Sample.

Group 3 Internal Assessment
Geography Higher Level

What has the impact of the filming of 'Pirates of the Caribbean' had on beach characteristics of Golden Grove Beach, Grand Bahama?

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Contents Page:

Introduction:

Grand Bahama is one of over 700 islands and 2,400 keys in The Commonwealth of The Bahamas. It is the fourth largest island in the country and is approximately 90 miles long and 12 miles wide. The island has a small population of approximately 50,000 people. In 2005, the film "Pirates of the Caribbean" started filming and took place on a number of islands in the Caribbean, including Grand Bahama. To operate a number of the pirate ships, an open water filming facility was created on an area of about 3,500 acres located on Golden Grove Beach. A large metal water tank was created for the filming. The tank is about 376,000 square feet and 16 feet deep. It is large enough to operate multiple, full-scale pirate ships. Since filming ended, the tank has not been used and has been left and is deteriorating. This investigation relates to the Oceans and Coastal Margins section of the Geography HL syllabus. The area of coastline to the East of the tank has been greatly affected from pollution and erosion. There is also pressure on the coastline such as tourism and recreation, industry, and preventing coastal hazards. I am going to be investigating the impact the tank has had on the beach and reasons for it.

Image 1: Map of Grand Bahama Island:

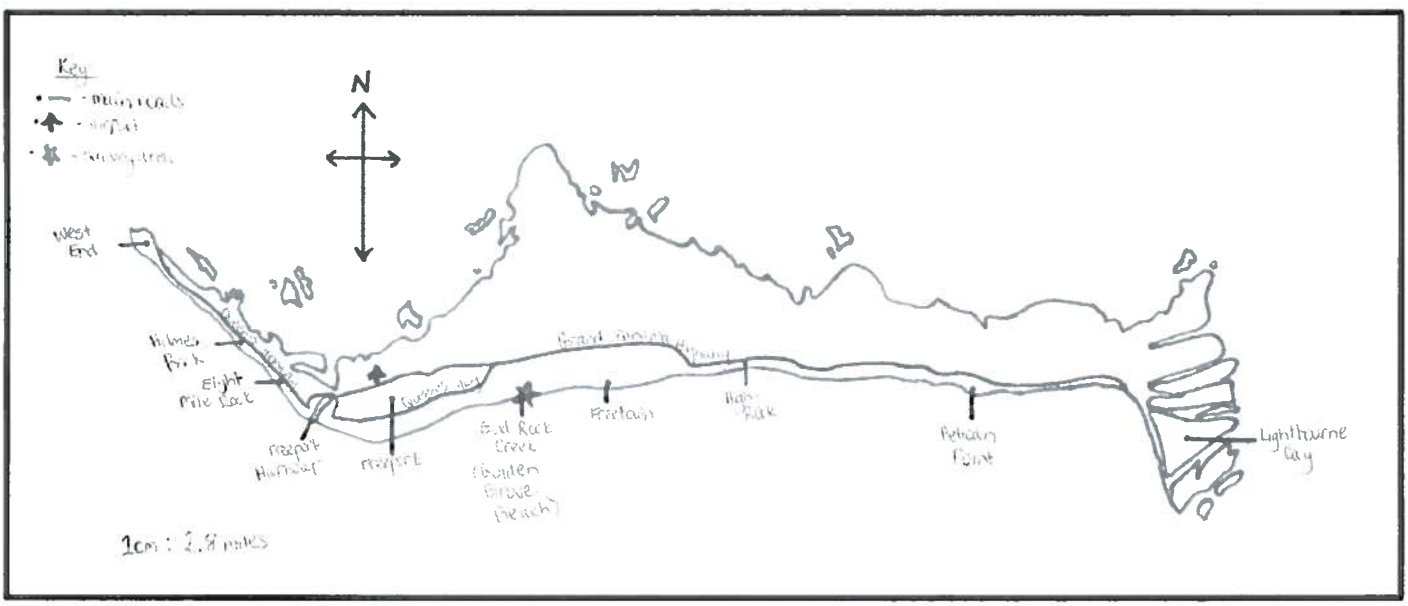
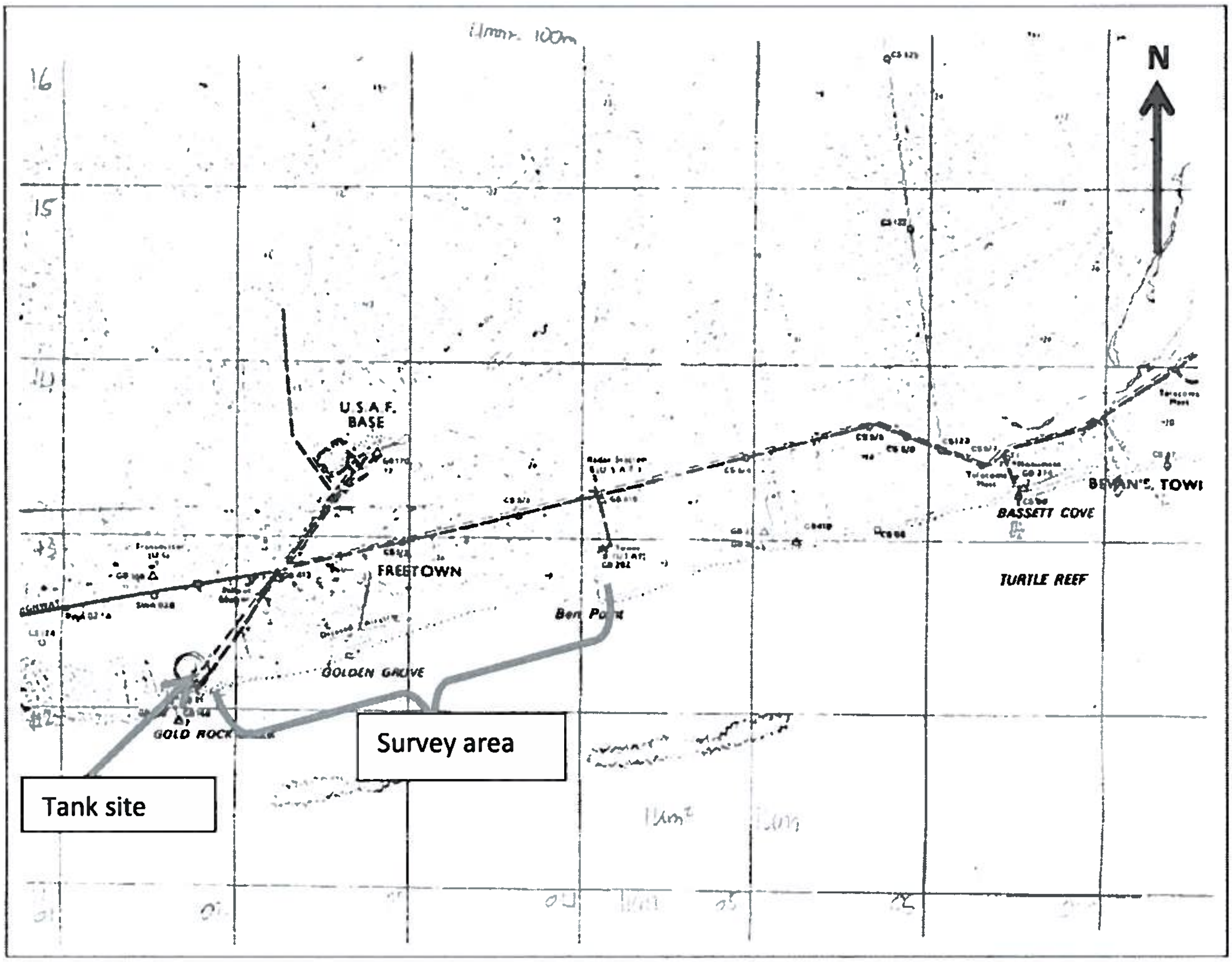


