FORMER ST GABRIELS CONVENT, LIVERPOOL

FLOOD RISK ASSESSMENT

Final Report v1.0

October 2015

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Report Title:	**Former St Gabriels Convent, Liverpool** Flood Risk Assessment Final Report v1.0
Client:	St Gabriels (Liverpool) Ltd
Date of Issue:	23 October 2015

Prepared by:	James Aldridge BEng (Hons) MSc *Associate Director*
Checked and Approved by:	Kevin Tilford BSc MSc(Eng) PhD MBA MCIWEM C.WEM CEnv *Managing Director*

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1 INTRODUCTION

1.1 PURPOSE OF REPORT

Weetwood Services Ltd ('Weetwood') has been instructed by St Gabriels (Liverpool) Ltd to undertake a Flood Risk Assessment (FRA) for the proposed redevelopment of a site located at the former St Gabriels Children's Home, Liverpool.

The FRA has been undertaken in accordance with the requirements of the National Planning Policy Framework (NPPF) and supporting Planning Practice Guidance.

1.2 STRUCTURE OF THE REPORT

The report is structured as follows:

Section 1	Introduction and report structure
Section 2	Presents national and local flood risk and drainage planning policy
Section 3	Provides background information relating to the development site, the development proposals, ground conditions and existing site access arrangements
Section 4	Assesses the potential sources of flooding to the development site
Section 5	Presents flood risk mitigation measures based on the findings of the assessment
Section 6	Addresses the effect of the proposed development on surface water runoff and presents an illustrative surface water drainage scheme to ensure that surface water runoff is sustainably managed and flood risk is not increased elsewhere.
Section 7	Presents a summary of key findings
Section 8	Presents the recommendations

2 PLANNING POLICY AND GUIDANCE

2.1 NATIONAL PLANNING POLICY

The aim of the NPPF is to ensure that flood risk is taken into account at all stages in the planning process and is appropriately addressed.

2.1.1 Sequential Test

Paragraph 100 of the NPPF states that '*inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk but where development is necessary, making it safe without increasing flood risk elsewhere*'.

This policy is implemented through the application of the flood risk Sequential Test which aims to steer new development to areas with the lowest probability of flooding.

2.2 REQUIREMENTS FOR SUSTAINABLE DRAINAGE SYSTEMS

Planning applications for major developments[1] are required[2] to provide Sustainable Drainage Systems (SuDS) for the management of surface water runoff, unless demonstrated to be inappropriate[3] or disproportionately expensive.

In considering a development that includes a sustainable drainage system, the local planning authority will need to be satisfied that the proposed minimum standards of operation are appropriate and that there are clear arrangements in place for ongoing maintenance.

Technical standards have been published by Defra in relation to the design, construction and operation of sustainable drainage systems. According to the guidance, the surface water drainage system must be designed so that:

- Flooding does not occur on any part of the site for a 1 in 30 annual probability rainfall event, unless an area is designed to hold and/or convey water as part of the design;
- Flooding does not occur in any part of a building during a 1 in 100 annual probability event; and
- Flows resulting from rainfall in excess of a 1 in 100 annual probability rainfall event are managed in exceedance routes that minimise the risks to people and property, so far as is reasonably practicable.
- For previously developed sites, the peak discharge rate from the proposed development to any drain, sewer or surface water body for the 1 in 1 annual probability rainfall event and the 1 in 100 annual probability rainfall event should not exceed the rate of discharge from the site prior to redevelopment for that event.
- For previously developed sites the runoff volume from the proposed development to any highway drain, sewer or surface water body in the 1 in 100 annual probability, 6 hour rainfall event should never exceed the runoff volume from the development site prior to redevelopment for that event.

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[1] Developments of 10 dwellings or more; or equivalent non-residential or mixed development (as set out in Article 2(1) of the Town and Country Planning (Development Management Procedure) (England) Order 2010)

[2] Written Statement (HCWS161) made by the Secretary of State for Communities and Local Government (Mr Eric Pickles) on 18 December 2014

[3] Paragraph 082 (Reference ID: 7-082-20150323) of the Planning Practice Guidance outlines how a sustainable drainage system might be judged to be inappropriate

2.3 LOCAL PLANNING POLICY AND GUIDANCE

Policy EP13 – Flood Prevention of the Liverpool Unitary Development Plan states that: *"...planning permission will not be granted for development which would:*

> *ii. be likely to increase the risk of flooding elsewhere;*
> *iii. result in an adverse impact on the water environment due to additional surface water run off."*

Strategic Policy 1 – Sustainable Development Principals of the Liverpool Core Strategy Submission Draft states that *"New development should ... not exacerbate potential sources of flood risk, include flood mitigation measures and provide Sustainable Urban Drainage Systems (SUDS)."*

2.4 RELEVANT DOCUMENTS

The FRA has been informed by the following documents:

- Strategic Flood Risk Assessment (SFRA), Liverpool City Council, January 2008
- Preliminary Flood Risk Assessment (PFRA), Liverpool City Council, June 2011

3 SITE DETAILS AND PROPOSED DEVELOPMENT

3.1 SITE LOCATION

The approximately 2.7 hectare (ha) site is located at the junction between Beaconsfield Road and Church Road, Liverpool, at Ordnance Survey National Grid Reference SJ 418 875, as shown in **Figure 1**.

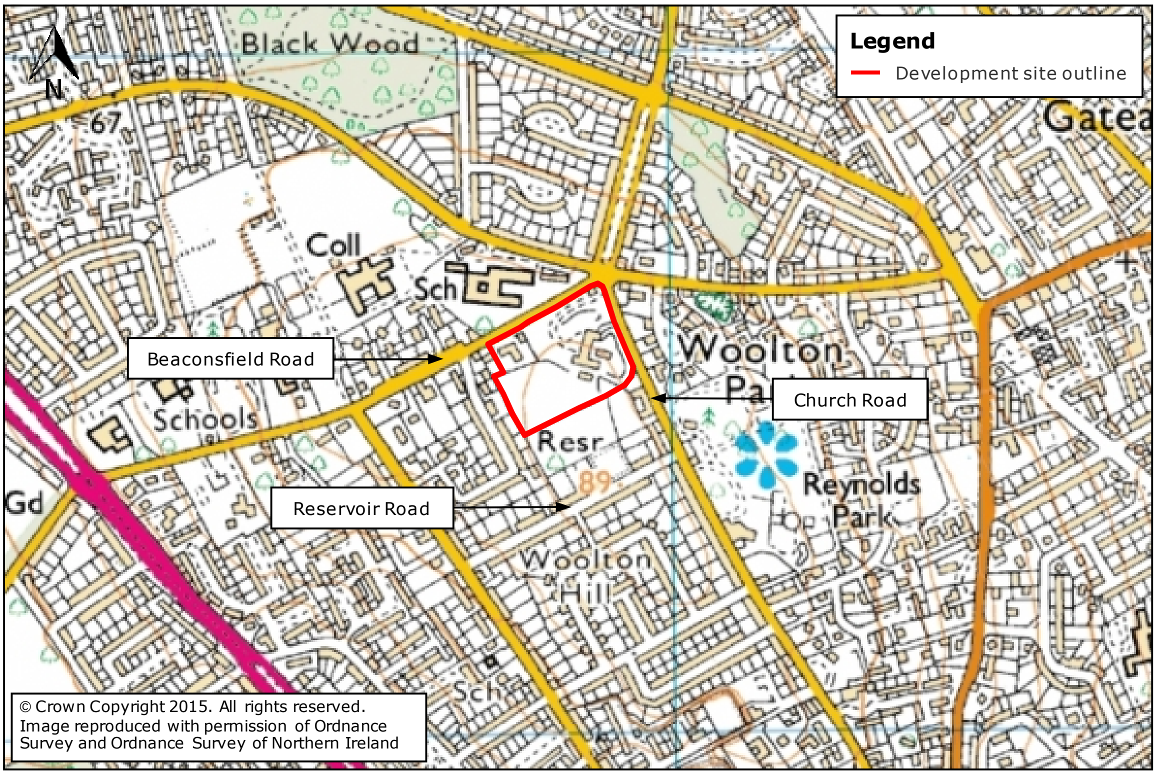

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Figure 1: Site Location

3.2 EXISTING AND PROPOSED DEVELOPMENT

The site currently comprises of the former St Gabriels Children's Home and benefits from an extant full planning permission[4] for the development of care village for the elderly.

The current proposals are for the construction of up to 48 residential dwellings with associated access roads, driveways and public open space (**Appendix A**). The NPPF Planning Practice Guidance classifies residential development as 'more vulnerable' land use.

3.3 ACCESS AND EGRESS

Vehicular access to the site is provided in a number of locations along the northern and eastern boundaries of the site.

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[4] Ref: 12F/1571

3.4 GROUND CONDITIONS

According to the British Geological Survey (BGS) surface geology maps[5] the bedrock geology underlying the site comprises of the Chester Pebble Beds Formation. Superficial deposits were not recorded at the site.

The site is shown to be located above a principal bedrock aquifer and within groundwater source protection Zone 3.

3.5 SITE LEVELS

A topographic survey of the site has been undertaken by Survey Solutions and is provided in **Appendix B**. This information has been utilised to develop a digital elevation model as illustrated in **Figure 2**.

The topography at site is shown to slope down from the southern boundary in all directions; with levels ranging between approximately 80.4 and 89.6 metres above Ordnance Datum (m AOD).

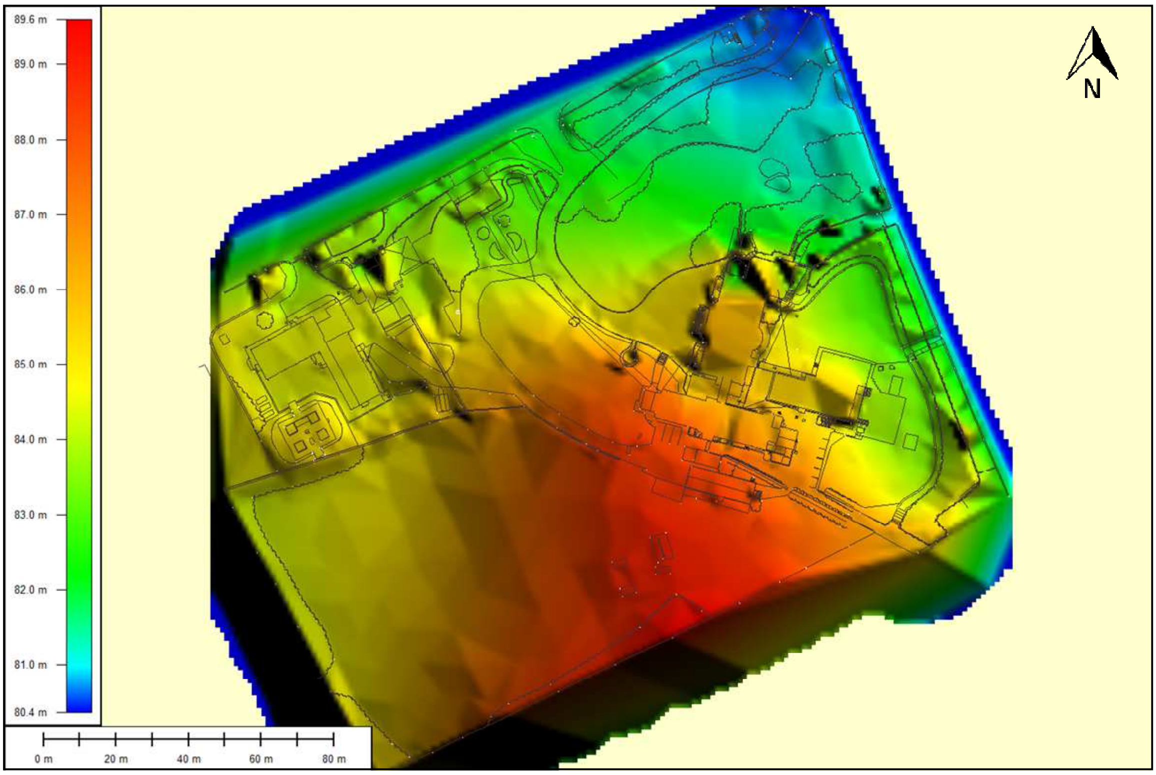

Figure 2: Digital Elevation Model

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[5] http://mapapps.bgs.ac.uk/geologyofbritain/home.html

4 REVIEW OF FLOOD RISK

4.1 FLOOD ZONE DESIGNATION

Flood Zones refer to the probability of river and sea flooding, ignoring the presence of defences. The NPPF Planning Practice Guidance defines Flood Zones as follows:

- **Flood Zone 1: Low Probability**. Land having a less than 1 in 1,000 annual probability of river or sea flooding.
- **Flood Zone 2: Medium Probability**. Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or Land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding.
- **Flood Zone 3a: High Probability**. Land having a 1 in 100 or greater annual probability of river flooding; or Land having a 1 in 200 or greater annual probability of sea flooding.
- **Flood Zone 3b: The Functional Floodplain**. This zone comprises land where water has to flow or be stored in times of flood. Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency.

The Flood Zones are shown on the EA Flood Map for Planning (Rivers and Sea). The Planning Practice Guidance states that the Zones shown on the EA Flood Map do not take account of the possible impacts of climate change and consequent changes in the future probability of flooding.

According to the EA Flood Map for Planning (Rivers and Sea) (**Figure 3**) the site is located in Flood Zone 1.

4.2 SEQUENTIAL TEST

The proposed development site is situated within Flood Zone 1 and therefore satisfies the requirements of the Sequential Test.

4.3 HISTORICAL RECORDS OF FLOODING

Figures 4.2.2 and 5.2.1 of the Liverpool City Council PFRA indicate that no past flood events have been recorded at the site.

