DRAINAGE STATEMENT

for

Land at Filbert Close, Hatfield, AL10 9ED

Grid Reference: 521692E, 206608N

Prepared for

Lambert Smith Hampton

on behalf of

Hertfordshire County Council

August 2019

Reference: ST2629/DS-1908

Revision 0

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Revision	*Author*	*Checked by*	*Issue Date*
0	*SJB*	*DGS*	*22.08.19*

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APPENDICES

1. Introduction

1.1.1. Stomor Ltd has been commissioned by Lambert Smith Hampton, on behalf of Hertfordshire County Council (HCC) to prepare a Drainage Statement associated with a proposed residential development at the former Hazel Grove Primary School playing field site off Filbert Close in Hatfield. This document has been prepared to support the Clients Outline Planning Application.

1.1.2. The site is located to the south west of Hazel Grove and Filbert Close, in the south west of Hatfield. A Site Location Plan is provided in **Appendix A**.

1.1.3. The application site comprises the playing field of the former Hazel Grove Primary School, part of a former playground and an area of dense woodland. The total site area equates to approximately 0.93 hectares (ha).

1.1.4. Development proposals comprise the construction of 39No. dwellings, formation of new vehicular access and associated parking and landscaping.

1.2. <u>Flood Risk Vulnerability and the NPPF Sequential Test</u>

1.2.1. The Indicative Floodplain Map obtained from the UK government website is provided in **Figure 1.1**. This shows that the application site, lies within Flood Zones 1, land assessed to have a low probability of flooding.

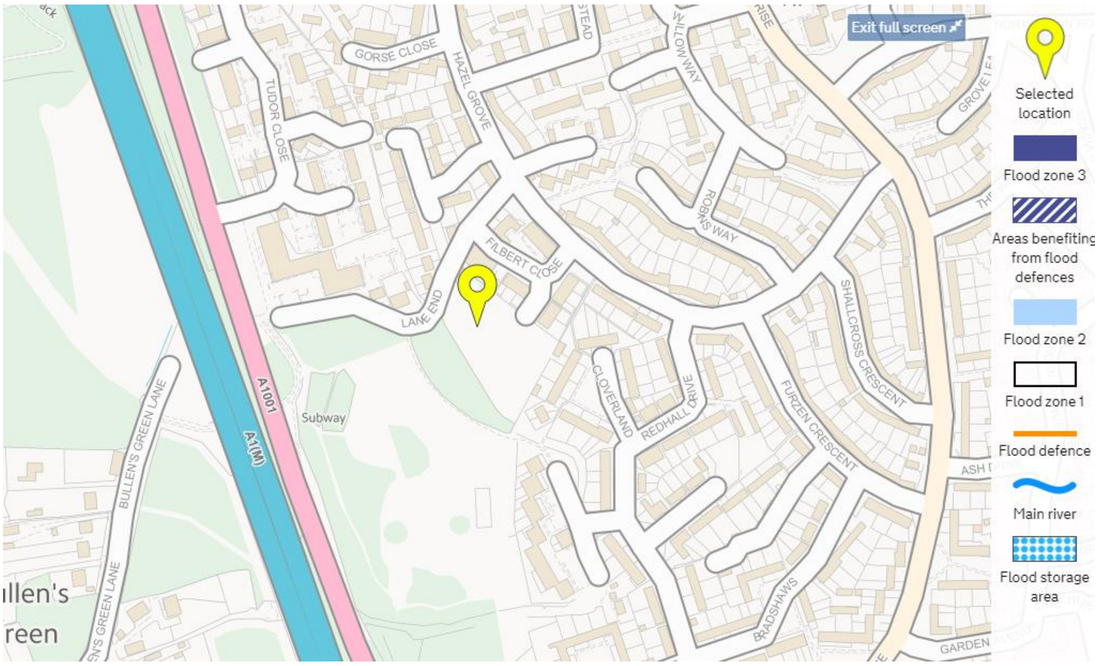


Figure 1.1 – UK Government Indicative Floodplain Map

1.2.2. The difference between Flood Zones 1, 2 and 3 are described in the table below:

Zone 1 Low Probability	Land assessed as having a less than 1 in 1000 annual probability of river or sea flooding in any year (<0.1%)
Zone 2 Medium Probability	Land assessed as having between a 1 in 100 and 1 in 1000 annual probability of river flooding (1% - 0.1%) or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.55% – 0.1%) in any year.
Zone 3a High Probability	Land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%) or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.
Zone 3b The Functional Floodplain	Land where water has to flow or be stored in times of flood. (Land which would flood with an annual probability of 1 in 20 (5%) or greater in any year or is designed to flood in an extreme (0.1%) flood or at another probability to be agreed between the LPA and the EA including water conveyance routes).

1.2.3. NPPG for Flood Risk and Coastal Change identifies that all types of development are appropriate in Flood Zone 1.

1.2.4. The site is currently undeveloped and, as such, does not have a vulnerability classification. Proposals for the site are for residential dwellings which have a vulnerability classification of ‘More Vulnerable’.

1.2.5. NPPG and associated documents identify that site-specific flood risk assessments should identify and assess the risks of all forms of flooding to and from the development and demonstrate how these flood risks will be managed so that the development remains safe throughout its lifetime, taking climate change into account.

2. Site Location & Surrounding Area

2.1. The site is located on the south western side of Filbert Close, on the south western side of Hatfield. The south eastern boundary is defined by the rear of properties fronting Cloverland, while a recreational ground known as Redhall Lane Park defines the south western boundary. The north western boundary of the site abuts Lane End, which is a country lane.

2.2. Inspection of the topographical survey identifies that the site generally falls from north east to south west. The highest recorded level on the topographical survey is 89.13m AOD, located near the western corner, and the lowest surveyed level is 84.45m AOD, located on the south western boundary.

2.3. The site is located within a Groundwater Source Protection Total Catchment Zone (Zone 3), which is defined as the total area needed to support the abstraction or discharge form a protected groundwater source. A copy of the EA Groundwater Source Protection Zone map is provided in **Appendix B**.

2.4. Inspection of the British Geological Survey (BGS) website identifies that the underlying bedrock geology of the site comprises the Lewes Nodular Chalk Formation and Seaford Chalk Formation. However, it is noted that the site lies close to the extent of the Lambeth Group bedrock. Local borehole scans obtained from the BGS website indicate that the area in the vicinity of the site is underlain by a gravelly clay strata overlaying chalk.

2.5. Inspection of the EA Surface Water Flood Risk Map identifies that there are areas at low risk of surface water flooding within the site. The velocity map for the low surface water flood risk indicates that there is a low risk surface water flow path which originates from Filbert Close and runs southwards across the site towards the A1.

3. Existing Drainage

3.1. Surface Water Drainage

3.1.1. The site is primarily greenfield apart from an area of approximately 400m^2 hardstanding in the northern corner. The topographical survey does not identify how this impermeable area currently drains, but historic records show that this area drains via 2No. gullies to a surface water drain which served the former school. The surface water drain is shown running along the north western boundary, connecting to the public surface water sewer which runs through the south of the site. An Existing Drainage Plan, Drawing ST-2629-03, has been prepared and is provided in **Appendix C**.

3.1.2. Surface water runoff across the remaining greenfield areas of the site currently flows overland towards the south west.

3.1.3. There are no receiving watercourses within the vicinity of the site. The nearest designated watercourse is an Ordinary Watercourse located approximately 200m to the west of the site, on the western side of the A1.

3.1.4. The site lies within the Ellen Brook/Upper Colne catchment. Ellen Brook, which is an EA designated Main River, is located approximately 850m to the north west of the site.

3.1.5. TWU sewer records have been obtained for the area. The records identify a public surface water sewer running south west across the site from Filbert Close. This sewer connects to a 525mm diameter public surface water sewer in Lane End, which then runs south eastwards through the south of the site. Both of these sewers have been identified on the topographical survey. TWU sewer records are provided in **Appendix D**. These sewers have been incorporated within the development layout and will include associated easements.

3.1.6. The topographical survey identifies two manholes within the north west of the site which appear to be related to the public surface water sewer and historic school outfall. One of the identified manholes is recorded to include a sluice gate.

3.1.7. The Winter Rain Acceptance Potential (WRAP) for the area is identified as Soil Class 2. However, borehole geotechnical information from the BGS website indicates that the underlying soil conditions would reflect WRAP Soil Class 3. Greenfield runoff rates have been calculated based upon The SuDS Manual (C753) which gives flow rates as follows, a copy of the calculation sheet is provided in **Appendix D**:

Greenfield Runoff (l/s)		
1 in 1 year	Q1	2.12
1 in 30 years	Q30	5.75
1 in 100 years	Q100	7.97

3.1.8. As previously stated, a 400m^2 impermeable area within the north of the site currently discharges to the public surface water sewer network at an uncontrolled rate. The brownfield runoff rate has been calculated based upon the Modified Rational Method which gives the following flow rates, a copy of the calculation sheet is provided in **Appendix D**:

Storm Event	Rainfall Intensity	Peak Runoff Rate
1 in 1 year	50mm/h	5.56l/s
1 in 30 years	116mm/h	14.01l/s
1 in 100 years	153mm/h	16.90l/s

3.2. <u>Foul Drainage</u>

3.2.1. Inspection of the TWU sewer records show that a public foul water sewer runs south westwards across the site from Filbert Close. This sewer connects to a 225mm diameter public foul water sewer in Lane End, which runs south eastwards across the southern part of the site. The public foul water sewers have been identified on the topographical survey, which shows that they both run parallel to the aforementioned public surface water sewers. These sewers have been incorporated within the development layout and will include associated easements.

