Beach Profile and Tar Ball Monitoring for Oil Spill Response Planning Volunteer Manual 2018-2019

A Gulf Coast community project to train citizens in oil spill response planning

THE UNIVERSITY of NEW ORLEANS

OCC | Owens Coastal Consultants

SECOND DRAFT

This Manual has been prepared specifically for the Dauphin Island program and will be updated and upgraded as the program evolves.

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1. Program Background

This citizen science program seeks to build coastal community subject matter expert capacity through a project to collect quantitative beach dynamics and tar ball data for oil spill planning and response in coastal regions with offshore oil and gas operations. The program aims to:

- develop a community-based, shoreline data collection program focused on creating an understanding of shoreline environments;
- provide new perspectives for communities and enable them to better understand the shoreline environment, the disruption caused by oil spills, the potential environmental changes, and socio-economic impacts; and
- collect two critical key data sets that typically are lacking at the time of a spill response: Seasonal Beach and Sediment Dynamics, and Background Shoreline Oiling.

Local community groups learn about effective oil spill response planning by participating in beach profiling and tar ball surveys. Through these field activities, citizens:

- learn first-hand the key geological and oceanographic parameters that influence oil behavior and treatment options;
- learn about the value of the data required for effective oil spill treatment plans and develop skills as citizen scientists in valuable shoreline data collection;
- undertake beach profiling and tar ball surveys on their local beaches; and
- generate valuable long-term data relevant to analyzing the effects of oil spills on the shoreline.

This program is funded by a grant from the National Academy of Sciences. It is being executed by academic subject matter experts from the University of New Orleans Coastal Research Laboratory and Pontchartrain Institute for Environmental Sciences, Coastal Education Program. Professional expert support is provided by the consulting firm Owens Coastal Consultants.

1.1 What is Beach Profiling?

Beach profiling is a simple survey technique that measures the beach topography. Profiling requires a minimum of three people and follows a straightforward manual process to measure the width, elevation and slope of a beach. Measurements are taken at regular intervals along a profile line (or transect) positioned perpendicular to the shoreline (Figure 1). The data are used to create a graphic view of the beach shape (Figure 2). The transect location is established at the onset of the monitoring program and remains in the same position for all subsequent surveys. This consistent application of the survey method allows observations on the changing size and shape of a beach through time (Figures 4 and 5).

Figure 1. Beach profiling using the rod-and-horizon method.

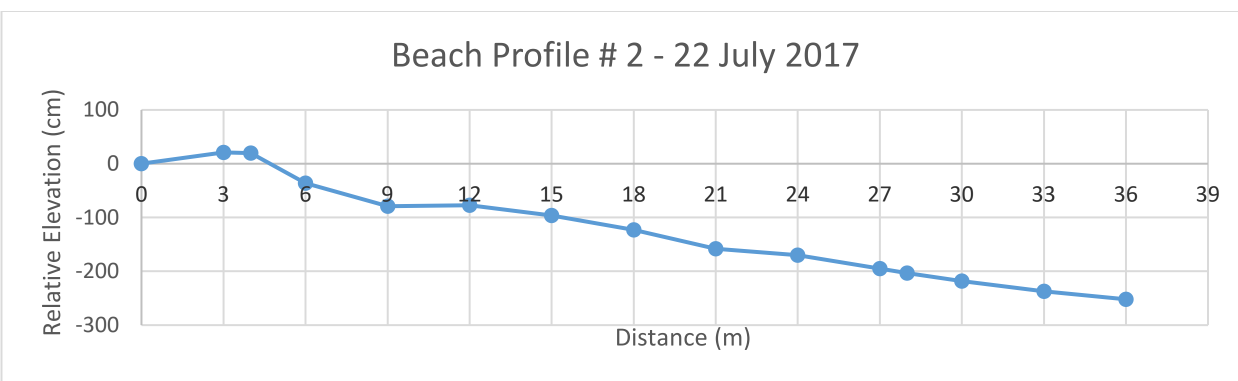


Figure 2. Example of beach profile: note the intermediate measurement points at 4 m and 28 m along the transect

1.2 What is a Tar Ball Shoreline Oiling Survey?

A tar ball is a small (<10 cm diameter) piece of weathered oil that has been deposited on a beach (Figure 3). A Tar Ball Shoreline Oiling Survey documents the number and character (color, texture) of any tar balls observed in a defined section of beach. Baseline or "background" tar ball data and background shoreline oiling information is generated by monitoring the same area at regular intervals. This time series data set provides an understanding of historical oiling or of the influence of potential existing continuous sources of oiling, such as vessels and natural seeps (Section 1.4).

Figure 3. Example of a tar ball on a sand beach

1.3 Why Monitor the Shape of the Beach?

Beaches are highly dynamic shoreline environments in which the sediments are constantly redistributed by winds, waves and tidal processes.

The Gulf Coast typically has a seasonal "summer-winter" cycle with narrower and lower beaches in winter months as cold-fronts generate high-energy storm waves, which erode and remove sand from the intertidal zone to form subtidal sandbars (Figure 4). The frequency of the passage of these winter storms means that typically there is insufficient time for the sand to move back up the beach before the next storm arrives. The sands eventually return to the beach during periods of lower-energy summer wave action. Superimposed on this seasonal cycle may be a single storm event at any time of the year when there is sufficient time for the sand to be replaced as a ridge migrates up the beach during a period of constructive low-energy waves: this is referred to as a "storm cycle" and the migrating sand ridge is called a "ridge and runnel" system. Beach profiling is a simple tool which enables seasonal ("summer-winter") cycles and storm-induced changes to be documented on a particular beach and provides an indication of whether a beach is likely to rebuild or erode at any given point in time.

In the event of an oil spill, understanding the beach dynamics and the “beach stage” (that is, whether the beach is in an erosional or constructive phase of a beach cycle) is an important element for recognizing the likelihood of burial of oil by beach sediments during constructive wave action or removal of oil during periods of beach erosion.

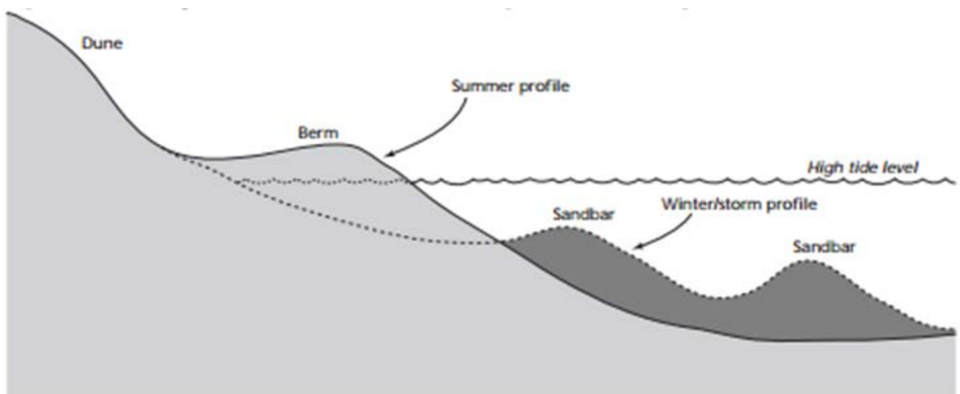


Figure 4. Typical summer/winter (or storm/post-storm) beach profiles (source WHOI, 2001)

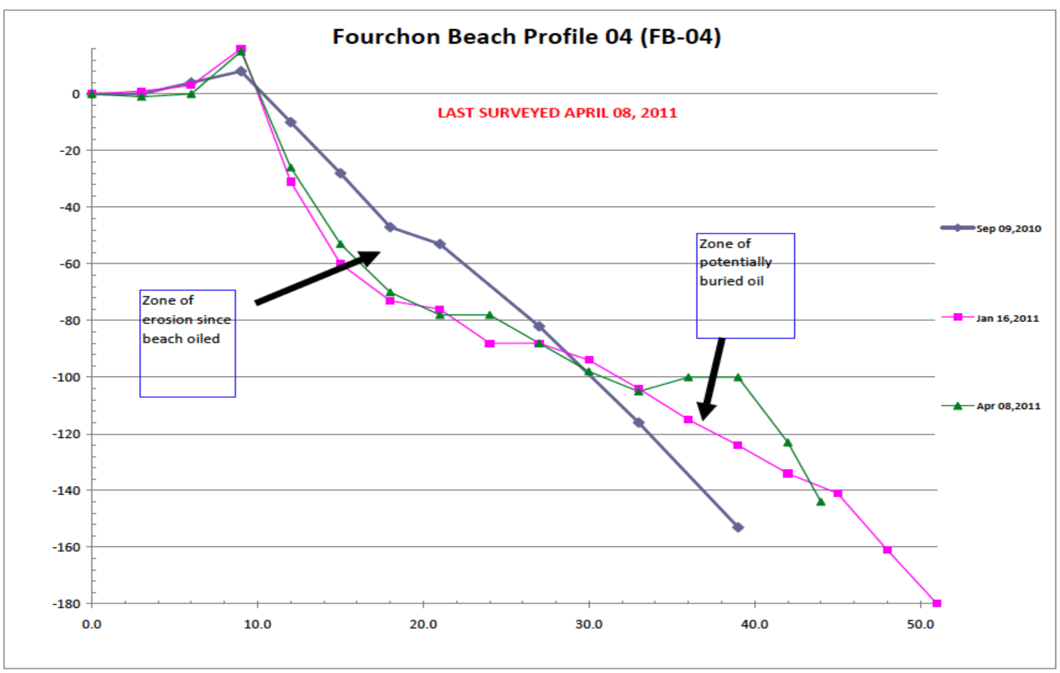


Figure 5. Time series of beach profiles indicating a zone that was eroded and a zone of sediment accumulation that may have buried surface oil.

Figure 5 is the plotted graph of a beach profile surveyed near Fourchon, LA on September 09, 2010, January 16, 2011, and April 08, 2011, after the beach had been oiled.

- The upper beach between 10 and 28 m distance seaward from the 0 m back stake was eroded between the time of the first survey (September 2010) and January 2011 survey. The maximum decrease in elevation was 32 cm (12½ inches) at the 21 m distance along the profile. This sediment was not replaced by the time of the April 2012 survey.
    - Any surface oil in this zone of the upper beach almost certainly would have been eroded during this period.
- The lower half of the profile seaward of 30 m was a zone of sediment build up, with a maximum increase in beach height of 56 cm (22 inches) at the 39 m distance.
    - Any surface oil in this zone of the lower beach likely would have been buried during this period.

