Appendix 9.1: Flood Risk Assessment

Department: ERM
Project: Springfield Solar Farm and BESS
Document Code: 0733745

May 2025

INDEX

1 INTRODUCTION

1.1 Purpose of This Report

1.1.1.1 Voltalia UK Ltd. (Voltalia) is proposing to develop Springfield Solar Farm and BESS, located to the north of Oldhamstocks, East Lothian, Scotland.

1.1.1.2 Environmental Resources Management Limited (ERM) has been commissioned by Voltalia (the Applicant) to undertake a Flood Risk Assessment (FRA) for the construction of the Springfield Solar Farm and BESS (the Proposed Development).

1.1.1.3 This FRA is a Technical Appendix to **Chapter 9: Water Resources and Flood Risk.**

1.1.1.4 The primary purpose of this FRA is to assess and determine the flood risk from various sources associated with the Proposed Development and the impacts of the Proposed Development on flood risk elsewhere in accordance with national and local policy and guidance.

1.2 Policy and Guidance

1.2.1.1 National Planning Framework 4 (NPF4)[1] states that "Development proposals will not increase the risk of surface water flooding to others, or itself be at risk" with "proposals at risk of flooding or in a flood risk area only supported if they are:

- Essential infrastructure where the location is required for operational reasons;
- Water compatible uses;
- Redevelopment of an existing building or site for an equal or less vulnerable use; or
- Development of previously used sites in built up areas where the LDP has identified a need to bring these into positive use and where proposals demonstrate that long term safety and resilience can be secured in accordance with relevant Scottish Environmental Protection Agency (SEPA) advice."

1.2.1.2 NPF4 is supplemented by the following guidance documents that have been considered in the authoring of this FRA:

- Scottish Government Flood Risk Planning Advice[2];
- SEPA Guidance Note: Technical Flood Risk Guidance for Stakeholders[3];

---

[1] Scottish Government (2024). National Planning Framework 4. Available online at: https://www.gov.scot/publications/national-planning-framework-4/documents/ Accessed 14/04/2025

[2] Scottish Government (2015). Flood Risk: Planning Avice. Available online at: https://www.gov.scot/publications/flood-risk-planning-advice/ Accessed 14/04/2025.

[3] SEPA (2022). Technical Flood Risk Guidance for Stakeholders. Available online at: https://www.sepa.org.uk/media/162602/ss-nfr-p-002-technical-flood-risk-guidance-for-stakeholders.pdf Accessed 14/04/2025

- Construction Industry Research and Information Association (CIRIA) Guidance Document C624: Development and Flood Risk[4];
- SEPA Flood Modelling Guidance for Responsible Authorities[5];
- SEPA: Climate change allowances for flood risk assessment in land use planning[6]; and
- East Lothian Strategic Flood Risk Assessment[7].

[4] CIRIA (2004). Development and Flood Risk – Guidance for the Construction Industry. Available online at: https://www.ciria.org/CIRIA/CIRIA/Item_Detail.aspx?iProductCode=C624 Accessed 14/04/2025

[5] SEPA. Flood Modelling Guidance for Responsible Authorities. Available online at: https://www.sepa.org.uk/media/219653/flood_model_guidance_v2.pdf

[6] SEPA (2024). Climate Change Allowances for Flood Risk Assessment in Land Use Planning. Available online at: https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fwww.sepa.org.uk%2Fmedia%2Ftx2hrn51%2Fclimate-change-allowances-guidance-1.docx&wdOrigin=BROWSELINK Accessed 14/04/2025.

[7] East Lothian Council (2024). Strategic Flood Risk Assessment. Accessed 14/04/2025.

2 PROPOSED DEVELOPMENT

2.1 Development Description

2.1.1.1 The Proposed Development comprises a solar powered energy generating station, including a co-located Battery Energy Storage System (BESS). The Proposed Development will have a generating capacity of up to approximately 165 MW from the solar PV modules (solar panels), while the BESS will have a generating capacity of up to approximately 80 MW.

2.1.1.2 A full description of the components of the Proposed Development is provided in **Chapter 3: Development Description** and are shown in **Volume 2, Figure 3.1: Site Layout Plan.**, However, the principle components of Proposed Development for the purposes of this report are the:

- Solar PV Arrays;
- Central Inverters;
- BESS;
- Substation Electrical Infrastructure; and
- Access tracks.

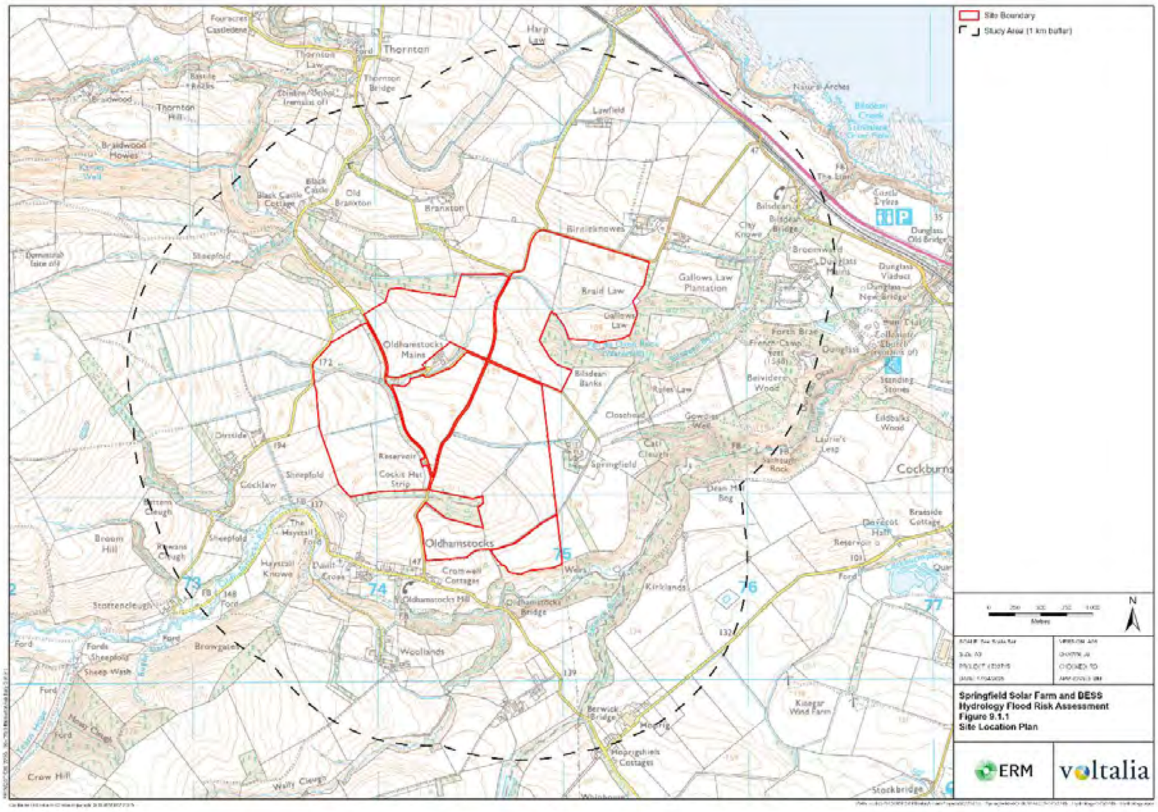
3 EXISTING SITE

3.1 Site Location

3.1.1.1 The Site comprises approximately 182 hecatres (ha) of agricultural greenfield land north of Oldhamstocks village, within the boundaries of Springfield Farm, as shown in **Figure 9.1.1**.

3.1.1.2 Other settlements surrounding the Site include Oldhamstocks Mains (small estate within in centre of Site), Innerwick (2.6 km north-west), and Dunglass (2.5 km east).

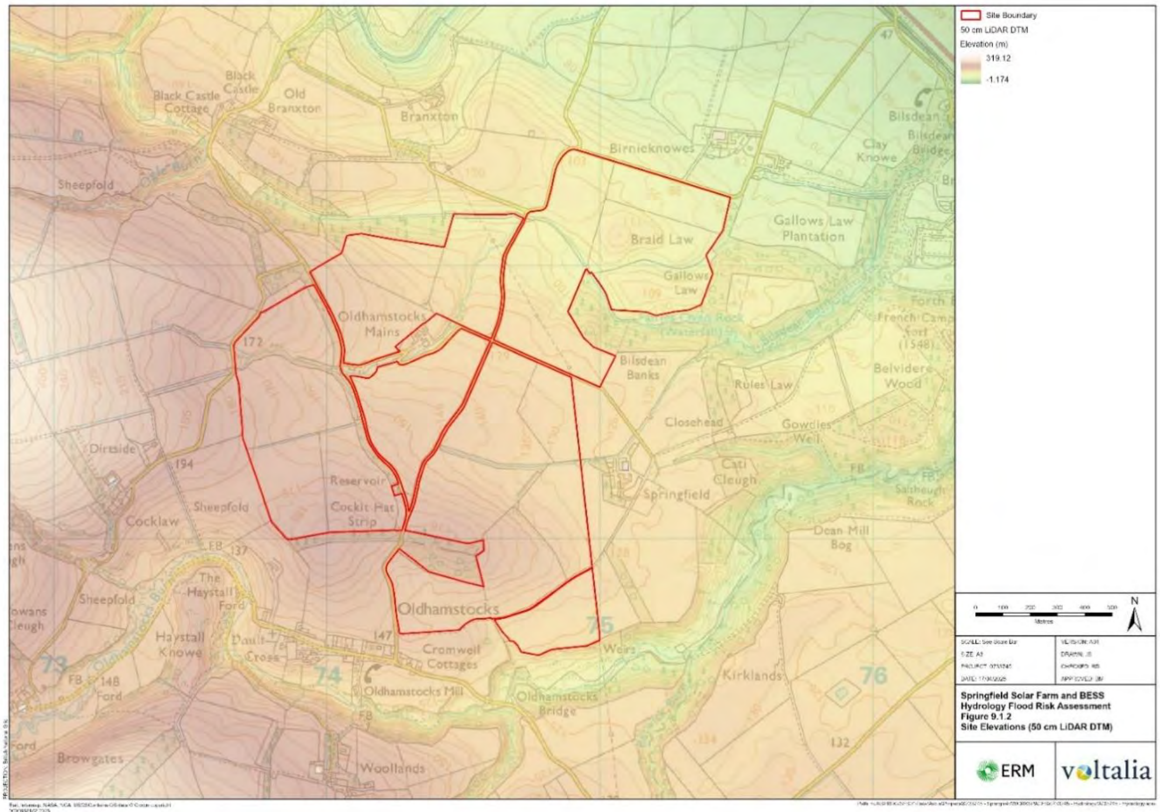
FIGURE 9.1.1 SITE LOCATION PLAN



3.2 Elevations

3.2.1.1 Light Detection and Ranging (LiDAR) data (2022) at 50 cm resolution identifies that the Site elevation ranges between 85 m Above Ordnance Datum (m AOD) in the north east and 190 m AOD in the south west, with elevations across the Site shown in **Figure 9.1.2**.

FIGURE 9.1.2 SITE ELEVATIONS



3.3 Hydrological Setting

3.3.1.1 The Site is located entirely within the East Lothian Coastal catchment. The Site is drained by a number of burns and field drains which make up the headwaters of the Bilsdean Burn, which flows through the centre of the Site past Oldhamstocks Mains, before then flowing west to east along the northern extent of the Site and eventually flowing through Bilsdean town before reaching the coast via Bilsdean Creek.

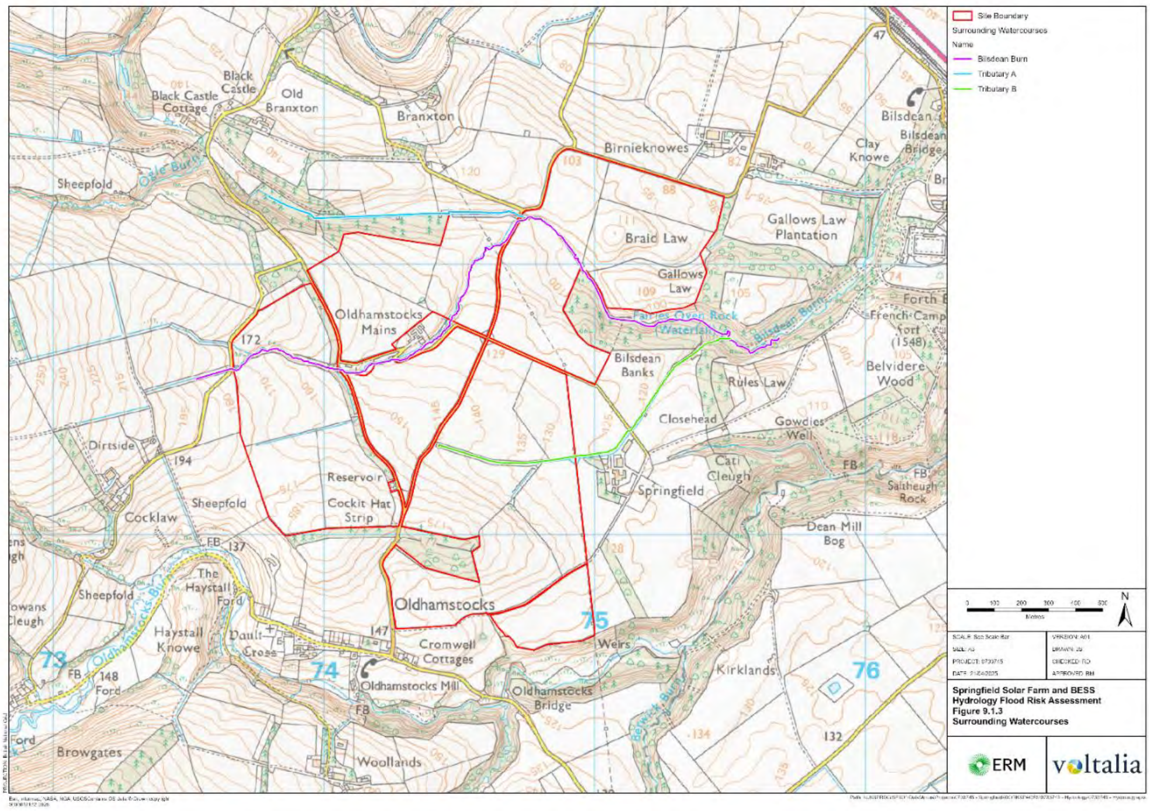
3.3.1.2 There are two main tributaries to the Bilsdean Burn. One tributary (referenced as Tributary A from here on in) is located along the northern extent of the Site flowing west to east before draining into the Bilsdean Burn at the location of a minor road crossing. The other tributary (referenced as Tributary B from here on in) flows from the centre of the Site in a west to east direction towards Springfield Farm, before then discharging into the Bilsdean Burn approximately 500 m downstream of the Site at E 375475, N 671737.

3.3.1.3 To the south of the Site is the Oldhamstocks Burn / Dunglass Burn. The southern areas of the Site are located within this burn's catchment area.

3.3.1.4 A Site walkover was conducted in March 2025 to observe the surface water flow paths across the Site and review the condition and nature of the watercourses within the Site and associated structures (e.g., bridges, culverts).

3.3.1.5 The watercourses within the Site are shown within **Figure 9.1.3**, and a summary of each is provided below.

FIGURE 9.1.3 SURROUNDING WATERCOURSES

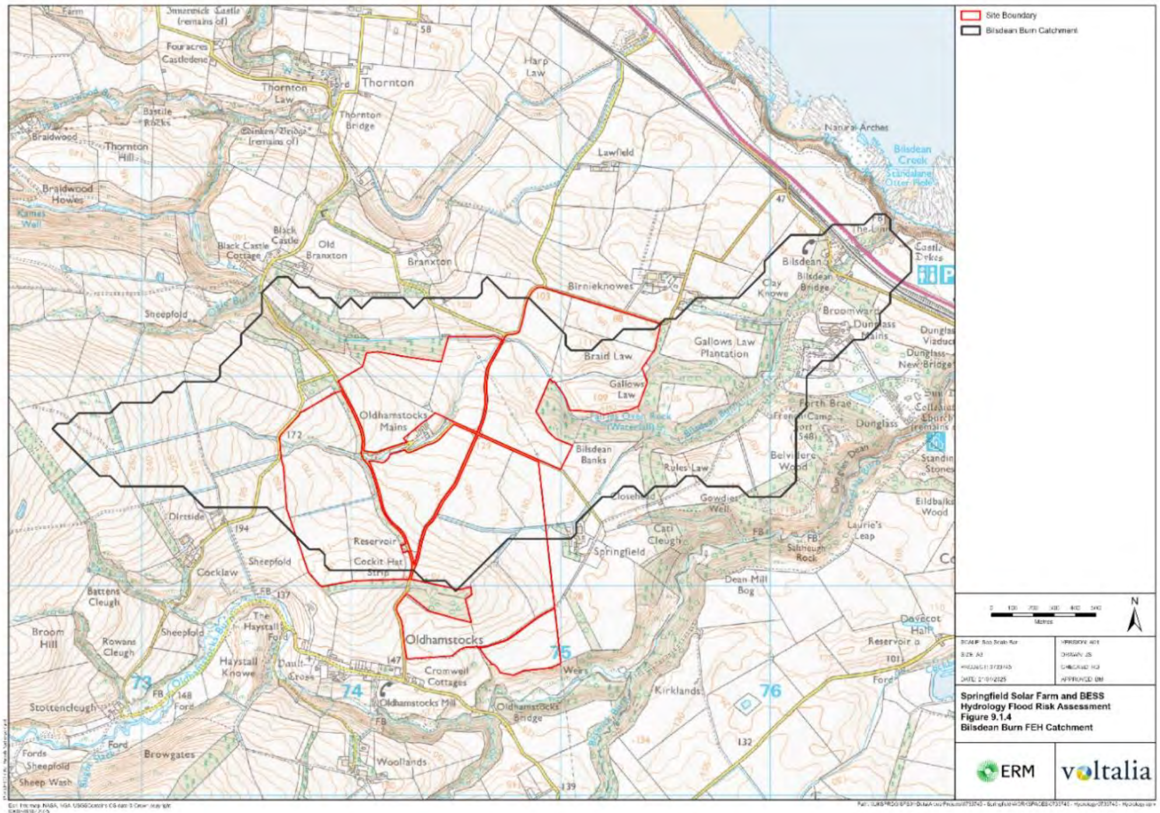


3.3.2 Bilsdean Burn

3.3.2.1 The Bilsdean Burn drains the majority of the northern extent of the Site, with the Flood Estimation Handbook (FEH) data explorer[8] showing that the watercourse drains a total area of 3.52 km^2 (from the point of discharge to Bilsdean Creek). The FEH catchment extent for the Bilsdean Burn is shown in **Figure 9.1.4**.

[8] UK Centre for Ecology and Hydrology (2024). Flood Estimation Handbook Data Explorer. Available online at: https://fehweb.ceh.ac.uk/Map Accessed 15/04/2025

FIGURE 9.1.4 BILSDEAN BURN FEH CATCHMENT



3.3.2.2 The Bilsdean Burn was traversed during the Site survey. The watercourse flows through the centre of the Site before passing beneath a minor track (via a culvert). The Tributary A watercourse drains into the Bilsdean Burn at a bridge crossing beneath a minor road. The banks and channel definition of the Bilsdean Burn downstream of the minor road (at the general location of the BESS and substation compound) are shown in **Plate 1**.

3.3.2.3 Further downstream of the bridge crossing (approximate E 374953, N 672007) the Bilsdean Burn banks become less defined, and there is evidence of an existing crossing over the watercourse (without any intervening structure) as shown in **Plate 2.**

3.3.2.4 There is a culvert beneath a minor road (approximate E 374047, N 671613) which is located upstream of Oldhamstocks Mains. The culvert was identified as being a circular plastic culvert in a good condition and is shown in **Plate 3**.

PLATE 1 BILSDEAN BURN DOWNSTREAM OF MINOR ROAD

PLATE 2 CHANGE IN BANK DEFINITION AT CROSSING POINT ACROSS BILSDEAN BURN

PLATE 3 CULVERT OF BILSDEAN BURN

3.3.3 Tributary A

3.3.3.1 Tributary A flows along the northern boundary of the Site towards the bridge crossing of Bilsdean Burn, where it drains into the burn.

3.3.3.2 To the west of the minor road, the watercourse flows south-west to north-east in a highly straightened channel. The height of the left bank ranges from approximately 0.5 m to 2 m. The land on the left bank slopes steeply towards the watercourse, and as such, surface water runoff will flow downhill and into the burn. The right bank varies in height from 0.5 m to 1 m, but in areas there are breaks in the bank. The land immediately adjacent to the right bank is relatively flat, and rushes and saturated ground were observed at the time of the visit. Further upstream, the watercourse banks of the watercourse, the right bank of the watercourse becomes much lower and less defined.

3.3.3.3 At the minor road crossing of the Bilsdean Burn (approximate E 374713, N 672176) there is an arch bridge, shown in Error! Reference source not found. below. The culvert is approximately 1.5 m in height, with the channel approximately 1.5 m deep and 2.5 m wide at the point of the crossing. The crossing appeared to be in a good condition at the time of survey, with no evidence of debris or blockage.

3.3.3.4 The flows along the watercourse were shown to be very slow during the survey. An example image of the watercourse from the site walkover survey is shown in **Plate 4**.

3.3.3.5 A narrow field drain was identified during the walkover survey which drains from a south to north direction towards Tributary A, and is culverted beneath an existing agricultural access track at E 374473, N 672194. Due to the diameter of the culvert and the slope of the ground draining towards it, it is assessed that during periods of extended or extreme rainfall the culvert would be overtopped. An example image of the field drain and the culvert are shown in **Plate 5**.

PLATE 4 ARCH BRIDGE CROSSING OF TRIBUTARY A (DOWNSTREAM OF CROSSING IS BILSDEAN BURN)

PLATE 5 IMAGE OF TRIBUTARY A FROM SITE WALKOVER

PLATE 6 CULVERT OF A FIELD DRAIN FLOWING INTO TRIBUTARY A

3.3.4 Tributary B

3.3.4.1 Tributary B flows from the centre of the Site in a west to east direction towards Springfield Field before ultimately draining into Bilsdean Burn downstream of the Site. Observations from the Site walkover survey indicate that the watercourse has little to no flow, with a width of approximately 0.2 m and banks of approximately 0.3 m. An example image of the watercourse is shown in **Plate 6**.

PLATE 7 IMAGE OF TRIBUTARY B FROM SITE WALKOVER

3.4 Hydrogeology

3.4.1.1 The northern half of the Site is underlain by the Inverclyde group, a moderately productive aquifer where flow is virtually all through fractures and other discontinuities. The southern half of the Site is underlain by the Stratheden Group which is also a moderately productive aquifer but with significant intergranular flow. It is described as: sandstone, partly pebbly with subordinate siltstone and mudstone produce moderate amounts of groundwater (**Volume 2, Figure 9.3**).

3.4.1.2 Under the WFD the Study Area is underlain by the Torness Coastal groundwater body (ID: 150730) and the Torness groundwater body (ID: 150568) which are both classified as being in Good condition.

3.5 Flood Mapping

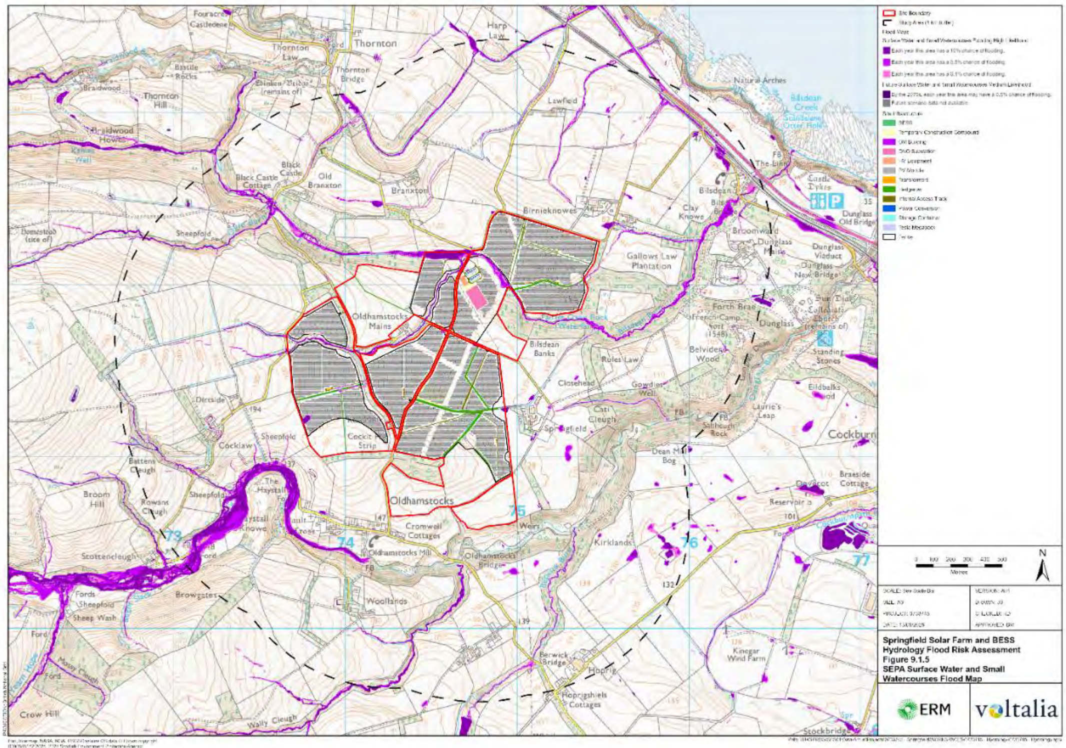
3.5.1.1 The SEPA Flood Maps show that the Site is not at risk of fluvial (river) flooding in, up to, and including the 'Low' risk 1 in 1,000-year scenario (**Volume 2, Figure 9.4**). However, the SEPA flood maps only model watercourses with catchment areas over 3 km^2 and therefore, there could still be the potential for fluvial flooding to occur on-Site from watercourses with smaller contributing catchments.

3.5.1.2 The SEPA Flood Maps show that the Site is at risk of flooding from surface water and small watercourses, which provide modelled flood extents for watercourses with a catchment of less than 10 km^2. Flood extents are present at the location of PV arrays on the western boundary of the Site (E 373773, N 671220), two areas adjacent to the public road passing through the Site (E 374748, N 671646 and E 374556, N 671728), internal access tracks and junctions for the BESS compound access tracks. All electrical infrastructure, including inverters, the BESS. Substation, Power Control System units and operational buildings are located outwith of the areas at Low to High risk flooding based on the SEPA Flood Map.

3.5.1.3 The SEPA National Flood Risk Assessment for Scotland (NFRAS)[9] identifies areas as being potentially vulnerable to flood risk, referred to as Potentially Vulnerable Areas (PVAs). The NFRAS indicates the Site and surrounding area is not located within a PVA.

3.5.1.4 The SEPA surface water and small watercourses flood map is shown in **Figure 9.1.5**.

FIGURE 9.1.5 SEPA SURFACE WATER AND SMALL WATERCOURSES FLOODMAP



---

[9] SEPA (2018). National Flood Risk Assessment for Scotland. Available online at: https://beta.sepa.scot/flooding/flood-risk-management-planning-in-scotland/national-flood-risk-assessment/ Accessed 15/04/2025.

3.6 Historic Flooding

3.6.1.1 The Chronology of British Hydrological Events[10] was reviewed to identify any flood events at or within the vicinity of the Proposed Development. No known reported flooding incidents were identified as part of the review.

