AMENDED

Flood Risk Assessment

Land off Plover Road, Minster, Sheppey

Client

Dalemarch (Sheppey) Ltd
No 1 Lonsdale Gardens
Tunbridge Wells
Kent
TN1 1NU

Ref: 7267
Date: May 2018

Consulting Engineers

GTA Civils Ltd
Gloucester House
66a Church Walk
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Schedule of Appendices

Issue	Issue date	Compiled	Checked
Preliminary Issue	02 May 2018	JP	MR
First Issue	04 June 2018	JP	MR
Second Issue	20 September 2018	JP	MR

Report by: John Pakenham BSc (Hons)
Checked by: Martin Roberts I Eng, ACIWEM, MCIHT

Executive Summary

- The proposal is for a development of 30 new dwellings on agricultural land to the south side of the Parsonage.
- The site is in Flood Zone 1 as indicated by the Environment Agency Flood Map, i.e. in an area having a low annual probability of flooding from fluvial sources.
- Other flood sources have been assessed – surface water/overland flow, sewers, groundwater, overland flow and artificial. This site is at 'Low Risk' of flooding.
- The proposed dwelling units will be set 0.15m above ambient ground levels: no flood mitigation measures are proposed.
- SUDS: to comply with NPPF, surface water drainage systems must be designed with sustainability in mind. Due to the Clay geology, the ideal choice of infiltration is not feasible here: the soil will not possess sufficiently high permeability for soaking away.
- The surface water drainage strategy utilises a combination of porous pavings and tank. There will be 2 control manholes above the terminal offsite control. These will restrict flows *within* the site to a lower rate than is usual.
- The offsite (terminal) rate – into the ditch at the NW corner – will be restricted to the practical minimum limit of vortex devices, namely 2.0l/s in the critical storm. The greenfield Qbar runoff rate is 1.1 litre/second.
- The tank and porous pavings have been sized to store the storm water volume in the critical '1 in 100 years plus 40% climate change' event. The proposed drainage layout is shown in Appendix D.
- The filtering quality of pavings' sub-bases will provide treatment (cleanse the water); no other pollution control is necessary for residential dwellings.
- The foul drainage will be routed into the public foul sewerage network under gravity, following a Section 106 application and permission from Southern Water.

1 Introduction

1.1 This report has been prepared for Dalemarch (Sheppey) Ltd in relation to Land off Plover Road, Minster, Sheppey, ME12 3BT. No responsibility is accepted to any third party for all or part of this study in connection with this or any other development.

1.2 GTA Civils Ltd. was appointed by the client to provide a Flood Risk Assessment (FRA) as required by the Environment Agency and Swale Borough Council in order to achieve Planning Approval at said property.

1.3 This report will take the form of a formal Flood Risk Assessment in accordance with the 2018 National Planning Policy Framework (NPPF) and the 2015 Planning Practice Guidance (PPG).

1.4 The second version of this report has been prepared following an objection notice from the Lower Medway Internal Drainage Board. Sections 2.6 and 3.3 – plus the topographic survey and drainage strategy layout have been amended/corrected.

2 Existing Site and Current Flood Conditions

2.1 The application site lies within the area administered by Swale Borough Council (SBC). A site location map and aerial view are shown in Appendix A.

2.2 The site is currently a vacant, greenfield site. Along the eastern boundary is an un-named ditch, on the other side of which is a residential site. To the northeast of the site is agricultural land.

2.3 The area of the existing site is approximately 7700m^2 (0.77ha) and is accessed from Yarrow Drive (off Plover Road) to the northwest.

2.4 The site slopes from southwest to northeast. The levels range from 16.7m AOD at the south corner to 13.1m AOD at the north corner. The existing site levels are indicated on the topographic survey in Appendix B.

2.5 The site is underlain with London Clay according to the BGS online geological map, with no recorded drift deposits overlying it. The soil type is likely to have low permeability.

2.6 Hydrology: an unnamed drain/brook flows northwest, approximately 250m northeast of the east corner at its closest. This discharges into the Barton Point and Queenborough Lines, which flows into the Thames Estuary. There is a ditch that flows southeast through the site. This serves the residential development in Clover Court to the west and so has flowing water in it. This is shown on the topographic survey in Appendix B. (It shall be diverted to outside the site's NE boundary – as set out on the drainage strategy layout in Appendix D. This diversion shall be subject to the IDB's permission).

2.7 Public sewers: Southern Water's sewer records for this area (see Appendix B) show a 150mm diameter foul main sewer (ref 4101) in Plover Road to the southwest. Nearby there is a storm water head of run (ref 4150), which is 525mm diameter. Both of these are at a higher elevation to this site, however. It is understood that there is a foul manhole available to the NW adjacent to the play area to the east of the existing houses off Yarrow Drive/clover Close.

2.8 The site is free draining to the ditch along the northeast and to the land to the north, which subsequently drains to a stream along its northern boundary.

2.9 The adjacent existing social housing site to the northwest, is currently draining to the ditch which runs across the proposed food store site. The surface water run-off from this

site is restricted to 4.0l/s for the roofs and parking courts, and a further 4.0l/s restricted outfall for the highway drainage.

2.10 A greenfield run-off calculation has been carried out in Micro Drainage using the ICP SUDS method which is contained in Appendix E. This shows an existing Q_{bar} greenfield run-off from the aggregated contributing area (ie to be positively drained, 3214m^2) of 4.7l/s. The greenfield runoff rates for the post-development contributing area are as follows:

Qbar: 1.1 l/s
Q1: 0.9 l/s
Q30: 2.5 l/s
Q100: 3.5 l/s

2.11 Fluvial Flood risk: The Environment Agency's Flood Map for Planning (Rivers and Seas) in Appendix C shows that the site is within Flood Zone 1 (FZ1). The annual probability of fluvial (river) is less than 0.1%, ie it is outside the '1 in 1000 years' flood zone.

2.12 Tidal flooding: the site is 1.9 kilometres inland - and removed from tidally influenced rivers.

2.13 Surface water flooding: occurs when excess rainwater does not infiltrate into the ground, or is not intercepted by urban drainage systems, and instead flows across the surface. The EA's surface water flood map in the 'Low Risk' scenario ('1 in 1000 years' storm event) in Appendix C shows that an overland flow route affects the southeast edge. Although this is shallow it is relatively fast flowing. This will be covered in the next section .

2.14 Artificial sources: flooding from reservoirs, canals and docks. The EA's reservoir flooding map (in Appendix C) shows the site as being outside of areas designated as being at risk of flooding if a reservoir were to fail. There are no docks or canals in this area.

2.15 Groundwater flooding: occurs when water levels in the ground rise above the surface. SBC's SFRA does not show any historical groundwater flood incidents near to the site.

3 Proposed Development & Drainage Strategy

3.1 The planning application is for 30 new private residential dwellings.

3.2 The site is in fluvial FZ1 and so does not need to pass the Sequential or Exception Tests. The overall risk of flooding to the site is Low, with the exception of an overland flow route along the southeast gardens.

3.3 The overland flow route will be managed by introducing a 450mm culvert along the east boundary . This will lead from the entrance point to the exit as shown on the drainage strategy layout in Appendix D. The headwall within the ditch at the NE corner of the site will be subject to Ordinary Watercourse Consent from the LLFA.

3.4 The proposed units' ground floor finished floor levels (FFLs) shall be set at least 0.15m above ambient ground levels. All housing will be at low risk of flooding, and no flood mitigation measures are required.

3.5 Due to the Clay geology, discharge of surface water to soakaways is considered to be unfeasible. Therefore, a site drainage strategy has been developed discharging into the re-routed ditch along northwest boundary – at the north corner - as shown on drawing 7267/1060B in Appendix D.

3.6 A series of 3 areas of porous pavings has been designed with orifices controlling the flow rate from the first 2 into the third. These orifices will be protected by a plastic mesh screen to minimise the risk of clogging.

3.7 As the current greenfield (Qbar) runoff rate is less than the practical minimum limit of vortex devices, namely 2.0l/s (see section 2.10 above), the offsite runoff rate will be limited to 2.0l/s in the critical 100 years +40% CC storm event. The final storage structure will be porous paving over an underground attenuation tank, whose dimensions are 222m^2 x 0.8m deep. This is needed as the high voids ratio will allow a relatively shallow tank of this plan area to fit into this space, ie there is insufficient area for above ground storage in this part of the site.

3.8 The pavings' sub-base layers will filter impurities in the water. This complies with the CIRIA guidelines.

3.9 Various sustainable drainage systems were considered to store the excess storm water:

- Porous Pavings: it is proposed to use permeable paving for external drives.

- Green roofs: not practical for this development due to the proposed steep pitches of the roofs.
- Ponds/Swales: there is limited space for these features.
- Rainwater harvesting tanks: the use of rainwater harvesting tanks on a residential development where each householder would be required to maintain their own tank is not generally considered good practice or commercially viable.

3.10 A Micro Drainage simulation of the SW network has been carried out to demonstrate that the system will cope with the peak 1 in 100 years + 40% critical storm events. The results are contained in Appendix E.

