Planning Application for the Aylesbury Estate Regeneration

Plot 18 Reserved Matters Application

Drainage Strategy Report

WSP

v1

Notting Hill Housing · Southwark Council · hta · DUGGAN MORRIS ARCHITECTS · GL Hearn Part of Capita plc · WSP · AECOM · Tamla Trees consulting arborists

AYLESBURYNOW

AYLESBURY ESTATE
PLOT 18

DRAINAGE STRATEGY REPORT

CONFIDENTIAL

APRIL 2016

WSP | PARSONS BRINCKERHOFF

AYLESBURY ESTATE
PLOT 18
DRAINAGE STRATEGY REPORT

Notting Hill Housing Trust

Confidential

Project no: 70009682
Date: April 2016

WSP | Parsons Brinckerhoff
Unit 9, The Chase
John Tate Road
Foxholes Business Park
Hertford
SG13 7NN

Tel: +44 (0)1992 526 000
Fax: +44 (0)1992 526 001
www.wspgroup.com
www.pbworld.com

QUALITY MANAGEMENT

ISSUE/REVISION	FIRST ISSUE	REVISION 1	REVISION 2	REVISION 3
Remarks	Draft	Final	Final	
Date	October 2015	November 2015	April 2016	
Prepared by	C Sharp	C Sharp	C Moriarty	
Signature				
Checked by	M Stillion	M Stillion	M Stillion	
Signature				
Authorised by	M Stillion	M Stillion	M Stillion	
Signature				
Project number	70009682	70009682	70009682	
Report number	NHH-AES-WSP-C-PLOT 18-X-XX-RP-DSR	NHH-AES-WSP-C-PLOT 18-X-XX-RP-DSR	NHH-AES-WSP-C-PLOT 18-X-XX-RP-DSR	
File reference				

TABLE OF CONTENTS

APPENDICES

1 EXECUTIVE SUMMARY

1.1 PLOT 18, AYLESBURY ESTATE

1.1.1 The Aylesbury Estate Regeneration Scheme was granted Outline Planning Permission in August 2015 under planning application number 14/AP/3844. Plot 18 of the Aylesbury Estate Regeneration Scheme will provide two new development blocks comprising residential units, a Health Centre, an Early Years Facility, commercial uses and community facilities.

1.1.2 The Plot 18 site covers an area of 1.02Ha, and is currently occupied by residential flats and temporary community buildings.

1.1.3 The strategy for draining surface water from the proposed development is to employ a network of gravity drains and sewers and to attenuate peak rate discharges from the development in compliance with Thames Water's requirements, as agreed for the whole Aylesbury Estate.

1.1.4 A storm water attenuation tank will be provided below ground within the site and an existing adopted sewer in Thurlow Street adjacent to the site will provide the outfall for surface water discharges.

1.1.5 Foul flows will also be catered for by a separate network of sewers and drains which will also discharge by gravity to the existing sewer in Thurlow Street.

1.1.6 The proposals for drainage at Plot 18 are consistent with the approved Aylesbury Estate drainage strategy and Flood Risk Assessment as provided with the above Outline Planning Permission.

2 INTRODUCTION

2.1 APPOINTMENT AND BRIEF

2.1.1 WSP have been commissioned by Notting Hill Housing Trust (NHHT) to prepare a Drainage Strategy Report for the proposed redevelopment of Plot 18 within the Aylesbury Estate Regeneration Area in the London Borough of Southwark.

2.1.2 The Aylesbury Estate Regeneration Scheme was granted Outline Planning Permission in August 2015 subject to satisfactory discharge of conditions. The outline application was supported by a Flood Risk Assessment and Drainage Strategy (Document Reference NHH-AES-WSP-C-MPL-X-XX-RP-FRA dated 23/09/2014) which covered the whole Aylesbury Estate Area.

2.1.3 Condition 5 of the outline consent states*; No development shall commence within a Plot until a surface water drainage strategy has been submitted to and approved by the Local Planning Authority (in consultation with Thames Water and the Environment Agency).*

2.1.4 Condition 7 of the outline consent states*; No development shall commence within a Plot until a drainage strategy detailing any proposed on and/or off site drainage works has been submitted to and approved in writing by the Local Planning Authority (in consultation with Thames Water).*

2.1.5 A Reserved Matters Planning Application is to be submitted for the Plot 18 redevelopment and this report addresses the requirements of Outline Planning Conditions 5 and 7 specifically in the context of Plot 18. Reference should also be made to document NHH-AES-WSP-C-MPL-X-XX-RP-FRA.

3 EXISTING SITE

3.1 SITE LOCATION

3.1.1 Plot 18 is located in the northern sector of the Aylesbury Estate Regeneration Area and is bounded by Thurlow Street to the east, Inville Road to the south, Dawes Street to the west and the Dawes Street open space area (to the rear of Taplow block) to the north. A site location plan is included at Appendix A and a topographical survey of the existing Plot 18 site can be found in Appendix B.

3.2 SITE DESCRIPTION

3.2.1 The Plot 18 site has an area of approximately 1.02 Ha. The site is occupied by a number of buildings; two large four storey residential flat blocks “Missenden” and “Northchurch”, a single storey Medical Centre which forms an extension of the “Taplow” flat block and three other single storey prefabricated buildings. The two flat blocks have small garden areas adjacent and the south-eastern corner of the site is occupied by a hard paved play area.

3.2.2 “Missenden” block has its frontage onto Dawes Street and “Northchurch” sits perpendicular to Dawes Street with its frontage facing south.

3.2.3 Site levels fall only slightly from east to west, with levels at Thurlow Street nominally around 2.9m AOD and on Dawes Street 2.6m. The hard paved play area is at a lower level of 2.3m AOD.

3.2.4 Thurlow Street is an adopted highway however Dawes Street and Inville Road are owned and maintained by the Housing Authority. All the adjacent roads are positively drained by road gullies connected via private drains to the adopted sewer system.

3.2.5 The site is crossed by existing adopted utilities which are shown on the topographical/GPR survey. No watercourses or land drains are present.

3.3 SITE DRAINAGE

3.3.1 The sewerage undertaker is Thames Water (TW) and their sewer record plan of the existing site is included at Appendix C.

3.3.2 Adopted combined sewers are present on the site and in adjacent roads at Thurlow Street and Dawes Street. An on-site sewer drains the rear of the Northchurch block and picks up flows from the existing Day Nursery. This is a 450mm diameter pipe which drains in an easterly direction to connect to the 525/600mm diameter combined sewer at manhole no. 9302 in Thurlow Street.

3.3.3 A second on-site sewer of 150mm diameter drains the existing prefabricated buildings and outfalls to manhole no. 9206 also in Thurlow Street. The existing sewer invert level at manhole no. 9206 is recorded as -1.10m AOD.

3.3.4 In order to avoid constraining the development these onsite sewers will be abandoned.

3.4 GROUND CONDITIONS

3.4.1 A site investigation will be commissioned to establish the geology of the Plot 18 site and to test for the presence of contamination. A number of previous studies have been carried out for the wider Aylesbury Estate Regeneration Area and these reports were submitted with the Outline Planning Permission.

3.4.2 Made ground is present across the site from successive development. The geology of the area around the Aylesbury Estate site can be summarised as follows; the site is underlain by Kempton Park Gravel, these layers overlay Lambeth Group soils which in turn overlay Thanet Sand Formations. All of which overlays the White Chalk Group.

3.4.3 A tree root radar investigation on trees adjacent to Inville Road and Merrow Street has been produced by Tamla Trees Ltd and is included in Appendix H.

4 PROPOSED DEVELOPMENT

4.1 DEMOLITION

4.1.1 The Plot 18 redevelopment proposals include the demolition of all the existing buildings within the site ie the residential flat blocks “Missenden” and “Northchurch”, the single storey medical centre extension at “Taplow” block, the “Taplow” ramp and the three prefabricated buildings situated centrally within the site.

4.1.2 Existing adoptable drainage will be abandoned within the site ahead of new drainage networks being provided as part of the redevelopment scheme.

4.1.3 Private drainage and utilities will also be abandoned with some utility routes being diverted within or around the site.

4.1.4 The demolition works will result in a clear unconstrained site being created for the redevelopment.

4.2 CONSTRUCTION

4.2.1 Following demolition, two new development blocks are proposed;

- The North Block, comprising four linked blocks of differing heights including 122 residential units. The North Block also contains commercial space and a Community Facility including a Library, Stay & Play Facility & Community Trust Space to be located at ground floor level.
- The South Block will provide a public function and comprises a Health Centre with consultation and treatment rooms, community and visitor facilities and an Early Years Facility.

4.2.2 The remaining areas within the Plot 18 curtilage will accommodate routes for access to the buildings and hard and soft landscaping.

4.2.3 The redevelopment will be served by new foul and surface water drainage networks. An underground storm water attenuation tank will be provided beneath the open space area.

4.2.4 The existing perimeter roads; Thurlow Street, Inville Road and Dawes Street will be retained and the streetscape enhanced. A new east-west road is proposed to the north of the North Block linking Dawes Street with Thurlow Street.

4.2.5 All roads will be positively drained to the adoptable sewer network via highway drains designed in accordance with the Southwark Streetscape Design Manual (SSDM).

4.2.6 Utilities will be laid in adoptable highways or in dedicated easements through the public realm, generally in accordance with the National Joint Utilities Group (NJUG) Guidelines on the positioning of underground utilities.

4.2.7 The proposed site layout showing the development proposals for Plot 18 is included at Appendix D.

5 SURFACE WATER AND SUDS DRAINAGE STRATEGY

5.1 GENERAL PRINCIPLES

5.1.1 The design principles and key design parameters for providing surface water drainage to the Plot 18 redevelopment are consistent with the strategic approach set out in the Flood Risk Assessment and Drainage Strategy document as referred to in paragraph 2.1.2.

5.1.2 A key aim of the Aylesbury Estate drainage strategy is to not exacerbate existing flood risk associated with properties situated upstream, or downstream of the site. This is consistent with the principles set out within the National Planning Policy Framework; the Plot 18 development drainage strategy will sustain this principle.

5.1.3 The proposed Plot 18 development drainage will comprise a network of gravity drains and sewers designed and constructed to current adoptable and building regulations standards. Sustainable drainage (SuDS) techniques will be employed where possible to provide source control, water quality and bio-diversity enhancement.

5.1.4 The primary external surface water piped drainage network will be designed and constructed to Sewers for Adoption 7th Edition standards and will be offered for adoption to Thames Water under Section 104 of the Water Industry Act. All pipework will be below ground with access provided by conventional manhole chambers. The secondary piped networks serving single curtilages will be designed and constructed in compliance with the Building Regulations requirements.

5.1.5 Based on the current site layout it is anticipated that piped surface water networks will extend around the two proposed development blocks to accept flows from the roofs of the buildings. External paved open space areas and adjacent new highway drains will also connect to the new network. Provision will also be made for future connections from two areas of adjacent development parcels which have been attributed to the Plot 18 catchment in the Masterplan Drainage Strategy (refer to Appendix S of the Flood Risk Assessment).

5.1.6 All the Plot 18 surface water discharges (including from the adjacent areas mentioned above) will be conveyed to an off-line attenuation tank which will permit controlled discharges from the development into the existing combined sewer in Thurlow Street. The location of the tank is to be beneath the hard landscaped public realm area in the south-east corner of the site.

5.1.7 Non-adoptable drains will be required for public realm and private curtilages, these will connect to the main sewers. Dedicated highways drains will be provided in roads which will also connect to the main sewers. Highway drains will be adopted under the Section 38 highways adoption agreement.

5.1.8 The proposed foul and surface water drainage networks will remain separate and will only become combined immediately prior to connection into the existing TW combined sewer.

5.1.9 The existing sewer which serves the Northchurch block and Day Nursery will be diverted into the proposed new road to avoid constraining development. A new manhole on the Thurlow Street sewer will provide a point of connection for the diversion.

5.1.10 Drainage works will be required in Thurlow Street. The existing 525/600mm diameter combined sewer intrudes into the Plot 18 site at manhole number 9206. The presence of the sewer in this location and beneath the Thurlow Street footway will constrain construction of the North Block.

5.1.11 In order to mitigate this constraint the existing sewer will be diverted into the Thurlow Street carriageway over a length of approximately 54m.

5.1.12 Drainage networks will be able to drain to the outfall sewer in Thurlow Street by gravity.

5.1.13 From information compiled for other locations within the Aylesbury Estate, infiltration techniques are not considered viable and have not been considered as part of the Plot 18 surface water drainage strategy.

5.1.14 The drainage proposals will incorporate suitable pollution control measures such as trapped gullies and catchpit manholes where required on the highway drainage system.

5.1.15 The proposed preliminary drainage layout for Plot 18 is included at Appendix E.

5.1.16 For the South Block, the attenuation tank and downstream foul and surface water drainage networks will be constructed so that adequate drainage provision is in place prior to roof and pavement construction and building occupation.

5.1.17 The North Block foul and surface water drainage connections will be in place prior to construction of the building.

5.2 HYDRAULIC DESIGN

5.2.1 Thames Water have confirmed the proposed allowable rate of discharge from the Aylesbury Estate redevelopment. The allowable peak discharge rate for Plot 18 is equivalent to the 1 in 1 year 15 minute storm “brownfield runoff” reduced by 50% to provide a required improvement in capacity to the downstream sewers. An email from Thames Water confirming the design storm parameter is included at Appendix F.

5.2.2 The existing and proposed impermeable areas discharging into the existing TW sewer have been calculated as;

- 0.81 Ha Existing
- 0.98 Ha Proposed

In line with the approved drainage strategy for Aylesbury Estate an allowance is included within Plot 18 for future connections of minor catchment areas within future adjacent development plots 9b and 10a. These allowances are for impermeable areas of 0.20 Ha and 0.19 Ha respectively.

5.2.3 The existing and proposed peak rates of discharge from the site are;

- 81.00 litres/ second Existing
- 40.07 litres / second Proposed

This demonstrates a greater than 50% reduction as required by Condition 5. Details of peak rate discharge calculations are provided at Appendix G.

5.2.4 Volumetric runoff mitigation is provided by restricting off site surface water flows to less than the existing one year event, details of which are provided below. This approach is in line with the Code for Sustainable Homes, BS 8582-13 and Defra Document W5-074; Preliminary Rainfall Runoff Management for Developments. Source control features such as green roofs are able to provide initial and longer term storage benefits.

5.2.5 Preliminary drainage design has been undertaken using a WinDES hydraulic model in order to size the drainage network to adoptable standards and assess the required surface water storage requirements for critical 1 in 100 year storm events plus 30% allowance for climate change.

5.2.6 The required storage volume will be provided by a below ground off-line storage tank to be located beneath the open space area within the square, as shown on the preliminary drainage layout at Appendix E.

5.2.7 The storage volume and discharge rates for Plot 18 are shown below.

Catchment	Required Tank Storage	Outflow
Plot 18	640 m^3	40.07 l/s

5.2.8 The storage volume caters for discharges up to the required worst case design storm such that no surface flooding will occur. Output from the WinDES surface water drainage design calculations is included at Appendix G.

5.2.9 For design exceedance storm events in excess of the worst case design storm, exceedance flows will be managed at ground level. In line with the Outline Planning Permission and as demonstrated by the proposed site levels, any exceedance flows will be held locally within road corridors and below adjacent floor levels until capacity within the proposed surface water drainage network becomes available. Conveyance routes, indicative floor levels and over-site levels are provided on the preliminary drainage layout.

5.3 SUSTAINABLE DRAINAGE

5.3.1 A SuDS hierarchy can be assessed for suitability in applying sustainable drainage techniques to Plot 18 as follows.

SUDS Technique	Can they be feasibly incorporated into the site?	Comments
Green Roofs	✓	On roofs within Plots 18. The green roofs can provide an element of source control and biodiversity enhancement
Basins and Ponds	**X**	Due to limited open space open features cannot be included.
Filter Strips, Swales and Bio-Retention	✓	Small localised bio-retention areas can be provided as source control, water quality and biodiversity enhancement. Space limitations preclude the use of swales.
Infiltration techniques	**X**	No BRE Digest 365 compliant test results are situated in Plot 18 therefore Infiltration SuDS will not be considered further.
Permeable surfaces and tree pits	**X/✓**	Permeable paving has not been proposed due to highway adoption issues. Tree pit and geo-cellular soil vault assembly provision can be used to add an element of source control and water quality enhancement for highway runoff.
Rainwater Harvesting	**X**	Rainwater butts will not be suitable in the Plot 18 development.
Tanked Systems	✓	It is currently proposed to incorporate 640m^3 of tank storage onsite for proposed surface water attenuation.

5.3.2 The main SuDS drainage feature will be the surface water attenuation tank which allows the required reduction in peak discharge rates. Any additional SuDS features as indicated in the above table will provide further lagging of peak discharge rates into the attenuation tank with consequent reductions in outflow.

6 FOUL WATER DRAINAGE STRATEGY

6.1 GENERAL PRINCIPLES

6.1.1 The proposed piped foul water drainage network will comprise gravity drains and sewers designed and constructed to Sewers for Adoption 7th Edition standards and will be offered for adoption to Thames Water under Section 104 of the Water Industry Act. The secondary piped networks serving single curtilages will be designed and constructed in compliance with the Building Regulations requirements.

6.1.2 All pipework will be below ground with access provided by conventional manhole chambers. A pumping station will not be required to achieve a drainage outfall.

6.1.3 Based on the current site layout it is anticipated that piped foul water networks will extend around the two proposed development blocks to accept flows from the soil and vent pipes within the buildings.

6.1.4 The foul and surface water drainage networks will remain separate and will only become combined immediately prior to connection into the existing TW combined sewer.

6.1.5 The foul drainage networks will be able to drain to the existing outfall sewer in Thurlow Street by gravity.

6.2 HYDRAULIC DESIGN

6.2.1 An estimate of the existing foul flows generated by the site is provided below.

Existing residential	7.13 l/s
Total	7.13 l/s

6.2.2 Foul flows will be generated by all proposed land uses within plot 18. The estimated peak foul discharge is provided below.

Proposed residential	5.60 l/s
Proposed Health Centre	1.97 l/s
Proposed Community Facilities	0.88 l/s
Total	8.45 l/s

6.2.3 The resulting increase in foul discharges from the site is 1.32 l/s. This rate of discharge has been deducted from the allowable surface water discharge from the site.

6.2.4 A preliminary foul and surface water drainage layout is included at Appendix E.

6.2.5 Output from the foul water drainage design calculations is included at Appendix G.

7 CONCLUSIONS

7.1 GENERAL

7.1.1 The drainage strategy for the Plot 18 redevelopment is described above and shown on the proposed drainage layout at Appendix E.

7.1.2 The proposals comprise a conventional drainage system designed and constructed to adoptable standards.

7.1.3 From the hydraulic analysis provided at Appendix G it can be concluded that the Plot 18 redevelopment drainage will deliver the reduced peak discharges required by Southwark Council under Outline Planning Permission 5 and by Thames Water in reducing peak outflows to the River Thames.

