



Lime Down

Solar Park

Environmental Statement

Volume 3, Appendix 11-5: Flood Risk Assessment and Outline Drainage Strategy – Lime Down C2 (Clean)

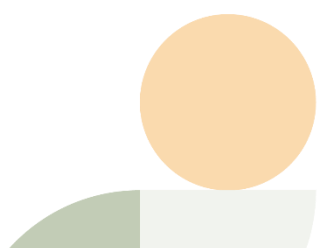
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Appendix 11-5: Flood Risk Assessment and Outline Drainage Strategy – Lime Down C2

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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 C2.

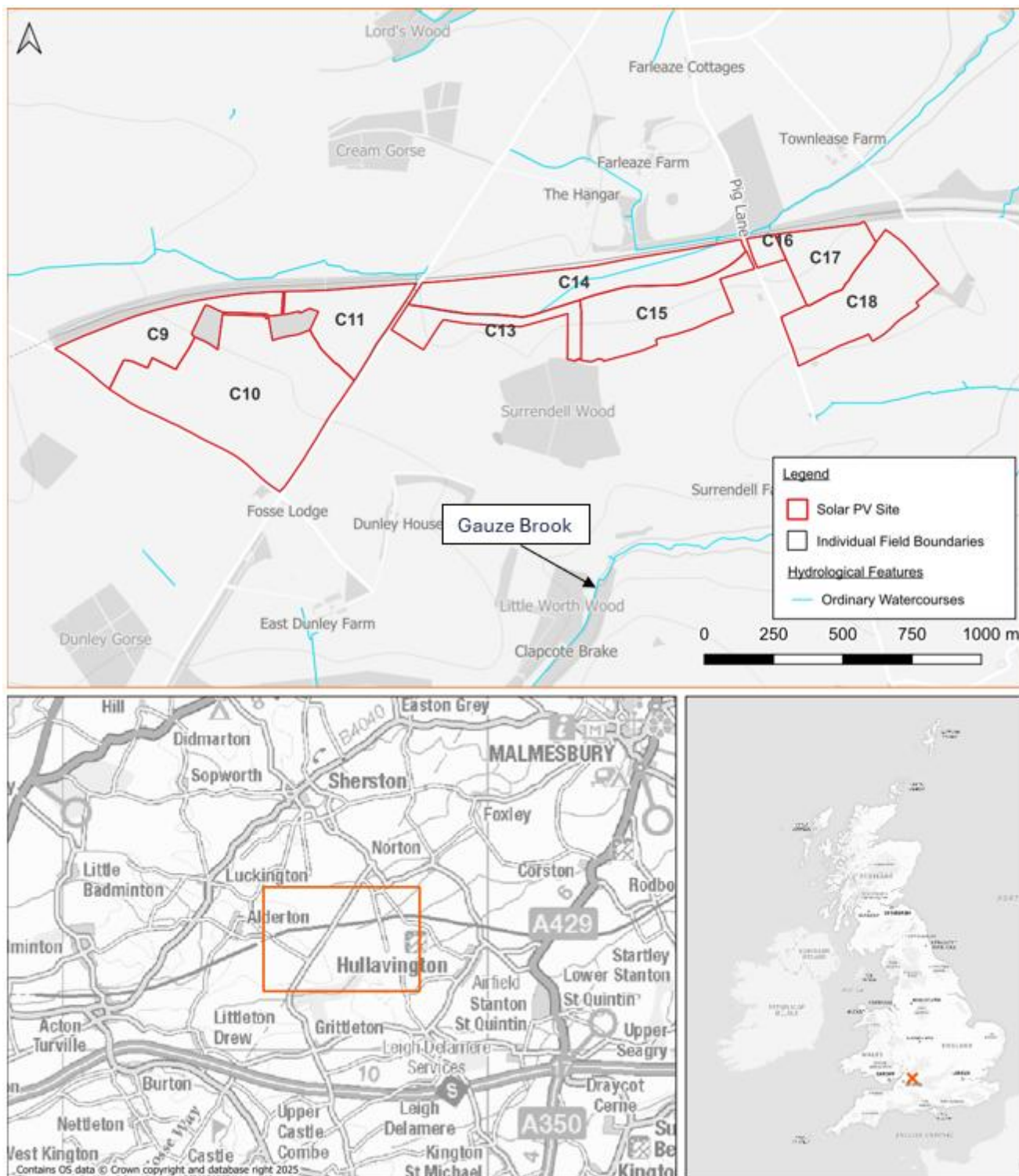


Figure 1: Site Location

1.2 Site Location

1.2.1 Lime Down C2 is located approximately 0.9km southeast of Alderton, a village in Wiltshire, and is situated about 2km north of the M4 motorway. The grid references are centred at 384980N,182570E (north-west), 385690N,182110E (south-west), 387810N,183030E (north-east), and 387586N,182560E (south-east).

1.3 Existing Site Conditions

1.3.1 Online mapping (including Google Maps / Google Streetview imageryⁱ (accessed May 2025) shows that Lime Down C2 comprises agricultural / arable fields.

1.4 Topography

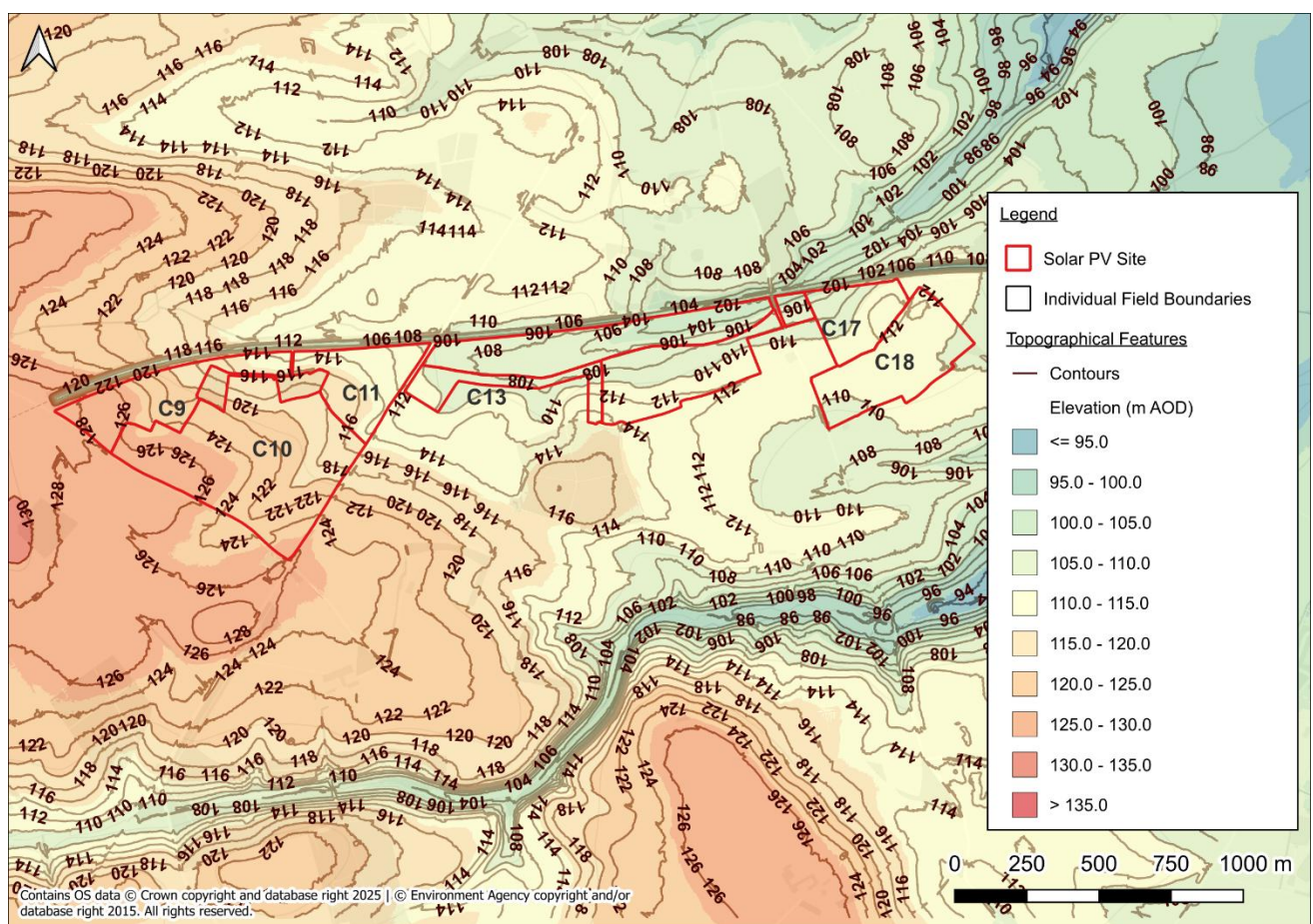


Figure 2: LiDAR Plan

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 C2 slopes from approximately 128m AOD in the west to approximately 102m AOD in the north-east (Figure 2).

1.5 Hydrology

1.5.1 The nearest main river is the Gauze Brook, located approximately 800m south of Lime Down C2, flowing

in a south-easterly direction. However, there are various unnamed land drainage ditches located on-site and in the immediate vicinity (within 200m from the Site) that have been identified via Google Earth and OS MasterMap data.

- 1.5.2 Main rivers are under the jurisdiction of the EA, while all land drainage ditches are classified as ordinary watercourses and fall within the jurisdiction of the Wiltshire Lead Local Flood Authority (LLFA).

1.6 Water Framework Directive Status

- 1.6.1 Lime Down C2 is located within the Avon Bristol Rural Operational Catchment, largely within the Tributary – Source to Conf Sherston Avon Water Body Catchment and partially within the Gauze Brook – Source to Conf River Avon Water Body Catchment.

- 1.6.2 The Tributary – Source to Conf Sherston Avon Water Body catchment has a Cycle 3 Ecological status of Good in 2019 and 2022 and a Fail chemical status in 2019 (no data in 2022).

- 1.6.3 The Gauze Brook – Source to Conf River Avon Water Body catchment has a Cycle 3 Ecological status of Moderate in 2019 and 2022 and a Fail chemical status in 2019 (no data in 2022).

- 1.6.4 A summary of the Water Body Classifications for the catchments are included as Annex A.

1.7 Geology

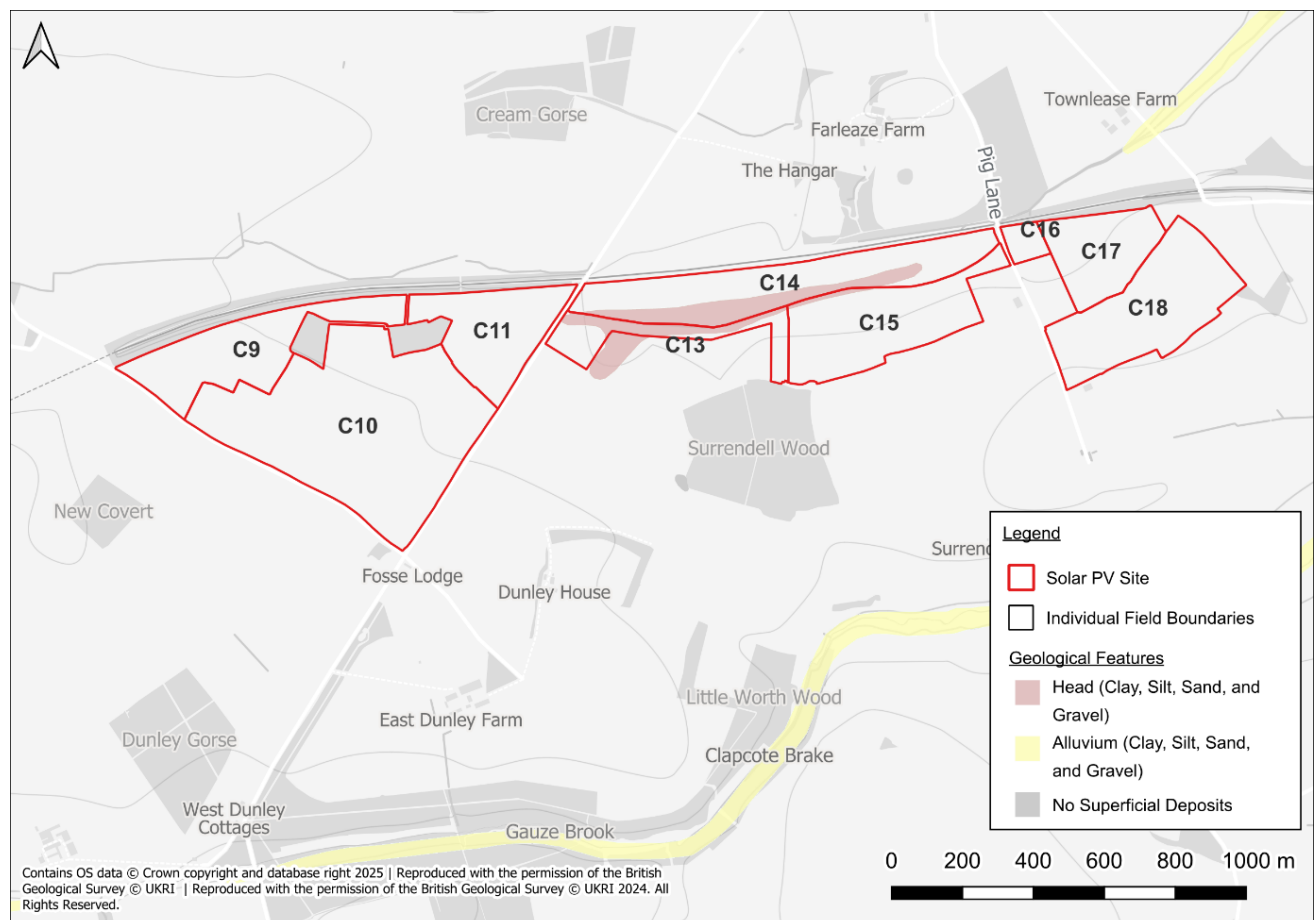


Figure 3: Superficial Deposits

- 1.7.1 Reference to the British Geological Survey (BGS) online mappingⁱⁱ (1:50,000 scale) indicates that Lime Down C2 is underlain by the superficial deposits Head which comprises Clay, Silt, Sand and Gravel (see **Figure 3** for the locations of the varying deposits).
- 1.7.2 There are also areas on the Lime Down C2 identified as not being underlain by any superficial deposits.
- 1.7.3 Lime Down C2 is identified as being underlain by the following bedrock deposits (see **Figure 4** for the locations of the varying deposits):
- Chalfield Oolite Formation comprising Limestone & Oodial; and
 - Forest Marble Limestone (Limestone & Oodial).
- 1.7.4 The geological mapping is available at a scale of 1:50,000 and as such may not be accurate on a site-specific basis.
- 1.7.5 There are no BGS boreholes located at Lime Down C2.

