ORIEL

Design File Note

PROJECT NAME
ORIEL

ORIGINATOR	ORIGINATOR LOGO
TERRELL LIMITED	TERRELL

TITLE

PLANNING CONSENT
REF 2020/4825/P - CONDITION 25
DRAINAGE

STAGE(s) (RIBA/BSRIA):	**RIBA 4**	SUITABILITY CODE:	**S2 – For Information**

ORL	TER	XX	XX	TRP	C	200061	P05
PROJECT	ORIGINATOR	FUNCTIONAL BREAKDOWN	SPATIAL BREAKDOWN	FORM	DISCIPLINE	SEQUENCE NUMBER	REVISION

File Note

By	STEVE HASWELL		
Our ref	3098-TER-FNT-200061	Revision	P05
Date	03.04.24		
Pages	**26**	Status	**FORMAL**
Project	3098 - PROJECT ORIEL - BYUK		
Subject	**DRAINAGE PLANNING CONSENT REF 2020-4825-P - CONDITION 25**		
CC			

PROJECT ORIEL – PLANNING CONSENT REF 2020/4825/P - CONDITION 25

DRAINAGE DESIGN NOTES

These notes set out briefly what has been done in terms of Stage 4 design regarding surface water design for the new Project Oriel/Moorfields Hospital at St Pancras Hospital, in support of Planning Condition 25 of consent Ref 2020/4825/P which states:

"Prior to any above ground construction, full details of the sustainable urban drainage system and permeable paving shall be submitted to and approved in writing by the local planning authority. Such system shall be based on the details set out within the Flood Risk and Drainage assessment hereby approved. Details shall include a maintenance plan. The system shall be implemented as part of the development and thereafter retained and maintained."

The designs described below follow the principles of the Flood Risk Assessment and Stage 3 designs by AECOM.

The Flood Risk Assessment for the development Ref ORL-INF-XX-XX-RP-PL Rev 1.0 dated May 2021 was based on an approximate impermeable area of 0.785ha for the site and suggested that the proposed run off from the site would be reduced by 85% of the existing 1 in 100 year event discharge rate ie reduced from 137.6L/S to 20.8L/S.

The discharge is to an existing combined drain on site which then discharges to a Thames Water combined sewer in St Pancras Way on the west side of the site. A Pre-Planning Enquiry was submitted to Thames Water and their response dated 26 February 2021 (Ref DS6081542) confirmed that a flow of 20.8L/S to their

sewer would be acceptable (see Appendix A)

The design is therefore based on the 1 in 100-year storm + 40% climate change allowance and a permitted total discharge rate of 20.8L/S for the 1 in 100-year event. The MicroDrainage calculations for the development are included in Appendix B. There are two discharge points to the drainage network on the existing site. The discharge from the eastern network has a restricted discharge of 5.9L/S and the discharge from the western network has a restricted discharge of 14.9L/S. The stored volumes within each network (ie attenuation crates, pipes and manholes) are indicated on pages 16 and 21 of Appendix B and also indicated on the Surface Water Drainage Layout S4 ORL-TER-ZZ-LG-DPL-C-209912 Rev C11 in Appendix C.

Following discussions with the contractor regarding buildability the attenuation facilities are to consist of GRP tanks to the east of the new building and larger GRP pipes to the west on St Pancras Way. It has also been necessary to introduce two hydro brake flow controls to be able to get the drainage network around the tower crane base LC1 at the entrance to the Lower Ground Floor. The drainage scheme also incorporates areas of permeable paving which are under drained and connect to the drainage network. However, for the purposes of the hydraulic design exercise the permeable paving areas have been treated as impermeable areas and included in the attenuation volume calculations but the available subbase volume under the paving has not been modelled and has been excluded from the overall attenuation volumes, meaning that final volumes in the two systems are slightly over designed. (see marked up version of the Surface Water Drainage Layout S4 ORL-TER-ZZ-LG-DPL-C-209912 Rev C11 in Appendix C showing the permeable paved areas and the 280m^2 area excluded from the original MicroDrainage calculations but now included).

The planted areas around the site have also been incorporated into the impermeable areas for the purposes of the hydraulic design and it is not thought necessary for an allowance for saturated green areas to be considered.

We have also, following further discussions with the contractor, included a forecourt separator on the northwest corner of the site on St Pancras Way to cater for any spillages from fuel deliveries to the site on Granary Street. The St Pancras Way location works better with the existing falls on Granary Street enabling the drains to be installed at a shallower depth. (Note the requirement for the separator is still the subject of discussions with the Highway Authority)

A S106 sewer connection application has been sent to Thames Water for an indirect consent to connect surface water and foul water to the existing combined water on site at the southwest corner of the new building and a copy of their consent is included in Appendix A.

