Fosse Green Energy

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EN010154

6.3 Environmental Statement Appendices

Appendix 9-D: Framework Surface Water Drainage Strategy

VOLUME
6

Planning Act 2008 (as amended)

Regulation 5(2)(a)

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (as amended)

18 July 2025

Planning Act 2008

The Infrastructure Planning

(Applications: Prescribed Forms and

Procedure) Regulation 2009 (as amended)

Fosse Green Energy

Development Consent Order 202[ ]

6.3 Environmental Statement Appendices

Appendix 9-D: Framework Surface Water Drainage Strategy

Regulation Reference	Regulation 5(2)(a)
Planning Inspectorate Scheme Reference	EN010154
Application Document Reference	EN010154/APP/6.3
Author	Fosse Green Energy Limited

Version	Date	Issue Purpose
Rev 1	18 July 2025	DCO Submission

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Executive Summary

ES 1 AECOM has been commissioned to prepare an Framework Surface Water Drainage Strategy in relation to the Development Consent Order (DCO) application for the construction, operation, and decommissioning of Fosse Green Energy (hereafter referred to as 'the Proposed Development'). This Framework Surface Water Drainage Strategy forms a technical appendix to **Chapter 9: Water Environment** of the ES **[EN010154/APP/6.1]**.

ES 2 The infrastructure for the Proposed Development will comprise the construction, operation and maintenance, and decommissioning of a solar photovoltaic (PV) electricity generating facility, with an on-site Battery Energy Storage System (BESS) and other associated infrastructure, with a total capacity exceeding 50 megawatts (MW), along with an import and export connection to the national transmission network at the proposed National Grid substation near Navenby.

ES 3 The Proposed Development will have a 60-year lifetime, with decommissioning therefore expected around 2093 (based on an anticipated 2033 commissioning). The DCO Site is located approximately 9km south and south west of Lincoln, located within North Kesteven District of Lincolnshire. The area within and surrounding the Proposed Development is a primarily rural setting, comprising of open agricultural fields, individual trees, woodlands, hedgerows, linear tree belts, farm access tracks, local transport roads and villages.

ES 4 The DCO Site is made up of two elements:

a. The 'Principal Site', which is the location where ground mounted solar PV panels, BESS and associated ancillary infrastructure will be installed, access tracks, an on-site substation; and

b. The 'Cable Corridor', which will comprise the underground electrical infrastructure required to connect the Principal Site to the national transmission system.

ES 5 This Framework Surface Water Drainage Strategy primarily relates to the Principal Site during the operational phase of the Proposed Development, as works within the Cable Corridor are proposed to be underground and therefore are not anticipated to have any increases in contributing areas during the operational phase (i.e. there will be no permanent above ground, built development). Surface water runoff during the construction of the Proposed Development is to be managed by the onsite contractors through the Construction Environment Management Plan (CEMP), a **Framework CEMP** is submitted with the DCO application **[EN010154/APP/7.7]**.

ES 6 The Proposed Development within the Principal Site will consist of the following infrastructure:

a. Solar PV panels (also known as 'modules');

b. PV module mounting structures;
c. BESS;
d. Inverters;
e. Step-up transformers;
f. Switchgear;
g. An Onsite Substation and control buildings;
h. Onsite cabling;
i. Ancillary infrastructure (e.g. combiner boxes, weather stations);
j. Electricity export via high-voltage cable route and connection to the National Electricity Transmission System;
k. Fencing and security;
l. Access tracks; and
m. Landscaping and biodiversity enhancement areas.

ES 7 The physical infrastructure proposed across the DCO Site is described in further detail in **ES Volume 6.1, Chapter 3: The Proposed Development**.

ES 8 This Framework Surface Water Drainage Strategy has been prepared in accordance with the requirements of the Overarching National Policy Statement (NPS) for Energy (EN-1) (Ref 1) the NPS for Renewable Energy Infrastructure (EN-3) (Ref 2), and the National Planning Policy Framework (NPPF) (Ref 3). The proposed use of the Proposed Development would be classed as ‘Essential Infrastructure’ in accordance with Annex 3 of NPPF (Ref 3).

ES 9 This report should be read in conjunction with the Flood Risk Assessment (FRA) presented in **Appendix 9-C: Flood Risk Assessment [EN010154/APP/6.3]**.

1. Introduction

1.1 Background

1.1.1 AECOM has been commissioned to undertake an Framework Surface Water Drainage Strategy for the Proposed Development in relation to the Development Consent Order (DCO) application for the construction, operation, and decommissioning of Fosse Green Energy (hereafter referred to as the ‘Proposed Development’).

1.1.2 In this technical appendix and throughout the ES, the following definitions are used to describe the key areas of the Proposed Development, as shown in **Figure 1-2: DCO Site Plan [EN010154/APP/6.2]:**

a. **The DCO Site** – the maximum extent of land required for the construction, operation (including maintenance), and decommissioning of the Proposed Development. The DCO Site comprises the Principal Site and the Cable Corridor. The boundary of the DCO Site is referred to as the DCO Site Boundary. The total area of the DCO Site is 1,370 hectares (ha).

b. **Principal Site** – the area of the DCO Site covered by the ground-mounted solar photovoltaic (PV) panels, Solar Station Compounds, Battery Energy Storage System (BESS), Onsite Substation, planting and mitigation areas, interconnecting cables between solar PV areas, and associated infrastructure. The Principal Site includes Interconnecting Cable Corridors, Solar PV Array Areas, and areas of habitat enhancement and mitigation planting. The total area of the Principal Site is 1,070ha.

c. **Cable Corridor** – the area of the DCO Site in which the 400 kilovolt (kV) and associated cables (the Grid Connection Cables) will be installed between the Onsite Substation and the proposed National Grid substation near Navenby. The proposed National Grid substation near Navenby is subject to a separate application and does not form part of the Proposed Development. The Cable Corridor partially overlaps the Principal Site and is 351ha.

1.1.3 The Proposed Development within the Principal Site will consist of the following infrastructure:

a. Solar PV panels (also known as ‘modules’);

b. PV panel mounting structures;

c. BESS (proposed to either be ‘centralised’, located at a single BESS compound, or ‘distributed’, located at Solar Station Compounds distributed throughout the Principal Site);

d. Inverters;

e. Transformers;

f. Switchgear;

g. An Onsite Substation and control buildings;

h. Onsite cabling;

i. Ancillary infrastructure (e.g. combiner boxes, weather stations);

j. Electricity export and import via high-voltage Grid Connection Cable and connection to the National Electricity Transmission System;

k. Fencing and security;

l. Access tracks; and

m. Landscaping, permissive paths and biodiversity mitigation and enhancement areas.

1.1.4 The area within and surrounding the DCO Site is a primarily rural setting, comprising open agricultural fields, individual trees, woodlands, hedgerows, linear tree belts, farm access tracks, local transport roads and villages. The area within and surrounding the DCO Site is described in more detail in **Chapter 2: Site and Surroundings [EN010154/APP/6.1].**

1.1.5 This Framework Surface Water Drainage Strategy solely relates to the drainage design of the Principal Site, with regards to handling surface water generated by new impermeable areas within the Principal Site. It will therefore only consider the drainage of the Principal Site during operation of the Proposed Development. No drainage design is proposed for the Cable Corridor during operation, as the Cable Corridor is not deemed to contribute any additional runoff due to the cables being buried below ground.

1.1.6 The **Framework Construction Environment Management Plan (CEMP)**, submitted with the DCO application **[EN010154/APP/7.7]** provides detail on the mitigation for, and management of surface water runoff during the construction phase, including for the Cable Corridor.

1.1.7 The following stakeholders have been consulted where applicable:

a. The Environment Agency;

b. Upper Witham Internal Drainage Board; and

c. Trent Valley Internal Drainage Board.

2. Design Assumptions

2.1.1 The following design assumptions have been used to produce this strategy:

a. The solar PV panels will be mounted from the ground by a minimum of 800mm, allowing rainfall/runoff to infiltrate into the ground beneath the panels. Therefore, the solar PV panels will not lead to a substantive increase in impermeable area within the Principal Site. The drainage regime of the solar PV panel areas is therefore assumed to remain consistent with its pre-developed state.

b. New access roads will be permeable. Therefore, the Principal Site's access roads will not lead to an increase in impermeable area. The drainage regime of the access roads is therefore assumed to remain consistent with its pre-developed state.

c. Solar Station Compounds (including BESS containers in case of a distributed BESS option (BESS containers distributed throughout the Principal Site associated with Solar Station Compounds) and the Onsite Substation are considered to be 100% impermeable as a worst-case scenario. It has also been assumed 100% of the runoff from these areas will contribute to the drainage system, and therefore a Volumetric Runoff Coefficient (Cv) of 1 has been used.

d. In the case of a centralised (single BESS compound) BESS option, an allowance for runoff from the single BESS Compound has been included, reasonably assuming a lined gravel build up will capture and evaporate some of the runoff before it enters the drainage system, a Volumetric Runoff Coefficient (Cv) of 0.85 has been used.

e. The drainage system for new impermeable areas has been designed to accommodate the 1 in 100-year storm, plus a 40% allowance for an increase in peak rainfall intensity due to climate change.

f. The discharge of surface water for new impermeable areas via infiltration is unlikely to be viable due to ground conditions. This will be confirmed with on-site Ground Investigation works during detailed design following DCO consent.

g. All swale features will avoid all archaeological sites and sensitive sites, although there are no currently identified sites within the Principal Site.

h. Flood Estimation Handbook (FEH) 2022 rainfall data has been used for this assessment (Ref 10).

