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Surface Water and Foul Water Drainage Strategy

SeAH Monopile Facility, Teesport

L05858-CLK-ZZ-EX.ZZ-TN-C-0001

SeAH Wind Ltd.

Report No.	Date.
SeAH-CLK-ZZ-EX.ZZ-TN-C-0001	12/04/22

Project
SeAH Monopile Facility

Client Name
SeAH Wind Ltd.

Issue Date/ Number	Status	Description of Amendments
12/04/2022	S2	First Issue

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Contents

1 Introduction

1.1.1 SeAH Wind Ltd. will develop a Monopile Manufacturing Facility in Teesport, North Yorkshire, United Kingdom.

1.1.2 This report has been produced by Clarkebond (UK) Limited on behalf of SeAH Wind Ltd. to set out the strategy for disposal of Surface Water and Foul Water from the proposed development so as not to cause flooding to the site or third party land.

2 Planning Condition

The planning conditions related to drainage is outline Condition 13. For clarity the wording of the condition is as follows:

> *Prior to the commencement of the development, or in accordance with the phasing plan agreed through discharge of condition 4, a detailed scheme for the disposal of foul and surface water from the development hereby approved shall be submitted to and approved in writing by the Local Planning Authority in consultation with Northumbrian Water and the Lead Local Flood Authority. Thereafter the development shall take place in accordance with the approved details.*

This report provides the details required to clear this condition.

3 Surface Water Drainage

The surface water drainage is divided into 4 separate networks which are indicated in Figure 1 below.

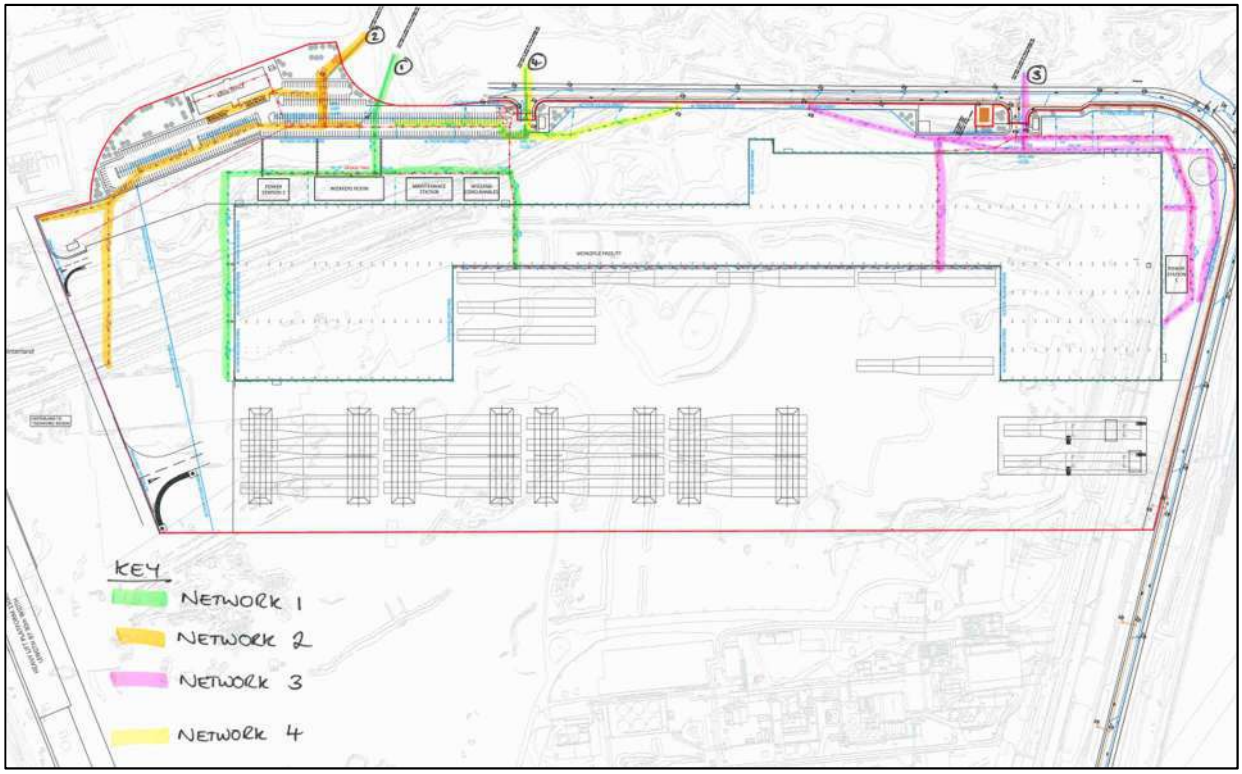

Figure 1 - Surface Water Networks

Network 1 will be draining approximately 4.2ha (hectares) of clean surface water runoff from the roofs of the Monopile Facility, Power Station 2, Workers Room, Maintenance Station and Welding Consumables. It will discharge into an existing manhole within the curtilage of the site, fitted with a non-return valve and discharges freely into the South Bank Arterial Drainage Channel as seen in Appendix C.

Network 2 will be draining approximately 5.5ha of surface water runoff from the concrete service yard, tarmac car parking areas and Main Office building. The runoff will pass through a petrol interceptor before discharging into an existing manhole within the curtilage of the site, fitted with a non-return valve and discharges freely into the South Bank Arterial Drainage Channel.

Network 3 will be draining approximately 7.7ha of surface water runoff from the Monopile Facility, Power Station 1 and tarmac areas surrounding the building where HGV's will be tracking. The network is separated so that the clean surface water discharge from the buildings will connect downstream of a petrol interceptor and the runoff for the tarmac areas will pass through the petrol interceptor before connecting into an existing manhole within the curtilage of the site, fitted with a non-return valve and discharging freely into the South Bank Arterial Drainage Channel.

Network 4 will be draining approximately 2.5ha of surface water runoff from the tarmac car parking area. The runoff will pass through a petrol interceptor before discharging into an existing manhole within the curtilage of the site, fitted with a non-return valve and discharging freely into the South Bank Arterial Drainage Channel.

4 Foul Water Drainage

The foul water drainage is separated into two separate networks which are indicated in Figure 2 below.

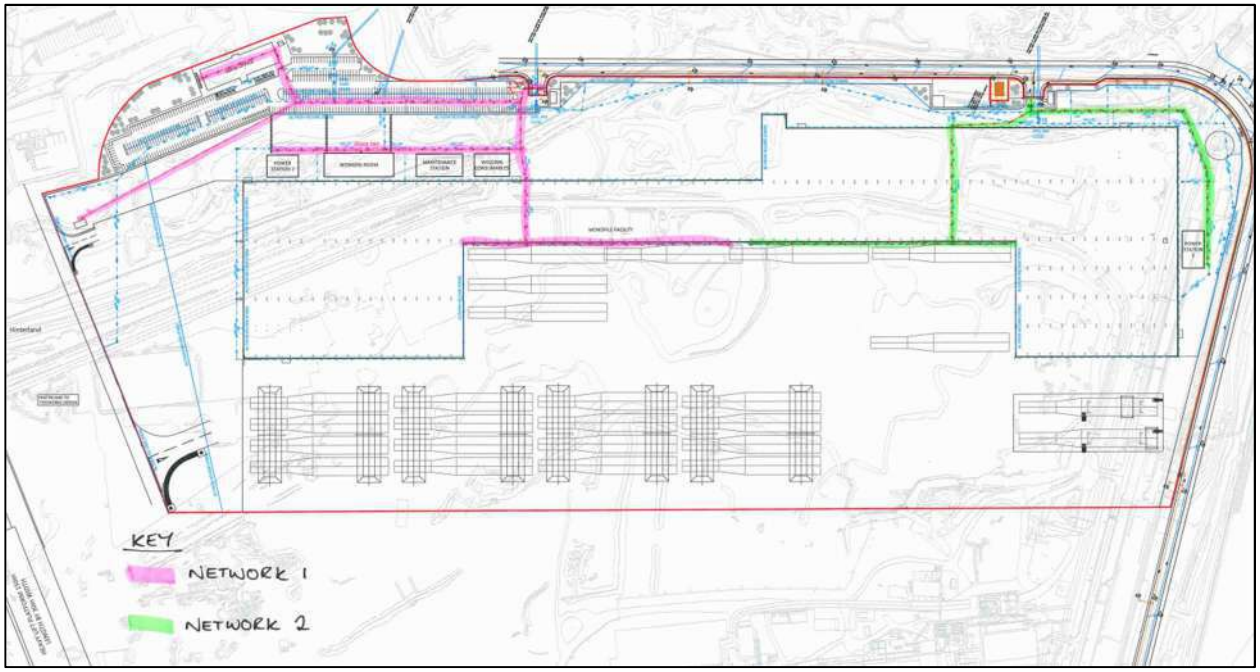

Figure 2 - Foul Water Networks

Network 1 will be taking half of the development via gravity to a package pump station chamber at the boundary of the development which will then pump water into the existing system within the access road. There will be a grease trap outside the Workers Room prevent grease and fats from the kitchen entering the foul network and blocking the pipework. The gatehouse located at the northern side of the development near the quay will require a small package pump station and pumped main that will discharge into a manhole within the development, then discharging via gravity to the aforementioned package pump station at the boundary of the development. A chemical dosing unit will be installed where required.

Network 2 will be taking the other half of the development via gravity to a proposed manhole on the boundary of the development which will then discharge into the existing system within the access road via gravity. A chemical dosing unit will be installed where required.

5 Operation and Maintenance

The system will remain entirely private and will be owned and maintained by the Management Company appointed by SeAH Wind Ltd. The Operation and Maintenance manual document reference is SEAH-CLK-ZZ-EX.ZZ-RP-C-0001(Drainage Operation and Maintenance Manual).

