



Project Name : Land West of Kingfisher Grove, Three Mile Cross

Job No : 23-117

Note Title : Drainage Strategy – Technical Note

Author : CR

Checked : NM

Approved : GG

Date : July 2024

1.0 INTRODUCTION

1.1 *Background*

1.1.1 Odyssey has been commissioned by Sovereign Network Group to undertake a surface water and foul drainage strategy, as part of a reserved matters application for a proposed development at Land West of Kingfisher Grove, Three Mile Cross.

1.1.2 The proposals comprise a residential development of up to 49 dwellings including the creation of new vehicular access, public open space, landscape planting, surface water attenuation and associated infrastructure.

1.1.3 Outline planning permission, subject to conditions, was granted on 31st January 2023 following an inquiry held in November 2022 (Wokingham Borough Council planning application number 201002).

1.1.4 This technical note sets out variations from the approved outline application to the current strategy and the justification for these changes.

1.2 *Existing Site Conditions*

1.2.1 The 5.9 hectare (ha) site is located approximately 6.3 kilometres (km) to the south west of Earley railway station. The site is bounded by a residential development in the north, undeveloped



land and a smaller residential area in the east, undeveloped land in the south and a road (A33) along with a small commercial development in the west. The site currently comprises greenfield land, and broadly falls from the east to the west, and the levels range from 63.34 metres Above Ordnance Datum (m AOD) in the east to 47.25 m AOD in the north-west.

1.2.2 As per the approved Flood Risk Assessment and Drainage Strategy undertaken as part of the outline planning application the following greenfield peak flow rates were calculated. As the developable area for this site is less than 50ha, the Institute of Hydrology (IoH) Report 124 Flood Estimation for Smaller Catchments (1994) method is suitable (50ha is used in the formula and the flow rate is linearly interpolated based on the ratio of the development area). This methodology is approved in the Construction Industry Research and Information Association (CIRIA) C753 The SuDS Manual; the parameters used are presented in **Table 1.1**.

Table 1.1: Interim Code of Practice SuDS Parameters

Parameter	Value	Unit
SAAR	700	Millimetres (mm)
Soil Index	0.450	-
Region	6	-
Urban	0.000	-

1.2.3 **Table 1.2** summarises the greenfield discharge rates for the total developable area (1.044 ha).

Table 1.2: Greenfield Surface Water Discharge Rates

Return Period	Existing Greenfield Discharge Rates from Site (litres per second (l/s))	Existing Greenfield Discharge Rates per Hectare (l/s/ha)
QBAR	4.6	4.4
Q1	3.9	3.7
Q30	10.4	10.0
Q100	14.6	14.0

1.2.4 The basins and permeable paving were designed to accommodate a 1 in 100 year storm plus 40% to account for climate change. An additional 10% roof area allowance was included to account for urban creep.



2.0 SURFACE WATER DRAINAGE STRATEGY

2.1 *Approved Surface Water Drainage Strategy*

2.1.1 The outline strategy proposed that surface water generated by the development would be attenuated in detention basins located at topographical low points, prior to discharging to a ditch that runs along the west of the site. It was also proposed to incorporate areas of permeable paving to provide additional attenuation storage.

2.1.2 In line with the drainage hierarchy set out in the Planning Practice Guidance (PPG), infiltration was initially considered but determined to be unviable due to the underlying bedrock on site comprising London Clay Formation.

2.2 *Variations to the Surface Water Drainage Strategy*

2.2.1 There is no route to connect flows from the site to the ditch without crossing third party land, therefore discharging surface water to this location would not be viable. In line with the drainage hierarchy, the next preferred option is for surface water to be discharged to a sewer. Surface water from the site would be conveyed to an existing Thames Water public sewer near the site access. This sewer network ultimately discharges into a watercourse to the north of the site.

2.2.2 Confirmation has been obtained from Thames Water that this sewer currently has capacity to accommodate surface water from the development (up to 4.6l/s), and discharging to the sewer network would be a viable option.

2.2.3 The proposal to attenuate surface water flows using dry detention basins is continued from the outline strategy. However, the shape and formation of these has been redesigned to suit the updated site layout and existing topography. The proposed basins are between 1.025m and 1.264m deep, including an allowance for freeboard greater than 300mm. They are to be constructed with side slopes at a grade of 1 in 3, with the top 300mm depth being at a grade of 1 in 6.

2.2.4 Permeable paving is no longer proposed as the additional attenuation volume would not be required. The proposed engineering layout is shown in **Drawing 23-117-001G**.

2.2.5 The surface water calculations have been revised to account for the updated site layout impermeable areas, proposed dry detention basins, and the use of the latest Flood Estimation Handbook (FEH22) data. The proposed discharge rate is unchanged at 4.6 l/s. The supporting calculations are included in **Appendix A**, and exceedance flow path routes are shown in **Drawing 23-117-005A**.



3.0 FOUL DRAINAGE STRATEGY

3.1 *Approved Foul Water Drainage Strategy*

3.1.1 The outline foul drainage strategy proposed flows would be conveyed to an existing foul sewer at the north of the site immediately before this connects to an adopted pumping station. Following a pre-development enquiry, Thames Water confirmed adopted status of the pumping station and adjoining sewers within Kingfisher Grove, and that there is currently capacity within the public network to accommodate the anticipated discharge from the site.

3.2 *Variations to the Foul Water Drainage Strategy*

3.2.1 No variation to the approved outline foul strategy is proposed; the design intention remains to make a gravity connection to the adopted foul sewer, subject to an approved Section 106 application.

