Statement on the Dorset and East Devon World Heritage Site in the context of Sidmouth Beach Management Plan

Prepared by

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April 2022

Sidmouth East Beach Joint position statement, April 2022

Section A - Foreword and Background
Prepared by Tom Buxton-Smith

A1 Foreword

East Devon District Council (EDDC)), Natural England (NE) and Jurassic Coast Team (JCT) have published this updated position statement in response to the evolution of the Beach Management Plan (BMP) The document is to build on and update the June 2016 Joint position statement, and reflect on the proposed changes to the preferred option, known as the 'hybrid option', and potential further changes which could still be developed as part of the detailed design stage.
It is noted that there are currently no changes proposed at East Beach between the former preferred option, and they hybrid option.

The document is also to explain the sensitivities of the Jurassic Coast at East Beach, and help the reader understand the various designations, and important geology at the site.

A2 Background

East Devon District Council (EDDC) has prepared a Beach Management Plan (BMP) for Sidmouth and East Beach. This was developed into an Outline Business Case (OBC) however there was insufficient funding to deliver the preferred option of the BMP.

Following a change in government funding policy, and further economic work, further funding eligibly was identified. The original preferred option is unpopular with most parties due to it being a compromise on all fronts. With the funding eligibility increase, it was decided that other options should be investigated, as some during the BMP stage were more popular, but unaffordable, so dismissed.
Following a study process, a hybrid preferred option was developed, which is a combination of the original preferred option, and the offshore option.

The former preferred option consisted of:
Raising the existing splash wall along the whole town's frontage.
Recharging Town Beach
Altering the river training wall and access ramp
Recharging East Beach
120m Long groyne at East Beach

Hybrid Option consists of
Raising the existing splash wall where required along the towns frontage
One or Two additional offshore rock islands to complement the existing two.
Recharging Town Beach
Altering the river training wall and access ramp
Recharging East Beach
120m Long groyne at East Beach

The revised OBC is being finalised and due to be submitted for funding approval in 2022. Once approved, further funding will be unlocked to carry out the detailed design stage and construction. At the detailed design stage, further modelling will be undertaken to investigate other variations of the hybrid option, and more public consultation will be undertaken as the plans are finalised.

The BMP project aims to maintain the existing standard of Sidmouth's Coastal Defences, reduce the rate of erosion at East beach and to do so in an integrated, justifiable and sustainable way.

Section B. Environmental Designations

In response to questions raised by the Sidmouth Beach Management Plan Advisory Group regarding the importance of the Environmental Designations NE and the JCT provide the following summary.

B1 Sidmouth to Beer Coast SSSI Prepared by Gareth Townsend.

East Beach at Sidmouth is within Unit 001 of this SSSI 'River Sid to Weston Mouth Foreshore'. The last site check was carried out on the 15th January 2021 and concluded that the natural processes were unhindered and therefore this unit was deemed in a favourable condition.

This SSSI is important for many reasons as this stretch of Devon coastline supports the most westerly example of species-rich chalk grassland in England and a diverse invertebrate fauna is associated with the site. There are also important geological and stratigraphic features displayed here.

Extending for approximately 12km the site consists mainly of south-facing cliffs with occasional coastal valleys. The cliffs are generally very steep and in places rise to 160m above the shingle foreshore. In the west New Red Sandstone with a capping of Greensand occurs, but as the strata dip eastward chalk beds appear beneath an overlay of clay-with flints.
The grassland of the cliff tops and ledges is characteristically species-rich with many plants typical of calcareous soils present. These include Purging flax Linum catharticum, Squinancywort Asperula cynanchica, Carline Thistle Carlina vulgaris, Small Scabious Scabiosa columbaria, Common Rockrose Helianthemum nummularium, Ploughman's Spikenard Inula conyza and Salad Burnet Sanguisorba minor. Several species of orchid occur including Pyramidal Orchid Anacamptis pyramidalis and Autumn Lady's-tresses Spiranthes spiralis. The site also supports the nationally rare Purple Gromwell Lithospermum purpurocaeruleum and the nationally scarce Tree Mallow Lavatera arborea, Nottingham Catchfly Silene nutans and Sea Kale Crambe maritime.

In sheltered areas and along sections of the cliffs a rich scrub community forms dense thickets. This includes Dogwood Cornus sanguinea, Wayfaring Tree Viburnum lantana, Wild Privet Ligustrum vulgare, Blackthorn Prunus spinosa and Hawthorn Crataegus monogyna. Associated climbers are Traveller's joy Clematis vitalba and Madder Rubia peregrina.

The wide variety of aspects and habitats supports an equally varied invertebrate fauna. Butterflies, grasshoppers and crickets are numerous. The nationally scarce Rufous Grasshopper Gomphocerippus rufus, Grey Bush-cricket Platycleis denticulata and Bog Bush-cricket Metrioptera brachyptera have been recorded. In some of the streams the rare caddis flies Plectronemia brevis, Adicella filicornis and Ernodes articularis occur.

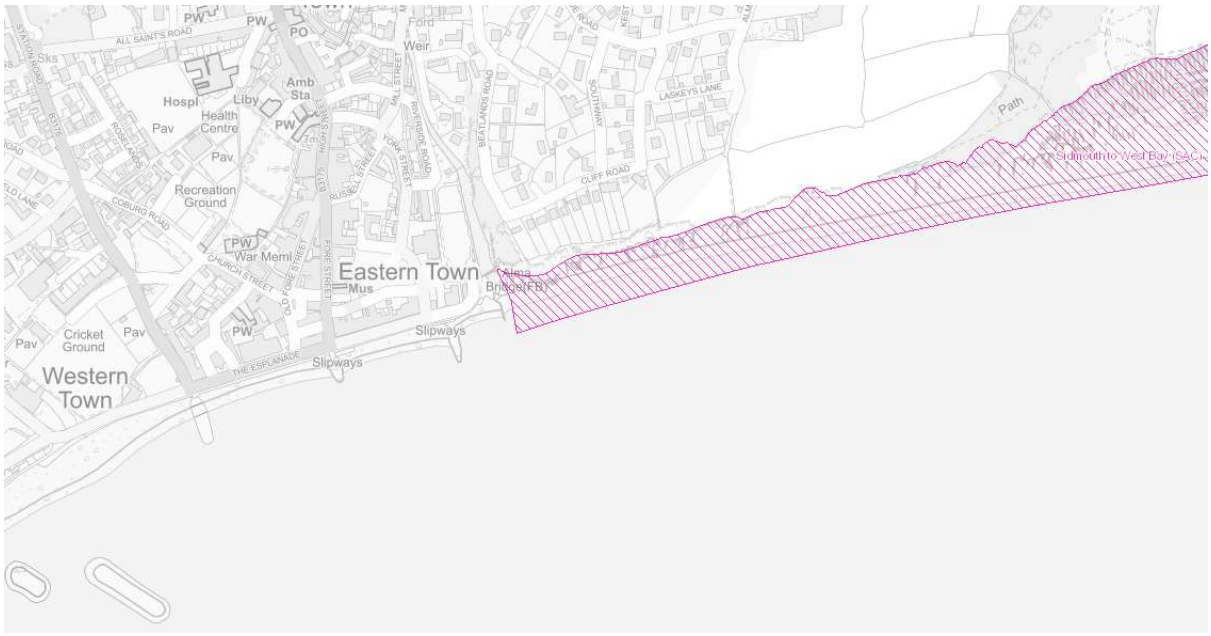
These cliff sections provide the finest exposures of the Foxmould Sands and Chert Beds (Upper Greensand) in South-West England. The site may be used as the type locality for these members, and the section is of critical importance as a standard with which to compare and contrast inland exposures. The quality of exposure allows particularly good opportunities to study the sedimentology of Upper Greensand Chert and hardground formation. The site is also of importance as it contains some of the most westerly major Upper Cretaceous exposures in England, which are of great stratigraphic importance. They show the intriguing lateral thickness and facies variations of the Cenomanian Limestone, containing an abundant and in part rare fauna. The Neocardioceras Hardground at the tip of the Cenomanian yields ammonites that are scarcely known elsewhere in Britain at this horizon. The site beautifully displays the basal Turonian or Beer Stone, a large echinoderm-rich calcarenite lens and also the major erosional truncation of the Lower Turonian and Cenomanian. A unique site for its sedimentology and stratigraphically-important fossil horizons.

For further information please see SSSI detail (naturalengland.org.uk)

Another important SSSI is the **Ladram Bay to Sidmouth SSSI** with the cliffs below High Peak and Chit Rocks at Sidmouth yielding remains of Middle Triassic fossil fish, amphibians and reptiles. Specimens of the labyrinthodont Mastodonsaurus (including type material) and the rhynchosaur Rhynchosaurus are closely similar to forms from the Warwick and Bromsgrove area in the Midlands, and allow correlation between the two areas. The remains from High Peak are disarticulated but well preserved, and fresh cliff falls will almost certainly yield more material. The best fauna of Middle Triassic fossil vertebrates in southern Britain.

