Frodsham Solar

Environmental Statement: Volume 2
Appendix 9-1: Flood Risk Assessment and Drainage Strategy
Part 5 of 5

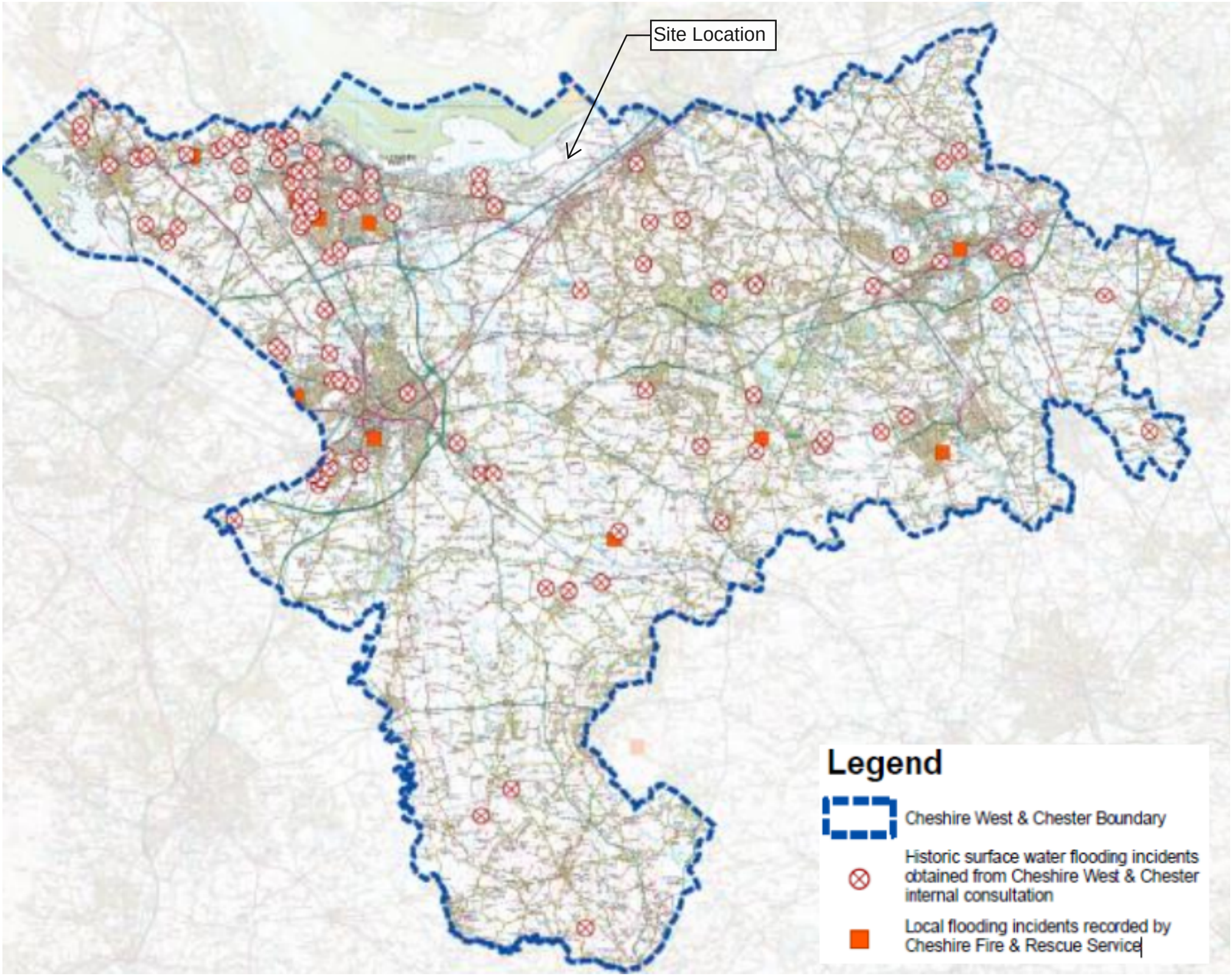
July 2025

Cubico
SUSTAINABLE INVESTMENTS

PINS Ref: EN010153
Document Ref: EN010153/DR/6.2
Planning Act 2008; and Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations Regulation 5(2)(e)

Revision P02

Appendix L SFRA Map


Site Location
Legend
Cheshire West & Chester Boundary
Historic surface water flooding incidents obtained from Cheshire West & Chester internal consultation
Local flooding incidents recorded by Cheshire Fire & Rescue Service

Appendix M Flood Warning and Evacuation Plan

Frodsham Solar

Outline Flood Warning & Evacuation Plan

May 2025

Waterco

Assessment | Modelling | Design

Project Information	
Project:	Frodsham Solar
Report Title:	Outline Flood Warning & Evacuation Plan
Client:	Axis P.E.D Ltd
Instruction:	The instruction to undertake this Outline Flood Warning & Evacuation Plan was received from Andrew Russell of Axis P.E.D Ltd
File Ref:	14740-FWEP-01

Approval Record	
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	Document History	
Revision	**Date**	**Comment**
01	09/05/2025	First Issue

Introduction

This Outline Flood Warning and Evacuation Plan (FWEP) sets out how to prepare for and respond to a flood event. This FWEP has been prepared for Frodsham solar located to the north of the M56, Frodsham, Cheshire West, referred to as 'the site' herein. A site Location Plan and Aerial Image are in included in Appendix A.

Understanding the Flood Risk

The site is bordered by the River Weaver to the north and east, and the Manchester Ship Canal to the north-west. The River Mersey is located approximately 250m north-west of the site at its nearest point.

The site is intersected by several watercourses namely Red Wall Ditch, The Lum, Marsh Green and Ship Street Course. The water levels in the watercourses intersecting the site are controlled by an existing Environment Agency pumping station and the associated flood risk is very low.

The River Weaver (river flooding) and the River Mersey (tidal flooding) present the main source of flood risk to the site.

River Weaver Flooding

Detailed river modelling of the River Weaver shows that the site is flood free during all events up to and including the 1.33% (1 in 75) Annual Exceedance Probability (AEP) event. As shown in Figure 1, during the 1% (1 in 100) AEP event, the flood defences on the eastern site boundary are overtopped and the easternmost extent of the site is estimated to flood with depths generally less than 300mm. All site access routes are flood free.

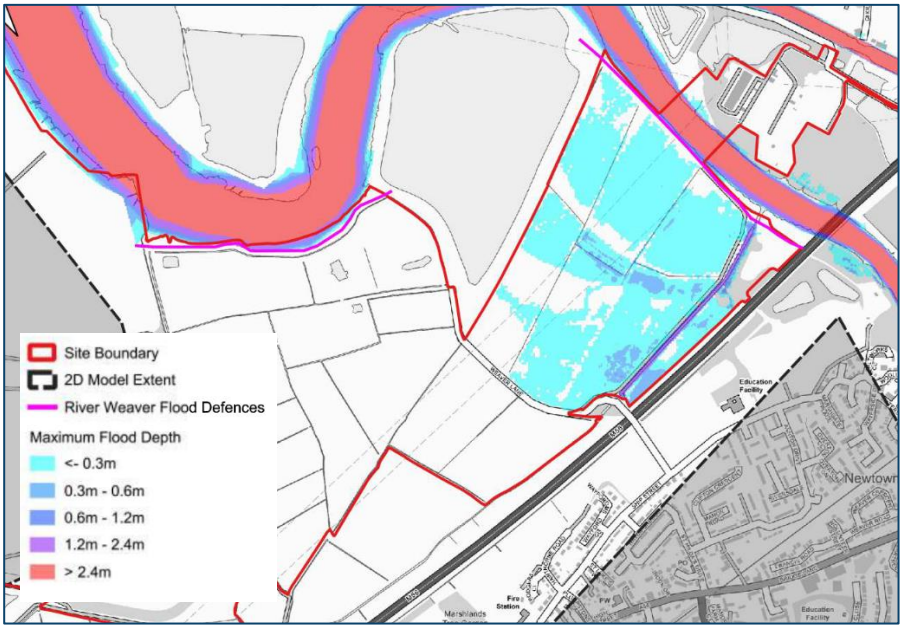


Figure 1 - 1% AEP Weaver Fluvial Event – Defended

As shown in Figure 2, during the 1% AEP event with 67% climate change, the lower lying eastern extent of the site is estimated to flood. Flood water overtops the River Weaver defences on the eastern boundary of the site. Flood depths generally vary from 740mm to 1.14m.

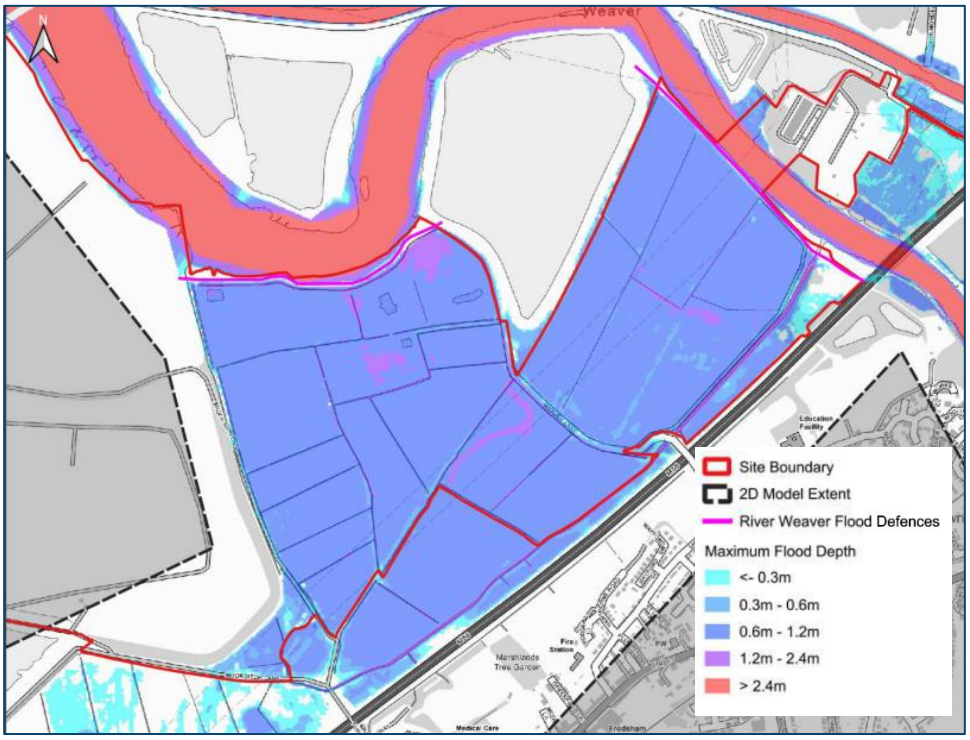


Figure 2 - 1% AEP plus 67% CC Weaver Fluvial Event – Defended

Flooding from the River Weaver can also occur from a breach of the flood defences. When accounting for a breach of the flood defences on the northern site boundary during the 1% AEP plus 67% CC event, flood depths generally vary from 0.79m to 1.19m. The flood extent is unchanged relative to the defended scenario. When accounting for a breach of the flood defences on the eastern site boundary during the 1% AEP plus 67% CC event, flood depths generally vary from 0.96m to 1.36m. The flood extent is unchanged relative to the defended scenario.

River Mersey Flooding

Detailed river modelling of the Mersey Estuary shows that the site is partially shown to flood during the present day 0.5% (1 in 200) AEP event. As shown in Figure 3, floodwater from the Mersey Estuary enters the River Weaver and results in overtopping of the River Weaver flood defences on the northern site boundary. Flooding is concentrated to land south of the River Weaver flood defences and flood depths are less than 350mm.

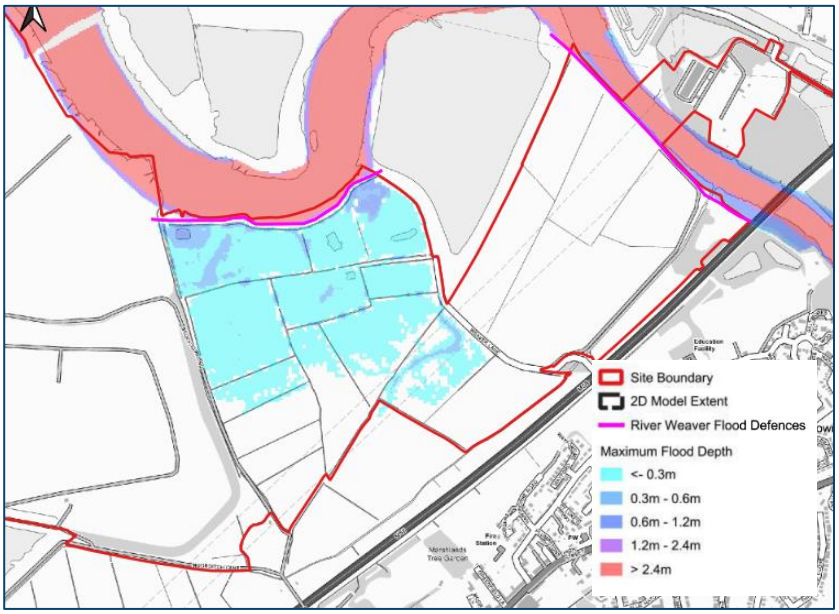


Figure 3 – 0.5% AEP Mersey Tidal Event – Defended

As shown in Figure 4, when accounting for climate change on the 0.5% AEP event up to the year 2075, the eastern extent of the site is estimated to flood. Floodwater from the Mersey Estuary enters the River Weaver and results in overtopping of the River Weaver flood defences on the northern site boundary. Flood depths vary from approximately 800mm – 1.32m.

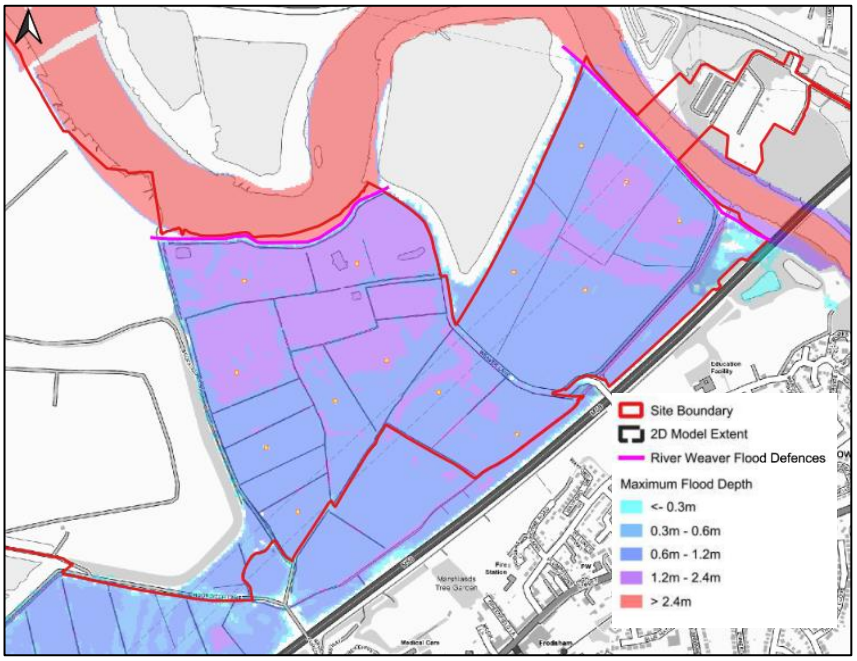


Figure 4 – 0.5% AEP Mersey Tidal Event (Year 2075 – Upper End Allowance) – Defended

Flooding from the River Mersey can also occur from a breach of the Mersey defences. Figure 5 shows that during the present day 0.5% AEP breach event, flooding is concentrated to land south of the River Weaver flood defences and flood depths are less than 350mm.

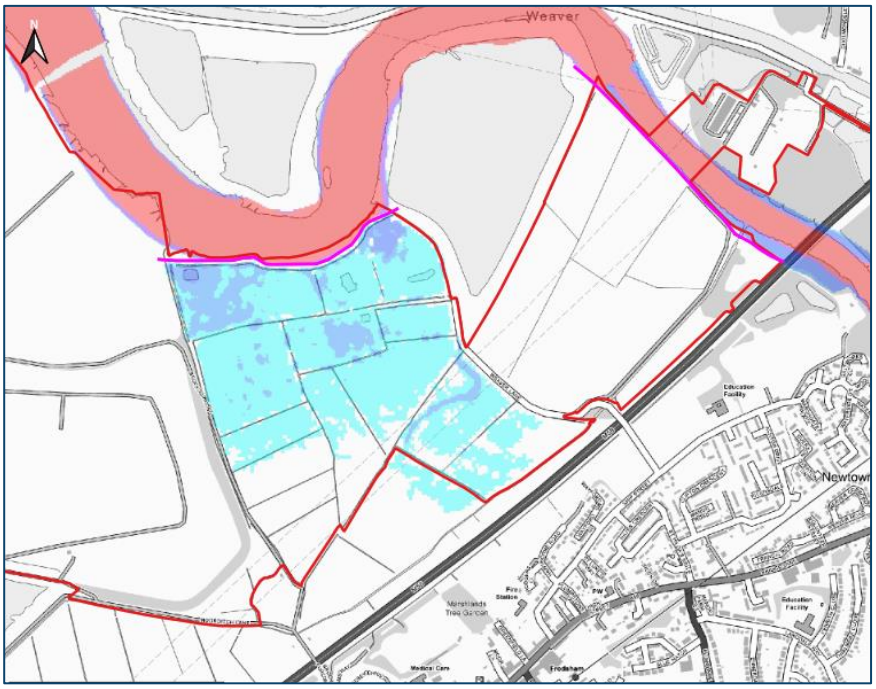


Figure 5 – 0.5% AEP Tidal Event (Breach Scenario)

The flood extent and depths during the 0.5% AEP breach event with climate chage up to the year 2075 are similar (less than 80mm difference) when compared to the defended scenario.

The site access points off Brook Furlong and Weaver Lane to the south (bridges over the M56) are flood free in all considered flood events. The western extent of the site (Frodsham windfarm site) is flood free during all considered flood events and would provide a safe area of refuge during all flood events.

The existing access in the western extent of the site (Marsh Lane) is flood free during all considered fluvial flood events of the River Weaver. Marsh Lane in the western extent of the site is at risk of flooding during the tidal Mersey defended and breach flood events with climate change applied to the year 2075. Flood depths during the 0.5% AEP (year 2075) upper end tidal breach event are generally in the region of 150mm and a maximum of 240mm. Flood depths along Marsh Lane in the western extent of the site during the 0.5% AEP year 2075 upper end tidal breach event are shown in Figure 6.

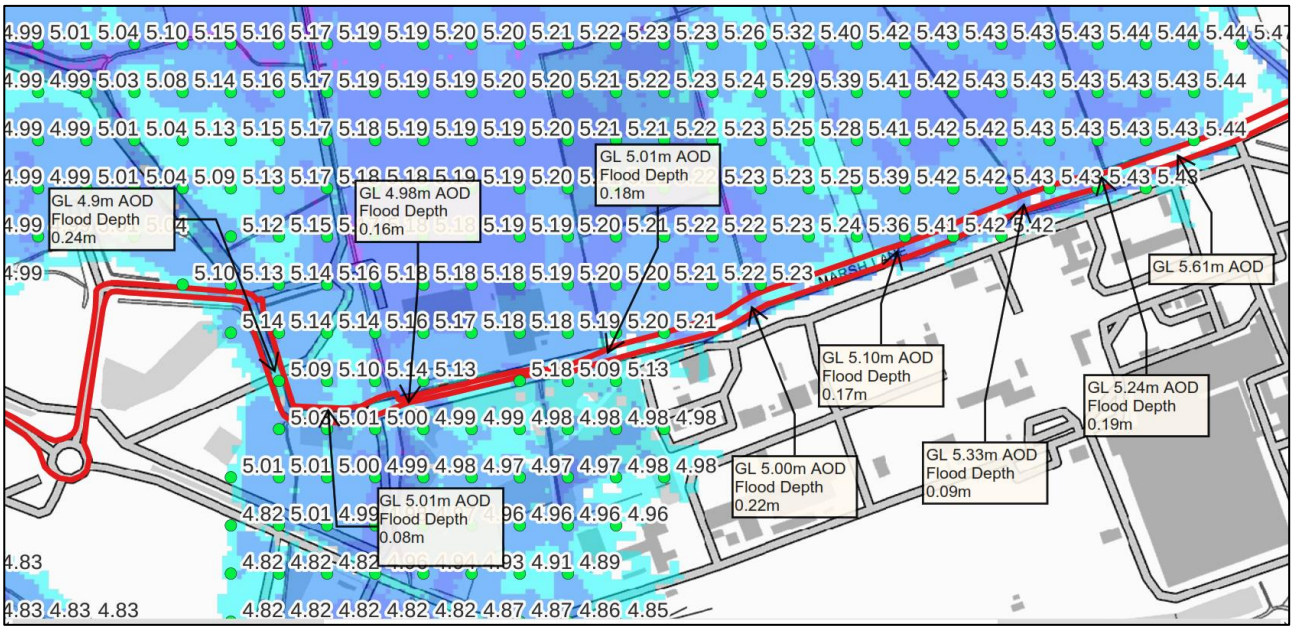


Figure 6 – 0.5% AEP Year 2075 Upper End Breach Event – Tidal Mersey – Marsh Lane Flood Depths

Flooding Time of Inundation

The time of inundation of floodwater represents the time that flood water takes to distribute across the site from first entry (from when flood water first overtops a flood defence or flows through a defence breach).

Detailed time of inundation mapping is provided as Appendix B. During a fluvial flood event of the River Weaver, flood inundation times are slow. During the 1% AEP plus 67% climate change event, floodwater takes 23 hours to disperse across the site. From when flood defences are first overtopped, little to no flooding is witnessed on site for up to 12 hours. A similar scenario is witnessed during the River Weaver defence breach event.

During a tidal flood event of the River Mersey, flooding inundation times are faster relative to a fluvial flood event. During the present day 0.5% AEP event, floodwater takes 2 hours to disperse across the flood extent. During the defended 0.5% AEP plus climate change (year 2075) event, flood water takes 1 hour to disperse across the site. Land in the southern extent of the site (near the access bridges at Brook Furlong and Weaver Lane) is flood free for up to 30 minutes following floodwater ingress into the site. It is however noted that tidal flooding can be predicted and flood warnings would be available (ensuring the site is not occupied in times of tidal flooding).

During the 0.5% AEP plus climate change (year 2075) breach event, flood water takes 1 hours to disperse across the site. Land in the southern extent of the site (near the access bridges at Brook Furling and Weaver Lane) is flood free for up to 30 minutes following floodwater ingress into the site.

National Guidance on Weather and Flood Alerts/Warnings

Flood Alerts and Warnings

The Environment Agency flood forecasting and warnings service operates in areas at risk of flooding from rivers or the sea and relies on direct measurements of rainfall, river levels, tide levels, in-house predictive models, rainfall radar data and information from the Met Office. This service operates 24 hours a day, 365 days a year.

Flood Alerts are available for the area. Flood Alerts is a free service that provides Flood Alerts direct to telephone, mobile and email.

Flood Warnings are also available for the area. Flood Warnings is a free service that provides Flood Warnings direct to telephone, mobile and email.

Flood Alerts and Warnings are also published online and are available to view on the Environment Agency website: Flood alerts and warnings - GOV.UK (check-for-flooding.service.gov.uk).

Registration to receive Flood Alerts/Warnings can be done online by following the link below. It is also possible to register to receive Flood Alerts/Warnings by calling Floodline on 0345 988 1188.

Register for Flood Alerts/Warnings: Sign up for flood warnings - GOV.UK (environment-agency.gov.uk)

A summary of Flood Alerts and Warnings, and government advice is provided below.

Flood Alert

A Flood Alert is issued to warn people of the possibility of flooding and encourage them to be alert, stay vigilant and make early / low impact preparations for flooding. A Flood Alert icon is made up of a black house with 1 waved line of water covering the bottom, all within an orange triangle.

Flood Alert
Flooding is possible - be prepared

The Environment Agency issues a Flood Alert when forecasts show that flooding may be possible from:

- Rivers.
- High tides, surges or strong winds at sea.

The Environment Agency usually issues a Flood Alert between 2 and 12 hours before flooding. Flood Alerts are usually issued during waking hours where possible.

Flood Warning

A Flood Warning is used to warn people that flooding is expected, and action should be taken immediately. A Flood Warning icon is made up of a black house with 2 waved lines of water covering the bottom, all within a red triangle.

Flood Warning
Flooding is expected - immediate action required

The Environment Agency issues a Flood Warning when forecasts show that flooding is expected from:

- Rivers.
- Heavy rain that will cause rivers to flash flood.
- High tides and surges coupled with strong winds at sea.

The Environment Agency usually issues a Flood Warning 30 minutes to 2 hours before flooding.

Severe Flood Warning

A severe flood warning means that flooding could cause danger to life and significant disruption to communities. You must act now. A Severe flood warning icon is made up of a red house with 3 waved lines of water covering the bottom, all within a red triangle.

Severe Flood Warning
Severe flooding - danger to life

The Environment Agency issues a severe flood warning when flooding threatens life and communities.

UK Weather Warnings

The Met Office issues weather warnings when severe weather has the potential to impact the UK. The Met Office issues warnings for rain and other extreme weather conditions. The weather warnings are given a colour depending on a combination of both the impact the weather may have and the likelihood of those impacts occurring:

Red - Extreme weather is expected. Red means that people should take action now to keep themselves and others safe from the impact of the weather. Widespread damage, travel and power disruption and risk to life is likely. People must avoid dangerous areas and follow the advice of the emergency services and local authorities.

Amber - There is an increased likelihood of bad weather affecting people, which could potentially disrupt plans and possibly cause travel delays, road and rail closures, interruption to power and the potential risk to life and property. Amber means that people need to be prepared to change plans and protect themselves, family and community from the impacts of the severe weather based on the forecast from the Met Office.

Yellow - Severe weather is possible over the next few days. Yellow means that people should plan ahead thinking about possible travel delays, or the disruption of your day-to-day activities. The Met Office is monitoring the developing weather situation and yellow means keep an eye on the latest forecast and be

aware that the weather may change or worsen.

Met Office weather warnings are available online on the link below:

https://www.metoffice.gov.uk/weather/warnings-and-advice/uk-warnings#?date=2023-11-02

Weather warnings are also available from the Met Office social media platforms and can be sent by signing up to receive email alerts.

Preparing for a Flood at Frodsham Solar

The following measures should be undertaken in preparation for a flood event:

Site management and operatives will be required to register to receive EA Flood Alerts / Warnings and Met Office Weather Warnings. Flood and weather warnings would inform site operatives of potential flooding on site and in the locality.

A copy of this Flood Warning and Evacuation Plan will be made readily accessible to all site operatives.

