

DRAINAGE STRATEGY

for

Mr R ROBINSON

PROPOSED AGRICULTURAL BUILDING

at

STANDRIDGE FARM

SLAIDBURN

AUGUST 2018

REFORD

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1. INTRODUCTION

- 1.1 This drainage strategy has been produced on behalf of Mr R Robinson in support of a planning permission for the erection of an agricultural building for free range egg production together with associated feed bins, a hardstanding area and access track at Standridge, Wigglesworth Road, Slaidburn, BB7 4TR.
- 1.2 The Lead Local Flood Authority has been consulted on the earlier application and required the following:
- *A desk top study of the existing drainage and flood risk of the area.*
 - *An indicative site drainage strategy to include drawings, calculations and exceedance routes.*
 - *Details of ground conditions.*
- 1.3 There is no foul water drainage to be discharged from the site.
- 1.4 There is dirty wash down water from within the building to be collected.
- 1.5 This drainage strategy will address the issues previously raised by the LLFA.
- 1.6 The application site comprises an existing agricultural enterprise that operates from Standridge Farm, Tossie Road, Slaidburn that extends to approximately 70 hectares of owner occupied land. The enterprise is situated about 2.5km to the east of the settlement of Slaidburn, on the B6478 road that connects Slaidburn to Tossie further to the east. A site location plan is included within Appendix A.
- 1.7 The developed site is flat. To the north of the new building the ground falls to the north towards a watercourse, which flows to the north into the Barn Gill and ultimately the River Hodder.
- 1.8 Another watercourse lies to the west of the site and connects to the one to the north.
- 1.9 The watercourses take surface water runoff from the existing area.
- 1.10 The access to the site is from the B6478.

2. BASE INFORMATION

Existing site

- 2.1 The proposal relates to land to the north of the B6478, approx. 2.5km to the east of the settlement of Slaidburn.
- 2.2 The existing site comprises grassland.
- 2.3 The site has a general fall towards the watercourse to the north.

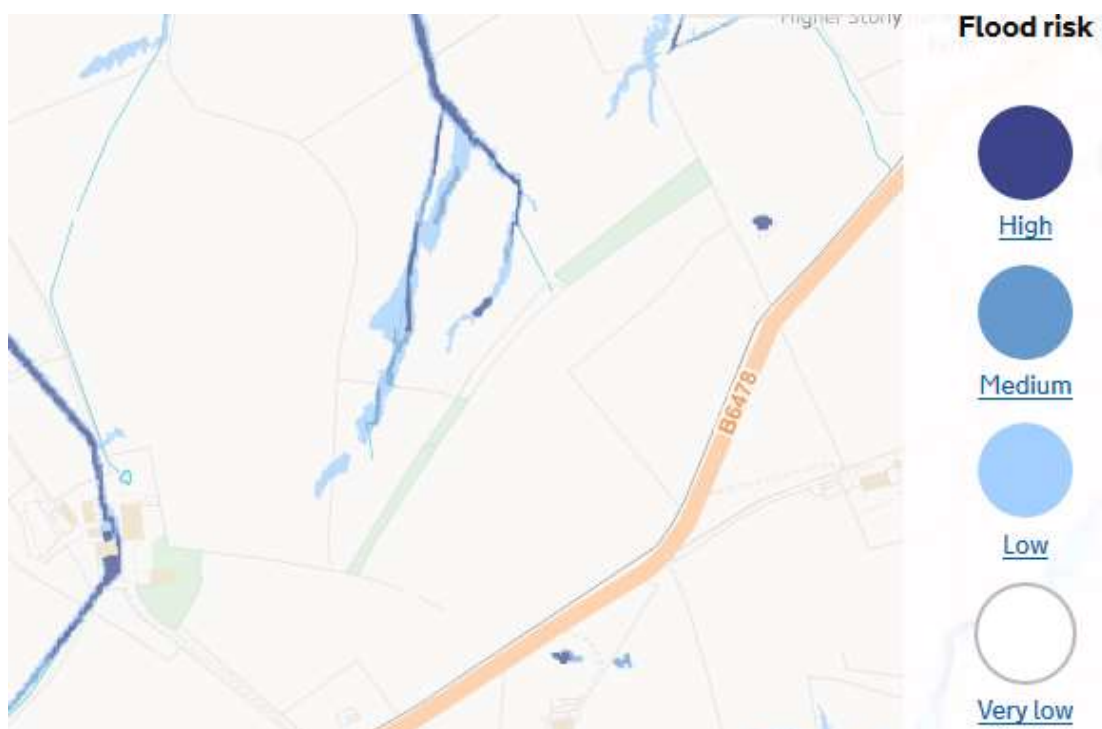
Site geology

- 2.4 A detailed site investigation has not been carried out.
- 2.5 The online Soilscales Viewer has identified the site lying in a region characterised by slowly permeable wet very acid upland soils with a peaty surface with impeded drainage, which are not conducive to infiltration.
- 2.6 Excavations that have been carried out on the site have confirmed the site geology, which are not conducive to the discharge of surface water by infiltration. Infiltration tests have therefore not been carried out.