For further information please see SSSI detail (naturalengland.org.uk)

B2 Sidmouth to West Bay Special Area of Conservation (SAC) Prepared by Gareth Townsend.



The Designated features of this important SAC are the Annual vegetation of drift lines, Vegetated sea cliffs of the Atlantic and Baltic coasts, and the Tilio-Acerion forests of slopes, screes and ravines.

The Sidmouth to West Bay SAC stretches for some 33km along the coast of East Devon and West Dorset. The site lies within the East Devon Area of Outstanding Natural Beauty (AONB), the Dorset AONB, and the Jurassic Coast World Heritage Site.

Geologically the underlying rocks are from the Triassic, Jurassic and Cretaceous Periods. This geology, the geomorphological process that act upon it and the fossils it yields are recognised as being of outstanding universal value under the UNESCO World Heritage Site designation.

The SAC is in many places subject to minimal management intervention and supports a stunning range of wildlife. Natural succession has created a varied range of habitats from open bare ground, calcareous, acidic and neutral grassland, springs, wet flushes, scrub and woodland. There is a diverse invertebrate fauna associated with these habitats and notable plants include the early gentian (Gentianella. anglica) and purple gromwell (Lithospermum purpureocaeruleum). The foreshore is mostly rock and shingle, providing suitable habitat for a number of specialist plants and animals including Sea kale and the Scaly cricket.

The South West Coast Path National Trail runs the entire length of the SAC, allowing public access along the coast, although much of the SAC and cliffs are largely inaccessible due to topography and dense unmanaged cliff scrub and woodland. Public access to the coast and beaches is high in some locations (principally Sidmouth, Branscombe, Lyme Regis and Charmouth), the attractions being fossil collecting, open air recreation, walking etc.

The SAC falls into both the Dorset and East Devon AONBs. Two National Character Areas cover this stretch of the coast, Blackdowns (147) and Marshwood and Powerstock Vales (139). A common characteristic of the coast in these two areas is that of a predominantly undisturbed, remote coast, punctuated by points where access is easy and visitor numbers high, albeit to quite small stretches.

For further information please see
https://designatedsites.naturalengland.org.uk/SiteGeneralDetail.aspx?SiteCode=UK0019864

B3 Jurassic Coast World Heritage Site – Prepared by Sam Scriven

B3.1 Overview of World Heritage

The geological exposures at East Cliff, Sidmouth, are an important part of the WHS, generally known as the Jurassic Coast. World Heritage Status is the highest possible global conservation designation and recognises sites of unique and exceptional heritage. The UK government is committed to protecting its WHSs on behalf of all the peoples of the world through the World Heritage Convention, which is administered by UNESCO, a specialist agency of the United Nations.

The purpose of the World Heritage Convention is to identify properties that have "*Outstanding Universal Value*" (OUV); a "*cultural and/or natural significance which is so exceptional as to transcend national boundaries and to be of common importance for present and future generations of all humanity*" (from the Operational Guidelines for the World Heritage Convention 2013, Para 49).

OUV itself is underpinned by three pillars – i) the Site must meet one or more of the World Heritage **Criteria**, ii) it must demonstrate **Integrity** and iii) it must have **appropriate Protection and Management** in place. If any of these are compromised then the Site's OUV, and therefore its World Heritage Status, may be threatened.

The Dorset and East Devon Coast meets **Criterion viii** (*to be outstanding examples representing major stages of earth's history, including the record of life, significant on-going geological processes in the development of landforms, or significant geomorphic or physiographic features*) due to the area's exceptional rocks, fossils and landforms. The specific reasons it was inscribed as a World Heritage Site are described in a Statement of Outstanding Universal Value (SOUV).

Further to the SOUV, a set of attributes are defined for the Site that help in understanding its Integrity and management requirements. Attributes are aspects of a property which are associated with or express the OUV and can be tangible or intangible

The boundaries of the Site are described rather than mapped. The landward boundary is the break in slope at the top of the cliff and the seaward boundary is mean low water mark. Laterally, the WHS has gaps at town frontages.

More details on the Jurassic Coast's OUV, attributes, management requirements and boundaries can be found in the Jurassic Coast Partnership Plan 2020-2025 and its appendices (link below). This document will focus in particular on the nature of the WHS at Sidmouth using the framework of OUV.

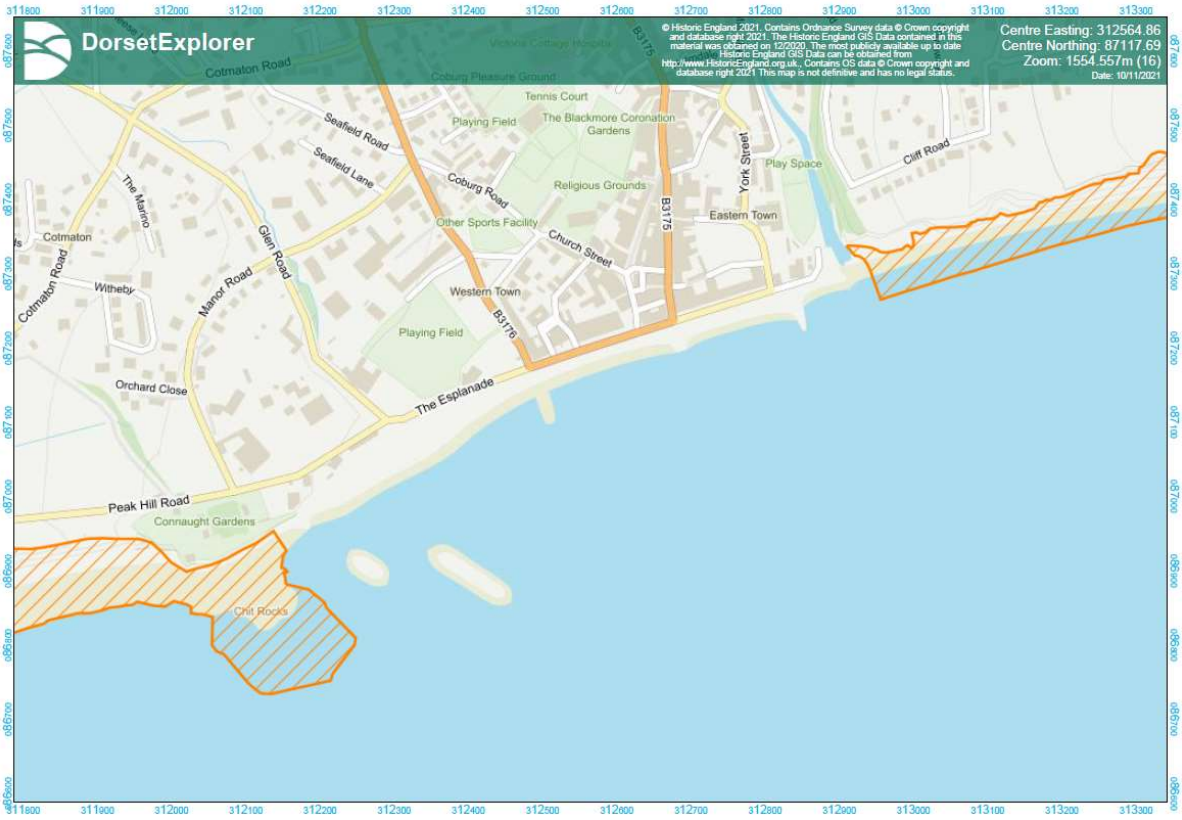
www.jurassiccoast.org/partnershipplan

B3.2 The Jurassic Coast at Sidmouth – Boundaries, Criteria, Integrity and Protection & Management

Boundaries of the Site

Working west to east across the seafront of Sidmouth, the WHS ends at Chit Rocks then starts again to the east of the town. The map below is for guidance only; the primary definition of the

boundaries of the Jurassic Coast WHS are a set of written descriptions (see Appendix 2 of the Jurassic Coast Partnership Plan).



Criteria

Eastward from the mouth of the River Sid, the cliff exposes layers of Otter Sandstone and Mercia Mudstone that dip towards the east. These rocks represent a part of the Triassic Period and are approximately 242 million years old. The transition from sandstone to mudstone recorded in this sequence marks a relatively rapid change in conditions of the geological past from a landscape dominated by seasonal rivers to a hot desert environment dominated by playa lakes. Boundaries between geological units are crucial to understanding the large changes that take place over millions of years. In contrast to the separate rock units as a whole, which can be hundreds of meters thick and exposed across miles of coastline, the boundaries between them are often very narrow and only visible and accessible in particular places. East cliff, Sidmouth, is one such place and so is of great sensitivity relative to other locations along the WHS.

The Otter Sandstone is relatively rich in fossils for sediments of this type and of this age. Noted in particular for its reptile and fish fauna, it has also yielded amphibians, insects, plants and important footprint trackways. The Otter Sandstone continues to be an important source of new species and other specimens that have enabled the correlation of Devon's geology with other parts of the world. The Otter Sandstone geology, and therefore the palaeontological interest, extends to the west of Sidmouth, but Pennington Point is the source of a particularly diverse fossil biota.

