



# **Lime Down**

## **Solar Park**

# **Environmental Statement**

## **Volume 3, Appendix 11-7: Flood Risk Assessment and Outline Drainage Strategy – Lime Down E1 (Clean)**

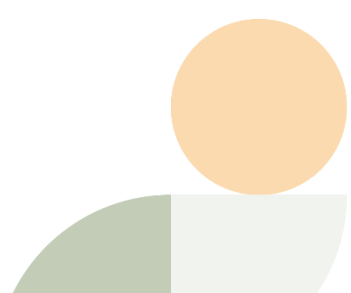
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# Appendix 11-7: Flood Risk Assessment and Outline Drainage Strategy – Lime Down E1

For: Lime Down Solar Park Ltd

Site: Lime Down Solar Park

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# 1. Site Details

1.1.1 The aim of this section of the report is to outline key environmental information associated with the baseline environment of Lime Down E1.

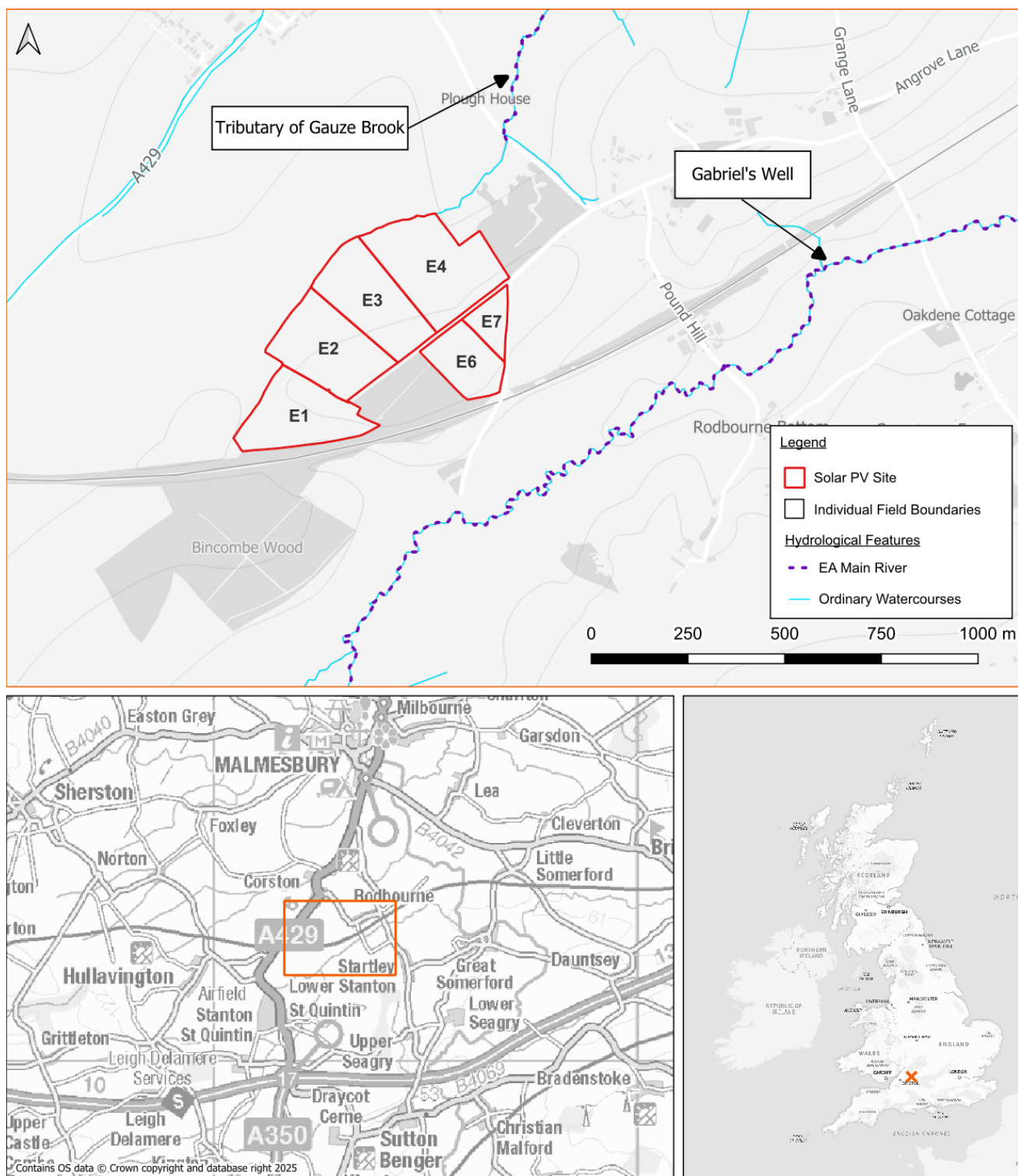


Figure 1: Site Location

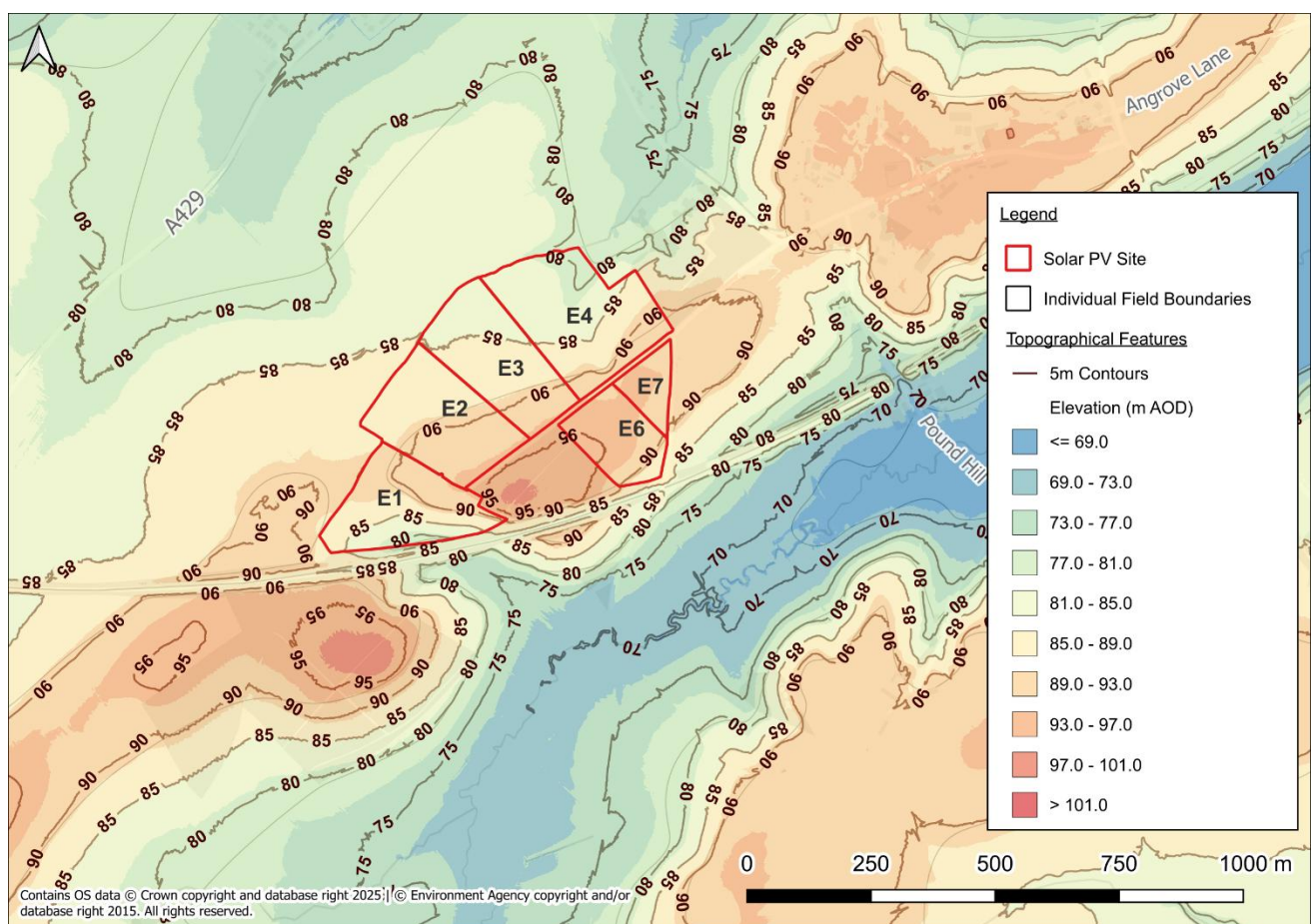
## 1.2 Site Location

1.2.1 Lime Down E1 is located approximately 3.2km southwest of Malmesbury, a town in north Wiltshire. The Site is centred at National Grid Reference 392677E, 183040N.

## 1.3 Existing Site Conditions

1.3.1 Online mapping (including Google Maps / Google Streetview imagery) accessed May 2025 shows that the Scheme area comprises agricultural / arable fields. The Scheme area is bordered by more rural land in all orientations with a railway line to the south. Access is provided via an unnamed road leading off Pound Hill.

## 1.4 Topography



**Figure 2: LiDAR Plan**

1.4.1 Topographic levels to metres Above Ordnance Datum (m AOD) have been derived from a 1m resolution Environment Agency (EA) composite ‘Light Detecting and Ranging’ (LiDAR) Digital Terrain Model (DTM). A review of LiDAR ground elevation data shows that Lime Down E1 slopes from approximately 97m AOD in the southwest to approximately 80m AOD in the north (Figure 2).

## 1.5 Hydrology

1.5.1 The nearest watercourse is Gabriel’s Well, a Main River, which is located approximately 200m to the

south of Lime Down E1.

1.5.2 Other watercourses in the area include a tributary of Gauze Brook, which begins as an Ordinary Watercourse at the north-eastern boundary of Lime Down E1, before it becomes a Main River approximately 260m north-east.,

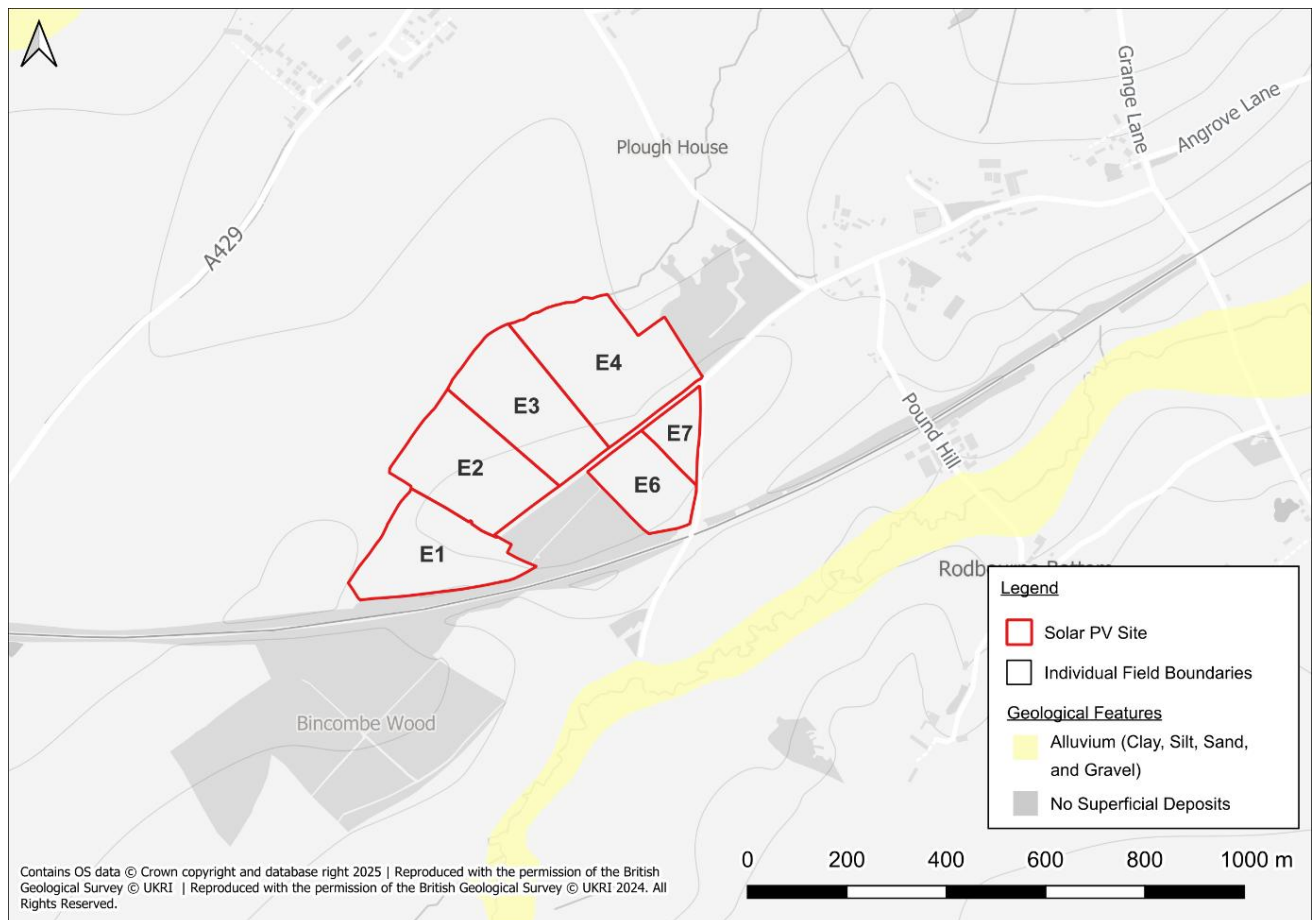
1.5.3 Main Rivers are within the jurisdiction of the EA and land drainage ditches and Ordinary Watercourses which fall within the jurisdiction of the Wiltshire County Council Lead Local Flood Authority.

## 1.6 Water Framework Directive Status

1.6.1 Lime Down E1 is located within the Avon Bristol Rural Catchment, largely within the Gauze Brook – source to conf R Avon (Brist) Water Body Catchment and partially within the Rodbourne Bk – source to conf R Avon (Brist) Water Body Catchment.

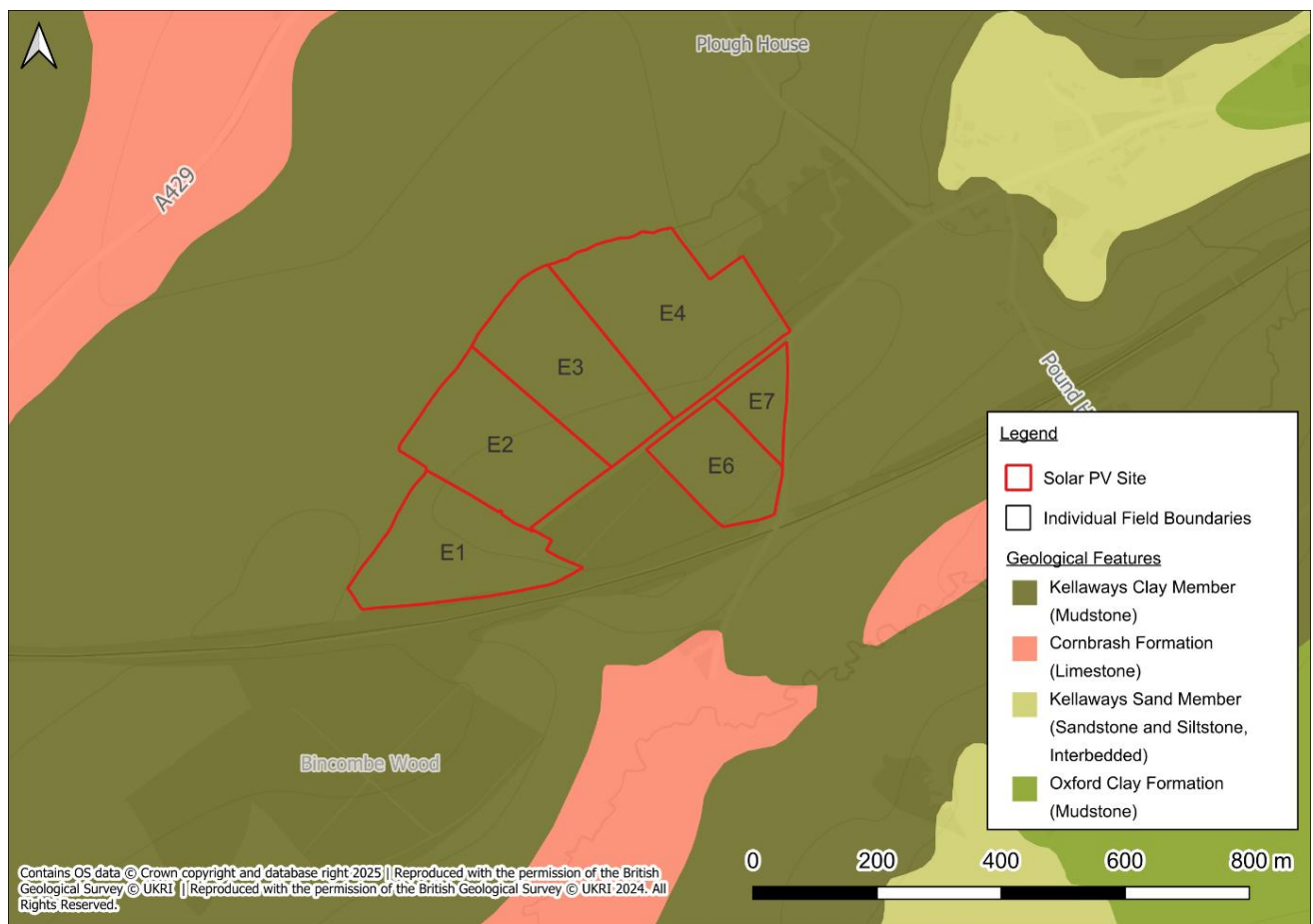
1.6.2 The Gauze Brook – source to conf R Avon (Brist) Water Body catchment has a Cycle 3 Ecological status of Moderate in 2019 in 2022 and a Failing chemical status in 2019 (no data in 2022). The Rodbourne Bk – source to conf R Avon (Brist) Water Body catchment has a Cycle 3 Ecological status of Moderate in 2019 and 2022 and a Failing chemical status in 2019 (no data in 2022). A summary of the Water Body Classifications for the catchments are included as Annex A.

## 1.7 Geology



**Figure 3: Superficial Deposits**

- 1.7.1 Reference to the British Geological Survey (BGS)ii online mapping (1:50,000 scale) indicates that Lime Down E1 is not underlain by superficial deposits (see Figure 3 for deposit location).
- 1.7.2 Lime Down E1 is identified as being underlain by Kellaways Clay Member, comprising of mudstone (see Figure 4 for deposit location):
- 1.7.3 The geological mapping is available at a scale of 1:50,000 and as such may not be accurate on a Site-specific basis.
- 1.7.4 There are no British Geological Survey boreholes located at Lime Down E1.



**Figure 4: Bedrock Deposits**

## 1.8 Hydrogeology

- 1.8.1 According to the EA's Aquifer Designation data, obtained from MAGIC Map's online mappingiii [accessed 02/06/25], the Forest Marble Formation is classified as a Secondary A Aquifer.
- 1.8.2 According to the EA's Aquifer Designation data, obtained from MAGIC Map's online mapping [accessed 02/06/25], the Kellaways Clay Member is classified as Unproductive.
- 1.8.3 Lime Down E1 is not underlain by superficial deposits and there are no identified aquifers.
- 1.8.4 The EA's 'Source Protection Zones' data, obtained from MAGIC Map's online mapping [accessed

02/06/25], indicates that Lime Down E1 is not located within a Groundwater Source Protection Zone.

## 1.9 Proposed Site Conditions

- 1.9.1 Lime Down E1 proposes a ground mounted solar photo-voltaic plant with associated electrical infrastructure, including a substation located in Field E6, and access. See **ES Volume 1, Chapter 3: The Scheme [EN010168/APP/6.1]**.
- 1.9.2 An **Outline Landscape and Ecological Management Plan (LEMP) [EN010168/APP/7.18]** has been developed to support the DCO application. This details that the vast majority of the Site is proposed to be utilised for Solar PV Panels and supporting infrastructure, with internal access and peripheral areas comprising landscaped buffers, in line with the embedded mitigation described throughout the ES.
- 1.9.3 The impermeable substation access roads are required to provide a robust, all weather access route to the compounds at Lime Down. These routes will need to accommodate exceptional loads associated with transformer delivery, installation and maintenance. The proposed transformers weights have individual weights of approximately 180-200tn, these loads will generate high axial loads to the load bearing track surface. In addition, these impermeable substation access tracks are needed for reliable year-round access/egress for emergency vehicles, including fire services. The use of the impermeable tracks in the substation route reflects both the operational requirements of the electrical infrastructure and the need to maintain a safe and resilient emergency access corridor throughout the lifespan of the project.
- 1.9.4 Where a 132kV or 400kV substation is proposed within this area, the detailed design will include a controlled drainage strategy for the substation compound. This will include sealed drainage or sealed drainage components where required, together with suitable treatment, interception, containment and isolation measures to prevent spills, leaks or firewater from affecting ground or controlled waters. The drainage principles for substations are set out in **the Firewater Containment and Drainage Strategy – Lime Down Substation [EN010168/EXAM/9.9]**, which is the governing reference for containment and release matters.