3. Supporting Information

3.1 Flood Risk

3.1.1 The potential flood risk to the Proposed Development is summarised in **Table 1** below. For further detail of the Proposed Development's potential flood risk, refer to the FRA that is included in **Appendix 9-C: Flood Risk Assessment** of this ES **[EN010154/APP/6.1]**.

Table 1: Proposed Development Flood Risk Summary for Principal Site

Flood Risk Source	Pre- Development Flood Risk Level	Post-Proposed Development Flood Risk Level	Comments
Fluvial	Low – High	Low – High	Solar PV Panel infrastructure within Flood Zones 2 are not envisaged to alter the existing flood extents topography and are proposed to be installed to

Flood Risk Source	Pre- Development Flood Risk Level	Post-Proposed Development Flood Risk Level	Comments
			enable sufficient freeboard to remain operational in times of flood. No change to flood risk level.
Tidal	Low Residual	Low Residual	Tidal sea level assessment undertaken, Principal Site at low risk from River Witham and Brant due to site levels, except for Field 54, where sea level rise may impact the DCO Site during the H++ scenario. However, residual risk is Low as tidal defences at Boston designed for beyond 300 years including climate change and, in addition, embedded mitigation for the credible maximum scenario exceed mitigation requirements for potential sea level rise. No change to flood risk level.
Pluvial	Low – High	Low – High	Increased surface water runoff is proposed to be managed on-site to mimic the pre-development conditions for up to and including the 1 in 100 + 40% climate change (CC) event, with discharge rates limited to existing Greenfield rates. No change to flood risk level.
Groundwater	Low	Low	North Kesteven District Council's Strategic Flood Risk Assessment indicates the area that the DCO Site Boundary located within is deemed not to be at risk of groundwater flooding, with no recorded groundwater flood events. No change to flood risk level.
Sewers	Low	Low	No records of sewer flooding in the Principal Site within the North Kesteven District Council SFRA. No proposed connection to public foul or surface water sewers. No change to flood risk level.
Artificial Sources	Low Residual	Low Residual	Environment Agency online mapping shows the maximum extent of flooding from artificial sources are not located within the vicinity of the DCO Site Boundary. No change to flood risk level.

3.2 Existing Surface Water Drainage

3.2.1 The area within the Principal Site Boundary comprises largely agricultural fields interspersed with smaller areas of individual trees, hedgerows, tree belts (linear), small woodlands, watercourses, and ditches.

3.2.2 There is no known formal piped drainage system within the Principal Site. It is assumed that for low intensity rainfall events, rainfall would infiltrate to ground where it lands. For rainfall events where rainfall intensity exceeds the local rate of infiltration, it is assumed that runoff generated would either discharge to localised watercourses via overland flow paths or pond in topographical low spots within the Principal Site and slowly drain to the underlying strata over time.

3.2.3 No details on any field drainage systems have been available at this stage. If any existing field drainage systems found on the Principal Site are damaged during construction and will also result in a negative impact offsite, they will be repaired as far as reasonably practicable to their existing operational capacity to ensure flood risk is not increased. Remediation and maintenance of encountered land drains during construction is addressed within the **Framework CEMP [EN010154/APP/7.7]**, submitted with the DCO application.

3.3 Geology and Hydrogeology

3.3.1 A desktop assessment has been completed, finding bedrock and superficial geology within the DCO Site. The maps indicate there is an approximate north-south geological boundary separating the DCO Site:

a. Bedrock: Scunthorpe Mudstone (Mudstone and Limestone interbedded) Formation Group, which is designated a Secondary B aquifer and Charmouth Mudstone Formation Group, also a Secondary B aquifer to the west of Bassingham, and Lincolnshire Limestone, a Principal aquifer to the east of Bassingham.

b. Superficial Deposits: Alluvium – Clay, silt, sand and gravel, is found surrounding the River Witham. Fulbeck Sand and Gravel Member – Sand and gravel, and Balderton Sand and Gravel Member – Sand and gravel is also found in the vicinity of the Main Rivers within the Principal Site Boundary.

3.3.2 The online Soilscape map viewer (Ref 5) describes the soils beneath the Principal Site as ‘Slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils’ with ‘Impeded drainage’ properties, and ‘Naturally wet very acidic sandy and loamy soils’ with ‘Naturally wet’ drainage properties.

3.3.3 North Kesteven District Council’s Strategic Flood Risk Assessment (Ref 6) indicates the DCO Site is not located within an area deemed to be at risk of groundwater flooding. No site-specific ground investigation information has been undertaken; however, a review of selected BGS borehole records available indicate shallow groundwater at depths of 2 to 3m below ground level (bgl) is likely to be present in the area, particularly in the river valleys and where the permeable superficial deposits are encountered. The depth to groundwater in the underlying bedrock geology is currently unknown.

3.3.4 The Principal Site is not located within a Source Protection Zone, from review of the online MAGIC mapping service (Ref 11).

4. Proposed Surface Water Drainage Strategy

4.1 Overview

4.1.1 As the Principal Site is considered a greenfield site, it is assumed that rainfall currently permeates into the ground where it falls, and that any runoff generated within arable fields where direct infiltration does not occur, it collects in local low spots where it then naturally infiltrates to ground or enters a watercourse or other water body.

4.1.2 This Framework Surface Water Drainage Strategy (Drainage Strategy) for the Principal Site aims to mimic the natural drainage conditions as far as possible, by using Sustainable Drainage Systems (SuDS) to manage surface water flows generated by the Proposed Development infrastructure.

4.1.3 The proposed solar PV panels will be mounted a minimum of 800mm above ground level, typically on narrow diameter piled legs. This prevents sealing the ground with an impermeable surface beneath the solar panels, allowing rainfall/runoff to infiltrate to ground throughout the Principal Site. As a result, it is considered that the impermeable area within solar PV panel areas will remain substantively consistent to its pre-development state.

4.1.4 Despite not contributing towards the impermeable areas, in order to limit the potential for channelisation from rainfall dripping off the end of the PV panels, the areas between, under and surrounding the solar PV panels will be planted with suitable planting such as native grassland and wildflower mix (noting that planting types will be described within the **Framework Landscape and Ecological Management Plan (LEMP) [EN010154/APP/7.15]** submitted with the DCO application). This planting will intercept and absorb rainfall running off the panels, preventing it from concentrating and potentially forming channels in the ground. Further details of the solar PV panel design can be found in **Chapter 3: The Proposed Development** of this ES **[EN010154/APP/6.1]**.

4.1.5 New access roads will be permeable, in line with paragraph 2.10.85 from NPS EN-3 (Ref 2) (this is secured within the **Design Approach Document** (**Appendix A: Design Commitments [EN010154/APP/7.3]**). Therefore, the Principal Site's access roads will not lead to an increase in impermeable area. The drainage regime of the access roads is therefore assumed to remain consistent with its pre-developed state.

4.1.6 The Indicative Site Layout Plans (included in **Figure 3-2A: Indicative Fixed South Facing Site Layout Plan** and **Figure 3-2B: Indicative Single Axis Tracker Site Layout Plan [EN010154/APP/6.2]**) show options for distributed and centralised BESS areas, with distributed BESS co-located with Solar Station Compounds spread across the Principal Site, and a single location centralised BESS Compound (single BESS compound) and, like the Onsite Substation compound, are assumed to be 100% impermeable.

4.1.7 In order to drain surface water from these proposed impermeable areas, it is proposed to construct a swale around the Solar Station Compounds, the centralised BESS area and Onsite Substation. The swales will collect and treat surface water before discharge. Both options are assessed together as a worst case conservative approach. Paragraph 056 of the Planning Practice Guidance for Flood Risk and Coastal Change (Ref 9) states that the surface water should be discharged in the following hierarchy:

a. Into the ground (infiltration);

b. To a surface water body;

c. To a surface water sewer, highway drain, or another drainage system; to a combined sewer.

