

AMBERLEY DRIVE, WYTHENSHAWE, MANCHESTER

DRAINAGE & SUDS STRATEGY

Curtins Ref: 083091-CUR-01-XX-RP-C-92000

Revision: P02

Issue Date: 19 October 2023

Client Name: Wythenshawe Community Housing group (WCHG)

Client Address: Wythenshawe House
8 Poundswick Lane
Wythenshawe
Manchester
M22 9TA

Site Address: Amberley Dr, Wythenshawe, Manchester M23 2RH

Rev	Description	Issued by	Checked	Date
P01	ISSUED FOR COMMENT	JS	ATL	25 August 2023
P02	PLANNING ISSUE	ATL	MW	19 October 2023

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1 INTRODUCTION

1.1 Background

Curtins were appointed by Wythenshawe Community Housing group (WCHG) to provide a Drainage Statement for the proposed development for eight properties located on Amberley Drive,, to the Northeast of Boncarn Drive and to the West of Mill Brook.

The site is located within the Flood Zone 1 which is defined as very low risk of flooding from rivers or the sea. The site is smaller than 1.0 Ha but is located within the Manchester and Trafford South Critical Drainage Area. A Flood Risk Assessment has been prepared by WML Consulting (Ref 11110/FRA/01, dated May 2023). Therefore, the Drainage & SuDS Strategy covers the design of the proposed drainage system.

A private maintenance company should be appointed to provide maintenance services pertaining to the drainage asset.

The report is based on currently available information.

Proposals contained or forming part of this statement represent the design intent and may be subject to alteration or adjustment in completing the detailed design for this project. Where such adjustments are undertaken as part of the detailed design and are deemed a material deviation from the intent contained in this document, prior approval shall be obtained from the relevant authority in advance of commencing such works.

1.2 Proposed Development

The development comprises of eight new properties. The proposal will include:

- 8 new semi-detached properties
- 8 External driveways
- External footways around the properties

The total site area is approximately 0.15 Ha.

The proposed site layout is enclosed in Appendix A.

2 EXISTING SITE DETAILS

2.1 Site Location

The site is located on Amberley Drive , to the Northeast of Boncarn Drive and to the West of Mill Brook in Wythenshawe. Add a post code and national grid references.

The existing site is currently a greenfield site. (See Figure 1).

The site is bound by Amberley Drive to the West & Mill Brook to the East

Figure 1: Aerial Photograph (© Microsoft Corporation 2023)



2.2 Flood Risk

The flood risks to the proposed site has been assessed as part of the FRA produced by WML

The FRA concluded that:

- The risk of flooding(add from what sources) is considered low.
- Groundwater flood risk is considered to be low.
- Sewer flood risk is considered to be low.
- Reservoir flood risk is considered to be low.

The risk from surface water flooding, based on on-line surface water flood mapping, the potential risk to the site is categorised from 'very low' to 'high'.

Mitigation measures have been noted within the FRA; the main mitigation measure was to set the proposed FFLs at a level 300mm above the adjacent ground levels

Further information is available in the FRA produced by WML

2.3 Existing Drainage

A CCTV has been carried out in August 2023 (see Appendix B);

The CCTV survey highlights that the following drainage exists on the site:

- A 225mm diameter combined sewer passes through the Southern end of the site, flowing from South to North, before flowing North Westerly along the edge of the Western Amberley Drive footpath. When changing direction, the pipe increases from a 225mm to 300mm diameter pipe.
- A 225mm diameter surface water sewer passes through the Southern end of the site, flowing from West to East, and discharges to Mill Brook. Upstream of this, the sewer flows in a southerly direction within Amberley Drive, where it increases to a 300mm sewer. The UU Records indicate that this is a 'Section 104 Sewer', which indicates that it has been adopted recently, or is undergoing the process of adoption.

The existing public combined sewer will need to be diverted where clashes with the proposed development. The proposed diversion can be seen on the Proposed Drainage Layout in Appendix D

The drainage survey confirmed that there is no other existing drainage within the site.

The surveys and UU records indicate wider drainage exists within the vicinity of the site:

- A 300mm diameter public combined sewer, adjacent to Nos 3-36 Arley House, on the opposite side of Amberley Road to the site. This sewer flows in a North-easterly direction.
- 825mm diameter surface water sewers within Boncarn Drive and Chedlin Drive. Both of these sewers flow in Southeasterly direction and connect into the 300mm sewer in Amberley Drive noted above. As above, these sewers are also noted as 'Section 104 Sewers'.
- The topographical survey indicates a number of road gullies within Amberley Drive, adjacent to the proposed site. The CCTV survey does not confirm where these gullies connect to, and it is possible there is a highway drain with this section of Amberley Drive. Further survey work is required in order to confirm the drainage route from these road gullies.

The existing drainage within the development boundary should be maintained and protected during the works.

3 DRAINAGE STRATEGY

3.1 Proposed Foul Water Drainage

Existing survey information shows a foul water drain within the Southern vicinity of the site.

The proposed drainage is a separate foul and surface water drainage system that will outfall to the existing drainage network.

A Predevelopment enquiry has been sent to United Utilities; they have confirmed that the preferred point of connection would be to the 300mm diameter combined sewer in Amberley Drive, at an unrestricted rate. A copy of the UU correspondence is available in Appendix D.

The foul water from the new developments is proposed to discharge via a new connection to the existing combined sewer located within Amberley Drive. The connection point is to the however, will be made to the North West of the site outside of the site boundary. S106 Approval will be required from United Utilities for the new connection.

The proposed peak foul flow rate has been estimated as 4.5 l/s, based on an estimated loading of 10 Discharge Units per property. The final foul flow should be reassessed at a detailed design, once the final internal layouts and number of appliances are confirmed.

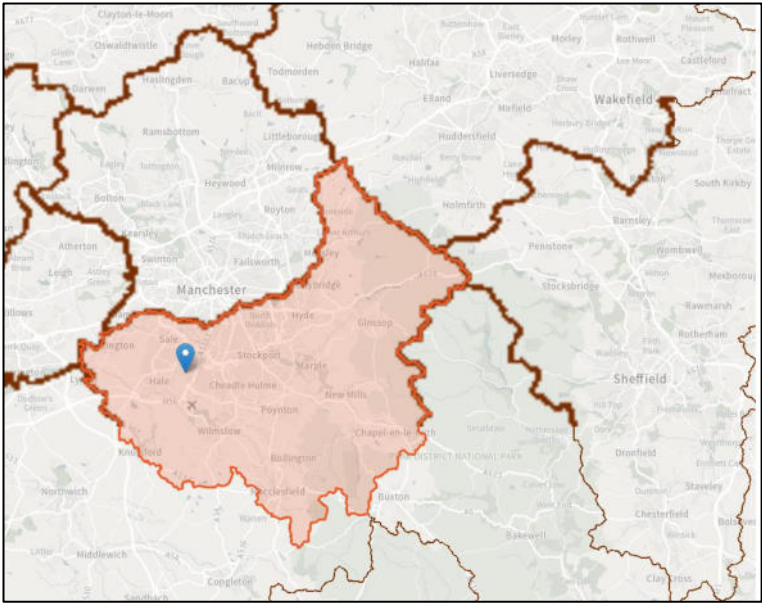
3.2 Proposed Surface Water Drainage

The new development site drainage is designed in accordance with the current best practice to provide adequate capacity not to flood in the critical 1 in 30-year storm event, and flood water, if there is any, generated for up to the critical 1 in 100-year plus climate change storm event shall be constrained within the site boundary, so not to cause safety issues to the buildings, essential services or adjoining developments and services.

As released in February 2016 and updated in May 2022, the Environment Agency has provided updated climate change allowances for peak rainfall intensities which should be applied to new developments. Table 1 demonstrates the climate change allowances with central and upper end allowances being considered.

Based on the nature of the development, the lifespan of the building in excess of up to 60 years is anticipated. Therefore, the 2070s epoch is adopted and the climate change allowance for 3.3% and 1.0% annual exceedance rainfall events are 40% and 45% respectively. As such, these additional climate change allowances will be applied to the calculation.

Table 1: (Extract Environment Agency Guidance) Peak Rainfall Intensity Allowance in small and urban catchments



Upper Mersey Management Catchment peak rainfall allowances

3.3% annual exceedance rainfall event

Epoch	Central allowance	Upper end allowance
2050s	20%	35%
2070s	30%	40%

1% annual exceedance rainfall event

Epoch	Central allowance	Upper end allowance
2050s	25%	40%
2070s	30%	45%

*Use '2050s' for development with a lifetime up to 2060 and use the 2070s epoch for development with a lifetime between 2061 and 2125.

In following the standard hierarchy of drainage solutions, consideration should firstly be given to the discharge of surface water runoff by sustainable methods such as infiltration.

The FRA provides further details of the assessment of the drainage hierarchy and has concluded that the most suitable discharge is to Mill Brook, which is located approximately 5m East of the site.

As stated in the FRA, the surface water discharge from the site will require limited to the predevelopment Greenfield Rate. An updated Greenfield Runoff rate has been calculated, based on the current hardstanding area of 0.11Ha.