1.4 History of Tar Ball Occurrences on Gulf Coast Beaches

There is a long history of tar balls on the Gulf Coast beaches from Texas to Florida due to the natural offshore oil seeps. "Background" surface oiling is defined as that chronic (long-term, continuous) concentration or frequency of oil residue or tar balls (TB) that may be present on a shoreline without an acute or specific input source (such as an oil spill event).

"Background" oiling is a function of source and the primary chronic contributions are from:

- river runoff downstream from urban areas,
- commercial fishing and shipping activities (such as illegal bilge pumping),
- offshore hydrocarbon production,
- sea bottom natural hydrocarbon seeps, or
- prior anthropogenic releases (oil spills).

Alabama "background" oiling data are based on up to five surveys during May 2010; before Deepwater Horizon oil made landfall on the coast (Table 1). During this one month period, Dauphin Island beaches had a highest frequency of 192 tar balls for every 1000 m, and an average of 5.8 tar balls per 1000 m; that is one every 5.2 m (5.7 yards) and one every 172 m (187 yards) respectively, with an average size of 2.6 cm (1.0 inch) (data from Taylor *et al*. 2014).

Table 1. Background Tar Ball Data for Alabama – May 2010

County	Discrete Length Surveyed (km)	Tar Balls Observed (#)	Average Frequency (# / km)	Highest Frequency (# / km)	Average Size (cm)	Largest Size (cm)
Dauphin Island	**49.5**	**286**	**5.8**	**192.3**	**2.6 (1")**	**6.0 (2.4")**
Gulf Shores	40.6	40	1	18.6	0.4 (1/8")	15 (6")
Orange Beach	8.4	0	0	0	0	0
Alabama Average			***4.9***		***2.2***	

Table 2. Tar Ball Oiling Categories (NOO = No Observed Oil)

Tar Balls per 1m²	**Tar Ball Size**			
	<1 cm	1-5 cm	5-10 cm	>10 cm
0	**NOO**	**NOO**	**NOO**	**NOO**
<1	Negligible	Light	Light	Light
1-10	Light	Moderate	Moderate	**Heavy**
11-100	Moderate	**Heavy**	**Heavy**	**Heavy**
>100	**Heavy**	**Heavy**	**Heavy**	**Heavy**

Table 2 presents oiling categories that are used to characterize the degree or severity of oiling on a beach based on the frequency and size of observed tar balls. These categories can be used to map the tar ball distribution on the coast.

1.5 Who Will Use the Data Collected by this Program?

The data collected by this program will be shared with decision making end-users (e.g. Alabama DEM, NOAA) for data integration into existing and future scientific coastal environmental databases.

During a spill response, the Shoreline Cleanup Assessment Technique (SCAT) team would use the beach profile and tar ball data to better develop their recommendations for cleanup or treatment of oiled shorelines. The information the SCAT team generates drives the shoreline response decision process (Section 2.1).

1.6 How Do These Data Help to Better Respond to Oil Spills?

Historical data play a significant role in planning and prioritizing a shoreline response. The outcome and success of a shoreline cleanup response largely depends on the quality of the information that is available for the decision makers.

Beach profile data are essential to help response personnel understand where oil might be buried or remobilized. By combining beach profile data with initial oiling data from a spill, the SCAT team can recommend where to look for buried oil and to what depths (Figure 6). In addition, SCAT can recommend priorities for beach areas where there is potential for wave action to move oil. Knowing how to prioritize oiled shorelines enables the cleanup operations to progress with optimized efficiency and effectiveness. Missed opportunities can lead to a more lengthy and complex response.

Figure 6. A buried oil layer on a sand beach

Data on background shoreline oiling (tar ball counts and location) help responders to identify natural collection areas. These data play an important role in establishing realistic and achievable clean up targets. In addition, knowing the extent of background oiling can also help scientists to detect possible links between oiling and potential environmental changes.

2. Oil Spill Response – The Shoreline Cleanup Assessment Process

2.1 What is SCAT – Shoreline Cleanup Assessment Technique?

SCAT is a tool used throughout the United States and worldwide for pre-spill planning and during a spill response to survey an affected area and make recommendations for treatment. During a response, these data are crucial to the decision making process. How oiled shoreline environments are treated or cleaned impacts the long-term success of the response. The local environmental, cultural and socio-economic resources and their sensitivities must be considered so that the shoreline response program leads to positive results rather than unnecessary additional harm to the ecosystem and the community.

A SCAT Program:

- Describes the shoreline character (shoreline type).
- Defines where oil is located (or if no oil is present).
- Describes the oil character and the oil concentration in an area.
- Identifies resources (ecological, cultural, human use) affected or potentially affected by a spill.

- Provides information to help managers decide:
    - Whether or not a location needs to be cleaned.
    - Cleanup objectives and priorities.
    - Appropriate cleanup tactics.
    - How much to clean.
    - How to end cleanup.
- Supports Operations teams during the treatment program.
- Provides closure with interagency inspections once the shoreline treatment objectives have been met.

Why do we need a SCAT program?

- Interagency SCAT field teams provide recommendations for decision makers and stakeholders to assess the need for treatment and to sign-off affected areas when the team agrees endpoints (cleanup goals) are met or no further treatment is recommended (Figure 6).
- Data generated by the SCAT teams are used by decision makers to develop priorities, treatment targets, and best management practices (BMPs).
- SCAT team recommendations enable effective treatment by accelerating recovery without causing additional harm to the environment.

Shoreline assessment data and the derived information are important, not only to spill management and stakeholders to aid decision making and planning, but also to the general public to understand the evolving situation.

Figure 6. SCAT Teams provide an opportunity for the agencies participating in the response, the responsible party, and local landowners or managers to work together in the shoreline treatment decision making process.

2.2 Shoreline Treatment Decision Making Process

An effective and efficient response depends largely on rapid and informed decision making. A well-planned shoreline assessment program provides critical information that enables decision makers to plan and execute a successful shoreline clean-up operation (Figure 7).

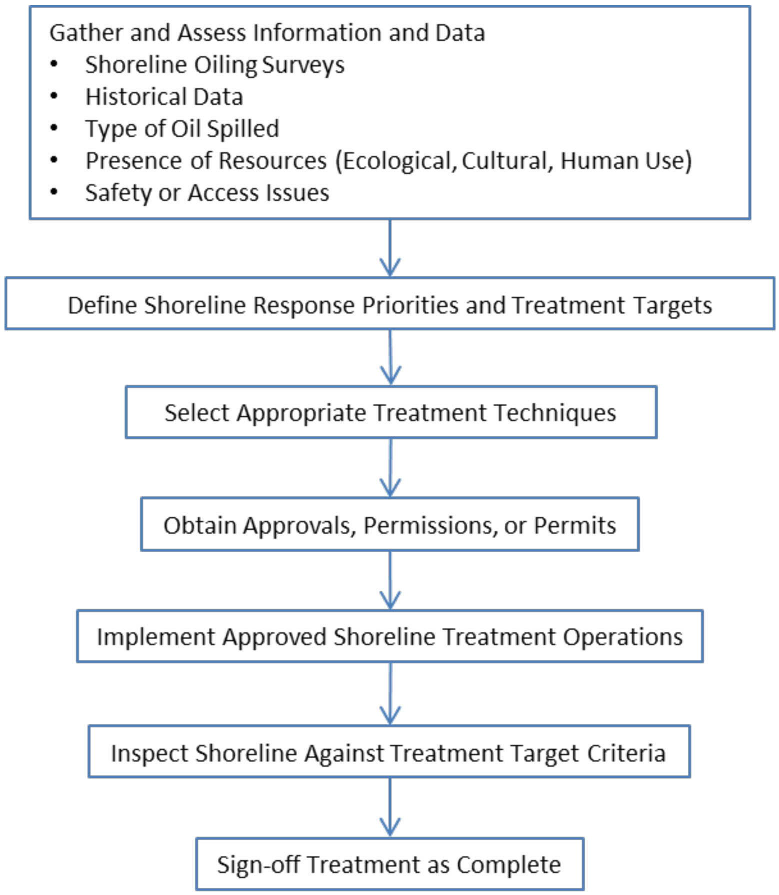


Figure 7. The Shoreline Treatment Decision Making Process

2.3 Oil Spill Treatment Targets

Measurable treatment targets for a shoreline response ensure that everyone involved, from the management level to the response operators in the field, understands which segments require treatment or clean up and what level of residual oiling is considered acceptable in those segments. When those mutually-agreed upon targets are achieved, this means that no further treatment (NFT) is required and that a segment can be removed from the response, and clean-up teams redeployed elsewhere as required. The involvement of the appropriate environmental agencies in the development of NFT targets ensures that their requirements and concerns can be fully taken into account in the decision making process.

When recommending NFT targets to the spill management team, the SCAT Team must understand the:

- degree of oiling
- rate of weathering
- potential for remobilization
- potential for natural recovery
- shoreline type and sensitivity
- potential for exposure to wildlife and the public.

Typically, treatment targets are defined for each of the affected shoreline types and uses. An understanding of the capabilities and limitations of the available treatment techniques is essential; in particular, the team should be aware of any negative impact that each treatment option may have on the shoreline habitat. It is important to note that it is rarely technically or economically practical to attempt to clean to pre-spill conditions or to the NOO (No Oil Observed) standard, and that some treatment activities may have a negative net environmental benefit (NEB), particularly on sensitive shorelines.

Examples of shoreline NFT targets:

- No more than 1% tar balls that are less than 2 cm in diameter (Figure 8).
- No oil or tar balls greater than background deposition rates (where there is good documentation of background oiling data).
- No oiling on hard substrates greater than Coat* (0.1 mm thick) and no greater than 20% distribution.
- No surface oiling more than 10% distribution and more than Cover* (1 cm thick).

** Note: these are standard oil thickness categories used by SCAT teams*

Agreement that sufficient effort has been completed and that targets have been achieved typically occurs through an inspection process that includes representatives of the key parties involved in the response operation (Figure 6). This agreement generates a Segment Inspection Report (SIR). Cleanup is completed (on a segment-by-segment basis) when all involved parties agree that:

- sufficient appropriate treatment has been achieved;
- further activities may cause a negative Net Environmental Benefit (NEB) and No Further Treatment (NFT) is required.