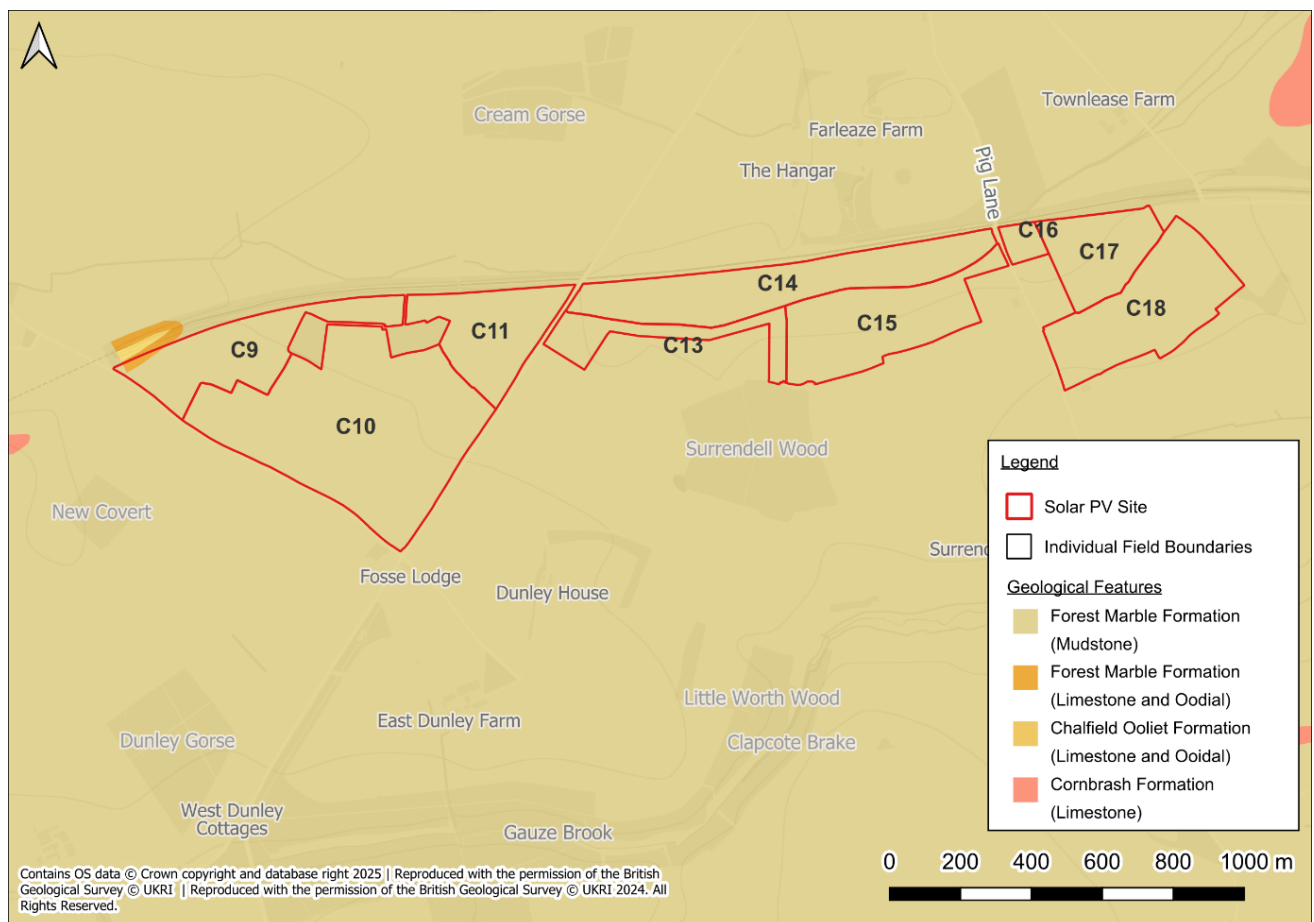


Figure 4: Bedrock Deposits

1.8 Hydrogeology

- 1.8.1 According to the EA Aquifer Designation data, obtained from MAGIC Map's online mappingⁱⁱⁱ [accessed 02/06/25], the Head Deposits are classified as a Secondary A Aquifer.

1.8.2 The underlying Forest Marble Formation is described as a Secondary A Aquifer.

1.8.3 The EA ‘Source Protection Zones’ data, obtained from MAGIC Map’s online mapping [accessed 02/06/25], indicates that Lime Down C2 is located within a Groundwater Source Protection Zone.

1.9 Proposed Site Conditions

1.9.1 Lime Down C2 proposes a ground mounted Solar PV Panels , associated infrastructure and access. See Chapter 3: Scheme Description of the ES.

1.9.2 An **Outline Landscape and Ecological Management Plan (LEMP) [EN010168/APP/7.18]** has been developed to support the DCO application, and details that the vast majority of the Site is proposed to be utilised for Solar PV Panels, supporting infrastructure, internal access and peripheral areas will comprise 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.

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 C2.

2.2 Tidal Flood Risk

2.2.1 Lime Down C2 is situated at a minimum of approximately 102m 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 C2 is situated wholly in Flood Zone 1, meaning it is an area considered to have <0.1% annual probability of flooding from rivers or the sea. Flood maps are included as Figure 5 below and **ES Volume 2, Figure 11-4: Lime Down C2 Fluvial and Surface Water Risk Map [EN010168/EXAM/6.2] (Rev 2)** produced at Deadline 3 of Examination

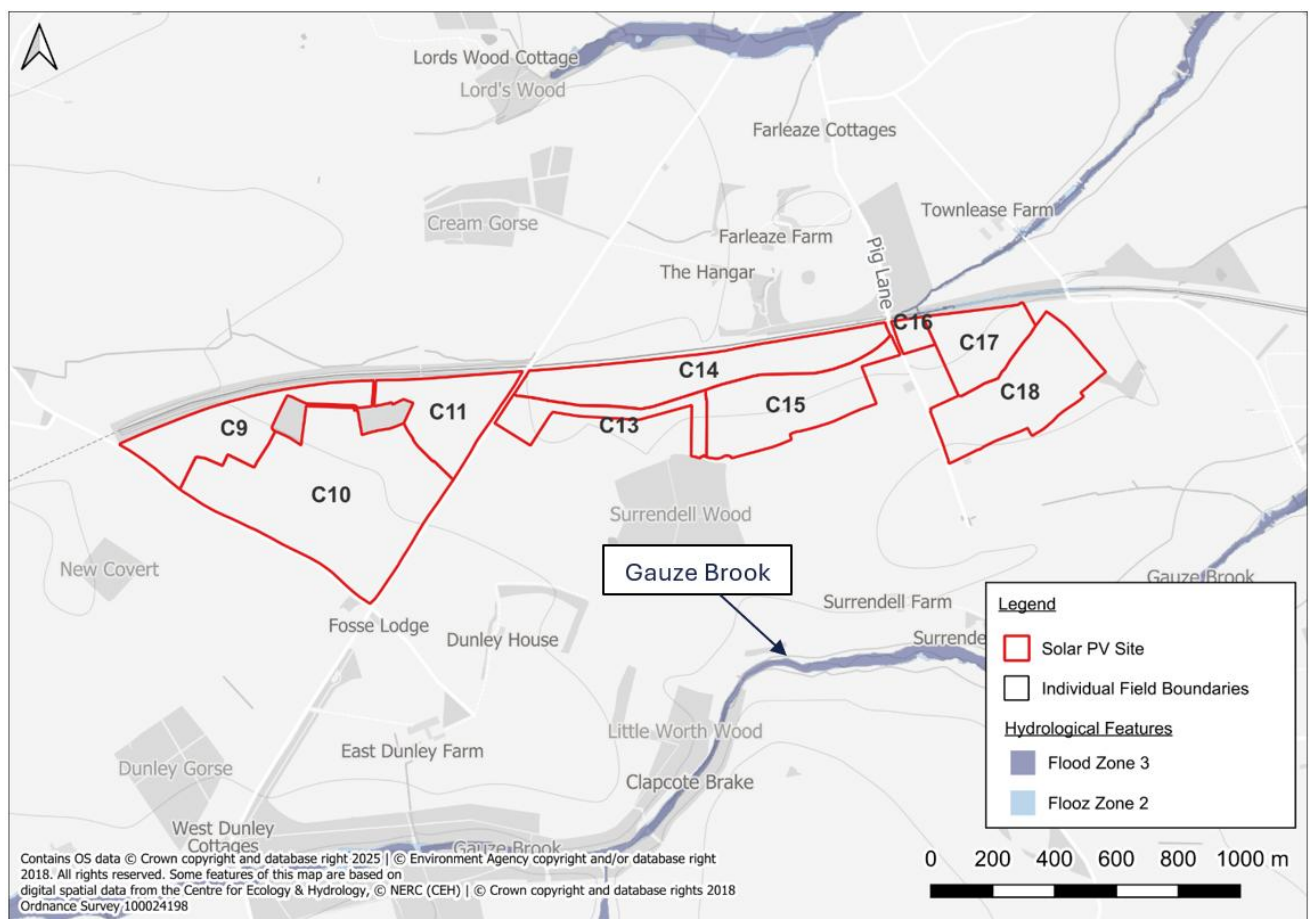


Figure 5: EA's Flood Map for Planning

2.3.2 The nearest watercourse is a network of unnamed land drainage ditches located within the immediate vicinity, within 200m of Lime Down C2. The land drainage ditches flow in an easterly direction. All the land drainage ditches are Ordinary Watercourses and are within the jurisdiction of the Wiltshire Lead

Local Flood Authority. Additionally, the nearest main river, the Gauze Brook, is located approximately 800m south of Lime Down C2 and, due to this distance, does not pose a risk to the Site.

- 2.3.3 Fluvial flooding could occur if the land drainage ditches overtopped their banks during or following an extreme rainfall event.
- 2.3.4 The EA 'Historical Flood Map' indicates that there are no recorded incidents of historical flooding on-site or within the immediate vicinity; however, this does not imply that Lime Down C2 has never flooded in the past, but rather that there are no documented records of such events, likely due to the Lime Down C2's rural setting.
- 2.3.5 There is no site-specific information within third party reports relating to fluvial flood risk.
- 2.3.6 To estimate flood levels for a 1% Annual Exceedance Probability (AEP) event with a 71% climate change allowance^v, 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.
- 2.3.7 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. It should also be noted that the surface water mapping does not reflect the location of the land drainage ditches within the Site, and instead follows topographic low points and drainage paths identified from the LIDAR, the calculations were therefore taken based on these pathways shown on the LIDAR dataset. 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.
- 2.3.8 It is further noted that the NaFRA2 mapping was released in January 2025 which supersedes the EA's previous flood risk mapping. 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.
- 2.3.9 Based on the analysis, the surface water flood maps offer a suitable and conservative basis for assessing fluvial flood risk at Lime Down C2. A more detailed exploration of surface water flood risks can be found in Section 2.4.