In preparation for a flood event, site operatives and where relevant site management, will be required to:

- Receive training on procedures to follow in the event of a flooding. This includes being aware of:
    - The Flood Evacuation Route Plan provided as Appendix C. The Flood Evacuation Route Plan shows the fastest route to high ground and is based on a flood event from the Mersey (where flooding inundation times are fastest). Separate evacuation routes are shown to Brook Furlong and Weaver Lane. The applicable evacuation route depends on the operative's position on site at the time of flooding.
    - Locations of safe refuge on site. All inverter / transformer substations which are distributed across the site have been designed with a floor level above flood levels. Each inverter / transformer substation therefore provides an area of safe refuge should flooding occur without warning and evacuation is not possible. The elevated western extent of the site (Frodsham wind farm) also provides a place of refuge.
    - The operation, layout and design of the site. All infrastructure including the panels and inverter / transformer substations have been designed so that they are above estimated flood levels and can remain operational during a flood event. Site operatives will be required to understand the layout of the site and its access tracks to ensure they can quickly access a point of safe refuge should flooding occur without warning.
- Prepare and maintain emergency kits which are to be stored in each place of safe refuge (all inverter / transformer substations). The kit should include a torch, protective (warm and waterproof) clothing, bottled water, ready to eat non-perishable foods and a fist aid kit.

- Always carry a mobile phone (communication method) when working on site.
- Always carry a supply of any prescribed essential medication when working on site.
- Ensure they have access (keys or padlock combinations) to all security gates and buildings on site.
- Be familiar with emergency contact numbers provided below.
- Be familiar with the flood protocols detailed in the following sections.

Actions Following a Flood or Weather Warning for Frodsham Solar

The following actions should be undertaken on receipt of an EA Flood Alert or Warning / Yellow, Amber or Red Met Office Weather Warning:

- Site operatives will be required to regularly check news / media outlets for any updates on worsening weather conditions.
- Avoid travelling to the site.
- If on site, leave the site immediately ensuring it is secured on leaving. The site can be operated remotely, and routine maintenance works can be temporarily suspended. Once off-site, check travel routes and public transport schedules (for any road closures, cancelations etc.) to ensure safe travel to a place of residence. The Site Manager is responsible to ensure that all operatives have left the site and to inform operatives on the next shift of the flooding.

The following actions will be required where flooding occurs without warning:

If a site operative is on site when flooding occurs i.e. where no warning is received, the site operative will be required to:

- Raise the alarm, ensuring all staff / visitors on site are aware of the flooding.
- Where safe to do so, evacuate immediately. The evacuation route detailed in Appendix C should be followed when leaving the site.
- Where safe evacuation is not possible, for example parts of the site become cut off by flood water, proceed to the nearest point of safe refuge. Places of safe refuge include the elevated western extent of the site (Frodsham wind farm) and all inverter / transformer substations on site (shown on the Flood Evacuation Route Plan provided as Appendix C). Operatives will be required to stay in the place of safe refuge until flood waters have receded. In an emergency, dial 999 and await rescue.

Actions Following a Flood

Flood water can contain pollutants including raw sewage. Contact with remnant flood water should be avoided as it may be contaminated. Cleaning and disinfectant of infrastructure (fencing, CCTV posts, panel supporting columns) on site may be required following a flood event.

Emergency Contact Details

IN THE EVENT OF AN EMERGENCY DIAL 999	
Floodline - 0345 988 1188	EA Incident Hotline - 0800 80 70 60
NHS 111 Service (non-emergency) - 111	Frodsham Fire Station (non -emergency) 01606 868906
Electricity (24-hour Emergency Service) – 0800 40 40 90	Gas (24-hour emergency service) – 0800 111 999
Other useful Contacts (to be provided by site manager / residents)	

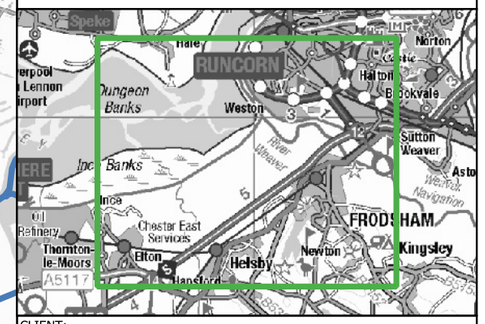
This FWEP should be updated every 5 years accounting for the latest flood risk information. Emergency contact details should be reviewed annually.

Appendix A Location Plan & Aerial Image

Notes:
1) All dimensions are in metres and all levels in metres above Ordnance Datum unless stated otherwise

LEGEND

- Site Boundary
- Land Not Within Site Boundary
- Watercourses
- Waterbodies



CLIENT:
Frodsham Solar Ltd

waterco
www.waterco.co.uk

SCHEME:
Frodsham Solar

PLOT TITLE:
Location Plan

PLOT STATUS:	DATE:
FINAL	30-04-2025

DRAWN:	CHECKED:	APPROVED:	PLOT SCALE AT A3:
JP	AW	NJ	1:30000

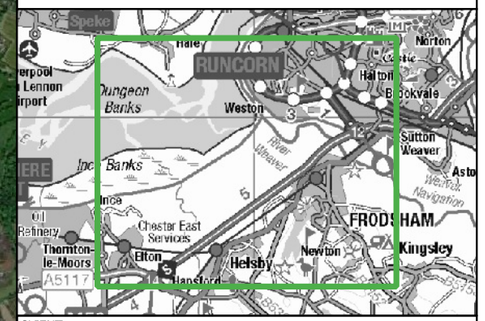
PLOT NAME:	REVISION:
14740_Location_Plan	-

0 600 1,200 1,800 2,400 3,000 m

Notes:
1) All dimensions are in metres and all levels in metres above Ordnance Datum unless stated otherwise

LEGEND

- Site Boundary
- Land Not Within Site Boundary



CLIENT:
Frodsham Solar Ltd

waterco
www.waterco.co.uk

SCHEME:
Frodsham Solar

PLOT TITLE:
Aerial Plan

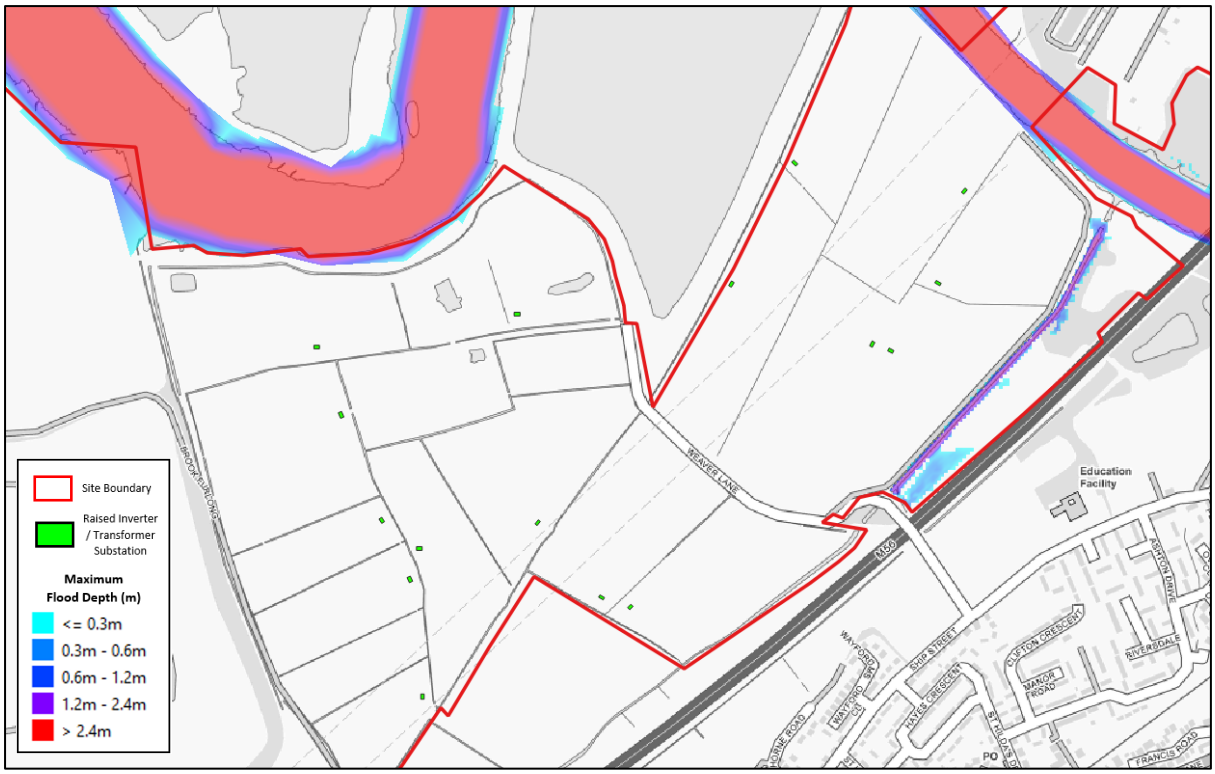
PLOT STATUS:	DATE:
FINAL	30-04-2025

DRAWN:	CHECKED:	APPROVED:	PLOT SCALE AT A3:
JP	AW	NJ	1:30000

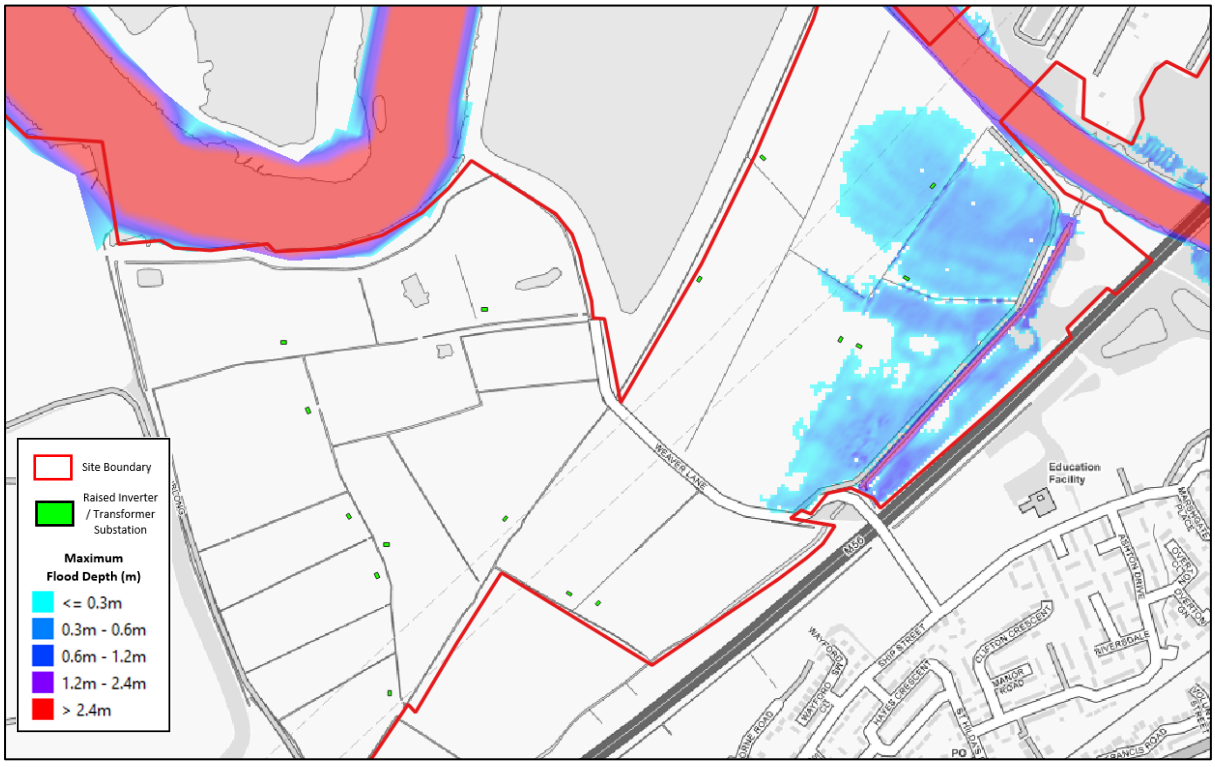
PLOT NAME:	REVISION:
14740_Aerial_Plan	-

Appendix B Flood Inundation Mapping

River Weaver Defended 1% AEP plus 67% Climate Change Event – Time of Inundation 0hrs



River Weaver Defended 1% AEP plus 67% Climate Change Event – Time of Inundation 12hrs



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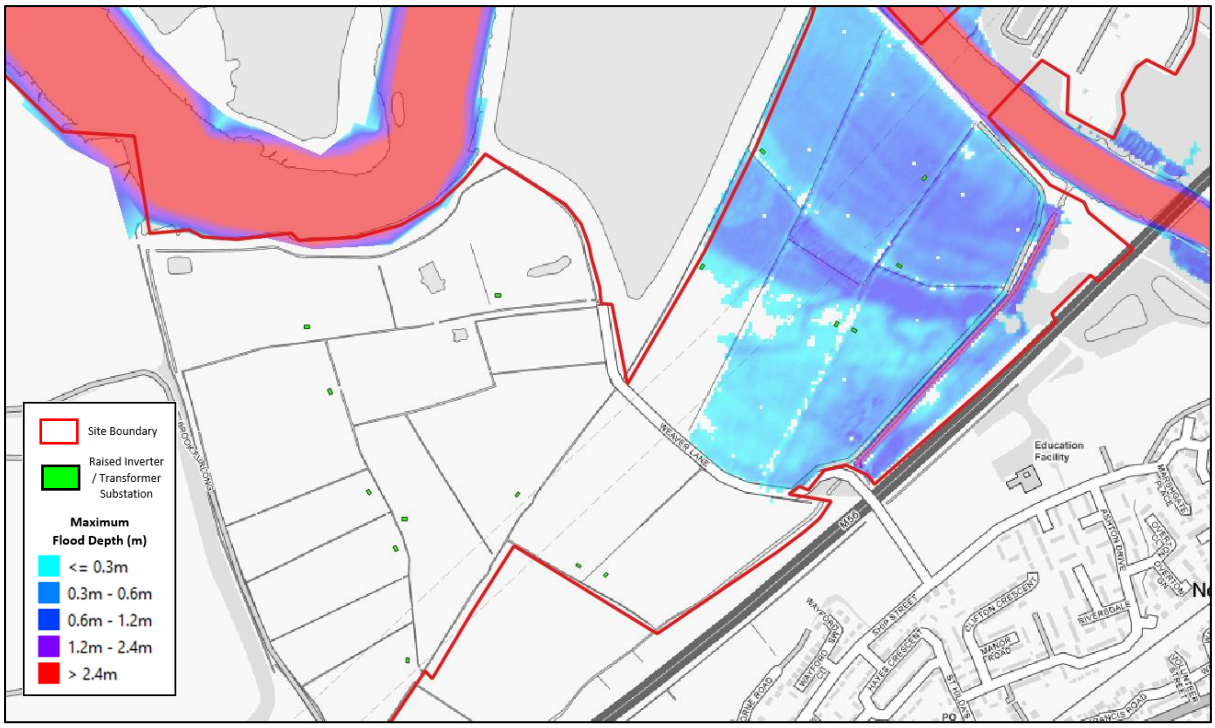

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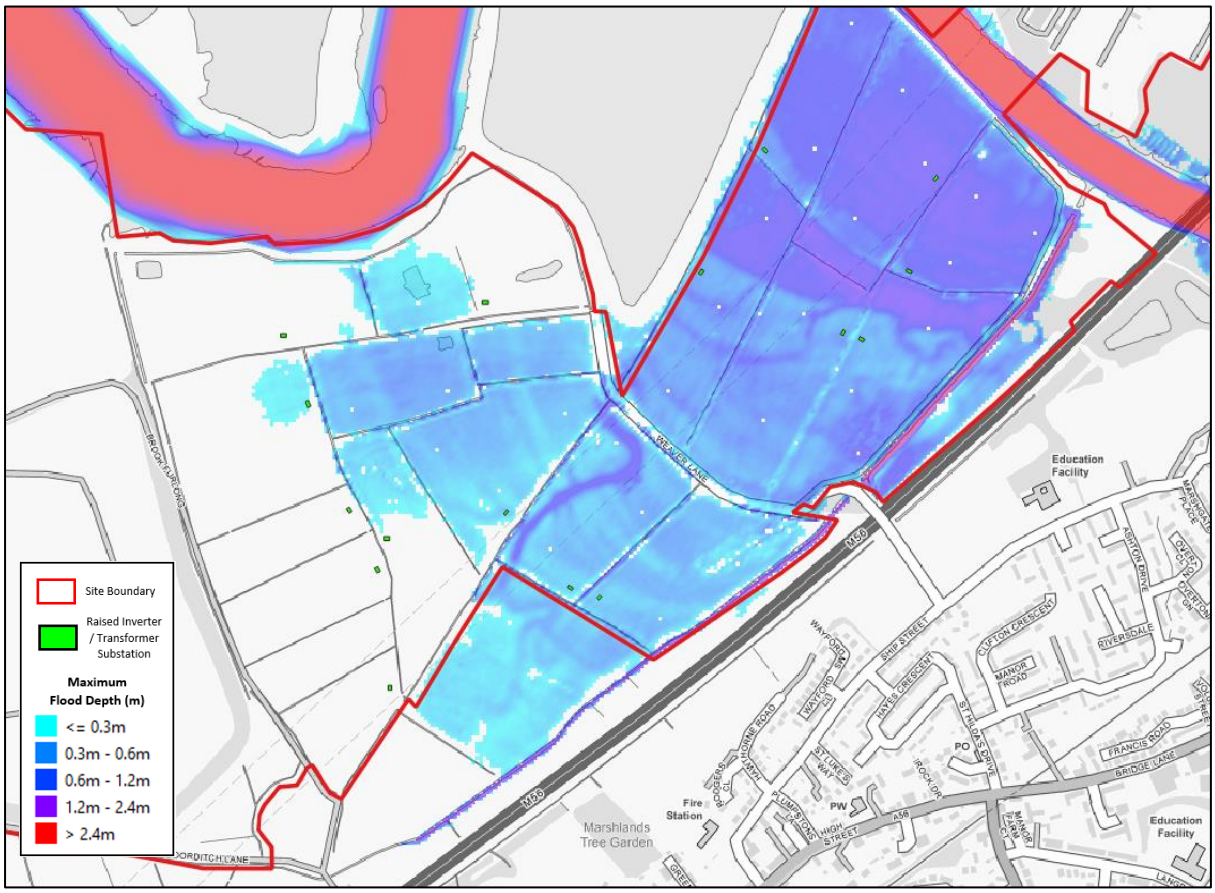
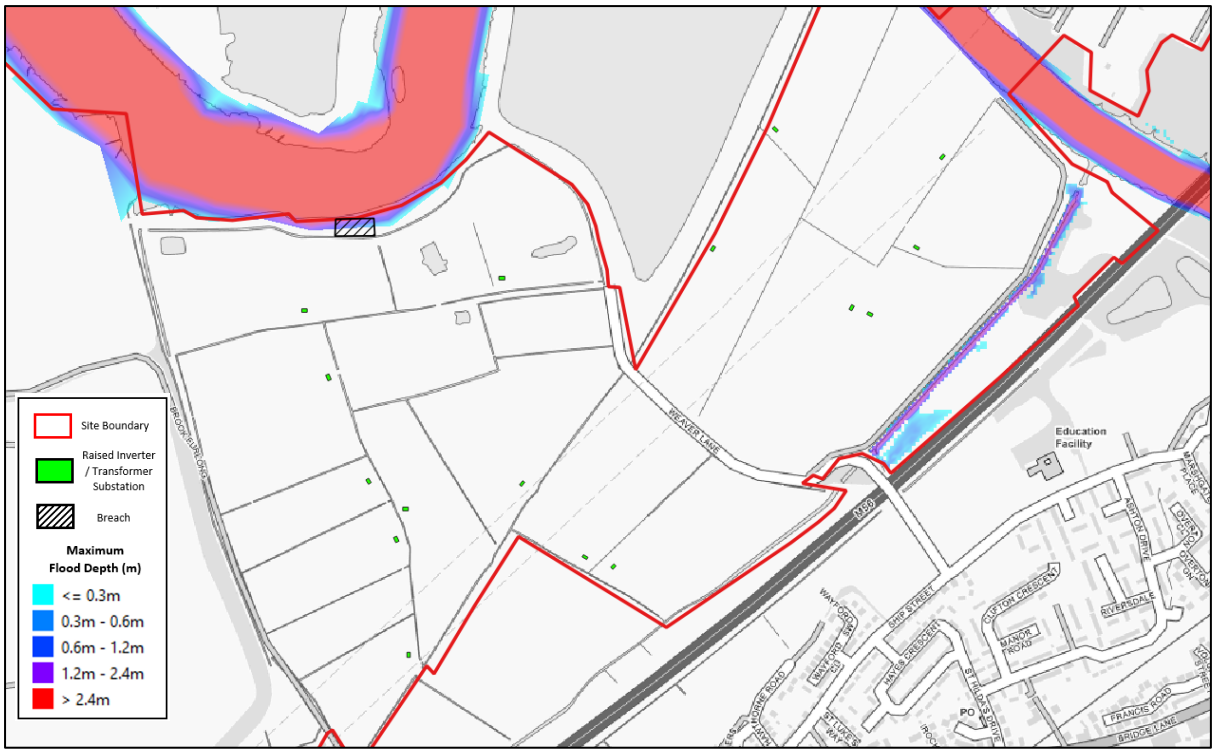
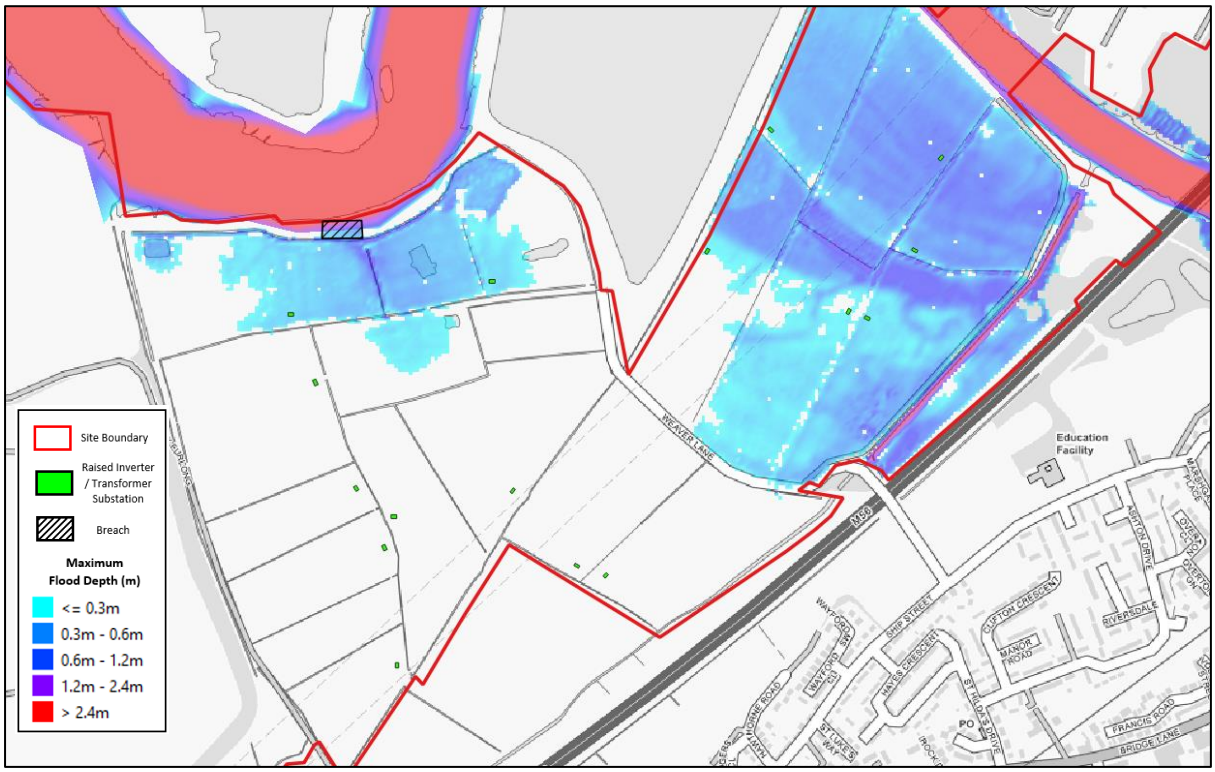


River Weaver Defended 1% AEP plus 67% Climate Change Event – Time of Inundation 23hrs

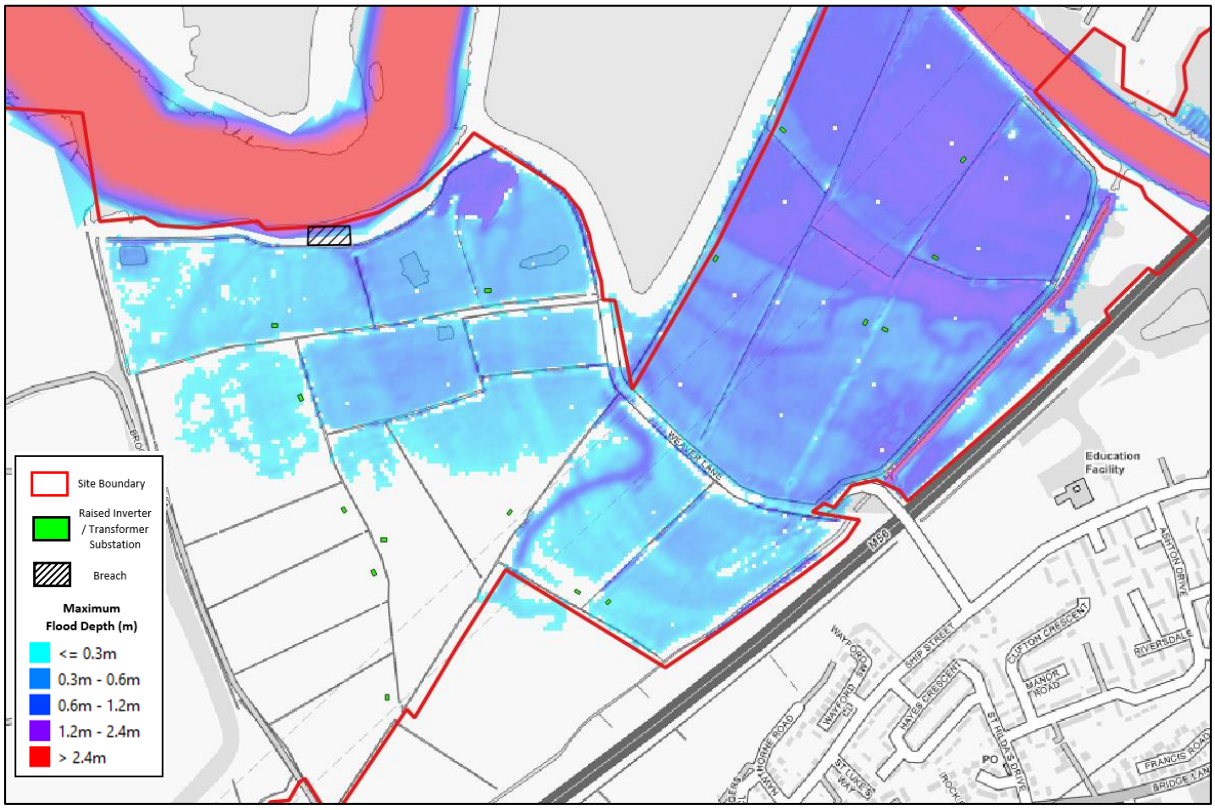
River Weaver Breach 1 1% AEP plus 67% Climate Change Event – Time of Inundation 0hrs



