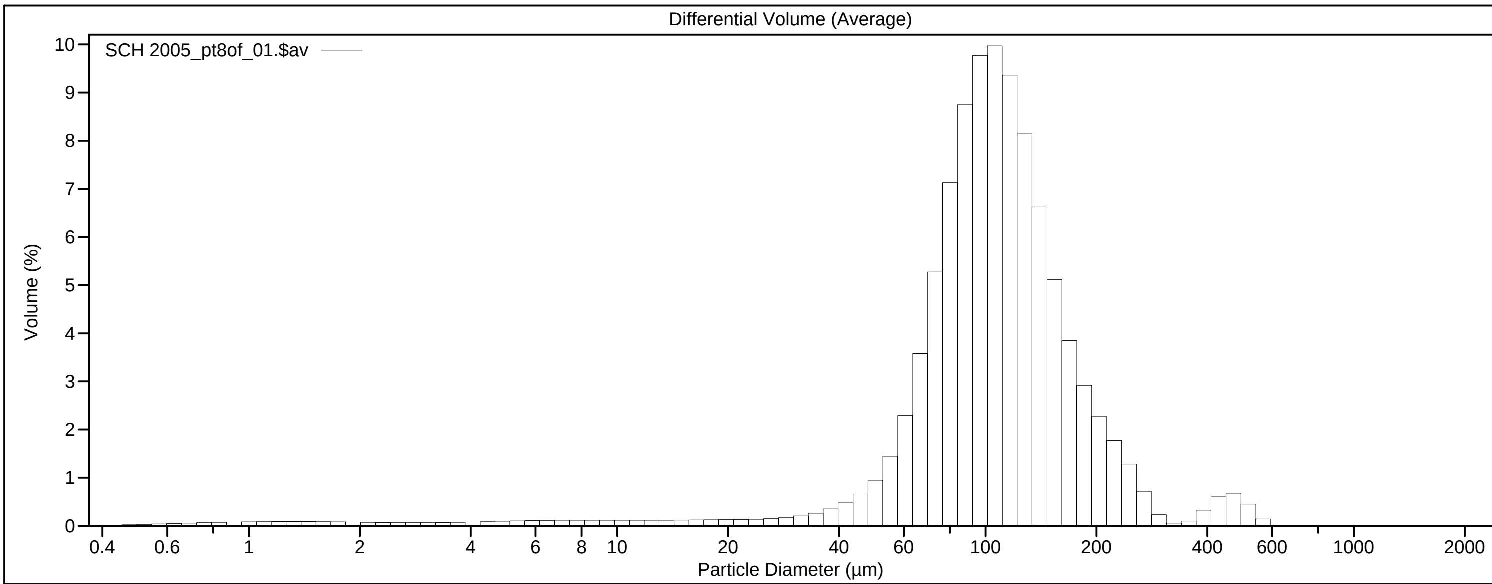
File name:	C:\LS13320\SCH-2005-6-grain-size\Offshore-samples\SCH 2005_pt8of_01.$av SCH 2005_pt8of_01.$av
Sample ID:	pt8off
Comment 1:	Collected 11-7-05
Comment 2:	Post-dredging
Optical model:	Fraunhofer.rf780z

Volume Statistics (Arithmetic) SCH 2005_pt8of_01.$av

Calculations from 0.375 µm to 2000 µm

Volume:	100%		
Mean:	119.0 µm	S.D.:	72.00 µm
Median:	105.7 µm	Variance:	5184 μm^2
Mean/Median ratio:	1.126	Skewness:	2.697 Right skewed
Mode:	105.9 µm	Kurtosis:	11.25 Leptokurtic

d_{10}: 61.30 µm d_{50}: 105.7 µm d_{90}: 186.2 µm



SCH 2005_pt8of_01.$av

Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %
0.375	0	7.422	2.31	146.8	79.5
0.412	0.0068	8.148	2.43	161.2	84.6
0.452	0.020	8.944	2.55	176.9	88.4
0.496	0.042	9.819	2.67	194.2	91.4
0.545	0.074	10.78	2.78	213.2	93.6
0.598	0.11	11.83	2.90	234.1	95.4
0.657	0.16	12.99	3.01	256.9	96.7
0.721	0.22	14.26	3.13	282.1	97.4
0.791	0.29	15.65	3.25	309.6	97.6
0.869	0.36	17.18	3.37	339.9	97.7
0.954	0.44	18.86	3.50	373.1	97.8
1.047	0.52	20.71	3.63	409.6	98.1
1.149	0.61	22.73	3.76	449.7	98.7
1.261	0.70	24.95	3.90	493.6	99.4
1.385	0.79	27.39	4.05	541.9	99.8
1.520	0.88	30.07	4.22	594.9	99.99
1.669	0.96	33.01	4.42	653.0	100
1.832	1.05	36.24	4.68	716.9	100
2.011	1.13	39.78	5.04	787.0	100
2.208	1.20	43.67	5.52	863.9	100
2.423	1.27	47.94	6.18	948.3	100
2.660	1.34	52.63	7.12	1041	100
2.920	1.40	57.77	8.57	1143	100
3.206	1.47	63.42	10.9	1255	100
3.519	1.54	69.62	14.4	1377	100
3.863	1.61	76.43	19.7	1512	100
4.241	1.69	83.90	26.8	1660	100
4.656	1.78	92.10	35.6	1822	100
5.111	1.87	101.1	45.4	2000	100
5.610	1.97	111.0	55.3		
6.159	2.08	121.8	64.7		
6.761	2.20	133.8	72.8		