It is anticipated that the proposed footway adjacent to Amberley Drive will be put forward for adoption. Therefore, the runoff from this area will drop onto the carriageway, and into the existing road gullies. This area has been excluded from the drainage calculations.

The Greenfield Rate has been calculated using the online tool supplied by www.uksuds.com.

The Greenfield Flows have been calculated as:

- 1 Year = 0.31 l/s
- 30 Year = 0.60 l/s
- 100 Year = 0.74 l/s

The greenfield runoff rate calculation is enclosed in Appendix D.

Since the greenfield runoff rates are very low for the site, any flow restriction is highly susceptible to blockage. It is generally considered that a minimum restriction of 5.0 l/s is used, in order to prevent future blockages.

The proposed surface water drainage is to be served by a series of pipes, which then discharge to Mill Brook in the Northeast corner of the site. The discharge rate is controlled by a Hydrobrake Vortex flow control, located in the final manhole upstream of the outfall.

In addition to the climate change allowance, a further allowance of 10% has been included in the 100-year event calculations to account for urban creep.

The 100-year (+climate change and urban creep allowances) has been checked with a surcharged outfall, set 1m above the soffit of the outfall pipe. The surcharge level of the outfall is to be confirmed by the LLFA.

The required attenuation storage is provided by a series of oversized pipes, up to a maximum diameter of 450mm.

The drainage layout and surface drainage storage calculations are available in Appendix E.

Due to the nature of the proposed site hardstanding areas (roofs, driveways and footpaths), the pollution risk to the watercourse is considered low, and therefore it is considered that the introduction of SuDs features is not required.

The Environment Agency Main River Map indicates that Mill Brook is not a main river. As Mill Brook is ordinary watercourse Land Drainage consent from LLFA will be required for a new connection.

The final design of the drainage networks shall be in accordance with the legislation set by the Environment Agency, Manchester City Council and United Utilities.

3.3 Foul Water Diversion

As the existing public combined sewer routes passes under the proposed properties, a diversion of the existing combined sewer will be required.

The proposed diversion will start at UU Manhole 1801 and will be re-routed into Amberley Drive. At this point, the sewer diversion will turn in a Northerly direction, and will re-connect to the existing sewer via a new manhole. The indicative diversion route is shown on the drainage layout, which is available in Appendix E.

The abandoned section of sewer will be grubbed or grouted up in accordance with United Utilities' requirements.

The proposed sewer diversion will need to maintain the current flow capacity of the sewer to be removed. The current Invert Level of manhole UU 1801 is currently not known; further survey works are required in order to confirm the required sewer capacity.

The diverted sewer will be subject to a 6m easement where it passes within the site. No structural elements are permitted within this easement.

The diversion will require approval from UU as part of a Section 185 Agreement.

3.4 Surface Water Diversion

The existing public surface water sewer also passes under the proposed properties, and therefore, a diversion of the existing combined sewer will also be required.

The proposed diversion will start at UU Manhole 1815 and will be re-routed through the Southern part of the site, forming a new outfall into Mill Brook. The indicative diversion route is shown on the drainage layout, which is available in Appendix E.

The abandoned section of sewer will be grubbed or grouted up in accordance with United Utilities' requirements.

The proposed sewer diversion will need to maintain the current flow capacity of the sewer to be removed. The current gradient of the existing sewer downstream of MH 1815 is currently not known; further survey works are required in order to confirm the required sewer capacity.

The diverted sewer will be subject to a 6m easement where it passes within the site. No structural elements are permitted within this easement.

The diversion will require approval from UU as part of a Section 185 Agreement. Land Drainage Consent will also be required from the LLFA.

3.5 Maintenance

A suitable maintenance strategy should be adopted to ensure the drainage network is cleaned regularly and the routine maintenance and cleansing regime should be documented.

It is recommended that the drainage system is inspected as a minimum twice a year, with the system also being inspected after any major storm event. Significant sediment deposition is likely in areas used for storage, so a post clean-up operation may be required including the removal of litter, vegetation, sewerage debris and larger objects.

As the flows are being attenuated on site there will be a period of time after storm events where the network is still partially or fully surcharged and is draining down. Where this surcharging is still present after 48hrs appropriate action should be taken.

It is assumed that the drainage system will be maintained by the on-site management team.

A copy of the final construction drainage layout should be provided in the final Operations and Maintenance Manual.

APPENDIX A

Proposed Site Layout

Notes: This Drawing is the copyright of Paddock Johnson Partnership Limited

and may not be used without prior written consent. Dimensions are given in metres unless otherwise stated. Dimensions should be scaled.

Due to inaccuracies of scanning, scanned images should not be scaled.

REV	DATE	DESCRIPTION	BY
A	07.02.22	Amended following Client comment.	SD
B	11.03.22	House layouts updated to latest versions.	SD
C	15.03.22	Revised and omitted trees indicated. Colour added. Drawing changed to A1 and 1:500 scale.	SD
D	23.11.22	Site Units on the wooded area omitted. New trees added to the wooded area. Drawing scale revised to fit sheet.	SD
E	11.04.23	Layout updated following LPA comments. Various minor amendments & landscape	SD
F	26.05.23	Plot 1 planting amended.	SD
G	05.06.23	Various minor amendments & landscape	SD
H	05.06.23	Various minor amendments & landscape	SD
J	06.07.23	Buildings moved to 150mm back from edge of pavement following SE advice and existing drainage survey indicated.	SD
L	09.08.23		SD
M	21.08.23		SD

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CLIENT: Wythenshawe CHG

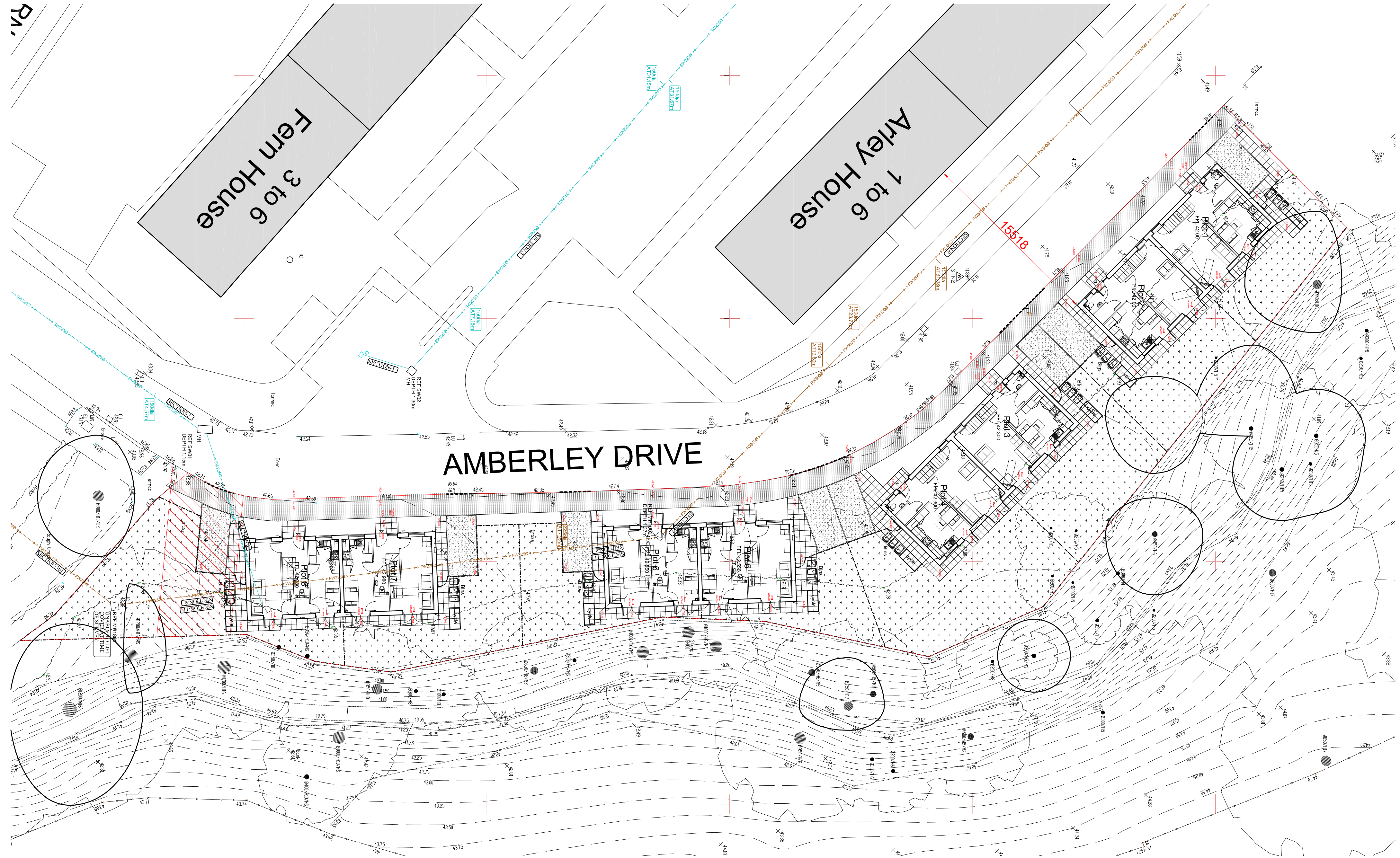
PROJECT: New Housing
Amberley Drive
Wythenshawe

