



Flood Risk Assessment for Land Adjacent Benhall, Hambledon Road

Denmead, Hants



Flood Risk Assessment for

**Land Adjacent Benhall,
Hambleton Road
Denmead, Hants**

Prepared By

.....
A P Traves
Senior Engineer

Opus International Consultants (UK) Ltd
Fareham Office
Modulus House, Salterns Lane
Fareham, PO16 0QS
United Kingdom

Reviewed By

.....
M J Akmenkalns
Engineer

Telephone: +44 1329 822021
Facsimile: +44 1329 825274

Date: 17 February 2014
Reference: EF1421 FRA/APT
Status: Issue 1

Contents

1	Introduction.....	ii
2	Development Description & Location	ii
3	Local Development Documents & Strategic Flood Risk Assessment	ii
4	Catchment Flood Management & Shoreline Management Plans.....	iii
5	Catchment Data.....	iii
6	Sewerage Authority Data.....	iv
7	Walkover Survey	v
8	Source-Pathway-Receptor Assessments	v
9	Flood Probability.....	vi
10	Climate Change	vi
11	Detailed Development Proposals & Surface Water Strategy	vi
12	Sequential & Exception Tests	vii
13	Flood Risk Management Measures.....	vii
14	Off Site Impacts.....	vii
15	Residual Risks.....	viii

Appendices

Appendix A	Existing and Proposed Site Layout
Appendix B	SFRA Data, EA Data & BGS Data
Appendix C	Surface Water Character Areas
Appendix D	Conditions & Limitations

1 Introduction

- 1.1 Instructions were received from D & K Contracting Services Ltd to undertake a Flood Risk Assessment (FRA) for the development of land adjacent Benhall, Hambledon Road, Denmead, Hants.
- 1.2 This assessment has been prepared by A P Traves BSc CEng MStructE MCIHT.
- 1.3 The client's attention is drawn to the conditions and limitations contained in Appendix D.

2 Development Description & Location

- 2.1 The Business Park comprises approximately 0.18 Ha of land at adjacent Benhall, Hambledon Road, Denmead, Hants (grid reference SU 674 103). The land is identified on the aerial photograph in Appendix A and site survey drawing 1663, a copy of which is contained in Appendix A.
- 2.2 The site use currently comprises an undeveloped vacant plot.
- 2.3 It is proposed to develop the site for 10 residential units and associated parking. The proposed layout is shown on D & K Contracting Services drawing 2013/08, a copy of which is contained in Appendix A.

3 Local Development Documents & Strategic Flood Risk Assessment

- 3.1 The Partnership for Urban South Hampshire (PUSH) Strategic Flood Risk Assessment (SFRA) has been reviewed (refer to appendix for local mapping) and this indicates the following.
- 3.2 SFRA map set 1A indicates the site is located in FZ2.
- 3.3 SFRA map set 1D indicates the site is not in a breach risk area.
- 3.4 SFRA map set 1E indicates the site lies in 2115AD Climate change FZ3.
- 3.5 SFRA map set 1F2 indicates the site overlies low permeability bedrock and is not in an historic groundwater flooding area.
- 3.6 SFRA map set 1F5 indicates no observed sewer flooding incidents at the site.
- 3.7 SFRA EA historic flood zone map set indicates the site is not in an historic flood zone.
- 3.8 Flood mapping data has also been reviewed from the EA website (refer to Appendix for local mapping). This indicates the following:
- 3.9 The EA mapping indicates the site is in FZ2 with no main rivers in or immediately abutting the site.

- 3.10 The EA mapping indicates the site is in a low flood risk zone for flooding from rivers and the sea (AEP between 0.1% and 1%)
- 3.11 The EA mapping indicates the site is not in an area at risk of flooding from reservoirs.
- 3.12 The EA mapping indicates the site is generally at very low risk of flooding from surface water (less than 0.1%AEP), with the watercourse to the southern side of the site at higher risk medium-high (greater than 3.3%AEP)
- 3.13 The EA mapping indicates the site is not located in a Source Protection Zone (SPZ).
- 3.14 The EA mapping indicates the site is not within surface water risk area or safeguard zone for drinking water.
- 3.15 The EA mapping indicates the groundwater is not in an at risk area or groundwater safeguard zone.