Consultation

- 2.3.10 The EA were consulted in October 2024 for any site-specific flood data and modelling; a response was received on the 13/11/24 and is included as Annex C. Product 4 data received for the area has been produced using the EA's National Generalised Model- JFLOW. This modelling is fit for the purpose of the Flood Zones; However, it is not based on a specific channel survey. The basic JFLOW water depths for

the 1% Annual Exceedance Probability event and the 0.1% Annual Exceedance Probability Event are also included in Annex C. The mapping indicates that at Lime Down C2, flood depths remain consistent, as the area lies entirely within Flood Zone 1.

2.3.11 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.

2.3.12 Lime Down C2 is not located within an Internal Drainage Board (IDB).

Summary

2.3.13 Lime Down C2 is therefore considered to be at **Low** risk of fluvial flooding.

2.4 Surface Water Flood Risk

2.4.1 The Environment Agency's National Flood Risk Assessment (NaFRA) mapping, known as the Long-Term Flood Risk Map (Surface Water), was updated in January 2025. This provides the most up-to-date indication of surface water flood risk across the Site, although at the time of writing, the NaFRA mapping only projects climate change scenarios to the year 2060.

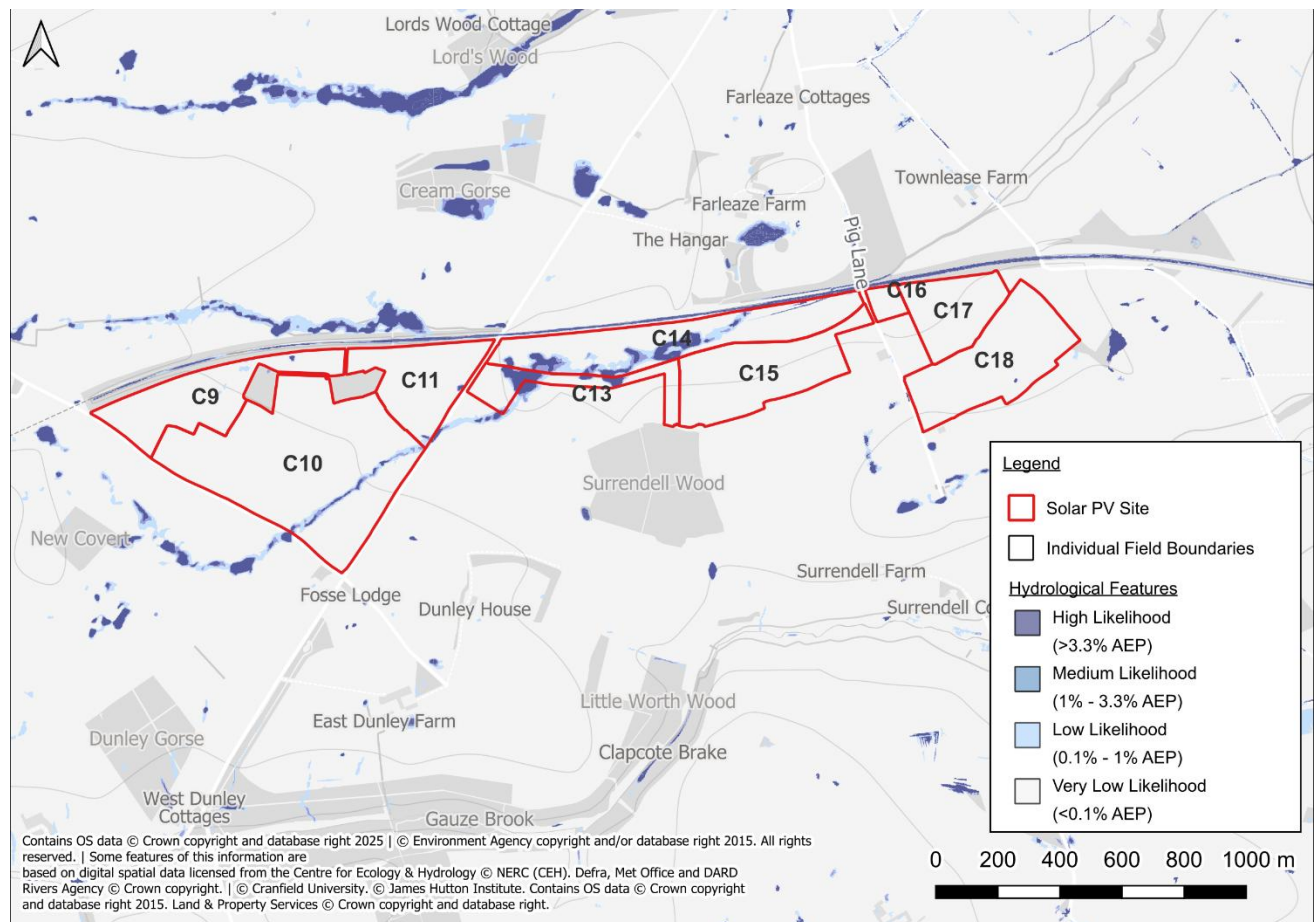


Figure 6 EA's Long-Term Flood Risk Map (Flood Risk from Surface Water)

- 2.4.2 The mapping shows that the majority of Lime Down C2 is at **Very Low risk** of surface water flooding, with an annual probability of less than 0.1%. However, several localised areas of **Low to High risk** (0.1% to greater than 3.3% annual chance) are present, particularly within Fields C9 to C11 and Fields C13, C14, and C18. These areas of predicted flooding largely coincide with the courses of existing unnamed land drainage ditches that flow within and around the Site (**see Figure 6**).
- 2.4.3 Depth mapping derived from NaFRA indicates that predicted flood depths are generally low, remaining predominantly below 300mm, which is considered passable for pedestrians and vehicles. In Fields C13 and C14, some isolated locations are shown with depths between 300mm and 600mm. One small area of ponding in Field C14 is predicted to exceed 600mm. Elsewhere, depths are not anticipated to exceed this threshold.
- 2.4.4 There is no evidence from relevant third-party reports (listed in **ES Volume 3, Appendix 11-1: Flood Risk Assessment and Outline Drainage Strategy – Covering Report [EN010168/APP/6.3]**) to indicate that Lime Down C2 has historically experienced surface water flooding.
- 2.4.5 Taking into account these findings and the embedded mitigation proposed as part of the development design, 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.
- 2.4.6 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]**.
- 2.4.7 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.
- 2.4.8 The approach to managing surface water runoff is detailed in **ES Volume 3, Appendix 11-1: Flood Risk Assessment and Outline Drainage Strategy – Covering Report [EN010168/APP/6.3]**, which confirms that appropriate Sustainable Drainage Systems (SuDS) will be implemented to ensure there is no increase in flood risk elsewhere.

2.5 Groundwater Flood Risk

- 2.5.1 The geology is identified above in Section 1.0. There were no legible boreholes in the near vicinity.
- 2.5.2 The Wiltshire Strategic Flood Risk Assessment (SFRA) map^{vi} (listed ‘Sources of Information’ in **ES Volume 3, Appendix 11-1: Flood Risk Assessment and Outline Drainage Strategy – Covering Report [EN010168/APP/6.3]**) suggests that Lime Down C2 is located in an area of no risk to groundwater flooding, due to the nature of the local geological deposits.
- 2.5.3 No buildings and no basement levels are identified on plans which may otherwise be at increased risk from groundwater seepage.

- 2.5.4 It can be concluded that the risk of groundwater flooding is **Low**; therefore, no further 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 C2's rural setting, the presence of sewerage infrastructure is unlikely. Utility records have been checked, and no public sewers are identified within Lime Down C2.
- 2.6.3 It can therefore be concluded that the risk of sewer flooding is **Negligible**; therefore, no further site-specific mitigation measures are required.

2.7 Reservoir and Canal Flooding

- 2.7.1 There are no canals within the vicinity of Lime Down C2, therefore there is no associated risk.
- 2.7.2 The EA 'Flood Risk from Reservoirs' map shows that Lime Down C2 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 land drainage ditches and potentially impact Lime Down C2. 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 C2 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 C2 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 C2 forms part of the wider Scheme and includes Solar PV Panelled Areas and eight Conversion Units / 33kV Sub-distribution Switch Rooms. This section provides the Outline Drainage Strategy for Lime Down C2. 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 eight Conversion Unit / 33kV Sub-distribution Switch Room equipment pads, Lime Down C2 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. Lime Down C2 forms part of the wider Scheme and includes Solar PV Panelled Areas and eight Conversion Units / 33kV Sub-distribution Switch Rooms. Excluding the eight Conversion Unit / 33kV Sub-distribution Switch Room equipment pads, Lime Down C2 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 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 eight Conversion Units / 33kV Sub-distribution Switch Rooms; and
- An outline drainage strategy for the positively drained hardstanding surfaces, comprising the eight Conversion Units / 33kV Sub-distribution Switch Rooms. The detailed drainage layout, final SuDS components, conveyance routes, levels, outfalls, flow controls, treatment train 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 [REP3-015]**, **ES Volume 3, Appendix 11-1: Flood Risk Assessment and Drainage Strategy - Covering Report [REP3-039]** 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 [REP3-094] and Outline Soil Resources Management Plan [REP3-098]**, 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 [REP3-100] and Outline Operational Environmental Management Plan [REP3-094]**, 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.

3.3 Drainage Strategy – Proposed Hardstanding Surfaces

- 3.3.1 Lime Down C2 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 areas within Lime Down C2. 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 ²)
8 x Conversion Units / 33kV Sub-Distribution Switch Rooms	600 (8 × 75 m ²)

- 3.3.2 The assessed hardstanding surfaces have been identified using the indicative infrastructure areas currently proposed for Lime Down C2, or, where the final equipment layout is not fixed, the relevant maximum design parameters set out in **ES Volume 1, Chapter 3: The Scheme [APP-055]**. 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 C2. 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) Guidance¹ 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.”

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 C2 based on the assessed hardstanding surfaces, greenfield runoff rates, controlled discharge rates, indicative attenuation volumes, SuDS options and maintenance principles. The detailed drainage design, including the final layout, levels, outfall arrangement 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, where relevant, the drainage system would be isolated and managed in accordance with the relevant containment strategy.

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 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

¹ https://www.wiltshire.gov.uk/media/13768/Wiltshire-Council-Drainage-Betterment-Strategy/pdf/Wiltshire_Council_Drainage_Betterment_Strategy__June_2024.pdf?m=1731336788693

- 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.
- 3.4.5 However, given the small contributing area, low calculated discharge rates and dispersed nature of the eight Conversion Units/ 33kV Distribution Switch Rooms, 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 or filter drain 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. The drainage hierarchy has therefore been applied proportionately, recognising the small contributing areas and dispersed nature of the eight Conversion Units / 33kV Sub-distribution Switch Rooms.
- 3.4.6 Nevertheless, greenfield runoff rates have been calculated for the eight Conversion Units/ 33kV Distribution Switch Rooms and is detailed further below.

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 and will be attenuated on Site and discharged at controlled rates in line with greenfield runoff principles and the LLFA requirement for 30% betterment.
- 3.5.2 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 D.
- 3.5.3 This approach demonstrates that a feasible drainage solution can be accommodated within Lime Down C2 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 ³)
Conversion Unit / 33kV Sub- distribution Switch Room, per unit	0.2	0.5	0.6	0.1	0.1	6.1*

* The Conversion Unit / 33kV Sub-distribution Switch Room attenuation volume is calculated on a per-unit basis. For Lime Down C2, each unit requires approximately 6.1 m³ of indicative local storage, to be provided through source-control SuDS such as perimeter French drains, filter drains or equivalent features. Eight units are proposed at Lime Down C2, giving a cumulative indicative local storage requirement of approximately 48.8 m³.

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

SuDS Measure	Amenity Benefit	Biodiversity Benefit	Suitability for Proposed Development	Reasoning
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/ 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. 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	The attenuation benefits provided through the use of rainwater harvesting are considered to be limited and would only be realised when the tanks were not full. Water usage on site is unlikely to be significant and therefore the benefit of retaining water is limited.
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 where infiltration to ground is not appropriate or where additional protection of controlled waters is required.

	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.		
Porous/ Permeable Surfacing (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.	✓	
Underground Attenuation Tanks / Geocellular Storage / Oversized 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.	X	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

Everyday Rainfall

- 3.7.1 The hardstanding surfaces requiring positive drainage have been identified using either the indicative area of the infrastructure proposed at Lime Down C2, or, where the final equipment layout is not fixed, the 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 C2 and within the assessed design envelope.
- 3.7.2 Greenfield runoff rates have been calculated for each assessed hardstanding surfaces. 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.
- 3.7.3 The eight 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 75m² per unit. This provides a conservative basis for assessment.
- 3.7.4 For an individual 75m² unit, the calculated runoff rate is very low, with a proposed discharge rate of approximately 0.1l/s and an indicative local storage volume of approximately 6.1m³. Across Lime Down C2, the cumulative assessed area of the eight Conversion Units / 33kV Sub-distribution Switch Rooms is 600m². The calculated cumulative greenfield runoff rates are 0.2l/s for the 1 in 2 year event, 0.5l/s for the 1 in 30 year event and 0.6l/s for the 1 in 100 year event. The proposed cumulative discharge rate is 0.1l/s, with a cumulative storage requirement of 48.8m³.
- 3.7.5 Given the small contributing area, low calculated runoff rates 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.
- 3.7.6 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.
- 3.7.7 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 E.

