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Highways | Traffic | Transportation | Water

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**St. Michael's ALC Site
Carlton Road, Barnsley
Flood Risk Assessment**

Ref: 5464/TW/001/01

Checked and Approved:  Date: August 2009.....

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**St. Michael's ALC Site
Carlton Road, Barnsley
Flood Risk Assessment**

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1. INTRODUCTION

- 1.1 Sanderson Associates (CE) Ltd have been appointed to undertake a Flood Risk Assessment for the proposed redevelopment of a site at Carlton Road, Barnsley. The site location is shown on drawing 5464/001 contained in Appendix A.
- 1.2 This Flood Risk Assessment has been undertaken in accordance with the Government Guideline, Planning Policy Statement 25 (PPS 25) December 2006.
- 1.3 The following assessment discusses the present and future flood risk, to the site, over the lifetime of the development using a risk based assessment. It also aims to advise of mitigation measures required to protect the proposed development based on the outcome of the analysis of flood risk.
- 1.4 Consultation with both the Environment Agency and Yorkshire Water has taken place. The consultation responses are discussed in Section 3 and are included in Appendix B.

2. EXISTING SITUATION

2.1 Existing Site Description

- 2.1.1 The site is located approximately 2 Miles to the North East of Barnsley City Centre in the suburb of Carlton.
- 2.1.2 The site is bounded to the South and East by the Carlton industrial estate and to the North and West by residential properties. The B6132 Carlton Road also runs along the Western Boundary.
- 2.1.3 The site is currently occupied by St Michael's Catholic & C of E School, Edward Sheerien School and St. Dominic's Catholic Primary School.
- 2.1.4 The nearest main river to the site is the River Dearne. It runs to the South West of the site boundary and is approximately 0.9 miles away, at its closest point.
- 2.1.5 There are also a number of minor water courses in the vicinity of the site. A small watercourse/drain runs west to east 150m to the southern boundary of the site this watercourse is culverted under the existing Carlton Industrial Estate. A small unnamed watercourse runs approximately 0.3 miles to the North East of the site and unnamed artery of the River Dearne runs approximately 1.4 miles to the east of the site.

2.2 Existing Site Analysis

2.2.1 The existing site layout has been assessed to establish the estimated surface water run off from the existing site. Drawing 5464/002 shows the existing permeable and impermeable areas of the site.

2.2.2 The site area is 108,766m² (10.88Ha) with 34,800m² (3.48Ha) being impermeable and the remaining 73,966m² (7.40Ha) being permeable. The site is therefore 32% impermeable.

2.2.3 The current estimated surface water run off rate from the existing site topographical survey has been assessed using WinDES. The estimated run off rate is 235 l/s for a 1 in 1 year return period. The WinDES output files are contained within Appendix C. The surface water run off from the impermeable and roof areas outfall into the existing 375mm diameter surface water sewer located in Carlton Road. There are no other known outfalls from the site.

2.2.4 The WinDES design has been based upon 25mm/hr rainfall which is more reflective of the design criteria at the time the school drainage system was designed some 30 years ago.

3. CONSULTATIONS

- 3.1 As part of this Flood Risk Assessment, the Environment Agency and Yorkshire Water have been consulted regarding the flood risk for this site. The responses received are contained within Appendix B.
- 3.2 The response from the Environment Agency confirms that the site falls within Flood Zones 1. A site in Flood Zone 1 is considered to have less than 0.1% annual probability of flooding
- 3.3 The Environment Agency also confirm that they hold no record of past flood events for this area and have no record of any watercourses on or abutting the site.
- 3.4 The Environment Agency state that if the existing site drains to a public sewer. The run off from the proposed development should be attenuated to provide 30% reduction in the final surface water discharge to the public sewer, compared with the existing outflow prior to redevelopment.
- 3.5 The Environment Agency also state that storm water storage facilities should be provided to accommodate the flood volume for a 1 in 100 year return period plus 20% for climate change without causing any flooding to buildings or adjacent land.
- 3.6 The response from Yorkshire Water confirms that there are adopted sewers within the vicinity of the site. A 300mm diameter concrete surface water sewer runs from South to North under the B6312 Carlton Road to the West of the site. This sewer increases to a 375mm diameter concrete pipe as it runs North. A 150mm diameter Vitruvius clay combined sewer runs from South to North through the residential properties at the western boundary of the site. This sewer also increases in size to a 225mm diameter concrete pipe as it runs North. A 375mm diameter concrete combined sewer runs from West to East

and crosses the site at the Northern boundary, under the existing tennis court. It is assumed that there is private drainage within the site, but no evidence of their location has been provided.

4. PROPOSED DEVELOPMENT

- 4.1 The proposed development is for the demolition of the existing buildings and the construction of an Advanced Learning Centre and sport facilities including a football pitch, tennis courts, a cricket pitch and athletics track. There will also be car parking and public transport facilities associated with the development.
- 4.2 The site will be developed generally in accordance with Barnsley M.D.C. plan ED1942-AL (0) 01 contained within Appendix A.
- 4.3 There are currently no detailed drainage plans for the site, however the drainage will have to be designed to ensure that there is no increase in overall surface water run off rates from that of the existing site which is estimated at 235 l/s.
- 4.4 The proposed permeable and impermeable area plan 5464/003 is included in Appendix A. The proposal decreases the impermeable area of the site by 5,641m² (0.56Ha) which is a 16% reduction due to the proposals.
- 4.5 The 16% reduction in impermeable area assists towards reducing the overall discharge rate into the existing sewer system by 30% as recommended by the Environment Agency.

