Outline Surface Water Drainage Strategy

Land to the West of Marden

Final Report

February 2022

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Revision History

Revision Ref/Date	Amendments	Issued to
P01 / November 2021	Draft Report	Donna Clarke (Origin Power Services Limited)
P02 / February 2022	Draft Report (revision of site layout)	Donna Clarke (Origin Power Services Limited)
C01 / February 2022	Final Report	Donna Clarke (Origin Power Services Limited)

Contract

This report describes work commissioned by Donna Clarke of Origin Power Services Ltd by an email dated 07 July 2021. Tom Smith of JBA Consulting carried out this work.

Subsequent to the preparation of the initial report, JBA was instructed to complete amendments to the outline Surface Water Drainage Strategy to reflect revisions to the site layout. The most notable changes include alterations to impermeable surfacing associated with the DNO/Customer HV and BESS compounds. The additional tasks were commissioned by Donna Clarke of Origin Power Services Ltd by an email dated 13th January 2022. Tom Smith carried out this work.

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Purpose

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Executive summary

JBA Consulting was commissioned by Donna Clarke of Origin Power Services Ltd in July 2021 to prepare an outline Surface Water Drainage Strategy to support a planning application for development of a solar energy farm at Land to the West of Marden, Kent. In January 2022, following receipt of the initial draft drainage strategy report, JBA were requested to revise the report, and associated MicroDrainage calculations, to reflect provision of new DNO/Customer HV and BESS Compound layouts. This report details the revised Surface Water Drainage scheme.

The proposed development site is approximately 74.5ha in size and is situated to the north of Sheephurst Lane, some 0.74km to the west of Marden. The site is currently occupied by agricultural fields thus considered greenfield land.

The proposed planning application relates to development of a solar energy farm including installation of photovoltaic panels and, construction of a DNO/Customer HV Compound, BESS Compound and site access roads.

Post development the total impermeable area at the site will amount to 750m^2, comprising 209m^2 of hardstanding associated with the DNO/Customer HV Compound and 541m^2 of roof area associated with the BESS Compound.

It is understood that the individual solar panels will drain directly onto the ground and the site access roads will be underlain by permeable gravel surfaces (MOT Type 3 or similar).

Considering the size of the site and the fact that the DNO/Customer HV Compound and BESS Compound are proposed to be located on opposite sides of the solar energy farm it is proposed to install two separate outfalls to two separate watercourses. Within this strategy the DNO/Customer HV Compound and BESS Compound areas have been referred to as Catchment One and Catchment Two, respectively.

Catchment One:

It is understood that the majority of the DNO/Customer HV Compound will remain underlain by permeable surfacing post development. Therefore, attenuation storage sizing for DNO/Customer HV Compound has been based on slab runoff and roof runoff only, amounting to a total area of 209m^2.

Precipitation which lands upon the impermeable slab within the Customer Compound and upon roof areas associated with the Transformation Station and Switchgear Station will be directed towards several filter drains. Water within the filter drains will be conveyed in a northerly direction towards a vegetated swale. From the swale any attenuated water will be gradually discharged to an ordinary watercourse at a controlled rate of 1.5 l/s via a flow control device (hydro-brake or similar).

The main purpose of the swale will be to provide sufficient attenuation for all surface water runoff generated by Catchment One however, the use of above ground SuDS will also provide ecological and amenity benefits.

Calculations indicate that approximately 7.8m^3 of storage will be required to accommodate all runoff from 209m^2 of impermeable surfacing during the 1 in 100-year storm plus 40% climate change event, whilst limiting discharge to 1.5 l/s.

Preliminary calculations indicate that a swale with a length of 40m, base width of 1.0m, longitudinal gradient of 1:200 and 1:3 side slope will provide sufficient accommodation for all runoff generated by impermeable surfacing in Catchment One during the 1 in 100-year storm plus 40% climate change event.

Catchment Two

It is proposed that runoff from all impermeable surfaces associated with the BESS Compound will be directed into a swale located adjacent north of the development. The main purpose of the swale will be to provide sufficient attenuation for all surface water runoff generated by Catchment Two however, the use of above ground SuDS will also provide ecological and amenity benefits.

Calculations indicate that approximately 25.9m^3 of storage will be required to accommodate all runoff from 541m^2 of impermeable surfacing during the 1 in 100-year storm plus 40% climate change event, whilst limiting discharge to 1.5 l/s.

Preliminary calculations indicate that a swale with dimensions of 40m long x 1.0m wide (at the base) x 1.0m deep will provide sufficient accommodation for all runoff generated from 328m^2 of impermeable surfacing during the 1 in 100-year storm plus 40% climate change event.

The proposed SuDS components will provide sufficient treatment to runoff from the proposed development which has been demonstrated using the simple-index approach.

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Abbreviations

AEP	Annual Exceedance Probability
FEH	Flood Estimation Handbook
FRA	Flood Risk Assessment
FSR	Flood Studies Report
Ha	Hectare
LIDAR	Light Detection and Ranging
m AOD	metres Above Ordnance Datum
NPPF	National Planning Policy Framework
SAAR	Standard Annual Average Rainfall
SFRA	Strategic Flood Risk Assessment
SuDS	Sustainable Drainage Systems
SWDS	Surface Water Drainage Strategy
SWMP	Surface Water Management Plan
TSS	Total Suspended Solids

1 Introduction

1.1 Terms of Reference

JBA Consulting was commissioned by Donna Clarke of Origin Power Services Ltd in July 2021 to prepare an outline Surface Water Drainage Strategy to support a planning application for development of a solar energy farm at Land to the West of Marden, Kent.

In January 2022, following receipt of the initial draft drainage strategy report, JBA were requested to revise the drainage strategy, and associated MicroDrainage calculations, to reflect provision of new DNO/Customer HV and BESS Compound layouts. This report details the revised Surface Water Drainage scheme.

The site is currently vacant and comprises agricultural land. According to plans provided by the client, the proposals include installation of photovoltaic panels across the majority of the site along with construction of a DNO/Customer HV Compound, a BESS Compound and access roads.

1.2 Site Description

The proposed development site is approximately 74.5ha in size and is situated to the north of Sheephurst Lane, some 0.74km to the west of Marden. The site is currently occupied by agricultural fields thus considered greenfield land.

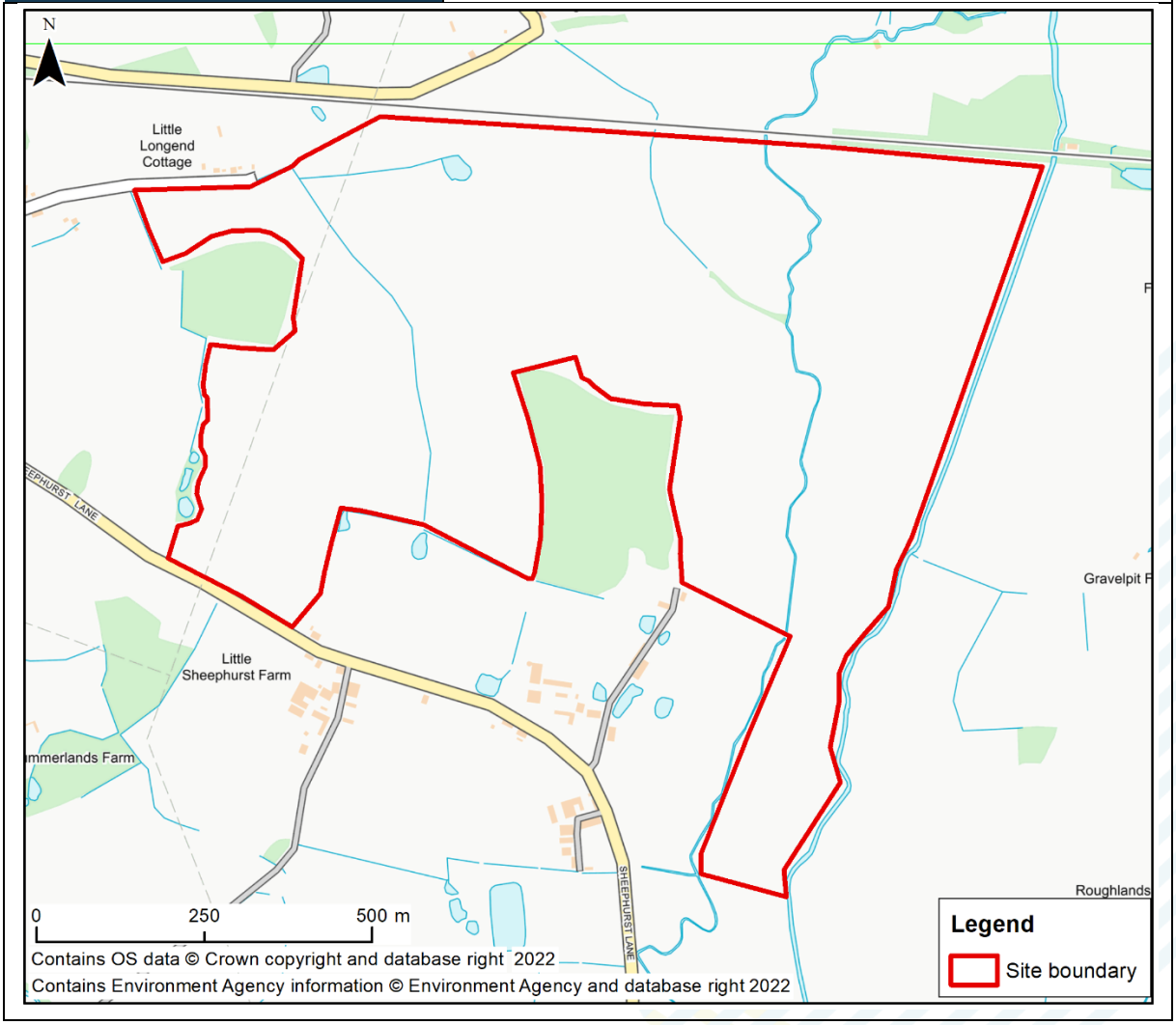
Having reviewed aerial imagery, the north of the site is bound by a railway track with Sheephurst Lane adjacent to the south. Agricultural fields extend beyond the site to the west with a number of residential dwellings located adjacent north west along Burtons Lane.

The Lesser Teise flows along the eastern periphery of the red outline application boundary with the River Teise situated some 0.65km to the south.

A summary of the site details has been included in Table 1-1.

Table 1-1: Summary of site details

Site name	Land to the West of Marden, Kent TN12 9NP
Site area	Approximately 74.5ha
Existing land use	Greenfield – Agricultural Land
Proposal	Development of a solar energy farm
OS NGR	TQ7259044548
Country	England (NPPF applies)
Local Planning Authority	Kent County Council
Lead Local Flood Authority	Kent County Council
Sewerage Undertaker	Southern Water



1.3 Development Proposal

The proposed planning application relates to development of a solar energy farm including installation of photovoltaic panels and, construction of a DNO/Customer HV Compound, BESS Compound and site access roads.

According to plans provided the compound areas will comprise of the following:

- DNO Compound
- Customers Compound

- Transformation Station
- Switchgear Station
- LV Switchboard
- Comms Room
- Aux TX
- Batteries
- 15MW/33MWH Energy Storage Barn

Post development the total impermeable area at site will amount to 750m^2, comprising 209m^2 of hardstanding associated with the DNO/Customer HV Compound and 541m^2 of impermeable surfacing associated with the BESS Compound.

It is understood that the individual solar panels will drain directly onto the ground and the site access roads will be underlain by permeable gravel surfaces (MOT Type 3 or similar).

Additionally, it is understood that the majority of the DNO/Customer HV Compound will remain underlain by permeable surfacing post development. Therefore, attenuation storage sizing for DNO/Customer HV Compound has been based on slab runoff and roof runoff only.

Given that the development will introduce impermeable surfacing at the site, SuDS will be incorporated within the scheme to manage post development runoff. Attenuation sizing within the strategy has been based on a total impermeable area of 750m^2.

Proposed plans are shown in Appendix A.

2 Details of Proposed Development Site

2.1 Site Topography

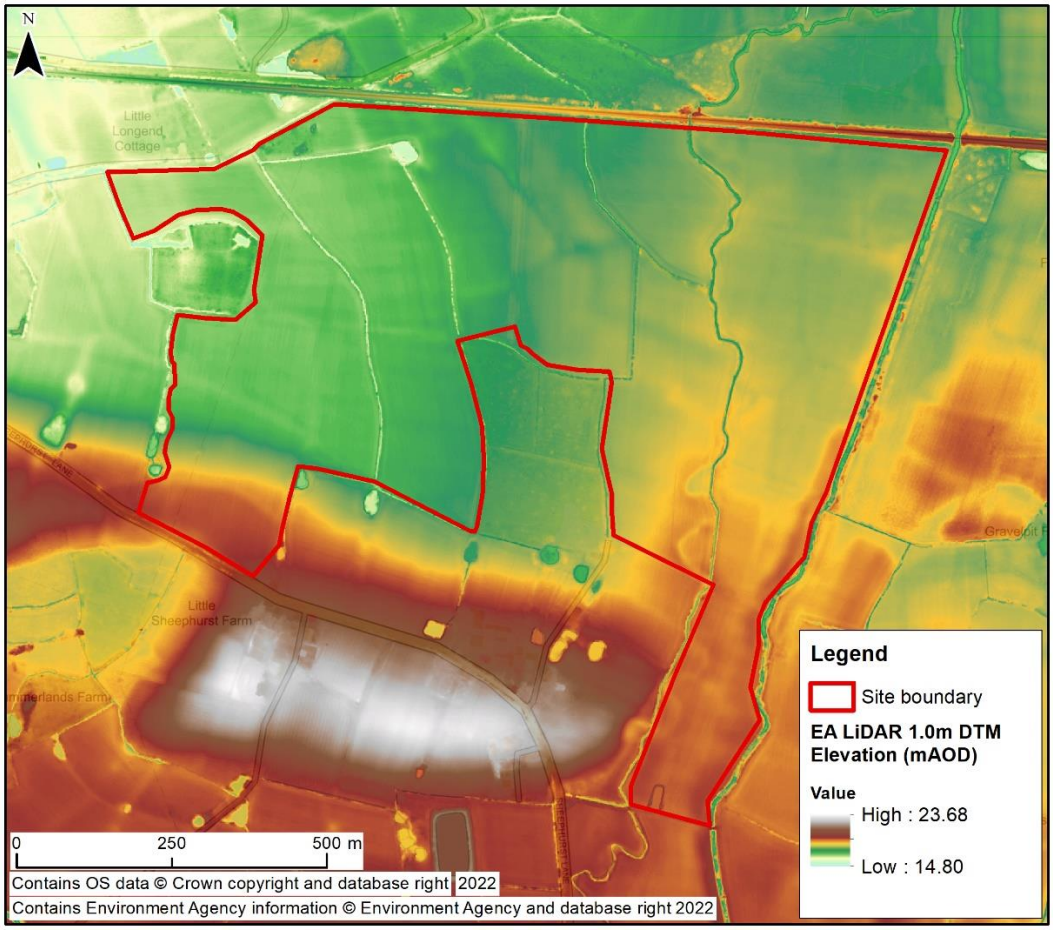
A topographic survey was undertaken at the site by Above Surveying Ltd in October 2021 and provided by the client for inclusion within this report. The survey indicates that the site has a 5.50m gradient and generally slopes down from land along the southern boundary towards the north-western corner. Topographic levels within the red outline boundary are reported to range between 16.50m AOD and 22.00m AOD.