## 2. Assessment of Flood Risk

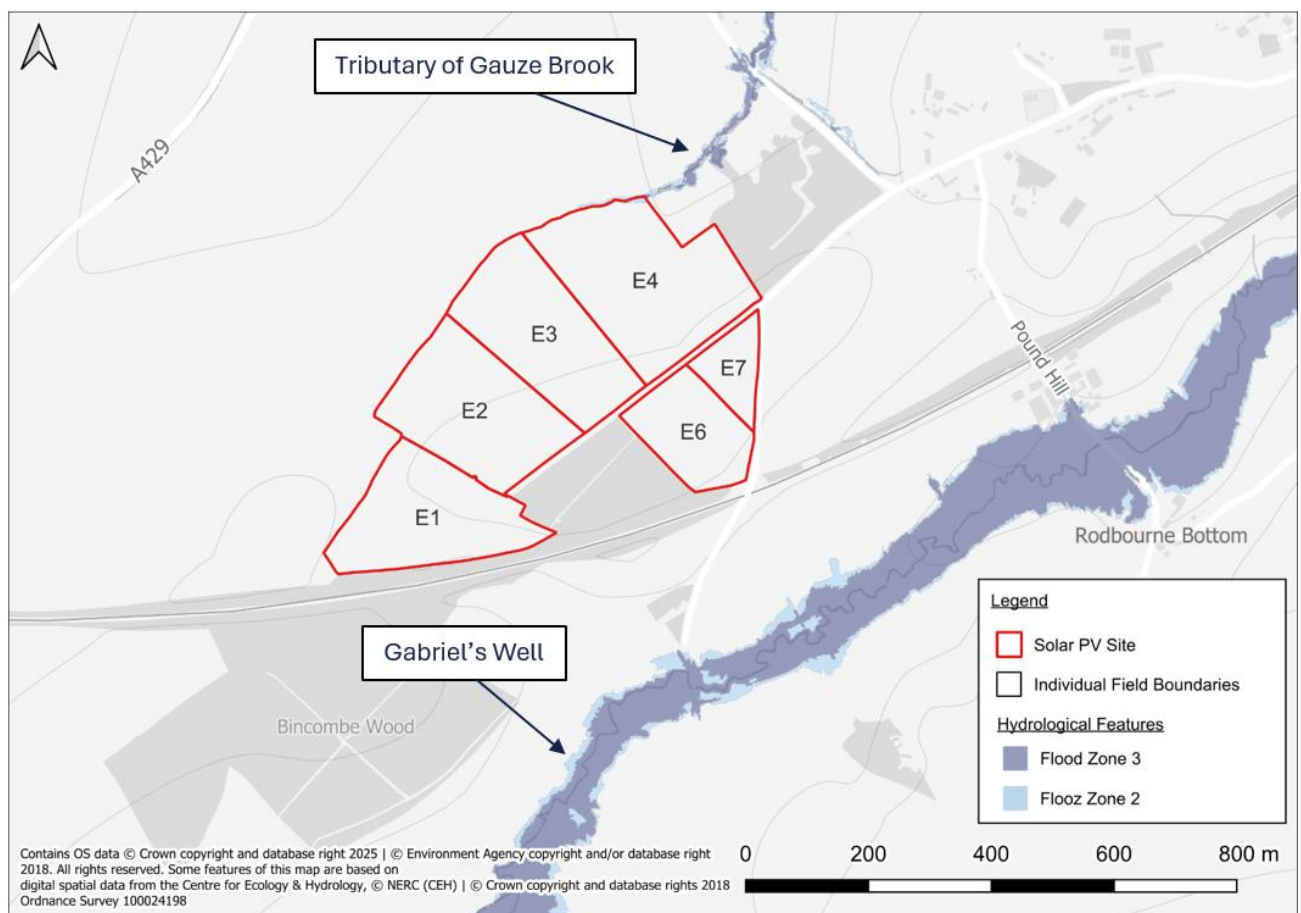
2.1.1 The aim of this section of the report is to assess and summarise the existing flood risk at Lime Down E1.

### 2.2 Tidal Flood Risk

2.2.1 Lime Down E1 is situated at a minimum of approximately 80m AOD and is significantly above sea level. Therefore, there is **Negligible** risk from tidal flooding.

### 2.3 Fluvial Flood Risk

2.3.1 According to the EA's Flood Map for Planning (updated in March 2025)iv, Lime Down E1 is almost entirely within Flood Zone 1, meaning it is at low risk from fluvial flooding (<0.1% annual probability). A small part of Field E4 extends into Flood Zone 2, associated with a tributary of Gauze Brook flowing north-east, but this does not encroach into any areas proposed for Scheme. The proposed substation in Field E6 is located entirely within Flood Zone 1 and outside any mapped fluvial flood extents, and is therefore considered to be at low risk of fluvial flooding. Flood maps are included as Figure 5 below and **ES Volume 2, Figure 11-6: Lime Down E1 Fluvial and Surface Water Risk Map [EN010168/EXAM/6.2] (Rev 2)** produced at Deadline 3 of Examination



**Figure 5: EA's Flood Map for Planning**

- 2.3.2 As above, the nearest watercourse is a tributary of Gauze Brook, located at the north-eastern boundary of the Lime Down E1 which flows in a north-easterly direction. Any out of channel flooding from the Ordinary Watercourse will flow in a north-easterly direction following the areas sloping topography.
- 2.3.3 The EA 'Historical Flood Map' indicates that Lime Down E1 has no recorded history of flooding on the Lime Down E1 or in the immediate vicinity. The nearest recorded flood event occurred approximately 60m south of Lime Down E1, in May 1932.
- 2.3.4 There is no site-specific information within third party reports relating to fluvial flood risk.
- 2.3.5 In the absence of modelled flood data, surface water flood maps can be used to provide an understanding of potential fluvial flood risk from any smaller watercourses. There are no formal flow routes picked up by the surface water mapping which direct water into Lime Down E1.
- 2.3.6 To estimate flood levels for a 1% Annual Exceedance Probability (AEP) event with a 71% climate change allowance, Manning's open channel flow formula was applied. A detailed explanation of the calculation, including sources of data and the chosen coefficients, is provided in Annex B. This method was selected as it provides a practical estimate of flow characteristics based on channel shape, roughness, and gradient, particularly where detailed hydraulic modelling has not been undertaken. Cross-sectional data from EA LiDAR, captured in Q1 2020 and detailed in Annex B, informed the calculations. The estimated flood levels suggest limited extents, expected to be smaller than those shown on the EA's 0.1% surface water mapping. This mapping is referenced for context only and was not used as an input to the calculation. The estimated flood extents derived from the Manning's assessment are anticipated to be more limited in extent than those indicated by the EA's 0.1% AEP surface water mapping. The EA mapping has therefore been used as a precautionary indication of potential exceedance flow routes and extents only, with the 1% AEP plus climate change Manning's assessment adopted as the basis for the design event assessment.
- 2.3.7 It is noted that the Manning's calculation was completed prior to the release of updated NaFRA2 mapping in January 2025. The revised mapping shows a reduction in surface water flood extents across the Site. This supports the view that the current Manning's calculation remains conservative, and there is no requirement to update it.

### **Consultation**

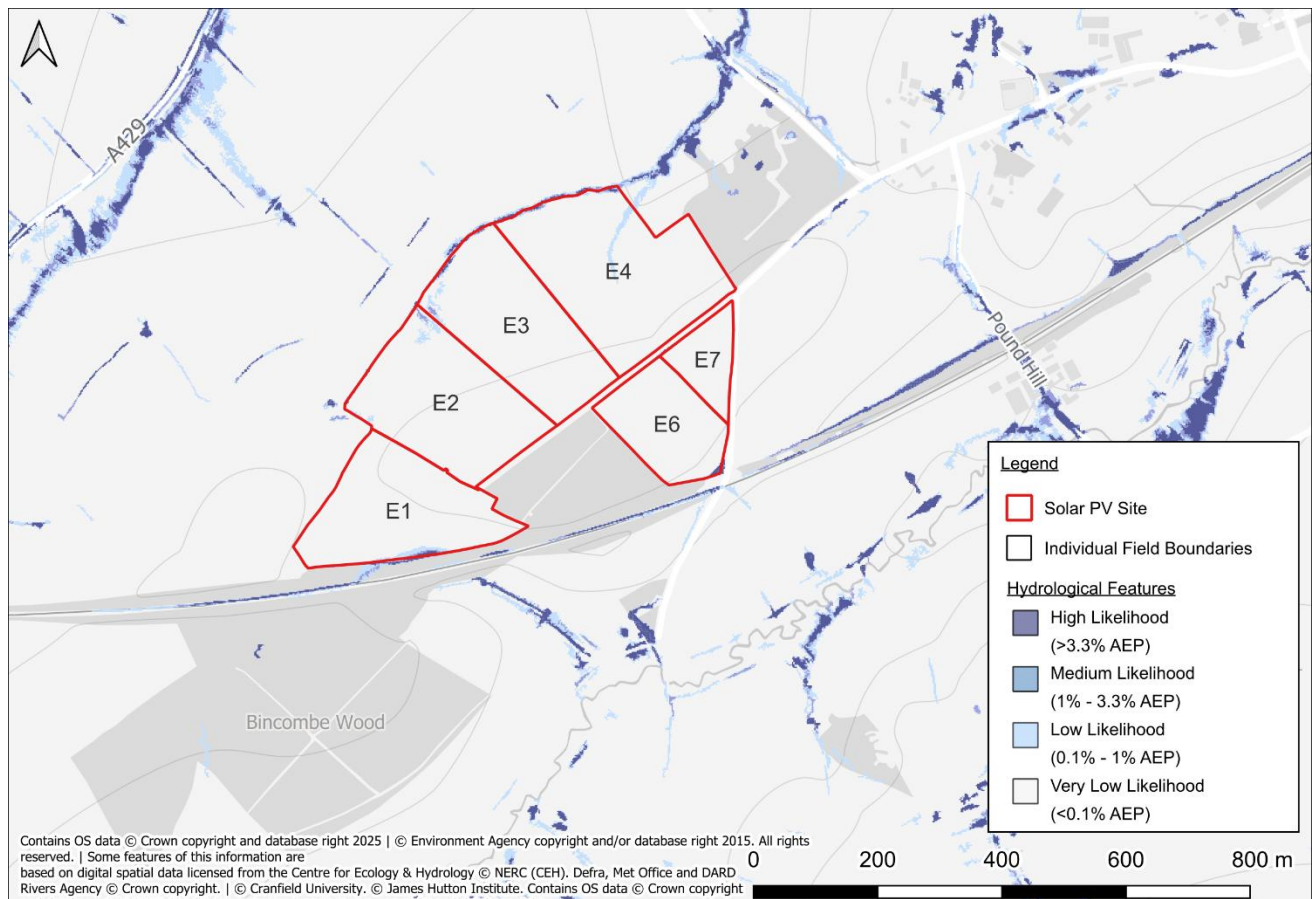
- 2.3.8 Consultation has been undertaken throughout the EIA process with the EA and Wiltshire Council. Comments and recommendations received have been noted and applied throughout this Flood Risk Assessment and Drainage Strategy. A record of consultation and The Applicant's responses are included in ES Chapter 11: Hydrology, Flood Risk and Drainage.
- 2.3.9 Lime Down E1 is not located within an Internal Drainage Board.

### **Summary**

- 2.3.10 Given the above, Lime Down E1 is therefore considered to be at Low risk of fluvial flooding.

## 2.4 Surface Water Flood Risk

- 2.4.1 The EA's National Flood Risk Assessment Mapping (NaFRA), known as the 'Long Term Flood Risk Map' (Surface Water)vi, was updated in January 2025. The NaFRA mapping provides an updated view of surface water flooding across the Site, however it should be noted that at the time of writing, the NaFRA mapping only delivers climate change insight up to the year 2060.
- 2.4.2 According to the EA's Long Term Flood Risk Map (Surface Water) the majority of Lime Down E1 is at Very Low risk of surface water flooding, meaning it has a <0.1% annual probability of flooding. However, there are some small areas of Low to High risk (0.1 - >3.3% annual chance of flooding), particularly at Fields E1 – E4 and a small section in the southernmost extent of Field E6. The areas of risk in Fields E2 – E4 are associated with the presence of the tributary of Gauze Brook which flows in a north-easterly direction. Other areas of risk across Lime Down E1 are associated with topographic depressions within the Fields and ponding along the railway line to the south.



**Figure 6: EA's Long-Term Flood Risk Map (Flood Risk from Surface Water)**

- 2.4.3 With reference to the depth mapping provided by the NaFRA data, flood depths are anticipated to be low, with depths remaining largely below 300mm which is considered passable to people and vehicles. Some depths between 300mm and 600mm are anticipated in Fields E1 and E6 however these are small areas associated with topographic low points, and do not form flow routes within the Site.
- 2.4.4 The proposed substation in Field E6 is located in the northern part of the field, outside the mapped

surface water flow paths. Although the southern extent of Field E6 shows some localised risk, the substation will be sequentially located within the area of lowest risk and raised above surrounding ground levels.

- 2.4.5 There is no indication within relevant third-party reports (listed in ‘Sources of Information’ in **ES Volume 3, Appendix 11-1: Flood Risk Assessment and Outline Drainage Strategy – Covering Report [EN010168/APP/6.3]**) to suggest that Lime Down E1 has historically experienced surface water flooding.
- 2.4.6 Based on the above and considering the embedded mitigation as part of the design of the solar panels, the overall risk of surface water flooding is considered to be Low. The proposed solar panels will be raised above surrounding ground levels and will be appropriately waterproofed, thereby reducing the potential to be impacted in the event of surface water flooding.
- 2.4.7 Associated electrical infrastructure, such as inverters, transformers, cabling and substations, will be located outside mapped flood extents where feasible, or otherwise elevated above the design flood level with appropriate freeboard, in line with the embedded mitigation strategy outlined in **Appendix 11.1: Flood Risk Assessment and Outline Drainage Strategy – Covering Report [EN010168/APP/6.3]**.
- 2.4.8 Smaller electrical components such as conversion units, where present, are minor in scale and will be protected through elevation or localised resilience measures, consistent with the approach set out in the Covering Report. The potential for the development to exacerbate surface water flood risk off-site is also addressed through the use of appropriate SuDS features, as described in the Covering Report.

## **2.5 Groundwater Flood Risk**

- 2.5.1 The geology is identified above in Section 1.0. There were no boreholes identified from BGS records at Lime Down E1.
- 2.5.2 There is no information within relevant third-party reports (listed ‘Sources of Information’ in **ES Volume 3, Appendix 11-1: Flood Risk Assessment and Outline Drainage Strategy – Covering Report [EN010168/APP/6.3]**) to suggest that Lime Down E1 has experienced historical groundwater flooding.
- 2.5.3 No buildings, other than the supporting unstaffed infrastructure, and no basement levels are identified on plans which may otherwise be at increased risk from groundwater seepage.
- 2.5.4 Soilscape<sup>vii</sup> mapping indicates that Lime Down E1 is located in ‘impeded drainage’.
- 2.5.5 It can be concluded that the risk of groundwater flooding is Low and no site-specific mitigation measures are required.

## **2.6 Sewer Flooding**

- 2.6.1 No site-specific incidents of sewer flooding have been identified from relevant third-party reports.
- 2.6.2 On the basis of Lime Down E1’s rural setting, the presence of sewerage infrastructure is unlikely. Utility records have been checked and identify no public sewers within Lime Down E1.
- 2.6.3 It can therefore be concluded that the risk of sewer flooding is **Negligible**.

## 2.7 Reservoir and Canal Flooding

- 2.7.1 There are no canals within the vicinity of Lime Down E1, therefore there is no associated risk.
- 2.7.2 The EA 'Flood Risk from Reservoirs' map shows that Lime Down E1 is not at risk of flooding from reservoirs.
- 2.7.3 It can therefore be concluded that there is **Negligible** risk of flooding from artificial sources.

## 2.8 Residual Flood Risks

- 2.8.1 A residual risk is an exceedance event, such as the 1 in 1000 year (0.1% AEP) flood event that would overtop the unnamed Gauze Brook tributary and potentially impact Lime Down E1. As the probability of a 1 in 1000 year flood event occurring is 0.1% in any given year, the probability is low and, therefore, no additional mitigation beyond the embedded mitigation measures of the Scheme is required.
- 2.8.2 In the event of the defences failing or an exceedance event occurring, the residual risk to people working or present in the vicinity, as construction workers, residents, or public right of way (PRoW) users, within Lime Down E1 can be managed through the implementation of an appropriate Site management plan. This plan will recognise the residual risks and outline the actions to be taken by staff in the event of a flood to ensure that occupants are placed in a place of safety,

## 2.9 Summary of Flood Risk

- 2.9.1 It can be concluded that the risk to Lime Down E1 from all sources of flooding is **Negligible** to **Low**, however, it would be prudent to include the below mitigation measures.

## 2.10 Embedded Mitigation

- 2.10.1 Embedded Mitigation is detailed in **ES Volume 3, Appendix 11-1: Flood Risk Assessment and Outline Drainage Strategy – Covering Report [EN010168/APP/6.3]**.
- 2.10.2 During the construction phase, temporary works and construction activities will be managed to maintain existing floodplain storage, floodplain capacity and overland flood flow routes. Temporary compounds, plant and material storage will be located outside areas identified as potentially susceptible to flooding where reasonably practicable, and construction activities will be undertaken in accordance with the **Outline CEMP [REP2-019]** to ensure flood risk is not increased elsewhere.

## 2.11 Impact on Off-Site Flood Risk

- 2.11.1 The Solar PV Panels and associated electrical infrastructure, including inverters, transformers, cabling, and substations, will, where possible, be located outside the flood extent. If this is not feasible, they will be elevated with appropriate freeboard above the local flood level. These components will be installed on concrete foundations or pads mounted on frames, allowing floodwater to flow freely underneath. This approach prevents any loss of floodplain volume and ensures there is no increase in flood risk elsewhere - areas where panels are proposed in Flood Zones 2 / 3 have undergone the appropriate floodplain storage calculations – see **ES Volume 3, Appendix 11-6 and 11-8 [EN010168/APP/6.3]**. The components are insignificant in size with detailed dimensions provided in ES Chapter 3: Scheme

Description. Additionally, any units incorporating hardstanding surfaces will feature SuDS measures to mitigate any increase in surface water runoff. Together, these measures ensure the Scheme does not contribute to an increase in flood risk.

2.11.2 Surface water management has been considered in **ES Volume 3, Appendix 11-1: Flood Risk Assessment and Outline Drainage Strategy – Covering Report [EN010168/APP/6.3]**.

## 3. Outline Drainage Strategy

### 3.1 Introduction

3.1.1 Lime Down E1 forms part of the wider Scheme and includes Solar PV Panelled Areas, one 132kV Substation with associated access track, and three Conversion Units / 33kV Sub-distribution Switch Rooms. This section provides the Outline Drainage Strategy for Lime Down E1. It identifies the areas requiring formal drainage consideration, sets out the basis of the runoff and attenuation calculations, and demonstrates that a feasible drainage solution can be accommodated within the assessed design envelope. Excluding the 132kV Substation, the associated access track where conservatively assessed as hardstanding surfaces, and the three Conversion Unit / 33kV Sub-distribution Switch Room equipment pads, Lime Down E1 will remain largely permeable following development. Solar PV infrastructure is not treated as contributing to the overall extent of positively drained hardstanding surfaces for the purposes of this Outline Drainage Strategy.

3.1.2 For the purpose of this assessment, this Outline Drainage Strategy is split as follows:

- A description of surface water drainage from the Solar PV Panelled Areas, excluding the 132kV Substation, the 132kV Substation access track and the three Conversion Units / 33 kV Sub-distribution Switch Rooms; and
- An outline drainage strategy for the positively drained hardstanding surfaces, comprising the 132kV Substation, the 132kV Substation access track where conservatively assessed as hardstanding surfaces, and the three Conversion Units / 33kV Sub-distribution Switch Rooms.

3.1.3 The detailed drainage layout, final SuDS components, conveyance routes, levels, outfalls, flow controls, treatment train, isolation arrangements and maintenance regime will be confirmed at detailed design and secured through the relevant DCO drainage requirement.

### 3.2 Solar PV Panelled Areas

3.2.1 Solar PV panelled areas are not treated as formal impermeable drainage catchments within this Outline Drainage Strategy. The panels are elevated above ground level, drain to the existing ground, are not sealed into a drainage network, and do not create a connected impermeable surface.

3.2.2 This approach is supported by national policy and the submitted evidence base. **NPS EN-3 paragraph 2.10.84** recognises that solar PV panels drain to the existing ground and that the drainage impact will not, in general, be significant. This position is also addressed in **ES Volume 1, Chapter 11: Hydrology, Flood Risk and Drainage [REP1-017]**, **ES Volume 3, Appendix 11-1: Flood Risk Assessment and Outline Drainage Strategy - Covering Report [REP1-037]** and **the Applicant's Response to the Lead Local Flood Authority on Hydraulic Modelling Requirements [REP2-045]**.

3.2.3 The Applicant's review of the relevant research and guidance confirms that, where vegetated ground cover is established and maintained, soil compaction is avoided or remediated, and connected preferential flow routes are not created, solar PV panels are not predicted to increase surface water runoff rates or volumes in a manner that requires formal attenuation.

3.2.4 The principal effect of the panels is local redistribution of rainfall within the same field, including potential concentration at panel drip-lines. This does not generate additional rainfall volume. Whether redistributed rainfall becomes runoff is governed by the condition of the receiving ground, including

vegetation cover, soil structure, compaction, surface roughness, slope and hydrological connectivity.

- 3.2.5 Those controlling factors are addressed through the embedded mitigation secured for the Scheme. Construction phase controls are secured through **the Outline Construction Environmental Management Plan [REP2-019]** and **Outline Soil Resources Management Plan [APP-280]**, including controls on construction trafficking, soil handling, temporary drainage, decompaction and reinstatement. Operational ground cover and land management controls are secured through **the Outline Landscape and Ecological Management Plan [APP-283]** and **Outline Operational Environmental Management Plan [REP2-021]**, including the establishment and maintenance of vegetated ground cover beneath and between the arrays.
- 3.2.6 On this basis, no formal attenuation storage is proposed for the solar PV panelled areas. Additional built SuDS across the panelled fields would not be proportionate, as the policy and evidence base indicate that solar PV panels do not materially increase surface water runoff where the relevant ground condition, vegetation and flow connectivity controls are secured. The Outline Drainage Strategy for these areas is therefore to maintain diffuse drainage to the existing ground, preserve existing field-scale flow behaviour, protect existing drainage features, and manage soil and vegetation condition through the secured construction and operational controls. Internal access tracks within the Solar PV Panelled Areas will be formed using permeable materials and, where practicable, maintained at existing ground levels. These tracks are not treated as positively drained hardstanding surfaces requiring formal attenuation, except where specifically and conservatively assessed within this Outline Drainage Strategy, such as the 132kV Substation access track.
- 3.2.7 The measures described above also represent the application of Natural Flood Management (NFM) principles where practicable, in accordance with NPS EN-1 paragraphs 5.8.12, 5.8.15 (bullet 8) and 5.8.32. At Lime Down E1, these measures include retaining permeable vegetated ground, maintaining diffuse drainage and existing field-scale flow routes, managing soil compaction and vegetation condition, and using permeable access tracks and source-control SuDS where appropriate. These measures complement the formal attenuation provided for positively drained infrastructure. No reliance is placed on unquantified NFM benefits to provide the attenuation storage or restricted discharge rates identified within this Outline Drainage Strategy. Further information on why NFM is not deemed appropriate for the Scheme are provided in **9.66 Lime Down D - Natural Flood Management Viability Report [REP5-109]**.