6 Conclusion

Figure 3 below summarises the key features of the Surface Water systems, which will discharge freely into the South Bank Arterial Drainage Channel.

Surface Water System Summary				
Network	**Area(ha)**	**Largest Pipe Dia.**	**Peak Outfall Discharge**	**Notes**
1	4.2	750mm	1304l/s	
2	5.5	900mm	1575l/s	Requires Interceptor
3	7.7	900mm	2555l/s	Requires Interceptor
4	2.5	600mm	915l/s	Requires Interceptor

Figure 3 - SWS Summary

The foul water system pipe sizing and requirements are subject to detailed design following confirmation of the number of heads at any one time on site, there may also be future requirements of items such as chemical dosing units.

7 APPENDICES

Appendix A – Proposed Drainage Strategy

Appendix B – MicroDrainage Calculations

Appendix C – South Bank Arterial Drainage

Appendix A – Proposed Drainage Strategy

KEY

- PROPOSED SURFACE WATER DRAINAGE
- PROPOSED FOUL WATER DRAINAGE
- PROPOSED FOUL RISING MAIN
- BUILDING PERIMETER LAND DRAIN
- ALTHON HD1000 (C250, D400, F900 - SEE PLAN)
- SURFACE WATER SYSTEM (BY OTHERS)
- FOUL WATER SYSTEM (BY OTHERS)
- PETROL INTERCEPTOR
- GREASE TRAP

NOTE: PIPE DIAMETERS AND GRADIENTS TO BE CONFIRMED SUBJECT TO DETAILED DESIGN.

0 10 20 30 40 50 60 70 80 90 100

SCALE 1:1000 (A0) METRES

CDM RESIDUAL RISKS

The work shown on this drawing is both familiar to the designers and routinely safely built in similar circumstances by competent contractors.
Risks are considered significant.
~~Relevant data is included in the Pre-Construction Information Pack.~~

Signed: S.IHLE **Date:** 11/04/2022

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4. THE CONTRACTOR IS TO BE RESPONSIBLE FOR ALL DIMENSIONS, LEVELS AND FOR THE CORRECT SETTING OUT OF ALL WORKS ON SITE.
5. ALL WORKS ARE TO COMPLY WITH THE RELEVANT STANDARDS AND CODES OF PRACTICE AND TO THE APPROVAL OF THE LOCAL AUTHORITY FOR BUILDING REGULATIONS
6. INTERNAL DRAIN RUNS AND CONNECTION POINTS TO BE CONFIRMED AT DETAILED DESIGN.

Rev.	Description	By	Chk	Date
P02	SW PIPE DIAMETERS UPDATED	JLH	SI	11.04.22
P01	PLANNING	JLH	SI	08.04.22

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BRISTOL EXETER LONDON

Client: SeAH

Project: SeAH MONOPILE FACILITY

Drawing Title: DRAINAGE STRATEGY LAYOUT

Drawing Status: SUITABLE FOR INFORMATION S2

Drawing No.: SEAH-CLK-ZZ-EX.ZZ-DR-C-1500

Clarkebond Project No.	Scale	Revision
L05858	1/1000	P02

Drawn	Checked	Sheet Size	Date of First Issue
JLH	SI	A0	08/04/22

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Appendix B – MicroDrainage Calculations

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Surface Network 1

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	17.900	Add Flow / Climate Change (%)	0
Ratio R	0.350	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Surface Network 1

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	1.572	4-8	2.585

Total Area Contributing (ha) = 4.157

Total Pipe Volume (m³) = 191.918

Network Design Table for Surface Network 1

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	52.000	0.173	300.0	0.000	5.00	0.0	0.600	o	750	Pipe/Conduit	
1.001	50.000	0.167	300.0	1.576	0.00	0.0	0.600	o	750	Pipe/Conduit	
1.002	80.000	0.267	300.0	1.363	0.00	0.0	0.600	o	750	Pipe/Conduit	
1.003	70.000	0.233	300.0	0.075	0.00	0.0	0.600	o	750	Pipe/Conduit	
1.004	58.605	0.219	267.4	0.066	0.00	0.0	0.600	o	750	Pipe/Conduit	
2.000	58.300	0.259	225.0	0.803	5.00	0.0	0.600	o	450	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	5.54	7.978	0.000	0.0	0.0	0.0	1.61	711.5	0.0
1.001	50.00	6.06	7.804	1.576	0.0	0.0	0.0	1.61	711.5	213.5
1.002	50.00	6.88	7.638	2.939	0.0	0.0	0.0	1.61	711.5	398.0
1.003	50.00	7.61	7.371	3.014	0.0	0.0	0.0	1.61	711.5	408.1
1.004	50.00	8.18	7.138	3.080	0.0	0.0	0.0	1.71	754.0	417.0
2.000	50.00	5.72	8.125	0.803	0.0	0.0	0.0	1.35	214.9	108.8

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Network Design Table for Surface Network 1

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
2.001	26.175	0.116	225.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
2.002	11.792	0.052	225.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
2.003	90.000	0.400	225.0	0.191	0.00	0.0	0.600	o	450	Pipe/Conduit	
2.004	17.677	0.079	225.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.005	50.390	1.819	27.7	0.083	0.00	0.0	0.600	o	750	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
2.001	50.00	6.04	7.866	0.803	0.0	0.0	0.0	1.35	214.9	108.8
2.002	50.00	6.19	7.750	0.803	0.0	0.0	0.0	1.35	214.9	108.8
2.003	50.00	7.30	7.697	0.995	0.0	0.0	0.0	1.35	214.9	134.7
2.004	50.00	7.52	7.297	0.995	0.0	0.0	0.0	1.35	214.9	134.7
1.005	50.00	8.34	6.919	4.157	0.0	0.0	0.0	5.33	2354.1	562.9

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Area Summary for Surface Network 1

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.000	0.000	0.000
1.001	User	-	100	1.576	1.576	1.576
1.002	User	-	100	1.363	1.363	1.363
1.003	User	-	100	0.075	0.075	0.075
1.004	User	-	100	0.066	0.066	0.066
2.000	User	-	100	0.803	0.803	0.803
2.001	-	-	100	0.000	0.000	0.000
2.002	-	-	100	0.000	0.000	0.000
2.003	User	-	100	0.191	0.191	0.191
2.004	-	-	100	0.000	0.000	0.000
1.005	User	-	100	0.083	0.083	0.083
				Total	Total	Total
				4.157	4.157	4.157

Simulation Criteria for Surface Network 1

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

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

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	17.900	Storm Duration (mins)	30
Ratio R	0.350		

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 1

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.350
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	17.900	Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.000	S1	15 Winter	1	+0%	100/15 Summer			
1.001	S2	15 Winter	1	+0%	100/15 Summer			
1.002	S3	15 Winter	1	+0%	100/15 Summer			
1.003	S4	15 Winter	1	+0%	100/15 Summer			
1.004	S5	15 Winter	1	+0%	100/15 Summer			
2.000	S8	15 Winter	1	+0%	30/15 Summer	100/15 Summer		
2.001	S9	15 Winter	1	+0%	30/15 Summer			
2.002	S10	15 Winter	1	+0%	30/15 Summer			
2.003	S11	15 Winter	1	+0%	30/15 Summer			
2.004	S12	15 Winter	1	+0%	30/15 Summer			
1.005	S6	15 Winter	1	+0%				

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	S1	8.081	-0.647	0.000	0.00			1.1	OK	

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 1

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.001	S2	8.081	-0.474	0.000	0.24			142.1	OK	
1.002	S3	7.974	-0.414	0.000	0.41			260.1	OK	
1.003	S4	7.709	-0.412	0.000	0.41			259.0	OK	
1.004	S5	7.467	-0.421	0.000	0.40			258.1	OK	
2.000	S8	8.347	-0.228	0.000	0.47			92.5	OK	2
2.001	S9	8.092	-0.223	0.000	0.50			90.9	OK	
2.002	S10	7.996	-0.203	0.000	0.58			90.1	OK	
2.003	S11	7.930	-0.217	0.000	0.50			102.0	OK	
2.004	S12	7.549	-0.198	0.000	0.60			101.6	OK	
1.005	S6	7.130	-0.539	0.000	0.18			349.4	OK	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 1

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model		FSR	Ratio R 0.350
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	17.900	Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.000	S1	15 Winter	30	+0%	100/15 Summer			
1.001	S2	15 Winter	30	+0%	100/15 Summer			
1.002	S3	15 Winter	30	+0%	100/15 Summer			
1.003	S4	15 Winter	30	+0%	100/15 Summer			
1.004	S5	15 Winter	30	+0%	100/15 Summer			
2.000	S8	15 Winter	30	+0%	30/15 Summer	100/15 Summer		
2.001	S9	15 Winter	30	+0%	30/15 Summer			
2.002	S10	15 Winter	30	+0%	30/15 Summer			
2.003	S11	15 Winter	30	+0%	30/15 Summer			
2.004	S12	15 Winter	30	+0%	30/15 Summer			
1.005	S6	15 Winter	30	+0%				

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
1.000	S1	8.365	-0.363	0.000	0.00			2.5	OK

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 1

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
1.001	S2	8.365	-0.190	0.000	0.57			344.4	OK
1.002	S3	8.286	-0.102	0.000	0.99			631.9	OK
1.003	S4	7.986	-0.135	0.000	1.00			624.3	OK
1.004	S5	7.721	-0.166	0.000	0.96			622.7	OK
2.000	S8	8.681	0.106	0.000	1.10			217.9	SURCHARGED
2.001	S9	8.462	0.146	0.000	1.05			190.6	SURCHARGED
2.002	S10	8.344	0.144	0.000	1.22			189.9	SURCHARGED
2.003	S11	8.234	0.087	0.000	1.04			212.0	SURCHARGED
2.004	S12	7.789	0.041	0.000	1.24			209.9	SURCHARGED
1.005	S6	7.256	-0.412	0.000	0.42			830.4	OK

