

Title	Drainage Technical Note
Job Name	Stoneshollow Solar Farm, Barlestone
Job number	23-309
Date	24/03/2023

1 INTRODUCTION

- 1.1.1 This Technical Note has been prepared to support the discharge of Conditions 17 (surface water drainage scheme), 18 (construction surface water management), 19 (maintenance schedule) and 20 (soakage testing) placed upon planning application 21/01395/FUL, which was consented in August 2022.
- 1.1.2 The note is supported by plans and typical details of the features, enclosed with this note.
- 1.1.3 The planning application was supported by a Flood Risk Assessment produced by RPS Group (v001, November 2021), which should be read in conjunction with this note.
- 1.1.4 The FRA included a concept drainage strategy, with mitigation comprising the use of gravel bases to accommodate roof runoff from containerised infrastructure, allowing water to percolate into the ground. This note explains the process of producing more detailed designs based on the FRA concepts.

2 SITE GEOLOGY AND PROPOSALS

2.1 Geology

- 2.1.1 The site is approximately 106ha of agricultural land which is predominantly used for arable and grazing.
- 2.1.2 According to British Geological Survey (BGS) data the site is underlain by mudstone geology which typically has poor permeability. The SoilScapes website defines the soils beneath the site to have impeded drainage.

2.2 Proposals

- 2.2.1 The site proposals include solar panels and associated containerised infrastructure. The containers are approximately 30m² each in area and are proposed to be dispersed across the site. According to the FRA, the combined area of the dispersed containers will measure approximately 0.29ha, which equates to approximately 0.27%

of the total site area. The remaining site will be permeable, covered either by grass or tracks, which will be constructed from permeable materials.

- 2.2.2 Connection to the grid will be facilitated by a sub-surface cable. As this will be a buried service that predominantly follows existing roads, it will have negligible impact on drainage once installed and likewise has not been considered by this note.
- 2.2.3 Construction will be facilitated by a temporary construction compound area. The drainage implications of which are the subject of Condition 18 and therefore included in this note.
- 2.2.4 The site layout plan is enclosed with this note.
- 2.2.5 The anticipated lifetime of the proposed infrastructure is 40 years.

3 CONDITION 20

3.1.1 Condition 20 states:

"No development approved by this planning application shall take place until such time as infiltration testing has been carried out (or suitable evidence to preclude testing) to confirm or otherwise, the suitability of the site for the use of infiltration as a drainage element, has been submitted to and approved in writing by the Local Planning Authority."

- 3.1.2 Given the permeability of the underlying ground is fundamental to the drainage methodology, Condition 20 has been addressed first by this note.
- 3.1.3 As explained above, the geology beneath the site is likely to have relatively low rates of infiltration.
- 3.1.4 The concept drainage strategy described in the FRA proposed to direct runoff to gravel bases beneath the containers, allowing water to slowly soak to the ground as per the existing situation. The methodology and calculations used in this note will account for the likely low infiltration rates and as a result will not need to be informed by specific soakage testing.
- 3.1.5 The above approach has been agreed with the LLFA, with relevant correspondence enclosed with this note.

4 CONDITION 17

4.1.1 Condition 17 states:

"No development approved by this planning permission shall take place until such time as a surface water drainage scheme has been submitted to, and approved in writing, by the Local Planning Authority"

4.1.2 The FRA proposed a drainage scheme that would encourage surface water from the very limited hardstanding across the site to be drained to ground. This replicates the existing situation and is the most preferred option by the SuDS hierarchy.

