

Appendix D

3.2 - Microdrainage Results Southampton Airport Runway Extension.pdf

Mott MacDonald		Page 1
Mott MacDonald House 8-10 Sydenham Road Croydon, CR0 2EE, United Kin...	Southampton Airport Runway Extension	
Date 24/06/2019	Designed by A. Hay	
File RIBA 4 Drainage Model S...	Checked by G. Tregillis	
Innovyze	Network 2019.1	

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)	5	PIMP (%)	100
M5-60 (mm)	19.800	Add Flow / Climate Change (%)	0
Ratio R	0.350	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	100	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.950	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
1.000	35.969	0.310	116.0	0.095	5.00	0.0	0.600	o	225	Pipe/Conduit	
2.000	65.241	0.245	266.3	0.368	5.00	0.0	0.600	o	375	Pipe/Conduit	
2.001	46.436	0.161	288.0	0.156	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.001	83.051	0.203	409.0	0.167	0.00	0.0	0.600	o	525	Pipe/Conduit	
1.002	22.420	0.241	93.1	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.003	3.355	0.002	2236.3	0.000	0.00	0.0	0.600	o	225	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	80.78	5.49	12.000	0.095	0.0	0.0	0.0	1.21	48.2	26.4
2.000	77.90	5.98	11.945	0.368	0.0	0.0	0.0	1.11	122.1	98.4
2.001	79.84	5.65	11.625	0.000	10.0	0.0	0.0	1.19	189.7	10.0
1.001	73.09	6.91	11.390	0.262	10.0	0.0	0.0	1.10	238.4	75.7
1.002	82.15	5.28	11.187	0.000	5.0	0.0	0.0	1.36	53.9	5.0
1.003	82.58	5.21	10.946	0.000	5.0	0.0	0.0	0.27	10.6	5.0

Mott MacDonald		Page 2
Mott MacDonald House 8-10 Sydenham Road Croydon, CR0 2EE, United Kin...	Southampton Airport Runway Extension	
Date 24/06/2019	Designed by A. Hay	
File RIBA 4 Drainage Model S...	Checked by G. Tregillis	
Innovyze	Network 2019.1	

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)
SWMH04	13.416	1.416	Open Manhole	1200	1.000	12.000	225				
SWMH01	13.265	1.320	Open Manhole	1350	2.000	11.945	375				
SWMH02	13.300	1.675	Open Manhole	1350	2.001	11.625	450	2.000	11.700	375	
SWMH03	13.327	1.937	Open Manhole	1500	1.001	11.390	525	1.000	11.690	225	
								2.001	11.464	450	
Soakaway	12.919	1.732	Open Manhole	1500	1.002	11.187	225	1.001	11.187	525	
SWMH06	12.751	1.805	Open Manhole	1200	1.003	10.946	225	1.002	10.946	225	
	13.000	2.055	Open Manhole	0		OUTFALL		1.003	10.945	225	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
SWMH04	615715.902	5646404.323	615715.902	5646404.323	Required	
SWMH01	615763.517	5646544.075	615763.517	5646544.075	Required	
SWMH02	615742.701	5646482.244	615742.701	5646482.244	Required	
SWMH03	615727.995	5646438.198	615727.995	5646438.198	Required	
Soakaway	615809.870	5646424.267	615809.870	5646424.267	Required	
SWMH06	615830.697	5646415.968	615830.697	5646415.968	Required	
	615833.893	5646414.947			No Entry	

Mott MacDonald		Page 3
Mott MacDonald House 8-10 Sydenham Road Croydon, CR0 2EE, United Kin...	Southampton Airport Runway Extension	
Date 24/06/2019	Designed by A. Hay	
File RIBA 4 Drainage Model S...	Checked by G. Tregillis	
Innovyze		Network 2019.1

