Brighton Marina to River Adur - Ecological Design Strategy

Final Report

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Prepared for:

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Issued to:	Brighton & Hove City Council and Adur District Council
Prepared by	Gareth James BSc (Hons) QCIEEM Ecologist
Reviewed by	Charlie Dwight BSc CEcol MCIEEM Principal Ecologist
Authorised by	Graham Kenn BSc MSc CEng MICE CEnv MCIWEM C.WEM Project Director
JBA Project Manager	Johan Skanberg-Tippen BSc MSc
Address	35 Perrymount Road, Haywards Heath, RH16 3BW

Contract

This report describes work commissioned by Brighton & Hove City Council. The Client's representative for the contract was Charlie Poole of Brighton & Hove City Council. Charlie Dwight and Gareth James of JBA Consulting carried out this work.

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Abbreviations

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

1 Introduction

1.1 Site Description

The open coast 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 which consists of 2.15km located within the local authority of Adur District Council frontage and 8.85km located along the frontage of within the Brighton & Hove City Council 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 open 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 Brighton and Hove City Council (BHCC) in association with Adur District Council (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.

1.2 Proposed Development

The Proposed Development aims to achieve a consistent standard of protection along the frontage to reduce the risk of coastal erosion and coastal flooding through the refurbishment of existing defence assets, where required, and the construction of new

assets. Consequently, the Proposed Development will provide material benefits by reducing erosion and flood risk to people, property and the environment. This will include the provision of protection for 8 residential and 73 commercial properties (including Shoreham Sewage Pumping Station and Shoreham Power Station), and reduction in flood risk for a further six residential and eight commercial properties.

The proposed scheme entails works at six locations along the frontage, however, planning permission is being sought only for the construction of two rock armour revetments in Area 2 and Area 4, along with a footpath, access steps and a ramp in Area 2. All other proposals are considered to be permitted development.

One rock revetment would be located within Adur District and the other within Brighton and Hove. Both would be located to the south of Basin Road South.

The rock revetment within Adur (Area 2) 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 would be approximately 3m wide and approximately 545m long. The location of the access ramp and steps is to be determined.

The rock revetment within Brighton and Hove (Area 4) would span area of approximately 261m in length, with a width range between 11.8m and 9.8m, and a height range of between 2m and 3m from toe to crest.

Rocks used for the revetment (approximately 15,000 tonnes) would be delivered from the Lydd Ranges Sea Defence scheme (in Lydd, Kent, approximately 40 miles from the site) by barge or road to be used for the proposed development.

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 4 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

Under the Environment Act 2021, all planning permissions granted in England (with a few exemptions) will have to deliver at least 10% biodiversity net gain from an as yet unconfirmed date, expected to be in November 2023. Biodiversity Net Gain (BNG) will be measured using Defra's Biodiversity Metric (version 3.1 at the time of assessment) and habitats will need to be secured for at least 30 years. 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 principles (Baker et al., 2016) and guidelines (Baker et al., 2019). Increase in habitat units is achieved through compensation and enhancement measures.

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 on Previously Developed Land (priority habitat)
- u1b - Developed Land; Sealed Surface
- u1b5 - Buildings
- u1e - Built Linear Features

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 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.

5 Compensation

5.1 Creation of compensatory coastal vegetated shingle

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 at the following locations:

- Creation of 0.9ha of new coastal vegetated shingle, located to the west of Basin Road South LWS (within BHCC)
- Enhancement of 0.22ha of existing poor condition (to moderate condition) of coastal vegetated shingle, within Area 2

5.2 Methodology for creation of compensatory coastal vegetated shingle

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. This is applicable to the two areas of creation of compensatory coastal vegetated shingle for this scheme. 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).

The creation and enhancement of coastal vegetated shingle adjacent to Basin Road South LWS (Area 4) and within Area 2 (area of new footpath) will aim to create a stable area of shingle on the crest of the beach to minimise chances of erosion and displacement of the created habitat. Following the crest of the beach being stabilised,

trenches will be dug and the seedbank of existing coastal vegetated shingle in Area 4 will be taken from and placed into the created trenches and left to recolonise naturally. It is intended that seeds will also be sourced from the Millennium Seedbank at Wakehurst Place in West Sussex. Any plants sourced will be native and appropriate to the coastal locality and sourced locally and will include rare invertebrate larval food plant species (recorded on or adjacent to the site).

The created habitat in both areas will also be fenced to prevent damage from human disturbance. Creation of costal vegetated shingle including new planting will be carried out in spring. The newly created habitats will be monitored and where die back is observed, additional planting may be required, until the desired area and a habitat condition of moderate is achieved. Using a combination of natural seedbank taken from Area 4 and new plants (using locally sourced native species) grown at Wakehurst Place, will provide a better chance of the habitat becoming established.

