

# Twyford Embankment - Environmental Setting and Site Design

Waste Recovery Permit Application

EKFB Joint Venture

JER9490  
Twyford Embankment -  
Environmental Setting and  
Site Design  
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25 June 2024

## Quality Management

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- Appendix D** Conceptual Site Model

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# 1 INTRODUCTION

- 1.1.1 This report has been prepared to support an application for a bespoke Environmental Permit for the deposit of waste for recovery to develop Twyford Embankment, Portway Road, Twyford, Buckinghamshire, MK18 4EB.
- 1.1.2 The application is being made by Eiffage Kier Ferroviaire BAM (EKFB) joint venture.
- 1.1.3 In producing this report, reference has been made to the EA Guidance “What to include in your environmental setting and site design report”.<sup>1</sup>

## 1.2 Background

- 1.2.1 HS2 is Britain’s new high speed rail line being built from London to the North-West. The route of the rail line will intercept some historic landfill sites, including the Finmere Quarry landfill, which will require the excavation and removal of a proportion of the deposited waste. As part of the required mitigation for the scheme, a number of landscape bunds need to be formed, including the landscaping bund at the Twyford Embankment section of the development. Suitable waste from the Finmere historic landfill site is to be used to form the landscape bund and will be placed using a deposit for recovery permit.
- 1.2.2 Basic pre-application discussions have been held with the EA national permitting team (Pre-Application Reference: EPR/LB3404MV/A001) The advice received is that the proposed activities require a bespoke Waste Recovery Permit to progress.
- 1.2.3 A Nature and Heritage Conservation Screening Report was also obtained from the EA to identify protected species and habitats within relevant screening distances. A Receptor Plan is included in Appendix B to the Supporting Information Document.

