FINAL REPORT

High School Coastal Monitoring Program, Year 2: A Pilot Project in Education, Public Awareness, and Coastal Management

Ball High School, Galveston, Texas, 1998/1999

James C. Gibeaut, Roberto Gutierrez, Ade Agbe*

*Ball High School
4115 Avenue O
Galveston, Texas 77550

A Report of the Texas Coastal Coordination Council pursuant to National Oceanic and Atmospheric Administration Award No. NA770Z0202

Funding for the Texas High School Coastal Monitoring Program is provided by the Texas Coastal Coordination Council, Conoco, and the Exxon Foundation

Bureau of Economic Geology
Noel Tyler, Director
The University of Texas at Austin
Austin, Texas 78713-8924

August 1999

CONTENTS

INTRODUCTION

The Texas Coastal Monitoring Program engages people who live along the coast in the study of their natural environment. High school students, teachers, and scientists work together to gain a better understanding of dune and beach dynamics on the Texas coast. Scientists from The University of Texas at Austin (UT) provide the tools and training needed for scientific investigation. Students and teachers learn how to measure the topography, map the vegetation line and shoreline, and observe weather and wave conditions. By participating in an actual research project, the students obtain an enhanced science education. Public awareness of coastal processes and the Texas Coastal Management Program is heightened through this program. The students' efforts also provide coastal communities with valuable data on their changing shoreline.

This report describes the program and our experiences during the second year at Ball High School on Galveston Island, Texas (Fig. 1). Discussions of the data collected by the students and recommendations for future high school projects are also included. A manual with detailed field procedures, field forms, classroom exercises, and teaching materials was prepared during the first year and revised during the second year. A full-color poster describing the project was also developed during the first year and revised during the second year. A major addition to the program this year is the web site (http://www.utexas.edu/research/beg/thscmp/index.html).

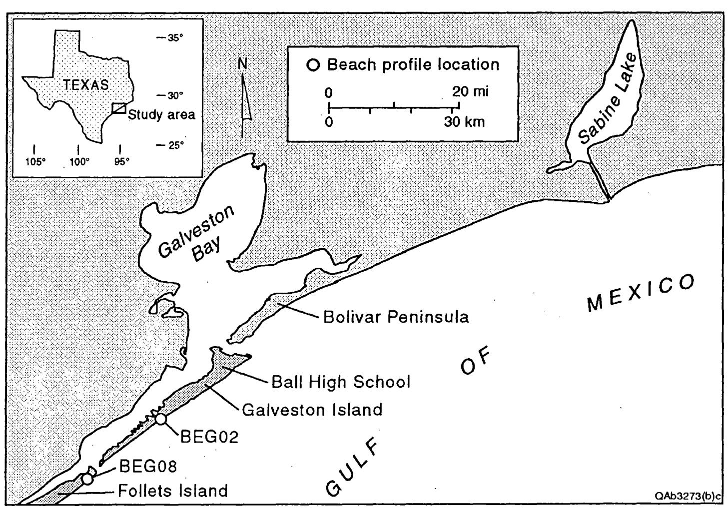


Figure 1. Study area.

PROGRAM DESCRIPTION

Goals

The coastal monitoring program has three major goals:

(1) Provide high school students with an inquiry-based learning experience.

Students make several field trips to their study sites during the school year. Working in teams, they conduct topographic surveys (beach profiles) of the foredune and beach, map the vegetation line and shoreline, collect sediment samples, and observe weather and wave conditions. Back in the classroom, students analyze their data and look for relationships among the observed phenomena. UT scientists provide background information and guide inquiries about the data, but students are encouraged to form their own hypotheses and to test them. Through their collaboration with working scientists on an actual research project, the students gain an enhanced science education.

(2) Increase public awareness and understanding of coastal processes and hazards.

We expect that the participating students will discuss the program with their parents, classmates, and neighbors, further expanding the reach of the program. We expect the program to attract media attention as well. A World Wide Web site (http://www.utexas.edu/research/beg/thscmp/index.html) containing the latest information is central to the community outreach portion of the project. Coastal residents may wish to view the effects of a storm that strikes the upper coast. They will be able to do so by accessing the Texas Coastal Monitoring Program web site to view maps, graphs, and photographs collected by Ball High School. Curiosity may drive this inquiry at first, but eventually there is an increased awareness and appreciation of coastal processes and how future storms could affect one's community.

(3) Obtain a better understanding of the relationship between coastal processes, beach morphology, and shoreline change and make data and findings available for solving coastal management problems.

The Bureau of Economic Geology (Bureau) at UT has conducted a 30-year research program to monitor shorelines and investigate coastal processes. An important part of this program is the repeated mapping of the shoreline and measurement of beach profiles. Over time, these data are used to determine the rate of shoreline change. A problem we face is the limited temporal resolution in our shoreline data. The beach is a dynamic environment where significant changes in shape and sand volume can occur over periods of days or even hours. Tides, storms, and seasonal wind patterns cause large, periodic or quasi-periodic changes in the shape of the beach. If coastal data are not collected often enough, periodic variations in beach morphology could be misinterpreted as secular changes. The High School Coastal Monitoring Program helps address this problem by providing scientific data at key locations along the Texas coast. These data are integrated into the ongoing coastal research program at the Bureau and are made available to other researchers and coastal managers.

Methods

The central element in the high school monitoring program is at least three class field trips during the academic year. During each trip, students visit several locations and apply scientific procedures to measure beach morphology and make observations on beach, weather, and wave conditions. These procedures were developed during the program's pilot year (1997/98) and are presented in detail in a manual that also includes field forms. Following is a general discussion of the field measurements.

(1) Beach profile

Students use a pair of Emery rods, a metric tape, and a hand level to accurately survey a shore-normal beach profile from the foredunes to the waterline. The students begin the profile at a presurveyed datum stake so that they can compare each new profile with earlier profiles. Consistently oriented photographs are taken with a digital camera. The beach profiles provide detailed data on the volume of sand and the shape of the beach.

(2) *Shoreline mapping*

Using a differential Global Positioning System (GPS) receiver, students walk along the vegetation line and shoreline mapping these features for display on Geographic Information System software. The GPS mapping provides measurements of the rate of shoreline change.

(3) *Sediment sampling*

Students take sediment samples along the beach profile at the foredune crest, berm top, and beach face. They then sieve the samples, weigh the grain-size fractions, and inspect the grains using a microscope. These samples show the dependence of sand characteristics on the various processes acting on the beach.

(4) *Beach processes*

Students measure wind speed and direction, estimate the width of the surf zone, and observe the breaker type. They note the wave direction, height, and period and estimate the longshore current speed and direction using a float, stop watch, and tape measure. From these measurements, students can infer relationships between physical processes and beach changes in time and space. Students also learn to obtain weather and oceanographic data from resources on the Internet.

Training

UT scientists provide the teachers with all the training, information, field forms, and equipment needed to conduct the field and lab measurements. During the school year, UT scientists accompany the students on at least one of the field trips and make at least two classroom visits. The classroom visits provide students with even more insight into conducting scientific research. The scientists discuss with the students general and theoretical issues regarding scientific research, as well as specific techniques and issues related to coastal research. The visits also provide the scientists with an opportunity to ensure the quality of the data.

Data Management, Data Analysis, and Dissemination of Information

The World Wide Web is central to the dissemination of data collected for this program. A web site, which resides on a UT server, was implemented toward the end of the 1998/1999 school year. The web site provides all the information needed to begin a beach monitoring program, as well as curriculum materials for high school teachers. Each school in the program has an area on the web site to post its data and observations, including photos taken by an electronic camera. UT scientists manage the data in an electronic data base and make it available to the public. UT scientists also evaluate the data in light of coastal management problems.

STUDENT, TEACHER, AND SCIENTIST INTERACTIONS

UT scientists, Drs. Gibeaut and Gutierrez, worked with Ms. Cain and Dr. Agbe of Ball High School in developing and conducting the project. Ms. Cain is the head of the Science Department at Ball High School and Dr. Agbe is the Marine Science teacher. UT scientists worked directly with one of Dr. Agbe's Aquatic Sciences classes, which had 18 students in the 11th and 12th grades. This class was deemed an "enhanced" class. The class did not carry an official "honors" or "advanced placement" designation, but the students chose this particular class to receive enhanced instruction.

Because this was the second year of the project at Ball High and Dr. Agbe was involved in the first year, less time was required for equipment set-up and teacher training. On October 6, 1998, Dr. Gibeaut presented a lecture introducing the program to the students. On October 22, Drs. Gibeaut and Gutierrez conducted field training for the students and teacher, and the students made a full set of beach measurements at two locations, one at Galveston Island State Park and another on the north end of Follets Island. The students made two more field trips to these locations during the academic year, one on December 3, 1998, and the last one on March 2, 1999. Dr. Gibeaut accompanied the class on these trips. Other instructional stops, such as on the west end of the Galveston Seawall and critically eroding subdivisions, were made during the field trips. In addition to the beach monitoring program trips, on December 7 and 9, Dr. Gibeaut and Ms. Amy Neuenschwander (UT) presented lectures and conducted a field trip on applying remote-sensing techniques to environmental analysis. During and after field trips and during lectures, UT scientists discussed careers in science and university life with students. These visits by UT scientists, then, served not only to enhance scientific instruction at Ball High, but also to give students insight into science as a career.

During the field trips, the students were divided into two teams. One team measured the profile and took sediment samples while the other team collected data on the weather and waves and conducted a GPS survey of the shoreline and vegetation line. Team members had specific tasks, and students took turns performing them. After each team completed its tasks at the first location, the teams switched roles so that everyone would have an opportunity to conduct all measurements.

Dividing students into two five- to seven-member teams, one that conducts the profile and sediment sampling and the other that measures the processes and the shoreline, works well. Each team finishes at about the same time, although for short profiles, the profiling team may finish early. In this case, an extra task can be assigned to the profiling team. It is important to assign each student a job to keep him or her focused and interested. Time for a little fun should also be allowed. People normally think of the beach as a place of recreation, and participation in this project should not change that. In fact, it is hoped that program participants will enjoy going to the beach even more because of their newly acquired knowledge and observation skills.

It was originally planned that the students would measure four profiles on each field trip. Although it may be possible to visit four locations and return by the end of the school day (2:30), it is clear that this is too much work for the students. Little time would be allowed for lunch, and the quality of the data and learning experience for the students would suffer. Furthermore, managing and analyzing data from four profiles would require more time in the classroom than is available. It was therefore decided to measure two locations during each trip. Doing so allows ample time for careful data collection and gets the students back to school about 1 hour before the end of the day. During this hour, equipment and samples are stored, and data are filed or transferred to the computer.