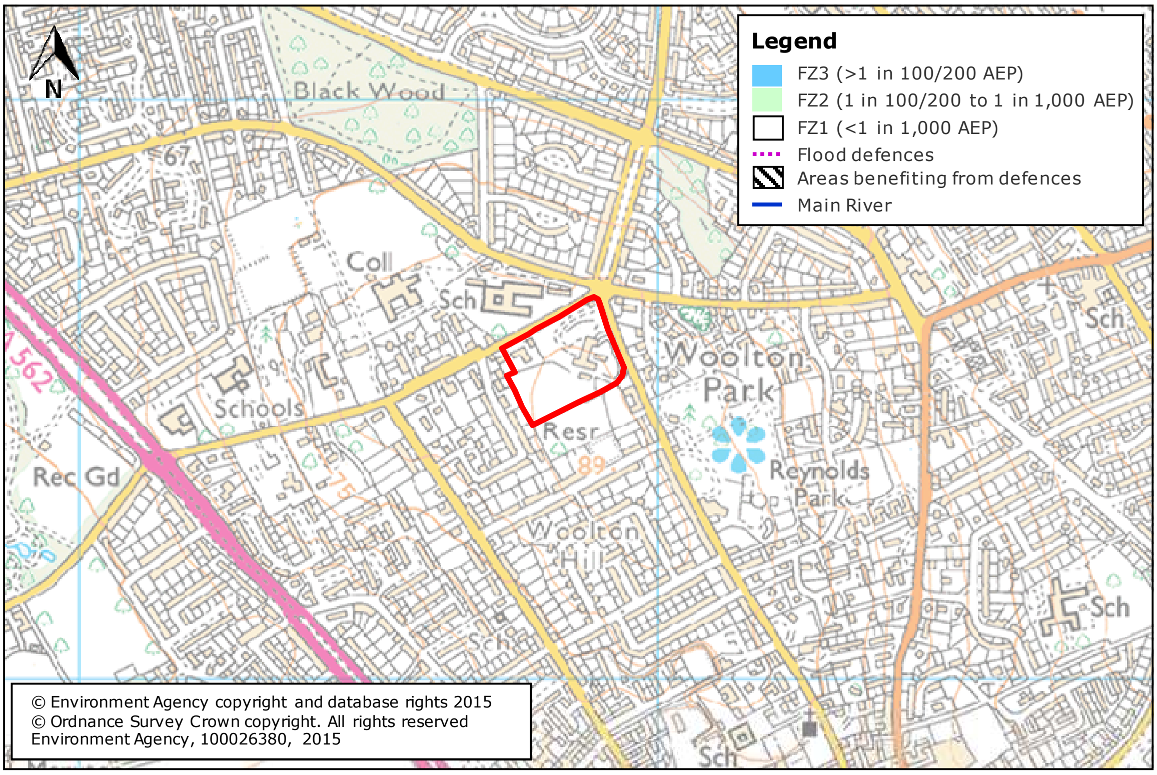
4.4 FLUVIAL FLOOD RISK

There are no watercourses in the vicinity of the site. In addition to this, OS Mapping indicates that the site is located at the top of a hill. Consequently, the site is not considered to be at risk of fluvial flooding.

4.5 FLOOD RISK FROM RESERVOIRS, CANALS AND OTHER ARTIFICIAL SOURCES

The EA Risk of Flooding from Reservoirs map (**Figure 4**) indicates that the site is not considered to be at risk of flooding from reservoirs although there is a covered reservoir 70 m south of the site. In the unlikely event that reservoir failure occurs, the consequences are expected to be limited by the sites location and the surrounding topography. There are no canals within the vicinity of the site.

Any residual risk of reservoir flooding will be mitigated though implementation of the measures proposed in **Section 5** of this report.


N
Legend
FZ3 (>1 in 100/200 AEP)
FZ2 (1 in 100/200 to 1 in 1,000 AEP)
FZ1 (<1 in 1,000 AEP)
Flood defences
Areas benefiting from defences
Main River
Black Wood
Coll
Sch
Schools
Rec Gd
Resr
89
Woolton Park
Reynolds Park
Woolton Hill
Sch
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Environment Agency, 100026380, 2015

Figure 3: Environment Agency Flood Map for Planning (Rivers & Sea)
(Source: EA website)

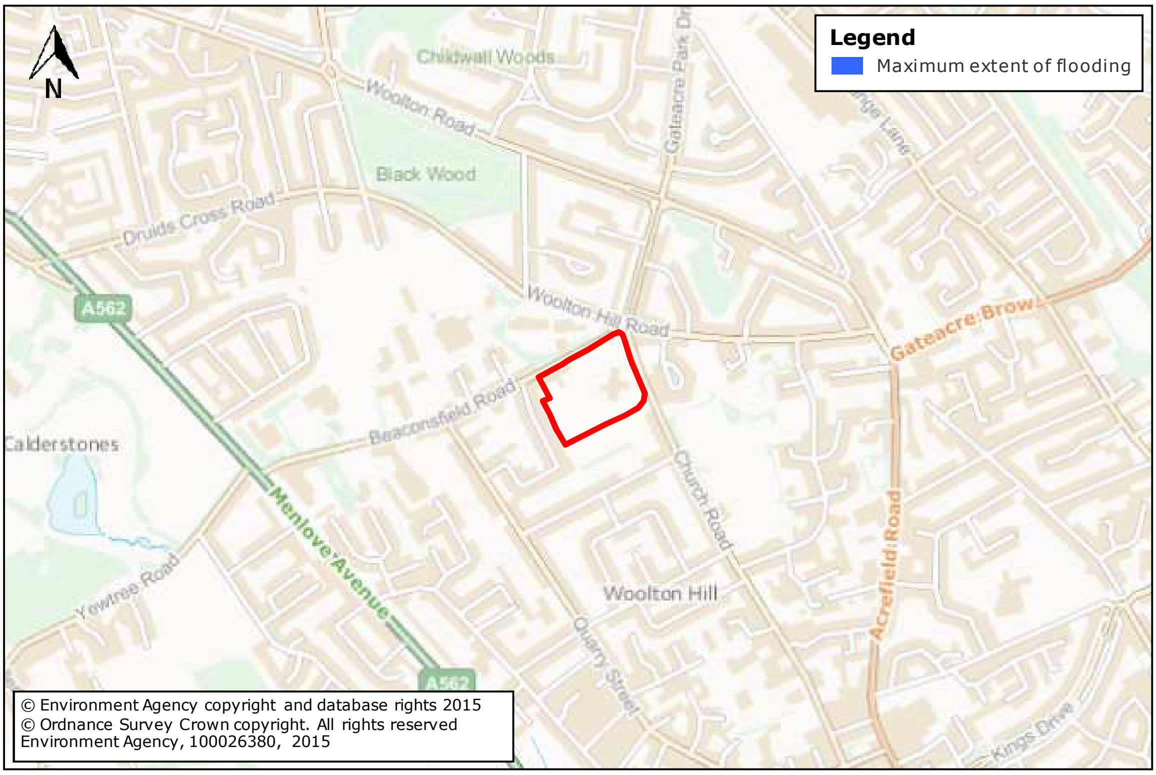


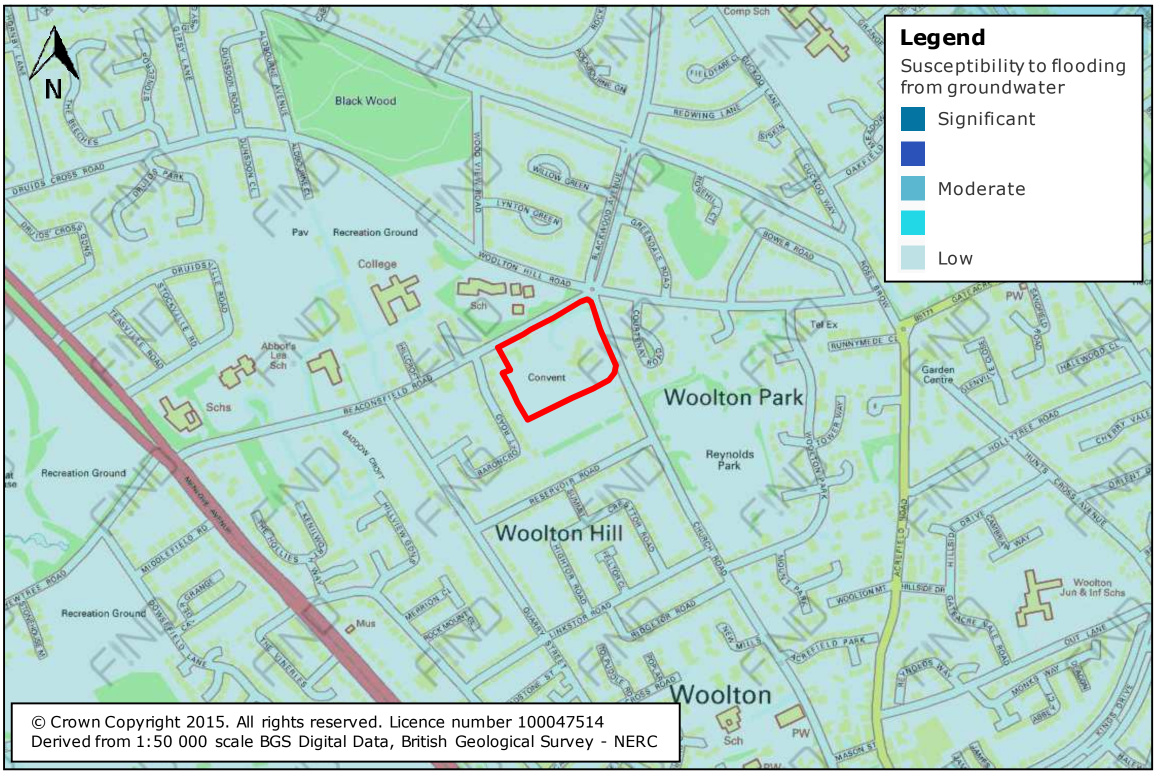
Figure 4: Environment Agency Risk of Flooding from Reservoirs Map
(Source: EA website)

4.6 FLOOD RISK FROM GROUNDWATER

As detailed in **Section 3.4**, the bedrock geology at the site is believed to comprise of the Chester Pebble Beds Formation. Superficial deposits were not recorded at the site. The geology underlying the site is therefore likely to have a high permeability. However, the risk of groundwater emergence is expected to be low due to the sites location relative to the surrounding topography.

The above assessment is supported by the BGS Groundwater Flooding Hazard map (**Figure 5**) which shows that the susceptibility to groundwater flooding at the site is considered to be low.

Any residual risk of flooding from groundwater will be mitigated through the implementation of the measures proposed in **Section 5** of this report.



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Derived from 1:50 000 scale BGS Digital Data, British Geological Survey - NERC

Figure 5: Groundwater Flooding Hazard Map
(Source: Findmaps)

4.7 FLOOD RISK FROM SURFACE WATER

As detailed in **Section 3.4 and 4.6,** the geology underlying the site is expected to have a high permeability which would limit the potential for surface water flooding. In addition, the existing roof and hardstanding areas at the site are served by a formal surface water drainage system[6]. As such, the propensity for surface water to be generated at the site is assessed to be low.

The EA Risk of Flooding from Surface Water map (**Figure 6**) indicates that all but a small area along the eastern boundary is considered to be at a very low risk of surface water flooding.

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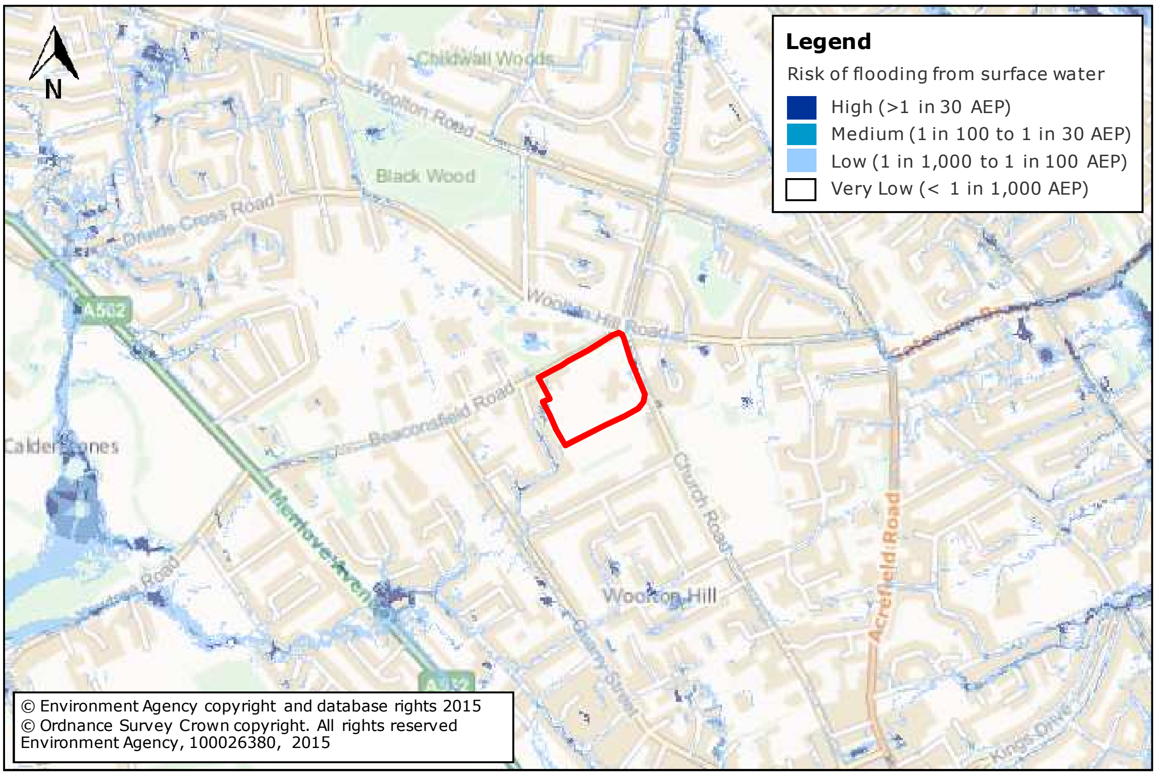
[6] NJP, Flood Risk Assessment for Poor Servants of the Mother of God – St Gabriels Convent, Appendix D, June 2012, Planning Ref: 12L/0197

The area along the eastern boundary of the site is shown to be at a low risk of surface water flooding.