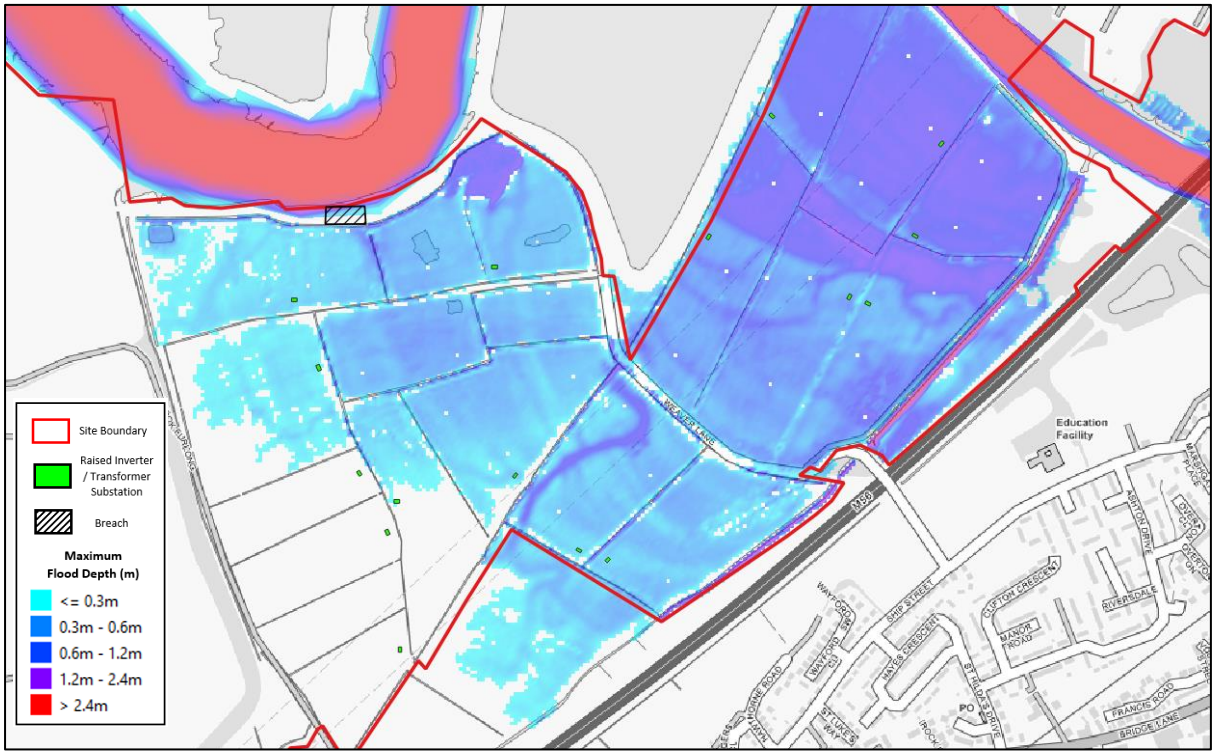
River Weaver Breach 1 1% AEP plus 67% Climate Change Event – Time of Inundation 13hrs



River Weaver Breach 1 1% AEP plus 67% Climate Change Event – Time of Inundation 15hrs

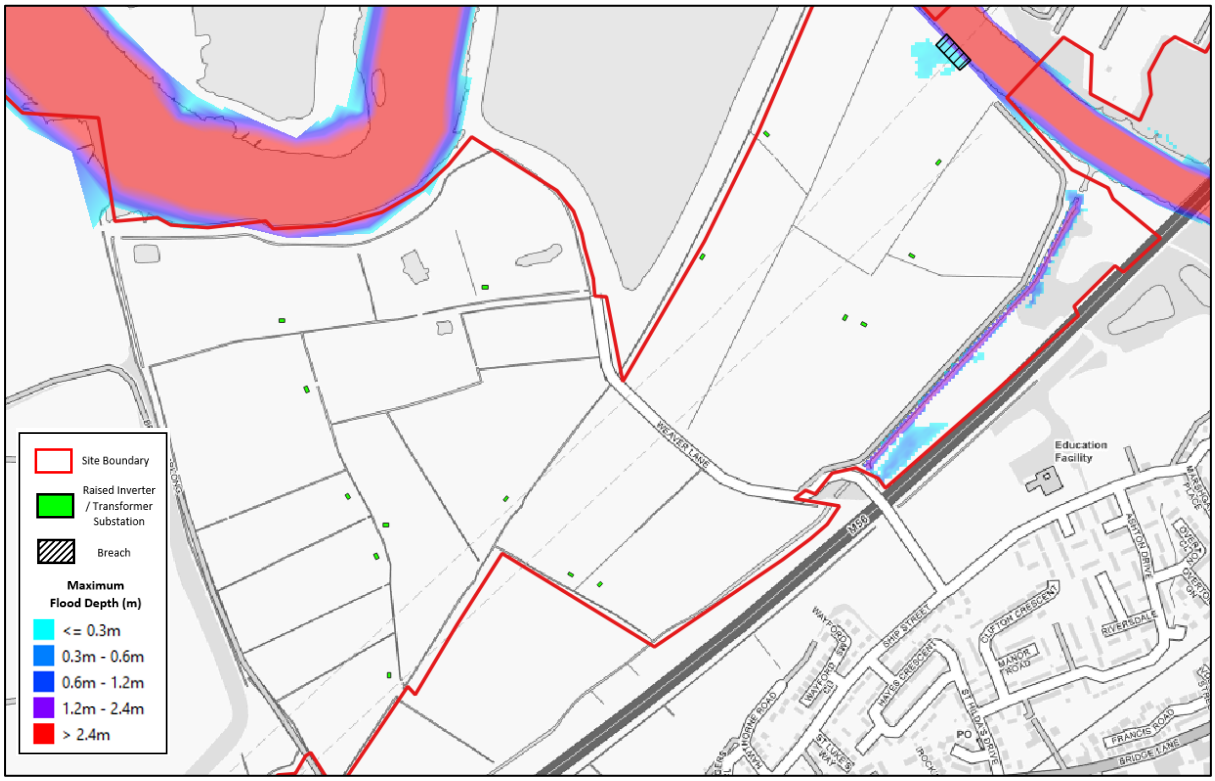


River Weaver Breach 1 1% AEP plus 67% Climate Change Event – Time of Inundation 16hrs

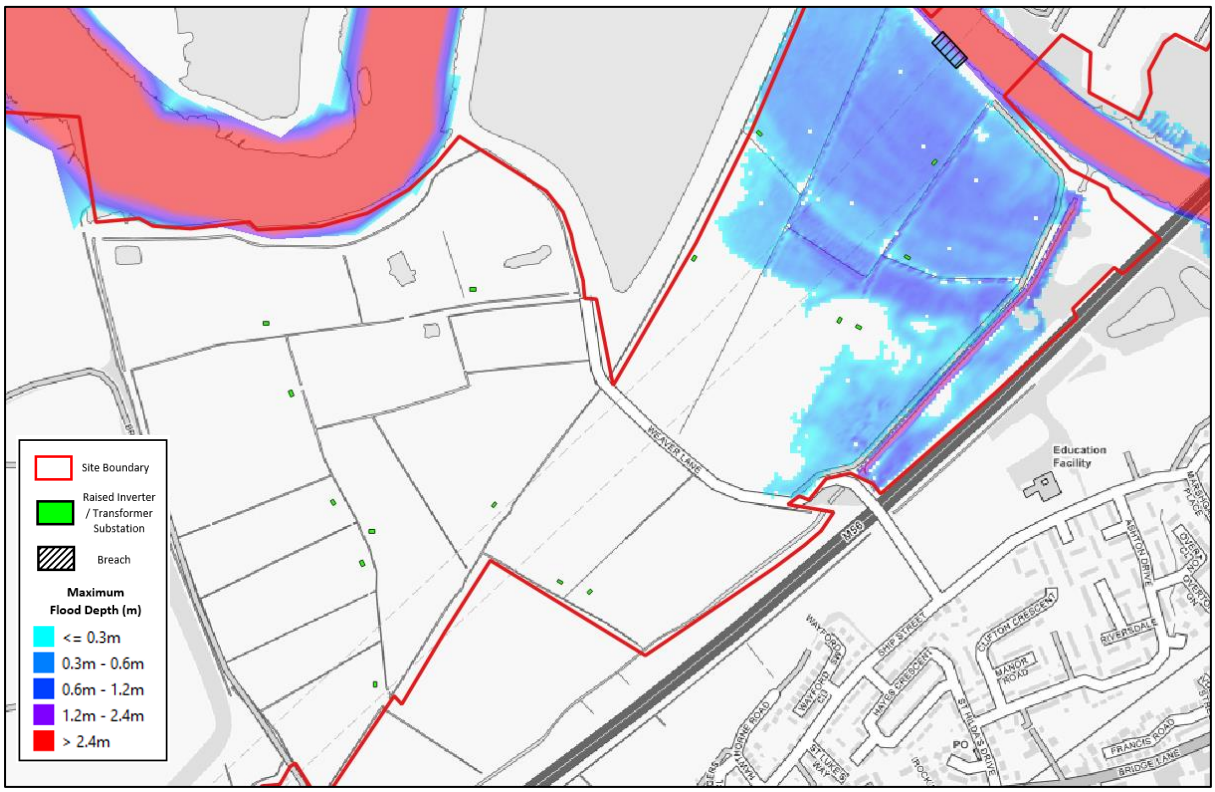


River Weaver Breach 1 1% AEP plus 67% Climate Change Event – Time of Inundation 23hrs

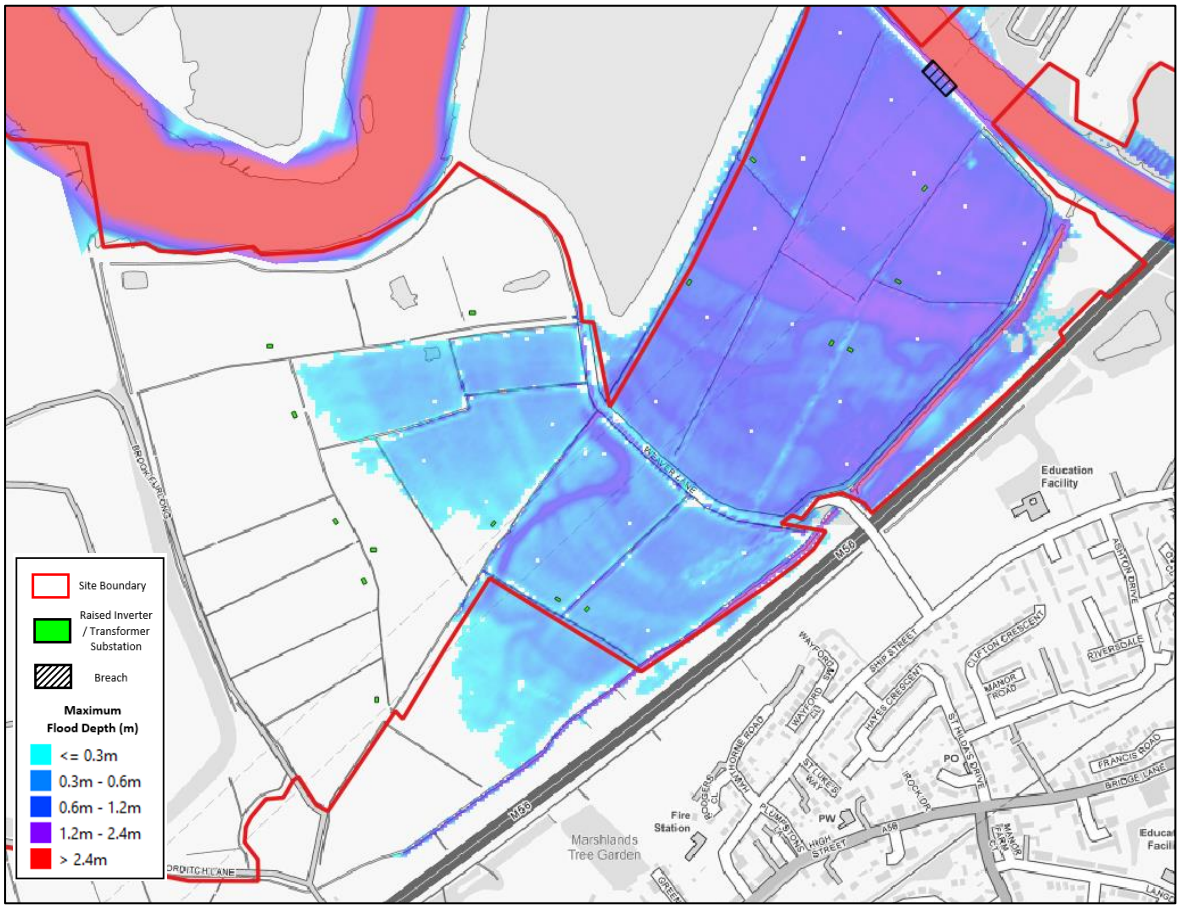
River Weaver Breach 2 1% AEP plus 67% Climate Change Event – Time of Inundation 0hrs



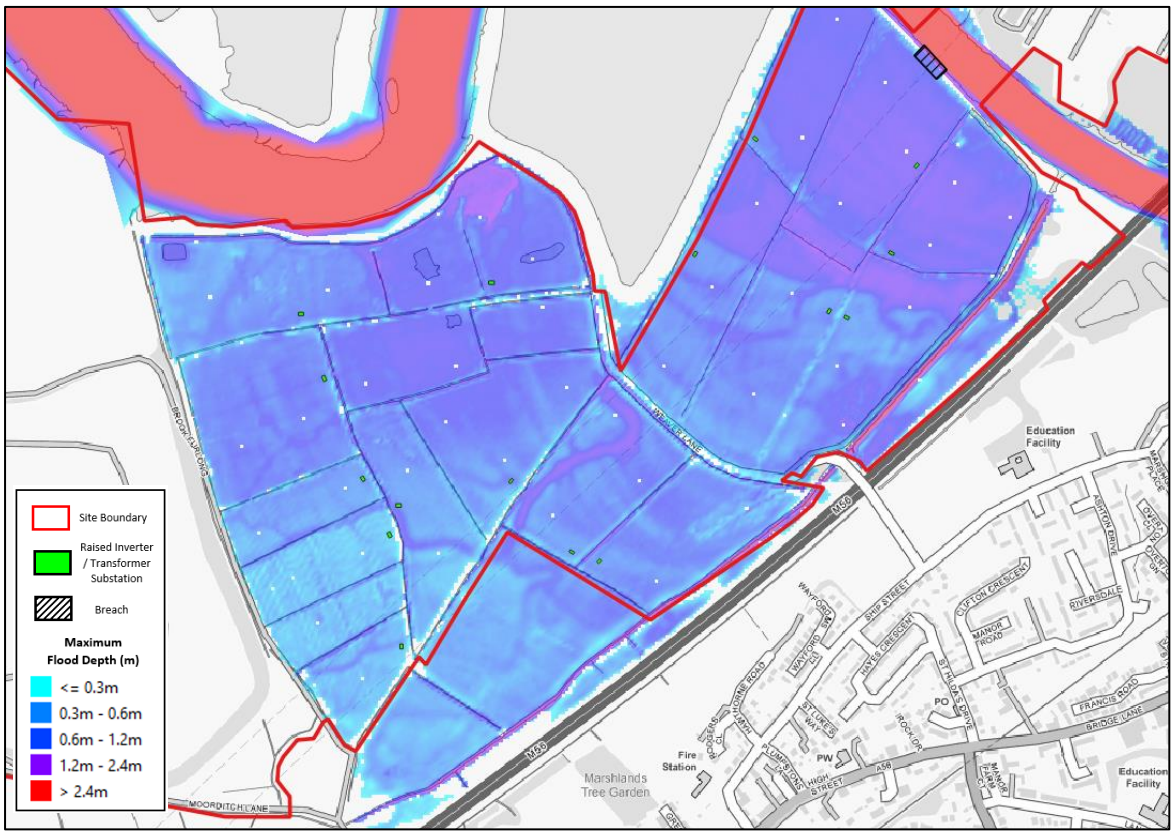
River Weaver Breach 2 1% AEP plus 67% Climate Change Event – Time of Inundation 12hrs



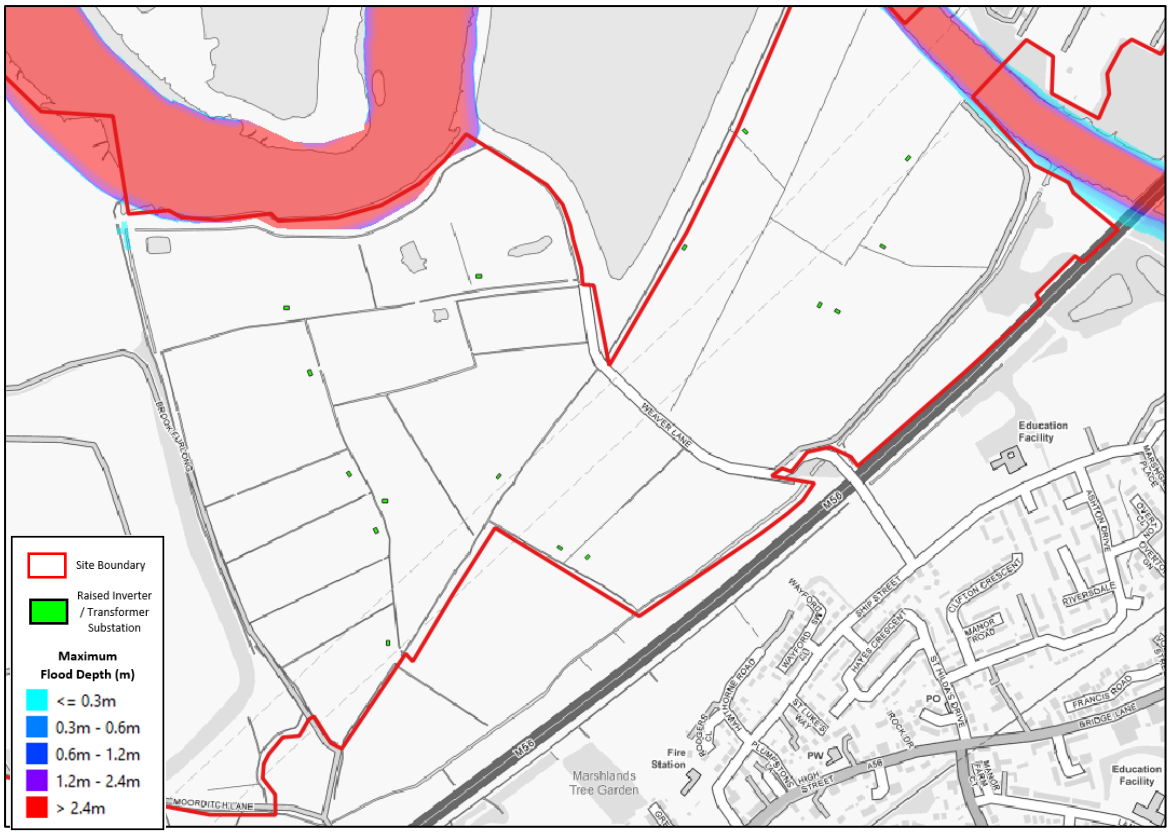
River Weaver Breach 2 1% AEP plus 67% Climate Change Event – Time of Inundation 14hrs



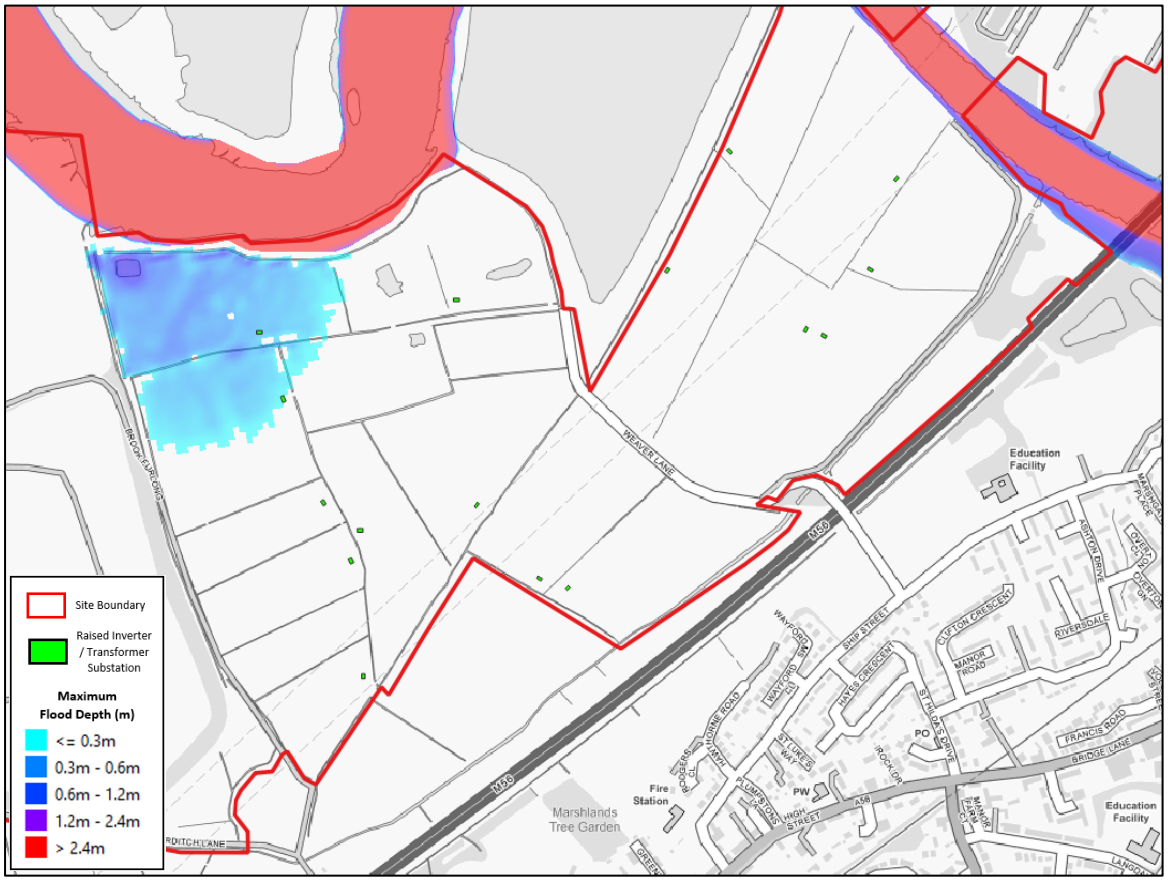
River Weaver Breach 2 1% AEP plus 67% Climate Change Event – Time of Inundation 23hrs



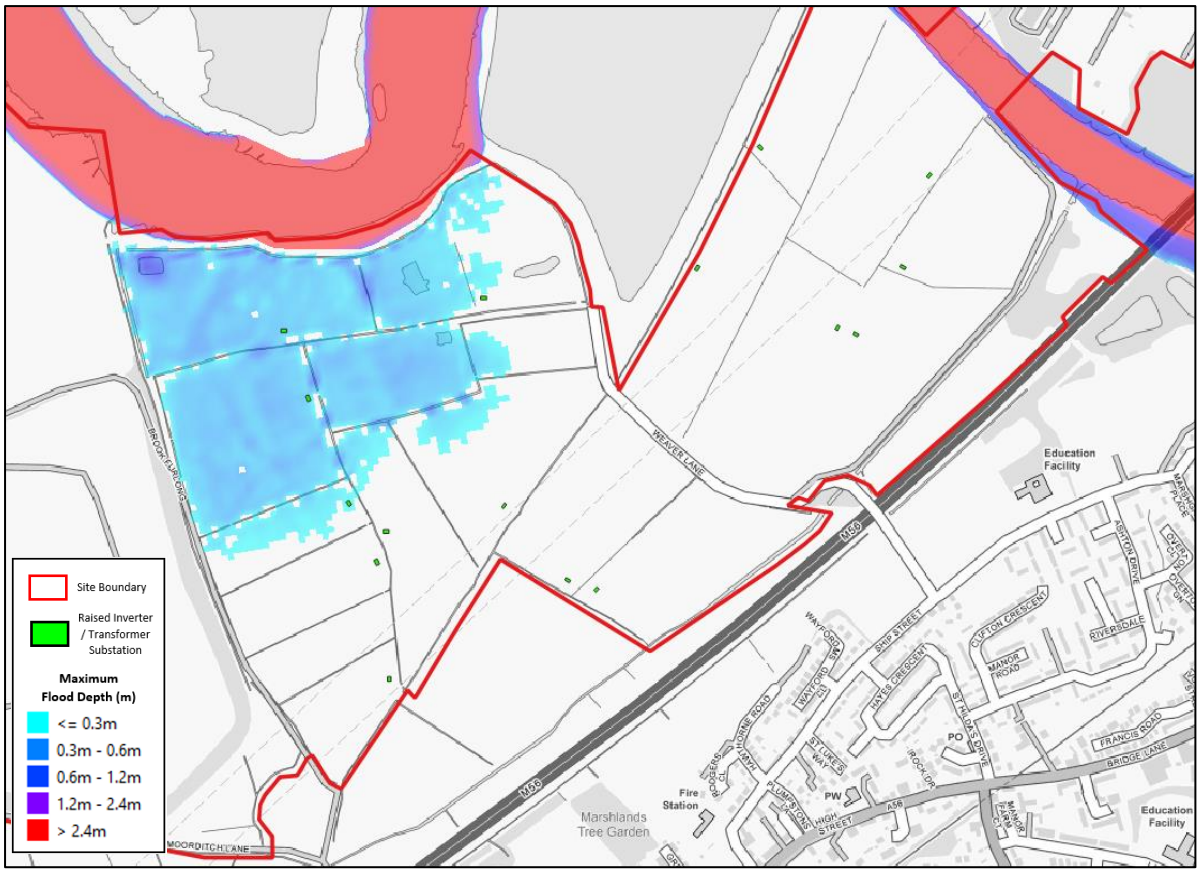
Mersey Estuary Defended 0.5% AEP Present Day Higher Central Event- Time of Inundation 0hrs