EFFECTS ON SCIENCE CURRICULUM

The Texas High School Coastal Monitoring Program addresses several requirements of Texas Essential Knowledge and Skills (TEKS) for science. The program was relevant in the following 1998/1999 Texas high school courses: (1) Environmental Systems; (2) Aquatic Science; and (3) Geology, Meteorology, and Oceanography. TEKS related to applying scientific methods in field and laboratory investigations in these courses are well covered in the Coastal Monitoring Program. Specific requirements, such as (1) collecting data and making measurements with precision, (2) analyzing data using mathematical methods, (3) evaluating data and identifying trends, and (4) planning and implementing investigative procedures, are an excellent fit with the program. TEKS that require students to use critical thinking and scientific problem solving to make informed decisions are also well served. Teachers and scientists can use the program to illustrate to students the role science could, should, or does play in developing public policy. A case study of a local erosion problem could be used to illustrate.

Interviews with the students at the end of the school year revealed that the students

(1) were pleased with the independent work and critical thinking the project promoted,

(2) felt that they could accommodate three field trips per year without letting their other academic work suffer,

(3) were very pleased with the web site, which was unveiled at the end of the year, and would like to use the Internet for further learning,

(4) would like to use computer techniques for profile analysis instead of manual plotting,

(5) seemed to be especially interested in the Global Positioning System receiver and would like more instruction on and access to this instrument, and

(6) thought sand-size analysis techniques in the lab were tedious and difficult with the sieving equipment provided.

With the advent of the web site, students next year will gain more experience on the Web. We will implement data entry and plotting through the web site, thus addressing points 3 and 4. As for point 5, we intend to provide more formal instruction on the Global Positioning System, possibly including a lab exercise independent of the beach measurements. This exercise would also include the basics of map making and incorporating GPS data into mapping software. The low-cost sieving equipment apparently hinders the sand-size-analysis exercise. We are considering seeking funds for more sophisticated mechanical sieving equipment and possibly installing a settling tube. We are also considering reducing the number of sand samples acquired and analyzed by the students.

Probably because of the field trips, some animosity was reported among the students in classes not chosen to participate in the beach-monitoring program. The Galveston Independent School District would like to see the program expanded to all environmental-system classes, and we will work with the science teacher next year to see how we can include more students in the program.

EFFECTS ON SCIENTIFIC RESEARCH, COASTAL MANAGEMENT, AND PUBLIC AWARENESS

During the 1998/1999 academic year, Ball High School students measured a profile at a location in Galveston Island State Park (BEG02, Fig. 1) three times. They also measured a profile on Follets Island to the southwest of Galveston Island (BEG08, Fig. 1) three times. Ball High School students had measured these same locations the previous year, and the Bureau had conducted quarterly surveys at these locations from 1983 through 1985 after Hurricane Alicia. Since 1985, however, the beaches had been surveyed on an irregular schedule about once per year and only when specific projects were funded to do so or when Bureau personnel were in the area conducting other work. The High School Beach Monitoring Program helps ensure that the time series at these key locations are continued. The profiles and process data that the students collected have been incorporated into the beach-profile data base at the Bureau, and scientists are using these data to investigate beach erosion patterns in the area.

Although it will take time to incorporate the data into products that support coastal management, it is clear that the data will be useful in explaining beach cycles and defining short-term versus long-term trends. Defining these trends is important for making decisions regarding coastal development and beach nourishment. The program has increased public awareness through the students, but to date, the increase is mostly confined to the students' friends and families. The web site will be instrumental in extending the reach of the program to the public. During this second year, we implemented the web site, and we will expand and improve it next year. The program has also attracted the attention of the Texas Education Administration, and they will be filming students measuring the beach in the fall of 1999, further increasing public awareness of coastal processes.

Scientific Results of 1998/1999 Studies

Tropical Storm Frances struck the southeast Texas coast September 7 through 13, 1998, and caused extensive beach and dune erosion and damage to structures. The storm surge peaked at only 1.4 m above mean sea level, but extreme water levels (> .78 m) lasted for 64 hours. Although peak wave height was 4.09 m during the storm, extreme wave heights (>2.30 m) lasted for 73 hours. Beach-profile data collected by the students, along with data collected by the Bureau, quantify the storm erosion and initial poststorm recovery at BEG-02 and BEG-08 (see Appendices A and B for profile and volume plots).

The beaches at Galveston Island State Park (BEG-02, Fig. 1) lost 40 m^3 of sand per meter of shoreline during Frances. Before the storm, this beach had a prominent foredune and a smaller incipient foredune seaward of the foredune. These dunes were completely removed with a portion of the sand deposited landward (see profiles in Appendix A). The shoreline and vegetation line retreated landward 20 m during the storm. Recovery of the beach proceeded quickly, however, with a steady return of sand over the winter. By March 2, the beach had regained 92 percent of the volume eroded by Frances (see graphs in Appendix B). The shoreline also advanced steadily and regained its prestorm position over the winter. Also over the winter, however, the vegetation line moved only 6 m seaward and this advance was aided by a human-made artificial foredune that consists of washover sand bulldozed from the picnic area. The bulldozed washover sand also contributed to the volume recovery of the beach/dune system.

At BEG-08 on Follets Island (Fig. 1), Frances eroded 33 m^3/m of sand. The foredune was removed, leaving a former secondary dune as the foredune (see profiles in Appendix A). Only a small amount of washover sand was deposited through low areas in the former secondary dune. The shoreline retreated 23 m, and the vegetation line retreated 21 m. As at the state park, this beach began recovering soon after the storm, with one-half of the sand eroded returning by October 22, 6 weeks later (see graphs in Appendix B). By the end of the winter, the beach contained the same amount of sand as before the storm. The shoreline position began advancing seaward after the storm and by March had regained its prestorm position. The vegetation line has not moved from its prestorm position.

Even though most of the sand removed by Frances returned to the beaches during the following winter, the shapes of the beaches have not recovered. Dune formation and seaward advance of the vegetation line may take several years, and in some areas, the vegetation line may never return to its prestorm position before long-term erosion begins again. People are forming an artificial foredune at BEG-02, whereas the BEG-08 beach is natural. The human manipulation will have a significant impact on the beach recovery, and continued monitoring of BEG-02 and BEG-08 will provide insight into the processes of natural and enhanced poststorm beach recovery.

RECOMMENDATIONS

We consider the second year of the coastal monitoring program an overall success and offer the following recommendations for continuance and expansion of the program.

(1) Emphasize to the students that they are working on a real research project and are collecting scientifically valid data that will eventually appear in a scientific publication. This is a major point that makes this program different from most other field trips or laboratory exercises. Students' not being asked to conduct experiments that have no real consequence seems to make a difference to many students, and it probably improves the quality of the data.

(2) Clearly tell the students about the specific scientific problems being addressed, but also emphasize that what they are gaining in experience is not just how to measure beaches but how to conduct scientific field research in general. The students are also learning a different way to view their surroundings.

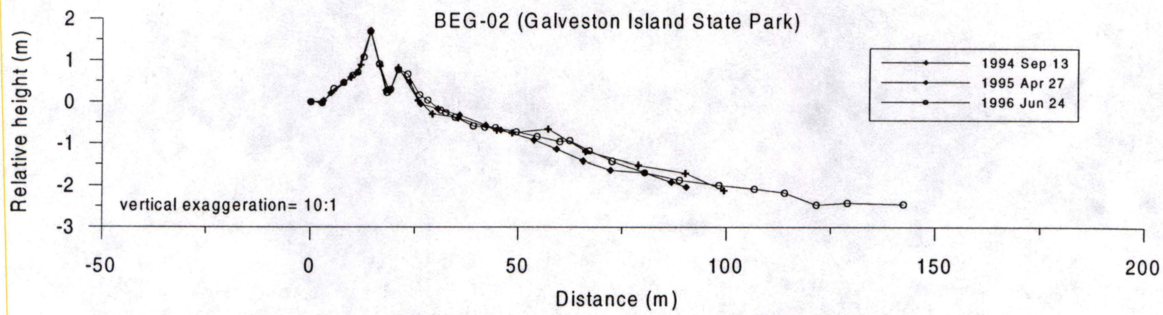
(3) Survey a reasonable number of beaches, which in most cases means two. The program goals of scientific research and science education could be at odds with one another. From a purely scientific point of view, it would be desirable to acquire as many data as possible. That approach, however, would not allow time for discussions on the beach that are not directly related to the measurements. It would also hinder the development of observation skills and keep the students from enjoying their work.

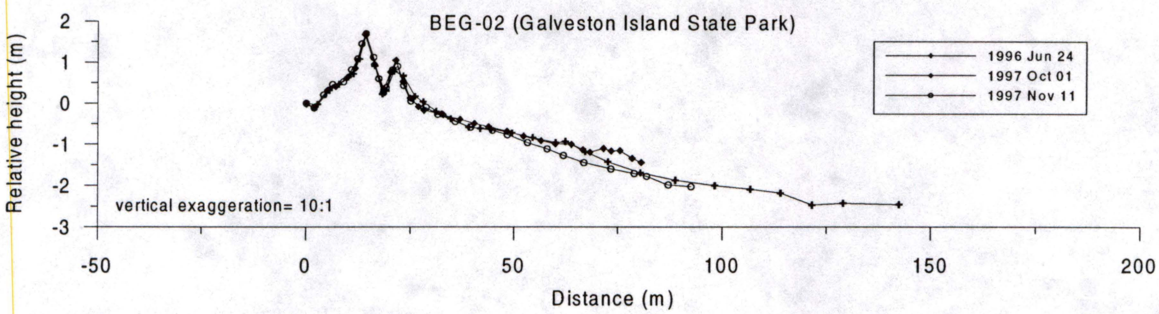
(4) The number of official field trips depends on the class, but a maximum of four trips is reasonable. Some students might be encouraged to make additional trips on weekends or after school. Interested students should be encouraged to use the program in a science fair project.