DRAWING NUMBER: 18073-PJA-00-XX-DR-A-1001-M
DRAWING TITLE: Feasibility Plan 10
STATUS: PRELIMINARY

SCALE: 1:200 @ A1
DATE: 23.12.21
BY: SD
CHECKED: SD

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Adopted Bitmac Pavement

Bitmac Parking Space with 50mm pin kerb edging

PCC Paving

Grass

Existing Tree retained

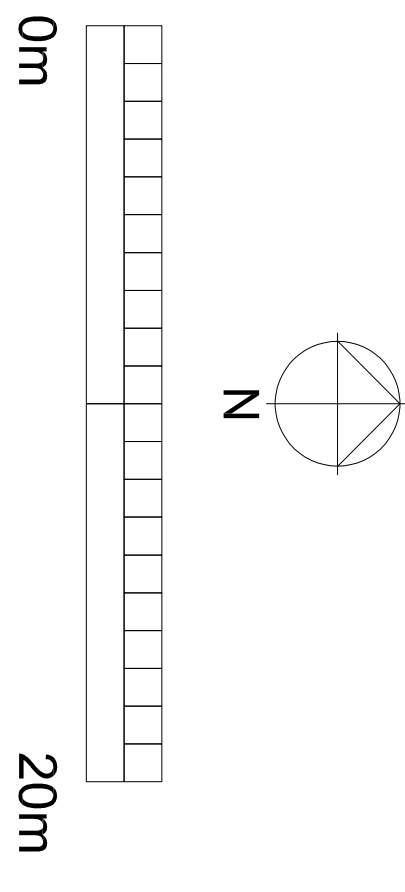
1800mm high Close-Boarded Treated Timber Fencing

New Planting

Dropped Kerb

Drainage Outfall Easement

Existing Brook



4no. 3B/5P Wide Semi-Detached Houses @ 96.1 sqm
4no. 2B/4P Wide Semi-Detached Houses @ 99.0 sqm
Total 8 no. Houses
384.4sqm
356.0sqm
740.4sqm

APPENDIX B

United Utilites Sewer Records

Topographical/ GPR/ CCTV Survey Plan

Curtins Consulting Ltd

**51-55
Tithebarn Street,
Liverpool,
L2 2SB**

FAO:

How to contact us:

**United Utilities Water Limited
Property Searches
Haweswater House
Lingley Mere Business Park
Great Sankey
Warrington
WA5 3LP**

Telephone: 0370 7510101

E-mail: propertysearches@uuplc.co.uk

**Your Ref: 083091 PO7516
Our Ref: UUPS-ORD-498905
Date: 30/06/2023**

Dear Sirs

Location: FLAT 3 FERN HOUSE AMBERLEY DRIVE, MANCHESTER, M23 2RW

I acknowledge with thanks your request dated 29/06/2023 for information on the location of our services.

Please find enclosed plans showing the approximate position of United Utilities' apparatus known to be in the vicinity of this site.

The enclosed plans are being provided to you subject to the United Utilities terms and conditions for both the wastewater and water distribution plans which are shown attached.

If you are planning works anywhere in the North West, please read United Utilities' access statement before you start work to check how it will affect our network. <http://www.unitedutilities.com/work-near-asset.aspx>.

I trust the above meets with your requirements and look forward to hearing from you should you need anything further.

If you have any queries regarding this matter please [contact us](#).

Yours Faithfully,



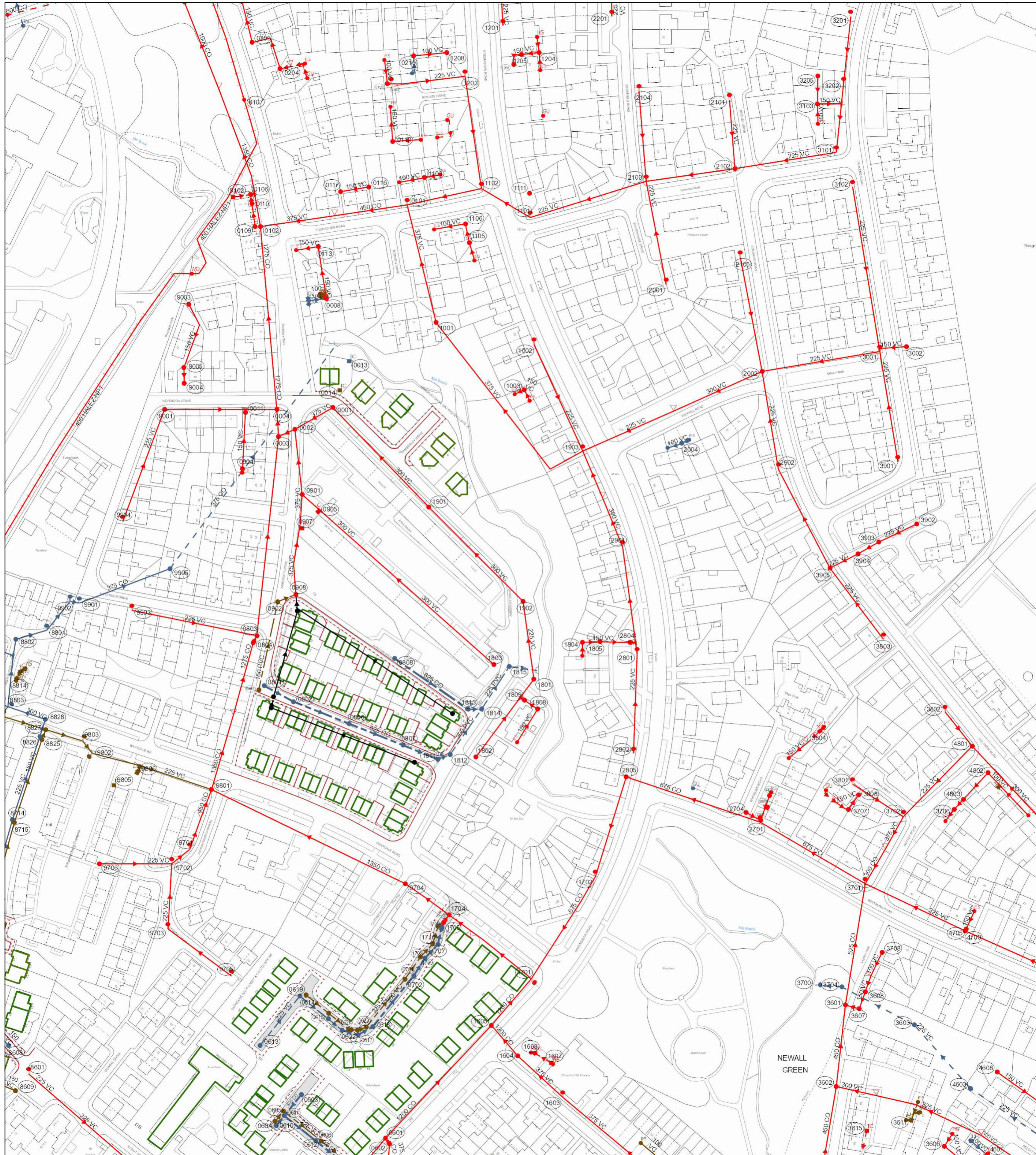
Karen McCormack
Property Searches Manager

TERMS AND CONDITIONS - WASTEWATER AND WATER DISTRIBUTION PLANS

These provisions apply to the public sewerage, water distribution and telemetry systems (including sewers which are the subject of an agreement under Section 104 of the Water Industry Act 1991 and mains installed in accordance with the agreement for the self construction of water mains) (UUWL apparatus) of United Utilities Water Limited "(UUWL)".

TERMS AND CONDITIONS:

- This Map and any information supplied with it is issued subject to the provisions contained below, to the exclusion of all others and no party relies upon any representation, warranty, collateral contract or other assurance of any person (whether party to this agreement or not) that is not set out in this agreement or the documents referred to in it.
- This Map and any information supplied with it is provided for general guidance only and no representation, undertaking or warranty as to its accuracy, completeness or being up to date is given or implied.
- In particular, the position and depth of any UUWL apparatus shown on the Map are approximate only. UUWL strongly recommends that a comprehensive survey is undertaken in addition to reviewing this Map to determine and ensure the precise location of any UUWL apparatus. The exact location, positions and depths should be obtained by excavation trial holes.
- The location and position of private drains, private sewers and service pipes to properties are not normally shown on this Map but their presence must be anticipated and accounted for and you are strongly advised to carry out your own further enquiries and investigations in order to locate the same.
- The position and depth of UUWL apparatus is subject to change and therefore this Map is issued subject to any removal or change in location of the same. The onus is entirely upon you to confirm whether any changes to the Map have been made subsequent to issue and prior to any works being carried out.
- This Map and any information shown on it or provided with it must not be relied upon in the event of any development, construction or other works (including but not limited to any excavations) in the vicinity of UUWL apparatus or for the purpose of determining the suitability of a point of connection to the sewerage or other distribution systems.
- No person or legal entity, including any company shall be relieved from any liability howsoever and whensoever arising for any damage caused to UUWL apparatus by reason of the actual position and/or depths of UUWL apparatus being different from those shown on the Map and any information supplied with it.
- If any provision contained herein is or becomes legally invalid or unenforceable, it will be taken to be severed from the remaining provisions which shall be unaffected and continue in full force and affect.
- This agreement shall be governed by English law and all parties submit to the exclusive jurisdiction of the English courts, save that nothing will prevent UUWL from bringing proceedings in any other competent jurisdiction, whether concurrently or otherwise.



