Brighton Marina to River Adur - Ecological Design Strategy

Final Report

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Prepared for:

Brighton & Hove City Council

Brighton & Hove City Council

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Abbreviations

AEP	Annual Exceedance Probability
ADC…….	Adur District Council
BHCC……..	Brighton & Hove City Council
BNG	Biodiversity Net Gain
CVS.....	Coastal Vegetated Shingle
FCERM	Flood and Coastal Erosion Risk Management
INNS.....	Invasive Non-Native Species
LWS	Local Wildlife Site

1 Introduction

The coastal frontage between the River Adur and Brighton Marina, is at risk of flooding from wave overtopping. The total length of coastal frontage is approximately 11km with 2.15km located within the local authority of Adur District Council (ADC) and 8.85km located along the frontage within the Brighton & Hove City Council (BHCC) local authority.

There are significant erosive forces at the Shoreham end of the frontage. There is a natural drift of sediment along the South coast, Brighton included, from west to east. The supply of natural sediment (shingle beach) drift material to the western beaches of the study area (Shoreham frontage) is impeded by the mouth of the River Adur and associated training walls. Limited sediment supply, coupled with wave action, has resulted in significant erosive forces at the western end of the frontage. As a result, the residual life of the existing defences is inadequate. The coast frontage is also at risk of flooding from wave overtopping due to a combination of significant variations in defence heights and beach widths, poor maintenance and deterioration of defence assets.

The shingle beach along the frontage provides the main form of coastal defence and is controlled by a series of timber, rock, masonry and concrete groynes. Historic storm events have previously led to flooding of commercial premises and properties along Brighton seafront and on adjacent roads. Emergency repair works have been undertaken to repair breaches in seawalls and some structures, but many remain in a collapsed or partially collapsed condition. There are significant variations in defence heights and beach widths along the frontage which have resulted in a number of weak points susceptible to flooding. Deteriorated and aged assets along the frontage have resulted in a poorly controlled beach susceptible to significant storm draw down and breach risk.

The Brighton Marina to River Adur Flood and Coastal Erosion Risk Management Strategy (FCERM) has been put forward by BHCC in association with ADC. The FCERM (the Proposed Development) aims to manage risks associated with flooding and coastal erosion through implementation of a defences with a 0.5% Annual Exceedance Probability (AEP) (1 in 200 year) standard of protection for the first 15 years of the strategy. The FCERM Strategy is split into seven areas, and this is shown on Figure 1-1 below.

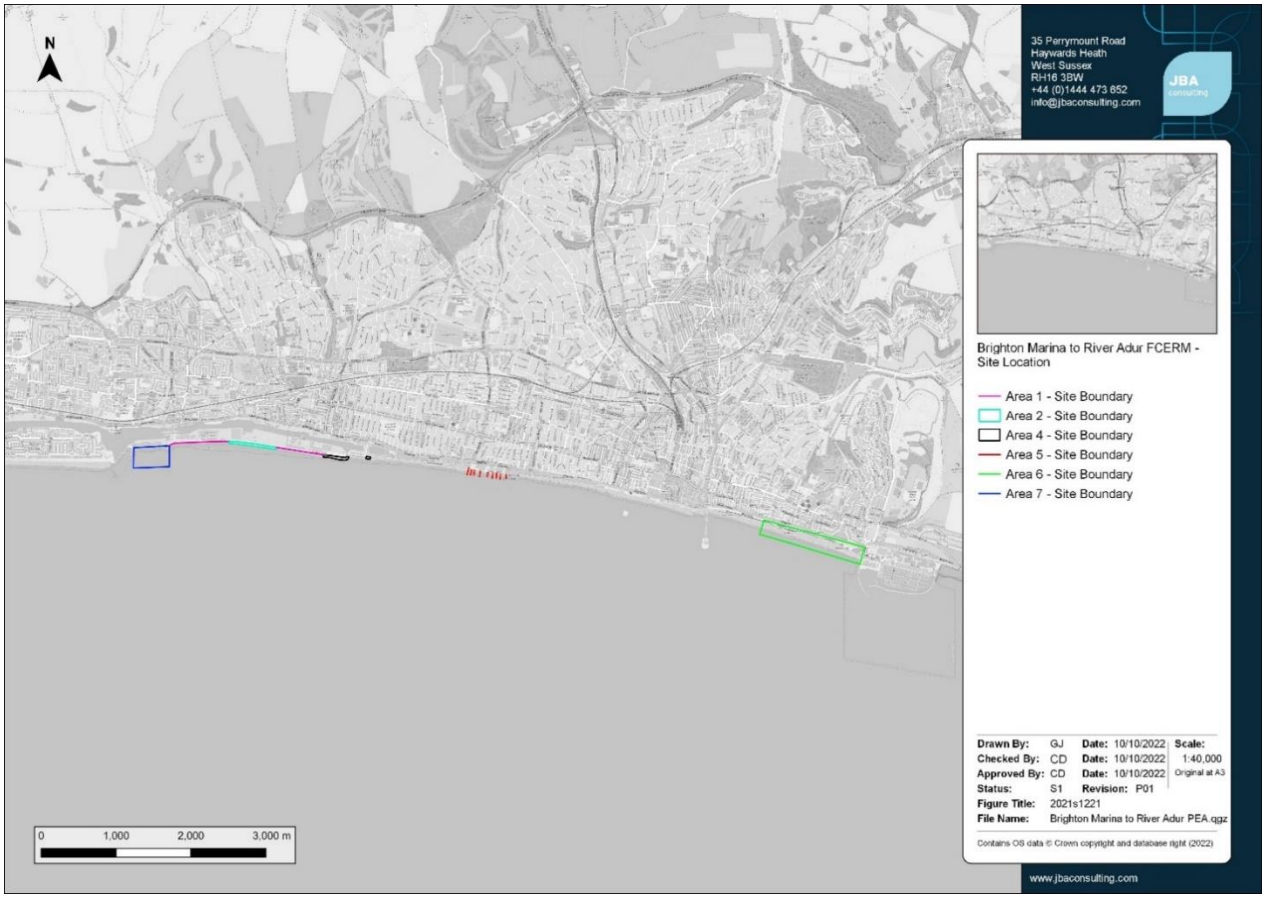


Figure 1-1: FCERM and overview of Areas 1-7

1.1 Proposed development

Planning permission is being sought for the construction of two rock armour revetments in Area 2 and Area 4, and a footpath, access steps and an access ramp in Area 2. A summary of the works proposed in each location is outlined below.

This EcIA has been undertaken to support the planning applications for these two rock revetments, along with the implementation of new footpath, access steps and ramp in Area 2. This EcIA includes assessment of the likely ecological impacts of these proposed works, and also gives consideration to the ecological impacts of the wider scheme (permitted development).

