19th November 2019
Quinn Estates Ltd

HERNE BAY GOLF CLUB – SITES 1 AND 2
DETAILED DRAINAGE SUMMARY

INTRODUCTION

This report has been prepared to summarise the proposed surface water drainage for Site 2 of the development at Herne Bay golf club, under planning application reference CA/15/00844/OUT, for the purposes of discharge of condition 13 – Drainage and Surface Water.

This condition states:

> *No development within a Construction Phase shall commence (save for any Advance Infrastructure and Enabling Works) until a surface water drainage scheme based on sustainable drainage principles and an assessment of the hydrological and hydrogeological context of the development, has been submitted to and approved in writing by the local planning authority. The drainage strategy should demonstrate the surface water runoff generated up to and including the 100 year plus climate change (e.g. 30% increase in intensity) critical storm will not exceed the runoff from the site prior to the Development following the corresponding rainfall event and should prevent surface water from the site discharging onto the highway. Also the strategy shall include details of the design, location and capacity of all such SUDS features and shall include ownership, long-term management/maintenance and monitoring arrangements/responsibilities.*

PROPOSED SURFACE WATER DRAINAGE - SITE 1

At outline planning stage, MLM consulting engineers prepared a drainage strategy showing the surface water from Site 1 connecting into their infrastructure drainage free discharge, as they had provided storage downstream.

This is shown on drawing no. 10071/1061. Full simulation of the system has been carried out on PDS 'Flow' and the results are contained in Appendix B.

A proposed foul drainage layout has been indicated on 10071/1061 which shows the foul connecting to an existing foul sewer in Braid Drive by gravity.

PROPOSED SURFACE WATER DRAINAGE - SITE 2

At outline planning stage, MLM consulting engineers prepared a drainage strategy showing the surface water from Site 2 connecting to the Plenty Brook to the south of the site at the greenfield run-off rate.

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T: 01444 871444 E: enquiries@gtacivils.co.uk www: gtacivils.co.uk

The 'QBAR' greenfield rate for site 2 impermeable area has been calculated as 1 l/s – see Microdrainage ICP SUDS results in Appendix B.

However, as it is impractical to restrict to this rate, it is proposed to discharge this site at 2 l/s, which is the minimum practical restriction outlined for small sites in Kent County Council 'Drainage and Planning Policy Statement' dated June 2017, extract from page 27 below:

> Small sites are associated with low greenfield runoff rates. Given advances in technology and design of flow controls, it is now possible to achieve controlled flow rates of 2 l/s. This should be considered the minimum rate to be set for small sites, unless agreed with Kent County Council.

EXTRACT FROM KCC Drainage Planning Policy Statement

The proposed drainage strategy for Site 2 is shown on drawing 10071/1062 in appendix A.

A cellular tank is shown storing the 1 in 100 year + 40% peak storm which requires **202m3.**

A full Microdrainage simulation has been carried out and is contained in Appendix B.

Part of the condition states that surface water should not discharge onto the highway. A drainage channel has been provided at the entrance to the site which provides a cut off to water from the private areas entering the public highway.

A drainage maintenance plan has been prepared as a standalone document to this report.

A proposed foul drainage layout has been indicated on 10071/1062 which shows the foul connecting to an existing foul sewer in Braid Drive by gravity.

Report by:

Martin Roberts
I Eng, ACIWEM, MCIHT

APPENDIX A

Proposed Site 1&2 Drainage layouts
10071/1061 and 1062

GENERAL NOTES

1. The location, size, depth and identification of existing services that may be shown or referred to on this drawing have been assessed from non intrusive observations , record drawings or the like. The contractor shall safely carry out intrusive investigations, trial holes or soundings prior to commencing work to satisfy himself that it is safe to proceed and that the assessments are accurate. any discrepancies shall be notified to gta prior to works commencing.

2. Prior to commencement of works the contractor shall provide co-ordinated and dimensioned installation drawings and calculations and allow 10 working days for gta`s checking procedure prior to proceeding with those works or the ordering of materials.

3. Tender or billing drawings shall not be used for construction or the ordering of materials.

4. Do not scale. All dimensions and levels to be site confirmed.

5. This drawing shall be read in conjunction with all relevant architects, consultants drawings and specifications, together with H&S plan requirements

7. All drawings specifications and recommendations made by gta are subject to Local Authority and other relevant Statutory Authorities approval. Any works or services made abortive due to the client proceeding prior to these approvals is considered wholly at the Clients risk. gta hold no responsibility for resulting abortive works or costs.

N

Block A
FFL 10.800

Block B
FFL 11.450

Block B drain points to be confirmed

Block C
2 storeys
pub
150 covers
FFL 12.500

Block C drain points to be confirmed

Block D
FFL 11.250

Block D
Plots 11-26

Block E
FFL 11.925

Block E
Plots 27-28

Block F
FFL 12.450

Block F
Plots 29-51

Block G
FFL 11.325

Block G
Plots 52-60

Refuse
FFL 10.600

Refuse
Block F

Cycles
12 bikes
FFL 10.900

Cycles
24 bikes
FFL 12.450

market square

village green / pub garden

urban square

linear park

THANET WAY

Thanet Way (A2990)

ExSMH
1500mmø
CL 10.78
IL 7.03
New 450ø connection @ IL 7.33

ExFMH
1350mmø
CL 10.71
IL 6.35
New Foul Connection to Ex Foul Sewer MH via new backdrop @ IL 8.61 drop to IL 6.35

New Foul and Surface Water drainage connections to existing manholes in adjacent site. Benching to be made good to adoptable standard

EX 750ø SWS

EX 150ø FWS

SPECIFICATION NOTES

1. ALL DRAINAGE SHALL BE CONSTRUCTED AND COMMISSIONED IN ACCORDANCE WITH BS EN 295 & BS EN752, BUILDING REGULATIONS DOC. H AND ANY PARTICULAR REQUIREMENTS OF THE BUILDING CONTROL OFFICER.