The number of fossils found, and the rate at which they are recovered, correlate to the level of active collecting effort and the conditions of the beach. Typically, fossils are recovered from fallen blocks of sandstone or from the rock ledges that are exposed on the foreshore at times when the beach volume is much reduced. The foreshore ledges tend to be the source of the best specimens and allow for bedding surface features such as footprints to be exposed and collected. It is important

to note that, like most fossils recovered from a coastal environment, specimens on East Beach can only be observed once already exposed and therefore at risk of being destroyed by the sea. All fossils recoveries from East Beach are therefore rescues. Nevertheless, the value of the locality lies in its ongoing productivity driven by unconstrained coastal processes. At the heart of the matter is the potential for the locality to yield new or important specimens as the rocks continue to erode. The number and rate of discoveries are less relevant in terms of determining the palaeontological value of the exposures, which is based instead on the palaeontological significance of any specimens recovered. For example, the palaeontological interests of Furzy Cliff SSSI, near Weymouth, are protected mainly based on the discovery of a single specimen of a unique dinosaur that established the potential for those exposures to produce additional material.

This specimen illustrates the potential of the exposures at East Cliff. It was recovered from Pennington Point by a local collector and resides in the collection at Sidmouth Museum. It belonged to a meat-eating reptile, but a positive scientific description is not possible based on an isolated fragment of jaw. At some point, hopefully, more of this creature will be discovered and its identity revealed.

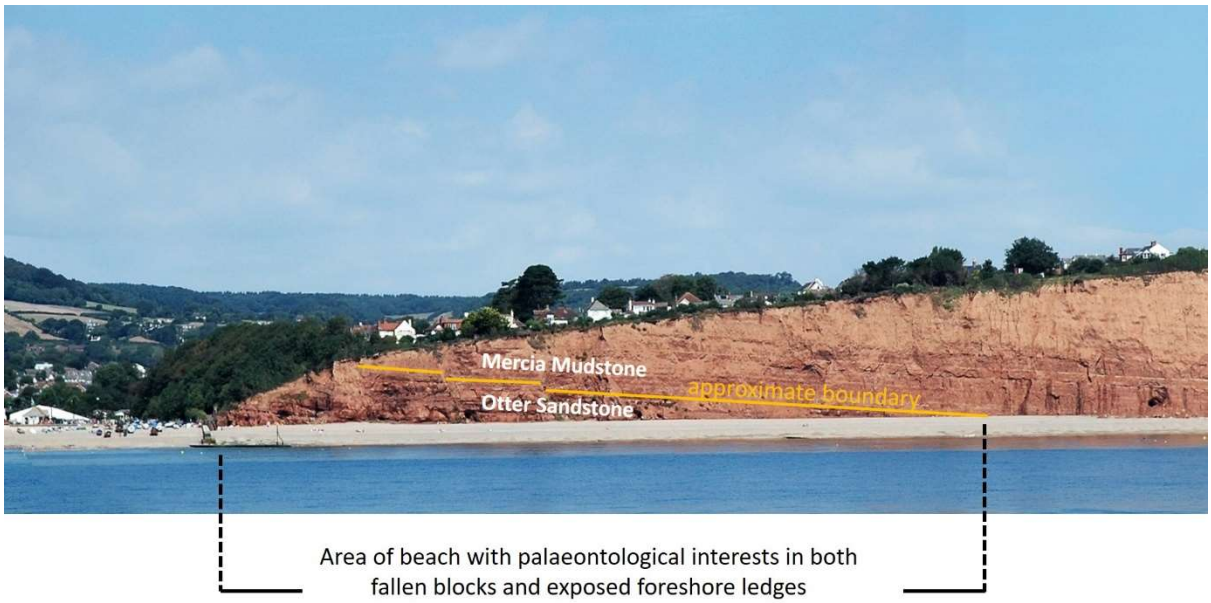
The value of geological and paleontological interests like those at East Cliff is that they provide us insights into Earth's systems, the causes and impacts of long-term climate change and patterns of evolution. The Otter Sandstone specifically '*provides important information about a freshwater and terrestrial ecosystem that marks recovery from the end-Permian mass extinction but pre-dated the appearance of dinosaurs and mammals'*. This quote is from a scientific paper published in 2019 and titled *The Middle Triassic (Anisian) Otter Sandstone biota (Devon, UK): review, recent discoveries and ways ahead*, published in the Proceedings of the Geologists' Association. The authors of this paper also state that '*the rate of recovery of new material, particularly of vertebrates, indicates that many taxa await discovery*'.

Earth Science is a global endeavour, where individual localities such as East Cliff contribute to a larger understanding of patterns, systems, and processes. Loss of or damage to the scientific interests at Sidmouth impoverishes our collective access to knowledge about the Earth - the rocks and fossils along the Jurassic Coast are established through World Heritage Status as being amongst the highest value in that regard.

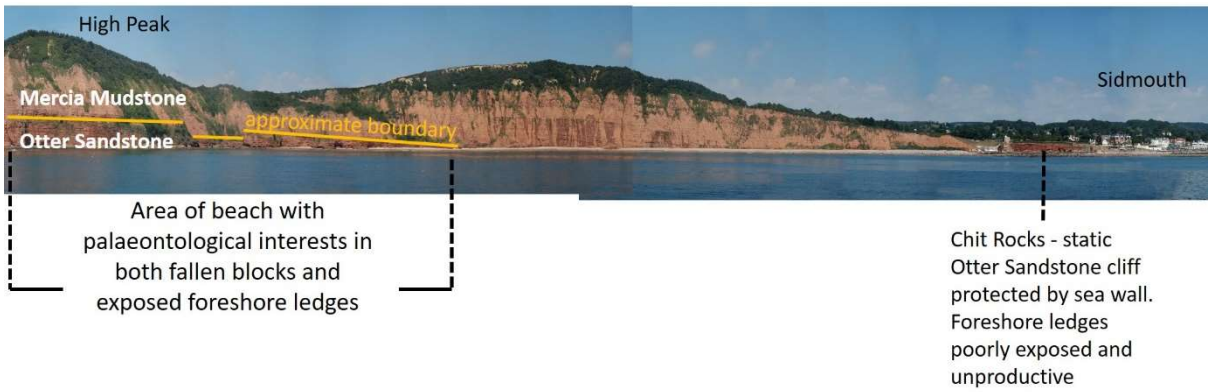
The baseline conservation objective for these interests therefore is to embrace unconstrained coastal processes that maintain the geological exposures and their palaeontological productivity.

Overview imagery

East Cliff



West of Sidmouth



Integrity

The concept of **Integrity** is defined by UNESCO in the Operational Guidelines for the Implementation of the World Heritage Convention, stating that; "*Properties proposed under criterion (viii) should contain all or most of the key interrelated and interdependent elements in their natural relationships*" (paragraph 93).

The statement of Integrity for the Dorset and East Devon Coast WHS includes the following points:

- The nominated Site contains all of the key interdependent elements of the geological succession exposed on the coastline. It is a near-complete and unique succession of Triassic, Jurassic and Cretaceous rocks.
- Its completeness in representing key features of the Mesozoic Era is clearly demonstrated by the remarkable range of localities selected through the Geological Conservation Review (GCR).

- The fossil biotas at the key localities are often very rich, and show key, interrelated elements of the record of life.

The transitional boundary between the Otter Sandstone Formation and the Mercia Mudstone Group (as seen at Pennington Point and East Cliff) is vital to establishing the near continuous record of the Triassic Period exposed on the East Devon Coast (showing a transition from an arid landscape dominated by rivers to one dominated by ephemeral lakes), and so plays an important role in the Integrity of the WHS. Whilst this boundary is also visible under High Cliff, the exposure of it at East Cliff has been shown to be the superior of the two from a scientific point of view. For more details, please refer to Gallois, R. W. 2004. *The type section of the junction of the Otter Sandstone Formation and the Mercia Mudstone Group (mid Triassic) at Pennington Point, Sidmouth*. Geoscience in south-west England, **11**, 51-58.

The fossils recovered from below East Cliff are globally important in their own right, but under the pillar of Integrity should be considered in the wider context of the whole WHS. The Otter Sandstone is the principal source of Triassic fossils on the Jurassic Coast. It is one of the essential 'interrelated elements' that demonstrate the record of life on this World Heritage Site. East Cliff is an important source of fossils from the Otter Sandstone, but their significance and availability is not confined to East Cliff in that the same fossil diversity can, in principle, be expected to occur to the West of Sidmouth. The stratigraphy is, however, a different matter. The stratigraphy of East Cliff is established as the type section for the junction of the Otter Sandstone and overlying Mercia Mudstone and associated Pennington Point Member, and therefore of relatively higher value to the exposures West of Sidmouth.

Stratigraphic, fossil reptile and fossil fish interests at East Cliff are each included in the Geological Conservation Review (GCR) (a GB-wide geological inventory that provides the basis for selecting geological SSSIs) as separate entries.