1.1.1 Section 73 Update

Planning permission was granted for Area 2 works in June 2023 by Adur District Council (AWDM/0321/23) and Area 4 works in September 2023 by Brighton and Hove City Council (BH2023/00627). However, this assessment has been updated in support of applications under Section 73 of the Town and Country Planning Act to amend the works for the Area 2a rock revetment and areas of compensatory Coastal Vegetated Shingle habitat, detailed below.

The following changes to the Area 2a rock revetment works have been made:

Change to the rock revetment crest height from 5.5m AOD to 6m AOD and the toe of the rock revetment from 3.5m AOD to 4m AOD due to the presence of the sheet pile wall.

Reduction in the length of the rock revetment at its western end by 20 metres.

Change to the alignment of the proposed footpath above the eastern end of the rock revetment. This is due to the presence of a new emergency sheet pile wall which has been installed by Shoreham Port.

The coastal vegetated shingle compensatory habitat was amended due to concerns regarding the suitability and longevity of some of the approved locations for compensatory habitat. Table 1-1 below outlines the key changes that have taken place, however the overall aim of the scheme to compensate on an 8:1 ration remains the same. Changes are also proposed to the design of the rock revetment in Area 2.

Table 1-1: Comparison of approved compensatory habitat vs proposed for the Section 73 update

Compensatory Habitat Reference	Approved Area (ha)	Proposed Area (ha)	Reason
Area 2 Enhancement	0.22	0.22	Changes to the design of the rock revetment and

Compensatory Habitat Reference	Approved Area (ha)	Proposed Area (ha)	Reason
			associated works are proposed however overall area of enhancement is the same. The design drawings have been updated to reflect this (JBA, 2024a, b and c).
Area 4 creation	0.09*	0.021	Reduced area as location is exposed and recent storm has reduced the size beach crest available.
Spending Beach	-	0.065	Introduced as no further suitable compensation sites found within BHCC and due to high potential for enhancement, being closed to the public and existing vegetation is in moderate condition.
Carats cafe	-	0.017	Added as no further suitable compensation sites found within BHCC and due to the area of beach being semi-sheltered on a

Compensatory Habitat Reference	Approved Area (ha)	Proposed Area (ha)	Reason
			raised upper section of the beach.
Totals	**0.31**	**0.32**	
*The figure in the approved EDS (May, 2023) stated this to be 0.9, however this was a typo fault and should have been 0.09.			

1.1.2 Planning permission

Adur District Council

Construction of a new rock revetment defence along central Shoreham frontage facing Basin Road in Area 2. The proposed alignment follows the seaward perimeter of the existing beach crest. Construction of a new footpath along the top of the existing sheet piles, along with a new beach access ramp and steps.

The rock revetment would span an area of approximately 740m in length, with a width range between 8.6m and 11.8m, and a height range of between 2m and 3m from toe to crest.

The footpath will be approximately 3m wide and approximately 570m long.

An access ramp will be located at the eastern end of the rock armour revetment, providing access from the carparking space to the beach. The access ramp will provide safe access for vehicles to the beach (for maintenance only), and access for pedestrians.

Two access steps will be built providing save access to the beach from the new footpath. The first access steps are located at the western extent of the new footpath, and the second access steps are located centrally along the footpath providing access to the beach between the two existing rock armour groynes, where at present, there is no safe pedestrian access.

Brighton and Hove City Council

Construction of a rock armour revetment along the seaward edge of the beach ridge, in Area 4.

A rock armour, 130m in length has been built to date, however the remaining 120m revetment (total of 250m) has been put on hold whilst additional material is being sourced. The Area 4 General Arrangement drawing (JBA, 2024f) shows the rock revetment works to date. It is the current working assumption that the remainder of 4

revetment will be completed simultaneously with the Area 2a rock revetment works. The rock armour is 10.6 to 10.9m wide and 3m from toe to crest.

Approximately 7000 ton of rocks for the revetment were imported from Lydd Ranges Sea Defence scheme (in Lydd, Kent, approximately 40 miles from the site) by road to complete the first 130m of revetment. The remaining 120m would be constructed of rock imported from another source.

1.1.3 Permitted development and further planning permission

Other works that form part of the Brighton Marina to River Adur FCERM are likely to constitute permitted development (or require a separate planning application) are as outlined below.

Adur District Council

Area 1 (permitted development): construction of new concrete upstand flood wall along the top of the existing sheet pile wall.

Area 2: patching repair to the concrete wall.

Area 7: Beach nourishment through regular recycling undertaken by BHCC.

Brighton and Hove City Council

Area 6: Beach shingle material will be obtained from Area 6 to undertake recharge for regular recycling undertaken by BHCC.

2 Methodology

2.1 Field Surveys

The following field surveys were undertaken at the site:

- Initial site walkover to inform Ground Investigation (GI) works (November 2021);
- UKHab Survey (June 2022) and updated walkover (October & November 2022).

2.2 UK Habitat Classification Survey

A UKHab survey was undertaken by Gareth James BSc QCIEEM in June 2022 and updated by Gareth James and Max Robards in October 2022, with Gareth James undertaking another walkover in November 2022. The majority of habitats on site were mapped to level 3 of the UK Habitat Classification scheme (UK Habitat Classification Working Group, 2018a) implemented using the field key (Carey & Butcher, 2018) with reference to the relevant definitions (UK Habitat Classification Working Group, 2018b).

Secondary codes were added where relevant to provide information on the management and environment relating to any particular habitat parcel. The classification was made using surveyor judgement by eye, with a species list collected for each of the main habitat parcels. No quadrats were used as assigning habitats proved straight forward. Botanical nomenclature follows Stace (2019).

2.3 Biodiversity Net Gain

This assessment has been revised as part of the Section 73 applications, and since its original approval, it is now a legal requirement to meet a minimum 10% net gain in biodiversity in the UK. However, given the original scheme has been granted approval, statutory obligations do not apply to this assessment, although there is still a requirement to provide a measurable net gain in biodiversity under policy DM37 of City Plan Part 2 (Local Plan for BHCC). Biodiversity Net Gain (BNG) was still carried out as part of the proposal however to quantify suitable enhancement effort. To keep things consistent with the original application, the Metric 3.1[1] was updated alongside this assessment. This sits alongside:

- a strengthened legal duty for public bodies to conserve and enhance biodiversity,
- new biodiversity reporting requirements for local authorities, and
- mandatory spatial strategies for nature: Local Nature Recovery Strategies or 'LNRS'.