PN	US/MH Name	Level Exceeded
1.000	S1	
1.001	S2	
1.002	S3	
1.003	S4	
1.004	S5	
2.000	S8	2
2.001	S9	
2.002	S10	
2.003	S11	
2.004	S12	
1.005	S6	

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

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model		FSR	Ratio R 0.350
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	17.900	Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.000	S1	15 Winter	100	+30%	100/15 Summer			
1.001	S2	15 Winter	100	+30%	100/15 Summer			
1.002	S3	15 Winter	100	+30%	100/15 Summer			
1.003	S4	15 Winter	100	+30%	100/15 Summer			
1.004	S5	15 Winter	100	+30%	100/15 Summer			
2.000	S8	15 Winter	100	+30%	30/15 Summer	100/15 Summer		
2.001	S9	15 Winter	100	+30%	30/15 Summer			
2.002	S10	15 Winter	100	+30%	30/15 Summer			
2.003	S11	15 Winter	100	+30%	30/15 Summer			
2.004	S12	15 Winter	100	+30%	30/15 Summer			
1.005	S6	15 Winter	100	+30%				

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
1.000	S1	9.446	0.718	0.000	0.02			9.6	SURCHARGED

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
1.001	S2	9.450	0.895	0.000	0.89			532.3	SURCHARGED
1.002	S3	9.339	0.951	0.000	1.54			978.8	SURCHARGED
1.003	S4	8.711	0.590	0.000	1.55			971.7	SURCHARGED
1.004	S5	8.137	0.250	0.000	1.49			969.5	SURCHARGED
2.000	S8	10.007	1.432	6.767	1.43			283.3	FLOOD
2.001	S9	9.566	1.250	0.000	1.54			279.5	SURCHARGED
2.002	S10	9.296	1.097	0.000	1.79			279.1	SURCHARGED
2.003	S11	9.062	0.915	0.000	1.60			324.9	SURCHARGED
2.004	S12	7.981	0.234	0.000	1.92			324.5	SURCHARGED
1.005	S6	7.364	-0.305	0.000	0.66			1303.7	OK

PN	US/MH Name	Level Exceeded
1.000	S1	
1.001	S2	
1.002	S3	
1.003	S4	
1.004	S5	
2.000	S8	2
2.001	S9	
2.002	S10	
2.003	S11	
2.004	S12	
1.005	S6	

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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Surface Network 2

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	17.900	Add Flow / Climate Change (%)	0
Ratio R	0.350	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Surface Network 2

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	1.907	4-8	3.141	8-12	0.407

Total Area Contributing (ha) = 5.455

Total Pipe Volume (m³) = 205.974

Network Design Table for Surface Network 2

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	70.000	0.233	300.0	1.233	5.00	0.0	0.600	o	600	Pipe/Conduit	
1.001	70.000	0.233	300.0	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
2.000	60.000	0.512	117.1	0.821	5.00	0.0	0.600	o	450	Pipe/Conduit	
1.002	38.682	0.129	300.0	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
1.003	70.000	0.156	450.0	1.930	0.00	0.0	0.600	o	900	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	5.83	6.914	1.233	0.0	0.0	0.0	1.40	396.0	166.9
1.001	50.00	6.67	6.681	1.233	0.0	0.0	0.0	1.40	396.0	166.9
2.000	50.00	5.53	6.954	0.821	0.0	0.0	0.0	1.88	298.6	111.2
1.002	50.00	7.07	6.099	2.054	0.0	0.0	0.0	1.61	711.5	278.2
1.003	50.00	7.86	5.716	3.984	0.0	0.0	0.0	1.47	935.5	539.4

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Network Design Table for Surface Network 2

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.004	41.002	0.091	450.0	0.145	0.00	0.0	0.600	o	900	Pipe/Conduit	
1.005	58.370	0.130	450.0	0.710	0.00	0.0	0.600	o	900	Pipe/Conduit	
3.000	30.000	0.805	37.3	0.418	5.00	0.0	0.600	o	300	Pipe/Conduit	
1.006	16.000	0.036	450.0	0.000	0.00	0.0	0.600	o	900	Pipe/Conduit	
1.007	12.105	0.027	450.0	0.000	0.00	0.0	0.600	o	900	Pipe/Conduit	
4.000	60.000	0.794	75.6	0.091	5.00	0.0	0.600	o	225	Pipe/Conduit	
4.001	46.130	0.383	120.4	0.107	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.008	12.242	0.027	453.4	0.000	0.00	0.0	0.600	o	900	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.004	50.00	8.32	5.560	4.129	0.0	0.0	0.0	1.47	935.5	559.1
1.005	50.00	8.99	5.469	4.839	0.0	0.0	0.0	1.47	935.5	655.3
3.000	50.00	5.19	7.805	0.418	0.0	0.0	0.0	2.58	182.7	56.7
1.006	50.00	9.17	5.340	5.258	0.0	0.0	0.0	1.47	935.5	712.0
1.007	50.00	9.30	5.304	5.258	0.0	0.0	0.0	1.47	935.5	712.0
4.000	50.00	5.66	8.294	0.091	0.0	0.0	0.0	1.51	59.9	12.3
4.001	50.00	6.31	7.500	0.198	0.0	0.0	0.0	1.19	47.3	26.8
1.008	50.00	9.44	5.277	5.455	0.0	0.0	0.0	1.46	931.9	738.7

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Area Summary for Surface Network 2

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	User	-	100	1.233	1.233	1.233
1.001	-	-	100	0.000	0.000	0.000
2.000	User	-	100	0.821	0.821	0.821
1.002	-	-	100	0.000	0.000	0.000
1.003	User	-	100	0.168	0.168	0.168
	User	-	100	0.138	0.138	0.307
	User	-	100	1.623	1.623	1.930
1.004	User	-	100	0.145	0.145	0.145
1.005	User	-	100	0.353	0.353	0.353
	User	-	100	0.357	0.357	0.710
3.000	User	-	100	0.194	0.194	0.194
	User	-	100	0.225	0.225	0.418
1.006	-	-	100	0.000	0.000	0.000
1.007	-	-	100	0.000	0.000	0.000
4.000	User	-	100	0.091	0.091	0.091
4.001	User	-	100	0.107	0.107	0.107
1.008	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				5.455	5.455	5.455

Free Flowing Outfall Details for Surface Network 2

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.008	S22	9.657	5.250	0.000	1800	0

Simulation Criteria for Surface Network 2

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

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

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	17.900	Storm Duration (mins)	30
Ratio R	0.350		

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 2

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.350
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	17.900	Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.000	S13	15 Winter	1	+0%	100/15 Summer	100/15 Summer		
1.001	S14	15 Winter	1	+0%	100/15 Summer			
2.000	S25	15 Winter	1	+0%	100/15 Summer	100/15 Summer		
1.002	S15	15 Winter	1	+0%	30/15 Winter			
1.003	S16	15 Winter	1	+0%	30/15 Summer			
1.004	S17	15 Winter	1	+0%	30/15 Summer			
1.005	S18	15 Winter	1	+0%	30/15 Summer			
3.000	S51	15 Winter	1	+0%	100/15 Summer			
1.006	S19	15 Winter	1	+0%	30/15 Summer			
1.007	S20	15 Winter	1	+0%	30/15 Summer			
4.000	S23	15 Winter	1	+0%	100/15 Summer			
4.001	S24	15 Winter	1	+0%	30/15 Summer			
1.008	S21	15 Winter	1	+0%	30/15 Summer			

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 2

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	S13	7.181	-0.333	0.000	0.39			140.1	OK	4
1.001	S14	6.938	-0.343	0.000	0.38			137.1	OK	
2.000	S25	7.140	-0.264	0.000	0.35			97.2	OK	4
1.002	S15	6.420	-0.428	0.000	0.38			220.9	OK	
1.003	S16	6.219	-0.397	0.000	0.47			378.0	OK	
1.004	S17	6.121	-0.339	0.000	0.48			354.2	OK	
1.005	S18	6.066	-0.303	0.000	0.50			387.6	OK	
3.000	S51	7.918	-0.187	0.000	0.30			49.4	OK	
1.006	S19	5.992	-0.248	0.000	0.79			388.9	OK	
1.007	S20	5.949	-0.255	0.000	0.89			385.9	OK	
4.000	S23	8.360	-0.159	0.000	0.18			10.5	OK	
4.001	S24	7.609	-0.116	0.000	0.47			21.1	OK	
1.008	S21	5.913	-0.264	0.000	0.91			395.1	OK	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 2

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.350
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	17.900	Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.000	S13	15 Winter	30	+0%	100/15 Summer	100/15 Summer		
1.001	S14	15 Winter	30	+0%	100/15 Summer			
2.000	S25	15 Winter	30	+0%	100/15 Summer	100/15 Summer		
1.002	S15	15 Winter	30	+0%	30/15 Winter			
1.003	S16	15 Winter	30	+0%	30/15 Summer			
1.004	S17	15 Winter	30	+0%	30/15 Summer			
1.005	S18	15 Winter	30	+0%	30/15 Summer			
3.000	S51	15 Winter	30	+0%	100/15 Summer			
1.006	S19	15 Winter	30	+0%	30/15 Summer			
1.007	S20	15 Winter	30	+0%	30/15 Summer			
4.000	S23	15 Winter	30	+0%	100/15 Summer			
4.001	S24	15 Winter	30	+0%	30/15 Summer			
1.008	S21	15 Winter	30	+0%	30/15 Summer			

