

Flaxlands Solar Farm

Outline Drainage Strategy

Ampyr Solar Europe

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Prepared for:

Ampyr Solar Europe

Prepared by:

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1. Introduction

- 1.1.1 AECOM Limited (AECOM) has been commissioned by Ampyr Solar Europe to provide consulting services in support of a new proposed solar farm known as Flaxlands Solar Farm (the 'Proposed Development') on a Site located 1.7 km north of Royal Wootton Bassett, Wiltshire (the 'Site').
- 1.1.2 Ampyr Solar Europe have proposed a concept layout for a 49.9 MW solar farm and 49.9 MW Battery Energy Storage System (BESS) for the Site. The purpose of this report is to document the proposed outline surface water drainage strategy that will serve the Proposed Development. This outline strategy will demonstrate the principles of the drainage serving Proposed Development and how it will adhere to the requirements of the Wiltshire Council. It is anticipated that the detailed design of the surface water drainage will then be developed by the Principal Contractor who will ensure it aligns with strategy documented in this report and secured through planning conditions.

2. Guidance Documents

- 2.1.1 Table 1 includes a list of documents that have been referred to in developing this Flaxlands Solar Farm surface water drainage strategy.

Table 1: Standards, Guidelines and Policy Documents

Document Title	Document Reference	Author	Date and/or Revision
Wiltshire Council Drainage and Betterment Strategy	–	Wiltshire Council	June 2024
The SuDS Manual (C753)	CIRIA C753	CIRIA	2015
Otter and Water Vole Survey Report Flaxlands Solar Farm	–	AECOM	2024
National Planning Policy Framework (NPPF)	NPPF	Ministry of Housing, Communities & Local Government	Updated 2025
Flood Risk Assessment Flaxlands Solar Farm	–	AECOM	2025
BRE National Agricultural Good Practice Guidance for Solar Farm	69696	BRE	2014
National Policy Statement (NPS) for Renewable Energy Infrastructure (EN-3)	NPS EN-3	Environment Agency	2021

3. Proposed Development Description

3.1.1 The Proposed Development comprises a 49.9 MW solar farm and 49.9 MW Battery Energy Storage System (BESS).

3.1.2 Figure 1 below shows the proposed concept design for the Proposed Development.



Figure 1: Flaxlands Solar Farm Proposed Layout (Ampyr Solar Europe, revision R11)

4. Existing Site Conditions

4.1 Site Description

- 4.1.1 The Site is located within Wiltshire County, approximately 1.7 km north of Royal Wootton Bassett and approximately 150 m north of the M4 (Grid reference: SU 06910 85466). The Site, which is currently entirely greenfield, is made up of two adjoining land parcels referred to as the western and eastern land parcels. The land parcels currently consist of agricultural fields bounded by hedgerows and tree-lined hedgerows. Isolated trees and existing farm tracks are spread throughout the Site.



Figure 2: Existing Site

4.2 Topography

- 4.2.1 The Site's topography was assessed using 1 m LiDAR data that was retrieved from Department for Environmental, Food & Rural Affairs (DEFRA)¹ data survey website in September 2024.
- 4.2.2 As shown in Figure 1, the western land parcel predominantly falls to the west. The elevation along the boundary adjacent to the building labelled Building A in Figure 3, is 137.0 mAOD. This elevation drops to 107.0 mAOD along western boundary. The north of the western land parcel appears to fall north towards an unnamed ordinary watercourse (refer to Paragraph 4.4.7).
- 4.2.3 The eastern land parcel is divided by a ridgeline situated in the middle third of the parcel which lies at an elevation of 153.5 mAOD. North of the ridgeline, the parcel falls north to an elevation of 147.0 mAOD. South of the ridgeline the parcels falls south to an elevation of 139.0 mAOD.

¹ DEFRA survey data download, <https://environment.data.gov.uk/survey>, accessed September 2024

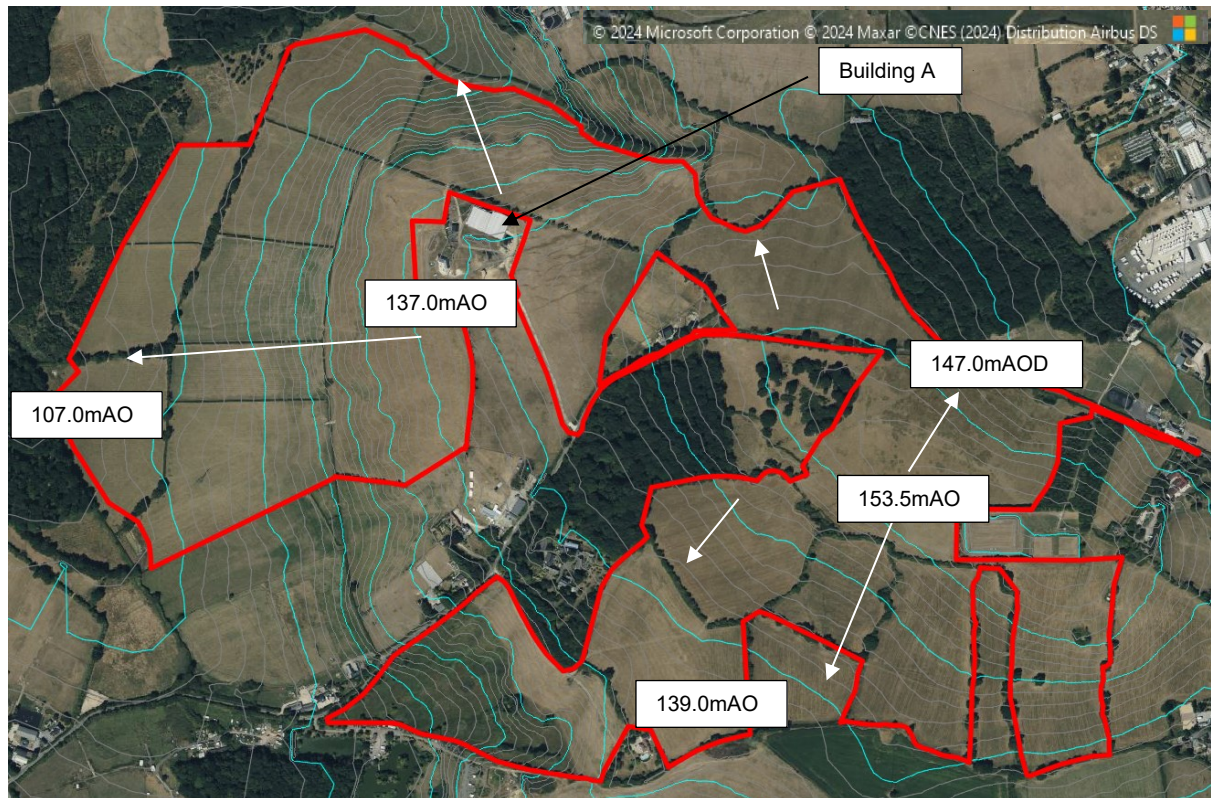


Figure 3: Site Topography (DEFRA, 2024)

4.3 Geology and Groundwater

4.3.1 A desktop review has been conducted of available geological and groundwater mapping information to understand bedrock and superficial geology within the development boundary. Maps of the geological conditions have been accessed (on 22nd October 2024).