4.1.8 Due to the current understanding of the ground conditions within the Principal Site, it is preferred to utilise surface water bodies to discharge runoff from the Solar Station Compounds / centralised BESS compound and Onsite Substation where possible. Therefore, surface water runoff from the Onsite Substation swales and the majority of the Solar Station Compound swales (where possible within the DCO Site) is proposed to be prioritised to local watercourses. The discharge to these watercourses will be maintained at existing greenfield runoff rates by restricting rates using a flow control. The flow control will use a restriction on the outlet of the swale which will hold water back within the swale and release it at a controlled rate.

4.1.9 Swales around all of the BESS areas (for both the centralised and distributed options) and Onsite Substation area will be lined with an impermeable membrane or similar impermeable barrier to prevent any pollution associated with fire water runoff from entering the ground. Penstocks will also be used in the event of a fire to prevent any pollution associated with fire water runoff from entering the local watercourses without prior testing.

4.1.10 In the north of the Principal Site, there are seven Solar PV fields (fields 14, 18, 19, 25, 29, 32 and 34 as shown in the Framework Drainage Strategy General Arrangement Drawing included in **Annex C: Drainage Strategy General Arrangement** of this appendix **[EN010154/APP/6.3]**) where surface water bodies are not available in suitable locations to discharge runoff from the lined Solar Station Compound swales; it is, therefore, proposed to discharge flows from the lined swales to infiltration swales lining the boundaries of these seven fields. The swales are to be designed to attenuate flows for the 1 in 100 year + 40% climate change event and fire water runoff (if deemed to be clean) and slowly infiltrate to ground whilst also making use of evapotranspiration. As set out above, discharge of runoff will be controlled from the Solar Station

Compounds by penstocks at each location which can isolate the runoff from the BESS prior to entering the infiltration swales.

4.1.11 As part of the non-statutory consultation for the Proposed Development, properties along The Avenue in Morton, adjacent to solar PV fields 25, 30 and 34, are known to experience surface water flooding from natural overland runoff from these fields. The online flood map for surface water (Ref 6) indicates a medium flood risk to these properties.

4.1.12 As a voluntary enhancement measure, edge swales are proposed to capture excess runoff from the PV fields to reduce existing surface water risk running off the fields. Edge swales within Fields 25, 30, and 34 will be sized and located accordingly to capture as much excess overland surface water runoff that can be reasonably accommodated, providing betterment by reducing the existing surface water flood risk to properties along The Avenue. Refer to **Section 4.7** for further detail on the proposed swales to reduce flood risk to the Avenue. This is secured within the **Design Approach Document (Appendix A: Design Commitments [EN010154/APP/7.3]**).

4.1.13 Where possible, surface water will drain from the Proposed Development's swale-based drainage system to local receiving watercourses via a new open green ditch. If a piped system is required, the piped section will be shortened and the last 10m section of the outfall route will be open green ditch wherever possible, unless this affects maintenance of the watercourse by the Internal Drainage Board (IDB) or Environment Agency.

4.2 Contributing Areas

4.2.1 The new impermeable areas within the Principal Site are related to the proposed Solar Station Compounds, centralised BESS Compound and Onsite Substation area. Design Options include both the alternative layouts for the BESS and associated infrastructure; either distributed throughout the DCO Site and located within Solar Station Compounds or centralised and located at a single BESS Compound.

4.2.2 The proposed impermeable areas associated with the Solar Station Compounds, centralised BESS Compound and Onsite Substation areas are approximately 0.05ha per Solar Station Compound (distributed BESS option), approximately 4.78ha for a single BESS compound (centralised BESS option), and approximately 1.4ha for the Onsite Substation.

4.2.3 The Solar Station Compounds are spread across the DCO Site and can be located individually or in groups of up to 5. This Framework Surface Water Drainage Strategy provides high level drainage arrangements for both the distributed option, the centralised option, and the Onsite Substation.

4.2.4 The Solar Station Compounds and the Onsite Substation area are considered 100% impermeable, with 100% of the runoff contributing to the drainage system; therefore, a Volumetric Runoff Coefficient (Cv) of 1 has been used throughout these designs.

4.2.5 The centralised BESS option within a single BESS Compound is assumed to consist of a gravel base, with absorption and evaporation of water reasonably expected to be retained within the gravel base before it enters the drainage network. Therefore, although lined, it is expected that 85% of run off generated from the area is expected to enter the drainage system. A Volumetric Runoff Coefficient (Cv) of 0.85 has, therefore, been used for the design of the single BESS Compound.

4.3 Greenfield Runoff Rates

4.3.1 The equivalent greenfield runoff rates for the BESS and Substation options have been calculated for the Principal Site using FEH 2022 (Ref 10) rainfall data based on the proposed contributing impermeable areas. Refer to **Annex A: Greenfield Runoff Rate** of this appendix **[EN010154/APP/6.3]** for the calculated rates. These rates are also shown in **Table 2, Table 3** and **Table 4** below.

Table 2: Greenfield Discharge Rates for Solar Station Compounds

Return Period (Years)	Discharge Rate (l/s) (1 ha)	Pro Rata Discharge Rate (l/s) (0.05 ha per BESS unit
1	0.18	0.09
Qbar	0.21	0.11
30	0.51	0.26
100	0.74	0.37

Table 3: Greenfield Discharge Rates for single BESS Compound

Return Period (years)	Discharge Rate (l/s) (4.78ha)
1	8.63
Qbar	9.92
30	35.30
100	41.75

Table 4: Greenfield Discharge Rates for Onsite Substation

Return Period (years)	Discharge Rate (l/s) (1.4ha)
1	2.53
Qbar	2.9
30	7.12
100	10.34

4.4 Proposed Attenuation

4.4.1 Attenuation will be required within the Principal Site to temporarily store surface water runoff generated from the Solar Station Compounds, single BESS Compound and Onsite Substation across the Principal Site, before it is discharged at the greenfield rate. Attenuation will be provided in the form of lined swales surrounding three sides of the BESS area (both for centralised and distributed BESS options). The Onsite Substation will also have a swale surrounding three sides.

4.4.2 In order to calculate the attenuation requirements for the Principal Site, the rainfall data to be used needs to be defined. Flood Estimation Handbook (FEH) 2022 (Ref 10) rainfall data has been used.

4.4.3 Based on the online climate change allowances for rainfall, both the Lower Trent and Erewash Management Catchment and the Witham Management Catchment (which are both contained within the Principal Site) require a 40% uplift for rainfall intensity associated with the 1 in 100-year event based on using the upper end allowance. The allowances for the 1 in 30 year event, also require climate change to be assessed for developments of this nature. However, for swales to be design to the 1 in 100 year plus climate change extent, the 1 in 30 year plus climate change scenario will by default also be effectively stored in the swales.

4.4.4 Therefore, the attenuation features for the Solar Station Compounds, single BESS Compound and Onsite Substation have been sized to accommodate the 1 in 100-year event plus a 40% allowance for climate change as there is no proposed piped network from the runoff into the swales to test the 1 in 30 year event.

4.4.5 The discharge from all swales has been restricted to the greenfield QBAR rate. The required storage volume was determined using the InfoDrainage 'Quick Storage Estimate' tool. The 'Quick Storage Estimate' tool provides an upper and lower estimate for the storage volume required, as shown in **Annex B: InfoDrainage Quick Storage Estimates** of this appendix **[EN010154/APP/6.3]**. The upper estimate will be used to size the attenuation, taking a conservative approach. The volume requirements are detailed in **Table 5** below.

Table 5: Attenuation Volume Requirements

Feature	Impermeable Area (ha)	Allowable Discharge Rate (l/s)	Attenuation Volume Required (m^3)
Single BESS and solar station compounds*	0.05	0.11	73
Substation	1.4	2.90	2,067
AC-coupled BESS Compound	4.78	9.92	5,883

*Total attenuation requirements discussed further in Section 4.11

4.4.6 In addition to the attenuation requirements for regular surface water runoff during normal operation, the BESS swales will also be required to store fire water runoff in the event of a fire. The impact on attenuation requirements as a result of fire water runoff storage are discussed further in the Fire Water Runoff section (Section 4.11) of this Framework Surface Water Drainage Strategy.

4.4.7 In areas of the Principal Site where Solar Station Compounds are grouped together, the attenuation requirements of the swale around them will be increased proportionately. A breakdown of the storage requirements within fields containing Solar Station Compounds across the DCO Site is contained in **Table 13** in **Section 4.11**.

4.4.8 This required storage volume will be provided in the form of swales around three sides of the Solar Station Compounds, single BESS Compound and Onsite Substation. Swales will be approximately 0.6m deep with 1 in 3 side slopes. The location of swales and the drainage design is shown in the Framework Surface Water Drainage Strategy drawing in **Annex C: Drainage Strategy General Arrangement** of this appendix **[EN010154/APP/6.3]**.

