12-0083

FLOOD RISK ASSESSMENT

FOR

EC HARRIS

AT

BACTON LOW RISE REDEVELOPMENT, CAMDEN

Rolton Group Limited, Registered in England No. 1547400 at The Charles Parker Building, Midland Road, Higham Ferrers, Northants, NN10 8DN

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REVISION & ISSUE RECORD

Revision	Date	Name	Position	Signature
/	October 2012	Shaun Pentlow	Senior Project Engineer	S.D. Pentlow
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Revision	Date	Name	Position	Signature
A	Nov 2012	Shaun Pentlow	Senior Project Engineer	S.D. Pentlow
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CONTENTS

PREFACE

a) This Risk Assessment and/or opinion has been prepared for the specific purpose stated therein.

b) The Risk Assessment has been prepared for the exclusive use by:-

- EC Harris
- Local Authority (London Borough of Camden)
- Environment Agency
- BREEAM Assessor

c) This document is issued only to the persons stated above and on the understanding that this Practice is not held responsible for the actions of others who obtain any unauthorised disclosure of its contents, or place reliance on any part of its findings, facts or opinions, be they specifically stated or implied.

d) This study is a risk based assessment of potential flooding issues at the study site and the information presented and the conclusions drawn are for guidance only and provide no guarantee against flooding.

1.0 INTRODUCTION

This Flood Risk Assessment has been prepared on behalf of EC Harris to support a planning application for the site and to assess the Flood Risk impact of the development on the surrounding area.

This report has been written and formatted generally in accordance with the requirements outlined in National Planning Policy Framework (NPPF) and its technical guidance.

To further assist the checking process included in Appendix F is a copy of the EA guidance note checklist and its location within the report.

2.0 SITE SUMMARY

The site is located in north London, within the London Borough of Camden to the south of Hampstead Heath. It is bounded by Lismore Circus and the mainline railway to the north, Wellesley Road to the south and Vicars Road to the east and Haverstock Rad to the west. It is centred on National Grid reference 528070mE, 185330mN. The site is split into two parts with the main section to the west denoted as Bacton Low Rise (BLR) and the smaller section to the east denoted as District Housing Office (DHO).

Location plans of the site are included in Appendix A.

3.0 SITE LEVELS – EXISTING AND PROPOSED

3.1 EXISTING LEVELS

From a review of information available, the site levels generally fall in a south east direction. It would appear that external levels allow water to flow to existing gullies in the existing roads, Wellesley Road to the south and Vicars Road to the east. Low points occur on the corner of Wellesley Road and on Vicars Road, outside the DHO site.

Drawing INF02 in Appendix B indicates the pre-development levels as existing levels together with the proposed site overlay.

3.2 PROPOSED LEVELS

The proposed site levels will be dictated by the existing road levels surrounding the site which will therefore allow the current above ground surface water flow to be maintained in a south easterly direction off site. The exception to this will be the existing low point on Vicars Road outside the DHO site. The anticipated finished floor level of the DHO block adjacent to this low point will place it sufficiently high to allow the flows off site along Weedington Road to the south.

Drawing INF02 in Appendix B indicates the existing and proposed falls, based on the latest site layout, which will be retained in the detailed design.

4.0 EXISTING SITE DRAINAGE SYSTEM

From site drainage record drawings, Thames Water Asset information and the current topographical survey, the existing building has a positive outfall into the adjacent drainage system within Wellesley road and Vicars Road. Within Vicars Road and the northern section of Wellesley Road, the existing Thames Water sewer is a large culvert (1168 x 787) and is assumed to be relatively deep. The existing adopted drainage within the Highway is indicated as a combined sewer, as is the current private drainage network.

Refer to Appendix C for details of the existing drainage to the site.

5.0 HYDRAULIC INFLUENCES

The key features of the existing site drainage infrastructure, which influence the hydrology of the site are identified below.

5.1 GOSPEL OAK FLEET RIVER

The Gospel Oak Fleet River is identified as a former River which was incorporated into the local sewer system by the 1870's with the exception of Hampstead Heath area. This is now identified as an overflow surface water sewer. It is understood that the River runs beneath the adjacent railway line and is therefore believed to be at a significant depth below the site. The River is therefore not considered to be a flood risk to the proposed site. Refer to Appendix C for details of the location of this sewer.

5.2 GROUND CONDITIONS

The ground conditions are believed to be made ground overlying London Clay and therefore based on this information, groundwater flooding is not considered to be a risk.

6.0 IDENTIFICATION OF POTENTIAL FLOODING SOURCES

6.1 TIDAL/COASTAL

Due to the sites location, tidal or coastal flooding is not considered to be an issue.

6.2 WATER COURSES

As indicated in Section 5.0 the River Fleet is culverted beneath the site, believed to be at considerable depth and therefore it is unlikely that River flooding will affect the site directly. Regents Canal is located approximately 1km to the south of the site and from a site and surrounding area inspection, there does not appear to be any other watercourses in the vicinity of the site. Therefore flooding from watercourses is considered unlikely to be an issue.

6.3 GROUNDWATER

Groundwater flooding is not known to be an issue historically. The proposed development is underlain by impermeable soils and natural ground water levels are anticipated to be lowered by the adjacent railway embankment. Due to the existing site slopes, groundwater flooding is considered unlikely to be an issue.

6.4 PONDS/ LAKES

There are no known ponds or lakes adjacent to or in the vicinity of the site. The nearest ponds are those within Hampstead Heath which is located approximately 1km to the north of the site. The risk of flooding from these lakes are identified in Appendix D and identify this flood risk to the north of the site beyond the railway line

6.5 ARTIFICIAL SOURCES

There are no other known artificial sources of potential flooding adjacent to the site.

7.0 EXISTING FLOOD RISKS

Included in Appendix D is the Environment Agency's indicative flood plain map which indicates the site to be outside the 1 in 1000 year return period storm event which places it within flood Zone 1. Also included in Appendix D is a map extract indicating the risk of flooding from reservoirs which identifies this to be beyond the site boundary to the north of the railway.

With reference to the North London Strategic Flood Risk Assessment dated August 2008 by Mouchel, and the Floods in Camden Report of the Floods Scrutiny Panel London Borough of Camden June 2003, Camden is identified as having no existing fluvial flood risk although there are some areas where historical surface water flooding has been evident. These areas are to the central and west side of Camden and include Wendling on Haverstock Road to the west of the development and the railway cutting to the north. The potential for above ground flows will be considered during detailed design to ensure that these would not inundate the new development properties. Also the potential for basement flooding will be considered during detailed design and a precautionary approach applied to limit the potential basement flood risk.

As the proposed development will be within Flood Zone 1 in accordance with NPPF when considered in a sequential context, the proposals lie in the lowest flood zone, making them the most preferential with respect to flood risk.

8.0 ANALYSIS OF PROPOSED DEVELOPMENT AND SITE DRAINAGE SYSTEM

8.1 PROPOSED DEVELOPMENT

The proposed development consists of the demolition and reconstruction of the existing flats, garages and ancillary buildings together with the necessary adjustments and reconstruction of the external areas.

8.2 SURFACE WATER DRAINAGE

The existing site drainage system is a combined system which appears to convey both foul and storm drainage to the combined Thames water culvert for both the BLR and DHO site within Wellesley Road and Vicars Road. Due to the likely impermeable nature of the ground and the presence of made ground following demolition, soakaways are unlikely to be a suitable means of surface water disposal. It is likely that the proposed development will require the existing drainage to be fully reconstructed to provide drainage to the new buildings. This will need to be a separated system with the final connection combined prior to discharging into the existing Thames Water combined sewer via the existing connections. The BLR site currently has two connections to the Thames Water sewer, on the North of the site and the east which it is proposed to retain. The principal of the drainage design will need to ensure that both the peak discharge and the volume of discharge are not increased by the proposed development.

The initial concept details for the surface water storage system for the BLR and DHO sites are detailed below and identified on INF 10 and 11 in Appendix E.

Surface water concept drainage BLR site

The existing impermeable area for the BLR site is approximately 5470m^2 and the proposed impermeable area is 8030 m^2. Applying the allowable peak discharge rate to this area of 0.014 l/s/m^2 for the 1 in 1 year return period and a reduction of 30% to account for future climate change increases, the maximum peak flow will be 53.6 l/s.

