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PRELIMINARY DRAINAGE CALCULATIONS

FOR

MICHAEL GRAVES

AT

294-298 WHITECHAPEL ROAD, CLECKHEATON

REF: E21/7893

DATE – APRIL 2022

PREPARED BY:

M.HUDDLESTON. MSc

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NETWORK

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	2	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	19.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.350	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	4.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
1	0.052	4.00	139.150	1200	417577.515	425972.902	2.050
2	0.012	4.00	139.200	1200	417556.874	425975.846	2.160
9	0.036	4.00	139.515	1200	417541.455	425989.222	1.350
3	0.014	4.00	139.700	1500	417539.893	425978.268	2.709
4	0.008	4.00	139.948	1500	417537.567	425963.125	3.001
5	0.008	4.00	140.068	1500	417531.882	425958.860	3.141
6	0.053	4.00	140.353	1500	417517.015	425960.981	3.469
7			139.868	2400	417512.905	425932.166	3.067
8			139.727	1500	417514.749	425927.784	2.958

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	1	2	20.850	0.600	137.100	137.040	0.060	350.0	800	4.15	50.0
1.001	2	3	17.153	0.600	137.040	136.991	0.049	350.0	600	4.37	50.0
2.000	9	3	11.065	0.600	138.165	137.441	0.724	15.3	150	4.07	50.0
1.002	3	4	15.321	0.600	136.991	136.947	0.044	350.0	600	4.57	50.0
1.003	4	5	7.107	0.600	136.947	136.927	0.020	350.0	600	4.66	50.0
1.004	5	6	15.018	0.600	136.927	136.884	0.043	350.0	600	4.85	50.0
1.005	6	7	29.107	0.600	136.884	136.801	0.083	350.0	600	5.23	50.0
1.006	7	8	4.754	0.600	136.801	136.769	0.032	150.0	600	5.27	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	2.332	2797.9	7.0	1.250	1.360	0.052	0.0	16	0.295
1.001	1.296	366.3	8.7	1.560	2.109	0.064	0.0	63	0.554
2.000	2.590	45.8	4.9	1.200	2.109	0.036	0.0	33	1.698
1.002	1.296	366.3	15.4	2.109	2.401	0.114	0.0	83	0.656
1.003	1.296	366.3	16.5	2.401	2.541	0.122	0.0	86	0.670
1.004	1.296	366.3	17.6	2.541	2.869	0.130	0.0	88	0.680
1.005	1.296	366.3	24.8	2.869	2.467	0.183	0.0	105	0.753
1.006	1.986	561.5	24.8	2.467	2.358	0.183	0.0	85	1.021

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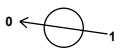
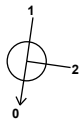
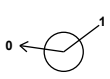
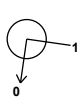
Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	20.850	350.0	800	Storage Tank	139.150	137.100	1.250	139.200	137.040	1.360
1.001	17.153	350.0	600	Circular_Default Sewer Type	139.200	137.040	1.560	139.700	136.991	2.109
2.000	11.065	15.3	150	Circular_Default Sewer Type	139.515	138.165	1.200	139.700	137.441	2.109
1.002	15.321	350.0	600	Circular_Default Sewer Type	139.700	136.991	2.109	139.948	136.947	2.401
1.003	7.107	350.0	600	Circular_Default Sewer Type	139.948	136.947	2.401	140.068	136.927	2.541
1.004	15.018	350.0	600	Circular_Default Sewer Type	140.068	136.927	2.541	140.353	136.884	2.869
1.005	29.107	350.0	600	Circular_Default Sewer Type	140.353	136.884	2.869	139.868	136.801	2.467
1.006	4.754	150.0	600	Circular_Default Sewer Type	139.868	136.801	2.467	139.727	136.769	2.358