The Biodiversity Metric 3.1 calculation tool (Natural England, 2021) was used to calculate all biodiversity losses and gains for this site, following the good practice

[1] The Biodiversity Metric 3.1 was used as this was the correct version used at the time of the approved application

principles (Baker et al., 2016) and guidelines (Baker et al., 2019). Due to the difficulties in quantifying on-site BNG for urban coastal environments where irreplaceable habitats are present and enhancement opportunities are limited to 'Greening the Grey', the outputs generated by the Biodiversity Metric indicated a biodiversity net loss of -0.32% for the project as a whole. A Biodiversity Net Gain Justification report was produced to justify why the metric is not applicable to this scheme and more appropriate compensation and enhancement measures were suggested which form the basis of this design strategy.

3 Baseline Ecological Results

3.1 Habitats

The UKHab survey undertaken by JBA Consulting in June 2022, October 2022 & November 2022 identified various habitat types within each of the different areas and these are listed below:

- g3c - Other neutral grassland
- s - Sparsely vegetated shingle
- s3b - Coastal vegetated shingle (priority habitat)
- t2h - Beach
- u1 - Built-up areas & gardens
- u1a - Open Mosaic Habitats (OMH) on previously developed land (priority habitat)
- u1b - Developed land; sealed surface
- u1b5 - Buildings
- u1e - Built linear features

Full habitat descriptions and UKHab maps can be found within the Ecological Impact Assessment for the site (JBA, 2023)

3.2 Protected Species

The following habitats present on site are known to support several protected species including:

- Breeding birds
- Wintering birds
- Fish & marine mammals
- Terrestrial Invertebrates

4 Impacts and Mitigation as a result of the proposed scheme

4.1 Summarised impacts as result of the proposed scheme

There will be ecological impacts occurring as a result of this scheme and these are listed below:

- Permanent loss of 0.03ha coastal vegetated shingle in Area 4 due to coastal defence works
- Temporary disturbance impacts to 0.07ha of fragmented poor condition coastal vegetated shingle within Area 2, during construction of a new coastal footpath.
- Permanent loss of 0.11ha of existing shingle beach (0.01ha in Area 1 and a combined total of 0.10ha in Area 2).
- The loss of coastal vegetated shingle will impact upon terrestrial invertebrate assemblages within the footprint of the scheme extents. 51 'notable' species have been recorded within 2km of the scheme extents, some of which are associated with coastal vegetated shingle and are considered likely to occur within Area 2 and Area 4.

4.2 Mitigation during construction works (Area 4)

4.2.1 Stockpile Existing Seedbank (Area 4)

A total of 0.03ha of existing coastal vegetated shingle vegetation at the Local Wildlife Site (LWS) will be lost to facilitate the placement of new rock armour within Area 4.

The rock revetment construction will be undertaken in stages and will involve the removal (excavation of shingle), deposit of geotextile material, deposit of rock and deposit of excavated material.

The first stage of the construction will be the excavation of existing coastal vegetated shingle (seedbank) from the rock armour footprint and nearby working area using an excavator down to a depth of minimum 200mm. This area will be approximately 30m long by 20m wide. Scraping of the vegetated shingle will be undertaken by a bucket mounted excavator to a depth of 200mm under ECoW supervision.

The scraped vegetated shingle and seedbank will be stockpiled (with no covering) on the upper beach (above Mean High Water Springs) adjacent to the first rock armour construction area and will be demarcated with appropriate signage to prevent damage by tracked vehicles. Construction of the rock armour revetment will then commence for the first 20m (approx.) section of the coastal defence.

Once the rock armour section is constructed, the rear of the rock crest will be backfilled with the coastal vegetated shingle stockpile under the supervision of an

ECoW. The shingle will backfill a void which will likely occur between the exiting LWS and the new rock armour. If the stockpile volume is not large enough to complete the backfill, shingle arisings from the beach will be used and then topped up with the vegetated shingle stockpile. Placement of the existing seedbank will help the LWS to become more established at its current location and the rock armour will help to reduce coastal erosion or loss of the LWS in the longer term.

The stages above will be repeated in approximately 20m wide sections of rock armour revetment until the full structure is built.

Appendix B illustrates the stages of the construction works including the indicative location of the stockpiled coastal vegetated shingle.

5 Compensation

The loss of 0.03ha of existing coastal vegetated shingle will occur as a result of placement of a new rock armour within Area 4 (Basin Road South Local Wildlife Site (LWS). In addition, creation of a new footpath will result in temporary disturbance to 0.07ha of existing poor condition coastal vegetated shingle within Area 2. The loss will be compensated at an 8:1 ratio and comprise a total of 0.33ha at four different locations across the wider site extent, These are listed below and shown on the Compensation and Enhancement Plan in Appendix A:

1. Enhancement of 0.22ha of existing poor condition (to moderate condition) of coastal vegetated shingle, within Area 2 (ADC);
2. Creation of 0.021ha of new coastal vegetated shingle in Area 2d (within BHCC);
3. Creation of 0.017ha of new coastal vegetated shingle within Area 1, near Carat's café (ADC);
4. Enhancement of 0.065ha of existing moderate condition coastal vegetated shingle (to good condition) within Area 7, Spending Beach (ADC).

The loss of coastal vegetated shingle occurs within the BHCC boundary, and every effort has been made to search for suitable areas of compensation within the same administrative boundary as the loss (BHCC). However, due to limited space and availability of suitable areas for vegetation establishment, the majority of the compensatory habitat areas fall within the neighbouring ADC administrative boundary. It is thought that the areas chosen will be more suitable for establishing coastal vegetation long term and given, will contribute to providing stepping stone habitat which is functionally linked on a landscape-scale to Area 4 where the loss occurs. The outcome will be more frequent, smaller areas of coastal vegetated shingle spread across the coastline, which maximises the limited space available and will add to dispersal functionality across a larger scale.

5.1 Justification for approach

Throughout the life cycle of this project, including the wider scheme, JBA ecologists have looked at various locations for the delivery of compensatory coastal vegetated shingle within Brighton & Hove and Adur & Worthing administrative boundaries.

The main issues surrounding the location of compensatory coastal vegetated shingle is coastal squeeze and making sure that the habitat is secured and safeguarded for 30 years and will be viably functional. The areas of shingle beach between Shoreham Harbour and Brighton Marina are all urban on the landward side of the beach, the succession of urbanisation has led to fragmented pockets of coastal vegetated shingle now occurring along this section of the Sussex coastline.

The original compensation strategy for the proposed works sought to create coastal vegetated shingle in fewer but larger areas across the coastal frontage, with the majority falling within Area 4 where the impacts occur. However, due to risks foreseen with exposure and coastal erosion, and the limited space available on the beach crest, the long-term viability of creating coastal vegetated shingle within Area 4 was seen as not viable. Therefore, further compensation areas were sought across the wide extent.

This has resulted in a greater number of scattered areas being proposed to fulfil the 8:1 ratio of compensation. However this approach may have greater benefits in providing stepping stone habitat of this important habitat across a highly urbanised coastline. The majority of compensation now falls within the Adur and Worthing administrative boundary, which is outside of the jurisdiction of BHCC, where the impacts occur. However, due to limited options and good suitability of these areas it is considered the best approach in terms of ecology functionality.