The volume of discharge for a 360 minute 100 year storm provides an existing discharge volume of 285 cum (approx.) and a proposed discharge volume of 317 cum (approx.). This is therefore an additional 32 cum and this is mitigated by the discharge volume achieved at the DHO site as indicated below.

As the proposed impermeable area is to be larger than the existing impermeable area, the volume of discharge is critical for the BLR site and as such it is proposed to provide two separate storage systems. The

larger storage tank to the east of the site provides storage for the long term discharge and the smaller tank to the north of the site provides storage for the short term storage. The calculations in Appendix E identify the two storage systems combined to produce an overall maximum peak discharge of 52.4 l/s. The detailed drainage design for the scheme should ensure the peak flow and the volume of discharge are not increased.

Surface water concept drainage DHO site

The existing impermeable area for the DHO site is approximately 4560m^2 and the proposed impermeable area is 3860 m^2. Applying the allowable peak discharge rate to this area of 0.014 l/s/m^2 for the 1 in 1 year return period and a reduction of 30% to account for future climate change increases, the maximum peak flow will be 44.7 l/s. The calculations in Appendix E identify the peak discharge as 42.0 l/s.

The volume of discharge for a 360 minute 100 year storm provides an existing discharge volume of 237 cum (approx.) and a proposed discharge volume of 201 cum (approx.). This is therefore a reduction of 36 cum which provides mitigation for the additional 32 cum provided by the BLR site. Refer to the table below for the combined drainage information. Therefore, the EA guidelines set out in the document 'preliminary rainfall runoff management for new developments' for surface water discharge and long term storage have been attained.

The detailed drainage design for the scheme should ensure the peak flow and the volume of discharge across the combined site is not increased following redevelopment. This may include other forms of SuDS systems such as green roofs and rainwater harvesting which will be considered during the detailed design of the scheme.

The basis of the current design incorporates a Hydrobrake or similar flow restricting device for both sites and cellular storage used to provide the necessary storage. The current proposals identify these to be 1m depth tanks throughout which would need to be confirmed during the detailed design process. The proposed drainage system has been simulated for the worst case 1 in 100 year return period storm event (including a 30% additional flow allowance for climate change). Refer to the table below (and calculations in Appendix E) to identify the existing and proposed drainage discharge values.

Site	Existing Peak Discharge	Proposed Peak discharge	Existing discharge Volume	Proposed discharge volume
BLR	53.6 l/s	52.4 l/s	285	317
DHO	44.7 l/s	42.0 l/s	237	201
COMBINED	98.3 l/s	94.4 l/s	522	518

8.3 CLIMATE CHANGE AND DILAPIDATION

National Planning Policy Framework (which sets out the government requirements for the management and reduction of flood risk in the land use planning process) requires the investigation of climate change on the proposed development. The technical guidance identifies that the storm intensity could be increased by up to 30% by 2115 (Table 5). A 30% climate change allowance has been identified in the calculations in Appendix E and will be included within the detailed storage design. A dilapidation factor should also be applied to the storage system in accordance with best practice which will need to be considered during the detailed design process.

9.0 ASSESSMENT, PROBABILITY AND RATE OF POTENTIAL FLOODING

The development is currently identified above the 1 in 1000 year flood plain extent (in Flood Zone 1). Also the site levels will be designed to ensure that during inundation of the site drainage system, surface water will be directed beyond the building towards the south east. Therefore should any overland flooding occur it would be limited to the carriageways and based on the proposed levels would limit the flooding depth to approximately 0.25m. Due to the relatively flat nature of the ground, the flow of flood water would be very slow. This would place it in the category of low risk in accordance with figure 3.2 in document Flood Risks to People Phase 2 FD2321/TR1, which is identified below.

Velocity Coefficient C	0.5									
(V+C) * D	Depth									
Velocity	0.25	0.50	0.75	1.00	1.25	1.50	1.75	2.00	2.25	2.50
0.00	0.13	0.25	0.38	0.50	0.63	0.75	0.88	1.00	1.13	1.25
0.50	0.25	0.50	0.75	1.00	1.25	1.50	1.75	2.00	2.25	2.50
1.00	0.38	0.75	1.13	1.50	1.88	2.25	2.63	3.00	3.38	3.75
1.50	0.50	1.00	1.50	2.00	2.50	3.00	3.50	4.00	4.50	5.00
2.00	0.63	1.25	1.88	2.50	3.13	3.75	4.38	5.00	5.63	6.25
2.50	0.75	1.50	2.25	3.00	3.75	4.50	5.25	6.00	6.75	7.50
3.00	0.88	1.75	2.63	3.50	4.38	5.25	6.13	7.00	7.88	8.75
3.50	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00
4.00	1.13	2.25	3.38	4.50	5.63	6.75	7.88	9.00	10.13	11.25
4.50	1.25	2.50	3.75	5.00	6.25	7.50	8.75	10.00	11.25	12.50
5.00	1.38	2.75	4.13	5.50	6.88	8.25	9.63	11.00	12.38	13.75

	From	To	
Class 1	0.75	1.25	Danger for some
Class 2	1.25	2.50	Danger for most
Class 3	2.50	20.00	Danger for all

Figure 3.2: Velocity, depth and flood hazard matrix

10.0 PROPOSED DEVELOPMENT IMPLICATIONS

Following development of the site, the retention and reduction of flow from the proposed drainage system will be sufficient to ensure that the peak flows off site are reduced, following development. The additional volume of flow from the site is mitigated by virtue of the provision of the long term storage system and reduced peak discharge from the site. Therefore the proposed development implications are likely to result in a net marginal flood risk benefit to the site and surrounding area compared to the current situation.

11.0 CONCLUSION

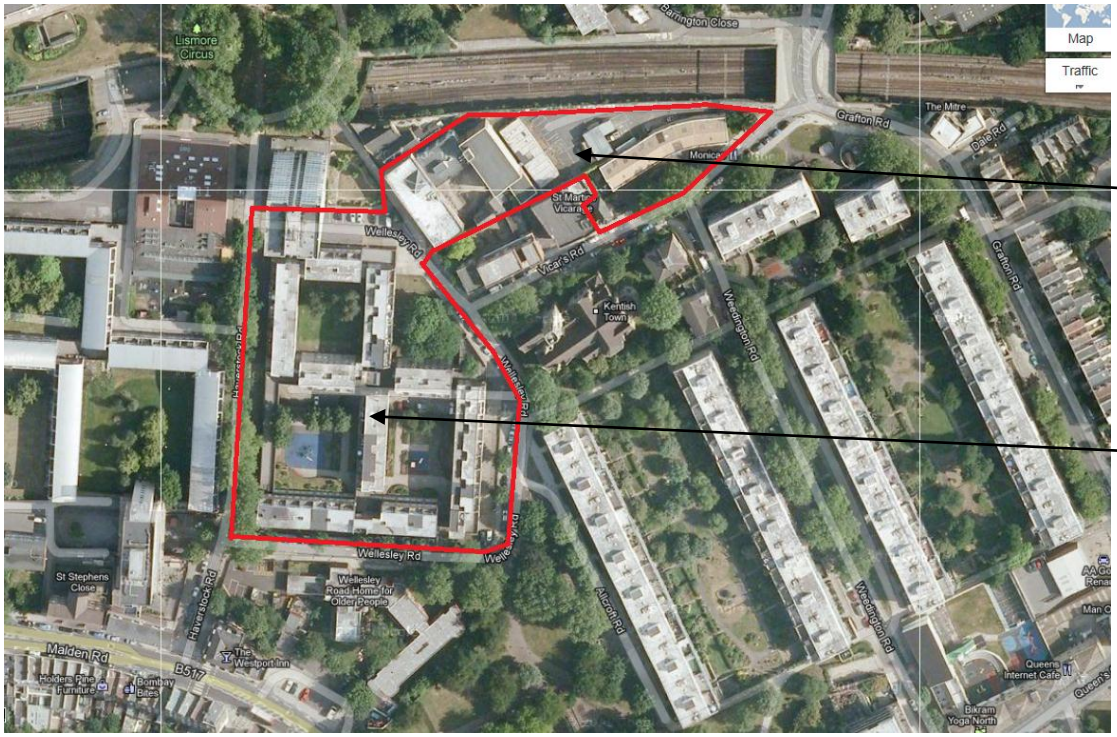
In conclusion, the proposed drainage system will ensure that the site and surrounding area flood risk is maintained and marginally reduced. The EA guidelines set out in the document 'preliminary rainfall runoff management for new developments' for surface water discharge and long term storage have been attained for the development and the calculations provided to reinforce this statement.

