DRAINAGE STRATEGY

INCORPORATING AN ASSESSMENT OF FLOOD RISK

for

COARS FARM LIMITED

PROPOSED HOLIDAY ACCOMMODATION

AND ASSOCIATED BUILDINGS

at

COARS FARM

WRIGGLESWORTH, SKIPTON

JULY 2021

REFORD

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1. INTRODUCTION

1.1 This surface water and foul water drainage strategy, incorporating an assessment of flood risk, has been produced on behalf of Coars Farm Limited in support of a planning application for a proposed development comprising 15 holiday units, a 10 bed holiday converted house and barn, a restaurant / café, admin / storage building at Coars Farm, Wrigglesworth, Skipton. A location plan is included within Appendix A.

1.2 This report describes the existing site conditions and proposed development. It assesses the potential impact of proposals on existing sewers and includes a proposed strategy for the provision of new drainage to serve the proposed development.

2. BASE INFORMATION

Existing site

2.1 The proposal relates to land (approx. 2.7 hectares) at Coars Farm, Wrigglesworth, Skipton.

2.2 The site lies to the south of Wrigglesworth on the western side of Forest Becks Brow, the road linking Wrigglesworth to Sawley.

2.3 The majority of the existing site comprises rough shrubland. In the north eastern corner of the site lies the established garden centre and café. The existing farmhouse lies in the north western corner of the site.

2.4 The site has a general fall from the northern, western and southern boundaries to the centre of the eastern boundary.

2.5 Access to the site is available from Forest Becks Brow.

Proposed development

2.6 The proposed development will comprise 15 holiday units, a 10 bed holiday converted house and barn, a restaurant / café, admin / storage building. The masterplan is shown on drawing *COA01 / Dwg 10* accompanying the planning application.

Site geology

2.7 The online Soilscapes viewer has identified that the geology encountered will be slowly permeable seasonally wet acid loamy and clayey soils with impeded drainage. It is expected that the underlying cohesive deposits are unlikely to offer the necessary permeability to make soakaway drainage a viable option.

Understanding of existing drainage within and local to the site

2.8 A watercourse lies immediately opposite the site on the eastern side of Forest Becks Brow and flows to the east to discharge into the Agden Beck approx. 340m from the site's eastern boundary.

2.9 A watercourse in culvert crosses the site from its north western corner to discharge into the watercourse that lies immediately opposite the site on the eastern side of Forest Becks Brow and flows to the east to discharge into the Agden Beck.

2.10 Within the site are separate surface water and foul water drainage systems serving the existing development. Surface water is discharged into the watercourse. Foul water from the café and farmhouse is treated by a treatment plant that is located within the roundabout at the northern end of the site.

2.11 There are no public sewers within the area.

Flood risk

2.12 The flood map for planning identifies the site lying within Flood Zone 1, the lowest risk.

2.13 The Long Term Flood Risk map on the GOV.uk website shows the majority of the site is at a very low risk of surface water flooding. A very low risk means that each year, this area has a chance of flooding of less than 1 in 1000 (0.1%). A low risk of surface water flooding is shown along the line of the culverted watercourse crossing the site. A high risk is shown within the low part of the site where water can accumulate prior to discharging under the road to the watercourse that lies immediately opposite the site on the eastern side of Forest Becks Brow. To mitigate against the risk of surface water flooding:

- The culverted watercourse flowing through the site is to be diverted and improved through the site to enable development to occur.
- A drainage ditch is to be constructed along the site's western boundary to intercept overland surface water flows. An outfall from the ditch will connect to the new culvert.
- A positive surface water drainage system is to be installed within the site with attenuation storage.
- The floor level of the holiday units are to be set a minimum 300mm above existing ground levels.

2.14 There are no canals or artificial sources local to the development site.

2.15 There are no sewers local to the development site.

2.16 The Environment Agency risk of flooding from reservoirs map identifies the site is not at risk.

2.17 The Environment Agency does not consider groundwater flooding to be a significant flood risk factor in the Ribble Valley area.

2.18 Surface water runoff from the development will be controlled to the Greenfield runoff rate, Qbar, and attenuation provided. As such there will be no change to the flood risk upstream or downstream of this location.

3. PROPOSED DRAINAGE STRATEGY

3.1 The proposed drainage layout is included within Appendix B.

Surface Water Drainage

3.2 In accordance with the National Standards for Sustainable Drainage, the drainage strategy should incorporate the use of Sustainable Drainage (SUDS) where possible. The approach promotes the use infiltration features in the first instance. If drainage cannot be achieved solely through infiltration due to site conditions or contamination risks, the preferred options are (in order of preference):

(i) a controlled discharge to a local waterbody or watercourse, or
(ii) a controlled discharge into the public sewer network (depending on availability and capacity).

3.3 The rate and volume of discharge should be restricted to the pre-development values as far as practicable.

Surface water drainage discharges from the developed site

3.4 The online Soilscapes viewer has identified that the geology encountered will be slowly permeable seasonally wet acid loamy and clayey soils with impeded drainage. It is expected that the underlying cohesive deposits are unlikely to offer the necessary permeability to make soakaway drainage a viable option.

3.5 In line with common practice, surface water runoff from the proposed development should mimic those from the existing site. It is therefore intended that surface water runoff from the developed site will be attenuated and discharged into the culverted watercourse that flows through the site and discharges into the watercourse that lies immediately opposite the site on the eastern side of Forest Becks Brow and flows to the east to discharge into the Agden Beck.

3.6 Surface water runoff from the development will be controlled to the Greenfield runoff rate, Qbar. Attenuation will be provided allowing surface water runoff generated by all rainfall events up to the 100 year critical rain storm plus 40% on stored volumes to

discharge into the watercourse. The additional 40% is to allow for climate change and has been included in the surface water volume.

