

Sustainable Drainage Strategy Proposal
Sunset Park Homes
Whitfield Road
Brackley
NN13 5TD

Minh Ngoc Nguyen

June 2023

INTEGRATED DESIGNS GENERAL NOTES

Project No.	MN-089-23-SPH-SUDS
Title	Sustainable Drainage Strategy (SUDS) Proposal for Sunset Park Homes Whitfield Road, Brackley, NN13 5TD
Client	Mr A. Smith
Date	21 st June 2023
Office	Integrated Designs & Associates Ltd, 38 Old Walsall Road, Great Barr, Birmingham, B42 1NP
Status	Final

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Date	21 st June 2023	Date	21 st June 2023

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Where field investigations have been carried out, these have been restricted to a level of detail required to achieve the stated objectives of the work.

This work has been undertaken in accordance with the quality management system of IDA Limited.

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Limitations of Assessment

The findings of this report are based on information obtained from a variety of sources as detailed within the report, and which Integrated Designs & Associates Ltd believes to be true. No responsibility is taken for the authenticity of this information.

This report is intended solely for the purposes of the instructing client and cannot be relied upon by a third party without the written consent of Integrated Designs & Associates Ltd.

1.0 Introduction

Integrated Designs & Associates Limited (hereafter referred to as IDA) was appointed by Mr. A. Smith to carry out a design of Sustainable Urban Drainage Strategy (SUDS) Proposal for the land at Sunset Park Homes, Whitfield Road, Brackley, NN13 5TD.

It is usual for the Environmental Agency to raise an objection to development applications that are within Flood Zones 2, and 3, or those sites which are in excess of 1 hectare, until the question of flood risk has been properly evaluated. Whilst the proposed development site has been shown to lie entirely within Flood Zone 1 and is under 1 hectare in area, the requirements of the Buckinghamshire Council Planning Policy, this assessment is required to consider the current conditions of the application site and to inform recommendations for the betterment of controlling flood risk (surface water flooding) on-site and off-site.

The assessment of design utilises information obtained from a Drainage Design Statement conducted by Engineering Consultancy 49 (Reference: *EC49-23-18-01*, dated 8th June 2023, **Appendix E**) and readily available hydrological data (**Appendix C**) to propose a strategy that incorporates SUDS for the proposed development.

2.0 Objectives & Aims

The objectives of this assessment are to determine the appropriate SUDS for the proposed development with regards to the site conditions and function to assist with an existing Planning Condition for the Planning Applications referenced 21/04437 – 21/04458 for Plots 1A-20A of the proposed development.

Since 6th April 2015, the Government's planning policy (HCWS161 – Sustainable Drainage systems) on eco-friendly sustainable drainage systems came into effect. It states that all major developments (*defined within 'The Town & Country Planning Order 2015'*) should '*ensure that sustainable drainage systems for the management of runoff are put in place*'.

Well-designed SUDS aim to drain a site in a sustainable way with considerations to water quantity, water quality, biodiversity, and amenity. SUDS focuses on three key areas; controlling surface water quantity (*flood risk management*), improving surface water quality (*water quality management*), and providing added development amenity (*including biodiversity*) benefits.

By having a good understanding of various conditions on a site-by-site basis, the selection and design of SUDS are to be made appropriate to the functions of the new development and surrounding area.

3.0 Site Location & Description

The site is a plot of land located on the Southern end of Whitfield Road, Brackley, NN13 5TD. The site is currently used as a static caravan and holiday home park and contains 139no. dwellings. The site lies approximately 3.70km Northeast of Brackley Town Centre, grid reference 462099, 238668 (**Appendix A**). The site is regular in shape with an approximate total area of 2.21ha.

The proposal for the redevelopment of the site is for the installation of 88no. new static caravan and holiday homes (**Appendix B**)

4.0 Preliminary Study

4.1 Geology

An assessment of the onsite geological characteristics would determine the suitability of infiltration SUDS into the natural ground strata.

The desk study reviewed extracts of geological maps obtained from the British Geological Survey at 1:50,000 scale.

The geological maps indicate that the bedrock consists of the Forest Marble Formation deposited during the Bathonian Age, Mid-Jurassic Epoch. The formation consists of greenish grey, silicate-mudstone, variably calcareous with lenticular, typically cross-bedded limestone units and a variety of limestone types (sandy medium to coarsely bioclastic grainstone).

The geological maps indicate that the superficial deposits consist of till-derived Diamicton sediment deposited between the Cromerian & Ipswichian Stage, Mid-Pleistocene Epoch.

The geological maps show no indication of artificial deposits beneath the proposed development site.

There are no records of linear geological features within 250m of the study site boundary.

IDA undertook an initial soakaway investigation under the guidance of BRE365 dated 18th April 2023. **Appendix C** presents images and log of the initial investigation. The trial pit measured 2m (l) x 0.30m (w) x 1.5m (d) and the lithologies encountered include gravel hardcore from 0.00-0.05mbgl, followed by firm brown sandy clay from 0.05-1.50mbgl. The trial pit was filled with water and after 240 minutes

of observation, there were no notable changes in the water level. Therefore it was concluded that soakaways infiltrating at this depth would be deemed unsuitable for the proposed development.

4.2 Hydrogeology & Hydrology

An assessment of the hydrogeological and hydrology conditions of the site shows that it lies entirely within a Flood Zone 1 (land assessed as having less than a 1-in-100-year annual probability of fluvial flooding, <0.1%), therefore the risk induced by flooding from rivers & seas (RoFRaS) is considered very low.

An assessment of the effects of surface water runoff induced by pluvial action was carried out to determine the current potential risks to the site and surrounding area. A review of the flood map data (**Appendix C**, *source: gov.uk*) was scrutinised.

The flood map observes that the site is not affected by surface water flooding in a low-, medium- and high-case scenario.

The site walkover carried out during the initial BRE365 infiltration test observes the site's profile to be dipping in a Southeasterly direction from Whitfield Road.

5.0 SUDS Overview

5.1 Existing Pre-Development Conditions

Based on a site walkover of the existing onsite conditions, it is apparent that surface water runoff from hardstanding areas such as pathways and roofs drain via infiltration into the ground. The plots are all covered by a layer of gravel hardcore. The foul water is currently managed and directed into Klargester Sceptic Tank found in each plot (1A-20A).

The 'Scoping Report for the Sustainability Appraisal (SA) of the Local Plan for Buckinghamshire' states that it is essential to ensure that future development does not exacerbate known problems. Specifically, the capacity of sewers across the area, however, it is recognised that problems are often localised and should not preclude development. The report recommends the introduction of Sustainable Drainage Systems (SUDS), with a view to controlling runoff to the greenfield runoff rate. Such considerations should be given to an approach to intercept and control runoff rates, in line with the recommendations of Policy SI 13 Sustainable Drainage.

Existing pre-development greenfield runoff rates have been calculated using the IH124 Methodology. Calculated rates are included in **Appendix F**. Greenfield runoff rates are calculated to be 35.96l/s for a 1-in-100 year return period and 42.53 for a 1-in-200 year return period.

