REPORT

SuDS Drainage Strategy

Land adjacent to the Wastewater Treatment Works
Britford Salisbury Wiltshire SP5 4DX

Client: Wiltshire Wildlife Community Energy Limited

Reference: 6742-RHD-ZZ-XX-RP-Z-0001
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1 Introduction

Royal HaskoningDHV has been appointed by the Wiltshire Wildlife Community Energy Limited to prepare a Surface Water Drainage Strategy for a proposed solar farm development on the land adjacent to the Wastewater Treatment Works, Britford, Salisbury, Wiltshire SP5 4DX. Proposed development plans are included in **Appendix A** and the site location is shown in **Figure 1**.

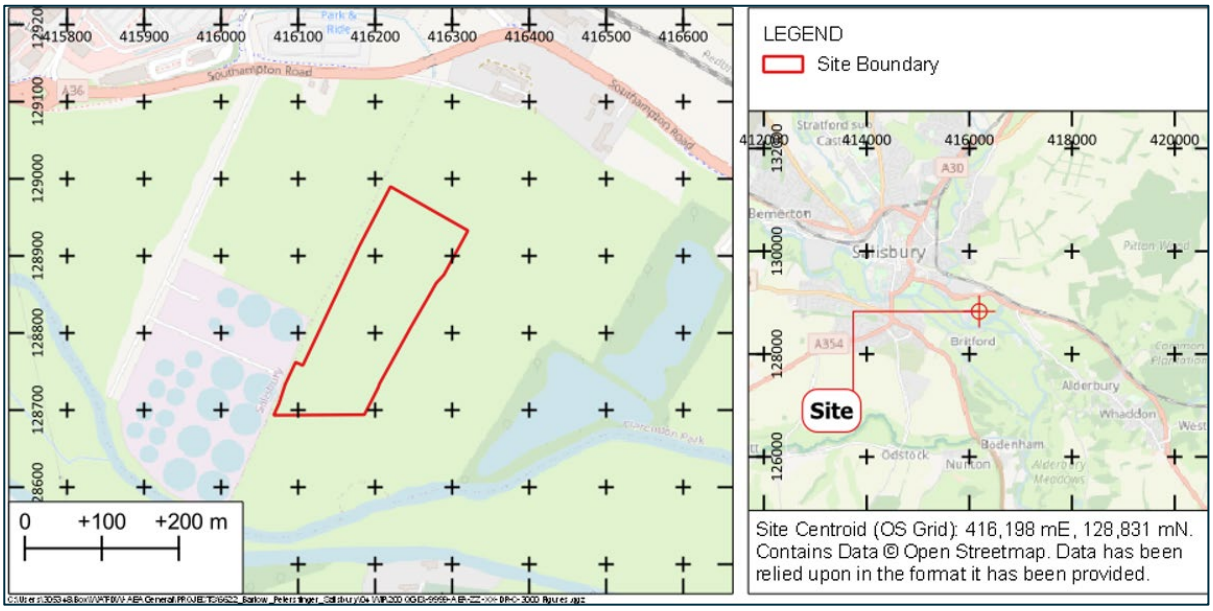

Figure 1-1: Site Location Plan

The existing site is undeveloped agricultural land. A wastewater treatment works is located to the immediate southwest. The town of Salisbury is located approximately 1.50km to the northwest.

The site is shown to be in Flood Zone 3 (high risk) on the Environment Agency (EA) Flood Map for Planning. The flood source is the River Avon, an EA 'Main River' which is located around 200m south of the site boundary. As the site is partly located in Flood Zone 3, a site-specific flood risk assessment is required as part of the planning application to meet the requirements of the National Planning Policy Framework[1] (NPPF), and this has been provided separately. This Surface Water Drainage Strategy document will consider the implications of the surface water and fluvial risk on the proposed drainage system, but will focus on management of surface water for the proposed development.

The content of this Sustainable Drainage Strategy (SuDS) report is based on the advice set out in the National Planning Policy Framework (NPPF) and the Technical Guidance to the NPPF, published in July 2021.

This report is based on site specific infiltration tests, geology mapping, OS mapping, topographic survey, Strategic Flood Risk Assessment and local policy.

This document includes the following sections:

[1] Ministry of Housing, Communities & Local Government, "National Planning Policy Framework," 20 July 2021. [Online]. Available: https://www.gov.uk/government/publications/national-planning-policy-framework--2.

- Section 2 - describes the relevant policy;
- Section 3 - site description, including site levels, proximity to watercourses etc.;
- Section 4 – details the proposed drainage strategy;
- Section 5 – maintenance of proposed drainage features;
- Section 6 - concludes the report.

2 Policy Context

2.1 Introduction

This section sets out the policy context. The content of this SuDS report is based on the advice set out in the NPPF published in July 2021 and Annex 3: Flood risk vulnerability classification, also in the NPPF.

2.2 National Planning Policy Framework

The 'requirement' for SuDS on a 'major' development is set out in Paragraph 169 of the NPPF (2021) which states:

"Major developments should incorporate sustainable drainage systems unless there is clear evidence that this would be inappropriate. The systems used should:

- *Take account of advice from the lead local flood authority;*
- *Have appropriate proposed minimum operational standards;*
- *Have maintenance arrangements in place to ensure an acceptable standard of operation of the lifetime of the development; and*
- *Where possible, provide multifunctional benefits."*

The solar farm is a temporary development and would not be considered "major" development if only its actual ground area impact were considered. The land will be returned to full agricultural use after the expiration of the temporary solar farm consent, so SuDS that would require new intrusive or otherwise unnatural elements (e.g. pipework or tanks) or land shaping (e.g. swales) should only be required as a last resort to enable easy restoration to existing agricultural use with minimal ground disturbance or disruption to new and improved ecological features.

2.3 Flood Zone

The Flood Map for Planning shows the site to be located in Flood Zone 3 meaning it has greater than a 1 in 100 annual probability of flooding from fluvial sources. The EA Flood Map for Planning has been enclosed in **Appendix B** for reference. A Flood Risk Assessment has been provided as a separate document to consider the risk to the development and recommend mitigation measures.

2.4 Local Policy

The Wiltshire Core Strategy was adopted by the Council in January 2015. The Local Plan will guide development within the District for the period to 2026. The Local Plan has been developed in accordance with national planning policy and guidance, as well as the Council's own ambitions for growth and change.

‘Core Policy 67: Flood Risk’ of the Wiltshire Core Strategy covers the District’s approach to surface water management for new developments, and encourages the use of SuDS to help achieve this. Policy 67 states:

“All new development will include measures to reduce the rate of rainwater run-off and improve rainwater infiltration to soil and ground (sustainable urban drainage) unless site or environmental conditions make these measures unsuitable”

As discussed in this report, infiltration tests have demonstrated that infiltration would not be suitable at the site, therefore alternative measures to manage the surface water runoff have been considered.

3 Existing Site Assessment

3.1 Site Description

The site covers 2.23 hectares and is located on undeveloped agricultural land adjacent to the Wastewater Treatment Works, Britford, Salisbury, Wiltshire SP5 4DX.

The proposed development comprises the construction of a solar farm comprising 23 rows of solar arrays. The proposed development plans are included in **Appendix A**.

3.2 Local Watercourses

The River Avon is located approximately 200m south of the site, as shown on Figure 2. In addition, there are a number of drainage ditches surrounding the site which ultimately discharge to the River Avon to the south east. One such drainage ditch forms part of the south eastern boundary.

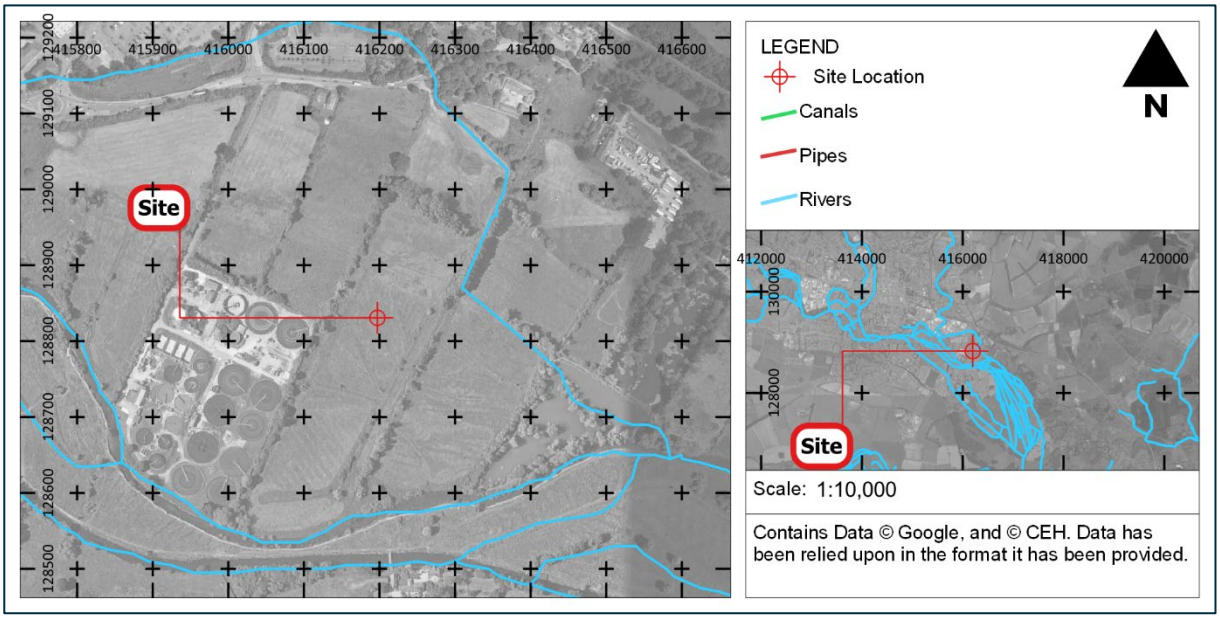

Figure 3-1: Nearby Watercourses

3.3 Site Levels

A topographic survey is enclosed in **Appendix C**. The site is relatively flat at between 42.50m AOD and 43.00m AOD. The ground level is higher to the north of the site and the lower levels are along the southeast boundary.

3.4 Geology and Groundwater

The online British Geological Survey resource (www.bgs.ac.uk) shows the site has a bedrock geology of Newhaven Chalk Formation – Chalk. Superficial deposits of Alluvium – Clay, sand and gravel are also present. Both the chalk and alluvium deposits suggest there may be good infiltration at the site.

Infiltration tests were carried out in August 2022 and the test report is included in **Appendix D**. Tests were carried out at six locations across the site, at depths of between 0.50m and 1.50m below ground level. The soil descriptions identify sandy gravel and clay in all of the test pits. It was not possible to achieve infiltration rates to BRE365 standard as the ground conditions were noted to be practically impermeable in the shallow test pits, and groundwater entering the deeper pits. The groundwater was monitored for approximately 30 to 45 minutes and the average depth was recorded to be approximately 0.70m to 0.80m below ground level. The conclusion of the test report was that soakaways and shallow infiltration would not be suitable for the site.

The site is not located above a groundwater Source Protection Zone. The site is however located in a Medium to High groundwater vulnerability zone with a soluble rock risk (https://magic.defra.gov.uk/magicmap.aspx). This identifies there to be a reasonably high risk of a pollutant reaching the groundwater. This highlights the importance of filtering pollutants from any runoff leaving the site, to reduce the risk of contaminating any local groundwater resources. It is not recommended to include infiltration devices in areas with high groundwater vulnerability, as this can create pathways for pollution to reach the aquifer.

3.5 Sewers

With reference to the Wessex Water sewer records included in **Appendix E**, there is a combined sewer crossing the site. The proposed development is located at surface level so it unlikely to have an impact on the sewer. However, a buffer will be left undeveloped along the route of the combined sewer to allow access in the future.

3.6 Climate Change Allowances

Pluvial Climate Change Allowances are determined by the predicted increase in peak rainfall intensity. These are determined by regional variations, which are based on the management catchments. Management catchments are sub-catchments of river basin districts. The site is located in the Avon Hampshire management catchment. Table 1 presents the Peak Rainfall Intensity climate change allowances.
The guidance also sets out which climate change allowance should be used for different development lifetimes [24]. This guidance is outlined below:

Development with a lifetime beyond 2100

This includes development proposed in applications or local plan allocations.
For flood risk assessments and strategic flood risk assessments assess the upper end allowances. You must do this for both the 1% and 3.3% annual exceedance probability events for the 2070s epoch (2061 to 2125).
Design your development so that for the upper end allowance in the 1% annual exceedance probability event:

- there is no increase in flood risk elsewhere
- your development will be safe from surface water flooding

Development with a lifetime of between 2061 and 2100

For development with a lifetime between 2061 and 2100 take the same approach but use the central allowance for the 2070s epoch (2061 to 2125).

Development with a lifetime up to 2060

For development with a lifetime up to 2060, take the same approach but use the central allowance for the 2050s epoch (2022 to 2060).

The lifetime of the proposed solar farm is anticipated to be between 30 years and 40 years, which would take it up to around 2060. For this reason, the central allowance for the 2050s epoch was used to estimate the climate change allowance.

The Application Site is located in the Avon Hampshire management catchment, climate change allowances are based on a 1981 to 2000 baseline. The 2050, 30 Year Central Climate Change allowance for peak rainfall intensity is 20%. The 2050, 100 Year Central Climate Change allowance for peak rainfall intensity is 25%.

Table 1: Peak rainfall intensity allowance in Avon Hampshire management catchment

Management catchment name	2050s central for 30yr RP	2050s upper end for 30yr RP	2050s central for 100yr RP	2050s upper end for 100yr RP	2070s central for 30yr RP	2070s upper end for 30yr RP	2070s central for 100yr RP	2070s upper end for 100yr RP
Avon Hampshire	**20%**	35%	**25%**	40%	25%	40%	25%	45%

4 Proposed Drainage Strategy

4.1 Relevant SuDS Policy

Sustainable Drainage Systems (SuDS) mimic the natural drainage system and provide a method of surface water drainage which can decrease the quantity of water discharged, and hence reduce the risk of flooding. In addition to reducing flood risk, these features can improve water quality and provide biodiversity and amenity benefits.