6 Biodiversity Net Gain

6.1 Approach for Quantifying and Delivery of Biodiversity Net Gain

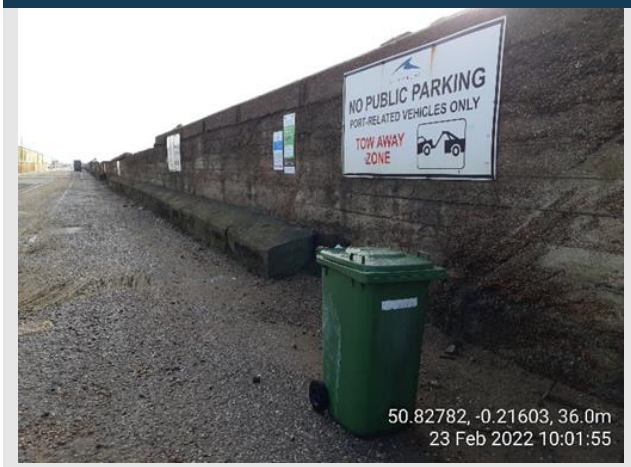
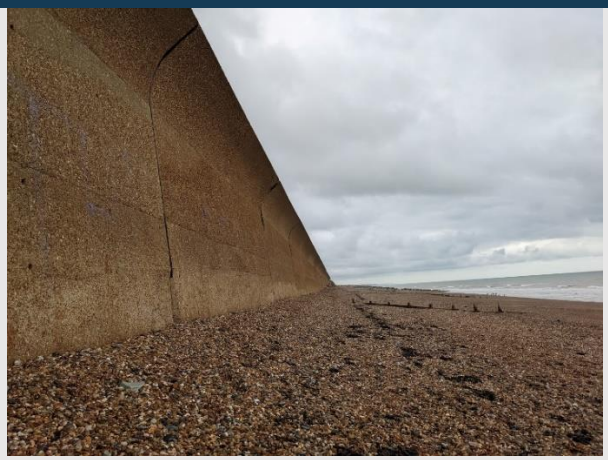
Due to the presence of intertidal and irreplaceable habitats (coastal vegetated shingle) within the project boundary, it was not possible to deliver a quantifiable biodiversity net gain (within the local area), using a Biodiversity Metric. Therefore, in accordance with Principal 6 of the Biodiversity Metric Guidance, 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. The wall will contain an integrated (solar powered) natural rainwater capture irrigation system. Habitat creation features created on both the landward and seaward sides of the wall will provide habitats for a range of species.

The landward (north facing) side of the wall will incorporate four shade tolerant native planted cassettes, including the larval food plants of rare invertebrate species, recorded on or adjacent to the site (Lyons, 2018): 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).

A range of bird nest boxes and bug hotels (refer Appendix A) will be incorporated into the landward side of the wall to provide additional habitat.

The seaward side of the Biodiversity Wall will incorporate eight planters, made from old, recycled timber groynes. These structures will be fixed to the existing concrete wall at the base and planted with locally sourced native salt tolerant species including:

- 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

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. The creation of artificial features (see Figure B-1) will be fixed onto the base of the timber planters, to enable collection of sediment and provide habitats for semi aquatic species including seaweeds, bivalves and shellfish.

The Biodiversity Wall will be subject to detailed design which will be submitted for the approval of the local planning authority, and prior to creation.

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 0.30ha of newly created (0.09ha) and enhanced (0.22ha) 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.

7.2 Research and Post Monitoring: Biodiversity Wall

It is proposed that research and monitoring will be undertaken with the University of Brighton. The project team will develop a research project which will collect biological data from the Biodiversity Wall to enable an assessment of the walls value for biodiversity. It is recommended that the following data is collected to enable statistical analysis:

- Plants – species composition, percentage cover and overall habitat condition/structure
- Invertebrates – species, distribution and preferred habitat type or feature

- Birds – species, usage (nesting)
- Intertidal and marine – species, percentage cover, preferred habitat features

Baseline data will be collected in year 0 (pre-intervention/control) and for five consecutive years post intervention (post construction) and data will be analysed to determine how species diversity, composition and distribution occurs overtime, and identify potential correlations between species diversity, and preferred habitat features associated with both the landward and seaward sides of the Biodiversity Wall.

Results from the study will be shared with the local records centre and presented within a scientific publication to help inform future projects.

Outline and Full detailed design will be developed at a later date to include detailed information on a planting list, natural integrated irrigation system, and the provision and approximate location of artificial habitats and features.

A Examples of items that could be included on the landward side of the Biodiversity Wall

A.1 Cassette Planter

An example of a cassette planter which will be incorporated into the landward side of the Biodiversity Wall.