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	225	SWMH04	13.416	12.000	1.191	Open Manhole	1200
2.000	o	375	SWMH01	13.265	11.945	0.945	Open Manhole	1350
2.001	o	450	SWMH02	13.300	11.625	1.225	Open Manhole	1350
1.001	o	525	SWMH03	13.327	11.390	1.412	Open Manhole	1500
1.002	o	225	Soakaway	12.919	11.187	1.507	Open Manhole	1500
1.003	o	225	SWMH06	12.751	10.946	1.580	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	35.969	116.0	SWMH03	13.327	11.690	1.412	Open Manhole	1500
2.000	65.241	266.3	SWMH02	13.300	11.700	1.225	Open Manhole	1350
2.001	46.436	288.0	SWMH03	13.327	11.464	1.413	Open Manhole	1500
1.001	83.051	409.0	Soakaway	12.919	11.187	1.207	Open Manhole	1500
1.002	22.420	93.1	SWMH06	12.751	10.946	1.580	Open Manhole	1200
1.003	3.355	2236.3		13.000	10.945	1.830	Open Manhole	0

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D, L (mm)	W (mm)
---------------------	--------------	--------------	--------------	------------------	-----------	--------

1.003		13.000	10.945	0.000	0	0
-------	--	--------	--------	-------	---	---

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.840	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m ³ /ha Storage	0.000
Hot Start (mins)	0	Inlet Coefficient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	1440
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	12

Number of Input Hydrographs 0 Number of Storage Structures 2
 Number of Online Controls 2 Number of Time/Area Diagrams 0
 Number of Offline Controls 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Mott MacDonald		Page 4
Mott MacDonald House 8-10 Sydenham Road Croydon, CR0 2EE, United Kin...	Southampton Airport Runway Extension	
Date 24/06/2019	Designed by A. Hay	
File RIBA 4 Drainage Model S...	Checked by G. Tregillis	
Innovyze	Network 2019.1	

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Winter
Return Period (years)	100	Cv (Summer)	0.950
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.800	Storm Duration (mins)	720
Ratio R	0.350		

Mott MacDonald		Page 5
Mott MacDonald House 8-10 Sydenham Road Croydon, CR0 2EE, United Kin...	Southampton Airport Runway Extension	
Date 24/06/2019 File RIBA 4 Drainage Model S...	Designed by A. Hay Checked by G. Tregillis	
Innovyze	Network 2019.1	

Online Controls for Storm

Orifice Manhole: Soakaway, DS/PN: 1.002, Volume (m³): 20.7

Diameter (m) 0.001 Discharge Coefficient 0.600 Invert Level (m) 11.187

Complex Manhole: SWMH06, DS/PN: 1.003, Volume (m³): 2.9

Orifice

Diameter (m) 0.001 Discharge Coefficient 0.600 Invert Level (m) 10.946

Mott MacDonald		Page 6
Mott MacDonald House 8-10 Sydenham Road Croydon, CR0 2EE, United Kin...	Southampton Airport Runway Extension	
Date 24/06/2019	Designed by A. Hay	
File RIBA 4 Drainage Model S...	Checked by G. Tregillis	
Innovyze	Network 2019.1	

Offline Controls for Storm

Pipe Manhole: Soakaway, DS/PN: 1.002, Loop to PN: 1.003

Diameter (m)	0.225	Roughness k (mm)	0.600
Section Type	Pipe/Conduit	Entry Loss Coefficient	0.500
Slope (1:X)	200.0	Coefficient of Contraction	0.600
Length (m)	6.300	Upstream Invert Level (m)	11.600

Mott MacDonald		Page 7
Mott MacDonald House 8-10 Sydenham Road Croydon, CR0 2EE, United Kin...	Southampton Airport Runway Extension	
Date 24/06/2019	Designed by A. Hay	
File RIBA 4 Drainage Model S...	Checked by G. Tregillis	
Innovyze	Network 2019.1	

Storage Structures for Storm

Cellular Storage Manhole: Soakaway, DS/PN: 1.002

Invert Level (m) 10.892 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.25000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	338.0	338.0	1.001	0.0	416.0
1.000	338.0	416.0			

Complex Manhole: SWMH06, DS/PN: 1.003

Infiltration Trench

Infiltration Coefficient Base (m/hr) 0.25000 Trench Width (m) 1.5
Infiltration Coefficient Side (m/hr) 0.25000 Trench Length (m) 17.5
Safety Factor 2.0 Slope (1:X) 500.0
Porosity 0.30 Cap Volume Depth (m) 0.000
Invert Level (m) 11.500 Cap Infiltration Depth (m) 0.000