4 Catchment Flood Management & Shoreline Management Plans

- 4.1 The site is at an elevation of some 37m AOD and is remote from the influence of tidal flooding. Shoreline Management Plans are not applicable to this location.
- 4.2 The Test and Itchen Catchment Flood Management Plan summary – December 2009 (CFMP) indicates the site falls within Policy sub-area 5 Havant and Denmead. The CFMP states that Policy 4 is the preferred policy approach:
- *“Areas of low, moderate or high flood risk where we are already managing the flood risk effectively but where we may need to take further actions to keep pace with climate change This policy will tend to be applied where the risks are currently deemed to be appropriately-managed, but where the risk of flooding is expected to significantly rise in the future. In this case we would need to do more in the future to contain what would otherwise be increasing risk. Taking further action to reduce risk will require further appraisal to assess whether there are socially and environmentally sustainable, technically viable and economically justified options.”*
- 4.3 Overall the CFMP does not present any issues that would prohibit the development of this site with respect to flood issues provided the surface water drainage is based on SuDS principles.

5 Catchment Data

- 5.1 The site lies on the periphery of the Wallington catchment and is remote from the downstream gauging station The River Wallington is gauged at NRFA station 42001 (grid ref SU 587 074). The catchment above the station comprises some 111 km² and is characterised as permeable headwaters (Chalk) with impervious Eocene clays dominating below the

headwaters. Largely rural but with significant urban development in the east of the catchment.

- 5.2 The BGS Infiltration SuDS Georeport for the site is contained in Appendix B and identifies particular attributes described in the following paragraphs:
- 5.3 Section 1 of Part 2 of the SuDS Georeport indicates that very significant constraints to infiltration SuDS with respect to soluble rocks, landslides, shallow mining, or made ground are not present. It does however indicate the persistent shallow groundwater.
- 5.4 Section 2 of Part 2 of the SuDS Georeport indicates that groundwater is likely to be less than 3m below the ground surface for at least part of the year. This classification is determined from the bedrock and superficial deposits generic permeabilities site topography and superficial deposit thickness. The superficial deposits are indicated to be of spatially variable permeability with permeability in the range very low to high. Bedrock is indicated to be of spatially variable permeability in the range very low to moderate.
- 5.5 Section 3 of Part 2 of the SuDS Georeport considers the impact of increased infiltration upon potential ground stability hazards (soluble rocks, landslides, shallow mining, running sands, swelling clays, compressible ground and collapsible ground). The report identifies that consideration should be given landslide, swelling clays and running sand. Increased infiltration is reported to be unlikely to cause geohazards with respect to the other characteristics.
- 5.6 Section 4 of Part 2 of the SuDS Georeport considers groundwater quality protection. The report identifies that the site is not in a Source Protection Zone (SPZ). The report also identifies that the predominant flow mechanism through the unsaturated zone is through pore space and fractures, a process that has some potential for contamination removal. No made ground is reported to be at the site, thus potential contamination mobilisation in fill is not applicable.
- 5.7 Section 5 of Part 2 of the SuDS Georeport considers the geological mapping at the site location. The superficial deposits on the site are indicated to be Head deposits comprising un lithified deposits of clay silt, sand and gravel. The bedrock under the site is indicated to be London Clay Formation (Sand, silt and Clay) .
- 5.8 The BGS infiltration SuDS Georeport indicates within the report limitations that the report is based on 1:50,000 digital geological maps and not site-specific data. It also identifies that the report is not an alternative for an on site investigation or soakaway test which might reach a different conclusion.

6 Sewerage Authority Data

- 6.1 The site is connected to the public foul sewer network. The existing connection is to be retained.