2. DRAIN BEDDING IS TO BE PROVIDED AS D200.0, D200.1 and D200.2 AS SHOWN ON THE DRAINAGE DETAILS SHEETS.

3. 'EFFECTIVE COVER' IS THE MINIMUM DEPTH OF COVER OVER THE PIPE CROWN AT ANY TIME DURING THE CONSTRUCTION PROCESS.

4. ALL CONCRETE PIPEWORK, MANHOLES AND FITTINGS SHALL BE TO BS 5911 (ALL RELEVANT PARTS). ALL CONCRETE PIPEWORK TO BE TO HIGH STRENGTH

5. WHERE CONNECTIONS ARE TO BE MADE TO EXISTING MANHOLES/SEWERS, INVERT LEVELS, PIPE SIZES & ORIENTATION SHALL BE CHECKED PRIOR TO THE COMMENCEMENT OF THE WORKS AND ANY VARIANCE REPORTED TO THE ENGINEER IMMEDIATELY.

6. WHERE PIPELINES CROSS, EACH IS TO BE SURROUNDED WITH GRADE ST4 MASS CONCRETE FOR A DISTANCE NOT LESS THAN 1m CENTRED ON THE CROSSING POINT. LENGTH OF SURROUND TO BE EXTENDED AS NECESSARY TO WITHIN 150mm OF THE NEXT NEAREST FLEXIBLE JOINTS.

7. THE CONTRACTOR IS TO ENSURE THAT PROTECTIVE MEASURES ARE TAKEN TO ENSURE THAT DRAINAGE PIPEWORK AND FITTINGS ARE NOT DAMAGED BY SITE TRAFFIC PRIOR TO OVERSITE FILLING OPERATIONS BEING COMPLETED AROUND BUILDINGS.

8. ALL PRIVATE DRAINAGE PIPEWORK SHALL BE PVCu. ALL ADOPTED DRAINAGE TO BE VC. ALL UNDERBUILDING DRAINS TO BE LAID AT A GRADIENT OF 1:40

9. WHERE DRAINS PASS THROUGH FOUNDATIONS OR CONNECT TO MANHOLES, FLEXIBLE PIPE JOINTS ARE TO PROVIDED WITHIN 150mm OF THE FACE OF THE STRUCTURE AND WITHIN A FURTHER 600mm TO FORM A ROCKER PIPE.

10. WHERE PIPES PASS THROUGH SCREEN WALLS, FOOTINGS OR RETAINING WALLS, LINTELS ARE TO BE PROVIDED.

11. WHERE PIPELINES PASS WITHIN 1m OF BUILDINGS OR WALLS THE FOUNDATIONS ARE TO BE TAKEN DOWN BELOW THE BOTTOM OF THE TRENCH

12. 450mm DIA. INSPECTION CHAMBERS (FIC/SIC) MAY BE USED:
- WITH 350mm REDUCED OPENING WHERE THE DEPTH FROM COVER TO INVERT EXCEEDS 1000mm.

300mm DIA. POLYPROPYLENE ACCESS CHAMBERS (FAC/SAC) MAY BE USED
- WHERE THE DEPTH FROM COVER TO INVERT DOES NOT EXCEED 600mm AND WHERE THE PIPE SIZE DOES NOT EXCEED 100mm DIA.

13. STEEL COVERS WITHIN PROPERTY BOUNDARIES SHALL BE:
(UNLESS NOTED ON DRAWING OR MANHOLE SCHEDULE)
-ON PRIVATE DRIVEWAYS: FACTA GRADE B (BS EN ISO 1461: 1999)
-ON PRIVATE PATHWAYS, VERGES OR ON GARDENS: FACTA GRADE A (BS EN ISO 1461: 1999)

DUCTILE IRON COVERS OUTSIDE PROPERTY BOUNDARIES SHALL BE:
(UNLESS NOTED ON DRAWING OR MANHOLE SCHEDULE)
-ON ACCESS ROADS AND CAR PARKS: GRADE D400 (BS EN 124:1994)
-ON SHARED PATHWAYS, VERGES: GRADE A15 (BS EN 124:1994)

14. COVER LEVELS SHOWN 'CL' AND INVERT LEVELS SHOWN 'IL' ARE IN METRES ABOVE ORDNANCE DATUM.

15. ALL DRAINS TO BE 100mm DIAMETER UNLESS NOTED OTHERWISE

16. ALL DRAINS MARKED 'FWS' OR 'SWS' ARE PROPOSED ADOPTED SEWERS AND ARE TO BE CONSTRUCTED IN ACCORDANCE WITH 'SEWERS FOR ADOPTION, 7TH EDITION'