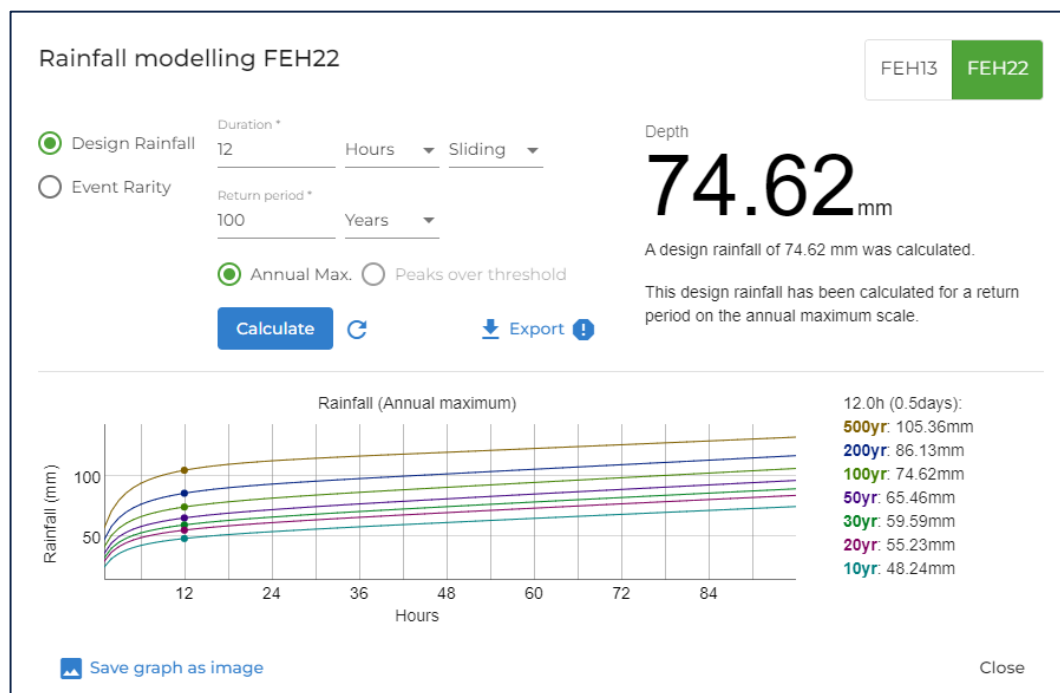
4.1.3 The gravel bases would discharge water via natural soakage rather than a fitted outfall. However, as discussed above, it is assumed that infiltration rates in the underlying ground would be very low. Therefore, the gravel bases have been sized to store runoff generated during a 1 in 100 year, 12 hour storm, inclusive of climate change and with no infiltration or outflow allowance in the calculations.

4.1.4 If infiltration is higher than expected on the site, then the proposed gravel bases would provide further capacity.

4.2 Storage Requirements

4.2.1 To calculate the volume of runoff generated from the containers during the 1 in 100 year, 12 hour storm, the Depth-Duration-Frequency model in the Flood Estimation Handbook (FEH) was used. The FEH predicted rainfall depth for the present day is 74.62mm, as shown in Figure 4-1.

Figure 4-1 Depth-Duration Curve Model Results



- 4.2.2 In accordance with the NPPF and the Flood Risk and Coastal Change PPG, an allowance for climate change must be applied to the design rainfall. The proposed site is estimated to have an anticipated lifetime of 40 years. The site lies within the Tame Anker and Mease Management Catchment. For a development with a 40-year lifetime, the central allowance for the 2070s epoch is applied. This equates to a 25% uplift in rainfall rates. Therefore, the 1 in 100 year, 12 hour + 25% (the design event) rainfall depth is 93.28mm.
- 4.2.3 The footprint areas of all containers will be 29.74m², which will result in a runoff volume of approximately 2.8m³ during a design event.
- 4.2.4 The gravel bases would be lined by a permeable geomembrane and extend at least 300mm on all sides of the infrastructure, forming a minimum area 34.22m². The bases would have depths of 300mm and porosity of 0.3, resulting in a storage capacity of 3.1m³.
- 4.2.5 Typical details of the proposed containers are enclosed with this note.
- 4.2.6 The above approach was agreed in principle with the Lead Local Flood Authority (LLFA), relevant correspondence is enclosed with this note.

4.3 Design for Exceedance

- 4.3.1 As demonstrated above, the storage capacity of the gravel beds would exceed the volume of runoff in a design event, providing some additional capacity for an exceedance event.
- 4.3.2 In the unlikely event the capacity of the beds was exceeded, water would slowly dissipate overland onto surrounding grassed areas, where it would absorb into the ground as per the existing site.
- 4.3.3 The proposed infrastructure would be raised on plinths or pads which would prevent flood damage in an exceedance event, as shown in the typical details enclosed with this note.

5 CONDITION 18

5.1.1 Condition 18 states:

"No development approved by this planning permission shall take place until such time as details in relation to the management of surface water on site during construction has been submitted to, and approved in writing, by the Local Planning Authority"

5.1.2 The proposed temporary construction compound will be formed from permeable gravel or hardcore material, similar to the proposed access tracks. Therefore, rain falling on the surface will percolate into the ground as per the existing situation. Given the compound would be a temporary measure, and would be replaced with panels and grassed following completion of construction, it is unlikely that the gravel would become significantly clogged with silt to render it ineffective. The proposed maintenance, outlined in Section 6 will further reduce this risk. As a result, no further mitigation of surface water from the compound is required.

