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# West Beach, West Bay, Beach Management Plan

Document: 1 Version: 0

Lyme Regis & West Beach, West Bay, Beach  
Management Plan Reviews

West Dorset District Council

30 April 2012

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30 April 2012

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## Document history

### West Beach, West Bay, Beach Management Plan

Lyme Regis & West Beach, West Bay, Beach Management Plan Reviews

West Dorset District Council

This document has been issued and amended as follows:

Version	Date	Description	Created by	Verified by	Approved by
1.0	03/04/2012	Draft	Alan Frampton		
1.0	30/04/2012	Final	Alan Frampton	Dr Jonathan Rogers	Dr Jonathan Rogers

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## Executive Summary

This Beach Management Plan (BMP) covers the West Beach, West Bay, frontage covering the defended area to the west of the western West Bay Harbour breakwater. The area covered by this BMP is the responsibility of West Dorset District Council (WDDC); the coastal operating authority. In addition, Plymouth Coastal Observatory (PCO) undertakes coastal monitoring of the area as part of the South West Strategic Regional Coastal Monitoring Programme.

The aim of this BMP, which has been developed utilising best practice contained in the CIRIA Beach Management Manual (second edition), is to inform, guide and assist the responsible authorities and organisations in managing the beach, and to ensure that beach management continues to manage the risk of coastal erosion and flooding, whilst recognising and managing the environmental and amenity implications.

This area is primarily at risk of coastal erosion and landsliding in its western part and has been subject to major coastal slope stabilisation works in the past. The eastern part of the frontage is primarily at risk of coastal flooding and it is this area where beach management activities are primarily focused at the current time; the beach here having been recharged in 2005 as part of the West Bay Coastal Defence and Harbour Improvements Scheme. These defences protect between £45m and £60m of assets.

The beach itself provides some direct amenity resource that is of benefit to the local economy. Its main purpose, however, is to provide protection to the backing seawall which is topped by a promenade and car park that are an important resource for the tourism sector in the area, although no value of the benefit of this resource is currently available.

It is the management of the beaches in support of the overall coastal defence measures to reduce the risk of further coastal flooding and erosion that this BMP defines. In doing so, the interaction between the beach and the surrounding hard defence structures forms a key consideration within the BMP, although the BMP does not itself define the management regime for these hard defence structures. The management regime defined in this BMP is also presented in the context of the wider environmental setting and important amenity value of the beach environment to the local economy.

Ultimately the seawall will continue to provide defence against coastal flood and erosion risk. However, the concern in the immediate future is how long it will be sustainable to continue to protect the seawall along the eastern part of the BMP frontage through beach recycling and further beach recharge, or if an alternative defence option may be needed in place of a beach (e.g. rock armour as placed along the base of the seawall in the western part of the BMP frontage). Such decisions relating to the long-term defence will be subject to future studies. However, these will be informed by the monitoring regime defined in this BMP.

The key objective of this BMP is to manage the risk of coastal erosion and flooding by ensuring that an adequate beach is maintained in support of the hard defence/control structures, such that the Standard of Protection (SoP) of the scheme is retained. The

current defences are considered to be in good to fair condition. The SoP has been assessed to be 1 in 200 years at the present time (0.05% Annual Probability of Occurrence, APO) against critical overtopping that could cause structural failure of the seawall, although the SoP for public safety is estimated to be less than 1 in 1 years (i.e. less than 100% APO). There is a moderate risk of undermining of the defences as a result of low beach levels along parts of the frontage recharged in 2005.

The monitoring and intervention strategy defined in this BMP has been developed in the context of selecting a technically, economically, environmentally and socially sustainable management approach for the next 10 years (the BMP review period).

This strategy has been developed alongside the *West Beach, West Bay, Options Report* that has shown the most appropriate option for the sustainable management of West Beach for flood and erosion risk management purposes, is for periodic recharge using a land based source similar to that used as part of the 2005 scheme when the beach was first created. However, there remains some uncertainty about the timing of when any such works may be required due to a limited amount of post 2005 recharge survey data being available.

The limited analysis undertaken for this study suggests that the annual recycling of sediment from West Bay Harbour to West Beach does have the effect of raising the beach volume above the minimum volume required. This is beneficial for reducing the risk of defence failure from a flood risk management perspective. This operation should therefore continue for the immediate future whilst more survey data is captured and a better understanding of the effect and longevity on the beach of the dredge material is developed. This should occur alongside regular review of beach volumes to better determine timing of future recharge.

When future monitoring indicates that Alarm Levels defined in Section 3.3 of this BMP are consistently being exceeded, then this is a strong indication that the effect of annual recycling is no longer increasing beach volume sufficiently. As such, when this situation is reached measures should be taken to begin the planning and implementation of a beach recharge campaign.

If a Crisis Level defined Section 3.3 of this BMP is identified as being reached on a profile, the immediate task would be to carry out a visual inspection of the profile concerned to validate the survey data and check that it is representative of the general beach area (i.e. not a localised 'low' point). If the Crisis Level is shown to be a general problem to be addressed, then timely action will be required to safeguard the integrity of the sea wall. Ultimately, the response to the Crisis Level being reached will be for beach recharge to be carried out. If not already in process (due to Alarm Levels having been reached), then planning and implementation of a beach recharge campaign should begin.

It is likely that the occurrence of a Crisis Level will be as a result of a storm event that erodes a large amount of beach material in a short period of time. Whilst the preferred solution of beach recharge is being planned and implemented, a short term measure will be to place rock armour along the toe of the seawall to reduce the risk of it being undermined.



In order to be in a position to implement a rock armour solution in a rapid time-frame should the situation ever arise, it is recommended that analysis be undertaken to determine (a) the appropriate size of rock to place in a crisis situation, such that it is large enough to withstand the forces it will experience, and (b) the source of rock that will be used, noting that any possible source must be near to the site and readily available whenever it may be required; this should also consider the viability of creating a local stockpile near to the site as a way of ensuring this ready availability.

The Action Plan provided in Section 6 of this BMP provides a summary of the recommendations made throughout the BMP. The Action Plan identifies actions grouped by type as being either for 'Monitoring', 'Maintenance', 'For Future Studies'. It is intended that this Action Plan be used to guide future management of this area.

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## Glossary

Term	Definition
Accretion	Accumulation of sediment due to the natural action of waves, currents and wind.
Alarm Level	The level before Crisis Level. This is usually a predetermined value where the monitored beach parameter falls to within range of the Crisis Level, but has not resulted in systematic failure of the function being monitored, e.g. recession of a beach crest eroding to within 10m of an asset, where it has been predetermined that an extreme storm event could result in recession of 5m. The Alarm Level in this example is therefore a 5m buffer. Increased monitoring would be required when an Alarm Level is compromised and intervention undertaken if deemed necessary. Managing Alarm Levels can be planned in advance.
Amenity	The tangible or intangible elements of a location that contribute to a perceived positive character of the area for the enjoyment of those that use it.
AONB	Area of Outstanding Natural Beauty. Designated by the Countryside Commission. The purpose of the AONB designation is to identify areas of national importance and to promote the conservation and enhancement of natural beauty. This includes protecting its flora, fauna, geological and landscape features. This is a statutory designation.
APO	Annual probability of occurrence.
ATT	Admiralty Tide Table.
Backwash	The seaward return of the water following the up-rush (swash) of the waves. For any given tide stage the point of farthest return seaward of the backwash is known as the 'limit of backwash'.
BAP	Biodiversity Action Plan. A strategy for conserving and enhancing wild species and wildlife habitats in the UK.
Beach	A deposit of non-cohesive material (e.g. sand, gravel) situated on the interface between dry land and the sea (or other large expanse of water) and actively 'worked' by present day hydrodynamic processes (i.e. waves, tides and currents) and sometimes by winds.
Beach Profile	Cross-section perpendicular to the shoreline. The profile can extend seawards from any selected point on the landward side or top of the beach into the nearshore.
Beach recharge (nourishment)	Artificial process of replenishing a beach with material from another source.
Beach recycling/re-profiling	The movement of sediment along a beach area, typically from areas of accretion to areas of erosion, and shaping the beach profile to have a desired crest height, width and slope.

Term	Definition
BMP	Beach Management Plan. It provides a basis for the management of a beach for coastal defence purposes, taking into account coastal processes and the other uses of the beach.
Breaching	Failure of the beach head allowing flooding by tidal action.
CIRIA	Construction Industry Research and Information Association.
Climate Change	Long term changes in climate. The term is generally used for changes resulting from human intervention in atmospheric processes through, for example, the release of greenhouse gases to the atmosphere from burning fossil fuels, the results of which may lead to increased rainfall and sea level rise.
Coastal squeeze	The reduction in habitat area which can arise if the natural landward migration of a habitat under sea level rise is prevented by a fixation of the high water mark.
Crest	Highest point on a beach face, breakwater or seawall.
Crest level/height	The vertical level of the beach relative to mOD.
Crest width	The horizontal distance of the beach measured from the seaward edge of the promenade to the point where the beach slope angle drops down towards the sea.
Crisis Level	The level at which the function being monitored, such as the stability of the beach and/or any backing structures (seawall/promenade), could be compromised and emergency remedial action becomes necessary, e.g. as in the case described under Alarm Level above, the beach crest recedes to within 4m of an asset that requires protection, where it has been predetermined that an extreme event could result in 5m of recession.
Defra	Department for Environment, Food and Rural Affairs (formerly known as MAFF)
Environment Agency	Environment Agency. UK non-departmental government body responsible for delivering integrated environmental management including flood defence, water resources, water quality and pollution control.
Erosion	Wearing away of the land, usually by the action of natural forces.
FDGiA	Flood Defence Grant in Aid. The mechanism by which most of the funding for flood and coastal defence works in England is provided by the Government. The grants are used to cover our operating costs and to fund capital projects.
Flood and Coastal Risk Management	Flood and coastal risk management addresses the scientific and engineering issues of rainfall, runoff, rivers and flood inundation, and coastal erosion, as well as the human and socio-economic issues of planning, development and management.
Flood Zone	A geographical area officially designated subject to potential flood damage. The Environment Agency uses Flood Zone 2 and Flood Zone 3.

Term	Definition
Geomorphology/ morphology	The branch of physical geography/geology which deals with the form of the Earth, the general configuration of its surface, the distribution of the land, water, etc.
GIS	Geographical Information System
Groyne	Narrow, roughly shore-normal structure built to reduce longshore currents, and/or to trap and retain beach material. Most groynes are of timber or rock, and extend from a seawall, or the backshore, well onto the foreshore and rarely even further offshore.
Groyne bay	The compartment between two groynes.
Hard defence	General term applied to impermeable coastal defence structures of concrete, timber, steel, masonry etc, which reflect a high proportion of incident wave energy.
Heritage Coast	Heritage Coasts represent stretches of our most beautiful, undeveloped coastline, which are managed to conserve their natural beauty and, where appropriate, to improve accessibility for visitors. Definition is formalised by agreement between the relevant maritime local authorities and Natural England.
Hold the Line	An SMP policy to maintain or change the level of protection provided by defences in their present location.
Joint probability	The probability of two (or more) things occurring together.
Joint Probability Analysis (JPA)	Function specifying the joint distribution of two (or more) variables.
Joint return period	Average period of time between occurrences of a given joint probability event.
LiDAR	Light Detection and Ranging. This is an airborne mapping technique which uses a laser to measure the distance between the aircraft and the ground.
Listed Building	A building or other structure officially designated as being of special architectural, historical or cultural significance.
Locally generated (wind) waves	Locally generated short period and irregular waves created by the flow of air over water.
Longshore transport	Movement of material parallel to the shore, also referred to as longshore drift.
MMO	Marine Management Organisation. An executive non-departmental public body established and given powers under the Marine and Coastal Access Act 2009. Responsible for managing activities in the marine environment including marine licensing and marine planning.

Term	Definition
mCD	metres Chart Datum. Approximately the lowest astronomical tidal level, excluding the influence of the weather.
mOD	metres Ordnance Datum. A universal zero point used in the UK, equal to the mean sea level at Newlyn in Cornwall.
Mean sea level	Average height of the sea surface over a 19-year period.
Mean High Water (MHW)	The average of all high waters observed over a sufficiently long period.
Mean High Water Springs (MHWS)	The average height of the high waters of spring tides.
Mean Low Water (MLW)	The average of all low waters observed over a sufficiently long period.
Mean Low Water Springs (MLWS)	The average height of the low waters of spring tides.
Met Office	UK Meteorological Office.
Monitoring	Systematic recording over time
Natural England	A non-departmental public body of the UK government responsible for ensuring that England's natural environment, including its land, flora and fauna, freshwater and marine environments, geology and soils, are protected and improved. It also has a responsibility to help people enjoy, understand and access the natural environment.
Nearshore	The zone that extends from the swash zone to the position marking the start of the offshore zone, typically to water depths of about 20m.
NFCDD	National Flood and Coastal Defence Database.
No Active Intervention	An SMP policy that assumes that existing defences are no longer maintained and will fail over time or undefended frontages will be allowed to evolve naturally.
Offshore	The zone beyond the nearshore zone where sediment motion induced by waves alone effectively ceases and where the influence of the seabed on wave action has become small in comparison with the effect of wind.
Overtopping	Water carried over the top of a coastal defence due to wave run-up exceeding the crest height.
Overwashing	The effect of waves overtopping a coastal defence, often carrying sediment landwards which is then lost to the beach system.

Term	Definition
PCO	Plymouth Coastal Observatory. Based at the University of Plymouth, responsible for the South-West Strategic Regional Coastal Monitoring Programme.
Policy Unit	A Policy Unit relates to the policy area defined by the Shoreline Management Plan (SMP).
Ramsar	Designated under the, “Ramsar Convention on Wetlands of International Importance especially as Waterfowl Habitat.” 1971. The objective of this designation it to stem the progressive encroachment onto, and loss of wetlands.
Relict	Features or sediment formed or deposited by processes no longer active in the area.
Return Period	A statistical measurement denoting the average probability of occurrence of a given event over time.
Rock Armour	Wide-graded quarry stone normally bulk-placed as a protective layer to prevent erosion of the seabed and or other slopes by current and/or wave action.
SAC	Special Area of Conservation: this designation aims to protect habitats or species of European importance and can include Marine Areas. SACs are designated under the EC Habitats Directive (92/43/EEC) and will form part of the Natura 2000 site network. All SACs sites are also protected as Site of Special Scientific Interest, except those in the marine environment below the Mean Low Water (MLW).
Scheduled Monument	Scheduled Monument: formerly referred to as Scheduled Ancient Monuments. Scheduled Monuments are nationally important archaeological sites which have been awarded scheduled status in order to protect and preserve the site for the educational and cultural benefit of future generations. The main legislation concerning archaeology in the UK is the Ancient Monuments and Archaeological Areas Act 1979. This Act, building on legislation dating back to 1882, provides for nationally important archaeological sites to be statutorily protected as Scheduled Monuments.
Scour	Removal of underwater material by waves or currents, especially at the toe of a shore protection structure.
Sea level change	The rise and fall of sea levels throughout time in response to global climate and local tectonic changes.
Seawall	Massive structure built along the shore to prevent erosion and damage by wave action.
Sediment	Particulate matter derived from rock, minerals or bioclastic debris.
Sediment transport	The movement of a mass of sedimentary material by the forces of currents and waves.

Term	Definition
Significant wave height, $H_s$	The average height of the highest of one third of the waves in a given sea state.
SMP	Shoreline Management Plan. It provides a large-scale assessment of the risks associated with coastal processes and presents a policy framework to manage these risks to people and the developed, historic and natural environment in a sustainable manner.
SPA	Special Protection Area. These are internationally important sites, being set up to establish a network of protected areas for birds
SSSI	Sites of Special Scientific Interest. These sites, notified by Natural England, represent some of the best examples of Britain's natural features including flora, fauna, and geology. This is a statutory designation
Standard of Protection (SoP)	The level of return period event which the defence is expected to withstand without experiencing significant failure.
Storm surge	A rise in the sea surface on an open coast, resulting from a storm.
Sustainability (in coastal flood and erosion risk management)	The degree to which coastal flood and erosion risk management options avoid tying future generations into inflexible or expensive options for flood defence. This usually includes consideration of other defences and likely developments as well as processes within catchments. It will take account of long term demand for non-renewable materials.
Swash	The area onshore of the surf zone where the breaking waves are projected up the foreshore.
Swell waves	Remotely wind-generated waves (i.e. Waves that are generated away from the site). Swell characteristically exhibits a more regular and longer period and has longer crests than locally generated waves.
SWL	Still water level. The level that the sea surface would assume in the absence of wind and waves.
Tide	Periodic rising and falling of large bodies of water resulting from the gravitational attraction of the moon and sun acting on the rotating earth.
Toe level	The level of the lowest part of a structure, generally forming the transition to the underlying ground.
UKCP09	UK Climate Projections 2009. Research giving predictions of how future climate change may affect the UK.
UKHO	United Kingdom Hydrographic Office.
UNESCO	United Nations Educational, Scientific and Cultural Organisation.



Term	Definition
Wave climate	Average condition of the waves at a given place over a period of years, as shown by height, period, direction etc.
Wave direction	Direction from which a wave approaches.
Wave height	The vertical distance between the crest and the trough.
Wave hindcast	In wave prediction, the retrospective forecasting of waves using measured wind information.
Wave period	The time it takes for two successive crests (or troughs) to pass a given point.
Wave refraction	Process by which the direction of approach of a wave changes as it moves into shallow water.
Wave reflection	The part of an incident wave that is returned (reflected) seaward when a wave impinges on a beach, seawall or other reflecting surface.
WDDC	West Dorset District Council. Coastal Operating Authority as defined under the Coast Protection Act 1949 with permissive powers to provide defence against coastal erosion.
WFD	Water Framework Directive. A European Directive that aims to establish a framework for the protection of inland surface waters (rivers and lakes), transitional waters (estuaries), coastal waters and groundwater.
World Heritage Site	A place of 'outstanding universal value' selected by UNESCO.

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# 1 Introduction

## 1.1 Background

This Beach Management Plan (BMP) covers the West Beach, West Bay, frontage covering the defended area to the west of the western West Bay Harbour breakwater (see Figure 1-1). This BMP provides a review and update of the existing BMP prepared by Posford Duvivier in 2000.

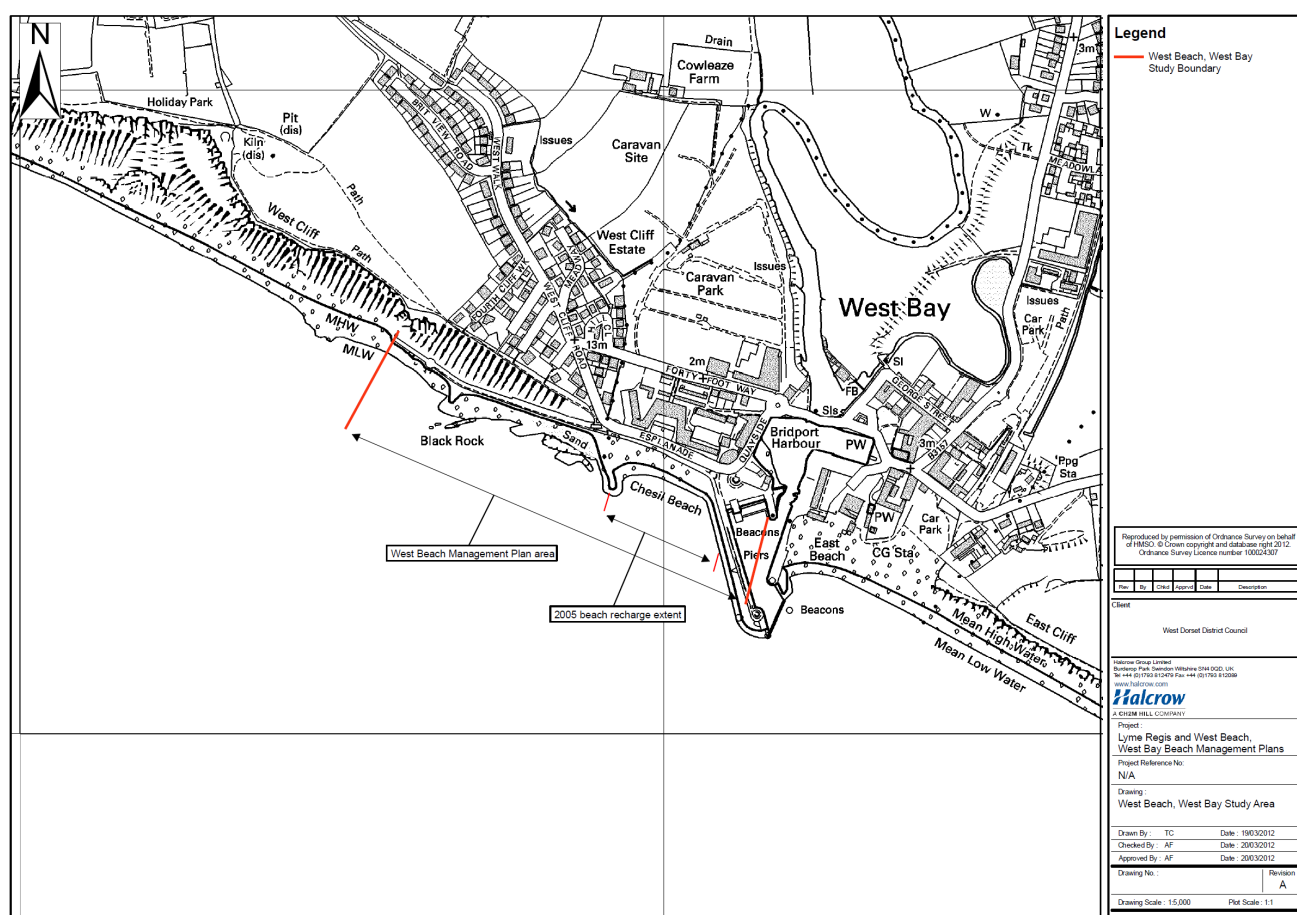


Figure 1-1 West Beach, West Bay, Beach Management Plan area

This area is primarily at risk of coastal erosion and landsliding in its western part and has been subject to major coastal slope stabilisation works in the past. The eastern part of the frontage is primarily at risk of coastal flooding and it is this area where beach management activities are primarily focused at the current time; the beach here having been recharged in 2005 as part of the West Bay Coastal Defence and Harbour Improvements Scheme. These defences protect between £45m and £60m of assets (West Dorset District Council, 2001; Halcrow, 2011). The beach itself provides some direct amenity resource that is of benefit to the local economy. Its main purpose, however, is to provide protection to the backing seawall which is topped by promenade and car park that are an important resource for the tourism sector in the area, although no value of the benefit of this resource is currently available.

