Econergy International Ltd.

Solar Farm on Land South of Berrington

Flood Risk Assessment

680407-R1(04)-FRA

AUGUST 2022

RSK GENERAL NOTES

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This work has been undertaken in accordance with the quality management system of RSK LDE Ltd.

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1 INTRODUCTION

1.1 Context

RSK Land and Development Engineering Ltd (RSK) was commissioned to carry out a Flood Risk Assessment (FRA) for RSK ADAS Ltd (the 'client'). The assessment is in support of the planning submission for the proposed solar farm at land south of Berrington (the 'site').

The assessment has been prepared in accordance with the National Planning Policy Framework (NPPF)[1] and its accompanying Planning Practice Guidance[2], the Interim Code of Practice for Sustainable Drainage[3], BS 8533-2017 Assessing and Managing Flood Risk in Development Code of Practice[4], BS 8582:2013 Code of practice for surface water management for development sites[5] and the Non-statutory technical standards for sustainable drainage systems[6], with site-specific advice from the Environment Agency (EA), the Lead Local Flood Authority (LLFA), the Local Planning Authority (LPA), the architect and the client.

The NPPF sets out the criteria for development and flood risk by stating that inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk, but where development is necessary, making it safe without increasing flood risk elsewhere.

The key definitions within the PPG are:

> "Flood risk" is a combination of the probability and the potential consequences of flooding from all sources – including from rivers and the sea, directly from rainfall on the ground surface and rising groundwater, overwhelmed sewers and drainage systems, and from reservoirs, canals and lakes and other artificial sources; and,
>
> "Areas at risk of flooding" means areas at risk from all sources of flooding. For fluvial (river) and sea flooding, this is principally land within Flood Zones 2 and 3. It can also include an area within Flood Zone 1 which the EA has notified the local planning authority as having critical drainage problems.

For this site, the key aspects that require the assessment are:

> The EA's indicative flood zone map shows the site is located within Flood Zone 1 (shown in **Figure 1.1**); and,
>
> The total site area is 44.09Ha therefore surface water drainage must be considered, and sustainable drainage systems (SuDS) incorporated, where possible.

[1] Communities and Local Government, 'National Planning Policy Framework', July 2021.

[2] Communities and Local Government, 'Planning Practice Guidance - Flood Risk and Coastal Change, ID 7', March 2014. http://planningguidance.planningportal.gov.uk/blog/guidance/flood-risk-and-coastal-change/

[3] DEFRA, 'Interim Code of Practice for Sustainable Drainage Systems' National SUDS Working Group, July 2004.

[4] BSI, 'BS 8533-2017 Assessing and managing flood risk in development Code of practice', December 2017.

[5] BSI, 'BS 8582:2013 Code of practice for surface water management for development sites', November 2013.

[6] DEFRA, 'Sustainable Drainage Systems - Non-statutory technical standards for sustainable drainage systems', March 2015.

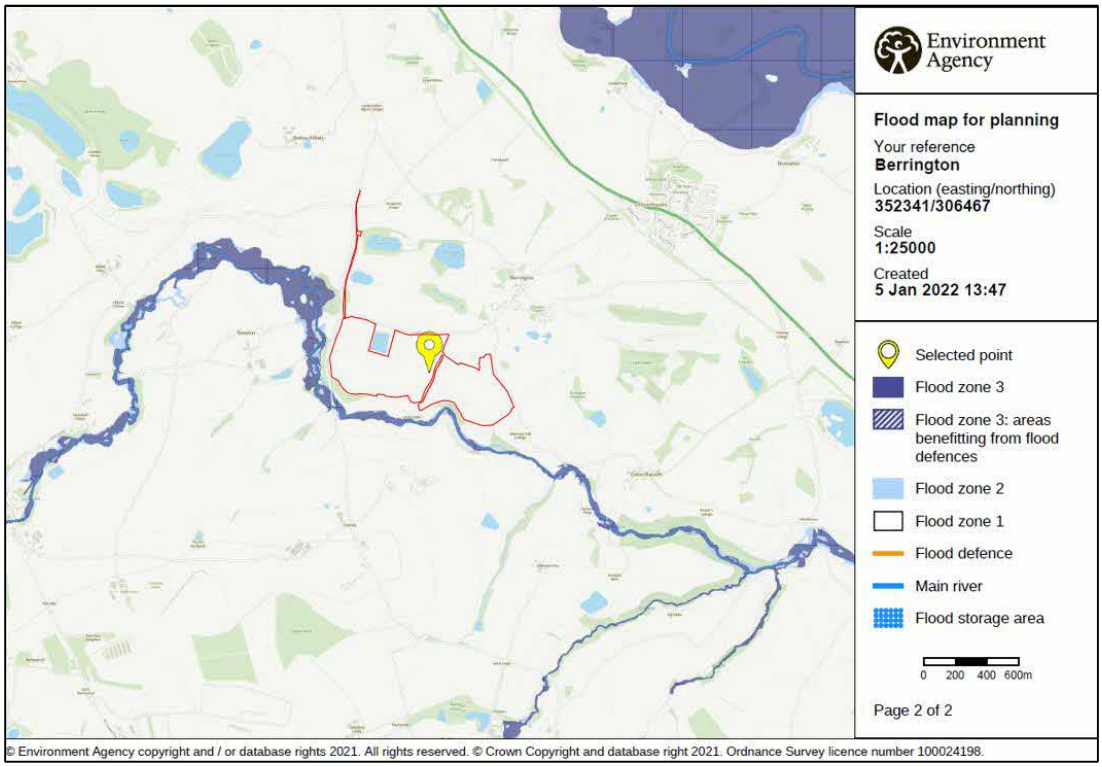


Figure 1.1: Environment Agency 'Flood map for planning' (accessed January 2022)

1.2 Scope of work

A key element of project development is to prepare a FRA to establish the flood risk associated with the proposed development and to propose suitable mitigation, if required, to reduce the risk to a more acceptable level.

The scope of work relating to a FRA is based on the guidance provided in Section 14 of the NPPF and its accompanying Planning Practice Guidance.

A site-specific FRA must demonstrate that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall. The scope of this assessment therefore comprises the following elements:

- To review architect plans, planning information and other studies to determine existing site conditions;
- To obtain information on the hydrology and hydrological regime in and around the site;
- To obtain the views of the EA/LLFA including scope, location and impacts;
- To determine the extent of new flooding provision and the influence on the site;
- To assess the impact on the site from climate change effects and anticipated increases in rainfall over a 25 year period for energy production uses;
- To review site surface water drainage based on the proposed layout and, if necessary, to determine the extent of infrastructure required; and
- To prepare a report including calculations and summaries of the source information and elements reviewed.

Reliance has been placed on factual and anecdotal data obtained from the sources identified. RSK cannot be held responsible for the scope of work, or any omissions,

misrepresentation, errors or inaccuracies with the supplied information. New information, revised practices or changes in legislation may necessitate the re-interpretation of the report, in whole or in part.

The comments given in this report and opinions expressed are subject to RSK Group Service Constraints provided in **Appendix A**.

2 SITE DESCRIPTION

2.1 Existing site

2.1.1 Location

Site Name and Address: Land South of Berrington, Shrewsbury, SY5 6HA

Site National Grid Reference: 352387 E, 306466 N

The site is approximately 44.09Ha in size and is located approximately 6.0km south of Shrewsbury. The site is located off Cliff Hollow road to north and can be accessed via the existing entrance off this road. The main site is comprised of two fields intersected by a private drive, both fields are noted to be arable land. A section of the site boundary extends northwards to the east of highway.

Table 2.1: Site setting

Direction	Characteristic
North	The site is generally bound by Cliff Hollow to the north of the site. There is a small reservoir which cuts into the north-west boundary, whilst to the north east of the site there is an area of small mire-like feature.
East	The east of the site is bound by a single track country lane, arable land continues east of the site.
South	The southern boundary is defined by a treed hedgerow, south of the trees is Cound Brook which flows from west to east.
West	The site is bound by a single track country lane along the western boundary. West of the lane is Cound Brook.

Figure 2.1 shows a site location map.

Figure 2.1: Site location map

2.1.2 Land use and topography

The existing site is currently comprised of undeveloped arable land. The site can therefore be described as being Greenfield.

The approximate land use of the site is as follows:

Table 2.2: Existing site land uses

Land use	Area (Ha)	Percentage (%)
Impermeable	0	0
Permeable	44.09	100
Total	44.09	100

Topographic data has been assessed using available elevation models for the site (LiDAR-DTM-1m-2020-SJ50nw). The elevation data used is shown in Figure 2.2, the contours provided on the figure give an indication of the orientation of fall across the site.

The highest point within the main site is located at the northern boundary at approximately 90.5mAOD (Above Ordnance Datum), with the land falling southwards towards Cound Brook. The lowest on-site point is located within the south-eastern corner, being approximately 74.00mAOD.

Figure 2.2: Site topography (Derived from LiDAR)

2.1.3 Hydrology

2.1.3.1 Main River

The closest Environment Agency designated 'Main River' is Cound Brook to the south of the site outside of the site boundary. The river flows east and joins the River Severn approximately 4.0km east of the site.

2.1.3.2 Other Waterbodies

To the north-west of the site is a reservoir with raised embankments.

To the north-east of the site is a relatively small mire-like feature, approximately 150m in length and width. Ordnance Survey mapping indicates a drain discharges to the area of ground depression and British Geological Survey mapping indicates the feature has peat surface geology. There is no clear outfall and so is assumed to be an isolated feature.

2.1.4 Geology

2.1.4.1 Desk Study

According to British Geological Surveying mapping, the underlying geology on the site can be described as the following:

Superficial Geology (split):

West boundary: Glaciofluvial Deposits, Devensian - Sand and Gravel. Superficial Deposits formed up to 2 million years ago in the Quaternary Period. Local environment previously dominated by ice age conditions (UGF).

Remainder of site: Till, Devensian - Diamicton. Superficial Deposits formed up to 2 million years ago in the Quaternary Period. Local environment previously dominated by ice age conditions (U).

Bedrock Geology:

Salop Formation - Mudstone, Sandstone and Conglomerate. Sedimentary Bedrock formed approximately 272 to 310 million years ago in the Permian and Carboniferous Periods. Local environment previously dominated by rivers.

BGS Borehole data records were searched for nearby borehole logs that may give relevant information regarding the on-site geology. The closest borehole (SJ50NW13) is approximately 0.5km east of the site. The borehole exhibited clay sand and gravel strata geology to a depth of 20.1mbgl (66 feet), the remaining borehole recorded clay and sandstone strata to a depth of 70mbgl (230 feet). The resting water level within the borehole was recorded at a depth of 32mbgl (108 feet).