3.11 The volumes in the 3 areas are summarised thus:

	Area 1	Area 2	Area 3	Tank
Volume needed:	37.43m^3	26.76m^3	114.66m^3	162.0m^3
Volume provided:	39.6m^3	28.8m^3	119.43m^3	168.72m^3

3.12 Exceedance flows: if the outfall hydrobrake were to get clogged up, the resulting flow would be into the adjacent ditch – ie away from nearby houses. Although this is not ideal, the downstream receptor is not particularly sensitive (the ditches appear to be dry a lot of the time).

3.13 Maintenance of the SuDS system will be the overall responsibility of the Applicant. The ongoing maintenance programme will be contracted out to a Property Maintenance company. Regular inspections of the porous pavings, tank and control manholes/orifices/hydrobrake shall be made in line with industry standards. A formal Maintenance Plan will be drafted during the next stage.

3.14 Foul drainage: it is proposed to discharge the development's foul water into the existing public foul sewer to the NW of the north corner – see section 2.7 above. The drainage strategy layout is shown in Appendix D.

3.15 Permission to discharge into the public sewer – by means of a Section 106 application – will be sought from Southern Water, the owner of the sewerage network.

4 Conclusions

4.1 The application site has a Low Risk flood risk profile. There is an identified overland flow route along the SE boundary, which will be managed by forming a wide, shallow swale within these gardens.

4.2 The site's surface water flow rate will be discharged to the watercourse at the north corner at 2.0l/s in the critical storm. This runoff rate is the practical minimum limit of vortex devices (eg hydrobrakes).

4.3 A combination of underground tank and porous pavings' sub-bases shall hold the volume in the critical storm event (1 in 100 years + 40%). The porous pavings' fill will filter the water – thus complying with CIRIA guidelines.

4.4 This development will not increase the flood risk, either on this site or to neighbouring properties, and so complies fully with the 2012 NPPF/2015 PPG.

- End of Report -

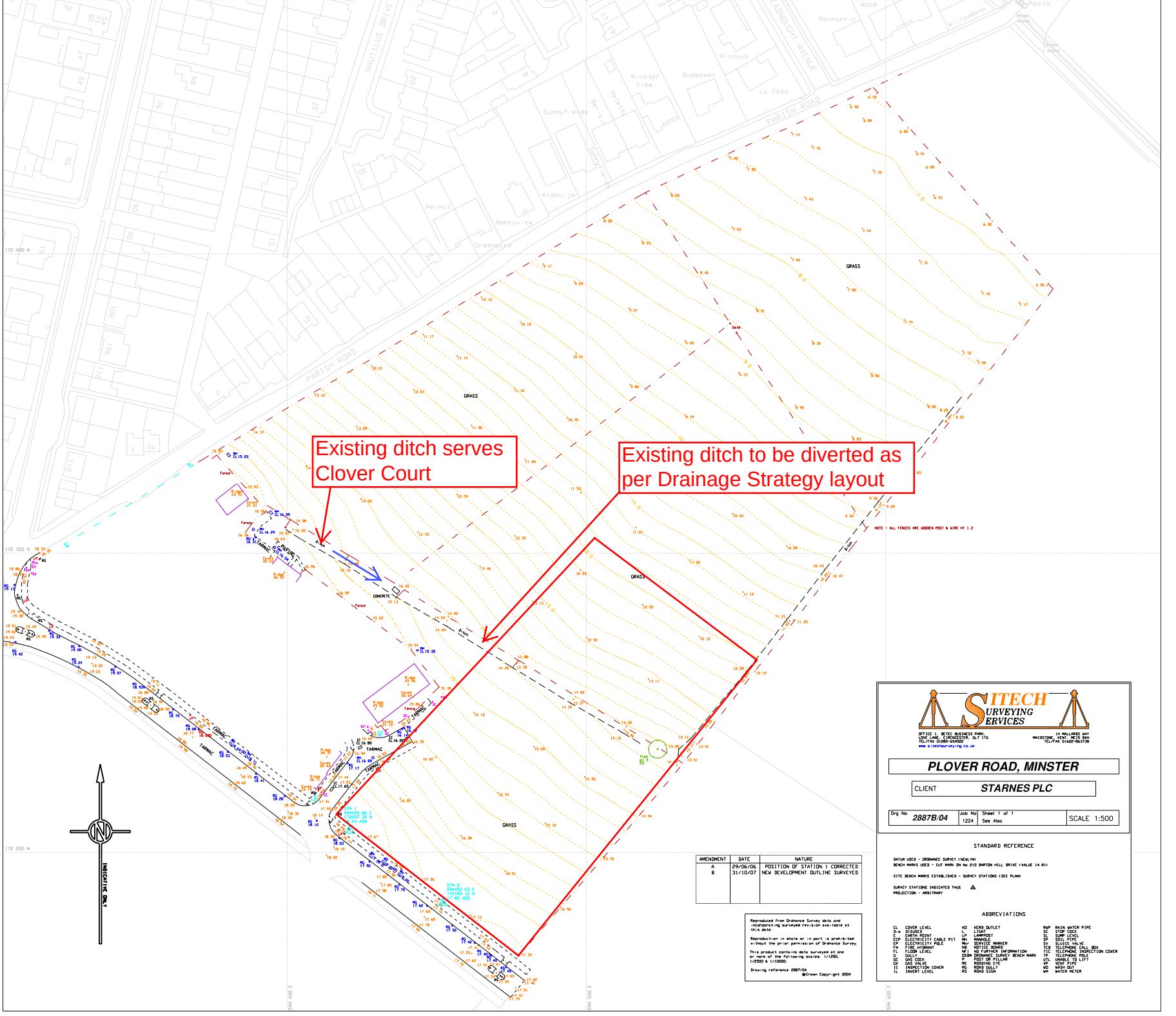
Appendix A

Site Location Map & Aerial Photo


Site Location
Layzells Clubs
Noreen Avenue
Shurland Avenue
Scrapsgate Road
Sunnyside Avenue
Silverdale Avenue
Saxon Avenue
Londis
Punch Partnerships (Pml)
B2008
B2008
Darlington Drive
Dreadnought Avenue
Fleetwood Close
Barton Hill Drive
Nautilus Drive
Sanspareil Avenue
Summerville Avenue
Nextstep Nursery Consultants
Gulliver Taverns
Hilltop Road
Parish Road
Elder Walk
Mistletoe Drive
Heron Drive
Plover Road
Coral Road
Lilac Road
Hazel Avenue
Thistle Hill Way
Nettle Way
Poppy Crescent
Charlock Drive
Thistle Walk
Aster Road
Buckthorne Road

Appendix B

Topographic Survey & Sewer Records



AMENDMENT	DATE	NATURE
A	29/06/06	POSITION OF STATION 1 CORRECTED
B	31/10/07	NEW DEVELOPMENT OUTLINE SURVEYED

SITECH SURVEYING SERVICES

OFFICE 1: METEC BUSINESS PARK, LOVE LANE, CIRENCESTER, GL7 1YG
TEL/FAX 01285-654582
www.sitechsurveying.co.uk

14 MALLARDS WAY
MAIDSTONE, KENT ME15 8XH
TEL/FAX 01622-863738

PLOVER ROAD, MINSTER

CLIENT **STARNES PLC**

Drg No	Job No	Sheet	SCALE
2887B/04	1224	1 of 1 See Also	1:500

STANDARD REFERENCE

DATUM USED - ORDNANCE SURVEY (NEWLYN)
BENCH MARKS USED - CUT MARK ON No 210 BARTON HILL DRIVE (VALUE 14.81)

SITE BENCH MARKS ESTABLISHED - SURVEY STATIONS (SEE PLAN)

