October – 2018

TECHNICAL NOTE

Drainage Calculations

53-55 Joel Street, Northwood Hills

1.0 Introduction

1.1 Lanmor Consulting Ltd has been appointed by to prepare drainage calculations for the proposed development of a 2-storey building with accommodation in the roof to provide 4 residential units (1 x 1 bedroom and 3 x 2-bedroom flats) and a storage unit with associated works including landscaping and installation of crossovers at the site rear of 53-55 The Broadway (Ferndown) Joel Street, Northwood Hills. This is for the release of condition 5 of the planning permission in association with the Council of the London Borough of Hillingdon (5564/APP/2018/2088).

2.0 Existing Site Conditions

2.1 The British Geological Survey indicates that the site has an underlying bedrock of London Clay Formation containing clay, silt and sand, formed approximately 48 – 56 million years ago in the Palaeogene Period. There is no indication that there are any superficial deposits overlaying the bedrock.

3.0 Existing Drainage

3.1 According to Thames Water Asset mapping, there is one foul water sewer located beneath Ferndown, which is located to the northeast. There are no surface water sewers within the immediate vicinity of the site. The foul sewer is 150mm diameter in size. There is also one foul sewer which is a 150mm diameter pipe falling from northwest to southeast at the rear of the adjacent properties however it is unknown where the sewer flows and what it serves therefore further investigation will be carried out to identify the sewer route and if it requires diverting. The Thames Water records are located in Appendix A.

4.0 Proposed Drainage

Foul Water

4.1 A new network of foul pipes and manholes are to be installed on site to serve the proposed development. This network will connect to the existing Thames Water foul sewer in Ferndown. The proposed connection to the public sewer will be constructed subject to a Section 106 application with Thames Water.

Surface Water

4.2 With regards to the discharge of surface water runoff from the development the Sustainable Urban Drainage Systems (SUDs) Hierarchy has been considered when designing the drainage strategy for the site. As the proposed dwellings will incorporate sloping roofs, the use of green roofs will not be possible. The use of infiltration techniques such as soakaways has also been discounted due to existing ground conditions being clay and unsuitable for soakaways as well as the lack of space.

4.3 Next on the hierarchy is the discharge to watercourse, the proposed development is not situated near enough to a watercourse and therefore is not a viable option.

4.4 Next is discharge to a surface water sewer, there are no surface water sewers located within proximity of the site and therefore the only option will be to also connect the proposed surface water to the Thames Water foul water sewer located under Ferndown to the northwest opposite the site. A new network of surface water pipes and manholes are to be installed on and off site to serve the proposed development.