Protection and Management

Appropriate levels of protection and management must be demonstrated as part of the WHS nomination process. This is to account for individual nation states having their own legislative approach to heritage conservation. In the main, it was the statutory designations of SSSIs and AONBs that were used to demonstrate that the geological interests along the Dorset and East Devon Coast had enough protection to sustain World Heritage Status on behalf of all humanity. The SSSIs mainly functioned to protect the Criteria and Integrity of the WHS and are underpinned by the Geological Conservation Review. The East Devon and Dorset AONBs were used to protect areas of the Site not designated as SSSIs as well as the Site's setting and as an alternative to a 'buffer zone'. Natural England therefore have a key role in representing the interests of the WHS through their work to protect SSSIs.

The WHS also has its own management framework, which is adopted by local planning authorities, the Department for Digital, Culture, Media and Sport (DCMS) and was submitted to UNESCO. The latest iteration of the management framework for our WHS is the Jurassic Coast Partnership Plan 2020 - 2025.

World Heritage is not a statutory designation under UK law, but WHSs are given the highest level of significance in the National Planning Policy Framework, where they are categorised as Designated Heritage Assets. Almost all relevant planning policy and guidance therefore is found under the historic environment chapters in National Planning Policy Framework and National Planning Practice Guidance. This reflects the fact that every other WHS in England is cultural, and the Jurassic Coast is

the only natural WHS. This means that the approach to the protection and management of the Jurassic Coast must combine certain aspects of heritage and nature conservation. In practice this often means Natural England and the Jurassic Coast Trust working collaboratively at officer level to deal with casework like the Sidmouth Beach Management Plan whilst Historic England work collaboratively with the Jurassic Coast Trust at a wider policy and procedural level to advise DCMS about major issues affecting the Site.

The procedure by which issues affecting the WHS can be referred to government and UNESCO comes from paragraph 172 of the Operational Guidelines for the Implementation of the World Heritage Convention;

"*172. The World Heritage Committee invites the States Parties to the Convention to inform the Committee, through the Secretariat, of their intention to undertake or to authorize in an area protected under the Convention major restorations or new constructions which may affect the Outstanding Universal Value of the property. Notice should be given as soon as possible (for instance, before drafting basic documents for specific projects) and before making any decisions that would be difficult to reverse, so that the Committee may assist in seeking appropriate solutions to ensure that the Outstanding Universal Value of the property is fully preserved*."

Threats to natural WHSs are interpreted based on their impact to OUV and Integrity; advice on such matters is provided to UNESCO by the International Union for Nature Conservation.

Taken as a whole, the protection and management pillar of OUV for the Jurassic Coast can be summarised as a combination of statutory designations, adopted Site management policy, national planning policy and government accountability to UNESCO and the international community.

Setting

Protection of the Site's setting forms part of the protection and management pillar of OUV but is often considered separately as it can relate to specific landscape impacts. The setting of the Jurassic Coast is defined in both functional and experiential terms, which can be summarised as the natural processes outside the boundaries of the Site that support its OUV and the ways in which people experience the Site's OUV through its connection to wider landscape character. See section 4 for more details on the sensitivity of the Site's setting in the context of the BMP.

Management of Fossil collecting

The role of responsible fossil collectors in the conservation of the WHS is established in the policies of the Jurassic Coast Partnership Plan 2020 – 2025. However, it is important to note that, due to scarcity and importance of the fossils at East Cliff, it is not an appropriate location to promote as a place for 'casual' fossil hunting or inexperienced collectors.

B5 The East Devon AONB – Prepared by Gareth Townsend

An Area of Outstanding Natural Beauty (AONB) is land protected by the Countryside and Rights of Way Act 2000 (CROW Act). It protects the land to conserve and enhance its natural beauty. The CROW Act sets out the roles and responsibilities that different organisations must follow to manage AONBs.

The East Devon AONB, full of contrast and colour, diverse and rich in wildlife and a working landscape home to approximately 30,640 residents.

Designated in 1963, covering 268 sq/kms and a third of East Devon District, the AONB skirts the major settlements in the area with the exception of Budleigh Salterton.

The World Heritage Site 'Jurassic' coastline and South West Coast Path play an important role in the popularity of the AONB. With its dramatic cliffs, a unique insight into 185 million years of earth history and attractive coastal villages that still retain a vernacular character and rural charm, the coast brings in significant economic benefit to the area.

For further information please see

East Devon Area of Outstanding Natural Beauty (landscapesforlife.org.uk)

https://www.gov.uk/guidance/areas-of-outstanding-natural-beauty-aonbs-designation-and-management

B6 Natural England's General Comments on Flood and Coastal Erosion Risk Management - Prepared by Gareth Townsend

Many rivers and coasts have been subject to human intervention, often over many centuries. While reducing flood and erosion risk this approach has significantly affected the ways in which they evolve and has often limited their ability to 'shape' the natural environment and the associated wildlife and landscape interest that contributes to a feeling of "wildness" in such areas.

Coastal and river habitats owe much of their conservation and landscape interest and sense of 'wildness' to the shaping action of coastal and fluvial processes. Conserving this interest usually depends on allowing these processes to act unhindered or harnessing them sustainably so that we use natural systems themselves to help reduce flood risk. Many of our coasts and rivers are extremely dynamic and climate change resilience relies on the ability of such systems to adjust themselves to rising sea-levels or increased river flows.

Until recently interventions were thought of in terms of 'flood and coastal defence'. Policymakers and engineers now accept the need to manage flood and erosion risk through more sustainable approaches.

Natural England believes that sustainable management of flood and erosion risk is best achieved by solutions that work with the physical processes that shape coastal and riverine environments and sympathetic land management and land-use planning, which makes space for rivers and coasts to evolve sustainably and safeguards supplies of sediment, is crucial if our coasts and rivers are to adapt in response to climate change.

Communities rightly expect to be able to contribute to decisions on the future management of our coasts and rivers. Decisions involving the withdrawal of maintenance or realignment of existing defences can easily become polarised leading to confrontation and a failure to reach a consensus on future management. Operating authorities have the lead role in this consultation process.

In adopting new approaches we need to recognise the legitimate concerns of communities in or close to flood plains or eroding cliffs and support appropriate adaptive measures such as the relocation of critical assets (e.g. electricity supply substations and water treatment works).

Inappropriate development in floodplains and on eroding coasts can constrain options for future management. We need spatial allocations that provide the space for coasts and rivers to evolve, for example by allowing the use of managed realignment to create a more resilient coastal environment. The land-use planning system needs to be robust so as to limit inappropriate development in locations that are at risk of flooding or erosion.

Section C- Summary of advice from Natural England – Prepared by Gareth Townsend

C1 Position Statement on Preferred and Hybrid Option

Natural England understands that a compromise solution is needed to move this process forward but would like to remind the advisory group that none of the options presented during this process are likely to be impact-free on the protected landscapes and the designated sites around Sidmouth, and the current Hybrid option is no exception.

C2 Summary of Our Advice on the Hybrid Option

Natural England understands that at the Sidmouth and East Beach BMP Advisory Group (consultative Meeting) 25th Oct 2021, the Advisory Group voted to take forward option B (alternative option – Town Island(s) and East Beach Groyne) with addition stage check, to OBC and detailed design stage. This also known as the hybrid option

As detailed in our previous responses to consultations, Natural England have advised against options to construct groynes on East Beach as they are likely to result in direct impacts upon the designated geodiversity, landscape and nature conservation interests in that area.

There is also a risk that groynes on East Beach would also affect sediment supply to Pennington Point. Evidence suggests that this frontage relies upon sediment movement from the east during phases of dominant easterly and south-easterly waves to create and retain a healthy beach. A groyne would trap much of this material, preventing the east-west movement of sediment to this frontage.

As a member of the Project Group Natural England accepted the 'preferred option' of groynes at that time, as a compromise solution given the limitation to finances. Changes to the EA funding mechanisms and with the EDDC additional funding secured, now allows for this option to be reviewed.

We are disappointed the current Hybrid option being taken forward still includes an East Beach Groyne, and given the uplift in funding, more environmentally acceptable options have not been fully explored.

We note that one or more Town Islands, positioned offshore, in front of Sidmouth Town, are proposed as part of the preferred Hybrid option. These interventions do not always behave as expected once in place and this has the greatest uncertainty associated with it however, as previously stated we regard this type of intervention as offering the 'least worst' solution with regard to the natural environment, depending upon the detailed design, and this is likely to provide the most acceptable option.

At the detailed design phase, we would advise that options to replace the East Beach Groyne with the more acceptable option of offshore island(s) should be further explored. Assessment of the option for offshore breakwaters will be needed to confidently predict the impacts which might result from their installation. Subject to detailed design (number, height, size, orientation, position) breakwaters should have a lesser impact on longshore sediment transport than groynes. A more detailed assessment of near-shore sediment dynamics would provide greater certainty regarding its significance to the supply of sediment to the beaches and the implications of disrupting it.

Offshore islands/breakwaters, although more acceptable than the groyne could still have the potential to negatively impact the designated site interests on East Beach depending on the degree to which they modify or obstruct sediment movement. In the extreme they could result in an increase in beach volume to such an extent that cliff erosion was halted, with resulting impacts upon WHS and SSSI geological exposures and SAC/SSSI vegetation communities. The objective of the BMP is to slow the rate of erosion not to prevent it.