Understanding of existing drainage and flood risk local to the site

- 2.7 The site lies within Flood Zone 1 as identified on the Environment Agency's flood map for planning, the lowest risk.
- 2.8 Watercourses lie to the west and the north of the site. The watercourses take surface water runoff from the local area and flow into the Barn Gill and ultimately the River Hodder.
- 2.9 The extract from Ordnance Survey mapping shows the watercourses locations.
- 2.10 The Environment Agency's flood Risk of Flooding from Surface Water map shows the site at a very low risk. The watercourses are identified as having a high risk within their channels.

- 2.11 It should be noted that surface water flooding can be difficult to predict, much more so than river or sea flooding as it is hard to forecast exactly where or how much rain will fall in any storm. In addition, local features can greatly affect the chance and severity of flooding.
- 2.12 Extracts from the Ordnance Survey and the Environment Agency's Risk from Surface Water map are shown below.



2.13 There are no public sewers local to the site.

Proposed development

2.14 The proposed development is for a large single building of approx. size 86m by 37m, along with an associated hardstanding area for the turning of vehicles and car parking and an access track to the site from the B6478.

3. DRAINAGE STRATEGY

Surface water drainage

- 3.1 Guidance for the disposal of surface water from a development site is for soakaways to be considered as the primary solution. If this is not practical, discharge to a waterbody or watercourse is to be considered as the next available alternative. Only if neither of these options is available, and other sustainable drainage methods not possible, should the use of the public sewerage system be considered.
- 3.2 The rate and volume of discharge should strive to provide betterment and be restricted to the pre-development values as far as practicable.
- 3.3 The online Soilsmap Viewer has identified the site lying in a region characterised by slowly permeable wet very acid upland soils with a peaty surface with impeded drainage, which are not conducive to infiltration. This is supported by excavations that have been carried out on the site. The nature of the geology of the site means that infiltration back into the ground is not feasible.
- 3.4 Watercourses lie to the west and the north of the site. The watercourses take surface water runoff from the local area and flow into the Barn Gill and ultimately the River Hodder.
- 3.5 It is therefore intended that new surface water drainage will be constructed, appropriately sized to take all surface water runoff from the new building roof and hardstanding area, to discharge into the watercourse that lies to the north of the site. The total area of the new building roof and hardstanding area is 4,700m².
- 3.6 Surface water runoff from the access track to the site from the B6478 will be collected by a French drain running along its length. The area of the access track is 1,200m².
- 3.7 The flow from the development will be controlled to pre-development runoff rates allowing surface water runoff generated by all rainfall events up to the 100 year critical rain storm plus 30% on stored volumes. The additional 30% is to allow for climate change and has been included in the surface water volume.

3.8 To determine the restricted surface water discharge rate from the developed site, Greenfield runoff has been calculated using the 'Causeway Flow' programme. The calculations are based upon the developed area of the site, which has been measured as 0.47ha. The pre-development discharge rates have been calculated as follows:

- Qbar 5.16 l/s
- Q1 4.49 l/s
- Q30 8.77 l/s
- Q100 10.74 l/s

3.9 A surface water drainage design has been carried out for rainfall events up to the 100 year critical rain storm plus 30% on stored volumes. The additional 30% is to allow for climate change and has been included in the surface water volume. Surface water flows from the developed site are to be attenuated to 5 l/s. Attenuation is provided by a dry pond located within the land between the northern site boundary and the watercourse.

3.10 The surface water drainage design is included within Appendix B.

3.11 Exceedance flows will be away from the development across the adjacent field into the local watercourses.

3.12 The attenuation pond will also act to provide water quality treatment prior to surface water discharging into the watercourse. In addition a fuel interceptor is to be installed on the discharge pipe from the hardstanding area.

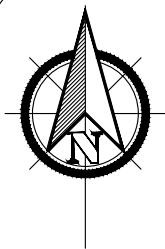
Dirty water drainage

3.13 An underground sealed dirty water tank is provided at the northern end of the building to collect and store the wash down water from within the building. The tank will be regularly emptied by pump and taken away.