3.2.2. Historic records indicate that the foul water outfall from the school runs westwards from the north eastern boundary towards the public foul water sewer. The topographical survey identified a separate foul water drain connecting to the public foul water sewer in Lane End in addition to the foul sewer originating from Filbert Close. The survey also identified an upstream inspection chamber associated with the additional main, located within the site. However, the survey did not identify any further foul water infrastructure upstream of the inspection chamber.

3.2.3. It is recommended that further investigations are carried out to confirm the routes and status of all the historic and current drains/sewers within the site.

4. Proposed Development

4.1. Development proposals comprise 39No. dwellings, formation of a new vehicular access and associated parking and landscaping.

4.2. The proposed dwellings would have an NPPF flood risk vulnerability classification of 'More Vulnerable'. As previously discussed, the proposed development will be situated within Flood Zone 1. NPPG identifies that all classifications of development are permitted within Flood Zone 1.

5. Proposed Site Drainage

5.1. Surface Water Drainage

5.1.1. The site is primarily greenfield with an area of approximately 400m^2 (0.04ha) hardstanding in the northern corner. As such, the proposed development will generate an increase in the impermeable area. Based upon the latest development layout, the proposed development would generate an impermeable area of approximately 5,900m^2 (0.59ha).

5.1.2. An Indicative Drainage Strategy, Drawing ST-2629-11, is provided in **Appendix F**. The strategy demonstrates a proposed Sustainable Drainage Systems (SuDS) layout to provide sufficient source control and storage to avoid flooding within the site during all storms up to and including the 1 in 100 year storm event plus a 40% allowance for climate change.

5.1.3. In accordance with EA guidance, the order of consideration for the disposal of surface water runoff from a development should be as follows; infiltration methods, watercourses then public sewer network.

5.1.4. Infiltration tests were not provided for this Outline Planning Application. Inspection of the BGS website identifies that the bedrock geology of the site comprises Lewes Nodular Chalk Formation and Seaford Chalk Formation, although local boreholes have indicated that a clay strata overlays the chalk bedrock. The Client has identified that the site lies within an area where there is potential for the presence of chalk mines. A Risk Evaluation Assessment has been undertaken by Pell Frischmann in this regard which recommended against the use of infiltration drainage, although suggested that infiltration drainage may potentially only be considered within open space areas which are well away from any dwellings, gardens, roads or services.

5.1.5. The nearest watercourse is located approximately 200m to the west of the site, with the A1 and third party land between. It is therefore considered that an outfall to a nearby watercourse is not suitable for the proposed development.

5.1.6. Public surface water sewers run through the application site and are considered the most suitable point of surface water discharge from the development.

5.1.7. A Pre-Planning Enquiry has been submitted to TWU to confirm whether a potential connection to the public sewer would be acceptable. In their response, TWU confirmed that a surface water connection would be acceptable, provided that infiltration methods and a connection to a nearby watercourse are shown not to be feasible. However, TWU identified that a connection to the public surface water sewer would need to be restricted to a discharge rate of 5l/s/per hectare. A copy of the TWU correspondence is provided in **Appendix G**.

5.1.8. As previously discussed, the greenfield runoff rate for the application site equates to 2.12l/s for a 1 in 1 year storm event, 5.75l/s for a 1 in 30 year storm event and 7.97l/s for a 1 in 100 year storm event. However, there is an existing connection to the public surface water sewer which is positively draining an area of hardstanding within the north of the site. Brownfield runoff calculations identify that this area of hardstanding is currently discharging to the public surface water sewer at 5.56l/s for a 1 in 1 year storm event, 14.01l/s for a 1 in 30 year storm event and 16.90l/s for a 1 in 100 year storm event. Therefore, based upon the above and TWU's response, a proposed discharge rate of 5l/s for all storm events up to and including the 1 in 100 year storm event is considered to provide a significant betterment on the existing situation.

5.1.9. Table 26.2 of the SuDS Manual gives pollution hazard indices for different land use classifications. A summarised version of this table is reproduced below:

Land use	**Pollution hazard level**	**Total suspended solids**	**Metals**	**Hydro-carbons**
Residential roofs	Very low	0.2	0.2	0.05
Residential driveways, low traffic roads and non-residential car parking with infrequent change (< 300 traffic movements a day)	Low	0.5	0.4	0.4

5.1.10. Table 26.3 of the SuDS Manual provides typical treatments levels from various different SuDS features. The following SuDS features will be included as part of the surface water drainage proposals for the development:

	Mitigation indices		
Type of SuDS component	**TSS**	**Metals**	**Hydrocarbons**
Filter Drain	0.4	0.4	0.4
Swale	0.5	0.6	0.6
Permeable Paving	0.7	0.6	0.7
Detention Basin	0.5	0.5	0.6

5.1.11. To deliver adequate treatment, the selected SuDS components should have a total mitigation index that equals or is greater than the pollution hazard index. Where a single SuDS component is insufficient, additional components in a series would be required, where:

Total SuDS mitigation index = mitigation index$_1$ + 0.5 (mitigation index$_n$)

5.1.12. Surface water runoff from residential roofs and roads will, as a minimum, pass through a filter drain and detention basin. Therefore, the total SuDS mitigation for residential roofs and roads would be as follows:

	Mitigation indices		
SuDS components	**TSS**	**Metals**	**Hydrocarbons**
Filter Drain	0.4	0.4	0.4
Detention Basin	0.35	0.3	0.35
Total	**0.75**	**0.7**	**0.75**

5.1.13. From the above tables it can be seen that the SuDS proposed on the development would provide more than adequate treatment for the potential pollution hazards generated by the land uses.

5.1.14. Drainage proposals will retain the 1 in 100 year storm within the site, without generating a flood risk to proposed dwellings within or adjacent to the development, while also making provision for climate change, relating to a 40% increase in rainfall intensity.

5.1.15. The proposed drainage strategy has been modelled using Micro Drainage. Copies of Micro Drainage output files for the development are provided in **Appendix H**, demonstrating that the proposed SuDS features provide sufficient storage to avoid flooding during the 1 in 100 year storm event plus 40% allowance for climate change.

5.1.16. As previously mentioned, there is an existing low risk of surface water flooding on the site, with an associated low risk surface water flow route running southwards across the site. Overland flow routes have been shown on the drainage strategy to demonstrate that exceedance flow routes have been considered and how surface water originating from off-site will be managed through the development.

5.2. Foul Drainage

5.2.1. A proposed development of 39No. residential units would be expected to generate a peak foul flow rate of approximately 1.81l/s, based upon 4000 litres/unit dwelling/day, in accordance with Sewers for Adoption 7th Edition.

5.2.2. An indicative strategy for the discharge of foul water flows from the development has been prepared and is shown in principle on Drawing ST-2629-11, attached in **Appendix F**. This drawing shows an illustrative drainage layout to demonstrate that the site can be drained based upon the proposed development. This drawing is a strategy only and must not be used for construction purposes.

5.3. Detailed Design and Approvals

5.3.1. During detailed design stage, discharge rates and connections will need to be approved by TWU via a Section 106 Agreement for connections to the public sewer, where necessary.

5.3.2. Proposed drainage systems will need to be modelled in Micro Drainage to confirm required pipe sizes and storage volumes.

5.3.3. Overland flow routes have been shown on the drainage strategy through the development, to identify proposed flow paths for surface water runoff during extreme storm events. Final external levels will be designed to prevent overland flow routes from entering buildings.

5.4. Maintenance of Drainage Features

5.4.1. The design process should consider the maintenance of the components (access, waste management etc.) including any corrective maintenance to repair defects or improve performance of SuDS. Inlets, outlets, control structures or other below ground features should be as shallow as reasonably possible to allow easy access for maintenance and to reduce safety risks, while ensuring that sufficient depth is maintained for structural stability.

5.4.2. A SuDS Management Plan must be provided prior to the first occupation which will identify the following:

- The function of SuDS.
- How and why it works on the site.
- Impacts on amenity and wildlife, indicating how they can be enhanced.
- Health and safety issues.

- Long-term expectations for the SuDS on site.

5.4.3. Usually SuDS components are on or near the surface and most can be managed using landscape maintenance techniques. Typical inspection and maintenance requirements for surface SuDS features are identified below:

Activity	Indicative frequency	Typical tasks
Routine/regular maintenance	Monthly (for normal care of SuDS)	• litter picking • grass cutting (cuttings to compost, wildlife piles or removed from site) Height and frequency dependent upon amenity of grass area. • inspection of inlets, outlets and control structures.
Occasional maintenance	Annually (dependent on the design)	• silt control around components • vegetation management around components • suction sweeping of permeable paving in autumn after leaf fall • silt and debris removal from inlets, outlets, gratings, catchpits, control chambers, soakways and cellular storage. • strim wet swale or pond edges in September to October or 3-year rotation for wildlife value • wetland vegetation to be cut to 30% height annually and to 100mm on a 3 year rotation • remove overhanging trees or growth within SuDS features
Remedial maintenance	As required (tasks to repair problems due to damage or vandalism)	• inlet/outlet repair • erosion repairs • reinstatement of edgings • reinstatement following pollution • removal of silt build up.