Assessment and numerical modelling will be required at the detailed design stage on any option taken forward to demonstrate that a suitable solution can be achieved, giving consideration to the impact on coastal processes and near-shore sediment dynamics. It would be necessary to conduct these detailed assessments before a conclusion could be reached regarding the performance of these options and the extent of predicted impacts upon the interest features of the designated sites.

It has been discussed that temporary planning permission could be sort to install rock revetment at the toe of East Cliff. We have expressed serious concerns with rock armour due to the environmental acceptability with impacts to the foreshore, designated sites, and cliff geology. Other

issues include its damage to the outstanding universal value (OUV) for which the Dorset and East Devon World Heritage Site (WHS) is inscribed and the associated Geological Conservation Review interests, adverse impact on the setting of the Dorset and East Devon WHS, and adverse impacts on the landscape of the East Devon AONB/Heritage Coast.

A rock revetment at the toe of the cliff will not halt recession of the cliff, erosion would continue until a stable profile is found. Whilst a small rock revetment may slow erosion and therefore recession of the cliff, it will not halt erosion. Erosion would likely continue at the top of the cliff due to subaerial processes.

Natural England advise that resources are best directed to completing the BMP and implementing a sustainable beach management scheme across Sidmouth and East Beach rather than exploring this unsustainable and damaging option.

Section D – Summary of Advice from the Jurassic Coast Team – Prepared By Sam Scriven

D1 Potential impacts of the Sidmouth Beach Management scheme

In order to examine the potential impacts of the proposed Beach Management scheme at East Cliff, it is useful to consider the character of this specific part of the WHS through its attributes. As stated in the introduction, attributes are associated with or express the OUV of the Site and are defined to help in understanding its Integrity and management requirements. They are written as general descriptions (see appendix 1), but the table below lists the specific interest that express each attribute at East Beach.

Features of East Beach, Sidmouth, that constitute attributes of the WHS.	
Stratigraphy and structure	• Type section for the junction between the Otter Sandstone and Mercia Mudstone • Type section for the Pennington Point Member of the Otter Sandstone Formation • Significant exposure of Mercia Mudstone
Palaeontological record	• Permian-Triassic reptiles • Triassic fossil fishes
Geomorphological features and processes	• General unconstrained beach and coastal processes that form part of a wider sediment cell
Ongoing scientific investigation and educational use, and role in the history of science	• Potential for ongoing stratigraphic research as well as new fossil discoveries from the Otter Sandstone exposures • Amenity of high quality natural coastal landscape and its potential to inspire an interest in Earth Science / geological heritage
Underlying geomorphological processes in the setting of the Site	• The expression of underlying geology as part of landscape character • Drainage & groundwater regimes that influence mass movement within the coastal slope and cliffs • Wave energy and patterns that drive beach & coastal processes

Sensitivities

The key elements of East Cliff that contribute to the WHS's OUV are the stratigraphy and palaeontological record. The scientific importance of these is established in published scientific literature including the Geological Conservation Review Series. The potential for ongoing scientific investigation at this location is also a key characteristic and linked to the geological exposures and possibility of new fossil discoveries. The geomorphological features of East Cliff are not specifically noted as having scientific interest, in contrast to places like Ladram Bay (sea stacks) or Chesil Beach. In general terms, the significance of the geomorphological character of East Beach relates to how it expresses the link between geology and local landscape character, and in how unconstrained coastal processes maintain the quality of the WHS at this location. Critically, active coastal processes maintain the stratigraphical and paleontological integrity of East Cliff (cliff and foreshore). With all that in mind, the sensitivities of the WHS at East Cliff can be summarised as:

1. **Stratigraphy** - the exposure of the Otter Sandstone and its boundary with the overlying Mercia Mudstone as key parts of both the Criteria and Integrity of the Site;
2. **Palaeontology** - the potential for new fossil discoveries both in fallen blocks of Otter Sandstone and in the bedrock of foreshore ledges as a key part of the Criteria of the Site;
3. **Setting** - the links between the WHS, coastal processes, and landscape character / amenity.

Describing the setting of the Jurassic Coast WHS at Sidmouth

The setting of the Jurassic Coast at Sidmouth can be interpreted by linking the Attributes of the Site to current landscape character areas defined in the 2019 East Devon Landscape Character Assessment. A full analysis is provided in Appendix 2 and is based on the landscape character types that intersect with East Beach, Sidmouth:

- 1B – Open coastal plateaux
- 2A – Steep wooded scarp slopes
- 3A – Upper farmed and wooded valley slopes
- 4D – Coastal slopes and combes
- 4H – Cliffs

The table below gives summary descriptions of the connections between the WHS's attributes and landscape character as an expression of the functional and experiential setting of the Site.

Features of East Beach, Sidmouth, that constitute attributes and setting of the WHS	**Connections with landscape character**
Stratigraphy and structure • Type section for the junction between the Otter Sandstone and Mercia Mudstone • Type section for the Pennington Point Member of the Otter Sandstone Formation	The cliffs, as well as being an important source of scientific information about the Earth, provide an opportunity to directly observe the relationship between the land and its underlying geology. This includes the relative hardness of rocks in creating the steep and gentle slopes in the line of the cliff top, which extends inland to shape the scarps, valleys and combes. The colour of the geology is a visually striking feature of the coast, being the most prominent clue to the desert origins of these

• Significant exposure of Mercia Mudstone	rocks. It is also picked up in local settlements through the use of local building stone. Together, the local stone vernacular and the coastal geology provide a tangible link between nature and culture.
Palaeontological record • Permian-Triassic reptiles • Triassic fossil fishes	The availability of fossils at East Cliff is intimately linked to the dynamic nature of the coast, both in terms of cliff falls and changing beach levels. This dynamism is an important part of landscape character at the coast and how people experience the WHS. Although not part of landscape character, it is important to note that important collections of Triassic fossils, including specimens from East Beach, exist in Sidmouth Museum, Lyme Regis Museum, RAMM in Exeter and Bristol University. These are essentially part of the 'setting' of the WHS, as they are the principal means by which a wide / public audience can engage with the rich palaeontological heritage of Sidmouth and the Otter Sandstone.
Geomorphological features and processes • General unconstrained beach and coastal processes that form part of a wider sediment cell	The 'open coast' quality of the WHS at large and the dominance of unconstrained coastal processes have a strong presence at East Cliff. These are the key features of the geomorphology of East Cliff and its dynamic characteristics – cliff falls and beach evolution. There is a strong seasonal component to how people will experience this dynamism, with winter storm conditions presenting almost a completely different character of coastline to a tranquil summer day. Cliff fall events themselves are often witnessed at this location. Habitat and species distribution can also help to express the underlying geomorphological processes within the coastal slope.
Ongoing scientific investigation and educational use, and role in the history of science • Potential for ongoing stratigraphic research as well as new fossil discoveries from the Otter Sandstone exposures • Amenity of high quality natural coastal landscape and its potential to inspire and interest in Earth Science / geological heritage	Engagement with the WHS depends on people being able to access it, whether for scientific, educational, or recreational purposes. The South West Coast Path and beach access points are key elements of the landscape that enable people to experience the OUV of the Site. The sense of openness, exposure, wildness, and tranquillity are all intangible expressions of the overtly natural state of the WHS. They are, in part, a consequence of ongoing and unconstrained coastal geomorphological processes and key characteristics of the coastal landscape. In the experiential setting of the WHS, these qualities have a higher profile than the interests that underpin Criteria and Integrity because they are more immediately available (compared to fossils or geological stories). In short, the experience of a natural coastline is the way people will first and most regularly encounter the WHS. Views into the Site from town frontages are especially important therefore as 'windows' into the WHS and are key in establishing an experience of its character as a *natural* Site. In that sense, the geomorphological processes that

	sustain the WHS inscription are perhaps *the* key point of connection between people and the coastline.
Underlying geomorphological processes in the setting of the Site • The expression of underlying geology as part of landscape character • Drainage & groundwater regimes that influence mass movement within the coastal slope and cliffs • Wave energy and patterns that drive beach & coastal processes	The relative hardness of rocks in creating the steep and gentle slopes in the cliff profile and line of the cliff top extends inland to shape scarps, valleys and combes. Groundwater regimes that intersect the coastline and feed water into the coastal slope are a key driver for dynamic coastal processes. The unconstrained wave energy and patterns affecting East Cliff is the other key driver that shapes its open and exposed landscape character.

Potential impacts from Beach Management schemes

For the purposes of this position statement, three configurations are considered – a rock revetment, a groyne with replenished beach, and offshore breakwaters. The table below provides an overview assessment of impacts on the key sensitivities identified above.