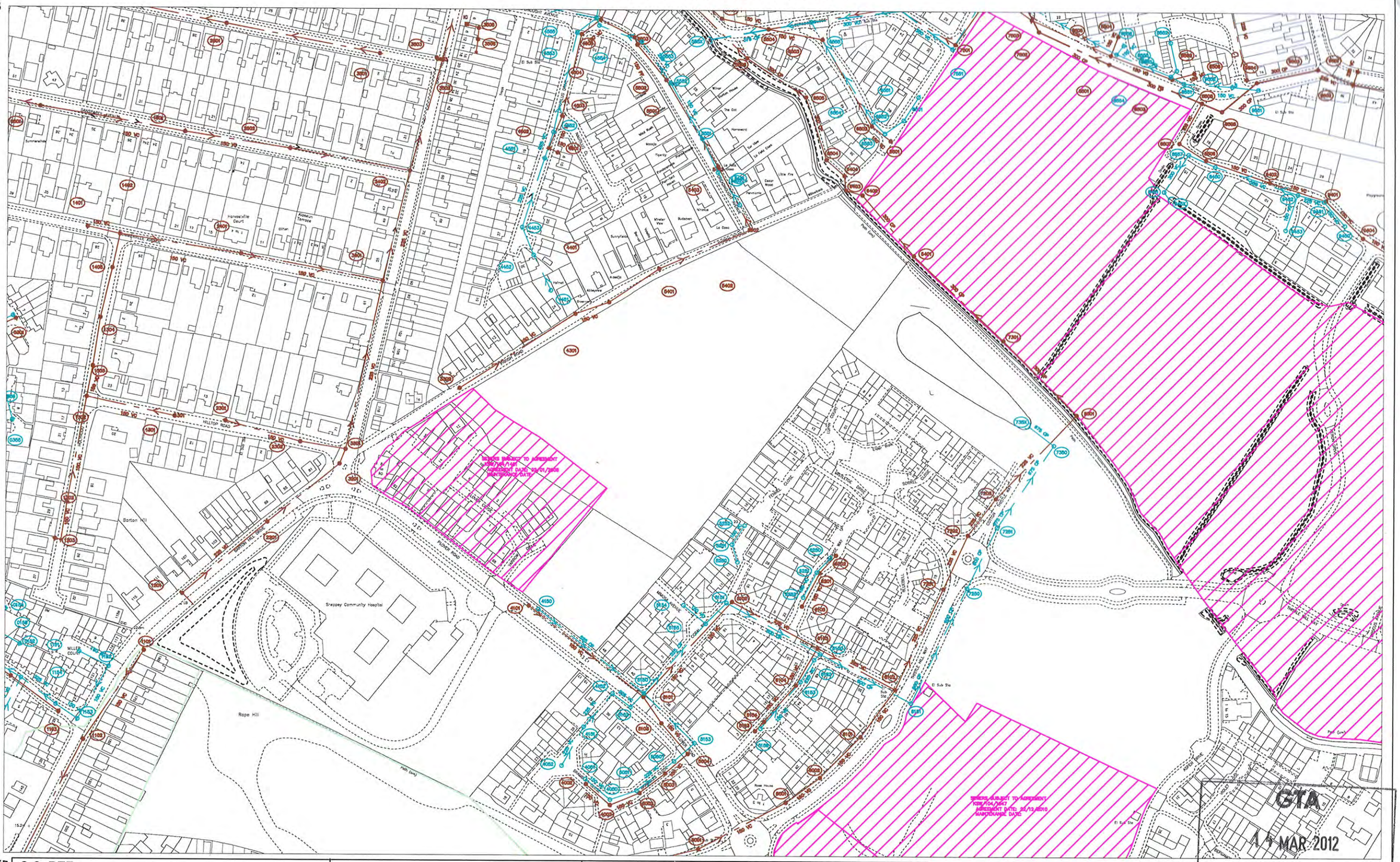
SURVEY STATIONS INDICATED THUS ▲
PROJECTION - ARBITRARY

ABBREVIATIONS

CL	COVER LEVEL	KO	KERB OUTLET	RWP	RAIN WATER PIPE
D/S	DISUSED	L	LIGHT	SC	STOP COCK
E	EARTH POINT	LP	LAMPPOST	SL	SUMP LEVEL
ECP	ELECTRICITY CABLE PIT	MH	MANHOLE	SOP	SOIL PIPE
EP	ELECTRICITY POLE	MM	MAGNETIC MARKER	SV	SLUICE VALVE
FH	FIRE HYDRANT	NB	NOTICE BOARD	TCB	TELEPHONE CALL BOX
FL	FLOOR LEVEL	NFI	NO FURTHER INFORMATION	TIC	TELEPHONE INSPECTION COVER
G	GULLY	OSBM	ORDNANCE SURVEY BENCH MARK	TP	TELEPHONE POLE
GC	GAS COCK	P	POST OR PILLAR	UTL	UNABLE TO LIFT
GV	GAS VALVE	RE	RODDING EYE	VP	VENT PIPE
IC	INSPECTION COVER	RG	ROAD GULLY	WO	WASH OUT
IL	INVERT LEVEL	RS	ROAD SIGN	WM	WATER METER

SEWER RECORDS PAGE 1 OF 2

172603



172025

O.S. REF. TQ9472SE	Drawn by: singhpo	The positions of pipes shown on this plan are believed to be correct, but Southern Water Services Ltd accept no responsibility in the event of inaccuracy. The actual positions should be determnined on site. WARNING: BAC pipes are constructed of Bonded Asbestos Cement WARNING: Unknown (UNK) materials may include Bonded Asbestos Cement	N
	Scale: 1:2500		
Title: 133609_Land off Plover Road	Date: 12/03/2012	Based upon Ordnance Survey Digital Data with the permission of the controller of H.M.S.O. Crown Copyright Reserved Licence No. WU 298530.	