Whilst the local SFRA suggests surface water runoff is controlled to the greenfield runoff rate, this is considered impractical based on the size and developed nature of the site and immediate surroundings.

The maps and site walkover have indicated that SUDS would be beneficial for the new development. It is understood that with the increasing effects of climate change, pluvial conditions are to increase across the UK. SUDS for the development will be able to relieve the pressure off local sewage systems and create a sustainable means to reduce surface water flow.

5.2 Post-Development Conditions

A study of the plans of the proposed layout shows a reduction of hardstanding areas owed to the reduce number of caravan dwellings. No changes have been made to the internal road layout of the site.

5.3 Hierarchy of Surface Water Disposal

Document H (H3) Drainage and Waste Disposal: Building Regulations (2010) detail the proposed hierarchy for the disposal of surface water resulting from a development. Surface water runoff must discharge to one of the following, listed in order of priority:

- ❖ A suitable method of infiltration (such as soakaways or similar SUDS features mimicking natural drainage conditions); or where this is not reasonably practicable;
- ❖ A watercourse; or where this is not reasonably practicable;
- ❖ A sewer.

The site conditions and development proposals have therefore been assessed against this approach. The initial soakaway test identified that infiltration to a depth of 1.50mbgl is considered impractical due to the high clay-content of the shallow-level soils. IDA sought a deep soakaway solution utilising the ECO 90 Drainage systems provided by Groundwater Dynamics Ltd.

On the 15th May 2023, Groundwater Dynamics Ltd undertook a soakaway test in three test locations (TD1-TD3) drilling a series of 89mm boreholes to 1.50mbgl, 3.00mbgl, 6.00mbgl and 12.00mbgl. The result of the investigation identifies that natural infiltration can be achieved from 3.00mbgl, provided

an attenuation system with an 11.7m³ capacity overlies the deep infiltration soakaway system to allow for steady discharge from the attenuation crates, into the ECO-90 Drain devices and then into the natural groundwater table.

5.4 Mitigation Measures

The purpose of this section of the report is to provide information for utilisation as part of the planning application for the proposed development site. The mitigation measures outlined below may be adopted to reduce the consequences of flooding to people and property.

5.4.1 Floor Levels & Site Layout

The Environment Agency generally requires finished floor levels to be set 600mm above the 1 in 100 year + climate change flood level. The whole of the site has been shown to lie within a Flood Zone 1 with no specific requirements for setting finished floor levels at a certain level.

5.4.2 Access & Egress

Access and egress to and from the site are from a roadway to the North of the site. This route lies entirely within a Flood zone 1. It is therefore considered that a safe, dry access and egress route is currently available above the 1 in 100-year flood level.

5.4.3 Flood Resistant & Resilient Design

As the proposed developments are located within dry land above the 1 in 100-year flood event, there is no need to include flood-resistant and resilient design measures within the proposal.

5.4.4 Flood Warning & Evacuation

The site lies entirely within a Flood Zone 1 with no requirements to monitor flood warnings or develop a flood evacuation procedure.

5.5 Sustainable Drainage Systems

5.5.1 Filter Drains

Filter drains are shallow trenches filled with stone/gravel/sand that create temporary subsurface storage for the attenuation, conveyance, and filtration of surface water runoff. The stone may be contained in a simple trench lined with a geotextile geomembrane or other impermeable liner, or within a more structural facility such as a concrete trough.

Filter drains can help reduce pollutant levels in runoff by filtering out fine sediments metals, hydrocarbons and other pollutants. They can also encourage adsorption and biodegradation processes.

5.5.2 Attenuation System

The provision of a geocellular attenuation system will aim to relieve the burden of discharge into the ECO-90 Drainage systems and prevent the potential of flooding during a storm event.

Geocellular storage crates provide a high void ratio (95%) and can be installed and inspected relatively easily. Plastic geocellular systems can increase the void space and therefore the storage capacity below the subsurface. Void systems, such as permavoids have a void ratio of 95% (i.e. for every 1m³ there is 0.95m³ of void space), which has been factored into the storage calculations. Geocellular modules have the added advantage of reducing the amount of aggregate subbase required, thus keeping costs lower. A technical datasheet is presented in **Appendix G**.

A drainage design statement carried out by Engineering Consultancy 49 instructed by Groundwater Dynamics Ltd has determined that an attenuation crate with a storage capacity of 11.7m³ is required per 200m² of impermeable area to be treated. Therefore each plot (1A-20A) will require an 11.7m³ capacity attenuation crate.

5.5.3 ECO-90 Drainage Device

The provision of the ECO-90 Drainage Device enhances and accelerates multiple soil strata's ability to absorb water. The device consists of five open chambers made from standard HDPE (High-density polyethylene) thermoplastic. The ECO-90 has no moving parts, requires no external energy source and is self-cleaning, requiring no ongoing maintenance. A technical guide is presented in **Appendix G**.

A drainage design statement carried out by Engineering Consultancy 49 instructed by Groundwater Dynamics Ltd has determined that 20no. of devices are required per plot to a depth of 3.00mbgl.

6.0 SUDS Maintenance

Sustainable Drainage Systems require continued monitoring and maintenance to ensure their effective functionality and to reduce the possibility of flooding occurring as a result of blockage or damages within the system. The SUDS Manual (C753, 2015) provides information on the operation

and maintenance requirements for a variety of SUDS; the details regarding the operation and maintenance requirements for the proposed SUDS are provided below:

Maintenance Schedule	Required Action	Typical Frequency
Attenuation Storage Tanks: Geocellular Attenuation Tanks		
Regular Maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action	Monthly for 3 months, then annually
	Remove debris from the catchment surface (where it may cause risks to performance)	Monthly
	For systems where rainfall infiltrates into the tank from above, check surface of filter for blockage by sediment, algae or other matter; remove and replace surface infiltration medium as necessary.	Annually
	Remove sediment from pre-treatment structures and/or internal forebays	Annually, or as required
Remedial Actions	Repair/rehabilitate inlets, outlet, overflows and vents	As required
Monitoring	Inspect/check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed	Annually
	Survey inside of tank for sediment build-up and remove if necessary	Every 5 years or as required
Filter Drains		
Regular Maintenance	Remove litter (including leaf litter) and debris from filter drain surface, access chambers and pre-treatment devices	Monthly (or as required)
	Inspect filter drain surface, inlet/outlet pipework and control systems for blockages, clogging, standing water and structural damage	Monthly
	Inspect pre-treatment systems, inlets and perforated pipework for silt accumulation, and establish appropriate silt removal frequencies	Six monthly
	Remove sediment from pre-treatment devices	Six monthly, or as required
Occasional Maintenance	Remove or control tree roots where they are encroaching the sides of the filter drain, using recommended methods (e.g. NJUG, 2007 or BS 3998:2010)	As required
	At locations with high pollution loads, remove surface geotextile and replace, and wash or replace overlying filter medium	Five yearly, or as required
	Clear perforated pipework of blockages	As required

Table 7.0: SUDS operation and recommended maintenance requirements.