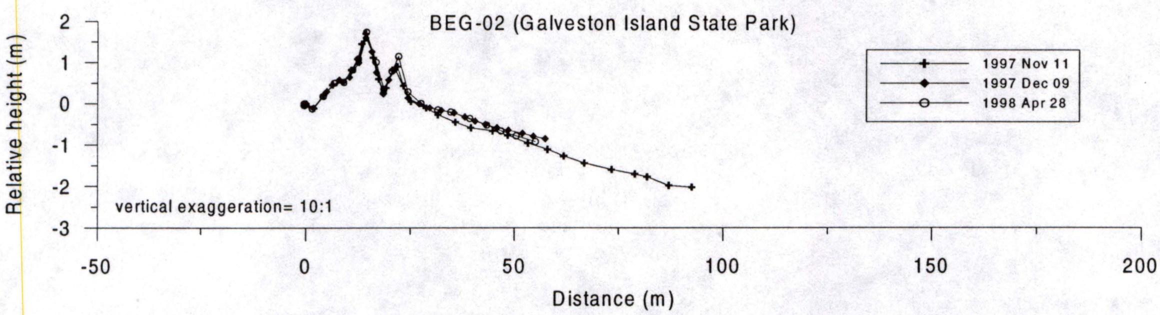
(5) When adding additional schools to the program, a 2- to 3-day seminar before the school year begins and including all the teachers is desirable. Instruction would be more efficient, and teachers and scientists would benefit by exchanging ideas.

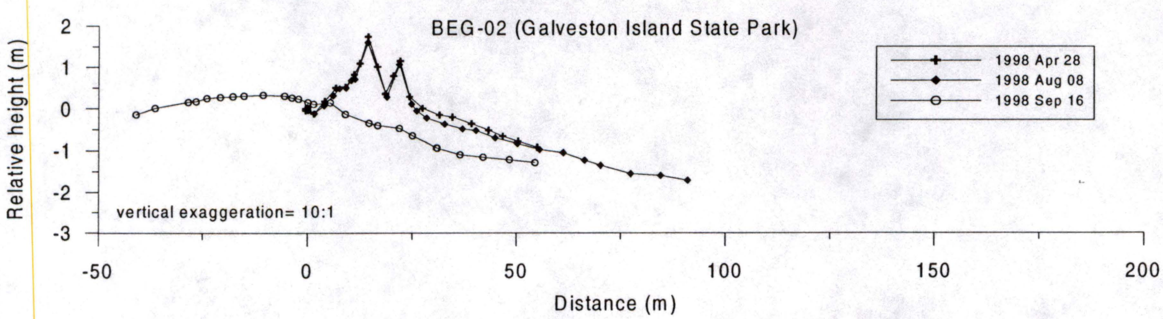
(6) A web site adds an important dimension to the project, especially when multiple schools are participating. A web site at which students can exchange observations with other schools in Texas will increase the educational value of the program by allowing students to observe differences in the processes acting along the coast. A web site would also introduce the Internet to students and illustrate how it can be used to conduct research. Furthermore, the Internet is important in increasing public awareness of coastal processes.

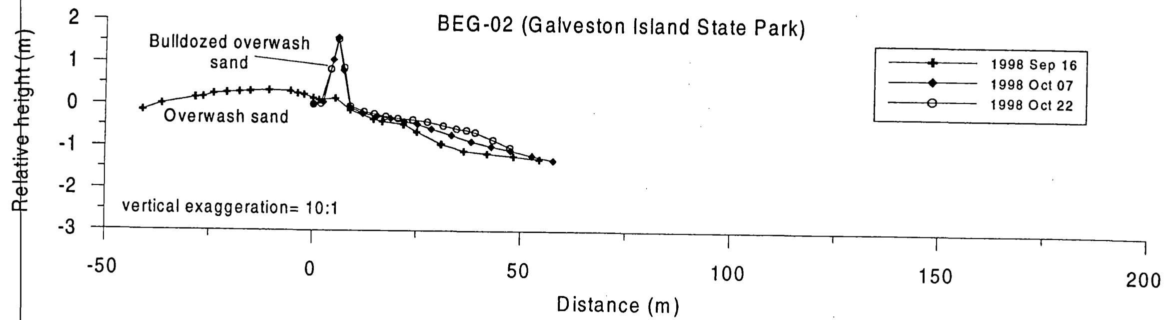
APPENDIX A: GRAPHS OF BEACH PROFILES

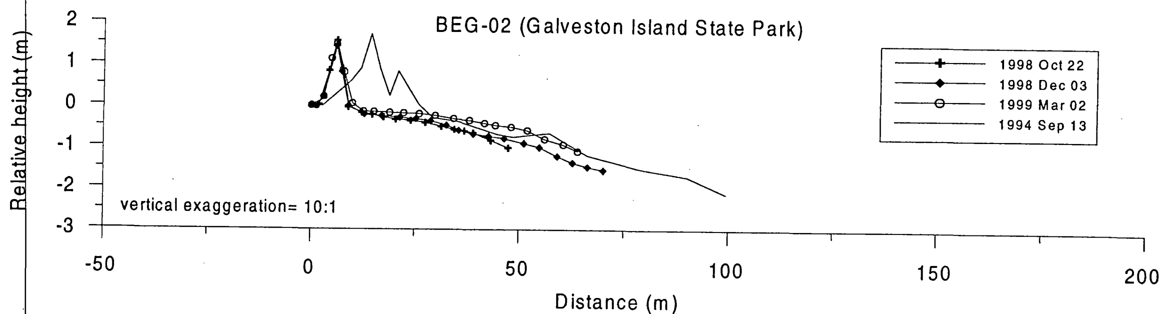


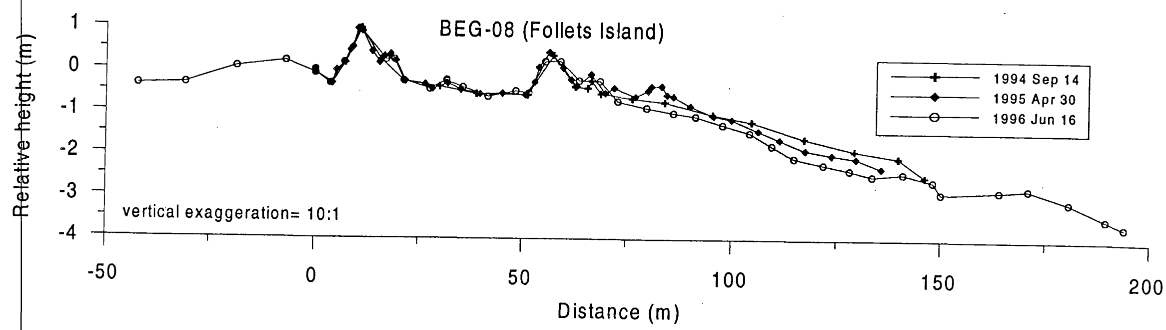


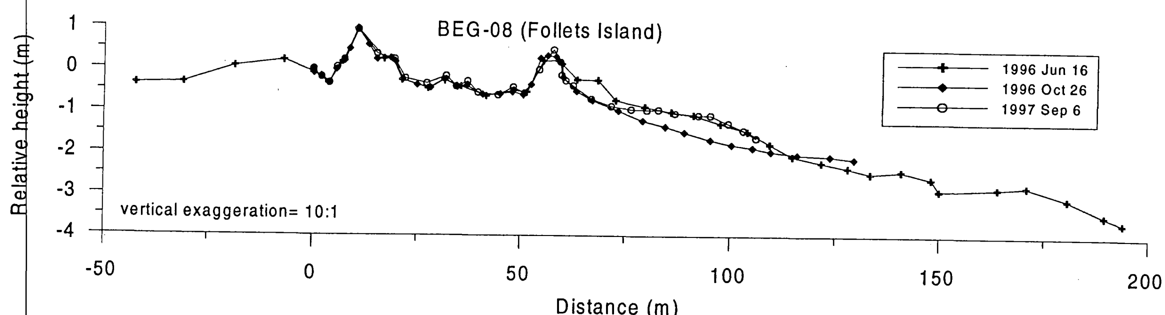


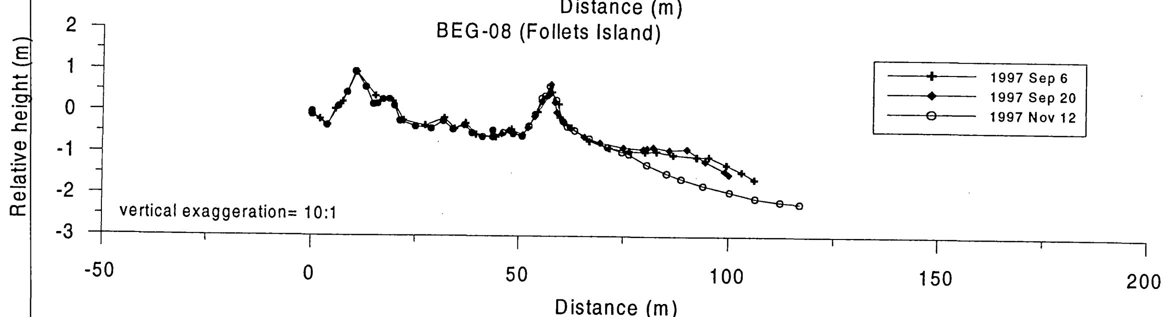


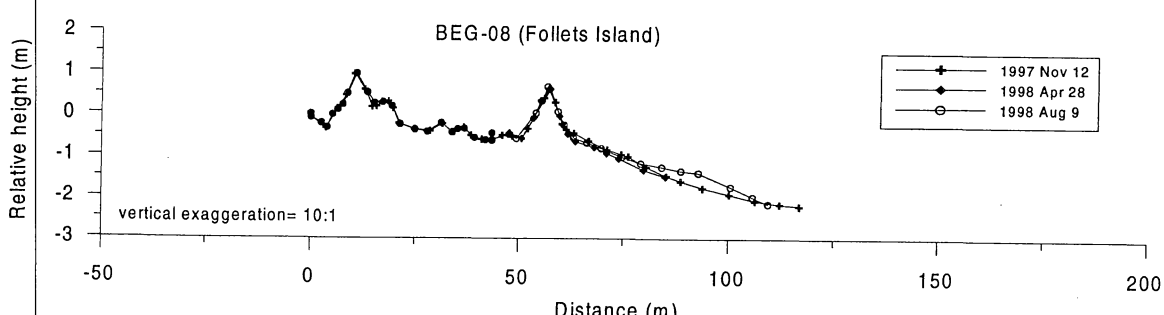

BEG-02 (Galveston Island State Park)
Bulldozed overwash sand
Overwash sand
vertical exaggeration= 10:1
1998 Sep 16
1998 Oct 07
1998 Oct 22
Relative height (m)
Distance (m)