The surface water drainage proposals are shown on the following drawings:

ORL-TER-ZZ-LG-DPL-C-209912 Surface Water Drainage Layout S4 Rev C11
ORL-TER-ZZ-ZZ-DDT-C-209930-Construction Details Sheet S4 Rev C04

included in Appendix C

MAINTENANCE

The Proposed Development will be situated on private land and will only serve a single curtilage. so it will remain in private ownership and be maintained by an appropriate management company in perpetuity. The details below are provided as outline maintenance guidance and are supplemented by the details included in Ciria C753 – The SuDS Manual (reproduced in Appendix D). However, it is expected that the management company appointed to maintain the proposed drainage network will prepare an Operations and Maintenance Manual specifically for the Proposed Development that will include details of all items used to construct the system, including materials used, suppliers' details and manufacturers' suggested maintenance regimes.

- Drainage Channels: Inspections should be frequent and regular, depending on local conditions. However, these will be at least annually. Inspections should include gratings, covers including their locking bolts, sumps, sump buckets, exposed concrete surrounds and adjacent paving.
- Gullies: Inspections should be frequent and regular depending on local conditions. Inspect all gullies for damage and clean out sumps. Any petrol/oil spillages should be cleaned up as soon as possible.
- Channels: After removal of gratings and/or inspection covers, channels should be flushed with water or high-pressure jetting. All surfaces and joints should be checked and repaired as necessary. Empty all silt buckets and clean out sump/gully and connections. Replace bucket and gratings ensuring they are correctly fitted.
- Below Ground Manholes and Drainage: Manholes and catchpit inspections should be frequent and regular, depending on local conditions, but at least annually. The drainage system should be cleaned / jetted as necessary. Full CCTV inspection of drainage runs should be carried out every 5 years or as required to suit instances of blockage.
- Vortex Flow Control Devices will be contained within a suitably sized manhole with a cover that can be regularly accessed and inspected from the surface or entered (with appropriate training) to maintain the units if a blockage is detected from the surface. The units will include a pull cord connected to the manhole cover frame to allow the bypass door on the units to be opened to drain down the system in event that the standard orifice is blocked. This allows the chamber to be emptied prior to operatives safely entering the system for maintenance. The inspection regime is expected to

be no less than 6-monthly intervals of routine inspection and after large rainfall events, in line with standard best practice.

APPENDIX A
THAMES WATER PRE-PLANNING RESPONSE
THAMES WATER SEWER CONNECTION CONSENT

[redacted]
AECOM
Midpoint
Alencon Link
Basingstoke
RG21 7PP

Wastewater pre-planning
Our ref DS6081542

26 February 2021

Pre-planning enquiry: Confirmation of sufficient capacity

Site: Oriel Building MEH, St Pancras Way, London, NW1 0PE

Dear [redacted],

Thank you for providing information on your development.

Proposed site: Education Centre (210 people), Lab (100 people), Restaurant (800 people), Office (42 people), Hospital (1200 people), Hospital therapy and recovery (50 beds), Impermeable area : 8280m2
Proposed foul water discharge by gravity into combined water sewer downstream of manhole TQ29836601 via existing connection.
Proposed surface water discharge at 20.8 l/s for all storm events up to and including 1:100yr+40%CC into combined water sewer downstream of manhole TQ29836601 via an existing connection.

We have completed the assessment of the foul water flows and surface water run-off based on the information submitted in your application with the purpose of assessing sewerage capacity within the existing Thames Water sewer network.

Foul Water

If your proposals progress in line with the details you've provided, we're pleased to confirm that there will be sufficient sewerage capacity in the adjacent combined water sewer 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.

Surface Water

When developing a site, policy 5.13 of the London Plan and Policy 3.4 of the Supplementary Planning Guidance (Sustainable Design And Construction) states that every attempt should be made to use flow attenuation and SuDS/Storage to reduce the surface water discharge from the site as much as possible.

In accordance with the Building Act 2000 Clause H3.3, positive connection of surface water to a public sewer will only be consented when it can be demonstrated that the hierarchy of disposal methods have been examined and proven to be impracticable. Before we can consider your surface water needs, you'll need written approval from the lead local flood authority that you have followed the sequential approach to the disposal of surface water and considered all practical means.

The disposal hierarchy being:

1. store rainwater for later use.
2. use infiltration techniques where possible.
3. attenuate rainwater in ponds or open water features for gradual release.
4. attenuate rainwater by storing in tanks or sealed water features for gradual release.
5. discharge rainwater direct to a watercourse.
6. discharge rainwater to a surface water sewer/drain.
7. discharge rainwater to the combined sewer.
8. discharge rainwater to the foul sewer

Where connection to the public sewerage network is still required to manage surface water flows, we will accept these flows at a discharge rate in line with CIRIA's best practice guide on SuDS or that stated within the sites planning approval.

If the above surface water hierarchy has been followed and if the flows are restricted to a total of 20.8 l/s, then Thames Water would not have any objections to the proposal.

Please see the attached 'Planning your wastewater' leaflet for additional information.

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 have any further questions, please contact me on 0800 009 3921.