According to development plans provided by the client, the proposed DNO/Customer HV Compound in the south-west of the site will be constructed upon land with an approximate elevation of between 18.25m AOD and 19.00m AOD. In addition, the BESS Compound will be constructed upon land with an approximate elevation of 19.25m AOD.

1.0m LIDAR elevation data obtained from the Environment Agency indicates that land to the south is elevated higher than the site. Having reviewed EA topographic data, the site appears to be located on the edge of a plateau with land at the site and within the surrounding area sloping in the northerly direction towards the railway embankment.

Figure 2-1 shows the topography of the site and the surrounding area, using Environment Agency 1.0m LIDAR DTM. The topographic survey is included in Appendix B.

Figure 2-1: Topography of proposed development site and surrounding area



2.2 Geology

The British Geological Survey's (BGS) Geology of Britain Viewer[1] indicates that the proposed development site is located upon Weald Clay Formation (Mudstone) bedrock geology. This Lithology is characterised by dark grey thinly-bedded shales and mudstones with subordinate siltstones, sandstones (including Horsham Stone Member), shelly limestones and clay ironstones.

According to BGS mapping the site is also underlain by superficial deposits comprising River Terrace Deposits (Clay and Silt) and Alluvium (Clay, Silt, Sand and Peat). Review of Cranfield Soilscapes online viewer indicates that the site is underlain by loamy and clayey floodplain soils with naturally high groundwater.

Given that online records suggested that high groundwater may be present beneath the site, in-situ groundwater monitoring was undertaken in August 2021 by Southern Testing to establish the true, resting groundwater level beneath the site.

Four machine dug trial pits were excavated across the site, positioned within the areas proposed to be developed as the compound and access road, to a depth of between 2.50 and 3.10mbgl. The general geological profile encountered within the machine excavated trial pits was summarised by Southern Testing as follows:

Depth (m)	Thickness (m)	Soil Type	Description
GL – 0.2/0.3	0.2 – 0.3	Topsoil	Dark brown silty clay TOPSOIL with rootlets.
0.2/0.3 – 0.5/0.7	0.3 – 0.4	Subsoil	Firm pale brown slightly silty CLAY with rootlets.
0.5 – 2.7/2.9	2.2	Clay	Stiff and very stiff pale grey mottle dark brown CLAY becoming laminated at depth.
1.4 – 2.1/2.9 (TP03 and TP04 only – refer to appendix D)	0.7 – 1.5	Gravel	Pale brown and dark orange brown silty sandy GRAVEL. Gravel is fine to medium flat SILTSTONE, SANDSTONE and rounded flint with some black ironstaining.
2.5/2.6-2.53/2.63 (TP01 and TP02 only – refer to appendix D)	0.03	Limestone	Dark grey and cream shelly LIMESTONE band.
2.7/2.9 – 3.0/3.1+	0.3+	Clay/ Mudstone	Stiff and very stiff pale blue grey fissured CLAY (becoming weak MUDSTONE at base of pit is TP01 and TP02)

[1] British Geological Survey. Geology of Britain viewer http://mapapps.bgs.ac.uk/geologyofbritain/home.html?

Southern Testing also reported that groundwater was encountered within all the trial pits ranging from 2.00mbgl in TP04 to 2.90mbgl in TP02.

Given that the underlying strata, above the resting groundwater level, comprises clay the site is not considered suitable for infiltration SuDS drainage and an alternative means of surface water discharge will be required.

2.3 Watercourses

Several drains have been identified throughout the site (refer to Figure 2-2). These are classified as ordinary watercourses, managed by the Upper Medway Internal Drainage Board (IDB), and follow the topographic profile of the site, generally flowing in a northerly direction towards the railway embankment.

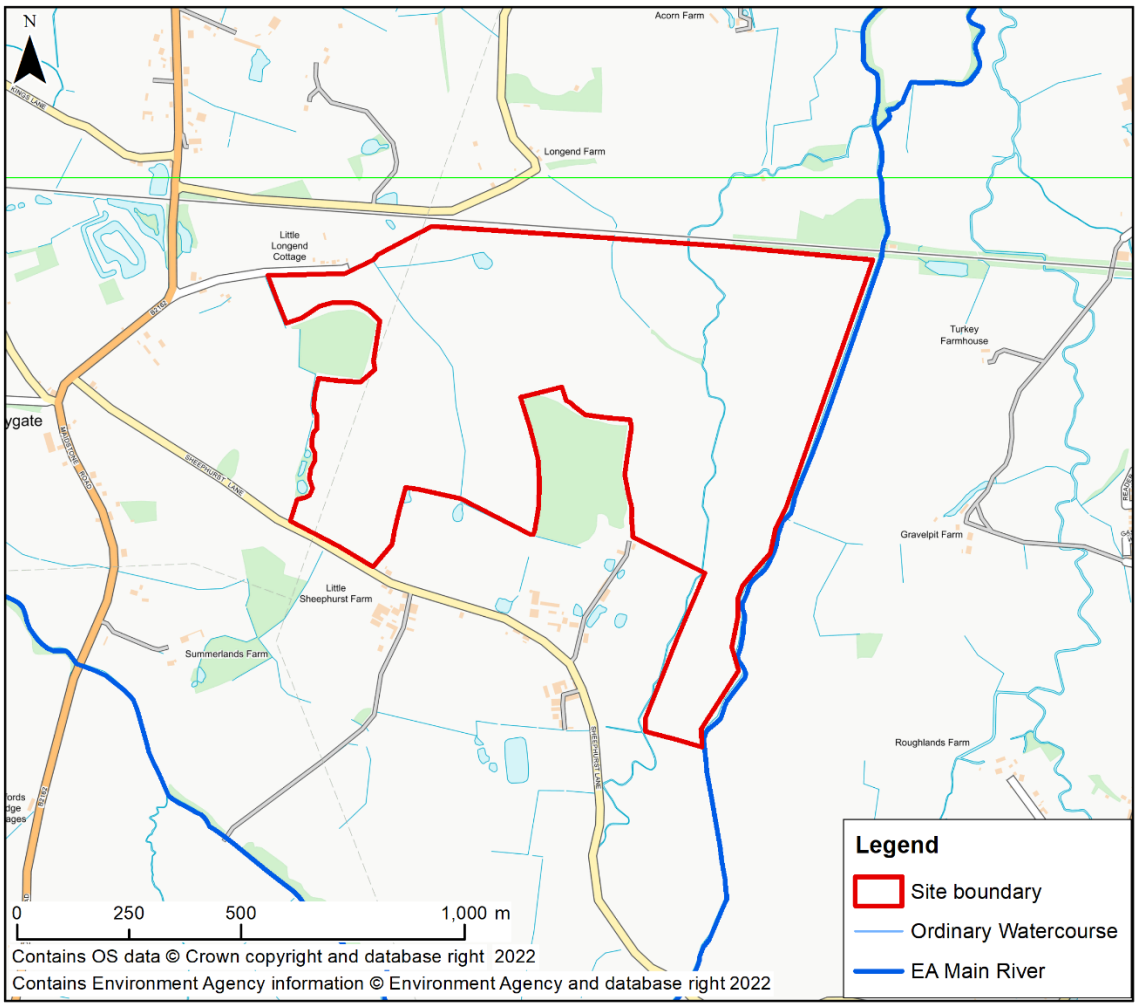
In addition to the ordinary watercourses, a number of 'main' watercourses (managed by the Environment Agency) have been identified within proximity to the development. These include:

- The Lesser Tiese which flows in a northerly direction along the eastern boundary of the site, and;
- The River Tiese approximately 650m to the south which flows in a westerly direction.

The River Tiese is a tributary of the River Medway. The Tiese's source is in Tunbridge Wells in the High Weald to join the Medway at Yalding in the Low Weald

According to the Environment Agency, the section of River Tiese and Lesser Tiese which flows past the site is not designated artificial or heavily modified and has an overall Water Body Classification of moderate.

Figure 2-2: Open watercourses within proximity to the site



The ordinary watercourses were surveyed in October 2021 by EDI Surveys Ltd with details of the bank and bed levels provided on a watercourse plan (refer to Appendix C).

Given the present use of the site it is likely that runoff generated within the red outline boundary currently drains to ground and via overland flow into the nearby drainage channels.

The drainage channels which cross the site, and are located within proximity to the DNO/Customer HV Compound, are classified as ordinary watercourses and are managed by the Upper Medway IDB. Therefore, should post development discharge to watercourse be proposed prior approval will be required from Upper Medway IDB.

2.4 Utility Service Infrastructure

The application area is currently occupied by greenfield agricultural land therefore no formal drainage infrastructure is considered to currently serve the site.

Despite this, a utility search has been provided by the client (undertaken by Landmark Information Group) to gain an understanding of the service arrangements within vicinity to the site. The utility search includes asset information obtained from:

- Environment Agency
- Instalcom - [CenturyLink, Global Crossing, Fibernet & Fiberspan]
- LinesearchbeforeUdig
- Network Rail
- Openreach - [British Telecommunications]
- South East Water
- Southern Water
- UK Power Networks
- Utility Assets

Review of the search report indicates that the majority of identified infrastructure at the site or within close proximity is located in the west (beneath land associated with the wildlife corridor) or along the southern boundary.

According to the Landmark utilities report no service infrastructure is located in the vicinity of the proposed DNO/Customer HV Compound or BESS Compound. Despite this, it is recommended that a detailed utility survey is carried out prior to construction commencing to confirm the location and details of the existing services and check for any unidentified services.

2.5 Flood Risk

This section provides an overview of the risk posed by fluvial, tidal, surface water and reservoir flooding. Refer to report reference FKO-JBAU-XX-XX-RP-HM-0001-S3-P01-Marden_FRA for details of the full Flood Risk Assessment; undertaken for the development in April 2021 by JBA Consulting.

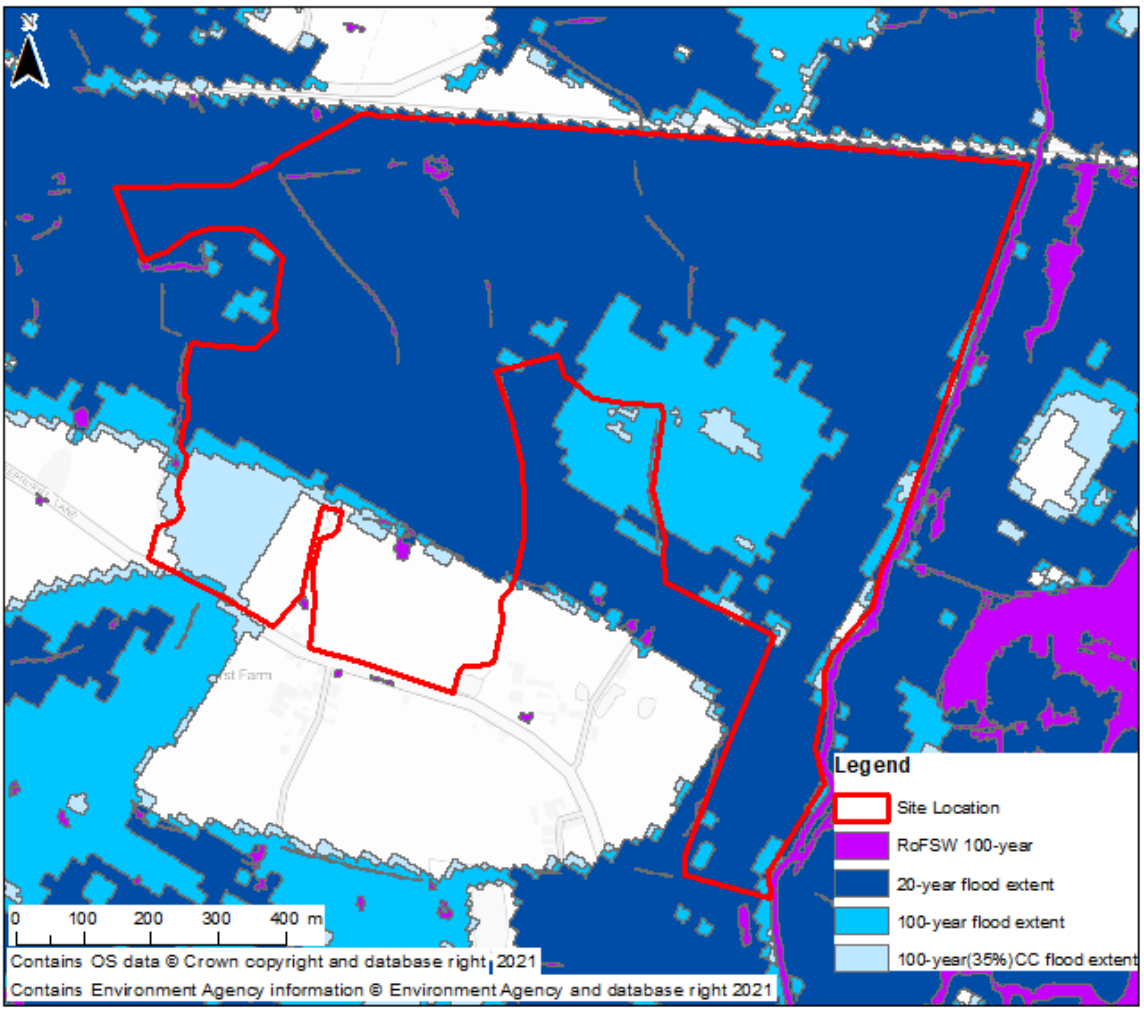
A summary of the report finding are as follows:

A large proportion of the site is located within flood zone 3; defined as land with a greater than 1 in 100-year (1.0% AEP) probability of fluvial flooding. However, an area of land in the centre south of the site is located entirely within Flood Zone 1 thus outside of both Flood Zone 2 and Flood Zone 3 extents.

The Flood Risk Assessment included analysis of modelled flood depths for the 20-year and 100-year scenarios, derived from the Medway Model 2015. Additionally, given the nature of the development and its design lifetime, in line with guidance, it was considered appropriate to assess the development for the 1 in 100-year event with 35% allowance for climate change.

Figure 2-3 shows the fluvial flood extents for the 20-year, 100-year, 100-year plus 35% climate change events and the 100-year risk of surface water flooding (taken from FKO-JBAU-XX-XX-RP-HM-0001-S3-P01-Marden_FRA).

Figure 2-3: Environment Agency Modelled Fluvial and Pluvial Extents



Based upon the findings of the Flood Risk Assessment the developer adopted a sequential approach when redesigning the site layout and has moved the most vulnerable element of the build, the DNO/Customer HV Compound, to the lowest risk area in the south of the site.

3 Outline Surface Water Drainage Strategy

3.1 Overview

As the development will introduce areas of impermeable surfacing to the site, there will be changes to the rates and volumes of surface water runoff generated within the application boundary in comparison with the existing Greenfield site. Any development should look to maximise the use of SuDS through considerate design layout to reduce runoff from future development and to introduce a multitude of benefits for the surrounding area and local community.

This Surface Water Drainage Strategy (SWDS) provides a summary of the preferred options for managing surface water runoff from the site, so that the development will not increase surface water flood risk to the surrounding areas. The strategy is supported by initial calculations of pre- and post-development runoff rates and storage volumes. These calculations have been used to inform the type and sizing of SuDS proposed on the application site.