The SuDS management train incorporates a hierarchy of techniques and considers all three SUDS criteria of flood reduction, pollution reduction, and landscape and wildlife benefits. In decreasing order of preference, the preferred means of disposal of surface water runoff is:

- Discharge to ground.
- Discharge to a surface water body.
- Discharge to a surface water sewer.
- Discharge to a combined sewer.

The philosophy of SuDS is to replicate as closely as possible the natural drainage from a site predevelopment and to treat runoff to remove pollutants, resulting in a reduced impact on the receiving watercourses. The benefits of this approach are as follows:

- Reducing runoff rates, thus reducing the flood risk downstream;
- Reducing pollutant concentrations, thus protecting the quality of the receiving water body;
- Groundwater recharge;
- Contributing to the enhanced amenity and aesthetic value of development areas; and
- Providing habitats for wildlife in developed areas, and opportunity for biodiversity enhancement.

One of the multifunctional environmental benefits of a solar farm is soil quality improvement from cessation of intensive agricultural use and organic management of the land. It is expected that soil health will be improved through increase in soil organic matter, increase in the diversity of soil flora, fauna and microbes, and improved soil structure. All of the elements of a solar farm can be removed very easily with minimal topsoil disturbance which should leave the improved and enriched soil as a benefit for the return to agricultural use.

Additionally although a solar farm is a temporary consent that does not change the greenfield land classification, its 30-year lifetime is not short. Temporary land drainage measures that might unnaturally change the existing baseline could subsequently be relied off-site as part of the wider ecosystem services network. When the solar farm is decommissioned and these are removed/reverse, there is a risk of adverse “downstream” impacts for those who have relied on the temporary benefit of the SuDS. Therefore, although SuDS are intended to contribute to flood resilience, the nature of a solar farm and its whole-life context needs to be carefully considered so that the sustainable development can be implemented in a sustainable manner and with an eye on the future restoration to existing conditions and the resumption of pastoral use.

The management of surface water has been considered with respect to the SuDS hierarchy and site constraints, in Table 2 (as detailed in the CIRIA 753 'The SUDS Manual', Section 3.2.3).

Hierarchy (most preferred first)	Suitable?	Comment
1. Store rainwater for later use	No	Unlikely to be required for later use on a solar farm site.
2. Discharge to the Ground (Infiltration)	No	Infiltration tests failed at the site and high groundwater levels suggest infiltration would not be viable.
3. Discharge to Surface Water (lake, watercourse, canal, etc.)	Yes	Ditch on site boundary discharges to the River Avon to the south.
4. Discharge to Surface Water Sewer, Highway Drain or another Drainage System	No	Discharge to a watercourse has a higher position on the drainage hierarchy and therefore takes precedent.
5. Discharge to Combined Sewer		
6. Discharge to Foul Sewer		

Table 2: CIRIA 753 Table 2, The SuDS Hierarchy (adapted)

According to the SuDS hierarchy above, the most suitable discharge location for the development is to the ditch which is located on the south eastern site boundary. This in turn discharges to the River Avon, located around 200m to the south.

4.2 Drainage Strategies for Solar Farm Developments

Compared to agricultural (arable & livestock) use, a solar farm is likely to be inherently better for surface water drainage than a continuation of the existing use. If a solar farm proposal avoids the creation of new hardstanding, includes mitigation for ancillary buildings, and will not alter existing landforms (e.g. levelling or bunds), a solar farm will not change existing characteristics and should be a positive improvement even with no additional SuDS measures.

The primary reason for this is the significant advantage from full year-round organically managed vegetated ground cover on a solar farm compared with intensive arable or livestock grazing uses. Research undertaken by Cook and McCuen (2013) found that providing full vegetation cover beneath the solar panels is maintained, the change in runoff characteristics from solar farm sites is likely to be insignificant and that ground cover has a much more important control over runoff.

Guidance in the Essex Design Guide (https://www.essexdesignguide.co.uk/supplementary-guidance/solarfarm-guiding-principles/flood-risk-and-suds/) highlights the potential for solar farms to interrupt overland flow routes, reduce the amount of rainfall absorbed into the ground and increase the rate and volume of surface water runoff. One of the main consequences of this is the increased risk of soil erosion at solar farm sites, discussed below. The Essex Design Guide has prepared guidance on solar array developments and drainage which is located here: https://www.essexdesignguide.co.uk/suds/further-guidance/solar-array-development/

A solar farm already includes designed-in surface water flood risk mitigation. This is something solar PV planning applications do not always effectively communicate. It can be helpful to clarifying some of the ways that surface water flood risk is addressed without adding in new features.

Panel Runoff

The nature of the Proposed Development means that precipitation would be intercepted by between 25% to 40% of the surface of the Site that is typically over-sailed by solar panels. A known concern is the risk of water "sheeting" off a solar array façade, running off at speed onto the same ground, pooling, and over time

creating erosion and runoff channels alter existing surface water flows. This issue can arise due to simplified drawings typically submitted with planning applications. These show what looks to be a solid façade when, in actuality, a typical solar array has gaps between each panel on an array which allows surface water to fall off in many locations on to fully vegetated ground beneath.

Figure 4-1 is an extract from an elevation plan for a typical (fixed) array and highlights the gaps between the panels making up the solar array. The approx. 15 degree pitch means water is less likely to run down with velocity that helps it to "jump" the gaps. Rather, water runs off at a reduced speed due to the pitch, and drips down through the gaps. There is a significantly reduced risk of water sheeting down in one area at the lower edge of the arrays. **Figure 4-2** is from the underside of an array providing a helpful visual aid to show what the gaps are like.

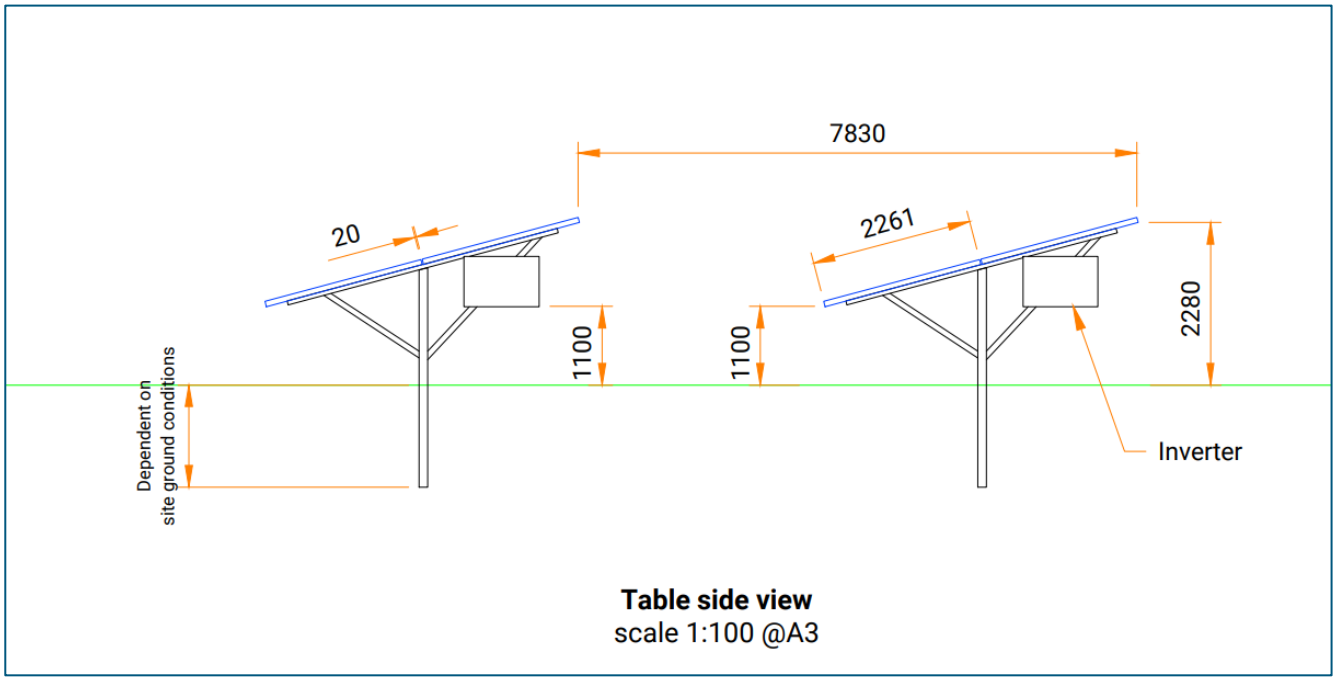

Figure 4-1: Elevations for a typical fixed array



Figure 4-2: Underside of a solar panel

Figure 4-1 and **Figure 4-2** are provided for context and comparison only.

As result of the construction of the solar panels, some rainfall will be intercepted by the surface of the arrays before reaching ground level. Intercepted rainfall will either run down the face of the panels and drip onto the ground below or will be lost due to evaporation from the face of the panels. Without mitigation there is a risk of erosion of the ground on which rainwater drips. This could then result in the formation of rivulets which could increase the speed at which runoff discharges from the site. However, the potential for erosion to occur as a result of the 'drip effect' is appropriately mitigated by features of the solar arrays themselves, as per the images above. In addition, several mitigation techniques have been suggested as described in the following sections.

Vegetated Ground

In addition to the above, appropriate seeded vegetation will be provide below and between rows of the solar panels to act as a level spreader/energy dissipater to promote low erosivity sheet flow during operation of the solar farm. The vegetation will be managed organically and will either be mowed or used for light grazing. The grassland will not only grow between array gaps, but it includes all ground under the arrays as well. This means that excluding the access tracks and ancillary buildings most of the Site will be fully vegetated species rich pastoral grassland.

This full year-round coverage will be a positive improvement compared to existing intensive grazing use. Without any additional development being required the gaps between the arrays are natural filter strips (SuDS).

Figure 4-3 is from Chelworth solar farm in 2022, after 5 years of land management by the Wiltshire Wildlife Trust under a similar regime as is being proposed at Petersfinger. Although land in front of panels may also be managed through annual mowing, it is clear that substantial vegetation is present beneath the arrays. At Petersfinger, existing historic water meadow features will be enhanced as a consequence of reduced grazing. The proposed year-round ground coverage is an improvement with respect to surface water infiltration compared to the existing agricultural use where vegetation is tightly grazed.



Figure 4-3: Chelworth Solar Farm

The key takeaway is that the majority of the Site has mitigation and SuDS inherently designed-in. The arrays are designed to avoid sheeting/pooling/erosion. Water drips off at multiple points onto vegetated ground below, and there is significant space between rows to act as natural filter strips with vegetated ground that slows the movement of surface water.

As previously discussed, infiltration tests demonstrated that infiltration is not possible at the site. This, along with the shallow groundwater, suggests that on the existing site and the proposed development, most of the surface water runoff would be directed to the surrounding ditches rather than infiltrate to the ground. Therefore, any drainage strategy designed for the proposed development should similarly aim to discharge runoff towards the existing ditches.

The shallow groundwater limits the depth of any filter drain or ditch that could be included to provide attenuation capacity, therefore it is not possible the significantly attenuate the runoff within gravel filled trenches or drainage ditches. It would be superfluous to include a large balancing pond at the downstream end to manage the runoff, and this would require pumping to the outfall point on the ditch, which is considered to be an over-engineered solution.

Therefore, given the site limitations, it is not possible to significantly attenuate and manage the runoff from the solar array itself during extreme rainfall events. Rather, it is accepted that in extreme events the runoff would create overland flow and be directed towards the surrounding ditches and ultimately to the River Avon, as is the existing situation. It should be noted that there are no properties or other receptors between the low point of the site (to the south east) and the River Avon, which would become flooded in the event that the surface water drainage system overflowed. The surface water flows would follow the natural topography towards the River Avon.

A robust land management plan will be included in the development, to maintain the vegetation and long grass between the solar arrays, which will help to slow overland flow and reduce erosion. The land management plan will include regular site inspections and maintenance of areas which are identified as being within the main flow paths, which could be at highest risk of erosion. These areas will be remediated if they become eroded, and new vegetation will be planted to help manage the issue. It is recommended that the land management inspections occur more regularly during the winter months, between October and March, which is when the highest rainfall is expected. A separate land management plan will be provided as part of this application.

The 'built' part of the development includes a new access road and some units which will include the infrastructure relating to the development. Runoff from these impermeable areas will be managed using sustainable drainage methods, and these have been discussed below.

4.3 Potential New Impermeable Surfaces

Solar Arrays

The majority of the Petersfinger Solar Farm developed area will be occupied by solar arrays. Although arrays have a large land take, the actual ground impact is negligible. The only intrusion will be from the pile-driven posts. There will be one post for about 6-7 panels, so likely to be 6-7m between each post. Posts are made of galvanized steel and are not solid poles. Traditional fixed solar arrays have surface area ground impact in the range of 0.0012m^2 - 0.0014m^2 .

The number of the modules in this solar farm would be 2,736, with panel width of 1.034m. Assuming that there will be posts ever 6m the total number of posts would be approx. 441.

Based on this, if the 0.0014 m^2 per post is assumed, the total solar farm ground impact would be 0.62 m^2 on a 2.23 ha (22,300 m^2) Site. This means that what covers the majority of the land as "development" will have a ground impact on 0.0003% of the Site.

A robust land management plan will be the focus here, with the runoff form the panels reaching the ground and following the natural topography of the site towards the south east. Runoff will either then be intercepted by the proposed swale or be directed towards the existing ditches and drains and ultimately to the River Avon.