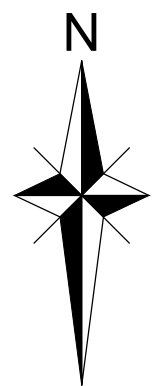
4.0 CONCLUSION

4.1.1 Odyssey has been commissioned by Sovereign Network Group to undertake a surface water and foul drainage strategy, as part of a reserved matters application associated with an outline planning application for a proposed development at Land West of Kingfisher Grove, Three Mile Cross.

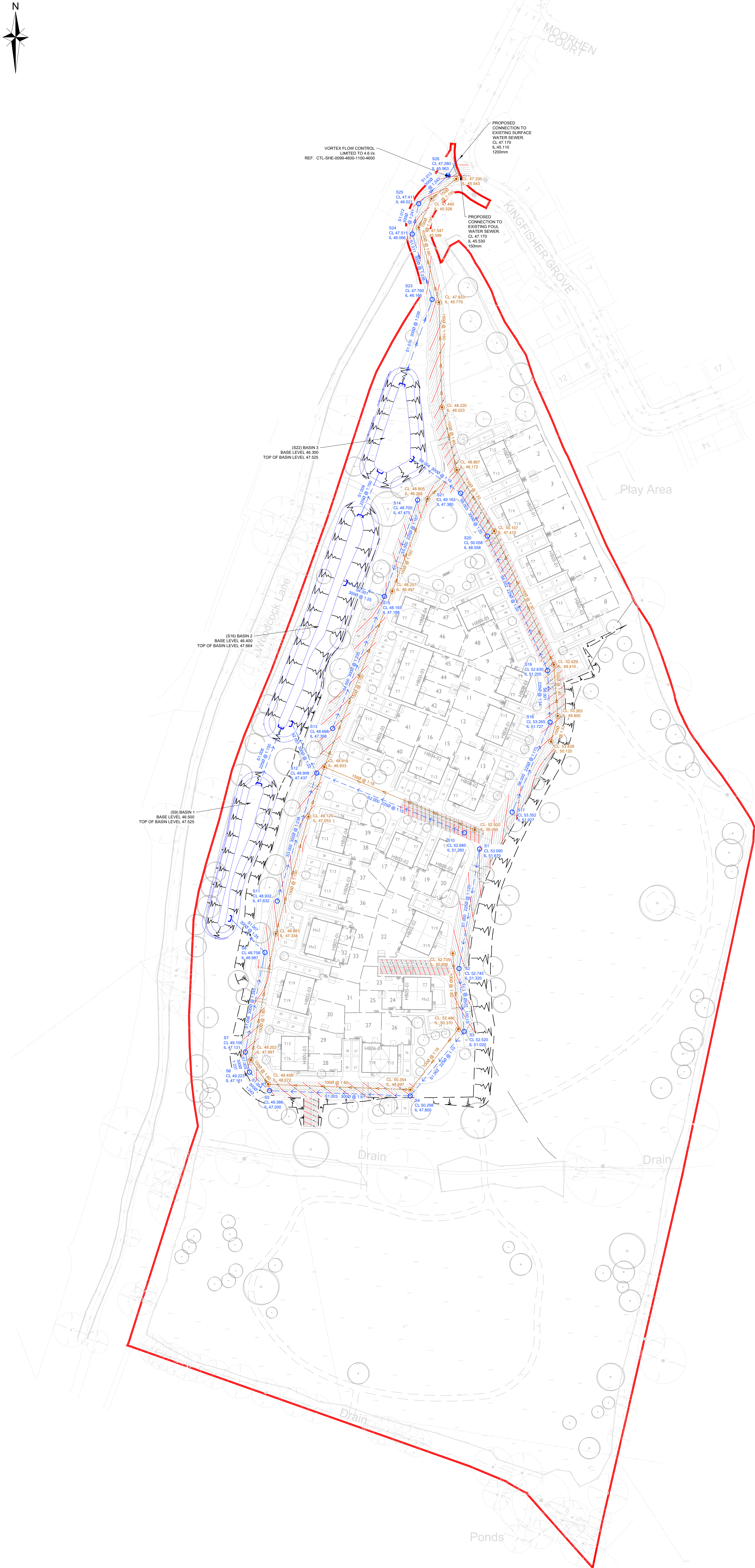
4.1.2 The proposed surface water drainage strategy has been revised since the approval of the outline strategy. The proposal is to discharge to a Thames Water sewer instead of directly to the watercourse, due to restrictions associated with crossing third party land. There is no amendment to the foul strategy.

4.1.3 This Technical Note demonstrates the design changes to the proposed development regarding surface water and foul drainage are commensurate with national and local policy.

DRAWINGS



P:\23-117 - Land West of Kingfisher Grove, Three Mile Cross\Tech\Acad\Drawings\23-117-001 Drainage Strategy.dwg



NOTES

1. DO NOT SCALE FROM THIS DRAWING. WORK FROM FIGURED DIMENSIONS ONLY.

2. ALL DIMENSIONS SHOWN ON THIS DRAWING ARE IN METRES.

3. PROPOSALS ARE INDICATIVE ONLY TO DEMONSTRATE DRAINAGE STRATEGY AND ARE SUBJECT TO EVOLVE THROUGH DETAILED DESIGN

4. TOPOGRAPHICAL SURVEY HAS BEEN PROVIDED BY GROUND SURVEYS LTD. DRAWING REFERENCE 7280-01A. DATED JANUARY 2020.

5. SITE LAYOUT HAS BEEN PROVIDED BY DWG ARCHITECTURE

LEGEND

SITE BOUNDARY

WATERCOURSE

PROPOSED SURFACE WATER SEWER AND MANHOLE

VORTEX FLOW CONTROL

PROPOSED HEADWALL

PROPOSED FOUL WATER SEWER AND MANHOLE

EXISTING FOUL WATER SEWER AND MANHOLE

EXISTING SURFACE WATER SEWER AND MANHOLE

EXISTING DECOMMISSIONED SEWER

RISK OF FLOODING FROM SURFACE WATER FOR THE 1 IN 30 YEAR STORM EVENT

RISK OF FLOODING FROM SURFACE WATER FOR THE 1 IN 100 YEAR STORM EVENT

RISK OF FLOODING FROM SURFACE WATER FOR THE 1 IN 1000 YEAR STORM EVENT

PROPOSED BASIN. FIRST 300mm DEPTH BELOW SURFACE AT 1 IN 6 GRADIENT, 1 IN 3 GRADIENT BELOW THIS.