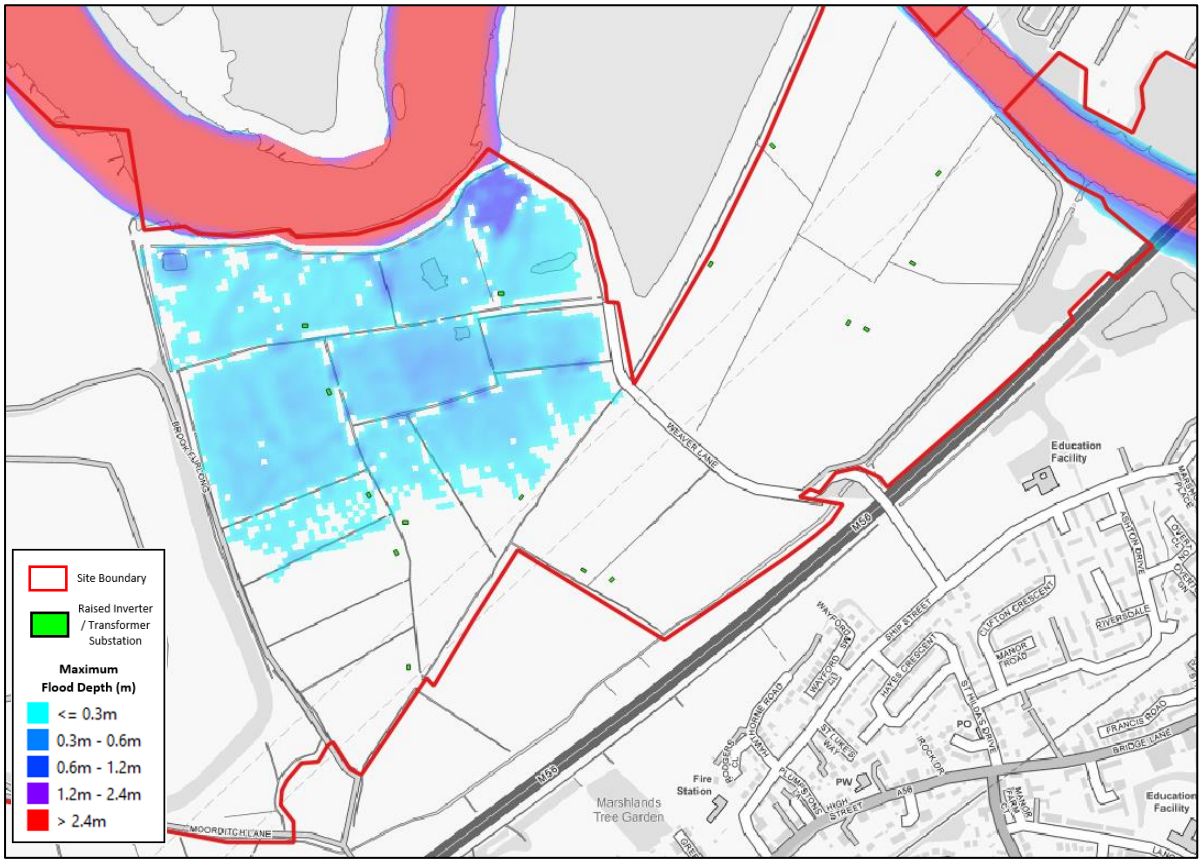
Mersey Estuary Defended 0.5% AEP Present Day Higher Central Event- Time of Inundation 0.5hrs



Mersey Estuary Defended 0.5% AEP Present Day Higher Central Event- Time of Inundation 1hrs



Mersey Estuary Defended 0.5% AEP Present Day Higher Central Event- Time of Inundation 2hrs



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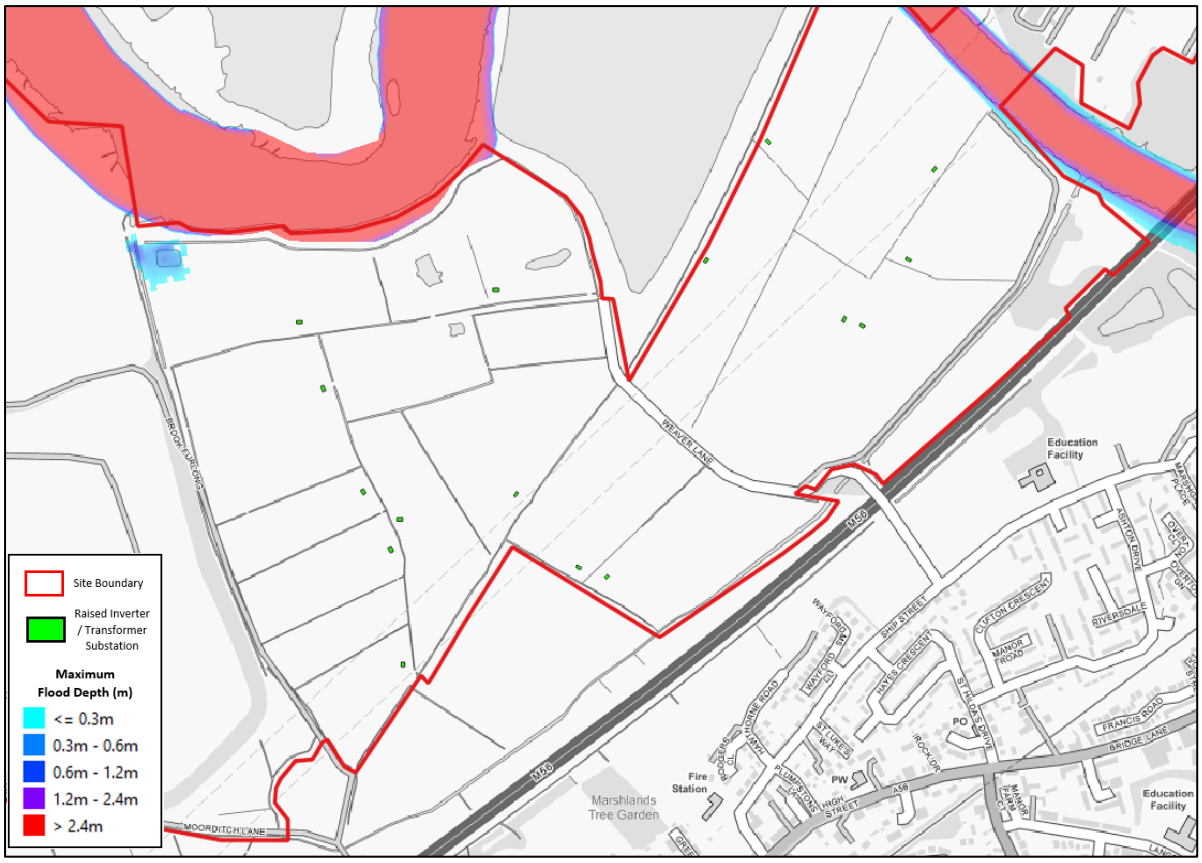

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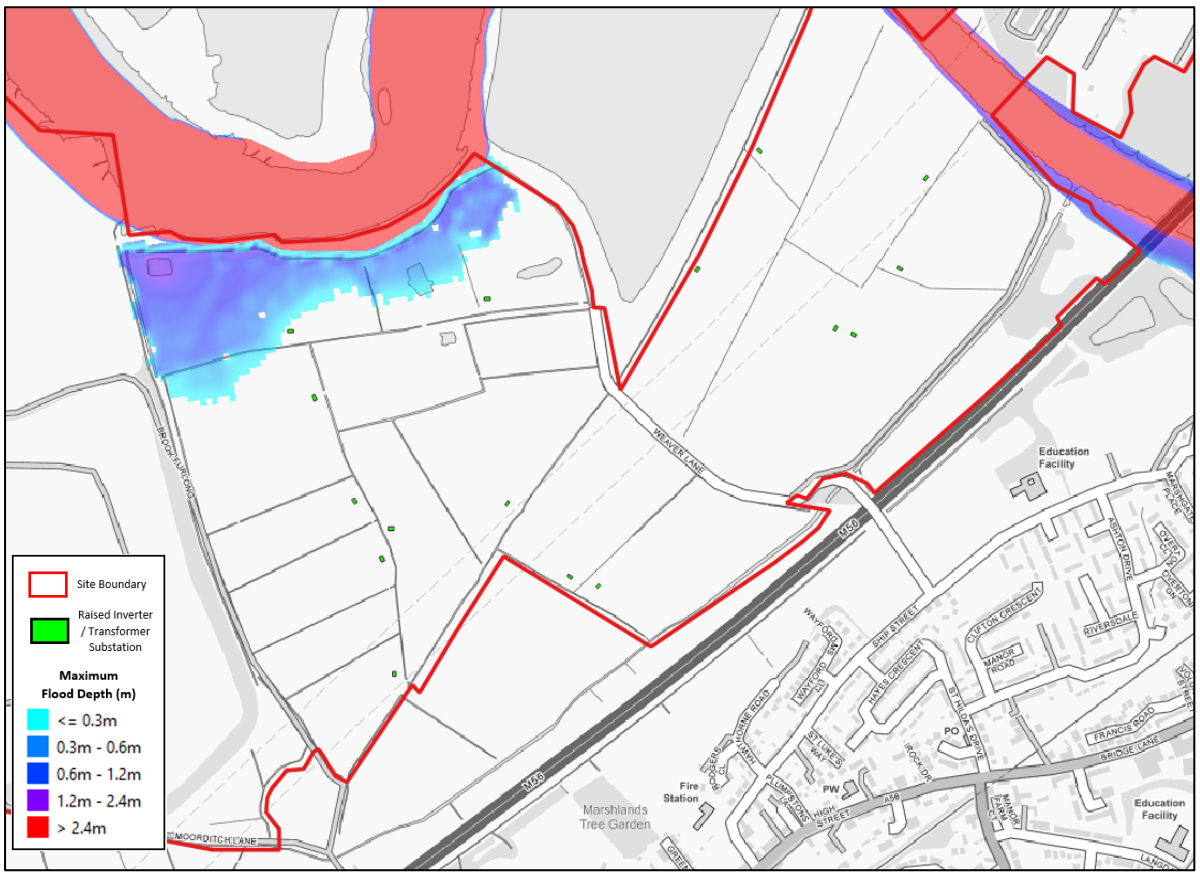

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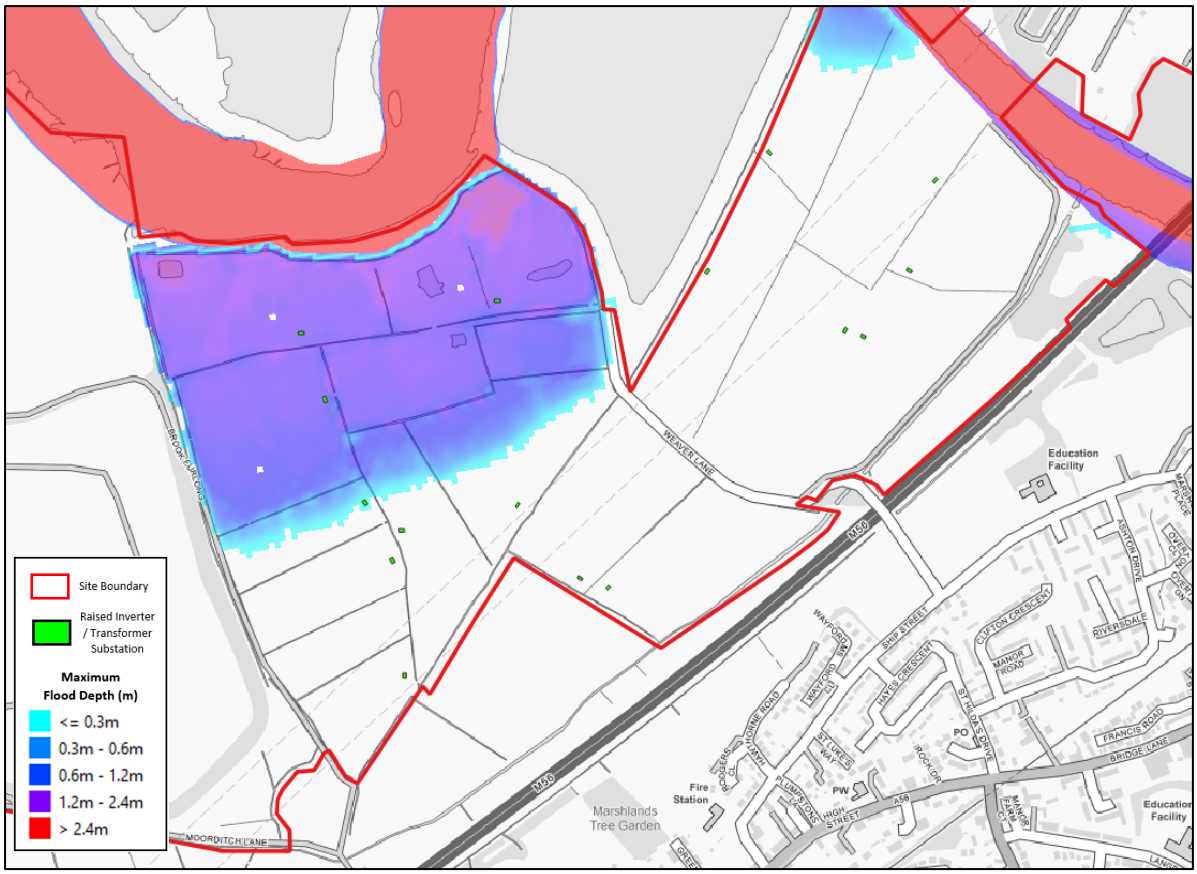

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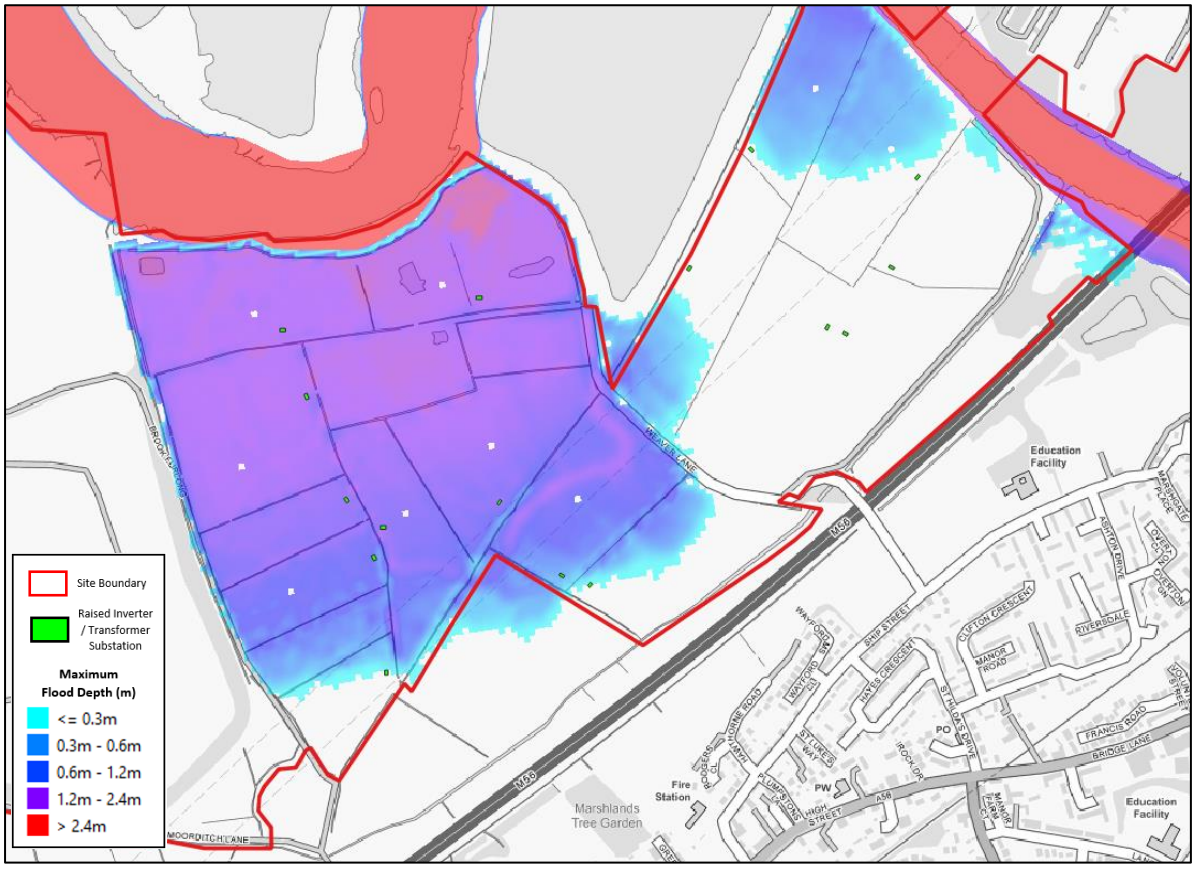

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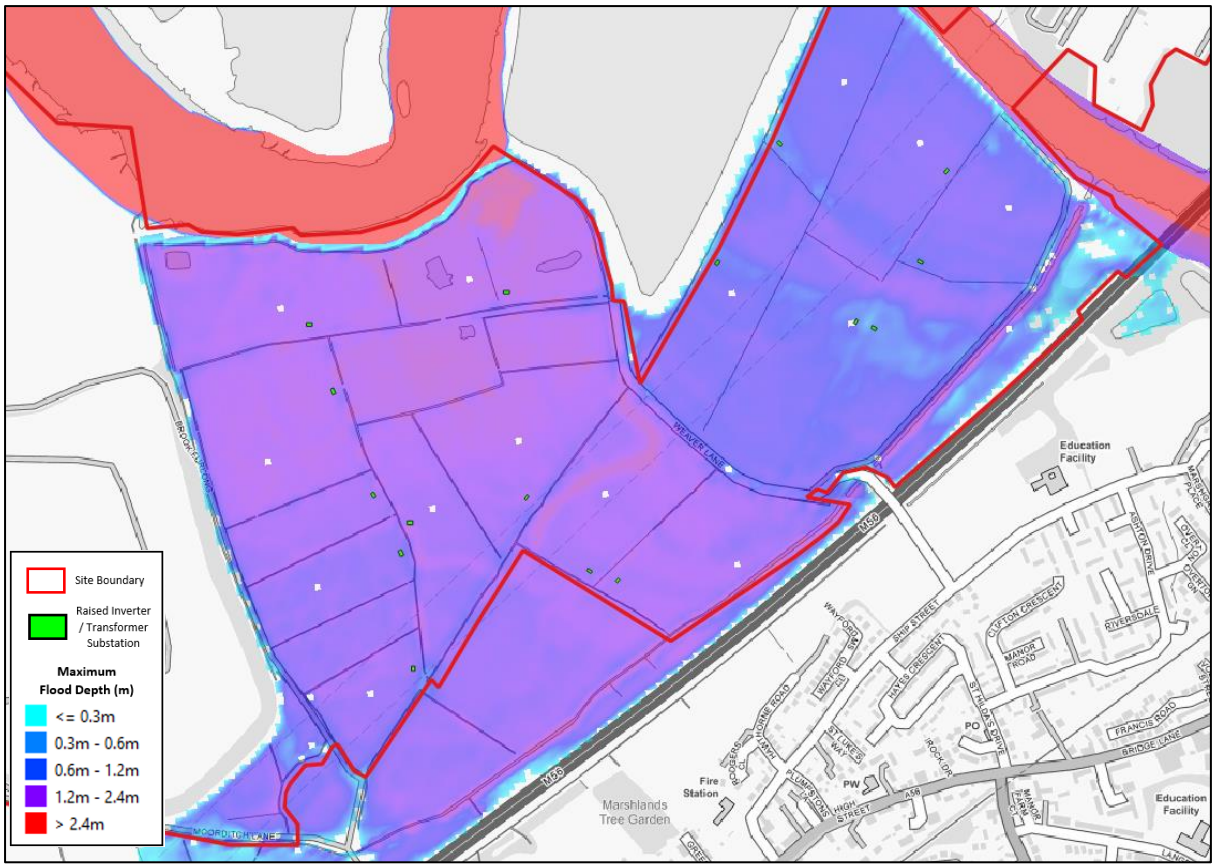

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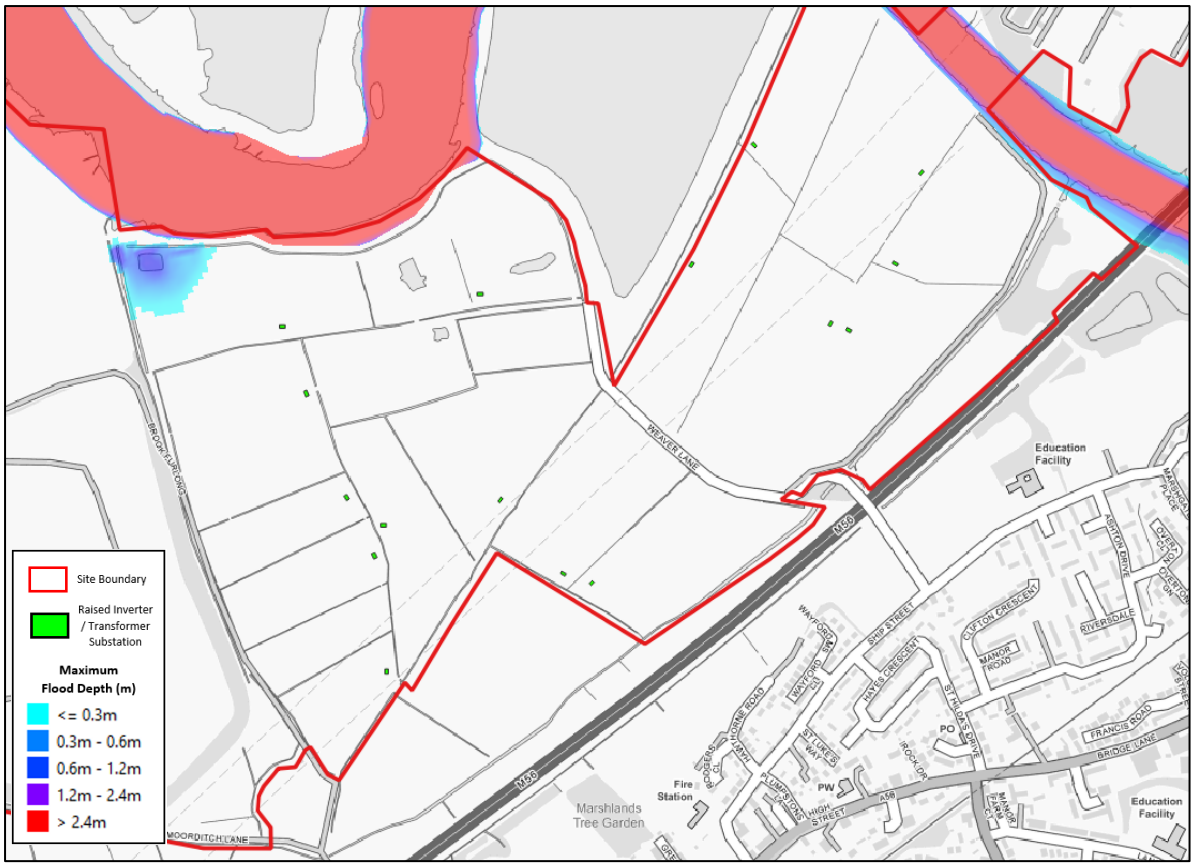

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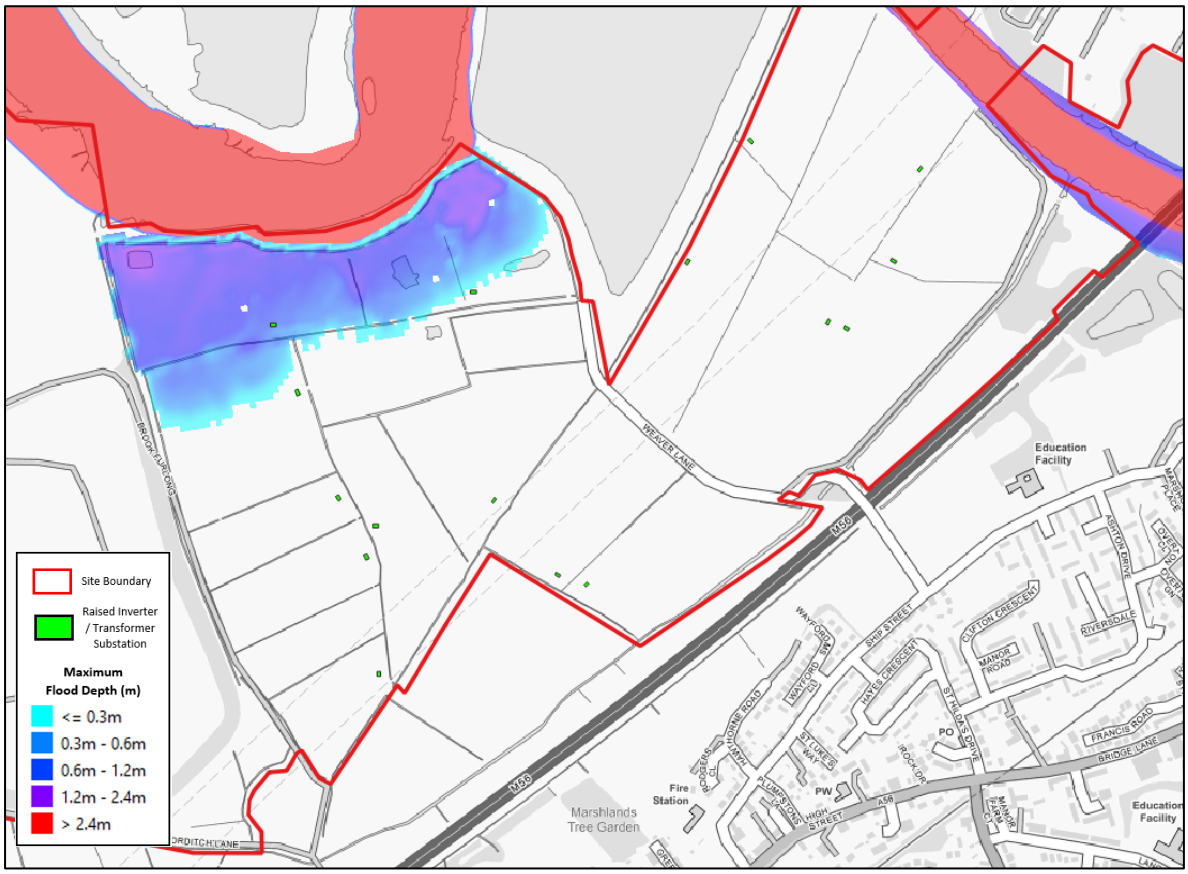

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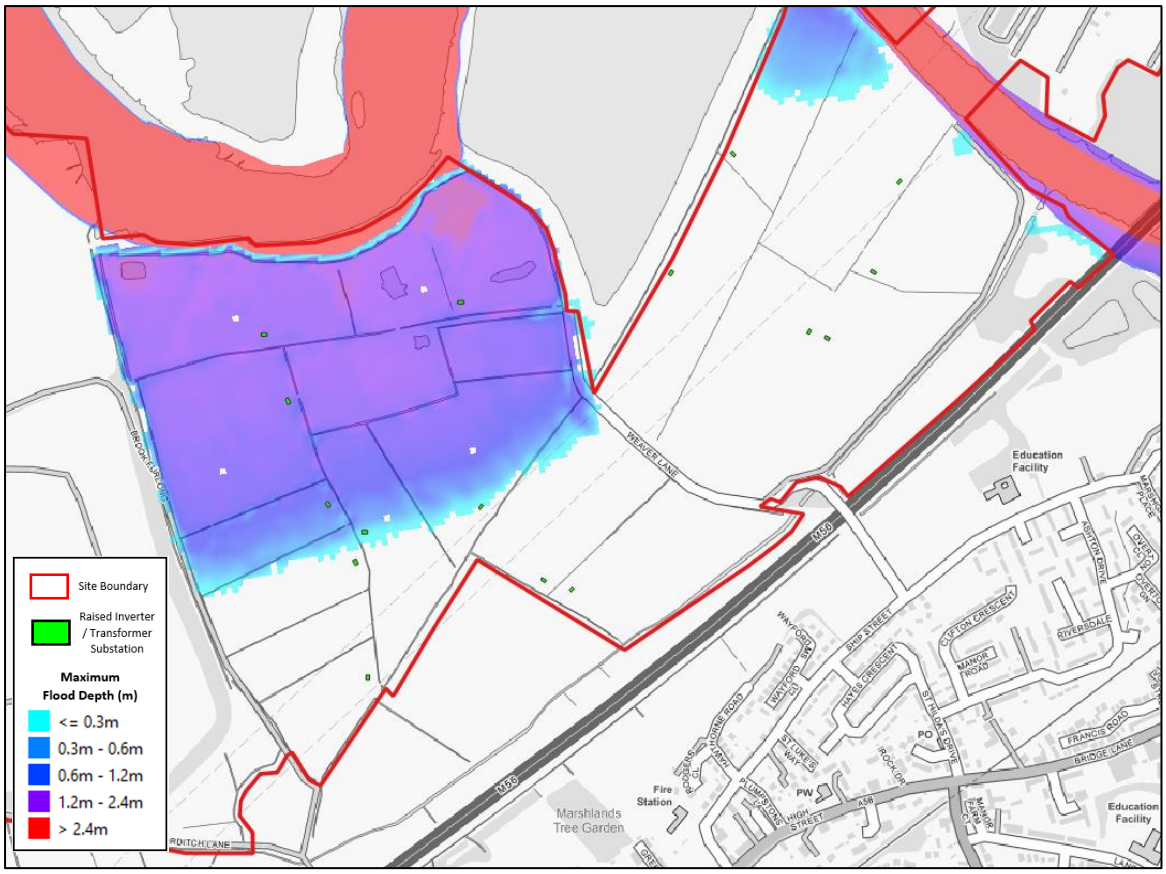