IDA have sought JPR Environmental on previous projects to carry out contracted maintenance work for a range of SUDS-related projects. The contact information is provided below:

JPR Environmental
The Malthouse
Standish
Stonehouse
Gloucestershire
GL10 3DL
Telephone: 01453 822 584
E-mail: jpr@jprenvironmental.co.uk

It is recommended that a contractor is sought by the client to manage the SUDS prior to the commencement of tenancy occupation, and a contract is drafted for the management of the aforementioned features.

8.0 Conclusion & Recommendations

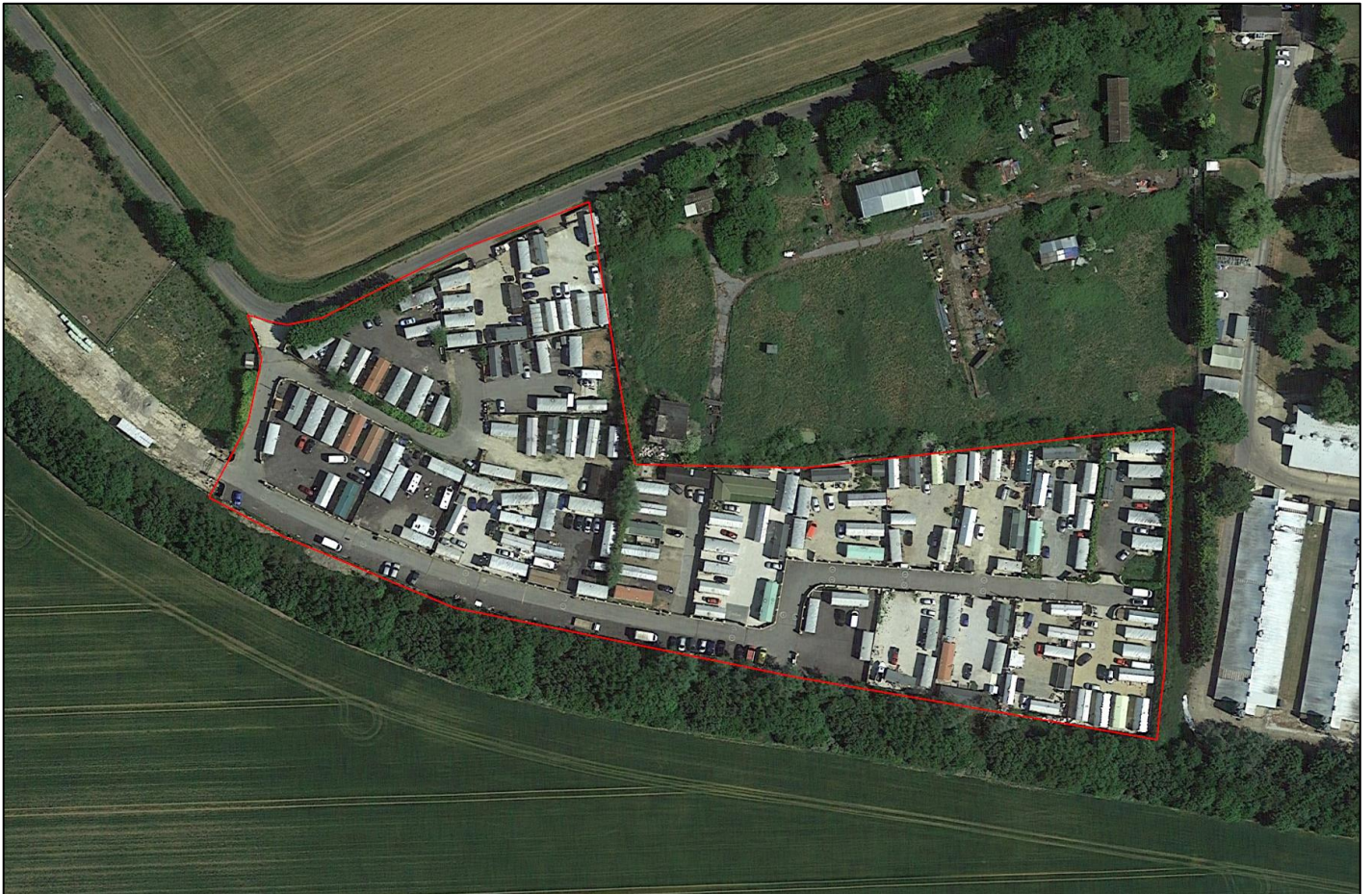
The proposed development is to provide several SUDS techniques to sustainably manage the discharge of surface water into the receiving sewer system. These systems include the use of:

- ❖ Filter Drains;
- ❖ Attenuation System/Crates;
- ❖ ECO-Drain Device

The report outlines recommendations to adequately manage SUDS to allow for the systems to operate efficiently during the lifetime of the proposed development and reduce the risk of surcharging/flooding should an issue arise within the SUDS network.

Appendix A

Site Location

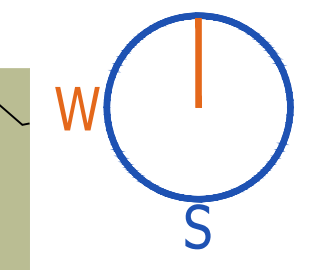


Appendix A: Site Location
Sunset Park Homes,
Whitfield Road, Brackley, NN13 5TD









Appendix B

Development Design Proposal

Do not scale from this drawing, except for planning purposes.
Any discrepancies are to be reported to WS Planning & Architecture.
Refer to Structural Engineers details for all structural design criteria.
This drawing remains the copyright of WS Planning & Architecture.



Key:

-  Soakaway
-  Surface Water Drainage
-  Cesspit
-  Foul Drainage
-  EV Charging Point
-  Outside Lighting
-  Shrubs/Green corridors
-  Mains Water