It is the management of the beaches in support of the overall coastal defence measures to reduce the risk of further coastal flooding and erosion that this BMP defines. In doing so, the interaction between the beach and the surrounding hard

defence structures forms a key consideration within the BMP, although the BMP does not itself define the management regime for these hard defence structures. The management regime defined in this BMP is also presented in the context of the wider environmental setting and important amenity value of the beach environment to the local economy.

## 1.2 Objectives

The area covered by this BMP is the responsibility of West Dorset District Council (WDDC); the coastal operating authority. In addition, Plymouth Coastal Observatory (PCO) undertakes coastal monitoring of the area as part of the South West Strategic Regional Coastal Monitoring Programme.

The aim of this BMP, which has been developed utilising best practice contained in the CIRIA Beach Management Manual (second edition), is to inform, guide and assist the responsible authorities and organisations in managing the beach, and to ensure that beach management continues to manage the risk of coastal erosion and flooding, whilst recognising and managing the environmental and amenity implications.

The key objective of this BMP is to manage the risk of coastal erosion and flooding by ensuring that an adequate beach is maintained in support of the hard defence/control structures, such that the Standard of Protection (SoP) of the scheme is retained. The current SoP has been assessed to be 1 in 200 years at the present time (0.05% Annual Probability of Occurrence, APO) against critical overtopping that could cause structural failure of the seawall, although the SoP for public safety is estimated to be less than 1 in 1 years (i.e. less than 100% APO) (refer to Section 3.2 and/or Appendix C).

The BMP sets out the strategy for monitoring and intervention to maintain the beach to ensure it continues to provide adequate SoP to West Bay, in combination with the hard defence/control structures along the frontage.

This monitoring and intervention strategy has been developed in the context of selecting a technically, economically, environmentally and socially sustainable management approach for the next 10 years (the BMP review period). Details of the option development are provided in the *West Beach, West Bay, Options Report* (Halcrow, 2012). This strategy aligns to the Shoreline Management Plan policies for this frontage that are set for a 100 year planning horizon, and which aim to 'Hold the Line' of existing defence along the length of the BMP frontage (refer to Section 1.7.1).

The BMP also recommends what further studies may be appropriate to aid future coastal erosion and flood risk management in this area. Recommendations are contained throughout the BMP, and are identified with **bold underlined text**. These are also summarised in an Action Plan presented in Section 6.

## 1.3 Location

### 1.3.1 Environmental setting

The entire BMP frontage lies within the Dorset Area of Outstanding Natural Beauty (AONB). However, only the western part of the BMP area is directly within several areas of conservation designation:

- Lyme Bay and Torbay candidate Special Area of Conservation (SAC)

- Sidmouth to West Bay SAC
- West Dorset Coast Site of Special Scientific Interest (SSSI) (status favourable as of 03/10/2011)
- Dorset and East Devon UNESCO World Heritage Site (the 'Jurassic Coast').

Figure 1-2 shows the extents of the various environmental designations in relation to the BMP area. Appendix A contains further details about these designations for ease of future reference.

There are also a range of historic environment features and assets within and around the BMP area, including 30 Listed Buildings and structures. Figure 1-3 shows the location of these historic environment features in relation to the BMP area.

Further detail and discussion of the environmental characteristics relating to the BMP area is provided in Section 2.7.



Figure 1-2 Natural environmental designations at West Beach, West Bay



Figure 1-3 Historic environment features at West Beach, West Bay

### 1.3.2 History of flooding and erosion

The western side of West Bay that is the subject of this BMP has historically suffered from coastal flooding, coastal erosion and landsliding.

Flooding of West Bay has occurred on many occasions in the past and has been well documented since 1774. Recent severe coastal flooding has occurred in 1974, 1978, 1988, 1990, 1991, 1995, 1996 and 2004, although in most cases flooding of the area is also from the wider harbour and East Beach frontages of West Bay, both of which are outside of this BMP area (Environment Agency, 2009).

Erosion and landsliding along the western part of the BMP area has been greatly reduced as a result of significant slope stabilisation and coast protection works over several decades. The adjacent undefended cliffs to the west of the BMP area do, however, pose a risk of outflanking in the future (Halcrow, 2011).

### 1.3.3 Defence history

West Beach is a narrow sand and shingle beach backed by a seawall. This seawall consists of a granite faced reinforced concrete wall with wave return, a concrete stepped base and steel sheet piled toe. Originally constructed in around 1887, a 50m section of the original seawall, located at the eastern end of West Beach, was completely reconstructed in 1963 following storm damage. During this construction work a wave return wall and toe protection, in the form of Portland Stone rock

armour, was also added to the western section. The seawall provides important protection to both the promenade and surrounding cliffs and properties.

In 2005, further defence works were undertaken as part of the West Bay Coastal Defence and Harbour Improvement Scheme. This scheme included the alteration of the harbour piers and re-nourishment of West Beach with imported sediment from a land based source. Rock groynes were also constructed along this frontage to try and stabilise the beach in front of the seawall.

Located adjacent to this 2005 scheme area (i.e. the western part of the BMP frontage to the west of the western rock groyne) is West Cliff. West Cliff has historically been prone to landslides and coastal erosion. The foot of these cliffs has been protected from erosion since 1969 when a seawall was constructed and rock armour placed in front of the toe protection. Despite this construction, erosion has continued to be a problem and a number of further engineering attempts have been made to try and stabilise the cliffs. Most recently this involved the insertion of drainage pipes and the use of gabions in the 1990's.

Full details of the defences are provided in Section 3.2 and Appendix C.

#### 1.3.4 Current defence condition

The defences along the frontage at the current time are considered to be in good to fair condition.

The SoP provided against overtopping in terms of structural stability of the defence has been assessed to be 1 in 200 years at the present time (0.05% Annual Probability of Occurrence, APO).

There is, however, a moderate risk of undermining of the defences as a result of low beach levels along parts of the frontage recharged in 2005.

Section 3.2 and Appendix C provide further details.

#### 1.3.5 Amenity value

The Dorset coast is a popular tourist destination and as such the local economy is heavily dependant on this source of revenue. There are numerous accommodation facilities in West Bay for tourists including two caravan sites. The beach itself is popular for a range of activities including dog walking, storm watching, swimming, fishing/angling, beachcombing, bird watching and fossil hunting. Some water-based sports such as jet skiing are prohibited off the beach but the coastline is extensively used for yachting, motor cruising and scuba diving.

#### 1.3.6 Land ownership

The Golden Cap Estate is a large National Trust property on the northern boundary of the BMP area. There are a number of other land owners within and adjacent to the BMP area. These are shown in Figure 1-4, although precise details of each individual land owner are not provided. West Dorset District Council should be contacted if this information is required.



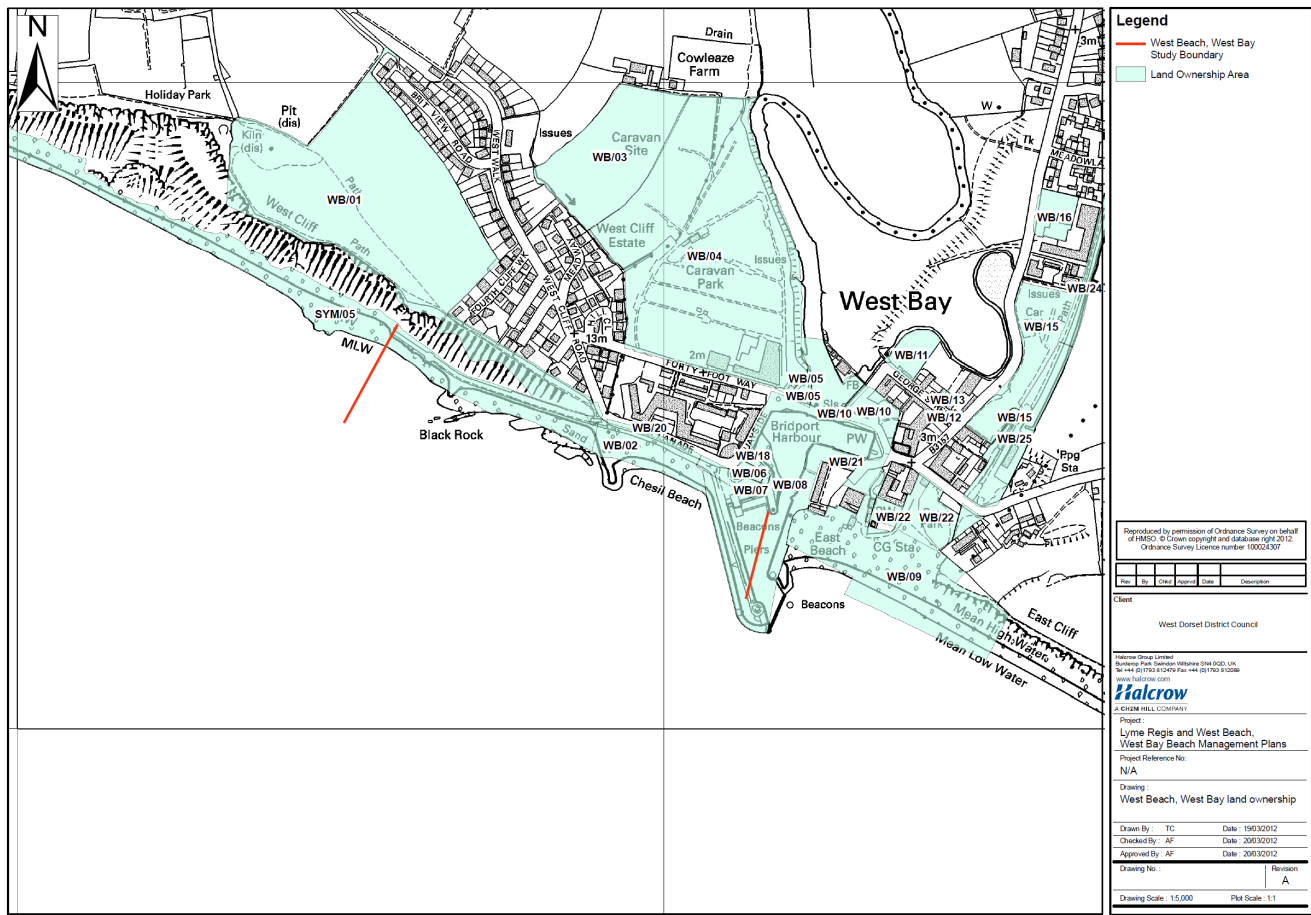


Figure 1-4 Land ownership at West Beach, West Bay

### 1.3.7 Highways, services and utilities

The local road (the Esplanade) that runs along the back of West Beach is a key access route between West Bay and West Cliff for both local residents and for transporting recycled material from West Bay Harbour to West Beach each February/March. At this time the road is closed for about one week to allow safe movement of plant and dump trucks. After the works, West Dorset District Council cleans the road, which becomes covered in silt and mud during the recycling operations.

There are car parking spaces available on the Esplanade in addition to spaces in West Bay around the harbour.

Surface water run off from the road discharges onto West Beach through a series of outflows situated within the seawall at the back of the beach.

There are no known major services or utilities in the immediate vicinity that could be impacted by future beach management works.

## 1.4 Issues

### 1.4.1 Flood and coastal erosion risk management

The defences along the BMP frontage protect against the risk of coastal flooding in the eastern part, and against coastal erosion and landsliding in the western part (see Figure 1-5).



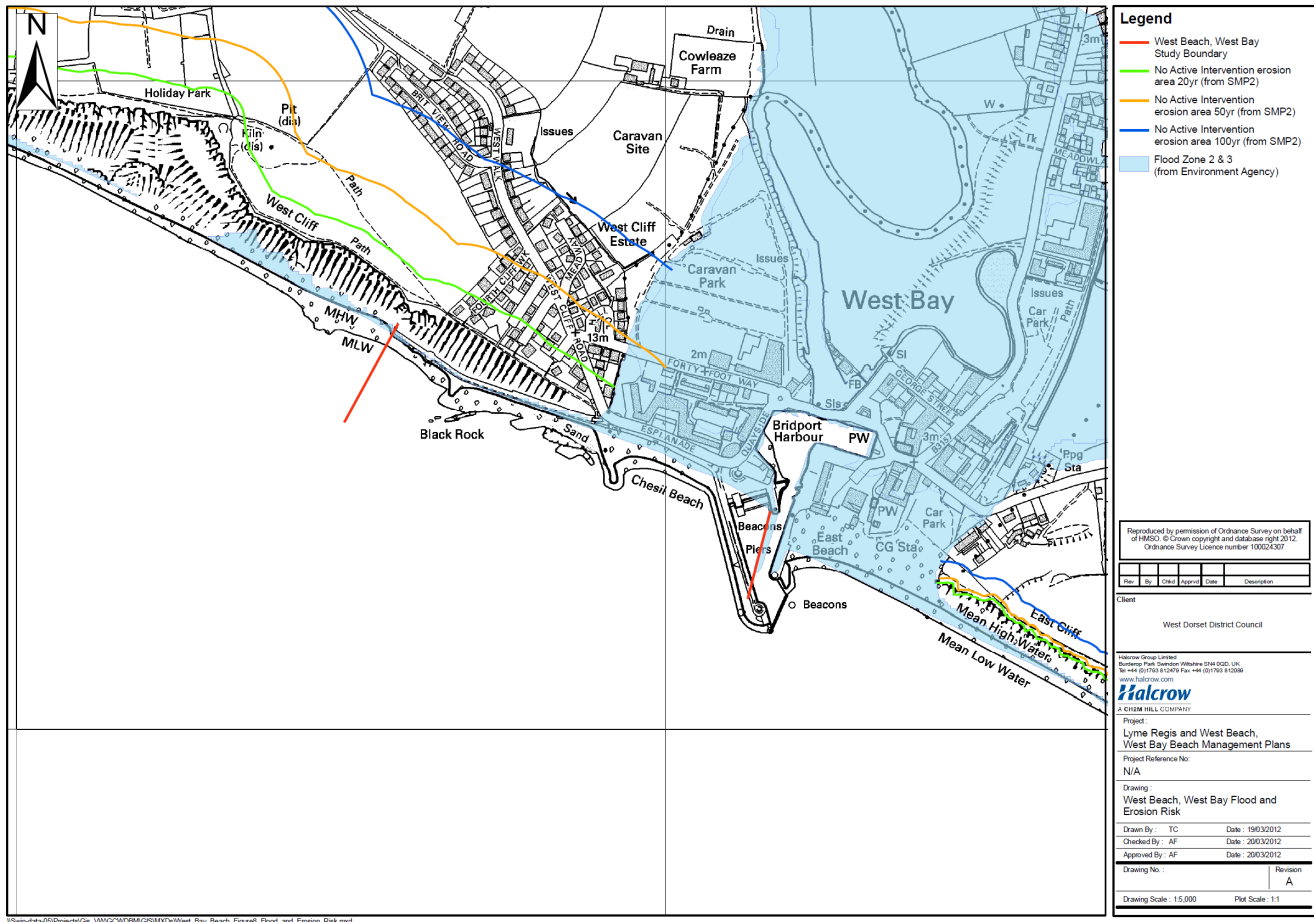


Figure 1-5 Flood and erosion risk at West Beach, West Bay

The 2005 scheme constructed a raised seawall and rock groyne, and placed recharged beach material on the eastern frontage to improve the level of protection against coastal flood risk. The western part of the BMP frontage is protected by an older seawall constructed in the 1960's. This area has very little beach in front of the seawall. Rather, there is rock armour along the base of the seawall in this area.

Ultimately the seawall will continue to provide defence against coastal flood and erosion risk. However, the concern is how long it will be sustainable to continue to protect the seawall along the eastern part of the BMP frontage through beach recycling and further beach replenishment, or if an alternative defence option may be needed in place of a beach (e.g. rock armour as placed along the base of the seawall in the western part of the BMP frontage).

The aim of this BMP is to identify how the beach can be managed in the immediate future to continue to protect the seawall in the eastern part of the frontage. Any decision to provide an alternative defence in place of a beach will be taken through future study, and informed by monitoring data collected as part of the monitoring regime set out in Section 4 of this BMP.

#### 1.4.2 Environmental considerations

The following environmental considerations for beach management activities at West Beach have been identified:

- Impact of beach management activities on internationally and nationally designated sites – need to avoid disturbance to notable and protected habitats and species. Potential requirement for Habitats Regulations Assessment to assess impacts of beach management activities on the integrity of the international conservation sites. **Early consultation with Natural England during the development of the future beach recharge scheme will be required.**
- Impact of the beach management activities the on the AONB.
- Lack of monitoring of designated habitats/species to appraise impacts on European sites.

#### 1.4.3 Public safety and amenity considerations

The following public safety and amenity considerations for beach management activities at West Beach have been identified:

- Access and noise/visual disturbance to recreational users in the vicinity of BMP activities, as the beach is used extensively for amenity purposes - **all works will need to be programmed to minimise the impact on amenity users by avoiding the peak holiday season, where possible.** Also, there is a need to ensure safe public access of any possible recycling/re-profiling works.
- Access and noise/visual disturbance to residents/local businesses.

#### 1.4.4 Uncertainties about coastal processes

The detailed review of coastal processes provided in Appendix B provides a good understanding of the beach at West Beach, West Bay, given the limited available data. However, there remain a number of uncertainties with regards current understanding of the processes occurring at the shoreline, which will ultimately determine the future behaviour of the beach. These are discussed below.

1. A key uncertainty relates to the cross-shore movement of material along the shingle beach, particularly in the eastern part of the recharged groyne bay. Beach profile analysis shows that there is erosion of the beach berm, but the formation of beach crests on the upper/middle beach. This suggests that there is some cross-shore movement of material. It is uncertain whether material is lost permanently, or whether it can be transported back onshore during favourable conditions. Beach volume analysis and topographic analysis suggests that this may not be the case since there has been an overall decreasing trend in CSA and volume. **Ongoing beach monitoring will help to confirm any patterns, but in the meantime, the timing of any future beach recharge should consider this cross-shore movement.**
2. A second uncertainty relates to the simplistic method of calculating actual and critical/minimum beach volumes undertaken for this study. **This analysis could be improved through regular capture and analysis of LiDAR survey data to provide a more robust assessment of beach volumes.** The current analysis provides a useful indication of recent trends but is based on a limited amount of data and a number of critical assumptions. Use of LiDAR over the coming years would provide a useful means to assess when further capital beach recharge is likely to be required at West Beach. **This could also be**

**supported by a survey to determine accurately the underlying bed levels of the hard geology on which the beach sits to further aid calculation of accurate beach volumes.**

The monitoring regime set out in Section 4 includes measures that aim to improve understanding of these uncertainties.

## 1.5 Responsibilities for management

Responsibility for the management and operation of activities along the BMP frontage varies depending upon the activity. Table 1-1 summarise the roles and responsibilities.