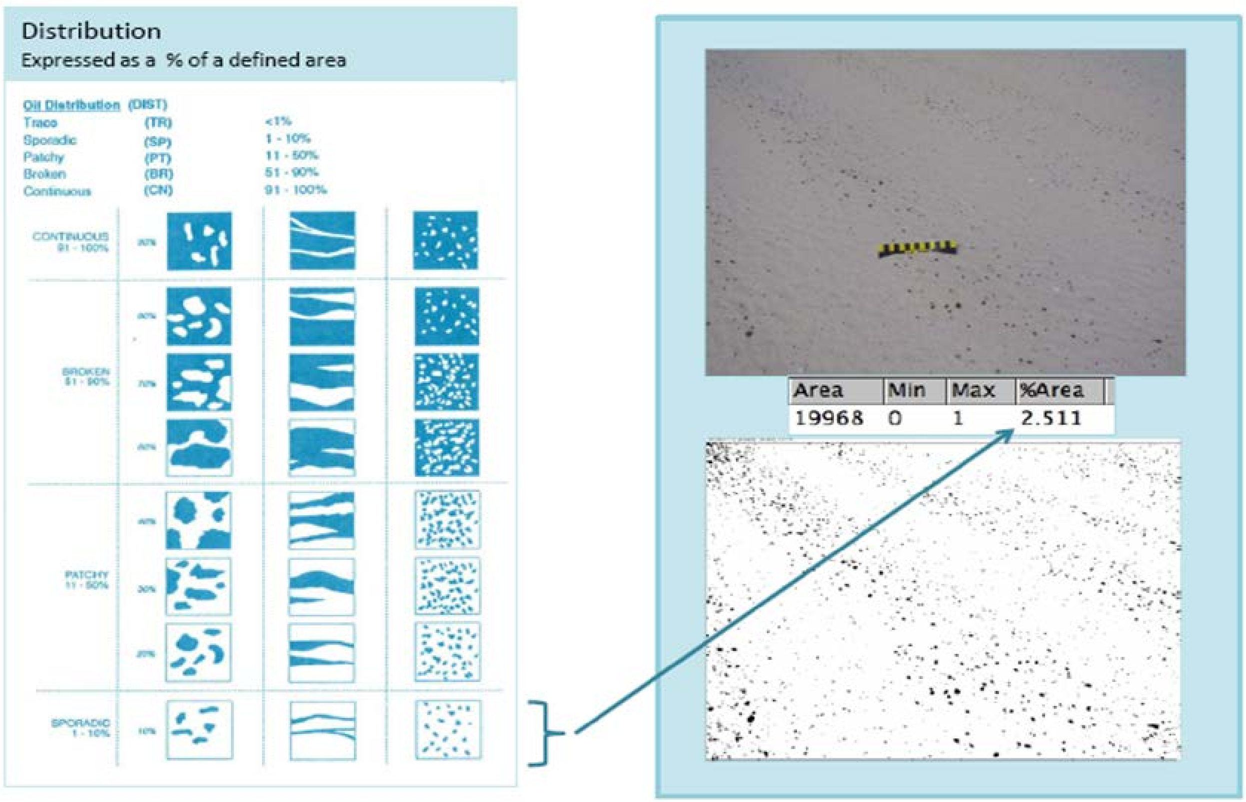


Figure 8. Less than (<) 1% distribution of tar balls

3. Methodology

3.1 Beach Profiling

The rod-and-horizon beach profiling method is a rapid beach profiling technique that uses simple and inexpensive equipment to measure elevations and distances (Emery 1960) (see Equipment Checklist, Appendix 1). Permanent markers or control points are typically back stakes that identify the starting point of the profile so the transect can be surveyed repeatedly along the same line (Figure 9). "Emery Rods" (named after the scientist who developed the technique) are used to measure changes in the elevation of the beach surface along the profile. A measurement tape is used to determine horizontal distances along the transect, with the "0 m" distance being the permanent marker at the landward end of the transect.

3.1.1 Step-by-Step Instructions for the Emery Method of Beach Profiling

1. **Find the Starting Point.** Control points or back stakes (a reference stake or post in the ground or other marker such as the top of a wall) are already established for each beach profile transect (Figure 9). *The same control points are reused for each subsequent profile and are the starting point of all measurements.* The primary control point is the starting "0 m" reference point for the transect. A second control point (stake or pin) or object (sometimes a utility pole, tree, chimney, etc.) is used to define a line to follow to measure the beach profile.

Figure 9. Example of a permanent control point

2. **Begin Notes.** Fill in the top part of the log sheet. Include names of people in the team, the date, profile name or number, beach location, etc.

3. **Record Stake of Control Point Height.** Measure the height of the ground in relation to the control point or the top of the back stake. Place the rod (scale down) on the ground flush against the control point. "Scale down" means the 0 (zero) cm end of the survey rod should be on the ground ("upside down") to measure the height of the control point from the ground up.

4. Read the **vertical difference** between the top of the stake or from the control point to the ground.

5. Set Back Rod. Place the back rod (scale up – the "0 cm" is at the top) on the ground next to the control point/back stake. This is the opposite from the placement in Step 3, where the 0 cm end is on the ground.

6. Set Front Rod.

a. The standard horizontal distance between the two rods is 3 meters. By always measuring at standard 3 m, 6 m, 9 m, etc. distances on each survey, it is easy to compare beach elevation changes between profiles during the data analysis.

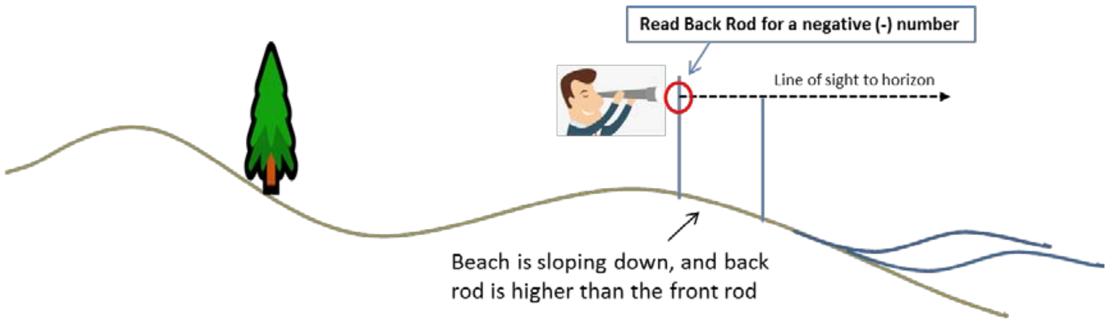
b. If an intermediate feature is present within the 3 m horizontal distance, such as the Last High Water Swash (LHWS) line, the crest of a dune or a beach ridge, or a beach scarp, then the front rod is set at that feature. After the measurement (Step 7 below), the next distance will be one that is at the 3 m interval. For example, when an intermediate feature is documented at 1.25 m, the next measurement will be at a 1.75 m distance; if an intermediate feature is documented at 0.4 m, the next measurement will be at a 2.6 m distance, etc. (Figure 2).

c. Looking back toward land and the back rod, the front person places the front rod (with scale up) on the profile line using the back stake(s) as a guide to make sure the line is being followed. Use a survey measuring tape for this distance and be careful to hold both rods straight up and down while setting the front rod in place.

7. Observe, Measure and Record.

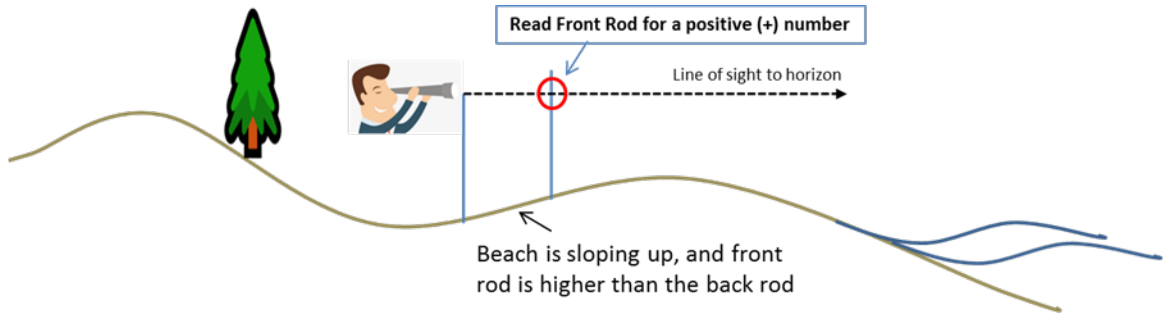
a. Measure and Record the horizontal distance on the Beach Profile form.
Replace with diagram.

b. From the back rod, if the beach elevation slopes down, the back person (OBSERVER) sights the horizon and the top of the front rod. This line-of-sight will intersect on the back rod. Read and say aloud the elevation number marked on the back rod that is in line with the front rod top and the horizon. *Keep both rods vertical when reading!* This number is the NEGATIVE height difference of the slope of the beach between the two rods.



c. If the beach elevation goes up, the Observer sights the horizon and the top of the back rod. This line-of-sight will intersect on the front rod. Read and say aloud the elevation number marked on the front rod that is in line with the back rod top and the horizon.

This number is the POSITIVE height difference of the slope of the beach between the two rods.



d. It takes careful attention by both rod-holders to ensure the elevation number is correct on each measurement. A single error will make the rest of the data plot incorrectly on a graph. The Recorder should always repeat back the elevation change to the Observer (and make sure to always note if "+" or "–") and the horizontal distance as these numbers are entered onto the Beach Profile form. Also, the Recorder notes any features at the front rod (such as edge of dune, slope change, water line, etc.) in the notes column on the form.

8. Move Ahead. After the measurements (horizontal distance and elevation difference) are recorded on the form, the Observer moves the back rod to the same spot occupied by the front rod. The person at the front rod should wait for the Observer to come up alongside in order to be certain that the back rod is placed in the correct location. After the back rod is in place, the front rod can be moved ahead and placed on the ground in line with the back rod and the original control point(s). The front person is responsible for making sure that each forward move stays on the profile line.

9. Repeat Steps 6, 7, and 8. Observe, Measure, Record, and Move.

a. Continue to move ahead, repeat these steps all the way to the water. As you move along the profile, everyone on the team should look ahead for features to record and measure.
b. The Recorder is responsible for ensuring measurements are made at the standard 3 m interval. If intermediate measurements are taken the total should still come to 3 m.