EXISTING THAMES WATER FOUL PUMPING STATION

55.000 - PROPOSED HIGHWAY CONTOURS (SHOWN AT 20mm INTERVALS)

G

LEVELS TITLE AMENDED

CR

GG

GG

16.10.24

F

DRAINAGE UPDATED AS PER NEW LEVELS

CR

NM

GG

07.10.24

E

DRAINAGE UPDATED TO AVOID CLASH

CR

NM

GG

11.07.24

D

DRAINAGE LEVEL INFORMATION ADDED

CR

NM

GG

05.07.24

C

UPDATED TO REFLECT LAYOUT CHANGES

CR

NM

GG

07.06.24

B

UPDATED TO REFLECT LAYOUT CHANGES

CR

NM

GG

26.04.24

A

UPDATED FOR FOUL STRATEGY

JW

JW

27.07.23

Rev

Amendments

CR

GG

16.10.24

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Job Title

LAND WEST OF KINGFISHER GROVE, THREE MILE CROSS

Drawing Title

PRELIMINARY ENGINEERING LAYOUT

Client

SOVEREIGN

Scale

1:500 @A0

Date

JUL 23

Designed

HM

Drawn

HM

Checked

JW

Approved

GG

Job No

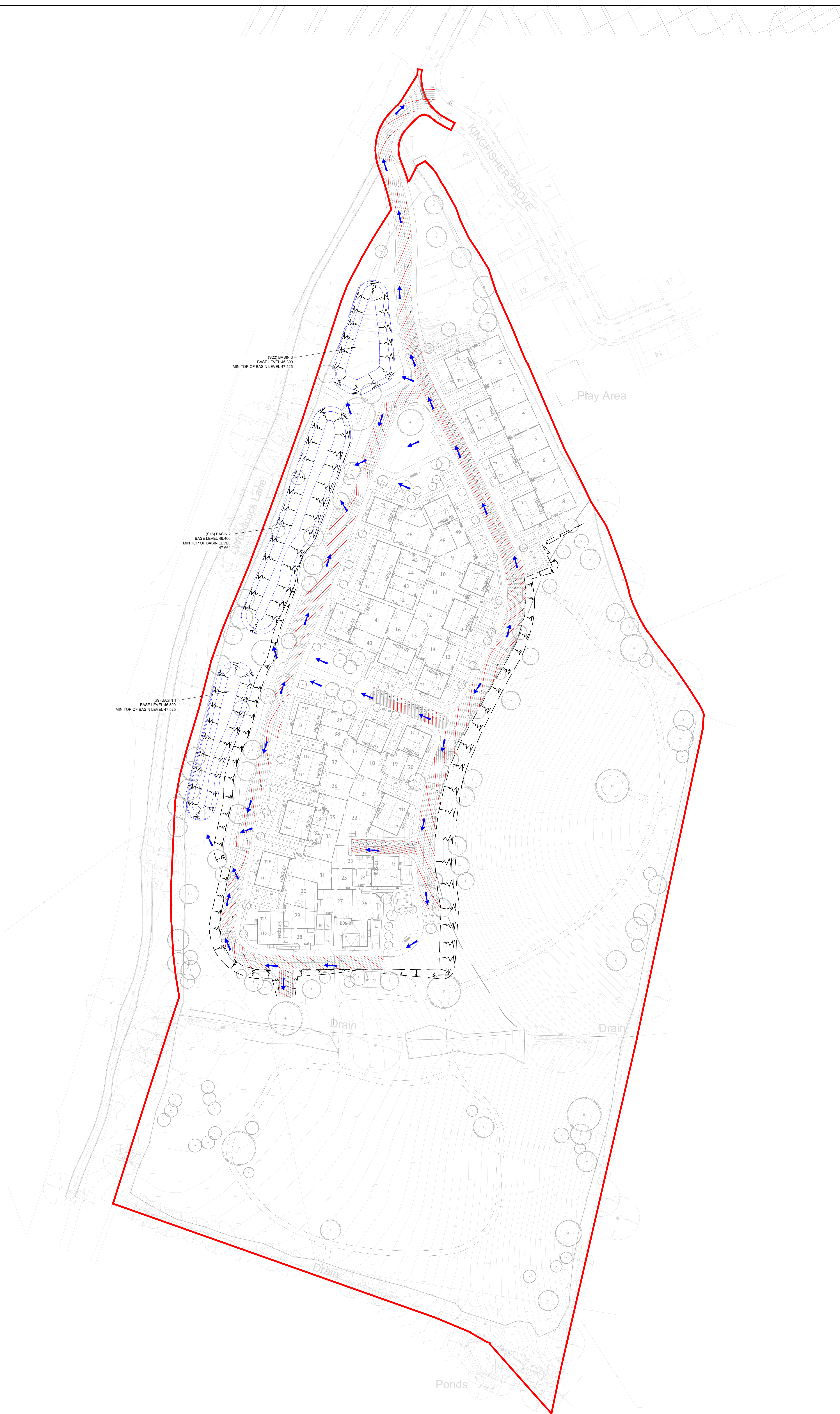
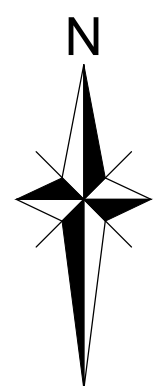
23-117

