

LAND ADJACENT TO WOODGATE NURSERIES

LIDSEY ROAD, WOODGATE

FLOOD RISK AND DRAINAGE STATEMENT

September 2021

FortRidge
Consulting Limited

For

HANBURY PROPERTIES LIMITED



STATUS OF REPORT

Revision	Document Note or Changes	Prepared or Revised By	Date
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ACRONYMS AND ABBREVIATIONS

ACRONYM	Description
AOD	Above Ordnance Datum
ADC	Arun District Council
AStGWF	Areas Susceptible to Groundwater Flooding (National map produced by the EA)
BGS	British Geological Survey
DEFRA	Department for Environment, Food and Rural Affairs
EA	Environment Agency
FFL	Finished Floor Level
ha	Hectares
LLFA	Lead Local Flood Authority
LPA	Local Planning Authority
m	Metres
mm	Millimetres
NPPF	National Planning Policy Framework
PPG	Planning Practice Guidance
QBAR	Mean Annual Flood (IoH Report No. 124 Flood Estimation for Small Catchments)
SFRA	Strategic Flood Risk Assessment
WSCC	West Sussex County Council (LLFA)

1.0 INTRODUCTION

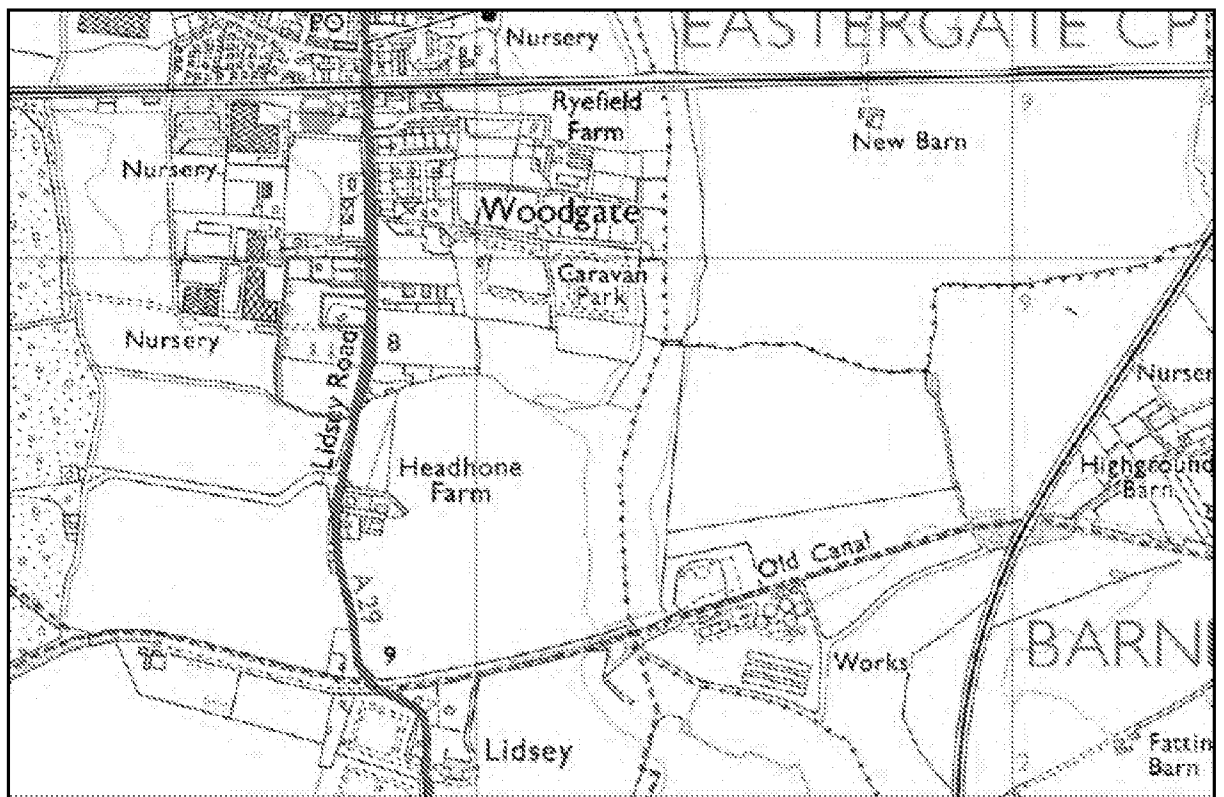
- 1.1 FortRidge Consulting Limited was commissioned by Hanbury Properties, to prepare a Flood Risk Assessment and Drainage Statement in support of an outline planning application for land at Woodgate. This Flood Risk Assessment and Drainage Statement summarises the approach taken in developing the drainage strategy for the site.
- 1.2 The requirements and policies of Arun District Council (ADC), West Sussex County Council as Lead Local Flood Authority (WSSC) and the Environment Agency (EA) have been taken into account when considering flood risk at the Site.
- 1.3 The purposes of the Report are:
 - to confirm that the proposed development will not be subject to unacceptable flood risk or to show that flood risk can be managed acceptably.
 - to provide strategies and mitigation proposals for site drainage
- 1.4 The Report presents a preliminary assessment of flood risk in accordance with the National Planning Policy Framework (NPPF), July 2021 and its supporting Planning Practice Guidance (PPG), published by the Department of Communities and Local Government.
- 1.5 The NPPF and supporting PPG provide guidance on how flood risk should be considered during planning and development processes. The requirement to protect both new and established development from increased risk of flooding forms an essential part of the guidance.
- 1.6 Arun District Council is the Local Planning Authority (LPA), controlling flood risk and water environment issues, through policies and guidance presented in the ADC Strategic Flood Risk Assessment, Final report dated August 2016.
- 1.7 WSSC, in its role as Lead Local Flood Authority (LLFA), are a statutory consultee for all major applications. Guidance published by WSSC (Revised November 2018) and ADC have been referred to in compiling this report.

Pre-application consultation

- 1.8 A pre-application submission was made to ADC. Drainage matters were presented in the form of a drainage technical note. A response was provided by ADC and has been taken into account in compiling this FRA&DS.
- 1.9 In addition, there has been an exchange of emails providing further information to ADC's drainage engineers, including a window sample log and winter groundwater monitoring information.

2.0 THE SITE

- 2.1 The site is located adjacent to the settlement of Woodgate, to the west of A29, Lidsey Road.
- 2.2 The ordnance survey reference for the site is OS X (Eastings) 493694 and OS Y (Northings) 103881.
- 2.3 The nearest Post Code is PO20 3SU.
- 2.4 The overall site area is approximately 3.53 hectares including open space provisions.
- 2.5 A site location plan is shown below and at Figure 1 at the end of the report:

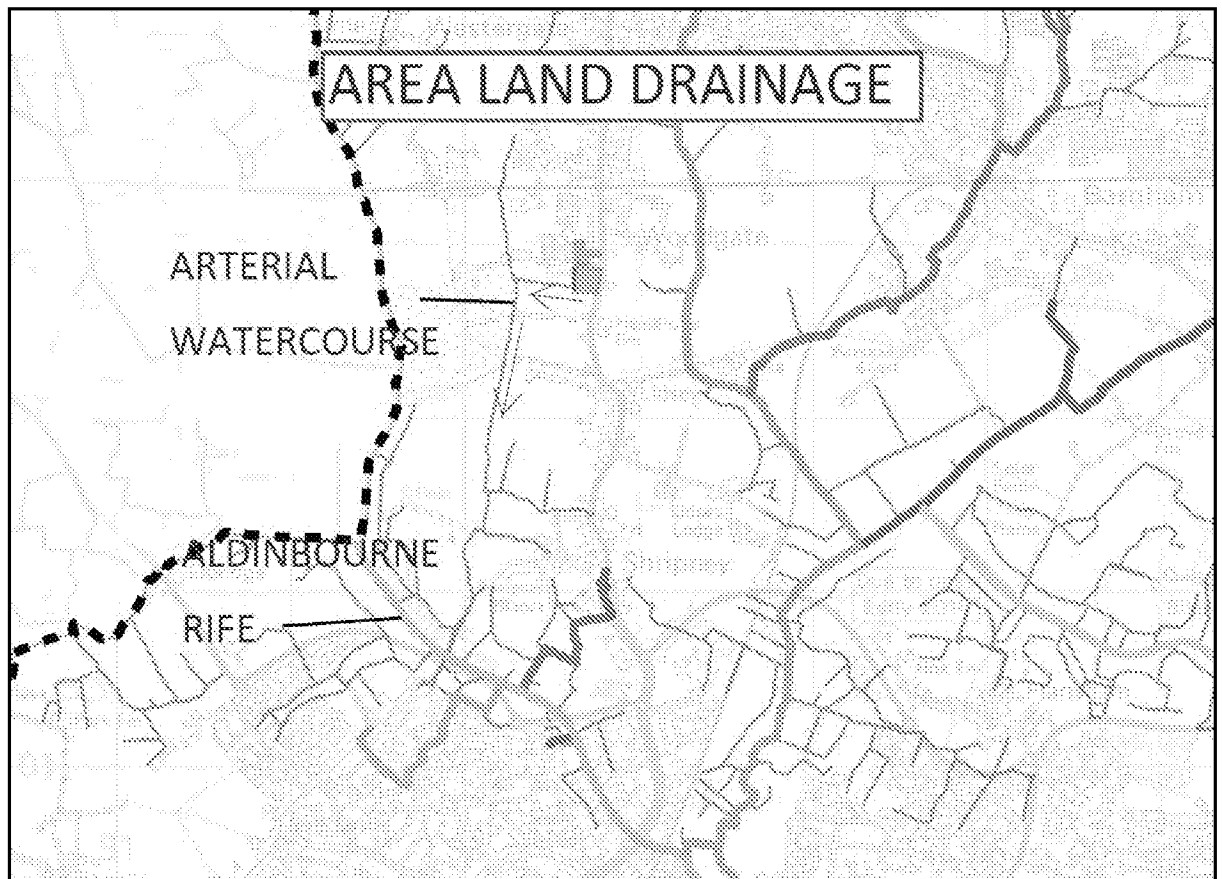


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Topography

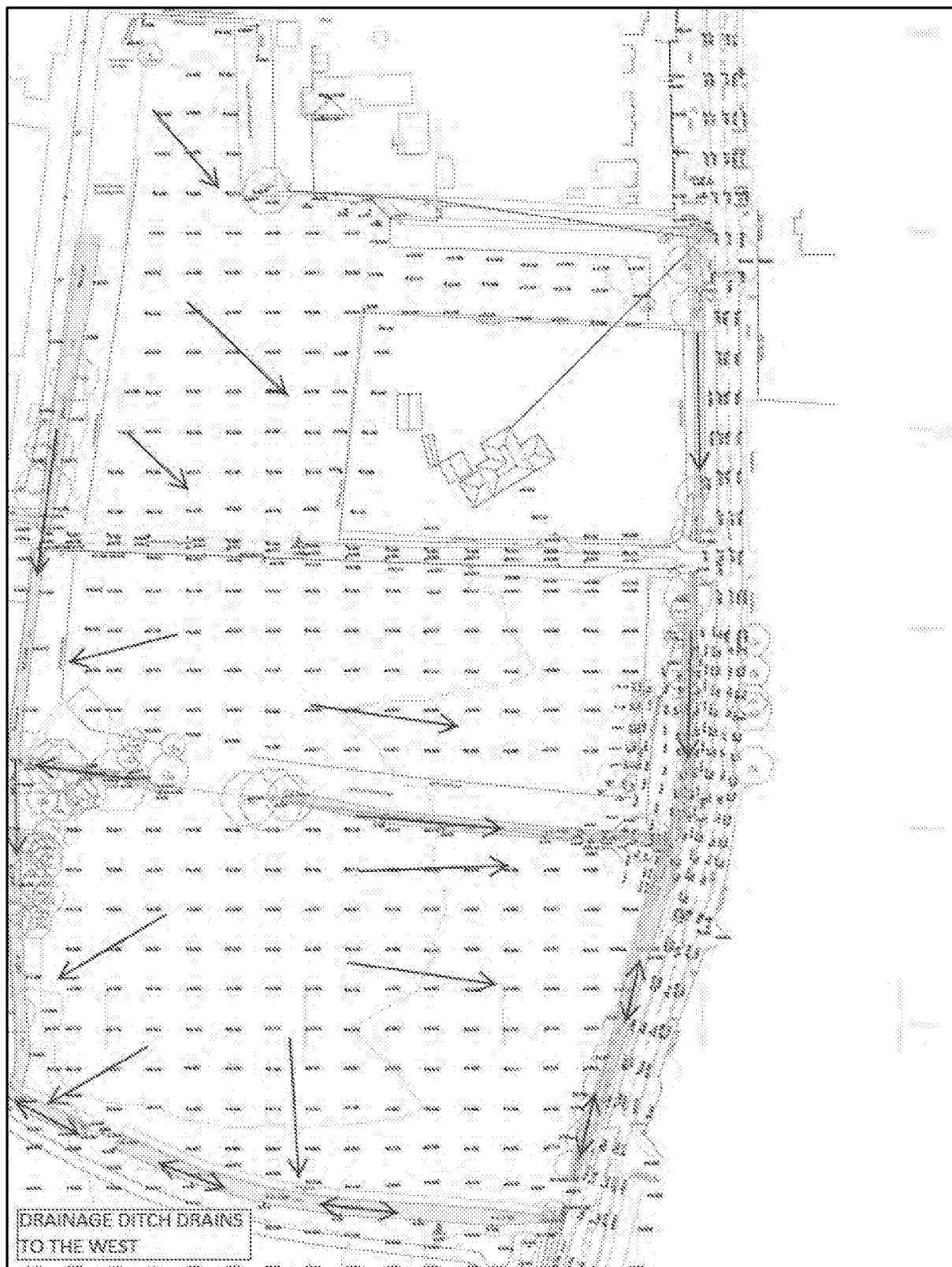
- 2.6 A Topographical survey has been carried out. A copy is shown at Appendix 1.
- 2.7 The site is relatively flat with levels varying from 9.66mAOD in the north of the site to 8.2mAOD in the east of the site adjacent to Lidsey Road, excluding ditch bed levels.

- 2.8 The land falls in an easterly direction towards Lidsey Road with part of the site falling in a westerly direction.
- 2.9 The site is bounded on all sides by drainage ditches that are characteristic of the area.
- 2.10 The ditch along the southern/eastern boundary drains in two directions in the winter when the ditch is full. It is characterised as a 'wet ditch'.



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- 2.11 The area land drainage maps from the SFRA show the area drains to the Aldingbourne Rife to the south of the site.
- 2.12 The existing runoff within the site is indicated below. The site is relatively flat and drains towards the boundary ditches.



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Geology and Hydrogeology

- 2.13 British Geological Survey (BGS) mapping indicates the superficial geology in the area to be: *"1:50 000 scale superficial deposits description: River Terrace Deposits (undifferentiated) - Sand, Silt And Clay. Superficial Deposits formed up to 3 million years ago in the Quaternary Period. Local environment previously dominated by rivers (U)"*
- 2.14 British Geological Survey (BGS) mapping indicates the bedrock geology in the area to be: *"1:50 000 scale bedrock geology description: London Clay Formation - Clay, Silt And Sand. Sedimentary Bedrock formed approximately 48 to 56 million years ago in the Palaeogene Period. Local environment previously dominated by deep seas."*
- 2.15 The BGS map is reproduced as **Figure 2**.
- 2.16 The bedrock geology beneath the whole Site comprises solid geology of the Kellaway Clay Member and The Oxford Clay Formation.
- 2.17 Soilscape information indicates that the soil underlying the Site comprises loamy soils with naturally high groundwater, draining to local shallow groundwater.
- 2.18 Host soil classification shows the soils to be: *'Soils seasonally waterlogged by fluctuating groundwater and with relatively slow lateral saturated conductivity.'*
- 2.19 The Wallingford SuDS Tools show the site to be Soil Type 2.

Ground Investigation

- 2.20 A geotechnical investigation has been carried out by Ashdown Site Investigation Limited. The window samples WS102 and WS103 show worked ground overlying clay overlying sand.
- 2.21 Groundwater monitoring was undertaken in the winter for 2020-21. The results are shown in **Appendix 9**.
- 2.22 Based on the SI and the BGS information infiltration drainage will not be possible across the site and therefore attenuated surface water drainage will be designed to connect to the watercourse to the west of the site.

Groundwater

- 2.23 The EA Groundwater Vulnerability Map shows that the Site is not underlain by an aquifer.
- 2.24 The area is shown on SFRA mapping to be at high risk from groundwater flooding ($\geq 75\%$).

Watercourses

- 2.25 The roadside ditch adjacent to the site appears to function as a two-way 'wet ditch'.
- 2.26 The site is bounded on all sides by drainage ditches that a feature of the area, draining water from agricultural fields via arterial land drains and watercourse to the Aldingbourne Rife that serves the area.

Existing Drainage

- 2.27 The SFRA map documents of the area around the Site confirms that there are no known sewer flooding problems. There is a record of surface water flooding adjacent to Wings.

Site Walkover

- 2.28 Site visits have been made on 1st December 2020 and on 10th May 2021 to investigate the possibility of a drainage connection from a manhole on the east side of Lidsey Road to the east.
- 2.29 The highways manhole had a connection in from the adjacent gully and a pipe running out to the south, towards the hedge line. There was no evidence of a pipe crossing Lidsey Road to/from the ditch on the western side of the road.

Site Access

- 3.2 The proposed site accesses are off the main A29, Lidsey Road. These are detailed in the accompanying Transport Assessment.

Vulnerability Classification

- 3.3 Table 2 of the Governments Planning Practice Guidance provides a detailed list of the types of development falling into the vulnerability classifications. This list provides guidance on the various uses and their subsequent flood risk vulnerability classification.
- 3.4 As per Table 2, **More Vulnerable** classification applies to the residential dwellings.
- 3.5 Table 3 of the Planning Practice Guidance show the compatible flood zones for the flood vulnerability classification:

Flood Zones	Flood Risk Vulnerability Classification				
	Essential infrastructure	Highly vulnerable	More vulnerable	Less vulnerable	Water compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test required	✓	✓	✓
Zone 3a †	Exception Test required †	x	Exception Test required	✓	✓
Zone 3b *	Exception Test required *	x	x	✓	✓

Key:

✓ Development is appropriate

x Development should not be permitted

4.0 FLOOD RISK ASSESSMENT

Fluvial Flooding

- 4.1 Flood Zones shown on the Environment Agency flood maps for planning service are the main constraints used to inform the LPA when to consult the EA and LLFA on flood risk in development control decisions.
- 4.2 The Flood Zones refer to the probability of flooding and this varies depending on the source of flooding being fluvial or coastal. Flood Zones 1, 2 and 3 refer to low, medium and high risk of flooding. These zones for fluvial risks of flooding correspond to the Annual Exceedance Probabilities (AEP) of less than 0.1%, in the range of 0.1-1% and greater than 1% in any given year, respectively.
- 4.3 The Flood Zones, as described in the PPG, indicate the probability of flooding without the presence of defences and significant manmade structures such as bridges, culverts, and rail or motorway embankments. They show areas that may be at risk from flooding and where further investigation in the form of a Flood Risk Assessment should be used to ascertain the probable risk of flooding on site.
- 4.4 An extract from the Flood Map (for the Site) is presented as **Figure 5**. This indicates that the Site is entirely located within **Flood Zone 1 (Low probability)** defined as:

“**Flood Zone 1** – Land having a less than 1 in 1,000 annual probability of river or sea flooding.
(Shown as ‘clear’ on the Flood Map – all land outside Zones 2 and 3)

Coastal Flooding

- 4.5 The Site is at an elevation of circa 8-10mAOD and is not located within any tidal areas and is not at risk from tidal flooding.

Climate Change

- 4.6 EA Climate Change Allowances for Flood Risk Assessments were updated in February 2016. This advice updates previous climate change allowances to support the NPPF.
- 4.7 Having regard to ADC’s SFRA review of Climate Change and future flood risk the site remains in Flood Zone 1 in future scenarios.

Groundwater Flooding

- 4.8 Groundwater flooding occurs where groundwater levels rise sufficiently to intersect the ground surface and flow onto low-lying areas. Generally, groundwater flooding may be a problem where developments are over permeable soils or rocks.
- 4.9 The Arun DC SFRA map documents show the area to be at high risk from groundwater flooding ($\geq 75\%$).
- 4.10 The SFRA notes that: *mapping suggests that there is a high risk of groundwater flooding at this location. Therefore, it is likely infiltration techniques will not be suitable. However, this should be confirmed via a site investigation and the potential for infiltration techniques should be assessed.*
- 4.11 The SFRA also notes that: *compared with other sources, current understanding of the risks posed by groundwater flooding is limited and mapping of flood risk from groundwater sources is in its infancy. Under the Flood and Water Management Act (2010), LLFAs have powers to undertake risk management functions in relation to groundwater flood risk. Groundwater level monitoring records are available for areas on Major Aquifers. However, for low lying valley areas, which can be susceptible to groundwater flooding caused by a high water table in mudstones, clays and superficial alluvial deposits, very few records are available. Additionally, there is increased risk of groundwater flooding where long reaches of watercourse are culverted as a result of elevated groundwater levels not being able to naturally pass into watercourses and be conveyed to less susceptible areas. Section 5.2.2 reports on the bedrock geology and superficial deposits within the district, and summarises that the geology of the district indicates susceptibility to groundwater emergence and flooding, a fact identified in the historical record.*

As part of the SFRA deliverables, mapping of the whole District has been provided showing the Areas Susceptible to Groundwater Flooding (AStGWF). This information is provided in Appendix F. The AStGWF is a strategic-scale map showing groundwater flood areas on a 1km square grid.

The data was produced to annotate indicative Flood Risk Areas for Preliminary Flood Risk Assessment (PFRA) studies and allow the LLFAs to determine whether they may be at risk of flooding from groundwater.

This data shows the proportion of each 1km grid square, where geological and hydrogeological conditions indicate that groundwater might emerge. It does not show the likelihood of groundwater flooding occurring, nor does it take account of the chance of flooding from groundwater rebound (rising groundwater levels resulting from a reduction in abstraction

rates from groundwater). This dataset covers a large area of land, and only isolated locations within the overall susceptible area are actually likely to suffer the consequences of groundwater flooding.

The AStGWF data should be used only in combination with other information, for example local or historical data. It should not be used as sole evidence for any specific flood risk management, land use planning or other decisions at any scale. However, the data can help to identify areas for assessment at a local scale where finer resolution datasets exist. It should be noted that although an area may be designated as susceptible to groundwater flooding, this does not mean that groundwater flooding will definitely be a problem within these areas, rather it provides an indication of potential risk.

Significant events of groundwater flooding reported in West Sussex⁴⁴ are reported to have occurred in:

- 1974
- Winter 1993–1994
- Winter 2000–2001
- Winter 2002–2003
- Westergate/Barnham area
- 2013/14 –Westergate/Barnham area
- 2014 – Northfields Lane/Nyton Road/Level Mere Lane, Aldingbourne

It was observed that the extensive groundwater flooding of winter 2000 / 2001 followed a period of exceptionally high rainfall, but the direct source was not identified and therefore it may be that flooding was caused by a burst underground pipe rather than flooding from hard rock aquifers or superficial deposits⁴⁵.

Developers planning to build within groundwater emergence zones should still investigate whether groundwater flooding is likely to be a problem locally.