LS Particle Size Analyzer

Santa Cruz Harbor Sediment Monitoring (Fall 2005)

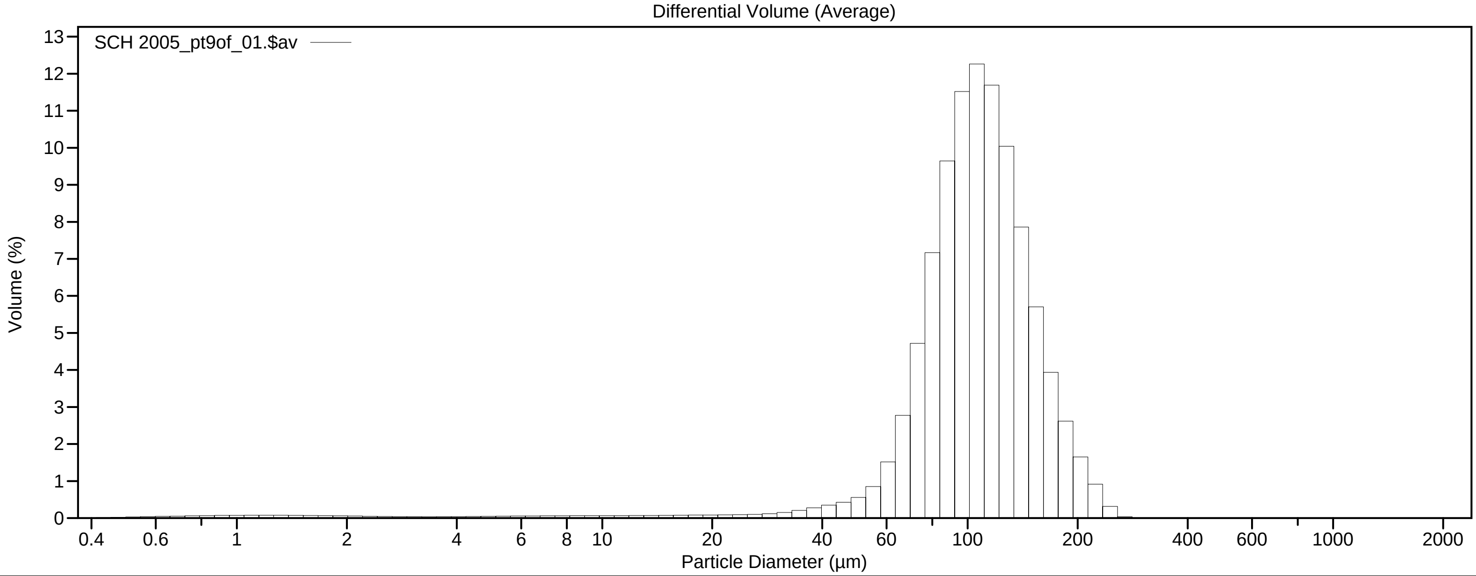
File name:	C:\LS13320\SCH-2005-6-grain-size\Offshore-samples\SCH 2005_pt9of_01.$av SCH 2005_pt9of_01.$av
Sample ID:	pt9off
Comment 1:	Collected 11-7-05
Comment 2:	Post-dredging
Optical model:	Fraunhofer.rf780z

Volume Statistics (Arithmetic) SCH 2005_pt9of_01.$av

Calculations from 0.375 µm to 2000 µm

Volume:	100%		
Mean:	110.1 µm	S.D.:	39.05 µm
Median:	106.8 µm	Variance:	1525 µm^2
Mean/Median ratio:	1.031	Skewness:	0.259 Right skewed
Mode:	105.9 µm	Kurtosis:	1.129 Leptokurtic