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 2

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
1.000	S13	7.398	-0.116	0.000	0.96			343.1	OK
1.001	S14	7.137	-0.144	0.000	0.90			323.3	OK
2.000	S25	7.281	-0.123	0.000	0.85			234.1	OK
1.002	S15	6.975	0.126	0.000	0.79			457.6	SURCHARGED
1.003	S16	6.899	0.283	0.000	0.99			792.7	SURCHARGED
1.004	S17	6.773	0.313	0.000	1.08			794.8	SURCHARGED
1.005	S18	6.677	0.307	0.000	1.15			900.0	SURCHARGED
3.000	S51	7.998	-0.107	0.000	0.73			121.0	OK
1.006	S19	6.505	0.266	0.000	1.93			950.1	SURCHARGED
1.007	S20	6.410	0.206	0.000	2.18			949.1	SURCHARGED
4.000	S23	8.401	-0.118	0.000	0.45			25.8	OK
4.001	S24	7.870	0.145	0.000	1.18			53.4	SURCHARGED
1.008	S21	6.294	0.117	0.000	2.26			977.9	SURCHARGED

PN	US/MH Name	Level Exceeded
1.000	S13	4
1.001	S14	
2.000	S25	4
1.002	S15	
1.003	S16	
1.004	S17	
1.005	S18	
3.000	S51	
1.006	S19	
1.007	S20	
4.000	S23	
4.001	S24	
1.008	S21	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 2

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.350
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	17.900	Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.000	S13	15 Winter	100	+30%	100/15 Summer	100/15 Summer		
1.001	S14	15 Winter	100	+30%	100/15 Summer			
2.000	S25	15 Winter	100	+30%	100/15 Summer	100/15 Summer		
1.002	S15	15 Winter	100	+30%	30/15 Winter			
1.003	S16	15 Winter	100	+30%	30/15 Summer			
1.004	S17	15 Winter	100	+30%	30/15 Summer			
1.005	S18	15 Winter	100	+30%	30/15 Summer			
3.000	S51	15 Winter	100	+30%	100/15 Summer			
1.006	S19	15 Winter	100	+30%	30/15 Summer			
1.007	S20	15 Winter	100	+30%	30/15 Summer			
4.000	S23	15 Winter	100	+30%	100/15 Summer			
4.001	S24	15 Winter	100	+30%	30/15 Summer			
1.008	S21	15 Winter	100	+30%	30/15 Summer			

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 2

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
1.000	S13	8.741	1.227	27.731	1.34			480.0	FLOOD
1.001	S14	8.683	1.402	0.000	1.05			376.1	FLOOD RISK
2.000	S25	8.623	1.219	19.524	1.15			316.7	FLOOD
1.002	S15	8.552	1.703	0.000	1.02			591.3	SURCHARGED
1.003	S16	8.469	1.853	0.000	1.46			1168.5	SURCHARGED
1.004	S17	8.190	1.730	0.000	1.62			1193.7	SURCHARGED
1.005	S18	7.924	1.554	0.000	1.77			1386.3	SURCHARGED
3.000	S51	8.395	0.290	0.000	1.16			193.2	SURCHARGED
1.006	S19	7.498	1.258	0.000	3.05			1498.5	SURCHARGED
1.007	S20	7.048	0.843	0.000	3.46			1503.4	SURCHARGED
4.000	S23	8.918	0.399	0.000	0.67			38.8	SURCHARGED
4.001	S24	8.570	0.845	0.000	1.78			80.5	SURCHARGED
1.008	S21	6.595	0.418	0.000	3.64			1574.7	SURCHARGED

PN	US/MH Name	Level Exceeded
1.000	S13	4
1.001	S14	
2.000	S25	4
1.002	S15	
1.003	S16	
1.004	S17	
1.005	S18	
3.000	S51	
1.006	S19	
1.007	S20	
4.000	S23	
4.001	S24	
1.008	S21	

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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Surface Network 3

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	17.900	Add Flow / Climate Change (%)	0
Ratio R	0.350	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Surface Network 3

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	2.414	4-8	4.834	8-12	0.432

Total Area Contributing (ha) = 7.681

Total Pipe Volume (m³) = 382.648

Network Design Table for Surface Network 3

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	58.466	0.130	450.0	0.529	5.00	0.0	0.600	o	600	Pipe/Conduit	
1.001	72.952	0.162	450.0	0.277	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.002	80.000	0.178	450.0	0.261	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.003	81.398	0.181	450.0	0.300	0.00	0.0	0.600	o	600	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	5.85	6.923	0.529	0.0	0.0	0.0	1.14	322.7	71.6
1.001	50.00	6.92	6.793	0.805	0.0	0.0	0.0	1.14	322.7	109.0
1.002	50.00	8.09	6.631	1.066	0.0	0.0	0.0	1.14	322.7	144.3
1.003	50.00	9.28	6.453	1.366	0.0	0.0	0.0	1.14	322.7	184.9

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Network Design Table for Surface Network 3

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
2.000	90.000	0.400	225.0	0.484	5.00	0.0	0.600	o	450	Pipe/Conduit	
2.001	80.000	0.356	225.0	0.266	0.00	0.0	0.600	o	450	Pipe/Conduit	
2.002	15.767	0.212	74.3	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.004	4.500	0.010	450.0	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
1.005	4.500	0.010	450.0	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
3.000	30.000	0.067	450.0	1.428	5.00	0.0	0.600	o	750	Pipe/Conduit	
3.001	80.000	0.178	450.0	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
4.000	23.000	1.317	17.5	1.370	5.00	0.0	0.600	o	600	Pipe/Conduit	
3.002	64.734	0.144	450.0	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
3.003	60.000	0.133	450.0	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
3.004	65.266	0.145	450.0	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
5.000	103.300	0.459	225.0	2.766	5.00	0.0	0.600	o	900	Pipe/Conduit	
5.001	10.651	0.047	225.0	0.000	0.00	0.0	0.600	o	900	Pipe/Conduit	
5.002	73.947	0.594	124.6	0.000	0.00	0.0	0.600	o	900	Pipe/Conduit	
1.006	12.199	0.027	450.0	0.000	0.00	0.0	0.600	o	900	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
2.000	50.00	6.11	7.818	0.484	0.0	0.0	0.0	1.35	214.9	65.6
2.001	50.00	7.10	7.418	0.751	0.0	0.0	0.0	1.35	214.9	101.7
2.002	50.00	7.21	7.062	0.751	0.0	0.0	0.0	2.36	375.5	101.7
1.004	50.00	9.33	6.122	2.117	0.0	0.0	0.0	1.31	579.9	286.6
1.005	50.00	9.39	6.112	2.117	0.0	0.0	0.0	1.31	579.9	286.6
3.000	50.00	5.38	6.769	1.428	0.0	0.0	0.0	1.31	579.9	193.4
3.001	50.00	6.40	6.702	1.428	0.0	0.0	0.0	1.31	579.9	193.4
4.000	50.00	5.07	7.991	1.370	0.0	0.0	0.0	5.85	1652.9	185.5
3.002	50.00	7.22	6.524	2.798	0.0	0.0	0.0	1.31	579.9	378.9
3.003	50.00	7.98	6.380	2.798	0.0	0.0	0.0	1.31	579.9	378.9
3.004	50.00	8.81	6.247	2.798	0.0	0.0	0.0	1.31	579.9	378.9
5.000	50.00	5.83	7.900	2.766	0.0	0.0	0.0	2.08	1326.3	374.6
5.001	50.00	5.91	7.441	2.766	0.0	0.0	0.0	2.08	1326.3	374.6
5.002	50.00	6.35	7.394	2.766	0.0	0.0	0.0	2.81	1785.2	374.6
1.006	50.00	9.53	5.952	7.681	0.0	0.0	0.0	1.47	935.5«	1040.1

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Area Summary for Surface Network 3

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	User	-	100	0.529	0.529	0.529
1.001	User	-	100	0.277	0.277	0.277
1.002	User	-	100	0.261	0.261	0.261
1.003	User	-	100	0.300	0.300	0.300
2.000	User	-	100	0.484	0.484	0.484
2.001	User	-	100	0.266	0.266	0.266
2.002	-	-	100	0.000	0.000	0.000
1.004	-	-	100	0.000	0.000	0.000
1.005	-	-	100	0.000	0.000	0.000
3.000	User	-	100	1.428	1.428	1.428
3.001	-	-	100	0.000	0.000	0.000
4.000	User	-	100	1.370	1.370	1.370
3.002	-	-	100	0.000	0.000	0.000
3.003	-	-	100	0.000	0.000	0.000
3.004	-	-	100	0.000	0.000	0.000
5.000	User	-	100	2.766	2.766	2.766
5.001	-	-	100	0.000	0.000	0.000
5.002	-	-	100	0.000	0.000	0.000
1.006	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				7.681	7.681	7.681

Free Flowing Outfall Details for Surface Network 3

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.006	S32	9.740	5.925	0.000	1800	0

Simulation Criteria for Surface Network 3

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

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

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm)	17.900
Return Period (years)	100	Ratio R	0.350
Region	England and Wales	Profile Type	Summer

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Synthetic Rainfall Details

Cv (Summer) 0.750 Storm Duration (mins) 30
Cv (Winter) 0.840

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 3

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model		FSR	Ratio R 0.350
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	17.900	Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	S39	15 Winter	1	+0%	30/15 Winter				7.121
1.001	S40	15 Winter	1	+0%	30/15 Summer				7.013
1.002	S41	15 Winter	1	+0%	30/15 Summer				6.891
1.003	S42	15 Winter	1	+0%	30/15 Summer				6.838
2.000	S33	15 Winter	1	+0%	100/15 Summer				7.981
2.001	S34	15 Winter	1	+0%	100/15 Summer				7.614
2.002	S35	15 Winter	1	+0%	100/15 Summer				7.229
1.004	S36	15 Winter	1	+0%	30/15 Summer				6.788
1.005	S37	15 Winter	1	+0%	30/15 Summer				6.774
3.000	S26	15 Winter	1	+0%	30/15 Summer				7.107
3.001	S27	15 Winter	1	+0%	30/15 Summer				7.034
4.000	S38	15 Winter	1	+0%	100/15 Summer				8.142
3.002	S28	15 Winter	1	+0%	30/15 Summer				6.945
3.003	S29	15 Winter	1	+0%	30/15 Summer				6.898
3.004	S30	15 Winter	1	+0%	30/15 Summer				6.841
5.000	S43	15 Winter	1	+0%	100/15 Summer				8.222
5.001	S44	15 Winter	1	+0%	100/15 Summer				7.851
5.002	S45	15 Winter	1	+0%	100/15 Winter				7.665
1.006	S31	15 Winter	1	+0%	30/15 Summer				6.762

