

FLOSH MEADOWS, CLEATOR, SR12A AND TOP MEADOWS

Drainage Strategy

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Client:

Lakeland Associates (Cleator) Ltd Revision:

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Executive Summary

Site Location	The site is located off A5086, Cleator, CA23 3EP (nearest) at NGR 301752E 514082N. The
	overall development footprint measures approximately 3.30 Ha, entirely greenfield.
Site Proposals	The site is proposed to be developed with residential units.
Ground Conditions	The site is located in an area underlain by drift deposits consisting of soft - stiff clays.
	Surface water cannot be discharged utilising infiltration techniques.
Nearest Watercourse	The River Ehen is located 300m to the south of the overall site boundary beyond third
	party land. It is not possible to make a direct connection to a water course to dispose of
	surface water.
Nearest water feature	Within the development site, an historic man-made culverted mill race flows from north
	to south and outfalls via a culvert below the public highway located to the south. The mill
	race conveys flows from agricultural land located to the north of the development site.
	Surface water should discharge to the surface water feature. Surface water discharge
	should restricted to a greenfield rate matching Qbar for the development, in this case 32
	litres/sec.
Nearest Surface Water	Adjacent to proposed site entrance, discharging within 40m of the head of the run to a
Sewer.	UU combined sewer at A5086. Another surface water sewer is located within Howthorne
	Fields to the south of Flosh Meadows. Neither sewer is suitable for disposal of surface
	water. The reasons are covered in greater detail within section 3.0.
Nearest Combined	On site adjacent to southern boundary
Sewer	
Nearest Foul Water	Adjacent to proposed site entrance, discharging within 40m to a UU combined sewer at
Sewer	A5086
SUDS	Pipes, flow control

The above summary should not be used in isolation and reference should be made the full report which provides a detailed assessment of the risks affecting the development.



1. Introduction

Coast Consulting Engineers have been commissioned by Lakeland Associates (Cleator) Ltd to produce a drainage strategy to accompany a planning application for a proposed development at Flosh Meadows, Cleator. This strategy is produced only for the phases known as SR12A Mid Meadows (4/17/2214) and Top Meadows (4/17/2390), although the strategy also references the wider site, as the drainage from SR12A and Top Meadows discharges into the phase known as SR12, The Meadows. This Assessment is reviewed in accordance with the National Planning Policy Framework (NPPF) for Development and Flood Risk.

A flood risk assessment has previously been completed by RWO Associates reference RO/14016.200 Version 3, dated October 2017 and has subsequently been approved. As such, this report does not assess flood risk to the proposed development.

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2. Site location, Existing Topography, Geology and Proposals

2.1 Site Location

The site is located off A5086, Cleator, CA23 3EP (nearest) at NGR 301752E 514082N. The entire development footprint measures approximately 3.30 Ha, entirely greenfield.

The site location is indicated in Figure 2.11 and the proposed phasing in Figure 2.12 below.



Figure 2.11 – Site Location





Figure 2.12 – Proposed Phasing



2.2 Existing Topography

A topographical survey of the site has been undertaken and is included in Appendix A. The overall development site generally falls in a southerly direction. Site levels range from approximately 67.50m AOD at the north of SR12A to 63.00m AOD at the southern extents of SR12.

The surrounding area is developed as follows:

North:Agricultural LandEast:Agricultural Land and residential propertiesSouth:Residential propertiesWest:Agricultural Land

Figure 2.21 below extracted from Google maps shows the existing site.



Figure 2.21 – Satellite image of the existing site.



2.3 Existing sewers and watercourses

A combined sewer is located within the development land, adjacent to the southern boundary line of SR12. Adopted foul and surface water sewers are located within Flosh Meadows, adjacent to the proposed site entrance, the head of each run is located at the proposed site entrance. The adopted surface water and foul sewers outfall into a combined sewer approximately 40m downstream of the head of each run. All sewers are owned and maintained by United Utilities Ltd (UU). Figure 2.31 below shows the location of the existing public sewers within the vicinity of the site.

Within the overall development site, an historic man-made culverted mill race flows from north to south and outfalls via a culvert below the public highway located to the south of SR12. The mill race conveys flows from agricultural land located to the north of SR12A. Figure 2.32 overleaf shows the location of the natural watercourses within the vicinity of the site. Please also refer to Appendix C for further information on the existing drainage regime.

The River Ehen is located approximately 300m to the south of the site boundary, beyond third party land.







Figure 2.32 – watercourses.

2.4 Geology

A phase 2 intrusive investigation of ground conditions has been completed by Geo Environmental Engineering Ltd, reference 2018-3167 dated 09.08.2018. The report states that the site is underlain by varying ground conditions, largely comprising soft to stiff clays. Ground water was encountered across the site at depths of between 1.50m to 2.90m.

2.5 Development Proposals

The site is proposed to be developed with residential units. A copy of the proposed architectural site layout can be found in Appendix B.



3. Surface Water Disposal

3.1 Existing Surface Water Drainage

There are no existing sewers serving the greenfield site.

An existing historic, man-made, culverted, mill race flows through the site from north to south. The race outfalls from the development via a culvert below the public highway located to the south of SR12. The race is not a natural watercourse and is not identified on GroundSure plans (ref figure 2.32) above or historic Pre 1800's mining plans (ref figure 3.11) below.

Please also refer to Appendix C for further information on the existing drainage regime.





3.2 Proposed Surface Water Drainage

In line with national standards, consideration has been given to the preferred hierarchy for disposal of surface water from the development, as contained in Part H of the Building Regulations. The hierarchy is as follows:

- 1. By infiltration
- 2. To watercourse
- 3. To sewer

As noted earlier, superficial deposits comprise of soft - stiff clays with a low permeability. It is considered that utilisation of infiltration techniques will not be applicable for the proposed development.

The nearest watercourse to the development is located approximately 300m to the south of the site boundary, beyond third party land. As such, it will not be possible to make a direct connection to a watercourse.

Following discussions between the developer and the LLFA, it has been agreed to discharge surface water to the Mill Race located within the site boundary.

3.3 SUDS Techniques

In line with National Planning Policy, SUDS techniques will be utilised as part of the design of the surface water network. The applicable techniques and the benefits that they bring to the development are outlined below.

- Flow control: A vortex flow control device will be utilised to restrict flows to the equivalent of existing site greenfield rate (Qbar)
- Surface water conveyance: Surface water will be conveyed through the development utilising below ground pipes.
- Surface water treatment: Attenuated surface water flows will be stored in a piped network.

3.4 SuDS Maintenance

Regular inspection and maintenance is key to the effective operation of SuDS features. Maintenance responsibility for SuDS features proposed as part of the development is to be placed with a responsible organisation and in this case a nominated management and maintenance company.

Removal of debris and any settled silt from SuDS features is the key maintenance requirement for the continued effective operation of the SuDS features. Most of the maintenance activities can be undertaken as part of regular landscape maintenance activities.

3.5 Post Development Discharge Rate

Proposed surface water discharge rates will be limited from the development to the equivalent of the pre-development Qbar green field run off rate, for all storms up to and including 1 in 100 year return period rainfall event + 40% increase in rainfall intensity to account for the predicted effects of climate change.

In line with national and local standards the greenfield run off rate for 3.30 Ha of developed land has been calculated using the Institute of Hydrology (IH) Report 124 Flood Estimation for Small Catchments (1994) method, with flow rate linearly interpolated due to site being smaller than 50Ha. HR Wallingford Greenfield runoff rate estimation for sites tool, available at <u>https://www.uksuds.com</u> has been used to calculate Qbar run off rate at 32.02 l/sec. An assessment of the allowable discharge rate is outlined below in figure 3.51.

Default Edited Q _{BAR} (Vs): 32.02 32.02
Q _{BAR} (I/s): 32.02 32.02
1 in 1 year (l/s): 27.85 27.85
1 in 30 years (l/s): 54.43 54.43
1 in 100 year (I/s): 66.59 66.59
1 in 200 years (l/s): 75.88 75.88

licence agreement, which can both be found at www.uksuds.com/terms-and-conditions.htm. The outputs from this tool are estimates of greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of this data in the design or operational characteristics of any drainage scheme.



Please refer to Appendix D for further information on green field run off rates. Note – the 'developed land' includes for all phases of the proposed development.

3.6 Surface Water Attenuation

Surface water will be restricted for all events up to an including the 100 year event with a 50% allowance for climate change and a 10% allowance for urban creep. Attenuated flows will be contained on site within a designated storage system. Please refer to the calculations and drainage strategy contained within Appendix E. Note – the allowable discharge rate and drainage calculations include for all phases of the

development.

By restricting the peak rate of discharge from the site Qbar to the watercourse for all

events up to and including the 100-year event, the proposed development will provide

betterment from the existing regime in line with the table below.



Return period	greenfield rate	Proposed	Betterment
Qbar	32.02 l/s	32.0 l/s	0%
30	54.43 l/s	32.0 l/s	31%
100	66.59 l/s	32.0 l/s	52%
100+50%	99.85 l/s	32.0 l/s	68%

3.7 Proposed Foul Drainage

It is proposed to discharge a portion of the foul water to the adjacent UU combined sewer and a portion to the existing foul sewer in Flosh Meadows, both via gravity connections.

4. References

The following reference documents have been used in the preparation of this report.

- National Planning Policy Framework 2021.
- PPG 2021.
- Environment Agency online flood maps.
- Sewers for Adoption 6th Edition WRC plc, April 2006.
- Building Regulations Document H 2010.
- Improving the Flood Performance of New Buildings Defra.
- Rainfall runoff management for developments SC030219 Defra.
- Susdrain.org
- The SuDS Manual CIRIA C753.

Appendices

Appendix A



	VERGE FENCE - CHAIN LINK FENCE - METAL FENCE - WOODEN FENCE - POST & RAIL HEDGE WALL BARRIER		2000 2000 2000 2000 2000 2000	CO FO TR BU TR GA SU EA	NCRETE EDGI OTPATH ACK ILDING EE TE RVEY STATIOI VES	E	
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	ELECTRIC ABOVE GRO	DUND		SURVE	Y BOUNDARY		
ABBREVIATIO (AC) A/G	ASSUMED CONNECTION ABOVE GROUND	ON	INT KV	INTERC KILO VO	EPTOR		
(AR) ASB AV BB	ASSUMED ROUTE ASBESTOS CEMENT AIR VALVE BELISHA BEACON		LD LH LP LV	LOOP D LAMP H LAMP P LOW VO	ETECTOR OLE OST OLTAGE		
BD BL BO	BACK DROP BASE LEVEL BOLLARD		MK MH MT	MARKE MANHO METER	R		
BOL BT CATV CB	BOLLARD LIGHT BRITISH TELECOM CABLE TELEVISION CONTROL BOX		O/H PE PTG	OVERH POLYET PIPE TO	EAD THYLENE GROUND		
CI CL CR CWS	CAST IRON COVER LEVEL CABLE RISER COMBINED WATER SE	WER	PVC TFR RE RED	POLYVI TAKEN RODDIN REDUN	NYL CHLORID FROM RECOR IG EYE DANT SERVICI	E E	
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HV IC Id IL	INSPECTION COVER INVERT DEPTH INVERT LEVEL		WL WO WR	WATER WASH (WATER	LEVEL DUT RISER		
DISCLAIMER Unless otherw manholes, if n	ise stated, all services show ot traced, are assumed to be	n on this plan have been e direct.	surveyed using	approved o	letectors and th	ne connections	s between
No guarantee In ideal conditi Utilities traced Electromagnet	can be given that all services ons the depth accuracies for using GPR techniques show ic techniques provide an est	s have been shown. r the underground utilities v depths approximately fi imated depth which is m	s located is +/- 10 rom ground level easured from gro	0% of depti to the top ound level t	h. of the utility. Uti to the centre of	ilities traced u the utility. Dra	sing iinage and
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Appendix B

Appendix C

Appendix D

richard hall

Cleator

Runoff estimation approach

Flosh Meadows

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013), the SuDS Manual C753 (Ciria, 2015) and

the basis for setting consents for the drainage of surface water runoff from sites.

the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may

Calculated by:

Site name:

be

Site location:

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Site Details

C	
Latitude:	54.51164° N
Longitude:	3.51942° W
Reference:	2032601581
Date:	May 28 2021 13:23

Ranon countation app	IH124		J	
Site characteristics				Notes
Total site area (ha):		3.30		(1) Is Q _{BAD} < 2.0 I/s/ha?
Methodology				
Q _{BAR} estimation method:	om SPR and	SAAR	When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.	
SPR estimation method:	Calculate fro	om SOIL typ	е	
Soil characteristics		Default	Edited	
SOIL type:		4	4	(2) Are flow rates < 5.0 l/s?
HOST class:		N/A	N/A	Where flow rates are less than 5.0 1/2 concert for discharge is
SPR/SPRHOST:		0.47	0.47	usually set at 5.0 l/s if blockage from vegetation and other
Hydrological characte	ristics	Default	Edited	the blockage risk is addressed by using appropriate drainage elements.
SAAR (mm):		1271	1271	
Hydrological region:		10	10	$(3) \text{ is SPR/SPRIOS1} \leq 0.3?$
Growth curve factor 1 year:		0.87	0.87	Where groundwater levels are low enough the use of soakaways
Growth curve factor 30 years:		1.7	1.7	to avoid discharge offsite would normally be preferred for disposal of surface water runoff
Growth curve factor 100 years:		2.08	2.08	
Growth curve factor 200 years	ars:	2.37	2.37	j []

Greenfield runoff rates

	Default	Edited
Q _{BAR} (I/s):	32.02	32.02
1 in 1 year (l/s):	27.85	27.85
1 in 30 years (l/s):	54.43	54.43
1 in 100 year (l/s):	66.59	66.59
1 in 200 years (l/s):	75.88	75.88

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement, which can both be found at www.uksuds.com/terms-and-conditions.htm. The outputs from this tool are estimates of greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of this data in the design or operational characteristics of any drainage scheme.