*Table 1-1 Assigned responsibilities for West Beach, West Bay, beach management operations.*

Management Operation	Assigned Responsibility
Monitoring of beach and other coastal processes	Plymouth Coastal Observatory
Initiation of post-storm surveys	West Dorset District Council and West Bay Harbour Master
Operations to maintain beach profile, including recycling and recharge.	West Dorset District Council
Cleaning/clearance of promenade of shingle/landslide debris for amenity.	West Dorset District Council
Cleaning/clearance of beach in response to pollution incidents.	West Dorset District Council or Dorset County Council ( <i>depending on nature of hazard</i> )
All structural maintenance of promenade, seawall, groynes etc.	West Dorset District Council
All maintenance of access steps and ramps to beach from seawalls/promenades	West Dorset District Council
All maintenance of footpath and cycleways including signs for designated public footpaths and rights of way.	West Dorset District Council and Dorset County Council
Litter clearance	West Dorset District Council
Maintenance of seats, litter bins etc	West Dorset District Council
Provision of signage	West Dorset District Council
Flood warning and response actions	West Dorset District Council, Environment Agency and Dorset County Council

Management Operation	Assigned Responsibility
Emergency planning	West Dorset District Council, Environment Agency and Dorset County Council

Actual ownership of the assigned responsibility for each management operation identified in Table 1-1 is in some cases held by different departments within the identified organisation. Therefore, in order to support Table 1-1 and to provide clarity on who should be contacted for each item, Appendix D provides more specific contact details for those responsible for each management operation. Appendix D also contains contact details for some of the other key stakeholders who do not have a direct management role at West Beach but who are likely to be key contacts for future beach recharge studies.

## 1.6 Licences, approvals and consents

West Dorset District Council are currently licensed under the Food and Environmental Protection Act (FEPA) (1985) (licence number 34651/10/0) to undertake a five year maintenance dredging programme at Lyme Regis and West Bay. In respect of West Bay, where the sediment dredged is suitable for beach recharge, it is permitted under this licence to replenish the amenity beach to the west of the harbour (West Beach).

The dredging programme was initiated in 2010 and is licensed until 2014. Further works that extend the dredging programme past 2014 or any additional works will require licensing under the Marine and Coastal Access Act (2009) – a Marine Licence.

At the point when further beach recharge is required, it is likely that the project will require a marine license and consideration under the Marine Work (Environmental Impact Assessment) Regulations, 2007, to determine whether an Environmental Impact Assessment is required. The Marine Management Organisation (MMO) would act as the competent authority with the local authority taking the role a statutory consultee.

In addition to the marine licence, any capital scheme will also require some form of planning consent from West Dorset District Council. It is recommended that the local planning officer be consulted at the time when a capital scheme is being developed to determine the most appropriate route for planning consent.

## 1.7 Linkages to other appropriate documents

### 1.7.1 Shoreline Management Plan policy

The current Shoreline Management Plan (SMP) covering the West Beach, West Bay frontage was adopted in June 2011 (Halcrow, 2011). The SMP policy recommended for this section of coast is to 'Hold the Line' for the next 100 years. To the west of this section the policy is, however, for 'No Active Intervention' over this period.

Table 1-2 summarises the SMP policies that apply to the entire West Bay frontage, though only policy, unit 6a12, covers the BMP area.

Table 1-2 SMP policies adopted June 2011 (from Halcrow, 2011)

Policy Unit	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
6a10 – East Cliff (West Bay)	Allow natural coastal evolution to continue through <b>No Active Intervention</b> .	Allow natural coastal evolution to continue through <b>No Active Intervention</b> .	Allow natural coastal evolution to continue through <b>No Active Intervention</b> .
6a11 – West Bay (East Beach to eastern pier)	Continue to maintain existing defence position to protect West Bay, through a <b>Hold the Line</b> policy.	Maintain the existing defences for as long as technically possible, through a <b>Hold the Line</b> policy.	Build new defences in a more sustainable position, through implementing a <b>Managed Realignment</b> policy.
6a12 – West Bay (West Beach from eastern pier) to West Cliff (East) (includes West Bay Harbour)	Continue to maintain existing defence position to protect West Bay, through a <b>Hold the Line</b> policy.	Continue to maintain existing defence position to protect West Bay, through a <b>Hold the Line</b> policy.	Continue to maintain existing defence position to protect West Bay, through a <b>Hold the Line</b> policy.
6a13 – West Cliff (East) to Thorncombe Beacon	Allow natural coastal evolution to continue through <b>No Active Intervention</b> .	Allow natural coastal evolution to continue through <b>No Active Intervention</b> .	Allow natural coastal evolution to continue through <b>No Active Intervention</b> .

## 1.7.2 West Dorset District Council planning policy

The following sections summarise local planning policies that are relevant for flood and coastal erosion risk management activities defined in this BMP.

### 1.7.2.1 West Dorset Local Plan 2006

The current *West Dorset District Local Plan* was adopted by the Council on 14 July 2006 and contains policies and proposals for development in the area until 2016. The Plan will help the local community thrive socially and economically, whilst ensuring that development does not harm the environment, or threaten the special characteristics of West Dorset. Relevant policies are:

- Policy SA1 (Area of Outstanding Natural Beauty).
- Policy SA2 (Heritage Coast Protection).

#### 1.7.2.2 West Dorset Local Development Framework Core Strategy (Draft, 2007)

The *West Dorset District Council Core Strategy Issues and Options Paper* was published in July 2007. The Report sets out the vision, objectives and spatial strategy for the area up to 2026. The Council's vision for the area is to ensure that the beauty of the coast, countryside and historic settlements remain.

#### 1.7.3 World Heritage Site Management Plan 2009-2014

The *Dorset and East Devon Coast World Heritage Site Management Plan* defines a number of objectives for the long-term sustainable management of the site. These objectives include to conserve the geology and geomorphology of the site; to conserve, and enhance where appropriate, the quality of the landscape and seascape of the site; and to foster the gathering and dissemination of scientific information about the site.

In line with these objectives, the management plan sets out a range of policies covering all aspects of coastal management. The following policies are particularly relevant to this plan area:

- Policy 1.3 to seek to avoid or mitigate any negative impacts of coastal defence works on the natural processes of erosion and exposed geology.
- Policy 1.6 ensuring that effects on the Outstanding Universal Value of the World Heritage Site are considered in all coastal erosion and sea defence planning and implementation.

#### 1.7.4 Dorset Coast Strategy 2011-2021

The *Dorset Coast Strategy* is a high level non-statutory document that provides a framework for how members of the Dorset Coast Forum, of which West Dorset District Council are members, can improve the planning and management of the Dorset Coast and inshore waters.

The goals of the strategy include establishing integrated coastal policy, identifying strategic opportunities for resource development, engaging and developing participation of a wide range of partners, and identifying solutions for sustainable coastal development, management and access.

These goals should be considered in all management decisions in this plan area.

## 2 Supporting Information

This section of the BMP provides a summary of the physical setting of the BMP area along the defended western frontage of West Bay. The aim of this summary is to provide an overview of the coastal processes affecting this frontage and the impacts of human intervention upon them, as well as details of the environmental features of the site that must be considered when undertaking beach management in this area. This includes the following information:

- Wave climate (typical waves, extreme waves).
- Water level climate (tidal information, extreme water levels).
- Joint probability extreme wave and water levels.
- Climate change.
- Sediment transport (sediments, shoreline movement, beach stability).
- Environmental characteristics.

This summary is based upon more detailed assessment undertaken in developing this BMP. The detailed assessment is provided in Appendices A and B.

### 2.1 Wave climate

#### 2.1.1 Typical waves

Wave climate studies for West Bay found that the prevailing wave direction was from the south-west, although it has been reported (SCOPAC, 2004) that after 1982, there were fewer south-easterly storms and a higher proportion of waves from the west and south-west.

The wave climate information presented below is taken from the South West Strategic Regional Coastal Monitoring Programme Annual Report (PCO, 2010). As part of the South West Strategic Regional Coastal Monitoring Programme, a network of ten Datawell directional Waverider MKII wave buoys have been deployed in 10 to 12m water depths. There are two buoys of relevance to this study: Chesil and West Bay. The WaveRider buoy at West Bay, deployed on the 1st November 2006, is located closest to the study area and was selected for further discussion on this basis.

The findings of the wave climate studies for West Bay are reflected in the wave data (see Figure 2-1), which shows that for the time series available (i.e. November 2006 to May 2010) the majority of waves, including the largest waves, have come from the 210° to 225° direction sector.



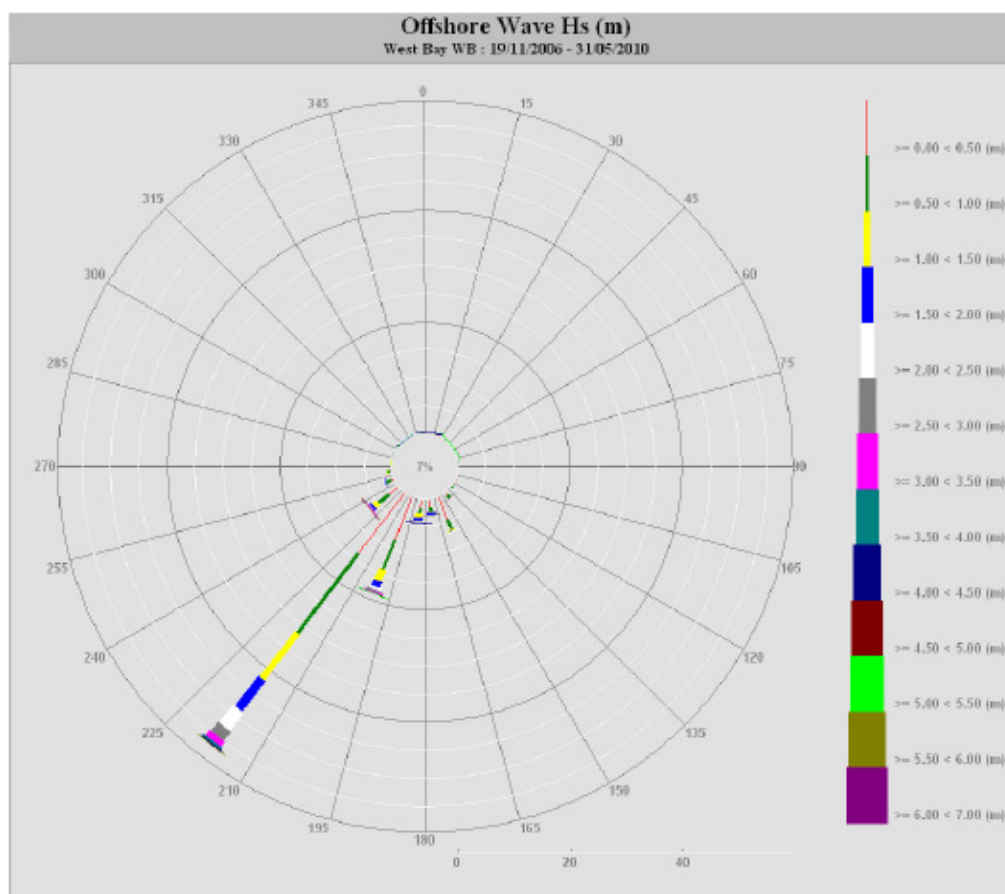


Figure 2-1 Percentage of occurrence of direction vs. significant wave height ( $H_s$ ) for November 2006 to May 2010 (all measured data) (PCO, 2010).

Waves along much of the Lyme Regis to West Bay shoreline are likely to be depth limited, as much of the shallow inshore zone is characterised by intermittent limestone ledges and boulder aprons (SCOPAC, 2004).

Monthly mean significant wave heights ( $H_s$ ) for 2009 to 2010, as recorded by the WaveRider buoy at West Bay, ranged from 0.41m to 1.99m. During the highest events (as defined by PCO), wave heights ( $H_s$ ) reached between 4.05m and 5.80m (PCO, 2010).

For the West Bay WaveRider buoy, PCO (2010) reported that 2009-2010 was relatively uneventful in terms of the number of storms (storms are defined by PCO as wave events with significant wave height ( $H_s$ ) in excess of 2m). Two events were notable, the first on 14<sup>th</sup> November 2009 when  $H_s$  peaked at 5.80m, and the second was on the 16<sup>th</sup> January 2010, when  $H_s$  exceeded the storm threshold 3.75m.

### 2.1.2 Extreme waves

Extreme waves can occur during storm events, with waves generated locally to the site having relatively short wave periods. However, extreme events can also be generated far from the site by storms in the Atlantic, when long-period swell waves may be created which can potentially lead to significant overwashing/ overtopping events.

Extreme wave heights have been obtained from the Environment Agency Coastal Boundaries swell wave dataset (Environment Agency, 2011a). Extreme swell wave



heights are presented in Table 2-1 for a range of return periods and wave directions for the data point 2632. This point is located approximately 40km from the BMP area and is one of several extreme swell wave data points available. **Any future studies of the BMP area would need to transform these extreme swell waves to the study site in order to provide local values.**

Table 2-1 Extreme swell wave heights at data point 2632 (Environment Agency, 2011a).

Extreme swell wave heights (m) by Return Period (1 in X Years)						
Direction	1	10	50	100	200	500
Southeast	2.28	2.78	3.03	3.12	3.20	3.29
South	3.17	3.85	4.12	4.20	4.27	4.35
Southwest	3.68	4.33	4.70	4.84	4.97	5.12
Northwest	1.53	2.09	2.61	2.73	2.82	2.93

## 2.2 Water levels

### 2.2.1 Tidal information

The tidal regime can be defined as the behaviour of water levels, which are in turn driven by the action of tides and other influences, such as shoreline morphology, river flows, winds, atmospheric pressure and storm events.

The tidal levels for West Bay have been taken from the Admiralty Tide Tables (United Kingdom Hydrographic Office, 2010) and are presented in Table 2-2. The values have been converted to a common datum (Ordnance Datum, OD).

Table 2-2 Tide levels for West Bay from the 2011 Admiralty Tide Tables (United Kingdom Hydrographic Office, 2010).

Location	Tidal Level (mOD)					CD to OD conversion
	MHWS	MHWN	MLWN	MLWS	MSL	
Standard Port – Plymouth (Devon Port)						
Bridport (West Bay)	1.85	0.75	-0.65	-1.55	0.21	-2.25

### 2.2.2 Extreme water levels

The shoreline under review is exposed to modest storm surges that travel up the English Channel driven by cyclonic weather systems that approach from the northeast Atlantic (SCOPAC, 2004).

The most recent estimate of extreme tide levels for this area is provided by the Environment Agency's R&D project 'Coastal Flood Boundary Conditions for UK Mainland and Islands' (Environment Agency, 2011a). The data relevant to the frontage at West Bay is shown in Table 2-3. This is from data point defined as chainage 4786 which is located approximately 2km offshore of West Bay.

Table 2-3 Extreme tide levels for a range of return periods at West Bay.

Return Period (1 in x years)	1	10	25	50	100	200	500
Environment Agency (2011a)	2.39mOD	2.62mOD	2.71mOD	2.78mOD	2.85mOD	2.92mOD	3.01mOD

### 2.3 Joint probability extreme waves and water levels

Joint probability wave and water levels for West Bay have been sourced from work presented in the East Beach and Freshwater Beach Management Plan (Environment Agency, 2009), and completed by HR Wallingford (1998) for the West Bay Coastal Defence Scheme. The joint probability wave and water levels are presented in Table 2-4.

Table 2-4 Joint Probability Extreme Wave Heights and Water Levels for West Bay (HR Wallingford, 1998).

Joint Return Period	Water Level (mOD)	Wave Height (m)
1 in 10	0.0	5.4
	2.0	5.2
	2.2	5.0
	2.3	4.9
	2.5	4.0
	2.5	3.9
	2.7	3.0
	2.8	2.0
	2.8	1.0
	2.8	0.0
1 in 20	0.0	5.7
	2.0	5.6
	2.3	5.3
	2.4	5.0
	2.5	4.4
	2.6	4.0
	2.7	3.0
	2.8	2.0

Joint Return Period	Water Level (mOD)	Wave Height (m)
	2.9	1.0
	2.9	0.0
1 in 50	0.0	6.1
	2.0	6.0
	2.0	6.0
	2.3	5.8
	2.5	5.0
	2.7	4.0
	2.8	3.0
	2.9	2.0
	2.9	1.0
	2.9	0.0
1 in 100	0.0	6.4
	2.0	6.4
	2.3	6.2
	2.3	6.0
	2.5	5.5
	2.7	5.0
	2.8	4.0
	2.9	3.0
	3.0	2.0
	3.0	1.0
	3.0	0.2
	3.0	0.00
1 in 200	0.0	6.8
	2.0	6.7
	2.3	6.6
	2.5	6.0
	2.5	5.9

Joint Return Period	Water Level (mOD)	Wave Height (m)
	2.7	5.0
	2.9	4.0
	3.0	3.0
	3.0	2.2
	3.0	2.1
	3.1	1.0
	3.1	0.0

## 2.4 Climate change and risk

Information on the impacts of climate change is available from 'Advice for Flood and Coastal Erosion Risk Management Authorities' (Environment Agency, 2011b). This is the latest guidance and highlights that the main risk of climate change in relation to beach management is from sea level rise.

The guidance (Environment Agency, 2011b) suggests that predictions of the future rate of sea level rise for the UK coastline should be taken from UKCP09. Data downloaded from UKCP09 provides sea level rise from 1990. Anticipated rates of relative sea level rise and surge estimates over three time periods are presented in Table 2-5. The following estimates are presented in the table:

- Lower End Estimate: this is the low emissions scenario, 50% frequency, taken from the UKCP09 User Interface.
- Change Factor: this is the medium emissions scenario, 95% frequency, taken from the UKCP09 User Interface.
- Upper End Estimate: these are generic values of sea level rise provided in the climate change guidance; they are 4mm (up to 2025), 7mm (2026 to 2050), 11mm (2051 to 2080), and 15mm (2081 to 2115).
- H++ Scenario: these are generic values of sea level rise provided in the climate change guidance; they are 6mm (up to 2025), 12.5mm (2026 to 2050), 24mm (2051 to 2080), and 33mm (2081 to 2115).
- Upper End Estimate + Surge Estimate: This is the upper end estimate plus the upper end surge estimate. The surge estimate are generic values provided in the climate change guidance; they are 20cm (up to the year 2020's), 35cm (up to the year 2050's), and 70cm (up to the year 2080's). With regard to the surge increase, the uncertainty with surge increase is even greater than for sea level rise.

The climate change guidance (Environment Agency, 2011b) recommends that in planning future coastal management options, the Change Factor (medium 95% frequency scenario) be used as the preferred scenario. All other scenarios are included to demonstrate the sensitivity of decision making through time, and can be used to refine the options to prepare for a wider range of future change.

A graph showing the predicted change in relative sea level over the next 100 years for the 5, 50 and 95% confidence levels, for a medium emissions scenario, is presented in Figure 2-2.

Table 2-5 Relative sea level rise estimates for West Bay (UKCP09, 2012). \*See text above for an explanation of the terms used in this table.

Time period	Various estimates of relative sea level rise and surge (mm/year)				
	Lower End Estimate	Change Factor	Upper End Estimate	H++ Scenario	Upper End Estimate + Surge Estimate
2011 to 2025	0.04	0.08	0.06	0.08	0.26
2011 to 2055	0.15	0.27	0.29	0.52	0.64
2011 to 2105	0.42	0.77	1.09	2.27	1.79

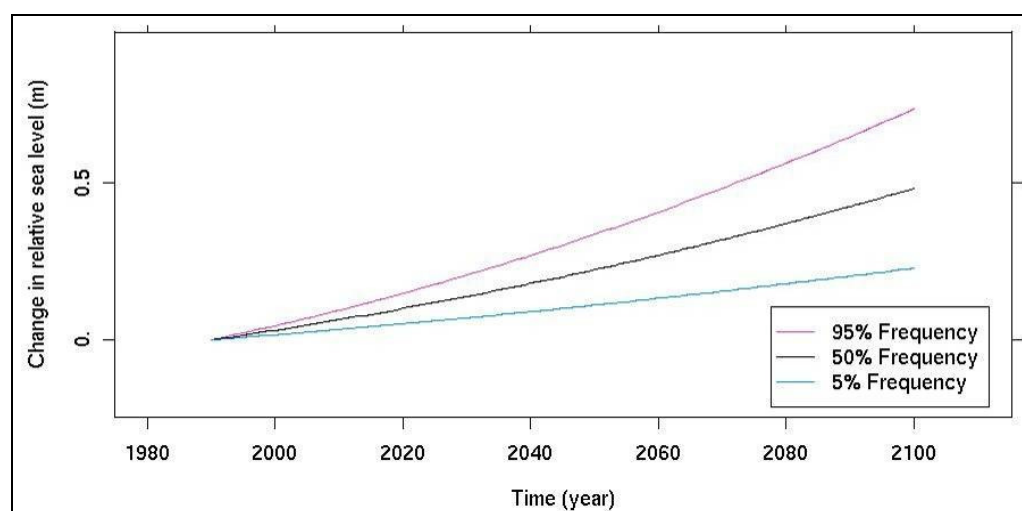


Figure 2-2 Projected change to relative sea level over the next 100 years for a medium emissions scenario (source: UKCP09, 2012).