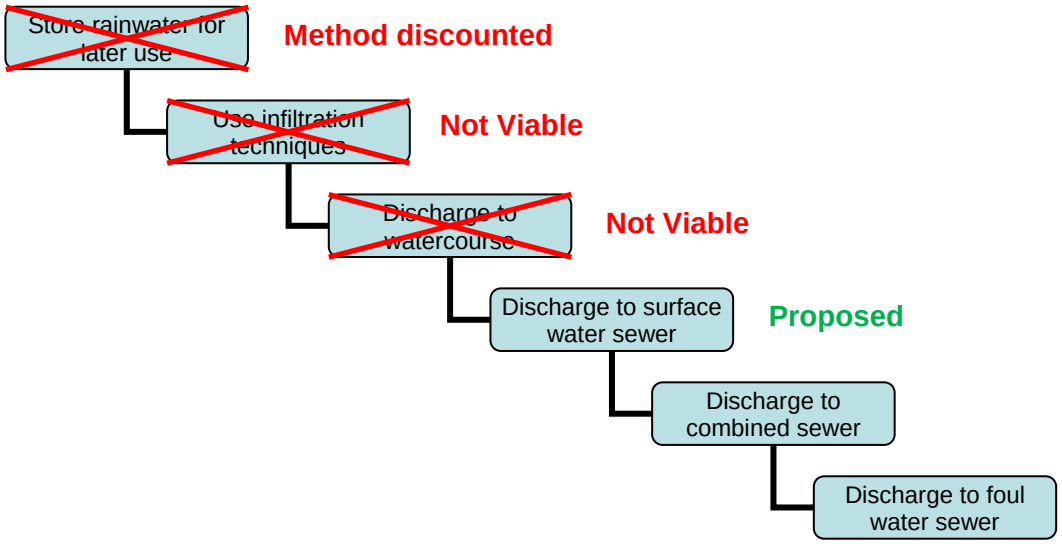


Figure 4.1 – Sustainable Drainage Hierarchy

4.5 The most sustainable option for the discharge of the surface water will be to attenuated flows and restrict the discharge to the existing surface water sewer. Calculations have been completed to determine the brownfield runoff rates for the existing site for each return period and is tabulated below.

Return Period	Rate
1 in 1	3.6 l/s
1 in 30	8.5 l/s
1 in 100	11.35 l/s

Table 4.1 – Brownfield Runoff Rates

4.6 Drainage calculations have been undertaken to determine the necessary size of the attenuation tank needed to ensure no flooding occur on the site for a 1 in 100-year return period plus an allowance of 40% for climate change. The attenuation tank will have a volume of 9.2m^3 and will be able to cater for all surface water runoff produced from the permeable paving and roof of the building. The attenuation storage tank will be provided in the form of below ground cellular storage crates. A typical layout for the attenuation tank is provided below and full calculations for the tank have been calculated using MicroDrainage and are provided in Appendix B.

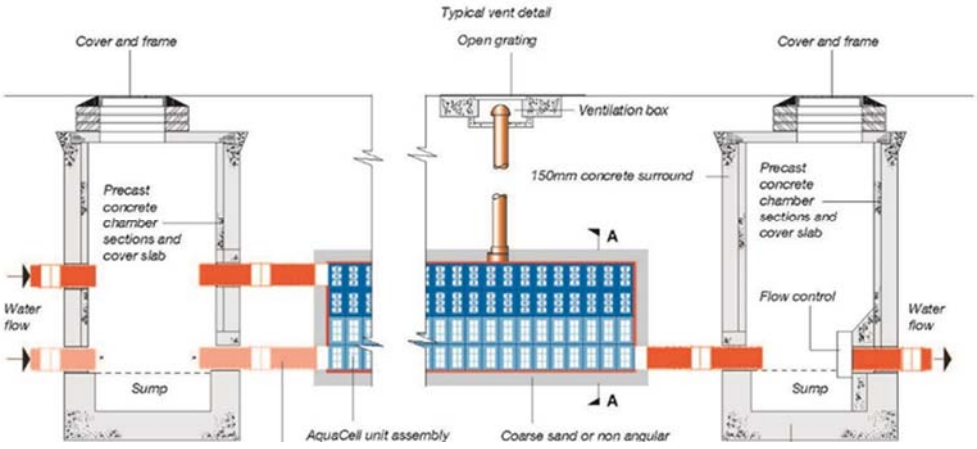


Figure 4.2 – AquaCell Attenuation Tank

4.7 The surface water will be discharged from the tank via a hydro-brake which will have a restricted flow rate of 2 l/s. This rate has been selected to ensure the unit will function appropriately and to achieve self-cleansing velocity. The proposed runoff from the new dwellings will then discharge through a new connection to the existing Thames Water network located towards the northwest of the site, subject to a S106 application.

4.8 Drawing 181099/500/01 in Appendix B shows the foul and surface water drainage layout for the development and full calculations for the SuDS structures have also been included.

5.0 Surface Water Drainage Maintenance

5.1 Regularly inspecting the surface water drainage network for blockages and clearing unwanted debris / silt from the system should improve the performance of the surface water network and decrease the need for future repairs. In the event that road gullies become blocked, high pressure water jets can be used to clear the gully and ensure they are functioning correctly, this should be undertaken by certified trained professionals.