7 Walkover Survey

- 7.1 A site reconnaissance was undertaken on 21 January 2014.
- 7.2 The site comprises a roughly rectangular plot of land at a level around 37m at the site frontage falling to about 36.5m at the rear. There is a watercourse (ditch running east to west along the southern side of the site with an invert level of around 35.5m AOD ie ditch depth is some 1.5m at site frontage decreasing to some 1.0m deep at the rear of the site.
- 7.3 The land on the far bank (southern side) of the watercourse comprises an industrial estate at significantly lower elevation than the site. Road between industrial premises and site RG= 36.15m AOD, main 'factory' DPC level 36.48m AOD. ie the road on the industrial site is some 1m below the opposing level of the proposed development site and the factory set 0.5m lower than the same site level. It is very evident on site that the EA mapping of surface water flood risk accords with actual local topography and watercourses whereas the EA Flood Zone mapping does not.

8 Source-Pathway-Receptor Assessments

- 8.1 The site is at an elevation of approximately 37m AOD and remote from the effects of tidal flooding. The site is not therefore at risk of tidal flooding.
- 8.2 EA mapping indicates that the site is at very low risk of flooding from surface water.
- 8.3 The site is not located in the vicinity of any reservoirs and EA flood risk from reservoirs mapping does not indicate any reservoir flood risk to the site.
- 8.4 As discussed in paragraph 7.3 the flood zone mapping does not accord with the actual topography of the site and adjacent industrial estate as well as that for surface water flood mapping. The EA mapping indicates a low risk of flooding from rivers or the sea.
- 8.5 The site is not in a location with sewer flooding incidents and is not considered to be at risk of sewer flooding.
- 8.6 The critical flood source is surface water pluvial flooding and run-off within the site. The site surface water system will accord with the principles of CIRIA C697.
- 8.7 The new flood receptors of the development would be:
- Dwellings
 - Building occupants
- 8.7 The proposed development and existing site classifications to Table 2 of NPPF Technical Guidance are as follows:
- | | |
|-----------------------------|-----------------|
| • Existing agricultural use | Less vulnerable |
| • Proposed residential use | More vulnerable |

9 Flood Probability

- 9.1 The Environment Agency (EA) flood zones shown on the outputs and included in the Appendix represents current best estimates of zone 2 and zone 3 flooding as defined in Table 1 of the Technical Guidance to the National Planning Policy Framework. It does not take account of potential climate change impacts.

Zone 2	Medium Probability of fluvial flooding (1%-0.1%)
Zone 3a	High Probability of tidal flooding (>1%)
Zone 3b	Functional Floodplain (>5% probability of flooding)

The flood map does not differentiate between zones 3a and 3b.

Zone 3b is only considered appropriate for water-compatible development.

Zone 3a is additionally considered appropriate for less vulnerable uses.

- 9.2 As discussed in paragraph 7.3 and 8.4 the flood zone mapping does not accord with actual site and local topography as well as the surface water flood mapping. The site is indicated to currently lie in flood Zone 2 (0.1-1.0% AEP)

10 Climate Change

- 10.1 Assuming a design life of 100 years, increase in rainfall (Table 5 of NPPF Technical Guidance.) due to climate change is +30% to current rates. The SFRA mapping indicates the site at 2115AD as FZ3.
- 10.2 Surface water drainage strategy is discussed in section 11.

11 Detailed Development Proposals & Surface Water Strategy

- 11.1 It is proposed to develop 10 residential units and associated parking facilities on the site.
- 11.2 The site soils comprise low permeability soils and the BGS infiltration SUDS suitability report indicates an anticipated depth to groundwater is likely to be less than 3m for at least part of the year. Party 1 of the BGS report indicates there are significant constraints for the suitability of infiltration SUDS.
- 11.3 Given the constraint of the depth of the site ditch and the impermeable nature of the site soils a shallow form of run-off storage/attenuation is required. It is therefore proposed to use permeable pavement construction for this purpose.
- 11.4 The SUDS treatment train is also required to address discharge water quality. There are not considered to be any potential pollution risk hot spots as the proposed development comprises a residential roofs. As discussed in the foregoing paragraphs the surface water solutions for the sites are Type C permeable pavement SuDS storage and inherent attenuation.