2.1.5 Hydrogeology

Hydrogeological information was obtained from the online Magic Maps service. The site is underlain with bedrock geology designated as a 'Secondary A' aquifer. The site is underlain with superficial deposits designated as 'Secondary (undifferentiated)'.

The site is not located within a Groundwater Source Protection Zone. However, is within Drinking Water Safeguard Zone (Surface Water).

2.2 Development proposals

The proposed development is for energy end use. The development proposals include the erection of a 30MW Solar Photovoltaic (PV) array comprising ground mounted solar PV panels, vehicular access from Cliff Hollow with internal access tracks, landscaping and associated infrastructure including spares containers and grid connection infrastructure including inverters and battery stations dotted throughout the site.

A section of land adjacent to the highway aligned northwards will be used for the cable routing.

The approximate land uses of the proposed site are summarised in **Table 2.3** below.

Table 2.3: Proposed site land uses

Land use	Area (Ha)	Percentage
Impermeable	0.0	0%
Permeable	44.09	100%
Total	44.09	100%

The site layout is in **Appendix B**.

3 LEGISLATION, POLICY AND GUIDANCE

3.1 National policy

Table 3.1: National legislation and policy context

Legislation	Key provisions
National Planning Policy Framework (2021)	The aims of planning policy on development and flood risk are to ensure that flood risk is taken into account at all stages in the planning process to avoid inappropriate development in areas at risk of flooding, and to direct development away from areas at highest risk. Where new development is, exceptionally, necessary in such areas, policy aims to make it safe without increasing flood risk elsewhere and where possible, reducing flood risk overall.
Planning Practice Guidance (2014)	The NPPF is supported by an online Planning Practice Guidance, which provide additional guidance on flood risk.
Flood and Water Management Act 2010[7]	The Flood and Water Management Act (FWMA) aims to implement the findings of the 2007 Pitt Review and co-ordinate control of drainage and flood issues. There are a number of increased responsibilities within the Act that affect adoption of SuDS features and the role of the EA to expand on the mapping data they provide. The implementation of SuDS features has many beneficial impacts on the treatment of surface water during remediation works.
Water Resources Act 1991[8]	Section 24 – The EA is empowered under this Act to maintain and improve the quality of 'controlled' waters Section 85 – It is an offence to cause or knowingly permit pollution of controlled waters Section 88 – Discharge consents are required for discharges to controlled waters
Water Framework Directive (2000)[9]	The Water Framework Directive (WFD) requires all inland and coastal waters to reach 'good' chemical and biological status by 2015. Flood risk management is unlikely to have a significant impact on chemical water quality except where maintenance works disturb sediment (such as de-silting) or where pollutants are mobilised from contaminated land by floodwaters. The main impact of the WFD on flood risk management, both now and in the future, relates to the ecological quality of water bodies. Channel works, such as straightening and deepening, or flood risk management schemes that modify geomorphological processes can change river morphology. The WFD aims to protect conservation sites identified by the EC Habitats Directive and

[7] Flood and Water Management Act, 2010

[8] Water Resources Act, 1991

[9] EU Water Framework Directive, 2000

Legislation	Key provisions
	Birds Directive that have water-related features, by designating them as 'protected sites'.

3.2 Local policy

Table 3.2: Local policy legislation and policy context

Legislation	Key provisions
Shropshire Local Development Framework[10] 2011	'**Policy CS18 – Sustainable Water Management** Developments will integrate measures for sustainable water management to reduce flood risk, avoid an adverse impact on water quality and quantity within Shropshire, including groundwater resources, and provide opportunities to enhance biodiversity, health and recreation, by ensuring that: Planning applications and allocations in the Site Allocations and Management of Development (SAMDev) DPD, are in accordance with the tests contained in PPS25, and have regard to the SFRAs for Shropshire; New development is designed to be safe, taking into account the lifetime of the development, and the need to adapt to climate change. Proposals should have regard to the design guidance provided in the SFRAs for Shropshire; All development within local surface water drainage areas, as identified by the Water Cycle Study, and any major development proposals, demonstrate that surface water will be managed in a sustainable and coordinated way. Proposals will be supported by either a Surface Water Management Statement or Plan, depending on the scale of the development; All developments, including changes to existing buildings, include appropriate sustainable drainage systems (SUDS) to manage surface water. All developments should aim to achieve a reduction in the existing runoff rate, but must not result in an increase in runoff; New development improves drainage by opening up existing culverts where appropriate; Proposals within areas of infrastructure capacity constraint, as identified by the Water Cycle Study and the Implementation Plan, and any major development, demonstrates that there is adequate water infrastructure in place to serve the development; New development enhances and protects water quality, including Shropshire's groundwater resources; New development, including changes to existing buildings, incorporate water efficiency measures, in accordance with the sustainability checklist in Policy CS6, to meet the water efficiency objectives within the

[10] Shropshire Local Development Framework: Adopted Core Strategy, Shropshire Council, March 2011

Legislation	Key provisions
	Shropshire Water Cycle Study to protect water resources and reduce pressure on wastewater treatment infrastructure.

3.3 Area guidance

Table 3.3: Area Guidance

Study	Overview of key provisions and policies
SFRA: Shropshire Level 1 Strategic Flood Risk Assessment[11] 2018	The principle aim of the SFRA was to map all forms of flood risk in order to provide an evidence base to locate new development. It also aims to provide appropriate policies for the management of flood risk and identify the level of detail required for site-specific FRAs. The SFRA contains information and maps detailing flood sources and risks. There is no information provided in the SFRA considered specific to flood risk within the site boundary or to Berrington. General guidance provided in the SFRA is summarised below. Sustainable Drainage Systems (SuDS) aim to mimic the natural processes of Greenfield surface water drainage by encouraging water to flow along natural flow routes and thereby reduce runoff rates and volumes during storm events while providing some water treatment benefits. SuDS also have the advantage of providing effective Blue and Green infrastructure and ecological and public amenity benefits when designed and maintained properly. Developers should refer to the Shropshire Council SuDS Handbook for guidance on how to design SuDS systems on new developments to meet Local SuDS standards
CFMP: River Severn Catchment Flood Management Plan[12] 2009	Catchment Flood Management Plans (CFMP) give an overview of the flood risk from inland sources across each river catchment and recommend ways of managing those risks now and over the next 50-100 years. The EA is responsible for producing CFMPs. The site falls within the 'Shropshire Tributaries' sub-catchment and the policy applicable to this site is Policy Option 2 which states "Areas of low to moderate flood risk where we can generally reduce existing flood risk management actions". The CFMP provides the following key proposed actions: 'Rely less on raised flood defences in the long term as this is not sustainable, by taking opportunities to restore sustainable natural storage of floodwater on undeveloped floodplains'; Surface water flooding is a growing problem. Local authorities are mainly responsible for managing this, but

[11] Shropshire Level 1 Strategic Flood Risk Assessment, JBA Consulting, October 2018

[12] River Severn Catchment Flood Management Plan: Summary Report, Environmental Agency, December 2009

Study	Overview of key provisions and policies
	it often has to be integrated with other organisations' assets, for example their sewers or rivers. and, Flooding cannot be entirely eliminated and so residents, owners, and businesses need to manage some risks themselves.'

3.4 Site-specific consultation

As part of this assessment, the following authorities have been contacted to obtain relevant data/guidance and establish key site constraints:

Table 3.4: Key site-specific consultations

Consultee	Date issued	Enquiry	Appendix
Lead Local Flood Authority (LLFA) – Shropshire Council	-	A pre-application enquiry submitted to obtain further flood information and policy guidance (20/12/2021). A response had not been received at the time of writing the report.	**-**
Environment Agency (EA)	January 2022	The response detailed that there are no records of historic flooding in the area and no detailed modelling of the nearby watercourse.	**Appendix C**

Key findings are referred to in the relevant part of Section 4 and full details are contained in the relevant appendices.

4 SOURCES OF FLOOD RISK

4.1 Criteria

In accordance with the NPPF[1] and advice from the EA, a prediction of the flood sources and levels is required along with the effects of climate change from the present for the design life of the development (in this case assumed to be 25 years).

Changes to climate change guidance in July 2021 indicate that increased allowances in peak river flow and rainfall intensity should now be incorporated within any assessment. The appropriate allowance for peak river flow is based on the site's location in the country, the lifetime of development, the relevant flood zone and the vulnerability of the proposed end use.

The flood risk elements that need to be considered for any site are defined in BS 8533 as the "Forms of Flooding" and are listed as:

Flooding from rivers (fluvial flood risk);
Flooding from the sea (tidal flood risk);
Flooding from the land;
Flooding from groundwater;
Flooding from sewers (sewer and drain exceedance, pumping station failure etc); and,
Flooding from reservoirs, canals and other artificial structures.

The following section reviews each of these in respect of the subject site.

4.2 Definitions of Risk

Table 4.1: Flood Map for Planning Risk Zoning

Flood Zone	Description
Flood Zone 1	Land assessed as having a less than 1 in 1,000 annual probability of river or sea flooding (<0.1%)
Flood Zone 2	Flood Zone 2 - land assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1% – 0.1%), or between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5% – 0.1%) in any year
Flood Zone 3	Land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%), or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.
Flood Zone 3b	Land having the potential to flood for storm events up to the 1 in 20 year return period (>5% annual probability of flooding occurring). It is classified as 'functional floodplain'

Table 4.2: Flood Risk from Rivers or the Sea and Flood Risk from Surface Water

Flood Risk	Description
High	High risk means that each year this area has a chance of flooding of greater than 3.3%. This takes into account the effect of any flood defences in the area. These defences reduce but do not completely stop the chance of flooding as they can be overtopped, or fail.
Medium	Medium risk means that each year this area has a chance of flooding of between 1% and 3.3%. This takes into account the effect of any flood defences in the area. These defences reduce but do not completely stop the chance of flooding as they can be overtopped, or fail.
Low	Low risk means that each year this area has a chance of flooding of between 0.1% and 1%. This takes into account the effect of any flood defences in the area. These defences reduce but do not completely stop the chance of flooding as they can be overtopped, or fail.
Very Low	Means that each year this area has a chance of flooding of less than 0.1%. This takes into account the effect of any flood defences in the area. These defences reduce but do not completely stop the chance of flooding as they can be overtopped, or fail.

Table 4.3: Flood Risk category matrix from Reservoirs, Groundwater, sewers and other artificial sources

Threat Probability	Low Impact	Medium Impact	High Impact
High	Medium	Medium	High
Medium	Low	Medium	Medium
Low	Low	Low	Low
Very Low	Very Low		

4.3 Flooding from rivers (fluvial flood risk)

4.3.1 Main river

The EA Flood Zone mapping study for England and Wales is available on their website at: https://flood-map-for-planning.service.gov.uk.