As Proposed Site Development Scheme Masterplan



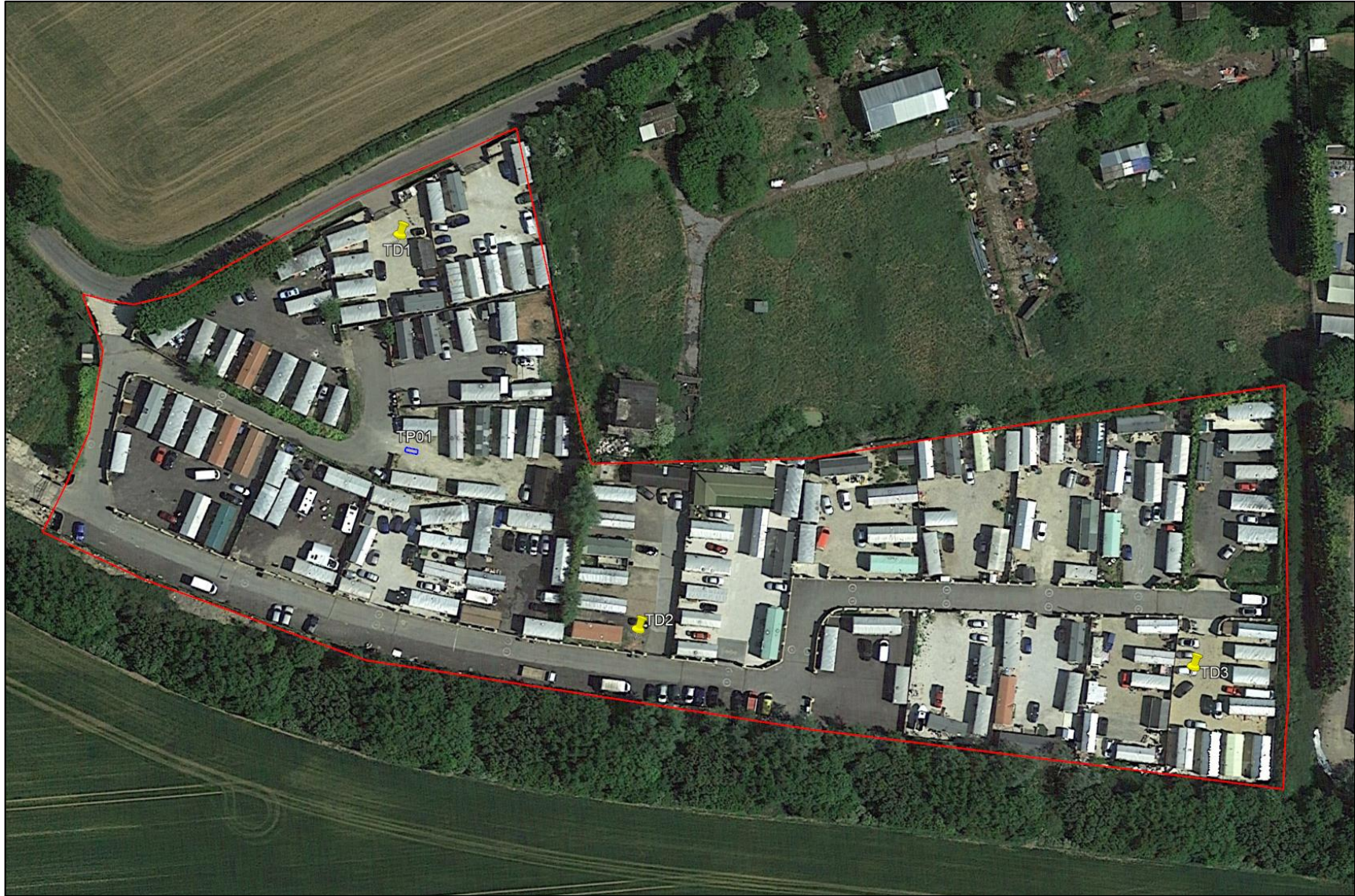
Rev	Date	Description
1	February 2023	MR
2	February 2023	BW

WS PLANNING & ARCHITECTURE
 11, The Quadrant, Brackley, NN13 5TD
 Tel: 01295 252525
 Email: info@wsplanning.co.uk
 Website: www.wsplanning.co.uk

Title: As Proposed Site Development Scheme Masterplan
 Drawing No: J004023-TD-00

Appendix C

Trial Pit Log & Photographs



Intrusive Investigation Test Locations
Sunset Park Homes,
Whitfield Road, Brackley, NN13 5TD



Integrated Designs & Associates Ltd
 38 Old Walsall Road
 Birmingham, B42 1NP
 Tel: 0121 358 2233
 email: contact@integratedesigns.co.uk

Borehole Log	
Client :	Mr. A. Smith
Co-ords :	462086, 238677
Level :	
Date :	18th April 2023

Borehole No.
TP01
 Hole Type
TP
 Sheet : 1/1

Location :

Project No. : MN-088-23-SPH
 Project Name: Land adjacent to 8 Addison Street, Wednesbury, WS10 9AW

Scale :

Logged by
MN

Sample Depth	Water Strikes	Depth (m)	Trial Pit Profile	Level (m)	Legend	Stratum Description	
		0		0.05		Gravel Hardcore	
		1					Firm brown sandy clay
		1.5					E.O.H
		2					
		3					
		4					
		5					
		6					

Notes Trial pit dimensions 2000mm(l) x 300mm(w) x 1500mm (d). Trial pit was created for a BRE365 infiltration test. The water was noted to be standing within the trial pit after 240 minutes of observation.

Appendix D

Hydrology Maps

Flood map for planning

Your reference
<Unspecified>

Location (easting/northing)
462143/238672

Created
20 Jun 2023 16:18

Your selected location is in flood zone 1, an area with a low probability of flooding.

You will need to do a flood risk assessment if your site is **any of the following**:

- bigger than 1 hectare (ha)
- In an area with critical drainage problems as notified by the Environment Agency
- identified as being at increased flood risk in future by the local authority's strategic flood risk assessment
- at risk from other sources of flooding (such as surface water or reservoirs) and its development would increase the vulnerability of its use (such as constructing an office on an undeveloped site or converting a shop to a dwelling)