ABBREVIATIONS

D307.0	DETAIL NUMBER - SEE DRAINAGE DETAIL SHEET
FD	FOUL DRAIN
SWD	SURFACE WATER DRAIN
FWS	ADOPTABLE FOUL WATER SEWER
SWS	ADOPTABLE SURFACE WATER SEWER
MH	MANHOLE
IC	INSPECTION CHAMBER
SA	SOAKAWAY
FIC	450mm DIA. FOUL INSPECTION CHAMBER - D202.6
SIC	450mm DIA. SURFACE WATER INSPECTION CHAMBER - D202.6
FAC	300mm DIA. FOUL ACCESS CHAMBER - D202.18
SAC	300mm DIA. SURFACE WATER ACCESS CHAMBER - D202.18
CI	CAST IRON
VC	VITRIFIED CLAY
CONC	CONCRETE
PVC-U	POLYVINYL CHLORIDE - UNPLASTICISED
G	SMALL GULLY - D209.0
YG	YARD GULLY - D209.2
RG	ROAD GULLY - D208.1
CPG	CAR PARK GULLY - D208.2
DP	BELOW GROUND DRAIN POINT
SVP	SOIL VENT PIPE DROP
SS	STUB STACK OR DIRECT DRAIN CONNECTION
RP	EXTERNAL RODDING POINT - D213.1
DT	SURFACE WATER DISTRIBUTION TANK
FFL	FINISHED FLOOR LEVEL
SSL	STRUCTURAL SLAB LEVEL
GL	GROUND LEVEL
CL	COVER LEVEL
IL	INVERT LEVEL
SL	SUMP LEVEL
BL	BASE LEVEL
HL	HIGH LEVEL
BD	BACKDROP
CBS	CONCRETE BED & SURROUND
CLASS S	GRANULAR BED & SURROUND
CLASS B	GRANULAR BED

DESIGN NOTES

1. SURFACE WATER DESIGN BASED ON DIRECT CONNECTION TO EXISTING INFRASTRUCTURE DRAINAGE WITH NO RESTRICTON AS PER MLM CONSULTING ENGINEER'S STRATEGY

2. DRAIN POINTS AND LOCATIONS TO BE CONFIRMED BY ARCHITECT.

3. CONTRACTOR TO ESTABLISH LOCATIONS OF ALL EXISTING SERVICES PRIOR TO COMMENCING.

4. EXISTING TREES TO BE PROTECTED WHERE EXCAVATIONS RUN CLOSE.

5. APPROVAL TO BE GAINED FROM SOUTHERN WTER FOR CONNECTIONS TO SEWERS AND DISCHARGE RATES

KEY

- Private surface water drain
- Private foul drain
- Adoptable foul sewer
- Adoptable highway drain
- FIC — Foul Plastic Inspection Chamber - D202.6
- SIC — Surface Water Plastic Inspection Chamber - D202.6
- SAC — 300mm diameter Surface Water Access Chamber - D202.18
- FAC — 300mm diameter Foul Water Access Chamber - D202.18
- FWMH — Private Foul Manhole
- SWMH — Private Surface Water Manhole
- FWSMH — Adoptable Foul water Sewer Manhole
- HWMH — Adoptable Highway Manhole
- SVP — Foul drain point D307.0
- RWP — SW Drain point for RWP D203.5
- Drainage channel
- bdIL 9.28 — Pipe backdrop into manhole