3.7 To determine the restricted surface water discharge rates from the developed site, the pre-development Greenfield runoff rates have been calculated using the 'Causeway Flow' programme. The calculations are based upon the developed area of the site of 1.8ha, having removed the areas of land within the site that are not to be developed, measured at 0.9ha. The existing pre-development Greenfield runoff rates have been calculated as follows:

- Qbar 17.7 l/s
- Q1 15.4 l/s
- Q30 30.1 l/s
- Q100 36.9 l/s

3.8 A surface water drainage design has been carried out for the proposed site development for all events up to the 100 year critical rain storm plus 40% for climate change on stored volumes. Attenuation is provided using underground storage within landscaping and car parking areas.

3.9 The surface water drainage design is included within Appendix C.

Foul Water Drainage

3.10 Foul water discharges from the site will be treated by a new sewage treatment plant and the effluent discharged into the culverted watercourse that flows through the site and discharges into the watercourse that lies immediately opposite the site on the eastern side of Forest Becks Brow and flows to the east to discharge into the Agden Beck. The existing treatment plant is to be removed.

3.11 A typical plant is the Marsh Industries Ultra Polylok 150PE Sewage Treatment Plant. The initial sizing of the plant, to be confirmed, has been based on 15 two bed holiday units, a 10 bed holiday converted house and a café to cater for a total of 80 people.

3.12 Due to the size of the sewage treatment plant required, a licence will be required from the Environment Agency to make an effluent discharge into the watercourse.

4. SUMMARY AND CONCLUSIONS

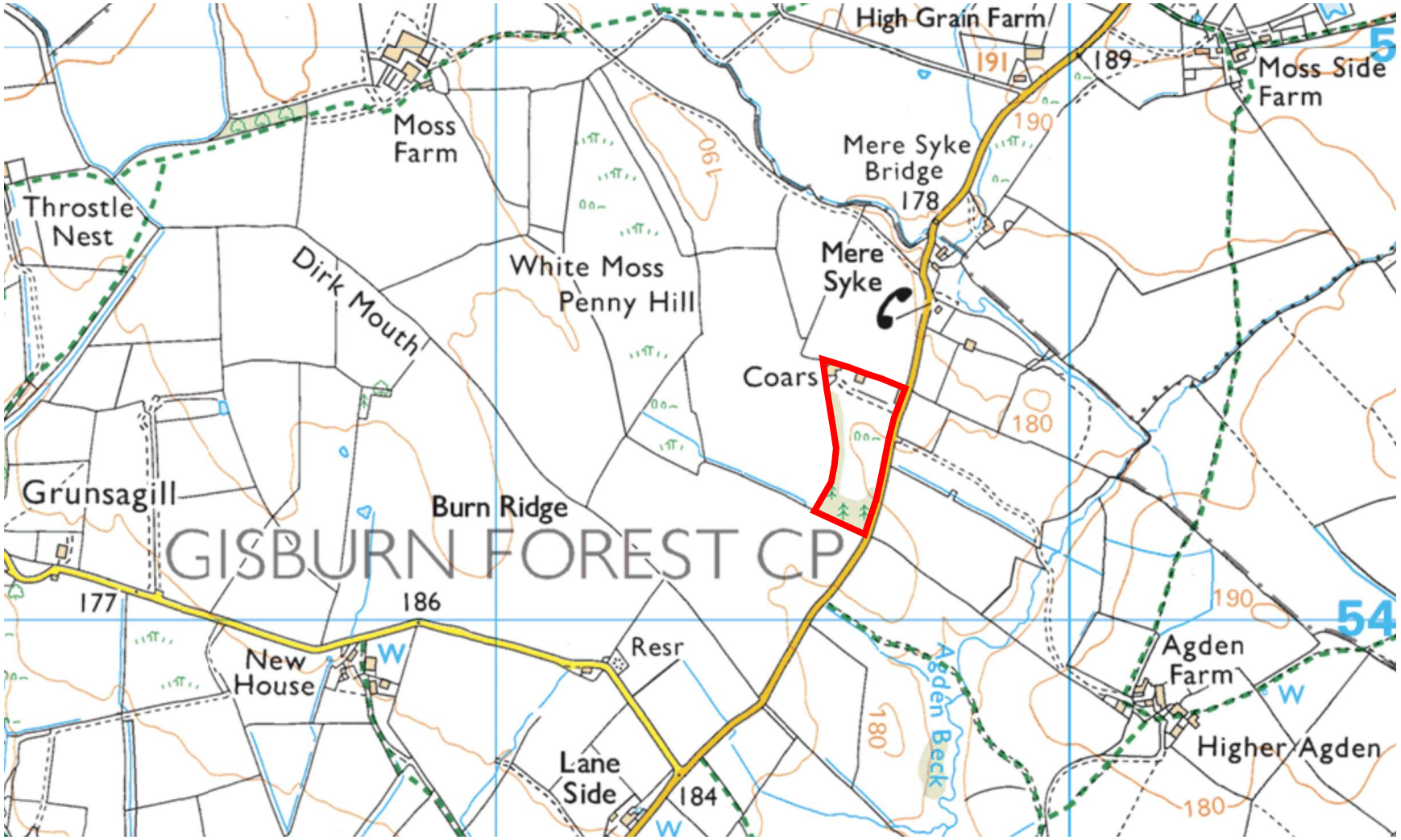
4.1 This surface water and foul water drainage strategy, incorporating an assessment of flood risk, has been produced on behalf of Coars Farm Limited in support of a planning application for a proposed development comprising 15 holiday units, a 10 bed holiday converted house and barn, a restaurant / café, admin / storage building at Coars Farm, Wrigglesworth, Skipton.

4.2 The nature of the local geology means that infiltration of surface water runoff back into the ground is not feasible on this site.

4.3 Surface water runoff from the developed site will be attenuated to the Greenfield runoff rate, Qbar, and discharged into the culverted watercourse that flows through the site and discharges into the watercourse that lies immediately opposite the site on the eastern side of Forest Becks Brow and flows to the east to discharge into the Agden Beck. Attenuation is provided using underground storage within landscaping and car parking areas.