## 2.5 Sediment transport

### 2.5.1 Sediments

Any new material that may have been supplied to the coastal frontage by erosion of the cliffs at West Bay is currently prevented by the seawall and cliff stabilisation measures. Exceptions to this may be when material eroded from the cliffs may fall seaward across the sea wall. However, following the completion of the cliff stabilisation works at West Bay in the mid 1990's, it is unlikely that this mechanism would provide a significant contemporary source of sediment.

The sediments on the West Beach between the western harbour arm and the new rock groyne are now primarily governed by the replenishment material placed on the beach as part of the beach replenishment scheme completed in 2005.

The beach between the harbour and the new rock groyne has been replenished with 18,000m<sup>3</sup> shingle-sized material sourced from a quarry operated by Hansons at Whiteball, Wellington in Somerset. The shingle is a mixture of Permian/Triassic gravels/pebbles comprised of quartzite and sandstone with a grain size distribution consisting of the following:

1. 63mm - 100%;
2. 50mm - 91%;
3. 37.5mm - 77%;
4. 20mm - 7%; and
5. 14mm - 1%.

Since the 2005 replenishment, sediment dredged from the West Bay harbour entrance has been recycled to West Beach to top up the beach volume. This recycling occurs annually (approximately February/March) and typically places 8,000 to 10,000m<sup>3</sup> of sand and silt material on West Beach during each campaign. In placing the material, the 2005 replenishment shingle is scraped back from the beach and the dredged material placed on the beach. The shingle material is then moved back over the top of the dredged material and the beach is re-graded.

### 2.5.2 Sediment transport mechanisms

Sediment transport along the shore at West Bay is complex. Numerical modelling reported on in Brampton (1993) suggested that that net drift at West Bay is extremely variable in direction and was highly sensitive to small changes in the directional wave climate.

As reported by SCOPAC (2004), High-Point Rendel (1997a; 1997b) proposed that prior to the construction of the harbour, longshore transport would have taken place both to the west and east. The report suggests that landslides along the Doghouse Hill and Thorncombe Beacon headland in the late 1700's engulfed cliff toe beaches and severed the drift pathway from the west. After the harbour piers were infilled in the 1820's, littoral drift and exchange between West Beach and East Beach was reduced.

Sediment transport studies, reported on in more detail in SCOPAC (2004) suggest that today there is movement of the shingle from East Beach to West Beach, but no return from west to east. This is in part confirmed by recent observations where 'pea-sized' shingle that is present on East Beach, but is part of the replenishment material, has been observed in the harbour entrance (Middleton, *Pers. Comms.*, 2011).

Numerous studies suggest that there is an onshore-offshore exchange of sediment at West Bay. It is reported on in SCOPAC (2004) that temporary accumulations could form very close inshore related to profile variations arising from storms.

A model of the sediment transport processes at West Bay and the adjacent coastline, as developed as part of the SCOPAC study (SCOPAC, 2004) is presented in Figure 2-3.

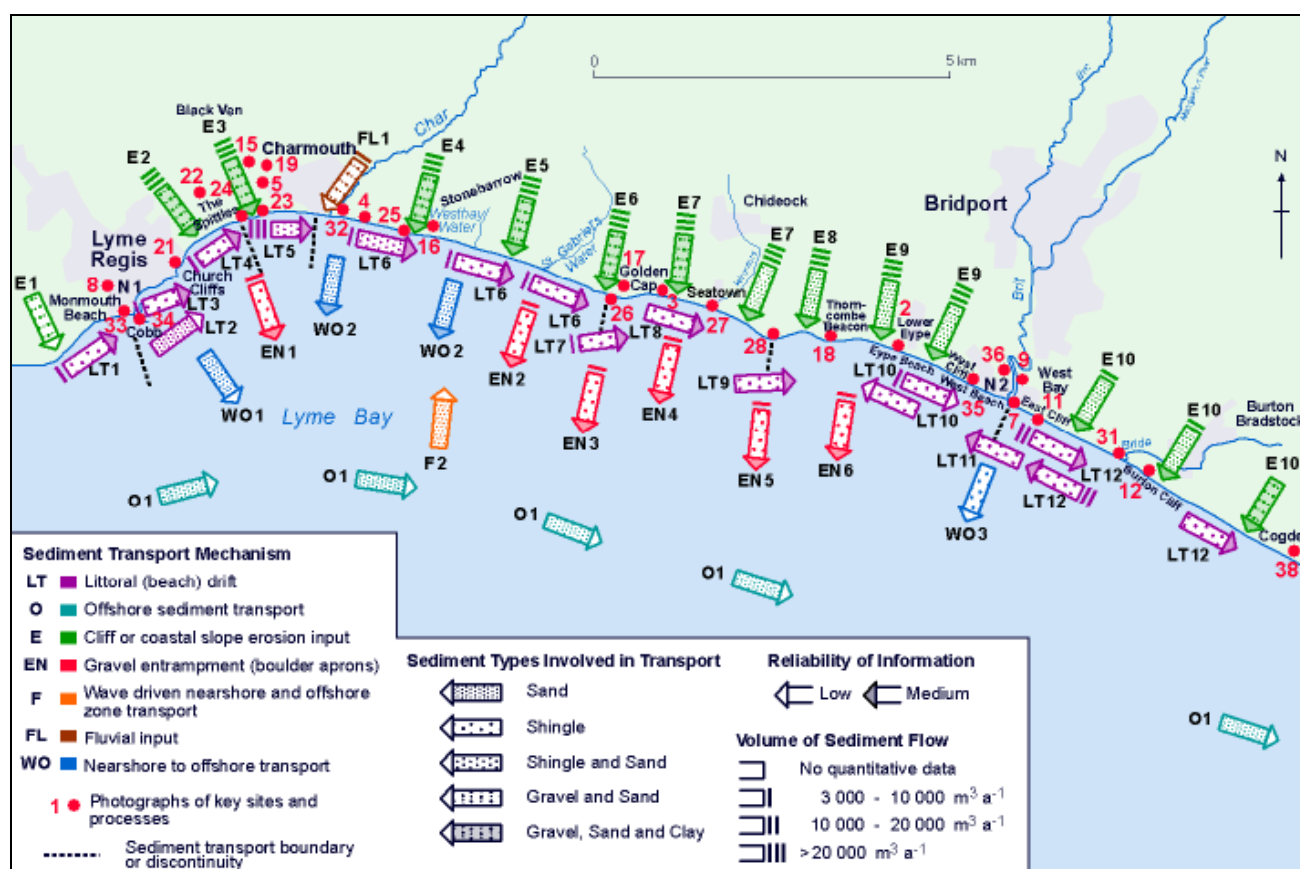


Figure 2-3 Illustration summarising sediment transport at West Bay and the coastline to the east (from SCOPAC, 2004).

## 2.6 Shoreline movement

### 2.6.1 Overview of the evolution of this shoreline

The shoreline at West Bay has been fixed in position since the 1700's, with the first human intervention, which began with the construction of the harbour in 1742-1746 and seawalls and esplanades in the late 1800's (SCOPAC, 2004). This was followed with the infilling of the permeable piers in the 1820's, and in 1963, the esplanade was extended along the toe of West Cliff and a rock groyne was constructed at Black Rock. Cliff instability occurring from the mid-1970's called for various remedial works (SCOPAC, 2004). A recent stabilisation/drainage scheme was completed in 1997 (Middleton, *Pers. Comms.*, 2011).

Due to the historic cliff falls and infilling of the piers at West Bay in the 1820's, which resulted in an interruption to longshore drift, beaches along the shoreline became depleted of sediment and the beach eroded set-back by some 100m (SCOPAC, 2004). This led to the exposure of sea-walls and loss of amenity facilities. Prior to the existing scheme (described below), beach levels to the west of the new rock groyne were 1 to 1.5m lower than the present replenished level (Middleton, *Pers. Comms.*, 2011).

In response to the issue of beach erosion and low beach levels, a beach replenishment scheme was implemented and is inherent to the ongoing evolution of the foreshore. The West Bay Coastal Defence and Harbour Improvements Scheme is summarised below:

1. Completion of a major beach replenishment scheme in 2005, which involved the replacement of the western pier with the new western harbour arm, construction of a new rock groyne and replenishment of the beach with some 18,000m<sup>3</sup> of shingle (SCOPAC, 2004). The new rock groyne serves to retain to the replenished beach and prevent its erosion.
2. On an annual basis (approximately February/March), the West Bay harbour entrance is dredged to remove sand and silt material to maintain a navigable channel. Typically, 8,000 to 10,000m<sup>3</sup> is dredged from the channel during each campaign. All of this dredged material is then placed on the beach at West Bay. The replenishment shingle is scraped back from the beach and the dredged material placed on the beach. The shingle material is then moved back over the top of the dredged material and the beach is re-graded.

Observations by West Dorset District Council (Middleton, *Pers. Comms.*, 2011) have found some of the replenished shingle has been transported, from the replenished beach, over the rock groyne where it abuts the seawall.

### 2.6.2 Beach profile analysis

Beach profile analysis undertaken as part of this BMP review involved both a review of recent analysis by PCO, who undertake beach monitoring of this coastline for the South West Strategic Regional Monitoring Programme, and new analysis undertaken in developing this BMP. Critically, the recent beach profile data has been compared to the 2005 replenished design beach. This analysis is described in detail in Appendix B, and summarised in brief below.

From the review of beach profiles, it is evident that there have been significant changes to the height and width of the beach crest since 2007. The following observations have been made:

- To the east of the new rock groyne (profile 6a00701), the beach crest has grown wider and higher than the profiled crest. Profiles from the 8/4/2009 to 25/03/2001 show general stability of the material above the beach crest, however, below this, the beach is lower than the design profile on the upper and middle beach. The beach profile data for 25/03/2011 indicate that the beach profile is at the same height as the design beach crest.
- To the east, at profile 6a00699, the crest width narrowed to as little as 4m wide during 2010. However, the 2011 winter profile suggests some recovery, although the beach crest is still less than the design profile width at approximately 7m wide.
- The height and width beach of the beach crest at profile 6a00698 has shown significant movement from the design profile, showing a drop of nearly 1m to approximately 3m in 2010. The 14/08/2010 profile and profiles measured since then all show that the beach profile is always below the design profile, including the beach crest and beach profile.



Using Halcrow's SANDS software, a comparison was made with the existing beach profiles and the original design profile of the beach as developed for the 2005 scheme. The design profile was sourced from the East and West Beach Management Plan (Posford Duvivier, *et al.*, 2000), as shown in Figure 2-4.

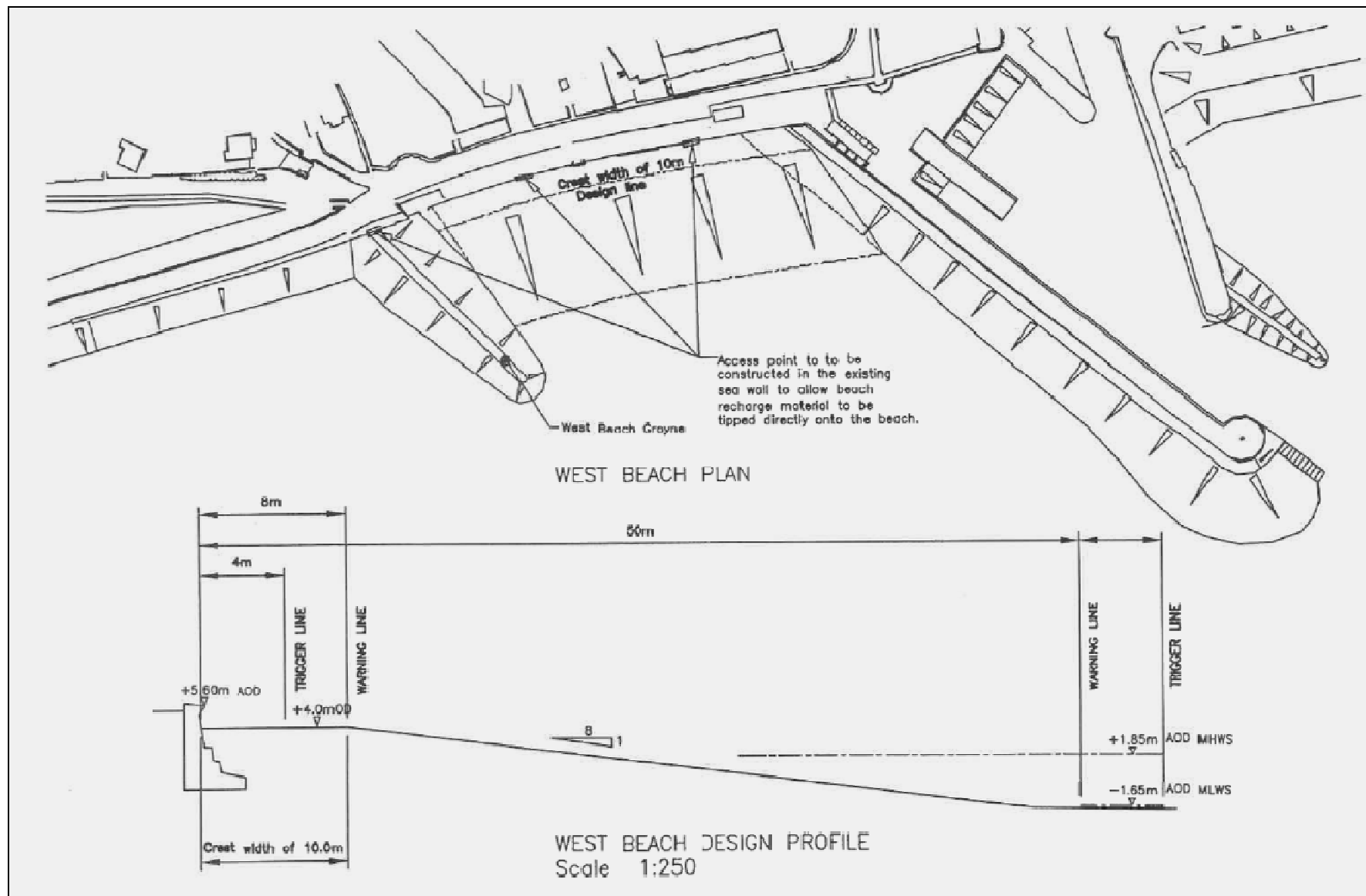


Figure 2-4 West Beach design profile (Posford Duvivier, et al., 2000).

The analysis shows that for profile 6a00701 (located immediately to the east of the rock groyne) has seen accretion of material since the initial recharge in 2005 and each subsequent annual recycling campaign. However, it should be noted that following the annual recycling campaign, the beach is not always returned to the design beach profile, rather to the best visual observation (as confirmed by WDDC), which could mean that in some locations on the beach, accretion may be attributed to the placement of recharge material, rather than any natural accretion.

To the east, at profiles 6a00699 and 6a00698, the opposite is true. Here the analysis suggests that there has been a general trend of erosion of the recharge material, both since the initial recharge in 2005, and also after each annual recycling event. These trends are reflected by the volume analysis, where there has been a net reduction in volume from the design profile between 6a00701 and 6a00698, for each year from 2007 to 2011. The only exception to this is between profiles 6a00701 - 6a00699 (adjacent to the new rock groyne) during 2008 where beach volume is greater than the design profile. Review of the beach profiles for this year shows significant accretion at the toe of the seawall, which may explain these results.

### 2.6.3 Beach profile storm response

Two of the profiles within the BMP area are used for post-storm surveys; profiles 6a00698 and 6a00701. There are three post-storm surveys available in the PCO data, captured after storms on:

- 4<sup>th</sup> December 2007;
- 21 August 2008; and
- 28<sup>th</sup> November 2009.

The change in the beach in response to each event is described in detail in Appendix B, but overall it can be seen that the beach response varies depending on the storm conditions. In some cases, storm events result in lowering and narrowing of the beach crest and overall flattening of the profile, whilst under different storm conditions there is raising of beach levels with storm berm creation on the upper beach.

**Further collection of post-storm survey data will enable a review alongside recorded wave and tide data to provide enhanced understanding of beach response to different conditions as part of future studies.**

### 2.6.4 Predictions of future shoreline change

Based on the comparison of present-day profiles to the design profiles used for the 2005 replenishment scheme, it is seen that there has been accretion of sediment at the western end of the replenished beach. However, east of this area, which is in the lee of the western rock groyne, towards the central and eastern part of the recharged groyne bay, the beach crest has narrowed from the design profile and adjacent to the western harbour arm (profile 6a00698), the beach crest level has dropped significantly. On the middle and lower beach, the beach profile is lower than the design profile.

Comparison of actual beach volumes with minimum beach volumes required to protect the stability of the seawall (see Figure 2-5) shows that without the annual addition to the beach of approximately 10,000m<sup>3</sup> of sediment from the dredging of

West Bay Harbour, the volume of beach material would already be below the upper limit of critical volumes (i.e. the alarm level). However, the addition of this material annually suggests that the impact of placing dredge material on the beach serves to provide sufficient volume to the beach to delay the need to implement further beach recharge, certainly over the next 10 years based upon current estimates.

These patterns of erosion and accretion along West Beach, within the recharged groyne bay, are likely to continue over the immediate term. Continued monitoring of the beach over the coming years will enable ongoing assessment of the beach volume changes to enable the timing of the need for any future recharge works to be reviewed regularly.

Ultimately, the position of the shoreline will remain fixed in its current position by the seawall defences that back the beach along the length of the BMP area. The concern is whether the seawall will continue to be protected by a beach into the future through ongoing recycling of material and eventually further beach replenishment, or if an alternative defence option may be needed in place of a beach. This will depend on a number of factors including the rate of future sea level rise and future response of the beach to storm events, and ongoing monitoring will aid future decisions in this regard.

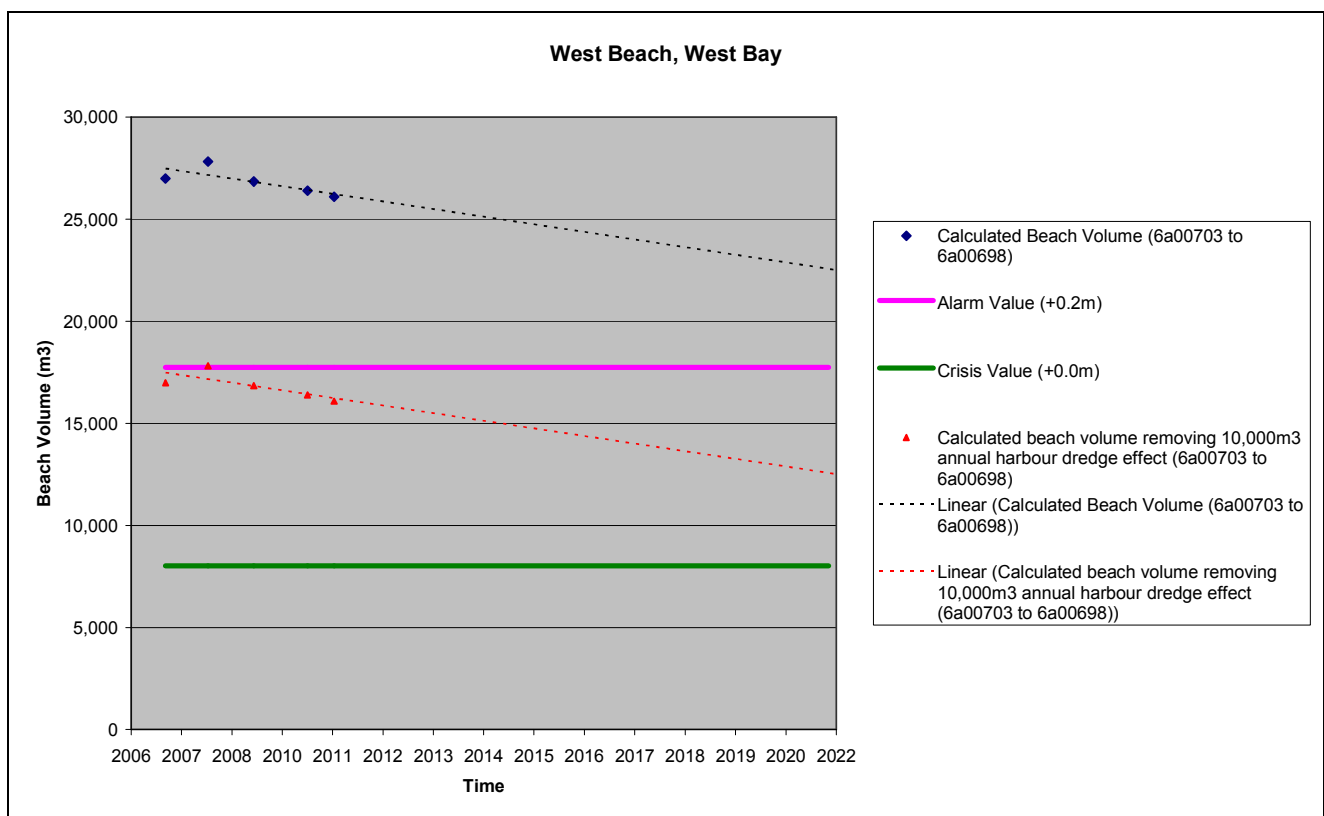


Figure 2-5 Comparing actual beach volumes to critical beach volumes, extrapolating 10 years.