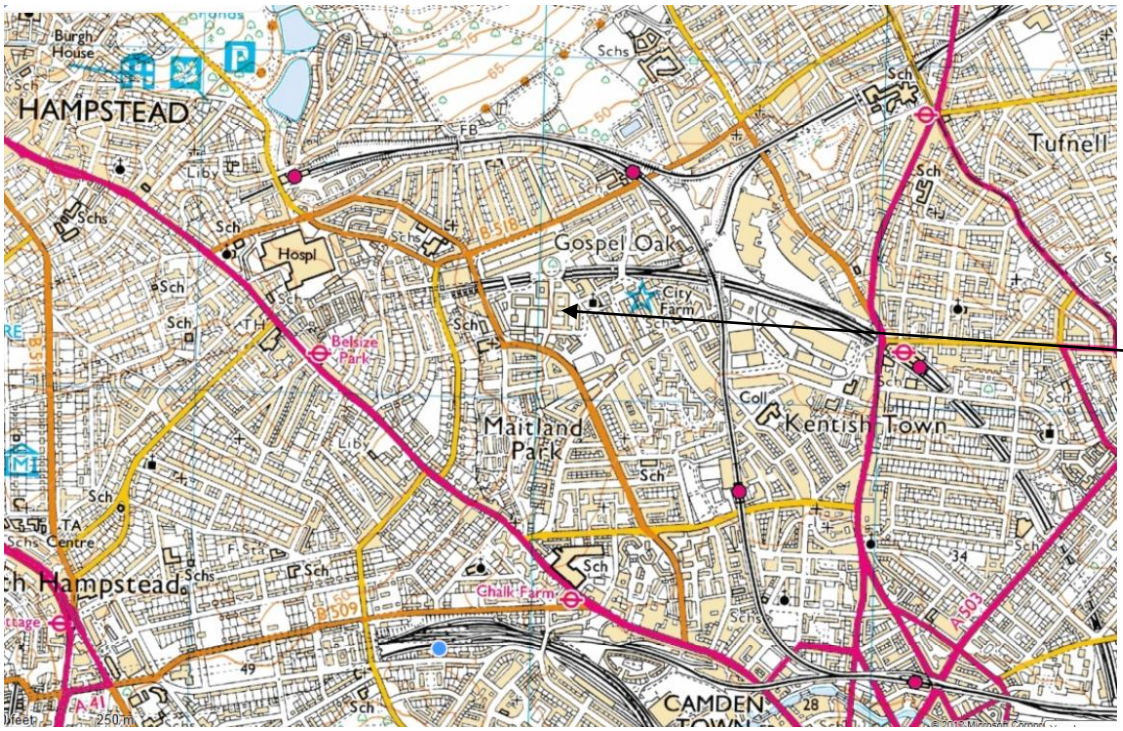
In order to indicate NPPF compliance, Appendix J indicates a copy of the EA guidance note checklist and its location within the report.

12.0 REFERENCES

- National Planning Policy Framework (NPPF) dated March 2012 by Communities and Local Government.
- Technical Guidance to the National Planning Policy Framework dated March 2012 by Communities and Local Government.
- North London Strategic Flood Risk Assessment dated August 2008 by Mouchel
- The Floods in Camden Report of the Floods Scrutiny Panel London Borough of Camden June 2003
- FRA Guidance Note 1 by the EA
- Phase 1 Geo-Environmental Desk Study at Bacton low Rise Estate, Gospel Oak, london by Rolton Group Ltd., May 2012
- EA/DEFRA document W5-074/A/TR/1 revision E 'preliminary rainfall runoff management for new developments' dated January 2012
- EA/DEFRA document Flood Risks to People Phase 2 FD2321/TR1 dated March 2006

APPENDIX A
LOCATION PLAN





APPENDIX B
SITE LEVELS – PRIOR TO AND AFTER DEVELOPMENT AND FLOOD ROUTING PLAN

Existing/Proposed Fall

Existing/ Proposed Fall

Existing/Proposed Fall

Existing/ Proposed Fall

Low point

Existing/ Proposed Fall

Existing/ Proposed Fall

Existing/ Proposed Fall off site

Low point

Existing/Proposed Fall

VICAR'S ROAD

WELLESLEY ROAD

HAVERSTOCK ROAD

ALLCROFT RO

WEEDINGTON

Vicarage

Hall

St Martin's Church

Play Area

Tunnel

42.3m

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NOTES

1. This drawing is to be read in conjunction with all the relevant contract documentation.

2. All dimensions are in mm unless otherwise stated. Dimensions to be checked on site prior to construction and any discrepancies reported to the Rolton Group Engineer.

3. Drawings marked Preliminary are for guidance/approval only, i.e. NOT for Construction.

Rev.	Date	Description of Issue	Chkd
P1	17.09.12	Preliminary issue	SDP

Revisions

Issue Purpose:
PRELIMINARY

Project
Bacton Low Rise
Camden

Drawing Title:
Proposed and existing levels & falls
BLR and DHO site

Designer's Risk Assessment Reference:
DRA CIVILS 001

Specification Reference:

Drawn By: AJM
Checked By: SDP

Scales: NTS@A1 NTS@A3
Date: Sept 12

Drawing No. 12-0083/INF/02 P1
Rev.