Appendix E

Innovyze

10 HB

Micro Drainage	Page 1
	Micro Drainage

Coast Co	onsulti	ng En	ginee	rs Ltd								Page O
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1.002	31.512	0.185	170.3	0.129	0.00	C	.0	0.600	0	225	Pipe/Condu	it 🖣
1.003	25.483	0.150	169.9	0.104	0.00	C	.0	0.600	0	225	Pipe/Condu	uit ዋ
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Network Results Table

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 325.6
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 0.00
 0.0
 0.600
 o
 375
 Pipe/Conduit
 #

 1.008
 21.726
 0.067
 324.3
 0.029
 0.00
 0.0
 0.600
 o
 375
 Pipe/Conduit
 #

PN	Rain	Т.С.	US/IL	Σ I.Area	Σ Base	Foul	Add Flow	Vel	Cap	Flow	
	(mm/nr)	(mins)	(m)	(ha)	Flow (1/s)	(1/s)	(1/S)	(m/s)	(1/S)	(1/s)	
1.000	0.00	5.43	63.013	0.061	0.0	0.0	0.0	1.64	1225.0	0.0	
1.001	0.00	5.97	62.908	0.179	0.0	0.0	0.0	1.64	1223.9	0.0	
1.002	0.00	6.50	62.774	0.308	0.0	0.0	0.0	1.00	39.7	0.0	
1.003	0.00	6.92	62.589	0.412	0.0	0.0	0.0	1.00	39.8	0.0	
1.004	0.00	7.22	62.439	0.447	0.0	0.0	0.0	1.00	39.8	0.0	
1.005	0.00	7.53	62.335	0.475	0.0	0.0	0.0	1.00	39.8	0.0	
1.006	0.00	7.76	62.223	0.504	0.0	0.0	0.0	1.00	39.7	0.0	
2.000	0.00	5.97	62.586	0.115	0.0	0.0	0.0	1.24	268.0	0.0	
2.001	0.00	6.47	62.365	0.340	0.0	0.0	0.0	1.24	267.7	0.0	
2.002	0.00	6.85	62.249	0.405	0.0	0.0	0.0	1.00	110.4	0.0	
2.003	0.00	7.40	62.181	0.470	0.0	0.0	0.0	1.00	110.3	0.0	
2.004	0.00	7.62	62.079	0.532	0.0	0.0	0.0	1.00	110.7	0.0	
2.005	0.00	7.86	62.038	0.574	0.0	0.0	0.0	0.99	109.9	0.0	
1.007	0.00	8.26	61.993	1.099	0.0	0.0	0.0	1.00	110.3	0.0	
1.008	0.00	8.62	61.919	1.128	0.0	0.0	0.0	1.00	110.5	0.0	
				@1000	2020 Tppor						
				ST 202-	ZUZU IIIIO	луде					

Coast Consulting Engineers Ltd		Page 1
Suite 6, Vita House	FLOSH MEADOWS	
Fish Quay	CLEATOR	
North Shields NE30 1JA	1:2	Micco
Date 09/06/2023	Designed by RH	
File 230609 REVISED SURFACE W	Checked by PL	Diamage
Innovyze	Network 2020.1	I
STORM SEWER DESIGN	by the Modified Rational Method	
Network Design	n Table for 180518 SW1.SWS	
PN Length Fall Slope I Area T	E Base & HYD DIA Section 7	
(m) (m) (1:X) (ha) (mi	ns) Flow (1/s) (mm) SECT (mm)	Design
		-
3.000 15.459 0.048 322.1 0.070 5	.00 0.0 0.600 o 375 Pipe/Cond	luit 🖰
1.009 26.775 0.109 245.6 0.000 0	.00 0.0 0.600 o 300 Pipe/Cond	duit 🗬
1.010 3.900 0.016 243.8 0.000 0	.00 0.0 0.600 o 300 Pipe/Cond	luit 💣
Netwo	ork Results Table	
PN Rain T.C. US/IL E I.A	Area Σ Base Foul Add Flow Vel Ca	p Flow
(mm/hr) (mins) (m) (ha	a) Flow $(1/s)$ $(1/s)$ $(1/s)$ (m/s) $(1/s)$	s) (1/s)
3.000 0.00 5.26 61.900 $0.$	070 0.0 0.0 0.0 1.00 110	.9 0.0
1.009 0.00 9.07 61.852 1.	198 0.0 0.0 0.0 1.00 70	.6 0.0
1.010 0.00 9.13 61.743 1.	198 0.0 0.0 0.0 1.00 70	.9 0.0
Free Flowing Outia	all Details for 180518 SWI.SWS	
Outfall Outfall C	. Level I. Level Min D.L W	
Pipe Number Name	(m) (m) I. Level (mm) (mm)	
	(m)	
1.010 C1	63.006 61.727 61.727 1350 0	
1.010 01		
Simulation Cr	iteria for 180518 SW1.SWS	
Volumetric Runoff Coeff	0.750 Additional Flow - % of Total Flo	w 0.000
Hot Start (mins)	1.000 MADD Factor ^ 10m³/na Storag	e 2.000 + 0.800
Hot Start Level (mm)	0 Flow per Person per Day (1/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 Hudrogr	anha () Number of Storage Structures 12	
Number of Online Cont:	rols 3 Number of Time/Area Diagrams 0	
Number of Offline Cont	rols 0 Number of Real Time Controls 0	
Synthet	ic Rainfall Details	
Doinfall Madel	TCD ME (0 (mm) 10 (00	
Return Period (vears)	2. Ratio R 0 223	
Region	England and Wales Profile Type Summer	

Coast Consulting Engineers Ltd		Page 2
Suite 6, Vita House	FLOSH MEADOWS	
Fish Quay	CLEATOR	
North Shields NE30 1JA	1:2	Mirro
Date 09/06/2023	Designed by RH	Dcainago
File 230609 REVISED SURFACE W	Checked by PL	Diamage
Innovyze	Network 2020.1	•

Synthetic Rainfall Details

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

Coast Consulting Engineers Ltd					Page 3			
Suite 6, Vita House	FLOSH ME	ADOWS						
Fish Ouay	CLEATOR							
North Shields NE30 1JA	Micco							
Date 09/06/2023	Designed	bv RH						
File 230609 REVISED SURFACE W	Checked	by PL			Drainage			
Innovyze	Network	2020.1						
Online Cont	rols for	180518	SW1.SWS					
Hydro-Brake® Optimum Manhole	e: 3 HB,	DS/PN: 1	1.002, Vc	lume (m³): 45.9			
Unit	Defense	MD CHE (107 7000 3	110 7000				
Desic	n Head (m)	MD-SHE-U	107-7000-2	2.119				
Design	Flow (l/s)			7.0				
	Flush-Flo™		Ca	lculated				
7	Objective	Minimis	se upstream	storage				
	Available			Yes				
Dia	ameter (mm)			107				
Invert	Level (m)			62.774				
Minimum Outlet Pipe Dia	ameter (mm)			150				
Suggested Manhole Dia	umeter (mm)			1200				
Control Points Head (m) Flor	w (l/s)	Contro	ol Points	Head	(m) Flow (l/s)			
Design Point (Calculated) 2.119 Flush-Flo™ 0.469	7.0 6.1 Mea	an Flow o	Kick-1 ver Head Ra	Flo® 0. ange	957 4.8 - 5.6			
The hydrological calculations have be Hydro-Brake® Optimum as specified. Si Hydro-Brake Optimum® be utilised then	en based or hould anoth these stor	the Head er type o age rout:	d/Discharge of control ing calcula	e relations device oth ations will	ship for the her than a l be invalidated			
Depth (m) Flow (1/s) Depth (m) Flow	w (l/s) Dep	oth (m) F	low (l/s)	Depth (m)	Flow (l/s)			
0.100 3.7 1.200	5.4	3.000	8.2	7.000	12.3			
0.200 5.4 1.400	5.8	3.500	8.9	7.500	12.7			
0.300 5.9 1.600	6.1	4.000	9.4	8.000	13.1			
	6.5	4.500	10.0	8.500	13.5			
0.600 6.0 2.200	7.1	5.500	11.0	9.500	14.3			
0.800 5.6 2.400	7.4	6.000	11.4					
1.000 4.9 2.600	7.7	6.500	11.9					
Hydro-Brake® Optimum Manhole: 10 HB, DS/PN: 2.002, Volume (m³): 13.2								
UNIT KEIERENCE MD-SHE-UIU/-6UUU-15/5-6UUU Design Head (m) 1 575								
Design	Flow $(1/s)$			6.0				
	Flush-Flo™		Ca	lculated				
	Objective	Minimis	se upstream	n storage				
P	Application			Surface				
Sump) AVAIIADIE meter (mm)			106				
Invert Level (m) 62.249								
Minimum Outlet Pipe Diameter (mm) 150								
©1982-2020 Innovyze								