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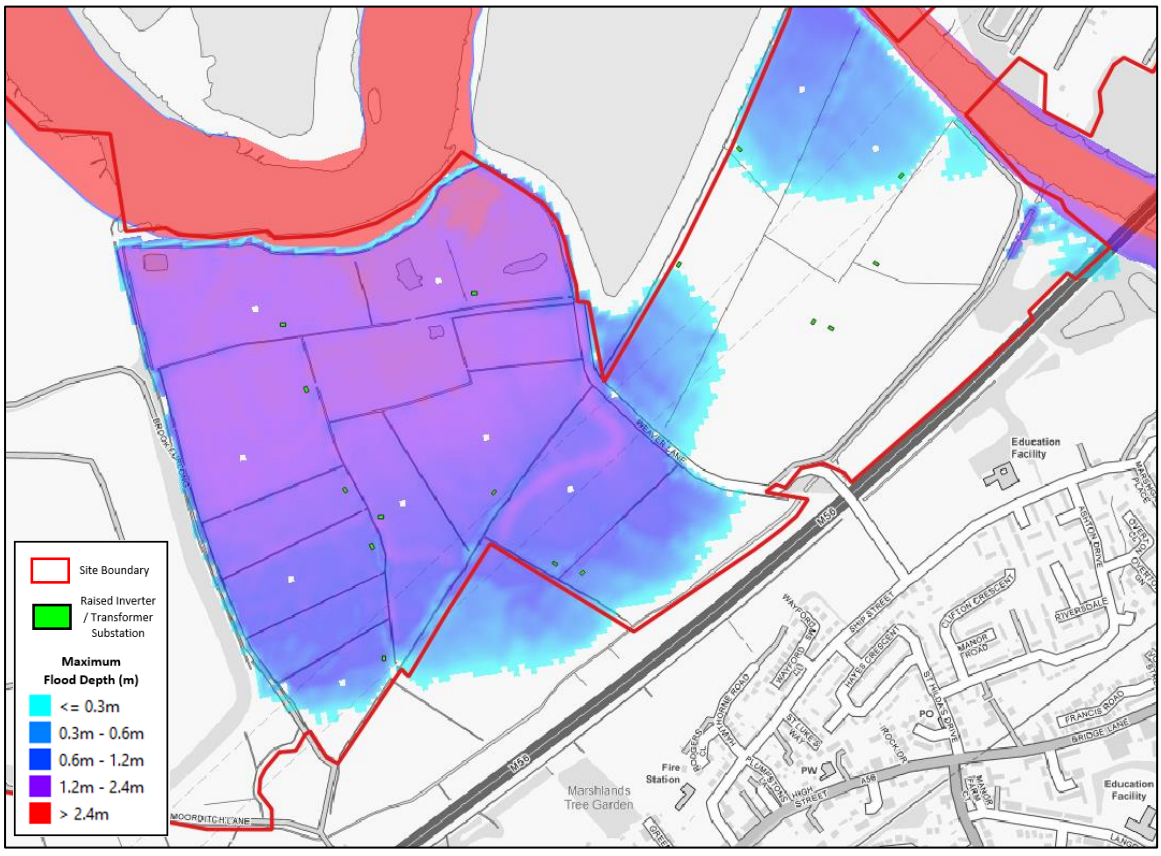

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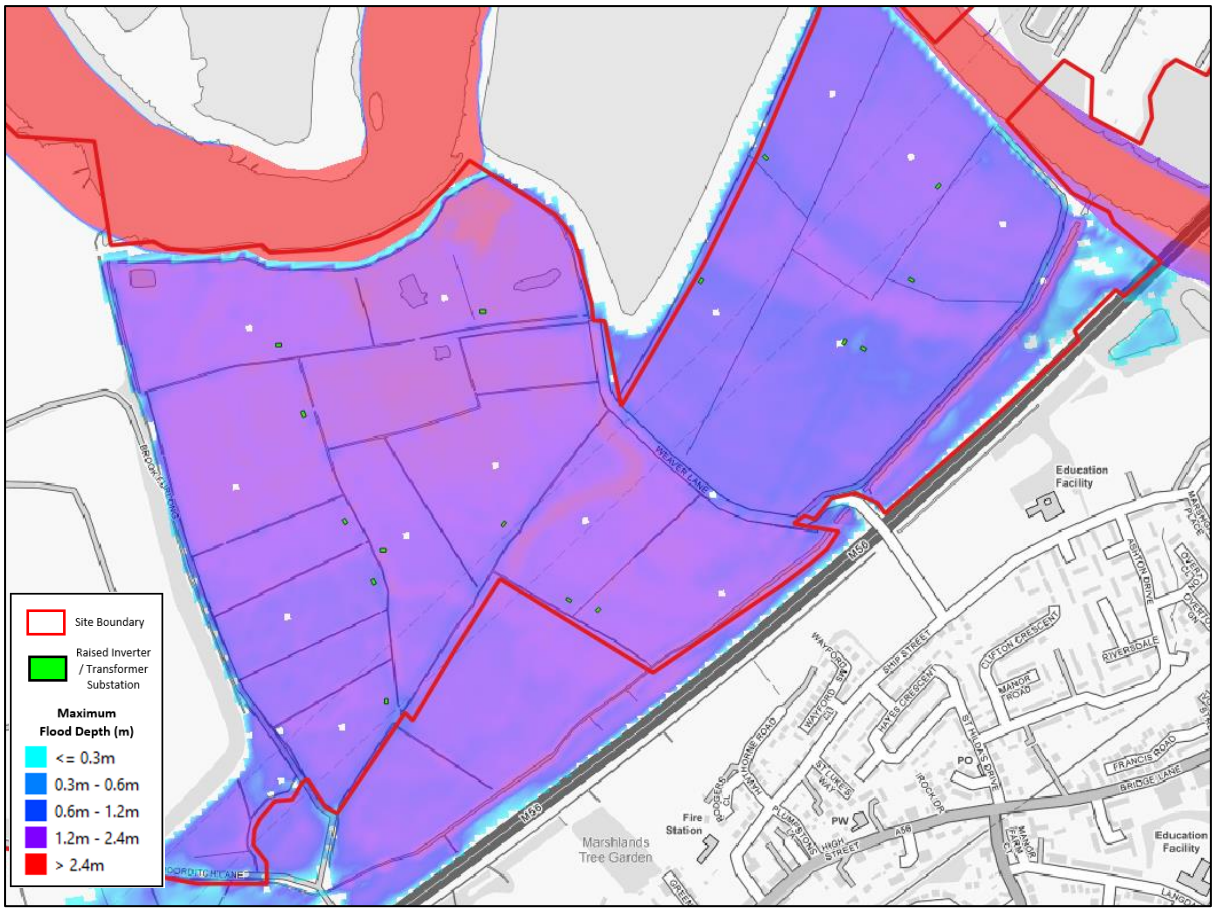


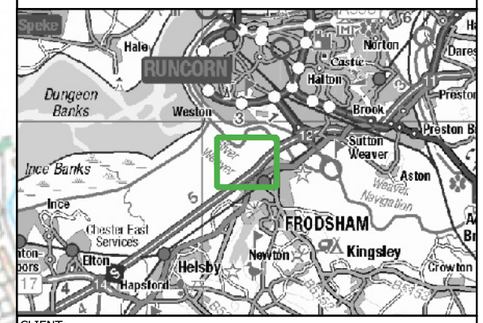
Appendix C Flood Evacuation Route Plan

NB. This area is not open water, but is now covered by grassland and scrub

Notes:
1) All dimensions are in metres and all levels in metres above Ordnance Datum unless stated otherwise.
4) This drawing is an ammendment of the Indicative Operational Site Layout by Axis.

LEGEND

- Site Boundary
- Evacuation route (Brook Furlong)
- Evacuation route (Weaver Lane)
- Inverter / transformer refuge area



0 100 200 300 400 m

CONTAINS OS DATA © CROWN COPYRIGHT (2025)

CLIENT:
Frodsham Solar Ltd

www.waterco.co.uk

SCHEME:
Frodsham Solar

PLOT TITLE:
Flood Evacuation Route Plan

PLOT STATUS:			DATE:
FINAL			26-03-2025
DRAWN:	CHECKED:	APPROVED:	PLOT SCALE AT A3:
JP	AW	NJ	1:6000

PLOT NAME:	REVISION:
14740_Flood_Evacuation_Route_Plan	-

Appendix N Greenfield Runoff Rates

ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.450
Area (ha)	2.490	Urban	0.000
SAAR (mm)	758	Region Number	Region 9

Results l/s

QBAR Rural	12.0
QBAR Urban	12.0
Q100 years	26.2
Q1 year	10.6
Q30 years	21.2
Q100 years	26.2

Appendix O MicroDrainage Simulations

Summary of Results for 100 year Return Period (+45%)

Half Drain Time : 1763 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	9.808	0.128	0.0	8.6	8.6	769.9	Flood Risk
30 min Summer	9.844	0.164	0.0	10.4	10.4	1042.3	Flood Risk
60 min Summer	9.881	0.201	0.0	10.6	10.6	1315.7	Flood Risk
120 min Summer	9.916	0.236	0.0	10.6	10.6	1578.2	Flood Risk
180 min Summer	9.937	0.257	0.0	10.6	10.6	1736.3	Flood Risk
240 min Summer	9.952	0.272	0.0	10.6	10.6	1846.1	Flood Risk
360 min Summer	9.971	0.291	0.0	10.6	10.6	1989.6	Flood Risk
480 min Summer	9.983	0.303	0.0	10.6	10.6	2077.4	Flood Risk
600 min Summer	9.990	0.310	0.0	10.6	10.6	2133.5	Flood Risk
720 min Summer	9.995	0.315	0.0	10.6	10.6	2169.2	Flood Risk
960 min Summer	9.999	0.319	0.0	10.7	10.7	2201.1	Flood Risk
1440 min Summer	9.998	0.318	0.0	10.7	10.7	2191.7	Flood Risk
2160 min Summer	9.992	0.312	0.0	10.6	10.6	2144.7	Flood Risk
2880 min Summer	9.986	0.306	0.0	10.6	10.6	2097.8	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	144.785	0.0	466.9	24
30 min Summer	94.850	0.0	638.5	39
60 min Summer	58.929	0.0	1112.8	68
120 min Summer	35.248	0.0	1320.7	128
180 min Summer	25.960	0.0	1436.8	188
240 min Summer	20.834	0.0	1510.3	246
360 min Summer	15.196	0.0	1590.0	366
480 min Summer	12.105	0.0	1623.8	486
600 min Summer	10.127	0.0	1632.0	604
720 min Summer	8.742	0.0	1624.0	724
960 min Summer	6.912	0.0	1580.3	962
1440 min Summer	4.959	0.0	1472.9	1400
2160 min Summer	3.556	0.0	2651.0	1716
2880 min Summer	2.813	0.0	2681.0	2084

Summary of Results for 100 year Return Period (+45%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
4320 min Summer	9.972	0.292	0.0	10.6	10.6	1999.6	Flood Risk
5760 min Summer	9.958	0.278	0.0	10.6	10.6	1894.0	Flood Risk
7200 min Summer	9.945	0.265	0.0	10.6	10.6	1792.4	Flood Risk
8640 min Summer	9.932	0.252	0.0	10.6	10.6	1696.3	Flood Risk
10080 min Summer	9.920	0.240	0.0	10.6	10.6	1608.7	Flood Risk
15 min Winter	9.808	0.128	0.0	8.6	8.6	769.9	Flood Risk
30 min Winter	9.844	0.164	0.0	10.4	10.4	1042.7	Flood Risk
60 min Winter	9.881	0.201	0.0	10.6	10.6	1316.0	Flood Risk
120 min Winter	9.916	0.236	0.0	10.6	10.6	1578.6	Flood Risk
180 min Winter	9.937	0.257	0.0	10.6	10.6	1736.6	Flood Risk
240 min Winter	9.952	0.272	0.0	10.6	10.6	1846.1	Flood Risk
360 min Winter	9.971	0.291	0.0	10.6	10.6	1988.9	Flood Risk
480 min Winter	9.983	0.303	0.0	10.6	10.6	2076.2	Flood Risk
600 min Winter	9.990	0.310	0.0	10.6	10.6	2132.0	Flood Risk
720 min Winter	9.995	0.315	0.0	10.6	10.6	2167.8	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
4320 min Summer	2.031	0.0	2575.0	2904
5760 min Summer	1.620	0.0	3429.1	3744
7200 min Summer	1.366	0.0	3541.6	4536
8640 min Summer	1.192	0.0	3621.2	5280
10080 min Summer	1.065	0.0	3657.8	6056
15 min Winter	144.785	0.0	466.9	24
30 min Winter	94.850	0.0	638.5	38
60 min Winter	58.929	0.0	1112.8	68
120 min Winter	35.248	0.0	1320.9	126
180 min Winter	25.960	0.0	1437.3	184
240 min Winter	20.834	0.0	1511.2	242
360 min Winter	15.196	0.0	1592.2	360
480 min Winter	12.105	0.0	1627.4	476
600 min Winter	10.127	0.0	1637.4	594
720 min Winter	8.742	0.0	1631.2	708

Summary of Results for 100 year Return Period (+45%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
960 min Winter	9.999	0.319	0.0	10.7	10.7	2200.6	Flood Risk
1440 min Winter	9.999	0.319	0.0	10.7	10.7	2196.2	Flood Risk
2160 min Winter	9.989	0.309	0.0	10.6	10.6	2121.5	Flood Risk
2880 min Winter	9.980	0.300	0.0	10.6	10.6	2056.0	Flood Risk
4320 min Winter	9.959	0.279	0.0	10.6	10.6	1899.8	Flood Risk
5760 min Winter	9.937	0.257	0.0	10.6	10.6	1733.5	Flood Risk
7200 min Winter	9.916	0.236	0.0	10.6	10.6	1577.7	Flood Risk
8640 min Winter	9.897	0.217	0.0	10.6	10.6	1436.6	Flood Risk
10080 min Winter	9.880	0.200	0.0	10.6	10.6	1311.7	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
960 min Winter	6.912	0.0	1590.9	936
1440 min Winter	4.959	0.0	1488.9	1374
2160 min Winter	3.556	0.0	2658.2	1756
2880 min Winter	2.813	0.0	2694.7	2196
4320 min Winter	2.031	0.0	2621.7	3116
5760 min Winter	1.620	0.0	3435.1	3976
7200 min Winter	1.366	0.0	3551.5	4760
8640 min Winter	1.192	0.0	3636.4	5544
10080 min Winter	1.065	0.0	3680.8	6352

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 350792 378300 SJ 50792 78300
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	1.000
Cv (Winter)	1.000
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+45

Time Area Diagram

Total Area (ha) 2.490

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	3	0.830	3	6	0.830	6	9	0.830

Model Details

Storage is Online Cover Level (m) 10.000

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00000
Membrane Percolation (mm/hr)	1000
Max Percolation (l/s)	6919.4
Safety Factor	2.0
Porosity	0.30
Invert Level (m)	9.680
Width (m)	50.0
Length (m)	498.2
Slope (1:X)	10000.0
Depression Storage (mm)	5
Evaporation (mm/day)	3
Membrane Depth (m)	0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0158-1060-0320-1060
Design Head (m)	0.320
Design Flow (l/s)	10.6
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	158
Invert Level (m)	9.675
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1200

Control Points	**Head (m)**	**Flow (l/s)**
Design Point (Calculated)	0.320	10.6
Flush-Flo™	0.211	10.6
Kick-Flo®	0.291	10.1
Mean Flow over Head Range	-	7.4

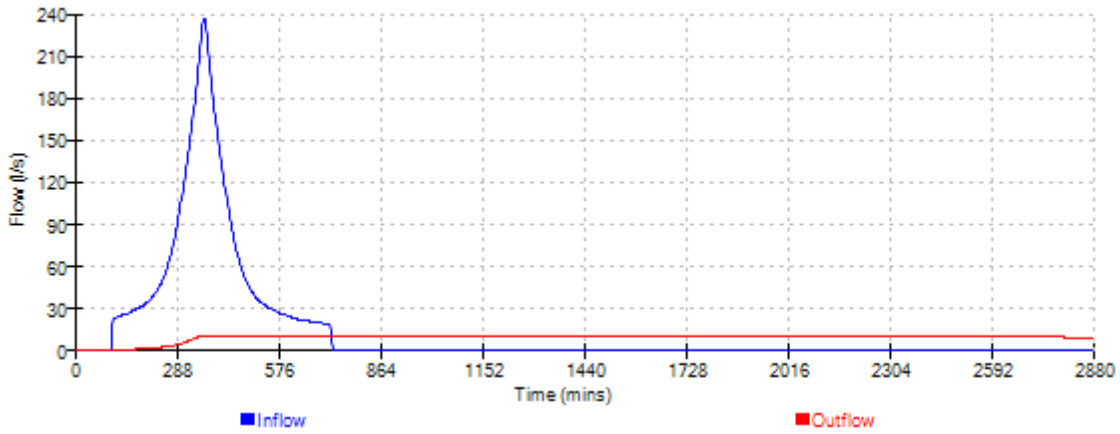
The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing

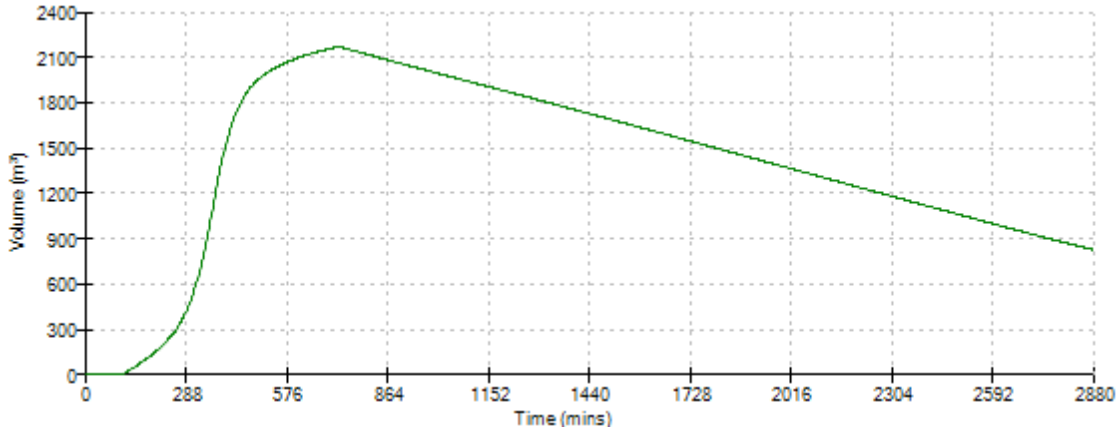
Hydro-Brake® Optimum Outflow Control

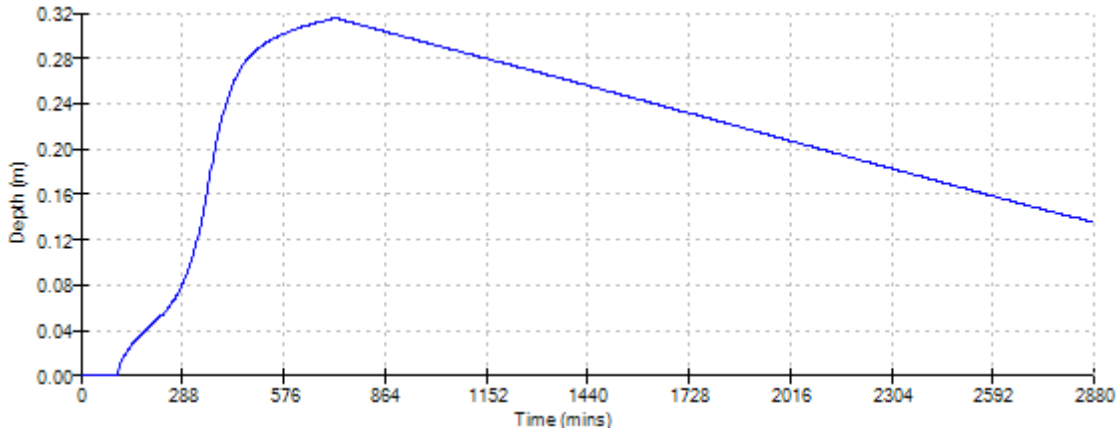
calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	5.7	1.200	19.8	3.000	30.8	7.000	46.8
0.200	10.6	1.400	21.4	3.500	32.9	7.500	48.4
0.300	10.3	1.600	22.8	4.000	35.2	8.000	50.0
0.400	11.8	1.800	24.1	4.500	37.4	8.500	51.6
0.500	13.1	2.000	25.3	5.000	39.4	9.000	53.1
0.600	14.3	2.200	26.5	5.500	41.4	9.500	54.6
0.800	16.3	2.400	27.7	6.000	43.3		
1.000	18.2	2.600	28.8	6.500	45.0		

