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FLOOD RISK ASSESSMENT
SURFACE AND FOUL WATER DRAINAGE STRATEGY
FOR
DALLAS BURSTON

02nd SEPTEMBER 2020

Flood Risk Assessment
Foul and Surface Water Drainage Strategy
Brixworth Local Services Centre
Land off Northampton Road
Northampton Road
Brixworth
Northamptonshire
NN6 9DQ

REVISIONS

REV	PURPOSE	REVISION DETAILS	DATE
0	FOR APPROVAL	INITIAL ISSUE	08th JULY 2020
1	FINAL	REVISED TO FINAL	09th JULY 2020
2	FINAL	SITE PLAN AMENDED	02nd SEPTEMBER 2020

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1.0 INTRODUCTION

1.1 PURPOSE OF THE REPORT

Framptons has commissioned Bridges Pound on behalf of Dallas Burston to undertake a Flood Risk and Drainage Assessment in respect of a proposed development at Brixworth Local Services Centre.

The report has been prepared to accompany the detailed planning application for the proposed development as outlined in section 1.2.

1.2 PROPOSED DEVELOPMENT

The proposed development involves the provision of a local services centre.

A copy of the proposed development plan is contained within Appendix A.

1.3 REQUIREMENT FOR FLOOD RISK ASSESSMENT

A Flood Risk Assessment should be carried out where the development is within a flood zone 2 or 3, when the site area is greater than 1 hectare (ha), where the development could be affected by sources other than rivers and sea, or in an area which has critical drainage problems as notified by the Environment Agency (EA).

According to the EA Flood Map for Planning, the application site is located within 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). The site is larger than 1 ha. The Site has potential to be affected by other sources of flooding other than rivers and the sea. Therefore, a Flood Risk Assessment would be required to support a planning application.

1.4 SCOPE OF THE FLOOD RISK ASSESSMENT

The FRA has been undertaken in accordance with the guidelines of the Environment Agency Flood Risk Assessment (FRA) Guidance Note 3.

In line with the National Planning Practice Guide (Flood Risk and Costal Change) (NPPG) requirements, the FRA will consider all potential sources of flood risk, such as pluvial flooding,

sewers, overland flow routes, groundwater flooding, reservoir flooding and ordinary watercourses.

The FRA will also establish a management regime for surface water runoff from the site such that flood risk to adjoining areas is not exacerbated and where possible improved. If not managed properly, surface water runoff from the site could potentially lead to increase in flood risk to other areas or the development itself. Given that the application seeks planning permission, an indicative surface water drainage strategy will be included in which potential measures for draining surface water will be discussed. This will have a specific focus on implementing SuDS strategies, where viable.

The Foul Drainage Assessment will review the existing foul water drainage systems within and adjacent to the development site and identify the peak flows from the proposed development.

1.5 LIMITATIONS OF THIS REPORT

This report has been prepared by Bridges Pound on behalf of our client in regards to the scope of the report as described in section 1.4 above and takes into account the particular instructions and requirements set out in our fee proposal and the acceptance thereof. This Report must not be relied on by any third party, unless such reliance has expressly been given. and no responsibility for the contents of the report is provided to any third party.

The report is based on the interpretation and assessment of data provided by third parties. Bridges Pound cannot guarantee the reliability of the third-party information obtained. The conclusion and findings of the report may change if the third-party data is subsequently amended or updated.

This report cannot be reproduced without Bridges Pound's written consent. Except for the intended use of the report as described in section 1.1.

2.0 PROPOSED DEVELOPMENT SITE

2.1 SITE INFORMATION

The Site is located at land off Northampton Road, Brixworth, Northamptonshire. The site is approximately 8.9 km North of Northampton train station. The Ordnance Survey Easting and Northings for the approx. centre of the proposed Site are E=474792, N=269419 with a National Grid Reference of SP747694

The site is roughly triangular in shape. The Site is currently a grass field. The total site area is approximately 1.20 ha

The site location and site boundary are shown in Figures 1 and 2 below.

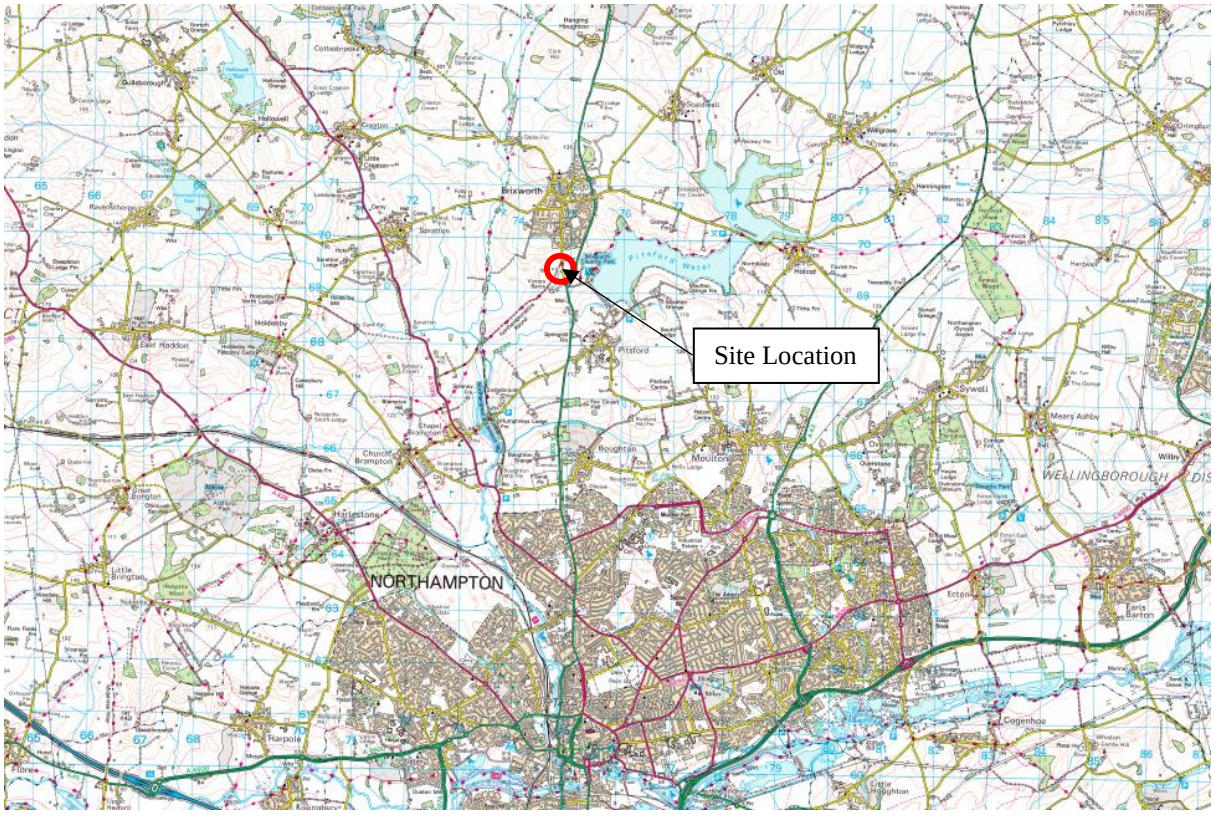


Figure 1 – Site Location Plan

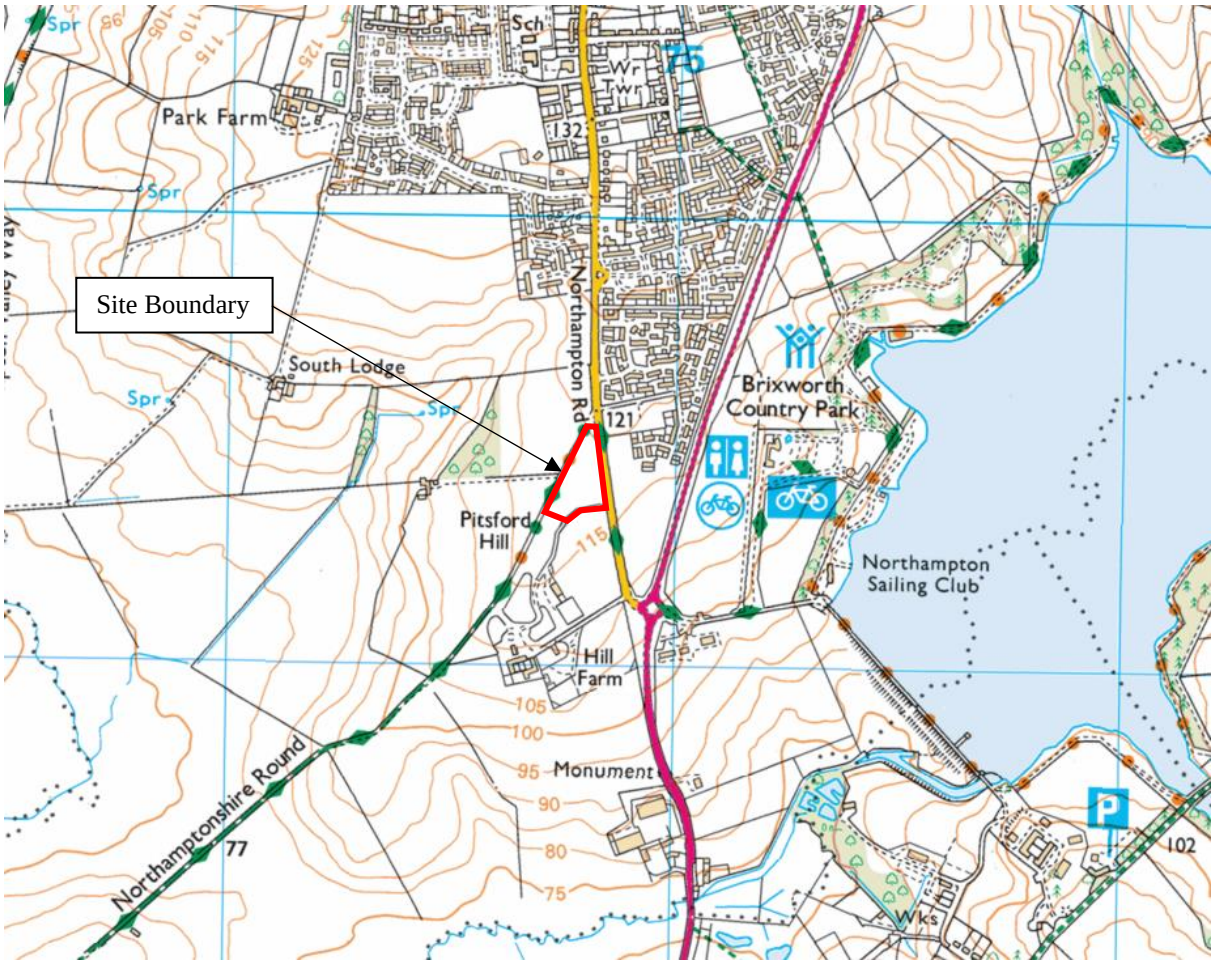


Figure 2 – Site Plan

The Site is bounded by a road with agricultural land beyond to the North and West, to the East is Northampton Road with a new housing development beyond. To the South is a cricket ground with houses and a vine yard to the South West. The majority of the site boundary is dense hedgerow and trees. The site is accessed off a private road which in turn is accessed from Northampton Road

Within the site boundary the site is fully impermeable being a grassed field. The site falls from the Northern tip towards the South. The highest elevation being 119.55 m above ordnance datum (AOD), the lowest elevation being 115.70 m AOD, approximately centrally on the Southern boundary.

The surrounding land is generally falling away from the site towards the East, South and West, the land to the North is falling towards the Site.

2.2 EXISTING DRAINAGE

2.2.1 Main Rivers

The nearest Main River to the proposed site is the River Nene which is located approximately 9.60 km to the South of the Site.

2.2.2 Ordinary and Manmade Watercourses

From a review of the Ordnance Survey Data there are no existing watercourses within or bounding the. There is a drainage ditch running just outside the Eastern boundary.

There are two un named watercourses running away from the Site towards the South. The closest is 0.48 km to the West within Agricultural field and the next closest is the outfall from Pitsford Waters which is 0.98 km to the South of the Site. Both of these joins together and run into the River Nene.

2.2.3 Public Sewers

Anglian Water

A Pre-Planning Report has been obtained from Anglian Water (AW) which has an extract from their sewer records which shows their assets to the North of the Site.