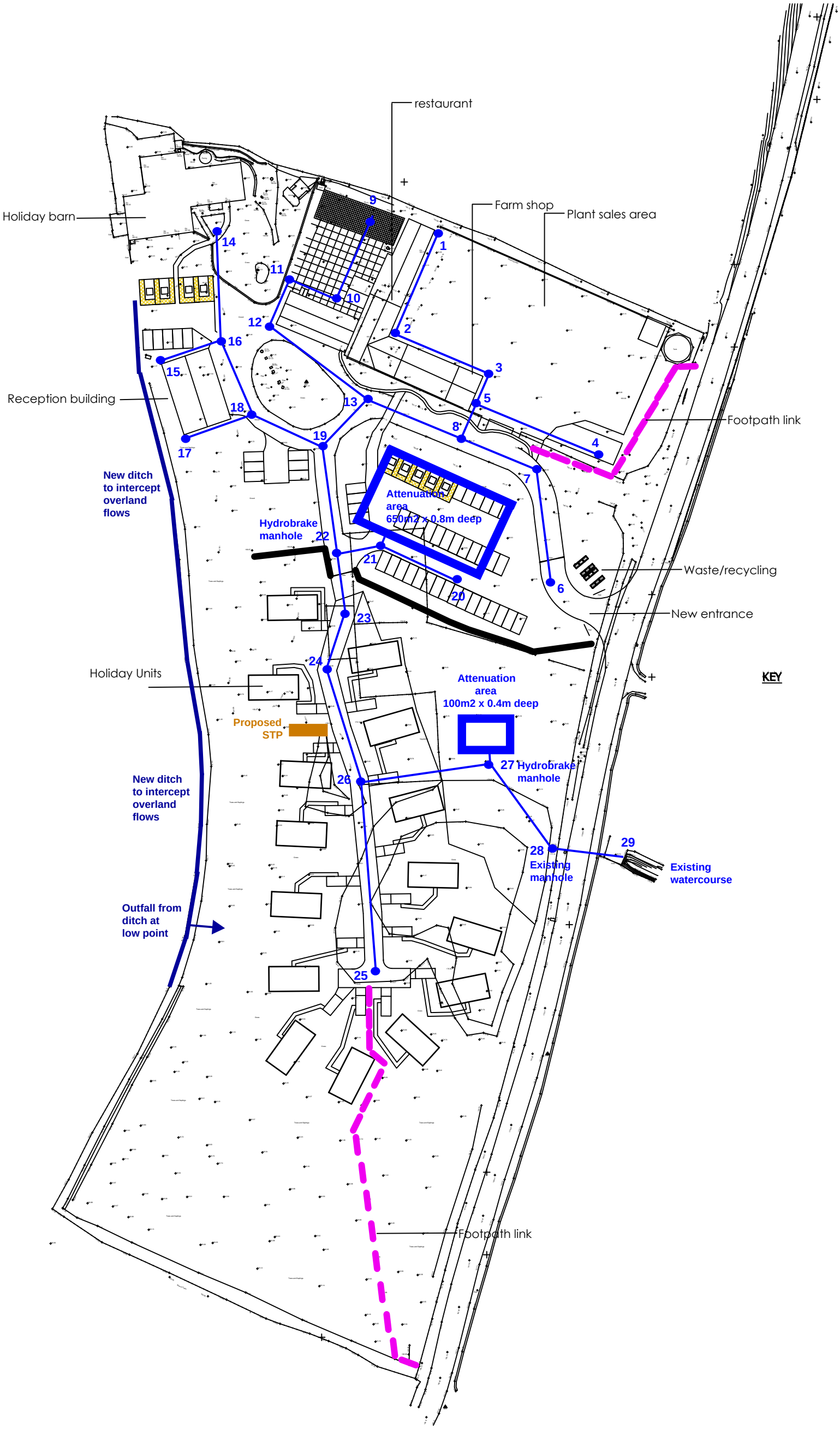
4.4 Foul water discharges from the site will be treated by a new sewage treatment plant and the effluent discharged into the culverted watercourse that flows through the site and discharges into the watercourse that lies immediately opposite the site on the eastern side of Forest Becks Brow and flows to the east to discharge into the Agden Beck.

APPENDIX A



LOCATION PLAN

APPENDIX B



DRAINAGE LAYOUT

APPENDIX C

PRE-DEVELOPMENT GREENFIELD RUNOFF RATES

Pre-development discharge

Site Makeup	Greenfield
Greenfield Method	IH124
Positively Drained Area (ha)	1.800
SAAR (mm)	1287
Soil Index	4
SPR	0.47
Region	10
Betterment (%)	0
	Calc
QBar (l/s)	17.7

Return Period (years)	Growth Factor	Q (l/s)
1	0.87	15.4
30	1.70	30.1
100	2.08	36.9

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	2	Maximum Rainfall (mm/hr)	75.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	17.800	Minimum Backdrop Height (m)	2.000
Ratio-R	0.260	Preferred Cover Depth (m)	0.900
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Depth (m)
1	0.006	5.00	183.200	1200	1.300
2	0.044	5.00	182.800	1200	1.321
3	0.053	5.00	182.800	1200	1.792
4	0.060	5.00	182.600	1200	1.350
5	0.075	5.00	182.200	1200	2.088
6	0.027	5.00	181.000	1200	1.425
7	0.012	5.00	181.900	1200	2.490
8	0.017	5.00	181.500	1200	2.283
9	0.006	5.00	183.800	1200	1.300
10	0.035	5.00	182.300	1200	1.000
11	0.031	5.00	182.300	1200	1.327
12	0.027	5.00	181.400	1200	1.125
13	0.009	5.00	181.000	1200	1.948
14	0.040	5.00	182.400	1200	1.350
15	0.006	5.00	181.700	1200	1.300
16	0.048	5.00	181.500	1200	1.494
17	0.018	5.00	181.300	1200	1.300
18	0.006	5.00	181.000	1200	1.394
19	0.034	5.00	180.600	1200	1.896
20	0.065	5.00	179.800	1800	1.397
21	0.065	5.00	179.800	1200	1.590
22	0.007	5.00	179.800	1200	1.661
23	0.010	5.00	179.700	1200	1.618
24	0.035	5.00	179.400	1200	1.379
25	0.075	5.00	179.800	1200	1.425
26	0.070	5.00	179.100	1200	1.183
27			179.000	1800	1.204
28			179.000	1200	1.300
29			178.500	1200	0.870