Soil Conditions

4.3.2 British Geological Survey (BGS) mapping² indicates the Site is set across five bedrock formations, as shown in Figure 3. These include:

- Ampthill Clay Formation – Mudstone;
- Ampthill Clay Formation and Kimmeridge Clay Formation – Mudstone;
- Hazelbury Bryan Formation and Kingston Formation – Sandstone;
- Stanford Formation – Limestone; and
- Oxford Clay formation – Mudstone.

² Open BSG Geology View, <https://www.bgs.ac.uk/map-viewers/bgs-geology-viewer/>

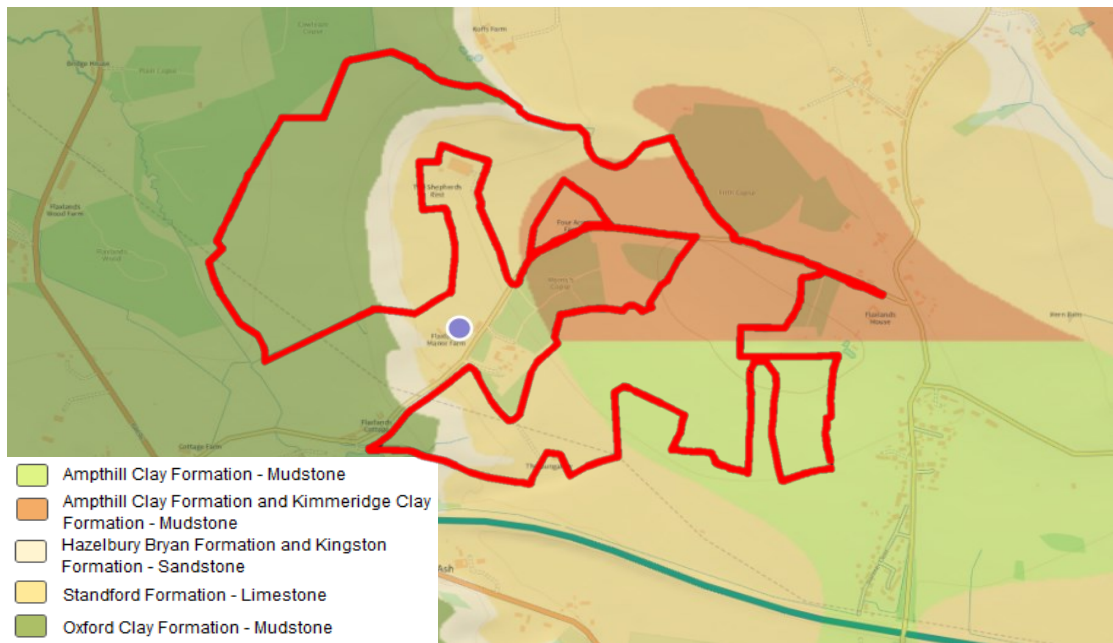


Figure 4: Bedrock Geology (BGS Open Geology Viewer, October 2024)

- 4.3.3 There is limited information available for the Superficial deposits within the Site. BGS mapping only show superficial deposits in one area of the Site; these deposits consist of gravel, sand, silt and clay, as shown in Figure 4.

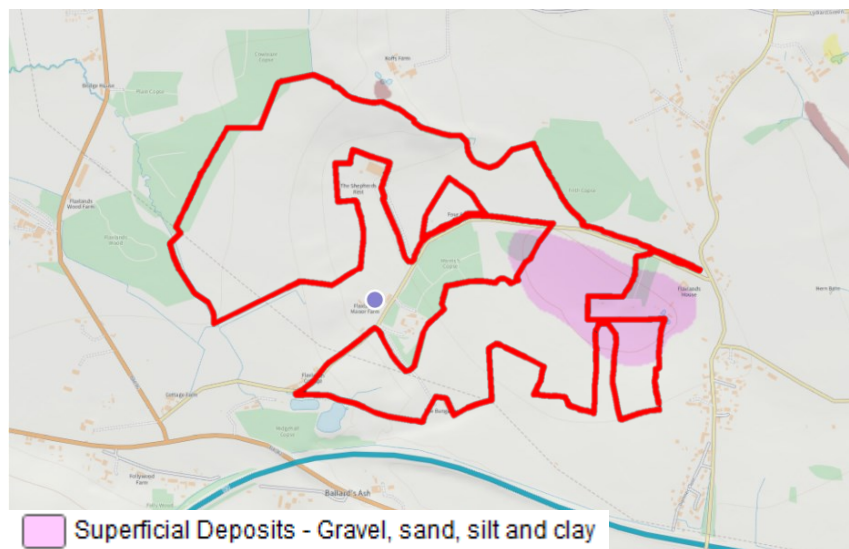


Figure 5: Superficial Deposits (BGS Open Geology Viewer, October 2024)

- 4.3.4 There are no existing borehole records within the Site. Nearby borehole records located within the same bedrock geology have therefore been used as reference instead. The boreholes referred to listed in Table 2.

Table 2. Nearby Borehole records

Borehole Ref	Bedrock Geology	Soils encountered	Distance from the Site
SU08SE65	Ampthill Clay Formation	Clay soils up to a depth of 70 m	0.85 km east
SU08NE6	Oxford Clay formation	Clay soils up to a depth of 16 m	1 km west
SU08SE34	Oxford Clay formation	Clay soils up to a depth of 1.2 m	0.5 km south

Source: BGS Borehole Records, October 2024:

https://mapapps2.bgs.ac.uk/geoindex/home.html?layer=BGSBoreholes&_ga=2.172006247.535636014.1743092269-739109675.1743092269

- 4.3.5 Based on the information publicly available on the BGS website, it appears geology is variable throughout the Site but is mostly Clay.

Groundwater

- 4.3.6 The Environment Agency's (EA) Online Interactive Maps³ were accessed on 23rd October 2024 and show that the Site lies within a Source Protection Zone 2c. The EA extended the Source Protection Zones to include areas where there is protective geology cover, such as clay. Thus, whilst the Site does lie directly within Source Protection Zone 2 – Outer Zone, activities below the surface, such as deep drilling, could create pathways for pollutants to enter the groundwater. Solar PV piles will reach a depth of between 1 to 2 m below ground level which could go through shallower clay layers. Since the clay is up to 70m thick, this is not considered to impose a risk this to the Site as this activity, nor any other no below ground activities, would penetrate beyond the clay soil layers.

- 4.3.7 The EA Online Interactive Maps show that there is a band of High groundwater vulnerability that runs through the Site, as shown in Figure 5. The band appears to follow the Hazelbury Bryan and Kingston (Sandstone) and Standford (Limestone) bedrock geology formations. High groundwater vulnerability areas are defined as areas that easily transmit pollution to groundwater and characterised by high-leaching soils and the absence of low-permeability superficial deposits. The Site is also located entirely within an area designated as a Soluble Rock Risk.