The position of the underground apparatus shown on this plan is approximate only and is given in accordance with the best information currently available. United Utilities Water will not accept liability for any loss or damage caused by the actual position being different from those shown.

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Refo	Cover	Func	Invert	Size x	Size y	Shape	Matl	Length	Grad
0210	CO	0	44.09	675	100	VC	CO	17.74109	1 in 232
3701	49.33	CO	44.09	675	100	VC	CO	67.23094	1 in 232
3801	49.78	CO	47.53	225	100	VC	VC	33.28863	1 in 92
9706	CO	0	225	225	100	VC	VC	45	1 in 100
2102	CO	0	225	225	100	VC	VC	49.48947	1 in 172
2105	50.54	CO	47.01	225	100	VC	VC	64.13268	1 in 100
2802	45.32	CO	42.31	225	100	VC	VC	55.02835	1 in 219
4801	CO	0	225	225	100	VC	VC	54.45181	1 in 219
8828	45.32	CO	42.31	225	100	VC	VC	21.89198	1 in 219
0110	47.15	SW	45.66	150	150	VC	VC	4.990721	1 in 219
3802	52.49	CO	50.38	225	100	VC	VC	24.20744	1 in 219
1603	49.9	CO	46.87	375	100	VC	VC	53.37058	1 in 219
1902	42.45	CO	41.09	300	100	VC	VC	73.53911	1 in 219
3607	CO	0	150	150	100	VC	VC	1.531443	1 in 219
0804	CO	0	1275	150	100	VC	VC	4.472136	1 in 14287937
2704	CO	0	1275	150	100	VC	VC	8.398477	1 in 14287937
3001	53.92	CO	0	225	100	VC	VC	65.9242	1 in 14287937
0204	CO	0	150	150	100	VC	VC	28.29944	1 in 14287937
1205	CO	0	150	150	100	VC	VC	9.457278	1 in 14287937
3903	CO	0	225	100	100	VC	VC	13.225	1 in 14287937
2001	48.07	CO	46.41	225	100	VC	VC	58.0617	1 in 14287937
0113	CO	0	150	150	100	VC	VC	12.22037	1 in 14287937
1105	CO	0	100	100	100	VC	VC	10.61411	1 in 14287937
0008	CO	0	150	150	100	VC	VC	29.08102	1 in 14287937
1203	45.94	CO	42.42	225	100	VC	VC	62.64882	1 in 116
3706	CO	0	150	150	100	VC	VC	8.062863	1 in 116
2103	48.88	CO	0	225	100	VC	VC	67.05222	1 in 116
4802	CO	0	150	150	100	VC	VC	19.98176	1 in 116
3707	CO	0	150	150	100	VC	VC	9.882163	1 in 116
2703	SW	0	150	150	100	VC	VC	1.027408	1 in 116
1903	45.26	CO	40.99	375	100	VC	VC	123.207	1 in 116
3205	CO	0	150	150	100	VC	VC	15.27424	1 in 116
0011	CO	0	150	150	100	VC	VC	1.655524	1 in 116
0807	45.97	SW	42.19	825	100	VC	VC	20.77078	1 in 415
0615	50.24	SW	47.4	225	100	VC	VC	9.917253	1 in 197
1707	48.2	SW	45.62	1200	100	VC	VC	9.1023	1 in 455
0603	51.08	SW	49.63	600	100	VC	VC	10.04553	1 in 103
0806	46.47	SW	42.27	825	100	VC	VC	32.28744	1 in 103
1812	44.92	FO	42.1	300	100	PVC	VC	30.79944	1 in 107
0810	51.66	FO	50.55	225	100	VC	VC	7.481185	1 in 103
0821	50.01	FO	48.68	225	100	VC	VC	4.975208	1 in 45
1705	47.86	CO	44.05	300	100	UN	VC	5.071624	1 in 185
0702	46.06	FO	47.64	225	100	VC	VC	15.00953	1 in 37
1708	47.8	SW	47.64	225	100	UN	VC	9.274504	1 in 37
1811	45.3	SW	0	0	100	UN	VC	0.312099	1 in 50
0822	49.9	FO	48.47	225	100	VC	VC	5.030962	1 in 313
0704	47.4	CO	42.11	1350	100	VC	VC	118.8694	1 in 313
1711	48.25	FO	46.52	225	100	PVC	VC	10.02257	1 in 313
0805	45.34	FO	43.74	150	100	PVC	VC	49.76258	1 in 313
3905	CO	0	225	100	100	VC	VC	61.82091	1 in 313
1204	CO	0	150	150	100	VC	VC	8.87784	1 in 313
3101	53.75	CO	50.28	225	100	VC	VC	56.71961	1 in 313
1808	CO	0	150	150	100	VC	VC	8.708962	1 in 313
8828	47.75	SW	45.78	300	100	VC	VC	9.988146	1 in 83
2002	50.35	CO	46.18	300	100	VC	VC	53.7122	1 in 21
3803	51.35	CO	48.17	225	100	VC	VC	49.27602	1 in 142
1002	CO	0	225	100	100	VC	VC	64.88451	1 in 142
0103	44.16	CO	42.77	225	100	VC	VC	41.10004	1 in 142
2901	45.92	CO	41.54	300	100	VC	VC	29.15476	1 in 121
3606	CO	0	225	100	100	VC	VC	32.25151	1 in 121
9903	45.24	CO	42.83	225	100	VC	VC	70.40597	1 in 17888001
3708	CO	0	150	150	100	VC	VC	14.33734	1 in 17888001
8714	49.45	SW	48.03	225	100	VC	VC	48.34048	1 in 21
0904	CO	0	150	150	100	VC	VC	31.11238	1 in 21
2101	50.94	SW	48.91	225	100	VC	VC	38.11824	1 in 142
9904	44.26	CO	41.2	225	100	VC	VC	68.12866	1 in 142
8827	47.31	FO	44.88	225	100	VC	VC	1.28725	1 in 73
1102	45.28	CO	41.77	225	100	VC	VC	41.97818	1 in 13
8715	49.49	FO	47.71	150	100	VC	VC	48.15601	1 in 13
1804	CO	0	150	150	100	VC	VC	9.753429	1 in 25
9905	CO	0	225	100	100	VC	VC	54.4021	1 in 69
1802	CO	0	50.43	225	100	VC	VC	82.21922	1 in 161
3803	CO	0	225	100	100	VC	VC	45.17743	1 in 161
8801	45.83	SW	44.39	375	100	VC	VC	20.61503	1 in 46
1101	45.86	CO	42.73	225	100	VC	VC	31.38471	1 in 46
3902	CO	0	225	100	100	VC	VC	23.12401	1 in 25
3201	53.51	CO	52.08	225	100	VC	VC	37.21559	1 in 25
3901	53.23	CO	50.55	225	100	VC	VC	61.81424	1 in 25
4808	CO	0	150	150	100	VC	VC	37.8607	1 in 197
1801	43.02	CO	41.33	225	100	VC	VC	43.41698	1 in 197
2902	49.61	CO	46.89	225	100	VC	VC	54.74488	1 in 105
0806	51.91	SW	48.53	600	100	VC	VC	50.04111	1 in 307
1701	48.24	CO	43.21	1200	100	VC	VC	42.58744	1 in 79
0802	46.07	SW	42.35	825	100	VC	VC	42.97971	1 in 412
1604	CO	0	1200	100	100	VC	VC	22.14929	1 in 365
0801	45.38	SW	42.4	825	100	VC	VC	18.26279	1 in 365
0813	51.57	SW	49.31	225	100	VC	VC	35.04347	1 in 100
0808	44.04	SW	42.09	825	100	VC	VC	49.23646	1 in 379
0817	49.81	FO	45.78	900	100	VC	VC	4.21863	1 in 307
0605	51.53	SW	49.6	600	100	VC	VC	22.04381	1 in 315
0818	49.75	SW	45.75	900	100	VC	VC	36.12724	1 in 315
9702	48.61	CO	46.1	225	100	VC	VC	12.80625	1 in 67
9904	42.12	CO	39.37	225	100	VC	VC	62	1 in 67
8802	47.32	FO	44.56	225	100	VC	VC	68.74999	1 in 94
8803	47.45	SW	45.68	300	100	VC	VC	37.49954	1 in 49
2701	47.51	FO	43.78	675	100	VC	VC	78.1589	1 in 49
4607	CO	0	150	150	100	VC	VC	0.975291	1 in 49
2808	CO	0	150	150	100	VC	VC	1.040521	1 in 49
1901	41.84	CO	0	300	100	VC	VC	76.38062	1 in 49
0903	41.6	CO	36.94	1275	100	VC	VC	15.0303	1 in 49
2804	CO	0	150	150	100	VC	VC	3.12448	1 in 13
8825	47.81	FO	45.46	150	100	VC	VC	6.087524	1 in 13
3601	CO	0	44.4	525	100	VC	VC	67.89988	1 in 234
9902	45.81	SW	43.92	375	100	VC	VC	5.09902	1 in 234
0001	41.2	CO	38.12	375	100	VC	VC	24.18977	1 in 234
1805	CO	0	150	150	100	VC	VC	16.51042	1 in 234
0202	CO	0	375	100	100	VC	VC	9.948558	1 in 234
8808	52.1	SW	50.76	150	100	VC	VC	15.08891	1 in 49
0004	CO	0	1275	150	100	VC	VC	101.4002	1 in 49
9703	50.07	CO	47.33	225	100	VC	VC	36.05051	1 in 150
1003	CO	0	150	150	100	VC	VC	5.831711	1 in 150
0101	43.1	CO	38.55	450	100	VC	VC	60.4475	1 in 126
4803	CO	0	100	100	100	VC	VC	7.441275	1 in 439
9803	47.2	44.71	225	100	100	VC	VC	8.778169	1 in 439
1106	CO	0	100	100	100	VC	VC	17.49182	1 in 439
0203	CO	0	150	150	100	VC	VC	23.26887	1 in 439
0115	CO	0	100	100	100	VC	VC	2.080581	1 in 439
8801	47.29	CO	41.68	1350	100	VC	VC	42.72002	1 in 439
2805	CO	0	675	100	100	VC	VC	57.66735	1 in 439
0623	49.8	FO	46.37	225	100	VC	VC	34.01423	1 in 439
0801	51.27	CO	48.31	1200	100	VC	VC	65.47162	1 in 439
0908	43.72	CO	40.51	375	100	VC	VC	55.55609	1 in 214
1814	43.85	SW	41.50	225	100	PVC	VC	9.386909	1 in 214
1709	48.66	FO	47.23	225	100	VC	VC	10.02116	1 in 14
1813	43.81	SW	0	0	100	UN	VC	0.4037072	1 in 14
0814	50.95	SW	48.96	225	100	VC	VC	20.0717	1 in 155
1815	42.79	SW	41.75	225	100	PVC	VC	15.50033	1 in 155
081								93.03348	1 in 155
1803	43.1	CO	41.21	300	100	VC	VC	14.12757	1 in 115
1102	CO	0	150	150	100	VC	VC	8.873763	1 in 609
0102	CO	0	100	100	100	VC	VC	14.15979	1 in 609
0202	40.23	CO	36.45	300	100	VC	VC	70.99965	1 in 609
3102	53.03	CO	50.55	225	100	VC			