d_{10}: 69.74 µm d_{50}: 106.8 µm d_{90}: 159.8 µm



SCH 2005_pt9of_01.$av

Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %
0.375	0	7.422	1.64	146.8	84.8
0.412	0.0066	8.148	1.70	161.2	90.5
0.452	0.019	8.944	1.76	176.9	94.5
0.496	0.041	9.819	1.83	194.2	97.1
0.545	0.071	10.78	1.89	213.2	98.7
0.598	0.11	11.83	1.96	234.1	99.7
0.657	0.16	12.99	2.02	256.9	99.97
0.721	0.21	14.26	2.09	282.1	99.999
0.791	0.27	15.65	2.17	309.6	100
0.869	0.34	17.18	2.25	339.9	100
0.954	0.41	18.86	2.33	373.1	100
1.047	0.48	20.71	2.41	409.6	100
1.149	0.56	22.73	2.50	449.7	100
1.261	0.64	24.95	2.59	493.6	100
1.385	0.72	27.39	2.69	541.9	100
1.520	0.79	30.07	2.80	594.9	100
1.669	0.86	33.01	2.96	653.0	100
1.832	0.93	36.24	3.16	716.9	100
2.011	0.99	39.78	3.44	787.0	100
2.208	1.04	43.67	3.79	863.9	100
2.423	1.09	47.94	4.22	948.3	100
2.660	1.14	52.63	4.78	1041	100
2.920	1.18	57.77	5.63	1143	100
3.206	1.21	63.42	7.14	1255	100
3.519	1.25	69.62	9.92	1377	100
3.863	1.29	76.43	14.6	1512	100
4.241	1.33	83.90	21.8	1660	100
4.656	1.37	92.10	31.4	1822	100
5.111	1.41	101.1	43.0	2000	100
5.610	1.46	111.0	55.2		
6.159	1.52	121.8	66.9		
6.761	1.58	133.8	77.0		

LS Particle Size Analyzer

Santa Cruz Harbor Sediment Monitoring (Fall 2005)

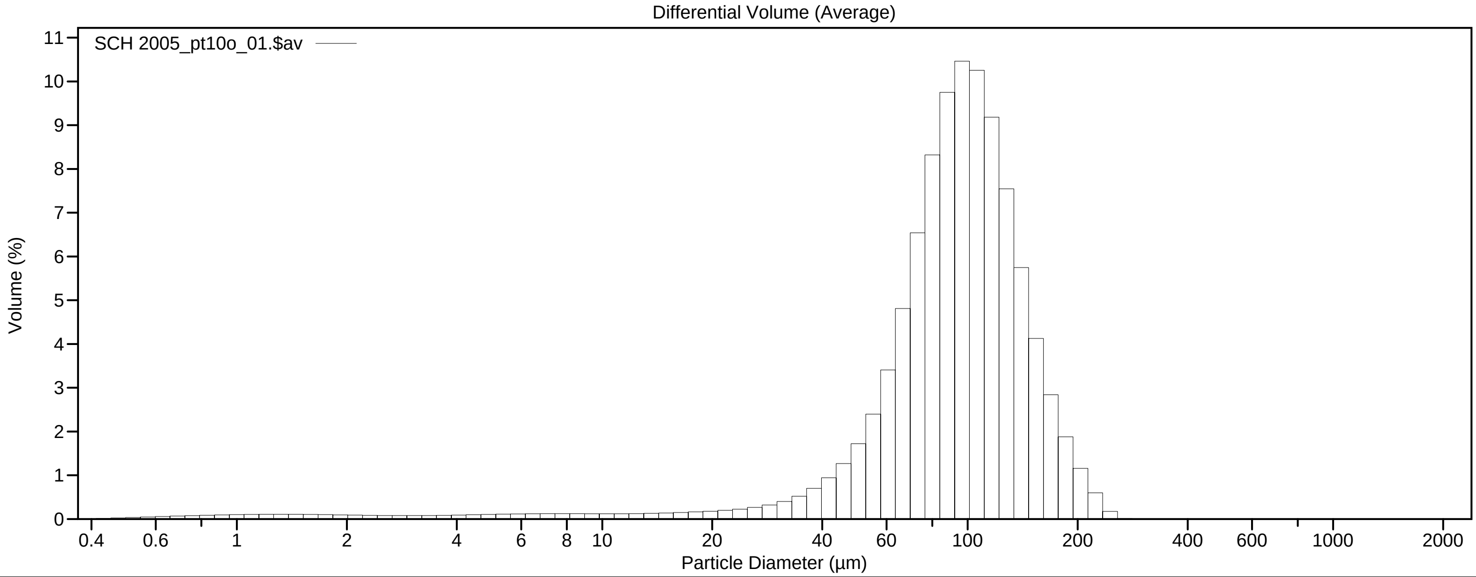
File name:	C:\LS13320\SCH-2005-6-grain-size\Offshore-samples\SCH 2005_pt10o_01.$av SCH 2005_pt10o_01.$av
Sample ID:	pt10off
Comment 1:	Collected 11-7-05
Comment 2:	Post-dredging
Optical model:	Fraunhofer.rf780z