	Stratigraphy (Criteria and Integrity)	Palaeontology (Criteria)	Setting
Rock revetment	A rock revetment introduces a hard coastal defence in front of the stratigraphy currently exposed in the cliff. The need to reduce erosion rates in front of the houses on Cliff Road means that a revetment would need to run the length of the exposed boundary between the Otter Sandstone and Mercia Mudstone, entirely obscuring it at beach level. In addition, a rock revetment would essentially stop erosion from the sea and cause the cliff face above the revetment to degrade over time. When the beach level is low enough to expose them, the beach ledges provide a horizontal section of the stratigraphy. With a revetment in place these will only be available on the lower part of the shoreline and then only during a suitable tide. Overall, a revetment causes a near complete loss of meaningful access to the stratigraphy at this location and is therefore highly damaging to the Criteria and Integrity of the WHS. It is also not in line with the stated aim of the BMP and SMP policy.	The prevention of erosion to the cliff face would extinguish this location's potential to yield new fossils of scientific importance from fallen blocks of sandstone, at least for the lifetime of the scheme. A rock revetment would have no effect on the ability of East Cliff to retain a beach, meaning it is likely that fossiliferous foreshore ledges would continue to be exposed under certain conditions. However, the footprint of the revetment would mean a significant reduction in the total surface area of exposed ledges and so would also result in a reduction of the potential for new fossil discoveries. Overall, a rock revetment significantly reduces the quality of and access to the palaeontological interests at this location and is therefore damaging to the Criteria of the WHS.	A rock revetment introduces a large and obviously man-made structure that would damage the current sense of an exposed and wild coast. It would also narrow the width of passable beach and thus restrict access along the foreshore. The rock revetment is likely to be made of material different to the local red rocks. Overall, a revetment reduces the visible area of cliff face, detracts from the exposed geology of the WHS through the introduction of a man-made structure built of foreign materials, damages landscape character and reduces the accessibility of the foreshore.
Groyne and beach	The proposed groyne will be positioned beyond the stratigraphic exposures of key interest, specifically the boundary between the Otter Sandstone and Mercia Mudstone. A replenished beach will be designed to reduce – but not stop – erosion of East Cliff by the sea; cliff exposures will remain accessible and will be maintained via wave processes, albeit not as actively as they are currently with no coastal defences in place. Access to the stratigraphy exposed in the	Reduced erosion rates at East Cliff will slow but not wholly impede the discovery of fossils from fallen blocks of sandstone. The replenished beach will bury the foreshore ledges and be designed not to diminish in the way that naturally occurring beaches do at this location. As a result, the foreshore ledges will effectively be inaccessible for the lifespan of the scheme. Overall, a groyne and replenished beach significantly reduces the quality of and access to	Beaches are an integral part of the natural coastline. Therefore, the creation of a beach that is artificially sustained does not fundamentally alter the presentation of the coast, nor does it detract from the visibility of the exposed geology and the way cliffs dominate the view into the WHS. However, to achieve this, the replenished beach must be made from material that matches other local beaches.

	foreshore will be greatly reduced or lost altogether. This is certainly damaging, but is not considered to prevent continued use of the location as a stratigraphic type section. A groyne and replenished beach is an artificial intervention on what is essentially a pristine part of the WHS and is therefore damaging to the Criteria of the Site. However, on balance, it is regarded as an acceptable compromise to carry into the detailed design phase since the Integrity of the Site is largely maintained.	the palaeontological interests at this location and is therefore damaging to the Criteria of the WHS.	The groyne component is more damaging since it introduces a large and obviously man-made structure within the boundaries of the WHS that affects the current sense of an exposed and wild coast. In principle, the replenished beach will help to soften the impacts of the groyne when viewed from Sidmouth sea front. When viewing the WHS from the east, either at beach level or from the cliff top, the groyne structure will likely detract more severely from the natural character of the coastline. The replenished beach will create an amenity for visitors and may improve access to a small part of the WHS. However, the groyne will act as a significant barrier to access when walking east along the beach. Walking west towards Sidmouth, the groyne will be an obstacle to safe passage along the shoreline. This could create a serious hazard for walkers and emergency responders that may require access along the foreshore beyond the coastal defence scheme.
Breakwaters	Breakwaters achieve a reduction in erosion rates at East Cliff without any man-made structures being placed within the boundaries of the WHS. Compared to other proposals, there is the potential for variations in storm direction to cause variability in beach volume and therefore cliff erosion rates. This approach modifies coastal processes to sustain beach volume below East Cliff rather than artificially creating a beach. The increased emphasis on working with coastal processes is more compatible with the OUV of the WHS. However, it is harder to predict the size of the beach that will result and therefore the amount erosion rates are reduced. Overall, breakwaters appear to be the most sympathetic approach, particularly if they allow for no man-	Similar impacts to a groyne and replenished beach. A breakwater is likely to reduce the frequency of fossil discoveries from fallen blocks of sandstone, whilst the formation of a stable beach would obscure the foreshore ledges for at least the lifetime of the scheme. A breakwater is likely to significantly reduce the quality of and access to the palaeontological interests at this location and is therefore damaging to the Criteria of the WHS. However, there is uncertainty in this conclusion in the absence of more detailed modelling. For example, a design that allows for occasional beach draw down, and therefore opportunities to access the foreshore ledges, may be more environmentally acceptable than other options.	The purpose of a breakwater would be to facilitate the natural accretion of a beach below East Cliff via the reduction of wave energy reaching the foreshore. Beaches are an integral part of the natural coastline and so the creation of a beach via the modification of wave energy and patterns does not fundamentally alter the presentation of the coast, nor does it detract from the visibility of the exposed geology and the way cliffs dominate the view into the WHS. Breakwaters would sit away from the exposed geology, present no barriers to the view into the WHS, would not impede access to or along the foreshore and would have a reduced impact on the experiential setting of the WHS; however,

	made structures to be placed within the boundaries of the WHS. If the use of breakwaters still requires the placement of a groyne to prevent eastward loss of beach sediment, then the impacts are likely to be equivalent or worse than the groyne with replenished beach option.		some negative impacts would remain from the introduction of new man-made structures into the immediate surrounding of the Site. If a terminal groyne is necessary, then the same impacts arise as with the groyne and replenished beach option.

D2 Conclusions

Summary of observations

The three design approaches to beach management at East Cliff, Sidmouth, all cause negative impacts to the OUV of the WHS. As a result, it should be noted that our preference is to do nothing. However, the JCT have committed to the aim of the Sidmouth BMP and are therefore seeking a design approach that minimises negative impacts on the WHS.

A rock revetment will have the most severe impact on the Criteria, Integrity and setting of the WHS as it will significantly reduce the viability of that location as the type section of the Pennington Point Member of the Otter Sandstone and its boundary with the Mercia Mudstone. Support for this approach, when other less damaging options are available, will demonstrate a total failure of the protection and management provision for the WHS and ultimately compromise the OUV of the Site.

The groyne with replenished beach has a mixture of impacts, with the most serious being to the palaeontological element of the Site's Criteria and also to the Site's setting.

Breakwaters have similar serious impacts on the Site's palaeontological interests but are potentially less detrimental to the Site's setting. It is important to note that the extent of beach accretion behind the breakwater will be hard to predict and therefore the extent of negative impacts harder to assess. Whereas a replenished beach can be designed to have a profile that accommodates interaction between the sea and the cliff, the breakwater scheme could result in extensive beach accretion that prevents this. It is also possible that a terminal groyne would still be necessary in order to stop the loss of beach material to the east. If this were the case, then all of the impacts associated with the groyne and replenished beach scheme would apply here as well as *additional* setting impacts caused by the breakwaters. In practice, this approach is the least well understood in terms of the potential impacts it may have on the OUV of the WHS. A breakwater could be more or less damaging, depending on how the beach behind the breakwater behaves and whether or not a terminal groyne is required. More detailed modelling is necessary to answer these questions. In principle, the WHS would require a breakwater approach to allow a degree of erosion of East Cliff to continue and also allow for the periodic denudation of the beach in front of East Cliff in order to expose the foreshore rock ledges for study.

With regards to the Site's OUV, the three models create tension between the relative impacts they have on the stratigraphy, palaeontology, protection & management, and setting of the WHS. The table below summarises these impacts using a traffic light approach and assumes the breakwater option *does not* include a terminal groyne. The Groyne and replenished beach option is currently being taken forward to detailed design phase and includes the option of further modelling for how a breakwater may be used and how much it would cost. A breakwater may have the potential to be the least damaging option, if the design parameters allow for no terminal groyne and also for the occasional draw down of East Beach behind the breakwater. It should therefore be given full consideration at the design stage to better understand its anticipated impact in comparison to other options

	Criteria	Integrity	Protection and Management	Setting
Do nothing				
Rock revetment				
Groyne with replenished beach				
Breakwaters				

The objective for the protection and management pillar of the Site's OUV is to secure mitigation against negative impacts of development, as per policy R2 of the Jurassic Coast Partnership Plan;

Policy R2; *Any development resulting in a negative impact to the OUV of the WHS will only be acceptable if it is both essential and unavoidable. In these circumstances mitigation measures will be undertaken.*

This has been and will continue to be achieved through successful cooperation between EDDC, the JCT and NE. The duty of the JCT and NE is to identify where appropriate compromises can be made.