### 3.3 Drainage Strategy – Proposed Hardstanding Surfaces

- 3.3.1 Lime Down E1 currently comprises agricultural land. For the purposes of the runoff calculations, the undeveloped areas are treated as greenfield and permeable, with existing field drainage and local drainage features forming part of the baseline drainage regime. Table 1 identifies the assessed hardstanding surfaces within Lime Down E1. These areas have been included within this Outline Drainage Strategy because they would either be positively drained or have been conservatively assessed as requiring positive drainage.

**Table 1: Proposed Hardstanding Surfaces**

| Hardstanding Infrastructure                               | Hardstanding Area (m <sup>2</sup> ) |
|-----------------------------------------------------------|-------------------------------------|
| 132kV Substation                                          | 9,000                               |
| 132kV Substation Access Track                             | 8,310                               |
| 3 x Conversion Units / 33kV Sub-Distribution Switch Rooms | 225 (3 × 75 m <sup>2</sup> )        |

- 3.3.2 The assessed hardstanding surfaces have been identified using the indicative infrastructure areas currently proposed for Lime Down E1, or, where the final equipment layout is not fixed, the relevant

maximum design parameters set out in ES Volume 1, Chapter 3: The Scheme [EN010168/APP/6.1]. Where the Works Plan envelope or indicative infrastructure area is smaller than the relevant Chapter 3 maximum parameter, the assessed area has been limited to the area that can feasibly be accommodated within Lime Down E1. This provides a conservative but realistic basis for demonstrating that the required drainage infrastructure can be delivered within the assessed design envelope.

3.3.3 The assessed hardstanding surfaces have the potential to increase surface water runoff rates and volumes if unmanaged. Surface water runoff from these areas will therefore be controlled so that the Scheme does not result in a material increase in flood risk on-site or elsewhere.

3.3.4 Wiltshire Council Sustainable Drainage Systems (SuDS) Guidance<sup>1</sup> states the following:

*“With regards the control of surface water discharges from new development, Wiltshire Council requires post development discharges from greenfield sites to provide 30% betterment over pre-development discharges for all storm events between the 1 in 1year and 1 in 100year return period events.”*

3.3.5 A fixed detailed drainage layout drawing or sketch is not submitted at this outline stage. The purpose of this Outline Drainage Strategy is to demonstrate that a feasible drainage solution can be accommodated within Lime Down E1 based on the assessed hardstanding surfaces, greenfield runoff rates, controlled discharge rates, indicative attenuation volumes, SuDS options, containment principles and maintenance arrangements. The detailed drainage design, including the final layout, levels, outfall arrangement, isolation measures and maintenance access, will be submitted and approved in accordance with the relevant DCO drainage requirement before the relevant part of the authorised development commences.

### 3.4 Drainage Hierarchy

3.4.1 The proposed surface water drainage strategy has been prepared in accordance with the drainage hierarchy set out in the National Standards for Sustainable Drainage Systems (SuDS) and in line with Paragraph 080 of the National Planning Practice Guidance (NPPG): Flood Risk and Coastal Change. The hierarchy prioritises reuse and infiltration where feasible, followed by discharge to an above-ground surface water body, discharge to a surface water sewer or other surface water drainage system, and finally discharge to a combined sewer.

3.4.2 The following drainage hierarchy review considers normal operation. In the event of a potential pollution incident, including a firewater scenario where relevant, the drainage system would be isolated and managed in accordance with the relevant containment strategy. Firewater management is discussed further below.

3.4.3 The hierarchy establishes the following order of preference for runoff destinations:

- Priority 1: Collect surface water for reuse within the development (e.g. irrigation or non-potable supply).
- Priority 2: Infiltrate runoff to the ground, where ground conditions and groundwater levels permit.
- Priority 3: Discharge runoff to an above-ground surface water body such as a watercourse, pond

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<sup>1</sup> [https://www.wiltshire.gov.uk/media/13768/Wiltshire-Council-Drainage-Betterment-Strategy/pdf/Wiltshire\\_Council\\_Drainage\\_Betterment\\_Strategy\\_\\_June\\_2024.pdf?m=1731336788693](https://www.wiltshire.gov.uk/media/13768/Wiltshire-Council-Drainage-Betterment-Strategy/pdf/Wiltshire_Council_Drainage_Betterment_Strategy__June_2024.pdf?m=1731336788693)

or wetland.

- Priority 4: Discharge runoff to a surface water sewer, highway drain or other drainage system.
- Priority 5: Discharge runoff to a combined sewer.

3.4.4 Where higher levels of the hierarchy cannot be achieved, proportionate justification must be provided to demonstrate compliance with national policy while ensuring effective flood risk management and long-term sustainability.

#### **Priority 1: Surface Water Collected for non-Potable Use**

Rainwater harvesting has been considered for the proposed development and may be incorporated at detailed design to provide water for operational use, including potable use where appropriate and subject to the necessary treatment and water quality requirements. However, Lime Down E1 does not include a sustained non-potable demand capable of reliably receiving and using runoff from the positively drained hardstanding surfaces during design rainfall events. Rainwater harvesting is therefore not relied upon for attenuation or flood storage and reuse cannot provide the sole means of surface water disposal. A secondary discharge route and the required attenuation storage are therefore provided independently of any rainwater harvesting provision.

#### **Priority 2: Surface Water Infiltrated to Ground**

- 3.4.5 Where surface water collected for non-potable use (Priority 1) cannot be the sole method of disposal, the next consideration is infiltration (soakaways and permeable surfaces).
- 3.4.6 As described above, the Site is not underlain by superficial deposits and the underlying bedrock comprises the Kellaways Clay Member, comprising mudstone. Soils mapping describes the majority of the Site, including the area where the 132kV Substation is proposed, as having “*slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils with impeded drainage*”.
- 3.4.7 In line with the National Standards for SuDS, infiltration should only be used where ground conditions are suitable, groundwater is protected, and land stability is not compromised. The available ground condition information indicates that infiltration potential is likely to be limited, with impeded drainage soils and mudstone bedrock reducing the likelihood of reliable long-term soakaway performance.
- 3.4.8 Infiltration is therefore not considered suitable as the primary method of surface water disposal for the 132kV Substation drainage catchment. This avoids relying on soakaways where ground conditions are unlikely to provide adequate infiltration capacity, particularly during prolonged or high intensity rainfall.
- 3.4.9 This does not preclude the use of permeable surfaces, shallow filter drains or local French drain arrangements as source-control features for small, discrete areas of supporting infrastructure, where appropriate. Such features would manage small volumes locally and would not be relied upon as the primary outfall for the 132kV Substation drainage catchment.
- 3.4.10 Surface water from the 132kV Substation and other positively drained hardstanding surfaces will therefore be managed through a controlled drainage system, with attenuation and restricted discharge to an appropriate receiving drainage feature or watercourse.

#### **Priority 3: Discharge to an Above Ground Surface Water Body**

- 3.4.11 Where surface water collected for non-potable use (Priority 1) cannot be the sole method of disposal, and infiltration to ground (Priority 2) has been demonstrated to be unsuitable, discharge to an above ground waterbody should be the next consideration.
- 3.4.12 The nearest watercourse is Gabriel’s Well, a Main River, which is located approximately 200m to the

south of Lime Down E1. Discharge to this watercourse at controlled rates is considered feasible by gravity, subject to detailed design of the outfall arrangement and any necessary approvals.

**Priority 4: Discharged to a Surface Water Sewer, or Another Piped Surface Water Drainage System**

3.4.13 As described above, discharge to Gabriel’s Well appears feasible; therefore, a connection to a public surface water sewer is not proposed. Should detailed design demonstrate that direct discharge to the watercourse is not feasible, alternative lower-priority destinations would be reviewed in accordance with the drainage hierarchy and subject to the relevant approvals.

**Priority 5: Discharge to a Combined Sewer**

3.4.14 As described above, discharge to Gabriel’s Well appears feasible; therefore, discharge to a combined sewer is not proposed.

### 3.5 Surface Water Discharge

3.5.1 In accordance with the 2025 National Standards for SuDS in England Guidance, runoff destinations have been assessed following the required hierarchy.

3.5.2 As infiltration is not considered suitable as the primary discharge route for the 132kV Substation drainage catchment, runoff from the positively drained hardstanding surfaces will be attenuated on Site and discharged at controlled rates to Gabriel’s Well in line with greenfield runoff principles and the LLFA requirement for 30% betterment.

3.5.3 Greenfield runoff rates have been calculated for each assessed hardstanding surface using the FEH Statistical (2025) method and are summarised in Table 2. The proposed discharge rates and associated attenuation volumes are indicative and have been prepared using the indicative infrastructure areas currently proposed, or the maximum relevant design parameters set out in **ES Volume 1, Chapter 3: The Scheme [APP-055]** where the final equipment layout is not fixed. Greenfield calculation input parameters and results are provided in Annex C.

3.5.4 This approach demonstrates that a feasible drainage solution can be accommodated within Lime Down E1 and that peak runoff from positively drained hardstanding surfaces can be controlled so that the Scheme does not result in a material increase in flood risk on-site or elsewhere. The attenuation volumes are indicative and are provided to demonstrate the feasibility of the Outline Drainage Strategy. The final drainage design may rationalise the number, location and form of SuDS components, provided the detailed design remains within the assessed design envelope and achieves the drainage principles secured through the relevant DCO drainage requirement.

**Table 2: Greenfield Runoff Rates**

| Infrastructure                | 1 in 2 year (l/s) | 1 in 30 year (l/s) | 1 in 100 year (l/s) | 1 in 2 year +30% betterment (l/s) | Proposed Discharge Rate (l/s) | Attenuation (m <sup>3</sup> ) |
|-------------------------------|-------------------|--------------------|---------------------|-----------------------------------|-------------------------------|-------------------------------|
| 132kV Substation              | 5.4               | 11.4               | 14.2                | 3.8                               | 3.8                           | 954.7                         |
| 132kV Substation Access Track | 5.0               | 10.5               | 13.1                | 3.5                               | 3.5                           | 880.3                         |
| Conversion Units / 33kV       | 0.1               | 0.3                | 0.3                 | 0.1                               | 0.1                           | 6.2*                          |

|                               |  |  |  |  |  |  |
|-------------------------------|--|--|--|--|--|--|
| Sub-distribution Switch Rooms |  |  |  |  |  |  |
|-------------------------------|--|--|--|--|--|--|

\*The Conversion Unit / 33kV Sub-distribution Switch Room attenuation volume is calculated on a per-unit basis. For Lime Down E1, each unit requires approximately 6.2m<sup>3</sup> of indicative local storage, to be provided through source-control SuDS such as perimeter French drains, filter drains or equivalent features. Three units are proposed at Lime Down E1, giving a cumulative indicative local storage requirement of approximately 18.6m<sup>3</sup>.

**3.6 Sustainable Drainage Systems**

3.6.1 The SuDS appraisal approach outlined in the SuDS Manual (C753) has been applied to determine the most suitable methods for achieving sustainable surface water attenuation and conveyance to support the proposed development. The SuDS options summarised in Table 3 below have been considered:

**Table 3: SuDS Options for Proposed Development**

| <b>SuDS Measure</b>                | <b>Amenity Benefit</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <b>Biodiversity Benefit</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <b>Suitability for Proposed Development</b> | <b>Reasoning</b>                                                                                                                                                                                                                      |
|------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Soakaways                          | Although soakaways are typically below ground, they can contribute to amenity by allowing the land above to be used for landscaping or recreation. When integrated with visible SuDS features or planting, they can enhance the visual quality of a site and support multifunctional, attractive spaces.                                                                                                                                                                                              | Soakaways support biodiversity indirectly by promoting groundwater recharge and maintaining natural hydrological conditions. When combined with vegetated SuDS components, they can enhance habitat connectivity and contribute to ecological networks across a site.                                                                                                                                                                                                                                                      | X                                           | As described above, the use of soakaways is not considered to be feasible.                                                                                                                                                            |
| Swales, Detention Basins and Ponds | Swales, detention basins and ponds contribute positively to site amenity by providing visually attractive, multifunctional spaces that enhance the quality and character of a development. These features can be integrated within the landscape as green corridors, linking open spaces and promoting interaction between people and water. When appropriately designed, they offer opportunities for recreation, education and visual interest, creating a more appealing and liveable environment. | Swales, detention basins and ponds deliver significant biodiversity value through the provision of varied and connected habitats. Swales function as linear green corridors, enabling wildlife movement and supporting diverse vegetation. Detention basins create temporary wetland conditions that benefit a range of species, while ponds provide permanent aquatic and marginal habitats supporting invertebrates, amphibians and birds. Collectively, these features enhance habitat diversity, strengthen ecological | ✓                                           | Sufficient space is available on site to utilise a pond, basin or swale as an above ground attenuation feature. In order to facilitate gravity drainage, attenuation features should be located towards the topographic lower levels. |

|                          |                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                          |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                          |                                                                                                                                                                                                                                                                                                                                                                                   | connectivity and contribute to the establishment of a resilient green-blue network across the site.                                                                                                                                                                                                                                                                                                      |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Filter Drains/<br>Strips | Filter drains and filter strips can contribute to site amenity by creating attractive, vegetated edges that soften hard surfaces and integrate drainage within the landscape. When aligned along roads or paths, they form part of functional green corridors that enhance visual quality and support a sense of place.                                                           | These features provide ecological value through vegetated zones that support invertebrates and small fauna. When linked with other SuDS components, they strengthen habitat connectivity and contribute to the wider green-blue network promoted within the SuDS approach.                                                                                                                               | ✓ | Filter drains are trenches filled with stone/gravel that create temporary subsurface storage for the filtration, attenuation, and conveyance of surface water runoff. Ideally, filter drains receive lateral inflow from adjacent impermeable surfaces pretreated over a filter strip. Filter drains can help manage peak flows by naturally limiting rates of conveyance through the filter medium and by providing attenuation storage when the rate of flow at the outlet is controlled.                                                                                                                                                                                                                                                                                                                |
| Bioretention Systems     | Bioretention systems, including rain gardens and bioretention planters, provide attractive, vegetated features that enhance the streetscape and create visually appealing focal points within developments. They contribute to high-quality, multifunctional spaces by integrating drainage into the landscape and improving the relationship between people, water and planting. | These systems deliver biodiversity value through diverse planting and soil conditions that support pollinators, invertebrates and small fauna. They also play a key role in improving water quality by filtering and treating pollutants from surface runoff before infiltration or discharge. Collectively, they enhance ecological connectivity and contribute to the wider green-blue infrastructure. | ✓ | Bioretention systems (including rain gardens and raised box planters) are shallow landscaped depressions that can reduce runoff rates and volumes and treat pollution. They also provide attractive landscape features and biodiversity. Bioretention systems can help reduce flow rates from a site by promoting infiltration / evapotranspiration and providing some attenuation storage. Bioretention systems can also provide very effective treatment functionality. Bioretention systems are a very flexible surface water management component that can be integrated into a wide variety of developments / densities using different shapes, materials, planting, and dimensions.<br>Bioretention systems (including rain gardens) should be considered within the detailed drainage design stage. |

|                                            |                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                               |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|--------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Rainwater Harvesting                       | Rainwater harvesting systems can contribute to site amenity by visibly demonstrating sustainable water management and promoting environmental awareness. When integrated within building or landscape design, they can enhance the character of a development by supporting water features, irrigation, or other non-potable uses that add functional and aesthetic value to spaces. | By reducing surface water runoff, rainwater harvesting systems help protect downstream SuDS features and receiving watercourses from pollution and erosion. Stored water can also be used to support planting and green infrastructure, indirectly benefiting biodiversity through improved vegetation health and habitat provision.                                          | X | Rainwater harvesting may be incorporated at detailed design to provide water for operational use, including potable use where appropriate and subject to the necessary treatment and water quality requirements. However, there is no sustained water demand that can be relied upon to ensure storage capacity is available during design rainfall events. Rainwater harvesting is therefore not relied upon for attenuation or flood storage, and the required attenuation storage and discharge controls are provided independently of any rainwater harvesting provision. |
| Green Roofs                                | Green roofs enhance the visual quality of buildings and contribute to the creation of more attractive and liveable urban environments. They can provide accessible or visual green spaces within dense developments, offering opportunities for recreation, relaxation, and improved wellbeing while demonstrating sustainable design in practice.                                   | Green roofs support biodiversity by providing valuable habitats for invertebrates, birds, and pollinators, particularly where native or species-rich planting is used. They also improve water quality and reduce runoff rates by capturing, filtering, and slowly releasing rainfall, supporting the wider SuDS objectives of managing water quantity, quality, and ecology. | X | Green roofs are not identified on development plans. Given the nature of the Scheme, green roofs are not considered a practical option. The benefits achieved through installing a green roof would be disproportionate to the significant ongoing maintenance and construction costs involved.                                                                                                                                                                                                                                                                               |
| Porous/ Permeable Surfacing (infiltration) | Porous and permeable surfaces can enhance the quality and functionality of developed areas by integrating drainage directly into hardstanding such as car parks, footpaths and access roads. They maintain a natural appearance, reduce surface water ponding, and                                                                                                                   | Infiltration-based permeable surfaces promote natural groundwater recharge and improve water quality by filtering and retaining pollutants within the sub-base before infiltration. When combined with adjacent vegetated SuDS features, they can contribute to                                                                                                               | X | Controlled drainage measures, including sealed surfacing or sealed drainage components where required, can be incorporated within the 132kV Substation Area to prevent uncontrolled infiltration of spills, leaks or firewater into ground or controlled waters. The detailed drainage design should include appropriate treatment, interception, containment and isolation measures                                                                                                                                                                                          |

|                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                         |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|-----------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                         | contribute to safer, more attractive public spaces while supporting the seamless integration of SuDS within the built environment.                                                                                                                                                                                                                                                                        | habitat connectivity and support the wider green-blue network across a site.                                                                                                                                                                                                                                                                                                                                                                            |   | proportionate to the substances stored and the sensitivity of the receiving environment. The drainage principles are set out in the <b>Firewater Containment and Drainage Strategy – Lime Down Substation [REP3-120]</b> .                                                                                                                                                                                                                                                                                 |
| Porous/<br>Permeable<br>Surfacing<br>(Lined)                                            | Lined porous and permeable surfaces provide an attractive, functional drainage solution that manages runoff close to source while maintaining the appearance and usability of hardstanding areas such as car parks, courtyards and footpaths. They support high-quality, multi-functional urban design by integrating water management within the built environment without detracting from site amenity. | Although infiltration is prevented, lined permeable surfaces still contribute to SuDS objectives by providing effective pollutant removal through filtration and sedimentation within the surface and sub-base layers. By controlling and treating runoff before discharge to other SuDS components, they protect downstream water quality and can indirectly support biodiversity by maintaining cleaner flows to connected green-blue infrastructure. | ✓ | The final extent, depth and configuration of any lined permeable surfacing or lined sub-base storage will be confirmed at detailed design. Where such storage is used, the available storage volume will be calculated based on the surface area, proposed depth and appropriate void ratio for the selected material. Typically, the storage offered can be calculated by multiplying the surface area of the permeable surfacing (m <sup>2</sup> ) by the proposed depth (m) by a porosity ratio of 0.3. |
| Underground<br>Attenuation<br>Tanks /<br>Geocellular<br>Storage /<br>Oversized<br>Pipes | Underground attenuation tanks and geocellular storage systems provide essential runoff control while preserving the use and appearance of surface areas. By locating storage below ground, they enable land above to be used for landscaping, parking, or recreation, supporting efficient land use and maintaining overall site amenity.                                                                 | These systems offer limited direct biodiversity value but can contribute indirectly by facilitating above-ground green spaces and protecting downstream SuDS features. When designed with pre-treatment measures, they assist in pollutant removal, improving water quality prior to discharge and supporting the performance of connected ecological SuDS components.                                                                                  | × | Underground attenuation storage is not proposed, as alternative SuDS features have been selected that provide sufficient on-site attenuation while offering additional water quality, amenity, and biodiversity benefits.                                                                                                                                                                                                                                                                                  |

### 3.7 Attenuation Storage

#### Extreme Rainfall

- 3.7.1 Attenuation storage will be required to manage surface water runoff from the positively drained hardstanding surfaces and achieve the controlled discharge rates set out below. A combination of SuDS features, and flow control devices is proposed to manage surface water runoff at Lime Down E1.
- 3.7.2 The hardstanding surfaces requiring positive drainage have been identified using either the indicative area of the infrastructure proposed at Lime Down E1, or, where the final equipment layout is not fixed, the relevant maximum design parameters for that equipment set out in **ES Volume 1, Chapter 3: The Scheme [APP-055]**. The calculations are therefore conservative and are provided for illustrative purposes to demonstrate that a feasible drainage solution can be accommodated within Lime Down E1 and within the assessed design envelope.
- 3.7.3 Greenfield runoff rates have been calculated for each assessed hardstanding surface. The proposed discharge rates have then been restricted in accordance with the LLFA drainage requirement, with attenuation storage sized to manage runoff up to and including the 1% AEP plus 45% climate change event.
- 3.7.4 The larger hardstanding surfaces, including the 132kV Substation Area and associated access track where conservatively assessed as hardstanding surfaces, will be collected and conveyed to formal attenuation and flow control features prior to discharge at the restricted rate.
- 3.7.5 The three Conversion Units / 33kV Sub-distribution Switch Rooms comprise small, discrete areas of supporting electrical infrastructure. Switchgear comprises electrical disconnect switches, fuses and circuit breakers used to control, protect and isolate electrical equipment. For the purposes of this assessment, runoff calculations have been based on the maximum 15m by 5m footprint for Integrated Conversion Units / 33kV Sub-distribution Switch Rooms defined in **ES Volume 1, Chapter 3: The Scheme [APP-055]**, equivalent to 75m<sup>2</sup> per unit. This provides a conservative basis for assessment.
- 3.7.6 For an individual 75m<sup>2</sup> unit, the indicative local storage volume is approximately 6.2m<sup>3</sup>. Across Lime Down E1, three Conversion Units / 33kV Sub-distribution Switch Rooms are proposed, giving a cumulative assessed area of 225m<sup>2</sup> and a cumulative indicative local storage requirement of approximately 18.6m<sup>3</sup>. The calculated greenfield runoff rates for the combined Conversion Unit / 33kV Sub-distribution Switch Room area are 0.1l/s for the 1 in 2 year event, 0.3l/s for the 1 in 30 year event and 0.3l/s for the 1 in 100 year event. Runoff from each unit will be managed locally through source-control SuDS, with final flow controls confirmed at detailed design.
- 3.7.7 Given the small contributing area, low calculated runoff volumes and dispersed nature of the infrastructure, it is not considered proportionate to provide long piped drainage connections from each unit to a formal outfall. Runoff from each unit will therefore be managed locally using a perimeter French drain, filter drain or equivalent source-control SuDS arrangement. These features will provide local storage and source control around the equipment pads and will not be relied upon as strategic attenuation basins or as part of a wider piped drainage network.
- 3.7.8 Final dimensions, aggregate specification, freeboard and maintenance requirements for the French drains will be confirmed at detailed design, having regard to the final equipment layout and local ground conditions. This approach is consistent with the drainage hierarchy and source control principles set out in CIRIA C753: The SuDS Manual, and avoids creating unnecessary point discharges from small, isolated areas of supporting electrical infrastructure.
- 3.7.9 Hydraulic calculations carried out in Causeway Flow demonstrate that the illustrative drainage approach

has sufficient capacity to manage runoff from the assessed hardstanding surfaces up to and including the 1% AEP plus 45% climate change event. Key details for the proposed attenuation storage and flow control required to manage surface water runoff are summarised in the tables below. Hydraulic calculations are provided in Annex D.