The risk of pluvial flooding at the site is assessed to be low. Any residual flood risk from this source will be addressed through the mitigation measures detailed in **Section 5** and the surface water drainage strategy in **Section 6.**


N
Childwall Woods
Woolton Road
Black Wood
Druids Cross Road
Gateacre Park Drive
A562
Woolton Hill Road
Beaconsfield Road
Calderstones
Menlove Avenue
Church Road
Woolton Hill
Acrefield Road
Church Street
Kings Drive
Legend
Risk of flooding from surface water
High (>1 in 30 AEP)
Medium (1 in 100 to 1 in 30 AEP)
Low (1 in 1,000 to 1 in 100 AEP)
Very Low (< 1 in 1,000 AEP)
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Environment Agency, 100026380, 2015

Figure 6: Environment Agency Risk of Flooding from Surface Water
(Source: EA website)

5 FLOOD RISK MITIGATION MEASURES

5.1 FLOOD MITIGATION

The residual risk of flooding at the site will be mitigated though the implementation of the following measure:

- Finished floor levels to be set at a minimum of 150 mm above adjacent ground levels following any re-profiling of the site.

This will enable any potential overland flows to be conveyed safely across the site without affecting property in accordance with the approach promoted by government policy[7].

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[7] Making Space for Water, Taking forward a new Government strategy for flood and coastal erosion risk management in England, March 2005, Dept for Environment, Food and Rural Affairs

6 SURFACE WATER MANAGEMENT

6.1 DISPOSAL OF SURFACE WATER

In accordance with the NPPF Planning Practice Guidance[8], surface water runoff should be disposed of according to the following hierarchy:

1. Into the ground (infiltration)
2. To a surface water body
3. To a surface water sewer, highway drain, or another drainage system
4. To a combined sewer

A preliminary assessment of the geology underlying the site indicates that the disposal of surface water by infiltration may be feasible. Infiltration testing should be undertaken in accordance with BRE365[9] to determine whether infiltration is a practicable solution for disposing of surface water generated at the site.

In the event that infiltration is not a practicable method for disposal of surface water generated at the site, United Utilities has confirmed that surface water can be discharged to the public surface water sewers along Blackwood Avenue at a maximum rate of 78.0 l/s (**Appendix C**).

Based on the above, two surface water drainage strategies have been developed, the first is for a disposal by infiltration scheme and the second is for the disposal of all surface water to the public sewer network.

6.2 MANAGING SURFACE WATER WITHIN THE DEVELOPMENT

The proposed impermeable areas within the development have been calculated to be 0.852 ha.

6.3 SCENARIO A – INFILTRATION POSSIBLE

6.3.1 Peak Flow / Volume Control

This scheme assumes that infiltration rates at the site are in the region of 0.3 m per hour.

The disposal of surface water by infiltration would result in a significant reduction in the maximum rates and volumes of surface water leaving the site.

6.3.2 Illustrative Surface Water Drainage Scheme

The proposed infiltration devices have been modelled using the Detailed Design module of MicroDrainage Source Control (**Appendix D**).

The required storage structures have been sized to cater for the 1 in 100 annual probability rainfall event including a 30% increase in rainfall intensity in order to allow for climate change, in accordance with EA guidance[10].

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[8] Paragraph 080, Reference ID: 7-080-20150323

[9] BRE Digest 365: Soakaway Design

[10] Climate Change Allowances for Planners – Guidance to Support the National Planning Policy Framework, September 2013, EA ref: LIT 8496 NA/EAD/Sept 2013/V12

The proposed surface water drainage scheme is summarised as follows:

- Surface water runoff generated from roofs and hardstanding associated with the new detached, semi-detached and terraced dwellings discharged to 3.2 x 3.2 m soakaway crates within the rear gardens;
- Runoff generated across the roof and hardstanding areas surrounding the bespoke dwelling discharged to a 4.0 x 4.0 m soakaway crate within the front garden;
- Runoff generated across the across the proposed roads and remaining roof areas discharged to 3 no. infiltration basins providing a total storage volume of 221 m^3 with a land-take of approximately 510 m^2.

An indicative layout for the proposed infiltration devices is provided in **Appendix E**. There is the potential for additional SuDS features such as filter strips and swales to be incorporated into the drainage scheme, and this could be taken forward at the detailed design stage.

6.4 SCENARIO B – DISCHARGE TO SEWER

6.4.1 Peak Flow Control

The existing roof and hardstanding areas at the site have a total area of 0.675 ha, of which 0.589 ha is positively drained by an existing on-site drainage system[11] discharging to the public combined sewers along Beaconsfield Road and Church Road.

The peak runoff rates from the existing positively drained impermeable surfaces have been calculated using the Modified Rational Method (MRM) (**Appendix F**) with reference to the maximum capacity of the existing drainage system; calculated using the Colebrook-White equation with the Darcy-Weisbach formula, taking account of local head losses. The results are summarised in **Error! Reference source not found.**.

Table 1: Surface Water Drainage - Existing Site

Annual probability of rainfall event	Runoff Rate (l/s)	Capacity (l/s)	Discharge Rate (l/s)
1 in 1	53.2	89.3	53.2
1 in 2	68.8		68.8
1 in 30	130.1		89.3
1 in 100	168.1		89.3

Liverpool City Council requires the maximum discharge rate from previously developed sites to be restricted to the existing 1 in 2 annual probability discharge rate, including a 30% reduction. As such, the peak discharge rate from the site should be restricted to a maximum of 48.2 l/s.

The proposed maximum discharge rate is 38% lower than the allowable discharge rate to the public sewer network stipulated by United Utilities.

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[11] NJP, Flood Risk Assessment for Poor Servants of the Mother of God – St Gabriels Convent, Appendix D, June 2012, Planning Ref: 12L/0197

6.4.2 Volume Control

The development proposals will result in a 0.177 ha increase in the extent of impermeable areas at the site. This would be expected to increase the volume of runoff generated at the site by 50.3 m^3.

In order to mitigate the increase in the volume of runoff generated following redevelopment of the site; 620 m^2 of proposed permeable surfaces should be re-graded to ensure that runoff generated across these areas does not contribute to runoff leaving the site.

6.4.3 Illustrative Surface Water Drainage Scheme

The surface water storage facilities have been modelled using the Detailed Design module of MicroDrainage Source Control (**Appendix G**).

The required storage structures have been sized to store the 1 in 100 annual probability rainfall event including a 30% increase in rainfall intensity in order to allow for climate change, in accordance with EA guidance[12].

It is proposed to discharge surface water from the site at a maximum rate of 48.2 l/s to the public surface water sewer network in Blackwood Avenue. A total storage volume of 228 m^3 with a land-take of approximately 527 m^2 would be reqired.

The storage facilities have been sized to accommodate the entire storage requirements for the site. This is likely to be an overestimate as the storage capacity within the surface water conveyance system and other SuDS features has not been taken into account.

An indicative layout for proposed attenuation storage structures at the site is provided in **Appendix H**. Additional SuDS features, such as filter strips and swales may be incorporated into the surface water drainage strategy at the detailed design stage.

6.5 MAINTENANCE OF SUDS

SuDS elements within the curtilage of residential dwellings would be the responsibility of the owner of the property. The pipe network, designed to Sewers for Adoption (7th edition) standard, may be adopted by the sewerage undertaker. SuDS in open spaces may be adopted by the local authority / water company / maintained by a management company.

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[12] Climate Change Allowances for Planners – Guidance to Support the National Planning Policy Framework, September 2013, EA ref: LIT 8496 NA/EAD/Sept 2013/V12

7 SUMMARY

This FRA has been prepared on behalf of St Gabriels (Liverpool) Ltd and relates to the proposed redevelopment of a site located at the former St Gabriels Children's Home, Liverpool.

According to the EA Flood Map for Planning (Rivers and Sea) the proposed development is located outside of the 1 in 1,000 annual probability flood outline and is therefore defined by the NPPF as being situated within Flood Zone 1. The site is also assessed to be at a low risk of flooding from alternative sources.

As the site is in Flood Zone 1, the flood risk Sequential Test is deemed to have been addressed and the Exception Test need not be addressed.

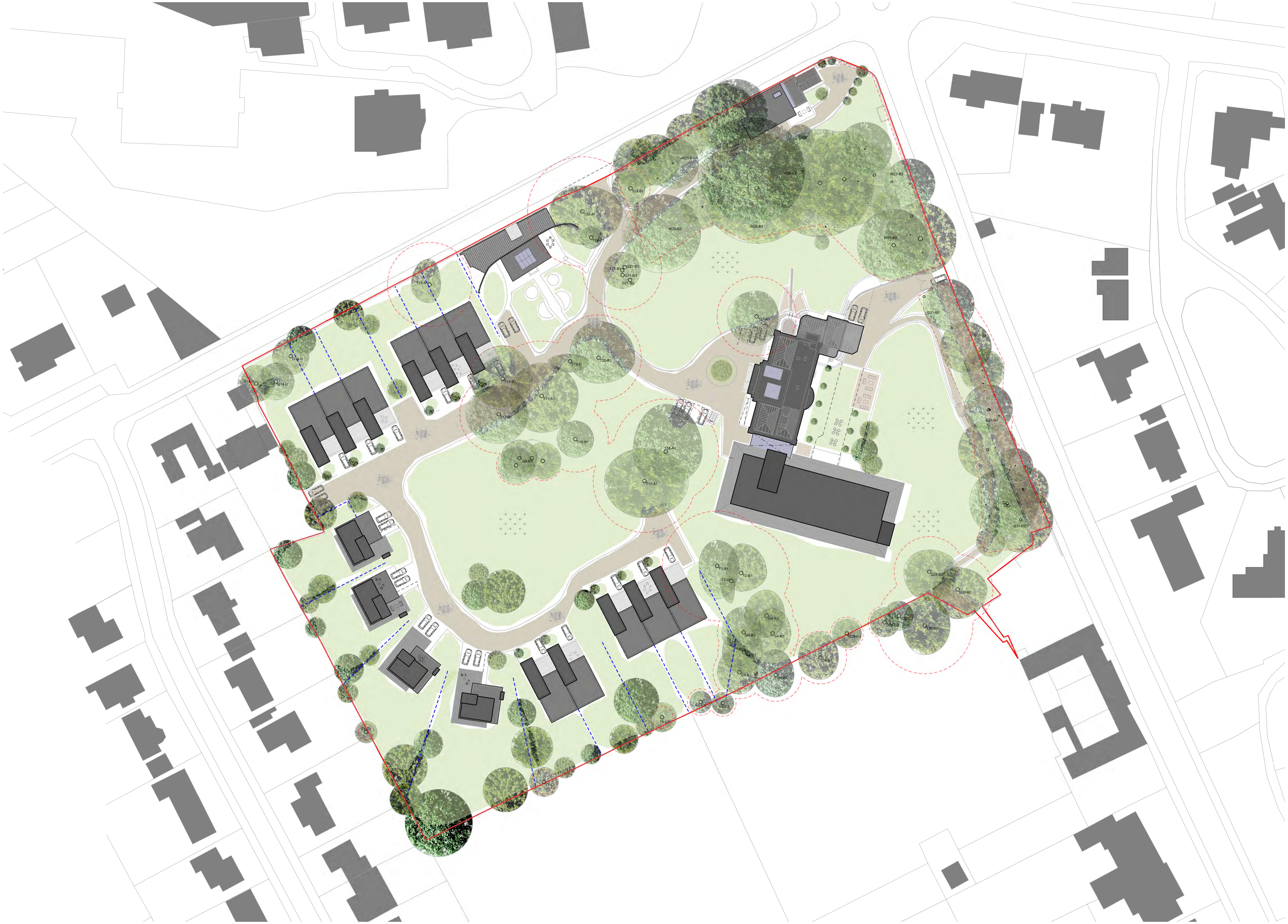
Surface water runoff from the developed site can be sustainably managed in accordance with the NPPF and local policy. Two drainage strategies are presented, one based on disposal of surface water by infiltration, and one based on disposal to the public sewer network. The proposals provide the opportunity for the inclusion of SuDS elements, ensuring that there will be no increase in surface water runoff from the proposed development.