Table 4: Conversion Unit/33kV Distribution Switch Room Attenuation Storage

Contributing Area	75m ² (per unit)
Flow Rate	0.1l/s
Flow Control	HydroBrake
Flow Control Design Head	0.75m
Estimated Required Volume (1 in 100 year +45%CC)	6.1m ³ (per unit)

Everyday Rainfall

- 3.7.8 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 5: Conversion Unit/33kV Distribution Switch Room Everyday Rainfall*

Contributing Area	75m ²
Rainfall Depth	0.005m
Runoff Volume	0.4m ³
Required Additional Depth	0.4m

**The calculations above assume that the 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.*

- 3.7.9 As shown in the tables above, the everyday rainfall volumes are limited and can be accommodated within the preferred SuDS features by providing the required additional storage depth. 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 C2 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 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 and maintenance requirements, and will ensure that peak runoff from positively drained hardstanding surfaces is 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. 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.
- 3.8.4 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.
- 3.8.5 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 [EN010168/APP/3.1]**.

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 C2.
- 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 6: Pollution Hazard Indices

Land Use	Pollution Hazard Level	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Other Roofs (typically commercial/industrial roofs)	Low	0.5	0.2**	0.4
Commercial Yard and Delivery Areas, Non-residential Car Parking and all roads except Low Traffic Roads	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 7 below demonstrates the mitigation indices for typical SuDS components that may be used within the final drainage design.

Table 7: SuDS Mitigation Indices

Type of SuDS	Mitigation Indices		
	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Permeable Surfacing	0.7	0.6	0.7
Swale	0.5	0.6	0.6
Detention basin	0.5	0.5	0.6
Pond	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 Maintenance

3.11.1 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.

3.11.2 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]**.

3.11.3 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 Conclusions

- 4.1.1 Lime Down C2 would comprise ground mounted Solar PV Panels and associated Scheme and access roads.

Flood Risk

- 4.1.2 Lime Down C2 is situated wholly in Flood Zone 1, meaning it is an area considered to have <0.1% annual probability of flooding from rivers or the sea.
- 4.1.3 The majority of Lime Down C2 is at Very Low risk of surface water flooding. However, several localised areas of **Low to High risk** are present, particularly within Fields C9 to C11 and Fields C13, C14, and C18. These areas of predicted flooding largely coincide with the courses of existing unnamed land drainage ditches that flow within and around the Site
- 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 The Solar PV Panels and other electrical infrastructure, including inverters, transformers, cabling and substations, which is to be sat on a concrete foundation/pad that will be mounted on frames and raised above ground level allowing flood water to flow freely underneath.

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 proposed SuDS features will attenuate surface water runoff from the positively drained hardstanding surfaces areas 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 preferred SuDS features by providing the required additional storage depth.
- 4.1.8 It is concluded that a suitable combination of SuDS components, such as detention basins, ponds, swales and/or permeable surfacing, can provide sufficient treatment for the assessed pollution hazard indices

4.2 Recommendations

- 4.2.1 Embedded Mitigation is detailed in Appendix 11-1: Flood Risk Assessment and Outline Drainage Strategy – Covering Report [EN010168/APP/6.3], in which this FRA has informed.

Annexes

Annex A- Water Body Catchment Classifications Summaries

Gauze Brook – Source to Conf River Avon 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	High	High	Good	Good	2015	
Invertebrates	High	High	High	Good	2015	
Macrophytes and Phytobenthos Combined	High	High	Good	Good	2015	
Macrophytes sub element	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	
Cadmium 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

Tributary (source to conf River Sherston Avon) Catchment Classification Summary

Classification Item	2019 Classification		2022 Classification	Cycle 3 Objectives		
	Cycle 2	Cycle 3	Cycle 3	Status	Year	Reasons
Ecological	Good	Good	Good	Good	2015	
Biological Quality Elements	Good	Good	Good	Good	2015	
Invertebrates	Good	Good	Good	Good	2015	
Macrophytes and Phytobenthos Combined	Good	Good	Good	Good	2015	
Physio-Chemical Quality Elements	Good	Good	Good	Good	2015	
Acid Neutralising Capacity	N/A	N/A	N/A	Good	2015	
Ammonia (Phys-Chem)	Good	Good	Good	Good	2015	
Dissolved Oxygen	High	High	High	Good	2015	
Phosphate	Good	Good	Good	Good	2015	
Temperature	High	High	High	Good	2015	
pH	High	High	High	Good	2015	
Hydromorphological Supporting Elements	Supports Good	Supports Good	Supports Good	Supports Good	2015	
Supporting Elements (surface Water)	N/A	N/A	N/A	N/A	N/A	
Mitigation Measures Assessment	N/A	N/A	N/A	N/A	N/A	
Specific Pollutants	N/A	N/A	N/A	N/A	N/A	
Iron	N/A	N/A	N/A	N/A	N/A	
Manganese	N/A	N/A	N/A	N/A	N/A	
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	N/A	Good	2015	
Dioxins and dioxin-like compounds	N/A	Good	N/A	Good	2015	
Heptachlor and cis-Heptachlor Epoxide	Good	Good	N/A	Good	2015	
Hexabromocyclododecane	Good	Good	N/A	Good	2015	
Hexachlorobenzene	Good	Good	N/A	Good	2015	
Hexachlorobutadiene	Good	Good	N/A	Good	2015	
Mercury and Its Compounds	Fail	Fail	N/A	Good	2040	Natural conditions: Chemical status recovery time
Perfluorooctane sulphonate (PFOS)	Good	Good	N/A	Good	2015	
Polybrominated diphenyl ethers (PBDE)	Fail	Fail	N/A	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	
Other Pollutants	N/A	N/A	N/A	N/A	2015	Did not require assessment

Annex B – Manning’s Open Channel Flow Mapping

317212 Lime Down Solar C2

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^{1/3} for the channel and 0.04s/m^{1/3} 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.

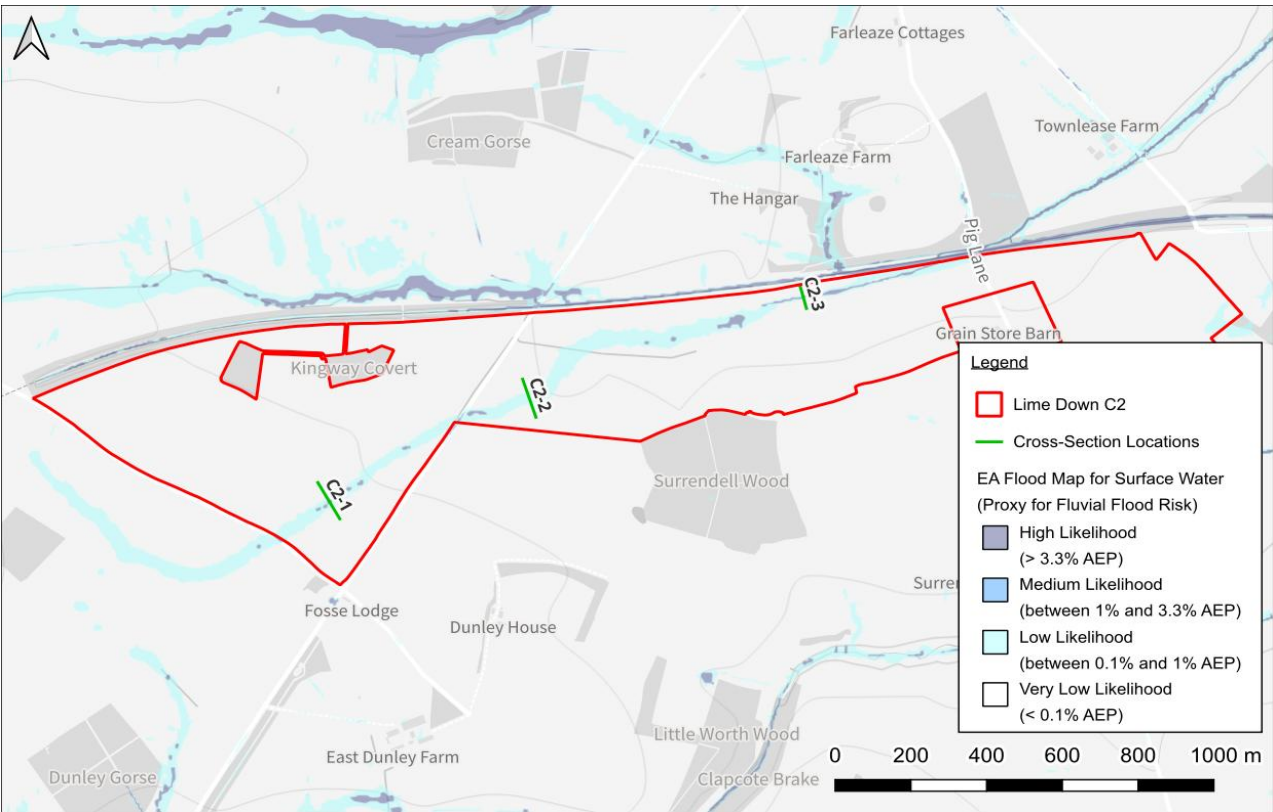
In the absence of detailed flood extent data covering the site, the extents of the EA surface water flood map (0.1% AEP event, present day) have been compared to underlying LiDAR data to provide an estimate of water levels. The surface water flood map has been used as a proxy for fluvial flooding given 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 (m AOD)	Estimated Equivalent Flow (m³/s)	Flow +71% CC Uplift (m³/s)	Equivalent Flood Level (m AOD)
C2-1	0.1% AEP EA FMfSW water level	104.16	1.4	2.4	104.22 (+60mm)
C2-2	0.1% AEP EA FMfSW water level	110.51	9.5	16.3	110.60 (+91mm)
C2-3	0.1% AEP EA FMfSW water level	120.91	7.1	12.1	121.02 (+107mm)

Tabulated Cross-Section Properties // C2-1

(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
C2-1	0.000	103.918	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0067
C2-1	0.000	103.918	0.000	0.000	0.000	0.000	0.000	1.041	1.041	0.0067
C2-1	0.000	103.919	0.001	0.022	0.262	0.002	0.000	2.094	2.094	0.0067
C2-1	0.012	103.943	0.025	0.206	0.456	0.060	0.151	2.875	2.877	0.0067
C2-1	0.042	103.966	0.048	0.304	0.502	0.137	0.509	3.656	3.659	0.0067
C2-1	0.081	103.987	0.069	0.368	0.527	0.219	0.989	4.404	4.409	0.0067
C2-1	0.135	104.007	0.089	0.424	0.546	0.317	1.648	5.153	5.158	0.0067
C2-1	0.152	104.012	0.094	0.442	0.570	0.344	1.865	5.608	5.615	0.0067
C2-1	0.185	104.020	0.102	0.471	0.613	0.393	2.264	6.546	6.553	0.0067
C2-1	0.282	104.040	0.122	0.525	0.638	0.536	3.448	7.764	7.771	0.0067
C2-1	0.427	104.064	0.146	0.578	0.651	0.739	5.234	9.194	9.202	0.0067
C2-1	0.462	104.069	0.151	0.587	0.654	0.786	5.654	9.567	9.575	0.0067
C2-1	0.528	104.078	0.160	0.604	0.654	0.875	6.466	10.075	10.084	0.0067
C2-1	0.633	104.091	0.173	0.622	0.684	1.019	7.758	12.103	12.112	0.0067
C2-1	0.801	104.109	0.191	0.644	0.659	1.243	9.806	12.773	12.783	0.0067
C2-1	0.997	104.127	0.209	0.674	0.649	1.479	12.208	13.443	13.454	0.0067
C2-1	1.055	104.132	0.214	0.682	0.647	1.546	12.923	13.648	13.659	0.0067
C2-1	1.166	104.142	0.224	0.690	0.655	1.689	14.280	14.907	14.918	0.0067
C2-1	1.401	104.160	0.242	0.711	0.654	1.970	17.154	16.338	16.351	0.0067
C2-1	1.625	104.175	0.257	0.732	0.648	2.221	19.905	17.055	17.068	0.0067
C2-1	1.751	104.184	0.266	0.736	0.652	2.380	21.446	18.330	18.343	0.0067
C2-1	2.031	104.200	0.282	0.758	0.645	2.679	24.875	19.039	19.053	0.0067
C2-1	2.418	104.220	0.302	0.788	0.639	3.067	29.608	19.777	19.792	0.0067
C2-1	2.839	104.240	0.322	0.818	0.635	3.470	34.774	20.514	20.530	0.0067
C2-1	2.861	104.241	0.323	0.820	0.651	3.491	35.043	21.615	21.631	0.0067
C2-1	3.171	104.256	0.338	0.830	0.639	3.820	38.830	22.241	22.258	0.0067
C2-1	3.669	104.277	0.359	0.853	0.638	4.301	44.932	23.569	23.587	0.0067
C2-1	3.794	104.282	0.364	0.858	0.647	4.422	46.467	24.640	24.657	0.0067
C2-1	3.873	104.285	0.367	0.861	0.652	4.497	47.427	25.255	25.273	0.0067
C2-1	4.255	104.301	0.383	0.869	0.640	4.894	52.114	26.052	26.071	0.0067
C2-1	4.710	104.316	0.398	0.888	0.638	5.304	57.686	26.850	26.869	0.0067
C2-1	5.059	104.327	0.409	0.903	0.636	5.602	61.956	27.280	27.300	0.0067
C2-1	5.039	104.328	0.410	0.895	0.641	5.630	61.715	28.339	28.359	0.0067
C2-1	5.266	104.336	0.418	0.899	0.644	5.861	64.498	29.528	29.548	0.0067
C2-1	5.872	104.354	0.436	0.917	0.643	6.405	71.909	30.898	30.918	0.0067
C2-1	6.123	104.361	0.443	0.925	0.642	6.623	74.990	31.330	31.351	0.0067
C2-1	6.569	104.373	0.455	0.937	0.647	7.007	80.447	32.774	32.796	0.0067
C2-1	6.757	104.378	0.460	0.942	0.649	7.173	82.751	33.405	33.428	0.0067
C2-1	7.462	104.396	0.478	0.957	0.654	7.795	91.389	35.713	35.736	0.0067
C2-1	7.502	104.397	0.479	0.958	0.655	7.831	91.884	35.906	35.929	0.0067