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 3

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	S39	-0.402	0.000	0.21			59.8	OK	
1.001	S40	-0.380	0.000	0.27			79.6	OK	
1.002	S41	-0.340	0.000	0.30			89.7	OK	
1.003	S42	-0.215	0.000	0.35			103.0	OK	
2.000	S33	-0.286	0.000	0.27			54.0	OK	
2.001	S34	-0.254	0.000	0.38			76.2	OK	
2.002	S35	-0.283	0.000	0.29			76.3	OK	
1.004	S36	-0.085	0.000	0.50			175.8	OK	
1.005	S37	-0.088	0.000	0.52			180.6	OK	
3.000	S26	-0.412	0.000	0.36			163.6	OK	
3.001	S27	-0.418	0.000	0.29			151.8	OK	
4.000	S38	-0.450	0.000	0.14			161.9	OK	
3.002	S28	-0.329	0.000	0.53			271.0	OK	
3.003	S29	-0.233	0.000	0.45			227.5	OK	
3.004	S30	-0.156	0.000	0.36			184.2	OK	
5.000	S43	-0.578	0.000	0.26			314.6	OK	
5.001	S44	-0.490	0.000	0.43			308.8	OK	
5.002	S45	-0.628	0.000	0.20			306.0	OK	
1.006	S31	-0.090	0.000	1.22			531.8	OK	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 3

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.350
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	17.900	Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	S39	15 Winter	30	+0%	30/15 Winter				7.525
1.001	S40	15 Winter	30	+0%	30/15 Summer				7.467
1.002	S41	15 Winter	30	+0%	30/15 Summer				7.431
1.003	S42	15 Winter	30	+0%	30/15 Summer				7.381
2.000	S33	15 Winter	30	+0%	100/15 Summer				8.096
2.001	S34	15 Winter	30	+0%	100/15 Summer				7.778
2.002	S35	15 Winter	30	+0%	100/15 Summer				7.372
1.004	S36	15 Winter	30	+0%	30/15 Summer				7.305
1.005	S37	15 Winter	30	+0%	30/15 Summer				7.286
3.000	S26	15 Winter	30	+0%	30/15 Summer				7.863
3.001	S27	15 Winter	30	+0%	30/15 Summer				7.823
4.000	S38	15 Winter	30	+0%	100/15 Summer				8.236
3.002	S28	15 Winter	30	+0%	30/15 Summer				7.771
3.003	S29	15 Winter	30	+0%	30/15 Summer				7.624
3.004	S30	15 Winter	30	+0%	30/15 Summer				7.457
5.000	S43	15 Winter	30	+0%	100/15 Summer				8.447
5.001	S44	15 Winter	30	+0%	100/15 Summer				8.182
5.002	S45	15 Winter	30	+0%	100/15 Winter				7.826
1.006	S31	15 Winter	30	+0%	30/15 Summer				7.267

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 3

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	S39	0.003	0.000	0.50			144.9	SURCHARGED	
1.001	S40	0.074	0.000	0.62			181.9	SURCHARGED	
1.002	S41	0.200	0.000	0.53			157.1	SURCHARGED	
1.003	S42	0.328	0.000	0.60			178.8	SURCHARGED	
2.000	S33	-0.172	0.000	0.65			132.3	OK	
2.001	S34	-0.089	0.000	0.96			193.0	OK	
2.002	S35	-0.140	0.000	0.73			189.4	OK	
1.004	S36	0.433	0.000	1.00			349.2	SURCHARGED	
1.005	S37	0.424	0.000	1.00			350.6	SURCHARGED	
3.000	S26	0.345	0.000	0.84			377.5	SURCHARGED	
3.001	S27	0.371	0.000	0.61			314.2	SURCHARGED	
4.000	S38	-0.356	0.000	0.35			396.9	OK	
3.002	S28	0.497	0.000	1.21			615.2	SURCHARGED	
3.003	S29	0.494	0.000	1.15			575.9	SURCHARGED	
3.004	S30	0.460	0.000	1.08			545.8	SURCHARGED	
5.000	S43	-0.353	0.000	0.65			771.8	OK	
5.001	S44	-0.159	0.000	1.00			720.8	OK	
5.002	S45	-0.468	0.000	0.47			719.6	OK	
1.006	S31	0.415	0.000	3.60			1570.7	SURCHARGED	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 3

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.350
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	17.900	Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	S39	15 Winter	100	+30%	30/15 Winter				8.869
1.001	S40	15 Winter	100	+30%	30/15 Summer				8.824
1.002	S41	15 Winter	100	+30%	30/15 Summer				8.736
1.003	S42	15 Winter	100	+30%	30/15 Summer				8.557
2.000	S33	15 Winter	100	+30%	100/15 Summer				9.027
2.001	S34	15 Winter	100	+30%	100/15 Summer				8.817
2.002	S35	15 Winter	100	+30%	100/15 Summer				8.424
1.004	S36	15 Winter	100	+30%	30/15 Summer				8.263
1.005	S37	15 Winter	100	+30%	30/15 Summer				8.204
3.000	S26	15 Winter	100	+30%	30/15 Summer				9.496
3.001	S27	15 Winter	100	+30%	30/15 Summer				9.436
4.000	S38	15 Winter	100	+30%	100/15 Summer				9.686
3.002	S28	15 Winter	100	+30%	30/15 Summer				9.316
3.003	S29	15 Winter	100	+30%	30/15 Summer				8.958
3.004	S30	15 Winter	100	+30%	30/15 Summer				8.557
5.000	S43	15 Winter	100	+30%	100/15 Summer				9.076
5.001	S44	15 Winter	100	+30%	100/15 Summer				8.550
5.002	S45	15 Winter	100	+30%	100/15 Winter				8.355
1.006	S31	15 Winter	100	+30%	30/15 Summer				8.095

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 3

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	S39	1.346	0.000	0.72			206.6	SURCHARGED	
1.001	S40	1.431	0.000	0.95			278.2	SURCHARGED	
1.002	S41	1.506	0.000	1.08			319.8	SURCHARGED	
1.003	S42	1.504	0.000	1.24			367.8	SURCHARGED	
2.000	S33	0.759	0.000	0.96			195.3	SURCHARGED	
2.001	S34	0.949	0.000	1.31			265.4	SURCHARGED	
2.002	S35	0.912	0.000	0.94			243.6	SURCHARGED	
1.004	S36	1.391	0.000	1.72			603.7	SURCHARGED	
1.005	S37	1.342	0.000	1.73			605.1	SURCHARGED	
3.000	S26	1.978	0.000	1.26			565.1	SURCHARGED	
3.001	S27	1.984	0.000	1.00			521.2	FLOOD RISK	
4.000	S38	1.095	0.000	0.53			609.4	FLOOD RISK	
3.002	S28	2.042	0.000	1.86			945.1	SURCHARGED	
3.003	S29	1.827	0.000	1.81			907.2	SURCHARGED	
3.004	S30	1.560	0.000	1.73			880.3	SURCHARGED	
5.000	S43	0.276	0.000	1.02			1217.9	SURCHARGED	
5.001	S44	0.210	0.000	1.70			1230.5	SURCHARGED	
5.002	S45	0.061	0.000	0.77			1183.3	SURCHARGED	
1.006	S31	1.243	0.000	5.86			2554.8	SURCHARGED	

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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Surface Network 4

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	17.900	Add Flow / Climate Change (%)	0
Ratio R	0.350	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Surface Network 4

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	1.382	4-8	1.111

Total Area Contributing (ha) = 2.493

Total Pipe Volume (m³) = 48.495

Network Design Table for Surface Network 4

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	90.000	0.300	300.0	1.173	5.00	0.0	0.600	o	525	Pipe/Conduit	
1.001	39.494	0.132	300.0	0.409	0.00	0.0	0.600	o	525	Pipe/Conduit	
2.000	90.000	0.400	225.0	0.578	5.00	0.0	0.600	o	375	Pipe/Conduit	
2.001	10.606	0.047	225.2	0.121	0.00	0.0	0.600	o	450	Pipe/Conduit	
2.002	16.000	0.515	31.1	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	6.16	5.761	1.173	0.0	0.0	0.0	1.29	278.8	158.9
1.001	50.00	6.68	5.461	1.582	0.0	0.0	0.0	1.29	278.8	214.3
2.000	50.00	6.25	7.712	0.578	0.0	0.0	0.0	1.20	133.0	78.3
2.001	50.00	6.38	7.312	0.699	0.0	0.0	0.0	1.35	214.8	94.7
2.002	50.00	6.45	7.265	0.699	0.0	0.0	0.0	3.66	581.8	94.7

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Network Design Table for Surface Network 4

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.002	5.000	0.017	300.0	0.212	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.003	17.250	0.058	300.0	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.002	50.00	6.74	5.254	2.493	0.0	0.0	0.0	1.40	396.0	337.6
1.003	50.00	6.94	5.238	2.493	0.0	0.0	0.0	1.40	396.0	337.6

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Area Summary for Surface Network 4