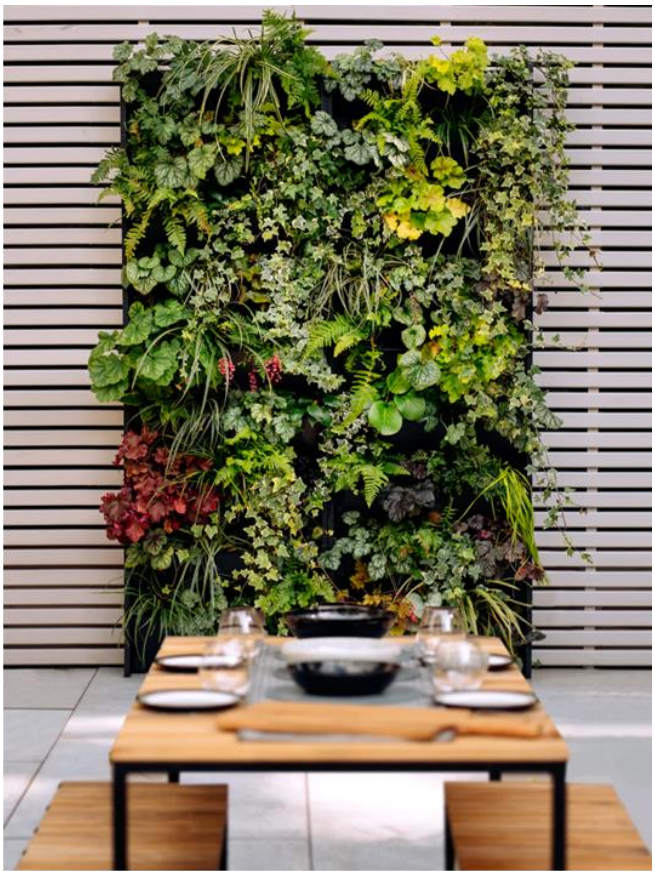


Figure A-1: Example of cassette planter

A.2 Bird Boxes

There is a population of the red-listed House Sparrow *Passer domesticus* within the vicinity of Shoreham Port. Monitoring of this species in the UK suggests that there has been a severe decline in the UK population, with an estimated 71% decline between 1977 and 2008 in both rural and urban populations (RSPB, 2023). The proposed provision of nest boxes for birds incorporated into the Biodiversity Wall will benefit House Sparrow as well as other birds using the area. Below are some examples of bird boxes which could be incorporated into/mounted to the Biodiversity Wall following completion of detailed design.



Figure A-2: Build-in Bird Box

The build-in bird box is a compact bird box and is designed to be built into a construction with standard bricks as it has a width of just half a brick, and height of a full length. The design of the box allows it to sit flush with the other bricks with a small lip protruding at the top to act as a weather shelter, preventing rain from entering the box. It is made of polymer concrete which is completely freeze and thaw resistant which offers a long lifespan. The front panel is removable to allow for maintenance and surveying. If this box cannot be incorporated into the wall, it also offers two holes on the back plate for external mounting, if necessary, as part of the creation of the Biodiversity Wall (NHBS, 2023). The entrance is approx. 28mm which and is suitable for species such as Blue Tit *Cyanistes caeruleus* & Great Tit *Parus major* both of which are likely to be present in the wider area and could take up residency if implemented into the wall.

Another bird box that could be incorporated into the Biodiversity Wall is the sparrow terrace nest box. These boxes are made from sustainable FSC® certified timber and have excellent insulation properties. This makes them warm in winter and cool in summer. These boxes are carefully designed with the correct dimensions and ventilation and don't offer perches for intruders to grip onto and threaten the occupants. The entrance hole is 32mm and is suitable for species likely to be present in the vicinity including House Sparrow and Great Tit (RSPB, 2023).



Figure A-3: RSPB sparrow terrace nest box

Another nest box which could be incorporated into the wall is the WoodStone Build-in Open Nest Box. This is intended to be built into walls to provide nesting cavities. for species such as Black Redstart *Phoenicurus ochruros* which has historically bred in the vicinity of Shoreham Port. This box will also support species such as Robin *Erithacus rubecula*. The box is constructed from FSC certified WoodStone and the nest box will not deteriorate like a traditional wooden nest box (NHBS, 2023).



Figure A-4: WoodStone Build-in Open Nest Box

A.3 Bug Hotels

One of the key focuses behind the Biodiversity Wall is targeting rare terrestrial invertebrates recorded on or adjacent to the scheme through the planting of larval food plants and also attracting pollinators. Below are some examples which could be incorporated into/mounted to the Biodiversity Wall following completion of detailed design.



Figure A-5: Solitary Beehive

The solitary beehive is manufactured from durable FSC timber and provides valuable habitat for bees in modern gardens. The beehive is great for education and can be easily dismantled to see the formation of small cells and where eggs have been laid which is ideal for monitoring purposes. It should be cited in a visible and warm place. It should be oriented to face between southeast and south and to catch some sun (NHBS, 2023).