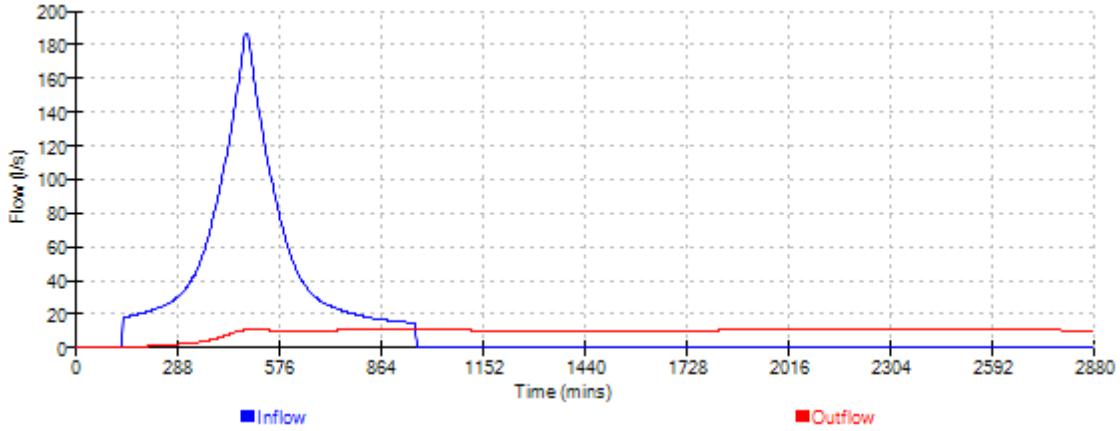
Event: 720 min Summer

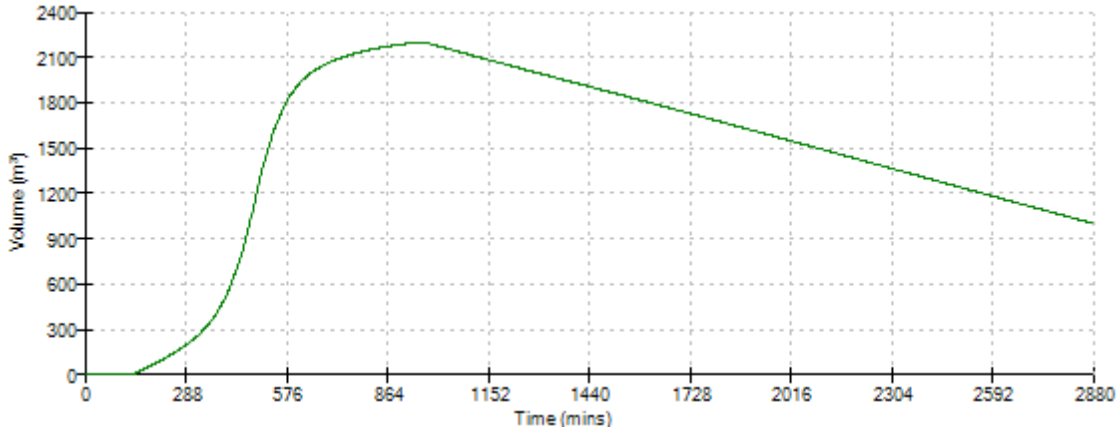


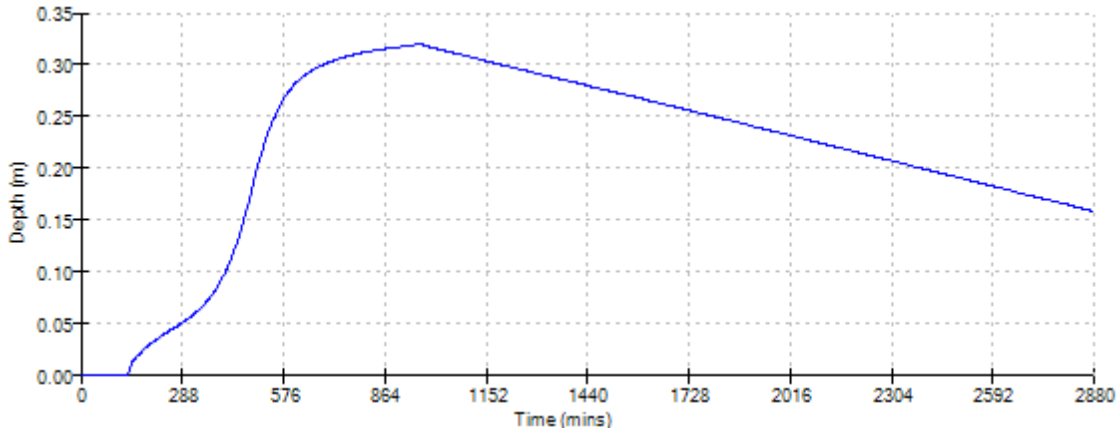




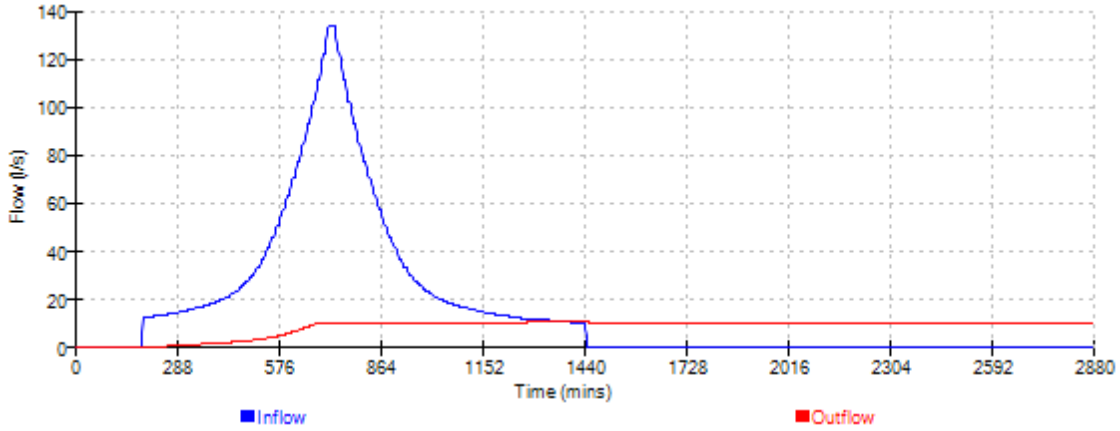
Event: 960 min Summer

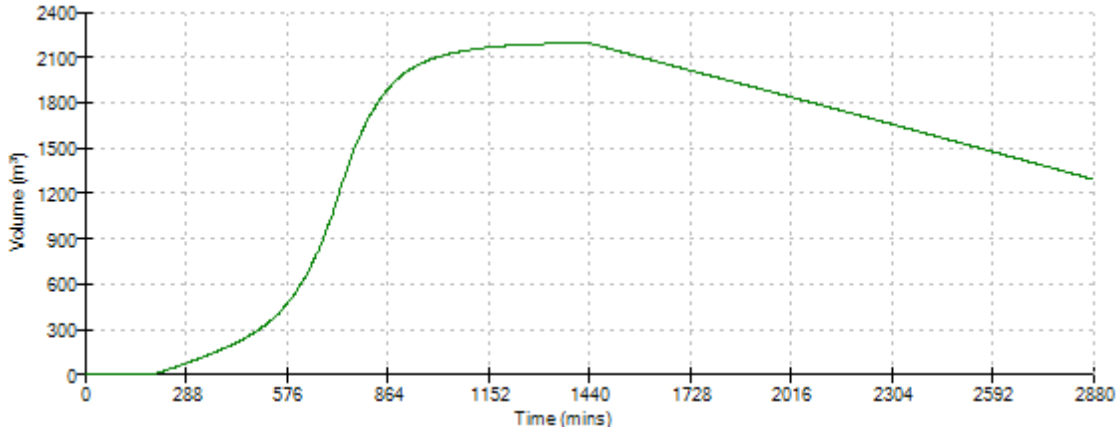


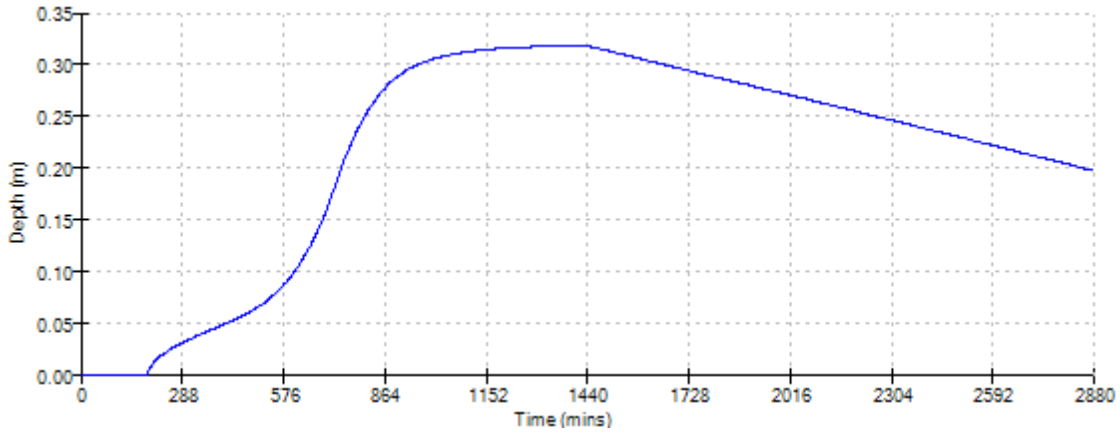




Event: 1440 min Summer







Appendix P Concept Drainage Sketch

Firewater to be managed via an internal fire suppression system that would be built into the interior of each battery container unit.

Firewater will be directed to a collection lagoon via a dedicated pipework. During a firefighting event, the valve from the lagoon would be shut and firewater held

Stone sub-grade with a depth of 295mm and a void ratio of 30%, sufficient to provide the 2201m3 of storage required to accommodate the 1 in 100 year plus 45% CC event.

Flow control chamber limiting flows to 10.6l/s

Discharge location

0 25 50 m

Notes:
1) This sketch has not been subject to formal checks or approvals. Its validity and use must therefore be limited to discussion and information purposes only.
2) Unless otherwise noted the risks associated with this proposal are not considered to be extra ordinary and within the remit of an experienced and competent contractor.
3) All dimensions in millimetres and all levels in metres above ordnance datum unless shown otherwise.
4) This drawing is an ammendment of the 3272-01-SK005 Landscape Masterplan Draft Rev J by Axis. This drawing provides a concept only and is not intended for detailed design.

LEGEND

- Proposed Permeable Stone Surfacing
- Proposed Surface Water Drain
- Hydrobrake
- Ordinary Watercourses

CLIENT:
Frodsham Solar Ltd

waterco
www.waterco.co.uk

SCHEME:
Frodsham Solar

PLOT TITLE:
Concept Drainage Sketch - Option 1

PLOT STATUS:	DATE:
SKETCH	18-10-2024

DRAWN:	CHECKED:	APPROVED:	PLOT SCALE AT A3:
MW	AW	NJ	1:1000

PLOT NAME:	REVISION:
14740_Concept_Drainage_Sketch	-

Firewater to be managed via an internal fire suppression system that would be built into the interior of each battery container unit.

Firewater will be directed to a collection lagoon via a dedicated pipework. During a firefighting event, the valve from the lagoon would be shut and firewater held

Discharge location

Flow control chamber limiting flows to 10.6l/s

Stone sub-grade with a depth of 295mm and a void ratio of 30%, sufficient to provide the 2201m3 of storage required to accommodate the 1 in 100 year plus 45% CC event.

0 25 50 m

Notes:
1) This sketch has not been subject to formal checks or approvals. Its validity and use must therefore be limited to discussion and information purposes only.
2) Unless otherwise noted the risks associated with this proposal are not considered to be extra ordinary and within the remit of an experienced and competent contractor.
3) All dimensions in millimetres and all levels in metres above ordnance datum unless shown otherwise.
4) This drawing is an ammendment of the 3272-01-SK005 Landscape Masterplan Draft Rev J by Axis. This drawing provides a concept only and is not intended for detailed design.

LEGEND

- Proposed Permeable Stone Surfacing
- Proposed Surface Water Drain
- Hydrobrake
- Ordinary Watercourse

CLIENT:
Frodsham Solar Ltd

Waterco
www.waterco.co.uk

SCHEME:
Frodsham Solar

PLOT TITLE:
Concept Drainage Sketch - Option 2

PLOT STATUS:			DATE:
SKETCH			18-10-2024
DRAWN:	CHECKED:	APPROVED:	PLOT SCALE AT A3:
MW	AW	NJ	1:1000

PLOT NAME:	REVISION:
14740_Concept_Drainage_Sketch	-

Appendix Q Maintenance Schedule

Operation and Maintenance Requirements for Permeable Surfacing (Compound Surfacing)

Maintenance Schedule	Required Action	Typical Frequency
Occasional maintenance	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 50mm of the level or the surfacing	As required
	Repair / restore permeable roads following construction activities (if required), for example if compaction has occurred leading to rutting	As required
	Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging)
Monitoring	Inspect for evidence of poor operation and / or weed growth – if required, take remedial action	Three-monthly, 48hr after large storms in first six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually

Ref. Table 20.15, CIRIA C753 'The SuDS Manual'

The maintenance requirements detailed above are to be undertaken by the site owner.

Appendix R Watercourse Crossings Plan

Crossing Point Ref.	Watercourse Ref. D# - Ordinary Watercourse W# - Main River	Crossing	
		Existing or New	Type
CP1	D22	Existing	Replacement open span vehicular crossing, with MV and LV cable crossing.
CP2	D23	New	New open span vehicular crossing and MV and LV cable crossing.
CP3	D32	New	New open span vehicular crossing and MV cable crossing.
CP4	D24	New	New open span vehicular crossing and MV cable crossing.
CP5	D32	New	New open span vehicular crossing and MV cable crossing.
CP6	D36	New	New open span vehicular crossing and MV and LV cable crossing.
CP7	D9	Existing	Replacement open span vehicular crossing, with MV and LV cable crossing.
CP8	D13	New	New open span vehicular crossing and MV cable crossing.
CP9	D5	New	New open span vehicular crossing and MV cable crossing.
CP10	D19	New	New open span vehicular crossing and MV cable crossing.
CP11	D10	New	Replacement open span vehicular crossing, with MV and LV cable crossing.
CP12	D11	New	New open span vehicular crossing and MV cable crossing.
CP13	D9	New	New open span vehicular crossing and MV cable crossing.
CP14	W2	Existing	Replacement open span vehicular crossing, with MV and LV cable crossing.

Crossing Point Ref.	Watercourse Ref. D# - Ordinary Watercourse W# - Main River	Crossing	
		Existing or New	Type
CP15	D1	New	New open span vehicular crossing, with MV and LV cable crossing.
CP16	D2	Existing	Replacement open span vehicular crossing, with MV cable crossing.
CP17	W2	New	New open span vehicular crossing, with MV cable crossing.
CP18	D3	Existing	Replacement open span vehicular crossing, with MV cable crossing.
CP19	D4	New	New open span vehicular crossing, with MV and LV cable crossing.
CP20	Not used		
CP21	D6	New	New open span vehicular crossing, with MV cable crossing.
CP22	W1	New	Replacement open span vehicular crossing, with MV cable crossing.
CP23	D3	Existing	Retain existing vehicular crossing.
CP24	D16	Existing	Retain existing vehicular crossing, new LV cable crossing.
CP25	D15	Existing	Retain existing vehicular crossing, new LV cable crossing.

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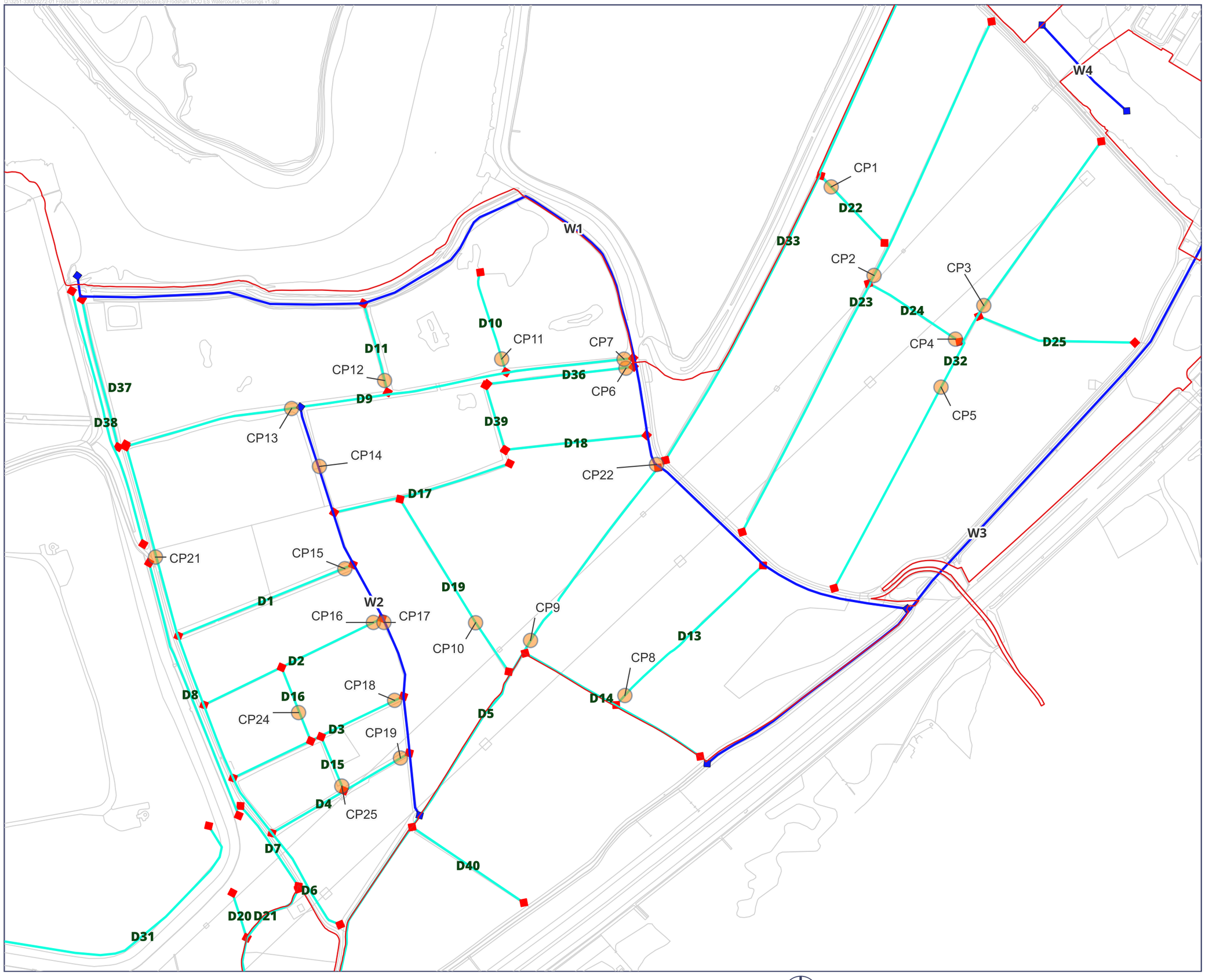

Order Limits

Crossing Points

Main Rivers

Ditches

N

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Project

Frodsham Solar Environmental Statement

Figure Number

Appendix 2-1 Figure 1

Figure Title

Indicative Watercourse Crossing Points

Scale

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Date

April 2025

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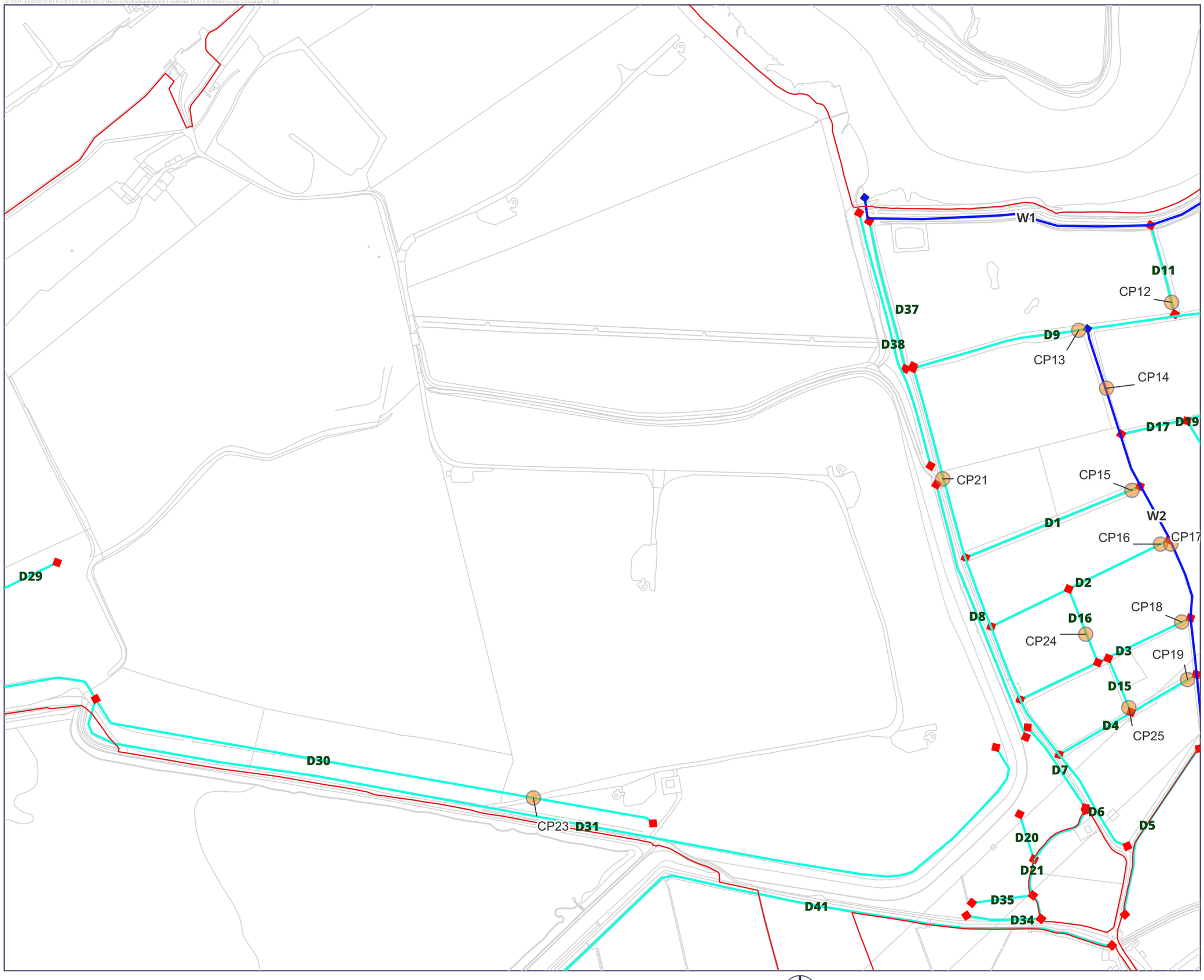

Order Limits

Crossing Points

Main Rivers

Ditches

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Project

Frodsham Solar Environmental Statement

Figure Number

Appendix 2-1 Figure 2

Figure Title

Indicative Watercourse Crossing Points

Scale

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Date

April 2025

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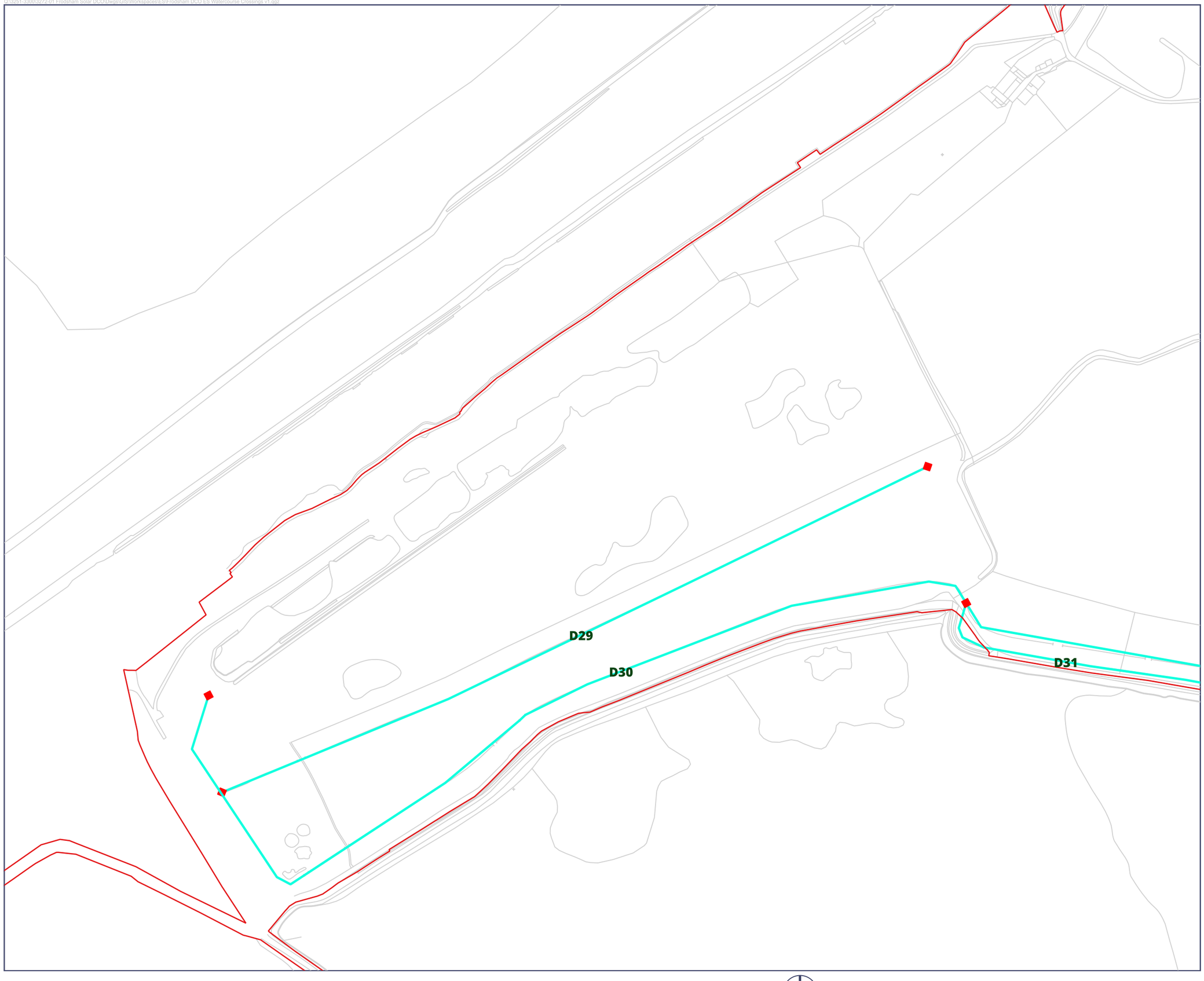

Order Limits

Ditches

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Frodsham Solar Environmental Statement

Figure Number

Appendix 2-1 Figure 3

Figure Title

Indicative Watercourse Crossing Points

Scale

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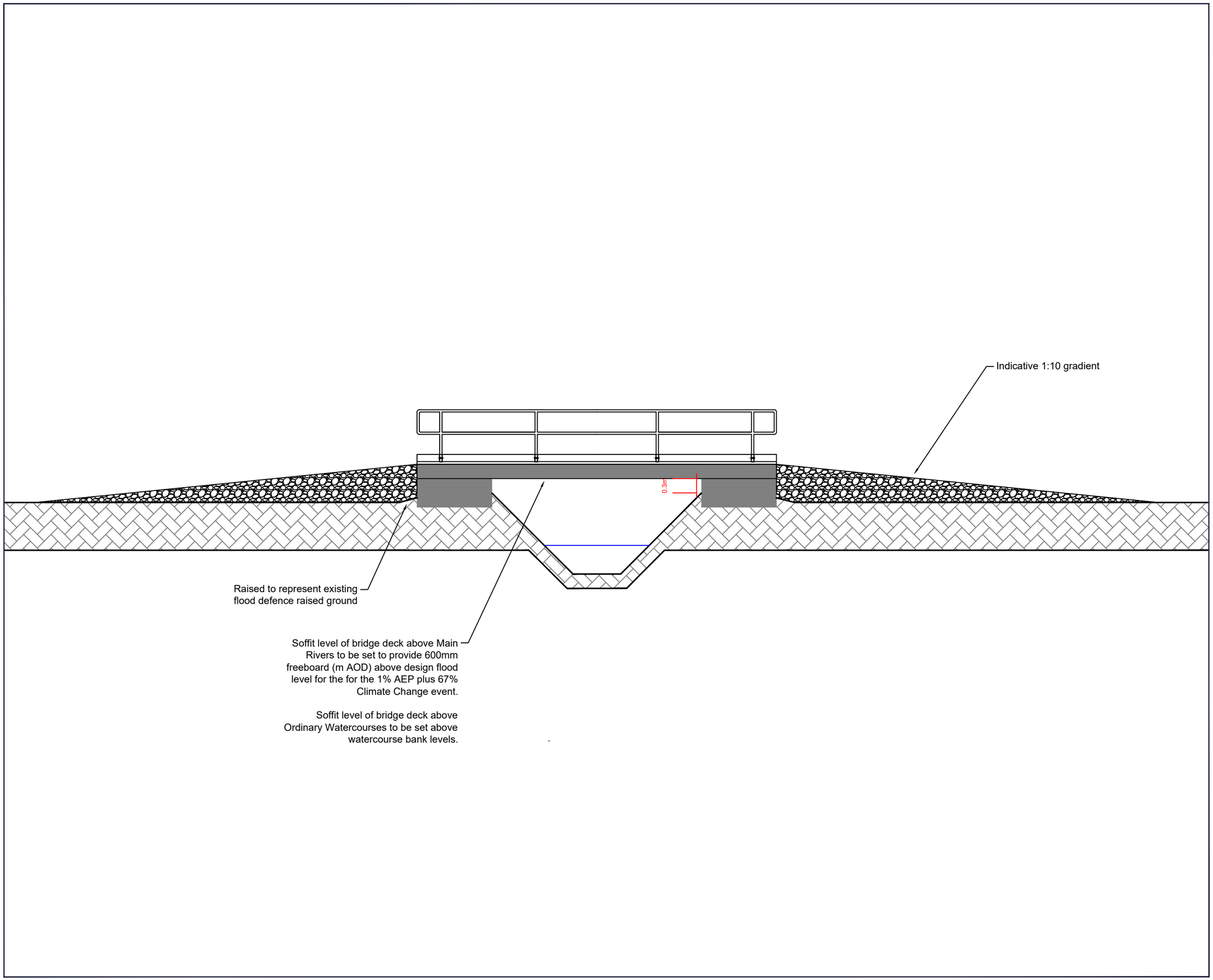
Date

April 2025



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Case Reference: EN010153
Document Reference: EN010153/DR/6.3
Regulation 5(2)(a) Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

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Document
Environmental Statement: Volume 3

Project
FRODSHAM SOLAR

Figure Number
Figure 2-5j

Figure Title
Indicative Permanent Watercourse Crossing

Scale
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Date
May 2025

Appendix S Watercourse Crossing Design Justification

Project:	Frodsham Solar	**Scheme No:**	14740
Subject:	Watercourse Crossing Design Justification	**Revision:**	01
Client:	Frodsham Solar Limited	**Date:**	09/05/2025
Doc Ref:	14740-Bridge Design Technical Note-01		
Author:	Aled Williams BSc (Hons) MCIWEM C.WEM		
Checker:	Megan Williams BSc (Hons) MSc MICWEM		
Approver:	Mike Wellington BEng (Hons) MSc CEng CEnv FICE FCIWEM C.WEM IMaPS MAPM		

Introduction

Waterco have been instructed to prepare a Technical Note in relation to access road crossings over watercourses associated with Frodsham Solar to the north of the M56, Frodsham, Cheshire, WA6 7BQ. The purpose of this Technical Note is to justify the watercourse bridge crossing design parameters.

Watercourse Crossings

A watercourse crossing schedule and accompanying map is included in Appendix A. Three crossings are proposed over designated Environment Agency (EA) 'Main Rivers', specifically CP14, CP17 and CP22. CP14 and CP22 are existing culverted crossing points and will be replaced. CP17 is a new crossing point. The remainder of the crossing points comprise a combination of new, replacement and retained crossings over watercourses designated as 'Ordinary Watercourses'.