8 RECOMMENDATIONS

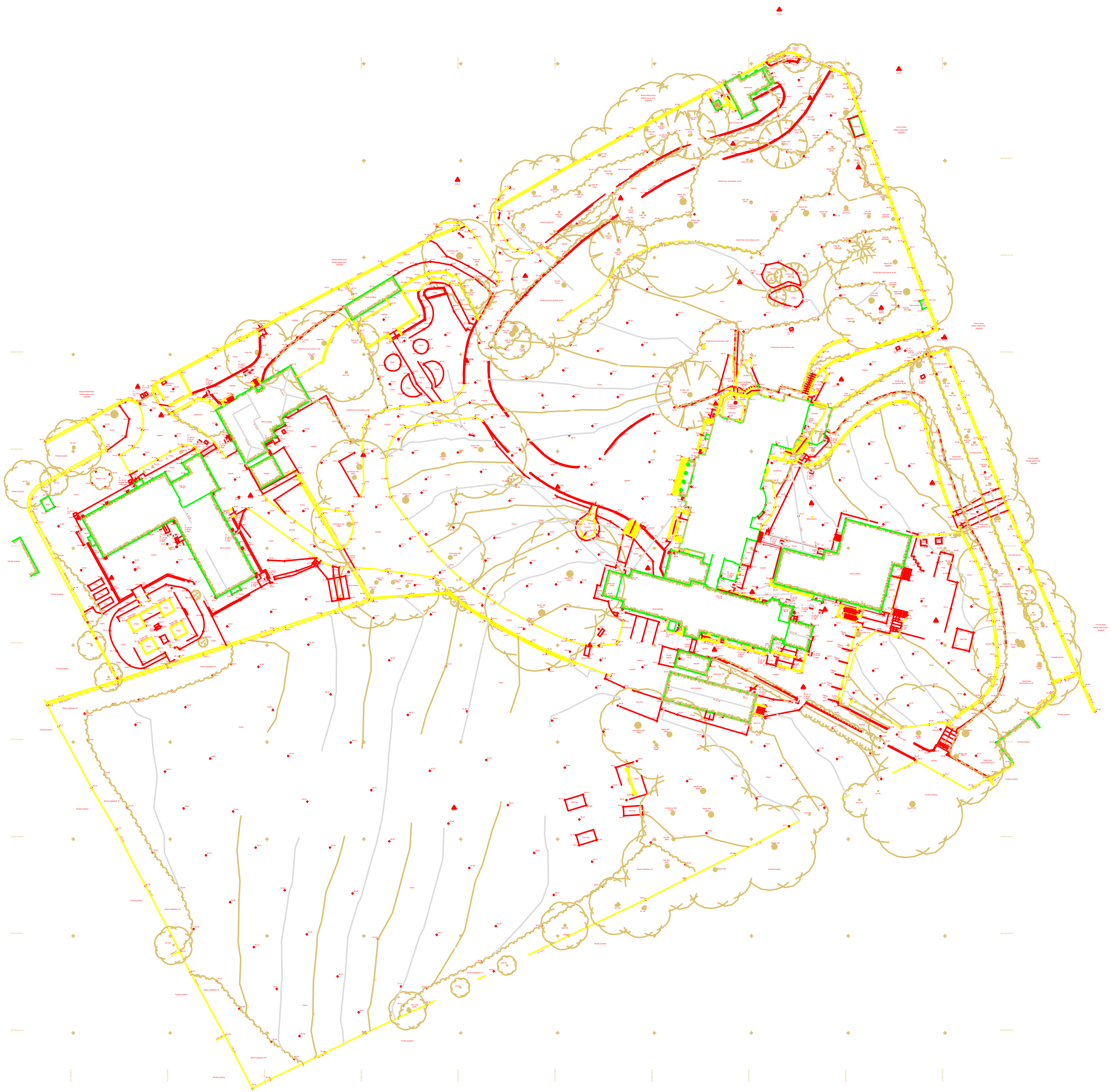
This FRA has demonstrated that the proposed development may be completed without conflicting with the requirements of the NPPF subject to the following:

- Finished floor levels to be set 150 mm above adjacent ground levels.
- The detailed drainage design, developed in accordance with the principles set down in this FRA, should be submitted to and approved by the local planning authority prior to the commencement of development.

APPENDIX A:	Development Proposals



APPENDIX B:	Topographic Survey



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Original Sheet Size A0H

TOPOGRAPHICAL & MEASURED BUILDING SURVEYS

ABBREVIATIONS & SYMBOLS

AH	Arch Head Height	FH	Fire Hydrant	RSJ	Rolled Steel Joist
AR	Assumed Route	FBD	Floor Board Direction	SI	Sign Post
AV	Air Valve	FH	Fire Hydrant	SP	Arch Spring Point Height
BB	Belisha Beacon	FL	Floor Level	SV	Stop Valve
BH	Bore Hole	FP	Flag Pole	SW	Surface Water
BL	Bed Level	FW	Foul Water	SY	Stay
BO	Bollard	GG	Gully Grate	Tac	Tactile Paving
BrP	Brace Post	GV	Gas Valve	TC	Telecom Cover
BS	Bus Stop	HH	Head Height	TH	Trial Pit
BU	Bush	IC	Inspection Cover	THL	Threshold Level
B/W	Barbed Wire Fence	IL	Invert Level	TL	Traffic Light
BX	Box (Utilities)	I/R	Iron Railings	ToW	Top of Wall
C/B	Close Board Fence	KO	Kerb Outlet	TP	Telegraph Pole
CH	Cill Height	LP	Lamp Post	TV	Cable TV Cover
CL	Cover Level	MH	Manhole	UB	Universal Beam
C/L	Chain Link Fence	MP	Marker Post	UC	Unknown Cover
C-Lev	Ceiling Level	NB	Name Board	UK	Unknown Tree
Col	Column	OHL	Overhead Line (approx)	USB	Under Side Beam
C/P	Chestnut Paling Fence	Pan	Panel Fence	UTL	Unable To Lift
CR	Cable Riser	PB	Post Box	VP	Vent Pipe
DC	Drainage Channel	PM	Parking Meter	WB	Waste Bin
DH	Door Head Height	PO	Post	WH	Weep Hole
DP	Down Pipe	P/R	Post & Rail Fence	WL	Water Level
DR	Drain	P/W	Post & Wire Fence	WM	Water Meter
EL	Eaves Level	P/Wall	Partition Wall	WO	Wash Out
EP	Electric Pole	RE	Rodding Eye	⬭	Floor to Ceiling Height
ER	Earth Rod	RL	Ridge Level		
ET	EP+Transformer	RP	Reflector Post	⬭ F/C	Floor to False Ceiling Ht
FB	Flower Bed	RS	Road Sign		
FBD	Floor Board Direction	RSD	Roller Shutter Door	▲	Survey Control Station

DRAWING NOTE

Topographical Surveys

Trees are drawn to scale showing the average canopy spread. Descriptions and heights should be used as a guide only.

All building names, descriptions, number of storeys, construction type including roof line details are indicative only and taken externally from ground level.

All below ground details including drainage, voids and services have been identified from above ground and therefore all details relating to these features including; sizes, depth, description etc will be approximate only. All critical dimensions and connections should be checked and verified prior to starting work.

Detail, services and features may not have been surveyed if obstructed or not reasonably visible at the time of the survey.

Measured Building Surveys

Measurements to internal walls are taken to the wall finishes at approx 1m above the floor level and the wall assumed to be vertical.

Cill heights are measured as floor to the cill and head heights are measured from cill to the top of window.

General

The contractor must check and verify all site and building dimensions, levels, utilities and drainage details and connections prior to commencing work. Any errors or discrepancies must be notified to Survey Solutions immediately.

The accuracy of the digital data is the same as the plotting scale implies. All dimensions are in metres unless otherwise stated.

The survey control listed is only to be used for topographical surveys at the stated scale. All control must be checked and verified prior to use.

Do not scale from this drawing.

CONTROL CO-ORDINATES

STATIONS	EASTINGS	NORTHINGS	LEVEL	DESCRIPTION

REV	DESCRIPTION	DRAWN	APPR	DATE

SURVEY SOLUTIONS

Ipswich Coventry Yeovil Norwich Perth Nottingham Brentwood

Tel No: 0845 0405 969
Fax No: 0845 0405 970
www.survey-solutions.co.uk
enquiries@survey-solutions.co.uk

LAND SURVEYING BUILDING SURVEYING UNDERGROUND SURVEYING

PROJECT TITLE
ST GABRIELS CONVENT
LIVERPOOL

DRAWING DETAIL
TOPOGRAPHICAL SURVEY
Sheet 2 of 2

CLIENT
ST GABRIELS (LIVERPOOL) LTD

SCALE
1:200

SURVEYOR	SURVEY DATE	CHECKED BY	APPROVED BY	DWG STATUS
ACA	16/11/11	SLP	PDS	FINAL

DRAWING NUMBER	REVISION	ISSUE DATE
15763cv-02		16.04.2015

APPENDIX C: United Utilities Correspondence

From: Lunt, John [mailto:John.Lunt@uuplc.co.uk]
Sent: 02 October 2015 09:09
To: James Aldridge
Subject: RE: (UU ref: DE1259) Beaconsfield Road, Liverpool

Hi James,

The proposed development should explore the route of discharging surface water flows in to either of the two public surface water sewers located within Blackwood Avenue.

I appreciate your comments on how the site discharged historically however with all new development the hierarchy for surface water run-off along with following NPPF guidelines should be adhered to wherever possible.

Regards,

John

From: Lunt, John [mailto:John.Lunt@uuplc.co.uk]
Sent: 14 July 2015 09:26
To: James.Aldridge@weetwood.net
Cc: Wastewater Developer Services
Subject: (UU ref: DE1259) Beaconsfield Road, Liverpool

Hi James,

In reply, I have carried out an assessment of your pre-development enquiry based on the information submitted of which the advice provided will remain valid for 12 months.

The foul water flows emanating from the proposed development will be allowed a free discharge in to the public combined sewerage system adjacent to the site.

The surface water flows generated from the site should discharge to soak-away wherever practicable and thereafter UU would allow a surface water discharge in to the nearby public surface water sewerage system at a run-off rate of 78 l/s.

In addition to the above comments please be aware that any on site drainage systems must be designed in accordance with Building Regulations, National Planning Policies, Planning Conditions and Local Lead Flood Authority Guidelines of which we would recommend that you liaise and make suitable agreements with the relevant statutory bodies beforehand.

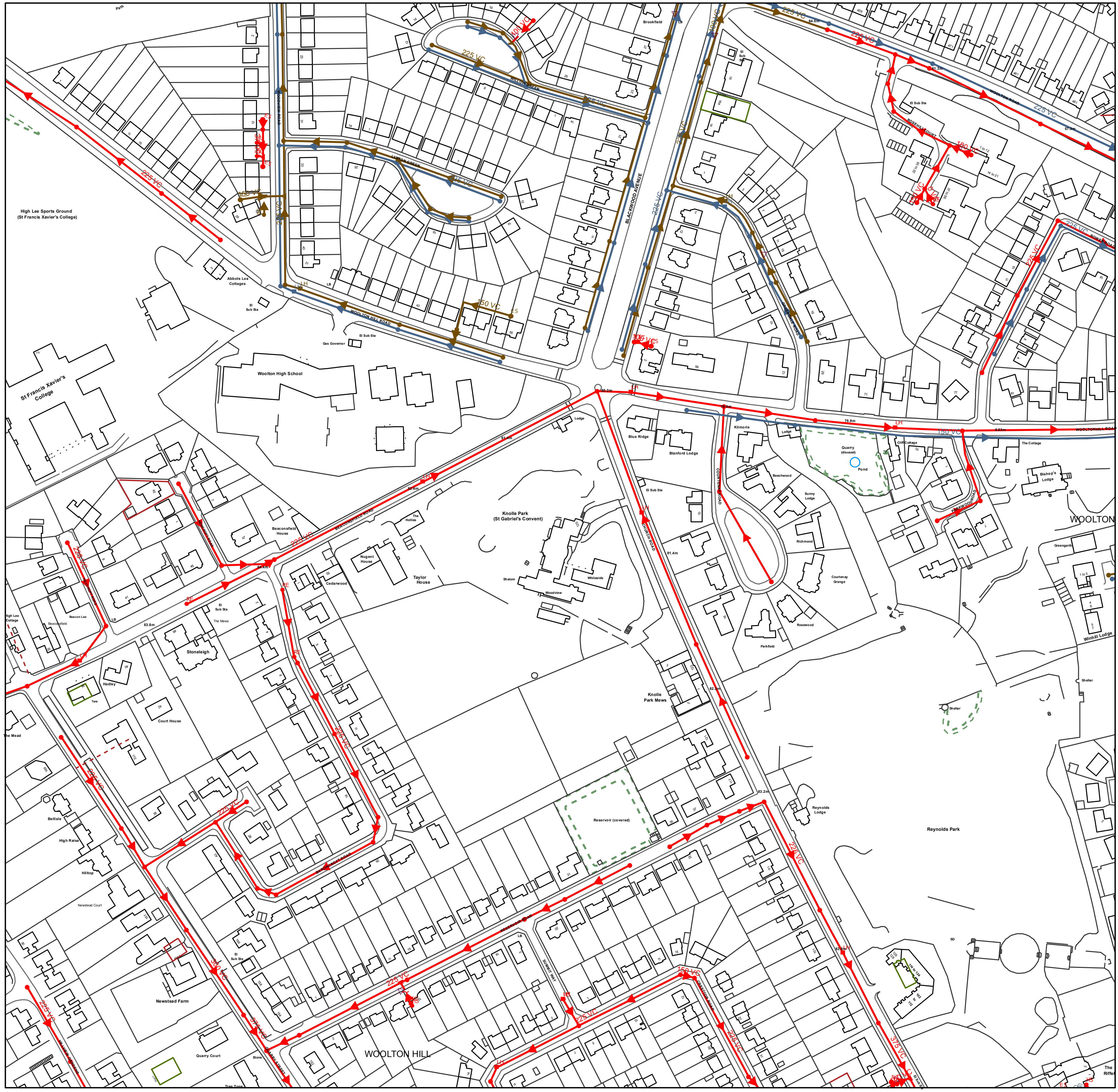
If you have any queries or comments in relation to the above then please don't hesitate to get in touch.

Regards,

John

John Lunt
Developer Query Engineer
Developer Services and Planning
Operational Control
United Utilities

T; 01925 679411 (Int; 79411)
unitedutilities.com



Extract from Map of Public Sewers

The position of underground apparatus shown on this plan is approximate only and is given in accordance with the best information currently available.

The actual positions may be different from those shown on the plan and private pipes, sewers or drains may not be recorded.

United Utilities will not accept any liability for any damage caused by the actual positions being different from those shown.