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	1	1200	Manhole	Adoptable	2	1200	Manhole	Adoptable
1.001	2	1200	Manhole	Adoptable	3	1500	Manhole	Adoptable
2.000	9	1200	Manhole	Adoptable	3	1500	Manhole	Adoptable
1.002	3	1500	Manhole	Adoptable	4	1500	Manhole	Adoptable
1.003	4	1500	Manhole	Adoptable	5	1500	Manhole	Adoptable
1.004	5	1500	Manhole	Adoptable	6	1500	Manhole	Adoptable
1.005	6	1500	Manhole	Adoptable	7	2400	Manhole	Adoptable
1.006	7	2400	Manhole	Adoptable	8	1500	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
1	417577.515	425972.902	139.150	2.050	1200				
						0	1.000	137.100	800
2	417556.874	425975.846	139.200	2.160	1200		1	1.000	137.040	800
						0	1.001	137.040	600
9	417541.455	425989.222	139.515	1.350	1200				
						0	2.000	138.165	150
3	417539.893	425978.268	139.700	2.709	1500		1	2.000	137.441	150
							2	1.001	136.991	600
						0	1.002	136.991	600
4	417537.567	425963.125	139.948	3.001	1500		1	1.002	136.947	600
						0	1.003	136.947	600
5	417531.882	425958.860	140.068	3.141	1500		1	1.003	136.927	600
						0	1.004	136.927	600
6	417517.015	425960.981	140.353	3.469	1500		1	1.004	136.884	600
						0	1.005	136.884	600

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Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
7	417512.905	425932.166	139.868	3.067	2400		1	1.005	136.801	600
							0	1.006	136.801	600
8	417514.749	425927.784	139.727	2.958	1500		1	1.006	136.769	600

Simulation Settings

Rainfall Methodology	FSR	Skip Steady State	✓
FSR Region	England and Wales	Drain Down Time (mins)	240
M5-60 (mm)	19.000	Additional Storage (m³/ha)	20.0
Ratio-R	0.350	Check Discharge Rate(s)	✓
Summer CV	0.750	Check Discharge Volume	✓
Winter CV	0.840	100 year 360 minute (m³)	
Analysis Speed	Detailed		

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 %)
2	0	0	0
30	0	0	0
100	0	0	0
100	30	0	0

Pre-development Discharge Rate

Site Makeup	Greenfield	Growth Factor 30 year	1.95
Greenfield Method	IH124	Growth Factor 100 year	2.48
Positively Drained Area (ha)		Betterment (%)	0
SAAR (mm)		QBar	
Soil Index	1	Q 1 year (l/s)	
SPR	0.10	Q 30 year (l/s)	
Region	1	Q 100 year (l/s)	
Growth Factor 1 year	0.85		

Pre-development Discharge Volume

Site Makeup	Greenfield	Return Period (years)	100
Greenfield Method	FSR/FEH	Climate Change (%)	0
Positively Drained Area (ha)		Storm Duration (mins)	360
Soil Index	1	Betterment (%)	0
SPR	0.10	PR	
CWI		Runoff Volume (m³)	

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Node 7 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	136.801	Product Number	CTL-SHE-0084-3500-1300-3500
Design Depth (m)	1.300	Min Outlet Diameter (m)	0.100
Design Flow (l/s)	3.5	Min Node Diameter (mm)	1200

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STORM SIMULATIONS

Results for 2 year Critical Storm Duration. Lowest mass balance: 99.23%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute winter	1	49	137.158	0.058	5.0	0.0950	0.0000	OK
60 minute winter	2	50	137.159	0.119	5.7	0.1473	0.0000	OK
15 minute winter	9	10	138.204	0.039	6.3	0.0649	0.0000	OK
60 minute winter	3	51	137.157	0.166	9.8	0.3112	0.0000	OK
60 minute winter	4	49	137.158	0.211	9.4	0.3845	0.0000	OK
60 minute winter	5	49	137.158	0.231	8.5	0.4204	0.0000	OK
60 minute winter	6	52	137.157	0.273	11.1	0.5666	0.0000	OK
60 minute winter	7	48	137.158	0.357	7.2	1.6158	0.0000	OK
15 minute summer	8	1	136.769	0.000	3.4	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)
60 minute winter	1	1.000	2	4.6	0.107	0.002	2.7350	
60 minute winter	2	1.001	3	5.4	0.374	0.015	0.8808	
15 minute winter	9	2.000	3	6.3	1.777	0.138	0.0392	
60 minute winter	3	1.002	4	8.7	0.470	0.024	1.1630	
60 minute winter	4	1.003	5	7.8	0.468	0.021	0.6703	
60 minute winter	5	1.004	6	6.6	0.394	0.018	1.6890	
60 minute winter	6	1.005	7	7.2	0.368	0.020	4.3554	
60 minute winter	7	Hydro-Brake®	8	3.4				23.5