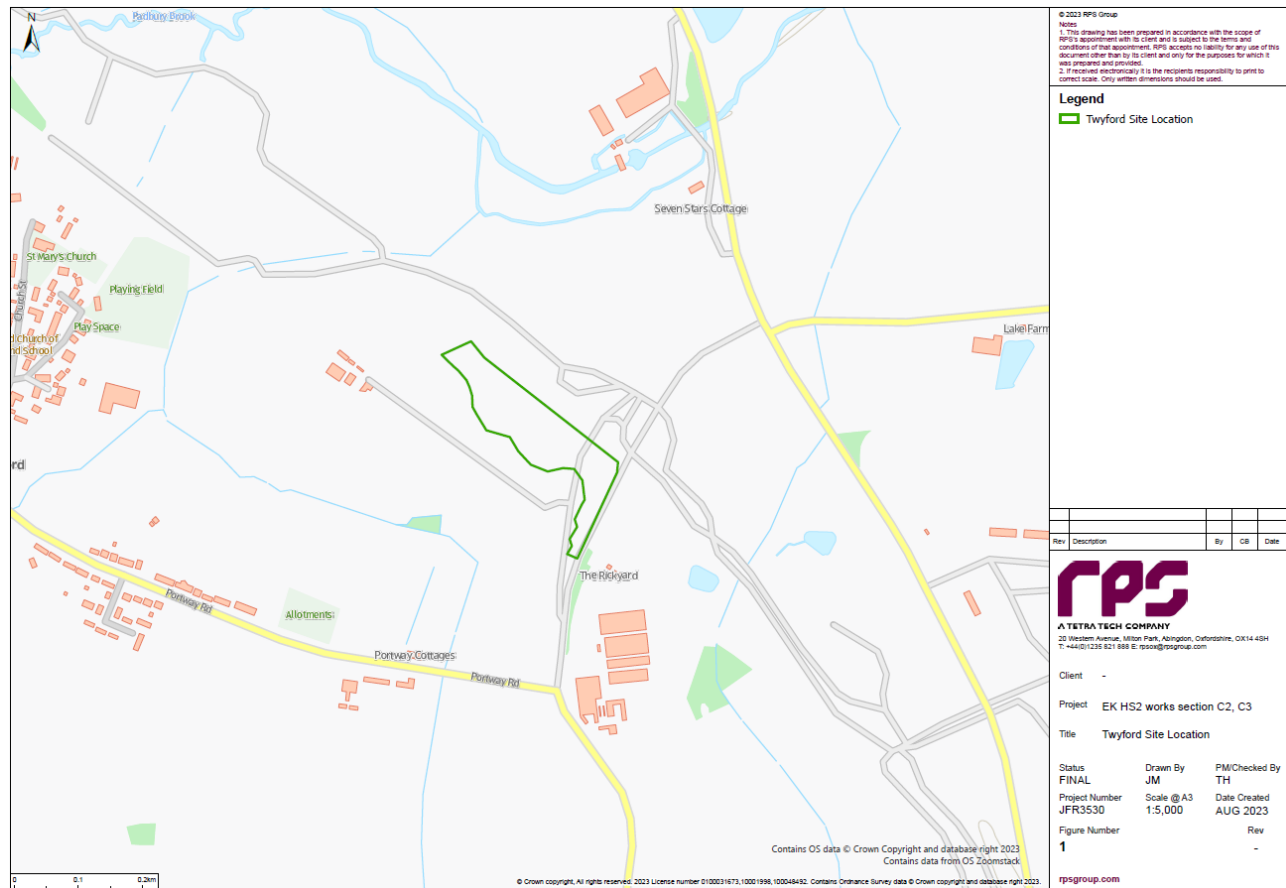
## 1.3 Site details

- 1.3.1 The site lies in a largely open and rural location approximately 150m from Twyford. The centre of the site is at approximate grid reference SP 67282 26395. The site address is:  
Portway Road, Twyford,  
Buckinghamshire,  
MK 18 4EB
- 1.3.2 The site location is shown in Figure 1.1, below, and a copy is included in Appendix B to the Supporting Information report.
- 1.3.3 The site lies approximately 500m east of the village of Twyford. It is immediately surrounded by fields that are associated with agriculture.
- 1.3.4 The earliest historical maps date back to 1880, when the site appears to be entirely used as farmland. In 1900 the Grand Central Railway is shown cutting through the southern tip of the site and, from 1982, a sewage treatment works is shown immediately to the west of the site. Otherwise, the site appears to have remained as farmland.

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<sup>1</sup> <https://www.gov.uk/guidance/landfill-operators-environmental-permits/what-to-include-in-your-environmental-setting-and-site-design-report>

**Figure 1-1: Site Location**



- 1.3.1 There are no Sites of Special Scientific Interest (SSSI), Special Protections Areas (SPAs), Special Areas of Conservations (SACs) or Ramsar sites within 2km of the site.
- 1.3.2 The EA nature and heritage conservation screening report (EPR/HP3524SS/P001) indicates that there is a single protected species within the screening distance of 500m of the site, as shown in Table 1-1 below:

**Table 1-1: Protected Species**

| Protected Species     | Screening Distance (m) |
|-----------------------|------------------------|
| Bullhead Cottus Gobio | Up to 500 m            |

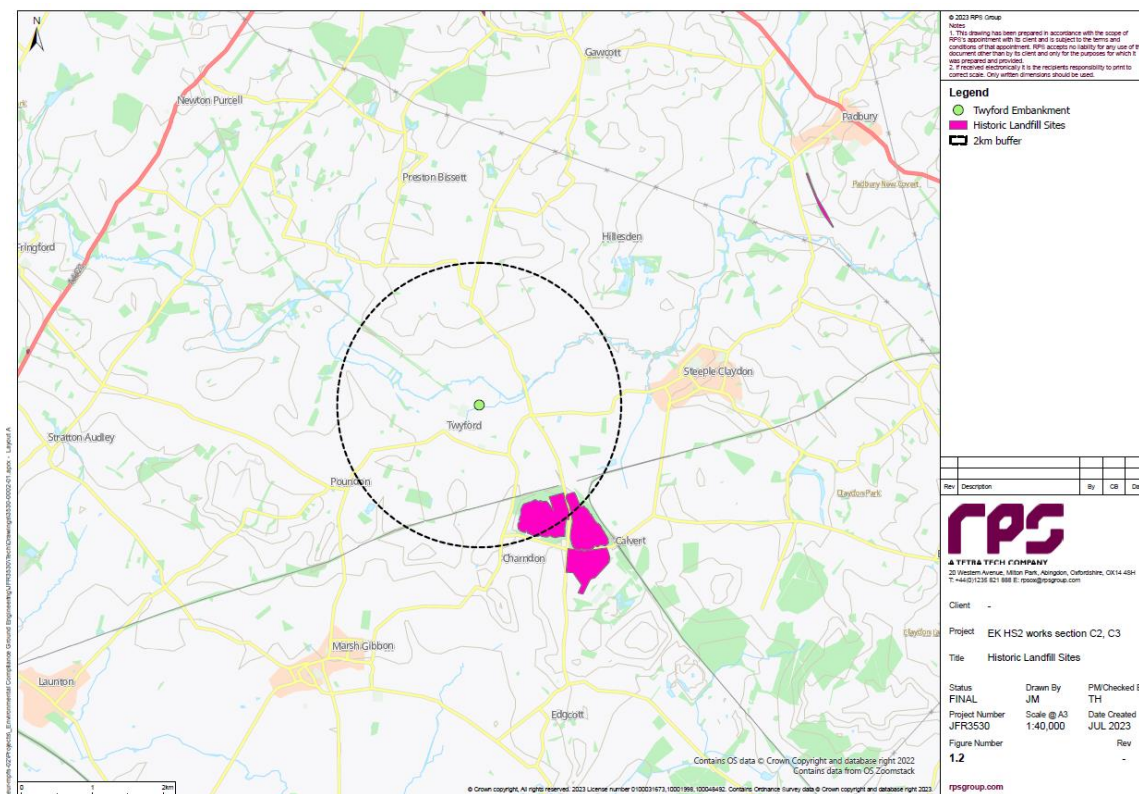
- 1.3.3 The Conservation Screening Report is included in Appendix B to the Environmental Risk Assessment (Appendix C of the Permit Application Supporting Information).
- 1.3.4 The following habitat designations lie within a 500 m screening distance:

**Table 1-2: Habitat Designations**

| Habitat Designation | Distance from site |
|---------------------|--------------------|
| Deciduous woodland  | 154m SE            |
| Deciduous woodland  | 156m SE            |
| Deciduous woodland  | 244m SE            |

- 1.3.5 The closest designated environmental receptor indicated by the Groundsure Report (reference: GS-8TS-SSR-FCP-MAQ) purchased for the site is a designated ancient woodland 1306 m to the north of the site.
- 1.3.6 An environmental receptor plan is included within Appendix C of this report.
- 1.3.7 The DEFRA data services platform<sup>2</sup> has been reviewed for historic landfills and it has been confirmed that there are a number of historic areas of landfill to the south of the site as shown in Figure 1-2 below.

**Figure 1-2: Historic Landfill Sites**



## Topography

- 1.3.8 Twyford Embankment crosses an area of open fields across a generally flat landform.

## 1.4 Site Development

### Historical Development

- 1.4.1 As stated above, the Grand Central Railway is the only industrial use of the site shown in historical maps.
- 1.4.2 Nearby Land uses identified are:

<sup>2</sup> <https://environment.data.gov.uk/DefraDataDownload/?mapService=EA/HistoricLandfill&Mode=satial>

- A sewage treatment works, approximately 15m NW of the site boundary, shown on maps from 1982 onwards.
- Unspecified pits associated with a farm 125m W of the site boundary, shown on maps between 1900 and 1982.
- Mills to the north of the site, at a distance of 322 to 346m, marked on maps from 1880 to 1982.
- Unspecified works 349m SW of the site, shown on the 1982 map.

1.4.3 There are no historical tanks recorded within 500m of the site.

1.4.4 There is no active, recently closed or historical landfill within 500m of the site. There are no active, recently closed or historical waste sites within 500m of the site.

1.4.5 The Groundsure Report identified that there is a single waste exemption registered at the site which is for the spreading of plant matter to confer benefit. However, upon searching the Environment Agency register there is no record of this exemption.

## Proposed Development

1.4.6 The site has been acquired for the route of the HS2 high speed rail line from London to Birmingham. At Twyford Embankment a landscape bund is to be constructed to mitigate against the visual impacts caused by an acoustic barrier designed to reduce noise impacts from the rail line.

1.4.7 Suitable waste excavated from the Finmere Quarry landfill site, and screened/treated prior to use, is to be used in the construction of the landscape bund. The construction using waste material constitutes a deposition for recovery activity. The landscape bund will be constructed of both treated waste and natural materials (high plasticity class 2 and 4 Oxford Clay). The treated waste will be re-used within the southern section of the bund.

1.4.8 In total, approximately 40,000 m<sup>3</sup> of waste will be used to form the embankment. The construction using waste material constitutes a recovery activity.

1.4.9 The waste material will be placed in a layer 100mm – 200mm thick and rolled in position. Non-waste is also being used in the construction of the embankment and will comprise approximately 90% of the bund's material with waste material being recovered to make up the further 10%.