Suite 6, Vita House FLoSH MEADOWS Fish Quay CLEATOR North Shields NE30 IJA 1:2 Date 09/06/2023 Designed by PL File 230609 REVISED SURPACE W Checked by PL Innovyze Network 2020.1 Hydro-Brake@ Optimum Manhole: 10 HB, DS/PN: 2.002, Volume (m ³): 13.2 Suggested Manhole Diameter (mm) 1200 Control Points Head (m) Flow (J/s) Design Point (Calculated) 1.575 Flush-Flow 0.463 Flush-Flow 0.463 Flush-Flow 0.463 Flush-Flow 0.463 Suggested ben these retrage routing calculations will be invalidated Depth (m) Flow (L/s) Depth (m) Flow (L/s) Depth (m) Flow (L/s) Depth (m) Flow (L/s) Depth (m) Flow (L/s) 0.100 3.6 1.200 5.3 0.200 5.7 3.600 8.7 0.200 5.7 3.600 8.7 0.200 5.7 3.600 13.3 0.500 5.9 2.000 7.0 0.400 <td< th=""><th>Coast Consu</th><th>lting Eng</th><th>gineers</th><th>Ltd</th><th></th><th></th><th></th><th></th><th></th><th>Pa</th><th>ge 4</th><th></th></td<>	Coast Consu	lting Eng	gineers	Ltd						Pa	ge 4	
Fish Quay CLEATOR 1:2 Designed by RH Date 09/06/2023 Designed by RH Checked by PL Designed by RH File 230609 REVISED SURFACE W Checked by PL Designed by RH Innovyze Network 2020.1 Hydro-Brake@ Optimum Manhole: 10 HB, DS/PN: 2.002, Volume (m ²): 13.2 Suggested Manhole Diameter (mm) 1200 Control Points Head (m) Plow (1/e) Control Points Head (m) Plow (1/e) Control Points Head (m) Plow (1/e) Design Point (Calculated) 1.575 Flow-Flow 0.468 5.9 Mann Flow core Read Range - 7.2 The hydrological calculations have been based on the Head/Discharge relationship for the Pydro-Brake@ Optimum be utilised then these storage routing calculations will be involidated Depth (m) Flow (1/e) Depth (m) Flow (1/e) Out of 3.6 1.200 5.7 0.200 5.7 3.500 8.1 7.000 12.1 0.200 5.7 1.600 8.100 13.3 0.200 5.7 3.600 12.9<	Suite 6, Vi	ta House			FLOSH	MEADOWS						
North Shields NE30 1JA 1:2 Date 09/06/2023 Designed by RH Date 09/06/2023 Designed by RH Checked by PL Designed by RH Innovyze Network 2020.1 Checked by PL Designed by RH Innovyze Network 2020.1 Suggested Manhole Diameter (um) 1200 Control Points Head (n) Flow (1/e) Not set (1/	Fish Quay	CLEAT	OR									
Date 09/06/2023 File 230609 REVISED SURFACE W Designed by RH Checked by PL Designed by RH Checked by PL Innovyze Network 2020.1 Hydro-Brake@ Optimum Manhole: 10 HB, DS/PN: 2.002, Volume (m ³): 13.2 Suggested Manhole Diameter (mm) 1200 Control Points Head (n) Flow (1/e) Flush-Flo [®] Control Points Head (n) Flow (1/e) Flush-Flo [®] Design Point (Calculated) 1.575 Flush-Flo [®] 6.0 Flow Flow (1/e) Flow Flow (1/e) Control Points Head (n) Flow (1/e) Flow (1/e) Design Point (Calculations have been based on the Head/Discharge relationship for the Hydro-Brake@ Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum as specified. Should another type of 0.1(a) 0.100 S.6 1.200 7.00 12.1 0.200 1.00 5.7 1.000 3.000 8.1 7.000 1.00 12.1 0.200 0.100 3.6 1.000 1.200 5.3 1.000 3.000 13.7 1.000 8.1 0.500 7.00 12.1 1.000 1.00 12.9 1.000 1.00 12.9 1.000 1.00 12.9 1.000 1.01 1.00 2.60 7.6 1.01 1.00 2.60 7.6 1.01 1.00 2.60 7.6 Notione Flow (1/e) 0.000 Interference MD-3HE-0235-3200-1642-3200 18.9 1.000 1.612 1.622 1.612 1.622 2.0 1.00 1.612 1.622	North Shield	ds NE30	1JA		1:2					N/	licco	
Pile 230609 RVUISED SURPACE W Checked by PL Unified Innovyze Network 2020.1 Hydro-Brake@ Optimum Manhole: 10 HB, DS/PN: 2.002, Volume (m³): 13.2 Suggested Manhole Diameter (mm) 1200 Control Points Head (m) Flow (1/s) Design Point (Calculated) 1.575 6.0 Kick-Flo@ 0.952 4.7 Fliph-FloW One over Head Range - 5.2 The hydrological calculations have been based on the Head/Discharge relationship for the approxement as specified. Should another type of control device other than a Rydro-Brake@ Optimum Be utilised then these storage routing calculations will be invalidated Depth (m) Flow (1/s) Depth (m) Flow (1/s) Out (1/s) Other (m) Flow (1/s) Other (1/s) Depth (m) Flow (1/s) Other (1/s) Other (1/s) Other (1/s) <tr< th=""><th>Date 09/06/2</th><th>Desig</th><th>ned by R</th><th>Η</th><th></th><th></th><th></th><th>iliu</th><th></th></tr<>	Date 09/06/2	Desig	ned by R	Η				iliu				
Into brook in the product of the product 2020.1 Innovyze Network 2020.1 Hydro-Brake@ Optimum Manhole: 10 HB, DS/PN: 2.002, Volume (m³): 13.2 Suggested Manhole Diameter (mm) 1200 Control Points Head (m) Flow (1/s) Design Point (Calculated) 1.575 G.0 Flush-Flow 0.466 S.9 [Mean Flow wore Head Range - 5.2 The hydrological calculations have been based on the Head/Diacharge relationship for the Hydro-Brake@ Optimum as specified. Should another type of control device other than a Hydro-Brake@ Optimum be utillsed then these storage routing calculations will be involidated Depth (m) Flow (1/s) Depth (m) Flow (1/s) Depth (m) Flow (1/s) Depth (m) Flow (1/s) 0.100 3.6 1.200 5.3 3.000 8.1 7.000 12.1 0.100 3.6 1.200 5.3 3.000 8.1 7.000 12.1 0.100 3.6 1.200 5.3 3.000 8.1 7.000 12.1 0.100 5.9 1.800 6.4 4.500 9.8 8.500 13.3 0.200 5.7 1.600 7.0 13.2 <	File 230609	REVISED	SURFACI	F. W	Checke	ed by PL					raina	16
Hydro-Brake@ Optimum Manhole: 10 HB, DS/PN: 2.002, Volume (m³): 13.2 Suggested Manhole Diameter (mm) 1200 Control Points Head (m) Flow (1/s) Control Points Head (m) Flow (1/s) Design Point (Calculated) 1.575 6.0 Kick-Flo@ 0.952 4.7 Fluin-Flom 0.468 5.9 Mean Flow over Bead Range - 5.2 The hydrological calculations have been based on the Head/Discharge relationship for the Hydrological calculations have been based on the Head/Discharge relationship for the hydrological calculations have been based on the Head/Discharge relationship for the invalidated Depth (m) Flow (1/s) 0.100 3.6 1.200 5.3 3.500 8.1 7.000 12.1 0.200 5.3 1.400 5.7 3.500 8.1 7.000 12.5 0.300 5.9 2.200 7.0 5.500 10.3 9.000 13.7 0.600 5.9 2.200 7.6 6.500 11.81 9.500 14.0 0.800 5.5	Innowyze		001011101		Netwo:	rk 2020	1					_
Hydro-Brake@ Optimum Manhole: 10 HB, DS/FN: 2.002, Volume (m³): 13.2 Suggested Manhole Diameter (mm) 1200 Control Points Bead (m) Flow (1/s) Control Points Head (m) Flow (1/s) Design Foint (Calculated) 1.575 6.0 Kick-Flo@ 0.952 4.7 Flush-Flom 0.468 5.9 Mean Flow over Head Range - 5.2 The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum we butilised then these storage routing calculations will be invalidated Depth (m) Flow (1/s) 0.100 3.6 1.200 5.3 3.000 8.1 7.000 12.1 0.200 5.7 1.600 6.4 4.500 9.8 6.500 13.3 0.500 5.9 2.200 7.6 5.500 10.3 9.500 14.0 0.500 5.9 2.600 7.6 6.500 11.20 22.6 0.6000 5.9 2.600	11110 1 2 2 0				1100.000	LK 2020.	<u> </u>					
Control Points Head (m) Flow (1/s) Control Points Head (m) Flow (1/s) Design Point (Calculated) 1.575 6.0 Kick-Flo@ 0.952 4.7 Flush-Flo ^m 0.468 5.9 Man Flow over Head Range - 5.2 The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum as specified. Should another type of control device other (1/s) Depth (m) Flow (1/s) 0.00 1.21 0.100 3.6 1.200 5.3 3.000 8.1 7.000 12.1 0.200 5.3 1.400 5.7 5.500 10.3 9.000 13.7 0.500 5.9 2.000 6.4 4.500 9.8 8.500 13.3 0.600 5.9 2.000 7.6 6.500 11.7 14.0 Midro-Brake@ Optimum Manhole: 17 HB, DS/PN: 1.009, Volume (m³): 9.6 Unit Reference MD-SHE-0235-3200-1642-3200 22.0 <td><u>Hydro-</u></td> <td>Brake® O</td> <td>ptimum Suc</td> <td>Manho ggested</td> <td>le: 10 H d Manhole</td> <td>B, DS/PN Diameter</td> <td>: 2.002 (mm) 1200</td> <td>, Volume</td> <td><u>ə (m</u></td> <td>³): 1</td> <td>3.2</td> <td></td>	<u>Hydro-</u>	Brake® O	ptimum Suc	Manho ggested	le: 10 H d Manhole	B, DS/PN Diameter	: 2.002 (mm) 1200	, Volume	<u>ə (m</u>	³): 1	3.2	
Design Point (Calculated) 1.575 6.0 Kick-Flo® 0.952 4.7 Flush-Flo [®] 0.468 5.9 Mean Plow over Head Range - 5.2 The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake@ Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum Manbole 7.000 12.1 0.100 3.6 1.200 5.3 3.000 8.1 7.000 12.1 0.200 5.3 1.400 5.7 3.500 8.7 7.500 12.9 0.400 5.9 1.800 6.4 4.500 9.8 8.500 13.3 0.600 5.9 2.000 7.6 6.500 11.3 14.0 0.800 5.5 2.400 7.3 6.000 11.3 14.0 0.800 5.5 1.000 4.9 2.60 7.6	Control	Points	Head	(m) F.	low (l/s)	Con	trol Poin	nts	Head	(m) E	[low (l,	/s)
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Depth (m) Flow (1/s) 0.100 3.6 1.200 5.3 3.000 8.1 7.000 12.1 0.200 5.3 1.400 5.7 3.500 8.7 7.500 12.5 0.300 5.7 1.600 6.0 4.000 9.3 8.000 12.9 0.400 5.9 1.800 6.4 4.500 9.8 8.500 13.3 0.500 5.9 2.200 7.0 5.500 10.3 9.000 13.7 0.600 5.5 2.400 7.3 6.000 11.3 9.500 14.0 Hydro-Brake@ Optimum Manhole: 17 HB, DS/PN: 1.009, Volume (m ³): 9.6 Unit Reference MD-SHE-0235-3200-1642-3200 Design Flow (1/s) 32.0 Flow Calculated Objective Minimise upstream storage Minimu Outlet Pipe Diameter (mm) 300 300 Surgace Minimu O	The hydrolo Hydro-Brake Hydro-Brake	gical calc ® Optimum Optimum®	ulations as speci be utili	have } fied. sed the	been based Should ar en these s	d on the H nother typ storage ro	ead/Disch e of cont uting cal	narge rela trol devic lculations	ation ce ot s wil	ship her tl l be	for the han a invalid	ated
0.100 3.6 1.200 5.3 3.000 8.1 7.000 12.1 0.200 5.3 1.400 5.7 3.500 8.7 7.500 12.5 0.300 5.7 1.600 6.0 4.000 9.8 8.000 12.9 0.400 5.9 1.800 6.4 4.500 9.8 8.500 13.3 0.500 5.9 2.000 6.7 5.000 10.3 9.000 13.7 0.600 5.5 2.400 7.3 6.000 11.3 1.000 14.0 0.800 5.5 2.400 7.6 6.500 11.7 14.0 Hydro-Brake@ Optimum Manhole: 17 HB, DS/PN: 1.009, Volume (m³): 9.6 Unit Reference MD-SHE-0235-3200-1642-3200 Design Plow (1/s) 3.0 Flush-Flow Calculated Objective Minimise upstream storage Application Surface Sump Available Yes Diameter (mm) 300 300 Suggested Manhole Diameter (mm) 300 1.642	Depth (m)	Flow (1/s	s) Depth	(m) F.	low (l/s)	Depth (m)	Flow (l	/s) Depth	1 (m)	Flow	(l/s)	
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0.300 5.7 1.600 6.0 4.000 9.3 8.000 12.9 0.400 5.9 1.800 6.4 4.500 9.8 8.500 13.3 0.500 5.9 2.200 7.0 5.500 10.8 9.500 14.0 0.600 5.5 2.400 7.3 6.000 11.7 Hydro-Brake@ Optimum Manhole: 17 HB, DS/PN: 1.009, Volume (m ³): 9.6 Unit Reference MD-SHE-0235-3200-1642-3200 Design Head (m) 1.642 Design Flow (1/s) 32.0 Flush-Flo ^m Calculated Objective Minimise upstream storage Application Surface Sump Available Yes Diameter (mm) 235 Invert Level (m) 61.852 Minimum Outlet Pipe Diameter (mm) 300 Suggested Manhole Diameter (mm) 1800 Control Points Head (m) Flow (1/s) Kick-Flo [®] 1.101 26.4 Flush-Flo ^m 0.503 32.0 Mean Flow over Head Range - 27.5 The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake@ Optimum a specified. Should another type of control device other than a Hydro-Brake@ Optimum a specified. Should another type of control device other than a Hydro-Brake@ Optimum a specified. Should another type of control device other than a Hydro-Brake@ Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum As specified. Should another type of control device other than a Hydro-Brake Optimum As specified. Should another type of control device other than a Hydro-Brake Optimum As specified. Should another type of control	0.200	5	.3 1	.400	5.7	3.500		8.7 7	.500		12.5	
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Coast Consulting Er	Page 5						
Suite 6, Vita House							
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Date 09/06/2023		Designed by	RH				
File 230609 REVISED	D SURFACE W	Checked by	PL		Dialitage		
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0.800 3	31.0 2.200	36.8 5.	000 54.7	8.500	70.8		
1.000 23	28.8 2.400	38.4 5.	500 57.3	9.000	72.8		
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1.600 3	3.500	46.1 7.	000 64.4				

Coast Consulting Engineers Ltd		Page 6
Suite 6, Vita House	FLOSH MEADOWS	
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<u>Storage Stru</u> <u>Cellular Stora</u> Inve Infiltration Coefficient Infiltration Coefficient Depth (m) Area (m²) Inf. Ar 0.000 51.8 0.520 51.8 <u>Cellular Stora</u> Inve Infiltration Coefficient	Intervolk 2020.1 ctures for 180518 SW1.SWS ge Manhole: 1, DS/PN: 1.00 rt Level (m) 63.585 Safety Fa Base (m/hr) 0.00000 Poro Side (m/hr) 0.00000 ea (m²) Depth (m) Area (m²) 0.0 0.521 0.0 ge Manhole: 2, DS/PN: 1.00 rt Level (m) 63.015 Safety Fa Base (m/hr) 0.00000	00 ctor 2.0 sity 0.95 nf. Area (m²) 0.0 01 ctor 2.0 sity 0.95
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Cellular Stora Inve Infiltration Coefficient Infiltration Coefficient	ge Manhole: 4, DS/PN: 1.00 rt Level (m) 62.589 Safety Fa Base (m/hr) 0.00000 Poro Side (m/hr) 0.00000	<u>03</u> ctor 2.0 sity 0.95
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Cellular Stora	ge Manhole: 6, DS/PN: 1.00	05
Inve Infiltration Coefficient Infiltration Coefficient	rt Level (m) 62.335 Safety Fa Base (m/hr) 0.00000 Poro Side (m/hr) 0.00000	ctor 2.0 sity 0.95
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0.000 25.9 0.520 25.9	0.0 0.521 0.0 0.0	0.0
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Suite 6, Vita House FLOSH MEADOWS Fish Quay CLEATOR North Shields NE30 1JA 1:2 Date 09/06/2023 Designed by PH File 230609 REVISED SURPACE W Checked by PL Network 2020.1 Network 2020.1 Cellular Storage Manhole: 7, DS/PN: 1.006 Innevyze Network 2020.1 Cellular Storage Manhole: 7, DS/PN: 1.006 Infiltration Coefficient Base (m/hr) 0.00000 Depth (m) Area (m²) Inf. Area (m²) 0.000 25.9 0.0 October (m) Area (m²) Infiltration Coefficient Base (m/hr) 0.00000 Depth (m) Area (m²) Inf. Area (m²) October (m) Area (m²) Invert Level (m) 63.413 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Depth (m) Area (m²) Inf. Area (m²) October (m) Area (m²) Invert Level (m) 62.621 0.0 Infiltration Coefficient Side (m/hr) 0.00000 Depth (m) Area (m²) Inf. Area (m²) October (m) Area (m²) Infiltration Coefficient Side	Coast Consulting Engineers Ltd		Page 7	
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Depth (m) Area (m²) Inf. Area (m²) Depth (m) Area (m²) Inf. Area (m²) 0.000 388.5 0.0 0.520 388.5 0.0 Cellular Storage Manhole: 10 HB, DS/PN: 2.002 Invert Level (m) 62.249 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Depth (m) Area (m²) Inf. Area (m²) Depth (m) Area (m²) Inf. Area (m²) 0.000 170.0 0.0 0.520 170.0 0.0 0.521 0.0 0.0 0.522 170.0 0.0 0.520 170.0 0.0 0.520 170.0 0.0 Invert Level (m) 62.181 Infiltration Coefficient Side (m/hr) 0.00000		Side (m/mi) 0.00000		
0.000 388.5 0.0 0.521 0.0 0.0 Cellular Storage Manhole: 10 HB, DS/PN: 2.002 Invert Level (m) 62.249 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Perosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 Depth (m) Area (m²) Inf. Area (m²) 0.000 170.0 0.0 0.520 170.0 0.0 Cellular Storage Manhole: 11, DS/PN: 2.003 Invert Level (m) 62.181 Infiltration Coefficient Side (m/hr) 0.00000	Depth (m) Area (m ²) Inf. Are	ea (m ²) Depth (m) Area (m ²) Inf. Area	(m²)	
0.520 388.5 0.0 <u>Cellular Storage Manhole: 10 HB, DS/PN: 2.002</u> Invert Level (m) 62.249 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 Depth (m) Area (m²) Inf. Area (m²) Depth (m) Area (m²) Inf. Area (m²) 0.000 170.0 0.0 0.520 170.0 0.0 <u>Cellular Storage Manhole: 11, DS/PN: 2.003</u> Invert Level (m) 62.181 Infiltration Coefficient Side (m/hr) 0.00000	0.000 388.5	0.0 0.521 0.0	0.0	
Cellular Storage Manhole: 10 HB, DS/PN: 2.002Invert Level (m) 62.249 Safety Factor 2.0Infiltration Coefficient Base (m/hr) 0.00000Porosity 0.95Infiltration Coefficient Side (m/hr) 0.00000Depth (m) Area (m²) Inf. Area (m²)Depth (m) Area (m²) Inf. Area (m²)0.000 170.0 0.00.521 0.0 0.0Cellular Storage Manhole: 11, DS/PN: 2.003Invert Level (m) 62.181 Infiltration Coefficient Side (m/hr) 0.0000	0.520 388.5	0.0		
Cellular Storage Manhole: 10 HB, DS/PN: 2.002Invert Level (m) 62.249 Safety Factor 2.0Infiltration Coefficient Base (m/hr) 0.00000Porosity 0.95Infiltration Coefficient Side (m/hr) 0.00000Depth (m) Area (m²) Inf. Area (m²)Depth (m) Area (m²) Inf. Area (m²)0.000 170.0 0.00.521 0.0 0.0Cellular Storage Manhole: 11, DS/PN: 2.003Invert Level (m) 62.181 Infiltration Coefficient Side (m/hr) 0.0000				
Invert Level (m) 62.249 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 Depth (m) Area (m ²) Inf. Area (m ²) Depth (m) Area (m ²) Inf. Area (m ²) 0.000 170.0 0.0 0.521 0.0 0.0 0.520 170.0 0.0 0.521 0.0 0.0 Cellular Storage Manhole: 11, DS/PN: 2.003 Invert Level (m) 62.181 Infiltration Coefficient Side (m/hr) 0.00000	<u>Cellular Storage</u>	Manhole: 10 HB, DS/PN: 2.002		
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 Depth (m) Area (m ²) Inf. Area (m ²) Depth (m) Area (m ²) Inf. Area (m ²) 0.000 170.0 0.0 0.521 0.0 0.0 0.520 170.0 0.0 0.0 Cellular Storage Manhole: 11, DS/PN: 2.003 Invert Level (m) 62.181 Infiltration Coefficient Side (m/hr) 0.00000	Inve	rt Level (m) 62.249 Safety Factor 2.	0	
Infiltration Coefficient Side (m/hr) 0.00000 Depth (m) Area (m ²) Inf. Area (m ²) Depth (m) Area (m ²) Inf. Area (m ²) 0.000 170.0 0.0 0.521 0.0 0.0 0.520 170.0 0.0 0.0 Cellular Storage Manhole: 11, DS/PN: 2.003 Invert Level (m) 62.181 Infiltration Coefficient Side (m/hr) 0.00000	Infiltration Coefficient	Base (m/hr) 0.00000 Porosity 0.9	5	
Depth (m) Area (m²) Inf. Area (m²) Depth (m) Area (m²) Inf. Area (m²) 0.000 170.0 0.0 0.520 170.0 0.0 Cellular Storage Manhole: 11, DS/PN: 2.003 Invert Level (m) 62.181 Infiltration Coefficient Side (m/hr)	Infiltration Coefficient	Side (m/hr) 0.00000		
0.000 170.0 0.0 0.521 0.0 0.0 0.520 170.0 0.0 0.0 <u>Cellular Storage Manhole: 11, DS/PN: 2.003</u> Invert Level (m) 62.181 Infiltration Coefficient Side (m/hr) 0.00000	Depth (m) Area (m ²) Inf. Area	ea (m ²) Depth (m) Area (m ²) Inf. Area	(m²)	
0.000 170.0 0.0 0.521 0.0 0.0 0.520 170.0 0.0 0.521 0.0 0.0 <u>Cellular Storage Manhole: 11, DS/PN: 2.003</u> Invert Level (m) 62.181 Infiltration Coefficient Side (m/hr) 0.00000				
Cellular Storage Manhole: 11, DS/PN: 2.003 Invert Level (m) 62.181 Infiltration Coefficient Side (m/hr) 0.00000	0.000 170.0	0.0 0.521 0.0	0.0	
Cellular Storage Manhole: 11, DS/PN: 2.003	0.520 170.0	0.0		
Invert Level (m) 62.181 Infiltration Coefficient Side (m/hr) 0.00000	Cellular Storag	ge Manhole: 11, DS/PN: 2.003		
Invert Level (m) 62.181 Infiltration Coefficient Side (m/hr) 0.00000				
Infiltration Coefficient Base (m/br) 0 00000 Safety Factor 2 0	Invert Level (m)	62.181 Infiltration Coefficient Side	(m/hr) 0.00000 Factor 2.0	
		Salety Salety	140001 2.0	