Image 2: Map of the area investigated (Department of Land and Surveys 1975):



2.3cm: 1km

Hypotheses:

1. There will be poorer environmental quality closer to the tank site. This is because the tank site has not been taken care of or repaired, therefore the metal walls are left to rust and pollute both the ocean and land around it.
2. There will be larger stones closer to the tank site. This is because larger stones require more wave energy to be transported so they will only be carried a short distance by Long shore drift because the tank is blocking the wave energy.
3. There will be a steeper gradient of beach closer to the tank site. This is due to the fact that sand and stones have accumulated here and have not traveled down the beach because the tank is blocking the wave energy.

Method:

- Date of fieldwork collection: 4^{th} of May, 2013
- Time of fieldwork collection: 8:30am – 3:00pm
- Weather conditions: sunny, partly cloudy, 80°F
- Sample site selection: Areas along the Golden Grove Beach coastline every 100m from the tank site

In my Geography class, we split into groups of 3-4 as the area of beach was too large to evaluate individually. Each member in the groups had a booklet of different hypotheses but decided to have one person take all the notes as we only had that one day to collect data, therefore didn't want to waste any time. As a class, we decided to use a systematic transect sampling technique so the data points would be evenly distributed. We chose this method over random sampling because we were looking at how the beach gradually changed the further you walked away from the tank. If we were to use random sampling, we would have found unrepresentative results as large areas of the beach wouldn't have been studied. Therefore we walked down the beach and marked the sand and numbered it every 100 meters away from the tank site, continuing this up to 2000m. At the area closest to the site we measured the specific distance from the beach to the wall of the tank, which was 10m. Each group was assigned with areas on the beach numbered 1 to 20.
First, before studying Golden Grove Beach, we went to another area called Bishops where there was a very similar stretch of beach. This was to test out each method for each hypothesis and make sure we knew what to do and what not to do.

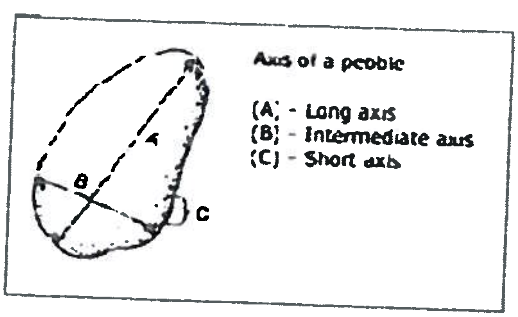
Hypothesis 1 Method: There will be poorer environmental quality closer to the tank site.
1. Start at the first numbered area that your group was assigned to.
2. Before collecting results, create an environmental quality survey. This is marked on a scale from -2 to 2 with -2 being the strongest negative opinion and 2 being the strongest positive opinion on the area. To survey the area, observe the type of foliage, cleanliness, evidence of pollution and human interaction, size, etc.
3. As a group, rate the area by placing one check mark on each row in the table. Add up the total for each column and find the overall score. Repeat this for the other areas your group was assigned to.