**Table 4: 132kV Substation Area Attenuation Storage**

|                                                         |                     |
|---------------------------------------------------------|---------------------|
| <b>Contributing Area</b>                                | 9,000m <sup>2</sup> |
| <b>Flow Rate</b>                                        | 3.8l/s              |
| <b>Flow Control</b>                                     | HydroBrake          |
| <b>Flow Control Design Head</b>                         | 1.0m                |
| <b>Estimated Required Volume (1 in 100 year +45%CC)</b> | 954.7m <sup>3</sup> |

**Table 5: 132kV Access Tracks Attenuation Storage**

|                                                         |                     |
|---------------------------------------------------------|---------------------|
| <b>Contributing area</b>                                | 8,310m <sup>2</sup> |
| <b>Flow Rate</b>                                        | 3.5l/s              |
| <b>Flow Control</b>                                     | HydroBrake          |
| <b>Flow Control Design Head</b>                         | 0.75m               |
| <b>Estimated Required Volume (1 in 100 year +45%CC)</b> | 880.3m <sup>3</sup> |

**Table 6: Conversion Unit/33kV Distribution Switch Room Attenuation Storage**

|                                                         |                                                              |
|---------------------------------------------------------|--------------------------------------------------------------|
| <b>Number of Units</b>                                  | 3                                                            |
| <b>Contributing Area</b>                                | 75 m <sup>2</sup> per unit (225 m <sup>2</sup> cumulative)   |
| <b>Flow Rate</b>                                        | 0.1l/s per Unit                                              |
| <b>Flow Control</b>                                     | HydroBrake                                                   |
| <b>Flow Control Design Head</b>                         | 0.75m                                                        |
| <b>Estimated Required Volume (1 in 100 year +45%CC)</b> | 6.2 m <sup>3</sup> per unit (18.6 m <sup>3</sup> cumulative) |

### **Everyday Rainfall**

3.7.10 In addition to managing extreme rainfall events, measures should be implemented to ensure runoff generated during more frequent everyday rainfall events is sustainably managed. For these events, where practicable, the volume of runoff generated from the first 5mm of rainfall should not leave the Site.

**Table 7: 132kV Substation Area Everyday Rainfall\***

|                          |                     |
|--------------------------|---------------------|
| <b>Contributing Area</b> | 9,000m <sup>2</sup> |
| <b>Rainfall Depth</b>    | 0.005m              |

|                                  |                    |
|----------------------------------|--------------------|
| <b>Runoff Volume</b>             | 45.0m <sup>3</sup> |
| <b>Required Additional Depth</b> | 0.05m              |

**Table 8: 132kV Access Tracks Everyday Rainfall\***

|                                  |                     |
|----------------------------------|---------------------|
| <b>Contributing Area</b>         | 8,310m <sup>2</sup> |
| <b>Rainfall Depth</b>            | 0.005m              |
| <b>Runoff Volume</b>             | 41.55m <sup>3</sup> |
| <b>Required Additional Depth</b> | 0.04m               |

**Table 9: Conversion Unit/33kV Distribution Switch Room Everyday Rainfall\***

|                          |                                                            |
|--------------------------|------------------------------------------------------------|
| <b>Number of Units</b>   | 3                                                          |
| <b>Contributing Area</b> | 75 m <sup>2</sup> per unit (675 m <sup>2</sup> cumulative) |
| <b>Rainfall Depth</b>    | 0.005m                                                     |
| <b>Runoff Volume</b>     | 0.4m <sup>3</sup>                                          |

\*| additional storage depths presented for the 132kV Substation Area and 132kV Access Tracks assume that storage is provided within a basin for the purposes of illustration. The final form of storage may differ depending on the detailed layout and may include other SuDS components capable of providing equivalent storage and treatment. Everyday rainfall associated with the Conversion Units / 33kV Sub-distribution Switch Rooms will be managed locally through the source-control SuDS arrangements described above.

3.7.11 As shown in the tables above, the everyday rainfall volumes are limited and can be accommodated within the proposed SuDS features. This allows the first 5 mm of rainfall to be retained and managed within the drainage system through infiltration where local ground conditions permit, evaporation, evapotranspiration, or subsequent controlled release depending on the final SuDS arrangement.

### 3.8 Preferred Drainage Scheme

3.8.1 The viable SuDS features and associated hydraulic calculations have been reviewed above. The final extent and arrangement of hardstanding surfaces will be confirmed at detailed design; however, the calculations presented in this report have been prepared using the indicative infrastructure areas currently proposed, or the maximum relevant design parameters set out in **ES Volume 1, Chapter 3: The Scheme [APP-055]** where the final equipment layout is not fixed. The calculations are therefore conservative and are provided to demonstrate that a feasible drainage solution can be accommodated within Lime Down E1 and within the assessed design envelope.

3.8.2 Greenfield runoff rates have been calculated for the assessed hardstanding surfaces and the proposed discharge rates have been restricted in accordance with the LLFA drainage requirement. The identified receiving watercourse is Gabriel's Well located approximately 200m south of Lime Down E1, with the indicative cumulative controlled discharge rates provided within Tables 4, 5 and 6. The proposed SuDS features will attenuate surface water runoff from the positively drained hardstanding surfaces up to and including the 1% AEP plus 45% climate change event. The final drainage design will confirm the detailed

layout, attenuation volumes, flow controls, outfall arrangement, treatment train, isolation measures and maintenance requirements, and will ensure that peak runoff from positively drained hardstanding surfaces are controlled so that the Scheme does not result in a material increase in flood risk on-site or elsewhere.

- 3.8.3 The drainage strategy is necessarily proportionate to the current stage of design. The final technology, equipment layout, finished levels, drainage catchments and configuration of the drainage system remain subject to detailed design. It is therefore neither possible nor appropriate at this stage to define separate drainage arrangements, dimensions and attenuation volumes for each individual item of infrastructure. For the purposes of demonstrating feasibility, the Causeway Flow calculation applies the total assessed hardstanding area and the committed restricted discharge rate to determine the indicative attenuation storage requirement. The generic tank shown within the calculation is a nominal software storage unit used solely to derive the required storage volume and does not represent a proposed tank or other drainage feature. The dimensions assigned to that unit should therefore not be interpreted as proposed drainage dimensions.
- 3.8.4 The assessment conservatively assumes that runoff from the identified hardstanding areas is managed through a controlled drainage system and demonstrates that sufficient attenuation can be provided within the available land using one or more appropriate SuDS or other attenuation features. Undertaking separate calculations and fixing dimensions for each component at this stage would imply a degree of design certainty that does not exist, unnecessarily constrain the subsequent optimisation of the Scheme and would not materially improve the assessment of flood risk. The final drainage arrangement, including the contributing catchments, conveyance system, storage type, dimensions and required volumes, will be recalculated and verified against the final technology and layout at detailed design stage. It will remain subject to the discharge limits, design standard and drainage principles established by this strategy and secured through Requirement 5 of the **Draft Development Consent Order [rep4-004]**.

3.9 Event Exceedance

- 3.9.1 The illustrative SuDS approach has been sized to manage surface water runoff from the positively drained hardstanding surfaces up to and including the 1% AEP plus 45% climate change event. Storm events in excess of this design event may result in temporary shallow exceedance flooding within lower-risk areas of Lime Down E1.
- 3.9.2 Finished levels for sensitive electrical infrastructure and equipment plinths will be set above surrounding ground levels where practicable. Exceedance routes will be confirmed at detailed design and will direct residual flows away from critical equipment, buildings and access points where practicable, so that exceedance flooding does not result in a material increase in flood risk on-site or elsewhere.

3.10 Surface Water Treatment

- 3.10.1 In accordance with DEFRA’s National standards for sustainable drainage systems and the Simple Index Approach as described in C753 The SuDS Manual (2015), other roofs have a ‘low’ pollution hazard level, with commercial yards classified as having a ‘medium’ pollution hazard level. The table below shows the pollution hazard indices for each land use.

Table 10: Pollution Hazard Indices

| Land Use | Pollution Hazard Level | Total Suspended Solids (TSS) | Metals | Hydrocarbons |
|----------|------------------------|------------------------------|--------|--------------|
|----------|------------------------|------------------------------|--------|--------------|

|                                                                                                               |        |     |       |     |
|---------------------------------------------------------------------------------------------------------------|--------|-----|-------|-----|
| <b>Other Roofs (typically commercial/industrial roofs)</b>                                                    | Low    | 0.5 | 0.2** | 0.4 |
| <b>Commercial Yard and Delivery Areas, Non-residential Car Parking and all roads except Low Traffic Roads</b> | Medium | 0.7 | 0.6   | 0.7 |

Table extract taken from the CIRIA C753 publication 'The SuDS Manual' – Table 26.2

\* Indices values range from 0-1.

\*\* up to 0.8 where there is potential for metals to leach from the roof

3.10.2 Runoff from positively drained hardstanding surfaces will be routed through an appropriate SuDS treatment train before controlled discharge. Table 11 below demonstrates the mitigation indices for typical SuDS components that may be used within the final drainage design.

**Table 11: SuDS Mitigation Indices**

| Type of SuDS               | Mitigation Indices           |        |              |
|----------------------------|------------------------------|--------|--------------|
|                            | Total Suspended Solids (TSS) | Metals | Hydrocarbons |
| <b>Permeable Surfacing</b> | 0.7                          | 0.6    | 0.7          |
| <b>Swale</b>               | 0.5                          | 0.6    | 0.6          |
| <b>Detention basin</b>     | 0.5                          | 0.5    | 0.6          |
| <b>Pond</b>                | 0.7                          | 0.7    | 0.5          |

Table extract taken from the CIRIA C753 publication 'The SuDS Manual' -Table 26.3

3.10.3 It is concluded that a suitable combination of SuDS components, such as detention basins, ponds, swales, lined permeable surfacing and/or filter drains, can provide sufficient treatment for the assessed pollution hazard indices. The final treatment train will be confirmed at detailed design and will be coordinated with the required attenuation, isolation and maintenance arrangements.

### 3.11 Firewater Consideration

3.11.1 The firewater containment and pollution control principles apply to the 132kV Substation drainage at Lime Down E1. Detailed design will identify the appropriate containment, isolation and treatment measures for the substation compound, in accordance with the principles set out in **Firewater Containment and Drainage Strategy – Lime Down Substation [REP3-120]**.

3.11.2 The principal potential pathway for contaminated firewater or polluted runoff from the 132kV Substation Area would be through the proposed surface water drainage system. The drainage system will therefore be designed so that it can be isolated in the event of a pollution incident or firewater containment scenario. Where required, this will include lined drainage components, controlled outfalls and shut-off valves to prevent uncontrolled discharge to ground or surface water receptors.

3.11.3 In the event of a fire or pollution incident, the relevant outfall valve would be closed and retained water would be held within the drainage system. The retained water would then be sampled and tested to

determine the appropriate disposal route. Depending on the results, this may comprise treatment and controlled discharge subject to the relevant approval, or removal from Site by tanker.

- 3.11.4 The detailed containment volume, valve arrangement, testing procedure, treatment requirements and maintenance regime will be confirmed through detailed design and will be consistent with the substation firewater containment strategy.
- 3.11.5 This does not alter the outline drainage assessment, which demonstrates that normal operational surface water runoff can be managed without increasing flood risk

### **3.12 Maintenance**

- 3.12.1 Routine inspections and maintenance of the surface water drainage system is required to ensure that the drainage infrastructure continues to operate effectively for the lifetime of the development, without increasing flood risk on or off site.
- 3.12.2 Maintenance of surface water drainage features will be the responsibility of the undertaker or operator. Maintenance of the operational drainage system will be carried out in accordance with the final drainage design and the principles set out in **Outline Operational Environmental Management Plan [REP3-094]**. Firewater-related inspection, testing and maintenance requirements for the 132kV Substation drainage system will be confirmed in accordance with **Firewater Containment and Drainage Strategy – Lime Down Substation [REP3-120]**.
- 3.12.3 The final maintenance arrangements will be confirmed at detailed design and will reflect the final drainage components, flow controls, treatment measures, isolation valves and outfall arrangements.

## 4. Conclusions and Recommendations

- 4.1.1 Lime Down E1 comprises ground mounted Solar PV Panels, one 132kV Substation, associated access track and supporting electrical infrastructure.

### **Flood Risk**

- 4.1.2 Lime Down E1 is situated almost wholly within Flood Zone 1 with the exception of the northernmost extent of Field E4 which is located in Flood Zone 2. The extent of Flood Zone 2 is considered to be associated with a tributary of Gauze Brook (which flows in a north-easterly direction) and does not encroach into the area proposed for Scheme.
- 4.1.3 The majority of Lime Down E1 is at Very Low risk of surface water flooding; however, there are some small areas of Very Low to High risk particularly at Fields E1 – E4 and a small section in the southernmost extent of Field E6. The areas of risk in Fields E2 – E4 are associated with the presence of the tributary of Gauze Brook. Other areas of risk across Lime Down E1 are associated with topographic depressions within the Fields and ponding along the railway line to the south.
- 4.1.4 The risk of flooding from all sources has been assessed and the flood risk is considered to be **Negligible to Low** and therefore does not require site-specific mitigation measures.
- 4.1.5 Solar PV Panels are raised above ground level and do not form a connected impermeable drainage catchment. The proposed 132kV Substation is located in Flood Zone 1 and will be subject to a controlled drainage strategy. Where smaller electrical infrastructure is located in areas of mapped surface water interaction, it will be elevated or provided with appropriate local resilience measures in accordance with the embedded mitigation set out in the Covering Report.

### **Drainage Strategy**

- 4.1.6 Solar PV panelled areas are not treated as formal impermeable drainage catchments within this Outline Drainage Strategy. The panels are elevated above ground level, drain to the existing ground, are not sealed into a drainage network, and do not create a connected impermeable surface.
- 4.1.7 Greenfield runoff rates have been calculated for the assessed hardstanding surfaces and the proposed discharge rates have been restricted in accordance with the LLFA drainage requirement. The identified receiving watercourse is Gabriel's Well approximately 200m south of Lime Down E1, with the indicative cumulative controlled discharge rates provided within Tables 4, 5 and 6. The proposed SuDS features will attenuate surface water runoff from the positively drained hardstanding surfaces up to and including the 1% AEP plus 45% climate change event. In addition, the everyday rainfall volumes are limited and can be accommodated within the proposed SuDS features.
- 4.1.8 The drainage strategy is necessarily proportionate to the current stage of design. As such, an outline drainage sketch is provided in Annex F, however, a fixed detailed drainage layout drawing will not be submitted at this outline stage, as the final drainage layout will depend on the detailed design of the site.
- 4.1.9 It is concluded that a suitable combination of SuDS components, such as detention basins, ponds, swales, lined permeable surfacing and/or filter drains, can provide sufficient treatment for the assessed pollution hazard indices.

- 4.1.10 In the event of a firewater incident, the drainage system will be designed so that it can be isolated in the event of a pollution incident or firewater containment scenario.

## **4.2 Recommendations**

- 4.2.1 Embedded mitigation is detailed in **ES Volume 3, Appendix 11-1: Flood Risk Assessment and Outline Drainage Strategy – Covering Report [REP3-039]**. The final drainage design for the 132kV Substation, associated access track and supporting electrical infrastructure will be submitted and approved in accordance with the relevant DCO drainage requirement.

## **Annexes**

## **Annex A- Water Body Catchment Classifications Summaries**

**Rodbourne Bk – source to conf R Avon (Brist) Water Body Catchment Classification Summary**

| Classification Item                            | 2019 Classification |               | 2022 Classification | Cycle 3 Objectives |                       |                                                        |
|------------------------------------------------|---------------------|---------------|---------------------|--------------------|-----------------------|--------------------------------------------------------|
|                                                | Cycle 2             | Cycle 3       | Cycle 3             | Status             | Year                  | Reasons                                                |
| Ecological                                     | Moderate            | Moderate      | Moderate            | Good               | 2027 - Low Confidence | Disproportionately expensive: Disproportionate burdens |
| Biological Quality Elements                    | Moderate            | Moderate      | Moderate            | Good               | 2027 - Low Confidence | Disproportionately expensive: Disproportionate burdens |
| Invertebrates                                  | Moderate            | Moderate      | Moderate            | Good               | 2015                  |                                                        |
| Macrophytes and Phytobenthos Combined          | Moderate            | Moderate      | Moderate            | Good               | 2027 - Low Confidence | Disproportionately expensive: Disproportionate burdens |
| Macrophytes sub element                        | Moderate            | Moderate      | Moderate            |                    |                       |                                                        |
| Physio-Chemical Quality Elements               | High                | High          | High                | Good               | 2027 - Low Confidence | Disproportionately expensive: Disproportionate burdens |
| Ammonia (Phys-Chem)                            | High                | High          | High                | Good               | 2015                  |                                                        |
| Dissolved Oxygen                               | High                | High          | High                | Good               | 2015                  |                                                        |
| Phosphate                                      | High                | High          | High                | Good               | 2015                  | Disproportionately expensive: Disproportionate burdens |
| Temperature                                    | High                | High          | High                | Good               | 2015                  |                                                        |
| pH                                             | High                | High          | High                | Good               | 2015                  |                                                        |
| Hydromorphological Supporting Elements         | Supports Good       | Supports Good | Supports Good       | Supports Good      | 2015                  |                                                        |
| Hydrological Regime                            | Supports Good       | Supports Good | Supports Good       |                    | 2015                  |                                                        |
| Specific Pollutants                            |                     |               |                     | N/A                | 2015                  |                                                        |
| Copper                                         |                     |               |                     |                    |                       |                                                        |
| Triclosan                                      |                     |               |                     |                    |                       |                                                        |
| Zinc                                           |                     |               |                     |                    |                       |                                                        |
| Chemical                                       | Fail                | Fail          | N/A                 | Good               | 2063                  | Natural conditions: Chemical status recovery time      |
| Priority Hazardous Substances                  | Fail                | Fail          | N/A                 | Good               | 2063                  | Natural conditions: Chemical status recovery time      |
| Benzo(a)pyrene                                 | Good                | Good          |                     | Good               | 2015                  |                                                        |
| Cadium and Its Compounds                       |                     |               |                     |                    |                       |                                                        |
| Di(2-ethylhexyl)phthalate (Priority hazardous) |                     |               |                     |                    |                       |                                                        |
| Dioxins and dioxin-like compounds              | Good                | Good          |                     | Good               | 2015                  |                                                        |
| Heptachlor and cis-Heptachlor Epoxide          | Good                | Good          |                     | Good               | 2015                  |                                                        |
| Hexabromocyclododecane                         | Good                | Good          |                     | Good               | 2015                  |                                                        |
| Hexachlorobenzene                              | Good                | Good          |                     | Good               | 2015                  |                                                        |
| Hexachlorobutadiene                            | Good                | Good          |                     | Good               | 2015                  |                                                        |
| Mercury and Its Compounds                      | Fail                | Fail          |                     | Good               | 2040                  | Natural conditions: Chemical status recovery time      |
| Nonylphenol                                    |                     |               |                     |                    |                       |                                                        |
| Perfluorooctane sulphonate (PFOS)              | Good                | Good          |                     | Good               | 2015                  |                                                        |
| Polybrominated diphenyl ethers (PBDE)          | Fail                | Fail          |                     | Good               | 2063                  | Natural conditions: Chemical status recovery time      |
| Tributyltin Compounds                          |                     |               |                     |                    |                       |                                                        |
| Priority substances                            | Good                | Good          | N/A                 | Good               | 2015                  |                                                        |
| Cypermethrin (Priority)                        | Good                | Good          |                     | Good               | 2015                  |                                                        |
| Fluoranthene                                   | Good                | Good          |                     | Good               | 2015                  |                                                        |
| Lead and Its Compounds                         |                     |               |                     |                    |                       |                                                        |
| Nickel and Its Compounds                       |                     |               |                     |                    |                       |                                                        |
| Other Pollutants                               | N/A                 | N/A           | N/A                 | N/A                | 2015                  | Did not require assessment                             |