LEGEND

Water Course
Overflow Pipe
Sludge Main
Highway Drain

	Combined	Surface Water	Foul	Abandoned
Public Sewer				
Private Sewer				
Section 104				
Rising Main				

ST GABRIELS CONVENT CHURCH ROAD WOOLTON LIVERPOOL L25 6EJ

Printed By : Property Searches Date: 23/09/2015

DO NOT SCALE

Approximate Scale: 1:2500

United Utilities
helping life flow smoothly

APPENDIX D:	Surface Water Attenuation – Infiltration Possible

Summary of Results for 100 year Return Period (+30%)

Half Drain Time : 79 minutes.

Storm Event	**Max Level (m)**	**Max Depth (m)**	**Max Infiltration (l/s)**	**Max Volume (m³)**	**Status**
15 min Summer	0.492	0.492	0.7	4.8	O K
30 min Summer	0.609	0.609	0.8	5.9	O K
60 min Summer	0.679	0.679	0.8	6.6	O K
120 min Summer	0.686	0.686	0.8	6.7	O K
180 min Summer	0.662	0.662	0.8	6.4	O K
240 min Summer	0.630	0.630	0.8	6.1	O K
360 min Summer	0.568	0.568	0.7	5.5	O K
480 min Summer	0.513	0.513	0.7	5.0	O K
600 min Summer	0.463	0.463	0.7	4.5	O K
720 min Summer	0.417	0.417	0.6	4.1	O K
960 min Summer	0.338	0.338	0.6	3.3	O K
1440 min Summer	0.217	0.217	0.5	2.1	O K
2160 min Summer	0.103	0.103	0.5	1.0	O K
2880 min Summer	0.052	0.052	0.5	0.5	O K
4320 min Summer	0.037	0.037	0.3	0.4	O K
5760 min Summer	0.029	0.029	0.3	0.3	O K
7200 min Summer	0.024	0.024	0.2	0.2	O K
8640 min Summer	0.021	0.021	0.2	0.2	O K

Storm Event	**Rain (mm/hr)**	**Time-Peak (mins)**
15 min Summer	128.285	18
30 min Summer	84.226	32
60 min Summer	52.662	60
120 min Summer	31.800	90
180 min Summer	23.353	124
240 min Summer	18.644	160
360 min Summer	13.543	228
480 min Summer	10.792	296
600 min Summer	9.043	362
720 min Summer	7.823	426
960 min Summer	6.219	552
1440 min Summer	4.493	794
2160 min Summer	3.241	1144
2880 min Summer	2.568	1468
4320 min Summer	1.847	2200
5760 min Summer	1.461	2912
7200 min Summer	1.217	3672
8640 min Summer	1.048	4320

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
10080 min Summer	0.019	0.019	0.2	0.2	O K
15 min Winter	0.555	0.555	0.7	5.4	O K
30 min Winter	0.692	0.692	0.8	6.7	O K
60 min Winter	1.010	1.010	1.0	7.5	O K
120 min Winter	1.062	1.062	1.1	7.5	O K
180 min Winter	0.822	0.822	0.9	7.3	O K
240 min Winter	0.708	0.708	0.8	6.9	O K
360 min Winter	0.618	0.618	0.8	6.0	O K
480 min Winter	0.538	0.538	0.7	5.2	O K
600 min Winter	0.466	0.466	0.7	4.5	O K
720 min Winter	0.402	0.402	0.6	3.9	O K
960 min Winter	0.294	0.294	0.6	2.9	O K
1440 min Winter	0.139	0.139	0.5	1.4	O K
2160 min Winter	0.047	0.047	0.4	0.5	O K
2880 min Winter	0.037	0.037	0.3	0.4	O K
4320 min Winter	0.027	0.027	0.2	0.3	O K
5760 min Winter	0.021	0.021	0.2	0.2	O K
7200 min Winter	0.018	0.018	0.2	0.2	O K
8640 min Winter	0.015	0.015	0.1	0.1	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
10080 min Summer	0.923	5024
15 min Winter	128.285	18
30 min Winter	84.226	31
60 min Winter	52.662	58
120 min Winter	31.800	92
180 min Winter	23.353	132
240 min Winter	18.644	172
360 min Winter	13.543	246
480 min Winter	10.792	316
600 min Winter	9.043	386
720 min Winter	7.823	450
960 min Winter	6.219	578
1440 min Winter	4.493	820
2160 min Winter	3.241	1092
2880 min Winter	2.568	1468
4320 min Winter	1.847	2180
5760 min Winter	1.461	2928
7200 min Winter	1.217	3592
8640 min Winter	1.048	4328

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
10080 min Winter	0.014	0.014	0.1	0.1	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
10080 min Winter	0.923	5080

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time / Area Diagram

Total Area (ha) 0.022

Time (mins)	**Area (ha)**
0-4	0.022

Model Details

Storage is Online Cover Level (m) 1.500

Cellular Storage Structure

Invert Level (m) 0.000 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.30000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.30000

Depth (m)	**Area (m²)**	**Inf. Area (m²)**	**Depth (m)**	**Area (m²)**	**Inf. Area (m²)**
0.000	10.2	10.2	0.800	0.0	19.2
0.700	10.2	19.2			

Summary of Results for 100 year Return Period (+30%)

Half Drain Time : 82 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	0.397	0.397	0.6	3.9	O K
30 min Summer	0.488	0.488	0.7	4.7	O K
60 min Summer	0.537	0.537	0.7	5.2	O K
120 min Summer	0.537	0.537	0.7	5.2	O K
180 min Summer	0.513	0.513	0.7	5.0	O K
240 min Summer	0.484	0.484	0.7	4.7	O K
360 min Summer	0.428	0.428	0.7	4.2	O K
480 min Summer	0.378	0.378	0.6	3.7	O K
600 min Summer	0.333	0.333	0.6	3.2	O K
720 min Summer	0.293	0.293	0.6	2.8	O K
960 min Summer	0.224	0.224	0.5	2.2	O K
1440 min Summer	0.126	0.126	0.5	1.2	O K
2160 min Summer	0.054	0.054	0.5	0.5	O K
2880 min Summer	0.042	0.042	0.4	0.4	O K
4320 min Summer	0.030	0.030	0.3	0.3	O K
5760 min Summer	0.024	0.024	0.2	0.2	O K
7200 min Summer	0.020	0.020	0.2	0.2	O K
8640 min Summer	0.017	0.017	0.2	0.2	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
15 min Summer	128.285	17
30 min Summer	84.226	31
60 min Summer	52.662	56
120 min Summer	31.800	88
180 min Summer	23.353	122
240 min Summer	18.644	158
360 min Summer	13.543	226
480 min Summer	10.792	292
600 min Summer	9.043	356
720 min Summer	7.823	420
960 min Summer	6.219	542
1440 min Summer	4.493	780
2160 min Summer	3.241	1104
2880 min Summer	2.568	1468
4320 min Summer	1.847	2184
5760 min Summer	1.461	2936
7200 min Summer	1.217	3648
8640 min Summer	1.048	4352

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
10080 min Summer	0.015	0.015	0.1	0.1	O K
15 min Winter	0.449	0.449	0.7	4.4	O K
30 min Winter	0.556	0.556	0.7	5.4	O K
60 min Winter	0.620	0.620	0.8	6.0	O K
120 min Winter	0.617	0.617	0.8	6.0	O K
180 min Winter	0.583	0.583	0.7	5.7	O K
240 min Winter	0.540	0.540	0.7	5.2	O K
360 min Winter	0.457	0.457	0.7	4.4	O K
480 min Winter	0.384	0.384	0.6	3.7	O K
600 min Winter	0.321	0.321	0.6	3.1	O K
720 min Winter	0.264	0.264	0.6	2.6	O K
960 min Winter	0.172	0.172	0.5	1.7	O K
1440 min Winter	0.058	0.058	0.5	0.6	O K
2160 min Winter	0.038	0.038	0.3	0.4	O K
2880 min Winter	0.030	0.030	0.3	0.3	O K
4320 min Winter	0.022	0.022	0.2	0.2	O K
5760 min Winter	0.017	0.017	0.2	0.2	O K
7200 min Winter	0.015	0.015	0.1	0.1	O K
8640 min Winter	0.013	0.013	0.1	0.1	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
10080 min Summer	0.923	5136
15 min Winter	128.285	17
30 min Winter	84.226	31
60 min Winter	52.662	58
120 min Winter	31.800	94
180 min Winter	23.353	132
240 min Winter	18.644	170
360 min Winter	13.543	242
480 min Winter	10.792	312
600 min Winter	9.043	378
720 min Winter	7.823	442
960 min Winter	6.219	566
1440 min Winter	4.493	766
2160 min Winter	3.241	1088
2880 min Winter	2.568	1468
4320 min Winter	1.847	2204
5760 min Winter	1.461	2832
7200 min Winter	1.217	3608
8640 min Winter	1.048	4336

Summary of Results for 100 year Return Period (+30%)

Storm Event	**Max Level (m)**	**Max Depth (m)**	**Max Infiltration (l/s)**	**Max Volume (m³)**	**Status**
10080 min Winter	0.011	0.011	0.1	0.1	O K

Storm Event	**Rain (mm/hr)**	**Time-Peak (mins)**
10080 min Winter	0.923	5096

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time / Area Diagram

Total Area (ha) 0.018

Time (mins)	**Area (ha)**
0-4	0.018

Model Details

Storage is Online Cover Level (m) 1.500

Cellular Storage Structure

Invert Level (m) 0.000 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.30000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.30000

Depth (m)	**Area (m²)**	**Inf. Area (m²)**	**Depth (m)**	**Area (m²)**	**Inf. Area (m²)**
0.000	10.2	10.2	0.800	0.0	19.2
0.700	10.2	19.2			

Summary of Results for 100 year Return Period (+30%)

Half Drain Time : 84 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m^3)	Status
15 min Summer	0.488	0.488	1.0	7.4	O K
30 min Summer	0.608	0.608	1.1	9.2	O K
60 min Summer	0.683	0.683	1.1	10.4	O K
120 min Summer	0.692	0.692	1.1	10.5	O K
180 min Summer	0.669	0.669	1.1	10.2	O K
240 min Summer	0.638	0.638	1.1	9.7	O K
360 min Summer	0.579	0.579	1.1	8.8	O K
480 min Summer	0.525	0.525	1.0	8.0	O K
600 min Summer	0.475	0.475	1.0	7.2	O K
720 min Summer	0.429	0.429	0.9	6.5	O K
960 min Summer	0.348	0.348	0.9	5.3	O K
1440 min Summer	0.223	0.223	0.8	3.4	O K
2160 min Summer	0.105	0.105	0.7	1.6	O K
2880 min Summer	0.052	0.052	0.7	0.8	O K
4320 min Summer	0.037	0.037	0.5	0.6	O K
5760 min Summer	0.029	0.029	0.4	0.4	O K
7200 min Summer	0.024	0.024	0.3	0.4	O K
8640 min Summer	0.021	0.021	0.3	0.3	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
15 min Summer	128.285	18
30 min Summer	84.226	32
60 min Summer	52.662	60
120 min Summer	31.800	94
180 min Summer	23.353	128
240 min Summer	18.644	162
360 min Summer	13.543	230
480 min Summer	10.792	298
600 min Summer	9.043	364
720 min Summer	7.823	430
960 min Summer	6.219	558
1440 min Summer	4.493	796
2160 min Summer	3.241	1144
2880 min Summer	2.568	1468
4320 min Summer	1.847	2200
5760 min Summer	1.461	2904
7200 min Summer	1.217	3672
8640 min Summer	1.048	4352

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
10080 min Summer	0.019	0.019	0.3	0.3	O K
15 min Winter	0.551	0.551	1.0	8.4	O K
30 min Winter	0.690	0.690	1.1	10.5	O K
60 min Winter	1.171	1.171	1.5	11.8	O K
120 min Winter	1.277	1.277	1.6	11.9	Flood Risk
180 min Winter	0.980	0.980	1.4	11.6	O K
240 min Winter	0.728	0.728	1.2	11.0	O K
360 min Winter	0.637	0.637	1.1	9.7	O K
480 min Winter	0.558	0.558	1.0	8.5	O K
600 min Winter	0.485	0.485	1.0	7.4	O K
720 min Winter	0.420	0.420	0.9	6.4	O K
960 min Winter	0.307	0.307	0.9	4.7	O K
1440 min Winter	0.143	0.143	0.8	2.2	O K
2160 min Winter	0.047	0.047	0.7	0.7	O K
2880 min Winter	0.037	0.037	0.5	0.6	O K
4320 min Winter	0.027	0.027	0.4	0.4	O K
5760 min Winter	0.021	0.021	0.3	0.3	O K
7200 min Winter	0.018	0.018	0.2	0.3	O K
8640 min Winter	0.015	0.015	0.2	0.2	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
10080 min Summer	0.923	5080
15 min Winter	128.285	18
30 min Winter	84.226	32
60 min Winter	52.662	58
120 min Winter	31.800	92
180 min Winter	23.353	134
240 min Winter	18.644	174
360 min Winter	13.543	250
480 min Winter	10.792	320
600 min Winter	9.043	390
720 min Winter	7.823	456
960 min Winter	6.219	588
1440 min Winter	4.493	822
2160 min Winter	3.241	1092
2880 min Winter	2.568	1456
4320 min Winter	1.847	2188
5760 min Winter	1.461	2904
7200 min Winter	1.217	3664
8640 min Winter	1.048	4272

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
10080 min Winter	0.014	0.014	0.2	0.2	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
10080 min Winter	0.923	5096

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time / Area Diagram

Total Area (ha) 0.034

Time (mins)	**Area (ha)**
0-4	0.034

Model Details

Storage is Online Cover Level (m) 1.500

Cellular Storage Structure

Invert Level (m) 0.000 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.30000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.30000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	16.0	16.0	0.800	0.0	27.2
0.700	16.0	27.2			

Summary of Results for 100 year Return Period (+30%)