Table 1: Example of the Environmental Quality Survey that we used:

	-2	-1	0	1	2	
Ugly						Attractive
Crowded						Peaceful
Threatening						Welcoming
Monotonous						Varied
Drab						Colourful
Manmade						Natural
Weak						Strong
Bare						Vegetated
TOTAL						OVERALL SCORE

Hypothesis 2 Method:

1. Starting where the water hits the shore, randomly select 10 stones. We decided to only select 10 stones as we realized in our control that the majority of the coastline had very little stones to choose from. Also, we decided that 10 stones would be enough to find a suitable average result. We also chose a random sampling technique to avoid subjectivity and biased selections. To randomly select you must stand in one area, close your eyes, and select stones in close proximity of you. This is the sample size.
2. Then, measure the size of each stone by using a ruler to measure the long, intermediate and short axis. We used the guide below to do so (Image 3: Shepherd 2013):



mps= a x b x c

3. Record results for each stone in a table. Repeat this process perpendicular to the shore on the middle of the beach, approximately 3-4 meters away, directly in front of the first sample area.

Hypothesis 3 Method:

1. Starting where the water meets the shore, hold a ranging pole so it is straight up and face the back of the beach away from the sea.
2. Have another person walk directly opposite you towards the back of the beach and stand with a second ranging pole on the next highest point. Using a meter ruler, measure the distance.
3. Have that person hold the clinometer next to a specific spot on the ranging pole and at eye level, directing it to the same spot on the opposite ranging pole. Measure the slope angle in degrees.
4. Repeat this process until you reach the top of the beach

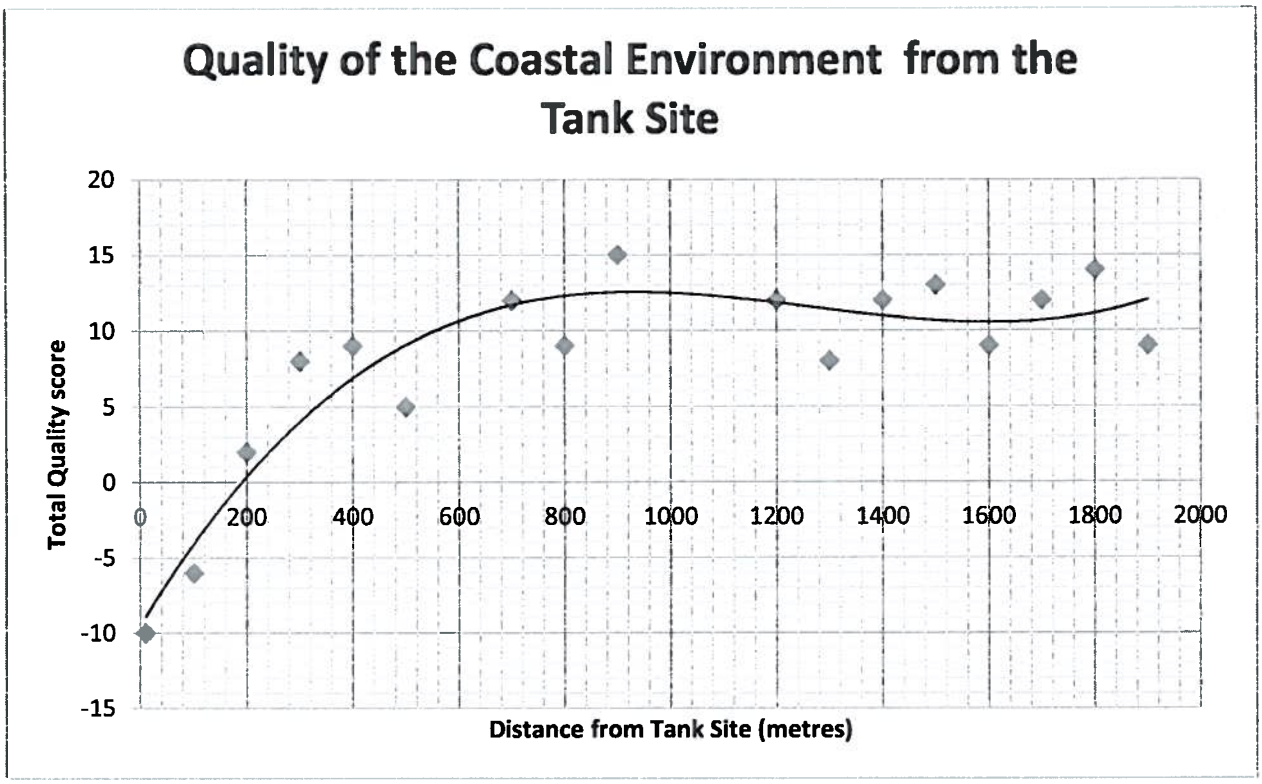
These methods are the most effective because they have repeats; therefore they will give the most reliable results.