5.1.3 During the construction of the solar farm there is potential for soil compaction and erosion through vehicular movements. It is recommended that these effects are duly considered as part of the Construction Environmental Management Plan.

5.1.4 It is recommended that following measures are considered:

- Construction, and use, of internal access tracks early in the process;
- Use of low tyre pressure machinery to reduce compaction;
- A delivery and construction schedule that minimises repeat journeys; and
- Temporary measures such as sediment traps using geotextiles, straw and temporary bunding.

5.1.5 Where the soil has been disturbed as part of the construction process it is recommended that the soil is adequately prepared for seeding. Tillage (mechanical loosening) may be advisable where the soil is compacted. This should be carried out to target the specific depth and location of any observed compaction and minimise disturbance elsewhere. A native seed mix should be used which allows for rapid establishments of ground cover. The seed mix should, where possible, include plants with a diversity of root structures. It is also recommended that consideration is given to including species that are particularly effective at breaking up compacted soil and increasing soil organic matter content.

6 CONDITION 19

6.1.1 Condition 19 states:

"Prior to first use of the development approved by this planning permission, details in relation to the long-term maintenance of the surface water drainage system within the development are to be submitted to and approved in writing by the Local Planning Authority".

6.1.2 The primary method of managing surface water on the site will be to allow water to pass through permeable gravel and soak into the ground. This will be either as the formation of access tracks and the construction compound, or as the base beneath containerised infrastructure. The infrastructure will be maintained for the duration of the design life of the development in accordance with the recommendations in the CIRIA Suds Manual (C753), summarised in Table 6-1.

6.1.3 The responsibility for undertaking the maintenance will rest with the operator.

Table 6-1 Gravel Beds Maintenance

Maintenance Schedule	Action	Frequency
Regular maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action.	Monthly for 3 months, then annually
	Remove debris from the surface where it may affect performance	Monthly
Remedial actions	Replacement of clogged geotextile (reconstruct filter bed where required)	As required

7 SUMMARY

7.1.1 Calibro has been appointed to discharge Conditions 17 – 20 placed upon planning application 21/01395/FUL, which was consented in August 2022. The conditions relate to the management of surface water drainage on the site.

7.1.2 Due to the underlying ground conditions, it is presumed that the infiltration rates on the site would be very low. Therefore the methodology used to address the conditions takes a conservative approach and makes no allowance for infiltration in the calculations. As a result, no soakage testing is required.

7.1.3 The vast majority of the site will be grass covered with solar arrays. The arrays will allow rainwater to fall onto the grass and absorb into the ground. The cessation of intensive agricultural practices, including ploughing of arable fields, will result in a betterment in terms of runoff and soil erosion.

- 7.1.4 The access tracks and temporary construction compound will be formed from permeable gravel and therefore allow rainfall to percolate into the ground as per the existing site with no further mitigation required.
- 7.1.5 The only hardstanding on site will be dispersed containerised infrastructure such as inverters, spare parts containers and batteries. Their combined area will cover less than 0.3% of the site area. To mitigate potential impacts on surface water, runoff from their roofs will be directed to gravel bases, which will be wrapped in permeable membranes to allow water to soak into the ground as per the existing site.
- 7.1.6 The gravel bases have been sized to accommodate runoff during a design rainfall event, i.e., 1 in 100 year, 12 hour duration storm with a 25% uplift to allow for the impacts of climate change. Bases that are 300mm deep and extend at least 300mm from the edge of the containers will provide more storage than the volume of runoff generated in a design event, to allow for exceedance.
- 7.1.7 In the unlikely event the capacity of the bases were exceeded, water would slowly disperse across grassed areas to soak into the ground, as per the existing site. The containers would be raised on plinths to negate the risk of damage to them.
- 7.1.8 All infrastructure will be maintained by the operator in accordance with the recommendations in the CIRIA SuDS Manual.