5.2 Methodology for creation of compensatory coastal vegetated shingle

5.2.1 Beach re-profiling

The creation of a natural beach profile is crucial to the establishment of shingle vegetation. A study of regeneration of vegetation (Walmsley & Davy 2001) suggested that recontoured beaches should be left to allow natural reshaping by winter storms before any attempt to plant vegetation is made. Table 5-1 below, shows the slope and sediment size best for restoring vegetation on shingle beaches, based on a natural beach profile:

Table 5-1: Slope and sediment size best for restoring vegetation on shingle beaches (Doody & Randall, 2003).

Feature	Size and range	Comment
Slope	1:100 - 1:15	Natural range of slope
Sediment size	2mm-200mm	Range of shingle used to define habitat (Randall, 1977).
Sand content	10-20% sand content	Best for vegetation establishment (Walmsley & Davy, 2001).

Beach re-profiling will be guided by a suitably qualified engineer and ecologist to ensure that the desired profile is achieved, and existing vegetation is not disturbed.

5.2.2 Brash Piles

The use of brash piles to encourage establishment of coastal vegetation has been used successfully at Dungeness and Lydd coastal vegetation sites. It is thought that they act as windbreaks which catch seeds on the wind, making them fall to the shingle where they can germinate, and secondly that the brash has a shading effect which allows more moisture to remain in the shingle for longer into summer which helps the plants to grow. Any waste material arising from removal of old timber groyne structures can be recycled and re-used to create brash piles within areas of coastal vegetated shingle.

5.2.3 Seed planting

Seeds will be used to encourage coastal vegetation to establish (sourced from Kew/Wakehurst Place). Natural coastal processes (movement of shingle beach) will allow the seeds to establish within the shingle sediment. The habitat will be fenced, and the progress of the habitat creation will be closely monitored in year 1 by the ECoW, to ensure the habitat becomes established. Where the habitat fails to regenerate and /or fails to meet the desired habitat condition, additional enhancement works which may include plug planting of whips) may be required.

The seedbank provided by Kew/Wakehurst Place will comprise native species and replicate species found along the south coast and to include the following species where suitable:

- Sea Kale
- Sea Beet
- Sea Mayweed
- Rock Samphire
- Yellow Horned Poppy
- Bittersweet
- Curled dock
- Sea Campion
- Thrift
- Herb Robert

5.2.4 Removal of silver ragwort INNS

The invasive non-native species Silver Ragwort *Senecio cineraria* will be removed from Area 7, spending beach and the wider site to enhance the existing areas of coastal vegetated shingle. Prior to removal, the distribution of this species across the site will be mapped to identify sources of colonisation and inform an appropriate extent of removal works to ensure re-colonisation does not occur. A method statement will be produced detailing the extent of removal and which eradication techniques to

use at each location. Hand pulling is the preferred option as this will eliminate potential risks associated with contamination of herbicides. If hand pulling is unsuccessful after the first year, further hand pulling will be required in Years 2 and 3, and the use of herbicide should also be considered. The method statement should be updated to reflect any changes in management. Eradication techniques are detailed on Table 5.2 below[2].

Table 5.2. Methods for controlling Silver Ragwort

Year	Method	Description and reference source	Reference
Years 1, 2, 3	Hand pulling	Hand pulling of plant and roots. All plants should be transported by an appropriate waste carrier and disposed of at a suitably licensed landfill site. Pulling should be carried out before flowering/seeding occurs (May-July) as removal after this time can result in the unintentional spreading of seed.	Smith, 2009; LCWG, 2011
Years 2 and 3 (if required)	Chemical control	Chemical control through herbicides such as Glyphosate or Clopyralid in April & September. Professional advice should be sought, and personnel should obtain relevant licenses for herbicide use. Repeated treatments may be required.	Smith, 2009; LCWG, 2011

5.2.5 Invertebrates

To prevent death or injury to rare invertebrates, sweep netting will be undertaken by a suitably qualified ecologist, immediately prior to impacting areas of existing coastal vegetated shingle, to encourage dispersal of these species into retained 'like for like' habitats (LWS coastal vegetated shingle road verge, located north of the existing lorry park).

[2] There is currently a lack of information on the removal of Silver Ragwort *Senecio cineraria*, therefore the control methods recommended in this document are largely based on generic recommendations for the removal of invasive ruderal plant species, or are intended for Common Ragwort *Jacobea vulgaris*, which has similar genetic characteristics and is therefore likely to respond similarly to herbicide.

5.3 Specific details for compensation areas

Specific compensation details for each of the four proposed compensation areas are provided in the subheadings below.

5.3.1 New Creation (Areas 1 and 4)

A total of 0.017ha of new coastal vegetated shingle in Area 1 and 0.021ha in Area 4 (existing LWS). In Area 4, the beach (above the mean high-water tide) will be re profiled, using an excavator (in accordance with methods deployed successfully at Black Rock) to create troughs to represent an undulating beach effect, which is consistent with natural coastal processes. Seeds (as detailed above) will be evenly scattered into the base of the trough of the undulating profiles in early spring or early autumn 2024.

5.3.2 Enhancement in Area 2

Ecological enhancement of 0.22ha of existing (poor condition) vegetated shingle (within Area 2, location of proposed new footpath) to moderate condition will be achieved through natural re-seeding. The same species and supplier specified above will be used, and seeds will be sown in spring to maximise the chance of natural establishment. The beach will not be re profiled at this location, and the seed mix will be evenly scattered into crevices within the existing shingle beach (above the mean water tide), and in accordance with the supplier instructions. The habitat will be fenced and closely monitored in year 1 to ensure the seed become established through natural processes. Protective fencing will be used along the footpath to facilitate natural regeneration.

This method has been selected at this location due to limited space which prevents beach reprofiling and is based upon a method which was successfully deployed on the beach at Lydd (Kent), during annual shingle recycling. Vegetated shingle successfully became established through natural regeneration (additional seeding was not required at Lydd). Conversely the results of translocation of individual mature sea kale and sea beet plants trialled within Area 1 (west of Carats Café) in late spring 2023 indicated translocation of mature individual plants was not successful with all translocated specimens dying back within days of translocation. This method was considered and subsequently discounted due to the high risk of failure.

5.3.3 Enhancement in Area 7, Spending Beach

The compensation area known as spending beach will be enhanced from moderate to good condition coastal vegetated shingle habitat.

The area currently shows signs of disturbance and nutrient enrichment and is frequented with litter. The sediment sizes here show a good diversity in range size, however, there is a lack of the small/medium-sized shingle rocks (10-50mm) The

following improvements are recommended to encourage a greater diversity of coastal plant species typical of vegetated shingle habitat.