4.5 Proposed Discharge Routes

4.5.1 All but 7 of the solar PV fields (fields 14, 18, 19, 25, 29, 32 and 34) have the capacity to drain via gravity to a watercourse, via the attenuation for Solar Station Compounds (in the case of the distributed BESS option), the Onsite Substation, and the single BESS Compound (in the case of the centralised BESS option).

4.5.2 The 7 solar PV fields that do not have a positive runoff flow path to a watercourse or surface waterbody are presented in **Table 6**, which indicates the solar PV fields in question and the number of Solar Station Compounds / Impermeable areas within each.

Table 6: Solar PV Panel Fields and Solar Station Compounds areas with no positive drainage

PV Area	No. BESS per Solar PV Field	Impermeable Area (ha)
14	1	0.05
18	1	0.05
19	1	0.05
25	1	0.05
29	3	0.15
32	1	0.05
34	1	0.05

4.5.3 Refer to **Section 4.11** and **Table 13** for swale volumes for solar PV fields containing Solar Station Compounds. The seven fields in Table 6 above will intercept runoff and will infiltrate the Solar Station Compound runoff volume to ground, following isolation and treatment if fire water runoff is a contributing volume. An assessment of conservative infiltration rates will be carried out to confirm the swales can accommodate this; refer to **Table 13** in **section 4.11** for required volumes to store for the design event.

4.5.4 With typical soil types encountered on this part of the Principal Site being sandy / loamy soils, conservative infiltration rates taken from The SuDS manual (CIRIA C753) (Ref 8) are in the region of $1x10^{-7}$m/s.

4.5.5 The Solar Station Compound swales for the fields in **Table 6** will discharge to the infiltration swales at greenfield rates, in accordance with the principles of the Framework Surface Water Drainage Strategy. Edge swales within these fields will provide additional attenuation capacity. Swales within these fields can provide lengths in excess of 300m. A typical infiltration swale, assuming all impermeable runoff drained at uncontrolled rates, for an area with 3 Solar Station Compound areas, would require a swale approximately 150m long, 6m wide and 0.6m deep. There is sufficient space within the fields to increase swales as required, following infiltration testing to be undertaken at detailed design, post DCO submission.

4.6 Water Quality

4.6.1 To assess the risk to receiving watercourses, an assessment has been undertaken of the proposed surface water drainage system in accordance with the Simple Index Approach as detailed within CIRIA C753 The SuDS Manual (Ref 8). This method determines the pollution hazard level of the land use proposed and then assesses the level of treatment the proposed drainage system will provide to ensure it provides sufficient water quality mitigation. In order to pass the Simple Index Approach the following condition must be met for each of the three pollutants (Total Suspended Solids, Metals and Hydrocarbons) considered in this approach:

Total SuDS Mitigation Index ≥ Pollution Hazard Index

4.6.2 The impermeable areas within the Principal Site consist of the BESS compound and the Onsite Substation. In accordance with the SuDS Manual this land use is best defined as ‘commercial/industrial’ roofs. **Table 7** below details the pollution hazard indices associated with this land use. **Table 8** below lists the mitigation indices associated with the swale. These values demonstrate the Simple Index Approach (SIA) condition is met for each of the pollutants as the mitigation indices are higher than the hazard indices. Therefore, the proposed swales surrounding the BESS and substations are sufficient to treat the runoff from these areas, as noted in the following tables.

Table 7: Pollution Hazard Indices for BESS and Onsite Substation

Land Use	Pollution Hazard Indices			
	Pollution Hazard Level	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Other roof (typically commercial/industrial roofs)	Low	0.3	0.2	0.05

Table 8: Mitigation Indices for BESS and Onsite Substation swales

Type of SuDS Component	Pollution Hazard Indices		
	Total Suspended Solids (TSS)	Metals	Hydrocarbons
BESS/Substation Swales	0.3	0.2	0.05

4.6.3 The access roads will not contribute to any additional impermeable area to the Principal Site, but they will be trafficked and therefore they have the potential to pollute the watercourses within the Principal Site. The operational site working compound will also contribute runoff from parking areas. The perimeter swales and compound swales will be used to capture any pollutants from the trafficked areas before discharging to the watercourses. **Table 9** and **Table 10** below lists the pollutant hazard indices and mitigation indices used as part of the Simple Index Approach (SIA) and demonstrates the proposed perimeter swales are sufficient to treat the runoff from the access roads.

Table 9: Pollution Hazard Indices for access roads

Land Use	Pollution Hazard Indices			
	Pollution Hazard Level	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Low Traffic roads and on residential car parking with infrequent change (i.e. <300 traffic movements/day)	Low	0.5	0.4	0.4

Table 10: Mitigation Indices for access road swales

Land Use	Pollution Hazard Indices		
	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Perimeter Swales	0.5	0.6	0.6

4.6.4 Firefighting water, and its potential contaminants, is not included in this section as any fire water applied to BESS areas would be contained within the swale and removed from the Principal Site via controlled methods (e.g. tanker) if found to be polluted following testing (see **Section 4.11** on Fire Water Runoff for further details).

4.7 The Avenue at Morton Hall

4.7.1 As discussed in **Section 4.1**, properties adjacent to solar PV fields 25, 30 and 34 (as shown on the Framework Surface Water Drainage Strategy drawing in **Annex C: Drainage Strategy General Arrangement** of this appendix **[EN010154/APP/6.3]**) experience surface water flooding from natural overland runoff from these fields.

4.7.2 There is no legislative requirement to provide a reduction to existing surface water flood risk. However, the Proposed Development can provide a reduction in the volume of overland flow received by these properties, with each of the three adjacent fields proposed to incorporate edge swales to capture overland runoff and discharge via the swales to ground via infiltration. The Applicant has chosen to provide voluntary enhancement in this location (this is secured within the **Design Approach Document (Appendix A: Design Commitments [EN010154/APP/7.3]**).

4.7.3 The swale length has been reviewed for each field using LiDAR survey data to intercept the overland flow contours that drain towards the properties in The Avenue. The available volume of these swales is based on the swale length and ground profile, with a 1900mm wide, 600mm deep swale with 1 in 3 side slopes, with an infiltration rate of $1x10^{-7}$m/s. The maximum volumes that can be accommodated by the swales are set out in **Table 11** below.

Table 11: Edge Swale Volumes

Field no.	Length of Swale (m)	Volume of attenuation available (m^3)
25	218	523
30	128	310
34	131	317

4.7.4 InfoDrainage Software has been used with FSR rainfall data to estimate the Greenfield Runoff Volumes generated by the field catchments, these calculations are included in **Annex D: Greenfield Runoff Volumes for The Avenue** of this appendix **[EN010154/APP/6.3]**. Using FSR data is an acceptable method to assess greenfield runoff rates and volumes.

4.7.5 The calculation has assessed all storm durations for the 1 in 100 year plus 40% climate change, from the 15 minute duration event upwards to test the extent of the potential reduction in surface water risk to the properties, taking into account the infiltration of the underlying ground.

4.7.6 To assess the greenfield runoff volumes within InfoDrainage, an effective contributing area is pro-rata'd from the total greenfield area. InfoDrainage recommends the effective contributing area for a model as 20% of the total area.

4.7.7 The greenfield volume runoff calculator tool within InfoDrainage does not facilitate climate change allowance to be included in the calculation. To account for the inclusion of 40% climate change to assess the greenfield runoff volume, the contributing area has been increased by 40%; for example, a 1 ha contributing area would be represented as 1.4ha in the runoff volume assessment.

4.7.8 **Table 12** indicates the available swale volumes and the maximum storm durations during the 1 in 100 year plus 40% climate change event, that each swale can accommodate, i.e. representing the critical storm duration.

Table 12: Equivalent Greenfield Runoff Volumes

Field no.	Volume of attenuation available(m^3)	Maximum (Critical) Storm Duration (mins)	Greenfield Volume resulting from Maximum Storm Duration (m^3)
25	523	4320	517
30	310	5700	304
34	317	10080	79

4.7.9 **Table 12** indicates the edge swales have the capacity to provide significant attenuation, reducing flood risk from surface water runoff to the properties in The Avenue. Field 34 provides significantly more attenuation than required; however, the swale length is needed to intercept the full contour of the field, to avoid runoff "bypassing" the swale.

4.7.10 For runoff volumes beyond the critical storm durations, the excess will overtop the swales and flow overland as existing.

4.8 Exceedance Flows

4.8.1 The proposed surface water drainage network has been designed to accommodate runoff from all storms up to and including the 100 year +40% climate change event. For an extreme storm event, any exceedance flows that cannot be retained by the proposed attenuation will flow overland, following the existing topography, where ultimately, they will be contained within the perimeter swales, or discharge to the nearest watercourse as the existing flow paths convey at present.