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	User	-	100	0.423	0.423	0.423
	User	-	100	0.751	0.751	1.173
1.001	User	-	100	0.409	0.409	0.409
2.000	User	-	100	0.333	0.333	0.333
	User	-	100	0.245	0.245	0.578
2.001	User	-	100	0.121	0.121	0.121
2.002	-	-	100	0.000	0.000	0.000
1.002	User	-	100	0.212	0.212	0.212
1.003	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				2.493	2.493	2.493

Simulation Criteria for Surface Network 4

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

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

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	17.900	Storm Duration (mins)	30
Ratio R	0.350		

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 4

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.350
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	17.900	Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	S46	15 Winter	1	+0%	30/15 Summer	100/15 Winter			6.036
1.001	S47	15 Winter	1	+0%	30/15 Summer				5.883
2.000	S52	15 Winter	1	+0%	30/15 Summer	100/15 Winter			7.910
2.001	S53	15 Winter	1	+0%	30/15 Winter				7.535
2.002	S54	15 Winter	1	+0%					7.394
1.002	S48	15 Winter	1	+0%	30/15 Summer				5.815
1.003	S49	15 Winter	1	+0%	30/15 Summer				5.625

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	S46	-0.250	0.000	0.50			129.7	OK	1
1.001	S47	-0.102	0.000	0.58			139.5	OK	
2.000	S52	-0.177	0.000	0.50			63.1	OK	1
2.001	S53	-0.227	0.000	0.49			74.5	OK	
2.002	S54	-0.321	0.000	0.18			74.3	OK	
1.002	S48	-0.039	0.000	1.00			215.2	OK	

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 4

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.003	S49	-0.212	0.000	0.75			215.2	OK	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 4

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.350
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	17.900	Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	S46	15 Winter	30	+0%	30/15 Summer	100/15 Winter			7.171
1.001	S47	15 Winter	30	+0%	30/15 Summer				6.753
2.000	S52	15 Winter	30	+0%	30/15 Summer	100/15 Winter			8.322
2.001	S53	15 Winter	30	+0%	30/15 Winter				7.777
2.002	S54	15 Winter	30	+0%					7.463
1.002	S48	15 Winter	30	+0%	30/15 Summer				6.416
1.003	S49	15 Winter	30	+0%	30/15 Summer				6.082

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	S46	0.885	0.000	1.11			289.9	SURCHARGED	1
1.001	S47	0.767	0.000	1.54			373.4	SURCHARGED	
2.000	S52	0.235	0.000	1.15			146.6	SURCHARGED	1
2.001	S53	0.015	0.000	1.05			158.8	SURCHARGED	
2.002	S54	-0.252	0.000	0.39			159.7	OK	
1.002	S48	0.562	0.000	2.65			569.4	SURCHARGED	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 4

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.003	S49	0.244	0.000	1.97			569.6	SURCHARGED	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 4

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.350
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	17.900	Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	S46	15 Winter	100	+30%	30/15 Summer	100/15 Winter			9.196
1.001	S47	15 Winter	100	+30%	30/15 Summer				8.269
2.000	S52	15 Winter	100	+30%	30/15 Summer	100/15 Winter			9.289
2.001	S53	15 Winter	100	+30%	30/15 Winter				7.923
2.002	S54	15 Winter	100	+30%					7.665
1.002	S48	15 Winter	100	+30%	30/15 Summer				7.446
1.003	S49	15 Winter	100	+30%	30/15 Summer				6.598

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	S46	2.910	1.651	1.75			457.0	FLOOD	1
1.001	S47	2.283	0.000	2.44			591.1	SURCHARGED	
2.000	S52	1.202	1.835	1.81			229.7	FLOOD	1
2.001	S53	0.161	0.000	1.75			266.3	SURCHARGED	
2.002	S54	-0.050	0.000	0.67			270.4	OK	
1.002	S48	1.591	0.000	4.25			914.9	SURCHARGED	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 4

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.003	S49	0.761	0.000	3.17			914.8	SURCHARGED	

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Appendix C – South Bank Arterial Drainage

1	Working near water	Working near water	Working near water
2	Unknown ground conditions		
3	Deep excavations		
4	Contaminated ground		
5	COMAH site	COMAH site	COMAH site
No.	Construction Risk	Maintenance Risk	Demolition Risk

In addition to the hazards/risks normally associated with the types of work detailed on this drawing take note of the above.

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION BOX

Drawing Notes

1. This drawing is to be read in conjunction with:-

   TW-SIZ-XX-JBAU-SB-00-DR-C-0001-Holme_Beck_Key_Plan
   TW-SIZ-XX-JBAU-SB-00-DR-C-0002-Holme_Beck_General_Arrangement_High_Tip_West
   TW-SIZ-XX-JBAU-SB-00-DR-C-0003-Holme_Beck_General_Arrangement_High_Tip_North
   TW-SIZ-XX-JBAU-SB-00-DR-C-0004-Holme_Beck_General_Arrangement_Inter_Tidal_Channel

   TW-SIZ-XX-JBAU-SB-00-DR-C-0101-Holme_Beck_Long_Section_Sheet_1_of_4
   TW-SIZ-XX-JBAU-SB-00-DR-C-0102-Holme_Beck_Long_Section_Sheet_2_of_4
   TW-SIZ-XX-JBAU-SB-00-DR-C-0103-Holme_Beck_Long_Section_Sheet_3_of_4
   TW-SIZ-XX-JBAU-SB-00-DR-C-0104-Holme_Beck_Long_Section_Sheet_4_of_4

   TW-SIZ-XX-JBAU-SB-00-DR-C-0201-Holme_Beck_Cross_Sections_Sheet_1_of_3
   TW-SIZ-XX-JBAU-SB-00-DR-C-0202-Holme_Beck_Cross_Sections_Sheet_2_of_3
   TW-SIZ-XX-JBAU-SB-00-DR-C-0203-Holme_Beck_Cross_Sections_Sheet_3_of_3

   TW-SIZ-XX-JBAU-SB-00-DR-C-0301-South_Bank_Details_Sheet_1_of_4
   TW-SIZ-XX-JBAU-SB-00-DR-C-0302-South_Bank_Details_Sheet_2_of_4
   TW-SIZ-XX-JBAU-SB-00-DR-C-0303-South_Bank_Details_Sheet_3_of_4
   TW-SIZ-XX-JBAU-SB-00-DR-C-0304-South_Bank_Details_Sheet_4_of_4

2. All dimensions are in metres unless noted otherwise.
3. All levels are in metres relative to ordnance datum Newlyn (mAOD) unless noted otherwise.
4. All coordinates are in metres relative to ordnance survey national grid.
5. Do not scale from this drawing. All dimensions must be checked/ verified on site.
6. For clarity purposes existing and proposed services have been omitted from this drawing.

C02	Comments	Minor changes								
Rev.:	Date	17/11/21	Drawn	MM	Designed	JA	Checked	ST	Approved	RD
C01	Comments	Issued For Planning Permission								
Rev.:	Date	11/11/21	Drawn	JN	Designed	JA	Checked	ST	Approved	RD
P01	Comments	First Issue								
Rev.:	Date	11/10/21	Drawn	JN	Designed	JA	Checked	ST	Approved	RD

Client Approval

- A - Approved
- B - Approved with Revisions
- C - Do Not Use

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Project

South Bank Arterial Drainage

Title

South Bank
Holme Beck
Key Plan
for

Client

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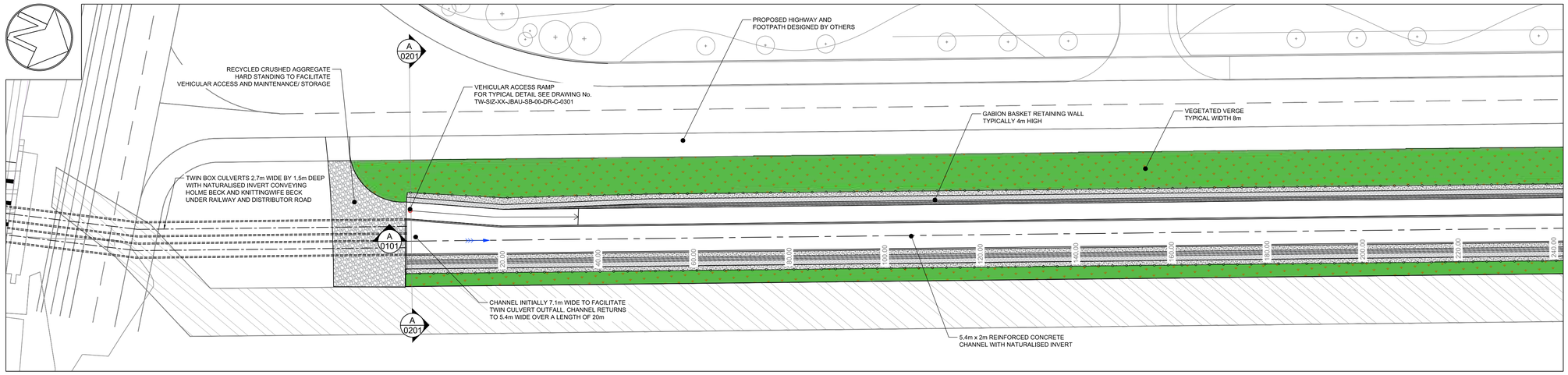
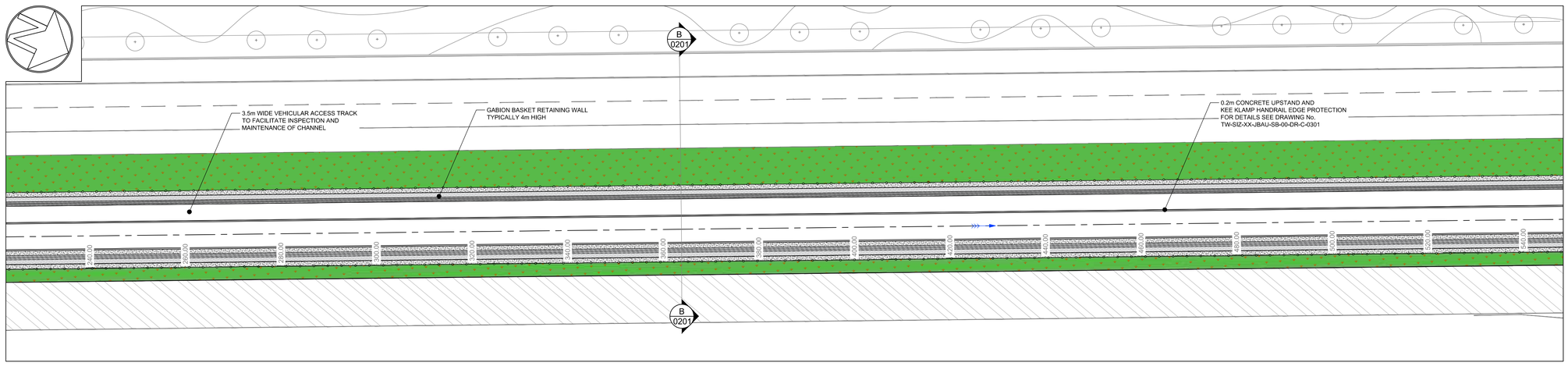
Drawn: J. Ness 06/09/2021	Designed: J. Alcock 06/09/2021		
Checked: S. Thomson 11/10/2021	Approved: R. Dobson 11/10/2021		
Project Reference: 2021s1087	Scale: 1:2500 @A1		
Drawing Number:	Status:	Revision:	Sheet Size:
TW-SIZ-XX-JBAU-SB-00-DR-C-0001	A1	C02	A1