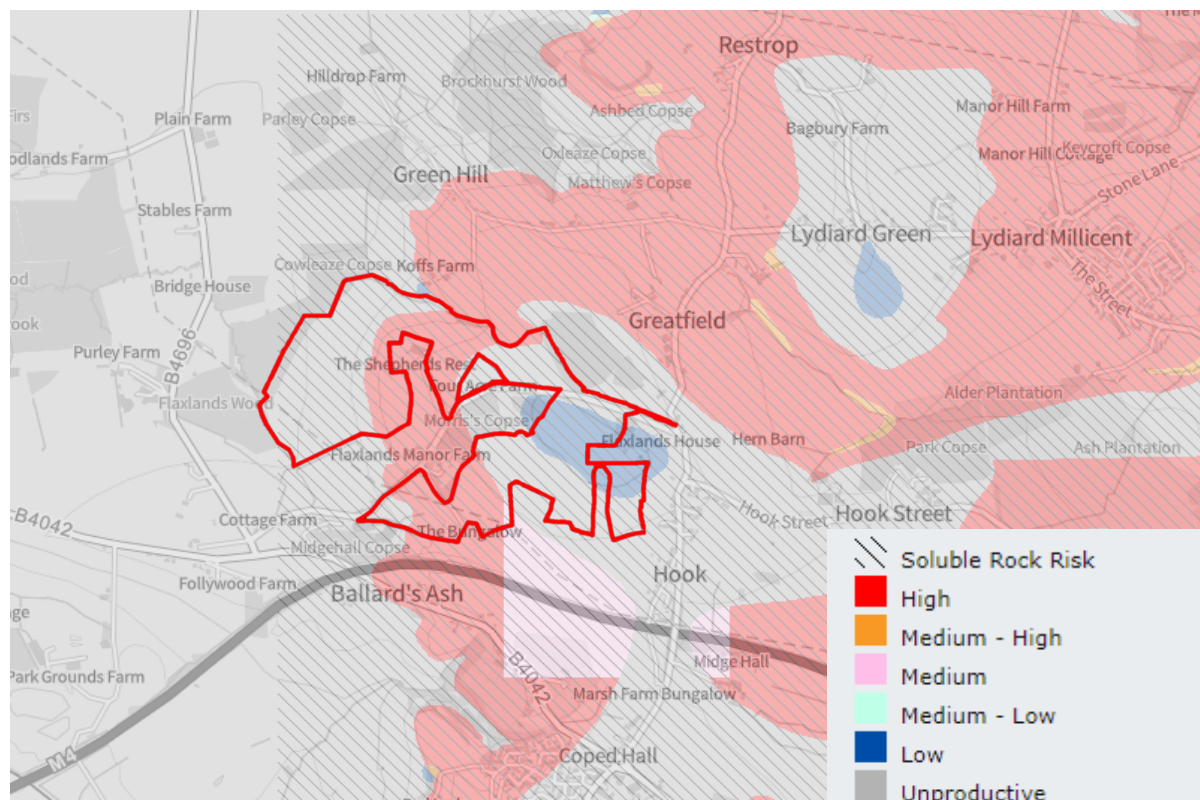


Figure 6: Groundwater Vulnerability Map (Magic Maps, October 2024)

³ EA's Online Interactive Map, <https://magic.defra.gov.uk/MagicMap.html>, access 23rd October 2024

- 4.3.8 No information was available to understand the groundwater levels within the Site. Given the area that the Site covers, it is expected that groundwater level could vary across the Site.

4.4 Watercourses

- 4.4.1 The Land Drainage Act (1991)⁴ (LDA) and the Water Industry Act (1991)⁵ have been referenced to provide guidance on the definition of Ordinary Watercourses and Main Rivers.
- 4.4.2 According to the LDA, an “Ordinary Watercourse” (OWC) is defined as *“a watercourse that does not form part of a main river”*.
- 4.4.3 The LDA also defines a “watercourse” to include *“all rivers and streams and all ditches, drains, cuts, culverts, dikes, sluices, sewers (other than public sewers within the meaning of the Water Industry Act 1991) and passages, through which water flows”*.
- 4.4.4 According to the Water Industry Act, a “main river” is defined as *“a watercourse shown as such on the main river map for England or the main river map for Wales and includes any structure or appliance for controlling or regulating the flow of water into, in or out of the channel which*
a. is a structure or appliance situated in the channel or in any part of the banks of the channel; and
b. is not a structure or appliance vested in or controlled by an internal drainage board;”.
- 4.4.5 Main Rivers identified on the Statutory Main River Map are maintained by the Environment Agency (EA) whereas, OWCs are maintained by the Lead Local Flood Authority (LLFA).

Main Rivers

- 4.4.6 The EA’s Statutory Main River Map⁶, accessed 25th March 2025, indicates that there are no main rivers within the Site. The closest Main River to the Site appears to be the Thunder Brook, which is situated 1.5 km south of the Site.

Ordinary Watercourses

- 4.4.7 Review of online mapping indicates there are several ordinary watercourses that lie on the periphery of the Site, as shown in Figure 6. The Woodbridge Brook lies along the far western border of the Site. There appears to be two field ditches within the Site that contribute to the Woodbridge Brook. An unnamed watercourse, which flows north contributing to the River Key catchment, lies along the northern border of the Site.

⁴ Land Drainage Act 1991 c.59, UK Public General Act, Legislation.gov.uk

⁵ Water Industry Act 1991 c.56 UK Public General Act, Legislation.gov.uk

⁶ EA Statutory Main River Map, <https://www.arcgis.com/apps/webappviewer/>, accessed 25th March 2025

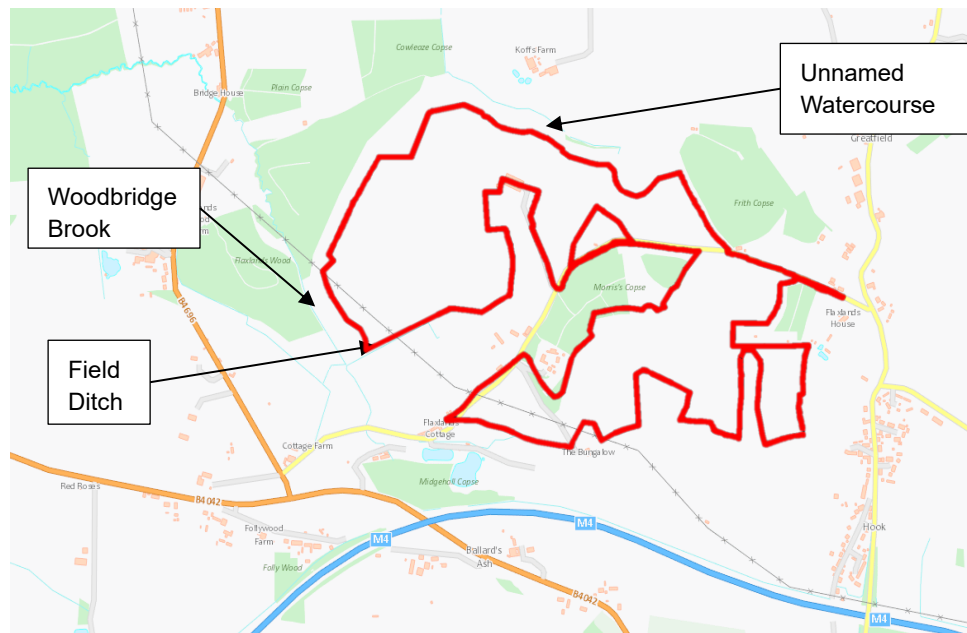


Figure 7: Ordinary Watercourses

- 4.4.8 Within the Site boundary, several other unnamed ordinary watercourses and ponds were identified during an Otter and Water Vole Survey⁷. These waterbodies are not identified on standard mapping services (e.g. Google Maps, Open Street Map, etc.). They were typically located in hedgerows or low points of the Site. The location of the identified waterbodies is shown in Figure 8 below, which is taken from the Otter and Water Vole Survey Report. A full description of each waterbody is provided within the report. It is stated in the report that the ditches were man-made and heavily managed as drainage ditches for the existing fields.