Kind Regards,

[redacted]

Developer Services – Technical Coordinator, Sewer Adoptions Team

Tel: 0800 009 3921

[redacted]

Get advice on making your sewer connection correctly at connectright.org.uk

Clearwater Court, Vastern Road, Reading, RG1 8DB

Find us online at developers.thameswater.co.uk

Mr Eric Princemin,
BOUYGUES UK LTD,
Becket House, 1 Lambeth Palace Road,
London.
SE1 7EU

DS reference: DS4132825

developer.services@thameswater.co.uk

0800 009 3921
Monday to Friday, 8am to 5pm

thameswater.co.uk/developerservices

3 July 2023

Notice of consent to indirectly connect to a public sewer

Site address: St Pancras Hospital, St Pancras Way, London NW1 0PE

Dear Mr Princemin,

Thank you for your application for a new sewer connection at the above address.

We are pleased to inform you that we have given our conditional consent for your proposed indirect connection(s) to the public sewer, under Section 106 of the Water Industry Act 1991.

What is this consent for?

This consent is given solely for the legal right of communication (i.e. method/mode of connection) with the public sewer, in accordance with the description below.

This consent does not guarantee capacity exists within our network. For capacity-based enquiries or preplanning concerns regarding our network please make a Pre-Planning Enquiry application. Applications can be made on the Thames Water website.

This Consent does not give you any inferred right to enter or cross land owned by a third party and must not be used to discharge any drainage-related planning conditions. You will be responsible for obtaining any necessary licences and/or permission from the highway authority, planning authority and/or third-party land owners.

You must obtain permission from the owner of the private drainage system you propose to connect to.

Inspections

We usually do not need to inspect your works because your connection as agreed below is to a private drainage system which is not owned or maintained by Thames Water.
We will however need to carry out or witness a connectivity check for your connection to ensure that your private drains are discharging into the correct sewer for the following boroughs: -
Brent, Barnet, Ealing, Enfield, Harrow, Hillingdon, and Kingston Upon Thames
This is due to a significant rise in the number of pollutions caused by misconnections within these boroughs.

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If your site is not within the above-mentioned boroughs, your contractor can carry out the connection, which we do not need to supervise/inspect.
If your site is within the above-mentioned boroughs, please call us on 0800 009 3921 to schedule a connectivity check, at least ten working days prior to your estimated completion date for the connection works.

Our consent is subject to the below conditions:

Location	Description
St Pancras Hospital, St Pancras Way, London NW1 0PE	**Indirect foul water Connection (Inspection not required)** Indirect foul water Connection 1 x 225mm internal diameter indirect foul water drain connection into an existing 300mm diameter foul water lateral (private) drain via a new within the development site. As per drawing No. Indirect Connections for TWU (1).pdf (1092 KB) Indirect surface water Connection 1 x 300mm internal diameter indirect surface water drain connection into an existing 300mm diameter surface water lateral (private) drain via a new within the development site. As per drawing No. Indirect Connections for TWU (1).pdf (1092 KB) Indirect surface water Connection 1 x 150mm internal diameter indirect surface water drain connection into an existing 225mm diameter surface water lateral (private) drain via a new within the development site. As per drawing No. Indirect Connections for TWU (1).pdf (1092 KB)

Please note that we will allow ONE amendment to be made to this consent within 12 months from date of issue. Any more than ONE amendment within this time period will entail additional fees. Any amendments sought beyond this time period will require a new application to be submitted.

The reference number for your application is **DS4132825** please quote this in any future correspondence.

If you're proposing to build within three metres of a public sewer, or within one metre of a lateral drain, you'll need to apply to us for a separate build over agreement. You can do this via **thameswater.co.uk/buildover**.

Please take note of the 'Additional guidance/conditions' included below.

If you've any queries, please call our helpdesk on 0800 009 3921 (8am to 5pm, Monday to Friday) or email developer.services@thameswater.co.uk.

Yours sincerely,

Dominic Olu Aalabi
Technical Coordinator – Wastewater Connections

Letter Issue Version 4.1

Additional Guidance/Conditions

An infrastructure charge will be payable as a result of connecting a property to the public sewerage system for the first time for domestic purposes, under Section 146(2)b of the Water Industry Act 1991. We will invoice this charge separately if applicable.

Please note that this approval only covers the connections detailed in the attached notice. No other works affecting the public sewerage system may be carried out without our written consent.

Under no circumstances should foul water be discharged into the surface water sewerage system. Surface water drainage must not discharge to the foul sewerage system unless otherwise stated in the description above.

It is your responsibility to confirm the exact location, diameter, and invert levels of the public sewer prior to making the connection. You will be held liable for any misconnection (i.e. foul water discharge to a surface water sewer or surface water discharge to foul water sewer) resulting from this connection. You should carry out connectivity surveys to confirm the type of sewer your existing private drains connect to and take appropriate action to rectify if you find cross connections.

When detailing the private drainage, we advise you to assume that the public sewer may occasionally surcharge up to ground level and particular care is needed where development is proposed in low lying areas.