5.4.4. For below-ground SuDS, such as permeable paving and filter trenches the manufacturer or designer should provide maintenance advice. This should include routine and long-term actions that can be incorporated into the SuDS Management Plan.

5.4.5. Funding for the maintenance of SuDS features on the site should be resolved at the start of the development process.

6. Summary and Recommendations

6.1 Stomor Ltd has been commissioned by Lambert Smith Hampton, on behalf of Hertfordshire County Council to prepare a Drainage Statement associated with a proposed residential development at the former Hazel Grove Primary School playing field site off Filbert Close in Hatfield.

6.2 The application site has a total area of approximately 0.93ha and currently forms part of the former Hazel Grove Primary School playing fields.

6.3 The proposed development would have a NPPF flood risk vulnerability classification of 'More Vulnerable'. The site is located within Flood Zone 1, which NPPG identifies as being acceptable for 'More Vulnerable' development.

6.4 An existing surface water drain associated with the former school appears to run along the north western boundary of the site, while an existing foul water drain is shown running westwards across the site from the north eastern boundary.

6.5 There are existing public foul and surface water sewers running within the site. Both of which run westwards across the site from the southern end of Filbert Close, before connecting to additional public sewers on the north western boundary and running south eastwards across the site.

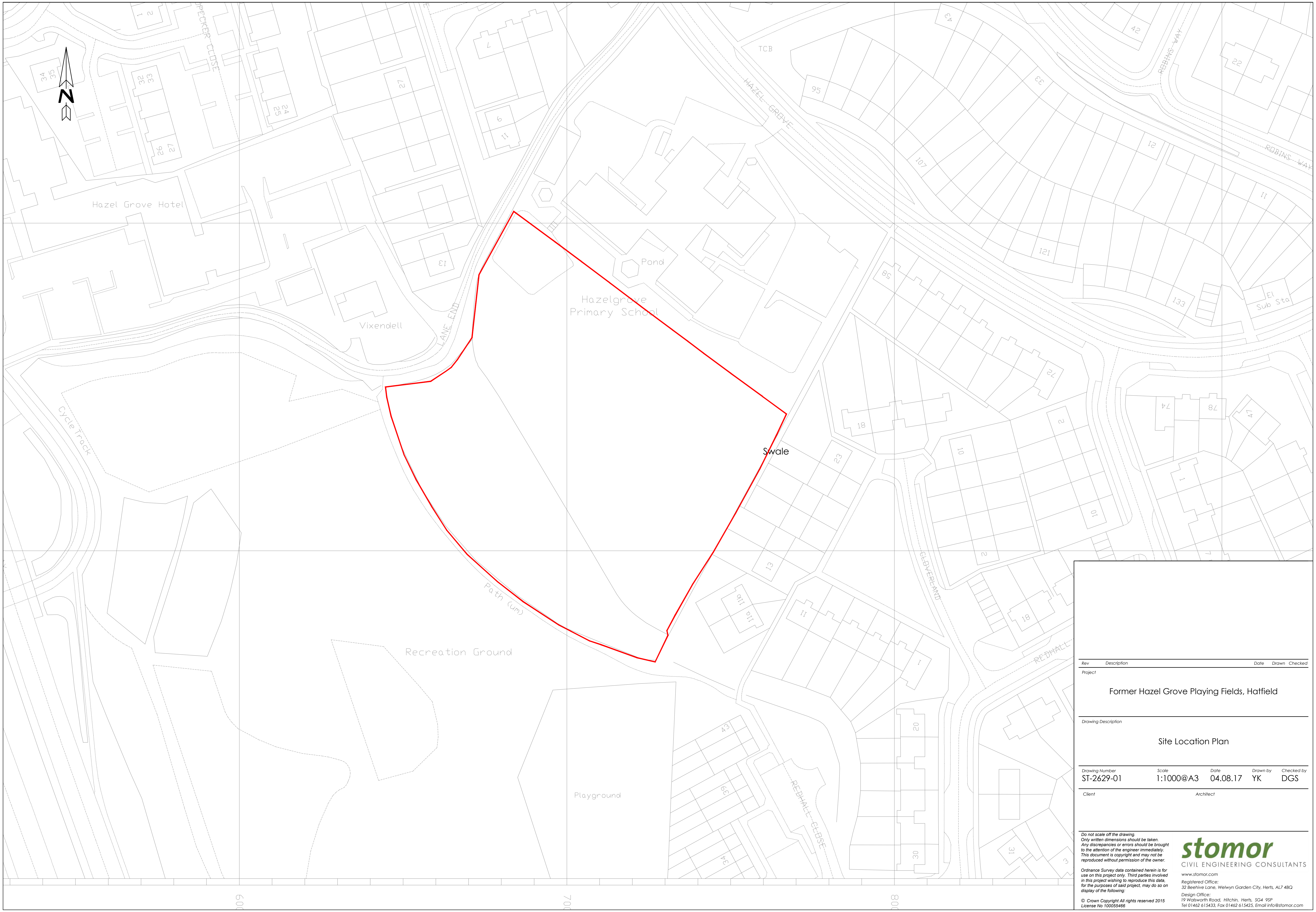
6.6 The proposed drainage strategy identifies potential SuDS measures which are considered feasible across the site. The strategy demonstrates a proposed layout of flow control and attenuation features to provide storage on the development for all storm events up to and including the 1 in 100 year plus a 40% allowance for climate change.

6.7 There is an existing low risk of surface water flooding within the site. Overland flow routes have been considered and are shown on the proposed drainage strategy.

6.8 In accordance with the CIRIA SuDS Manual, the SuDS proposed on the development would provide adequate treatment for the potential pollution hazards generated by the proposed land uses.

6.9 The proposed SuDS solutions will need to have clear, enforceable maintenance regimes in place so that they provide effective flood protection and water treatment for the long term.

APPENDIX A



Rev	Description	Date	Drawn	Checked

Project

Former Hazel Grove Playing Fields, Hatfield

Drawing Description

Site Location Plan

Drawing Number	Scale	Date	Drawn by	Checked by
ST-2629-01	1:1000@A3	04.08.17	YK	DGS

Client

Architect

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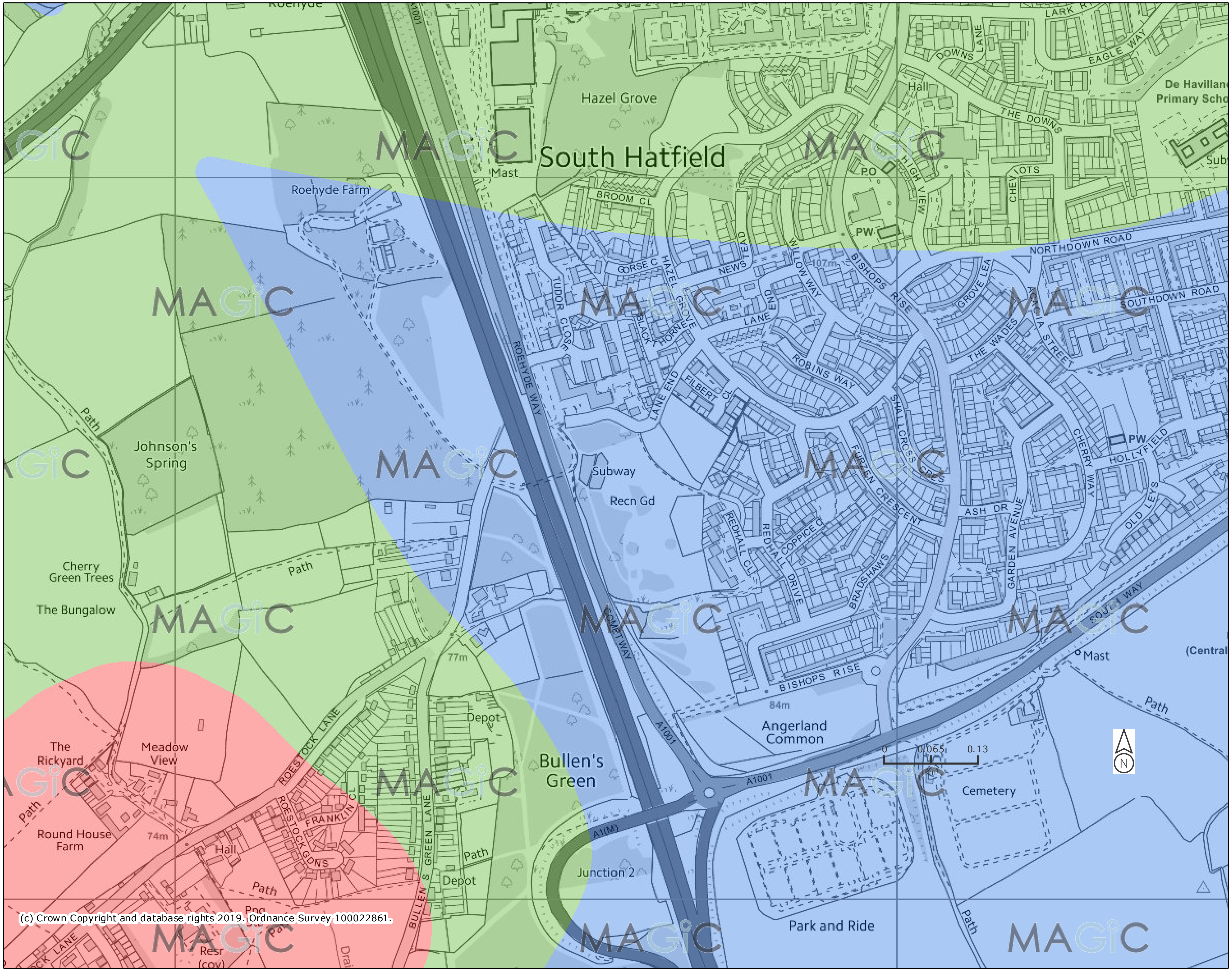
APPENDIX B

Magic Map



Legend

Source Protection Zones merged (England)

- Zone I - Inner Protection Zone
- Zone I - Subsurface Activity
- Zone II - Outer Protection Zone
- Zone II - Subsurface Activity
- Zone III - Total Catchment
- Zone III - Subsurface Activity
- Zone of Special Interest

Projection = OSGB36
xmin = 520300
ymin = 205900
xmax = 523000
ymax = 207300

0 0.1 0.2
km

Map produced by MAGIC on 20 August, 2019.