⁷ Otter and Water Survey Report Flaxlands Solar Farm, AECOM, 2025

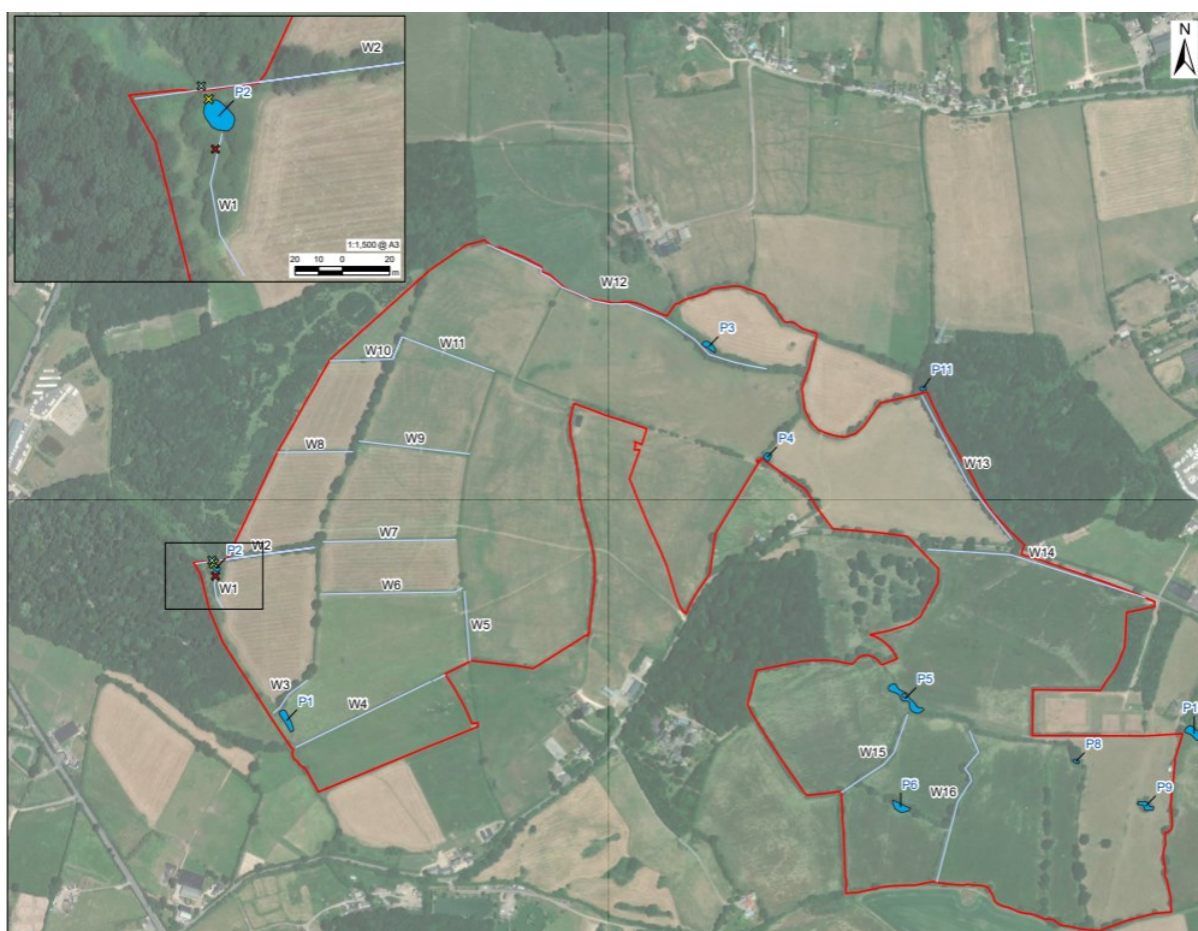


Figure 8: Location of waterbodies identified from Otter and Water Vole Survey (Otter and Water Vole Survey Report Flaxlands Solar Farm, AECOM, 2025)

4.5 Flood Risk

4.5.1 A Flood Risk Assessment (FRA)⁸ has been prepared for the Site. A summary of the commentary included in this document is provided in Table 3 below:

Table 3: Flood Risk Summary

Flood Risk Source	Source	Flood Risk to the Site	Mitigation Required?
Fluvial	Main river/ordinary watercourse	Very Low	None
Tidal	The Sea	Negligible	None
Pluvial (surface water)	Runoff from surrounding surfaces	Very Low	Yes, drainage strategy for BESS
Groundwater	Rising groundwater levels	Low	None
Sewers	Surrounding public/private drainage systems	Very Low	None
Artificial sources	Reservoirs / Canals	Very Low	None

⁸ Flaxlands Solar Farm Flood Risk Assessment, AECOM, 2025

- 4.5.2 As stated in Table 3, flood risk from all sources appears to be low throughout the Site. However, it is stated in Section 5.4 of the FRA, that there are very small localised parts of the Site where the risk of surface water flooding up to 20cm in the present day scenario is 'low' (between 0.1% and 1% chance per year), 'medium' (between 1% and 3.3% chance per year) and high (more 3.3% chance per year). These areas appear to correlate to with ordinary watercourses identified throughout the Site. During 2040 to 2060, where the effect of climate change is accounted for, the chance of surface water flooding does increase slightly in the western parcel, however the depths remain shallow and are generally located in areas where watercourses are present. The majority of the Site remains at a 'very low' risk of annual surface water flooding up to 20cm. As Solar PV Panels will be set at least 0.60m above ground where panels are located within these higher risk areas, there will still be a minimum of 0.40m freeboard between the maximum surface water flood level and the bottom of the panel. For further information regarding the Site's flood risk, refer to Section 5 of the FRA.

4.6 Existing Surface Drainage Regime

- 4.6.1 As mentioned in Section 4.1, the Site is greenfield land consisting mostly of sloping arable fields. Surface water runoff that does not soak into ground will flow overland, generally in the form of sheet flow towards and subsequently into the network of ponds and ditches on Site and into the nearby Ordinary Watercourses beyond the Site boundary, or pond against a boundary hedge embankment where it will slowly infiltrate to ground.
- 4.6.2 By assessing the Site topography, it was determined that there are four main catchments within the Site. These are illustrated within in Figure 9.