SOUTH BANK CHANNEL - CHAINAGE 0 - 240m



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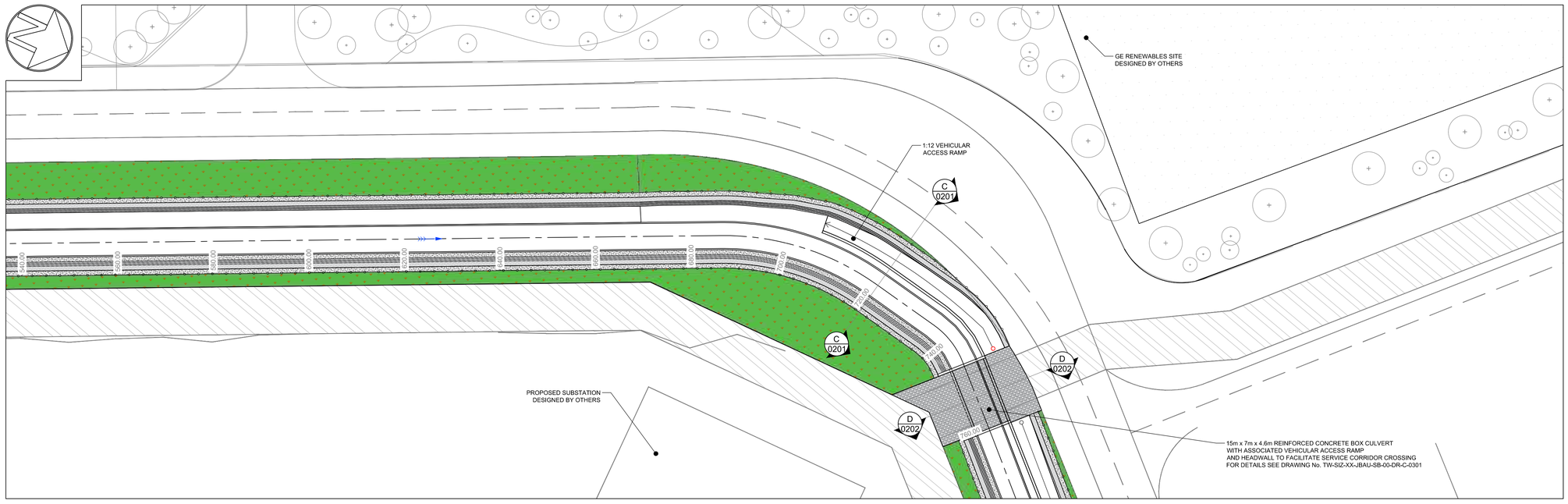

SOUTH BANK CHANNEL - CHAINAGE 540 - 760m

1	Working near water	Working near water	Working near water
2	Unknown ground conditions		
3	Deep excavations		
4	Contaminated ground		
5	COMAH site	COMAH site	COMAH site
No.	Construction Risk	Maintenance Risk	Demolition Risk

In addition to the hazards/risks normally associated with the types of work detailed on this drawing take note of the above.

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION BOX

Drawing Notes

1. This drawing is to be read in conjunction with:-

TW-SIZ-XX-JBAU-SB-00-DR-C-0001-Holme_Beck_Key_Plan
TW-SIZ-XX-JBAU-SB-00-DR-C-0002-Holme_Beck_General_Arrangement_High_Tip_West
TW-SIZ-XX-JBAU-SB-00-DR-C-0003-Holme_Beck_General_Arrangement_High_Tip_North
TW-SIZ-XX-JBAU-SB-00-DR-C-0004-Holme_Beck_General_Arrangement_Inter_Tidal_Channel

TW-SIZ-XX-JBAU-SB-00-DR-C-0101-Holme_Beck_Long_Section_Sheet_1_of_4
TW-SIZ-XX-JBAU-SB-00-DR-C-0102-Holme_Beck_Long_Section_Sheet_2_of_4
TW-SIZ-XX-JBAU-SB-00-DR-C-0103-Holme_Beck_Long_Section_Sheet_3_of_4
TW-SIZ-XX-JBAU-SB-00-DR-C-0104-Holme_Beck_Long_Section_Sheet_4_of_4

TW-SIZ-XX-JBAU-SB-00-DR-C-0201-Holme_Beck_Cross_Sections_Sheet_1_of_3
TW-SIZ-XX-JBAU-SB-00-DR-C-0202-Holme_Beck_Cross_Sections_Sheet_2_of_3
TW-SIZ-XX-JBAU-SB-00-DR-C-0203-Holme_Beck_Cross_Sections_Sheet_3_of_3

TW-SIZ-XX-JBAU-SB-00-DR-C-0301-South_Bank_Details_Sheet_1_of_4
TW-SIZ-XX-JBAU-SB-00-DR-C-0302-South_Bank_Details_Sheet_2_of_4
TW-SIZ-XX-JBAU-SB-00-DR-C-0303-South_Bank_Details_Sheet_3_of_4
TW-SIZ-XX-JBAU-SB-00-DR-C-0304-South_Bank_Details_Sheet_4_of_4

2. All dimensions are in metres unless noted otherwise.
3. All levels are in metres relative to ordnance datum Newlyn (mAOD) unless noted otherwise.
4. All coordinates are in metres relative to ordnance survey national grid.
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LEGEND

- GABION BASKET RETAINING WALL
- VEGETATED VERGE
- REINFORCED CONCRETE ELEMENT
- 3.5m WIDE VEHICULAR ACCESS TRACK
- POST AND WIRE FENCE
- VEHICULAR ACCESS POINT AND HARDSTANDING
- SERVICE CORRIDOR (DESIGNED BY OTHERS)
- INSITU CONCRETE ELEMENT
- DIRECTION OF FLOW

C02	Comments	Minor changes								
Rev.:	Date	17/11/21	Drawn	MM	Designed	JA	Checked	ST	Approved	RD
C01	Comments	Issued For Planning Permission								
Rev.:	Date	11/11/21	Drawn	JN	Designed	JA	Checked	ST	Approved	RD