In December 2013, the EA released an additional form of mapping 'Risk of Flooding from Rivers and Sea', which shows the Environment Agency's assessment of the likelihood of flooding from rivers and the sea at any location and is based on the presence and effect of all flood defences, predicted flood levels, and ground levels, which is available at:

https://flood-warning-information.service.gov.uk/long-term-flood-risk

The latest Environment Agency published flood zone map (**Figure 4.1**) shows the site to be located in Flood Zone 1. The latest 'Risk of Flooding from Rivers and Sea' flood map (**Figure 4.2**), indicates that the site is considered to be at '**very low**' risk of flooding. There are areas at risk of flooding outside of the southern boundary, thought it is thought these areas are at significantly lower ground level than the site.

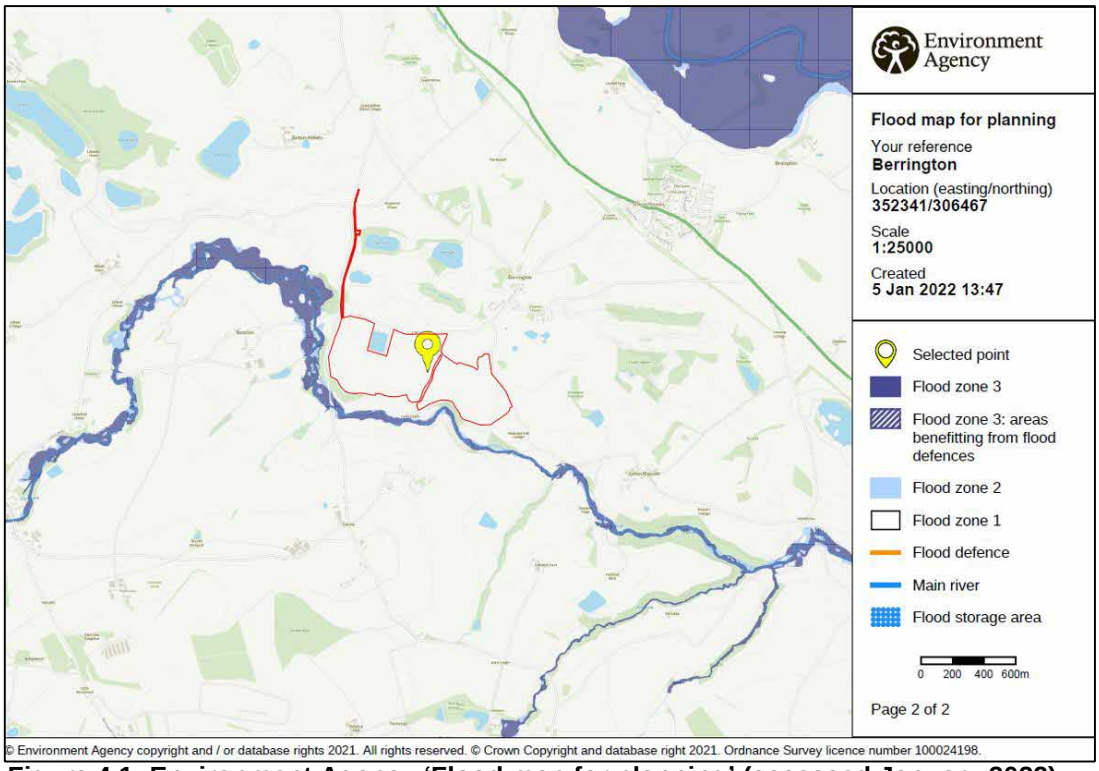


Figure 4.1: Environment Agency 'Flood map for planning' (accessed January 2022)

Figure 4.2: Environment Agency 'Flood risk from rivers or the sea' map (accessed January 2022)

The resultant fluvial flood risk to the site is considered to be **very low**.

4.3.2 Climate change

Fluvial flooding is likely to increase as a result of climate. A greater intensity and frequency of precipitation is likely to raise river levels and increase the likelihood of a river overtopping its banks. Climate change guidance for river modelling was updated by the EA in July 2021, however it is envisaged that climate change will not increase the fluvial risk to the site.

4.4 Flooding from the sea (tidal flood risk)

The site is not considered to be at risk from tidal flooding due to its inland location and its elevated position, indicating a '**very low**' risk of flooding.

4.4.1 Climate change

Climate change is not considered to result in an increased risk of tidal flooding to the site.

4.5 Flooding from the land (overland pluvial flood risk)

If intense rain is unable to soak into the ground or be carried through manmade drainage systems, for a variety of reasons, it can run off over the surface causing localised floods before reaching a river or other watercourse.

Generally, where there is impermeable surfacing or where the ground infiltration capacity is exceeded, surface water runoff can occur. Excess surface water flows from the site are believed to drain naturally to the local water features, either by overland flow or through infiltration.

The EA's surface water flood map (

Figure 4.3) shows the site is predominantly at a very low risk of surface water flooding. There are minor isolated areas of high risk flooding within the site boundary, however these are likely due to topographically low areas which impede drainage.

There are no major surface water flow paths developing on the site or flowing through the site. There is shown to be a surface water flow path on the south-eastern boundary which may indicate the presence of ditch within the treeline, however this will not impact upon the proposed development.

Given the proposed development, it is not likely that the solar panels and associated infrastructure will generate significant quantities of on-site surface water runoff. Where inverters and the access track, which contains the remainder of the equipment, are to be located, a means to control surface water runoff to prevent surface water flooding elsewhere will be considered. The scheme will incorporate a suitable surface water drainage system for the development and will ensure that any runoff generated from the development will be controlled and managed in a suitable manner. This is discussed further in **Section 7**.

As surface water flooding is not considered to impact on the proposed development, the risk of surface water flooding at the site is considered to be **very low**.

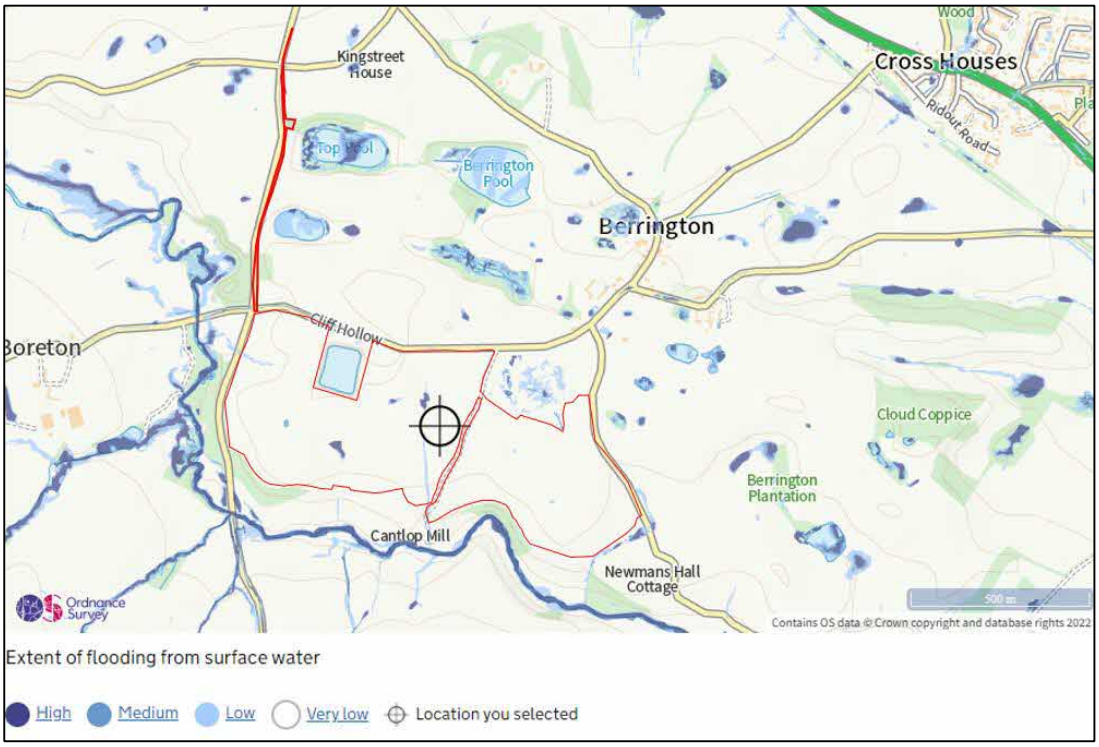


Figure 4.3: Environment Agency 'Flood risk from surface water' map (accessed January 2022)

4.5.1 Climate change

Surface water flooding is likely to increase as a result of climate change in a similar ratio to fluvial flooding. Increased intensity and frequency of precipitation is likely to lead to reduced infiltration and increased overland flow. Climate change guidance for rainfall intensity has been updated by the EA in July 2021. Revised allowances for climate change have been included in the indicative drainage strategy (refer to Section 7).

4.6 Flooding from groundwater

Groundwater flooding tends to occur after much longer periods of sustained high rainfall. Higher rainfall means more water will infiltrate into the ground and cause the water table to rise above normal levels. Groundwater tends to flow from areas where the ground level is high, to areas where the ground level is low. In low-lying areas, the water table is usually at shallower depths anyway, but during very wet periods, with all the additional groundwater flowing towards these areas, the water table can rise up to the surface causing groundwater flooding.

There is little evidence which can provide an indication of groundwater levels within the site area. The closest borehole log, as discussed in Section 2.1.4 is approximately 0.5km east of the site and records a Groundwater level of 32mbgl. On the contrary, the peat geology within the mire outside of the north-eastern boundary may indicate a Groundwater level close to the surface.

From the above and due to the sporadic nature of groundwater flooding, the design of the development and the possibility of groundwater emergence at the site, it is unlikely that groundwater flooding would affect the development.

Primarily due to nature of the development, the resultant groundwater flood risk is considered to be **low**. Further evidence is required to fully assess the Groundwater level at the site if later deemed as an important factor to the design of the development.

4.6.1 Climate change

Climate change could increase the risk of groundwater flooding as a result of increased precipitation filtering into the groundwater body. If winter rainfall becomes more frequent and heavier, groundwater levels may increase. Higher winter recharge may however be balanced by lower recharge during the predicted hotter and drier summers. This is less likely to cause a significant change to flood risk than from other sources, since groundwater flow is not as confined. It is probable that any locally perched aquifers may be more affected, but these are likely to be isolated. The change in flood risk is likely to be low.

4.7 Flooding from sewers

Flooding from artificial drainage systems occurs when flow entering a system, such as an urban storm water drainage system, exceeds its conveyance capacity, the system becomes blocked or it cannot discharge due to a high water level in the receiving watercourse. A sewer flood is often caused by surface water drains discharging into the combined sewer systems; sewer capacity is exceeded in large rainfall events causing the backing up of floodwaters within properties or discharging through manholes.