10. Stop at the Water. Make a measurement that includes the water line (WL). In the Notes column of the log sheet abbreviate to "WL" and record the TIME of the measurement. Because the height of the tide is changing, the time of the reading is important. Estimate the place on the beach where the water level would be without the waves, the still water level. There is no need to measure how far up the beach the swash is going at the time of the measurement.

11. **Continue On (Optional).** The process can be continued into the water if teams see fit. This is optional and not necessary. In cold water there is a risk of hypothermia. In rough seas there is a risk of getting hit by breaking waves. DO NOT TAKE CHANCES. *Always keep your personal safety and that of your team members in mind.* A few extra points on a graph are not worth the risk of personal injury.

12. **Final Reading.** At the last measurement, record the TIME finished in the Notes column.

13. **Photograph the Beach.** Take four photographs of the beach. It helps to place the profile rods down on the profile line part way up the beach, near the last high-water swash (LHWS) line.
    a. From the starting point/control point, with the view seaward along the transect line in the direction toward the water line.
    b. From the water line or end point, with the view landward along the transect line in the direction toward the starting point/control point.
    c. From the middle of the transect (near the LHWS), with the view alongshore to the right of the profile.
    d. From the middle of the transect (near the LHWS), with the view alongshore to the left of the profile.

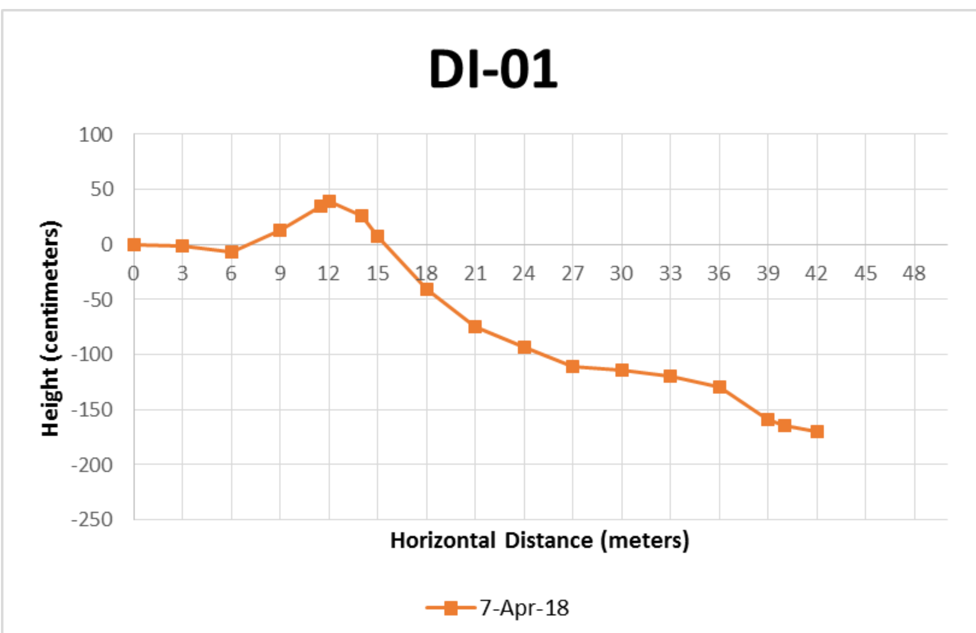
14. Conduct the **Tar Ball survey** (See Section 3.2- Tar Ball Survey).

15. **Pack Up.** Gather up all the gear, including any posts back at the control points, notes, and field gear. The profile is done!

The original document on the Emery (rod-and-horizon) beach profiling method is in the references (Section 7) or can be retrieved from http://onlinelibrary.wiley.com/doi/10.4319/lo.1961.6.1.0090/epdf

The example below shows how the data from Dauphin Island Profile 1 (DI-01) is entered into an Excel spread sheet and then plotted into a graph.

Distance to Front Rod (m)	Elevation Difference (cm)	Notes	Cumulative Distance (m)	Cumulative Elevation from Back Stake (cm)
0	0		0	0
3	-2		3	-2
3	-5		6	-7
3	20		9	13
2.5	22	Dune Crest	11.5	35
0.5	3.5		12	38.5
2	-13		14	25.5
1	-18		15	7.5
3	-48		18	-40.5
3	-34		21	-74.5
3	-19		24	-93.5
3	-18		27	-111.5
3	-3		30	-114.5
3	-5		33	-119.5
3	-10		36	-129.5
3	-30	LHWS	39	-159.5
1	-5		40	-164.5
2	-6	WL	42	-170.5



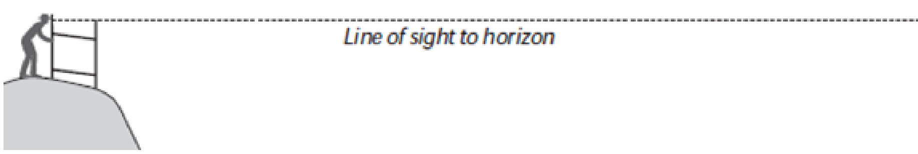
3.1.2 Beach Profiling Tips

A beach profiling checklist and equipment list are provided in Appendix 1 to assist in planning for fieldwork and conducting the profiles.

The horizon must be visible to conduct the Emery Method. If fog or rain obscures the sea/sky horizon, the survey cannot be done on that day.

Readings are taken as follows:

- If the beach surface slopes **DOWN** towards the ocean, then the top of the front rod is **LOWER** than the top of the Observer's back rod. The Observer takes his/her eye level down so that the top of the forward rod is in line with the horizon. S/he takes the vertical reading (in centimeters) on the back rod where it intersects the horizon. This is recorded as a **NEGATIVE** (-) number.



- If the beach surface slopes **UP** towards the ocean, then the forward rod is **HIGHER** than the Observer's back rod. The Observer takes his/her eye level to the top of the back rod and takes the vertical reading (in centimeters) on the forward rod where it intersects the horizon. This is recorded as a **POSITIVE** (+) number.

Care should be taken to ensure the rods are held vertically, without leaning in any direction. The role of the person holding the front rod is to ensure the rods are lined up with the back stake so that the same transect line is followed every time. The rod should be held lightly on the surface of the beach so that the rod does not sink into the beach sediment and cause inaccurate measurements.

During the profile survey, observations on the beach should be recorded, including:

- Changes in beach substrate (sediment type).
- Vegetation.
- Last High Water Swash (LHWS) line.
- Any vehicle tracks on the beach.
- Any walls, fences or other manmade structures along the profile.
- Water-line.

Profiles should ideally be taken at low tide, preferably at the lowest tide of the month, so that the maximum beach width may be measured.

3.1.3 Beach Profile Locations

Beach profile locations, spacing, and survey frequency of profile transects are chosen on the basis of the specific need required of a project. A very detailed study of a beach would require very closely spaced and frequently surveyed beach profiles. This is because the more 2-D cross sectional profiles and surveys that are accumulated, the more information about alongshore changes and the response of the shoreline to specific processes will be collected. For this project, the focus is on understanding the inter-seasonal to seasonal response of the beach and the relationship of beach dynamics to the presence of oiled residues, such as tar balls. The goal is to therefore establish a semi-regular survey interval of approximately seven locations.

Profile locations and control points for each beach profile are provided in Appendix 5.

3.1.4 Equipment Checklist

An equipment checklist is provided in Appendix 1.

3.1.5 Photo Documentation

Photographs are an additional tool for understanding the beach dynamics. When taken consistently with the same view of the beach, the photos visually illustrate the beach formation changes over time (Figure 10).

Ensure that files are not too large: 1 MB maximum, 250 KB is sufficient.

For each profile, take a minimum of four (4) photographs in the same order for the data files (Figure 10).

1. From the starting point/control point, with the view seaward along the transect line in the direction towards the water line.
2. From the water line or end point, with the view landward along the transect line in the direction towards the starting point/control point.
3. From the middle of the transect (near the LHWS), with the view alongshore to the right of the profile.
4. From the middle of the transect (near the LHWS), with the view alongshore to the left of the profile.

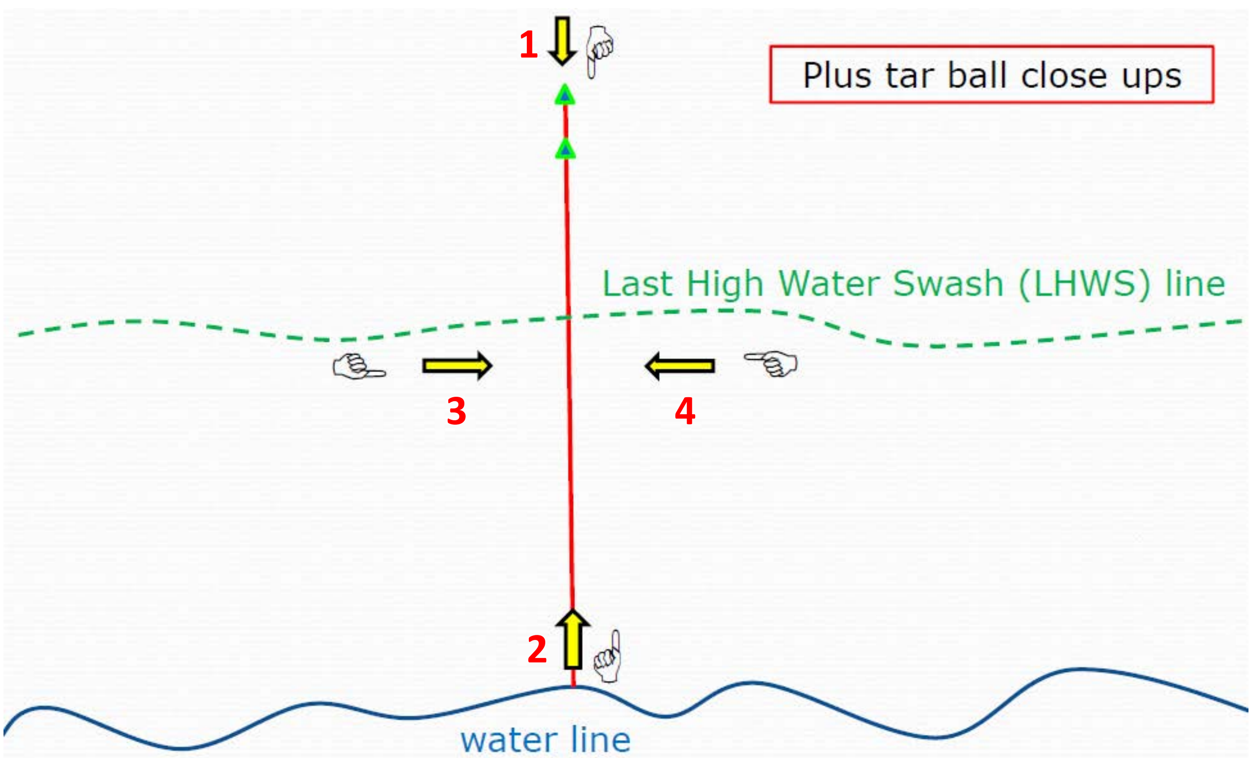


Figure 10. Photo location and views for a beach profile survey

After this set, take any additional photos you may think useful to document the features on the beach such as, an erosion scarp or a ridge and runnel (Figure 11) and any observed tar balls.