Where the developer/owner/occupier proposes to discharge trade effluent into the public sewer, a trade effluent consent will be required. Trade effluent can be best described as anything other than domestic sewage (toilet, bath or sink waste) or uncontaminated surface water and roof drainage (rainwater). For enquiries and application forms contact your Retailer or visit the Thames Water website at https://wholesale.thameswater.co.uk/Wholesale-services/Business-customers/Trade-effluent

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APPEDNDIX B
MICRODRAINAGE CALCULATIONS

Terrell Ltd		Page 1
164-180 Union Street London SE1 0HL	PROJECT ORIEL EASTERN NETWORK REV 28.03.24	Micro Drainage
Date 28/03/2024 File EASTERN TANKS EXTRA AREA	Designed by m.d.c. Checked by	
Micro Drainage	Network 2020.1.3	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	1	PIMP (%)	100
M5-60 (mm)	21.000	Add Flow / Climate Change (%)	0
Ratio R	0.440	Minimum Backdrop Height (m)	0.000
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	0.000
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	0.000
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Storm

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	6.185	0.100	61.9	0.171	5.00	0.0	0.600	o	300	Pipe/Conduit	
1.001	14.700	0.400	36.8	0.017	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.002	27.000	0.075	360.0	0.031	0.00	0.0	0.600	o	3000	Pipe/Conduit	
1.003	6.680	0.025	267.2	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.004	7.090	0.020	354.5	0.321	0.00	0.0	0.600	o	3000	Pipe/Conduit	
1.005	10.150	0.125	81.2	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	5.05	21.600	0.171	0.0	0.0	0.0	2.00	141.6	23.2
1.001	50.00	5.15	21.500	0.188	0.0	0.0	0.0	2.60	183.9	25.5
1.002	50.00	5.28	18.620	0.219	0.0	0.0	0.0	3.44	24299.5	29.7
1.003	50.00	5.39	18.545	0.219	0.0	0.0	0.0	0.96	67.6	29.7
1.004	50.00	5.43	18.270	0.540	0.0	0.0	0.0	3.46	24488.0	73.1
1.005	50.00	5.58	18.250	0.540	0.0	0.0	0.0	1.12	19.7«	73.1

Terrell Ltd		Page 2
164-180 Union Street London SE1 0HL	PROJECT ORIEL EASTERN NETWORK REV 28.03.24	Micro Drainage
Date 28/03/2024 File EASTERN TANKS EXTRA AREA	Designed by m.d.c. Checked by	
Micro Drainage	Network 2020.1.3	

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
S2	23.390	1.790	Open Manhole	600	1.000	21.600	300				
S3	23.400	1.900	Open Manhole	600	1.001	21.500	300	1.000	21.500	300	
Tank 1 start	23.350	4.730	Open Manhole	3000	1.002	18.620	3000	1.001	21.100	300	
Tank 1 end	23.260	4.715	Open Manhole	3000	1.003	18.545	300	1.002	18.545	3000	
Tank 2 start	23.200	4.930	Open Manhole	3000	1.004	18.270	3000	1.003	18.520	300	
Tank 2 end	22.715	4.465	Open Manhole	1200	1.005	18.250	150	1.004	18.250	3000	
	22.490	4.365	Open Manhole	0		OUTFALL		1.005	18.125	150	

No coordinates have been specified, layout information cannot be produced.

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164-180 Union Street London SE1 0HL	PROJECT ORIEL EASTERN NETWORK REV 28.03.24	Micro Drainage
Date 28/03/2024 File EASTERN TANKS EXTRA AREA	Designed by m.d.c. Checked by	
Micro Drainage	Network 2020.1.3	

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	300	S2	23.390	21.600	1.490	Open Manhole	600
1.001	o	300	S3	23.400	21.500	1.600	Open Manhole	600
1.002	o	3000	Tank 1 start	23.350	18.620	1.730	Open Manhole	3000
1.003	o	300	Tank 1 end	23.260	18.545	4.415	Open Manhole	3000
1.004	o	3000	Tank 2 start	23.200	18.270	1.930	Open Manhole	3000
1.005	o	150	Tank 2 end	22.715	18.250	4.315	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	6.185	61.9	S3	23.400	21.500	1.600	Open Manhole	600
1.001	14.700	36.8	Tank 1 start	23.350	21.100	1.950	Open Manhole	3000
1.002	27.000	360.0	Tank 1 end	23.260	18.545	1.715	Open Manhole	3000
1.003	6.680	267.2	Tank 2 start	23.200	18.520	4.380	Open Manhole	3000
1.004	7.090	354.5	Tank 2 end	22.715	18.250	1.465	Open Manhole	1200
1.005	10.150	81.2		22.490	18.125	4.215	Open Manhole	0

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164-180 Union Street London SE1 0HL	PROJECT ORIEL EASTERN NETWORK REV 28.03.24	Micro Drainage
Date 28/03/2024 File EASTERN TANKS EXTRA AREA	Designed by m.d.c. Checked by	
Micro Drainage	Network 2020.1.3	

Online Controls for Storm

Hydro-Brake® Optimum Manhole: Tank 2 end, DS/PN: 1.005, Volume (m³): 40.3

Unit Reference	MD-SHE-0083-5800-4200-5800
Design Head (m)	4.200
Design Flow (l/s)	5.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	83
Invert Level (m)	18.250
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	4.200	5.8	Kick-Flo®	0.742	2.6
Flush-Flo™	0.364	3.2	Mean Flow over Head Range	-	4.1