Data Presentation and Analysis:

1. There will be poorer environmental quality closer to the tank site.
2. There will be larger stones closer to the tank site.
3. There will be a steeper gradient of beach closer to the tank site.

To display the results from the first hypothesis I produced a scatter graph with a polynomial trend line to show how the quality of the coastal environment changed as you moved further away from the tank site.

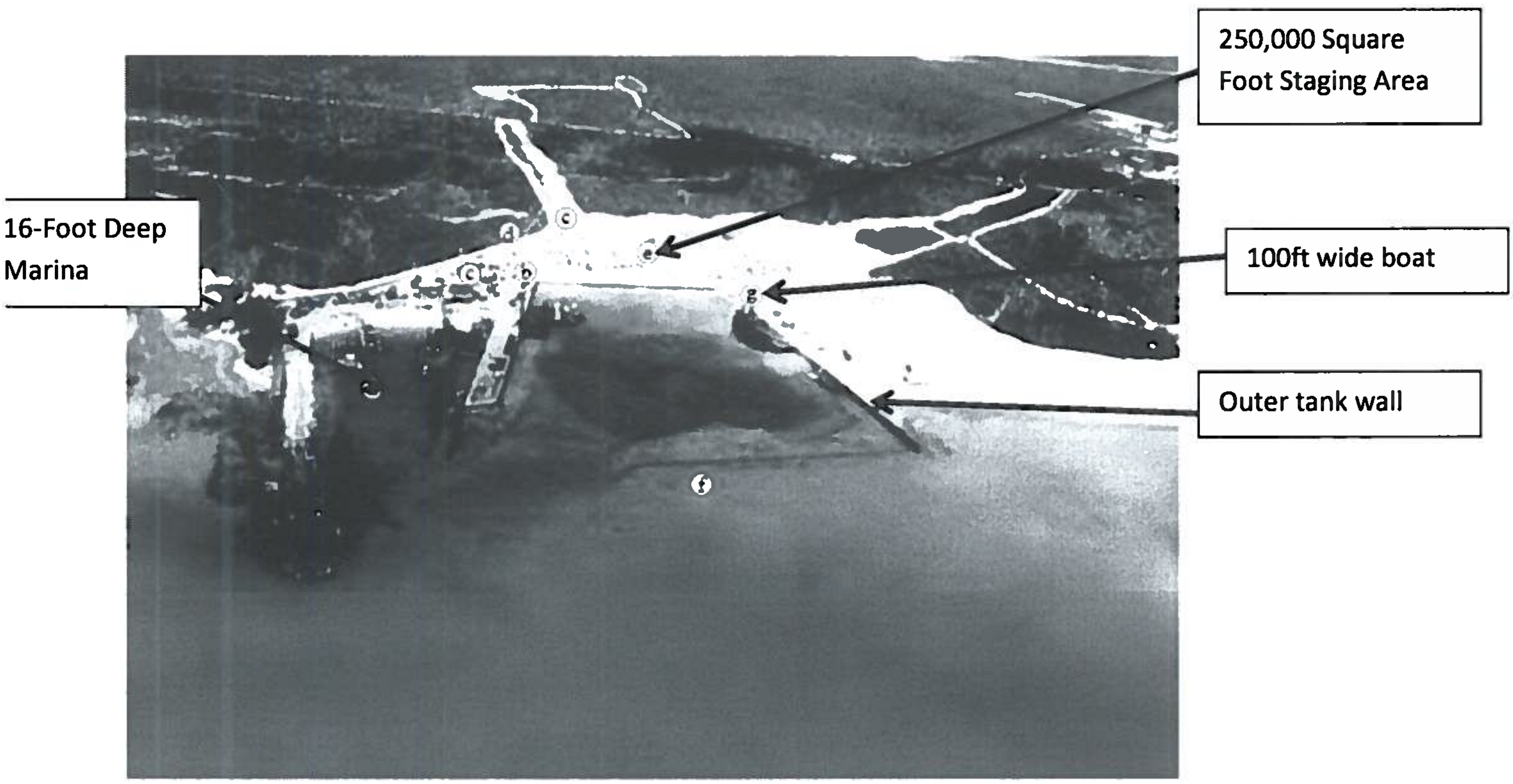
Graph 1:



The results clearly show that the further you walk from the tank site the higher the quality of the environment. At the tank site's location, approximately 10m away, a -10 out of a possible 16 points was scored. The area that scored the highest was 900m away with 15. After this point, the quality of the area fluctuates between about 8 and 13 possible points.