Prioritising mitigation of negative impacts

All beach management options for East Cliff considered here would have severe negative impacts on the palaeontological heritage of the WHS. Indeed, due to the nature of the palaeontological interests at East Cliff, it seems likely that *any* design for coastal defences would limit the location's potential to yield new fossil discoveries. However, as noted earlier, the availability of important fossils from the Otter Sandstone is not wholly constrained to East Cliff. The stratigraphic interest is an entirely different matter. East Cliff is the type section of the boundary between the Otter Sandstone and Mercia Mudstone and plays a key role in the Integrity of the WHS. Maintaining the Site's Integrity must be a priority and so, in this case, the stratigraphic interests are given priority over the paleontological interests.

Each approach considered here negatively impacts the stratigraphic exposures at East Beach. Whilst creating an artificially retained beach below East Cliff is more sympathetic to the vertical sections in the cliff face, the horizontal sections occasionally exposed on the foreshore will be buried. However, the cliff face provides the most reliable access to the stratigraphy, so it is given a greater weight of value relative to the foreshore ledges.

Negative impacts on the Site's setting are an additional concern – and inevitable – considering that East Cliff is an essentially pristine piece of natural coastline. For any coastal defence scheme at East Cliff, use of appropriate materials and access issues must be considered.

A compromise

The geology of East Cliff is highly sensitive and is of great significance within the World Heritage Site. It must be acknowledged that construction of coastal defences of any design at this location will be the single most damaging thing to have occurred to the OUV of the Jurassic Coast since its inscription as a WHS. It is therefore imperative that the design minimise that damage as much as possible and be sympathetic to maintaining OUV into the future.

The beach management proposal being carried forward to detailed design phase by East Devon District Council includes a replenished beach with a terminal groyne and allows for the use of a breakwater to be tested as part of the detailed modelling. Both options must be considered in detail to determine the least damaging to the OUV.

With groyne and breakwater proposals, the key area of compromise from the WHS's position is an acceptance that the palaeontological interests of East Cliff will be severely degraded but that the stratigraphic interests will be largely retained. The success of the latter point is entirely contingent on the detailed design phase demonstrating a final scheme that minimises damage to the Integrity of the WHS. To that end, priorities for the detailed design phase are listed below.

Negative impacts on setting will be an inevitable consequence of any coastal defence scheme at this location and should be carefully considered and minimised as far as is practicable at the detailed design stage.

If the costs of modelling and implementation of a less impactful design at east beach are too high, or if a decision is made to divert the funding necessary to support said design towards another part of the Sidmouth BM scheme, a clear justification must be made for this decision, in line with the shared commitment to the Protection and Management of the WHS.

Priorities for detailed design phase

As the scheme moves into the detailed design phase, the following outcomes for the WHS must be secured:

- Both groyne and breakwater options should be modelled in detail
- The groyne must not be positioned near to, nor in front of, key stratigraphic exposures in the cliff;
- The replenished / accreted beach *must* be designed to retain a erosional relationship between the cliff face and the sea, thus enabling maintenance of a key stratigraphic exposure that supports the Integrity of the WHS;
- East Devon District Council must commit to maintaining the replenished beach at appropriate levels in the future, preventing accretion that would compromise the vertical stratigraphic exposures;
- The occasional denudation of designed / retained beach is of significant value to the WHS and therefore it should be considered as a part of the final design off the scheme
- The specific configuration of the groyne, and the possible role of a breakwater, should reflect an approach that minimises negative impacts on the integrity, attributes and setting of the WHS;
- Visual impacts and access issues should be considered at every step of design.

In addition:

- NE and JCT will collaborate in order to record the geological and palaeontological interests at East Cliff in advance of the construction of coastal defences;
- Efforts should be pursued, in partnership, to support the acquisition and/or display of important local fossils at Sidmouth Museum to help offset damage to the palaeontological interests at East Cliff.

Section E – Appendices: - Prepared by Sam Scriven

Appendix 1: Attributes for the Dorset and East Devon Coast World Heritage Site

Agreed by Steering group meeting of 26/09/12

Introduction

The Earth science interests of the Dorset and East Devon Coast World Heritage Site are recognised within the Geological Conservation Review (GCR): a UK-wide audit of the best sites of their type in Great Britain. The GCR supports the Sites of Special Scientific Interest (SSSI) that provide the legal framework to protect the coast. The Site is currently monitored through the SSSI's but by looking at the GCR sites within them uses a set of **very detailed attributes** for the Site. Furthermore, the GCR sites on this coast lie within four categories; stratigraphy, palaeontology, geomorphology and structure, and are available on request.

Attributes

1) Stratigraphy (the rock record) and structure

The property includes a near-continuous sequence of Triassic, Jurassic and Cretaceous rock exposures, representing almost the entire Mesozoic Era (between 251 and 66 million years ago), or approximately 185 million years of Earth history. Because the overall tilt or 'dip' of the rocks is gently to the east, each section of coast contains its own unique part of the story that add up to the whole; a globally significant site.

2) Palaeontological record

The property contains a diverse range of internationally important Mesozoic fossil localities, including key areas for Triassic reptiles, and for Jurassic and Cretaceous mammals, reptiles, fish and insects. These chart virtually one third of the entire evolution of complex life forms. The ammonite zonation is also important as these animals changed rapidly through time and can therefore be used to date the relative ages of the rocks and place them in a time context with other sites.

3) Geomorphological features and processes

A wide range of significant geomorphological features and processes are also represented within the property. It is renowned for its demonstration of landsliding, and of beach formation and evolution in relation to changing sea level, including raised beaches and offshore peat deposits. The coast demonstrates spectacularly how geological structure controls the evolution of bays and headlands and how erosion on a discordant and concordant coastline creates these features. There are also superb examples of the formation of caves, arches and sea stacks.

4) Ongoing scientific investigation and educational use, and role in the history of science.

The coast played a key role in the development of the Earth sciences over the last two centuries and continues to provide an outdoor classroom for teaching, and an unparalleled resource for ongoing research. The continuous rock sequence contained in the naturally eroding cliffs allows scientists to test existing theories and generate new ones. Fossils new to science continue to be found through responsible collecting efforts, and thus contribute to maintaining the OUV of this Site. The ability to study erosional processes is also important, and is also now benefiting from the application of new monitoring techniques.

5) Underlying geomorphological processes in the setting of the Site

The reasons for the form, diversity and quality of the coastal landscape are found in the underlying geology and the geomorphological processes acting on it. Much of the landscape is dominated by relic features and dates back to a time of active processes under very different climatic conditions from today. The long-term preservation of the Site's OUV depends on the maintenance of dynamic natural processes in the setting, and the awareness that processes acting in the land or sea setting may impact on the Site itself.

Appendix 2: analysis of links between Landscape Character in East Devon and the attributes of the Jurassic Coast WHS.

Landscape character type	Associations with OUV of the WHS
1B: Open coastal plateaux	Associations with OUV of the WHS
Key characteristics;	
• **High,** undulating, **open plateaux, dissected and separated by combes and river valleys.** Underlain by Permian and Triassic sandstone and mudstone in the west and limestone in the east.	Directly observable relationship between underlying geodiversity of the WHS and landscape character
• **Little woodland,** with occasional plantations and estate planting. Some **windblown vegetation.**	NA
• A relatively large scale landscape, with a **regular medium to large field pattern, dense low hedges,** containing mix of species **and occasional hedgerow oaks. Mixed land use, mainly arable.**	NA
• Semi-natural habitats include salt-tolerant coastal grassland, hedgerows, trees and verges, and wind-cropped thickets of blackthorn.	NA
• Local influence of Rousdon Estate, and a post-medieval pattern of fields and farms. Numerous former limestone quarries, particularly around Beer.	NA
• **Prehistoric archaeology** including barrows and hillforts, with a concentration of prehistoric toolmaking sites and evidence of Roman occupation on Beer Head.	Some association with ancient use of local stone and a visible relationship between ancient settlements, land use and coastal setting / landforms
• **Low settlement density,** mainly limited to scattered farms or hamlets. There are also several campsites and caravan parks.	NA
• **Few roads, but many rights of way,** including long sections of the South West Coast Path. Main roads are straight and fast along ridges. Minor roads linking combes are narrow and often sunken.	SWCP key route for accessing and enjoying the WHS

• **Variations in underlying geology are reflected in soil colour**, being red in the west and paler in the east.	Directly observable relationship between underlying geodiversity of the WHS and landscape character
• **Extensive views along coast,** often visible from South West Coast Path. Much of the LCT has a sense of openness and exposure. Context of open sky to the south and land to the north adds to the sense of place	Open views of the coast from the cliff top are an important part of experiential setting of the WHS. Sense of 'openness' and 'exposure' are intangible links to the dominance of ongoing and unconstrained coastal geomorphological processes.
Relevant landscape guidelines;	
Protect • The setting of the Jurassic Coast World Heritage Site.	Correlates directly with policy R4 of the Jurassic Coast Partnership Plan