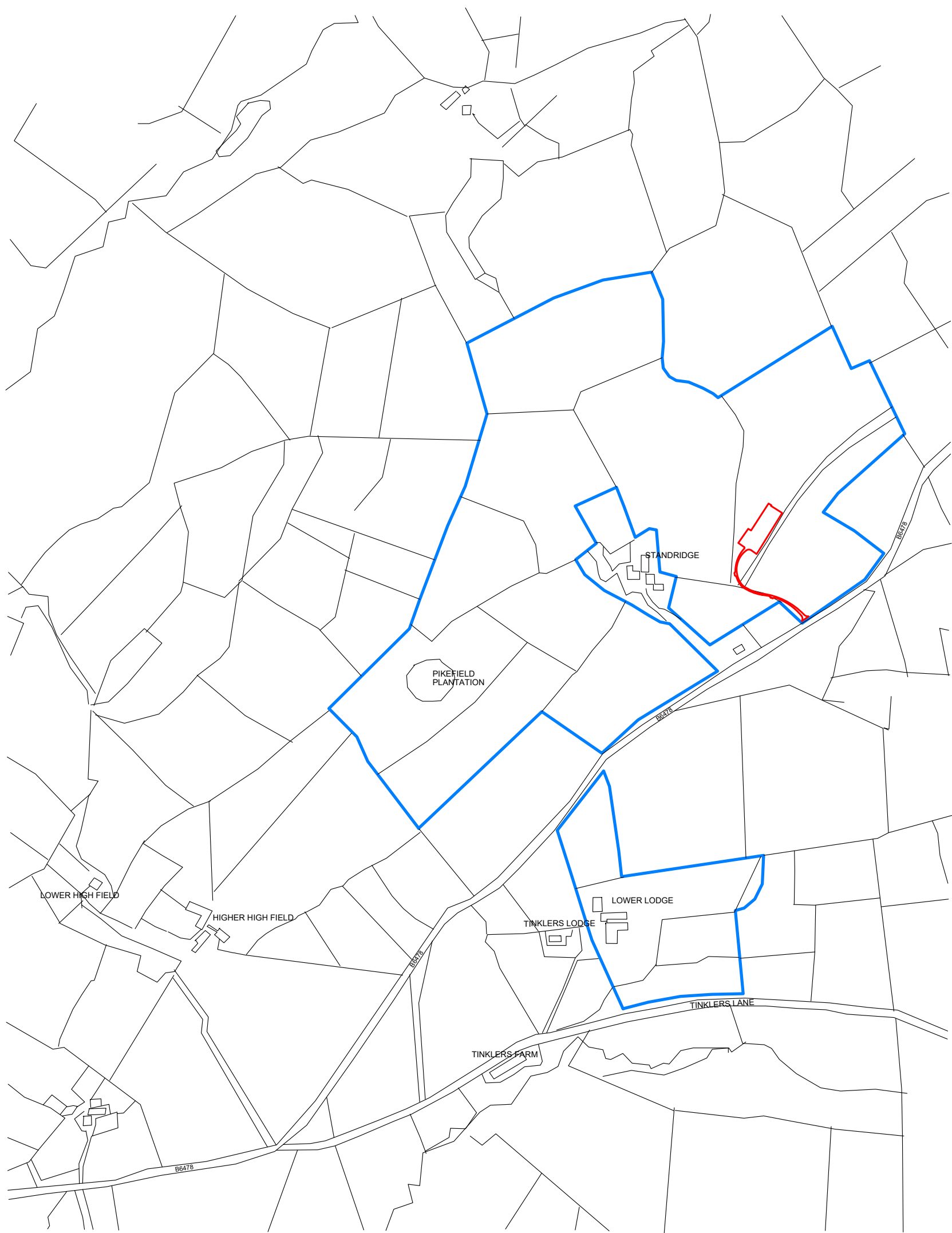
4. SUMMARY AND CONCLUSIONS

- 4.1 This drainage strategy has been produced on behalf of Mr R Robinson in support of a planning permission for the erection of an agricultural building for free range egg production together with associated feed bins and hardstanding areas and access at Standridge, Wigglesworth Road, Slaidburn, BB7 4TR.
- 4.2 This drainage strategy has addressed the issues previously raised by the LLFA.
- 4.3 Infiltration of surface water runoff into the ground is not a viable solution for this site.
- 4.4 It is intended that new surface water drainage will be constructed, appropriately sized to take all surface water runoff from the new building roof and hardstanding area, be attenuated to 5 l/s prior to discharge into the watercourse that lies to the north of the site. The total area of the new building roof and hardstanding area is 4,700m².
- 4.5 Surface water runoff from the access track to the site from the B6478 will be collected by a French drain running along its length. The area of access track is 1,200m².
- 4.6 A surface water drainage design has been carried out for rainfall events up to the 100 year critical rain storm plus 30% on stored volumes. The additional 30% is to allow for climate change and has been included in the surface water volume. Attenuation is provided by a dry pond located within the land between the northern site boundary and the watercourse.
- 4.7 An underground sealed dirty water tank is provided at the northern end of the building to collect and store the wash down water from within the building. The tank will be regularly emptied by pump and taken away.
- 4.8 There is no foul water drainage associated with the development.

APPENDIX A



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LOCATION PLAN

Site: Standridge Farm
Slaidburn

Client: Mr R. Robinson

Drawn: BS

Date: 12.02.18

Scale: 1:10,000 @ A3

Project No: ROBINSO/02 Dwg 00

Amendments:

Notes:
All work is to be carried out to the latest current British standards Codes of Practice and recognised working practices. All work and materials should comply with Health and Safety legislation and to be approved by the Local Authority Planning / Building Control Officer.
All dimensions are in millimetres unless where explicitly shown otherwise. The contractor should check and clarify all dimensions as work proceeds and notify the design team of any discrepancies. Do not scale off the drawings, if in doubt ask.
Avalon Chartered Town Planning are not liable for work undertaken prior to Full Planning Consent and/or Building Regulations Approval

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APPENDIX B

ARCAS

ACCESS TRACK

1200 m²

BUILDING

 3200 m^2

HARDSTANDING AREA

$$1500 \text{ m}^2$$

EXCEEDANCE
ROUTE TO
WATERCOURSE

24
↑ TO WATERCOURSE
23
ATTENUATION
POND.