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	1	2	25.000	0.600	181.900	181.479	0.421	59.4	100	5.42	48.6
1.001	2	3	25.000	0.600	181.479	181.058	0.421	59.4	100	5.83	47.3
1.002	3	5	10.000	0.600	181.008	180.187	0.821	12.2	150	5.89	47.1
2.000	4	5	30.000	0.600	181.250	180.187	1.063	28.2	150	5.26	49.2
1.003	5	8	10.000	0.600	180.112	179.292	0.820	12.2	225	5.93	47.0
3.000	6	7	28.000	0.600	179.575	179.410	0.165	169.7	225	5.47	48.5
3.001	7	8	20.000	0.600	179.410	179.292	0.118	169.5	225	5.80	47.4
1.004	8	13	28.000	0.600	179.217	179.052	0.165	169.7	300	6.32	45.8
4.000	9	10	25.000	0.600	182.500	181.300	1.200	20.8	100	5.25	49.2
4.001	10	11	12.000	0.600	181.300	181.098	0.202	59.4	100	5.45	48.5
4.002	11	12	12.000	0.600	180.973	180.275	0.698	17.2	225	5.51	48.3
4.003	12	13	28.000	0.600	180.275	179.127	1.148	24.4	225	5.68	47.8
1.005	13	19	16.000	0.600	179.052	178.704	0.348	46.0	300	6.44	45.5
5.000	14	16	25.000	0.600	181.050	180.081	0.969	25.8	150	5.21	49.3
6.000	15	16	16.000	0.600	180.400	180.131	0.269	59.5	100	5.27	49.1
5.001	16	18	20.000	0.600	180.006	179.606	0.400	50.0	225	5.45	48.5
7.000	17	18	16.000	0.600	180.000	179.731	0.269	59.5	100	5.27	49.1
5.002	18	19	18.000	0.600	179.606	178.779	0.827	21.8	225	5.55	48.2
1.006	19	22	26.000	0.600	178.704	178.139	0.565	46.0	300	6.62	45.0
8.000	20	21	20.000	0.600	178.403	178.285	0.118	169.5	225	5.33	48.9
8.001	21	22	12.000	0.600	178.210	178.139	0.071	169.0	300	5.50	48.4
1.007	22	23	15.000	0.600	178.139	178.082	0.057	263.2	300	6.88	44.3
1.008	23	24	16.000	0.600	178.082	178.021	0.061	262.3	300	7.16	43.6
1.009	24	26	28.000	0.600	178.021	177.917	0.104	269.2	300	7.65	42.4

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)
1.000	1.001	7.9	0.8	1.200	1.221	0.006	0.0
1.001	1.001	7.9	6.4	1.221	1.642	0.050	0.0
1.002	2.902	51.3	13.2	1.642	1.863	0.103	0.0
2.000	1.902	33.6	8.0	1.200	1.863	0.060	0.0
1.003	3.767	149.8	30.3	1.863	1.983	0.238	0.0
3.000	1.001	39.8	3.5	1.200	2.265	0.027	0.0
3.001	1.001	39.8	5.0	2.265	1.983	0.039	0.0
1.004	1.204	85.1	36.5	1.983	1.648	0.294	0.0
4.000	1.699	13.3	0.8	1.200	0.900	0.006	0.0
4.001	1.001	7.9	5.4	0.900	1.102	0.041	0.0
4.002	3.171	126.1	9.4	1.102	0.900	0.072	0.0
4.003	2.660	105.8	12.8	0.900	1.648	0.099	0.0
1.005	2.324	164.3	49.6	1.648	1.596	0.402	0.0
5.000	1.990	35.2	5.3	1.200	1.269	0.040	0.0
6.000	1.000	7.9	0.8	1.200	1.269	0.006	0.0
5.001	1.854	73.7	12.4	1.269	1.169	0.094	0.0
7.000	1.000	7.9	2.4	1.200	1.169	0.018	0.0
5.002	2.817	112.0	15.4	1.169	1.596	0.118	0.0
1.006	2.323	164.2	67.6	1.596	1.361	0.554	0.0
8.000	1.001	39.8	8.6	1.172	1.290	0.065	0.0
8.001	1.206	85.3	17.0	1.290	1.361	0.130	0.0
1.007	0.964	68.2	83.0	1.361	1.318	0.691	0.0
1.008	0.966	68.3	82.8	1.318	1.079	0.701	0.0
1.009	0.953	67.4	84.5	1.079	0.883	0.736	0.0

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)
9.000	25	26	46.000	0.600	178.375	177.992	0.383	120.1	225	5.64	47.9
1.010	26	27	32.000	0.600	177.917	177.796	0.121	264.5	300	8.20	41.1
1.011	27	28	26.000	0.600	177.796	177.700	0.096	270.8	300	8.66	40.2
1.012	28	29	18.000	0.600	177.700	177.630	0.070	257.1	300	8.97	39.5

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)
9.000	1.192	47.4	9.7	1.200	0.883	0.075	0.0
1.010	0.962	68.0	98.2	0.883	0.904	0.881	0.0
1.011	0.950	67.2	95.9	0.904	1.000	0.881	0.0
1.012	0.976	69.0	94.4	1.000	0.570	0.881	0.0