5. SEQUENTIAL AND EXCEPTION TESTS

5.1 The proposed site has been assessed in accordance with PPS 25.

5.2 The Sequential Test

5.2.1 The site falls within Flood Zone 1. It is considered to have less than 0.1% annual probability of flooding from watercourses.

5.2.2 As the development is an educational facility, the flood risk classification as determined from Table D2 (Annex D, PPS 25) is 'More Vulnerable'.

5.2.3 In accordance with Table D3 (Annex D, PPS 25) a site that is in Flood Zone 1 with a flood risk classification of 'More Vulnerable' is considered appropriate.

5.3 The Exception Test

5.3.1 As development is considered appropriate in accordance with Table D3 there is no requirement for the Exception Test to be applied in this instance.

6. ASSESSMENT OF FLOOD RISK

6.1 Flooding from Land

6.1.1 The main risk of flooding from overland flow is from the impermeable areas within the site and the immediate surrounding areas.

6.1.2 The impermeable areas of the site would be decreased by 5,641m² as part of the development proposals. Therefore there will be a decrease in surface water runoff within the site.

6.1.3 The site falls from South West to North East, with an approximate 16m level difference across the site from a level of 84m AOD in the South west to 68m AOD in the northeast. The buildings are not located within falls to the north. The flood flow routes on drawing 5464/005 show the flood flow routes of the land to the west does not affect the site.

6.1.4 The risk of flooding can be reduced further by designing the site drainage so that there is sufficient capacity to take the anticipated surface water run off from the impermeable and roof areas for a 1 in 30 year storm without the proposed system flooding and contain flood waters in specific areas of the site from a 1 in 100 year event. This should be done as part of the detailed site drainage design which should use sustainable drainage techniques wherever possible. Section 7 discusses the different options available to achieve this scenario on this site.

6.1.5 The site layout and internal car park grades and falls required to mitigate against the risk of flooding are discussed in Section 7.

6.2 Flooding from Rivers / Watercourses

6.2.1 From information provided by the Environment Agency, the threat to the site from surrounding rivers and watercourses can be deemed as negligible, as the site is within Flood Zone 1.

6.3 Flooding from Groundwater

6.3.1 There are no known recorded groundwater levels in this area to quantify the risk of groundwater flooding to the site. However, mitigation measures to protect the property against flooding from groundwater are discussed in Section 7.

6.3.2 Due to the elevated nature of the site, which is one of the highest points in the locality the risk of flooding from groundwater is considered negligible.

6.4 Flooding from Sewers

6.4.1 From the information provided by Yorkshire Water, there is risk of flooding from the public sewers as public sewers can be found in the vicinity of the site. Possible mitigation measures are outlined in Section 7.

6.4.2 The risk of flooding is from the 225mm diameter combined sewer that runs from South to North through the residential properties at the western boundary of the site. From an analysis of existing contours and a flow diagram there is the possibility that if the manholes to the south of the site surcharges, that the flood water will flow into the site. The volumes of such flood water is not considered to be significant and any flood waters would spread out and be shallow in depth.

6.4.3 Another source of flood risk is from existing surface water sewers in Carlton Road (375mm diameter) and at the front of the properties to the west of Carlton Road (150mm diameter).

6.4.4 It is considered that any flood waters from these sewers would be initially contained within the highway and would flow away from the site in a northerly direction.

6.4.5 Overall it is considered that flooding from sewers does not represent a significant flood risk to the site. However there are mitigation measures proposed in Section 7 which will further reduce the residual risk of flooding to buildings from this source.

6.5 Flooding from Climate Change

6.5.1 It is considered that a precautionary response be provided about the effects of climate change. The intensity of rainfall is estimated to increase by up to 10% by the year 2055 and up to 30% by the year 2115. Peak river flow is estimated to increase by up to 20% between the years 2025 and 2115.

- 6.5.2 Any proposed drainage design for the site should include allowances for 20% Climate Change within the calculations, as the lifetime of the development is considered to be 50 – 100 years.

7. MITIGATION OF FLOOD RISK

7.1 Mitigation of Flood Risk to the Proposed Buildings

7.1.1 It is important that any proposed development that has the potential to change the flood mechanisms on a site is designed such that there is no increased flood risk to the site itself, or surrounding sites.

7.1.2 It is recommended that a solid concrete floor with damp proof membranes is installed in the proposed new buildings as they are generally regarded as the most flood resilient floor types with effective connections between the damp proof course and the damp proof membranes. The damp proof membranes should be between the surface screed and the concrete slab as this enables the concrete floor to dry out quickly should flooding occur, from any source. As the area is not threatened by floods from watercourses there is no minimum level specified for finished floor levels within the site.