Coast Consulting Engineers Ltd		Page 8
Suite 6, Vita House	FLOSH MEADOWS	
Fish Quay	CLEATOR	
North Shields NE30 1JA	1:2	Micco
Date 09/06/2023	Designed by RH	
File 230609 REVISED SURFACE W	Checked by PL	Diamage
Innovyze	Network 2020.1	·
<u>Cellular Storag</u>	e Manhole: 11, DS/PN: 2	2.003
	Porosity 0.95	
Depth (m) Area (m ²) Inf. Are	ea (m ²) Depth (m) Area (m ²)	Inf. Area (m²)
0.000 200.0	0.0 0.521 0.0	0.0
0.520 200.0	0.0	
Cellular Storag	e Manhole: 12, DS/PN: 2	2.004
Inver Infiltration Coefficient	t Level (m) 62.079 Safety	Factor 2.0 prosity 0.95
Infiltration Coefficient	Side (m/hr) 0.00000	01001Cy 0.90
Depth (m) Area (m ²) Inf. Are	ea (m ²) Depth (m) Area (m ²)	Inf. Area (m²)
0.000 129.5	0.0 0.521 0.0	0.0
0.520 129.5	0.0	
Cellular Storag	e Manhole: 15, DS/PN: 1	.008
Inver Infiltration Coefficient	ct Level (m) 61.919 Safety	Factor 2.0
Infiltration Coefficient	Side (m/hr) 0.00000 PC	STOSILY 0.95
Donth (m) Aron (m^2) Inf Arc	(m^2) Donth (m) Aros (m ²)	$T_{mf} = \lambda_{mod} (m^2)$
		III. ALEA (m-)
0.000 30.0	0.0 0.521 0.0	0.0
0.520 50.0	0.0	
<u>Ce</u> llular Storag	<u>e Manhole: 16,</u> DS/PN: 3	3.000
Inver Infiltration Coofficient	t Level (m) 61.900 Safety	Factor 2.0
Infiltration Coefficient	Side (m/hr) 0.00000	JIUSILY 0.93
Depth (m) Area (m ²) Inf. Are	ea (m ²) Depth (m) Area (m ²)	Inf. Area (m²)
0.000 51.8	0.0 0.521 0.0	0.0
0.520 51.8	0.0	
Cellular Storage	Manhole: 17 HB, DS/PN:	1.009
	,	
Inver	t Level (m) 61.852 Safety	Factor 2.0
Intiltration Coefficient	Base (m/hr) 0.00000 Po Side (m/hr) 0.00000	prosity 0.95
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Suite 6, Vita House	FLOSH MEADOWS	
Fish Quay	CLEATOR	
North Shields NE30 1JA	1:2	Micco
Date 09/06/2023	Designed by RH	
File 230609 REVISED SURFACE W	Checked by PL	Drainage
Innovyze	Network 2020.1	
Cellular Storage	Manhole: 17 HB, DS/PN: 1.009	
Depth (m) Area (m²) Inf. Ar	ea (m ²) Depth (m) Area (m ²) Inf. Area (m	m²)
0.000 77.7	0.0 0.521 0.0	0.0
0.520 77.7	0.0	
<u>619</u>	82-2020 Innovyze	
C E O		

Coast Consulting Engineers Ltd		Page 10					
Suite 6, Vita House	FLOSH MEADOWS						
Fish Ouav	CLEATOR						
North Shields NE30 1JA	1:2	Micco					
Date 09/06/2023	Designed by RH	MILIU					
Filo 230600 DEVISED SUDENCE W	Charled by RI	Drainage					
THE 250009 REVISED SURFACE W	Notwork 2020 1						
IIIIOVyZe	Network 2020.1						
Summary of Critical Results by	Maximum Level (Rank 1) for 180518	SW1.SWS					
Areal Reduction Factor Hot Start (mins) Hot Start Level (mm)	<u>mulation Criteria</u> 1.000 Additional Flow - % of Total Flow 0 MADD Factor * 10m ³ /ha Storage 0 Inlet Coeffiecient	0.000					
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 Hydrogra Number of Online Cont Number of Offline Cont	aphs 0 Number of Storage Structures 13 rols 3 Number of Time/Area Diagrams 0 rols 0 Number of Real Time Controls 0						
Synthe	etic Rainfall Details						
Rainfall Model	FSR Ratio R 0.220						
M5-60 (mm)	18.600 Cv (Winter) 1.000						
Margin for Flood Risk Warr Analysis DI	ting (mm) 300.0 Timestep 2.5 Second Increment (Extended) 'S Status OFF						
DV	D Status OFF						
Inerci	a Status Off						
Profile(s)	Summer and Wint	er					
Duración(S) (mins) 15,	50, 60, 120, 180, 240, 560, 480, 600, 72 960, 14	440					
Return Period(s) (years)		2					
Climate Change (%)		0					
		Water					
US/MH Return Clima	te First (X) First (Y) First (Z) Overf	low Level					
PN Name Storm Period Chang	e Surcharge Flood Overflow Act	. (m)					
1.000 1 240 Summer 2 +	0%	63.117					
1.001 2 240 Summer 2 +	0%	63.117					
1.002 3 HB 240 Summer 2 +	0% 2/15 Summer	63.116					
1.003 4 120 Summer 2 +	0%	62.684					
1.004 5 60 Summer 2 +	0%	62.547					
1.005 6 60 Summer 2 +	U3 N2	62.451					
2.000 8 15 Summer 2 +	0% 0%	62.686					
2.001 9 480 Summer 2 +	 0%	62.618					
2.002 10 HB 480 Summer 2 +	0%	62.617					
2.003 11 360 Summer 2 +	0%	62.256					
2.004 12 360 Summer 2 +	0%	62.194					
2.005 13 360 Summer 2 +	U% N%	62.181 62.174					
1.007 1.1.000 Summer 2 T		V2 • 1 / 4					
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Suite 6, Vita House	FLOSH MEADOWS	
Fish Quay	CLEATOR	
North Shields NE30 1JA	1:2	Mirro
Date 09/06/2023	Designed by RH	Dcainago
File 230609 REVISED SURFACE W	Checked by PL	Diamage
Innovyze	Network 2020.1	•

Summary of Critical Results by Maximum Level (Rank 1) for 180518 SW1.SWS

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	1	-0.871	0.000	0.00		80	4.4	OK	
1.001	2	-0.766	0.000	0.01		83	6.1	OK	
1.002	3 HB	0.117	0.000	0.16			6.0	SURCHARGED	
1.003	4	-0.130	0.000	0.37		140	13.7	OK	
1.004	5	-0.117	0.000	0.46			16.5	OK	
1.005	6	-0.109	0.000	0.52			18.8	OK	
1.006	7	-0.099	0.000	0.60		51	20.8	OK	
2.000	8	-0.425	0.000	0.08		6	19.1	OK	
2.001	9	-0.272	0.000	0.07		102	15.9	OK	
2.002	10 HB	-0.007	0.000	0.06		192	5.8	OK	
2.003	11	-0.300	0.000	0.08		315	7.8	OK	
2.004	12	-0.260	0.000	0.11		248	9.5	OK	
2.005	13	-0.231	0.000	0.13			10.8	OK	
1.007	14	-0.194	0.000	0.29			27.8	OK	

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Suite 6, Vita House	FLOSH MEADOWS	
Fish Quay	CLEATOR	
North Shields NE30 1JA	1:2	Mirro
Date 09/06/2023	Designed by RH	Dcainago
File 230609 REVISED SURFACE W	Checked by PL	Diamage
Innovyze	Network 2020.1	

Summary of Critical Results by Maximum Level (Rank 1) for 180518 SW1.SWS

PN	US/MH Name	s	torm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.008	15	360	Summer	2	+0%					62.152
3.000	16	360	Summer	2	+0%					62.138
1.009	17 HB	360	Summer	2	+0읭					62.137
1.010	18	360	Summer	2	+0읭					61.897

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
1.008	15	-0.142	0.000	0.29		126	27.7	OK	
3.000	16	-0.137	0.000	0.02		115	2.0	OK	
1.009	17 HB	-0.015	0.000	0.40		154	25.4	OK	
1.010	18	-0.146	0.000	0.52			25.4	OK	

Coast Co	onsulti	ng En	iginee	rs Ltd						I	Page 0
Suite 6,	Vita	House	;		FL	FLOSH MEADOWS					
Fish Qua	ay				CL	CLEATOR					
North Sh	nields	NE30	1JA		1:	30					Micco
Date 09/	/06/202	23			De	signed by	RH				
File 230)609 RE	CVISED	SURF	ACE W.	Ch	ecked by I	PL				Digiliga
Innovyze	9				Ne	twork 2020	0.1				
		0.000									
		STORM	1 SEWE	IR DESI	GN by	the Modif	ied R	atior	na⊥ M	lethod	
			N7					0.011	OF 10		
			Netw	ork Des	sign T	able for .	180518	SWI	.SWS		
PN	Length	Fall	Slope	I.Area	T.E.	Base	k	HYD	DIA	Section Tv	pe Auto
	(m)	(m)	(1:X)	(ha)	(mins)	Flow (l/s)	(mm)	SECT	(mm)	1	Design
1.000	41.957	0.105	399.6	0.061	5.00	0.0	0.600	0	975	Pipe/Condu	it 🐴
1.001	53.639	0.134	400.3	0.118	0.00	0.0	0.600	0	975	Pipe/Condu	it 🖁
1.002	31.512	0.185	170.3	0.129	0.00	0.0	0.600	0	225	Pipe/Condu	it 🖷
1.003	25.483	0.150	169.9	0.104	0.00	0.0	0.600	0	225	Pipe/Condu	it 🕜
1.004	17.652	0.104	169.7	0.035	0.00	0.0	0.600	0	225	Pipe/Condu	it 🗗
1.005	18.982	0.112	169.5	0.028	0.00	0.0	0.600	0	225	Pipe/Condu	it 🗬
1.006	13.655	0.080	170.7	0.029	0.00	0.0	0.600	0	225	Pipe/Condu	it 💣
2.000	71.706	0.221	324.5	0.115	5.00	0.0	0.600	0	525	Pipe/Condu	it 🦰
2.001	37.730	0.116	325.3	0.225	0.00	0.0	0.600	0	525	Pipe/Condu	it 🛱
2.002	22.253	0.068	325.0	0.065	0.00	0.0	0.600	0	375	Pipe/Condu	it 🖷
2.003	33.218	0.102	325.7	0.065	0.00	0.0	0.600	0	375	Pipe/Condu	it 🛱
2.004	13.246	0.041	323.1	0.062	0.00	0.0	0.600	0	375	- Pipe/Condu	it 🛱
1.004 1.005 1.006 2.000 2.001 2.002 2.003 2.004	17.652 18.982 13.655 71.706 37.730 22.253 33.218 13.246	0.104 0.112 0.080 0.221 0.116 0.068 0.102 0.041	169.7 169.5 170.7 324.5 325.3 325.0 325.7 323.1	0.035 0.028 0.029 0.115 0.225 0.065 0.065 0.065	0.00 0.00 5.00 0.00 0.00 0.00 0.00	0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	0.600 0.600 0.600 0.600 0.600 0.600 0.600 0.600		225 225 225 525 525 375 375 375	Pipe/Condu Pipe/Condu Pipe/Condu Pipe/Condu Pipe/Condu Pipe/Condu Pipe/Condu	it 9 it 9 it 9 it 9 it 9 it 9 it 9