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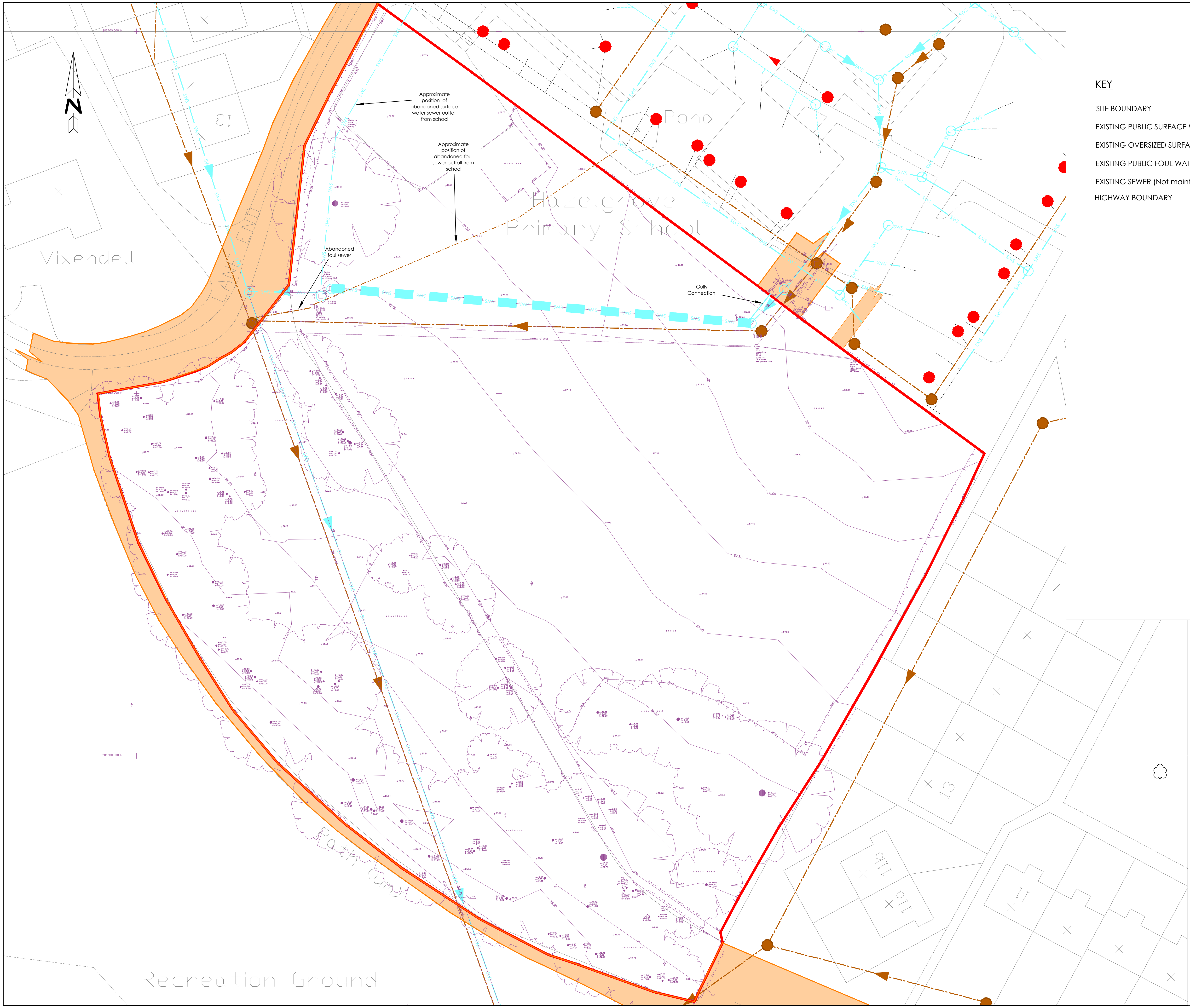
APPENDIX C



KEY

SITE BOUNDARY	
EXISTING PUBLIC SURFACE WATER SEWER	
EXISTING OVERSIZED SURFACE WATER SEWER	
EXISTING PUBLIC FOUL WATER SEWER	
EXISTING SEWER (Not maintained or operated by TWU)	
HIGHWAY BOUNDARY	

Rev	Description	Date	Drawn	Checked

Project

Former Hazel Grove School Playing Fields, Hatfield

Drawing Description

Topographical Survey and Existing Drainage Plan

Drawing Number	Scale	Date	Drawn by	Checked by
ST-2629-03	1:500@A3	04.09.17	DGS	SB

Client

Architect

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APPENDIX D

Asset location search

Thames Water Property Searches

Stomor Ltd
19

HITCHIN
SG4 9SP

Search address supplied 41
Filbert Close
Hatfield
AL10 9SH

Your reference 2629-Former Hazel Grove Playing Field

Our reference ALS/ALS Standard/2017_3607499

Search date 10 July 2017

Notification of Price Changes...

From **1 September 2016** Thames Water Property Searches will be increasing the prices of its Asset Location Searches. This will be the first price rise in three years and is in line with the RPI at 1.84%. The increase follows significant capital investment in improving our systems and infrastructure.

Enquiries received with a higher payment prior to 1 September 2016 will be non-refundable. For further details on the price increase please visit our website at

www.thameswater-propertysearches.co.uk

Thames Water Utilities Ltd
Property Searches, PO Box 3189, Slough SL1 4WW
DX 151280 Slough 13

searches@thameswater.co.uk
www.thameswater-propertysearches.co.uk

0845 070 9148

searchcode

Asset location search

Thames Water Property Searches

Search address supplied: 41, Filbert Close, Hatfield, AL10 9SH

Dear Sir / Madam

An Asset Location Search is recommended when undertaking a site development. It is essential to obtain information on the size and location of clean water and sewerage assets to safeguard against expensive damage and allow cost-effective service design.

The following records were searched in compiling this report: - the map of public sewers & the map of waterworks. Thames Water Utilities Ltd (TWUL) holds all of these.

This searchprovides maps showing the position, size of Thames Water assets close to the proposed development and also manhole cover and invert levels, where available.

Please note that none of the charges made for this report relate to the provision of Ordnance Survey mapping information. The replies contained in this letter are given following inspection of the public service records available to this company. No responsibility can be accepted for any error or omission in the replies.

You should be aware that the information contained on these plans is current only on the day that the plans are issued. The plans should only be used for the duration of the work that is being carried out at the present time. Under no circumstances should this data be copied or transmitted to parties other than those for whom the current work is being carried out.

Thames Water do update these service plans on a regular basis and failure to observe the above conditions could lead to damage arising to new or diverted services at a later date.

Contact Us

If you have any further queries regarding this enquiry please feel free to contact a member of the team on 0845 070 9148, or use the address below:

Thames Water Utilities Ltd
Property Searches
PO Box 3189
Slough
SL1 4WW

Email: searches@thameswater.co.uk
Web: www.thameswater-propertysearches.co.uk

Waste Water Services

Please provide a copy extract from the public sewer map.

Enclosed is a map showing the approximate lines of our sewers. Our plans do not show sewer connections from individual properties or any sewers not owned by Thames Water unless specifically annotated otherwise. Records such as "private" pipework are in some cases available from the Building Control Department of the relevant Local Authority.

Where the Local Authority does not hold such plans it might be advisable to consult the property deeds for the site or contact neighbouring landowners.

This report relates only to sewerage apparatus of Thames Water Utilities Ltd, it does not disclose details of cables and or communications equipment that may be running through or around such apparatus.

The sewer level information contained in this response represents all of the level data available in our existing records. Should you require any further Information, please refer to the relevant section within the 'Further Contacts' page found later in this document.

For your guidance:

- The Company is not generally responsible for rivers, watercourses, ponds, culverts or highway drains. If any of these are shown on the copy extract they are shown for information only.
- Any private sewers or lateral drains which are indicated on the extract of the public sewer map as being subject to an agreement under Section 104 of the Water Industry Act 1991 are not an 'as constructed' record. It is recommended these details be checked with the developer.

Clean Water Services

Please provide a copy extract from the public water main map.

With regard to the fresh water supply, this site falls within the boundary of another water company. For more information, please redirect your enquiry to the following address:

Affinity Water Ltd
Tamblin Way
Hatfield
AL10 9EZ
Tel: 0845 7823333

For your guidance:

- Assets other than vested water mains may be shown on the plan, for information only.
- If an extract of the public water main record is enclosed, this will show known public water mains in the vicinity of the property. It should be possible to estimate the likely length and route of any private water supply pipe connecting the property to the public water network.