Enhancements will include the following:

- Litter should be removed from the area during the winter period to limit disturbance to flora and fauna;
- Shingle within the range size of 10-50mm will be added to the areas of beach profile where infilling is required to encourage vegetation to establish. The aim should be to create a series of waves of mounded shingle to create a series of microclimates. The spaces between shingle become filled with organic matter and other material and improve moisture retention properties.
- The existing coastal plant species (except negative indicator species[3]) should be retained and protected where possible throughout improvement works. Drawing upon previous experience within Area 4, placement of shingle over existing plant species has been proven to work more effectively at protecting this habitat than translocating individual species.
- To avoid any disturbance to the remaining areas of coastal vegetated shingle, temporary fencing should be erected to define the working boundary.
- Plug planting and seeding of vegetation using details described above would take place after the installation of the shingle substrate to encourage a greater diversity of coastal plant species to develop.
- Where timber groynes have been removed from the beach during engineering works, these can be used to create brash piles. This is likely to have additional benefits to invertebrates which are known to be supported in the area.

5.4 Monitoring

An ECoW will be present on site throughout the works and will ensure the protection of existing habitats, and that the creation and enhancement of new coastal vegetated shingle meets the specification in terms of area cover and habitat condition. Where the seeds fail to establish, further enhancement will be required (following discussions with Wakehurst Place). The results of three methods will be closely monitored to help inform other projects.

Monitoring for BNG purposes will be carried out in accordance with timeframes specified within the Ecological Design Strategy which should be read in conjunction with this addendum. Newly created habitats will be maintained for a minimum of 30 years and monitoring in accordance with timings set out within the Ecological Design Strategy.

[3] Negative indicator species are those which indicate high nutrient enrichment or disturbance and include common nettle, bristly oxtongue, creeping thistle,

Weeding of the new shingle habitat should be undertaken regularly for the first 3 years of the scheme's creation through hand weeding.

6 Biodiversity Net Gain

6.1 Approach for Quantifying and Delivery of Biodiversity Net Gain

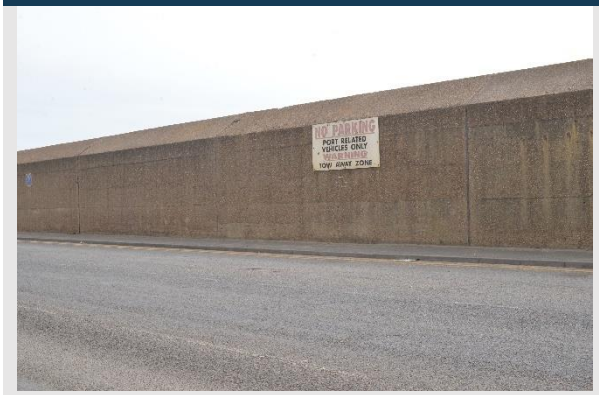
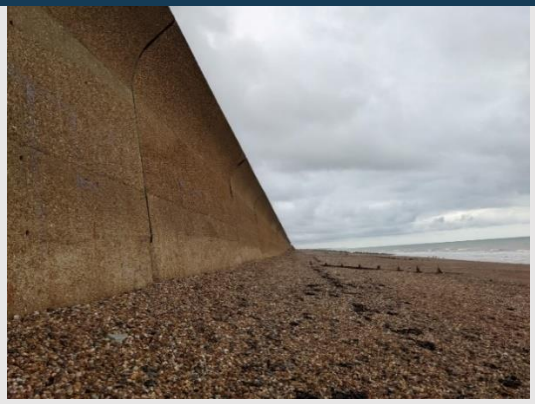
Due to the presence of intertidal and irreplaceable habitats (coastal vegetated shingle) within the project boundary, it was not possible to deliver a quantifiable biodiversity net gain (within the local area), using a Biodiversity Metric. Therefore, in accordance with Principal 6 of the Biodiversity Metric Guidance (version 3.1), biodiversity net gain will be delivered on-site and through a bespoke ecological design strategy. Habitat creation and enhancement (on-site and within an urban coastal environment landscape) and based upon the greening the grey concept will provide ecologically valuable, stepping stone habitats through the creation of a biodiversity wall, created to target an assemblage of species including: rare invertebrates, breeding birds and semi aquatic crustaceans, which are local and have been previously recorded within or immediately adjacent to the project boundary.

6.2 Current condition of existing concrete sea defence wall

An existing concrete wall (sea defence) is located along Basin Road South, which is dominated by commercial buildings and sealed surfaces in the vicinity of Shoreham Port to the north and West Hove beach and the English Channel to the south. The existing concrete sea wall currently provides no opportunities for biodiversity.

The wall is approximately 200m in length and 4m in height and proposed to be enhanced for biodiversity and based upon the 'Greening the Grey' concept (Naylor et al., 2017). A photo of both the landward and seaward side of the wall at present is shown below in Table 6-1.

Table 6-1: Condition of existing concrete wall

Current Landward Side of Wall	Current Seaward Side of Wall
	

6.3 Enhancement of existing concrete sea defence wall

To provide a biodiversity net gain (on-site) for the scheme, the existing concrete wall will be enhanced, to create a Biodiversity Wall based upon the 'Greening the Grey' concept. Due to issues surrounding vandalism and limited space on the landward side, and exposure to coastal erosion on the seaward side, bespoke planters have been designed in collaboration between ecologists, engineers, landscape ecologists and green infrastructure specialists to be integrated on the top of the new sea wall. A draft diagram of the planter is shown in Figure 6-1 below, showing the product dimensions.