**Gauze Brook - source to conf R Avon (Brist) Water Body Catchment Classification Summary**

**Gauze Brook - source to conf R Avon (Brist) Water Body Catchment Classification Summary**

| Classification Item                    | 2019 Classification   |                       | 2022 Classification | Cycle 3 Objectives    |                       |                                                                          |
|----------------------------------------|-----------------------|-----------------------|---------------------|-----------------------|-----------------------|--------------------------------------------------------------------------|
|                                        | Cycle 2               | Cycle 3               |                     | Status                | Year                  | Reasons                                                                  |
| Ecological                             | Moderate              | Moderate              | Moderate            | Good                  | 2027 - Low Confidence | Disproportionately expensive: Disproportionate burdens                   |
| Biological Quality Elements            | High                  | High                  | Good                | Good                  | 2015                  |                                                                          |
| Invertebrates                          | High                  | High                  | High                | Good                  | 2015                  |                                                                          |
| Macrophytes and Phytobenthos Combined  | High                  | High                  | Good                | Good                  | 2015                  |                                                                          |
| Macrophytes subelement                 | High                  | High                  | Good                | Good                  |                       |                                                                          |
| Physio-Chemical Quality Elements       | Moderate              | Moderate              | Moderate            | Good                  | 2027 - Low Confidence | Disproportionately expensive: Disproportionate burdens                   |
| Acid Neutralising Capacity             |                       |                       |                     |                       |                       |                                                                          |
| Ammonia (Phys-Chem)                    | High                  | High                  | High                | Good                  | 2015                  |                                                                          |
| Dissolved Oxygen                       | Poor                  | Poor                  | Poor                | Good                  | 2015                  |                                                                          |
| Phosphate                              | Poor                  | Poor                  | Poor                | Good                  | 2027 - Low Confidence | Disproportionately expensive: Disproportionate burdens                   |
| Temperature                            | High                  | High                  | High                | Good                  | 2015                  |                                                                          |
| pH                                     | High                  | High                  | High                | Good                  | 2015                  |                                                                          |
| Hydromorphological Supporting Elements | Supports Good         | Supports Good         | Supports Good       | Supports Good         | 2015                  |                                                                          |
| Hydrological Regime                    | Does not support good | Does not support good | Supports Good       | Does not support good |                       | Disproportionately expensive: Unfavourable balance of costs and benefits |
| Morphology                             | Supports Good         | Supports Good         | Supports Good       |                       |                       |                                                                          |
| Supporting Elements (surface Water)    |                       |                       |                     | N/A                   | 2015                  |                                                                          |
| Specific Pollutants                    |                       |                       |                     | N/A                   | 2015                  |                                                                          |
| Copper                                 |                       |                       |                     |                       |                       |                                                                          |
| Triclosan                              |                       |                       |                     |                       |                       |                                                                          |
| Zinc                                   |                       |                       |                     |                       |                       |                                                                          |
| Iron                                   |                       |                       |                     |                       |                       |                                                                          |
| Manganese                              |                       |                       |                     |                       |                       |                                                                          |
| Chemical                               | Fail                  | Fail                  | N/A                 | Good                  | 2063                  | Natural conditions: Chemical status recovery time                        |
| Priority Hazardous Substances          | Fail                  | Fail                  | N/A                 | Good                  | 2063                  | Natural conditions: Chemical status recovery time                        |
| Benzo(a)pyrene                         | Good                  | Good                  |                     | Good                  | 2015                  |                                                                          |
| Cadium and Its Compounds               |                       |                       |                     |                       |                       |                                                                          |
| Dioxins and dioxin-like compounds      | Good                  | Good                  |                     | Good                  | 2015                  |                                                                          |
| Heptachlor and cis-Heptachlor Epoxide  | Good                  | Good                  |                     | Good                  | 2015                  |                                                                          |
| Hexabromocyclododecane                 | Good                  | Good                  |                     | Good                  | 2015                  |                                                                          |
| Hexachlorobenzene                      | Good                  | Good                  |                     | Good                  | 2015                  |                                                                          |
| Hexachlorobutadiene                    | Good                  | Good                  |                     | Good                  | 2015                  |                                                                          |
| Mercury and Its Compounds              | Fail                  | Fail                  |                     | Good                  | 2040                  | Natural conditions: Chemical status recovery time                        |
| Nonylphenol                            |                       |                       |                     |                       |                       |                                                                          |
| Perfluorooctane sulphonate (PFOS)      | Good                  | Good                  |                     | Good                  | 2015                  |                                                                          |
| Polybrominated diphenyl ethers (PBDE)  | Fail                  | Fail                  |                     | Good                  | 2063                  | Natural conditions: Chemical status recovery time                        |
| Priority substances                    | Good                  | Good                  | N/A                 | Good                  | 2015                  |                                                                          |
| Cypermethrin (Priority)                | Good                  | Good                  | N/A                 | Good                  | 2015                  |                                                                          |
| Fluoranthene                           | Good                  | Good                  | N/A                 | Good                  | 2015                  |                                                                          |
| Lead and Its Compounds                 |                       |                       |                     |                       |                       |                                                                          |
| Nickel and Its Compounds               |                       |                       |                     |                       |                       |                                                                          |
| Other Pollutants                       | N/A                   | N/A                   | N/A                 | N/A                   | 2015                  | Did not require assessment                                               |

## **Annex B – Manning’s Open Channel Flow Mapping**

Manning's Open Channel Flow Calculation

Methodology

Cross-sections through the floodplain were extracted from Environment Agency (EA) LiDAR DTM data (flown March 2020) at the locations shown in Figure 1. These cross-sections can be considered representative of the channel and general floodplain adjacent to the site and at the location of the proposed development. The cross-sections were imported into Flood Modeller and the "tabulate cross section properties" tool was utilised to establish the level-flow relationship for the channel and wider floodplain. This tool utilises the Manning's open channel flow equation. Manning's 'n' roughness was set to 0.03s/m<sup>1/3</sup> for the channel and 0.04s/m<sup>1/3</sup> for the floodplain. These values were chosen based on Chow (1959)\* and aerial imagery. The channel slope was set for each cross-section based on underlying LiDAR.

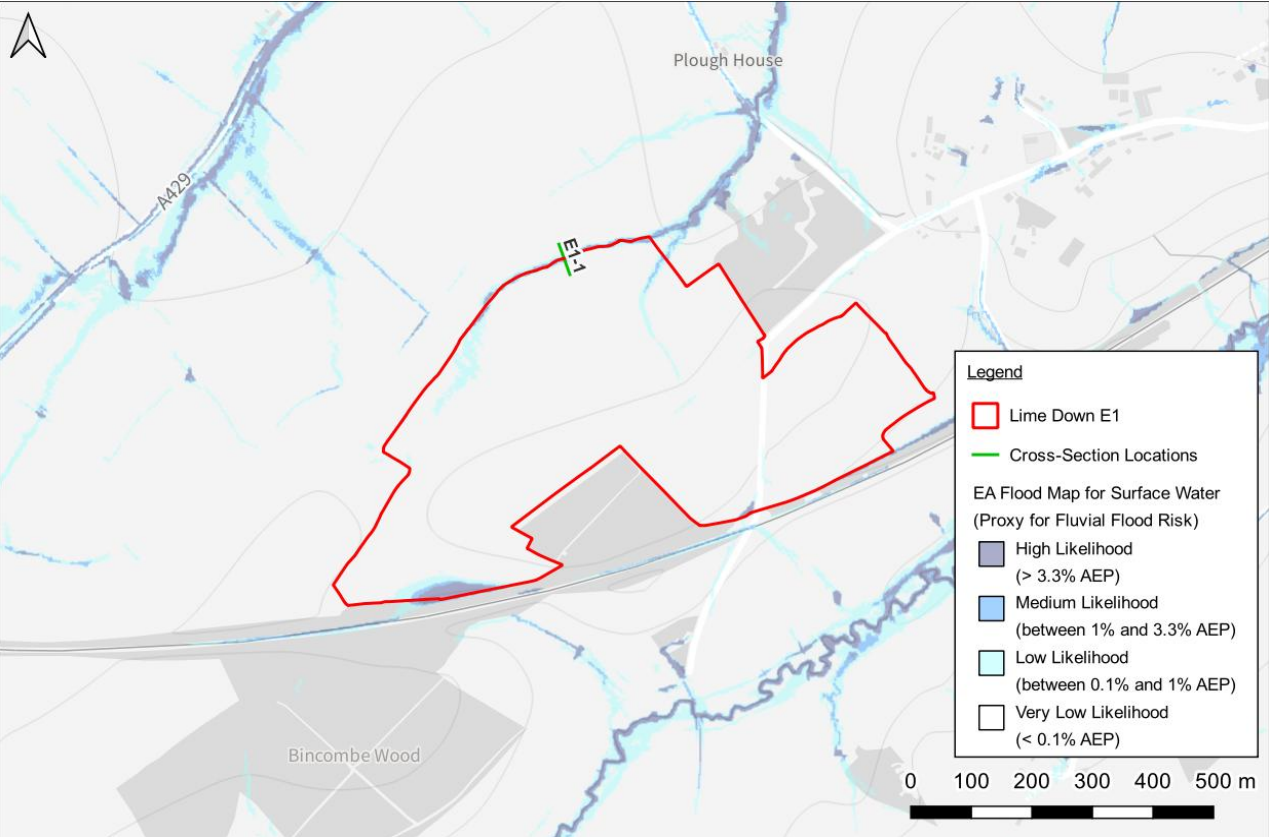
In the absence of detailed flood extent data covering the site, the extents of the EA surface water flood map (0.1% AEP event, present day) have been compared to underlying LiDAR data to provide an estimate of water levels. The surface water flood map has been used as a proxy for fluvial flooding given the similarity to the EA Flood Zone 2 extent and the additional detail it affords. The EA has since released the NaFRA2 mapping, however, a review of the flood extents indicates they are smaller across much of the study area. As such, the calculations presented here can be considered conservative.

Within this excel workbook, the xlookup function has been used along with the Flood Modeller level-flow relationship for the cross-sections to determine the equivalent flow for each estimated water level, rounding up where a direct match is not found. The appropriate climate change uplifts have then been applied to these flows and a second xlookup used to determine the equivalent level for the increased flow.

Cross-sections have been located at suitable locations throughtout the proposed development. Whilst it is acknowledged that the Manning's open channel flow equation used to determine the level-flow relationship does not constitute detailed hydraulic modelling, the calculation can still be considered suitable to demonstrate the scale of the changes in water level that can be expected when considering a +71% uplift in flows (Avon Bristol and North Somerset Streams Management Catchment, 2080's higher allowance).

\*Chow, V.T. (1959). Open-Channel Hydraulics. New York, NY: McGraw-Hill.

Cross-Section Locations



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Calculated Flows and Levels

| Cross-Section | Level Description             | Estimated Flood Level<br>(m AOD) | Estimated Equivalent Flow<br>(m³/s) | Flow +71% CC Uplift<br>(m³/s) | Equivalent Flood Level<br>(m AOD) |
|---------------|-------------------------------|----------------------------------|-------------------------------------|-------------------------------|-----------------------------------|
| E1-1          | 0.1% AEP EA FMFSW water level | 81.75                            | 10.2                                | 17.4                          | 81.90<br>(+146mm)                 |

Tabulated Cross-Section Properties // E1-1

(Calculated by Flood Modeller)

| Node | Flow (m³/s) | Stage (m AOD) | Depth (m) | Velocity (m/s) | Froude no. | Area (m²) | Conveyance (m³/s) | Width (m) | W Perim. (m) | Slope  |
|------|-------------|---------------|-----------|----------------|------------|-----------|-------------------|-----------|--------------|--------|
| E1-1 | 0.000       | 80.751        | 0.000     | 0.000          | 0.000      | 0.000     | 0.000             | 0.000     | 0.000        | 0.0155 |
| E1-1 | 0.001       | 80.785        | 0.034     | 0.200          | 0.491      | 0.004     | 0.007             | 0.255     | 0.265        | 0.0155 |
| E1-1 | 0.006       | 80.819        | 0.068     | 0.318          | 0.551      | 0.017     | 0.044             | 0.510     | 0.531        | 0.0155 |
| E1-1 | 0.016       | 80.853        | 0.102     | 0.417          | 0.589      | 0.039     | 0.131             | 0.765     | 0.796        | 0.0155 |
| E1-1 | 0.035       | 80.887        | 0.136     | 0.505          | 0.618      | 0.069     | 0.281             | 1.020     | 1.062        | 0.0155 |
| E1-1 | 0.063       | 80.921        | 0.170     | 0.586          | 0.642      | 0.108     | 0.510             | 1.275     | 1.327        | 0.0155 |
| E1-1 | 0.103       | 80.955        | 0.204     | 0.662          | 0.661      | 0.156     | 0.829             | 1.530     | 1.592        | 0.0155 |
| E1-1 | 0.152       | 80.987        | 0.236     | 0.732          | 0.678      | 0.208     | 1.225             | 1.754     | 1.827        | 0.0155 |
| E1-1 | 0.214       | 81.019        | 0.268     | 0.798          | 0.693      | 0.268     | 1.717             | 1.979     | 2.062        | 0.0155 |
| E1-1 | 0.288       | 81.051        | 0.300     | 0.862          | 0.706      | 0.334     | 2.314             | 2.203     | 2.296        | 0.0155 |
| E1-1 | 0.376       | 81.082        | 0.331     | 0.922          | 0.718      | 0.408     | 3.023             | 2.428     | 2.531        | 0.0155 |
| E1-1 | 0.480       | 81.114        | 0.363     | 0.981          | 0.729      | 0.489     | 3.852             | 2.652     | 2.766        | 0.0155 |
| E1-1 | 0.599       | 81.146        | 0.395     | 1.037          | 0.739      | 0.577     | 4.808             | 2.877     | 3.000        | 0.0155 |
| E1-1 | 0.734       | 81.178        | 0.427     | 1.092          | 0.749      | 0.672     | 5.898             | 3.101     | 3.235        | 0.0155 |
| E1-1 | 0.870       | 81.205        | 0.454     | 1.147          | 0.758      | 0.758     | 6.985             | 3.244     | 3.387        | 0.0155 |
| E1-1 | 1.017       | 81.232        | 0.481     | 1.200          | 0.766      | 0.848     | 8.170             | 3.386     | 3.540        | 0.0155 |
| E1-1 | 1.187       | 81.263        | 0.512     | 1.243          | 0.773      | 0.955     | 9.536             | 3.623     | 3.785        | 0.0155 |
| E1-1 | 1.376       | 81.293        | 0.542     | 1.286          | 0.780      | 1.070     | 11.052            | 3.860     | 4.030        | 0.0155 |
| E1-1 | 1.584       | 81.324        | 0.573     | 1.329          | 0.786      | 1.192     | 12.724            | 4.097     | 4.275        | 0.0155 |
| E1-1 | 1.812       | 81.355        | 0.604     | 1.371          | 0.793      | 1.322     | 14.558            | 4.334     | 4.521        | 0.0155 |
| E1-1 | 2.062       | 81.386        | 0.635     | 1.414          | 0.799      | 1.459     | 16.560            | 4.571     | 4.766        | 0.0155 |
| E1-1 | 2.333       | 81.416        | 0.665     | 1.456          | 0.805      | 1.603     | 18.737            | 4.808     | 5.011        | 0.0155 |
| E1-1 | 2.626       | 81.447        | 0.696     | 1.497          | 0.811      | 1.754     | 21.095            | 5.045     | 5.256        | 0.0155 |
| E1-1 | 2.780       | 81.462        | 0.711     | 1.507          | 0.943      | 1.845     | 22.333            | 7.083     | 7.298        | 0.0155 |
| E1-1 | 2.831       | 81.466        | 0.715     | 1.511          | 0.953      | 1.874     | 22.736            | 7.321     | 7.537        | 0.0155 |
| E1-1 | 3.226       | 81.495        | 0.744     | 1.542          | 0.945      | 2.092     | 25.910            | 7.706     | 7.928        | 0.0155 |
| E1-1 | 3.496       | 81.513        | 0.762     | 1.562          | 0.974      | 2.238     | 28.077            | 8.527     | 8.753        | 0.0155 |
| E1-1 | 3.787       | 81.531        | 0.780     | 1.579          | 0.995      | 2.399     | 30.416            | 9.348     | 9.579        | 0.0155 |
| E1-1 | 4.149       | 81.550        | 0.799     | 1.599          | 1.062      | 2.594     | 33.324            | 11.230    | 11.464       | 0.0155 |
| E1-1 | 4.593       | 81.571        | 0.820     | 1.620          | 1.052      | 2.835     | 36.895            | 11.714    | 11.949       | 0.0155 |
| E1-1 | 4.772       | 81.579        | 0.828     | 1.629          | 1.050      | 2.930     | 38.330            | 11.946    | 12.182       | 0.0155 |
| E1-1 | 5.360       | 81.604        | 0.853     | 1.651          | 1.072      | 3.247     | 43.054            | 13.427    | 13.664       | 0.0155 |
| E1-1 | 6.263       | 81.637        | 0.886     | 1.690          | 1.063      | 3.705     | 50.307            | 14.367    | 14.606       | 0.0155 |
| E1-1 | 7.065       | 81.663        | 0.912     | 1.724          | 1.061      | 4.097     | 56.745            | 15.228    | 15.469       | 0.0155 |
| E1-1 | 7.946       | 81.690        | 0.939     | 1.761          | 1.062      | 4.512     | 63.826            | 16.089    | 16.332       | 0.0155 |
| E1-1 | 8.017       | 81.692        | 0.941     | 1.764          | 1.062      | 4.545     | 64.391            | 16.149    | 16.392       | 0.0155 |
| E1-1 | 8.684       | 81.711        | 0.960     | 1.787          | 1.068      | 4.860     | 69.750            | 17.026    | 17.270       | 0.0155 |

| Node | Flow (m³/s) | Stage (m AOD) | Depth (m) | Velocity (m/s) | Froude no. | Area (m²) | Conveyance (m³/s) | Width (m) | W Perim. (m) | Slope  |
|------|-------------|---------------|-----------|----------------|------------|-----------|-------------------|-----------|--------------|--------|
| E1-1 | 9.398       | 81.730        | 0.979     | 1.810          | 1.073      | 5.192     | 75.483            | 17.903    | 18.148       | 0.0155 |
| E1-1 | 10.164      | 81.750        | 0.999     | 1.827          | 1.085      | 5.563     | 81.639            | 19.238    | 19.484       | 0.0155 |
| E1-1 | 10.244      | 81.752        | 1.001     | 1.829          | 1.086      | 5.602     | 82.282            | 19.373    | 19.619       | 0.0155 |
| E1-1 | 11.077      | 81.771        | 1.020     | 1.853          | 1.088      | 5.978     | 88.969            | 20.235    | 20.482       | 0.0155 |
| E1-1 | 11.962      | 81.790        | 1.039     | 1.878          | 1.091      | 6.371     | 96.080            | 21.097    | 21.345       | 0.0155 |
| E1-1 | 12.010      | 81.791        | 1.040     | 1.879          | 1.132      | 6.393     | 96.467            | 22.753    | 23.001       | 0.0155 |
| E1-1 | 12.058      | 81.792        | 1.041     | 1.880          | 1.146      | 6.416     | 96.855            | 23.380    | 23.628       | 0.0155 |
| E1-1 | 12.639      | 81.808        | 1.057     | 1.859          | 1.125      | 6.798     | 101.523           | 24.393    | 24.641       | 0.0155 |
| E1-1 | 13.007      | 81.815        | 1.064     | 1.866          | 1.125      | 6.970     | 104.475           | 24.845    | 25.094       | 0.0155 |
| E1-1 | 14.360      | 81.839        | 1.088     | 1.898          | 1.120      | 7.566     | 115.342           | 25.828    | 26.078       | 0.0155 |
| E1-1 | 15.814      | 81.862        | 1.111     | 1.932          | 1.117      | 8.184     | 127.019           | 26.811    | 27.062       | 0.0155 |
| E1-1 | 15.938      | 81.864        | 1.113     | 1.935          | 1.116      | 8.238     | 128.021           | 26.910    | 27.161       | 0.0155 |
| E1-1 | 17.990      | 81.896        | 1.145     | 1.970          | 1.119      | 9.130     | 144.499           | 28.865    | 29.117       | 0.0155 |
| E1-1 | 18.347      | 81.901        | 1.150     | 1.978          | 1.118      | 9.275     | 147.367           | 29.069    | 29.321       | 0.0155 |
| E1-1 | 20.322      | 81.926        | 1.175     | 2.028          | 1.116      | 10.020    | 163.231           | 29.758    | 30.013       | 0.0155 |
| E1-1 | 22.421      | 81.952        | 1.201     | 2.079          | 1.116      | 10.783    | 180.090           | 30.448    | 30.704       | 0.0155 |
| E1-1 | 24.642      | 81.977        | 1.226     | 2.131          | 1.117      | 11.563    | 197.933           | 31.137    | 31.395       | 0.0155 |
| E1-1 | 24.730      | 81.978        | 1.227     | 2.133          | 1.117      | 11.594    | 198.640           | 31.172    | 31.430       | 0.0155 |
| E1-1 | 26.783      | 82.001        | 1.250     | 2.171          | 1.120      | 12.339    | 215.127           | 32.204    | 32.463       | 0.0155 |
| E1-1 | 28.951      | 82.025        | 1.274     | 2.209          | 1.123      | 13.108    | 232.538           | 33.237    | 33.497       | 0.0155 |
| E1-1 | 29.217      | 82.028        | 1.277     | 2.212          | 1.123      | 13.208    | 234.680           | 33.415    | 33.675       | 0.0155 |
| E1-1 | 31.513      | 82.053        | 1.302     | 2.241          | 1.128      | 14.062    | 253.119           | 34.945    | 35.206       | 0.0155 |
| E1-1 | 33.801      | 82.075        | 1.324     | 2.277          | 1.131      | 14.842    | 271.499           | 35.921    | 36.182       | 0.0155 |
| E1-1 | 36.742      | 82.103        | 1.352     | 2.315          | 1.136      | 15.869    | 295.122           | 37.492    | 37.755       | 0.0155 |
| E1-1 | 37.078      | 82.106        | 1.355     | 2.320          | 1.137      | 15.982    | 297.819           | 37.641    | 37.904       | 0.0155 |
| E1-1 | 40.799      | 82.138        | 1.387     | 2.370          | 1.142      | 17.211    | 327.709           | 39.193    | 39.458       | 0.0155 |
| E1-1 | 42.962      | 82.156        | 1.405     | 2.400          | 1.145      | 17.904    | 345.078           | 39.991    | 40.257       | 0.0155 |
| E1-1 | 45.197      | 82.173        | 1.422     | 2.429          | 1.148      | 18.611    | 363.032           | 40.789    | 41.056       | 0.0155 |
| E1-1 | 45.422      | 82.175        | 1.424     | 2.430          | 1.148      | 18.693    | 364.841           | 40.954    | 41.220       | 0.0155 |
| E1-1 | 46.762      | 82.189        | 1.438     | 2.426          | 1.151      | 19.278    | 375.601           | 42.609    | 42.876       | 0.0155 |
| E1-1 | 47.691      | 82.196        | 1.445     | 2.436          | 1.152      | 19.577    | 383.063           | 42.967    | 43.234       | 0.0155 |
| E1-1 | 51.506      | 82.220        | 1.469     | 2.497          | 1.155      | 20.627    | 413.703           | 43.325    | 43.593       | 0.0155 |
| E1-1 | 55.471      | 82.245        | 1.494     | 2.558          | 1.159      | 21.686    | 445.551           | 43.684    | 43.952       | 0.0155 |
| E1-1 | 59.582      | 82.269        | 1.518     | 2.619          | 1.163      | 22.753    | 478.577           | 44.042    | 44.311       | 0.0155 |
| E1-1 | 61.654      | 82.284        | 1.533     | 2.632          | 1.166      | 23.422    | 495.221           | 45.116    | 45.385       | 0.0155 |
| E1-1 | 64.978      | 82.305        | 1.554     | 2.665          | 1.171      | 24.381    | 521.916           | 46.190    | 46.460       | 0.0155 |
| E1-1 | 66.281      | 82.315        | 1.564     | 2.667          | 1.175      | 24.848    | 532.382           | 47.264    | 47.534       | 0.0155 |
| E1-1 | 71.982      | 82.346        | 1.595     | 2.734          | 1.181      | 26.328    | 578.173           | 48.215    | 48.486       | 0.0155 |
| E1-1 | 72.737      | 82.350        | 1.599     | 2.742          | 1.196      | 26.523    | 584.237           | 49.520    | 49.791       | 0.0155 |
| E1-1 | 75.581      | 82.368        | 1.617     | 2.757          | 1.189      | 27.419    | 607.080           | 50.004    | 50.274       | 0.0155 |
| E1-1 | 79.224      | 82.386        | 1.635     | 2.797          | 1.192      | 28.323    | 636.342           | 50.487    | 50.758       | 0.0155 |
| E1-1 | 84.515      | 82.411        | 1.660     | 2.856          | 1.197      | 29.592    | 678.839           | 51.024    | 51.296       | 0.0155 |
| E1-1 | 89.980      | 82.436        | 1.685     | 2.914          | 1.202      | 30.874    | 722.739           | 51.561    | 51.833       | 0.0155 |
| E1-1 | 97.456      | 82.470        | 1.719     | 2.985          | 1.210      | 32.646    | 782.785           | 52.635    | 52.908       | 0.0155 |
| E1-1 | 97.921      | 82.475        | 1.724     | 2.975          | 1.214      | 32.912    | 786.520           | 53.709    | 53.982       | 0.0155 |