Most adopted surface water drainage networks are designed to the criteria set out in Sewers for Adoption[13]. One of the design parameters is that sewer systems be designed such that no flooding of any part of the site occurs in a 1 in 30 year rainfall event. By definition a 1 in 100 year event would exceed the capacity of the surrounding sewer network as well as any proposed drainage.

Sewer records obtained from Severn Trent Water (**Appendix D**), show there to be no Severn Trent Water assets on-site or within the vicinity of the site.

Development has the potential to cause an increase in impermeable area, an associated increase in surface water runoff rates and volumes, and a consequent potential increase in downstream flood risk due to overloading of sewers, watercourses, culverts and other drainage infrastructure.

To ensure that sewer and surface water flooding is not exacerbated; surface water must be considered within the design of the site. This ensures that any additional surface water and overland flows are managed correctly, to minimise flood risk to the site and the surrounding area.

The resultant sewer flood risk is considered to be **very low**.

[13] WRC, 'Sewers for Adoption' 8th Edition, August 2018

4.7.1 Climate change

The impact of climate change is likely to be negative regarding flooding from sewers. Increased rainfall and more frequent flooding put existing sewer and drainage systems under additional pressure resulting in the potential for more frequent surcharging and potential flooding. This would increase the frequency of local sewer flooding but would not impact the site.

4.8 Other sources of flooding

4.8.1 Reservoirs

Flood events can occur from a sudden release of large volumes of water from reservoirs, canals and artificial structures.

The EA reservoir flood map (reproduced as **Figure 4.4**) shows the largest area that might be flooded if a reservoir were to fail and release the water it holds. Since this is a prediction of a worst-case scenario, it is unlikely that any actual flood would be this large. According to the EA Reservoir flood maps the site is not at risk of flooding from reservoirs.

Reservoir flooding is also extremely unlikely. There has been no loss of life in the UK from reservoir flooding since 1925. Since then reservoir safety legislation has been introduced to ensure reservoirs are maintained.

The resultant flood risk is considered to be **very low**.

Reservoirs can be managed over time, controlling inflow/outflow of water and therefore there is the capacity to control the effects of climate change. Increased rainfall has the potential to increase base flow, but this should be minimal. It is unlikely that there will be a substantial change to the risk of flooding for this site.

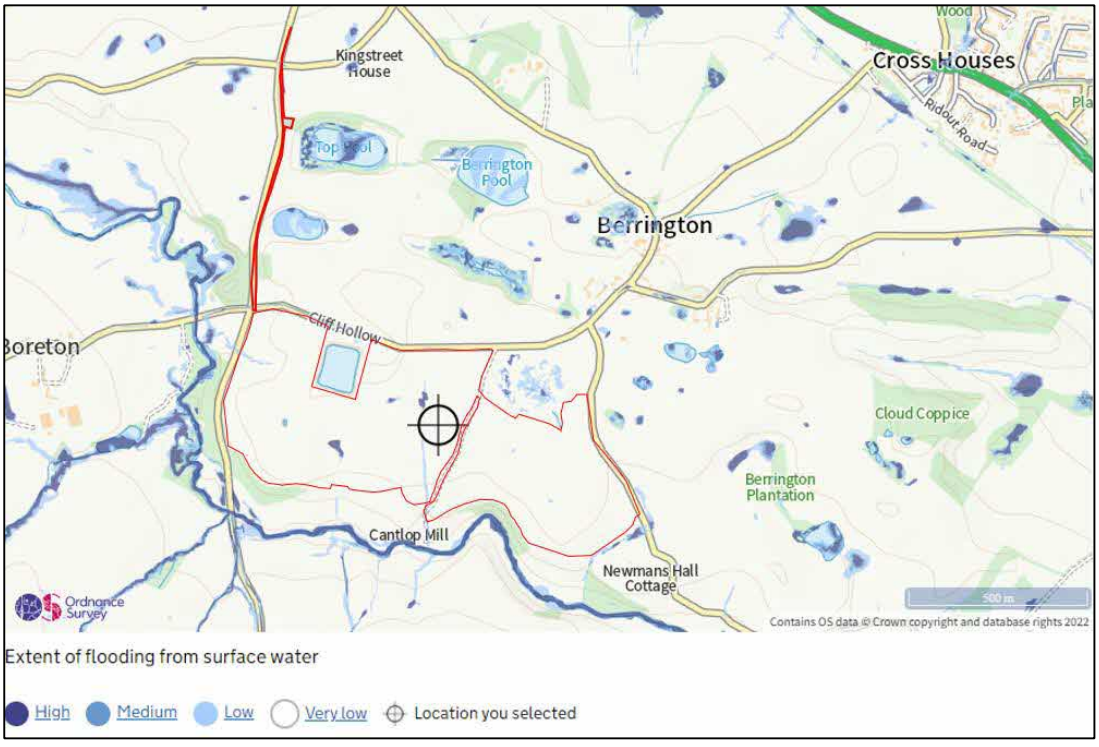


Figure 4.4: Environment Agency 'Flood risk from reservoirs' map (accessed January 2022)

4.8.2 Canals

There are no Canal & Rivers Trust owned canals by the within the vicinity of the site. As a result, the risk to the site from this source is considered very low.

4.8.3 Blockages of artificial drainage systems

There is a possibility that flooding may result due to culverts and/or sewers being blocked by debris or structural failure. This can cause water to backup and result in localised flooding, as well as placing areas with lower ground levels at risk.

Outside of the north-western boundary is an artificial waterbody raised above the surrounding ground level. Though not classified as a reservoir, the waterbody is thought to be retaining water for agricultural use. It is likely the levels are carefully managed and the levels will change seasonally.

If the banks of the waterbody were to breach then there may be localised flooding with damage to nearby equipment. The risk of flooding from artificial drainage systems is considered to be **low**.

Climate change is unlikely to affect the flooding risk to the site from such blockages.

5 FLOOD MITIGATION MEASURES

5.1 Overview

The site lies within Flood Zone 1 with no significant sources of flooding identified to the site. The development proposals should ensure there is no exacerbation of flood risk offsite as a result of the development, therefore to facilitate the development of the site a surface water drainage network has been designed.

5.2 Overland flood flow

No further overland flow control measures are proposed as all surface water runoff from impermeable areas up to the 1 in 100 year climate change storm will be stored on-site and discharged via natural infiltration into the ground.

5.3 Finished floor levels

As this site will not be affected by fluvial flooding and no significant risks have been identified associated with flooding from other sources, there is no need to incorporate any freeboard levels into the finished floor levels of the design. Low lying areas that could lead to ponding of surface flows will be avoided by careful design of finished levels.

5.4 Flood compensation

The site is shown to be outside of the 1 in 100 year plus climate change fluvial flood extent, so floodplain compensatory measures are not deemed necessary.

5.5 Safe access/egress

The site lies outside of the 1 in 1000 year fluvial flood extent, therefore safe access and egress will be available up to this storm event.

6 PLANNING CONTEXT

6.1 Application of planning policy

Section 14 of the NPPF includes measures specifically dealing with development planning and flood risk using a sequential characterisation of risk based on planning zones and the EA Flood Map. The main study requirement is to identify the flood zones and vulnerability classification relevant to the proposed development, based on an assessment of current and future conditions.

6.2 Land use vulnerability

Planning Practice Guidance (PPG) includes a list of appropriate land uses in each flood zone dependent on vulnerability to flooding. In applying the Sequential Test, reference is made to **Table 6.1** below, reproduced from Table 3 of PPG.

Table 6.1: Flood risk vulnerability and flood zone 'compatibility'

Flood Risk Vulnerability Classification		Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Flood Zone	Zone 1	**Appropriate**	Appropriate	Appropriate	Appropriate	Appropriate
	Zone 2	Appropriate	Appropriate	Exception Test Required	Appropriate	Appropriate
	Zone 3a	Exception Test Required	Appropriate	Should not be permitted	Exception Test Required	Appropriate
	Zone 3b functional floodplain	Exception Test Required	Appropriate	Should not be permitted	Should not be permitted	Should not be permitted

With reference to Table 2 of the PPG, the use as a solar farm energy production site is classed as 'Essential Infrastructure'. This classification of development is appropriate for areas within Flood Zone 1 and therefore appropriate for the subject site.

6.3 Sequential Test

The Sequential Test aims to direct new development to areas with the lowest probability of flooding. The site has been identified as located within Flood Zone 1 with no other significant flooding issues from other sources. It is therefore considered to pass the Sequential Test.

6.4 Exception Test

In accordance with **Table 6.1**, there is no requirement to apply the Exception Test for an ‘essential infrastructure’ development within Flood Zone 1.

7 SURFACE WATER DRAINAGE ASSESSMENT

7.1 Scope

The site is located in Flood Zone 1 and is greater than 1Ha in size, therefore the EA requires such development to focus on the management of surface water run-off. This section discusses the potential quantitative effects of the development on both the risk of surface water flooding on-site and elsewhere within the catchment, as well as the type of potential SuDS features that could be incorporated as part of the masterplan.

In accordance with the Defra Non-Statutory Technical Standards, the surface water drainage strategy should seek to implement a SuDS hierarchy that aspires to achieve reductions in surface water runoff rates to greenfield rates. Where a reduction to the greenfield rate is not practicable, the proposed surface water drainage strategy should not exceed the existing runoff rate.

In addition, Building Regulations Part H[14] requires that the first choice of surface water disposal should be to discharge to an adequate soakaway or infiltration system, where practicable. If this is not reasonably practicable then discharge should be to a watercourse, the least favourable option being to a sewer (surface water before combined). Infiltration techniques should therefore be applied wherever they are appropriate.

This assessment includes an overview and comparison of the existing greenfield scenario and proposed development scenario.

7.2 Pre-development situation

The existing site area is 44.09Ha and 0% impermeable.

The pro-rata IoH 124 method[15] has been used to estimate the Greenfield surface water runoff for the total site area of the site, shown in **Table 7.1**. Calculations are contained in **Appendix E**.