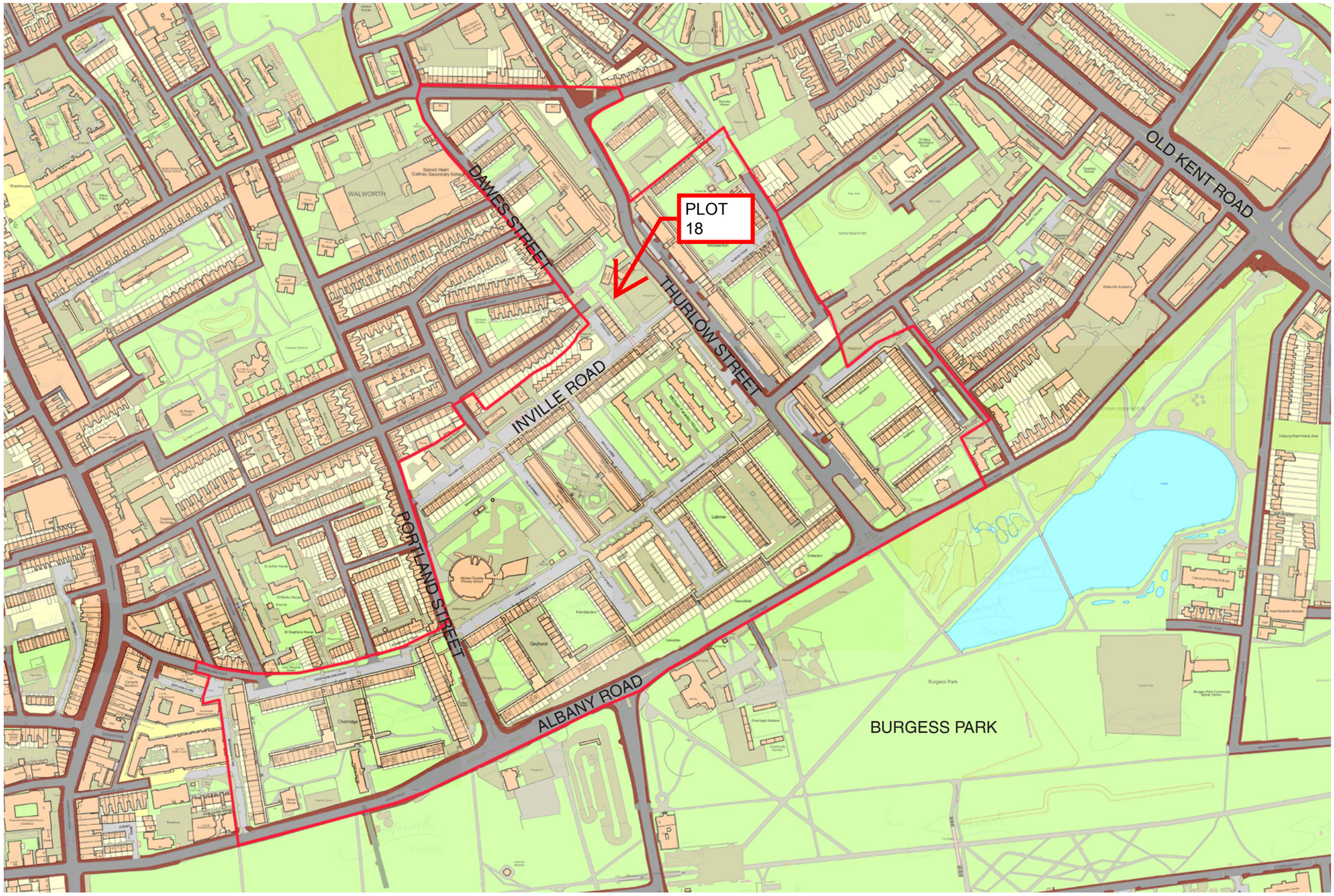
7.1.4 From the hydraulic analysis provided in Section 6 it can also be concluded that the Plot 18 redevelopment drainage will not adversely affect local sewer capacity or directly cause any flooding therefore meeting the requirements of Southwark Council under Outline Planning Permission7.

Appendix A

SITE LOCATION PLAN

Key

- Aylesbury Estate Regeneration - Masterplan Boundary
- Existing carriageway maintained at public expense
- Existing footway maintained at public expense



Site Location Plan

Drawing Title: Masterplan Area Location
Drawn by: OLC
Job Reference: NHH-AES

NHH-AES-HTA-L_MPL-X-XX-SK_140409-01
Date: 08.04.2014

Scale: 1:4000

Revision: -

Notes:
-

Notes:
Do not scale drawings unless by agreement wih HTA. Use figured dimensions only. Check all dimensions on site prior to commencing work. Drawings to be read in conjunction with other relevant consultant information.

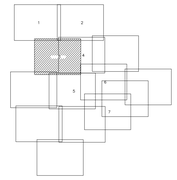
HTA Design LLP
106–110
Kentish Town Road
London NW1 9PX
020 7485 8555
www.hta.co.uk

Appendix B

TOPOGRAPHICAL SURVEY

NOTES;

SHEET LAYOUT



GPS Note:
This survey is related to Ordnance Survey National Grid by GPS 'rapid static' methods. No scale factor has been applied to the survey information. All horizontal distances taken from this drawing are ground distances.

Revision	Description	Date

UTILITY KEY

- ELECTRIC CABLE
- TELECOMS CABLE
- CABLE TELEVISION
- COMMUNICATION CABLE
- WATER PIPE
- GAS PIPE
- FOUL DRAINAGE
- SURFACE DRAINAGE
- COMBINED DRAINAGE
- FUEL PIPE
- VENT PIPE
- OFFSET FILL PIPE
- GAUGE LINE
- VAPOUR RECOVERY
- SERVICE DUCTS
- UNIDENTIFIED
- CABLE / PIPE RISER
- END OF TRACE
- BACKDROP / TRAPPED EXIT

ABBREVIATIONS

AC	ASBESTOS CEMENT	LP	LAMP POST
AR	ASSUMED ROUTE	MH	MANHOLE
BB	BASE BEND	MW	MONITORING WELL
BD	BACKDROP	OH	OVERHEAD
BH	BOREHOLE	OSA	OFF SURVEY AREA
BR	BRICK	PE	POLYETHYLENE
BT	BT INSPECTION CHAMBER	PL	PLASTIC
CCTV	CCTV INSPECTION CHAMBER	PR	PIPE RISER
CBX	CONTROL BOX	PVC	POLYVINYL CHLORIDE
CI	CAST IRON	RE	RODDING EYE
CL	COVER LEVEL	RWP	RAIN WATER PIPE
CR	CABLE RISER	S/A	SOAKAWAY
CP	CATCHPIT	SI	SPUN IRON
d	DEPTH	ST	STOP TAP
DI	DUCTILE IRON	S.T	STEEL
DP	DOWN PIPE	SV	SLUICE VALVE
EOSC	END OF TRENCH SCAR	SVP	SOIL VENT PIPE
EOT	END OF TRACE	TE	TRAPPED EXIT
ER	EARTHING ROD	TFR	TAKEN FROM RECORD
EP	ELECTRICITY POLE	TL	TRAFFIC LIGHT
FH	FIRE HYDRANT	TP	TELEGRAPH POLE
FL	FLOOD LIGHT	UTCCTV	UNABLE TO CCTV
G	GULLY	UTF	UNABLE TO FIND
GPR	GROUND PENETRATING RADAR	UTL	UNABLE TO LIFT
GRP	GLASS REINFORCED PLASTIC	UTS	UNABLE TO SURVEY
GV	GAS VALVE	VC	VITRIFIED CLAY
HL	HIGH LEVEL	VP	VENT PIPE
HOR	HEAD OF RUN	VR	VAPOUR RECOVERY
IC	INSPECTION CHAMBER	WL	WATER LEVEL
IL	INVERT LEVEL	WM	WATER METER
		WO	WASH OUT VALVE
SWS	SURFACE WATER SEWER		
FWS	FOUL WATER SEWER		
CWS	COMBINED WATER SEWER		

DISCLAIMER

ELECTRO-MAGNETIC TECHNIQUES AND/OR GROUND PENETRATING RADAR HAVE BEEN USED IN THE LOCATION OF UNDERGROUND SERVICES THE RESULTS ARE NOT INFALLIBLE AND TRIAL EXCAVATIONS SHOULD BE CARRIED OUT TO CONFIRM SERVICE IDENTIFICATION, POSITIONS AND PARTICULARLY DEPTHS, WHERE THESE ARE CRITICAL. ALTHOUGH ALL REASONABLE EFFORT HAS BEEN MADE IN SEARCHING AVAILABLE RECORD DRAWINGS, THE COMPLETENESS OF THE UNDERGROUND SERVICES INFORMATION CANNOT BE GUARANTEED. THE METHODS OF SURVEY DOES NOT DIFFERENTIATE BETWEEN LIVE AND DEAD SERVICES AND AS SUCH ALL SERVICES SHOULD BE TREATED AS LIVE.

WHERE SERVICES ARE NON-METALLIC POSITIONS MAY BE TAKEN FROM RECORDS,TRENCH SCARS & SURFACE DETAIL.

WHERE QUOTED, DEPTH ESTIMATIONS ARE GENERALLY TO THE CENTRE OF THE SERVICE. DEPTHS TO GRAVITY SEWERS AND DRAINS ARE GENERALLY TO INVERT LEVELS UNLESS OTHERWISE STATED.

PIPE SIZES WHICH CANNOT BE OBTAINED BY VISUAL SURVEY ARE TAKEN FROM RECORD DRAWINGS OR MARKER PLATES WHERE AVAILABLE.

WHERE GROUND PENETRATING RADAR HAS BEEN USED IT WILL PRIMARILY HAVE BEEN TO IDENTIFY UNDERGROUND UTILITIES IF POSSIBLE WE WILL ALSO IDENTIFY UNDERGROUND STRUCTURES/ TANKS ETC. BUT CANNOT GUARENTEE TO HAVE LOCATED ALL SUCH ITEMS THE USE OF RADAR CAN BE LIMITED BOTH BY SURFACE CONDITIONS AND ALSO BY SOIL TYPE. DEPTH ESTIMATES WOULD NOT NORMALLY BE PROVIDED FOR SERVICES LOCATED WITH GPR.

terrain
Land and Architectural Surveyors

Terrain Surveys Ltd
Bridge Chambers
28a High Street
Welwyn
Herts
AL6 9EQ

Tel 01438 841300
Fax 01438 841301
enquiries@terrainsurveys.co.uk
www.terrainsurveys.co.uk

Client
NOTTING HILL HOUSING

Project
SITES 2-14 (EXCLUDING 7)
AYLESBURY ESTATE
LONDON, SE17

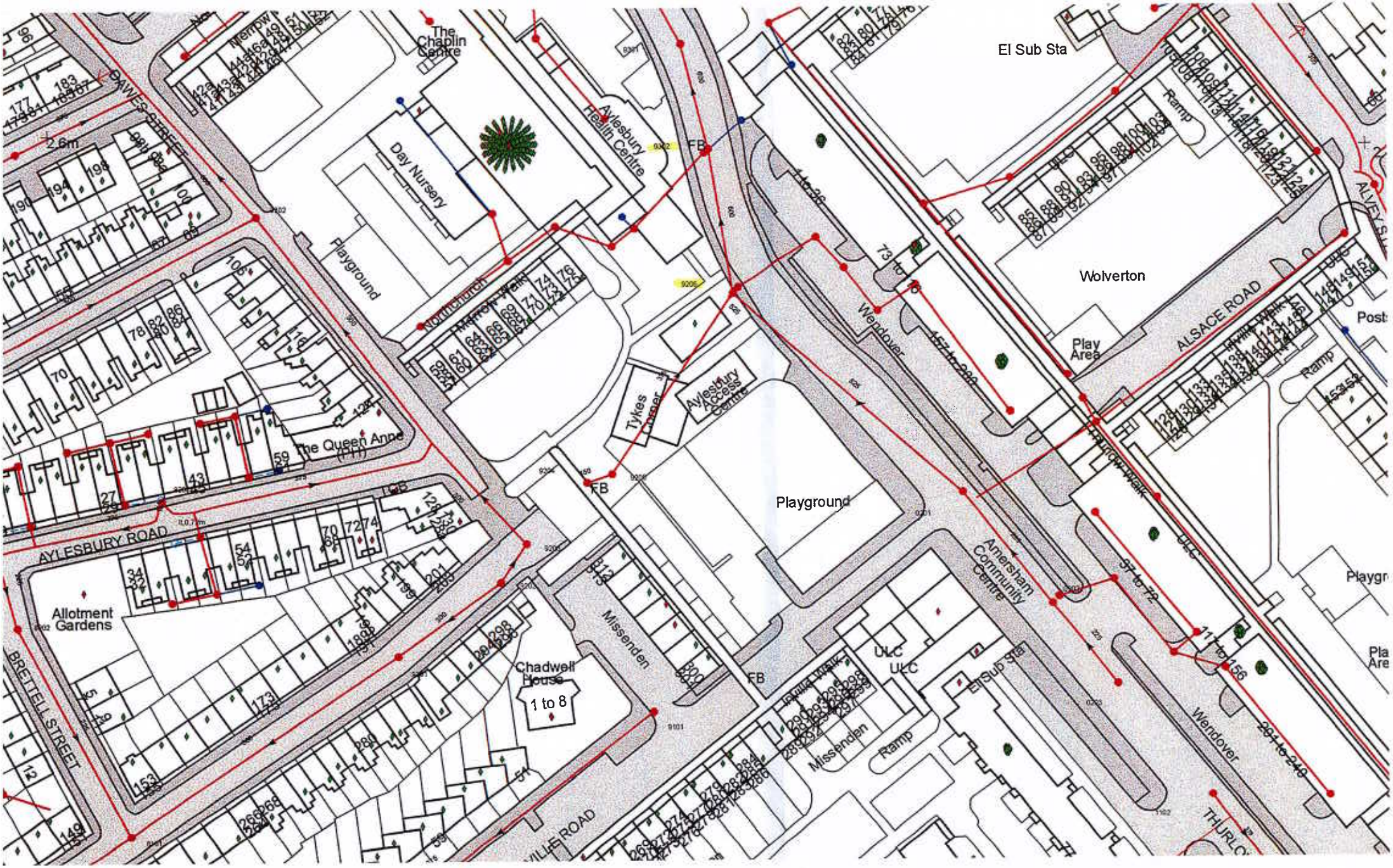
Title
UNDERGROUND SERVICES

Drawn by	Checked by
SM/MW/LC	CDW
Scale 1:200@A0	Date JUL 2014
Drawing Number TS14-142S\24	Revision –
Sheet 3 of 7	

All levels related to the Ordnance Survey GPS network.

Appendix C

THAMES WATER RECORDS


The Chaplin Centre
Aylesbury Health Centre
Day Nursery
Playground
Northchurch
Memorial Walk
Tykes Corner
Aylesbury Access Centre
The Queen Anne (PH)
AYLESBURY ROAD
Allotment Gardens
BRETTELL STREET
Chadwell House
1 to 8
Missenden
Playground
Wendover
1 to 36
73 to 155
157 to 289
Wolverton
Play Area
ALSACE ROAD
Amersham Community Centre
ULC
Ramp
El Sub Sta
37 to 72
111 to 156
294 to 249
THURLOE

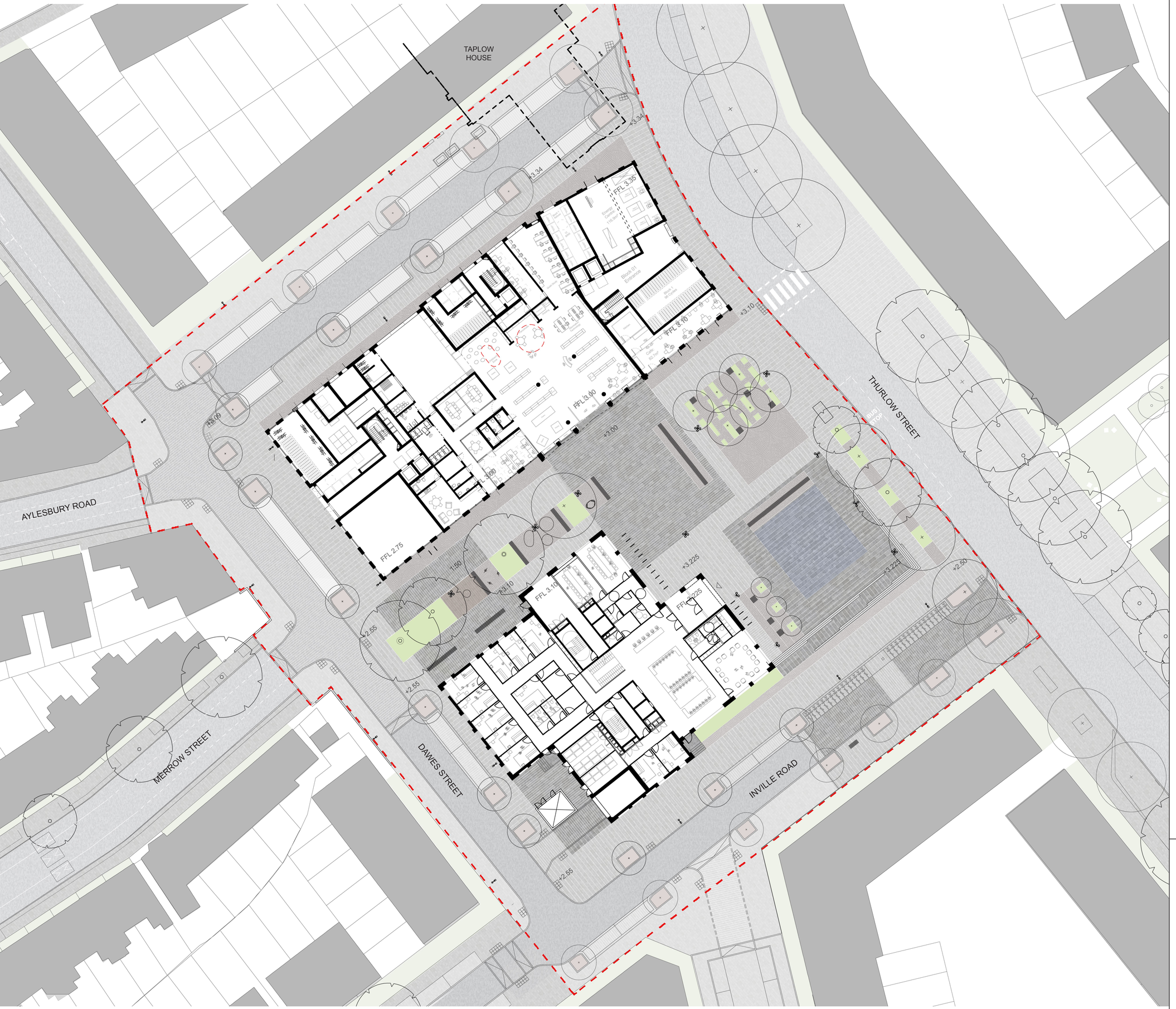
NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