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)	Depth (m)	Flow (l/s)
0.100	2.4	0.800	2.7	2.000	4.1	4.000	5.7	7.000	7.4
0.200	3.0	1.000	3.0	2.200	4.3	4.500	6.0	7.500	7.6
0.300	3.2	1.200	3.2	2.400	4.5	5.000	6.3	8.000	7.9
0.400	3.2	1.400	3.5	2.600	4.6	5.500	6.6	8.500	8.1
0.500	3.2	1.600	3.7	3.000	5.0	6.000	6.9	9.000	8.3
0.600	3.0	1.800	3.9	3.500	5.3	6.500	7.1	9.500	8.5

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164-180 Union Street London SE1 0HL	PROJECT ORIEL EASTERN NETWORK REV 28.03.24	Micro Drainage
Date 28/03/2024 File EASTERN TANKS EXTRA AREA	Designed by m.d.c. Checked by	
Micro Drainage	Network 2020.1.3	

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

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
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 Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm) 21.000	Cv (Summer) 0.750
Region England and Wales		Ratio R 0.440	Cv (Winter) 0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	100
Climate Change (%)	40

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flow / Cap.	Maximum Vol (m³)	Discharge Vol (m³)
1.000	S2	240 minute 100 year Winter I+40%	23.390	22.633	0.733	0.26	0.291	116.818
1.001	S3	240 minute 100 year Winter I+40%	23.400	22.631	0.831	0.15	0.713	128.431
1.002	Tank 1 start	240 minute 100 year Winter I+40%	23.350	22.629	1.009	0.00	29.214	134.056
1.003	Tank 1 end	240 minute 100 year Winter I+40%	23.260	22.629	3.784	0.09	198.479	-23.058
1.004	Tank 2 start	240 minute 100 year Winter I+40%	23.200	22.628	1.358	0.00	31.027	170.989
1.005	Tank 2 end	240 minute 100 year Winter I+40%	22.715	22.629	4.229	0.34	40.219	135.555

PN	US/MH Name	Pipe Flow (l/s)	Status
1.000	S2	20.5	SURCHARGED
1.001	S3	22.5	SURCHARGED
1.002	Tank 1 start	22.2	SURCHARGED
1.003	Tank 1 end	4.4	SURCHARGED
1.004	Tank 2 start	12.9	SURCHARGED
1.005	Tank 2 end	5.9	FLOOD RISK

Total stored volume within the network ie within pipes, manholes and tanks 299.943cu m

Terrell Ltd		Page 1
164-180 Union Street London SE1 0LH	PROJECT ORIEL WESTERN NETWORK	
Date 28/02/2023 10:45 File WESTERN NETWORK.MDX	Designed by m.d.c. Checked by	
Micro Drainage	Network 2020.1.3	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	1	PIMP (%)	100
M5-60 (mm)	21.000	Add Flow / Climate Change (%)	0
Ratio R	0.440	Minimum Backdrop Height (m)	0.000
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	0.000
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	0.000
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
3.000	35.890	1.050	34.2	0.000	5.00	0.0	0.600	o	150	Pipe/Conduit	
3.001	0.750	0.050	15.0	0.008	0.00	0.0	0.600	o	150	Pipe/Conduit	
3.002	3.965	0.050	79.3	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
3.003	1.900	0.050	38.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
3.004	42.000	0.100	420.0	0.012	0.00	0.0	0.600	o	1050	Pipe/Conduit	
3.005	26.175	0.050	523.5	0.164	0.00	0.0	0.600	o	1200	Pipe/Conduit	
3.006	11.800	0.040	295.0	0.057	0.00	0.0	0.600	o	300	Pipe/Conduit	
4.000	10.510	0.445	23.6	0.017	5.00	0.0	0.600	o	150	Pipe/Conduit	
4.001	5.720	0.470	12.2	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
3.007	5.065	0.065	77.9	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
3.000	50.00	5.35	20.300	0.000	0.0	0.0	0.0	1.73	30.5	0.0
3.001	50.00	5.35	19.250	0.008	0.0	0.0	0.0	2.61	46.2	1.1
3.002	50.00	5.41	19.200	0.008	0.0	0.0	0.0	1.13	20.0	1.1
3.003	50.00	5.43	19.150	0.008	0.0	0.0	0.0	1.64	28.9	1.1
3.004	50.00	5.85	17.475	0.020	0.0	0.0	0.0	1.68	1450.5	2.7
3.005	50.00	6.11	17.225	0.184	0.0	0.0	0.0	1.63	1841.4	24.9
3.006	50.00	6.33	17.175	0.241	0.0	0.0	0.0	0.91	64.3	32.6
4.000	50.00	5.08	18.200	0.017	0.0	0.0	0.0	2.08	36.8	2.3
4.001	50.00	5.12	17.755	0.017	0.0	0.0	0.0	2.90	51.3	2.3
3.007	50.00	6.38	17.135	0.258	0.0	0.0	0.0	1.78	126.0	34.9

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164-180 Union Street London SE1 0LH	PROJECT ORIEL WESTERN NETWORK	
Date 28/02/2023 10:45 File WESTERN NETWORK.MDX	Designed by m.d.c. Checked by	
Micro Drainage	Network 2020.1.3	