594072

595016

GTA
13 MAR 2012

RECEIVED
Southern Water

SEWER RECORDS PAGE 2 OF 2

Node	Cover	Invert	Size	Material	Shape	
0106X	16.53	15.43	150	VC	CIRC	
0152X	16.73	14.84	225	VC	CIRC	
0154X	17.52	15.57	150	VC	CIRC	
0155X	17.12	15.41	100	VC	CIRC	
0301X	16.13	14.7	150	VC	CIRC	
0352X	16.08	14.32	150	VC	CIRC	
0355X	18.43	16.93	150	VC	CIRC	
0356X	17.64	15.94	150	VC	CIRC	
0404X	12.48	10.9	150	VC	CIRC	
0501X	11.33	8.53	150	VC	CIRC	
1101X	22.12	20.33	150	VC	CIRC	
1102X	17.53	16.04	150	VC	CIRC	
1103X	17.69	16.28	150	VC	CIRC	
1151X	19.24	17.83	150	VC	CIRC	
1152X	20.15	17.58	150	VC	CIRC	
1153X	18.05	16.3	150	VC	CIRC	
1154X	17.64	15.51	225	VC	CIRC	
1201X	23.6	22.03	225	VC	CIRC	
1202X	21.76	20.41	150	VC	CIRC	
1203X	21.5	20.68	100	VC	CIRC	
120DX			150	VC	CIRC	
1301X	19.15	18.22	150	VC	CIRC	
1302X	19.32	17.75	150	VC	CIRC	
1303X	18.43	16.96	150	VC	CIRC	
1304X	18.394	16.874	150	VC	CIRC	
1401X	15.82	14.57	150	VC	CIRC	
1402X	15.76	13.86	150	VC	CIRC	
1403X	16.2	14.73	150	VC	CIRC	
1501X	11.41	9.08	150	VC	CIRC	
150DY			150	VC	CIRC	*
150DX			150	VC	CIRC	*
2201X	20.96	19.38	225	VC	CIRC	
2301X	18.78	17.69	150	VC	CIRC	
2302X	18.32	17.3	150	VC	CIRC	
2401X	14.6	12.16	150	VC	CIRC	
2501X	7.16	4.98	150	VC	CIRC	
2502X	9.96	8.02	150	VC	CIRC	
3201X	19.04	17.33	225	VC	CIRC	
3301X	18.49	16.73	225	VC	CIRC	
3302X	14.56	12.5	150	VC	CIRC	
3401X	12.39	10.69	225	VC	CIRC	
3402X	8.18	6.38	225	VC	CIRC	
3501X	7.19	5.47	150	VC	CIRC	
3502X	6.77	4.97	225	VC	CIRC	
3505X			UNK	UNK	CIRC	
3506X			UNK	UNK	CIRC	
350DX			UNK	UNK	CIRC	
4002X	20.63	18.74	150	VC	CIRC	
4003X	21.15	18.52	150	VC	CIRC	
4050X	21.09	18.74	150	VC	CIRC	
4051X	20.54	18.97	150	VC	CIRC	
4052X	20.11	18.78	225	VC	CIRC	
4101X	18.02	18.02	150	VC	CIRC	
4150X	18.05	16.2	525	CP	CIRC	
4151X	19.28	17.56	225	VC	CIRC	
4152X	18.36	16.17	225	VC	CIRC	
4301X	10.39	8.65	150	VC	CIRC	
4401X	9.59		150	VC	CIRC	
4451X	10.12	8.75	150	VC	CIRC	
4452X	9.33	7.96	225	VC	CIRC	
4453X	8.74	7.19	225	VC	CIRC	
4501X	7.45	5.69	150	VC	CIRC	
4502X	7.23	5.54	150	VC	CIRC	
4503X	6.63	5.16	150	VC	CIRC	
4504X	5.39	4.69	150	VC	CIRC	
4505X	5.29	4.49	150	VC	CIRC	
4551X	7.48	5.97	225	VC	CIRC	
4552X	6.97	5.53	225	VC	CIRC	
4553X	5.42	4.57	300	VC	CIRC	
4554X	5.23	4.35	225	VC	CIRC	
4555X	5.22	4.25	300	VC	CIRC	
5001X	20.95	19.14	150	VC	CIRC	
5002X	20.93	18.2	150	VC	CIRC	
5003X	20.18	17.51	150	VC	CIRC	
5004X	19.53	17.28	150	VC	CIRC	
5050X	19.85	17.74	225	VC	CIRC	
5051X	20.94	18.16	225	VC	CIRC	
5101X	18.26	15.43	150	VC	CIRC	
5102X	14.59	12.3	225	VC	CIRC	
5103X	18.89	16.23	150	VC	CIRC	*
5103X	17.55	15.7	150	VC	CIRC	*
5104X	17.2	15.37	150	VC	CIRC	
5150X	18.31	15.6	525	CP	CIRC	
5151X	14.56	12.81	600	CP	CIRC	
5152X	18.68	16.04	225	VC	CIRC	
5153X	19.57	17.55	225	VC	CIRC	
5154X	15.4	14.02	150	VC	CIRC	
5155X	15.48	13.71	525	CP	CIRC	
5156X	17.42	15.91	150	VC	CIRC	
5250X	13.77	12.38	150	VC	CIRC	
5251X	12.82	11.69	150	VC	CIRC	
5401X	8.36	6.793	150	VC	CIRC	
5402X	6.89	5.43	150	VC	CIRC	
5403X	6.63	5.14	150	VC	CIRC	
5451X	6.941	5.761	UNK	UNK	CIRC	
5452X	6.93		150	VC	CIRC	
5501X	5.78	4.75	150	PF	CIRC	
5502X	5.45	4.64	150	PF	CIRC	
5503X	5.41	4.61	150	VC	CIRC	
5504X	5.55	4.55	150	VC	CIRC	
5505X	5.29	4.25	150	VC	CIRC	
5506X	5.3	4.24	300	CP	CIRC	
5551X	6.39	5.16	150	VC	CIRC	
5552X	5.87	4.67	225	VC	CIRC	
5553X	5.6	4.35	225	VC	CIRC	
6001X	18.3	16.76	150	VC	CIRC	
6002X	17.14	15.67	150	VC	CIRC	
6101X	15.52	13.63	150	VC	CIRC	
6102X	13.88	11.56	225	VC	CIRC	
6103X	14.25	12.05	225	VC	CIRC	
6104X	15.34	13.57	150	VC	CIRC	
6105X	13.5	11.97	150	VC	CIRC	
6150X	14.32	12.82	600	CP	CIRC	
6151X	14.18	11.94	600	CP	CIRC	
6152X	14.44	12.91	225	VC	CIRC	
6153X	15.23	13.75	225	VC	CIRC	
6201X	12.39	10.76	UNK	UNK	CIRC	
6251X	12.39	11.06	UNK	UNK	CIRC	
6252X	13.21	11.86	150	VC	CIRC	
6401X	6.47	4.93	300	CP	CIRC	
6402X	6.06	4.74	300	CP	CIRC	
6403X	6.32	4.69	300	CP	CIRC	
6404X	6.47	4.64	300	CP	CIRC	
6501X	6.57	5.72	150	VC	CIRC	
6502X	6.46	5.38	150	VC	CIRC	
6503X	6.7	4.7	150	VC	CIRC	
6504X	6	4.57	300	CP	CIRC	
6505X	5.72	4.41	300	CP	CIRC	
6551X	7.27	5.47	225	VC	CIRC	
6552X	6.8	5.08	225	VC	CIRC	
6553X	6.69	5.03	225	VC	CIRC	
6554X	6.59	4.99	225	VC	CIRC	
6555X	6.53		375	CP	CIRC	
7201X	10.6	8.66	225	VC	CIRC	
7202X	9.48	7.15	225	VC	CIRC	
7203X	8.56	5.99	225	VC	CIRC	
7250X	10.43	8.61	600	CP	CIRC	
7251X	9.06	7.14	675	CP	CIRC	
7301X	7.17	5.21	300	CP	CIRC	
7350X	8.77	7.14	675	CP	CIRC	
7501X	8.16	5.96	150	VC	CIRC	
7502X	10.36	8.97	300	CP	CIRC	
7503X	10.13	8.07	150	VC	CIRC	
7551X	8.07		300	VC	CIRC	
8301X	7.74	5.5	300	CP	CIRC	
8450X	11.53	9.6	300	VC	CIRC	
8451X	11	9.25	300	VC	CIRC	
8501X	10.95	9.22	300	CP	CIRC	
8502X	11.42	9.73	150	VC	CIRC	
8503X	11	9.5	150	VC	CIRC	
8504X	10.46	9.11	150	VC	CIRC	
8505X	10.12	8.77	150	VC	CIRC	
8506X	11.45	11.45	150	VC	CIRC	
8507X	11.35	9.95	150	VC	CIRC	
8508X	11.75		300	CP	CIRC	
8551X	11.18	10.11	150	VC	CIRC	
8552X	11.24	10.24	150	VC	CIRC	
8553X	11.16	10.01	150	VC	CIRC	
8554X	11.01	9.93	150	VC	CIRC	
8555X	10.43	9.33	150	VC	CIRC	
8556X	10.3	9.18	150	VC	CIRC	
8557X	11.4	9.45	300	VC	CIRC	
9401X	12.2	10.65	150	VC	CIRC	
9402X	11.9	10.4	150	VC	CIRC	
9450X	12.3	11	150	VC	CIRC	
9451X	12.12	10.2	225	VC	CIRC	
9452X	12.2	9.9	300	VC	CIRC	
9453X	11.65	10.3	150	VC	CIRC	
9501X	13.57	12.54	225	VC	CIRC	
9502X	13.59	12.23	225	VC	CIRC	
9503X	13.09	11.64	300	CP	CIRC	
9504X	12.27	10.54	300	CP	CIRC	
9505X	12.05	9.65	300	CP	CIRC	
9506X	12.3	11.58	225	VC	CIRC	
9551X	12.21	10.95	150	VC	CIRC	
9552X	12.02	10.67	150	VC	CIRC	

Node	Cover	Invert	Size	Material	Shape

LINE STYLES / COLOURS

- Brown — Foul
- Foul Syphon Sewer
- Foul Vacuum Main
- Foul Rising Main
- Red — Combined
- Combined Syphon Sewer
- Combined Rising Main
- Lateral Drain
- Orange — Building Over Agreement Area
- Dark Blue — Treated Effluent
- Purple — Sludge
- Sewer Catchment
- Section 104 Area
- Light Blue — Surface Water
- Surface Water Rising Main
- Yellow — Private
- Green — Access Shaft
- Decommissioned

MATERIALS

AK	Alkathene
BAC	Bonded Asbestos Cement
BRC	Brick (Common)
BRE	Brick (Engineering)
CC	Concrete Box Culvert
CI	Cast Iron
CO	Concrete (In-Situ)
CP	Concrete (Pre-Cast)
CSB	Concrete Segments (bolted)
CSU	Concrete Segments (unbolted)
DI	Ductile Iron
GRC	Glass Reinforced Concrete
GRP	Glass Reinforced Plastic
MAC	Masonry in regular Courses
MAR	Masonry in random Courses
PE	Polyethylene
PF	Pitch Fibre
PP	Polypropylene
PVC	Polyvinyl Chloride
RPM	Reinforced Plastic Matrix
SI	Spun Iron
ST	Steel
VC	Vitrified Clay
XXX	Other
ZZZ	Unknown

- Manhole (SW)
- Manhole (F&C)
- Lamp hole (SW)
- Lamp hole (F&C)
- Pumping Station (SW)
- Pumping Station (F&C)
- Side entry manhole (SW)
- Side entry Manhole (F&C)
- Blind shaft (SW)
- Blind shaft (F&C)
- Ejector station (SW)
- Ejector station (F&C)
- Watersight door (SW)
- Watersight door (F&C)
- Flushing ch. Mn-e (SW)
- Flushing ch. Mn-e (F&C)
- Flushing ch. No-e (SW)
- Flushing ch. No-e (F&C)
- Demarcation Chamber

LEGEND - SEWERS

- Washout (SW)
- Washout (F&C)
- Rodding Eye (SW)
- Rodding Eye (F&C)
- Gauging point (SW)
- Gauging point (F&C)
- Intercept chamber (SW)
- Intercept chamber (F&C)
- Storm Tank (SW)
- Storm Tank (F&C)
- Vortex chamber (SW)
- Vortex chamber (F&C)
- Label ellipse
- Dummy/624 manhole
- Outfall
- Penstock chamber
- DambOards
- Storm Overflow
- Backdrop manhole
- Other (s)
- Other
- Change in sewer (s)
- Change in sewer
- Reflux valve
- Flap valve
- Cascade
- Anode
- Valve
- Closed Valve
- Air Valve
- Hatch box (SW)
- Hatch box (F&C)
- Direction arrow
- Emptying valve
- Catchpit
- Soakaway
- Inlet
- Balancing Pond
- Wastewater treatment works
- Marine treatment works
- Outfall headworks
- Vent
- Vent column
- Tidal storage tank
- Blank end
- Head of Public Sewer
- Micro Pumping Station

SHAPES (S)

A	Arched	R	Rectangular
B	Barrel	S	Square
C	Circular	T	Trapezoidal
E	Egg	U	U Shape
H	Horseshoe	X	Other