Half Drain Time : 80 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	0.621	0.621	2.1	12.6	O K
30 min Summer	0.690	0.690	2.4	15.6	O K
60 min Summer	0.727	0.727	2.5	17.2	O K
120 min Summer	0.737	0.737	2.6	17.7	O K
180 min Summer	0.727	0.727	2.5	17.3	O K
240 min Summer	0.711	0.711	2.5	16.5	O K
360 min Summer	0.677	0.677	2.3	15.0	O K
480 min Summer	0.645	0.645	2.2	13.6	O K
600 min Summer	0.616	0.616	2.1	12.4	O K
720 min Summer	0.590	0.590	2.0	11.4	O K
960 min Summer	0.544	0.544	1.8	9.7	O K
1440 min Summer	0.473	0.473	1.5	7.3	O K
2160 min Summer	0.397	0.397	1.2	5.2	O K
2880 min Summer	0.344	0.344	1.1	3.9	O K
4320 min Summer	0.272	0.272	0.8	2.4	O K
5760 min Summer	0.227	0.227	0.7	1.7	O K
7200 min Summer	0.194	0.194	0.6	1.2	O K
8640 min Summer	0.170	0.170	0.5	0.9	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
15 min Summer	128.285	17
30 min Summer	84.226	31
60 min Summer	52.662	54
120 min Summer	31.800	86
180 min Summer	23.353	120
240 min Summer	18.644	154
360 min Summer	13.543	222
480 min Summer	10.792	288
600 min Summer	9.043	352
720 min Summer	7.823	416
960 min Summer	6.219	540
1440 min Summer	4.493	780
2160 min Summer	3.241	1144
2880 min Summer	2.568	1500
4320 min Summer	1.847	2208
5760 min Summer	1.461	2936
7200 min Summer	1.217	3672
8640 min Summer	1.048	4400

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
10080 min Summer	0.151	0.151	0.4	0.7	O K
15 min Winter	0.660	0.660	2.3	14.2	O K
30 min Winter	0.734	0.734	2.6	17.6	O K
60 min Winter	0.776	0.776	2.7	19.6	O K
120 min Winter	0.782	0.782	2.8	20.0	O K
180 min Winter	0.766	0.766	2.7	19.1	O K
240 min Winter	0.742	0.742	2.6	18.0	O K
360 min Winter	0.694	0.694	2.4	15.7	O K
480 min Winter	0.650	0.650	2.2	13.8	O K
600 min Winter	0.611	0.611	2.1	12.2	O K
720 min Winter	0.576	0.576	1.9	10.8	O K
960 min Winter	0.516	0.516	1.7	8.7	O K
1440 min Winter	0.427	0.427	1.4	5.9	O K
2160 min Winter	0.339	0.339	1.0	3.8	O K
2880 min Winter	0.282	0.282	0.8	2.6	O K
4320 min Winter	0.212	0.212	0.6	1.5	O K
5760 min Winter	0.172	0.172	0.5	1.0	O K
7200 min Winter	0.145	0.145	0.4	0.7	O K
8640 min Winter	0.126	0.126	0.4	0.5	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
10080 min Summer	0.923	5136
15 min Winter	128.285	17
30 min Winter	84.226	31
60 min Winter	52.662	58
120 min Winter	31.800	92
180 min Winter	23.353	130
240 min Winter	18.644	166
360 min Winter	13.543	238
480 min Winter	10.792	306
600 min Winter	9.043	372
720 min Winter	7.823	434
960 min Winter	6.219	560
1440 min Winter	4.493	808
2160 min Winter	3.241	1164
2880 min Winter	2.568	1524
4320 min Winter	1.847	2208
5760 min Winter	1.461	2936
7200 min Winter	1.217	3672
8640 min Winter	1.048	4344

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
10080 min Winter	0.111	0.111	0.3	0.4	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
10080 min Winter	0.923	5136

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time / Area Diagram

Total Area (ha) 0.058

Time (mins)	**Area (ha)**
0-4	0.058

Model Details

Storage is Online Cover Level (m) 1.300

Infiltration Basin Structure

Invert Level (m) 0.000 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.30000 Porosity 1.00
Infiltration Coefficient Side (m/hr) 0.30000

Depth (m)	**Area (m²)**	**Depth (m)**	**Area (m²)**
0.000	0.0	1.300	84.9

Summary of Results for 100 year Return Period (+30%)

Half Drain Time : 106 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	0.743	0.743	5.3	44.3	O K
30 min Summer	0.845	0.845	6.1	55.6	O K
60 min Summer	0.910	0.910	6.6	63.4	O K
120 min Summer	0.931	0.931	6.7	66.1	O K
180 min Summer	0.927	0.927	6.7	65.5	O K
240 min Summer	0.913	0.913	6.6	63.8	O K
360 min Summer	0.879	0.879	6.3	59.6	O K
480 min Summer	0.843	0.843	6.1	55.4	O K
600 min Summer	0.810	0.810	5.8	51.6	O K
720 min Summer	0.778	0.778	5.6	48.1	O K
960 min Summer	0.721	0.721	5.2	42.1	O K
1440 min Summer	0.629	0.629	4.5	33.2	O K
2160 min Summer	0.526	0.526	3.8	24.5	O K
2880 min Summer	0.449	0.449	3.3	18.8	O K
4320 min Summer	0.341	0.341	2.7	12.1	O K
5760 min Summer	0.269	0.269	2.2	8.4	O K
7200 min Summer	0.218	0.218	1.9	6.1	O K
8640 min Summer	0.180	0.180	1.7	4.6	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
15 min Summer	128.285	18
30 min Summer	84.226	32
60 min Summer	52.662	60
120 min Summer	31.800	94
180 min Summer	23.353	126
240 min Summer	18.644	162
360 min Summer	13.543	230
480 min Summer	10.792	298
600 min Summer	9.043	364
720 min Summer	7.823	428
960 min Summer	6.219	558
1440 min Summer	4.493	808
2160 min Summer	3.241	1168
2880 min Summer	2.568	1528
4320 min Summer	1.847	2248
5760 min Summer	1.461	2944
7200 min Summer	1.217	3672
8640 min Summer	1.048	4408

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
10080 min Summer	0.149	0.149	1.5	3.6	O K
15 min Winter	0.795	0.795	5.7	49.9	O K
30 min Winter	0.905	0.905	6.5	62.8	O K
60 min Winter	0.978	0.978	7.1	72.1	O K
120 min Winter	0.999	0.999	7.2	75.0	O K
180 min Winter	0.991	0.991	7.2	73.9	O K
240 min Winter	0.970	0.970	7.0	71.1	O K
360 min Winter	0.921	0.921	6.7	64.8	O K
480 min Winter	0.872	0.872	6.3	58.8	O K
600 min Winter	0.825	0.825	5.9	53.3	O K
720 min Winter	0.782	0.782	5.6	48.5	O K
960 min Winter	0.705	0.705	5.1	40.5	O K
1440 min Winter	0.584	0.584	4.2	29.3	O K
2160 min Winter	0.456	0.456	3.4	19.3	O K
2880 min Winter	0.367	0.367	2.8	13.6	O K
4320 min Winter	0.254	0.254	2.1	7.7	O K
5760 min Winter	0.185	0.185	1.7	4.8	O K
7200 min Winter	0.139	0.139	1.4	3.2	O K
8640 min Winter	0.106	0.106	1.2	2.3	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
10080 min Summer	0.923	5136
15 min Winter	128.285	18
30 min Winter	84.226	32
60 min Winter	52.662	60
120 min Winter	31.800	98
180 min Winter	23.353	136
240 min Winter	18.644	174
360 min Winter	13.543	248
480 min Winter	10.792	318
600 min Winter	9.043	386
720 min Winter	7.823	454
960 min Winter	6.219	586
1440 min Winter	4.493	836
2160 min Winter	3.241	1192
2880 min Winter	2.568	1556
4320 min Winter	1.847	2252
5760 min Winter	1.461	2992
7200 min Winter	1.217	3672
8640 min Winter	1.048	4408

Summary of Results for 100 year Return Period (+30%)

Storm Event	**Max Level (m)**	**Max Depth (m)**	**Max Infiltration (l/s)**	**Max Volume (m³)**	**Status**
10080 min Winter	0.081	0.081	1.1	1.6	O K

Storm Event	**Rain (mm/hr)**	**Time-Peak (mins)**
10080 min Winter	0.923	5136

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time / Area Diagram

Total Area (ha) 0.199

Time (mins)	**Area (ha)**
0-4	0.199

Model Details

Storage is Online Cover Level (m) 1.300

Infiltration Basin Structure

Invert Level (m) 0.000 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.30000 Porosity 1.00
Infiltration Coefficient Side (m/hr) 0.30000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	15.0	1.300	171.3

Summary of Results for 100 year Return Period (+30%)

Half Drain Time : 123 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	0.714	0.714	7.9	73.0	O K
30 min Summer	0.826	0.826	8.9	91.9	O K
60 min Summer	0.901	0.901	9.6	105.7	O K
120 min Summer	0.927	0.927	9.9	110.6	O K
180 min Summer	0.923	0.923	9.9	110.0	O K
240 min Summer	0.910	0.910	9.7	107.3	O K
360 min Summer	0.875	0.875	9.4	100.8	O K
480 min Summer	0.839	0.839	9.1	94.2	O K
600 min Summer	0.804	0.804	8.7	88.0	O K
720 min Summer	0.771	0.771	8.4	82.3	O K
960 min Summer	0.711	0.711	7.9	72.6	O K
1440 min Summer	0.613	0.613	7.0	57.7	O K
2160 min Summer	0.500	0.500	6.0	42.6	O K
2880 min Summer	0.414	0.414	5.2	32.4	O K
4320 min Summer	0.292	0.292	4.2	20.0	O K
5760 min Summer	0.209	0.209	3.5	12.9	O K
7200 min Summer	0.150	0.150	3.0	8.5	O K
8640 min Summer	0.105	0.105	2.7	5.6	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
15 min Summer	128.285	18
30 min Summer	84.226	32
60 min Summer	52.662	60
120 min Summer	31.800	98
180 min Summer	23.353	130
240 min Summer	18.644	164
360 min Summer	13.543	234
480 min Summer	10.792	302
600 min Summer	9.043	368
720 min Summer	7.823	434
960 min Summer	6.219	566
1440 min Summer	4.493	812
2160 min Summer	3.241	1188
2880 min Summer	2.568	1532
4320 min Summer	1.847	2252
5760 min Summer	1.461	2992
7200 min Summer	1.217	3680
8640 min Summer	1.048	4408

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
10080 min Summer	0.070	0.070	2.4	3.6	O K
15 min Winter	0.770	0.770	8.4	82.1	O K
30 min Winter	0.891	0.891	9.5	103.8	O K
60 min Winter	0.976	0.976	10.4	120.3	O K
120 min Winter	1.004	1.004	10.6	126.0	Flood Risk
180 min Winter	0.998	0.998	10.6	124.8	O K
240 min Winter	0.979	0.979	10.4	120.9	O K
360 min Winter	0.931	0.931	9.9	111.3	O K
480 min Winter	0.880	0.880	9.4	101.8	O K
600 min Winter	0.832	0.832	9.0	92.9	O K
720 min Winter	0.786	0.786	8.6	84.9	O K
960 min Winter	0.705	0.705	7.8	71.5	O K
1440 min Winter	0.574	0.574	6.6	52.2	O K
2160 min Winter	0.431	0.431	5.4	34.3	O K
2880 min Winter	0.329	0.329	4.5	23.5	O K
4320 min Winter	0.196	0.196	3.4	11.9	O K
5760 min Winter	0.113	0.113	2.8	6.1	O K
7200 min Winter	0.058	0.058	2.3	2.9	O K
8640 min Winter	0.045	0.045	2.0	2.2	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
10080 min Summer	0.923	5136
15 min Winter	128.285	18
30 min Winter	84.226	32
60 min Winter	52.662	60
120 min Winter	31.800	110
180 min Winter	23.353	138
240 min Winter	18.644	176
360 min Winter	13.543	252
480 min Winter	10.792	324
600 min Winter	9.043	394
720 min Winter	7.823	462
960 min Winter	6.219	596
1440 min Winter	4.493	852
2160 min Winter	3.241	1212
2880 min Winter	2.568	1584
4320 min Winter	1.847	2288
5760 min Winter	1.461	2992
7200 min Winter	1.217	3672
8640 min Winter	1.048	4344

Summary of Results for 100 year Return Period (+30%)

Storm Event	**Max Level (m)**	**Max Depth (m)**	**Max Infiltration (l/s)**	**Max Volume (m³)**	**Status**
10080 min Winter	0.041	0.041	1.8	2.0	O K