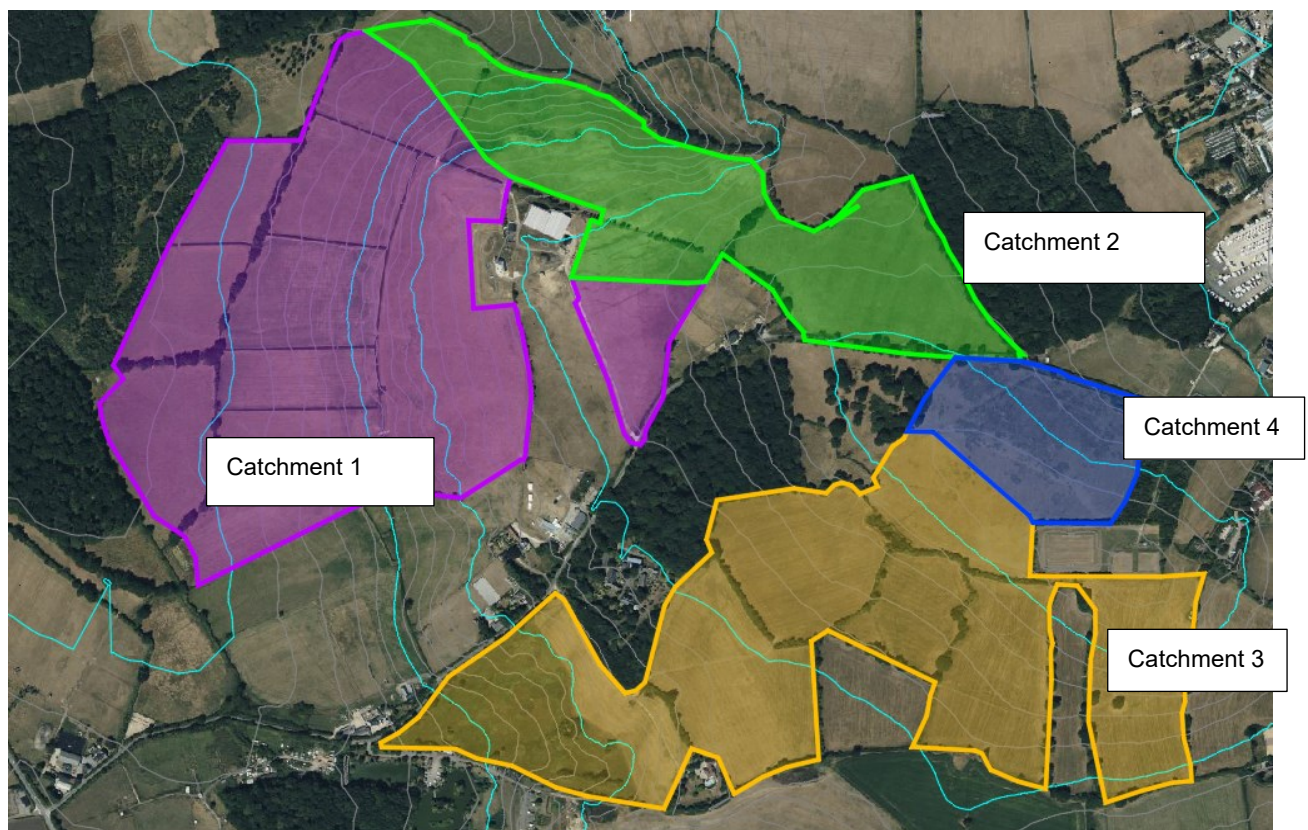


Figure 9: Existing Surface Water Catchments

- 4.6.3 The proposed surface water strategy has been developed to respect the existing catchment boundaries and surface water regime. Boundary swales will be located on the Site boundary where the Site obstructs the higher elevated regions of existing catchments to ensure these regions continue to outfall at their existing location.

4.6.4 The area of each existing catchment is listed in below.

Table 4. Contributing Catchment Areas

	Contributing Catchment Area (ha.)
Catchment 1	34.15
Catchment 2	15.30
Catchment 3	31.43
Catchment 4	5.82

5. Proposed Outline Surface Water Drainage

5.1 Overview of Strategy

- 5.1.1 The proposed outline surface water drainage strategy aims to closely replicate the existing drainage regime and has been developed with respect to the pre-application enquiry responses from the Wiltshire Council (Application no.: ENQ/2024/01008, dated 6th December 2024). The solar panels will be elevated off the ground, with the area beneath them covered in wild planting and native grasses. This arrangement ensures that the introduction of solar panels does not seal the ground with an impermeable surface, noting solar panel infrastructure typically occupies only 5% of a field area, leaving 95% as existing⁹. Any runoff from the panels will fall onto the field, where it will either infiltrate into the ground or run off according to the existing drainage regime. The understanding of how solar PV panels will impact existing runoff rates is based on the paragraph 3.10.75 of National Policy Statement (NPS) for Renewable Energy Infrastructure (EN-3), which states *"Where a Flood Risk Assessment has been carried out this must be submitted alongside the applicant's ES. This will need to consider the impact of drainage. As solar PV panels will drainage to the existing ground, the impact will not, in general, be significant."*
- 5.1.2 There will be two types of roads throughout the Proposed Development: access roads and perimeter roads. Access roads will be the larger of the two types and are used sparingly; they have been positioned to provide access to the substation and MV stations from the existing public road network. Perimeter roads will be smaller and will be located around the fields to provide maintenance access to the panels. The access roads will be constructed solely from aggregate material, whilst the perimeter roads will be compressed earth. Despite the lack of impermeable material in either road type build up, the roads could still result in additional runoff compared to the greenfield scenario. This runoff, which will drain into the solar fields, in addition to greenfield runoff from the solar PV panel fields themselves will then be captured by boundary swales which will be installed along the downstream edges of certain solar PV panel fields. Managing runoff in this manner is based on the guidance provided in paragraph 3.10.76 NPS for Renewable Energy Infrastructure (EN-3), which states *"Where access tracks need to be provided, permeable tracks should be used, and localised Sustainable Drainage Systems (SuDS), such as swales and infiltration trenches, should be used to control any runoff where recommended."*
- 5.1.3 The boundary swales will not connect to the existing ordinary watercourses. Instead, they will capture runoff from the solar PV panel fields at the low point. Here, the captured runoff will pond and gradually infiltrate into the ground. In the event of a large storm or if the capacity of the downstream swales is exceeded, runoff will overflow the swales and discharge, as existing, overland into the existing ordinary watercourses or field boundary hedges. As mentioned in paragraph 5.1.1, the impact Solar PV panel fields to existing drainage is generally not significant. Therefore, the proposed runoff rate should be equivalent to greenfield runoff rates.
- 5.1.4 The substation area will be covered in a 300 mm gravel layer. This will allow runoff to be attenuated within the gravel layer and potentially infiltrate to ground. However, given the likely poor infiltration, a network of perforated drains will be installed within the gravel layer to assist draining the substation area. The captured runoff will then discharge to the proposed detention basin. Within the substation area, only the oil filled transformers pose an environmental risk. To ensure these transformers do not leak harmful substances, the oil transformer areas will be bunded and will have an oil separation system.
- 5.1.5 Like the substation area, the BESS will be covered in a 300 mm gravel layer. The BESS however, has the potential to leak harmful substances during a fire. To prevent these harmful substances infiltrating to ground, the BESS will be bunded and lined with an impermeable membrane to contain any firefighting runoff. A network of perforated drains will be installed within the gravel to drain the BESS. Runoff will then be conveyed to the proposed detention basin.
- 5.1.6 The proposed detention basin will receive runoff from the substation area and BESS. It has been sized to discharge at the equivalent greenfield runoff rate and to hold emergency firewater runoff. Runoff will then be discharged into a boundary swale which conveys the discharge to the existing catchment outfall where the substation area and BESS are located. Since firewater runoff from the BESS area would

⁹ BRE National Agricultural Good Practice Guidance for Solar Farms, BRE National Solar Centre, July 2014

potentially be contaminated, the detention basin will be lined with an impermeable liner and will have a sluice gate on the outfall to ensure any contaminated runoff can be isolated. Fire water must be isolated from the surface water network, *and tested* or removed from site, to prevent contamination to ground and waterbodies. This is discussed further in Section 5.6.