NODE REFERENCING SYSTEM

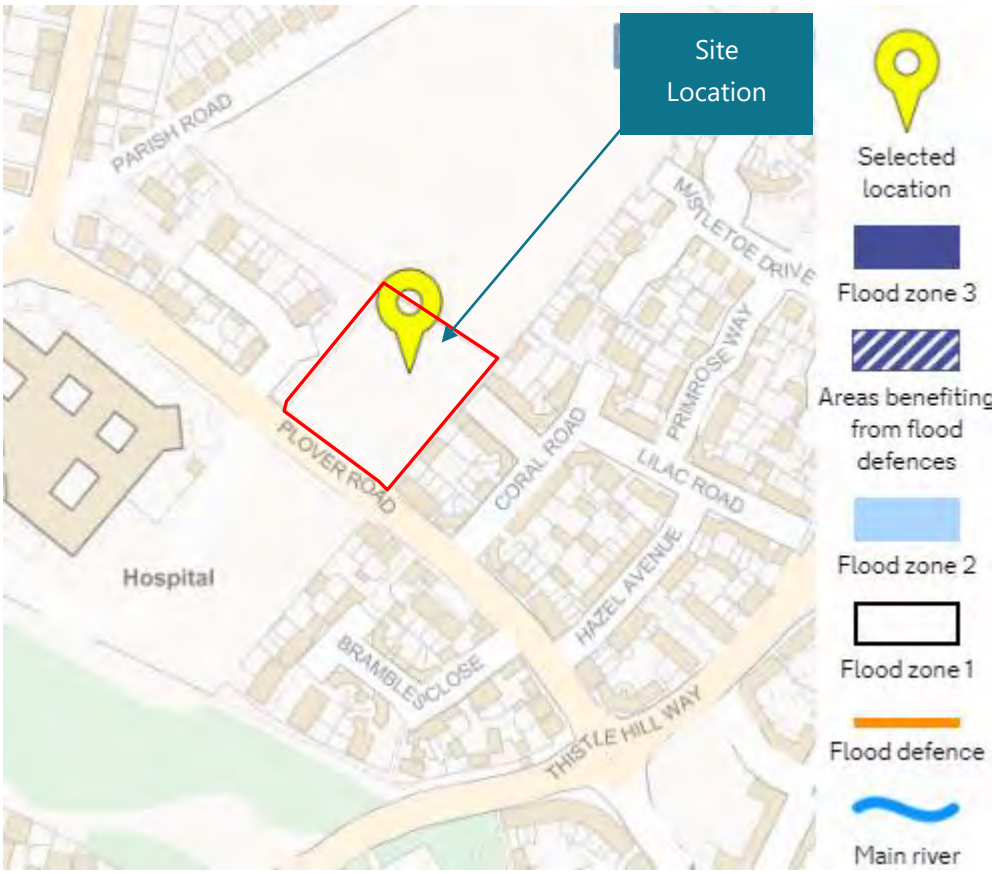
- 1st digit: hundred metre easting identifier
- 2nd digit: hundred metre northing identifier
- sewer type identifier
- 3rd digit: 0-4 = Foul/Combined; 5-9 = Surface Water
- 4th digit: next sequential node

Drawn by:	singhpo
Title:	133609_Land off Plover Road
Date:	12/03/2012

Southern Water

Appendix C

Environment Agency Flood & Groundwater Maps

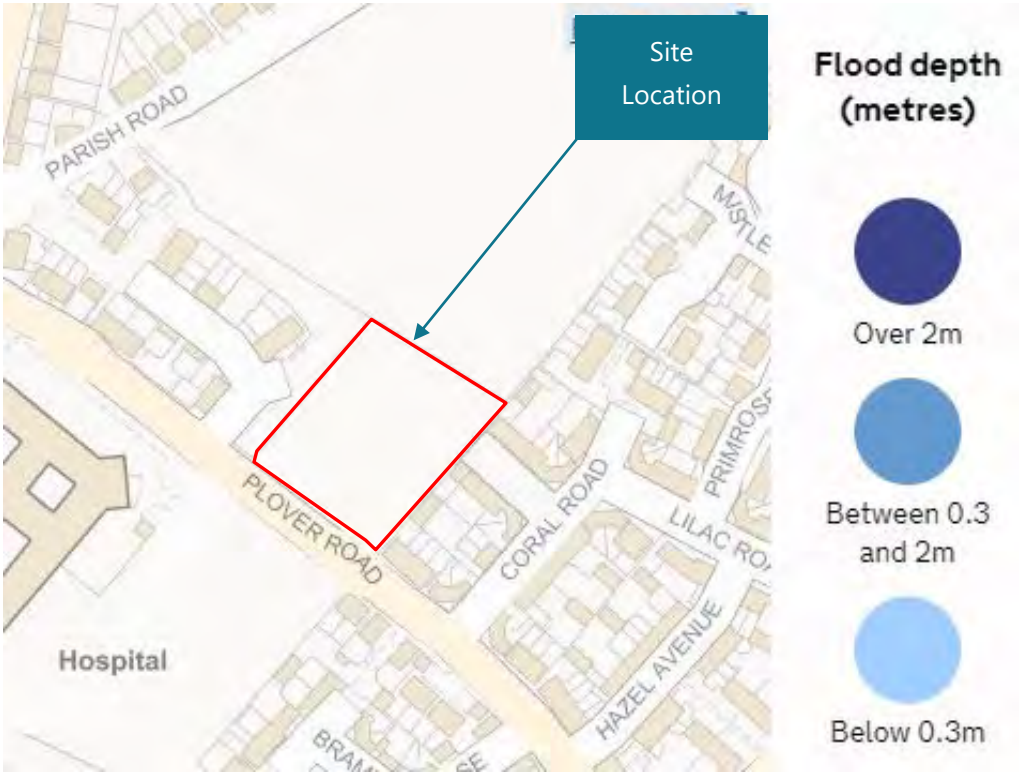


EA's Online Flood Map for Planning (Rivers and Seas)

This site is in fluvial Flood Zone 1 (FZ1)

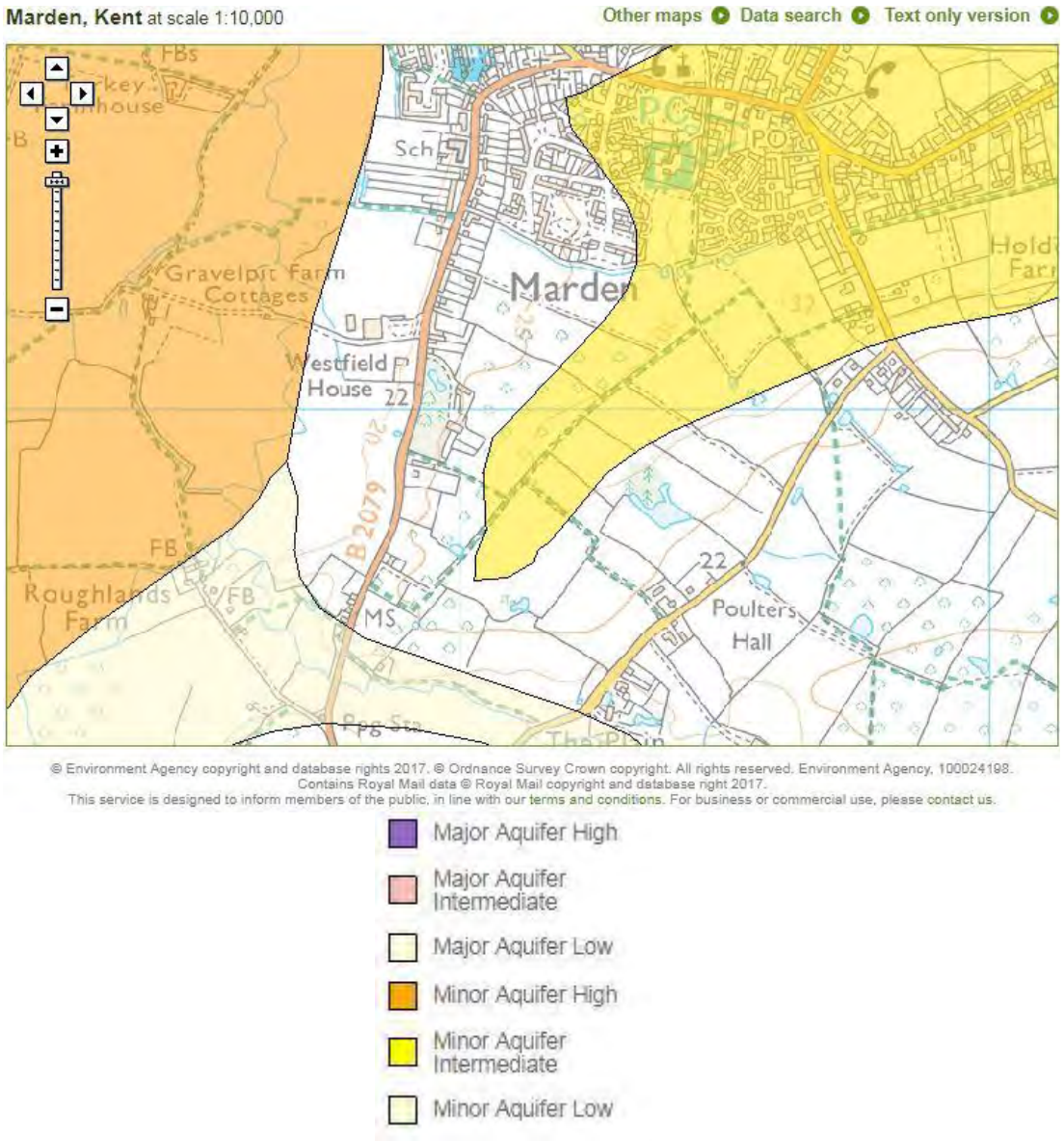
EA's Online Surface Water Flood Depth Map in the 'Low Risk Scenario'
(1 in 1000 years storm event)

A shallow overland flow route affects the southeast boundary: this will be routed through the gardens



EA's Online Risk of Flooding from Reservoirs' Map

The site is not in an area susceptible to flooding if a nearby reservoir were to fail



Environment Agency's Groundwater Vulnerability Zone Map

The site overlies a 'Minor Aquifer – Intermediate'

Appendix D

Proposed Scheme Drawings Including Drainage Strategy

Dalemarch (Sheppey) Ltd.