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	25.000	59.4	100	Circular	183.200	181.900	1.200	182.800	181.479	1.221
1.001	25.000	59.4	100	Circular	182.800	181.479	1.221	182.800	181.058	1.642
1.002	10.000	12.2	150	Circular	182.800	181.008	1.642	182.200	180.187	1.863
2.000	30.000	28.2	150	Circular	182.600	181.250	1.200	182.200	180.187	1.863
1.003	10.000	12.2	225	Circular	182.200	180.112	1.863	181.500	179.292	1.983
3.000	28.000	169.7	225	Circular	181.000	179.575	1.200	181.900	179.410	2.265
3.001	20.000	169.5	225	Circular	181.900	179.410	2.265	181.500	179.292	1.983
1.004	28.000	169.7	300	Circular	181.500	179.217	1.983	181.000	179.052	1.648
4.000	25.000	20.8	100	Circular	183.800	182.500	1.200	182.300	181.300	0.900
4.001	12.000	59.4	100	Circular	182.300	181.300	0.900	182.300	181.098	1.102
4.002	12.000	17.2	225	Circular	182.300	180.973	1.102	181.400	180.275	0.900
4.003	28.000	24.4	225	Circular	181.400	180.275	0.900	181.000	179.127	1.648
1.005	16.000	46.0	300	Circular	181.000	179.052	1.648	180.600	178.704	1.596
5.000	25.000	25.8	150	Circular	182.400	181.050	1.200	181.500	180.081	1.269
6.000	16.000	59.5	100	Circular	181.700	180.400	1.200	181.500	180.131	1.269
5.001	20.000	50.0	225	Circular	181.500	180.006	1.269	181.000	179.606	1.169
7.000	16.000	59.5	100	Circular	181.300	180.000	1.200	181.000	179.731	1.169

Link
1.000
1.001
1.002
2.000
1.003
3.000
3.001
1.004
4.000
4.001
4.002
4.003
1.005
5.000
6.000
5.001
7.000

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
5.002	18.000	21.8	225	Circular	181.000	179.606	1.169	180.600	178.779	1.596
1.006	26.000	46.0	300	Circular	180.600	178.704	1.596	179.800	178.139	1.361
8.000	20.000	169.5	225	Circular	179.800	178.403	1.172	179.800	178.285	1.290
8.001	12.000	169.0	300	Circular	179.800	178.210	1.290	179.800	178.139	1.361
1.007	15.000	263.2	300	Circular	179.800	178.139	1.361	179.700	178.082	1.318
1.008	16.000	262.3	300	Circular	179.700	178.082	1.318	179.400	178.021	1.079
1.009	28.000	269.2	300	Circular	179.400	178.021	1.079	179.100	177.917	0.883
9.000	46.000	120.1	225	Circular	179.800	178.375	1.200	179.100	177.992	0.883
1.010	32.000	264.5	300	Circular	179.100	177.917	0.883	179.000	177.796	0.904
1.011	26.000	270.8	300	Circular	179.000	177.796	0.904	179.000	177.700	1.000
1.012	18.000	257.1	300	Circular	179.000	177.700	1.000	178.500	177.630	0.570

Link
5.002
1.006
8.000
8.001
1.007
1.008
1.009
9.000
1.010
1.011
1.012

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	England and Wales	Skip Steady State	x
M5-60 (mm)	17.800	Drain Down Time (mins)	240
Ratio-R	0.260	Additional Storage (m³/ha)	20.0
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

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 %)
1	0	0	0
30	0	0	0
100	0	0	0
100	40	0	0

Node 22 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	178.139	Product Number	CTL-SHE-0096-5000-1660-5000
Design Depth (m)	1.660	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	5.0	Min Node Diameter (mm)	1200

Node 27 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	177.796	Product Number	CTL-SHE-0186-1770-1200-1770
Design Depth (m)	1.200	Min Outlet Diameter (m)	0.225
Design Flow (l/s)	17.7	Min Node Diameter (mm)	1500

Node 21 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	178.210
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	650.0	0.0	0.800	650.0	0.0	0.801	0.0	0.0

Node 27 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	177.796
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	94

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	100.0	0.0	0.400	100.0	0.0	0.401	0.0	0.0

Results for 1 year Critical Storm Duration. Lowest mass balance: 99.24%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	181.919	0.019	0.7	0.0237	0.0000	OK
15 minute winter	2	11	181.540	0.061	5.4	0.1101	0.0000	OK
15 minute winter	3	10	181.057	0.049	10.9	0.0847	0.0000	OK
15 minute winter	4	10	181.295	0.045	6.5	0.0908	0.0000	OK
15 minute winter	5	10	180.179	0.067	25.2	0.1234	0.0000	OK
15 minute winter	6	10	179.616	0.040	2.9	0.0611	0.0000	OK
15 minute winter	7	11	179.459	0.049	4.1	0.0599	0.0000	OK
15 minute winter	8	11	179.347	0.130	30.7	0.1661	0.0000	OK
15 minute winter	9	10	182.515	0.015	0.7	0.0186	0.0000	OK
15 minute winter	10	11	181.355	0.055	4.5	0.1013	0.0000	OK
15 minute winter	11	10	181.010	0.037	7.6	0.0597	0.0000	OK
15 minute winter	12	11	180.324	0.049	10.5	0.0781	0.0000	OK
30 minute summer	13	18	179.156	0.104	39.0	0.1275	0.0000	OK
15 minute winter	14	10	181.086	0.036	4.3	0.0616	0.0000	OK
15 minute winter	15	10	180.420	0.020	0.7	0.0239	0.0000	OK
15 minute winter	16	10	180.064	0.058	10.1	0.1037	0.0000	OK
15 minute winter	17	10	180.034	0.034	2.0	0.0483	0.0000	OK
15 minute winter	18	10	179.656	0.050	12.5	0.0613	0.0000	OK
15 minute winter	19	11	179.054	0.350	58.3	0.5216	0.0000	SURCHARGED
15 minute winter	20	10	178.467	0.064	7.1	0.2239	0.0000	OK
720 minute winter	21	510	178.347	0.137	7.1	84.9514	0.0000	OK
15 minute winter	22	11	178.958	0.819	65.9	0.9954	0.0000	SURCHARGED
15 minute summer	23	9	178.140	0.058	5.6	0.0725	0.0000	OK
15 minute winter	24	10	178.095	0.074	9.2	0.1209	0.0000	OK
15 minute winter	25	10	178.438	0.063	8.1	0.1368	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	1.000	2	0.6	0.221	0.081	0.0760	
15 minute winter	2	1.001	3	5.2	1.059	0.667	0.1238	
15 minute winter	3	1.002	5	10.7	2.221	0.209	0.0484	
15 minute winter	4	2.000	5	6.3	1.448	0.188	0.1313	
15 minute winter	5	1.003	8	25.0	2.675	0.167	0.0935	
15 minute winter	6	3.000	7	2.8	0.516	0.071	0.1562	
15 minute winter	7	3.001	8	4.1	0.629	0.102	0.1377	
15 minute winter	8	1.004	13	30.9	1.224	0.363	0.7080	
15 minute winter	9	4.000	10	0.7	0.269	0.049	0.0646	
15 minute winter	10	4.001	11	4.3	1.001	0.550	0.0519	
15 minute winter	11	4.002	12	7.6	1.449	0.060	0.0634	
15 minute winter	12	4.003	13	10.4	1.688	0.099	0.1733	
30 minute summer	13	1.005	19	38.8	1.651	0.236	0.3764	
15 minute winter	14	5.000	16	4.2	1.332	0.120	0.0792	
15 minute winter	15	6.000	16	0.6	0.601	0.081	0.0170	
15 minute winter	16	5.001	18	9.9	1.347	0.135	0.1478	
15 minute winter	17	7.000	18	1.9	0.814	0.242	0.0374	
15 minute winter	18	5.002	19	12.4	1.619	0.111	0.4175	
15 minute winter	19	1.006	22	65.3	1.056	0.398	1.8309	
15 minute winter	20	8.000	21	6.8	0.743	0.171	0.1835	
720 minute winter	21	8.001	22	-5.1	-0.243	-0.060	0.5012	
15 minute winter	22	1.007	23	4.6	0.525	0.067	0.1332	
15 minute summer	23	1.008	24	5.5	0.510	0.081	0.1797	
15 minute winter	24	1.009	26	9.1	0.461	0.135	0.6293	
15 minute winter	25	9.000	26	7.9	0.886	0.167	0.4144	