Drawing No

23-117-001

Rev

G



- NOTES
- DO NOT SCALE FROM THIS DRAWING. WORK FROM FIGURED DIMENSIONS ONLY.
 - ALL DIMENSIONS SHOWN ON THIS DRAWING ARE IN METRES.
 - ALL EXISTING LEVELS, GRADIENTS, DEPTHS, ETC. ARE TO BE CHECKED ON SITE PRIOR TO CONSTRUCTION. ANY DISCREPANCIES ARE TO REPORTED TO THE ENGINEER IMMEDIATELY
 - TOPOGRAPHICAL SURVEY HAS BEEN PROVIDED BY GROUND SURVEYS LTD. DRAWING REFERENCE 7280-01A. DATED JANUARY 2020.
 - SITE LAYOUT HAS BEEN PROVIDED BY DWG ARCHITECTS
 - THE LEVELS SHOWN ON THIS DRAWING ARE PRELIMINARY AND SUBJECT TO CHANGE.

- KEY
- PROPOSED SITE BOUNDARY
 - PROPOSED HIGHWAY CONTOURS (SHOWN AT 20mm INTERVALS)
 - PROPOSED EXCEEDANCE FLOW ROUTE

A LEVELS UPDATED				CR	GG	GG	16.10.24
Rev	Amendments			Des	Chk	App	Date
 ODYSSEY Trinity House White Hart Lane Barnsley S62 4AF Telephone: 01226 321144 Fax: 01226 321144 E info@odysseyconsult.co.uk W www.odysseyconsult.co.uk							
Job Title							
LAND WEST OF KINGFISHER GROVE, THREE MILE CROSS							
Drawing Title							
EXCEEDANCE FLOW ROUTES							
Client							
SOVEREIGN							
Scale	Date			Designed			
1:500 @A0	OCT 24			CR			
Drawn	Checked			Approved			
CN	NM			GG			
Job No	Drawing No						Rev
23-117	23-117-005						A

APPENDIX A

Drainage Strategy Calculations

Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	5	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.200
CV	0.750	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	4.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	x
Maximum Rainfall (mm/hr)	50.0		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Node Type	Manhole Type	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)	Notes
✓ 1	0.007	4.00	53.095	Manhole	Adoptable	1200	470955.392	167282.150	1.425	
✓ 9			47.525	Manhole	Adoptable	1200	470869.203	167279.471	1.168	Auto-design is off
✓ 16			47.664	Manhole	Adoptable	1200	470898.680	167352.957	1.264	Auto-design is off
✓ 22	0.044	4.00	47.525	Manhole	Adoptable	1200	470923.614	167424.108	1.225	Auto-design is off
✓ 23	0.009	4.00	47.760	Manhole	Adoptable	1200	470938.941	167472.947	1.594	
✓ 2	0.065	4.00	52.745	Manhole	Adoptable	1200	470948.320	167240.654	1.425	
✓ 3	0.036	4.00	52.520	Manhole	Adoptable	1200	470950.048	167218.783	1.500	
✓ 5	0.082	4.00	49.386	Manhole	Adoptable	1200	470882.542	167198.256	2.186	
✓ 7	0.006	4.00	49.106	Manhole	Adoptable	1200	470874.149	167211.646	1.975	
✓ 8	0.082	4.00	48.758	Manhole	Adoptable	1200	470880.936	167246.242	1.771	
✓ 11	0.013	4.00	48.932	Manhole	Adoptable	1200	470885.220	167264.065	1.300	
✓ 12	0.130	4.00	48.908	Manhole	Adoptable	1200	470898.907	167308.503	1.471	
✓ 10	0.033	4.00	52.685	Manhole	Adoptable	1200	470950.170	167287.786	1.425	
✓ 17	0.009	4.00	53.352	Manhole	Adoptable	1200	470966.716	167294.966	1.425	
✓ 18	0.055	4.00	53.265	Manhole	Adoptable	1200	470979.889	167326.206	1.538	
✓ 19	0.035	4.00	52.630	Manhole	Adoptable	1200	470979.002	167344.100	1.425	
✓ 20	0.136	4.00	50.058	Manhole	Adoptable	1200	470958.160	167390.811	1.500	
✓ 21	0.043	4.00	49.163	Manhole	Adoptable	1200	470948.825	167405.679	1.783	
✓ 13	0.044	4.00	48.698	Manhole	Adoptable	1200	470904.402	167324.020	1.300	
✓ 15	0.120	4.00	48.193	Manhole	Adoptable	1200	470922.411	167369.873	1.005	
✓ 14	0.015	4.00	48.700	Manhole	Adoptable	1200	470933.916	167403.309	1.225	
✓ 24	0.014	4.00	47.510	Manhole	Adoptable	1200	470932.060	167495.663	1.444	
✓ 25	0.007	4.00	47.410	Manhole	Adoptable	1200	470934.297	167506.256	1.389	
✓ 26	0.014	4.00	47.280	Manhole	Adoptable	1200	470944.458	167516.029	1.317	
✓ 26_OUT			47.200	Manhole	Adoptable	1200	470950.799	167520.605	1.316	
✓ 4	0.017	4.00	50.298	Manhole	Adoptable	1200	470931.352	167196.418	2.498	
✓ 6	0.007	4.00	49.223	Manhole	Adoptable	1200	470875.589	167204.671	2.062	