3.6.1.2 Consultations with East Lammermuir Community Council from February to March 2025 identified there has been historic flooding of the Site, predominantly associated with surface water flow paths leading to pluvial flooding in low lying areas, and overtopping of the Bilsdean Burn. The key details from this consultation are as follows:

- A historical curling pond (located at NGR E374604, N 672169) has an anecdotal history of flooding. A review of topographic data surrounding the curling pond and outcomes from the water resources and flood risk Site walkover indicates that the curling pond is located at a low point of a surface water flow path, and ponding at the location is a result of surface water settling at this point during what could be considered more 'regular' rainfall events. During more extreme events the Bilsdean Burn may have the potential to overtop and increase the water levels at the location of the historic curling pond.

- A minor road located on a crossing of the Bilsdean Burn (at NGR E 374724, N 672175) has an anecdotal history of flooding, likely due to a build-up of water along the flow route of the Bilsdean Burn.

- An agricultural field located within the Site at NGR E 374514, N 671706, which will comprise of PV panels, has an anecdotal history of flooding. A review of topography indicates that the flooding within this field is pluvial in nature, with surface water settling within low lying areas of the field.

3.7 Flood Risk Vulnerability Classification

3.7.1.1 SEPA Flood Risk and Land Use Vulnerability Guidance sets the following vulnerability classifications of the types of infrastructure and land use that can be located within designated flood zones:

- Most Vulnerable;
- Highly Vulnerable;
- Least Vulnerable;
- Essential Infrastructure; and
- Water Compatible Uses.

3.7.1.2 In accordance with the SEPA Flood Risk and Land Use Vulnerability Guidance the Proposed Development is defined as 'Essential Infrastructure' falling under the definition 'All forms of renewable, low-carbon and zero emission technologies for electricity generation and distribution and transmission electricity grid networks and primary substations'.

---

[10] University of Dundee and British Hydrological Society (2025). Chronology of British Hydrological Events. Available online at: https://cbhe.hydrology.org.uk/ Accessed 15/04/2025.

3.7.1.3 Policy 22 of the NPF4 sets out the exceptions where infrastructure can be located in a flood risk area, which includes the location of essential infrastructure where the location is required for operational reasons.

4 FLOOD RISK ASSESSMENT

4.1 Methodology

4.1.1.1 Policy 22 of the NPF4 requires applicants to demonstrate that all risks of flooding are understood and demonstrated; Annex F of the NPF4 defines flooding from all sources as per the flooding sources and definitions in **Table 4.1**. This FRA will therefore assess flooding from fluvial, pluvial, sewer, groundwater and coastal sources in accordance with the NPF4. Whilst it is not referenced in Annex F of the NPF4, flooding from artificial sources (i.e., canals, reservoirs) will also be assessed for completeness.

TABLE 4.1 FLOODING SOURCES

FLOODING SOURCE	DEFINITION
Watercourse / Fluvial	Caused by excessive rainfall or snow melt within a limited period, which overwhelms the capacity of the watercourse or river channel, particularly when the ground is already saturated. It can also arise as a result of the blockage of a channel and/or associated structures such as small bridges and culverts.
Pluvial	Occurs when rainwater ponds or flows over the ground (overland flow) before it enters a natural or man-made drainage systems (e.g. a river or sewer/drain). It can also occur when drainage systems are at full capacity. It is often combined with sewer flooding and groundwater flooding.
Sewer	Occurs when the sewerage infrastructure has to deal with loads beyond its design capacity. This occurs most often as a result of high intensity rainfall events.
Groundwater	Occurs when the water table rises above ground level. In Scotland this is most commonly associated with the movement of water through sands and gravels, often connected to the rise and fall of river levels.
Coastal	Occurs as a result of high tide, storm surge and wave activity raising the level of the sea above adjoining land.

Source: Annex F, NPF 4.

4.1.1.2 In assessing flood risk to and from the Proposed Development, flood risk sources have been appraised and classed as the following:

- Negligible (where little or no risk is identified).
- Low (where theoretical risk is identified, but mitigating factors may influence flood levels).
- Moderate to High (where modelled levels or historical events show risk to the Site).

4.1.1.3 This has considered several factors when attributing the residual risk of flooding to the Site, including:

- depth of flooding;
- flooding extent / ingress into Site;
- type of infrastructure affected; and
- intervening structures / flood protection.

4.2 Fluvial and Pluvial Sources

4.2.1 Site Specific Hydraulic Model

4.2.1.1 Acknowledging that the SEPA Flood Map shows that the Site is at risk of flooding from pluvial (surface water) and small watercourses associated with overland surface water flow paths and the Bilsdean Burn and its tributary, fluvial and pluvial flooding is assessed as one potential flood source.

4.2.1.2 Given the relatively small contributing catchment of Bilsdean Burn at the Site (approximately 2.5 km^2) it is assessed that the lag time within the catchment (the time between surface water first touching ground to entering the watercourse) will be short, and therefore the key risk of flooding will be from periods of intense rainfall which will result in surface water flow paths across the Site and overtopping of the Bilsdean Burn and its tributaries.

4.2.1.3 To assess this potential risk of flooding and to build on the SEPA surface water and small watercourses flood extents and depths, a Site-specific hydraulic model has been built which simulates potential flooding impacts during a combined 1 in 200-year (plus climate change) rainfall event with 1 in 2-year fluvial flows in the Bilsdean Burn and Tributary. From here in on this modelled scenario is referred to as the 'combined fluvial and surface water scenario'.

4.2.1.4 A summary of the modelling approach and methodology is provided in **Table 4.2**, with further details provided in the modelling method statement in **Appendix A** of this FRA.

TABLE 4.2 MODELLING APPROACH SUMMARY

MODEL COMPONENT	MODEL ITEM
Model Type	2D fluvial and direct rainfall.
Software	Flood Modeller Pro for hydraulic modelling. REFH2 for rainfall and flow generation.
Inputs / Inflows	REFH2 rainfall hyetographs and flow hydrographs.
Events	Rainfall: 1 in 200 year +39% climate change uplift Fluvial: 1 in 2-year
Durations	Rainfall: 3 hours (in accordance with SEPA modelling guidance) Fluvial: 10.5 hour for 1 in 2-year event

MODEL COMPONENT	MODEL ITEM
Ground DTM	50 cm resolution LiDAR DTM
Grid Size	1 m
Timestep	0.5 seconds
Roughness Values	Mannings N values, derived from survey notes and aerial imagery.

4.2.2 Modelled Flood Extents and Depths at the Site

4.2.2.1 The hydraulic modelling outputs for the combined fluvial and surface water scenario shows that there is flooding at the location of the PV panels. Modelling result figures for the modelled scenarios shown in **Appendix B** of this FRA.

4.2.2.2 Flood depths at the locations of PV arrays are typically significantly lower than the minimum 0.8m base height of the panels in the combined fluvial and surface water scenario. SEPA advises through Technical Flood Risk Guidance for Stakeholders a minimum freeboard of 0.6m above flood levels to account for uncertainties within hydraulic modelling. Accounting for the base height of the panels flooding at PV arrays up to depths of 0.2m will disperse around the base of panels without impacting panels or exceeding SEPA freeboard requirements. In some locations across the Proposed Development PV arrays are shown to have flood depths up to approximately 0.4m. Given that a freeboard of approximately 0.4m will still existing in these isolated locations and the panels will have 'in built' weather resilience to rainfall as part of standard design for solar panels, the flood risk in these instances is not assessed as being significant.

4.2.2.3 The flood depths at the location of the BESS and HV infrastructure are shown to be limited to the existing access road which the access tracks will connect to and no electrical infrastructure is within the modelled flood extent.

4.2.3 Impacts on Flood Risk Elsewhere

4.2.3.1 The location of solar panels within the floodplain is not anticipated to result in a decrease in the storage capacity of the floodplain or flow routes, due to the narrow footings which the panels will sit on. During flood events flood water will disperse across the floodplain as per the existing scenario, and there will be no loss in the storage capacity of the underlying ground.

4.2.4 Pluvial and Fluvial Flood Risk Summary

4.2.4.1 Acknowledging the raised nature of the PV arrays and the limited footprint of the PV array structures, it is assessed that the PV panels will remain operational without increasing flood risk elsewhere in, up to, and including the in 1 in 200-year (plus 39%) scenario.

4.2.4.2 As such the pluvial and fluvial flood risk at the Site, and the potential to increase flood risk elsewhere, is assessed to be Low without accounting for the measures detailed above.

4.3 Sewer Flooding

4.3.1.1 Asset figures provided by Scottish Water indicate that there is a freshwater pipe along the route of the existing access road through the Site, which connects to a water mains system in Oldhamstocks village, which is 4 to 6 inches in diameter within the Site and its vicinity. Prior to construction, Scottish Water will be consulted to agree an appropriate design protection measures to prevent any structural damage to the asset. The fresh water pipe is connected to a Scottish Water sealed reservoir unit, and any flows within the pipe are assessed to be controlled by the connectivity to the reservoir. It is assessed that the flows within the pipe will therefore be controlled in accordance with Scottish Water management practices, and there is limited risk of exceedance resulting in flooding at the Site.

4.3.1.2 Neither the East Lothian Council SFRA nor available data suggest that sewer flooding is a problem in the area and that the Site is in a Critical Drainage Area.

4.3.1.3 Therefore, the risk of flooding from sewers is assessed to be Negligible.

4.4 Groundwater Flooding

4.4.1.1 The NFRAS illustrates the proportion of each 1 km square where geological and hydrogeological conditions show that groundwater might emerge. It does not show the likelihood of groundwater flooding to occur. The mapping shows that the Site is located within grid squares of <25% and 25 to 50%.

4.4.1.2 The British Geological Survey (BGS) borehole records[11] indicate there are two borehole records approximately 400 m north of the Site (BGS reference NT77SE6 and NT77SE7, which provide borehole scans for multiple boreholes). These scans indicate that groundwater was encountered at 2.7 to 25 m below ground level.

4.4.1.3 Acknowledging that the groundwater levels within the vicinity of the Site are significantly below the potential depth the PV arrays will be driven into the surface or foundations for any ancillary infrastructure, the risk of groundwater rising and interacting with the Proposed Development is low and therefore the risk of groundwater flooding is assessed to be Negligible.

4.5 Coastal Flooding

4.5.1.1 The Site is located at approximately 85 to 190 m AOD and approximately 1.2 km from the coastline. The SEPA Flood Map shows that the Site is not at risk of coastal flooding in the Low to High likelihood scenarios.

4.5.1.2 Whilst the Site is located relatively close to the coast, the catchment draining towards the coastline is very steep in terms of elevation, and therefore the watercourses within the

---

[11] British Geological Survey. Borehole Records. Available online at: https://mapapps2.bgs.ac.uk/geoindex/home.html Accessed 17/04/2025

vicinity of the Site will not have a tidal influence nor will water levels within the watercourses be influenced by sea levels.

4.5.1.3 As such the risk of coastal flooding is assessed to be Negligible.

4.6 Artificial Sources

4.6.1.1 A review of OS mapping shows there are no canals within the vicinity of the Site. The SEPA Reservoirs Flood Map[12] indicates the Site will not be inundated in a scenario where there is a structural breach of the nearest reservoir or loch. Therefore, the risk of flooding from an artificial source is assessed to be Negligible.

[12]SEPA. Reservoirs Flood Map. Available online at: https://map.sepa.org.uk/reservoirsfloodmap/Map.htm Accessed 17/04/2025

5 FLOOD RISK MANAGEMENT MEASURES

5.1.1.1 As outlined in **Section 4.2** the Site is at risk of fluvial and pluvial flooding, and additional flood risk management measures are required. The following mitigation measures will be considered to reduce the probability of flooding during extreme events and residual risks should also be considered.

5.2 Construction

5.2.1.1 It is possible the Site may flood during the duration of the construction works, and therefore, there should be emphasis placed on managing and mitigating the risks to the proposed temporary works as well as not increasing the flood risk elsewhere.

5.2.1.2 During construction, pollution prevention guidelines will be followed by the appointed contractor to protect water quality in the event of flooding and/or extreme rainfall.

5.2.1.3 A Construction Environmental Management Plan (CEMP) will incorporate measures to prevent an increase in flood risk during the construction works. Examples of such measures include:

- topsoil and other construction materials will be stored outside of the 1 in 200-year floodplain extent wherever possible and only moved to the works areas immediately prior to use;
- the construction site office and supervisor will be notified of any potential flood occurring by use of the SEPA flood warning service;
- the Contractor should produce a Flood Risk Management Action Plan/ Method Statement which will provide details of the response to an impending flood and include:
  - a 24-hour availability and ability to mobilise staff in the event of a flood warning;
  - the removal of all plant, machinery and material capable of being mobilised in a flood for the duration of any holiday close down period;
  - details of the evacuation and site closedown procedures; and
  - arrangements for removing any potentially hazardous material and anything capable of becoming entrained in flood waters from the works areas.
- The Contractor should develop a construction methodology that reduces the potential for accidental release of pollutants into adjacent watercourses.

5.3 Operation

5.3.1.1 During operation, the following measures should be considered during a flood event to allow for a fast recovery following the flood event:

- site drainage and landscape design follow relevant guidance to minimise the risk from exceedance flows and any overland flow entering the Proposed Development;
- adequate containment of storage areas, to ensure that material does not wash away and cause pollution and damage to infrastructure; and

- adoption of flood proofing and resilience measures to minimise damage to buildings and the timescales for the resulting clean-up operation e.g. wet-proofing by raising electrical wiring above flood levels, galvanised and stainless-steel fixings, solid concrete floors and water-resistant wall coatings and plasters;

- implementation of the Surface Water Management Strategy; and

- oil interceptors that satisfy regulatory requirements for discharge to surface water courses.

5.3.1.2 Future landowners should subscribe to the SEPA flood warning service in the area.

6 OUTLINE SURFACE WATER DRAINAGE STRATEGY

6.1 Introduction

6.1.1.1 The Proposed Development includes a range of infrastructure which varies in footprint and permeability. To effectively manage surface water runoff for the different types of infrastructure, this Outline Surface Water Drainage Strategy details the proposed surface water management measures for different elements of the Proposed Development in accordance with the footprint and permeability of the infrastructure.

6.1.1.2 The measures within this Outline Surface Water Drainage Strategy will inform the detailed design of the surface water drainage measures which will be produced prior to the construction phase.

6.1.1.3 This Outline Surface Water Drainage Strategy has been produced in accordance with the following guidance:

- The National Planning Framework ('NPF') 4, 2023[13].
- Scottish Environment Protection Agency's (SEPA) Regulatory Method: Sustainable Urban
- Drainage Systems, 2019[14].
- Sustainable Urban Drainage Scottish Working Party's (SUDSWP) Water Assessment and
- Drainage Assessment Guide, 2016[15].
- The CIRIA SuDS Manual, 2015[16].
- The General Binding Rules 10, 11 and 21 of the Water Environment (Controlled Activities)
- (Scotland) Regulations 2011[17].

---

[13] Scottish Government (2023). National Planning Policy 4. Available online at: https://www.gov.scot/publications/national-planning-framework-4/ Accessed 16/04/2025.
[14] SEPA (2019). Regulatory Method: SuDS. Available online at: https://www.sepa.org.uk/media/219048/wat-rm-08-regulation-of-sustainable-urban-drainage-systems-suds.pdf Accessed 16/04/2025.
[15] SuDS Working Party (2016). Water Assessment and Drainage Assessment Guide. Available online at: https://www.sepa.org.uk/media/163472/water_assessment_and_drainage_assessment_guide.pdf Accessed: 16/04/2025
[16] CIRIA (2015). The SuDS Manual C753. Available online at: https://www.ciria.org/CIRIA/CIRIA/Item_Detail.aspx?iProductCode=C753 Accessed 16/04/2025.
[17] Scottish Government (2021). The Water Environment (Controlled Activities) (Scotland) Amendment Regulations 2021. Available online at: https://www.legislation.gov.uk/ssi/2021/412/contents/made Accessed: 16/04/2025

- SEPA's Guidance Note 2: Planning advice on Sustainable Drainage Systems (SuDS), 2010[18].
- The Flood Risk Management (Scotland) Act 2009[19].
- The Flood Risk Management (Scotland) Act 2009: Surface Water Management Planning Guidance 2018[20].
- East Lothian Council. SuDS Supplementary Planning Guidance[21].

6.1.1.4 **Section 6.2** and **Section 6.3** outline the surface water drainage methodology for the PV arrays, the BESS and the substation compound, respectively.

6.2 PV Array Surface Water Drainage

6.2.1 PV Array Surface Water Runoff

6.2.1.1 The PV Array will comprise rows of solar panel modules mounted on metal frames and pile driven into the ground to limit the footprint of PV array units. The panels would be mounted at approximately 0.7 to 0.9 m (depending on conditions) from the ground at the lowest point, rising to up to no more than 3.2 m at the highest point.

6.2.1.2 Installation of the PV arrays does not involve the introduction of hardstanding at ground level, meaning the superficial cover for the majority of the Site will remain the same as the baseline. Additionally, the PV array tables will have regular rainwater gaps to prevent water from being concentrated along a single drip line. As such, rainfall landing on the solar panels will drain through rainwater gaps and infiltrate into the ground beneath and between each row of panels.

6.2.1.3 The PV arrays have the potential to concentrate rainfall under the drip line, leading to channelisation and compaction of soils, which can establish preferential flow routes for surface water in extreme events.

6.2.1.4 Research in the United States by Cook & McCuen[22] outlines that solar panels do not have a significant effect on runoff volumes or peak flows; however, where the ground beneath

---

[18] SEPA (2010). Land Use Planning System SEPA Guidance Note 2: Planning Advice on SuDS. Available online at: https://geosmartinfo.co.uk/wp-content/uploads/2023/01/lups-gu2-planning-guidance-on-sustainable-drainage-systems-suds.pdf Accessed: 16/04/2025

[19] Scottish Government (2009). Flood Risk Management (Scotland) Act 2009. Available online at: https://www.legislation.gov.uk/asp/2009/6/contents Accessed 16/04/2025.

[20] Scottish Water, SEPA and Scottish Government (2018). Flood Risk Management Act (Scotland) 2009: Surface Water Management Planning Guidance. Available online at: https://www.gov.scot/publications/flood-risk-management-scotland-act-2009-surface-water-management-planning/documents/ Accessed 16/04/2025.

[21] East Lothian Council (2019). SuDS Supplementary Planning Guidance. Available online at: https://eastlothianconsultations.co.uk/housing-environment/ldp-sustainable-drainage-systems-spg/ Accessed 16/04/2025.

[22] Cook, Lauren & McCuen, Richard. (2013). Hydrologic Response of Solar Farms. Journal of Hydrologic Engineering. 18. 536-541. 10.1061/(ASCE)HE.1943-5584.0000530.

panels is bare, there may be an increase in peak discharge. Other research studies quantified this increase ranging from 1.5 % to 8.6 %, depending on site specific parameters.

6.2.1.5 The raised nature of PV Arrays will not prevent soil from absorbing rainwater, as the panels will not be placed directly on the ground, and each PV Row will be separated, with the same area of soil available for infiltration as per the baseline scenario.

6.2.1.6 Once rainfall has fallen off a PV Array, the water will be able to spread and flow along the ground under the PV Arrays evenly into the rain-shadow of the row below, so as to mobilise the same percentage of the ground for infiltration as was available prior to the installation of PV Arrays.

6.2.1.7 Water will drip off each PV Module with small gaps between modules. This means that the surface area to drip line length ratio will be the same as for "traditional" solar array layouts, which use the same modules.

6.2.1.8 The energy of the flow which drains from PV Arrays will be greater than that of the rainfall. Therefore, this could result in erosion under the driplines and possibly lead to ground instability. In addition, intensification of the runoff from panels, along the 'drip line', into small channels / rivulets, could be exacerbated where PV Arrays are not positioned in alignment with topography. In order to avoid increased erosion rates, the grass beneath the panels would be well maintained throughout the lifetime of the Proposed Development. During the operational phase the likelihood of soil erosion occurring as a result of the Development is therefore assessed to be minimal.

6.2.1.9 During the construction phase, unnecessary soil disturbance on saturated soils would be avoided in order to minimise soil compaction. As such, the area under the drip line should be seeded with a suitable grass mix, to prevent rilling (incisions in soil caused by concentrated water flow) and an increase in surface water runoff rates.

6.2.1.10 All internal access tracks will be made up of a permeable aggregate (type 2 aggregate or similar) which will be subject to a maintenance program in accordance with best practice maintenance for solar farms. As such it is assessed that internal tracks will not comprise of impermeable surfaces.

6.3 Substation and BESS Compound Surface Water Drainage

6.3.1 Substation and BESS Hardstanding Surfaces

6.3.1.1 The substation and BESS compound is located on the southern (right) bank of the Bilsdean Burn and will comprise of electrical infrastructure and container units set on top of concrete (or similar) plinths.

6.3.1.2 The units within the compound will be set on a concrete plinth up to 0.5 m in height, and underlain by a permeable gravel subbase (e.g., type 2, aggregate or similar) and a permeable mesh membrane up to a depth of 0.5 m, as detailed in **Appendix C** of this FRA.

6.3.1.3 A review of the substation and BESS compound layout plans (Figure 3.8 and Figure 1.2) indicates that the total hardstanding surfaces which make up the substation and BESS compound are those detailed below.

TABLE 6.1 SUBSTATION AND BESS COMPOUND HARDSTANDING SURFACES

INFRASTRUCTURE	TOTAL AREA (M^2)
Battery Containers (40 units)	520
PGC Power Conversion Unit (12 units)	712
Tesla Megapack (10 units)	240
Substation (1 unit)	14
Storage Container (2 units)	54
O&M Building (1 unit)	154
Transformers (1 units)	60
Total m^2	1754
Total (ha)	0.18 ha

6.3.2 Surface Water Discharge Method

6.3.2.1 In accordance with the drainage hierarchy within the SuDS Manual, infiltration as a means of surface water management has been assessed as a preferential solution.

6.3.2.2 Borehole records approximately 400 m north of the Site (as detailed in **Section 4.4**) indicate that underlying strata within the vicinity of the Site comprises of various clay-based soils. The National Soils Map of Scotland[23] indicates the soil types at the Site comprise fluvioglacial sands and gravels derived mainly from Upper Old Red Sandstone sediments. As such it is unlikely that the discharge of surface water runoff by infiltration based systems will be feasible as the primary method for surface water disposal from the Proposed Development. Whilst any proposed SuDS features should encourage infiltration, they will also require a positive outfall.

6.3.2.3 In accordance with the drainage hierarchy, the next appropriate outfall for surface water drainage is to a surface watercourse. Given the distance of the substation and BESS compound from Bilsdean Burn and the topography generally falling from south to north (i.e., towards the burn), it is assessed that discharging to the burn will imitate the existing surface water flow paths at the Site.

[23] Scotland's Environment. Scotland's Soils. Available online at: https://map.environment.gov.scot/Soil_maps/?layer=1 Accessed 16/04/2025

6.3.3 Surface Water Runoff Rate

6.3.3.1 Greenfield runoff rates for the 0.18 hectares (ha) of hardstanding within the substation and BESS compound have been calculated using the Interim Code of Practice for SuDS (ICP SuDS)[24] method via Info Drainage Software, with rates shown in **Table 6.2**.

TABLE 6.2 SUBSTATION AND BESS COMPOUND EXISTING GREENFIELD RUNOFF RATES

RETURN PERIOD	FLOW (L/S)
Qbar (2-year)	0.3
30-year	0.7
100-year	1.0
200-year	1.1

6.3.4 Proposed Discharge Rates

6.3.4.1 In accordance with East Lothian Council SuDS Supplementary Planning Guidance, the peak surface water runoff rate for greenfield developments should be restricted to the pre-development discharge rate, where reasonably practicable. However, the SuDS Working Party Water Assessment and Drainage Assessment Guide specifies that the minimum discharge rate for any new development site should be set at 5 l/s. As such, surface water discharge from the Proposed Development should be restricted to 5.0l/s.

6.3.5 Return Period Design

6.3.5.1 The proposed surface water drainage system should be designed to ensure that the post development runoff rate and volume do not exceed the pre-development greenfield runoff rate. As detailed in the previous section in accordance with the SuDS Working Party Water Assessment and Drainage Assessment Guide the discharge rate will be limited to 5.0l/s.

6.3.5.2 Formal on-site drainage should be provided up to the 1 in 30-year return period event and attenuation measures should be designed such that SuDS features will not surcharge during a 30-year return period rainfall event.

[24] SuDS Working Group (2004). Interim Code of Practice for SuDS. Available online at: https://www.susdrain.org/files/resources/other-guidance/nswg_icop_for_suds_0704.pdf Accessed 16/04/2025

6.3.5.3 No flooding to property or critical roads should occur during the 1 in 200-year event, with all surface water during this event (with an 39% allowance for climate change, in accordance with SEPA climate change allowances[25]) contained on-site.

6.3.6 Surface Water Attenuation

6.3.6.1 The surface water attenuation volume will be provided within the underlying aggregate and permeable mesh. To calculate the area available, the areas beneath the infrastructure and access roads have been discounted as providing attenuation volume, providing a total area available for attenuation of approximately 3,500 m^2 (0.35 ha).

6.3.6.2 Stone surfacing will comprise a minimum of 500 mm of unbound free-draining aggregate subbase and permeable mesh lining, which will allow storage of storm water.

6.3.6.3 Surface water will be channelled through the subbase network through a perforated piped system, which will then connect to an outfall to the Bilsdean Burn. The piped system will include inspection chambers to facilitate maintenance programmes.

6.3.6.4 The free draining subbase has been designed in Info Drainage software utilising cellular storage with design details in accordance with the SuDS Manual guidelines for cellular storage.

6.3.6.5 The porosity of a capping layer is defined by the type of fill material applied, with typical porosity values extracted from Info Drainage shown in **Table 6.3**. A conservative approach has been taken for the porosity value in order to assess a scenario where storage within the sub base is limited, and as such a porosity value of 0.2 has been applied within the design of the structure (i.e., the lowest range within the graded gravel category).

6.3.6.6 In order to restrict surface water flows to 5 l/s an HydroBrake (or other flow restricting device) will be placed on the outfall of the pipes from the subbase.

TABLE 6.3 TYPICAL POROSITY VALUES

MATERIAL	POROSITY
Clean Stone	0.4 to 0.5
Uniform Gravel	0.3 to 0.4
Graded Sand or Gravel	0.2 to 0.3

6.3.6.7 The structure is shown to provide suitable attenuation capacity during the 1 in 200-year (+39 %) critical event with maximum rates calculated at 5 l/s, as shown in **Appendix D** to this

[25] SEPA. Climate Change Allowances for Flood Risk Assessments in Land Use Planning. Available online at: https://scottishepa.maps.arcgis.com/apps/webappviewer/index.html?id=2ddf84e295334f6b93bd0dbbb9ad7417 Accessed 16/04/2025

FRA. Due to the limited impermeable extents, the surface water runoff and outfall rates generated are extremely low and flow rates leaving the system will be negligible, demonstrating the porous nature of the Proposed Development.

6.3.6.8 During an exceedance event, which exceeds the 1 in 200-year (+39% climate change uplift) event, surface water flow routes will disperse as per the baseline scenario within the location of the substation and BESS compound. The substation and compound are located within an agricultural catchment with no residential or manned property on-site. Therefore, any exceedance will disperse within the extent of the Proposed Development, with no risk to people or the built environment.

6.3.7 Water Quality

6.3.7.1 In order to determine whether the proposed SuDS features for the Proposed Development will be sufficient at removing pollutants from surface water runoff, the CIRIA SuDS Manual (2015) Simple Index Approach has been applied and is provided in **Appendix E** of this FRA. This approach provides pollution hazard levels and indices to relevant pollutants based upon contributing hardstanding surfaces.

6.3.8 Maintenance

6.3.8.1 The proposed surface water drainage system will require routine maintenance to ensure it remains fully operational and effective. The proposed SuDS features will remain under private ownership and should therefore be maintained by either the Site owner or a suitable private management company.