The Lidsey SWMP identified that groundwater flooding has been reported in Elm Grove in Barnham, Northfields Lane/Nyton Road in Westergate, and Wandleys Lane in Eastergate⁴⁶.

- 4.12 There is no historical record of groundwater flooding in Woodgate. The area is located on the edge of the identified groundwater emergence zone.

Surface Water Flooding

- 4.13 Surface Water Flooding occurs when the intensity of rainfall exceeds ground infiltration. Typically, this happens where the ground surface is impermeable, such as roads and paved areas within urban development and where there are impermeable soils, such as clay.

4.14 The Environment Agency's 'Flood risk from surface water' shows that the Site lies primarily within an area at low risk of surface water flooding.

4.15 The Environment Agency's surface water flood risk map indicates little potential for surface water flood risk. The surface water flood map is reproduced as **Figure 6**.

Flooding from Infrastructure Failure

4.16 Where infrastructure retains, transmits or controls the flow of water, flooding may occur if there is a structural, hydraulic, geotechnical, mechanical or operational failure. There are three main categories of infrastructure associated with this mechanism of flooding:

- Failure of infrastructure designed to store or carry water (e.g. dam break, canal leak, burst water mains).
- Failure of infrastructure designed to protect an area from flooding (e.g. breached flood defences, flap valve or penstock failure, pumping station failure).
- Failure of a pipe, bridge or culvert due to blockage.

4.17 There is no major infrastructure that could affect the site due to failure. Therefore, the risk of flooding from this mechanism of flooding is considered low.

Flooding from Reservoirs

4.18 The Environment Agency's map 'Flood Risk from Reservoirs' shows that the Site is not within an area at risk of reservoir flooding. The reservoirs flood risk map is reproduced as **Figure 7**.

Historical Flooding

4.19 There are no records of historical flooding on the site.

Sequential and Exception Tests

4.20 The Site is classified as Flood Zone 1 (low risk) and will remain so having regard to available future scenario modelling (including ADC's SFRA). The sequential and exception tests are not required having regard to government policy in the NPPF and guidance on the PPG.

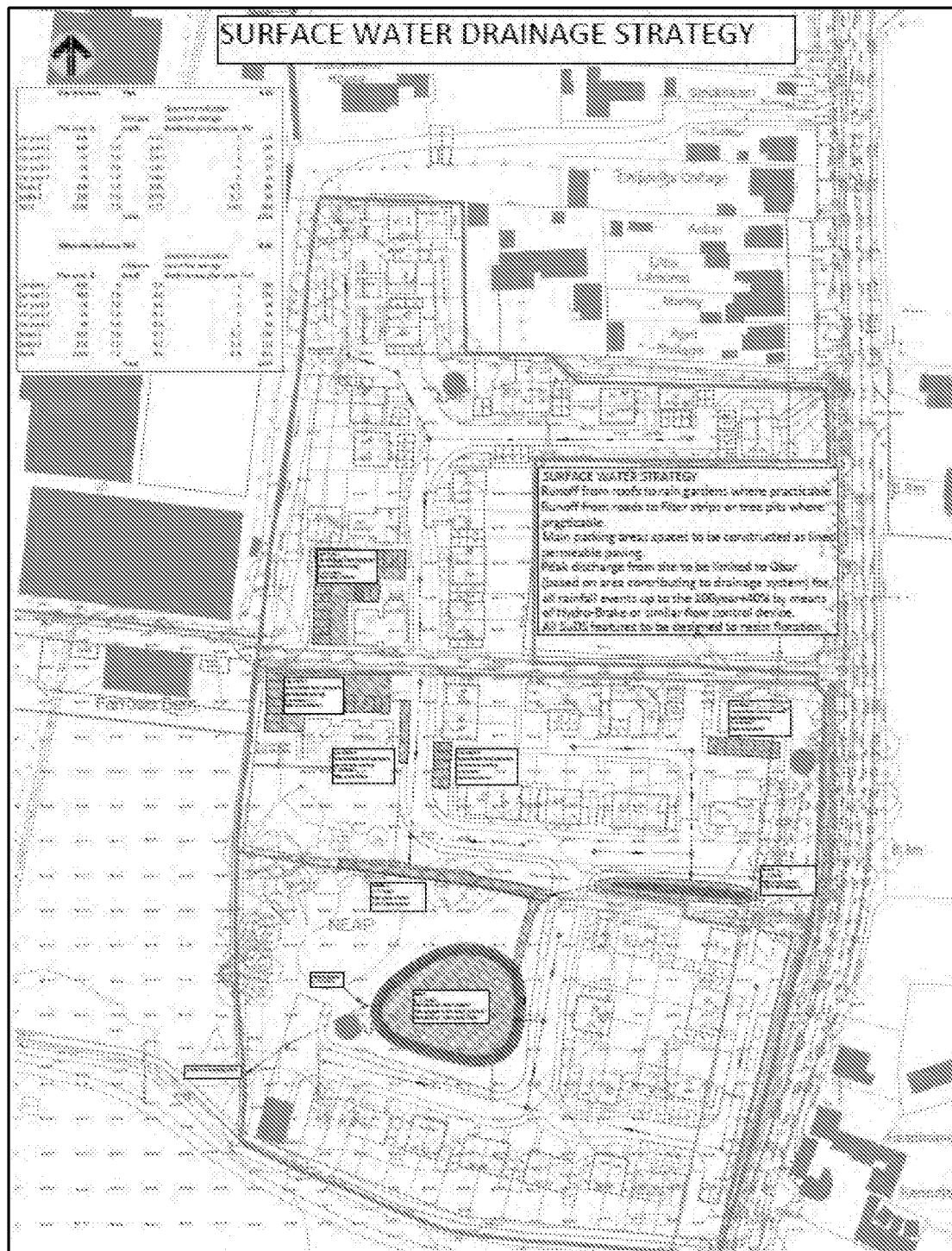
5.0 SURFACE WATER DRAINAGE STRATEGY AND FLOOD MITIGATION

- 5.1 According to the site investigation report, due to the presence of high groundwater within the site infiltration drainage will not be possible. Attenuation drainage will be provided on the site in accordance with planning and drainage policy requirements.
- 5.2 The site topography is such that the site drains towards the south and east of the site. The surrounding ditches all drain to the west as indicated on the SFRA mapping included in Appendix 2.
- 5.3 Attenuation will be provided by detention basins or other shallow SuDS features on Site, before discharging to new or existing ditches within the site connecting to the existing watercourses adjacent to the site that drain to the west.
- 5.4 The discharge rate will be restricted to the Greenfield runoff rate (QBAR), in accordance with Arun DC policy. It is noted that Qbar calculations relate to only the positively-drained impermeable surfaces.
- 5.5 It is anticipated that swales, filter strips and filter drains will feature extensively within the SuDS scheme, together with other shallow conveyance systems. Taking into account the potential for flotation and groundwater infiltration components will need to be lined and weighted sufficiently to withstand flotation pressures.
- 5.6 The existing roadside ditch along the eastern boundary, adjacent to the A29 Lidsey Road will need to be realigned and culverted to accommodate the proposed access.
- 5.7 A summary of the existing runoff calculations from the site is shown below (area of positively drained impermeable surfaces) together with strategic site wide storage requirements:

Greenfield runoff calculations	
Drained Area (including allowance for creep)	1.8ha
Greenfield Runoff Rate (QBAR)	3.5 l/s
1 in 1-year runoff	2.97 l/s
1 in 30-year runoff	8.04 l/s
1 in 100-year runoff	11.15 l/s

Storage Summary	
Impermeable Area (Incl Creep)	1.8ha
Permitted discharge (reduced to less than Qbar)	3.6l/s (based on 2l/s/ha)
30-year storage required	1201m ³
100-year plus 40% climate change storage required	1587m ³

5.8 The proposed surface water drainage strategy is shown below and in more detail at Appendix 6:



SURFACE WATER DRAINAGE STRATEGY (see Appendix 6)

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5.9 Storage volumes have been assessed as follows:

30yr Volumes			TWL		8.25
	Plan area	IL	Effective depth	Geometry reduction factor for average depth across plan area	Vol
Car park 1	450		8	0.25	113
Car park 2	460		7.8	0.45	207
Car park 3	40		7.8	0.45	18
Car park 4	60		7.8	0.45	27
Car park 5	90		7.8	0.45	41
Swale 1	230		7.5	0.75	86
Swale 2	250		7.5	0.75	94
Pond	1050		7.5	0.75	669
Total					1254
100yr+40% Volumes			TWL		8.40
	Plan area	IL	Effective depth	Geometry reduction factor for average depth across plan area	Vol
Car park 1	450		8	0.4	180
Car park 2	460		7.8	0.6	276
Car park 3	40		7.8	0.6	24
Car park 4	60		7.8	0.6	36
Car park 5	90		7.8	0.6	54
Swale 1	230		7.5	0.9	104
Swale 2	250		7.5	0.9	113
Pond	1050		7.5	0.9	851
Total					1637

5.10 There is no historical record of flooding in proximity to the site. Groundwater measurements have indicated that groundwater can be close to the surface.

5.11 It will therefore be necessary to design all underground components, including SuDS components to take account of potential high groundwater levels.

5.12 Mitigation measures to be considered should include sealed SuDS components to avoid the risk of groundwater infiltration, elevated finished floor levels and elevated road levels.

5.13 SuDS components will need to be designed to withstand flotation pressures.

Water Quality

5.14 Water Quality assessment should be in compliance with the guidance in The SuDS Manual, CIRIA Repot C753.

5.15 Surface water generated from the site will be accommodated through a drainage treatment train, which will include the use of SuDS. The approach to water quality risk management is the Simple Index Approach. This approach is defined in Table 26.2 of the SuDS Manual.

5.16 The approach is a simple stepped system as follows:

Step 1- Allocate suitable pollution hazard indices for the proposed land use

Step 2 - select SuDS with a total pollution mitigation index that equals or exceeds the pollution hazard index.

Step 3 – Where the discharge is to protected surface waters or groundwater, consider the need for a more precautionary approach.

5.17 The pollution hazard indices are defined in table 26.2 of the SuDS Manual.

TABLE 26.2 Pollution hazard indices for different land use classifications				
Land use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydrocarbons
Residential roofs	Very low	0.2	0.2	0.05
Other roofs (typically commercial/ industrial roofs)	Low	0.3	0.2 (up to 0.8 where there is potential for metals to leach from the roof)	0.05
Individual property driveways, residential car parks, low traffic roads (eg cul de sacs, homezones and general access roads) and non-residential car parking with infrequent change (eg schools, offices) ie < 300 traffic movements/day	Low	0.5	0.4	0.4
Commercial yard and delivery areas, non-residential car parking with frequent change (eg hospitals, retail), all roads except low traffic roads and trunk roads/motorways ¹	Medium	0.7	0.6	0.7
Sites with heavy pollution (eg haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured, industrial sites, trunk roads and motorways ¹	High	0.8 ²	0.6 ²	0.9 ²

5.18 The total pollution hazard index for the site is:

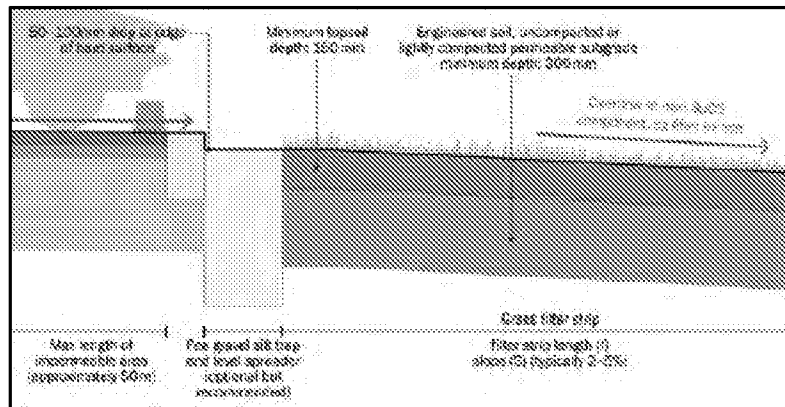
Land Use	Pollution hazard level	TSS	Metals	Hydro-carbons
Residential Roofs	Very Low	0.2	0.2	0.05
Drives and low traffic roads	Low	0.5	0.4	0.4
Total		0.7	0.6	0.45