Payment for this Search

A charge will be added to your suppliers account.

Further contacts:

Waste Water queries

Should you require verification of the invert levels of public sewers, by site measurement, you will need to approach the relevant Thames Water Area Network Office for permission to lift the appropriate covers. This permission will usually involve you completing a TWOSA form. For further information please contact our Customer Centre on Tel: 0845 920 0800. Alternatively, a survey can be arranged, for a fee, through our Customer Centre on the above number.

If you have any questions regarding sewer connections, budget estimates, diversions, building over issues or any other questions regarding operational issues please direct them to our service desk. Which can be contacted by writing to:

Developer Services (Waste Water)
Thames Water
Clearwater Court
Vastern Road
Reading
RG1 8DB

Tel: 0845 850 2777
Email: developer.services@thameswater.co.uk

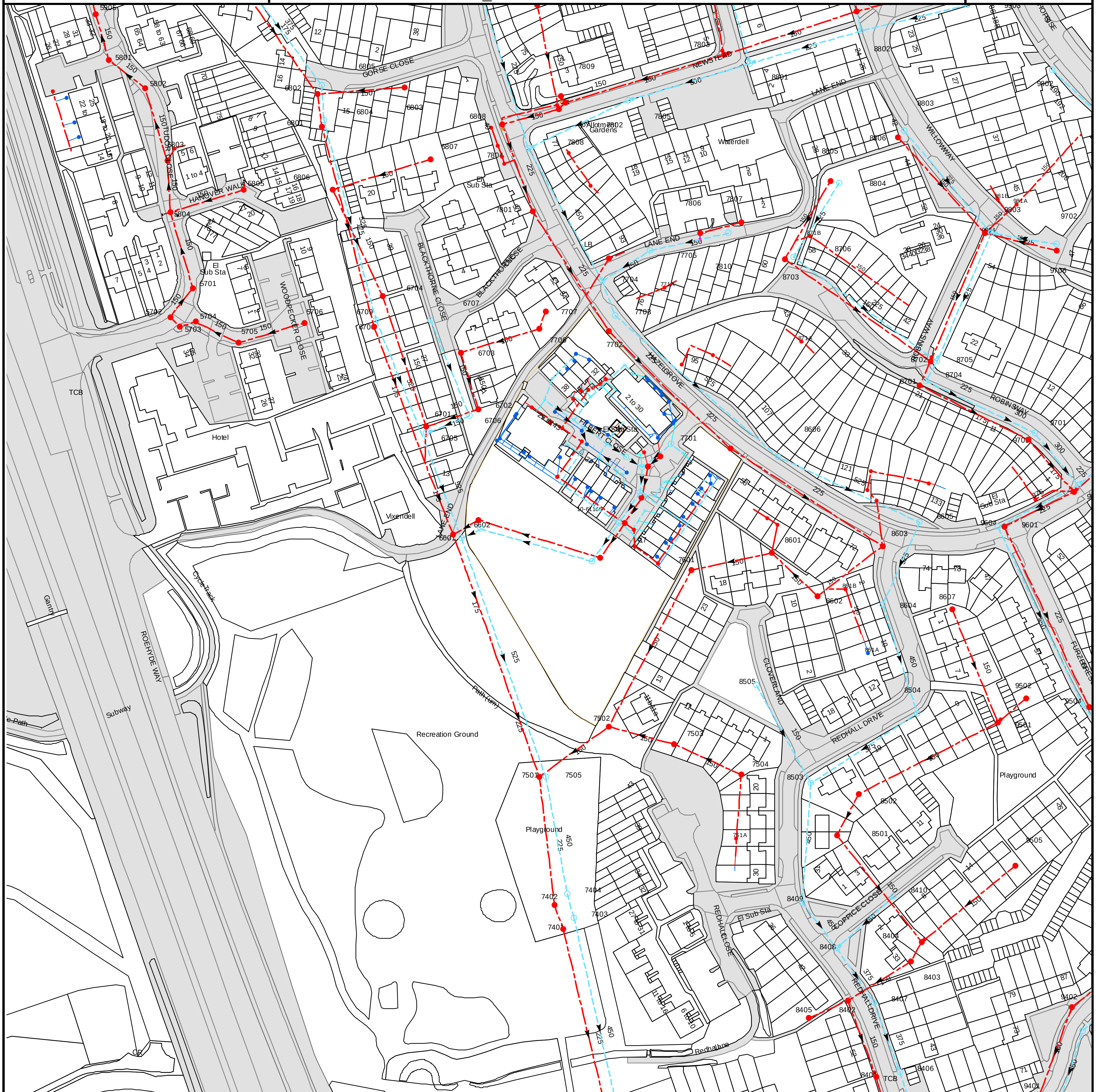
Clean Water queries

Should you require any advice concerning clean water operational issues or clean water connections, please contact:

Developer Services (Clean Water)
Thames Water
Clearwater Court
Vastern Road
Reading
RG1 8DB

Tel: 0845 850 2777
Email: developer.services@thameswater.co.uk

Asset Location Search Sewer Map - ALS/ALS Standard/2017_3607499



The width of the displayed area is 500 m and the centre of the map is located at OS coordinates 521710,206656

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.

Based on the Ordnance Survey Map with the Sanction of the controller of H.M. Stationery Office, License no. 100019345 Crown Copyright Reserved.

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
8405	87.87	86.36
9402	87.26	84.86
8407	87.48	85.75
8402	87.67	86.15
8403	n/a	n/a
8408	88.23	86.5
8404	89.53	87.18
7401	84.98	80.87
7403	84.99	81.55
8409	88.45	86.7
8410	89.59	88.31
7404	85.15	81.6
9505	90.87	89.55
751A	n/a	n/a
8501	89.35	88.04
8502	89.87	88.47
8503	89.02	87.13
7504	88.32	85.95
7503	86.88	85.2
7502	86.02	84.37
9501	92.29	89.71
8504	90.77	88.62
9502	93.16	91.14
8505	89.11	87.62
861A	n/a	n/a
8607	91.97	90.71
8604	91.27	89
9404	87.33	84.49
8401	86.63	84.12
8406	86.63	83.58
9605	95.15	91.65
9602	95.09	91.58
9504	93.84	90.92
9503	93.8	90.92
771E	n/a	n/a
761Z	n/a	n/a
762K	n/a	n/a
7601	88.98	86.97
761Y	n/a	n/a
761X	n/a	n/a
761W	n/a	n/a
761A	n/a	n/a
762F	n/a	n/a
7701	91.62	89.03
861H	n/a	n/a
8601	90.33	87.31
861G	n/a	n/a
8606	91.7	89.53
8602	89.94	87.64
861B	n/a	n/a
861E	n/a	n/a
861D	n/a	n/a
861F	n/a	n/a
8603	91.81	88.71
8605	92.08	89.28
861C	n/a	n/a
9604	93.23	91.19
9601	93.24	91.2
9705	95.72	93.83
9701	95.83	93.98
961A	n/a	n/a
681D	n/a	n/a
771B	n/a	n/a
7803	99.83	96.53
7810	n/a	n/a
7807	93.09	92.03
8801	100.8	96.77
8703	96.98	94.88
8706	97.11	94.86
871A	n/a	n/a
871B	n/a	n/a
8805	101.13	97.61
8804	101.14	98.69
8901	104.14	101.47
8802	104.12	101.41
8806	n/a	n/a
8803	103.92	101.21
8701	96.42	94.01
8704	96.67	93.99
8702	97.6	94.25
8705	97.62	94.27
9903	106.81	104.48
9804	102.62	98.4
9803	102.69	98.41
981B	n/a	n/a
981A	n/a	n/a
9802	n/a	n/a
9706	102.52	101.3
9702	102.55	101.29
763A	n/a	n/a
761C	n/a	87.61

Manhole Reference	Manhole Cover Level	Manhole Invert Level
761J	n/a	89.11
763B	n/a	n/a
772X	n/a	n/a
771D	n/a	89.22
771F	n/a	n/a
772B	n/a	n/a
772F	n/a	n/a
772V	n/a	n/a
771X	n/a	n/a
773I	n/a	n/a
772A	n/a	n/a
772G	n/a	n/a
772U	n/a	n/a
773J	n/a	n/a
771Y	n/a	n/a
771G	n/a	n/a
771W	n/a	n/a
772T	n/a	n/a
772S	n/a	n/a
773A	n/a	n/a
771V	n/a	n/a
772R	n/a	n/a
771O	n/a	n/a
773B	n/a	n/a
772J	n/a	n/a
762H	n/a	n/a
761H	n/a	83.76
761M	n/a	86.32
762E	n/a	n/a
762I	n/a	n/a
762D	n/a	n/a
762C	n/a	n/a
762O	n/a	n/a
762J	n/a	n/a
762B	n/a	n/a
761L	n/a	87.21
761G	n/a	86.93
762N	n/a	n/a
762Y	n/a	n/a
761K	n/a	88.02
762X	n/a	n/a
762M	n/a	n/a
761E	n/a	87.44
762W	n/a	n/a
762V	n/a	n/a
762L	n/a	n/a
762U	n/a	n/a
762Z	n/a	n/a
762R	n/a	n/a
761D	n/a	87.54
761I	n/a	86.65
762T	n/a	n/a
7808	92.58	90.41
7809	n/a	n/a
7802	92.85	91.92
771N	n/a	n/a
781A	n/a	n/a
771M	n/a	n/a
771K	n/a	n/a
771L	n/a	n/a
781B	n/a	n/a
773E	n/a	n/a
771U	n/a	n/a
7704	91.6	89.82
773D	n/a	n/a
773K	n/a	n/a
7702	91.5	89.33
7703	91.36	89.76
771T	n/a	n/a
7805	95.71	91.48
771Q	n/a	n/a
771P	n/a	n/a
772P	n/a	n/a
7705	92.7	91.63
772Q	n/a	n/a
771A	n/a	n/a
771C	n/a	n/a
7806	94.21	93.22
6801	87.74	83.58
6805	87.81	83.06
6804	87.75	83.05
6806	88.05	86.69
6709	87.52	82.83
6704	87.84	86.25
6803	90.18	86.39
6807	90.03	87.06
6707	88.4	87.07
681A	n/a	n/a
681B	n/a	n/a
681C	n/a	n/a
6808	92.03	89.83
7804	91.98	90.05
7801	91.83	89.53