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	Velocity Equation	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	Link Type	T of C (mins)	Rain (mm/hr)
? 1.000	1	2	42.094	0.600	Colebrook-White	51.670	51.320	0.350	120.3	225	Circular	4.59	50.0
? 1.001	2	3	21.939	0.600	Colebrook-White	51.320	51.020	0.300	73.1	225	Circular	4.83	50.0
? 1.002	3	4	29.150	0.600	Colebrook-White	51.020	47.875	3.145	9.3	225	Circular	4.94	50.0
✓ 1.003	4	5	48.845	0.600	Colebrook-White	47.800	47.200	0.600	81.4	300	Circular	5.41	50.0
✓ 1.004	5	6	9.460	0.600	Colebrook-White	47.200	47.161	0.039	242.6	300	Circular	5.56	50.0
✓ 1.005	6	7	7.122	0.600	Colebrook-White	47.161	47.131	0.030	237.4	300	Circular	5.68	50.0
✓ 1.006	7	8	35.255	0.600	Colebrook-White	47.131	46.987	0.144	244.8	300	Circular	6.27	50.0
? 1.007	8	9	15.750	0.600	Colebrook-White	46.987	46.357	0.630	25.0	300	Circular	6.35	50.0
? 1.008	9	16	15.000	0.600	Colebrook-White	46.500	46.400	0.100	150.0	225	Circular	6.59	50.0
? 1.009	16	22	15.000	0.600	Colebrook-White	46.400	46.300	0.100	150.0	225	Circular	4.87	50.0

Name	US Node	DS Node	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Minimum Depth (m)	Maximum Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
? 1.000	1	2	1.191	47.3	0.9	1.200	1.200	1.200	1.200	0.007	0.0	22	0.478
? 1.001	2	3	1.531	60.9	9.8	1.200	1.275	1.200	1.275	0.072	0.0	61	1.133
? 1.002	3	4	4.323	171.9	14.6	1.275	2.198	1.275	2.198	0.108	0.0	44	2.673
✓ 1.003	4	5	1.744	123.2	16.9	2.198	1.886	1.886	2.198	0.125	0.0	75	1.234
✓ 1.004	5	6	1.005	71.0	28.1	1.886	1.762	1.762	1.886	0.207	0.0	131	0.948
✓ 1.005	6	7	1.016	71.8	29.0	1.762	1.675	1.675	1.762	0.214	0.0	133	0.964
✓ 1.006	7	8	1.000	70.7	29.8	1.675	1.471	1.471	1.675	0.220	0.0	136	0.958
? 1.007	8	9	3.157	223.1	40.9	1.471	0.868	0.868	1.471	0.302	0.0	86	2.423
? 1.008	9	16	1.065	42.3	40.9	0.800	1.039	0.800	1.039	0.302	0.0	179	1.208
? 1.009	16	22	1.065	42.3	89.0	1.039	1.000	1.000	1.039	0.657	0.0	225	1.085



Links

	Name	US Node	DS Node	Length (m)	ks (mm) / n	Velocity Equation	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	Link Type	T of C (mins)	Rain (mm/hr)
?	1.010	22	23	32.000	0.600	Colebrook-White	46.300	46.166	0.134	238.8	300	Circular	5.69	50.0
?	1.011	23	24	23.735	0.600	Colebrook-White	46.166	46.066	0.100	238.0	300	Circular	6.08	50.0
?	1.012	24	25	10.827	0.600	Colebrook-White	46.066	46.021	0.045	240.6	300	Circular	6.26	50.0
?	1.013	25	26	14.098	0.600	Colebrook-White	46.021	45.963	0.058	243.1	300	Circular	6.49	50.0
?	1.014	26	26_OUT	7.820	0.600	Colebrook-White	45.963	45.884	0.079	99.0	150	Circular	6.62	50.0
?	2.000	10	12	55.291	0.600	Colebrook-White	51.260	47.512	3.748	14.8	225	Circular	4.27	50.0
?	2.001	12	16	20.100	0.600	Colebrook-White	47.437	46.432	1.005	20.0	300	Circular	4.86	50.0
?	3.000	11	12	46.498	0.600	Colebrook-White	47.632	47.437	0.195	238.0	300	Circular	4.76	50.0
?	4.000	13	15	49.263	0.600	Colebrook-White	47.398	47.188	0.210	234.6	300	Circular	4.80	50.0
?	4.001	15	16	14.000	0.600	Colebrook-White	47.188	46.628	0.560	25.0	300	Circular	4.88	50.0
?	5.000	14	15	35.360	0.600	Colebrook-White	47.475	47.263	0.212	167.0	225	Circular	4.58	50.0
?	6.000	17	18	33.904	0.600	Colebrook-White	51.927	51.727	0.200	169.5	225	Circular	4.56	50.0
?	6.001	18	19	17.916	0.600	Colebrook-White	51.727	51.205	0.522	34.3	225	Circular	4.70	50.0
?	6.002	19	20	51.150	0.600	Colebrook-White	51.205	48.633	2.572	19.9	225	Circular	4.99	50.0
?	6.003	20	21	17.556	0.600	Colebrook-White	48.558	47.663	0.895	19.6	300	Circular	5.07	50.0
?	6.004	21	22	20.100	0.600	Colebrook-White	47.380	46.300	1.080	18.6	300	Circular	5.16	50.0