4.9 Amenity and Ecological Value of SuDS Features

4.9.1 SuDS features will not be on publicly accessible land. Consequently, the potential amenity benefit provided by the proposed drainage is not considered relevant to the design. The design of the drainage, however, will be discrete so that is does not hinder the aesthetic value of the Principal Site.

4.9.2 Incorporating swales within the Principal Site provides an opportunity to add ecological value to the Principal Site.

4.10 Impact of Special Scientific Interest (SSSI) Sites

4.10.1 There are no Sites of Special Scientific Interest (SSSIs), Special Areas of Conservation (SACs), Special Protection Areas (SPAs), Local Wildlife Sites, scheduled monuments or listed buildings within the Principal Site Boundary.

4.10.2 Runoff from fire water from the BESS areas will be captured so it cannot discharge off site or to ground and will be tested/removed off site by tanker if contamination is found to be present.

4.11 Fire Water Runoff

4.11.1 The proposed BESS within the Solar Station Compounds and single BESS Compound areas require fire water tanks to supress a fire, should one break out. The BESS containers will contain an internal fire suppression system, with a sump to contain any water used in the event of an internal fire. This water will not be directed to the surrounding swales.

4.11.2 In the event of a fire, the fire service may also use clean water to douse surrounding BESS units to prevent propagation of fire. This external firewater runoff may contain particles from a fire which could then enter the external drainage system within the BESS compound. In the unlikely event of fire water being discharged, the runoff will be contained and tested/treated before being allowed to discharge to the local watercourses, or to ground in the case of the proposed infiltration swales as discussed above.

4.11.3 It is proposed to contain the external fire water runoff within the swale surrounding the Solar Station Compounds, where it can be held and tested before either being released into the surrounding watercourses or to ground (if found to have no contaminants present, or contaminants that are within acceptable legal limits) or taken off site by a tanker for treatment elsewhere. The swale will then be cleaned of all contaminants. A **Framework Battery Safety Management Plan [EN010154/APP/7.17]** is submitted with the DCO application which discusses fire management in more detail.

4.11.4 Each swale will be underlain with an impermeable liner to prevent any contaminants entering the ground.

4.11.5 The swale will be controlled by a penstock valve that can be closed before a fire is put out. The penstock valves will be located in proximity to the access road so they can be easily reached in the event of a fire. They will also be located to the west of the Solar Station Compounds and the Onsite Substation wherever possible to reduce the potential of their operation being affected by the prevailing wind conditions directing a potential fire towards the penstock.

4.11.6 National Fire Chiefs Council (NFCC) guidance ("*Grid Scale Battery Energy Storage System planning – Guidance for FRS*", 2022, Ref 7) has been used to determine the volume storage of fire water runoff. The NFCC guidance states firefighting supplies '*should be capable of delivering no less than 1,900 litres per minute for at least 2 hours*'. On top of this supply requirement, a 30% additional capacity has been applied for storage in the swale. This equates to approximately 300m^3. It should be noted that the 300m^3 storage is required for each group of BESS (i.e. 300m^3 will be required if there is one BESS on its own or five BESS grouped together). This is based on the likely scenario that, in the unlikely event of a fire, only one BESS would be on fire at the any given time.

4.11.7 The NPPF Planning Practice Guidance (Ref 4); Renewable and low carbon energy was revised in August 2023 to include discussions on BESS within Paragraphs 032 to 036 inclusive. Paragraph 034 notes the requirement for applicants to consider the NFCC Guidance, and Paragraph 036 notes that local planning authorities should consider the NFCC guidance when determining applications.

4.11.8 It is noted that the NFCC guidance has undergone a consultation to update it following the growth in battery storage facilities across the UK and the interest in battery safety. The consultation was proposed to conclude on 22 August 2024. The new guidance may be released during the ES or Examination stage; if so, this assessment will be updated to reflect the latest guidance. The draft guidance proposed lower fire water requirements than the current guidance.

4.11.9 By using the swale for fire water storage as well as surface water storage, there is the potential that, in the event of a fire, the swale may already contain surface water and reduce the capacity for fire water storage. Therefore, the swale should be sized to serve both purposes. It is considered overly conservative to provide the required fire water storage on top of the 1 in 100 year + 40% storage already provided, as it is extremely unlikely a fire will occur at the same time as the 1 in 100 year event. Therefore, taking a pragmatic approach, an allowance has been made that a 1 in 2 year event could occur at the same time as a fire. Therefore, the swale will need to contain the 1 in 2 year event plus the fire water storage runoff or the 1 in 100 year + 40% event on its own, whichever is greater (thereby providing for the worst case scenario).

4.11.10 In order to determine the attenuation volume required, a quick storage estimate calculation was made for a single Solar Station Compound based on the 1 in 2 year event (see **Annex A: Greenfield Runoff Rate** of this appendix **[EN010154/APP/6.3]**), which gave a value of 15m³. A comparison was then made between the 1 in 2 year plus fire water storage and the 1 in 100 year + 40% event. See **Table 13** below, which highlights, in green, the worst-case storage required in the design for each Solar Station Compound configuration and the single BESS Compound.

Table 13: Attenuation Storage

	Attenuation storage (m^3)			
Number of BESS	**1 in 2 year**	**1 in 100 year + 40%**	**Firewater storage**	**Total**
1 BESS	15	73	300	315
2 BESS	30	146	300	330
3 BESS	45	219	300	345
4 BESS	60	292	300	360
5 BESS	75	365	300	375
Single BESS Compound	1,193	5,883	300	1,493 5,883

4.11.11 The worst-case storage volumes as detailed within **Table 13** have then been provided within the swales as part of the drainage design for the DCO Site. The locations of Solar Station Compound swales are shown in the Framework Drainage Strategy drawing in **Annex C: Drainage Strategy General Arrangement** of this appendix **[EN010154/APP/6.3]**.

4.11.12 The volume requirements for containment of fire water runoff within the swale and its configuration are subject to agreement with the Local Fire and Rescue Service.

4.12 Proposed Foul Water Drainage Strategy

4.12.1 Once the Principal Site is operational, foul water drainage will only be required for the staffed control building. This building will only be used by a small number of staff; therefore, the anticipated foul flows from the building will be low. It is understood Anglian Water have public sewers within the Principal

Site, however following a review of asset records for both companies there are no public sewers within at least 30m of the building. The Environment Agency has advised 30m as a minimum distance to provide a public sewer connection instead of a septic tank arrangement on previous solar schemes.

4.12.2 As the DCO Site compound in the area of the single BESS compound is more than 30m from a public sewer and due to the low flows and no public sewers being present in the vicinity of the building, the foul water flows will be dealt with via a sealed cesspit, i.e. with no overflow to ground pipe system.

4.13 Adoption and Maintenance

4.13.1 The proposed Surface Water Drainage Strategy will be maintained by the Applicant, or another private operator to be confirmed, and secured through the DCO. All proposed drainage features should be maintained according to standard practice.

5. References

Ref 1 Department for Energy Security and Net Zero (November 2023) Overarching National Policy statement for Energy (EN-1). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/47854/1938-overarching-nps-for-energy-en1.pdf

Ref 2 Department for Energy Security and Net Zero (November 2023). National Policy Statement for Renewable Energy Infrastructure (EN-3). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/37048/1940-nps-renewable-energy-en3.pdf

Ref 3 Department for Energy Security and Net Zero (November 2023). National Policy Statement for Renewable Energy Infrastructure (EN-5). Available at: https://assets.publishing.service.gov.uk/media/65a78a5496a5ec000d731abb/nps-electricity-networks-infrastructure-en5.pdf

Ref 4 National Planning Policy Framework (March 2012, updated December 2023). Available at: https://assets.publishing.service.gov.uk/media/669a25e9a3c2a28abb50d2b4/NPPF_December_2023.pdf

Ref 5 Land Information Systems Soilscapes soil types viewer (online). Available at: https://www.landis.org.uk/soilscapes/

Ref 6 North Kesteven Strategic Flood Risk Assessment (2009). Available at: https://www.n-kesteven.gov.uk/planning-building/planning/planning-policy/evidence-base-monitoring

Ref 7 National Fire Chiefs Council (2022) Grid Scale Battery Energy Storage System planning – Guidance for FRS. Available at: https://nfcc.org.uk/wp-content/uploads/2023/10/Grid-Scale-Battery-Energy-Storage-System-planning-Guidance-for-FRS.pdf

Ref 8 CIRIA (2015) Report C753 The SuDS Manual 2nd Edition. Available at : https://www.ciria.org/

Ref 9 Department of Communities and Local Government (2014, updated August 2022) National Planning Practice Guidance: Flood Risk and Coastal Change. Available online: https://www.gov.uk/guidance/flood-risk-and-coastal-change

Ref 10 FEH web service

Ref 11 MAGIC Mapping Service https://magic.defra.gov.uk/MagicMap.aspx

Annex A Greenfield Runoff Rate

Greenfield Runoff rates for DC-coupled Solar Station Compounds

hrwallingford

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	[redacted]
Site name:	Fosse Green Solar BESS
Site location:	BESS

Site Details

Latitude:	53.14754° N
Longitude:	0.64053° W
Reference:	739672703
Date:	Dec 04 2023 11:52

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.