Figure 11. Additional photo of a migrating ridge

Note: the ridge and runnel (trough) feature in the photograph would have intermediate survey points to document the change from dry to wet sand (x) at right, as well as the bottom and top of the scarp feature at left.

3.1.6 Beach Profile Data Form

The data sheet is included in Appendix 2. The data sheet should be used to ensure that Beach Profiles are taken from the same location and generate precise measurements every time. This ensures consistency and allows direct comparison of profile measurements and beach elevations over time.

NOTE: The first row of data is always “0 cm” Elevation and “0 m” Distance, as this is the origin of the line at the start or control point, and from this point:

- the first reading is for the vertical height difference from the control point to the ground, and
- the second reading is the first seaward forward horizontal observation.

3.2 Tar Ball Survey

3.2.1 Tar Ball Shoreline Oiling Survey Method

After completion of the beach profile at each site, a tar ball survey should be conducted along a 100 meter length of shoreline (Figure 12), centering on the beach profile transect:

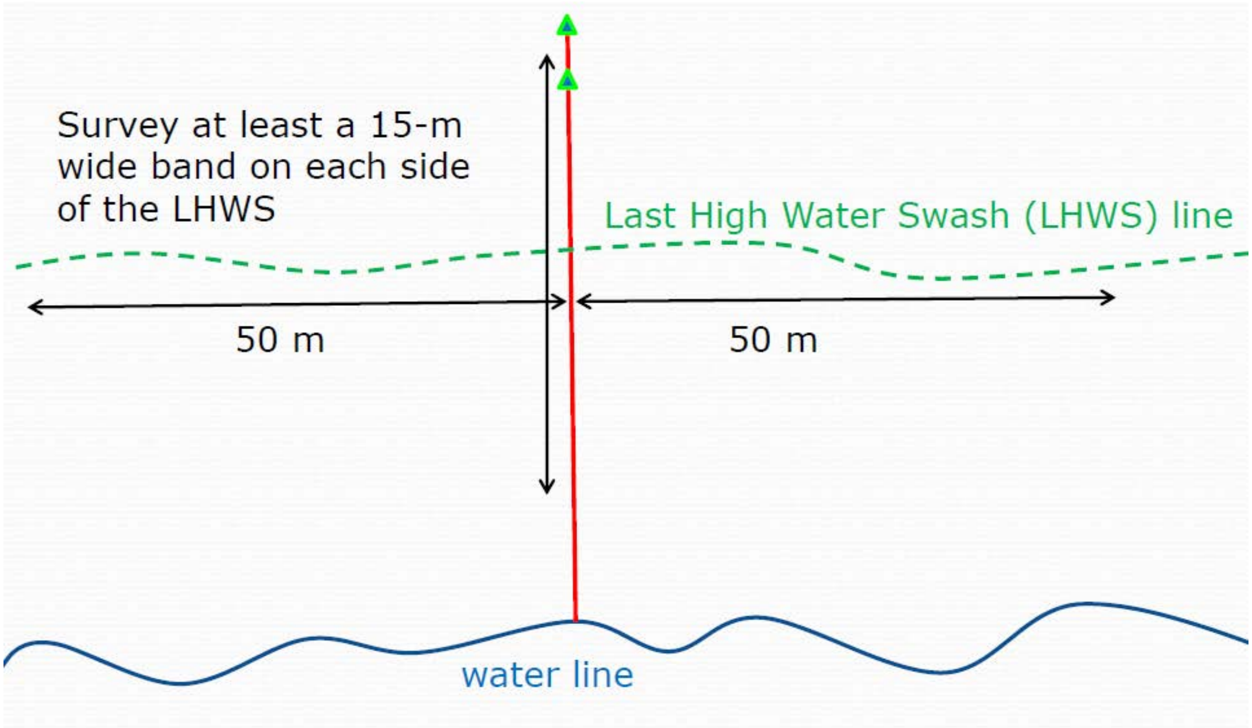


Figure 12. Tar ball survey length

Team members should look for tar balls in the intertidal zone, concentrating in the upper intertidal zone near the Last High Water Swash, and:

→ If no oil/tar balls are observed, note NOO (No Oil Observed) on the beach profile form.

→ If tar balls are observed record observations on the Tar Ball Shoreline Oiling Survey (SOS) Form (Appendix 2).
  - Tar ball size can be estimated or measured using a photo scale (Appendix 3).
  - Shoreline lengths or areas can be estimated or measured using measuring tape or a handheld GPS unit.

Note: If the nature of the transect does not allow at least 15 m on each side of LHWS use your best judgement and record the distance you were able to complete.

3.2.2 Photo Documentation

Representative photos should be taken of the tar balls encountered during the survey. Always use a photo scale for these photos (Figure 13). Photos of all the observed tar balls are not required. A few photos that document the representative size, shape, distribution, and type of tar balls found is sufficient (Figure 14).

Figure 13. Use of scales to photograph tar balls

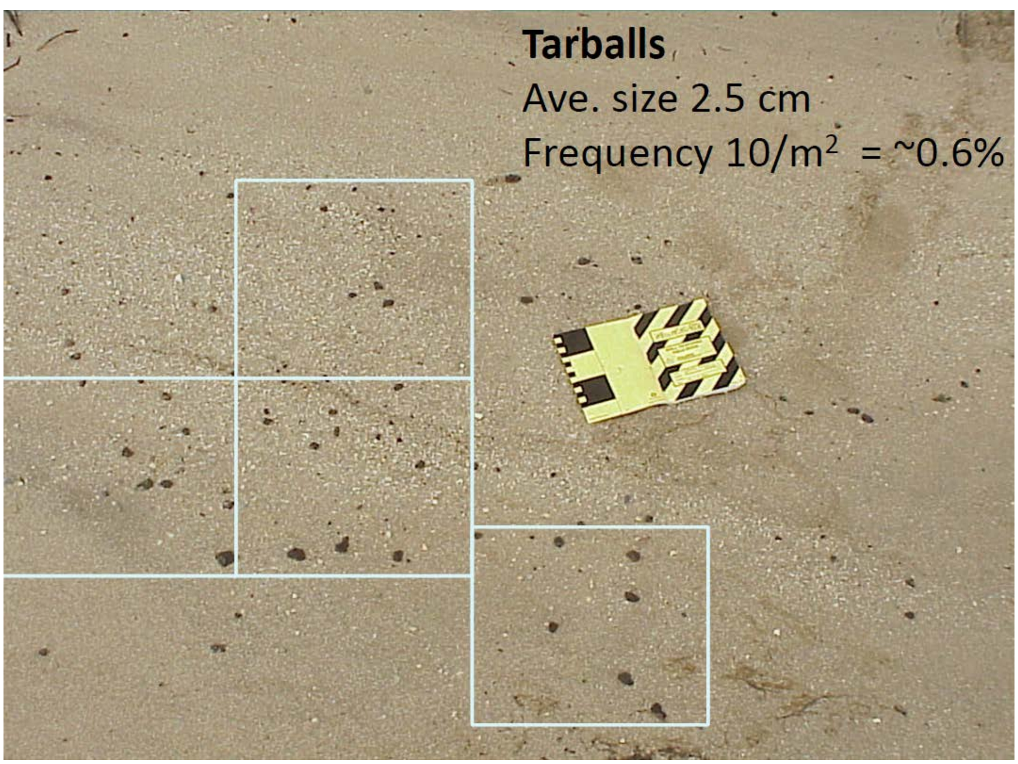


Figure 14. Example of method to document tar balls using 25-cm squares

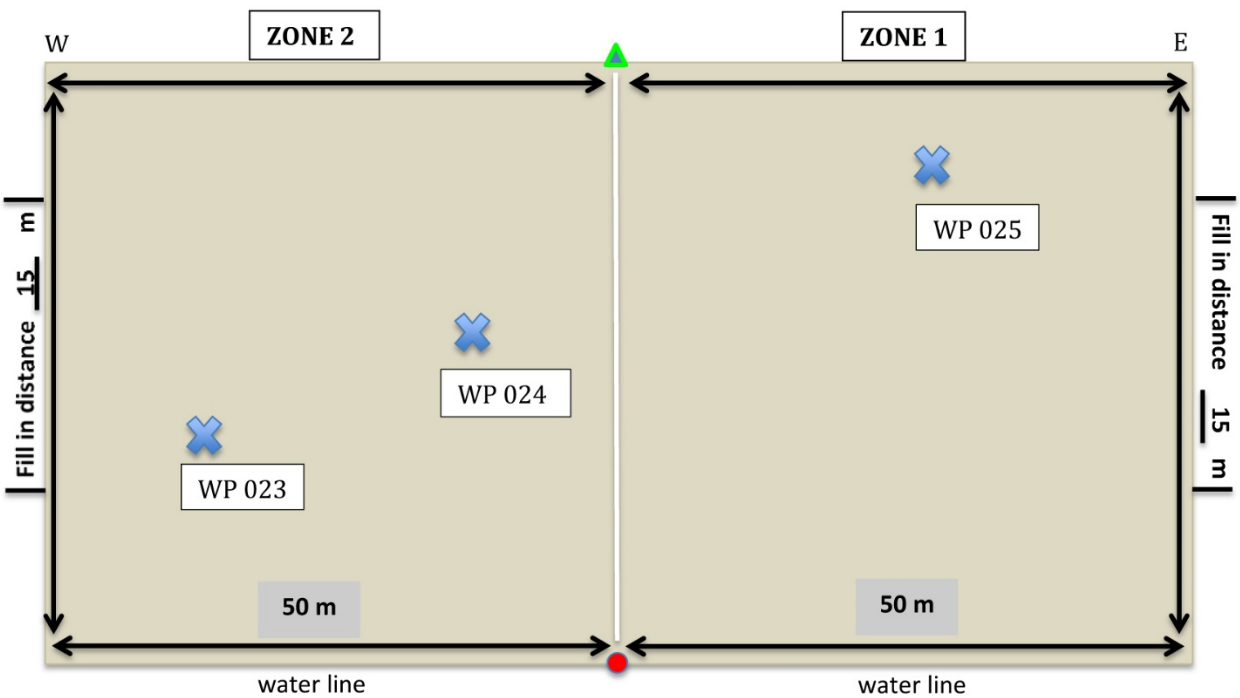
3.2.3 Tar Ball Data Form

The data sheet is included in Appendix 2. An example of a completed form is provided below.