Notes

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

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

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

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

Flood map for planning

Your reference
<Unspecified>

Location (easting/northing)
462143/238672

Scale
1:2500

Created
20 Jun 2023 16:18


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



Figure 1 – Extent of Flooding from Surface Water

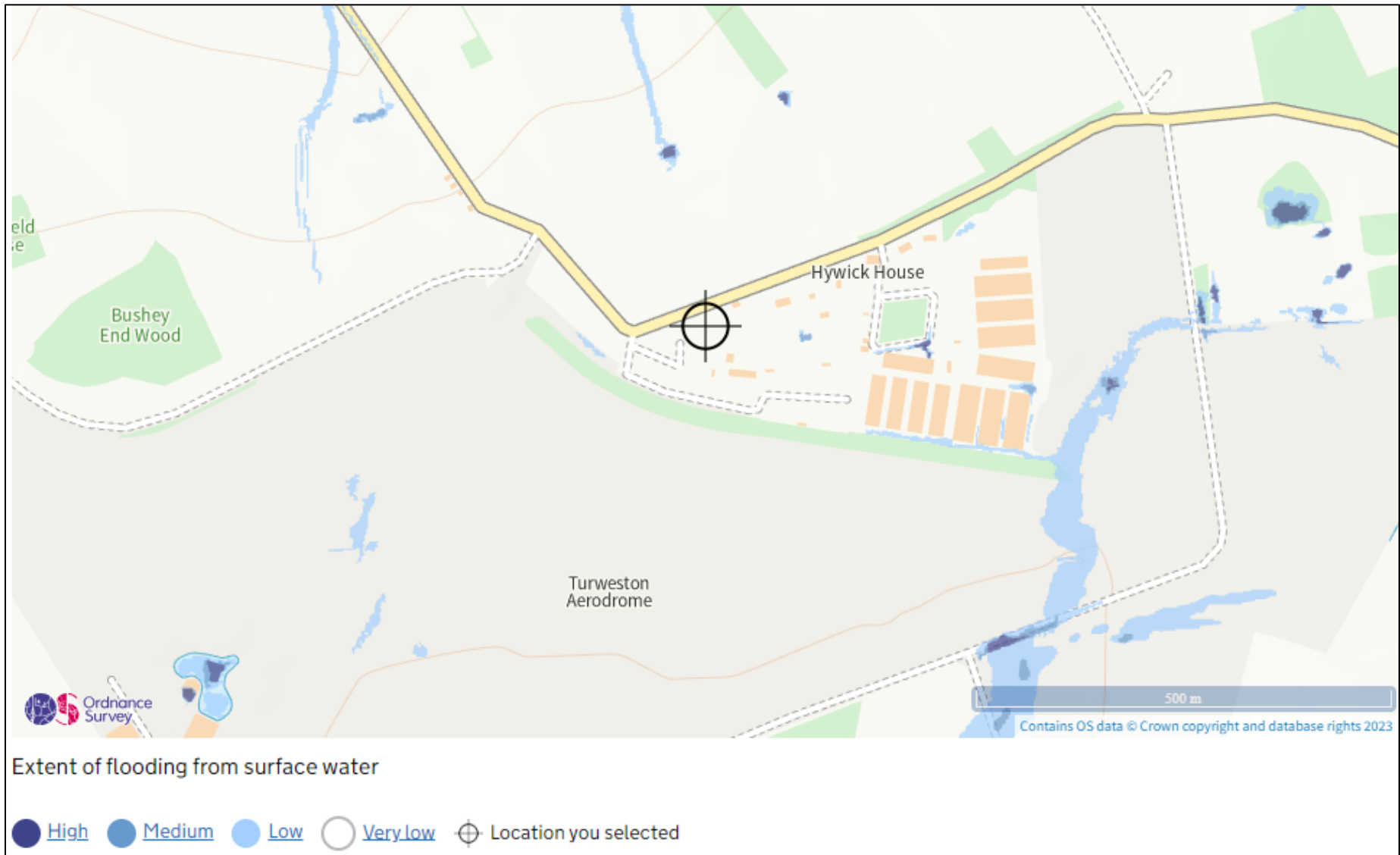


Figure 2- Surface Water Flood Risk: Water Depth in a Low-Risk Scenario

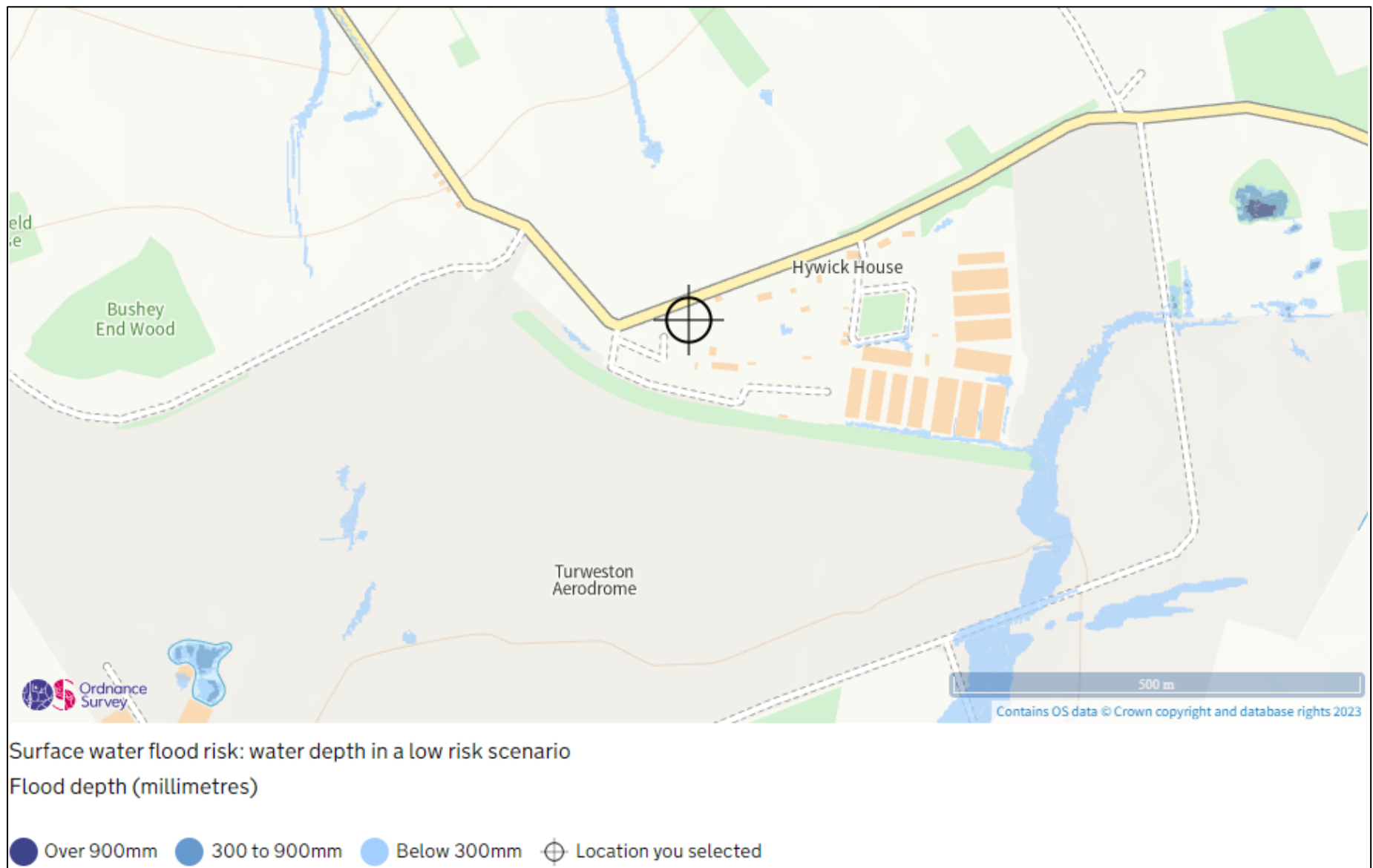
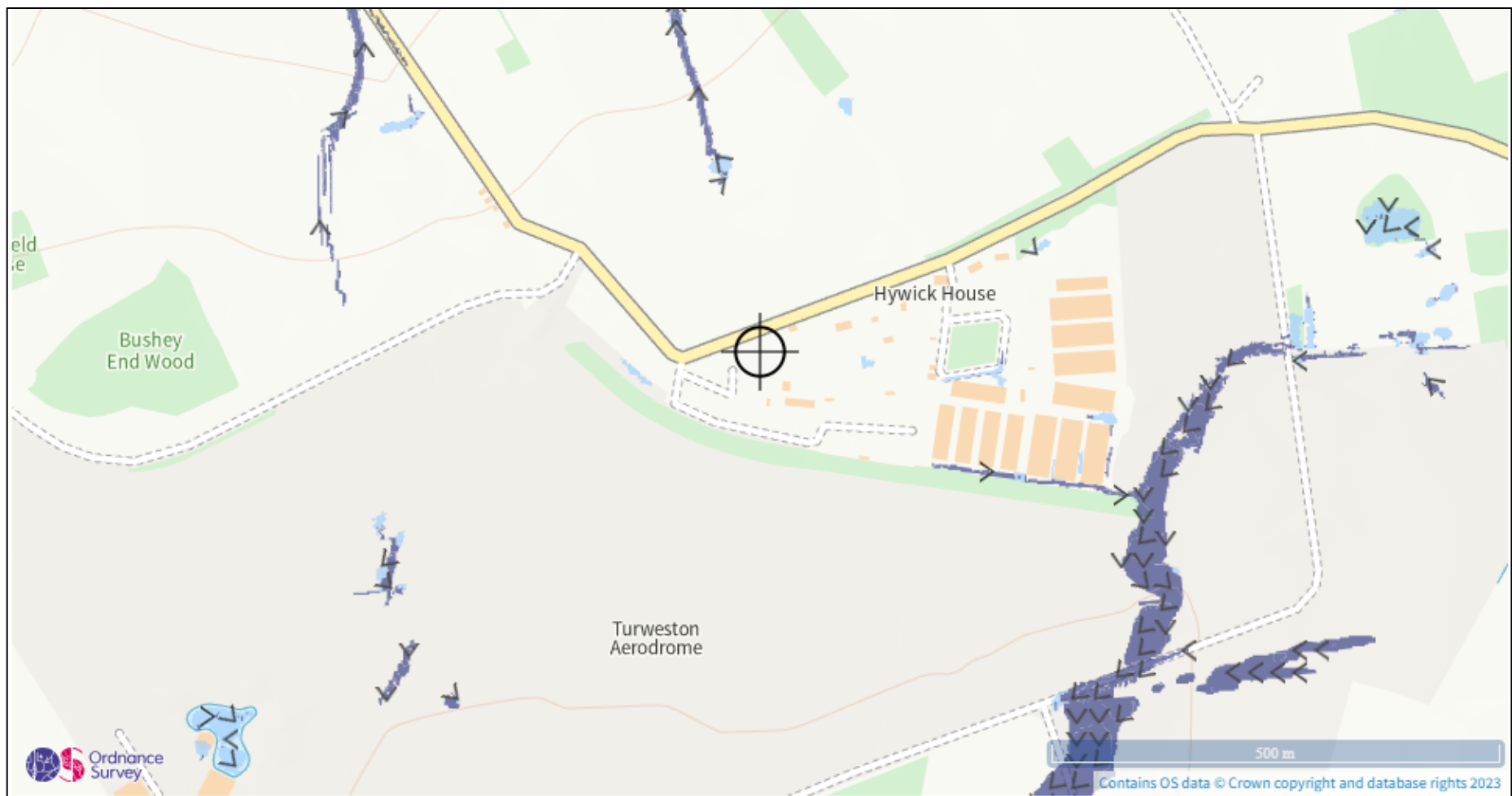