- 11.5 The pavement construction should be installed with ‘Imbitex’ ® or similar products which would provide the appropriate level of treatment to deal with the low level of hydro-carbons spillage risk for the development.
- 11.6 Overall three treatment stages will occur:
- ‘Imbitex’ bioremediation membrane
 - Filtration through permeable pavement
 - Straining action through vegetation in the existing swale on site.

12 Sequential & Exception Tests

- 12.1 The site is located within FZ2. The site is located at the LPA boundary between Winchester CC and Havant BC on the HBC side of the boundary. The land North and West of the site comprises the existing urban area of Waterlooville. Developers are currently delivering a large strategic housing area on the Southwest side of the existing town (reference West of Waterlooville SH2 allocation in the WCC Local Plan). The site comprises a small infill plot within the eventual larger single conurbation, split between the two LPAs. Whilst the site is not allocated within the current HBC plan there have been preapplication discussions with HBC with respect to the form of residential development that could be acceptable on the site.

As a windfall infill site outside current allocations then in accordance with paragraph 5 of the Technical Guidance to the NPPF the proposed development “*should take into account the flood risk vulnerability of land uses (see table 2)applying the Exception Test if required (see table 3).*” As an FZ2 site, table 1 designates more vulnerable uses (housing-table 2) as an appropriate land use within FZ2.

- 12.2 Application of the Exceptions Test is not required for more vulnerable usage in FZ2.

13 Flood Risk Management Measures

- 13.1 The source pathway receptor assessment is contained in Chapter 8.
- 13.2 Paragraph 8.56 identifies that management of the overland flow from surface run-off is the governing flood source. The management of the storage and conveyance of these volumes and flows is provided for by the surface water strategy set out in Chapter 11.
- 13.3 The surface water strategy mimics the existing run-off regime. There will therefore be no adverse impact on flood flow rates outside the site.

14 Off Site Impacts

- 14.1 The surface water strategy mimics the existing run-off regime. There will therefore be no adverse impact on flood flow rates outside the site.

15 Residual Risks

- 15.1 The proposed surface water strategy for the development provides for flood events up to 1:100 year 2115AD +30% rainfall. The residual flood risk is therefore events in excess of 1:100 year 2115AD +30% rainfall.

APPENDIX A:

Existing & Proposed Site Layout



Aerial view on site.