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
C2-1	7.666	104.401	0.483	0.961	0.659	7.976	93.883	36.781	36.805	0.0067
C2-1	7.919	104.407	0.489	0.966	0.664	8.200	96.987	38.039	38.063	0.0067
C2-1	8.312	104.416	0.498	0.972	0.665	8.548	101.797	39.223	39.248	0.0067
C2-1	8.551	104.421	0.503	0.978	0.663	8.745	104.730	39.485	39.510	0.0067
C2-1	8.993	104.430	0.512	0.987	0.671	9.108	110.143	41.274	41.300	0.0067
C2-1	10.228	104.455	0.537	1.007	0.658	10.155	125.266	42.454	42.481	0.0067
C2-1	11.091	104.470	0.552	1.027	0.654	10.795	135.831	42.950	42.977	0.0067
C2-1	12.538	104.494	0.576	1.059	0.654	11.844	153.556	44.387	44.416	0.0067
C2-1	14.093	104.518	0.600	1.091	0.651	12.918	172.594	45.194	45.224	0.0067
C2-1	15.344	104.536	0.618	1.115	0.650	13.761	187.920	45.903	45.934	0.0067
C2-1	16.650	104.555	0.637	1.139	0.649	14.617	203.920	46.613	46.645	0.0067
C2-1	17.524	104.567	0.649	1.154	0.650	15.180	214.615	47.159	47.191	0.0067
C2-1	18.678	104.583	0.665	1.173	0.650	15.917	228.748	47.918	47.951	0.0067
C2-1	19.870	104.598	0.680	1.192	0.651	16.665	243.352	48.677	48.711	0.0067
C2-1	20.742	104.609	0.691	1.206	0.651	17.203	254.032	49.189	49.223	0.0067
C2-1	22.279	104.628	0.710	1.230	0.651	18.120	272.856	49.906	49.942	0.0067
C2-1	23.872	104.646	0.728	1.253	0.652	19.050	292.362	50.624	50.660	0.0067
C2-1	26.014	104.670	0.752	1.283	0.654	20.277	318.599	51.643	51.681	0.0067
C2-1	27.587	104.687	0.769	1.304	0.655	21.161	337.861	52.375	52.413	0.0067
C2-1	29.599	104.708	0.790	1.329	0.656	22.270	362.501	53.243	53.282	0.0067
C2-1	31.684	104.729	0.811	1.354	0.658	23.397	388.044	54.110	54.151	0.0067
C2-1	31.889	104.731	0.813	1.357	0.658	23.506	390.551	54.187	54.228	0.0067
C2-1	33.477	104.747	0.829	1.373	0.661	24.383	409.998	55.463	55.504	0.0067
C2-1	36.342	104.773	0.855	1.405	0.662	25.864	445.081	56.363	56.406	0.0067
C2-1	39.325	104.800	0.882	1.437	0.664	27.370	481.620	57.264	57.308	0.0067
C2-1	39.445	104.801	0.883	1.438	0.664	27.428	483.089	57.283	57.327	0.0067
C2-1	41.990	104.822	0.904	1.466	0.665	28.636	514.260	57.804	57.848	0.0067
C2-1	44.611	104.843	0.925	1.494	0.667	29.855	546.359	58.324	58.369	0.0067
C2-1	47.712	104.867	0.949	1.526	0.669	31.261	584.342	58.845	58.891	0.0067
C2-1	50.912	104.891	0.973	1.558	0.670	32.680	623.524	59.366	59.412	0.0067
C2-1	54.147	104.914	0.996	1.589	0.672	34.069	663.141	59.713	59.760	0.0067
C2-1	57.474	104.938	1.020	1.621	0.673	35.466	703.893	60.060	60.108	0.0067
C2-1	60.892	104.961	1.043	1.651	0.675	36.872	745.748	60.407	60.455	0.0067
C2-1	63.453	104.979	1.061	1.673	0.677	37.933	777.121	60.928	60.977	0.0067
C2-1	66.068	104.996	1.078	1.694	0.679	39.004	809.147	61.449	61.498	0.0067
C2-1	69.356	105.017	1.099	1.721	0.680	40.298	849.415	61.753	61.802	0.0067
C2-1	72.718	105.038	1.120	1.748	0.682	41.598	890.593	62.056	62.107	0.0067
C2-1	75.083	105.053	1.135	1.766	0.688	42.507	919.555	63.290	63.342	0.0067
C2-1	77.484	105.067	1.149	1.784	0.694	43.433	948.956	64.524	64.576	0.0067
C2-1	77.651	105.068	1.150	1.785	0.694	43.498	951.001	64.577	64.629	0.0067
C2-1	77.651	105.068	1.150	1.785	0.694	43.498	951.001	64.577	64.629	0.0067
C2-1	77.850	105.071	1.153	1.782	0.703	43.695	953.442	66.670	66.723	0.0067
C2-1	81.741	105.097	1.179	1.798	0.696	45.454	1001.095	66.764	66.820	0.0067
C2-1	86.505	105.124	1.206	1.832	0.696	47.215	1059.442	66.857	66.917	0.0067
C2-1	91.394	105.150	1.232	1.866	0.697	48.979	1119.315	66.950	67.014	0.0067
C2-1	96.403	105.176	1.258	1.900	0.697	50.745	1180.660	67.044	67.111	0.0067
C2-1	101.533	105.203	1.285	1.933	0.698	52.514	1243.494	67.137	67.209	0.0067
C2-1	106.781	105.229	1.311	1.967	0.699	54.285	1307.764	67.231	67.306	0.0067
C2-1	112.148	105.256	1.338	2.001	0.700	56.059	1373.490	67.324	67.403	0.0067
C2-1	117.629	105.282	1.364	2.034	0.701	57.835	1440.618	67.418	67.500	0.0067
C2-1	123.227	105.308	1.390	2.067	0.702	59.613	1509.174	67.511	67.597	0.0067
C2-1	128.936	105.335	1.417	2.100	0.704	61.394	1579.103	67.605	67.694	0.0067
C2-1	134.761	105.361	1.443	2.133	0.705	63.178	1650.433	67.698	67.791	0.0067

Tabulated Cross-Section Properties // C2-2

(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
C2-2	0.000	110.167	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0130
C2-2	0.001	110.181	0.014	0.139	0.531	0.009	0.010	1.218	1.219	0.0130
C2-2	0.002	110.184	0.017	0.150	0.595	0.013	0.018	2.077	2.078	0.0130
C2-2	0.003	110.187	0.020	0.157	0.654	0.022	0.031	3.809	3.810	0.0130
C2-2	0.004	110.188	0.021	0.157	0.641	0.026	0.036	4.302	4.302	0.0130
C2-2	0.006	110.190	0.023	0.154	0.631	0.037	0.050	6.036	6.037	0.0130
C2-2	0.007	110.191	0.024	0.151	0.630	0.043	0.057	7.435	7.435	0.0130
C2-2	0.030	110.203	0.036	0.216	0.534	0.138	0.261	8.309	8.310	0.0130
C2-2	0.031	110.204	0.037	0.210	0.538	0.147	0.271	9.393	9.394	0.0130
C2-2	0.031	110.204	0.037	0.210	0.567	0.147	0.271	10.453	10.454	0.0130
C2-2	0.050	110.210	0.043	0.231	0.562	0.216	0.437	12.485	12.486	0.0130
C2-2	0.082	110.217	0.050	0.268	0.567	0.306	0.720	13.446	13.448	0.0130
C2-2	0.116	110.223	0.056	0.299	0.571	0.388	1.018	13.913	13.915	0.0130
C2-2	0.198	110.235	0.068	0.351	0.584	0.563	1.736	15.238	15.240	0.0130
C2-2	0.282	110.244	0.077	0.397	0.596	0.710	2.471	15.744	15.747	0.0130
C2-2	0.378	110.254	0.087	0.439	0.608	0.862	3.318	16.250	16.253	0.0130
C2-2	0.506	110.265	0.098	0.481	0.640	1.052	4.439	18.239	18.243	0.0130
C2-2	0.550	110.269	0.102	0.488	0.632	1.126	4.821	18.489	18.492	0.0130
C2-2	0.770	110.285	0.118	0.537	0.641	1.434	6.751	20.048	20.051	0.0130
C2-2	0.816	110.288	0.121	0.546	0.643	1.494	7.161	20.292	20.296	0.0130
C2-2	1.125	110.306	0.139	0.600	0.655	1.874	9.865	21.859	21.863	0.0130
C2-2	1.331	110.317	0.150	0.627	0.660	2.121	11.669	23.039	23.044	0.0130
C2-2	1.347	110.318	0.151	0.628	0.661	2.144	11.816	23.287	23.291	0.0130
C2-2	1.399	110.321	0.154	0.631	0.684	2.217	12.270	25.544	25.548	0.0130
C2-2	1.378	110.323	0.156	0.607	0.659	2.269	12.086	26.200	26.205	0.0130
C2-2	1.416	110.325	0.158	0.610	0.659	2.322	12.417	26.635	26.640	0.0130
C2-2	1.712	110.338	0.171	0.639	0.666	2.680	15.019	28.557	28.562	0.0130
C2-2	1.738	110.339	0.172	0.642	0.666	2.709	15.242	28.673	28.678	0.0130
C2-2	2.012	110.349	0.182	0.671	0.671	3.000	17.643	29.473	29.478	0.0130
C2-2	2.305	110.359	0.192	0.699	0.676	3.299	20.214	30.272	30.277	0.0130
C2-2	2.625	110.370	0.203	0.721	0.679	3.639	23.027	31.656	31.662	0.0130
C2-2	2.770	110.375	0.208	0.729	0.680	3.799	24.296	32.466	32.471	0.0130
C2-2	2.846	110.378	0.211	0.730	0.682	3.898	24.962	33.317	33.323	0.0130
C2-2	2.962	110.382	0.215	0.734	0.683	4.033	25.976	34.277	34.283	0.0130
C2-2	3.224	110.390	0.223	0.748	0.687	4.313	28.277	35.690	35.696	0.0130
C2-2	3.370	110.394	0.227	0.756	0.688	4.457	29.558	36.245	36.251	0.0130
C2-2	4.075	110.411	0.244	0.802	0.695	5.084	35.744	37.486	37.493	0.0130
C2-2	4.191	110.415	0.248	0.800	0.694	5.236	36.759	38.637	38.643	0.0130
C2-2	4.649	110.425	0.258	0.826	0.698	5.626	40.778	39.393	39.400	0.0130
C2-2	5.130	110.435	0.268	0.852	0.702	6.024	44.996	40.149	40.156	0.0130
C2-2	5.405	110.441	0.274	0.862	0.704	6.267	47.402	40.920	40.928	0.0130
C2-2	5.483	110.444	0.277	0.858	0.705	6.392	48.089	42.298	42.306	0.0130