Volume Statistics (Arithmetic) SCH 2005_pt10o_01.$av

Calculations from 0.375 µm to 2000 µm

Volume:	100%		
Mean:	97.64 µm	S.D.:	40.95 µm
Median:	95.53 µm	Variance:	1677 $µm^2$
Mean/Median ratio:	1.022	Skewness:	0.254 Right skewed
Mode:	96.49 µm	Kurtosis:	0.692 Leptokurtic

d_{10}: 50.49 µm d_{50}: 95.53 µm d_{90}: 149.6 µm



SCH 2005_pt10o_01.$av

Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %
0.375	0	7.422	2.71	146.8	89.2
0.412	0.0081	8.148	2.83	161.2	93.3
0.452	0.024	8.944	2.96	176.9	96.2
0.496	0.050	9.819	3.08	194.2	98.1
0.545	0.087	10.78	3.20	213.2	99.2
0.598	0.14	11.83	3.32	234.1	99.8
0.657	0.19	12.99	3.45	256.9	99.99
0.721	0.26	14.26	3.58	282.1	100
0.791	0.34	15.65	3.72	309.6	100
0.869	0.43	17.18	3.87	339.9	100
0.954	0.52	18.86	4.03	373.1	100
1.047	0.62	20.71	4.21	409.6	100
1.149	0.73	22.73	4.41	449.7	100
1.261	0.84	24.95	4.64	493.6	100
1.385	0.95	27.39	4.90	541.9	100
1.520	1.05	30.07	5.22	594.9	100
1.669	1.16	33.01	5.63	653.0	100
1.832	1.26	36.24	6.15	716.9	100
2.011	1.36	39.78	6.85	787.0	100
2.208	1.45	43.67	7.79	863.9	100
2.423	1.53	47.94	9.06	948.3	100
2.660	1.62	52.63	10.8	1041	100
2.920	1.70	57.77	13.2	1143	100
3.206	1.77	63.42	16.6	1255	100
3.519	1.85	69.62	21.4	1377	100
3.863	1.94	76.43	27.9	1512	100
4.241	2.03	83.90	36.3	1660	100
4.656	2.13	92.10	46.0	1822	100
5.111	2.23	101.1	56.5	2000	100
5.610	2.35	111.0	66.7		
6.159	2.46	121.8	75.9		
6.761	2.59	133.8	83.5		

LS Particle Size Analyzer

Santa Cruz Harbor Sediment Monitoring (Fall 2005)

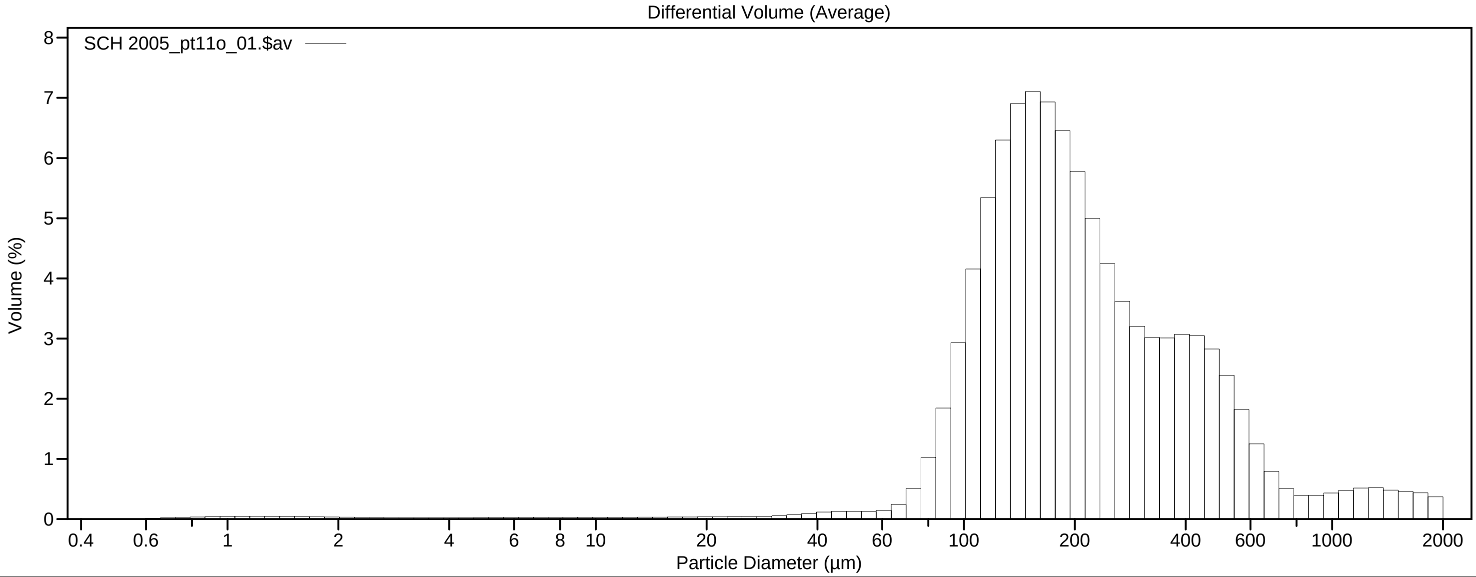
File name:	C:\LS13320\SCH-2005-6-grain-size\Offshore-samples\SCH 2005_pt11o_01.$av SCH 2005_pt11o_01.$av
Sample ID:	pt11off
Comment 1:	Collected 11-7-05
Comment 2:	Post-dredging
Optical model:	Fraunhofer.rf780z