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## 2 PATHWAY AND RECEPTOR

### 2.1 Geology<sup>3</sup>

- 2.1.1 Ground investigations and published geology specific to the site indicate this section of the HS2 route to be underlain by the following geological stratigraphy.
- 2.1.2 Artificial Ground is not mapped within the site. Made Ground is present associated with the Great Central Railway and Sewage works adjacent or nearby to the site. Investigations confirmed the presence of Made Ground (approximately 2m thick) at one location in the south-west near to the dismantled railway.
- 2.1.3 Superficial geology beneath this section of the route is mapped as River Terrace Deposits (Undifferentiated) sand and gravel, underlying the northern half of the site only. Alluvium is mapped off site to the north and south, associated with the nearby surface watercourses. River Terrace Deposits were not recorded on site from previous investigations, although it was recorded off site to the north-west. Alluvium was recorded to be present on site from previous investigations, however it has been considered that this may have been incorrectly logged weathered Oxford Clay, owing to their similar composition.
- 2.1.4 The bedrock geology of the site comprises firm to stiff clays of Oxford Clay Formation (typically 4.5 to 8.0m thick) across the entire site, underlain by clayey sand and gravels and stiff clays of the Kellaways Formation (about 5.5m thick). This is underlain sequentially by the Cornbrash, Forest Marble and White Limestone Formations of the Great Oolite Group, with a combine thickness of over 12m, although not proven in this area.
- 2.1.5 The Alluvium and Oxford Clay have high plasticity and low permeability, The combined thickness of the two units ranges between 2.0m to 9.0m.

### 2.2 Hydrology

- 2.2.1 Two water courses are recorded within the vicinity of the site; an unnamed tributary of Padbury Brook located 200m northwest of the site, and Portway Stream located 200m southeast. Both watercourses are considered to be receptors, however they are also proposed to be partially diverted by the HS2 scheme, with culverts beneath the Twyford embankment, and will therefore be lined. HS2 constructed catchment ponds are located within the vicinity of the site, with the nearest located 85m west.

#### Surface Water Abstractions

- 2.2.2 There is no historical surface water abstraction within 2,000m of the site.

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<sup>3</sup> Twyford Viaduct to Barton Hartshorn Embankment: Hydrogeological Appraisal Report 1MC06-CEK-EV-REP-CS06\_CL10-000026

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## Flooding

- 2.2.3 The EA flood risk maps<sup>4</sup> have been consulted and it is shown that the site is located in flood zone 1, an area with a low probability of flooding. The Groundsure report gives the highest risk of on-site flooding as a 1 in 30-year event leading to 0.1m to 0.3m.
- 2.2.4 The Groundsure Report indicates no record of historical flood events within 250m of the site. The Groundsure report gives the highest risk of flooding within 50m of the site as a 1 in 30-year event leading to 0.3m to 1.0m.
- 2.2.5 The highest risk of groundwater flooding on-site and within 50m of the site is Low, according to the Groundsure report.
- 2.2.6 HS2-constructed catchment ponds are located within the vicinity of the Site. Flood catchment ponds and compensation areas have been put in place for track drainage and to prevent flooding due to HS2 structures impacting the local hydrology.

## 2.3 Hydrogeology

- 2.3.1 The superficial River Terrace Deposits mapped across the north of the site, but encountered only locally off site, are classified as a Secondary A Aquifer, where intergranular flow will occur locally. However, it is considered that groundwater present within the River Terrace Deposits is perched on top of the underlying Oxford Clay and is not representative of a continuous groundwater table.
- 2.3.2 Alluvium present on and off-site is also classified as a Secondary A Aquifer, however based upon the investigation information the Alluvium and Oxford Clay, which is classified as Unproductive Strata, are indicated to be dominated by cohesive soils with limited and discontinuous pockets of granular soils, and are considered to act generally as a combined low permeability unit underlying the site.
- 2.3.3 The shallowest groundwater aquifer underlying the site is considered to be the Kellaways Sand Formation, which is described as a “Secondary A Aquifer”. These are permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers.
- 2.3.4 The Great Oolite Group (GOG) (a collective name for Cornbrash Formation, Forest Marble Formation, White Limestone Formation, Rutland Formation, Taynton Limestone Formation and Sharp’s Hill Formation) underlies the Kellaways Formation. Of the GOG Formation the Cornbrash Formation and Forest Marble Formation are also classified as Secondary A Aquifers, while the White Limestone Formation is classified as a Principal Aquifer. These are layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale.
- 2.3.5 There are no identified Groundwater Source Protection Zones (GSPZ) within a 500m radius of the site.

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<sup>4</sup> [Flood map for planning - GOV.UK \(flood-map-for-planning.service.gov.uk\)](https://www.gov.uk/flood-map-for-planning.service.gov.uk)

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- 2.3.6 Further detail is provided in a Hydrogeological Assessment Report (HAR) which was prepared for EKFB by ASC and is included with this application as Appendix I to the Supporting Information document.