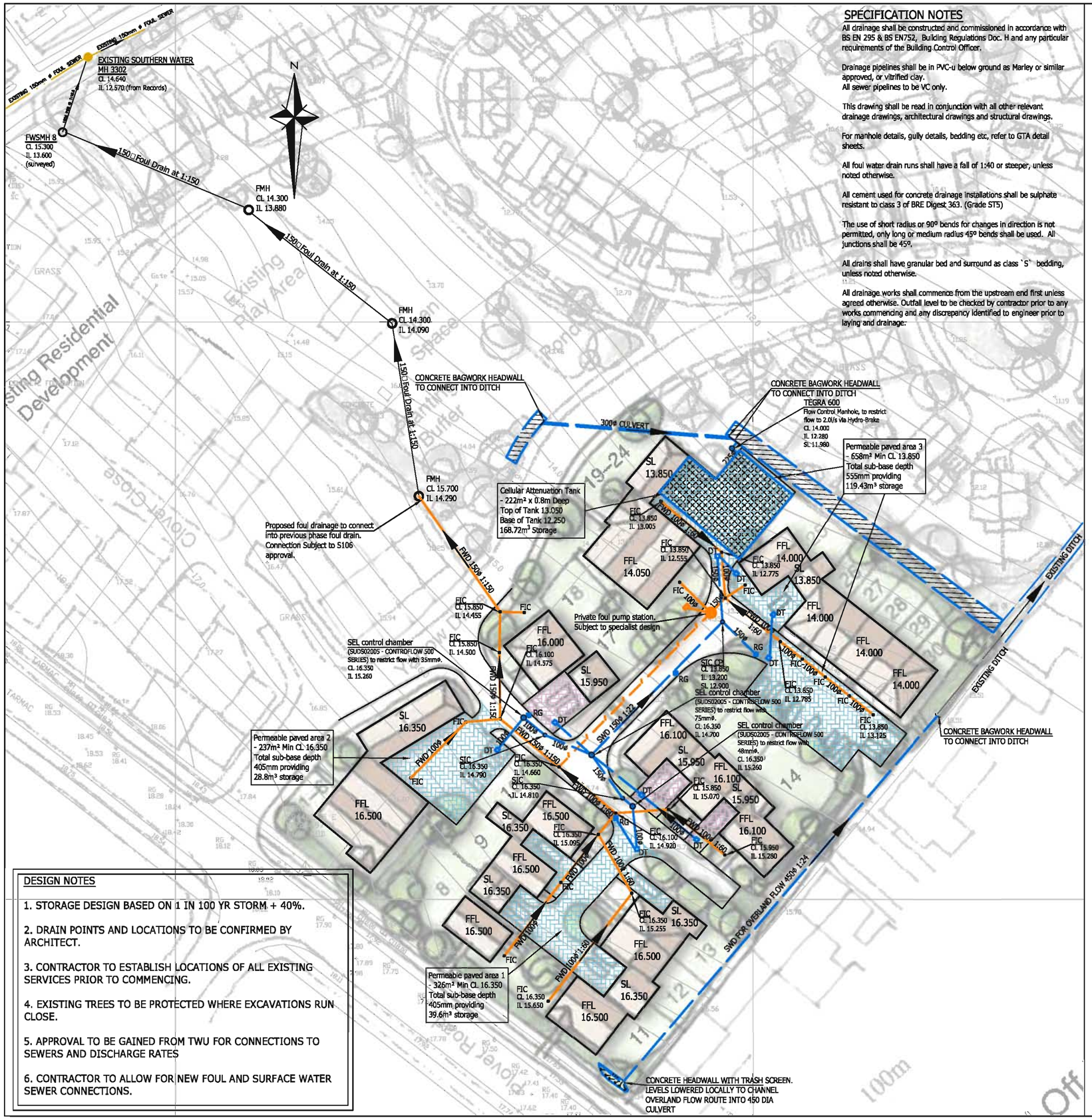
Proposed Residential Layout

Proposed Residential Development, Land Off Plover Road, Minster Sheppey

Client	Project	Drawing			
Dalemarch Sheppey Ltd	Proposed Residential Development, Land Off Plover Road, Minster, Sheppey	Proposed Residential Layout			
		Scale 1:1000 @A3		Drawn By	SJB
		Date May 2018		Drawing No.	**2279B–02B**

design bdb

Church Barn, Milton Manor Farm, Ashford Road, Canterbury, CT4 7PP
t: 01227 456699 www.bdb-design.co.uk



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:

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 S911 (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'

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

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.

DESIGN NOTES

1. STORAGE DESIGN BASED ON 1 IN 100 YR STORM + 40%.

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 TWU FOR CONNECTIONS TO SEWERS AND DISCHARGE RATES

6. CONTRACTOR TO ALLOW FOR NEW FOUL AND SURFACE WATER SEWER CONNECTIONS.

LEGEND

- Existing Foul Sewer
- MH0201 — Existing Foul Manhole
- Private Foul Drain
- Private Foul Rising Main
- Private Foul Pump Station
- FIC — Private Foul Inspection Chamber
- Previous Phase Foul Drainage
- FMH — Previous Phase Foul Manhole
- Private Storm Drain
- SIC — Private Storm Inspection Chamber
- SIC CP — Private Storm Catchpit
- SEL CONTROL CHAMBER — SEL Control Chamber
- TEGRA 600 — SEL Control Chamber
- Permeable Paving Carriageway Construction Sub-base Thickness Shown on Layout
- Permeable Paved Drives Minimum 255mm Thick Sub-base
- Proposed Ditch Diversion
- Cellular Attenuation Tank Located Beneath Permeable Paved Area

Rev	Amendments	Date	Dsn	Chk
B	Overland flow route pipe added	13/09/18	JP	MR
A	Flow Restriction Adjusted	30/04/18	LT	MR
-	Initial Issue	22/03/18	LT	MR

Status: PRELIMINARY

Client: DALEMARCH (SHEPPEY) LTD

Architect:

Project: LAND AT PLOVER ROAD, MINSTER, ME12 3BT

Title: PROPOSED DRAINAGE STRATEGY

Date	Scale @ A2
MARCH 2018	1:500
Clients Ref.	Project Ref. 7267

gtaCivils Consulting Engineers
Gloucester House, 66a Church Walk,
Burgess Hill, West Sussex, RH15 9AS
Tel.01444 871444 Web: www.gtacivils.co.uk

Drawing Number: 7267/1060 Rev. B

Appendix E

Drainage Calculation Sheets

ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.450
Area (ha)	0.321	Urban	0.000
SAAR (mm)	565	Region Number	Region 7

Results l/s

QBAR Rural	1.1
QBAR Urban	1.1
Q100 years	3.5
Q1 year	0.9
Q30 years	2.5
Q100 years	3.5

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.272	4-8	0.121

Total Area Contributing (ha) = 0.393

Total Pipe Volume (m^3) = 1.614

STORM SEWER DESIGN by the Modified Rational Method

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
S1.000	7.157	0.490	14.6	0.100	4.00	0.0	0.600	o	100	Pipe/Conduit	
S1.001	2.200	0.450	4.9	0.000	0.00	0.0	0.600	o	100	Pipe/Conduit	
S1.002	9.250	0.110	84.1	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S2.000	10.793	0.800	13.5	0.036	4.00	0.0	0.600	o	100	Pipe/Conduit	
S3.000	6.910	0.490	14.1	0.067	4.00	0.0	0.600	o	100	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)
S1.000	50.00	4.06	15.750	0.100	0.0	0.0	0.0	2.03	16.0	13.5
S1.001	50.00	4.07	15.260	0.100	0.0	0.0	0.0	3.52	27.7	13.5
S1.002	50.00	4.21	14.810	0.100	0.0	0.0	0.0	1.10	19.4	13.5
S2.000	50.00	4.09	15.500	0.036	0.0	0.0	0.0	2.11	16.6	4.9
S3.000	50.00	4.06	15.750	0.067	0.0	0.0	0.0	2.07	16.2	9.1