Manhole Reference	Manhole Cover Level	Manhole Invert Level
7404	n/a	-2.92
84YV	n/a	n/a
9402	n/a	-2.98
9403	n/a	n/a
7401	2.96	n/a
9404	2.5	-2.55
84YW	n/a	n/a
84ZR	n/a	n/a
84ZS	n/a	n/a
84YR	n/a	n/a
83ZU	n/a	n/a
84YX	n/a	n/a
84ZU	n/a	n/a
84YU	n/a	n/a
84YT	n/a	n/a
84YY	n/a	n/a
94YW	n/a	n/a
94YX	n/a	n/a
94YY	n/a	n/a
93ZV	n/a	n/a
93ZW	n/a	n/a
9405	2.6	-2.43
93YT	n/a	n/a
9406	2.5	-1.37
94YV	n/a	n/a
9407	2.58	.38
5401	3.6	.58
5402	3.73	.53
5304	4	.3
5405	3.61	1.36
5306	n/a	-2.79
6401	3.71	-.39
6302	3.43	-1.07
6403	3.29	-.61
6404	n/a	-2.86
6405	n/a	n/a
7402	3.49	.29
7405	3.17	-2.03
84ZY	n/a	n/a
83ZT	n/a	n/a
84ZX	n/a	n/a
84ZT	n/a	n/a
84ZW	n/a	n/a
84YQ	n/a	n/a
84ZQ	n/a	n/a
84YS	n/a	n/a
84YZ	n/a	n/a
6202	2.71	-.04
7202	2.52	-.27
92YY	n/a	n/a
93YQ	n/a	n/a
9206	3.01	-1.09
93YY	n/a	n/a
5202	2.83	-.57
6203	2.73	.83
7203	2.44	-.69
82YU	n/a	n/a
82XZ	n/a	n/a
82YT	n/a	n/a
82YS	n/a	n/a
82YR	n/a	n/a
82XX	n/a	n/a
82XW	n/a	n/a
82XU	n/a	n/a
82XV	n/a	n/a
82XT	n/a	n/a
8203	2.88	n/a
82YY	n/a	n/a
82XS	n/a	n/a
82XQ	n/a	n/a
82WY	n/a	n/a
9204	2.52	1.92
9205	2.54	.65
5305	3.38	.38
6303	3.18	.25
7301	2.69	-.73
8302	2.64	-1.06
93YR	n/a	n/a
93YX	n/a	n/a
93YZ	n/a	n/a
93ZS	n/a	n/a
93ZR	n/a	n/a
5203	2.96	n/a
6205	2.54	-.12
7204	2.58	n/a
82XR	n/a	n/a
82WW	n/a	n/a
5201	2.85	-.81
6204	2.65	-.25
8201	2.81	-.57
82YW	n/a	n/a

Manhole Reference	Manhole Cover Level	Manhole Invert Level
82YZ	n/a	n/a
82YV	n/a	n/a
9202	2.51	.4
9203	2.33	n/a
9301	2.45	-1.25
93YV	n/a	n/a
93XZ	n/a	n/a
93YU	n/a	n/a
5301	3.65	-1.7
5302	3.67	-2.4
5303	3.71	n/a
6301	3.46	.46
8301	2.62	-1.14
83ZV	n/a	n/a
93YS	n/a	n/a
93YW	n/a	n/a
93ZQ	n/a	n/a
9302	2.77	-1.23
93ZU	n/a	n/a
90ZW	n/a	n/a
90ZV	n/a	n/a
90ZT	n/a	n/a
9001	2.53	.23
82ZR	n/a	n/a
82ZS	n/a	n/a
7201	2.62	-.08
8202	2.7	-.3
82ZQ	n/a	n/a
5102	2.93	.51
7105	2.43	-1.02
9101	2.57	-.53
6201	2.43	.23
9201	2.6	-.52
6004	2.48	-.52
8003	2.5	-1.75
80ZT	n/a	n/a
5403	3.52	.92
6402	n/a	n/a
7403	3.1	-2.35
9401	2.46	-2.49
5404	3.29	.23
5004	3.1	-.8
7003	2.44	-.51
8001	2.62	-1.15
8002	2.5	-1.8
6101	2.58	-.57
7103	2.64	-.61
81ZU	n/a	n/a
81ZV	n/a	n/a
81ZR	n/a	n/a
81ZT	n/a	n/a
70ZT	n/a	n/a
7004	2.41	-2.09
90ZU	n/a	n/a
7001	2.77	1.37
5003	3.3	n/a
91ZX	n/a	n/a
7102	2.51	-.99
91ZW	n/a	n/a
5101	2.95	-.91
7104	2.61	-1.09
8102	2.63	-1.13
7101	2.58	n/a
8101	2.56	-.87
6001	3.15	-.42
5002	3.54	-1.06
6003	2.76	-1.09
90ZS	n/a	n/a
6002	2.69	-.61
7002	2.28	-.67
5001	3.35	-1.39
80ZU	n/a	n/a
90ZX	n/a	n/a
531A	n/a	n/a
531B	n/a	n/a
631A	n/a	n/a

Appendix D

DEVELOPMENT PROPOSALS



LEGEND

- Proposed Masterplan Buildings
- P1-1 Paving within square: Natural stone paving - grey granite or similar
- P1-2 Paving within square: Natural stone paving - dark grey granite or similar
- P2 Paving to shared surface / traffic carpet roads & parking bays on Dawes St / Inville Rd: Natural stone setts - grey granite or similar
- P3 Parking bays outwith square (adjacent to north block): Imitation granite sett precast concrete blocks, anti-shift units, mid / silver grey, laid stretcher bond - 'City Pave VS5' as supplied by Tobermore or similar
- P4 Footpath surface outwith square: Bitmac/ In-situ concrete to match existing
- P5 Carriageway surface outwith square: Bituminous surface mixture to LBS / Engineer's specification
- E2-1 Kerbs:100mm upstand150x300mm grey ganite fine picked to all sides
- E2-2 Kerbs:60mm upstand 150x300mm grey granite, fine picked to all sides
- PL1/PL2/PL4 New tree planting
- Existing Tree
- PL3 Shrub planting
- U1 Seating elements, natural stone - grey granite or similar
- W1 Dynamic fountains - incorporating jets, mist and mirror pool
- 'Santander Cycles' Cycle Hire
- E1 Step Units: Natural stone to match adjacent paved surface - grey granite or similar. Natural stone hazard warning at top and bottom of steps with contrasting colour visibility strips inset into steps
- U4 Bus stop - delivered in line with TFL guidelines / specification
- Sheffield Cycle Stands
- Phase 1 Extent of Public Open Space Related Works
- Phase 1 Highways Related Works

C	01.04.15	EEO	Revised Issue
B	17.11.15	EEO	Revised Issue
A	03.11.15	EEO	Revised Issue
-	15.10.15	EEO	Initial Issue

Final Illustrative Masterplan

Drawing Title: Final Plot-18 Landscape Layout Revision: C

Drawing Number: NHH-P18-HTA-L_X_XX_DR-2901

Drawn by: EEO

Date: 05/10/2015

Job Reference: NHH-P18

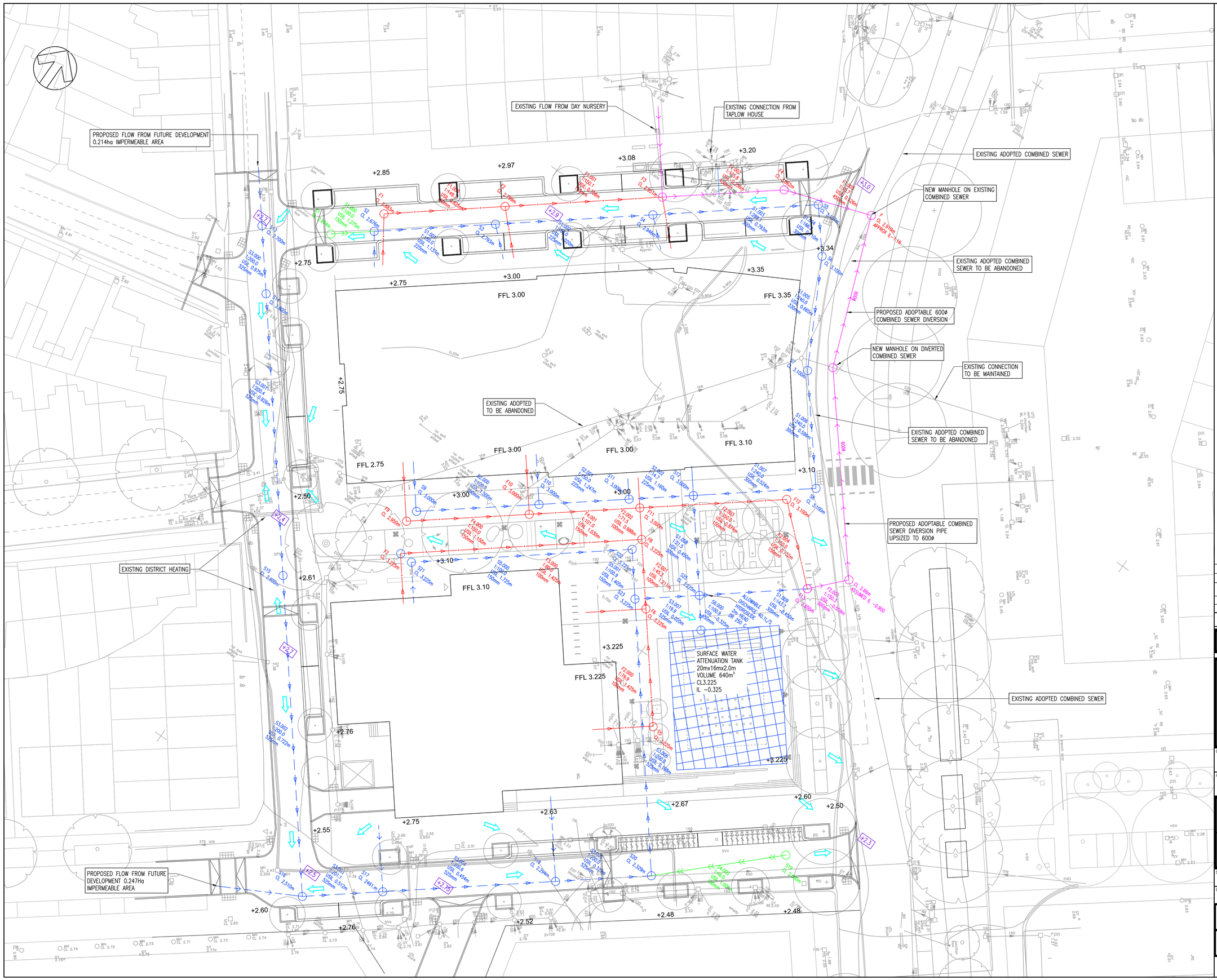
Scale: 1:250@A1

Notes:
Do not scale drawings unless by agreement wih HTA.
Use figured dimensions only. Check all dimensions on site prior to commencing work. Drawings to be read in conjunction with other relevant consultant information.

HTA Design LLP
106–110
Kentish Town Road
London NW1 9PX
020 7485 8555
www.hta.co.uk

Appendix E

PRELIMINARY DRAINAGE LAYOUT



DO NOT SCALE

NOTES

1. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH ALL RELATED DOCUMENTATION, DRAWINGS AND STANDARD DETAILS.
2. THE WORKS SHALL BE CARRIED OUT IN ACCORDANCE WITH SEWERS FOR ADOPTION 7TH EDITION
3. ALL DRAINAGE OUTFALLS AND CONNECTIONS TO EXISTING SYSTEMS SHALL BE CHECKED & SURVEYED AND THE RESULTS PASSED TO THE OVERSEEING AUTHORITY / CLIENT IN ADVANCE OF THE START OF DRAINAGE WORKS.

KEY:

- PROPOSED COMBINED SEWER
- PROPOSED SURFACE WATER SEWER
- PROPOSED FOUL SEWER
- PROPOSED HIGHWAY DRAINAGE
- OVERLAND FLOW ROUTE FOR EXCEEDENCE OVER 1 IN 100 YEAR EVENT PLUS 30% FOR CLIMATE CHANGE
- +2.7 INDICATIVE ROAD LEVEL

REV	DATE	BY	DESCRIPTION	CHK	APD
E	25/04/2016	CM	INTERNAL LANDSCAPE LAYOUT UPDATED	CM	MGS
D	22/04/2016	PBB	REVISED TO SUIT REVISIONS TO ROAD LEVELS.	CM	MGS
C	01/04/2016	SJF	DRAINAGE UPDATED TO SUIT LATEST LANDSCAPE LAYOUT.	CS	MGS
B	17/11/2015	SJF	LEVELS AND FLOW ARROWS ADDED.	CS	MGS
A	29/09/2015	SJF	FIRST ISSUE	CS	MGS

DRAWING STATUS: PLANNING APPLICATION

WSP | PARSONS BRINCKERHOFF
Unit 9, The Chase, John Tate Road
Foxholes Business Park, Hertford SG13 7NN
Tel: +44 (0)1992 526000 Fax: +44 (0)1992 526001
www.wspgroup.com www.pbworld.com

CLIENT: NHH

ARCHITECT: HTA

PROJECT: AYLESBURY ESTATE SOUTHWARK

TITLE: PLOT 18 DRAINAGE STRATEGY

SCALE @ A1:	CHECKED:	APPROVED:
1:250	CS	MGS
CAD FILE: 9682-D-001.DWG	DESIGN-DRAWN: SJF	DATE: September 15
PROJECT No: 70009682	DRAWING No: 9682-D-001	REV: E

PROJECT DOCUMENT REF: NHH-AES-WSP-C-D01-00-M2_PLOT 18 D001

Appendix F

THAMES WATER CORRESPONDENCE

From: Timothy Dale [mailto:timothy.dale@thameswater.co.uk]
Sent: 24 June 2015 10:34
To: Dyason, James
Subject: FW: 1012957737 *Aylesbury Estate Plot 18 Southwark

Morning James

Sorry for the confusion on the methodology for the Aylesbury Estate.

Have had feedback from Modelling and can confirm that we will accept the surface water flows to the 1 in 1 year 15 minute event plus 50% reduction for each development parcel associated with the proposed development.

Kind regards

Tim Dale
Adoptions Engineer
Developer Services

Appendix G

DRAINAGE CALCULATIONS

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes BS Manhole Sizes SFA7

FEH Rainfall Model

Return Period (years)	2
Site Location	GB 532600 177950 TQ 32600 77950
C (1km)	-0.027
D1 (1km)	0.316
D2 (1km)	0.306
D3 (1km)	0.249
E (1km)	0.328
F (1km)	2.500
Maximum Rainfall (mm/hr)	50
Maximum Time of Concentration (mins)	30
Foul Sewage (l/s/ha)	0.000
Volumetric Runoff Coeff.	0.750
Add Flow / Climate Change (%)	0
Minimum Backdrop Height (m)	0.000
Maximum Backdrop Height (m)	20.000
Min Design Depth for Optimisation (m)	1.200
Min Vel for Auto Design only (m/s)	1.00
Min Slope for Optimisation (1:X)	500

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)	Auto Design
S1.000	6.277	0.063	100.0	0.022	5.00	0.0	0.600	o	150	
S1.001	17.588	0.117	150.0	0.034	0.00	0.0	0.600	o	225	
S1.002	22.834	0.152	150.0	0.064	0.00	0.0	0.600	o	225	
S1.003	23.956	0.083	289.1	0.103	0.00	0.0	0.600	o	300	
S1.004	7.443	0.045	166.2	0.000	0.00	0.0	0.600	o	300	
S1.005	16.688	0.070	240.0	0.000	0.00	0.0	0.600	o	300	
S1.006	17.101	0.071	240.0	0.000	0.00	0.0	0.600	o	300	
S1.007	17.785	0.074	240.0	0.065	0.00	0.0	0.600	o	300	
S2.000	17.768	0.178	100.0	0.037	5.00	0.0	0.600	o	150	
S2.001	13.057	0.087	150.0	0.047	0.00	0.0	0.600	o	225	
S2.002	9.325	0.635	14.7	0.062	0.00	0.0	0.600	o	225	
S1.008	14.491	0.675	21.5	0.000	0.00	0.0	0.600	o	300	
S3.000	9.882	0.049	200.0	0.239	5.00	0.0	0.600	o	525	
S3.001	40.875	0.204	200.4	0.044	0.00	0.0	0.600	o	525	
S3.002	46.541	0.210	221.6	0.067	0.00	0.0	0.600	o	525	
S3.003	11.664	0.058	201.1	0.269	0.00	0.0	0.600	o	525	

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)
S1.000	50.00	5.10	1.275	0.022	0.0	0.0	0.0	1.00	17.8	2.9
S1.001	50.00	5.38	1.137	0.056	0.0	0.0	0.0	1.07	42.4	7.6
S1.002	50.00	5.74	1.020	0.120	0.0	0.0	0.0	1.07	42.4	16.3
S1.003	50.00	6.17	0.793	0.224	0.0	0.0	0.0	0.92	64.9	30.3
S1.004	50.00	6.27	0.710	0.224	0.0	0.0	0.0	1.22	86.0	30.3
S1.005	50.00	6.55	0.665	0.224	0.0	0.0	0.0	1.01	71.4	30.3
S1.006	50.00	6.83	0.596	0.224	0.0	0.0	0.0	1.01	71.4	30.3
S1.007	50.00	7.12	0.524	0.289	0.0	0.0	0.0	1.01	71.4	39.1
S2.000	50.00	5.29	1.500	0.037	0.0	0.0	0.0	1.00	17.8	5.0
S2.001	50.00	5.50	1.247	0.084	0.0	0.0	0.0	1.07	42.4	11.4
S2.002	50.00	5.54	1.160	0.146	0.0	0.0	0.0	3.43	136.5	19.8
S1.008	50.00	7.20	0.450	0.435	0.0	0.0	0.0	3.41	240.9	58.9
S3.000	50.00	5.10	0.975	0.239	0.0	0.0	0.0	1.58	342.1	32.4
S3.001	50.00	5.54	0.926	0.283	0.0	0.0	0.0	1.58	341.8	38.3
S3.002	50.00	6.05	0.722	0.349	0.0	0.0	0.0	1.50	324.8	47.3
S3.003	50.00	6.18	0.512	0.618	0.0	0.0	0.0	1.58	341.1	83.7