	Name	US Node	DS Node	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Minimum Depth (m)	Maximum Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
?	1.010	22	23	1.013	71.6	132.7	0.925	1.294	0.925	1.294	0.979	0.0	300	1.026
?	1.011	23	24	1.015	71.7	133.9	1.294	1.144	1.144	1.294	0.988	0.0	300	1.028
?	1.012	24	25	1.009	71.3	135.8	1.144	1.089	1.089	1.144	1.002	0.0	300	1.022
?	1.013	25	26	1.004	71.0	136.7	1.089	1.017	1.017	1.089	1.009	0.0	300	1.017
?	1.014	26	26_OUT	1.010	17.8	138.6	1.167	1.166	1.166	1.167	1.023	0.0	150	1.029
?	2.000	10	12	3.424	136.1	4.5	1.200	1.171	1.171	1.200	0.033	0.0	28	1.587
?	2.001	12	16	3.531	249.6	23.9	1.171	0.932	0.932	1.171	0.176	0.0	62	2.261
?	3.000	11	12	1.015	71.7	1.8	1.000	1.171	1.000	1.171	0.013	0.0	33	0.433
?	4.000	13	15	1.022	72.2	6.0	1.000	0.705	0.705	1.000	0.044	0.0	58	0.622
?	4.001	15	16	3.157	223.1	24.3	0.705	0.736	0.705	0.736	0.179	0.0	67	2.096
?	5.000	14	15	1.009	40.1	2.0	1.000	0.705	0.705	1.000	0.015	0.0	35	0.534
?	6.000	17	18	1.001	39.8	1.2	1.200	1.313	1.200	1.313	0.009	0.0	27	0.450
?	6.001	18	19	2.240	89.1	8.7	1.313	1.200	1.200	1.313	0.064	0.0	47	1.431
?	6.002	19	20	2.947	117.2	13.4	1.200	1.200	1.200	1.200	0.099	0.0	51	1.983
?	6.003	20	21	3.566	252.0	31.8	1.200	1.200	1.200	1.200	0.235	0.0	72	2.472
?	6.004	21	22	3.661	258.8	37.7	1.483	0.925	0.925	1.483	0.278	0.0	77	2.640

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	42.094	120.3	225	Circular	53.095	51.670	1.200	52.745	51.320	1.200
1.001	21.939	73.1	225	Circular	52.745	51.320	1.200	52.520	51.020	1.275
1.002	29.150	9.3	225	Circular	52.520	51.020	1.275	50.298	47.875	2.198
1.003	48.845	81.4	300	Circular	50.298	47.800	2.198	49.386	47.200	1.886
1.004	9.460	242.6	300	Circular	49.386	47.200	1.886	49.223	47.161	1.762
1.005	7.122	237.4	300	Circular	49.223	47.161	1.762	49.106	47.131	1.675
1.006	35.255	244.8	300	Circular	49.106	47.131	1.675	48.758	46.987	1.471
1.007	15.750	25.0	300	Circular	48.758	46.987	1.471	47.525	46.357	0.868
1.008	15.000	150.0	225	Circular	47.525	46.500	0.800	47.664	46.400	1.039
1.009	15.000	150.0	225	Circular	47.664	46.400	1.039	47.525	46.300	1.000
1.010	32.000	238.8	300	Circular	47.525	46.300	0.925	47.760	46.166	1.294

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	1	1200	Manhole	Adoptable	2	1200	Manhole	Adoptable
1.001	2	1200	Manhole	Adoptable	3	1200	Manhole	Adoptable
1.002	3	1200	Manhole	Adoptable	4	1200	Manhole	Adoptable
1.003	4	1200	Manhole	Adoptable	5	1200	Manhole	Adoptable
1.004	5	1200	Manhole	Adoptable	6	1200	Manhole	Adoptable
1.005	6	1200	Manhole	Adoptable	7	1200	Manhole	Adoptable
1.006	7	1200	Manhole	Adoptable	8	1200	Manhole	Adoptable
1.007	8	1200	Manhole	Adoptable	9	1200	Manhole	Adoptable
1.008	9	1200	Manhole	Adoptable	16	1200	Manhole	Adoptable
1.009	16	1200	Manhole	Adoptable	22	1200	Manhole	Adoptable
1.010	22	1200	Manhole	Adoptable	23	1200	Manhole	Adoptable

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)
1.011	23.735	238.0	300	Circular	47.760	46.166	1.294	47.510	46.066	1.144
1.012	10.827	240.6	300	Circular	47.510	46.066	1.144	47.410	46.021	1.089
1.013	14.098	243.1	300	Circular	47.410	46.021	1.089	47.280	45.963	1.017
1.014	7.820	99.0	150	Circular	47.280	45.963	1.167	47.200	45.884	1.166
2.000	55.291	14.8	225	Circular	52.685	51.260	1.200	48.908	47.512	1.171
2.001	20.100	20.0	300	Circular	48.908	47.437	1.171	47.664	46.432	0.932
3.000	46.498	238.0	300	Circular	48.932	47.632	1.000	48.908	47.437	1.171
4.000	49.263	234.6	300	Circular	48.698	47.398	1.000	48.193	47.188	0.705
4.001	14.000	25.0	300	Circular	48.193	47.188	0.705	47.664	46.628	0.736
5.000	35.360	167.0	225	Circular	48.700	47.475	1.000	48.193	47.263	0.705
6.000	33.904	169.5	225	Circular	53.352	51.927	1.200	53.265	51.727	1.313
6.001	17.916	34.3	225	Circular	53.265	51.727	1.313	52.630	51.205	1.200
6.002	51.150	19.9	225	Circular	52.630	51.205	1.200	50.058	48.633	1.200
6.003	17.556	19.6	300	Circular	50.058	48.558	1.200	49.163	47.663	1.200
6.004	20.100	18.6	300	Circular	49.163	47.380	1.483	47.525	46.300	0.925