Storm Event	**Rain (mm/hr)**	**Time-Peak (mins)**
10080 min Winter	0.923	5024

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time / Area Diagram

Total Area (ha) 0.326

Time (mins)	**Area (ha)**
0-4	0.326

Model Details

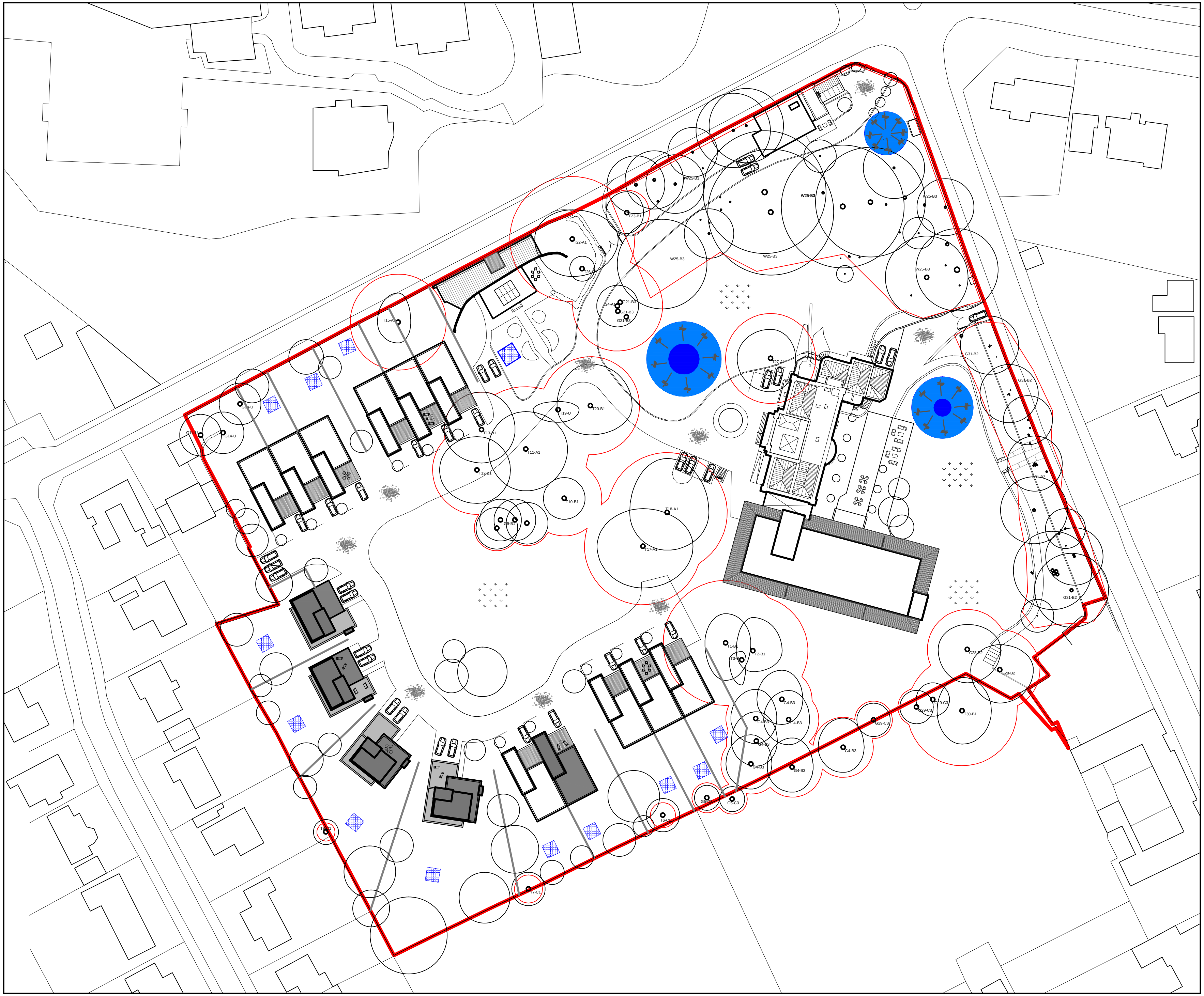
Storage is Online Cover Level (m) 1.300

Infiltration Basin Structure

Invert Level (m) 0.000 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.30000 Porosity 1.00
Infiltration Coefficient Side (m/hr) 0.30000

Depth (m)	**Area (m²)**	**Depth (m)**	**Area (m²)**
0.000	45.0	1.300	253.6

APPENDIX E:	Indicative Layout – Infiltration Possible



General:

1. Do not scale from this drawing.
2. All adoptable sewers and associated works are to comply fully with Sewers for Adoption 7th Edition and sewerage undertaker specifications.
3. All private drainage works to be carried out in accordance with Building Regulations 2015 Edition.
4. The Contractor should investigate and locate as necessary all existing services prior to commencement on site and discuss requirement for protection with the relevant undertaker.
5. The Contractor should apply for sewer permits, road opening permits and discharge consents as necessary from the appropriate authorities prior to commencement on site.

Notes:

1. Attenuation storage requirements are based on the 1 in 100 AEP event plus 30% to account for climate change.
2. All drainage details are indicative only and subject to detailed design.

Weetwood
Development • Planning • Environment

70 Cowcross Street,
London,
EC1M 6EJ

Tel: 0203 757 5444
Email: info@weetwood.net

Client:

St Gabriels (Liverpool) Ltd

Project Title:

Former St Gabriels Convent, Liverpool

Drawing Title:

Indicative Layout - Infiltration Possible

Drawn:	Checked:	Date:
JA	KT	5 October 2015

Drawing No:	Rev:
3017 151005 SA-I	A

APPENDIX F: Modified Rational Method Calculation Record

The Modified Rational Method[13] has been used to calculate the runoff from the impermeable surfaces at the existing site.

The following parameters have been obtained from the maps in Volume 3 of the Wallingford Procedure:

M5-60 minute rainfall depth:	20 mm
Ratio of M5-60 to M5-2 day rainfall:	0.4
Average Annual Rainfall:	825 mm
Winter Rain Acceptance Potential/ Soil Type:	4
The Urban Catchment Wetness Index (UCWI) value:	88.2

A time of concentration of 15 minutes has been used.

A rainfall estimation calculation has been carried out to convert the M5-60 minute rainfall to the 5-minute duration rainfall for the 1 in 1, 1 in 2, 1 in 30 and 1 in 100 annual probability rainfall events. The calculated rainfall intensities for these events are 31.1, 40.2, 76.1 and 98.3 mm/hr respectively.

The flow rate as given by the Modified Rational Method is:

$$\mathbf{Q=2.78 \times C_v \times C_r \times \text{rainfall intensity} \times \text{impermeable area}}$$

where:

C_v is the volumetric runoff coefficient = P_r/PIMP = 0.8033
where P_r is Percentage Runoff and PIMP is Percentage Impermeable Area
C_r is the routing coefficient = 1.3
Impermeable Area = 0.589 ha

The peak discharges of surface runoff from impermeable areas of the existing site are shown in the table below:

Peak Runoff Rate for Impermeable Surfaces at Existing Site

Annual probability of rainfall event	Rate (l/s)
1 in 1	53.2
1 in 2	68.8
1 in 30	130.1
1 in 100	168.1

---

[13] The Wallingford Procedure, Volume 4, 1981

APPENDIX G:	Surface Water Attenuation – Discharge to Sewer

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	1.033	0.833	10.5	37.9	O K
30 min Summer	1.106	0.906	10.8	44.3	O K
60 min Summer	1.113	0.913	10.9	45.0	O K
120 min Summer	1.079	0.879	10.7	41.9	O K
180 min Summer	1.029	0.829	10.5	37.5	O K
240 min Summer	0.972	0.772	10.2	32.8	O K
360 min Summer	0.857	0.657	9.9	24.2	O K
480 min Summer	0.742	0.542	9.9	16.9	O K
600 min Summer	0.623	0.423	9.9	10.8	O K
720 min Summer	0.491	0.291	9.9	5.6	O K
960 min Summer	0.259	0.059	9.8	0.5	O K
1440 min Summer	0.200	0.000	7.3	0.0	O K
2160 min Summer	0.200	0.000	5.3	0.0	O K
2880 min Summer	0.200	0.000	4.2	0.0	O K
4320 min Summer	0.200	0.000	3.0	0.0	O K
5760 min Summer	0.200	0.000	2.4	0.0	O K
7200 min Summer	0.200	0.000	2.0	0.0	O K
8640 min Summer	0.200	0.000	1.7	0.0	O K
10080 min Summer	0.200	0.000	1.5	0.0	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
15 min Summer	128.285	17
30 min Summer	84.226	30
60 min Summer	52.662	48
120 min Summer	31.800	82
180 min Summer	23.353	116
240 min Summer	18.644	150
360 min Summer	13.543	216
480 min Summer	10.792	278
600 min Summer	9.043	338
720 min Summer	7.823	392
960 min Summer	6.219	490
1440 min Summer	4.493	0
2160 min Summer	3.241	0
2880 min Summer	2.568	0
4320 min Summer	1.847	0
5760 min Summer	1.461	0
7200 min Summer	1.217	0
8640 min Summer	1.048	0
10080 min Summer	0.923	0

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Winter	1.098	0.898	10.8	43.6	O K
30 min Winter	1.185	0.985	11.2	52.0	O K
60 min Winter	1.198	0.998	11.3	53.3	O K
120 min Winter	1.148	0.948	11.0	48.4	O K
180 min Winter	1.075	0.875	10.7	41.5	O K
240 min Winter	0.991	0.791	10.3	34.4	O K
360 min Winter	0.819	0.619	9.9	21.7	O K
480 min Winter	0.623	0.423	9.9	10.8	O K
600 min Winter	0.337	0.137	9.9	1.6	O K
720 min Winter	0.203	0.003	9.2	0.0	O K
960 min Winter	0.200	0.000	7.3	0.0	O K
1440 min Winter	0.200	0.000	5.3	0.0	O K
2160 min Winter	0.200	0.000	3.8	0.0	O K
2880 min Winter	0.200	0.000	3.0	0.0	O K
4320 min Winter	0.200	0.000	2.2	0.0	O K
5760 min Winter	0.200	0.000	1.7	0.0	O K
7200 min Winter	0.200	0.000	1.4	0.0	O K
8640 min Winter	0.200	0.000	1.2	0.0	O K
10080 min Winter	0.200	0.000	1.1	0.0	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
15 min Winter	128.285	17
30 min Winter	84.226	30
60 min Winter	52.662	52
120 min Winter	31.800	90
180 min Winter	23.353	126
240 min Winter	18.644	162
360 min Winter	13.543	228
480 min Winter	10.792	290
600 min Winter	9.043	326
720 min Winter	7.823	366
960 min Winter	6.219	0
1440 min Winter	4.493	0
2160 min Winter	3.241	0
2880 min Winter	2.568	0
4320 min Winter	1.847	0
5760 min Winter	1.461	0
7200 min Winter	1.217	0
8640 min Winter	1.048	0
10080 min Winter	0.923	0

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time / Area Diagram

Total Area (ha) 0.199

Time (mins)	**Area (ha)**
0-4	0.199

Model Details

Storage is Online Cover Level (m) 1.500

Tank or Pond Structure

Invert Level (m) 0.200

Depth (m)	**Area (m²)**	**Depth (m)**	**Area (m²)**
0.000	5.0	1.300	131.2

Hydro-Brake® Outflow Control

Design Head (m)	1.200	Diameter (mm)	134
Design Flow (l/s)	11.3	Invert Level (m)	0.000
Hydro-Brake® Type	Md6 SW Only		

Depth (m)	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**
0.100	4.4	1.200	11.3	3.000	17.7	7.000	27.1
0.200	9.1	1.400	12.1	3.500	19.2	7.500	28.1
0.300	9.9	1.600	13.0	4.000	20.5	8.000	29.0
0.400	9.6	1.800	13.7	4.500	21.7	8.500	29.9
0.500	9.2	2.000	14.5	5.000	22.9	9.000	30.7
0.600	9.1	2.200	15.2	5.500	24.0	9.500	31.6
0.800	9.5	2.400	15.9	6.000	25.1		
1.000	10.4	2.600	16.5	6.500	26.1		

Weetwood
No 2 Smithy Farm
Bruera
Chester CH3 6EW
Date 22/09/2015 14:53
File
Micro Drainage

Designed By KevinTilford
Checked By
Source Control W.12.1

Cascade Summary of Results for 3017 150922 Basin (West).srcx

Upstream Structures	**Outflow To**	**Overflow To**
(None)	3017 150922 Basin (Corner).srcx	(None)

Storm Event	**Max Level (m)**	**Max Depth (m)**	**Max Control (l/s)**	**Max Volume (m³)**	**Status**
15 min Summer	0.992	0.792	31.5	114.3	O K
30 min Summer	1.081	0.881	32.5	134.4	O K
60 min Summer	1.097	0.897	32.6	138.0	O K
120 min Summer	1.053	0.853	32.2	127.7	O K
180 min Summer	0.991	0.791	31.5	114.0	O K
240 min Summer	0.923	0.723	30.9	99.7	O K
360 min Summer	0.786	0.586	30.2	73.4	O K
480 min Summer	0.652	0.452	30.2	51.0	O K
600 min Summer	0.530	0.330	30.2	33.4	O K
720 min Summer	0.432	0.232	30.0	21.5	O K
960 min Summer	0.315	0.115	27.5	9.4	O K
1440 min Summer	0.222	0.022	21.6	1.6	O K
2160 min Summer	0.200	0.000	15.7	0.0	O K
2880 min Summer	0.200	0.000	12.5	0.0	O K
4320 min Summer	0.200	0.000	9.0	0.0	O K
5760 min Summer	0.200	0.000	7.1	0.0	O K
7200 min Summer	0.200	0.000	5.9	0.0	O K

Storm Event	**Rain (mm/hr)**	**Time-Peak (mins)**
15 min Summer	128.285	17
30 min Summer	84.226	30
60 min Summer	52.662	48
120 min Summer	31.800	82
180 min Summer	23.353	116
240 min Summer	18.644	150
360 min Summer	13.543	214
480 min Summer	10.792	274
600 min Summer	9.043	330
720 min Summer	7.823	384
960 min Summer	6.219	498
1440 min Summer	4.493	734
2160 min Summer	3.241	0
2880 min Summer	2.568	0
4320 min Summer	1.847	0
5760 min Summer	1.461	0
7200 min Summer	1.217	0