Table 7.1: IOH 124 surface water runoff (greenfield) for total site area (44.09Ha)

Return period	Peak flow (l/s)
QBar	17.09
1 in 1 year	133.5
1 in 30 year	35.0
1 in 100 year	45.9

[14] HM Government (2010 with 2013 amendments), 'The Building Regulations 2010: Approved Document H - Drainage and Waste Disposal (2002 Edition incorporating 2010 amendments)'

[15] Institute of Hydrology (IoH), 'Flood Estimation for small catchments - Report 124', 1994

7.3 Off-site discharge options and limits

7.3.1 Infiltration

Infiltration should be considered as the primary option to discharge surface water from the developed site. The effectiveness of infiltration is completely dependent on the physical conditions at the site. Potential obstacles include:

Local variations in permeability preventing infiltration – It is understood from the BGS geological mapping that the site is underlain with superficial clay, silt, sand and gravel geology, underlain with chalk bedrock geology;

Shallow groundwater table - For infiltration drainage devices, Building Regulation approved document H states that these "should not be built in ground where the water table reaches the bottom of the device at any time of the year" The resting water level within nearby BGS boreholes, located 0.2km east of the site, was recorded at a depth of 32mbgl; and,

Source Protection Zones - The site is located within a Groundwater Source Protection Zone III – Total catchment.

Based on the underlying geology of the site, any infiltration techniques used in the surface water drainage design will be designed based off assumed infiltration rates, pending any infiltration testing.

7.3.2 Discharge to watercourse

Discharging surface water directly to a local watercourse is not considered feasible for the site, as there are no drainage ditches / ordinary watercourses on or within the nearby vicinity of the site.

7.3.3 Discharge to surface water sewer

There are no surface water sewers on-site or within the vicinity of the site, hence discharge to sewer is not a feasible option.

7.4 Post-development situation

According to the principles of the BRE planning guidance for the development of large-scale ground mounted solar PV systems, in general solar panels do not increase the impermeable area of a site and it is generally considered that they do not contribute to an increase in surface water runoff from the site.

The solar panels will not increase the impermeable area across the site; therefore, no formal drainage is required. As such a pragmatic approach has been developed to promote infiltration and provide storage areas across the site. This will involve the design of backfilled trenches / swale features for the inverter stations. These features will intercept and attenuate runoff, promoting infiltration across the site.

7.4.1 Solar arrays

7.4.1.1 Design

It is anticipated that any precipitation falling on each solar panel will runoff the panels and flow towards / infiltrate in the rain shadow of the down-slope modules. The rows of panels

on the site are generally aligned from parallel to a 45º angle to the contours of the site. As such rainwater falling of the trailing edge of the panels will generally flow away from the base of the panels between a 90º and 45º angle towards the rain shadow of the down-slope panels. This feature will enable the use of the rain shadow area of the panels to maintain the infiltration potential of the site.

In some instances, runoff from solar panels could result in the kinetic compaction of soils at the base of the panels and the intensification of runoff into rivulets running along the trailing edge of the rows of panels. This could conceivably lead to a slight increase in the amount of runoff when compared to the pre-development situation resulting from a decrease in infiltration potential.

The specifications of the solar array supports are to be designed to be widely spaced and are driven vertically into the ground with no additional foundations. The arrays are in rows with spaces of several metres in between the leading edge of one row and the trailing edge of the row behind.

The panels are typically mounted in triple horizontal rows and are separated by a horizontal 'rainwater' gap. This gap allows rainwater to drain freely to the ground between the panels helping to replicate the Greenfield runoff conditions.

7.4.1.2 Vegetation and soil structure

Sustainable management of the post development situation in terms of vegetation planting and soil type can be used as a means of managing surface water runoff from the solar panels. As such to ensure that there is no increase in surface water runoff managed sustainable vegetation (with a good soil structure e.g. chisel ploughed soils) will be allowed to grow beneath the solar panels, which will avoid kinetic compaction and ensure that any potential instances of rivulet formation are minimised and surface water runoff flows over the ground in a natural way. Vegetation planting and soil management should be site wide to encompass all solar panel rows.

7.4.2 Drainage

It is intended that surface water runoff from the power stations (9 in total) and storage facility will be discharged to the ground after passing through a drainage trench to closely mimic the existing situation. The design rainfall event for this assessment has been taken as the 6 hour, 1 in 100-year event with the intention of retaining any additional surface water runoff generated as a result of the development on the site in the drainage trench. The possible methods of discharging surface water from the site will be via the existing drainage infrastructure on site or due to the small volumes of runoff, by using natural infiltration / evaporation.

Table 7.2 details the specifications of the indicative drainage trenches that could be used to serve the inverter stations.

The length of the drainage trench has been determined using the perimeters of the inverter stations, power stations. It is intended that test ditches are backfilled with a granular material for health and safety reasons and to allow access.

The rainfall data used in the calculations has been gathered from the Centre of Ecology and Hydrology's Flood Estimation Handbook rainfall database, Point rainfall at 352243, 306493. In accordance with National Planning Policy Framework, climate change has

been taken into consideration for the lifetime of the development; as such an increase in rainfall of 20% has been included in the storage requirements.

Table 7.2: Approximate Drainage Trench Sizing and Volumes

Description	1 in 100-year Rainfall (m)	Impermeable Development Area (m^2)	1 in 100 yr Surface Water Volume Required (m^3)	1 in 100yr Volume Required with 20% Climate Change (m^3)	Trench Sizing				Volume Created (m^3)*
					Side Slope	Base Width (m)	Depth (m)	Length (m)	
Power Station	0.072	8.33	0.6	0.72	Vertical	1.0	0.8	3	0.72
Storage Facility	0.072	30	2.16	2.6	Vertical	1.0	0.9	10	2.7

*Assuming a void ratio of 0.3

The attenuation volume (m^3) calculated per metre for the hardstanding, has been calculated using a void ratio of 0.3 of the total volume of aggregate in the trench. The trenches are to be a back filled with suitably sized and sourced aggregate, to allow appropriate attenuation.

If natural infiltration on-site is not adequate to effectively discharge surface water runoff from the inverter stations, the trenches would be utilised as on-site attenuation. These would be designed to store excess runoff before naturally discharging at greenfield rates across the site.

Figure 7.1 shows the cross-sectional diagram of the proposed infiltration trenches surrounding the inverter stations.

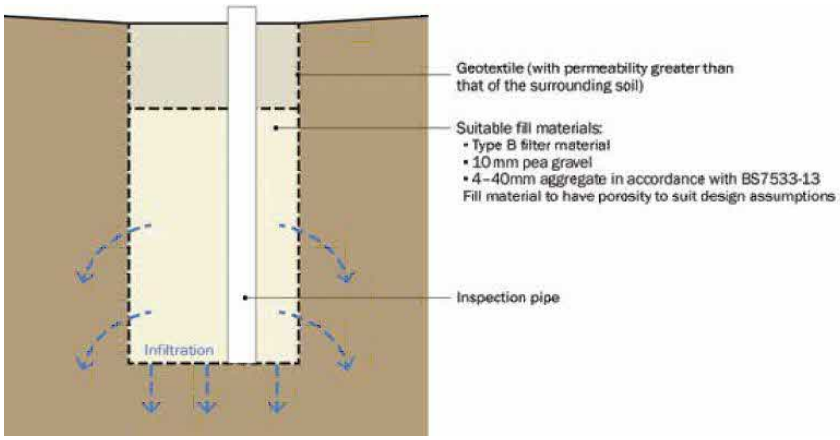


Figure 7.1: Cross-sectional diagram of an infiltration trench (taken from Ciria document C753)

7.4.3 Access track surface water drainage

Where required, access tracks are kept to a minimum, and be a temporary measure. As such, 'floating roads' could be used on site, typically these will require a wide strip of geotextile laid on the ground covered by a nominal layer of stone to form the track. As such the access tracks will maintain a permeable nature and not increase the surface water runoff from the development. Any flows in excess of the infiltration rates will discharge to the surrounding ground and will not impact on land outside of the site. For solar panel maintenance access could be gained by way of using 4x4 vehicle, quadbike or agricultural vehicles to minimise impacts on the ground.

Although part of the access track crosses the high risk surface water flow path, this should not disrupt the route of the existing flow path as it will be made from permeable material.

7.4.4 Maintenance

Maintenance of any drainage network is essential to ensure optimal performance of the drainage elements. As such maintenance requirements of the drainage system will include, but not be limited to the inspection and cleaning of backfilled trenches / swales to ensure that the capacity and infiltration rates are maintained.

The drainage systems are likely to remain in private ownership and therefore the site operator will be responsible for the maintenance of the drainage features on-site.

8 CONCLUSIONS AND RECOMMENDATIONS

This FRA complies with the NPPF and Planning Practice Guidance and demonstrates that flood risk from all sources has been considered in the proposed development. It is also consistent with the Local Planning Authority requirements with regard to flood risk.

The site lies in an area designated by the EA as Flood Zone 1, outlined to have a chance of flooding of 1 in 1000 or less (≤0.1%) in any year.

NPPF sets out a Sequential Test, which states that preference should be given to development located within Flood Zone 1. This flood risk assessment demonstrates that the requirements of the Sequential Test have been met, with the site area located within Flood Zone 1 and 'Essential Infrastructure' classification of the development.

This flood risk assessment has considered multiple sources of flooding and concluded the following:

Table 8.1: Flood risk summary

Source	Level of risk	Mitigation
Fluvial	Very Low	The site is wholly located within Flood Zone 1
Tidal	Very Low	The site is inland and elevated.
Surface water	Very Low	The isolated areas of high risk are not deemed significant to the development proposals.
Groundwater	Low	Further evidence is required ascertain groundwater levels, though not considered significant due the nature of the development proposals.
Sewers	Very Low	There are no sewers which cross the site.
Reservoirs	Very Low	The site in not located in an area at risk from reservoir flooding.
Artificial sources	Low	There is a waterbody outside of the northern boundary which may pose as a risk.

The site is currently a greenfield site and is existing agricultural land. The proposed development will only alter the impermeable area on site by a diminutive amount, resulting in a negligible increase in surface water runoff. The solar panels will not increase the impermeable area on-site, and therefore will not increase the volume of surface water runoff.

NPPF sets out a Sequential Test, which states that preference should be given to development located within Flood Zone 1. This flood risk assessment demonstrates that the requirements of the Sequential Test and the Exception Test have been met, with the

site's location within Flood Zone 1 and 'Essential Infrastructure' classification of the development.

Overall, taking into account the above points, the development of the site should not be precluded on flood risk grounds.

APPENDIX A
RSK GROUP SERVICE CONSTRAINTS

1. This report and the drainage design carried out in connection with the report (together the "Services") were compiled and carried out by RSK LDE Ltd (RSK) for Econergy International Ltd (the "client") in accordance with the terms of a contract between RSK and the "client". The Services were performed by RSK with the skill and care ordinarily exercised by a reasonable civil engineer at the time the Services were performed. Further, and in particular, the Services were performed by RSK taking into account the limits of the scope of works required by the client, the time scale involved and the resources, including financial and manpower resources, agreed between RSK and the client.

2. Other than that expressly contained in paragraph 1 above, RSK provides no other representation or warranty whether express or implied, in relation to the Services.