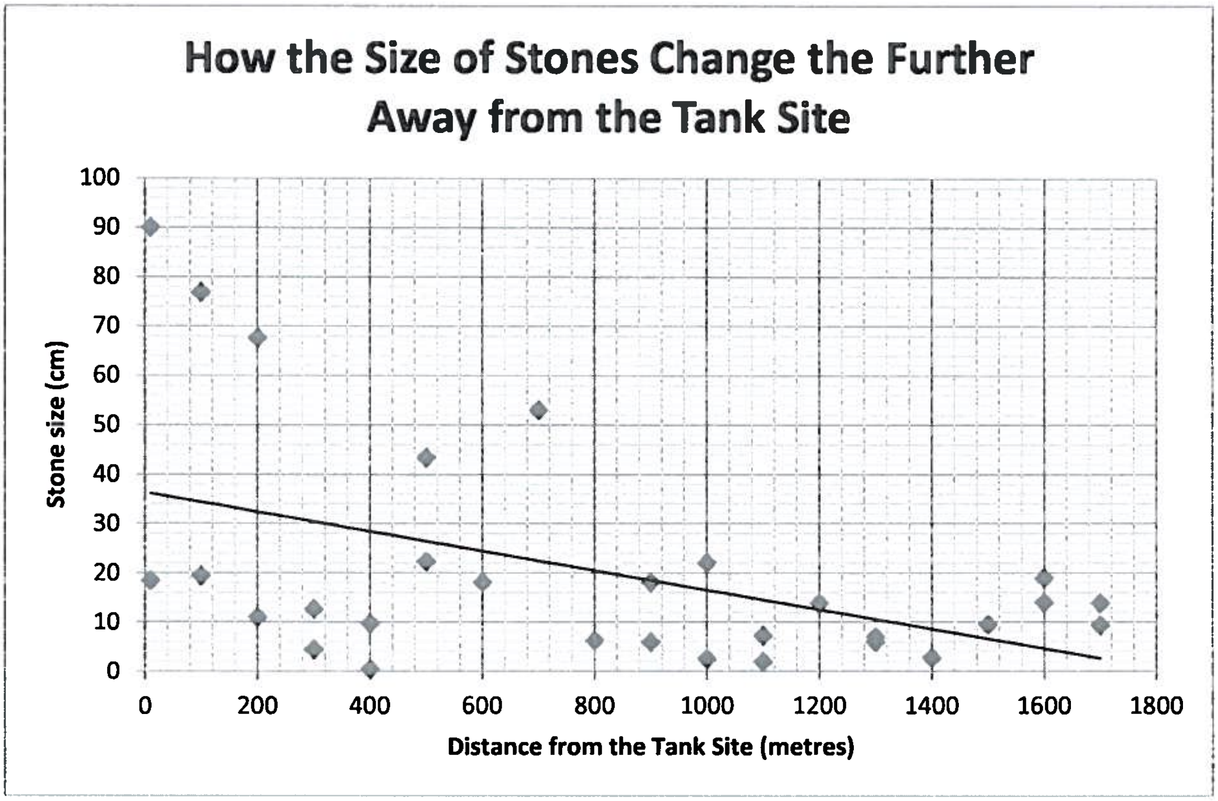
Reasons for this are that during the construction of the tank in 2005, a huge amount of land had to be cleared using heavy machinery, damaging the natural surroundings on the coast (as seen in the photograph below). Although as you can see, the beach to the east of the tank appears very large, however today, the quality of that same area of the beach is extremely poor and mainly consists of stones and rubble. This is due to the large walls of the tank disrupting the process of long shore drift, eroding the beach near it and building up stones and boulders. Also, this tank has not been taken care of since filming ended 8 years ago (according to Karl Dehmel, a local living nearby). Due to the lack of care, the tank has rusted to a point where it has polluted the ocean and land around it. The area further away from the tank scored much higher in the environmental survey as the construction of the tank had never affected the area and is too far away to be polluted by the rust. Furthermore, the area further away from the tank does not continue improving after 900m as it could have been affected by other reasons such as locals using the beach for their own leisure. This brings the risk of littering and harming the coastal environment.

Image 4: The Bahamas Film Studio Tank, 2005: (http://www.bahamasfilm.com/video/The%20Bahamas%20Film%20Studios_An%20Introduction_for%20Web.pdf)



For the next hypothesis studying stone sizes, I produced a scatter graph to show how the size of stones changed the further away from the tank site.

Graph 2:



Generally, the further away from the tank you go, the smaller the stone size. Significantly larger stones were found close to the tank, such as one that was 90cm at 10m and 76.8cm at 100m. Since this was a random sampling technique, a wide range of results were produced from the different areas as both small and large stones were located in close range of one another. Although generally, the stones closer to the shore were small and those towards the back of the beach were much larger. Therefore, there is a wide range of stone sizes closer to the tank. I then used Spearman's rank as a statistical method to show the strength of the relationship between the two factors. To do so, I used this equation:

R (relationship) $= 1 - \frac{6 \sum d^2}{N^3 - N}$

Image 5: Process results:

6 x sum of difference squared

37389

$N^3 - N$

26970

R

-0.386318131

Significance level

95%

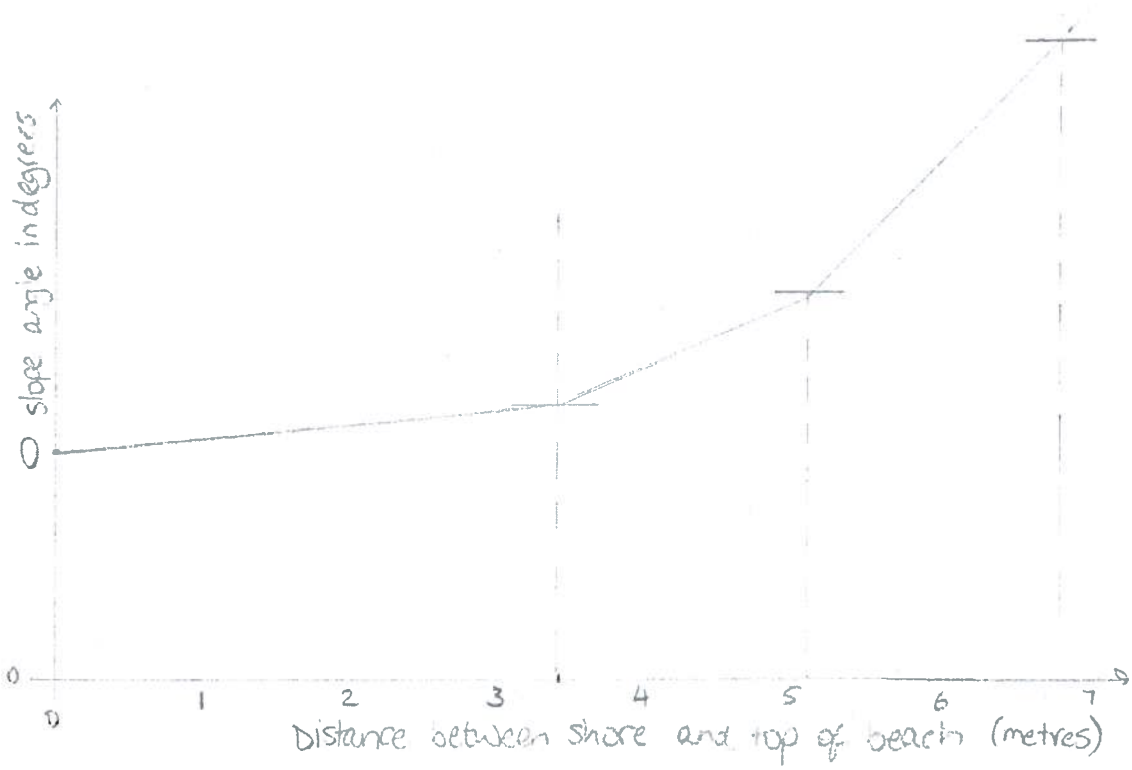
95% certainty that the stones get smaller the further away you get from the tank

I came to a 95% certainty that the stones get smaller the further away you get from the tank.

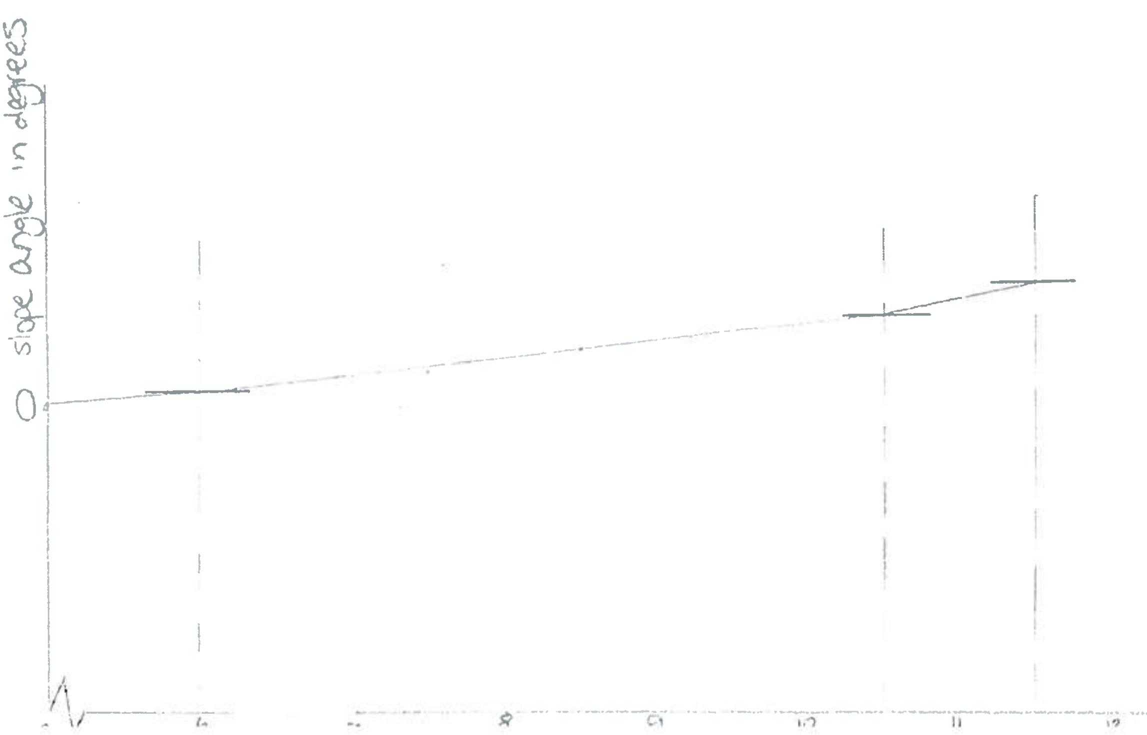
Reasons why my graph shows this pattern is because the tank has disrupted the process of long shore drift and now acts as a barrier for incoming high-energy waves. Long shore drift is the process of transporting material down the length of a beach. This also breaks down stones by attrition and abrasion. Due to the presence of the tank, wave energy is weakened and is not strong enough to transport material down the length of the beach, hence why there is a build-up of large stones. This explains the anomalies found in the first 700m. Stones of a wide range were located in close proximity of each other and since we used random sampling, it was very likely to find both small and large stones closer to the tank site.