Figure 3 – Surface Water Flood Risk: Water Velocity in a Low-Risk Scenario



Surface water flood risk: water velocity in a low risk scenario
Flood velocity (metres/second)

● Over 0.25 m/s ● Less than 0.25 m/s ↖ Direction of water flow ⊕ Location you selected

Figure 4 – Surface Water Flood Risk: Water Depth in a Medium-Risk Scenario

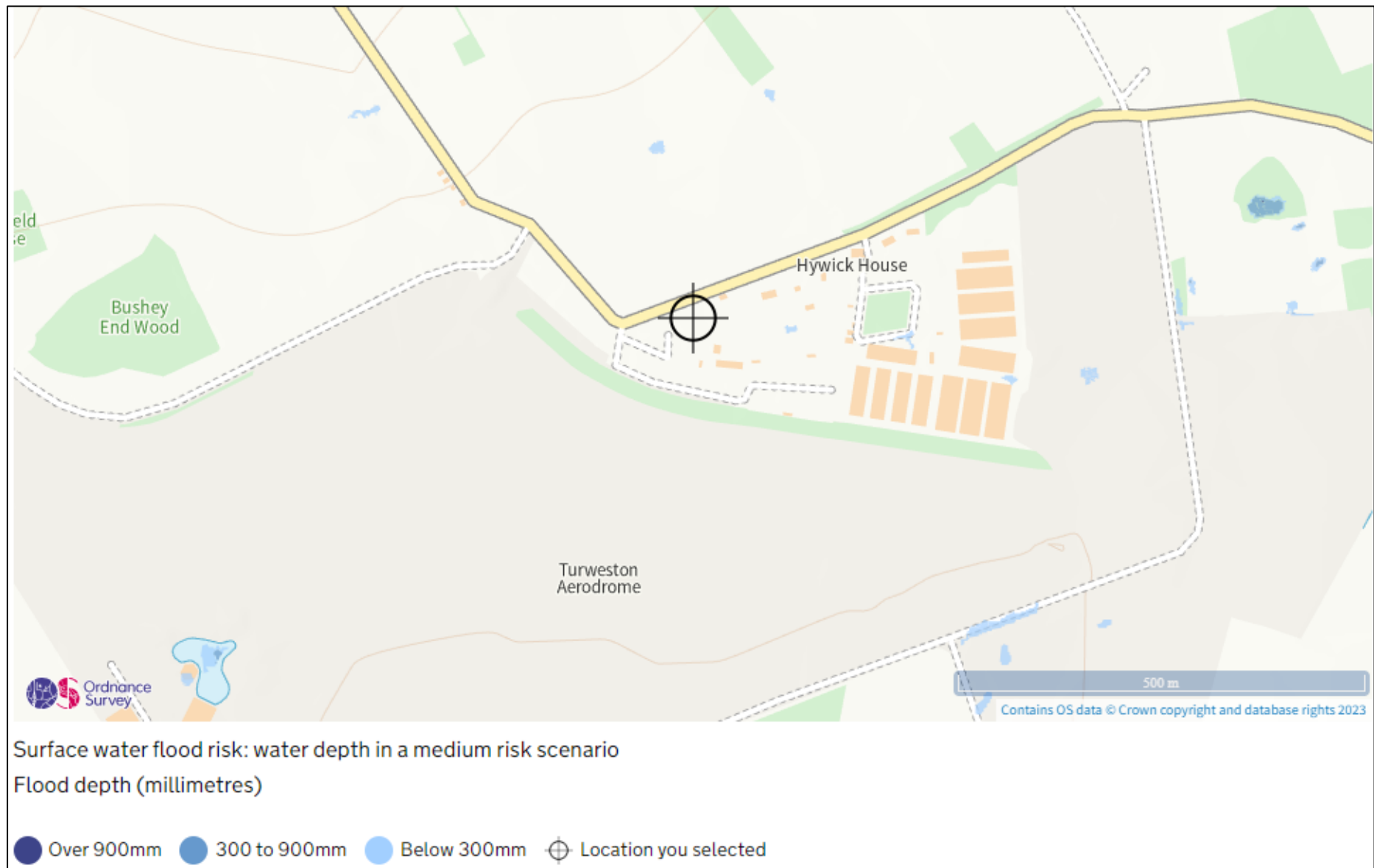
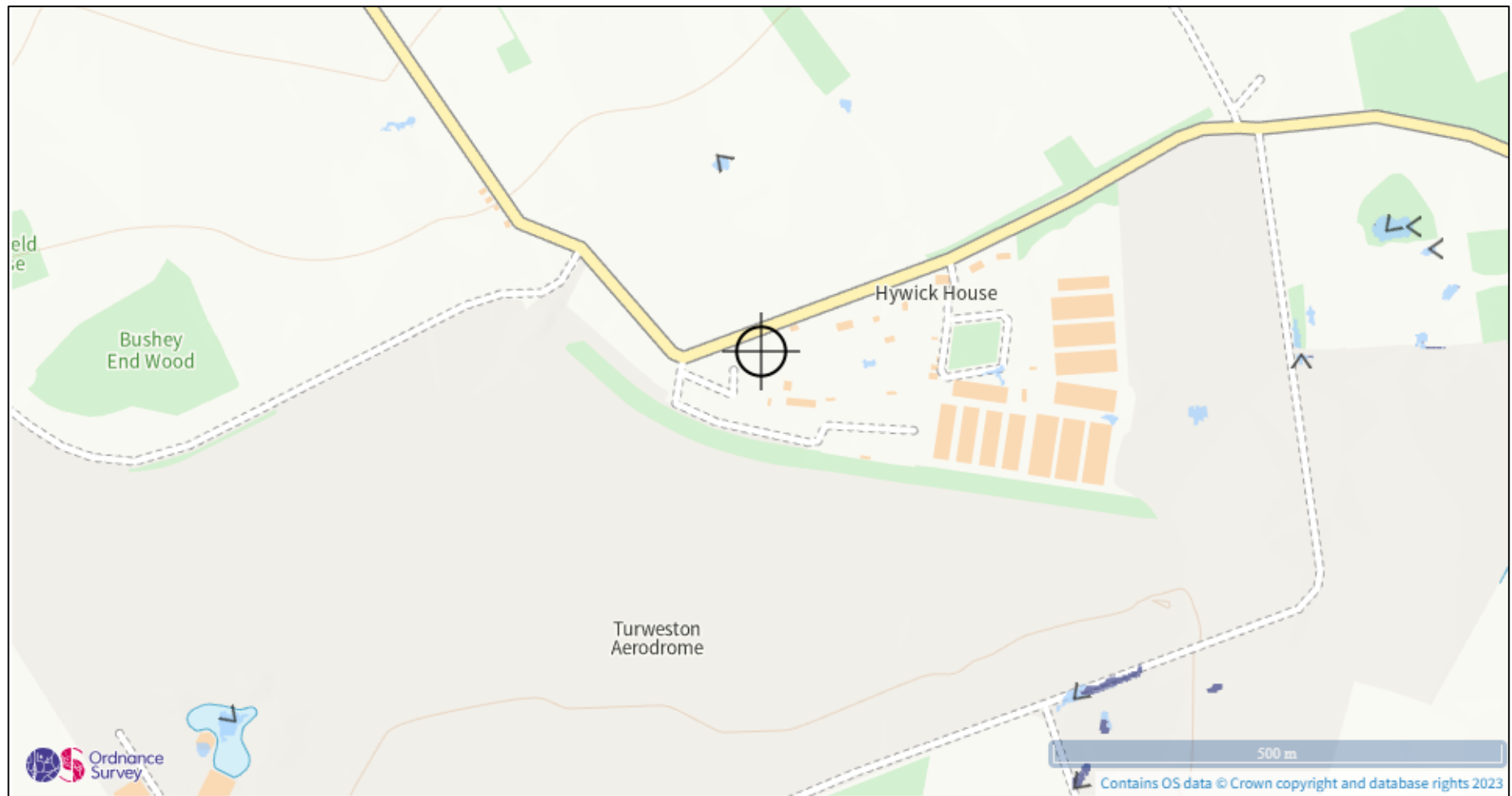