3. Unless otherwise agreed in writing, the Services were performed by RSK exclusively for the purposes of the client. RSK is not aware of any interest of or reliance by any party other than the client in or on the Services. Unless expressly provided in writing, RSK does not authorise, consent or condone any party other than the client relying upon the Services. Should this report or any part of this report, or otherwise details of the Services or any part of the Services be made known to any such party, and such party relies thereon that party does so wholly at its own and sole risk and RSK disclaims any liability to such parties. Any such party would be well advised to seek independent advice from a competent environmental consultant and/or lawyer.

4. It is RSK's understanding that this report is to be used for the purpose described in the introduction to the report. That purpose was a significant factor in determining the scope and level of the Services. Should the purpose for which the report is used, or the proposed use of the site change, this report may no longer be valid and any further use of or reliance upon the report in those circumstances by the client without RSK's review and advice shall be at the client's sole and own risk. Should RSK be requested to review the report after the date of this report, RSK shall be entitled to additional payment at the then existing rates or such other terms as agreed between RSK and the client.

5. The passage of time may result in changes in site conditions, regulatory or other legal provisions, technology or economic conditions which could render the report inaccurate or unreliable. The information and conclusions contained in this report should not be relied upon in the future without the written advice of RSK. In the absence of such written advice of RSK, reliance on the report in the future shall be at the client's own and sole risk. Should RSK be requested to review the report in the future, RSK shall be entitled to additional payment at the then existing rate or such other terms as may be agreed between RSK and the client.

6. The observations and conclusions described in this report are based solely upon the Services, which were provided pursuant to the agreement between the client and RSK. RSK has not performed any observations, investigations, studies or testing not specifically set out or required by the contract between the client and RSK. RSK is not liable for the existence of any condition, the discovery of which would require performance of services not otherwise contained in the Services. For the avoidance of doubt, unless otherwise expressly referred to in the introduction to this report, RSK did not seek to evaluate the presence on or off the site of asbestos, electromagnetic fields, lead paint, heavy metals, radon gas or other radioactive or hazardous materials.

7. The Services are based upon RSK's observations of existing physical conditions at the site gained from a walk-over survey of the site together with RSK's interpretation of information including documentation, obtained from third parties and from the client on the history and usage of the site. The Services are also based on information and/or analysis provided by independent testing and information services or laboratories upon which RSK was reasonably entitled to rely. The Services clearly are limited by the accuracy of the information, including documentation, reviewed by RSK and the observations possible at the time of the walk-over survey. Further RSK was not authorised and did not attempt to independently verify the accuracy or completeness of information, documentation or materials received from the client or third parties, including laboratories and information services, during the performance of the Services. RSK is not liable for any inaccurate information or conclusions, the discovery of which inaccuracies required the doing of any act including the gathering of any information which was not reasonably available to RSK and including the doing of any independent investigation of the information provided to RSK save as otherwise provided in the terms of the contract between the client and RSK.

8. The phase II or intrusive environmental site investigation aspects of the Services is a limited sampling of the site at pre-determined borehole and soil vapour locations based on the operational configuration of the site. The conclusions given in this report are based on information gathered at the specific test locations and can only be extrapolated to an undefined limited area around those locations. The extent of the limited area depends on the soil and groundwater conditions, together with the position of any current structures and underground facilities and natural and other activities on site. In addition, chemical analysis was carried out for a limited number of parameters [as stipulated in the contract between the client and RSK] [based on an understanding of the available operational and historical information,] and it should not be inferred that other chemical species are not present.

9. Any site drawing(s) provided in this report is (are) not meant to be an accurate base plan, but is (are) used to present the general relative locations of features on, and surrounding, the site. Features (boreholes, trial pits etc) annotated on site plans are not drawn to scale but are centred over the appropriate location. Such features should not be used for setting out and should be considered indicative only.

APPENDIX B
PROPOSED SITE LAYOUT

APPENDIX C
ENVIRONMENT AGENCY CORRESPONDENCE

Product 4 (Detailed Flood Risk Data) for Berrington Farm, Smithy, Shrewsbury, SY5 6HD

Reference number: 246031
Date of issue: 04 January 2021

We are unable to provide you with a full product response because:

- There is no detailed modelled information available for this site.
- We do not have any records of flooding in this area.

Flood Map for Planning (Rivers and Sea)

The Flood Map for planning (Rivers and Sea) indicates the area at risk of flooding, assuming no flood defences exist, for a flood event with a 0.5% chance of occurring in any year for flooding from the sea, or a 1% chance of occurring for fluvial (river) flooding (flood zone 3). It also shows the extent of the Extreme Flood Outlines (Flood zone 2) which represents the extent of a flood event with a 0.1% chance of occurring in any year, or the highest recorded historic extent if greater. The flood zones refer to the land at risk of flooding and does not refer to individual properties. It is possible for properties to be built at a level above the floodplain but still fall within the risk area.

The Flood Map only indicates the extent and likelihood of flooding from rivers or the sea. It should also be remembered that flooding may occur from other sources such as surface water sewers, road drainage, etc.

To find out which flood zone a location is in please use: https://flood-map-for-planning.service.gov.uk/

Definition of flood zones

- Zone 1 - The area is within the lowest probability of flooding from rivers and the sea, where the chance of flooding in any one year is less than 0.1% (i.e. a 1000 to 1 chance).
- Zone 2 - The area which falls between the extent of a flood with an annual probability of 0.1% (i.e. a 1000 to 1 chance) fluvial and tidal, or greatest recorded historic flood, whichever is greater, and the extent of a flood with an annual probability of 1% (i.e. a 100 to 1 chance) fluvial / 0.5% (i.e. a 200 to 1 chance) tidal. (Land shown in light blue on the Flood Map).

- Zone 3 - The chance of flooding in any one year is greater than or equal to 1% (i.e. a 100 to 1 chance) for river flooding and greater than or equal to 0.5% (i.e. a 200 to 1 chance) for coastal and tidal flooding.

Note: The Flood Zones shown on the Environment Agency's Flood Map for Planning (Rivers and Sea) do not take account of the possible impacts of climate change and consequent changes in the future probability of flooding. Reference should therefore also be made to the Strategic Flood Risk Assessment when considering location and potential future flood risks to developments and land uses.

Areas Benefitting From Defences

Where possible we show the areas that benefit from the flood defences, in the event of flooding:

- from rivers with a 1% (1 in 100) chance in any given year, or;
- from the sea with a 0.5% (1 in 200) chance in any given year.

If the defences were not there, these areas would flood. Please note that we do not show all areas that benefit from flood defences.

The associated Dataset is available here: https://data.gov.uk/dataset/flood-map-for-planning-rivers-and-sea-areas-benefiting-from-defences

Recorded Flooding

Following examination of our records of historical flooding we have no record of flooding in the area. The absence of coverage for an area does not mean that the area has never flooded, only that we do not currently have records of flooding in this area. It is also possible that the pattern of flooding in this area has changed and that this area would now flood or not flood under different circumstances.

Please note; the records of flooding from between October 2019 and March 2020 and beyond are still being reviewed, the outcomes of which have not yet been published or reflected within this request for information.

You may also wish to contact your Local Authority or Internal Drainage Board, to see if they have other relevant local flood information.

Flood Defences

Flood defences do not completely remove the chance of flooding. They can be overtopped by water levels which exceed the capacity of the defences.

If flood defences are located in your area, you can access this data here: https://data.gov.uk/dataset/spatial-flood-defences-including-standardised-attributes

Planning developments

If you have requested this information to help inform a development proposal, then you should note the information on GOV.UK on the use of Environment Agency Information for Flood Risk Assessments. You can also request pre application advice:

https://www.gov.uk/planning-applications-assessing-flood-risk
https://www.gov.uk/government/publications/pre-planning-application-enquiry-form-preliminary-opinion

Supporting Information

Surface Water

Managing the risk of flooding from surface water is the responsibility of Lead Local Flood Authorities. The 'risk of flooding from surface water' map has been produced by the Environment Agency on behalf of government, using information and input from Lead Local Flood Authorities.

You may wish to contact your Local Authority who may be able to provide further detailed information on surface water.

It is not possible to say for certain what the flood risk is but we use the best information available to provide an indication so that people can make informed choices about living with or managing the risks. The information we supply does not provide an indicator of flood risk at an individual site level. Further information can be found on the Agency's website:

https://flood-warning-information.service.gov.uk/long-term-flood-risk

Flood Risk from Reservoirs

The Flood Risk from Reservoirs map can be found on the Long Term Flood Risk Information website:

https://flood-warning-information.service.gov.uk/long-term-flood-risk/map?map=Reservoirs

Flood Alert & Flood Warning Area

We issue flood alert/warnings to specific areas when flooding is expected. If you receive a flood warning you should take immediate action.

You can check whether you are in a Flood Alert/Warning Area and register online using the links below:

https://www.gov.uk/check-flood-risk

https://www.gov.uk/sign-up-for-flood-warnings

Email: Enquiries_Westmids@environment-agency.gov.uk
Website: www.gov.uk/government/organisations/environment-agency

If you would prefer to register by telephone, or if you need help during the registration process, please call Floodline on 0345 988 1188.

The associated dataset for flood warning areas is available here: https://data.gov.uk/dataset/flood-warning-areas3

The associated dataset for flood alert areas is available here: https://data.gov.uk/dataset/flood-alert-areas2

Flood Risk Activity Permits

We now consider applications for works, which may be Flood Risk Activities, under Environmental Permitting Regulations. This replaces the process of applying for a Flood Defence Consent. You may need an environmental Permit for flood risk activities if you want to do work:

- in, under, over or near a main river (including where the river is in a culvert)
- on or near a flood defence on a main river
- in the flood plain of a main river
- on or near a sea defence

Please go to this website to find out more about how to apply: https://www.gov.uk/guidance/flood-risk-activities-environmental-permits.
Please be aware that Bespoke and Standard Rules permits can take up to 2 months to determine and will incur a charge.

Further details about the Environment Agency information supplied can be found on the GOV.UK website:

https://www.gov.uk/browse/environment-countryside/flooding-extreme-weather

Flood Risk and Coastal Change

Climate Change allowances for planning (SHWG area)

August 2021

The National Planning Practice Guidance refers to Environment Agency guidance on considering climate change in planning decisions which is available online: https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

This has been updated and replaces the March 2016 guidance.