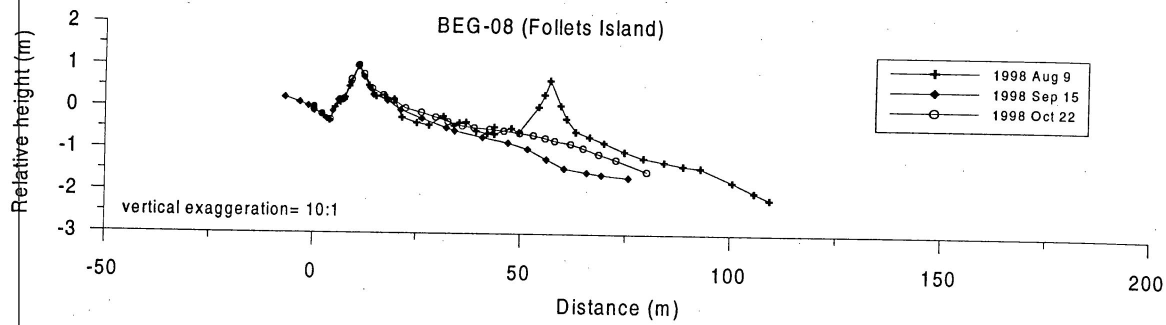

BEG-02 (Galveston Island State Park)
vertical exaggeration= 10:1
1998 Oct 22
1998 Dec 03
1999 Mar 02
1994 Sep 13
Relative height (m)
Distance (m)

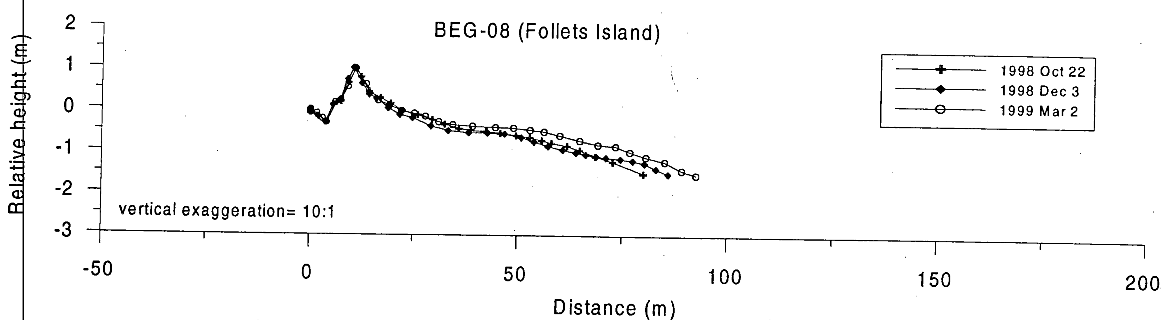

BEG-08 (Follets Island)
Relative height (m)
Distance (m)
vertical exaggeration= 10:1
1994 Sep 14
1995 Apr 30
1996 Jun 16


BEG-08 (Follets Island)
Relative height (m)
Distance (m)
vertical exaggeration= 10:1
1996 Jun 16
1996 Oct 26
1997 Sep 6


BEG-08 (Follets Island)
Relative height (m)
Distance (m)
vertical exaggeration= 10:1
1997 Sep 6
1997 Sep 20
1997 Nov 12

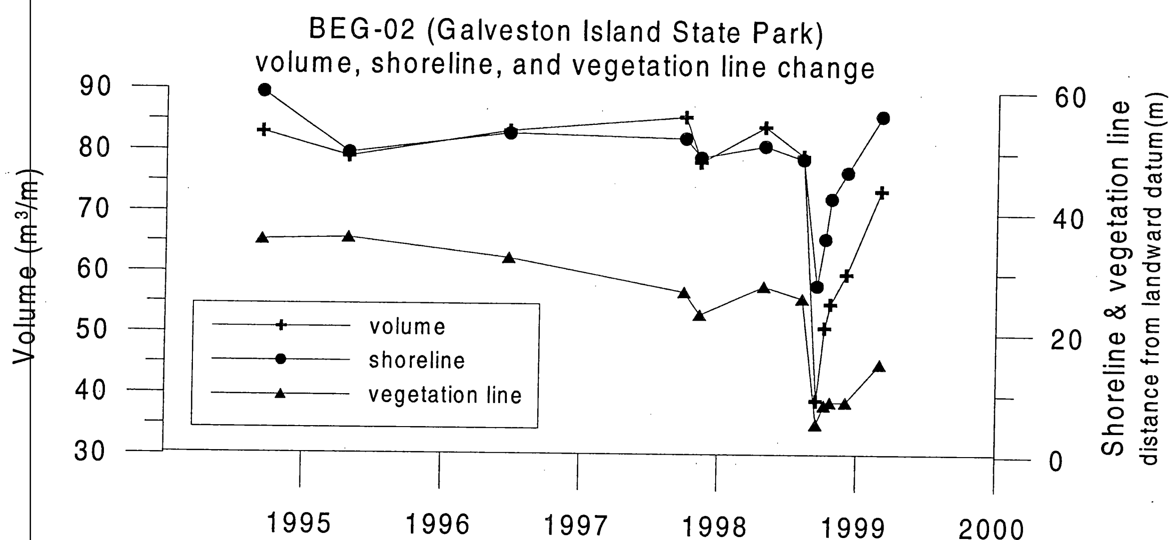

BEG-08 (Follets Island)
Relative height (m)
Distance (m)
vertical exaggeration= 10:1
1997 Nov 12
1998 Apr 28
1998 Aug 9

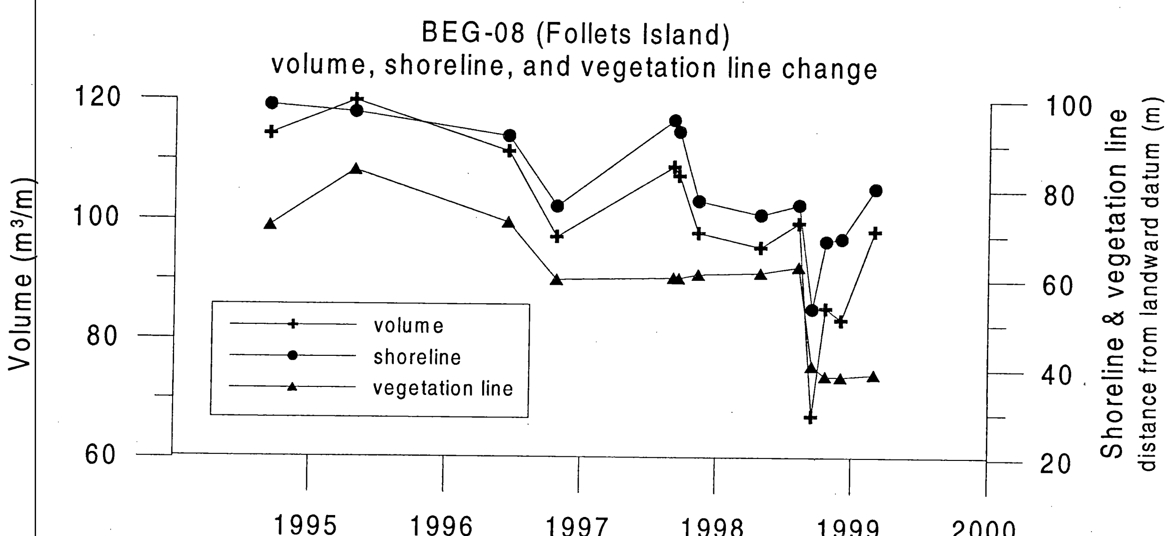

BEG-08 (Follets Island)
1998 Aug 9
1998 Sep 15
1998 Oct 22
Relative height (m)
vertical exaggeration= 10:1
Distance (m)
2
1
0
-1
-2
-3
-50
0
50
100
150
200


BEG-08 (Follets Island)
1998 Oct 22
1998 Dec 3
1999 Mar 2
Relative height (m)
vertical exaggeration= 10:1
Distance (m)
2
1
0
-1
-2
-3
-50
0
50
100
150
200

APPENDIX B: GRAPHS OF BEACH VOLUME, SHORELINE, AND VEGETATION LINE CHANGE

Profile data were entered into the public domain software package called "Beach Morphology and Analysis Package" (BMAP). BMAP Version 2, developed by the U.S. Army Corp of Engineers, is commonly used by coastal engineers and scientists for beach-profile analysis. Beach-volume calculations and profile plots were created using BMAP. Students plotted their data and made volume calculations as class exercises, but UT scientists generated the tables and graphs presented here.





APPENDIX C: STUDENT-COLLECTED DATA

entered profile data JLG

EMERY BEACH PROFILE

Profile Name Beg 02 **Date (yr/mo/dy)** 99/3/2 **Start Time** 11:00

Back rod person Krysta Pacini **Back rod assistant** [illegible]

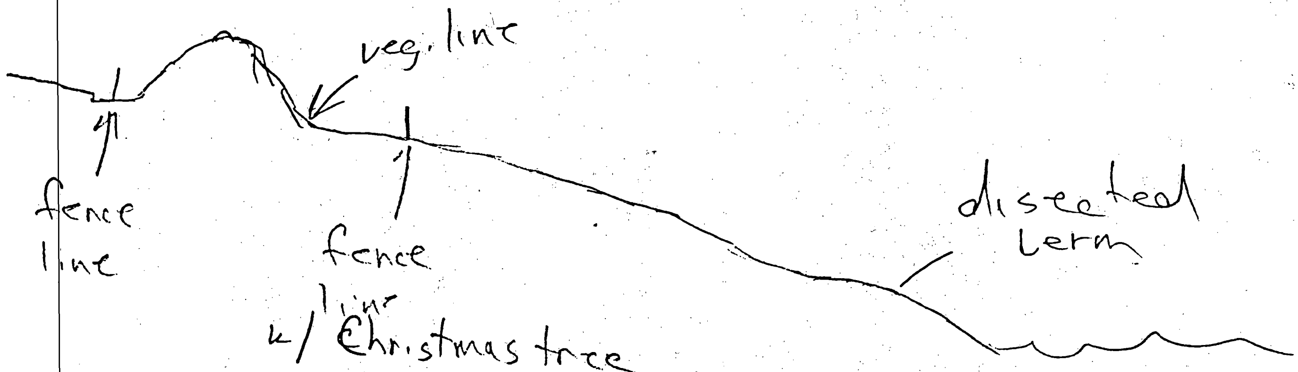
Front rod person Priscilla Leal **Front rod assistant** Cody Widmeyer

Data recorder Alex Baker **Observer/sampler** Clinton Mack

Datum description Corner of concrete slab. o.k. condition - unchanged

Profile Azimuth________ **(Magnetic degrees)**

Sketch/Notes



lower berm is hard and dissected w/ rills w/ 10-15cm relief - crossing same situation @ BEG08 earlier today.