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
S5	21.500	1.200	Open Manhole	450	3.000	20.300	150				
S6	20.000	0.750	Open Manhole	450	3.001	19.250	150	3.000	19.250	150	
TANK START	19.700	0.500	Junction		3.002	19.200	150	3.001	19.200	150	
TANK END	19.700	0.550	Junction		3.003	19.150	150	3.002	19.150	150	
S7	19.650	2.175	Open Manhole	2100	3.004	17.475	1050	3.003	19.100	150	725
S8	19.300	2.075	Open Manhole	2100	3.005	17.225	1200	3.004	17.375	1050	
S9	19.200	2.025	Open Manhole	2100	3.006	17.175	300	3.005	17.175	1200	
S10	19.280	1.080	Open Manhole	450	4.000	18.200	150				
S11	19.700	1.945	Open Manhole	450	4.001	17.755	150	4.000	17.755	150	
S12/ HYD	19.410	2.275	Open Manhole	1500	3.007	17.135	300	3.006	17.135	300	
								4.001	17.285	150	
	19.470	2.400	Open Manhole	0		OUTFALL		3.007	17.070	300	

No coordinates have been specified, layout information cannot be produced.

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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
3.000	o	150	S5	21.500	20.300	1.050	Open Manhole	450
3.001	o	150	S6	20.000	19.250	0.600	Open Manhole	450
3.002	o	150	TANK START	19.700	19.200	0.350	Junction	
3.003	o	150	TANK END	19.700	19.150	0.400	Junction	
3.004	o	1050	S7	19.650	17.475	1.125	Open Manhole	2100
3.005	o	1200	S8	19.300	17.225	0.875	Open Manhole	2100
3.006	o	300	S9	19.200	17.175	1.725	Open Manhole	2100
4.000	o	150	S10	19.280	18.200	0.930	Open Manhole	450
4.001	o	150	S11	19.700	17.755	1.795	Open Manhole	450
3.007	o	300	S12/ HYD	19.410	17.135	1.975	Open Manhole	1500

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
3.000	35.890	34.2	S6	20.000	19.250	0.600	Open Manhole	450
3.001	0.750	15.0	TANK START	19.700	19.200	0.350	Junction	
3.002	3.965	79.3	TANK END	19.700	19.150	0.400	Junction	
3.003	1.900	38.0	S7	19.650	19.100	0.400	Open Manhole	2100
3.004	42.000	420.0	S8	19.300	17.375	0.875	Open Manhole	2100
3.005	26.175	523.5	S9	19.200	17.175	0.825	Open Manhole	2100
3.006	11.800	295.0	S12/ HYD	19.410	17.135	1.975	Open Manhole	1500
4.000	10.510	23.6	S11	19.700	17.755	1.795	Open Manhole	450
4.001	5.720	12.2	S12/ HYD	19.410	17.285	1.975	Open Manhole	1500
3.007	5.065	77.9		19.470	17.070	2.100	Open Manhole	0

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Online Controls for Storm

Hydro-Brake® Optimum Manhole: S12/ HYD, DS/PN: 3.007, Volume (m³): 4.8

Unit Reference	MD-SHE-0163-1490-1775-1490
Design Head (m)	1.775
Design Flow (l/s)	14.9
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	163
Invert Level (m)	17.135
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.775	14.9	Kick-Flo®	1.097	11.9
Flush-Flo™	0.516	14.9	Mean Flow over Head Range	-	13.0

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)	Depth (m)	Flow (l/s)
0.100	5.8	0.800	14.3	2.000	15.8	4.000	21.9	7.000	28.7
0.200	12.9	1.000	13.1	2.200	16.5	4.500	23.2	7.500	29.7
0.300	14.2	1.200	12.4	2.400	17.2	5.000	24.4	8.000	30.6
0.400	14.7	1.400	13.3	2.600	17.9	5.500	25.6	8.500	31.5
0.500	14.9	1.600	14.2	3.000	19.1	6.000	26.7	9.000	32.4
0.600	14.8	1.800	15.0	3.500	20.6	6.500	27.7	9.500	33.3

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Micro Drainage	Network 2020.1.3	

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

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
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 Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm) 21.000	Cv (Summer) 0.750
Region England and Wales		Ratio R 0.440	Cv (Winter) 0.840