FUEL INTERCEPTOR

SURFACE WATER DRAINAGE LAYOUT

260.5m

Drainage Design Report

Flow

v7.0

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Network	Storm Network
Filename	C:\Users\Bob\Documents\reford\18.479 slaidburn\drainage design\slaidburn.pfd
Username	Bob Ford (r.e.ford@virginmedia.com)
Last analysed	09/08/2018 13:00:36
Report produced on	09/08/2018 13:17:51

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Rainfall Methodology	FSR
Return Period (years)	2
Additional Flow (%)	0
FSR Region	England and Wales
M5-60 (mm)	20.000
Ratio-R	0.240
CV	0.750
Time of Entry (mins)	5.00
Maximum Time of Concentration (mins)	30.00
Maximum Rainfall (mm/hr)	75.0
Minimum Velocity (m/s)	1.00
Connection Type	Level Soffits
Minimum Backdrop Height (m)	2.000
Preferred Cover Depth (m)	1.200
Enforce best practice design rules	

Name	Area (ha)	T of E (mins)	Add Inflow (l/s)	Cover Level (m)	Node Type	Diameter (mm)	Depth (m)
T1	0.040	5.00		261.000	Manhole	1200	1.425
T2	0.040	5.00		251.000	Manhole	1200	1.425
T3	0.040	5.00		241.000	Manhole	1200	1.425
T4				236.000	Manhole	1200	1.425
T5				236.000	Manhole	1200	1.573
1	0.038	5.00		235.500	Manhole	1500	1.425
2	0.038	5.00		235.500	Manhole	1500	1.637
3	0.038	5.00		235.500	Manhole	1500	1.425
4	0.038	5.00		235.500	Manhole	1500	1.708
5	0.014	5.00		235.500	Manhole	1200	1.756
6	0.014	5.00		235.500	Manhole	150	1.862
7	0.014	5.00		235.500	Manhole	150	1.974
8	0.014	5.00		235.500	Manhole	150	2.080
9	0.014	5.00		235.500	Manhole	150	2.192
10	0.014	5.00		235.500	Manhole	1200	2.275
11	0.027	5.00		235.500	Manhole	1200	1.425
12	0.027	5.00		235.500	Manhole	150	1.496
13	0.027	5.00		235.500	Manhole	150	1.608
14	0.027	5.00		235.500	Manhole	150	1.714
15	0.027	5.00		235.500	Manhole	150	1.826
16	0.014	5.00		235.500	Manhole	1200	1.425
17	0.014	5.00		235.500	Manhole	150	1.531
18	0.014	5.00		235.500	Manhole	150	1.643
19	0.014	5.00		235.500	Manhole	150	1.749
20	0.014	5.00		235.500	Manhole	150	1.861
21	0.014	5.00		235.500	Manhole	1200	1.944
22	0.027	5.00		235.500	Manhole	1200	2.393
23				230.000	Manhole	1200	1.000
24				225.000	Manhole	1200	0.600

Name	US Node	DS Node	Length (m)	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	Link Type	T of C (mins)	Rain (mm/hr)	Min DS IL (m)	Lateral Area (ha)	Lateral Ins Point (%)	Lateral T of E (mins)
1.000	T1	T2	100.000	259.575	249.575	10.000	10.0	225	Circular	5.40	52.5				
1.001	T2	T3	100.000	249.575	239.575	10.000	10.0	225	Circular	5.80	51.2				
1.002	T3	T4	100.000	239.575	234.575	5.000	20.0	225	Circular	6.37	49.4				
1.003	T4	T5	25.000	234.575	234.427	0.148	168.9	225	Circular	6.78	48.2				
1.004	T5	16	25.000	234.427	234.075	0.352	71.0	225	Circular	7.05	47.5				
2.000	1	2	36.000	234.075	233.863	0.212	169.8	225	Circular	5.60	51.9				
2.001	2	4	12.000	233.863	233.792	0.071	169.0	225	Circular	5.80	51.2				
3.000	3	4	36.000	234.075	233.792	0.283	127.2	225	Circular	5.52	52.1				
2.002	4	5	8.000	233.792	233.744	0.048	166.7	225	Circular	5.93	50.8				
2.003	5	6	18.000	233.744	233.638	0.106	169.8	225	Circular	6.23	49.8				
2.004	6	7	19.000	233.638	233.526	0.112	169.6	225	Circular	6.55	48.9				
2.005	7	8	18.000	233.526	233.420	0.106	169.8	225	Circular	6.85	48.0				
2.006	8	9	19.000	233.420	233.308	0.112	169.6	225	Circular	7.16	47.2				
2.007	9	10	14.000	233.308	233.225	0.083	168.7	225	Circular	7.40	46.6				
2.008	10	22	20.000	233.225	233.107	0.118	169.5	225	Circular	7.73	45.7				
4.000	11	12	12.000	234.075	234.004	0.071	169.0	225	Circular	5.20	53.3				
4.001	12	13	19.000	234.004	233.892	0.112	169.6	225	Circular	5.52	52.1				
4.002	13	14	18.000	233.892	233.786	0.106	169.8	225	Circular	5.82	51.1				
4.003	14	15	19.000	233.786	233.674	0.112	169.6	225	Circular	6.13	50.1				
4.004	15	22	14.000	233.674	233.107	0.567	24.7	225	Circular	6.22	49.9				
1.005	16	17	18.000	234.075	233.969	0.106	169.8	225	Circular	7.35	46.7				
1.006	17	18	19.000	233.969	233.857	0.112	169.6	225	Circular	7.67	45.9				
1.007	18	19	18.000	233.857	233.751	0.106	169.8	225	Circular	7.97	45.2				
1.008	19	20	19.000	233.751	233.639	0.112	169.6	225	Circular	8.28	44.4				
1.009	20	21	14.000	233.639	233.556	0.083	168.7	225	Circular	8.52	43.9				
1.010	21	22	20.000	233.556	233.107	0.449	44.5	225	Circular	8.69	43.6				
1.011	22	23	80.000	233.107	229.000	4.107	19.5	225	Circular	9.13	42.6				
1.012	23	24	40.000	229.000	224.400	4.600	8.7	225	Circular	9.28	42.3				