Enclosures

Proposed Site Layout Plan

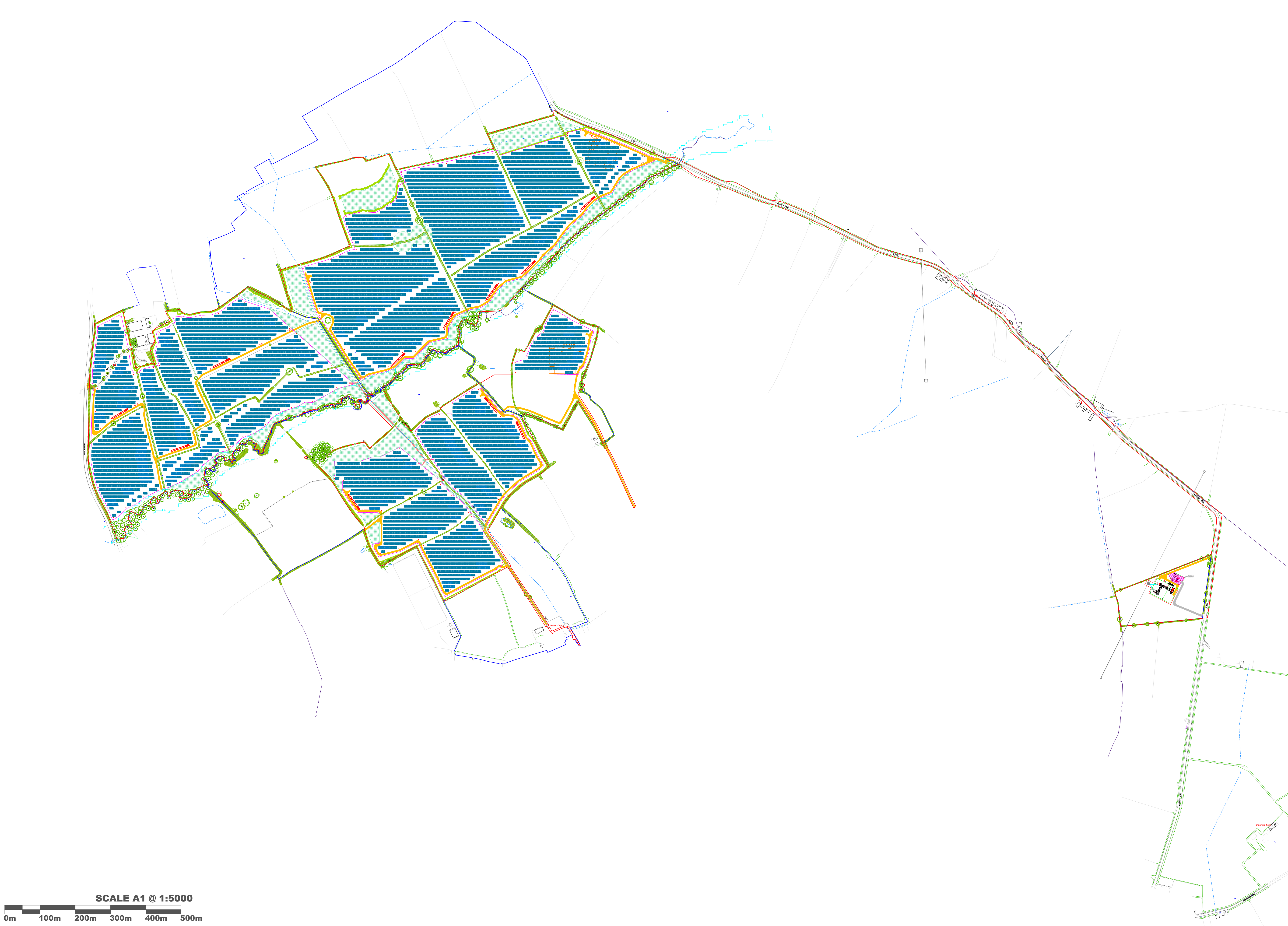
Inverter Station Typical Detail

Spares Container Typical Detail

Customer Switchgear Typical Details

Battery Station Typical Details

LLFA Correspondence



REVISIONS:

- Initial design

Legend:

- Inverter
- Battery stations
- Spare containers
- Customer switchgear container
- Solar panels
- Deer Fencing
- Water courses and water bodies
- Rights of Way
- Wildlife Enhancement Area
- Construction Compound
- CCTV Cameras
- Cable route
- Access road
- Existing road
- Temporary road
- Landholder's Property
- Access gate
- Tree Root protection areas
- Tree and hedge planting/enhancement
- Banks
- Local Authority Border
- Planning Redline