7.1.3 The finished floor level should be higher than the internal site roads wherever possible, to mitigate against the risks of flooding from the private sewer network on the site and sewers adjacent to the site as mentioned in Section 6.4. If the buildings are lower than the internal site roads, then the building must be outside any flood flow routes, or entrance points protected by linear drains.

7.1.4 The layout of external surfaces within the new development should ensure that the grades of such surfaces fall away from any access points into the buildings wherever possible.

7.1.5 Where any external surfaces within the proposed development cannot fall away from access points to the buildings, a suitable high capacity

linear drain should be installed across any access points to reduce the risk of any flood water entering the buildings.

- 7.1.6 The electrical circuits in the proposed buildings should be set a minimum of 450mm above the finished floor level (in accordance with the Part M of the Building Regulations 2000). The electrical circuits should be run to sockets and switches from the ceiling cavity between the ground and first floors to ensure that they are not affected should any flood water enter the building.
- 7.1.7 The proposed drainage for the site will have an outfall rate of 16% less than that of the current situation due to the decreases in impermeable areas. This will help reduce the risk of the local sewers surcharging during peak storm conditions.
- 7.1.8 The proposed drainage discharge rate will have to be further reduced by 14% to provide a total reduction of 30% less than the existing discharge rate of 235 l/s which means the maximum discharge from the site is to be 165 l/s.
- 7.1.9 In order to attenuate the surface water run off into the adopted sewer to 165 l/s the use of SUDS should be investigated. Use of soakaways should be promoted, subject to further site investigation and positive percolation testing of the ground.
- 7.1.10 If soakaways are not feasible then the drainage should be attenuated by underground storage in the system up to the 1 in 30 year event.

- 7.1.11 An estimate of the amount of storage required to attenuate the 1 in 30 year event has been undertaken using WinDES source control, which confirms that the amount of storage required on site would be between 389m³ and 693 m³ for the proposed 2.91 Ha impermeable area. The results are contained within Appendix C.
- 7.1.12 The storage could also be provided within the site with dry basins designed into the sports field areas to reduce drainage construction costs.
- 7.1.13 For the 1 in 100 year event the amount of storage required on site would be between 594 m³ and 1,012m³. This amount of storage must be contained within the site and should be provided by the use of dry basins designed into the sports field areas which would fill in times of flood but would remain useable at all other times.