Rainfall Methodology	FSR		Return Period (years)	Climate Change (%)
FSR Region	England and Wales		1	0
M5-60 (mm)	20.000		30	0
Ratio-R	0.240		100	0
Summer CV	0.750		100	30
Winter CV	0.840			
Analysis Speed	Normal			
Drain Down Time (mins)	240			
Additional Storage (m³/ha)	20.0			
Storm Durations (mins)	15			
	30			
	60			
	120			
	180			
	240			
	360			
	480			
	600			
	720			
	960			
	1440			
Check Discharge Rate(s)	x			
1 year (l/s)				
30 year (l/s)				
100 year (l/s)				
Check Discharge Volume	x			
100 year 360 minute (m³)				

Hydro-Brake®												
Node	Flap Valve	Online / Offline	Replaces Downstream Link	Loop to Node	Invert Level (m)	Design Depth (m)	Design Flow (l/s)	Objective	Sump Available	Product Number	Min Outlet Diameter (m)	Min Node Diameter (mm)
23	x	Online	x		229.000	1.000	5.0	(HE) Minimise upstream storage		CTL-SHE-0106-5000-1000-5000	0.150	1200

Depth/Area/Inf Area									
Node	Base Inf Coefficient (m/hr)	Side Inf Coefficient (m/hr)	Safety Factor	Porosity	Invert Level (m)	Time to half empty (mins)	Depth (m)	Area (m²)	Inf. Area (m²)
23	0.00000	0.00000	2.0	1.00	229.000		0.000	450.0	0.0
Link Surround									
Node	Base Inf Coefficient (m/hr)	Side Inf Coefficient (m/hr)	Safety Factor	Porosity	Invert Level (m)	Time to half empty (mins)	Link	Surround Shape	Diameter (mm)
T2	0.00000	0.00000	2.0	0.30	249.575	0	1.000	(Trench)	600
T3	0.00000	0.00000	2.0	0.30	239.575	0	1.001	(Trench)	600
T4	0.00000	0.00000	2.0	0.30	234.575	0	1.002	(Trench)	600
T5	0.00000	0.00000	2.0	0.30	234.427	9	1.003	(Trench)	600

Results for 1 year Critical Storm Duration. Lowest mass balance: 97.91%															
Event	US Node ID	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status	Link ID	DS Node ID	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	T1	10	259.601	0.026	4.8	0.0440	0.0000	OK	1.000	T2	4.7	1.439	0.028	0.3294	
15 minute winter	T2	11	249.611	0.036	9.5	0.0618	0.0000	OK	1.001	T3	9.2	1.719	0.056	0.5461	
15 minute winter	T3	11	239.627	0.052	13.7	0.0891	0.0000	OK	1.002	T4	13.5	1.317	0.116	1.0968	
15 minute winter	T4	12	234.667	0.092	13.5	0.1154	0.0000	OK	1.003	T5	13.0	1.020	0.327	0.3202	
15 minute winter	T5	12	234.496	0.069	13.0	0.1325	0.0000	OK	1.004	16	12.8	0.969	0.207	0.3322	
15 minute winter	1	11	234.125	0.050	4.5	0.1150	0.0000	OK	2.000	2	4.4	0.514	0.110	0.3108	
15 minute winter	2	11	233.934	0.071	8.8	0.1584	0.0000	OK	2.001	4	8.7	0.563	0.219	0.1885	
15 minute winter	3	11	234.122	0.047	4.5	0.1070	0.0000	OK	3.000	4	4.4	0.357	0.095	0.4789	
15 minute winter	4	11	233.908	0.116	17.4	0.2573	0.0000	OK	2.002	5	17.2	0.837	0.429	0.1648	
15 minute winter	5	11	233.859	0.115	18.8	0.1489	0.0000	OK	2.003	6	18.7	0.889	0.470	0.3784	
15 minute winter	6	11	233.758	0.120	20.3	0.0202	0.0000	OK	2.004	7	20.0	0.906	0.504	0.4207	
15 minute winter	7	12	233.652	0.126	21.6	0.0202	0.0000	OK	2.005	8	21.6	0.921	0.544	0.4227	
15 minute winter	8	12	233.551	0.131	22.9	0.0200	0.0000	OK	2.006	9	23.1	0.925	0.580	0.4742	
15 minute winter	9	12	233.448	0.139	24.4	0.0202	0.0000	OK	2.007	10	24.3	0.938	0.610	0.3635	
15 minute winter	10	12	233.366	0.141	25.6	0.1763	0.0000	OK	2.008	22	25.5	0.966	0.640	0.5387	
15 minute winter	11	10	234.118	0.042	3.2	0.0642	0.0000	OK	4.000	12	3.1	0.464	0.079	0.0819	
15 minute winter	12	10	234.064	0.060	6.3	0.0227	0.0000	OK	4.001	13	6.2	0.619	0.156	0.1908	
15 minute winter	13	11	233.968	0.076	9.4	0.0267	0.0000	OK	4.002	14	9.3	0.703	0.235	0.2396	
15 minute winter	14	11	233.877	0.090	12.3	0.0301	0.0000	OK	4.003	15	12.4	1.090	0.313	0.2188	
15 minute winter	15	11	233.732	0.058	15.4	0.0182	0.0000	OK	4.004	22	15.5	0.943	0.147	0.2480	
15 minute winter	16	13	234.172	0.097	14.1	0.1281	0.0000	OK	1.005	17	14.0	0.838	0.353	0.3014	
15 minute winter	17	13	234.070	0.101	15.0	0.0203	0.0000	OK	1.006	18	15.2	0.855	0.381	0.3369	
15 minute winter	18	13	233.962	0.105	16.2	0.0198	0.0000	OK	1.007	19	16.2	0.870	0.407	0.3353	
15 minute winter	19	13	233.860	0.109	17.2	0.0194	0.0000	OK	1.008	20	17.2	0.894	0.431	0.3647	
15 minute winter	20	13	233.750	0.110	18.2	0.0186	0.0000	OK	1.009	21	18.1	1.171	0.453	0.2170	
15 minute winter	21	13	233.631	0.075	19.1	0.0960	0.0000	OK	1.010	22	19.0	1.111	0.243	0.3883	
15 minute winter	22	12	233.256	0.149	59.9	0.2015	0.0000	OK	1.011	23	60.4	4.281	0.510	1.2062	
600 minute winter	23	420	229.215	0.215	12.8	96.9410	0.0000	OK	1.012	24	4.8	1.940	0.027	0.0992	145.6
600 minute winter	24	420	224.426	0.026	4.8	0.0000	0.0000	OK							