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
C2-2	5.530	110.445	0.278	0.859	0.705	6.434	48.500	42.443	42.451	0.0130
C2-2	6.072	110.456	0.289	0.879	0.708	6.909	53.259	43.935	43.943	0.0130
C2-2	6.631	110.466	0.299	0.902	0.711	7.353	58.162	44.858	44.866	0.0130
C2-2	6.920	110.471	0.304	0.913	0.723	7.582	60.695	46.691	46.699	0.0130
C2-2	7.122	110.476	0.309	0.911	0.715	7.817	62.462	47.267	47.275	0.0130
C2-2	7.556	110.483	0.316	0.927	0.718	8.150	66.271	47.951	47.960	0.0130
C2-2	8.275	110.494	0.327	0.953	0.722	8.683	72.580	48.871	48.879	0.0130
C2-2	9.026	110.505	0.338	0.978	0.726	9.225	79.167	49.790	49.799	0.0130
C2-2	9.090	110.506	0.339	0.980	0.726	9.275	79.721	49.957	49.966	0.0130
C2-2	9.545	110.513	0.346	0.991	0.729	9.629	83.715	51.103	51.112	0.0130
C2-2	10.165	110.522	0.355	1.007	0.733	10.095	89.152	52.444	52.453	0.0130
C2-2	11.309	110.537	0.370	1.038	0.738	10.893	99.190	53.972	53.981	0.0130
C2-2	11.519	110.540	0.373	1.042	0.739	11.056	101.025	54.595	54.605	0.0130
C2-2	11.684	110.543	0.376	1.041	0.740	11.221	102.478	55.522	55.532	0.0130
C2-2	12.024	110.548	0.381	1.046	0.739	11.501	105.460	56.426	56.435	0.0130
C2-2	13.476	110.565	0.398	1.080	0.744	12.474	118.189	57.996	58.006	0.0130
C2-2	13.647	110.567	0.400	1.084	0.744	12.590	119.695	58.226	58.236	0.0130
C2-2	14.082	110.572	0.405	1.093	0.749	12.884	123.507	59.428	59.438	0.0130
C2-2	14.806	110.580	0.413	1.108	0.757	13.367	129.854	61.292	61.302	0.0130
C2-2	15.726	110.591	0.424	1.120	0.752	14.046	137.924	62.180	62.191	0.0130
C2-2	16.679	110.601	0.434	1.137	0.755	14.674	146.280	63.509	63.520	0.0130
C2-2	16.770	110.602	0.435	1.138	0.755	14.738	147.086	63.667	63.678	0.0130
C2-2	18.397	110.618	0.451	1.167	0.757	15.768	161.352	65.179	65.190	0.0130
C2-2	20.315	110.635	0.468	1.203	0.761	16.887	178.172	66.326	66.338	0.0130
C2-2	21.020	110.642	0.475	1.211	0.763	17.355	184.355	67.634	67.646	0.0130
C2-2	21.739	110.648	0.481	1.224	0.765	17.762	190.665	68.018	68.030	0.0130
C2-2	23.653	110.663	0.496	1.257	0.768	18.824	207.455	68.992	69.005	0.0130
C2-2	25.646	110.679	0.512	1.289	0.771	19.901	224.932	69.967	69.980	0.0130
C2-2	25.646	110.679	0.512	1.289	0.771	19.901	224.932	69.967	69.980	0.0130
C2-2	26.170	110.684	0.517	1.292	0.777	20.255	229.526	71.784	71.797	0.0130
C2-2	26.383	110.686	0.519	1.293	0.777	20.399	231.396	72.188	72.201	0.0130

Annex C – EA Product Data



- Lime Down C2: SPZ2c and SPZ3
- Lime Down D: SPZ1c and SPZ2c and SPZ3
- Lime Down E1: SPZ1c and SPZ2c
- Lime Down E2: SPZ1c and SPZ2c

The aquifer designations in the areas given are,

- Alluvium – Secondary A Aquifer with Medium to High Vulnerability
- Forest Marble limestone member - Principal Aquifer with High Vulnerability
- Forest Marble mudstone member - Secondary A Aquifer with High Vulnerability
- Cornbrash - Secondary A Aquifer with High Vulnerability
- Kellaways Clay – Unproductive Strata

Provision of FRA Product 4

Thank you for your recent request to use Environment Agency flood data. The information is attached.

If you have requested this information to help inform a development proposal, then you should note the information on [GOV.UK](https://www.gov.uk/government/publications/pre-planning-application-enquiry-form-preliminary-opinion) on the use of Environment Agency Information for Flood Risk Assessments and our attached advisory text.

<https://www.gov.uk/planning-applications-assessing-flood-risk>

<https://www.gov.uk/government/publications/pre-planning-application-enquiry-form-preliminary-opinion>

Further details about the Environment Agency information supplied and the permitted use of this information can be found on the [GOV.UK](https://www.gov.uk/browse/environment-countryside/flooding-extreme-weather) website:

<https://www.gov.uk/browse/environment-countryside/flooding-extreme-weather>

<http://www.nationalarchives.gov.uk/doc/open-government-licence/version/3>

We respond to requests under the Freedom of Information Act 2000 (FOIA) and Environmental Information Regulations 2004 (EIR).

If you are not satisfied with our response to your request for information you can contact us within 2 calendar months to ask for our decision to be reviewed.

We really value your thoughts on how we are doing and will always make changes where we can to improve our service. Please click on the link below and fill in our survey.

<http://www.smartsurvey.co.uk/s/EnvironmentAgencyCustomerSurvey/?a=DC> Thank you.

Kind regards

[REDACTED]
Environment Agency, Wessex Enquiries, Customer & Engagement Team

[REDACTED] Wessex Enquiries

[REDACTED] mabbett.eu>

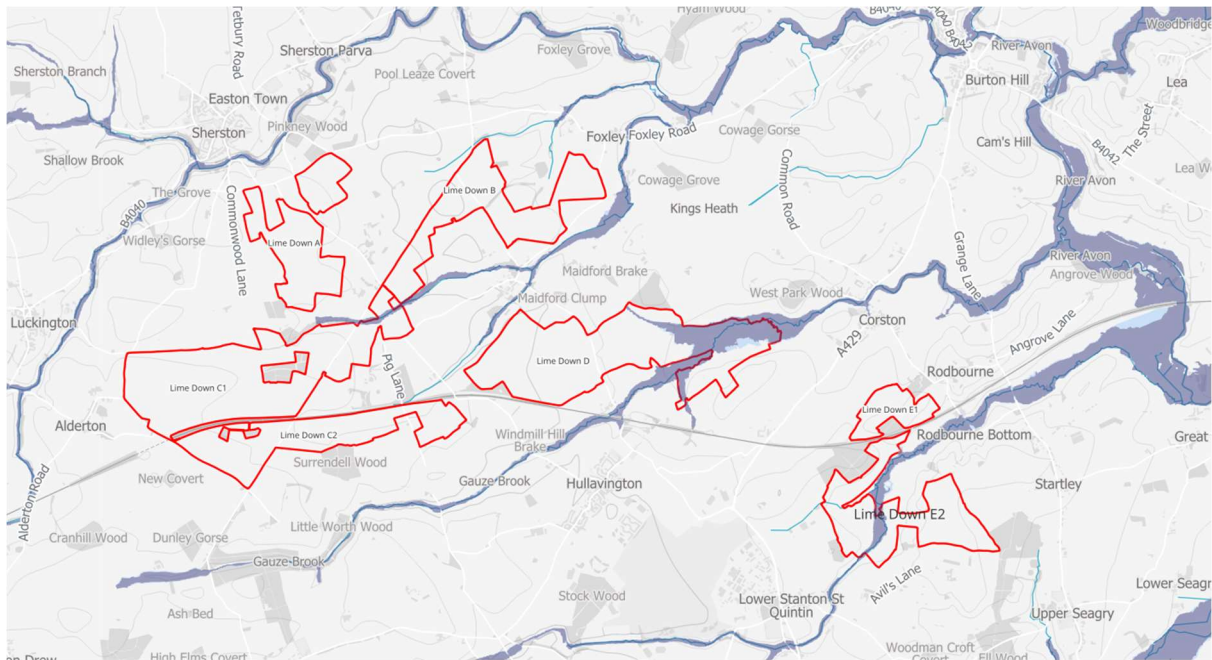
Sent: 15 October 2024 14:01

To: Enquiries, Unit <enquiries@environment-agency.gov.uk>

Subject: 317212 Lime Down Data Request

To whom it may concern,

Mabbett & Associates Ltd have been instructed to undertake a Flood Risk Assessment and Drainage Strategy in support of a proposed solar site in Wiltshire, known as the site hereon. I attach a site location plan and the site details below. The site has been split into parcels which can be seen below (Lime Down A, B, C1, C2, D, E1 and E2).



According to the EA online Flood M Planning, the Site is shown to be located within Flood Zones 1, 2 and 3, however we would be grateful if you could provide **any nearby modelled flood level data** in order to inform our assessment of the Site.

It would therefore be useful if you are able to confirm/provide the following information where available:

Site Details

Site Name Lime Down SOLar

Address

Lime Down A: SN16 0PU (NGR: 385982, 184814)

Lime Down B: SN16 0JS (NGR: 388179, 185419)

Lime Down C1: SN14 6NL (NGR: 385300, 183486)

Lime Down C2: SN16 0JZ (NGR: 386684, 182717)

Lime Down D: SN14 6EU (NGR: 389526, 183654)

Lime Down E1: SN16 0EX (NGR: 392655, 183066)

Lime Down E2: SN14 6DA (NGR: 393123, 181766)

Data Request

Please provide any of the following information to enable us to complete our assessment:

Historical Flooding Information

- Any records, photographs, flood extents from known historic events in the area

Technical Data

- Any hydraulic models covering the site
- Raw and processed results for the model(s) above
 - Hydraulic modelling report for the model(s) above
 - Modelled floodplain levels and flows for node points within and in the immediate vicinity of the Site taking into account the most recent climate change allowances (where these have been modelled);
- Hydrology report and/or flood estimation calculation records for the model(s) above
- Survey data used to build the model or inform nearby studies

Supporting Data

- Flood/coastal defence survey data
- Operational procedures for hydraulic structures
- Section 19 flood investigation reports
- The date and type of modelling that flood levels have been derived from;
- The technical report summarising the modelling methodology;
- Confirmation that the data is appropriate/relevant to inform flood risk within the Site;
- Details of any flood defences within the vicinity of the Site (i.e type, crest levels, Standard of Protection, condition, etc) and any associated breach and/or overtopping flood extents and depths;
- Hazard mapping detailing the depth, velocity and associated hazard rating for the Site;
- Any information in relation to surface water flooding including confirmation is located within or outside of a Critical Drainage Area;
- Any information in relation to on-Site drainage;
- Any information in relation to groundwater flooding in the area. Where possible, please provide borehole locations and ground water levels;
- Details of sensitive aquifers and known contamination issues;
- Any information/mapping of historical flooding events on Site from all sources of flooding (i.e fluvial, tidal, surface water, groundwater, sewer, reservoir, canal, etc).

Where available please can you provide flood levels, estimated return periods, photographs and other such data that may be relevant to our assessment;

We trust this request is acceptable but please do not hesitate to contact us if you require any further information to assist with your response or wish to discuss the Site in further detail.

We look forward to hearing from you.

Thanks,



Consultant | Water Environment Team



IOSH & IEMA Training Course Provider

**Anglesey | Belfast | Cardiff | Carlisle | Dublin | Dundee | Edinburgh | Forres | Glasgow |
Inverness | Leicester | Manchester | Winchester**

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Please consider the environment before printing this e-mail

Our ref: 381197-WX
Date: 4th November 2024

Thank you for your enquiry which was received on 15th October 2024. We respond to requests under the Freedom of Information Act 2000 and Environmental Information Regulations 2004.

Abstract

Name	Product 4
Description	Flood Risk Information for land at Lime Down NGR: ST9009082825
Licence	Open Government Licence
Information Warnings	<i>The mapping of features provided as a background in this product is © Ordnance Survey. It is provided to give context to this product. The Open Government Licence does not apply.</i>
Attribution	Contains Environment Agency information © Environment Agency and/or database rights. Contains Ordnance Survey data © Crown copyright 2023 Ordnance Survey AC0000807064.

Open Data

The following Environment Agency published datasets are now available on the weblink below as part of the Government's 'Open Data' project and are available for you to download free of charge.

Environment Agency published datasets: <https://data.gov.uk/data/search?publisher=environment-agency&unpublished=false>

You will need to search and select the name of the following datasets to take you directly to the weblink to enable you to download the data:

- Flood Map for Planning (Rivers and the Sea) – Flood Zones 2 and 3
- Flood Map for Planning (Rivers and Sea) – Areas Benefiting from Defences
- Flood Map for Planning (Rivers and Sea) Spatial Flood Defences
- Flood Map for Planning (Rivers and Sea) Flood Storage Areas
- Recorded Flood Outlines
- Historic Flood Map
- Risk of Flooding from Surface Water Extent for:
 - 3 percent annual chance
 - 1 percent annual chance
 - 0.5 percent annual chance

You can also access the Flood Map for Planning here: <https://flood-map-for-planning.service.gov.uk/>

You can also access the Risk of Flooding from Surface Water maps and Risk of Flooding from Reservoirs information here: <https://flood-warning-information.service.gov.uk/long-term-flood-risk/map>

Recorded Historic Flood Events

We no longer produce pdf copies of the Historic Flood Map. This information is available to search, select, and download free of charge as part of the Government's 'open data' as

- Recorded Flood Outlines
- the Historic Flood Map

Our historic records indicate that there was flooding in the area in **1925** (fluvial), **1932** (fluvial), **1954** (fluvial), **1979** (fluvial), **1999** (fluvial/unconfirmed source), **2007** (fluvial), **2009** (fluvial), **2012** (fluvial/unconfirmed source) and **2013** (fluvial).