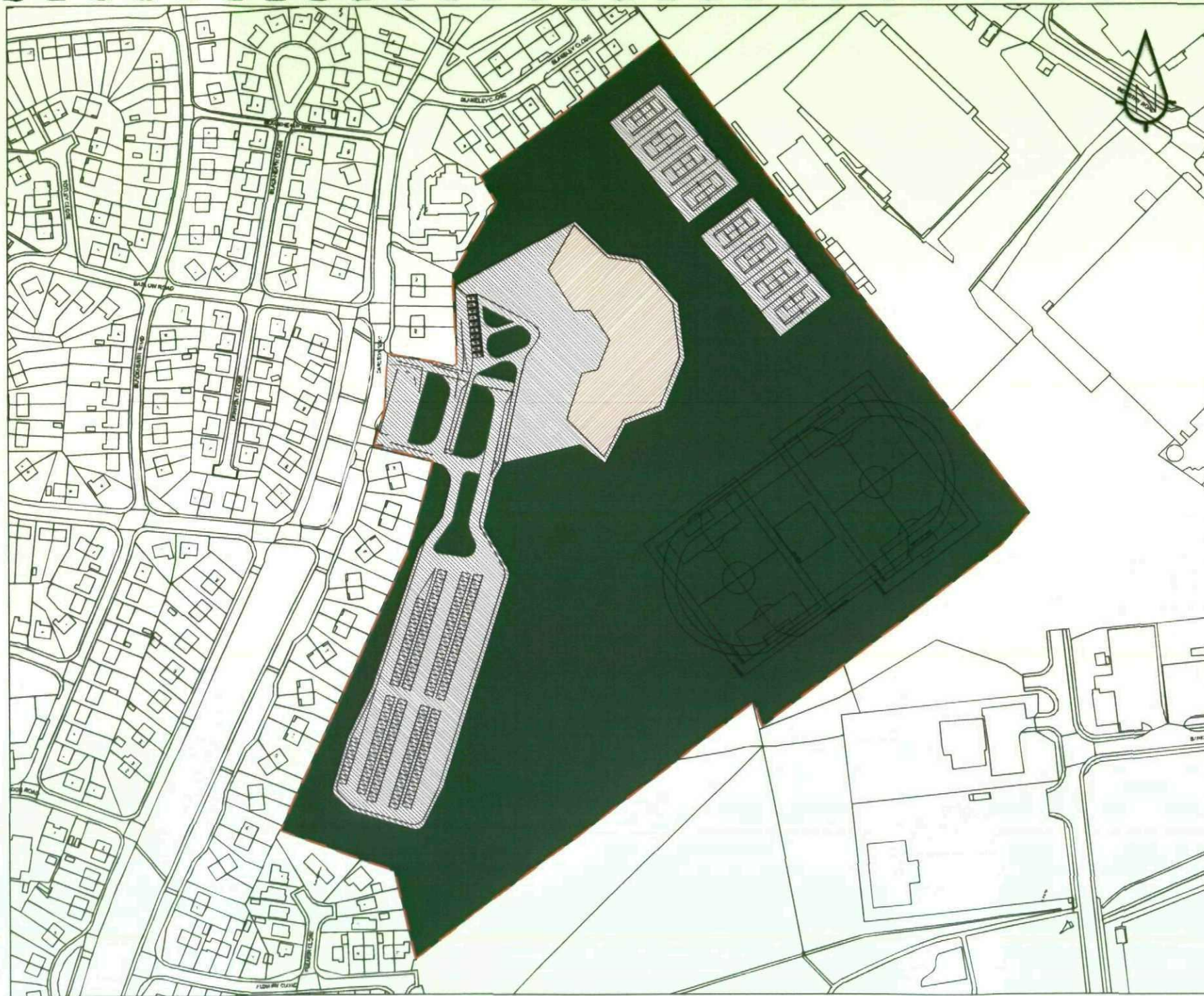
8. CONCLUSIONS

- 8.1 This report serves to review and assess the sources of potential flooding to the site, the impact of the proposed development on the flooding mechanisms of the site and the impact on the surrounding area.
- 8.2 The proposed development falls within Flood Zone 1 which means it has less than 0.1% annual probability of flooding, from watercourses, in any given year.
- 8.3 As can be seen from the assessment undertaken, the main risk of flooding to this site comes from the sewers that flow in the vicinity of the site.
- 8.4 Considering the assessment undertaken, it is envisaged that as long as the site drainage is designed to accept runoff capacities and decrease overall discharge from the site, to 165 l/s there will be no increase in flood risk to the site or the surrounding areas.
- 8.5 This report concludes that the proposed development can be safely developed without there being an increase in the risk of flooding to the site or surrounding areas, in accordance with PPS25 and the Environment Agency recommendations.

APPENDICES

APPENDIX A

Draw ings



KEY

	IMPERMEABLE AREA (BUILDINGS) = 5,088m ² (58)
	IMPERMEABLE AREA (FOOTWAY) = 24,091m ² (228)
	TOTAL IMPERMEABLE AREA = 29,179m ² (278)
	PERMEABLE AREA = 79,807m ² (738)
	TOTAL AREA = 108,986m ² (1008)

Rev	Amendment	Drawn	Date	Checked
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Client	BARNLEY M.B.C.			
Project Title	FLOOD RISK ASSESSMENT ST MICHAEL'S ALC SITE CARLTON ROAD, BARNLEY			
Drawing Title	PROPOSED PERMEABLE AND IMPERMEABLE AREAS			
Scale	1:1000	Drawn By	TW	
Drawing Size	A1	Checked By	JMoK	
Date	17.08.09	Approved By	JMoK	
	Drawing Number	3454/003	Rev	



Rev	Amendment	Drawn	Date	Checked

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Client
BARNLEY M.B.C.

Project Title
**FLOOD RISK ASSESSMENT
ST MICHAEL'S ALC SITE
CARLTON ROAD, BARNLEY**

Drawing Title
EXISTING CONTOURS

Scale 1:1000	Drawn By TW
Drawing Size A1	Checked By JMcK
Date 17.08.09	Approved By JMcK



Rev	Amendment	Drawn	Date	Checked


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 1 0182 84620 1 0182 84620

Client:	BARNLEY M.B.C.			
Project Title:	FLOOD RISK ASSESSMENT ST MICHAEL'S ALC SITE CARLTON ROAD, BARNLEY			
Drawing Title:	EXISTING FLOW			
Scale:	1:1000	Drawn By:	TW	
Drawing Size:	A1	Checked By:	JMcK	
Date:	17.08.09	Approved By:	JMcK	
Drawing Number:	5484/005	Rev:		

APPENDIX B
Consultation Responses

Thomas Walker

From: Wiles, Lynne [lynne.wiles@environment-agency.gov.uk]
Sent: 25 August 2009 08:39
To: Thomas Walker
Subject: Your Enquiry: RFI/2009/9822
Attachments: Standard Notice Commercial (Feb 2008).doc; RFI 9822 Map.pdf

Our Ref: RFI/2009/9822

Your Ref: 090814/e103

Dear Thomas

RE: ST MICHAELS ALC SITE: CARLTON ROAD, BARNSELEY - FLOOD RISK ASSESSMENT

Thank you for your enquiry dated 14 August 2009.

Under Planning Policy Statement 25 Development and Flood Risk (PPS25) land is divided into three zones with regard to flood risk.

Zone 1, little or no risk, this is land outside the 1 in 1000 year flood plain, land deemed to be safe from flooding in the event of a flood with a 0.1% probability of occurring in any one year.

Zone 2, medium risk; land between the 1 in 1000 and 1 in 100 year fluvial (1 in 200 year tidal) flood plain. Between 0.1% and 1.0% (0.5%) probability of occurring in any one year.

Zone 3, high risk, land within the 1 in 100 year fluvial (1 in 200 year tidal) flood plain, at risk in the event of a flood with a 1.0% (0.5%) probability of occurring in any one year.

These zones do not take account of any flood defences that may exist as these could be overtopped or breached by a more severe flood event than designed for or maintained against.