Access Tracks and Ancillary Buildings

It is proposed that the internal access tracks will be fully permeable with no tarmac or other hardstandings. Most will follow existing farm tracks so would not even be new access routes. As such they will have no impact with respect to surface water drainage. However, for the purpose of the drainage model it has been assumed that no infiltration will occur, thereby assuming a worst-case scenario.

Geotextile membrane layers will help to secure the aggregate to prevent it sinking into the soil and this will help prevent ground compaction. After the construction of the solar farm the heaviest vehicles likely to use the tracks are occasional van or 4x4 type vehicles. This means there is low risk of over-use causing compaction that could compromise permeability. Despite this, it will be reasonable to include monitoring and maintenance of the internal accesses over the lifetime of the solar farm.

In construction there will be no HGVs using the internal access tracks around the site except from the highway into the site. All HGVs making deliveries to the site for construction will drop off in temporary

construction compounds at the access point. This means there is low risk of traffic/vehicles causing excess soil compaction either in construction or during operation which could limit the efficacy of the tracks' permeability.

Inverter units will be attached to piled foundations beneath panels so will not constitute additional impermeable area. The transformer substation building unit will compromise a 40ft shipping container placed on concrete blocks which ensure the building is 900m from the ground. The DNO cabin will compromise a pre-fabricated 6m by 5m Glass Reinforced Plastic (GRP) or steel building on concrete blocks of the same height.
Therefore, the only impermeable surface would be the area of blocks that stabilise these buildings on the gravel base.

Lack of hardstanding beneath the building, the permeable foundation, and the void between the building and ground means that although the transformer units would have a total top-down area impact of 460m^2 this will not have the same effect as if these were creating 460m^2 of new impermeable surface. Instead, the bases formed by gravel will provide storage of surface water runoff prior to infiltration or discharge towards a new swale feature.

The drainage modelling takes a conservative approach and suggests that the ancillary buildings on site will entail new hardstanding. However, this is not entirely accurate. The buildings are pre-fabricated containers. They are not intended as permanent buildings. The Site will require full reinstatement of the land to agricultural use at the end of the solar farm's operational life. Therefore, there is no interest in creating any kind of permanent foundation for the temporary ancillary buildings. No poured concrete or other non-permeable foundation will be used.

As the 460 m^2 of inverter and transformer blocks are dispersed across a 23,800m^2 Site they only represent a 2% impact based on a top-down view that assumes they create new impermeable surface.

4.4 Site Specific SuDS

The various SuDS methods have been considered in relation to site-specific constraints. Table 3 outlines the constraints and opportunities to each of the SuDS devices in accordance with the hierarchical approach outlined in The SuDS Manual CIRIA C753. It also indicates what could and could not be incorporated within the development, based upon site-specific criteria.

Table 3: SuDS Selection Matrix

SuDS Component	Description	Constraints and Opportunities	Suitable?
1. Infiltrating SuDS	Infiltration can contribute to reducing runoff rates and volumes while supporting baseflow and groundwater recharge processes. The suitability and infiltration rate depends on the permeability of the surrounding soils.	Infiltration tests on the site demonstrated poor infiltration and shallow groundwater, which will preclude the use of infiltration devices.	No
2. Filter Drains and Filter Strips	Filter drains are shallow trenches filled with stone gravel that create temporary subsurface storage for the attenuation, conveyance and filtration of surface water runoff. Filter strips are uniformly graded and gently sloping strips of grass or dense vegetation, designed to treat runoff from adjacent impermeable areas by promoting sedimentation, filtration and infiltration.	Poor infiltration rates at the site therefore would not provide a suitable means of discharging to the ground.	No

SuDS Component	Description	Constraints and Opportunities	Suitable?
3. Permeable Pavement	Pervious surfaces can be used in combination with aggregate sub-base and/or geocellular/modular storage to attenuate and/or infiltrate runoff from surrounding surfaces and roofs. Liners can be used where ground conditions are not suitable for infiltration.	Lined permeable paving to be used on the proposed access road to filter and attenuate runoff from this areas.	Yes
4. Green & Blue Roofs	Green Roofs provide areas of visual benefit, ecological value, enhanced building performance and the reduction of surface water runoff. They are generally more costly to install and maintain than conventional roofs but can provide many long-term benefits and reduce the on-site storage volumes.	Not suitable for a solar farm development	No
5. Rainwater Harvesting	Rainwater Harvesting is the collection of rainwater runoff for use. It can be collected from roofs or other impermeable areas, stored, treated (where required) and then used as a supply of water for domestic, commercial and industrial properties.	Not suitable for a solar farm development	No
6. Swales	Swales are designed to convey, treat and attenuate surface water runoff and provide aesthetic and biodiversity benefits. They can replace conventional pipework as a means of conveying runoff; however space constraints of some sites can make it difficult incorporating them into the design.	A conveyance swale/ditch has been proposed as part of the drainage system to direct runoff towards the outfall point.	Yes
7. Rills and Channels	Rills and Channels keep runoff on the surface and convey runoff along the surface to downstream SuDS components. They can be incorporated into the design to provide a visually appealing method of conveyance. They also provide effectiveness in pre-treatment removal of silts.	A number of vegetated ditches have been proposed as part of the drainage system to direct runoff towards the outfall point.	Yes
8. Bioretention Systems	Bioretention systems can reduce runoff rates and volumes and treat pollution through the use of engineer soils and vegetation. They are particularly effective in delivering interception but can also be an attractive landscape feature whilst providing habitat and biodiversity.	Vegetated areas between solar array to intercept runoff from panels and ditches use to direct runoff through site.	Yes
9. Retention Ponds and Wetlands	Ponds and Wetlands are features with a permanent pool of water that provide both attenuation and treatment of surface water runoff. They enhance treatment processes and have great amenity and biodiversity benefits. Often a flow control system at the outfall controls the rates of discharge for a range of water levels during storm events.	Attenuation within a pond would result in a pumped system being required, which would be less sustainable than a gravity outfall. High groundwater and whole site is located in FZ3 so balancing pond not recommended.	No
10. Detention Basins	Detention Basins are landscaped depressions that are usually dry, except	High groundwater and difficulty to implement on the site due to final outfall	No

SuDS Component	Description	Constraints and Opportunities	Suitable?
	during and immediately following storm events, and can be used as a recreational or other amenity facility. They are generally appropriate to manage high volumes of surface water from larger sites, such as a neighbourhood.	location being relatively high, therefore pumping would be necessary.	
11. Geocellular Systems	Attenuation storage tanks are used to create a below-ground void space for the temporary storage of surface water before infiltration, controlled release or use. The inherent flexibility in size and shape means they can be tailored to suit the specific characteristics and requirements of any site.	Over-engineered solution given the proposed development type so not considered further.	No
12. Proprietary Treatment Systems	Proprietary treatment systems are manufactured products that remove specific pollutants from surface water runoff. They are especially useful where site constraints preclude the use of other methods and can be useful in reducing the maintenance requirements of downstream SuDS.	Not required as pollutants would be filtered out through the use of lined permeable paving and by passing through the gravel filled trenches and vegetated ditches.	No

Given the limitations of the site and the proposed development use, it is recommended that runoff from the proposed access road and roof of buildings is attenuated using lined permeable paving. This will discharge at a restricted rate to a swale which will direct the runoff towards the existing ditch at the south east corner of the site.

4.5 Greenfield Runoff Rates

The proposed area covered by the access road and roof areas is 460m^2 (0.046 ha). Greenfield runoff rates were estimated for this impermeable area using the ICP SuDS method on the MicroDrainage software. The soil factor has been increased from 0.15 to 0.45, to reflect the poor infiltration at the site. The runoff rates for have been estimated for the 1 in 1 year, 1 in 30 year and 1 in 100 year events:

- QBAR: 0.3 l/s
- 1 in 100 year: 0.8 l/s
- 1 in 30 year: 0.6 l/s
- 1 in 1 year: 0.2 l/s

The MicroDrainage greenfield runoff rates are included at **Appendix F.** The 1 in 100 year greenfield runoff rate of 0.8 l/s has been used to design the system, given the limitations outlined previously, to reduce the risk of the drainage system being overwhelmed.

4.6 Lined Permeable Paving

Lined permeable paving can be used on the new access road on the northeast side of the site. The ground is rather flat in this location, at between 42.74m AOD to 43.00m AOD. The higher cover level of 43.00m

AOD has been used for the area of permeable paving. A total area of 373m^2, as measured off the proposed development plans, has been used, and it is assumed that the lined permeable paving will drain itself and will also receive runoff from the roof areas of the small buildings nearby. This results in a total impermeable area draining to the lined permeable paving of 460m^2.

The depth of the course graded aggregate layer for the permeable paving will be designed to meet both structural and attenuation requirements; hence, once CBR (California Bearing Ratio) values have been measured, they will inform the structural design at a detailed design stage. Given the 30-40% of voids likely to be available within a sub-base of a course grade aggregate, it is likely that there will provide significant storage volumes within the paved structure.

Unlike other infiltration systems, the pollutants carried within the surface water run-off are filtered out as they pass through the course grade aggregate and sub-base. Once trapped they are then broken down over time; figures from the Construction Industry Research and Information Association have shown that 60-95% of suspended solids and 70-90% of hydrocarbons are removed by permeable surfaces. As such, no further treatment of runoff is required from the permeable paving areas.

The permeable paving should be lined to prevent runoff from entering the underlying ground, given the vulnerable groundwater classification. It can instead be used as attenuation and to treat the runoff before it re-enters the drainage ditch system. To utilise the capacity in the permeable paving sub-base, an orifice plate control will be included on the outfall. Based on a design flow of 0.80 l/s and design depth in the permeable paving sub-base of around 500mm, the orifice plate diameter will need to be 20mm.

The permeable paving has been modelled in MicroDrainage to estimate the required sub-base depth to manage a 1 in 100 year (+25%CC) storm event, discharging at a rate of 0.80 l/s. This demonstrated that a minimum sub-base depth of around 200mm would be required.

4.7 Swale

Swales are shallow channels designed to store and/or convey runoff and remove pollutants. The swale channel is broad and shallow and covered by dense vegetation (usually grass) to slow flows and trap pollutants. Where ground conditions permit, the swales will allow the runoff to infiltrate.

Details on the design and benefits of swales are included in the CIRIA SUDS Manual (C753). However, the three main types of swales are summarised here:

- Standard conveyance swales – Particularly effective to direct and convey runoff from the drained area to another stage of the surface water management train. These can be designed for vegetative filtration or detention, depending on the level of flow constraint and ponding depths at the site;
- Dry swales – a vegetated conveyance channel designed to include a filter bed of prepared soil that overlays an underdrain system. This provides additional treatment and conveyance capacity beneath the base of the swales. These swales remain dry most of the time so do not become boggy in wet weather.
- Wet swales – Similar to the conveyance swale but designed to encourage wet, marshy conditions in the base to enhance treatment processes.

Swales are typically designed to be trapezoidal in cross section as these are easiest to construct and maintain. The side slopes should be no greater than 1 in 3 to promote sheet flow, low velocities and to maximise the wetted perimeter to promote filtration and minimise erosion.

It is proposed that the standard conveyance swales are included at the site. A conveyance swale with a 1m wide base and 1:3 side slopes is proposed along the south eastern boundary of the site. The swale will be kept as shallow as possible, given the high groundwater locally. The lined permeable paving will discharge to this swale, and it will provide a second treatment stage of the runoff discharging from the permeable paving before it reaches the existing ditch downstream.

Although the runoff from the solay panels will be managed largely through a robust land management plan, any exceedance flows in extreme events will also be directed towards the swale on the south east boundary. Therefore, this will help to intercept flows and direct them towards the south and to the existing ditch network. However, for the purpose of the drainage design, the swale has been designed and modelled assuming only the discharge from the lined permeable paving will be discharge to it.

The outfall to the watercourse would have an invert level of 41.99m AOD, which would be at the base of the receiving ditch.
The system was modelled for the 1 in 1 year, 1 in 30 year (+20%CC) and 1 in 100 year (+25%CC) storm events. The results demonstrated that all events could be managed within the proposed drainage system with no flooding. However, it is acknowledged that the overland flows from the solar arrays could be directed to the swale which could result in a greater volume of surface water reaching this location. A review of the aerial mapping indicates that there are no property or other receptors in the location of the swale and outfall point, or between the south east site boundary and the River Avon. Therefore, any overflowing of the proposed swale system would simply direct water into the River Avon, by following the natural topography and it is highly unlikely that any overflowing surface water would result in a significant flood risk to others.

The MicroDrainage results including the full network are in **Appendix G**, and the proposed surface water drainage layout is included in **Appendix H**.

4.8 Drainage Exceedance

In the event of drainage system failure under extreme rainfall events or blockage, flooding may occur within the site. In the event of the development's drainage system failure, the runoff flow will be dictated by topography on site. This is likely to mean that surface water will flow to the southeast towards the existing ditch and ultimately to the River Avon. There are no vulnerable receptors in this area and no part of the proposed development is in this area, therefore it is unlikely to create a significant risk to others.

4.9 Water Quality

The drainage system has been designed to meet the water quality requirements set out by Table 26.2 of the CIRIA SuDS Manual C753 which sets out the specific pollution hazard indices for access roads. While the pollution hazards for solar panels are not listed, surface water runoff from these areas is considered to be generally uncontaminated and it is likely that much of the runoff from the panels themselves would be similar to residential roofs, which have been considered below. The Pollution Hazard Indices are summarized in Table 4-3– Summary of Pollution Hazard Indices.