Rev	Amendments	Date	Dsn	Chk
T1	INITIAL ISSUE	14/10/19	CS	MR

Status: TENDER

Client: Quinn Estates Ltd

Architect: CLAGUE ARCHITECTS

Project: HERNE BAY GOLF CLUB
THE LINKS, EDDINGTON, HERNE BAY

Title: SITE 1
DRAINAGE LAYOUT

Date: JUNE 2019 | Scale @ A0: 1:200

Clients Ref. | Project Ref.: 10071

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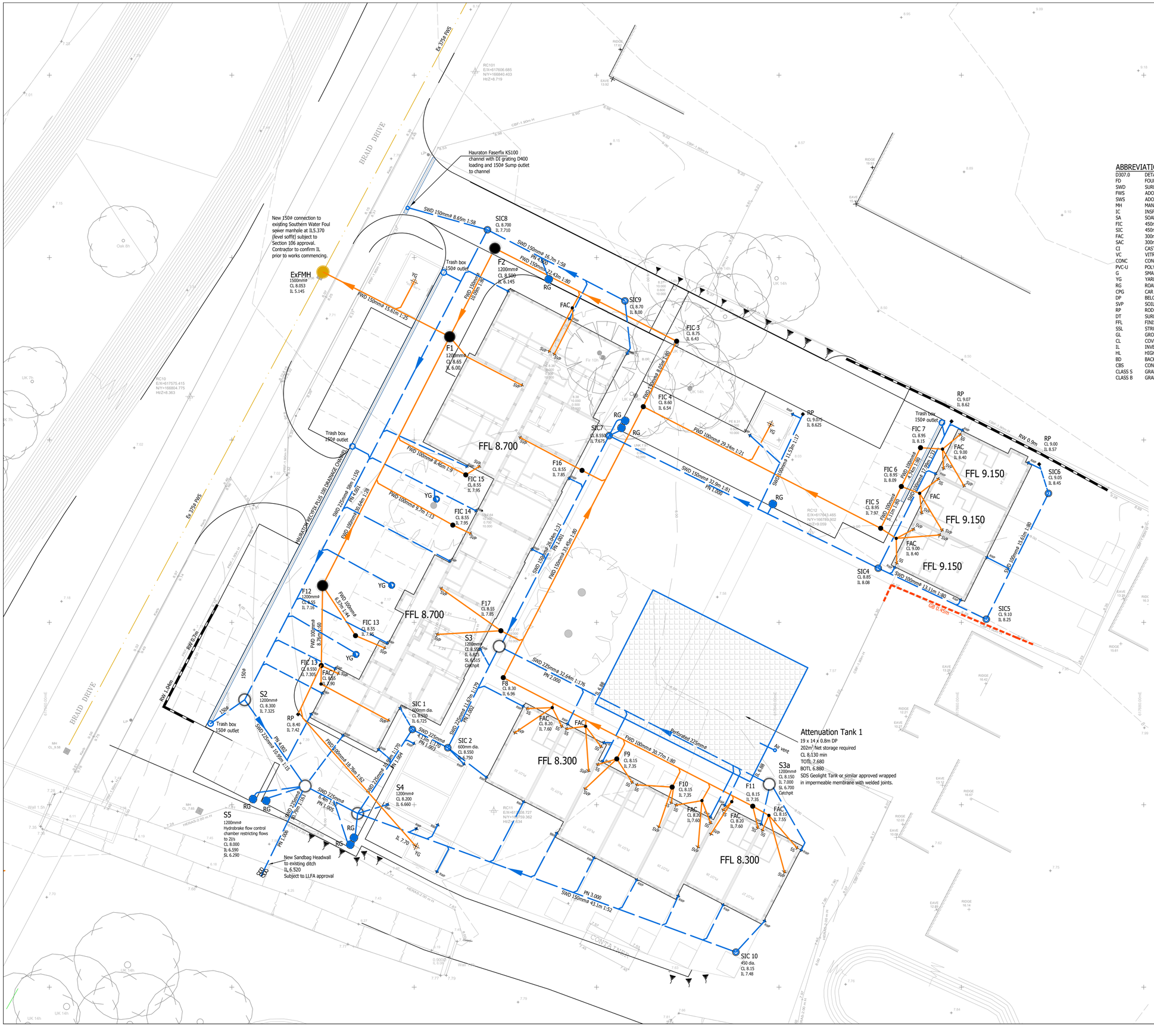
Tel.01444 871444 Web: www.gtacivils.co.uk

Drawing Number: 10071-1061 | Rev.: T1



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3. Do not scale. All dimensions and levels to be site confirmed.

4. This drawing shall be read in conjunction with all relevant architects, consultants drawings and specifications, together with H&S plan requirements.

5. Copyright : This drawing must not be copied, amended nor reproduced without the prior written agreement of gta.

6. All drawings specifications and recommendations made by gta are subject to Local Authority and other relevant Statutory Authorities approval. Any works or services made abortive due to the client proceeding prior to these approvals is considered wholly at the Clients risk. gta hold no responsibility for resulting abortive works or costs.

ABBREVIATIONS

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IC	INSPECTION CHAMBER
SA	SOAKAWAY
FIC	450mm DIA. FOUL INSPECTION CHAMBER - D202.6
SIC	450mm DIA. SURFACE WATER INSPECTION CHAMBER - D202.6
FAC	300mm DIA. FOUL ACCESS CHAMBER - D202.18
SAC	300mm DIA. SURFACE WATER ACCESS CHAMBER - D202.18
CI	CAST IRON
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IL	INVERT LEVEL
HL	HIGH LEVEL
BD	BACKDROP
CBS	CONCRETE BED & SURROUND
CLASS S	GRANULAR BED & SURROUND
CLASS B	GRANULAR BED

SPECIFICATION NOTES

All drainage shall be constructed and commissioned in accordance with BS EN 295 & BS EN752, Building Regulations Doc. H and any particular requirements of the Building Control Officer.

Drainage pipelines shall be in PVC-u below ground as Marley or similar approved, or vitrified clay.
All sewer pipelines to be VC only.

This drawing shall be read in conjunction with all other relevant drainage drawings, architectural drawings and structural drawings.

For manhole details, gully details, bedding etc, refer to GTA detail sheets.

All foul water drain runs shall have a fall of 1:40 or steeper, unless noted otherwise.

All cement used for concrete drainage installations shall be sulphate resistant to class 3 of BRE Digest 363. (Grade ST5)

The use of short radius or 90º bends for changes in direction is not permitted, only long or medium radius 45º bends shall be used. All junctions shall be 45º.

All drains shall have granular bed and surround as class `S` bedding, unless noted otherwise.

All drainage works shall commence from the upstream end first unless agreed otherwise. Outfall level to be checked by contractor prior to any works commencing and any discrepancy identified to engineer prior to laying and drainage.