Infiltration Trench

Infiltration Coefficient Base (m/hr) 0.25000 Trench Width (m) 1.5
Infiltration Coefficient Side (m/hr) 0.25000 Trench Length (m) 17.5
Safety Factor 2.0 Slope (1:X) 500.0
Porosity 0.30 Cap Volume Depth (m) 0.000
Invert Level (m) 11.500 Cap Infiltration Depth (m) 0.000

Infiltration Trench

Infiltration Coefficient Base (m/hr) 0.25000 Trench Width (m) 1.5
Infiltration Coefficient Side (m/hr) 0.25000 Trench Length (m) 17.5
Safety Factor 2.0 Slope (1:X) 500.0
Porosity 0.30 Cap Volume Depth (m) 0.000
Invert Level (m) 11.500 Cap Infiltration Depth (m) 0.000

Mott MacDonald		Page 8
Mott MacDonald House 8-10 Sydenham Road Croydon, CR0 2EE, United Kin...	Southampton Airport Runway Extension	
Date 24/06/2019	Designed by A. Hay	
File RIBA 4 Drainage Model S...	Checked by G. Tregillis	
Innovyze	Network 2019.1	

1 year Return Period 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 0.000
 Hot Start Level (mm) 0 Inlet Coefficient 0.800
 Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
 Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 2
 Number of Online Controls 2 Number of Time/Area Diagrams 0
 Number of Offline Controls 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.350
 Region England and Wales Cv (Summer) 0.750
 M5-60 (mm) 19.700 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 ON

Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600,
 720, 960, 1440
 Return Period(s) (years) 1, 30, 100
 Climate Change (%) 0, 20, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow
1.000	SWMH04	15 Winter	1	+0%	100/15 Summer		
2.000	SWMH01	15 Winter	1	+0%	30/15 Summer	100/15 Summer	
2.001	SWMH02	15 Winter	1	+0%	30/15 Summer		
1.001	SWMH03	15 Winter	1	+0%	30/15 Summer		
1.002	Soakaway	1440 Winter	1	+0%	1/1440 Winter		30/120 Summer
1.003	SWMH06	720 Winter	1	+0%	30/120 Summer	100/120 Winter	

PN	US/MH Name	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m ³)	Pipe Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	SWMH04		12.080	-0.145	0.000	0.27		12.4	OK
2.000	SWMH01		12.115	-0.205	0.000	0.40		46.1	OK
2.001	SWMH02		11.813	-0.262	0.000	0.36		61.6	OK
1.001	SWMH03		11.623	-0.292	0.000	0.41		90.6	OK
1.002	Soakaway	40	11.414	0.002	0.000	0.00	0.0	0.0	SURCHARGED
1.003	SWMH06		10.951	-0.220	0.000	0.00		0.0	OK

Mott MacDonald		Page 9
Mott MacDonald House 8-10 Sydenham Road Croydon, CR0 2EE, United Kin...	Southampton Airport Runway Extension	
Date 24/06/2019 File RIBA 4 Drainage Model S...	Designed by A. Hay Checked by G. Tregillis	
Innovyze	Network 2019.1	

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

PN	US/MH Name	Level Exceeded
1.000	SWMH04	
2.000	SWMH01	2
2.001	SWMH02	
1.001	SWMH03	
1.002	Soakaway	
1.003	SWMH06	17

Mott MacDonald		Page 10
Mott MacDonald House 8-10 Sydenham Road Croydon, CR0 2EE, United Kin...	Southampton Airport Runway Extension	
Date 24/06/2019	Designed by A. Hay	
File RIBA 4 Drainage Model S...	Checked by G. Tregillis	
Innovyze	Network 2019.1	

30 year Return Period 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 0.000
 Hot Start Level (mm) 0 Inlet Coefficient 0.800
 Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
 Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 2
 Number of Online Controls 2 Number of Time/Area Diagrams 0
 Number of Offline Controls 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.350
 Region England and Wales Cv (Summer) 0.750
 M5-60 (mm) 19.700 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 ON

Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600,
 720, 960, 1440
 Return Period(s) (years) 1, 30, 100
 Climate Change (%) 0, 20, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow
1.000	SWMH04	15 Winter	30	+20%	100/15 Summer		
2.000	SWMH01	15 Winter	30	+20%	30/15 Summer	100/15 Summer	
2.001	SWMH02	15 Winter	30	+20%	30/15 Summer		
1.001	SWMH03	15 Winter	30	+20%	30/15 Summer		
1.002	Soakaway	960 Winter	30	+20%	1/1440 Winter		30/120 Summer
1.003	SWMH06	960 Winter	30	+20%	30/120 Summer	100/120 Winter	

PN	US/MH Name	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m ³)	Pipe Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	SWMH04		12.155	-0.070	0.000	0.79		35.9	OK
2.000	SWMH01		12.448	0.128	0.000	1.17		134.4	SURCHARGED
2.001	SWMH02		12.119	0.044	0.000	1.00		171.0	SURCHARGED
1.001	SWMH03		11.949	0.034	0.000	1.13		250.4	SURCHARGED
1.002	Soakaway	40	11.879	0.467	0.000	0.00	8.6	0.0	SURCHARGED
1.003	SWMH06		11.873	0.702	0.000	0.00		0.0	SURCHARGED

Mott MacDonald		Page 11
Mott MacDonald House 8-10 Sydenham Road Croydon, CR0 2EE, United Kin...	Southampton Airport Runway Extension	
Date 24/06/2019 File RIBA 4 Drainage Model S...	Designed by A. Hay Checked by G. Tregillis	
Innovyze	Network 2019.1	

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

PN	US/MH Name	Level Exceeded
1.000	SWMH04	
2.000	SWMH01	2
2.001	SWMH02	
1.001	SWMH03	
1.002	Soakaway	
1.003	SWMH06	17

Mott MacDonald		Page 12
Mott MacDonald House 8-10 Sydenham Road Croydon, CR0 2EE, United Kin...	Southampton Airport Runway Extension	
Date 24/06/2019	Designed by A. Hay	
File RIBA 4 Drainage Model S...	Checked by G. Tregillis	
Innovyze	Network 2019.1	

100 year Return Period 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 0.000
 Hot Start Level (mm) 0 Inlet Coefficient 0.800
 Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
 Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 2
 Number of Online Controls 2 Number of Time/Area Diagrams 0
 Number of Offline Controls 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.350
 Region England and Wales Cv (Summer) 0.750
 M5-60 (mm) 19.700 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 ON

Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600,
 720, 960, 1440
 Return Period(s) (years) 1, 30, 100
 Climate Change (%) 0, 20, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow
1.000	SWMH04	240 Winter	100	+40%	100/15 Summer		
2.000	SWMH01	15 Winter	100	+40%	30/15 Summer	100/15 Summer	
2.001	SWMH02	240 Winter	100	+40%	30/15 Summer		
1.001	SWMH03	240 Winter	100	+40%	30/15 Summer		
1.002	Soakaway	240 Winter	100	+40%	1/1440 Winter		30/120 Summer
1.003	SWMH06	720 Winter	100	+40%	30/120 Summer	100/120 Winter	

PN	US/MH Name	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m ³)	Pipe Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	SWMH04		12.924	0.699	0.000	0.25		11.6	SURCHARGED
2.000	SWMH01		13.268	0.948	3.311	1.65		189.6	FLOOD
2.001	SWMH02		13.010	0.935	0.000	0.37		63.5	FLOOD RISK
1.001	SWMH03		12.907	0.992	0.000	0.42		92.1	SURCHARGED
1.002	Soakaway	40	12.883	1.472	0.000	0.00	49.1	0.0	FLOOD RISK
1.003	SWMH06		12.858	1.686	106.389	0.00		0.0	FLOOD

Mott MacDonald		Page 13
Mott MacDonald House 8-10 Sydenham Road Croydon, CR0 2EE, United Kin...	Southampton Airport Runway Extension	
Date 24/06/2019 File RIBA 4 Drainage Model S...	Designed by A. Hay Checked by G. Tregillis	
Innovyze	Network 2019.1	

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

PN	US/MH Name	Level Exceeded
1.000	SWMH04	
2.000	SWMH01	2
2.001	SWMH02	
1.001	SWMH03	
1.002	Soakaway	
1.003	SWMH06	17