Results for 30 year Critical Storm Duration. Lowest mass balance: 97.91%															
Event	US Node ID	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status	Link ID	DS Node ID	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	T1	10	259.615	0.040	11.6	0.0676	0.0000	OK	1.000	T2	11.4	1.858	0.069	0.6178	
15 minute winter	T2	11	249.631	0.056	23.0	0.0967	0.0000	OK	1.001	T3	22.5	2.206	0.136	1.0387	
15 minute winter	T3	11	239.657	0.082	33.8	0.1436	0.0000	OK	1.002	T4	33.6	1.623	0.288	2.1431	
15 minute winter	T4	12	234.734	0.159	33.6	0.2117	0.0000	OK	1.003	T5	32.6	1.268	0.818	0.6404	
15 minute winter	T5	12	234.545	0.118	32.6	0.2830	0.0000	OK	1.004	16	33.4	1.138	0.541	0.7434	
15 minute winter	1	14	234.245	0.170	11.1	0.3913	0.0000	OK	2.000	2	10.8	0.579	0.271	1.2957	
15 minute winter	2	13	234.242	0.379	21.9	0.8452	0.0000	SURCHARGED	2.001	4	17.1	0.590	0.428	0.4773	
15 minute winter	3	14	234.238	0.163	11.1	0.3746	0.0000	OK	3.000	4	10.8	0.418	0.235	1.2699	
15 minute winter	4	13	234.235	0.443	38.9	0.9798	0.0000	SURCHARGED	2.002	5	31.8	0.925	0.792	0.3182	
15 minute winter	5	13	234.214	0.470	35.6	0.6062	0.0000	SURCHARGED	2.003	6	33.5	0.980	0.842	0.7159	
15 minute winter	6	13	234.168	0.530	37.3	0.0890	0.0000	SURCHARGED	2.004	7	34.4	0.986	0.865	0.7557	
15 minute winter	7	13	234.112	0.586	38.2	0.0938	0.0000	SURCHARGED	2.005	8	36.7	0.989	0.924	0.7159	
15 minute winter	8	13	234.051	0.631	38.9	0.0959	0.0000	SURCHARGED	2.006	9	38.5	1.000	0.968	0.7557	
15 minute winter	9	13	233.978	0.670	39.2	0.0972	0.0000	SURCHARGED	2.007	10	39.8	1.077	0.997	0.5568	
15 minute winter	10	13	233.913	0.688	40.1	0.8628	0.0000	SURCHARGED	2.008	22	44.1	1.459	1.108	0.7954	
15 minute winter	11	10	234.143	0.068	7.9	0.1021	0.0000	OK	4.000	12	7.8	0.580	0.195	0.1617	
15 minute winter	12	10	234.104	0.100	15.7	0.0377	0.0000	OK	4.001	13	15.4	0.752	0.388	0.3897	
15 minute winter	13	11	234.024	0.132	23.3	0.0465	0.0000	OK	4.002	14	23.1	0.873	0.580	0.4750	
15 minute winter	14	11	233.939	0.153	30.6	0.0508	0.0000	OK	4.003	15	30.7	1.366	0.771	0.5422	
15 minute winter	15	13	233.854	0.180	38.1	0.0564	0.0000	OK	4.004	22	37.1	1.150	0.353	0.5171	
15 minute winter	16	14	234.437	0.362	36.6	0.4808	0.0000	SURCHARGED	1.005	17	32.3	0.962	0.811	0.7159	
15 minute winter	17	14	234.362	0.393	36.1	0.0789	0.0000	SURCHARGED	1.006	18	34.2	0.970	0.861	0.7557	
15 minute winter	18	14	234.270	0.413	38.0	0.0776	0.0000	SURCHARGED	1.007	19	36.0	0.982	0.904	0.7159	
15 minute winter	19	14	234.170	0.419	39.7	0.0746	0.0000	SURCHARGED	1.008	20	37.6	1.044	0.945	0.7557	
15 minute winter	20	14	234.053	0.414	41.4	0.0696	0.0000	SURCHARGED	1.009	21	40.9	1.357	1.024	0.5568	
15 minute winter	21	13	233.951	0.395	41.8	0.5037	0.0000	SURCHARGED	1.010	22	45.3	1.255	0.580	0.7954	
15 minute winter	22	13	233.814	0.707	112.1	0.9600	0.0000	SURCHARGED	1.011	23	110.6	3.777	0.934	2.4843	
600 minute winter	23	480	229.530	0.530	25.0	239.2887	0.0000	SURCHARGED	1.012	24	5.0	1.960	0.028	0.1015	190.6
120 minute summer	24	90	224.426	0.026	5.0	0.0000	0.0000	OK							