6.3.8.2 Draft maintenance schedules for the proposed SuDS features have been provided in **Appendix F** of this FRA. However, a pre-commencement condition should be applied to ensure a final Site-specific maintenance plan is provided post-consent for the proposed SuDS features.

7 RECOMMENDATIONS

7.1.1.1 The following outcomes of this FRA should be taken forward following the submission of the planning application for the Proposed Development prior to the detailed design stage:

- The results of the updated hydraulic modelling will be assessed, and the design of the Proposed Development will be reviewed to identify the appropriate mitigation required to ensure that the Proposed Development remains operational without increasing flood risk elsewhere in, up to, and including the 1 in 200-year (plus 39% climate change) flood event.

- Where the need for additional flood mitigation is required, such as micrositing infrastructure, flood resilience measures or compensatory storage, the approach for this mitigation will be agreed with SEPA prior to detailed design. The commitment to implementing flood mitigation measures (where required) in accordance with SEPA guidance will be secured through an appropriately worded planning condition.

- The design principles set out in this FRA will be incorporated into the detailed drainage design, which will be designed in accordance with The SuDS Manual, The Water Assessment and Drainage Assessment Guide, and East Lothian SuDS Supplementary Planning Guidance. The commitment to developing a detailed surface water drainage design in accordance with this guidance will be secured through an appropriately worded planning condition.

- Post-consent, a topographical survey of the Site should be completed which records the invert level and water level of the receiving watercourse. This will be required to inform the detailed drainage design of the Proposed Development.

- Following consultation with the local fire and rescue service a strategy should be developed to suitably control potentially contaminated fire water runoff.

- A pre-commencement condition should be applied to ensure a final Site-specific maintenance plan is provided post-consent for the proposed SuDS features.

8 SUMMARY AND CONCLUSIONS

8.1.1.1 This FRA has assessed the risk of flooding to and from the Proposed Development from a range of sources, based on flooding sources detailed within the NPF4, on a scale from Negligible to High.

8.1.1.2 A 2D hydraulic model has been built as part of this assessment, which identifies that the PV arrays, are at risk of flooding in up to and including the 1 in 200-year (plus 39%) rainfall combined with a 1 in 2-year river flow design event. The extent and level of flooding will not impact the operation of the PV Arrays or flood risk elsewhere due to the narrow stilts which will raise panels above flood levels whilst limiting the footprint on the surface.

8.1.1.3 Electrical infrastructure, including the BESS and substation compound, is shown not to be impacted in the modelled flood event.

8.1.1.4 The PV Arrays will not result in an increase in hardstanding areas and therefore will not significantly increase surface water runoff rates. The PV Arrays will have multiple drip lines along the face to allow surface water to disperse evenly, with native planting to be located beneath PV Arrays to prevent channelisation and alterations to surface water flow routes.

8.1.1.5 In order to maintain the discharge rate of 5.0l/s for all storms up to and including the 1 in 200-year return period with a 39% allowance for climate change, attenuation will be provided by utilising the underlying aggregate and permeable mesh base that sits beneath the BESS and substation compound.

8.1.1.6 The drainage solution for the BESS and substation compound would drain in accordance with existing Site elevations towards the network of surface watercourses south of the compound, which ultimately drain Bilsdean Burn.

APPENDIX A – HYDRAULIC MODELLING AND HYDROLOGY METHOD STATEMENT

voltalia

Hydrology and Hydraulic Modelling Method Statement

Department: ERM
Project: Springfield Solar Farm and BESS
Document Code: 0733745

May 2025

	NAME	FUNCTION	DATE
Elaborated by	Reagan Duff	Managing Consultant	April 2025
Validated by	Briony McIntosh	Managing Consultant	May 2025
Approved by	Peter Rodgers	Consulting Partner	May 2025

REVISION	AUTHOR	CAUSE FOR REVISION	DATE
01	Reagan Duff	Internal Review	April 2025
02	Reagan Duff	Final	May 2025

INDEX

1. INTRODUCTION

1.1.1.1 Hydraulic modelling has been undertaken to provide a quantitative assessment of the flood risk associated with the Bilsdean Burn and tributary watercourse, using a 2D hydraulic model. This modelling has been completed to identify the flood risk at Springfield Solar Farm (the Proposed Development), located on land near Oldhamstocks village (the Site).

1.1.1.2 Further details of the modelling approach are set out in this appendix and summarised in the Flood Risk Assessment (FRA), which this document is an appendix to.

2. SCOPE OF WORK

2.1.1.1 The purpose of this assessment is to identify current flood risk at the Site from Bilsdean Burn, its tributary and overland flow paths to inform the design of the Proposed Development, as part of the FRA.

2.1.1.2 Consultations with the local community council have indicated that following prolonged and/or intense rainfall the Bilsdean Burn and the tributary watercourse overtop, causing flooding along the banks of the watercourses, whilst there is also localised flooding from rainfall settling in topographic low points.

2.1.1.3 This hydraulic modelling study has been developed to understand the potential flooding risks at the Site based on data and information (which is fit for purpose) available at the time of the assessment.

3. HYDROLOGY METHODOLOGY

3.1 The Catchment

3.1.1.1 There is no gauging stations for the Bilsdean Burn on the National River Flow Archives (NRFA) hydrometric network dataset[1] or SEPA monitoring stations dataset[2]. Catchment descriptors were therefore utilised to estimate rainfall intensities from the FEH catchment descriptors for the Bilsdean Burn catchment.

3.1.1.2 The total contributing catchment of the Bilsdean Burn is 3.52 km^2 (from the point of discharge to Bilsdean Creek) based on Flood Estimation Handbook (FEH) catchment descriptors. Downstream of the confluence between Tributary A and the Bilsdean Burn (and downstream of Development infrastructure), the contributing catchment is 2 km^2.

[1] National River Flow Archive (2025). Hydrometric Network. Available online at: https://nrfa.ceh.ac.uk/data/search Accessed 24/04/2025
[2] SEPA (2025). Water Levels Information. Available online at: https://waterlevels.sepa.org.uk/Map Accessed 24/04/2025

3.1.1.3 Tributary A has a contributing catchment of 0.6km^2 at its downstream point before draining into Bilsdean Burn (30% of the total contributing area). As such the remaining 1.4 km^2 (70% of the total contributing area) has been allocated to Bilsdean Burn.

3.1.1.4 The FEH catchment extents at the Site and catchment descriptors at the downstream point of the 2D domain are shown in **Figure 9.2.1** and **Table 3.1** respectively.

FIGURE 9.2.1 FEH CATCHMENTS AT THE SITE

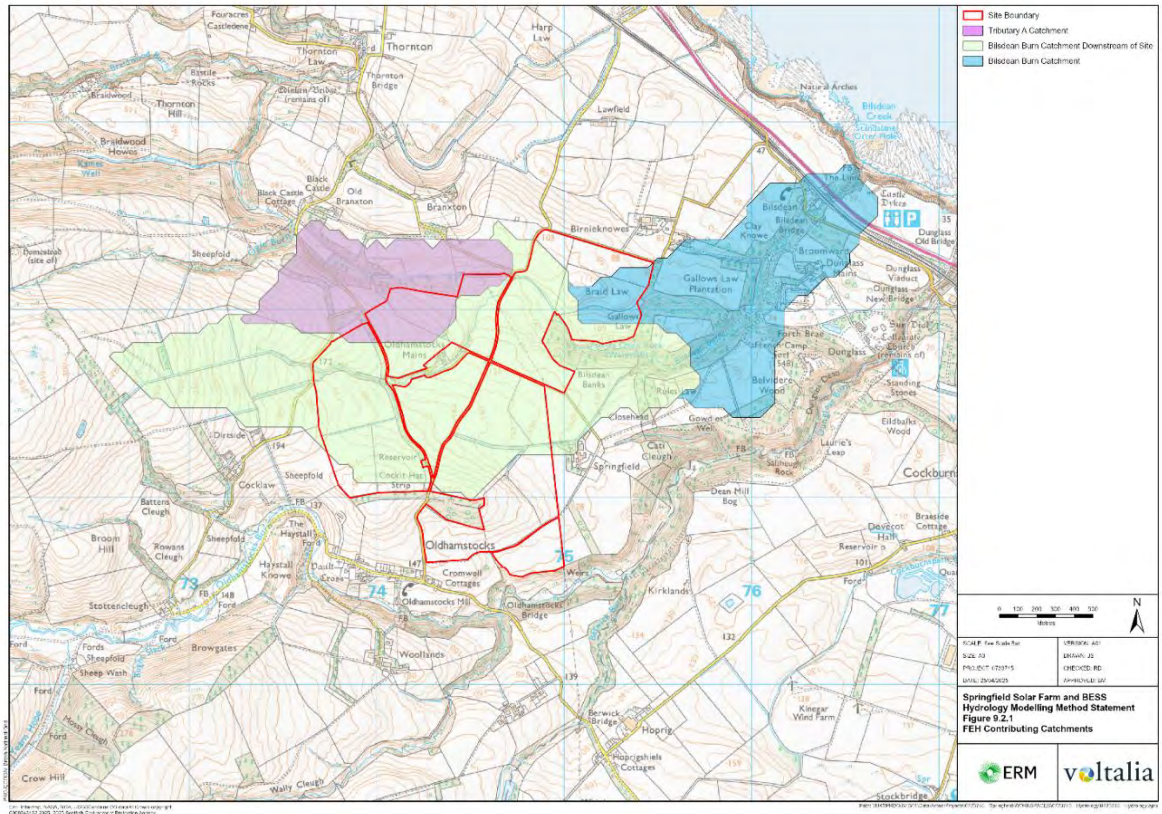


TABLE 3.1 FEH CATCHMENT DESCRIPTORS

DESCRIPTOR	VALUE
Area (km^2)	1.99
BFIHOST	0.779
BFIHOST19	0.702
DPLBAR	1.54
DPSBAR	102.2
PROPWET	0.43

DESCRIPTOR	VALUE
SAAR	707
SPRHOST	23.36
URBEXT1990	0

3.1.2 Peak Intensity Estimation

3.1.2.1 Peak rainfall intensities have been derived for the 0.5% annual exceedance probability (AEP) event (i.e., 1 in 200 year) plus climate change scenarios, using the Revitalized Flood Hydrograph Runoff (REFH2) method in conjunction with FEH13 catchment data.

3.1.2.2 The climate change allowances for the Forth river basin region includes a 56% increase in peak flows and a 39% increase in rainfall. As per SEPA Guidance peak rainfall intensity allowances should be used for river catchments smaller than 30km² therefore an uplift of 39% will be applied to the rainfall to account for climate change.

3.1.2.3 NPF4 requires that new development be assessed against a 1 in 200 year flood, with allowances for climate change. This section details the methods utilised to derive the rainfall intensities and flows for this scenario.

3.1.2.4 In accordance with SEPA Technical Flood Risk Guidance for Stakeholders[3] a 3 hour summer storm duration was applied to represent the rural catchment. The peak REFH2 values are shown in **Table 3.2** and Appendix A.

TABLE 3.2 ESTIMATED REFH2 RAINFALL INTENSITY

RETURN PERIOD	REFH2 PEAK DESIGN RAINFALL (MM/HR)
2	5.25
30	11.52
200	17.19
200+39%	23.89

[3] SEPA (2022). Technical Flood Risk Guidance for Stakeholders. Available online at: https://www.sepa.org.uk/media/162602/ss-nfr-p-002-technical-flood-risk-guidance-for-stakeholders.pdf Accessed 14/04/2025

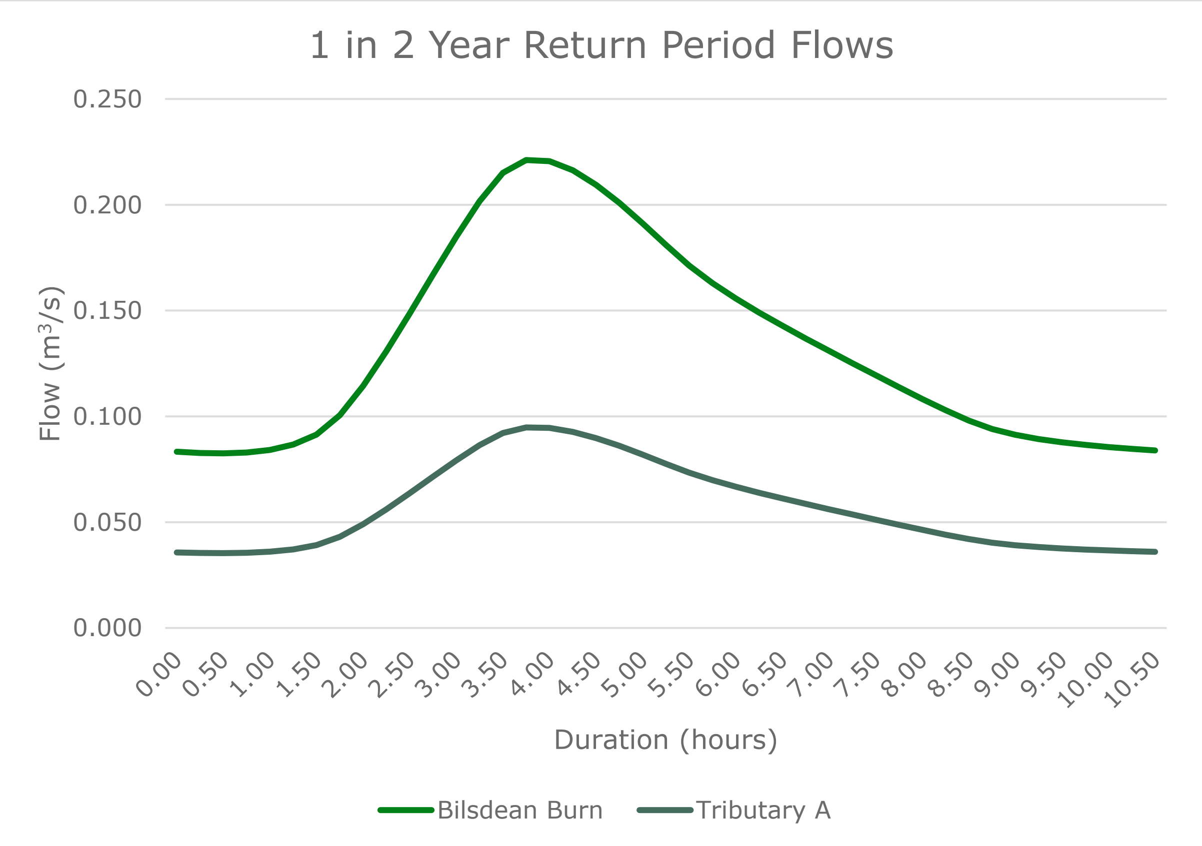
3.1.3 Peak Flow Estimation

3.1.3.1 Peak flows for the Bilsdean Burn and Tributary A have been derived from the REFH2 rainfall intensity data to generate peak flows for a 1 in 2-year scenario using the REFH2 method.

3.1.3.2 The flows for each return period were developed for the 2km^2 FEH catchment, then a pro-rata has been applied to reflect the contributing area for each watercourse (30% of the catchment for Tributary A and 70% of the catchment for Bilsdean Burn).

3.1.3.3 Output flow hydrographs for Bilsdean Burn and Tributary A are provided in **Chart 3.1**.

CHART 3.1 BILSDEAN BURN AND TRIBUTARY A HYDROGRAPHS



4. HYDRAULIC MODELLING METHODOLOGY

4.1 Model Build Approach

4.1.1.1 A 2D hydraulic model has been built using Flood Modeller Pro software to assess the surface water levels, fluvial flooding and hydraulic mechanisms at the Site.

4.1.1.2 The use of a 2D model has been selected for the following reasons:

- The availability of high-resolution LiDAR DTM (50cm) at the Site providing suitably representative topographic data, floodplain topography and channel geometry.

- The LiDAR DTM used to represent elevations across the model extent has been reviewed and shows the bed level of the watercourses to be greater than the bed levels identified during the site walkover. Therefore, the in channel representation of the Bilsdean Burn and its tributary are considered conservative.

- Only the culvert of Bilsdean Burn beneath the access road near the BESS and substation compound and the nearby bridge crossing have been incorporated into the model, and upstream culverts of the Bilsdean Burn have not been included. Not including these culverted upper sections is equivalent to a full blockage scenario and therefore represents a worst-case scenario for these parts of the watercourse. The downstream bridge crossing appears to have significant capacity in comparison to the relatively low peak flows for the Bilsdean Burn.

- Flow estimates for the downstream extent of the model have been used for the inflow for the 2D domain, which will provide conservative flow rates within the upper domain of the model.

- The raised nature of the solar panels using narrow stilts above existing ground levels would present a low risk in terms of floodplain storage and flow conveyance and damage to the infrastructure and as such the modelling approach is considered appropriate relative to the risk level at the Site.

4.2 Model Scenarios

4.2.1.1 To assess this potential risk of flooding and to build on the SEPA surface water and small watercourses flood extents and depths, a Site-specific hydraulic model has been built which simulates potential flooding impacts during a combined 1 in 200-year (plus climate change) direct rainfall and 1 in 2-year fluvial flows in the Bilsdean Burn and Tributary A, to assess the potential impact of surface water flooding on the in channel capacity of the watercourses (hereby referred to as combined fluvial and surface water flooding scenario).

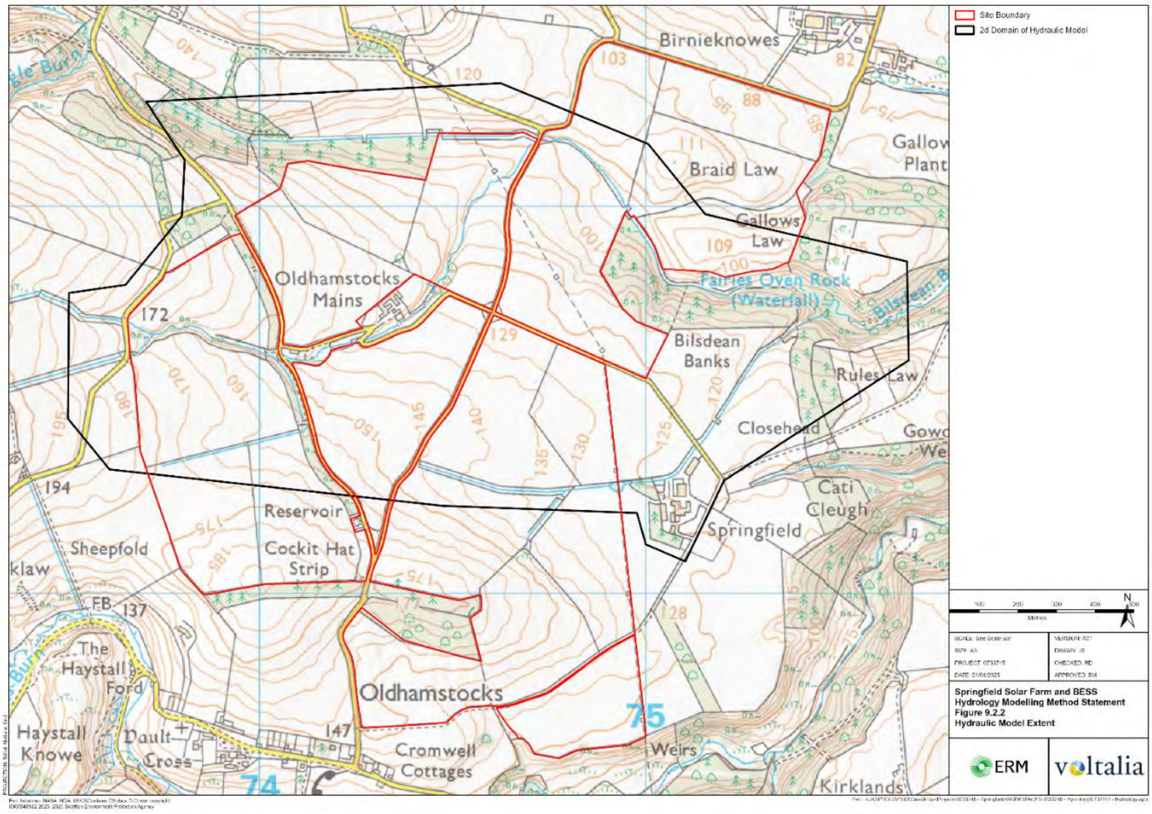
4.2.1.2 This scenario has been selected as the small nature of the catchment and relatively small flows within both watercourses during peak flow indicate the key flooding mechanisms at the Site is related to surface water runoff. This scenario therefore assesses the SEPA advised critical design event accounting for climate change whilst incorporating the 1 in 2-year flows of the Bilsdean Burn and Tributary A.

4.3 Model Extent

4.3.1.1 The model extent has been developed through reviewing the areas across the Site which are identified to have flooding risks/issues, as well as surrounding watercourses and topography data. The model uses a refined model extent to focus on the flooding associated with Bilsdean Burn, its tributaries and flow paths associated with the watercourse. This area has been identified through running iterative simulations to identify key flow paths, before then refining the model area to improve model run times.

4.3.1.2 The model extents are shown in **Figure 9.2.2**.

FIGURE 9.2.2 MODEL EXTENT



4.4 Elevation Data

4.4.1.1 All topographic data, including in channel levels and structures, is based on open source 50 cm resolution LiDAR DTM data.

4.4.1.2 To represent buildings and roads within the Study Area the OS buildings and roads datasets have been used. Buildings have been raised 0.3 m to represent the approximate height up to potential building ingress (e.g., door thresholds) and roads have been depressed 0.3 m to represent the curbside elevation drop.

4.5 Roughness Values

4.5.1.1 Roughness values across the 2D domain have been represented using Mannings N values derived from Chow 1959[4], which have been selected using site walkover notes and aerial imagery. The Mannings N values applied within the model are summarised in **Table 4.1**.

[4] Chow, V. T. (1959). Open-Channel Hydraulics. McGraw-Hill Book Company.

TABLE 4.1 MODEL ROUGHNESS VALUES

DESCRIPTION	MANNINGS N VALUE
Tree stumps no sprouts	0.04
Short grass	0.03
Scattered Brush Heavy Weeds	0.05
Medium to dense brush	0.07
Mature row crops	0.035
High grass	0.035
Dense willows	0.15
Watercourse channels	0.035

4.6 Boundary Conditions

4.6.1.1 Unrestricted flow out of the 2D domain has been set based on the LiDAR and mapping along the 2D domain boundary. The 2D domain boundary has a 1.2 slope applied to it as a normal depth boundary in Flood Modeller (1.2 is the recommended default value in Flood Modeller). This boundary allows water to leave the model in accordance with the defined slope when it reaches this point, to represent flow paths leaving the model domain.

4.6.1.2 An outflow at the downstream extent of the Bilsdean Burn has been applied as a normal depth boundary with a slope of 1.3, which has been calculated based on the slope of the watercourse along the last 100m within the model.

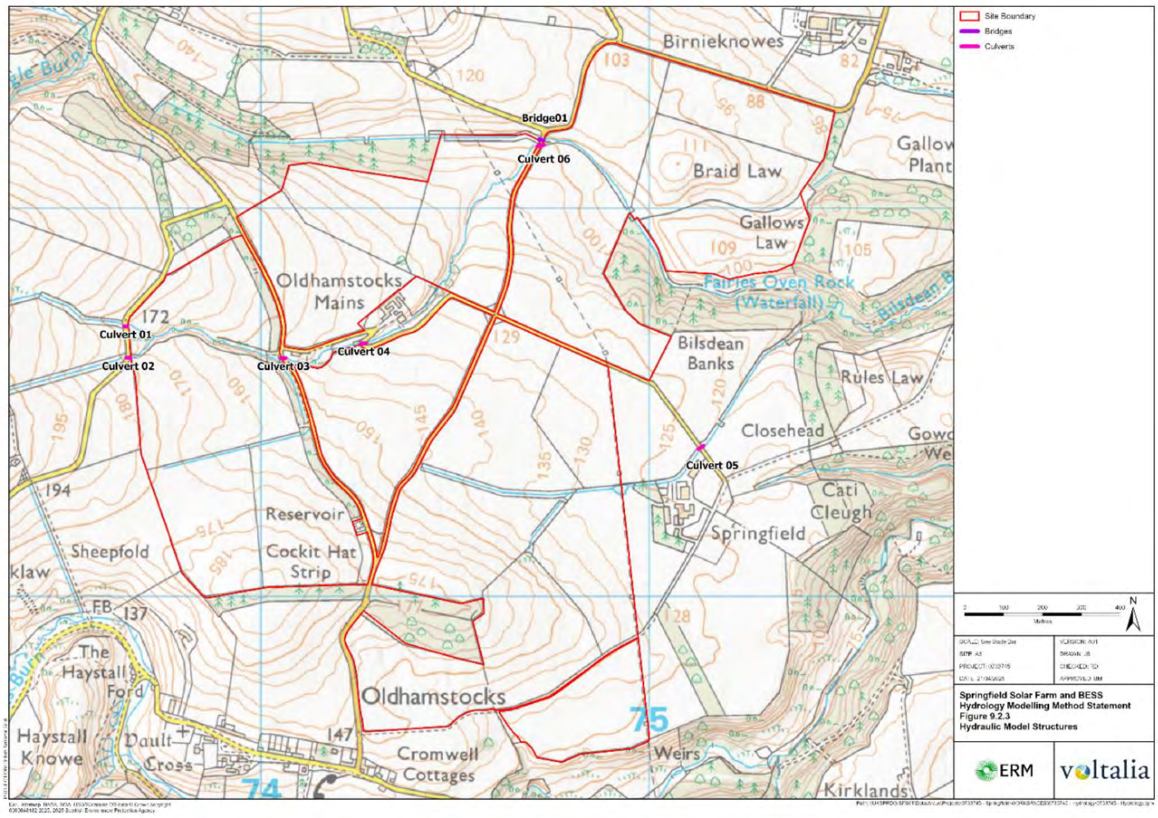
4.6.1.3 The inflow of the Bilsdean Burn and Tributary A have been represented using inflow boundaries at the upstream extent of each watercourse, with flows derived from REFH2 as detailed in **Section 3**.

4.7 Structures

4.7.1.1 Hydraulic structures within the channel have been represented through a combination of reviewing elevation data and field notes collected during the site walkover scheduled for the 3rd and 4th March 2025. The structures have been incorporated into the model as 2D structures in Flood Modeller, as either circular or rectangular culverts (depending on observations from the field survey).

4.7.1.2 Only the bridge crossing at the confluence of Tributary A and Bilsdean Burn, and the culvert of Bilsdean Burn upstream of this confluence have been included. This approach has been taken so that the smaller culverts upstream are represented as being completely blocked, with flows being diverted over the top of culverts. This approach is considered conservative and assesses the worst case scenario, whereby flows in these areas are constrained.

FIGURE 9.2.3 MODEL STRUCTURES



4.8 Simulation Parameters

4.8.1.1 A summary of the simulation parameters is provided in **Table 4.2**.

TABLE 4.2 SIMULATION PARAMETERS

MODEL COMPONENTS	MODEL ITEM
Software	Flood Modeller v7.0
Return Periods	Rainfall: 1 in 200 year +39% climate change uplift Fluvial: 1 in 2-year
Event Duration	Rainfall: 3 hours (in accordance with SEPA modelling guidance) Fluvial: 10.5 hour for 1 in 2-year event

MODEL COMPONENTS	MODEL ITEM
Grid Size	1 m
Timestep	0.5 seconds
Solver	API

5. SENSITIVITY TESTING

5.1 Calibration and Verification

5.1.1.1 There is no rainfall or river (flow or level) gauge situated near the study area to provide calibration or verification data.