Network Results Table

 1.007
 24.092
 0.074
 325.6
 0.021
 0.00
 0.0
 0.600
 o
 375
 Pipe/Conduit
 #

 1.008
 21.726
 0.067
 324.3
 0.029
 0.00
 0.0
 0.600
 o
 375
 Pipe/Conduit
 #

PN	Rain	T.C.	US/IL	Σ I.Area	Σ Base	Foul	Add Flow	Vel	Cap	Flow	
	(mm/hr)	(mins)	(m)	(ha)	Flow (l/s)	(1/s)	(1/s)	(m/s)	(1/s)	(1/s)	
1.000	0.00	5.43	63.013	0.061	0.0	0.0	0.0	1.64	1225.0	0.0	
1.001	0.00	5.97	62.908	0.179	0.0	0.0	0.0	1.64	1223.9	0.0	
1.002	0.00	6.50	62.774	0.308	0.0	0.0	0.0	1.00	39.7	0.0	
1.003	0.00	6.92	62.589	0.412	0.0	0.0	0.0	1.00	39.8	0.0	
1.004	0.00	7.22	62.439	0.447	0.0	0.0	0.0	1.00	39.8	0.0	
1.005	0.00	7.53	62.335	0.475	0.0	0.0	0.0	1.00	39.8	0.0	
1.006	0.00	7.76	62.223	0.504	0.0	0.0	0.0	1.00	39.7	0.0	
				0 115	0.0						
2.000	0.00	5.97	62.586	0.115	0.0	0.0	0.0	1.24	268.0	0.0	
2.001	0.00	6.47	62.365	0.340	0.0	0.0	0.0	1.24	267.7	0.0	
2.002	0.00	6.85	62.249	0.405	0.0	0.0	0.0	1.00	110.4	0.0	
2.003	0.00	7.40	62.181	0.470	0.0	0.0	0.0	1.00	110.3	0.0	
2.004	0.00	7.62	62.079	0.532	0.0	0.0	0.0	1.00	110.7	0.0	
2.005	0.00	7.86	62.038	0.574	0.0	0.0	0.0	0.99	109.9	0.0	
1 007	0 00	8 26	61 993	1 099	0 0	0 0	0 0	1 00	110 3	0 0	
1.008	0.00	8.62	61.919	1.128	0.0	0.0	0.0	1.00	110.5	0.0	
				@1982-	2020 Innos	7170					
				01002	2020 11110	' <u>y</u> <u>L</u> C					

Coast Consulting Engineers Ltd		Page 1							
Suite 6, Vita House	FLOSH MEADOWS								
Fish Quay	CLEATOR								
North Shields NE30 1JA	1:30	Mirro							
Date 09/06/2023	Designed by RH	Dcainago							
File 230609 REVISED SURFACE W	Checked by PL	Diamage							
Innovyze	Network 2020.1								
STORM SEWER DESIGN	N by the Modified Rational Method								
Network Desi	Network Design Table for 180518 SW1.SWS								
PN Length Fall Slope I.Area T (m) (m) (1:X) (ha) (m	T.E. Base k HYD DIA Section T mins) Flow (l/s) (mm) SECT (mm)	Type Auto Design							
3.000 15.459 0.048 322.1 0.070	5.00 0.0 0.600 o 375 Pipe/Conc	luit 💾							
1.009 26.775 0.109 245.6 0.000	0.00 0.0 0.600 o 300 Pipe/Cond	luit 🔐							
1.010 3.900 0.016 243.8 0.000	0.00 0.0 0.600 o 300 Pipe/Conc	luit 📅							
Net	work Results Table								
PN Rain T.C. US/IL Σ I	.Area Σ Base Foul Add Flow Vel Ca	p Flow							
(mm/hr) (mins) (m) (ha) Flow $(1/s)$ $(1/s)$ $(1/s)$ (m/s) $(1/s)$	s) (l/s)							
3.000 0.00 5.26 61.900	0.070 0.0 0.0 0.0 1.00 110	.9 0.0							
1.009 0.00 9.07 61.852	1.198 0.0 0.0 0.0 1.00 70	.6 0.0							
1.010 0.00 9.13 61.743	1.198 0.0 0.0 0.0 1.00 70	.9 0.0							
Free Flowing Out	fall Details for 180518 SW1.SWS								
Outfall Outfall	C. Level I. Level Min D,L W								
Pipe Number Name	(m) (m) I. Level (mm) (mm) (m)								
1.010 C1	63,006 61,727 61,727 1350 0								
Simulation (Criteria for 180518 SW1.SWS								
Volumetric Bunoff Coeff	0 750 Additional Flow - % of Total Flow	w 0 0 0 0							
Areal Reduction Factor	1.000 MADD Factor * 10m ³ /ha Storage	e 2.000							
Hot Start (mins)	0 Inlet Coefficien	t 0.800							
Hot Start Level (mm)	0 Flow per Person per Day (1/per/day) 0.000							
Foul Sewage per hectare (1/s)	0.000 Output Interval (mins) 1							
	-								
Number of Input Hydrog	raphs 0 Number of Storage Structures 13								
Number of Offline Con	trols 0 Number of Real Time Controls 0								
Synthe	etic Rainfall Details								
Rainfall Model	FSR M5-60 (mm) 19 600								
Return Period (years)	2 Ratio R 0.223								
Region	England and Wales Profile Type Summer								

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Suite 6, Vita House	FLOSH MEADOWS	
Fish Quay	CLEATOR	
North Shields NE30 1JA	1:30	Micro
Date 09/06/2023	Designed by RH	
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Innovyze	Network 2020.1	

Synthetic Rainfall Details

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

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Suite 6, Vita	a House		FLOSH M	EADOWS				
Fish Quay			CLEATOR					
North Shields	s NE30 1.	JA	1:30				Micco	
Date 09/06/20)23	-	Designe	d bv RH				
File 230609 F	REVISED SI	IRFACE W	Checked	by PL			Urainage	
Innovyze			Network	2020.1				
	4							
Online Controls for 180518 SW1.SWS								
Hydro-B	srake® Opt	imum Manho	le: 3 HB,	DS/PN:	1.002, V	olume (m³): 45.9	
		Uni Desi	lt Keierenc an Head (m	e MD-SHE-)	-0107-7000-	2119-7000 2 119		
		Desigr	n Flow (l/s)		7.0		
			Flush-Flo	ſM	C	alculated		
			Objectiv	e Minim:	ise upstrea	m storage		
		Sum	Applicatio	n		Surface		
		Di	lameter (mm)		107		
		Inver	rt Level (m)		62.774		
	Minimum C	outlet Pipe Di	Lameter (mm)		150		
	Suggest	ed Manhole Di	Lameter (mm)		1200		
Control P	Points	Head (m) Fl	ow (l/s)	Cont	rol Points	Head	(m) Flow (l/s)	
Design Point (Calculated)	2.119	7.0		Kick-	-Flo® 0.	.957 4.8	
	Flush-Flo ^T	0.469	6.1 Me	ean Flow	over Head F	Range	- 5.6	
The hydrologi	cal calcula	ations have b	een based o	on the He	ad/Discharg	e relation	ship for the	
Hydro-Brake®	Optimum as	specified.	Should anot	her type	of control	device ot	her than a	
Hydro-Brake O	ptimum® be	utilised the	n these sto	rage rou	ting calcul	ations wil	l be invalidated	
Depth (m)	Flow (l/s)	Depth (m) Fl	ow (1/s) De	epth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	
0.100	3.7	1.200	5.4	3.000	8.2	7.000	12.3	
0.200	5.4	1.400	5.8	3.500	8.9	7.500	12.7	
0.300	5.9	1.600	6.1	4.000	9.4	8.000	13.1	
0.400	6.0	1.800	6.5	4.500	10.0	8.500	13.5	
0.500	6.1	2.000	6.8 7 1	5.000	10.5	9.000	13.9	
0.800	5.6	2.400	7.4	6.000	11.4		11.0	
1.000	4.9	2.600	7.7	6.500	11.9			
Hydro-Bi	rake® Opt	imum Manhol	e: 10 HB,	DS/PN:	2.002, V	'olume (m	³): 13.2	
		Uni	lt Referenc	e MD-SHE-	-0107-6000-	1575-6000		
		Design	Lgn Head (m) Flow (1/s)		1.5/5 6 0		
		Deardi	Flush-Flo	/ [M	С	alculated		
			Objectiv	e Minim:	ise upstrea	m storage		
			Applicatio	n		Surface		
	Sump Available Yes							
		Di Thược	t Level (mm)		106 62.249		
	Minimum C	utlet Pipe Di	Lameter (mm	,)		150		
		Ť						
		<u></u>	202-2020	Innorre	<u></u>			
		UI:	シロエーエロエリ	τιπονyze	=			

Coast Consulting Engineers Ltd								Pa	ge 4	
Suite 6, Vita House	FLOSH	MEADO	WS						2	
Fish Ouav	CLEATO	R								
North Shields NE30 1.1A	1.30									
	Dociar	od by	DU	r				N]
	Desigi		пл	L					rain	ane
FILE 230609 REVISED SURFACE W	Checke	ea by	PL							J
Innovyze	Networ	rk 202	0.1							
Hydro-Brake® Optimum Manhole: 10 HB, DS/PN: 2.002, Volume (m ³): 13.2										
Suggested Manhole Diameter (mm) 1200										
Control Points Head (m) Flow	7 (l/s)	C	Cont	rol P	oints	:	Head	(m)	Flow	(l/s)
Design Point (Calculated) 1.575 Flush-Flo™ 0.468	6.0 5.9	Mean F	low	over	Kick- Head F	Flo® Range	0.	.952 -		4.7 5.2
	, ,			1/5	1	-			c .	1
The hydrological calculations have been Hydro-Brake® Optimum as specified.	n based	other	e He tvne	ead/Di	scharg	e rela devia	tion	ship her t	for t	he
Hydro-Brake Optimum® be utilised then	these s	torage	rou	ting	calcul	ations	s wil	l be	inval	idated
		-		-						
Depth (m) Flow (1/s) Depth (m) Flow	1 (l/s)	Depth	(m)	Flow	(l/s)	Depth	(m)	Flow	(1/s	•)
0.100 3.6 1.200	5.3	3.	000		8.1	7	.000		12.	1
0.200 5.3 1.400	5.7	3.	500		8.7	7	.500		12.	5
0.300 5.7 1.600	6.0	4.	000		9.3	8	.000		12.	9
0.400 5.9 1.800	6.4	4.	500		9.8	8	.500		13.	3
0.500 5.9 2.000	6.7	5.	000		10.3	9	.000		13.	7
0.600 5.9 2.200	7.0	5.	500		10.8	9	.500		14.	0
0.800 5.5 2.400	7.3	6.	000		11.3					
1.000 4.9 2.600	7.6	6.	500		11.7					
Hydro-Brake® Optimum Manhole	e: 17 H	ib, ds	/PN	: 1.0	009, 1	Volum	e (m	1 ³):	9.6	
Unit	Refere	nce MD-	-SHE	-0235	-3200-	1642-3	200			
Desig	n Head	(m)				1.	642			
Design	Flow (l	/s)				3	2.0			
	Flush-F	lo™			C	alcula	ted			
	Object:	ive M:	inim	ise u	pstrea	m stor	age			
A	pplicat	ion				Surf	ace			
Sump	Availa	ole					Yes			
Dia	meter (1	nm)					235			
Invert	Level	(m)				61.	852			
Minimum Outlet Pipe Dia	meter (1	nm)					300			
Suggested Manhole Dia	meter (1	nm)				1	800			
Control Points Head (m) Flow	/ (1/s)	C	Cont	rol P	oints	:	Head	(m)	Flow	(l/s)
Design Point (Calculated) 1.642	32.0				Kick-	Flo®	1.	.101		26.4
Flush-Flo™ 0.503	32.0	Mean F	low	over	Head F	lange		-		27.5
The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated										
Depth (m) Flow (l/s) Depth (m) Flow	/ (1/s)	Depth	(m)	Flow	(1/s)	Depth	(m)	Flow	(1/s	•)
0.100 7.8 0.200	23.7	0.	300		30.6	0	.400		31.	7
<u>ଜୀ ସନ</u>	32-2020	IInno	WW7	e						

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Suite 6, Vita House	FLOSH MEADOWS				
Fish Quay	CLEATOR				
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Date 09/06/2023	Designed by RH				
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Innovyze	Network 2020.1				
Hydro-Brake® Optimum Manhole: 17 HB, DS/PN: 1.009, Volume (m³):					
		III) FIOW (1/S)			
0.500 32.0 1.800	33.4 4.000 49.1 7.5	66.6			
0.600 31.8 2.000	35.2 4.500 52.0 8.0	68.8			
0.800 31.0 2.200	36.8 5.000 54.7 8.5	00 70.8			
1.000 28.8 2.400	38.4 5.500 57.3 9.0	00 72.8			
1.200 27.5 2.600	39.9 6.000 59.8 9.5	00 74.8			
1.400 29.6 3.000	42.8 6.500 62.2				
1.600 31.6 3.500	46.1 7.000 64.4				