Runoff estimation approach: FEH Statistical

Site characteristics

Total site area (ha): 0.1

Methodology

Q_{MED} estimation method:	Calculate from BFI and SAAR
BFI and SPR method:	Specify BFI manually
HOST class:	N/A
BFI / BFIHOST:	00.499
Q_{MED} (l/s):	
Q_{BAR} / Q_{MED} factor:	1.12

Hydrological characteristics

	Default	Edited
SAAR (mm):	579	596
Hydrological region:	5	5
Growth curve factor 1 year:	0.87	0.87
Growth curve factor 30 years:	2.45	2.45
Growth curve factor 100 years:	3.56	3.56
Growth curve factor 200 years:	4.21	4.21

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Q_{BAR} (l/s):		0.21
1 in 1 year (l/s):		0.18
1 in 30 years (l/s):		0.51
1 in 100 year (l/s):		0.74
1 in 200 years (l/s):		0.87

Greenfield runoff rates for AC-Coupled Single BESS Compound

hrwallingford

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	[redacted]
Site name:	Fosse green Solar BESS
Site location:	Centralised VBESS Area

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.

Site Details

Latitude:	53.14481° N
Longitude:	0.62456° W
Reference:	236235166
Date:	Sep 05 2024 09:15

Runoff estimation approach

FEH Statistical

Site characteristics

Total site area (ha):	4.78

Methodology

Q_{MED} estimation method:	Calculate from BFI and SAAR
BFI and SPR method:	Specify BFI manually
HOST class:	N/A
BFI / BFIHOST:	0.499
Q_{MED} (l/s):	
Q_{BAR} / Q_{MED} factor:	1.12

Hydrological characteristics

	Default	Edited
SAAF (mm):	579	596
Hydrological region:	5	5
Growth curve factor 1 year:	0.87	0.87
Growth curve factor 30 years:	2.45	2.45
Growth curve factor 100 years:	3.56	3.56
Growth curve factor 200 years:	4.21	4.21

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Q_{BAR} (l/s):		9.92
1 in 1 year (l/s):		8.63
1 in 30 years (l/s):		24.3
1 in 100 year (l/s):		35.3
1 in 200 years (l/s):		41.75

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at 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 www.uksuds.com/terms-and-conditions.htm. The outputs from this tool are estimates of 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, CEH, Hydrosolutions or any other organisation for the use of this data in the design or operational characteristics of any drainage scheme.

Greenfield Runoff rates for Onsite Substation

hr wallingford

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	[redacted]
Site name:	Fosse Green Solar BESS
Site location:	Substation 1.4 ha

Site Details

Latitude:	53.14754° N
Longitude:	0.64053° W
Reference:	4082512342
Date:	Dec 04 2023 11:56

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.

Runoff estimation approach

FEH Statistical

Site characteristics

Total site area (ha): 1.4

Methodology

Q_{MED} estimation method:	Calculate from BFI and SAAR
BFI and SPR method:	Specify BFI manually
HOST class:	N/A
BFI / BFIHOST:	00.499
Q_{MED} (l/s):	
Q_{BAR} / Q_{MED} factor:	1.12

Hydrological characteristics

	Default	Edited
SAAR (mm):	579	596
Hydrological region:	5	5
Growth curve factor 1 year:	0.87	0.87
Growth curve factor 30 years:	2.45	2.45
Growth curve factor 100 years:	3.56	3.56
Growth curve factor 200 years:	4.21	4.21

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

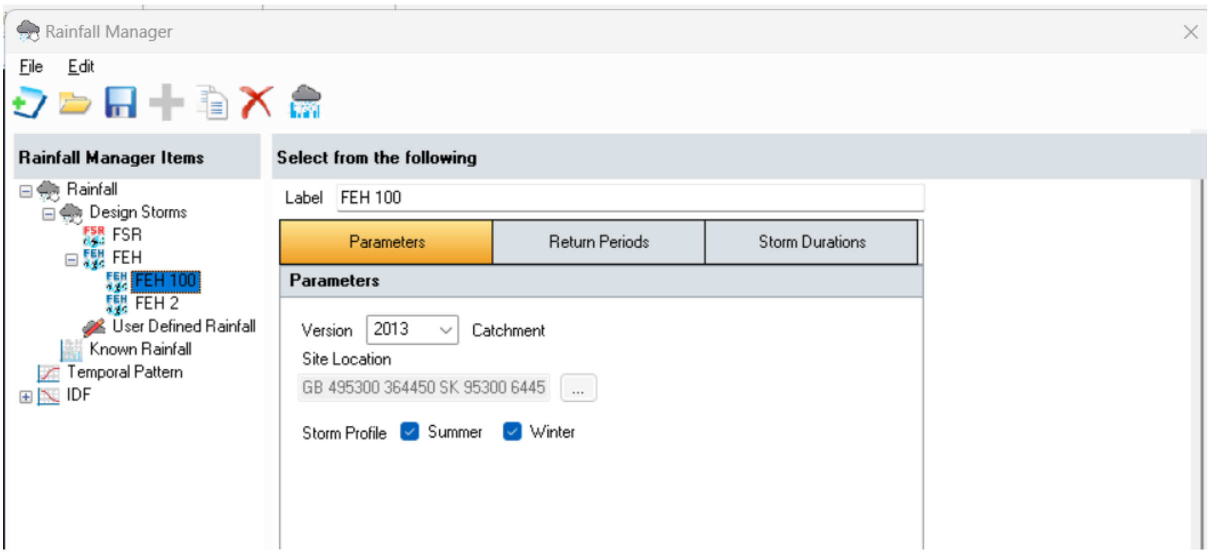
	Default	Edited
Q_{BAR} (l/s):		2.9
1 in 1 year (l/s):		2.53
1 in 30 years (l/s):		7.12
1 in 100 year (l/s):		10.34
1 in 200 years (l/s):		12.23

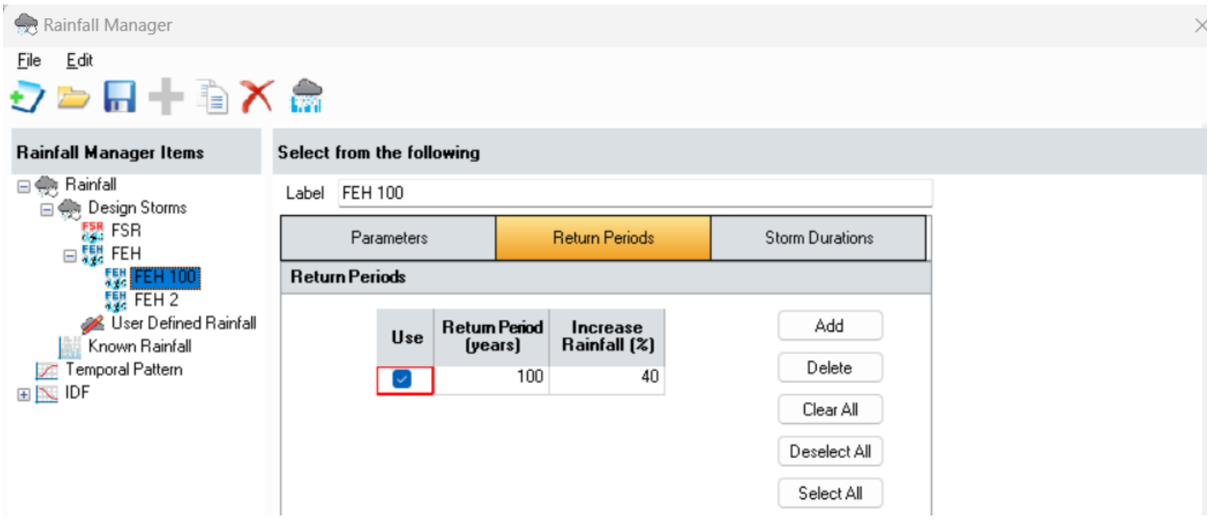
This report was produced using the greenfield runoff tool developed by HR Wallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement , which can both be found at www.uksuds.com/terms-and-conditions.htm. The outputs from this tool are estimates of 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, CEH, Hydrosolutions or any other organisation for the use of this data in the design or operational characteristics of any drainage scheme.