Table 4: Summary of Pollution Hazard Indices (Extracted from the CIRIA SuDS Manual C753 Simple Index Approach Tool)

Land Use	Pollution Hazard Level	Total suspended Solids (TSS)	Metals	Hydrocarbons

Low traffic roads (e.g. general access roads, <300 traffic movements/day)	Low	0.50	0.40	0.40
Roofing	Very low	0.20	0.20	0.05

Table 5: SuDS Component Pollution Mitigation Extracted and adapted from the CIRIA SuDS Manual C753 Simple Index Approach Tool – Low Traffic Roads

SuDS Component	Pollution Mitigation Indices		
Land Use	Total suspended Solids (TSS)	Metals	Hydrocarbons
Permeable Paving	0.70	0.60	0.70
Swale	(0.50)/2 = 0.25	(0.60)/2 = 0.30	(0.60)/2 = 0.30
Total Pollution Mitigation Provided	0.95	0.90	1.00

Table 6: SuDS Component Pollution Mitigation Extracted and adapted from the CIRIA SuDS Manual C753 Simple Index Approach Tool – Residential Roofs

SuDS Component	Pollution Mitigation Indices		
	Total suspended Solids (TSS)	Metals	Hydrocarbons
Swale	0.50	0.60	0.60
Total Pollution Mitigation Provided	0.50	0.60	0.60

The pollution mitigation measures detailed in Table 5 and Table 6 demonstrate that the contaminants contained in the surface water runoff from the different parts of the site can be managed.

5 Maintenance of the Proposed Drainage System

5.1 Adoption and Maintenance

All onsite SuDS and drainage systems will be privately maintained. A long-term maintenance regime should be agreed with the site owners before adoption. In addition to a long-term maintenance regime, it is recommended that all drainage elements implemented on site should be inspected following the first rainfall event post-construction and monthly for the first quarter following construction.

General maintenance of key SuDS components are provided in Table 7 below. Further details on typical maintenance requirements for permeable paving and swales are included in Table 8 and Table 9.

Table 7: General Maintenance Requirements (Source: CIRIA SuDS Manual C753)

TYPICAL KEY SUDS COMPONENTS OPERATION AND MAINTENANCE ACITIVIES													
Operation and Maintenance Activity	**SuDS Component**												
	Pond	**Wetlands**	**Detention Basin**	**Infiltration Basin**	**Soakaway**	**Infiltration Trench**	**Filter Drain**	**Modular Storage**	**Pervious pavement**	**Swale/Bioretention**	**Filter Strip**	**Green Roofs**	**Proprietary Treatment**
Regular Maintenance													
Inspection	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Litter/debris removal	✓	✓	✓	✓	-	✓	✓	-	✓	✓	✓	x	-
Grass cutting	✓	✓	✓	✓	-	✓	✓	-	-	✓	✓	x	x
Weed/invasive plant control	-	-	-	-	x	-	-	x	-	x	-	✓	x
Shrub management	-	-	-	-	x	x	x	x	-	-	-	x	x
Shoreline vegetation management	✓	✓	-	x	x	x	x	x	x	x	x	x	x
Aquatic vegetation management	✓	✓	-	x	x	x	x	x	x	x	x	x	x
Occasional Maintenance													
Sediment management	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Vegetation replacement	-	-	-	-	x	x	x	x	x	-	-	✓	x
Vacuum sweeping and brushing	x	x	x	x	x	x	x	x	✓	x	x	x	x
Remedial Maintenance													
Structure rehabilitation/repair	-	-	-	-	-	-	-	-	-	-	-	-	x
Infiltration surface reconditioning	x	x	x	-	-	-	-	x	-	-	-	x	x

Key:					
Will be Required	✓	May be Required	-	Not Normally Required	x

Table 8: Specific Maintenance Requirements for Permeable Paving (Source: CIRIA SuDS Manual C753)

Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Brushing and vacuuming	Three times per year at end of winter, mid-summer, after autumn leaf fall, or as required based on site specific observations of clogging or manufacturer's recommendations.
Occasional Maintenance	Stabilise and mow contributing and adjacent areas.	As required
	Removal of weeds.	As required
Remedial Actions	Remediate any landscaping which, through vegetation maintenance of soil slip, has been raised to within 50mm of the level of the paving	As required
	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance of a hazard to the user.	As required
	Rehabilitation of surface and upper sub-surface.	As required (if infiltration performance is reduced as a result of significant clogging.)
Monitoring	Initial inspection	Monthly for 3 months after installation. 3 monthly, 48 hours after large storms.
	Inspect for evidence of poor operation and/or weed growth. If required, take remedial action.	As required
	Inspect silt accumulation rates and establish appropriate brushing frequencies.	Annually
	Monitor inspection chambers.	Annually

Table 9: Specific Maintenance Requirements for Swales (Source: CIRIA SuDS Manual C753)

Maintenance Schedule	Required Action	Frequency
Regular Maintenance	Litter and debris removal	Monthly, or as required
	Grass cutting to retain grass height within specified design range.	Monthly, or as required
	Manage other vegetation and remove nuisance plants.	Monthly, or as required
	Inspect inlets, outlets and overflows for blockages and clear if required.	Monthly
	Inspect inlets and facility surface for silt accumulation, establish appropriate silt removal frequencies.	Six monthly

Occasional Maintenance	Check for poor vegetation growth due to lack of sunlight or dropping of leaf litter, and cut back adjacent vegetation where possible.	Annually
	Re-seed areas of poor vegetation growth. Alter plant types to better suit conditions if required.	Annually, 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
	Re-level uneven surfaces and re-instate design levels.	As required
	Scarify and spike topsoil level 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 or dispose of oils or petrol residues using safe standard practices.	As required
Monitoring	Inspect inlets, outlets and overflows for blockages, and clear if required.	Monthly
	Inspect infiltration surface for ponding, compaction, silt accumulation. Record areas where water is ponding for >48 hours.	Monthly, or as required
	Inspect inlets and facility surface for silt accumulation. Establish appropriate silt removal frequencies.	Six monthly

5.2 Visual Inspection/ Sweep

This should include a systematic review of the drainage infrastructure. Each element should be inspected to determine if remedial actions are needed. Where access chambers are provided, these should be used to access below ground infrastructure:

- Rodding eyes / inspection chambers are provided at both ends of all pipes; these should be used to determine the level of silt within the system.
- Permeable paving should be inspected for vegetation / defects (rocking blocks), it should be swept clear of debris.
- Outfall and orifice plate controls should be regularly inspected for blockages and cleared of silt accumulation and debris.

6 Conclusion

Royal HaskoningDHV has been appointed by the Wiltshire Wildlife Community Energy Limited to prepare a Surface Water Drainage Strategy for a proposed solar farm development on the land adjacent to the Wastewater Treatment Works, Britford, Salisbury, Wiltshire SP5 4DX.

The development proposals are for the construction of a solar farm comprising 23 rows of solar arrays.

The site is located within Flood Zone 3 on the EA's Flood Map for Planning. The flood risk to the site has been considered in a separate flood risk assessment, which analyse the risks to the development and highlight any mitigation measures which can be included in the development.

The site has a bedrock geology of Newhaven Chalk Formation – Chalk, with superficial deposits of Alluvium – Clay, sand and gravel. Both the chalk and alluvium deposits suggest there may be good infiltration at the site. However, infiltration tests were carried out in August 2022 and the soil descriptions identified sandy gravel and clay in all of the test pits. It was not possible to achieve infiltration rates to BRE365 standard as the ground conditions were noted to be practically impermeable in the shallow test pits, and groundwater entering the deeper pits. The average groundwater depth was recorded to be approximately 0.70m to 0.80m below ground level. The conclusion of the test report was that soakaways and shallow infiltration would not be suitable. Therefore an attenuation and discharge strategy has been proposed, with an outfall to the nearby ditch.

This is a "major development" because it is >1ha. A new building with a floorspace of more than 1000m^2 would also be 'major''. If Petersfinger Solar Farm sought planning consent for a building with a footprint of 460m^2, it would not be classed as major development. And, here, the potential new "hardstanding" is not concentrated in one area, but is dispersed across a large area, so would have significantly less potential impact on surface water than a single building that would not be classed as major development.

The new buildings on a permeable gravel base are not changing any underlying conditions beyond the topsoil. What would otherwise be topsoil is being replaced by gravel which has 30% more porosity and storage capacity than the existing topsoil would have. This means even if the gravel base is insufficient for storage and infiltration, the resulting conditions are no different than they would be on the as-is farmland, except that the extra storage capacity of the gravel base is a betterment compared to the topsoil in the event that underlying conditions are not supporting effective infiltration.

Even a conservative assumption of 460m^2 is much less than what would trigger "major development" classification in an ordinary planning context. Furthermore, the dispersed new impermeable areas are surrounded by year-round vegetated ground and wholly undeveloped natural "filter strips" between arrays.

Although solar farm land-take makes it "major", this is a box-ticking fact and not an accurate representation of impact with respect to flood risk. Inherent mitigation and SuDS incorporated into a solar farm means nil to low risk and more likely an improvement compared to existing pastoral use.

Sustainable Drainage options are limited at the site due to the presence of high groundwater and the requirement to keep all SuDS features very shallow. It is proposed that lined permeable paving is used on the access track. These will filter the runoff as well as providing attenuation, before new access road to manage runoff from this area. Guidance in the Essex Design Guide on new solar farms notes the main requirement for a drainage strategy for a solar farm is to manage the runoff to prevent scour and erosion from occurring. The main mitigation against this is a robust land management plan which will maintain and enhance vegetation and long grass between the panels. Runoff from the proposed access road and building

roofs will discharge to lined permeable paving which would outfall into a ditch/swale system. This would then direct runoff to the south east of the site where it would be discharged to an existing ditch which flows into the River Avon.

An orifice plate control will restrict the discharge rate from the lined permeable paving to 0.80 l/s, before the flow enters the swale. The permeable paving has been designed to manage up to and including a 1 in 100 year (+25%CC) event.

The model was run for several storm events and return periods. This demonstrated that all modelled storm events could be managed within the system. However, it is likely that overland flow from the solar array would follow the natural topography and could be intercepted by the swale, which would route the runoff to the south east of the site and into the existing ditch. Analysis of aerial mapping however shows that there are no properties or other receptors in this location, and the natural fall of the topography towards the River Avon would mean that any flows exceeding the drainage system would simply flow into the watercourse, which is undoubtably the scenario that occurs in the existing situation. As such, no offsite risk to others is anticipated as a result.

All elements of the proposed drainage system will remain private and the responsibility for maintenance will be with the site owner, or a maintenance company set up by the developer. Maintenance and management tasks have been considered for each part of the proposed drainage strategy.

7 Appendices

Appendix A – Proposed Development Plans

Notes:

1. All details are indicative only.
2. Dimensions are in metres unless stated otherwise.
3. Refer to HSE document "Avoiding danger from overhead power lines - Guidance Note GS6" to ensure safe operation of machinery in proximity to overhead power lines.

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Key Plan:



CCTV camera

Wessex Water main

Perimeter fence

4m access track

DNO cabin

Satellite mast

Transformer substation

Spares container

3,000 no. 500Wp Canadian Solar PV modules
2 in portrait 15° tilt configuration
[**1.5MWp** / **1.23MVA**]

7.5m

Petersfinger Bridge

Petersfinger

Hughenden Manor

Hughenden Cottage

Bow Acre House

Dormers

Ruin

Willow Cottage

Shelter

ESS

44.8m

A 36

SOUTHAMPTON ROAD

PETERSFINGER FARM

0.91m FF

Track

Tanks

Tank

Sewage Works

Pond

River Avon

Footbridge

Fishing Platforms

Rectory Farm

Sluice

Ford

FB

Drain

Def

CD

ED Bdy

CR

1:1000 @A1

REVISIONS				
C	14.01.22	Reduced to 1.5MWp	SS	HB
B	08.12.21	Reverted south, reduced to 2.38MWp	SS	HB
A	30.11.21	Relocated system north	SS	HB
-	10.11.21	First issue	SS	HB
REV	DATE	COMMENTS	BY	CHKD

CLIENT	Communities for Renewables CIC
PROJECT	Fairy Hill Solar Farm
LOCATION	Petersfinger, Salisbury, Wiltshire
TITLE	Proposed PV Layout
DWG NO	CfR-SALISB-GA-01
REV	C

HELIOWORKS

Appendix B – EA Flood Map for Planning

Flood map for planning

Your reference	Location (easting/northing)	Created
6742	**416208/128860**	**19 Jan 2023 10:29**

Your selected location is in flood zone 3, an area with a high probability of flooding.