5.2 Validation

5.2.1.1 Consultations with East Lammermuir Community Council from February to March 2025 identified that there has been historic flooding of the Site, predominantly associated with surface water flow paths leading to pluvial flooding in low lying areas and overtopping of the Bilsdean Burn. The key details of this consultation are provided below and are detailed further in the FRA:

- A historical curling pond (located at NGR E374604, N 672169) has an anecdotal history of flooding as a result of surface water settling at this point during what could be considered more 'regular' rainfall events. During more extreme events the Bilsdean Burn may have the potential to overtop and increase the water levels at the location of the historic curling pond.
- A minor road located on a crossing of the Bilsdean Burn (at NGR E 374724, N 672175) has an anecdotal history of flooding, likely due to a build-up of water along the flow route of the Bilsdean Burn.
- An agricultural field located within the Site at NGR E 374514, N 671706, which will comprise of PV panels, has an anecdotal history of flooding. A review of topography indicates that the flooding within this field is pluvial in nature, with surface water settling within low lying areas of the field.

5.2.1.2 Flood modelling results appear to represent the flooding at these locations in a similar nature to those identified during consultations with East Lammermuir Community Council, and generally align with the extents in the SEPA small watercourses and surface water map. Any differences within the extents of the SEPA mapping and this study is assessed to be a result of the modelling for this study accounting for localized hydraulic structures, a smaller grid size and model timestep.

5.3 Sensitivity and Blockage Analysis

5.3.1.1 SEPA's flood modelling guidance recommends sensitivity to physical parameters, such as surface roughness. The 200 year plus 39% return period for the sensitivity tests was used. The sensitivity runs undertaken included:

- A variation of -20% and +20% in Manning's roughness values.
- A 50% blockage of the bridge crossing between Bilsdean Burn and tributary A.

5.3.1.2 The results from the sensitivity testing indicate that there are no significant alterations to flood depths or velocities as a result of sensitivity testing.

6. MODELLING RESULTS PROCESSING

6.1.1.1 Following the approach applied in SEPA pluvial hazard mapping methodology maximum flood extent outputs were processed to remove all depths less than 0.1 m, which are not deemed to present a significant risk.

6.1.1.2 The modelling results are provided in Appendix B to the FRA, and discussed further within the FRA.

7. ASSUMPTION AND LIMITATIONS

7.1.1.1 Assumptions based on best practice guidance and project experience will be made to represent the hydraulic characteristics of the watercourse where required.

7.1.1.2 The development will not include new culverting of the Bilsdean Burn or its tributary, and any watercourse crossings will comprise clear span bridges designed in accordance with SEPA design standards.

7.1.1.3 It is assumed there are no abstractions from the watercourses. Private Water Supply questionnaires issued by ERM indicate no supplies abstracted from the Bilsdean Burn or its tributaries, at the time of writing.

7.1.1.4 All topographic data, including in channel levels and structures, will be based on open source 50cm resolution LiDAR DTM data and is assumed to be fit for purpose.

7.1.1.5 It is assumed that Flood Estimation Handbook (FEH) catchment data, purchased from the FEH Web Service is fit for purpose to inform the in-channel flow calculations.

7.1.1.6 It is assumed that any modelling which includes compensatory storage would be completed post submission of the application, if required.

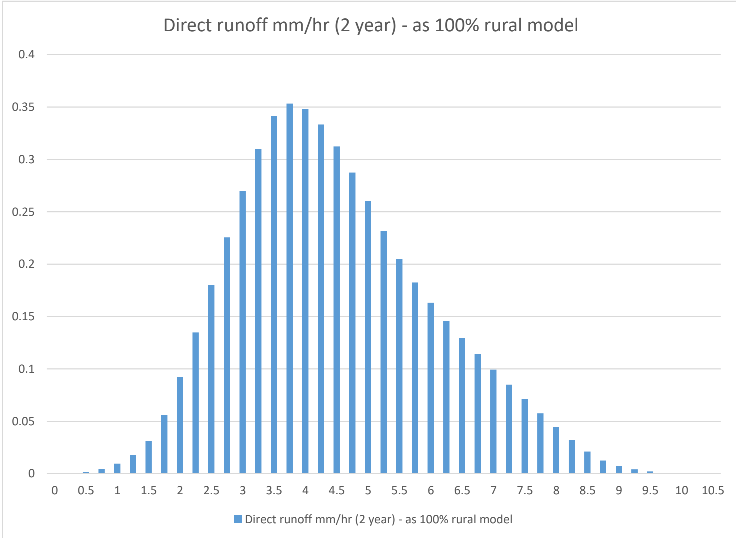
7.1.1.7 Should the layout and design of the Proposed Development change at detailed design the outcomes of this assessment may not be representative. It is therefore assumed that during the detailed design process the appointed contractor will review potential flooding risks at the location of infrastructure and confirm whether flooding risks are deemed appropriate.

APPENDIX A REFH2 OUTPUTS

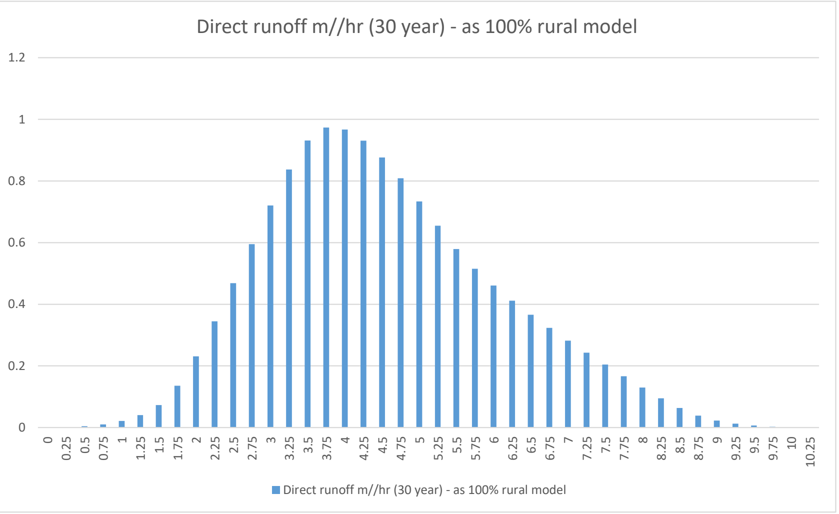
Catchment Area 1.99 km2 1992500 m2

Working Column m3/s > m/s | Working Column m/s > mm/hr

Time	Time (Hours)	2 year design rainfall - FEH22 model	Urban net rain mm (2 year) - as 100% rural model	Rural net rain mm (2 year) - as 100% rural model	Sewer loss m3/s (2 year) - as 100% rural model	Total net rain mm (2 year) - as 100% rural model	Direct runoff m3/s (2 year) - as 100% rural model	Direct runoff m/s (2 year) - as 100% rural model	Direct runoff mm/hr (2 year) - as 100% rural model	Baseflow m3/s (2 year) - as 100% rural model	Total flow m3/s (2 year) - as 100% rural model
00:00:00	0.00	0.360773	0	0.01933	0	0.01933	0	0	0	0.118986	0.118986
00:15:00	0.25	0.502943	0	0.02728	0	0.02728	0.000226	1.13665E-10	0.000409193	0.117938	0.118164
00:30:00	0.50	0.714724	0	0.039433	0	0.039433	0.000999	5.01406E-10	0.00180506	0.116907	0.117906
00:45:00	0.75	1.043956	0	0.059003	0	0.059003	0.002553	1.28143E-09	0.004613163	0.115905	0.118458
01:00:00	1.00	1.594831	0	0.093359	0	0.093359	0.005261	2.64029E-09	0.009505049	0.114946	0.120206
01:15:00	1.25	2.692406	0	0.166445	0	0.166445	0.009753	4.89508E-09	0.017622278	0.114054	0.123807
01:30:00	1.50	5.248879	0	0.356395	0	0.356395	0.01729	8.67758E-09	0.031239305	0.113267	0.130557
01:45:00	1.75	2.692406	0	0.19918	0	0.19918	0.030953	1.55345E-08	0.05592436	0.112661	0.143613
02:00:00	2.00	1.594831	0	0.123217	0	0.123217	0.051115	2.56536E-08	0.092353062	0.112334	0.163449
02:15:00	2.25	1.043956	0	0.082765	0	0.082765	0.074584	3.74322E-08	0.134756024	0.112366	0.18695
02:30:00	2.50	0.714724	0	0.057626	0	0.057626	0.09955	4.99623E-08	0.179864353	0.112791	0.212341
02:45:00	2.75	0.502943	0	0.041019	0	0.041019	0.124844	6.26572E-08	0.225565933	0.113621	0.238466
03:00:00	3.00	0.360773	0	0.029663	0	0.029663	0.14934	7.49513E-08	0.269824509	0.114849	0.26419
03:15:00	3.25	0	0	0	0	0	0.171607	8.61263E-08	0.310054787	0.116447	0.288053
03:30:00	3.50	0	0	0	0	0	0.188893	9.48022E-08	0.341287823	0.118351	0.307245
03:45:00	3.75	0	0	0	0	0	0.195488	9.81119E-08	0.35320284	0.120434	0.315922
04:00:00	4.00	0	0	0	0	0	0.192687	9.67059E-08	0.348141244	0.122528	0.315215
04:15:00	4.25	0	0	0	0	0	0.184458	9.25763E-08	0.333274628	0.124515	0.308973
04:30:00	4.50	0	0	0	0	0	0.172842	8.67461E-08	0.312285978	0.126322	0.299163
04:45:00	4.75	0	0	0	0	0	0.159054	7.98261E-08	0.287374103	0.127907	0.28696
05:00:00	5.00	0	0	0	0	0	0.143962	7.22518E-08	0.260106448	0.129242	0.273204
05:15:00	5.25	0	0	0	0	0	0.128317	6.44001E-08	0.231840475	0.130317	0.258634
05:30:00	5.50	0	0	0	0	0	0.113507	5.69673E-08	0.205082417	0.131133	0.244641
05:45:00	5.75	0	0	0	0	0	0.101022	5.07013E-08	0.182524691	0.131721	0.232744
06:00:00	6.00	0	0	0	0	0	0.090296	4.53179E-08	0.163144525	0.132115	0.222411
06:15:00	6.25	0	0	0	0	0	0.080623	4.04635E-08	0.145668479	0.132339	0.212963
06:30:00	6.50	0	0	0	0	0	0.071641	3.59555E-08	0.129439961	0.13241	0.204051
06:45:00	6.75	0	0	0	0	0	0.063135	3.16865E-08	0.114071266	0.132338	0.195473
07:00:00	7.00	0	0	0	0	0	0.054966	2.75864E-08	0.099310939	0.132131	0.187097
07:15:00	7.25	0	0	0	0	0	0.047069	2.36233E-08	0.085044015	0.131795	0.178864
07:30:00	7.50	0	0	0	0	0	0.039356	1.97523E-08	0.071108113	0.131335	0.170691
07:45:00	7.75	0	0	0	0	0	0.031833	1.59766E-08	0.057515763	0.130755	0.162588
08:00:00	8.00	0	0	0	0	0	0.024589	1.23409E-08	0.044427283	0.13006	0.154649
08:15:00	8.25	0	0	0	0	0	0.017773	8.91978E-09	0.032111203	0.129257	0.14703
08:30:00	8.50	0	0	0	0	0	0.01167	5.85715E-09	0.021085737	0.128356	0.140027
08:45:00	8.75	0	0	0	0	0	0.006962	3.4942E-09	0.012579133	0.127375	0.134337
09:00:00	9.00	0	0	0	0	0	0.004084	2.04992E-09	0.007379726	0.126341	0.130426
09:15:00	9.25	0	0	0	0	0	0.00228	1.14447E-09	0.004120078	0.125278	0.127559
09:30:00	9.50	0	0	0	0	0	0.001152	5.77969E-10	0.002080689	0.124201	0.125352
09:45:00	9.75	0	0	0	0	0	0.00048	2.40705E-10	0.000866538	0.123118	0.123598
10:00:00	10.00	0	0	0	0	0	0.000127	6.38126E-11	0.000229725	0.122037	0.122164
10:15:00	10.25	0	0	0	0	0	2.96E-06	1.48781E-12	5.35613E-06	0.120961	0.120964
10:30:00	10.50	0	0	0	0	0	0	0	0	0.119894	0.119894



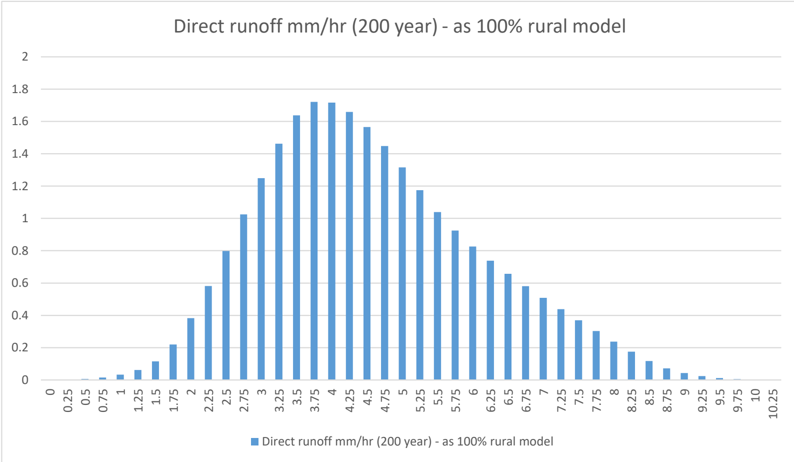
Catchment	1.99 km2	1992500 m2						Working Column m3/s > m/s	Working Column m/s > mm/hr		
Time	Time (Hours)	30 year design rainfall - FEH22 model	Urban net rain mm (30 year) - as 100% rural model	Rural net rain mm (30 year) - as 100% rural model	Sewer loss m3/s (30 year) - as 100% rural model	Total net rain mm (30 year) - as 100% rural model	Direct runoff m3/s (30 year) - as 100% rural model	Direct runoff m/s (30 year) - as 100% rural model	Direct runoff m//hr (30 year) - as 100% rural model	Baseflow m3/s (30 year) - as 100% rural model	Total flow m3/s (30 year) - as 100% rural model
00:00:00	0.00	0.791635	0	0.042676	0	0.042676	0	0	0	0.118986	0.118986
00:15:00	0.25	1.103593	0	0.061094	0	0.061094	0.0005	2.50946E-10	0.000903407	0.11794	0.11844
00:30:00	0.50	1.568298	0	0.090028	0	0.090028	0.002216	1.11209E-09	0.004003526	0.116921	0.119137
00:45:00	0.75	2.290723	0	0.138265	0	0.138265	0.005702	2.86187E-09	0.01030275	0.115954	0.121657
01:00:00	1.00	3.499492	0	0.226736	0	0.226736	0.011864	5.95409E-09	0.021434716	0.115074	0.126938
01:15:00	1.25	5.90787	0	0.425322	0	0.425322	0.022301	1.11926E-08	0.040293418	0.114337	0.136638
01:30:00	1.50	11.51747	0	0.982804	0	0.982804	0.040379	2.02654E-08	0.072955592	0.113838	0.154217
01:45:00	1.75	5.90787	0	0.582934	0	0.582934	0.074955	3.76185E-08	0.135426506	0.113772	0.188727
02:00:00	2.00	3.499492	0	0.370499	0	0.370499	0.127855	6.41679E-08	0.231004368	0.114419	0.242273
02:15:00	2.25	2.290723	0	0.252677	0	0.252677	0.190885	9.58019E-08	0.344886871	0.116002	0.306888
02:30:00	2.50	1.568298	0	0.177623	0	0.177623	0.259173	1.30074E-07	0.468267672	0.11864	0.377813
02:45:00	2.75	1.103593	0	0.127249	0	0.127249	0.329511	1.65375E-07	0.595351509	0.122382	0.451893
03:00:00	3.00	0.791635	0	0.092427	0	0.092427	0.398867	2.00184E-07	0.720662914	0.127228	0.526094
03:15:00	3.25	0	0	0	0	0	0.463426	2.32585E-07	0.837306585	0.133119	0.596545
03:30:00	3.50	0	0	0	0	0	0.515573	2.58757E-07	0.931524293	0.139908	0.655481
03:45:00	3.75	0	0	0	0	0	0.538656	2.70342E-07	0.973230421	0.147248	0.685904
04:00:00	4.00	0	0	0	0	0	0.535012	2.68513E-07	0.96664695	0.154681	0.689694
04:15:00	4.25	0	0	0	0	0	0.515163	2.58551E-07	0.930783991	0.161858	0.677021
04:30:00	4.50	0	0	0	0	0	0.48488	2.43353E-07	0.876069161	0.168563	0.653443
04:45:00	4.75	0	0	0	0	0	0.447705	2.24695E-07	0.808901544	0.174661	0.622365
05:00:00	5.00	0	0	0	0	0	0.406172	2.0385E-07	0.733861269	0.180064	0.586236
05:15:00	5.25	0	0	0	0	0	0.362456	1.8191E-07	0.654876332	0.184726	0.547182
05:30:00	5.50	0	0	0	0	0	0.320665	1.60936E-07	0.579370407	0.188652	0.509318
05:45:00	5.75	0	0	0	0	0	0.285241	1.43158E-07	0.515367237	0.191915	0.477157
06:00:00	6.00	0	0	0	0	0	0.254865	1.27912E-07	0.460483154	0.194615	0.449479
06:15:00	6.25	0	0	0	0	0	0.227631	1.14244E-07	0.411277528	0.196822	0.424452
06:30:00	6.50	0	0	0	0	0	0.202496	1.01629E-07	0.365864087	0.198583	0.401079
06:45:00	6.75	0	0	0	0	0	0.178824	8.97483E-08	0.323093946	0.199932	0.378756
07:00:00	7.00	0	0	0	0	0	0.156194	7.83911E-08	0.282207804	0.200893	0.357087
07:15:00	7.25	0	0	0	0	0	0.134379	6.74424E-08	0.242792559	0.201483	0.335862
07:30:00	7.50	0	0	0	0	0	0.113016	5.67209E-08	0.204195348	0.201718	0.314734
07:45:00	7.75	0	0	0	0	0	0.092083	4.62149E-08	0.166373756	0.201606	0.293689
08:00:00	8.00	0	0	0	0	0	0.071794	3.60321E-08	0.129715447	0.20116	0.272954
08:15:00	8.25	0	0	0	0	0	0.052522	2.636E-08	0.0948961	0.200396	0.252918
08:30:00	8.50	0	0	0	0	0	0.035028	1.758E-08	0.063288079	0.19934	0.234368
08:45:00	8.75	0	0	0	0	0	0.021242	1.06612E-08	0.038380402	0.198038	0.219281
09:00:00	9.00	0	0	0	0	0	0.01257	6.30857E-09	0.02271087	0.196566	0.209136
09:15:00	9.25	0	0	0	0	0	0.007053	3.53999E-09	0.012743964	0.194991	0.202045
09:30:00	9.50	0	0	0	0	0	0.003574	1.79373E-09	0.006457413	0.193357	0.196931
09:45:00	9.75	0	0	0	0	0	0.001492	7.48749E-10	0.002695497	0.191693	0.193184
10:00:00	10.00	0	0	0	0	0	0.000396	1.98808E-10	0.000715708	0.190017	0.190413
10:15:00	10.25	0	0	0	0	0	9.24E-06	4.63594E-12	1.66894E-05	0.188343	0.188353
10:30:00	10.50	0	0	0	0	0	0	0	0	0.186682	0.186682
10:45:00	10.75	0	0	0	0	0	0	0	0	0.185035	0.185035
11:00:00	11.00	0	0	0	0	0	0	0	0	0.183402	0.183402
11:15:00	11.25	0	0	0	0	0	0	0	0	0.181784	0.181784
11:30:00	11.50	0	0	0	0	0	0	0	0	0.18018	0.18018
11:45:00	11.75	0	0	0	0	0	0	0	0	0.178591	0.178591
12:00:00	12.00	0	0	0	0	0	0	0	0	0.177015	0.177015



12:15:00	12.25	0	0	0	0	0	0	0	0	0.175453	0.175453
12:30:00	12.50	0	0	0	0	0	0	0	0	0.173905	0.173905
12:45:00	12.75	0	0	0	0	0	0	0	0	0.172371	0.172371
13:00:00	13.00	0	0	0	0	0	0	0	0	0.17085	0.17085
13:15:00	13.25	0	0	0	0	0	0	0	0	0.169343	0.169343
13:30:00	13.50	0	0	0	0	0	0	0	0	0.167849	0.167849
13:45:00	13.75	0	0	0	0	0	0	0	0	0.166368	0.166368
14:00:00	14.00	0	0	0	0	0	0	0	0	0.1649	0.1649
14:15:00	14.25	0	0	0	0	0	0	0	0	0.163445	0.163445
14:30:00	14.50	0	0	0	0	0	0	0	0	0.162003	0.162003
14:45:00	14.75	0	0	0	0	0	0	0	0	0.160574	0.160574
15:00:00	15.00	0	0	0	0	0	0	0	0	0.159157	0.159157
15:15:00	15.25	0	0	0	0	0	0	0	0	0.157753	0.157753
15:30:00	15.50	0	0	0	0	0	0	0	0	0.156361	0.156361
15:45:00	15.75	0	0	0	0	0	0	0	0	0.154981	0.154981
16:00:00	16.00	0	0	0	0	0	0	0	0	0.153614	0.153614
16:15:00	16.25	0	0	0	0	0	0	0	0	0.152259	0.152259
16:30:00	16.50	0	0	0	0	0	0	0	0	0.150915	0.150915
16:45:00	16.75	0	0	0	0	0	0	0	0	0.149584	0.149584
17:00:00	17.00	0	0	0	0	0	0	0	0	0.148264	0.148264
17:15:00	17.25	0	0	0	0	0	0	0	0	0.146956	0.146956
17:30:00	17.50	0	0	0	0	0	0	0	0	0.145659	0.145659
17:45:00	17.75	0	0	0	0	0	0	0	0	0.144374	0.144374
18:00:00	18.00	0	0	0	0	0	0	0	0	0.1431	0.1431
18:15:00	18.25	0	0	0	0	0	0	0	0	0.141838	0.141838
18:30:00	18.50	0	0	0	0	0	0	0	0	0.140586	0.140586
18:45:00	18.75	0	0	0	0	0	0	0	0	0.139346	0.139346
19:00:00	19.00	0	0	0	0	0	0	0	0	0.138117	0.138117
19:15:00	19.25	0	0	0	0	0	0	0	0	0.136898	0.136898
19:30:00	19.50	0	0	0	0	0	0	0	0	0.13569	0.13569
19:45:00	19.75	0	0	0	0	0	0	0	0	0.134493	0.134493
20:00:00	20.00	0	0	0	0	0	0	0	0	0.133306	0.133306
20:15:00	20.25	0	0	0	0	0	0	0	0	0.13213	0.13213
20:30:00	20.50	0	0	0	0	0	0	0	0	0.130965	0.130965
20:45:00	20.75	0	0	0	0	0	0	0	0	0.129809	0.129809
21:00:00	21.00	0	0	0	0	0	0	0	0	0.128664	0.128664
21:15:00	21.25	0	0	0	0	0	0	0	0	0.127529	0.127529
21:30:00	21.50	0	0	0	0	0	0	0	0	0.126403	0.126403
21:45:00	21.75	0	0	0	0	0	0	0	0	0.125288	0.125288
22:00:00	22.00	0	0	0	0	0	0	0	0	0.124183	0.124183
22:15:00	22.25	0	0	0	0	0	0	0	0	0.123087	0.123087
22:30:00	22.50	0	0	0	0	0	0	0	0	0.122001	0.122001
22:45:00	22.75	0	0	0	0	0	0	0	0	0.120925	0.120925
23:00:00	23.00	0	0	0	0	0	0	0	0	0.119858	0.119858

Catchment	1.99	km2	1992500	m2				Working Column m3/s > m/s	Working Column m/s > mm/hr		

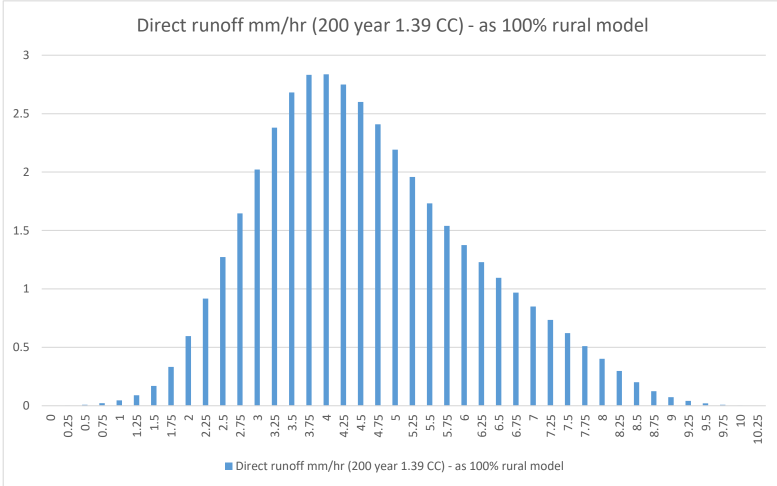
Time	Time (Hours)	200 year design rainfall - FEH22 model	Urban net rain mm (200 year) - as 100% rural model	Rural net rain mm (200 year) - as 100% rural model	Sewer loss m3/s (200 year) - as 100% rural model	Total net rain mm (200 year) - as 100% rural model	Direct runoff m3/s (200 year) - as 100% rural model	Direct runoff m/s (200 year) - as 100% rural model	Direct runoff mm/hr (200 year) - as 100% rural model	Baseflow m3/s (200 year) - as 100% rural model	Total flow m3/s (200 year) - as 100% rural model
00:00:00	0.00	1.181736	0	0.064058	0	0.064058	0	0	0	0.118986	0.118986
00:15:00	0.25	1.647421	0	0.09287	0	0.09287	0.000751	3.76683E-10	0.001356058	0.117942	0.118692
00:30:00	0.50	2.341123	0	0.139124	0	0.139124	0.00334	1.67615E-09	0.00603414	0.116935	0.120274
00:45:00	0.75	3.419545	0	0.21829	0	0.21829	0.008647	4.33981E-09	0.015623308	0.116001	0.124648
01:00:00	1.00	5.22397	0	0.368042	0	0.368042	0.018142	9.10516E-09	0.032778584	0.115195	0.133337
01:15:00	1.25	8.819147	0	0.716137	0	0.716137	0.034507	1.73183E-08	0.062345953	0.114607	0.149114
01:30:00	1.50	17.19304	0	1.738473	0	1.738473	0.063574	3.19068E-08	0.114864391	0.114394	0.177968
01:45:00	1.75	8.819147	0	1.067359	0	1.067359	0.121401	6.09291E-08	0.219344673	0.11489	0.236291
02:00:00	2.00	5.22397	0	0.688402	0	0.688402	0.212071	1.06435E-07	0.383164346	0.11659	0.32866
02:15:00	2.25	3.419545	0	0.473245	0	0.473245	0.32175	1.61481E-07	0.581330834	0.119904	0.441655
02:30:00	2.50	2.341123	0	0.334322	0	0.334322	0.441942	2.21803E-07	0.79849043	0.125059	0.567001
02:45:00	2.75	1.647421	0	0.240288	0	0.240288	0.56699	2.84562E-07	1.024423318	0.132163	0.699153
03:00:00	3.00	1.181736	0	0.174924	0	0.174924	0.691616	3.4711E-07	1.249594309	0.141235	0.832851
03:15:00	3.25	0	0	0	0	0	0.809208	4.06127E-07	1.462058007	0.152197	0.961406
03:30:00	3.50	0	0	0	0	0	0.906265	4.54838E-07	1.637417679	0.164808	1.071074
03:45:00	3.75	0	0	0	0	0	0.952364	4.77974E-07	1.720707827	0.178472	1.130836
04:00:00	4.00	0	0	0	0	0	0.950308	4.76943E-07	1.716993328	0.192372	1.14268
04:15:00	4.25	0	0	0	0	0	0.918253	4.60855E-07	1.659076665	0.205872	1.124125
04:30:00	4.50	0	0	0	0	0	0.866569	4.34915E-07	1.565694927	0.218572	1.085141
04:45:00	4.75	0	0	0	0	0	0.80172	4.02369E-07	1.448528305	0.230211	1.031932
05:00:00	5.00	0	0	0	0	0	0.728345	3.65543E-07	1.315955681	0.240624	0.968969
05:15:00	5.25	0	0	0	0	0	0.650398	3.26423E-07	1.175123799	0.249714	0.900112
05:30:00	5.50	0	0	0	0	0	0.575454	2.8881E-07	1.039715398	0.25748	0.832934
05:45:00	5.75	0	0	0	0	0	0.511723	2.56824E-07	0.924567862	0.26405	0.775773
06:00:00	6.00	0	0	0	0	0	0.457132	2.29426E-07	0.82593445	0.2696	0.726732
06:15:00	6.25	0	0	0	0	0	0.408355	2.04946E-07	0.737805466	0.27426	0.682615
06:30:00	6.50	0	0	0	0	0	0.3635	1.82434E-07	0.656762966	0.278117	0.641618
06:45:00	6.75	0	0	0	0	0	0.321395	1.61302E-07	0.580688936	0.281234	0.602629
07:00:00	7.00	0	0	0	0	0	0.281258	1.41158E-07	0.508169412	0.283654	0.564911
07:15:00	7.25	0	0	0	0	0	0.242626	1.2177E-07	0.438370342	0.285411	0.528037
07:30:00	7.50	0	0	0	0	0	0.204738	1.02755E-07	0.369916324	0.286531	0.49127
07:45:00	7.75	0	0	0	0	0	0.167508	8.40693E-08	0.302649566	0.287031	0.454539
08:00:00	8.00	0	0	0	0	0	0.131282	6.58881E-08	0.237197253	0.286928	0.41821
08:15:00	8.25	0	0	0	0	0	0.096683	4.85236E-08	0.174684876	0.28625	0.382933
08:30:00	8.50	0	0	0	0	0	0.065021	3.26331E-08	0.117479041	0.285039	0.350061
08:45:00	8.75	0	0	0	0	0	0.039773	1.99614E-08	0.071861094	0.283376	0.32315
09:00:00	9.00	0	0	0	0	0	0.02364	1.18643E-08	0.04271145	0.281392	0.305031
09:15:00	9.25	0	0	0	0	0	0.0133	6.6748E-09	0.024029288	0.27921	0.292509
09:30:00	9.50	0	0	0	0	0	0.00675	3.38789E-09	0.012196396	0.276909	0.283659
09:45:00	9.75	0	0	0	0	0	0.002821	1.41584E-09	0.005097026	0.274544	0.277365
10:00:00	10.00	0	0	0	0	0	0.00075	3.76229E-10	0.001354424	0.272151	0.2729
10:15:00	10.25	0	0	0	0	0	1.75E-05	8.77379E-12	3.15856E-05	0.269756	0.269773
10:30:00	10.50	0	0	0	0	0	0	0	0	0.267376	0.267376
10:45:00	10.75	0	0	0	0	0	0	0	0	0.265017	0.265017
11:00:00	11.00	0	0	0	0	0	0	0	0	0.262679	0.262679
11:15:00	11.25	0	0	0	0	0	0	0	0	0.260361	0.260361
11:30:00	11.50	0	0	0	0	0	0	0	0	0.258064	0.258064
11:45:00	11.75	0	0	0	0	0	0	0	0	0.255787	0.255787
12:00:00	12.00	0	0	0	0	0	0	0	0	0.25353	0.25353