Annex B InfoDrainage Quick Storage Estimates

BESS Areas Calculations (FEH 2022 – MicroDrainage notes 2013 but the data is FEH 2022, this an inherent issue in MicroDrainage to correctly show FEH 2022 dataset).

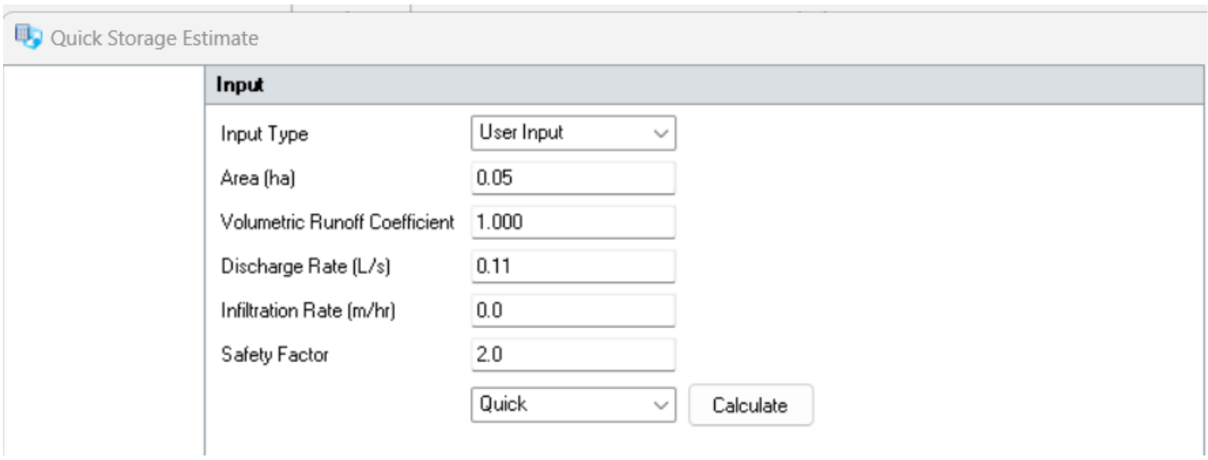
Design Parameters for FEH 2022

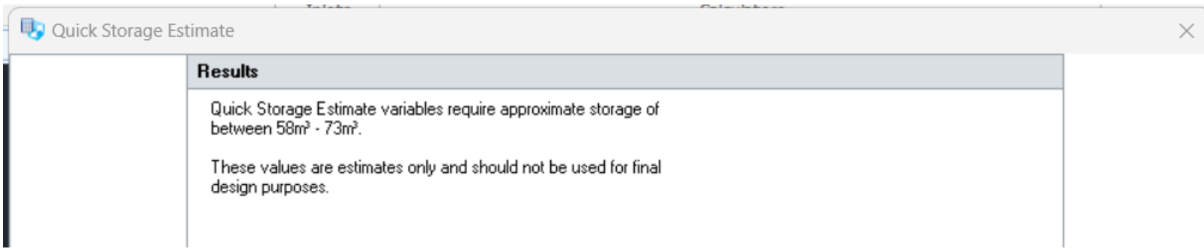




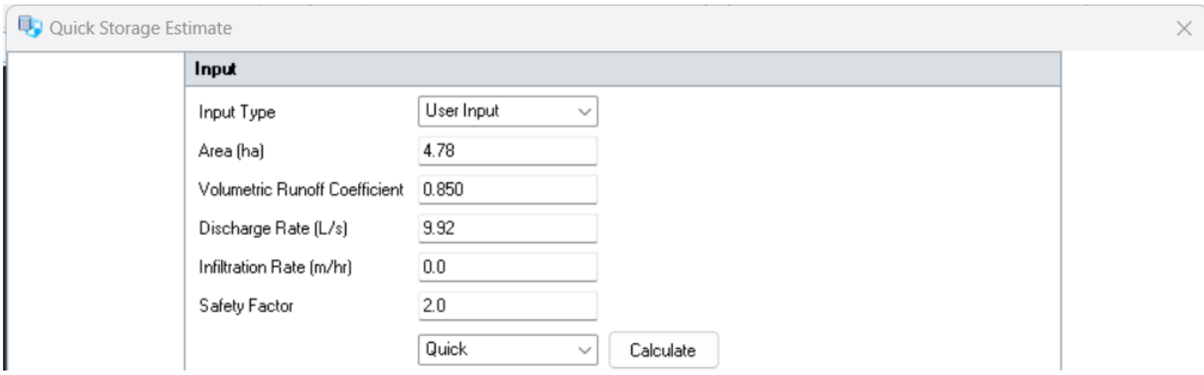
QSE Results

Solar Station Compound BESS Area





Single BESS Compound – Revised Cy of 0.85 Noted



1 in 2 year Results

Quick Storage Estimate

Results

Quick Storage Estimate variables require approximate storage of between 767m³ - 1193m³.

These values are estimates only and should not be used for final design purposes.

1 in 100 year Results

Quick Storage Estimate

Results

Quick Storage Estimate variables require approximate storage of between 4564m³ - 5883m³.

These values are estimates only and should not be used for final design purposes.

Onsite Substation

Quick Storage Estimate

Input

Input Type	User Input
Area (ha)	1.40
Volumetric Runoff Coefficient	1.000
Discharge Rate (L/s)	2.90
Infiltration Rate (m/hr)	0.0
Safety Factor	2.0
	Quick / Calculate

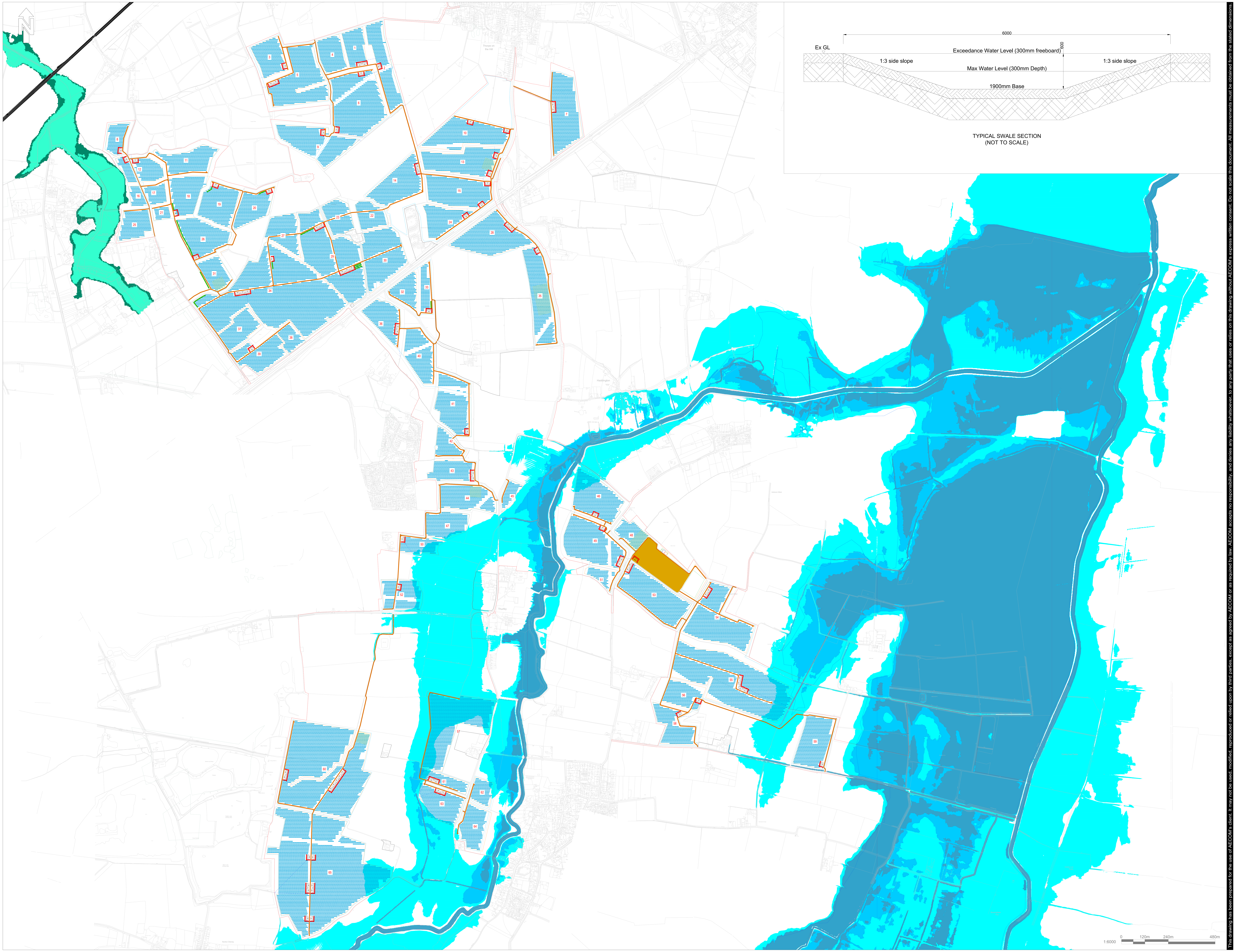
Quick Storage Estimate

Results

Quick Storage Estimate variables require approximate storage of between 1640m³ - 2067m³.