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)	Auto Design
S3.004	25.073	0.125	200.6	0.076	0.00	0.0	0.600	o	525	
S3.005	13.897	0.069	200.0	0.085	0.00	0.0	0.600	o	525	
S4.000	19.624	0.427	46.0	0.046	5.00	0.0	0.600	o	150	
S3.006	40.133	0.178	225.6	0.109	0.00	0.0	0.600	o	525	
S5.000	32.013	0.320	100.0	0.032	5.00	0.0	0.600	o	150	
S5.001	7.214	0.071	100.9	0.000	0.00	0.0	0.600	o	150	
S3.007	9.338	0.470	19.9	0.041	0.00	0.0	0.600	o	525	
S6.000	5.043	0.050	100.9	0.000	5.00	0.0	0.600	o	450	
S1.009	15.662	0.109	143.7	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)
S3.004	50.00	6.44	0.454	0.694	0.0	0.0	0.0	1.58	341.6	94.0
S3.005	50.00	6.59	0.329	0.780	0.0	0.0	0.0	1.58	342.1	105.6
S4.000	50.00	5.22	1.000	0.046	0.0	0.0	0.0	1.49	26.3	6.2
S3.006	50.00	7.04	0.198	0.935	0.0	0.0	0.0	1.49	321.9	126.5
S5.000	50.00	5.53	1.725	0.032	0.0	0.0	0.0	1.00	17.8	4.3
S5.001	50.00	5.65	1.405	0.032	0.0	0.0	0.0	1.00	17.7	4.3
S3.007	50.00	7.07	0.020	1.008	0.0	0.0	0.0	5.04	1091.4	136.4
S6.000	50.00	5.04	-0.325	0.000	0.0	0.0	0.0	2.02	322.0	0.0
S1.009	50.00	5.20	-0.450	0.000	40.1	0.0	0.0	1.31	92.6	40.1

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
S1	2.634	1.359	Open Manhole	1200	S1.000	1.275	150				
S2	2.676	1.539	Open Manhole	1200	S1.001	1.137	225	S1.000	1.212	150	
S3	2.793	1.773	Open Manhole	1200	S1.002	1.020	225	S1.001	1.020	225	
S4	2.946	2.153	Open Manhole	1200	S1.003	0.793	300	S1.002	0.868	225	
S5	3.107	2.397	Open Manhole	1200	S1.004	0.710	300	S1.003	0.710	300	
S6	3.100	2.435	Open Manhole	1200	S1.005	0.665	300	S1.004	0.665	300	
S7	3.100	2.504	Open Manhole	1200	S1.006	0.596	300	S1.005	0.596	300	
S8	3.100	2.576	Open Manhole	1200	S1.007	0.524	300	S1.006	0.524	300	
S9	3.000	1.500	Open Manhole	1200	S2.000	1.500	150				
S10	3.000	1.753	Open Manhole	1200	S2.001	1.247	225	S2.000	1.322	150	
S11	3.000	1.840	Open Manhole	1200	S2.002	1.160	225	S2.001	1.160	225	
S12	3.000	2.550	Open Manhole	1200	S1.008	0.450	300	S1.007	0.450	300	
								S2.002	0.525	225	
S13	2.722	1.747	Open Manhole	1500	S3.000	0.975	525				
S14	2.625	1.699	Open Manhole	1500	S3.001	0.926	525	S3.000	0.926	525	
S15	2.588	1.866	Open Manhole	1500	S3.002	0.722	525	S3.001	0.722	525	
S16	2.510	1.998	Open Manhole	1500	S3.003	0.512	525	S3.002	0.512	525	
S17	2.461	2.007	Open Manhole	1500	S3.004	0.454	525	S3.003	0.454	525	
S18	2.294	1.965	Open Manhole	1500	S3.005	0.329	525	S3.004	0.329	525	
S19	2.326	1.326	Open Manhole	1200	S4.000	1.000	150				
S20	2.329	2.131	Open Manhole	1500	S3.006	0.198	525	S3.005	0.259	525	61
								S4.000	0.573	150	
S21	3.225	1.500	Open Manhole	1200	S5.000	1.725	150				
S22	3.225	1.820	Open Manhole	1200	S5.001	1.405	150	S5.000	1.405	150	
S23	3.225	3.205	Open Manhole	1500	S3.007	0.020	525	S3.006	0.020	525	
								S5.001	1.333	150	938
S24	3.225	3.550	Open Manhole	1350	S6.000	-0.325	450				
S25	3.225	3.675	Open Manhole	1500	S1.009	-0.450	300	S1.008	-0.225	300	225
								S3.007	-0.450	525	
								S6.000	-0.375	450	225
S11	2.650	3.209	Open Manhole	1200		OUTFALL		S1.009	-0.559	300	

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	o	150	S1	2.634	1.275	1.209	Open Manhole	1200
S1.001	o	225	S2	2.676	1.137	1.314	Open Manhole	1200
S1.002	o	225	S3	2.793	1.020	1.548	Open Manhole	1200
S1.003	o	300	S4	2.946	0.793	1.853	Open Manhole	1200
S1.004	o	300	S5	3.107	0.710	2.097	Open Manhole	1200
S1.005	o	300	S6	3.100	0.665	2.135	Open Manhole	1200
S1.006	o	300	S7	3.100	0.596	2.204	Open Manhole	1200
S1.007	o	300	S8	3.100	0.524	2.276	Open Manhole	1200
S2.000	o	150	S9	3.000	1.500	1.350	Open Manhole	1200
S2.001	o	225	S10	3.000	1.247	1.528	Open Manhole	1200
S2.002	o	225	S11	3.000	1.160	1.615	Open Manhole	1200
S1.008	o	300	S12	3.000	0.450	2.250	Open Manhole	1200
S3.000	o	525	S13	2.722	0.975	1.222	Open Manhole	1500
S3.001	o	525	S14	2.625	0.926	1.174	Open Manhole	1500
S3.002	o	525	S15	2.588	0.722	1.341	Open Manhole	1500
S3.003	o	525	S16	2.510	0.512	1.473	Open Manhole	1500
S3.004	o	525	S17	2.461	0.454	1.482	Open Manhole	1500
S3.005	o	525	S18	2.294	0.329	1.440	Open Manhole	1500
S4.000	o	150	S19	2.326	1.000	1.176	Open Manhole	1200
S3.006	o	525	S20	2.329	0.198	1.606	Open Manhole	1500
S5.000	o	150	S21	3.225	1.725	1.350	Open Manhole	1200
S5.001	o	150	S22	3.225	1.405	1.670	Open Manhole	1200
S3.007	o	525	S23	3.225	0.020	2.680	Open Manhole	1500
S6.000	o	450	S24	3.225	-0.325	3.100	Open Manhole	1350
S1.009	o	300	S25	3.225	-0.450	3.375	Open Manhole	1500

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	6.277	100.0	S2	2.676	1.212	1.314	Open Manhole	1200
S1.001	17.588	150.0	S3	2.793	1.020	1.548	Open Manhole	1200
S1.002	22.834	150.0	S4	2.946	0.868	1.853	Open Manhole	1200
S1.003	23.956	289.1	S5	3.107	0.710	2.097	Open Manhole	1200
S1.004	7.443	166.2	S6	3.100	0.665	2.135	Open Manhole	1200
S1.005	16.688	240.0	S7	3.100	0.596	2.204	Open Manhole	1200
S1.006	17.101	240.0	S8	3.100	0.524	2.276	Open Manhole	1200
S1.007	17.785	240.0	S12	3.000	0.450	2.250	Open Manhole	1200
S2.000	17.768	100.0	S10	3.000	1.322	1.528	Open Manhole	1200
S2.001	13.057	150.0	S11	3.000	1.160	1.615	Open Manhole	1200
S2.002	9.325	14.7	S12	3.000	0.525	2.250	Open Manhole	1200
S1.008	14.491	21.5	S25	3.225	-0.225	3.150	Open Manhole	1500
S3.000	9.882	200.0	S14	2.625	0.926	1.174	Open Manhole	1500
S3.001	40.875	200.4	S15	2.588	0.722	1.341	Open Manhole	1500
S3.002	46.541	221.6	S16	2.510	0.512	1.473	Open Manhole	1500
S3.003	11.664	201.1	S17	2.461	0.454	1.482	Open Manhole	1500
S3.004	25.073	200.6	S18	2.294	0.329	1.440	Open Manhole	1500
S3.005	13.897	200.0	S20	2.329	0.259	1.545	Open Manhole	1500
S4.000	19.624	46.0	S20	2.329	0.573	1.606	Open Manhole	1500
S3.006	40.133	225.6	S23	3.225	0.020	2.680	Open Manhole	1500
S5.000	32.013	100.0	S22	3.225	1.405	1.670	Open Manhole	1200
S5.001	7.214	100.9	S23	3.225	1.333	1.742	Open Manhole	1500
S3.007	9.338	19.9	S25	3.225	-0.450	3.150	Open Manhole	1500
S6.000	5.043	100.9	S25	3.225	-0.375	3.150	Open Manhole	1500
S1.009	15.662	143.7	S11	2.650	-0.559	2.909	Open Manhole	1200

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	User	-	100	0.022	0.022	0.022
1.001	User	-	100	0.034	0.034	0.034
1.002	User	-	100	0.064	0.064	0.064
1.003	User	-	100	0.103	0.103	0.103
1.004	-	-	100	0.000	0.000	0.000
1.005	-	-	100	0.000	0.000	0.000
1.006	-	-	100	0.000	0.000	0.000
1.007	User	-	100	0.065	0.065	0.065
2.000	User	-	100	0.037	0.037	0.037
2.001	User	-	100	0.047	0.047	0.047
2.002	User	-	100	0.062	0.062	0.062
1.008	-	-	100	0.000	0.000	0.000
3.000	-	-	100	0.239	0.239	0.239
3.001	User	-	100	0.044	0.044	0.044
3.002	User	-	100	0.067	0.067	0.067
3.003	-	-	100	0.269	0.269	0.269
3.004	User	-	100	0.076	0.076	0.076
3.005	User	-	100	0.085	0.085	0.085
4.000	User	-	100	0.046	0.046	0.046
3.006	User	-	100	0.109	0.109	0.109
5.000	User	-	100	0.032	0.032	0.032
5.001	-	-	100	0.000	0.000	0.000
3.007	User	-	100	0.041	0.041	0.041
6.000	-	-	100	0.000	0.000	0.000
1.009	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				1.443	1.443	1.443

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.009	S11	2.650	-0.559	0.000	1200	0

Simulation Criteria for Storm

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

Number of Input Hydrographs	0	Number of Offline Controls	1	Number of Time/Area Diagrams	0
Number of Online Controls	2	Number of Storage Structures	1	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH	E (1km)	0.328
Return Period (years)	2	F (1km)	2.500
Site Location	GB 532600 177950 TQ 32600 77950	Summer Storms	Yes
C (1km)	-0.027	Winter Storms	Yes
D1 (1km)	0.316	Cv (Summer)	0.750
D2 (1km)	0.306	Cv (Winter)	0.840
D3 (1km)	0.249	Storm Duration (mins)	30

Online Controls for Storm

Non Return Valve Manhole: S12, DS/PN: S1.008, Volume (m³): 4.4

Hydroslide Manhole: S25, DS/PN: S1.009, Volume (m³): 9.7

Design Head (m) 2.000 — Application Stormwater — Maximum Head (m) 4.000
Design Flow (l/s) 40.0 — Model DR 250 C — Minimum Pipe Diameter (mm) 250
Range Combi — Invert Level (m) -0.450 — Minimum Manhole Diameter (mm) 1500

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	7.4	0.600	40.0	1.600	40.0	2.600	40.0	5.000	39.5	7.500	48.4
0.200	25.4	0.800	40.0	1.800	40.0	3.000	40.0	5.500	41.4	8.000	50.0
0.300	40.0	1.000	40.0	2.000	40.0	3.500	40.0	6.000	43.3	8.500	51.5
0.400	40.0	1.200	40.0	2.200	40.0	4.000	40.0	6.500	45.1	9.000	53.0
0.500	40.0	1.400	40.0	2.400	40.0	4.500	37.5	7.000	46.8	9.500	54.5

Offline Controls for Storm

Pipe Manhole: S25, DS/PN: S1.009, Loop to PN: S6.000

Diameter (m)	0.450	Length (m)	5.000	Coefficient of Contraction	0.600
Section Type	Pipe/Conduit	Roughness k (mm)	0.600	Upstream Invert Level (m)	-0.308
Slope (1:X)	294.1	Entry Loss Coefficient	0.500		

Storage Structures for Storm

Tank or Pond Manhole: S24, DS/PN: S6.000

Invert Level (m) -0.325

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	320.0	2.000	320.0	2.001	0.0

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

Simulation Criteria

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

Number of Input Hydrographs	0	Number of Offline Controls	1	Number of Time/Area Diagrams	0
Number of Online Controls	2	Number of Storage Structures	1	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH	D3 (1km)	0.249
Site Location	GB 532600 177950 TQ 32600 77950	E (1km)	0.328
C (1km)	-0.027	F (1km)	2.500
D1 (1km)	0.316	Cv (Summer)	0.750
D2 (1km)	0.306	Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	1, 2, 30, 100
Climate Change (%)	0, 0, 0, 30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)
S1.000	S1	15 Winter	1	+0%	30/15 Summer	100/15 Summer			1.321	-0.104	0.000	0.20	
S1.001	S2	15 Winter	1	+0%	30/15 Summer	100/15 Summer			1.204	-0.159	0.000	0.19	
S1.002	S3	15 Winter	1	+0%	30/15 Summer	100/15 Summer			1.117	-0.128	0.000	0.38	
S1.003	S4	15 Winter	1	+0%	30/15 Summer				0.937	-0.156	0.000	0.46	
S1.004	S5	15 Winter	1	+0%	30/15 Summer				0.848	-0.162	0.000	0.43	
S1.005	S6	15 Winter	1	+0%	30/15 Summer				0.803	-0.162	0.000	0.44	
S1.006	S7	15 Winter	1	+0%	30/15 Summer				0.735	-0.160	0.000	0.43	
S1.007	S8	15 Winter	1	+0%	30/15 Summer				0.680	-0.144	0.000	0.53	
S2.000	S9	15 Winter	1	+0%	30/15 Summer	100/15 Summer			1.558	-0.092	0.000	0.31	
S2.001	S10	15 Winter	1	+0%	30/15 Summer				1.331	-0.141	0.000	0.29	
S2.002	S11	15 Winter	1	+0%	100/15 Summer				1.221	-0.164	0.000	0.16	
S1.008	S12	15 Winter	1	+0%	30/15 Winter				0.550	-0.201	0.000	0.24	
S3.000	S13	15 Winter	1	+0%	100/15 Summer	100/15 Summer			1.111	-0.389	0.000	0.15	
S3.001	S14	15 Winter	1	+0%	100/15 Summer	100/15 Summer			1.052	-0.399	0.000	0.13	
S3.002	S15	15 Winter	1	+0%	30/15 Summer	100/15 Summer			0.862	-0.385	0.000	0.16	
S3.003	S16	15 Winter	1	+0%	30/15 Summer	100/15 Summer			0.716	-0.320	0.000	0.32	
S3.004	S17	15 Winter	1	+0%	30/15 Summer	100/15 Summer			0.653	-0.326	0.000	0.31	
S3.005	S18	15 Winter	1	+0%	30/15 Summer	100/15 Summer			0.551	-0.303	0.000	0.37	
S4.000	S19	15 Winter	1	+0%	100/15 Summer	100/15 Summer			1.052	-0.098	0.000	0.26	
S3.006	S20	15 Winter	1	+0%	30/15 Summer				0.425	-0.298	0.000	0.38	
S5.000	S21	15 Winter	1	+0%	100/15 Summer				1.778	-0.097	0.000	0.26	
S5.001	S22	15 Winter	1	+0%	100/15 Summer				1.460	-0.094	0.000	0.30	
S3.007	S23	15 Winter	1	+0%	30/15 Summer				0.187	-0.358	0.000	0.22	
S6.000	S24	30 Winter	1	+0%	30/15 Summer				-0.148	-0.273	0.000	0.17	
S1.009	S25	15 Winter	1	+0%	1/15 Summer		1/15 Summer	70	0.062	0.212	0.000	0.51	64.5

PN	US/MH Name	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	3.0	OK	4
S1.001	S2	7.1	OK	4
S1.002	S3	14.8	OK	2
S1.003	S4	26.6	OK	
S1.004	S5	26.7	OK	
S1.005	S6	26.5	OK	
S1.006	S7	26.4	OK	
S1.007	S8	32.5	OK	
S2.000	S9	5.1	OK	2
S2.001	S10	10.8	OK	
S2.002	S11	18.2	OK	
S1.008	S12	47.8	OK	
S3.000	S13	33.6	OK	3
S3.001	S14	38.7	OK	4
S3.002	S15	45.5	OK	4
S3.003	S16	75.4	OK	4
S3.004	S17	83.4	OK	2
S3.005	S18	91.9	OK	2
S4.000	S19	6.5	OK	4
S3.006	S20	107.8	OK	

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

PN	US/MH Name	Pipe Flow (l/s)	Status	Level Exceeded
S5.000	S21	4.4	OK	
S5.001	S22	4.5	OK	
S3.007	S23	115.9	OK	
S6.000	S24	29.5	OK	
S1.009	S25	40.0	SURCHARGED	