Results for 100 year Critical Storm Duration. Lowest mass balance: 97.91%															
Event	US Node ID	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status	Link ID	DS Node ID	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	T1	10	259.620	0.045	15.0	0.0766	0.0000	OK	1.000	T2	14.7	2.002	0.089	0.7418	
15 minute winter	T2	11	249.638	0.063	29.7	0.1101	0.0000	OK	1.001	T3	29.0	2.364	0.175	1.2481	
15 minute winter	T3	11	239.670	0.094	43.8	0.1657	0.0000	OK	1.002	T4	43.4	1.711	0.372	2.6355	
15 minute winter	T4	14	234.848	0.273	43.4	0.4108	0.0000	SURCHARGED	1.003	T5	40.8	1.297	1.023	0.9943	
15 minute winter	T5	14	234.772	0.345	40.8	1.3218	0.0000	SURCHARGED	1.004	16	33.0	1.145	0.535	0.9943	
30 minute winter	1	22	234.677	0.602	12.1	1.3835	0.0000	SURCHARGED	2.000	2	10.9	0.564	0.274	1.4318	
30 minute winter	2	22	234.670	0.807	22.3	1.8003	0.0000	SURCHARGED	2.001	4	17.1	0.581	0.429	0.4773	
15 minute winter	3	14	234.666	0.591	14.3	1.3599	0.0000	SURCHARGED	3.000	4	12.6	0.434	0.273	1.4318	
15 minute winter	4	14	234.661	0.869	42.0	1.9219	0.0000	SURCHARGED	2.002	5	31.3	0.926	0.780	0.3182	
15 minute winter	5	14	234.634	0.890	35.4	1.1485	0.0000	SURCHARGED	2.003	6	32.6	0.979	0.820	0.7159	
15 minute winter	6	14	234.576	0.938	36.7	0.1575	0.0000	SURCHARGED	2.004	7	34.6	0.983	0.868	0.7557	
15 minute winter	7	14	234.502	0.976	37.2	0.1562	0.0000	SURCHARGED	2.005	8	36.6	0.985	0.921	0.7159	
15 minute winter	8	14	234.420	1.000	37.4	0.1521	0.0000	SURCHARGED	2.006	9	38.5	1.012	0.968	0.7557	
15 minute winter	9	14	234.321	1.013	38.5	0.1469	0.0000	SURCHARGED	2.007	10	40.4	1.077	1.013	0.5568	
15 minute winter	10	14	234.232	1.007	40.4	1.2629	0.0000	SURCHARGED	2.008	22	44.5	1.495	1.118	0.7954	
15 minute winter	11	13	234.228	0.153	10.1	0.2315	0.0000	OK	4.000	12	10.0	0.605	0.250	0.4079	
15 minute winter	12	13	234.220	0.216	20.0	0.0818	0.0000	OK	4.001	13	20.1	0.779	0.505	0.7501	
15 minute winter	13	13	234.209	0.317	29.8	0.1120	0.0000	SURCHARGED	4.002	14	29.1	0.898	0.732	0.7159	
15 minute winter	14	13	234.193	0.406	39.2	0.1354	0.0000	SURCHARGED	4.003	15	37.1	1.362	0.934	0.7557	
15 minute winter	15	13	234.154	0.480	47.2	0.1502	0.0000	SURCHARGED	4.004	22	40.8	1.202	0.388	0.5568	
15 minute winter	16	14	234.695	0.620	38.3	0.8225	0.0000	SURCHARGED	1.005	17	34.4	0.960	0.865	0.7159	
15 minute winter	17	14	234.627	0.657	39.7	0.1322	0.0000	SURCHARGED	1.006	18	36.2	0.964	0.911	0.7557	
15 minute winter	18	14	234.544	0.687	41.5	0.1291	0.0000	SURCHARGED	1.007	19	38.0	0.970	0.955	0.7159	
15 minute winter	19	14	234.453	0.702	43.3	0.1249	0.0000	SURCHARGED	1.008	20	40.4	1.084	1.014	0.7557	
15 minute winter	20	13	234.345	0.706	40.6	0.1185	0.0000	SURCHARGED	1.009	21	43.9	1.447	1.101	0.5568	
15 minute winter	21	13	234.247	0.691	44.1	0.8815	0.0000	SURCHARGED	1.010	22	48.7	1.338	0.623	0.7954	
15 minute winter	22	13	234.101	0.993	115.4	1.3481	0.0000	SURCHARGED	1.011	23	114.6	3.536	0.968	2.9354	
960 minute winter	23	870	229.725	0.725	22.1	326.8961	0.0000	FLOOD RISK	1.012	24	5.0	1.960	0.028	0.1015	255.9
60 minute summer	24	47	224.426	0.026	5.0	0.0000	0.0000	OK							