View west towards back of site



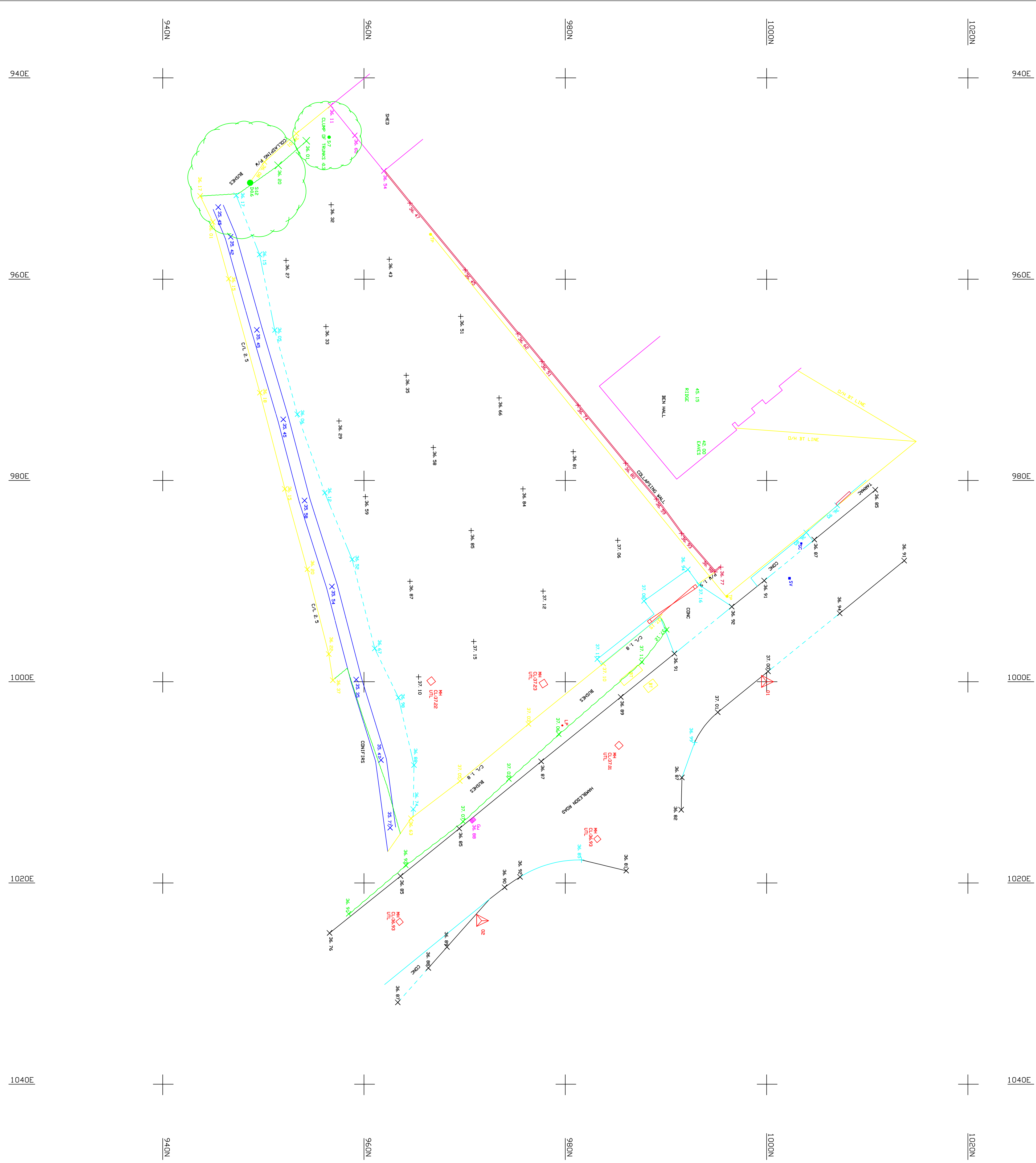
View South across site



View east up watercourse on southern boundary



View on outfall at head of watercourse (background to fence)



SITE PLAN KEY;