- 5.1.7 MV stations will be located across the Site. Like the substation areas and BESS, they will be covered in a 300 mm gravel layer. However, they will not include a perforated pipe network. Given the small size of the MV stations, they are not anticipated to cause large runoff volumes. The resultant runoff volume should be able to be attenuated within the gravel layer and infiltrate to ground. If the attenuation volume of the gravel layer is exceeded during a large storm event, runoff will overflow into the solar PV panel fields and be captured by the downstream swales.

5.2 Consideration of the Drainage Discharge Hierarchy

- 5.2.1 The National Planning Policy Framework (NPPF)¹⁰ recommends that where “*possible, preference should be given to multi-functional sustainable drainage systems, and to solutions that allow surface water to be discharged according to the following hierarchy of drainage options:*”

- *Into the ground (infiltration) and re-use, or then*
- *To a surface water body, or then*
- *To a surface water sewer, highway drain, or another drainage system, or then*
- *To a public foul sewer.”*

- 5.2.2 The following commentary aims to describe how the above hierarchy has been followed.

Rainwater Re-use

- 5.2.3 Rainwater re-use will not be considered with the Site as there are no uses for harvested runoff within the Proposed Development.

Infiltration

- 5.2.4 Runoff resulting from the solar panels is expected to fall to the ground and infiltrate. Any excess runoff shed from the solar fields will be captured by the proposed boundary swales. It is not proposed to provide an outlet from the most downstream boundary swales. Instead, runoff will collect in the most downstream swale and gradually infiltrate to ground and evaporate. As mentioned in Section 4.3, the soil conditions onsite are assumed to be clay. Whilst clay a soil has low permeability, runoff rates are not expected to exceed the existing greenfield runoff rates (as described in paragraph 5.1.1) so it is assumed that the downstream swales should be able to accommodate the runoff from the solar fields.

¹⁰ NPPF, Ministry for Housing, Communities and Local Government, 2012, updated 2025

Surface water body

- 5.2.5 If the capacity of the downstream boundary swales is reached because of a large rainfall event or consecutive rainfall events, it is intended to allow the swales to over top and discharge into the existing watercourses. Since the impermeability of the solar field will not change and runoff from the BESS area will be limited to the equivalent greenfield runoff rate, it is anticipated that in the event of over topping, the discharge rate will not exceed the equivalent greenfield discharge rate.

5.3 Hydraulic Modelling Parameters

- 5.3.1 A hydraulic model using the Infodrainage software (version 2023.3) has been prepared to inform the sizing of the detention basin serving the BESS and substation area. The following provides commentary on the parameters used in the hydraulic model.

Contributing Catchment Areas

- 5.3.2 Given the assumptions that the solar fields will have a negligible impact of runoff rates and swales are proposed to capture any excess runoff, the solar fields have not been considered as part of the hydraulic calculations. As such, only the contributing area from the BESS and substation area has been considered within the hydraulic calculations. The contribution area is shown:

- BESS and Substation – 0.71 ha

Runoff Coefficient

- 5.3.3 Whilst the entire Site is considered to contribute runoff to the proposed surface water drainage system, the permeability of different parts of the Site varies. As mentioned previously, since the solar fields are considered to have a negligible impact on the existing scenario they have not been included as part of the hydraulic modelling and their runoff coefficient has not been considered. The runoff coefficient used for the BESS and Substation area is stated below:

- BESS and Substation – 0.85

- 5.3.4 This coefficient was selected based on the guidance provided by InfoDrainage modelling software and is supposed to reflect water losses from antecedence moisture content of the stone and water trapped between the stone voids that will dry from evaporation.

Urban Creep

- 5.3.5 Urban creep has not been considered within the proposed surface water drainage system. The Proposed Development proposes to develop the entire Site, which does not leave any space for the expansion of impermeable surfaces.

Climate Change

- 5.3.6 The Site lies within the Avon Bristol and North Somerset Streams Management Catchment. The 2070s Upper End peak rainfall allowances for 1 in 3.33% AEP and the 1% AEP magnitude storm events in this catchment are 35% and 40% climate change allowance, respectively. These climate change allowances have been applied when modelling the proposed drainage strategy in guidance provided in the NPPF. Climate change allowances are by the Department for Environment Food & Rural Affairs and are generated from information by Met Office Hadley Centre (2019): UKCP Local Projections on a 5km grid over the UK for 1980-2080.

Rainfall

- 5.3.7 Wiltshire Council Drainage and Betterment Strategy (June 2024) states both Flood Studies Report (FSR) and Flood Estimation Handbook (FEH) methods should be considered, and the rainfall data which provides the more conservative results should be applied. As such both FSR and FEH 2022 rainfall data has been used in the hydraulic calculations. The results published in this report are based on FEH 2022 rainfall data, as these provided the more conservative results in all modelled scenarios.

Time of Entry

- 5.3.8 A 5-minute time of entry has been used when modelling the drainage network serving the BESS and Substation area.

5.4 Existing Runoff Rates

- 5.4.1 Wiltshire Council Drainage and Betterment Strategy (June 2024) states:

“Greenfield runoff rates should be calculated using appropriate rainfall data. Applicants should justify the rainfall methodology they are using. Applicants should compare Flood Estimation Handbook (FEH) and Flood Studies Report (FSR) rainfall data for the site and select the most conservative methodology on a site-by-site basis. These methods should be adjusted as appropriate to site conditions.

Calculations of greenfield rates can use a range of calculation methods, as rates and storage requirements will vary depending on different storm criteria it should be demonstrated during the later stages (reserved matters or discharge of conditions) of the planning process that the method selected is the most conservative of the options available.”

- 5.4.2 As stated in Wiltshire Council Drainage and Betterment Strategy, greenfield runoff rates were calculated using both FEH rainfall method which uses FEH catchment descriptors and the IH 124 method which incorporate FSR data. FEH catchment descriptors were download from FEH web service. Qmed was then calculated within InfoDrainage and growth factors were applied within the UKSuDS greenfield runoff calculator to determine the greenfield runoff rate for each return period. UKSuDS greenfield runoff calculator was again used to determine the greenfield runoff rates using the IH 124 Method. It should be noted that Rainfall runoff management for developments (DEFRA/EA, 2013, ref: SC0302019) states that greenfield runoff rates for developments 0-50 ha should be calculated using the Institute of Hydrology (IH) Report 124 Flood Estimation for Small Catchments (1994) method or the Index Flood, Qmed regression equation. As each existing catchment is smaller than 50 ha, this method is still appropriate to use for the Site. The greenfield runoff rates across the Site are listed in Table 5

Table 5: Greenfield runoff rates

	100% AEP (1 in 1 year) (l/s/ha)	Qbar (l/s/ha)	3.33% AEP (1 in 30 year) (l/s/ha)	1% AEP (1 in 100 year) (l/s/ha)
FEH Method	5.8	7.4	14.5	18.0
IH 124 Method	3.9	5.0	9.7	12.0

*Discharge rate per 1ha

 UK and Ireland Rural Runoff Calculator

ICP SUDS / IH 124	ADAS 345	FEH
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Site Location
 

Version

Area (ha)

SAAR (mm) 

SPRHOST

URBEXT

Median Annual Flood (QMED)
 BFIHOST
 FARL

Results	
QMED Rural (L/s)	6.9
QMED Urban (L/s)	6.9

Figure 10: IFEH QMed Calculations

Table 6. Existing Runoff Rates

	100% AEP (1 in 1 year)		Qbar		3.33% AEP (1 in 30 year)		1% AEP (1 in 100 year)	
	FEH	IH 124	FEH	IH 124	FEH	IH 124	FEH	IH 124
BESS and Substation	4.1	2.8	5.3	3.6	10.3	6.9	12.8	8.5
Catchment 1	198.1	133.2	252.7	170.8	495.2	331.3	614.7	409.8
Catchment 2 (includes BESS and Substation area)	88.7	59.7	113.2	76.5	221.9	148.4	275.4	183.6
Catchment 3	182.3	122.6	232.6	157.2	455.7	304.9	565.7	377.2
Catchment 4	337.8	227.1	431.0	291.2	844.5	564.9	1048.3	698.9

Source: UKSuDS.com Greenfield runoff rate estimation for sites

5.4.3 As is evident from the greenfield runoff rate shown in Table 6, the IH 124 method results in a more conservative runoff rate. The proposed discharge rates will therefore be based on the IH 124 method greenfield rates.