Client Approval

- A - Approved
- B - Approved with Revisions
- C - Do Not Use

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Project

South Bank Arterial Drainage

Title

South Bank
Holme Beck - High Tip West
General Arrangement
for

Client

TEESWORKS
The UK's largest industrial zone

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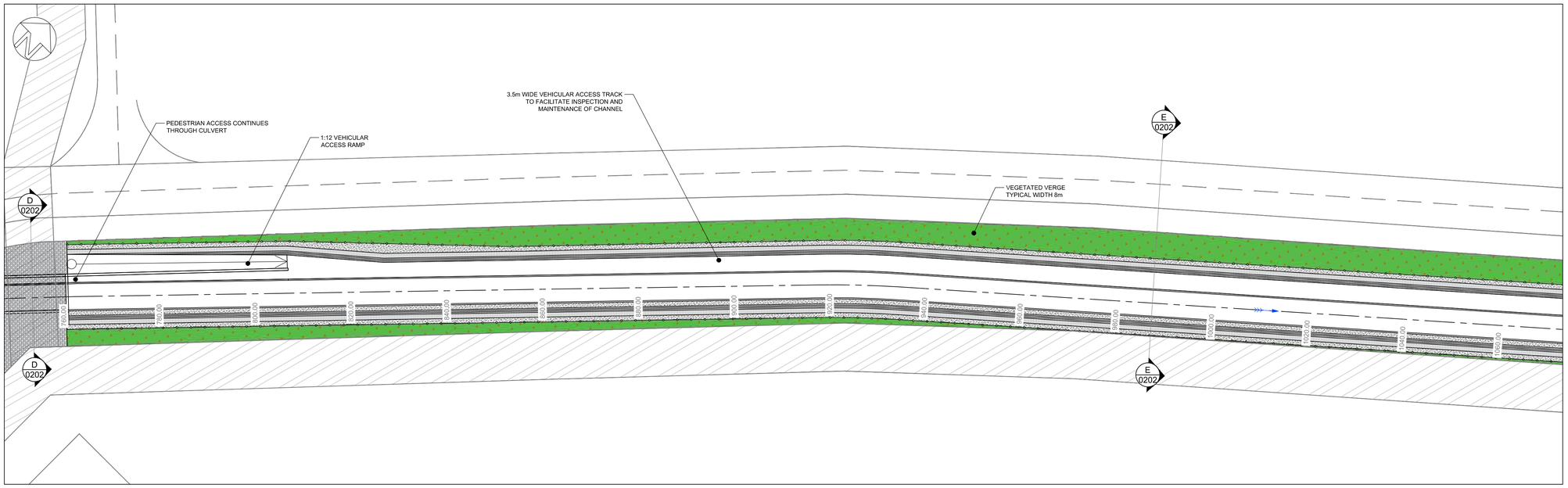
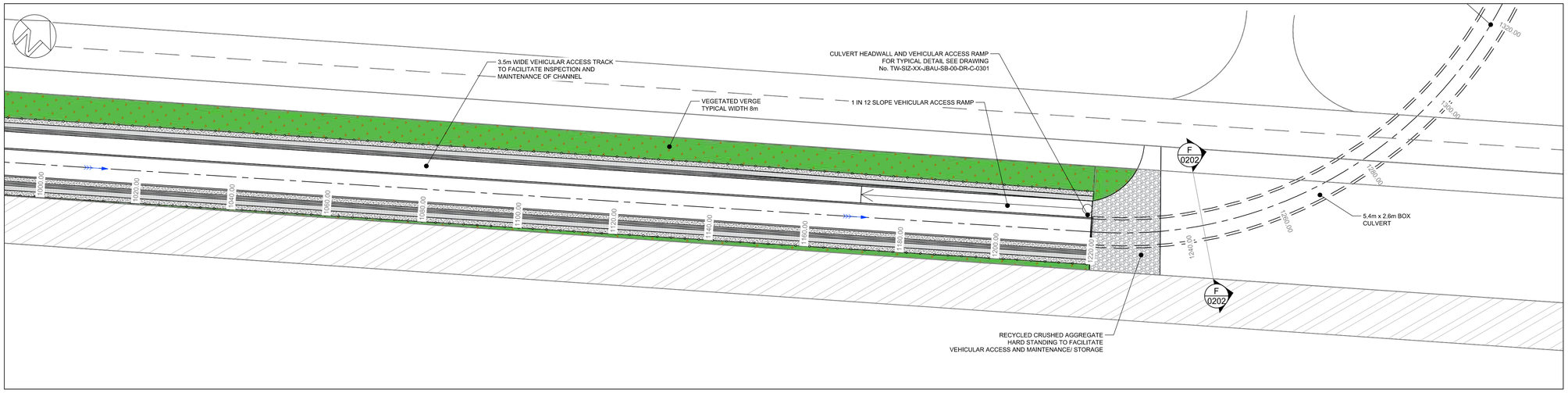
Drawn:	J. Ness	06/09/2021	Designed:	J. Alcock	06/09/2021
Checked:	S. Thomson	11/10/2021	Approved:	R. Dobson	11/10/2021
Project Reference:	2021s1087		Scale:	1:500 @A1	

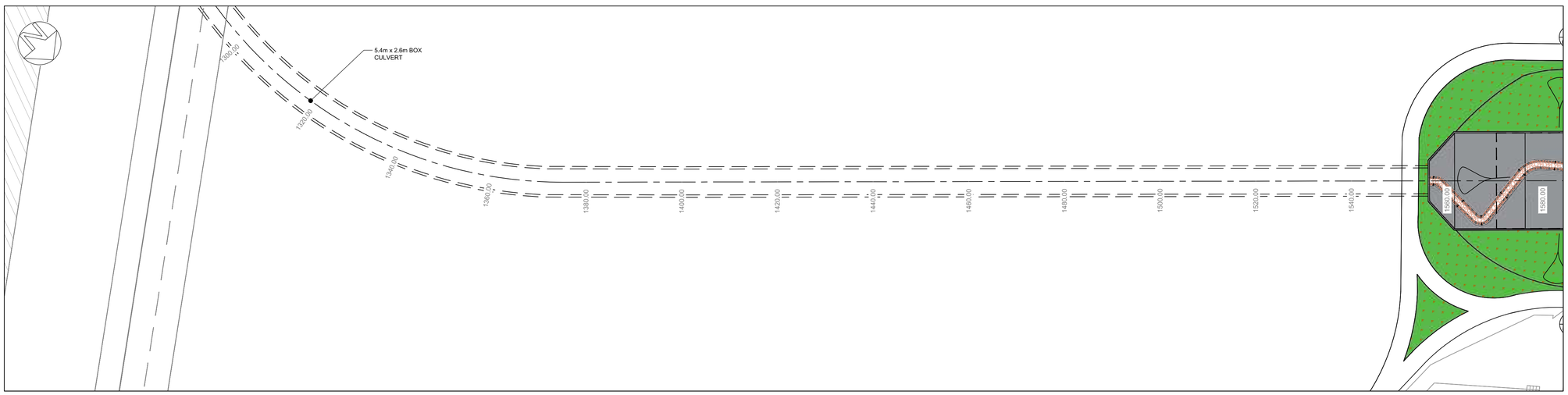
Drawing Number:	Status:	Revision:	Sheet Size:
TW-SIZ-XX-JBAU-SB-00-DR-C-0002	A1	C02	A1



SOUTH BANK CHANNEL - CHAINAGE 780 - 1080m



SOUTH BANK CHANNEL - CHAINAGE 1080 - 1220m



SOUTH BANK CHANNEL - CHAINAGE 1080 - 1220m

1	Working near water	Working near water	Working near water
2	Unknown ground conditions		
3	Deep excavations		
4	Contaminated ground		
5	COMAH site	COMAH site	COMAH site
No.	Construction Risk	Maintenance Risk	Demolition Risk

In addition to the hazards/risks normally associated with the types of work detailed on this drawing take note of the above.

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION BOX

Drawing Notes

1. This drawing is to be read in conjunction with:-

   TW-SIZ-XX-JBAU-SB-00-DR-C-0001-Holme_Beck_Key_Plan
   TW-SIZ-XX-JBAU-SB-00-DR-C-0002-Holme_Beck_General_Arrangement_High_Tip_West
   TW-SIZ-XX-JBAU-SB-00-DR-C-0003-Holme_Beck_General_Arrangement_High_Tip_North
   TW-SIZ-XX-JBAU-SB-00-DR-C-0004-Holme_Beck_General_Arrangement_Inter_Tidal_Channel

   TW-SIZ-XX-JBAU-SB-00-DR-C-0101-Holme_Beck_Long_Section_Sheet_1_of_4
   TW-SIZ-XX-JBAU-SB-00-DR-C-0102-Holme_Beck_Long_Section_Sheet_2_of_4
   TW-SIZ-XX-JBAU-SB-00-DR-C-0103-Holme_Beck_Long_Section_Sheet_3_of_4
   TW-SIZ-XX-JBAU-SB-00-DR-C-0104-Holme_Beck_Long_Section_Sheet_4_of_4

   TW-SIZ-XX-JBAU-SB-00-DR-C-0201-Holme_Beck_Cross_Sections_Sheet_1_of_3
   TW-SIZ-XX-JBAU-SB-00-DR-C-0202-Holme_Beck_Cross_Sections_Sheet_2_of_3
   TW-SIZ-XX-JBAU-SB-00-DR-C-0203-Holme_Beck_Cross_Sections_Sheet_3_of_3

   TW-SIZ-XX-JBAU-SB-00-DR-C-0301-South_Bank_Details_Sheet_1_of_4
   TW-SIZ-XX-JBAU-SB-00-DR-C-0302-South_Bank_Details_Sheet_2_of_4
   TW-SIZ-XX-JBAU-SB-00-DR-C-0303-South_Bank_Details_Sheet_3_of_4
   TW-SIZ-XX-JBAU-SB-00-DR-C-0304-South_Bank_Details_Sheet_4_of_4

2. All dimensions are in metres unless noted otherwise.
3. All levels are in metres relative to ordnance datum Newlyn (mAOD) unless noted otherwise.
4. All coordinates are in metres relative to ordnance survey national grid.
5. Do not scale from this drawing. All dimensions must be checked/ verified on site.
6. For clarity purposes existing and proposed services have been omitted from this drawing.

LEGEND

- GABION BASKET RETAINING WALL
- VEGETATED VERGE
- REINFORCED CONCRETE ELEMENT
- 3.5m WIDE VEHICULAR ACCESS TRACK
- POST AND WIRE FENCE
- VEHICULAR ACCESS POINT AND HARDSTANDING
- SERVICE CORRIDOR (DESIGNED BY OTHERS)
- INSITU CONCRETE ELEMENT
- DIRECTION OF FLOW

C02	Comments	Minor changes									
Rev.:	Date	17/11/21	Drawn	MM	Designed	JA	Checked	ST	Approved	RD	
C01	Comments	Issued For Planning Permission									
Rev.:	Date	11/11/21	Drawn	JN	Designed	JA	Checked	ST	Approved	RD	

Client Approval

- A - Approved
- B - Approved with Revisions
- C - Do Not Use

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Project

South Bank Arterial Drainage

Title

South Bank
Holme Beck - High Tip North
General Arrangement
for

Client

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Drawn:	J. Ness	06/09/2021	Designed:	J. Alcock	06/09/2021
Checked:	S. Thomson	11/10/2021	Approved:	R. Dobson	11/10/2021
Project Reference:	2021s1087		Scale:	1:500 @A1	

Drawing Number:	Status:	Revision:	Sheet Size:
TW-SIZ-XX-JBAU-SB-00-DR-C-0003	A1	C02	A1