## Groundwater Flow

- 2.3.1 Average groundwater levels for the Twyford Viaduct to Barton Hartshorn Embankment study area which includes the area for the landscape bund at Twyford Embankment range from approximately 0.05 m below ground level (bgl) to 19 m bgl. Given the linear nature of ground investigation monitoring points it is not possible to accurately provide a groundwater contour plan due to the large degree of interpolation outside of the immediate line of monitoring. The available data suggests that groundwater flow directions broadly follow topographical gradients.
- 2.3.2 Groundwater flow through the superficial deposits will be limited due to the largely clay dominated nature of the deposits. Intergranular flow will occur through the Alluvium and River Terrace Deposits where locally present.
- 2.3.3 Groundwater occurrence and flow through the bedrock is expected to be negligible due to the extremely low hydraulic conductivity and cohesive nature of the formation. Some intergranular groundwater flow can be expected through the underlying Kellaways Formation although this will be controlled by the sand content of the formation in the area which is understood to be regionally variable.

## Groundwater Quality

- 2.3.4 A Geo-environmental assessment was undertaken for areas of land that included the sewerage works (in proximity to Twyford Embankment and the Dismantled Great Central Railway). This identified a Moderate/Low risk to controlled waters. Ongoing groundwater sampling and testing is being carried out.

Should the final conclusions of the geo-environmental assessment report differ to that presented here as a result of the ongoing sampling and testing, this report will be updated.

## 2.4 Man-made Subsurface Pathways

- 2.4.1 The site lies in a rural setting, it is not anticipated that there will be underground utilities located within close proximity of the site.

## 2.5 Receptors and Compliance Points

- 2.5.1 The receptors and compliance points are detailed within this section. Further consideration of pathways and receptors is provided in the CSM provided within Appendix D.

## Human Health

- 2.5.2 Human health receptors are considered to include future site users. The treated waste within the landscaping bund will pass the agreed Zone 3 material re-use criteria and will be placed within low permeability engineered Oxford Clay.
- 2.5.3 The landscaping bund will be topped by a cover layer designed to a specific landscaping specification and reuse requirements. The cover layer will be demarcated by an orange layer simply to indicate the presence of treated waste beneath.

- 
- 2.5.4 Pathways of dermal contact, ingestion and inhalation will therefore be restricted by the depth of placement and the presence of the restoration layer.
  - 2.5.5 Risks to workers during the construction phase are considered to be low if appropriate mitigation measures are employed.

## **Groundwater**

- 2.5.6 The continuous groundwater table has been confirmed to be present at depth within the top of the Kellaways Formation Secondary A Aquifer, which overlain by over 4m of permeability superficial deposits and Oxford Clay. The thickness of low permeability material overlying the Secondary A Aquifer will be increased by the construction of the base of the landscaped bund from low permeability high plasticity clays.
- 2.5.7 The landscaping bund will be filled with material that has been treated offsite and will not contain any hazardous pollutants. The works are considered to have negligible effect on groundwater. Therefore, no compliance point is proposed for groundwater.

## **Surface Water**

- 2.5.8 The nearest surface water receptor is the Portway stream to the south and a HS2 Catchment Pond and Floodplain Compensation Area, located to the north. These assets will all be diverted and lined.
- 2.5.9 There are no residential properties with gardens that would be considered vulnerable to run-off due to the proposed profile of the site.
- 2.5.10 The treated waste will be deposited into the landscape bund, which is designed to be constructed of low permeability high plasticity clay. This will limit the potential for leaching and infiltration, therefore no surface water compliance points for run-off from the deposition for recovery activity are proposed.

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## **3 POLLUTION CONTROL MEASURES**

### **3.1 Site Engineering**

#### **Slope Stability**

- 3.1.1 Slope stability is considered in the Geotechnical Design Report presented in Appendix B to this ESSD report. The design is such that long-term stability is well within safety margins without the need for mitigation.
- 3.1.2 The landscape bund will be gently sloping to enable the land to be returned to arable use, and to maintain the gently undulating character of the landscape.
- 3.1.3 An attenuation layer is not deemed necessary for the non-hazardous waste to be deposited into the landscape bund.
- 3.1.4 Slope settlement monitoring is discussed in section 4.3. A detailed assessment of slope settlement is contained in the Geotechnical Design Report in Appendix B to this report.

#### **Capping**

- 3.1.5 The waste materials imported to the site make up approximately 10% of the total materials used to construct the landscape bund. An orange demarcation layer will be installed between treated waste and restoration cover layer. The landscape bund will be capped with existing ground and non-waste material as per landscaping design and reuse requirements.

### **3.2 Restoration**

- 3.2.1 Other than the capping material described in paragraph 3.1.5 above, no restoration will take place at the site.