Point #	dx (cm)	dz (cm)	notes (for points at front rod and area between rods)
1	0	0	Top of datum point.
2	0	0	Ground surface below/above datum point
3	122	-1	Fence
4	172	+22	
5	182	92	
6	119	35	Dune Crest
7	187	-68	
8	200	-75	
9	275	-19	
10	250	-1	2nd fence

EMERY BEACH PROFILE

Profile Name BEG 02 **Date (yr/mo/dy)** 99/3/2 **Start Time** 11:00

Point #	dx (cm)	dz (cm)	notes (for points at front rod and area between rods)
11	381	-2	
12	335	-1	
13	375	-2	
14	382	-4	
15	446	-7	
16	380	-4	
17	360	-7	
18	259	-5	Wet/dry line
19	380	-4	
20	382	-8	Berm Crest
21	417	-21	
22	448	-13	
23	340	-16	

Wind, Waves, and Littoral Drift Current

Profile Name BEG 02 Date (yr/mo/dy) 99/03/02 Start Time ~~10:52~~ 1113
Observers #1 Courtney M #2 Mike V #3 Ricardo R Recorder: Kelly C.

WIND S		
Direction (pointing into wind)	Sustained wind speed	Wind gust speed
195 °magnetic	18 km/hour	20 km/hour

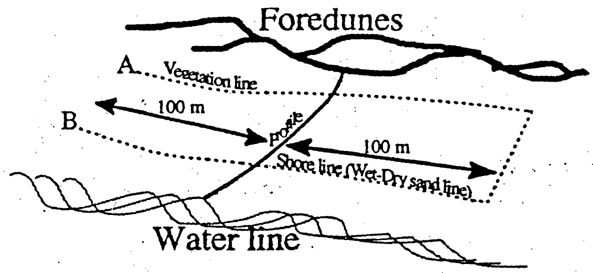
WAVES	*Observer #1*	*Observer #2*	*Observer #3*
Direction (pointing into waves)	157 °magnetic	157 °magnetic	145 °magnetic
Breaker height: estimated for seaward-most breakers.	___ cm 2ft	___ cm 2ft	___ cm 1½ft
Period: # seconds for 10 waves to pass stationary point divided by 10. 55	5.5 seconds	5.5 seconds	5 seconds
Surf zone width: distance from waterline to seaward most breakers.	400 meters	400 meters	450 meters
Number of longshore bars	2	2	2
Wave breaker type (check one):	☐ plunging	☒ spilling	☐ surging

LITTORAL DRIFT CURRENT	*Trial #1*	*Trial #2*	*Trial #3*
Distance float thrown offshore	30 meters	30 meters	35 meters
Distance float moves along shore in 50 seconds	18.75 meters	19.25 meters	19.3 meters
Littoral drift speed (cm/sec) = twice the drift distance (m)	___ cm/sec	___ cm/sec	___ cm/sec
Littoral drift direction: direction in which float moved	☒N ~~☐S~~ ☒E ☐W	☒N ☐S ☒E ☐W	☒N ☐S ☒E ☐W

Beach Orientation, Beach Shape and GPS Survey,

Profile Name BEG 02 **Date (yr/mo/dy)** 99/03/02	**Start Time** 11:13
GPS equipment ________	**Recorder:** Kelly C.

GPS Survey: Walk along vegetation line and wet-dry sand line 100m on either side of profile while recording the GPS track.



Start time (local) 11:13am

A. Start Point (degrees, decimal minutes):

94° 57.139 min **lat.** 29°N 11.609 min **long.**

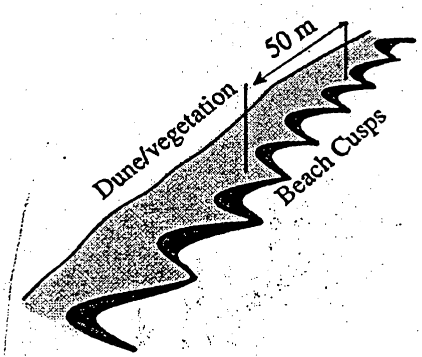
B. End Point (degrees, decimal minutes):

94° 57.126 **lat.** 29° 11.593 **long.**

End time (local) 11:27am

SHORELINE and FOREDUNE ORIENTATION	to north	to south
Foredune trend	48 °magnetic	227 °magnetic
Shoreline trend	51 °magnetic	232 °magnetic

BEACH CUSPS (if present)	lower set	upper set
Number of beach cusps in 50 meters	9	8
Elevation change across beach cusp	5 cm	15 cm



BEG02 [illegible]

entered profiledata JCG

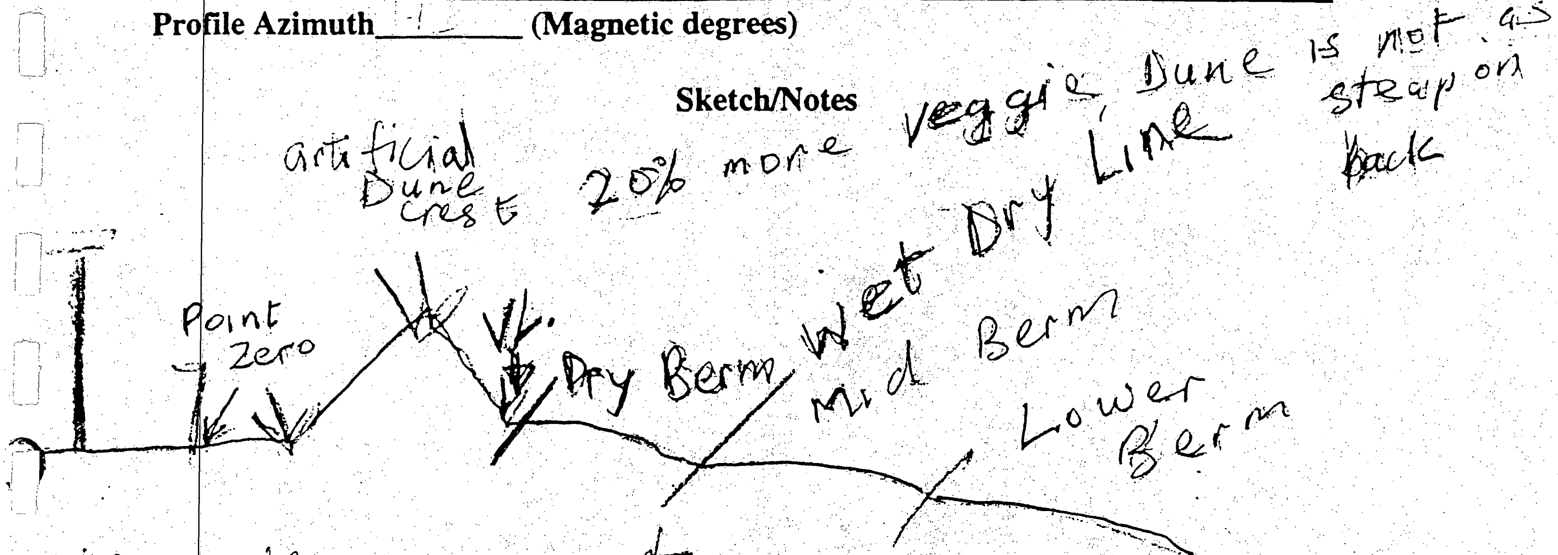
Emery Beach Profile

Profile Name BEG 02	**Date (yr/mo/dy)** 98/12/3 — **Start Time** 8:25 am
Back rod person Ricardo R.	**Back rod assistant** Cody W.
Front rod person Ryan H.	**Front rod assistant** Asa
Data recorder Courtney M.	**Observer/sampler** Priscilla L.

Datum description top corner of concrete

Profile Azimuth -| (Magnetic degrees)

Sketch/Notes



We were present During Spring low tide

Point #	dx (cm)	dz (cm)	notes (for points at front rod and area between rods)
1	0	0	Top of datum point.
2	0	0	Ground surface below/above datum point
3	141	0	dune starts forming
4	140	+21	
5	310	+122	dune crest
6	130	-62	
7	166	-82	vegetation line
8	390	-20	infront of dune sample taken
9	420	-4	
10	432	-14	sample taken TB

Emery Beach Profile

Profile Name BEY 02 **Date (yr/mo/dy)** 98/12/3 **Start Time** 8:25

Point #	dx (cm)	dz (cm)	notes (for points at front rod and area between rods)
11	385	-3	wet/dry line
12	358	-5	berm crest
13	380	-10	
14	296	-12	
15	351	-9	
16	365	-5	
17	373	-6	lower berm
18	470	-11	2nd berm crest
19	372	-10	
20	432	-21	
21	362	-16	
22	357	-10	beach face sample taken
23	376	-8	water edge

Wind, Waves, and Littoral Drift Current

Profile Name: Begt 2 Date (yr/mo/dy) 98-12-03 Start Time 8:30

Observers #1 Krysta #2 Michael #3 Kelly Recorder: Marisa

WIND		
Direction (pointing into wind)	Sustained wind speed	Wind gust speed
115 °magnetic	11 miles km/hour	15 km/hour

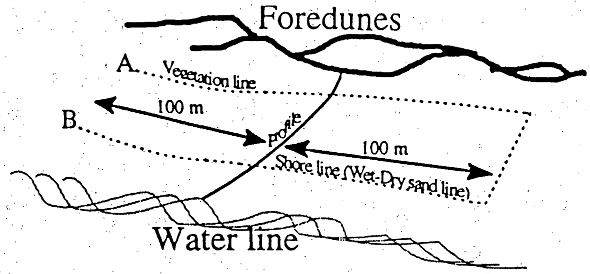
WAVES	*Observer #1*	*Observer #2*	*Observer #3*
Direction (pointing into waves)	150 °magnetic	155 °magnetic	145 °magnetic
Breaker height: estimated for seaward-most breakers.	30 cm	25 cm	35 cm
Period: # seconds for 10 waves to pass stationary point divided by 10.	4.5 seconds	5.4 seconds	____ seconds
Surf zone width: distance from waterline to seaward most breakers.	150 meters	200 meters	179 meters
Number of longshore bars	2	2	2
Wave breaker type (check one):	☐ plunging	☒ spilling	☐ surging

LITTORAL DRIFT CURRENT	*Trial #1*	*Trial #2*	*Trial #3*
Distance float thrown offshore	30 meters	30 meters	____ meters
Distance float moves along shore in 50 seconds	10.5 meters	6.4 meters	____ meters
Littoral drift speed (cm/sec) = twice the drift distance (m)	____ cm/sec	____ cm/sec	____ cm/sec
Littoral drift direction: direction in which float moved	☐N ☐S ☐E ☒W	☐N ☐S ☐E ☒W	☐N ☐S ☐E ☐W

Beach Orientation, Beach Shape and GPS Survey,

Profile Name 3EG02	Date (yr/mo/dy) 98/12/03	Start Time 0830
GPS equipment ________		Recorder: Maris 9

GPS Survey: Walk along vegetation line and wet-dry sand line 100m on either side of profile while recording the GPS track.