Manhole Reference	Manhole Cover Level	Manhole Invert Level
7901	94.7	91.7
7707	90.58	89.09
7505	84.93	82.13
7501	85	81.51
6602	85.82	82.58
6601	85.8	82.4
661B	n/a	83.63
661A	n/a	83.58
762S	n/a	n/a
763C	n/a	n/a
671F	n/a	n/a
671B	n/a	n/a
671E	n/a	n/a
6705	87.22	83.59
6701	n/a	n/a
773G	n/a	n/a
671G	n/a	n/a
6706	87.91	86.24
671A	n/a	n/a
771Z	n/a	n/a
6702	88.16	86.66
773F	n/a	n/a
771H	n/a	n/a
771J	n/a	n/a
6703	88.35	87.28
5705	n/a	n/a
7706	89.87	88.69
6708	87.49	83.01
5703	n/a	n/a
481D	n/a	n/a
481A	n/a	n/a
481B	n/a	n/a
481C	n/a	n/a
5905	82.17	79.82
5801	82.48	79.99
5802	82.72	80.11
5803	83	80.33
5702	n/a	n/a
5804	82.83	80.51
581A	n/a	n/a
5701	82.6	80.72
5704	n/a	n/a
5805	84.8	82.62
5706	n/a	n/a
6802	87.81	83.64
7402	84.95	80.91

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 0845 070 9148.

APPENDIX E

HR Wallingford
Working with water

Greenfield runoff estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	
Site name:	ST-2629
Site location:	Hatfield

This is an estimation of the greenfield runoff rate limits that are needed to meet normal best practice criteria in line with Environment Agency guidance “Preliminary rainfall runoff management for developments”, W5-074/A/TR1/1 rev. E (2012) and the SuDS Manual, C753 (Ciria, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site coordinates

Latitude:	51.74522° N
Longitude:	0.23857° W
Reference:	
Date:	2019-08-22 13:30

Methodology	IH124

Site characteristics

Total site area (ha)	0.93

Methodology

Qbar estimation method	Calculate from SPR and SAAR
SPR estimation method	Calculate from SOIL type

	Default	Edited
SOIL type	2	3
HOST class	---	---
SPR/SPRHOST	0.3	0.37

Hydrological characteristics

	Default	Edited
SAAR (mm)	661	661
Hydrological region	6	6
Growth curve factor: 1 year	0.85	0.85
Growth curve factor: 30 year	2.3	2.3
Growth curve factor: 100 year	3.19	3.19

Notes:

(1) Is Q_{BAR} < 2.0 l/s/ha?

Normally limiting discharge rates which are less than 2.0 l/s/ha are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consents are usually set at 5.0l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set in which case blockage work must be addressed by using appropriate drainage elements

(3) Is SPR/SPRHOST ≤ 0.3?

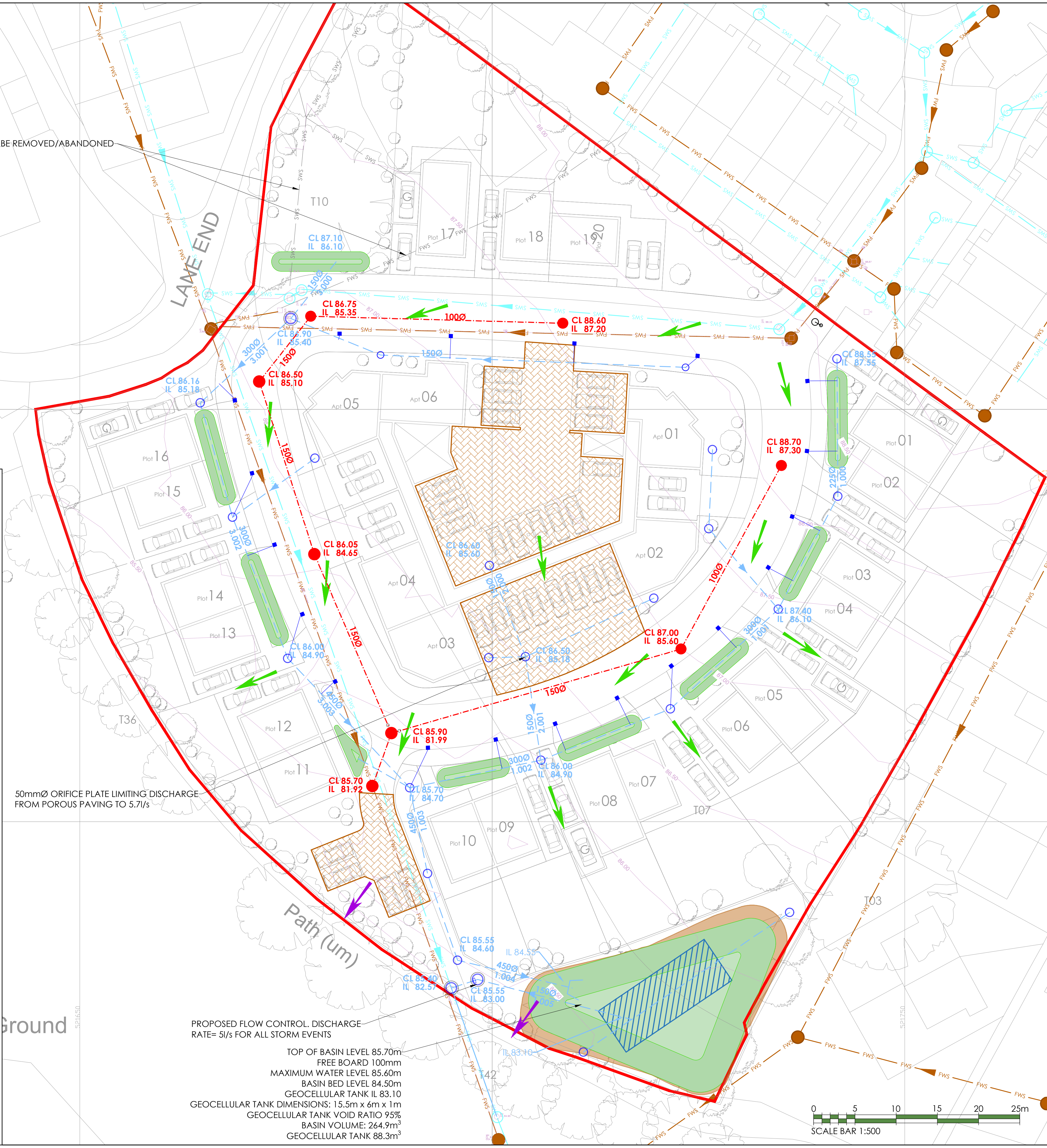
Where groundwater levels are low enough the use of soakaways to avoid discharge offsite may be a requirement for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Qbar (l/s)	1.58	2.5
1 in 1 year (l/s)	1.35	2.12
1 in 30 years (l/s)	3.65	5.75
1 in 100 years (l/s)	5.06	7.97

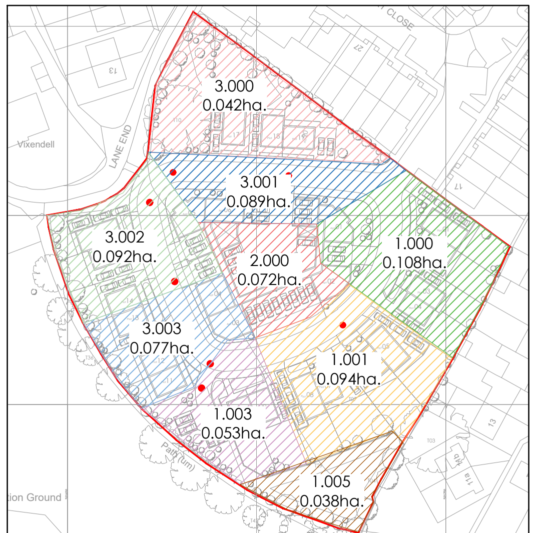
This report was produced using the greenfield runoff tool developed by HR Wallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement, which can both be found at http://uksuds.com/terms-and-conditions.htm. The outputs from this tool have been used to estimate storage volume requirements. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for use of this data in the design or operational characteristics of any drainage scheme.