Volume Statistics (Arithmetic) SCH 2005_pt11o_01.$av

Calculations from 0.375 µm to 2000 µm

Volume:	100%		
Mean:	278.6 µm	S.D.:	270.1 µm
Median:	189.0 µm	Variance:	72936 µm^2
Mean/Median ratio:	1.474	Skewness:	3.233 Right skewed
Mode:	153.8 µm	Kurtosis:	12.65 Leptokurtic

d_{10}: 104.1 µm d_{50}: 189.0 µm d_{90}: 518.6 µm



SCH 2005_pt11o_01.$av

Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %
0.375	0	7.422	0.83	146.8	31.5
0.412	0	8.148	0.86	161.2	38.6
0.452	0	8.944	0.89	176.9	45.5
0.496	0	9.819	0.92	194.2	51.9
0.545	0.00032	10.78	0.95	213.2	57.7
0.598	0.0046	11.83	0.98	234.1	62.7
0.657	0.018	12.99	1.01	256.9	67.0
0.721	0.039	14.26	1.04	282.1	70.6
0.791	0.068	15.65	1.07	309.6	73.8
0.869	0.10	17.18	1.11	339.9	76.8
0.954	0.14	18.86	1.14	373.1	79.8
1.047	0.19	20.71	1.18	409.6	82.9
1.149	0.23	22.73	1.22	449.7	85.9
1.261	0.28	24.95	1.26	493.6	88.8
1.385	0.33	27.39	1.30	541.9	91.2
1.520	0.37	30.07	1.34	594.9	93.0
1.669	0.41	33.01	1.40	653.0	94.2
1.832	0.45	36.24	1.47	716.9	95.0
2.011	0.48	39.78	1.56	787.0	95.5
2.208	0.51	43.67	1.68	863.9	95.9
2.423	0.54	47.94	1.81	948.3	96.3
2.660	0.57	52.63	1.94	1041	96.7
2.920	0.59	57.77	2.06	1143	97.2
3.206	0.61	63.42	2.21	1255	97.7
3.519	0.63	69.62	2.45	1377	98.3
3.863	0.65	76.43	2.95	1512	98.7
4.241	0.67	83.90	3.98	1660	99.2
4.656	0.70	92.10	5.82	1822	99.6
5.111	0.72	101.1	8.75	2000	100
5.610	0.75	111.0	12.9		
6.159	0.77	121.8	18.3		
6.761	0.80	133.8	24.6		

BECKMAN COULTER™

LS Particle Size Analyzer

Santa Cruz Harbor Sediment Monitoring (Fall 2005)

File name:	C:\LS13320\SCH-2005-6-grain-size\Offshore-samples\SCH 2005_pt12o_01.$av SCH 2005_pt12o_01.$av
Sample ID:	pt12off
Comment 1:	Collected 11-7-05
Comment 2:	Post-dredging
Optical model:	Fraunhofer.rf780z

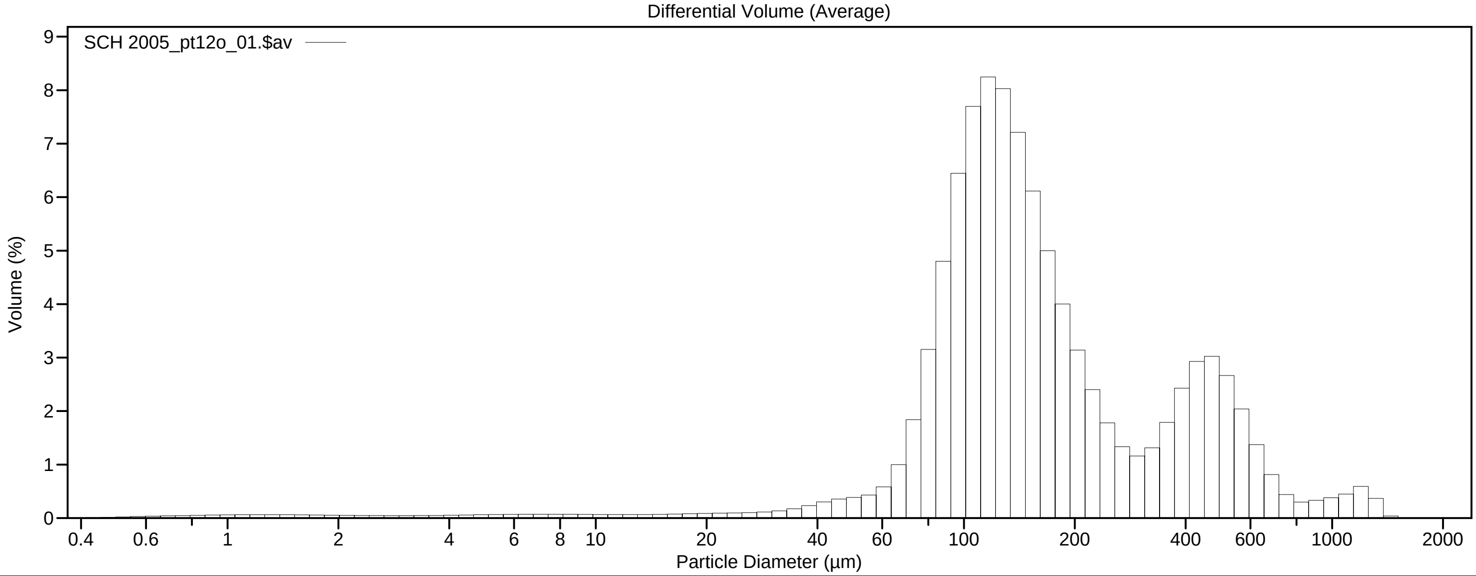
Volume Statistics (Arithmetic) SCH 2005_pt12o_01.$av