LEGEND

- Private Storm Drainage
- Private Foul Drainage
- FMH — Foul Water Manhole
- SMH — Storm Water Manhole
- RG — Road Gully
- SIC — Storm Water Inspection Chamber
- FIC — Foul Inspection Chamber
- FAC — Foul Access Chamber
- YG — Yard Gully
- RP — Rodding Point
- SW Channel - Type as shown

Rev	Amendments	Date	Dsn	Chk
T2	Updated to 2l/s outfall restriction	19/11/19	MB	MR
T1	TENDER ISSUE	08/10/19	MB	MR

Status: TENDER

Client: Quinn Estates Ltd

Architect: CLAGUE ARCHITECTS

Project: HERNE BAY GOLF CLUB
THE LINKS, EDDINGTON, HERNE BAY

Title: SITE 2
DRAINAGE LAYOUT

Date	Scale @ A1
JUNE 2019	1 : 200
Clients Ref.	Project Ref. 10071

gta Civils & Transport
Gloucester House, 66a Church Walk,
Burgess Hill, West Sussex, RH15 9AS
Tel.01444 871444 Web: www.gtacivils.co.uk

Drawing Number	Rev.
10071/1062	T2

APPENDIX B

Microdrainage greenfield run-off calculations
Microdrainage /FLOW simulation results

Design Settings

Rainfall Methodology	FEH-13	Minimum Velocity (m/s)	1.00
Return Period (years)	2	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.600
CV	0.750	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	2.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	x
Maximum Rainfall (mm/hr)	50.0		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
EXSWMH			10.780	1200	617806.678	166798.677	3.436
S2	0.036	2.00	10.803	1200	617812.217	166796.050	3.443
S3	0.008	2.00	11.175	1200	617846.425	166783.916	1.535
S5	0.032	2.00	11.070	1200	617820.240	166796.340	2.470
S6	0.102	2.00	11.200	1200	617837.201	166831.414	2.490
S7	0.041	2.00	11.260	1200	617843.562	166844.819	2.480
S8	0.063	2.00	10.790	1200	617813.901	166858.893	1.857
S9	0.035	2.00	10.960	1200	617801.461	166832.675	1.430
S10	0.032	2.00	10.450	1200	617801.414	166864.817	1.460
S10a	0.018	2.00	10.790	460	617809.360	166882.230	1.090
S11	0.011	2.00	12.430	1200	617880.675	166810.426	1.390
S12	0.046	2.00	12.420	1200	617889.899	166829.868	1.090
S13	0.070	2.00	12.000	1200	617856.052	166742.881	1.425
S13a	0.023	2.00	12.490	1200	617877.074	166787.862	1.430
S14	0.033	2.00	11.290	1200	617832.562	166754.026	1.425
S15	0.044	2.00	10.600	1200	617797.033	166764.546	1.350

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	S2	EXSWMH	6.130	0.600	7.360	7.344	0.016	383.1	450	4.14	50.0
1.001	S5	S2	8.028	0.600	8.600	8.270	0.330	24.3	300	4.04	50.0
1.002	S3	S5	28.983	0.600	9.640	9.290	0.350	82.8	300	3.74	50.0
2.001	S6	S5	38.960	0.600	8.710	8.600	0.110	354.2	300	3.99	50.0
2.002	S7	S6	14.838	0.600	8.780	8.710	0.070	212.0	300	3.21	50.0
2.003	S8	S7	32.831	0.600	8.940	8.780	0.160	205.2	300	2.98	50.0
2.004	S10	S8	13.821	0.600	8.990	8.933	0.057	242.5	300	2.48	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	1.032	164.2	80.5	2.993	2.986	0.594	0.0	223	1.028
1.001	3.200	226.2	69.7	2.170	2.233	0.514	0.0	114	2.830
1.002	1.729	122.2	18.2	1.235	1.480	0.134	0.0	78	1.250
2.001	0.829	58.6	47.2	2.190	2.170	0.348	0.0	204	0.919
2.002	1.076	76.0	25.6	2.180	2.190	0.189	0.0	120	0.974
2.003	1.094	77.3	20.1	1.550	2.180	0.148	0.0	104	0.923
2.004	1.005	71.0	6.8	1.160	1.557	0.050	0.0	62	0.640

Links

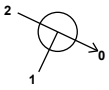
Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
2.005	S9	S8	29.020	0.600	9.530	9.010	0.520	55.8	225	2.28	50.0
2.006	S10a	S10	19.140	0.600	9.700	9.190	0.510	37.5	100	2.25	50.0
3.000	S11	S6	48.275	0.600	11.040	8.780	2.260	21.4	225	2.64	50.0
3.001	S12	S11	21.519	0.600	11.330	11.110	0.220	97.8	150	2.35	50.0
3.002	S13a	S13	49.651	0.600	11.060	10.575	0.485	102.4	225	2.64	50.0
3.003	S13	S14	26.000	0.600	10.575	9.865	0.710	36.6	225	2.84	50.0
3.004	S14	S3	32.948	0.600	9.865	9.710	0.155	212.6	225	3.46	50.0
4.000	S15	S2	34.972	0.600	9.250	8.900	0.350	99.9	150	2.58	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)
2.005	1.754	69.7	4.7	1.205	1.555	0.035	0.0	39	1.003
2.006	1.263	9.9	2.4	0.990	1.160	0.018	0.0	34	1.048
3.000	2.843	113.0	7.7	1.165	2.195	0.057	0.0	40	1.651
3.001	1.016	18.0	6.2	0.940	1.170	0.046	0.0	61	0.927
3.002	1.292	51.4	3.1	1.205	1.200	0.023	0.0	37	0.717
3.003	2.168	86.2	12.6	1.200	1.200	0.093	0.0	58	1.554
3.004	0.893	35.5	17.1	1.200	1.240	0.126	0.0	110	0.885
4.000	1.005	17.8	6.0	1.200	1.753	0.044	0.0	60	0.909