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Fish Quay	CLEATOR	
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Date 09/06/2023	Designed by RH	
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Innovyze	Network 2020.1	
Storage Struc	ctures for 180518 SW1.SW	<u>IS</u>
<u>Cellular Stora</u>	ge Manhole: 1, DS/PN: 1.	000
Inver Infiltration Coefficient Infiltration Coefficient	rt Level (m) 63.585 Safety Base (m/hr) 0.00000 Po Side (m/hr) 0.00000	Factor 2.0 rosity 0.95
Depth (m) Area (m²) Inf. Are	ea (m ²) Depth (m) Area (m ²)	Inf. Area (m²)
0.000 51.8 0.520 51.8	0.0 0.0	0.0
<u>Cellular Stora</u>	ge Manhole: 2, DS/PN: 1.	001
Inver Infiltration Coefficient Infiltration Coefficient	rt Level (m) 63.015 Safety Base (m/hr) 0.00000 Po Side (m/hr) 0.00000	Factor 2.0 rosity 0.95
Depth (m) Area (m²) Inf. Are	ea (m ²) Depth (m) Area (m ²)	Inf. Area (m²)
0.000 220.0 0.520 220.0	0.0 0.0	0.0
<u>Cellular Stora</u>	ge Manhole: 4, DS/PN: 1.	003
Inver Infiltration Coefficient Infiltration Coefficient	rt Level (m) 62.589 Safety Base (m/hr) 0.00000 Po Side (m/hr) 0.00000	Factor 2.0 rosity 0.95
Depth (m) Area (m ²) Inf. Are	ea (m ²) Depth (m) Area (m ²)	Inf. Area (m²)
0.000 129.5 0.520 129.5	0.0 0.0	0.0
<u>Cellular Stora</u>	ge Manhole: 6, DS/PN: 1.	005
Inver Infiltration Coefficient Infiltration Coefficient	rt Level (m) 62.335 Safety Base (m/hr) 0.00000 Po Side (m/hr) 0.00000	Factor 2.0 rosity 0.95
Depth (m) Area (m²) Inf. Are	ea (m ²) Depth (m) Area (m ²)	Inf. Area (m ²)
0.000 25.9 0.520 25.9	0.0 0.0	0.0
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Fish Quay	CLEATOR						
North Shields NE30 1JA	1:30	Micro					
Date 09/06/2023	Designed by RH						
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Innovyze	Network 2020.1	I					
<u>Cellular Stora</u>	ge Manhole: 7, DS/PN: 1.006						
Taua	white the second s	- 2.0					
Infiltration Coefficient	Base (m/hr) 0.00000 Porosity	v 0.95					
Infiltration Coefficient	Infiltration Coefficient Side (m/hr) 0.00000						
Donth (m) Area (m^2) Inf Ar	(m^2) Donth (m) Area (m^2) Inf	$\Delta rop (m^2)$					
Depth (m) Area (m-) Ini. Ar	ea (m-) Depen (m) Area (m-) Ini.	Area (m ⁻)					
0.000 25.9	0.0 0.521 0.0	0.0					
0.520 25.9	0.0						
Cellular Stora	ge Manhole: 8, DS/PN: 2.000						
	<u> </u>						
Inve	rt Level (m) 63.413 Safety Factor	r 2.0					
Infiltration Coefficient	Base (m/hr) 0.00000 Porosity	y 0.95					
Inflitration Coefficient	Side (m/nr) 0.00000						
Depth (m) Area (m²) Inf. Ar	rea (m²) Depth (m) Area (m²) Inf.	Area (m²)					
0 000 77 7	0.0 0.521 0.0	0 0					
0.520 77.7	0.0	0.0					
<u>Cellular Stora</u>	ge Manhole: 9, DS/PN: 2.001						
Inve	rt Level (m) 62 621 Safety Factor	r = 20					
Infiltration Coefficient	Base (m/hr) 0.00000 Porosity	y 0.95					
Infiltration Coefficient	Side (m/hr) 0.00000						
Depth (m) Area (m ²) Inf. Ar	ea (m^2) Depth (m) Area (m^2) Inf.	Area (m²)					
0.000 388.5	0.0 0.521 0.0	0.0					
0.520 500.5	0.0						
Cellular Storage	Manhole: 10 HB, DS/PN: 2.003	2					
		_					
Inve	rt Level (m) 62.249 Safety Factor	r 2.0					
Infiltration Coefficient	Base (m/hr) 0.00000 Porosity Side (m/hr) 0.00000	y 0.95					
Depth (m) Area (m ²) Inf. Ar	rea (m ²) Depth (m) Area (m ²) Inf.	Area (m²)					
0.000 170.0	0.0 0.521 0.0	0.0					
0.520 170.0	0.0						
<u>Cellular Storac</u>	ge Manhole: 11, DS/PN: 2.003						
Invert Level (m)	62.181 Infiltration Coefficient S	Side (m/hr) 0.00000					
Infiltration Coefficient Base (m/hr)	0.00000 Sa	fety Factor 2.0					

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Fish Quay	CLEATOR	
North Shields NE30 1JA	1:30	Micro
Date 09/06/2023	Designed by RH	
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Innovyze	Network 2020.1	-
<u>Cellular Storage</u>	e Manhole: 11, DS/PN: 2.003	
	Porosity 0.95	
Depth (m) Area (m ²) Inf. Are	a (m ²) Depth (m) Area (m ²) Inf. Area (m	m²)
0.000 200.0	0.0 0.521 0.0	0.0
0.520 200.0	0.0	
Cellular Storage	e Manhole: 12, DS/PN: 2.004	
Inver	t Level (m) 62 079 Safety Factor 2 0	
Infiltration Coefficient	Base (m/hr) 0.00000 Porosity 0.95	
Infiltration Coefficient	Side (m/hr) 0.00000	
Dopth (m) Area (m^2) Inf. Area	(m^2) Donth (m) Area (m ²) Inf Area (m ²)
Depth (m) Alea (m-) Int. Ale		m-)
0.000 129.5	0.0 0.521 0.0	0.0
0.520 129.5	0.0	
Cellular Storage	e Manhole: 15, DS/PN: 1.008	
	· · · · · · · · · · · · · · · · · · ·	
Inver	t Level (m) 61.919 Safety Factor 2.0	
Infiltration Coefficient	Base (m/hr) 0.00000 Porosity 0.95 Side (m/hr) 0.00000	
Depth (m) Area (m ²) Inf. Are	a (m ²) Depth (m) Area (m ²) Inf. Area (m	m²)
0.000 30.0	0.0 0.521 0.0	0.0
0.520 30.0	0.0	
<u>Cellular Storage</u>	e Manhole: 16, DS/PN: 3.000	
Inver	t Level (m) 61.900 Safety Factor 2.0	
Infiltration Coefficient	Base (m/hr) 0.00000 Porosity 0.95	
Infiltration Coefficient	Side (m/hr) 0.00000	
Depth (m) Area (m ²) Inf. Are	a (m ²) Depth (m) Area (m ²) Inf. Area (m	m²)
0.000 51.8	0.0	0.0
Cellular Storage	Manhole: 17 HB, DS/PN: 1.009	
Inver	t Level (m) 61.852 Safety Factor 2.0	
Infiltration Coefficient	Side (m/hr) 0.00000 POPOSILY 0.95	
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Fish Quay	CLEATOR										
North Shields NE30 1JA	1:30	Micco									
Date 09/06/2023											
File 230609 REVISED SURFACE W	Checked by PL	Drainage									
Innovyze											
Cellular Storage	Manhole: 17 HB, DS/PN: 1.009										
Depth (m) Area (m²) Inf. Ar	m²)										
0.000 77.7	0.0 0.521 0.0	0.0									
0.520 77.7	0.0										
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Suite 6, Vita Hou	ise	FLOSH MEADOWS									
Fish Quav		CLEATOR									
North Shields NF	30 1.TA	1.30	Misso								
Date 09/06/2023	100 1011	Designed by PH									
Eile 220600 DEVIC	ED CUDENCE M	Charled by Mi	Drainage								
FILE 230609 REVIS	SURFACE W										
Innovyze		Network 2020.1									
Summary of Cr	Summary of Critical Results by Maximum Level (Rank 1) for 180518 SW1.SWS 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 Coefficient 0.800 Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (1/per/day) 0.000 Foul Sewage per hectare (1/s) 0.000 Number of Input Hydrographs 0 Number of Storage Structures 13 Number of Online Controls 3 Number of Time/Area Diagrams 0											
Num	ber of Offline Con	trols 0 Number of Real Time Controls 0									
	Synt	hetic Rainfall Details									
	Rainfall Model	FSR Ratio R 0.220									
	Region E	ngland and Wales Cv (Summer) 1.000									
	M5-60 (mm)	18.600 Cv (Winter) 1.000									
Margin for Flood Risk Warning (mm) 300.0 Analysis Timestep 2.5 Second Increment (Extended) DTS Status OFF DVD Status OFF Inertia Status OFF											
Profile(s) Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960. 1440											
Return Pe Cli	riod(s) (years) mate Change (%)		30 0								
	<u> </u>										
			Watan								
IIS/MH	Return Clim	ate First (X) First (Y) First (7) Ov	water erflow Level								
PN Name St	orm Period Char	ge Surcharge Flood Overflow	Act. (m)								
1 000 1 000	2	1.0.9	60 00¢								
	Summer 30	+03 +03	63.286								
1.002 3 HB 360 S	Summer 30	+0% 30/15 Summer	63.286								
1.003 4 60 5	Summer 30	+0%	62.721								
1.004 5 60 \$	Summer 30	+0%	62.600								
1.005 6 60 5	Summer 30	+0%	62.524								
1.006 7 60 \$	Summer 30	+0%	62.437								
2.000 8 600 5	Summer 30	+0%	62.751								
2.001 9 600 S	Summer 30	+U3 +08 30/30 Summer	62./51 62.750								
2.002 10 00 000 2	Summer 30	+0%	62.328								
2.004 12 240 5	Summer 30	+0%	62.323								
2.005 13 240 3	Summer 30	+0%	62.318								
1.007 14 240 5	Summer 30	+0%	62.313								
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1		4									

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Summary of Critical Results by Maximum Level (Rank 1) for 180518 SW1.SWS

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m ³)	Flow / Cap.	Overflow (1/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.702	0.000	0.01		183	6.1	OK	
1.001	2	-0.597	0.000	0.01		181	5.2	OK	
1.002	3 HB	0.287	0.000	0.16			6.1	SURCHARGED	
1.003	4	-0.093	0.000	0.65		41	23.7	OK	
1.004	5	-0.064	0.000	0.85			30.4	OK	
1.005	6	-0.036	0.000	0.93		20	33.4	OK	
1.006	7	-0.011	0.000	1.00		18	34.5	OK	
2.000	8	-0.360	0.000	0.03		250	8.6	OK	
2.001	9	-0.139	0.000	0.08		233	18.9	OK	
2.002	10 HB	0.126	0.000	0.06		405	5.9	SURCHARGED	
2.003	11	-0.227	0.000	0.10		101	9.9	OK	
2.004	12	-0.131	0.000	0.17		96	14.0	OK	
2.005	13	-0.094	0.000	0.18			14.7	OK	
1.007	14	-0.055	0.000	0.41			39.2	OK	

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Fish Quay	CLEATOR	
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Innovyze	Network 2020.1	

Summary of Critical Results by Maximum Level (Rank 1) for 180518 SW1.SWS

PN	US/MH Name	s	torm	Return Period	Climate Change	First Surcl	t (X) harge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.008	15	240	Summer	30	+0%	30/240	Summer				62.296
3.000	16	240	Summer	30	+0%	30/240	Summer				62.280
1.009	17 HB	240	Summer	30	+0%	30/60	Summer				62.278
1.010	18	240	Summer	30	+0%						61.916

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
1.008	15	0.002	0.000	0.40		122	37.5	SURCHARGED	
3.000	16	0.005	0.000	0.03		126	2.9	SURCHARGED	
1.009	17 HB	0.126	0.000	0.48		135	30.8	SURCHARGED	
1.010	18	-0.127	0.000	0.63			30.8	OK	

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Suite 6,	Vita	House			F	LOSH N	MEADO	WS				
Fish Qua	ay				C	LEATOR	R					
North Sh	nields	NE30	1JA		1	:100 -	+50%					Micco
Date 09/06/2023								DЦ				
Date 00/	00/202					esigne	eu by	1/11				Drainade
File 230609 REVISED SURFACE W Checked by PL												
Innovyze	5				N	etwor}	x 2020	0.1				
		CTODA			CN be	, the	Madif	ind D	atica		lot bod	
		STORM	1 SEWE	R DESI	GN DY	the	Modii	ied K	atior	ial M	letnod	
			Netwo	ork Des	sign '	Table	for 1	180518	3 SW1	.SWS		
PN	Length	Fall	Slope	I.Area	T.E.	Ba	ase	k	HYD	DIA	Section Ty	pe Auto
	(m)	(m)	(1:X)	(ha)	(mins)) Flow	(l/s)	(mm)	SECT	(mm)		Design
1.000	41.957	0.105	399.6	0.061	5.00	C	0.0	0.600	0	975	Pipe/Condu	it 🔒
1.001	53.639	0.134	400.3	0.118	0.00)	0.0	0.600	0	975	Pipe/Condu	it 💣
1.002	31.512	0.185	170.3	0.129	0.00)	0.0	0.600	0	225	Pipe/Condu	it 🗗
1.003	25.483	0.150	169.9	0.104	0.00	C	0.0	0.600	0	225	Pipe/Condu	it 🗗
1.004	17.652	0.104	169.7	0.035	0.00	C	0.0	0.600	0	225	Pipe/Condu	it ዋ
1.005	18.982	0.112	169.5	0.028	0.00	C	0.0	0.600	0	225	Pipe/Condu	it 🗗
1.006	13.655	0.080	170.7	0.029	0.00	C	0.0	0.600	0	225	Pipe/Condu	it 🗗
2.000	71.706	0.221	324.5	0.115	5.00	C	0.0	0.600	0	525	Pipe/Condu	it 🖰
2.001	37.730	0.116	325.3	0.225	0.00	C	0.0	0.600	0	525	Pipe/Condu	it 🗬
2.002	22.253	0.068	325.0	0.065	0.00	C	0.0	0.600	0	375	Pipe/Condu	it 💣
2.003	33.218	0.102	325.7	0.065	0.00	C	0.0	0.600	0	375	Pipe/Condu	it 🗬
2.004	13.246	0.041	323.1	0.062	0.00	C	0.0	0.600	0	375	Pipe/Condu	it 🗬
2.005	14.105	0.043	328.0	0.042	0.00	C	0.0	0.600	0	375	Pipe/Condu	it 🗗