3.2 Design Guidance

A drainage strategy outlining the means of surface water disposal from the proposed development has been produced in line with guidance in relation to development sites as follows:

- Kent County Council Masterplanning Sustainable Drainage into Developments Guidance, September 2013
- Maidstone Borough Council Planning Policy Advice note: Large Scale (>50kW) Solar PV Arrays, January 2014
- CIRIA 753 "The SuDS Manual", November 2015
- Design of public sewers shall be undertaken in accordance with Sewerage Sector Guidance – v1.0 – October 2019
- Draft Overarching National Policy Statement for Energy (EN-1), September 2021

Where surface water is managed through sewers, they should be designed for 1 year/2-year storm 'in-pipe' flow and to ensure no surface water flooding during a 30-year storm event.

In line with the industry standards any flows up to the 30-year storm event should be accommodated underground (with no surface flooding), unless overground storage facilities are provided as part of the design. Any exceedance flows beyond the 30-year storm event and including the 100-year plus climate change storm event should be managed in a safe manner on site to reduce the risk of flooding to the development and elsewhere. A dedicated overland flow route should be provided through the development to convey any exceedance flows beyond the 100-year plus climate change event in a safe manner.

3.3 Water Quantity

Peak rate of runoff can be readily managed and reduced using flow control and attenuation techniques. The reduction of runoff volume can however be more difficult to achieve as it relies upon infiltration, evapo-transpiration or re-use. Where these SuDS techniques are not viable then the alternative is to provide appropriate attenuation in overground (e.g. detention basins, retention ponds, swales) and/or underground (e.g. permeable paving, tanks) storage facilities and then restricting runoff rates.

To mitigate against increasing downstream flooding due to the additional volume of runoff, alternative approaches should be considered as follows:

- Segregation of the Long-Term Storage Volume (LTS), the difference between the pre- and post-development runoff volumes from the main peak flow attenuation. The LTS is then discharged at very low rates (less than 2 l/s/ha) and the remaining peak flow attenuation can be discharged at equivalent greenfield runoff rates with suitable deductions made for the discharge from the LTS. In practice, this arrangement is quite complex and depends on catchment size, site layout, topography, viable runoff disposal options and number of outfalls.
- Restricting discharges for all return period storms up to the 100-year plus climate change storm event to the pre-development QBAR flow rate (for greenfield sites) or reduced existing 1-year/2-year flow rate (for brownfield sites). Effectively, surface water is managed collectively and discharged at low rates to extend the runoff hydrograph from the site.

The second approach has been adopted for the purpose of this study.

3.4 Water Quality

To mitigate against adverse impacts on the water quality in the receiving water environment, the SuDS Manual recommends the following steps to determine the required water quality management for discharges to surface water and groundwaters:

- Plan land use to prevent runoff and associated pollutants for most rainfall events up to 5mm in depth
- Identify the pollution hazard level associated with the given type of development
- Select risk assessment approach based on receiving water environment and the pollution hazard level
- Carry out the risk assessment for each outfall taking into account the pollution hazard level, the status of the receiving water environment and effectiveness of the proposed SuDS techniques.

Access roads and non-residential car parking with infrequent use are shown to present 'low' pollution hazard level and require application of a 'simple index approach' for water quality risk assessment for discharge to surface water.

It is assumed that no chemicals will be stored on site during operation. However, if at a later date, chemicals are to be stored there may be a requirement to install a pollution interceptor upstream of any SuDS system to prevent contamination of ground and watercourse.

3.5 Environment Agency, Flood Risk Assessment: Climate Change Allowance (2016)

The Environment Agency has produced guidance to support the National Planning Policy Framework (NPPF). Within this guidance, the EA set out the anticipated changes in extreme rainfall intensity on small and urban catchments. The details of the EA intensity allowances are set out in Table 3-1.

Table 3-1: Environment Agency Climate Change Allowances (2016)

Applies across all of England	Total potential change anticipated for the '2020s' (2015 to 2039)	Total Potential change anticipated for the '2050s' (2040 to 2069)	Total potential change anticipated for the '2080s' (2070 to 2115)
Upper End Projection	10%	20%	40%
Central Projection	5%	10%	20%

Given the nature of the proposed development, and its associated design life (assumed to be 30-50 years), it could be considered appropriate to adopt the '2050s' scenario for the purpose of this strategy. Despite this, a conservative approach has been adopted and a 40% allowance for climate change has been applied to rainfall intensity to reflect the Upper End Projection for the '2080s' scenario. This has been reflected within all MicroDrainage calculations.

3.6 Drainage Hierarchy

The following discharge hierarchy has been considered in line with NPPF guidance and Kent County Council Masterplanning Sustainable Drainage into Developments Guidance:

Discharge to the ground

The British Geological Survey's (BGS) Geology of Britain Viewer[2] indicates that the proposed development site is located upon Weald Clay Formation (Mudstone) bedrock geology.

Groundwater monitoring was undertaken at the site in August 2021 by Southern Testing to establish the true, resting groundwater level beneath the site. It is reported that groundwater was encountered within all four trial pits ranging from 2.00mbgl in TP04 to 2.90mbgl in TP02. In addition, the ground investigation confirmed that the underlying strata, above the resting groundwater level, comprises clay.

Given the findings of ground investigations, infiltration to ground is not considered a feasible method of discharge and therefore has not been considered further within this assessment.

Discharge to watercourse

Several Ordinary Watercourses have been identified at the site. These generally flow in a northerly direction following the topographic gradient of the site. In addition, the Lesser Teise is reported to flow along the eastern boundary of the development (refer to Figure 2-2).

Considering the size of the site and the fact that the DNO/Customer HV Compound and BESS Compound are proposed to be located on opposite sides of the solar energy farm it is proposed to install two separate outfalls to two separate watercourses.

[2] British Geological Survey. Geology of Britain viewer http://mapapps.bgs.ac.uk/geologyofbritain/home.html?

It is proposed that runoff from the DNO/Customer HV Compound will be managed via SuDS and discharged at a controlled rate to the Ordinary Watercourse located in the south of the site. Subject to approval from the Upper Medway IDB.

Runoff from the BESS Compound area, in the east of the site, is proposed to be discharged at a controlled rate to the Lesser Teise adjacent east. Subject to approval from Environment Agency and receipt of a Flood Risk Activity Permit.

The red outline boundary extends up to both watercourses therefore discharge of post development runoff from the proposed SuDS to both watercourses can be achieved without the need for third-party permission.

3.7 Runoff Rate and Volume Calculations

3.7.1 Solar Panels

As the solar panels will be mounted above ground, at an angle to the ground surface, the rain falling on the panels will immediately drop onto the existing soft landscaping under the panels. There will therefore be no increase in the runoff rates and volumes due to the panels.

As no panels are proposed perpendicular to the ground contours the risk of soil erosion and water channelling down the slope are minimised. It is therefore not deemed necessary to incorporate filter trenches/swales under the rows of panels.

3.7.2 Access Tracks

Internal access roads will be constructed from permeable materials such as MOT Type 3 (reduced fines aggregate) with a geogrid to enable surface water runoff to either infiltrate to the ground or run off at or below the greenfield runoff rate.

The surrounding area is greenfield land, as a result any additional runoff that is unable to infiltrate should not lead to any detrimental impacts either on or off-site.

3.7.3 DNO/Customer HV Compound

A DNO/Customer HV Compound will be constructed in the south west of the site measuring a total area of approximately 1540m^2. The compound area will comprise a DNO Compound, Customers Compound, Transformation Station and Switchgear Station.

Given that development of the DNO/Customer HV Compound area will introduce impermeable surfacing to the site post development water quality and quantity need to be considered. Both water quantity and quality from the DNO/Customer HV Compound area will be managed via combination of filter drains and swale.

From this point on the DNO/Customer HV Compound will be referred to as Catchment One.

3.7.4 BESS Compound

A BESS Compound is proposed to be installed in the south east of the site. According to plans provided by the client the BESS Compound will comprise a 15MW/33MWH Energy Storage Barn, Batteries, LV Switchboard, Comms Room and Aux TX. In total, the proposed BESS Compound will occupy an area amounting to 1116m^2.

Runoff from impermeable areas associated with the BESS Compound will be conveyed to a swale via filter drains. Any attenuated water will then be discharged at a controlled rate to the Lesser Teise. The BESS Compound area will subsequently be referred to as Catchment Two.

3.7.5 Greenfield runoff rates

To gain a better understanding of the current rainfall runoff from the post development impermeable areas, the FEH Statistical Method was used to estimate the greenfield runoff rates for the whole site and the areas of impermeable surfacing associated with the compound and battery storage, assuming that these areas were completely undeveloped, based on FEH catchment descriptors and the parameters listed below.

- Whole Site area – 74.5Ha
- Catchment One (DNO/Customer HV Compound) area – 0.154 Ha
- Catchment Two (BESS Compound) area – 0.112 Ha
- SAAR – 671
- BFI / BFIHOST – 0.67
- Hydrometric region – 7

Table 3-2: Greenfield runoff peak rates

Storm Event	Greenfield Site Runoff Rates (l/s)		
	Whole Site	Catchment One	Catchment Two
QBAR Rural	113.03	0.57	0.45
1 in 1-year	96.08	0.48	0.39
1 in 30-year	259.97	1.31	1.05
1 in 100-year	360.57	1.81	1.45

The QBAR runoff rate for Catchment One and Two has been estimated as 0.57 l/s and 0.45 l/s, respectively.

It is proposed to increase this flow rate for both catchments to a minimum of 1.5 l/s to maximise the size of outlet control devices and minimise the risk of blockages. This value has been used in calculations on an assumption that vortex devices will be used as a flow control (with minimum opening size of 65mm). If other flow control devices are used this flow rate may need to be increased to ensure the size of opening is adequate and the risk of blockages is not increased.

3.7.6 Catchment One – DNO/Customer HV Compound

Preliminary sizing of the required attenuation storage for the DNO/Customer HV Compound area has been carried out using the Source Control module in MicroDrainage. Simulations were run to calculate the required attenuation volume for all impermeable surfacing within Catchment One during the 1 in 100-year plus 40% climate change rainfall event.

It is understood that the majority of the DNO/Customer HV Compound will remain underlain by permeable surfacing post development. Therefore, attenuation storage sizing for DNO/Customer HV Compound has been based on slab runoff and roof runoff only, amounting to a total area of 209m^2.

Precipitation which lands upon the impermeable slab within the Customer Compound will be directed towards a filter drain which will be installed along the eastern edge of the slab. Runoff from impermeable surfacing, associated with the Transformation Station and Switchgear Station, will be directed towards a filter drain located adjacent east of the buildings. Water within the filter drains will be conveyed in a northerly direction towards a swale. The main purpose of the swale will be to provide sufficient attenuation for all surface water runoff generated by Catchment One however, the use of above ground SuDS will also provide ecological and amenity benefits.

From the swale any attenuated water will be gradually discharged to an ordinary watercourse at a controlled rate of 1.5 l/s via a flow control device (hydro-brake or similar).

The swale sizing has been estimated based on the following design parameters:

- Design rainfall using FEH catchment descriptor data imported into MicroDrainage software
- Cv values as 0.75 and 0.84 (default values from MicroDrainage) (summer and winter accordingly)
- Impermeable area – 209m^2 / 0.021 Ha. Calculated from drawing reference SCUKX-MARDN-001-100G (20211222) External Release.
- Maximum allowable discharge rate – 1.5 l/s.

The MicroDrainage calculation sheets are shown in Appendix E.

Calculations indicate that approximately 7.8m^3 of storage will be required to accommodate all runoff from 209m^2 of impermeable surfacing during the 1 in 100-year storm plus 40% climate change event, whilst limiting discharge to 1.5 l/s.

Preliminary calculations indicate that a swale with a length of 40m, base width of 1.0m, longitudinal gradient of 1:200 and 1:3 side slope will provide sufficient accommodation for all runoff generated by impermeable surfacing in Catchment One during the 1 in 100-year storm plus 40% climate change event

3.7.7 Catchment Two – BESS Compound

According to plans provided by the client Catchment Two will comprise development of an Energy Storage Barn with a roof area measuring 300m^2 and introduction of 241m^2 of hard surfacing associated with the Batteries, LV Switchboard, Comms Room and Aux TX.

Precipitation which lands upon impermeable surfacing (541m^2) will be directed towards a series of filter drains located throughout Catchment Two. Water within the filter drains will be conveyed in a northerly direction and discharged into a swale. The main purpose of the swale will be to provide sufficient attenuation for all surface water runoff generated by Catchment Two however, the use of above ground SuDS will also provide ecological and amenity benefits.

Preliminary sizing of the required swale has been carried out using the Source Control module in MicroDrainage. Simulations were run to calculate the required attenuation volume for the proposed development during the 1 in 100-year plus 40% climate change rainfall event.

From the swale any stored water will be gradually discharged to the Lesser Teise at a controlled rate of 1.5 l/s via a flow control device (hydro-brake or similar).

The swale sizing has been estimated based on the following design parameters:

- Design rainfall using FEH catchment descriptor data imported into MicroDrainage software
- Cv values as 0.75 and 0.84 (default values from MicroDrainage) (summer and winter accordingly)
- Impermeable area – 541m^2 / 0.054 Ha. Calculated from drawing reference SCUKX-MARDN-001-100G (20211222) External Release.Maximum allowable discharge rate – 1.5 l/s.

The MicroDrainage calculation sheets are shown in Appendix E.

Calculations indicate that approximately 25.9m^3 of storage will be required to accommodate all runoff from 541m^2 of impermeable surfacing during the 1 in 100-year storm plus 40% climate change event, whilst limiting discharge to 1.5 l/s.

Preliminary calculations indicate that a swale with the following dimensions will provide sufficient accommodation for all runoff generated from 541m^2 of impermeable surfacing during the 1 in 100-year storm plus 40% climate change event.

- Length: 40m
- Base Width: 1.0m
- Depth: 1.0m
- Side Slope: 1 in 3
- Slope: 1 in 200

Calculations indicate that the maximum water depth within the swale, for the 100-year climate change design event, is 0.424m; with 0.576m of freeboard.

It is recommended that the final design includes at least 0.15m of freeboard, above the maximum water level to mitigate residual flood risk from blockage or exceedance storm events. However, the remaining 0.4m of freeboard gives the developer the option to create a wet swale feature with a permanent water level at detailed design stage, if preferred.

The creation of a wet swale would provide further biodiversity enhancement, in addition to the swale in Catchment One and the wildlife corridor already planned as part of the development.

MicroDrainage calculation sheets are shown in Appendix E.

The calculated required storage volumes for both catchments are based on currently available information and design parameters described in this report. If any design parameters, including the current proposed site layout change, the calculations will need to be revisited to confirm their suitability.

The proposed surface water drainage plan is given in Appendix F.

3.7.8 Runoff Treatment

In accordance will the CIRIA SuDS Manual runoff from roof areas is considered to have a pollution hazard rating of very low. Nevertheless, it is suggested to include debris / sediment traps on any new drainage.

Runoff from both Catchments will be directed towards vegetated swales via filter drains before discharging into an ordinary watercourse and the Lesser Teise, respectively.

The simple Index Approach in the CIRIA SuDS Manual states that other roofs (typically commercial and industrial roofs) have pollution hazard indices of 0.3, 0.2 and 0.05 for total suspended solids (TSS), metals and hydrocarbons respectively. Low traffic roads and non-residential car parking with infrequent changes (ie < 300 traffic movements a day) have pollution hazard indices of 0.5, 0.4 and 0.4 for TSS, metals and hydrocarbons respectively.

The indicative SuDS mitigation indices for the proposed SuDS features are as follows:

- Filter drains: 0.4, 0.4 and 0.4 for TSS, metals and hydrocarbons respectively. And;
- Swales: 0.5, 0.6 and 0.6 for TSS, metals and hydrocarbons respectively.