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
EXSWMH	617806.678	166798.677	10.780	3.436	1200	1	1.000	7.344	450
S2	617812.217	166796.050	10.803	3.443	1200	1	4.000	8.900	150
						2	1.001	8.270	300
						0	1.000	7.360	450
S3	617846.425	166783.916	11.175	1.535	1200	1	3.004	9.710	225
						0	1.002	9.640	300
S5	617820.240	166796.340	11.070	2.470	1200	1	2.001	8.600	300
						2	1.002	9.290	300
						0	1.001	8.600	300
S6	617837.201	166831.414	11.200	2.490	1200	1	3.000	8.780	225
						2	2.002	8.710	300
						0	2.001	8.710	300
S7	617843.562	166844.819	11.260	2.480	1200	1	2.003	8.780	300
						0	2.002	8.780	300

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
S8	617813.901	166858.893	10.790	1.857	1200		1	2.005	9.010	225
							2	2.004	8.933	300
							0	2.003	8.940	300
S9	617801.461	166832.675	10.960	1.430	1200		0	2.005	9.530	225
S10	617801.414	166864.817	10.450	1.460	1200		1	2.006	9.190	100
							0	2.004	8.990	300
S10a	617809.360	166882.230	10.790	1.090	460		0	2.006	9.700	100
S11	617880.675	166810.426	12.430	1.390	1200		1	3.001	11.110	150
							0	3.000	11.040	225
S12	617889.899	166829.868	12.420	1.090	1200		0	3.001	11.330	150
S13	617856.052	166742.881	12.000	1.425	1200		1	3.002	10.575	225
							0	3.003	10.575	225
S13a	617877.074	166787.862	12.490	1.430	1200		0	3.002	11.060	225
S14	617832.562	166754.026	11.290	1.425	1200		1	3.003	9.865	225
							0	3.004	9.865	225
S15	617797.033	166764.546	10.600	1.350	1200		0	4.000	9.250	150

Simulation Settings

Rainfall Methodology	FEH-13	Skip Steady State	x	Check Discharge Rate(s)	x
Summer CV	0.750	Drain Down Time (mins)	240	Check Discharge Volume	x
Analysis Speed	Normal	Additional Storage (m³/ha)	20.0		

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 %)
30	0	0	0
100	40	0	0

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.96%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	EXSWMH	10	7.668	0.324	210.6	0.0000	0.0000	OK
15 minute summer	S2	10	7.771	0.411	210.0	0.5501	0.0000	OK
15 minute summer	S3	10	9.788	0.148	53.6	0.1825	0.0000	OK
15 minute summer	S5	10	8.884	0.284	180.9	0.3949	0.0000	OK
15 minute summer	S6	10	9.380	0.670	121.0	1.3072	0.0000	SURCHARGED
15 minute summer	S7	10	9.444	0.664	68.0	0.9710	0.0000	SURCHARGED
15 minute summer	S8	10	9.523	0.590	64.2	1.0670	0.0000	SURCHARGED
15 minute summer	S9	9	9.604	0.074	16.4	0.1196	0.0000	OK
15 minute summer	S10	10	9.523	0.533	22.9	0.8368	0.0000	SURCHARGED
15 minute summer	S10a	9	9.775	0.075	8.4	0.0373	0.0000	OK
15 minute summer	S11	9	11.111	0.071	24.8	0.0914	0.0000	OK
15 minute summer	S12	9	11.523	0.193	21.6	0.3807	0.0000	SURCHARGED
15 minute summer	S13	9	10.687	0.112	43.4	0.2365	0.0000	OK
15 minute summer	S13a	9	11.129	0.069	10.8	0.1005	0.0000	OK
15 minute summer	S14	9	10.235	0.370	58.7	0.5904	0.0000	SURCHARGED
15 minute summer	S15	9	9.404	0.154	20.6	0.2744	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	S2	1.000	EXSWMH	210.6	1.521	1.283	0.8392	85.7
15 minute summer	S3	1.002	S5	55.1	1.652	0.451	0.9660	
15 minute summer	S5	1.001	S2	182.1	3.002	0.805	0.4790	
15 minute summer	S6	2.001	S5	117.0	1.662	1.996	2.7163	
15 minute summer	S7	2.002	S6	60.4	0.857	0.794	1.0449	
15 minute summer	S8	2.003	S7	48.8	0.829	0.632	2.3119	
15 minute summer	S9	2.005	S8	16.4	1.065	0.235	0.7413	
15 minute summer	S10	2.004	S8	19.3	0.467	0.271	0.9733	
15 minute summer	S10a	2.006	S10	8.0	1.340	0.803	0.1353	
15 minute summer	S11	3.000	S6	24.5	1.101	0.217	1.2184	
15 minute summer	S12	3.001	S11	19.6	1.120	1.092	0.3618	
15 minute summer	S13	3.003	S14	43.2	1.272	0.501	0.7733	
15 minute summer	S13a	3.002	S13	10.7	0.715	0.208	0.7461	
15 minute summer	S14	3.004	S3	50.8	1.291	1.432	1.2377	
15 minute summer	S15	4.000	S2	18.3	1.135	1.029	0.5809	