APPENDIX C

United Utilities Correspondence

Andy Losty

From: seweradoptions@uuplc.co.uk
Sent: 12 July 2023 15:29
To: Marta Wolska
Subject: Pre Development Enquiry for: Amberley Drive M23 2RW UU Reference Number : 04266568

Good afternoon Marta,

Firstly, I can confirm we have no recorded historic flooding on the 300mm combined sewer. Diversion plans will need to be discussed with a diversion engineer by submitting a section 185 application.

Please note a sewer diversion will not be granted if the proposals have any detrimental impact on the network. Please see the application page below.

Guidance- <https://www.unitedutilities.com/globalassets/documents/builders--developers-docs/9910-wwk-s185-guide-to-sewer-diversions-jan2023-web-acc.pdf>

App form- <https://www.unitedutilities.com/globalassets/documents/builders--developers-docs/9910-wwp-s185-application-for-diversion-jan2023-web-acc.pdf>

Web page- <https://www.unitedutilities.com/builders-developers/your-development/large-developers/diversions/>

Pre Development Enquiry for: Amberley Drive M23 2RW UU Reference Number : 04266568

We have carried out an assessment of your application which is based on the information provided. This pre-development advice on your drainage strategy will be valid for 12 months. Your drainage strategy will need to be reviewed by other competent authorities as part of the planning process, and we advise that you carry out the necessary site investigations to confirm the viability of your proposals.

If your investigations require access to our public sewer network, we ask that you contact our network engineers with a request for an access certificate via our main contact telephone number 0345 6723 723 or refer to the link below:

<https://www.unitedutilities.com/builders-developers/working-near-our-assets/>

Foul Water

Foul flow from this site will be allowed to drain into the public foul water/combined sewer system.

Our preferred point of discharge as proposed to the 300mm diameter public combined sewer located to the West of your proposed development at an unrestricted rate.

In accordance with our infrastructure plans we may ask you to change your point of connection. Therefore please contact us when you are ready to formalise your drainage proposals, we would suggest before you submit for Full Planning.

Surface Water

All surface water flow from the proposed development should drain in-line with the drainage hierarchy, as outlined in Paragraph 80, (Reference ID: 7-080-20150323), of the National Planning Practice Guidance. We also recommend you prioritise the use of multi-functional sustainable drainage systems for the management of surface water in accordance with national planning policy.

Generally, the aim should be to discharge surface run off as high up the following hierarchy of drainage options as reasonably practicable.

This is outlined as follows, in order of priority:

1. **into the ground (infiltration);**

2. **to a surface waterbody;**
3. **to a surface water sewer or highway drain;**
4. **to a combined sewer.**

For guidance, The [North West SuDS Pro-Forma](#) provides information on the appropriate evidence required at each stage of the hierarchy, to demonstrate how each level has been discounted.

The Lead Local Flood Authority has responsibility for all surface water drainage concerns and their input to your proposal is critical. You should also consider whether it is necessary to discuss your proposal with the Environment Agency, or Internal Drainage Board (if operating in your area).

The Local Planning Authority are the determining authority for any application for planning permission and the appropriate authority for determining cost viability of a proposed drainage scheme, such assessments are outside of the jurisdiction of United Utilities.

Infiltration

Surface water runoff generated from this development should discharge to the ground via infiltration system where feasible.

A detailed evidence based feasibility assessment must be carried out in line with Chapter 25 of the CIRIA SuDS Manual 2015 to determine whether infiltration is a suitable method of surface water disposal.

Particular attention must be paid to Ground Water Source Protection Zones to ensure that the risk of pollution to these valuable resources is not compromised. Details can be obtained from the government website:

<https://www.gov.uk/guidance/groundwater-source-protection-zones-spzs#find-groundwater-spzs>

If your site is in a Groundwater Source Protection Zone, you should have regard to the Environment Agency's approach to Groundwater Protection. Information on this is available via the link below:

<https://www.gov.uk/government/publications/groundwater-protection-position-statements>

Please note that such a location could have implications for the principle of your development and the need for additional mitigating measures to protect the groundwater environment and public water supply in the detailed design of your site.

Waterbody

We recommend that you contact the Lead Local Flood Authority and/or Environment Agency to discuss a point of discharge to the open ordinary watercourse located in the site boundary of the proposed site.

We would encourage you to identify and engage with any third party landowner and riparian owner to agree access and discharge rights to the water body if this is not in your ownership.

Highway Drainage

If an evidence based assessment has been carried out and confirms that infiltration is not feasible, we recommend that you investigate the possibility of draining surface water to the highway drain where this ultimately discharges to a watercourse, by contacting the relevant Highway Authority.

Public Sewer

I note a surface water connection to a public sewer is not required currently. If this changes please submit evidence as to why infiltration and a connection to the watercourse is unviable and we can discuss an alternative point of connection.

Levels

For low-lying sites, (where the ground level of the site or the level of a basement is below the ground level at the point where the drainage connects to the public sewer), care should be taken to ensure that the property is not at increased risk of flooding. If these circumstances exist, we recommend that you contact us to discuss further. It could affect the detailed design of your site and result in the need to incorporate appropriate mitigating measures in your drainage scheme.

Land drainage / Overland flows / track drainage

United Utilities have no obligation, and furthermore we do not accept land drainage, overland flows or track drainage into the public sewerage network under any circumstances

Existing Wastewater Assets Crossing the Site

According to our public sewer records there are public sewers located within your site boundary. We will require unrestricted access to the sewer for maintenance purposes, we would ask that you maintain a minimum clearance of 6m which is measured 3m from the centre line of the pipe unless there happens to be a formal easement agreement in place, in which case the specified easement width would apply. If you cannot achieve this then you may wish to consider diverting and or abandoning the public sewer.

Please be aware that any proposed diversion may require modelling. This process may take up to 6 months in order to reach an acceptable design.