5.19 The SuDS mitigation indices are defined in Table 26.3 of the SuDS Manual:

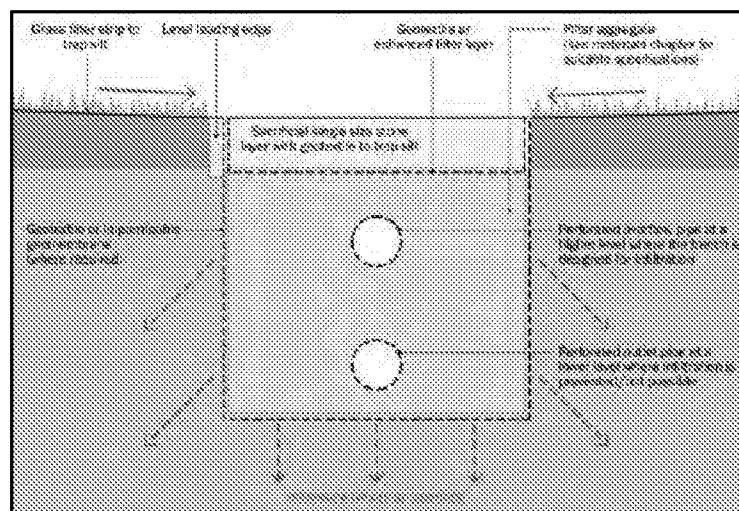
TABLE 26.3 Indicative SuDS mitigation indices for discharges to surface waters				
Type of SuDS component	Mitigation indices ^a			
	TSS	Metals	Hydrocarbons	
Filter strip	0.4	0.4	0.5	
Filter drain	0.4 ^b	0.4	0.4	
Swale	0.5	0.5	0.6	
Bioretention system	0.8	0.8	0.8	
Permeable pavement	0.7	0.6	0.7	
Detention basin	0.5	0.5	0.6	
Pond ^c	0.7 ^d	0.7	0.5	
Wetland	0.8 ^e	0.8	0.8	
Proprietary treatment systems ^{f,g}	These must demonstrate that they can address each of the contaminant types to acceptable levels for frequent events up to approximately the 1 in 1 year return period event, for inflow concentrations relevant to the contributing drainage area.			

5.20 The Hazard Index and the proposed mitigation methods are shown in the table below:

SuDS Component	TSS	Metals	Hydrocarbons
Detention basin	0.5	0.5	0.6
Filter Strip	0.4	0.4	0.5
Filter Drain	0.4	0.4	0.4
Mitigation totals	1.3	1.3	1.5
Hazard Index Total	0.7	0.6	0.45



Filter Strip Schematic (SuDS Manual)

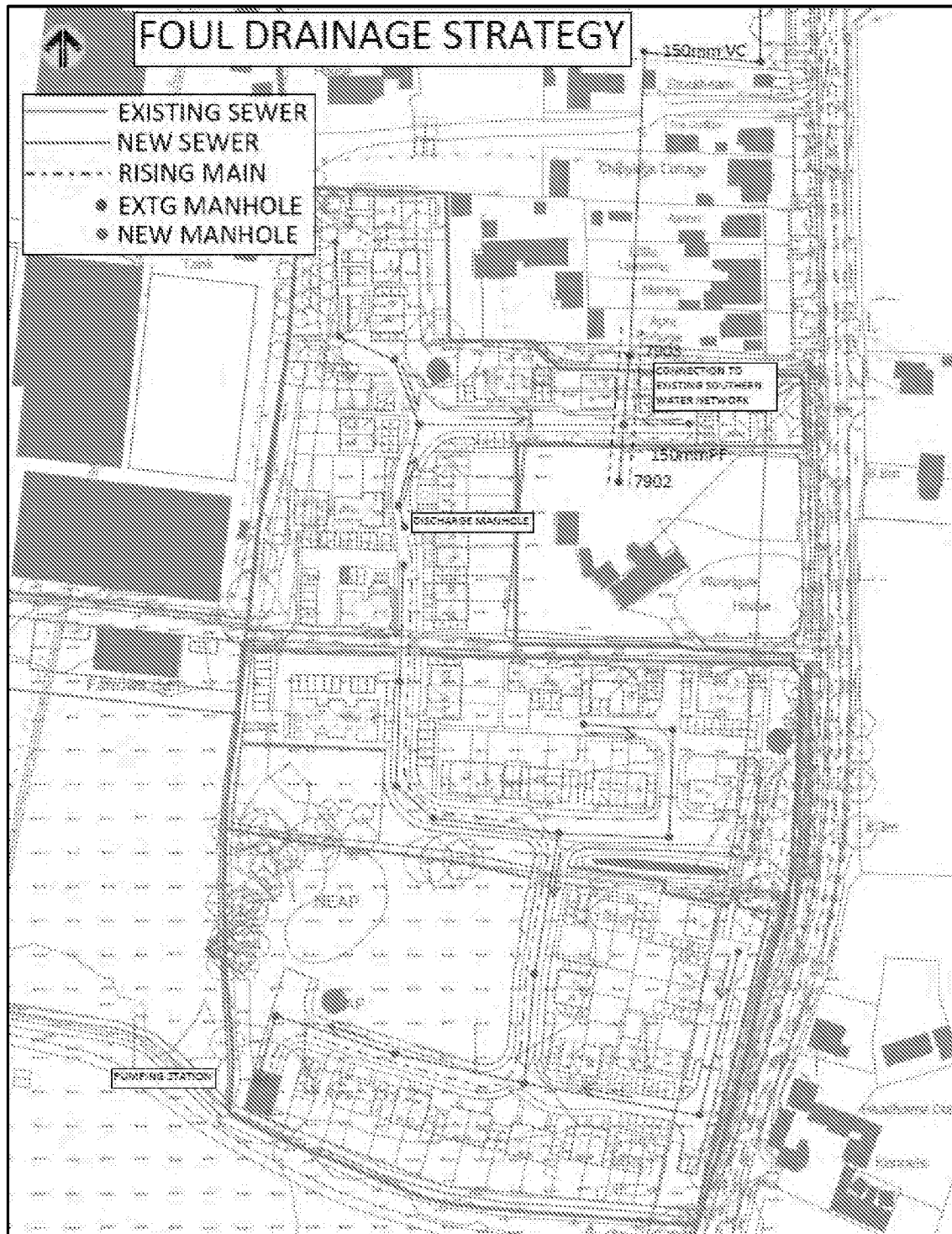


Filter Drain Schematic (SuDS Manual)

- 5.21 Therefore, the proposed Drainage Strategy including SuDS components consisting of filter strips and filter drains for the road drainage and piped drainage for roof and plot drainage all routed through a detention basin will achieve the required level of water quality improvement. These should be incorporated at detailed design stage, by way of discharge of suitable planning conditions.

6.0 FOUL WATER DRAINAGE STRATEGY

6.1 A copy of the local sewers records is shown in Appendix 5.



FOUL WATER DRAINAGE STRATEGY (see Appendix 6)

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6.2 It is proposed that the site will drain to the existing foul main sewer network that serves Woodgate House.

- 6.3 Gravity sewers will serve part of the site in close proximity to the existing sewer network.
- 6.4 The remainder of the site will drain to a pumping station that will discharge pumped flow back into the onsite gravity sewers. The illustrative Masterplan that supports the application incorporates land for a pumping station.
- 6.5 At 3xDWF the pumping station will have a design inflow of approximately 2.2l/s.
- 6.6 A pre-development enquiry has been made to Southern Water who are the sewerage undertaker for the area. Southern water has indicated that there is not currently sufficient capacity in the existing network but they will increase capacity for any consented scheme within two years. **(See Appendix 8)**
- 6.7 A Developer has a right to connect to the existing sewerage system that crosses the site. Any offsite network reinforcement that may be required is the responsibility of the sewerage undertaker and is funded by revenue collected from Infrastructure Charges.

7.0 SUMMARY AND CONCLUSIONS

- 7.1 FortRidge Consulting Limited was commissioned by Hanbury Properties, to prepare a Flood Risk Assessment and Drainage Statement in support of an outline planning application for the erection of new dwellings with associated access and infrastructure on land adjacent to Woodgate House
- 7.2 This Report presents an assessment of flood risk in accordance with the guidelines set out in the NPPF and the supporting PPG, as well as the policies of ADC and the EA. It also provides a statement of the means of foul and surface water drainage.
- 7.3 The Report confirms that the Site is suitable for the development proposals and complies with planning policies.
- 7.4 The EA (Gov.uk) Maps indicate that the Site is at a low risk of fluvial flooding, and a low risk of surface and reservoir water flooding.
- 7.5 The Arun DC SFRA map documents show the area to be at high risk from groundwater flooding ($\geq 75\%$). There is no historical record of groundwater flooding in Woodgate. The area is located on the edge of the identified groundwater emergence zone.
- 7.6 The SFRA indicates that there have been no historical surface water flood events at, or in proximity of the Site.
- 7.7 The Report demonstrates that the proposed development will remain at a low risk of flooding due to the nature of the site.
- 7.8 To mitigate against the effects of increased runoff SuDS attenuation drainage will be provided limiting flows to Q_{bar} .

Conclusion

- 7.9 In summary, the proposed development is located in an area at low risk of flooding and mitigation measures have been recommended in order to ensure that the site does not increase the risk of flooding elsewhere.
- 7.10 It is concluded that the proposed development complies with ADC, EA, and NPPF policies and guidance.
- 7.11 The proposed development will connect to the existing foul sewer crossing the site.