Start time (local) 8:50

A. Start Point (degrees, decimal minutes):

0310266 lat. 323.1058 long.

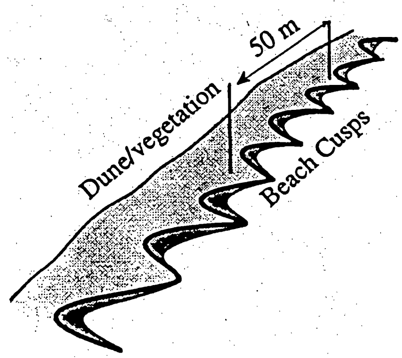
B. End Point (degrees, decimal minutes):

________ lat. ________ long.

End time (local) 9:00

SHORELINE and FOREDUNE ORIENTATION	to north	to south
Foredune trend	52 °magnetic	232 °magnetic
Shoreline trend	50 °magnetic	233 °magnetic

BEACH CUSPS (if present)	lower set	upper set
Number of beach cusps in 50 meters	____	____
Elevation change across beach cusp	____ cm	____ cm



EMERY BEACH PROFILE

Profile Name BEG-02 Date (yr/mo/dy) 98/10/22 Start Time 8:52

Back rod person Ricardo Rivera Back rod assistant Cody Widmeyer

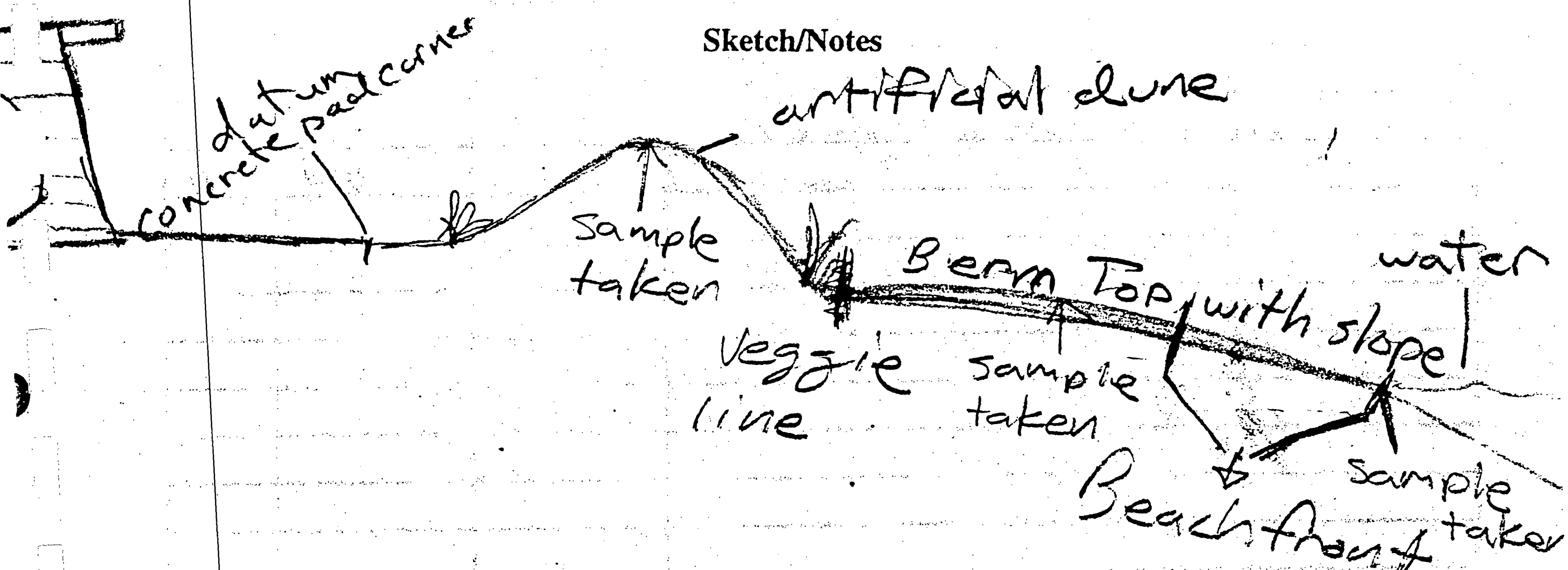
Front rod person John Austria Front rod assistant Ryan Hughes

Data recorder Courtney Mize Observer/sampler Alex

Datum description Corner of concret slab, on the left facing south

Profile Azimuth 139 (Magnetic degrees)

Sketch/Notes



Point #	dx (cm)	dz (cm)	notes (for points at front rod and area between rods)
1	0	0	Top of datum point.
2	0	0	Ground surface below/above datum point
3	176	+2	
4	245	+82	
5	183	+72	sand sample artifical dune crest
6	136	-68	
7	150	-92	base of artifical dune, vegitation line
8	332	-13	
9	246	-5	sand sample berm top
10	273	-6	

EMERY BEACH PROFILE

Profile Name BEG-02 **Date (yr/mo/dy)** 98/10/22 **Start Time** 8:52

Point #	dx (cm)	dz (cm)	notes (for points at front rod and area between rods)
11	293	-5	
12	359	-3	
13	350	-5	wet/dry line
14	381	-9	
15	321.5	-7	
16	240	-3	
17	207	-5	Berm Crest
18	425	-18	Sand Sample - Beg-02 - B.F. 98/10/22
19	420	-16	Water-Line 9:58

Wind, Waves, and Littoral Drift Current

Profile Name BE6Ø2 BG2	Date (yr/mo/dy) 98-10-22	Start Time 8 55A	
Observers #1 Michael Villere Eddie Garcia	#2 Priscilla Leal Matt Randall	#3 Asa Hrachwing Krysta Beini	Recorder: Eddie Garcia

WIND		
Direction (pointing into wind)	Sustained wind speed	Wind gust speed
10, 15, 18, 25 15 °magnetic	8, 10, 11, mph ~~km~~/hour	16 mph ~~km~~/hour

WAVES	Observer #1	Observer #2	Observer #3
Direction (pointing into waves)	124 °magnetic	122 °magnetic	120 °magnetic
Breaker height: estimated for seaward-most breakers.	50 cm	75 cm	50 cm
Period: # seconds for 10 waves to pass stationary point divided by 10.	4 seconds	6 seconds	5 seconds
Surf zone width: distance from waterline to seaward most breakers.	250 meters	300 meters	240 meters 210, 200
Number of longshore bars	4	3	2
Wave breaker type (check one):	☐ plunging	☒ spilling	☐ surging

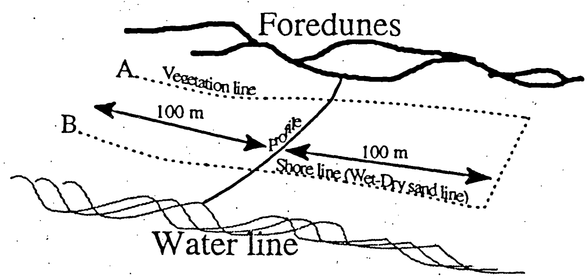
LITTORAL DRIFT CURRENT	Trial #1	Trial #2	Trial #3
Distance float thrown offshore	50 meters	25 meters	40 meters
Distance float moves along shore in 50 seconds	10 meters	20.1 meters	17.2 meters
Littoral drift speed (cm/sec) = twice the drift distance (m)	cm/sec	cm/sec	cm/sec
Littoral drift direction: direction in which float moved	☐N ☒S ☐E ☐W	☐N ☒S ☐E ☐W	☐N ☒S ☐E ☐W

Beach Orientation, Beach Shape and GPS Survey,

Profile Name BEGØ2 BG2 Date (yr/mo/dy) 98-10-22 Start Time 7:50

GPS equipment Garmen Recorder: [illegible]

GPS Survey: Walk along vegetation line and wet-dry sand line 100m on either side of profile while recording the GPS track.



Start time (local) 10:16

A. Start Point (degrees, decimal minutes):

0310259 UTM ~~lat.~~ 3231053 UTM ~~long.~~

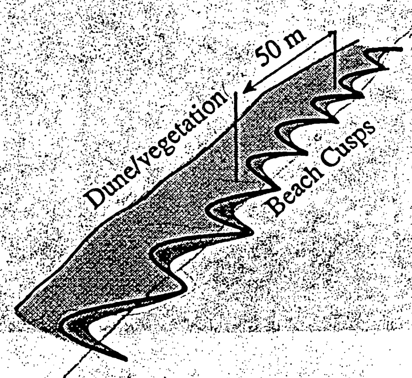
B. End Point (degrees, decimal minutes):

0310332 lat. 3231104 long.