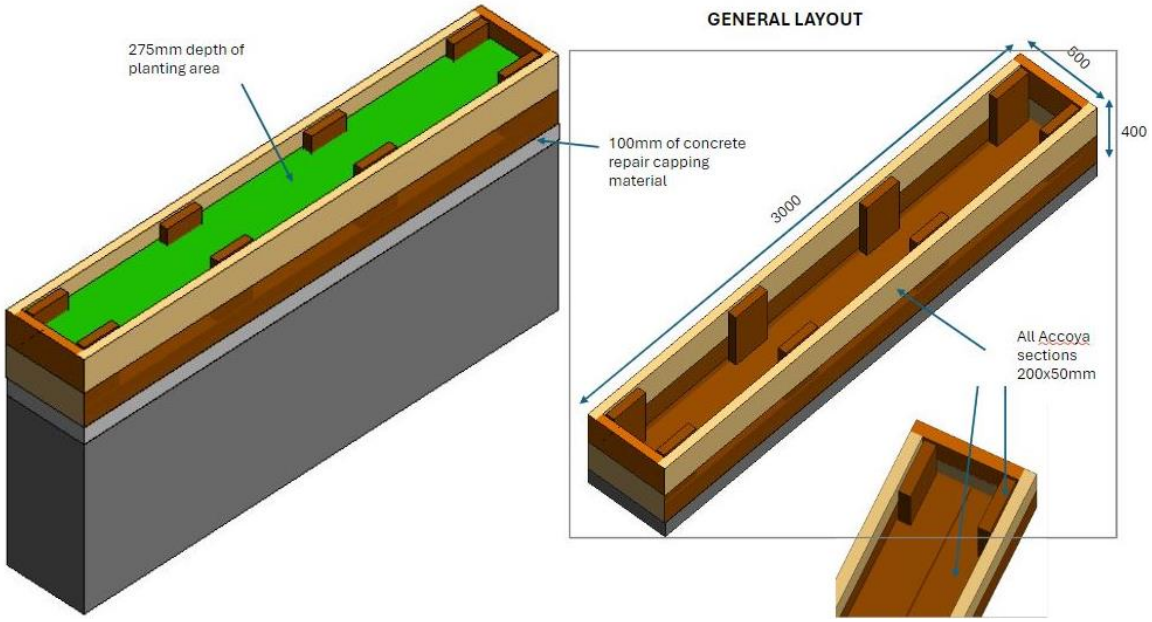


Figure 6-1. Draft design of planter to be situated on top of the sea wall.

The planters will be made from Accoya material and weepholes will be created by small diameter pipe inserts through the timber. Substrate will be added comprising recycled crushed brick with 10% recycled organic compost (cockleshell mulch). This will provide a suitable medium for locally sourced seeds of native salt tolerant species to be added, including the following species:

- Rock Samphire *Crithmum maritimum*
- Common Sea-lavender *Limonium vulgare*
- Sea Beet *Beta vulgaris var. maritima*
- Fescue grasses (various species) *Festuca spp.*
- Viper's-bugloss *Echium vulgare*
- Large-flowered Evening-primrose *Oenothera glazioviana*
- English Stonecrop *Sedum anglicum*
- Dune Pansy *Viola tricolor ssp, curtisii*

- Sea Campion *Silene uniflora*
- Additional plants species for targeted invertebrates including Ivy *Hedera helix*, and common mallow *Malva sylvestris*

The plants will attract pollinators and act as a stepping stone habitat and improve connectivity to existing habitats (coast, local gardens, parks and road verges) within the wider landscape.

A total of 138 bee bricks will be incorporated into the landward side of the wall to provide additional habitat for invertebrate species recorded on or adjacent to the site (Lyons, 2018). The bricks will be built into the wall just below the planters and spaced at two bricks per planter across the whole length of the wall. A design drawing showing the details of the planters and bee bricks is found in Appendix C. The combination of planters and bricks will help to attract the following invertebrate species:

Brown-banded Carder *Bombus humilis*, *Lixus scabricollis* (A Beetle), *Medon fusculus* (A Beetle), *Mogulones geographicus* (A Beetle), *Orthochaetes setiger* (A Beetle), Mallow Flea Beetle *Podagrica fuscicornis*, *Psilothrix viridicoerulea* (A Beetle), Five-spot Ermel *Ethmia terminella*, Viper's Bugloss (moth) *Hadena irregularis*, L-album Wainscot *Mythimna l-album*, Common Wainscot *Mythimna pallens*, Mallow Groundling *Platyedra subcinerea*, Beet Moth *Scrobipalpa ocellatella* and *Chlamydatus (Eurymerocoris) evanescens* (A True Bug).

The planter and bee brick design is shown on The location of the sea wall is shown on the Compensation and Enhancement Plan in Appendix A.

7 Maintenance & Monitoring

To ensure that mitigation, compensation, enhancement and biodiversity net gain measures are effective, and to understand the ecological value for biodiversity, ongoing monitoring of both mitigation and compensation is required.

All monitoring must be undertaken by suitably qualified and experienced ecologists. Should the monitoring visits show that the mitigation, compensation or enhancement measures are not effective, remedial action must be taken.

7.1 Habitats

A total of 0.33ha of newly created (0.04ha) and enhanced (0.29ha) of coastal vegetated shingle will be managed and monitored for 30 years post construction, and in accordance with the Biodiversity Metric 3.1 – Technical Supplement (Panks et al., 2022). Annual surveys of the created and enhanced coastal vegetated shingle and will be undertaken for the first five years post construction, and every five years thereafter, to ensure that the habitat becomes established.

The monitoring of the coastal vegetated shingle should assess:

- Vegetation composition
- Vegetation structure
- Sequence of colonisation and succession
- Habitat Condition
- Coastal processes
- Percentage cover of invasive non-native species (INNS)
- Percentage cover of scrub

All post monitoring data will be compiled into a report and made available to the local records centre. Where habitats fail to establish, remediation will be undertaken to ensure creation and enhancement of coastal vegetated shingle habitats reach the target condition score of moderate.