For my last hypothesis, I produced beach slope profile line graphs for 100, 300, 500 and 700m away from the tank site to show how the slope of the beach changed the further east you walked from the tank.

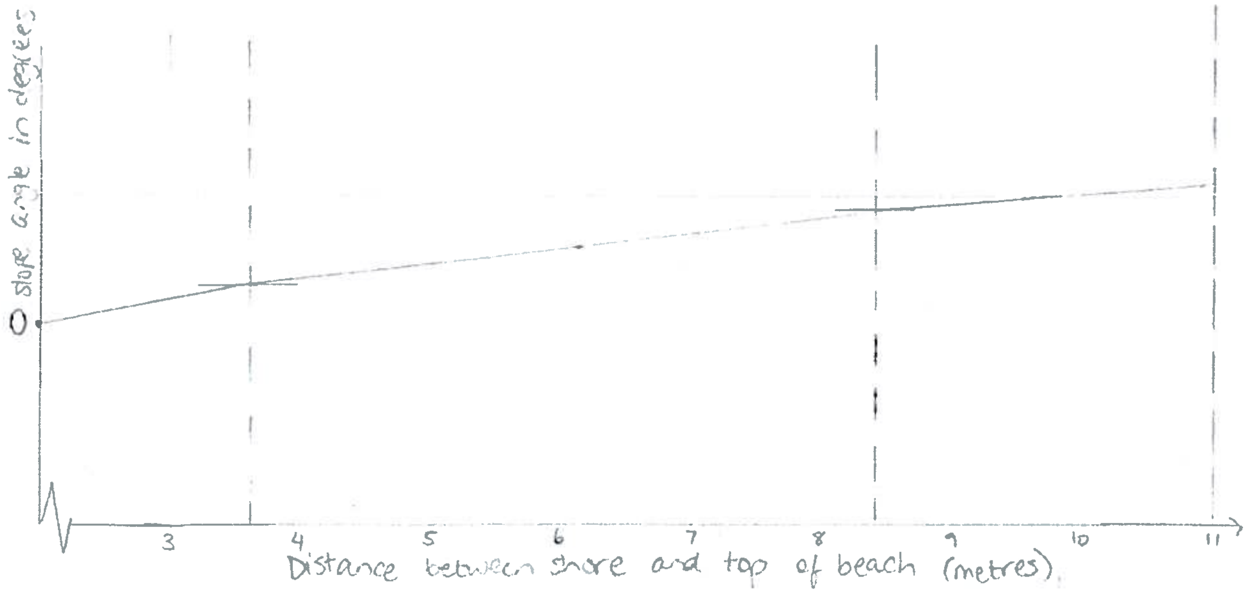
Graph 3: Beach Slope 100m East of Tank



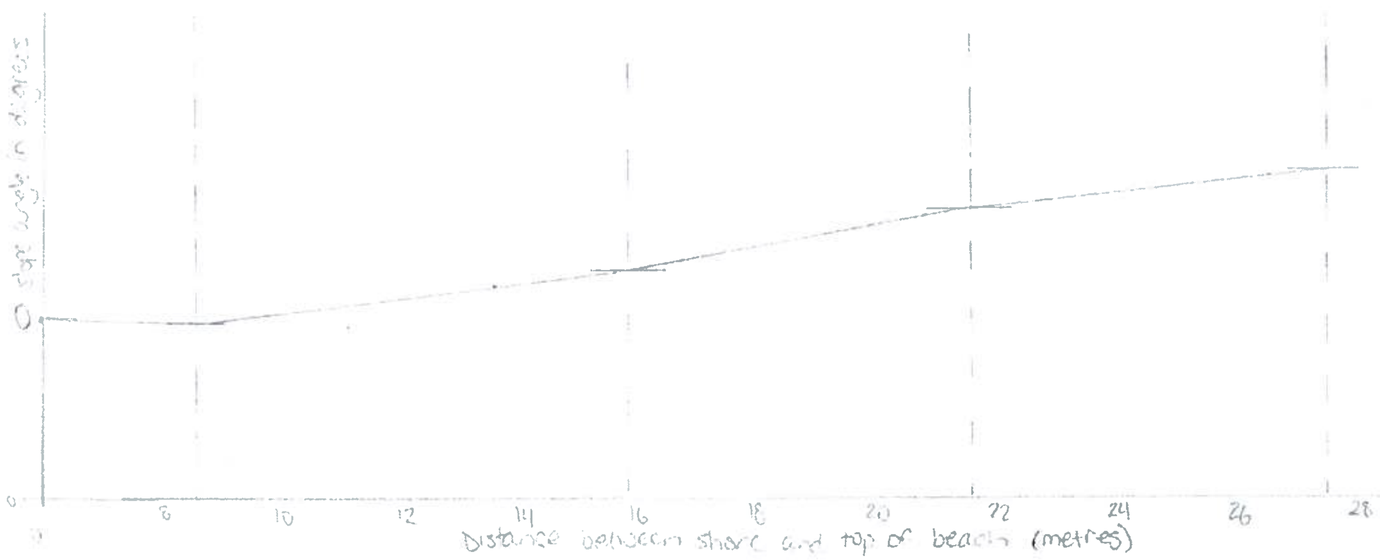
Graph 4: Beach Slope 300m East of Tank



Graph 5: Beach Slope 500m East of Tank



Graph 6: Beach Slope 700m East of Tank



As shown by each of the graphs, the slope of the beach gradually becomes more flat the further away from the tank you go. I decided to only produce graphs for 100, 300, 500 and 700m away out fo the possible 1700m as I thought that this would give the most average results. Clearly by the graphs, the results for 100m away differs greatly to the results from 700m away. 100m from the tank, not only is the slope very steep but the width of the beach is very short. This steepness is due to the build-up of large stones and boulders as they are unable to erode from wave energy as the waves are not strong enough. Whereas the slope at 700m away is much flatter. Here it decreases the first 8.5m towards the back of the beach then gradually increases until almost 28m back. The impact of the tank affected the gradient of the beach by stopping wave energy from transporting sand and sediment down the beach by long shore drift. This has led to a built-up of stones increasing in height as you go towards the back of the beach, for the waves are not powerful enough to reach them.

Conclusion:

- There will be poorer environmental quality closer to the tank site.
- There will be larger stones closer to the tank site.
- There will be a steeper gradient of beach closer to the tank site.

Overall, each hypothesis proved to be true. The quality of the environment is much poorer closer to the tank due to the initial construction. Using heavy machinery and man-made objects disrupted the natural environment by destroying vegetation and has built up large stones and boulders. Since filming ended, the surrounding area has barely changed and vegetation has not re-grown. There are larger stones closer to the tank site simply due to the fact that the tank is acting as a barrier to incoming waves. Stones are unable to travel down the beach by long shore drift and larger stones are unable to erode by attrition. The slope of the beach is also much steeper closer to the tank because waves are not strong enough to travel towards the back of the beach to break down stones. As you move further east away from the tank, the environmental quality improves as it was not affected by the construction of the tank, stones are smaller as high energy waves are able to break them down, and the slope is flatter because there is smaller sediment that can be moved by the swash and backwash.