Additionally, our historic records show a record of possible flooding pre 2012 for the area, however we are currently unable to confirm the date and source of this.

Please note - we cannot guarantee that this is an exhaustive list of all past flood events in this location. All reasonable care has been taken to ensure that the historical flood event data is as accurate as possible. The Environment Agency will update its records if new evidence emerges.

Modelled Fluvial Water Levels

We have not carried out any detailed fluvial flood risk modelling in this location.

The fluvial Flood Map in this area has been produced using our National Generalised Model (JFLOW). This modelling is fit for the purpose of the Flood Zones. However, it is not based on a specific channel survey. Neither water depths nor water levels were outputs specified when we commissioned this generalised modelling for the Flood Zones. Whilst the modelling process does provide some information on depth of water, it would have been possible to produce the flood extents without storing the water depth values, since water depth is only a 'by-product' of the calculation process. As this type of modelling was developed, tested and reviewed for production of the Flood Zone extents only, we have no information on the accuracy of the water depth data. Water depth or level outputs from this model are only suitable to be used for decision making at a broad catchment scale and is not fit for the purpose of a site-specific flood risk assessment.

For your information we have supplied maps showing the water depths derived from JFLOW for the 1% AEP (100yr) and 0.1% AEP (1000yr) fluvial modelled flood scenarios.

Please note - The Environment Agency is currently carrying out a project to update the National Generalised model (JFLOW). The New National Model outputs are expected in Spring 2025. Our published flood risk information for this area will be updated using outputs from the New National Model and this is expected to take place in late 2025 (current programme which may change). This will be carried out as part of the National project to update our National flood risk mapping and modelling information across England and will incorporate outputs from detailed local models together with updated National modelling.

New National Model Details.

The New National Modelling (NNM) is a set of models for rivers, surface water and the sea covering the whole of England. The NNM has been created to fill in gaps where we don't have local

hydraulic models, our local models require updating or we need additional model scenarios such as climate change runs.

Please also note - we are currently carrying out a National project to update our flood risk information for the whole of England. We will be updating our flood risk information in 2025 as part of the new National Flood Risk Assessment (NaFRA2). This will include the data displayed on the Check Your Long-Term Flood Risk service and the data displayed in the Flood Map for Planning (Rivers and Sea).

This should result in improvements to our mapping products, especially where we do not currently have any detailed local modelling. This means there will be some changes to our flood risk information in many areas when the new data is published.

You can find further information on the NaFRA2 project here: <https://www.gov.uk/guidance/updates-to-national-flood-and-coastal-erosion-risk-information>

For more information on climate change allowances please see the guidance on the Gov.UK website here: [Flood risk assessments: climate change allowances - GOV.UK](#). **Please be aware that this information is subject to change, please check the guidance regularly.**

Environmental Permit for Flood Risk Activities

In addition to any other permission(s) that you may have already obtained e.g. planning permission, you may need an environmental permit for flood risk activities (formerly known as Flood Defence Consent prior to 06 April 2016) if you want to do work:

- in, under, over or near a main river (including where the river is in a culvert)
- on or near a flood defence on a main river
- in the flood plain of a main river
- on or near a sea defence

For further information and to check whether a permit is required please visit: <https://www.gov.uk/guidance/flood-risk-activities-environmental-permits>.

For any further advice, please email Blandford.frap@environment-agency.gov.uk.

Ordinary Watercourse

Some of the watercourses adjoining this site are classed as an “Ordinary Watercourse” not a “Main River” under our control. Works to ordinary watercourses may require consent from either the Lead Local Flood Authorities or the Local Drainage Board.

Flood Asset Information

Please find enclosed details of Flood Assets within the area. This information has been taken from our Asset Information Management System database (AIMS).

Please note that flood defences can increase water levels elsewhere eg through channels being restricted by defences, or because defences prevent flood water flowing back into the river channel.

Planning

If you have questions regarding the planning nature of your enquiry, or require advice on floor levels, please contact our Sustainable Places team on wx.sp@environment-agency.gov.uk. Please be aware that we now charge for planning advice when consulted on pre-application enquiries. This new approach provides advice to developers in two ways. Firstly, there is the provision of ‘free’

Customer & Engagement, Wessex
Rivers House, East Quay, Bridgwater, Somerset, TA6 4YS
Email: wessexenquiries@environment-agency.gov.uk
www.environment-agency.gov.uk

advice available to everyone where we give a preliminary opinion on a proposed development. This sets out the environmental constraints together with any issues this raises for us. Should you wish us to review in detail any of these issues then we can do this through a chargeable scheme aimed at recovering our costs.

Strategic Flood Risk Assessment (SFRA)

When preparing a FRA to support a development proposal in this location you should refer to Wiltshire Council's SFRA Reports Level 1 which is available to download via the following link:

https://www.wiltshire.gov.uk/media/5691/Strategic-Flood-Risk-Assessment-Level-1/pdf/Wiltshire_Council_Level_1_SFRA_v5.0.pdf?m=637459765054370000

The Wiltshire Council Local Plan is available via this link: <https://www.wiltshire.gov.uk/planning-policy-local-plan-review-consultation>

Further Information

We advise that you also contact the drainage engineer/ flood risk management team at Wiltshire Council by email: drainage@wiltshire.gov.uk, or by phone: 0300 456 0105, based at: Bythesea Road, Trowbridge, Wiltshire, BA14 8JN, as they may be able to provide further advice with respect to localised flooding and drainage issues.

Further details about the Environment Agency information supplied can be found on our website: <https://www.gov.uk/browse/environment-countryside/flooding-extreme-weather>

We hope you find this information helpful. It is provided subject to the attached notice 'Use of Environment Agency Information for Flood Risk Assessments', which we strongly recommend you read.

Yours sincerely

Customer & Engagement, Wessex
Rivers House, East Quay, Bridgwater, Somerset, TA6 4YS
Email: wessexenquiries@environment-agency.gov.uk

Enc: Use of Environment Agency Information for Flood Risk Assessments (below)
381197-WX 100yr JFLOW Depth Map (1%AEP)
381197-WX 1000yr JFLOW Depth Map (0.1%AEP)
381197-WX Defence Map
381197-WX Defence Data

Use of Environment Agency Information for Flood Risk Assessments (FRAs)

Important

Use of Environment Agency data: you should note that

1. Information supplied by the Environment Agency may be used to assist in producing a Flood Risk Assessment (FRA) where one is required, but the use of Environment Agency information does not constitute such an assessment on its own.
2. As part of your data request, we have provided all of the modelled data we hold for your location. Please note that some of our modelled information may have been produced for purposes other than for flood zone generation. This may mean that some of the modelled data you have been provided with has a lower confidence level, and has not been used in producing our flood map, nor definitively reflects the predicted flood water level at the property/development site scale. To check the suitability of the use of this information in your FRA please contact your local Partnership & Strategic Overview (PSO) team.
3. This information covers flood risk from main rivers and the sea, and you will need to consider other potential sources of flooding, such as groundwater or surface water runoff. The information produced by the Local Planning Authority and the Lead Local Flood Authority (LLFA) may assist in assessing other sources of flood risk.
4. Where a planning application requires a FRA and this is not submitted or deficient, the Environment Agency may well raise an objection.
5. For more significant proposals in higher flood risk areas, we would be pleased to discuss details with you ahead of making any planning application, and you should also discuss the matter with your Local Planning Authority.

Pre-Planning Advice from the Environment Agency

If you have requested this information to help inform a development proposal, then we recommend that you undertake a formal pre-application enquiry using the form available from our website:

Pre-application Preliminary Opinion:

<https://www.gov.uk/government/publications/pre-planning-application-enquiry-form-preliminary-opinion>

Pre-application Charged Service:

<https://www.gov.uk/government/publications/planning-advice-environment-agency-standard-terms-and-conditions>

Depending on the enquiry we may also provide advice on other issues related to our responsibilities, including flooding, waste, land contamination, water quality, biodiversity, navigation, pollution, water resources, foul drainage or Environmental Impact Assessment.

Flood Risk Assessment (FRA) Guidance

You should refer to the Planning Practice Guidance of the National Planning Policy Framework (NPPF) and the Environment Agency's Flood Risk Standing Advice for information about Flood Risk Assessment (FRA) for new development in the different Flood Zones. These documents can be accessed via:

National Planning Policy Framework Planning Practice Guidance:

<http://planningguidance.planningportal.gov.uk/>

Environment Agency advice on FRAs:

<https://www.gov.uk/flood-risk-assessment-for-planning-applications#when-to-follow-standing-advice>

<https://www.gov.uk/government/publications/planning-applications-assessing-flood-risk>

381197-WX - JFLOW Fluvial Water depths (m) Without Flood Defences. 100 year (1% AEP) centred on land at Lime Down [390090,182825].
Created 01.11.2024



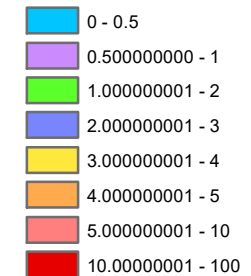
Scale 1:50,000



Legend

100yr JFLOW Depth

Metres



Information Warning

We do not recommend the use of water depths/levels derived from JFLOW for site specific investigations such as Flood Risk Assessments.

381197-WX - JFLOW Fluvial Water depths (m) Without Flood Defences. 1000 year (0.1% AEP) centred on land at Lime Down [390090,182825].
Created 01.11.2024



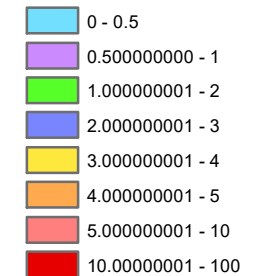
Scale 1:50,000



Legend

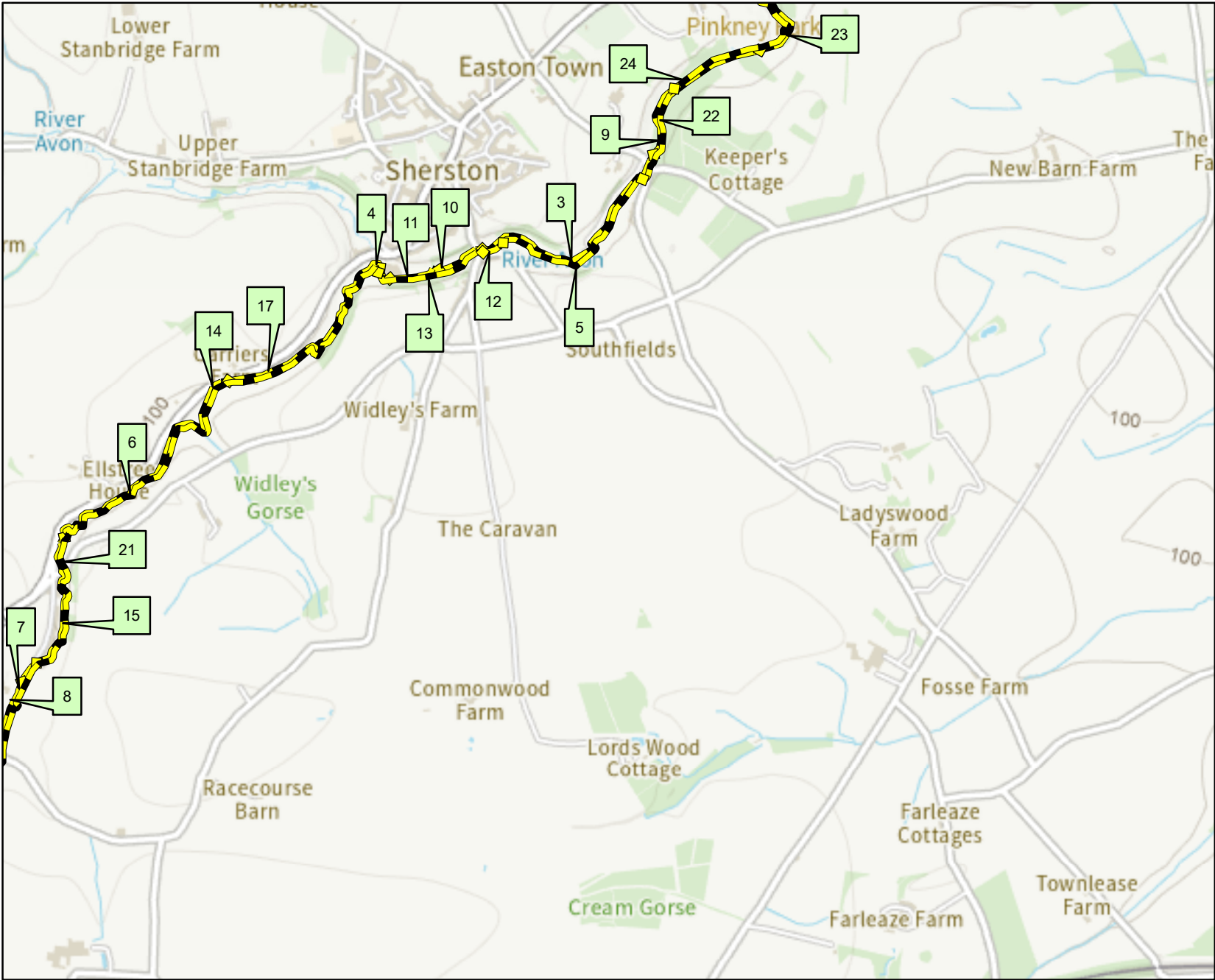
1000yr JFLOW Depth

Metres



Information Warning

We do not recommend the use of water depths/levels derived from JFLOW for site specific investigations such as Flood Risk Assessments.