5.2 The level and frequency of maintenance required on site is dependent on the type of facility. The type of maintenance will fall into one of three categories “regular maintenance”, “occasional maintenance” and “remedial maintenance”. Regular maintenance of the drainage and SUDs features will include, inspections, removal of litter / debris and sweeping of the surfaces. Occasional maintenance will include removal of sediment etc. and remedial maintenance may include structural repairs and infiltration reconditioning if required.

5.3 The drainage and SUDs elements, after an initial inspection following construction, should be inspected on a monthly basis for the first 12 months and after large storms, thereafter the following maintenance regime should be applied and adjusted if the 12 month monitoring process has identified any issues. For specialist pieces of equipment such as the Hydrobrake and pumps, maintenance brochures will be provided by the manufacturers. These will set out the frequency of inspections and correct methods of cleaning etc. that should be followed. It is recommended that, once installed, the facility should be inspected monthly for the first three months and thereafter at six monthly intervals or as advised in the maintenance brochure.

5.4 The information provided is only intended as guidance in standard maintenance practise for surface water drainage and SUDs features. The above measures should be reviewed regularly and modified to suit the site conditions.

5.5 For Permeable Paving Areas, the following maintenance is recommended:

Permeable Paving Maintenance Schedule		
	Required Action	Typical Frequency
Regular maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface)	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturer's recommendations – pay particular attention to areas where water runs onto pervious surfaces from adjacent impermeable areas as this area is most likely to collect the most sediment.
Occasional maintenance	Stabilise and mow contributing and adjacent areas	As required
	Removal of weeds or management using glyphosate applied directly into the weeds by an applicator rather than spraying	As required- once per year on less frequently used pavements
Remedial Actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50 mm of the level of the paving	As required
	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing material	As required
	Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging)
Monitoring	Inspect for evidence of poor operation and/or weed growth - if required, take remedial action.	Three-monthly, 48 hours after large storms in the first six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually

5.6 For the attenuation tank and boxed culverts, the following maintenance is recommended.

Attenuation Tank Maintenance Schedule		
	Required Action	Typical Frequency
Regular maintenance	Inspect and identify any areas that are not operating correctly. If required take remedial action	Annually
	Remove debris from the catchment surface (where it may cause risk to performance).	Monthly
	For systems where rainfall infiltrates in the tank from above, check surface of filter for blockage by sediment, algae or other matter, remove and replace surface infiltration medium as necessary	Annually
	Remove sediment from pre-treatment structures.	Annually or as required
Remedial Actions	Repair/rehabilitate inlets/outlets, overflows and vents.	As required
Monitoring	Inspect/check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed.	Annually
	Survey inside of tanks for sediment build-up and remove if necessary	Every 5 years or as required