DATE: 31 May 2022

TITLE:
Stoneshollow PV layout

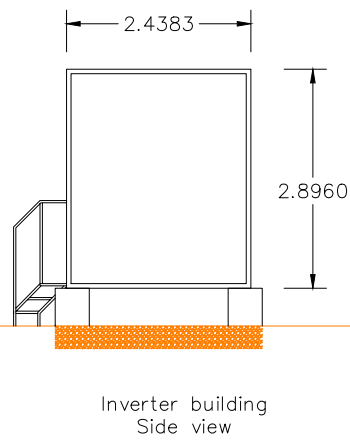
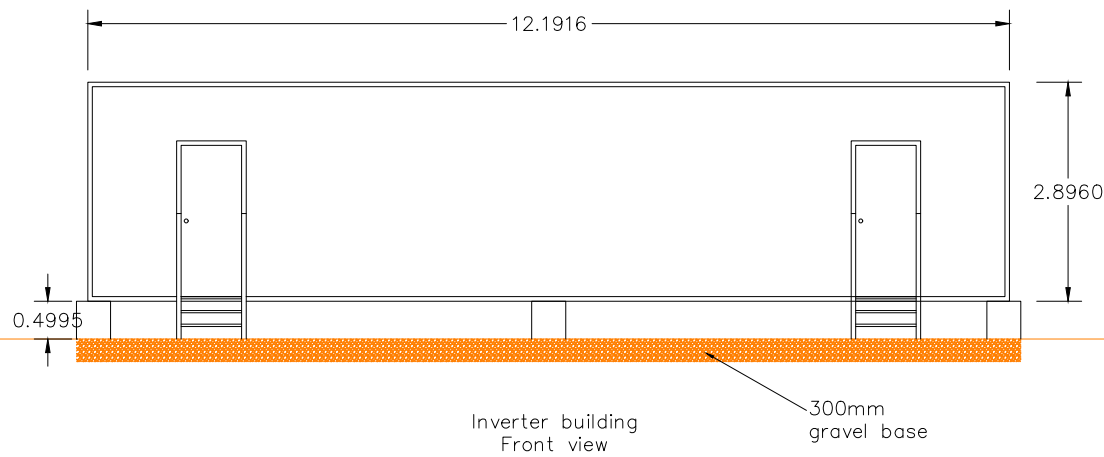
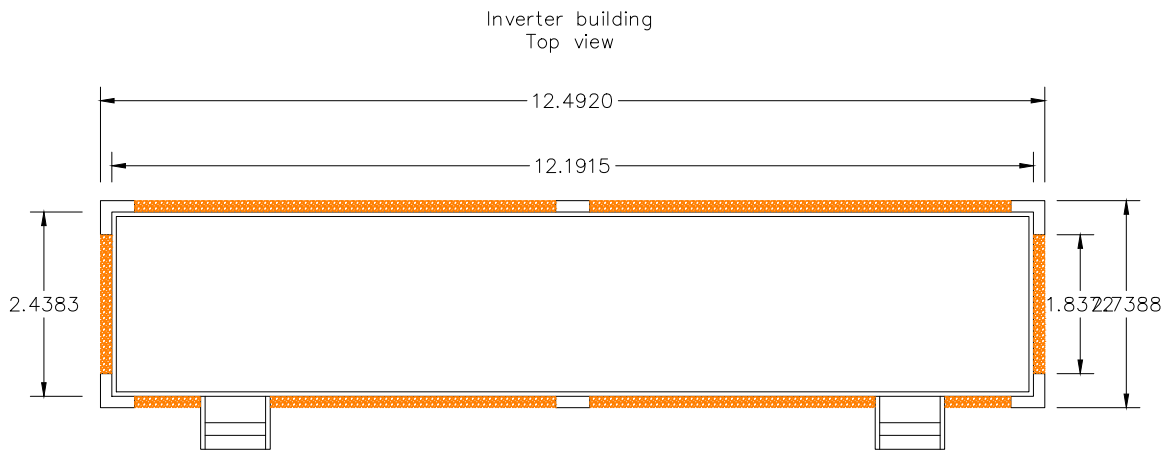
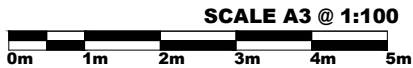
PROJECT TITLE:
Stoneshollow