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.011	23	1200	Manhole	Adoptable	24	1200	Manhole	Adoptable
1.012	24	1200	Manhole	Adoptable	25	1200	Manhole	Adoptable
1.013	25	1200	Manhole	Adoptable	26	1200	Manhole	Adoptable
1.014	26	1200	Manhole	Adoptable	26_OUT	1200	Manhole	Adoptable
2.000	10	1200	Manhole	Adoptable	12	1200	Manhole	Adoptable
2.001	12	1200	Manhole	Adoptable	16	1200	Manhole	Adoptable
3.000	11	1200	Manhole	Adoptable	12	1200	Manhole	Adoptable
4.000	13	1200	Manhole	Adoptable	15	1200	Manhole	Adoptable
4.001	15	1200	Manhole	Adoptable	16	1200	Manhole	Adoptable
5.000	14	1200	Manhole	Adoptable	15	1200	Manhole	Adoptable
6.000	17	1200	Manhole	Adoptable	18	1200	Manhole	Adoptable
6.001	18	1200	Manhole	Adoptable	19	1200	Manhole	Adoptable
6.002	19	1200	Manhole	Adoptable	20	1200	Manhole	Adoptable
6.003	20	1200	Manhole	Adoptable	21	1200	Manhole	Adoptable
6.004	21	1200	Manhole	Adoptable	22	1200	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Node Type	MH Type	Connections	Link	IL (m)	Dia (mm)	Link Type
1	470955.392	167282.150	53.095	1.425	1200	Manhole	Adoptable		0	1.000	51.670	225 Circular
9	470869.203	167279.471	47.525	1.168	1200	Manhole	Adoptable		1	1.007	46.357	300 Circular
16	470898.680	167352.957	47.664	1.264	1200	Manhole	Adoptable		0	1.008	46.500	225 Circular
									1	4.001	46.628	300 Circular
									2	2.001	46.432	300 Circular
									3	1.008	46.400	225 Circular
									0	1.009	46.400	225 Circular
22	470923.614	167424.108	47.525	1.225	1200	Manhole	Adoptable		1	6.004	46.300	300 Circular
									2	1.009	46.300	225 Circular
									0	1.010	46.300	300 Circular
23	470938.941	167472.947	47.760	1.594	1200	Manhole	Adoptable		1	1.010	46.166	300 Circular
									0	1.011	46.166	300 Circular
2	470948.320	167240.654	52.745	1.425	1200	Manhole	Adoptable		1	1.000	51.320	225 Circular
									0	1.001	51.320	225 Circular
3	470950.048	167218.783	52.520	1.500	1200	Manhole	Adoptable		1	1.001	51.020	225 Circular
									0	1.002	51.020	225 Circular

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Node Type	MH Type	Connections	Link	IL (m)	Dia (mm)	Link Type	
5	470882.542	167198.256	49.386	2.186	1200	Manhole	Adoptable		1	1.003	47.200	300	Circular
									0	1.004	47.200	300	Circular
7	470874.149	167211.646	49.106	1.975	1200	Manhole	Adoptable		1	1.005	47.131	300	Circular
									0	1.006	47.131	300	Circular
8	470880.936	167246.242	48.758	1.771	1200	Manhole	Adoptable		1	1.006	46.987	300	Circular
									0	1.007	46.987	300	Circular
11	470885.220	167264.065	48.932	1.300	1200	Manhole	Adoptable						
									0	3.000	47.632	300	Circular
12	470898.907	167308.503	48.908	1.471	1200	Manhole	Adoptable		1	3.000	47.437	300	Circular
									2	2.000	47.512	225	Circular
									0	2.001	47.437	300	Circular
10	470950.170	167287.786	52.685	1.425	1200	Manhole	Adoptable		0	2.000	51.260	225	Circular
17	470966.716	167294.966	53.352	1.425	1200	Manhole	Adoptable		0	6.000	51.927	225	Circular
									1	6.000	51.727	225	Circular
									0	6.001	51.727	225	Circular
19	470979.002	167344.100	52.630	1.425	1200	Manhole	Adoptable		1	6.001	51.205	225	Circular
									0	6.002	51.205	225	Circular
20	470958.160	167390.811	50.058	1.500	1200	Manhole	Adoptable		1	6.002	48.633	225	Circular
									0	6.003	48.558	300	Circular
21	470948.825	167405.679	49.163	1.783	1200	Manhole	Adoptable		1	6.003	47.663	300	Circular
									0	6.004	47.380	300	Circular
13	470904.402	167324.020	48.698	1.300	1200	Manhole	Adoptable		0	4.000	47.398	300	Circular
									1	5.000	47.263	225	Circular
									2	4.000	47.188	300	Circular
									0	4.001	47.188	300	Circular
14	470933.916	167403.309	48.700	1.225	1200	Manhole	Adoptable		0	5.000	47.475	225	Circular
24	470932.060	167495.663	47.510	1.444	1200	Manhole	Adoptable		1	1.011	46.066	300	Circular
									0	1.012	46.066	300	Circular
25	470934.297	167506.256	47.410	1.389	1200	Manhole	Adoptable		1	1.012	46.021	300	Circular
									0	1.013	46.021	300	Circular

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Node Type	MH Type	Connections	Link	IL (m)	Dia (mm)	Link Type
26	470944.458	167516.029	47.280	1.317	1200	Manhole	Adoptable	1	1.013	45.963	300	Circular
								0	1.014	45.963	150	Circular
26_OUT	470950.799	167520.605	47.200	1.316	1200	Manhole	Adoptable	1	1.014	45.884	150	Circular
								0				
4	470931.352	167196.418	50.298	2.498	1200	Manhole	Adoptable	1	1.002	47.875	225	Circular
								0	1.003	47.800	300	Circular
6	470875.589	167204.671	49.223	2.062	1200	Manhole	Adoptable	1	1.004	47.161	300	Circular
								0	1.005	47.161	300	Circular

