Swanage Field Activities - Coastal Processes (LSD) and Management

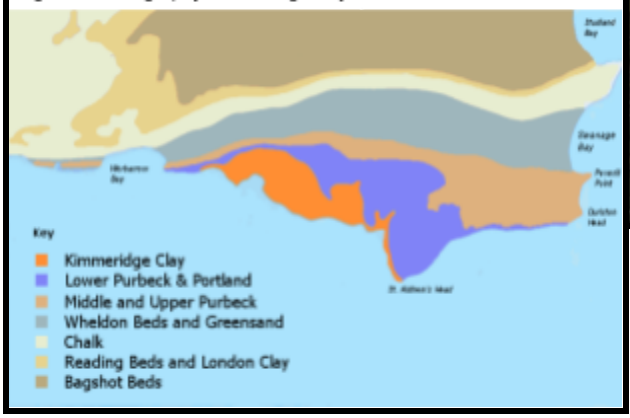
Swanage (Beach, Bay and Town)

Starting points:
1. Read the following background to coastal management at Swanage:

Swanage is located on the south-east corner of the Isle of Purbeck, and its coastline is therefore under the jurisdiction of Purbeck District Council. As Swanage is one of the few developed areas of coastline on the Isle of Purbeck, it is considered economically viable to carry out coastal defence works to protect the town from flooding and erosion. Coastal defence works have been carried out in the area since the nineteenth century.

Figure 1: Swanage Bay Aerial Oblique (View from South)

Figure 2: Stratigraphy of Swanage Bay



Today, Swanage has 1.8km of coastal defence works, mainly concrete or stone seawalls and timber groynes. The seawall and groynes to the south of the bay were put in place in the late nineteenth century. Further coastal defence works were added in the 1920s and 1930s, in the form of an extension to the sea wall and timber groynes. Unfortunately, although effective in the area they were constructed, these works starved the beach further to the north of sediment and the scheme therefore had to be extended in the 1960s.

During the winter months, land slips still occur in the cliffs around Swanage as rainfall lubricates the impermeable marl beds within the cliffs, causing the Purbeck limestone beds on top of them to slip onto the beach below. In the 1980s, rock armour was put in place at the base of the cliffs and groundwater drained from the rock to improve stability and reduce the frequency of slippage.*

In the late 1990s, a review and consultation based on the existing coastal defences was undertaken in order to develop a strategic framework for the long term management of the coastline. The aim of the review was to determine the most suitable method of

retaining sediment, dissipating wave energy and thus reducing the risk of flooding and slippage whilst still maintaining the beach.
The most cost effective method was found to be the replacement of the 1930s groynes and replenishment of the beach sediment. Eighteen timber groynes were put in place in 2005, constructed out of certified tropical hardwood and some material salvaged from the pre-existing groynes. In November of the same year, 90,000 m3 of sand was deposited on the beach. The works were finally completed in June 2006 at an estimated cost of £2.2 million. The beach will need to be recharged with around 40,000m3 of sand every 20 years.

**Marl or marlstone is a calcium carbonate or lime-rich mud or mudstone which contains variable amounts of clays and silt. The key feature in respect of land slips is the presence of clay which is impermeable and very fine grained (microscopic) causing it to be soft and malleable. Clay thus can be "squeezed", it traps and retains water and provides a lubricated slippage surface for mass movement.*

1. Using the information above and in pairs/groups, complete the "graphic" below to describe the historical coastal management that has taken place along Swanage Beach. To do this you will need to *extract* coastal management *events* from the narrative above and summarise these onto the timeline. Each point should be *dated* and *numbered*. The events can then be noted **onto the map** by adding the relevant numbers from the time line. The first has been done for you.

2. Briefly, in your own words, explain why the Beach at Swanage needs to be managed. Include discussion of the physical processes at work (eg Longshore drift, mass movement) and the needs of people in the area (residents, businesses and visitors).

Century

1800s
(19th C)

1. seawall and groynes (Late 19th Century)

1900s
(20th C)

2000s
(21st C)

Part A - Field Investigation

Aims of the investigation (Part A):

- To understand the physical processes operating in Swanage Bay.
- To employ quantitative data collection and interpretation techniques to investigate physical processes.

Longshore drift investigation

This fieldwork investigation assesses the presence of the transportational process of longshore drift along the beach at Swanage. A working hypothesis for the study is that **"Longshore Drift operates at Swanage Beach".**

The hypothesis is to be investigated by collecting, analysing and presentation data to determine whether it is true or false.

Introduction

The process of longshore drift is significant to the formation of beaches, spits, bars and tombolos. It is also responsible for the distribution of sediment and, at times, pollution along our coastline.

Swanage beach in East Dorset is the perfect location for carrying out this fieldwork investigation into the scale of longshore drift operating within a bay. The beach is made up of sand and shingle and it is kept in place by **20 groynes** that run out to sea at a 90 degree angle from the coastline. The bay faces east and the beach runs north-south (see the map provided above).