Figure 1

Location Plan

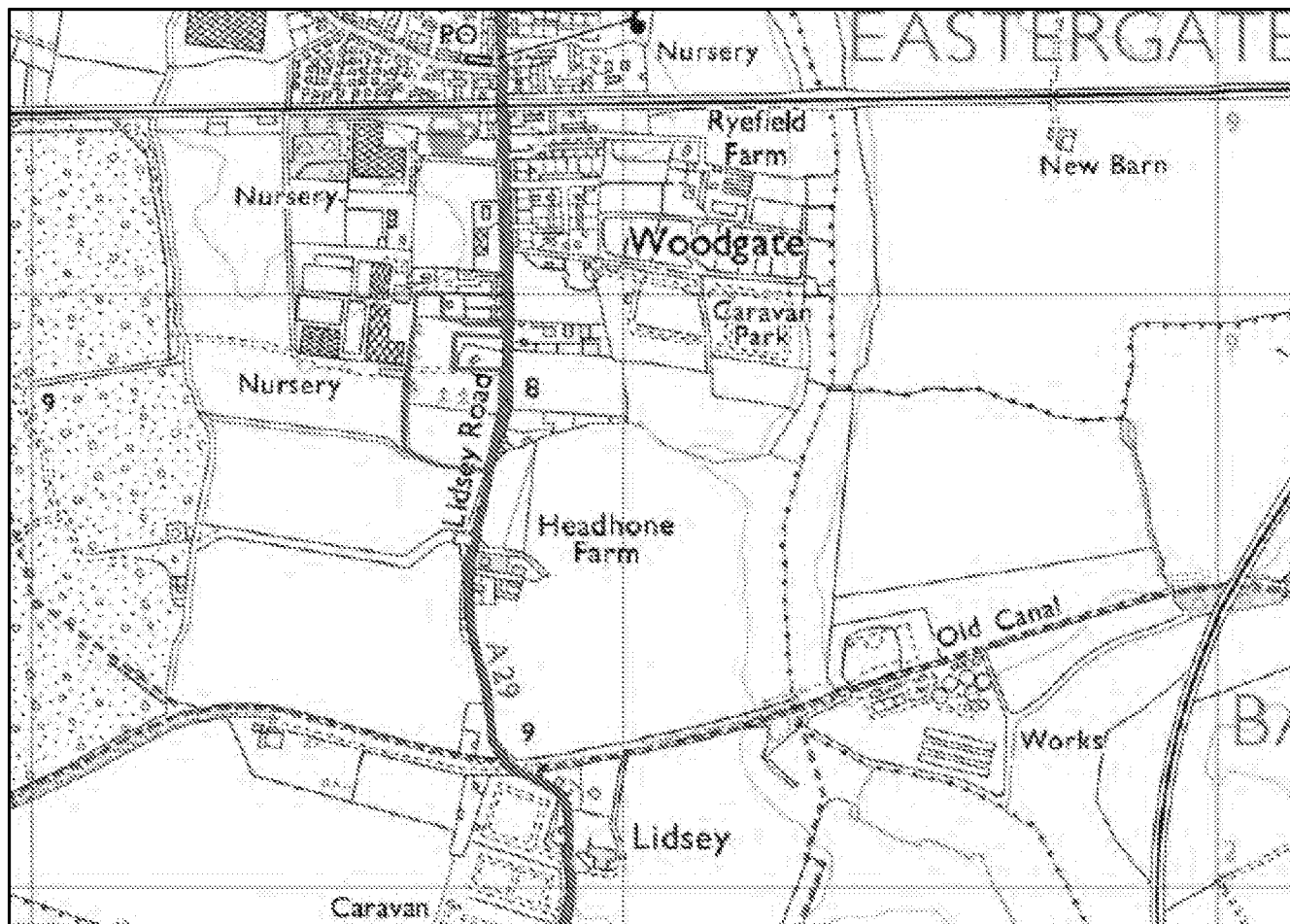


FIGURE 1: LOCATION PLAN

OS X (Eastings) 493694

OS Y (Northings) 103881.