Network Results Table

 1.007
 24.092
 0.074
 325.6
 0.021
 0.00
 0.0
 0.600
 o
 375
 Pipe/Conduit
 #

 1.008
 21.726
 0.067
 324.3
 0.029
 0.00
 0.0
 0.600
 o
 375
 Pipe/Conduit
 #

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (1/s)	Foul (1/s)	Add Flow (1/s)	Vel (m/s)	Cap (1/s)	Flow (1/s)	
		· - /	. ,	(- /	- (/ - /	() -)	(() -)	() =)	() =)	
1.000	0.00	5.43	63.013	0.061	0.0	0.0	0.0	1.64	1225.0	0.0	
1.001	0.00	5.97	62.908	0.179	0.0	0.0	0.0	1.64	1223.9	0.0	
1.002	0.00	6.50	62.774	0.308	0.0	0.0	0.0	1.00	39.7	0.0	
1.003	0.00	6.92	62.589	0.412	0.0	0.0	0.0	1.00	39.8	0.0	
1.004	0.00	7.22	62.439	0.447	0.0	0.0	0.0	1.00	39.8	0.0	
1.005	0.00	7.53	62.335	0.475	0.0	0.0	0.0	1.00	39.8	0.0	
1.006	0.00	7.76	62.223	0.504	0.0	0.0	0.0	1.00	39.7	0.0	
2.000	0.00	5.97	62.586	0.115	0.0	0.0	0.0	1.24	268.0	0.0	
2.001	0.00	6.47	62.365	0.340	0.0	0.0	0.0	1.24	267.7	0.0	
2.002	0.00	6.85	62.249	0.405	0.0	0.0	0.0	1.00	110.4	0.0	
2.003	0.00	7.40	62.181	0.470	0.0	0.0	0.0	1.00	110.3	0.0	
2.004	0.00	7.62	62.079	0.532	0.0	0.0	0.0	1.00	110.7	0.0	
2.005	0.00	7.86	62.038	0.574	0.0	0.0	0.0	0.99	109.9	0.0	
4 005		0.00	61 000	1 0 0 0	0.0						
1.007	0.00	8.26	61.993	1.099	0.0	0.0	0.0	1.00	110.3	0.0	
1.008	0.00	8.62	61.919	1.128	0.0	0.0	0.0	1.00	110.5	0.0	
				©1982-	2020 Innov	vyze					_

Coast Consulti	ng Engineers Ltd			Page 1								
Suite 6, Vita	House	FLOSH MEADOWS										
Fish Quay		CLEATOR										
North Shields	NE30 1JA	1:100 +50%		Mirro								
Date 09/06/202	3	Designed by RH		Dcainago								
File 230609 RE	VISED SURFACE W	Checked by PL		Diamage								
Innovyze		Network 2020.1		_ I								
	STORM SEWER DESIGN by the Modified Rational Method											
	Network Design	Table for 180518	3 SW1.SWS									
PN Length	Fall Slope I.Area T.F	. Base k	HYD DIA Section	Type Auto								
(m)	(m) (1:X) (ha) (min	ns) Flow (1/s) (mm)	SECT (mm)	Design								
3.000 15.459	0.048 322.1 0.070 5.	0.0 0.600	o 375 Pipe/Con	duit 🦰								
1.009 26.775 1.010 3.900	0.109 245.6 0.000 0. 0.016 243.8 0.000 0.	0.0 0.600	o 300 Pipe/Con o 300 Pipe/Con	duit 🔐 duit 🗬								
	Netwo	ork Results Table										
PN Rai	in T.C. US/IL Σ I.A:	rea E Base Foul	Add Flow Vel Ca	p Flow								
(mm/)	hr) (mins) (m) (ha)) Flow (1/s) (1/s)	(1/s) (m/s) (1/	's) (1/s)								
3.000 0	.00 5.26 61.900 0.0	0.0 0.0	0.0 1.00 110).9 0.0								
1.009 0	.00 9.07 61.852 1.3	198 0.0 0.0	0.0 1.00 70	0.6 0.0								
1.010 0	.00 9.13 61.743 1.1	198 0.0 0.0	0.0 1.00 70).9 0.0								
	Free Flowing Outfa	all Details for 18	30518 SW1.SWS									
	<u>1100 110wing outla</u>		0010 011.010									
	Outfall Outfall C	. Level I. Level M	1in D,L W									
	Pipe Number Name	(m) (m) I	Level (mm) (mm) (m)									
	1 010 C1	63 006 61 727 6	1 727 1350 0									
	Simulation Cr:	iteria for 180518	SW1.SWS									
Ve	olumetric Bunoff Coeff ().750 Additional Fl	ow - % of Total Flo	0.000 w								
1	Areal Reduction Factor 1	.000 MADD Fact	or * 10m³/ha Storag	je 2.000								
	Hot Start (mins)	0	Inlet Coeffiecier	nt 0.800								
	Hot Start Level (mm)	0 Flow per Person	n per Day (l/per/day	7) 0.000								
Manhole He Foul Sev	eadloss Coeff (Global) U wage per hectare (1/s) ().500).000 Ou	Run Time (mins utput Interval (mins	3) 60 3) 1								
1041 00			topat incortar (mine									
1	Number of Input Hydrogra	phs 0 Number of Stor	age Structures 13									
	Number of Online Contr Number of Offline Contr	ols 3 Number of Time ols 0 Number of Real	e/Area Diagrams 0 . Time Controls 0									
	Synthet:	ic Rainfall Detai	ls									
	Dainfall Madel		(5 60 (mm) 10 600									
	Return Period (vears)	FSR M 2	Ratio R 0.223									
	Region E	England and Wales Pro	ofile Type Summer									

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Suite 6, Vita House	FLOSH MEADOWS				
Fish Quay	CLEATOR				
North Shields NE30 1JA	1:100 +50%	Mirro			
Date 09/06/2023	Designed by RH	Dcainago			
File 230609 REVISED SURFACE W	Checked by PL	Diamade			
Innovyze	Network 2020.1	•			

Synthetic Rainfall Details

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

Coast Consulting Engineers Ltd				Page 3						
Suite 6, Vita House	FLOSH MEADOW	S								
Fish Quay	CLEATOR	-								
North Shields NE30 1.IA	1.100 +50%			Micco						
Date 09/06/2023	Designed by	RH								
File 230609 PEVISED SUPEACE W	Checked by P	Г		Drainage						
Ippouvze	Network 2020	1								
Online Con	trols for 1805	18 SW1.SWS								
Hydro-Brake® Optimum Manhol	e: 3 HB, DS/P	N: 1.002, V	olume (m³): 45.9						
Unit Reference MD-SHE-0107-7000-2119-7000										
Design Head (m) 2.119										
	Flush-Flo™	C	alculated							
	Objective Min	imise upstrea	m storage							
	Application		Surface							
Sum	p Available		Yes							
Inver	t Level (m)		62.774							
Minimum Outlet Pipe Di	ameter (mm)		150							
Suggested Manhole Di	ameter (mm)		1200							
Control Points Head (m) Flo	ow (l/s) Co	ntrol Points	Head	(m) Flow (l/s)						
Design Point (Calculated) 2.119	7.0	Kick	-Flo® 0.	957 4.8						
Flush-Flo™ 0.469	6.1 Mean Flo	ow over Head 1	Range	- 5.6						
The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated										
Depth (m) Flow (1/s) Depth (m) Flo	ow (l/s) Depth (n) Flow (l/s)	Depth (m)	Flow (l/s)						
0.100 3.7 1.200	5.4 3.0	8.2	7.000	12.3						
0.200 5.4 1.400	5.8 3.5	0 8.9	7.500	12.7						
0.300 5.9 1.600	6.1 4.0	9.4	8.000	13.1						
	6.5 4.5	0 10.0	8.500	13.5 13.9						
0.600 6.0 2.200	7.1 5.5	0 11.0	9.500	14.3						
0.800 5.6 2.400	7.4 6.0	00 11.4								
1.000 4.9 2.600	7.7 6.5	0 11.9								
Hydro-Brake® Optimum Manhol	e: 10 HB, DS/E	N: 2.002, V	Volume (m	³): 13.2						
Ini	t Reference MD-9	HE-0107-6000-	1575-6000							
Desi	gn Head (m)		1.575							
Design	Flow (l/s)		6.0							
	Flush-Flo™	C	alculated							
	Objective Min	ımise upstrea	m storage							
Sum	p Available		Juliace Yes							
Di	ameter (mm)		106							
Inver	t Level (m)		62.249							
Minimum Outlet Pipe Di	ameter (mm)		150							
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Coast Consu	lting	Fngi	noorg	T.t.c	1								Pa	a A	
Cuite 6 Mi		LIIGT	IICCI 5	шсс	T	ET OCU	MEADO	MAC						.yc ı	
Suite o, Vi	LA HO	use			1	e losh	MEAD	JWS							
Fish Quay						CLEAT	OR								-
North Shiel	ds Ni	E30 1	JA		-	1:100	+50%						N	lirm	n l
Date 09/06/	2023				I	Desig	ned by	/ RH	I					cain	
File 230609	REVI	SED S	URFACE	ΞW.	(Check	ed by	ΡL							lage
Innovyze					1	Netwo	rk 202	20.1							
Hydro-Brake® Optimum Manhole: 10 HB, DS/PN: 2.002, Volume (m³): 13.2															
			Sug	gest	ed Ma	nhole	Diamet	er (mm) 1	200					
Control	Point	s	Head	(m)	Flow	(1/s)		Cont	rol P	oints		Head	(m)	Flow	(1/s)
Design Point	(Calci	1] at od'	1	575		6 0				Kick-	-Flo®	0	952		17
Design Foill	Flue	sh-Floi	, ⊥. ™ ∩	468		5.9	Mean I	Flow	over	Head F	Rance	0.	- 20C		5.2
	I I U	511 1 10	0.	. 100		0.9	neun i	101	0101	iicuu i	lange				0.2
The hydrolo	gical	calcul	ations	hav	e beer	n base	d on th	ne He	ead/Di	scharg	ge rela	ation	ship	for t	he
Hydro-Brake	® Opti	mum as	specif	fied	. Sho	ould a	nother	type	e of c	ontrol	devid	ce ot	her t	han a	1
Hydro-Brake	Optim	um® be	utilis	sed ·	then t	these :	storage	e rou	uting	calcul	ations	s wil	l be	inval	idated
Depth (m)	Flow	(1/s)	Depth	(m)	Flow	(1/s)	Depth	(m)	Flow	(1/s)	Depth	(m)	Flow	(1/s	;)
		(=, =,	- op on	(,		(=, =,	- of our	()		(=, =,	- of on	()		(-/-	
0.100)	3.6	1.	.200		5.3	3	.000		8.1	7	.000		12.	1
0.200)	5.3	1.	400		5.7	3	.500		8.7	7	.500		12.	5
0.300)	5.7	1.	.600		6.0	4	.000		9.3	8	.000		12.	9
0.400)	5.9	1.	.800		6.4	4	.500		9.8	8	.500		13.	3
0.500)	5.9	2.	.000		6.7	5	.000		10.3	9	.000		13.	7
0.600)	5.9	2.	.200		7.0	5	.500		10.8	9	.500		14.	0
0.800)	5.5	2.	400		7.3	6	.000		11.3					
1.000)	4.9	2.	.600		7.6	6	.500		11.7					
Hydro-	-Brake	⊃® ∩nt	-imum	Man	hole	• 17	HB. DS	S/PN	· 1)	009.	Volum	e (m	1 ³)•	96	
<u></u>	Diano		211104111			• - •		, 11		,	<u>, , , , , , , , , , , , , , , , , , , </u>	0 (1	,.		
					Unit	Refere	ence MD	-SHE	-0235	-3200-	1642-3	200			
				Γ	esign	Head	(m)				1.	642			
				Des	sian F	low (1	() /s)				3	2.0			
					F	lush-F	'lo™			С	alcula	ted			
						Object	ive M	linim	uise u	pstrea	m stor	age			
					Ap	plicat	ion				Surf	ace			
					Sump	Availa	ble				0411	Yes			
					Diam	eter ('mm)					235			
				Tr	vert	Level	(m)				61.	852			
	Mir	nimum (Dutlet	Pine	Diam	eter ((mm)				01.	300			
	2	Suggest	ced Man	hole	e Diam	eter ((mm)				1	800			
Control	Point	s	Head	(m)	Flow	(l/s)		Cont	rol P	oints		Head	(m)	Flow	(1/s)
Design Point	(Calcı	ulated) 1.	642		32.0				Kick-	-Flo®	1.	.101		26.4
	Flus	sh-Flo	™ 0.	.503		32.0	Mean H	Flow	over	Head H	Range		_		27.5
											-				
The hydrolo	gical	calcul	ations	hav	e beer	n base	d on th	ne He	ead/Di	scharg	je rela	ation	ship	for t	he
Hydro-Brake® Optimum as specified. Should another type of control device other than a															
Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated															
Donth ()	Flore	(1/2)	Denth	(m)	Flow	(1/2)	Denth	(m)	Flore	(1/2)	Donth	/m)	Flore	, (1/-	• •
Depcii (m)	FIOM	(1/5)	Depui	(111)	TOM	(1/5)	Depui	(111)	TOM	(1/5)	Pebru	. (111)	FIOM	(1/5	• /
0.100)	7.8	0.	.200		23.7	0	.300		30.6	0	.400		31.	7
					©1982	2-202	0 Inno	DVVZ	e						

Coast Consulting Engineers Ltd	Page 5								
Suite 6, Vita House	FLOSH MEADOWS								
Fish Quay	CLEATOR								
North Shields NE30 1JA	1:100 +50%		Mirro						
Date 09/06/2023	Designed by RH								
File 230609 REVISED SURFACE W		Diamage							
Innovyze Network 2020.1									
Hydro-Brake® Optimum Manhol	e: 17 HB, DS/PN:	1.009, Volume (m ³): 9.6						
		IOW (I/S) Depth (M) F	10w (1/S)						
0.500 32.0 1.800	33.4 4.000	49.1 7.500	66.6						
0.600 31.8 2.000	35.2 4.500	52.0 8.000	68.8						
0.800 31.0 2.200	36.8 5.000	54.7 8.500	70.8						
1.000 28.8 2.400	38.4 5.500	57.3 9.000	72.8						
1.200 27.5 2.600	39.9 6.000	59.8 9.500	74.8						
1.400 29.6 3.000	42.8 6.500	62.2							
1.600 31.6 3.500	46.1 7.000	64.4							