Results for 1 year Critical Storm Duration. Lowest mass balance: 99.24%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	26	10	178.055	0.138	24.6	0.3186	0.0000	OK
120 minute winter	27	82	177.986	0.190	12.3	18.5271	0.0000	OK
120 minute winter	28	82	177.773	0.073	8.4	0.0824	0.0000	OK
120 minute winter	29	82	177.699	0.069	8.4	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	26	1.010	27	25.3	1.490	0.372	0.6125	
120 minute winter	27	1.011	28	8.4	0.638	0.125	0.3434	
120 minute winter	28	1.012	29	8.4	0.665	0.122	0.2281	78.3

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.24%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	181.930	0.030	1.6	0.0369	0.0000	OK
15 minute winter	2	12	181.872	0.393	13.1	0.7062	0.0000	SURCHARGED
15 minute winter	3	10	181.084	0.076	22.9	0.1311	0.0000	OK
15 minute winter	4	10	181.324	0.074	15.8	0.1492	0.0000	OK
15 minute winter	5	11	180.233	0.121	58.1	0.2228	0.0000	OK
15 minute winter	6	12	179.902	0.327	15.5	0.4939	0.0000	SURCHARGED
15 minute winter	7	12	179.890	0.480	12.5	0.5890	0.0000	SURCHARGED
15 minute winter	8	11	179.883	0.666	69.3	0.8520	0.0000	SURCHARGED
15 minute winter	9	10	182.523	0.023	1.6	0.0285	0.0000	OK
15 minute winter	10	12	181.509	0.209	10.8	0.3831	0.0000	SURCHARGED
15 minute winter	11	11	181.028	0.055	16.8	0.0883	0.0000	OK
15 minute winter	12	10	180.347	0.072	23.8	0.1158	0.0000	OK
15 minute winter	13	12	179.742	0.690	91.8	0.8440	0.0000	SURCHARGED
15 minute winter	14	10	181.108	0.058	10.6	0.0991	0.0000	OK
15 minute winter	15	10	180.431	0.031	1.6	0.0375	0.0000	OK
15 minute winter	16	10	180.101	0.095	24.6	0.1688	0.0000	OK
15 minute winter	17	10	180.058	0.058	4.8	0.0813	0.0000	OK
15 minute winter	18	11	179.697	0.091	30.7	0.1109	0.0000	OK
15 minute winter	19	11	179.590	0.886	129.0	1.3206	0.0000	SURCHARGED
720 minute winter	20	570	178.583	0.180	2.1	0.6246	0.0000	OK
720 minute winter	21	570	178.583	0.373	17.7	230.8921	0.0000	SURCHARGED
15 minute summer	22	10	179.264	1.125	127.6	1.3669	0.0000	SURCHARGED
30 minute summer	23	17	178.145	0.063	6.9	0.0795	0.0000	OK
15 minute winter	24	11	178.125	0.104	15.8	0.1709	0.0000	OK
15 minute winter	25	10	178.475	0.100	19.8	0.2191	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	1.000	2	1.6	0.265	0.198	0.1227	
15 minute winter	2	1.001	3	9.9	1.260	1.254	0.1933	
15 minute winter	3	1.002	5	22.8	2.676	0.444	0.0852	
15 minute winter	4	2.000	5	15.5	1.834	0.462	0.2538	
15 minute winter	5	1.003	8	56.6	2.830	0.378	0.3071	
15 minute winter	6	3.000	7	10.7	0.655	0.270	1.1136	
15 minute winter	7	3.001	8	28.0	0.808	0.704	0.7954	
15 minute winter	8	1.004	13	72.6	1.219	0.853	1.9717	
15 minute winter	9	4.000	10	1.6	0.283	0.118	0.1150	
15 minute winter	10	4.001	11	9.2	1.173	1.167	0.0924	
15 minute winter	11	4.002	12	16.8	1.826	0.133	0.1107	
15 minute winter	12	4.003	13	23.6	1.750	0.223	0.7095	
15 minute winter	13	1.005	19	97.6	1.604	0.594	1.1267	
15 minute winter	14	5.000	16	10.4	1.707	0.296	0.1524	
15 minute winter	15	6.000	16	1.5	0.770	0.196	0.0321	
15 minute winter	16	5.001	18	24.4	1.699	0.332	0.3014	
15 minute winter	17	7.000	18	4.7	1.022	0.595	0.0732	
15 minute winter	18	5.002	19	30.2	1.698	0.270	0.4935	
15 minute winter	19	1.006	22	133.0	1.889	0.810	1.8309	
720 minute winter	20	8.000	21	2.1	0.470	0.053	0.7378	
720 minute winter	21	8.001	22	-13.5	-0.265	-0.158	0.8450	
15 minute summer	22	1.007	23	4.6	0.554	0.067	0.1358	
30 minute summer	23	1.008	24	6.8	0.527	0.100	0.2438	
15 minute winter	24	1.009	26	15.6	0.521	0.232	0.9872	
15 minute winter	25	9.000	26	19.4	1.005	0.409	0.8876	