As such, the proposed SuDS features have a mitigation index higher than the pollution hazard index.

The proposed SuDS components will therefore provide adequate treatment for surface water runoff.

3.7.9 Amenity and Biodiversity

Whilst the primary objective of a SuDS scheme is to provide attenuation storage, developers should look to maximise biodiversity and amenity benefits, where possible.

Across this development site, a combination of filter drains and swales will be utilised to manage surface water runoff from the development.

The ecological potential of the SuDS system can be maximised by utilising local planting and locating SuDS adjacent to proposed impermeable features. The strategy should create a range of habitats and provide varied water depths within the SuDS features which should be sustained by ensuring that an effective management regime is implemented.

3.7.10 Design for exceedance

All SuDS features have been sized to sufficiently accommodate all surface water runoff during the modelled 1 in 100-year plus 40% climate change event.

Despite this, final site level setting and landscaping should be considered such that any exceedance surface water flows, caused as a result of blockage or extreme rainfall event, are directed away from the proposed structures and towards the formal drainage systems or less vulnerable areas such as open spaces.

Potential overland flow routes are shown on the conceptual surface water drainage strategy in Appendix F. These are based upon the topographic survey detailed in Appendix B.

3.8 Construction stage

Surface water runoff will need to be managed during the construction stage of the development to minimise the risk of flooding and pollution to the surrounding environment. This will be addressed within an Environmental Management Plan prepared for the development by an appointed contractor for the works prior to construction commencing.

4 Long Term Management

It is envisaged that the surface water drainage system will remain in private ownership and be maintained by the site owner/occupier or their appointed management company.

A maintenance plan will be prepared prior to the site occupancy to ensure the drainage system remains operational and effective for the lifetime of the development.

The long-term management strategy will be confirmed at condition discharge stage, however the following maintenance items are recommended for the conveyance system, filter drain and swale:

Table 4-1: Drainage System Maintenance Requirements

Element	Activity	Frequency
Conveyance pipes and chambers	Visual inspection and jetting /cleaning	Every five years or as required
	Visual inspection for physical damage and remediation	Annually or as required
Catchpits	Visual inspection and jetting /cleaning	Annually or as required
	Visual inspection and replacement/ re-setting covers if damaged and/or dislodged	Annually or as required
Outlet control chamber with flow device	Visual inspection and remediation of any faults	Annually or as required following significant storm event

Notes:

1. Jetting of pipes should only be carried out after removal of larger debris, as jetting alone may dislodge the debris further downstream leading to an increased flood risk elsewhere.
2. The removed waste material (both solids and liquids) from the drainage conveyance/ storage system should be treated as contaminated and disposed of at a licenced waste management facility. It should not be re-used within the development or outside its boundary to minimise the risk of pollution to the environment.

The CIRIA SuDS manual 2015 stipulates the following maintenance requirements for the proposed SuDS elements.

Figure 4-1: Swale Maintenance Requirements (From CIRIA SuDS Manual 2015)

TABLE 17.1 Operation and maintenance requirements for swales

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

Figure 4-2: Filter Drain Maintenance Requirements (From CIRIA SuDS Manual 2015)

TABLE 16.1 Operation and maintenance requirements for filter drains

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

5 Construction (Design and Management) review

Under the construction (Design and Management) Regulations (CDM 2015) it is the designer's duty to:

- Eliminate foreseeable health and safety risks to anyone affected by the project
- Take steps to reduce or control any risks that cannot be eliminated
- Communicate, cooperate and coordinate with the client, other designers and contractors involved in the project so that designs are compatible, and health and safety risks accounted for during the project and beyond.

The following hazards associated with construction, operation and maintenance of the mitigation measures outlined in Section 3 and 4 have been identified during the preliminary site assessment:

Activity	Hazard / Risk	Eliminate Hazard / Reduce Risk	Control Measures
Construction Stage			
Construction of drainage system/ Excavations	Underground services - any potential unidentified services within the site boundary	Further information, including utility detection survey, will be needed in order to fully check for clashes at the detailed design stage.	Detailed utility survey to be carried out prior to construction commencing to confirm the location and details of the existing services and check for any unidentified services.
Construction of drainage system/ Excavations	Hazard - Ground and groundwater conditions Risks: • Collapse of drainage systems due to soil stability issues; • Potential residual contaminants; • Pollution to surface water.	Proposed SuDS to be shallow and lined. Despite this, ground investigations should be undertaken to check soil stability and groundwater.	Long term groundwater monitoring and testing of geotechnical properties of soils to confirm design parameters.
Plant / Material Delivery	Hazard -Vehicular access to the site from Sheephurst Lane; Risk - Collisions and injury/ damage to people/vehicles.	Hazard cannot be eliminated by design. Hazard not specific to drainage construction but applicable to the wider site construction.	Site managed to minimise risks. Traffic management to be prepared prior to

			construction activities commencing. Public to be notified of construction activities to take place.
Excavations/ Connection to watercourse	Hazards - working at height, flowing water; Risk - fall into excavation, injury, ill health, asphyxiation, drowning.	Hazard cannot be eliminated by design. The proposed drainage system is to be designed to achieve the required hydraulic conditions whilst minimising depth of excavation.	Trench supports as required. Minimise man entry to confined spaces.
Construction activities	Environmental: • Pollution to soil and the local water environment	Early identification of any TPOs and other environmental / ecological factors which may impact upon design and construction.	Surveys undertaken. Site managed to minimise risks.
Construction activities	Unexploded ordnance	Unexploded bomb (UXB) risk map has been reviewed through https://zeticauxo.com/ The website shows the site has a 'moderate' UXB risk.	Unexploded bomb (UXB) risk map reviewed. Observation during excavations
Maintenance Stage			
Working in watercourse	Hazards: • Working near water Risks: • Drowning • Asphyxiation • Ill/health/ death	Hazard cannot be eliminated by design.	Over-pumping/bung at upstream section of watercourse may be required to manage the existing flow in the channel. Work to be undertaken in dry weather conditions.
Working near open SuDS features	Hazards: • Working near water • Uneven Ground	It is recommended that all SuDS features are constructed following best practice guidance.	shallow side slopes, maximum design water depth with

	Risks: • Drowning • Slips trips and falls • Ill/health/ death		overflow, passive surveillance, detailed design in accordance with Health and safety principles for SuDS: framework and checklists CIRIA RP992 The SuDS Manual Update Paper RP992/17
Clearance of drainage system	Hazards - oil/fuel, sediment, working at height Risks -pollution, falls in watercourse/ ill health	Hazard cannot be eliminated by design. Non-man entry inspection chambers should be used, where possible, to eliminate confined space entry.	Any sediment / debris removed from the drainage system should be considered as contaminated and disposed of to a licenced waste management facility.
Decommissioning Stage			
Removal of the drainage system.	Hazards and risks: largely as per the construction stage, except that the removal of the drainage system will increase a risk of flooding / pollution to the site and the local area.	It is recommended to reinstate the site to greenfield condition or install replacement SuDS based drainage in line with the current guidance.	Reinstate the site to greenfield condition or install replacement SuDS based drainage in line with the current guidance.

It should be noted that the potential hazards have been identified through a desk study of currently available information and this list should not be considered as exhaustive. A detailed site survey should be undertaken prior to any construction / installation activities commencing to confirm the presence of potential unidentified hazards on and in the immediate vicinity of the site.

6 Conclusions and recommendations

JBA Consulting was commissioned by Donna Clarke of Origin Power Services Ltd in July 2021 to prepare an outline Surface Water Drainage Strategy to support a planning application for development of a solar energy farm at Land to the West of Marden, Kent. In January 2022, following receipt of the initial draft drainage strategy report, JBA were requested to revise the report, and associated MicroDrainage calculations, to reflect provision of new DNO/Customer HV and BESS Compound layouts. This report details the revised Surface Water Drainage scheme.

The proposed development site is approximately 74.5ha in size and is situated to the north of Sheephurst Lane, some 0.74km to the west of Marden. The site is currently occupied by agricultural fields thus considered greenfield land.

The proposed planning application relates to development of a solar energy farm including installation of photovoltaic panels and, construction of a DNO/Customer HV Compound, BESS Compound and site access roads.

Post development the total impermeable area at the site will amount to 750m^2, comprising 209m^2 of hardstanding associated with the DNO/Customer HV Compound and 541m^2 of roof area associated with the BESS Compound.

It is understood that the individual solar panels will drain directly onto the ground and the site access roads will be underlain by permeable gravel surfaces (MOT Type 3 or similar).

Considering the size of the site and the fact that the DNO/Customer HV Compound and BESS Compound are proposed to be located on opposite sides of the solar energy farm it is proposed to install two separate outfalls to two separate watercourses. Within this strategy the DNO/Customer HV Compound and BESS Compound areas have been referred to as Catchment One and Catchment Two, respectively.

Catchment One:

It is understood that the majority of the DNO/Customer HV Compound will remain underlain by permeable surfacing post development. Therefore, attenuation storage sizing for DNO/Customer HV Compound has been based on slab runoff and roof runoff only, amounting to a total area of 209m^2.

Precipitation which lands upon the impermeable slab within the Customer Compound and upon roof areas associated with the Transformation Station and Switchgear Station will be directed towards several filter drains. Water within the filter drains will be conveyed in a northerly direction towards a vegetated swale. From the swale any attenuated water will be gradually discharged to an ordinary watercourse at a controlled rate of 1.5 l/s via a flow control device (hydro-brake or similar).

The main purpose of the swale will be to provide sufficient attenuation for all surface water runoff generated by Catchment One however, the use of above ground SuDS will also provide ecological and amenity benefits.

Calculations indicate that approximately 7.8m^3 of storage will be required to accommodate all runoff from 209m^2 of impermeable surfacing during the 1 in 100-year storm plus 40% climate change event, whilst limiting discharge to 1.5 l/s.

Preliminary calculations indicate that a swale with a length of 40m, base width of 1.0m, longitudinal gradient of 1:200 and 1:3 side slope will provide sufficient accommodation for all runoff generated by impermeable surfacing in Catchment One during the 1 in 100-year storm plus 40% climate change event.

Catchment Two

It is proposed that runoff from all impermeable surfaces associated with the BESS Compound will be directed into a swale located adjacent north of the development. The main purpose of the swale will be to provide sufficient attenuation for all surface water runoff generated by Catchment Two however, the use of above ground SuDS will also provide ecological and amenity benefits.

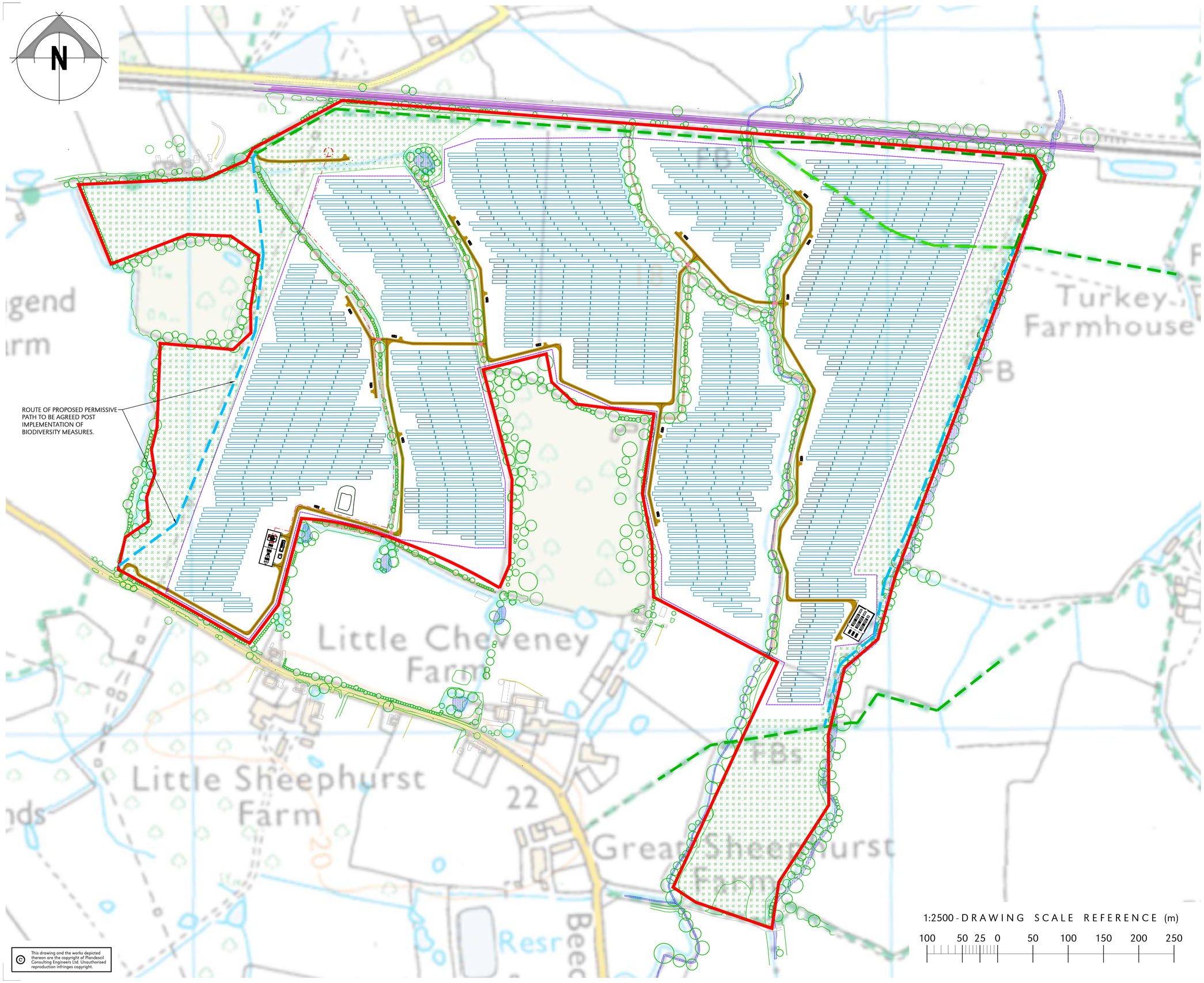
Calculations indicate that approximately 25.9m^3 of storage will be required to accommodate all runoff from 541m^2 of impermeable surfacing during the 1 in 100-year storm plus 40% climate change event, whilst limiting discharge to 1.5 l/s.

Preliminary calculations indicate that a swale with dimensions of 40m long x 1.0m wide (at the base) x 1.0m deep will provide sufficient accommodation for all runoff generated from 328m^2 of impermeable surfacing during the 1 in 100-year storm plus 40% climate change event.

The proposed SuDS components will provide sufficient treatment to runoff from the proposed development which has been demonstrated using the simple-index approach.

Appendices

A Proposed Site Plan



GENERAL NOTES:

1. All dimensions noted are in millimetres unless stated otherwise.
2. All levels to be above Ordnance Survey Datum defined levels (A.O.Dm) unless noted otherwise.
3. Do not scale from this drawing, if dimensions are not clear ask.
4. This document has been created in accordance with Plandescil Ltd. Terms & Conditions along with the scope of works provided by the client to Plandescil Ltd. Any use of this document other than for its original purpose is prohibited, Plandescil Ltd. accept no liability for any third party uses of this document.
5. Plandescil Ltd. to be immediately notified of any suspected omissions or discrepancies.
6. This drawing is to be read in conjunction with the following Plandescil drawings
   - 27899 - 051 Rev 0 - Proposed Solar Farm Aerial Site Location Plan
   - 27899 - 052 Rev 0 - Proposed Solar Farm Framework Plan and System Summary
   - 27899 - 053 Rev 0 - Proposed Solar Farm Footpath & Boundary Layout
7. All setting out to be coordinated by the Contractor and to be checked onsite prior to construction.