APPENDIX C
EXISTING SITE DRAINAGE SYSTEM

Local Drainage - Building Survey

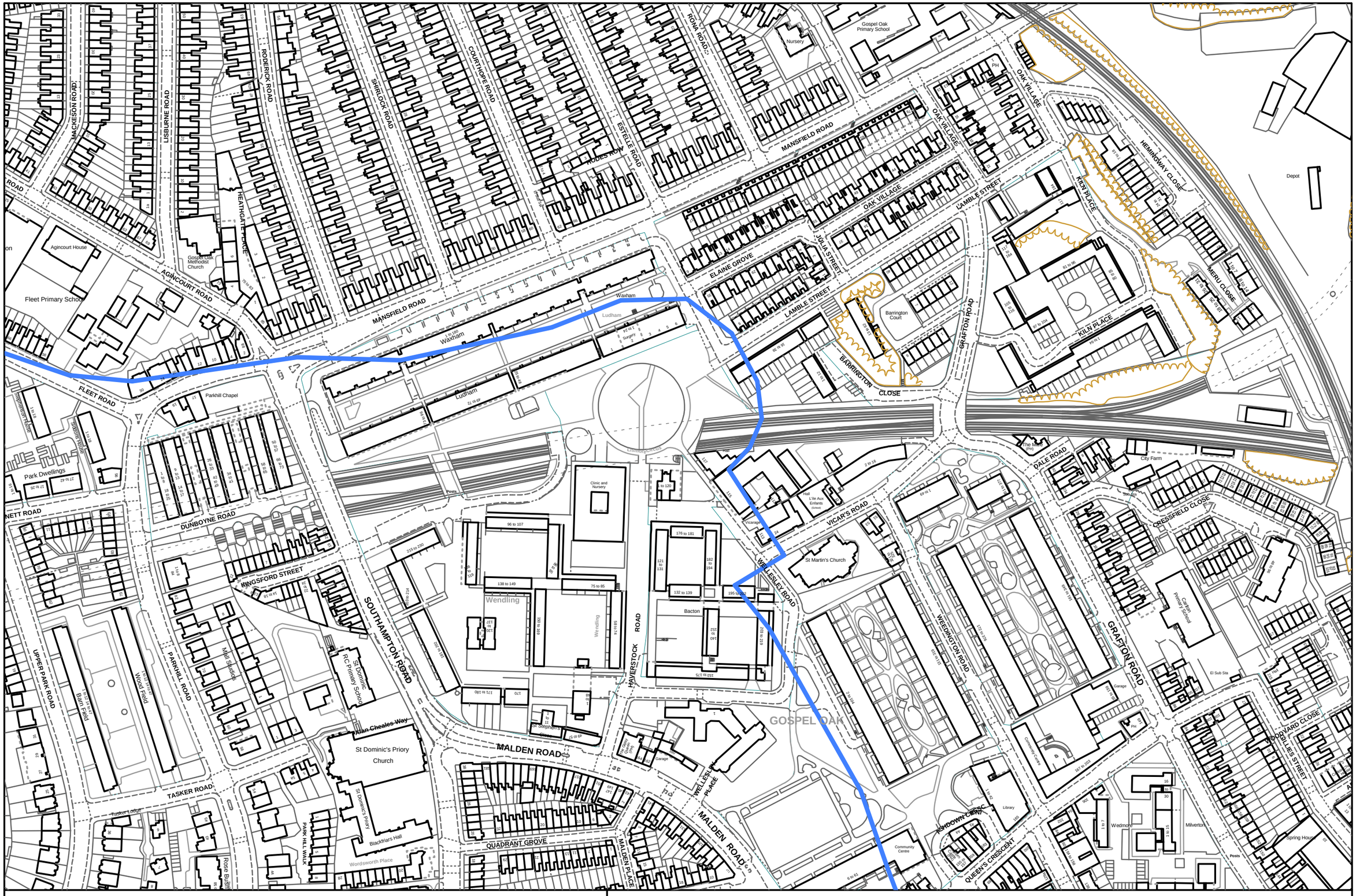
Scale 1 :NTS

Print Date: 10/06/2011

Printed By: md

Map Ref No: 01

Camden



Gospel Oak Fleet River

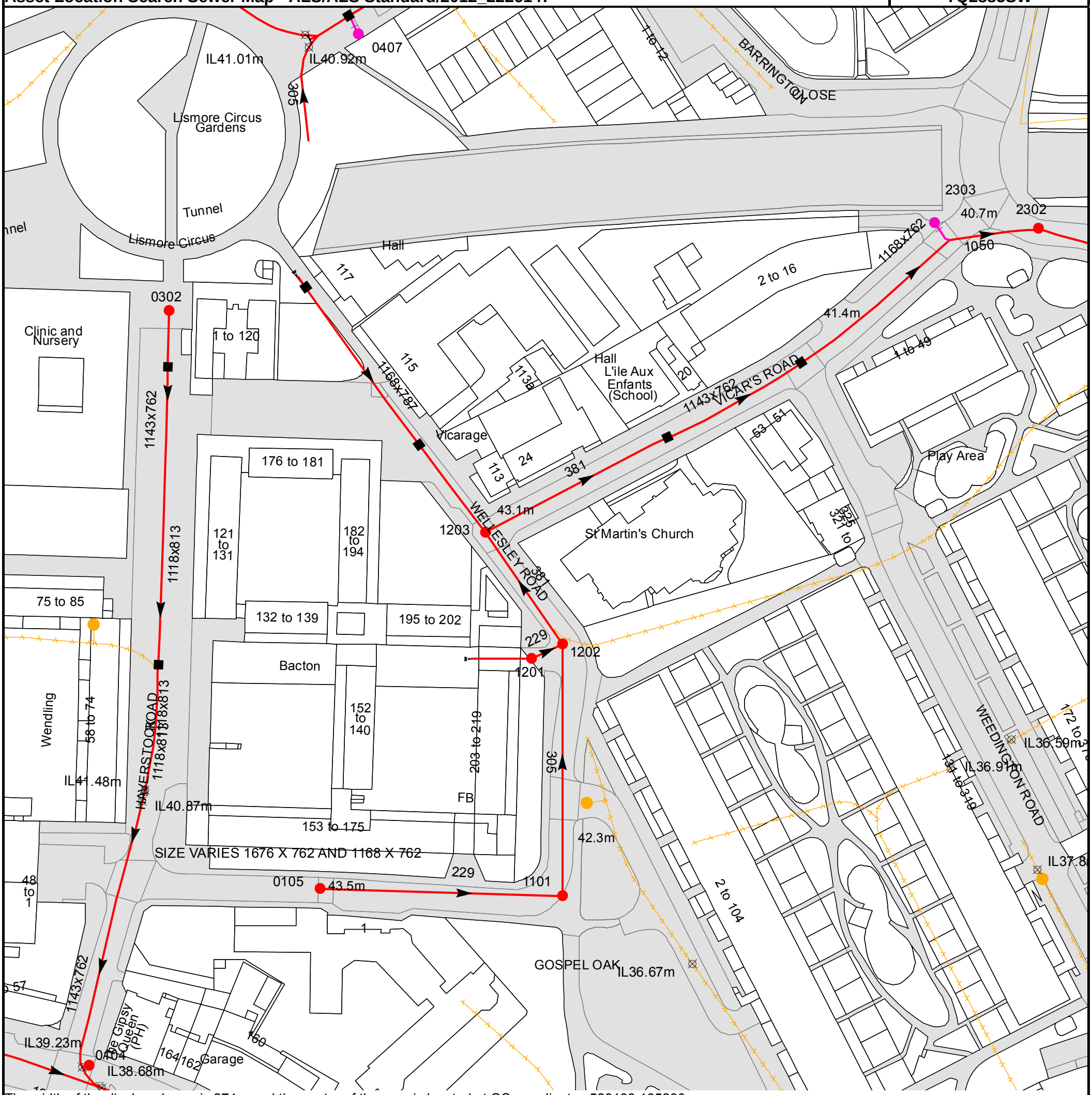
Scale 1:2500

Print Date: 27/07/2012

Printed By:

Map Ref No:

Asset Location Search Sewer Map - ALS/ALS Standard/2012_2226147 | **TQ2885SW**



The width of the displayed area is 274m and the centre of the map is located at OS coordinates 528133,185280

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

Manhole Reference	Manhole Cover Level	Manhole Invert Level
0104	n/a	n/a
0302	n/a	42
2302	n/a	n/a
2303	n/a	n/a
1101	n/a	n/a
0105	n/a	n/a
1201	n/a	n/a
1202	n/a	n/a
1203	n/a	n/a
-	-	-
0407	n/a	n/a

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

ALS Sewer Map Key

Public Sewer Types (Operated & Maintained by Thames Water)

Foul: A sewer designed to convey waste water from domestic and industrial sources to a treatment works.

Surface Water: A sewer designed to convey surface water (e.g. rain water from roofs, yards and car parks) to rivers or watercourses.

Combined: A sewer designed to convey both waste water and surface water from domestic and industrial sources to a treatment works.

Trunk Surface Water

Trunk Foul

Storm Relief

Trunk Combined

Vent Pipe

Bio-solids (Sludge)

Proposed Thames Surface Water Sewer

Proposed Thames Water Foul Sewer

Gallery

Foul Rising Main

Surface Water Rising Main

Combined Rising Main

Sludge Rising Main

Proposed Thames Water Rising Main

Vacuum

Sewer Fittings

A feature in a sewer that does not affect the flow in the pipe. Example: a vent is a fitting as the function of a vent is to release excess gas.

Air Valve

Dam Chase

Fitting

Meter

Vent Column

Operational Controls

A feature in a sewer that changes or diverts the flow in the sewer. Example: A hydrobrake limits the flow passing downstream.

Control Valve

Drop Pipe

Ancillary

Weir

End Items

End symbols appear at the start or end of a sewer pipe. Examples: an Undefined End at the start of a sewer indicates that Thames Water has no knowledge of the position of the sewer upstream of that symbol, Outfall on a surface water sewer indicates that the pipe discharges into a stream or river.

Outfall

Undefined End

Inlet

Other Symbols

Symbols used on maps which do not fall under other general categories

Public/Private Pumping Station

Change of characteristic indicator (C.O.C.I.)

Invert Level

Summit

Areas

Lines denoting areas of underground surveys, etc.

Agreement

Operational Site

Chamber

Tunnel

Conduit Bridge

Other Sewer Types (Not Operated or Maintained by Thames Water)

Foul Sewer

Surface Water Sewer

Combined Sewer

Gulley

Culverted Watercourse

Proposed

Abandoned Sewer

Notes:

1) All levels associated with the plans are to Ordnance Datum Newlyn.

2) All measurements on the plans are metric.