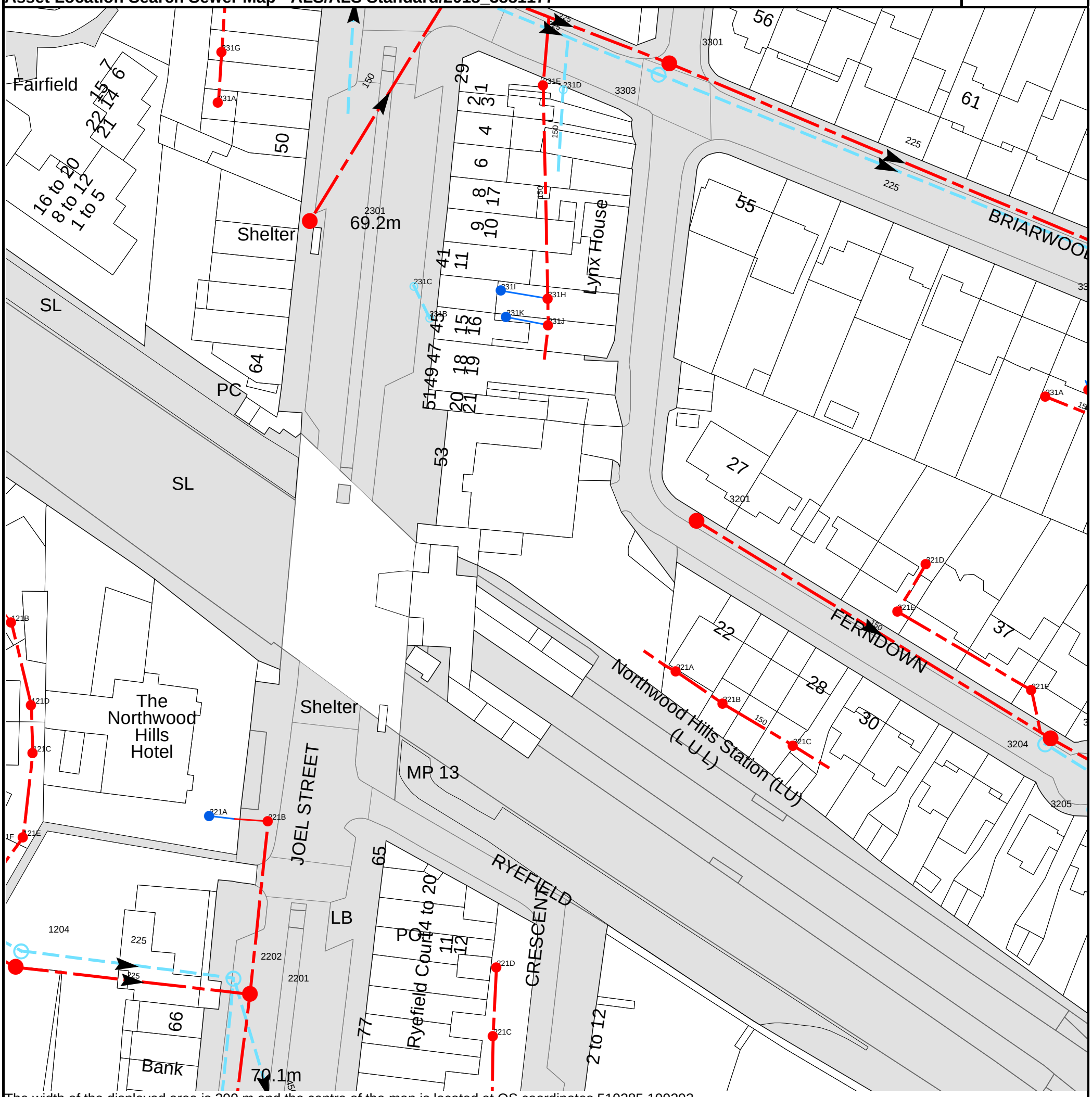
5.7 For specialist pieces of equipment such as the Hydrobrake and pumps, maintenance brochures will be provided by the manufacturers. These will set out the frequency of inspections and correct methods of cleaning etc. that should be followed. It is recommended that once installed the facility should be inspected monthly for the first three months and thereafter at six monthly intervals or as advised in the maintenance brochure.

5.8 The above information is only intended as guidance in standard maintenance practise for surface water drainage and SUDs features. The above measures should be reviewed regularly and modified to suit the site conditions.