LEGEND

- Railway
- Existing Roads
- Connection Route
- Perimeter Fence (4,500 m)
- Boundary
- Public Footpath (Existing)
- Public Footpath Removed (Proposed)
- Public Footpath Relocation (Proposed)
- Permissive Footpath (Proposed)
- Biodiversity Area (8.78 ha)
- Maintenance Track
- Ditch Crossing
- Ditch
- Water
- Trees
- Power Station (x16)
- Battery Energy Storage System
- HV Compound
- PV Structure 2P30
- PV Structure 2P15
- Existing Properties

PROPOSAL ONLY
NOT CDM 2015 COMPLIANT

Note: Proposed site plan and information from Statkraft, no survey or design work undertaken by Plandescil Ltd. Drawing adapted from Statkraft drawing SCUKX-MARDN-000 100 (G)

Statkraft

ISSUED FOR CLIENT REVIEW

Rev	Date	Rev By	Chkd	Description
B	08-02-22	DAD	AF	Amendments to Boundary & Footpath
A	01-02-22	DAD	AF	Minor Amendments
0	18-01-22	-	AF	First Issue

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civil / structural / environmental / surveying

Client
Origin Power Servcies Ltd

Project
Proposed Solar Farm,
Land North of Sheephurst Lane,
Marden, Tonbridge

Drawing Title
Proposed Solar Farm
Site Layout

Scale	U.N.O.	Date	Drawn By
1:2500 (A1)		January 2022	DAD

Drawing No. 27899/050 Rev B

1:2500 - DRAWING SCALE REFERENCE (m)

100 50 25 0 50 100 150 200 250

B Topographic Survey

SCALE OF MAIN DRAWING:
1:2000 when printed 100% on A0
Do not scale from this plot. All dimensions to be checked on-site.

LEGEND

- Tree canopy/hedgerow/foliage. Heights where given are to nearest meter.[1]
- Tree shapes for use in *PVcase*. **These do not represent exact tree locations**, but rather, entities which will be automatically recognised and converted to appropriate shading elements by *PVcase*. Areas of forest are therefore filled with trees of appropriate height. Height to nearest meter.[1]
- Water (dashed for apparent drainage feature or approx. path)
- Sealed road
- Unsealed track
- Power-line (or other overhead line) with utility post
- Fence, gate
- Railway track
- Public footpath/bridleway
- Apparent field boundary (As seen from aerial survey. NOT official boundary.)
- UAV mapping boundary (approx.)
- Building or other permanent structure
- Stone wall

ELEVATIONS

- Elevation of point above vertical datum (see 'COORDINATE REFERENCE SYSTEM AND DATUM' at bottom).[2]
- Contours (0.25 m) of digital surface model (dashed when over areas of obvious crop or vegetation).[3,4]

G.I.S. DATA

- 100m grid in OSGB36 map projection
- LAT. LONG. The specific lines of latitude and longitude which pass through the site are marked in degrees, minutes, seconds (WGS84).
- NORTH Grid North follows the direction of the North-South lines of the OSGB36 grid.
  True North follows lines of longitude, which converge on the axis of rotation of the Earth. True South points to the equator.
  The convergence angle (precision 2 d.p.) between Grid North and True North for this specific location is given.
  Magnetic North is not shown (but will be different again).

Third-party data

Site boundaries from client. Approx. public footpath routes from OS map.

NOTES

1. Heights of hedgerows and dense trees are marked alongside the foliage. All tree/hedge heights given are approximate heights above nearby ground, based on the Digital Surface Model.
2. It is important to note that this grid is from a Surface Model, not a Terrain Model, and therefore point-heights can only be interpreted as terrain when on areas of earth or hardstanding.
3. Likewise, the Contours are surface contours, not terrain contours, so should be interpreted carefully. Where contours are obviously not on earth or hardstanding, they are dashed.
4. Contours are generated from a subsampled (10m) terrain model to provide smooth but representative contour lines. Where contours cross trees, the path of the contour below the tree(s) is approximated.
5. Lat./long. lines are precisely calculated, but should be considered approximate because they represent a spherical coordinate system on a map projection. Locations and dimensions are accurate in the underlying map projection. But conversion of coordinates from the map projection to lat./long. (if required) should be performed using the appropriate transformation, not by inference from this plot.
6. Features hidden under dense vegetation (e.g. walls, fences) are only marked if visible from drone footage (or location otherwise provided or noted).

REVISIONS

1.0	8 Oct. 2021	Published to client [TMH]

PROJECT
STATKRAFT - UAV SURFACE TOPOGRAPHY
Sheepwash Project in Kent, U.K.

TITLE
SHEEPWASH LINEWORK ("CAD")

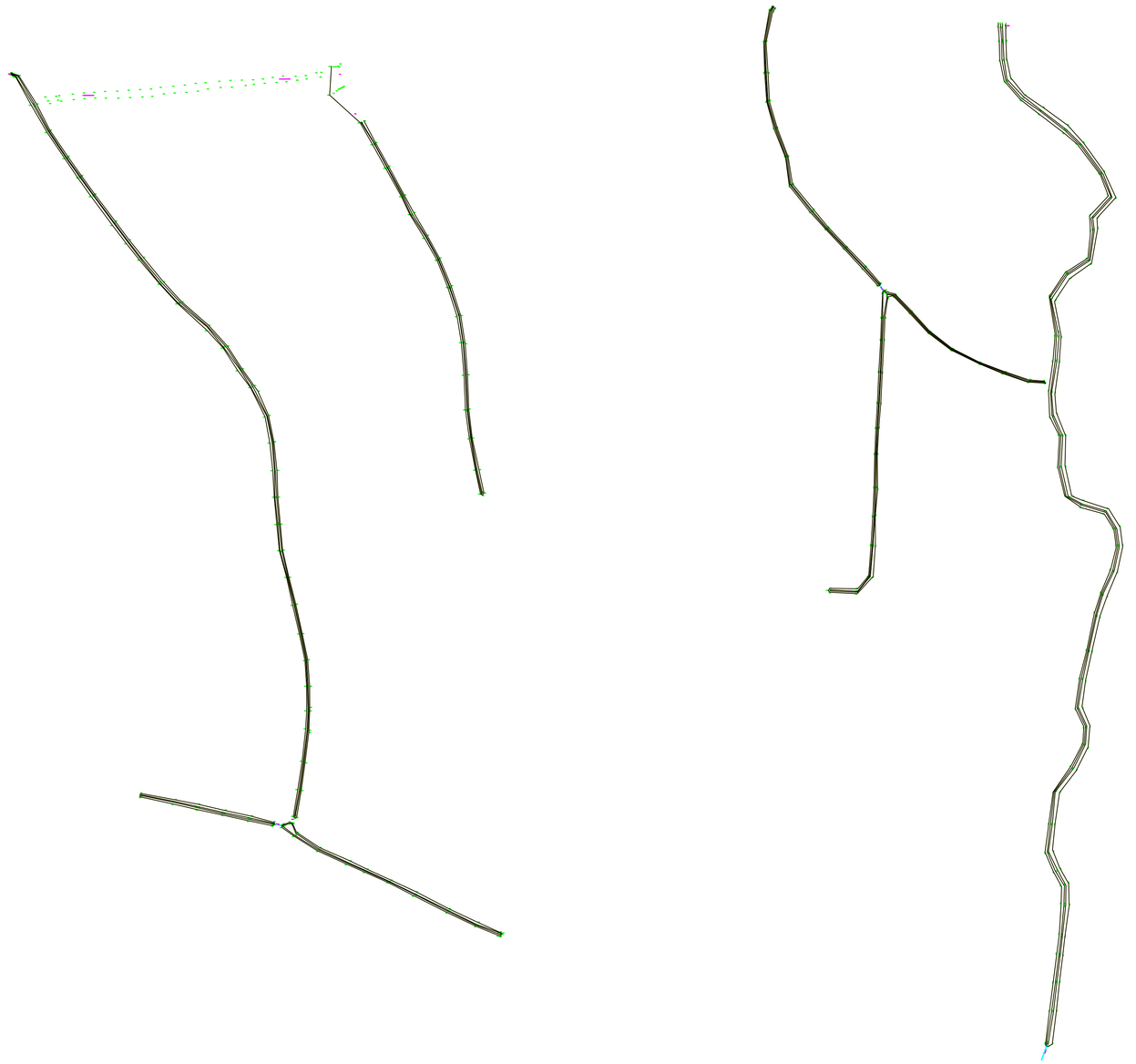
DETAILS
Statkraft, 19th Floor, 22 Bishopsgate, EC2N 4BQ,
London (Gareth Hawkins)

above
Above Surveying Ltd.
Block C2 Knowledge Gateway
Nesfield Road,
Colchester, CO4 3ZL, U.K.
T: +44 1206 483043
E: support@abovesurveying.com

LOCATION
West of Marden, Kent, TN12 9NZ

COORDINATE SYSTEM AND DATUM
OSGB36, British National Grid Map Projection (EPSG: 27700). Units: meters
Elevations relative to sea level as height in meters above Ordnance Datum Newlyn (ODN) (EPSG: 5101). Geoid model, OSGM15.

C Watercourse Survey



GRID
NORTH

0 25 50 75 100 m

Original Drawing Size: A1

NOTES:–

The accuracy and content of this drawing are dependent on the original specification and EDI should be consulted before use at other scales.

Where underground services are shown, all reasonable care has been taken within the spirit of the original specification and requirement. Before use of this information the user should consult EDI and satisfy themselves of the completeness and accuracy of such detail before undertaking any works. Due to the nature of this work and limitations imposed by ground conditions and the detection equipment no guarantee can be given that all services have been recorded. Trial holes should be dug at critical locations.

All reasonable care has been taken in the survey detail represented on this drawing but any discrepancies must be reported to EDI immediately.

Our aim is to produce the best possible results within the specification and cost constraints of our clients. Any comments are most welcome.

Levels shown at kerbs are channel level unless stated.

LEGEND

Features:

AV	Air Valve
AB	Air Brick
BO	Bollard
BH	Borehole
BM	Benchmark
BP	Boundary Post
BS	Bus Stop
BT	British Telecom
CL	Cover Level
COL	Column
CTV	Cable TV Cover
DCH	Drainage Channel
DF	Drinking Fountain
DIS	Disused
DK	Drop Kerb
DPC	Damp proof Course
EC	Electricity IC
EJ	Expansion Joint
FO	Forth Road
FH	Fire Hydrant
FHR	Fire Hose Reel
FO	Flagstaff
G	Gully
GV	Gas Valve
IC	Inspection Cover
IL	Invert Level
JBX	Junction Box
KO	Kerb Outlet
LB	Letter Box
LBN	Litter Bin
LLP	Low Level LP
LP	Lamp Post
MP	Marker Post
MS	Mile Stone
MT	Mercury Telecom
OHL	Overhead Line
OP	Overflow Pipe
PM	Parking Meter
PP	Power Pole
RAD	Radiator
RE	Rodding Eye
RNP	Road Name Plate
RS	Road Sign
RSD	Roller Shutter Door
RWP	Rain Water Pipe
SD	Service Duct
SV	Stop Valve
TCB	Telephone Call Box
TP	Telegraph Pole
TS	Traffic Signal
UB	Universal Beam
UNK	Unknown
UR	Urinal
UTL	Unable to lift
V	Vent
VP	Vent Pipe
WM	Water Meter
WO	Wash Out
WP	Waste Pipe

Building Level Details:

D	Door
EL	Eave Level
FFL	Floor Level
FRL	Flat Roof Level
HL	Head Level
PPL	Parapet Level
RL	Ridge Level
SL	Sill Level
SP	Springer of Arch
TA	Top of Arch
W	Window
62.30	Ceiling/Beam Soffit

Boundary Types:

BW	Barbed Wire
CB	Close Boarded
CH	Chainlink
CI	Corrugated Iron
CP	Chestnut Paling
IR	Iron Railing
IW	Interwoven
LL	Larch Lap
PAL	Palisade
PR	Post & Rail
PW	Post & Wire
TNR	Timber Knee Rail
RTW	Retaining Wall
VSF	Vehicle Safety Fence
WMF	Wire Mesh Fence

Surfaces & Finishes:

B	Brickwork
BB	Breeze Block
C	Concrete
CLT	Ceiling Tiles
CP	Carpet
CPS	Concrete Paving Slabs
CPT	Carpet Tiles
CR	Concrete Render
CT	Ceramic Tiles
FT	Floor Tiles
HBD	Hardboard
L	Linoleum
P	Plaster
PAV	Brick Paviors
S	Steel work
T	Tarmac
TSP	Textured Safety Paving
VT	Vinyl Tiles

Services:

C	CATV cables
CCTV	CCTV cables
D	Data cables
E	Electric cables
F	Foul water
G	Gas pipes
H	Heating duct
SD	Service ducts
S	Storm water
T	Telecom cab.
U	Unidentified
W	Water pipes
150ø	Pipe Diameter/Flow
	Overhead Lines

Survey Station
Fence
Gate
Painted Road Markings
Edge of Vegetation
Kerb/Drop Kerb
Tree
Top / Bottom *Banks*
Building
Overhead Building Detail
Wall

Control: All levels and co-ordinates are related to the datums described.

The horizontal control of this survey is based on Ordnance Survey grid as translated from GPS coordinates using Leica's SmartNet service. We have not applied a reverse scale factor and therefore all dimensions will be scaled by the local OS scale factor. The vertical control of this survey is based on OS datum as translated from GPS coordinates using the OSGM02 transformation as supplied by the OS. This may differ from the existing OS benchmarks in the area which should be disregarded; all levels should be taken from EDI survey stations.

Rev.	Job No.	Date	Revision Detail	Surveyor	Chkd

CLIENT

Statkraft (Gareth Hawkins)
Unit C2
19th Floor, 22 Bishopsgate
London
EC2N 4BQ

PROJECT

Ditch Surveys
"Sheepwash" Project
West of Marden
Kent
TN12 9NZ

Job No.	Surveyor	Checked	Date	Scale
19914	S.Cullum	LW	Oct. 2021	NTS

GROUND SURVEYING CONDUCTED BY:

EDI SURVEYS LTD
163-165 Ranelagh Road, Ipswich, Suffolk IP2 0AH
Telephone | 01473 211222
Email | enquiries@edisurveys.co.uk
Our Services:- Topographic Surveys, Measured Building Surveys, GPS Surveying and Control, 3D laser Scanning, Utility Surveying and Drainage Investigation.
Click the link below to visit our website and find out more.
www.edisurveys.co.uk

DRAWING No. 19914/T/01-01

REV. -

DELIVERABLES PROVIDED BY:

above
Above Surveying Ltd.
Block C2 Knowledge Gateway
Nesfield Road,
Colchester, CO4 3ZL, U.K.

T: +44 1206 483043
E: support@abovesurveying.com

D Southern Testing Ground Water Monitoring

Our Ref: PS/KJ/J14893

25 August 2021

Origin Power Services Limited
Lower Ground Floor
40 Bloomsbury Way
London
WC1A 2SE

For the attention of Donna Clarke
Email: donna.clarke@originpower.co.uk

Southern Testing
Environmental & Geotechnical

Southern Testing Laboratories Ltd
Keeble House, Stuart Way
East Grinstead, West Sussex RH19 4QA

t 01342 333100 f 01342 410321
e info@southerntesting.co.uk w southerntesting.co.uk

Dear Madam,

Re: Trial Pitting Investigation at: Land West of Marden, Kent, TN12 9SD
National Grid Reference: TQ 72233 44554
Geology: Alluvium / River Terrace Deposits over Weald Clay

1 Authority

Our authority for carrying out this work is contained in our completed Project Order Form from Donna Clarke of Origin Power, dated 10 August 2021.