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

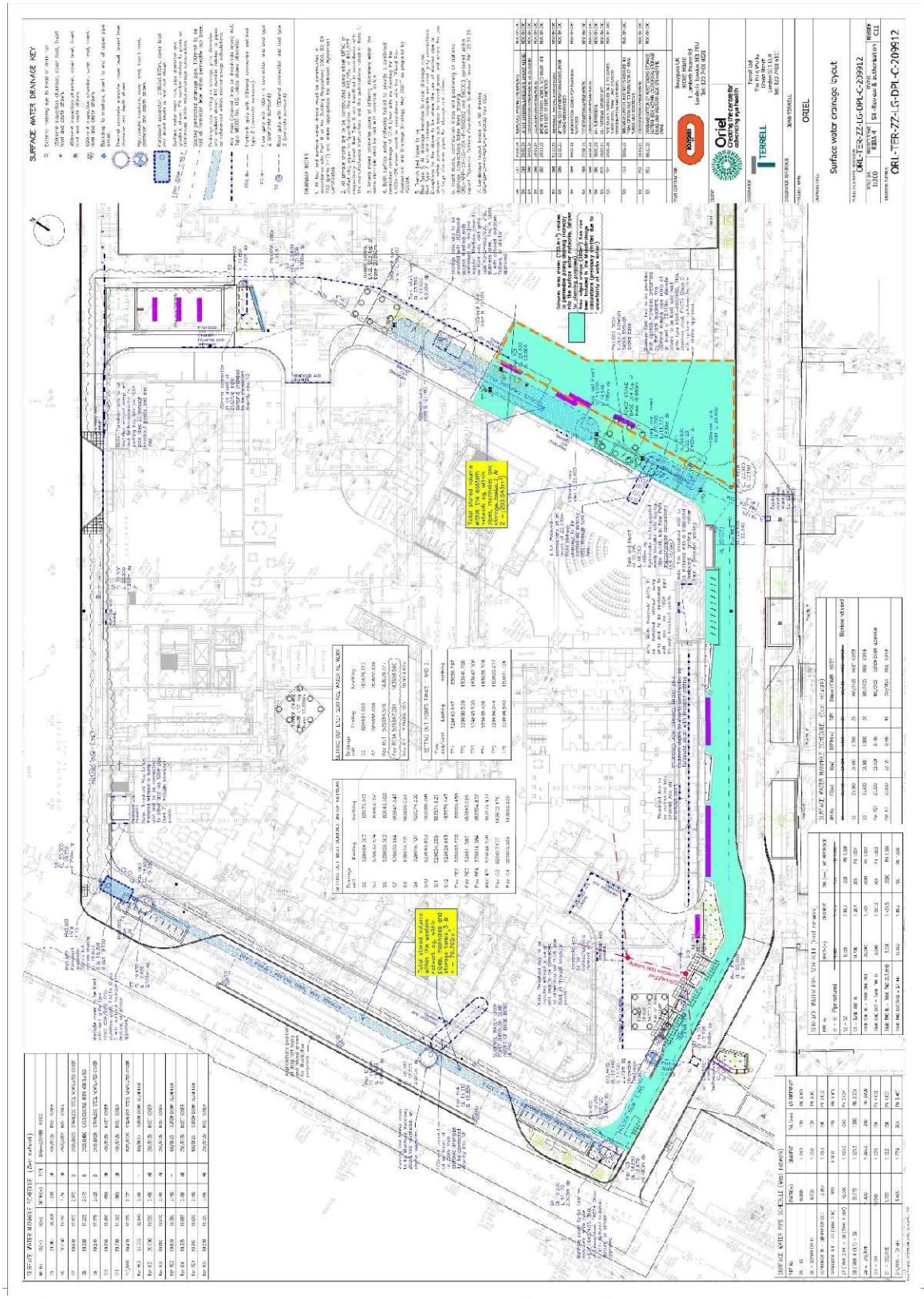
Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	100
Climate Change (%)	40