## **Annex C – Greenfield Calculations**

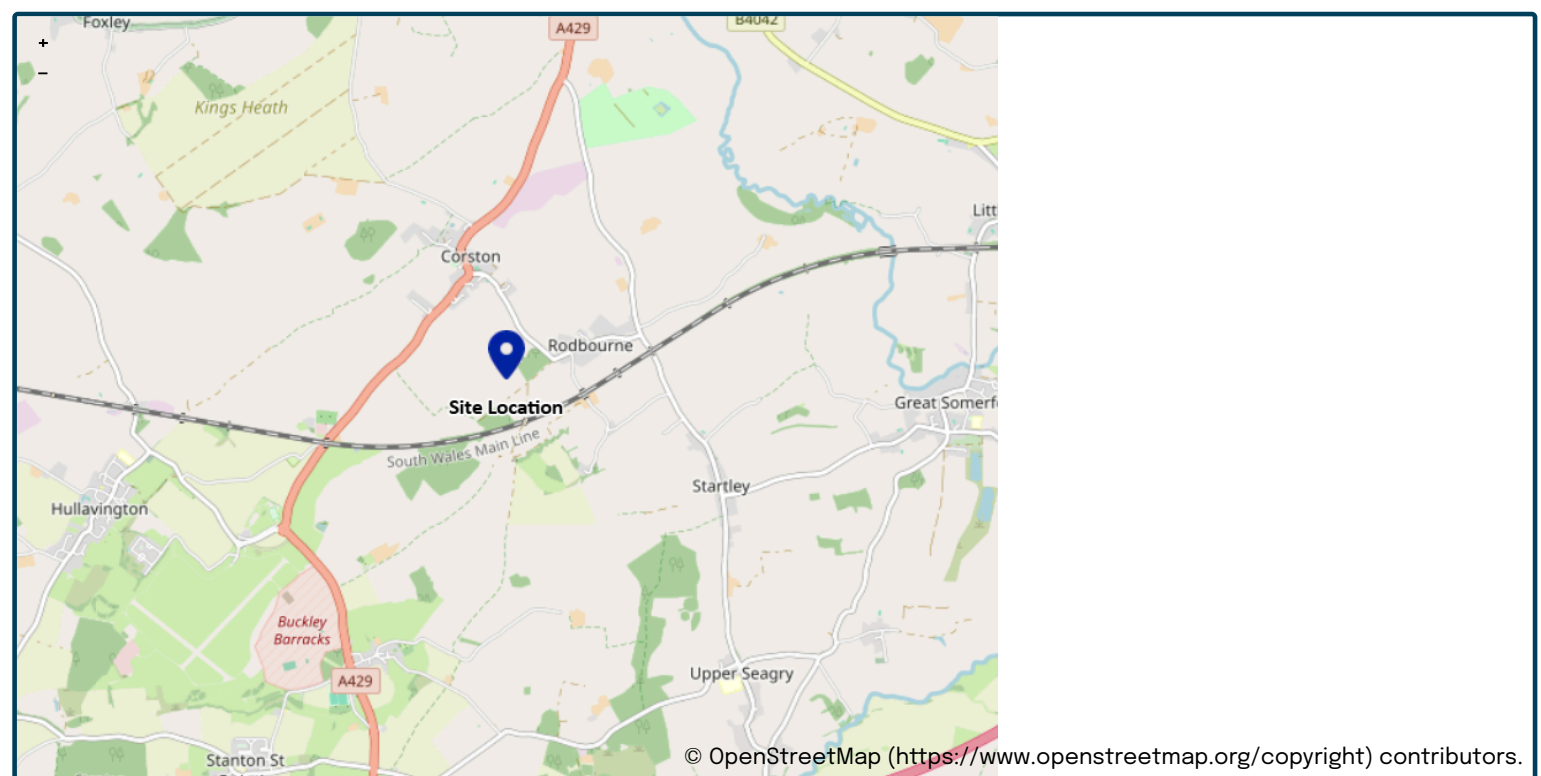
This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance “Rainfall runoff management for developments”, SC030219 (2013), the SuDS Manual C753 (CIRIA, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

## Project details

|               |                                         |
|---------------|-----------------------------------------|
| Date          | <input type="text" value="23/06/2026"/> |
| Calculated by | <input type="text" value="GH"/>         |
| Reference     | <input type="text" value="317212"/>     |
| Model version | <input type="text" value="2.2.3"/>      |

## Location

|               |                                           |
|---------------|-------------------------------------------|
| Site name     | <input type="text" value="Lime Down E1"/> |
| Site location | <input type="text"/>                      |



|                                       |                                     |
|---------------------------------------|-------------------------------------|
| Site easting (British National Grid)  | <input type="text" value="392796"/> |
| Site northing (British National Grid) | <input type="text" value="182915"/> |

## Site details

|                      |                                  |    |
|----------------------|----------------------------------|----|
| Total site area (ha) | <input type="text" value="0.9"/> | ha |
|----------------------|----------------------------------|----|

# Greenfield runoff

## Method

|        |                                   |
|--------|-----------------------------------|
| Method | <div>FEH statistical (2025)</div> |
|--------|-----------------------------------|

## FEH statistical (2025)

|                                   | <u>My value</u>  | <u>Map value</u> |
|-----------------------------------|------------------|------------------|
| SAAR9120 (mm)                     | <div>821</div>   | <div>mm</div>    |
| BFIHOST19scaled                   | <div>0.352</div> |                  |
| QMed-QBar conversion              | <div>1.075</div> | <div>1.075</div> |
| QMed (l/s)                        | <div>5.4</div>   | <div>l/s</div>   |
| QBar (FEH statistical 2025) (l/s) | <div>5.8</div>   | <div>l/s</div>   |

## Growth curve factors

|                        | <u>My value</u> | <u>Map value</u> |
|------------------------|-----------------|------------------|
| Hydrological region    | <div>8</div>    | <div>8</div>     |
| 1 year growth factor   | <div>0.78</div> |                  |
| 2 year growth factor   | <div>0.93</div> |                  |
| 10 year growth factor  | <div>1.49</div> |                  |
| 30 year growth factor  | <div>1.95</div> |                  |
| 100 year growth factor | <div>2.43</div> |                  |
| 200 year growth factor | <div>2.78</div> |                  |

## Results

|                           |                                   |                |
|---------------------------|-----------------------------------|----------------|
| Method                    | <div>FEH statistical (2025)</div> |                |
| Flow rate 1 year (l/s)    | <div>4.6</div>                    | <div>l/s</div> |
| Flow rate 2 year (l/s)    | <div>5.4</div>                    | <div>l/s</div> |
| Flow rate 10 years (l/s)  | <div>8.7</div>                    | <div>l/s</div> |
| Flow rate 30 years (l/s)  | <div>11.4</div>                   | <div>l/s</div> |
| Flow rate 100 years (l/s) | <div>14.2</div>                   | <div>l/s</div> |
| Flow rate 200 years (l/s) | <div>16.3</div>                   | <div>l/s</div> |

Please note runoff estimation is subject to significant uncertainty. Results are therefore normally reported to only 1 decimal place. Where 2 decimal places are provided, this does not indicate accuracy to this level, it has been adopted to prevent ‘zero’ figures from being reported. Outputs less than 0.01 l/s are reported as 0.01 l/s.

### Disclaimer

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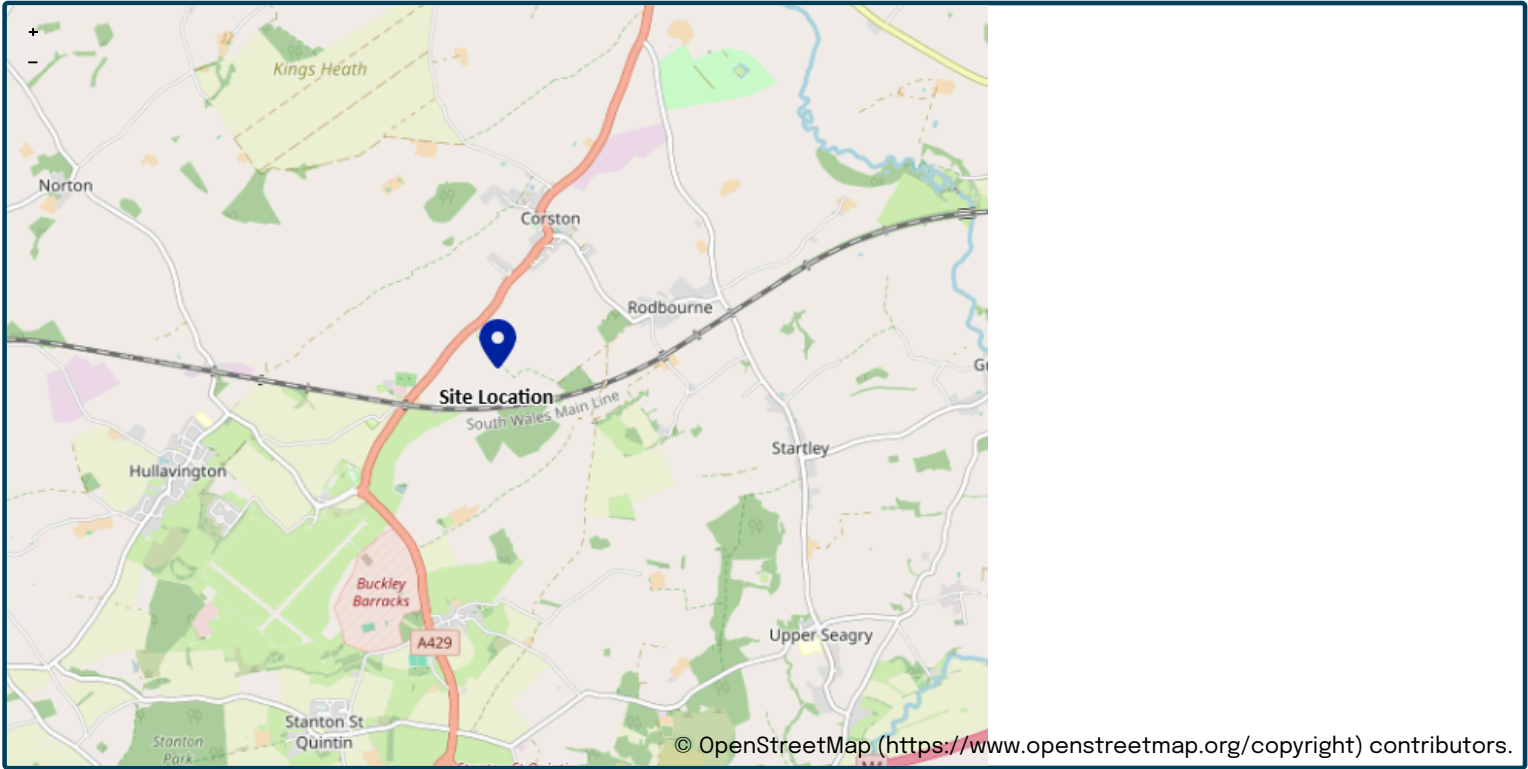
This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance “Rainfall runoff management for developments”, SC030219 (2013), the SuDS Manual C753 (CIRIA, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

## Project details

|               |                                         |
|---------------|-----------------------------------------|
| Date          | <input type="text" value="08/07/2026"/> |
| Calculated by | <input type="text" value="GH"/>         |
| Reference     | <input type="text" value="317212"/>     |
| Model version | <input type="text" value="2.2.3"/>      |

## Location

|               |                                           |
|---------------|-------------------------------------------|
| Site name     | <input type="text" value="Lime Down E1"/> |
| Site location | <input type="text"/>                      |



|                                       |                                     |
|---------------------------------------|-------------------------------------|
| Site easting (British National Grid)  | <input type="text" value="392072"/> |
| Site northing (British National Grid) | <input type="text" value="182693"/> |

## Site details

|                      |                                    |    |
|----------------------|------------------------------------|----|
| Total site area (ha) | <input type="text" value="0.831"/> | ha |
|----------------------|------------------------------------|----|

# Greenfield runoff

## Method

|        |                                   |
|--------|-----------------------------------|
| Method | <div>FEH statistical (2025)</div> |
|--------|-----------------------------------|

## FEH statistical (2025)

|                                   | <u>My value</u>  | <u>Map value</u> |
|-----------------------------------|------------------|------------------|
| SAAR9120 (mm)                     | <div>821</div>   | <div>mm</div>    |
| BFIHOST19scaled                   | <div>0.352</div> |                  |
| QMed-QBar conversion              | <div>1.075</div> | <div>1.075</div> |
| QMed (l/s)                        | <div>5</div>     | <div>l/s</div>   |
| QBar (FEH statistical 2025) (l/s) | <div>5.4</div>   | <div>l/s</div>   |

## Growth curve factors

|                        | <u>My value</u> | <u>Map value</u> |
|------------------------|-----------------|------------------|
| Hydrological region    | <div>8</div>    | <div>8</div>     |
| 1 year growth factor   | <div>0.78</div> |                  |
| 2 year growth factor   | <div>0.93</div> |                  |
| 10 year growth factor  | <div>1.49</div> |                  |
| 30 year growth factor  | <div>1.95</div> |                  |
| 100 year growth factor | <div>2.43</div> |                  |
| 200 year growth factor | <div>2.78</div> |                  |

## Results

|                           |                                   |                |
|---------------------------|-----------------------------------|----------------|
| Method                    | <div>FEH statistical (2025)</div> |                |
| Flow rate 1 year (l/s)    | <div>4.2</div>                    | <div>l/s</div> |
| Flow rate 2 year (l/s)    | <div>5.0</div>                    | <div>l/s</div> |
| Flow rate 10 years (l/s)  | <div>8.0</div>                    | <div>l/s</div> |
| Flow rate 30 years (l/s)  | <div>10.5</div>                   | <div>l/s</div> |
| Flow rate 100 years (l/s) | <div>13.1</div>                   | <div>l/s</div> |
| Flow rate 200 years (l/s) | <div>15.0</div>                   | <div>l/s</div> |

Please note runoff estimation is subject to significant uncertainty. Results are therefore normally reported to only 1 decimal place. Where 2 decimal places are provided, this does not indicate accuracy to this level, it has been adopted to prevent ‘zero’ figures from being reported. Outputs less than 0.01 l/s are reported as 0.01 l/s.

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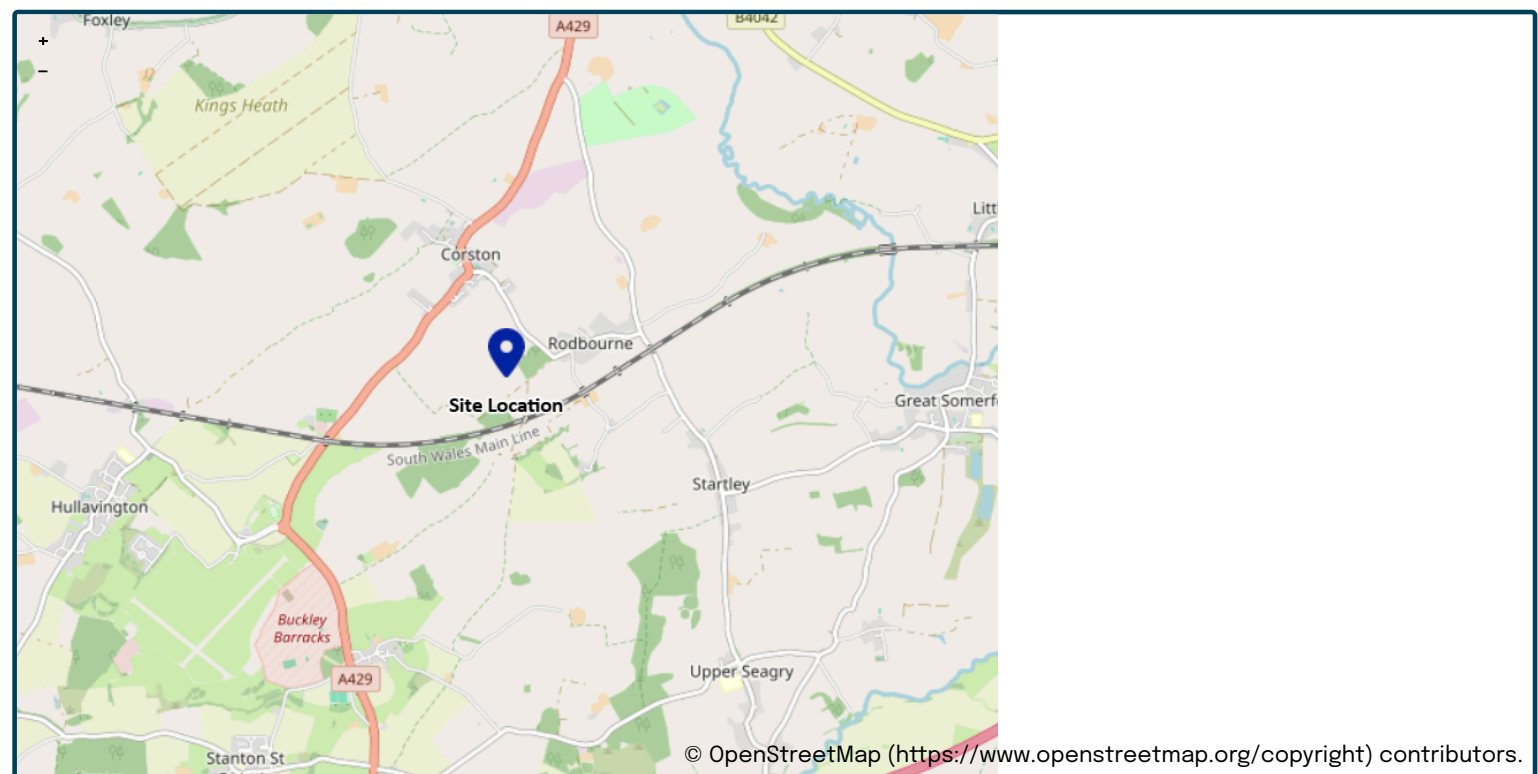
This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance “Rainfall runoff management for developments”, SC030219 (2013), the SuDS Manual C753 (CIRIA, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

## Project details

|               |                                         |
|---------------|-----------------------------------------|
| Date          | <input type="text" value="23/06/2026"/> |
| Calculated by | <input type="text" value="GH"/>         |
| Reference     | <input type="text" value="317212"/>     |
| Model version | <input type="text" value="2.2.3"/>      |

## Location

|               |                                           |
|---------------|-------------------------------------------|
| Site name     | <input type="text" value="Lime Down E1"/> |
| Site location | <input type="text"/>                      |



|                                       |                                     |
|---------------------------------------|-------------------------------------|
| Site easting (British National Grid)  | <input type="text" value="392796"/> |
| Site northing (British National Grid) | <input type="text" value="182915"/> |

## Site details

|                      |                                   |    |
|----------------------|-----------------------------------|----|
| Total site area (ha) | <input type="text" value="0.02"/> | ha |
|----------------------|-----------------------------------|----|

# Greenfield runoff

## Method

|        |                                   |
|--------|-----------------------------------|
| Method | <div>FEH statistical (2025)</div> |
|--------|-----------------------------------|

## FEH statistical (2025)

|                                   | <u>My value</u>               | <u>Map value</u> |
|-----------------------------------|-------------------------------|------------------|
| SAAR9120 (mm)                     | <div>821</div> <div>mm</div>  |                  |
| BFIHOST19scaled                   | <div>0.352</div>              |                  |
| QMed-QBar conversion              | <div>1.075</div>              | <div>1.075</div> |
| QMed (l/s)                        | <div>0.1</div> <div>l/s</div> |                  |
| QBar (FEH statistical 2025) (l/s) | <div>0.1</div> <div>l/s</div> |                  |

## Growth curve factors

|                        | <u>My value</u> | <u>Map value</u> |
|------------------------|-----------------|------------------|
| Hydrological region    | <div>8</div>    | <div>8</div>     |
| 1 year growth factor   | <div>0.78</div> |                  |
| 2 year growth factor   | <div>0.93</div> |                  |
| 10 year growth factor  | <div>1.49</div> |                  |
| 30 year growth factor  | <div>1.95</div> |                  |
| 100 year growth factor | <div>2.43</div> |                  |
| 200 year growth factor | <div>2.78</div> |                  |

## Results

|                           |                                   |
|---------------------------|-----------------------------------|
| Method                    | <div>FEH statistical (2025)</div> |
| Flow rate 1 year (l/s)    | <div>0.1</div> <div>l/s</div>     |
| Flow rate 2 year (l/s)    | <div>0.1</div> <div>l/s</div>     |
| Flow rate 10 years (l/s)  | <div>0.2</div> <div>l/s</div>     |
| Flow rate 30 years (l/s)  | <div>0.3</div> <div>l/s</div>     |
| Flow rate 100 years (l/s) | <div>0.3</div> <div>l/s</div>     |
| Flow rate 200 years (l/s) | <div>0.4</div> <div>l/s</div>     |

Please note runoff estimation is subject to significant uncertainty. Results are therefore normally reported to only 1 decimal place. Where 2 decimal places are provided, this does not indicate accuracy to this level, it has been adopted to prevent ‘zero’ figures from being reported. Outputs less than 0.01 l/s are reported as 0.01 l/s.