## 2.7 Environmental characteristics

### 2.7.1 Natural environment

The western part of the BMP area only is directly within several areas of conservation designation:

- Lyme Bay and Torbay candidate Special Area of Conservation (SAC).
- Sidmouth to West Bay SAC.
- West Dorset Coast Site of Special Scientific Interest (SSSI) (status favourable 03/10/11).
- Dorset and East Devon UNESCO World Heritage Site (the 'Jurassic Coast').

Figure 1-2 above shows the extent of these designations. Appendix A contains the designation's citations. The geology and habitats are discussed further Sections 2.7.3 and 2.7.4 respectively.

### 2.7.2 Landscape

The high value of the landscape in the Study Area is reflected by its designation as Dorset Area of Outstanding Natural Beauty (AONB). This site is characterised for its downs, heaths, vales, lowlands and scarplands.

The West Dorset Heritage Coast lies within 400m to the east and west of the Study Area. This richly coloured landscape comprises sandstone cliffs backed by pebble beaches, and vivid Devon red sandstone broken by the white chalk headland at Beer.

The extent of these landscape designations in respect of the BMP area are shown in Figure 1-3 above. Appendix A contains details of the citations for both of the designated landscapes.

### 2.7.3 Geology and geomorphology

#### 2.7.3.1 Designated Geological Sites

The West Dorset Site of Special Scientific Interest (SSSI) lies 300m to the east and west of the Study Area and is designated for both its geological and biological characteristics. It is an important geological site, famous for its fossil reptiles in the sea cliffs (see Section 2.7.4).

The Dorset and East Devon UNESCO World Heritage Site (the 'Jurassic Coast') lies 300m to the east and west of the BMP area. This site was primarily designated for its:

- Sequencing of 185 million years of geological history from the Triassic, Jurassic and Cretaceous periods.
- Contribution the area has made to earth sciences and understanding of geology.
- Remarkable varied coastal scenery and geomorphology with unique features.
- A combination of important habitats and conservation features.

### 2.7.3.2 Geomorphology

The BMP area both fronts and is adjacent to a section of very geologically active coastline. The beach level along the BMP area is artificially maintained. This is due to the historic cliff retreat linked with a period of beach lowering that is thought to be in response to the interception of drift by the West Bay piers in the 1920s (SCOPAC, 2004). The recharged beach is held in place with artificial structures at the north-west end and the harbour to the south east. The South Devon and Dorset Shoreline Management Plan (Halcrow, 2011) comments that the piers at the entrance to West Bay Harbour have a significant local influence upon littoral processes, as do the rock groynes to the north west of the harbour, preventing the influx of new material to West Beach from either the south east or north west.

SCOPAC (2004) comments 'that [the intercepted littoral drift – *author's note*] this has led to a trend for variable accretion/erosion and shoreline fluctuation to the east, but erosion and setback of the shoreline by up to 100m to the west.' SCOPAC continues to summarise the historic sediment transport events that provides evidence to the interruption of the sediment cell. However, periodic occurrences of shingle accumulations in the harbour entrance indicate that the piers do not form a complete barrier to drift and limited bypassing is possible. However, there are only small annual dredge volumes removed to maintain a navigable harbour entrance channel. Due to the depleted nature of West Beach it is thought that very little material passes from East Beach across the harbour entrance.

Sediment transport processes are discussed further in Section 2.5 and Appendix B.

### 2.7.4 Ecology

#### 2.7.4.1 Designated Conservation Sites

The following nature conservation designations and their qualifying interest features are all within or lie in close proximity to the BMP area:

- Sidmouth to West Bay SAC

***Vegetated sea cliff of the Atlantic and Baltic coasts*** - Vegetation is very varied and includes pioneer communities on recent slips, calcareous grassland and scrub on detached chalk blocks and extensive self-sown woodland dominated by ash *Fraxinus excelsior* or sycamore *Acer pseudoplatanus*.

***Tilio-Acerion forests of slopes, scree and ravines*** - A mosaic of Tilio-Acerion, sycamore *Acer pseudoplatanus* woodland, mixed scrub, grassland and pioneer communities. This mosaic of habitats is rich in invertebrates, especially bees and wasps, such as *Ectemnius ruficornis*, *Andrena simillima* and *Nomada fulvicornis*. The woodland has a hazel *Corylus avellana* understorey and a ground-flora dominated by ivy *Hedera helix* (with numerous ivy broomrape *Orobancha ederae*) and hart's-tongue *Phyllitis scolopendrium*, with abundant dog's mercury *Mercurialis perennis* and tutsan *Hypericum androsaemum*. The Red Data Book lichen *Parmelia quercina* occurs on ash *Fraxinus excelsior* trees; and

***Annual vegetation of drift lines*** - This feature is an Annex 1 habitat, it is not given in the designation as the primary reason for site selection and

therefore does not detail species. However, it is likely that the following species would be present: Sea beet *Beta vulgaris* ssp. *Maritima* and orache *Atriplex* ssp., in the annual vegetation of the drift lines and Sea-kale *Crambe maritima* and sea pea *Lathyrus japonicus* in the stony banks.

- Lyme Bay and Torbay candidate SAC

**Reefs** - The Lyme Bay Reefs area is indicative of offshore reefs, where sea squirts (e.g. *Ascidella aspersa* and *Phallusia mammillata*), sponges (e.g. *Cliona celata*), anemones (e.g. *Aiptasia mutabilis* and *Urticina felina*), corals (e.g. *Alcyonium digitatum*, *Caryophyllia smithii* and *Leptopsammia pruvoti*), sea fans (e.g. *Eunicella verrucosa*) and bryozoans (e.g. *Pentapora fascialis*) dominate and sustain a wide diversity of other species.

**Submerged or partially submerged sea caves** - These habitats are characterised by communities of mussels *Mytilus edulis*, barnacles *Balanus crenatus*, cushion sponges, encrusting bryozoans and colonial ascidians. Caves that occur in deeper water are subject to less water movement from the surrounding sea, and silt may accumulate on the cave floor. The sponges, soft corals, solitary ascidians, bryozoans and sessile larvae of jellyfish are characteristic of deeper cave systems. These caves may also provide shelter for crabs, lobsters *Homarus gammarus*, crawfish *Palinurus elephas* and fish such as leopard-spotted goby *Thorogobius ephippiatus*.

In addition to the rare habitats cited in the SAC (detailed in Appendix A), the SSSI citations list a number of habitats that give reason for notification and are applicable to the BMP, namely:

- West Dorset Coast Site of Special Scientific Interest (SSSI)

**Cliff, undercliff and landslips** – The extreme instability of the cliffs has given rise to large undercliff areas with very varied topography. The range of plant communities is wide, from mature woodland to pioneer communities on bare sand or clay. Characteristic plants of these unstable areas are Coltsfoot *Tussilago farfara*, Creeping Bent *Agrostis stolonifera*, and Slender Centaury *Centaurea tenuiflorum*, a nationally rare species not recently recorded elsewhere in Britain is present. Areas of impeded drainage and flushing are dominated by tall herbs and grasses. In places, more diverse communities of shorter vegetation occupy these flushes, with strong populations of Marsh Helleborine *Epipactis palustris* etc.

On more stable soils, short sward communities are maintained by rabbit grazing. The character of the vegetation is varied. With less grazing, taller grasses dominate. The strongest British population of the nationally rare and protected plant Stinking Goosefoot *Chenopodium vulvaria* occurs on exposed soil in this location.

The landslips, seepages and other cliff features provide varied conditions which support a diverse insect fauna particularly rich in rare species. This is the only known British site for the moth Morris's Wainscot *Photedes morrisii*.

**Neutral grassland** - Grasses and sedges of neutral grassland include Common Bent *Agrostis capillaris*, Sweet Vernal-grass *Anthoxanthum odoratum*, Quaking-grass *Briza media*, Spring-sedge *Carex caryophyllaea* and

Carnation Sedge *C. panicea*. Among the less common herbs are the nationally scarce Corky fruited Water-dropwort *Oenanthe pimpinelloides* and Green-winged Orchid *Orchis morio*.

**Dry acidic grassland** - On soils derived from the *Bridport Sands* and the Upper Greensand, the grassland has a healthy character with stands dominated by Bristle Bent *Agrostis curtisii*. This community grades into scrub of Bracken and Gorse, and both the local Climbing Corydalis *Corydalis claviculata* and the nationally scarce Greater Broomrape *Orobancha rapum-genistae* are present. Some more restricted species of calcareous clay soils such as Dyer's Greenweed *Genista tinctoria* and Strawberry Clover *Trifolium fragiferum* are also present.

**Woodland** - Locally, where it is associated with some of the flushes, Alder *Alnus glutinosa* and Grey Willow *Salix cinerea* are frequent. The drier woodland is typically dominated by Pedunculate Oak *Quercus robur* with Downy Birch *Betula pubescens*, an understorey of Hazel *Corylus avellana* and abundant Holly *Ilex aquifolium*.

**Fauna** - There are a number of Red Data Book species present in the SSSI and listed in the designation. Including the strongest national populations of two mining bees, *Lasioglossum laticeps* and *L. angusticeps*. Red Data Book flies include the endangered crane fly *Arctoconopa melampodia* and the chloropid *Platycephala umbraculata* which have been recorded on few other sites. There is an important beetle fauna associated with the site.

#### 2.7.4.2 Biodiversity Action Plan (BAP) Habitats

Dorset Biodiversity Strategy (produced by Dorset Environmental Record Centre) and Action for Biodiversity in the South West are the relevant biodiversity plans for the Study Area. There is currently no Local BAP. The following are listed as UK priority BAP habitats and are potentially represented in the BMP area. The associated targets are quoted under them:

- Maritime cliffs and slopes
  - i Maintain the existing free-functioning maritime cliff and slope resource;
  - ii No overall net loss of cliff and slope functionality as a result of coast protection or engineering works;
  - iii Increase the extent of maritime cliff and slopes unaffected by coastal engineering/coast protection;
  - iv Increase the area of cliff-top semi-natural habitats; and
  - v Achieve favourable or recovering condition.
- Sabellaria alveolata reefs
  - i Maintain the extent and quality of the existing resource;
  - ii Survey to determine the full extent of the habitat;
  - iii Ensure water quality is sufficient to maintain habitat;



- iv Re-establish/ restore *Sabellaria alveolata* reefs where they were formerly present;
  - v Continue to survey and monitor to improve our knowledge of the habitat; and
  - vi Raise awareness of the wildlife value of the habitat.
- Sub-littoral sands and gravels
    - i Maintain the extent and quality of marine priority habitats;
    - ii Assess feasibility of restoration of damaged habitats;
    - iii Improve understanding by promoting research and survey; and
    - iv Promote awareness amongst public, especially divers.

A number of County-wide BAPs have also been written for priority species and habitats in Dorset. Of relevance to the BMP area are the following, with the relevant targets quoted.

- Coastal Vegetated Shingle
  - i Ensure no loss in the extent or quality of coastal vegetated shingle;
  - ii Restore quality of damaged or degraded shingle habitats where natural regeneration is unlikely; and
  - iii Establish demonstration site.
- Sabellaria Alveolata reefs
  - i Ensure no loss in the extent or quality of the habitat.
- Sub-littoral sands and gravels
  - i Ensure no loss in the extent or quality of the habitat.
- Maritime Cliffs and slopes
  - i Ensure no loss in the extent or quality of maritime cliff and slope;
  - ii Secure sympathetic management of remaining maritime cliff and slope; and
  - iii Provide a minimum 10m buffer on maritime cliff and slope.

### 2.7.5 Fisheries

The harbour at West Bay has 115 drying moorings. There are 15 commercial moorings for either fishing vessels or passenger vessels carrying fewer than 12 people. Commercial tripping boats are mainly used in the summer. The tripping boats offer sightseeing, fishing and diving trips. The commercial fishing fleet is understood to be comprised of mainly under 10m vessels that work within the six or twelve mile limits (i.e. non Vessel Monitoring System (VMS) vessels).

There is likely to be a variety of gears utilised in this area, including trawling, pair trawling, drift/fixed netting, potting, scallop and oyster dredging and hook and line.

**This subject, and recreational angling, will require further consideration as part of any future environmental impact assessment that is likely to be required to implement future beach recharge at West Beach (refer to Section 1.6).**

## 2.7.6 Historic environment

The BMP area is within the Bridport Historic Urban Character Area (see Figure 2-6). There are no Scheduled Monuments or Registered Historic Parks and Gardens within the BMP area. However, there are 30 Grade II listed buildings and structures (see Figure 1-3 above).

The archaeological potential of West Bay is stated in Bridport's Historic Urban Character Area to be high (Dorset County Council, 2011). This is because it lies in an historic area and there is a high potential for buried remains and geo-archaeological deposits in the harbour. However, along the western part of the BMP area at West Cliff, there are no listed buildings and the archaeology potential is reported as low.

There is a wreck located offshore of West Bay, known as the 'The West Bay Wreck', which was designated in 2005. The date, origin and name of the vessel are unknown. However, the presence of a bronze cannon of seventeenth century date suggests that the ship was of some importance.

**Bridport Historic Urban Character Area 26 – West Bay**

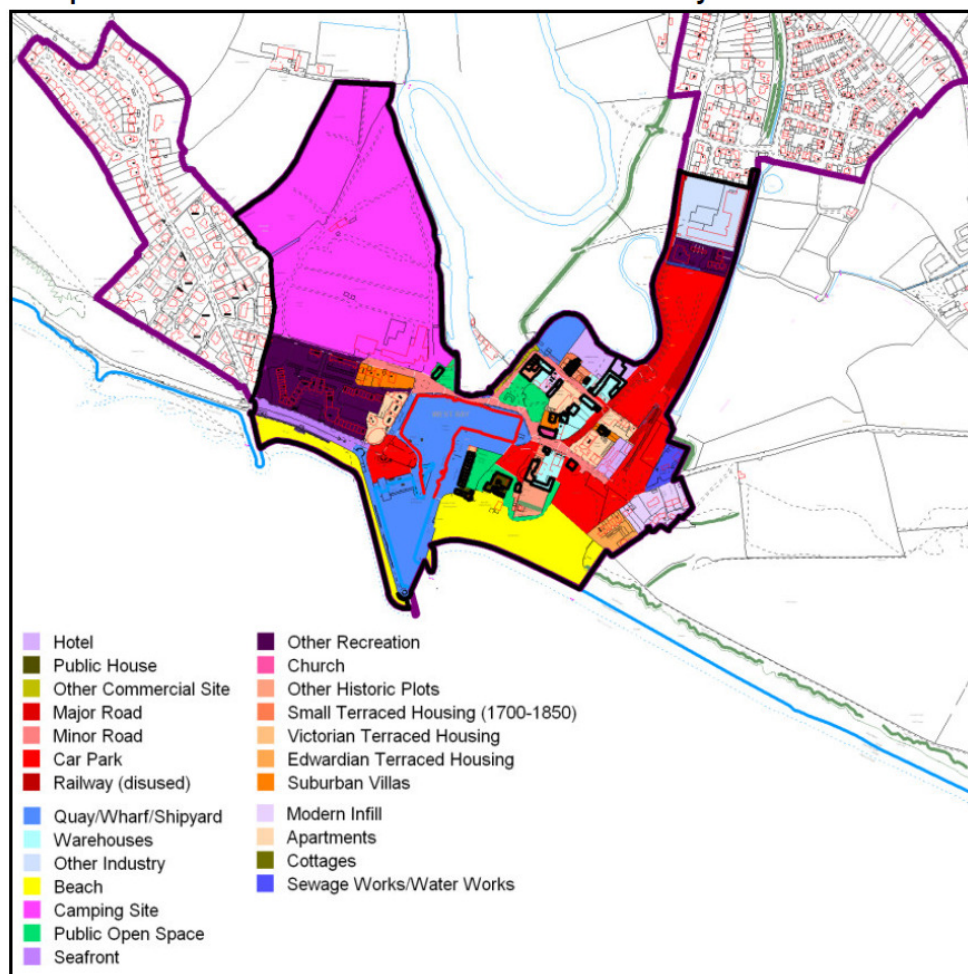


Figure 2-6 Bridport's Historic Urban Character Area- West Bay (Source: Dorset County Council 2011).

## 3 Scheme Design

### 3.1 Scheme description

The current defences along the eastern part of the BMP frontage were constructed in 2005 as part of the West Bay Coastal Defences and Harbour Improvement Scheme. These works included alteration of the harbour piers and re-nourishment of West Beach with imported sediment from a land based source. Rock groynes were also constructed to try and stabilise the beach in front of the seawall.

The defences along the western part of the BMP frontage were constructed over the course of several schemes historically. The current seawall was constructed in 1963 with additional slope stabilisation measures implemented in the cliff behind the seawall as recently as the 1990's.

The following provides a brief description of the current defences along the BMP frontage. Further information is provided in Appendix C.

#### 3.1.1 West Beach

The defence along this section comprises of a reinforced concrete wall, faced with granite, with a wave return wall section on top. Below beach level construction includes a concrete stepped base and steel sheet piled toe. During the site visit undertaken on the 13<sup>th</sup> December 2011 the top of the first concrete step was visible above the beach level (Figure 3-1).



Figure 3-1 Eastern end of seawall

Historical documents indicate that the western end is comprised of the original masonry wall with the wave return structure being added during works to the eastern section in 1963 (Figure 3-2).



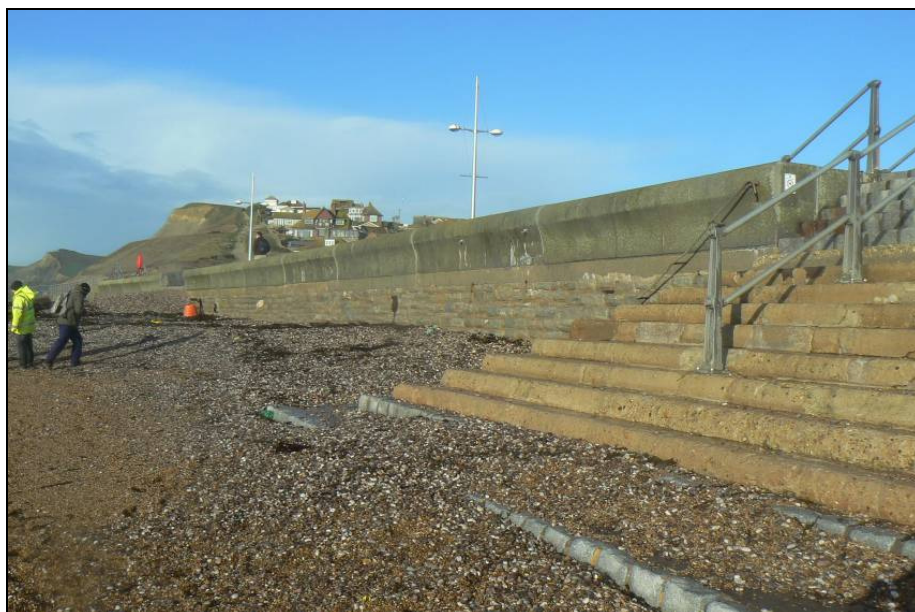


Figure 3-2 Western end of seawall

### 3.1.2 Rock Groyne

The rock groyne was constructed in front of the West Beach seawall during 2005 to try and reduce the on going scour issues and retain recharge beach material placed between the groyne and the harbour arm as part of the 2005 scheme (Figure 3-3).



Figure 3-3 Rock groyne at western end of recharged beach section of BMP frontage.

This rock groyne essentially marks the boundary between the eastern (recharged West Beach) and western (West Cliff) sections of the BMP frontage.