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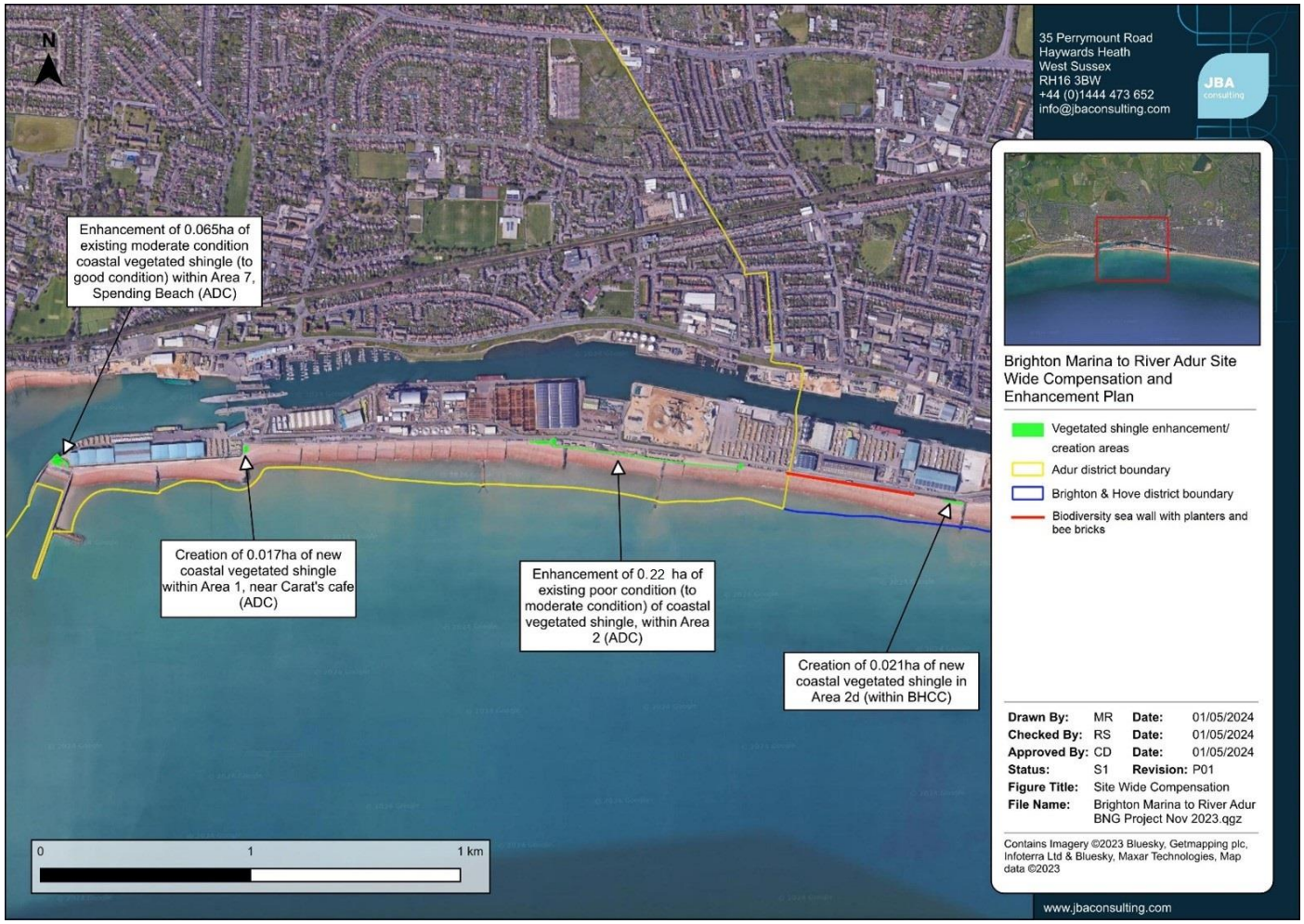
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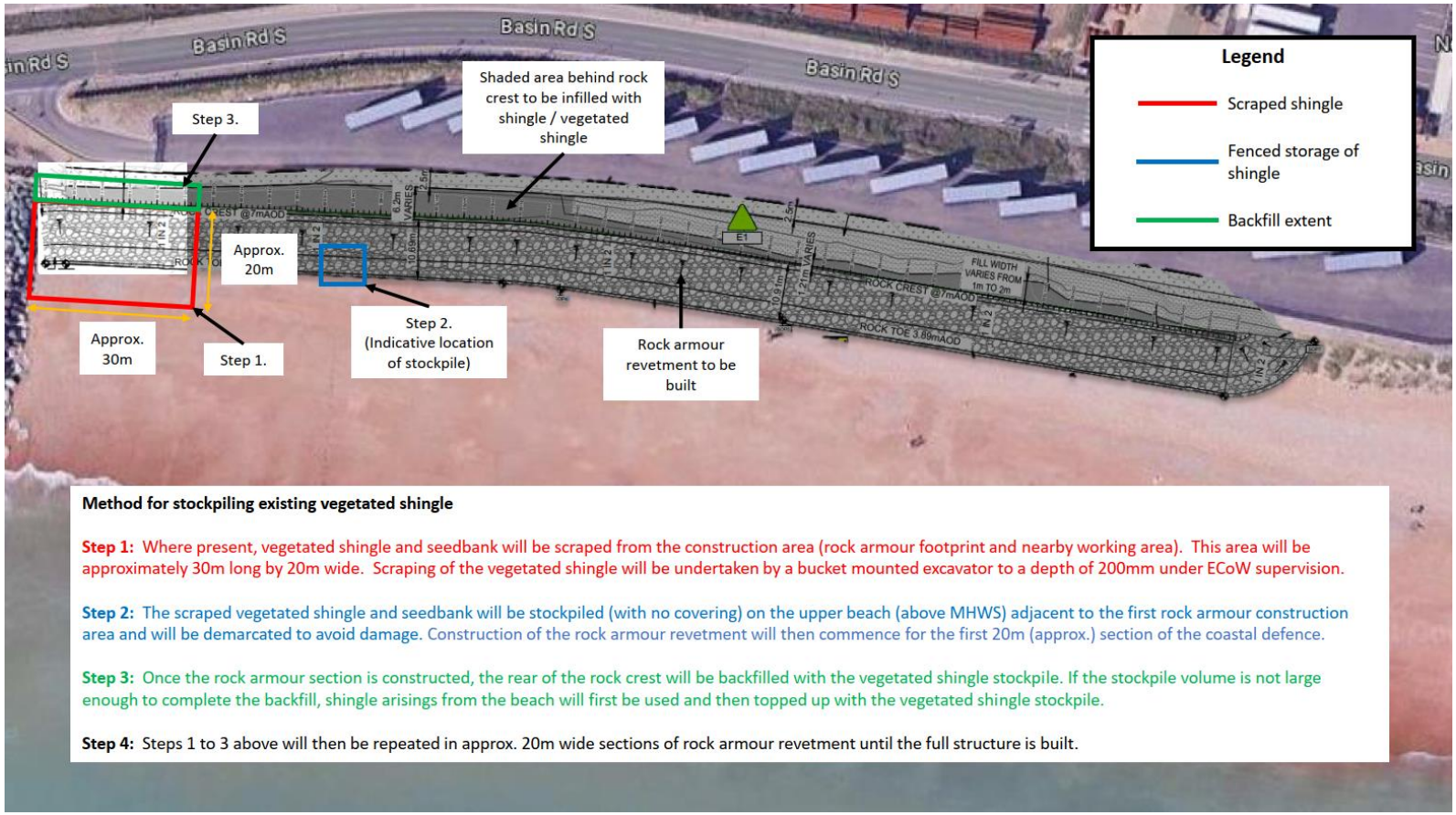
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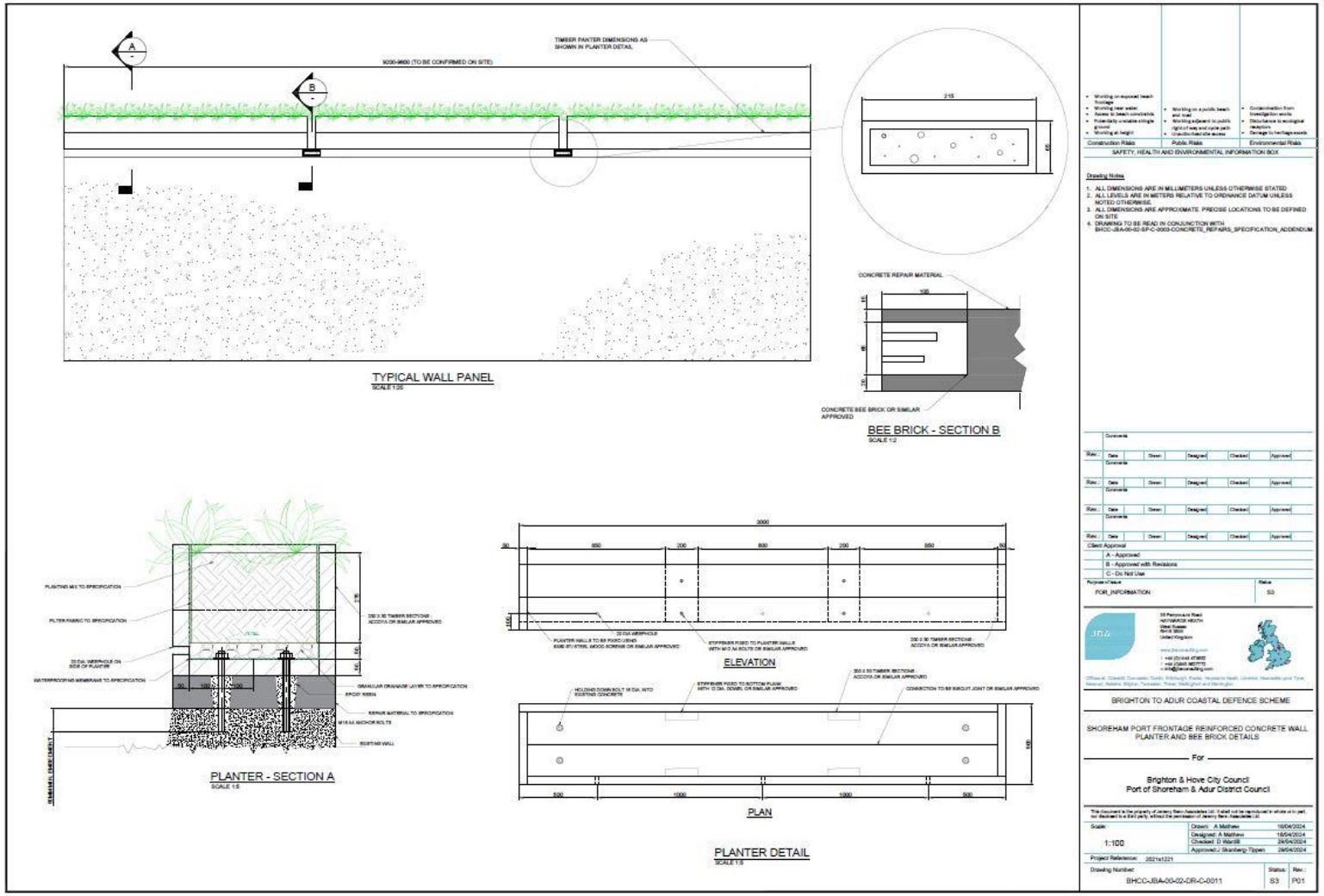
A Compensation and Enhancement Plan