Please refer to the link below to obtain full details of the processes involved with sewer diversions:

<https://www.unitedutilities.com/builders-developers/larger-developments/wastewater/sewer-diversions/>

Existing Water Assets Crossing the Site

It is the developer responsibility to identify utilities on-site. Where clean water assets are shown on our records, we recommend that you contact our Water Pre-Development Team, via the following email address:

DeveloperServicesWater@uuplc.co.uk. Further information for this service can be found on our website via the link below:

<https://www.unitedutilities.com/builders-developers/larger-developments/pre-development/water-pre-dev/>

Connection Application

Although we may discuss and agree discharge points and rates in principle, please be aware that you will have to apply for a formal sewer connection. This is so that we can assess the method of construction, Health & Safety requirements and to ultimately inspect the connection when it is made. Details of the application process and the form itself can be obtained from our website by following the link below:

<https://www.unitedutilities.com/builders-developers/wastewater-services/sewer-connections/sewer-connection/>

We recommend that the detailed design should confirm the locations of all utilities in the area and ensure that any proposed drainage solution considers routing and clash checks where required.

If we can be of any further assistance please don't hesitate to contact us further.

Many thanks and kind regards,



Ashleigh Bellerby

Assistant Developer Engineer
Developer Services & Metering
Customer Services

T: 07826891650

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----- Original Message -----

From: seweradoptions@uuplc.co.uk [seweradoptions@uuplc.co.uk]

Sent: 29/06/2023 15:45

To: marta.wolska@curtins.com

Subject: 04266568 Amberley Drive M23 2RW

Dear Marta

PRE DEVELOPMENT APPLICATION AT: – UU Ref 04266568

Please accept this email as receipt of your application received on 28.6.2023 for the above development. This has now been logged on our system and the job reference is 04266568 we would ask that you quote this reference in all future correspondence.

I have reviewed your application (and attachments) and can confirm this is suitable to be passed to Ashleigh Bellerby for technical assessment. You will receive their response within 8 working days.

Kind regards Jill



Jill Ellis

Customer Advisor Advanced
Developer Services & Metering
Customer Services

Direct Tel: 01925 233 064

Tel: 0345 072 6067

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APPENDIX D

Greenfield Runoff Rate Calculation

Calculated by:	Jake Sullivan
Site name:	Amberley Drive
Site location:	Wythenshawe

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013), the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:	53.38763° N
Longitude:	2.28486° W
Reference:	4098929987
Date:	Aug 15 2023 10:12

Runoff estimation approach

IH124

Site characteristics

Total site area (ha):	0.1608
-----------------------	--------

Methodology

Q _{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Notes

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

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

Soil characteristics

	Default	Edited
SOIL type:	2	2
HOST class:	N/A	N/A
SPR/SPRHOST:	0.3	0.3

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

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

Hydrological characteristics

	Default	Edited
SAAR (mm):	824	824
Hydrological region:	10	10
Growth curve factor 1 year:	0.87	0.87
Growth curve factor 30 years:	1.7	1.7
Growth curve factor 100 years:	2.08	2.08
Growth curve factor 200 years:	2.37	2.37

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

Default

Edited

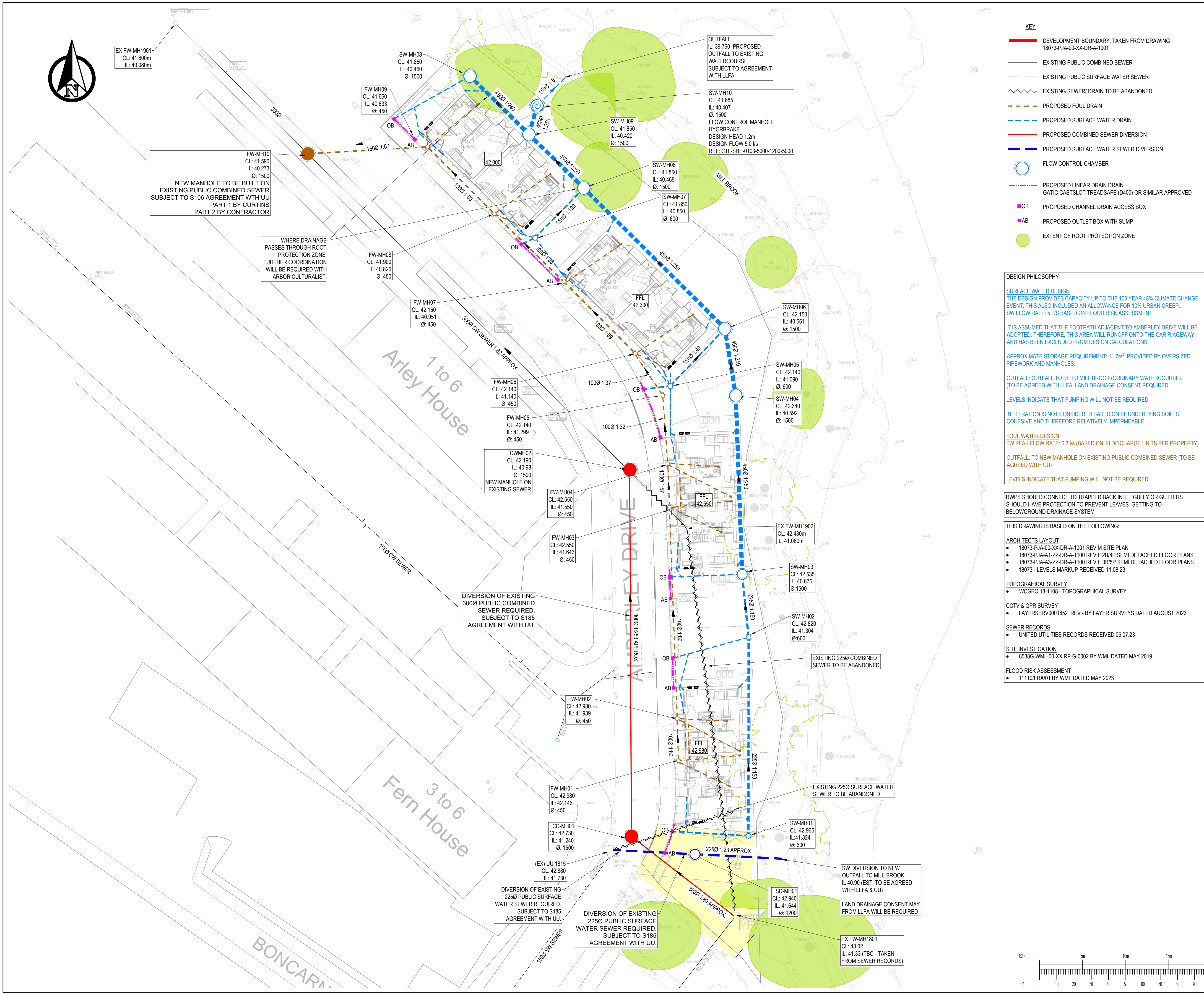
Q_{BAR} (l/s):	0.35	0.35
1 in 1 year (l/s):	0.31	0.31
1 in 30 years (l/s):	0.6	0.6
1 in 100 year (l/s):	0.74	0.74
1 in 200 years (l/s):	0.84	0.84

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 www.uksuds.com/terms-and-conditions.htm. The outputs from this tool are estimates of greenfield runoff rates. 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 the use of this data in the design or operational characteristics of any drainage scheme.

APPENDIX E

Proposed Drainage Layout

Surface Water Model Details and Results



- KEY**
- DEVELOPMENT BOUNDARY, TAKEN FROM DRAWING 18073-PJA-00-XX-DR-A-1001
 - EXISTING PUBLIC COMBINED SEWER
 - EXISTING PUBLIC SURFACE WATER SEWER
 - EXISTING SEWER/ DRAIN TO BE ABANDONED
 - PROPOSED FOUL DRAIN
 - PROPOSED SURFACE WATER DRAIN
 - PROPOSED COMBINED SEWER DIVERSION
 - PROPOSED SURFACE WATER SEWER DIVERSION
 - FLOW CONTROL CHAMBER
 - PROPOSED LINEAR DRAIN DRAIN GATIC CASTSLOT TREADSAFE (D400) OR SIMILAR APPROVED
 - PROPOSED CHANNEL DRAIN ACCESS BOX
 - PROPOSED OUTLET BOX WITH SUMP
 - EXTENT OF ROOT PROTECTION ZONE

DESIGN PHILOSOPHY

SURFACE WATER DESIGN
THE DESIGN PROVIDES CAPACITY UP TO THE 100 YEAR 45% CLIMATE CHANGE EVENT. THIS ALSO INCLUDED AN ALLOWANCE FOR 10% URBAN CREEP. SW FLOW RATE: 5 L/S BASED ON FLOOD RISK ASSESSMENT.

IT IS ASSUMED THAT THE FOOTPATH ADJACENT TO AMBERLEY DRIVE WILL BE ADOPTED. THEREFORE, THIS AREA WILL RUN OFF ONTO THE CARRIAGEWAY, AND HAS BEEN EXCLUDED FROM DESIGN CALCULATIONS.