Nearest Post Code : PO20 3SU

Figure 2
BGS Geology Map

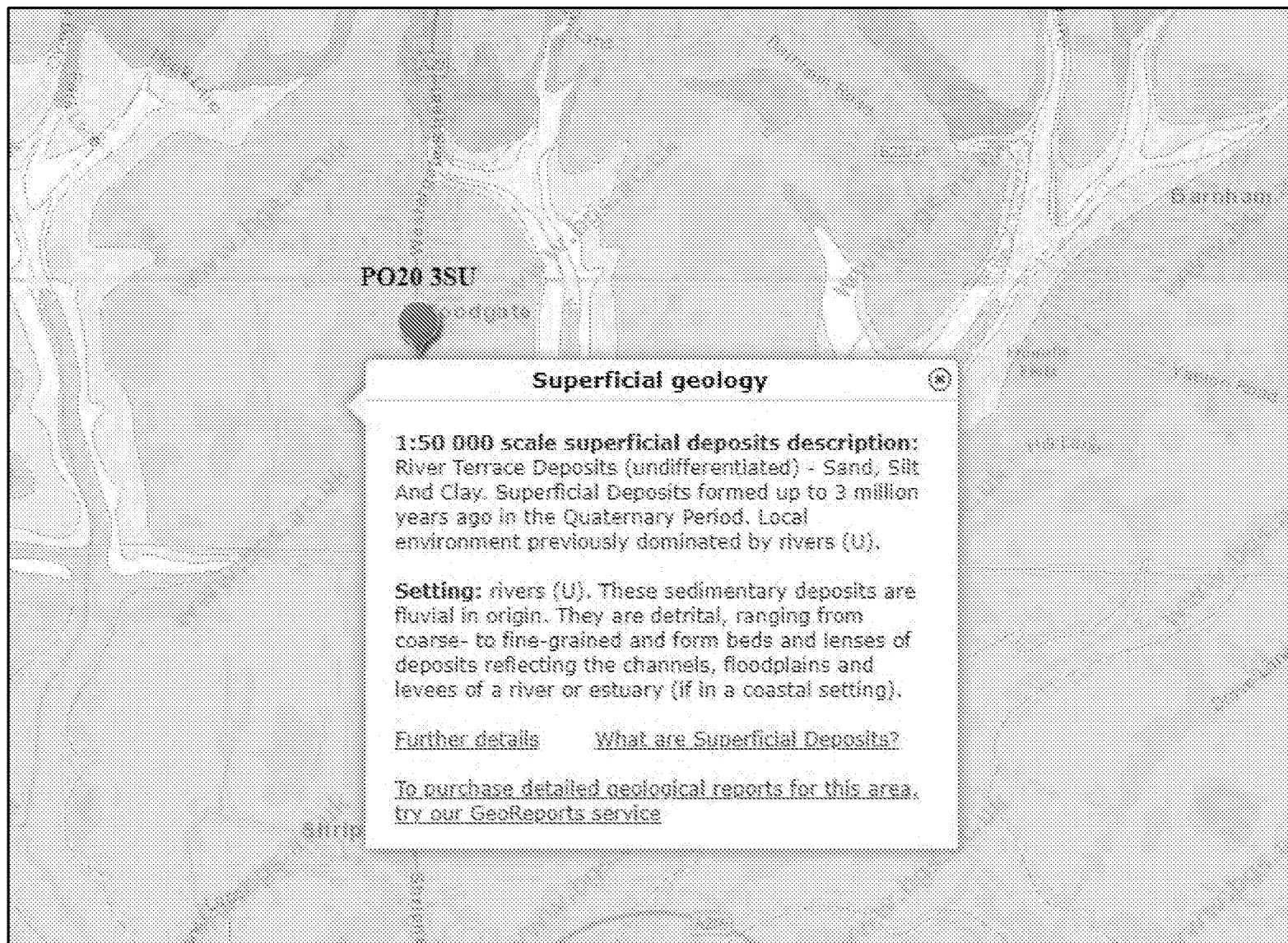


FIGURE 2.1: BGS Geology map - Superficial

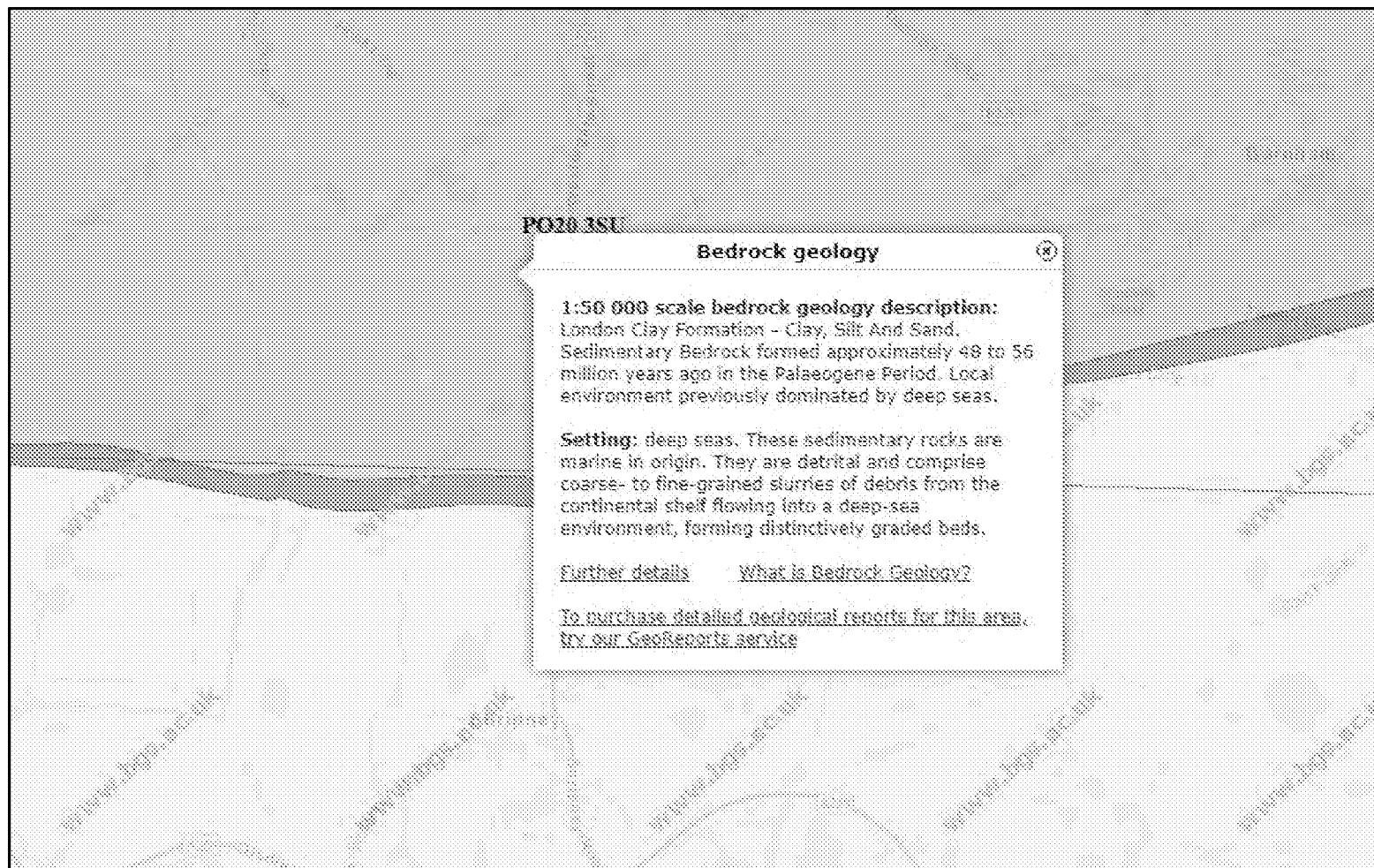


FIGURE 2.2: BGS Geology map – Bedrock

Figure 3
EA Bedrock Map

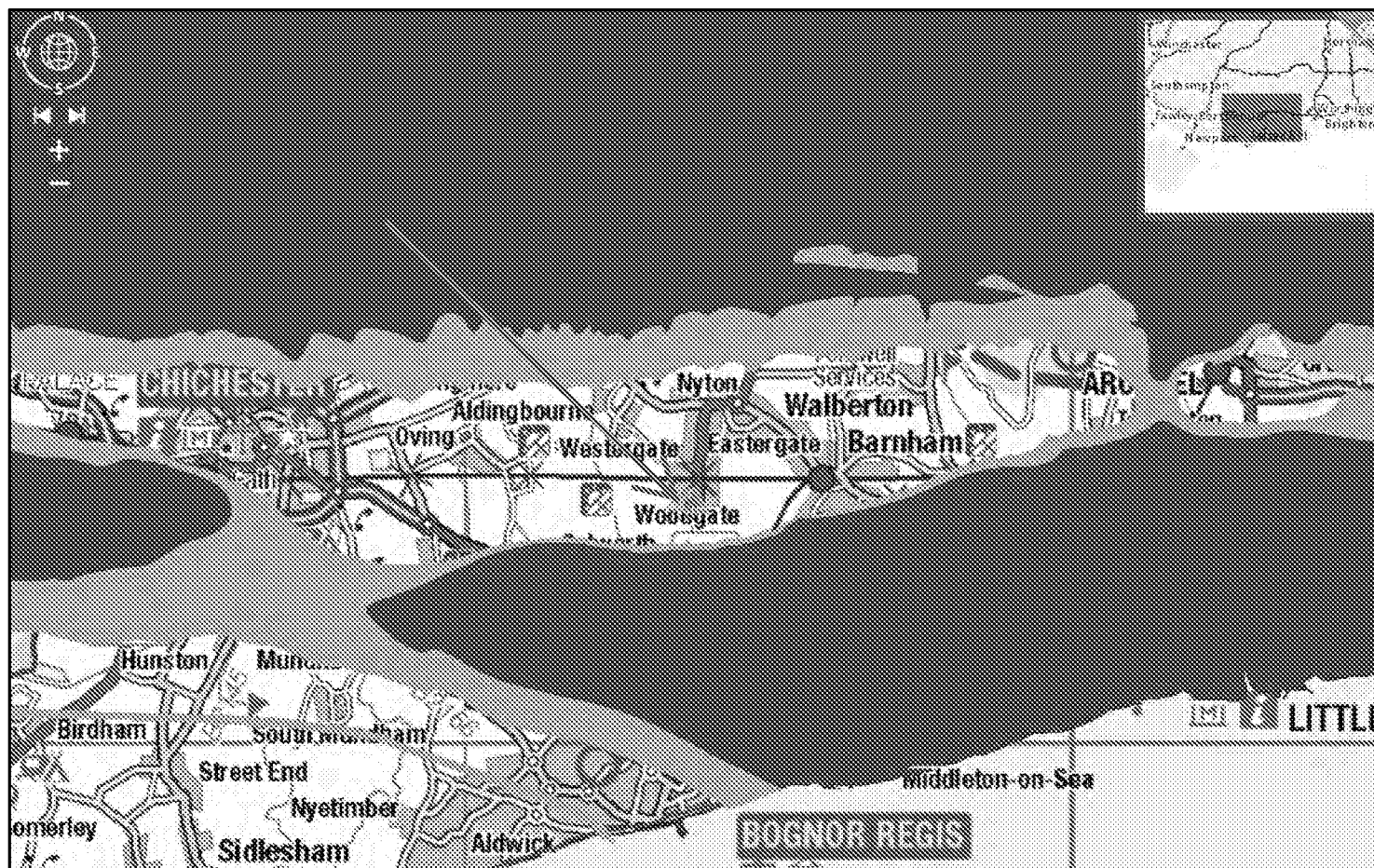


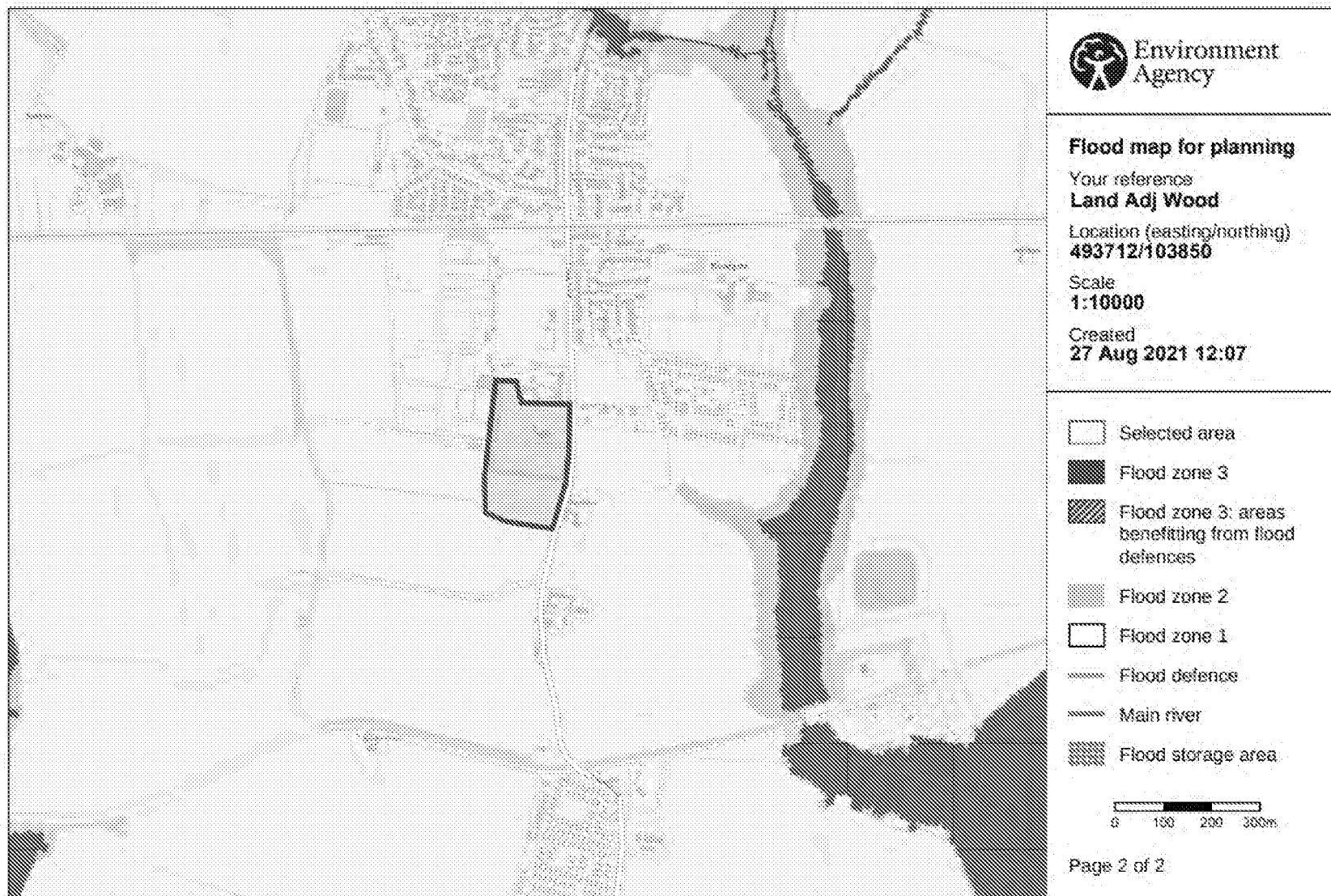
FIGURE 3: EA Bedrock Map

Figure 4
Soilscales Map



FIGURE 4: Soils Map (Magic Maps)

Figure 5
EA Flood Map



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FIGURE 5: GOVERNMENT FLOOD MAP FOR PLANNING-FLOOD ZONE 1

Figure 6
EA Surface Water Flood Map

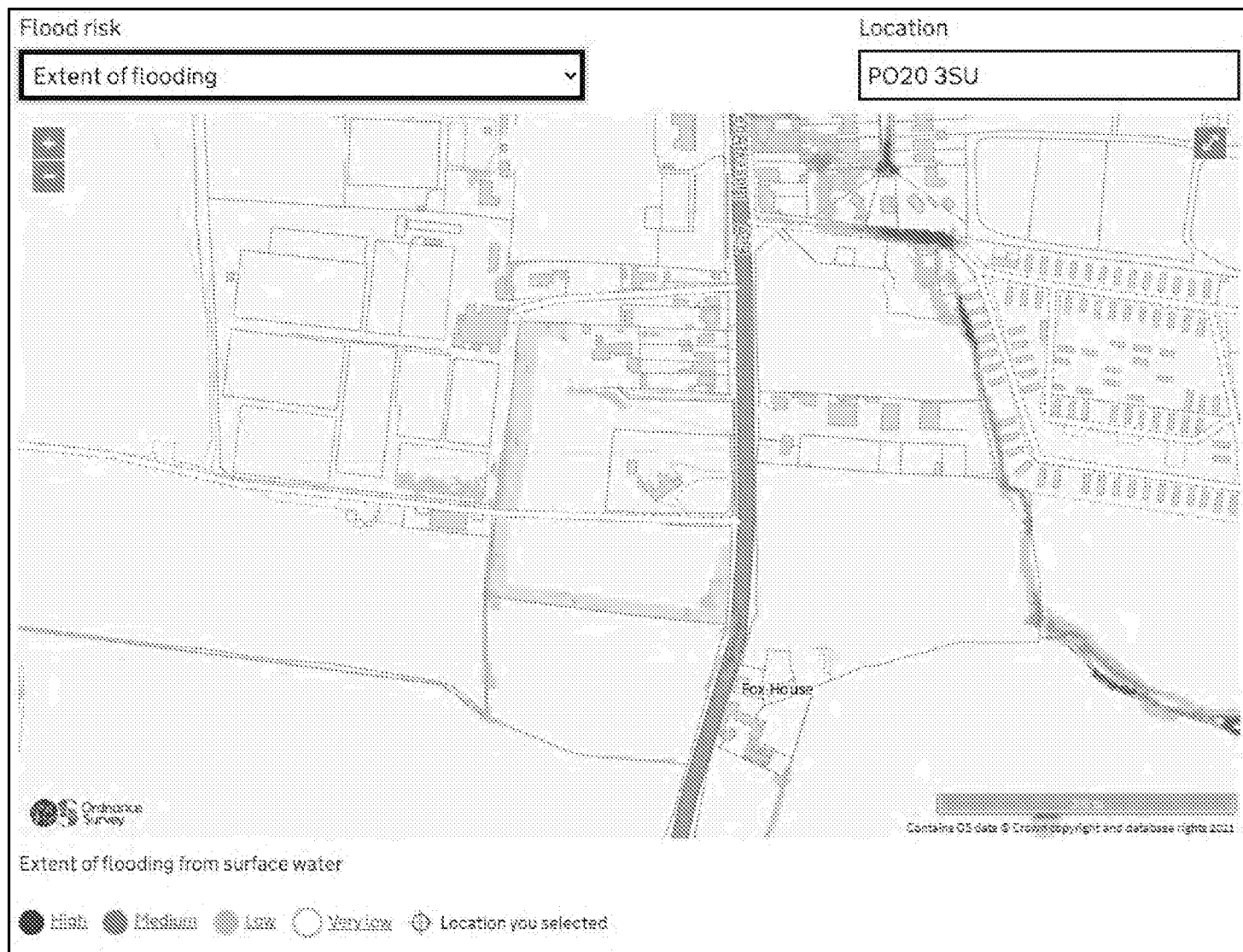


FIGURE 6: GOVERNMENT SURFACE WATER FLOOD MAP - VERY LOW RISK

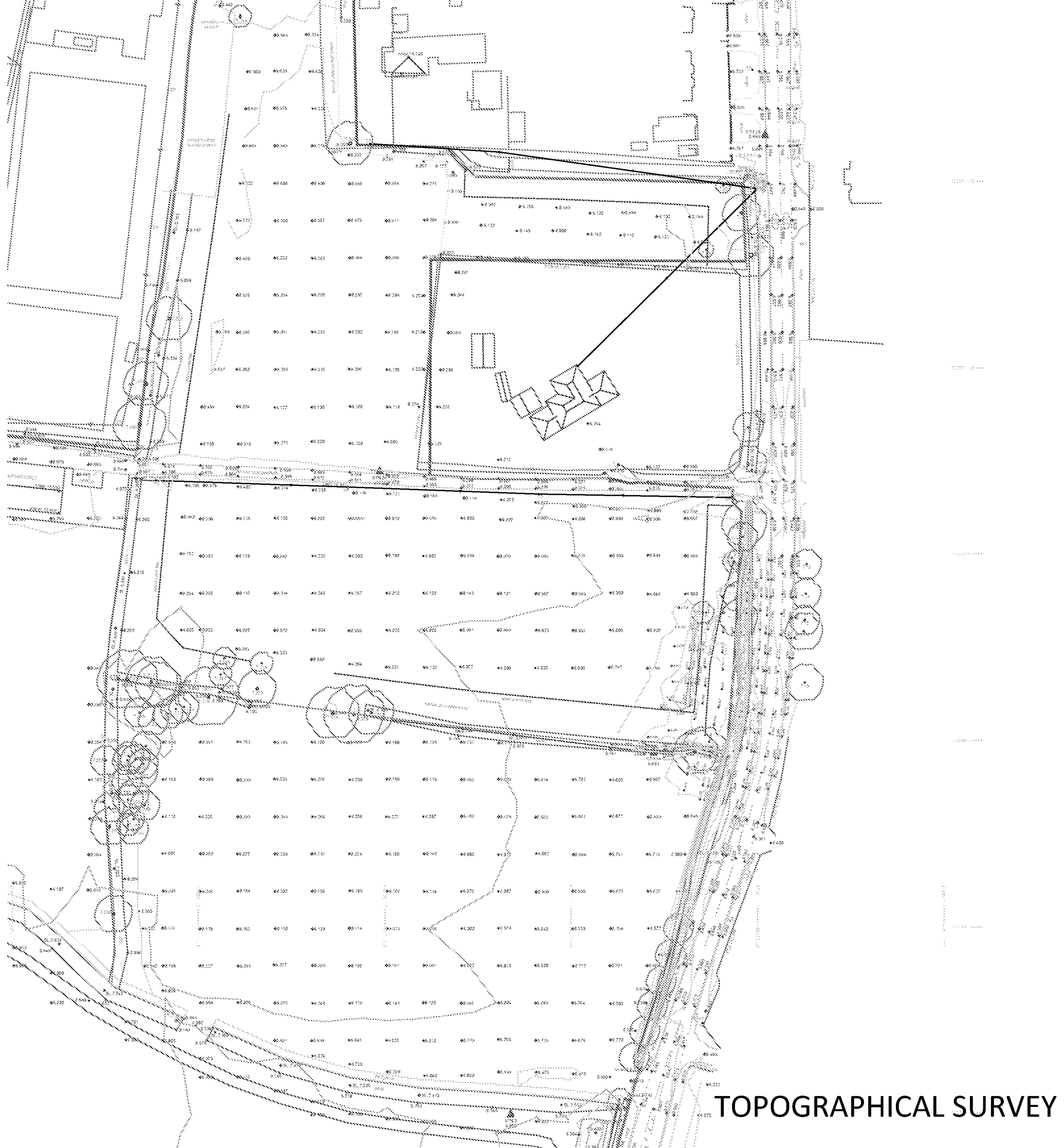
Figure 7
EA Reservoir Flood Map



FIGURE 7: GOVERNMENT RESERVOIR FLOOD MAP-NONE

Appendix 1

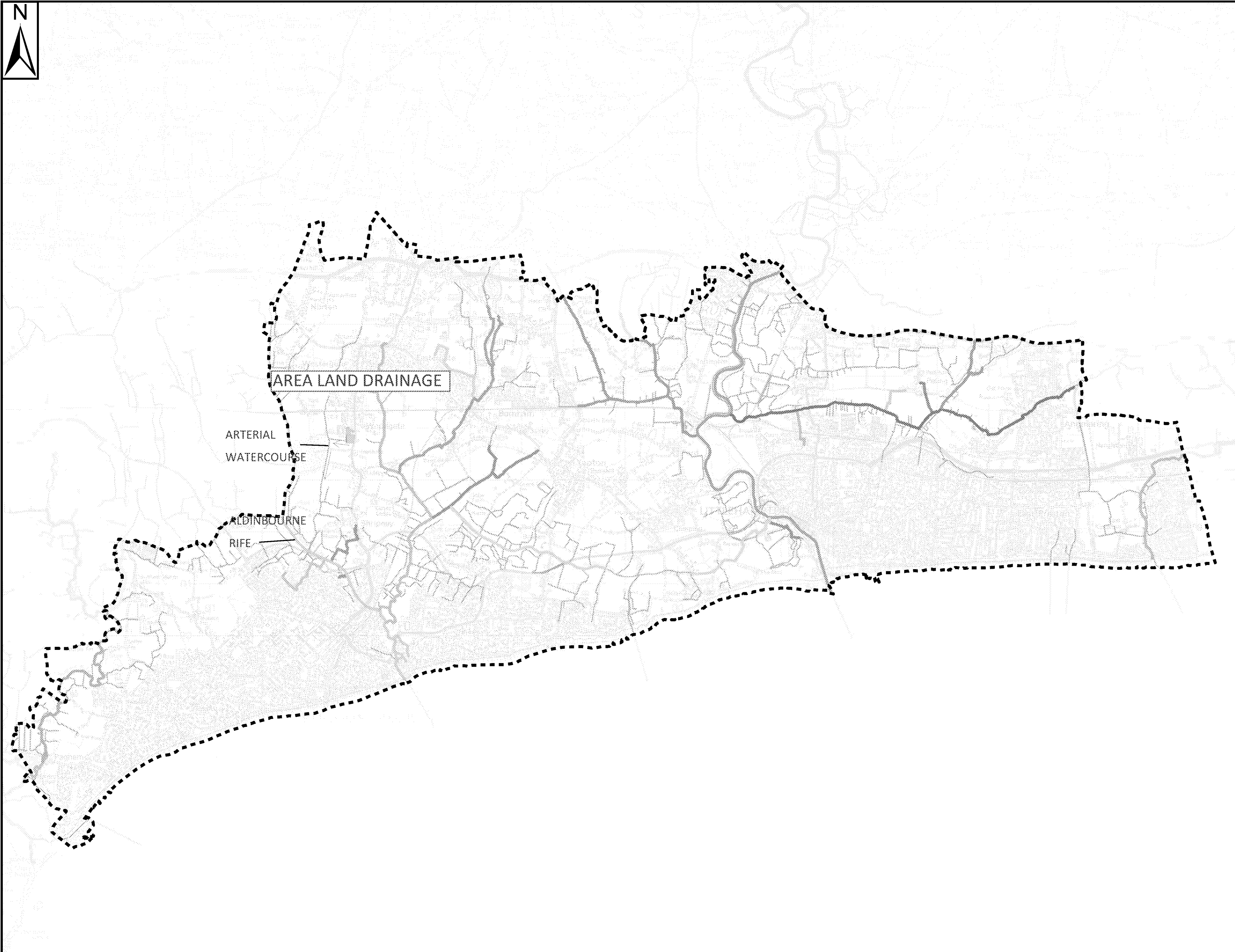
Topographical Survey



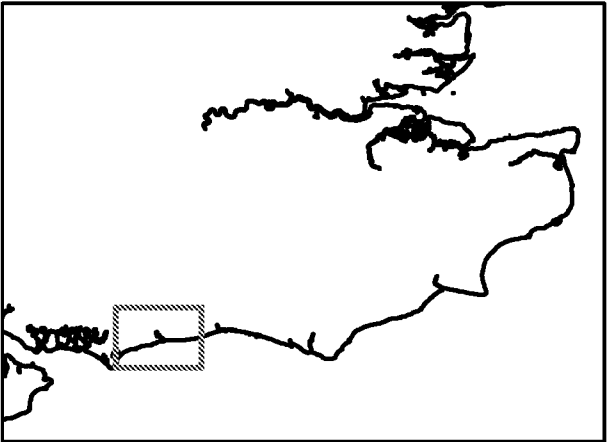
TOPOGRAPHICAL SURVEY

Appendix 2

SFRA Mapping



Key Plan



Legend

- Arun District SFRA boundary
- Main Rivers**
- Aidingbourne Rife
 - Ash Grove
 - Bamham Lane Ditch
 - Bamham Rife
 - Black Ditch
 - Decoy Ponds Ditch
 - East Poling Drain
 - Eel Springs Ditch
 - Ferring Rife
 - Forebridge Rife
 - Lidsey Rife
 - Little Tortington Stream
 - North Bersted Ditch
 - Pagham Harbour Channels
 - Pagham Rife
 - River Arun
 - Rope Walk Ditch
 - Ryebank Rife
 - Shripney Manor Ditch
 - West Poling Drain
 - Yapton Rife
 - Ordinary watercourse

REF	Date	Comments
A	June 2016	-

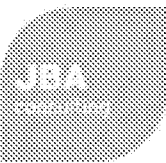


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ARUN DISTRICT COUNCIL

SFRA: APPENDIX B
WATERCOURSES

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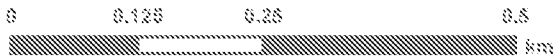


Key Plan



Legend

- Arun District SFPA boundary
- Main Rivers:**
- Aidingbourne Rife
 - Ash Grove
 - Barnham Lane Ditch
 - Barnham Rife
 - Black Ditch
 - Deasy Ponds Ditch
 - East Poling Oram
 - Elst Springs Ditch
 - Ferring Rife
 - Forebridge Rife
 - Lidsey Rife
 - Little Turlington Stream
 - North Basset Ditch
 - Pegham Harbour Channels
 - Pegham Rife
 - River Arun
 - Rope Walk Ditch
 - Ryebank Rife
 - Shrotony Manor Ditch
 - West Poling Oram
 - Wypton Rife
 - Ordinary watercourse



REF	Date	Comments
A	June 2016	
B		
C		

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ARUN DISTRICT COUNCIL

LEVEL 1 SFRA: APPENDIX B
WATERCOURSES

Sheet No. 31 of 48 Index Number: AGC_31

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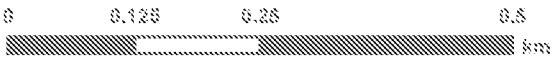


Key Plan



Legend

- Arun District SFPA boundary
- Main Rivers:**
- Aidingbourne Rife
 - Ash Grove
 - Barnham Lane Ditch
 - Barnham Rife
 - Bosc Ditch
 - Deasy Ponds Ditch
 - East Poling Grom
 - Elst Springs Ditch
 - Ferring Rife
 - Forebridge Rife
 - Lidsey Rife
 - Little Turlington Stream
 - North Bosc Ditch
 - Pegham Harbour Channels
 - Pegham Rife
 - River Arun
 - Rope Walk Ditch
 - Ryebank Rife
 - Shripney Manor Ditch
 - West Poling Grom
 - Ypton Rife
 - Ordinary watercourse



REF	Date	Comments
A	June 2016	
B		
C		

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LEVEL 1 SFRA: APPENDIX B WATERCOURSES

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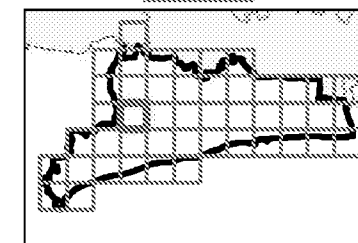
Notes

The Areas Susceptible to Groundwater Flooding (ASGWFF) is a strategic scale map showing groundwater flood areas on a 1km square grid. The data was produced to facilitate iterative Flood Risk Areas for Preliminary Flood Risk Assessment (PFRA) studies and allow the Local Flood Authority (LFA) to determine whether there may be a risk of flooding from groundwater.

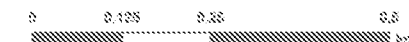
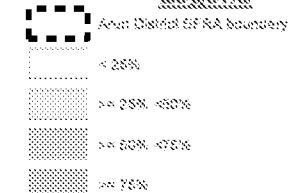
This data shows the proportion of each 1km grid square where geological and hydrogeological conditions show that groundwater might emerge. It does not show the likelihood of groundwater flooding occurring. It does not take account of the chance of flooding from groundwater recharge. This dataset covers a large area of land, and only isolated localities within the overall susceptible area are actually likely to suffer the consequences of groundwater flooding.

The ASGWFF data should be used only in combination with other information, for example local data or historic data. It should not be used as sole evidence for any specific flood risk management, land use planning or other decisions at any scale. However, the data can help to identify areas for assessment at a local scale where finer resolution datasets exist.

Key Plan



Legend



REF	Date	Comments
A	June 2018	-
B		
C		

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ARUN DISTRICT COUNCIL LEVEL 1 SFRA: APPENDIX F AREAS SUSCEPTIBLE TO GROUNDWATER

Sheet No: 21 of 48

Index Number: AOC_21

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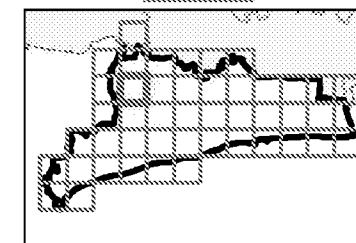
Notes

The Areas Susceptible to Groundwater Flooding (ASGWFF) is a strategic scale map showing groundwater flood areas on a 1km square grid. The data was produced to provide indicative Flood Risk Areas for Preliminary Flood Risk Assessment (PFRA) studies and allow the Local Flood Authority (LFA) to determine whether there may be a risk of flooding from groundwater.

This data shows the proportion of each 1km grid square where geological and hydrogeological conditions show that groundwater might emerge. It does not show the likelihood of groundwater flooding occurring. It does not take account of the chance of flooding from groundwater recharge. This dataset covers a large area of land, and only isolated localities within the overall susceptible area are actually likely to suffer the consequences of groundwater flooding.

The ASGWFF data should be used only in combination with other information, for example local data or historic data. It should not be used as sole evidence for any specific flood risk management, land use planning or other decisions at any scale. However, the data can help to identify areas for assessment at a local scale where finer resolution datasets exist.

Key Plan



Legend

Arun District FRA boundary

< 25%

>= 25% < 50%

>= 50% < 75%

>= 75%

0 0.125 0.25 0.5 km

REF	Date	Comments
A	June 2018	-
B		
C		

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ARUN DISTRICT COUNCIL LEVEL 1 SFRA: APPENDIX F AREAS SUSCEPTIBLE TO GROUNDWATER

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Index Number: ADC_31

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Appendix 3

Proposed Development



REPORT REFERENCE: DLA 2052 L 28 S07

Appendix 4

Storage Calculations

Calculated by:

Site name:

Site location:

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.

Site Details

Latitude:

Longitude:

Reference:

Date:

Runoff estimation approach

Site characteristics

Total site area (ha):

Methodology

Q_{BAR} estimation method:

SPR estimation method:

Soil characteristics

	Default	Edited
SOIL type:	2	2
HOST class:	N/A	N/A
SPR/SPRHOST:	0.3	0.3

Hydrological characteristics

	Default	Edited
SAAR (mm):	739	739
Hydrological region:	7	7
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Growth curve factor 200 years:	3.74	3.74

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.

(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.

(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):	3.5	3.5
1 in 1 year (l/s):	2.97	2.97
1 in 30 years (l/s):	8.04	8.04
1 in 100 year (l/s):	11.15	11.15
1 in 200 years (l/s):	13.07	13.07

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.

Fortridge Consulting Ltd							Page 1
Stone House Business Centre Market Place Chipping Norton, OX7 5NH			Designed by Alistair Checked by				
Date 10/09/2021 10:48 File Woodgate 30yr+40% SRCX							
Innovyze			Source Control 2020.1				
<u>Summary of Results for 30 year Return Period (+40%)</u>							
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max √ Outflow (l/s)	Max Volume (mE)	Status
15 min Summer	7.878	0.178	3.6	0.0	3.6	320.0	O K
30 min Summer	7.936	0.236	3.6	0.0	3.6	424.7	O K
60 min Summer	7.999	0.299	3.6	0.0	3.6	538.1	O K
120 min Summer	8.066	0.366	3.6	0.0	3.6	658.2	O K
180 min Summer	8.105	0.405	3.6	0.0	3.6	729.1	O K
240 min Summer	8.132	0.432	3.6	0.0	3.6	777.9	O K
360 min Summer	8.170	0.470	3.6	0.0	3.6	845.8	O K
480 min Summer	8.196	0.496	3.6	0.0	3.6	893.2	O K
600 min Summer	8.216	0.516	3.6	0.0	3.6	928.2	O K
720 min Summer	8.231	0.531	3.6	0.0	3.6	954.9	O K
960 min Summer	8.251	0.551	3.6	0.0	3.6	991.8	O K
1440 min Summer	8.270	0.570	3.6	0.0	3.6	1025.3	O K
2160 min Summer	8.270	0.570	3.6	0.0	3.6	1026.3	O K
2880 min Summer	8.255	0.555	3.6	0.0	3.6	999.6	O K
4320 min Summer	8.222	0.522	3.6	0.0	3.6	940.3	O K
5760 min Summer	8.194	0.494	3.6	0.0	3.6	889.1	O K
7200 min Summer	8.168	0.468	3.6	0.0	3.6	842.5	O K
8640 min Summer	8.143	0.443	3.6	0.0	3.6	798.2	O K
10080 min Summer	8.119	0.419	3.6	0.0	3.6	754.8	O K
15 min Winter	7.899	0.199	3.6	0.0	3.6	358.9	O K
30 min Winter	7.965	0.265	3.6	0.0	3.6	476.9	O K
Storm Event	Rain (mm/hr)	Flooded Volume (mE)	Discharge Volume (mE)	Overflow Volume (mE)	Time-Peak (mins)		
15 min Summer	96.371	0.0	297.2	0.0	27		
30 min Summer	64.160	0.0	306.5	0.0	41		
60 min Summer	40.933	0.0	551.6	0.0	72		
120 min Summer	25.357	0.0	608.8	0.0	130		
180 min Summer	18.948	0.0	609.7	0.0	190		
240 min Summer	15.333	0.0	606.9	0.0	250		
360 min Summer	11.348	0.0	598.6	0.0	370		
480 min Summer	9.161	0.0	589.2	0.0	488		
600 min Summer	7.755	0.0	579.9	0.0	608		
720 min Summer	6.765	0.0	571.1	0.0	728		
960 min Summer	5.449	0.0	557.3	0.0	966		
1440 min Summer	4.013	0.0	542.6	0.0	1446		
2160 min Summer	2.951	0.0	1133.2	0.0	2164		
2880 min Summer	2.370	0.0	1112.6	0.0	2800		
4320 min Summer	1.739	0.0	1064.9	0.0	3460		
5760 min Summer	1.394	0.0	1805.8	0.0	4152		
7200 min Summer	1.175	0.0	1902.3	0.0	4904		
8640 min Summer	1.021	0.0	1985.2	0.0	5712		
10080 min Summer	0.908	0.0	1999.4	0.0	6472		
15 min Winter	96.371	0.0	301.7	0.0	27		
30 min Winter	64.160	0.0	308.3	0.0	41		
ø1982- 2020 Innovyze							

Fortridge Consulting Ltd							Page 2
Stone House Business Centre Market Place Chipping Norton, OX7 5NH			Designed by Alistair Checked by				
Date 10/09/2021 10:48 File Woodgate 30yr+40% SRCX							
Innovyze			Source Control 2020.1				
<u>Summary of Results for 30 year Return Period (+40%)</u>							
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max √ Outflow (l/s)	Max Volume (mE)	Status
60 min Winter	8.036	0.336	3.6	0.0	3.6	604.8	O K
120 min Winter	8.112	0.412	3.6	0.0	3.6	741.0	O K
180 min Winter	8.157	0.457	3.6	0.0	3.6	822.3	O K
240 min Winter	8.188	0.488	3.6	0.0	3.6	878.9	O K
360 min Winter	8.233	0.533	3.6	0.0	3.6	959.0	O K
480 min Winter	8.264	0.564	3.6	0.0	3.6	1015.7	O K
600 min Winter	8.288	0.588	3.6	0.0	3.6	1057.7	O K
720 min Winter	8.306	0.606	3.6	0.0	3.6	1089.9	O K
960 min Winter	8.331	0.631	3.6	0.0	3.6	1135.6	O K
1440 min Winter	8.357	0.657	3.6	0.0	3.6	1183.4	O K
2160 min Winter	8.367	0.667	3.6	0.0	3.6	1201.0	O K
2880 min Winter	8.359	0.659	3.6	0.0	3.6	1187.0	O K
4320 min Winter	8.322	0.622	3.6	0.0	3.6	1120.4	O K
5760 min Winter	8.286	0.586	3.6	0.0	3.6	1055.4	O K
7200 min Winter	8.252	0.552	3.6	0.0	3.6	993.9	O K
8640 min Winter	8.213	0.513	3.6	0.0	3.6	922.6	O K
10080 min Winter	8.172	0.472	3.6	0.0	3.6	849.1	O K
Storm Event	Rain (mm/hr)	Flooded Volume (mE)	Discharge Volume (mE)	Overflow Volume (mE)	Time-Peak (mins)		
60 min Winter	40.933	0.0	603.3	0.0	70		
120 min Winter	25.357	0.0	609.6	0.0	128		
180 min Winter	18.948	0.0	603.8	0.0	188		
240 min Winter	15.333	0.0	595.8	0.0	246		
360 min Winter	11.348	0.0	577.5	0.0	364		
480 min Winter	9.161	0.0	562.4	0.0	482		
600 min Winter	7.755	0.0	552.5	0.0	600		
720 min Winter	6.765	0.0	545.8	0.0	718		
960 min Winter	5.449	0.0	538.3	0.0	950		
1440 min Winter	4.013	0.0	536.8	0.0	1416		
2160 min Winter	2.951	0.0	1109.9	0.0	2160		
2880 min Winter	2.370	0.0	1091.9	0.0	2764		
4320 min Winter	1.739	0.0	1058.1	0.0	3980		
5760 min Winter	1.394	0.0	2023.7	0.0	4504		
7200 min Winter	1.175	0.0	2130.6	0.0	5472		
8640 min Winter	1.021	0.0	2100.9	0.0	6320		
10080 min Winter	0.908	0.0	2054.5	0.0	7168		
ø1982- 2020 Innovyze							

Fortridge Consulting Ltd		Page 3																																										
Stone House Business Centre Market Place Chipping Norton, OX7 5NH																																												
Date 10/09/2021 10:48 File Woodgate 30yr+40% SRCX	Designed by Alistair Checked by																																											
Innovyze		Source Control 2020.1																																										
<u>Rainfall Details</u> <table> <tr> <td>Rainfall Model</td> <td>FSR</td> <td>Winter Storms</td> <td>Yes</td> </tr> <tr> <td>Return Period (years)</td> <td>30</td> <td>Cv (Summer)</td> <td>0.750</td> </tr> <tr> <td>Region</td> <td>England and Wales</td> <td>Cv (Winter)</td> <td>0.840</td> </tr> <tr> <td>M5-60 (mm)</td> <td>19.000</td> <td>Shortest Storm (mins)</td> <td>15</td> </tr> <tr> <td>Ratio R</td> <td>0.350</td> <td>Longest Storm (mins)</td> <td>10080</td> </tr> <tr> <td>Summer Storms</td> <td>Yes</td> <td>Climate Change %</td> <td>+40</td> </tr> </table> <u>Time Area Diagram</u> Total Area (ha) 1.800 <table> <thead> <tr> <th>Time (mins)</th> <th>Area</th> <th>Time (mins)</th> <th>Area</th> <th>Time (mins)</th> <th>Area</th> </tr> <tr> <th>From</th> <th>To: (ha)</th> <th>From</th> <th>To: (ha)</th> <th>From</th> <th>To: (ha)</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>4 0.400</td> <td>4</td> <td>8 0.800</td> <td>8</td> <td>12 0.600</td> </tr> </tbody> </table>			Rainfall Model	FSR	Winter Storms	Yes	Return Period (years)	30	Cv (Summer)	0.750	Region	England and Wales	Cv (Winter)	0.840	M5-60 (mm)	19.000	Shortest Storm (mins)	15	Ratio R	0.350	Longest Storm (mins)	10080	Summer Storms	Yes	Climate Change %	+40	Time (mins)	Area	Time (mins)	Area	Time (mins)	Area	From	To: (ha)	From	To: (ha)	From	To: (ha)	0	4 0.400	4	8 0.800	8	12 0.600
Rainfall Model	FSR	Winter Storms	Yes																																									
Return Period (years)	30	Cv (Summer)	0.750																																									
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Ratio R	0.350	Longest Storm (mins)	10080																																									
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