APPENDIX F



PIPE No.	Subtotal Area (ha.)	PIMP	Imp. Area (ha.)	Imp. Area + 10% Urban Creep (ha.)
1.000	0.143	70%	0.098	0.108
1.001	0.146	60%	0.086	0.094
2.000	0.074	90%	0.066	0.072
2.001	-	-	-	-
1.002	-	-	-	-
3.000	0.130	30%	0.038	0.042
3.001	0.091	95%	0.085	0.089
3.002	0.114	75%	0.084	0.092
3.003	0.089	80%	0.070	0.077
1.003	0.089	55%	0.048	0.053
1.004	-	-	-	-
1.005	0.055	70%	0.038	0.038
TOTAL	0.930	67%	0.611	0.665

DRAINAGE AREAS PLAN
SCALE 1:2000



AREAS SHOWN IN THIS PLAN REPRESENT THE IMPERMEABLE AREA + 10% URBAN CREEP.

EXISTING TOTAL IMPERMEABLE AREA: ≈0.04ha
PROPOSED TOTAL IMPERMEABLE AREA: ≈0.59ha

PROPOSED IMP. AREA + 10% URBAN CREEP: ≈0.65ha

EXISTING GREENFIELD RUNOFF RATES (0.93ha):

- 1 IN 1 Y.S.= 1.3l/s
- 1 IN 30 Y.S.= 3.6l/s
- 1 IN 100 Y.S.=5.02l/s

EXISTING BROWNFIELD RUNOFF RATES (0.04ha):

- 1 IN 1 Y.S.= 5.6l/s
- 1 IN 30 Y.S.= 14.0l/s
- 1 IN 100 Y.S.=16.9l/s

PROPOSED DISCHARGE RATE FOR ALL STORM EVENTS: 5l/s

KEY

- SITE BOUNDARY
- EXISTING PUBLIC FOUL WATER SEWER
- EXISTING PUBLIC SURFACE WATER SEWER
- PUBLIC FOUL WATER SEWER TO BE REMOVED
- PUBLIC SURFACE WATER SEWER TO BE REMOVED
- PROPOSED SURFACE WATER PRIVATE DRAIN
- PROPOSED FOUL WATER PRIVATE DRAIN
- PROPOSED INSPECTION CHAMBER
- PROPOSED MANHOLE
- PROPOSED HYDROBRAKE
- PROPOSED ROAD GULLY
- PROPOSED POROUS PAVING WITH 350mm SUB-BASE
- PROPOSED DRY SWALE
- PROPOSED ATTENUATION BASIN
- PROPOSED GEOCELLULAR TANK
- PROPOSED OVERLAND FLOW ROUTE
- EXCEEDANCE FLOW ROUTE

THIS IS AN INDICATIVE DRAINAGE STRATEGY AND SHOULD NOT BE USED FOR CONSTRUCTION PURPOSES. DRAINAGE PROPOSALS ARE SUBJECT TO DETAILED DESIGN. THE ACTUAL POSITION AND DETAILS OF ANY EXISTING SERVICES ARE SUBJECT TO A DETAILED SURVEY.

Rev	Description	Date	Drawn	Checked

Project

Former Hazel Grove Playing Fields, Hatfield

Drawing Description

Indicative Drainage Strategy

Drawing Number	Scale	Date	Drawn by	Checked by
ST-2629-11	1:500@A3	20.08.19	SIV	SJB

Client

Architect

Do not scale off the drawing. Only written dimensions should be taken. Any discrepancies or errors should be brought to the attention of the engineer immediately. This document is copyright and may not be reproduced without permission of the owner.

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stomor
CIVIL ENGINEERING CONSULTANTS
www.stomor.com
Registered Office: 32 Beehive Lane, Welwyn Garden City, Herts, AL7 4BQ
Design Office: 19 Walsworth Road, Hitchin, Herts, SG4 9SP
Tel 01462 615433, Fax 01462 615425, Email info@stomor.com

APPENDIX G

Mr Jack Dudmish

STOMOR LTD
19 Walsworth Road.
Hitchin,
Hertfordshire,
SG4 9SP

Wastewater pre-planning
Our ref DS6064896

21 August 2019

Pre-planning enquiry: Capacity Confirmation

Dear Jack,

Thank you for providing information on your development.

Site: Land at Filbert Close, Hatfield, Hertfordshire - AL10 9ED

Existing site: Greenfield site.
Proposed site: Flats (39 units).
Proposed foul water discharge by gravity between manholes TL2106661A & TL2106761M.
Proposed surface water discharge at 5.0 l/s for all storm events up to and including 1:100y+40%CC between manholes TL2106661B & TL2106761H.

We're pleased to confirm that there will be sufficient foul and surface water capacity in our sewerage network to serve your development.

This confirmation is valid for 12 months or for the life of any planning approval that this information is used to support, to a maximum of three years.

You'll need to keep us informed of any changes to your design – for example, an increase in the number or density of homes. Such changes could mean there is no longer sufficient capacity.

What happens next?
Please make sure you submit your connection application, giving us at least 21 days' notice of the date you wish to make your new connection/s.

If you've any further questions, please contact me on 020 3577 7608.

Yours sincerely

Zaid Kazi

Thames Water

APPENDIX H

Existing Network Details for Surface Network 1

* - Indicates pipe has been modified outside of System 1

	PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	k (mm)	HYD SECT	DIA (mm)	Section Type
*	1.000	31.090	1.375	22.6	0.108	5.00	0.600	o	225	Pipe/Conduit
*	1.001	34.481	1.200	28.7	0.094	0.00	0.600	o	300	Pipe/Conduit
*	2.000	12.000	0.420	28.6	0.072	5.00	0.600	o	150	Pipe/Conduit
*	2.001	13.000	0.130	100.0	0.000	0.00	0.600	o	150	Pipe/Conduit
*	1.002	17.033	0.200	85.2	0.000	0.00	0.600	o	300	Pipe/Conduit
*	3.000	6.875	0.550	12.5	0.042	5.00	0.600	o	150	Pipe/Conduit
*	3.001	14.010	0.220	63.7	0.089	0.00	0.600	o	300	Pipe/Conduit
*	3.002	30.298	0.130	233.1	0.092	0.00	0.600	o	300	Pipe/Conduit
*	3.003	21.898	0.200	109.5	0.077	0.00	0.600	o	450	Pipe/Conduit
*	1.003	20.327	0.100	203.3	0.053	0.00	0.600	o	450	Pipe/Conduit
*	1.004	16.288	0.100	162.9	0.000	0.00	0.600	o	450	Pipe/Conduit
*	1.005	15.170	0.530	28.6	0.038	0.00	0.600	o	150	Pipe/Conduit

	PN	US/MH Name	US/CL (m)	US/IL (m)	US C.Depth (m)	DS/CL (m)	DS/IL (m)	DS C.Depth (m)	Ctrl	US/MH (mm)
*	1.000	1	88.550	87.550	0.775	87.400	86.175	1.000		600
*	1.001	2	87.400	86.100	1.000	86.000	84.900	0.800		600
*	2.000	3	86.600	85.600	0.850	86.500	85.180	1.170		600
*	2.001	4	86.500	85.180	1.170	86.000	85.050	0.800	Orifice	600
*	1.002	3	86.000	84.900	0.800	85.700	84.700	0.700		600
*	3.000	4	87.100	86.100	0.850	86.900	85.550	1.200		600
*	3.001	5	86.900	85.400	1.200	86.160	85.180	0.680		1200
*	3.002	6	86.160	85.180	0.680	86.000	85.050	0.650		600
*	3.003	7	86.000	84.900	0.650	85.700	84.700	0.550		600
*	1.003	8	85.700	84.700	0.550	85.600	84.600	0.550		600
*	1.004	9	85.600	84.600	0.550	85.600	84.500	0.650		600
*	1.005	10	85.600	83.100	2.350	85.064	82.570	2.344	Hydro-Brake®	1200

Free Flowing Outfall Details for Surface Network 1

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.005	11	85.064	82.570	0.000	1200	0

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Online Controls for Surface Network 1

Orifice Manhole: 4, DS/PN: 2.001, Volume (m^3): 0.6

Diameter (m) 0.050 Discharge Coefficient 0.600 Invert Level (m) 85.180

Hydro-Brake® Optimum Manhole: 10, DS/PN: 1.005, Volume (m^3): 5.3

Unit Reference	MD-SHE-0087-5000-2500-5000
Design Head (m)	2.500
Design Flow (l/s)	5.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	87
Invert Level (m)	83.100
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	**Head (m)**	**Flow (l/s)**
Design Point (Calculated)	2.500	5.0
Flush-Flo™	0.379	3.6
Kick-Flo®	0.777	2.9
Mean Flow over Head Range	-	3.8

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**
0.100	2.6	1.200	3.6	3.000	5.4	7.000	8.1
0.200	3.4	1.400	3.8	3.500	5.8	7.500	8.4
0.300	3.6	1.600	4.1	4.000	6.2	8.000	8.6
0.400	3.6	1.800	4.3	4.500	6.6	8.500	8.9
0.500	3.6	2.000	4.5	5.000	6.9	9.000	9.1
0.600	3.5	2.200	4.7	5.500	7.2	9.500	9.4
0.800	2.9	2.400	4.9	6.000	7.5		
1.000	3.3	2.600	5.1	6.500	7.8		

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Storage Structures for Surface Network 1