### **3.3 Surface Water Management**

- 3.3.1 Surface water at the site will be generated from incidental rainfall only.
- 3.3.2 During the course of the earthworks it will be necessary to ensure the working platform is carefully maintained and profiled to ensure no deterioration of the surface from an engineering perspective, and to ensure run-off is intercepted and managed in a controlled manner. Areas of ponded water will be pumped out or otherwise dealt with by the contractor.

### **3.4 Post Closure Controls**

- 3.4.1 The embankment will be constructed to achieve levels approved by Buckinghamshire Council.
- 3.4.2 There is no requirement for a Closure and Aftercare Plan for recovery activities.
- 3.4.3 Upon completion of the recovery activity, a completion report shall be prepared detailing the waste accepted as part of the recovery activity, outcomes of monitoring throughout the life of the permit and confirmation that no pollution incidents or contamination have occurred at the site. If any pollution incidents or contamination are identified, details of any investigation and remediation shall be confirmed.

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- 3.4.4 Upon permit surrender the surrender application will include records of the waste types recovered during the operational phase. Evidence will be provided to show that only permitted wastes have been accepted and that the site is in a satisfactory state.

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## 4 MONITORING

### 4.1 Weather

- 4.1.1 Average annual precipitation recorded for the region is 647.8 mm as recorded between 1991 – 2020 at Reading University, Whitenights<sup>5</sup>, located approximately 8km southwest of the site. Climate data for this climate station are summarised below using Met Office data:

**Table 4-1: Climate Summary**

| Month     | Max. temp (°C) | Min.temp (°C) | Days of air frost (days) | Sunshine (hours) | Rainfall (mm) | Days of rainfall ≥ 1 mm (days) |
|-----------|----------------|---------------|--------------------------|------------------|---------------|--------------------------------|
| January   | 8.01           | 2.13          | 8.87                     | 55.60            | 65.19         | 11.83                          |
| February  | 8.54           | 2.16          | 7.93                     | 76.49            | 45.55         | 9.70                           |
| March     | 11.21          | 3.5           | 4.73                     | 119.71           | 40.27         | 8.57                           |
| April     | 14.21          | 5.12          | 1.87                     | 170.24           | 48.72         | 9.27                           |
| May       | 17.39          | 7.96          | 0.23                     | 199.93           | 43.51         | 8.10                           |
| June      | 20.37          | 10.80         | 0.00                     | 198.95           | 47.16         | 7.67                           |
| July      | 22.70          | 12.86         | 0.00                     | 205.52           | 48.94         | 8.13                           |
| August    | 22.28          | 12.71         | 0.00                     | 190.47           | 56.87         | 8.47                           |
| September | 19.27          | 10.39         | 0.00                     | 145.30           | 49.71         | 8.23                           |
| October   | 15.09          | 7.89          | 0.97                     | 106.58           | 73.75         | 10.63                          |
| November  | 10.98          | 4.67          | 3.86                     | 60.17            | 73.13         | 11.80                          |
| December  | 8.37           | 2.52          | 9.17                     | 48.51            | 65.44         | 11.47                          |
| Annual    | 14.90          | 6.92          | 37.63                    | 1577.47          | 658.24        | 113.87                         |

### 4.2 Gas Monitoring

- 4.2.1 Gas monitoring is not required as the waste to be accepted is inert and therefore not expected to generate gas. Furthermore, the waste will be deposited above the surface level of the surrounding ground.

### 4.3 Settlement Monitoring

- 4.3.1 Calculations and modelling of slope stability were undertaken at the design stage and published in the Twyford Embankment Geotechnical Design Report (GDR) (report reference: MC06-CEK-GT-REP-CS06\_CL10-000002).
- 4.3.2 The static slope stability of earthworks was modelled using Talren 5 software and the Bishop circular method of analysis. Full details of the methodology are presented in section 9.4.1.1 of the Twyford GDR reproduced in Appendix B to this report.
- 4.3.3 In accordance with Eurocode 7, slope geometries are considered stable when the minimum reported Factor of Security (FoS) is ≥1.

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<sup>5</sup> <https://www.metoffice.gov.uk/research/climate/maps-and-data/uk-climate-averages>

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4.3.4 The GDR reported that all calculated and modelled FoS results, at all chainages for Twyford Embankment, were >1 (see section 9.4 and Table 9-28 – Result of slope stability calculations in the Twyford GDR).

4.3.5 Therefore, no monitoring for slope stability is deemed necessary.

## **4.4 Amenity Monitoring**

4.4.1 Daily monitoring will be undertaken in accordance with operating procedures for amenity issues such as dust. This will be achieved via visual inspections.