Tar Ball Survey

Date: 03FEB19
Location and Profile # DI 02

Directions:
1. Walk transect and place 'X' and waypoint number on map below where tar ball(s) are found.
2. Fill out data chart and use scale for pictures.
3. Fill in distance walked on side of the map.



ZONE 2							
TB ID #	Size (cm)	Pic. #	WP #	TIDAL ZONE (check one)			
				LITZ	MITZ	UITZ	SUTZ
2	5	154	23	X			
3	1	155	24		X		

ZONE 1							
TB ID #	Size (cm)	Pic. #	WP #	TIDAL ZONE (check one)			
				LITZ	MITZ	UITZ	SUTZ
1	3	153	25				X

Est. Average Size: 3 cm   Size of largest TB: 5 cm   Total Number of TBs: 3

4. Survey Schedule

- The goal is to profile and survey on the lowest tide days of the month. Sometimes this is not possible due to personal schedules and daylight hours.
- A calendar schedule noting the best days in each month for the tides is in Appendix 4.
- If it is not possible to profile during the recommended time period (green highlighted calendar dates in Appendix 4), select a date close to the low tide days (yellow denotes acceptable alternate days). Please avoid surveying on dates noted in red.
- Additional information on tide predictions for Dauphin Island can be found at: https://tidesandcurrents.noaa.gov/noaatidepredictions.html?id=8735180

5. Data Management

After field work is completed, the data forms and photos should be uploaded to the google drive. If you have any questions regarding surveys or data collection, email Mark Kulp at mkulp@uno.edu.

Forms can be photographed with a cell phone and sent as a picture in JPEG or PDF format. This can be done through document scanner smart-phone applications or traditional scanners. Photographic images should not exceed 1 MB each.

Do not discard submitted forms. The original forms will be collected the next time UNO personnel meet with volunteers. This ensures we have a digitally and physically accurate database.

6. Glossary

BMP	Best Management Practice
GPS	Global Positioning System
HW or HHW	High Water or Highest High Water
Horizontal distance	The distance over a horizontal plane
ITZ	Intertidal Zone - The zone between high water and low water.
LHWS	Last High Water Swash
LW or LLW	Low Water or Lowest Low Water
LITZ or LI	Lower Intertidal Zone – underwater during most of the tidal cycle
MITZ or MI	Mid Intertidal Zone – underwater during about half of the tidal cycle
UITZ or UI	Upper Intertidal Zone – underwater during some of the tidal cycle
SOS	Shoreline Oiling Survey
STZ or SU	Supratidal Zone – The zone above the HHW; above the water line except during high spring tides or storms
Vertical elevation change	The change of beach elevation (up or down)
Waypoint	Waypoint marked on a handheld GPS unit
WL	Water Line, the still water location on a profile

7. References

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University of Maine Sea Grant. Southern Maine Beach Profile Monitoring Volunteer Manual. Sea Grant Maine, Maine Coastal Programs, University of Maine Cooperative Extension, University of Maine, Maine Geological Survey. Retrieved from: http://www.seagrant.umaine.edu/files/Jake%20Aman/Volunteer_Manual.pdf January 2018.

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Taylor, E., Challenger, G.E., Owens, E.H. and Mauseth, G.S., 2014. Background oiling documented by SCAT surveys along the Gulf Coast Shorelines prior to and following MC252 oiling (Poster). Gulf of Mexico Oil Spill & Ecosystem Science Conference Report, p. 59. http://gulfresearchinitiative.org/wp-content/uploads/2014_GulfConferenceReport.pdf

Appendix 1 - Beach Profile and Equipment Checklist

✓	**Equipment Checklist**
	Profile rods
	Measuring tape
	GPS and spare batteries
	Camera and spare batteries
	Photo scales
	Forms/clipboard
	Pencils/pens
	Check weather forecast for temperature and select appropriate clothing and suncreeen, etc.
	Check weather forecast for strong onshore winds that might cause a water level set up

✓	**Beach Profile Checklist**
	Conduct "tailgate" Job Safety Analysis (JSA) briefing and sign JSA form.
	Check that the horizon is visible.
	Find the profile starting stake and lineup against the landward and seaward landmarks.
	Begin note-taking on the form.
	Take a Waypoint and note GPS coordinates at the starting stake.
	Take a seaward photograph from starting stake.
	Record the starting stake height. Put the 0 (zero) end of the rod on the ground and read the height of the stake from the ground up.
	Set BACK rod at starting stake (keeping rod vertical) and FORWARD rod at 3 m distance along the transect line (or a shorter intermediate distance if necessary). Remember, as a team, to check that the transect line stays aligned properly with the landmarks.
	From the BACK rod to the FORWARD rod, measure Vertical Elevation Change and Horizontal Distance. • Observer carefully calls out if the elevation is a negative "-" or a positive "+" reading. • The Recorder should repeat the vertical and horizontal readings back to the Observer to ensure that the correct numbers are recorded. • The Recorder should verify that a 3 m interval is maintained along the transect when intermediate elevations are measured. • Note any substrate/vegetation or other features, such as the Last High Water Swash (LHWS) line, dune vegetation, wrack, etc.
	Move BACK rod to the exact spot where the FORWARD rod was placed (keeping rod vertical and in line with the profile marker).
	Move FORWARD rod seaward 3m or to an intermediate distance less than 3m if there is a land feature requiring a smaller interval to measure the elevation change accurately. Ensure that the intermediate distances add up to a 3 m interval such that the overall 3 m spacing is maintained throughout the transect.
	Repeat until the water line (WL).
	Take a Waypoint and note GPS Coordinates at the water line.
	Note time at Water Line (last profile reading).
	Take a landward photograph from the water line.
	Take alongshore photographs (each way) from near the Last High Water Swash (LHWS) or wrack line. Take your first picture toward the right and the last picture toward your left. Orientation for left and right is looking landward.
	Conduct Tar Ball survey 50 m on either side of the profile transect in the upper intertidal and supratidal zones near the LHWS (see Section 2.2)

Appendix 2 – Forms

BEACH PROFILE RECORDING FORM		
Date (dd/mmm/yy):		Profile Number/ Name:
Team (names): Lead:		
Back Stake Height:		Time at Water Line (24 hour):
Image Number (Start):		Image Number (End):
Coordinates (Start)		Coordinates (End)
GPS Way Point # (Start):	GPS #:	GPS Way Point # (End):
Oil/Tar balls Observed?		NO YES (CIRCLE ONE) If yes, fill out Tar Ball Form
Distance (m)	**Elevation (cm)**	**Notes** (substrate, Last High Water Swash (LHWS), vegetation, tar balls, water line (WL), etc.)
0	0	

REV 21DEC2018

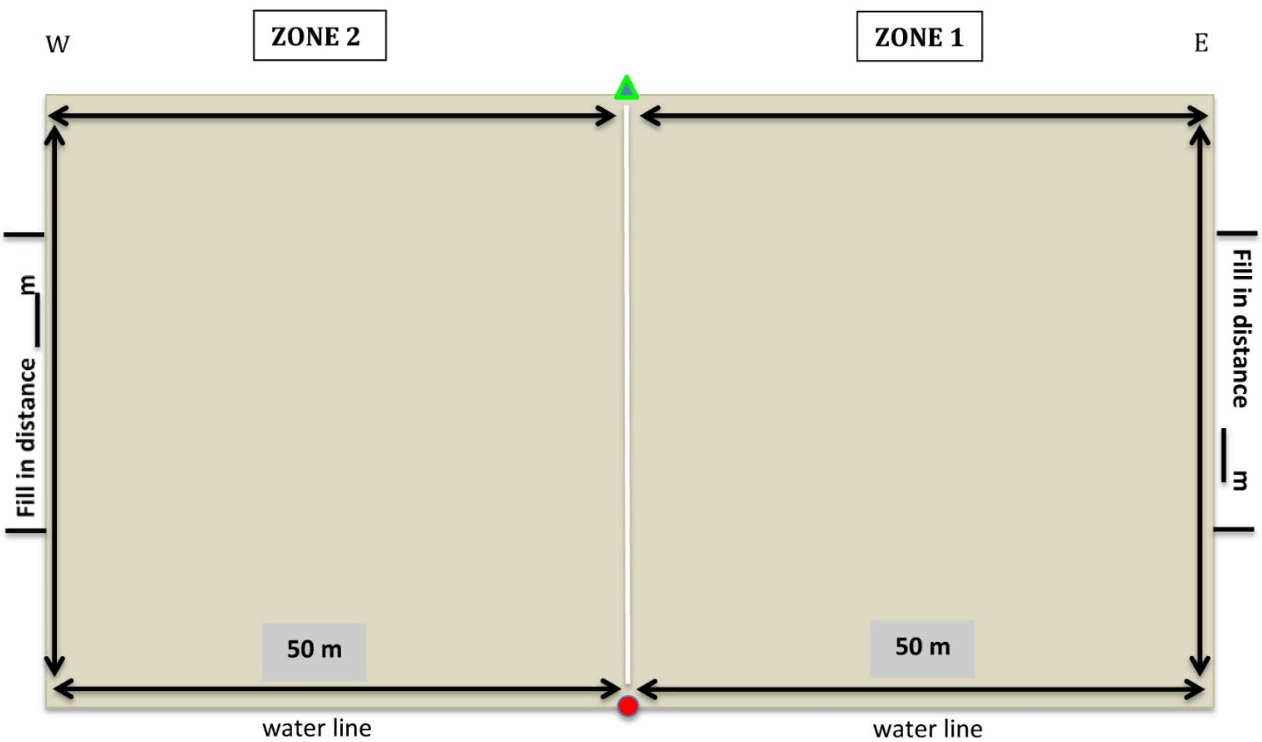
Tar Ball Survey

Date ____________

Location and Profile # ________________
.