This means:

- you must complete a flood risk assessment for development in this area
- you should follow the Environment Agency's standing advice for carrying out a flood risk assessment (see www.gov.uk/guidance/flood-risk-assessment-standing-advice)

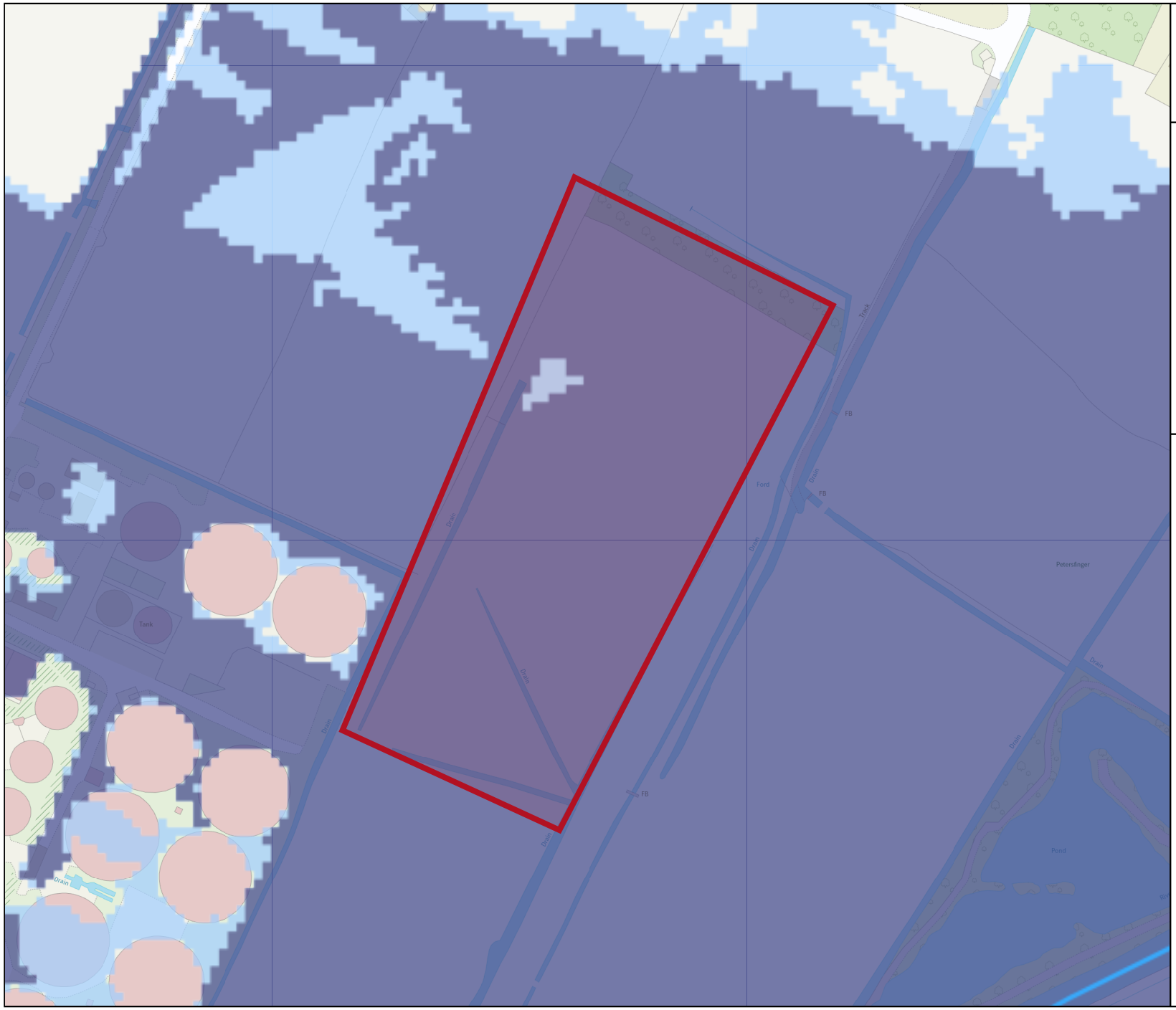
Notes

The flood map for planning shows river and sea flooding data only. It doesn't include other sources of flooding. It is for use in development planning and flood risk assessments.

This information relates to the selected location and is not specific to any property within it. The map is updated regularly and is correct at the time of printing.

Flood risk data is covered by the Open Government Licence which sets out the terms and conditions for using government data. https://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/

Use of the address and mapping data is subject to Ordnance Survey public viewing terms under Crown copyright and database rights 2022 OS 100024198. https://flood-map-for-planning.service.gov.uk/os-terms



Environment Agency

Flood map for planning

Your reference
6742

Location (easting/northing)
416208/128860

Scale
1:2500

Created
19 Jan 2023 10:29

- Selected area
- Flood zone 3
- Flood zone 2
- Flood zone 1
- Flood defence
- Main river
- Water storage area

0 20 40 60m

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Appendix C – Topographic Survey

SURVEY CONTROL: 15664				
STATION	EASTING	NORTHING	HEIGHT	DESCRIPTION
LDSR501	416322.388	128927.423	43.864	RETRO TARGET
LDSR502	416315.003	128936.956	43.431	RETRO TARGET
LDSR503	416306.622	128936.401	43.988	RETRO TARGET
LDSR504	416286.623	128947.751	43.890	RETRO TARGET
LDSR505	416211.757	128967.474	43.943	RETRO TARGET

INDICATIVE

P&W/BWF (TP)

ToF:43.89

ToF:44.03

ToF:43.98

LDSR501

LDSR502

LDSR503

LDSR504

LDSR505

CNC

TROUGH

MH

CL 42.78

IC 42.97

SHEEP SHELTER

DENSE UNDERGROWTH

UNDERGROWTH

PLANTING

ELECTRIC (TP)

REV.	DATE	DETAILS	
-	25/07/22	Original Issue	
		Surveyed by:XRS	Drawn by: HRH

NOTES:

Land Development Services Ltd. own the copyright of this drawing. Their written consent must be obtained before this drawing is copied, forwarded to any third parties, or used for any purpose other than the one for which it was supplied.

This survey has been carried out to an accuracy consistent with the presentation scale noted below. Interrogated dimensions will therefore be within the tolerance associated with this scale. The same accuracies implied by the plotting scale are equally applicable to digital data supplied for CAD.

The horizontal & vertical control of this survey is based on Ordnance Survey grid as translated from GPS co-ordinates using the OSTN15 & OSGM15 transformation as supplied by OS. We have applied a reverse scale factor to maintain true ground distances. Vertical values may differ from existing OS benchmarks in the vicinity which should be disregarded. All levels should be taken from LDS survey stations.

Boundaries shown are not necessarily legal boundaries.

All levels, heights, measurements and dimensions are in metres unless otherwise stated.

Eaves levels are taken at the bottom of the lowest roof tile. Where underside of fascia or other features are surveyed these are recorded as such.

All below-ground features (including drainage, voids and services) have been identified from above ground and therefore all details relating to these (such as sizes, depth, pipe positions and alignments, description etc.) will be approximate only. Underground services have not been traced, but any visible surface features have been located. No allowance has been made for any sub-surface manholes or other chambers or voids below ground level. While every effort is made to identify all visible above-ground features, it should be noted that there may be features obscured at the time of survey.

Spot heights displayed within the road width are road/gutter levels, not top of kerb.

Trees have been drawn diagrammatically (i.e. circular) showing average canopy spread, however their true shape in plan will be different. Every effort has been taken to identify species, but no responsibility can be taken for the accuracy of this information.

Services

BB	Belisha Beacon
BH	Borehole
BOL	Bollard
CATV	Cable TV Cover
CCTV	CCTV Security Camera
EP	Electricity Pole
ER	Earthing Rod
FH	Fire Hydrant
FL	Flood Light
FS	Flagstaff
GV	Gas Valve
GY	Gully
IC	Inspection Cover
IC-BT	BT Cover
IC-E	Electricity Cover
IC-G	Gas Cover
IC-TL	Traffic Light Cover
IC-W	Water Cover
LP	Lamp Post
MH	Manhole (Foul/Surface Water)
	Cover Level
	Invert Level (or Unable to Lift)
	Pipe Diam & Flow Direction
MP	Marker Post
MW	Monitoring Well
RE	Rodding Eye
RS	Road Sign
RWP	Rainwater Pipe
SC	Stop Cock
SV	Stop Valve
SVP	Soil & Vent Pipe
TL	Traffic Lights
TP	Telegraph Pole
WM	Water Meter
WP	Waste Pipe
WV	Water Valve
	Overhead Wire

Levels

AHL	Arch Head Level
CL	Cover Level
CLG	Ceiling Level
DHL	Door Head Level
DK	Drop Kerb Level
DPC	Damp Proof Course Level
FFL	Finished Floor Level
GL	Ground Level
IL	Invert Level
OSBM	Ordnance Survey Benchmark
SPL	Spring Point of Arch
Thr	Threshold Level
To...	Top of Feature (eg. Fence/Wall)
TrHt	Tree Height (to Datum)
us...	underside of Feature (eg. Beam)
WCL	Window Cill Level
WHL	Window Head Level

Fences

AIF	Angle Iron Fence
BWF	Barbed Wire Fence
CBF	Close Boarded Fence
CIF	Corrugated Iron Fence
CLF	Chain-link Fence
GP	Gate Post
IR	Iron Railings
LLF	Larch Lap Fence
OBF	Open Boarded Fence
P&R	Post & Rail Fence
P&Rb	Post & Rod Fence
P&W	Post & Wire Fence
RW	Retaining Wall
(CP/SP/TP)	(Cnc Post/Steel Post/Timber Post)

Trees

1. Species (or UNKNOWN)
2. Canopy Spread
3. Trunk Diameter

TrHt Tree Height (to Datum)

Coniferous, Deciduous, Dead

General Text/Features

CNC	Concrete
FB	Flower Bed

Survey Control

Sloping Clg: Arrow indicates direction of downward slope

LDS
Land & Building Surveyors

www.lds-survey.co.uk
01722 338232 / enquiries@lds-survey.co.uk

RICS THE SURVEY ASSOCIATION

Land Development Services Ltd.
Apothecary House, Fowler's Road, Salisbury. SP1 2QU

Client:
WILTSHIRE WILDLIFE COMMUNITY ENERGY LTD

Drawing Title:
TOPOGRAPHIC SURVEY

Project:
PETERSFINGER FARM SALISBURY

Survey is to OS Grid, located via use of GPS positioning.

Level values in metres, related to Ordnance Datum Newlyn.

Scale:	Drawing No:	Revision:
1:250 Plotted on A1	LDS/15664 TP1	-

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0 1 2 3 4 5 10 15 20 25
METRES

Appendix D – Infiltration Test Results

YEX4437
Fairy Hill Solar Farm – SP5 3DB
August 22

Dear Mr Barlow,

Please find below the results of your Infiltration testing. The information contained below is a summary of the site works carried out on 24th August 2022.

Geology

An examination of the available British Geological Survey data of the area for the site has been examined and indicates that the site has superficial drift deposits composed of Alluvium (clay, sand and gravel), and bedrock deposits recorded as the Newhaven Chalk Formation (chalk).

Fieldworks

The programme of this investigation included the excavation of six trial pits. The locations of the soakaway tests were selected by the client. During this work, the soils encountered were logged in general accordance with BS5930: 1990, as amended in 2007.

Percolation Testing

During the soakaway tests the water failed to achieve a fall from 75% to 25% of the effective depth of the storage volume in TP04 and TP06. Ground water entered the remaining four trial pits at various levels. Excavation was stopped at the presence of ground water and monitored for approximately thirty to forty five minutes. The results obtained from the soakaway tests are summarised below:

WS	Dimensions (m)	Depth (m)	Soil Description	Infiltration Rate (m/sec)	Drainage Characteristics
TP01	1.10 x 0.40	1.20	Blueish grey sandy GRAVEL.	N/A	N/A
TP02	1.0 x 0.40	0.50	Cream and mottled orange sandy CLAY.	N/A	N/A
TP03	1.30 x 0.40	1.40	Blueish grey sandy GRAVEL.	N/A	N/A
TP04	0.80 x 0.40	0.50	Grey and mottled orange CLAY.	N/A	Practically Impermeable
TP05	1.20 x 0.40	1.50	Blueish grey sandy GRAVEL.	N/A	N/A
TP06	0.70 x 0.40	0.50	Grey and mottled orange CLAY.	N/A	Practically Impermeable

Conclusion

The soils encountered beneath the site were found to be predominantly clay and/or gravel. The soakage rates obtained during the investigation were found to be practically impermeable within the shallow trial pits with ground water entering the deeper pits. Ground water was monitored for approximately thirty to forty five minutes with the average depth of the water rising to approximately 0.70mbgl to 0.80mbgl. Given the data from the test, it is considered that soakaways and shallow infiltration systems are not suitable for this site.

References

- Building Research Establishment (BRE) Digest 365, *Soakaway Design*, September 1991.
- British Standards Institution (1999) BS5930: *Code of practice for site investigations*, B.S.I., London.
- British Standards Institution (2007), Amendment No 1, BS5930: *Code of practice for site investigations*, B.S.I., London.

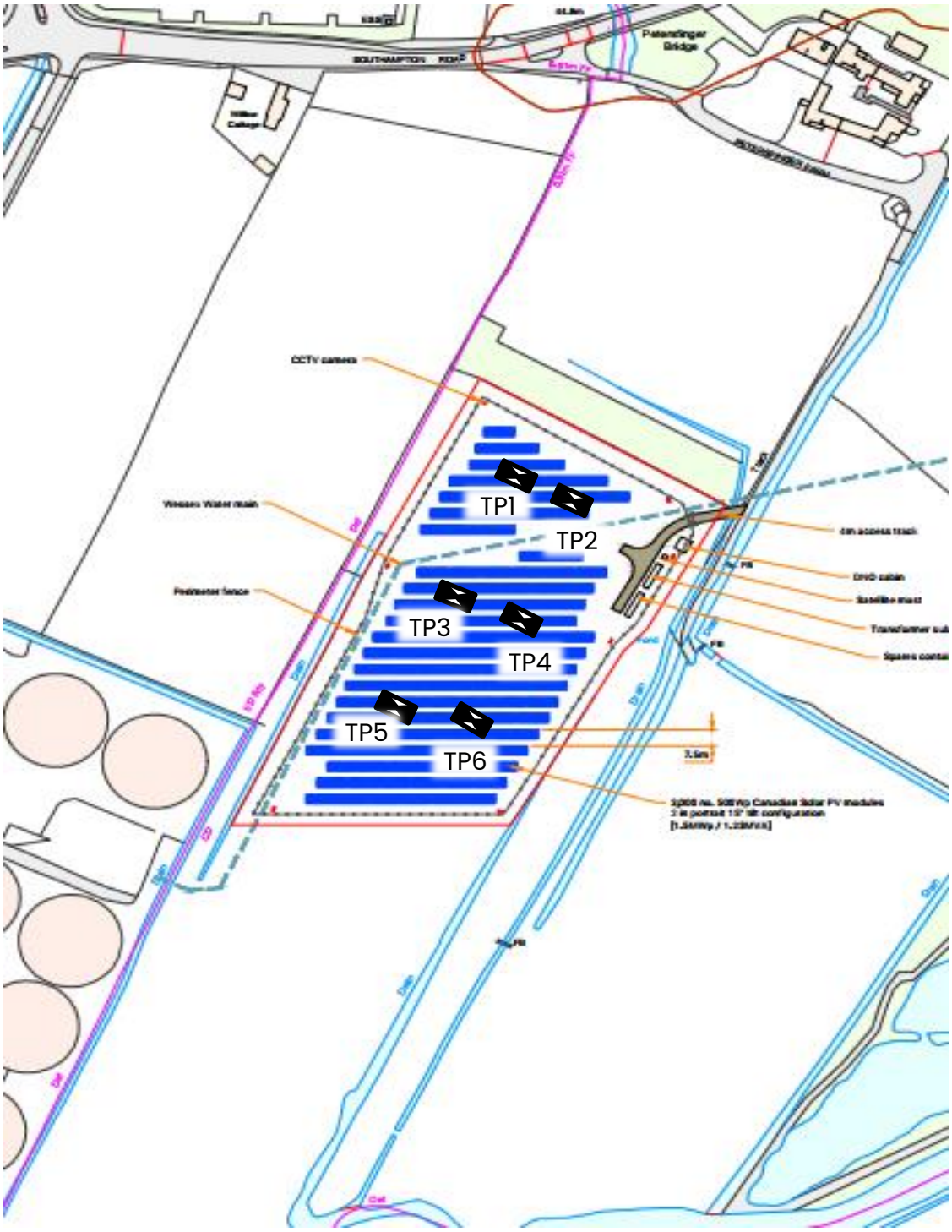
Please do contact me on 01243 787150 or 07758 162624 should you have any questions.