Results for 100 year +30% Critical Storm Duration. Lowest mass balance: 97.91%															
Event	US Node ID	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status	Link ID	DS Node ID	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	T1	10	259.627	0.052	19.5	0.0874	0.0000	OK	1.000	T2	19.2	2.153	0.116	0.8980	
15 minute winter	T2	10	249.648	0.073	38.7	0.1268	0.0000	OK	1.001	T3	37.7	2.529	0.228	1.5160	
15 minute winter	T3	11	239.685	0.110	57.2	0.1936	0.0000	OK	1.002	T4	56.7	1.806	0.485	2.9508	
30 minute winter	T4	24	235.286	0.710	49.0	1.6273	0.0000	SURCHARGED	1.003	T5	41.1	1.307	1.031	0.9943	
30 minute winter	T5	24	235.213	0.786	41.1	3.7971	0.0000	SURCHARGED	1.004	16	36.6	1.116	0.593	0.9943	
30 minute winter	1	23	235.392	1.317	17.2	3.0285	0.0000	FLOOD RISK	2.000	2	12.5	0.567	0.315	1.4318	
30 minute winter	2	23	235.383	1.520	25.8	3.3917	0.0000	FLOOD RISK	2.001	4	17.6	0.580	0.440	0.4773	
30 minute winter	3	23	235.378	1.303	17.9	2.9971	0.0000	FLOOD RISK	3.000	4	12.6	0.415	0.274	1.4318	
30 minute winter	4	23	235.370	1.578	38.7	3.4897	0.0000	FLOOD RISK	2.002	5	34.3	0.921	0.855	0.3182	
30 minute winter	5	23	235.329	1.585	38.5	2.0443	0.0000	FLOOD RISK	2.003	6	36.5	0.968	0.918	0.7159	
30 minute winter	6	23	235.239	1.601	40.7	0.2690	0.0000	FLOOD RISK	2.004	7	37.1	0.974	0.932	0.7557	
30 minute winter	7	23	235.129	1.603	39.7	0.2565	0.0000	SURCHARGED	2.005	8	40.0	1.005	1.005	0.7159	
30 minute winter	8	23	235.005	1.585	41.4	0.2410	0.0000	SURCHARGED	2.006	9	43.0	1.082	1.081	0.7557	
30 minute winter	9	23	234.856	1.548	44.5	0.2244	0.0000	SURCHARGED	2.007	10	46.1	1.159	1.155	0.5568	
15 minute winter	10	14	234.747	1.522	44.6	1.9081	0.0000	SURCHARGED	2.008	22	49.5	1.486	1.243	0.7954	
15 minute winter	11	13	234.780	0.705	14.6	1.0641	0.0000	SURCHARGED	4.000	12	11.9	0.617	0.299	0.4773	
15 minute winter	12	13	234.777	0.772	24.3	0.2928	0.0000	SURCHARGED	4.001	13	23.1	0.790	0.580	0.7557	
15 minute winter	13	13	234.758	0.866	35.5	0.3058	0.0000	SURCHARGED	4.002	14	32.9	0.903	0.828	0.7159	
15 minute winter	14	13	234.719	0.933	45.3	0.3105	0.0000	SURCHARGED	4.003	15	41.2	1.365	1.035	0.7557	
15 minute winter	15	14	234.650	0.976	53.6	0.3056	0.0000	SURCHARGED	4.004	22	44.0	1.230	0.419	0.5568	
30 minute winter	16	24	235.135	1.060	42.1	1.4060	0.0000	SURCHARGED	1.005	17	37.1	0.946	0.932	0.7159	
30 minute winter	17	23	235.069	1.100	37.3	0.2211	0.0000	SURCHARGED	1.006	18	39.4	0.991	0.990	0.7557	
30 minute winter	18	23	234.988	1.131	39.6	0.2126	0.0000	SURCHARGED	1.007	19	41.7	1.049	1.049	0.7159	
15 minute winter	19	14	234.900	1.149	44.0	0.2044	0.0000	SURCHARGED	1.008	20	44.6	1.123	1.122	0.7557	
15 minute winter	20	14	234.804	1.165	44.6	0.1958	0.0000	SURCHARGED	1.009	21	47.5	1.455	1.190	0.5568	
15 minute winter	21	14	234.718	1.162	47.5	1.4810	0.0000	SURCHARGED	1.010	22	58.7	1.674	0.752	0.7954	
15 minute winter	22	14	234.584	1.476	126.1	2.0035	0.0000	SURCHARGED	1.011	23	122.4	3.626	1.034	3.1788	
720 minute winter	23	690	230.000	1.000	35.6	451.0782	0.0000	FLOOD RISK	1.012	24	5.0	1.960	0.028	0.1015	227.5
30 minute summer	24	89	224.426	0.026	5.0	0.0000	0.0000	OK							