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.24%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	26	11	178.113	0.196	52.7	0.4535	0.0000	OK
120 minute winter	27	80	178.096	0.300	23.0	29.2852	0.0000	SURCHARGED
120 minute winter	28	80	177.804	0.104	16.4	0.1172	0.0000	OK
120 minute winter	29	80	177.727	0.097	16.4	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	26	1.010	27	52.9	1.649	0.778	1.3169	
120 minute winter	27	1.011	28	16.4	0.758	0.244	0.5625	
120 minute winter	28	1.012	29	16.4	0.795	0.238	0.3712	134.3

Results for 100 year Critical Storm Duration. Lowest mass balance: 99.24%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	13	182.117	0.217	3.6	0.2649	0.0000	SURCHARGED
15 minute winter	2	12	182.095	0.616	16.4	1.1067	0.0000	SURCHARGED
30 minute summer	3	18	181.093	0.085	27.1	0.1465	0.0000	OK
15 minute winter	4	10	181.335	0.085	20.4	0.1725	0.0000	OK
15 minute winter	5	12	180.520	0.408	75.3	0.7552	0.0000	SURCHARGED
15 minute winter	6	12	180.322	0.747	15.7	1.1286	0.0000	SURCHARGED
15 minute winter	7	12	180.313	0.903	18.9	1.1081	0.0000	SURCHARGED
15 minute winter	8	12	180.297	1.080	79.7	1.3825	0.0000	SURCHARGED
15 minute winter	9	10	182.526	0.026	2.0	0.0319	0.0000	OK
15 minute winter	10	12	181.681	0.381	13.9	0.6976	0.0000	SURCHARGED
15 minute winter	11	11	181.035	0.062	21.0	0.0995	0.0000	OK
15 minute winter	12	11	180.356	0.081	29.8	0.1306	0.0000	OK
15 minute winter	13	12	180.108	1.056	109.9	1.2916	0.0000	SURCHARGED
15 minute winter	14	10	181.116	0.066	13.6	0.1143	0.0000	OK
15 minute winter	15	10	180.435	0.035	2.0	0.0425	0.0000	OK
30 minute summer	16	18	180.112	0.106	29.5	0.1875	0.0000	OK
15 minute winter	17	12	180.106	0.106	6.1	0.1490	0.0000	SURCHARGED
15 minute winter	18	11	179.996	0.390	39.9	0.4750	0.0000	SURCHARGED
15 minute winter	19	11	179.889	1.185	156.4	1.7651	0.0000	SURCHARGED
960 minute winter	20	750	178.722	0.319	2.1	1.1080	0.0000	SURCHARGED
960 minute winter	21	750	178.722	0.512	17.8	317.0471	0.0000	SURCHARGED
15 minute winter	22	9	179.346	1.207	162.0	1.4661	0.0000	SURCHARGED
120 minute winter	23	82	178.182	0.100	6.0	0.1259	0.0000	OK
120 minute winter	24	82	178.181	0.160	10.8	0.2624	0.0000	OK
15 minute winter	25	10	178.492	0.117	25.5	0.2548	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	1.000	2	2.8	0.359	0.355	0.1956	
15 minute winter	2	1.001	3	11.3	1.440	1.433	0.1936	
30 minute summer	3	1.002	5	27.0	2.777	0.527	0.0973	
15 minute winter	4	2.000	5	20.9	1.900	0.620	0.4112	
15 minute winter	5	1.003	8	65.5	2.803	0.437	0.3977	
15 minute winter	6	3.000	7	17.8	0.666	0.448	1.1136	
15 minute winter	7	3.001	8	30.9	0.831	0.775	0.7954	
15 minute winter	8	1.004	13	82.4	1.316	0.969	1.9717	
15 minute winter	9	4.000	10	2.0	0.348	0.148	0.1181	
15 minute winter	10	4.001	11	11.4	1.451	1.444	0.0929	
15 minute winter	11	4.002	12	21.0	1.932	0.166	0.1308	
15 minute winter	12	4.003	13	29.7	1.883	0.280	0.7370	
15 minute winter	13	1.005	19	114.9	1.632	0.699	1.1267	
15 minute winter	14	5.000	16	13.4	1.823	0.381	0.1837	
15 minute winter	15	6.000	16	1.9	0.820	0.248	0.0380	
30 minute summer	16	5.001	18	29.5	1.782	0.401	0.3338	
15 minute winter	17	7.000	18	6.0	1.048	0.766	0.1252	
15 minute winter	18	5.002	19	35.4	1.832	0.316	0.7159	
15 minute winter	19	1.006	22	160.6	2.281	0.978	1.8309	
960 minute winter	20	8.000	21	2.0	0.438	0.050	0.7954	
960 minute winter	21	8.001	22	-13.8	-0.210	-0.161	0.8450	
15 minute winter	22	1.007	23	4.6	0.536	0.068	0.1655	
120 minute winter	23	1.008	24	6.0	0.546	0.087	0.4708	
120 minute winter	24	1.009	26	10.5	0.550	0.155	1.4514	
15 minute winter	25	9.000	26	25.1	1.030	0.529	1.1172	