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

Simulation Criteria

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

Number of Input Hydrographs	0	Number of Offline Controls	1	Number of Time/Area Diagrams	0
Number of Online Controls	2	Number of Storage Structures	1	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH	D3 (1km)	0.249
Site Location	GB 532600 177950 TQ 32600 77950	E (1km)	0.328
C (1km)	-0.027	F (1km)	2.500
D1 (1km)	0.316	Cv (Summer)	0.750
D2 (1km)	0.306	Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	1, 2, 30, 100
Climate Change (%)	0, 0, 0, 30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)
S1.000	S1	15 Winter	2	+0%	30/15 Summer	100/15 Summer			1.328	-0.097	0.000	0.26	
S1.001	S2	15 Winter	2	+0%	30/15 Summer	100/15 Summer			1.213	-0.149	0.000	0.24	
S1.002	S3	15 Winter	2	+0%	30/15 Summer	100/15 Summer			1.132	-0.113	0.000	0.49	
S1.003	S4	15 Winter	2	+0%	30/15 Summer				0.961	-0.132	0.000	0.59	
S1.004	S5	15 Winter	2	+0%	30/15 Summer				0.871	-0.139	0.000	0.56	
S1.005	S6	15 Winter	2	+0%	30/15 Summer				0.826	-0.139	0.000	0.56	
S1.006	S7	15 Winter	2	+0%	30/15 Summer				0.760	-0.135	0.000	0.56	
S1.007	S8	15 Winter	2	+0%	30/15 Summer				0.708	-0.117	0.000	0.68	
S2.000	S9	15 Winter	2	+0%	30/15 Summer	100/15 Summer			1.566	-0.084	0.000	0.40	
S2.001	S10	15 Winter	2	+0%	30/15 Summer				1.344	-0.128	0.000	0.38	
S2.002	S11	15 Winter	2	+0%	100/15 Summer				1.230	-0.155	0.000	0.21	
S1.008	S12	15 Winter	2	+0%	30/15 Winter				0.564	-0.186	0.000	0.31	
S3.000	S13	15 Winter	2	+0%	100/15 Summer	100/15 Summer			1.132	-0.368	0.000	0.19	
S3.001	S14	15 Winter	2	+0%	100/15 Summer	100/15 Summer			1.070	-0.380	0.000	0.17	
S3.002	S15	15 Winter	2	+0%	30/15 Summer	100/15 Summer			0.883	-0.364	0.000	0.20	
S3.003	S16	15 Winter	2	+0%	30/15 Summer	100/15 Summer			0.747	-0.289	0.000	0.41	
S3.004	S17	15 Winter	2	+0%	30/15 Summer	100/15 Summer			0.683	-0.296	0.000	0.40	
S3.005	S18	15 Winter	2	+0%	30/15 Summer	100/15 Summer			0.586	-0.268	0.000	0.48	
S4.000	S19	15 Winter	2	+0%	100/15 Summer	100/15 Summer			1.060	-0.090	0.000	0.34	
S3.006	S20	15 Winter	2	+0%	30/15 Summer				0.461	-0.262	0.000	0.49	
S5.000	S21	15 Winter	2	+0%	100/15 Summer				1.786	-0.089	0.000	0.33	
S5.001	S22	15 Winter	2	+0%	100/15 Summer				1.469	-0.086	0.000	0.38	
S3.007	S23	15 Winter	2	+0%	30/15 Summer				0.210	-0.335	0.000	0.28	
S6.000	S24	30 Winter	2	+0%	30/15 Summer				-0.064	-0.189	0.000	0.21	
S1.009	S25	15 Winter	2	+0%	1/15 Summer		1/15 Summer	70	0.142	0.292	0.000	0.51	112.8

PN	US/MH Name	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	3.9	OK	4
S1.001	S2	9.2	OK	4
S1.002	S3	19.0	OK	2
S1.003	S4	34.3	OK	
S1.004	S5	34.3	OK	
S1.005	S6	34.2	OK	
S1.006	S7	34.0	OK	
S1.007	S8	41.9	OK	
S2.000	S9	6.6	OK	2
S2.001	S10	13.8	OK	
S2.002	S11	23.4	OK	
S1.008	S12	61.6	OK	
S3.000	S13	43.2	OK	3
S3.001	S14	49.9	OK	4
S3.002	S15	58.5	OK	4
S3.003	S16	97.1	OK	4
S3.004	S17	107.2	OK	2
S3.005	S18	117.7	OK	2
S4.000	S19	8.3	OK	4
S3.006	S20	138.3	OK	

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

PN	US/MH Name	Pipe Flow (l/s)	Status	Level Exceeded
S5.000	S21	5.7	OK	
S5.001	S22	5.8	OK	
S3.007	S23	148.5	OK	
S6.000	S24	35.4	OK	
S1.009	S25	40.0	SURCHARGED	

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

Simulation Criteria

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

Number of Input Hydrographs	0	Number of Offline Controls	1	Number of Time/Area Diagrams	0
Number of Online Controls	2	Number of Storage Structures	1	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH	D3 (1km)	0.249
Site Location	GB 532600 177950 TQ 32600 77950	E (1km)	0.328
C (1km)	-0.027	F (1km)	2.500
D1 (1km)	0.316	Cv (Summer)	0.750
D2 (1km)	0.306	Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	1, 2, 30, 100
Climate Change (%)	0, 0, 0, 30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)
S1.000	S1	15 Winter	30	+0%	30/15 Summer	100/15 Summer			1.913	0.488	0.000	0.73	
S1.001	S2	15 Winter	30	+0%	30/15 Summer	100/15 Summer			1.895	0.533	0.000	0.62	
S1.002	S3	15 Winter	30	+0%	30/15 Summer	100/15 Summer			1.833	0.588	0.000	1.18	
S1.003	S4	15 Winter	30	+0%	30/15 Summer				1.615	0.522	0.000	1.54	
S1.004	S5	15 Winter	30	+0%	30/15 Summer				1.421	0.412	0.000	1.43	
S1.005	S6	15 Winter	30	+0%	30/15 Summer				1.301	0.336	0.000	1.43	
S1.006	S7	15 Winter	30	+0%	30/15 Summer				1.165	0.269	0.000	1.43	
S1.007	S8	15 Winter	30	+0%	30/15 Summer				1.029	0.205	0.000	1.77	
S2.000	S9	15 Winter	30	+0%	30/15 Summer	100/15 Summer			1.688	0.038	0.000	1.06	
S2.001	S10	15 Winter	30	+0%	30/15 Summer				1.488	0.015	0.000	1.10	
S2.002	S11	15 Winter	30	+0%	100/15 Summer				1.294	-0.092	0.000	0.64	
S1.008	S12	15 Winter	30	+0%	30/15 Winter				0.787	0.037	0.000	0.85	
S3.000	S13	15 Winter	30	+0%	100/15 Summer	100/15 Summer			1.408	-0.092	0.000	0.51	
S3.001	S14	15 Winter	30	+0%	100/15 Summer	100/15 Summer			1.381	-0.069	0.000	0.43	
S3.002	S15	15 Winter	30	+0%	30/15 Summer	100/15 Summer			1.292	0.046	0.000	0.45	
S3.003	S16	15 Winter	30	+0%	30/15 Summer	100/15 Summer			1.177	0.141	0.000	0.94	
S3.004	S17	15 Winter	30	+0%	30/15 Summer	100/15 Summer			1.078	0.099	0.000	0.93	
S3.005	S18	15 Winter	30	+0%	30/15 Summer	100/15 Summer			0.954	0.101	0.000	1.15	
S4.000	S19	15 Winter	30	+0%	100/15 Summer	100/15 Summer			1.126	-0.024	0.000	0.89	
S3.006	S20	15 Winter	30	+0%	30/15 Summer				0.808	0.085	0.000	1.23	
S5.000	S21	15 Winter	30	+0%	100/15 Summer				1.838	-0.037	0.000	0.90	
S5.001	S22	15 Winter	30	+0%	100/15 Summer				1.531	-0.024	0.000	1.00	
S3.007	S23	30 Winter	30	+0%	30/15 Summer				0.685	0.140	0.000	0.56	
S6.000	S24	60 Winter	30	+0%	30/15 Summer				0.552	0.427	0.000	0.16	
S1.009	S25	60 Winter	30	+0%	1/15 Summer		1/15 Summer	70	0.552	0.702	0.000	0.51	169.4

PN	US/MH Name	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	10.9	SURCHARGED	4
S1.001	S2	23.6	SURCHARGED	4
S1.002	S3	45.7	SURCHARGED	2
S1.003	S4	89.0	SURCHARGED	
S1.004	S5	87.6	SURCHARGED	
S1.005	S6	86.9	SURCHARGED	
S1.006	S7	87.3	SURCHARGED	
S1.007	S8	108.9	SURCHARGED	
S2.000	S9	17.6	SURCHARGED	2
S2.001	S10	40.3	SURCHARGED	
S2.002	S11	71.9	OK	
S1.008	S12	170.9	SURCHARGED	
S3.000	S13	114.5	OK	3
S3.001	S14	129.5	OK	4
S3.002	S15	130.5	SURCHARGED	4
S3.003	S16	221.8	SURCHARGED	4
S3.004	S17	251.3	SURCHARGED	2
S3.005	S18	284.4	SURCHARGED	2
S4.000	S19	21.9	OK	4
S3.006	S20	345.8	SURCHARGED	

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

PN	US/MH Name	Pipe Flow (l/s)	Status	Level Exceeded
S5.000	S21	15.3	OK	
S5.001	S22	15.1	OK	
S3.007	S23	293.4	SURCHARGED	
S6.000	S24	26.3	SURCHARGED	
S1.009	S25	40.0	SURCHARGED	

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

Simulation Criteria

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

Number of Input Hydrographs	0	Number of Offline Controls	1	Number of Time/Area Diagrams	0
Number of Online Controls	2	Number of Storage Structures	1	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH	D3 (1km)	0.249
Site Location	GB 532600 177950 TQ 32600 77950	E (1km)	0.328
C (1km)	-0.027	F (1km)	2.500
D1 (1km)	0.316	Cv (Summer)	0.750
D2 (1km)	0.306	Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	1, 2, 30, 100
Climate Change (%)	0, 0, 0, 30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)
S1.000	S1	15 Winter	100	+30%	30/15 Summer	100/15 Summer			2.645	1.220	11.259	2.94	
S1.001	S2	15 Winter	100	+30%	30/15 Summer	100/15 Summer			2.692	1.330	16.729	1.54	
S1.002	S3	15 Winter	100	+30%	30/15 Summer	100/15 Summer			2.800	1.555	7.604	1.54	
S1.003	S4	15 Winter	100	+30%	30/15 Summer				2.929	1.837	0.000	2.12	
S1.004	S5	15 Winter	100	+30%	30/15 Summer				2.765	1.755	0.000	1.84	
S1.005	S6	15 Winter	100	+30%	30/15 Summer				2.637	1.672	0.000	1.72	
S1.006	S7	15 Winter	100	+30%	30/15 Summer				2.519	1.624	0.000	1.55	
S1.007	S8	15 Winter	100	+30%	30/15 Summer				2.391	1.566	0.000	2.46	
S2.000	S9	15 Winter	100	+30%	30/15 Summer	100/15 Summer			3.001	1.351	1.369	2.08	
S2.001	S10	15 Winter	100	+30%	30/15 Summer				2.818	1.346	0.000	1.62	
S2.002	S11	15 Winter	100	+30%	100/15 Summer				2.598	1.213	0.000	0.98	
S1.008	S12	15 Winter	100	+30%	30/15 Winter				1.967	1.217	0.000	1.28	
S3.000	S13	15 Winter	100	+30%	100/15 Summer	100/15 Summer			2.724	1.224	1.804	1.02	
S3.001	S14	15 Winter	100	+30%	100/15 Summer	100/15 Summer			2.650	1.199	25.040	0.52	
S3.002	S15	15 Winter	100	+30%	30/15 Summer	100/15 Summer			2.597	1.351	9.146	0.60	
S3.003	S16	15 Winter	100	+30%	30/15 Summer	100/15 Summer			2.535	1.499	25.456	1.40	
S3.004	S17	15 Winter	100	+30%	30/15 Summer	100/15 Summer			2.462	1.483	1.063	1.33	
S3.005	S18	15 Winter	100	+30%	30/15 Summer	100/15 Summer			2.294	1.441	0.362	1.78	
S4.000	S19	15 Winter	100	+30%	100/15 Summer	100/15 Summer			2.329	1.179	3.103	1.21	
S3.006	S20	15 Winter	100	+30%	30/15 Summer				2.035	1.312	0.000	1.93	
S5.000	S21	15 Winter	100	+30%	100/15 Summer				2.588	0.713	0.000	1.63	
S5.001	S22	60 Winter	100	+30%	100/15 Summer				1.832	0.277	0.000	0.86	
S3.007	S23	60 Winter	100	+30%	30/15 Summer				1.827	1.282	0.000	0.65	
S6.000	S24	60 Winter	100	+30%	30/15 Summer				1.624	1.499	0.000	0.16	
S1.009	S25	60 Winter	100	+30%	1/15 Summer		1/15 Summer	70	1.624	1.774	0.000	0.51	223.5

PN	US/MH Name	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	43.8	FLOOD	4
S1.001	S2	58.2	FLOOD	4
S1.002	S3	59.6	FLOOD	2
S1.003	S4	122.6	FLOOD RISK	
S1.004	S5	113.2	SURCHARGED	
S1.005	S6	104.6	SURCHARGED	
S1.006	S7	94.7	SURCHARGED	
S1.007	S8	151.1	SURCHARGED	
S2.000	S9	34.4	FLOOD	2
S2.001	S10	59.3	FLOOD RISK	
S2.002	S11	110.6	SURCHARGED	
S1.008	S12	257.9	SURCHARGED	
S3.000	S13	230.4	FLOOD	3
S3.001	S14	154.9	FLOOD	4
S3.002	S15	173.8	FLOOD	4
S3.003	S16	329.1	FLOOD	4
S3.004	S17	361.2	FLOOD	2
S3.005	S18	438.8	FLOOD	2
S4.000	S19	29.8	FLOOD	4

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

PN	US/MH Name	Pipe Flow (l/s)	Status	Level Exceeded
S3.006	S20	540.7	FLOOD RISK	
S5.000	S21	27.8	SURCHARGED	
S5.001	S22	13.1	SURCHARGED	
S3.007	S23	343.2	SURCHARGED	
S6.000	S24	26.3	SURCHARGED	
S1.009	S25	40.0	SURCHARGED	

Wallingford Procedure - Modified Rational Method

Peak Discharge Rate

Client	NHH
Job Title	AYLESBURY ESTATE - PLOT 18
Job No.	70009682
Made By	SJF
Checked By	DSB
Approved By	CS

Unit 9, The Chase
John Tate Road
Foxholes Business Park
Hertford
SG13 7NN

Modified Rational Method

Qp = 3.61 x Cv x i x A

Storm Duration		15	mins
Return Period		1	year
M5-60 min		20.5	mm
(From Windes FSR)			
r		0.438	
(From Windes FSR)			
D		15	minutes
(Storm duration)		0.25	hours
Z1		0.65	
(From Figure A.3a or A.3b read to an accuracy of 0.01)			
M5-D		13.3	mm
Z2	15min	0.62	
(From Table A1)	30min	0.00	
	60min	0.00	
MT-D		8.3	mm
i		33.0	mm/hr
(Average point intensity)			
Areal Reduction Factor		1	
(From Figure A.4)			
Average Areal Intensity		33.0	mm/hr
Cv		0.84	(winter)
Impermeable Area		0.812	ha
	Qp=	81	l/s

Peak Discharge Rate

Client	NHH
Job Title	AYLESBURY ESTATE - PLOTS 10a & 9C
Job No.	50600304
Made By	SJF
Checked By	DSB
Approved By	CS

Unit 9, The Chase
John Tate Road
Foxholes Business Park
Hertford
SG13 7NN

Existing and Proposed Peak Foul Flow Rates, based on Sewers for Adoption 7th Edition		
	Existing	Proposed
Residential Dwellings	154	122
Retail/Trade/Community (Ha)	0	0
Residential Foul Flow Rate(l/s)	7.13	5.65
Trade Foul Flow Rate (l/s)	0	2.85
Total Foul Flow (l/s)	7.13	8.50

Additional Foul Flow (l/s) =	1.37

Proposed Peak Discharge rate to TWUL Sewer (l/s)		
		Total
1 year 15 minute SW discharge rate (Wallingford)		81
Minus additional (extra over) FW discharge	1.37	80
London Plan aspirational 50% reduction	x 0.5	40
Total Proposed Surface Water Discharge to TWUL Sewer		40

FOUL SEWERAGE DESIGN

Design Criteria for Foul

Pipe Sizes BS Manhole Sizes SFA7

Industrial Flow (l/s/ha)	0.00	Domestic (l/s/ha)	0.00	Maximum Backdrop Height (m)	0.000
Industrial Peak Flow Factor	0.00	Domestic Peak Flow Factor	6.00	Min Design Depth for Optimisation (m)	1.200
Flow Per Person (l/per/day)	222.00	Add Flow / Climate Change (%)	0	Min Vel for Auto Design only (m/s)	0.75
Persons per House	3.00	Minimum Backdrop Height (m)	0.000	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Foul

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Auto Design
F1.000	17.558	0.117	149.7	0.000	20	0.1	1.500	o	150	
F1.001	22.822	0.152	150.1	0.000	20	0.1	1.500	o	150	
F1.002	17.654	0.130	135.8	0.000	20	0.2	1.500	o	450	
F1.003	13.166	0.836	15.7	0.000	0	0.0	1.500	o	450	
F2.000	17.092	0.214	79.9	0.000	0	0.7	1.500	o	100	
F2.001	10.075	0.223	45.2	0.000	0	0.7	1.500	o	100	
F3.000	34.957	0.437	80.0	0.000	0	0.7	1.500	o	100	
F2.002	4.575	0.064	71.5	0.000	0	0.0	1.500	o	100	
F4.000	18.075	0.121	150.0	0.000	20	0.1	1.500	o	150	
F4.001	15.753	0.156	101.0	0.000	21	0.1	1.500	o	150	
F2.003	21.295	0.142	150.0	0.000	21	0.3	1.500	o	150	
F2.004	13.274	0.088	150.0	0.000	0	0.0	1.500	o	150	
F2.005	6.162	0.041	150.3	0.000	0	40.1	1.500	o	300	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F1.000	0.825	0.000	0.1	20	0.0	29	0.43	0.71	12.6	1.0
F1.001	0.708	0.000	0.2	40	0.0	41	0.52	0.71	12.6	2.1
F1.002	0.256	0.000	0.4	60	0.0	36	0.54	1.55	246.1	3.2
F1.003	0.126	0.000	0.4	60	0.0	22	1.13	4.56	724.4	3.2
F2.000	1.425	0.000	0.7	0	0.0	24	0.49	0.74	5.8	0.7
F2.001	1.211	0.000	1.4	0	0.0	29	0.74	0.99	7.8	1.4
F3.000	1.425	0.000	0.7	0	0.0	24	0.49	0.74	5.8	0.7
F2.002	0.988	0.000	2.1	0	0.0	40	0.71	0.79	6.2	2.1
F4.000	1.150	0.000	0.1	20	0.0	29	0.43	0.71	12.6	1.0
F4.001	1.030	0.000	0.2	41	0.0	38	0.61	0.87	15.4	2.1
F2.003	0.874	0.000	2.6	62	0.0	69	0.69	0.71	12.6	5.5
F2.004	0.732	0.000	2.6	62	0.0	69	0.69	0.71	12.6	5.5
F2.005	-0.559	0.000	42.7	62	0.0	162	1.17	1.13	79.9	45.6