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## 5 SITE CONDITION REPORT

- 5.1.1 A Site Condition Report (SCR) is not required for a permitted activity where waste is permanently deposited for recovery. Therefore, an SCR is not included as part of the Environmental Permit application. Notwithstanding see ASC's CSM report provided as Appendix D.

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## REFERENCES

1. DEFRA Data Services Platform  
<https://environment.data.gov.uk/DefraDataDownload/?mapService=EA/HistoricLandfill&Mode=spatial>
2. Twyford Viaduct to Barton Hartshorn Embankment: Hydrogeological Appraisal Report 1MC06-CEK-EV-REP-CS06\_CL10-000026
3. Environment Agency Flood Risk Maps: [Flood map for planning - GOV.UK \(flood-map-for-planning.service.gov.uk\)](https://floodmapforplanning.service.gov.uk/)
4. Meteorological data source: <https://www.metoffice.gov.uk/research/climate/maps-and-data/uk-climate-averages>

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## Appendices

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# **Appendix A**

## **Twyford Embankment Groundsure Report**

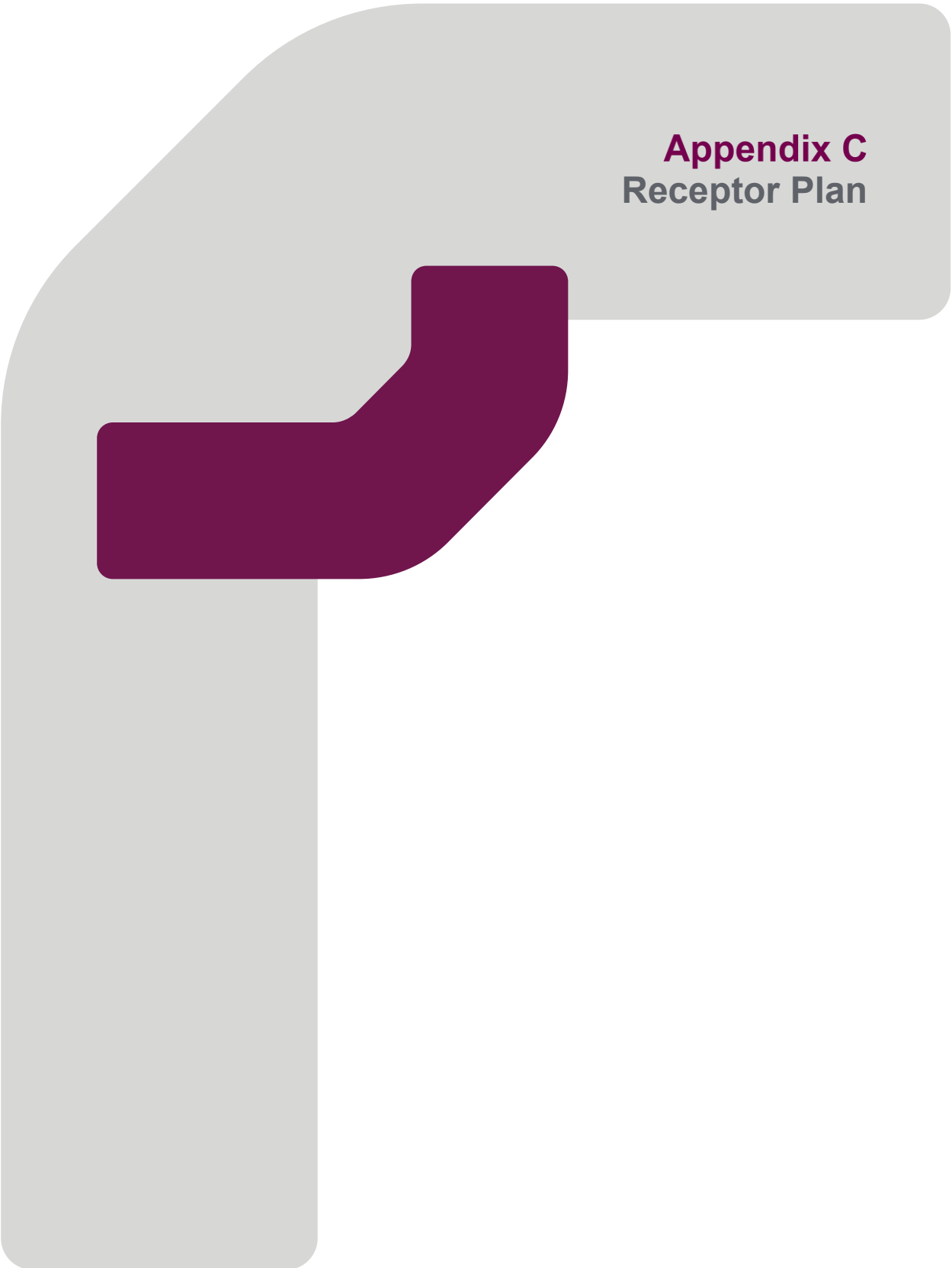
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## **Appendix B**