LOCATION:
CV13 0EH

CONFIGURATION:
Typical fixed tilt table

49.9 MW

REV:	A
FILENAME: 20210906_A017_3P495.dwg	



NOTES

1. All details are indicative only.
2. Dimensions are in metres unless stated otherwise.

LEGEND

DETAILS

TITLE	Battery Storage System
REVISION	A

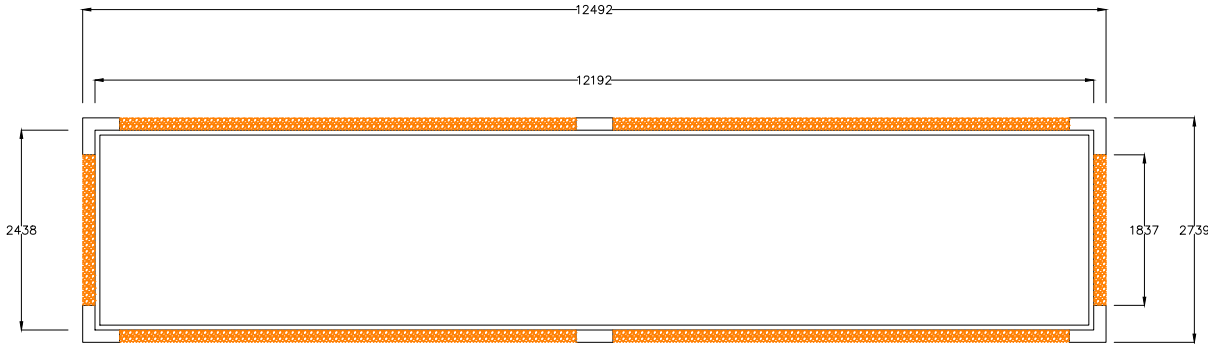
JBM
SOLAR

NOTES

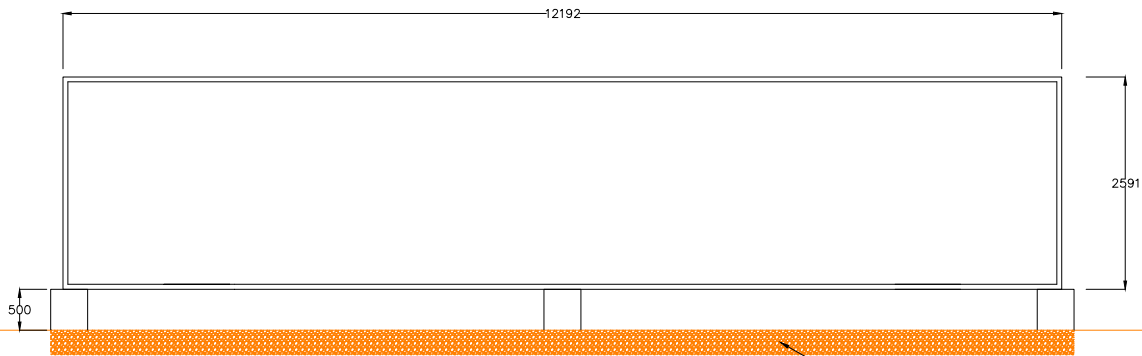
- 1. All details are indicative only.
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LEGEND