Calculations from 0.375 µm to 2000 µm

Volume:	100%		
Mean:	219.4 µm	S.D.:	205.2 µm
Median:	140.0 µm	Variance:	42097 µm^2
Mean/Median ratio:	1.568	Skewness:	2.472 Right skewed
Mode:	116.3 µm	Kurtosis:	7.545 Leptokurtic

d_{10}: 80.68 µm d_{50}: 140.0 µm d_{90}: 490.6 µm

Differential Volume (Average)



SCH 2005_pt12o_01.$av

Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %
0.375	0	7.422	1.57	146.8	53.8
0.412	0.0049	8.148	1.65	161.2	59.9
0.452	0.014	8.944	1.72	176.9	64.9
0.496	0.030	9.819	1.79	194.2	68.9
0.545	0.053	10.78	1.85	213.2	72.0
0.598	0.081	11.83	1.92	234.1	74.4
0.657	0.12	12.99	1.98	256.9	76.2
0.721	0.16	14.26	2.05	282.1	77.6
0.791	0.20	15.65	2.12	309.6	78.7
0.869	0.25	17.18	2.19	339.9	80.0
0.954	0.31	18.86	2.27	373.1	81.8
1.047	0.37	20.71	2.36	409.6	84.3
1.149	0.43	22.73	2.45	449.7	87.2
1.261	0.49	24.95	2.55	493.6	90.2
1.385	0.56	27.39	2.65	541.9	92.9
1.520	0.62	30.07	2.76	594.9	94.9
1.669	0.68	33.01	2.90	653.0	96.3
1.832	0.74	36.24	3.07	716.9	97.1
2.011	0.79	39.78	3.30	787.0	97.5
2.208	0.84	43.67	3.61	863.9	97.8
2.423	0.89	47.94	3.96	948.3	98.2
2.660	0.94	52.63	4.35	1041	98.5
2.920	0.98	57.77	4.78	1143	99.0
3.206	1.03	63.42	5.36	1255	99.6
3.519	1.08	69.62	6.36	1377	99.96
3.863	1.12	76.43	8.20	1512	100
4.241	1.18	83.90	11.4	1660	100
4.656	1.23	92.10	16.2	1822	100
5.111	1.30	101.1	22.6	2000	100
5.610	1.36	111.0	30.3		
6.159	1.43	121.8	38.6		
6.761	1.50	133.8	46.6		

LS Particle Size Analyzer

Santa Cruz Harbor Sediment Monitoring (Fall 2005)

File name:	C:\LS13320\SCH-2005-6-grain-size\Offshore-samples\SCH 2005_pt13o_01.$av SCH 2005_pt13o_01.$av
Sample ID:	pt13off
Comment 1:	Collected 11-7-05
Comment 2:	Post-dredging
Optical model:	Fraunhofer.rf780z