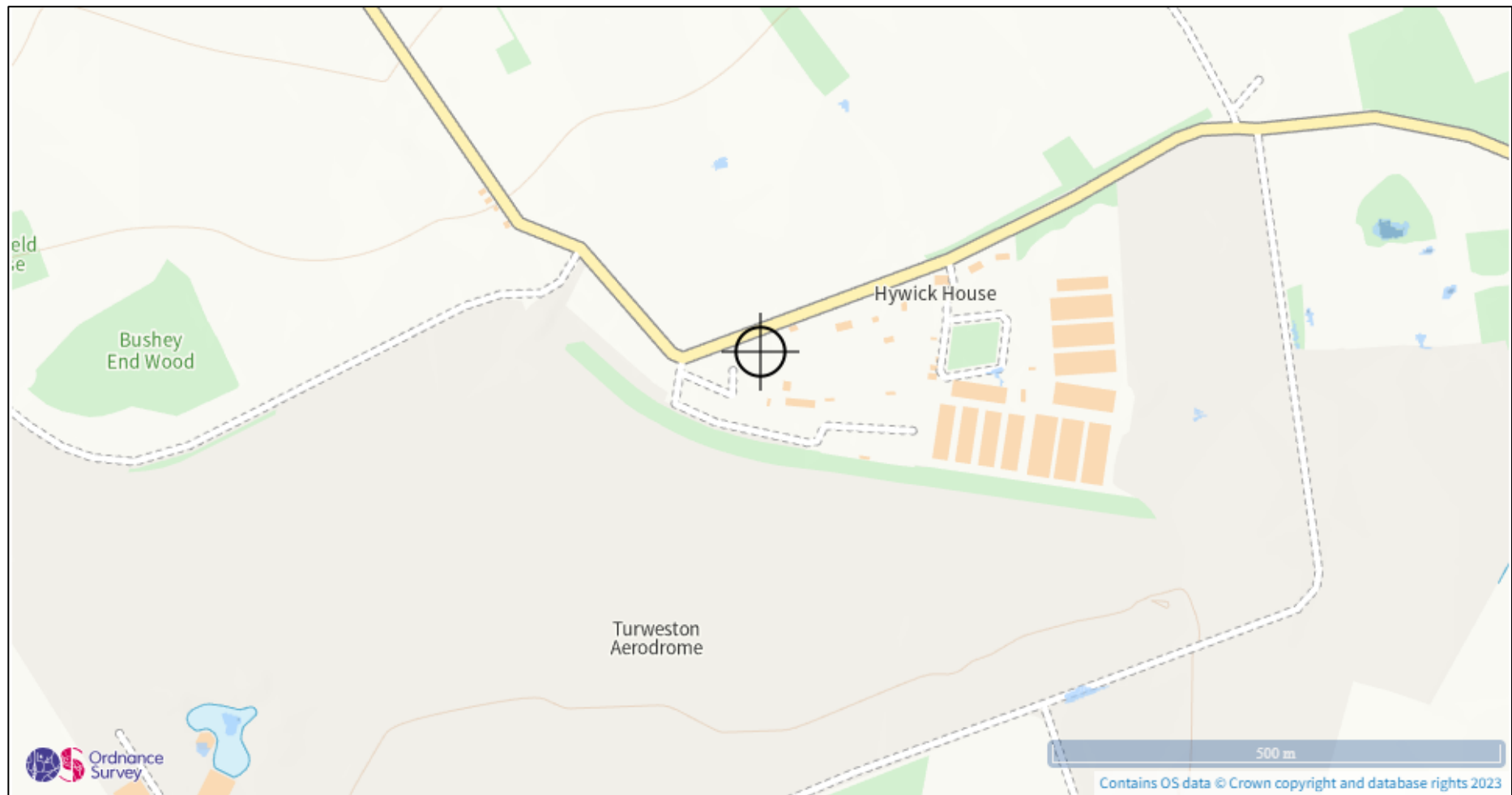
Figure 5 – Surface Water Flood Risk: Water Velocity in a Medium-Risk Scenario