Manhole Schedules for Foul

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
F1	2.683	1.858	Open Manhole	1200	F1.000	0.825	150				
F2	2.799	2.091	Open Manhole	1200	F1.001	0.708	150	F1.000	0.708	150	
F3	2.951	2.695	Open Manhole	1350	F1.002	0.256	450	F1.001	0.556	150	
F4	3.062	2.936	Open Manhole	1350	F1.003	0.126	450	F1.002	0.126	450	
F	2.973	3.683	Open Manhole	0		OUTFALL		F1.003	-0.710	450	
F5	3.225	1.800	Open Manhole	1200	F2.000	1.425	100				
F6	3.225	2.014	Open Manhole	1200	F2.001	1.211	100	F2.000	1.211	100	
F7	3.225	1.800	Open Manhole	1200	F3.000	1.425	100				
F8	3.225	2.237	Open Manhole	1200	F2.002	0.988	100	F2.001	0.988	100	
								F3.000	0.988	100	
F9	2.950	1.800	Open Manhole	1200	F4.000	1.150	150				
F10	3.000	1.971	Open Manhole	1200	F4.001	1.030	150	F4.000	1.030	150	
F11	3.000	2.127	Open Manhole	1200	F2.003	0.874	150	F2.002	0.924	100	
								F4.001	0.874	150	
F12	3.100	2.368	Open Manhole	1200	F2.004	0.732	150	F2.003	0.732	150	
F13	2.650	3.209	Open Manhole	1200	F2.005	-0.559	300	F2.004	0.643	150	1052
F	0.000		Open Manhole	0		OUTFALL		F2.005	-0.600	300	

PIPELINE SCHEDULES for Foul

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
F1.000	o	150	F1	2.683	0.825	1.708	Open Manhole	1200
F1.001	o	150	F2	2.799	0.708	1.941	Open Manhole	1200
F1.002	o	450	F3	2.951	0.256	2.245	Open Manhole	1350
F1.003	o	450	F4	3.062	0.126	2.486	Open Manhole	1350
F2.000	o	100	F5	3.225	1.425	1.700	Open Manhole	1200
F2.001	o	100	F6	3.225	1.211	1.914	Open Manhole	1200
F3.000	o	100	F7	3.225	1.425	1.700	Open Manhole	1200
F2.002	o	100	F8	3.225	0.988	2.137	Open Manhole	1200
F4.000	o	150	F9	2.950	1.150	1.650	Open Manhole	1200
F4.001	o	150	F10	3.000	1.030	1.821	Open Manhole	1200
F2.003	o	150	F11	3.000	0.874	1.977	Open Manhole	1200
F2.004	o	150	F12	3.100	0.732	2.218	Open Manhole	1200
F2.005	o	300	F13	2.650	-0.559	2.909	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
F1.000	17.558	149.7	F2	2.799	0.708	1.941	Open Manhole	1200
F1.001	22.822	150.1	F3	2.951	0.556	2.245	Open Manhole	1350
F1.002	17.654	135.8	F4	3.062	0.126	2.486	Open Manhole	1350
F1.003	13.166	15.7	F	2.973	-0.710	3.233	Open Manhole	0
F2.000	17.092	79.9	F6	3.225	1.211	1.914	Open Manhole	1200
F2.001	10.075	45.2	F8	3.225	0.988	2.137	Open Manhole	1200
F3.000	34.957	80.0	F8	3.225	0.988	2.137	Open Manhole	1200
F2.002	4.575	71.5	F11	3.000	0.924	1.976	Open Manhole	1200
F4.000	18.075	150.0	F10	3.000	1.030	1.821	Open Manhole	1200
F4.001	15.753	101.0	F11	3.000	0.874	1.977	Open Manhole	1200
F2.003	21.295	150.0	F12	3.100	0.732	2.218	Open Manhole	1200
F2.004	13.274	150.0	F13	2.650	0.643	1.857	Open Manhole	1200
F2.005	6.162	150.3	F	0.000	-0.600		Open Manhole	0

Area Summary for Foul

Pipe Number	Gross Area (ha)	Pipe Total (ha)
1.000	0.000	0.000
1.001	0.000	0.000
1.002	0.000	0.000
1.003	0.000	0.000
2.000	0.000	0.000
2.001	0.000	0.000
3.000	0.000	0.000
2.002	0.000	0.000
4.000	0.000	0.000
4.001	0.000	0.000
2.003	0.000	0.000
2.004	0.000	0.000
2.005	0.000	0.000
	Total	Total
	0.000	0.000

Free Flowing Outfall Details for Foul

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
F1.003	F	2.973	-0.710	0.000	0	0

Free Flowing Outfall Details for Foul

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
F2.005	F	0.000	-0.600	0.000	0	0

Simulation Criteria for Foul

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

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

Synthetic Rainfall Details

Rainfall Model	FEH	E (1km)	0.328
Return Period (years)	2	F (1km)	2.500
Site Location	GB 532600 177950 TQ 32600 77950	Summer Storms	Yes
C (1km)	-0.027	Winter Storms	Yes
D1 (1km)	0.316	Cv (Summer)	0.750
D2 (1km)	0.306	Cv (Winter)	0.840
D3 (1km)	0.249	Storm Duration (mins)	30

Appendix H

TREE ROOT RADAR INVESTIGATION

Tree Root Radar Investigation

Plot 18 - Aylesbury Estate, Masterplan Site, Southwark, London

Client: **Notting Hill Housing Association**

Job Reference: 02447R

Consultant: Keiron Hart (BSc Hons, C.Env, F.Arbor.A, MICFor, MEWI)

Tamla Trees
consulting arborists

February 2016

Contents

1. Executive Summary

1.1 Tamla Trees ltd has been appointed by Notting Hill Housing Association (via HTA Architects) to investigate the rooting of trees growing in land adjacent to Inville Road and Merrow Street, London, SE17 2NP. The tree root radar was undertaken by Lloyd Bore under our direction.

1.2 The site consists of a dead end road with path leading to the south east along Inville Road. The three trees (T293-T295) which are the subject of this report are located within a brick bound planting area, rectangular in shape and orientated south west to north east. To the north of this planter the trees overhang a playground and Merrow Street, while to the south the trees overhang a narrow path with a block of flats immediately beyond it.

1.3 This report identifies locations of roots with a diameter greater than 20mm along the scan lines. Scanning conditions were difficult in several areas with a very large number of nonroot reflectors present within the soil, such as utilities. Although these may affect the accuracy of the results, the scan results will still provide an overall trend.

1.4 We have been asked to complete this exercise due to the requirement for a central utility duct to be routed to the north of trees T293, T294 & T295. Concerns have been raised that this may sever significant structural roots. The results indicate that ideally this should (ideally) be located no closer than 6m from the base of the trees.

1.5 The scanning conditions of some lines was poor, with a large amount of non-root reflectors such as services, which may affect the accuracy of the scan results, but will still indicated the trend. The TreeRadar equipment only picks up roots with a diameter greater than 20mm, finer roots will not be picked up.

2. Background

2.1 A TreeRadar investigation was carried out on 21st January 2016. The location of the scan lines are shown on the Tree Radar Plan at Appendix 3.

2.2 Not all scan lines were within the BS5837 root protection areas of the trees. The individual scan lines were measured from the tree and/or other fixed points, and a 'marker' (usually the tree trunk) was noted to assist plotting parallel lines. Photographs were taken, and the lines were then plotted on a plan and described in survey tables. Each scan line has a unique file number (e.g. 005) and the lines are shown on a digital plan. Trees are referenced in accordance with the numbering used in the Tamla Trees Tree Constraints Plan, drawing number 02027P_TCP_02.

3. Methodology

3.1 The TreeRadar unit is a scanning cart with a 400MHz antenna which sends a beam every 1cm down to a depth prescribed by the operator (usually between 2 - 3m, which is the maximum depth). The reflection is recorded in a field computer and then analysed by the latest software, TBA. Water and metal reflect, therefore the machine records live roots which contain moisture, and cannot detect dead dried out roots. For each scan line a 'virtual trench' is produced which shows all roots with a diameter greater than 20mm. The machine cannot determine root diameter, other than it being greater than 20mm, due to the lack of correlation between the amounts of live root tissue in a root compared to the thickness of a root. A large root, for example, may only have a live central core.

3.2 Each group of scan lines is organised into a 'top down ' root morphology. The software in effect 'joins the dots' of root hits to produce this, but the reality of the root growth between the root hits may be slightly different.

3.3 The results are shown as a top down view (plan) and a cross section of each scan line. The plan extracts are not to scale. The location of the scan lines are based on the plotting from the survey, and the length of the line on the plan by the exact length of the scan. The cross section of each scan line shows where the roots are in relation to depth and distance. The coloured areas represent root density (relative to the scan area). An example is shown on the following page:

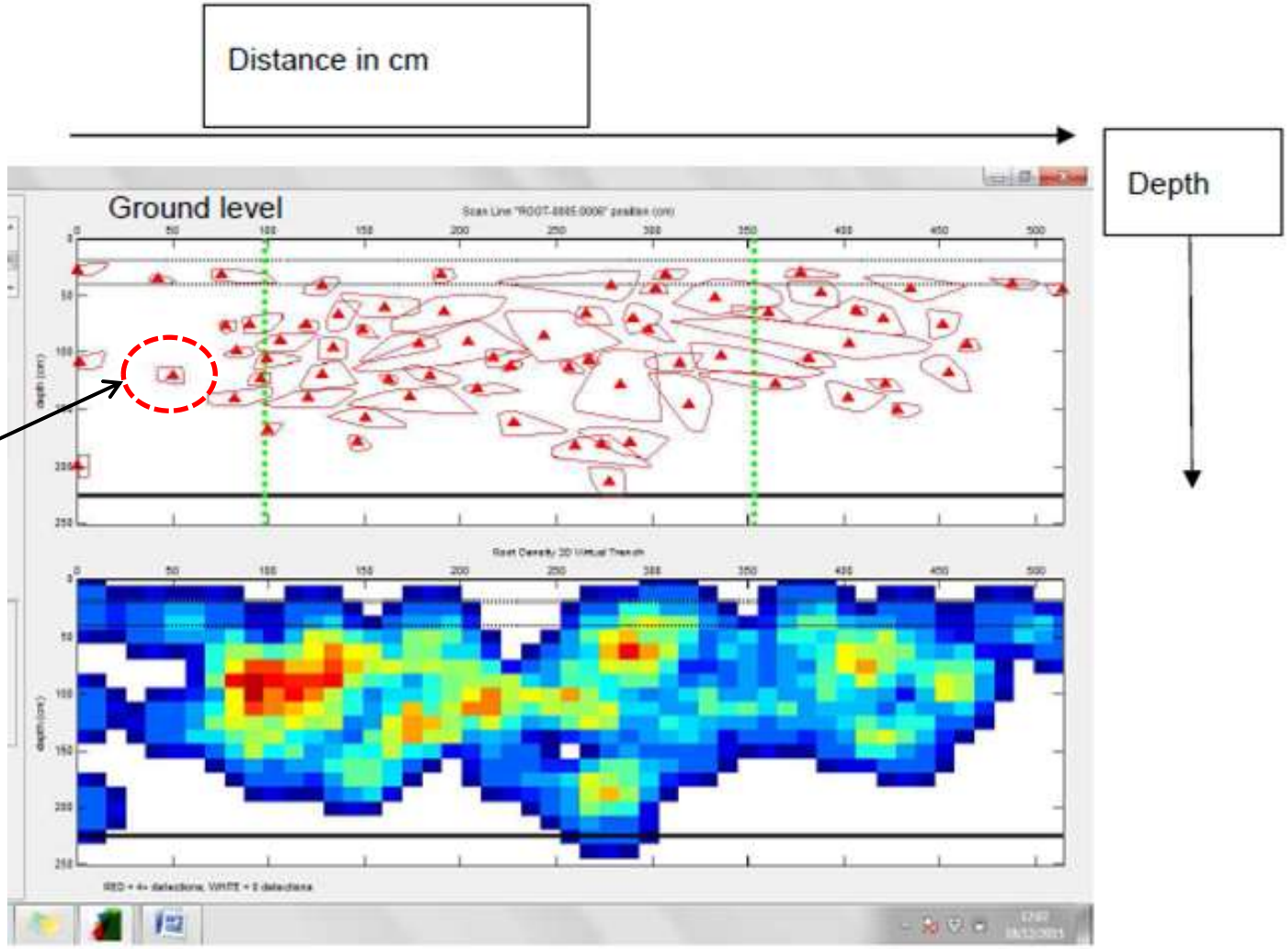
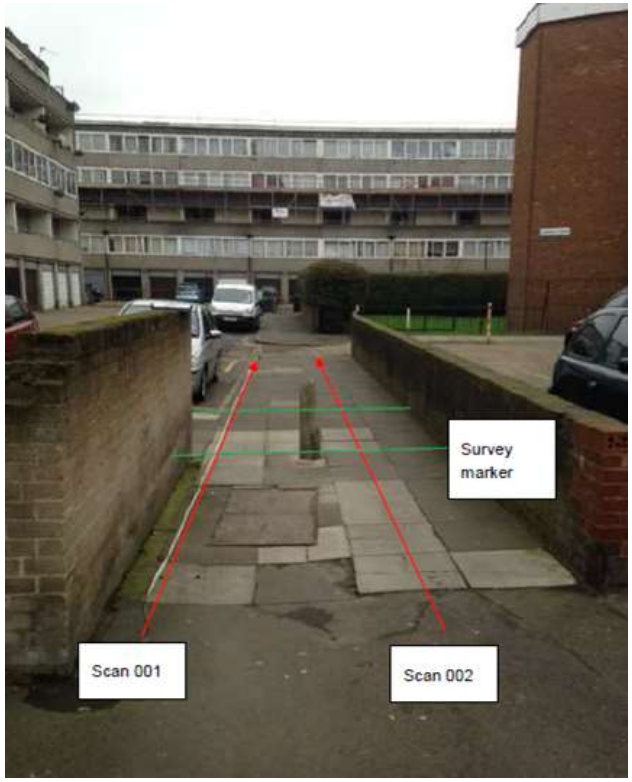


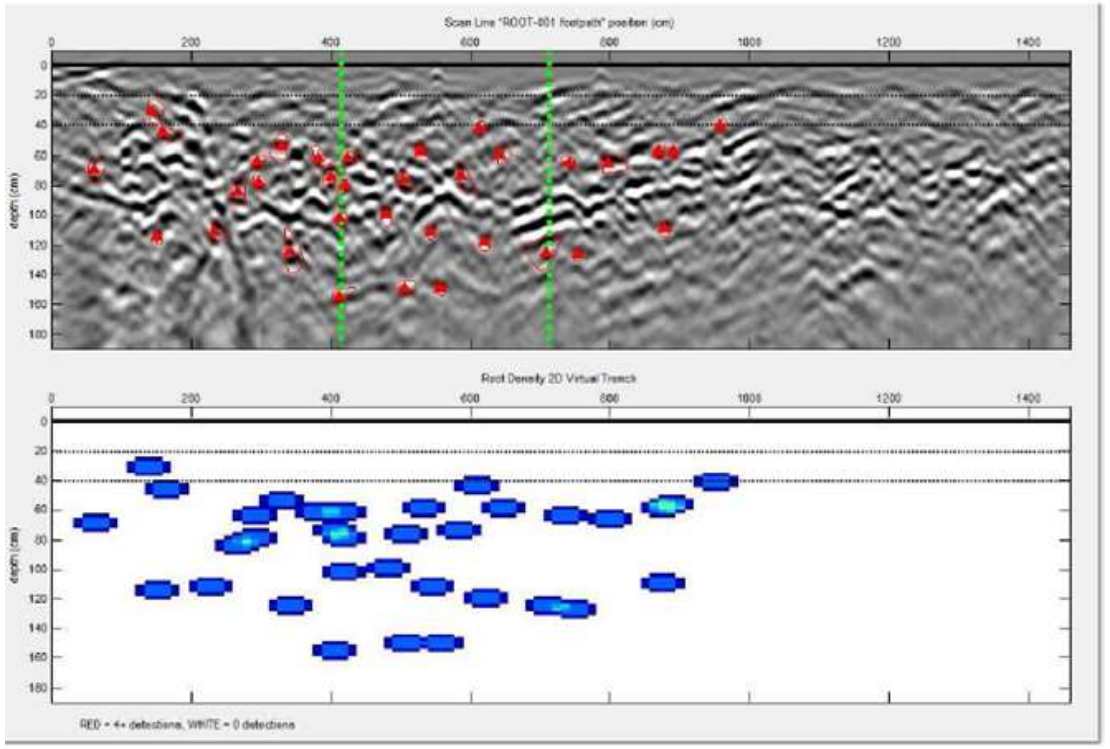
Fig 1 – Example scan output

4.0 Results

4.1 The location and orientation of selected scan lines is described below, together with a summary of the results.

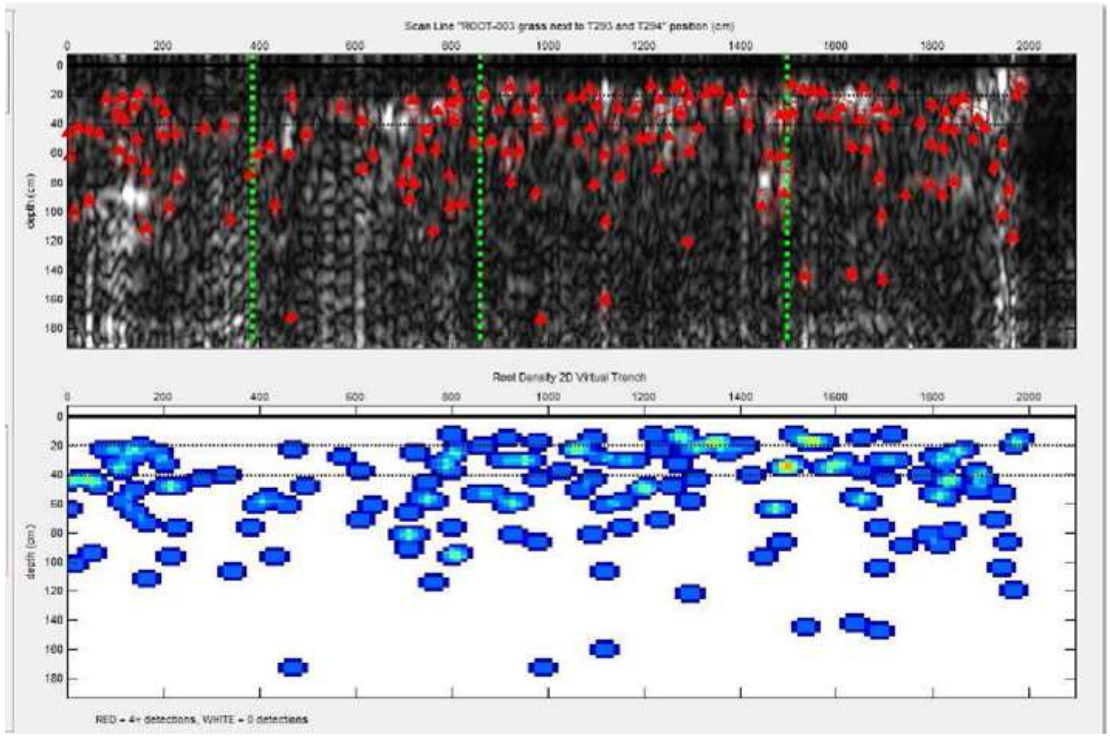
4.2 **Scan 001 and 002:** Running from North West to south east for a length of 15m within the footpath along Inville Road, parallel to the end wall of the raised planter containing the trees. Line starts at corner of planter, with markers at the end of the raised bed and at the start of the parking area. Scan 001 is 0.5m from the wall; scan 002 is 2m from the wall. **Note:** Scan line 2 shown below results for 001 were almost identical:





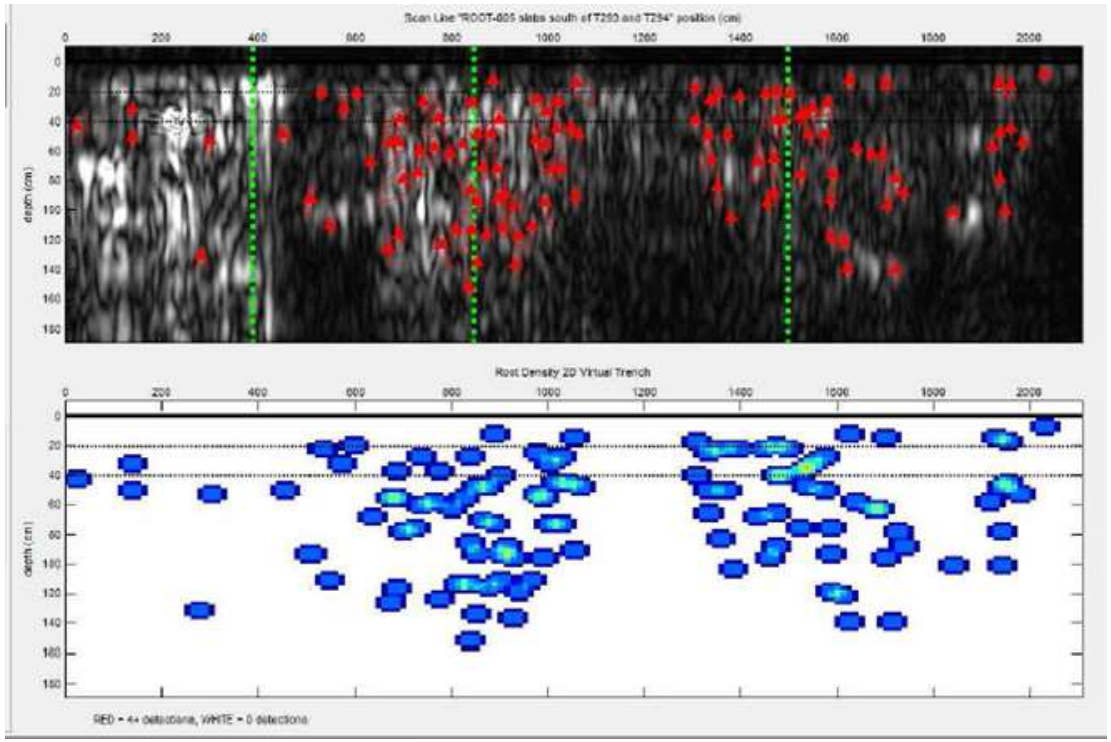
4.3 **Comments:** Results found tree roots extending into the footpath, with the majority below 400mm in depth. Large number of non-root reflectors (probably services) found within the soil structure.

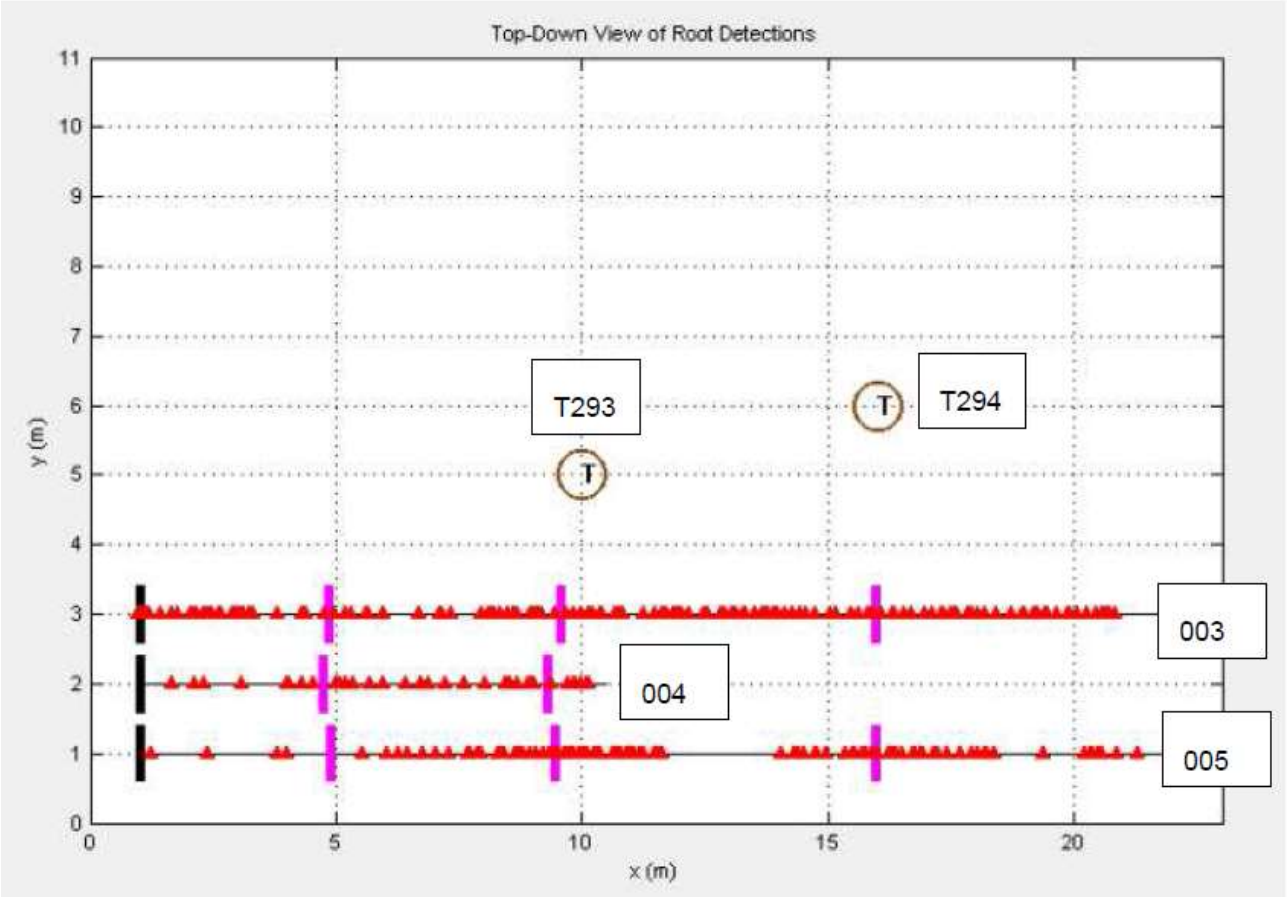
4.4 **Scan 003:** Running from the south western end of the planter for a length of 21m to the fence at the end of the planter, on the south side of T293 and T294, parallel to and 0.5m from the brick wall. Markers at the start of the concrete pad in Inville Road, the trunk of T293 and the trunk of T294.



4.5 **Comments:** Scanning conditions average. Moderate to high rooting density. Majority of tree roots found between 200-800mm in depth with a few shallower and few roots deeper than 1400mm.

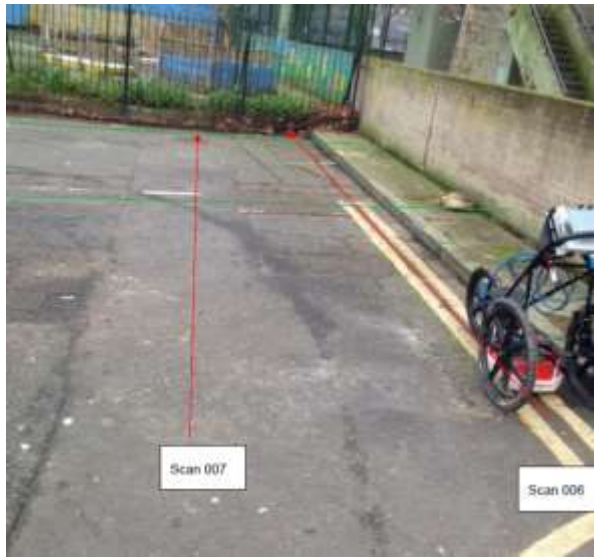
4.6 **Scan 004 and 005:** Starting level with the start of scan 003 and running parallel to it on the outside of the planter wall. Scan 004 is 0.5m south west of the wall, ending at the stair well (10m in length). Scan 005 is 1.5m from the wall ending at the fence line (21 in length). Markers at the start of the concrete pad in Inville Road, the trunk of T293 and the trunk of T294. **Note:** Scan line 5 results shown below:



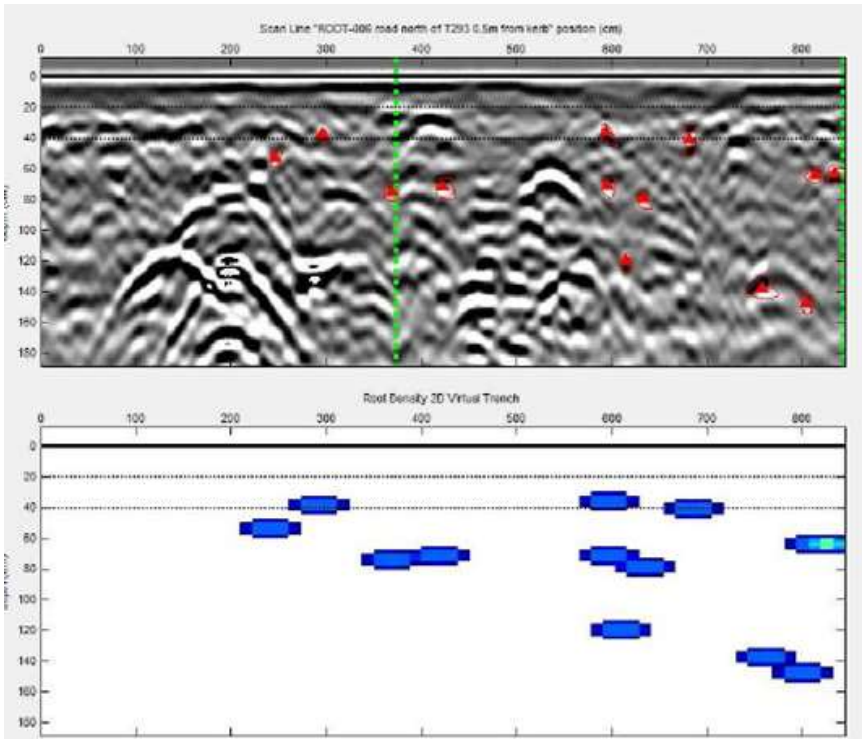


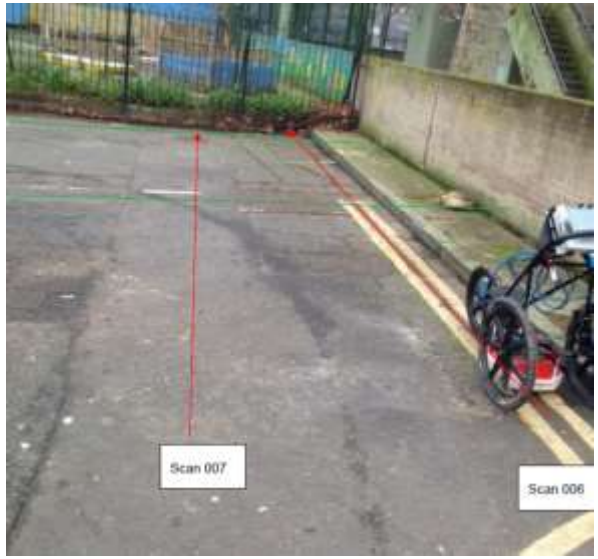
4.7 **Comments:** Roots found to extend beneath the path but at a significantly lower density to scan 003. Roots did not extend beneath the base of the stairwell in line 005. Roots unevenly distributed and found more densely near the tree stems. No roots found at a depth less than 150mm.

4.8 **Scan 006-010:** Scan lines within the carriageway turning head on Merrow Street to the northwest of the planter, parallel to the wall. Scan lines run from level with the start of lines 003-005, for a length of 9m, finishing at the boundary fence of the nursery. Scan line 006 is 0.5m from the edge of the kerb, 007 is 2m from the kerb, 008 is 4m from the kerb,009 is 6m from the kerb and 010 is 9m from the kerb (avoiding manhole covers). Markers used were the same as in lines 003-005.

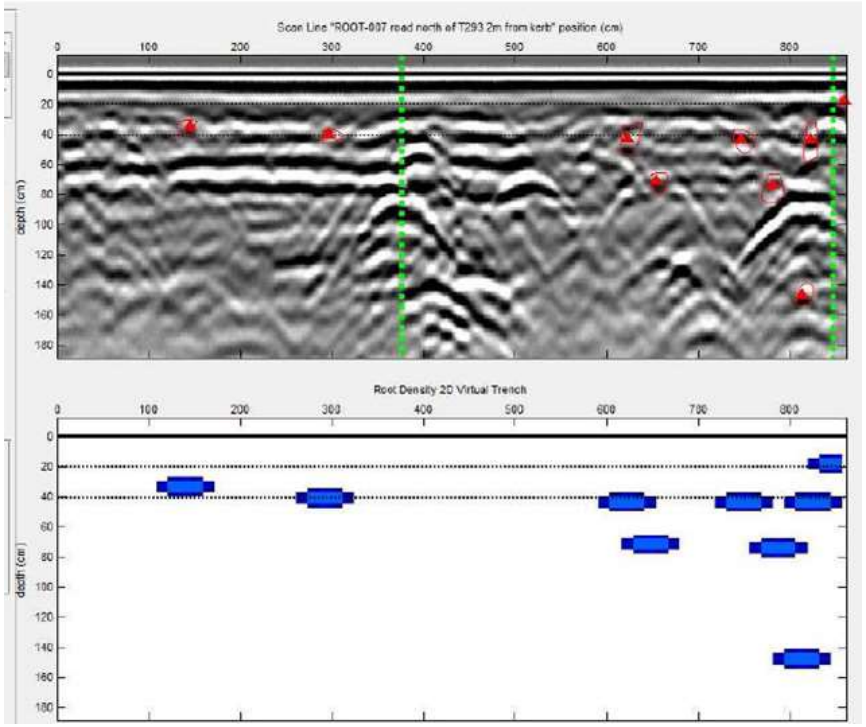


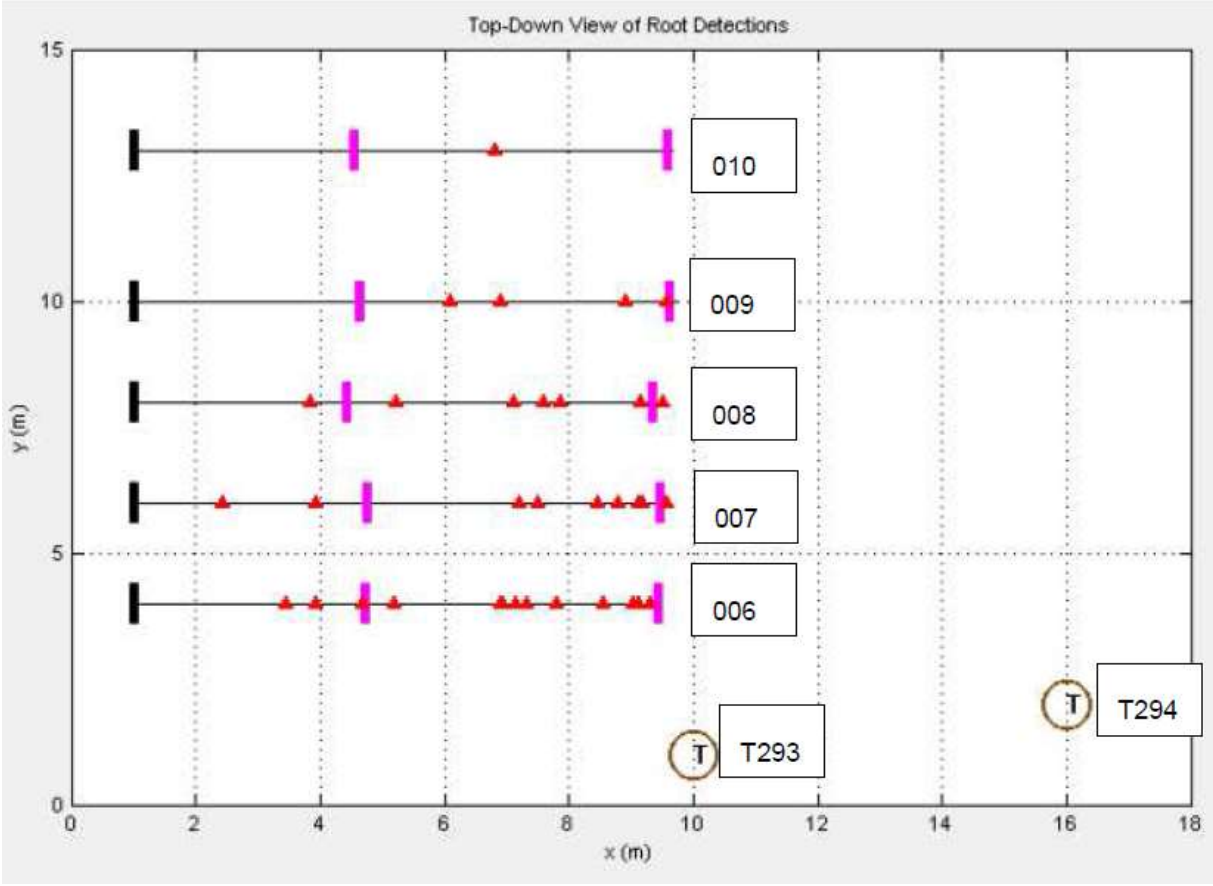
Scan 6




Scan 007
Scan 006

Scan 7

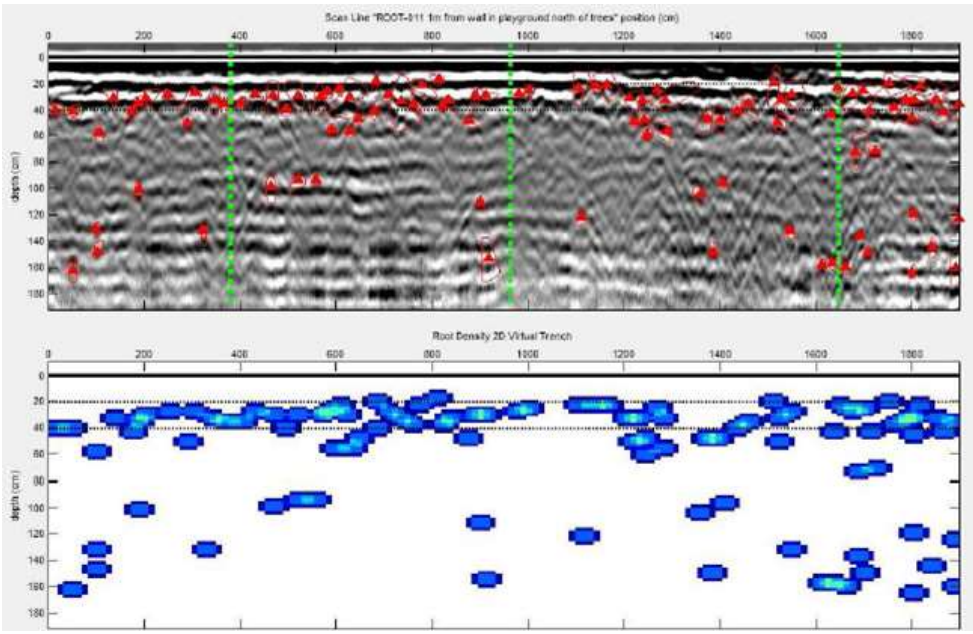

Scan Line "ROOT-007 road north of T293 2m from kerb" position (cm)
depth (cm)
Root Density 2D Virtual Trench
depth (cm)



4.9 **Comments:** Tree roots are present in very low densities beneath the carriageway, declining in number as the distance from the trees increases. All are below 300mm in depth. Scanning conditions difficult due to high number of non-root reflectors. **Note:** Individual results for Scans 8, 9 & 10 not shown but support the progressive reduction as shown above as you move away from T293.