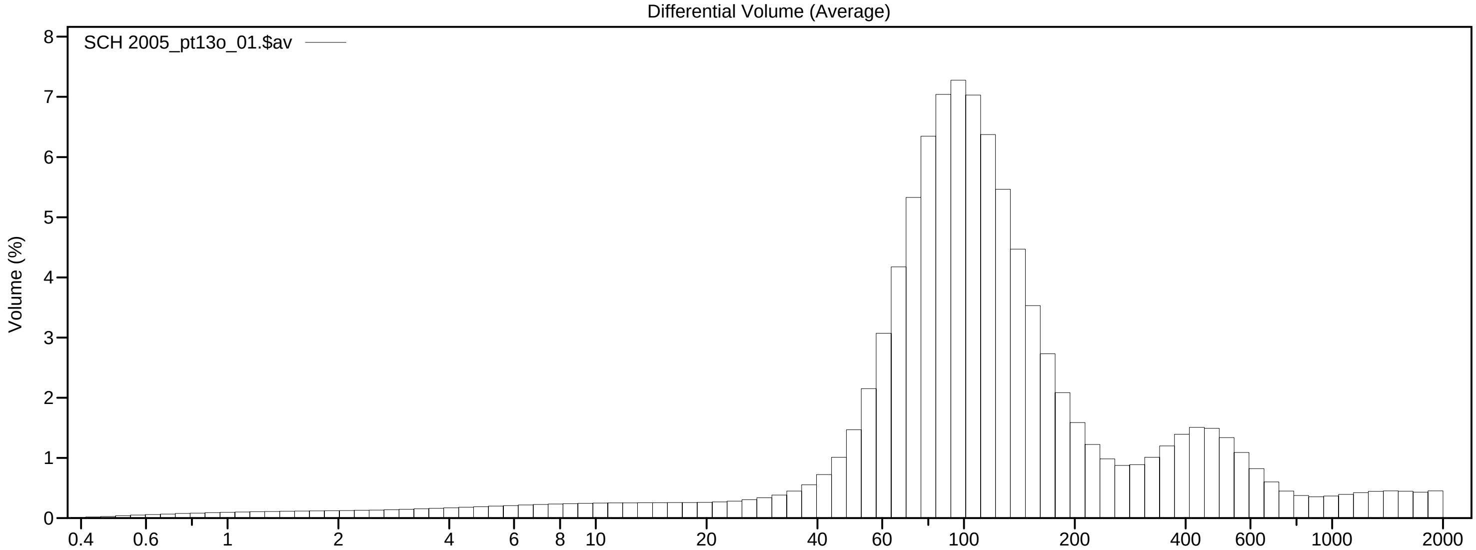
Volume Statistics (Arithmetic) SCH 2005_pt13o_01.$av

Calculations from 0.375 µm to 2000 µm

Volume:	100%		
Mean:	193.2 µm	S.D.:	279.6 µm
Median:	104.3 µm	Variance:	78193 µm^2
Mean/Median ratio:	1.853	Skewness:	3.650 Right skewed
Mode:	96.49 µm	Kurtosis:	15.05 Leptokurtic

d_{10}: 44.32 µm d_{50}: 104.3 µm d_{90}: 447.8 µm

Differential Volume (Average)



SCH 2005_pt13o_01.$av

Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %
0.375	0	7.422	3.78	146.8	71.1
0.412	0.010	8.148	4.02	161.2	74.6
0.452	0.029	8.944	4.26	176.9	77.3
0.496	0.056	9.819	4.50	194.2	79.4
0.545	0.095	10.78	4.75	213.2	81.0
0.598	0.14	11.83	5.00	234.1	82.2
0.657	0.20	12.99	5.26	256.9	83.2
0.721	0.27	14.26	5.51	282.1	84.1
0.791	0.35	15.65	5.77	309.6	85.0
0.869	0.43	17.18	6.03	339.9	86.0
0.954	0.52	18.86	6.28	373.1	87.2
1.047	0.62	20.71	6.54	409.6	88.6
1.149	0.72	22.73	6.81	449.7	90.1
1.261	0.82	24.95	7.10	493.6	91.6
1.385	0.93	27.39	7.40	541.9	92.9
1.520	1.05	30.07	7.74	594.9	94.0
1.669	1.16	33.01	8.12	653.0	94.8
1.832	1.28	36.24	8.57	716.9	95.4
2.011	1.40	39.78	9.12	787.0	95.9
2.208	1.53	43.67	9.85	863.9	96.2
2.423	1.66	47.94	10.9	948.3	96.6
2.660	1.79	52.63	12.3	1041	97.0
2.920	1.93	57.77	14.5	1143	97.3
3.206	2.08	63.42	17.5	1255	97.8
3.519	2.23	69.62	21.7	1377	98.2
3.863	2.39	76.43	27.1	1512	98.7
4.241	2.56	83.90	33.4	1660	99.1
4.656	2.74	92.10	40.4	1822	99.5
5.111	2.93	101.1	47.7	2000	100
5.610	3.13	111.0	54.7		
6.159	3.34	121.8	61.1		
6.761	3.56	133.8	66.6		

LS Particle Size Analyzer

Santa Cruz Harbor Sediment Monitoring (Fall 2005)