Regards



Nick Hammond
Geo-Environmental Engineer

Appendix A



Site Investigation Plan

YOUR ENVIRONMENT

Fairy Hill Solar Farm
YEX4437
Aug-22

Appendix B

YOUR ENVIRONMENT
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info@yourenvironment.org
01243 787150

Log of Boring TP1
Sheet 1 of 1

YE Engineer N. Hammond

Location	Fairy Hill Solar Farm, Petersfinger, Salisbury, SP5 3DB
Date	August 24, 2022
Project Reference	YEX4437

Water level data
Completion: Depth NA m
Elevation NA m
24 hour: Depth ____ m
Elevation ____ m

Width 0.4 m
Length 1.1 m
Depth 1.2 m

Method (Trial pit, window etc) Trial Pit - Machine Excavation

Stratum depth (m) From	Stratum depth (m) To	Sample Depth From (m)	Sample Depth To (m)	Sample Type	GW	Install Details	LITHOLOGY
0.00	0.30					NONE	Brown clayey, gravelly SAND. Sand is fine - medium. Gravel is medium - coarse, mixed angular and sub-angular of mixed lithology.
0.30	0.80						Cream and mottled orange sandy CLAY. Sand is fine - medium.
0.80	1.10						Blueish grey sandy GRAVEL. Sand is medium - coarse. Gravel is medium - coarse, angular of mixed lithology.
							End of TP1

Remarks: .

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Log of Boring	TP2
Sheet 1 of	1

YE Engineer N. Hammond

Location	Fairy Hill Solar Farm, Petersfinger, Salisbury, SP5 3DB
Date	August 24, 2022
Project Reference	YEX4437

Water level data

Completion: Depth NA m
Elevation NA m

24 hour: Depth ____ m
Elevation ____ m

Width 0.4 m
Length 1.0 m
Depth 0.5 m

Method (Trial pit, window etc) Trial Pit - Machine Excavation

Stratum depth (m) From	Stratum depth (m) To	Sample Depth From (m)	Sample Depth To (m)	Sample Type	GW	Install Details	LITHOLOGY
0.00	0.30					NONE	Brown clayey, gravelly SAND. Sand is fine - medium. Gravel is medium - coarse, mixed angular and sub-angular of mixed lithology.
0.30	0.50						Cream and mottled orange sandy CLAY. Sand is fine - medium.
							End of TP2

Remarks: .

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Log of Boring	TP3
Sheet 1 of	1

YE Engineer N. Hammond

Location	Fairy Hill Solar Farm, Petersfinger, Salisbury, SP5 3DB
Date	August 24, 2022
Project Reference	YEX4437

Water level data

Completion: Depth NA m
Elevation NA m

24 hour: Depth ____ m
Elevation ____ m

Width 0.4 m
Length 1.3 m
Depth 1.4 m

Method (Trial pit, window etc) Trial Pit - Machine Excavation

Stratum depth (m) From	To	Sample Depth From (m)	Sample Depth To (m)	Sample Type	GW	Install Details	LITHOLOGY
0.00	0.30					NONE	Brown clayey, gravelly SAND. Sand is fine - medium. Gravel is medium - coarse, mixed angular and sub-angular of mixed lithology.
0.30	0.60						Brown and mottled orange CLAY.
0.60	1.10						Blueish grey sandy GRAVEL. Sand is medium - coarse. Gravel is medium - coarse, angular of mixed lithology.
							End of TP3

Remarks: .

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Log of Boring	TP4
Sheet 1 of	1

YE Engineer N. Hammond

Location	Fairy Hill Solar Farm, Petersfinger, Salisbury, SP5 3DB
Date	August 24, 2022
Project Reference	YEX4437

Water level data

Completion: Depth NA m
Elevation NA m

24 hour: Depth ____ m
Elevation ____ m

Width 0.4 m
Length 0.8 m
Depth 0.5 m

Method (Trial pit, window etc) Trial Pit - Machine Excavation

Stratum depth (m) From	Stratum depth (m) To	Sample Depth From (m)	Sample Depth To (m)	Sample Type	GW	Install Details	LITHOLOGY
0.00	0.30					NONE	Brown clayey, gravelly SAND. Sand is fine - medium. Gravel is medium - coarse, mixed angular and sub-angular of mixed lithology.
0.30	0.50						Grey and mottled orange CLAY.
							End of TP4

Remarks: .

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01243 787150

Log of Boring	TP5
Sheet 1 of	1

YE Engineer N. Hammond

Location	Fairy Hill Solar Farm, Petersfinger, Salisbury, SP5 3DB
Date	August 24, 2022
Project Reference	YEX4437

Water level data

Completion: Depth NA m
Elevation NA m

24 hour: Depth ____ m
Elevation ____ m

Width 0.4 m
Length 1.2 m
Depth 1.5 m

Method (Trial pit, window etc) Trial Pit - Machine Excavation

Stratum depth (m) From	To	Sample Depth From (m)	Sample Depth To (m)	Sample Type	GW	Install Details	LITHOLOGY
0.00	0.30					NONE	Brown clayey, gravelly SAND. Sand is fine - medium. Gravel is medium - coarse, mixed angular and sub-angular of mixed lithology.
0.30	0.60						Grey and mottled orange CLAY.
0.60	1.50						Blueish grey sandy GRAVEL. Sand is medium - coarse. Gravel is medium - coarse, angular of mixed lithology.
							End of TP5

Remarks: .

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01243 787150

Log of Boring	TP6
Sheet 1 of	1

YE Engineer N. Hammond

Location	Fairy Hill Solar Farm, Petersfinger, Salisbury, SP5 3DB
Date	August 24, 2022
Project Reference	YEX4437

Water level data

Completion: Depth NA m
Elevation NA m

24 hour: Depth ____ m
Elevation ____ m

Width 0.4 m
Length 0.7 m
Depth 0.5 m

Method (Trial pit, window etc) Trial Pit - Machine Excavation

Stratum depth (m) From	Stratum depth (m) To	Sample Depth From (m)	Sample Depth To (m)	Sample Type	GW	Install Details	LITHOLOGY
0.00	0.30					NONE	Brown clayey, gravelly SAND. Sand is fine - medium. Gravel is medium - coarse, mixed angular and sub-angular of mixed lithology.
0.30	0.50						Grey and mottled orange CLAY.
							End of TP6

Remarks: .

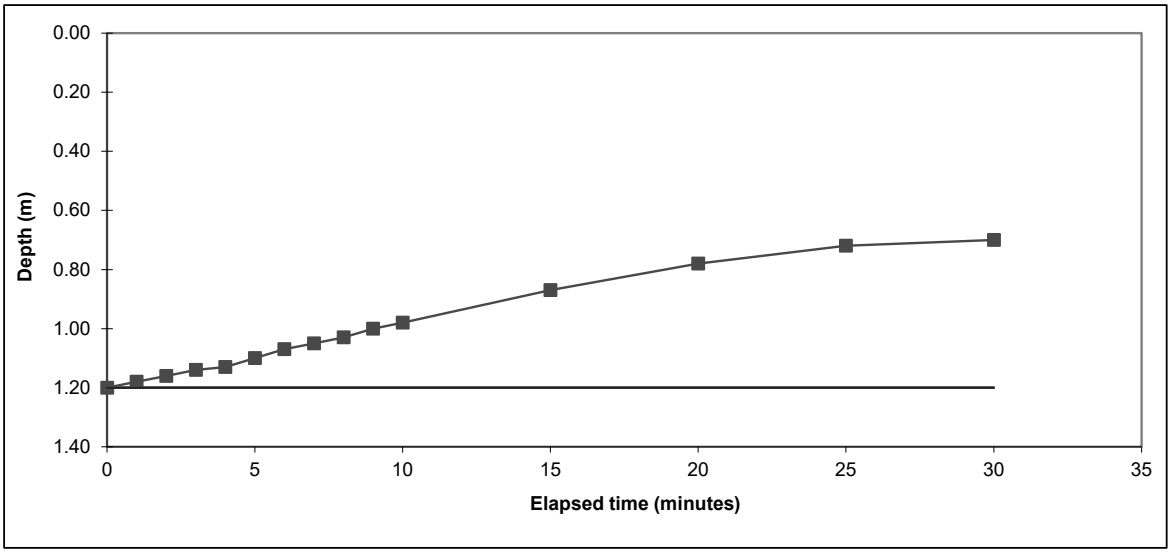
Appendix C

Your Environment

Soakaway Test

Trial Pit No:	TP1	Test No:	1	Date:	24/08/2022
Length (m):	1.100		Datum Height:	0.00	m agl
Width (m):	0.40		Granular infill:	None	
Depth (m):	1.20		Porosity of infill:	1	(assumed)

Elapsed time (minutes)	Water Depth (m below datum)	Elapsed time (minutes)	Water Depth (m below datum)
0	1.200	30	0.700
1	1.180		
2	1.160		
3	1.140		
4	1.130		
5	1.100		
6	1.070		
7	1.050		
8	1.030		
9	1.000		
10	0.980		
15	0.870		
20	0.780		
25	0.720		



Start water depth for analysis (mbgl)	1.20		
75% effective depth (mbgl):	1.20	Elapsed time (mins):	#N/A
50% effective depth (mbgl):	1.20		
25% effective depth (mbgl):	1.20	Elapsed time (mins):	#N/A
Base of soakage zone (mbgl):	1.20		
Volume outflow between 75% and 25% effective depth (m^3):			
Mean surface area of outflow (m^2):		0.44	
(side area at 50% effective depth + base area)			
Time for outflow between 75% and 25% effective depth (mins):			

Soil infiltration rate (m/s):	**Test incomplete as 25% effective depth not achieved. Unable to reliably determine soil infiltration rate.**

Remarks Results processed following BRE 365 (2007).

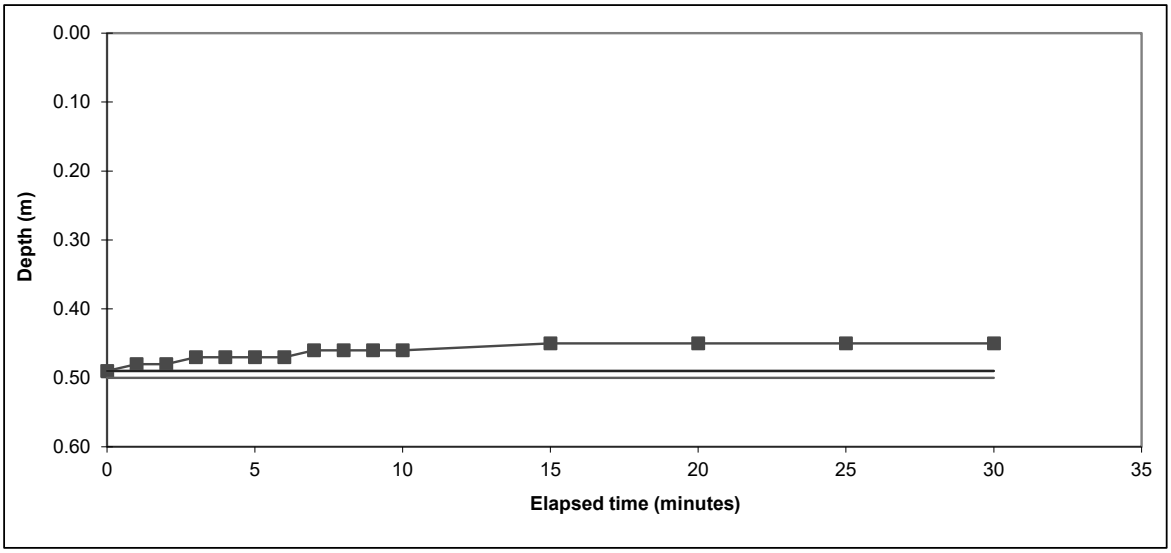
Client:	Harry Barlow	**TP1**
Site:	Fairy Hill Solar Farm	

Your Environment

Soakaway Test

Trial Pit No:	TP2	Test No:	1	Date:	24/08/2022
Length (m):	1.000		Datum Height:	0.00	m agl
Width (m):	0.40		Granular infill:	None	
Depth (m):	0.50		Porosity of infill:	1	(assumed)

Elapsed time (minutes)	Water Depth (m below datum)	Elapsed time (minutes)	Water Depth (m below datum)
0	0.490	30	0.450
1	0.480		
2	0.480		
3	0.470		
4	0.470		
5	0.470		
6	0.470		
7	0.460		
8	0.460		
9	0.460		
10	0.460		
15	0.450		
20	0.450		
25	0.450		



Start water depth for analysis (mbgl)	0.49		
75% effective depth (mbgl):	0.49	Elapsed time (mins):	#N/A
50% effective depth (mbgl):	0.50		
25% effective depth (mbgl):	0.50	Elapsed time (mins):	#N/A
Base of soakage zone (mbgl):	0.50		
Volume outflow between 75% and 25% effective depth (m^3):			
Mean surface area of outflow (m^2):		0.40	
(side area at 50% effective depth + base area)			
Time for outflow between 75% and 25% effective depth (mins):			

Soil infiltration rate (m/s):	**Test incomplete as 25% effective depth not achieved. Unable to reliably determine soil infiltration rate.**

Remarks Results processed following BRE 365 (2007).