12:15:00	12.25	0	0	0	0	0	0	0	0	0.251293	0.251293
12:30:00	12.50	0	0	0	0	0	0	0	0	0.249076	0.249076
12:45:00	12.75	0	0	0	0	0	0	0	0	0.246879	0.246879
13:00:00	13.00	0	0	0	0	0	0	0	0	0.244701	0.244701
13:15:00	13.25	0	0	0	0	0	0	0	0	0.242542	0.242542
13:30:00	13.50	0	0	0	0	0	0	0	0	0.240402	0.240402
13:45:00	13.75	0	0	0	0	0	0	0	0	0.238281	0.238281
14:00:00	14.00	0	0	0	0	0	0	0	0	0.236178	0.236178
14:15:00	14.25	0	0	0	0	0	0	0	0	0.234095	0.234095
14:30:00	14.50	0	0	0	0	0	0	0	0	0.232029	0.232029
14:45:00	14.75	0	0	0	0	0	0	0	0	0.229982	0.229982
15:00:00	15.00	0	0	0	0	0	0	0	0	0.227953	0.227953
15:15:00	15.25	0	0	0	0	0	0	0	0	0.225942	0.225942
15:30:00	15.50	0	0	0	0	0	0	0	0	0.223948	0.223948
15:45:00	15.75	0	0	0	0	0	0	0	0	0.221973	0.221973
16:00:00	16.00	0	0	0	0	0	0	0	0	0.220014	0.220014
16:15:00	16.25	0	0	0	0	0	0	0	0	0.218073	0.218073
16:30:00	16.50	0	0	0	0	0	0	0	0	0.216149	0.216149
16:45:00	16.75	0	0	0	0	0	0	0	0	0.214242	0.214242
17:00:00	17.00	0	0	0	0	0	0	0	0	0.212352	0.212352
17:15:00	17.25	0	0	0	0	0	0	0	0	0.210478	0.210478
17:30:00	17.50	0	0	0	0	0	0	0	0	0.208621	0.208621
17:45:00	17.75	0	0	0	0	0	0	0	0	0.206781	0.206781
18:00:00	18.00	0	0	0	0	0	0	0	0	0.204956	0.204956
18:15:00	18.25	0	0	0	0	0	0	0	0	0.203148	0.203148
18:30:00	18.50	0	0	0	0	0	0	0	0	0.201355	0.201355
18:45:00	18.75	0	0	0	0	0	0	0	0	0.199579	0.199579
19:00:00	19.00	0	0	0	0	0	0	0	0	0.197818	0.197818
19:15:00	19.25	0	0	0	0	0	0	0	0	0.196073	0.196073
19:30:00	19.50	0	0	0	0	0	0	0	0	0.194343	0.194343
19:45:00	19.75	0	0	0	0	0	0	0	0	0.192628	0.192628
20:00:00	20.00	0	0	0	0	0	0	0	0	0.190929	0.190929
20:15:00	20.25	0	0	0	0	0	0	0	0	0.189244	0.189244
20:30:00	20.50	0	0	0	0	0	0	0	0	0.187575	0.187575
20:45:00	20.75	0	0	0	0	0	0	0	0	0.18592	0.18592
21:00:00	21.00	0	0	0	0	0	0	0	0	0.184279	0.184279
21:15:00	21.25	0	0	0	0	0	0	0	0	0.182653	0.182653
21:30:00	21.50	0	0	0	0	0	0	0	0	0.181042	0.181042
21:45:00	21.75	0	0	0	0	0	0	0	0	0.179445	0.179445
22:00:00	22.00	0	0	0	0	0	0	0	0	0.177861	0.177861
22:15:00	22.25	0	0	0	0	0	0	0	0	0.176292	0.176292
22:30:00	22.50	0	0	0	0	0	0	0	0	0.174737	0.174737
22:45:00	22.75	0	0	0	0	0	0	0	0	0.173195	0.173195
23:00:00	23.00	0	0	0	0	0	0	0	0	0.171667	0.171667
23:15:00	23.25	0	0	0	0	0	0	0	0	0.170152	0.170152
23:30:00	23.50	0	0	0	0	0	0	0	0	0.168651	0.168651
23:45:00	23.75	0	0	0	0	0	0	0	0	0.167163	0.167163
24:00:00	24.00	0	0	0	0	0	0	0	0	0.165688	0.165688
24:15:00	24.25	0	0	0	0	0	0	0	0	0.164226	0.164226
24:30:00	24.50	0	0	0	0	0	0	0	0	0.162778	0.162778
24:45:00	24.75	0	0	0	0	0	0	0	0	0.161341	0.161341
25:00:00	25.00	0	0	0	0	0	0	0	0	0.159918	0.159918
25:15:00	25.25	0	0	0	0	0	0	0	0	0.158507	0.158507
25:30:00	25.50	0	0	0	0	0	0	0	0	0.157109	0.157109
25:45:00	25.75	0	0	0	0	0	0	0	0	0.155722	0.155722
26:00:00	26.00	0	0	0	0	0	0	0	0	0.154348	0.154348
26:15:00	26.25	0	0	0	0	0	0	0	0	0.152987	0.152987
26:30:00	26.50	0	0	0	0	0	0	0	0	0.151637	0.151637
26:45:00	26.75	0	0	0	0	0	0	0	0	0.150299	0.150299

27:00:00	27.00	0	0	0	0	0	0	0	0	0.148973	0.148973
27:15:00	27.25	0	0	0	0	0	0	0	0	0.147659	0.147659
27:30:00	27.50	0	0	0	0	0	0	0	0	0.146356	0.146356
27:45:00	27.75	0	0	0	0	0	0	0	0	0.145065	0.145065
28:00:00	28.00	0	0	0	0	0	0	0	0	0.143785	0.143785
28:15:00	28.25	0	0	0	0	0	0	0	0	0.142516	0.142516
28:30:00	28.50	0	0	0	0	0	0	0	0	0.141259	0.141259
28:45:00	28.75	0	0	0	0	0	0	0	0	0.140012	0.140012
29:00:00	29.00	0	0	0	0	0	0	0	0	0.138777	0.138777
29:15:00	29.25	0	0	0	0	0	0	0	0	0.137553	0.137553
29:30:00	29.50	0	0	0	0	0	0	0	0	0.136339	0.136339
29:45:00	29.75	0	0	0	0	0	0	0	0	0.135136	0.135136
30:00:00	30.00	0	0	0	0	0	0	0	0	0.133944	0.133944
30:15:00	30.25	0	0	0	0	0	0	0	0	0.132762	0.132762
30:30:00	30.50	0	0	0	0	0	0	0	0	0.131591	0.131591
30:45:00	30.75	0	0	0	0	0	0	0	0	0.13043	0.13043
31:00:00	31.00	0	0	0	0	0	0	0	0	0.129279	0.129279
31:15:00	31.25	0	0	0	0	0	0	0	0	0.128138	0.128138
31:30:00	31.50	0	0	0	0	0	0	0	0	0.127008	0.127008
31:45:00	31.75	0	0	0	0	0	0	0	0	0.125887	0.125887
32:00:00	32.00	0	0	0	0	0	0	0	0	0.124777	0.124777
32:15:00	32.25	0	0	0	0	0	0	0	0	0.123676	0.123676
32:30:00	32.50	0	0	0	0	0	0	0	0	0.122585	0.122585
32:45:00	32.75	0	0	0	0	0	0	0	0	0.121503	0.121503
33:00:00	33.00	0	0	0	0	0	0	0	0	0.120431	0.120431

Catchment		1.99 km2	1992500 m2					Working Column m3/s > m/s	Working Column m/s > mm/hr		
Time	Time (Hours)	200 year 1.39 CC design rainfall - FEH22 model	Urban net rain mm (200 year 1.39 CC) - as 100% rural model	Rural net rain mm (200 year 1.39 CC) - as 100% rural model	Sewer loss m3/s (200 year 1.39 CC) - as 100% rural model	Total net rain mm (200 year 1.39 CC) - as 100% rural model	Direct runoff m3/s (200 year 1.39 CC) - as 100% rural model	Direct runoff m/s (200 year 1.39 CC) - as 100% rural model	Direct runoff mm/hr (200 year 1.39 CC) - as 100% rural model	Baseflow m3/s (200 year 1.39 CC) - as 100% rural model	Total flow m3/s (200 year 1.39 CC) - as 100% rural model
00:00:00	0.00	1.642613	0	0.089621	0	0.089621	0	0	0	0.118986	0.118986
00:15:00	0.25	2.289915	0	0.131831	0	0.131831	0.00105	5.26997E-10	0.001897188	0.117944	0.118994
00:30:00	0.50	3.254161	0	0.201154	0	0.201154	0.004695	2.3562E-09	0.008482304	0.116951	0.121645
00:45:00	0.75	4.753167	0	0.322949	0	0.322949	0.012241	6.14344E-09	0.022116393	0.116057	0.128297
01:00:00	1.00	7.261318	0	0.560146	0	0.560146	0.025928	1.30126E-08	0.046845242	0.115343	0.141271
01:15:00	1.25	12.25861	0	1.128817	0	1.128817	0.049961	2.50745E-08	0.090268378	0.114943	0.164904
01:30:00	1.50	23.89832	0	2.862107	0	2.862107	0.093783	4.70681E-08	0.1694453	0.115099	0.208882
01:45:00	1.75	12.25861	0	1.807412	0	1.807412	0.184365	9.25296E-08	0.333106417	0.116346	0.300712
02:00:00	2.00	7.261318	0	1.179113	0	1.179113	0.329613	1.65427E-07	0.595536528	0.119502	0.449115
02:15:00	2.25	4.753167	0	0.815548	0	0.815548	0.507667	2.54789E-07	0.917240183	0.12526	0.632927
02:30:00	2.50	3.254161	0	0.578295	0	0.578295	0.704709	3.53681E-07	1.273250148	0.134018	0.838726
02:45:00	2.75	2.289915	0	0.416658	0	0.416658	0.91145	4.5744E-07	1.646784668	0.145983	1.057432
03:00:00	3.00	1.642613	0	0.303824	0	0.303824	1.119317	5.61765E-07	2.022353952	0.161214	1.280531
03:15:00	3.25	0	0	0	0	0	1.317618	6.61289E-07	2.380640628	0.179615	1.497233
03:30:00	3.50	0	0	0	0	0	1.484078	7.44832E-07	2.681396478	0.200819	1.684898
03:45:00	3.75	0	0	0	0	0	1.567272	7.86586E-07	2.831708417	0.223866	1.791138
04:00:00	4.00	0	0	0	0	0	1.569971	7.8794E-07	2.83658423	0.247407	1.817378
04:15:00	4.25	0	0	0	0	0	1.521432	7.63579E-07	2.74888536	0.270367	1.791799
04:30:00	4.50	0	0	0	0	0	1.438952	7.22184E-07	2.599863662	0.292059	1.731011
04:45:00	4.75	0	0	0	0	0	1.333452	6.69236E-07	2.409248797	0.31203	1.645482
05:00:00	5.00	0	0	0	0	0	1.212779	6.08672E-07	2.191219271	0.329985	1.542764
05:15:00	5.25	0	0	0	0	0	1.083597	5.43838E-07	1.957816164	0.345749	1.429346
05:30:00	5.50	0	0	0	0	0	0.958796	4.81203E-07	1.732329538	0.359309	1.318105
05:45:00	5.75	0	0	0	0	0	0.852391	4.278E-07	1.540079521	0.370868	1.22326
06:00:00	6.00	0	0	0	0	0	0.761328	3.82097E-07	1.375548678	0.38072	1.142048
06:15:00	6.25	0	0	0	0	0	0.680189	3.41375E-07	1.228948927	0.389085	1.069274
06:30:00	6.50	0	0	0	0	0	0.605798	3.04039E-07	1.094540468	0.39611	1.001908
06:45:00	6.75	0	0	0	0	0	0.536158	2.69088E-07	0.968717493	0.401903	0.938061
07:00:00	7.00	0	0	0	0	0	0.469928	2.35848E-07	0.849053966	0.406539	0.876467
07:15:00	7.25	0	0	0	0	0	0.406267	2.03898E-07	0.734033572	0.410078	0.816345
07:30:00	7.50	0	0	0	0	0	0.343754	1.72524E-07	0.621086281	0.412559	0.756313
07:45:00	7.75	0	0	0	0	0	0.282181	1.41622E-07	0.509837614	0.414009	0.69619
08:00:00	8.00	0	0	0	0	0	0.222075	1.11455E-07	0.401238988	0.414457	0.636532
08:15:00	8.25	0	0	0	0	0	0.164407	8.2513E-08	0.297046721	0.413943	0.57835
08:30:00	8.50	0	0	0	0	0	0.111288	5.58535E-08	0.201072562	0.412533	0.523821
08:45:00	8.75	0	0	0	0	0	0.068525	3.43916E-08	0.123809672	0.410355	0.47888
09:00:00	9.00	0	0	0	0	0	0.040866	2.05098E-08	0.073835155	0.407624	0.44849
09:15:00	9.25	0	0	0	0	0	0.023036	1.15612E-08	0.041620449	0.404547	0.427583
09:30:00	9.50	0	0	0	0	0	0.011707	5.87553E-09	0.021151902	0.40126	0.412967
09:45:00	9.75	0	0	0	0	0	0.004897	2.45759E-09	0.008847333	0.397855	0.402752
10:00:00	10.00	0	0	0	0	0	0.001302	6.53434E-10	0.002352362	0.394395	0.395697
10:15:00	10.25	0	0	0	0	0	3.04E-05	1.52391E-11	5.48609E-05	0.390926	0.390957
10:30:00	10.50	0	0	0	0	0	0	0	0	0.387477	0.387477
10:45:00	10.75	0	0	0	0	0	0	0	0	0.384059	0.384059
11:00:00	11.00	0	0	0	0	0	0	0	0	0.38067	0.38067
11:15:00	11.25	0	0	0	0	0	0	0	0	0.377312	0.377312
11:30:00	11.50	0	0	0	0	0	0	0	0	0.373983	0.373983
11:45:00	11.75	0	0	0	0	0	0	0	0	0.370683	0.370683
12:00:00	12.00	0	0	0	0	0	0	0	0	0.367413	0.367413
12:15:00	12.25	0	0	0	0	0	0	0	0	0.364171	0.364171



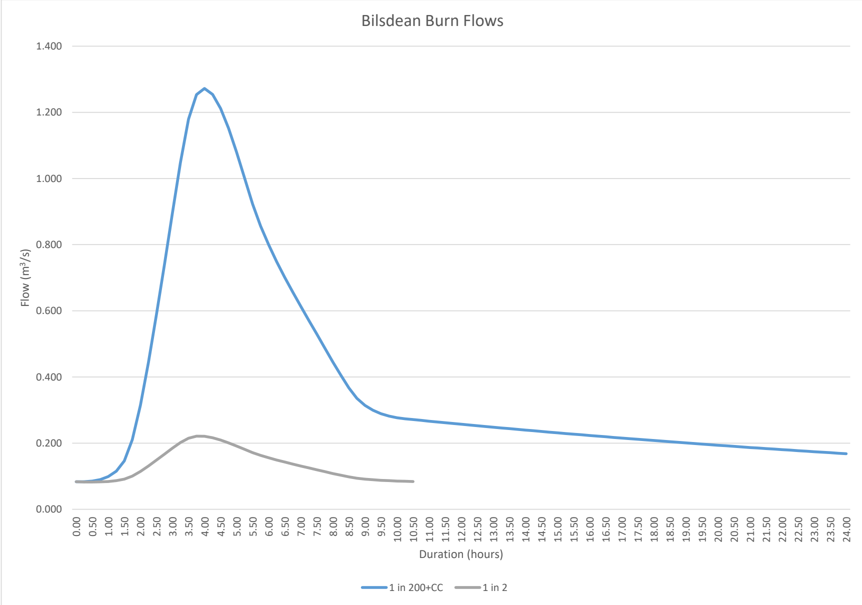
12:30:00	12.50	0	0	0	0	0	0	0	0	0.360958	0.360958
12:45:00	12.75	0	0	0	0	0	0	0	0	0.357773	0.357773
13:00:00	13.00	0	0	0	0	0	0	0	0	0.354617	0.354617
13:15:00	13.25	0	0	0	0	0	0	0	0	0.351488	0.351488
13:30:00	13.50	0	0	0	0	0	0	0	0	0.348387	0.348387
13:45:00	13.75	0	0	0	0	0	0	0	0	0.345313	0.345313
14:00:00	14.00	0	0	0	0	0	0	0	0	0.342267	0.342267
14:15:00	14.25	0	0	0	0	0	0	0	0	0.339247	0.339247
14:30:00	14.50	0	0	0	0	0	0	0	0	0.336254	0.336254
14:45:00	14.75	0	0	0	0	0	0	0	0	0.333287	0.333287
15:00:00	15.00	0	0	0	0	0	0	0	0	0.330346	0.330346
15:15:00	15.25	0	0	0	0	0	0	0	0	0.327432	0.327432
15:30:00	15.50	0	0	0	0	0	0	0	0	0.324543	0.324543
15:45:00	15.75	0	0	0	0	0	0	0	0	0.32168	0.32168
16:00:00	16.00	0	0	0	0	0	0	0	0	0.318841	0.318841
16:15:00	16.25	0	0	0	0	0	0	0	0	0.316028	0.316028
16:30:00	16.50	0	0	0	0	0	0	0	0	0.31324	0.31324
16:45:00	16.75	0	0	0	0	0	0	0	0	0.310476	0.310476
17:00:00	17.00	0	0	0	0	0	0	0	0	0.307737	0.307737
17:15:00	17.25	0	0	0	0	0	0	0	0	0.305022	0.305022
17:30:00	17.50	0	0	0	0	0	0	0	0	0.302331	0.302331
17:45:00	17.75	0	0	0	0	0	0	0	0	0.299664	0.299664
18:00:00	18.00	0	0	0	0	0	0	0	0	0.29702	0.29702
18:15:00	18.25	0	0	0	0	0	0	0	0	0.294399	0.294399
18:30:00	18.50	0	0	0	0	0	0	0	0	0.291802	0.291802
18:45:00	18.75	0	0	0	0	0	0	0	0	0.289227	0.289227
19:00:00	19.00	0	0	0	0	0	0	0	0	0.286675	0.286675
19:15:00	19.25	0	0	0	0	0	0	0	0	0.284146	0.284146
19:30:00	19.50	0	0	0	0	0	0	0	0	0.281639	0.281639
19:45:00	19.75	0	0	0	0	0	0	0	0	0.279154	0.279154
20:00:00	20.00	0	0	0	0	0	0	0	0	0.276691	0.276691
20:15:00	20.25	0	0	0	0	0	0	0	0	0.27425	0.27425
20:30:00	20.50	0	0	0	0	0	0	0	0	0.27183	0.27183
20:45:00	20.75	0	0	0	0	0	0	0	0	0.269432	0.269432
21:00:00	21.00	0	0	0	0	0	0	0	0	0.267055	0.267055
21:15:00	21.25	0	0	0	0	0	0	0	0	0.264699	0.264699
21:30:00	21.50	0	0	0	0	0	0	0	0	0.262363	0.262363
21:45:00	21.75	0	0	0	0	0	0	0	0	0.260049	0.260049
22:00:00	22.00	0	0	0	0	0	0	0	0	0.257754	0.257754
22:15:00	22.25	0	0	0	0	0	0	0	0	0.25548	0.25548
22:30:00	22.50	0	0	0	0	0	0	0	0	0.253226	0.253226
22:45:00	22.75	0	0	0	0	0	0	0	0	0.250992	0.250992
23:00:00	23.00	0	0	0	0	0	0	0	0	0.248777	0.248777
23:15:00	23.25	0	0	0	0	0	0	0	0	0.246583	0.246583
23:30:00	23.50	0	0	0	0	0	0	0	0	0.244407	0.244407
23:45:00	23.75	0	0	0	0	0	0	0	0	0.242251	0.242251
24:00:00	24.00	0	0	0	0	0	0	0	0	0.240113	0.240113
24:15:00	24.25	0	0	0	0	0	0	0	0	0.237995	0.237995
24:30:00	24.50	0	0	0	0	0	0	0	0	0.235895	0.235895
24:45:00	24.75	0	0	0	0	0	0	0	0	0.233814	0.233814
25:00:00	25.00	0	0	0	0	0	0	0	0	0.231751	0.231751
25:15:00	25.25	0	0	0	0	0	0	0	0	0.229706	0.229706
25:30:00	25.50	0	0	0	0	0	0	0	0	0.22768	0.22768
25:45:00	25.75	0	0	0	0	0	0	0	0	0.225671	0.225671
26:00:00	26.00	0	0	0	0	0	0	0	0	0.22368	0.22368
26:15:00	26.25	0	0	0	0	0	0	0	0	0.221706	0.221706
26:30:00	26.50	0	0	0	0	0	0	0	0	0.21975	0.21975
26:45:00	26.75	0	0	0	0	0	0	0	0	0.217811	0.217811
27:00:00	27.00	0	0	0	0	0	0	0	0	0.21589	0.21589
27:15:00	27.25	0	0	0	0	0	0	0	0	0.213985	0.213985