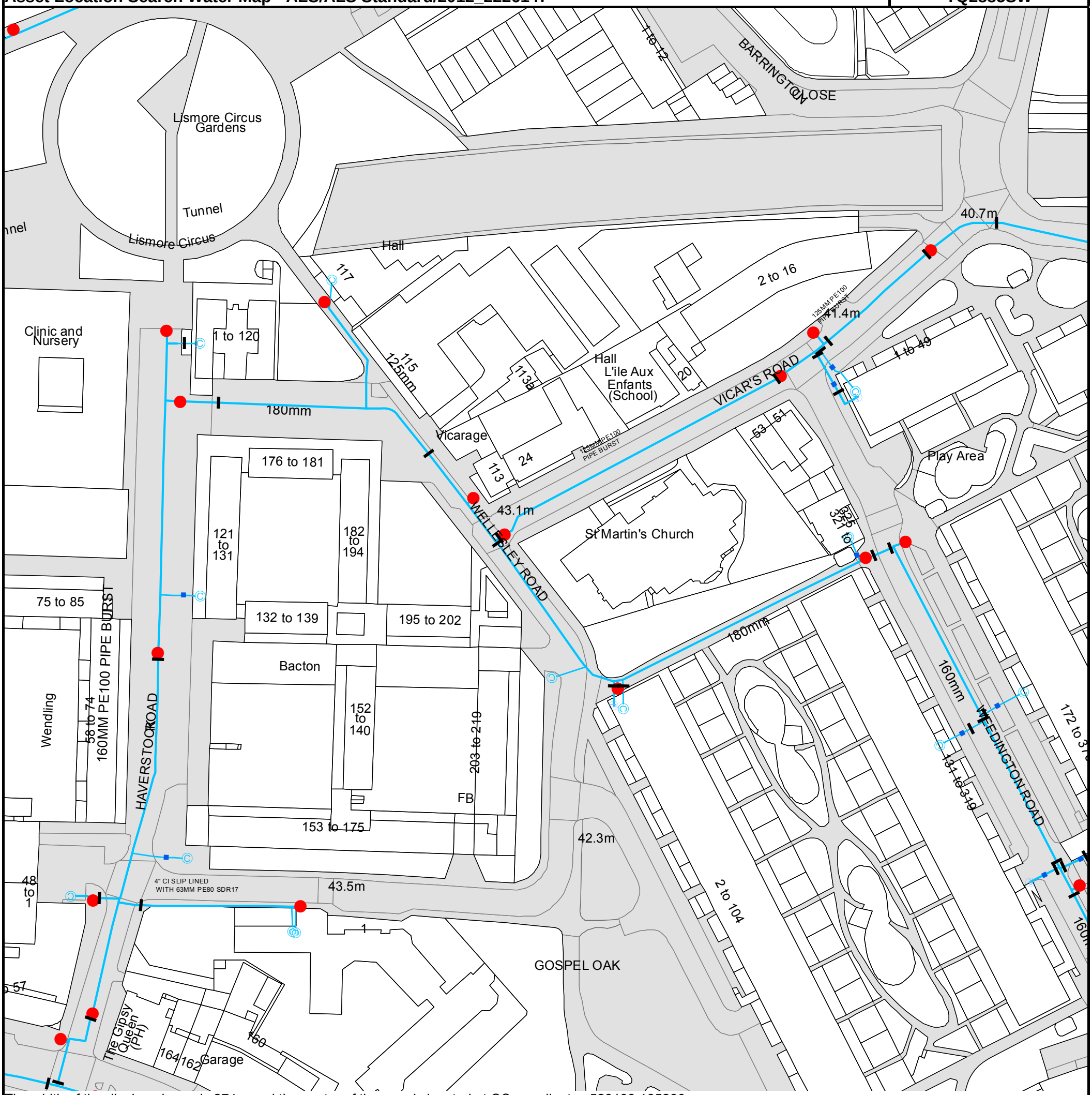
3) Arrows (on gravity fed sewers) or flecks (on rising mains) indicate direction of flow.

4) Most private pipes are not shown on our plans, as in the past, this information has not been recorded.

5) 'na' or '0' on a manhole level indicates that data is unavailable.

6) The text appearing alongside a sewer line indicates the internal diameter of the pipe in milimetres. Text next to a manhole indicates the manhole reference number and should not be taken as a measurement. If you are unsure about any text or symbology present on the plan, please contact a member of Property Insight on 0118 925 1504.

Asset Location Search Water Map - ALS/ALS Standard/2012_2226147 | **TQ2885SW**



The width of the displayed area is 274m and the centre of the map is located at OS coordinates 528133,185280

ALS Water Map Key

Water Pipes (Operated & Maintained by Thames Water)

4"

Distribution Main: The most common pipe shown on water maps. With few exceptions, domestic connections are only made to distribution mains.

16"

Trunk Main: A main carrying water from a source of supply to a treatment plant or reservoir, or from one treatment plant or reservoir to another. Also a main transferring water in bulk to smaller water mains used for supplying individual customers.

3" SUPPLY

Supply Main: A supply main indicates that the water main is used as a supply for a single property or group of properties.

3" FIRE

Fire Main: Where a pipe is used as a fire supply, the word FIRE will be displayed along the pipe.

3" METERED

Metered Pipe: A metered main indicates that the pipe in question supplies water for a single property or group of properties and that quantity of water passing through the pipe is metered even though there may be no meter symbol shown.

Transmission Tunnel: A very large diameter water pipe. Most tunnels are buried very deep underground. These pipes are not expected to affect the structural integrity of buildings shown on the map provided.

Proposed Main: A main that is still in the planning stages or in the process of being laid. More details of the proposed main and its reference number are generally included near the main.

PIPE DIAMETER	DEPTH BELOW GROUND
Up to 300mm (12")	900mm (3')
300mm - 600mm (12" - 24")	1100mm (3' 8")
600mm and bigger (24" plus)	1200mm (4')

Valves

- General Purpose Valve
- Air Valve
- Pressure Control Valve
- Customer Valve

Hydrants

- Single Hydrant

Meters

- Meter

End Items

Symbol indicating what happens at the end of a water main.

- Blank Flange
- Capped End
- Emptying Pit
- Undefined End
- Manifold
- Customer Supply
- Fire Supply

Operational Sites

- Booster Station
- Other
- Other (Proposed)
- Pumping Station
- Service Reservoir
- Shaft Inspection
- Treatment Works
- Unknown
- Water Tower

Other Symbols

- Data Logger

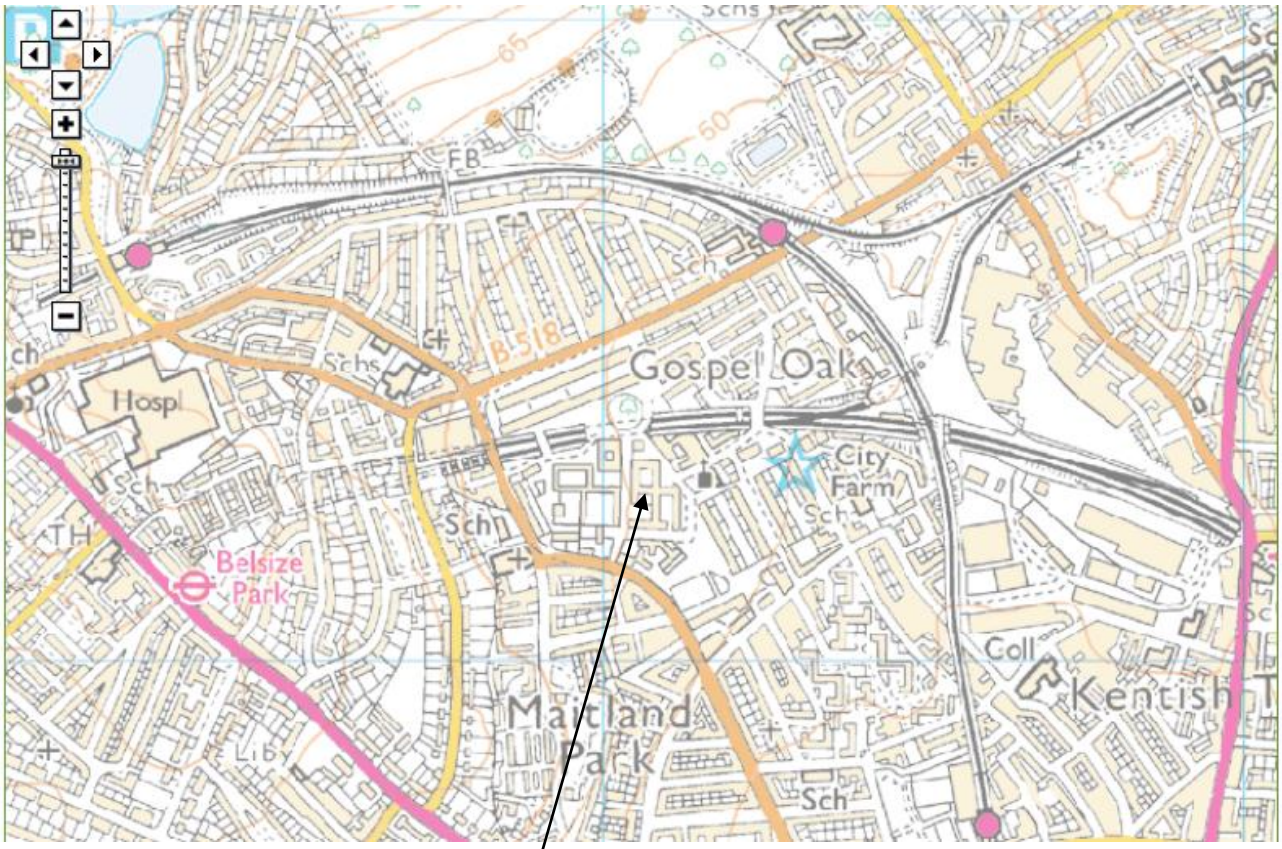
Other Water Pipes (Not Operated or Maintained by Thames Water)

Other Water Company Main: Occasionally other water company water pipes may overlap the border of our clean water coverage area. These mains are denoted in purple and in most cases have the owner of the pipe displayed along them.