permeable paving



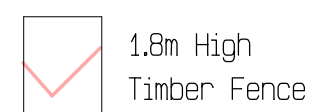
Grass/Amenity



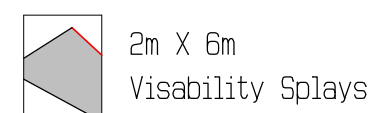
Parking Bays



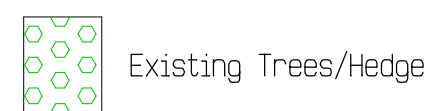
Permeable Hardstanding Drive



1.8m High
Timber Fence



2m X 6m
Visibility Splays



Existing Trees/Hedge



Various Low
Level Planting



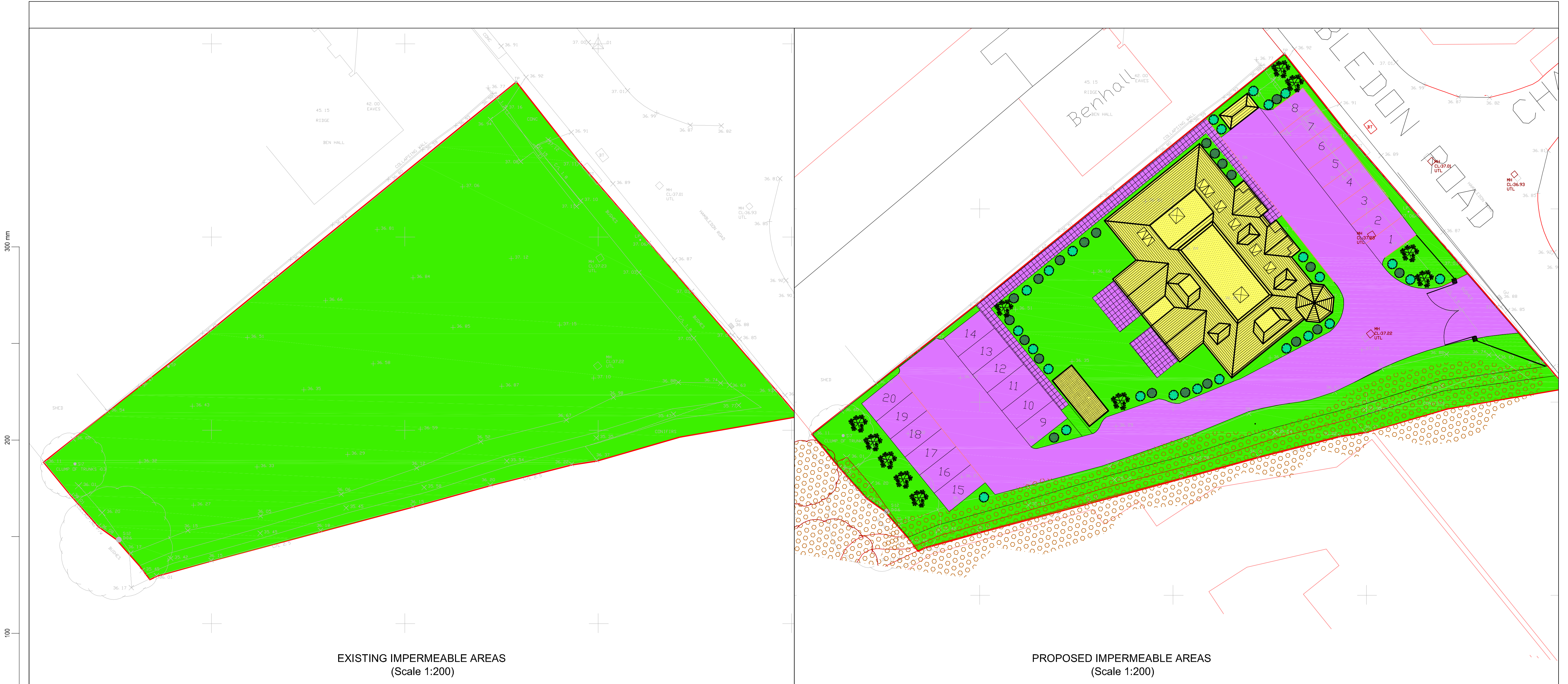
D & K Contracting Services Limited 44 The Hundred Romsey Hampshire SO51 8BX Tel: 07194 519500 or 01794 511981 Mob: 07836 386496 Email: dnkcountrypohomes@aol.com	
Client Mr DeSouza	
Project Title Benhall, Hambledon Road Waterlooville, PO7 6XB	
Drawing Title PROPOSED SITE PLAN	
Scale 1:200 On A2 Paper 0 2m 4m 6m 8m 10m	Drawn By AC
Drawing No. 2013/08	Rev.

APPENDIX B:

**SFRA Map Data, EA Data
& BGS Data**

APPENDIX C:

Surface Water Character Areas



EXISTING IMPERMEABLE AREAS
(Scale 1:200)

PROPOSED IMPERMEABLE AREAS
(Scale 1:200)

-EXISTING AREA KEY-		Sqm	%
—	Area of Interest (Private Catchment)	1850	100
 	Existing Soft	1850	100

-EXISTING AREA KEY-		Sqm	%
—	Area of Interest (Private Catchment)	1850	100
 	Proposed Porous	763	41.2
 	Proposed Roof	337	18.2
 	Proposed Soft	752	40.6

300 mm
200
100
0
10 mm

1:200@ A1
1:400@ A3
0 2 4 6 8 10 12 14 16 18 20 m

Revision	Amendment	Approved	Revision Date
P1	Initial issue	AT	18.02.2014



Drawn	Designed	Approved	Revision Date
CGJ	AT	AT	18.02.2014

Project No.	Scale
FA E-F-1421.00	1:200

Project	
Benhall	
Sheet	
Impermeable Areas	
Drawing No.	Sheet No.
100	01
Revision	
P1	