Spares container
Top view

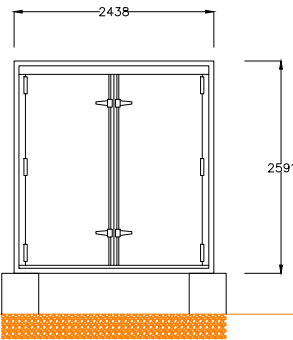


Spares container
Front view



300mm
gravel base

Spares container
Side view



SCALE A3 @ 1:100



JBM
SOLAR

DETAILS

TITLE
Typical Spares Container

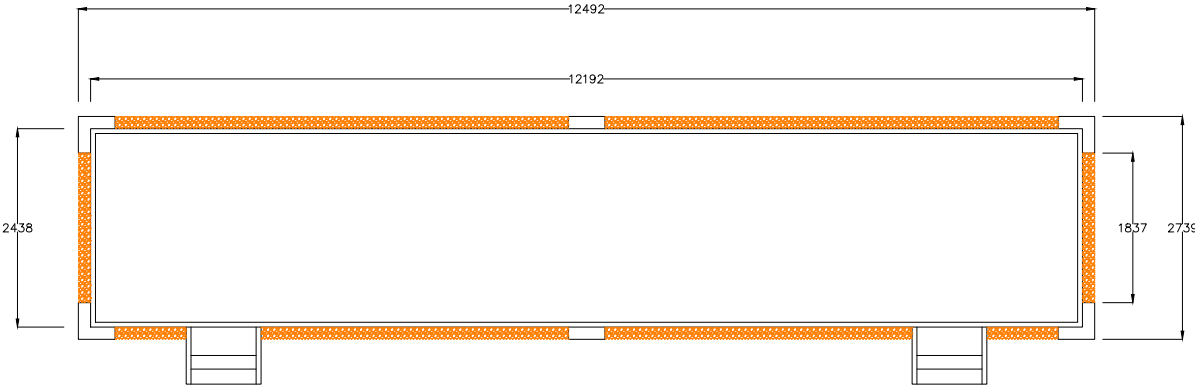
REVISION
A

NOTES

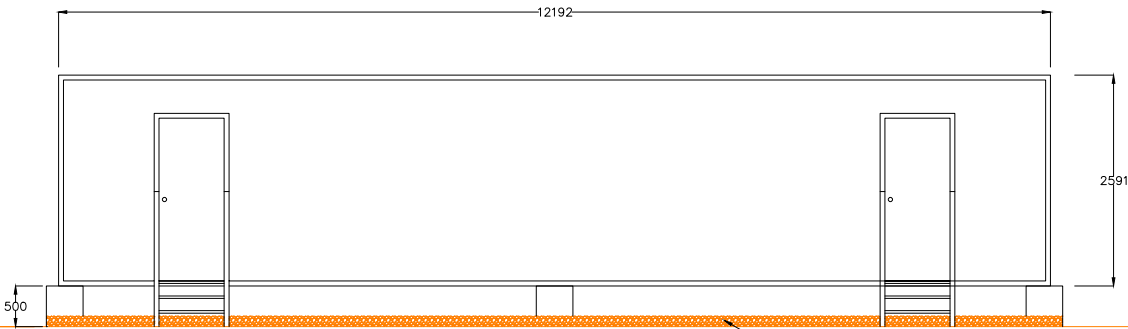
- 1. All details are indicative only.
- 2. Dimensions are in metres unless stated otherwise.

LEGEND

Customer switchgear
Top view

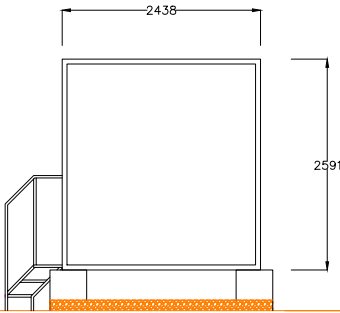


Customer switchgear
Front view



300mm
gravel base

Customer switchgear
Side view



SCALE A3 @ 1:100



JBM
SOLAR

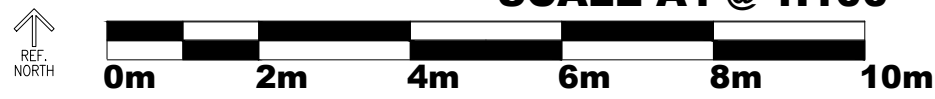
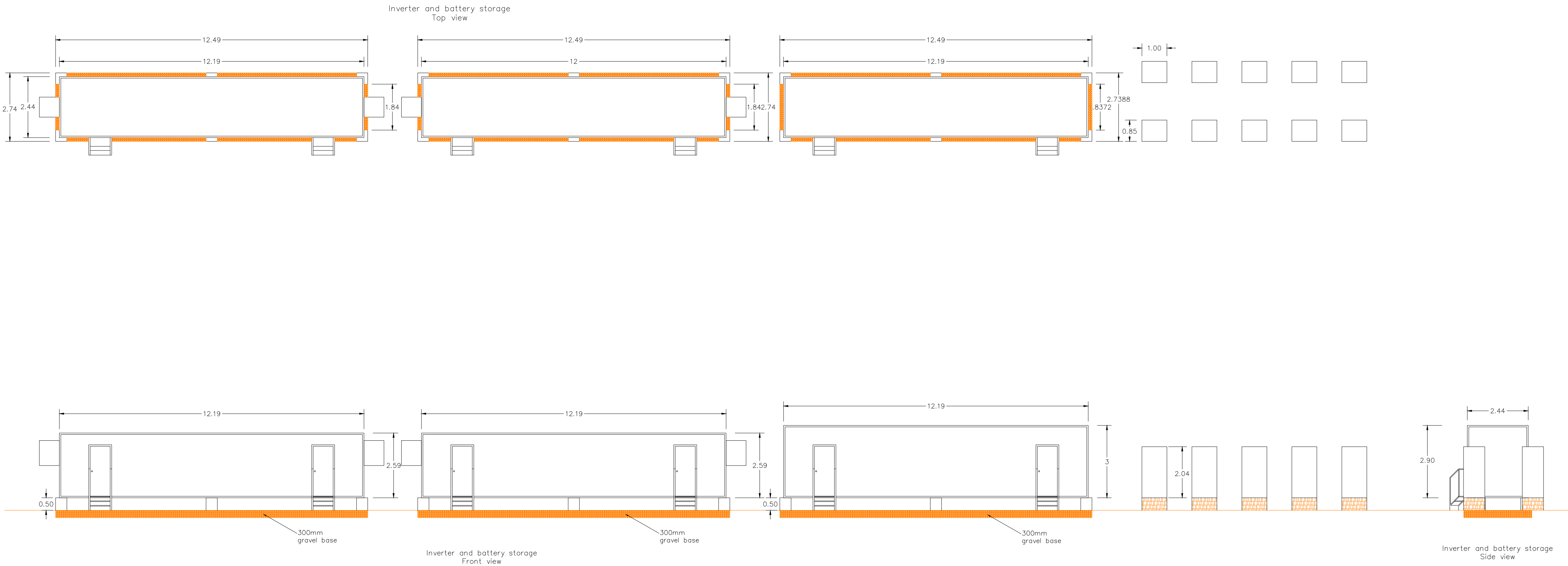
DETAILS