Scale: 1:20,000



Legend

Defences

- Barrier Beach
- Beach
- Bridge Abutment
- Cliff
- Demountable Defence
- Dunes
- Embankment
- Engineered High Ground
- Flood Gate
- Natural High Ground
- Promenade
- Quay
- Spillway
- Wall

This data has been extracted from the Asset Information Management System (AIMS OM) which was created to draw various data sources into one database and has been populated with information of varying quality.

Product 4 - AIMS Information381197-WXDate:22/10/2024

Map Ref	Asset ID	Asset Type	Right or left bank	Asset Description	Approx length (m)	Actual fluvial downstream crest level (mAOD)	Actual fluvial downstream crest level accuracy	Actual fluvial upstream crest level (mAOD)	Actual fluvial upstream crest level accuracy	Actual fluvial coastal crest level (mAOD)	Actual fluvial coastal crest level accuracy	NGR	Most recent inspection	Overall condition
3	40115	Natural High Ground	Left	Natural Bank	878.51	DNR	DNR	DNR	DNR	DNR	DNR	ST8592785717	07/04/2009	2 - Good
4	40116	Natural High Ground	Left	Stone wall	63.60	DNR	DNR	DNR	DNR	DNR	DNR	ST85158562	07/04/2009	2 - Good
5	40419	Natural High Ground	Right	Natural Bank	714.43	DNR	DNR	DNR	DNR	DNR	DNR	ST85898565	07/04/2009	2 - Good
6	40420	Natural High Ground	Left	Natural Bank	959.72	DNR	DNR	DNR	DNR	DNR	DNR	ST84218478	19/12/2007	3 - Fair
7	4605	Natural High Ground	Left	Natural channel with masonry retaining wall	89.38	DNR	DNR	DNR	DNR	DNR	DNR	ST8389484163	23/10/1996	3 - Fair
8	4606	Natural High Ground	Left	Natural Bank	1229.01	DNR	DNR	DNR	DNR	DNR	DNR	ST83618359	19/12/2007	3 - Fair
9	4730	Natural High Ground	Left	Natural Bank	275.81	DNR	DNR	DNR	DNR	DNR	DNR	ST8615986133	07/04/2009	3 - Fair
10	4731	Natural High Ground	Left	Natural channel with stone retaining wall	181.67	DNR	DNR	DNR	DNR	DNR	DNR	ST85438562	07/04/2009	2 - Good
11	4849	Natural High Ground	Left	Natural Bank	189.57	DNR	DNR	DNR	DNR	DNR	DNR	ST8525585581	07/04/2009	2 - Good
12	4851	Natural High Ground	Right	Stone Wall	83.61	DNR	DNR	DNR	DNR	DNR	DNR	ST85568567	07/04/2009	2 - Good
13	4852	Natural High Ground	Right	Natural Bank	425.87	DNR	DNR	DNR	DNR	DNR	DNR	ST85348558	07/04/2009	2 - Good
14	4853	Natural High Ground	Left	Natural channel with gabion retaining wall	35.34	DNR	DNR	DNR	DNR	DNR	DNR	ST8458185202	23/10/1996	2 - Good
15	4854	Natural High Ground	Left	Masonry Wall	537.87	DNR	DNR	DNR	DNR	DNR	DNR	ST84028445	23/10/1996	3 - Fair
17	88456	Natural High Ground	Left	Natural Bank	825.00	DNR	DNR	DNR	DNR	DNR	DNR	ST8491285333	19/12/2007	3 - Fair
21	89868	Natural High Ground	Right	Natural Bank	3685.06	DNR	DNR	DNR	DNR	DNR	DNR	ST8404084431	19/12/2007	3 - Fair
22	98384	Natural High Ground	Right	Natural Bank	708.60	DNR	DNR	DNR	DNR	DNR	DNR	ST8619186219	07/04/2009	3 - Fair
23	98385	Natural High Ground	Right	Natural channel with stone retaining wall	561.70	DNR	DNR	DNR	DNR	DNR	DNR	ST86538659	07/04/2009	3 - Fair
24	98386	Natural High Ground	Left	Natural channel with masonry retaining wall	1001.16	DNR	DNR	DNR	DNR	DNR	DNR	ST8650586598	07/04/2009	2 - Good

Notes
* Overall Condition has been taken from the most recent inspection
* Inspections are of a purely visual nature and do not necessarily reflect the true condition of the asset
* Condition: 1 = very good, Condtion 2 = good, Condition 3 = fair, Condition 4 = poor, Condition 5 = very poor
* Crest level accuracy: 1 = ± 0.01 to 0.05m, 2 = ± 0.05 to 0.15m, 3 = ± 0.15 to 0.75m, 4 = ± 0.75 or greater
* DNR = data not recorded

Annex D – Greenfield Calculations

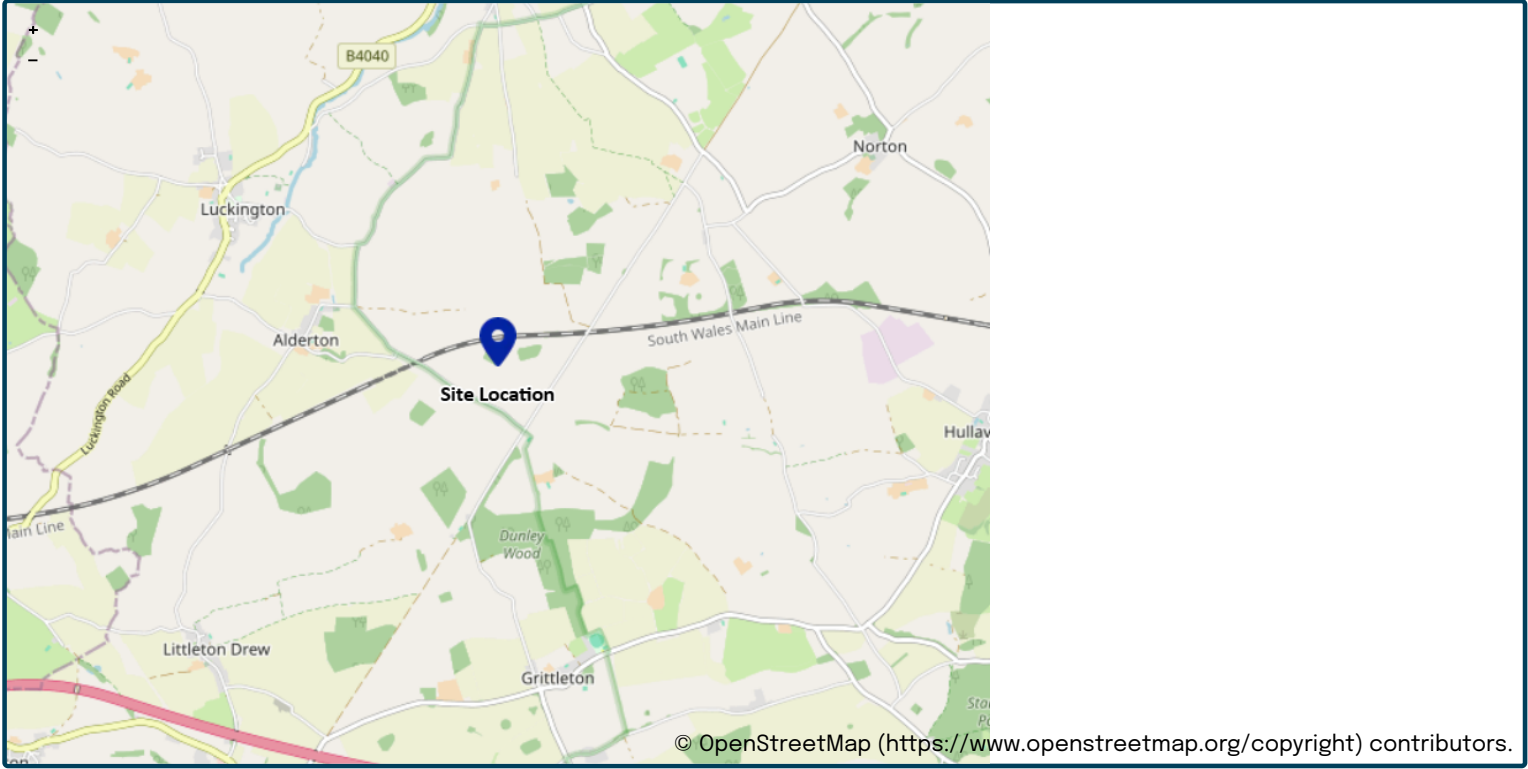
This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance “Rainfall runoff management for developments”, SC030219 (2013), the SuDS Manual C753 (CIRIA, 2015) and the non-statutory standards for SuDS (Defra, 2015). 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	23/06/2026
Calculated by	GH
Reference	317212
Model version	2.2.3

Location

Site name	Lime Down C2
Site location	



Site easting (British National Grid)	385498
Site northing (British National Grid)	182409

Site details

Total site area (ha)	0.06	ha
----------------------	-----------------------------------	----

Greenfield runoff

Method

Method	FEH statistical (2025)
--------	------------------------

FEH statistical (2025)

	<u>My value</u>	<u>Map value</u>
SAAR9120 (mm)	889	mm
BFIHOST19scaled	0.554	
QMed-QBar conversion	1.075	1.075
QMed (l/s)	0.2	l/s
QBar (FEH statistical 2025) (l/s)	0.2	l/s

Growth curve factors

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

Results

Method	FEH statistical (2025)
Flow rate 1 year (l/s)	0.2
Flow rate 2 year (l/s)	0.2
Flow rate 10 years (l/s)	0.4
Flow rate 30 years (l/s)	0.5
Flow rate 100 years (l/s)	0.6
Flow rate 200 years (l/s)	0.7

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

This report was produced using the Greenfield runoff rate estimation tool (2.2.3) developed by HR Wallingford and available at uksuds.com (<https://www.uksuds.com/>). The use of this tool is subject to the UK SuDS terms and conditions and licence agreement, which can both be found at uksuds.com/terms-conditions (<https://www.uksuds.com/terms-conditions>). The outputs from this tool have been used to estimate Greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, Centre for Ecology and Hydrology, Wallingford Hydrosolutions or any other organisation for the use of these data in the design or operational characteristics of any drainage scheme.

Annex E – 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 (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)	Invert Level (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
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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-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 (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (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 Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
960 minute winter	Storage	915	99.842	0.592	0.4	6.1706	0.0000	OK
Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Discharge Vol (m³)				
960 minute winter	Storage	Hydro-Brake®	0.1	10.1				

Annex F – SuDS Maintenance Schedule

Bioretention Systems Maintenance Schedule

Maintenance Schedule	Required Action	Typical Frequency
Regular inspections	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
Regular maintenance	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
Occasional maintenance	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
Remedial actions	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
Regular Maintenance	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)
Occasion Maintenance	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)
Remedial Actions	Repair erosion or other damage by reseedling 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
Regular Maintenance	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
Occasional Maintenance	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
Regular Inspections	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
Regular Maintenance	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
Remedial Actions	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
Regular Maintenance	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
Occasional Maintenance	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
Remedial Actions	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
Monitoring	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 pre-treatment systems for silt accumulation; establish appropriate silt removal frequencies	Half yearly
	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
Regular Maintenance	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
Occasional Maintenance	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
Remedial Actions	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)
Monitoring	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	Inlets, outlets and surface control structures – Inspect surface structures, removing obstructions and silts as necessary. Check there is no physical damage. Strim Vegetation 1 m min. surround to structures and keep hard aprons free from silt and debris.	Monthly
	Inspect chambers and below-ground control chambers – Remove cover and inspect, ensuring that water is flowing freely and that the exit route for water is unobstructed. Remove debris and silt. 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
Regular maintenance	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
Remedial actions	Repair/rehabilitate inlets, outlet, overflows and vents	As required
Monitoring	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
Regular Maintenance	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
Occasional Maintenance	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
Remedial Actions	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

- i [REDACTED]
- ii <https://www.bgs.ac.uk/map-viewers/geoindex-onshore/>
- iii <https://magic.defra.gov.uk/>
- iv <https://flood-map-for-planning.service.gov.uk/>
- v <https://environment.data.gov.uk/hydrology/climate-change-allowances/river-flow>
- [REDACTED]