APPROXIMATE STORAGE REQUIREMENT: 11.7m³, PROVIDED BY OVERSIZED PIPEWORK AND MANHOLES.

OUTFALL: OUTFALL TO BE TO MILL BROOK (ORDINARY WATERCOURSE). (TO BE AGREED WITH LLFA, LAND DRAINAGE CONSENT REQUIRED)

LEVELS INDICATE THAT PUMPING WILL NOT BE REQUIRED.

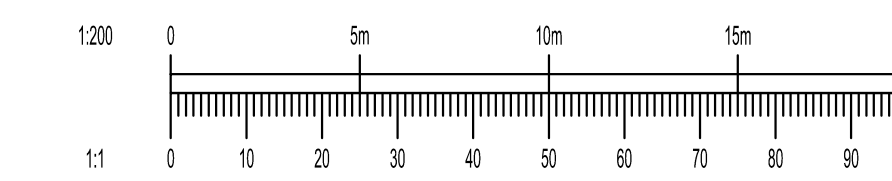
INFILTRATION IS NOT CONSIDERED BASED ON SI: UNDERLYING SOIL IS COHESIVE AND THEREFORE RELATIVELY IMPERMEABLE.

FOUL WATER DESIGN
FW PEAK FLOW RATE: 6.3 l/s (BASED ON 10 DISCHARGE UNITS PER PROPERTY)

OUTFALL: TO NEW MANHOLE ON EXISTING PUBLIC COMBINED SEWER (TO BE AGREED WITH UU)

LEVELS INDICATE THAT PUMPING WILL NOT BE REQUIRED.

- RWPS SHOULD CONNECT TO TRAPPED BACK INLET GULLY OR GUTTERS SHOULD HAVE PROTECTION TO PREVENT LEAVES GETTING TO BELOWGROUND DRAINAGE SYSTEM
- THIS DRAWING IS BASED ON THE FOLLOWING:
- ARCHITECTS LAYOUT**
- 18073-PJA-00-XX-DR-A-1001 REV M SITE PLAN
 - 18073-PJA-A1-ZZ-DR-A-1100 REV F 2B/4P SEMI DETACHED FLOOR PLANS
 - 18073-PJA-A3-ZZ-DR-A-1100 REV E 3B/5P SEMI DETACHED FLOOR PLANS
 - 18073 - LEVELS MARKUP RECEIVED 11.08.23
- TOPOGRAPHICAL SURVEY**
- WGEO 18-1108 - TOPOGRAPHICAL SURVEY
- CCTV & GPR SURVEY**
- LAYERSERV0001852 REV - BY LAYER SURVEYS DATED AUGUST 2023
- SEWER RECORDS**
- UNITED UTILITIES RECORDS RECEIVED 05.07.23
- SITE INVESTIGATION**
- 8538G-WML-00-XX RP-G-0002 BY WML DATED MAY 2019
- FLOOD RISK ASSESSMENT**
- 11110/FRA/01 BY WML DATED MAY 2023



GENERAL NOTES:

- DO NOT SCALE THIS DRAWING. ANY AMBIGUITIES, OMISSIONS AND ERRORS ON DRAWINGS SHALL BE BROUGHT TO THE ENGINEERS ATTENTION IMMEDIATELY. ALL DIMENSIONS MUST BE CHECKED / VERIFIED ON SITE.
- ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE.
- FOR GENERAL NOTES REFER TO DRAWING.
- THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS AND ENGINEERS DRAWINGS AND SPECIFICATIONS.
- DESIGN BASED ON TOPOGRAPHICAL SURVEY AND CCTV SURVEY INFORMATION AVAILABLE AT THE TIME OF DESIGN.
- ALL EXISTING SEWERS, CONNECTIONS, PIPE SIZES AND INVERT LEVELS TO BE CONFIRMED BY CONTRACTOR PRIOR TO COMMENCEMENT OF WORKS TO ENSURE CONNECTIVITY. ANY VARIANCE FROM THE INFORMATION SHOWN SHOULD BE REPORTED TO THE ENGINEER FOR REVIEW.
- DO NOT SCALE THIS DRAWING. ANY AMBIGUITIES, OMISSIONS AND ERRORS ON DRAWINGS SHALL BE BROUGHT TO THE ENGINEERS ATTENTION IMMEDIATELY. ALL DIMENSIONS MUST BE CHECKED / VERIFIED ON SITE.
- ALL DIMENSIONS ARE IN METRES AND LEVELS IN METRES ABOVE ORDNANCE DATUM UNLESS OTHERWISE NOTED.
- WHERE EXISTING DRAINAGE IS BEING USED, ALLOWANCES SHOULD BE MADE TO REMEDIATE THIS DRAINAGE IN LINE WITH AVAILABLE CCTV SURVEY INFORMATION. IF NO SURVEY IS AVAILABLE, IT IS ADVISED TO OBTAIN ONE PRIOR TO COMMENCEMENT OF WORKS.
- ALL EXISTING SERVICES TO BE LOCATED PRIOR TO COMMENCEMENT OF ANY DRAINAGE WORKS, AND WHERE NECESSARY PROTECTION OR DIVERSIONS TO BE UNDERTAKEN TO AVOID CONFLICT WITH THE PROPOSED WORK.
- ALL FOUL POP UPS LOCATIONS ARE INDICATIVE ONLY AND TO BE CONFIRMED BY THE ARCHITECT AND M&E ENGINEER. PIPE SIZES AND RAINWATER PIPE LOCATIONS ARE ALSO TO BE CONFIRMED.
- COVER LEVELS, GULLY POSITIONS, AND BUILDINGS LOCATION ARE APPROXIMATE AND SHALL BE CONFIRMED BY ARCHITECT/ LANDSCAPE ARCHITECT.
- ALL PIPE DIAMETERS GIVEN ARE NOMINAL INTERNAL PIPE DIAMETERS. THESE ARE TO BE CONFIRMED ONCE A DETAILED CAPACITY CHECK HAS BEEN UNDERTAKEN AT A LATER DESIGN STAGE.
- OUTFALL CONNECTION(S) SUBJECT TO AGREEMENT WITH THE APPROVING AUTHORITY.

P02	AMENDED IN LINE WITH UPDATED SITE PLAN	19.10.23	ATL	MW
P01	ISSUED FOR COMMENT	25.08.23	JS	ATL
Rev.	Description:	Date:	By:	Chkd:

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Status: **PLANNING** **S2**

Client: **WCHG**

Project: **AMBERLEY DRIVE**

Orig Title: **DRAINAGE LAYOUT**

Drawn By	Designed By	Checked By
JS	JS	AL
Date	25.08.23	Scales @ A1
1:200		
Project No - Originator - Function - Spatial - Form - Discipline - Number	Revision	
083091 - CUR - XX - XX - D - C - 92500	P02	

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	England and Wales	Skip Steady State	x
M5-60 (mm)	17.000	Drain Down Time (mins)	240
Ratio-R	0.400	Additional Storage (m³/ha)	20.0
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

15 | 30 | 60 | 120 | 180 | 240 | 360 | 480 | 600 | 720 | 960 | 1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
30	0	0	0
100	45	10	0

Node OUTFALL Surcharged Outfall

Overrides Design Area	x	Depression Storage Area (m²)	0	Evapo-transpiration (mm/day)	0
Overrides Design Additional Inflow	x	Depression Storage Depth (mm)	0		

Applies to All storms

Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)
0	1.150	300	1.150	600	1.150	900	1.150	1200	1.150
60	1.150	360	1.150	660	1.150	960	1.150	1260	1.150
120	1.150	420	1.150	720	1.150	1020	1.150	1320	1.150
180	1.150	480	1.150	780	1.150	1080	1.150	1380	1.150
240	1.150	540	1.150	840	1.150	1140	1.150	1440	1.150

Node 11 Online Orifice Control

Flap Valve	✓	Design Depth (m)	1.200	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Design Flow (l/s)	5.0		
Invert Level (m)	40.407	Diameter (m)	0.047		

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
1 year 15 minute summer	92.521	26.180
1 year 15 minute winter	64.927	26.180
1 year 30 minute summer	60.022	16.984
1 year 30 minute winter	42.121	16.984
1 year 60 minute summer	40.398	10.676
1 year 60 minute winter	26.839	10.676
1 year 120 minute summer	24.980	6.602
1 year 120 minute winter	16.596	6.602
1 year 180 minute summer	19.271	4.959
1 year 180 minute winter	12.527	4.959
1 year 240 minute summer	15.301	4.043
1 year 240 minute winter	10.165	4.043
1 year 360 minute summer	11.775	3.030
1 year 360 minute winter	7.654	3.030