Environment Agency Position

EA correspondence dated 19th December 2024, included as Appendix B, states that:

'…Bridge and Cable Crossings of Watercourses

Issue

We are concerned with details of the proposed crossings, namely the:

- *the soffit level of the bridges*
- *the potential extension of existing culverts*

Impact

The bridges may restrict future maintenance of the watercourse and works to flood assets. Culverts can lead to an increase in flood risk, have a risk of blockage, and pose a maintenance burden.

Solution

Alternative cable crossing options should be considered. The soffit levels of bridges should be raised 600mm above the design flood level. We recognise this may have knock on effects to the proposed development, and would encourage the developer to liaise with us further on this issue.

Instead of installing / extending (existing) culverts, the applicant should consider installing a clear-span bridge crossing. Given that there are circa 25 crossings as part of this proposal, the applicant will need to model changes in flood risk from the proposed crossings.

Our position on this is supported by paragraphs 2.10.87 and 2.10.88 of National Policy Statement EN-3, which state

that:

- *culverting existing watercourses should be avoided*
- *where culverting for access is unavoidable, applicants should demonstrate that no reasonable alternatives exist, and where necessary it will only be in place temporarily for the construction period…*

…Construction Point Installations

Issue
Inappropriate design and installation of new crossing points.

Impact
Damage to the integrity of embankments, channel bed and reduced mammal passage.

Solution
For the design and installation of new crossing points, abutments should be set back at-least 8m from the top of the bank, not embedded in the bank as is illustrated in Figure 2-5j. This approach would avoid the necessity of over-pumping to ensure a dry environment for construction (PEIR, Chapter 7; Section 7.7; paragraph 7.7.36). This would not damage the integrity of the banks and channel bed. Setback abutments would also allow the bridge deck to be constructed at a higher level, reducing areas of deep shade and allowing free mammal passage...'

The design flood level for the design of on-site watercourse bridge crossings stipulated by the EA is the River Mersey 1 in 200 (0.5%) annual probability plus climate change event. The 0.5% annual probability plus climate change (upper end scenario) flood level for the River Mersey in the location of the access crossings is 5.88m AOD. Based on EA requirements, the bridge soffit levels would need to be set at 6.48m AOD in order to account for a 600mm freeboard. A bridge soffit of 6.48m AOD is approximately 1.5m above the watercourse bank levels.

The EA's justification for designing access crossings above the River Mersey design flood level, rather than the flood level associated with the watercourse which is subject to the bridge crossing, is to ensure that safe access and egress is available during a tidal flood event.

It is noted that all new or replacement watercourse access crossings will be open span bridge structures. No new culverts, or culvert extensions, are proposed.

Published Guidance

The EA document *'Standard Rules SR2015 No 28 – Installing a clear span bridge on a main river of up to 8 metres span and 4.2m width'* provides guidance on bridge crossing design. The standard rules detailed in SR2015 No 28 cannot be applied to the proposed watercourse crossings on site as each crossing falls within 200m of another bridge or culvert. However, this document has been referenced in absence of any alternative published guidance on the design of watercourse bridge crossings.

SR2015 No 28 provides typical design guidance and states that:

- The soffit shall be at least 0.6 metres higher than the top of the bank on both sides of the river.
- The approach ramp or steps for the bridge shall not extend further than is necessary to allow a gradient of 10% (1 metre vertical for 10 metres horizontal) on the approach.
- The level of the land at each end and surrounding the approach ramp or steps to the bridge shall not be changed by the construction.

- The bridge shall be securely attached to foundations which are no closer than a distance of 1 metre from the watercourse.

- The length of the bank disturbed by the activity shall extend to no more than 2 metres to either side of the bridge.

National Policy Statement for electricity networks infrastructure (EN-5) contains the following guidance in relation to access roads, however no specific guidance is provided to the design of watercourse crossings:

'2.9.17 - make the design of access roads, perimeter fencing, earth-shaping, planting and ancillary development an integral part of the site layout and design, so as to fit in with the surroundings'.

Bridge Crossing Design

All new or replacement watercourse access crossings for this project will be open span bridge structures. No new culverts, or culvert extensions, are proposed. An 'Indicative Permanent Watercourse Crossing' drawing is provided in Appendix C with an extract provided below (Figure 1). For crossings over designated Main Rivers, the soffit level of the bridge deck will be set 600mm above the 1% annual probability plus 67% climate change flood level. The flood level is applicable to the watercourse that the bridge spans. The approach ramp will have a 1 in 10 grade to ensure it does not extend further than is necessary.

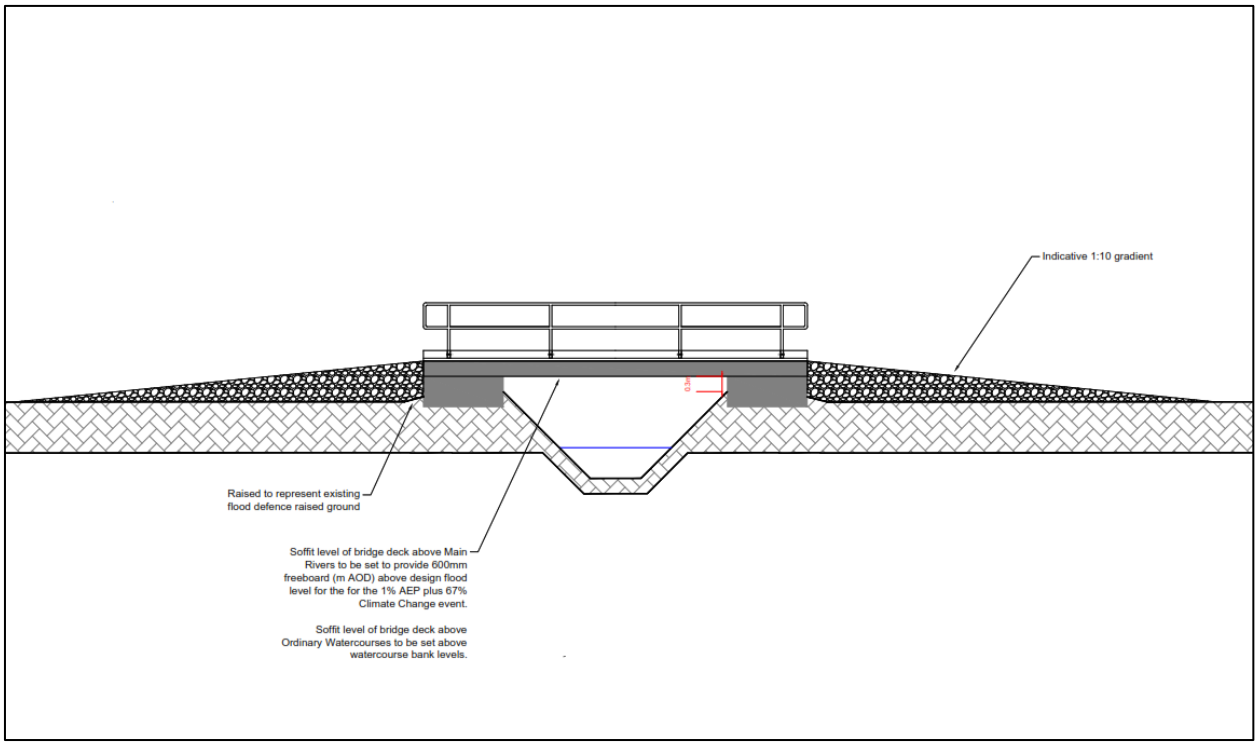

Figure 1 – Typical Watercourse Crossing

Detailed hydraulic analysis of the Main Rivers on site has been undertaken by Waterco with full details provided in the supporting document referenced 'ES Vol 2 Appendix 9-4: Waterco Ince and Frodsham Technical Note [EN010153/DR/6.2'. Table 1 provides a summary of the flood levels at the 'Main River' crossing points together with the proposed bridge soffit levels.

Table 1: Proposed Access Bridge Soffit Levels

Crossing Point Reference	1% AEP + 67% CC Peak Water Level	1% AEP + 106% CC Peak Water Level	Proposed Soffit Level including 600mm freeboard (m AOD)
CP14	4.74	4.84	5.34
CP17	4.74	4.84	
CP22	4.76	4.89	5.36

The proposed bridge soffit levels will provide 600mm above the 1% annual probability plus 67% climate change water level. The 1% annual probability plus 106% CC water level will also be below the proposed soffit levels.

New bridge crossings over Ordinary Watercourses will have a soffit level set above the watercourse bank level. This will ensure that the capacity of the channel is not impacted ensuring no detriment to flood risk.

Bridge Crossing Design Justification

Soffit Level

The soffit level has been set to provide a 600mm freeboard above the maximum estimated water level in the below river channel during the 1% annual probability plus 67% climate change event. This ensures that the bridge crossing will not impact on the channel capacity and will not disrupt flows within the channel during flooding conditions.

There is minimal fall in the watercourses on site and as such the flow velocity of the watercourses on site is very low (little to no flow was witnessed during site visits). The water levels in the watercourses on site rise following rainfall and fall when flows are pumped by an EA operated pumping station to the River Weaver. The risk of structure blockage i.e. by woody debris is low given the minimal velocity in the watercourses (debris would not be conveyed towards the bridge crossings) coupled with the large bridge span arising from provision of a 600mm freeboard above the design flood level.

Crossing points CP14 and CP22 are existing and currently comprise a concrete slab set over the watercourse with a soffit level below the level of the bank. The replacement crossings will provide flood risk benefits by raising the soffit level above the banks providing additional clearance to estimated flood levels.

The EA have requested that the bridge soffit is designed above the River Mersey 1 in 200 (0.5%) annual probability plus climate change flood level. This would result in a bridge soffit of 6.48m AOD approximately 1.5m above the watercourse bank levels. The EA justification for designing above the River Mersey flood level is to ensure that safe access and egress is available during a tidal flood event.

Raising the bridge soffits above the EA River Mersey tidal flood levels will not provide safe access and egress as all connecting access tracks (between all watercourse crossing points) will not be raised (they will be formed at existing ground levels). Therefore, raising the bridge soffits above the EA River Mersey flood level would result in the bridges forming ‘dry islands’ which would be cut off in the event of flooding.

Raising the level of the proposed access tracks within the River Mersey flood extent above the River Mersey design flood level has been considered as to provide a flood free access / egress route. New access tracks within the River Mersey flood extent cover a distance of approximately 3,215m. Raising the level of the new access tracks above the

River Mersey flood level is not considered to be practical or sustainable as:

- The access tracks would be raised approximately 1.5m (and up to 1.8m in isolated areas) above existing ground levels. This would be contrary to *2.9.17 of* National Policy Statement EN5 which states that access tracks should 'fit in with the surroundings'

- Raising the access tracks to 6.48m AOD (River Mersey design flood level including 600mm freeboard) would entail a significant amount of ground raising and associated import of material onto the site. Based on a 1.5m high, 5m wide access track (which allows spacing for a verge and installation of safety barriers) with a 1 in 3 side slope (from the height of the access track to adjacent existing ground levels), the cross sectional area of the access track would be approximately 14.25m² (with the width at the bottom of the side slopes being approximately 14m). Based on a cross-sectional area of 14.25m² and an access track distance of 3,215m within the River Mersey flood extent, approximately 45,813.75m³ of fill material would be required to facilitate raising the access tracks above the Mersey deign flood level. Import of this fill material is not considered to be sustainable (in context of numerous lorry loads to deliver the fill material to the site).

- Raising the access tracks and associated import of 45,813.75m³ of fill material to facilitate the ground raising would in turn displace a significant volume of floodwater and disrupt flood flow routes through the site, potentially resulting in increased flood risk to third parties. Increasing flood risk elsewhere would be contrary to 5.8.11 of Policy Statement EN1.

With respect to safe access and egress, the application is supported by a Flood Warning and Evacuation Plan which is appended to the Flood Risk Assessment and Drainage Strategy (document reference ES Vol 2 Appendix 9-1: Waterco Flood Risk Assessment and Drainage Strategy [EN010153/DR/6.2]) which sets out how all site operatives can remain safe in times of flooding. The Flood Warning and Evacuation Plan the that:

- Flood Warnings are available for the site.

- The site can be operated remotely, ensuring that no staff will be on site (undertaking maintenance) when a Flood Warning is in place.

- In the rare event that flooding happens without warning whilst staff are on site, multiple areas of safe refuge (raised above flood levels) will be available across the site.

Bridge Abutments

The EA have requested that the '*abutments should be set back at-least 8m from the top of the bank, not embedded in the bank'*. The proposed bridge design places the abutments into the landward side of the riverbank. The justification for placing the adjustments on the landward side of the riverbank is as follows:

- The bridge length would be kept to a minimum, minimising disruption to the land adjacent to the bridge. Abutments 8m from the top bank would result in all watercourse crossings being approximately 24m or greater in length, as opposed to approximately 8m in length based on the current design. A 24m bridge crossing length would result in additional use of concrete, contributing to the carbon footprint of the scheme.
- Abutments 8m from the top bank, resulting in all watercourse crossings being approximately 24m long, would create a shaded area beneath the bridge deck 8m either side of the watercourse. This would reduce biodiversity of the land adjacent to the watercourse (beneath the bridge deck) and create a void space beneath the bridge deck which would be difficult to maintain due to height restrictions (based on a bridge soffit 1.5m above ground levels, standing space beneath the bridge deck would be restricted, making maintenance difficult and creating health and safety risks).
- The current design does not include any voids or shading beyond the banks of the watercourse. The current

design is optimal in terms of reducing the bridge length and as such minimising disruption to land adjacent to the watercourse. Forming the abutments adjacent to the channel and on the landward side of the riverbank provides a continuation of the riverbank height and avoids the riverbank being placed beneath the bridge void (which would make it difficult to access for maintenance).

The banks of the Main Rivers on site are designated as flood defences by the EA. However, interrogation of the flood defence assets shows that the 'defences' comprise of natural high ground (as illustrated in Figures 2 and 3). There are no formal engineered flood defences assets in the location of the watercourse crossings. As such, the bridges will not impact on engineered flood defences. The proposed bridge design and abutment placing will not lower the height of the natural high ground which forms the riverbank. Hydraulic analysis undertaken by Waterco shows that the in-channel water levels (maximum of 4.89m AOD during the 1% annual probability plus 106% climate change event) do not reach a level high enough to reach the height of the flood defence. As such, setting the bridge abutment into the landward side of riverbank (natural high ground) will not create any flood risk detriment.

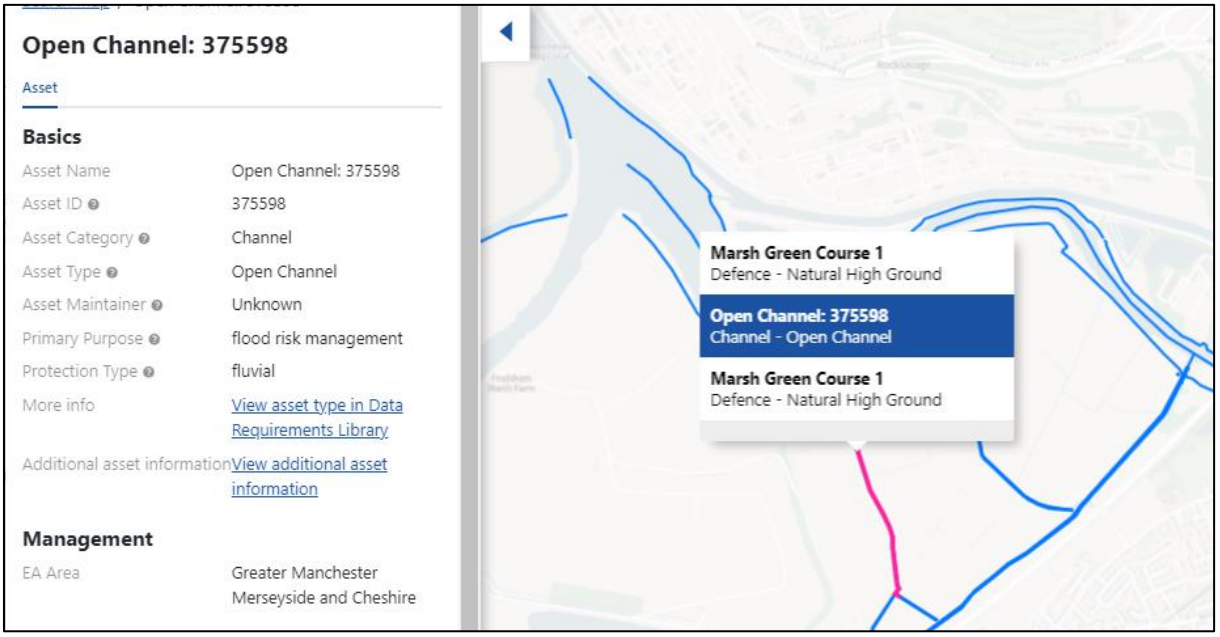

Figure 2 – On Site Watercourse Designation

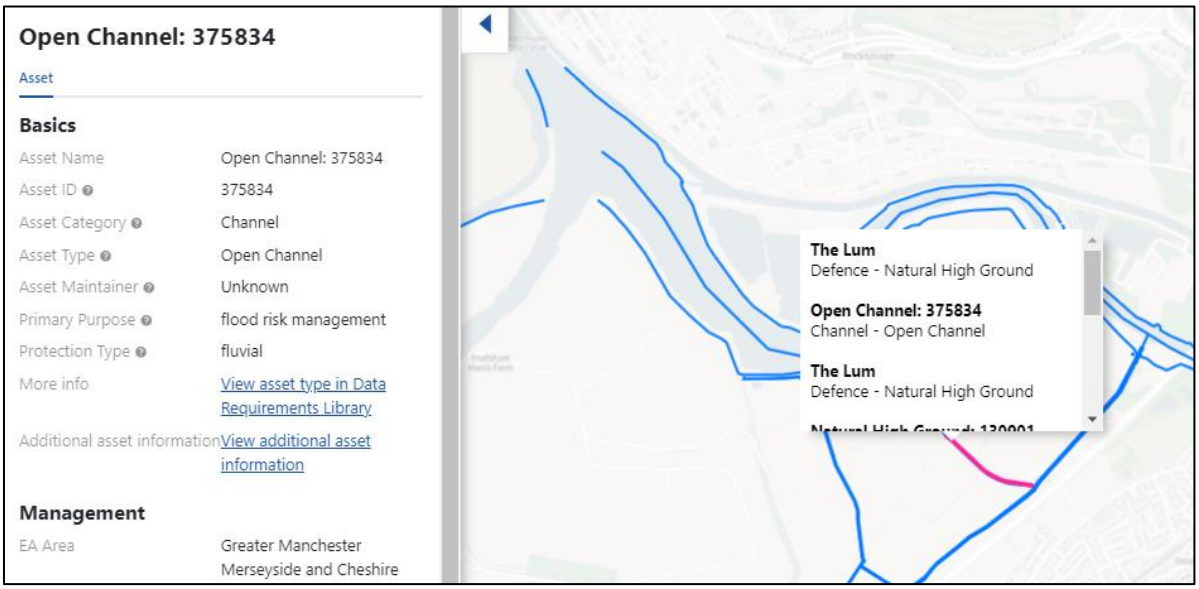

Figure 3 – On Site Watercourse Designation

Conclusions

All new or replacement watercourse access crossings will be open span bridge structures. No new culverts are proposed. For crossings over designated Main Rivers, the soffit level of the bridge deck will be set 600mm above the 1% annual probability plus 67% climate change flood level. The flood level is applicable to the watercourse that the bridge spans. The approach ramp will have a 1 in 10 grade to ensure it does not extend further than is necessary.

The proposed bridge design is in keeping with SR2015 No 28 and 2.9.17 of Policy Statement EN5. Raising the bridge height above the current proposed level would offer no flood risk benefits to the site or its surrounds.

The bridge design will not impact upon the channel capacity and the bridge soffit will be set 600mm above the 1% annual probability plus 67% climate change flood level. As such, there will be no impact upon flows within the watercourse and no increase in flood risk on site or elsewhere. Therefore, hydraulic modelling of the proposed bridges to determine changes in flood risk is not deemed necessary.

Appendix A Watercourse Crossing Point Schedule

Crossing Point Ref.	Watercourse Ref. D# - Ordinary Watercourse W# - Main River	Crossing	
		Existing or New	Type
CP1	D22	Existing	Replacement open span vehicular crossing, with MV and LV cable crossing.
CP2	D23	New	New open span vehicular crossing and MV and LV cable crossing.
CP3	D32	New	New open span vehicular crossing and MV cable crossing.
CP4	D24	New	New open span vehicular crossing and MV cable crossing.
CP5	D32	New	New open span vehicular crossing and MV cable crossing.
CP6	D36	New	New open span vehicular crossing and MV and LV cable crossing.
CP7	D9	Existing	Replacement open span vehicular crossing, with MV and LV cable crossing.
CP8	D13	New	New open span vehicular crossing and MV cable crossing.
CP9	D5	New	New open span vehicular crossing and MV cable crossing.
CP10	D19	New	New open span vehicular crossing and MV cable crossing.
CP11	D10	New	Replacement open span vehicular crossing, with MV and LV cable crossing.
CP12	D11	New	New open span vehicular crossing and MV cable crossing.
CP13	D9	New	New open span vehicular crossing and MV cable crossing.
CP14	W2	Existing	Replacement open span vehicular crossing, with MV and LV cable crossing.

Crossing Point Ref.	Watercourse Ref. D# - Ordinary Watercourse W# - Main River	Crossing	
		Existing or New	Type
CP15	D1	New	New open span vehicular crossing, with MV and LV cable crossing.
CP16	D2	Existing	Replacement open span vehicular crossing, with MV cable crossing.
CP17	W2	New	New open span vehicular crossing, with MV cable crossing.
CP18	D3	Existing	Replacement open span vehicular crossing, with MV cable crossing.
CP19	D4	New	New open span vehicular crossing, with MV and LV cable crossing.
CP20	Not used		
CP21	D6	New	New open span vehicular crossing, with MV cable crossing.
CP22	W1	New	Replacement open span vehicular crossing, with MV cable crossing.
CP23	D3	Existing	Retain existing vehicular crossing.
CP24	D16	Existing	Retain existing vehicular crossing, new LV cable crossing.
CP25	D15	Existing	Retain existing vehicular crossing, new LV cable crossing.

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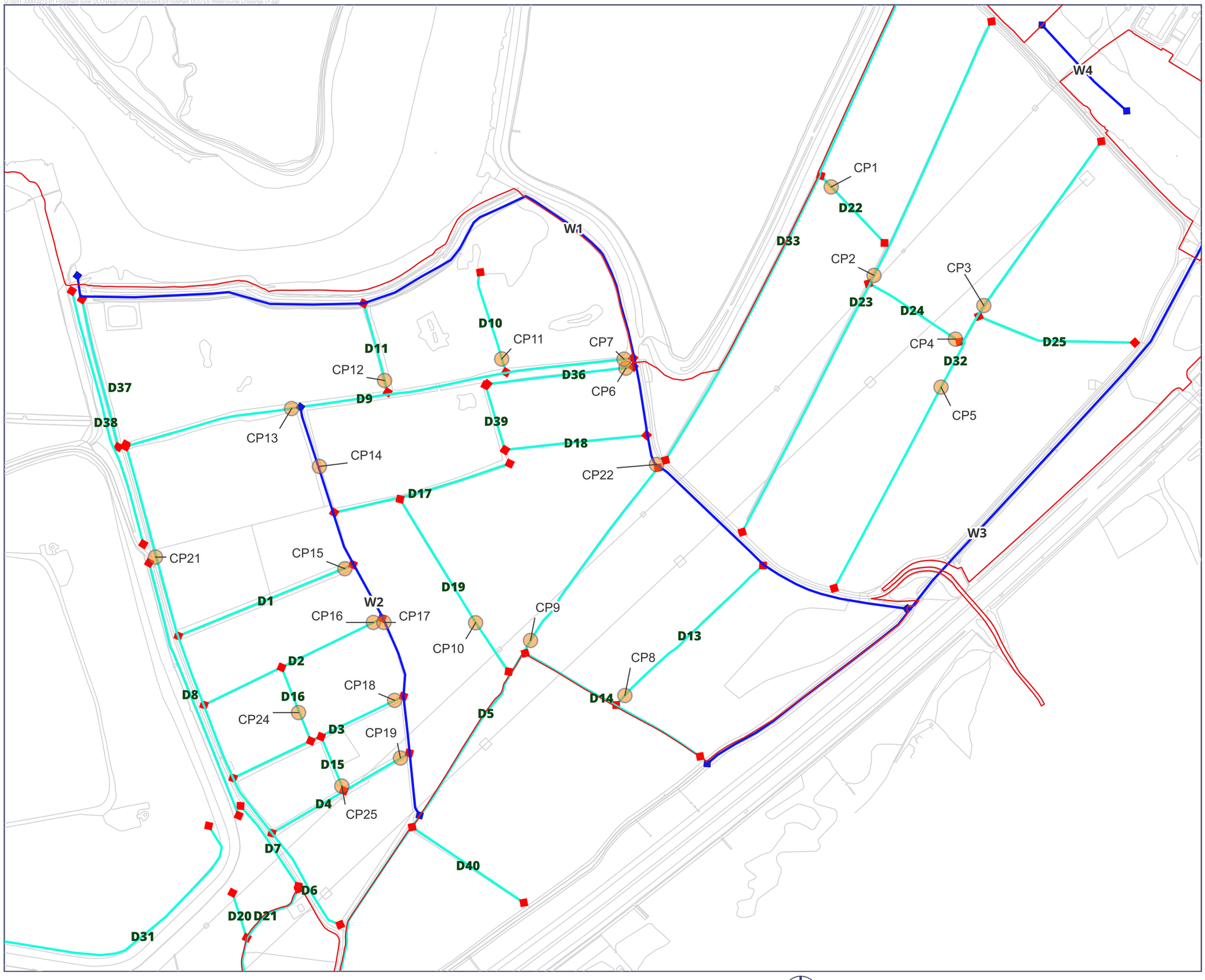