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.96%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	EXSWMH	10	7.731	0.387	310.7	0.0000	0.0000	OK
15 minute summer	S2	10	7.911	0.551	309.5	0.7383	0.0000	SURCHARGED
15 minute summer	S3	10	9.834	0.194	81.5	0.2392	0.0000	OK
15 minute summer	S5	10	9.381	0.781	260.4	1.0850	0.0000	SURCHARGED
15 minute summer	S6	10	10.364	1.654	196.5	3.2256	0.0000	SURCHARGED
15 minute summer	S7	10	10.408	1.628	87.8	2.3795	0.0000	SURCHARGED
15 minute summer	S8	9	10.451	1.518	81.1	2.7453	0.0000	SURCHARGED
15 minute summer	S9	10	10.494	0.964	29.3	1.5609	0.0000	SURCHARGED
15 minute summer	S10	9	10.450	1.460	52.8	2.2907	4.2872	FLOOD
15 minute summer	S10a	10	10.790	1.090	15.1	0.5406	0.0861	FLOOD
15 minute summer	S11	10	11.135	0.095	40.6	0.1231	0.0000	OK
15 minute summer	S12	9	12.032	0.702	38.5	1.3862	0.0000	SURCHARGED
15 minute summer	S13	10	11.123	0.548	77.7	1.1582	0.0000	SURCHARGED
15 minute summer	S13a	10	11.156	0.096	19.3	0.1392	0.0000	OK
15 minute summer	S14	10	10.738	0.873	84.0	1.3921	0.0000	SURCHARGED
15 minute summer	S15	10	10.001	0.751	36.9	1.3394	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	S2	1.000	EXSWMH	310.7	1.971	1.892	0.9301	148.5
15 minute summer	S3	1.002	S5	83.0	1.805	0.679	1.3319	
15 minute summer	S5	1.001	S2	263.3	3.740	1.164	0.5649	
15 minute summer	S6	2.001	S5	161.6	2.295	2.756	2.7435	
15 minute summer	S7	2.002	S6	80.3	1.140	1.056	1.0449	
15 minute summer	S8	2.003	S7	62.8	0.893	0.813	2.3119	
15 minute summer	S9	2.005	S8	23.1	1.064	0.332	1.1542	
15 minute summer	S10	2.004	S8	-29.5	0.463	-0.415	0.9733	
15 minute summer	S10a	2.006	S10	8.7	1.345	0.882	0.1498	
15 minute summer	S11	3.000	S6	39.0	1.210	0.345	1.3468	
15 minute summer	S12	3.001	S11	31.4	1.787	1.752	0.3750	
15 minute summer	S13	3.003	S14	57.4	1.467	0.666	1.0340	
15 minute summer	S13a	3.002	S13	19.2	0.709	0.374	1.3869	
15 minute summer	S14	3.004	S3	77.4	1.945	2.179	1.2968	
15 minute summer	S15	4.000	S2	28.3	1.609	1.595	0.6094	

ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.450
Area (ha)	0.260	Urban	0.000
SAAR (mm)	600	Region Number	Region 7

Results l/s

QBAR Rural	1.0
QBAR Urban	1.0
Q100 years	3.0
Q1 year	0.8
Q30 years	2.2
Q100 years	3.0

STORM SEWER DESIGN by the Modified Rational Method

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	33.055	0.405	81.6	0.015	2.00	0.0	0.600	o	150	Pipe/Conduit	
1.001	27.435	0.785	34.9	0.070	0.00	0.0	0.600	o	150	Pipe/Conduit	
2.000	33.254	0.185	179.8	0.008	2.00	0.0	0.600	o	225	Pipe/Conduit	
1.002	11.280	0.065	173.5	0.025	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.003	4.207	0.025	168.3	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.004	11.161	0.065	171.7	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
3.000	42.236	0.745	56.7	0.009	2.00	0.0	0.600	o	150	Pipe/Conduit	
1.005	6.588	0.070	94.1	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	50.00	2.49	8.080	0.015	0.0	0.0	0.0	1.11	19.7	2.0
1.001	50.00	2.76	7.675	0.085	0.0	0.0	0.0	1.71	30.2	11.5
2.000	50.00	2.57	7.000	0.008	0.0	0.0	0.0	0.97	38.6	1.1
1.002	50.00	2.95	6.815	0.118	0.0	0.0	0.0	0.99	39.3	16.0
1.003	50.00	3.02	6.750	0.118	0.0	0.0	0.0	1.01	40.0	16.0
1.004	50.00	3.21	6.725	0.118	0.0	0.0	0.0	0.99	39.6	16.0
3.000	50.00	2.53	7.480	0.009	0.0	0.0	0.0	1.34	23.7	1.2
1.005	50.00	3.29	6.660	0.127	0.0	0.0	0.0	1.35	53.6	17.2