Surface water flood risk: water velocity in a medium risk scenario
Flood velocity (metres/second)

● Over 0.25 m/s ● Less than 0.25 m/s ↖ Direction of water flow ⊕ Location you selected

Figure 6 – Surface Water Flood Risk: Water Depth in a High-Risk Scenario

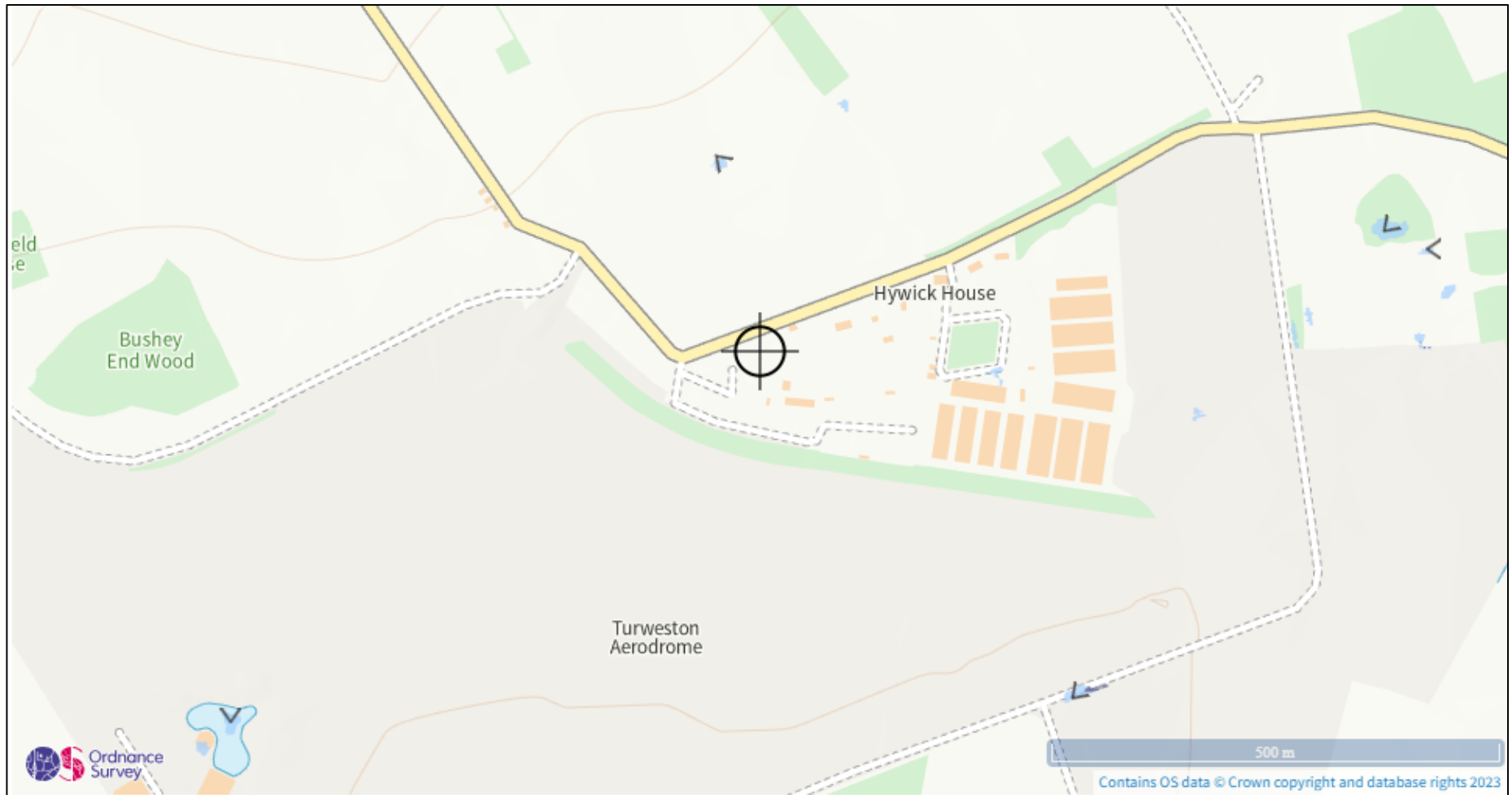


Surface water flood risk: water depth in a high risk scenario

Flood depth (millimetres)

- Over 900mm
- 300 to 900mm
- Below 300mm
- Location you selected

Figure 7 – Surface Water Flood Risk: Water Velocity in a High-Risk Scenario



Surface water flood risk: water velocity in a high risk scenario

Flood velocity (metres/second)

● Over 0.25 m/s ● Less than 0.25 m/s ↖ Direction of water flow ⊕ Location you selected

Appendix E

Greenfield Runoff Rate

Calculated by:

Site name:

Site location:

Site Details

Latitude:

Longitude:

Reference:

Date:

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013), the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Runoff estimation approach

Site characteristics

Total site area (ha):

Methodology

Q_{BAR} estimation method:

SPR estimation method:

Notes

(1) Is $Q_{BAR} < 2.0$ l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

Soil characteristics

	Default	Edited
SOIL type:	<input type="text" value="4"/>	<input type="text" value="4"/>
HOST class:	<input type="text" value="N/A"/>	<input type="text" value="N/A"/>
SPR/SPRHOST:	<input type="text" value="0.47"/>	<input type="text" value="0.47"/>

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

Hydrological characteristics

	Default	Edited
SAAR (mm):	<input type="text" value="668"/>	<input type="text" value="668"/>
Hydrological region:	<input type="text" value="5"/>	<input type="text" value="5"/>
Growth curve factor 1 year:	<input type="text" value="0.87"/>	<input type="text" value="0.87"/>
Growth curve factor 30 years:	<input type="text" value="2.45"/>	<input type="text" value="2.45"/>
Growth curve factor 100 years:	<input type="text" value="3.56"/>	<input type="text" value="3.56"/>
Growth curve factor 200 years:	<input type="text" value="4.21"/>	<input type="text" value="4.21"/>

(3) Is $SPR/SPRHOST \leq 0.3$?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Q_{BAR} (l/s):	10.1	10.1
1 in 1 year (l/s):	8.79	8.79
1 in 30 years (l/s):	24.75	24.75
1 in 100 year (l/s):	35.96	35.96
1 in 200 years (l/s):	42.53	42.53

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement, which can both be found at www.uksuds.com/terms-and-conditions.htm. The outputs from this tool are estimates of greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of this data in the design or operational characteristics of any drainage scheme.

Appendix F

Engineering Consultancy 49: Drainage Design Statement