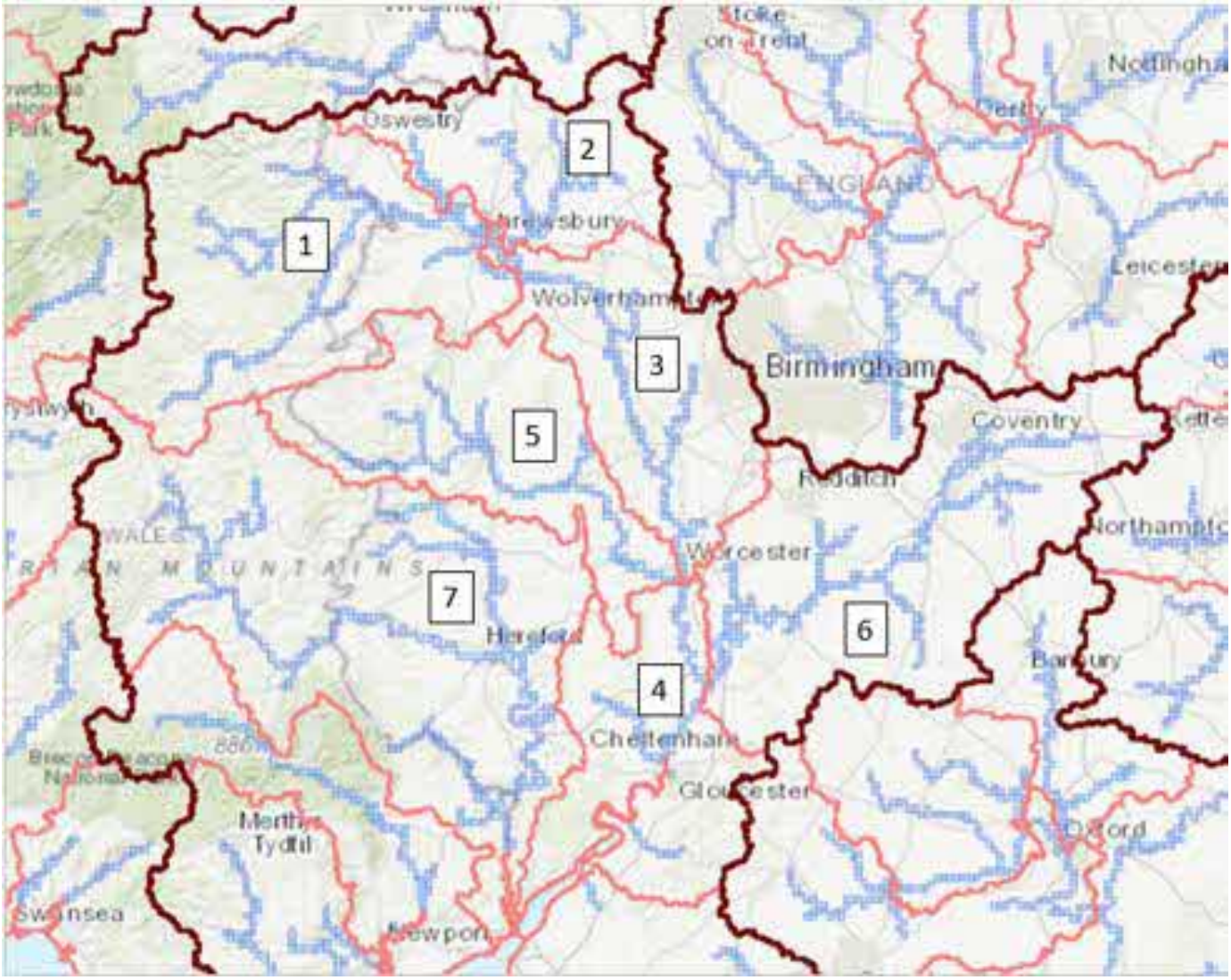
It should be used to help planners, developers and advisors implement the National Planning Policy Framework (NPPF)'s policies and practice guidance on flood risk. It will help inform Flood Risk Assessments (FRA's) for planning applications, local plans, neighbourhood plans and other projects.

Fluvial flooding – peak river flows

NPPG advises that an allowance should be added to 'peak river flows' to account for 'climate change' which should be specific to a 'management catchment' and development type (vulnerability). To work out which management catchment allowances to use, you need to: access the climate change allowances for peak river flow map

In Shropshire, Herefordshire, Worcestershire and Gloucestershire area, we would refer you to the map extract on page 2 below. This outlines the **'peak river flows'** within the specific 'Management catchments' for the Severn River Basin District, and specifies the range of percentage allowances to reflect individual development's vulnerability and lifetime. The following allowances should be used:

Development Vulnerability	Allowance (lifetime)
Essential Infrastructure	Higher Central - 2080's
Highly Vulnerable and More Vulnerable (residential)	Central - 2080's
Less Vulnerable and Water Compatible	Central - 2050's



1. Severn UplandsPeak River Flows	2020's	2050's	2080's
Higher Central	17%	24%	43%
Central	13%	18%	33%

2. Severn Middle Shrops Peak River Flows	2020's	2050's	2080's
Higher Central	20%	25%	44%
Central	15%	18%	33%

3. Severn Middle Worcs River Flows	2020's	2050's	2080's
Higher Central	16%	21%	40%
Central	12%	15%	30%

4. Severn Vale Peak River Flows	2020's	2050's	2080's
Higher Central	20%	28%	53%
Central	14%	19%	37%

5. Teme Peak River Flows	2020's	2050's	2080's
Higher Central	21%	33%	60%
Central	16%	24%	45%

6. Avon Peak River Flows	2020's	2050's	2080's
Higher Central	12%	14%	32%
Central	7%	8%	21%

7. Wye Peak River Flows	2020's	2050's	2080's
Higher Central	19%	27%	49%
Central	14%	20%	37%

Extract: Management Catchments within the Severn River Basin District – refer to interactive peak river flow map for more detail. The Environment Agency also provide these allowances in the peak river flow climate change allowances by management catchment **table** – you have to know your management catchment to get the information you need. (Allowances reflect the latest projections in UKCP18 and subsequent research that models how the latest rainfall projections are likely to affect peak river flows).

Sea Level rise allowances

Table 3 of the guidance (extract below) indicates that net sea level risk is as follows (updated from the 2013 version).

Area of England	Allowance	2000 to 2035 (mm)	2036 to 2065 (mm)	2066 to 2095 (mm)	2096 to 2125 (mm)	Cumulative rise 2000 to 2125 (metres)
South West	Higher central	5.8 (203)	8.8 (264)	11.7 (351)	13.1 (393)	1.21
South West	Upper end	7 (245)	11.4 (342)	16 (480)	18.4 (552)	1.62

Note - For sites utilising the Severn tidal model the above allowances should be considered and applied. As of August 2020, specific updated flood level data is now available for the 2096 to 2125 epoch based upon the Environment Agency's Tidal Severn model within the West Midlands area and will be provided where relevant as part of our Request For Information service; contact Enquiries_Westmids@environment-agency.gov.uk

Flood Risk Assessment considerations:

The design flood (1% flood level fluvial, or 0.5% tidal, plus climate change allowance) should be used to inform the sequential test, including appropriate location of built development; consideration of flood risk impacts, mitigation/enhancement and ensure 'safe' development.

Vulnerability classification

- Development classed as 'Essential Infrastructure' (as defined within Table 2 - Flood Risk Vulnerability Classification, Paragraph: 066 Reference ID: 7-066-20140306 of the NPPG) should be designed to the 'higher central' climate change allowance (2080).
- For highly vulnerable or more vulnerable development e.g. housing, the FRA should use the 'central' climate change allowance (2080), as a minimum, to inform built in resilience.
- For water compatible or less vulnerable development e.g. commercial, the FRA should use the 'central' climate change allowance (2050), as a minimum, to inform built in resilience.

Assessing off-site impacts and calculating floodplain storage compensation

The appropriate allowance to assess off-site impacts and calculate floodplain storage compensation depends on land uses in affected areas. Use the central 2080 allowance for most cases (including where more vulnerable or highly vulnerable is affected) but apply the higher central allowance when the affected area contains essential infrastructure.

Modelling approach

- **Major Development**:

For 'major' development (as defined within The Town and Country Planning Development Management Procedure (England) Order 2015)*, see definition note below, we would expect a detailed FRA to provide an appropriate assessment (hydraulic model) of the 1% with relevant climate change ranges.
There are two options:

Scenario 1 - Produce a model and incorporate relevant climate change allowances within your Management catchment area location.

Scenario 2 - Re-run an existing model and incorporate relevant climate change allowances as specified in the Management catchment area data.

- **Non Major Development**:

For 'non major' development, we would advise that a model is produced or existing model is re-run, similar to the above approach (Scenario 1 and 2). This would give a greater degree of certainty on the design flood extent to inform a safe development.

However, for 'non major' development only, in the absence of modelled climate change information it may be reasonable to utilise an alternative approach. To assist applicants and Local Planning Authorities we have provided some 'nominal' climate change allowances within the 'Table of nominal allowances' below. These should be considered as appropriate within any FRA. There are three additional options:

Scenario 3 - Where previous modelled data (for a variety of return periods) is available, you could interpolate your own climate change figure (see note iv below).
Scenario 4 - Where the 1% level is available from an existing model add on the relevant 'nominal climate change allowance' provided in the 'Table of nominal allowances' below.
Scenario 5 - Establish the 1% level, for example using topographical levels (including LiDAR) and assessment of watercourse flow and nature and then add on the relevant 'nominal climate change allowances' provided in the 'Table of nominal allowances' below.

– *Note: For definitions of 'major' development see 'Interpretation 2.—(1)', on page 5, at: www.legislation.gov.uk/uksi/2015/595/pdfs/uksi_20150595_en.pdf

Table of Nominal Allowances

Watercourse	Central allowance (2050) Water compatible and Less Vulnerable.	Central allowance (2080) More Vulnerable
Upper Severn	600mm	850mm
River Wye		
River Teme		
River Avon	200mm	400mm
Lower Severn	400mm	600mm
Tributaries and 'ordinary watercourses'	200mm	300mm

Notes to above:-

(i) Watercourse definition:
The "Upper Severn"/"Lower Severn" boundary is taken as Bevere Weir, North of Worcester, (national grid reference SO8376859428). These do not directly relate to management catchments.

Use of the Avon nominal is only valid upstream of the M5 crossing and downstream of that point the Lower Severn nominals should be used.

An 'Ordinary Watercourse' is a watercourse that does not form part of a main river. Main Rivers are indicated on our Flood Map. You can also check the classification of the watercourse with the LLFA, some of which have produced Drainage and Flooding Interactive Maps.

(ii) Where a site is near the confluence of two, or more, watercourses, the FRA should use the larger river climate change allowances.

(iii) We may hold more precise information for some of the "tributaries". We would recommend that you seek this information from us via a 'pre-planning enquiry/data request', to the email address below.