2A: steep wooded scarp slopes	Associations with OUV of the WHS
Key characteristics;	
• **A narrow band of steeply sloping land immediately below the plateau edges.** Underlying greensand geology contains springlines.	Directly observable relationship between underlying geodiversity of the WHS and landscape character. Springlines are part of the underlying geomorphological processes in the setting of the Site, as they may feed water into the coastal landslide systems.
• Extensive woodland, both deciduous and coniferous. Trees and hedgerows increase its wooded appearance. Notable mature oak and ash trees, with beech in the north.	NA
• **Land use of mixed woodland and semi-improved or unimproved pasture. Small scale, irregular field pattern.**	NA
• **Many patches of semi-natural habitats, including springline mires, scrub,** grassland and woodland.	Biodiveisty and habitat distribution expresses relationship between underlying geodiversity visible within the WHS and wider landscape character
• Concentration of Iron Age hillforts in prominent locations. Also Roman and medieval ironworking sites, and medieval farmsteads, banks, fields and lanes.	Some association with ancient use of local stone and a visible relationship between ancient settlements, land use and coastal setting / landforms

attered farms, often nestled in folds	NA
reed banks. Lanes often run at an nes and footpaths, but much of the	NA
ded areas, and a contrast of light and aried and distinctive patterns.	NA
cularly in deciduous woodlands, nd autumn leaves.	NA
nings in trees, there are sudden and g landscapes.	views of coast from nearby scarp slopes are an important parts of experiential setting of the WHS
uch of the LCT, particularly away	Adjacent to the coast, the sense of tranquillity is an intangible link to the overtly natural state of most of the World Heritage Site.
ontrolled to allow views out.	Helps to maintain views of and into the World Heritage Site as part of its experiential setting
ent techniques to control water run-	Could affect the amount of water that enters cliff slopes as well as the rate at which it enters. Both are drivers for that landslides that are a key component of the natural coastline and WHS designation.

y Slopes	Associations with OUV of the WHS
n Greensand, below the scarp slopes ys on upper slopes**.**	NA

• **Well-treed pastoral farmland, with** some **arable cultivation on lower slopes. Small to medium-size fields with irregular boundaries.** Associated with traditional Devon smallholdings.	NA
• Rich concentration of archaeological sites from all periods, but with many surviving medieval features including field patterns, churches, farms, villages and lanes.	Some association with ancient use of local stone and a visible relationship between ancient settlements, land use and coastal setting / landforms / geodiversity
• **Wide, species-rich hedges with many hedgerow trees**. Grassland, stream and woodland habitats add to rich biodiversity.	NA
• **A dispersed settlement pattern of isolated farms and small villages**. Villages are often nucleated around a church, and contain local stone (chert) and cob buildings. Some are estate villages.	Some association with ancient use of local stone relevant to the geology of the WHS
• **Very winding narrow lanes,** many sunken with high banks and flower-rich verges.	NA
• **An intimate and intricate landscape with wider views often confined by vegetation.** Where views occur, they contain distinctive patchwork patterns of fields.	NA
• Relatively **remote and tranquil with little** obvious **modern development.**	Adjacent to the coast, the sense of tranquillity is an intangible link to the overtly natural state of most of the World Heritage Site.
• Association with the early C.20th Camden Town school of artists in Blackdown Hills.	NA
Relevant landscape guidelines;	
Plan • Develop Natural Flood Management techniques to control water run-off.	Could affect the amount of water that enters cliff slopes as well as the rate at which it enters. Both are drivers for that landslides that are a key component of the natural coastline and WHS designation.
• Retain the pattern of small-scale settlements constructed of local materials.	Retention of use of local stone relevant to the geology of the WHS is a valuable link between nature and culture.

4D: coastal slopes and combes	Associations with OUV of the WHS
Key characteristics;	
• **Multiple branching valleys that can range from narrow and steep including scarp slopes to more open shallow systems.** Underlying Beer Limestone a highly-valued material for building and carving.	Some association with ancient use of local stone relevant to the geology of the WHS
• **Broadleaved woodland, dominant in places,** particularly along valley tops and along watercourses. Occasional remnant orchards.	NA
• Mix of unenclosed woodland **and small to medium irregular fields marked by low hedgebanks.** Mainly pasture, with pockets of wet pasture and scrub.	NA
• Semi-natural habitats include grassland, woodland, scrub, wet pasture and caves.	Caves in particular are associated with natural geomorphological processes in the setting of the site and the exploitation of building stone associated with the geology of the WHS
• Long history of settlement, with surviving historic buildings, lanes and field patterns. Prehistoric and Roman finds on High Peak, landscaped as part of the Bicton Estate.	Some association with ancient use of local stone and a visible relationship between ancient settlements, land use and coastal setting / landforms / geodiversity
• **Old settlements in combes, with stone** and locally flint **as dominant building material.** Settlement pattern varies and includes dispersed and nucleated villages. Beer is an historic fishing village.	Some association with ancient use of local stone and a visible relationship between ancient settlements, land use and coastal setting / landforms / geodiversity
• **Extensive coastal rights of way** (including South West Coast Path) **with steep paths down to beaches. Narrow, winding roads and limited vehicle access to coast.**	Coastal paths are key access point to the WHS and play a key role in the experiential setting of the Site
• **Coastal influence in exposure, vegetation and extensive views. High, open and exhilarating on top slopes, grading to intimate and enclosed in lower valleys.**	Directly observable relationship between underlying geodiversity of the WHS and landscape character. Views of coast are an important part of experiential setting of the WHS
• Sense of timelessness in parts, although also awareness of traffic and tourist influences, particularly in summer.	NA

• Coastal views, with High Peak both a viewpoint and a focal point with artistic associations.	Views of coast are an important part of experiential setting of the WHS
Relevant landscape guidelines;	
Protect • The setting of the Jurassic Coast World Heritage Site.	Correlates directly with policy R4 of the Jurassic Coast Partnership Plan
• Ensure tourism development is of appropriate scale and character, and does not impact negatively on the tranquillity or views of the adjacent Cliffs LCT.	Supports the protection of views into and of the WHS and therefore its experiential setting

4H - cliffs	Associations with OUV of the WHS
Key characteristics;	
• **Steeply-sloping cliffs of varying heights, nearly vertical in places;** slopes shallower elsewhere due to landslips. **Narrow** shingle **beaches at base of cliffs.**	Constituting the WHS itself, specifically its geomorphology, and directly observable relationship between the geodiversity of the WHS and landscape character
• A dynamic landscape, with **distinctive landforms and rock stratifications** related to limestone and sandstone geology which extends inland and out to sea.	Constituting the WHS itself, specifically its stratigraphy, as well as the connection between the exposed geology and the wider landscape
• **Predominantly treeless,** although the eastern end of the study area is densely vegetated, with deciduous woodland and fern-rich groundcover.	Related to ongoing geomorphological processes within the WHS
• **Unenclosed,** with occasional surviving examples of undercliff 'platts' used for vegetable growing.	Relates to the 'open coast' quality of the WHS at large and the dominance of unconstrained coastal processes
• **Cliff faces support important breeding colonies of seabirds**, and succulent plants. Local examples of extensively vegetated slumped landslips on lower half of cliff	Important habitats are associated with landslips, and therefore associated with a aspect of the WHSs OUV
• Remains of prehistoric barrows on cliff tops, also industrial remains (e.g. limekilns) and military archaeology.	Some association with ancient use of local stone and a visible relationship between ancient settlements, land use and coastal setting / landforms / geodiversity

• **Unsettled**	Unsettled due to ongoing active coastal processes
• **Accessible only along cliff top** via South West Coast Path, **or in some places along beach.**	Coastal paths and beaches are key access points to the WHS and play a key role in the experiential setting of the Site
• **Extensive and sometimes wild, with dominant marine influence and high levels of tranquillity** and remoteness away from settlements**.**	The wild and tranquil character of the coast is an intangible expression of the overtly natural state of large parts of the World Heritage Site.
• Strong influences of weather and season, and contrasting colours of white limestone and red sandstone.	Constituting the WHS itself, specifically its exposed stratigraphy, as well as the connections between seasons and the character of coastal processes (e.g. summer calm vs winter storms)
• **Extensive and dramatic views along coastline** from cliff-top path, and associations with artists	Views of coast are an important part of experiential setting of the WHS
Relevant landscape guidelines;	
Protect	
• The undeveloped and tranquil character of much of the LCT.	Relates to the protection of intangible elements of the experiential setting of the WHS
• The Jurassic Coast World Heritage Site and the coastal processes which underpin its inscription.	Correlates directly with policy R1 of the Jurassic Coast Partnership Plan
Manage	
• Manage in accordance with the *Jurassic Coast World Heritage Site Management Plan/ Partnership Plan*.	See the Jurassic Coast Partnership Plan, available to download from www.jurassiccoast.org/partnershipplan
Plan	
• Educate the public regarding the coast's geology, geomorphology, archaeology and vegetation, but without encouraging inappropriate exploration.	Relates to one of the purposes of World Heritage status, written into the World Heritage Convention, to engage communities and provide educational programmes in order to promote positive connection with OUV and sustainable uses of a WHS.