Order Limits

Crossing Points

Main Rivers

Ditches

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Project

Frodsham Solar Environmental Statement

Figure Number

Appendix 2-1 Figure 1

Figure Title

Indicative Watercourse Crossing Points

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Date

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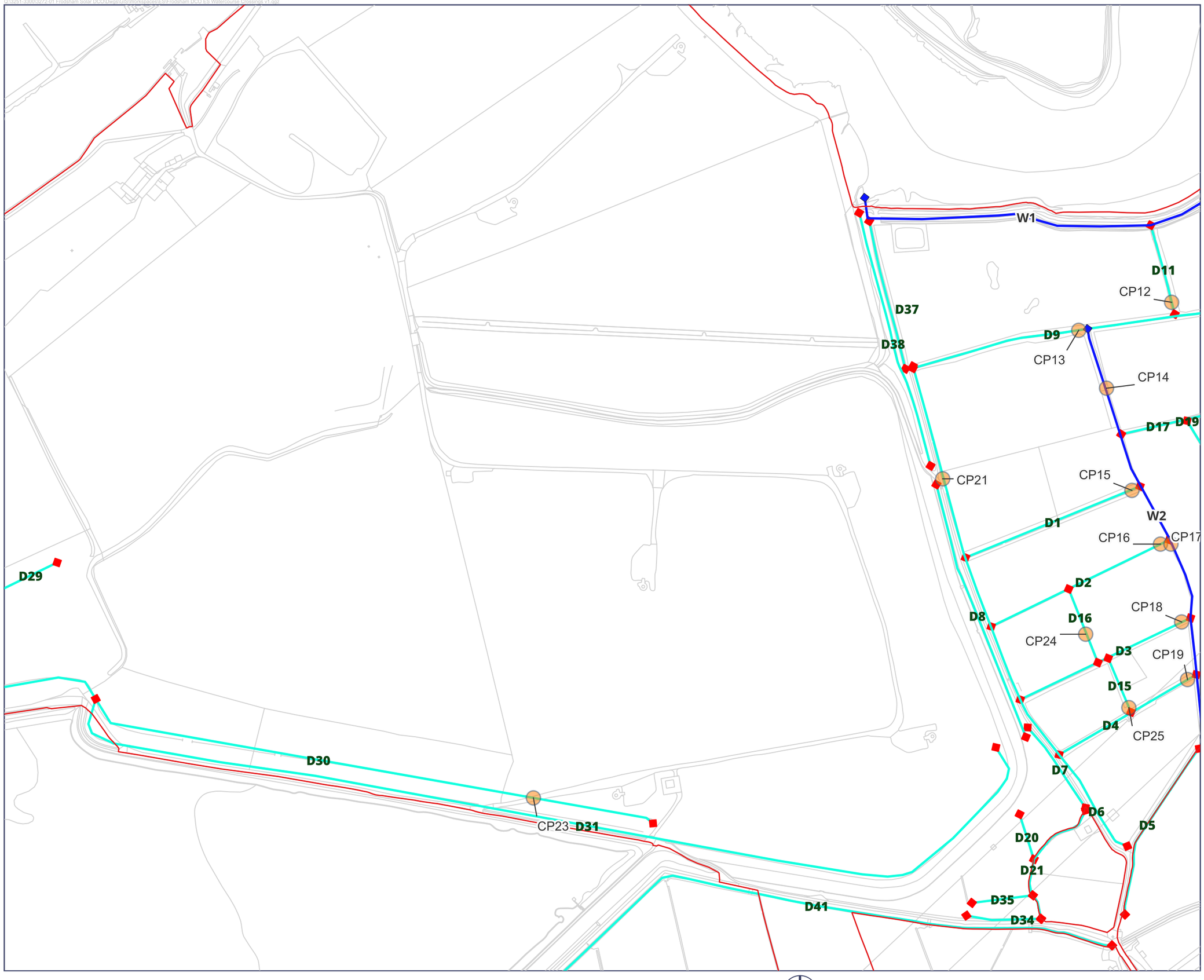

Order Limits

Crossing Points

Main Rivers

Ditches

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Frodsham Solar Environmental Statement

Figure Number

Appendix 2-1 Figure 2

Figure Title

Indicative Watercourse Crossing Points

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Date

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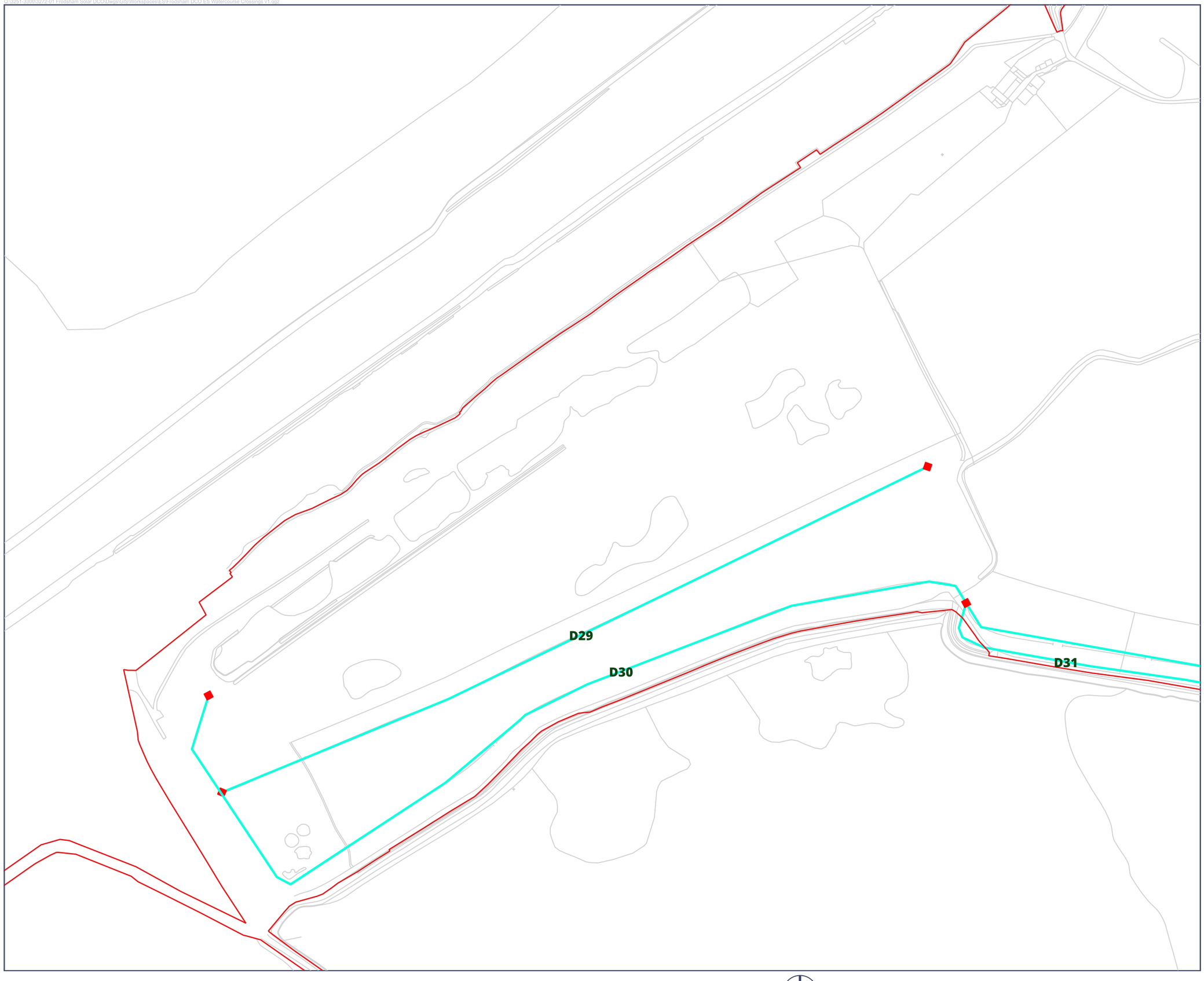

Order Limits

Ditches

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Project

Frodsham Solar Environmental Statement

Figure Number

Appendix 2-1 Figure 3

Figure Title

Indicative Watercourse Crossing Points

Scale

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Date

April 2025

Appendix B EA Correspondence

APPENDIX C – FLOOD RISK

Climate Change Flood Modelling (*Appendix 9-1: Flood Risk Assessment and Drainage Strategy, Paragraph 9.6.32 - 9.6.39 and Non-Technical Summary, Paragraph 2.1.6.)*

Issue
The Ince and Frodsham modelling does not consider climate change.

Impact
The modelling does not represent flood risk throughout the lifetime of the development.

Our approach is supported by Section 5.8.15 of EN-1 Overarching National Policy Statement for Energy, which states that Flood Risk Assessments (FRA) should consider a range of flooding events and be supported by appropriate data.

Solution
Carry out the modelling with a 67% increase in peak flow rate.

Bridge and Cable Crossings of Watercourses *(Non-Technical Summary, Paragraphs 2.4.118, 2.5, 3.2.2. Appendix 2-1 Indicative Watercourse Crossing Schedule. Table 2-9: Further associated development within the draft Order Limits in connection with the delivery of Work Nos 1 – 6. Figure 2-5j Indicative Permanent Watercourse Crossing.)*

Issue
We are concerned with details of the proposed crossings, namely the:

- the soffit level of the bridges
- the potential extension of existing culverts

Impact
The bridges may restrict future maintenance of the watercourse and works to flood assets. Culverts can lead to an increase in flood risk, have a risk of blockage, and pose a maintenance burden.

Solution
Alternative cable crossing options should be considered. The soffit levels of bridges should be raised 600mm above the design flood level. We recognise this may have knock on effects to the proposed development, and would encourage the developer to liaise with us further on this issue.

Instead of installing / extending (existing) culverts, the applicant should consider installing a clear-span bridge crossing. Given that there are circa 25 crossings as part of this proposal, the applicant will need to model changes in flood risk from the proposed crossings.

Our position on this is supported by paragraphs 2.10.87 and 2.10.88 of National Policy Statement EN-3, which state that:

- culverting existing watercourses should be avoided
- where culverting for access is unavoidable, applicants should demonstrate that no reasonable alternatives exist, and where necessary it will only be in place temporarily for the construction period.

Construction Phase Flood *(Non-Technical Summary, Paragraphs 3.2.5, 3.2.6, 2.4.169, 2.5.2, 2.5.9, 2.5.13. Table 2-7: 132kV Electrical Connection Design Parameters. Figure 2-1 Construction Compound and Access Track Layout. Table 9-8: Significance of Construction Effects.)*

Issue

A significant area of the site has been demonstrated to be at risk of flooding, and specific mitigations for these areas should be considered for the construction phase. It is unclear why the applicant has asserted that flooding during construction is unlikely (see Table 9-8).

Impact

There is a risk of flooding during the construction phase, which may jeopardize construction efforts, and increase flooding elsewhere. For example, the present-day tidal design event may inhibit safe access and egress to receptors on site during the construction phase.

Solution

The applicant should provide justification for assertions relating to the categorisation of construction phase flood risk significance. A sequential approach should be applied to the placement of the construction compounds (two main construction compounds, four secondary compounds, and two construction compounds north of the River Weaver) and mobile welfare units. East Compound 1, 2 and 3 (PEIR Volume 3 Figure 2-1) may be at risk of flooding, which should be avoided where possible***.***

Additional comment

As stated in section 2.5.2, the construction phase could last longer than the assumed 30-month programme assessed; therefore we would expect a conservative estimate of the construction phase duration, in the context of assessing flood risks.

Setbacks and Buffers *(Chapter 1 Introduction, Paragraph 1.3.10, 2.4.29, 2.4.162, 9.8.23, Appendix 9-1: Flood Risk Assessment and Drainage Strategy.)*

Issue
It is unclear whether setback/buffers are applicable to all phases of the development.

Impact
The proposed works may adversely affect flood assets (such as engineered embankments) and prevent access to the flood assets for inspection, remediation and replacement during all phases.

Solution
Where possible, we would seek setback from the watercourses for all phases. We require clarity on the proposed setback distance, including where this is measured from, and where this is applicable to all watercourses within the Order Limits.

Submerged Modules / Remaining Operational *(Appendix 9-1: Flood Risk Assessment and Drainage Strategy and Non-Technical Summary, Paragraph 6.6.12)*

Issue
The applicant has suggested that some solar PV modules would be allowed to flood in extreme events. We would not consider it acceptable for solar PV modules to be submerged in the (tidal) design flood event. If electrical infrastructure in specific areas of the site is isolated, then it is no longer operational.

EN-1 section 4.10.11 applicants should demonstrate that proposals have a high level of climate resilience built from the outset and should demonstrate how proposals can be adapted over their predicted lifetimes to remain resilient to a credible maximum climate change scenario.

Impact
The solar PV modules may no longer be operational during the design event and could inhibit flood flow routes.

Our approach is supported by Section 5.8.9 of the National Policy Statement for Energy (EN-1), which states that the sequential approach should be taken regarding locating development within a site. If this cannot be done, then the development should satisfy both elements of the exception test, particularly whether the development is safe for its lifetime.

Solution
The applicant needs to ensure that the site remains operational in times of flooding; this includes all solar PV modules being 600mm above the design flood level.

Impermeable Areas
(Chapter 1 Introduction, Paragraph 1.3.13. Chapter 2 Proposed Development, Paragraph 2.4.141, 2.4.152, 2.6.11.)

Issue
The applicant should ensure that proposed impermeable areas (such as the new public car parking area on Moorditch Lane and road matting) do not significantly increase the rate of runoff.

Impact
As the surface is impermeable, there would not exist natural processes to reduce the rate of runoff, such as interception and infiltration, leading to an increase in the rate of runoff. An increase in runoff rate can lead to an increase in fluvial flood risk.

Solution
Where feasible, we advise the applicant to include SuDS for all proposed impermeable areas utilising the SuDS Manual. Further consultation with the Lead Local Flood Authority (LLFA)/Local Planning Authority (LPA) on this matter is recommended to ensure a joined-up approach.

Flood Modelling Design event and 600mm Freeboard
(Chapter 2 Proposed Development, Paragraphs 2.4.17, 2.4.18, 2.4.35, 2.4.39, 2.4.41, 2.4.48. Images 2-2, 2-3, 2-4. Figure 2-5a Indicative Solar PV Modules, Figure 2-5b Indicative String Inverter. Figure 2-5c Indicative Power Conversion Unit (PCU). Figure 2-5j Indicative Permanent Watercourse Crossing. Appendix 9-1: Flood Risk Assessment and Drainage Strategy, Paragraphs 9.7.4, 9.7.12, 9.8.30, 9.8.31.)

Issue
The applicant has not used the most conservative design flood event to derive the design flood level. In this case, the tidal design event is more conservative than that of the fluvial design event (for example see 9.7.4 and 9.7.12). Notably there seems to be an inconsistency in the proposed tidal design flood level (see 9.7.12, Appendix 9-1: Flood Risk Assessment and Drainage Strategy pages: 25, 26, 30, and 39).

Impact
The proposal is not derived using the appropriate design flood level, and therefore hasn't adequately assessed flood risk to the site and elsewhere.

Our approach is supported by Section 5.8.15 of the National Policy Statement for Energy (EN-1), which states that FRAs should consider a range of flooding events and be supported by appropriate data.

Solution
Baring the assessment of cumulative impacts of fluvial and tidal sources, with consideration of joint probability analysis being more extreme, we anticipate that the applicant utilises the level derived from the Upper End tidal hydraulic model for the defended scenario. Sensitive equipment should then be positioned with a 600mm freeboard above the design flood level.

Bridge soffits, solar PV modules, combiner boxes, string inverters, and junction boxes need to be 600mm above the (tidal) design flood level. Centralised Inverters, transformers, power conversion units, standalone inverters finished floor levels need to be 600mm above the (tidal) design flood level. The applicant needs to clarify the tidal design flood level, and adjust the design as required. This may also influence the calculations relating to flood storage compensation, which should be updated.

Watercourse Crossings *(Chapter 2 Proposed Development, Paragraph 2.4.152)*

Issue
Temporary, pre-fabricated ditch crossings are proposed for use, with no detail provided regarding their form and installation. Permanent watercourse vehicular crossings are shown (figure 2-5j), but not temporary crossings.

Impact
Without an understanding of how the temporary crossings are designed, we are unable to determine a potential increase in flood risk.

Solution
We require more information about the proposed prefabricated bridges and whether these will be safe in a flood event.

Flood Flow *(Chapter 2 Proposed Development, Paragraph 2.4.157, 2.4.159. Table 2-9: Further associated development within the draft Order Limits in connection with the delivery of Work Nos 1 – 6.*)

Issue
Fencing is proposed in flood zones.

Impact
Fencing may impede flood flow routes.

Solution
The applicant should demonstrate that the solar panel permitter fencing will not increase flood risk elsewhere.

Additional comment
In a meeting with the applicant on 11 November 2024, we discussed floodplain compensation for the proposed scheme. The applicant has presented information on volume of storage lost because of the solar panel supports and other associated infrastructure. The applicant suggested that they would test the impact of solar panel supports within the hydraulic model. A similar approach could be taken for the permitter fencing. We acknowledge this will be difficult to test explicitly, however, this could be achieved using a flow constriction layer or elevated roughness approach. We welcome the opportunity to discuss this further with the applicant.

Drainage
(Chapter 2 Proposed Development, Paragraph 2.4.145, 2.4.155. Table 2-9: Further associated development within the draft Order Limits in connection with the delivery of Work Nos 1 – 6.)

Issue
Stone access tracks are likely to become decreasingly permeable from compaction and repeated vehicular use.

Impact
May lead to an increase in the rate of runoff due to a reduction in void ratio and capacity for effective drainage, by forming an impermeable surface throughout the lifetime of the development. An increase in runoff rate can lead to an increase in fluvial flood.

Solution
Assuming appropriate ground conditions swales are likely to be needed. Further consultation with the LLFA / LPA on this matter is recommended to ensure a joined-up approach.

Phasing of Works
(Chapter 2 Proposed Development, Paragraph 2.5.3, 2.5.4. Appendix 2-2 Indicative Construction Phasing and Resource Schedule.)

Issue

Flood storage compensation is not proposed to be completed before construction of components.

Impact
Increased flood risk to third parties.

Solution
Flood storage compensation is needed as part of the proposal, and should be completed before the construction of components which require flood storage compensation.

CEMP / OCEMP *(Non-Technical Summary, Paragraph 5.2.2, 6.2.11,6.6.15. Appendix 2-3: Outline Construction Environmental Management Plan. Table 5-9: Summary of the construction mitigation and management measures)*

Issue
The CEMP/OCEMP should contain a comprehensive list of mitigations to ensure that flood risk is managed safely during the construction phase.

Impact
If the proposed mitigations are insufficient, then the construction phase could be vulnerable to and increase flood risk.

Solution
We require a comprehensive list of mitigation measures, to ensure they are sufficient to safely manage flood risks during the construction phase.

We would advise consideration of the below within the CEMP.

- Vibration: Realtime vibration detection adjacent to flood assets to ensure that vibration is within safe limits and agreed thresholds for action and remediation.
- Scaffolding: If using scaffolding, then fix boards in place.
- Flood Warnings / Alerts: Sign up for flood warnings and alerts with works to stop and site made safe and evacuated during a flood event.
- SuDS: Temporary SuDS should be provided for all impermeable surfaces.
- Debris: Measures to prevent debris entering the watercourse during a flood event.
- Surveys: Where works are proposed close to a flood defence, we will require a survey to better understand it's geometry, condition, composition, structure, etc. Where possible the survey should be corroborated by as-built drawings.

- Buffer: There should be an appropriate buffer from the watercourse which could be demarked by Heras fencing, this helps to ensure no adverse effects to the watercourse and flood assets.

Tree Planting *(Figures 2-3 Illustrative Environmental Masterplan Sheets a, b, c, d and e)*

Issue
Planting trees within easements of both tidal (8m) and fluvial (16m) flood assets.

Impact
The roots of these trees have the potential to undermine the stability of flood defence assets.

Solution
Assets will require root protection.

Use of Third-party Data *(Chapter 9 Flood Risk, Drainage and Surface Water, Paragraph 9.3.1)*

Issue
The use of third-party data for the assessment of flood modelling.

Impact
Flood modelling will not assess the full extent of flood risk of the proposed development.

Solution
The applicant should provide evidence of any modelling checks, subsequent updates and document these in the FRA model reporting.

All our models are built for our own specific purposes and are made available as is. It is the responsibility of all applicants to ensure that the models are fit for their intended purposes and in line with the following government guidance:

- https://www.gov.uk/guidance/using-modelling-for-flood-risk-assessments
- https://www.gov.uk/government/publications/river-modelling-technical-standards-and-assessment/river-modelling-standards-who-theyre-for-and-how-to-use-them
- https://www.gov.uk/government/publications/river-modelling-technical-standards-and-assessment

If modelling is used to support an application, then it will need to be reviewed and confirmed as meeting the above standards.

Additional comment
Please be aware that:

- Environment Agency models are not designed to assess third-party developments. The applicant should not assume that the model is suitable for assessing the flood risk associated with the proposed development.
- It is the applicant's responsibility to assess the suitability of a model for the project.

Ince and Frodsham Pumping Station *(Chapter 9 Flood Risk, Drainage and Surface Water, Paragraph 9.6.27)*

Issue
The proposal adds receptors into the catchment drained by the Ince and Frodsham pumping station.

Impact
This creates additional burden on these facilities (Pumping Stations).

Solution
Form a contingency plan for the Ince and Frodsham pump failure scenario (which includes access to temporary pumps), with the consideration of the tidal design flood event. Additionally, discussions should be held regarding financial contributions or asset ownership to help with the maintenance burden or future options to decommission the assets, noting the proposal is dependent on the Ince and Frodsham pumping stations.

Additional comment
Our position is supported by the following:

- Section 5.8.15 of EN-1 Overarching National Policy Statement for Energy which states that FRAs should:
    - "consider both the potential adverse and beneficial effects of flood risk management infrastructure, including raised defences, flow channels, flood storage areas and other artificial features, together with the consequences of their failure and exceedance."
- Policy DM40 of the Cheshire West and Chester Local Plan Policies (2019) which states that FRAs must show:
    - "there is no adverse effect on the operational functions of any existing flood defence infrastructure."
    - "proposed resistance/resilience measures designed to deal with the current and future risks are appropriate".

Surveys *(Chapter 9 Flood Risk, Drainage and Surface Water, Paragraph 9.5.2, 9.6.1, 9.6.20, 9.6.22. Appendix 9-1: Flood Risk Assessment and Drainage Strategy.)*

Issue
It is unclear if flood defence crest heights have been derived from a topographic survey, LiDAR data, or the Environment Agency's asset data. The eastern section of the proposed development is heavily reliant on the flood defence system, and it seems the applicant is relying on third-party data to assess the condition of these flood defences (e.g., page 10 and 11 of the FRA).

Impact
The proposed crossing designs and hydraulic modelling may have inaccurate assumptions if there has not been a level survey of the flood defences. There may be insufficient residual-life in flood defences, which protect the proposed development throughout the design-life (40 years of operation).

Solution
We request the applicant carry out condition surveys, to ensure that there is sufficient residual life within the flood defences which will protect the proposed development.

Residual Flood Risk *(Chapter 9 Flood Risk, Drainage and Surface Water, Paragraph 9.7.7, 9.7.10, 9.7.14)*

Issue
The applicant has not demonstrated how they will safely manage residual flood risk.

Impact
Safely manage residual flood risk to the proposal from the assessed breach scenarios (tidal and fluvial).

Solution
Adjust the proposal as required to ensure that residual flood risk is being managed safely and provide further explanation.

Flood Storage Compensation *(Appendix 9-1: Flood Risk Assessment and Drainage Strategy. Table 5 – Summary of Flood Displacement (1% AEP plus 67% CC Defended Event)*

Issue

The applicant has assumed the less conservative fluvial design flood event rather than the tidal design flood event.

Impact

Inaccurate calculations due to an underestimate of the design flood level. Therefore, flood risk may increase elsewhere and to thirds parties.

Solution

The applicant should use the more conservative tidal design flood event in assessing flood storage compensation.

APPENDIX D - GEOMORPHOLOGY

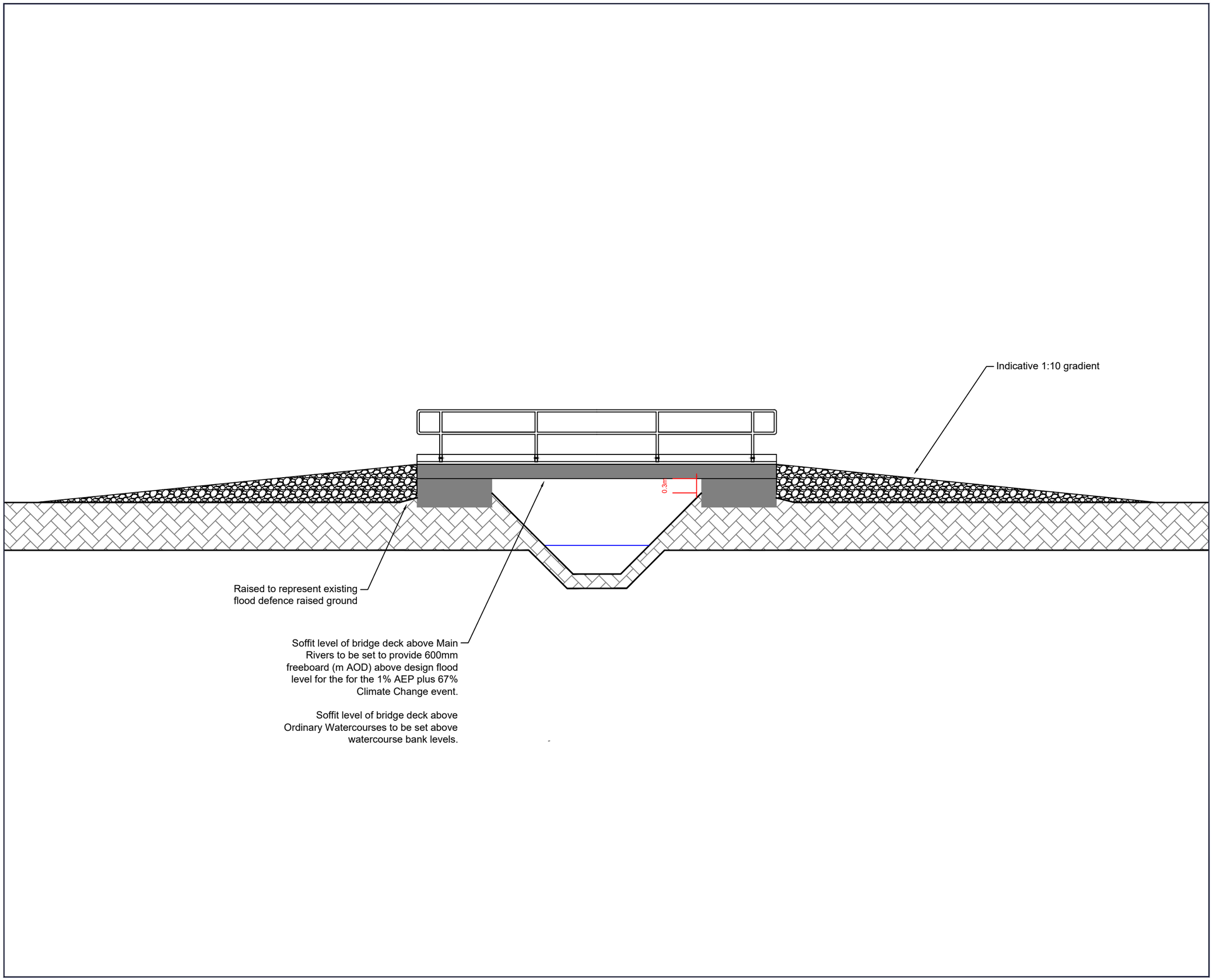
Crossing Point Installations (*Chapters 2,7 and 9 plus figures and appendices)*

Issue
Inappropriate design and installation of new crossing points.

Impact
Damage to the integrity of embankments, channel bed and reduced mammal passage.

Solution
For the design and installation of new crossing points, abutments should be set back at-least 8m from the top of the bank, not embedded in the bank as is illustrated in Figure 2-5j. This approach would avoid the necessity of over-pumping to ensure a dry environment for construction (PEIR, Chapter 7; Section 7.7; paragraph 7.7.36). This would not damage the integrity of the banks and channel bed. Setback abutments would also allow the bridge deck to be constructed at a higher level, reducing areas of deep shade and allowing free mammal passage.

Appendix C Indicative Watercourse Crossing Drawing



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Regulation 5(2)(a) Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

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Project
FRODSHAM SOLAR

Figure Number
Figure 2-5j

Figure Title
Indicative Permanent Watercourse Crossing

Scale
1:75 @A3

Date
May 2025