STORM SEWER DESIGN by the Modified Rational Method

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
4.000	16.741	0.215	77.9	0.010	2.00	0.0	0.600	o	150	Pipe/Conduit	
4.001	58.004	0.385	150.7	0.052	0.00	0.0	0.600	o	225	Pipe/Conduit	
4.002	11.623	0.735	15.8	0.054	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.006	10.389	0.064	163.0	0.017	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)
4.000	50.00	2.24	8.000	0.010	0.0	0.0	0.0	1.14	20.2	1.4
4.001	50.00	3.15	7.710	0.062	0.0	0.0	0.0	1.06	42.3	8.4
4.002	50.00	3.21	7.325	0.116	0.0	0.0	0.0	3.31	131.5	15.7
1.006	50.00	3.46	6.590	0.260	0.0	0.0	0.0	1.02	40.6	35.2

Online Controls for Storm

Hydro-Brake® Optimum Manhole: S5, DS/PN: 1.006, Volume (m³): 2.6

Unit Reference	MD-SHE-0066-2000-1045-2000	Sump Available	Yes
Design Head (m)	1.045	Diameter (mm)	66
Design Flow (l/s)	2.0	Invert Level (m)	6.590
Flush-Flo™	Calculated	Minimum Outlet Pipe Diameter (mm)	100
Objective	Minimise upstream storage	Suggested Manhole Diameter (mm)	1200
Application	Surface		

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.045	2.0	Kick-Flo®	0.592	1.5
Flush-Flo™	0.293	1.9	Mean Flow over Head Range	-	1.7

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)	Depth (m)	Flow (l/s)
0.100	1.6	0.600	1.6	1.600	2.4	2.600	3.0	5.000	4.1	7.500	5.0
0.200	1.9	0.800	1.8	1.800	2.6	3.000	3.2	5.500	4.3	8.000	5.1
0.300	1.9	1.000	2.0	2.000	2.7	3.500	3.5	6.000	4.5	8.500	5.3
0.400	1.9	1.200	2.1	2.200	2.8	4.000	3.7	6.500	4.6	9.000	5.4
0.500	1.8	1.400	2.3	2.400	2.9	4.500	3.9	7.000	4.8	9.500	5.6

Storage Structures for Storm

Cellular Storage Manhole: S3, DS/PN: 1.002

Invert Level (m) 6.880 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	266.0	266.0	0.800	266.0	318.8	0.900	0.0	318.8

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

Simulation Criteria

Areal Reduction Factor 1.000 Manhole Headloss Coeff (Global) 0.500 MADD Factor * 10m³/ha Storage 2.000
Hot Start (mins) 0 Foul Sewage per hectare (l/s) 0.000 Inlet Coeffiecient 0.800
Hot Start Level (mm) 0 Additional Flow - % of Total Flow 0.000 Flow per Person per Day (l/per/day) 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 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FEH Site Location GB 617685 166807 Cv (Summer) 0.750
FEH Rainfall Version 2013 Data Type Point Cv (Winter) 0.840

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

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

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Infil. Flow (l/s)	Maximum Vol (m³)	Discharge Vol (m³)	Maximum Velocity (m/s)	Pipe Flow (l/s)	Status
1.000	S1	60 minute 100 year Summer I+40%	8.850	8.141	-0.089	0.000	0.34		0.009	6.414	1.0	6.5	OK
1.001	S2	60 minute 100 year Summer I+40%	8.550	8.044	0.219	0.000	1.10		0.468	36.347	1.9	31.8	SURCHARGED
2.000	S11	960 minute 100 year Winter I+40%	8.150	7.679	0.454	0.000	0.01		0.107	9.694	0.3	0.4	SURCHARGED
1.002	S3	960 minute 100 year Winter I+40%	8.550	7.678	0.638	0.000	0.08	0.0	204.463	42.190	0.4	2.7	SURCHARGED
1.003	5	960 minute 100 year Winter I+40%	8.375	7.691	0.716	0.000	0.09		1.459	41.422	0.4	2.6	SURCHARGED
1.004	6	960 minute 100 year Winter I+40%	8.288	7.687	0.737	0.000	0.07		1.202	40.746	0.4	2.4	SURCHARGED
3.000	S10	960 minute 100 year Winter I+40%	8.150	7.682	0.052	0.000	0.02		0.031	11.018	0.7	0.5	SURCHARGED
1.005	S4	960 minute 100 year Winter I+40%	8.200	7.698	0.813	0.000	0.06		2.296	50.525	0.5	2.2	SURCHARGED

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

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Infil. Flow (l/s)	Maximum Vol (m³)	Discharge Vol (m³)	Maximum Velocity (m/s)	Pipe Flow (l/s)	Status
4.000	S7	60 minute 100 year Summer I+40%	8.700	8.049	-0.101	0.000	0.23		0.049	4.276	0.9	4.4	OK
4.001	S8	60 minute 100 year Summer I+40%	8.500	7.841	-0.094	0.000	0.62		0.160	26.509	1.1	25.4	OK
4.002	S9	60 minute 100 year Summer I+40%	8.300	7.720	0.170	0.000	0.37		2.066	49.615	2.3	41.7	SURCHARGED
1.006	S5	960 minute 100 year Winter I+40%	8.300	7.699	0.884	0.000	0.06		1.877	211.708	0.5	2.0	SURCHARGED