Collecting the Data

The only equipment required is a recording sheet and a metre rule (or tape measure) with clear one centimetre divisions.

Safety:

- **do not walk on the groynes,**
- **stay out of the swash zone,**
- **be aware of other beach users (eg do not throw anything and keep noise to a minimum, take care of belongings)**

Method:
Follow the instructions (a to d) below to complete the data collection.

a. Walk the length of the beach approaching each groyne from either the North side or the South side.

b. At each groyne, count THREE groyne uprights from the landward end (stay above the swash zone) and look at the accumulation of sediment on **both** sides of the groyne.

c. Measure the **drop** from the top of the groyne to the sediment on both the North and the South sides. Record this on the data sheet. It is important that you also record whether the measurement is on the North or South of the groyne that you are measuring.

Note: It is possible that longshore drift is dominant from one direction (N-S or S-N) but it is *also* possible that a variation in results may be obtained.

To extend this investigation you can record the type of sediment (both sand and shingle are usually present on Swanage Beach). A fifth column is included in the recording sheet for this purpose.

Extension
The type of sediment can then be added to a graph by means of a colour, for example sand could be yellow, small stones could be green, larger stones could be red. With this additional information, the pattern of drift *might* link to the type of beach sediment present.

d. Complete the data table below at each groyne:

Data Recording Table

Groyne No.	Drop N. Side (cm)	Drop S. Side (cm)	Diff (cm)	Sed. Type (Sand, Gravel)
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

Groyne No.	Drop N. Side (cm)	Drop S. Side (cm)	Diff (cm)	Sed. Type (Sand, Gravel)
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				

Part B - Field Investigation

Aims of the investigation (Part B):

- To understand how coastal processes at Swanage Beach/Bay affect people and human activity and how people have responded to them by undertaking a variety of coastal management actions.

- To recognise different types of coastal management approach, specific techniques and be able to discuss the pros and cons of these.

- To be able to employ qualitative data collection techniques to understand coastal management approaches.

Coastal Management at Swanage Bay - Background

The town, originally a small port and fishing village, flourished in the Victorian era, when it first became a significant quarrying port and later a seaside resort for the rich of the day. Today the town remains a popular tourist resort, this being the town's primary industry, with many thousands of visitors coming to the town during the peak summer season, drawn by the bay's sandy beaches and other attractions.

During the peak summer season many people are drawn by the town's beautiful setting, the beach and other attractions. The town has numerous hotels and guest rooms though the number (particularly of hotels) has reduced slightly in recent years. Swanage has a gently sloping white sand beach which is sheltered and generally calm. The beach is well served by local businesses providing refreshments and services. For hire are deck chairs, boats, pedalos and general watersports equipment. There are amusement arcades and parks.

The proximity of the town centre to the shore and its situation on Wealden Clays, makes the town vulnerable to the effects of marine erosion. This investigation can be linked to the transportation processes investigation above as, if there is significant sediment movement and/or entrapment, the beach may be subject to narrowing and thus provide less protection for the town than it has in the past. Added to this, the effects of climate change on sea level and the increasing development and value of human activity in the town, hard and soft engineering and coastal management strategies might be economically worthwhile.

In the following activity, you will carry out an assessment of the management strategies employed along the beach front. This begins with an assessment of the types and

frequency of approaches observed followed by an evaluation of the management strategy.
Method:
Follow the instructions below to complete the data collection.

a. Bi-Polar Survey – measuring the effectiveness of coastal defences

1. As you come across a type of coastal defence, add it to the table below
2. Create a symbol or initial for the defence (e.g. # or SW for Sea Wall)
3. Using this symbol, complete the bi-polar chart – scoring each defence in each category.
4. Using the same symbols, complete the map to show where the different types of coastal management approach are located on Swanage Beach.

Symbol / Initial	Type of defence:	Symbol / Initial	Type of defence:

Bi-Polar Chart		-3	-2	-1	0	1	2	3	
Cost	**Expensive**								**Cheap**
Life span	**Short Lived**								**Long lasting**
Appearance	**Ugly**								**Attractive**
Effectiveness	**Ineffective**								**Effective**
Impact on processes	**Bad effects**								**Good/no effects**

Impact if scheme fails	**Large effect**								**Minor effect**

Try ranking the schemes: (e.g. 1 = best in category, 9 = worst in category (depending on the no. of schemes**)**

Scheme	**Cost**	**Life span**	Appearance	Effectiveness	Impacts (processes)	Impacts (if fails)	**Total Score**
Groynes	£10, 000 each	30-40 years					
Sandstone Boulders	Transport & installation	20 years (approx)					
Shingle ridge	Free (natural)	Fluctuates					
Sea Wall	£6,000 per metre	50+ years					
Cliff wall	£2,000 per metre	15 years (collapse)					
Gabions	£100 per metre	Less than 10 years					
Vegetation matting	Low cost	Slumps prone to loss					
Jetty	£200, 000 total	50+ years					
Beach Recharge	£2m	70 years					