Site Assessment

The site is located in Flood Zone 1, which is land outside the floodplain as shown on our

02/09/2009

Flood Zone Maps. I have attached a map which indicates this. We have no record of any watercourses on or abutting this property but the map does show that there is a small watercourse/drain approximately 300 metres from the site. The site may be subject to flooding from a number of different sources including small or culverted watercourse, public sewers, highway drains and overland surface water flow. We would suggest that you contact the Local Authority Main Drainage Department who may hold more detailed information for the site and may be able to advise further.

Flood Risk Assessment (FRA) over 1ha – Flood Zone 1

A flood risk assessment must be submitted with a planning application on any proposed development site over 1ha. It should assess the existing and proposed surface water drainage from the site. In addition the FRA should also consider other potential sources of flooding including:

Flooding from groundwater

Flooding via overland flow from adjacent land

Flooding from surface water drainage

For a detailed view of what requires an FRA, you can look at our Flood Risk Standing Advice which can be found at

<http://www.environment-agency.gov.uk/research/planning/82587.aspx> A more comprehensive guide on flood risk assessments can be found in CIRIA report C624 'development and flood risk guidance for the construction industry'.

Surface water Runoff

There should be no increase in surface water runoff from the new development.

PPS25 recognises that the management of flood risk is not simply restricted to flood plains and that a catchment-wide approach should be employed.

Greenfield development sites should balance surface water discharge to the 1 in 1 year greenfield run-off rate, this is considered to be

5 l/sec/ha.

If the existing site is shown to drain to a watercourse or public sewer, then surface water

runoff should be attenuated to provide a 30% reduction in the final surface water discharge from the site when compared with the existing site outflow prior to redevelopment. However, if the site does not drain to a watercourse or public sewer at present, then flows must be attenuated to a maximum of 5 litres/second/hectare.

An "on site" storm water storage facility should be provided to accommodate the flood volume for a 1 in 100 year return period plus an allowance of 20% for climate change. If the drainage system is to be adopted it should be noted that sewage undertakers usually require storage designed to accommodate the 1 in 30 year event, preferably by means of oversized pipes or underground tanks. Additional volumes up to the 1 in 100 year return period (plus climate change) should be stored on site without causing any flooding to buildings or adjacent land.

SUDs

There are alternatives to conventional storage for the control of surface water run-off that are favoured by us where ground conditions are suitable. Sustainable Urban Drainage techniques (SUDs) tackle surface water run-off problems at source using features such as soakaways, permeable pavements, grassed swales, infiltration trenches, ponds and wetlands to attenuate flood peak flows, produce water quality improvements and environmental enhancements. We seek to promote the use of SUDs techniques to this site and we expect the developer of the site to submit detailed investigations such that the use of SUDs has been fully explored.

More information on SUDs can be found at: <http://www.ciria.org.uk/suds/>

For information on Green Roofs in particular, please visit: www.thegreenroofcentre.co.uk

Lesley Slaney is the Development Control Officer dealing with the Barnsley area. Her contact details are (0113 213 4779) or e-mail lesley.slaney@environment-agency.gov.uk

This information is based on data that is currently available to the Environment Agency and is subject to our standard notice. The Agency accepts no liability for any loss or damage arising from its use. The interpretation of the information is your responsibility.

If you require any further help, please do not hesitate to contact me.