Directions:

1. Walk transect and place 'X' and waypoint number on map below where tar ball(s) are found.
2. Fill out data chart and use a scale for pictures.
3. Fill in distance walked on side of the map.

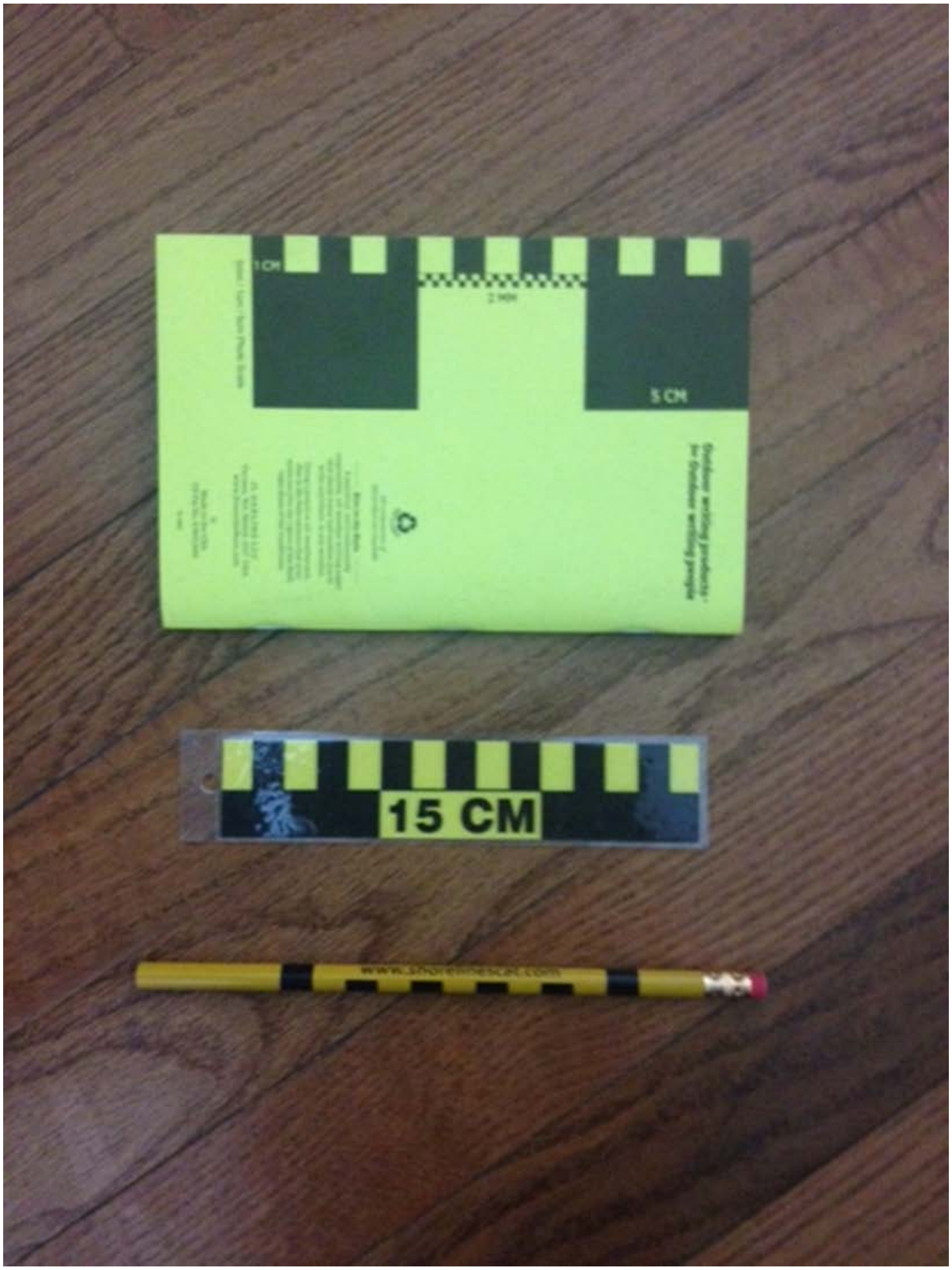


ZONE 2							
TB ID #	Size (cm)	Pic. #	WP #	TIDAL ZONE (check one)			
				LITZ	MITZ	UITZ	SUTZ

ZONE 1							
TB ID #	Size (cm)	Pic. #	WP #	TIDAL ZONE (check one)			
				LITZ	MITZ	UITZ	SUTZ

Est. Average Size _______ Size of largest TB _______ Total Number of TBs ____

Appendix 3 - Photo Scales



Appendix 4 - 2018 Tide Windows

Dauphin Island predicted astronomical tides:

- Highest High Water Level (during spring tides): +2.0 feet (+0.61 m)
- Mean Water Level: +0.6 feet (+0.2 m)
- Lowest Low Water Level (during spring tides): -0.7 feet (-0.21 m)

Survey Category	Predicted Low Water
	<0.0 m for 3 daylight hours
	<0.25 m for 3 daylight hours
	>0.25 m

Note that in the United States, tide levels are usually given in feet and should be converted to meters for scientific study purposes.

1. Check the tide tables for the time of the predicted low tide.
2. The day before and the day of a planned survey review the weather forecast.
   - Strong onshore winds out of the west southwest, south or southeast can raise the predicted water level
   - Strong offshore winds out of the east, northeast, north, or northwest can lower the predicted water level

The following tables predict the Ideal, Good, and Not Acceptable beach profile survey dates in 2018:

JANUARY 2019

MON	TUE	WED	THU	FRI	SAT	SUN
	1	2	3	4	5	6
	A	A	A	A	A	A
7	8	9	10	11	12	13
A	A	A	A	A	A	A
14	15	16	17	18	19	20
B	B	B	A	A	A	A
21	22	23	24	25	26	27
A	A	A	A	A	B	B
28	29	30	31			
B	A	A	A			

FEBRUARY 2019

FRI	SAT	SUN	MON	TUE	WED	THU
1	2	3	4	5	6	7
A	A	A	A	A	A	A
8	9	10	11	12	13	14
A	B	B	B	B	B	B
15	16	17	18	19	20	21
A	A	A	A	A	A	A
22	23	24	25	26	27	28
B	B	B	B	B	B	A

MARCH 2019

FRI	SAT	SUN	MON	TUE	WED	THU
1	2	3	4	5	6	7
A	A	A	A	A	B	B
8	9	10	11	12	13	14
B	B	B	B	B	B	B
15	16	17	18	19	20	21
B	A	A	A	A	B	B
22	23	24	25	26	27	28
B	B	C	C	C	B	B
29	30	31				
B	B	B				

APRIL 2019

MON	TUE	WED	THU	FRI	SAT	SUN
1	2	3	4	5	6	7
B	B	B	B	B	B	B
8	9	10	11	12	13	14
C	C	C	C	B	B	B
15	16	17	18	19	20	21
B	B	B	B	B	B	C
22	23	24	25	26	27	28
C	C	C	C	B	B	B
29	30					
B	B					

MAY 2019

WED	THU	FRI	SAT	SUN	MON	TUE
1	2	3	4	5	6	7
B	B	B	B	B	C	C
8	9	10	11	12	13	14
C	C	C	B	B	B	B
15	16	17	18	19	20	21
B	B	B	B	B	C	C
22	23	24	25	26	27	28
C	C	C	B	B	B	B
29	30	31				
B	B	B				

JUNE 2019

SAT	SUN	MON	TUE	WED	THU	FRI
1	2	3	4	5	6	7
B	B	B	B	C	C	C
8	9	10	11	12	13	14
C	B	B	B	B	B	B
15	16	17	18	19	20	21
B	B	B	B	C	C	C
22	23	24	25	26	27	28
C	B	B	B	B	B	B
29	30					
A	A					

JULY 2019

MON	TUE	WED	THU	FRI	SAT	SUN
1	2	3	4	5	6	7
B	B	B	C	C	C	C
8	9	10	11	12	13	14
B	B	B	B	A	A	B
15	16	17	18	19	20	21
B	B	B	C	C	C	C
22	23	24	25	26	27	28
B	B	B	B	B	A	A
29	30	31				
A	B	B				

AUGUST 2019

THU	FRI	SAT	SUN	MON	TUE	WED
1	2	3	4	5	6	7
C	C	C	C	B	B	B
8	9	10	11	12	13	14
B	B	B	B	B	B	B
15	16	17	18	19	20	21
C	C	C	C	C	B	B
22	23	24	25	26	27	28
B	B	B	B	B	B	B
29	30	31				
C	C	C				

SEPTEMBER 2019

SUN	MON	TUE	WED	THU	FRI	SAT
1	2	3	4	5	6	7
C	B	B	B	B	B	B
8	9	10	11	12	13	14
B	B	B	C	C	C	C
15	16	17	18	19	20	21
C	C	B	B	B	B	B
22	23	24	25	26	27	28
B	B	B	B	C	C	C
29	30					
C	B					

OCTOBER 2019

TUE	WED	THU	FRI	SAT	SUN	MON
1	2	3	4	5	6	7
B	B	B	B	B	B	B
8	9	10	11	12	13	14
B	B	C	C	C	C	B
15	16	17	18	19	20	21
B	B	B	B	B	B	B
22	23	24	25	26	27	28
B	B	B	C	C	B	B
29	30	31				
B	B	B				

NOVEMBER 2019

FRI	SAT	SUN	MON	TUE	WED	THU
1	2	3	4	5	6	7
B	B	B	B	B	B	B
8	9	10	11	12	13	14
B	B	B	B	B	B	A
15	16	17	18	19	20	21
A	A	A	A	A	B	B
22	23	24	25	26	27	28
B	B	B	B	A	A	A
29	30					
A	A					