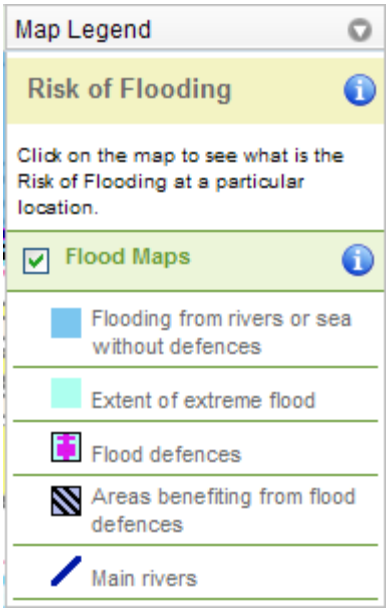
Private Main: Indiates that the water main in question is not owned by Thames Water. These mains normally have text associated with them indicating the diameter and owner of the pipe.

APPENDIX D
ENVIRONMENT AGENCY'S INDICATIVE FLOOD PLAIN MAPS

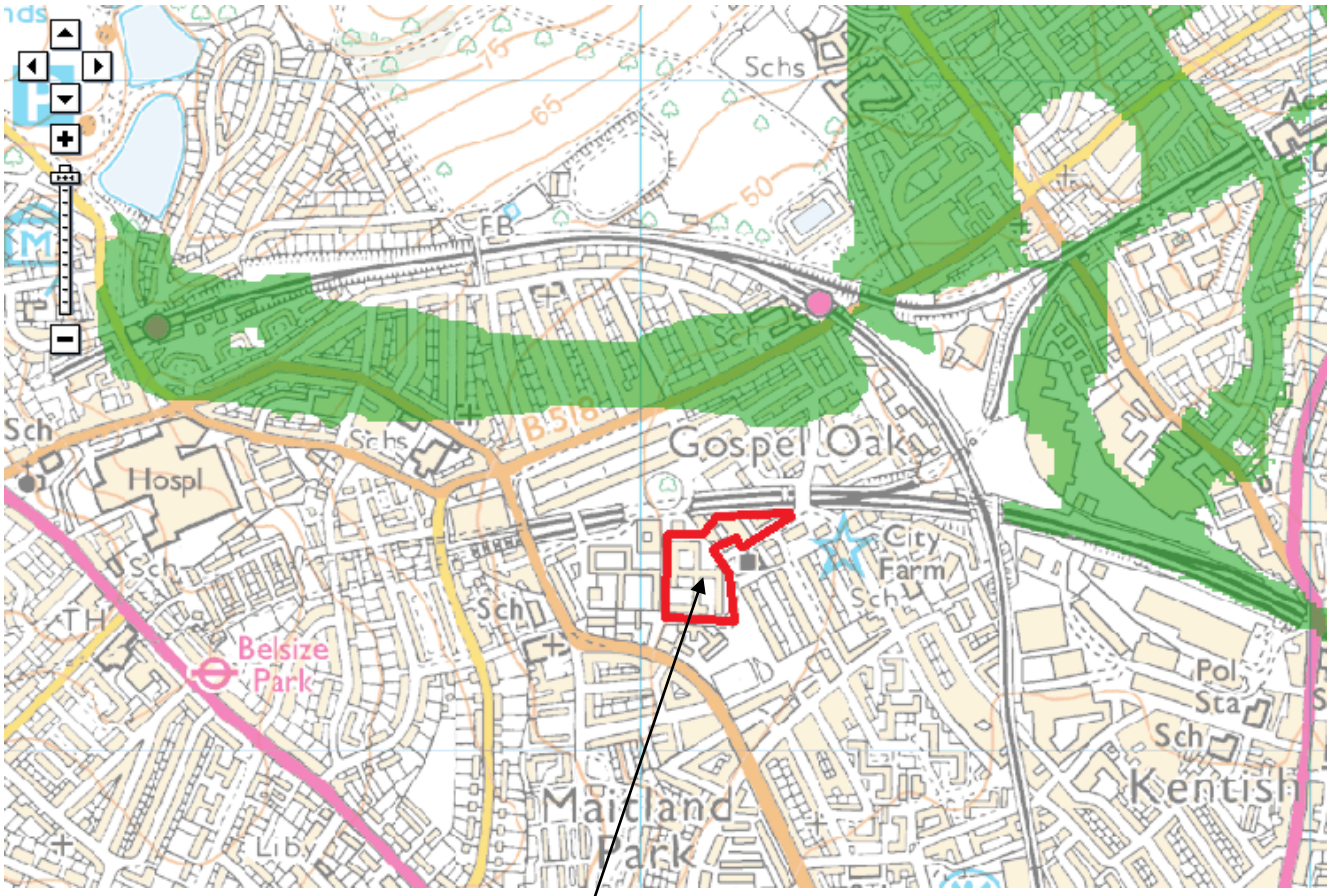
RISK OF FLOODING FROM RIVERS AND SEAS



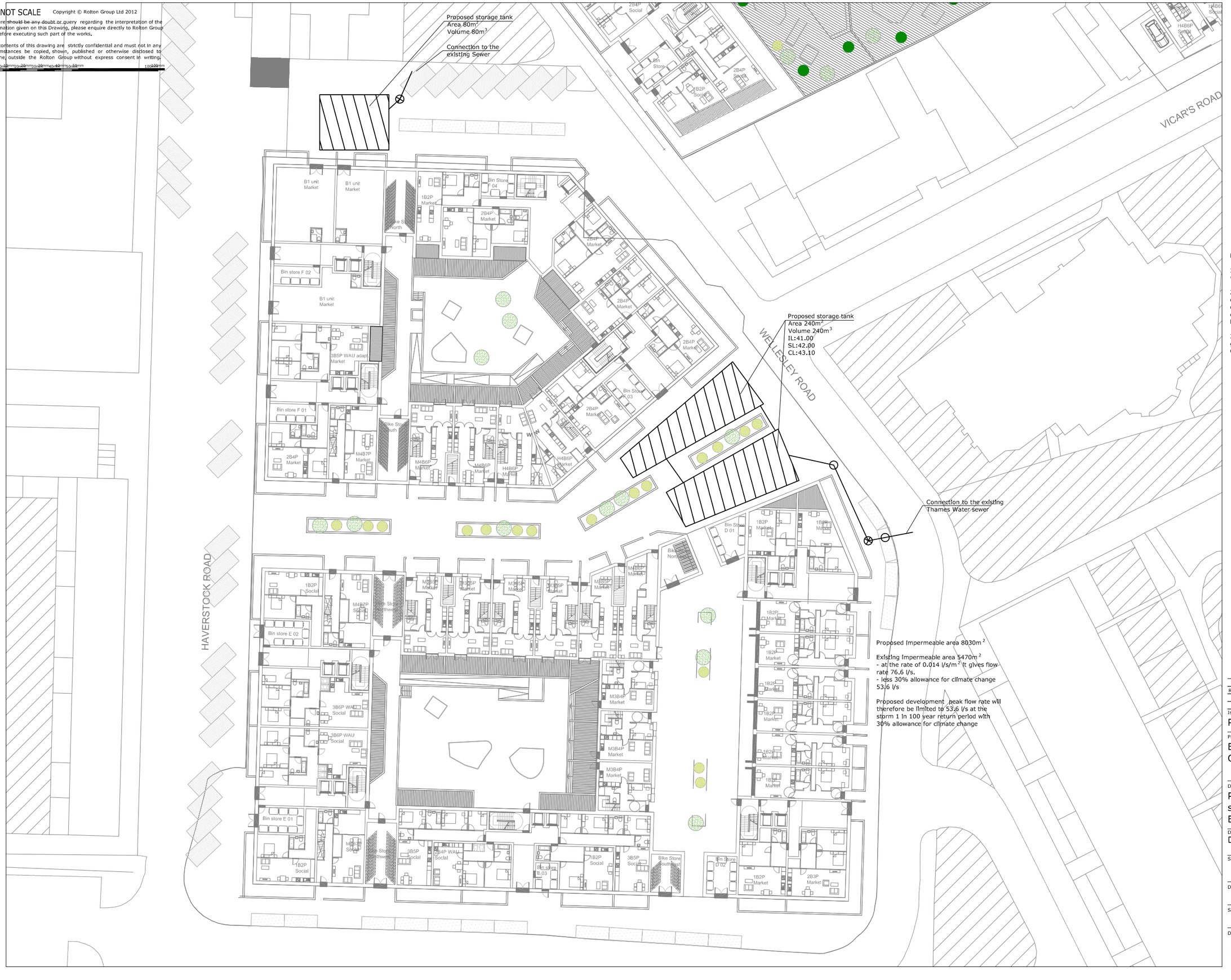
Approx. site location



RISK OF FLOODING FROM RESERVOIRS



APPENDIX E
PROPOSED DRAINAGE LAYOUT AND CALCULATIONS



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THE CHARLES PARKER BUILDING
MIDLAND ROAD, HIGHAM FERRERS
NORTHANTS NN10 8DN

ONE MINERVA BUSINESS PARK
LYNCH WOOD
PETERBOROUGH PE2 6FT

TWELVE QUARTZ POINT
STONEBRIDGE ROAD
BIRMINGHAM B46 3JL

NOTES

1. This drawing is to be read in conjunction with all the relevant contract documentation.

2. All dimensions are in mm unless otherwise stated. Dimensions to be checked on site prior to construction and any discrepancies reported to the Rolton Group Engineer.

3. Drawings marked Preliminary are for guidance/approval only, i.e. NOT for Construction.

Rev.	Date	Description of Issue	Chkd
P1	18.09.12	Preliminary issue	SDP

Revisions

Issue Purpose:
PRELIMINARY

Project
Bacton Low Rise
Camden

Drawing Title:
Proposed storm water storage plan
BLR site

Designer's Risk Assessment Reference:
DRA CIVILS 001

Specification Reference:

Drawn By: AJM
Checked By: SDP

Scales: 1:250@A1
1:500@A3
Date: Sept 12

Drawing No. 12-0083/INF/10
Rev. P1

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NOTES

1. This drawing is to be read in conjunction with all the relevant contract documentation.

2. All dimensions are in mm unless otherwise stated. Dimensions to be checked on site prior to construction and any discrepancies reported to the Rolton Group Engineer.

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Rev.	Date	Description of Issue	Chkd
P1	18.09.12	Preliminary issue	SDP

Revisions

Issue Purpose:
PRELIMINARY

Project
Bacton Low Rise
Camden

Drawing Title:
Proposed storm water storage plan
DHO site

Designer's Risk Assessment Reference:
DRA CIVILS 001

Specification Reference:

Drawn By: AJM
Checked By: SDP

Scales: 1:250@A1 1:500@A3
Date: Sept 12

Drawing No. 12-0083/INF/11 P1
Rev.

Proposed combined BLR network

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The Charles Parker Bu... Midland Road Northants NN10 8DN	12-0083 Bacton Low Camden Network No.1	
Date 03.09.2012 File BLR Proposed Sit...	Designed by A.Marciniak Checked by	
Micro Drainage	Network W.12.6.1	

STORM SEWER DESIGN by the Modified Rational Method

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)
1.000	6.600	0.066	100.0	0.330	5.00	0.0	0.600	o	450
1.001	12.000	0.120	100.0	0.000	0.00	0.0	0.600	o	450