Preliminary

Site Ref

Land adjacent Benhall

Catchment

Pre development

CIRIA C697 Initial stormwater generation assessment**Rainfall Parameters**

SAAR	800	mm	CWI	121	
2DM5 rain	58	mm	DPRCWI	-1.1	%
r	36	%	UCWI _{winter}	133	
M560 rain	21	mm	Hydrometric area	7 (SE)	

Soil Parameters

WRAP soil class	4	
SOIL	0.45	
SPR	47	%

Surface Parameters

Soft landscape	1850	m ²	Roof Standard (impermeable)	0	m ²
Permeable pavement	0	m ²	Pavement 1 (impermeable)	0	m ²
Green roof ₍₁₎	0	m ²	Pavement 2 (50% permeable)	0	m ²
A_p	1850	m ²	A	0	m ²
			A_i	0	m ²
			PIMP	100%	
			PR	84	%

(1) includes standard roof directed into permeable pavement

$$t = 5 \text{ mins } (t_{\text{entry}}) + t_{\text{concentration}} = 5 \text{ mins}$$

Flows

QBAR _{rural}	1.0	l/sec	TOTALS		
Q ₁ rural	0.8	l/sec	Q ₁ 0.8	Q ₁ urban	0.0 l/sec
Q ₃₀ rural	2.1	l/sec	Q ₃₀ 2.1	Q ₃₀ urban	0.0 l/sec
Q ₁₀₀ rural	3.0	l/sec	Q ₁₀₀ 3.0	Q ₁₀₀ urban	0.0 l/sec

Volumes

			TOTAL		
V _{100 6hr} rural	63.8	m ³	V _{100 6hr} 63.8	V _{100 6hr} urban	0.0 m ³

Site Ref

Land adjacent Benhall

Catchment

Post development premitigation

CIRIA C697 Initial stormwater generation assessment**Rainfall Parameters**

SAAR	800	mm	CWI	121	
2DM5 rain	58	mm	DPRCWI	-1.1	%
r	36	%	UCWI _{winter}	133	
M560 rain	21	mm	Hydrometric area	7 (SE)	

Soil Parameters

WRAP soil class	4	
SOIL	0.45	
SPR	47	%

Surface Parameters

Soft landscape	752	m ²	Roof Standard (impermeable)	337	m ²
Permeable pavement	763	m ²	Pavement 1 (impermeable)	0	m ²
Green roof ₍₁₎	0	m ²	Pavement 2 (50% permeable)	0	m ²
A_p	1515	m ²	A	337	m ²

(1) includes standard roof directed into permeable pavement

A_i	337	m ²
PIMP	100%	
PR	84	%

$$t = 5 \text{ mins } (t_{\text{entry}}) + t_{\text{concentration}} = 5 \text{ mins}$$

Flows

QBAR _{rural}	0.8	l/sec	TOTALS		
Q ₁ rural	0.7	l/sec	Q ₁ 4.7	Q ₁ urban	4.1 l/sec
Q ₃₀ rural	1.8	l/sec	Q ₃₀ 11.9	Q ₃₀ urban	10.1 l/sec
Q ₁₀₀ rural	2.5	l/sec	Q ₁₀₀ 15.2	Q ₁₀₀ urban	12.7 l/sec

Volumes

V _{100 6hr} rural	52.3	m ³	TOTAL		
			V _{100 6hr} 71.4	V _{100 6hr} urban	19.1 m ³

Site Ref

Land adjacent Benhall

Catchment

Post development postmitigation

CIRIA C697 Initial stormwater generation assessment**Rainfall Parameters**

SAAR	800	mm	CWI	121	
2DM5 rain	58	mm	DPRCWI	-1.1	%
r	36	%	UCWI _{winter}	133	
M560 rain	21	mm	Hydrometric area	7 (SE)	

Soil Parameters

WRAP soil class	4	
SOIL	0.45	
SPR	47	%

Surface Parameters

Soft landscape	750	m ²	Roof Standard (impermeable)	0	m ²
Permeable pavement	763	m ²	Pavement 1 (impermeable)	0	m ²
Green roof ₍₁₎	337	m ²	Pavement 2 (50% permeable)	0	m ²
A_p	1850	m ²	A	0	m ²