TITLE	typical Customer Switchgear
REVISION	A

NOTES

1. All details are indicative only.
2. Dimensions are in metres unless stated otherwise.

LEGEND



DETAILS

TITLE Typical battery station linear

REVISION A

JBM
SOLAR

Patrick Goodey

From: Jack Harriman <Jack.Harriman@leics.gov.uk>
Sent: 20 March 2023 11:39
To: Patrick Goodey
Subject: RE: [CAL: 23-309] Solar Farm - Washpit Lane, Barlestone - conditions discharge
Categories: Scanned by Gekko

Hi Patrick,

Having reviewed your email I advise that due to the nature of the development and the lack of positively drained system that the submission of material to support the design outlined above in an application to discharge condition 20 would be acceptable to the LLFA. It is presumed the design material required will be provided in the discharge of condition 17.

Jack Harriman
Technician (Flood Risk Management)
Unison Workplace Rep
Environment & Transport Department
Leicestershire County Council
Tel: 0116 305 2261

www.flooding@leics.gov.uk

www.leicestershire.gov.uk/planning-and-environment/flooding-and-drainage

From: Patrick Goodey <patrick.goodey@calibro-consultants.com>
Sent: 07 March 2023 14:38
To: Flooding <Flooding@leics.gov.uk>
Subject: [CAL: 23-309] Solar Farm - Washpit Lane, Barlestone - conditions discharge

CAUTION: This email originated from outside of the organisation. Do not click links or open attachments unless you recognise the sender and know the content is safe.

Hi,

We are supporting our client with the discharge of Conditions 17 - 20 placed upon the Hinckley and Bosworth BC decision notice for a proposed solar farm at Washpit Lane between Barlestone and Nailstone. The planning ref is 21/01395/FUL. The decision notice and your response are attached.

The FRA confirmed that the only hardstanding on site would be the dispersed containerised infrastructure (e.g., battery storage, spares containers etc.). Runoff from these is proposed to be stored in 300mm deep gravel base prior to soakage into the ground. Access tracks would be formed from permeable materials, as demonstrated in the FRA, so we wouldn't consider these in the condition application.

We propose to confirm the gravel base dimensions required by calculating the runoff from the containers during a 1 in 100 year +25% (to account for 40 years of climate change, consistent with the Tame Anker and Mease management catchment), 1 hour duration storm. We will presume a porosity of 0.3.

It is noted the soils are likely to have low soakage rates (BGS suggests mudstones and Soilscape suggests slowly permeable clays). Please confirm that reference to these datasets is sufficient to address condition 20?

Given the low permeability of the ground, we will allow for some freeboard above the design event. In the unlikely event the gravel base storage is exceeded, surcharged water would flow in a dispersed manner overland across grassed areas as per the existing site or the antecedent conditions.

Please confirm that the above approach would be acceptable to you.

I'm happy to discuss if it's easier, my numbers are provided below.

Thanks
Patrick

Patrick Goodey BSc MSc
Principal Flood Risk Consultant



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