Porous Car Park Manhole: 3, DS/PN: 2.000

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	23.0
Membrane Percolation (mm/hr)	1000	Length (m)	32.0
Max Percolation (l/s)	204.4	Slope (1:X)	40.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	86.150	Cap Volume Depth (m)	0.350

Dry Swale Manhole: 3, DS/PN: 1.002

Warning:- Volume should always be included unless the upstream pipe is being used for storage and/or as a carrier

Infiltration Coefficient Base (m/hr)	0.00000	Trench Infiltration Side (m/hr)	0.00000
Infiltration Coefficient Side (m/hr)	0.00000	Trench Porosity	0.30
Safety Factor	2.0	Side Slope (1:X)	3.0
Porosity	1.00	Slope (1:X)	22.0
Invert Level (m)	84.900	Cap Volume Depth (m)	0.000
Trench Height (m)	0.800	Cap Infiltration Depth (m)	0.000
Trench Width (m)	0.6	Include Swale Volume	Yes
Trench Length (m)	8.0		

Dry Swale Manhole: 7, DS/PN: 3.003

Warning:- Volume should always be included unless the upstream pipe is being used for storage and/or as a carrier

Infiltration Coefficient Base (m/hr)	0.00000	Trench Infiltration Side (m/hr)	0.00000
Infiltration Coefficient Side (m/hr)	0.00000	Trench Porosity	0.30
Safety Factor	2.0	Side Slope (1:X)	3.0
Porosity	1.00	Slope (1:X)	200.0
Invert Level (m)	84.900	Cap Volume Depth (m)	0.000
Trench Height (m)	0.800	Cap Infiltration Depth (m)	0.000
Trench Width (m)	0.6	Include Swale Volume	Yes
Trench Length (m)	9.8		

Dry Swale Manhole: 8, DS/PN: 1.003

Warning:- Volume should always be included unless the upstream pipe is being used for storage and/or as a carrier

Infiltration Coefficient Base (m/hr)	0.00000	Trench Infiltration Side (m/hr)	0.00000
Infiltration Coefficient Side (m/hr)	0.00000	Trench Porosity	0.30
Safety Factor	2.0	Side Slope (1:X)	3.0
Porosity	1.00	Slope (1:X)	50.0
Invert Level (m)	84.700	Cap Volume Depth (m)	0.000
Trench Height (m)	0.700	Cap Infiltration Depth (m)	0.000
Trench Width (m)	0.6	Include Swale Volume	Yes
Trench Length (m)	7.0		

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Porous Car Park Manhole: 9, DS/PN: 1.004

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	4.2
Membrane Percolation (mm/hr)	1000	Length (m)	32.0
Max Percolation (l/s)	37.3	Slope (1:X)	40.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	85.300	Cap Volume Depth (m)	0.300

Complex Manhole: 10, DS/PN: 1.005

Tank or Pond

Invert Level (m) 83.100

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	88.3	1.000	88.3	1.001	0.0

Tank or Pond

Invert Level (m) 84.500

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	135.5	0.400	207.1	0.800	290.7	1.199	386.0
0.100	152.2	0.500	226.8	0.900	313.4	1.200	386.2
0.200	169.8	0.600	247.4	1.000	337.0		
0.300	188.0	0.700	268.6	1.100	361.2		

Volume Summary (Static)

Length Calculations based on Centre-Centre

Pipe Number	USMH Name	Manhole Volume (m³)	Pipe Volume (m³)	Storage Structure Volume (m³)	Total Volume (m³)
1.000	1	0.283	1.236	0.000	1.519
1.001	2	0.368	2.437	0.000	2.805
2.000	3	0.283	0.212	26.565	27.060
2.001	4	0.373	0.230	0.000	0.603
1.002	3	0.311	1.204	2.332	3.847
3.000	4	0.283	0.121	0.000	0.404
3.001	5	1.696	0.990	0.000	2.687
3.002	6	0.277	2.142	0.000	2.419
3.003	7	0.311	3.483	5.268	9.062
1.003	8	0.283	3.233	2.993	6.509
1.004	9	0.283	2.590	2.268	5.141
1.005	10	2.827	0.268	353.185	356.281
Total		7.578	18.147	392.612	418.336

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

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 3.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 6
Number of Online Controls 2 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.438
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 20.000 Cv (Winter) 0.840

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	15 Winter	1	+0%					87.608
1.001	2	15 Winter	1	+0%					86.175
2.000	3	30 Winter	1	+0%	30/15 Summer				85.734
2.001	4	30 Winter	1	+0%	1/15 Summer				85.721
1.002	3	15 Winter	1	+0%	30/15 Summer				85.005
3.000	4	15 Winter	1	+0%	100/15 Summer				86.137
3.001	5	15 Winter	1	+0%	100/15 Summer				85.476
3.002	6	15 Winter	1	+0%	30/15 Summer				85.317
3.003	7	15 Winter	1	+0%	100/15 Summer				85.015
1.003	8	15 Winter	1	+0%	100/15 Summer				84.895
1.004	9	15 Winter	1	+0%	100/15 Summer				84.796
1.005	10	240 Winter	1	+0%	1/15 Summer				83.835

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.167	0.000	0.15		15.4	OK	

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.001	2	-0.225	0.000	0.14		26.7	OK	
2.000	3	-0.016	0.000	0.20		6.2	OK	
2.001	4	0.391	0.000	0.23		3.7	SURCHARGED	
1.002	3	-0.195	0.000	0.26		26.8	OK	
3.000	4	-0.113	0.000	0.14		6.0	OK	
3.001	5	-0.224	0.000	0.14		16.7	OK	
3.002	6	-0.163	0.000	0.43		28.1	OK	
3.003	7	-0.335	0.000	0.15		37.2	OK	
1.003	8	-0.255	0.000	0.39		69.4	OK	
1.004	9	-0.254	0.000	0.39		69.8	OK	
1.005	10	0.585	0.000	0.11		3.5	SURCHARGED	

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

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 3.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 6
Number of Online Controls 2 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.438
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 20.000 Cv (Winter) 0.840

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	15 Winter	30	+0%					87.645
1.001	2	15 Winter	30	+0%					86.229
2.000	3	30 Winter	30	+0%	30/15 Summer				86.321
2.001	4	30 Winter	30	+0%	1/15 Summer				86.312
1.002	3	15 Winter	30	+0%	30/15 Summer				85.243
3.000	4	15 Winter	30	+0%	100/15 Summer				86.161
3.001	5	15 Winter	30	+0%	100/15 Summer				85.575
3.002	6	15 Winter	30	+0%	30/15 Summer				85.533
3.003	7	15 Winter	30	+0%	100/15 Summer				85.191
1.003	8	15 Winter	30	+0%	100/15 Summer				85.150
1.004	9	240 Winter	30	+0%	100/15 Summer				84.987
1.005	10	240 Winter	30	+0%	1/15 Summer				84.985

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.130	0.000	0.37		38.0	OK	

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.001	2	-0.171	0.000	0.38		73.0	OK	
2.000	3	0.571	0.000	0.20		6.0	FLOOD RISK	
2.001	4	0.982	0.000	0.34		5.5	FLOOD RISK	
1.002	3	0.043	0.000	0.71		73.1	SURCHARGED	
3.000	4	-0.089	0.000	0.34		14.8	OK	
3.001	5	-0.125	0.000	0.41		46.9	OK	
3.002	6	0.053	0.000	1.20		79.1	SURCHARGED	
3.003	7	-0.159	0.000	0.39		98.7	OK	
1.003	8	0.000	0.000	1.01		180.5	OK	
1.004	9	-0.063	0.000	0.22		39.0	OK	
1.005	10	1.735	0.000	0.14		4.4	SURCHARGED	

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

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	3.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	6
Number of Online Controls	2	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.438
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	20.000	Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	15 Winter	100	+40%					87.686
1.001	2	15 Winter	100	+40%					86.369
2.000	3	60 Winter	100	+40%	30/15 Summer				86.478
2.001	4	60 Winter	100	+40%	1/15 Summer				86.472
1.002	3	15 Winter	100	+40%	30/15 Summer				85.868
3.000	4	15 Winter	100	+40%	100/15 Summer				86.421
3.001	5	15 Winter	100	+40%	100/15 Summer				86.240
3.002	6	15 Winter	100	+40%	30/15 Summer				86.148
3.003	7	15 Winter	100	+40%	100/15 Summer				85.668
1.003	8	360 Winter	100	+40%	100/15 Summer				85.600
1.004	9	360 Winter	100	+40%	100/15 Summer				85.598
1.005	10	360 Winter	100	+40%	1/15 Summer				85.596

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.089	0.000	0.67		69.1	OK	

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.001	2	-0.031	0.000	0.67		129.0	OK	
2.000	3	0.728	0.000	0.23		6.9	FLOOD RISK	
2.001	4	1.142	0.000	0.36		5.8	FLOOD RISK	
1.002	3	0.668	0.000	1.21		123.9	FLOOD RISK	
3.000	4	0.171	0.000	0.59		25.5	SURCHARGED	
3.001	5	0.540	0.000	0.64		74.1	SURCHARGED	
3.002	6	0.668	0.000	1.91		125.9	FLOOD RISK	
3.003	7	0.318	0.000	0.67		168.9	SURCHARGED	
1.003	8	0.450	0.000	0.26		47.1	FLOOD RISK	
1.004	9	0.548	0.000	0.26		46.1	FLOOD RISK	
1.005	10	2.346	0.000	0.16		5.0	FLOOD RISK	

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