2 Background and Objectives

The object of the investigation was to understand the in-situ ground and groundwater conditions in the area of the proposed compound and access road, to assist the drainage strategy to be completed by the Engineer.

3 Scope

This letter report presents our exploratory hole logs and water monitoring results. As with any site there may be differences in soil conditions between exploratory hole positions.

This report is not an engineering design and the figures and calculations contained in the report should be used by the Engineer, taking note that variations will apply, according to variations in design loading, in techniques used, and in site conditions. Our figures therefore should not supersede the Engineer's design.

Contamination issues are not considered in this report.

The findings and opinions conveyed via this Site Investigation Report are based on information obtained from a variety of sources as detailed within this report, and which Southern Testing Laboratories Limited believes are reliable. Nevertheless, Southern Testing Laboratories Limited cannot and does not guarantee the authenticity or reliability of the information it has obtained from others.

The site investigation was conducted and this report has been prepared for the sole internal use and reliance of Origin Power Ltd and their appointed Engineers. This report shall not be relied upon or transferred to any other parties without the express written authorization of Southern Testing Laboratories Limited. If an unauthorised third party comes into possession of this report they rely on it at their peril and the authors owe them no duty of care and skill.

Recommendations contained in this report may not be appropriate to alternative development schemes.

4 Geology

The published geology for the site comprises River Terrace Deposits over Weald Clay (with Limestone in the Weald Clay marked to the south of the subject site).

4.1 Terrace Gravels

Terrace Gravels are sheets of irregular and sub-rounded gravel and sand, laid down as terraces alongside rivers. Lenses of silt, clay or peat may also be present. Their composition reflects the geology of the river catchment area.

Terrace Gravels were commonly worked in the past, often on a piecemeal basis in 'borrow pits' as well as larger mineral workings. Old pits may have been infilled with poor quality or waste materials, and can contain contamination.

4.2 Weald Clay Formation

The Weald Clay Formation comprises dark grey thinly-bedded shales and mudstones with subordinate siltstones, sandstones (including the Horsham Stone Member), shelly limestones and clay ironstones. The mudstones weather to yellow and brown clays. Conspicuous bands of red clay also occur, usually in close association with sandstone beds.

The clays have often been worked for various purposes, and the clay ironstone, a low-grade iron ore, was worked from sporadic beds across the Wealden area. The steep sides of the degraded remains of former workings are usually unstable. Other workings have been filled with a variety of materials.

This formation is known to contain pyrite.

5 Site Description

The site comprised a series of agricultural fields which lay to the north of Sheephurst Lane.

The fields were generally level and were divided by drainage ditches and tree lined hedgerows. There were a number of mature oak trees within the hedgerows. Some of the fields were planted with wheat.

Access to the site was via an access track to the west of Little Cheveney Farm. A 6m wide grassed conservation strip was present around the boundaries of the fields.

6 Fieldwork

The fieldwork comprised the excavation of 4 No. trial pits at locations indicated by the Engineer. These were within the grassed margins of the fields and are shown on the appended plan (Figure 1).

The trial pits were excavated on 19 August 2021 at which time the weather was mild and dry.

7 Soils as found

The soils encountered are described in detail in the attached exploratory hole logs, but in general comprised a covering of weathered Terrace Gravels or weathered Clay over Weald Clay. A summary is given below.

Depth (m)	Thickness (m)	Soil Type	Description
GL – 0.2/0.3	0.2-0.3	Topsoil	Dark brown silty clay TOPSOIL with rootlets
0.2/0.3 – 0.5/0.7	0.3	Subsoil	Firm pale brown slightly silty CLAY with rootlets

Depth (m)	Thickness (m)	Soil Type	Description
0.5 – 2.7/2.9	2.2	CLAY	Stiff and very stiff pale grey mottle dark brown CLAY becoming laminated at depth. (Abundant selenite crystals from 2.0m in TP01 and TP02).
1.4 - 2.1/2.9 TP03 & TP04 only	0.7-1.5	GRAVEL	Pale brown and dark orange brown silty sandy GRAVEL. Gravel is fine to medium flat SILTSTONE, SANDSTONE and rounded flint with some black ironstaining. (Moist)
2.5/2.6 - 2.53/2.63 TP01 & TP02 only	0.03	LIMESTONE	Dark grey and cream shelly LIMESTONE band
2.7/2.9 -3.0/3.1+	0.3+	CLAY / MUDSTONE	Stiff and very stiff pale blue grey fissured CLAY (becoming weak MUDSTONE at base of pit in TP01 and TP02)

8 Groundwater Observations

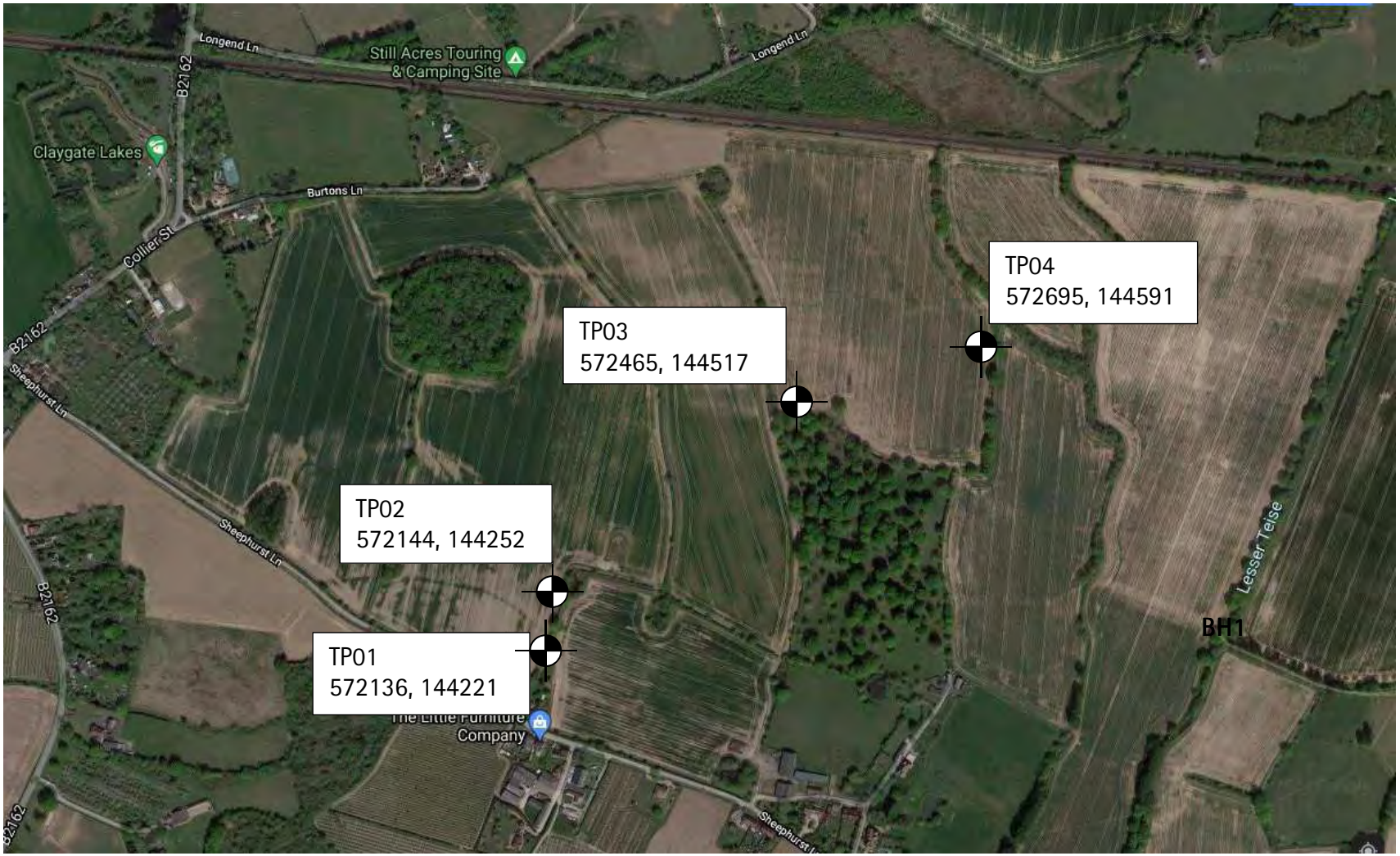
Groundwater was encountered in all the trial pits and was observed as follows.

Trial Pit	Initial Strike (m bgl)	Depth of Pit (m bgl)	Water Level Observation (m bgl)
TP01	Slow seep 3.0m	3.0	After 30mins = 2.85 After 60mins = 2.80 After 90mins = 2.75 After 120mins = 2.70
TP02	Slow seep 3.0m	3.1	After 30mins = 2.95 After 60mins = 2.90 After 90mins = 2.90
TP03	Moderate seep 2.1m	2.5	After 30mins = 2.20 After 90mins = 2.15 After 135mins = 2.10
TP04	Moderate seep 1.9m	3.1	After 15mins = 2.25 After 30mins = 2.20 After 45mins = 2.05 After 60mins = 2.00

If you have any queries or we can be of further assistance, please do not hesitate to contact us

Yours faithfully,

P J Sugden MSc FGS
For and on behalf of
Southern Testing Laboratories Limited
Email: psugden@southerntesting.co.uk



NB: Positions trial pits are only indicative unless dimensioned

Site: Land to West of Marden, Kent	STL: J14893	Fig No: 1
Date: 19 August 2021	Trial Pit Location Plan	

Southern Testing

Southern Testing: Keeble House, Stuart Way, East Grinstead, West Sussex RH19 4QA
ST Consult: Twigden Barns, Brixworth Road, Creaton, Northampton NN6 8NN

ST Consult

Southern Testing ST Consult

www.southerntesting.co.uk tel:01342 333100 www.stconsult.co.uk tel:01604 500020

Start - End Date:	Project ID:	Machine Type:	TP01
19/08/2021	J14893	JCB 3CX	Sheet 1 of 1

Project Name:	Land West of Marden, Kent, TN12 9SD	Remarks:	Co-ordinates:	Level (m AOD):	Logger:
			E 572136 - N 144221		PJS
Location:	Land West of Marden, Kent, TN12 9SD				
Client:	Origin Power Services Limited				

Samples and Insitu Testing			Level (m AOD)	Thickness (m)	Legend	Depth (m bgl)	Stratum Description
Depth (m)	Type	Results					
				(0.20)		0.20	Dark brown silty clay TOPSOIL
				(0.30)		0.50	Pale brown slighly silty CLAY
				(2.03)			Very stiff pale grey mottled dark orange brown CLAY with some roots. Becoming laminated with depth. Abundant fine selenite crystals from 2.0m
				(0.17)		2.53	2.5-2.53m Dark grey and cream shelly LIMESTONE band
							Very stiff pale grey mottled dark orange brown laminated CLAY
				(0.30)		2.70	Very stiff pale blue grey fissured CLAY / MUDSTONE
						3.00	Pit terminated at 3.00m.

1 2 3 4

Pit Dimension (m)		Pit Stability:	Water Strikes:
Width:	0.60	Stable	Groundwater encountered at 3.0m - slow seepage
Length:	2.20		
Depth:	3.00		

Southern Testing ST Consult

www.southerntesting.co.uk tel:01342 333100 www.stconsult.co.uk tel:01604 500020

Start - End Date:	Project ID:	Machine Type:	TP02
19/08/2021	J14893	JCB 3CX	Sheet 1 of 1

Project Name:	Land West of Marden, Kent, TN12 9SD	Remarks:	Co-ordinates:	Level (m AOD):	Logger:
			E 572144 - N 144252		JAC
Location:	Land West of Marden, Kent, TN12 9SD				
Client:	Origin Power Services Limited				

Samples and Insitu Testing			Level (m AOD)	Thickness (m)	Legend	Depth (m bgl)	Stratum Description
Depth (m)	Type	Results					
				(0.30)			Dark brown silty clay TOPSOIL with occasion flint gravel and roots
						0.30	
				(0.20)			Stiff dark orange / dark brown gravelly CLAY. Gravel is balck fine to medium ironstained SILTSTONE
						0.50	
				(2.13)			Very stiff pale grey mottled pale orange laminated CLAY with fine rootlets throughout. Abundant fine selenite crystals from 2.0m.
						2.63	2.6-2.63m Dark grey and cream shelly LIMESTONE band
				(0.27)			Very stiff pale grey mottled pale orange laminated CLAY.
						2.90	
				(0.20)			Very stiff pale blue grey fissured CLAY / MUDSTONE
						3.10	Pit terminated at 3.10m.

1 2 3 4

Pit Dimension (m)		Pit Stability:	Water Strikes:
Width:	0.60	Stable.	Groundwater encountered at 3.0m
Length:	2.40		
Depth:	3.10		

Southern Testing ST Consult

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Start - End Date:	Project ID:	Machine Type:	TP03
19/08/2021	J14893	JCB 3CX	Sheet 1 of 1

Project Name:	Land West of Marden, Kent, TN12 9SD	Remarks:	Co-ordinates:	Level (m AOD):	Logger:
			E 572465 - N 144517		PJS
Location:	Land West of Marden, Kent, TN12 9SD				
Client:	Origin Power Services Limited				

Samples and Insitu Testing			Level (m AOD)	Thickness (m)	Legend	Depth (m bgl)	Stratum Description
Depth (m)	Type	Results					
				(0.30)		0.30	Brown silty clay TOPSOIL with rootlets
				(0.40)		0.70	Firm brown mottled orange silty CLAY
				(0.70)		1.40	Stiff orange brown mottled creamy grey silty CLAY withn frequent black ironstined patech, and occasional thinly bedded weak ironstained SILTSTONE bands
				(0.70)		2.10	Pale brown and dark orange brown silty sandy GRAVEL. Gravel is fine to medium flat SILTSTONE, SANDSTONE and rounded flint with some black ironstaining. (Moist)
				(0.40)		2.50	Stiff pale blue grey CLAY
							Pit terminated at 2.50m.

1 2 3 4

Pit Dimension (m)		Pit Stability:	Water Strikes:
Width:	0.60	Unstable in gravel	Groundwater encountered at 2.1m
Length:	2.20		
Depth:	2.50		

Southern Testing ST Consult	Start - End Date:	Project ID:	Machine Type:	TP04
www.southerntesting.co.uk tel:01342 333100 www.stconsult.co.uk tel:01604 500020	19/08/2021	J14893	JCB 3CX	Sheet 1 of 1

Project Name:	Land West of Marden, Kent, TN12 9SD	**Remarks:**	**Co-ordinates:**	**Level (m AOD):** / **Logger:**
Location:	Land West of Marden, Kent, TN12 9SD		E 572695 - N 144591	PJS
Client:	Origin Power Services Limited			

Samples and Insitu Testing			Level (m AOD)	Thickness (m)	Legend	Depth (m bgl)	Stratum Description
Depth (m)	Type	Results					
				(0.20)		0.20	Dark orange brown silty clay TOPSOIL with rootlets
				(0.40)		0.60	Firm pale yellow brown very silty CLAY with some black ironstained patches.
				(0.80)		1.40	Stiff yellow / orange mottled creamy grey CLAY with some black ironstained patches.
				(1.50)		2.90	Dark orange and dark brown slightly clayey sandy GRAVEL. Gravel is fine to coarse flat SILTSTONE and rounded flint with some black ironstaining. (Moist)
				(0.20)		3.10	Stiff pale blue grey CLAY
							Pit terminated at 3.10m.