APPENDIX A

Thames Water Asset Location Search

Asset Location Search Sewer Map - ALS/ALS Standard/2018_3881177



The width of the displayed area is 200 m and the centre of the map is located at OS coordinates 510285,190292

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
3202	64.52	63.18
331E	n/a	n/a
3205	63.97	62.92
2202	70.41	67.31
2201	70.24	67
221B	n/a	n/a
231C	n/a	n/a
231B	n/a	n/a
221C	n/a	n/a
221D	n/a	n/a
231I	n/a	n/a
231K	n/a	n/a
231H	n/a	n/a
231J	n/a	n/a
321A	n/a	n/a
3201	66.81	65.74
321B	n/a	n/a
321C	n/a	n/a
321E	n/a	n/a
321D	n/a	n/a
321F	n/a	n/a
3204	64.54	63.15
331A	n/a	n/a
2301	69.16	67.17
231D	n/a	n/a
231E	n/a	n/a
3303	68.4	66.5
3301	67.41	65.47
121C	n/a	n/a
121D	n/a	n/a
121B	n/a	n/a
231A	n/a	n/a
231G	n/a	n/a
1203	72.35	67.61
1204	72.35	67.99
121E	n/a	n/a
221A	n/a	n/a

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 B

Drawing 181099/500/01 – Drainage Layout

DWG No.
181099-500-01

Thames Water Foul Water Drainage
Proposed Foul Water Drainage
Proposed Surface Water Drainage
Permeable Paving

NORTH
EAST
SOUTH
WEST

3201
CL=66.81
IL=65.74

150mm Ø Pipe 1 in 30 Fall

New connection to existing Thames Water foul water sewer subject to S106 approval

F E R N D O W N

CW 1.04 150mm Dia Fall 1:100

Attenuation Tank
8m x 3m x 0.4m deep

Protection slab as per requirement of structural engineer to cater for proposed vehicle loading