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
S3.001	4.746	0.420	11.3	0.000	0.00	0.0	0.600	o	100	Pipe/Conduit	
S3.002	8.770	0.090	97.4	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S4.000	8.102	0.800	10.1	0.021	4.00	0.0	0.600	o	100	Pipe/Conduit	
S1.003	32.342	1.500	21.6	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.004	11.141	0.900	12.4	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S5.000	8.886	0.000	0.0	0.169	4.00	0.0	0.600	o	100	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)
S3.001	50.00	4.09	15.260	0.067	0.0	0.0	0.0	2.31	18.2	9.1
S3.002	50.00	4.23	14.790	0.067	0.0	0.0	0.0	1.02	18.0	9.1
S4.000	50.00	4.06	15.500	0.021	0.0	0.0	0.0	2.44	19.2	2.8
S1.003	50.00	4.48	14.700	0.224	0.0	0.0	0.0	2.18	38.5	30.3
S1.004	50.00	4.55	13.200	0.224	0.0	0.0	0.0	2.88	50.9	30.3
S5.000	50.00	6.13	12.300	0.169	0.0	0.0	0.0	0.07	0.5«	22.9

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
S1.005	1.250	0.020	62.5	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.006	1.333	0.010	133.3	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)
S1.005	50.00	6.14	12.300	0.393	0.0	0.0	0.0	1.66	65.9	53.2
S1.006	50.00	6.16	12.280	0.393	0.0	0.0	0.0	1.36	96.1	53.2

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)
S1	16.350	0.600	Open Manhole	1200	S1.000	15.750	100				
S2	16.500	1.240	Open Manhole	1200	S1.001	15.260	100	S1.000	15.260	100	
S3	16.350	1.540	Open Manhole	1200	S1.002	14.810	150	S1.001	14.810	100	
S4	15.950	0.450	Open Manhole	1200	S2.000	15.500	100				
S5	16.350	0.600	Open Manhole	1200	S3.000	15.750	100				
S6	16.500	1.240	Open Manhole	1200	S3.001	15.260	100	S3.000	15.260	100	
S7	16.350	1.560	Open Manhole	1200	S3.002	14.790	150	S3.001	14.840	100	
S8	15.950	0.450	Open Manhole	1200	S4.000	15.500	100				
S4	16.500	1.800	Open Manhole	1200	S1.003	14.700	150	S1.002	14.700	150	
								S2.000	14.700	100	
								S3.002	14.700	150	
								S4.000	14.700	100	
S5	14.000	0.800	Open Manhole	1200	S1.004	13.200	150	S1.003	13.200	150	
S12	13.850	1.550	Open Manhole	1200	S5.000	12.300	100				
S6	13.850	1.550	Open Manhole	1200	S1.005	12.300	225	S1.004	12.300	150	
								S5.000	12.300	100	
S7	14.000	1.720	Open Manhole	1200	S1.006	12.280	300	S1.005	12.280	225	
S	14.000	1.730	Open Manhole	0		OUTFALL		S1.006	12.270	300	

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)
S1.000	o	100	S1	16.350	15.750	0.500	Open Manhole	1200
S1.001	o	100	S2	16.500	15.260	1.140	Open Manhole	1200
S1.002	o	150	S3	16.350	14.810	1.390	Open Manhole	1200
S2.000	o	100	S4	15.950	15.500	0.350	Open Manhole	1200
S3.000	o	100	S5	16.350	15.750	0.500	Open Manhole	1200
S3.001	o	100	S6	16.500	15.260	1.140	Open Manhole	1200
S3.002	o	150	S7	16.350	14.790	1.410	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)
S1.000	7.157	14.6	S2	16.500	15.260	1.140	Open Manhole	1200
S1.001	2.200	4.9	S3	16.350	14.810	1.440	Open Manhole	1200
S1.002	9.250	84.1	S4	16.500	14.700	1.650	Open Manhole	1200
S2.000	10.793	13.5	S4	16.500	14.700	1.700	Open Manhole	1200
S3.000	6.910	14.1	S6	16.500	15.260	1.140	Open Manhole	1200
S3.001	4.746	11.3	S7	16.350	14.840	1.410	Open Manhole	1200
S3.002	8.770	97.4	S4	16.500	14.700	1.650	Open Manhole	1200

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)
S4.000	o	100	S8	15.950	15.500	0.350	Open Manhole	1200
S1.003	o	150	S4	16.500	14.700	1.650	Open Manhole	1200
S1.004	o	150	S5	14.000	13.200	0.650	Open Manhole	1200
S5.000	o	100	S12	13.850	12.300	1.450	Open Manhole	1200
S1.005	o	225	S6	13.850	12.300	1.325	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)
S4.000	8.102	10.1	S4	16.500	14.700	1.700	Open Manhole	1200
S1.003	32.342	21.6	S5	14.000	13.200	0.650	Open Manhole	1200
S1.004	11.141	12.4	S6	13.850	12.300	1.400	Open Manhole	1200
S5.000	8.886	0.0	S6	13.850	12.300	1.450	Open Manhole	1200
S1.005	1.250	62.5	S7	14.000	12.280	1.495	Open Manhole	1200

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)
S1.006	o	300	S7	14.000	12.280	1.420	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)
S1.006	1.333	133.3	S	14.000	12.270	1.430	Open Manhole	0

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.100	0.100	0.100
1.001	-	-	100	0.000	0.000	0.000
1.002	-	-	100	0.000	0.000	0.000
2.000	-	-	100	0.036	0.036	0.036
3.000	-	-	100	0.067	0.067	0.067
3.001	-	-	100	0.000	0.000	0.000
3.002	-	-	100	0.000	0.000	0.000
4.000	-	-	100	0.021	0.021	0.021
1.003	-	-	100	0.000	0.000	0.000
1.004	-	-	100	0.000	0.000	0.000
5.000	-	-	100	0.169	0.169	0.169
1.005	-	-	100	0.000	0.000	0.000
1.006	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.393	0.393	0.393

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)
S1.006	S	14.000	12.270	14.000	0	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Manhole Headloss Coeff (Global)	0.500	Inlet Coeffiecient	0.800
Areal Reduction Factor	1.000	Foul Sewage per hectare (l/s)	0.000	Flow per Person per Day (l/per/day)	0.000
Hot Start (mins)	0	Additional Flow - % of Total Flow	0.000	Run Time (mins)	60
Hot Start Level (mm)	0	MADD Factor * 10m³/ha Storage	2.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Offline Controls	0	Number of Time/Area Diagrams	0
Number of Online Controls	4	Number of Storage Structures	5	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm)	20.900	Cv (Summer)	0.750
Return Period (years)	1	Ratio R	0.392	Cv (Winter)	0.840
Region	England and Wales	Profile Type	Summer	Storm Duration (mins)	30

Online Controls for Storm

Orifice Manhole: S2, DS/PN: S1.001, Volume (m³): 1.4

Diameter (m) 0.048 Discharge Coefficient 0.600 Invert Level (m) 15.260

Orifice Manhole: S6, DS/PN: S3.001, Volume (m³): 1.4

Diameter (m) 0.035 Discharge Coefficient 0.600 Invert Level (m) 15.260

Orifice Manhole: S4, DS/PN: S1.003, Volume (m³): 2.4

Diameter (m) 0.075 Discharge Coefficient 0.600 Invert Level (m) 14.700

Hydro-Brake® Optimum Manhole: S7, DS/PN: S1.006, Volume (m³): 1.9

Unit Reference	MD-SHE-0060-2000-1573-2000	Sump Available	Yes
Design Head (m)	1.573	Diameter (mm)	60
Design Flow (l/s)	2.0	Invert Level (m)	12.280
Flush-Flo™	Calculated	Minimum Outlet Pipe Diameter (mm)	75
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)	1.573	2.0	Kick-Flo®	0.537	1.2
Flush-Flo™	0.266	1.5	Mean Flow over Head Range	-	1.5

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should

Hydro-Brake® Optimum Manhole: S7, DS/PN: S1.006, Volume (m³): 1.9

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	1.3	0.600	1.3	1.600	2.0	2.600	2.5	5.000	3.4	7.500	4.1
0.200	1.5	0.800	1.5	1.800	2.1	3.000	2.7	5.500	3.6	8.000	4.2
0.300	1.5	1.000	1.6	2.000	2.2	3.500	2.9	6.000	3.7	8.500	4.4
0.400	1.5	1.200	1.8	2.200	2.3	4.000	3.1	6.500	3.9	9.000	4.5
0.500	1.3	1.400	1.9	2.400	2.4	4.500	3.2	7.000	4.0	9.500	4.6

Storage Structures for Storm

Porous Car Park Manhole: S1, DS/PN: S1.000

Infiltration Coefficient Base (m/hr)	0.00000	Porosity	0.30	Slope (1:X)	0.0
Membrane Percolation (mm/hr)	1000	Invert Level (m)	15.750	Depression Storage (mm)	5
Max Percolation (l/s)	90.3	Width (m)	5.0	Evaporation (mm/day)	3
Safety Factor	2.0	Length (m)	65.0	Membrane Depth (mm)	0

Porous Car Park Manhole: S4, DS/PN: S2.000

Infiltration Coefficient Base (m/hr)	0.00000	Porosity	0.30	Slope (1:X)	0.0
Membrane Percolation (mm/hr)	1000	Invert Level (m)	15.500	Depression Storage (mm)	5
Max Percolation (l/s)	23.9	Width (m)	4.1	Evaporation (mm/day)	3
Safety Factor	2.0	Length (m)	21.0	Membrane Depth (mm)	0