5.5 Proposed Discharge Rates

5.5.1 Wiltshire Council Drainage and Betterment Strategy (June 2024) states:

“Where full disposal of surface water via infiltration is not viable, the LLFA expect to see that the discharge rates restricted to provide betterment over the greenfield conditions.

- 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 1 year and 1 in 100-year return period events.*
- For greenfield development, the runoff volume from the development to any highway drain, sewer or surface water body in the 1 in 100-year, 6 hour rainfall event should never exceed the greenfield runoff volume for the same event.”*

- 5.5.2 As the BESS will be covered with an impermeable surface, its surface water runoff will be limited to the equivalent 1 in 1-year greenfield runoff rate. The option to discharge runoff at the equivalent greenfield runoff rates with an allowance for long-term storage was considered but not pursued due to practical difficulties of constructing attenuation features capable of achieving long-term storage. Instead, and to control runoff volumes, Approach 2 defined within the CIRIA SuDS Manual (2015) has been applied and this involves managing runoff from the Proposed Development and discharging at the equivalent greenfield Qbar rate for all storm events up the 1% AEP (1 in 100 year) plus a 40% climate change allowance. The proposed discharge rate for the BESS and substation area post mitigation is shown in Table 7 below:

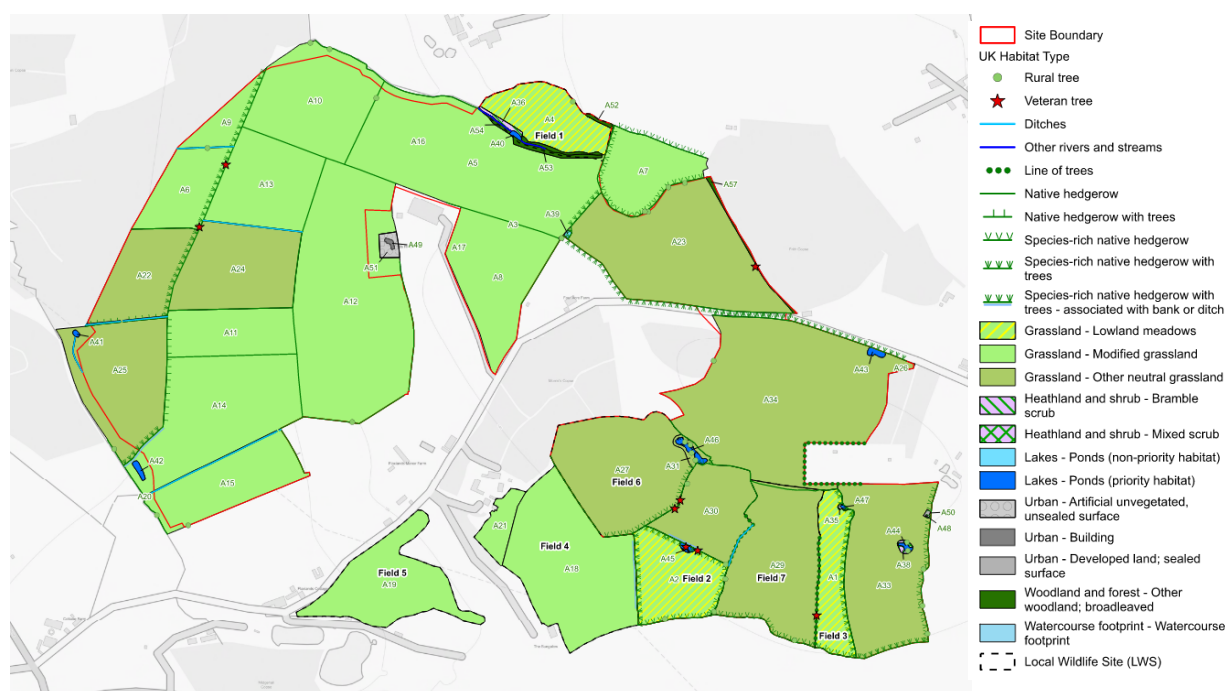
Table 7. Proposed Discharge Rates

	100% AEP (1 in 1 year)	1 Qbar	3.33% AEP (1 in 30 year)	1% AEP (1 in 100 year)
BESS and Substation	3.6	3.6	3.6	3.6

5.6 Proposed Storage Requirements

Solar PV Panel Fields

- 5.6.1 Post-development runoff rates from solar PV Panel fields are not expected to increase beyond the existing rates. The access roads and perimeter roads will be made from an entirely aggregate construction build-up and any runoff generated will be directed towards the solar fields where it will be absorbed by the wild planting and native grasses or infiltrated to ground. Any runoff not captured by the solar fields will be captured by boundary swales. The boundary swales will provide attenuation, but the exact volume has not been quantified. As the existing regime is considered to be negligibly impacted by the addition of solar PV panels, the boundary swales will ensure the existing regime is not exceeded during extreme events and will provide some betterment.
- 5.6.2 Due to consideration for Biodiversity Net Gain (BNG) requirements, swales will not be located at the lower side of every solar PV panel field. Instead, the following hierarchy has been followed when selecting which solar PV panel fields require swales:
- Swales are required where an access road drains onto it;
 - Swales are not required in fields that only have perimeter roads (i.e. does not receive runoff from access roads) as the solar fields and perimeter roads won't increase runoff; and
 - If the field only has a perimeter road draining on to it and is situated in modified grassland (lowest ecological value), a swale will be included to provide betterment for the overall scheme.
- 5.6.3 The ecological value of each field is shown where grassland is ranked as follows:
- Lowland meadows – highest ecological value;
 - Other neutral grassland; and
 - Modified grassland – lowest ecological value.



*Red Line Boundary is out of date. Lowland meadows are no within proposed Red Line Boundary

Figure 11: Grassland ecological value (UK Habitats within the Ecological Assessment Boundary, December 2024)

- 5.6.4 Where possible, swales will be located outside of the perimeter fencing of the solar PV panelled fields within 'buffer zones' subject to BNG requirements, space constraints and root protection zones. Where constraints restrict locating swales within these 'buffer zones', the swales will be located within the solar PV panel fields. In the event, that there is not sufficient space between the fence and PV panels for the swales, the PV panel legs will be located partially within the swales and the legs of the PV panels will be extended so that the PV panel still reaches the required height.