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## **Annex D – Hydraulic Calculations**

### Design Settings

|                                      |        |                                    |               |
|--------------------------------------|--------|------------------------------------|---------------|
| Rainfall Methodology                 | FEH-22 | Minimum Velocity (m/s)             | 1.00          |
| Return Period (years)                | 100    | Connection Type                    | Level Soffits |
| Additional Flow (%)                  | 0      | Minimum Backdrop Height (m)        | 0.200         |
| CV                                   | 1.000  | Preferred Cover Depth (m)          | 1.200         |
| Time of Entry (mins)                 | 5.00   | Include Intermediate Ground        | ✓             |
| Maximum Time of Concentration (mins) | 30.00  | Enforce best practice design rules | ✓             |
| Maximum Rainfall (mm/hr)             | 50.0   |                                    |               |

### Nodes

| Name    | Area<br>(ha) | T of E<br>(mins) | Cover<br>Level<br>(m) | Diameter<br>(mm) | Easting<br>(m) | Northing<br>(m) | Depth<br>(m) | Invert<br>Level<br>(m) |
|---------|--------------|------------------|-----------------------|------------------|----------------|-----------------|--------------|------------------------|
| Storage | 0.900        | 5.00             | 100.000               | 1200             | 0.000          | 0.000           | 1.000        | 99.000                 |

### Simulation Settings

|                      |          |                            |      |                         |   |
|----------------------|----------|----------------------------|------|-------------------------|---|
| Rainfall Methodology | FEH-22   | Skip Steady State          | x    | Check Discharge Rate(s) | x |
| Rainfall Events      | Singular | Drain Down Time (mins)     | 1440 | Check Discharge Volume  | x |
| Winter CV            | 1.000    | Additional Storage (m³/ha) | 0.0  |                         |   |
| Analysis Speed       | Normal   | Starting Level (m)         |      |                         |   |

### Storm Durations

|    |    |    |     |     |     |     |     |     |     |     |      |
|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| 15 | 30 | 60 | 120 | 180 | 240 | 360 | 480 | 600 | 720 | 960 | 1440 |
|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|------|

| Return Period<br>(years) | Climate Change<br>(CC %) | Additional Area<br>(A %) | Additional Flow<br>(Q %) |
|--------------------------|--------------------------|--------------------------|--------------------------|
| 100                      | 45                       | 0                        | 0                        |

### Node Storage Online Hydro-Brake® Control

|                          |        |                         |                                |
|--------------------------|--------|-------------------------|--------------------------------|
| Flap Valve               | x      | Objective               | (HE) Minimise upstream storage |
| Replaces Downstream Link | x      | Sump Available          | ✓                              |
| Invert Level (m)         | 99.000 | Product Number          | CTL-SHE-0092-3800-1000-3800    |
| Design Depth (m)         | 1.000  | Min Outlet Diameter (m) | 0.150                          |
| Design Flow (l/s)        | 3.8    | Min Node Diameter (mm)  | 1200                           |

### Node Storage Depth/Area Storage Structure

|                             |         |               |      |                           |        |
|-----------------------------|---------|---------------|------|---------------------------|--------|
| Base Inf Coefficient (m/hr) | 0.00000 | Safety Factor | 2.0  | Invert Level (m)          | 99.000 |
| Side Inf Coefficient (m/hr) | 0.00000 | Porosity      | 1.00 | Time to half empty (mins) |        |

| Depth<br>(m) | Area<br>(m²) | Inf Area<br>(m²) | Depth<br>(m) | Area<br>(m²) | Inf Area<br>(m²) |
|--------------|--------------|------------------|--------------|--------------|------------------|
| 0.000        | 900.0        | 900.0            | 1.000        | 1247.3       | 1266.1           |

**Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 99.99%**

| Node Event         | US<br>Node | Peak<br>(mins) | Level<br>(m) | Depth<br>(m) | Inflow<br>(l/s) | Node<br>Vol (m³) | Flood<br>(m³) | Status |
|--------------------|------------|----------------|--------------|--------------|-----------------|------------------|---------------|--------|
| 1440 minute winter | Storage    | 1410           | 99.903       | 0.903        | 35.0            | 954.7663         | 0.0000        | OK     |

| Link Event<br>(Upstream Depth) | US<br>Node | Link         | Outflow<br>(l/s) | Discharge<br>Vol (m³) |
|--------------------------------|------------|--------------|------------------|-----------------------|
| 1440 minute winter             | Storage    | Hydro-Brake® | 3.8              | 543.3                 |

### Design Settings

|                                      |        |                                    |               |
|--------------------------------------|--------|------------------------------------|---------------|
| Rainfall Methodology                 | FEH-22 | Minimum Velocity (m/s)             | 1.00          |
| Return Period (years)                | 100    | Connection Type                    | Level Soffits |
| Additional Flow (%)                  | 0      | Minimum Backdrop Height (m)        | 0.200         |
| CV                                   | 1.000  | Preferred Cover Depth (m)          | 1.200         |
| Time of Entry (mins)                 | 5.00   | Include Intermediate Ground        | ✓             |
| Maximum Time of Concentration (mins) | 30.00  | Enforce best practice design rules | ✓             |
| Maximum Rainfall (mm/hr)             | 50.0   |                                    |               |

### Nodes

| Name    | Area (ha) | T of E (mins) | Cover Level (m) | Diameter (mm) | Easting (m) | Northing (m) | Depth (m) | Invert Level (m) |
|---------|-----------|---------------|-----------------|---------------|-------------|--------------|-----------|------------------|
| Storage | 0.831     | 5.00          | 100.000         | 1200          | 0.000       | 0.000        | 0.750     | 99.250           |

### Simulation Settings

|                      |          |                            |      |                         |   |
|----------------------|----------|----------------------------|------|-------------------------|---|
| Rainfall Methodology | FEH-22   | Skip Steady State          | x    | Check Discharge Rate(s) | x |
| Rainfall Events      | Singular | Drain Down Time (mins)     | 1440 | Check Discharge Volume  | x |
| Winter CV            | 1.000    | Additional Storage (m³/ha) | 0.0  |                         |   |
| Analysis Speed       | Normal   | Starting Level (m)         |      |                         |   |

### Storm Durations

|    |    |    |     |     |     |     |     |     |     |     |      |
|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| 15 | 30 | 60 | 120 | 180 | 240 | 360 | 480 | 600 | 720 | 960 | 1440 |
|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|------|

| Return Period (years) | Climate Change (CC %) | Additional Area (A %) | Additional Flow (Q %) |
|-----------------------|-----------------------|-----------------------|-----------------------|
| 100                   | 45                    | 0                     | 0                     |

### Node Storage Online Hydro-Brake® Control

|                          |        |                         |                                |
|--------------------------|--------|-------------------------|--------------------------------|
| Flap Valve               | x      | Objective               | (HE) Minimise upstream storage |
| Replaces Downstream Link | x      | Sump Available          | ✓                              |
| Invert Level (m)         | 99.250 | Product Number          | CTL-SHE-0093-3500-0750-3500    |
| Design Depth (m)         | 0.750  | Min Outlet Diameter (m) | 0.150                          |
| Design Flow (l/s)        | 3.5    | Min Node Diameter (mm)  | 1200                           |

### Node Storage Depth/Area Storage Structure

|                             |         |               |      |                           |        |
|-----------------------------|---------|---------------|------|---------------------------|--------|
| Base Inf Coefficient (m/hr) | 0.00000 | Safety Factor | 2.0  | Invert Level (m)          | 99.250 |
| Side Inf Coefficient (m/hr) | 0.00000 | Porosity      | 1.00 | Time to half empty (mins) |        |

| Depth (m) | Area (m²) | Inf Area (m²) | Depth (m) | Area (m²) | Inf Area (m²) |
|-----------|-----------|---------------|-----------|-----------|---------------|
| 0.000     | 1050.0    | 1050.0        | 0.750     | 1324.4    | 1339.2        |

**Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 99.99%**

| Node Event         | US<br>Node | Peak<br>(mins) | Level<br>(m) | Depth<br>(m) | Inflow<br>(l/s) | Node<br>Vol (m³) | Flood<br>(m³) | Status |
|--------------------|------------|----------------|--------------|--------------|-----------------|------------------|---------------|--------|
| 1440 minute winter | Storage    | 1410           | 99.992       | 0.742        | 32.3            | 880.3179         | 0.0000        | OK     |

| Link Event<br>(Upstream Depth) | US<br>Node | Link         | Outflow<br>(l/s) | Discharge<br>Vol (m³) |
|--------------------------------|------------|--------------|------------------|-----------------------|
| 1440 minute winter             | Storage    | Hydro-Brake® | 3.5              | 511.9                 |

### Design Settings

|                                      |        |                                    |               |
|--------------------------------------|--------|------------------------------------|---------------|
| Rainfall Methodology                 | FEH-22 | Minimum Velocity (m/s)             | 1.00          |
| Return Period (years)                | 100    | Connection Type                    | Level Soffits |
| Additional Flow (%)                  | 0      | Minimum Backdrop Height (m)        | 0.200         |
| CV                                   | 1.000  | Preferred Cover Depth (m)          | 1.200         |
| Time of Entry (mins)                 | 5.00   | Include Intermediate Ground        | ✓             |
| Maximum Time of Concentration (mins) | 30.00  | Enforce best practice design rules | ✓             |
| Maximum Rainfall (mm/hr)             | 50.0   |                                    |               |

### Nodes

| Name    | Area<br>(ha) | T of E<br>(mins) | Cover<br>Level<br>(m) | Diameter<br>(mm) | Easting<br>(m) | Northing<br>(m) | Depth<br>(m) | Invert<br>Level<br>(m) |
|---------|--------------|------------------|-----------------------|------------------|----------------|-----------------|--------------|------------------------|
| Storage | 0.008        | 5.00             | 100.000               | 1200             | 0.000          | 0.000           | 0.750        | 99.250                 |

### Simulation Settings

|                      |          |                            |      |                         |   |
|----------------------|----------|----------------------------|------|-------------------------|---|
| Rainfall Methodology | FEH-22   | Skip Steady State          | x    | Check Discharge Rate(s) | x |
| Rainfall Events      | Singular | Drain Down Time (mins)     | 1440 | Check Discharge Volume  | x |
| Winter CV            | 1.000    | Additional Storage (m³/ha) | 0.0  |                         |   |
| Analysis Speed       | Normal   | Starting Level (m)         |      |                         |   |

### Storm Durations

|    |    |    |     |     |     |     |     |     |     |     |      |
|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| 15 | 30 | 60 | 120 | 180 | 240 | 360 | 480 | 600 | 720 | 960 | 1440 |
|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|------|

| Return Period<br>(years) | Climate Change<br>(CC %) | Additional Area<br>(A %) | Additional Flow<br>(Q %) |
|--------------------------|--------------------------|--------------------------|--------------------------|
| 100                      | 45                       | 0                        | 0                        |

### Node Storage Online Hydro-Brake® Control

|                          |        |                         |                                |
|--------------------------|--------|-------------------------|--------------------------------|
| Flap Valve               | x      | Objective               | (HE) Minimise upstream storage |
| Replaces Downstream Link | x      | Sump Available          | ✓                              |
| Invert Level (m)         | 99.250 | Product Number          | CTL-SHE-0014-1000-0750-1000    |
| Design Depth (m)         | 0.750  | Min Outlet Diameter (m) | 0.075                          |
| Design Flow (l/s)        | 0.1    | Min Node Diameter (mm)  | 1200                           |

### Node Storage Depth/Area Storage Structure

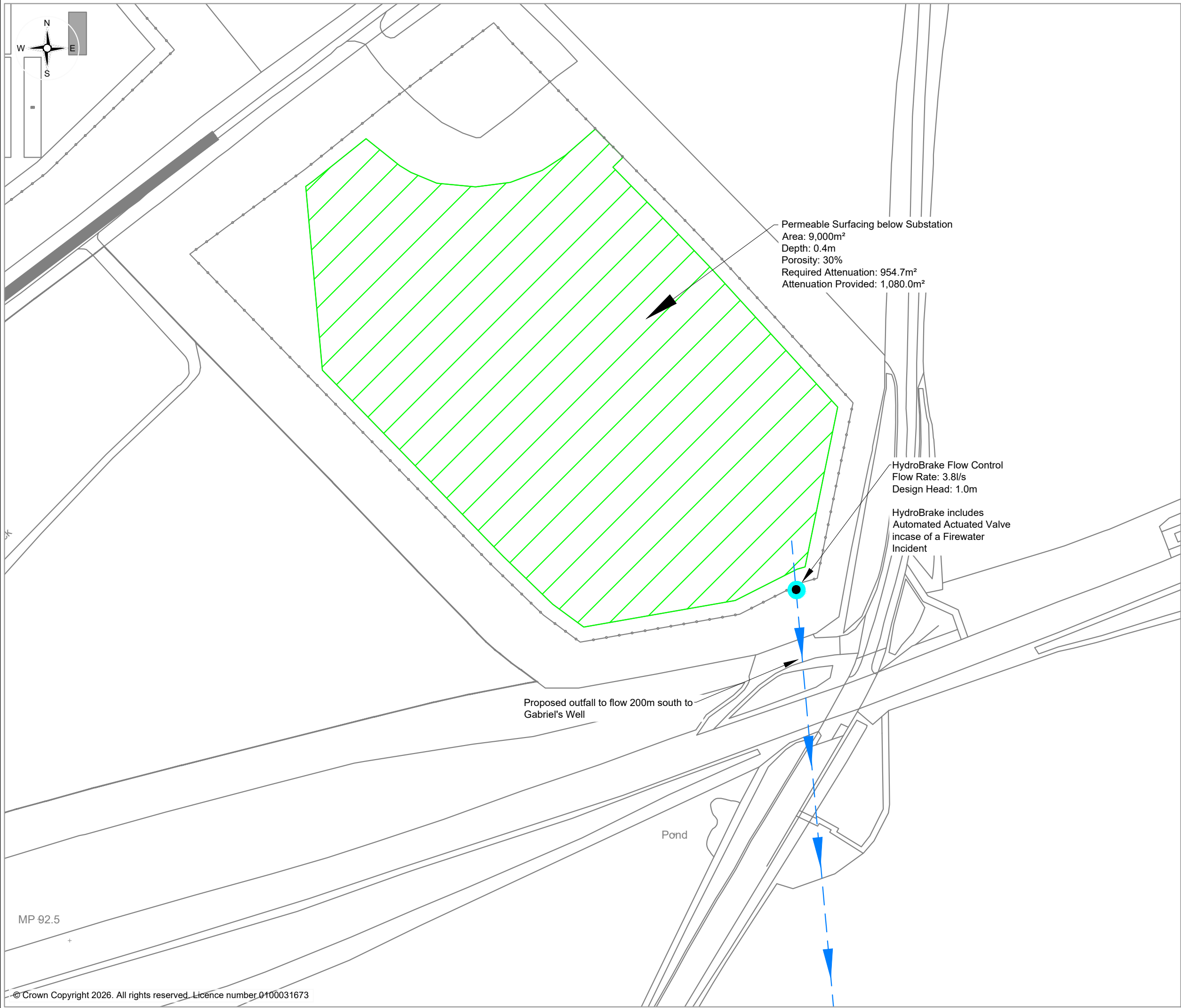
|                             |         |               |      |                           |        |
|-----------------------------|---------|---------------|------|---------------------------|--------|
| Base Inf Coefficient (m/hr) | 0.00000 | Safety Factor | 2.0  | Invert Level (m)          | 99.250 |
| Side Inf Coefficient (m/hr) | 0.00000 | Porosity      | 1.00 | Time to half empty (mins) | 900    |

| Depth<br>(m) | Area<br>(m²) | Inf Area<br>(m²) | Depth<br>(m) | Area<br>(m²) | Inf Area<br>(m²) |
|--------------|--------------|------------------|--------------|--------------|------------------|
| 0.000        | 1.0          | 1.0              | 0.750        | 24.9         | 26.2             |

**Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 100.00%**

| Node Event                     | US<br>Node | Peak<br>(mins) | Level<br>(m)     | Depth<br>(m)          | Inflow<br>(l/s) | Node<br>Vol (m³) | Flood<br>(m³) | Status |
|--------------------------------|------------|----------------|------------------|-----------------------|-----------------|------------------|---------------|--------|
| 960 minute winter              | Storage    | 915            | 99.842           | 0.592                 | 0.4             | 6.1706           | 0.0000        | OK     |
| Link Event<br>(Upstream Depth) | US<br>Node | Link           | Outflow<br>(l/s) | Discharge<br>Vol (m³) |                 |                  |               |        |
| 960 minute winter              | Storage    | Hydro-Brake®   | 0.1              | 10.1                  |                 |                  |               |        |

## **Annex E – Outline Drainage Sketch**



Legend:

- 132kV Substation
- Proposed Surface Water Flow Route
- Proposed HydroBrake with inclusion of Automated Valve

All Dimensions to be checked on site and not scaled from this drawing.  
This drawing is conceptual and not for construction  
This drawing is for planning only  
All services to be checked on site and not scaled from this drawing



**Arthian Ltd**  
13 Henderson Road,  
Inverness,  
IV1 1SN  
info@arthian.com  
+44 (0) 141 227 2300  
https://www.arthian.com

Client: **Island Green Power**

Site: **Lime Down**

Drawing Title: **Lime Down E1 Drainage Layout**

|                      |                  |                                 |
|----------------------|------------------|---------------------------------|
| Date:<br>05 Aug 2026 | Scale:<br>1:1000 | Paper Size:<br>A3 (297 x 420mm) |
|----------------------|------------------|---------------------------------|

|                 |                   |                     |                      |
|-----------------|-------------------|---------------------|----------------------|
| Drawn By:<br>GH | Checked By:<br>JR | Status:<br>Final v1 | Final Revision:<br>- |
|-----------------|-------------------|---------------------|----------------------|

|                                          |                                              |
|------------------------------------------|----------------------------------------------|
| CAD Ref:<br>317212 11.7_Drainage_Layout_ | Drawing No: / Client Ref:<br><b>Figure 1</b> |
|------------------------------------------|----------------------------------------------|

## **Annex F – SuDS Maintenance Schedule**

# Bioretention Systems Maintenance Schedule

| Maintenance Schedule          | Required Action                                                                                                                                                                                         | Typical Frequency                                                |
|-------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|
| <b>Regular inspections</b>    | Inspect infiltration surfaces for silting and ponding, record de-watering time of the facility and assess standing water levels in underdrain (if appropriate) to determine if maintenance is necessary | Quarterly                                                        |
|                               | Check operation of underdrains by inspection of flows after rain                                                                                                                                        | Annually                                                         |
|                               | Assess plants for disease infection, poor growth, invasive species etc and replace as necessary                                                                                                         | Quarterly                                                        |
|                               | Inspect inlets and outlets for blockage                                                                                                                                                                 | Quarterly                                                        |
| <b>Regular maintenance</b>    | Remove litter and surface debris and weeds                                                                                                                                                              | Quarterly (or more frequently for tidiness or aesthetic reasons) |
|                               | Replace any plants, to maintain planting density                                                                                                                                                        | As required                                                      |
|                               | Remove sediment, litter and debris build-up from around inlets or from forebays                                                                                                                         | Quarterly to biannually                                          |
| <b>Occasional maintenance</b> | Infill any holes or scour in the filter medium, improve erosion protection if required                                                                                                                  | As required                                                      |
|                               | Repair minor accumulations of silt by raking away surface mulch, scarifying surface of medium and replacing mulch                                                                                       | As required                                                      |
| <b>Remedial actions</b>       | Remove and replace filter medium and vegetation above                                                                                                                                                   | As required but likely to be > 20 years                          |