End time (local) 10:28

SHORELINE and FOREDUNE ORIENTATION	to north	to south
Foredune trend	50 °magnetic	240 °magnetic
Shoreline trend	50 °magnetic	230 °magnetic

BEACH CUSPS (if present)	lower set	upper set
Number of beach cusps in 50 meters	2 1/2	
Elevation change across beach cusp	10cm cm	cm



[illegible]

EMERY BEACH PROFILE

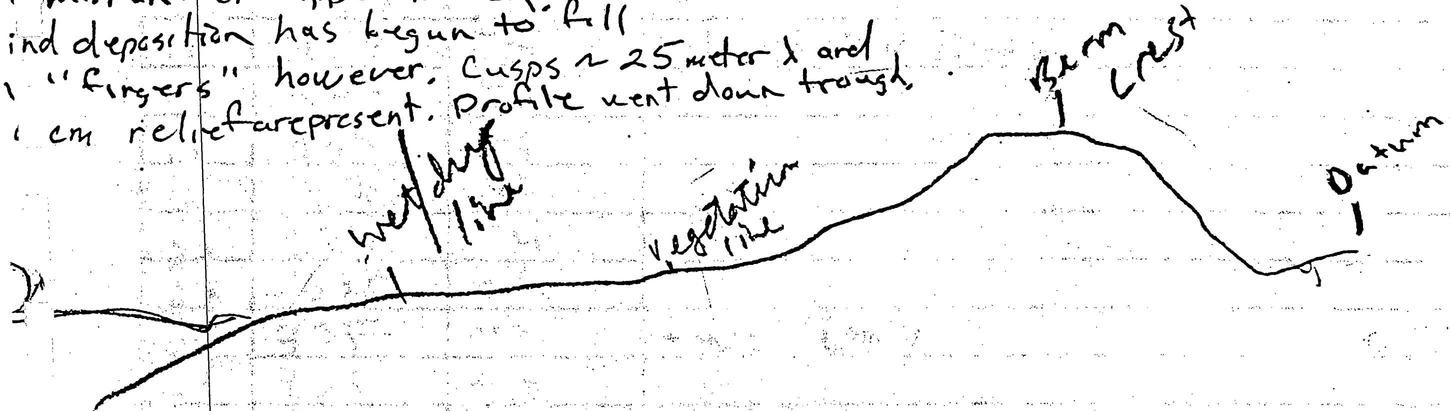
Profile Name	BEG-08	**Date (yr/mo/dy)**	99/3/2	**Start Time**	0900
Back rod person	Krysta	**Back rod assistant**	Ryan		
Front rod person	Leal	**Front rod assistant**	Cody		
Data recorder	Alec Baker	**Observer/sampler**	Clinton		

Datum description good shape (H-68-TX)

Profile Azimuth 146° **(Magnetic degrees)**

Sketch/Notes

Vegetation "fingers" still
min ant on upper beach.
ind deposition has begun to fill
"fingers" however. Cusps ~25 meter λ and
cm relief are present. Profile went down trough.



Point #	dx (cm)	dz (cm)	notes (for points at front rod and area between rods)
1	0	0	Top of datum point. H-68-TX
2	0	-6	Ground surface below/above datum point
3	156	-3	
4	128	-12	
5	98	-9	
6	223	48	
7	127	6	
8	168	32	Dune Crest
9	184	44	
10	255	38	

EMERY BEACH PROFILE

Profile Name BEGO 8 **Date (yr/mo/dy)** 990302 **Start Time** 0900

Point #	dx (cm)	dz (cm)	notes (for points at front rod and area between rods)
11	302	-39	
12	270	-12	
13	290	-13	
14	307	-6	
15	267	-7	
16	324	-13	
17	336	-7	
18	478	-3	Vegetation line
19	544	-3	
20	435	-1	
21	~~40~~ 398	-5	
22	330	-4	
23	380	-9	
24	475	-12	- Wet/Dry
25	433	-10	
26	424	-3	
27	339	-13	
28	384	-12	
29	450	-11	
30	406	-21	
31	340	-11	

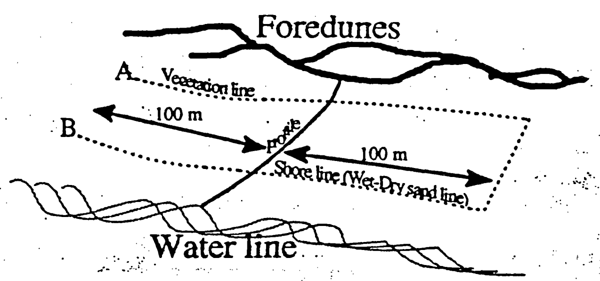
Beach Orientation, Beach Shape and GPS Survey, 0900

Profile Name BEG 08 **Date (yr/mo/dy)** 99/03/02 **Start Time** 9 am

GPS equipment ______________ **Recorder:** Kelly Covel

GPS Survey: **Walk along vegetation line and wet-dry sand line 100m on either side of profile while recording the GPS track.**

Start time (local) 9:27 am



A. Start Point (degrees, decimal minutes):

29° 3.165min **lat.** 95° 8.933min **long.**

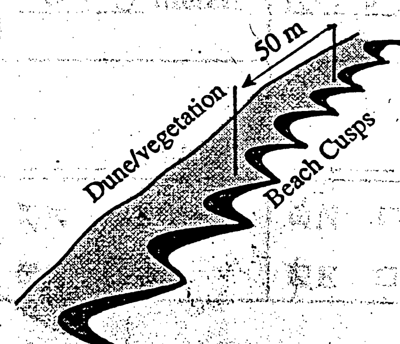
B. End Point (degrees, decimal minutes):

29° 3.153min **lat.** 95° 8.923min **long.**

End time (local) 9:58

SHORELINE and FOREDUNE ORIENTATION	**to north**	**to south**
Foredune trend	47 °magnetic	229 °magnetic
Shoreline trend	55 °magnetic	235 °magnetic

BEACH CUSPS (if present)	**lower set**	**upper set**
Number of beach cusps in 50 meters	16	~~10~~ 2
Elevation change across beach cusp	10 cm	20 cm



Wind, Waves, and Littoral Drift Current

Profile Name: BG08 Date (yr/mo/dy): 3/2/99 Start Time: 9:00

Observers #1: MichaelV. #2: CourtneyM. #3: John A. Recorder: KellyC.

RicardoR.

WIND WSW		
Direction (pointing into wind)	Sustained wind speed	Wind gust speed
183 °magnetic	14 km/hour	15 km/hour

WAVES	*Observer #1*	*Observer #2*	*Observer #3*
Direction (pointing into waves)	152 °magnetic	156 °magnetic	155 °magnetic
Breaker height: estimated for seaward-most breakers.	___ cm 2ft	___ cm 1½ ft	___ cm 1½ ft
Period: # seconds for 10 waves to pass stationary point divided by 10. 65/10 60/10	6.5 seconds	6.5 seconds	6 seconds
Surf zone width: distance from waterline to seaward most breakers.	500 meters	400 meters	600 meters
Number of longshore bars	3	2	3
Wave breaker type (check one):	☒ plunging	☐ spilling	☐ surging

LITTORAL DRIFT CURRENT	*Trial #1*	*Trial #2*	*Trial #3*	
Distance float thrown offshore	30 meters	35 meters	35 meters	30m
Distance float moves along shore in 50 seconds	21.2 meters	6.8 meters	16.65 meters	7.7 m
Littoral drift speed (cm/sec) = twice the drift distance (m)	[illegible] cm/sec	___ cm/sec	___ cm/sec	
Littoral drift direction: direction in which float moved	☒N ☐S ☒E ☐W	☒N ☐S ☒E ☐W	☒N ☐S ☒E ☐W	NE

entered profile data

Page _____ of _____

Emery Beach Profile

Profile Name BEG 08 Date (yr/mo/dy) 12/3/98 Start Time 10:20

Back rod person Alex Back rod assistant Marisa-Mack

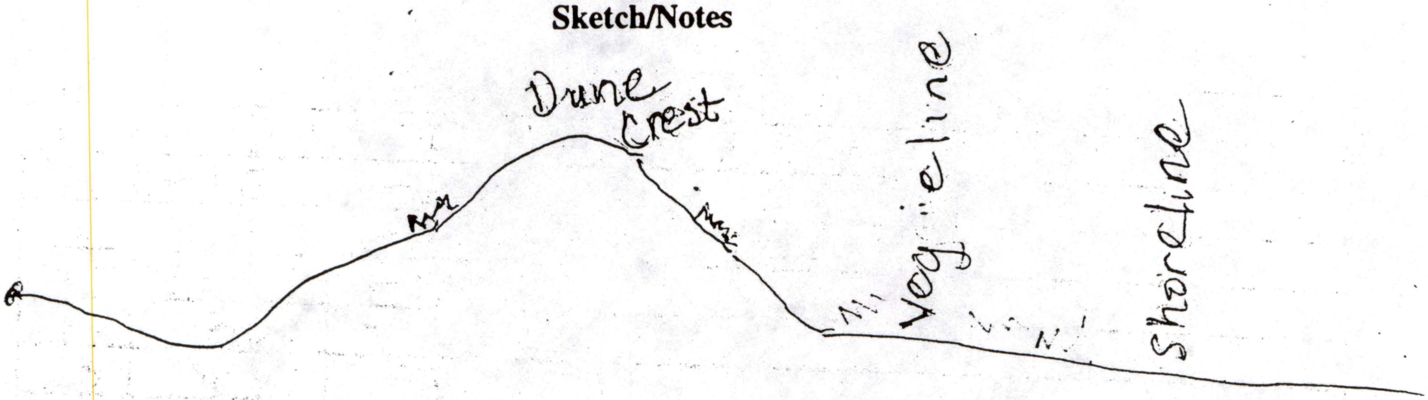
Front rod person Michael Front rod assistant Krysta

Data recorder Kelly Observer/sampler Austria

Datum description For information write the Director National Ocean survey Washington, D C

Profile Azimuth 145° (Magnetic degrees)

Sketch/Notes



Point #	dx (cm)	dz (cm)	notes (for points at front rod and area between rods)
1	0	0	Top of datum point.
2	0	-7	Ground surface below/above datum point
3	175	-8	debri line
4	190	-15	ditch
5	185	42	back of dune
6	157	11	hill on backside of dune
7	198	51	onside of bigger hill
8	138	28	top of dune
9	195	-38	top frontside of dune
10	178	-27	frontside of dune

Emery Beach Profile

Profile Name BEG 08 Date (yr/mo/dy) 12/3/98 Start Time 10:20

Point #	dx (cm)	dz (cm)	notes (for points at front rod and area between rods)
11	183	-10	frontside of dune
12	280	-23	dune front
13	280	-15	" "
14	310	-8	start of frontside of dune
15	440	-19	" "
16	420	-11	bermtop
17	490	-5	vegetation line
18	446	0	flat bermtop
19	410	-2	" "
20	404	-9	upper beach crest
21	305	-10	
22	330	-11	
23	360	-8	
24	315	-6	
25	230	-5	
26	245	-4	shoreline
27	235	-3	
28	347	-3	
29	295	-4	
30	280	-6	
31	275	-13	waterline
32	294	-13	