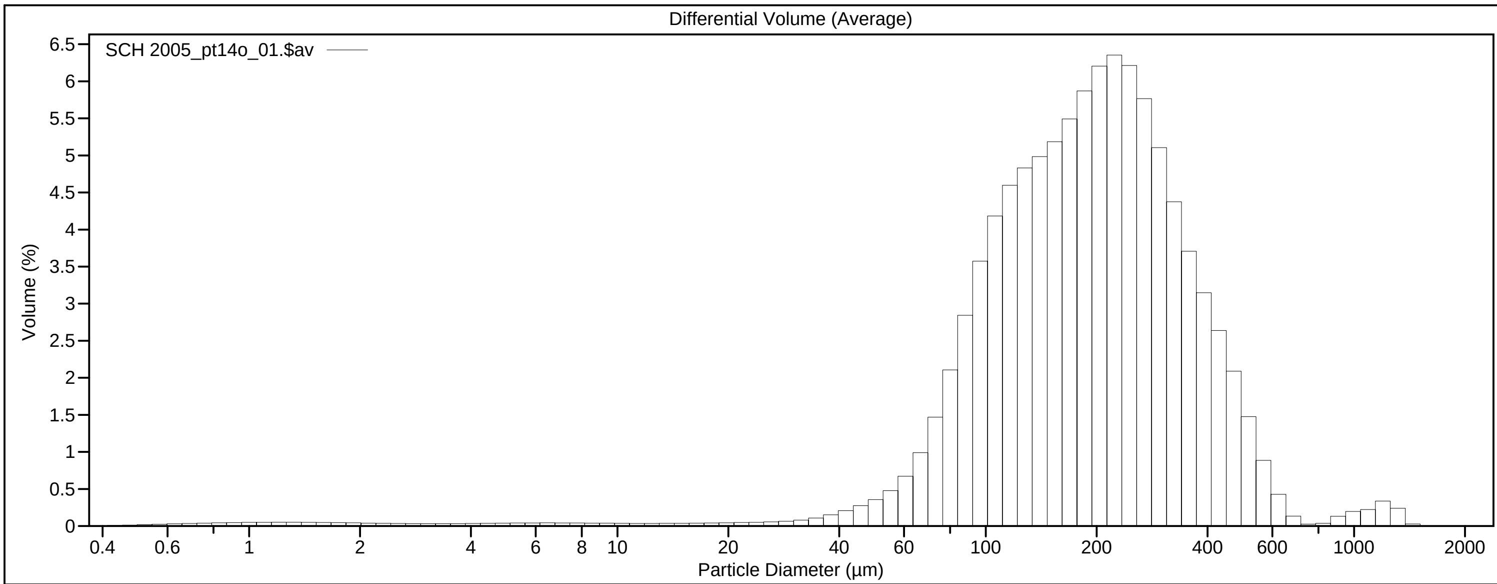
File name:	C:\LS13320\SCH-2005-6-grain-size\Offshore-samples\SCH 2005_pt14o_01.$av SCH 2005_pt14o_01.$av
Sample ID:	pt14off
Comment 1:	Collected 11-7-05
Comment 2:	Post-dredging
Optical model:	Fraunhofer.rf780z

Volume Statistics (Arithmetic) SCH 2005_pt14o_01.$av

Calculations from 0.375 µm to 2000 µm

Volume:	100%		
Mean:	225.2 µm	S.D.:	155.8 µm
Median:	193.5 µm	Variance:	24265 µm^2
Mean/Median ratio:	1.164	Skewness:	2.820 Right skewed
Mode:	223.4 µm	Kurtosis:	13.93 Leptokurtic

d_{10}: 87.65 µm d_{50}: 193.5 µm d_{90}: 396.5 µm



SCH 2005_pt14o_01.$av

Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %	Channel Diameter (Lower) µm	Cum. < Volume %
0.375	0	7.422	1.17	146.8	33.7
0.412	0.0043	8.148	1.21	161.2	38.9
0.452	0.013	8.944	1.25	176.9	44.4
0.496	0.026	9.819	1.29	194.2	50.3
0.545	0.046	10.78	1.32	213.2	56.5
0.598	0.070	11.83	1.36	234.1	62.8
0.657	0.10	12.99	1.39	256.9	69.0
0.721	0.13	14.26	1.43	282.1	74.8
0.791	0.17	15.65	1.46	309.6	79.9
0.869	0.22	17.18	1.50	339.9	84.3
0.954	0.26	18.86	1.55	373.1	88.0
1.047	0.31	20.71	1.59	409.6	91.1
1.149	0.36	22.73	1.64	449.7	93.8
1.261	0.41	24.95	1.69	493.6	95.9
1.385	0.46	27.39	1.74	541.9	97.3
1.520	0.51	30.07	1.81	594.9	98.2
1.669	0.56	33.01	1.89	653.0	98.6
1.832	0.61	36.24	2.00	716.9	98.8
2.011	0.65	39.78	2.15	787.0	98.8
2.208	0.69	43.67	2.35	863.9	98.8
2.423	0.73	47.94	2.63	948.3	99.0
2.660	0.76	52.63	2.98	1041	99.2
2.920	0.79	57.77	3.46	1143	99.4
3.206	0.83	63.42	4.13	1255	99.7
3.519	0.86	69.62	5.12	1377	99.97
3.863	0.89	76.43	6.59	1512	100
4.241	0.93	83.90	8.70	1660	100
4.656	0.96	92.10	11.5	1822	100
5.111	1.00	101.1	15.1	2000	100
5.610	1.04	111.0	19.3		
6.159	1.08	121.8	23.9		
6.761	1.12	133.8	28.7		