Evaluation:

The data that we had collected was sufficient enough to be able to answer my hypotheses. One thing I would have changed about the fieldwork methods was to analyze more areas of the beach. For this investigation, we used a systematic transect sampling technique and only analysed areas every 100m, meaning we missed areas of land in between. If we had more time, we could have analysed perhaps ever 50m away from the tank, giving more reliable results. For the environmental quality survey, we only had 3 other opinions on each area of land. To make these results more accurate, asking and averaging at least 10 people's opinions on the land would have been a more reliable way of collecting data. Not only ask 10 people, but ask a few people that perhaps live in the surrounding area who are aware of the impact of the tank. This would have given both an inside and outside opinion. I also believe that if we analyzed more areas of the beach, we would have received even more results for stone sizes and had more reliable results.

If I was to take this investigation further I would have investigated with more hypotheses and extended the investigating time over a longer period of time. I could analyze the area over a period of a few months and see if or how anything changes.

Works Cited:

Shepherd, J. *Huge Coursework Results Document.* 4 June 2013

Woods, Craig "*The Bahamas Film Studios at Gold Rock Creek.*" N.p., 2011. Web. <http://www.bahamasfilm.com/video/The%20Bahamas%20Film%20Studios_An%20Introduction_for%20Web.pdf>.

Appendix:

Hypothesis 3:

Results:

Factor 1	Factor 2				
Distance from tank	Stone size (cm)	Factor 1 rank	Factor 2 rank	difference	difference ²
10	90	29.5	1	28.5	812.25
10	18.4	29.5	10	19.5	380.25
100	76.8	27.5	2	25.5	650.25
100	19.4	27.5	8	19.5	380.25
200	67.6	25.5	3	22.5	506.25
200	11	25.5	17	8.5	72.25
300	4.4	23.5	26	-2.5	6.25
300	12.6	23.5	16	7.5	56.25
400	9.7	21.5	18	3.5	12.25
400	0.4	21.5	30	-8.5	72.25
500	22.3	19.5	6	13.5	182.25
500	43.4	19.5	5	14.5	210.25
600	18.1	18	11.5	6.5	42.25
700	53	17	4	13	169
800	6.2	16	23	-7	49
900	18.1	14.5	11.5	3	9
900	5.9	14.5	24.5	-10	100
1000	22	12.5	7	5.5	30.25
1000	2.5	12.5	28	-15.5	240.25
1100	7.2	10.5	21	-10.5	110.25
1100	1.9	10.5	29	-18.5	342.25
1200	13.8	9	14.5	-5.5	30.25
1300	5.9	7.5	24.5	-17	289
1300	6.9	7.5	22	-14.5	210.25
1400	2.7	6	27	-21	441
1500	9.4	5	19	-14	196
1600	13.9	3.5	13	-9.5	90.25
1600	18.9	3.5	9	-5.5	30.25
1700	9.25	1.5	20	-18.5	342.25
1700	13.8	1.5	14.5	-13	169
30					6231.5

Calculations:

6 x sum of difference squared

37389

N³ - N

26970

R

-0.386318131

Significance level

95%

95% certainty that the stones get smaller the further away you get from the tank