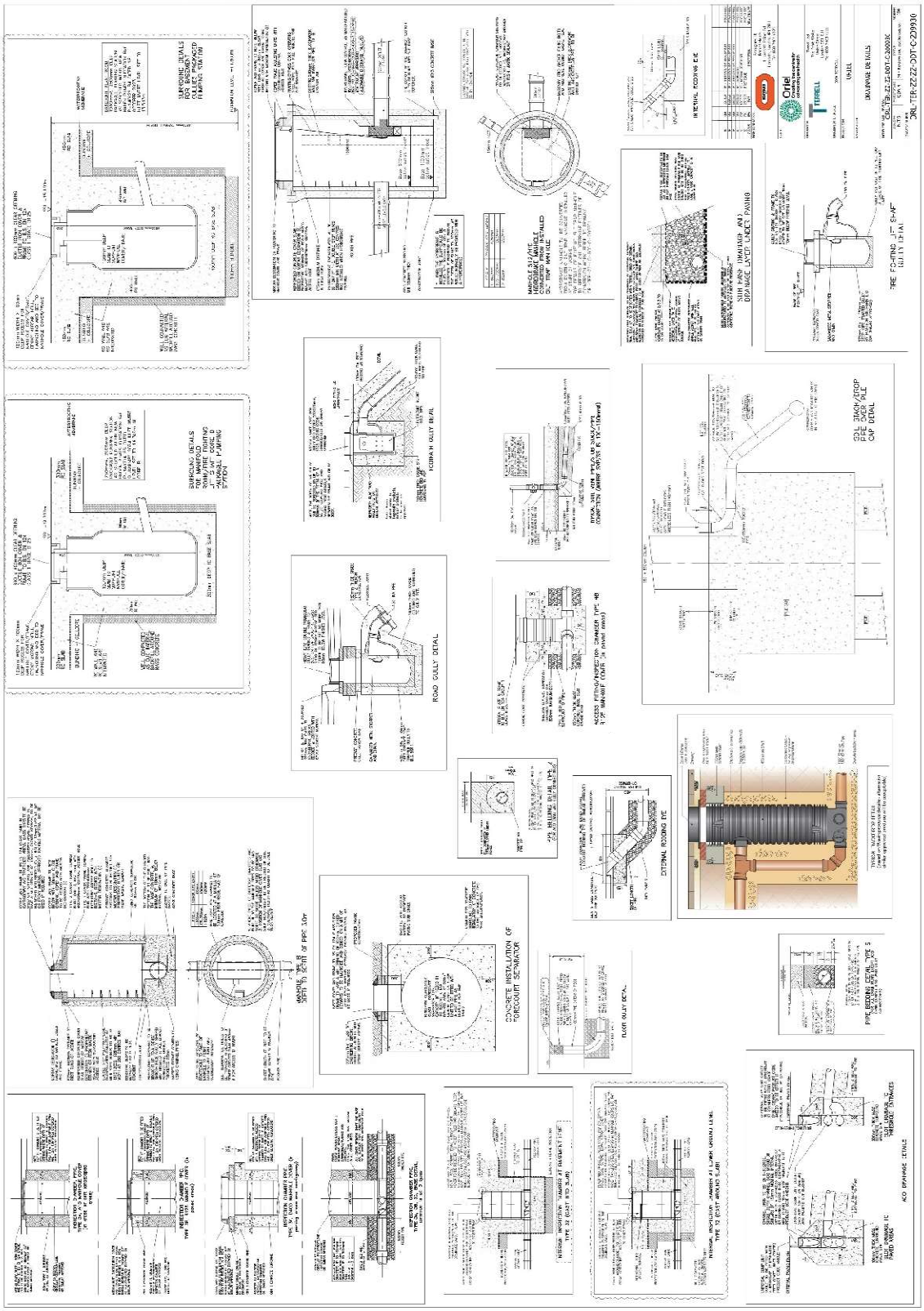
PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flow / Cap.	Maximum Vol (m³)	Discharge Vol (m³)	Pipe Flow (l/s)
3.000	S5	15 minute 100 year Summer I+40%	21.500	20.300	-0.150	0.00	0.000	0.000	0.0
3.001	S6	15 minute 100 year Winter I+40%	20.000	19.317	-0.083	0.41	0.021	2.531	5.8
3.002	TANK START	15 minute 100 year Summer I+40%	19.700	19.267	-0.083	0.42	0.065	2.262	5.8
3.003	TANK END	15 minute 100 year Summer I+40%	19.700	19.218	-0.082	0.41	0.085	2.263	5.8
3.004	S7	60 minute 100 year Winter I+40%	19.650	18.685	0.160	0.00	4.173	8.441	3.7
3.005	S8	60 minute 100 year Winter I+40%	19.300	18.685	0.260	0.02	39.587	73.622	19.8
3.006	S9	60 minute 100 year Winter I+40%	19.200	18.685	1.210	0.27	32.431	85.247	14.1
4.000	S10	60 minute 100 year Winter I+40%	19.280	18.680	0.330	0.18	0.076	8.511	5.8
4.001	S11	60 minute 100 year Winter I+40%	19.700	18.677	0.772	0.13	0.324	8.462	5.3
3.007	S12/ HYD	60 minute 100 year Winter I+40%	19.410	18.675	1.240	0.23	3.503	91.460	14.9

Total stored volume within the network ie within pipes, manholes and tanks 76.762cu m

PN	US/MH Name	Status
3.000	S5	OK
3.001	S6	OK
3.002	TANK START	OK*
3.003	TANK END	OK*
3.004	S7	SURCHARGED
3.005	S8	SURCHARGED
3.006	S9	SURCHARGED
4.000	S10	SURCHARGED
4.001	S11	SURCHARGED
3.007	S12/ HYD	SURCHARGED

APPENDIX C
SCHEME DESIGN DRAWINGS
ORL-TER-ZZ-LG-DPL-C-209912 Surface Water Drainage Layout S4 Rev C11
ORL-TER-ZZ-ZZ-DDT-C-209930-Construction Details Sheet S4 Rev C04


SURFACE WATER DRAINAGE KEY
Surface water drainage layout
ORL-TER-ZZ-LG-DPL-C-209912
ORIEL
TERRELL



APPENDIX D
SuDS MANUAL MAINTENANCE TABLES

CIRIA SuDS Manual 2015

TABLE 20.15 Operation and maintenance requirements for pervious pavements

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 surface 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 glyphospate 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	Initial inspection	Monthly for three months after installation
	Inspect for evidence of poor operation and/or weed growth – if required, take remedial action	Three-monthly, 48 h after large storms in first six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually

CIRIA SuDS Manual 2015

TABLE 21.3 Operation and maintenance requirements for attenuation storage tanks

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action	Monthly for 3 months, then annually
	Remove debris from the catchment surface (where it may cause risks to performance)	Monthly
	For systems where rainfall infiltrates into 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 and/ or internal forebays	Annually, or as required
Remedial actions	Repair/rehabilitate inlets, outlet, 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 tank for sediment build-up and remove if necessary	Every 5 years or as required