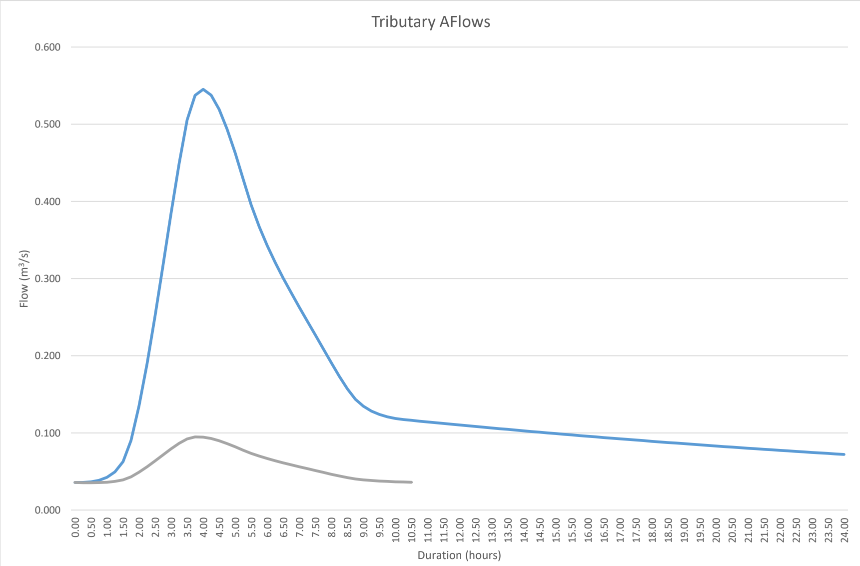
27:30:00	27.50	0	0	0	0	0	0	0	0	0.212097	0.212097
27:45:00	27.75	0	0	0	0	0	0	0	0	0.210226	0.210226
28:00:00	28.00	0	0	0	0	0	0	0	0	0.208371	0.208371
28:15:00	28.25	0	0	0	0	0	0	0	0	0.206532	0.206532
28:30:00	28.50	0	0	0	0	0	0	0	0	0.20471	0.20471
28:45:00	28.75	0	0	0	0	0	0	0	0	0.202904	0.202904
29:00:00	29.00	0	0	0	0	0	0	0	0	0.201114	0.201114
29:15:00	29.25	0	0	0	0	0	0	0	0	0.19934	0.19934
29:30:00	29.50	0	0	0	0	0	0	0	0	0.197581	0.197581
29:45:00	29.75	0	0	0	0	0	0	0	0	0.195838	0.195838
30:00:00	30.00	0	0	0	0	0	0	0	0	0.19411	0.19411
30:15:00	30.25	0	0	0	0	0	0	0	0	0.192397	0.192397
30:30:00	30.50	0	0	0	0	0	0	0	0	0.1907	0.1907
30:45:00	30.75	0	0	0	0	0	0	0	0	0.189017	0.189017
31:00:00	31.00	0	0	0	0	0	0	0	0	0.187349	0.187349
31:15:00	31.25	0	0	0	0	0	0	0	0	0.185697	0.185697
31:30:00	31.50	0	0	0	0	0	0	0	0	0.184058	0.184058
31:45:00	31.75	0	0	0	0	0	0	0	0	0.182434	0.182434
32:00:00	32.00	0	0	0	0	0	0	0	0	0.180825	0.180825
32:15:00	32.25	0	0	0	0	0	0	0	0	0.179229	0.179229
32:30:00	32.50	0	0	0	0	0	0	0	0	0.177648	0.177648
32:45:00	32.75	0	0	0	0	0	0	0	0	0.176081	0.176081
33:00:00	33.00	0	0	0	0	0	0	0	0	0.174527	0.174527
33:15:00	33.25	0	0	0	0	0	0	0	0	0.172987	0.172987
33:30:00	33.50	0	0	0	0	0	0	0	0	0.171461	0.171461
33:45:00	33.75	0	0	0	0	0	0	0	0	0.169948	0.169948
34:00:00	34.00	0	0	0	0	0	0	0	0	0.168449	0.168449
34:15:00	34.25	0	0	0	0	0	0	0	0	0.166963	0.166963
34:30:00	34.50	0	0	0	0	0	0	0	0	0.16549	0.16549
34:45:00	34.75	0	0	0	0	0	0	0	0	0.164029	0.164029
35:00:00	35.00	0	0	0	0	0	0	0	0	0.162582	0.162582
35:15:00	35.25	0	0	0	0	0	0	0	0	0.161148	0.161148
35:30:00	35.50	0	0	0	0	0	0	0	0	0.159726	0.159726
35:45:00	35.75	0	0	0	0	0	0	0	0	0.158317	0.158317
36:00:00	36.00	0	0	0	0	0	0	0	0	0.15692	0.15692
36:15:00	36.25	0	0	0	0	0	0	0	0	0.155536	0.155536
36:30:00	36.50	0	0	0	0	0	0	0	0	0.154163	0.154163
36:45:00	36.75	0	0	0	0	0	0	0	0	0.152803	0.152803
37:00:00	37.00	0	0	0	0	0	0	0	0	0.151455	0.151455
37:15:00	37.25	0	0	0	0	0	0	0	0	0.150119	0.150119
37:30:00	37.50	0	0	0	0	0	0	0	0	0.148794	0.148794
37:45:00	37.75	0	0	0	0	0	0	0	0	0.147481	0.147481
38:00:00	38.00	0	0	0	0	0	0	0	0	0.14618	0.14618
38:15:00	38.25	0	0	0	0	0	0	0	0	0.144891	0.144891
38:30:00	38.50	0	0	0	0	0	0	0	0	0.143612	0.143612
38:45:00	38.75	0	0	0	0	0	0	0	0	0.142345	0.142345
39:00:00	39.00	0	0	0	0	0	0	0	0	0.141089	0.141089
39:15:00	39.25	0	0	0	0	0	0	0	0	0.139844	0.139844
39:30:00	39.50	0	0	0	0	0	0	0	0	0.138611	0.138611
39:45:00	39.75	0	0	0	0	0	0	0	0	0.137388	0.137388
40:00:00	40.00	0	0	0	0	0	0	0	0	0.136176	0.136176
40:15:00	40.25	0	0	0	0	0	0	0	0	0.134974	0.134974
40:30:00	40.50	0	0	0	0	0	0	0	0	0.133783	0.133783
40:45:00	40.75	0	0	0	0	0	0	0	0	0.132603	0.132603
41:00:00	41.00	0	0	0	0	0	0	0	0	0.131433	0.131433
41:15:00	41.25	0	0	0	0	0	0	0	0	0.130273	0.130273
41:30:00	41.50	0	0	0	0	0	0	0	0	0.129124	0.129124
41:45:00	41.75	0	0	0	0	0	0	0	0	0.127985	0.127985
42:00:00	42.00	0	0	0	0	0	0	0	0	0.126856	0.126856
42:15:00	42.25	0	0	0	0	0	0	0	0	0.125736	0.125736

42:30:00	42.50	0	0	0	0	0	0	0	0	0.124627	0.124627
42:45:00	42.75	0	0	0	0	0	0	0	0	0.123527	0.123527
43:00:00	43.00	0	0	0	0	0	0	0	0	0.122438	0.122438
43:15:00	43.25	0	0	0	0	0	0	0	0	0.121357	0.121357
43:30:00	43.50	0	0	0	0	0	0	0	0	0.120287	0.120287

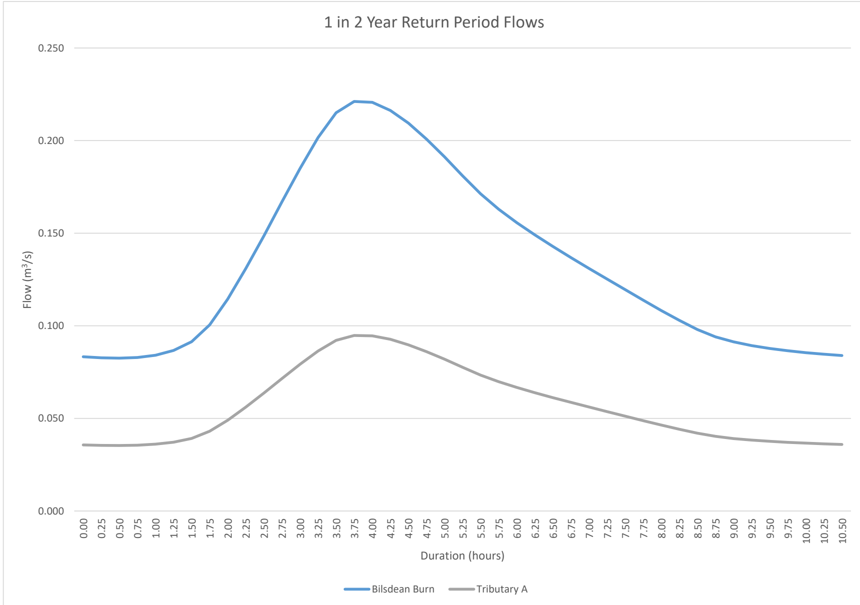
200+39% AEP	Time (Hours)	Catchment 1 Total flow m3/s (200 year 1.39 CC) - as 100% rural model	Bilsdean Burn (70%) Total flow m3/s (200 year 1.39 CC) - as 100% rural model	Tributary (30%) Total flow m3/s (200 year 1.39 CC) - as 100% rural model
	0.00	0.119	0.083	0.036
	0.25	0.119	0.083	0.036
	0.50	0.122	0.085	0.036
	0.75	0.128	0.090	0.038
	1.00	0.141	0.099	0.042
	1.25	0.165	0.115	0.049
	1.50	0.209	0.146	0.063
	1.75	0.301	0.210	0.090
	2.00	0.449	0.314	0.135
	2.25	0.633	0.443	0.190
	2.50	0.839	0.587	0.252
	2.75	1.057	0.740	0.317
	3.00	1.281	0.896	0.384
	3.25	1.497	1.048	0.449
	3.50	1.685	1.179	0.505
	3.75	1.791	1.254	0.537
	4.00	1.817	1.272	0.545
	4.25	1.792	1.254	0.538
	4.50	1.731	1.212	0.519
	4.75	1.645	1.152	0.494
	5.00	1.543	1.080	0.463
	5.25	1.429	1.001	0.429
	5.50	1.318	0.923	0.395
	5.75	1.223	0.856	0.367
	6.00	1.142	0.799	0.343
	6.25	1.069	0.748	0.321
	6.50	1.002	0.701	0.301
	6.75	0.938	0.657	0.281
	7.00	0.876	0.614	0.263
	7.25	0.816	0.571	0.245
	7.50	0.756	0.529	0.227
	7.75	0.696	0.487	0.209
	8.00	0.637	0.446	0.191
	8.25	0.578	0.405	0.174
	8.50	0.524	0.367	0.157
	8.75	0.479	0.335	0.144
	9.00	0.448	0.314	0.135
	9.25	0.428	0.299	0.128
	9.50	0.413	0.289	0.124
	9.75	0.403	0.282	0.121
	10.00	0.396	0.277	0.119
	10.25	0.391	0.274	0.117
	10.50	0.387	0.271	0.116
	10.75	0.384	0.269	0.115
	11.00	0.381	0.266	0.114
	11.25	0.377	0.264	0.113
	11.50	0.374	0.262	0.112
	11.75	0.371	0.259	0.111
	12.00	0.367	0.257	0.110
	12.25	0.364	0.255	0.109
	12.50	0.361	0.253	0.108
	12.75	0.358	0.250	0.107
	13.00	0.355	0.248	0.106
	13.25	0.351	0.246	0.105
	13.50	0.348	0.244	0.105
	13.75	0.345	0.242	0.104
	14.00	0.342	0.240	0.103
	14.25	0.339	0.237	0.102
	14.50	0.336	0.235	0.101
	14.75	0.333	0.233	0.100
	15.00	0.330	0.231	0.099
	15.25	0.327	0.229	0.098
	15.50	0.325	0.227	0.097
	15.75	0.322	0.225	0.097
	16.00	0.319	0.223	0.096
	16.25	0.316	0.221	0.095

2 AEP	Time (Hours)	Catchment 1 Total flow m3/s (2 year) - as 100% rural model	Bilsdean Burn (70%) Total flow m3/s (2 year) - as 100% rural model	Tributary (30%) Total flow m3/s (2 year) - as 100% rural model
	0.00	0.119	0.083	0.036
	0.25	0.118	0.083	0.035
	0.50	0.118	0.083	0.035
	0.75	0.118	0.083	0.036
	1.00	0.120	0.084	0.036
	1.25	0.124	0.087	0.037
	1.50	0.131	0.091	0.039
	1.75	0.144	0.101	0.043
	2.00	0.163	0.114	0.049
	2.25	0.187	0.131	0.056
	2.50	0.212	0.149	0.064
	2.75	0.238	0.167	0.072
	3.00	0.264	0.185	0.079
	3.25	0.288	0.202	0.086
	3.50	0.307	0.215	0.092
	3.75	0.316	0.221	0.095
	4.00	0.315	0.221	0.095
	4.25	0.309	0.216	0.093
	4.50	0.299	0.209	0.090
	4.75	0.287	0.201	0.086
	5.00	0.273	0.191	0.082
	5.25	0.259	0.181	0.078
	5.50	0.245	0.171	0.073
	5.75	0.233	0.163	0.070
	6.00	0.222	0.156	0.067
	6.25	0.213	0.149	0.064
	6.50	0.204	0.143	0.061
	6.75	0.195	0.137	0.059
	7.00	0.187	0.131	0.056
	7.25	0.179	0.125	0.054
	7.50	0.171	0.119	0.051
	7.75	0.163	0.114	0.049
	8.00	0.155	0.108	0.046
	8.25	0.147	0.103	0.044
	8.50	0.140	0.098	0.042
	8.75	0.134	0.094	0.040
	9.00	0.130	0.091	0.039
	9.25	0.128	0.089	0.038
	9.50	0.125	0.088	0.038
	9.75	0.124	0.087	0.037
	10.00	0.122	0.086	0.037
	10.25	0.121	0.085	0.036
	10.50	0.120	0.084	0.036
	10.75			
	11.00			
	11.25			
	11.50			
	11.75			
	12.00			
	12.25			
	12.50			
	12.75			
	13.00			
	13.25			
	13.50			
	13.75			
	14.00			
	14.25			
	14.50			
	14.75			
	15.00			
	15.25			
	15.50			
	15.75			
	16.00			
	16.25			





16.50	0.313	0.219	0.094	16.50
16.75	0.310	0.217	0.093	16.75
17.00	0.308	0.215	0.092	17.00
17.25	0.305	0.214	0.092	17.25
17.50	0.302	0.212	0.091	17.50
17.75	0.300	0.210	0.090	17.75
18.00	0.297	0.208	0.089	18.00
18.25	0.294	0.206	0.088	18.25
18.50	0.292	0.204	0.088	18.50
18.75	0.289	0.202	0.087	18.75
19.00	0.287	0.201	0.086	19.00
19.25	0.284	0.199	0.085	19.25
19.50	0.282	0.197	0.084	19.50
19.75	0.279	0.195	0.084	19.75
20.00	0.277	0.194	0.083	20.00
20.25	0.274	0.192	0.082	20.25
20.50	0.272	0.190	0.082	20.50
20.75	0.269	0.189	0.081	20.75
21.00	0.267	0.187	0.080	21.00
21.25	0.265	0.185	0.079	21.25
21.50	0.262	0.184	0.079	21.50
21.75	0.260	0.182	0.078	21.75
22.00	0.258	0.180	0.077	22.00
22.25	0.255	0.179	0.077	22.25
22.50	0.253	0.177	0.076	22.50
22.75	0.251	0.176	0.075	22.75
23.00	0.249	0.174	0.075	23.00
23.25	0.247	0.173	0.074	23.25
23.50	0.244	0.171	0.073	23.50
23.75	0.242	0.170	0.073	23.75
24.00	0.240	0.168	0.072	24.00
24.25	0.238	0.167	0.071	24.25
24.50	0.236	0.165	0.071	24.50
24.75	0.234	0.164	0.070	24.75
25.00	0.232	0.162	0.070	25.00
25.25	0.230	0.161	0.069	25.25
25.50	0.228	0.159	0.068	25.50
25.75	0.226	0.158	0.068	25.75
26.00	0.224	0.157	0.067	26.00
26.25	0.222	0.155	0.067	26.25
26.50	0.220	0.154	0.066	26.50
26.75	0.218	0.152	0.065	26.75
27.00	0.216	0.151	0.065	27.00
27.25	0.214	0.150	0.064	27.25
27.50	0.212	0.148	0.064	27.50
27.75	0.210	0.147	0.063	27.75
28.00	0.208	0.146	0.063	28.00
28.25	0.207	0.145	0.062	28.25
28.50	0.205	0.143	0.061	28.50
28.75	0.203	0.142	0.061	28.75
29.00	0.201	0.141	0.060	29.00
29.25	0.199	0.140	0.060	29.25
29.50	0.198	0.138	0.059	29.50
29.75	0.196	0.137	0.059	29.75
30.00	0.194	0.136	0.058	30.00
30.25	0.192	0.135	0.058	30.25
30.50	0.191	0.133	0.057	30.50
30.75	0.189	0.132	0.057	30.75
31.00	0.187	0.131	0.056	31.00
31.25	0.186	0.130	0.056	31.25
31.50	0.184	0.129	0.055	31.50
31.75	0.182	0.128	0.055	31.75
32.00	0.181	0.127	0.054	32.00
32.25	0.179	0.125	0.054	32.25
32.50	0.178	0.124	0.053	32.50
32.75	0.176	0.123	0.053	32.75
33.00	0.175	0.122	0.052	33.00
33.25	0.173	0.121	0.052	33.25
33.50	0.171	0.120	0.051	33.50
33.75	0.170	0.119	0.051	33.75
34.00	0.168	0.118	0.051	34.00



34.25	0.167	0.117	0.050	34.25
34.50	0.165	0.116	0.050	34.50
34.75	0.164	0.115	0.049	34.75
35.00	0.163	0.114	0.049	35.00
35.25	0.161	0.113	0.048	35.25
35.50	0.160	0.112	0.048	35.50
35.75	0.158	0.111	0.047	35.75
36.00	0.157	0.110	0.047	36.00
36.25	0.156	0.109	0.047	36.25
36.50	0.154	0.108	0.046	36.50
36.75	0.153	0.107	0.046	36.75
37.00	0.151	0.106	0.045	37.00
37.25	0.150	0.105	0.045	37.25
37.50	0.149	0.104	0.045	37.50
37.75	0.147	0.103	0.044	37.75
38.00	0.146	0.102	0.044	38.00
38.25	0.145	0.101	0.043	38.25
38.50	0.144	0.101	0.043	38.50
38.75	0.142	0.100	0.043	38.75
39.00	0.141	0.099	0.042	39.00
39.25	0.140	0.098	0.042	39.25
39.50	0.139	0.097	0.042	39.50
39.75	0.137	0.096	0.041	39.75
40.00	0.136	0.095	0.041	40.00
40.25	0.135	0.094	0.040	40.25
40.50	0.134	0.094	0.040	40.50
40.75	0.133	0.093	0.040	40.75
41.00	0.131	0.092	0.039	41.00
41.25	0.130	0.091	0.039	41.25
41.50	0.129	0.090	0.039	41.50
41.75	0.128	0.090	0.038	41.75
42.00	0.127	0.089	0.038	42.00
42.25	0.126	0.088	0.038	42.25
42.50	0.125	0.087	0.037	42.50
42.75	0.124	0.086	0.037	42.75
43.00	0.122	0.086	0.037	43.00
43.25	0.121	0.085	0.036	43.25
43.50	0.120	0.084	0.036	43.50