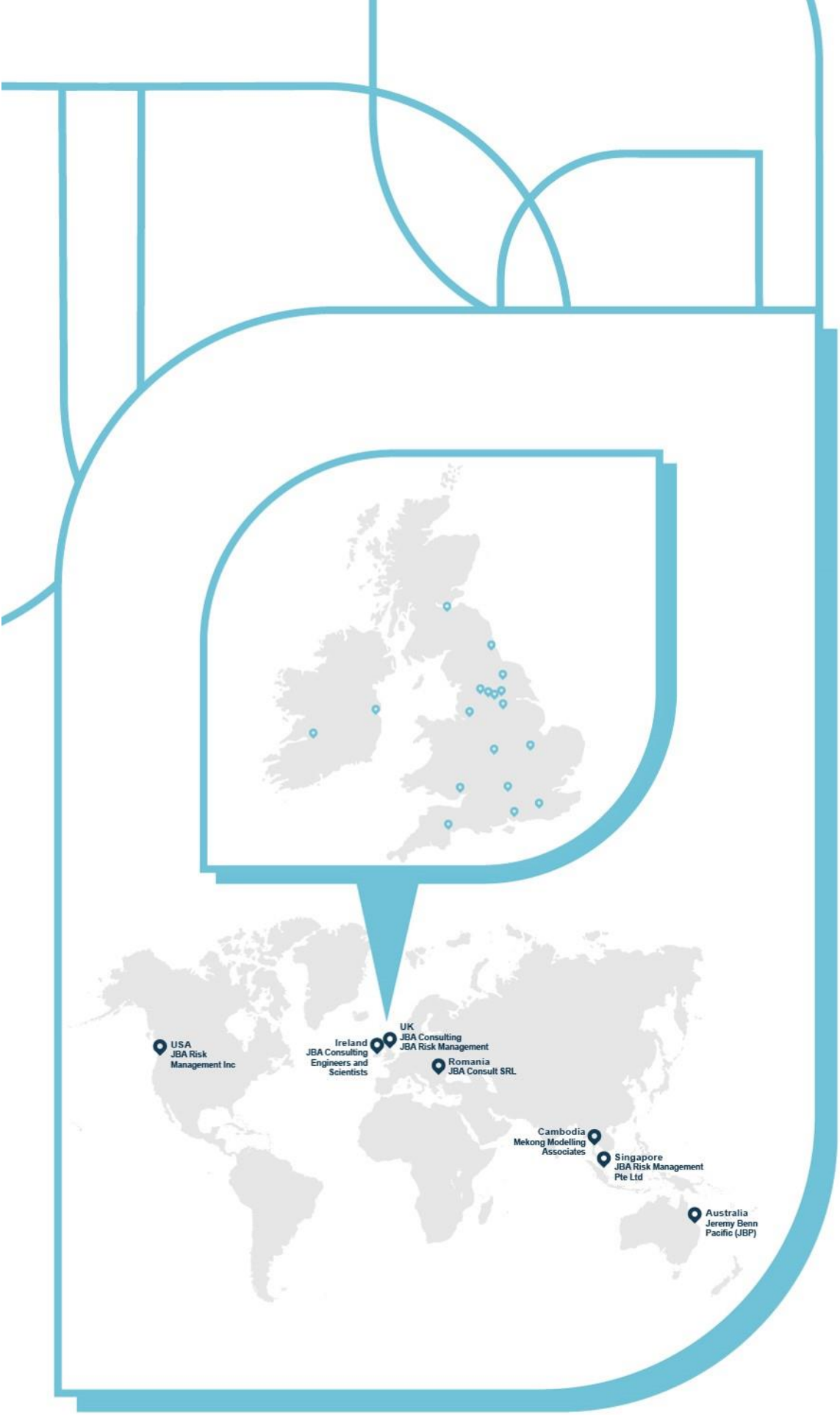


B Method for stockpiling existing coastal vegetated shingle



C Bee brick and planter design





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