2.000	5.000	0.050	100.0	0.473	6.00	0.0	0.600	o	450
2.001	5.000	0.050	100.0	0.000	0.00	0.0	0.600	o	450
1.002	9.600	0.096	100.0	0.000	0.00	0.0	0.600	o	450

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	5.05	41.000	0.330	0.0	0.0	0.0	2.03	323.4	44.7
1.001	50.00	5.15	40.934	0.330	0.0	0.0	0.0	2.03	323.4	44.7
2.000	50.00	6.04	40.914	0.473	0.0	0.0	0.0	2.03	323.4	64.1
2.001	50.00	6.08	40.864	0.473	0.0	0.0	0.0	2.03	323.4	64.1
1.002	50.00	6.16	40.814	0.803	0.0	0.0	0.0	2.03	323.4	108.7

Online Controls for Storm

Hydro-Brake® Manhole: 12, DS/PN: 1.001, Volume (m³): 3.8

Design Head (m) 1.200 Hydro-Brake® Type Md5 SW Only Invert Level (m) 40.934
Design Flow (l/s) 51.0 Diameter (mm) 272

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	9.8	1.200	50.7	3.000	77.1	7.000	117.8
0.200	25.2	1.400	53.6	3.500	83.3	7.500	121.9
0.300	38.3	1.600	56.7	4.000	89.1	8.000	125.9
0.400	45.1	1.800	59.9	4.500	94.5	8.500	129.8
0.500	48.0	2.000	63.1	5.000	99.6	9.000	133.6
0.600	48.4	2.200	66.1	5.500	104.4	9.500	137.2
0.800	47.8	2.400	69.0	6.000	109.1		
1.000	48.5	2.600	71.8	6.500	113.5		

Hydro-Brake® Manhole: 5, DS/PN: 2.001, Volume (m³): 3.6

Design Head (m) 1.100 Hydro-Brake® Type Md6 SW Only Invert Level (m) 40.864
Design Flow (l/s) 5.0 Diameter (mm) 91

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.7	1.200	5.2	3.000	8.2	7.000	12.5
0.200	3.8	1.400	5.6	3.500	8.8	7.500	12.9
0.300	3.6	1.600	6.0	4.000	9.4	8.000	13.4
0.400	3.5	1.800	6.3	4.500	10.0	8.500	13.8
0.500	3.6	2.000	6.7	5.000	10.6	9.000	14.2
0.600	3.8	2.200	7.0	5.500	11.1	9.500	14.6
0.800	4.2	2.400	7.3	6.000	11.6		
1.000	4.7	2.600	7.6	6.500	12.0		

Storage Structures for Storm

Cellular Storage Manhole: 12, DS/PN: 1.001

Invert Level (m) 40.934 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	80.0	240.0	1.001	0.0	302.0
1.000	80.0	302.0			

Cellular Storage Manhole: 5, DS/PN: 2.001

Invert Level (m) 40.864 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	240.0	0.0	1.001	0.0	0.0
1.000	240.0	0.0			

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

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720
Return Period(s) (years)	1, 100
Climate Change (%)	0, 30

PN	Storm	Return Period	Climate Change	First X Surcharge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
1.000	30 Winter	100	+30%	100/15 Summer				
1.001	30 Winter	100	+30%	100/15 Summer				
2.000	240 Winter	100	+30%	100/15 Summer				
2.001	240 Winter	100	+30%	100/15 Summer				
1.002	60 Winter	100	+30%					

PN	US/MH Name	Water Level (m)	Surch'ed Depth (m)	Flooded Volume (m³)	Flow / Cap.	O'flow (l/s)	Pipe Flow (l/s)	Status
1.000	1	41.875	0.425	0.000	0.88	0.0	149.3	SURCHARGED
1.001	12	41.778	0.394	0.000	0.25	0.0	48.4	SURCHARGED
2.000	4	42.958	1.594	0.000	0.30	0.0	50.4	FLOOD RISK
2.001	5	42.956	1.642	0.000	0.04	0.0	6.7	FLOOD RISK
1.002	18	40.982	-0.282	0.000	0.30	0.0	52.4	OK