CW 4
CL=66.810
IL=65.815

SW 1.04 150mm Dia Fall 1:150
SW 1.05 150mm Dia Fall 1:150

SW 4 - Hydrobrake
CL=66.810 Flow Rate = 2.0 l/s
IL=65.829 Design Head = 0.4m

FW 1.03 100mm Dia Fall 1:100

SW 1.03 150mm Dia Fall 1:150

SW 3
CL=66.810
IL=66.096

SW 1.02 150mm Dia Fall 1:150

SW 2
CL=66.810
IL=66.117

FW 1
CL=66.810
IL=65.982

FW 2
CL=66.810
IL=65.935

FW 3
CL=66.810
IL=65.869

FW 1.01 100mm Dia Fall 1:100

FW 1.02 100mm Dia Fall 1:100

FW 1.00 100mm Dia Fall 1:40

FW 3.00 100mm Dia Fall 1:40

FW 2.00 100mm Dia Fall 1:40

obscure window

obscure window

780 Sqft
1

Bedroom 1

Plant area

Kitchen

Bathroom

SVP from above

SVP from above

FFL:66.96

Sitting Room

Bedroom 2

Spaces for 8 bicycles

bin storage area

Garden

1.8m High Fence

1.8m High Fence

SW 1.01 150mm Dia Fall 1:150

SW 1
CL=66.810
IL=66.200

SW 1.00 100mm Dia Fall 1:100

+66.81

321A
CL=N/A
IL=N/A

45 degree line from neighbouring window

0.0m 1.0m 2.0m 3.0m 4.0m 5.0m
1:50

NOTES

1. All dimensions are in meters unless expressed otherwise and all levels are shown in meters and relate to an arbitrary site datum.
2. This drawing shall be read in conjunction with the drainage schedules and standard details.
3. All existing sewer routes are to be proved on site by the contractor and any discrepancies notified to engineer.
4. All sewers shall be constructed in accordance with Part H of the Building Regulations and Sewers for Adoption 7th Edition.
5. It is the contractors responsibility to ensure compliance with current building regulations and codes of practice.
6. Reference should be made to the structural engineers details for all aspects of foundation design and construction.
7. The contractor should check all dimensions on site. Any discrepancies shall be reported to the engineer immediately.
8. Connections to the adopted drainage authority sewers shall be made under the supervision of the authority. The contractor shall be responsible for obtaining the necessary consents required from the drainage authority.
9. Bed type S shall be used for rigid pipes. Bed type Z shall be used for all gully connections and pipes under proposed carriageways with less than 700mm cover. The concrete bed and surround is to extend to the side of the trench or be of minimum width and voids filled with well compacted selected backfill.
10. All precast concrete manhole units are to conform to B.S. 5911. Precast concrete cover slabs are to be heavy duty.
11. Downstream exit pipes of 600mm dia. and over should be fitted with heavy duty safety chains across their mouths.
12. Where large differential settlement is probable, several short lengths of pipe with flexible joints should be laid on either side of the chamber.
13. Where drains pass through foundations, a flexible joint should be provided within 150mm of the face of the structure.
14. Fast setting resin mortars may be used in lieu of cement mortar for bedding manhole frames where agreed with the Engineer to enable early cover loading.
15. The concrete base slab shall be 225mm minimum thickness for chambers up to 4500mm deep. Manholes over 4500mm deep require a slab 450mm thick.
16. All manholes over 2000mm deep are to be fitted with a "DANGER TEST FOR OXYGEN" sign
17. Appropriate measures (to be agreed with the district council's building control section) are to be taken to discourage rodent entry into the properties.
18. The contractor is to keep a record of any variations made on site, including the relocation of sewers or drains, so that an as built drawing can be prepared upon completion of the project.
19. Location of RWP's and SVP's to be confirmed by the architect, Sub Stacks shall not be used unless connected to a ventilated section of the sewer in accordance with Building Regulations.

Rev	Amendment	Drawn	Checked	Approved	Date

LANMOR Consulting
Civil Engineers & Transport Planning
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www.lanmor.co.uk

Joel Street
Northwood Hills

Drainage Layout
Site Plan

1 of 3

DRAWN	MK	CHECKED	RS	APPROVED	KBL
DATE	Oct-18	DATE	Oct-18	DATE	Oct-18
SCALE	1:50	PRJ No.	181099	SIZE	REV
DWG No.	181099-500-01			A1	-

MicroDrainage Calculations

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	66.099	0.270	2.0	6.5	O K
30 min Summer	66.150	0.321	2.0	7.7	O K
60 min Summer	66.165	0.336	2.0	8.1	O K
120 min Summer	66.143	0.314	2.0	7.5	O K
180 min Summer	66.104	0.275	2.0	6.6	O K
240 min Summer	66.063	0.234	2.0	5.6	O K
360 min Summer	65.996	0.167	2.0	4.0	O K
480 min Summer	65.952	0.123	2.0	2.9	O K
600 min Summer	65.925	0.096	1.9	2.3	O K
720 min Summer	65.913	0.084	1.8	2.0	O K
960 min Summer	65.899	0.070	1.5	1.7	O K
1440 min Summer	65.885	0.056	1.1	1.3	O K
2160 min Summer	65.874	0.045	0.8	1.1	O K
2880 min Summer	65.869	0.040	0.6	0.9	O K
4320 min Summer	65.862	0.033	0.5	0.8	O K
5760 min Summer	65.858	0.029	0.4	0.7	O K
7200 min Summer	65.855	0.026	0.3	0.6	O K
8640 min Summer	65.853	0.024	0.3	0.6	O K
10080 min Summer	65.852	0.023	0.2	0.5	O K
15 min Winter	66.136	0.307	2.0	7.4	O K
30 min Winter	66.195	0.366	2.0	8.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	142.242	0.0	7.7	17
30 min Summer	92.772	0.0	10.1	30
60 min Summer	57.587	0.0	12.5	48
120 min Summer	34.523	0.0	15.0	82
180 min Summer	25.253	0.0	16.5	116
240 min Summer	20.111	0.0	17.5	146
360 min Summer	14.561	0.0	19.0	206
480 min Summer	11.576	0.0	20.1	262
600 min Summer	9.683	0.0	21.0	316
720 min Summer	8.364	0.0	21.8	374
960 min Summer	6.634	0.0	23.1	492
1440 min Summer	4.779	0.0	24.9	734
2160 min Summer	3.437	0.0	26.9	1100
2880 min Summer	2.718	0.0	28.4	1468
4320 min Summer	1.950	0.0	30.5	2200
5760 min Summer	1.539	0.0	32.1	2936
7200 min Summer	1.280	0.0	33.4	3664
8640 min Summer	1.101	0.0	34.5	4368
10080 min Summer	0.969	0.0	35.4	5112
15 min Winter	142.242	0.0	8.6	17
30 min Winter	92.772	0.0	11.3	30