Coast Consulting Engineers	Ltd	Page 6
Suite 6, Vita House	FLOSH MEADOWS	
Fish Quay	CLEATOR	
North Shields NE30 1JA	1:100 +50%	Micco
Date 09/06/2023	Designed by RH	
File 230609 REVISED SURFACE	W Checked by PL	Diamaye
Innovyze	Network 2020.1	
Storag	e Structures for 180518 SW1.SWS	
Cellular	Storage Manhole: 1, DS/PN: 1.00	0
	Invert Level (m) 63,585 Safety Fac	tor 2.0
Infiltration Coef	ficient Base (m/hr) 0.00000 Poros	ity 0.95
Infiltration Coef	ficient Side (m/hr) 0.00000	
Depth (m) Area (m²)	Inf. Area (m ²) Depth (m) Area (m ²) Inf	E. Area (m²)
0.000 51.8	0.0 0.521 0.0	0.0
0.520 51.8	0.0	
Collular	Storage Manhole, 2 DS/DN, 1 00	1
	Storage Mannore: 2, DS/PN: 1.00	<u> </u>
	Invert Level (m) 63.015 Safety Fac	tor 2.0
Infiltration Coef	ficient Base (m/hr) 0.00000 Poros	ity 0.95
Infiltration Coef	ficient Side (m/hr) 0.00000	
Depth (m) Area (m²)	Inf. Area (m ²) Depth (m) Area (m ²) Inf	f. Area (m²)
0.000 220.0	0.0 0.521 0.0	0.0
0.520 220.0	0.0	
Cellular	Storage Manhole: 4, DS/PN: 1.00	3
	Invert Level (m) 62 589 Safety Fac	tor 20
Infiltration Coef	ficient Base (m/hr) 0.00000 Poros	ity 0.95
Infiltration Coef	ficient Side (m/hr) 0.00000	
Depth (m) Area (m²)	Inf. Area (m ²) Depth (m) Area (m ²) Inf	E. Area (m²)
0.000 129.5	0.0 0.521 0.0	0.0
0.520 129.5	0.0	
Collular	Storage Marbole, 6 DS/DN, 1 00	5
	Storage Mannore. 0, DS/FN. 1.00	5
	Invert Level (m) 62.335 Safety Fac	tor 2.0
Infiltration Coef	ficient Base (m/hr) 0.00000 Poros	ity 0.95
Intiltration Coef	ficient Side (m/hr) 0.00000	
Depth (m) Area (m²)	Inf. Area (m ²) Depth (m) Area (m ²) Inf	f. Area (m²)
0.000 25.9	0.0 0.521 0.0	0.0
0.520 25.9	0.0	
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Coast Consulting Engineers Ltd		Page 7									
Suite 6, Vita House	FLOSH MEADOWS										
Fish Quay	CLEATOR										
North Shields NE30 1JA	1:100 +50%	Micro									
Date 09/06/2023	Designed by RH	Dcainago									
File 230609 REVISED SURFACE W	Checked by PL	Drainage									
Innovyze	Network 2020.1										
<u>Cellular Stora</u>	age Manhole: 7, DS/PN: 1.006	2.0									
Infiltration Coefficien Infiltration Coefficien	Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000										
Depth (m) Area (m ²) Inf. Area (m ²) Depth (m) Area (m ²) Inf. Area (m ²)											
0.000 25.9 0.520 25.9	0.0 0.0	0.0									
Cellular Store	Cellular Storage Manhole: 8, DS/PN: 2.000										
Invert Level (m) 63.413 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000											
Depth (m) Area (m ²) Inf. A	urea (m²) Depth (m) Area (m²) Inf. An	rea (m²)									
0.000 77.7 0.520 77.7	0.0 0.521 0.0	0.0									
<u>Cellular Stora</u>	age Manhole: 9, DS/PN: 2.001										
Inv Infiltration Coefficien Infiltration Coefficien	rert Level (m) 62.621 Safety Factor t Base (m/hr) 0.00000 Porosity t Side (m/hr) 0.00000	2.0 0.95									
Depth (m) Area (m ²) Inf. A	rea (m²) Depth (m) Area (m²) Inf. An	rea (m²)									
0.000 388.5 0.520 388.5	0.0 0.521 0.0	0.0									
<u>Cellular Storage</u>	e Manhole: 10 HB, DS/PN: 2.002										
Inv Infiltration Coefficien Infiltration Coefficien	t Level (m) 62.249 Safety Factor t Base (m/hr) 0.00000 Porosity t Side (m/hr) 0.00000	2.0 0.95									
Depth (m) Area (m ²) Inf. A	rea (m ²) Depth (m) Area (m ²) Inf. An	rea (m²)									
0.000 170.0 0.520 170.0	0.0 0.0	0.0									
Cellular Stora	age Manhole: 11, DS/PN: 2.003										
Invert Level (m) Infiltration Coefficient Base (m/hr)	62.181 Infiltration Coefficient Si 0.00000 Safe	de (m/hr) 0.00000 ty Factor 2.0									

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Suite 6, Vita House	FLOSH MEADOWS										
Fish Quay	CLEATOR										
North Shields NE30 1JA	1:100 +50%	Micco									
Date 09/06/2023	Designed by RH										
File 230609 REVISED SURFACE W	Checked by PL	Digingda									
Innovvze	Network 2020.1										
Cellular Stora	ge Manhole: 11, DS/PN: 2.003										
	Porosity 0.95										
Denth (m) Area (m^2) Inf A	$max (m^2)$ Donth (m) Area (m ²) Inf	$\lambda = (m^2)$									
Depth (m) Afea (m ⁻) Inf. A	rea (m-) Depth (m) Area (m-) Ini.	Area (m ⁻)									
0.000 200.0	0.0 0.521 0.0	0.0									
0.520 200.0	0.0										
Collular Stora	α Marhola, 12 DS/DN, 2 004										
Cellular Storage Manhole: 12, DS/PN: 2.004											
Inve	ert Level (m) 62.079 Safety Facto	or 2.0									
Infiltration Coefficient	Base (m/hr) 0.00000 Porosit	y 0.95									
Infiltration Coefficient	z Side (m/hr) 0.00000										
Depth (m) Area (m^2) Inf A	rea (m^2) Depth (m) Area (m^2) Inf	Area (m^2)									
		Alea (m)									
0.000 129.5	0.0 0.521 0.0	0.0									
0.520 129.5	0.0										
Cellular Stora	ge Manhole• 15 DS/PN• 1 008										
	ge Haimore. 13, 25/11. 1.000										
Inve	ert Level (m) 61.919 Safety Facto	or 2.0									
Infiltration Coefficient	Base (m/hr) 0.00000 Porosit	у 0.95									
Infiltration Coefficient	z Side (m/hr) 0.00000										
Depth (m) Area (m ²) Inf. A	rea (m²) Depth (m) Area (m²) Inf.	Area (m²)									
0.000 30.0	0.0 0.521 0.0	0.0									
0.520 30.0	0.0										
Cellular Stora	ge Manhole: 16, DS/PN: 3.000										
	<u>go namorot ro, bo, rnt otoco</u>										
Inve	ert Level (m) 61.900 Safety Facto	or 2.0									
Infiltration Coefficient	Base (m/hr) 0.00000 Porosit	у 0.95									
Infiltration Coefficient	z Side (m/hr) 0.00000										
Depth (m) Area (m ²) Inf. A	rea (m²) Depth (m) Area (m²) Inf.	Area (m²)									
0.000 51.8	0.0 0.521 0.0	0.0									
0.520 51.0	0.0										
Cellular Storage	e Manhole: 17 HB, DS/PN: 1.00	19									
		_									
Inve	ert Level (m) 61.852 Safety Facto	or 2.0									
Infiltration Coefficient	Base (m/hr) 0.00000 Porosit	у 0.95									
Infiltration Coefficien	51ae (m/hr) 0.00000										
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Coast Cons	Coast consulting Engineers Ltd										
Suite 6, V	Vita H	ouse			FLOSH	MEADO	OWS				
Fish Quay					CLEAT	OR					
North Shie	elds	NE30 1	JA		1:100	+50%	Micro				
Date 09/06	5/2023				Desig	ned by	7 RH				
File 23060	9 REV	'ISED S	URFACE	w	Check	ed bv	Digiligh				
Innovyze					Netwo	rk 202	201				
11110 1 2 2 0					1100000	LIX 202					
		Call	ular S	torado	Manho	10.17	HR DO	/PN·	1 000	6	
		CETT	ulal S	LUIAYE	manno.	IC. I/	IID, D.)/ L IN .	1.005	_	
	Depth (m) Area (m ²) Inf. Area (m ²) Depth (m) Area (m ²) Inf. Area (m										n²)
		(,	- ()			- op on	(,	()			. ,
	0.	000	77.7		0.0	0.	.521	0.0		(0.0
	0.	520	77.7		0.0						
				©198	2-202) Innc	vvze				

Coast (Consul	ting E	ngineers	Ltd					Pag	je 10		
Suite 0	5, Vit	a Hous	e		FLOSH M	IEADOWS	5					
Fish Qu	lay				CLEATOR	l						
North S	Shield	ls NE3	0 1JA		1:100 +	·50%			N A			
Date 0	9/06/2	023			Designe	d by F	H					
Filo 2	20609 20609	REVISE	D SURFACE	W	Checked	by PI				ainage		
Theory	70000		D SOILI ACL		Notuork	2020	1					
тшохух	2e				Network	. 2020.	Ţ					
Sum	mary d	of Crit	ical Resu	ilts by	Maximur	n Leve	l (Rank	1) for 18	0518 SW	1.SWS		
				Sim	ulation	Criteri	a					
		Areal	Reduction	Factor 1	.000 A	ddition	al Flow -	% of Total	Flow 0.	000		
	Hot Start (mins) 0 MADD Factor * 10m³/na Storage 2.000 Hot Start Level (mm) 0 Inlet Coefficcient 0.800											
, I	Manhole	Headlo	ss Coeff (G	lobal) (0 1.500 Flo	w per P	erson per	Dav (l/per	(dav) 0.	000		
-	Foul Sewage per hectare (1/s) 0.000 Fiow per Person per Day (1/per/day) 0.000											
	Number of Input Hydrographs 0 Number of Storage Structures 13											
		Num	per of Onli	ne Contr	ols 3 Nu	mber of	Time/Area	a Diagrams	0			
		Numo	er of Offil	ne Contr	OIS U NU	mber oi	Real lime	e Controis	0			
	Synthetic Rainfall Details											
Rainfall Model FSR Ratio R 0.220												
			Reg	gion Eng	land and	Wales (Cv (Summer) 1.000				
	M5-60 (mm) 18.600 Cv (Winter) 1.000											
Margin for Flood Dick Marning (mm)												
Margin for Fiood Kisk Warning (mm) 300.0 Analysis Timestep 2.5 Second Increment (Extended)												
				DTS	S Status				OFF			
				DVI	D Status				OFF			
				Inertia	a Status				OFF			
				Profile	e(s)		Summer a	and Winter				
			Duratio	on(s) (mi	.ns) 15,	30, 60,	120, 180,	240, 360				
		Re	turn Period	l(s) (yea	rs)			100				
			Climate	e Change	(응)			50				
										Water		
	US/MH		Return	Climate	First	(X)	First (Y)	First (Z)	Overflow	v Level		
PN	Name	Stor	n Period	Change	Surch	arge	Flood	Overflow	Act.	(m)		
1 000	1	200 14	ton 100		100/100	C				64 680		
1 001	1	360 Win	ter 100	+50% +50%	100/180	Summer				64.689		
1.002	3 HB	360 Win	ter 100	+50%	100/15	Summer				64.690		
1.003	4	60 Sum	mer 100	+50%	100/30	Summer				62.851		
1.004	5	120 Sum	mer 100	+50%	100/15	Summer				62.788		
1.005	6	180 Sum	mer 100	+50%	100/15	Summer				62.729		
1.006	7	360 Sum	mer 100	+50%	100/15	Summer				62.700		
2.000	8	360 Win	ter 100	+50%	100/60	Summer				63./94		
2.001	э 10 нв	360 Win	ter 100	+50%	100/00	Summer				63.792		
2.003	11	360 Sum	mer 100	+50%	100/120	Summer				62.691		
2.004	12	360 Sum	mer 100	+50%	100/60	Summer				62.685		
2.005	13	360 Sum	mer 100	+50%	100/60	Summer				62.680		
1.007	14	360 Sum	mer 100	+50%	100/60	Summer				62.674		
1.008	15	360 Sum	mer 100	+50%	100/30	Summer				62.656		
				©198	2-2020	Innovy	ze					

Coast Consulting Engineers Ltd	Page 11	
Suite 6, Vita House	FLOSH MEADOWS	
Fish Quay	CLEATOR	
North Shields NE30 1JA	1:100 +50%	Mirro
Date 09/06/2023	Designed by RH	Dcainago
File 230609 REVISED SURFACE W	Checked by PL	Diamage
Innovyze	Network 2020.1	•

Summary of Critical Results by Maximum Level (Rank 1) for 180518 SW1.SWS

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	1	0.701	0.000	0.01		99	7.6	SURCHARGED	
1.001	2	0.806	0.000	0.01			6.5	SURCHARGED	
1.002	3 HB	1.691	0.000	0.18			6.7	FLOOD RISK	
1.003	4	0.037	0.000	0.77		25	28.3	SURCHARGED	
1.004	5	0.124	0.000	1.00			35.6	SURCHARGED	
1.005	6	0.169	0.000	1.01		110	36.3	SURCHARGED	
1.006	7	0.252	0.000	0.91		149	31.3	SURCHARGED	
2.000	8	0.683	0.000	0.06		62	14.5	SURCHARGED	
2.001	9	0.904	0.000	0.09			21.5	SURCHARGED	
2.002	10 HB	1.168	0.000	0.06			5.9	FLOOD RISK	
2.003	11	0.136	0.000	0.15		160	15.3	SURCHARGED	
2.004	12	0.232	0.000	0.26		199	21.6	SURCHARGED	
2.005	13	0.268	0.000	0.26			21.7	SURCHARGED	
1.007	14	0.306	0.000	0.38			36.0	SURCHARGED	
1.008	15	0.362	0.000	0.39		254	36.2	SURCHARGED	

Coast Consulting Engineers Ltd	Coast Consulting Engineers Ltd					
Suite 6, Vita House	FLOSH MEADOWS					
Fish Quay	CLEATOR					
North Shields NE30 1JA	1:100 +50%	Mirro				
Date 09/06/2023	Designed by RH	Dcainago				
File 230609 REVISED SURFACE W	Checked by PL	Diamage				
Innovyze	Network 2020.1					

Summary of Critical Results by Maximum Level (Rank 1) for 180518 SW1.SWS

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
3.000	16	360 Summer	100	+50%	100/30 Summer				62.640
1.009	17 HB 18	360 Summer 240 Summer	100 100	+50% +50%	100/15 Summer				62.639 61.920

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
3.000	16	0.365	0.000	0.16		254	13.9	SURCHARGED	
1.009	17 HB	0.487	0.000	0.50		273	32.0	SURCHARGED	
1.010	18	-0.123	0.000	0.66			32.0	OK	

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