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Normal	Additional Storage (m³/ha)	0.0
Summer CV	0.750	Skip Steady State	x	Check Discharge Rate(s)	x
Winter CV	0.840	Drain Down Time (mins)	240	Check Discharge Volume	x

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440
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Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
100	40	0	0

Node 26 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	45.963	Product Number	CTL-SHE-0099-4600-1200-4600
Design Depth (m)	1.200	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	4.6	Min Node Diameter (mm)	1200

Node 9 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	46.357
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	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	151.0	0.0	0.725	396.0	0.0	1.025	586.0	0.0

Node 16 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	46.400
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	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	242.0	0.0	0.964	737.5	0.0	1.264	938.0	0.0

Node 22 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	46.300
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	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	229.7	0.0	0.925	457.2	0.0	1.225	594.5	0.0

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.79%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	51.721	0.051	5.4	0.0575	0.0000	OK
480 minute winter	9	480	47.076	0.719	22.0	196.7189	0.0000	SURCHARGED
480 minute winter	16	480	47.076	0.676	28.8	281.6879	0.0000	SURCHARGED
480 minute winter	22	480	47.075	0.775	23.7	252.8069	0.0000	SURCHARGED
480 minute winter	23	472	47.075	0.909	7.6	1.0275	0.0000	SURCHARGED
15 minute winter	2	10	51.509	0.189	55.1	0.2133	0.0000	OK
15 minute winter	3	10	51.129	0.109	82.6	0.1235	0.0000	OK
15 minute winter	5	11	48.599	1.399	144.0	1.5828	0.0000	SURCHARGED
15 minute winter	7	11	48.119	0.988	146.8	1.1176	0.0000	SURCHARGED
15 minute winter	8	11	47.365	0.378	202.9	0.4279	0.0000	SURCHARGED
15 minute winter	11	10	47.707	0.075	10.0	0.0843	0.0000	OK
15 minute winter	12	10	47.611	0.174	134.8	0.1969	0.0000	OK
15 minute summer	10	10	51.325	0.065	25.3	0.0740	0.0000	OK
15 minute winter	17	10	51.990	0.063	6.9	0.0710	0.0000	OK
15 minute winter	18	10	51.854	0.127	49.0	0.1436	0.0000	OK
15 minute winter	19	10	51.338	0.133	75.8	0.1509	0.0000	OK
15 minute winter	20	10	48.776	0.218	180.0	0.2466	0.0000	OK
15 minute summer	21	9	47.633	0.253	213.1	0.2861	0.0000	OK
15 minute winter	13	10	47.540	0.142	33.7	0.1605	0.0000	OK
15 minute winter	15	10	47.386	0.198	137.0	0.2242	0.0000	OK
15 minute winter	14	10	47.557	0.082	11.5	0.0924	0.0000	OK
480 minute winter	24	472	47.074	1.008	6.3	1.1401	0.0000	SURCHARGED
480 minute winter	25	472	47.074	1.053	5.4	1.1907	0.0000	SURCHARGED
480 minute winter	26	472	47.073	1.110	4.9	1.2559	0.0000	FLOOD RISK
15 minute summer	26_OUT	1	45.884	0.000	4.6	0.0000	0.0000	OK
15 minute winter	4	11	48.939	1.139	95.5	1.2886	0.0000	SURCHARGED
15 minute winter	6	11	48.347	1.186	144.2	1.3416	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	5.4	0.253	0.113	0.8896	
480 minute winter	9	1.008	16	10.6	0.547	0.250	0.5966	
480 minute winter	16	1.009	22	8.7	0.548	0.205	0.5966	
480 minute winter	22	1.010	23	7.5	0.618	0.105	2.2534	
480 minute winter	23	1.011	24	6.1	0.550	0.084	1.6714	
15 minute winter	2	1.001	3	55.0	1.978	0.904	0.5995	
15 minute winter	3	1.002	4	82.5	3.890	0.480	0.8580	
15 minute winter	5	1.004	6	138.8	1.971	1.954	0.6662	
15 minute winter	7	1.006	8	146.5	2.080	2.072	2.4826	
15 minute winter	8	1.007	9	201.0	3.592	0.901	1.1064	
15 minute winter	11	3.000	12	9.9	0.388	0.138	1.3028	
15 minute winter	12	2.001	16	134.9	3.387	0.541	0.8535	
15 minute summer	10	2.000	12	25.3	2.259	0.186	0.7301	
15 minute winter	17	6.000	18	6.9	0.434	0.173	0.5444	
15 minute winter	18	6.001	19	49.1	2.062	0.551	0.4263	
15 minute winter	19	6.002	20	75.8	3.020	0.647	1.3076	
15 minute winter	20	6.003	21	180.1	3.575	0.715	0.8830	
15 minute summer	21	6.004	22	214.2	4.241	0.828	1.1679	
15 minute winter	13	4.000	15	33.6	0.816	0.465	2.0242	
15 minute winter	15	4.001	16	136.9	3.038	0.613	0.6300	
15 minute winter	14	5.000	15	11.5	0.735	0.286	0.6230	
480 minute winter	24	1.012	25	5.3	0.490	0.075	0.7624	
480 minute winter	25	1.013	26	4.7	0.248	0.067	0.9928	
480 minute winter	26	Hydro-Brake®	26_OUT	4.6				174.3
15 minute winter	4	1.003	5	85.3	1.212	0.692	3.4396	
15 minute winter	6	1.005	7	142.9	2.029	1.990	0.5015	