These values are estimates only and should not be used for final design purposes.

Annex C Drainage Strategy General Arrangement



TYPICAL SWALE SECTION
(NOT TO SCALE)

Project Management Initials: Designer: MT Checked: IH Approved: ST

AECOM

PROJECT

Fosse Green Solar

CLIENT

Fosse Green Solar Ltd

CONSULTANT

AECOM
Marlborough Court
10 Bricket Road
St Albans
Herts, AL1 3JX
United Kingdom

T +44 (0)1727 535000
[redacted]

NOTES

1. DO NOT SCALE FROM THIS DRAWING
2. ALL LEVELS SHOWN ARE IN METERS ABOVE ORDNANCE DATUM (AOD) UNLESS STATED OTHERWISE
3. SITE LEVELS BASED ON LiDAR SURVEY IN ABSENCE OF TOPOGRAPHIC SURVEY.
4. SITE BACKGROUND TAKEN FROM OS BASE MAP DATASET AND SHOULD NOT BE USED FOR DETAILED DESIGN PURPOSES
5. THE INFORMATION ON THIS PLAN IS GIVEN WITHOUT OBLIGATION OR WARRANTY. NO LIABILITY OF ANY KIND WHATSOEVER IS ACCEPTED BY AECOM FOR ANY ERRORS OR OMISSIONS. DRAINAGE STRATEGY DESIGN INDICATIVE AND SUBJECT TO CHANGE.
6. SOLAR PV PANEL HEIGHT MIN 600mm ABOVE GROUND LEVEL

LEGEND

- 2015 Model: 1:20 yr Extent (Flood Zone 3b - pre 2022 change to 1:30 yr)
- 2015 Model: 1:100yr + 20% CC
- 2015 Model: 1:1000 yr + 20% CC
- DC COUPLED SOLAR STATION COMPOUND OPTION
- 28 PV MODULES / FIELD NUMBER
- SITE BOUNDARY
- BESS ATTENUATION SWALE
- INFILTRATION SWALE
- PIPED CONNECTION FROM SWALE TO WATERCOURSE
- AC COUPLED BESS OPTION
- TEMPORARY CONSTRUCTION COMPOUND
- ONLINE FLOOD MAPS FOR PLANNING FLOOD ZONE 3
- ONLINE FLOOD MAPS FOR PLANNING FLOOD ZONE 2

SUITABILITY

S2 FOR INFORMATION

ISSUE/REVISION

I/R	DATE	DESCRIPTION
P02	18/10/24	PEIR SUBMISSION
P01	24/10/23	DRAFT FOR CONSULTATION

PROJECT NUMBER

60682158

SHEET TITLE

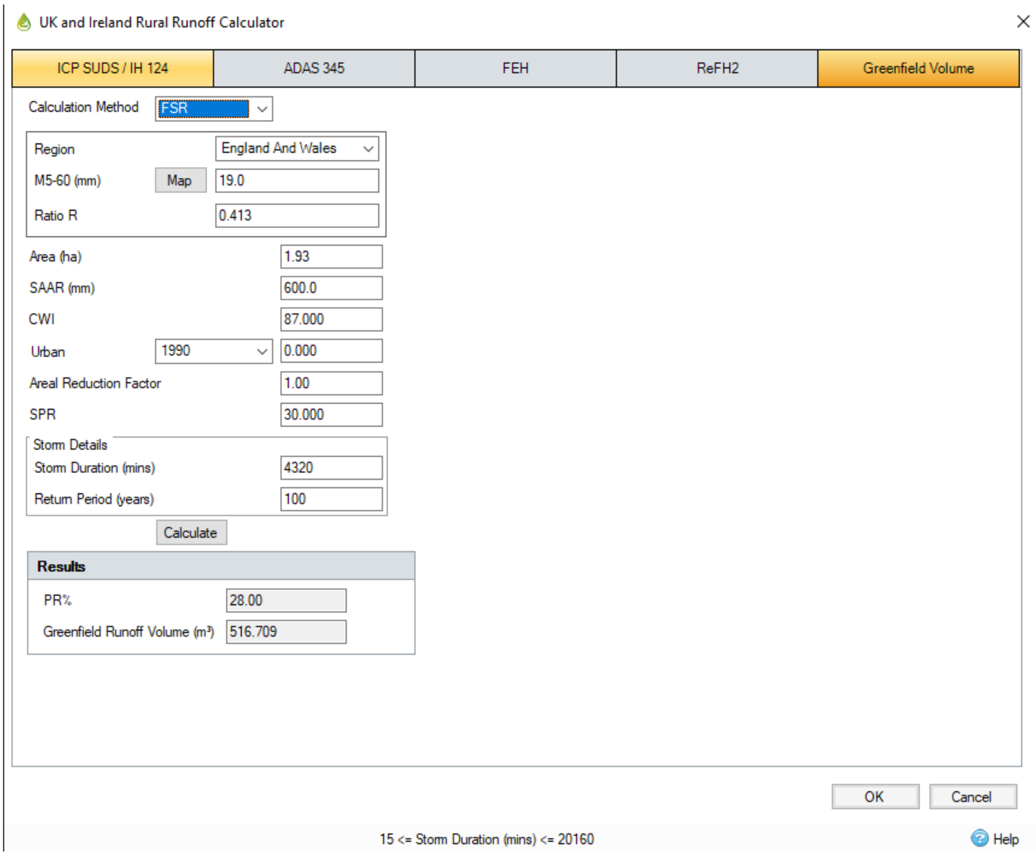
FOSSE GREEN ENERGY SOLAR FARM
DRAINAGE STRATEGY
OVERVIEW

SHEET NUMBER

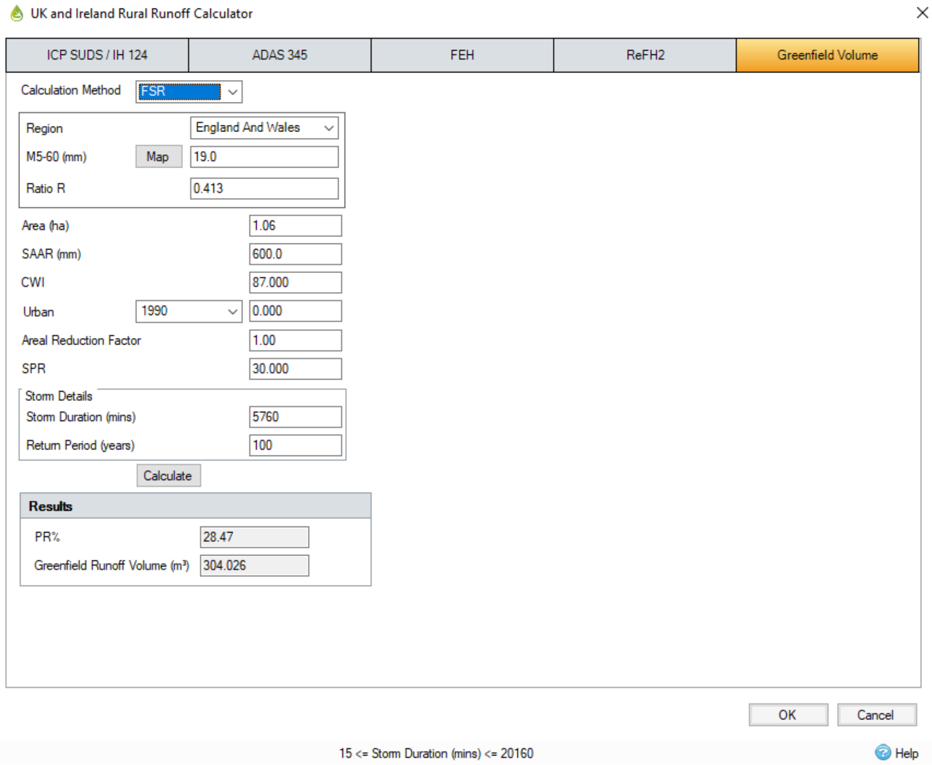
60682158-ACM-ZZ-XX-DR-CE-000000

Annex D Greenfield Runoff Volumes for The Avenue

Field 26



Field 31



Field 34