(1) includes standard roof directed into permeable pavement

A_i	0	m ²
PIMP	100%	
PR	84	%

$$t = 5 \text{ mins } (t_{\text{entry}}) + t_{\text{concentration}} = 5 \text{ mins}$$

Flows

QBAR _{rural}	1.0	l/sec	TOTALS		
Q ₁ rural	0.8	l/sec	Q ₁ 0.8	Q ₁ urban	0.0 l/sec
Q ₃₀ rural	2.1	l/sec	Q ₃₀ 2.1	Q ₃₀ urban	0.0 l/sec
Q ₁₀₀ rural	3.0	l/sec	Q ₁₀₀ 3.0	Q ₁₀₀ urban	0.0 l/sec

Volumes

			TOTAL		
V _{100 6hr} rural	63.8	m ³	V _{100 6hr} 63.8	V _{100 6hr} urban	0.0 m ³

APPENDIX D:
Conditions & Limitations

OPUS**ENGINEER'S INSPECTION****CONDITIONS AND LIMITATIONS**

1. The report is a record of a visual inspection carried out by, or under the direction of a Chartered Structural Engineer and must not be misinterpreted as a Structural Survey such as would be carried out by a Chartered Surveyor. The report is not a Valuation Survey.
2. The inspection is strictly limited to the items requested and these will be detailed in Clause 1 of the report. No consideration will be given to any other aspects or parts of the building.
3. The report is confidential to the Client(s) stated in Clause 1 and has been prepared to their instructions for their own purposes only and it is not permitted to disclose this report to any other parties (except the Clients own Solicitors, Surveyors, Building Societies or Estate Agents) without the prior consent of Opus.
4. The copyright of this report remains the property of Opus.
5. No liability for the contents of this report is accepted to any parties other than the Client(s) stated in Clause 1.1. No parties other than the client stated in Clause 1.1 should rely upon this report.
6. Unless specifically stated otherwise:-
 - a) Trial holes will not be excavated prior to the preparation of the report and the depth and construction of the foundations and type of sub-soil will not be inspected.
 - b) All external observations will be carried out by eye from the ground level only. Internal inspection is made within the limits of ready accessibility and it is not normal practice to lift floor coverings or floor boards, remove fixtures, panels or plaster, or move heavy items of furniture or bulky goods or materials.
 - c) No inspection will be made of any roof voids, floor joists, wall cavities, drainage pipework or any other hidden or inaccessible parts.
 - d) No timbers will be checked for damp, rot, infestation by wood-boring insects or other defects.
 - e) It should not be construed that any parts of the construction comply with the requirements of the Building Regulations Act or standard practice either current or as current at the time of original construction. No enquiries to any Authorities will be made.
 - f) No testing or enquiries into the presence of or susceptibility to pollution, contamination, radiation, methane, radon or other gases or hazardous substances has been carried out.
7. Unless specifically stated otherwise in the report, any recommendations for works given in the report are outline only and are to be confirmed or modified as appropriate at detailed design stage.
8. Where trial holes are specifically included in our instructions the condition of the footing and the founding soil relates only to the point of excavation and does not necessarily confirm a continuation of the same conditions throughout the non-inspected areas of the structure. Whilst such trial pits will usually provide a reasonable indication as to the general state of the foundations and ground conditions, these cannot be determined with complete certainty.
9. Under the Construction (Design & Management) Regulations latest edition, the Client has obligations for ensuring Health and Safety arising from any construction work. If it is proposed to proceed with construction work based upon information or recommendations contained in this report, these regulations probably apply. Further details of any issues arising from our report or the Clients obligations generally are available on request.
10. Unless dealt with more specifically above the Association of Consulting Engineers Conditions of Engagement Short Form Agreement 2002 apply.



**Opus International Consultants (UK)
Ltd**

Modulus House, Salterns Lane
Fareham, PO16 0QS
United Kingdom

t: +44 1329 822021

f: +44 1329 825274

w: www.opusinternational.co.uk

Registered in England & Wales,
Company Reg. No: 2847568
Reg Office: Willow House, Brotherswood Court
Great Park Road, Bristol, BS32 4QW