03
04
80
79
Save
New Swanage
Swanage Bay
SWANAGE
Groynes
Groynes
Hotel
Sch
Sch
Cemy
Hospl
A351
DIVING CENTRE
Pier
IRB & LB Sta
Peveril Point
Lookout Station
FB
19
29
23
4
44

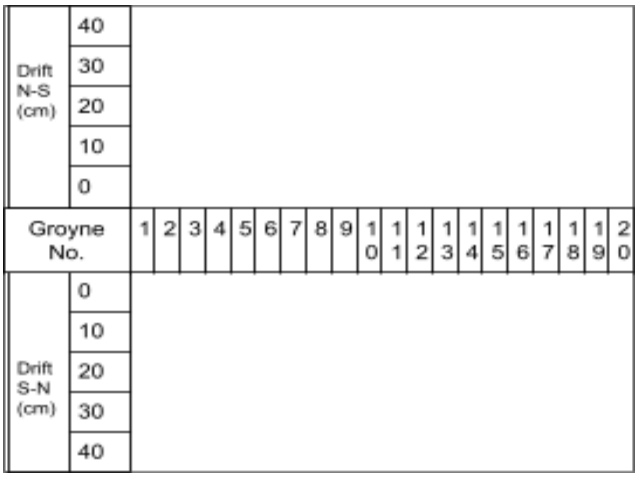
Data Processing and Interpretation
Part A - Longshore Drift Survey

a. Return to your data sheet and look at the “Drop North Side” and “Drop South Side” columns. Whichever column has the ***smallest drop***, that is the direction of longshore drift at that particular groyne (ie sediment is being moved from that direction). Now add the letter N or S against the number in the “Difference” column to indicate whether drift is from the North or the South.

b. The results can now be graphed very effectively onto a kite graph (see right for layout).

The results from the Difference column, in cm, are **drawn as bars** to the correct level above or below the box of the groyne to which they refer. Patterns in drift rapidly become apparent.

Use graph paper to lay out your graph and then plot the data you have collected.



c. Describe the results and suggest, based on the graph, whether there appears to be an overall dominant direction for the longshore drift of sediments at Swanage Beach. What do your findings suggest about the prevailing wind direction?

d. Do your results *confirm* the need for coastal management at Swanage Beach? If so, how useful are the groynes in achieving *sustainable* management?

e. Interpreting the Results

Patterns should be evident within the graph drawn to display the longshore drift results. These have been described (in g. above) to identify the dominant direction of drift and reasons suggested for those results. These reasons should relate to most recent wind directions that influence the fetch affecting wave activity along the beach.

Now, look back at the “working hypothesis” and answer the following questions:

1. Was the hypothesis correct?

2. What was the dominant direction of drift?

3. Why was this the case?

f. Evaluation

Now reflect upon the following features of the investigation:

- Was the hypothesis a good place to start?

- Did the data collection method work?

- Did you collect results that you could use?

- Were there any problems with the method (if so, what were they)?

- Did these problems affect the accuracy of the results (How/to what extent)?

- How much do these problems influence the conclusion?

- If you repeated the investigation at a different time of year, would you get the same results (Explain)?

- Would changes in results change your conclusion (suggest how)?

- How might such an investigation be improved in the future?

Data Processing and Interpretation
Part B - Coastal Management Strategy Survey

The town, originally a small port and fishing village, flourished in the Victorian era, when it first became a significant quarrying port and later a seaside resort for the rich of the day. Today the town remains a popular tourist resort, this being the town's primary industry, with many thousands of visitors coming to the town during the peak summer season, drawn by the bay's sandy beaches and other attractions.

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In the coastal management techniques survey (Part B Field Activity), you have carried out an assessment of the management strategies employed along the beach front. This begins with an assessment of the types and frequency of approaches observed followed by an evaluation of the management strategy using bi-polar scales.

Interpreting the Results

What patterns are evident from your data (consider the range of hard versus soft approaches, their impact and effectiveness).

Which approaches do you think are the most/least effective in achieving their coastal management aims (explain)?

What groups of people (stakeholders) and what activities use the beach and how might they be affected by the management techniques employed?

Do the different methods of management impact stakeholders differently? Explain how and why.

In your view, have the authorities at Swanage made good and appropriate decisions about the coastal management at Swanage? Explain your view with reference to the data you have collected and other observations.

Evaluation

Now reflect upon the following features of the investigation:

- Could you have started with an hypothesis? Suggest one.

- Did the *qualitative* data collection method work?

- Did you collect results that you could use?

- Were there any problems with the method? Outline these.

- Did these problems affect the accuracy of the results? (Suggest how)

- How much do these problems influence the conclusion?

- If you repeated the investigation how might you adapt or add to the methods?

- Would changes in the methods change your conclusion about whether the local authorities got their management strategy right? (Suggest how)