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Results for 30 year Critical Storm Duration. Lowest mass balance: 99.23%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
120 minute winter	1	110	137.386	0.286	5.5	0.4679	0.0000	OK
120 minute winter	2	114	137.385	0.345	6.4	0.4287	0.0000	OK
15 minute winter	9	10	138.220	0.055	11.9	0.0916	0.0000	OK
120 minute winter	3	108	137.385	0.394	7.5	0.7376	0.0000	OK
120 minute winter	4	110	137.384	0.437	6.7	0.7960	0.0000	OK
120 minute winter	5	110	137.384	0.457	6.2	0.8314	0.0000	OK
120 minute winter	6	104	137.385	0.501	9.7	1.0378	0.0000	OK
120 minute winter	7	102	137.385	0.584	6.7	2.6440	0.0000	OK
15 minute summer	8	1	136.769	0.000	3.4	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)
120 minute winter	1	1.000	2	5.2	0.090	0.002	9.8615	
120 minute winter	2	1.001	3	4.0	0.325	0.011	3.1193	
15 minute winter	9	2.000	3	11.9	2.106	0.260	0.0625	
120 minute winter	3	1.002	4	6.1	0.413	0.017	3.1894	
120 minute winter	4	1.003	5	5.6	0.403	0.015	1.6011	
120 minute winter	5	1.004	6	4.9	0.343	0.013	3.6167	
120 minute winter	6	1.005	7	6.7	0.349	0.018	7.7244	
120 minute winter	7	Hydro-Brake®	8	3.4				55.9

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Results for 100 year Critical Storm Duration. Lowest mass balance: 99.23%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
120 minute winter	1	116	137.667	0.567	7.4	0.9291	0.0000	OK
120 minute winter	2	118	137.668	0.628	8.3	0.7799	0.0000	SURCHARGED
15 minute winter	9	10	138.229	0.064	15.4	0.1062	0.0000	OK
120 minute winter	3	116	137.669	0.677	8.3	1.2675	0.0000	SURCHARGED
120 minute winter	4	116	137.670	0.723	6.7	1.3159	0.0000	SURCHARGED
120 minute winter	5	116	137.670	0.743	6.0	1.3515	0.0000	SURCHARGED
120 minute winter	6	116	137.670	0.786	10.4	1.6300	0.0000	SURCHARGED
120 minute winter	7	118	137.670	0.869	7.5	3.9319	0.0000	SURCHARGED
15 minute summer	8	1	136.769	0.000	3.4	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)
120 minute winter	1	1.000	2	5.7	0.110	0.002	18.6893	
120 minute winter	2	1.001	3	-5.1	0.322	-0.014	4.8316	
15 minute winter	9	2.000	3	15.4	2.247	0.337	0.0759	
120 minute winter	3	1.002	4	6.1	0.396	0.017	4.3156	
120 minute winter	4	1.003	5	5.4	0.390	0.015	2.0019	
120 minute winter	5	1.004	6	4.5	0.360	0.012	4.2302	
120 minute winter	6	1.005	7	7.5	0.368	0.020	8.1988	
120 minute winter	7	Hydro-Brake®	8	3.4				65.8

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Results for 100 year +30% CC Critical Storm Duration. Lowest mass balance: 99.23%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
180 minute winter	1	172	138.116	1.016	7.1	1.6639	0.0000	SURCHARGED
180 minute winter	2	172	138.116	1.076	7.5	1.3359	0.0000	SURCHARGED
15 minute winter	9	10	138.240	0.075	20.1	0.1247	0.0000	OK
180 minute winter	3	172	138.115	1.124	8.2	2.1034	0.0000	SURCHARGED
180 minute winter	4	172	138.115	1.168	7.0	2.1258	0.0000	SURCHARGED
180 minute winter	5	172	138.115	1.188	6.1	2.1597	0.0000	SURCHARGED
180 minute winter	6	172	138.115	1.231	9.7	2.5513	0.0000	SURCHARGED
180 minute winter	7	168	138.115	1.313	6.7	5.9421	0.0000	SURCHARGED
15 minute summer	8	1	136.769	0.000	3.4	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)
180 minute winter	1	1.000	2	4.5	0.088	0.002	32.7077	
180 minute winter	2	1.001	3	-5.0	0.293	-0.014	4.8316	
15 minute winter	9	2.000	3	20.1	2.395	0.439	0.0929	
180 minute winter	3	1.002	4	6.2	0.371	0.017	4.3156	
180 minute winter	4	1.003	5	5.3	0.378	0.015	2.0019	
180 minute winter	5	1.004	6	4.2	0.349	0.011	4.2302	
180 minute winter	6	1.005	7	6.7	0.362	0.018	8.1988	
180 minute winter	7	Hydro-Brake®	8	3.5				77.4

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