Yours sincerely,

Lynne Wiles
External Relations Officer
Tel. No: 0113 395 4529

02/09/2009

Email: lynne.wiles@environment-agency.gov.uk

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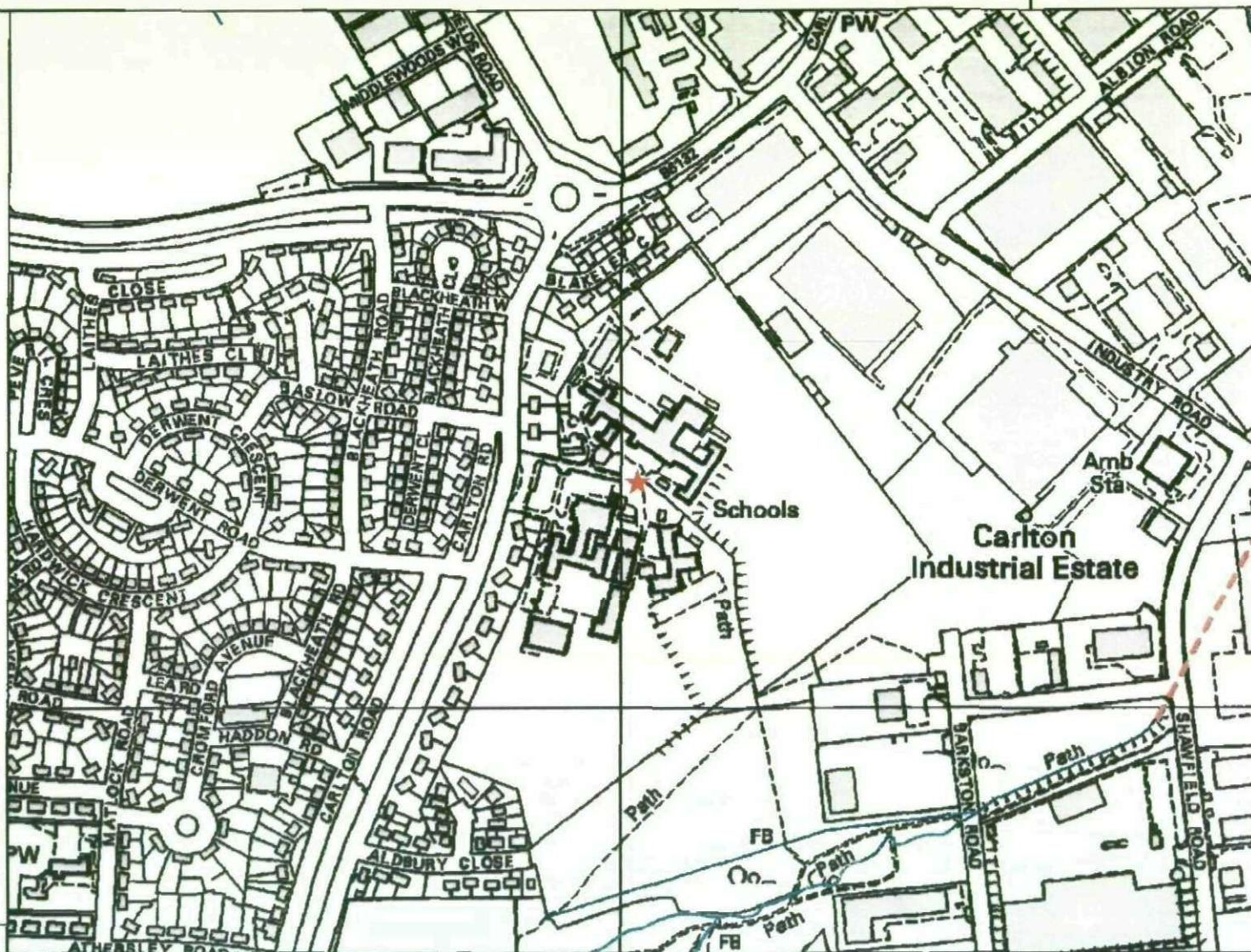
02/09/2009

RFI 9822 MAP



Legend

- Detailed River Network**
- Primary River
 - Secondary River
 - Tertiary River
 - D/S of High Water Mark
 - D/S of Seasonal Extension
 - Lake / Reservoir
 - Canal
 - Extended Culvert (greater than 50m)
 - Canal Tunnel
 - Underground River (inferred)
 - Underground River (local knowledge)
- Flood Map - Defences**
- Areas Benefiting from Flood Defences
 - Flood Map - Flood Storage Areas
 - Flood Map - Flood Zone 3
 - Flood Map - Flood Zone 2



0 50 100 150 m.



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YorkshireWater

RECEIVED
19 AUG 2009

tw

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Bradford
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Tel: 0800 1 385 385
Fax: (01274) 253502

Your Ref: LNSS-7UWKP5
Our Ref: E091815/FS

18th August 2009

Dear Thomas Walker,

LOCATION: CARLTON ROAD, BARNSELY

Thank you for your enquiry/notice dated 14/08/2009 concerning the above.

As requested I enclose copies of Yorkshire Water's records, for water mains and sewerage, also enclosed is a 'Protection of Mains and Services' form listing the necessary precautions when working within the vicinity of the Company's apparatus. The information on the plan is believed to be correct, but there may be departures from the positions indicated. The Company accepts no responsibility for any inaccuracy or omissions.

Water mains & services generally have a minimum cover of 900mm and 750mm respectively, although this is not guaranteed as some mains are laid with less cover than this standard depth. Any excavations undertaken should anticipate the presence of mains with minimal ground cover.

Public Sewers generally have a minimum cover of 1200mm, although this is not guaranteed, as some sewers are laid with less than this depth. Any excavations undertaken should anticipate the presence of sewers with minimal ground cover.

The exact position of the Company's apparatus must be located on site prior to commencing works, if necessary by excavating trial holes. Yorkshire Water's staff will render any assistance in locating and safeguarding our apparatus provided advance notification is received of the commencement of works. This assistance will in no way affect your legal liability. Any damage to our apparatus, as a result of your work, may have serious consequences and payment for all remedial works and other related expenses will be the responsibility of yourselves or your Contractor.

The Company has no responsibility for recording the locations of privately owned apparatus.

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Yours sincerely

Fiona Sorsby
Safe-Move



YorkshireWater

YORKSHIRE WATER PROTECTION OF MAINS AND SERVICES - WASTE WATER

1. The position of Yorkshire Water Services Ltd (YWS) apparatus shown on the existing mains record drawing(s) indicates the **general** position and nature of our apparatus and the accuracy of this information cannot be guaranteed. Any damage to YWS apparatus as a result of your works may have serious consequences and you will be held responsible for all costs incurred. Prior to commencing major works, the exact location of apparatus must be determined on site, if necessary by excavating trial holes. The actual position of such apparatus and that of service pipes which have not been indicated must be established on site by contacting the Customer Helpline **(0845 124 24 24) for water and (0845 124 24 29) for sewerage.**

2. The public sewer network is lawfully retained in its existing position and the sewerage undertaker is entitled to have it remain so without any disturbance. The provisions of section 159 of the Water Industry Act 1991 provides that the sewerage undertaker may "inspect, maintain, adjust, repair or alter" the network. Those rights are given to enable the sewerage undertaker to perform its statutory duties. Any development of the land or any other action that unacceptably hindered the exercise of those rights would be unlawful.