BESS and Substation Area

- 5.6.5 A lined detention basin is provided for the BESS and Substation area to attenuate runoff rates to the equivalent greenfield runoff rate for up to the 1 in 100-year event, including a 40% allowance for climate change.
- 5.6.6 In addition to the required attenuation storage, fire water storage will also be necessary to contain runoff from possible contaminated fire water from the BESS. According to the National Fire Chiefs Council (NFCC) guidance, firefighting supplies should be capable of delivering no less than 1,900 litres per minute for at least 2 hours, equating to a volume of 230,000 litres (230m³). To prevent fire water discharge from the basin during a fire, a penstock will be installed within the detention basin.
- 5.6.7 As it is possible that a fire could occur during a rainfall event, the detention basin has to be sized to be able accommodate the volume of runoff generated during a storm event and from the fire water. It is considered unlikely that a fire would occurring during the 1 in 100-year event; the 1 in 2 year event was considered the largest storm event where a fire could still occur.
- 5.6.8 The storage assessment volumes are shown in Table 8 below. These volumes were calculated using a hydraulic model developed in InfoDrainage. The results are provided in Annex B:

Table 8. Proposed Storage Assessment

Storm event	Design Volume required (m ³)
1 in 100-year event + 40% climate change	559
Critical 1 in 2-year event total runoff volume	156
Fire Water Storage	230
1 in 2-year event + Fire Water storage	386

- 5.6.9 As shown in Table 8, the volume required to attenuate the 1 in 100 year event + 40% climate change allowance is greater than the combined volume for the critical 1 in 2 year event and the fire water storage. As such, volume of the detention basin is will sized based volume required to attenuate 1 in 100-year event + 40% climate change allowance.
- 5.6.10 The total volume provided by the detention basin is 947m³. This volume allows for a minimum freeboard depth of 300mm in addition to the 1 in 100-year event + 40% climate change.
- 5.6.11 The BESS and Substation areas will be covered by 300mm gravel layer. It has been assumed that this gravel layer will have 30% porosity and will provide some attenuation storage. To account for this attenuation, the BESS and Substation area has been modelled as a permeable paving within the hydraulic model.

5.7 Water Quality

- 5.7.1 The required treatment for runoff generated within the Site has been assessed using the Simple Index Method as described in CIRIA C753 The SuDS Manual, which states the following:

Total SuDS Mitigation Index ≥ Pollution hazard index

- 5.7.2 The following section aims to demonstrate the minimum treatment to surface water runoff provided by the Site drainage infrastructure to ensure the pollution hazards associated to the Site are mitigated.

Solar PV Panel Fields

- 5.7.3 The Solar PV panelled fields have been classified as 'Other roofs' for purpose of assessing their pollution hazard. The panels will be made from glass and will only allow a small layer of dust/sediment to build up of its surface, which would then be washed away during rainfall events. Runoff from the panels will drain to ground and any excess runoff will flow off wild planting and native grasses before reaching the boundary swale. For this assessment, only the mitigation provided by the most downstream treatment (i.e. the swale) has been assessed. The SuDS mitigation indices for swales are listed in Table 9 and Table 10 below:

Table 9. Solar PV Panel Fields Pollution Hazard Indices

Land Use	Pollution Hazard Level	Pollution Hazard Indices		
		TSS	Metals	Hydrocarbons
Other roofs (Typically commercial/industrial roofs)	Low	0.3	0.2	0.05

Source: C753 The SuDS Manual Table 26.2 Pollution hazard indices for different land use classifications

Table 10. Solar PV Panel Fields Mitigation Indices

SuDS method	Mitigation Indices		
	TSS	Metals	Hydrocarbons
Swale	0.5	0.6	0.6

Source: C753 The SuDS Manual Table 26.3 Indicative SuDS Mitigation indices for discharges to surface waters

BESS and Substation Area

- 5.7.4 The BESS and Substation area will consist of transformers, batteries and control/storage rooms. The runoff pollution hazard from these items is expected to be Very Low. However, there will be an access road and four car parking spaces for BESS and substation area. The inclusion of these facilities increases the pollution hazard risk to Low (low traffic road, non-residential car parking with infrequent change). The SuDS Manual states the pollution hazard indices for this land-use and are listed in Table 11.

Table 11. BESS and Substation Pollution Hazard Indices

Land Use	Pollution Hazard Level	Pollution Hazard Indices		
		TSS	Metals	Hydrocarbons
Individual property driveways, residential car parks, low traffic roads (e.g. cul de sacs, homezones and general access roads) and non-residential car parking with infrequent change (e.g. schools, offices) i.e. < 300 traffic movements/day	Low	0.5	0.4	0.4

Source: C753 The SuDS Manual Table 26.2 Pollution hazard indices for different land use classifications

Table 12. BESS and Substation Mitigation Indices

SuDS method	Mitigation Indices		
	TSS	Metals	Hydrocarbons
Detention basin	0.5	0.6	0.6

Source: C753 The SuDS Manual Table 26.3 Indicative SuDS Mitigation indices for discharges to surface waters

- 5.7.5 As shown by the pollution hazard and mitigation indices provided in Table 11 and Table 12, respectively, the proposed detention basin provides sufficient treatment to mitigate the pollution hazard associated with runoff from the BESS and substation area. There will be other contamination threats from facilities within BESS and substation area, but these will be managed through bespoke methods as described below:
- In the event of a fire in the BESS, the batteries have the potential to leak harmful contaminants. The BESS will therefore be bunded and lined with an impermeable geomembrane, as required by NFCC, to prevent contaminant potentially soaking into the ground. The detention basin will be lined and will be fitted with a penstock, which will be closed during a fire to capture firefighting water runoff. This water will be detained until it can be pumped out and removed by a fire engine vehicle.
 - Oil filled transformers will be bunded and include oil separation systems to contain any oil leaks.

Access Roads

- 5.7.6 The Solar PV panelled fields have been classified as 'Low traffic roads' for purpose of assessing their pollution hazard. Runoff from the access roads will drain towards to the solar PV panel field, where it will run above ground through the wild planting and native grasses before reaching the boundary swale. For this assessment, only the mitigation provided by the most downstream treatment (i.e. the swale) has been assessed. The SuDS mitigation indices for swales are listed in Table 13 and Table 14 :

Table 13. Access Road Pollution Hazard Indices

Land Use	Pollution Hazard Level	Pollution Hazard Indices		
		TSS	Metals	Hydrocarbons
Individual property driveways, residential car parks, low traffic roads (e.g. cul de sacs, homezones and general access roads) and non-frequent residential car parking with infrequent change (e.g. schools, offices) i.e. < 300 traffic movements/day	Low	0.5	0.4	0.4

Source: C753 The SuDS Manual Table 26.2 Pollution hazard indices for different land use classifications

Table 14. Access Roads Mitigation Indices

SuDS method	Mitigation Indices		
	TSS	Metals	Hydrocarbons
Swale	0.5	0.6	0.6

Source: C753 The SuDS Manual Table 26.3 Indicative SuDS Mitigation indices for discharges to surface waters

5.8 Exceedance Flows

- 5.8.1 The proposed detention basin that will serve the BESS and substation area has been designed to accommodate runoff from all storms up to and including the 100 year +40% return period with a minimum freeboard depth of 300mm. For an extreme storm event or a blockage, any exceedance flows that cannot be retained by the proposed detention basin will flow overland, following the existing topography, where ultimately, they will be contained within the boundary swales and discharge to the nearest watercourse at a controlled rate.

5.9 Maintenance, Management and Adoption

- 5.9.1 The proposed outline surface water drainage strategy will be maintained by the Applicant, or another private operator to be confirmed. All proposed drainage features should be maintained according to standard practice.