Pit Dimension (m)		Pit Stability:	Water Strikes:
Width:	0.60	Unstable in gravel	Groundwater encountered at 1.9m
Length:	2.40		
Depth:	2.10		

TP01 Section

TP01 Section and Side

TP01 Arisings

TP01 Backfilled

TP02 Section

TP02 Arisings

TP02 Backfilled

TP03 Section

TP03 Stockpile showing gravels

TP03 Stockpile showing clay

TP03 Backfilled

TP04 Section

TP04 Stockpile showing gravels

TP04 Stockpile showing clay

TP04 Backfilled

E MicroDrainage Calculation Sheets

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Thomas Smith
Site name:	Land to the West of Marden
Site location:	

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:	51.17389° N
Longitude:	0.46416° E
Reference:	417531605
Date:	Feb 22 2022 13:06

Runoff estimation approach FEH Statistical

Site characteristics

Total site area (ha): 74.5

Methodology

Q_{MED} estimation method: Specify QMed manually

Q_{MED} (l/s): 99.5

Q_{BAR} / Q_{MED} factor: 1.14

Hydrological characteristics	Default	Edited
SAAR (mm):	671	671
Hydrological region:	7	7
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Growth curve factor 200 years:	3.74	3.74

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):		113.03
1 in 1 year (l/s):		96.08
1 in 30 years (l/s):		259.97
1 in 100 year (l/s):		360.57
1 in 200 years (l/s):		422.74

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 rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Thomas Smith
Site name:	DNO/Customer HV
Site location:	Compound Land to the West of Marden

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:	51.17169° N
Longitude:	0.46087° E
Reference:	222509741
Date:	Jan 20 2022 12:54

Runoff estimation approach FEH Statistical

Site characteristics

Total site area (ha): 0.154

Methodology

Q_{MED} estimation method: Specify QMed manually

Q_{MED} (l/s): 0.5

Q_{BAR} / Q_{MED} factor: 1.14

Hydrological characteristics	Default	Edited
SAAR (mm):	671	671
Hydrological region:	7	7
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Growth curve factor 200 years:	3.74	3.74

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):		0.57
1 in 1 year (l/s):		0.48
1 in 30 years (l/s):		1.31
1 in 100 year (l/s):		1.81
1 in 200 years (l/s):		2.12

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 55 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	17.013	0.213	0.0	1.4	1.4	6.5	O K
30 min Summer	17.016	0.216	0.0	1.4	1.4	6.6	O K
60 min Summer	17.008	0.208	0.0	1.4	1.4	6.1	O K
120 min Summer	16.997	0.197	0.0	1.4	1.4	5.4	O K
180 min Summer	16.986	0.186	0.0	1.4	1.4	4.7	O K
240 min Summer	16.974	0.174	0.0	1.4	1.4	4.1	O K
360 min Summer	16.950	0.150	0.0	1.4	1.4	2.9	O K
480 min Summer	16.921	0.121	0.0	1.4	1.4	1.8	O K
600 min Summer	16.892	0.092	0.0	1.4	1.4	1.0	O K
720 min Summer	16.864	0.064	0.0	1.4	1.4	0.5	O K
960 min Summer	16.828	0.028	0.0	1.4	1.4	0.1	O K
1440 min Summer	16.809	0.009	0.0	1.0	1.0	0.0	O K
2160 min Summer	16.800	0.000	0.0	0.8	0.8	0.0	O K
2880 min Summer	16.800	0.000	0.0	0.6	0.6	0.0	O K
4320 min Summer	16.800	0.000	0.0	0.4	0.4	0.0	O K
5760 min Summer	16.800	0.000	0.0	0.4	0.4	0.0	O K
7200 min Summer	16.800	0.000	0.0	0.3	0.3	0.0	O K
8640 min Summer	16.800	0.000	0.0	0.3	0.3	0.0	O K
10080 min Summer	16.800	0.000	0.0	0.2	0.2	0.0	O K
15 min Winter	17.027	0.227	0.0	1.5	1.5	7.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	199.611	0.0	7.9	17
30 min Summer	116.343	0.0	9.2	31
60 min Summer	67.811	0.0	10.7	50
120 min Summer	39.523	0.0	12.4	82
180 min Summer	28.821	0.0	13.6	116
240 min Summer	23.036	0.0	14.5	150
360 min Summer	16.799	0.0	15.9	216
480 min Summer	13.427	0.0	16.9	274
600 min Summer	11.285	0.0	17.8	328
720 min Summer	9.791	0.0	18.5	382
960 min Summer	7.967	0.0	20.1	488
1440 min Summer	5.957	0.0	22.5	734
2160 min Summer	4.455	0.0	25.3	0
2880 min Summer	3.625	0.0	27.4	0
4320 min Summer	2.599	0.0	29.5	0
5760 min Summer	2.052	0.0	31.0	0
7200 min Summer	1.709	0.0	32.3	0
8640 min Summer	1.471	0.0	33.4	0
10080 min Summer	1.296	0.0	34.3	0
15 min Winter	199.611	0.0	8.8	17

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	17.032	0.232	0.0	1.5	1.5	7.8	O K
60 min Winter	17.025	0.225	0.0	1.5	1.5	7.3	O K
120 min Winter	17.010	0.210	0.0	1.4	1.4	6.2	O K
180 min Winter	16.994	0.194	0.0	1.4	1.4	5.2	O K
240 min Winter	16.976	0.176	0.0	1.4	1.4	4.2	O K
360 min Winter	16.936	0.136	0.0	1.4	1.4	2.3	O K
480 min Winter	16.881	0.081	0.0	1.4	1.4	0.8	O K
600 min Winter	16.830	0.030	0.0	1.4	1.4	0.1	O K
720 min Winter	16.819	0.019	0.0	1.2	1.2	0.0	O K
960 min Winter	16.807	0.007	0.0	1.0	1.0	0.0	O K
1440 min Winter	16.800	0.000	0.0	0.7	0.7	0.0	O K
2160 min Winter	16.800	0.000	0.0	0.6	0.6	0.0	O K
2880 min Winter	16.800	0.000	0.0	0.4	0.4	0.0	O K
4320 min Winter	16.800	0.000	0.0	0.3	0.3	0.0	O K
5760 min Winter	16.800	0.000	0.0	0.3	0.3	0.0	O K
7200 min Winter	16.800	0.000	0.0	0.2	0.2	0.0	O K
8640 min Winter	16.800	0.000	0.0	0.2	0.2	0.0	O K
10080 min Winter	16.800	0.000	0.0	0.2	0.2	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	116.343	0.0	10.3	31
60 min Winter	67.811	0.0	12.0	56
120 min Winter	39.523	0.0	14.0	90
180 min Winter	28.821	0.0	15.3	126
240 min Winter	23.036	0.0	16.2	162
360 min Winter	16.799	0.0	17.8	228
480 min Winter	13.427	0.0	19.0	278
600 min Winter	11.285	0.0	19.9	308
720 min Winter	9.791	0.0	20.7	364
960 min Winter	7.967	0.0	22.5	488
1440 min Winter	5.957	0.0	25.2	0
2160 min Winter	4.455	0.0	28.3	0
2880 min Winter	3.625	0.0	30.7	0
4320 min Winter	2.599	0.0	33.0	0
5760 min Winter	2.052	0.0	34.7	0
7200 min Winter	1.709	0.0	36.2	0
8640 min Winter	1.471	0.0	37.4	0
10080 min Winter	1.296	0.0	38.4	0

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 572800 144850 TQ 72800 44850
C (1km)	-0.023
D1 (1km)	0.327
D2 (1km)	0.389
D3 (1km)	0.285
E (1km)	0.307
F (1km)	2.468
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.021

Time (mins) From:	To:	Area (ha)
0	4	0.021

Model Details

Storage is Online Cover Level (m) 17.300

Swale Structure

Infiltration Coefficient Base (m/hr)	0.00000	Length (m)	40.0
Infiltration Coefficient Side (m/hr)	0.00000	Side Slope (1:X)	3.0
Safety Factor	2.0	Slope (1:X)	200.0
Porosity	1.00	Cap Volume Depth (m)	0.250
Invert Level (m)	16.800	Cap Infiltration Depth (m)	0.000
Base Width (m)	1.0		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0066-1400-0250-1400
Design Head (m)	0.250
Design Flow (l/s)	1.4
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	66
Invert Level (m)	16.750
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.250	1.4
Flush-Flo™	0.094	1.4
Kick-Flo®	0.191	1.2
Mean Flow over Head Range	-	1.1

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.4	1.200	2.9	3.000	4.4	7.000	6.7
0.200	1.3	1.400	3.1	3.500	4.7	7.500	6.9
0.300	1.5	1.600	3.3	4.000	5.1	8.000	7.2
0.400	1.7	1.800	3.4	4.500	5.4	8.500	7.4
0.500	1.9	2.000	3.6	5.000	5.7	9.000	7.6
0.600	2.1	2.200	3.8	5.500	5.9	9.500	7.8
0.800	2.4	2.400	3.9	6.000	6.2		
1.000	2.6	2.600	4.1	6.500	6.5		

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Thomas Smith
Site name:	BESS Compound
Site location:	Land to the West of Marden

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:	51.17037° N
Longitude:	0.47243° E
Reference:	2324533685
Date:	Jan 20 2022 12:57

Runoff estimation approach FEH Statistical

Site characteristics

Total site area (ha): 0.112

Methodology

Q_{MED} estimation method: Specify QMed manually

Q_{MED} (l/s): 0.4

Q_{BAR} / Q_{MED} factor: 1.14

Hydrological characteristics	Default	Edited
SAAR (mm):	671	671
Hydrological region:	7	7
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Growth curve factor 200 years:	3.74	3.74

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):		0.45
1 in 1 year (l/s):		0.39
1 in 30 years (l/s):		1.05
1 in 100 year (l/s):		1.45
1 in 200 years (l/s):		1.7

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 156 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	18.308	0.358	0.0	1.5	1.5	18.7	O K
30 min Summer	18.328	0.378	0.0	1.5	1.5	20.8	O K
60 min Summer	18.341	0.391	0.0	1.5	1.5	22.2	O K
120 min Summer	18.338	0.388	0.0	1.5	1.5	21.8	O K
180 min Summer	18.327	0.377	0.0	1.5	1.5	20.7	O K
240 min Summer	18.319	0.369	0.0	1.5	1.5	19.9	O K
360 min Summer	18.305	0.355	0.0	1.5	1.5	18.4	O K
480 min Summer	18.290	0.340	0.0	1.5	1.5	16.9	O K
600 min Summer	18.275	0.325	0.0	1.5	1.5	15.5	O K
720 min Summer	18.260	0.310	0.0	1.5	1.5	14.1	O K
960 min Summer	18.233	0.283	0.0	1.5	1.5	11.7	O K
1440 min Summer	18.173	0.223	0.0	1.5	1.5	7.1	O K
2160 min Summer	18.094	0.144	0.0	1.5	1.5	2.7	O K
2880 min Summer	18.021	0.071	0.0	1.5	1.5	0.6	O K
4320 min Summer	17.967	0.017	0.0	1.1	1.1	0.0	O K
5760 min Summer	17.954	0.004	0.0	0.9	0.9	0.0	O K
7200 min Summer	17.950	0.000	0.0	0.8	0.8	0.0	O K
8640 min Summer	17.950	0.000	0.0	0.6	0.6	0.0	O K
10080 min Summer	17.950	0.000	0.0	0.6	0.6	0.0	O K
15 min Winter	18.331	0.381	0.0	1.5	1.5	21.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	199.611	0.0	20.2	18
30 min Summer	116.343	0.0	23.6	33
60 min Summer	67.811	0.0	27.4	62
120 min Summer	39.523	0.0	32.1	120
180 min Summer	28.821	0.0	35.1	150
240 min Summer	23.036	0.0	37.3	182
360 min Summer	16.799	0.0	40.8	248
480 min Summer	13.427	0.0	43.5	318
600 min Summer	11.285	0.0	45.7	386
720 min Summer	9.791	0.0	47.6	456
960 min Summer	7.967	0.0	51.7	588
1440 min Summer	5.957	0.0	57.9	824
2160 min Summer	4.455	0.0	64.9	1164
2880 min Summer	3.625	0.0	70.5	1472
4320 min Summer	2.599	0.0	75.8	2176
5760 min Summer	2.052	0.0	79.8	2872
7200 min Summer	1.709	0.0	83.0	0
8640 min Summer	1.471	0.0	85.8	0
10080 min Summer	1.296	0.0	88.2	0
15 min Winter	199.611	0.0	22.6	18

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	18.354	0.404	0.0	1.5	1.5	23.7	O K
60 min Winter	18.371	0.421	0.0	1.5	1.5	25.6	O K
120 min Winter	18.374	0.424	0.0	1.5	1.5	25.9	O K
180 min Winter	18.363	0.413	0.0	1.5	1.5	24.7	O K
240 min Winter	18.352	0.402	0.0	1.5	1.5	23.4	O K
360 min Winter	18.333	0.383	0.0	1.5	1.5	21.3	O K
480 min Winter	18.312	0.362	0.0	1.5	1.5	19.1	O K
600 min Winter	18.290	0.340	0.0	1.5	1.5	16.9	O K
720 min Winter	18.267	0.317	0.0	1.5	1.5	14.7	O K
960 min Winter	18.220	0.270	0.0	1.5	1.5	10.7	O K
1440 min Winter	18.120	0.170	0.0	1.5	1.5	3.9	O K
2160 min Winter	17.984	0.034	0.0	1.4	1.4	0.1	O K
2880 min Winter	17.967	0.017	0.0	1.2	1.2	0.0	O K
4320 min Winter	17.951	0.001	0.0	0.8	0.8	0.0	O K
5760 min Winter	17.950	0.000	0.0	0.7	0.7	0.0	O K
7200 min Winter	17.950	0.000	0.0	0.5	0.5	0.0	O K
8640 min Winter	17.950	0.000	0.0	0.5	0.5	0.0	O K
10080 min Winter	17.950	0.000	0.0	0.4	0.4	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	116.343	0.0	26.4	32
60 min Winter	67.811	0.0	30.8	60
120 min Winter	39.523	0.0	35.9	118
180 min Winter	28.821	0.0	39.3	170
240 min Winter	23.036	0.0	41.8	192
360 min Winter	16.799	0.0	45.7	270
480 min Winter	13.427	0.0	48.7	346
600 min Winter	11.285	0.0	51.1	420
720 min Winter	9.791	0.0	53.3	492
960 min Winter	7.967	0.0	57.8	626
1440 min Winter	5.957	0.0	64.8	850
2160 min Winter	4.455	0.0	72.7	1100
2880 min Winter	3.625	0.0	78.9	1468
4320 min Winter	2.599	0.0	84.9	2120
5760 min Winter	2.052	0.0	89.4	0
7200 min Winter	1.709	0.0	93.0	0
8640 min Winter	1.471	0.0	96.1	0
10080 min Winter	1.296	0.0	98.8	0

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 572800 144850 TQ 72800 44850
C (1km)	-0.023
D1 (1km)	0.327
D2 (1km)	0.389
D3 (1km)	0.285
E (1km)	0.307
F (1km)	2.468
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.054