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
1 year 480 minute summer	9.342	2.469
1 year 480 minute winter	6.207	2.469
1 year 600 minute summer	7.682	2.101
1 year 600 minute winter	5.249	2.101
1 year 720 minute summer	6.859	1.838
1 year 720 minute winter	4.609	1.838
1 year 960 minute summer	5.653	1.489
1 year 960 minute winter	3.745	1.489
1 year 1440 minute summer	4.127	1.106
1 year 1440 minute winter	2.773	1.106
30 year 15 minute summer	226.195	64.005
30 year 15 minute winter	158.733	64.005
30 year 30 minute summer	147.452	41.724
30 year 30 minute winter	103.475	41.724
30 year 60 minute summer	98.615	26.061
30 year 60 minute winter	65.517	26.061
30 year 120 minute summer	59.946	15.842
30 year 120 minute winter	39.827	15.842
30 year 180 minute summer	45.598	11.734
30 year 180 minute winter	29.640	11.734
30 year 240 minute summer	35.759	9.450
30 year 240 minute winter	23.758	9.450
30 year 360 minute summer	26.939	6.932
30 year 360 minute winter	17.511	6.932
30 year 480 minute summer	20.981	5.545
30 year 480 minute winter	13.940	5.545
30 year 600 minute summer	17.039	4.661
30 year 600 minute winter	11.642	4.661
30 year 720 minute summer	15.093	4.045
30 year 720 minute winter	10.143	4.045
30 year 960 minute summer	12.278	3.233
30 year 960 minute winter	8.133	3.233
30 year 1440 minute summer	8.788	2.355
30 year 1440 minute winter	5.906	2.355
100 year +45% CC +10% A 15 minute summer	423.061	119.712
100 year +45% CC +10% A 15 minute winter	296.885	119.712
100 year +45% CC +10% A 30 minute summer	278.374	78.770
100 year +45% CC +10% A 30 minute winter	195.350	78.770
100 year +45% CC +10% A 60 minute summer	187.417	49.529
100 year +45% CC +10% A 60 minute winter	124.515	49.529
100 year +45% CC +10% A 120 minute summer	114.312	30.209
100 year +45% CC +10% A 120 minute winter	75.946	30.209
100 year +45% CC +10% A 180 minute summer	86.951	22.375
100 year +45% CC +10% A 180 minute winter	56.520	22.375
100 year +45% CC +10% A 240 minute summer	68.114	18.001
100 year +45% CC +10% A 240 minute winter	45.253	18.001
100 year +45% CC +10% A 360 minute summer	51.133	13.158
100 year +45% CC +10% A 360 minute winter	33.238	13.158
100 year +45% CC +10% A 480 minute summer	39.658	10.480
100 year +45% CC +10% A 480 minute winter	26.348	10.480
100 year +45% CC +10% A 600 minute summer	32.099	8.780
100 year +45% CC +10% A 600 minute winter	21.932	8.780

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
100 year +45% CC +10% A 720 minute summer	28.365	7.602
100 year +45% CC +10% A 720 minute winter	19.063	7.602
100 year +45% CC +10% A 960 minute summer	22.984	6.052
100 year +45% CC +10% A 960 minute winter	15.225	6.052
100 year +45% CC +10% A 1440 minute summer	16.353	4.383
100 year +45% CC +10% A 1440 minute winter	10.990	4.383

Results for 1 year Critical Storm Duration. Lowest mass balance: 20.59%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	11	41.673	0.029	1.5	0.0140	0.0000	OK
15 minute winter	2	11	41.325	0.021	2.1	0.0073	0.0000	OK
960 minute winter	3	705	40.799	0.124	0.2	0.2332	0.0000	OK
960 minute winter	4	825	40.799	0.207	0.2	0.0587	0.0000	OK
15 minute winter	5	10	41.111	0.021	1.2	0.0101	0.0000	OK
960 minute winter	6	780	40.799	0.238	0.4	0.4452	0.0000	OK
15 minute winter	7	10	40.876	0.026	1.1	0.0118	0.0000	OK
960 minute winter	8	720	40.799	0.330	0.6	0.6221	0.0000	OK
960 minute winter	9	705	40.799	0.339	0.1	0.6436	0.0000	OK
960 minute winter	10	720	40.799	0.379	0.4	0.6704	0.0000	OK
960 minute winter	11	690	40.799	0.392	0.1	0.6929	0.0000	SURCHARGED
15 minute summer	OUTFALL	1	40.910	1.150	0.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	1.000	2	1.5	0.502	0.035	0.0684	
15 minute winter	2	1.001	3	2.1	1.151	0.017	0.0133	
960 minute winter	3	1.002	4	0.2	0.208	0.001	1.1092	
960 minute winter	4	1.003	6	0.2	0.179	0.001	0.6155	
15 minute winter	5	2.000	6	1.2	0.778	0.042	0.0138	
960 minute winter	6	1.004	8	0.4	0.224	0.002	2.4243	
15 minute winter	7	3.000	8	1.1	0.545	0.060	0.0157	
960 minute winter	8	1.005	10	0.4	0.268	0.002	1.1703	
960 minute winter	9	4.000	10	0.1	0.003	0.000	1.3009	
960 minute winter	10	1.006	11	0.1	0.177	0.000	0.4820	
960 minute winter	11	Orifice	OUTFALL	0.0				0.0

Results for 30 year Critical Storm Duration. Lowest mass balance: 20.59%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	41.690	0.046	3.8	0.0219	0.0000	OK
15 minute winter	2	10	41.337	0.033	5.2	0.0114	0.0000	OK
180 minute winter	3	120	40.907	0.232	1.9	0.4351	0.0000	OK
180 minute winter	4	116	40.907	0.315	1.5	0.0893	0.0000	OK
15 minute winter	5	10	41.123	0.033	2.9	0.0158	0.0000	OK
180 minute winter	6	116	40.908	0.347	4.5	0.6473	0.0000	OK
180 minute winter	7	116	40.908	0.058	0.6	0.0269	0.0000	OK
180 minute winter	8	116	40.909	0.440	19.4	0.8289	0.0000	OK
180 minute winter	9	124	40.917	0.457	7.8	0.8667	0.0000	SURCHARGED
120 minute winter	10	90	40.926	0.506	112.7	0.8940	0.0000	SURCHARGED
600 minute winter	11	330	40.909	0.502	0.1	0.8874	0.0000	SURCHARGED
15 minute summer	OUTFALL	1	40.910	1.150	0.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	1.000	2	3.7	0.654	0.087	0.1298	
15 minute winter	2	1.001	3	5.1	1.490	0.042	0.0253	
180 minute winter	3	1.002	4	1.5	0.310	0.007	2.0856	
180 minute winter	4	1.003	6	3.9	0.231	0.019	0.9823	
15 minute winter	5	2.000	6	2.9	1.003	0.102	0.0262	
180 minute winter	6	1.004	8	8.9	0.261	0.044	3.3295	
180 minute winter	7	3.000	8	0.8	0.463	0.044	0.0939	
180 minute winter	8	1.005	10	6.9	0.337	0.034	1.4050	
180 minute winter	9	4.000	10	-4.2	0.096	-0.020	1.5216	
120 minute winter	10	1.006	11	-70.9	-0.447	-0.348	0.5283	
600 minute winter	11	Orifice	OUTFALL	0.1				0.3

Results for 100 year +45% CC +10% A Critical Storm Duration. Lowest mass balance: 20.59%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	41.710	0.066	7.8	0.0330	0.0000	OK
120 minute winter	2	84	41.528	0.224	4.0	0.0794	0.0000	OK
120 minute winter	3	82	41.524	0.849	6.8	1.6005	0.0000	SURCHARGED
120 minute winter	4	80	41.522	0.930	8.6	0.2631	0.0000	SURCHARGED
120 minute winter	5	84	41.529	0.439	2.1	0.2159	0.0000	SURCHARGED
120 minute winter	6	80	41.523	0.962	14.0	1.8075	0.0000	SURCHARGED
120 minute winter	7	82	41.520	0.670	5.2	0.3225	0.0000	SURCHARGED
240 minute winter	8	160	41.520	1.051	35.2	1.9924	0.0000	SURCHARGED
240 minute summer	9	156	41.511	1.051	117.1	2.0074	0.0000	SURCHARGED
60 minute winter	10	46	41.657	1.237	591.5	2.1850	0.0000	FLOOD RISK
240 minute summer	11	160	41.533	1.126	408.9	1.9890	0.0000	FLOOD RISK
15 minute summer	OUTFALL	1	40.910	1.150	1.8	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	1.000	2	7.6	0.800	0.179	0.2186	
120 minute winter	2	1.001	3	4.5	1.285	0.037	0.2917	
120 minute winter	3	1.002	4	8.6	0.346	0.042	3.2869	
120 minute winter	4	1.003	6	14.0	0.290	0.069	1.2462	
120 minute winter	5	2.000	6	3.3	0.849	0.118	0.1618	
120 minute winter	6	1.004	8	15.0	0.339	0.073	3.6594	
120 minute winter	7	3.000	8	-5.0	0.563	-0.281	0.1421	
240 minute winter	8	1.005	10	52.2	0.335	0.256	1.4100	
240 minute summer	9	4.000	10	-110.3	-0.696	-0.531	1.5218	
60 minute winter	10	1.006	11	-368.8	-2.328	-1.810	0.5283	
240 minute summer	11	Orifice	OUTFALL	3.4				18.9