3. Sewers in highways will **generally** be laid to give 1200mm of cover from finished ground level working to kerb races, other permanent identification of the limits of the road or to an agreed line and level. Substantial increases or decreases to this 1200mm depth of cover will result in the sewer being re-laid at your expense.

4. All excavation works near to YWS apparatus should be by hand digging only.

5. Backfilling with a suitable material to a minimum 300mm above YW apparatus is required.

6. To enable future repair works to be carried out, a minimum clearance of 1000mm must be maintained where any works or services are installed adjacent to YWS apparatus and a minimum clearance of 150mm where any works or services cross the apparatus.

7. Adequate support must be provided where any works pass under existing YWS apparatus.

8. Jointing chambers, lighting columns and other structures must not be installed in such a way that future repairs to YWS apparatus are hindered.

9. YWS surface boxes must not be covered or buried. Any adjustment, alteration or replacement of manhole covers must be agreed on site prior to the commencement of the works with a YWS Inspector who may be contacted via our Call Centre on 0845 124 24 29.

10. Explosives must not be used within 100 metres of YWS apparatus or installations and vibrating equipment should not be used directly over any apparatus.

11. Ground levels over existing YWS apparatus are to be maintained.

12. Movement or operation by vehicles or heavy plant is not to be permitted in the immediate vicinity of YWS plant or apparatus unless there has been prior consultation and, if necessary, adequate protection provided without cost to YWS.

13. You will be held responsible for any damage or loss to YWS apparatus during and after completion of work, caused by yourselves, your servant or agent. Any damage caused or observed to YWS plant or apparatus should be immediately reported to YWS.

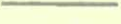
14. You should ensure that nothing is done on the site to prejudice the safety or operation of YWS employees, plant or apparatus.

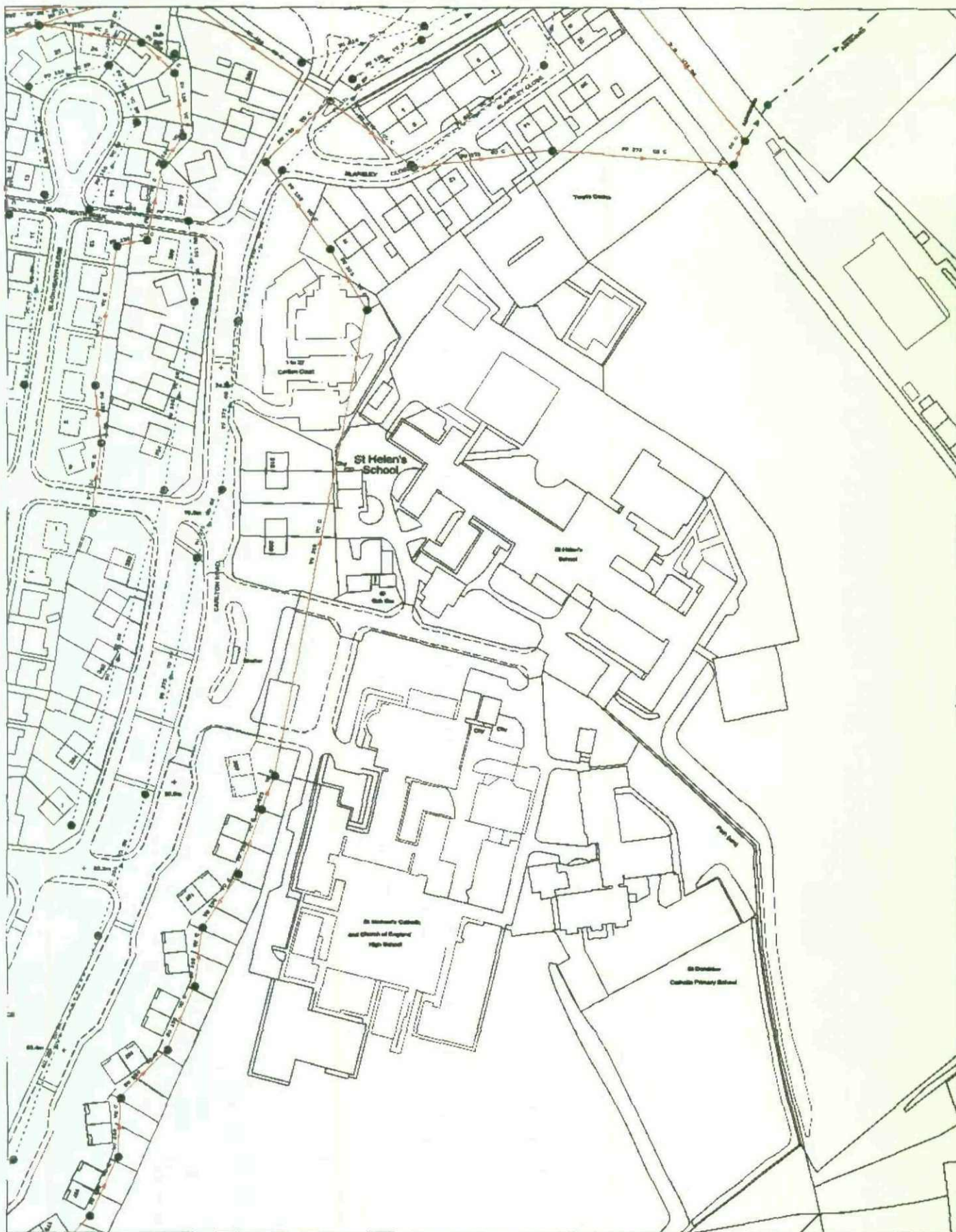
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Sewer Legend