Time (mins) From:	To:	Area (ha)
0	4	0.054

Model Details

Storage is Online Cover Level (m) 19.000

Swale Structure

Infiltration Coefficient Base (m/hr)	0.00000	Length (m)	40.0
Infiltration Coefficient Side (m/hr)	0.00000	Side Slope (1:X)	3.0
Safety Factor	2.0	Slope (1:X)	200.0
Porosity	1.00	Cap Volume Depth (m)	0.000
Invert Level (m)	17.950	Cap Infiltration Depth (m)	0.000
Base Width (m)	1.0		

Hydro-Brake® Optimum Outflow Control

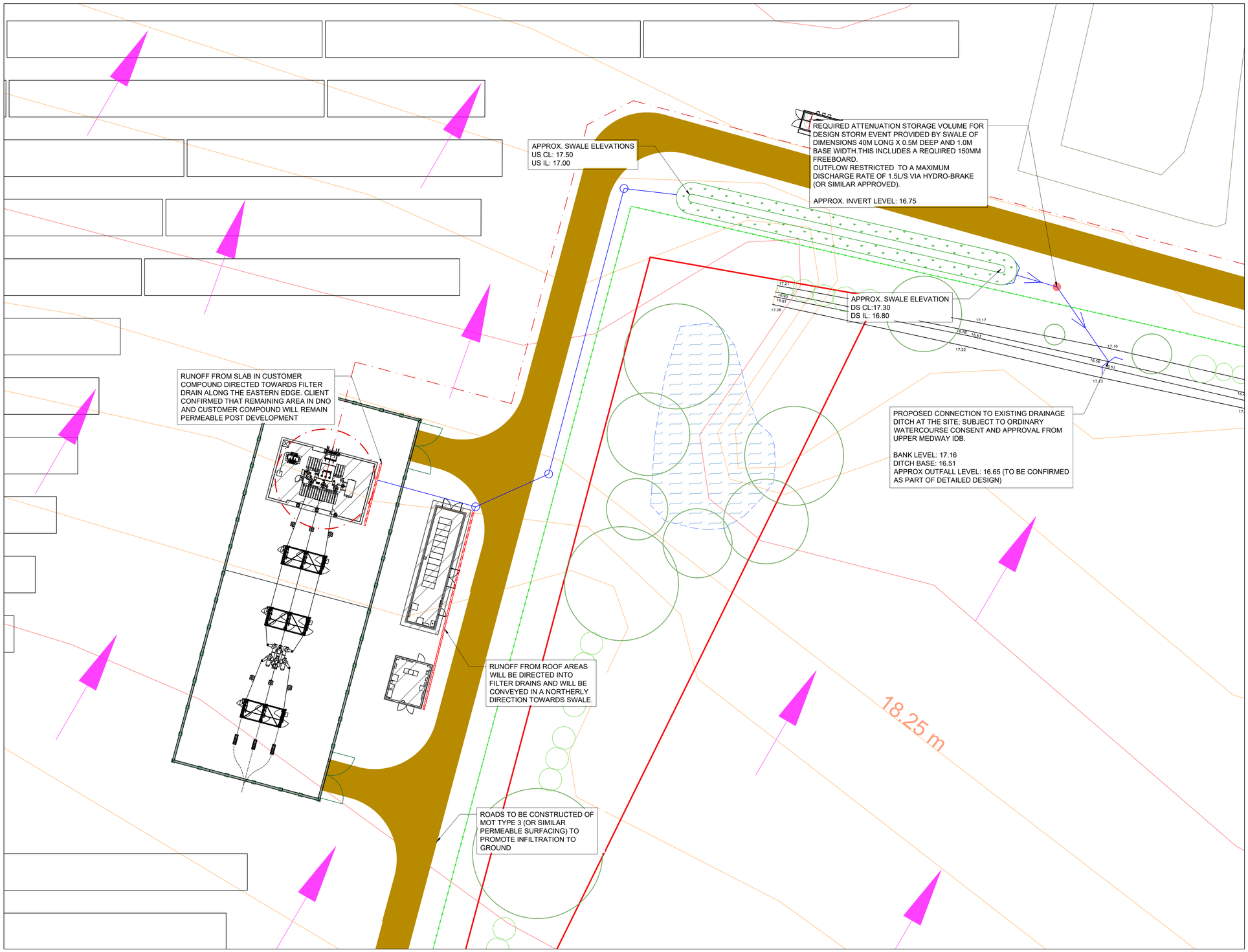
Unit Reference	MD-SHE-0065-1500-0500-1500
Design Head (m)	0.500
Design Flow (l/s)	1.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	65
Invert Level (m)	17.900
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.500	1.5
Flush-Flo™	0.147	1.5
Kick-Flo®	0.336	1.3
Mean Flow over Head Range	-	1.3

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.5	1.200	2.2	3.000	3.4	7.000	5.1
0.200	1.5	1.400	2.4	3.500	3.7	7.500	5.3
0.300	1.4	1.600	2.5	4.000	3.9	8.000	5.4
0.400	1.4	1.800	2.7	4.500	4.1	8.500	5.6
0.500	1.5	2.000	2.8	5.000	4.3	9.000	5.8
0.600	1.6	2.200	2.9	5.500	4.5	9.500	5.9
0.800	1.9	2.400	3.1	6.000	4.7		
1.000	2.0	2.600	3.2	6.500	4.9		

F Conceptual Drainage Plan



Construction Risks	Public Risks	Environmental Risks
• Flood Risk; • Unknown existing services; • Ground Conditions- possible instability, contamination and groundwater ingress; • Risk of UXOs on site; • Working at height; • Working near water; • Confined spaces, asphyxiation.	• Vehicle/Pedestrian Collision; • Members of public accessing site.	• Potential disturbance to protected species; • Effects on drainage from tree roots and leaf litter; • Pollution of surface water sewers / watercourses; • Fuel spillage.

In addition to the hazards/risks normally associated with the types of work detailed on this drawing take note of the above.
It is assumed that all works detailed on this drawing will be carried out by a competent contractor working, where appropriate, to an appropriate method statement.

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION BOX

Drawing Notes

1. All dimensions shown are in millimetres unless otherwise stated and levels in metres to Ordnance Datum.
2. Do not scale from this drawing. All dimensions must be checked/verified on site.
3. Any discrepancies noted on site are to be reported to the engineer immediately.
4. This drawing is based on the revised site layout titled SCUKX-MARDN-001-100G (20211222) External Release by Statkraft provided to JBA on 23/12/2021.
5. Surface water drainage strategy has been developed based on levels detailed within the topographic survey and watercourse survey. Details provided in drawing reference Sheepwash_UAV-TOPO_Linework_OSGB36_Rev1_20211008 and Sheepwash_DITCH-GROUND-SURVEY_Linework_OSGB36_Rev1_20211008.
6. No deep rooted trees to be planted in vicinity of any underground drainage elements.
7. No detailed modelling of the drainage system has been carried out at this stage and therefore the drainage layout should be read as indicative only.
8. Details of underground services provided within Landmark Information Group Utilities Report. However, final detailed survey of existing infrastructure on site should be undertaken prior to the detailed design stage. Presence and location of any other services is unknown at this stage.
9. It is proposed that runoff from the DNO/Customer HV Compound area will discharge to an ordinary watercourse at the site. Runoff generated by the BESS Compound will discharge to EA main river (Lesser Teise). Connection to watercourse is subject to obtaining relevant permissions such as registering for a flood risk activity exemption to construct the outfall and ordinary watercourse consent.
10. The proposed surface water drainage scheme will not cross third-party land.
11. The electronic model of this drawing is not to be used for setting out.
12. The drawing is for approvals and consultations with third party only - not for construction.
13. All cover levels assumed pending external design levels by others.

Key

- Site Boundary
- Perimeter Fence
- Proposed Swale
- Proposed Impermeable Area
- Access Road (MOT Type 3 or Other Permeable Surfacing)
- Proposed Filter Drains
- Potential Overland Flow Route
- Solar PV Panels
- Existing Topographic Contours
- Proposed Flow Control Device
- Grid Connection Route
- Proposed Surface Water Drainage Pipe
- Proposed Surface Water Manholes
- Proposed Outfall
- Trees
- Water Feature
- Drainage Ditch

Rev.:	Comments	Date	Drawn	Designed	Checked	Approved

Client Approval

- A - Approved
- B - Approved with Revisions
- C - Do Not Use

Purpose of Issue	Status
Planning	S3

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LAND TO THE WEST OF MARDEN

SURFACE WATER DRAINAGE STRATEGY
DNO/CUSTOMER HV COMPOUND

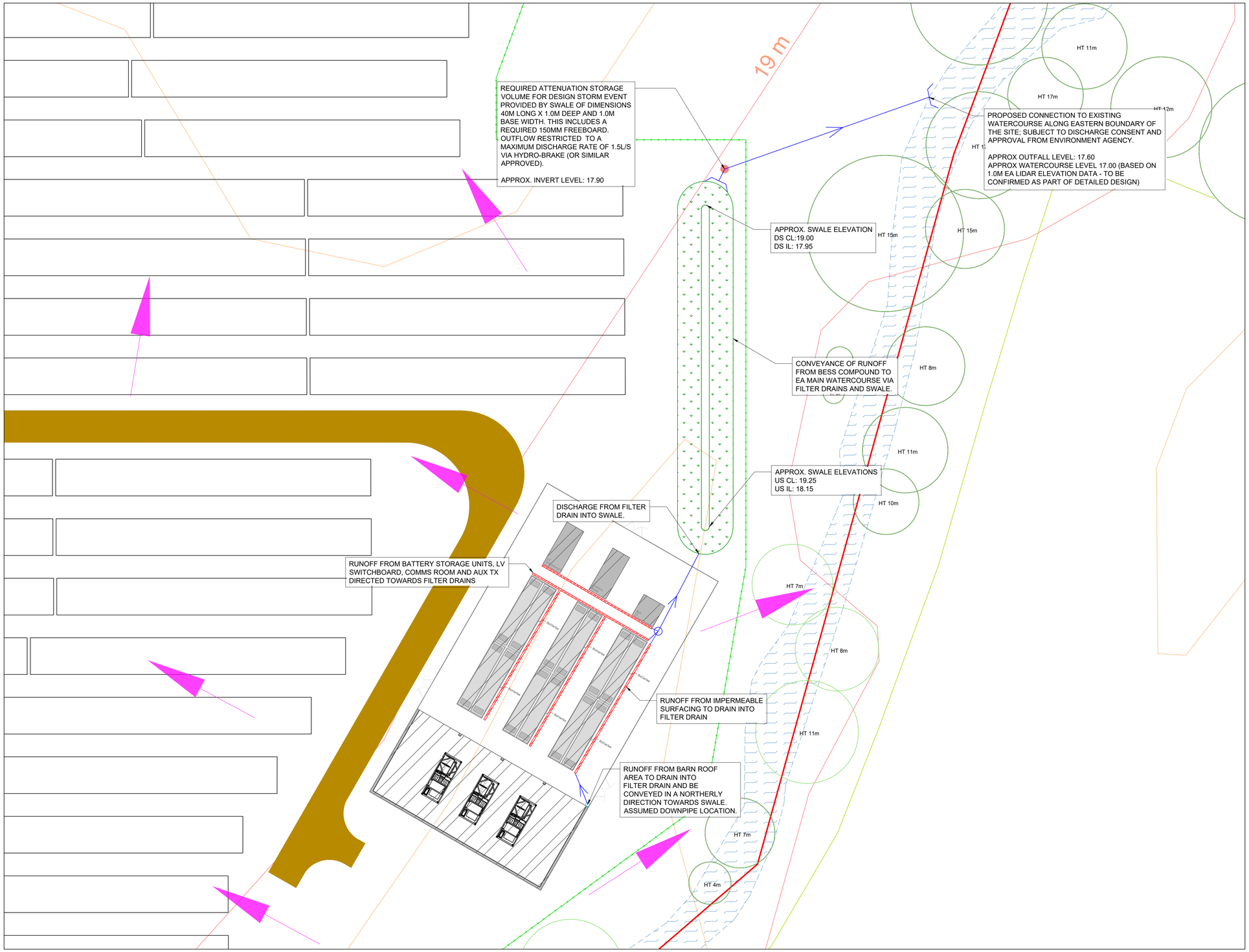
for

Origin Power Services Ltd

Scale:			
1:250 @ A1	Drawn:	Tom Smith	21/01/22
	Designed:	Tom Smith	21/01/22
	Checked:	Luke Virgo	03/02/22
	Approved:	Luke Virgo	03/02/22

Digital File Name: GGO-JBAU-XX-XX-DR-D-0001

Drawing Number:	Revision
GGO-JBAU-XX-XX-DR-D-0001	P02



Construction Risks	Public Risks	Environmental Risks
• Flood Risk; • Unknown existing services; • Ground Conditions- possible instability, contamination and groundwater ingress; • Risk of UXOs on site; • Working at height; • Working near water; • Confined spaces, asphyxiation.	• Vehicle/Pedestrian Collision; • Members of public accessing site.	• Potential disturbance to protected species • Effects on drainage from tree roots and leaf litter; • Pollution of surface water sewers / watercourses; • Fuel spillage.

In addition to the hazards/risks normally associated with the types of work detailed on this drawing take note of the above.
It is assumed that all works detailed on this drawing will be carried out by a competent contractor working, where appropriate, to an appropriate method statement.

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION BOX

Drawing Notes

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6. No deep rooted trees to be planted in vicinity of any underground drainage elements.
7. No detailed modelling of the drainage system has been carried out at this stage and therefore the drainage layout should be read as indicative only.
8. Details of underground services provided within Landmark Information Group Utilities Report. However, final detailed survey of existing infrastructure on site should be undertaken prior to the detailed design stage. Presence and location of any other services is unknown at this stage.
9. It is proposed that runoff from the compound area will discharge to an ordinary watercourse at the site. Runoff generated by the battery storage units will discharge to EA main river (Lesser Teise). Connection to watercourse is subject to obtaining relevant permissions such as registering for a flood risk activity exemption to construct the outfall and ordinary watercourse consent.
10. The proposed surface water drainage scheme will not cross third-party land.
11. The electronic model of this drawing is not to be used for setting out.
12. The drawing is for approvals and consultations with third party only - not for construction.
13. All cover levels assumed pending external design levels by others.

Key

- Site Boundary
- Perimeter Fence
- Proposed Swale
- Proposed Impermeable Area
- Access Road (MOT Type 3 or Other Permeable Surfacing)
- Proposed Filter Drains
- Potential Overland Flow Route
- Solar PV Panels
- Existing Topographic Contours
- Proposed Flow Control Device
- Assumed Rainwater Downpipe
- Proposed Surface Water Drainage Pipe
- Proposed Surface Water Manholes
- Proposed Outfall
- Trees
- EA Main Watercourse

Rev.:	Comments	Date	Drawn	Designed	Checked	Approved

Client Approval

	A - Approved
	B - Approved with Revisions
	C - Do Not Use

Purpose of Issue	Status
Planning	S3

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LAND TO THE WEST OF MARDEN

SURFACE WATER DRAINAGE STRATEGY BESS COMPOUND

for

Origin Power Services Ltd

Scale:		
1:250 @ A1	Drawn:	Tom Smith 21/01/22
	Designed:	Tom Smith 21/01/22
	Checked:	Luke Virgo 03/02/22
	Approved:	Luke Virgo 03/02/22

Digital File Name: GGO-JBAU-XX-XX-DR-D-0002

Drawing Number:	Revision
GGO-JBAU-XX-XX-DR-D-0002	P02

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OHSAS 18001:2007