As well as the solitary beehive, the Biodiversity Wall could also incorporate insect towers. The Insect Tower would provide valuable habitat on the landward side of the wall for solitary bees and other invertebrates. The nesting tubes are ideal for solitary bees to build their nests in whilst the vertical slots are designed to encourage butterflies. Other refuges implemented within the tower are perfect for ladybirds and lacewings (NHBS, 2023).



Figure. A-6: Insect Tower

A.4 Fixing plants and irrigation of the Biodiversity Wall

The final design of the Biodiversity Wall at present is still under consideration. Plants will be fixed to the wall and the design will be subject to consultation with botanical and green wall specialists. The integrated irrigation system will be broadly based upon the natural recycling of rainwater through the use of guttering and a drip system and potentially solar panel to enable a pump.

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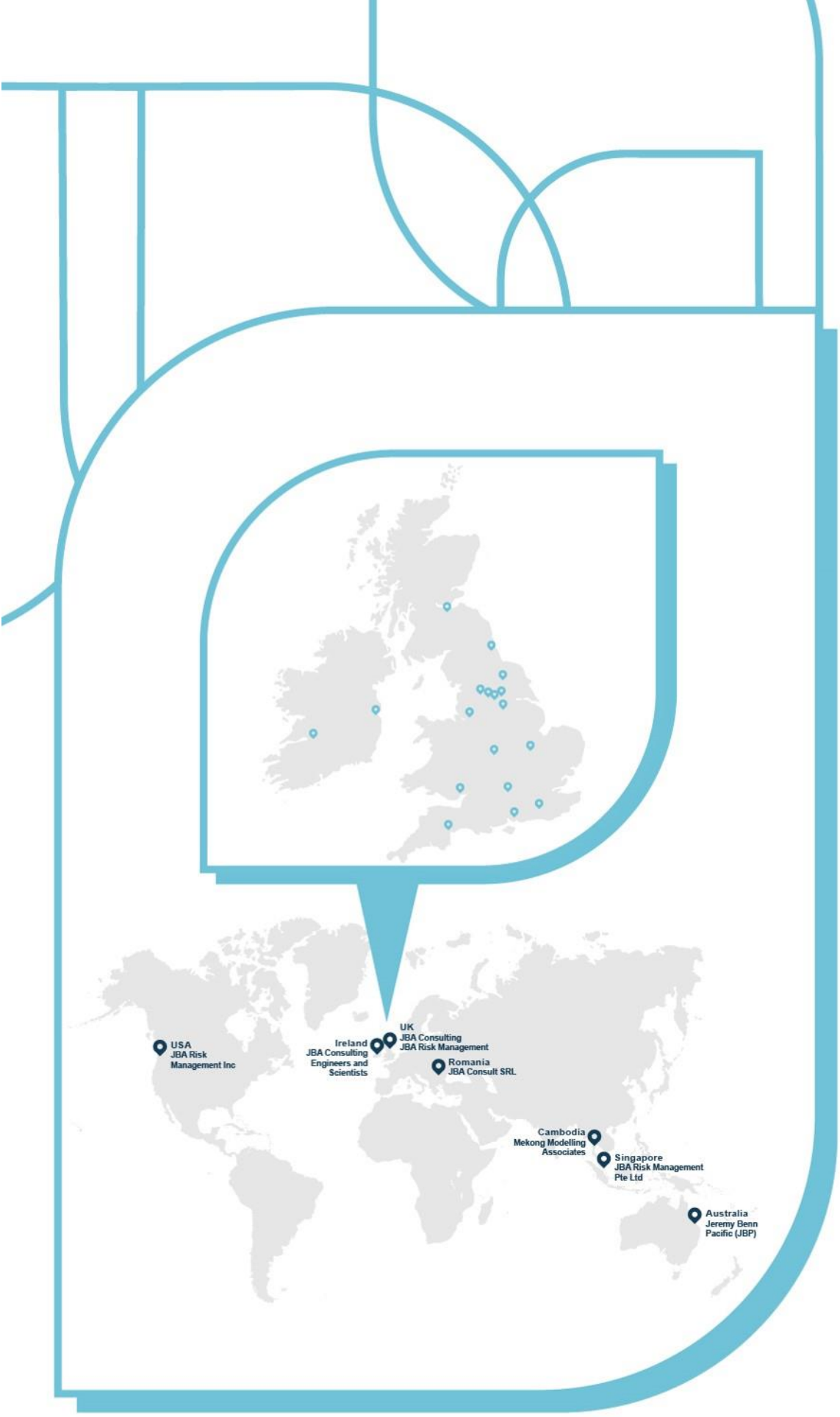
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