Warborough & Shillingford Neighbourhood Plan 2025

Appendix 6.0 Flood Report

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EXECUTIVE SUMMARY

The small village of Warborough and Hamlet of Shillingford flood during and after heavy rain. This Policy supports the Neighbourhood Plan Flood Risk objective;

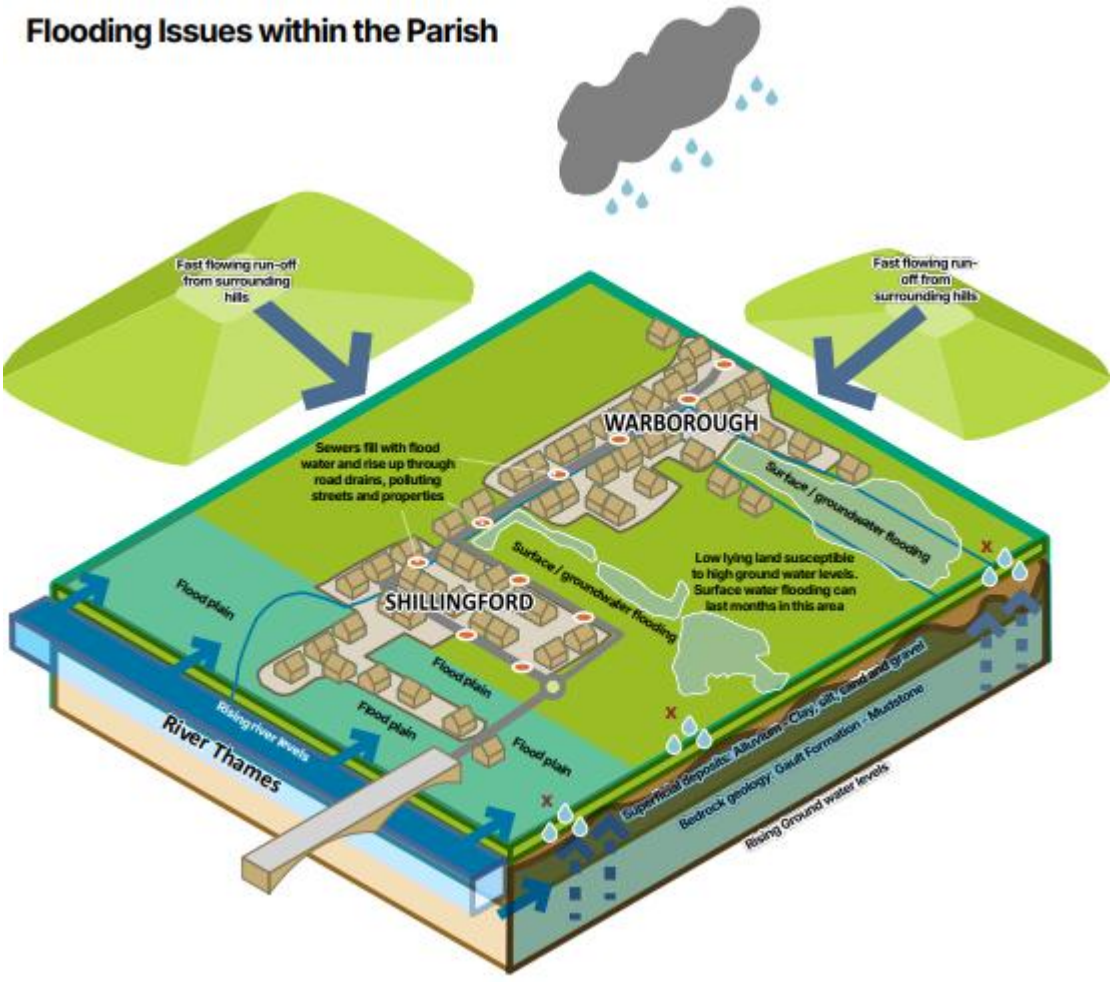
- To ensure relevant agencies work together to provide adequate surface water drainage and reliable sewerage works.
- To ensure new development does not cause new, or exacerbate existing, flooding, water, drainage, and sewage problems, and where possible mitigates existing problems.

This document describes the high flood risk environment of the Parish, being surrounded on all 4 sides by high risk flood categorisation and being subject to river (fluvial) flooding, surface (pluvial) flooding, ground water flooding and sewer flooding.

The evidence within this document will describe how Warborough and Shillingford flood and will show that the flooding experienced is explained, in part, by the Environment Agency river flooding mapping and surface water mapping. The evidence will also explain the two other types of flooding experienced, ground water flooding and sewer flooding. These four types of flooding interact with each other during periods of heavy, prolonged rainfall. The fields and large grass areas within the village attenuate the flood risk to the Parish, and in many cases heavily flood due to the combination of fluvial, surface and ground water flooding. In some cases this flooding is more extreme than the EA mapping for Fluvial and Surface Water.

The concern is that flooding is happening before the predictions made for climate change have occurred. The South Oxfordshire Local Plan Strategic Flood Risk Assessment 2019 (SFRA) quotes 'Climate change is predicted to result in more frequent and extreme rainfall events, increasing the frequency and severity (depth/hazard) of flooding from fluvial and surface water sources'.

The flood policy is a proactive policy to ensure that a future flood event does not cause severe flood damage to roads and property or risk the health and safety of residents within the Parish.



Introduction

Some of the flood risk within the parish can be explained, in part, by the Environment Agency maps which show that the parish is flanked on all 4 sides by High Risk Flood categorisation.

- On 3 sides by Fluvial (river) Flood Zone 3 (made up of the River Thame in the West, the River Thames in the south, and large agricultural drainage channels in the East. Figure 1) A flood risk triangle exists surrounding both communities shown in thick red lines. The southern sector of the triangle is characterised by Environment Agency Flood Zone 2 and 3. The flood risk is evidently increasing with greater impacts than previously experienced. (See Annex A for images of flooding).
- Warborough and Shillingford have a very high risk of Surface Water flooding (Figure 2) in the North and East. An added concern is that Warborough is dominated by a hill called Town Hill with a spot height of 71 metres above sea level which contributes to surface water flooding issues as it is made of gault clay which creates high surface water run off. The surface water risk also runs through the centre of the village because of the drainage ditches take large volumes of water to the Thames, areas closer to the Thames also have surface water flood risk.

In addition, the Parish has Ground Water Flood risk and this can be explained, in part, by the information presented within the Strategic Flood Risk Assessment for South Oxfordshire and Vale Of White Horse (September 2024) which shows the Parish at high risk for Ground Water flooding, see Figure 3.

Finally, these 3 types of flooding flood into the Sewer Network, causing the Sewer Network to become overloaded, and Sewage Flooding occurs.

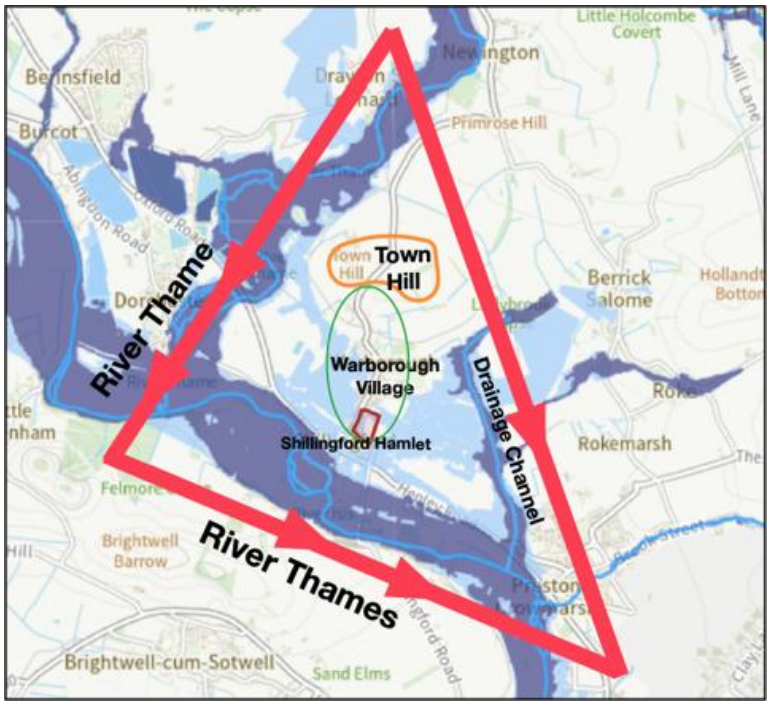


Figure 1 The Warborough & Shillingford Fluvial Flood Triangle based on Environment Agency Map

Surface Water Flooding and Geology

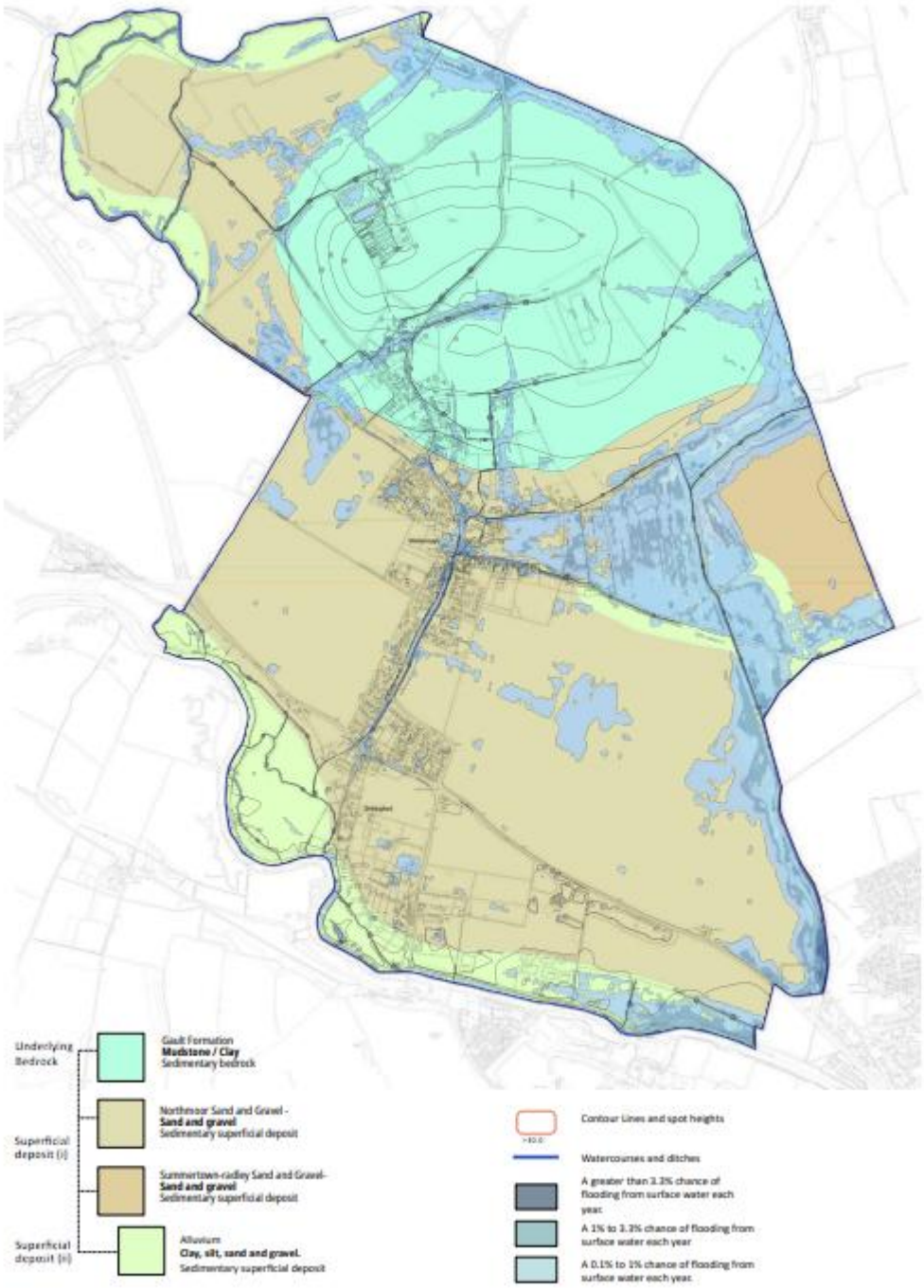


Figure 2 EA Surface Water Flooding map, plus geology

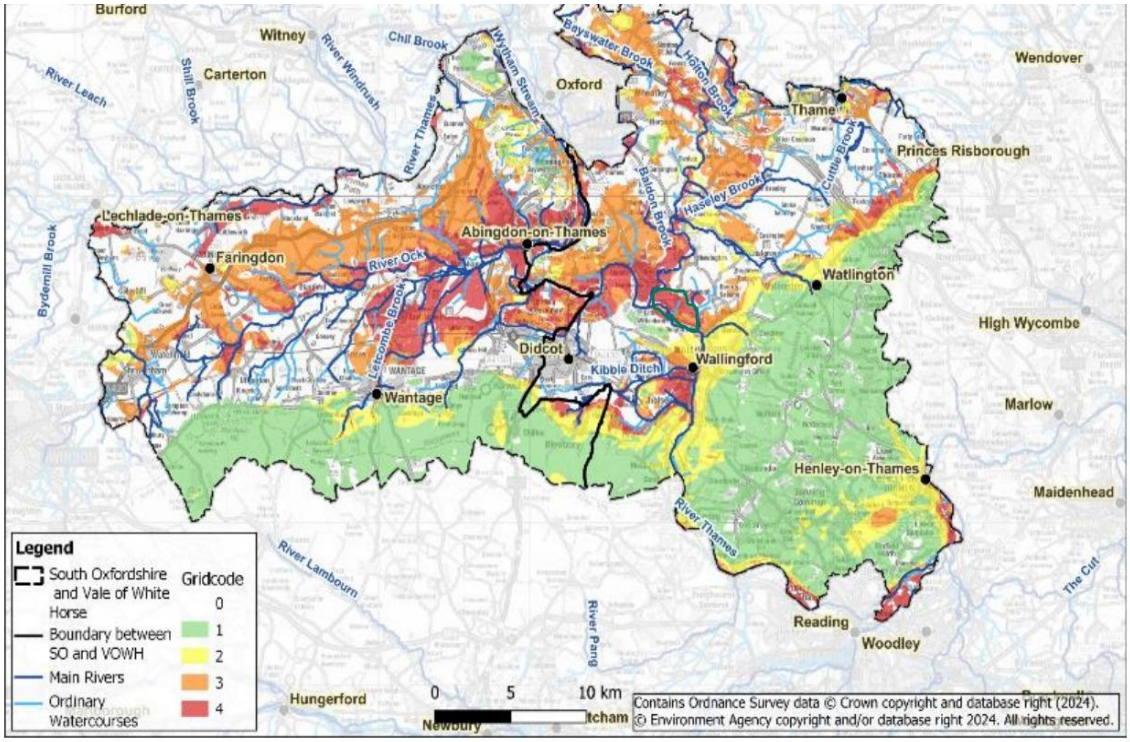


Figure 5-3: Risk of Groundwater emergence within South Oxfordshire and Vale of White Horse

Figure 3 : Ground Water Flood Risk, published within SFRA 2024 for South Oxfordshire and Vale Of White Horse, Copyright Environment Agency

LANDSCAPE CHARACTER AND FLUVIAL FLOOD RISK

The SODC Landscape character assessment defines Warborough and Shillingford as the River Thames Corridor (character area 4).

- Section 9.4.3 River Thames Corridor is exceptionally flat, with little perceptible variation in relief. The lowest areas of land located around the River Thame and the River Thames.
- 9.4.4. 'The floodplain is confined to a comparatively narrow strip where it is bounded by the harder rocks of the lower and upper greensand and chalk but widens considerably around the confluence of the Thames and Thame within the softer Gault Clay of the central vale.'



Figure 4 EA 2024 Natural Landform and Hydrology map in the SODC JLP Landscape Character Assessment 2024

The SODC JLP Landscape Character Assessment 2024 classifies this parish within the East Thames Lower Vale Figure 4.

GEOLOGY

The British Geological Survey (BGS) mapping indicates that ground conditions beneath the Parish are likely to comprise the Northmoor Sand and Gravel Member overlying the Gault Formation (comprising mudstone). The Environment Agency classifies the Northmoor Sand and Gravel Member as a Secondary A Aquifer. Secondary A Aquifers are formed of permeable layers capable of supporting water supplies at a local scale & in some cases forming an important source of base flow to rivers. The Gault Formation is classified as an Unproductive Stratum these are geological strata with low permeability that have negligible significance for water supply or river base flow. Shallow groundwater within the Northmoor Sand and Gravel Member is in hydraulic continuity with the river Thames, which adds to the understanding of why farm land 500m from the Thames floods and does not drain until after the Thames flooding has receded.

FLOODING

Warborough & Shillingford experience four types of flooding, these are, Fluvial (river), Surface Water (pluvial), Groundwater (aquifer) and Sewer. They interact with each other during periods of heavy, prolonged rainfall

Parish Catchment Area

The East side of Warborough is a massive flood plain of +100 hectares that is finely balanced by an agricultural drainage system that attenuates surface water run-off via field flooding and which partly drains into Warborough, running along drainage ditches parallel to the arterial A329 road.

The Parish drainage catchment area is twice the size of the Parish. (See Fig.5.). It is fed by Primrose Hill, Town Hill, Berwick Salome, Roke, Rokemarsh and Scald Hill. Apart from Town Hill, all sit outside the parish boundary. The fields in the east of Warborough attenuate this large volume of surface water runoff via field flooding in area A. Ground water flooding occurs in area B. The parish drains to the river Thames via drainage ditches at Shillingford and on the boundary with Preston Crowmarsh in the south. The water table may be in hydraulic continuity with the Thames in area B and was measured to be 1.5m bgl on the 'Plough Field' site in 2015. (See Annex A & D).

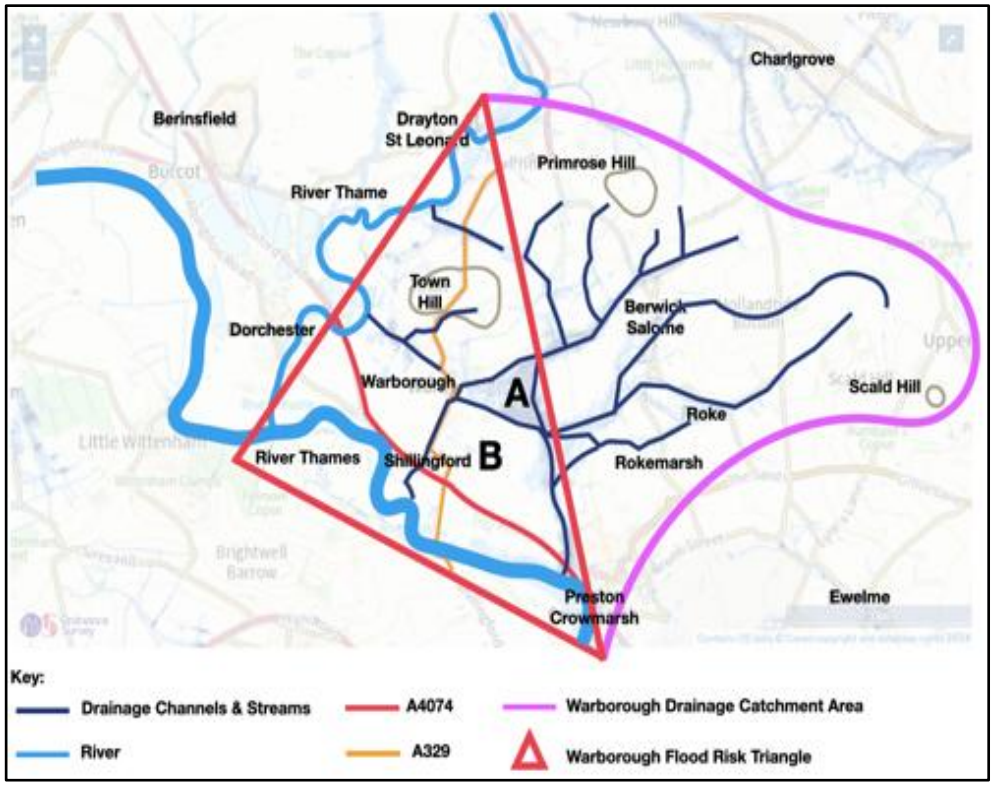


Fig. 5. Illustrated map of the estimated catchment area for rainfall run off in and beyond the Parish.

Fluvial, Surface Water & Groundwater Flooding in the Parish

The Schematic below in Fig. 6. uses the EA Flood Map overlayed with an illustrated schematic to show how the surface water runoff of Town Hill, Primrose Hill, Berwick Salome, Rokemarsh and Roke collects and attenuates via flooding in the east of Warborough, before draining to the river Thames at points C & D, and the river Thame at point F. Area A exhibits surface water flooding, (submerged fields) and Area B exhibits ground water flooding via the formation of large lakes that remain for weeks and months. Finally, Shillingford experiences fluvial flooding when the river Thames floods.

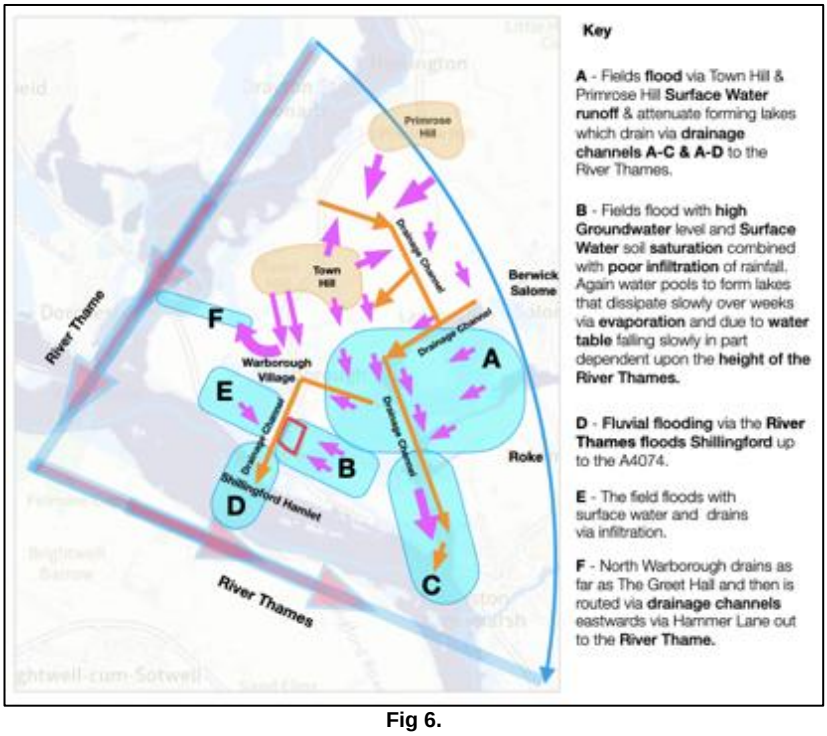
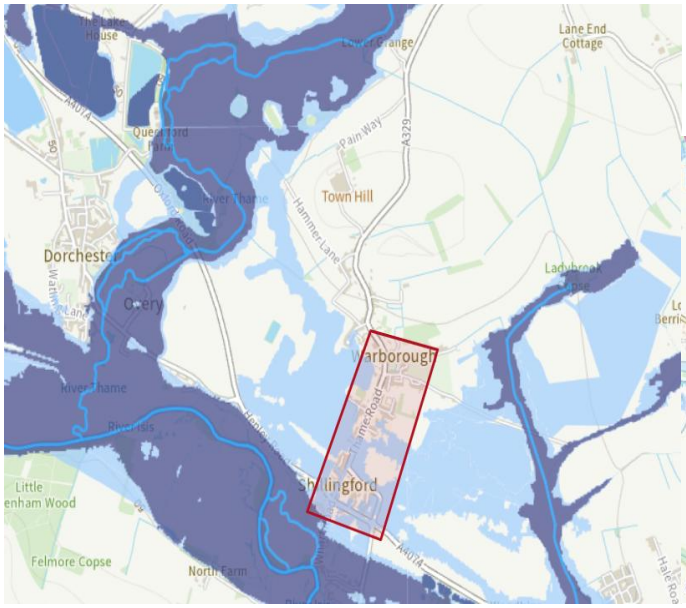
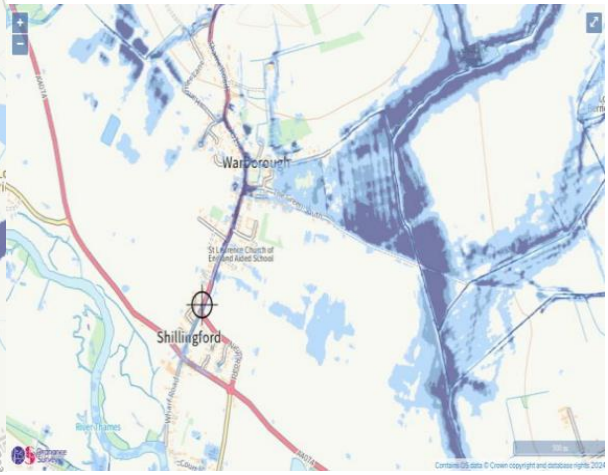


Fig 6.

The images below are the Environment Agency Maps for Fluvial flooding and Surface Water Flooding side by side (extracted Nov 2024). Many of the fields and green spaces in W&S are classified by the Environment Agency as flood risk (either fluvial or surface water). These fields attenuate flood risk to the Parish, which has roads and housing with flooding issues. The combined flood risk from both fluvial and surface mean the Parish is surrounded by high flood risk. Photographs shown in the appendices show that in some cases the flooding to these fields is worse than the combined mapping of fluvial and surface water.



Fluvial Flooding (Source Environment Agency Nov 2024)



Surface Water Flooding (Source Environment Agency)

Surface Water Flooding

The Surface Water flood risk for the Parish is mapped by the Environment Agency (see Figure 2, above).

The fields to the North and East become heavily flooded, and some turn into temporary lakes. The photographs in the appendix detail the flooding of these fields.
As described within this document the Parish experiences Fluvial, Surface and Groundwater flooding which increase the flooding severity and risk.

The surface water flood risk is heightened by the village ditch system which supports the flow of water through the Parish towards the river Thames. The ditch system runs at capacity during periods of heavy rainfall and floods onto adjacent roads when a flood event happens.
The ditch system is significantly narrower upstream in Warborough, and this area has a history of flooding, the flooding events in January/February 2024 have been photographed in this document. The ditch then widens along Thame Road and again gets significantly narrower and shallower as it gets closer to the Thames along Warborough Road, this area is subject to flooding. This then leads under the A4074 Henley Road onto Wharf Road which is flood zone 3 and regularly floods.
Given the ditch system already floods when a flood event happens, any additional water pushed into this ditch system by development of grassland / farm area which currently attenuates flood risk, will cause more severe flooding from the ditch system.

In the January 2024 flood event cars become stranded outside Greet Hall, and one person was rescued from a car.

Properties, driveways, gardens and roads within the Parish experience fluvial, surface water & ground water flooding and this was experienced during the 2024 flood events. The issues, risks and concerns of flooding were captured within a Parish Poll, and the results of this are published as a separate document and described in this document in the section 'Parish Feedback on Flood Risk'.

Ground Water Flooding

The September 2024 SFRA for South Oxfordshire and Vale Of White Horse explains that

- 'many areas of the Parish Groundwater levels are either at, or very near (within 0.025m of), the ground surface in the 100-year return period flood event. Within this zone there is a risk of groundwater flooding to both surface and subsurface assets. Groundwater may emerge at significant rates and has the capacity to flow overland and/or pond within any topographic low spots.'

Previous planning applications within the Parish, and the testing required for these, mean that knowledge has been obtained about the risk of Ground water flooding.

The Plough Field site has been borehole tested and infiltration rates have been recorded in 2015 by RPS who produced Welbeck Land's previous application for the same site in 2018. (Ref: P17/S4437/O SODC Portal – Flood Risk Assessment Part 2.)

Flooding from groundwater can happen when the level of water within the rock or soil underground – known as the water table – rises. When the water table rises and reaches ground level, water starts to seep through to the surface and flooding can happen. This means that water may rise up through floors or underground rooms such as cellars or basements. Groundwater flooding is much slower to occur than river flooding – it will usually happen days, weeks or even months after heavy or prolonged rainfall. And it may last weeks or even months.
Flooding from groundwater can happen in locations with sand and gravel such as in river valleys.

Permeability and Infiltration Test results – data from

It is noteworthy that comparative data with the Six Acres development site in 2018 demonstrated extremely poor infiltration rates for the site by up to 111% slower drainage, yet the sites are less than 300m apart. Also, trial depths of 3m could not be achieved on the site but were achieved on Six Acres. The borehole testing only achieved 42% of the required depth.



Fig. 7. Comparative sites in Warborough in 2018 showed via borehole testing, the poor permeability of Plough Field



Fig. 7a. P17/S4437/O Plough Field Infiltration bore holes (6 over 4.94ha)

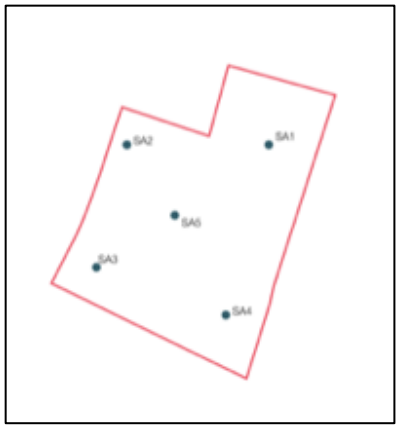


Fig. 7b. P17/S0241/FUL Six Acre Bore Holes (5 over 2.49ha)

Infiltration data taken from both Planning Applications in Fig 16.

Plough Field	Test Data	6 Acres	Best Data	Worst Data
TP1	1.58*10^-5	SA4a	6.8*10^-5	2.9*10^-5
TP2	2.23*10^-5	SA1b	8.2*10^-5	6.5*10^-5
TP6	5.56*10^-5	SA2	8.2*10^-5	9*10^-5
TP5	6.16*10^-5	SA5	8.9*10^-5	7*10^-5
TP3	7.88*10^-5	SA3	9.9*10^-5	5.2*10^-5
TP4 Best	1.14*10^-4	SA1a	1*10^-4	9*10^-5
N/A	N/A	SA4b	1.7*10^-4	1*10^-4
Average	**4.7*10^-5**	**Average**	**9.9*10^-5**	**7.1*10^-5**
% better filtration vs Plough Av	**0%**		**111%**	**51%**

Fig. 7c. Soakaway test results

Pits were unstable & collapsed.

Trial Pit Depths	Tgt 3 Metres
TP1 Actual	1.5
TP2 Actual	1.3
TP3 Actual	1.05
TP4 Actual	1.05
TP5 Actual	1.3
TP6 Actual	1.4
Total Depth	7.6
Av Depth	**1.27**
Target Depth	**18**
% of Tgt Depth	**42%**

Fig. 7e. Trial Pit depths

It is also noteworthy that the conditions reported by the borehole test team were that the soil was very unstable, that the target depth to test infiltration of 3m bgl could not be attained, and that the best depth of trial pit was 1.5m on one pit – the remaining 5 pits ranged from 1.4 m to 1.05m. We draw attention to the RPS conclusion below:

> ***Variances from BRE Digest 365 Soakaway Design (bgl – below ground level)***
>
> *The soakaway tests were proposed to comply fully with the methodology detailed within BRE Digest 365 Soakaway Design. However, due to the ground conditions encountered the proposed depth of the soakaway trial pits (3.00m bgl) could not be achieved due to unstable ground and a high-water table. In addition, due to the infiltration rates experienced, pit instability, access constraints and time restrictions it was not possible to carry out three infiltration tests per pit. A high-water table was recorded beneath the site with groundwater encountered at 1.50m bgl in the north of the site and 2.30m in the south of the site.*

Groundwater Flooding evidence and measurements.

Since a number of sites have made planning applications some data is available on ground water measurements and therefore ground water risk.
The groundwater has been measured on the site known as Plough Field in 2015 by RPS, it was found to be 1.5m bgl in the North of the site and this is defined as High by hydrologists. Regularly the groundwater height on the site and in the adjacent field is observed to be so high it is preventing infiltration resulting in flooding and the formation of lakes / pools which don't drain. Future risk is that the site and the adjacent field lakes / pools will join as ground water height increases across both fields caused by more frequent and intense rainfall. For historic groundwater flooding evidence See Annex B.

Compounding the risk of flooding – high ground water will cause subsidence and damp to properties and swales will become redundant as they will fill up with groundwater at the time they will be needed most.

Attention should also be focused upon the potential to cause flooding to developed areas adjacent to the site via groundwater displacement. In the case of the Plough Field site Infiltration tests were **not** conducted at appropriate points across the entire site, especially at one of the densest areas of development along the northern boundary,

nor were tests done along the length of the proposed swale. The inadequate testing was unacceptable and a request made for borehole testing on the North and West boundaries to confirm swales built to a 2m depth will not become redundant if the water table is at 1.5m bgl or higher than 1.5m bgl. With groundwater flooding on the northern boundary it strongly suggests the water table is less than 1m bgl and ground water heights should be confirmed along the North and West boundaries of the site.

Sewer Flooding – Roads, Gardens and Property

The SODC Strategic Flood Risk Assessment (March 2019), Paragraph 5.9 Flooding From Sewers, Table 5-5 shows that for location post code (OX10 7) 8 recorded incidents of sewer flooding occurred.

A combination of high ground water and surface water enters the sewer network, causing the sewer network to become overloaded and flood. The sewer overflow happens during a flood event and can continue a few days after the flood event until the fluvial flood has receded and surface and ground water has subsided.

In a severe flood the sewer flooding can enter roads, property, gardens and the village ditch system leading to the river Thames. The flooding sewers will combine with fluvial, surface and groundwater flooding.

The Parish Sewer Network is ‘Dorchester STW network map.pdf’, shown below and recent sewer flooding issues have been annotated onto this map, and some photographic evidence is shown (some video evidence is also available).

Dorchester STW



0 140 280 560 840 1,120 Meters

Current Scale : 1:11,655

Print Date : 29/11/2023
Map Centre On : 458879, 193751
Centre Tile No. : SU5893NE

Legend

DORCHESTER SDACFOULBN

- BRIDGE END (DORCHESTER) SPS
- DORCHESTER STW
- FARM WARBOROUGH SPS
- MARTINS LANE SPS
- QUEEN ST DORCHESTER SPS
- SHILLINGFORD COURT SPS
- SHILLINGFORD SPS
- WESTCROFT SPS
- WHARF SPS

Disclaimer: Based on the Ordnance Survey Map with the Sanction of the Controller of H.M Stationery Office License Number:- 100019345

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed.

Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified on site before any works are undertaken.

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(Location 1) Sewer Flooding January 2024 on the Thame Road was so severe the sewer was damaged and the road closed while it was repaired by Thames Water. The Sewer network flooded in various places throughout Warborough and Shillingford, location points (2) and (3) were photographed.
9th, 18th and 23rd February 2024 sewer flooding was again observed and photographed along the sewer network on (Location 1) Thame Road and (Location 3) Warborough Road .

(Location 1 and 2) Sewer Flood January 2021: The manholes pushed up in the public sewer on Thame Road and Warborough Road. Local residents have reported sewer flooding issues and manhole covers lifting with the force of the flood within their objection feedback to planning applications. After the January 2024 flood event a local resident quoted "The manhole in Warborough road was overflowing for several weeks after the heavy rains in early January. Thames Water were called out several times. The sewer water entered the village drainage ditch and given the extraordinary high ground water (that had caused the overspill in the first place) it sat there for some time, growing a sludgy sewage fungus". This is shown below as photograph Location 3.

Location 4 Pumping Station. A local resident explained "In response to some resident's concerns on drains backing up with foul water, Thames Water sent a vacuum tanker (Shillingford Court SPS, located on Wallingford Road) after the main flood event (on 7/8 January 2024). This alleviated the final drainage issues but prior to this the pumping station either had not coped with the volume or completely failed due to the volume."
Location 5: A local resident explained road manhole sewer flooding occurs at this location.
Location 6: January 2024 A local resident explained sewage was overflowing into the ditch system from the sewer network.

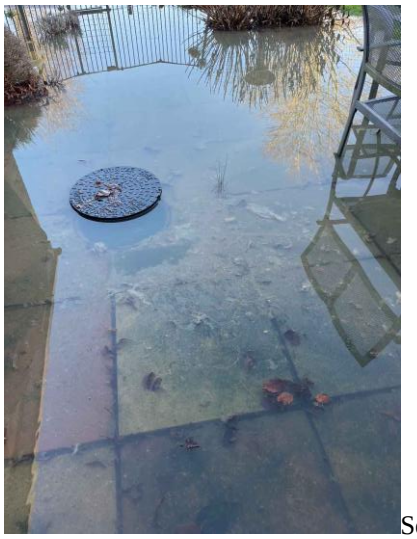
Since groundwater is entering the sewer system the sewers continue to flood until the groundwater has drained which can be many days after the main flood event.

Some residents in the parish area have described the sewer flooding issues. The residents who explained these issues want the information to be published anonymously but the following is an agreed description from one resident of their experience.

"During the flood events of January/February 2024, a house on Thame Road towards the centre of Warborough experienced inside toilets and shower drains backing up almost to the point of overflow and actual sewage overflow from external garden manholes.

Thames Water were called to investigate the issue and after inspecting the mains drainage system via camera, informed the house owner that there were no blockages but that the main sewer running along Thame Road was completely full and that the problem would remain until the volume of water backed up in the system had subsided."

A local parishioner explained that a sewer flooding issue had combined with other sources of flooding and impacted their house and garden in January 2024, and provided the following photographs.


Sewer flood in garden


Not all residents called Thames Water, a resident who had a similar situation explained they didn't call Thames Water, but instead called a drainage engineer, who provided similar feedback to Thames Water, that the issue wasn't a local blockage and would remain until the main sewer back up was resolved.



Location 1:Thame Road Sewer 18 Feb 2024 sewer overflow continues after flood



Location 3: Warborough Road Sewer 2024 sewer overflow continues after flood.

The 2024 photograph below, alongside Warborough Road, shows the sewer overflow has entered the village ditch system which then slowly moves thro' the village until the flood water recedes.



Sewage entered the village flood ditch system



Thames Water attending reports of manhole overflowing, Warborough Road, Jan 6, 2024

Sewer Flooding – The River Thames

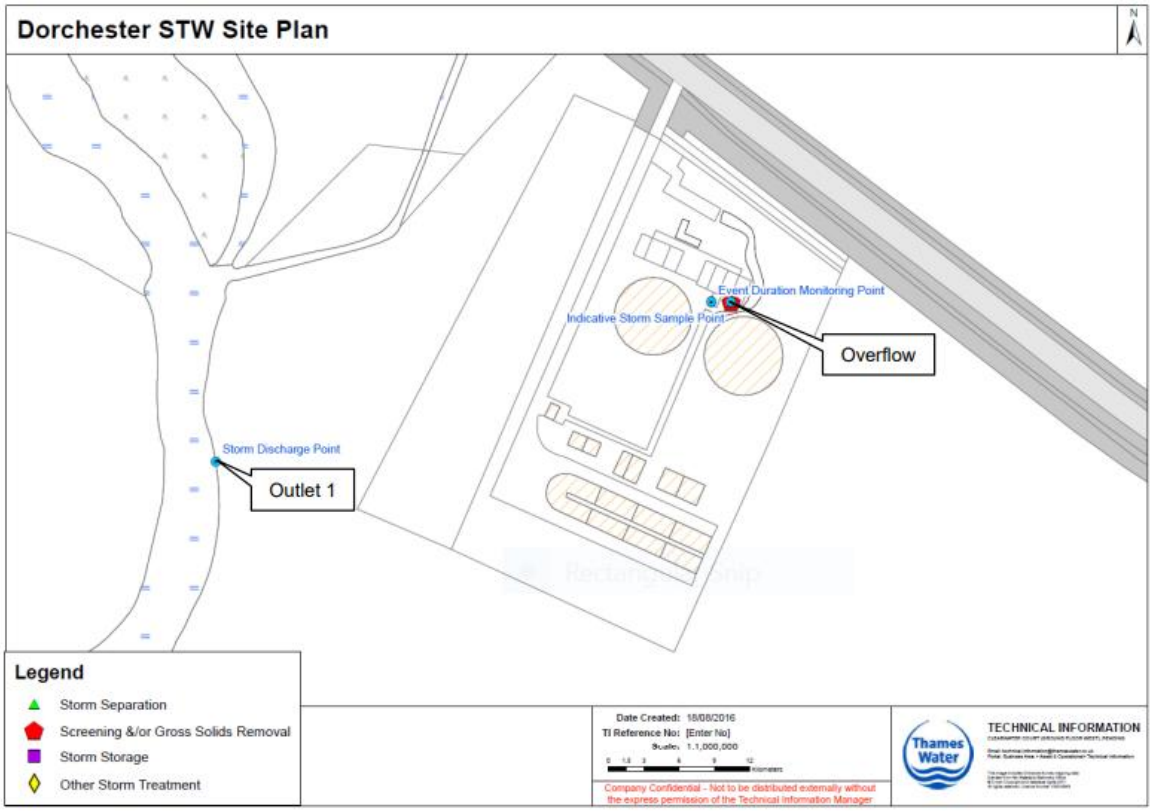
In line with national strategy the Parish does not want untreated sewage to go directly into the River Thames. The Sewage treatment plant which serves Warborough and Shillingford is based in Dorchester. This has a newly installed live recording mechanism (Duration Monitoring Equipment) to detect when a storm overflow is happening and untreated sewage is overflowing into the river Thames. **For the first 6 months of 2024 this live feed was captured and the first 6 months showed that 526 hours untreated sewage flowed into the river Thames.**

The population equivalent (PE) served by the works is stated to be 2,180 and forecast to be 2,334 by 2030. Thames Water state the design capacity of the works to be 1,920 but this figure is stated to be "assumed", which means a PE deficit of 260 rising to 414 by 2030.

Any extra housing will further increase this deficit, until an improved solution is implemented. An ONS figure of 2.4 people per household is commonly assumed as the amount an individual house would increase the deficit by.

Note: The measurement of spills is via Duration Monitoring Equipment (shown in the Thames Water Site Plan below), and a live interface shows the timing of any untreated sewer overflows, when the storm tanks are full and untreated sewage flows directly into the Thames. The Environment Agency publish a yearly update, and the next update will be published March 2025.

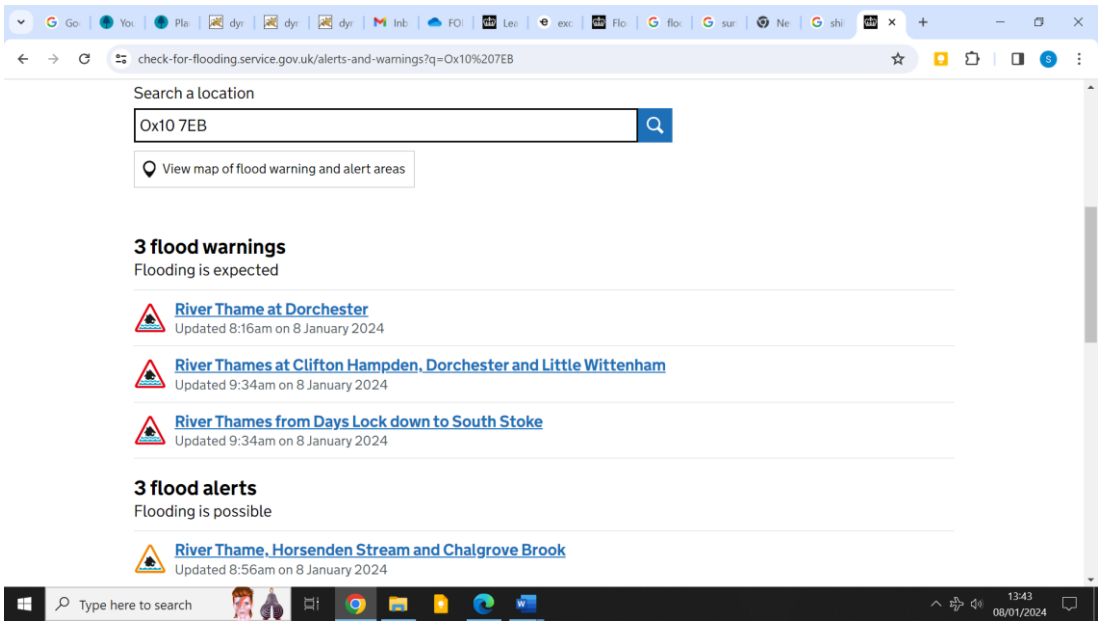
Schedule 7 – Site plan



Thames Water Dorchester Sewage Treatment Works Site Plan.

Flooding Is Expected Warning

In the days during and after the January 2024 flood event the Environment Agency site for flood warnings accurately predicted the flooding event for Warborough & Shillingford when it reported 'flooding is expected warnings' from both the River Thame and the River Thames. The post code shown is Thame Road, Warborough.



PROTECT THE FLOOD PLAIN

Due to the high risk flood environment of Warborough and Shillingford, the protection of the flood plain is vitally important in the protection of existing residents from the full impact of flooding from the Thames, The Thame and the agricultural ditch which encloses much of the Parish (Figure 1).

Parts of the Parish are subject to four types of flooding which act in confluence (Fluvial, Surface, Ground and Sewer) and the removal of part of the flood plain is very challenging to model, but the ramifications of an incorrect decision can be severe.

An example of why it's important to enforce the protection of the flood zone is explained by planning application: P20/S1069/FUL Shillingford Farm, where a farm building was built in the flood plain without planning permission. The land the building was to be built on was first raised in height with rubble and stone. When flooding happened, this raised land was a 'dry island', above the flood zone, but flood water was displaced flooding into neighbouring gardens and threatening property. An enforcement Investigation reference: SE19/617 was launched and the farm building was removed. However, ground levels were not restored, and some of the land used for parking. Subsequent flooding demonstrated the newly elevated site no longer flooded, and that flood waters were instead displaced to surrounding gardens and threatening property.


Nearby Garden Floods


Raised land currently used for parking

PARISHIONER FEEDBACK ON FLOOD RISK

When feedback on the Neighbourhood Plan has been requested from Parishioners, risk of flooding has consistently been a key area of concern.

After the last flood events in January and February 2024 a flood emergency planning community group was formed to plan for the next flood event. With support from the Parish Council a parish poll on flooding was commissioned and the full feedback is published separately.

The following is taken from initial responses (78 responses from parishioners) received as of October 2024.

Question	Number answered Yes
Do you consider flooding to be a risk to you and your property	55
Have you or your property been affected by flooding in the Parish boundary	41

When asked what type of flooding you consider to be a risk to you and your property (due to the nature of the flood risk in W&S the following clearly shows that residents are concerned about more than one flooding risk).

Flooding Risk	Number Of responses
Surface Water	51
Ground water	39
Sewer	29
River	26
Other	11

NPPF Policies FOR DEVELOPMENT IN AREAS OF FLOOD RISK

NPPF has a set of 'Planning and Flood Risk' polices which aim to protect areas at risk of flooding. The first of these from the NPPF December 2024 flood policies is shown below.

NPPF Paragraph 170 'Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk (whether existing or future). Where development is necessary in such areas, the development should be made safe for its lifetime without increasing flood risk elsewhere. '

NPPF Paragraph 173 explains that a sequential risk-based approach should also be taken to individual applications in areas known to be at risk now or in future from any form of flooding. Further paragraphs explain how this applied.

The Sequential Test guidance to steer new development to areas with the lowest risk of flooding from any source is a district wide guidance. Warborough and Shillingford have large areas at risk of flooding from river flooding, surface water flooding, groundwater flooding and Sewer flooding. Some areas of the Parish can be impacted simultaneously by multiple flood sources, this must be considered in any flood risk analysis.

We highlight that Warborough & Shillingford Flood Plain attenuates drainage from other parishes and, where the Environment Agency have highlighted areas with fluvial or surface water risks these should be respected, and any development proposals should consider the flood risks to surrounding properties. We also highlight the risks of groundwater and sewer flooding.

FUTURE RISK

We recommend No Greenfield Development on Warborough Flood Plain marked in blue.

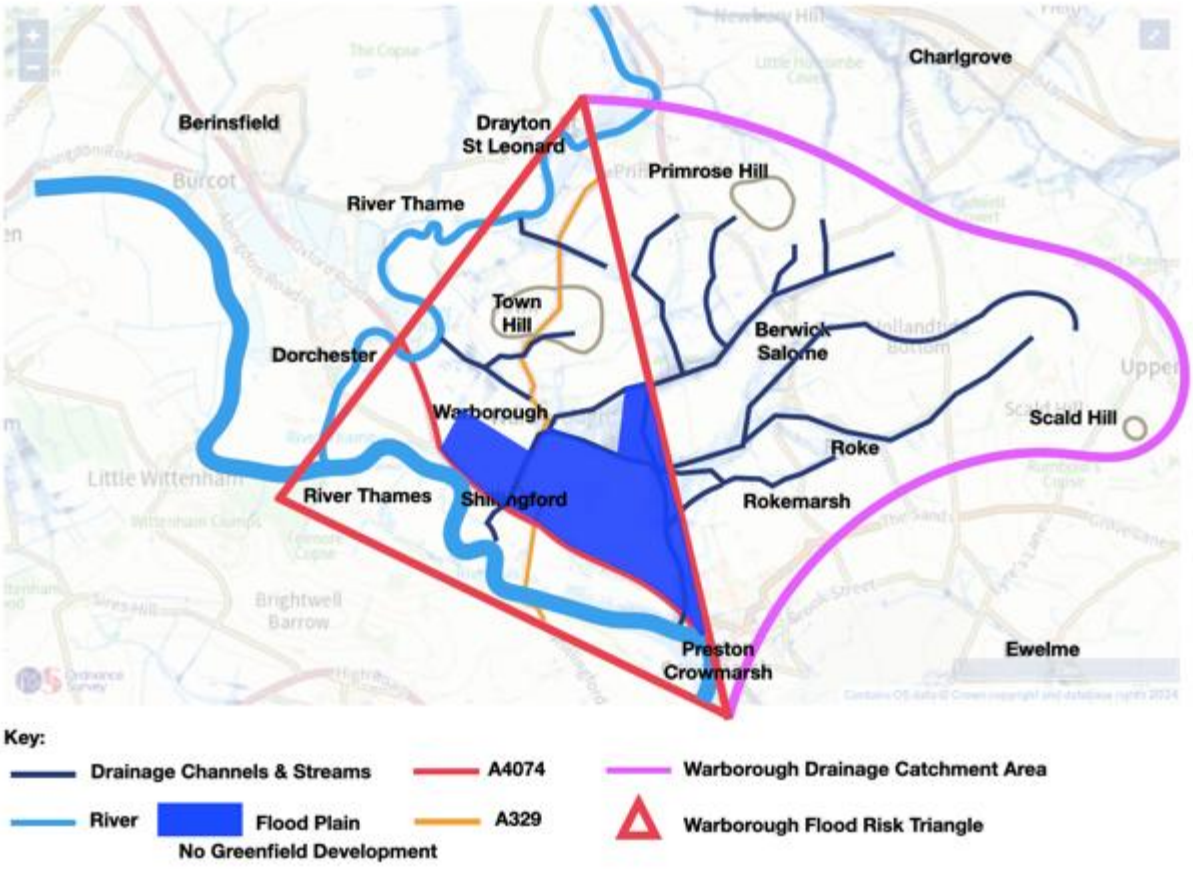


Fig 8. Illustrate Drainage and Catchment area that Warborough & Shillingford flood plain serves. We recommend there should be no development of Green Field sites in the area marked in blue.

Future Flood Risk

- **Fluvial** flooding may breach the A4074 and flood Warborough Road causing the Warborough Road drainage channels to backfill and flood. This nearly happened in 2024. If this happens then fluvial flooding will cause Warborough village to flood as it relies upon the drainage channels to function in Warborough Road for the wider village to drain. See Annex A Section 3b (i). A developer made a case to the Environment Agency to reduce the Flood Risk of 'Plough Field' from 2 to 1, we recommend the Environment Agency does not change the Flood Risk category from 2 to 1 in Warborough flood plain. The evidence in this document explains why this would be a mistake and lead to greater flooding of roads and properties.
- **Ground water flooding**. As the groundwater appears to be in continuity with the Thames and the frequency and scale of river flooding is increasing due to climate change (driving increased frequency and intensity of rainfall), we can expect increased ground water flooding in the Parish and rely on grassland to attenuate this risk. If the Ground Water risk is not controlled this will increase future increase the risk of subsidence and damp and will make property insurance expensive or prohibitive. Any SUD's plan will become redundant as the swales will flood from the ground up.

CONCLUSIONS

- We submit Warborough & Shillingford sit in **a high-risk fluvial flood triangle and with surface water flooding to the North and East means the parish is surrounded by high flood risk**. The grassland in the **Warborough and Shillingford flood plain** actively attenuates surface water and ground water flooding risk. Extensive photographic evidence is provided of the flooding which occurs on the fields to the East of the Parish, these are part of the Parish flood catchment area.
- **Extensive fluvial, surface water, ground water and sewer flooding occur in the Parish whenever a flood event happens, and this is predicted to increase with climate change. Some areas of the Parish can be impacted simultaneously by multiple flood sources, this must be considered in any flood risk analysis.**

- The evidence of Sewer flooding in Warborough and Shillingford is presented. The evidence that the sewage treatment plant is pumping sewage into the Thame when a flood event happens is presented. Sewer flooding is unacceptable.
- We submit **Annex A as a body of evidence of Local Knowledge**.
- We refer to Annex D: RPS Flood Risk Assessment, letter dated 3 March 2015, reviewing borehole testing carried out on the Plough Field site. We highlight groundwater was measured at 1.5m bgl and not as the applicant's FRA states at 2.3mbgl. We require that any development has accurate borehole and ground water testing before any planning permission decision is made.

Annex A – Local Knowledge and Photographic Evidence of Flooding

Survey of Flooding across the Parish on 2 Jan 2024 (together with other evidence)

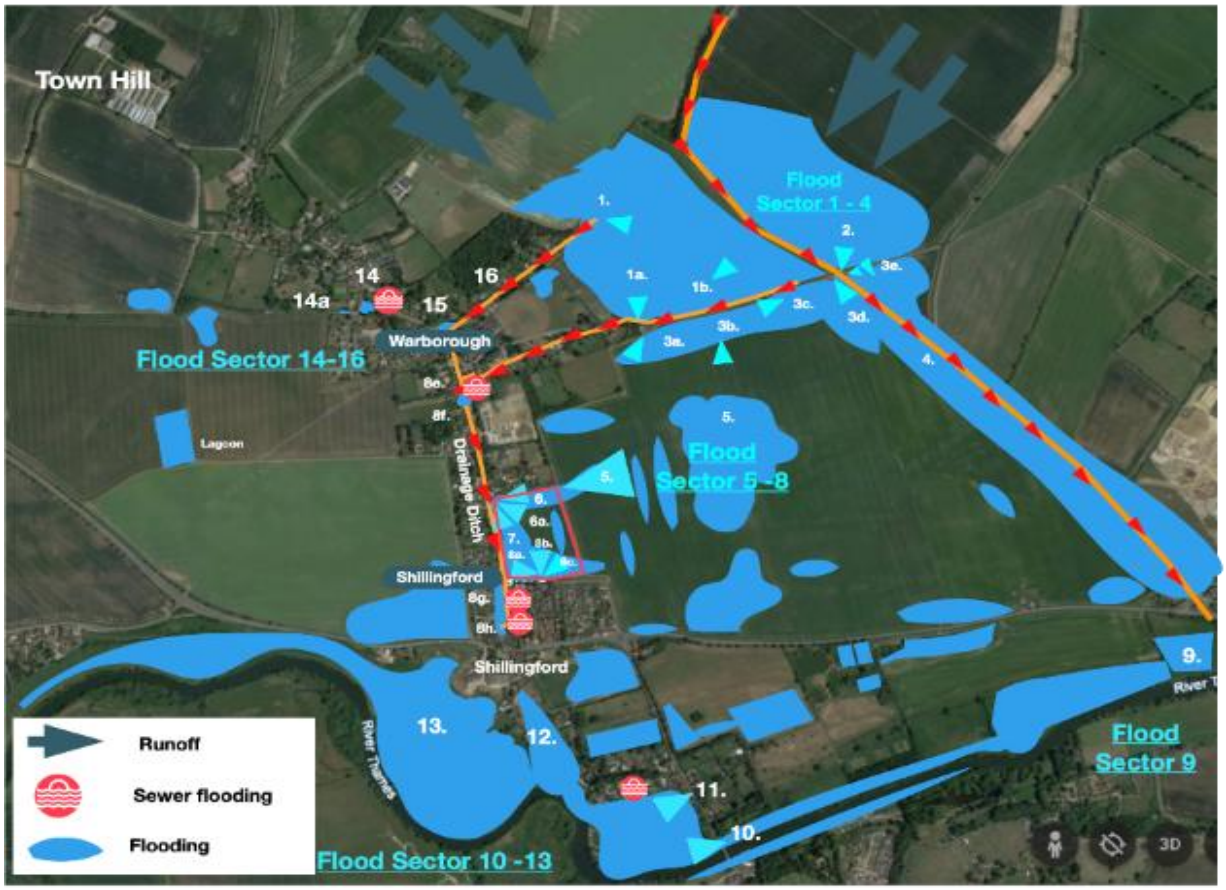
HOW WE FLOOD, ATTENUATE & DRAIN IN THE EAST & SOUTH OF WARBOROUGH & SHILLINGFORD

The gov.uk/guidance/flood-risk-and-coastal-change quotes…

> '"Flood risk" is a combination of the probability and the potential consequences of flooding. Areas at risk of flooding are those at risk of flooding from any source, now or in the future. Sources include rivers and the sea, direct rainfall on the ground surface, rising groundwater, overwhelmed sewers and drainage systems, reservoirs, canals and lakes and other artificial sources. Flood risk also accounts for the interactions between these different sources'.

As explained within the flood evidence Warborough and Shillingford experience flooding from 4 of these sources – rivers, surface water, rising ground water and overwhelmed sewers.
The Environment Agency mapping shows river flooding and surface water flooding separately, and also explains ground water flood risk separately. During a flood event all these forms of flooding happen simultaneously especially after prolonged rainfall when the ground water is at or near surface level.

The schematic A1 is based on the flood threats and evidenced with photography taken predominantly during Jan/Feb 2024 Flood events. The schematic does not include private gardens, houses, roads or driveways where photographic evidence was not available.



Annex A1. A schematic of where we flood / attenuate and drain - split into sectors – triangles show camera view.

A1(a). Flood Sector 1 – 4. Run Off from Town Hill, Primrose Hill, Berwick Salome & Roke.

Sector 1 attenuates a huge body of water by turning whole fields into lakes and a large proportion drains through W&S via the drainage network marked in orange. Cross reference the pictures below using the picture number with the schematic above.



Photo 1.



Photo 1a.



Photo 1b. Field 1 completely flooded.



Photo 2. Field 2 is completely flooded.



Photo 3a View from Cloud Cottage to Shillingford – Ditch is full.



Photo 3b. Field 5 is waterlogged with lakes (No.5.) forming.



Photo 3c. Drainage channel at max capacity from adjacent field



Photo 3d & 4 - Drainage running NE to SW to BP is full



Photo 3e & (4 right). Beyond the concrete culvert bridge to Benson the fields have flooded including the path.

A1(b). Flood Sector 5 – 8.

Plough Field (proposal previously submitted as a development site) plus the lake that forms in adjacent larger field.

(Note: site photography was taken from roof level elevation on scaffolding except when shot from New Road.)



Picture 5 & 6. Northeast Corner of Site plus lakes in adjacent field flooded - this is groundwater flooding and lasts for 2 months.



Picture 6 Surface water observed at the North East Corner of the site 5 Jan 2024.



Photo 6a. North Corner of site looking diagonally to South Corner and Shillingford Roundabout road sign.



Photo 7 North Corner of site looking to West Corner along Western Boundary. The pool at the base of the picture is the lowest point of the field.



Photo 8c Standing on New Road looking East across site into large Plough Field towards Benson.



Photo 8c New Road Looking North across the site to the houses on Gravel Lane.



5th January 2024 due South from North of the site



Flooding of fields looking out towards Chilterns

A1b (i). Flood Sector 8e – 8h.

Drainage Ditches at full capacity on Thame Road & Warborough Road. 2 Jan 2024.



Photo 8e. Thame Road Ditch – Quaker House 32 Thame Road – ditch is full.



Photo 8f Thame Road Ditch – Looking up towards Quaker House 32 Thame Road by the rope swing.



Photo 8f Thame Road Ditch – looking down Thame Road adjacent to Six Acres.



Photo 8g. Warborough Road looking up to West Corner of site and Thame Road.



Photo 8h location - Warborough Road dirt ditch is the same level as road.



8h. Warborough Road Drainage channel passing under the road.



Photo 8h. Warborough Road beginning to flood.



Photo 8h. Warborough Road flooding

A1(c). Sector 9 – (BP Benson Roundabout – River Thames behind tree line.)



Photo 9. Adjacent to BP roundabout looking at Thames (behind trees) and flooded plain as Plough Field discharges under A4074.

A1(d). Flood Sector 10.

Shillingford Bridge & River Thames.



Photo 10. Centre of Shillingford Bridge – River Thames has broken its banks looking west.

A1e. Flood Sector 11.

Thames Path – Shillingford.



Photo 12. Thames Path looking west flooded from Wallingford Road just before Shillingford Bridge.



Wharf Road, after fluvial Flood January 2024



Wharf Road Fluvial Flood January 2024

A1f. Sector 13. (West of Wharf Road)

18 Nov 2019	22 Dec 2019
	
18 Feb 2020	19 Feb 2020
	
20 Feb 2020	20 Feb 2020
	

Photos 13

Sector 14 – 16 (Greet Hall and the Green North)



A329 Thame Road, January 2024



A329 Thame Road, 18 February 2024



Photo 14: A329 Thame Road 18 February 2024, (Greet Hall junction)

These photographs are of The A329 Thame Road, close to the Greet Hall.
During the flood event in January 2024, the A329 Thame Road had been unpassable at the peak of the flood event with cars stranded and one person rescued from a car.

18th February 2024 flood event, the A329 Thame Road could not be differentiated from the verges.
A329 Thame Road was again completely flooded after 18th February 2024, photograph shows that a lorry is sitting low in the floodwater..



Photo 15 and 15b Green North / A329 Thame Road



Photo 14a. Hammer Lane.





Photo 16 The Green North.



Photo 16 The Green North.



Photo 16 Top of the Green, The Green North.



Photo Tennis Courts behind the Green, Jan 2024



North Warborough – near Cuckoo Penn, January 2024 with drainage ditches overwhelmed

Annex B - Groundwater Flooding.

Lake, ≈ 10 hectares in size, forms in the adjacent field every winter less than 350 metres from the site. See Fig 1. The lake is twice the size of the site and is enlarging westwards each year. Now the site corner, marked by the arrow has been flooded for weeks forming its own lake. See Fig 3. (Image with tree in foreground below.)

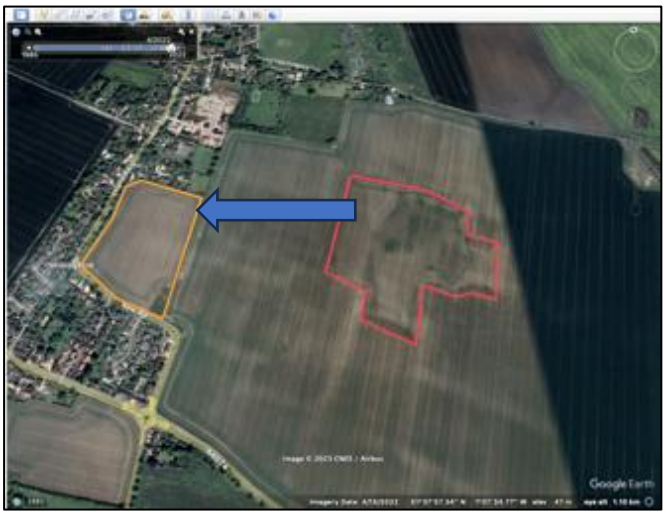


Fig.1. Red shape delineates groundwater lake



Fig.2. Image dated 2009

Fig. 1. Lake forms in adjacent field estimated to be double the size of the site.
Fig. 2. Farmer actively avoids and farms around lake. (Source Google Earth).
Lake is enlarging westwards and future risk is they will link.



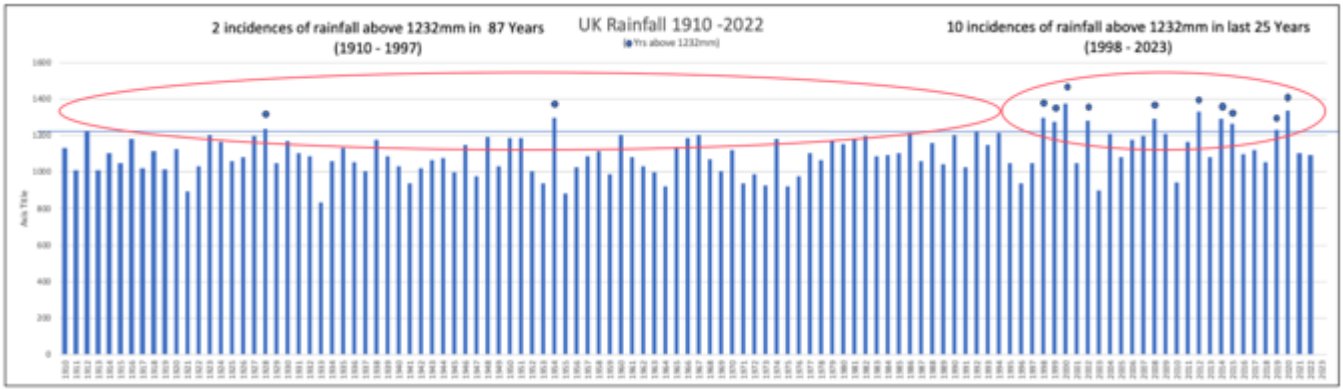
Fig. 3. Dated 6 Jan 2024

Fig.3. NE Site corner is flooding via the high water table. Groundwater flooding is forming a lake. Note the lake in the distance is shown in Fig 1 above in red. Smaller pools are forming before the main body of the large lake.

Annex C – Climate Change – warmer air holds more moisture leads to increased rainfall.

UK rainfall since 1910

A +400% incidence of rainfall above 1232mm a year has happened in 28% of the time of the prior period.



Annex C: Fig. 1. Source: Met Office

Local Rainfall recorded at RAF Benson

Benson Rainfall	Period in Days	mm	% Dec Av.
30/12/23 - 6/12/24	8	40.6	71%
December Average	31	57.23	100%

Annex C: Fig. 2.
Source: Check for Flooding Service.gov.uk

Frequency of UK Named Storms

Storms	2023 / 2024
Agnes	27-28 Sep
Babet	18-21 Oct
Ciarán	1-2 Nov
Debi	12-Nov
Elin	09-Dec
Fergus	10-Dec
Gerrit	27-28 Dec
Henk	02-Jan-24

Annex C: Fig. 3.
Source: Met Office

2023 confirmed as world's hottest year on record

The year 2023 has been confirmed as the warmest on record, driven by human-caused climate change and boosted by the natural El Niño weather event.

Last year was about 1.48C warmer than the long-term average before humans started burning large amounts of fossil fuels, the EU's climate service says.

Almost every day since July has seen a new global air temperature high for the time of year, BBC analysis shows.

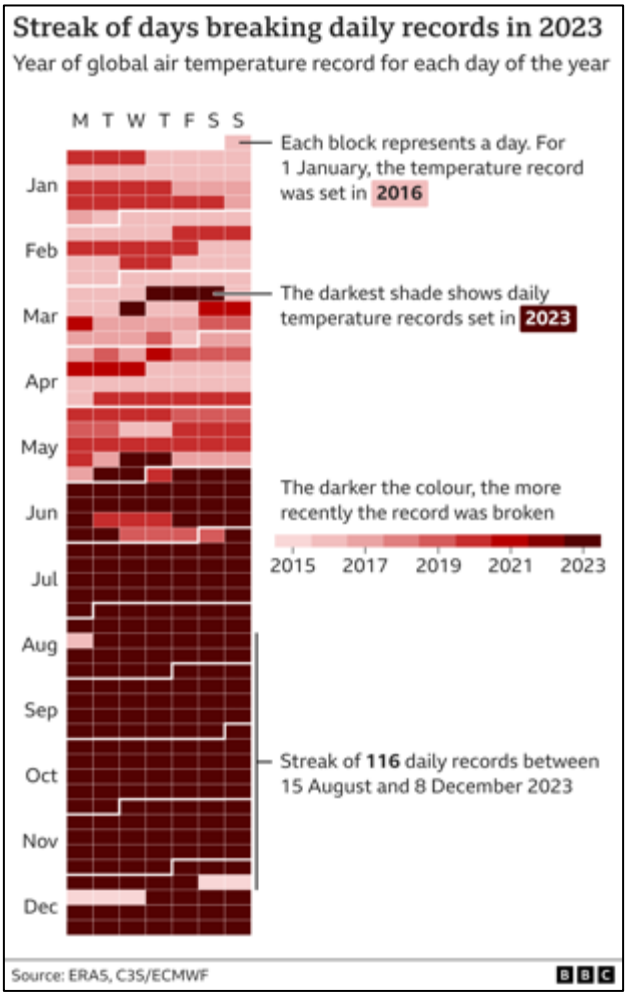
Sea surface temperatures have also smashed previous highs.

The Met Office reported last week that the UK experienced its second warmest year on record in 2023.

These global records are bringing the world closer to breaching key international climate targets.

- **A simple guide to climate change**

"What struck me was not just that [2023] was record-breaking, but the amount by which it broke previous records," notes Andrew Dessler, a professor of atmospheric science at Texas A&M University.



UK weather: 2023 was second warmest year on record, says Met Office

Average rainfall last year was also up, by 11% across the UK, but by more than 20% in England and Northern Ireland.

Scientists predict the UK will experience hotter, drier summers and warmer, wetter winters due to climate change. As the air warms up it is able to hold more moisture, resulting in increased rainfall.

Annex D – (retrieved from P17/S4437/O SODC Planning Portal – Flood Risk Assessment Part 2.) RPS Report on the Borehole Testing and Infiltration results.

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Our Ref: HLEI 34788/001L

Date: 3rd March 2015

Andy Wells
RPS Planning and Development
20 Western Avenue
Milton Park
Oxfordshire
OX14 4SG

By email: Andrew.Wells@rpsgroup.com

Dear Andy,

Re: Soakaway Testing Results
- Land Located at Shillingford, Wallingford, Oxfordshire OX10 7EL

Please find below the results of soakaway testing recently undertaken at the above site, as commissioned by RPS Planning and Development. The purpose of the investigation is to confirm the suitability of the geology beneath the site for soakaway drainage upon its development with residential properties.

Background:

The site currently comprises agricultural land and is located in an area of mixed residential and agricultural land use to the northeast of Shillingford. A site location plan is included as Figure 1.

British Geological Survey (BGS) mapping indicates that ground conditions beneath the site are likely to comprise the Northmoor Sand and Gravel Member overlying the Gault Formation (comprising mudstone). The Environment Agency classifies the Northmoor Sand and Gravel Member as a Secondary A Aquifer. Secondary A Aquifers are formed of permeable layers capable of supporting water supplies at a local scale and in some cases forming an important source of base flow to rivers. The Gault Formation is classified as an Unproductive Stratum these are geological strata with low permeability that have negligible significance for water supply or river base flow.

Shallow groundwater within the Northmoor Sand and Gravel Member may be in hydraulic continuity with the River Thames, located approximately 500m to the south of the site.

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Health, Safety and Environment
United Kingdom | Ireland | The Netherlands | USA | Canada | Australia

A BGS borehole log located approximately 100m south of the site indicates approximately 6m of sand and gravel deposits underlain by 35m of the Gault Formation.

Aim:

The purpose of the testing was to determine the permeability of shallow soils to assist in the design of infiltration drainage.

Methodology:

The soakaway tests were carried out to comply with the methodology detailed within BRE Digest 365 'Soakaway Design'. The soakaway test pits (test pits TP1 to TP6) were excavated at the site using a mechanical excavator between the 24th and 25th February 2015. Due to unstable sand and gravel deposits test pits were stepped at the sides to increase stability and could only be excavated to a maximum depth of up to 1.50m below ground level (bgl) to prevent collapse. Each test pit had approximate dimensions of 0.60m (width) by 2.30m (length). A test pit location plan is included as figure 2.

Encountered Ground Conditions:

The encountered geology was highly consistent across the site. Soft dark brown sandy clay was encountered at the surface at each trial pit location to a depth of between 1.00m bgl in test pit TP6 in the southwest of the site and 0.40m bgl in test pit TP3 in the northeast of the site. This was underlain by orange gravelly sand proven to a depth of 2.30m bgl in a preliminary trial pit in the vicinity of test pit TP1. Full copies of the soakaway trial pits logs are provided in Appendix A.

Groundwater was encountered within the Northmoor Sand and Gravel Member at a depth of 2.30m bgl in a preliminary test pit in the vicinity of TP1 in the south of the site and at 1.50m bgl in a preliminary test pit in the vicinity of TP3 in the north of the site. These pits both collapsed before testing could be undertaken. Groundwater flow direction is likely to be towards the south of the site in the direction of the nearby River Thames.

Soakaway Test:

Once excavated, test pits TP1 to TP6 were filled with water (delivered by tanker) to the top of the Northmoor Sand and Gravel Member and allowed to drain, with the depth to water recorded at regular intervals using a meter rule.

The soakaway test calculations are presented in Appendix B. Only one infiltration test could be completed for each test pit. The calculated infiltration rates for each of the soakaway tests are provided in Table 1 below:

Table 1: Calculated Infiltration Rates

Test Pit	Infiltration rate
TP1	1.58×10^{-5}
TP2	2.23×10^{-5}
TP3	7.88×10^{-5}
TP4	1.14×10^{-4}
TP5	6.16×10^{-5}
TP6	5.56×10^{-5}

Variances from BRE Digest 365 – Soakaway Design

The soakaway tests were proposed to comply fully with the methodology detailed within BRE Digest 365 'Soakaway Design'. However, due to the ground conditions encountered the proposed depth of the soakaway trial pits (3.00m bgl) could not be achieved due to unstable ground and a high water table. In addition, due to the infiltrations rates experienced, pit instability, access constraints and time restrictions it was not possible to carry out three infiltration tests per pit.

Conclusion:

The testing indicates that infiltration rates were broadly consistent across the site with the highest in test pit TP4 in towards the center of the site and the lowest in test pit TP1, in the southeast corner. A high water table was recorded beneath the site with groundwater encountered at 1.50m bgl in the north of the site and 2.30m in the south of the site.

Overall, the testing indicates that the ground in which the soakaway testing was undertaken could potentially be suitable for soakaway drainage, however, the feasibility of this drainage, along with the size and type of soakaway should be assessed by a specialist drainage engineer.

I trust the above is satisfactory, however, please do not hesitate to contact me should you wish to discuss further.

Yours sincerely

For RPS Health, Safety & Environment

Michael Andrews

Environmental Consultant

Enc: Figure 1: Site location Plan

Figure 2: Soakaway Test Location Plan

Appendix A: Test Pit Logs

Appendix B: Soakaway Test Calculations

(Note: Enclosures have not been included here. Please ref P17/S4437/O SODC Planning Portal – Flood Risk Assessment Part 2.)