Cascade Summary of Results for 3017 150922 Basin (West).srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
8640 min Summer	0.200	0.000	5.1	0.0	O K
10080 min Summer	0.200	0.000	4.5	0.0	O K
15 min Winter	1.068	0.868	32.3	131.3	O K
30 min Winter	1.174	0.974	33.5	156.8	O K
60 min Winter	1.195	0.995	33.8	162.1	O K
120 min Winter	1.132	0.932	33.0	146.6	O K
180 min Winter	1.043	0.843	32.1	125.5	O K
240 min Winter	0.942	0.742	31.1	103.7	O K
360 min Winter	0.732	0.532	30.2	63.9	O K
480 min Winter	0.519	0.319	30.2	32.1	O K
600 min Winter	0.371	0.171	29.2	14.8	O K
720 min Winter	0.292	0.092	26.5	7.3	O K
960 min Winter	0.223	0.023	21.7	1.7	O K
1440 min Winter	0.200	0.000	15.8	0.0	O K
2160 min Winter	0.200	0.000	11.4	0.0	O K
2880 min Winter	0.200	0.000	9.0	0.0	O K
4320 min Winter	0.200	0.000	6.5	0.0	O K
5760 min Winter	0.200	0.000	5.1	0.0	O K
7200 min Winter	0.200	0.000	4.3	0.0	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
8640 min Summer	1.048	0
10080 min Summer	0.923	0
15 min Winter	128.285	17
30 min Winter	84.226	30
60 min Winter	52.662	52
120 min Winter	31.800	90
180 min Winter	23.353	126
240 min Winter	18.644	162
360 min Winter	13.543	226
480 min Winter	10.792	280
600 min Winter	9.043	328
720 min Winter	7.823	382
960 min Winter	6.219	492
1440 min Winter	4.493	0
2160 min Winter	3.241	0
2880 min Winter	2.568	0
4320 min Winter	1.847	0
5760 min Winter	1.461	0
7200 min Winter	1.217	0

Cascade Summary of Results for 3017 150922 Basin (West).srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
8640 min Winter	0.200	0.000	3.7	0.0	O K
10080 min Winter	0.200	0.000	3.2	0.0	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
8640 min Winter	1.048	0
10080 min Winter	0.923	0

Cascade Rainfall Details for 3017 150922 Basin (West).srcx

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time / Area Diagram

Total Area (ha) 0.595

Time (mins)	**Area (ha)**
0-4	0.595

Cascade Model Details for 3017 150922 Basin (West).srcx

Storage is Online Cover Level (m) 1.500

Tank or Pond Structure

Invert Level (m) 0.200

Depth (m)	**Area (m²)**	**Depth (m)**	**Area (m²)**
0.000	71.0	1.300	311.3

Hydro-Brake® Outflow Control

Design Head (m) 1.200 Diameter (mm) 225
Design Flow (l/s) 33.7 Invert Level (m) 0.000
Hydro-Brake® Type Md5 SW Only

Depth (m)	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**
0.100	8.0	1.200	33.8	3.000	52.8	7.000	80.6
0.200	19.5	1.400	36.2	3.500	57.0	7.500	83.4
0.300	26.9	1.600	38.6	4.000	60.9	8.000	86.2
0.400	29.7	1.800	40.9	4.500	64.6	8.500	88.8
0.500	30.1	2.000	43.1	5.000	68.1	9.000	91.4
0.600	29.8	2.200	45.2	5.500	71.5	9.500	93.9
0.800	30.0	2.400	47.2	6.000	74.6		
1.000	31.6	2.600	49.1	6.500	77.7		

Cascade Summary of Results for 3017 150922 Basin (Corner).srcx

Upstream Structures	**Outflow To**	**Overflow To**
3017 150922 Basin (West).srcx	(None)	(None)

Storm Event	**Max Level (m)**	**Max Depth (m)**	**Max Control (l/s)**	**Max Volume (m³)**	**Status**
15 min Summer	0.723	0.523	36.9	8.9	O K
30 min Summer	0.760	0.560	36.9	10.2	O K
60 min Summer	0.749	0.549	36.9	9.8	O K
120 min Summer	0.667	0.467	36.9	7.1	O K
180 min Summer	0.561	0.361	36.9	4.3	O K
240 min Summer	0.479	0.279	36.8	2.5	O K
360 min Summer	0.407	0.207	35.8	1.4	O K
480 min Summer	0.376	0.176	35.0	1.0	O K
600 min Summer	0.354	0.154	34.2	0.8	O K
720 min Summer	0.332	0.132	33.3	0.6	O K
960 min Summer	0.282	0.082	30.3	0.2	O K
1440 min Summer	0.216	0.016	23.7	0.0	O K
2160 min Summer	0.200	0.000	17.3	0.0	O K
2880 min Summer	0.200	0.000	13.7	0.0	O K
4320 min Summer	0.200	0.000	9.9	0.0	O K
5760 min Summer	0.200	0.000	7.8	0.0	O K
7200 min Summer	0.200	0.000	6.5	0.0	O K

Storm Event	**Rain (mm/hr)**	**Time-Peak (mins)**
15 min Summer	128.285	16
30 min Summer	84.226	28
60 min Summer	52.662	46
120 min Summer	31.800	78
180 min Summer	23.353	106
240 min Summer	18.644	130
360 min Summer	13.543	186
480 min Summer	10.792	246
600 min Summer	9.043	308
720 min Summer	7.823	374
960 min Summer	6.219	492
1440 min Summer	4.493	730
2160 min Summer	3.241	0
2880 min Summer	2.568	0
4320 min Summer	1.847	0
5760 min Summer	1.461	0
7200 min Summer	1.217	0

Cascade Summary of Results for 3017 150922 Basin (Corner).srcx

Storm Event	**Max Level (m)**	**Max Depth (m)**	**Max Control (l/s)**	**Max Volume (m³)**	**Status**
8640 min Summer	0.200	0.000	5.6	0.0	O K
10080 min Summer	0.200	0.000	4.9	0.0	O K
15 min Winter	0.772	0.572	36.9	10.7	O K
30 min Winter	0.823	0.623	36.9	12.7	O K
60 min Winter	0.814	0.614	36.9	12.3	O K
120 min Winter	0.688	0.488	36.9	7.8	O K
180 min Winter	0.508	0.308	36.9	3.1	O K
240 min Winter	0.412	0.212	35.9	1.5	O K
360 min Winter	0.365	0.165	34.6	0.9	O K
480 min Winter	0.343	0.143	33.7	0.7	O K
600 min Winter	0.308	0.108	32.1	0.4	O K
720 min Winter	0.269	0.069	29.2	0.2	O K
960 min Winter	0.217	0.017	23.9	0.0	O K
1440 min Winter	0.200	0.000	17.3	0.0	O K
2160 min Winter	0.200	0.000	12.5	0.0	O K
2880 min Winter	0.200	0.000	9.9	0.0	O K
4320 min Winter	0.200	0.000	7.1	0.0	O K
5760 min Winter	0.200	0.000	5.6	0.0	O K
7200 min Winter	0.200	0.000	4.7	0.0	O K

Storm Event	**Rain (mm/hr)**	**Time-Peak (mins)**
8640 min Summer	1.048	0
10080 min Summer	0.923	0
15 min Winter	128.285	16
30 min Winter	84.226	31
60 min Winter	52.662	58
120 min Winter	31.800	88
180 min Winter	23.353	112
240 min Winter	18.644	132
360 min Winter	13.543	182
480 min Winter	10.792	252
600 min Winter	9.043	326
720 min Winter	7.823	376
960 min Winter	6.219	492
1440 min Winter	4.493	0
2160 min Winter	3.241	0
2880 min Winter	2.568	0
4320 min Winter	1.847	0
5760 min Winter	1.461	0
7200 min Winter	1.217	0

Cascade Summary of Results for 3017 150922 Basin (Corner).srcx

Storm Event	**Max Level (m)**	**Max Depth (m)**	**Max Control (l/s)**	**Max Volume (m³)**	**Status**
8640 min Winter	0.200	0.000	4.0	0.0	O K
10080 min Winter	0.200	0.000	3.6	0.0	O K

Storm Event	**Rain (mm/hr)**	**Time-Peak (mins)**
8640 min Winter	1.048	0
10080 min Winter	0.923	0

Cascade Rainfall Details for 3017 150922 Basin (Corner).srcx

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time / Area Diagram

Total Area (ha) 0.058

Time (mins)	**Area (ha)**
0-4	0.058

Cascade Model Details for 3017 150922 Basin (Corner).srcx

Storage is Online Cover Level (m) 1.500

Tank or Pond Structure

Invert Level (m) 0.200

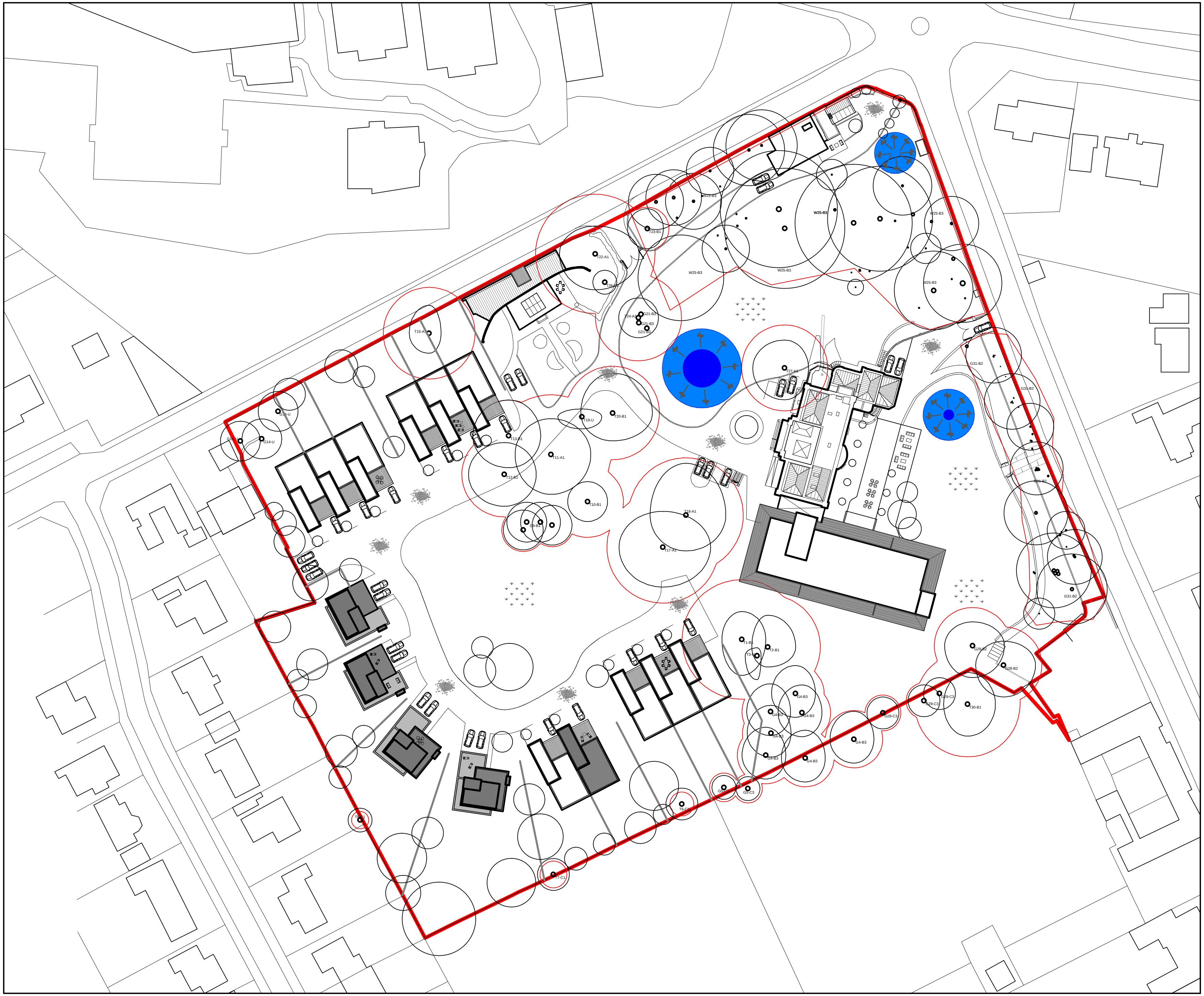
Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	0.0	1.300	84.9

Hydro-Brake® Outflow Control

Design Head (m)	0.900	Diameter (mm)	244
Design Flow (l/s)	36.9	Invert Level (m)	0.000
Hydro-Brake® Type	Md5 SW Only		

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	8.8	1.200	40.1	3.000	62.1	7.000	94.8
0.200	21.8	1.400	42.8	3.500	67.0	7.500	98.1
0.300	31.5	1.600	45.5	4.000	71.7	8.000	101.3
0.400	35.7	1.800	48.1	4.500	76.0	8.500	104.5
0.500	36.9	2.000	50.7	5.000	80.1	9.000	107.5
0.600	36.7	2.200	53.2	5.500	84.0	9.500	110.4
0.800	36.5	2.400	55.5	6.000	87.8		
1.000	37.8	2.600	57.8	6.500	91.4		

APPENDIX H:	Indicative Layout – Discharge to Sewer



General:

1. Do not scale from this drawing.
2. All adoptable sewers and associated works are to comply fully with Sewers for Adoption 7th Edition and sewerage undertaker specifications.
3. All private drainage works to be carried out in accordance with Building Regulations 2015 Edition.
4. The Contractor should investigate and locate as necessary all existing services prior to commencement on site and discuss requirement for protection with the relevant undertaker.
5. The Contractor should apply for sewer permits, road opening permits and discharge consents as necessary from the appropriate authorities prior to commencement on site.

Notes:

1. Attenuation storage requirements are based on the 1 in 100 AEP event plus 30% to account for climate change.
2. Discharge rate of 48.2 l/s to public surface water sewer network in Blackwood Avenue.
3. All drainage details are indicative only and subject to detailed design.

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Client:
St Gabriels (Liverpool) Ltd

Project Title:
Former St Gabriels Convent, Liverpool

Drawing Title:
Indicative Layout - Discharge to Sewer

Drawn:	Checked:	Date:
JA	KT	5 October 2015

Drawing No:	Rev:
3017 151005 SB-S	A

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