APPENDIX B – MODELLED FLOOD DEPTHS

FIGURE 9.1.6 1 IN 200- YEAR (PLUS 39%) FLOOD DEPTHS

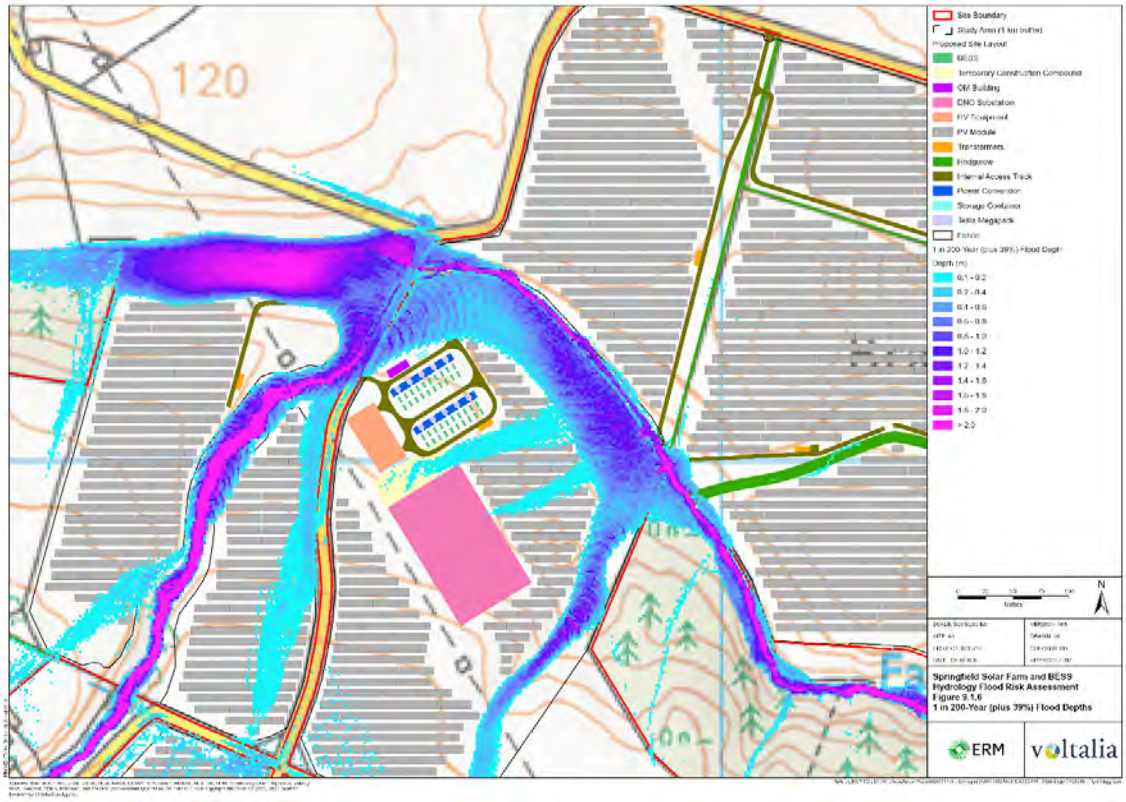


FIGURE 9.1.7 1 IN 2 -YEAR FLOOD DEPTHS

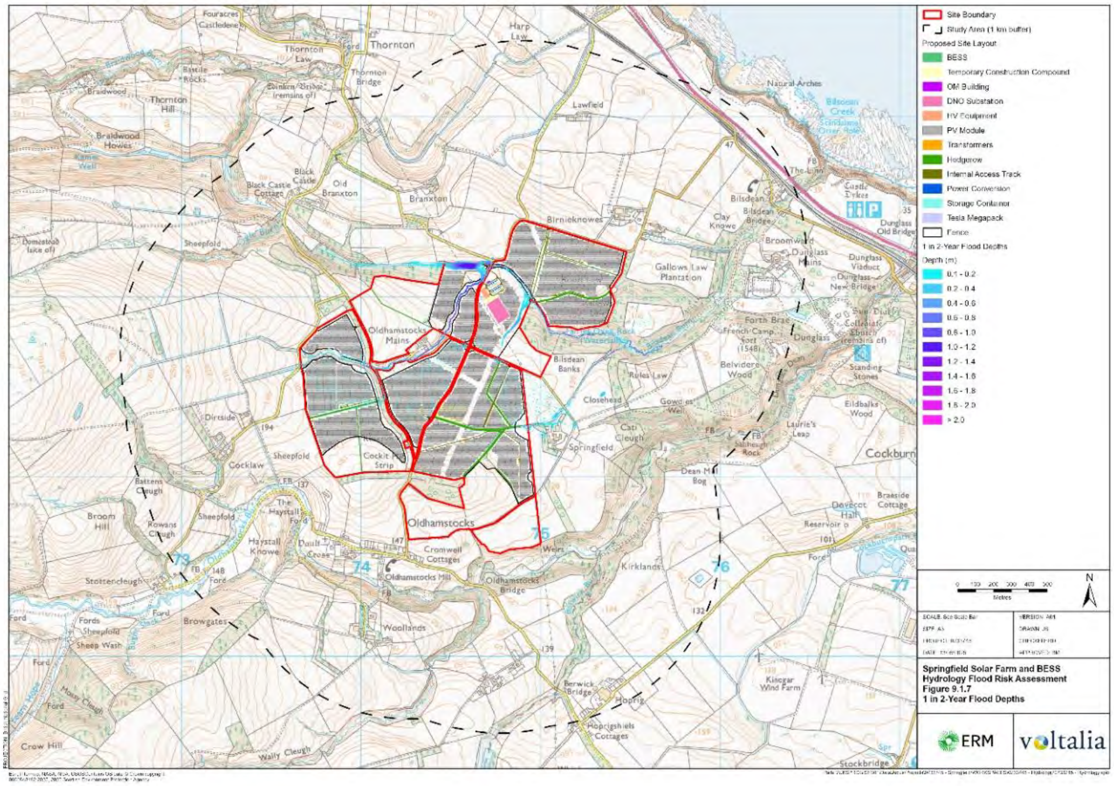


FIGURE 9.1.8 1 IN 30 YEAR FLOOD DEPTHS

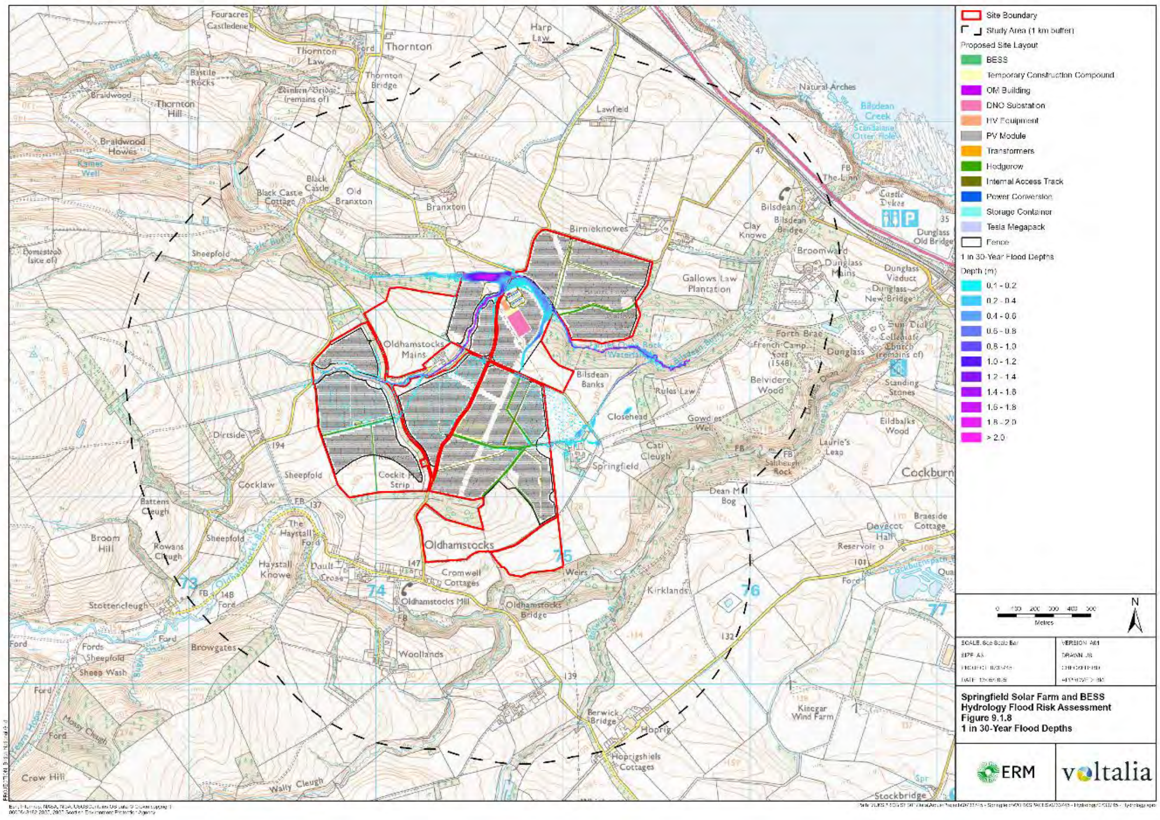


FIGURE 9.1.9 1 IN 200 YEAR FLOOD DEPTHS

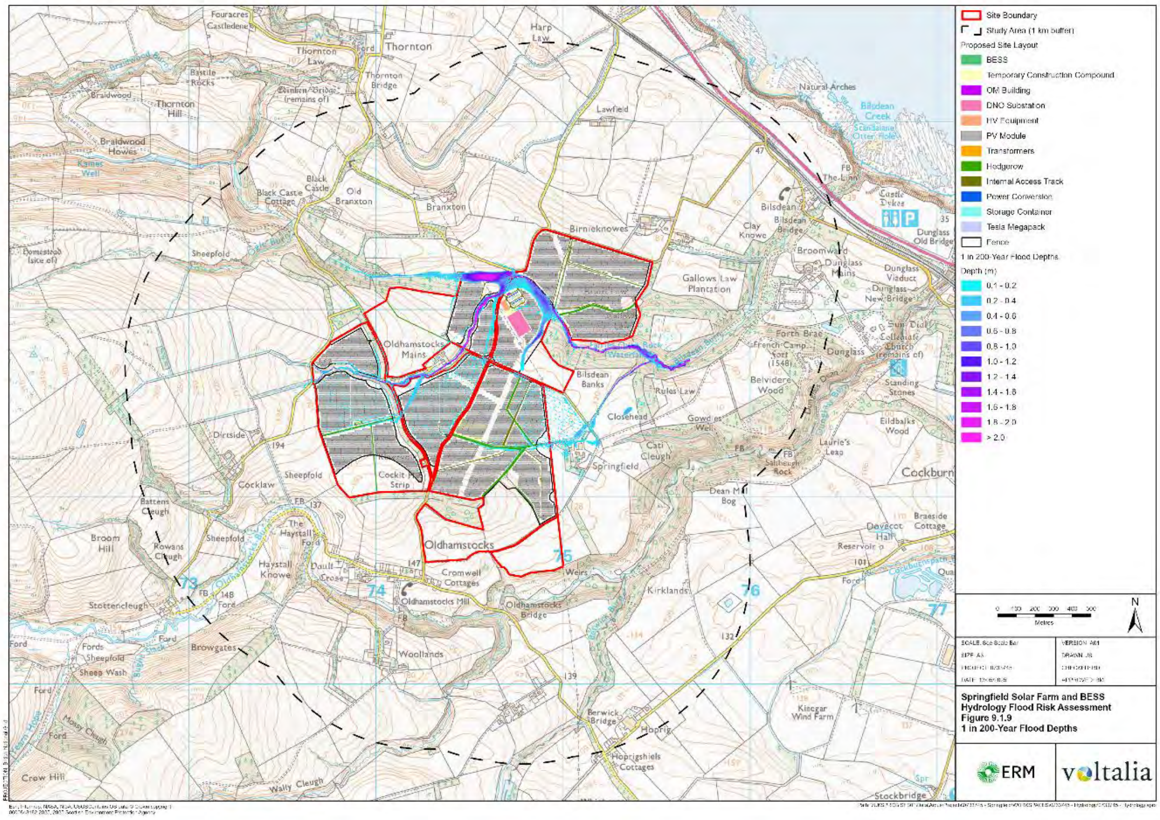
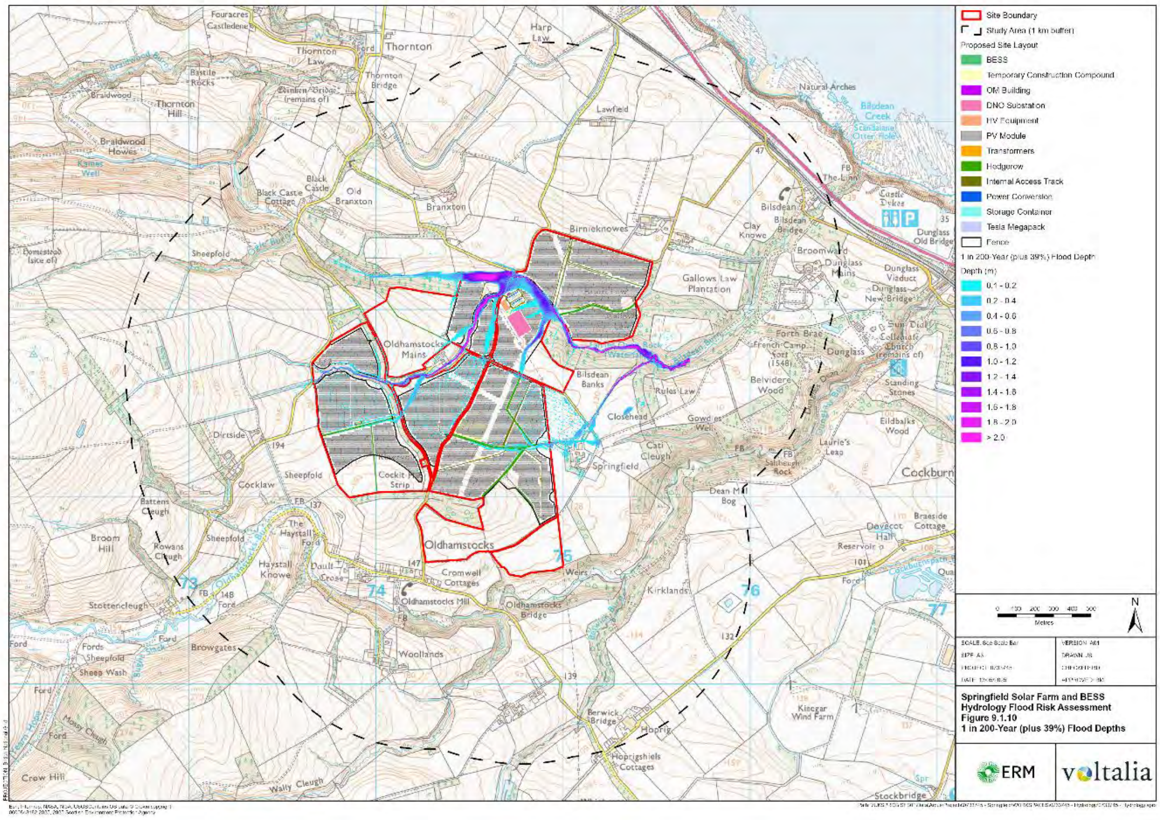
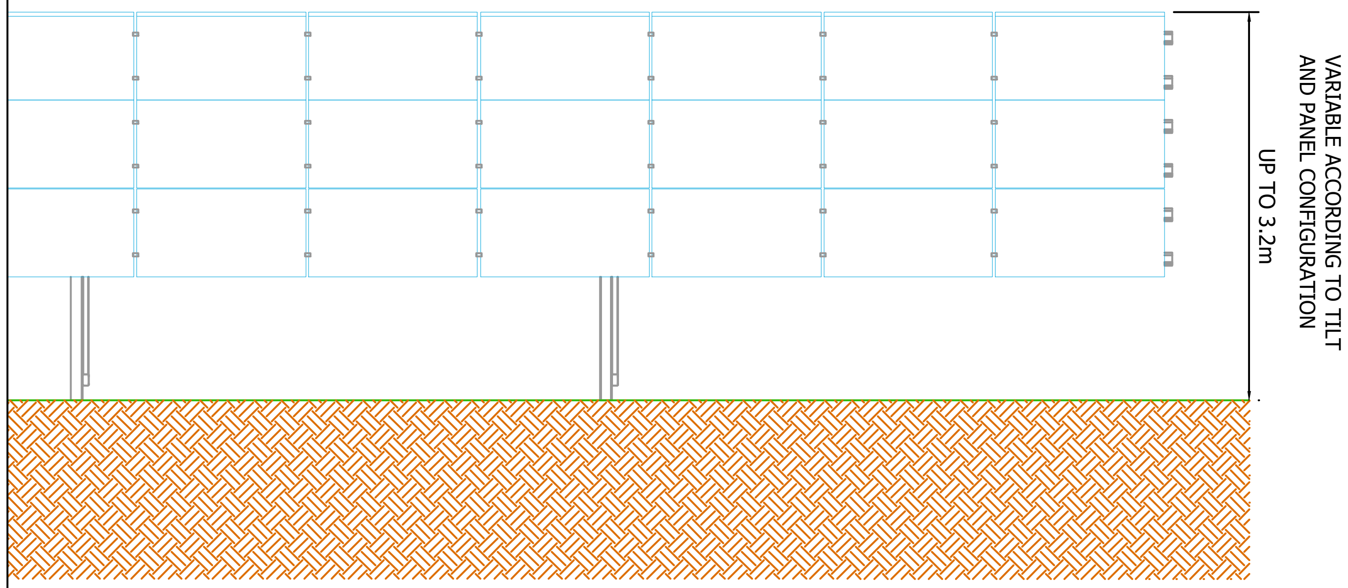


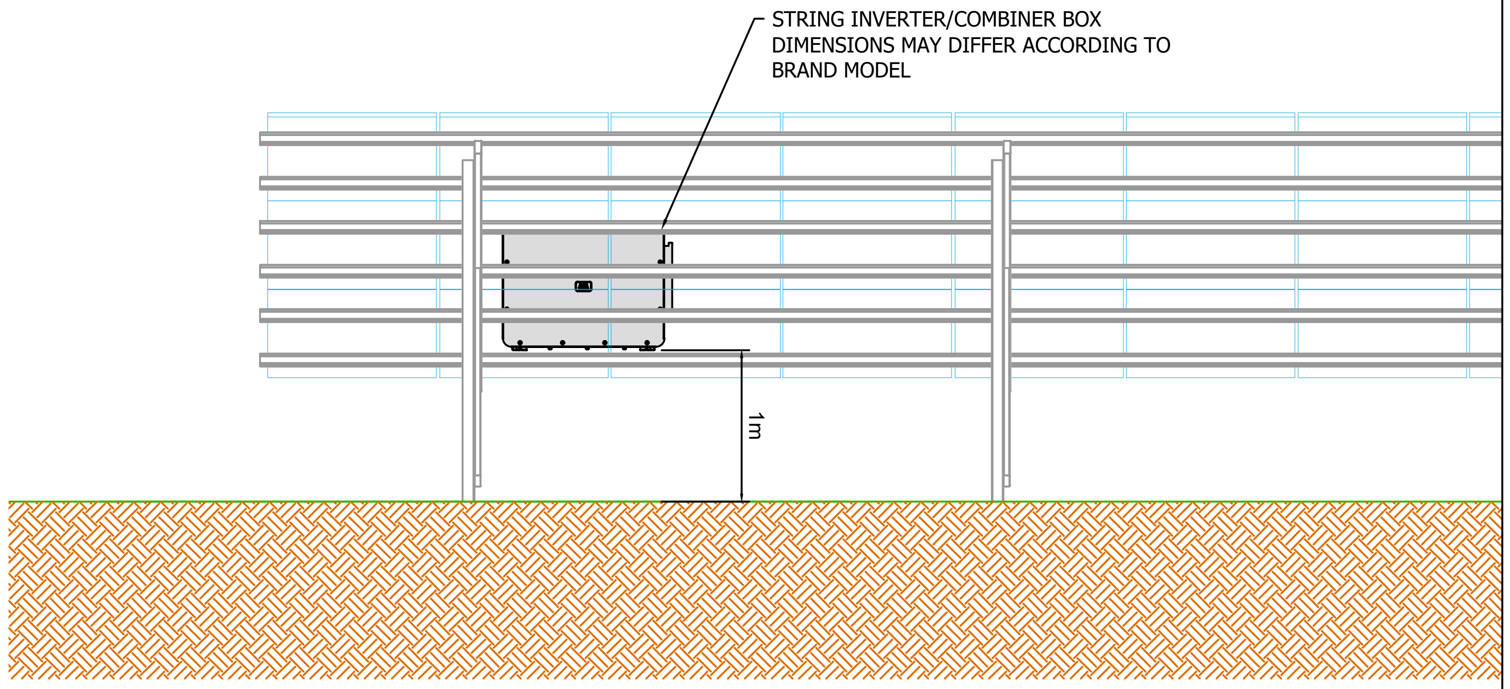
FIGURE 9.1.10 1 IN 200 (PLUS 39%) FLOOD DEPTHS



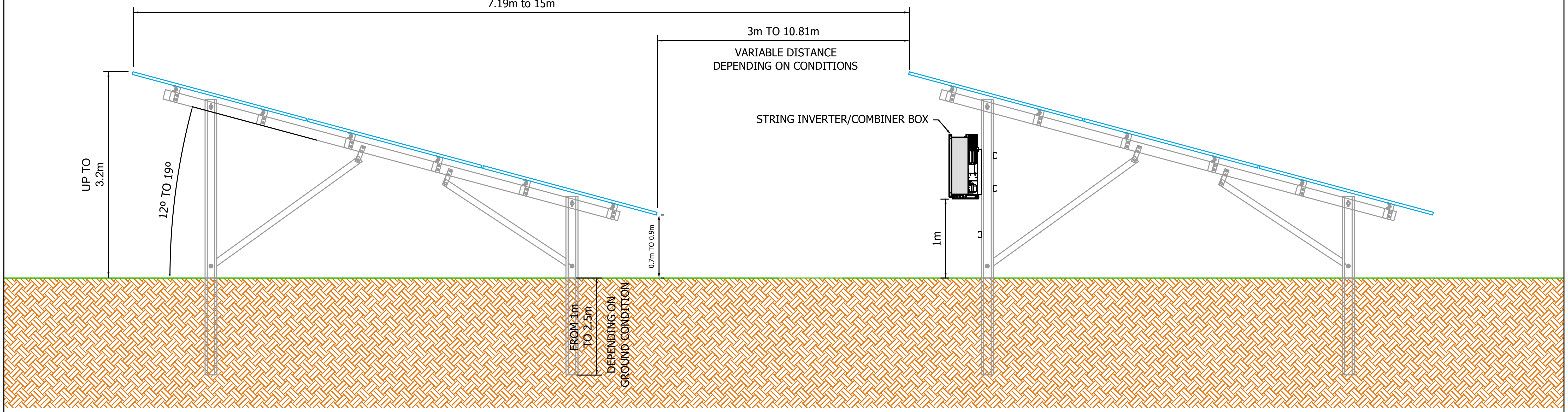
APPENDIX C – INFRASTRUCTURE PLANNING ELEVATION DRAWINGS



FRONT VIEW



REAR VIEW



SIDE VIEW

0 .5 1 1.5 2 2.5m

Rev.	Date	Description	By	Chk

PROJECT TITLE: SPRINGFIELD SOLAR BESS EIAR

CLIENT: voltalia

DRAWING TITLE: FIGURE 3.2 PV STRUCTURE DETAILS

DESIGNED:	DRAWN:	APPROVED:
-	SM	RC

INTERNAL PROJECT NUMBER: 0733745

SCALE @ A3: 1 : 50

APPROVED DATE: 12.03.25

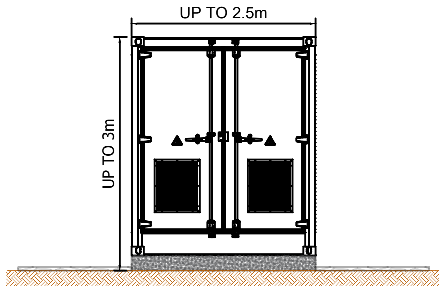
DRAWING NUMBER: DR_P_0008

REVISION: -

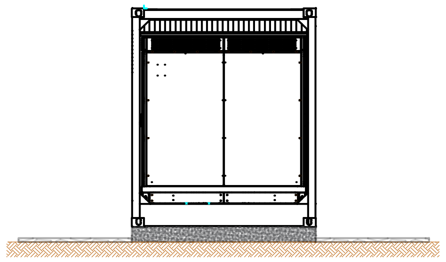
Environmental Resources Management

ERM

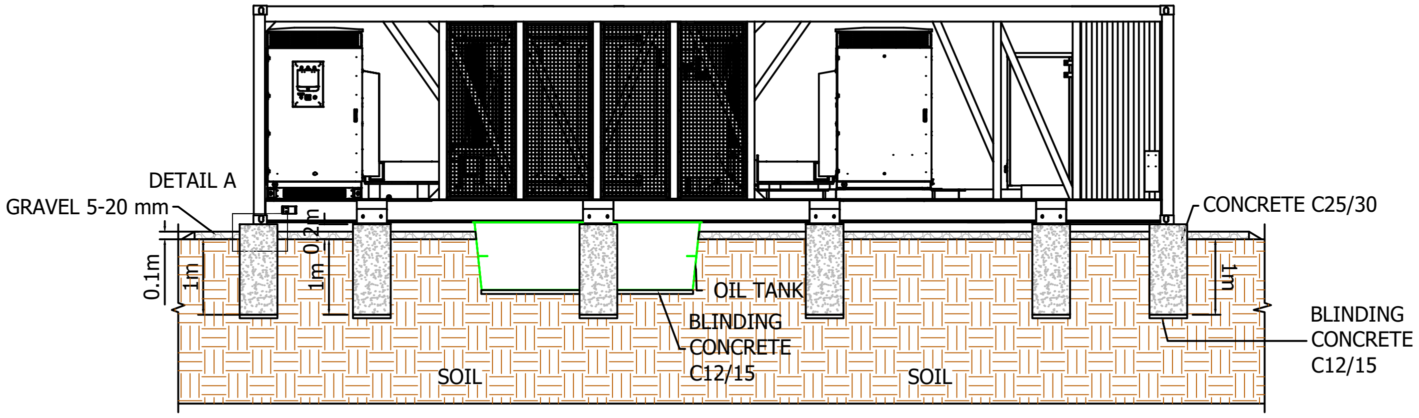
Y:\CAD\0733745_Springfield\01_01-Working\01_01-Drawings\BESS EIAR\0733745_DR_P_0008 - PV Structure Details.dwg



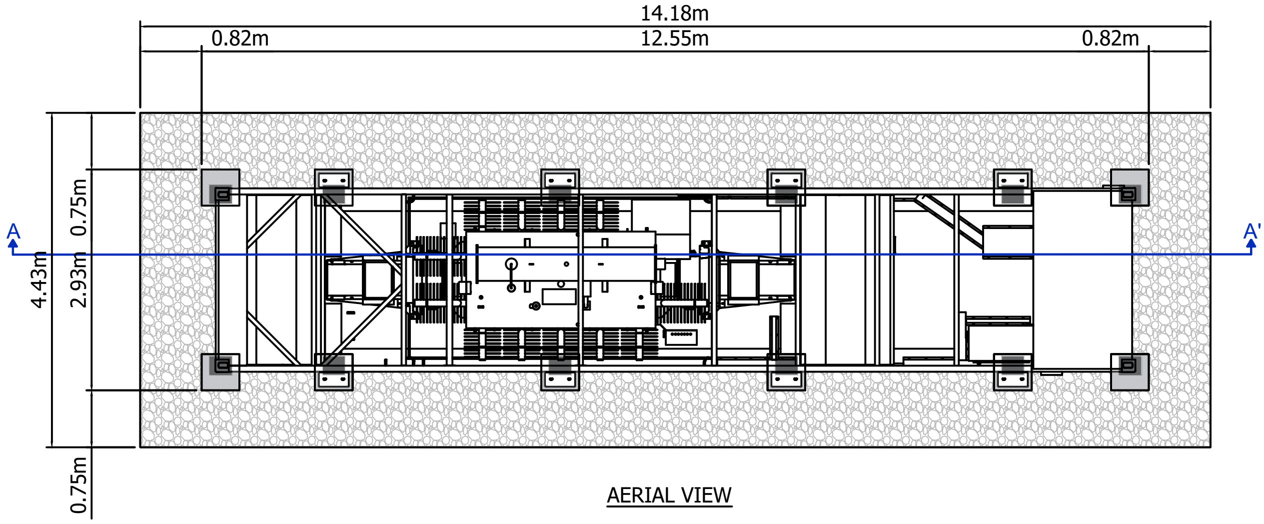
FRONT VIEW



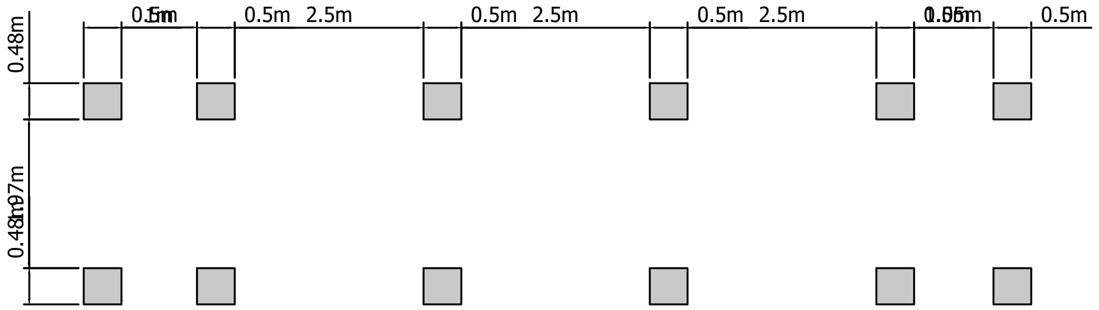
REAR VIEW



ELEVATION A-A'



AERIAL VIEW



FOUNDATIONS

0 1 2 3 4 5m

Rev.	Date	Description	By	Chk

PROJECT TITLE: SPRINGFIELD SOLAR BESS EIAR

CLIENT: voltalia

DRAWING TITLE: FIGURE 3.3 CENTRAL INVERTER DETAILS

DESIGNED:	DRAWN:	APPROVED:
-	SM	RC

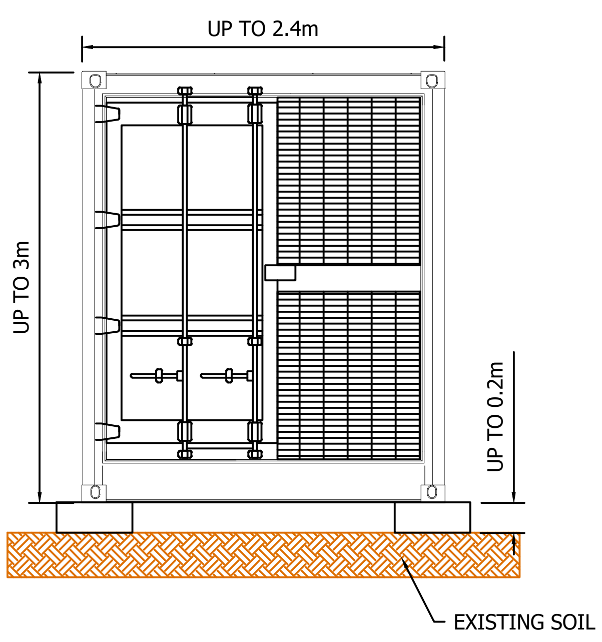
INTERNAL PROJECT NUMBER: 0733745

SCALE @ A3:	APPROVED DATE:	DRAWING NUMBER:	REVISION:
1 : 100	12.03.25	DR_P_0009	-

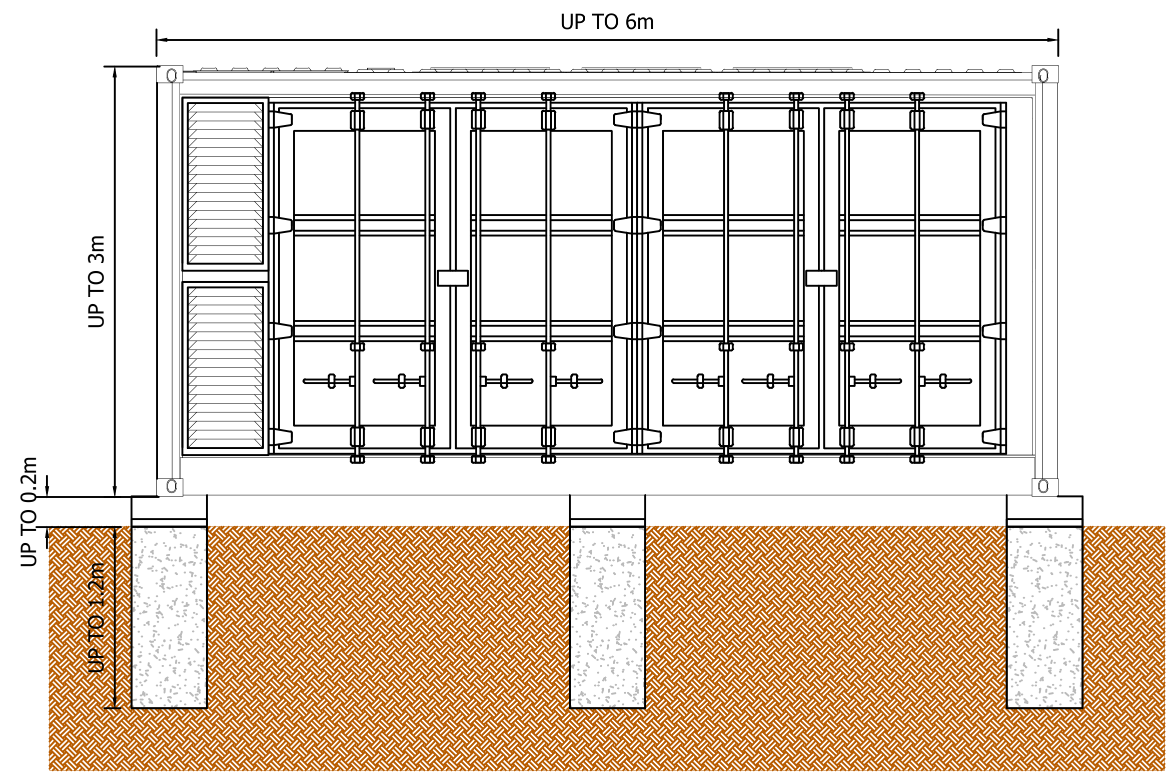
Environmental Resources Management

ERM

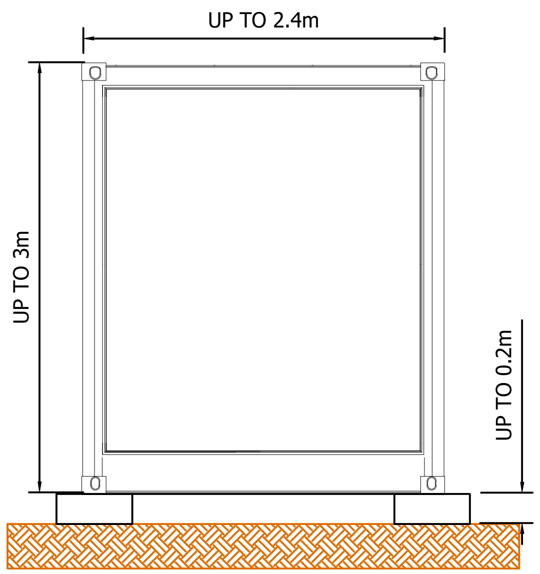
N



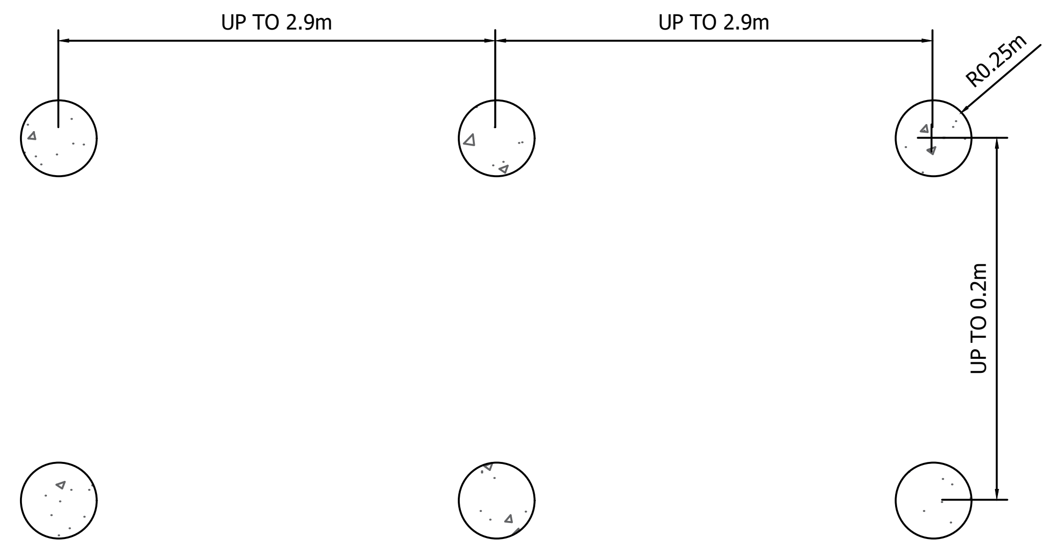
FRONT VIEW



SIDE VIEW



REAR VIEW



FOUNDATIONS

0 .5 1 1.5 2 2.5m

Rev.	Date	Description	By	Chk

PROJECT TITLE:
SPRINGFIELD SOLAR BESS EIAR

CLIENT:
voltalia

DRAWING TITLE:
FIGURE 3.4
BATTERY CONTAINER DETAIL

DESIGNED:	DRAWN:	APPROVED:
-	SM	RC

INTERNAL PROJECT NUMBER: 0733745

SCALE @ A3: 1 : 50

APPROVED DATE: 17.03.25

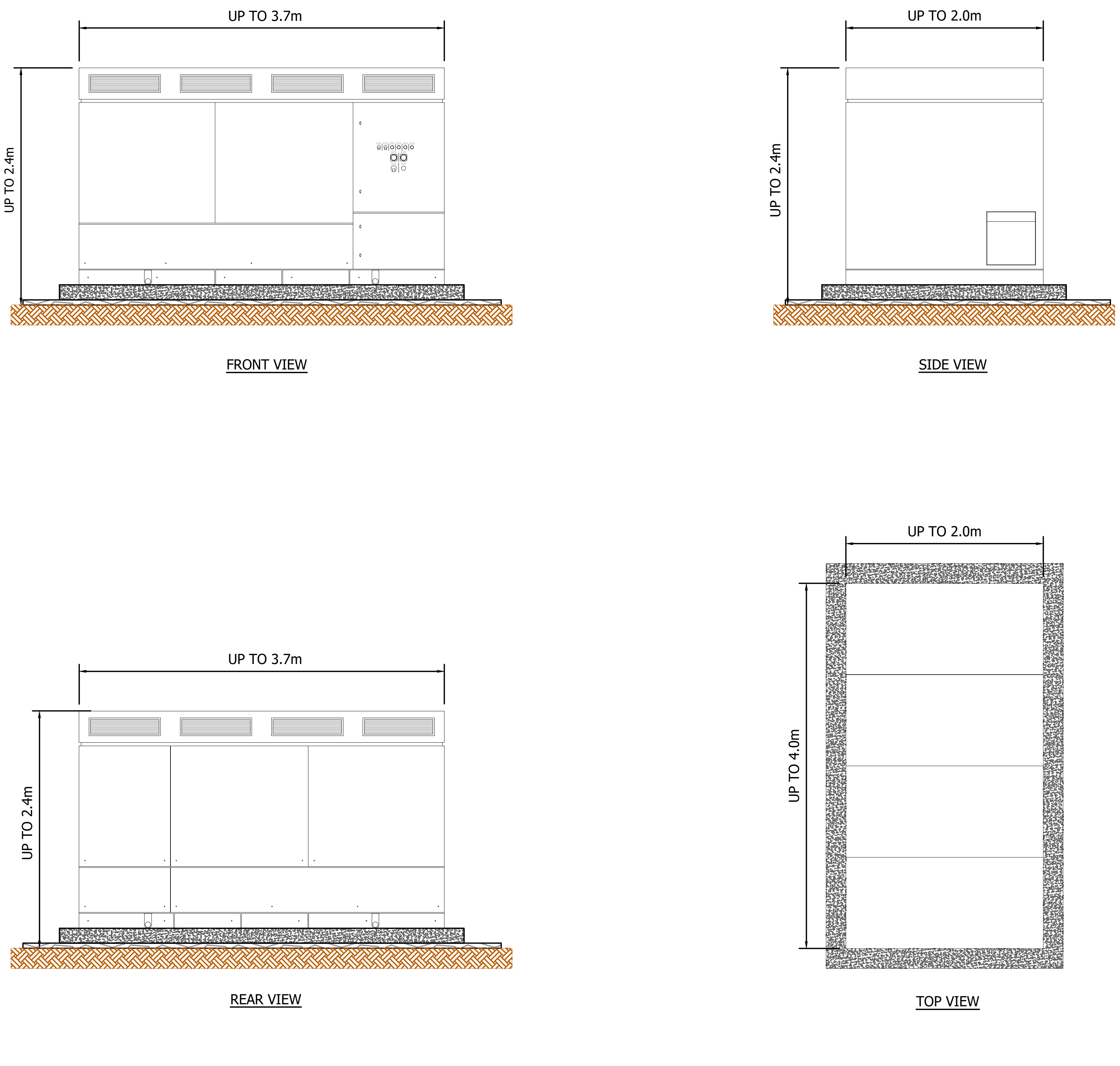
DRAWING NUMBER: DR_P_0004

REVISION: -

Environmental Resources Management

ERM

Y:\CAD\0733745_Springfield\01_01-Working\01_01-Drawings\BESS EIAR\0733745_DR_P_0004 - Battery Container Details.dwg