The closest public foul sewer that can accept the foul flows form the proposed development is a 150 mm internal diameter sewer approximately 0.36 km to the North within Knightons Walk.

There are sewers shown on the extract within the new housing development to the East of the Site. However, these are yet to be fully adopted by Anglian Water and are still classed as private drains under maintenance with the housing developer. These will be transferred to Anglian Waters ownership in the future on completion of the maintenance period and rectification of any defects identified.

A copy of the Pre-Planning Report received from Anglian Water is included in Appendix C.

2.2.4 Private Drains

We are unaware of any private drains within the Site boundary. As there are no records of previous development and the Site is and has been a grassed field, we wouldn't expect there to be any.

3.0 FLOOD RISK

3.1 SUMMARY OF FLOOD RISK

A Level 1 Strategic Flood Risk Assessment (SFRA) of the West Northamptonshire area was issued March 2019 by external consultants, which includes an assessment of flood risk from all sources of flooding. The data and findings of these reports have been used for this assessment as suggested by the Environment Agency.

3.2 WEST NORTHAMPTONSHIRE – STRATEGIC FLOOD RISK ASSESSMENT

A review of the West Northamptonshire SFRA Level 1 (dated March 2019) was undertaken to establish any flood risk issues relevant to this application.

The Site is not mentioned within the SFRA, however, Brixworth is mentioned regarding a risk from ground water flooding. From the maps within the SFRA it can be seen there is low risk from all sources of flooding mentioned within the report.

The potential sources of flooding are further discussed below with the risk level posed to the proposed development from each source.

3.3 COASTAL AND FLUVIAL FLOOD RISK

Coastal flood risk is the risk of flooding arising from the sea due to high tides including tidal surges. Fluvial flood risk is the risk arising from rivers and watercourses.

The proposed site is within a flood zone 1 and is therefore not at risk from flooding from either coastal or fluvial. The nearest tidal body of water is located in excess of 80 km to the North East. The nearest river is the River Nene which is located 9.60 km to the South there are also un-named watercourse with the closest being 0.48 km to the West.

Due to the topography of the surrounding land the site is elevated higher than the river and watercourses. Elevations taken from Google Earth show that the lowest point on site is approximately 42 m higher than the River Nene and at least 25 m higher than the water courses.

It is therefore considered that there is very low risk from Coastal flooding and a very low risk from Fluvial flooding.

3.4 GROUNDWATER FLOODING

Groundwater flooding is where water emerges above ground level due to prolonged rainfall that raises the water table. Groundwater flooding generally occurs in low lying areas that are underlain with permeable bedrock and superficial geology.

Section 6.30 and Map 10 of the SFRA indicates that ground water flooding does occur within the borough. From the maps it can be seen that there is a Very Low to Negligible Risk for groundwater flooding. Although Brixworth is mentioned as having groundwater flooding it can be seen from Map 10 that this occurs to the North of the village away from the proposed Site.

After reviewing the British Geological Survey (BGS) website and the nearest borehole scans it can be seen that the site is underlain with the Northampton Sand Formation which is a Ironstone, Ooidal Sedimentary Bedrock. There are no records of the superficial deposits over the bed rock, However, there are a large number of Borehole records from the new housing estate to the North East of the Site with the closest one to the Site showing Topsoil over Made Ground (Sand and Gravel) with Sandstone below.

At the time of writing this report a site investigation has not been carried out on the Site. However, From infiltration tests done in March 2017 they show that there is a 0.3 - 0.4 m layer of Silty, Clayey Sand which generally becomes a Dense Course Gravel and Cobbles of Ironstone and Sandstone.

As mentioned at the time of writing this report we did not have access to a Site Investigation, we would recommend that if one is carried out ground water monitoring points are installed to determine the ground water levels. However, from Map 10 and the elevation in relation to the majority of the surrounding land we would not expect for ground water flooding to be an issue on this Site. It is therefore considered that the risk to the development from groundwater flooding can be considered low risk.

3.5 SEWER FLOODING

Sewer flooding is generally caused from overloading of the sewerage system or due to poor maintenance or structural failure.

Section 6.27 and Map 4 of the SFRA indicates that Sewer Flooding has affected 68 properties within the Daventry area. However, it is known that Anglian Water have no records of public sewers within the site boundary so it is highly likely that none of the reports were within the vicinity of the proposed Site.

The information relating to sewer flooding is confidential and therefore the information supplied is based on the first 4 digits of a post code which in built up areas can cover a large number of properties.

In relation to sewer flooding from blockages, collapses and equipment failure, most sewered locations are at risk as these cannot be predicted with sufficient accuracy.

We have contacted Anglian Water; they have confirmed that their drainage networks in the area have no records of flooding on the vicinity of the Site that can be attributed to capacity limitations in the public sewerage system.

Due to the lack of public sewers in the immediate vicinity of the Site, it is therefore considered that the risk to the development from sewer flooding is considered low.

3.6 SURFACE WATER FLOODING AND OVERLAND FLOWS

Surface water flooding occurs where intense rainfall events that are unable to soak into the ground, enter drainage systems or exceed the drainage capacity in the area (i.e. sewer system and/or watercourse), leading to flooding.

An extract of the Flood Risk mapping for Planning risk of surface water flooding map is shown in Appendix B where it can be seen that the site is not affected by surface water flooding.

When reviewing the velocity and direction of surface water flooding surrounding the Site it can be seen that the majority of flooding is flowing away to the East and West. and flooding that is happening to the North and shown to be flowing towards the location of the Site is on the other

side of Northampton Road within the new housing development. This is shown to stop short of the Site and should now not be an issue as it will be picked up by the new surface water drainage system serving the housing development.

As there is no surface water flooding shown with the proposed Site or in close vicinity, it is therefore considered that the risk to the development from surface water flooding is considered low.

3.7 RESERVOIR FLOODING

Although the probability of a catastrophic dam failure is considered to be extremely low, the consequence of such an event would be severe. A review of the Flood Risk mapping for Planning flood risk for reservoirs identifies that the site is not at risk of flooding as a result of reservoir failure.

An extract of the Flood Risk Mapping for Planning risk of reservoir flooding map is shown in Appendix B.

As can be seen the Site and the surrounding land is not at risk of flooding from Reservoirs. It is therefore considered that the risk to the development from Reservoir flooding is considered very low.

3.8 SUMMARY OF FLOOD RISK

Based on the above, it can be seen that the site is at LOW to VERY LOW risk of flooding from the above sources.

It will be essential that the proposed development is designed to ensure that the increase in impermeable areas will not create a flood risk to the development or increase/contribute to the flood risk of adjacent areas as a result of the proposed development. This matter is discussed in more detail within Section 5 of this report.

4.0 SUSTAINABLE DRAINAGE

4.1 REVIEW OF SuDS OPTIONS

In order to comply with the national guidelines and policies set by the Non-Statutory Technical Standards for Sustainable Drainage, the design of the surface water drainage system should seek to maximise the use of SuDS techniques.

This section reviews the suitability of the different SuDS elements available for the proposed site.

As stated previously, where possible, it is proposed to incorporate a fully compliant SuDS drainage system to deal with the discharge of the surface water from the proposed development.

4.2 THE SuDS MANAGEMENT TRAIN

The overarching principles of a SuDS system are to minimise the impacts arising from the development on the quantity and quality of the development surface water run-off, whilst at the same time replicating the natural drainage from the site before development.

SuDS key objectives are to minimise the impacts from the development on the quantity and quality of run-off and to maximise amenity and biodiversity opportunities. The accepted SuDS management train consists of three elements:

Source control

- Water butts, green roofs, filter drains, pervious surfaces, swales

Site Control

- Swales, ponds, wetlands, infiltration devices

Regional Control

- Basins, ponds and wetlands
- Reservoirs

Disposal of surface water run-off by the preferred method of infiltration is subject to verification of suitable ground infiltration capacity and no contaminated ground issues. It is usual for infiltration testing to be undertaken in accordance with BRE Digest 365 and Figure 6 of

BS8004:1986, to ascertain if infiltration can be used as a viable method of drainage the surface water from the site. Evidence must be provided to the drainage authorities in the form of infiltration test results or a statement from a suitable site investigation.

The following is an illustration of these principles and how they may be applied to a development via a SuDS Management Train.

Various methods are currently available for source, site and regional control. A review has been undertaken of how best the various systems and sub techniques could be incorporated into the proposed surface water management design and these are set out in Table 1 below, that reviews the suitability of the different SuDS elements for the Site.

Table 1 – Review of SuDS elements for the proposed site

	Component	Suitability	Description
Source Control	Rainwater Harvesting	Yes	Small storage tanks on each individual unit to recycle water from roofs and some impermeable surfaces
	Blue Roofs	Yes	Vegetated roofs that reduce the run-off
	Bio-retention Systems	Yes	Vegetated depressions to convey water
Proprietary Systems	Treatment Channel	Yes	Linear drains filled with granular material to convey water
	Hydrodynamic or Vortex Separator	Yes	Manhole chamber that removes debris and pollutants and holds them
	Oil Separator	Yes	Tank that removes debris and pollutants and holds them
Infiltration Devices	Pervious Pavement	Yes	Surfaces that allow surface water inflow into underlying surfaces
	Soakaways	Yes	Below ground structure that stores water before it infiltrates to the surrounding ground
	Infiltration Trenches	Yes	Linear trenches filled with granular material that allow infiltration to the surrounding ground
	Infiltration Basins	Yes	Shallow depression that stores water before it infiltrates to the surrounding ground
Filtration	Open Swales	Yes	Shallow linear depression that conveys water
	Filter Strips	Yes	Linear trenches filled with granular material to convey water
Retention/ Detention	Detention Basin	Yes	Shallow depressions of open space that temporarily hold water
	Attenuation Pond/Wetland	Yes	Shallow depressions of open space that hold water both permanently and temporarily
	Attenuation Storage Tanks	Yes	Bellow ground structure for temporarily hold water

As the proposed SuDS strategy will only be seeking to utilise source and site wide methods, regional methods have not been considered.

4.3 WATER QUALITY

Table 26.2 of the SuDS Manual CIRIA document C753, as shown below indicates the minimum treatment indices appropriate for contributing pollution hazards for different land use classifications (see table 3 and 4). To deliver adequate treatment, the selected SuDS components should have a total mitigation index (for each contaminant type) that equals or exceeds the pollution hazard index.

Table 2 – CIRIA 753 Table 26.2 Pollution Hazard Indices

Land Use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydro-Carbons
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 driveway, residential car parks, low traffic roads (e.g. Cul de sacs, home zones and general access roads) and non-residential car parking with infrequent change (e.g. Schools, offices) i.e. < 300 traffic movements/day	Low	0.5	0.4	0.4
Commercial yard and delivery areas, non-residential car parking with frequent change (e.g. Hospitals, retail) all roads except low traffic roads and trunk roads/motorways	Medium	0.7	0.6	0.7
Sites with heavy pollution (e.g. 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, manufactured; industrial sites; trunk roads and motorways	High	0.8	0.8	0.9

Table 3 – CIRIA 753 Table 26.3 SuDS mitigation indices for discharge to surface waters

	Mitigation Indices		
Type of SuDS component	TSS	Metals	Hydrocarbons
Filter Strip	0.4	0.4	0.5
Filter Drain	0.4	0.4	0.4
Swale	0.5	0.6	0.6
Bioretention System	0.8	0.8	0.8
Pervious Pavement	0.7	0.6	0.7
Detention Basin	0.5	0.5	0.6
Pond	0.7	0.7	0.5
Wetland	0.8	0.8	0.8
Proprietary treatment systems	These must demonstrate that they can address each of the contaminant types to acceptable levels for frequent events up to approximately the 1 in1 year return period event, for inflow concentrations relevant to the contributing drainage area		

Table 4 – CIRIA 753 Table 26.4 SUDS mitigation indices for discharge to groundwater

Characteristics of the material overlying the proposed infiltration surface, through which the runoff percolates	TSS	Metals	Hydrocarbons
A layer of dense vegetation underlain by a soil with good contamination attenuation potentials of at least 300 mm in depth	0.6	0.5	0.6
A soil with good contamination attenuation potential of at least 300 mm in depth	0.4	0.3	0.3
Infiltration trench (where a suitable depth of infiltration material is included that provides treatment, i.e. graded gravel with sufficient small particles but not single size course aggregate such as 200 mm gravel) underlain by a soil with good contamination attenuation potential of at least 300 mm in depth	0.4	0.4	0.4
Constructed permeable pavement (where a suitable filtration layer is included that provides treatment, and including a geotextile at the base separating the foundation from the subgrade) underlain by a soil with good contamination attenuation potential of at least 300 mm in depth	0.7	0.6	0.7
Bioretention underlain by a soil with good contamination attenuation potential of at least 300 mm in depth	0.8	0.8	0.8
Proprietary treatment systems	These must demonstrate that they can address each of the contaminant types to acceptable levels for inflow concentrations relevant to the contributing area.		

Where more than one mitigation feature is to be used, CIRIA guidance states that the total mitigation index shall be calculated as follows:

Total SuDS mitigation index = Mitigation Index 1 + 0.5 x Mitigation index 2

The final treatment train combination will be determined at details design stage but is likely to incorporate the following components.

- Porous Paving
- Soakaways
- Open Swales
- Infiltration Basins

4.4 SOURCE PROTECTION ZONES

Source protection zones are areas defined by the Environment Agency around ground water abstraction points that are used for potable supply, including public/private and for the production of commercial food and drinks. Source protection zones are based on the time it takes for pollutants to reach an abstraction point. Depending on the proposed nature of the development, and the location of the proposed development site with regards to the source protection zones restrictions may be placed on the types of SuDS appropriate for certain areas.

From reviewing the source protection zones, it can be seen that there are non-affecting the proposed site with the nearest being 6.6 km from the Western boundary at Ravensthorpe Reservoir.

4.5 FUTURE SuDS MAINTENANCE RESPONSIBILITIES

It is expected that the maintenance of the drainage system will be the responsibility of the site owner/appointed management company. Where a site wide management company is appointed this will be funded by the owners of the proposed dwellings.

A maintenance schedule will need to be compiled once the detailed drainage design has been undertaken to suit the SuDS components selected for use on site.

5.0 PROPOSED SURFACE WATER DRAINAGE STRATEGY

5.1 SURFACE WATER DRAINAGE

In order to ensure that surface water runoff from the site does not cause an increase in flood risk the management of runoff has been considered via a sequential approach, in line with Building Regulations. The following options for the disposal of surface water runoff were considered, in order of preference.

- A soakaway or some other infiltration system;
- A watercourse or tidal outfall;
- A sewer.

5.1.1 Discharge to Soakaways

Infiltration tests have been undertaken on the Site in 2017 by external consultants. These were done in the Sandstone and Ironstone and provided acceptable infiltration rates to enable the use of infiltration as the primary means of surface water disposal. Therefore, it is proposed to discharge surface water via means of infiltration.

A copy of the infiltration test results are contained within Appendix F

5.1.2 Discharge to Watercourse

There are no watercourses running through or bounding the site. Therefore, it is not proposed to discharge into an ordinary watercourse.

5.1.3 Discharge to Sewer

There are no public sewers within the Site boundary or within close vicinity. Therefore, it is not proposed to discharge into a public sewer.

5.2 SITE SPECIFIC STRATEGY

It is proposed that the development of the site will increase the impermeable area. As discussed above the use of infiltration methods must be the first option for the disposal of surface water, as this has been proven to be suitable for surface water disposal via infiltration tests. Therefore, for the purpose of this report the surface water is to be disposed by infiltration.

5.2.1 Hydrological Characteristics of the Site

SAAR	633 mm	Overall Site Area	1.200 ha
M5-60	21.000 mm	Pre-Development Impermeable Area	0.000 ha
Rainfall Ratio	0.450	Post-Development Impermeable Area	0.736 ha

5.2.2 Peak Runoff Rates

Pre-Development,

The existing site is classed as a greenfield site, as such HR Wallingford SuDS website was used to calculate the greenfield runoff rates for the Site.

Greenfield runoff Qbar (l/s) = 5.15

The HR Wallingford calculations for the greenfield runoff are included within Appendix E

Post-Development

As the proposed development will increase the impermeable area it should be considered to keep flows to the existing greenfield flows offsite.

However, as the surface water is to all drain into some form of soakaway the discharge rates off site will be governed by the grounds ability for water to infiltrate into it. Also as this was a quarry where the majority of the site is considerably lower than the surrounding areas all water that currently lands on the site already soaked into the ground as this will be maintained during construction and upon completion of the proposed development there will be no increase in the flows infiltrating into the ground. Therefore, there shouldn't be an increase in the flows off site.

5.3 SURFACE WATER STRATEGY

Drawing Y539-BPL-00-XX-DR-C-0021/0022, included within Appendix D, shows the proposed surface water drainage strategy for the development.

As discussed earlier for the purpose of this report infiltration is being used for the disposal of surface water.

In order to demonstrate the possible magnitude of surface water storage required MicroDrainage has been used to approximate post-development attenuation. As the site will drain to soakaways or permeable pavements, we have done two examples one for the roof areas and service yard/road and for the permeable pavement. Both are based on the worst infiltration rate recorded on site 6.0 $x10^{-5}$ m/sec and for the 1 in 200 year storm with a 40% allowance for climate change. The attenuation volumes will be approximately 213 m^3 for the soakaway and 146 m^3 for the permeable pavement. These figures will be superseded by the detailed drainage design when available.

MicroDrainage calculations are included within Appendix E.

Roof water shall discharge from rainwater pipe positions around the proposed buildings into a below ground piped surface water system this will then be piped into the central landscaped area where it will connect onto dry swales. All infiltration systems must at least 5 m away from all buildings.

Parking and access roads should be constructed using porous paving which will infiltrate into the below ground. Surface water from hard paved areas bounding the porous paving this shall flow overland into the paving. Where rainwater down pipes are close to permeable paving there may be sufficient capacity within the sub-base to allow these rainwater pipes to discharge into the porous paving also.

The service road serving the proposed development will be mainly asphalt/concrete construction with gullies/drainage channels to collect surface water. These will then be piped below ground via gravity to the Western corner of the site. Surface water will pass through a suitable petrol interceptor prior to connecting onto a detention basin/pond. Any parking bays along the service road can be served by the gullies/drainage channels or could be porous paving.

Proposed build ups for the porous block paving access roads and parking bays are included within Appendix G.

The developments surface water drainage network shall be designed to not surcharge for a 1 in 2 year storm, not flood for a 1 in 30 year storm or flood water generated from a 1 in 100 year storm plus 40% climate change rainfall event shall be constrained within areas on site so not

to cause damage to buildings, essential services or adjoining developments and services. The proposed development lies within the Upper Nene catchment and therefore all attenuation should be designed for a 1 in 200 year storm + 40% for climate change.

Assuming the above is still correct at the time of construction. It is considered that there is unlikely to be any impact from the surface water discharge either upstream or downstream by draining the site via a restricted discharge ensuring the flows off site match the existing.

6.0 FOUL DRAINAGE ASSESSMENT

6.1 EXISTING FOUL SEWERS

Records obtained from Anglian Water indicate that there are no foul water sewers in close proximity to the Site. It is known that there are foul drains within the adjacent housing development. However, at the time of writing this report they have not been formally adopted by Anglian Water and are still classed as private drains. We are led to believe these drains are in the process of being adopted and are in the maintenance period prior to the formal adoption and full transfer to become Anglian Waters assets. The nearest public sewers suitable for a connection from the proposed development is with Knightons Way, approximately 0.36 km to the North of the Site.

6.2 FOUL WATER DISCHARGES

As the Site is currently a grassed field there are no existing foul producing units within the Site area.

At the time of writing this report we have not seen any internal plans for the proposed units. Assumptions have been made to show a very approximate indication of foul flows from the proposed development. Using BS EN 752-4 to calculate the peak foul flows based on 20 sinks, 4 shower, 45 toilet and hand basin, 2 washing machines and 6 dishwashers. Using a frequency factor of 0.5, gives a peak flow rate of 5.90 l/s from the proposed development.

These figures will be superseded once the internal layouts and number of appliances have been determined.

Due to the lack of public sewers in close vicinity to the Site and the surrounding topography. The foul water will need to be pumped to no less than 5 m from the public sewers so that the final connection can be done via gravity.

6.3 FOUL WATER DRAINAGE STRATEGY

Drawing Y539-BPL-00-XX-DR-C-0021/0022, included within Appendix D, shows the proposed foul water drainage strategy for the development.

Private drains shall be provided to serve all foul producing appliances with the buildings. The drains will be designed in accordance with BS EN 752:2017 and Building Regulations Part H.

Foul drainage from the proposed buildings will be collected and piped to PPIC chambers just outside the building which will then connect onto a new gravity drainage system which will flow South and into a pumping station which will then pump the foul water up to the foul public sewers within Knightons Way. Any pump station should not be located near to any infiltration systems to remove the risk of contamination due to pump station failure.

As the foul flows are to be pumped there should be an allowance within the wet well and or the upstream pipework and manholes (where suitable) to hold at least 1 hour of the peak design flow in case of pump failure, therefore, 5.90 l/s x 3600 sec requires a minimum volume of 21 m^3 should be provided. This figure and the means of holding the foul water is to be agreed in the detailed drainage design.

As there are to be a few units that will produce / serve food suitable grease interception methods should be utilised where required. It is recommended that a below counter grease trap or a dosing system is provided to any unit where required.

As mentioned earlier within the report there are existing drains within the housing development to the East of the proposed Site. These are in the process of being adopted by Anglian Water, enquiries should be made prior to works starting on Site if these have been adopted. As this will reduce the length of rising main required.

Assuming the above is still current at the time of construction, it is considered that there is unlikely to be any impact from the foul waste water discharges either upstream or downstream by draining the Site to the existing sewer network.

7.0 CONCLUSION AND RECOMMENDATIONS

This report has identified the following conclusions:

- The development site is shown on the Flood Maps for Planning as being entirely within Flood Zone 1.
- Flood Risk from all other sources are considered to be low to very low.
- The application site is greenfield.
- The proposed development will be a local services centre.
- The nearest main river to the Site is the River Nene, 9.60 km to the South.
- There are no ordinary watercourses within or bounding the site. The nearest being an unnamed watercourse 0.48 km to the West.
- Infiltration techniques have been proven to be suitable for this development.
- The site is not located within a source protection zone.
- Surface water is to drain via infiltration.
- Foul water drainage is to drain via gravity and then pumped of site to the public sewers.

Based on the above, the following recommendations are made:

- Building Floor Levels should be set 150 mm higher than the surrounding land where possible to mitigate against localised flooding caused by heavy/intense rain.
- The whole surface water drainage system for the proposed development should be designed to not surcharge for a 1 in 2 year storm; no flooding for a 1 in 30 year storm or any flooding for a 1 in 100 year storm + 40% allowance for climate change be constrained with areas on site so not to cause damage to buildings, essential services or adjoining developments and services.
- The proposed development lies within the Upper Nene catchment and therefore all attenuation should be designed for a 1 in 200 year storm + 40% for climate change.
- A full maintenance and inspection plan in relation to the SuDS elements shall be provided upon completion of the works.
- Further consultations with Anglian Water in the future are required to determine a closer foul water outfall.
- A suitable means of grease interception should be utilised where required

Therefore, if the principles set out within the previous sections of this report are followed, and developed at detail design stage by the Design Engineer, the site can be considered suitable for development and should not be precluded as a result of flood risk or drainage.

BRIDGES POUND
CONSULTING ENGINEERS

APPENDIX A

Proposed Development Plan

NOTES:

AT ARCHITECTURE LIMITED
WWW.ATARCHITECTURELTD.COM
OXFORD HOUSE, CLIFTONVILLE, NN1 5BE
INFO@AT-ARCHITECTURE.UK

NO DIMENSIONS TO BE SCALED FROM DRAWING
ALL DIMENSIONS ARE APPROXIMATE AND TO BE CHECKED ON SITE

THIS DRAWING IS FOR PLANNING PURPOSES ONLY SUBJECT TO BUILDING CONTROL STANDARDS AND COMMENTS

REV:	BY:	DATE:	DETAILS:
A	TJ	06.08.2020	LAYOUT AMENDMENTS

AT ARCHITECTURE
www.atarchitectureltd.com

PROJECT:

Brixworth Local Services Centre

DRAWING TITLE:

Proposed Site Plan

SCALE:	STAGE:	DATE:
1:1000 (A3)	Planning	June 2020

DRAWING NO: **A_1908 PL100**

REVISION: **A**

APPENDIX B

GOV.UK Flood Maps for Planning

Flood map for planning

Your reference	Location (easting/northing)	Created
Y539	**474801/269435**	**8 Jul 2020 15:37**

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

This means:

- you don't need to do a flood risk assessment if your development is smaller than 1 hectare and not affected by other sources of flooding
- you may need to do a flood risk assessment if your development is larger than 1 hectare or affected by other sources of flooding or in an area with critical drainage problems

Notes

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

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

Environment Agency

Flood map for planning

Your reference
Y539

Location (easting/northing)
474801/269435

Scale
1:10000

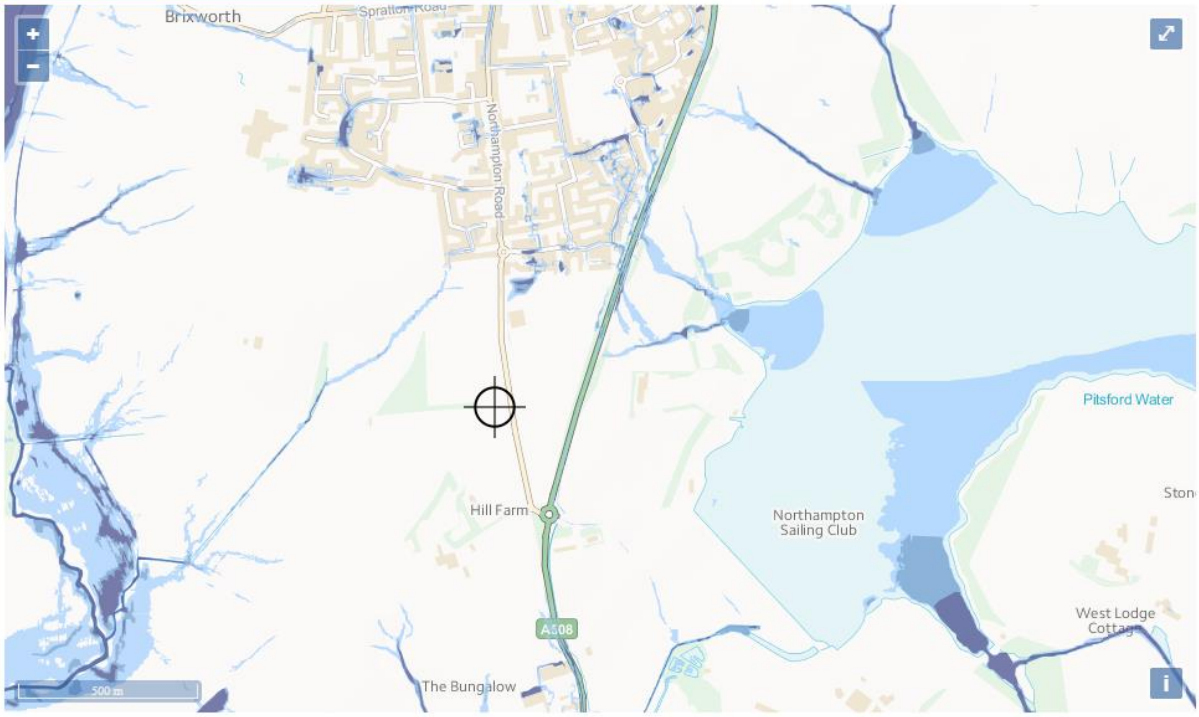
Created
8 Jul 2020 15:37

- Selected point
- Flood zone 3
- Flood zone 3: areas benefitting from flood defences
- Flood zone 2
- Flood zone 1
- Flood defence
- Main river
- Flood storage area

0 100 200 300m

Extent of flooding

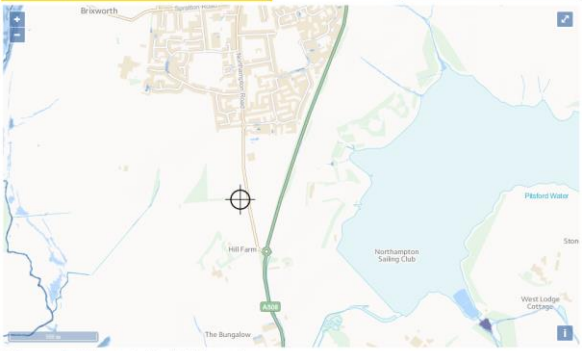
Enter a place or postcode



Extent of flooding from surface water

High Medium Low Very low Location you selected

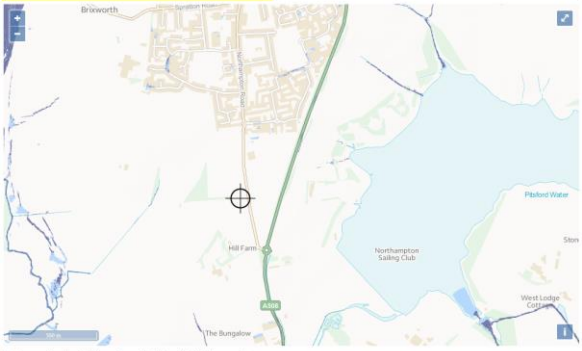
High risk: depth | Enter a place or postcode



Surface water flood risk: water depth in a high risk scenario
Flood depth (millimetres)

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

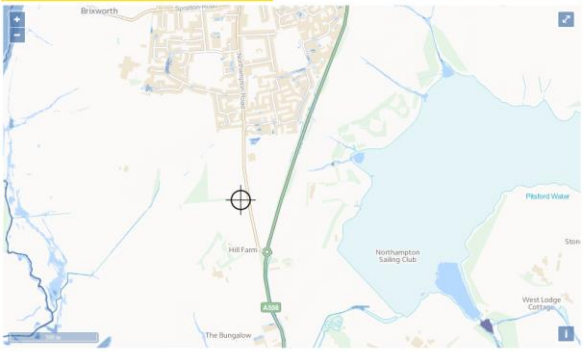
High risk: velocity | Enter a place or postcode



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

Over 0.25 m/s | Less than 0.25 m/s | Direction of water flow | Location you selected

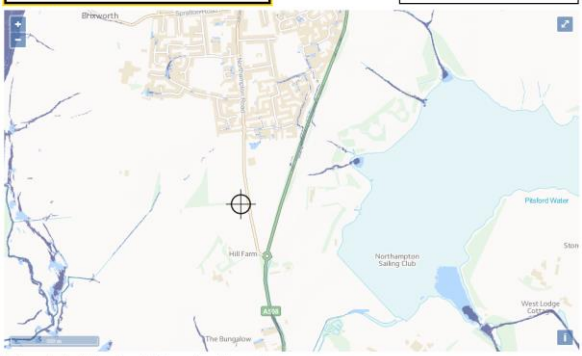
Medium risk: depth | Enter a place or postcode



Surface water flood risk: water depth in a medium risk scenario
Flood depth (millimetres)

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

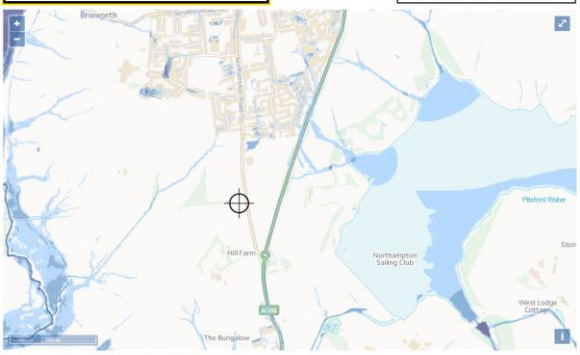
Medium risk: velocity | Enter a place or postcode



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

Over 0.25 m/s | Less than 0.25 m/s | Direction of water flow | Location you selected

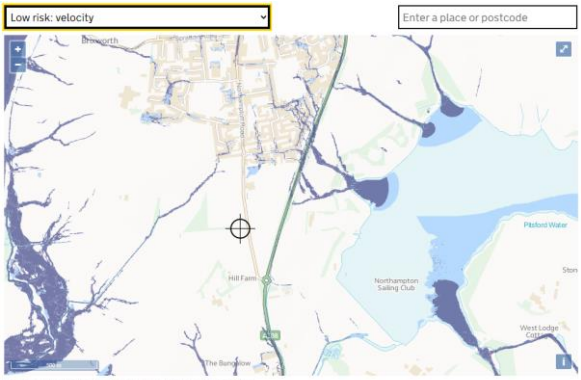
Low risk: depth | Enter a place or postcode



Surface water flood risk: water depth in a low risk scenario
Flood depth (millimetres)

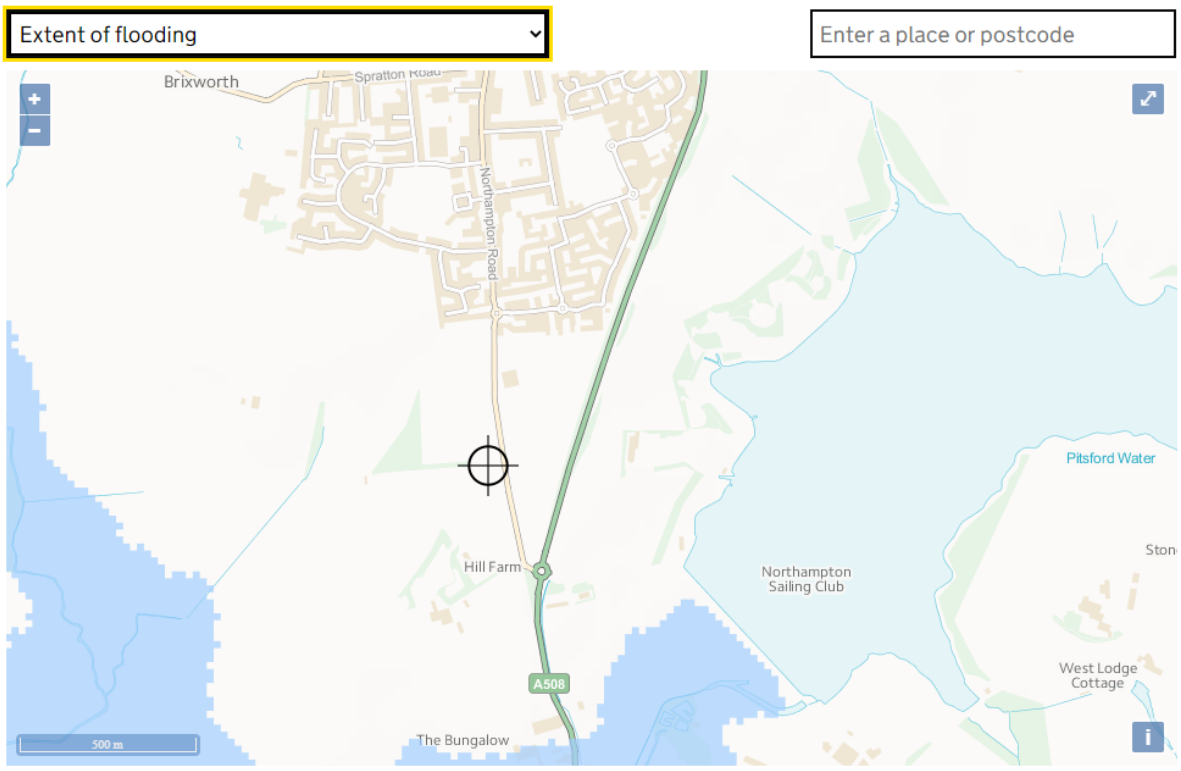
Over 900mm | 300 to 900mm | Below 300mm | Location you selected

Low risk: velocity | Enter a place or postcode



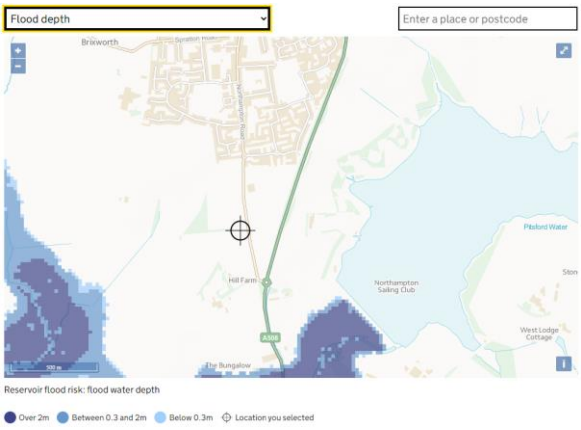
Surface water flood risk: water velocity in a low risk scenario
Flood velocity (metres/second)

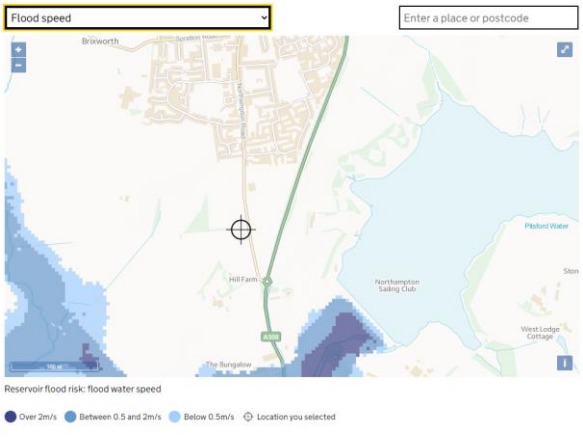
Over 0.25 m/s | Less than 0.25 m/s | Direction of water flow | Location you selected



Extent of flooding from reservoirs

Maximum extent of flooding Location you selected





BRIDGES POUND
CONSULTING ENGINEERS

APPENDIX C

Anglian Water Pre-Planning

Pre-Planning Assessment Report

Brixworth Local Services

InFlow Reference: PPE-0086791

Assessment Type: Used Water

Report published: 26/06/2020

Thank you for submitting a pre-planning enquiry.

This has been produced for Bridges Pound ltd.

Your reference number is **PPE-0086791**.

This report can be submitted as a drainage strategy for the development should it seek planning permission.

If you have any questions upon receipt of this report, you can submit a further question via InFlow. Alternatively, please contact the Planning & Capacity team on **0345 60 66 087**, Option 1 or email planningliaison@anglianwater.co.uk

---

Section 1 - Proposed development

The response within this report has been based on the following information which was submitted as part of your application:

List of planned developments	
Type of development	**No. Of units**
Shops	4
Restaurants and cafes	1
Hot food takeaways	2
Business	8
Non-residential	1
Assembly and leisure	1

The anticipated residential build rate is:

Year	Y1
Build rate	17

Development type: Greenfield

Planning application status: Unknown

Site grid reference number: SP7478469444

The comments contained within this report relate to the public water mains and sewers indicated on our records.

Your attention is drawn to the disclaimer in the useful information section of this report.

Section 2 - Assets affected

Our records indicate that there are no public water mains/public sewers or other assets owned by Anglian Water within the boundary of your development site. However, it is highly recommended that you carry out a thorough investigation of your proposed working area to establish whether any unmapped public or private sewers and lateral drains are in existence.

Due to the private sewer transfer in October 2011 many newly adopted public used water assets and their history are not indicated on our records. You also need to be aware that your development site may contain private water mains, drains or other assets not shown on our records. These are private assets and not the responsibility of Anglian Water but that of the landowner.

Section 3 - Water recycling services

In examining the used water system we assess the ability for your site to connect to the public sewerage network without causing a detriment to the operation of the system. We also assess the receiving water recycling centre and determine whether the water recycling centre can cope with the increased flow and effluent quality arising from your development.

Water recycling centre

The foul drainage from the proposed development is in the catchment of Brixworth Water Recycling Centre, which currently has capacity to treat the flows from your development site. Anglian Water cannot reserve capacity and the available capacity at the water recycling centre can be reduced at any time due to growth, environmental and regulation driven changes.

Used water network

It is noted that your preferred point of connection is located to the East of your development at National Grid Reference SP7487269381. The sewers at this location remain under private ownership, we are therefore unable to agree a connection. However we would be happy to re evaluate should these sewers transfer to Anglian Water ownership in the future. We have assessed connection to the nearest Anglian Water owned sewer. Our assessment has been based on development flows connecting to the nearest foul water sewer of the same size or greater pipe diameter to that required to drain the site. The infrastructure to convey foul water flows to the receiving sewerage network is assumed to be the responsibility of the developer. Conveyance to the connection point is considered as Onsite Work and includes all work carried out upstream from of the point of connection, including making the connection to our existing network. This connection point has been determined in reference to the calculated discharge flow and on this basis, a 150mm internal diameter pipe is required to drain the development site. The nearest practicable connection is to the 150mm diameter sewer at manhole 9805 in Knightons Walk at National Grid Reference NGR SP 74911 69870. Anglian water has assessed the impact of a pumped conveyance from the planned development to the public foul sewerage network and we can confirm that this connection is acceptable as the foul sewerage system, at present, has available capacity for your site. In line with Sewers for Adoption, the pumped discharge will need to connect via an intermediate manhole and at least 5 metres of an appropriately sized gravity sewer. The pump rate and configuration of the connection will be determined with your detailed design. You should submit this detail with your Section 106 new connection application. Please note that Anglian Water will request a suitably worded condition at planning application stage to ensure this strategy is implemented to mitigate the risk of flooding.

It is assumed that the developer will provide the necessary infrastructure to convey flows from the site to the network. Consequently, this report does not include any costs for the conveyance of flows.

Surface water disposal

You indicated on the Pre-Planning Application form that a connection to the public surface water sewer network is not required. Therefore a capacity assessment has not been made on the public surface water network.

As you may be aware, Anglian Water will consider the adoption of SuDs provided that they meet the criteria outline in our SuDs adoption manual. This can be found on our website. We will adopt features located in public open space that are designed and constructed, in conjunction with the Local Authority and Lead Local Flood Authority (LLFA), to the criteria within our SuDs adoption manual. Specifically, developers must be able to demonstrate:

1. Effective upstream source control,
2. Effective exceedance design, and
3. Effective maintenance schedule demonstrating than the assets can be maintained both now and in the future with adequate access.

If you wish to look at the adoption of any SuDs then an expression of interest form can be found on our website

As the proposed method of surface water disposal is not relevant to Anglian Water; we suggest that you contact the relevant Local Authority, Lead Local Flood Authority, the Environment Agency or the Internal Drainage Board, as appropriate.

Trade Effluent

We note that you do not have any trade effluent requirements. Should this be required in the future you will need our written formal consent. This is in accordance with Section 118 of the Water Industry Act (1991).

Used Water Budget Costs

Your development site will be required to pay an infrastructure charge for each new property connecting to the public sewer that benefits from Full planning permission.

You will be required to pay an infrastructure charge upon connection for each new plot on your development site. The infrastructure charge are types of charges set out in Section 146(2) of the Water Industry Act 1991

The charge should be paid by anyone who wishes to build or develop a property and is payable upon request of connection.

Payment of the infrastructure charge must be made before premises are connected to the public sewer.

Infrastructure charge for water recycling:	**£ 570.00**

The Water Recyling Infrastructure charge for your dwellings is:

Infrastructure charge	Number of units	Total
£ 570.00	0	£ 0

Infrastructure charges are raised on a standard basis of one charge per new connection (one for water and one for sewerage). However, if the new connection is to non- household premises, the fixed element is calculated according to the number and type of water fittings in the premises. This is called the "relevant multiplier" method of calculating the charge.

Details of the relevant multiplier for each fitting can be found at our website.

It has been assumed that the onsite used water network will be provided under Section 104 of the Water Industry Act

It is recommended that you also budget for connection costs.

Please note that we offer alternative types of connections depending on your needs and these costs are available at our website.

Section 4 - Map of Proposed Connection Points

Figure 1:Showing your used water point of connection

Section 5 - Useful information

Water Industry Act – Key used water sections

Section 98:

This provides you with the right to requisition a new public sewer. The new public sewer can be constructed by Anglian Water on your behalf. Alternatively, you can construct the sewer yourself under section 30 of the Anglian Water Authority Act 1977.

Section 102:

This provides you with the right to have an existing sewerage asset vested by us. It is your responsibility to bring the infrastructure to an adoptable condition ahead of the asset being vested.

Section 104:

This provides you with the right to have a design technically vetted and an agreement reached that will see us adopt your assets following their satisfactory construction and connection to the public sewer.

Section 106:

This provides you with the right to have your constructed sewer connected to the public sewer.

Section 185

This provides you with the right to have a public sewerage asset diverted.

Details on how to make a formal application for a new sewer, new connection or diversion are available on our website or via our Development Services team on **0345 60 66 087**.

Sustainable drainage systems

Many existing urban drainage systems can cause problems of flooding, pollution or damage to the environment and are not resilient to climate change in the long term. .

Our preferred method of surface water disposal is through the use of Sustainable Drainage Systems or SuDS.

SuDS are a range of techniques that aim to mimic the way surface water drains in natural systems within urban areas. For more information on SuDS, please visit our website

We recommend that you contact the Local Authority and Lead Local Flood Authority (LLFA) for your site to discuss your application.

Private sewer transfers

Sewers and lateral drains connected to the public sewer on the 1 July 2011 transferred into Water Company ownership on the 1 October 2011. This follows the implementation of the Floods and Water Management Act (FWMA). This included sewers and lateral drains that were subject to an existing Section 104 Adoption Agreement and those that were not. There were exemptions and the main non-transferable assets were as follows:

Surface water sewers and lateral drains that do not discharge to the public sewer, e.g. those that discharged to a watercourse.

Foul sewers and lateral drains that discharged to a privately owned sewage treatment/collection facility.

Pumping stations and rising mains will transfer between 1 October 2011 and 1 October 2016.

The implementation of Section 42 of the FWMA will ensure that future private sewers will not be created. It is anticipated that all new sewer applications will need to have an approved section 104 application ahead of a section 106 connection.

It is anticipated that all new sewer applications will need to have an approved Section104 application ahead of a Section 106 connection

Encroachment

Anglian Water operates a risk based approach to development encroaching close to our used water infrastructure. We assess the issue of encroachment if you are planning to build within 400 metres of a water recycling centre or, within 15 metres to 100 metres of a pumping station. We have more information available on our website

Locating our assets

Maps detailing the location of our water and used water infrastructure including both underground assets and above ground assets such as pumping stations and recycling centres are available from digdat

All requests from members of the public or non-statutory bodies for maps showing the location of our assets will be subject to an appropriate administrative charge.

We have more information on our website

Charging arrangements

Our charging arrangements and summary for this year's water and used water connection and infrastructure charges can be found on our website

Section 6 - Disclaimer

The information provided in this report is based on data currently held by Anglian Water Services Limited ('Anglian Water') or provided by a third party. Accordingly, the information in this report is provided with no guarantee of accuracy, timeliness, completeness and is without indemnity or warranty of any kind (express or implied).

This report should not be considered in isolation and does not nullify the need for the enquirer to make additional appropriate searches, inspections and enquiries. Anglian Water supports the plan led approach to sustainable development that is set out in the National Planning Policy Framework ('NPPF') and any infrastructure needs identified in this report must be considered in the context of current, adopted and/or emerging local plans. Where local plans are absent, silent or have expired these needs should be considered against the definition of sustainability holistically as set out in the NPPF.

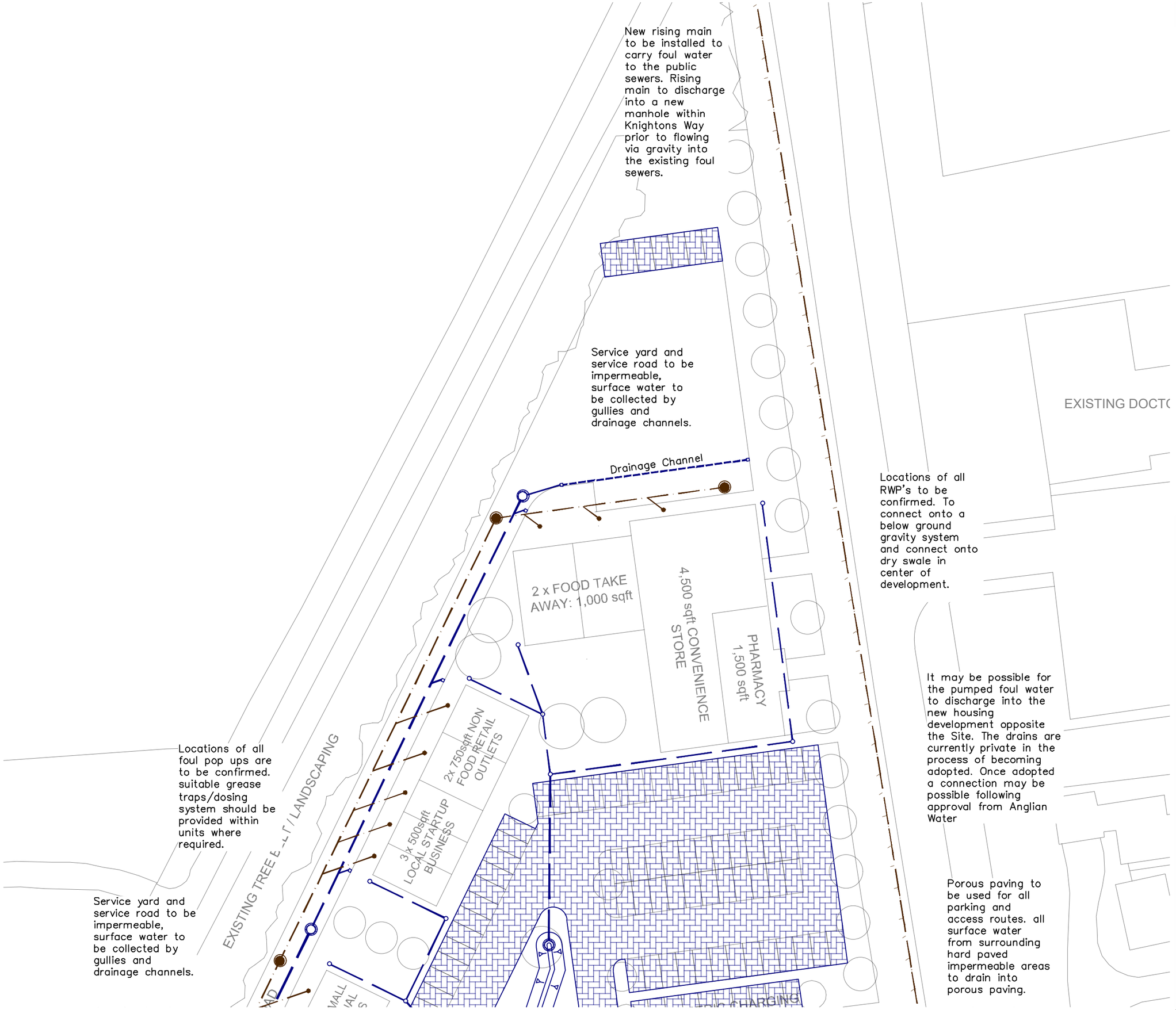
Whilst the information in this report is based on the presumption that proposed development obtains planning permission, nothing in this report confirms that planning permission will be granted or that Anglian Water will be bound to carry out the works/proposals contained within this report.

No liability whatsoever, including liability for negligence is accepted by Anglian Water or its partners, employees or agents, for any error or omission, or for the results obtained from the use of this report and/or its content. Furthermore, in no event will any of those parties be liable to the applicant or any third party for any decision made or action taken as a result of reliance on this report.

This report is valid for the date printed and the enquirer is advised to resubmit their request for an up to date report should there be a delay in submitting any subsequent application for water supply/sewer connection(s).

APPENDIX D

Proposed Drainage Plan



GENERAL NOTES

KEY:

Surface Water

- Pipe Runs =
- PPIC =
- PCC Manhole =
- Road Gully =
- Drainage Channel =
- Dry Swale =
- Petrol Interceptor =
- Porous Paving =

Foul Water

- Pipe Runs =
- PPIC =
- PCC Manhole =
- Rising main =

Rev.	Description	By	Chkd.	Date
P2	Drainage amended to suit revised Site plan	CB	DJR	02/09/20
P1	Initial Issue	CB	DJR	08/07/20

ISO 9001 REGISTERED FIRM

BRIDGES POUND
CONSULTING ENGINEERS

701 The Chandlery
50 Westminster Bridge Road
London SE1 7QY
Tel: 020 7953 7561

Bridge House
141 Albany Road
Coventry CV5 6ND
Tel: 02477 719547

Pennyhole West Office 1
Wharfebank Mills
Ilkley Road, Otley
LS21 3JP
Tel: 0113 274 0721

Email: general@bridgespound.co.uk

Client: Dallas Burston

Project: Brixworth Local Services

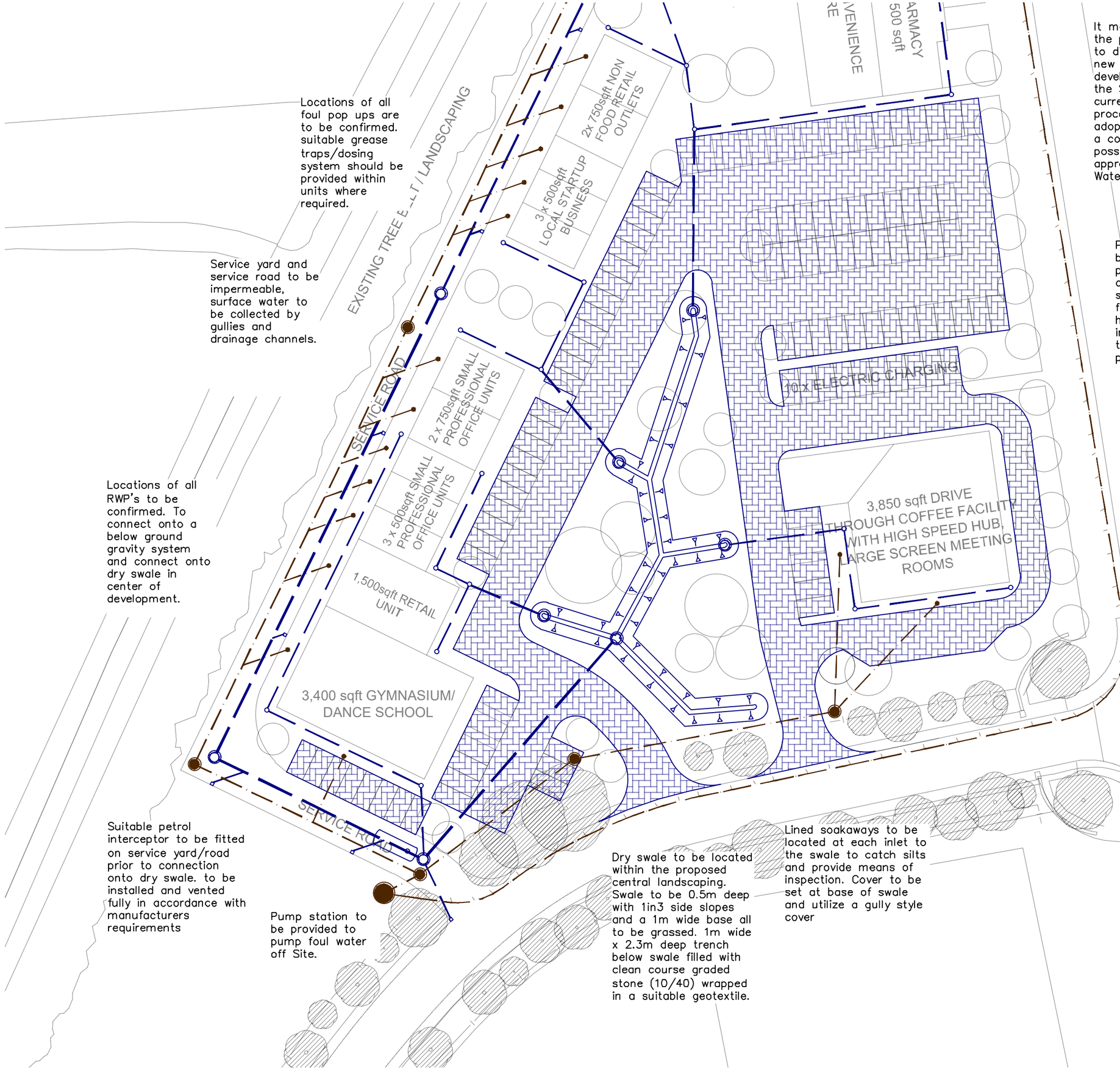
Title: Schematic Drainage Layout Sheet 1 of 2

Drawing Status: Information

Date: July 2020 | Drawn: CB | Chkd: DJR

Scale: 1:500 | A3 | BPL Ref: Y539

Project - Originator - Zone - Level - Type - Discipline - Number: Y539 - 00 - XX - XX - DR - C - 0021 | Rev: P2



GENERAL NOTES

KEY:

Surface Water

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Rev.	Description	By	Chkd.	Date
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ISO 9001 REGISTERED FIRM

BRIDGES POUND
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701 The Chandlery
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Ilkley Road, Otley
LS21 3JP
Tel: 0113 274 0721

Email: general@bridgespound.co.uk

Client: Dallas Burston

Project: Brixworth Local Services

Title: Schematic Drainage Layout Sheet 2 of 2

Drawing Status: Information

Date: July 2020 | Drawn: CB | Chkd: DJR

Scale: 1:500 | A3 | BPL Ref: Y539

Project - Originator - Zone - Level - Type - Discipline - Number: Y539 - 00 - XX - XX - DR - C - 0022 | Rev: P2

BRIDGES POUND
CONSULTING ENGINEERS

APPENDIX E

MicroDrainage Calculations

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Chris Brown
Site name:	Brixworth Local Services
Site location:	Brixworth

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:	52.31777° N
Longitude:	0.9042° W
Reference:	3802882397
Date:	Jul 02 2020 15:36

Runoff estimation approach

IH124

Site characteristics

Total site area (ha): 1.2

Methodology

Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	4	4
HOST class:	N/A	N/A
SPR/SPRHOST:	0.47	0.47

Hydrological characteristics

	Default	Edited
SAAR (mm):	633	633
Hydrological region:	5	5
Growth curve factor 1 year:	0.87	0.87
Growth curve factor 30 years:	2.45	2.45
Growth curve factor 100 years:	3.56	3.56
Growth curve factor 200 years:	4.21	4.21

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 ≤ 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):	5.15	5.15
1 in 1 year (l/s):	4.48	4.48
1 in 30 years (l/s):	12.62	12.62
1 in 100 year (l/s):	18.33	18.33
1 in 200 years (l/s):	21.68	21.68

Summary of Results for 200 year Return Period (+40%)

Half Drain Time : 10 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	9.667	0.097	117.9	115.9	O K
30 min Summer	9.679	0.109	117.9	129.6	O K
60 min Summer	9.669	0.099	117.9	117.6	O K
120 min Summer	9.638	0.068	117.9	81.2	O K
180 min Summer	9.620	0.050	117.3	59.3	O K
240 min Summer	9.612	0.042	99.6	50.2	O K
360 min Summer	9.602	0.032	76.0	38.7	O K
480 min Summer	9.596	0.026	61.9	31.6	O K
600 min Summer	9.592	0.022	52.5	26.7	O K
720 min Summer	9.589	0.019	45.4	23.1	O K
960 min Summer	9.585	0.015	36.0	18.3	O K
1440 min Summer	9.581	0.011	26.5	13.1	O K
2160 min Summer	9.578	0.008	18.3	9.1	O K
2880 min Summer	9.576	0.006	14.7	7.2	O K
4320 min Summer	9.574	0.004	10.0	4.9	O K
5760 min Summer	9.573	0.003	7.7	3.8	O K
7200 min Summer	9.573	0.003	6.5	3.3	O K
8640 min Summer	9.573	0.003	6.5	3.1	O K
10080 min Summer	9.572	0.002	5.3	2.6	O K
15 min Winter	9.683	0.113	117.9	134.0	O K
30 min Winter	9.692	0.122	117.9	145.4	O K
60 min Winter	9.673	0.103	117.9	122.4	O K
120 min Winter	9.626	0.056	117.9	66.9	O K
180 min Winter	9.612	0.042	98.4	49.5	O K
240 min Winter	9.604	0.034	80.8	40.5	O K
360 min Winter	9.595	0.025	59.5	30.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	194.556	0.0	14
30 min Summer	125.636	0.0	22
60 min Summer	76.852	0.0	40
120 min Summer	45.313	0.0	70
180 min Summer	33.234	0.0	98
240 min Summer	26.593	0.0	128
360 min Summer	19.268	0.0	188
480 min Summer	15.229	0.0	248
600 min Summer	12.644	0.0	308
720 min Summer	10.838	0.0	370
960 min Summer	8.466	0.0	490
1440 min Summer	5.950	0.0	732
2160 min Summer	4.163	0.0	1080
2880 min Summer	3.231	0.0	1440
4320 min Summer	2.266	0.0	2136
5760 min Summer	1.770	0.0	2944
7200 min Summer	1.471	0.0	3576
8640 min Summer	1.270	0.0	4392
10080 min Summer	1.126	0.0	5024
15 min Winter	194.556	0.0	15
30 min Winter	125.636	0.0	24
60 min Winter	76.852	0.0	42
120 min Winter	45.313	0.0	70
180 min Winter	33.234	0.0	98
240 min Winter	26.593	0.0	130
360 min Winter	19.268	0.0	188

Summary of Results for 200 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
480 min Winter	9.590	0.020	47.7	23.9	O K
600 min Winter	9.587	0.017	39.5	19.9	O K
720 min Winter	9.584	0.014	33.6	17.3	O K
960 min Winter	9.581	0.011	26.5	13.2	O K
1440 min Winter	9.578	0.008	19.5	9.6	O K
2160 min Winter	9.576	0.006	13.6	6.6	O K
2880 min Winter	9.574	0.004	10.0	5.0	O K
4320 min Winter	9.573	0.003	7.7	3.6	O K
5760 min Winter	9.573	0.003	6.5	3.1	O K
7200 min Winter	9.572	0.002	5.3	2.5	O K
8640 min Winter	9.572	0.002	4.1	2.1	O K
10080 min Winter	9.572	0.002	4.1	1.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
480 min Winter	15.229	0.0	246
600 min Winter	12.644	0.0	308
720 min Winter	10.838	0.0	374
960 min Winter	8.466	0.0	490
1440 min Winter	5.950	0.0	732
2160 min Winter	4.163	0.0	1056
2880 min Winter	3.231	0.0	1472
4320 min Winter	2.266	0.0	2208
5760 min Winter	1.770	0.0	2912
7200 min Winter	1.471	0.0	3464
8640 min Winter	1.270	0.0	4296
10080 min Winter	1.126	0.0	5168

Rainfall Details

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	200	Cv (Summer)	0.750
FEH Rainfall Version	2013	Cv (Winter)	0.840
Site Location	GB 475123 269447	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.536

Time (mins) From:	To:	Area (ha)
0	4	0.536

Model Details

Storage is Online Cover Level (m) 10.000

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.21386	Width (m)	63.0
Membrane Percolation (mm/hr)	1000	Length (m)	63.0
Max Percolation (l/s)	1102.5	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	9.570	Membrane Depth (m)	0

Summary of Results for 200 year Return Period (+40%)

Half Drain Time : 73 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	9.804	2.604	25.0	141.4	Flood Risk
30 min Summer	9.892	2.692	26.9	171.6	Flood Risk
60 min Summer	9.928	2.728	27.7	185.7	Flood Risk
120 min Summer	9.926	2.726	27.6	185.0	Flood Risk
180 min Summer	9.911	2.711	27.3	178.8	Flood Risk
240 min Summer	9.888	2.688	26.8	170.3	Flood Risk
360 min Summer	9.835	2.635	25.7	151.5	Flood Risk
480 min Summer	9.779	2.579	24.5	133.9	Flood Risk
600 min Summer	9.725	2.525	23.4	118.8	Flood Risk
720 min Summer	9.673	2.473	22.3	106.1	O K
960 min Summer	9.576	2.376	20.2	87.2	O K
1440 min Summer	9.141	1.941	16.3	64.8	O K
2160 min Summer	8.565	1.365	12.4	45.6	O K
2880 min Summer	8.221	1.021	10.1	34.1	O K
4320 min Summer	7.822	0.622	7.5	20.8	O K
5760 min Summer	7.602	0.402	6.0	13.4	O K
7200 min Summer	7.463	0.263	5.1	8.8	O K
8640 min Summer	7.365	0.165	4.4	5.5	O K
10080 min Summer	7.295	0.095	3.9	3.2	O K
15 min Winter	9.859	2.659	26.2	159.6	Flood Risk
30 min Winter	9.951	2.751	28.1	194.8	Flood Risk
60 min Winter	9.992	2.792	29.0	212.5	Flood Risk
120 min Winter	9.984	2.784	28.8	208.7	Flood Risk
180 min Winter	9.959	2.759	28.3	198.3	Flood Risk
240 min Winter	9.926	2.726	27.6	184.9	Flood Risk
360 min Winter	9.852	2.652	26.0	157.3	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	194.556	0.0	17
30 min Summer	125.636	0.0	31
60 min Summer	76.852	0.0	54
120 min Summer	45.313	0.0	86
180 min Summer	33.234	0.0	120
240 min Summer	26.593	0.0	154
360 min Summer	19.268	0.0	220
480 min Summer	15.229	0.0	286
600 min Summer	12.644	0.0	348
720 min Summer	10.838	0.0	408
960 min Summer	8.466	0.0	530
1440 min Summer	5.950	0.0	768
2160 min Summer	4.163	0.0	1128
2880 min Summer	3.231	0.0	1500
4320 min Summer	2.266	0.0	2208
5760 min Summer	1.770	0.0	2944
7200 min Summer	1.471	0.0	3672
8640 min Summer	1.270	0.0	4408
10080 min Summer	1.126	0.0	5136
15 min Winter	194.556	0.0	17
30 min Winter	125.636	0.0	31
60 min Winter	76.852	0.0	58
120 min Winter	45.313	0.0	92
180 min Winter	33.234	0.0	130
240 min Winter	26.593	0.0	166
360 min Winter	19.268	0.0	236

Summary of Results for 200 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
480 min Winter	9.775	2.575	24.4	132.8	Flood Risk
600 min Winter	9.702	2.502	22.9	112.8	Flood Risk
720 min Winter	9.631	2.431	21.4	97.1	O K
960 min Winter	9.479	2.279	18.5	76.1	O K
1440 min Winter	8.783	1.583	13.9	52.9	O K
2160 min Winter	8.218	1.018	10.1	34.0	O K
2880 min Winter	7.900	0.700	8.0	23.4	O K
4320 min Winter	7.557	0.357	5.7	11.9	O K
5760 min Winter	7.375	0.175	4.5	5.8	O K
7200 min Winter	7.265	0.065	3.7	2.2	O K
8640 min Winter	7.245	0.045	3.3	1.5	O K
10080 min Winter	7.240	0.040	2.9	1.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
480 min Winter	15.229	0.0	302
600 min Winter	12.644	0.0	364
720 min Winter	10.838	0.0	426
960 min Winter	8.466	0.0	542
1440 min Winter	5.950	0.0	792
2160 min Winter	4.163	0.0	1148
2880 min Winter	3.231	0.0	1504
4320 min Winter	2.266	0.0	2244
5760 min Winter	1.770	0.0	2944
7200 min Winter	1.471	0.0	3672
8640 min Winter	1.270	0.0	4248
10080 min Winter	1.126	0.0	5120

Rainfall Details

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	200	Cv (Summer)	0.750
FEH Rainfall Version	2013	Cv (Winter)	0.840
Site Location	GB 475123 269447	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.432

Time (mins) From:	To:	Area (ha)
0	4	0.432

Model Details

Storage is Online Cover Level (m) 10.000

Dry Swale Structure

Infiltration Coefficient Base (m/hr)	0.21386	Trench Length (m)	111.3
Infiltration Coefficient Side (m/hr)	0.21386	Trench Infiltration Side (m/hr)	0.21386
Safety Factor	2.0	Trench Porosity	0.30
Porosity	1.00	Side Slope (1:X)	3.0
Invert Level (m)	7.200	Slope (1:X)	0.0
Trench Height (m)	2.300	Cap Volume Depth (m)	0.000
Trench Width (m)	1.0	Cap Infiltration Depth (m)	0.000

APPENDIX F

Infiltration Results

Soil Infiltration Rate Calculations

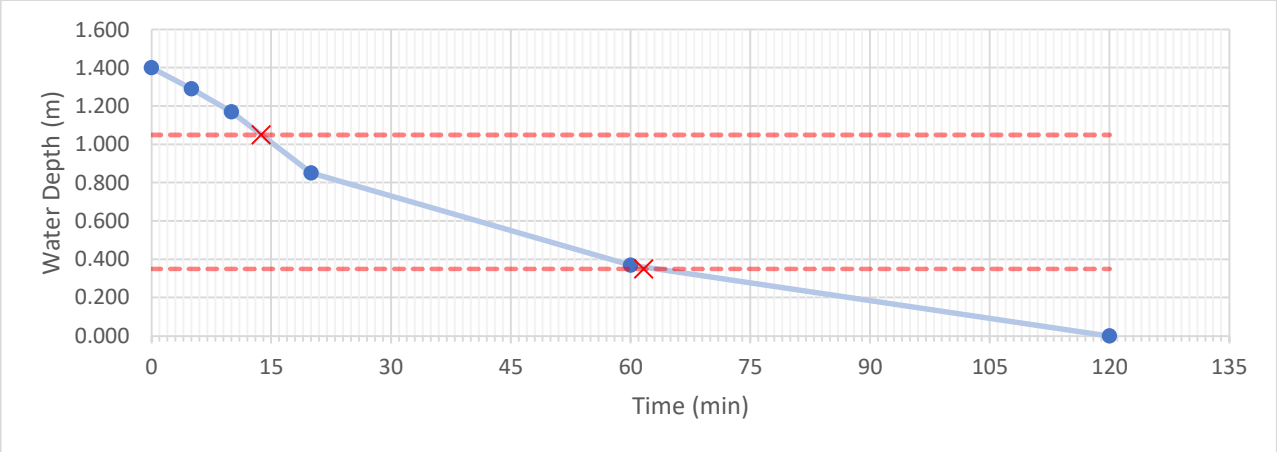
Site Brixworth Local Services
Date 16/03/2017 Job No. Y539
Location 1 By CB
Test No. 1 Weather unknown

On site pit dimensions

Length = 2.60 m
Width = 0.60 m
Depth = 2.80 m

Test Results

Time (min)	Meassurement	Water Depth (m)
0	1.400	1.400
5	1.510	1.290
10	1.630	1.170
20	1.950	0.850
60	2.430	0.370
120	2.800	0.000



Soil Infiltration Rate, F = $V_{p75-25} / a_{p50} \times t_{p75-25}$

V_{p75-25} = 1.092

a_{p50}= 6.04

t_{p75-25}= 2875

Soil Infiltration Rate, F = **6.28851E-05 m/s**

0.226386409 m/hr

Soil Infiltration Rate Calculations

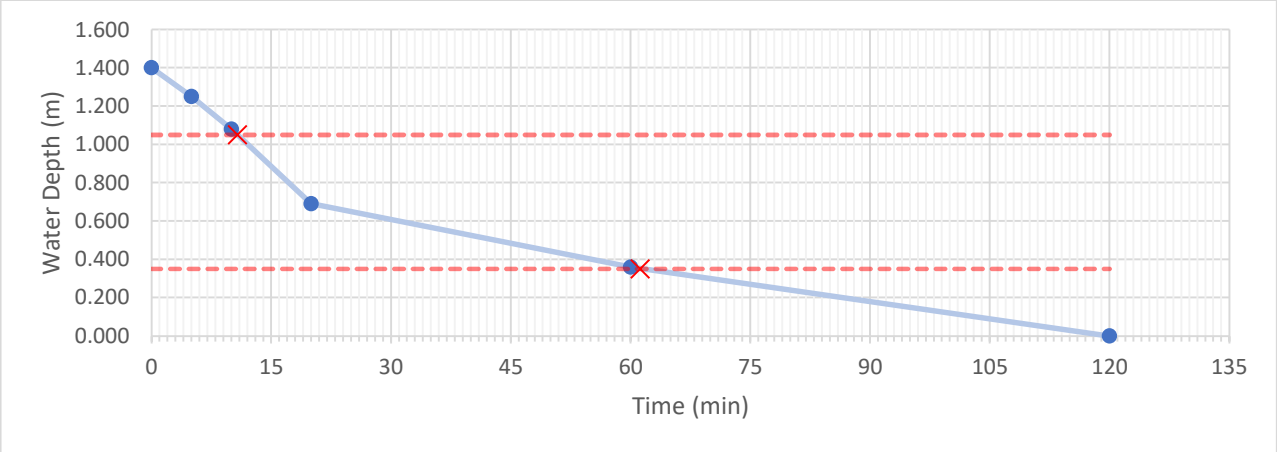
Site Brixworth Local Services
Date 16/03/2017 Job No. Y539
Location 2 By CB
Test No. 1 Weather unknown

On site pit dimensions

Length = 2.50 m
Width = 0.60 m
Depth = 2.80 m

Test Results

Time (min)	Meassurement	Water Depth (m)
0	1.400	1.400
5	1.550	1.250
10	1.720	1.080
20	2.110	0.690
60	2.440	0.360
120	2.800	0.000



Soil Infiltration Rate, F = $V_{p75-25} / a_{p50} \times t_{p75-25}$

V_{p75-25} = 1.05

a_{p50}= 5.84

t_{p75-25}= 3026.573427

Soil Infiltration Rate, F = **5.94053E-05 m/s**

0.213859102 m/hr

Soil Infiltration Rate Calculations

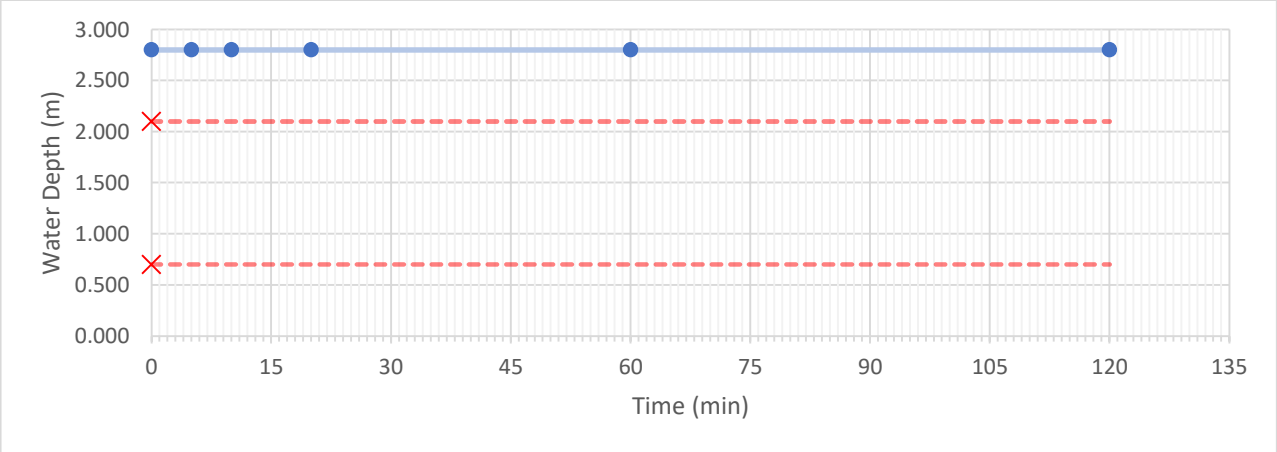
Site Brixworth Local Services
Date 16/03/2017 Job No. Y539
Location 3 By CB
Test No. 1 Weather unknown

On site pit dimensions

Length = 2.90 m
Width = 0.60 m
Depth = 2.80 m

Test Results

Time (min)	Meassurement	Water Depth (m)
0	0.000	2.800
5	0.000	2.800
10	0.000	2.800
20	0.000	2.800
60	0.000	2.800
120	0.000	2.800



Soil Infiltration Rate, F = $V_{p75-25} / a_{p50} \times t_{p75-25}$

V_{p75-25} = 2.436

a_{p50}= 11.54

t_{p75-25}= #DIV/0!

Soil Infiltration Rate, F = **Infiltration rate too hight to obtain an accurate infiltration rate**

Soil Infiltration Rate Calculations

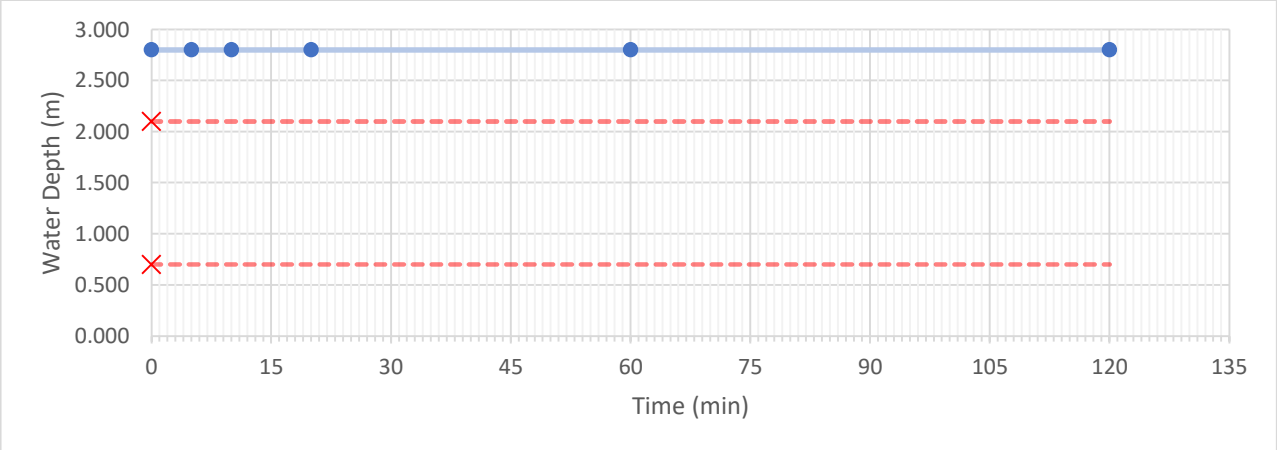
Site Brixworth Local Services
Date 16/03/2017 Job No. Y539
Location 4 By CB
Test No. 1 Weather unknown

On site pit dimensions

Length = 2.90 m
Width = 0.60 m
Depth = 2.80 m

Test Results

Time (min)	Meassurement	Water Depth (m)
0	0.000	2.800
5	0.000	2.800
10	0.000	2.800
20	0.000	2.800
60	0.000	2.800
120	0.000	2.800



Soil Infiltration Rate, F = $V_{p75-25} / a_{p50} \times t_{p75-25}$

V_{p75-25} = 2.436

a_{p50}= 11.54

t_{p75-25}= #DIV/0!

Soil Infiltration Rate, F = **Infiltration rate too hight to obtain an accurate infiltration rate**

Soil Infiltration Rate Calculations

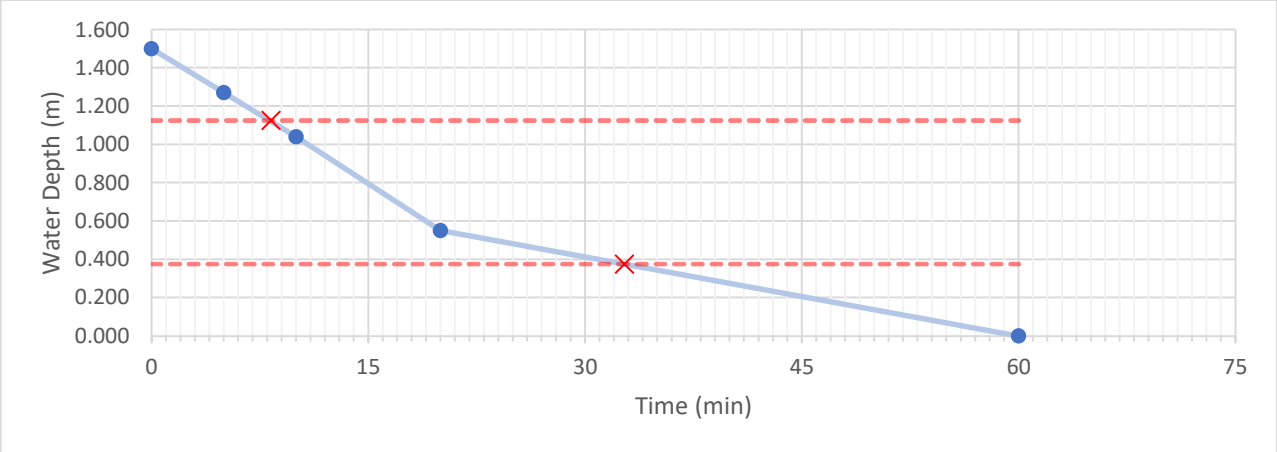
Site Brixworth Local Services
Date 16/03/2017 Job No. Y539
Location 5 By CB
Test No. 1 Weather unknown

On site pit dimensions

Length = 2.80 m
Width = 0.60 m
Depth = 3.00 m

Test Results

Time (min)	Meassurement	Water Depth (m)
0	1.500	1.500
5	1.730	1.270
10	1.960	1.040
20	2.450	0.550
60	3.000	0.000



Soil Infiltration Rate, F = $V_{p75-25} / a_{p50} \times t_{p75-25}$

V_{p75-25} = 1.26

a_{p50}= 6.78

t_{p75-25}= 1467.717996

Soil Infiltration Rate, F = **0.000126619 m/s**

0.455827721 m/hr

BRIDGES POUND
CONSULTING ENGINEERS

APPENDIX G

Porous Paving

Brett Landscaping and
Building Products
Sileby Road
Barrow upon Soar
Loughborough
Leicestershire
LE12 8LX

Customer Service Center
Tel 0845 6080 570
Fax 0845 6080 575

General Administration
Tel 01509 817 187
Fax 01509 817 197

PermCalc

PERMEABLE PAVEMENT DESIGN SUGGESTION

PROJECT: Brixworth Local Services
Land off Northampton Road
Brixworth
Northamptonshire
NN6 9DQ

CONTACT: Bridges Pound
TEL NO: 01132740721
ADDRESS: Pennyhole West Office 1
Wharfebank Mills
Ilkley Road, Otley
West Yorkshire
LS21 3JP

Region: England

DATE: 8 Jul 2020 11:26 AM

Notes:-

This design suggestion is given on the basis that the recipient has read, understood and accepts the disclaimer at the end ofthis document.

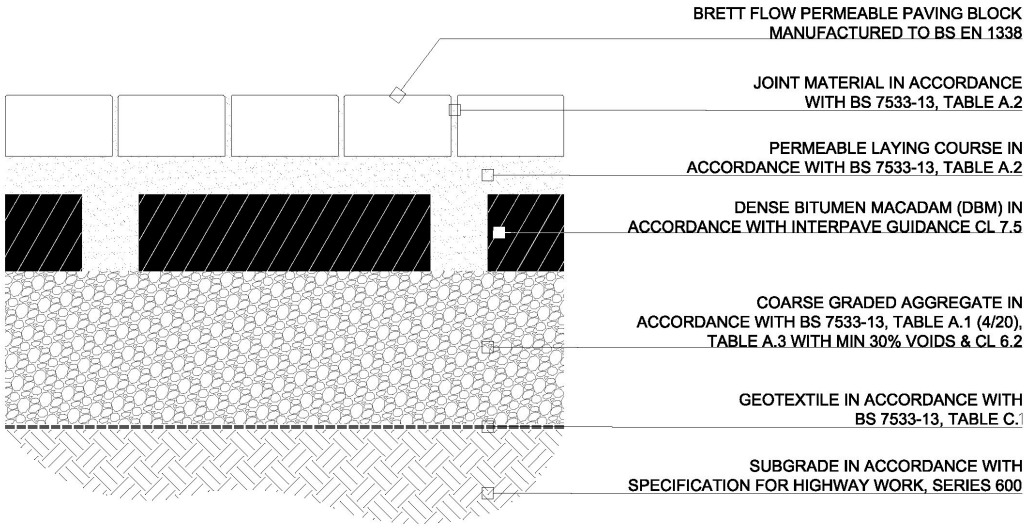
Directors: W. J. Brett J.Gilbert
Registered Office: 150 Aldersgate Street, London, EC1A 4AB
Brett Landscaping and Building Products is a trading name of Brett Landscaping Limited
Registered Company No: 227266

Suggested Pavement Solution

Permeable Pavement Design Suggestion

Alpha Flow	80 mm
Laying Course	50 mm
Dense Bitumen Macadam	150 mm
Coarse Graded Aggregate	150 mm
Lower Geotextile	Yes

System A with DBM



*INTERPAVE GUIDANCE '*PERMEABLE PAVEMENTS GUIDE TO THE DESIGN, CONSTRUCTION AND MAINTENANCE OF CONCRETE BLOCK PERMEABLE PAVEMENTS'* EDITION 6

Summary of pavement requirements

Depth needed for Structural design	300 mm
Depth needed for hydraulic design	10 mm
Is there spare hydraulic capacity	Yes
Spare hydraulic depth	140 mm
Additional catchment area to fully ultilise spare hydraulic storage capacity	7928 m²

Summary of hydraulic requirements

Available hydraulic storage	356,760 litres
Hydraulic storage require	7,820 litres
Spare hydraulic storage	348,940 litres
Half empty time	0.00 hours

The time to half empty is zero. This is because the water temporary stored in the sub base will infiltrate into sub grade or discharge from the pavement, at a rate greater than the inflow of water from the pavement surface and any others areas that may discharge into the pavement, for the design rainfall characteristics.

Notes

The above calculations were based upon a level site.