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	66.211	0.382	2.0	9.2	O K
120 min Winter	66.176	0.347	2.0	8.3	O K
180 min Winter	66.120	0.291	2.0	7.0	O K
240 min Winter	66.054	0.225	2.0	5.4	O K
360 min Winter	65.960	0.131	2.0	3.1	O K
480 min Winter	65.918	0.089	1.9	2.1	O K
600 min Winter	65.904	0.075	1.6	1.8	O K
720 min Winter	65.895	0.066	1.4	1.6	O K
960 min Winter	65.885	0.056	1.1	1.3	O K
1440 min Winter	65.875	0.046	0.8	1.1	O K
2160 min Winter	65.867	0.038	0.6	0.9	O K
2880 min Winter	65.862	0.033	0.5	0.8	O K
4320 min Winter	65.857	0.028	0.3	0.7	O K
5760 min Winter	65.853	0.024	0.3	0.6	O K
7200 min Winter	65.851	0.022	0.2	0.5	O K
8640 min Winter	65.849	0.020	0.2	0.5	O K
10080 min Winter	65.848	0.019	0.2	0.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	57.587	0.0	14.0	50
120 min Winter	34.523	0.0	16.8	88
180 min Winter	25.253	0.0	18.4	126
240 min Winter	20.111	0.0	19.6	158
360 min Winter	14.561	0.0	21.3	212
480 min Winter	11.576	0.0	22.5	258
600 min Winter	9.683	0.0	23.6	316
720 min Winter	8.364	0.0	24.4	376
960 min Winter	6.634	0.0	25.8	490
1440 min Winter	4.779	0.0	27.9	730
2160 min Winter	3.437	0.0	30.1	1088
2880 min Winter	2.718	0.0	31.8	1464
4320 min Winter	1.950	0.0	34.2	2204
5760 min Winter	1.539	0.0	36.0	2896
7200 min Winter	1.280	0.0	37.4	3616
8640 min Winter	1.101	0.0	38.6	4320
10080 min Winter	0.969	0.0	39.7	5080

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.300	Shortest Storm (mins)	15
Ratio R	0.415	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.029

Time (mins) From:	To:	Area (ha)
0	4	0.029

Model Details

Storage is Online Cover Level (m) 66.810

Tank or Pond Structure

Invert Level (m) 65.829

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	24.0	0.400	24.0	0.401	0.0

Hydro-Brake Optimum® Outflow Control

Unit Reference	MD-SHE-0075-2000-0400-2000
Design Head (m)	0.400
Design Flow (l/s)	2.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	75
Invert Level (m)	65.829
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.400	2.0
Flush-Flo™	0.124	2.0
Kick-Flo®	0.285	1.7
Mean Flow over Head Range	-	1.6

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	2.0	1.200	3.3	3.000	5.0	7.000	7.5
0.200	1.9	1.400	3.5	3.500	5.4	7.500	7.8
0.300	1.7	1.600	3.7	4.000	5.7	8.000	8.1
0.400	2.0	1.800	3.9	4.500	6.0	8.500	8.3
0.500	2.2	2.000	4.1	5.000	6.4	9.000	8.6
0.600	2.4	2.200	4.3	5.500	6.7	9.500	8.8
0.800	2.7	2.400	4.5	6.000	7.0		
1.000	3.0	2.600	4.7	6.500	7.3		

Event: 60 min Winter