Rev.	Date	Description	By	Chk

PROJECT TITLE: SPRINGFIELD SOLAR BESS EIAR

CLIENT: voltalia

DRAWING TITLE: FIGURE 3.5 POWER CONTROL SYSTEM DETAILS

DESIGNED:	DRAWN:	APPROVED:
-	SM	RC

INTERNAL PROJECT NUMBER: 0733745

SCALE @ A3: 1 : 50

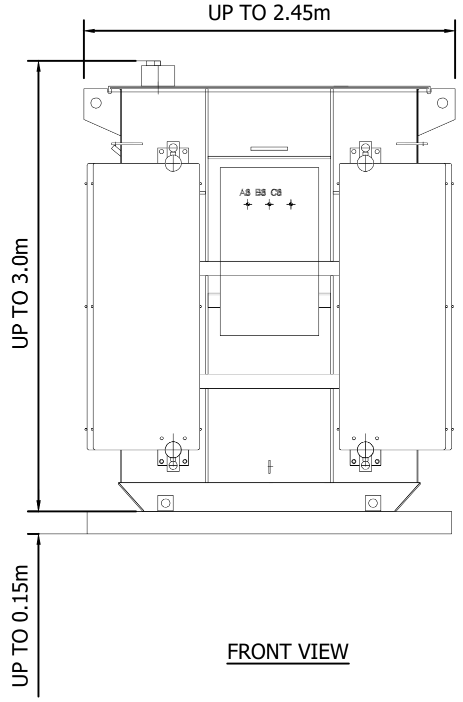
APPROVED DATE: 17.03.25

DRAWING NUMBER: DR_P_0003

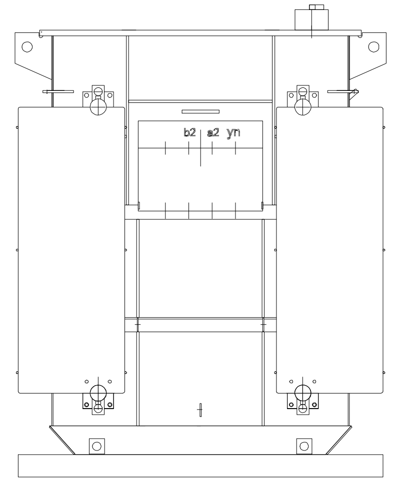
REVISION: -

Environmental Resources Management

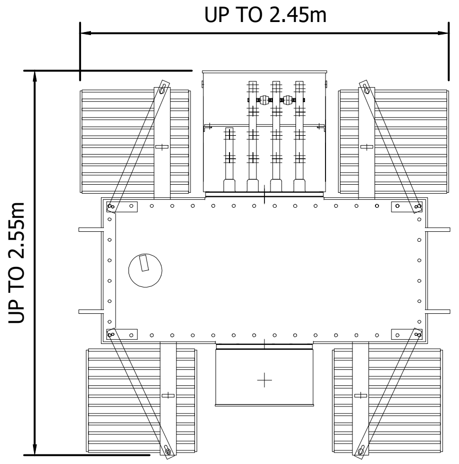
ERM



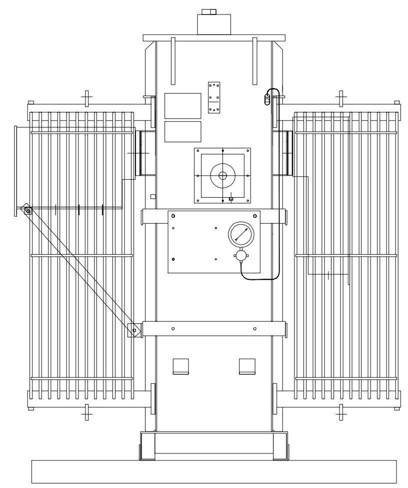
FRONT VIEW



REAR VIEW



AERIAL VIEW



SIDE VIEW

0 .5 1 1.5 2 2.5m

Rev.	Date	Description	By	Chk

PROJECT TITLE: SPRINGFIELD SOLAR BESS EIAR

CLIENT: voltalia

DRAWING TITLE: FIGURE 3.6 MV TRANSFORMER DETAILS

DESIGNED:	DRAWN:	APPROVED:
-	SM	RC

INTERNAL PROJECT NUMBER: 0733745

SCALE @ A3:	APPROVED DATE:	DRAWING NUMBER:	REVISION:
1 : 50	17.03.25	DR_P_0005	-

Environmental Resources Management

ERM

NOTES:

Rev.	Date	Description	By	Chk

PROJECT TITLE: SPRINGFIELD SOLAR BESS EIAR

CLIENT: voltalia

DRAWING TITLE: FIGURE 3.7 CUSTOMER SUBSTATION DETAIL

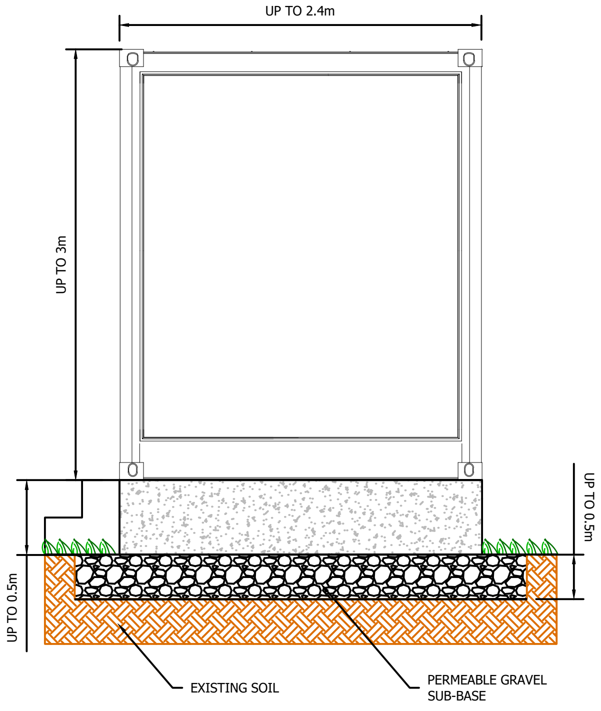
DESIGNED:	DRAWN:	APPROVED:
-	SM	RC

INTERNAL PROJECT NUMBER: 0733745

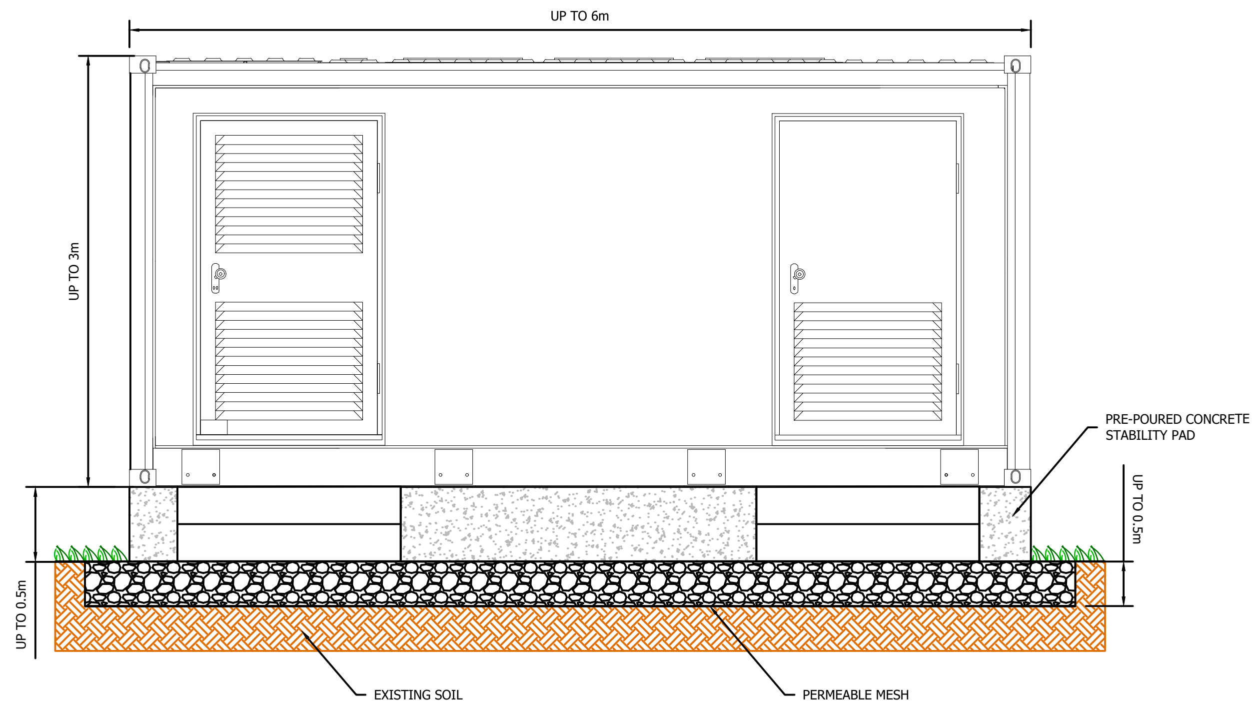
SCALE @ A1:	APPROVED DATE:	DRAWING NUMBER:	REVISION:
1 : 100	12.05.25	DR_P_0016	-

Environmental Resources Management

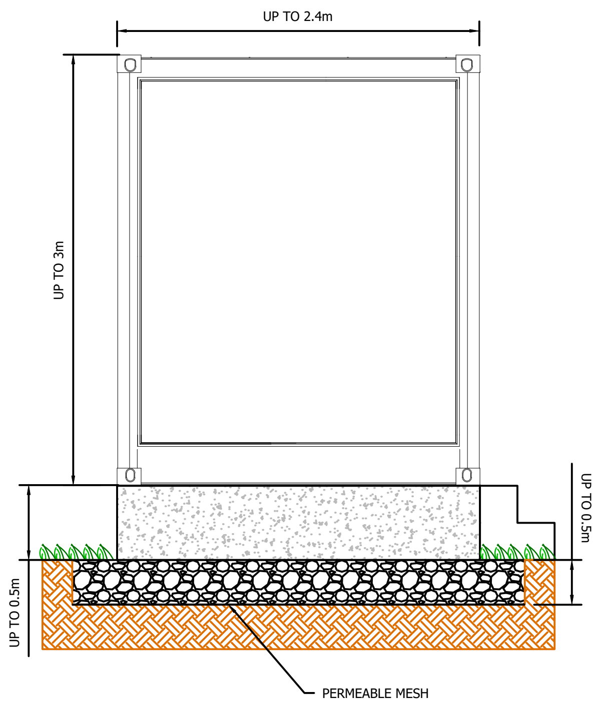
ERM



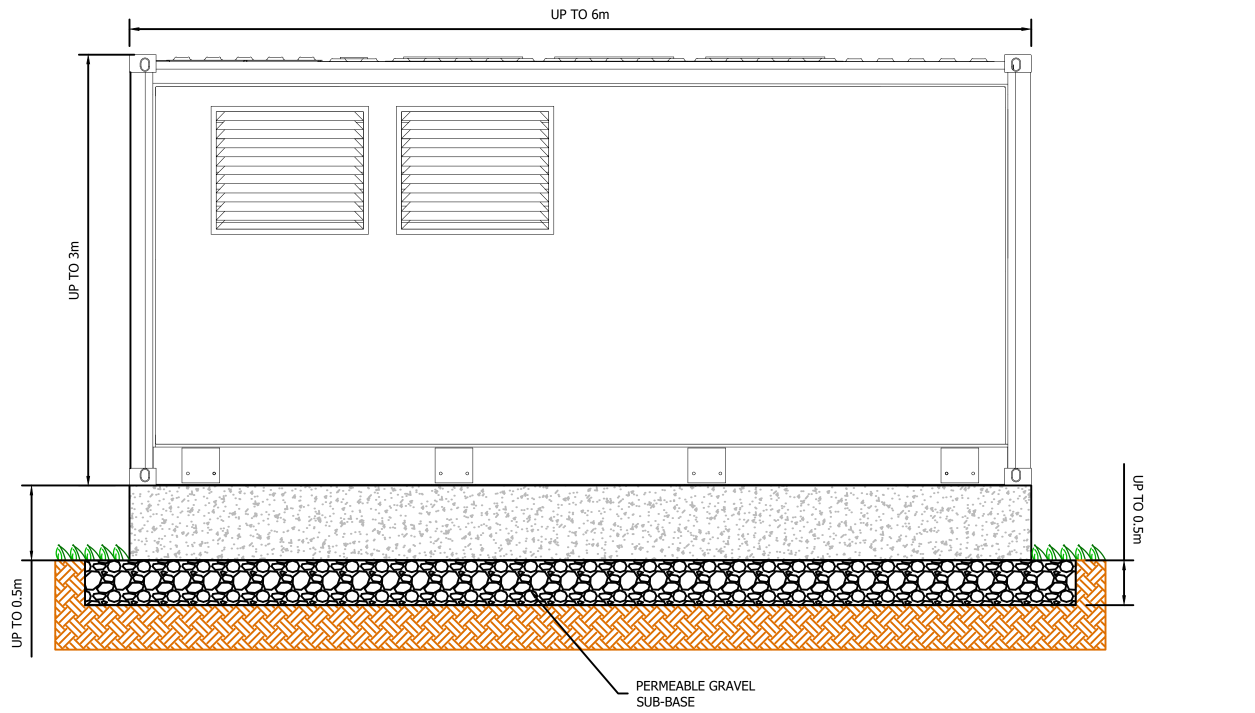
SIDE VIEW



FRONT VIEW



SIDE VIEW



REAR VIEW

0 .5 1 1.5 2 2.5m

Rev.	Date	Description	By	Chk

PROJECT TITLE:
SPRINGFIELD SOLAR
BESS EIAR

CLIENT:
voltalia

DRAWING TITLE:
FIGURE 3.8
33kV CUSTOMER
SUBSTATION DETAILS

DESIGNED: -
DRAWN: SM
APPROVED: RC
INTERNAL PROJECT NUMBER: 0733745
SCALE @ A3: 1 : 50
APPROVED DATE: 13.03.25
DRAWING NUMBER: DR_P_0015
REVISION: -

Environmental Resources Management

ERM

Y:\CAD\0733745_Springfield\01_01-Working\01-Drawings\BESS EIAR\0733745_DR_P_0015 - Customer Substation Details.dwg

Y:\CAD\0733745_Springfield\01-Working\01-Drawings\BESS EIAR\0733745_DR_P_0014 - DNO Substation Details.dwg

Rev.	Date	Description	By	Chk

PROJECT TITLE: SPRINGFIELD SOLAR BESS EIAR

CLIENT: voltalia

DRAWING TITLE: FIGURE 3.9 132 kV Customer SUBSTATION DETAILS

DESIGNED:	DRAWN:	APPROVED:
-	SM	RC

INTERNAL PROJECT NUMBER: 0733745

SCALE @ A3: 1 : 50

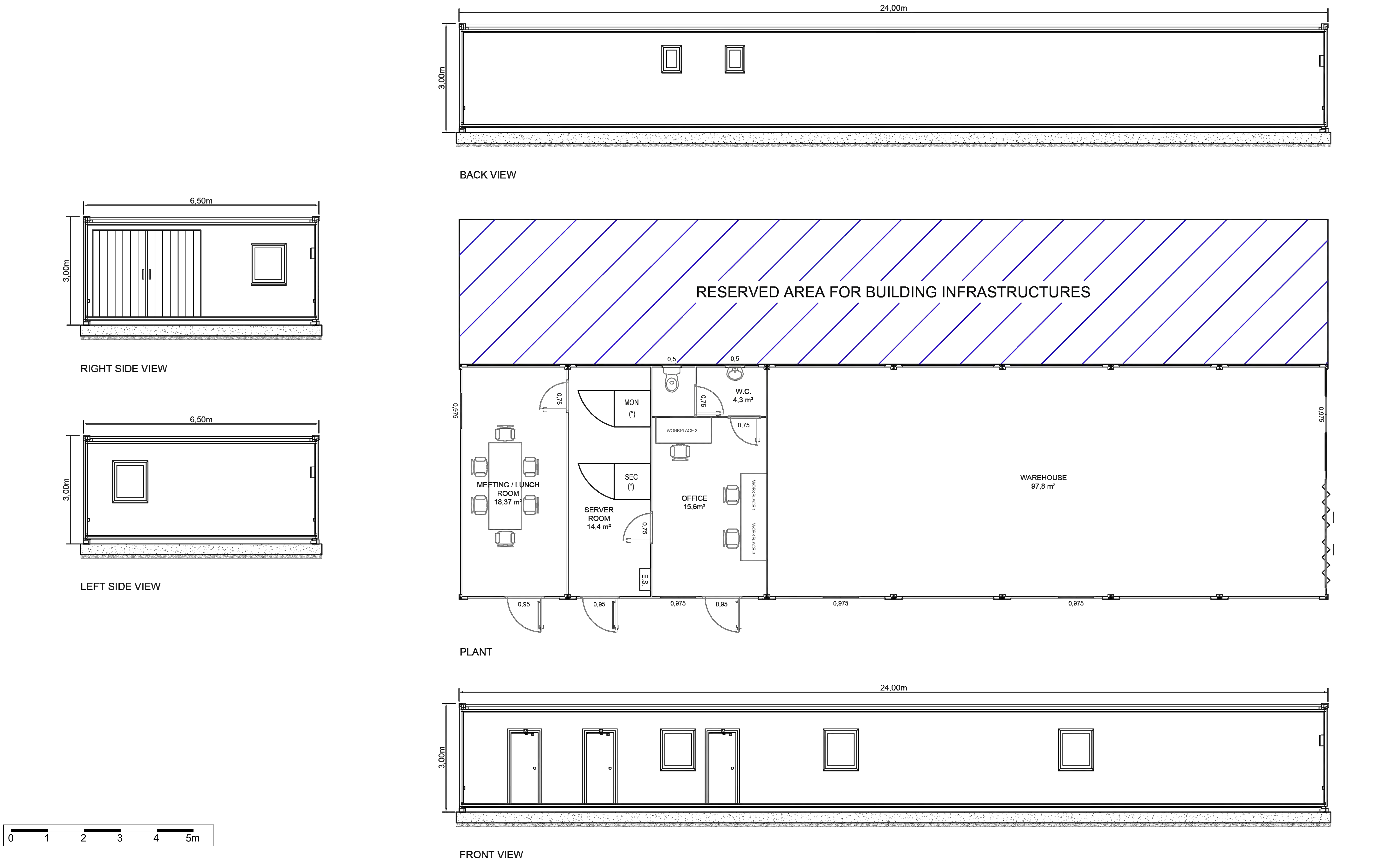
APPROVED DATE: 12.03.25

DRAWING NUMBER: DR_P_0014

REVISION: -

Environmental Resources Management

ERM



Rev.	Date	Description	By	Chk

PROJECT TITLE:
SPRINGFIELD SOLAR BESS EIAR

CLIENT:
voltalia

DRAWING TITLE:
FIGURE 3.10
O&M BUILDING DETAILS

DESIGNED:	DRAWN:	APPROVED:
-	SM	RC

INTERNAL PROJECT NUMBER: 0733745

SCALE @ A3:	APPROVED DATE:	DRAWING NUMBER:	REVISION:
1 : 100	13.03.23	DR_P_0019	-

Environmental Resources Management

ERM

Y:\CAD\0733745_Springfield\01-Working\01_01-Drawings\BESS EIAR\0733745_DR_P_0019 - O&M Building Details.dwg

APPENDIX D – INFODRAINAGE SURFACE WATER DRAINAGE OUTPUTS

Project:	Date: 17/04/2025		
	Designed by: reagan.duff	Checked by:	Approved By:
Report Title: Audit Report	Company Address:		

Rainfall

FEH

Type: FEH

Site Location	GB 375100 671800 NT 75100 71800
Rainfall Version	1999
C (1km)	-0.014
D1 (1km)	0.429
D2 (1km)	0.542
D3 (1km)	0.205
E (1km)	0.242
F (1km)	2.207
Summer	☑
Winter	☑

Return Period

Return Period (years)	Increase Rainfall (%)
1.0	0.000
30.0	0.000
200.0	0.000
200.0	39.000

Storm Durations

Duration (mins)	Run Time (mins)
15	30
30	60
60	120
120	240
180	360
240	480
360	720
480	960
600	1200
720	1440
960	1920
1440	2880
2160	4320
2880	5760
4320	8640
5760	11520
7200	14400
8640	17280
10080	20160

Project:	Date: 17/04/2025		
	Designed by: reagan.duff	Checked by:	Approved By:
Report Details: Audit Report Storm Phase: Phase	Company Address:		

Inflow Summary

Inflow Label	Connected To	Flow (L/s)	Runoff Method	Area (ha)	Percentage Impervious (%)	Urban Creep (%)	Adjusted Percentage Impervious (%)	Area Analysed (ha)
Catchment Area	Cellular Storage		Time of Concentration	0.18	100	0	100	0.18
TOTAL		**0.0**		**0.18**				**0.18**

Outfall Details

Outfalls

Outfall	Outfall Type	Gated	Fixed Surcharged Level (m)	Level Curve
Cellular Storage	Free Discharge			

Flood Warnings

Junctions

No flood warnings are reported

Stormwater Controls

No flood warnings are reported

Discharge Rate

Audit Details

Selected Rainfall
FEH

Results

Outfall	Rainfall	Audit Discharge Rate (L/s)	Actual Discharge Rate (L/s)	Pass/Fail
Cellular Storage	1 (years) + 0 (%)	5.5	0.8	Pass
	30 (years) + 0 (%)	5.5	1.7	Pass
	200 (years) + 0 (%)	5.5	2.2	Pass
	200 (years) + 39 (%)	5.5	2.8	Pass

APPENDIX E – SIMPLE INDEX APPROACH OUTPUTS

SUMMARY TABLE		DESIGN CONDITIONS			
		1	2	3	4
Land Use Type	Low traffic roads (e.g. residential roads and general access roads, < 300 traffic movements/day)				
Pollution Hazard Level	Low				
Pollution Hazard Indices					
TSS	0.5				
Metals	0.4				
Hydrocarbons	0.4				
SuDS components proposed		SuDS components can only be assumed to deliver these indices if they follow design guidance with respect to hydraulics and treatment set out in the relevant technical component chapters of the SuDS Manual. See also checklists in Appendix B			
Component 1	Pervious pavement (where the pavement is not designed as an infiltration component)				
Component 2	None				
Component 3	None				
SuDS Pollution Mitigation Indices					
TSS	0.7				
Metals	0.6				
Hydrocarbons	0.7				
Groundwater protection type	None				
Groundwater protection Pollution Mitigation Indices					
TSS	0				
Metals	0				
Hydrocarbons	0				
Combined Pollution Mitigation Indices		**Note: In order to meet both Water Quality criteria set out in the SuDS Manual (Chapter 4), Interception should be delivered for all impermeable areas wherever possible. Interception delivery and treatment may be met by the same components, but Interception requires separate evaluation.**	Reference to local planning documents should also be made to identify any additional protection required for sites due to habitat conservation (see Chapter 7 The SuDS design process). The implications of developments on or within close proximity to an area with an environmental designation, such as a Site of Special Scientific Interest (SSSI), should be considered via consultation with relevant conservation bodies such as Natural England		
TSS	0.7				
Metals	0.6				
Hydrocarbons	0.7				
Acceptability of Pollution Mitigation					
TSS	Sufficient				
Metals	Sufficient				
Hydrocarbons	Sufficient				

APPENDIX F– DRAINAGE MAINTENACE PROGRAM

OUTLINE MAINTENACE SCHEDULE FOR AGGREGATE ATTENUATION

Maintenance Schedule	**Required Action**	**Typical Frequency**
Regular Maintenance	Raking	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturers recommendations - pay particular attention to areas where water runs onto pervious surface from adjacent impermeable areas as this area is most likely to collect the most sediment
Occasional Maintenance	Stabilise and mow contributing and adjacent areas	As required
	Removal of weeds or management using glyphospate applied directly into the weeds by an applicator rather than spraying	As required – once per year on less frequently used pavements
Remedial Actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50 mm of the level of the stone	As required
	Remedial work to any depressions or rutting considered detrimental to the structural performance or a hazard to users, and replace lost jointing material	As required
	Rehabilitation of surface and upper substructure by remedial sweeping / raking	Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging)

Source: CIRIA (2015). The SuDS Manual. Table 20.15 Operation and Maintenance Requirements for Pervious Pavements.