(iv) We would also recommend that you contact us for our modelled '20%' allowances and associated flow data. This is available for some rivers. This data may help inform a more detailed climate change analysis (where necessary), including any interpolation of levels or flow to create a 'stage discharge rating' in order to estimate the required percentage; or be of assistance to inform 'less vulnerable' or 'water compatible' development proposals.

IMPORTANT NOTE
Please note the nominal climate change allowances are provided as a pragmatic approach, for consideration, in the absence of a modelled flood level and the applicant undertaking a detailed model of the watercourse. Use of nominal climate change allowances are not provided/ recommended as a preference to detailed modelling and historical data.

The Local Planning Authority may hold data within their Strategic Flood Risk Assessment (SFRA), or any future updates, which may help inform the above.

FREEBOARD NOTE
It is advised that Finished Floor Levels should be set no lower than '600mm' above the 1% river flood level plus climate change. Flood proofing techniques might be considered where floor levels cannot be raised (where appropriate). This 600mm freeboard takes into account any uncertainties in modelling/flood levels and wave action (or storm surge effects).

Surface Water

Table 2 of the guidance also indicates the relevant increases that surface water FRA should consider for an increase in peak rainfall intensity.

The following table is for **'peak rainfall intensity'** allowance in small and urban catchments. Please note that **surface water (peak rainfall intensity) climate change allowances should be discussed with the Lead Local Flood Authority (LLFA).**

Peak Rainfall Intensity - Applies across all of England	Total potential change anticipated for 2010-2039	Total potential change anticipated for 2040-2069	Total potential change anticipated for 2070-2115
Upper end	10%	20%	40%
Central	5%	10%	20%

Note to above:-

For river catchments around or over 5 square kilometres, the peak river flow allowances are appropriate.

Produced by: WestMidsPlanning@environment-agency.gov.uk

West Midlands Area -

Shropshire, Herefordshire, Worcestershire and Gloucestershire Sustainable Places Team.

APPENDIX D
SEWER RECORDS

dig .co.uk dat
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Date: 17/01/22

Scale: 1:1250

Map Centre: 352247,306466

Data updated: 14/12/21

Our Ref: 757460 - 1

Wastewater Plan A0

Do not scale off this Map. This plan and any information supplied with it is furnished as a general guide, is only valid at the date of issue and no warranty as to its correctness is given or implied. In particular this plan and any information shown on it must not be relied upon in the event of any development or works (including but not limited to excavations) in the vicinity of SEVERN TRENT WATER assets or for the purposes of determining the suitability of a point of connection to the sewerage or distribution systems. On 1 October 2011 most private sewers and private lateral drains in Severn Trent Water's sewerage area, were transferred into the ownership of Severn Trent Water. Please refer to your property deeds to check if you have a private sewer or lateral drain. A further transfer took place on 1 October 2012. Private pumping stations, which form part of these sewers, are not shown on this plan. For further details, please contact Severn Trent Water on or before 1 October 2016. Severn Trent Water does not possess complete records of these assets. These assets may not be displayed on the map. Reproduction by permission of Ordnance Survey on behalf of HMSO. © Crown Copyright and database right 2004. All rights reserved. Ordnance Survey licence number: 100031673. Document users other than SEVERN TRENT WATER business users are advised that this document is provided for reference purpose only and is subject to copyright, therefore, no further copies should be made from it.

nwhitfield@rsk.co.uk
bsf

SEVERN TRENT

SEVERN TRENT

GENERAL CONDITIONS AND PRECAUTIONS TO BE TAKEN WHEN CARRYING OUT WORK ADJACENT TO SEVERN TRENT WATER'S APPARATUS

Please ensure that a copy of these conditions is passed to your representative and/or your contractor on site. If any damage is caused to Severn Trent Water Limited (STW) apparatus (defined below), the person, contractor or subcontractor responsible must inform STW immediately on:
0800 783 4444 (24 hours)

a) These general conditions and precautions apply to the public sewerage, water distribution and cables in ducts including (but not limited to) sewers which are the subject of an Agreement under Section 104 of the Water Industry Act 1991(a legal agreement between a developer and STW, where a developer agrees to build sewers to an agreed standard, which STW will then adopt); mains installed in accordance with an agreement for the self-construction of water mains entered into with STW and the assets described at condition b) of these general conditions and precautions. Such apparatus is referred to as 'STW Apparatus' in these general conditions and precautions.

b) Please be aware that due to The Private Sewers Transfer Regulations June 2011, the number of public sewers has increased, but many of these are not shown on the public sewer record. However, some idea of their positions may be obtained from the position of inspection covers and their existence must be anticipated.

c) On request, STW will issue a copy of the plan showing the approximate locations of STW Apparatus although in certain instances a charge will be made. The position of private drains, private sewers and water service pipes to properties are not normally shown but their presence must be anticipated. This plan and the information supplied with it is furnished as a general guide only and STW does not guarantee its accuracy.

d) STW does not update these plans on a regular basis. Therefore the position and depth of STW Apparatus may change and this plan is issued subject to any such change. Before any works are carried out, you should confirm whether any changes to the plan have been made since it was issued.

e) The plan must not be relied upon in the event of excavations or other works in the vicinity of STW Apparatus. It is your responsibility to ascertain the precise location of any STW Apparatus prior to undertaking any development or other works (including but not limited to excavations).

f) No person or company shall be relieved from liability for loss and/or damage caused to STW Apparatus by reason of the actual position and/or depths of STW Apparatus being different from those shown on the plan.

In order to achieve safe working conditions adjacent to any STW Apparatus the following should be observed:

1. All STW Apparatus should be located by hand digging prior to the use of mechanical excavators.
2. All information set out in any plans received from us, or given by our staff at the site of the works, about the position and depth of the mains, is approximate. Every possible precaution should be taken to avoid damage to STW Apparatus. You or your contractor must ensure the safety of STW Apparatus and will be responsible for the cost of repairing any loss and/or damage caused (including without limitation replacement parts).
3. Water mains are normally laid at a depth of 900 mm. No records are kept of customer service pipes which are normally laid at a depth of 750 mm; but some idea of their positions may be obtained from the position of stop tap covers and their existence must be anticipated.
4. During construction work, where heavy plant will cross the line of STW Apparatus, specific crossing points must be agreed with STW and suitably reinforced where required. These crossing points should be clearly marked and crossing of the line of STW Apparatus at other locations must be prevented.
5. Where it is proposed to carry out piling or boring within 20 metres of any STW Apparatus, STW should be consulted to enable any affected STW Apparatus to be surveyed prior to the works commencing.
6. Where excavation of trenches adjacent to any STW Apparatus affects its support, the STW Apparatus must be supported to the satisfaction of STW. Water mains and some sewers are pressurised and can fail if excavation removes support to thrust blocks to bends and other fittings.
7. Where a trench is excavated crossing or parallel to the line of any STW Apparatus, the backfill should be adequately compacted to prevent any settlement which could subsequently cause damage to the STW Apparatus. In special cases, it may be necessary to provide permanent support to STW Apparatus which has been exposed over a length of the excavation before backfilling and reinstatement is carried out. There should be no concrete backfill in contact with the STW Apparatus.
8. No other apparatus should be laid along the line of STW Apparatus irrespective of clearance. Above ground apparatus must not be located within a minimum of 3 metres either side of the centre line of STW Apparatus for smaller sized pipes and 6 metres either side for larger sized pipes without prior approval. No manhole or chamber shall be built over or around any STW Apparatus.
9. A minimum radial clearance of 300 millimetres should be allowed between any plant or equipment being installed and existing STW Apparatus. We reserve the right to increase this distance where strategic assets are affected.
10. Where any STW Apparatus coated with a special wrapping is damaged, even to a minor extent, STW must be notified and the trench left open until the damage has been inspected and the necessary repairs have been carried out. In the case of any material damage to any STW Apparatus causing leakage, weakening of the mechanical strength of the pipe or corrosion-protection damage, the necessary remedial work will be recharged to you.
11. It may be necessary to adjust the finished level of any surface boxes which may fall within your proposed construction. Please ensure that these are not damaged, buried or otherwise rendered inaccessible as a result of the works and that all stop taps, valves, hydrants, etc. remain accessible and operable. Minor reduction in existing levels may result in conflict with STW Apparatus such as valve spindles or tops of hydrants housed under the surface boxes. Checks should be made during site investigations to ascertain the level of such STW Apparatus in order to determine any necessary alterations in advance of the works.
12. With regard to any proposed resurfacing works, you are required to contact STW on the number given above to arrange a site inspection to establish the condition of any STW Apparatus in the nature of surface boxes or manhole covers and frames affected by the works. STW will then advise on any measures to be taken, in the event of this a proportionate charge will be made.
13. You are advised that STW will not agree to either the erection of posts, directly over or within 1.0 metre of valves and hydrants,
14. No explosives are to be used in the vicinity of any STW Apparatus without prior consultation with STW.

TREE PLANTING RESTRICTIONS

There are many problems with the location of trees adjacent to sewers, water mains and other STW Apparatus and these can lead to the loss of trees and hence amenity to the area which many people may have become used to. It is best if the problem is not created in the first place. Set out below are the recommendations for tree planting in close proximity to public sewers, water mains and other STW Apparatus.

15. Please ensure that, in relation to STW Apparatus, the mature root systems and canopies of any tree planted do not and will not encroach within the recommended distances specified in the notes below.
16. Both Poplar and Willow trees have extensive root systems and should not be planted within 12 metres of a sewer, water main or other STW Apparatus.
17. The following trees and those of similar size, be they deciduous or evergreen, should not be planted within 6 metres of a sewer, water main or other STW Apparatus. E.g. Ash, Beech, Birch, most Conifers, Elm, Horse Chestnut, Lime, Oak, Sycamore, Apple and Pear. Asset Protection Statements Updated May 2014
18. STW personnel require a clear path to conduct surveys etc. No shrubs or bushes should be planted within 2 metre of the centre line of a sewer, water main or other STW Apparatus.
19. In certain circumstances, both STW and landowners may wish to plant shrubs/bushes in close proximity to a sewer, water main of other STW Apparatus for screening purposes. The following are shallow rooting and are suitable for this purpose: Blackthorn, Broom, Cotoneaster, Elder, Hazel, Laurel, Privet, Quickthorn, Snowberry, and most ornamental flowering shrubs.

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert

APPENDIX E
GREENFIELD RUNOFF CALCULATIONS

ICP SUDS Mean Annual Flood

Input

Return Period (years)	25	Soil	0.150
Area (ha)	44.090	Urban	0.000
SAAR (mm)	700	Region Number	Region 4

Result

QBAR Rural	17.9
QBAR Urban	17.9
Q25 years	33.5
Q1 year	14.8
Q30 years	35.0
Q100 years	45.9

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