Porous Car Park Manhole: S5, DS/PN: S3.000

Infiltration Coefficient Base (m/hr)	0.00000	Porosity	0.30	Slope (1:X)	0.0
Membrane Percolation (mm/hr)	1000	Invert Level (m)	15.750	Depression Storage (mm)	5
Max Percolation (l/s)	65.7	Width (m)	12.0	Evaporation (mm/day)	3
Safety Factor	2.0	Length (m)	19.7	Membrane Depth (mm)	0

Porous Car Park Manhole: S8, DS/PN: S4.000

Infiltration Coefficient Base (m/hr)	0.00000	Safety Factor	2.0	Width (m)	7.2
Membrane Percolation (mm/hr)	1000	Porosity	0.30	Length (m)	9.0
Max Percolation (l/s)	18.0	Invert Level (m)	15.500	Slope (1:X)	0.0

Porous Car Park Manhole: S8, DS/PN: S4.000

Depression Storage (mm) 5 Evaporation (mm/day) 3 Membrane Depth (mm) 0

Complex Manhole: S12, DS/PN: S5.000

Cellular Storage

Invert Level (m) 12.300 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	217.0	217.0	0.800	217.0	264.2	0.900	0.0	264.2

Porous Car Park

Infiltration Coefficient Base (m/hr)	0.00000	Porosity	0.30	Slope (1:X)	0.0
Membrane Percolation (mm/hr)	1000	Invert Level (m)	13.100	Depression Storage (mm)	5
Max Percolation (l/s)	182.8	Width (m)	7.0	Evaporation (mm/day)	3
Safety Factor	2.0	Length (m)	94.0	Membrane Depth (mm)	0

1 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 4 Number of Storage Structures 5 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 20.400 Cv (Summer) 0.750
Region England and Wales Ratio R 0.380 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 10.0 DVD Status ON
Analysis Timestep 2.5 Second Increment (Extended) Inertia Status ON
DTS Status ON

Profile(s) Winter
Duration(s) (mins) 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 40

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Maximum Vol (m³)	Pipe Flow (l/s)	Status
S1.000	S1	60 minute 1 year Winter I+0%	16.350	15.795	-0.055	0.000	0.32		4.432	4.6	OK

1 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.	Overflow (l/s)	Maximum Vol (m³)	Pipe Flow (l/s)	Status
S1.001	S2	60 minute 1 year Winter I+0%	16.500	15.769	0.409	0.000	0.18		0.613	3.3	SURCHARGED
S1.002	S3	60 minute 1 year Winter I+0%	16.350	15.180	0.220	0.000	0.21		0.419	3.6	SURCHARGED
S2.000	S4	60 minute 1 year Winter I+0%	15.950	15.527	-0.073	0.000	0.16		0.721	2.5	OK
S3.000	S5	60 minute 1 year Winter I+0%	16.350	15.791	-0.059	0.000	0.22		2.979	3.3	OK
S3.001	S6	60 minute 1 year Winter I+0%	16.500	15.779	0.419	0.000	0.11		0.623	1.8	SURCHARGED
S3.002	S7	60 minute 1 year Winter I+0%	16.350	15.175	0.235	0.000	0.13		0.448	2.0	SURCHARGED
S4.000	S8	60 minute 1 year Winter I+0%	15.950	15.519	-0.081	0.000	0.08		0.392	1.5	OK
S1.003	S4	60 minute 1 year Winter I+0%	16.500	15.169	0.319	0.000	0.21		0.868	7.7	SURCHARGED
S1.004	S5	60 minute 1 year Winter I+0%	14.000	13.241	-0.109	0.000	0.17		0.045	7.7	OK
S5.000	S12	720 minute 1 year Winter I+0%	13.850	12.530	0.130	0.000	0.85		47.752	2.2	SURCHARGED
S1.005	S6	180 minute 1 year Winter I+0%	13.850	12.539	0.014	0.000	0.06		0.356	1.7	SURCHARGED
S1.006	S7	180 minute 1 year Winter I+0%	14.000	12.539	-0.041	0.000	0.03		0.291	1.5	OK

30 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 4 Number of Storage Structures 5 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 20.400 Cv (Summer) 0.750
Region England and Wales Ratio R 0.380 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 10.0 DVD Status ON
Analysis Timestep 2.5 Second Increment (Extended) Inertia Status ON
DTS Status ON

Profile(s) Winter
Duration(s) (mins) 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 40

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Maximum Vol (m³)	Pipe Flow (l/s)	Status
S1.000	S1	60 minute 30 year Winter I+0%	16.350	15.917	0.067	0.000	0.38		16.506	5.5	SURCHARGED

30 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.	Overflow (l/s)	Maximum Vol (m³)	Pipe Flow (l/s)	Status
S1.001	S2	60 minute 30 year Winter I+0%	16.500	15.896	0.536	0.000	0.20		0.760	3.7	SURCHARGED
S1.002	S3	60 minute 30 year Winter I+0%	16.350	15.534	0.574	0.000	0.24		0.821	4.1	SURCHARGED
S2.000	S4	60 minute 30 year Winter I+0%	15.950	15.573	-0.027	0.000	0.37		1.969	5.8	OK
S3.000	S5	60 minute 30 year Winter I+0%	16.350	15.910	0.060	0.000	0.29		11.533	4.2	SURCHARGED
S3.001	S6	60 minute 30 year Winter I+0%	16.500	15.898	0.538	0.000	0.13		0.760	2.0	SURCHARGED
S3.002	S7	60 minute 30 year Winter I+0%	16.350	15.530	0.590	0.000	0.15		0.859	2.4	SURCHARGED
S4.000	S8	60 minute 30 year Winter I+0%	15.950	15.541	-0.059	0.000	0.21		0.845	3.6	OK
S1.003	S4	60 minute 30 year Winter I+0%	16.500	15.525	0.675	0.000	0.28		1.327	10.4	SURCHARGED
S1.004	S5	60 minute 30 year Winter I+0%	14.000	13.248	-0.102	0.000	0.23		0.054	10.4	OK
S5.000	S12	720 minute 30 year Winter I+0%	13.850	12.959	0.559	0.000	0.70		136.569	1.8	SURCHARGED
S1.005	S6	720 minute 30 year Winter I+0%	13.850	12.956	0.431	0.000	0.05		0.909	1.6	SURCHARGED
S1.006	S7	720 minute 30 year Winter I+0%	14.000	12.956	0.376	0.000	0.03		0.763	1.5	SURCHARGED

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 4 Number of Storage Structures 5 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 20.400 Cv (Summer) 0.750
Region England and Wales Ratio R 0.380 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 10.0 DVD Status ON
Analysis Timestep 2.5 Second Increment (Extended) Inertia Status ON
DTS Status ON

Profile(s)	Winter
Duration(s) (mins)	60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 40

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Maximum Vol (m³)	Pipe Flow (l/s)	Status
S1.000	S1	120 minute 100 year Winter I+40%	16.350	16.130	0.280	0.000	0.30		37.429	4.3	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.	Overflow (l/s)	Maximum Vol (m³)	Pipe Flow (l/s)	Status
S1.001	S2	120 minute 100 year Winter I+40%	16.500	16.101	0.741	0.000	0.23		0.992	4.2	SURCHARGED
S1.002	S3	60 minute 100 year Winter I+40%	16.350	15.674	0.714	0.000	0.27		0.979	4.6	SURCHARGED
S2.000	S4	60 minute 100 year Winter I+40%	15.950	15.734	0.134	0.000	0.41		6.305	6.3	SURCHARGED
S3.000	S5	120 minute 100 year Winter I+40%	16.350	16.122	0.272	0.000	0.19		26.781	2.7	SURCHARGED
S3.001	S6	120 minute 100 year Winter I+40%	16.500	16.109	0.749	0.000	0.15		0.999	2.3	SURCHARGED
S3.002	S7	60 minute 100 year Winter I+40%	16.350	15.669	0.729	0.000	0.18		1.016	2.8	SURCHARGED
S4.000	S8	60 minute 100 year Winter I+40%	15.950	15.679	0.079	0.000	0.24		3.678	4.3	SURCHARGED
S1.003	S4	60 minute 100 year Winter I+40%	16.500	15.664	0.814	0.000	0.31		1.490	11.3	SURCHARGED
S1.004	S5	960 minute 100 year Winter I+40%	14.000	13.625	0.275	0.000	0.17		0.602	7.6	SURCHARGED
S5.000	S12	960 minute 100 year Winter I+40%	13.850	13.624	1.224	0.000	0.76		276.643	2.0	SURCHARGED
S1.005	S6	960 minute 100 year Winter I+40%	13.850	13.620	1.095	0.000	0.07		1.723	2.0	SURCHARGED
S1.006	S7	960 minute 100 year Winter I+40%	14.000	13.620	1.040	0.000	0.03		1.514	1.8	SURCHARGED

gtaCivils
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Drainage - Flood Risk - Highways - Transport

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