Results for 100 year Critical Storm Duration. Lowest mass balance: 99.24%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
120 minute winter	26	82	178.180	0.263	29.8	0.6083	0.0000	OK
120 minute winter	27	84	178.172	0.376	28.0	36.6450	0.0000	SURCHARGED
120 minute winter	28	84	177.807	0.107	17.4	0.1211	0.0000	OK
120 minute winter	29	84	177.730	0.100	17.4	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
120 minute winter	26	1.010	27	28.0	1.119	0.411	2.1738	
120 minute winter	27	1.011	28	17.4	0.769	0.259	0.5879	
120 minute winter	28	1.012	29	17.4	0.808	0.252	0.3875	155.5

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.24%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	13	182.742	0.842	5.1	1.0293	0.0000	SURCHARGED
15 minute winter	2	13	182.727	1.248	20.9	2.2433	0.0000	FLOOD RISK
15 minute winter	3	12	181.615	0.607	36.5	1.0444	0.0000	SURCHARGED
15 minute winter	4	12	181.721	0.471	28.5	0.9520	0.0000	SURCHARGED
15 minute winter	5	12	181.233	1.121	91.8	2.0735	0.0000	SURCHARGED
15 minute winter	6	12	180.931	1.356	16.7	2.0473	0.0000	FLOOD RISK
15 minute winter	7	12	180.919	1.509	24.0	1.8512	0.0000	SURCHARGED
15 minute winter	8	12	180.901	1.683	97.1	2.1548	0.0000	SURCHARGED
15 minute winter	9	10	182.532	0.032	2.9	0.0386	0.0000	OK
15 minute winter	10	12	182.032	0.732	19.4	1.3403	0.0000	FLOOD RISK
15 minute winter	11	11	181.045	0.072	28.2	0.1152	0.0000	OK
15 minute winter	12	12	180.793	0.518	40.4	0.8337	0.0000	SURCHARGED
15 minute winter	13	12	180.630	1.578	136.7	1.9296	0.0000	SURCHARGED
15 minute winter	14	10	181.128	0.078	19.0	0.1349	0.0000	OK
15 minute winter	15	12	180.584	0.184	4.2	0.2253	0.0000	SURCHARGED
15 minute winter	16	12	180.560	0.554	44.5	0.9824	0.0000	SURCHARGED
15 minute winter	17	12	180.600	0.600	8.6	0.8442	0.0000	SURCHARGED
15 minute winter	18	12	180.444	0.837	42.8	1.0192	0.0000	SURCHARGED
15 minute winter	19	12	180.284	1.580	192.6	2.3547	0.0000	SURCHARGED
960 minute winter	20	915	179.587	1.184	3.0	4.1145	0.0000	FLOOD RISK
960 minute winter	21	915	179.587	1.377	26.8	496.9926	0.0000	FLOOD RISK
960 minute winter	22	915	179.587	1.448	25.7	1.7593	0.0000	FLOOD RISK
120 minute winter	23	80	178.994	0.912	6.5	1.1441	0.0000	SURCHARGED
120 minute winter	24	80	178.993	0.972	14.1	1.5935	0.0000	SURCHARGED
120 minute winter	25	80	179.007	0.632	14.3	1.3798	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 winter	1	1.000	2	4.2	0.564	0.538	0.1956	
15 minute winter	2	1.001	3	13.8	1.769	1.760	0.1956	
15 minute winter	3	1.002	5	32.7	2.793	0.637	0.1760	
15 minute winter	4	2.000	5	25.6	1.945	0.762	0.5281	
15 minute winter	5	1.003	8	78.1	2.821	0.521	0.3977	
15 minute winter	6	3.000	7	19.2	0.668	0.482	1.1136	
15 minute winter	7	3.001	8	35.1	0.906	0.881	0.7954	
15 minute winter	8	1.004	13	98.7	1.402	1.160	1.9717	
15 minute winter	9	4.000	10	2.9	0.482	0.214	0.1242	
15 minute winter	10	4.001	11	14.9	1.901	1.892	0.0929	
15 minute winter	11	4.002	12	28.2	1.955	0.224	0.3043	
15 minute winter	12	4.003	13	36.2	1.862	0.342	1.1136	
15 minute winter	13	1.005	19	139.1	1.976	0.847	1.1267	
15 minute winter	14	5.000	16	18.9	1.931	0.536	0.3361	
15 minute winter	15	6.000	16	3.3	0.873	0.423	0.1252	
15 minute winter	16	5.001	18	35.6	1.688	0.483	0.7954	
15 minute winter	17	7.000	18	7.4	1.149	0.936	0.1252	
15 minute winter	18	5.002	19	44.2	1.792	0.394	0.7159	
15 minute winter	19	1.006	22	195.6	2.777	1.191	1.8309	
960 minute winter	20	8.000	21	2.8	0.438	0.072	0.7954	
960 minute winter	21	8.001	22	-21.0	-0.298	-0.246	0.8450	
960 minute winter	22	1.007	23	4.6	0.532	0.068	0.1324	
120 minute winter	23	1.008	24	7.7	0.543	0.113	1.1267	
120 minute winter	24	1.009	26	11.0	0.549	0.163	1.9717	
120 minute winter	25	9.000	26	14.3	0.914	0.302	1.8295	

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.24%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
120 minute winter	26	80	178.994	1.077	37.4	2.4920	0.0000	FLOOD RISK
120 minute winter	27	80	178.985	1.189	36.0	41.0729	0.0000	FLOOD RISK
30 minute winter	28	25	177.808	0.108	17.7	0.1223	0.0000	OK
240 minute winter	29	136	177.731	0.101	17.7	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
120 minute winter	26	1.010	27	36.0	1.191	0.529	2.2534	
120 minute winter	27	1.011	28	17.7	0.773	0.263	0.5957	
30 minute winter	28	1.012	29	17.7	0.812	0.257	0.3926	116.0