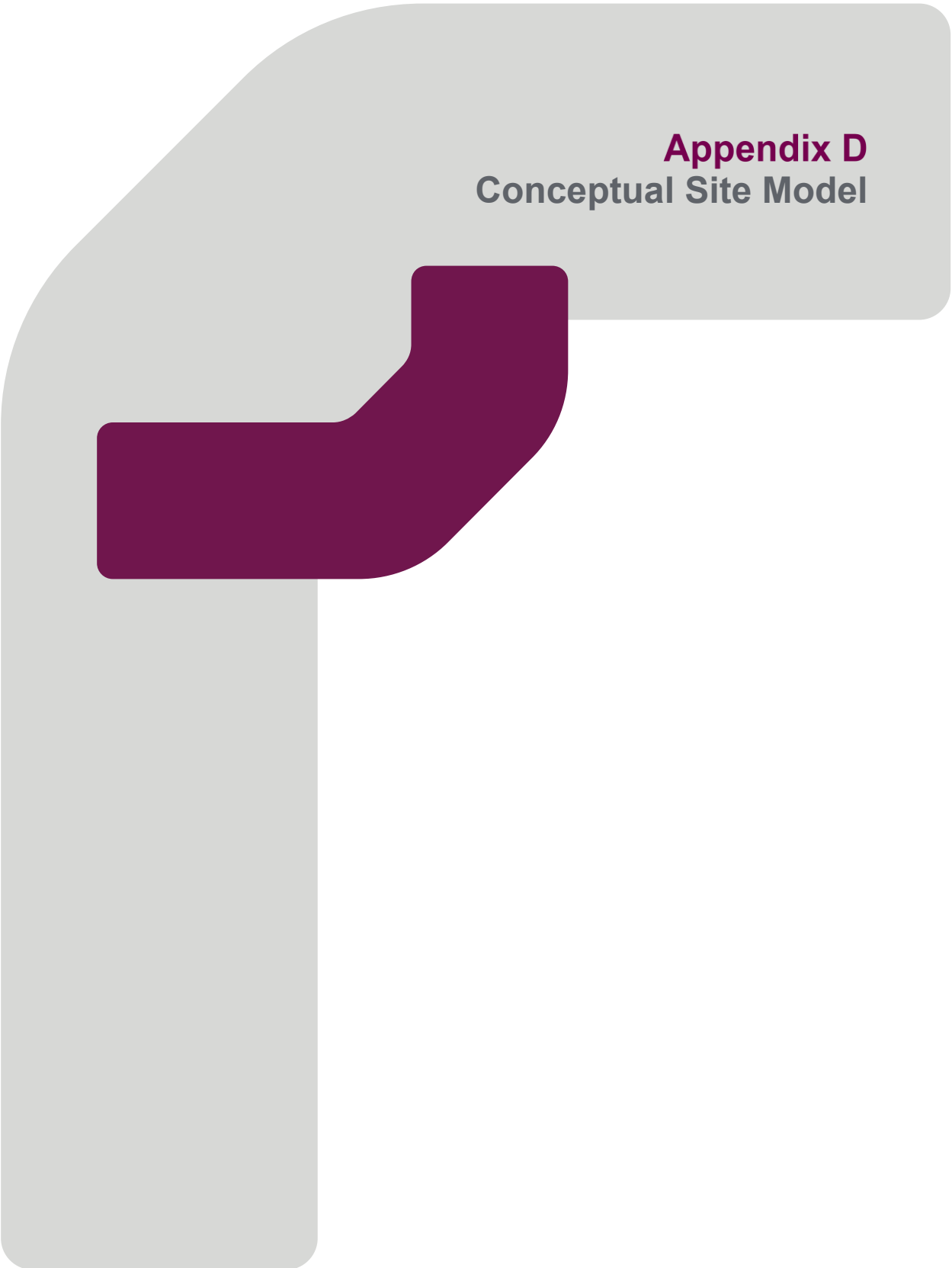
# **Twyford Embankment Geotechnical Design Report**

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## **Appendix C** **Receptor Plan**

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## **Appendix D**

### **Conceptual Site Model**