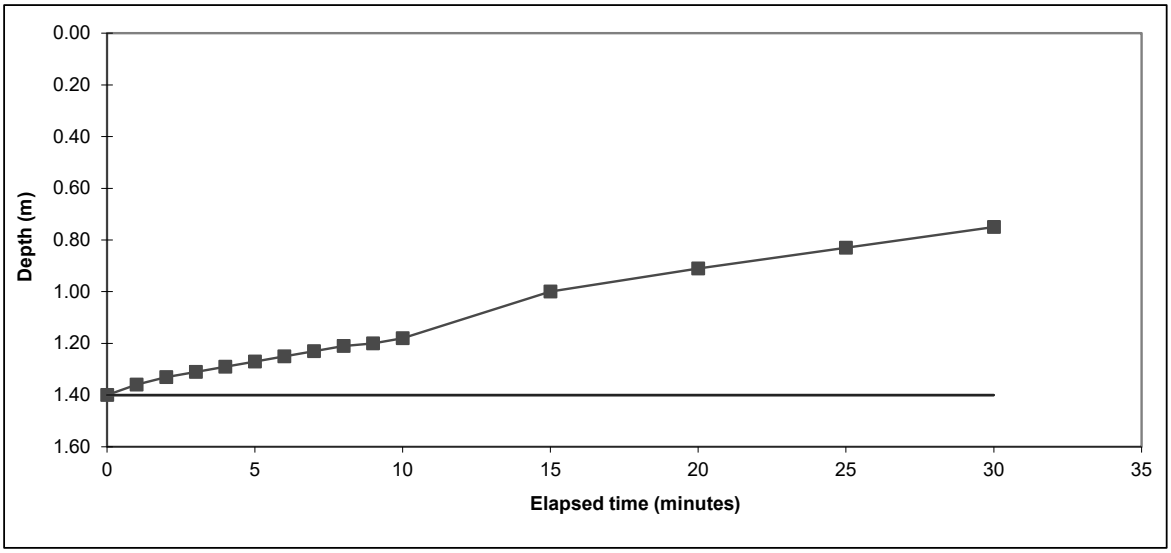
Client:	Harry Barlow	**TP2**
Site:	Fairy Hill Solar Farm	

Your Environment

Soakaway Test

Trial Pit No:	TP3	Test No:	1	Date:	24/08/2022
Length (m):	1.300		Datum Height:	0.00	m agl
Width (m):	0.40		Granular infill:	None	
Depth (m):	1.40		Porosity of infill:	1	(assumed)

Elapsed time (minutes)	Water Depth (m below datum)	Elapsed time (minutes)	Water Depth (m below datum)
0	1.400	30	0.750
1	1.360		
2	1.330		
3	1.310		
4	1.290		
5	1.270		
6	1.250		
7	1.230		
8	1.210		
9	1.200		
10	1.180		
15	1.000		
20	0.910		
25	0.830		



Start water depth for analysis (mbgl)	1.40		
75% effective depth (mbgl):	1.40	Elapsed time (mins):	#N/A
50% effective depth (mbgl):	1.40		
25% effective depth (mbgl):	1.40	Elapsed time (mins):	#N/A
Base of soakage zone (mbgl):	1.40		
Volume outflow between 75% and 25% effective depth (m^3):			
Mean surface area of outflow (m^2):		0.52	
(side area at 50% effective depth + base area)			
Time for outflow between 75% and 25% effective depth (mins):			

Soil infiltration rate (m/s):	**Test incomplete as 25% effective depth not achieved. Unable to reliably determine soil infiltration rate.**

Remarks Results processed following BRE 365 (2007).

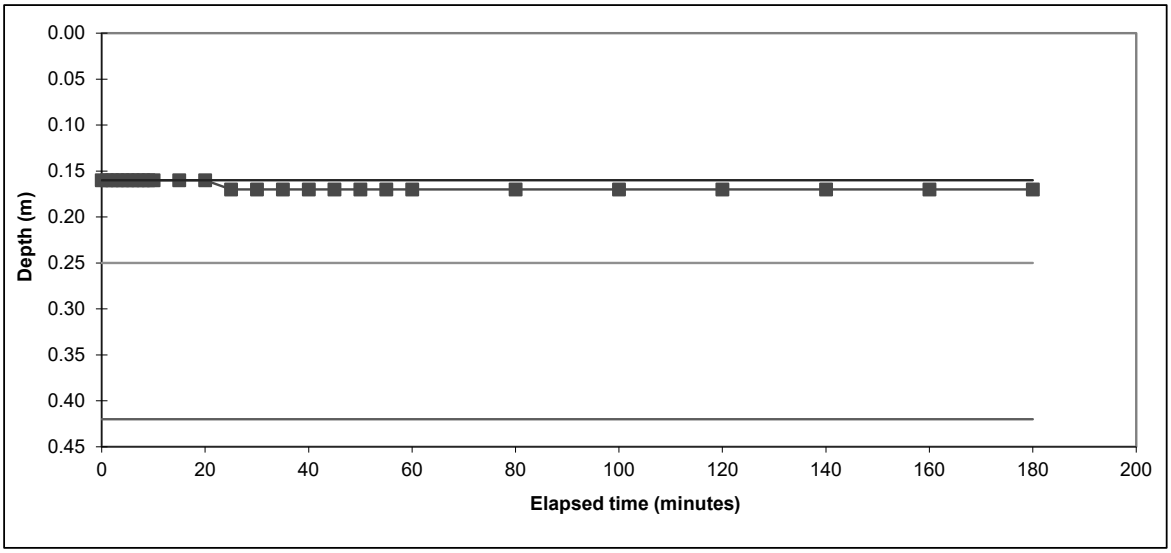
Client:	Harry Barlow	**TP3**
Site:	Fairy Hill Solar Farm	

Your Environment

Soakaway Test

Trial Pit No:	TP4	Test No:	1	Date:	24/08/2022
Length (m):	0.800		Datum Height:	0.00	m agl
Width (m):	0.40		Granular infill:	None	
Depth (m):	0.50		Porosity of infill:	1	(assumed)

Elapsed time (minutes)	Water Depth (m below datum)	Elapsed time (minutes)	Water Depth (m below datum)
0	0.160	30	0.170
1	0.160	35	0.170
2	0.160	40	0.170
3	0.160	45	0.170
4	0.160	50	0.170
5	0.160	55	0.170
6	0.160	60	0.170
7	0.160	80	0.170
8	0.160	100	0.170
9	0.160	120	0.170
10	0.160	140	0.170
15	0.160	160	0.170
20	0.160	180	0.170
25	0.170		



Start water depth for analysis (mbgl)	0.16		
75% effective depth (mbgl):	0.25	Elapsed time (mins):	#N/A
50% effective depth (mbgl):	0.33		
25% effective depth (mbgl):	0.42	Elapsed time (mins):	#N/A
Base of soakage zone (mbgl):	0.50		
Volume outflow between 75% and 25% effective depth (m^3):			
Mean surface area of outflow (m^2):		0.73	
(side area at 50% effective depth + base area)			
Time for outflow between 75% and 25% effective depth (mins):			

Soil infiltration rate (m/s):	**Test incomplete as 25% effective depth not achieved. Unable to reliably determine soil infiltration rate.**

Remarks Results processed following BRE 365 (2007).

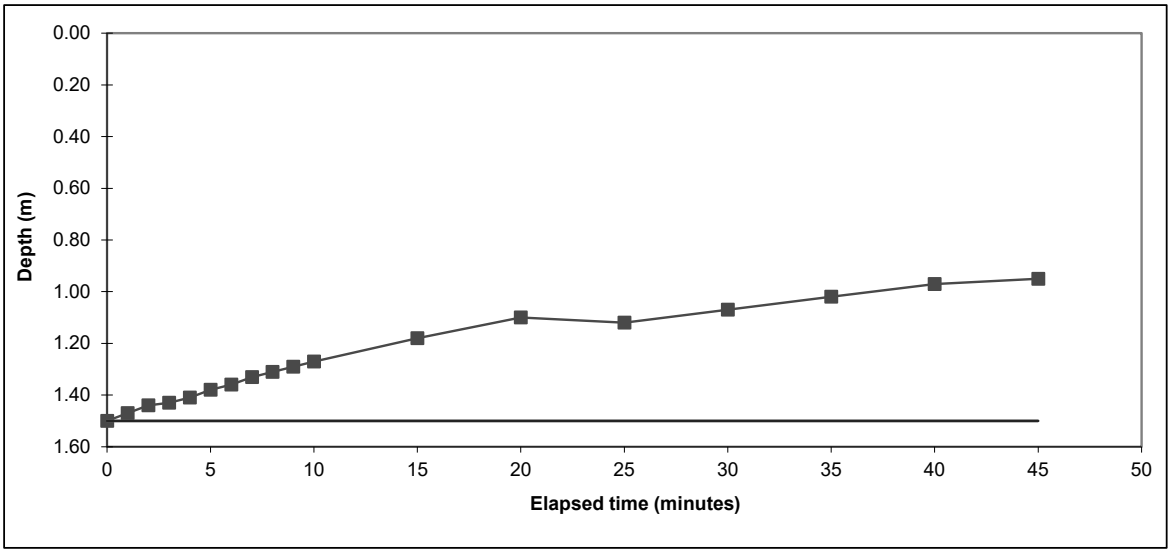
Client:	Harry Barlow	**TP4**
Site:	Fairy Hill Solar Farm	

Your Environment

Soakaway Test

Trial Pit No:	TP5	Test No:	1	Date:	24/08/2022
Length (m):	1.200		Datum Height:	0.00	m agl
Width (m):	0.40		Granular infill:	None	
Depth (m):	1.50		Porosity of infill:	1	(assumed)

Elapsed time (minutes)	Water Depth (m below datum)	Elapsed time (minutes)	Water Depth (m below datum)
0	1.500	30	1.070
1	1.470	35	1.020
2	1.440	40	0.970
3	1.430	45	0.950
4	1.410		
5	1.380		
6	1.360		
7	1.330		
8	1.310		
9	1.290		
10	1.270		
15	1.180		
20	1.100		
25	1.120		



Start water depth for analysis (mbgl)	1.50		
75% effective depth (mbgl):	1.50	Elapsed time (mins):	#N/A
50% effective depth (mbgl):	1.50		
25% effective depth (mbgl):	1.50	Elapsed time (mins):	#N/A
Base of soakage zone (mbgl):	1.50		
Volume outflow between 75% and 25% effective depth (m^3):			
Mean surface area of outflow (m^2):		0.48	
(side area at 50% effective depth + base area)			
Time for outflow between 75% and 25% effective depth (mins):			

Soil infiltration rate (m/s):	**Test incomplete as 25% effective depth not achieved. Unable to reliably determine soil infiltration rate.**

Remarks Results processed following BRE 365 (2007).

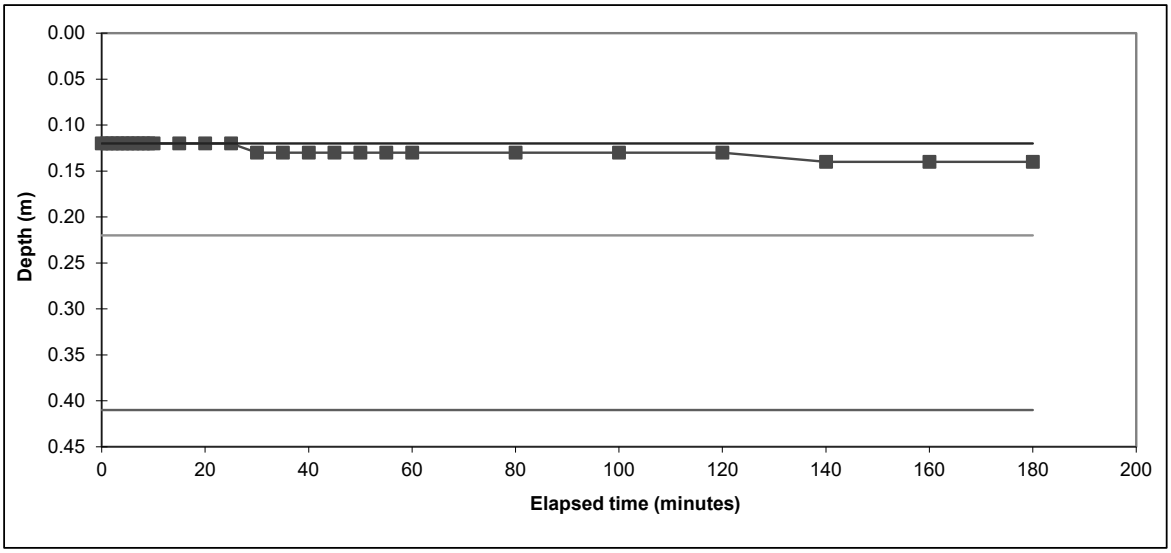
Client:	Harry Barlow	**TP5**
Site:	Fairy Hill Solar Farm	

Your Environment

Soakaway Test

Trial Pit No:	TP6	Test No:	1	Date:	24/08/2022
Length (m):	0.700		Datum Height:	0.00	m agl
Width (m):	0.40		Granular infill:	None	
Depth (m):	0.50		Porosity of infill:	1	(assumed)

Elapsed time (minutes)	Water Depth (m below datum)	Elapsed time (minutes)	Water Depth (m below datum)
0	0.120	30	0.130
1	0.120	35	0.130
2	0.120	40	0.130
3	0.120	45	0.130
4	0.120	50	0.130
5	0.120	55	0.130
6	0.120	60	0.130
7	0.120	80	0.130
8	0.120	100	0.130
9	0.120	120	0.130
10	0.120	140	0.140
15	0.120	160	0.140
20	0.120	180	0.140
25	0.120		



Start water depth for analysis (mbgl)	0.12		
75% effective depth (mbgl):	0.22	Elapsed time (mins):	#N/A
50% effective depth (mbgl):	0.31		
25% effective depth (mbgl):	0.41	Elapsed time (mins):	#N/A
Base of soakage zone (mbgl):	0.50		
Volume outflow between 75% and 25% effective depth (m^3):			
Mean surface area of outflow (m^2):		0.70	
(side area at 50% effective depth + base area)			
Time for outflow between 75% and 25% effective depth (mins):			

Soil infiltration rate (m/s):	**Test incomplete as 25% effective depth not achieved. Unable to reliably determine soil infiltration rate.**

Remarks Results processed following BRE 365 (2007).