### 3.1.3 West Cliff

The primary defence is comprised of a vertical concrete seawall with a promenade extending back to rear concrete retaining wall (Figure 3-4). The main purpose of the

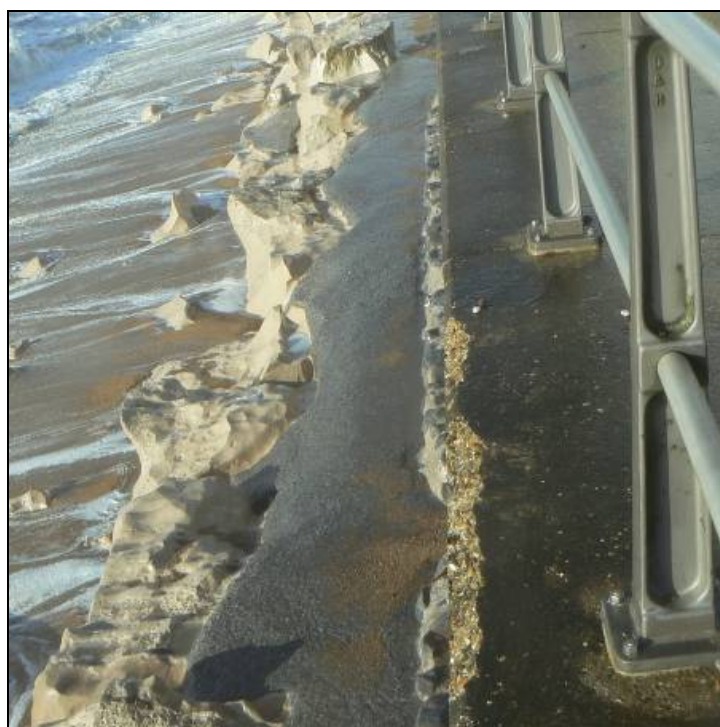
rear retaining wall is to prevent wave overtopping from reaching the face of West Cliff and to also limit cliff debris spilling onto the promenade.

There is very little beach along this section, with only a small amount of beach material located against the rock groyne (refer to Section 3.1.2) that is believed to have been transported through or over the rock groyne from the recharged beach section to the east.



*Figure 3-4 West Cliff seawall*

Toe protection at the base of the wall consists of Portland Stone rock armour that was added to eastern section in about 1963 (Figure 3-5).



*Figure 3-5 Portland stone rock armour and toe protection*



The crest level of the West Cliff defence is approximately one metre lower than along West Beach. The extent of this level difference is shown in Figure 3-6 and the implication was clearly visible during the site visit on 13<sup>th</sup> December 2011 with debris evident across the lower lying promenade due to wave overtopping (Figure 3-7).

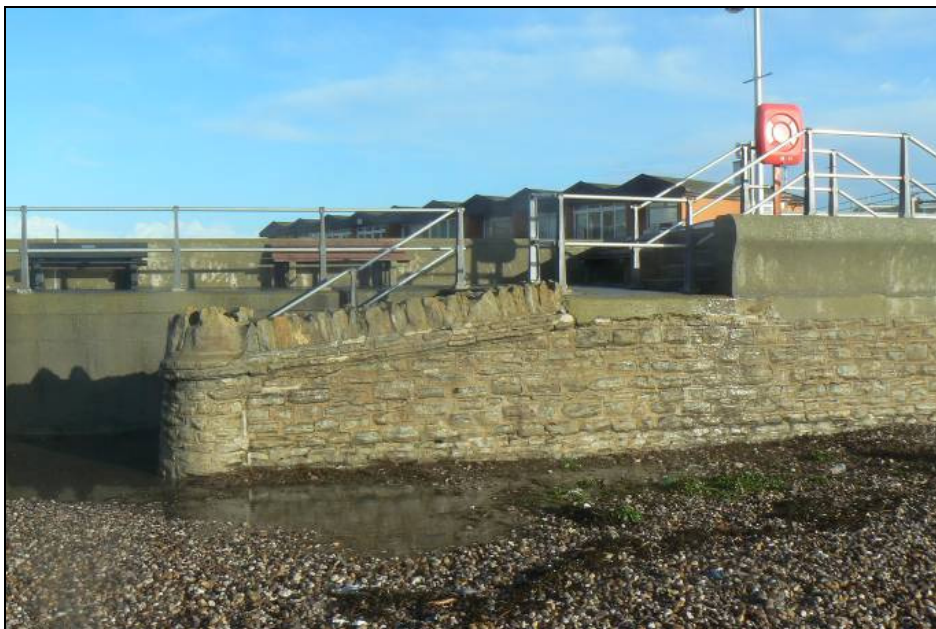


Figure 3-6 Difference in defence level



Figure 3-7 Evidence of overtopping (13<sup>th</sup> December 2011)

## 3.2 Standard of protection

### 3.2.1 Overtopping analysis

An overtopping analysis has been undertaken to investigate the standard of protection provided by the current defences described in Section 3.1.

The results of this analysis indicate that the current defence provides inadequate protection against public safety, with the overtopping criteria being exceeded in less than the 1 in 1 year return period event.

A greater standard of protection is provided by the existing defence against structural safety, with the overtopping threshold not being exceeded until the 1 in 200 year return period event. Even allowing for sea level rise, this SoP is not predicted to reduce by 2050.

Full details of the methodology, input values and results obtained are provided in Appendix C.

### 3.2.2 Undermining risk

Based upon the beach profile analysis presented in Section 2.6, beach levels along the toe of the seawall show a general trend of lowering, particularly along the central and eastern parts of the recharged groyne bay in the eastern part of the BMP area. These levels are low enough at times to expose the top of the steel sheet piles upon which the seawall is constructed.

The change in the beach in response storm events, based upon a limited amount of data (Section 2.6.3) varies depending on the storm conditions. In some cases, storm events result in lowering and narrowing of the beach crest and overall flattening of the profile, whilst under different storm conditions there is raising of beach levels with storm berm creation on the upper beach. Based on this limited analysis, depending on the storm event conditions and the beach level prior to the storm, there is potential for lowering of the beach level in front of the seawall during a storm that could significantly expose the base of the seawall and increase the risk of undermining. The risk of undermining is therefore considered to be moderate at the present time.

## 3.3 Trigger levels

The trigger levels defined previously as part of the 2005 scheme have been re-assessed as part of this BMP review. This re-assessment has determined that there is no evidence to suggest that the current trigger levels for the recharged beach at West Beach should be amended.

As such, the trigger levels to be used for determining when future beach recycling or beach recharge is required are stated below. These trigger levels have been defined as 'alarm' and 'crisis' levels based upon the estimated impact on flood and erosion risk of each level being reached (refer also to Figure 2-4 above):

- If the crest level falls to between +2 and 0mOD (Alarm Level).
- If the crest level falls to below 0mOD (Crisis Level).
- If the crest width is consistently less than 4m (Alarm Level).
- When MLWS level (-1.65mOD) comes consistently within 50 metres of the wall (Crisis Level).

## **4 Monitoring Regime**

The following describes the monitoring regime that is required to inform future management decisions at West Beach, West Bay. This monitoring regime has been developed in line with the preferred management regime defined in the *West Beach, West Bay, Options Report* (Halcrow, 2012).

### **4.1 Monitoring programme**

Table 4-1 provides an outline programme for implementing the monitoring regime, identifying key tasks and estimated timing of each task. This outline programme covers the next 10 years, in line with the review period for this BMP. Reference should be made to the rest of this section for more detail about the nature of the monitoring shown in Table 4-1.



Table 4-1 West Beach, West Bay, outline monitoring programme

TASK	2012			2013				2014				2015				2016				2017				2018				2019				2020				2021			
	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Agree and implement survey of additional profile locations with PCO																																							
Ongoing monitoring by PCO																																							
Pre- harbour dredge and recycling beach profile and bathy survey																																							
Enhanced monitoring of beach profiles and bathymetry post-recycling event																																							
Annual review of survey data to assess beach volumes and effectiveness of recycling operation in respect of beach performance																																							
Ongoing inspection of post-storm events to callout post-storm surveys by WDDC/West Bay Harbour Master																																							

## 4.2 Beach monitoring

### 4.2.1 Beach profile survey

Topographic beach profile surveys are carried out by the PCO every spring and autumn. Profiles are taken at pre defined locations within the management unit (see Figure 4-1). PCO also undertake post-storm surveys that are initiated by West Dorset District Council. To date only three post-storm surveys have been carried out (refer to Section 2.6.3). Data is available through the PCO website ([www.channelcoast.org](http://www.channelcoast.org)).

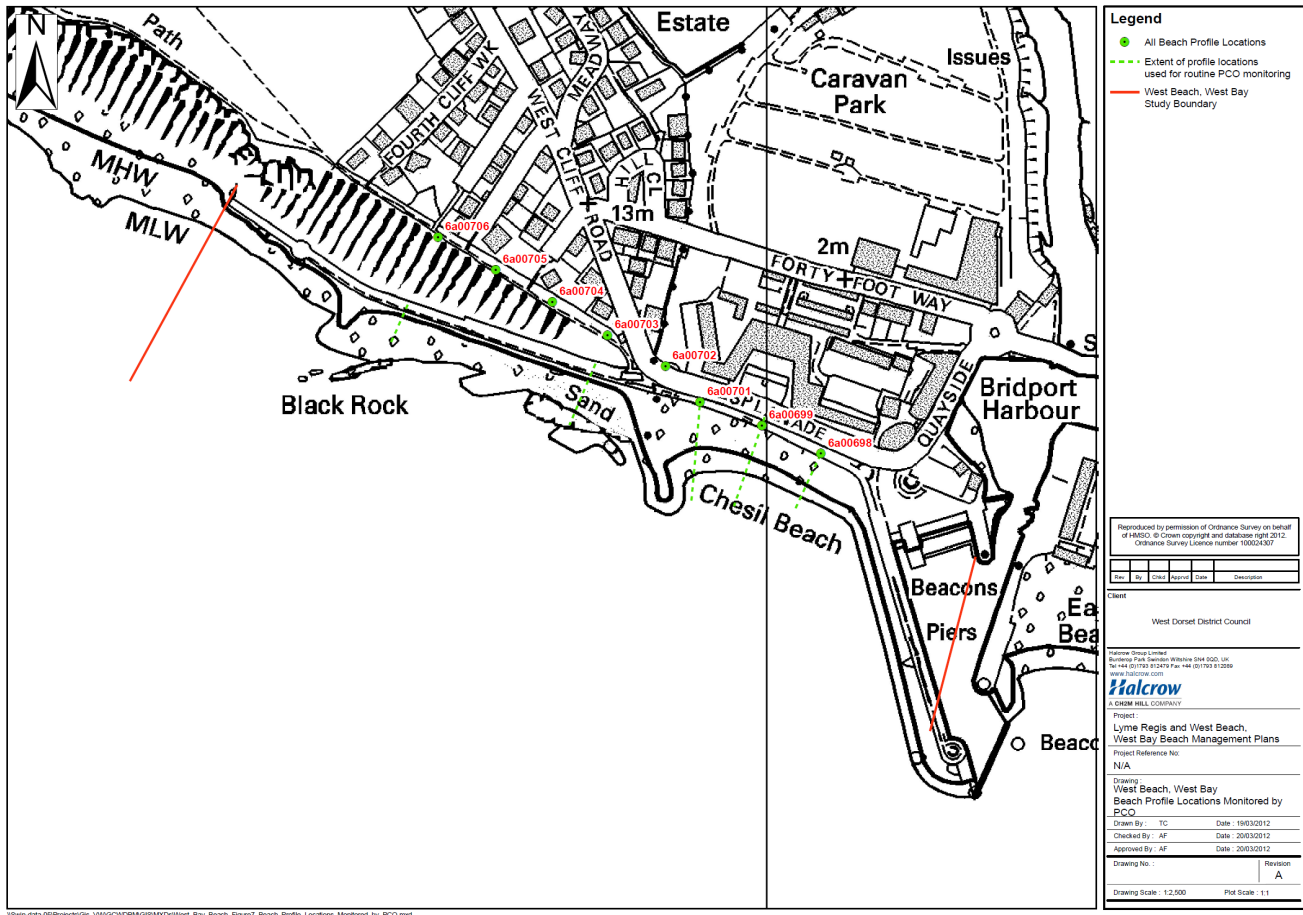


Figure 4-1 PCO beach profile survey locations

Table 4-2 provides a summary of the beach profile location, including origin co-ordinates, and highlights those profiles that are used for post-storm surveys and those profiles that PCO survey but do not report on in their annual monitoring reports. Within Table 4-2, the last 3 digits of the location ID are highlighted in bold. **It is recommended that these 3 digits be marked upon the sea wall at the back of West Beach** to allow ease of identification during walkover inspections and beach recycling events in the future (refer also to Section 4.2.6).

Table 4-2 PCO beach profile survey locations (those used for post-storm surveys are highlighted in yellow; those surveyed by PCO but not routinely reported in the annual monitoring reports are shaded grey)

Profile ID	Origin Easting	Origin Northing	Date of first survey	Date of most recent survey	Used for post-storm survey?
6a00698	346042.01	90416	19/03/2007	25/03/2011	Yes
6a00699	345996.02	90437.99	19/03/2007	25/03/2011	No
6a00700	345966.99	90465.01	19/03/2007	14/08/2010	No
6a00701	345947.99	90456	19/03/2007	25/03/2011	Yes
6a00702	345920.99	90484.01	19/03/2007	14/08/2010	No
6a00703	345876	90508	19/03/2007	25/03/2011	No
6a00704	345833	90534	19/03/2007	16/03/2011	No
6a00705	345789	90559	19/03/2007	16/03/2011	No
6a00706	345744.08	90584.42	19/03/2007	25/03/2011	No

Monitoring of beach profiles every spring and autumn by PCO will continue. As part of this regular surveying, **some additional profile locations should be added to the regular survey schedule to better capture data along the length of the recharged part of West Beach (refer to Figure 4-2). These need to be agreed in discussion with PCO.**

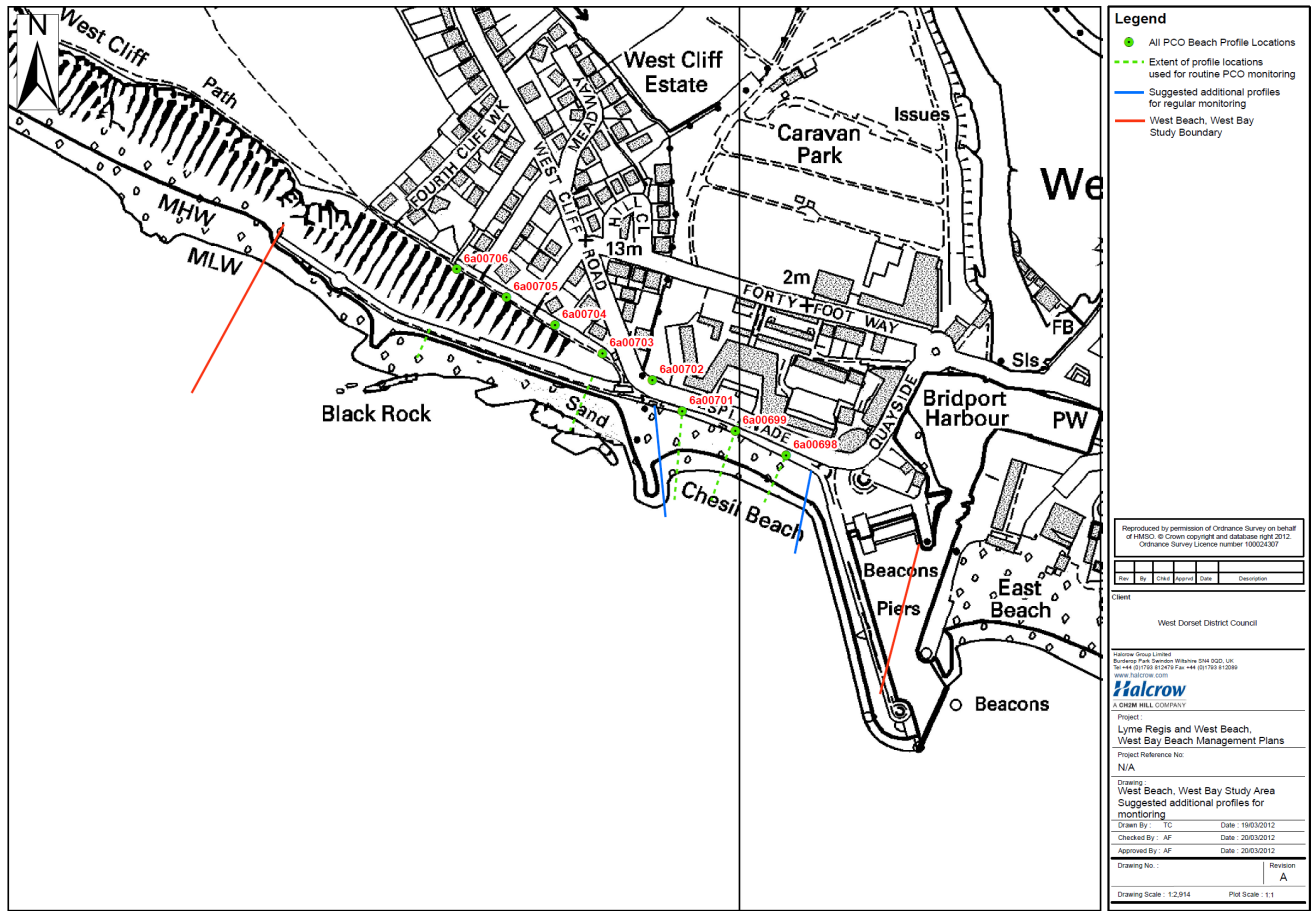


Figure 4-2 Proposed additional beach profile survey locations

In order to determine when there is a need to begin the process of implementing future beach recharge (refer also to Section 5.3), **a regular review of the PCO survey data to monitor beach volume in relation to minimum beach volume requirements is required**. This should build upon the analysis presented in Figure 2-5 above and with reference to the trigger levels stated in Section 3.3.

**In the 2013 and 2014, this review should also assess the effectiveness of the annual recycling of sediment from West Bay Harbour to West Beach** as a result of the enhanced monitoring that is to occur in this period (refer to Section 4.2.3).

In addition to the regular annual beach profile surveys, continued capture of post-storm surveys is to occur. In order to ensure that more post-storm surveys are triggered, the **West Bay Harbour Master is to be given a remit to advise WDDC engineers as to when a storm event has occurred that has caused a noticeable change in the beach**, such that the WDDC engineer can then call-out a post-storm survey via PCO.

Once a greater amount of post-storm survey data is gathered, **pre-storm profiles could occur if (a) sufficient understanding of the conditions of most concern can be developed through continued capture and review of post-storm surveys in the coming years (refer also to Section 4.5.2), and (b) opportunity arises and/or funding is available**. This is not a key requirement of the monitoring regime but would provide useful additional understanding of the beach behaviour in storm events to inform future management decisions.

#### 4.2.2 Master profile survey

There is much uncertainty about the precise volume of shingle on West Beach. This uncertainty is a result of a lack of understanding of where the sub-strata on which West Beach sits, is located beneath the beach.

To address this uncertainty **a survey of underlying bed level could be undertaken if the opportunity arises and/or funding is available**. This could involve undertaking a penetrative survey or Ground Penetrating Radar (if range of depth penetration is viable) to identify the level of the underlying bed layer that, in turn, will provide a definitive 'Master Profile' for use in beach profile analysis and will allow more accurate estimates of beach volumes to be made. Definition of the definitive master profile is not essential at this time for assessing trends in beach volume change as changes are referenced to a defined assumed master profile. Therefore this task could be the subject for more academic research in the coming years but not form a requirement of the monitoring programme in the next 10 years.

#### 4.2.3 Beach recycling logs and survey

During annual recycling works to move sediment from West Bay Harbour to West Beach, (see also Section 5.2) **beach recycling logs are to be maintained** by the West Bay Harbour Master and their operational staff. This information will allow future analysis of beach volume changes to more accurately account for the effects of beach recycling work and will enable the underlying natural beach movements to be identified.

A template of the beach recycling log to be used is provided in Appendix E of this BMP. It is to be completed in a simple manner, by tallying the number of truck loads (of known capacity) transported along the beach during a recycling event.

In order to validate the beach recycling logs, and to provide a greater amount of data to enable assessment of the effectiveness and longevity of the recycled material once placed on West Beach, **it is recommended that two separate beach surveys, 'in' (pre-recycling) and 'out' (post-recycling), are undertaken for the next two beach recycling campaigns (i.e. in 2013 and 2014)**. This will allow a relationship to be established between the information recorded on the beach recycling logs and the changes in beach profile/volume. Such information will improve confidence in the accuracy of future beach recycling logs when no pre-recycling and post-recycling surveys are conducted. West Dorset District Council should liaise with PCO to ensure that these surveys are compliant with the standards used in the South West Strategic Regional Coastal Monitoring Programme.

**For the next recycling event (in 2013), post-recycling surveys should occur weekly for 1 month after recycling, and then monthly for a full year** to allow assessment of the rate of loss of recycled volume once it has been placed. This additional survey and analysis is vital to allowing a more robust assessment of the effectiveness and sustainability of the annual recycling operations, as this will ultimately inform whether it is appropriate to continue the annual recycling from West Bay Harbour to West Beach after the next beach recharge event occurs. Should the evidence from this analysis supports this practice in the longer term, then annual recycling could continue. However, should the evidence not support long term recycling of sediment from the harbour to West Beach, this could have cost implications for the future

maintenance of the harbour in terms of increased costs for transport and disposal of dredge material.

#### 4.2.4 Bathymetric survey

Bathymetric surveys are to continue in line with the schedule determined by PCO. As of April 2012, the next bathymetric survey for Lyme Bay in the area of West Bay is not currently programmed.

In addition to the PCO schedule, **more regular (annual/bi-annual) harbour and nearshore bathymetry surveys are required to allow monitoring of the harbour and nearshore area** to aid understanding of where sediment moves to once it goes below MLWS level (the maximum extent of the beach profile surveys). If annual only, then consideration should be given to tying this requirement in with pre- and post-dredge bathymetry survey of West Bay Harbour and ensure that the data captured aligns with pre- and post-recycling beach profile survey lines.

#### 4.2.5 Sediment sampling

In order to understand the effect of annual recycling of sediment from West Bay harbour to West Beach upon the beach sediment grading, **regular sediment sampling should occur over a period of time (monthly)**. This would likely utilise hand cores and PSD analysis at various locations and depths within the beach.

In support of this, and in order to aid understanding of where both finer recycled material and coarser shingle sediment moves to/from West Beach, **a sediment tracer study could be undertaken if the opportunity arises and/or funding is available**. This study is not essential at this time for informing future management decisions. Therefore this task could be the subject for more academic research in the coming years but does not form a requirement of the monitoring programme in the next 10 years.

#### 4.2.6 Walkover survey

**Visual walkover inspections should be undertaken by the West Bay Harbour Master and/or WDDC engineer to monitor beach crest level against the seawall.**

One walkover survey should be undertaken every month during the winter (October to March) and one survey every two months during the summer (April to September). Throughout the year, additional walkover surveys will need to be carried out prior to and immediately after storm events, as required.

Visual inspection of the beach level against the seawall is required to allow use of the trigger levels identified in Section 3.3. **To aid the visual inspection, markers defining the distance from the wall crest and/or vertical level of the crest against the seawall could be marked on the seawall.**

In addition, **post-storm event visual inspections should be used to record when events have occurred that require the promenade behind the beach to be cleared of shingle/debris**. This information should be collated by the WDDC engineer so that it may be used to develop flood warning procedures in the future.

#### 4.2.7 Aerial photography and LiDAR

Aerial photography and LiDAR surveys are to continue to be flown annually by PCO. This data is available through the PCO website ([www.channelcoast.org](http://www.channelcoast.org)).

Continuation of these aerial photography and LiDAR surveys, combined with regular monitoring of beach profiles (refer to Section 4.2.1), will inform future derivation of long term trends of beach volume and recession rates.

In addition to the aerial LiDAR surveys, **if the opportunity arises and/or funding is available then consideration should be given to undertaking a number of terrestrial LiDAR surveys** at more frequent intervals than the PCO LiDAR schedule in order to support an improved and more accurate understanding of beach volume changes along West Beach.

#### 4.3 Structure monitoring

This BMP does not deal with the structural assets along the BMP frontage, only the interaction between these and the beach.

Full details of the monitoring of structural assets are provided in the WDDC asset management plan for the defences at West Beach and these should be referred to alongside this BMP as appropriate.

Details of all structural assets are also recorded in the Environment Agency's National Flood and Coastal Defence Database (NFCDD). Each asset is defined with its own unique asset number, as shown in Figure 4-3.



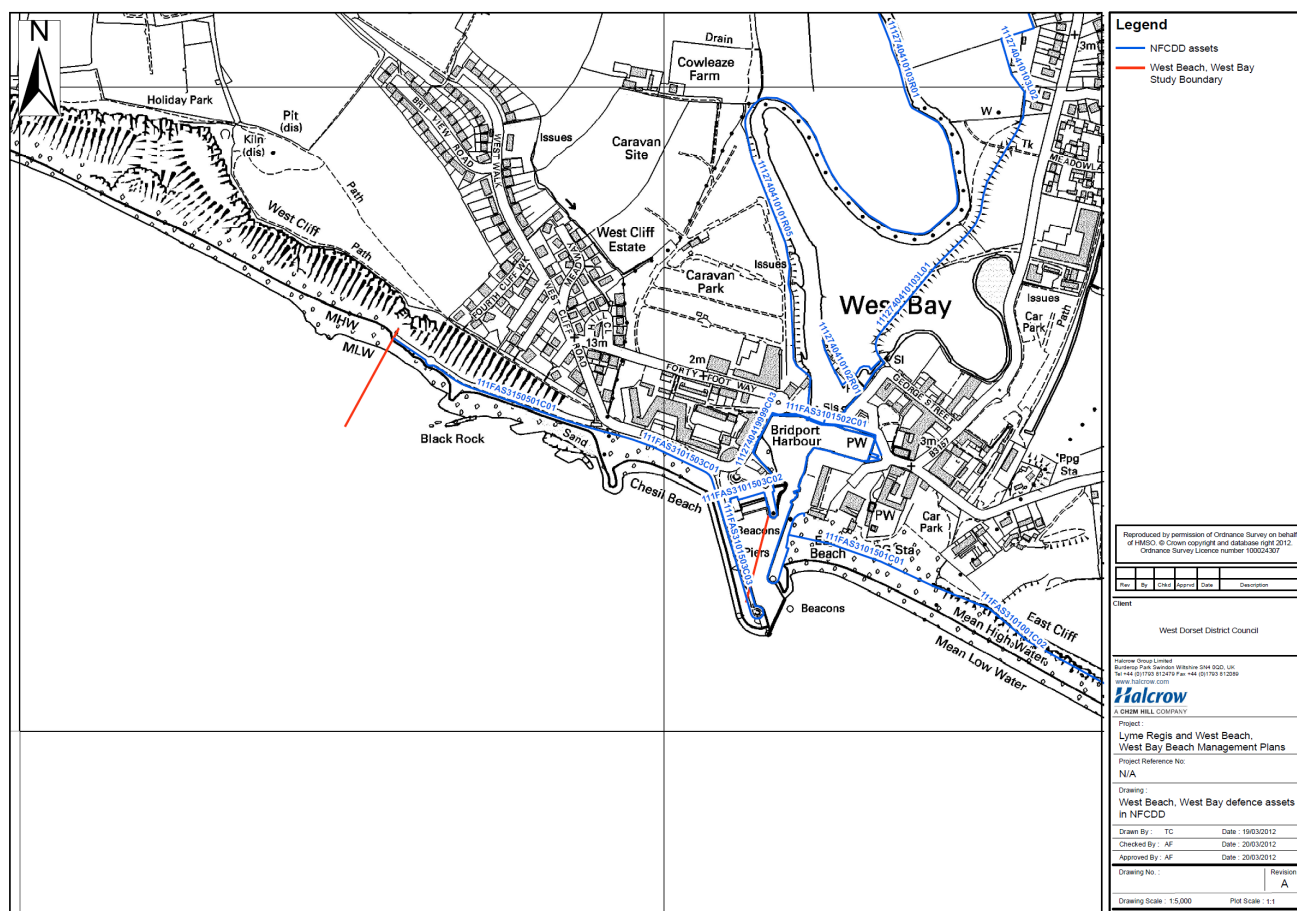


Figure 4-3 Defence assets along the West Beach BMP area, as defined in the Environment Agency's NFCCD

#### 4.4 Environmental monitoring

The area covered by this BMP is within the vicinity of a number of environmental designations. However, there are few designated features in the immediate area where beach recycling and future beach recharge is to occur along the eastern part of West Beach. As such, no specific monitoring of designated features is recommended.

However, there are many historic environment features in the area around West Beach (see Figure 1-3) and **visual inspections should seek to identify any impacts on these features as a result of beach works (or indeed if 'new' features are uncovered by storm events)**. In the event of impacts or new features being identified, then the Dorset Historic Environment Officer should be contacted (refer to Appendix D for contact details).

In addition, although water quality monitoring is undertaken at East Beach to the east of West Bay Harbour, consideration should be given to undertaking similar water quality sampling and monitoring at West Beach if data at East Beach is considered insufficient to provide a robust baseline for future Water Framework Directive (WFD) assessment that would be needed as part of future beach recharge. **Advice should be sought on this from the Environment Agency and sampling implemented as appropriate based on that advice.**



## 4.5 Physical conditions

### 4.5.1 Sea conditions

Wave climate is monitored by a wave buoy located approximately at the -10mCD contour offshore of West Bay (Figure 4-3). This wave buoy was installed and is maintained by PCO and recorded data is available through the PCO website ([www.channelcoast.org](http://www.channelcoast.org); refer also to Section 2.1). There is currently only a short-period of data available (data has only been recorded since November 2006) and few (if any) significant events have been recorded to make use of in future management decisions. In addition, tide levels are recorded by a tide gauge at West Bay Harbour (Figure 4-3).

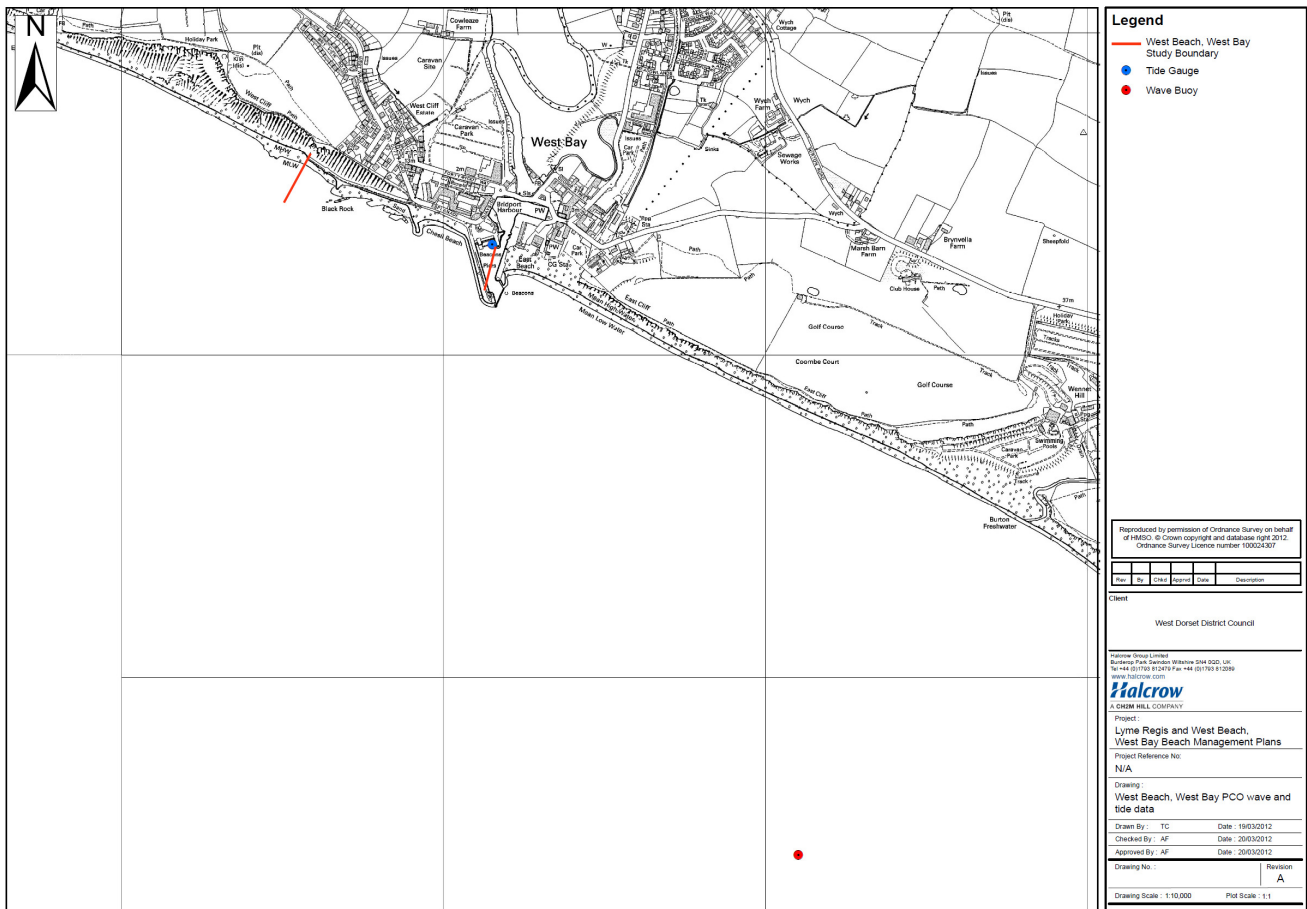


Figure 4-3 PCO wave buoy and tide gauge locations at West Bay

The ongoing recording of this site specific wave and water level data, in combination with additional monitoring of other parameters as discussed in the other parts of this section of the BMP, will aid improvements in the understanding of the relationship between these forcing parameters and the beach response. This will help to both improve understanding of the processes in this area as well as provide information that can provide a basis for developing improved flood warnings in the future.

### 4.5.2 Storm events

The movement of material along West Beach is significantly increased during storms as a result of increased wave action. In order to understand the effect of storm events

upon the beach response, **details of the storm conditions (waves, winds and water levels) will need to be recorded** in support of the post-storm profile surveys (refer to Section 4.2.1).

Data from the PCO wave buoy and tide gauge at West Bay (refer to Section 4.5.1) should be used for obtaining details of the wave and water levels conditions at the time of the storm event. Additional information on the offshore wave climate should also be recorded from other data sources such as near real time data from the National Data Buoy Centre (<http://www.ndbc.noaa.gov/>) and the CEFAS Wavenet (<http://www.cefasc.co.uk/data/wavenet.aspx>) websites. These websites provide data for a number of locations between the Atlantic and the English Channel that are relevant to West Beach, and recording of this information will allow assessment of any linkages between offshore and nearshore wave climate to be made once a sufficient data set is collected.

**A local wind gauge should also be installed at West Beach to record wind speed and direction as both can have a significant impact on flood risk. This should be done in conjunction with the Environment Agency who is responsible for managing flood risk around the wider West Bay area.**

This wind, wave and tide data should be recorded as part of the storm event record.

This storm record should contain details of all storm events including the prevailing conditions (as discussed in this section), pre/post-storm surveys, and effects/impacts of the event.

## **4.6 Warning and emergency procedures**

### **4.6.1 Flood warning and response procedures**

Flood warnings and responses are co-ordinated by West Dorset District Council with partner organisations (including the Environment Agency and Dorset County Council) in accordance with the *WDDC Emergency Planning Unit Operational Response Plan for Flooding, West Bay*.

The greater level of monitoring set out in Sections 4.1 to 4.5 of this BMP aims to provide improved information for understanding the whole beach system. In doing so, it is anticipated that this will also allow the relationship between certain wave and water levels being reached and the associated consequences to be better defined to improve flood warning procedures.

### **4.6.2 Landslide and cliff fall response procedures**

Occasional cliff falls occur along the West Cliff part of the BMP frontage, depositing debris along the promenade. When such events occur, the West Bay Harbour Master is to continue the current practice of moving this debris from the promenade to the adjacent beach area, where it would naturally reach if the seawall was not present in this area.

Should a large landslide event occur at West Cliff, then the *WDDC Emergency Planning Unit Operational Response Plan for Landslides/Cliff Falls, West Bay*, is to be followed.

### **4.6.3 Pollution incidents**

Pollution incidents can occur at varying scales. Minor pollution such as litter and small debris are typically dealt with by the West Bay Harbour Master.

Larger pollution incidents are dealt with by Dorset County Council, guided by Section 4 of the *Dorset Coastal Pollution Clearance Plan* (Dorset County Council Emergency Planning Service, 2010).

## **4.7 Data**

Having collected the beach monitoring data, it is important that all of the information is stored and analysed to allow decisions to be made with respect to ongoing maintenance and future management of West Beach.

Following each scheduled twice-yearly beach profile survey, the information collected is uploaded for storage and analysis to a database system that operated by the South West Strategic Regional Coastal Monitoring Programme at PCO. Additional survey data that is to be collected as per the requirements set out in this BMP, should be collected, stored and analysed in accordance with PCO quality standards and be compatible with PCO's database system (if PCO are not used to undertake the additional survey work).

Additional beach monitoring data, obtained from sources such as the post-storm visual walkover inspections (with associated storm event data – see Section 4.5.2) or beach recycling logs (see Section 4.2.3), should also be stored in the same database. The database should include any photographs taken during each survey.

This information should be used in compiling future annual beach monitoring reports produced by PCO.

In addition, each year a review of all survey data should be carried out with particular focus on beach volume changes and how they relate to the minimum beach volumes defined by the trigger levels in Section 3.3 (i.e. build on the analysis presented in Figure 2-5). These reviews could form part of the PCO annual report, or they could be completed separate to the PCO reporting. Either way, each review should be recorded in a standard format to enable later audit of decisions made in relation to future beach management, and in particular to justify assessments as to when future beach recharge is required.

## 5 Maintenance Regime

The following describes the maintenance regime that is necessary to ensure that the beach at West Beach, West Bay, continues to provide the required beach levels in support of the wider flood and coastal erosion risk management of the area. This maintenance regime has been developed in line with the preferred management regime defined in the *West Beach, West Bay, Options Report* (Halcrow, 2012).

### 5.1 Maintenance programme

Table 5-1 provides an outline programme of beach maintenance works that shows the key activities to be carried out over the next 10 years until the next BMP review. Reference should be made to the rest of this section for more detail about the nature of the works shown in Table 5.1.

Due to uncertainty as to when future beach recharge will be required, this programme does not include timing of tasks for implementing future beach recharge. This is discussed further in Section 5.3.

Table 5-1 Outline programme for implementing beach management works over the next 10 years

	2012			2013				2014				2015				2016				2017				2018				2019				2020				2021			
TASK	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
<b>BEACH RECYCLING</b>																																							
Annual West Bay Harbour dredge and recycling to West Beach under existing Marine Licence.																																							
Renewal of Marine Licence for harbour dredging																																							
Continued harbour dredging and recycling operations subject to renewed application(s) and findings of enhanced monitoring in 2013																																							
<b>MANAGEMENT</b>																																							
Undertake a review and update of the beach management plan																																							

## 5.2 Ongoing works

### 5.2.1 Beach

The options appraisal completed alongside the development of this BMP (Halcrow, 2012) has shown that the most appropriate option for the sustainable management of West Beach for flood and coastal erosion risk management purposes is for periodic recharge using a land based source similar to that used as part of the 2005 scheme when the beach was first created. However, there remains some uncertainty about the timing of when any such works may be required due to a limited amount of post 2005 recharge survey data being available.

The limited analysis undertaken for this study suggests that the annual recycling of sediment from West Bay Harbour to West Beach does have the effect of raising the beach volume above the minimum volume required. This is beneficial for reducing the risk of defence failure from a flood risk management perspective. This operation should therefore continue for the immediate future whilst more survey data is captured and a better understanding of the effect and longevity on the beach of the dredge material is developed. This should occur alongside regular review of beach volumes to better determine timing of future recharge.

No other regular works would occur. Any other works would be triggered if the trigger levels stated in Section 3.3 are compromised, and these are discussed in Sections 5.3 and 5.4.

### 5.2.2 Structures

This BMP only deals with the requirements to manage the beach as part of the overall defence system. Maintenance of the various structures along the BMP area is guided by other relevant WDDC asset management plans, and reference should be made to those as appropriate.

### 5.2.3 Public access, amenity and safety

Beach management activities should avoid the peak holiday season, weekends and public holidays where possible. This will minimise the impact of works on beach users and will reduce the minor risk to public safety that such work would pose. In order to ensure the safety of the public whilst works are being carried out, restrictions on public access to the areas of the beach being worked on should be implemented, with alternative routes provided if possible.

Experience elsewhere in the area has shown that closing the beach entirely is likely to be impractical, and **it is suggested that a banks-man is present with each machine, and that spare personnel along with signage are employed to direct public access to safe sections of the promenade and beach during works.**

**Information boards should be displayed whilst the works are being carried out to explain what is being done and why.** This will also serve to improve public education. Appendix F contains a best practice guide on how to communicate with the public and local businesses when undertaking beach maintenance works.

### 5.3 Alarm trigger level works

The actions listed below should be enacted if the **Alarm Level** is reached along the eastern, recharged beach section of West Beach (refer to Section 3.3).

If the crest level falls to between +2 and 0mOD (even with annual recycling of sediment from West Bay Harbour to West Beach), and the crest width is consistently less than 4m from the seawall, then this is a strong indication that the effect of annual recycling is no longer increasing beach volume sufficiently. As such, when this situation is reached measures should be taken to begin the planning and implementation of a beach recharge campaign.

Table 5-2 presents an indicative programme covering the key tasks that will need to be undertaken in order to implement a future beach recharge campaign.