Table extract taken from the CIRIA C753 publication 'The SuDS Manual' – Table 18.3

# Detention Basins Maintenance Schedule

| Maintenance Schedule        | Required Action                                                                                            | Typical Frequency                                                                                                     |
|-----------------------------|------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|
| <b>Regular Maintenance</b>  | Remove litter and debris                                                                                   | Monthly                                                                                                               |
|                             | Cut grass - for spillways and access routes                                                                | Monthly (during growing season), or as required                                                                       |
|                             | Cut grass - meadow grass in and around basin                                                               | Half yearly (spring – before nesting season, and autumn)                                                              |
|                             | Manage other vegetation and remove nuisance plants                                                         | Monthly (at start, then as required)                                                                                  |
|                             | Inspect inlets, outlets and overflows for blockages, and clear if required                                 | Monthly                                                                                                               |
|                             | Inspect banksides, structures, pipework etc for evidence of physical damage                                | Monthly                                                                                                               |
|                             | Inspect inlets and facility surface for silt accumulation. Establish appropriate silt removal frequencies. | Monthly (for first year), then annually or as required                                                                |
|                             | Check any penstocks and other mechanical devices                                                           | Annually                                                                                                              |
|                             | Tidy all dead growth before start of growing season                                                        | Annually                                                                                                              |
|                             | Remove sediment from inlets, outlet and forebay                                                            | Annually (or as required)                                                                                             |
|                             | Manage wetland plants in outlet pool – where provided                                                      | Annually (as set out in Chapter 23)                                                                                   |
| <b>Occasion Maintenance</b> | Reseed areas of poor vegetation growth                                                                     | As required                                                                                                           |
|                             | Prune and trim any trees and remove cuttings                                                               | Every 2 years, or as required                                                                                         |
|                             | Remove sediment from inlets, outlets, forebay and main basin when required                                 | Every 5 years, or as required (likely to be minimal requirements where effective upstream source control is provided) |
| <b>Remedial Actions</b>     | Repair erosion or other damage by reseeding or re-turfing                                                  | As required                                                                                                           |
|                             | Realignment of rip-rap                                                                                     | As required                                                                                                           |
|                             | Repair/rehabilitation of inlets, outlets and overflows                                                     | As required                                                                                                           |
|                             | Relevel uneven surfaces and reinstate design levels                                                        | As required                                                                                                           |

Table extract taken from the CIRIA C753 publication 'The SuDS Manual' – Table 22.1

## Filter Drains Maintenance Schedule

| Maintenance Schedule          | Required Action                                                                                                                                  | Typical Frequency           |
|-------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
| <b>Regular Maintenance</b>    | Remove litter (including leaf litter) and debris from filter drain surface, access chambers and pre-treatment devices                            | Monthly, or as required     |
|                               | Inspect filter drain surface, inlet/outlet pipework and control systems for blockages, clogging, standing water and structural damage            | Monthly                     |
|                               | Inspect pre-treatment systems, inlets and perforated pipework for silt accumulation, and establish appropriate silt removal frequencies          | Six Monthly                 |
|                               | Remove sediment from pre-treatment devices                                                                                                       | Six monthly, or as required |
| <b>Occasional Maintenance</b> | Remove or control tree roots where they are encroaching the sides of the filter drain, using recommended methods (eg NJUG, 2007 or BS 3998:2010) | As required                 |
|                               | At locations with high pollution loads, remove surface geotextile and replace, and wash or replace overlying filter medium                       | Five yearly, or as required |
|                               | Clear perforated pipework of blockages                                                                                                           | As required                 |

Table extract taken from the CIRIA C753 publication 'The SuDS Manual' – Table 16.1

## Filter Strip Maintenance Schedule

| Maintenance Schedule   | Required Action                                                                                                      | Typical Frequency                               |
|------------------------|----------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|
| Regular Maintenance    | Remove litter, debris, leaf litter, and other accumulated material from the filter strip surface                     | Monthly, or as required                         |
|                        | Inspect the filter strip for bare patches, erosion, rutting, ponding, channel formation, and signs of compaction     | Monthly                                         |
|                        | Check inflow areas, level spreaders, and downstream outfalls to ensure runoff is evenly distributed across the strip | Monthly                                         |
|                        | Mow vegetation to maintain an appropriate grass height and remove arisings where necessary                           | 3 to 6 times per year during the growing season |
|                        | Inspect vegetation cover and re-seed sparse or damaged areas                                                         | Six Monthly                                     |
|                        | Remove accumulated sediment at the upstream edge and other areas where deposition occurs                             | Six Monthly, or as required                     |
| Occasional Maintenance | Aerate compacted ground to restore infiltration performance                                                          | As required                                     |
|                        | Re-grade the surface where flow paths have become concentrated or bypassed sections have developed                   | As required                                     |
|                        | Undertake partial or complete re-seeding where vegetation cover has significantly deteriorated                       | As required                                     |

# Green Roofs Maintenance Schedule

| Maintenance Schedule       | Required Action                                                                                                                                                                                                 | Typical Frequency                                    |
|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|
| <b>Regular Inspections</b> | Inspect all components including soil substrate, vegetation, drains, irrigation systems (if applicable), membranes and roof structure for proper operation, integrity of waterproofing and structural stability | Annually and after severe storms                     |
|                            | Inspect soil substrate for evidence of erosion channels and identify any sediment sources                                                                                                                       | Annually and after severe storms                     |
|                            | Inspect drain inlets to ensure unrestricted runoff from the drainage layer to the conveyance or roof drain system                                                                                               | Annually and after severe storms                     |
|                            | Inspect underside of roof for evidence of leakage                                                                                                                                                               | Annually and after severe storms                     |
| <b>Regular Maintenance</b> | Remove debris and litter to prevent clogging of inlet drains and interference with plant growth                                                                                                                 | Six monthly and annually or as required              |
|                            | During establishment (ie year one), replace dead plants as required                                                                                                                                             | Monthly (but usually responsibility of manufacturer) |
|                            | Post establishment, replace dead plants as required (where > 5% of coverage)                                                                                                                                    | Annually (in autumn)                                 |
|                            | Remove fallen leaves and debris from deciduous plant foliage                                                                                                                                                    | Six monthly or as required                           |
|                            | Remove nuisance and invasive vegetation, including weeds                                                                                                                                                        | Six monthly or as required                           |
|                            | Mow grasses, prune shrubs and manage other planting (if appropriate) as required - clippings should be removed and not allowed to accumulate                                                                    | Six monthly or as required                           |
| <b>Remedial Actions</b>    | If erosion channels are evident, these should be stabilized with extra soil substrate similar to the original material, and sources of erosion damage should be identified and controlled                       | As required                                          |
|                            | If drain inlet has settled, cracked or moved, investigate and repair as appropriate                                                                                                                             | As required                                          |

Table extract taken from the CIRIA C753 publication 'The SuDS Manual' – Table 12.5

# Headwall Outfall Maintenance Schedule

| Maintenance Schedule   | Required Action                                                                                     | Typical Frequency         |
|------------------------|-----------------------------------------------------------------------------------------------------|---------------------------|
| Regular Maintenance    | Remove litter, debris, sediment and vegetation from around headwalls, flap valves and outfalls      | Monthly (or as required)  |
|                        | Visual inspection of headwalls, outfall structures and surrounding banks for damage or erosion      | Monthly                   |
|                        | Check for blockage or restriction at outfall and through flap valve                                 | Monthly                   |
|                        | Ensure flap valves open and close freely and are not jammed                                         | Monthly                   |
|                        | Inspect watercourse immediately upstream and downstream for signs of scour, deposition or pollution | Monthly                   |
|                        | Inspect structural condition of concrete, masonry or prefabricated elements                         | Half yearly               |
|                        | Check protection measures such as rip-rap, gabions or aprons                                        | Half yearly               |
| Occasional Maintenance | Clear accumulated silt or debris from outfall channel and apron                                     | Annually (or as required) |
|                        | Lubricate flap valve hinges and moving parts where applicable                                       | Annually                  |
|                        | Vegetation management to maintain clear access and flow paths                                       | Annually                  |
|                        | Replace damaged or corroded flap valves                                                             | As required               |
|                        | Reinstate scour protection where displaced or degraded                                              | As required               |
| Remedial Actions       | Clearance following flooding, blockage or pollution incident                                        | As required               |
|                        | Stabilise banks and reinstate channel morphology at outfall location if their failure occurs        | As required               |

# Infiltration Basins Maintenance Schedule

| Maintenance Schedule          | Required Action                                                                                                | Typical Frequency                                      |
|-------------------------------|----------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|
| <b>Regular Maintenance</b>    | Remove litter, debris and trash                                                                                | Monthly                                                |
|                               | Cut grass - for landscaped areas and access routes                                                             | Monthly (during growing season) or as required         |
|                               | Cut grass - meadow grass in and around basin                                                                   | Half yearly: spring (before nesting season) and autumn |
|                               | Manage other vegetation and remove nuisance plants                                                             | Monthly at start, then as required                     |
| <b>Occasional Maintenance</b> | Reseed areas of poor vegetation growth                                                                         | Annually, or as required                               |
|                               | Prune and trim trees and remove cuttings                                                                       | As required                                            |
|                               | Remove sediment from pre-treatment system when 50% full                                                        | As required                                            |
| <b>Remedial Actions</b>       | Repair erosion or other damage by reseeding or re-turfing                                                      | As required                                            |
|                               | Realign the rip-rap                                                                                            | As required                                            |
|                               | Repair or rehabilitate inlets, outlets and overflows                                                           | As required                                            |
|                               | Rehabilitate infiltration surface using scarifying and spiking techniques if performance deteriorates          | As required                                            |
|                               | Relevel uneven surfaces and reinstate design levels                                                            | As required                                            |
| <b>Monitoring</b>             | Inspect inlets, outlets and overflows for blockages, and clear if required                                     | <b>Monthly</b>                                         |
|                               | Inspect banksides, structures, pipework etc for evidence of physical damage                                    | <b>Monthly</b>                                         |
|                               | Inspect inlets and pre-treatment systems for silt accumulation; establish appropriate silt removal frequencies | <b>Half yearly</b>                                     |
|                               | Inspect infiltration surfaces for compaction and ponding                                                       | Monthly                                                |

Table extract taken from the CIRIA C753 publication 'The SuDS Manual' – Table 13.2

# Pervious Pavements Maintenance Schedule

| Maintenance Schedule          | Required Action                                                                                                                                                                      | Typical Frequency                                                                                                                                                                                                                                                                                                            |
|-------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Regular Maintenance</b>    | Brushing and vacuuming (standard cosmetic sweep over whole surface)                                                                                                                  | Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturer's recommendations – pay particular attention to areas where water runs onto pervious surface from adjacent impermeable areas as this area is most likely to collect the most sediment |
| <b>Occasional Maintenance</b> | Stabilise and mow contributing and adjacent areas                                                                                                                                    | As required                                                                                                                                                                                                                                                                                                                  |
|                               | Removal of weeds or management using glyphosate applied directly into the weeds by an applicator rather than spraying                                                                | As required - once per year on less frequently used pavements                                                                                                                                                                                                                                                                |
| <b>Remedial Actions</b>       | Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50 mm of the level of the paving                                             | As required                                                                                                                                                                                                                                                                                                                  |
|                               | Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing material | As required                                                                                                                                                                                                                                                                                                                  |
|                               | Rehabilitation of surface and upper substructure by remedial sweeping                                                                                                                | Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging)                                                                                                                                                                                                                     |
| <b>Monitoring</b>             | Initial inspection                                                                                                                                                                   | Monthly for three months after installation                                                                                                                                                                                                                                                                                  |
|                               | Inspect for evidence of poor operation and/or weed growth - if required, take remedial action                                                                                        | Three-monthly, 48 h after large storms in first six months                                                                                                                                                                                                                                                                   |
|                               | Inspect silt accumulation rates and establish appropriate brushing frequencies                                                                                                       | Annually                                                                                                                                                                                                                                                                                                                     |
|                               | Monitor inspection chambers                                                                                                                                                          | Annually                                                                                                                                                                                                                                                                                                                     |

Table extract taken from the CIRIA C753 publication 'The SuDS Manual' – Table 20.15

# Pipes Maintenance Schedule

| Maintenance Schedule   | Required Action                                                                                                                                                                                                                                                                 | Typical Frequency |
|------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|
| Regular Maintenance    | <b>Inlets, outlets and surface control structures –</b><br>Inspect surface structures, removing obstructions and silts as necessary. Check there is no physical damage.<br><br>Strim Vegetation 1 m min. surround to structures and keep hard aprons free from silt and debris. | Monthly           |
|                        | <b>Inspect chambers and below-ground control chambers –</b><br><br>Remove cover and inspect, ensuring that water is flowing freely and that the exit route for water is unobstructed. Remove debris and silt.<br><br>Undertake inspection after leaf fall in autumn.            | Monthly           |
| Occasional Maintenance | Check topsoil levels are 20mm above edges of baskets and chambers to avoid mower damage.                                                                                                                                                                                        | As necessary      |
| Remedial Works         | Unpack stone in basket features and unblock or repair and repack stone as design detail as necessary.                                                                                                                                                                           | As required       |
|                        | Repair physical damage if necessary.                                                                                                                                                                                                                                            | As required       |

Table extract taken from the CIRIA C753 publication 'The SuDS Manual' – Box B.2

# Pipes, Gullies, Catchpits, and Manholes Maintenance Schedule

---

| Maintenance Schedule   | Required Action                                                            | Typical Frequency         |
|------------------------|----------------------------------------------------------------------------|---------------------------|
| Regular Maintenance    | Remove litter, debris, leaves and floatables from grating and chamber      | Monthly (or as required)  |
|                        | Visual inspection of grating, cover and frame for damage or displacement   | Monthly                   |
|                        | Check for evidence of blockage, surcharge, standing water, or odours       | Monthly                   |
|                        | Inspect inlet and outlet pipes for blockage, damage or silt build-up       | Monthly                   |
|                        | Check chamber walls and benching for cracks or structural deterioration    | Half yearly               |
|                        | Measure silt and debris accumulation within the sump                       | Half yearly               |
|                        | Ensure grating slots and covers are clear and safe for traffic/pedestrians | Half yearly               |
| Occasional Maintenance | Structural repair to chamber, benching or pipe connections                 | As required               |
|                        | Replace damaged or corroded gratings, covers or frames                     | As required               |
|                        | Remove silt and debris from sump once 50% of sump depth is full            | Annually (or as required) |
|                        | Jet and cleanse inlet pipework                                             | Annually (or as required) |
| Remedial Actions       | Clearance following flooding, pollution incident, or blockage occurrence   | As required               |
|                        | Upgrade or modify catchpits if capacity is observed as insufficient        | As required               |

# Ponds and Wetlands Maintenance Schedule

| Maintenance Schedule   | Required Action                                                                                                                                                                                                                       | Typical Frequency                                                                     |
|------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| Regular Maintenance    | Remove litter and debris                                                                                                                                                                                                              | Monthly (or as required)                                                              |
|                        | Cut the grass - public areas                                                                                                                                                                                                          | Monthly (during growing season)                                                       |
|                        | Cut the meadow grass                                                                                                                                                                                                                  | Half yearly (spring, before nesting season, and autumn)                               |
|                        | Inspect marginal and bankside vegetation and remove nuisance plants (for first 3 years)                                                                                                                                               | Monthly (at start, then as required)                                                  |
|                        | Inspect inlets, outlets, banksides, structures, pipework etc for evidence of blockage and/or physical damage                                                                                                                          | Monthly                                                                               |
|                        | Inspect water body for signs of poor water quality                                                                                                                                                                                    | Monthly (May - October)                                                               |
|                        | Inspect silt accumulation rates in any forebay and in main body of the pond and establish appropriate removal frequencies; undertake contamination testing once some build-up has occurred, to inform management and disposal options | Half yearly                                                                           |
|                        | Check any mechanical devices, eg penstocks                                                                                                                                                                                            | Half yearly                                                                           |
|                        | Hand cut submerged and emergent aquatic plants (at minimum of 0.1m above pond base; include max 25% of pond surface)                                                                                                                  | Annually                                                                              |
|                        | Remove 25% of bank vegetation from water's edge to a minimum of 1 m above water level                                                                                                                                                 | Annually                                                                              |
|                        | Tidy all dead growth (scrub clearance) before start of growing season (Note: tree maintenance is usually part of overall landscape management contract)                                                                               | Annually                                                                              |
|                        | Remove sediment from any forebay                                                                                                                                                                                                      | Every 1-5 years, or as required                                                       |
|                        | Remove sediment and planting from one quadrant of the main body of ponds without sediment forebays.                                                                                                                                   | Every 5 years, or as required                                                         |
| Occasional Maintenance | Remove sediment from the main body of big ponds when pool volume is reduced by 20%                                                                                                                                                    | With effective pre-treatment, this will only be required rarely, eg every 25-50 years |
| Remedial Actions       | Repair erosion or other damage                                                                                                                                                                                                        | As required                                                                           |
|                        | Replant, where necessary                                                                                                                                                                                                              | As required                                                                           |
|                        | Aerate pond when signs of eutrophication are detected                                                                                                                                                                                 | As required                                                                           |
|                        | Realign rip-rap or repair other damage                                                                                                                                                                                                | As required                                                                           |
|                        | Repair / rehabilitate inlets, outlets and overflows.                                                                                                                                                                                  | As required                                                                           |

Table extract taken from the CIRIA C753 publication 'The SuDS Manual' – Table 23.1

# Soakaway Maintenance Schedule

| Maintenance Schedule   | Required Action                                                                                                                             | Typical Frequency                              |
|------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|
| Regular Maintenance    | Inspection for sediment and debris in pre-treatment components and flood of inspection tube or chamber and inside of concrete manhole rings | Annually                                       |
|                        | Cleaning of gutters and any filters on downpipes                                                                                            | Annually (or as required based on inspections) |
|                        | Trimming any routes that may be causing blockages                                                                                           | Annually (or as required)                      |
| Occasional Maintenance | Inspection for sediment and debris in pre-treatment components and flood of inspection tube or chamber and inside of concrete manhole rings | As required, based on inspections              |
| Remedial Actions       | Reconstruct soakaway and/or replace or clean void fill, if performance deteriorates or failure occurs                                       | As Required                                    |
|                        | Replacement of clogged geotextile (will require reconstruction of soakaway)                                                                 | As Required                                    |
| Monitoring             | Inspect silt traps and note rate of sediment accumulation                                                                                   | Monthly in the first year and then annually    |
|                        | Check soakaway to ensure emptying is occurring                                                                                              | Annually                                       |

Table extract taken from the CIRIA C753 publication 'The SuDS Manual' – Table 13.1

# Attenuation Storage Tanks Maintenance Schedule

| Maintenance Schedule       | Required Action                                                                                                                                                                                        | Typical Frequency                   |
|----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|
| <b>Regular maintenance</b> | Inspect and identify any areas that are not operating correctly. If required, take remedial action                                                                                                     | Monthly for 3 months, then annually |
|                            | Remove debris from the catchment surface (where it may cause risks to performance)                                                                                                                     | Monthly                             |
|                            | For systems where rainfall infiltrates into the tank from above, check surface of filter for blockage by sediment, algae or other matter; remove and replace surface infiltration medium as necessary. | Annually                            |
|                            | Remove sediment from pre-treatment structures and/or internal forebays                                                                                                                                 | Annually, or as required            |
| <b>Remedial actions</b>    | Repair/rehabilitate inlets, outlet, overflows and vents                                                                                                                                                | As required                         |
| <b>Monitoring</b>          | Inspect/check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed                                                                             | Annually                            |
|                            | Survey inside of tank for sediment build-up and remove if necessary                                                                                                                                    | Every 5 years or as required        |

Table extract taken from the CIRIA C753 publication 'The SuDS Manual' – Table 21.3

# Swales Maintenance Schedule

| Maintenance Schedule          | Required Action                                                                                                                        | Typical Frequency                                                                   |
|-------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| <b>Regular Maintenance</b>    | Remove litter and debris                                                                                                               | Monthly, or as required                                                             |
|                               | Cut grass - to retain grass height within specified design range                                                                       | Monthly (during growing season), or as required                                     |
|                               | Manage other vegetation and remove nuisance plants                                                                                     | Monthly at start, then as required                                                  |
|                               | Inspect inlets, outlets and overflows for blockages, and clear if required                                                             | Monthly                                                                             |
|                               | Inspect infiltration surfaces for ponding, compaction, silt accumulation, record areas where water is ponding for > 48 hours           | Monthly, or when required                                                           |
|                               | Inspect vegetation coverage                                                                                                            | Monthly for 6 months, quarterly for 2 years, then half yearly                       |
|                               | Inspect inlets and facility surface for silt accumulation, establish appropriate silt removal frequencies                              | Half yearly                                                                         |
| <b>Occasional Maintenance</b> | Reseed areas of poor vegetation growth, alter plant types to better suit conditions, if required                                       | As required or if bare soil is exposed over 10% or more of the swale treatment area |
| <b>Remedial Actions</b>       | Repair erosion or other damage by re-turfing or Reseeding                                                                              | As required                                                                         |
|                               | Relevel uneven surfaces and reinstate design levels                                                                                    | As required                                                                         |
|                               | Scarify and spike topsoil layer to improve infiltration performance, break up silt deposits and prevent compaction of the soil surface | As required                                                                         |
|                               | Remove build-up of sediment on upstream gravel trench, flow spreader or at top of filter strip                                         | As required                                                                         |
|                               | Remove and dispose of oils or petrol residues using safe standard practices                                                            | As required                                                                         |

Table extract taken from the CIRIA C753 publication 'The SuDS Manual' – Table 17.1



<sup>iii</sup> <https://magic.defra.gov.uk/>

<sup>iv</sup> <https://flood-map-for-planning.service.gov.uk/>

<sup>v</sup> <https://environment.data.gov.uk/hydrology/climate-change-allowances/river-flow>

<sup>vi</sup> <https://check-long-term-flood-risk.service.gov.uk/postcode>

<sup>vii</sup> <https://www.landis.org.uk/soilscapes/>