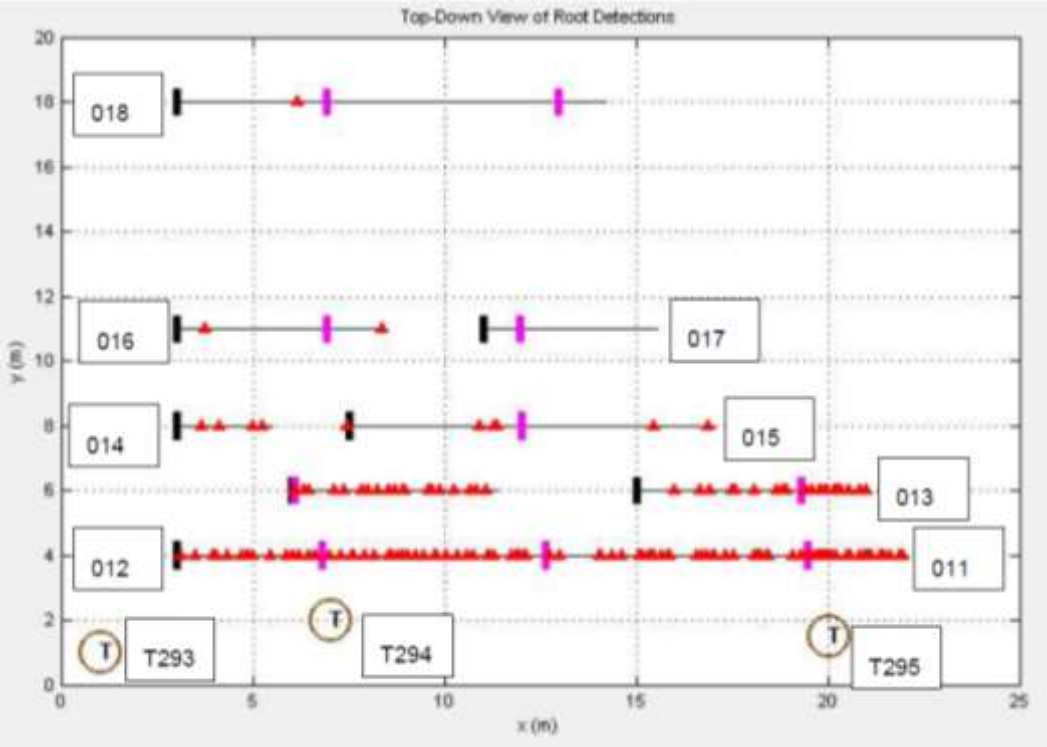
4.10 **Scan 011.** Scan running within the playground to the north west of the planting bed and 1m out from the wall, starting 0.5m from the boundary fence for a length of 19m finishing in the corner of the playground. Markers at trunk of T294, the bridge support for overhead footpath and fence line at the end of line 003.

Scan 11



4.11 **Comments.** Moderate to high density of roots in a shallow band between 180-600mm with another less dense and uneven distribution between 800-1600mm. Large number of non-root reflectors.

4.12 **Scan 012-018:** Scan lines were broken up by the play equipment in the playground, running parallel to scan 011 and using the same markers. Lines 012 and 013 are located 3m from the boundary wall and form a continuation of line 007. Lines 014 and 015 are 5m from the boundary wall as a continuation of line 008. Lines 016 and 017 are 8m from the boundary wall as a slightly staggered continuation of line 009. Scan 018 is located on the far side of the playground, 15m from the boundary wall.



4.13 **Comments:** Roots are generally deeper than 200mm and spread beneath the playground, with densities rapidly dropping as the distance from the trees increases. No roots were found on line 017, but 1 root was detected on scan 018. This may however be an anomaly or a root from nearby off-site trees. A large number of non-root reflectors were found.

5.0 Conclusions

5.1 The TreeRadar unit picks up roots with a diameter greater than 20cm in diameter. Roots were found to have spread from the planter into all the areas surveyed, but in far lower densities than those encountered in the grass surface on line 003. The roots are found in a generally deeper soil horizon than those typically quoted by the industry literature, likely due to the physical barriers from the wall footings and the hard-core beneath the hard surfacing. The spread is also far in excess of the root protection areas, though the density drops rapidly with increased distance from the trunk.

5.2 Placing the service utility trench no closer than 6m to T293, T294 & T295 on the northern side will limit root disturbance/ loss. This is closer than the BS5837 distances for T293 (9.2m) and T295 (7.2m).

Appendix 1 – BS5837 Survey Key

BS 5837 Cat	Description
A	Those of high quality and value: in such a condition as to be able to make a substantial contribution (> 40 years)
B	Those trees of moderate quality and value: those in such a condition as to make a significant contribution (> 20 years)
C	Those trees of low quality and value: currently in an adequate condition to remain until new planting could be established (> 10 years)
U	Those in such a condition that any existing value would be lost within 10 years and which should, in the current context, be removed regardless of development (< 10 years)

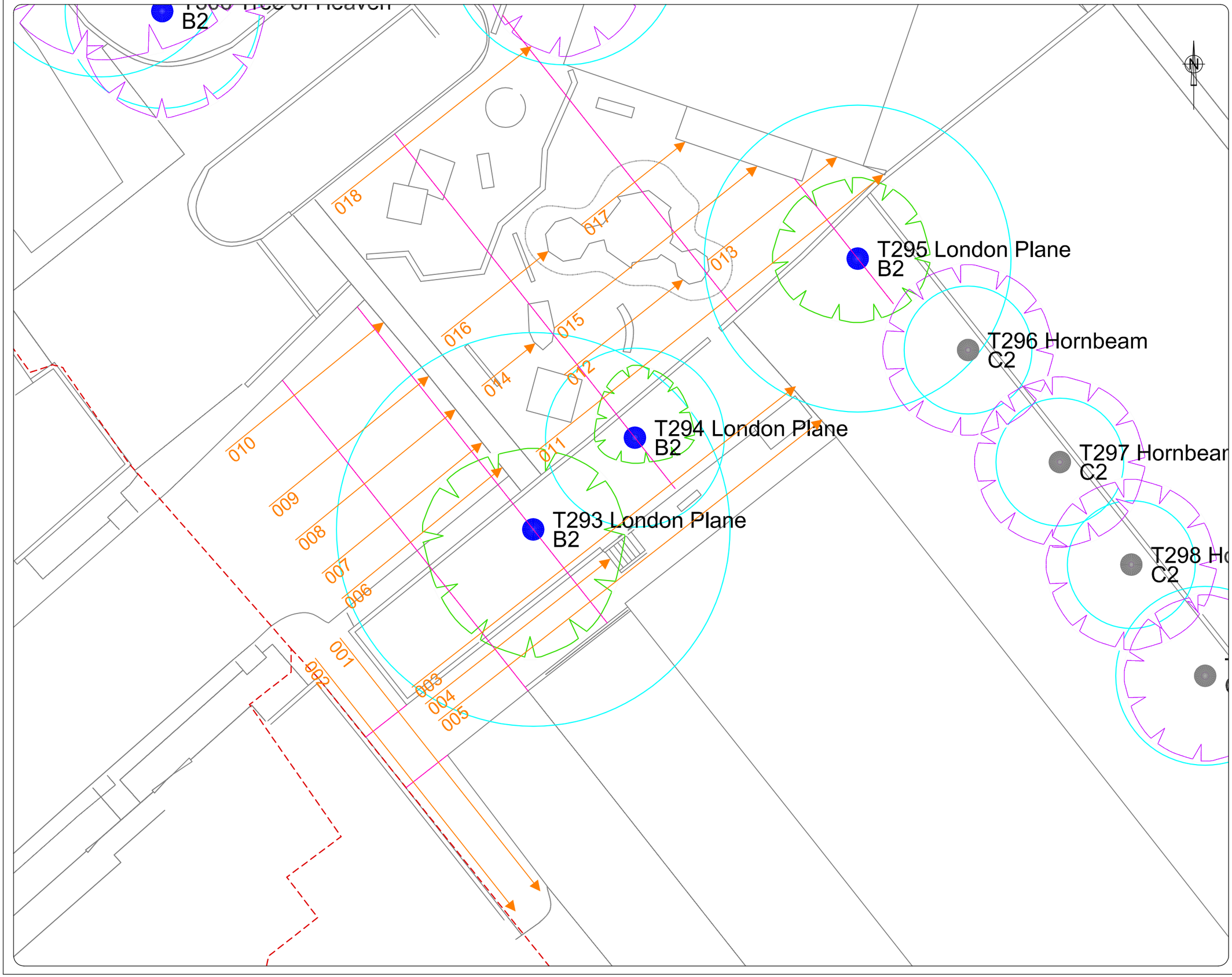
Note: Sub categories are denoted in the tree survey data (A1, B1, C2 etc.). You are referred to BS5837 for further detail if required.

Tree No.	T (tree), G (group), H (hedge), W (woodland) + Ref No.
Species	Common Name
Ht (m)	Measured height in metres
DBH (m)	Diameter at 1.5m above ground level
No of stems	An indication of the trees form @1.5m (1 = single stem, m/s = multi-stemmed)
Branch Spread	In m to cardinal points
Cr Ht Clearance (m)	Overall height of lowest branches from the ground level on side of proposed development
Life Stage	Young, Semi-Mature, Early-Mature, Mature, Over-Mature
General Observations	Observations on the condition of the tree(s)
Tree Work Specification	Proposed tree works in accordance with BS3998
BS Cat	See above
Life Exp	Estimated remaining contribution in years.
RPA Radius(m)	Radius of the trees Root Protection Area measured from the trunk to the edge of the RPA circle in metres

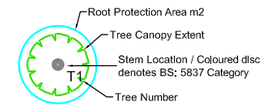
Appendix 2 – BS5837 Survey Data

Tree No.	Species	DBH (m)	No of Stems	Ht (m)	Crown Spread				BS Cat	Age Class	Life Expect	Cr Ht (m)	Observation	Recommendations	RPR (m)
					N	E	S	W							
T293	Plane (London)	0.77	1	14	3.8	4.3	6	5.2	B2	Mature	> 40	4.5	Managed as pollard and will need cyclical pruning.	No works	9.2
T294	Plane (London)	0.35	1	12	3.4	2.8	1.2	1.9	B2	Mature	> 40	4.5	Managed as pollard and will need cyclical pruning.	No works	4.2
T295	Plane (London)	0.6	1	12	3.8	3.4	3	4	B2	Mature	> 40	4.5	Managed as pollard and will need cyclical pruning.	No works	7.2

Appendix 3 - Tree Radar Plan



Tree Survey Drawing Key



See Tamla Trees, Tree Survey for Individual Tree Details

KEY

Please refer to Tamla Trees report for details

- Category A - Trees of high quality
- Category B - moderate quality
- Category C - low quality
- Category U - Dead, Dying or Defect trees with <10 years retention value

RPA - root protection area as defined by Table 2 BS 5837:2012

Proposed removal - to facilitate Development

Tree radar scan lines

Survey marker

REV AMENDMENTS DRAWN DATE AUTH'D

PROJECT
Aylesbury Plot 18

CLIENT
Notting Hill Housing

TITLE
Tree Radar Plan (TRP)
T293-295

Job	Scale	DRG NO	Revision
02027R	NTS @ A3	02027P_TRP_01	-
Date 01/02/2016	Type a		

Tamla Trees
consulting arborists

Appendix 4 – Site Photographs

Image 1 – Preparing for scan line 003

Image 2 – Roots were present in lower numbers below public highway

Image 3 – Roots were present in high numbers below hard standing but not below stairwell footing.

Image 4 – More roots were evident under the playground surface than public highway

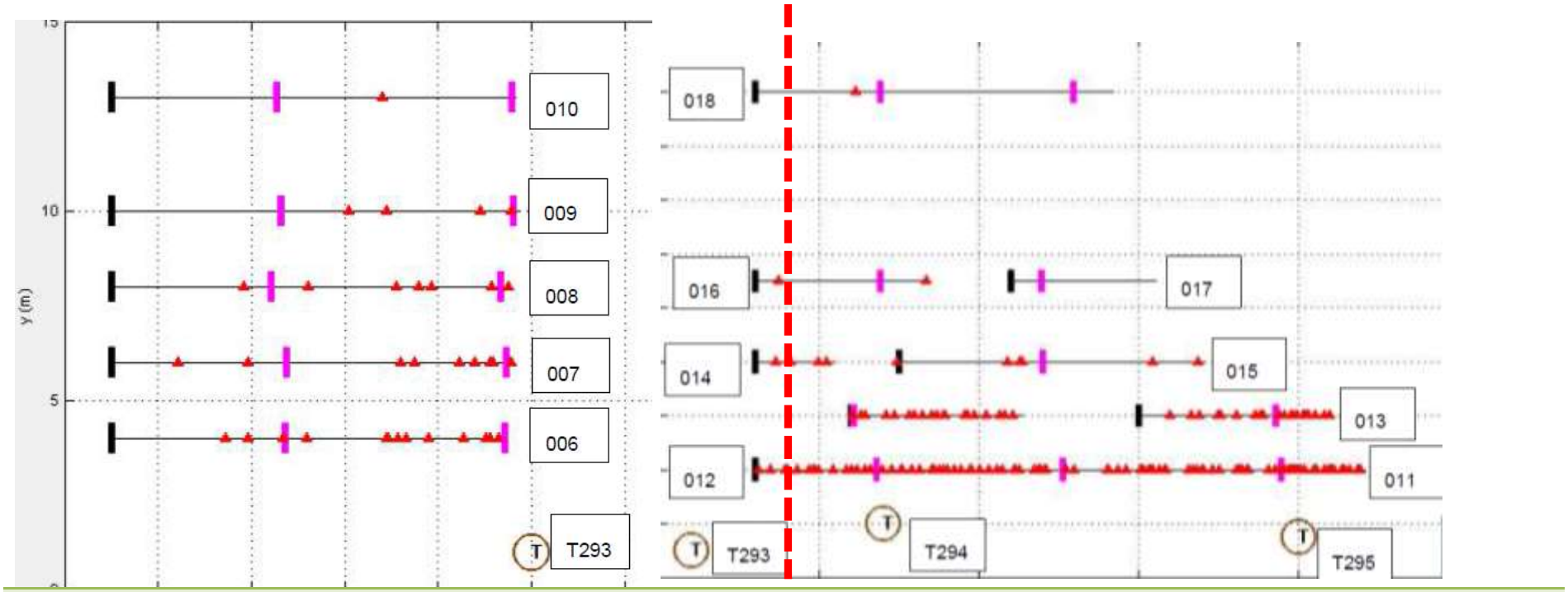


Image 5 – Composite of top down views. To the right of the red dashed line is the playground; to the left is the end of Merrow Street. As can be seen above there is a far greater number of roots within the playground area. This is probably due to shallower footings and greater permeability of the respective surface types.

Appendix 5 – Limitations

Full Legal Disclaimer

This report was prepared as a report of work instructed by client (as specified). Neither Tamla Trees ltd nor any associated company, nor any of their employees, nor any of their contractors, subcontractors or their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or any third party's use or the report and its findings. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favouring by Tamla Trees ltd or any associated company. The views and opinions of authors expressed herein do not necessarily state or reflect those of Tamla Trees ltd or any associated company.

Copyright & Non-Disclosure Notice

The content, layout and any supporting digital files associated with this report are subject to copyright owned by Tamla Trees ltd. Exceptions to this are present where that copyright has been legally assigned to Tamla Trees ltd by another party/ organisation. In addition Tamla Trees ltd may utilise content generated under license. Reproduction, scanning, copying or distribution of this report in any form is prohibited without prior written agreement.

Third Party Disclaimer

Tamla Trees ltd, sub-contractors or suppliers will not be responsible or liable for any claim of loss or damage resulting from the third party use of the information contained within this report.

Specific - Trees

All tree inspections, unless specified, have been undertaken from ground level and using non-invasive techniques. Comments contained within the report on the condition and risk associated with any tree relate to the condition of the tree at the date and time of survey. Please note that the condition of trees is subject to change. This change may occur, but is not limited to biological and non-biological factors as well as mechanical/ physical changes to conditions in the proximity of the tree. Trees should be inspected at intervals relative to risk/ target areas and in accordance with relevant HSE guidance. Tamla Trees ltd can provide further information on this matter if required. Where full access to trees (Ivy, materials at base, location on 3rd party land) was not possible Tamla Trees ltd accept no liability for issues that arise. Please note that this report should not be considered a full health and safety inspection of surveyed trees.

Please note no statutory control checks have been undertaken (unless specified). Where tree surgery works have been identified these works are based on the assumption that planning is approved, no tree works should be undertaken prior to determination of this application without up to date confirmation of the Tree Preservation Order / Conservation Area Status of the vegetation. All works should be undertaken in accordance with the appropriate Duty of Care. This should include, for example, site specific risk assessments and due diligence inspections for the presence of protected species.

Any comment/ measurements relating to 3rd party trees have been made without full access to the tree(s). Should these trees have any impact on the proposed development we would advise you to instruct us to contact the 3rd party and undertake further detailed inspection work.

A legal Duty of Care requires that any tree works specified in this report should be performed by qualified, arboricultural contractors who have been competency tested to determine their suitability for such works in line with Health & Safety Executive Guidelines. Additionally all works should be carried out according to British Standard 3998 (2010) Recommendations for Tree Work.