Table 5-2 Outline programme for implementing a future beach recharge campaign at West Beach

	Year 1				Year 2			
Task	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Monitoring indicates beach volumes consistently below alert volume.								
Instigate Project Appraisal for beach recharge campaign								
Procure consultant to undertake required studies								
Prepare Project Appraisal Report								
Prepare Environmental Impact Assessment								
Prepare Habitat Regulation Assessment								
Prepare Water Framework Directive Assessment								
Get PAR and Supporting Assessments approved								
Undertake Detailed Design								
Appoint Contractor								
Planning/Consent Applications (refer to Section 1.6)								
Construction Period								

#### 5.4 Crisis trigger level works

If a **Crisis Level** (refer to Section 3.3) is identified as being reached on a profile, the immediate task would be to carry out a visual inspection of the profile concerned to validate the survey data and that it is representative of the general beach area (i.e. not a localised 'low' point). If the Crisis Level is shown to be a general problem to be addressed, then timely action will be required to safeguard the integrity of the sea wall.

Ultimately the response to the Crisis Level being reached will be for beach recharge to be carried out. If not already in process (due to Alarm Levels having been reached), then planning and implementation of a beach recharge campaign should begin as per the process defined in Section 5.3.



However, it is likely that the occurrence of a Crisis Level will be as a result of a storm event that erodes a large amount of beach material over short period of time. Therefore whilst the ultimate response of beach recharge is being planned and implemented, a short term measure will be to place rock armour along the toe of the seawall to reduce the risk of it being undermined.

In order to be in a position to implement rock armour in a rapid time-frame should the situation ever arise, **it is recommended that analysis should be undertaken to determine (a) the appropriate size of rock to place in a crisis situation, such that it is large enough to withstand the forces it will experience (e.g. it is likely to require a similar size to the rock armour used along the toe of the seawall along West Cliff in the western part of the BMP area), and (b) the source of rock that will be used, noting that any possible source must be near to the site and readily available whenever it may be required; this should also consider the viability of creating a local stockpile near to the site as a way of ensuring this ready availability.**

## **5.5 Implementation**

### **5.5.1 Beach recycling and re-profiling**

The recycling and re-profiling will aim to retain the beach crest and width, and overall beach volume, adjacent to the seawalls above the Alarm Level (refer to Section 3.3). This will occur annually in line with the permission granted to West Bay Harbour in its current marine licence for undertaking annual dredging of the harbour (see Appendix G).

#### **5.5.1.1 Plant requirements**

The recycling of sediment from West Bay Harbour to West Beach, and the subsequent re-profiling of sediment along West Beach, will be carried out using a tracked bulldozer, a hydraulic excavator and a dump truck.

#### **5.5.1.2 Access**

Plant access to the beach will continue to be via the access point located to the western side of the recharged beach section, utilising an access ramp made up from the local beach material (refer to Figure 5-1).



Figure 5-1 The access point to West Beach from the Esplanade.

As part of this access route, it will also continue to be necessary to close off the Esplanade road between the harbour and the beach access point to ensure the safety of both the operatives and members of the public (refer to Figure 5-2). The road will then be cleaned at the end of the recycling works.



Figure 5-2 The access route along the Esplanade from the harbour to West Beach.

#### 5.5.1.3 Notifying and engaging with others

In addition to communicating effectively with the public (refer to Section 5.2.3) line it is recommended that explicit notification of beach works and contact details should there be any queries be provided to the following organisations/groups:

- The local Town Council.
- Local fishermen and those people who have a day to day interest in what is happening at the harbour, i.e. any businesses that may be affected.
- Local residents directly affected by road closure along the West Beach frontage when works occur.
- Natural England (in relation to nature conservation and coastal access interests).
- World Heritage Site (in relation to nature conservation interests).
- Dorset Historic Environment Officer (in relation to historic environment interests).

#### 5.5.2 Beach recharge

The precise method for implementing beach recharge will be determined by the contractor and designer in discussion with West Dorset District Council at the time such works are to be carried out. However, when beach recharge is required, the preferred sediment source will be from a land based quarry in the UK similar to that used for the 2005 beach recharge (Halcrow, 2012).

In addition, when beach recharge does occur, the requirements set out for implementation of beach recycling and re-profiling works in Section 5.5.1 should also be applied to the beach recharge case.

## 6 Action Plan

This section provides a summary of the recommendations made throughout the rest of this BMP in the form of an Action Plan. The Action Plan is presented below and identifies actions grouped by type as being either for 'Monitoring', 'Maintenance', 'For Future Studies'.

It is intended that this Action Plan be used to guide future management of this area.

Action No.	Action Description	Who by?	When by?	Related BMP Section(s)
<b>MONITORING ACTIONS</b>				
<b>WB_BMP_01</b>	Continue current beach monitoring to provide longer-term data to allow more accurate assessment of beach change patterns. As part of this regular surveying, some additional profile locations should be added to the regular survey schedule to better capture data along the length of the recharged part of West. These need to be agreed in discussion with PCO.	PCO  WDDC and PCO	Ongoing  August 2012	1.4.4  4.2.1
<b>WB_BMP_02</b>	If the opportunity arises and/or funding is available then consideration should be given to undertaking a number of terrestrial LiDAR surveys at more frequent intervals than the PCO aerial LiDAR schedule in order to support an improved and more accurate understanding of beach volume changes along West Beach.	WDDC	Subject to availability of funding	1.4.4 and 4.2.7
<b>WB_BMP_03</b>	Undertake a survey to determine accurately the underlying bed levels of the hard geology on which the beach sits to further aid calculation of accurate beach volumes if the opportunity arises and/or funding is available.	WDDC	Subject to availability of funding	1.4.4 and 4.2.2
<b>WB_BMP_04</b>	Continue to collect post-storm survey data. In support of this, the West Bay Harbour Master is to be given a remit to advise WDDC engineers as to when a storm event has occurred that has caused a noticeable change in the beach, such that more post-storm surveys can be called out via PCO.	PCO WDDC	Ongoing From April 2012	2.6.3 4.2.1
<b>WB_BMP_05</b>	In order to understand the effect of storm events upon the beach response, details of the storm conditions (waves, winds and water levels) will need to be recorded in support of the post-storm profile surveys (refer also to Action No. WB_BMP_04).	WDDC and PCO	Ongoing	4.5.2
<b>WB_BMP_06</b>	Once a greater amount of post-storm survey data is gathered (refer to Action No. WB_BMP_04 and WB_BMP_05), pre-storm profiles could occur if (a) sufficient understanding of the conditions of most concern can be developed through continued capture and review of post-storm surveys in the coming years, and (b) opportunity arises and/or funding is available.	WDDC	Subject to availability of funding	4.2.1
<b>WB_BMP_07</b>	In order to determine when there is a need to begin the process of implementing future beach recharge, a regular review of the PCO survey data to monitor beach volume in relation to minimum beach volume requirements is required.	WDDC	Annually	4.2.1

Action No.	Action Description	Who by?	When by?	Related BMP Section(s)
WB_BMP_08	The last 3 digits of the beach profile location IDs should be marked upon the sea wall at the back of West Beach to allow ease of identification during walkover inspections and beach re-cycling events in the future (Do in combination with Action No. WB_BMP_15).	WDDC	August 2012	4.2.1
WB_BMP_09	During annual recycling works to move sediment from West Bay Harbour to West Beach, beach recycling logs are to be maintained by the West Bay Harbour Master	WDDC	Annually	4.2.3
WB_BMP_10	In order to validate the beach recycling logs, and to provide a greater amount of data to enable assessment of the effectiveness and longevity of the recycled material once placed on West Beach, two separate beach surveys, 'in' (pre-recycling) and 'out' (post-recycling), are to be undertaken for the next two recycling campaigns (i.e. in 2013 and 2014).	WDDC	2013 and 2014	4.2.1 and 4.2.3
WB_BMP_11	For the next recycling event (in 2013), post-recycling surveys should occur weekly for 1 month after recycling, and then monthly for a full year to allow assessment of the rate of loss of recycled volume once it has been placed.	WDDC	2013	4.2.3
WB_BMP_12	In addition to the PCO schedule for bathymetric surveys, more regular (annual/bi-annual) nearshore bathymetry surveys are required to allow monitoring of the nearshore area to aid understanding of where sediment moves to once it goes below MLWS level	WDDC	2013 to 2014	4.2.4
WB_BMP_13	In order to understand the effect of annual recycling of sediment from West Bay harbour to West Beach upon the beach sediment grading, regular sediment sampling should occur over a period of time (monthly).	WDDC	2013 to 2014	4.2.5
WB_BMP_14	Visual walkover inspections should be undertaken by the West Bay Harbour Master and/or WDDC engineer to monitor beach crest level against the seawall. One walkover survey should be undertaken every month during the winter (October to March) and one survey every two months during the summer (April to September). Throughout the year, additional walkover surveys will need to be carried out prior to and immediately after storm events, as required.	WDDC	Ongoing	4.2.6



Action No.	Action Description	Who by?	When by?	Related BMP Section(s)
WB_BMP_15	Visual inspection of the beach level against the seawall is required to allow use of the trigger levels. To aid the visual inspection, markers defining the distance from the wall crest and/or height of beach crest against the seawall could be marked on the seawall (Do in combination with Action No. WB_BMP_08).	WDDC	August 2012	4.2.6
WB_BMP_16	Post-storm event visual inspections should be used to record when events have occurred that require the promenade behind the beach to be cleared of shingle/debris.	WDDC	Ongoing	4.2.6
WB_BMP_17	Visual inspections should seek to identify any impacts on the historic environment features as a result of beach works or if 'new' features are uncovered by storm events.	WDDC	Ongoing	4.4
WB_BMP_18	In addition, although water quality monitoring is undertaken at East Beach to the east of West Bay Harbour, consideration should be given to undertaking similar water quality sampling and monitoring at West Beach if data at East Beach is considered insufficient to provide a robust baseline for future Water Framework Directive (WFD) assessment that would be needed as part of future beach recharge. Advice should be sought on this from the Environment Agency and sampling implemented as appropriate based on that advice.	WDDC and Environment Agency	December 2012	4.4
WB_BMP_19	A local wind gauge should also be installed at West Beach to record wind speed and direction as both can have a significant impact on flood risk. This should be done in conjunction with the Environment Agency who is responsible for managing flood risk around the wider West Bay area.	WDDC and Environment Agency	2013	4.5.2
<b>MAINTENANCE ACTIONS</b>				
WB_BMP_20	When works are occurring on the beach, it is suggested that a banks-man is present with each machine, and that spare personnel along with signage are employed to direct public access to safe sections of the promenade and beach during works.	WDDC	Whenever works are occurring on the beach	5.2.3
WB_BMP_21	When works are occurring on the beach, information boards should be displayed to explain what is being done and why. This will also serve to improve public education.	WDDC	Whenever works are occurring on the beach	5.2.3

Action No.	Action Description	Who by?	When by?	Related BMP Section(s)
WB_BMP_22	In order to be in a position to implement rock armour in a rapid time-frame should the Crisis Level occur, analysis should be undertaken to determine (a) the appropriate size of rock to place in a crisis situation, such that it is large enough to withstand the forces it will experience (e.g. it is likely to require a similar size to the rock armour used along the toe of the seawall along West Cliff in the western part of the BMP area), and (b) the source of rock that will be used, noting that any possible source must be near to the site and readily available whenever it may be required; this should also consider the viability of creating a local stockpile near to the site as a way of ensuring this ready availability..	WDDC	October 2012	5.4
WB_BMP_23	When beach works are to occur, it is recommended that explicit notification of beach works and contact details should there be any queries be provided to the following organisations/groups: <ul style="list-style-type: none"> <li>• the local Town Council</li> <li>• local fishermen and those people who have a day to day interest in what is happening at the harbour, i.e. any businesses that made be affected</li> <li>• local residents directly affected by road closure along the West Beach frontage when works</li> <li>• Natural England (in relation to nature conservation and coastal access interests)</li> <li>• World Heritage Site (in relation to nature conservation interests)</li> <li>• Dorset Historic Environment Officer (in relation to historic environment interests).</li> </ul>	WDDC	Whenever works are occurring on the beach	5.5.1.3
<b>FOR FUTURE STUDIES</b>				
WB_BMP_24	Early consultation with Natural England required in order to confirm the requirements (if any) for a Habitat Regulation Assessment when beach recharge occurs.	WDDC	At time of scheme design for next recharge event	1.4.2
WB_BMP_25	Beach works should be programmed to avoid peak tourism periods in the Summer months whenever possible.	WDDC	At time of scheme design for next recharge event	1.4.3



Action No.	Action Description	Who by?	When by?	Related BMP Section(s)
WB_BMP_26	Any future studies of the BMP area would need to transform the extreme swell waves contained in the Environment Agency Coastal Boundaries swell wave dataset to the study site in order to provide local values.	WDDC	At time of scheme design for next recharge event	2.1.2
WB_BMP_27	There is likely to be a variety of gears utilised in this area, including trawling, pair trawling, drift/fixed netting, potting, scallop and oyster dredging and hook and line. This subject, and recreational angling, will require further consideration as part of any future environmental impact assessment that is likely to be required to implement future beach recharge at West Beach.	WDDC	At time of scheme design for next recharge event	2.7.5
WB_BMP_28	In order to aid understanding of where both finer recycled material and coarser shingle sediment moves to from West Beach, a sediment tracer study could be undertaken if the opportunity arises and/or funding is available.	WDDC	Subject to availability of funding and/or opportunity to work with other organisations (e.g. Universities)	4.2.5

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# Appendix A

## Environmental Designation Information

## Appendix A Environmental Designation Information

This appendix provides a summary list of natural environment and heritage features that are both within and adjacent to the West Beach, West Bay, Beach Management Plan area.

### 1. Lyme Bay and Torbay cSAC

Refer to SAC Selection Summary report by Natural England (copy provided on the accompanying CD; also available on Natural England website).

### 2. Sidmouth to West Bay SAC

Refer to designation summary sheet from Joint Nature Conservation Committee website (copy provided on the accompanying CD).

### 3. West Dorset SSSI

Refer to designation summary sheet from Natural England website (copy provided on the accompanying CD).

### 4. Dorset and East Devon UNESCO World Heritage Site (the 'Jurassic coast')

The Dorset and East Devon Coast World Heritage Site is England's first natural World Heritage Site - it is known as The Jurassic Coast. It covers 95 miles of truly stunning coastline from East Devon to Dorset, with rocks recording 185 million years of the Earth's history. World Heritage status was achieved because of the site's unique insight into the Earth Sciences as it clearly depicts a geological 'walk through time' spanning the Triassic, Jurassic and Cretaceous periods.

Further information about the World Heritage site is to be found at <http://www.jurassiccoast.com/>. Of particular relevance is the WHS management plan that is to be found on these pages.

### 5. Dorset Area of Outstanding Natural Beauty (AONB)

Details about the Dorset AONB can be found at <http://www.dorsetaonb.org.uk/default.asp?PageId=206>.

### 6. West Dorset Heritage Coast

Some information about the West Dorset Heritage Coast can be found online at <http://www.britainexpress.com/countryside/coast/west-dorset.htm>.

### 7. Listed Buildings

Information on Listed Buildings is available as GIS layers provided by West Dorset District Council, as shown plotted in Figure 1-3 within the BMP.

### 8. Dorset Biodiversity Strategy

Information on the Dorset Biodiversity Strategy, which includes details on coastal vegetated shingle can be found online at [http://www.dorsetwildlifetrust.org.uk/the\\_dorset\\_biodiversity\\_strategy.html](http://www.dorsetwildlifetrust.org.uk/the_dorset_biodiversity_strategy.html)



# Appendix B

## Coastal Processes Baseline

## **Appendix B Coastal Processes Baseline**

This appendix is provided on the accompanying CD.





# Appendix C

Defence Assessment

## **Appendix C      Defence Assessment**

This appendix is provided on the accompanying CD.



# Appendix D

Contact Details

## Appendix D Contact Details

Responsibility for the management and operation of activities along the BMP frontage varies depending upon the activity. Table D-1 summarise the roles, responsibilities and contact details.

*Table D-1 Contact details for assigned responsibilities for West Beach, West Bay, beach management operations.*

Management operation	Organisation with assigned responsibility	Contact within organisation
Monitoring of beach and other coastal processes	Plymouth Coastal Observatory	Plymouth Coastal Observatory, University of Plymouth, Reynolds Building, Drake Circus, Plymouth PL4 8AA. Tel. 01752 586155
Initiation of post-storm surveys	West Dorset District Council and West Bay Harbour Master	Technical Services, West Dorset District Council, Stratton House, 58-60 High West Street, Dorchester, Dorset, DT1 1UZ. Tel. (Switchboard) 01305 251010
Operations to maintain beach profile, including recycling and recharge.	West Dorset District Council	Technical Services, West Dorset District Council, Stratton House, 58-60 High West Street, Dorchester, Dorset, DT1 1UZ. Tel. (Switchboard) 01305 251010
Cleaning/clearance of promenade of shingle/landslide debris for amenity.	West Dorset District Council	Leisure and Tourism, West Dorset District Council, Stratton House, 58-60 High West Street, Dorchester, Dorset, DT1 1UZ. Tel. (Switchboard) 01305 251010
Cleaning/clearance of beach in response to pollution incidents.	West Dorset District Council or Dorset County Council ( <i>depending on nature of hazard</i> )	Technical Services, West Dorset District Council, Stratton House, 58-60 High West Street, Dorchester, Dorset, DT1 1UZ. Tel. (Switchboard) 01305 251010
All structural maintenance of promenade, seawall, groynes etc.	West Dorset District Council	Technical Services, West Dorset District Council, Stratton House, 58-60 High West Street, Dorchester, Dorset, DT1 1UZ. Tel. (Switchboard) 01305 251010
All maintenance of access steps and ramps to beach from seawalls/promenades	West Dorset District Council	Technical Services, West Dorset District Council, Stratton House, 58-60 High West Street, Dorchester, Dorset, DT1 1UZ. Tel. (Switchboard) 01305 251010

Management operation	Organisation with assigned responsibility	Contact within organisation
All maintenance of footpath and cycleways including signs for designated public footpaths and rights of way.	West Dorset District Council and Dorset County Council	Leisure and Tourism, West Dorset District Council, Stratton House, 58-60 High West Street, Dorchester, Dorset, DT1 1UZ. Tel. (Switchboard) 01305 251010  Rights of Way Team, Dorset County Council, County Hall, Dorchester, Dorset, DT1 1XJ. Tel.(Switchboard) 01305 221000
Litter clearance	West Dorset District Council	Leisure and Tourism, West Dorset District Council, Stratton House, 58-60 High West Street, Dorchester, Dorset, DT1 1UZ. Tel. (Switchboard) 01305 251010
Maintenance of seats, litter bins etc	West Dorset District Council	Leisure and Tourism, West Dorset District Council, Stratton House, 58-60 High West Street, Dorchester, Dorset, DT1 1UZ. Tel. (Switchboard) 01305 251010
Provision of signage	West Dorset District Council	Leisure and Tourism, West Dorset District Council, Stratton House, 58-60 High West Street, Dorchester, Dorset, DT1 1UZ. Tel. (Switchboard) 01305 251010
Flood warning and response actions	West Dorset District Council, Environment Agency and Dorset County Council	Flood Incident Management Team Leader, Environment Agency South Wessex Area Office, Rivers House, Sunrise Business Park, Higher Shaftesbury Road, Blandford, Dorset, DT11 8ST. Tel. (EA Switchboard) 08708 506 506
Emergency planning	West Dorset District Council, Environment Agency and Dorset County Council	Dorset County Council Emergency Planning Service, County Hall, Dorchester, Dorset, DT1 1XJ. Tel.(Switchboard) 01305 221000
Historic Environment	Dorset County Council	Dorset Historic Environment Officer, Environmental Services, County Hall, Dorchester, Dorset, DT1 1XJ. Tel. (Switchboard) 01305 221000

Management operation	Organisation with assigned responsibility	Contact within organisation
Natural Environment	Natural England	Natural England, Level 9, Renslade House, Bonhay Road, Exeter, EX4 3AW Tel. 0300 060 1110
World Heritage Site	Dorset County Council	Jurassic Coast Team, County Hall, Dorchester, Dorset, DT1 1XJ. Tel.(Switchboard) 01305 221000



# Appendix E

## Beach Recycling Log Template



## **Appendix E Beach Recycling Log Template**

This appendix is provided on the accompanying CD.



## Appendix F

EA Best Practice Guide for Public Engagement when  
undertaking beach maintenance works

## **Appendix F      EA Best Practice Guide for Public Engagement when undertaking beach maintenance works**

This appendix is provided on the accompanying CD.



## Appendix G

Marine Licence for West Bay and Lyme Regis  
Harbours

## **Appendix G     Marine Licence for West Bay and Lyme Regis Harbours**

This appendix is provided on the accompanying CD.

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