DECEMBER 2019

SUN	MON	TUE	WED	THU	FRI	SAT
1	2	3	4	5	6	7
A	A	B	B	B	B	B
8	9	10	11	12	13	14
B	B	A	A	A	A	A
15	16	17	18	19	20	21
A	A	A	A	B	B	B
22	23	24	25	26	27	28
A	A	A	A	A	A	A
29	30	31				
A	A	A				

Appendix 5 – Location Map

Appendix 6 – Profile Locations

DI-01: Audubon Bird Sanctuary East

DI-02: Audubon Bird Sanctuary West

DI-03: Public Beach East

DI-04: Public Beach West

DI-05: Sam Houston

DI-06: Linder Property

DI-07: Tierra Court

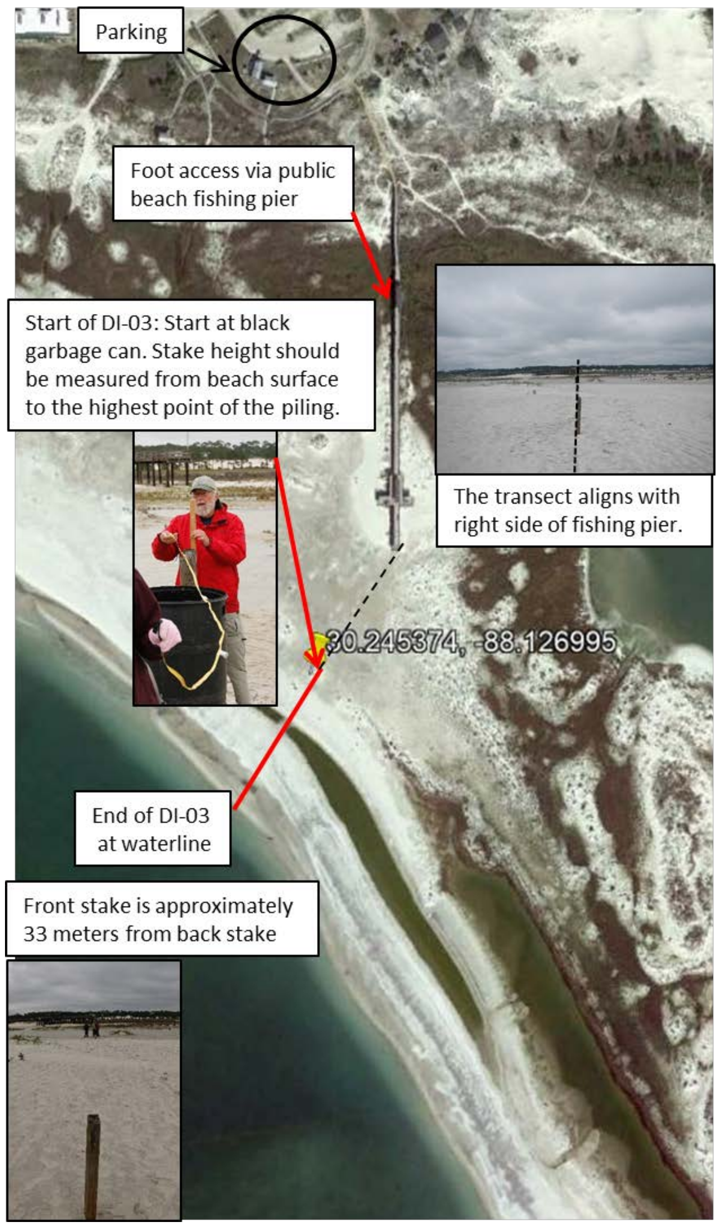
Profile #:	**DI-01**
Location Name	**Audubon Bird Sanctuary**
Start coordinate:	N 30.245129, W -88.089152
End coordinate:	N 30.244712, W -88.089086
Access:	Access via bird sanctuary or by the beach from the parking area at the entrance of a gated community at the end of Audubon Street
Start point (0m):	Wooden post with “Share the Beach Sign” at end of boardwalk. Take stake measurement on landward side of post.
Distances measured:	Every 3m (use intermediate measurements over the dune)
Maps and photographs:	

Profile #:	DI-02
Location Name	**Audubon Bird Sanctuary West**
Start coordinate:	N 30.244488, W -88.090943
End coordinate:	N 30.244326, W -88.090885
Access:	Access via bird sanctuary to the west or by the beach from the parking area at the entrance of a gated community at the end of Audubon Street
Start point (0m):	"These Dunes Aren't Made for Walking Sign" on wooden post
Distances measured:	Every 3m, with intermediate measurements taken over the dune

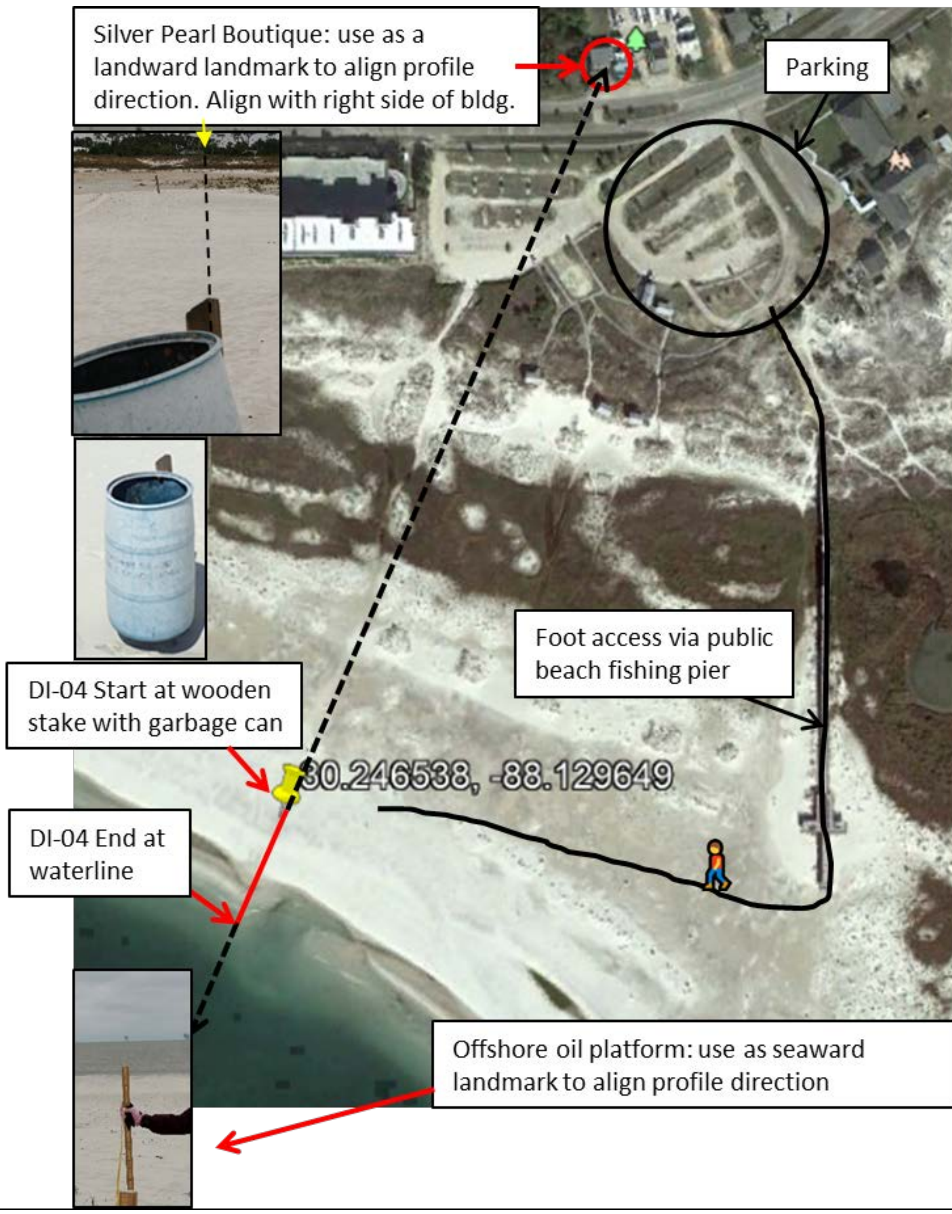
Maps and photographs:

Profile #:	DI-03
Location Name	**Public Beach East**
Start coordinate:	N 30.245374, W -88.126995
End coordinate:	N 30.244731, W -88.127519
Access:	Via the public beach fishing pier
Start point (0m):	Wooden post with black garbage can
Distances measured:	Every 3m (unless there is a significant change in elevation)

Maps and photographs:



Profile #:	DI-04
Location Name	**Public Beach West**
Start coordinate:	N 30.246538, W -88.129649
End coordinate:	N 30.245994, W -88.129930
Access:	Via public beach fishing pier and west along the beach
Start point (0m):	Wooden post with light blue garbage can
Distances measured:	Every 3m (unless there is a significant change in elevation)
Maps and photographs:	



Profile #:	DI-05
Location Name	**Sam Houston**
Start coordinate:	N 30.250241, W -88.158696
End coordinate:	N 30.250020, W -88.158673
Access:	Sam Houston
Start point (0m):	First post of dune fencing to left of parking lot. Stake height reading taken along inside (east side) of the wood dune fencing post.
Landward landmark:	None
Seaward landmark:	Large wooden post on the beach
Distances measured:	Every 3m (unless there is a significant change in elevation)

Maps and photographs:

Profile #:	DI-06
Location Name	**Linder Property**
Start coordinate:	N 30.242341, W -88.102788
End coordinate:	N 30.242088, W -88.102753
Access:	Within DeSoto Landing gated community. Ask team lead for gate code.
Start point (0m):	Metal stake
Landward landmark:	Back stake lines up with North edge of dune fence and right railing of staircase of gray house to left of Mark's house.
Seaward landmark:	Small offshore oil platform is often hard to see. Ensure lining up on landward side.
Distances measured:	Every 3m (unless there is a significant change in elevation)
Maps and photographs:	

Profile #:	**DI-07**
Location Name	**Tierra Court**
Start coordinate:	N 30.24906, W -88.18351
End coordinate:	N 30.24870, W -88.18348
Access:	From Bienville Blvd., turn on Tierra Court towards Gulf side (south).
Start point (0m):	Utility pole. Measurement taken from ground up to screw on east side of pole.
Landward landmark:	Utility pole
Seaward landmark:	Guy wire cable
Distances measured:	Every 3m (unless there is a significant change in elevation)

Maps and photographs: