



RIDGE

PLANNING APPLICATION
CONSULTATION
LLFA COMMENTS AND
RESPONSES

EASTLEIGH BOROUGH COUNCIL

25/06/2024

**PLANNING APPLICATION CONSULTATION
LLFA RESPONSES**

EASTLEIGH BOROUGH COUNCIL

June 2024

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1. COMMENTS AND ACTIONS REQUIRED:

1.1. Comment 1

Q: “We note that there are several watercourse crossings and while these are acceptable in principal, the culvert sizing may change during the ordinary watercourse consent process where this will be reviewed in detail.”

A: These calculations are attached in Appendix A down below.

1.2. Comment 2

Q: “We also note the location of The Causeway within the flood zone however this will need to be reviewed by the Environment Agency in relation to fluvial impacts as opposed to surface water.”

A: The form has been completed and will be in the Appendix B.

1.3. Comment 3

Q: “The Preliminary Water Management Strategy Plan (G277/21) within the Drainage Strategy lists the previously agreed discharge rates and storage volumes for these basins. Whole the discharge volumes are comparable, there are some significant differences in volume requirements at the 1:100 = climate change and there is concern that some basins are not of sufficient size. Please provide further information / evidence in relaying to this.”

A: The below extract from InfoDrainage demonstrates that the ponds have sufficient capacity for a 1:100 year storm with an additional 45% climate change allowance. A further allowance of 10% for urban creep has been included.

Stormwater Control	Storm Event	Max. US Level (m)	Max. DS Level (m)	Max. Inflow (L/s)	Max. Resident Volume (m³)	Max. Flooded Volume (m³)	Total Lost Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Percentage Available (%)	Status
POND N	FSR: 100 years: +45 %: 480 mins: Winter	17.387	17.387	300.3	2572.774	0.000	0.000	46.0	2128.815	2	OK
POND M	FSR: 100 years: +45 %: 360 mins: Winter	18.970	18.969	139.8	932.532	0.000	0.000	17.7	612.750	4	OK
POND EM	FSR: 100 years: +45 %: 480 mins: Winter	20.571	20.570	133.4	1169.475	0.000	0.000	16.3	770.321	3	OK

1.4. Comment 4

Q: “In addition, there is no information regarding the outfalls of the basins and would expect that the downstream network is sufficiently details to show the discharge point into the relevant watercourse, methodology for flow control and any interconnecting pipework.

A: Looking at the DS and the InfoDrainage model, there is one interlink between the Swale and Pond F, MH_CF13 – Pipe SW1.011. Reviewing the connection results in Info Drainage, they are large enough and do not causing any flooding in the critical storm periods. The SuDs Features implemented in the design all Discharge into 4 streams Hearts stream – Toll Brook – Foxwood Stream – Quobleigh stream. The outlets of the ponds are restricted to: Outfall H = 70.8L/s – Outfall G = 41.5 L/S – Swale = 5 L/S – Outfall F = 26.9 L/S – Outfall E = 32.3 L/S.

The images below show the calculation results for the interlink between the swale and pond F.

Junction	Storm Event	Cover Level (m)	Invert Level (m)	Max. Level (m)	Max. Inflow (L/s)	Max. Resident Volume (m³)	Max. Flooded Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Status
MH_CH47	FSR: 100 years: +45 %: 15 mins: Winter	22.990	18.921	20.240	642.1	1.492	0.000	659.0	475.780	Surcharged
OUTFALL_H	FSR: 100 years: +45 %: 960 mins: Summer	17.862	16.662	17.145	70.7	0.546	0.000	70.7	5273.003	OK
OUTFALL_F	FSR: 100 years: +45 %: 360 mins: Winter	17.770	16.570	16.940	26.9	0.419	0.000	26.9	745.944	OK
OUTFALL_G	FSR: 100 years: +0 %: 240 mins: Winter	20.563	19.363	19.791	41.5	0.485	0.000	41.5	933.870	OK
MH_CH50	FSR: 100 years: +45 %: 15 mins: Winter	20.830	18.036	18.645	1333.7	0.689	0.000	1293.8	919.625	OK
MH_CH36	FSR: 100 years: +45 %: 360 mins: Winter	25.710	23.750	24.814	18.1	1.203	0.000	17.0	664.076	Surcharged
MH_CH37	FSR: 100 years: +45 %: 15 mins: Winter	25.770	23.681	23.912	189.7	0.589	0.000	184.3	102.352	OK
MH_CH41	FSR: 100 years: +45 %: 360 mins: Winter	22.610	20.188	20.725	8.0	0.607	0.000	7.7	287.590	Surcharged
MH_CH31	FSR: 100 years: +45 %: 480 mins: Winter	22.430	19.470	20.364	10.8	1.012	0.000	10.7	555.323	Surcharged
MH_CG19	FSR: 100 years: +45 %: 120 mins: Winter	27.580	25.054	27.209	15.2	2.437	0.000	12.4	156.837	Surcharged
MH_CG20	FSR: 100 years: +45 %: 30 mins: Winter	27.430	24.600	24.662	12.5	0.070	0.000	12.4	36.413	OK
MH_CG29	FSR: 100 years: +45 %: 120 mins: Winter	25.619	23.119	25.087	27.4	2.226	0.000	24.2	289.424	Surcharged
MH_CF2	FSR: 100 years: +45 %: 15 mins: Winter	26.210	23.453	23.543	59.9	0.102	0.000	59.2	28.354	OK
MH_CF1	FSR: 100 years: +45 %: 480 mins: Winter	26.150	23.545	24.766	1.2	1.380	0.000	0.8	38.330	Surcharged
MH_CG32	FSR: 100 years: +45 %: 15 mins: Winter	25.970	21.530	22.882	326.3	6.635	0.000	429.8	258.280	Surcharged
MH_CF13	FSR: 100 years: +45 %: 1440 mins: Winter	21.720	19.536	20.784	5.4	1.411	0.000	4.3	659.374	Surcharged

Connection	Storm Event	Connection Type	From	To	Upstream Cover Level (m)	Max. US Water Level (m)	Discharge Volume (m³)	Max. Velocity (m/s)	Flow / Capacity	Max. Flow (L/s)	Status
SW9.001	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CH36	MH_CH37	25.710	24.418	21.875	0.9	0.03	17.6	Surcharged
SW9.000	FSR: 100 years: +0 %: 15 mins: Winter	Pipe	GG_H2	MH_CH36	27.826	24.319	26.983	0.5	0.08	52.3	OK
SW10.000	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	GG_H4	MH_CH41	22.618	20.523	9.168	0.5	0.08	15.8	OK
SW 12.001	FSR: 100 years: +45 %: 15 mins: Summer	Pipe	MH_CH31	MH_CH47	22.430	19.901	8.971	0.7	0.04	22.9	OK
SW 12.000	FSR: 100 years: +45 %: 960 mins: Winter	Pipe	GG_H5	MH_CH31	22.085	20.312	1081.362	0.3	0.03	11.3	Surcharged
SW5.000	FSR: 100 years: +0 %: 15 mins: Summer	Pipe	GG_G6	MH_CG19	27.877	25.622	20.745	0.5	0.18	48.4	OK
SW5.001	FSR: 100 years: +45 %: 30 mins: Winter	Pipe	MH_CG19	MH_CG20	27.580	25.949	36.870	1.0	0.04	12.5	Surcharged
SW6.000	FSR: 30 years: +0 %: 30 mins: Summer	Pipe	GG_G5	MH_CG29	26.056	24.594	67.354	0.7	0.17	46.8	OK
SW6.001	FSR: 30 years: +0 %: 480 mins: Winter	Pipe	MH_CG29	MH_CG28	25.619	24.511	438.837	1.6	0.08	25.3	Surcharged
SW1.002	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CF2	MH_CF3	26.210	23.543	28.354	1.3	0.09	59.2	OK
SW1.000	FSR: 100 years: +0 %: 15 mins: Summer	Pipe	GG_F8	MH_CF1	26.085	24.198	1.748	0.5	0.61	8.9	Surcharged
SW1.001	FSR: 100 years: +45 %: 480 mins: Winter	Pipe	MH_CF1	MH_CF2	26.150	24.766	38.313	0.6	0	0.8	Surcharged
SW5.013	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CG32	MH_CG34	25.970	22.882	253.654	1.5	0.9	429.8	Surcharged
SW1.010	FSR: 30 years: +0 %: 1440 mins: Summer	Pipe	Swale	MH_CF13	21.381	20.024	650.736	0.2	0.11	21.4	Surcharged
SW1.011	FSR: 100 years: +45 %: 60 mins: Summer	Pipe	MH_CF13	Pond_F	21.720	20.186	25.472	0.5	0.01	4.3	Surcharged

1.5. Comment 5

Q: It is also unclear whether the levels of the basins are at suitable depth to allow for the future development to connect without requiring additional attenuation within the different plots. Additional narrative should be provided to demonstrate that the levels are appropriate for future development."

A: We do have the Topo for the areas at the Outfalls and can confirm they are suitable. These will be surveyed in further detail during Stage 2 design development. As per "Comment 3", appropriate climate change and urban creep allowances have been accounted for in the design of the basins. The Drainage Strategy calcs show all the ponds, swales and geocellular tanks have an average of 16.45% spare capacity in the event of a critical storm. It might be reasonable making the GG tanks larger to allow more storage in case of future developments, but regarding the proposed development catchments, assumptions and allowances are okay.

Critical Storm Per Item

Stormwater Control	Storm Event	Max. US Level (m)	Max. DS Level (m)	Max. Inflow (L/s)	Max. Resident Volume (m³)	Max. Flooded Volume (m³)	Total Lost Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Percentage Available (%)	Status
Pond_F	FSR: 100 years: +45 %: 360 mins: Winter	18.228	18.228	93.1	529.038	0.000	0.000	26.9	746.491	47	OK
Swale	FSR: 100 years: +45 %: 1440 mins: Winter	20.784	20.784	66.6	1977.958	0.000	0.000	5.4	660.572	22	OK
POND_G	FSR: 100 years: +45 %: 960 mins: Winter	21.656	21.656	126.8	2128.422	0.000	0.000	41.5	3790.386	9	OK
POND_H	FSR: 100 years: +45 %: 960 mins: Winter	18.364	18.364	173.0	2270.180	0.000	0.000	70.7	5799.208	46	OK
GG_H2	FSR: 100 years: +45 %: 360 mins: Winter	24.814	24.814	146.3	951.143	0.000	0.000	18.1	671.607	11	OK
GG_H4	FSR: 100 years: +45 %: 360 mins: Winter	20.726	20.726	62.0	406.546	0.000	0.000	8.0	291.164	8	OK
GG_H5	FSR: 100 years: +45 %: 480 mins: Winter	20.365	20.365	84.9	719.104	0.000	0.000	10.8	556.687	5	OK
GG_G6	FSR: 100 years: +45 %: 120 mins: Winter	27.209	27.209	112.8	251.906	0.000	0.000	15.2	162.044	0	OK
GG_G5	FSR: 100 years: +45 %: 120 mins: Winter	25.098	25.098	199.0	443.439	0.000	0.000	27.4	292.522	8	OK
GG_F8	FSR: 100 years: +45 %: 480 mins: Winter	24.766	24.766	8.2	74.431	0.000	0.000	1.2	39.799	8	OK
GG_G5 (1)	FSR: 100 years: +45 %: 480 mins: Winter	25.026	25.026	60.3	522.218	0.000	0.000	7.2	368.461	17	OK

1.6. Comment 6

Q: Given the potential risk associated with the size and connectivity of the basins, we would recommend that the information is provided prior to granting planning but the points could be addressed by condition if necessary.

A: Please advise if the preceding responses do not satisfy queries.

APPENDIX A

WATER COURSE CALCULATION



RIDGE

**SURFACE WATER FLOW
ANALYSIS
FOXWOOD WATERCOURSE**

ONE HORTON HEATH

EASTLEIGH BOROUGH COUNCIL
February 2023

SURFACE WATER FLOW ANALYSIS FOXWOOD WATERCOURSE



SURFACE WATER FLOW ANALYSIS FOXWOOD WATERCOURSE ONE HORTON HEATH

EASTLEIGH BOROUGH COUNCIL

February 2023

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SURFACE WATER FLOW ANALYSIS FOXWOOD WATERCOURSE

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SECTION 1

INTRODUCTION

SURFACE WATER FLOW ANALYSIS

FOXWOOD WATERCOURSE

1. INTRODUCTION

1.1. Appointment and Brief

This surface water flow analysis has been prepared on behalf of Eastleigh Borough Council for the proposed development at One Horton Heath, approx. postcode SO50 7BZ (hereby referred to as the 'Application Site'). This report has been prepared for the benefit of the Hampshire County Council Lead Local Flood Authority and seeks to quantify existing flows within the Foxwood Watercourse and prove that the proposed bridge/crossing at the proposed local centre shall not impinge on the capacity of the watercourse.

The purpose of this document is to analyse existing flows within the Foxwood Watercourse. Catchment areas shall be defined, as well as existing, contributing land uses. An appropriate allowance for baseflow from groundwater shall be included in the calculations as will a determined allowance for climate change. This report shall demonstrate that the proposed bridge/crossing shall not affect the existing watercourse capacity.

This report aims to demonstrate that existing flows shall not be detrimentally affected and that flood risk shall not increase onsite, this shall be demonstrated as follows:

- Provide calculations to quantify the likely flow rate through the watercourse for the design peak return period storm of the development, with a suitable allowance for climate change.
- Analyse background mapping for the area to determine the nature of surface water flows and to determine the level within the existing watercourse.
- Model the flow capacity of the existing watercourse and compare this against the proposed cross sectional area of the bridge/crossing as required.

The proposed flow analysis outlined herein is subject to further detailed analysis at detailed design stage and once further topographical information is received.

1.2. Aims and Objectives

This flow analysis has been prepared with reference to the following requirements:

- The flow analysis must:
 - Ensure that flood risk to the Application Site and surrounding area is not increased over the lifetime of the Proposed Development.
 - Conform with all relevant National and Local flood risk policies.
 - Ensure that existing flows and flood risk are properly defined, quantified and mitigated to ensure that the development is kept safe for the entirety of its design life with respect to flood risk with a suitable allowance for climate change. As well as this the analysis should ensure that the capacity of the existing watercourse isn't affected through the proposals.
- The flow analysis should:
 - Quantify the existing drainage characteristics of the watercourse as far as is practical.
 - Look for opportunities to provide a reduction in flood risk to the Application Site and the surrounding area.
 - Adhere to current best practice guidance.
 - Contribute to the enhanced amenity and aesthetic value of the Application Site; and
 - Propose opportunities for biological enhancement and provide habitats for wildlife in urban areas.

SURFACE WATER FLOW ANALYSIS

FOXWOOD WATERCOURSE

1.3. Limitations

The purpose of this report is outlined in Section 1.2, together with those related matters specifically referred to therein and it is not intended to be used for any other purposes. The report is for the sole benefit and may only be relied upon by the addressee, to whom we will owe a duty of care. The report and any part of it is confidential to the addressee and should not be disclosed to any third party for any purpose, without the prior written consent of Ridge and Partners LLP as to the form and context of such disclosure. The granting of such consent shall not entitle the third party to place reliance on the report, nor shall it confer any third-party rights pursuant to the Contracts (Rights of Third Parties) Act. The report may not be assigned to any third party.

SURFACE WATER FLOW ANALYSIS

FOXWOOD WATERCOURSE

1.4. Reference Information

The following documents have been consulted:

- Hampshire County Council (2011) Preliminary Flood Risk Assessment.
- Eastleigh Borough Council JBA Consulting (2018) Eastleigh Hydrological Sensitivity Study Conceptual Surface Water Drainage Strategy.
- Partnership for Urban South Hampshire (2016) – Strategic Flood Risk Assessment 2016 Update.
- Partnership for Urban South Hampshire (2019) – Green Infrastructure Implementation Plan.
- Environment Agency JBA Consulting (2019) Itchen Tributaries Modelling Study.
- Communities and Local Government Document. (2021). The National Planning Policy Framework.
- Environment Agency. (2022). Flood Risk Assessments: Climate Change Allowances.
- Environment Agency. (2013). Rainfall Runoff Management for Developments.
- CIRIA. (2015). C753 – The SuDS Manual.
- Secretary of State. (2015). Building Regulations Approved Document H.
- Butler & Davies. (2018). 4th Ed. Urban Drainage.
- British Geological Survey Online Mapping Tool.
- DEFRA / EA Interactive online mapping (magic.defra.gov.uk).
- Department for Environment, Food and Rural Affairs. (2015). Non-Statutory Technical Standards for Sustainable Drainage Systems.
- Department for Environment, Food and Rural Affairs & Environment Agency. (2017). Flood Risk Assessment for Planning Applications.
- Environment Agency (2019) Flood risk mapping information.

This report should be read in conjunction with:

- PFA Consulting G277-DOC01 FRA – Flood Risk Assessment
- Odyssey Consulting Engineers 19-367 – Flood Risk Addendum
- Geomap EBC-OHH-08-09-19 – Topographical Survey

SECTION 2

PROJECT BACKGROUND & EXISTING FLOWS

SURFACE WATER FLOW ANALYSIS

FOXWOOD WATERCOURSE

2. PROJECT BACKGROUND & EXISTING FLOWS

2.1. Site Location and Existing Land Use

The site is located to the west of Horton Heath, Grid Reference SU 48916 17082, X (Easting) 448916, and Y (Northing) 117082. Latitude and Longitude (decimal), 50.951101, -1.3050041, Latitude and Longitude (degs, mins, secs), 50°57'04"N , 001°18'18"W. Postcode (nearest) is SO50 7BZ. The site is currently in agricultural use, mainly arable with some grassland. The overall site area location is shown below:

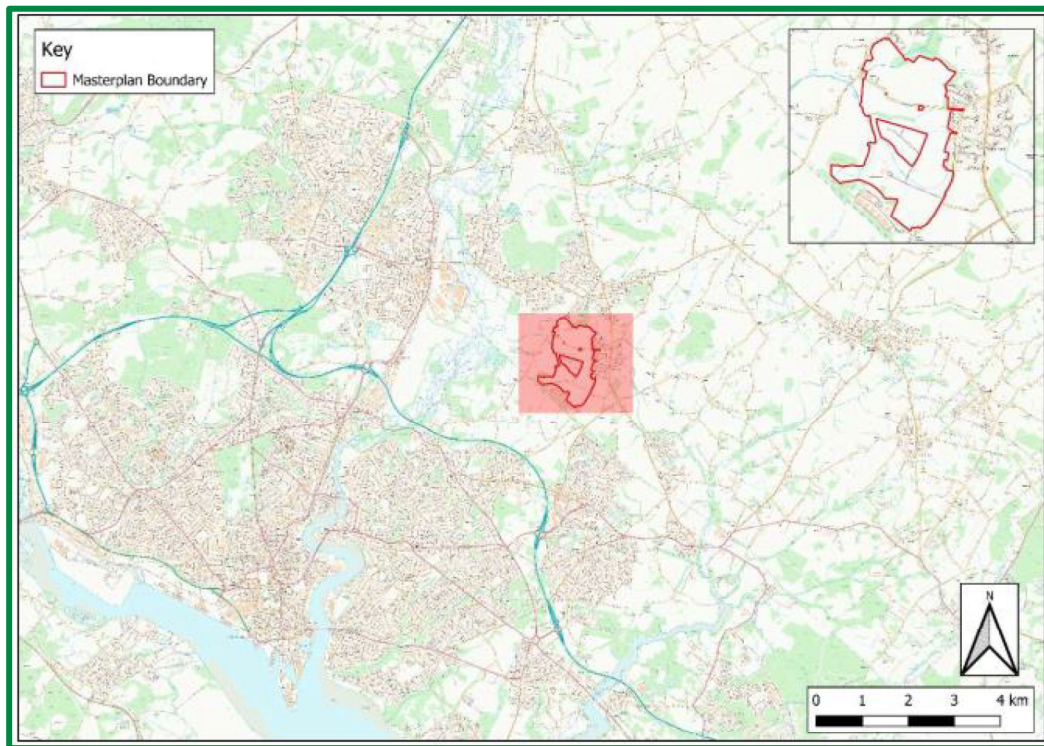


Figure 1: Site Location Area Plan (Google Earth Maps)

2.2. Topography

The site predominantly slopes from East to West from an elevation of circa 30 m Above Ordinance Datum (AOD) to the rear of Bramley Gardens down to circa 17m AOD at the Quobleigh Stream to the East. Local topography around the Foxwood Watercourse suggests that the approximate elevation of the ditch at the location of the proposed bridge/crossing is circa 24m AOD. The ditch is between 1.00-1.15m deep on the south side and circa 0.79m deep on the north side. The bed of the watercourse spans approximately 1.10m. In plan the southern side slopes are 1.98m wide, with the northern side slopes being approximately 5.51m wide as the watercourse passes under the proposed bridge. Further topographical information has been instructed to provide detailed levels and dimensions of the bank and channel bed; however, there is sufficient extant information to perform an appropriately detailed analysis.

2.3. Geology and Hydrogeology

British Geological Survey (BGS) online mapping indicates that the Application Site is situated on a bedrock of Wittering Formation sand, silt and clay. This is overlain by superficial deposits of Alluvium around the watercourses that pass through the site.

The Environment Agency's online mapping suggests the underlying bedrock to be classified as a secondary A Aquifer and the site is located within a medium groundwater vulnerability zone.

SURFACE WATER FLOW ANALYSIS

FOXWOOD WATERCOURSE

2.4. Hydrology

An arm of the Moorgreen Brook, a Main River, is present to the North of the site. This confluences with the Quobleigh Watercourse, also a Main River, this being the Southern arm of the Moorgreen Brook, to the West of the site. The Quobleigh Watercourse accepts flows from the Foxwood Watercourse, which flows through the Application Site. The Foxwood Watercourse is the watercourse that is the subject of this review.

The Foxwood Watercourse arises from the ridge on which the settlement of Horton Heath sits and owing to its small catchment and constant baseflow it is likely that the stream is spring fed from the Eastern Knowle Hill. The Foxwood Watercourse accepts additional flow from other minor watercourses before communicating with the Quobleigh Watercourse, notably a spur connecting from the North located to the South of Fir Tree Lane which connects to the Foxwood Watercourse to the West of the proposed Bridge.

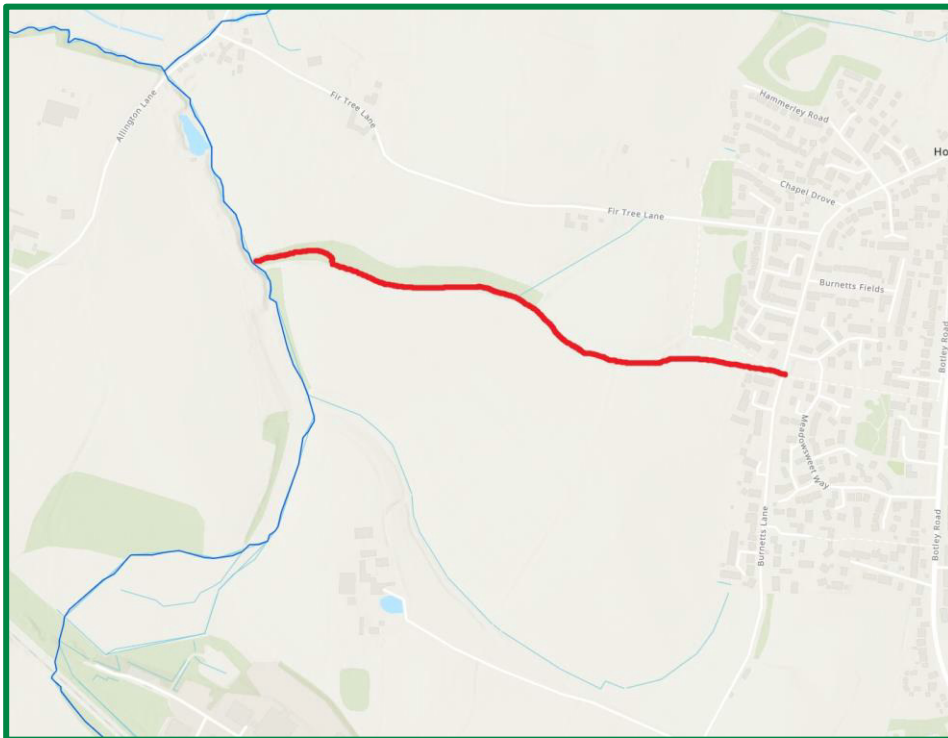


Figure 2 - Map showing Foxwood Watercourse route from the site to confluence with the Quobleigh Watercourse

An indication of the likely flows and flood extents of the Foxwood and Quobleigh Watercourses can be found on Environment Agency Long-term Flood Risk mapping, it should be noted that the mapping is not an accurate reflection of real world flows. This is as published in the Environment Agency's "What is the Risk of Flooding from Surface Water map?" methodology which states:

*"Although the maps appear to show flooding from ordinary watercourses, **they should not be taken as definitive mapping of flood risk from these as the conveyance effect of ordinary watercourses or drainage channels is not explicitly modelled.** Also, structures (such as bridges, culverts and weirs) and flood risk management infrastructure (such as defences) are not represented."*

SURFACE WATER FLOW ANALYSIS
FOXWOOD WATERCOURSE

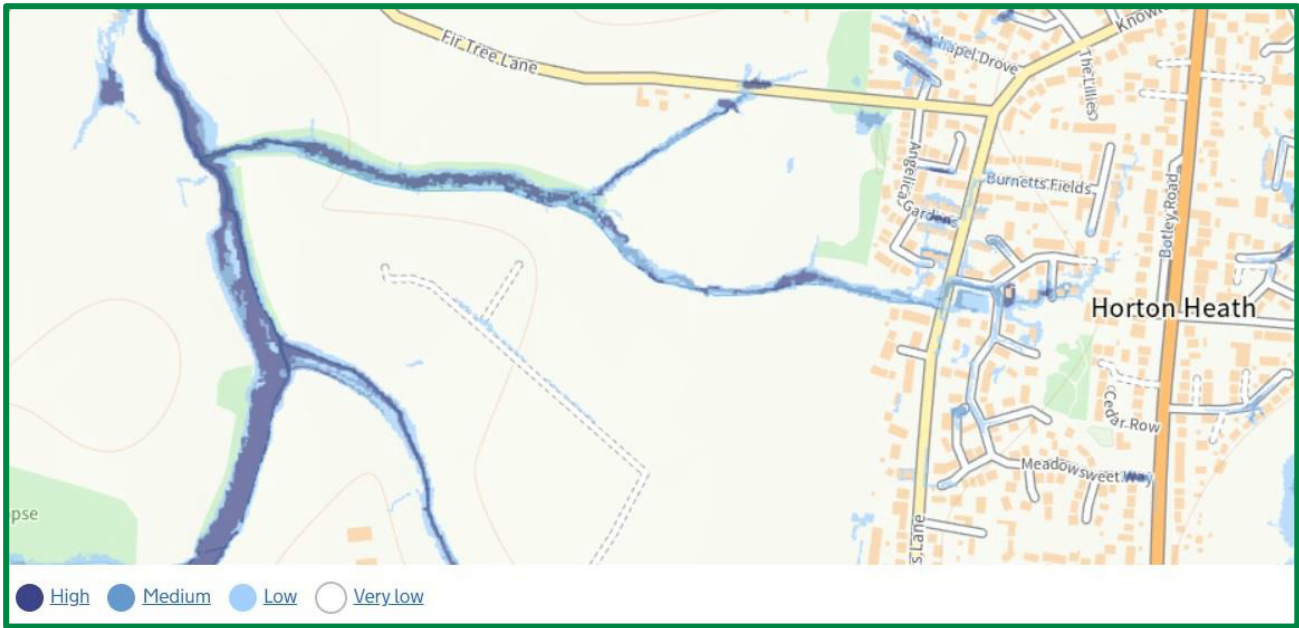


Figure 3 – EA surface water flood mapping – Risk

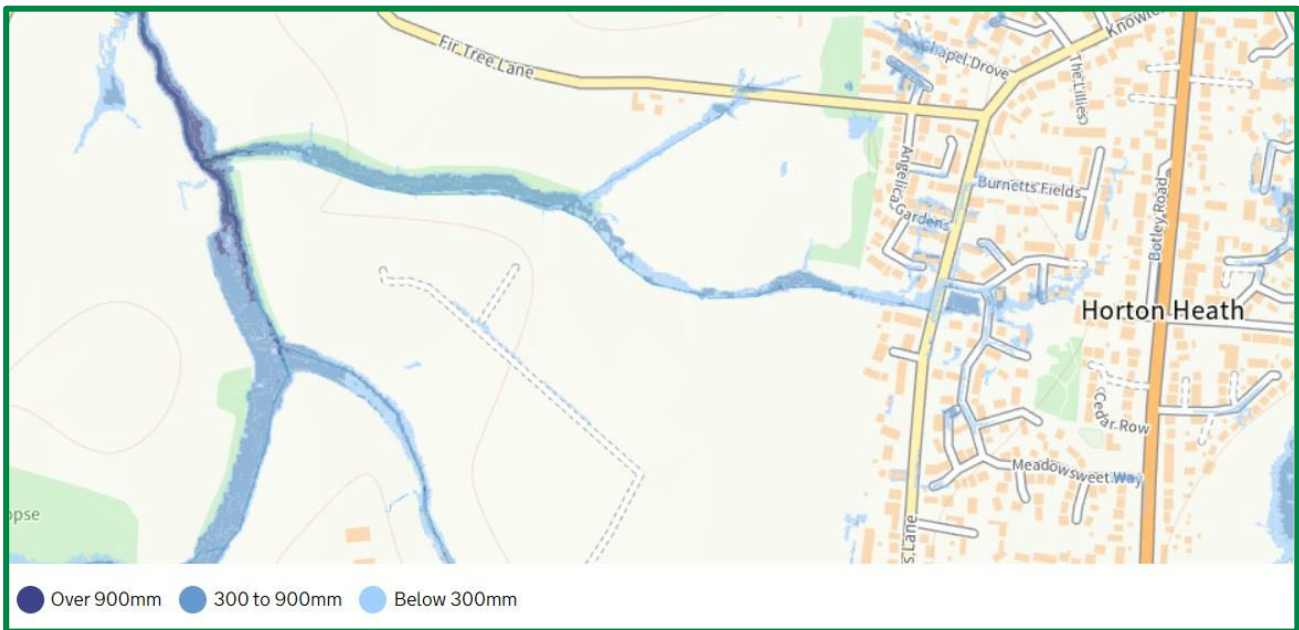


Figure 4 – EA surface water flood mapping – Depth

SURFACE WATER FLOW ANALYSIS FOXWOOD WATERCOURSE



Figure 5 – EA surface water flood mapping – Velocity

The EA's surface water flood map should not be taken as definitive as the map has been based on national LiDAR datasets which pick out depressions in the topographic ground profile and therefore would not be able to comprehensively survey the Foxwood Watercourse.

2.5. Proposed Crossing Design

The development in its current form proposes a bridge crossing constituting a reinforced concrete shell with stone and bituminous layers placed on top. The structure shall be clad in facing material such as brick and stone. The bridge spans approximately 9.50m and has a soffit height 1.80m above the banks of the Foxwood Watercourse. When considering pavement layers and the thickness of the reinforced concrete structure, which has been based on the Ridge and Partners LLP Tollbrook Bridge Structural Drawing (5015560-RDG-ST-XX-DR-S-1000-P02). The 1.80m requirement originates from the Hampshire County Council TG7 Technical Guidance Note (Adoption of Structures). As part of this report a review will be undertaken of the capacity of this structure and a comparison will be undertaken against existing flows to determine the appropriateness of such a structure. A review of a piped solution shall also be undertaken to see whether a precast concrete bridge can be avoided.

2.6. Quantifying Existing Flows

To appropriately determine the extent and quantity of overland flow passing along the Foxwood Watercourse; attention has been paid to the UK Centre for Ecology & Hydrology Flood Estimation Handbook web service which provides data on the quantity of land which contributes to a catchment:

SURFACE WATER FLOW ANALYSIS

FOXWOOD WATERCOURSE

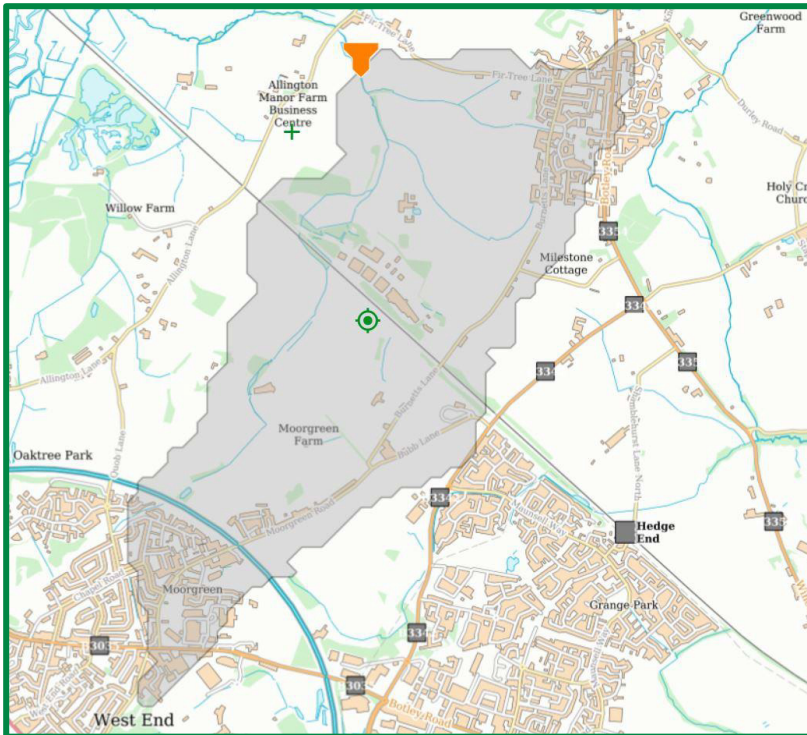


Figure 6 – FEH Catchment Mapping

The size of the catchment contributing to the western Moorgreen Brook is 3.825km². Breaking this area down one can determine the area for each of the contributing minor watercourses. To determine the catchment of the Foxwood Watercourse a review has been undertaken of TessaDEM data and Ordnance Survey data, the Foxwood Watercourse catchment extends to the majority of the settlement of Horton Heath as well as areas of open space within and to the North of the Application Site.

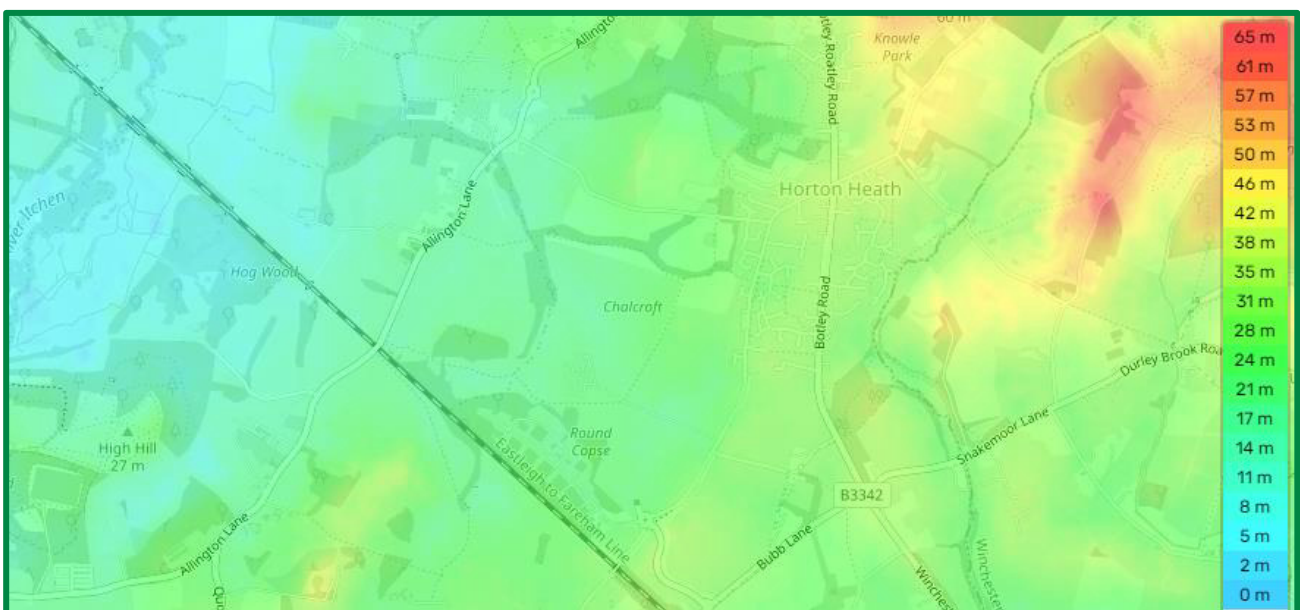


Figure 7 – Wider Topographical Mapping of the course of the Foxwood Watercourse (Contains information from TessaDEM [Open-Database-Licence], which is made available here under the Open Database License (ODbL). Also contains OS data © Crown copyright and database right 2022.

SURFACE WATER FLOW ANALYSIS

FOXWOOD WATERCOURSE

The area downstream of the bridge has been discounted and therefore only the areas shaded green and red on the below extract have been considered, where the green areas are greenfield areas and the red areas are impermeable areas of the settlement of Horton Heath. In the calculations it has conservatively been assumed that the entirety of the red area is impermeable, making no account for gardens, areas of public open space and verges, which are likely to be significant.

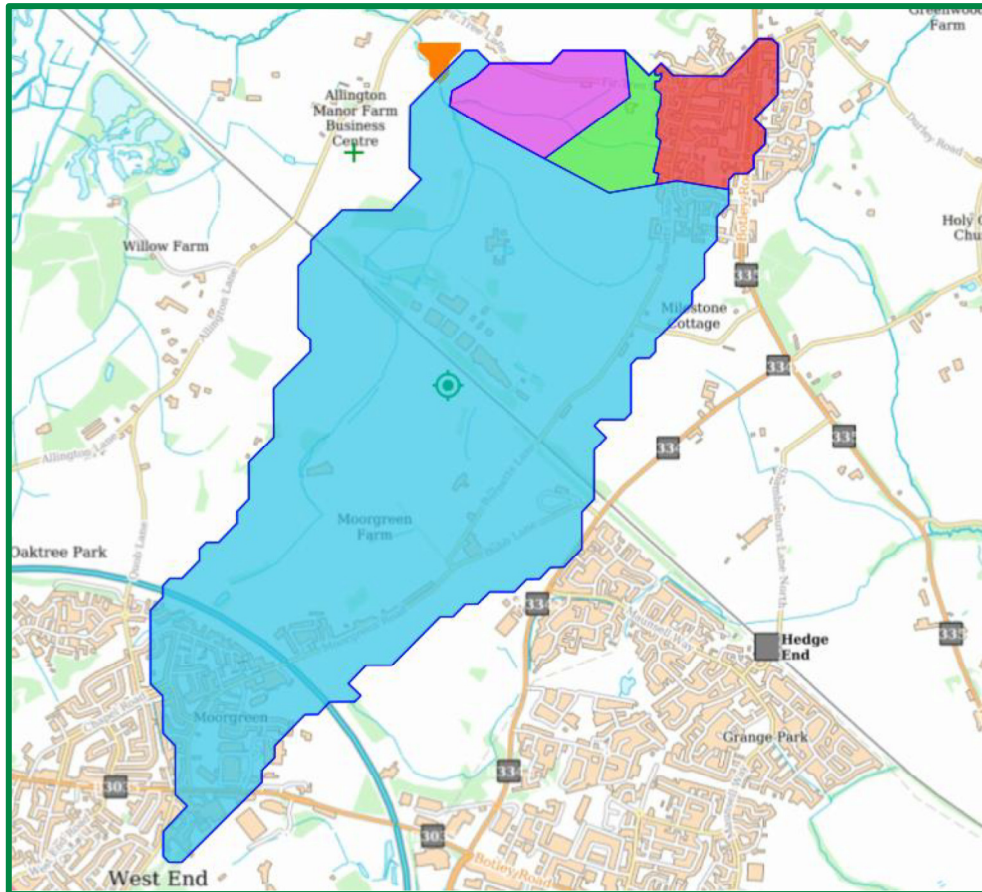


Figure 8 – Factored catchment extents

To determine how much flow this catchment will generate, greenfield runoff rate calculations have been undertaken utilising the Source Control module of the Innovzye MicroDrainage design package. The analysis relies on the IH124 method, which is appropriate for catchments above 50 hectares, and uses linear interpolation to generate a flow rate through the ICP SUDS method (Interim Code of Practice for Sustainable Drainage Systems). The calculations are based on the development being in region 7 and SAAR and Soil Index values for the catchment, being 800mm and 0.400 respectively. Owing to the largely impermeable nature of the underlying soils the Soil Index has been manually adjusted from 0.300 to 0.400, to conservatively estimate flow rates. The Partly Urbanised Catchment has been specified as 0.620, this being the percentage of the red area of the contributing catchment.

An appropriate climate change allowance will need to be added to this flow to accommodate future rainfall events. This could either be accommodated as a peak river flow allowance as per values published for the Test and Itchen Management Catchment (35% for the central allowance) or a peak rainfall allowance for this catchment (45% for the upper end allowance). To be conservative the 45% allowance has been applied. The results are presented in *Appendix A* and are tabulated overleaf:

SURFACE WATER FLOW ANALYSIS
FOXWOOD WATERCOURSE

AREA	QBAR (L/S)	Q1 (L/S)	Q30 (L/S)	Q100 (L/S)	Q100+CC (L/S)
33.892	312.8	265.9	567.1	676.5	980.9

Runoff is not the only contributor to watercourse flows and often a significant proportion of watercourse flow arises from influent groundwater, which is evident from the baseflow visible in the stream. The magnitude of groundwater input is dependent on the prevalent underlying strata with UK Centre for Ecology and Hydrology National River Flow Archive (NRFH) data suggesting that the contributing Base Flow Index (BFI) from groundwater can range from 0.150-0.350 within impervious clay catchments to greater than 0.9 in pervious chalk catchments. As the underlying ground at the site is typically a silty, sandy clay the higher BFI of 0.350 has been progressed. This has conservatively been applied to the calculations as an additional 35% of the maximum flow discussed previously. This results in a total flow of 1324.2l/s.

SECTION 3

QUANTIFYING CAPACITY OF EXISTING AND PROPOSED CONVEYANCE FEATURES

SURFACE WATER FLOW ANALYSIS

FOXWOOD WATERCOURSE

3. QUANTIFYING CAPACITY OF EXISTING AND PROPOSED CONVEYANCE FEATURES

3.1. Existing Watercourse

As discussed in Section 2 the local topography around the Foxwood Watercourse suggests that the approximate elevation of the ditch at the location of the proposed bridge is circa 24m AOD. The ditch is between 1.00-1.15m deep on the south side and circa 0.79m deep on the north side. The bed of the watercourse spans approximately 1.10m and in plan the southern side slopes are 1.98m wide, with the northern side slopes being approximately 5.51m wide as the watercourse passes under the proposed bridge. Aggregate cross sections have been deduced (see *Appendix B*), these have been based on a height of 0.79m and the equalised side slopes, which still produce the same cross sectional area, which is on average 3.623m². Average side slopes are approximately 1 in 4.52 (22.10%), an angle of 12.767 degrees from the horizontal.

This cross sectional area has been modelled in the Network module of the Innovyze MicroDrainage design package, utilising a user specified conduit. The gradient has been obtained from local topographical information, available on the Geomap survey, resulting in a gradient of 1 in 64.5 (1.55%). A Manning's n value of 0.060 has been applied to the channel, this being appropriate for a narrow channel in very poor condition. The capacity of the existing channel under such conditions is equal to 7573.5l/s (see *Appendix C*). As can be seen, the existing ditch is more than adequate to convey all anticipated flows from a design return period for residential development, with a suitable allowance for climate change.

ELEMENT	DESIGN FLOW RATE (L/S)
MAXIMUM FLOW	1324.2
DITCH CAPACITY	7573.5

By applying the base flow to the watercourse model one can determine the water level during the design return period event + climate change. In the upstream node the depth of water would be approximately 369mm. As can be seen in *Appendix B* this results in a cross sectional area of 1.01m².

3.2. Proposed Structure

The proposed bridge would not affect the flow characteristics of the main channel of the Foxwood Watercourse as it would span from bank to bank without effecting the channel itself and therefore would not impede flows.

An analysis has been undertaken of the capacity of a number of pipes to determine whether these conduits have adequate capacity to convey the expected surface water flows. The gradient of the pipes has been modelled at the same gradient of the existing channel. The capacity of a number of scenarios have been presented in *Appendix D* and tabulated overleaf:

SURFACE WATER FLOW ANALYSIS

FOXWOOD WATERCOURSE

PIPE DIAMETER/ DIMENSIONS (MM)	CAPACITY (L/S)	CROSS SECTIONAL AREA (M ²)
600	858.4	0.283
750	1541.1	0.442
900	2484.6*	0.636*
1050	3719.2*	0.866*
1200	5273.4*	1.131*
1350 X 800 (BOX CULVERT)	4514.3	1.080

**Soffit heights exceed existing bank height (790mm)*

As can be seen: 750, 900 and 1050mm pipes have more than adequate capacity to contain the maximum anticipated flows; however, they shall reduce the cross sectional area of the wetted extents. A 1200mm diameter pipe would have adequate cross sectional area but would exceed the height of the existing bank, thereby nullifying a significant portion of the pipe. A 1350x800mm box culvert is capable of containing the maximum anticipated flow whilst not reducing the cross sectional area of the wetted extents, such a system would not drastically exceed the adjacent bank level (0.79m high) and would still have adequate capacity and cross sectional area at existing bank height.

3.3. Structure Discussion

The incorporation of a bridge would result in a significantly increased build up owing to the requirement to have a 1.80m clearance under the bridge as well as the associated build up requirements, which can largely be avoided through the incorporation of a box culvert. With the increased build up there is an associated carbon impact, owing to the quantity of imported stone and precast concrete. There is also a logistical and earthworks impact as significant grading would be required to ensure that ground is graded to accommodate the increased height, this will have wider implications on the watercourse and the surrounding open space. For amenity, climate and design purposes, a box culvert would be preferable to a bridge.

SECTION 4

CONCLUSIONS

4. CONCLUSIONS

- The flows of the Foxwood Watercourse have been quantified in detail, with appropriate consideration to catchment mapping, climate change allowance, the permeability of the contributing catchment and the impact of groundwater to base flows.
- A selection of conveyance features has been presented which are capable of conveying the existing overland flows associated with the Foxwood Watercourse passing through the Application Site.
- Pipes and culverts can be selected which will have adequate capacity to contain maximum flows; however, only a box culvert with a minimum width of 1350mm and a minimum height of 800mm will be equivalent in cross sectional area to the former wetted area during the peak design return period storm.
- As a result of the implementation of such conveyance features proposed safe access and egress can be maintained over the Foxwood Watercourse and flows through the existing watercourse shall not be exceeded.
- It should be noted that this strategy presents a number of possible solutions to demonstrate that the flows from the Foxwood Watercourse can be successfully and sustainably conveyed and should not be interpreted as the definitive solution.

APPENDIX A

GREENFIELD RUNOFF CALCULATIONS FOR EXISTING CATCHMENT

Ridge and Partners LLP		Page 1
The Cowyards Blenheim Park, Oxford Road Woodstock OX20 1QR	One Horton Heath Site Wide Infastructure Eastleigh Borough Council	
Date 23/02/2023 File CATCHMENT CALCULATIONS.SRCX	Designed by Zak Simmonds Checked by Chris Levitt	
Innovyze	Source Control 2020.1	

ICP SUDS Mean Annual Flood

Input

Return Period (years) 100 SAAR (mm) 800 Urban 0.620
Area (ha) 33.892 Soil 0.400 Region Number Region 7

Results 1/s

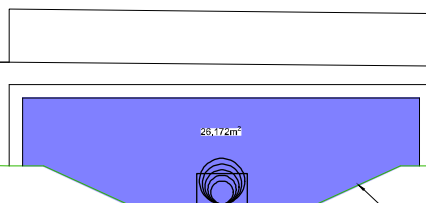
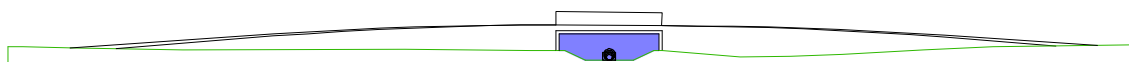
QBAR Rural 134.8
QBAR Urban 312.8

Q100 years 676.5

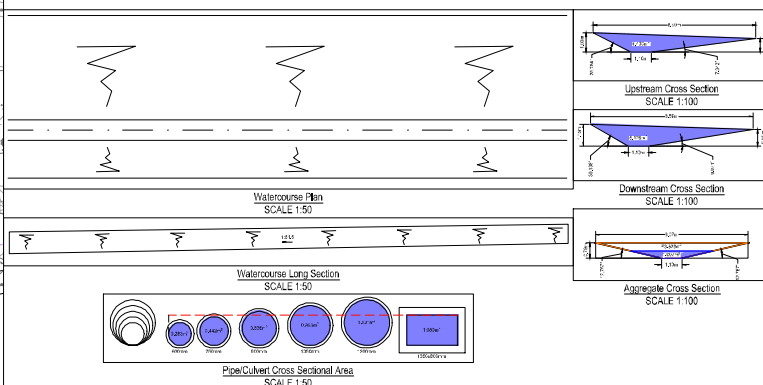
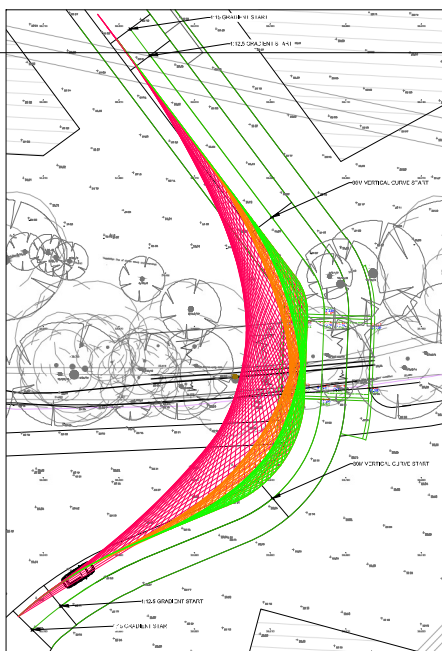
Q1 year 265.9
Q30 years 567.1
Q100 years 676.5

APPENDIX B

EXISTING DITCH AND PROPOSED CONVEYANCE FEATURE DETAILS



Indicative and conservative side slope extents considered

[illegible]

APPENDIX C

EXISTING DITCH CAPACITY CALCULATIONS

STORM SEWER DESIGN by the Modified Rational Method

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	19.345	0.300	64.5	0.000	5.00	1324.2	0.060	\/	-7	Pipe/Conduit	
1.001	5.000	0.080	62.5	0.000	0.00	0.0	0.060	\/	-7	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	5.22	24.520	0.000	1324.2	0.0	0.0	1.45	7573.5	1324.2
1.001	50.00	5.28	24.220	0.000	1324.2	0.0	0.0	1.48	7692.7	1324.2

Conduit Sections for Storm

NOTE: Diameters less than 66 refer to section numbers of hydraulic conduits. These conduits are marked by the symbols:- [] box culvert, \/ open channel, oo dual pipe, ooo triple pipe, O egg.

Section numbers < 0 are taken from user conduit table

Section Number	Conduit Type	Major Dimn. (mm)	Minor Dimn. (mm)	Side Slope (Deg)	Corner Splay (mm)	4*Hyd Radius (m)	XSect Area (m²)
-7	\/	1100	790	12.8		2.343	5.213

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	\/	-7	FOXWOOD 1	25.520	24.520	0.210	Open Manhole	3000
1.001	\/	-7	FOXWOOD 2	25.320	24.220	0.310	Junction	

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	19.345	64.5	FOXWOOD 2	25.320	24.220	0.310	Junction	
1.001	5.000	62.5		0.000	24.140		Open Manhole	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1
Number of Input Hydrographs	0	Number of Offline Controls	0
Number of Online Controls	0	Number of Storage Structures	0
		Number of Time/Area Diagrams	0
		Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.800	Storm Duration (mins)	30
Ratio R	0.350		

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 0 Number of Storage Structures 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR M5-60 (mm)	19.900 Cv (Summer)	0.750
Region	England and Wales	Ratio R	0.350 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0

Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	ON

Profile(s) Summer and Winter

Duration(s) (mins)	15
Return Period(s) (years)	1
Climate Change (%)	0

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Pipe Flow / Cap.	Pipe Flow (l/s)	Status
1.000	FOXWOOD 1	15 minute 1 year Summer I+0%	25.520	24.889	-0.421	0.000	0.19	1324.2	OK
1.001	FOXWOOD 2	15 minute 1 year Summer I+0%	25.320	24.591	-0.419	0.000	0.17	1343.5	OK

APPENDIX D

PROPOSED CONVEYANCE FEATURE CAPACITY CALCULATIONS

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	600	600MM PIPE	25.520	24.520	0.400	Junction	
1.001	o	750	750MM PIPE	25.520	24.520	0.250	Junction	
1.002	o	900	900MM PIPE	25.520	24.520	0.100	Open Manhole	1800
1.003	o	1050	1050MM PIPE	25.520	24.520	-0.050	Open Manhole	1950
1.004	o	1200	1200MM PIPE	25.520	24.520	-0.200	Open Manhole	2100
1.005	[]	-8	BOX CULVERT	25.520	24.520	0.200	Open Manhole	3000

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	19.345	64.5	750MM PIPE	25.520	24.220	0.700	Junction	
1.001	19.345	64.5	900MM PIPE	25.520	24.220	0.550	Open Manhole	1800
1.002	19.345	64.5	1050MM PIPE	25.520	24.220	0.400	Open Manhole	1950
1.003	19.345	64.5	1200MM PIPE	25.520	24.220	0.250	Open Manhole	2100
1.004	19.345	64.5	BOX CULVERT	25.520	24.220	0.100	Open Manhole	3000
1.005	19.345	64.5		0.000	24.220		Open Manhole	0

APPENDIX B

EA REQUIRED FORM

Pre-Application Enquiry Form (Preliminary Opinion)

Please read the following notes before completing this form:

This form should be used where you require preliminary advice from the Environment Agency relating to a specific plot of land. We will provide a free preliminary opinion on what environmental constraints may affect your proposed development and how to avoid or mitigate any identified environmental impacts. We may then offer a charged advice service for any further discussions you want about your proposed project.

Where you intend to submit a planning application to a Local Planning Authority (LPA) we recommend that you contact the relevant LPA to determine the likelihood of your proposed development receiving planning permission before submitting a pre-application enquiry to the Environment Agency. The LPA should also be able to advise you whether an Environmental Impact Assessment (EIA) will need to be submitted with your planning application.

Where you intend to apply to the Planning Inspectorate (PINS) for development consent for a Nationally Significant Infrastructure Project please use this form where you want a preliminary opinion from the Environment Agency. Please read the advice notes on the National Infrastructure Portal. Advice Note 11 Working with public bodies on national infrastructure before you contact us.

We will give you our preliminary opinion within 21 days of receiving your request in accordance with National Planning Policy Guidance. If we are unable to do this, we will contact you to request further time to respond.

How to complete and submit this form

Section 1 of this form contains the minimum information required for us to deal with your pre-application enquiry. If this information is not provided we will not be able to deal with your enquiry and will return a standard response to this effect.

Section 2 contains additional questions that you are encouraged to complete, as this will enable us to provide you with more detailed and useful advice.

Section 3 contains a set of notes, which provide an explanation of the questions in section 2. You are advised to read these carefully before completing this form.

Please submit the completed form to your local Environment Agency office:

[Environment Agency offices](#)

Where you are unable to access documents electronically or find your local Environment Agency office address, please contact us on 03708 506 506.

Preliminary Opinion Request Form

SECTION 1

1. About you

Please provide the following details:

Contact Name: Sami Sultan
Company Name: Ridge LLP
Your Ref: Graduate Civil Engineer
Address: 1 Royal court , King Worthy Winchester Hampshire
Postcode: SO23 7TW
Phone: 07824525308
Email: samisultan@ridge.co.uk

2. About your proposed development

Site Address/Location of Site	Submit a location plan A location plan clearly showing the boundary of the proposed development must be submitted with your enquiry. This should be at a scale between 1:100 and 1:2500 If there are any watercourses or water features on or within the vicinity of your development site, you will need to identify these on your location plan.
Horton Heath, Eastleigh	
Southampton	
Hampshire	
Postcode SO50 7BZ National Grid Map Reference	

3. Description of the Proposed Development

Please give a brief description of the type of development/change of use proposed:

There are 4 green infrastructure area planned. Site area 1 discharges surface water into Hearts Stream. Site area 2 discharges surface water into Toll Brook whereas site area 3 discharges surface water into Foxwood Stream. Site area 4 dischargers surface water into Qoubleigh Stream.
--

SECTION 2

4. Land Contamination

Please identify whether land contamination is potentially an issue:

Existing use of site	The site is currently an agricultural use, mainly arable with some grassland
Previous use(s) of site	

5. Flood Risk

Please identify whether your development is at risk from flooding:

Is the proposal within Flood Zone 2 or 3?	Yes ☐ No ☒
Have you contacted your Local Planning Authority to establish whether your site will need to be subject to the sequential test as required by the National Planning Policy Framework? If the site will be subject to the sequential test—see notes on page 3.	Yes ☐ No ☒

6. Foul Drainage

Please state the proposed method for dealing with foul drainage:

Main Sewer	
Package Treatment Plant	
Septic Tank	
Cesspool	
Other (please state)	The site is currently is not crossed with any public foul sewers

SECTION 3: USER NOTES

Q1: About You

Please provide your name, company name (if applicable) and full address in this section to enable us to respond to your enquiry. A phone number should also be provided, so we can contact you if we need to discuss your enquiry further or request more time to respond. If you would prefer a response to be sent via email rather than in a paper format, please also provide your full email address.

Q2: About the site

Please provide us with as much information as possible to enable us to locate the proposed development site. This must include the full address of the site, a postcode (where available) and/or a National Grid Reference (NGR) for the site. The NGR should be a minimum of six figures. A location plan must also be provided to show the boundary of the proposed development, preferably to a scale of between 1:100 and 1:2500.

Q3: Description of the proposed development

Please provide as full a description as possible of the proposed development.

Q4: Land Contamination

Identifying the existing/previous use of the site will give an indication of the possibility of contamination. Developers should also assess the potential for contamination when the development represents a particularly sensitive end use, e.g. nurseries, schools, gardens, or allotments. Where contamination poses a risk of pollution to controlled waters, we will provide advice to the local planning authority (LPA) at the planning application stage. We would therefore strongly advise that you complete the questions in the above table as this will help us better advise you of the information you would need to submit with your planning application. Please note that we do not offer advice on the risks to human health arising from development on land affected by land contamination. If required, this advice should be sought from your Local Authority Environmental Health Department.

Q5: Flood Risk

Where the development falls within Flood Zone 2 or 3, we will provide advice to the LPA on flood risk at the planning application stage either directly or on low risk development via our [Flood Risk Standing Advice](#).

IMPORTANT: If your site falls within Flood Zones 3 or 2 and has not been subjected by the LPA to the sequential test as set out in the National Planning Policy Framework (NPPF), any subsequent planning application may be refused if it fails this test. This will apply either to

- 'windfall' sites that have not been allocated via an adopted development plan or
- to sites that have been allocated via an adopted development plan which has not itself been subject to the sequential test

Applicants are advised to establish with the LPA at the pre-application stage whether their site will be acceptable in sequential test terms in order to avoid any unnecessary expenditure of time and resources at the planning application stage.

To determine whether your development is in a flood zone, refer to the [Flood Map](#) and put the postcode or place name in the Flood Map box.

Q6: Foul Drainage

Where mains drainage is available this should be the first option for disposal of foul sewage from the proposed development. You may require an environmental permit from us if the proposed method of foul drainage is not to main sewer.



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