BLR existing discharge volume

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The Charles Parker Bu... Midland Road Northants NN10 8DN	12-0083 Bacton Low Camden Network No.1	
Date 03.09.2012 File BLR Existing.mdx	Designed by A.Marciniak Checked by	
Micro Drainage	Network W.12.6.1	

STORM SEWER DESIGN by the Modified Rational Method

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)
1.000	6.600	0.066	100.0	0.500	6.00	0.0	0.600	o	450
1.001	12.000	0.120	100.0	0.047	0.00	0.0	0.600	o	450
1.002	9.600	0.096	100.0	0.000	0.00	0.0	0.600	o	300

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	6.05	41.000	0.500	0.0	0.0	0.0	2.03	323.4	67.7
1.001	50.00	6.15	40.934	0.547	0.0	0.0	0.0	2.03	323.4	74.1
1.002	50.00	6.25	40.814	0.547	0.0	0.0	0.0	1.57	111.1	74.1

User Report X:\11-0\3\5\7\Design Docs (deliverables)\Calculations\Discharge volume.spdx for Storm

PN	Discharge Volume (m³)	PN	Discharge Volume (m³)	PN	Discharge Volume (m³)
1.000	260.307	1.001	285.182	1.002	285.630

Proposed combined BLR Volume

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The Charles Parker Bu... Midland Road Northants NN10 8DN	12-0083 Bacton Low Camden Network No.1	
Date 03.09.2012 File BLR Proposed Sit...	Designed by A.Marciniak Checked by	
Micro Drainage	Network W.12.6.1	

User Report X:\11-0\3\5\7\Design Docs (deliverables)\Calculations\Discharge volume.spdx for Storm

PN	Discharge Volume (m³)	PN	Discharge Volume (m³)	PN	Discharge Volume (m³)
1.000	171.814	2.000	243.618	1.002	316.592
1.001	171.824	2.001	144.855		

Proposed DHO network

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Date 03.09.2012 File DHO Proposed Sit...	Designed by A.Marciniak Checked by	
Micro Drainage	Network W.12.6.1	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	1	Add Flow / Climate Change (%)	0
M5-60 (mm)	20.600	Minimum Backdrop Height (m)	0.000
Ratio R	0.436	Maximum Backdrop Height (m)	0.000
Maximum Rainfall (mm/hr)	50	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.00	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500
PIMP (%)	100		

Designed with Level Soffits

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)
1.000	9.800	0.098	100.0	0.300	6.00	0.0	0.600	o	450
1.001	25.000	0.250	100.0	0.086	0.00	0.0	0.600	o	450
1.002	3.400	0.034	100.0	0.000	0.00	0.0	0.600	o	300

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	6.08	39.400	0.300	0.0	0.0	0.0	2.03	323.4	40.6
1.001	50.00	6.29	39.302	0.386	0.0	0.0	0.0	2.03	323.4	52.3
1.002	50.00	6.32	39.052	0.386	0.0	0.0	0.0	1.57	111.1	52.3

Online Controls for Storm

Hydro-Brake® Manhole: 18, DS/PN: 1.002, Volume (m³): 7.0

Design Head (m) 1.200 Hydro-Brake® Type Md5 SW Only Invert Level (m) 39.052
Design Flow (l/s) 44.0 Diameter (mm) 254

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	9.1	1.200	43.7	3.000	67.3	7.000	102.7
0.200	23.0	1.400	46.5	3.500	72.6	7.500	106.3
0.300	34.0	1.600	49.3	4.000	77.7	8.000	109.8
0.400	39.0	1.800	52.2	4.500	82.4	8.500	113.2
0.500	40.7	2.000	55.0	5.000	86.8	9.000	116.5
0.600	40.7	2.200	57.6	5.500	91.1	9.500	119.7
0.800	40.3	2.400	60.2	6.000	95.1		
1.000	41.4	2.600	62.6	6.500	99.0		

Storage Structures for Storm

Cellular Storage Manhole: 1, DS/PN: 1.000

Invert Level (m) 39.400 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	90.0	240.0	1.001	0.0	302.0
1.000	90.0	302.0			

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

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880
Return Period(s) (years)	1, 100
Climate Change (%)	0, 30

PN	Storm	Return Period	Climate Change	First X Surcharge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
1.000	30 Winter	100	+30%	100/15 Summer				
1.001	30 Winter	100	+30%	100/15 Summer				
1.002	30 Winter	100	+30%	100/15 Summer				

PN	US/MH Name	Water Level (m)	Surch'ed Depth (m)	Flooded Volume (m³)	Flow / Cap.	O'flow (l/s)	Pipe Flow (l/s)	Status
1.000	1	40.267	0.417	0.000	0.24	0.0	42.0	SURCHARGED
1.001	12	40.256	0.504	0.000	0.21	0.0	56.9	SURCHARGED
1.002	18	40.110	0.758	0.000	0.68	0.0	42.0	SURCHARGED

DHO Existing discharge volume

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The Charles Parker Bu... Midland Road Northants NN10 8DN	12-0083 Bacton Low Camden Network No.1	
Date 03.09.2012 File DHO Existing.mdx	Designed by A.Marciniak Checked by	
Micro Drainage	Network W.12.6.1	

STORM SEWER DESIGN by the Modified Rational Method

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)
1.000	9.800	0.098	100.0	0.300	6.00	0.0	0.600	o	450
1.001	25.000	0.250	100.0	0.156	0.00	0.0	0.600	o	450
1.002	3.400	0.034	100.0	0.000	0.00	0.0	0.600	o	300

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	6.08	39.400	0.300	0.0	0.0	0.0	2.03	323.4	40.6
1.001	50.00	6.29	39.302	0.456	0.0	0.0	0.0	2.03	323.4	61.7
1.002	50.00	6.32	39.052	0.456	0.0	0.0	0.0	1.57	111.1	61.7

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PN	Discharge Volume (m^3)	PN	Discharge Volume (m^3)	PN	Discharge Volume (m^3)
1.000	156.142	1.001	237.425	1.002	237.533

DHO Proposed discharge volume

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The Charles Parker Bu... Midland Road Northants NN10 8DN	12-0083 Bacton Low Camden Network No.1	
Date 03.09.2012 File DHO Proposed Sit...	Designed by A.Marciniak Checked by	
Micro Drainage	Network W.12.6.1	

User Report X:\11-0\3\5\7\Design Docs (deliverables)\Calculations\Discharge volume.spdx for Storm

PN	Discharge Volume (m³)	PN	Discharge Volume (m³)	PN	Discharge Volume (m³)
1.000	156.126	1.001	200.991	1.002	201.114

APPENDIX F
FRA GUIDANCE NOTE 1: LOCATION WITHIN THE REPORT

Flood Risk Assessment (FRA) Guidance Note 1 **Development Greater Than 1 Hectare (ha) in Flood Zone 1 (and Critical Drainage areas less than 1ha)**	
	LOCATION WITHIN THE REPORT
Plans	
A location plan that includes geographical features, street names and identifies the catchment, watercourses or other bodies of water in the vicinity.	Appendix A and D
A plan of the site showing:	
• existing site	Appendix B
• development proposals	Appendix B and E
• identification of any structures (e.g. embankments), which may influence local flood flow overland or in any watercourses (e.g. culverts) present on the site.	Section 5 and Appendix C
Surveys	
Site levels - both existing and proposed. Reference to Ordnance Datum may be required where details of context of the site to its surroundings is needed.	Appendix B
Assessments	
The Applicant should submit:	
• Proposals for surface water management that aims to not increase, and where practicable reduce the rate of runoff from the site as a result of the development (in accordance with sustainable drainage principles, and the Local Planning Authority's published SFRA).	Section 8 and Appendix E
• Information about the surface water disposal measures already in place and their state of maintenance.	Section 4
• An assessment of the volume of surface water run-off likely to be generated from the proposed development.	Section 8
• Allowance in design for how the increased frequency and intensity of rainfall that is predicted as a result of climate change will affect the proposal (see Annex B of PPS25).	Section 8.3
• Information about other potential sources of flooding, if any, that may affect the site e.g. streams, surface water run-off, sewers, groundwater, reservoirs, canals and other artificial sources or any combination of these; including details on how these sources of flooding will be managed safely within the development proposal.	Section 5 and 6
• Confirmation as to whether Environment Agency consent is needed for any aspect of the work, and whether this has been applied for or not.	Not applicable

APPENDIX G
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