Wind, Waves, and Littoral Drift Current

Profile Name BEG 08 Date (yr/mo/dy) 98/12/3 Start Time 10:20am

Observers #1 Ryan H. #2 RicardoR #3 Courtney M. Recorder: Priscilla L

WIND		
Direction (pointing into wind)	Sustained wind speed	Wind gust speed
150 °magnetic	9 km/hour	9 1/2 km/hour

WAVES	*Observer #1*	*Observer #2*	*Observer #3*
Direction (pointing into waves)	135 °magnetic	140 °magnetic	136 °magnetic
Breaker height: estimated for seaward-most breakers.	24 cm	26 cm	25 cm
Period: # seconds for 10 waves to pass stationary point divided by 10.	3 seconds	3.5 seconds	3 seconds
Surf zone width: distance from waterline to seaward most breakers.	70 meters	79 meters	92 meters
Number of longshore bars	3	4	3
Wave breaker type (check one):	☐ plunging	☒ spilling ☒ Crumbling	☐ surging

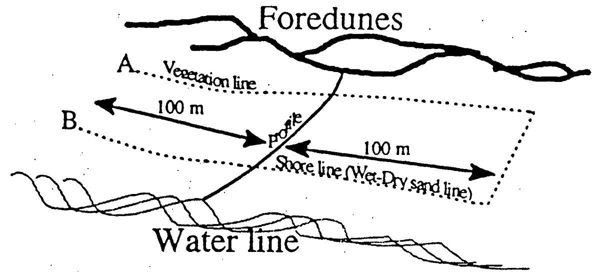
LITTORAL DRIFT CURRENT	*Trial #1*	*Trial #2*	*Trial #3*
Distance float thrown offshore	25 meters	30 meters	___ meters
Distance float moves along shore in 50 seconds	0.41 meters	1.18 meters	3.03 meters
Littoral drift speed (cm/sec) = twice the drift distance (m)	___ cm/sec	___ cm/sec	___ cm/sec
Littoral drift direction: direction in which float moved	☒N ☐S ☐E ☒W NW	☒N ☐S ☐E ☒W NW	☒N ☐S ☐E ☒W NW

Beach Orientation, Beach Shape and GPS Survey,

Profile Name BEG 08 **Date (yr/mo/dy)** 98/12/3 **Start Time** 10:48

GPS equipment Courtney Mize **Recorder:** Priscilla Leal

GPS Survey: **Walk along vegetation line and wet-dry sand line 100m on either side of profile while recording the GPS track.**



Start time (local) 10:58

A. Start Point (degrees, decimal minutes):

36° **lat.** ______ **long.**

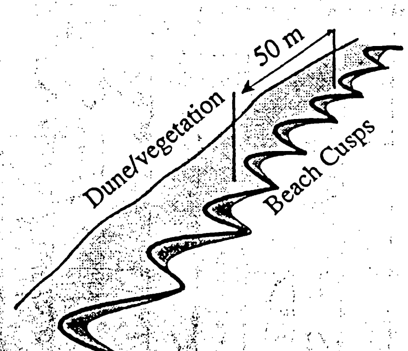
B. End Point (degrees, decimal minutes):

______ **lat.** ______ **long.**

End time (local) 11:20

SHORELINE and FOREDUNE ORIENTATION	**to north**	**to south**
Foredune trend	50 °magnetic	230 °magnetic
Shoreline trend	45 °magnetic	235 °magnetic

BEACH CUSPS (if present)	**lower set**	**upper set**
Number of beach cusps in 50 meters	45 m	45 m — λ
Elevation change across beach cusp	2 cm	6 cm



Entered
JCG

EMERY BEACH PROFILE

Profile Name BEG 08 Date (yr/mo/dy) 98/10/22 Start Time 11:04am

Back rod person Eddie G. Back rod assistant Mike V.

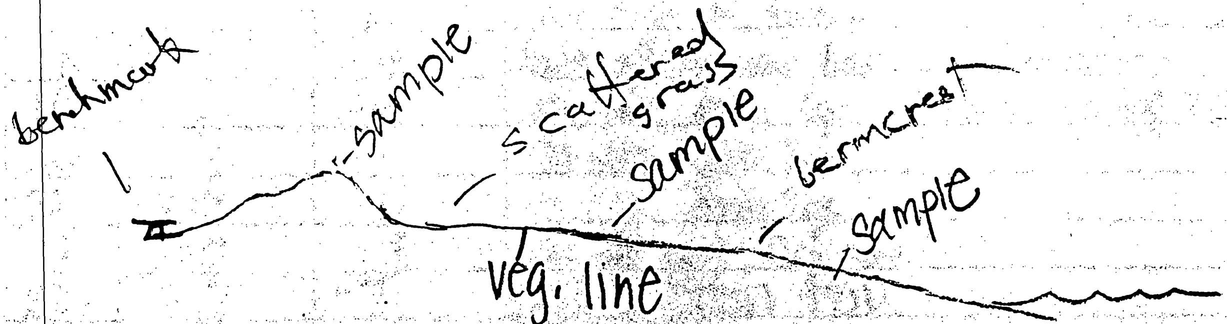
Front rod person Matthew R. Front rod assistant Krysta P.

Data recorder Priscilla Leal Observer/sampler Asa H.

Datum description Benchmark H. ~~18~~ TX 1979

Profile Azimuth 145° (Magnetic degrees)

Sketch/Notes



Point #	dx (cm)	dz (cm)	notes (for points at front rod and area between rods)
1	0	0	Top of datum point.
2	0	-7	Ground surface below/above datum point
3	195	-10	on the line of debris
4	204	-13	on the grass
5	230	47	back side of dune
6	110	3	back side of dune
7	180	46	back side of dune
8	175	34	crest side of dune (took sample
9	125	-24	Front side of foredune
10	200	-35	Front side of foredune

EMERY BEACH PROFILE

Profile Name BEG08 **Date (yr/mo/dy)** 98-10-22 **Start Time** 11:04am

Point #	dx (cm)	dz (cm)	notes (for points at front rod and area between rods)
11	270	-15	Front side of foredune
12	250	-13	Front side of foredune (scattered grass)
13	275	-18	Front side of foredune (scattered grass)
14	385	-10	Front side of foredune (scattered grass)
15	345	-11	Front Side of foredune (scattered grass)
16	295	-11	Front Side of foredune (scattered grass)
17	347	-10	Front Side of foredune (scattered grass)
18	287	-4	Front of vegetation line (scattered grass)
19	370	-3	On the Berm Top - sample BEG 08 TB
20	335	-4	On the Berm Top
21	380	-5	On the Berm Top
22	330	-5	On the wet, Dry line
23	280	-7	On the berm top
24	227	-10	On the berm top
25	385	-7	On the berm crest
26	300	-10	On the beach face
27	370	-11	On the beach face sample BEG08 BF
28	415	-13	On the beach face/water line/12:42 pm
29			
30			
31			
32			
33			
34			
35			
36			
37			
38			
39			
40			

Wind, Waves, and Littoral Drift Current

Profile Name BEG08	Date (yr/mo/dy) 98/10/08	Start Time 11:09 a.m.
Observers #1 Alex Baker #2 Ricardo Rivera #3 Courtney Mize		Recorder: John Austria

Cody Widmeyer, Ryan Hughes

WIND		
Direction (pointing into wind)	Sustained wind speed	Wind gust speed
35, 44 °magnetic	14, 12, 15 km/hour	24, 35 km/hour

29, 26, 40

WAVES	*Observer #1*	*Observer #2*	*Observer #3*
Direction (pointing into waves)	120 °magnetic	100 °magnetic	124 °magnetic
Breaker height: estimated for seaward-most breakers.	.70 m	1 m	1.3 m
Period: # seconds for 10 waves to pass stationary point divided by 10.	3.7 seconds	6.4 seconds	.34 seconds
Surf zone width: distance from waterline to seaward most breakers.	450 meters	475 meters	4-6 meters
Number of longshore bars	4	4	3
Wave breaker type (check one):	☐ plunging	☑ spilling (little plunge)	☐ surging

7.3, 4.2

LITTORAL DRIFT CURRENT	*Trial #1*	*Trial #2*	*Trial #3*
Distance float thrown offshore	20 meters	40 meters	20 meters
Distance float moves along shore in 50 seconds	27.4 meters	45.9 meters	20.4 meters
Littoral drift speed (cm/sec) = twice the drift distance (m)	54 cm/sec	90 cm/sec	40 cm/sec
Littoral drift direction: direction in which float moved	☐N ☑S ☐E ☑W	☐N ☑S ☐E ☑W	☐N ☑S ☐E ☑W

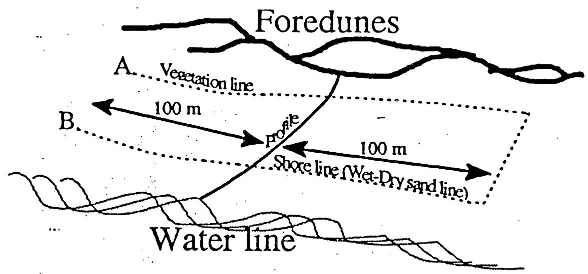
Lat. 0890945
Long. 3215843

Beach Orientation, Beach Shape and GPS Survey,

Profile Name BEC08 Date (yr/mo/dy) 98/10/22 Start Time 1109 am

GPS equipment GARMIN Recorder: John Austria

GPS Survey: Walk along vegetation line and wet-dry sand line 100m on either side of profile while recording the GPS track.



Start time (local) 17:17

A. Start Point (degrees, decimal minutes):

0290939 lat. 3215854 long.

B. End Point (degrees, decimal minutes):

0290776 lat. 3215732 long.

End time (local) 17:21

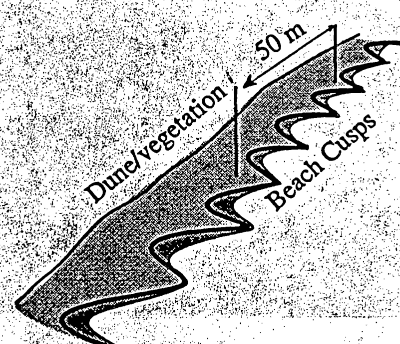
SHORELINE and FOREDUNE ORIENTATION	to north	to south
Foredune trend	30 °magnetic	237 °magnetic
Shoreline trend	50 °magnetic	230 °magnetic

BEACH CUSPS (if present)	lower set	upper set
Number of beach cusps in 50 meters	2	2
Elevation change across beach cusp	17 cm	6 cm

wet dry line:

0290784 lat. 3215726 long.

17:23 time



17:27 time

lat. 0290945

long. 3215843