	Combined Sewer		S24 Combined Sewer
	Surface Water Sewer		S24 Surface Water Sewer
	Foul Sewer		S24 Foul Sewer
	Section 104 Sewer		Public Rising Main
	Pumping Station		Abandoned Sewer
	Public Sewage Treatment Works		Syphon Sewer & Vacuum Sewer
			Manhole

Water Legend

	Water Main 4" and below
	Water Main 4" and above
	Raw Water Main
	Private Water Main
	Fire Hydrant
	Pumping Station



435458 : 408852	Map Name : SE3508ME	Title
 YorkshireWater	Yorkshire Water, PO Box 500, Halifax Road, Bradford BD8 2LZ. Contact Name Mrs F Samsby Contact Tel 75 4834	Notes
	Partial Key Red Sewer = F Dashed Sewer = C Surface Water/Sewer = SW Trade Sewer = TD Priority Sewer = PS	This plan is published as a general guide only and no warranty is made for its use in connection with any project. This plan is not to be used as a basis for any project. It is the user's responsibility to ensure that the plan is used in accordance with the terms and conditions of the plan.
Date Recd : 18/08/2008, 11:52:12	Date Gen : 18/08/2008, 11:52:21	
Source :	Sewer Network Enquiry	

APPENDIX C

Calculations

Sanderson Associates
Sanderson House
Jubilee Way
Huddersfield, WF4 4TD
Date 25-08-09
File 5464.SWS
Micro Drainage

ALC Site Carlton
Barnsley FRA
Existing site run off
Designed By JMcK
Checked By
System1 W.11.3

Page 1

**Micro
Drainage.**

STORM SEWER DESIGN by the Modified Rational Method

Global Variables

Pipe Size File C:\Program Files\Micro Drainage Ltd\WinDes\STANDARD.PIP
Manhole Size File C:\Program Files\Micro Drainage Ltd\WinDes\STANDARD.MHS

Location - England & Wales

Return Period (years)	1	Maximum Backdrop Height (m)	1.500
M5-60 (mm)	19.000	Min Cover Depth for Optimisation (m)	1.200
Ratio R	0.350	Min Vel for Auto Design Only (m/s)	1.00
Maximum Rainfall (mm/hr)	25	Min Slope for Optimisation (1:X)	500
Foul Sewage (l/s/ha)	0.00	Minimum Outfall Invert (m)	0.000
Overflow Setting (*Foul only)	0	Ground Level at Outfall (m)	0.000
Volumetric Runoff Coeff.	0.75	Outfall Manhole Name	
Add Flow / Climate Change (%)	0	Outfall Manhole Dia/Length (mm)	0
Minimum Backdrop Height (m)	0.200	Outfall Manhole Width (mm)	0

Designed with Level Soffits

Network Design Table

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
1.000	10.00	0.200	50.0	3.480	5.00	0.0	0.600	0	175

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E.Area (ha)	E.DWF (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	CAF (l/s)	Flow (l/s)
1.000	25.0	5.1	0.000	3.480	0.0	0.0	0.0	2.57	283.6	235.6

Variables	Result	Design	Overview 2D	Overview 3D	Vt
Region	England & Wales		Cv (Summer)		0.750
Return Period (years)	100		Cv (Winter)		0.840
Map	M5-60 (mm)	19.000	Impermeable Area (ha)		2.91
Ratio R	0.401		Maximum Allowable Discharge (l/s)		165
			Infil Coefficient (m/hr)		
			Safety Factor		2
			Climate Change %		20
					Apply

[Done](#)
[Help](#)

Variables	Result	Design	Overview 2D	Overview 3D	Vt
Global Variables require approximate storage of between 594 m² and 1012 m². These values are estimates only and should not be used for design purposes.					
Done			Help		

Variables	Result	Design	Overview 2D	Overview 3D	Vt
Region	England & Wales				
Return Period (years)	30				
Map	M5-60 (mm)				
Ratio R	0.401				
		Cv (Summer)			0.750
		Cv (Winter)			0.640
		Impermeable Area (ha)			2.91
		Maximum Allowable Discharge (l/s)			165
		Infil Coefficient (m/hr)			
		Safety Factor			2
		Climate Change %			20
					Apply

Done

Help

Variables	Result	Design	Overview 2D	Overview 3D	Vt
Global Variables require approximate storage of between 399 m³ and 693 m³. These values are estimates only and should not be used for design purposes.					
Done			Help		