Client:	Harry Barlow	**TP6**
Site:	Fairy Hill Solar Farm	

Appendix D

YEX4437
TP01 Photos









YEX4437
TP02 Photos









YEX4437
TP03 Photos









YEX4437
TP04 Photos









YEX4437
TP05 Photos









YEX4437
TP06 Photos









Appendix E – Sewer Records

Wessex Water
YTL GROUP

N
W E
S

Petersfinger Farm

Salisbury

Printed on : 18/05/2020 15:55

WATER MAINS **Public** **Private**

Public
Raw Water
Abandoned
Valve Hydrant PRV Meter M

SEWERS **Public - Section 104 - Private**

Foul
Combined
Surface
Abandoned sewers

OTHER WESSEX PIPES

Rising Mains
Effluent Disposal Main
Overflow

NON-WESSEX PIPES

Private Rising Mains
Culverted Water Course
Highway Drain

Information in this plan is provided for identification purposes only. No warranty as to accuracy is given or implied. The precise route of pipe work may not exactly match that shown. Wessex Water does not accept liability for inaccuracies. Sewers and lateral drains adopted by Wessex Water under the Water Industry (Schemes for Adoption of Private Sewers) Regulations 2011 are to be plotted over time and may not yet be shown.

In carrying out any works, you accept liability for the cost of any repairs to Wessex Water apparatus damaged as a result of your works. You are advised to commence excavations using hand tools only. Mechanical digging equipment should not be used until pipe work has been precisely located.

If you are considering any form of building works and pipe work is shown within the boundary of your property or a property to be purchased (or very close by) a surveyor should plot its exact position prior to commencing works or purchase. If you are proposing to build over or near Wessex Water's apparatus you should contact the Developer Services Team, tel: 01225 526333 or e-mail: developer.enquiries@wessexwater.co.uk to discuss your proposals to discuss your proposals.

Centre:416298.44 , 128972.94

Scale = 1:3200

Metres 50 100 150

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Appendix F – Greenfield Runoff Rates

ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.450
Area (ha)	0.046	Urban	0.000
SAAR (mm)	843	Region Number	Region 7

Results l/s

QBAR Rural	0.3
QBAR Urban	0.3
Q100 years	0.8
Q1 year	0.2
Q30 years	0.6
Q100 years	0.8

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Appendix G – MicroDrainage Results

STORM SEWER DESIGN by the Modified Rational Method

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	4.559	0.046	100.0	0.000	1.00	0.0	0.600		o	100	Pipe/Conduit	
S1.001	3.629	0.036	100.8	0.046	0.00	0.0		0.045	3	1000	1:3 Swale	
S1.002	20.942	0.021	997.2	0.000	0.00	0.0		0.045	3	1000	1:3 Swale	
S1.003	67.013	0.067	1000.2	0.000	0.00	0.0		0.045	3	1000	1:3 Swale	
S1.004	2.144	0.002	1072.0	0.000	0.00	0.0		0.045	3	1000	1:3 Swale	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	50.00	1.10	42.550	0.000	0.0	0.0	0.0	0.77	6.0	0.0
S1.001	50.00	1.22	42.454	0.046	0.0	0.0	0.0	0.51	111.6	6.3
S1.002	50.00	3.36	42.418	0.046	0.0	0.0	0.0	0.16	35.5	6.3
S1.003	50.00	10.21	42.397	0.046	0.0	0.0	0.0	0.16	35.4	6.3
S1.004	50.00	10.44	42.000	0.046	0.0	0.0	0.0	0.16	34.2	6.3

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Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
S1	43.000	0.450	Open Manhole	1200	S1.000	42.550	100				
S2	43.000	0.546	Open Manhole	10000	S1.001	42.454	1000	S1.000	42.504	100	
S3	43.100	0.682	Junction		S1.002	42.418	1000	S1.001	42.418	1000	
S4	43.000	0.603	Junction		S1.003	42.397	1000	S1.002	42.397	1000	
S5	42.400	0.400	Junction		S1.004	42.000	1000	S1.003	42.330	1000	330
S	42.400	0.402	Open Manhole	0		OUTFALL		S1.004	41.998	1000	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S1	594.921	-1073.106	594.921	-1073.106	Required	
S2	592.841	-1077.162	592.841	-1077.162	Required	
S3	591.177	-1080.387			No Entry	
S4	586.392	-1100.775			No Entry	
S5	554.326	-1159.618			No Entry	
S	552.973	-1161.282			No Entry	

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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	o	100	S1	43.000	42.550	0.350	Open Manhole	1200
S1.001	3 \=/	1000	S2	43.000	42.454	0.396	Open Manhole	10000
S1.002	3 \=/	1000	S3	43.100	42.418	0.532	Junction	
S1.003	3 \=/	1000	S4	43.000	42.397	0.453	Junction	
S1.004	3 \=/	1000	S5	42.400	42.000	0.250	Junction	

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	4.559	100.0	S2	43.000	42.504	0.396	Open Manhole	10000
S1.001	3.629	100.8	S3	43.100	42.418	0.532	Junction	
S1.002	20.942	997.2	S4	43.000	42.397	0.453	Junction	
S1.003	67.013	1000.2	S5	42.400	42.330	-0.080	Junction	
S1.004	2.144	1072.0	S	42.400	41.998	0.252	Open Manhole	0

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.004	S	42.400	41.998	0.000	0	0

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Online Controls for Storm

Orifice Manhole: S2, DS/PN: S1.001, Volume (m³): 42.8

Diameter (m) 0.020 Discharge Coefficient 0.600 Invert Level (m) 42.504

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Storage Structures for Storm

Porous Car Park Manhole: S2, DS/PN: S1.001

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	19.2
Membrane Percolation (mm/hr)	1000	Length (m)	19.2
Max Percolation (l/s)	102.4	Slope (1:X)	100.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	42.500	Membrane Depth (mm)	0

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Summary of Critical Results by Maximum Outflow (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.350
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	18.900	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 20, 25

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.000	S1	60 Winter	100	+25%	100/240 Winter			
S1.001	S2	960 Winter	100	+25%				
S1.002	S3	960 Winter	100	+25%				
S1.003	S4	960 Winter	100	+25%				
S1.004	S5	960 Winter	100	+25%				

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	42.615	-0.035	0.000	0.00		0.0	OK	
S1.001	S2	42.676	-0.324	0.000	0.00		0.3	OK	
S1.002	S3	42.431	-0.670	0.000	0.00		0.3	OK	
S1.003	S4	42.408	-0.592	0.000	0.00		0.3	OK	
S1.004	S5	42.038	-0.362	0.000	0.00		0.3	OK	

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Appendix H - Proposed Surface Water Drainage Layout

DATUM/GRID: OS (BY GPS)

1. GENERAL
(i) WORK TO FIGURED DIMENSIONS ONLY.
(ii) THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTURAL DRAWINGS, DETAILED SPECIFICATIONS WHERE APPLICABLE AND ALL ASSOCIATED DRAWINGS IN THIS SERIES.
(iii) ANY DISCREPANCY ON THIS DRAWING IS TO BE REPORTED IMMEDIATELY TO THE PARTNERSHIP FOR CLARIFICATION.
(iv) THE CONTRACTOR IS RESPONSIBLE FOR ALL TEMPORARY WORKS AND FOR THE STABILITY OF THE WORKS IN PROGRESS.
2. DRAINAGE GENERAL
(i) ALL FOUL AND STORM WATER DRAINS WHICH ARE NOT TO BE ADOPTED AS PUBLIC SEWERS UNDER A SECTION 104 AGREEMENT MUST BE CONSTRUCTED IN ACCORDANCE WITH THE BUILDING REGULATIONS, BS EN 752 AND WHERE APPROPRIATE THE RELEVANT AGREEMENT CERTIFICATES.
(ii) MANHOLES, GULLIES, GULLY CONNECTIONS, SEWERS AND OTHER SEWERAGE STRUCTURES INTENDED TO CONVEY SURFACE WATER ARE TO BE CONSTRUCTED IN ACCORDANCE WITH THE WATER AUTHORITIES ASSOCIATION SPECIFICATION 'SEWERS FOR ADOPTION' 6TH EDITION AND RELEVANT COUNCIL DESIGN GUIDE.
(iii) ALL CONCRETE USED IN DRAINAGE WORKS TO COMPLY WITH BRE DIGEST 363 FOR CLASS 2 SULPHATE CONDITIONS
3. MANHOLE COVERS AND FRAMES
(i) MANHOLE COVERS TO BE CLASS D400 IN HIGHWAYS, CLASS B125 IN FOOTWAYS AND VERGES, CLASS A15 IN NON-TRAFFICKED AREAS.
(ii) MANHOLE COVER AND FRAME TO BE BEDDED AND SURROUNDED IN 1:3 MORTAR.
4. MANHOLE RINGS, COVER SLABS & TAPERS
(i) PRECAST CONCRETE MANHOLE UNITS SHALL COMPLY WITH THE REQUIREMENTS OF BS 5911. THE RELEVANT ABSORPTION TESTS REQUIRED SHALL BE CARRIED OUT ON A SAMPLE OF THOSE RINGS AND SLABS USED UNLESS A CERTIFICATE OF TESTING IS SUPPLIED BY THE MANUFACTURER. COVER SLABS SITUATED UNDER CARRIAGEWAYS OR TRAFFICKED AREAS SHALL BE HEAVY DUTY AND THOSE ELSEWHERE SHALL BE LIGHT DUTY. MANHOLE UNITS SHALL BE COMPLETE WITH STEP IRONS IF REQUIRED.
5. PIPES
(i) PLASTIC PIPES SHALL BE OF UNPLASTICISED POLYVINYL CHLORIDE (UPVC) COMPLYING WITH THE REQUIREMENTS OF BS EN 1401.
(ii) CONCRETE PIPES SHALL BE SPUN BY A CENTRIFUGAL PROCESS OR BE VERTICALLY PRESSED. THEY SHALL POSSESS SELF INVERTING SOCKETS AND SHALL COMPLY WITH WITH THE REQUIREMENTS OF AND BE TESTED IN ACCORDANCE WITH BS 5911.
(iii) SOLID WALL CONCENTRIC EXTERNAL RIB-REINFORCED UNPLASTICISED PVC PIPE SHALL COMPLY WITH ASTM F978.
(iv) ALL VITRIFIED CLAY PIPES TO BE IN ACCORDANCE WITH BS EN 295.
(v) ALL PIPE CONNECTIONS TO MHS AND CATCH PITS TO HAVE MIN 600MM ROCKER PIPE AS CLOSE AS PRACTICABLE TO CHAMBER WALL.
6. GULLY GRATES & FRAMES
(i) GULLY GRATES AND FRAMES FOR CARRIAGEWAY GULLIES SHALL COMPLY WITH BS EN 142. GULLIES SHALL BE PATTERN GB4-325 FOR ROADS BELOW 50 DV AND PATTERN GA2-450 FOR ROADS ABOVE 50 DV. GULLY GRATES AND FRAMES FOR KERB SIDE GULLIES SHALL BE PATTERN GK-115 FOR ROADS BELOW 50 DV AND GK-165 FOR ROADS ABOVE 50 DV. CURVED BAR GULLY GRATES SHALL BE USED IN ROADS WHERE THE GRADIENT EXCEEDS 4%.

LEGEND

- DITCH/SWALE
- FLOW CONTROL CHAMBER
- SURFACE WATER SEWER
- LINED PERMEABLE PAVING
- OVERLAND FLOW

PERMEABLE PAVING AREA:3735QM CL: 43.00 IL: 42.50

PIPE NO: 1.001 100mm DIA 1:100 4.5m

ALL ROOF AREAS TO DRAIN TO UNDERMARBL PAVING ON THE ACCESS ROAD

78mm ORIFICE PLATE CONTROL TO RESTRICT FLOW TO 0.6 L/S

SWALE PIPE REF: 1.002

SWALE PIPE REF: 1.003

SWALE PIPE REF: 1.004 (OUTFALL)

CONVEYANCE SWALE TO DIRECT RUNOFF AND EXCEEDANCE FLOWS TO EXISTING DRAIN. SWALE TO BE 2m WIDE WITH 1:3 SIDE SLOPES

OUTFALL TO EXISTING DITCH MAXIMUM FLOW RATE 0.3 L/S
OUTFALL CL: 42.400
OUTFALL IL: 41.998

Def

Track

FB

ED Bdy

CD

REV	DATE	BY	CKD	APP'D	DESCRIPTION

PRELIMINARY DRAWING
FOR INFORMATION ONLY. NOT FOR CONSTRUCTION.

Client
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Project
LAND ADJACENT TO WWTW BRITFORD
WILTSHIRE SP5 4DX

Drawing
SURFACE WATER DRAINAGE STRATEGY
GENERAL ARRANGEMENT

Drawn by: LW Date: 10 FEB 2023

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Revision: -

Drawing Scale:

Drawing No: