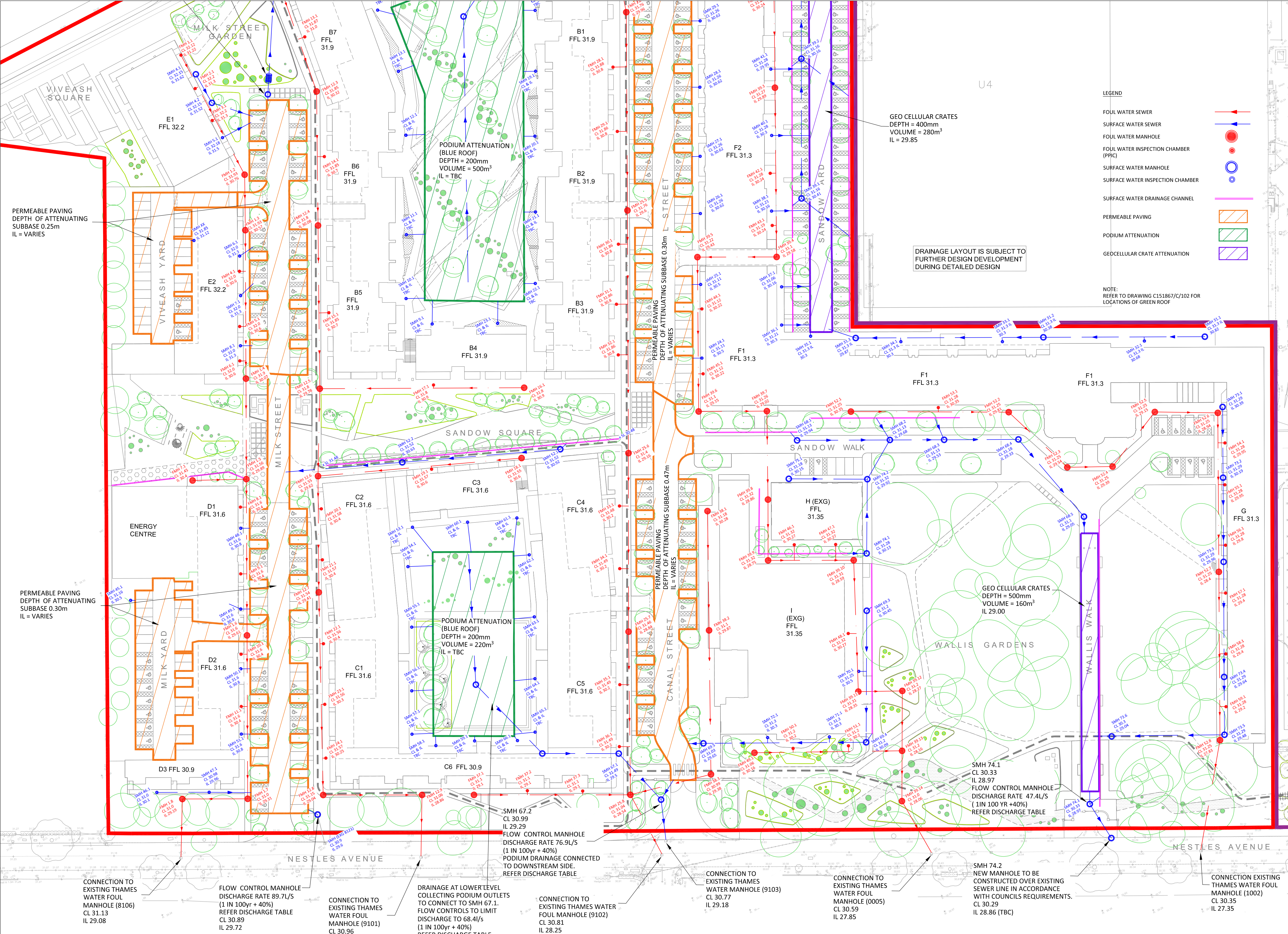




LEGEND

FOUL WATER SEWER
SURFACE WATER SEWER
FOUL WATER MANHOLE
FOUL WATER INSPECTION CHAMBER (P/C)
SURFACE WATER MANHOLE
SURFACE WATER INSPECTION CHAMBER
SURFACE WATER DRAINAGE CHANNEL
PERMEABLE PAVING
PODIUM ATTENUATION
GEOCELLULAR CRATE ATTENUATION

NOTE:
REFER TO DRAWING C151867/C/102 FOR LOCATIONS OF GREEN ROOF

- NOTES:**
- THIS DRAWING IS TO BE READ IN CONJUNCTION WITH C151867/C/001, C151867/C/101 AND C151867/C/102.
 - THE LOCATION OF EXISTING MANHOLES, PIPE SIZES, PIPE TYPE AND INVERT LEVELS TO BE CONFIRMED BY CONTRACTOR.
 - CONDITION OF EXISTING DRAINAGE CONNECTIONS FROM SITE TO BE CONFIRMED AND RETAINED IF FEASIBLE.

P3	21.04.17	UPDATED SITE LAYOUT	AB	JH
P2	27.01.17	SANDOW STREET & BUILDING H DRAINAGE	AB	JH
P1	25.01.17	PRELIMINARY ISSUE	AB	JH
Rev	Date	Description	By	Ckd

Architect:

MAKOWER ARCHITECTS

Hydrock Hydrock Consultants Ltd
Hydro Valley Innovation Centre
Central Boulevard
Southall
UB9 9JA
T +44 (0)121 5060040
info@hydrock.com
www.hydrock.com

Client:

BARRATT LONDON

Project Title:

FORMER NESTLÉ SITE HAYES

Drawing Title:

PROPOSED DRAINAGE STRATEGY SHEET 2

Drawing Status:

PRELIMINARY ISSUE

Hydrock Job No: C151867				
Drawn	Checked	Scale @ A1	Date	Issue Date
AB	JH	1:500	27.01.17	27.01.17
Drawing Number: C151867/C/002				Revision: P3

SURFACE WATER DISCHARGE RATES TO THAMES WATER SEWERS

TOTAL PROPOSED DISCHARGE L/S	RETURN PERIOD		
	1 IN 2 YR	1 IN 30 YR	1 IN 100 YR + 40%
74.7L/S	74.7L/S	192.3 L/S	270.7L/S

COMPLEX FLOW CONTROLS TO BE USED TO ACHIEVE FLOW RESTRICTION FOR EACH RETURN PERIOD



Canal &
River Trust

NESTLÉ DRIVE, HAYES STAGE THREE ASSESSMENT PRO-FORMA

HYDROLOGIST

Stewart Smith

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Email Stewart.Smith@canalrivertrust.org.uk

WORKS ENGINEER

Toby Pearce

Mobile: 07717225772

Email Toby.Pearce@canalrivertrust.org.uk

GATEWAY LINK

DATE ENQUIRY RECEIVED BY WATER MANAGEMENT

09/11/2016 (when **all** appropriate supporting information received)

SUMMARY OF PROPOSAL

The existing Nestlé factory, located alongside the Grand Union Canal in Hayes, London Borough of Hillingdon, is to be demolished. Barratt's are proposing a residential development comprising of apartment blocks to be constructed on their area of the site. The remainder of the site is to be developed by others. The Barratt's site is adjacent to the Grand Union Canal, GU-211. It is proposed to discharge to the canal via existing or possibly new outfalls.

PRE-DEVELOPMENT

The surface water from the site drains partly to the Grand Union Canal and partly to the Thames Water Sewers in Nestlé's Avenue. A drainage survey of the existing site has been used to determine the existing catchment which drains into the canal through the existing 14 outfalls. Three of these are within the Barratt's area of the site.

- Total area draining to canal = 36,282m²
- The Pre-development peak run-off (1:100 yr, excluding +30% cc) is estimated at 0.086 m³s⁻¹ (85.9 l/s).

POST-DEVELOPMENT

The existing site is to be split between two developers. This application is for the proposed Barratt's development only. The development shall comprise 1400 residential units. They are proposing to drain the surface water from the residential site partly to the canal and partly to the Thames Water Sewers. Infiltration testing has shown the ground conditions to be unsuitable for

infiltration. The post-development peak run-off flow is proposed to match the existing pre-developed flows to the canal. Currently, it is proposed to discharge via three outfalls, though this is subject to further design development. The existing outfalls will be reused if feasible.

Flow controls and attenuation shall be used to restrict the flows to the permitted discharge rates. The Barratt's development shall result in a 1.25ha reduction of impermeable area draining to the canal. From conversations with the neighbouring developer it is understood that they are currently proposing to abandon the existing outfalls to the canal within their section of the site in favour of draining to Thames Water Sewers. This will reduce the impermeable area draining to the canal by an additional 2.4ha. SUD's will be implemented, including permeable paving and green roofing.

- Total area draining to canal = 28,600m²
- The Post-development peak run-off (1:100 yr, +20% cc) is estimated at 0.086 m³s⁻¹ (85.9 l/s). The proposed flows to match existing. No urban creep allowed for, as site to be fully developed with apartments, allowing no scope for extensions etc.

METHODOLOGY

The surface water discharge from the existing site, has been calculated as required by Part 2 of the Code of Practice. Pre-development flows were calculated using QMED with adjusted URBEXT. Growth Factors were used to establish 1 in 100 year flows.

According to the developer, the drainage survey information shown on drawing 909-4-GEN-0019 does not have sufficient information to enable accurate modelling of the network. The Greenfield methods have therefore been used with an URBEXT adjustment in compliance with Part 2.

The discharge calculated is based on the Barratt's site only.

RISK REGISTER SCORE

Likelihood = 0

Consequence = 3

Risk = 0

MAXIMUM DISCHARGE VELOCITY

Stated by developer as "to be confirmed".

In terms of the Code of Practice for Third Party Works, high discharge velocities can be a problem for navigational safety. High flow velocities can also cause scouring. It is the responsibility of the Works Engineer to agree a final design that does not exceed a maximum outfall velocity of 0.3 ms⁻¹, whilst also ensuring this does not affect ability of the drainage system to achieve the agreed flow rate of 0.086 m³s⁻¹.

WATER ENGINEER COMMENTS

"I note the following: "The Post-development peak run-off (1:100 yr, +20% cc) is estimated at 0.086 m³s⁻¹ (85.9 l/s). The proposed flows to match existing". Should not the developer be encouraged to seek ways to reduce peak run off?"

Mike Wheeler, Senior Water Engineer, 15/11/16

ENVIRONMENT TEAM COMMENTS

"I have reviewed the various documents and would like the applicant to provide the following information or assurances:

1. There are three surface water outfalls to the canal. How many car parking spaces are served by each outfall?
2. The application states that the site exhibits soil contamination and that there will be removal of contaminated soil and site remediation. Can the developer please confirm that the surface water drains will only be laid in uncontaminated soils and that the sub-surface attenuation tanks will be resistant to the inward migration of any contaminants remaining in the surrounding soils."

Dr Lise Andreassen, Senior Environmental Scientist, 14/11/16

Response from developer:

1. "As per C151867/C/104 there were 63 parking spots draining to Canal Outlet 1, 68 parking spots to Canal Outlet 2 and 46 parking spots draining to Canal Outlet 3. These design plans have since been adjusted slightly and now there is 67, 67 and 51 parking spots draining to Canal Outlet 1,2 and 3 respectively. These may change again slightly (+/- 2) as the design plans have not yet been finalised.
2. The surface water drains will only be laid in uncontaminated soils and the proposed sub-surface attenuation systems will be lined with an impermeable membrane to prevent water infiltrating/ the inward migration of any contaminants.

Alex Badek, Senior Infrastructure Engineer, Hydrock, 15/11/16

Response from the environment team:

1. "As the number of car parking spaces exceeds 50 for each of the three outfalls to the canal, CRT requires that the Environment Agency's PPG3 guidance note on oil separators is followed: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/290142/pmho0406biyl-e-e.pdf.

Although PPG3 has been withdrawn by the EA due to resource shortages, it is still used by CRT to establish the required standards of pollution prevention for discharges entering its waterways.

Given the nature of the site (i.e. general car parking), potential spills would be expected to be small. As such, Class 1 by-pass separators (with an alarm) are acceptable and need to be located prior to **each** of the three outfalls. Class 1 separators are required as the discharge is to a surface water (i.e. the canal).

The applicant needs to:

- demonstrate that the selected separators are of the type specified and are sized in accordance with PPG3 (shown via submitted calculations)
- account for how silt storage is to be provided for
- provide sufficient access points in the design to allow for inspection and cleaning of the interceptors' internal chambers
- label the separators above ground and show their presence on a revised drainage plan
- submit an adequate maintenance procedure for the separators."

Dr Lise Andreassen, Senior Environmental Scientist, 16/11/16

RESPONSE SUMMARY

On the basis of the information provided a maximum discharge rate of $0.086 \text{ m}^3\text{s}^{-1}$ (in a 1:100 yr +20% cc return period event) to the Grand Union Canal is acceptable. The Works Engineer needs to ensure the outfall velocity does not exceed the Trusts maximum of 0.3 ms^{-1} .

With regards to environmental risk please see comments from the Environment Team (Lise Andreassen's comments).

SIGN OFF

Endorsed by Adam Comerford, National Hydrology Manager 09/12/2016

COMPLETED WITHIN FOUR WEEKS? Yes

Hydrock Consultants Ltd		Page 1
.	Former Nestlé Factory	
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.		
Date Jan 2017	Designed by .	
File	Checked by	
XP Solutions	Source Control 2015.1	
<u>ICP SUDS Mean Annual Flood</u> Input Return Period (years) 2 Soil 0.450 Area (ha) 7.150 Urban 0.000 SAAR (mm) 640 Region Number Region 6 Results l/s QBAR Rural 28.3 QBAR Urban 28.3 Q2 years 24.9 Q1 year 24.0 Q30 years 64.1 Q100 years 90.2		
©1982-2015 XP Solutions		

Hydrock Consultants Ltd		Page 1																																																																																																																																																																																																																																																																																		
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Summary of Results for 30 year Return Period Half Drain Time : 70 minutes. <table><tr><th>Storm Event</th><th>Max Level (m)</th><th>Max Depth (m)</th><th>Max Infiltration (l/s)</th><th>Max Control (l/s)</th><th>Max Σ Outflow (l/s)</th><th>Max Volume (m³)</th><th>Status</th></tr><tr><td>15 min Summer</td><td>29.970</td><td>0.120</td><td>0.0</td><td>15.2</td><td>15.2</td><td>79.9</td><td>O K</td></tr><tr><td>30 min Summer</td><td>29.995</td><td>0.145</td><td>0.0</td><td>18.2</td><td>18.2</td><td>96.2</td><td>O K</td></tr><tr><td>60 min Summer</td><td>30.008</td><td>0.158</td><td>0.0</td><td>19.7</td><td>19.7</td><td>105.4</td><td>O K</td></tr><tr><td>120 min Summer</td><td>30.014</td><td>0.164</td><td>0.0</td><td>20.2</td><td>20.2</td><td>108.8</td><td>O K</td></tr><tr><td>180 min Summer</td><td>30.010</td><td>0.160</td><td>0.0</td><td>19.9</td><td>19.9</td><td>106.5</td><td>O K</td></tr><tr><td>240 min Summer</td><td>30.004</td><td>0.154</td><td>0.0</td><td>19.3</td><td>19.3</td><td>102.6</td><td>O K</td></tr><tr><td>360 min Summer</td><td>29.992</td><td>0.142</td><td>0.0</td><td>17.9</td><td>17.9</td><td>94.4</td><td>O K</td></tr><tr><td>480 min Summer</td><td>29.981</td><td>0.131</td><td>0.0</td><td>16.6</td><td>16.6</td><td>87.1</td><td>O K</td></tr><tr><td>600 min Summer</td><td>29.972</td><td>0.122</td><td>0.0</td><td>15.4</td><td>15.4</td><td>81.0</td><td>O K</td></tr><tr><td>720 min Summer</td><td>29.964</td><td>0.114</td><td>0.0</td><td>14.4</td><td>14.4</td><td>75.8</td><td>O K</td></tr><tr><td>960 min Summer</td><td>29.952</td><td>0.102</td><td>0.0</td><td>12.7</td><td>12.7</td><td>67.5</td><td>O K</td></tr><tr><td>1440 min Summer</td><td>29.934</td><td>0.084</td><td>0.0</td><td>10.3</td><td>10.3</td><td>56.0</td><td>O K</td></tr><tr><td>2160 min Summer</td><td>29.918</td><td>0.068</td><td>0.0</td><td>8.1</td><td>8.1</td><td>45.2</td><td>O K</td></tr><tr><td>2880 min Summer</td><td>29.907</td><td>0.057</td><td>0.0</td><td>6.7</td><td>6.7</td><td>38.1</td><td>O K</td></tr><tr><td>4320 min Summer</td><td>29.894</td><td>0.044</td><td>0.0</td><td>5.2</td><td>5.2</td><td>28.9</td><td>O K</td></tr><tr><td>5760 min Summer</td><td>29.885</td><td>0.035</td><td>0.0</td><td>4.2</td><td>4.2</td><td>23.1</td><td>O K</td></tr><tr><td>7200 min Summer</td><td>29.879</td><td>0.029</td><td>0.0</td><td>3.6</td><td>3.6</td><td>19.0</td><td>O K</td></tr><tr><td>8640 min Summer</td><td>29.874</td><td>0.024</td><td>0.0</td><td>3.1</td><td>3.1</td><td>15.8</td><td>O K</td></tr><tr><td>10080 min Summer</td><td>29.870</td><td>0.020</td><td>0.0</td><td>2.8</td><td>2.8</td><td>13.3</td><td>O K</td></tr><tr><td>15 min Winter</td><td>29.985</td><td>0.135</td><td>0.0</td><td>17.0</td><td>17.0</td><td>89.7</td><td>O K</td></tr></table> <table><tr><th>Storm Event</th><th>Rain (mm/hr)</th><th>Flooded Volume (m³)</th><th>Discharge Volume (m³)</th><th>Time-Peak 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60 min Summer	30.968	0.0	142.1	48																																																																																																																																																																																																																																																																																
120 min Summer	18.658	0.0	171.2	82																																																																																																																																																																																																																																																																																
180 min Summer	13.726	0.0	188.9	116																																																																																																																																																																																																																																																																																
240 min Summer	10.992	0.0	201.8	150																																																																																																																																																																																																																																																																																
360 min Summer	8.021	0.0	220.9	216																																																																																																																																																																																																																																																																																
480 min Summer	6.411	0.0	235.5	280																																																																																																																																																																																																																																																																																
600 min Summer	5.385	0.0	247.3	342																																																																																																																																																																																																																																																																																
720 min Summer	4.668	0.0	257.2	404																																																																																																																																																																																																																																																																																
960 min Summer	3.724	0.0	273.6	530																																																																																																																																																																																																																																																																																
1440 min Summer	2.706	0.0	298.3	778																																																																																																																																																																																																																																																																																
2160 min Summer	1.964	0.0	324.7	1144																																																																																																																																																																																																																																																																																
2880 min Summer	1.563	0.0	344.6	1500																																																																																																																																																																																																																																																																																
4320 min Summer	1.132	0.0	374.5	2244																																																																																																																																																																																																																																																																																
5760 min Summer	0.900	0.0	397.0	2944																																																																																																																																																																																																																																																																																
7200 min Summer	0.753	0.0	415.2	3680																																																																																																																																																																																																																																																																																
8640 min Summer	0.651	0.0	430.7	4408																																																																																																																																																																																																																																																																																
10080 min Summer	0.575	0.0	444.0	5144																																																																																																																																																																																																																																																																																
15 min Winter	76.822	0.0	98.6	17																																																																																																																																																																																																																																																																																
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Hydrock Consultants Ltd		Page 3																																	
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Hydrock Consultants Ltd		Page 4																																																																																																									
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Model Details Storage is Online Cover Level (m) 31.320 Cellular Storage Structure Invert Level (m) 29.850 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr><tr><td>0.000</td><td>700.0</td><td>0.0</td><td>0.401</td><td>0.0</td><td>0.0</td></tr><tr><td>0.400</td><td>700.0</td><td>0.0</td><td></td><td></td><td></td></tr></table> Hydro-Brake Optimum® Outflow Control Unit Reference MD-SHE-0207-2210-1000-2210 Design Head (m) 1.000 Design Flow (l/s) 22.1 Flush-Flo™ Calculated Objective Minimise upstream storage Diameter (mm) 207 Invert Level (m) 29.810 Minimum Outlet Pipe Diameter (mm) 225 Suggested Manhole Diameter (mm) 1500 <table><tr><th>Control Points</th><th>Head (m)</th><th>Flow (l/s)</th></tr><tr><td>Design Point (Calculated)</td><td>1.000</td><td>22.0</td></tr><tr><td>Flush-Flo™</td><td>0.349</td><td>22.0</td></tr><tr><td>Kick-Flo®</td><td>0.727</td><td>18.9</td></tr><tr><td>Mean Flow over Head Range</td><td>-</td><td>18.4</td></tr></table> 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 <table><tr><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th></tr><tr><td>0.100</td><td>7.1</td><td>1.200</td><td>23.9</td><td>3.000</td><td>37.2</td><td>7.000</td><td>56.0</td></tr><tr><td>0.200</td><td>19.9</td><td>1.400</td><td>25.8</td><td>3.500</td><td>40.0</td><td>7.500</td><td>57.9</td></tr><tr><td>0.300</td><td>21.9</td><td>1.600</td><td>27.5</td><td>4.000</td><td>42.7</td><td>8.000</td><td>59.8</td></tr><tr><td>0.400</td><td>21.9</td><td>1.800</td><td>29.1</td><td>4.500</td><td>45.2</td><td>8.500</td><td>61.6</td></tr><tr><td>0.500</td><td>21.5</td><td>2.000</td><td>30.6</td><td>5.000</td><td>47.6</td><td>9.000</td><td>63.3</td></tr><tr><td>0.600</td><td>20.9</td><td>2.200</td><td>32.0</td><td>5.500</td><td>49.8</td><td>9.500</td><td>65.0</td></tr><tr><td>0.800</td><td>19.7</td><td>2.400</td><td>33.4</td><td>6.000</td><td>52.0</td><td></td><td></td></tr><tr><td>1.000</td><td>22.0</td><td>2.600</td><td>34.7</td><td>6.500</td><td>54.0</td><td></td><td></td></tr></table>			Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	0.000	700.0	0.0	0.401	0.0	0.0	0.400	700.0	0.0				Control Points	Head (m)	Flow (l/s)	Design Point (Calculated)	1.000	22.0	Flush-Flo™	0.349	22.0	Kick-Flo®	0.727	18.9	Mean Flow over Head Range	-	18.4	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	0.100	7.1	1.200	23.9	3.000	37.2	7.000	56.0	0.200	19.9	1.400	25.8	3.500	40.0	7.500	57.9	0.300	21.9	1.600	27.5	4.000	42.7	8.000	59.8	0.400	21.9	1.800	29.1	4.500	45.2	8.500	61.6	0.500	21.5	2.000	30.6	5.000	47.6	9.000	63.3	0.600	20.9	2.200	32.0	5.500	49.8	9.500	65.0	0.800	19.7	2.400	33.4	6.000	52.0			1.000	22.0	2.600	34.7	6.500	54.0		
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Hydrock Consultants Ltd		Page 1	
. . .		Former Nestle Site Network 1 - GC1	
Date 24.01.17 File Network 1_canal_GC1_out...		Designed by JH Checked by	
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Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 98 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	30.071	0.221	0.0	21.7	21.7	147.1	O K
30 min Summer	30.127	0.277	0.0	21.9	21.9	184.4	O K
60 min Summer	30.167	0.317	0.0	22.0	22.0	210.8	O K
120 min Summer	30.181	0.331	0.0	22.0	22.0	219.9	O K
180 min Summer	30.177	0.327	0.0	22.0	22.0	217.2	O K
240 min Summer	30.166	0.316	0.0	22.0	22.0	210.2	O K
360 min Summer	30.140	0.290	0.0	22.0	22.0	193.0	O K
480 min Summer	30.114	0.264	0.0	21.9	21.9	175.7	O K
600 min Summer	30.090	0.240	0.0	21.8	21.8	159.6	O K
720 min Summer	30.068	0.218	0.0	21.6	21.6	145.3	O K
960 min Summer	30.034	0.184	0.0	21.3	21.3	122.4	O K
1440 min Summer	29.997	0.147	0.0	18.4	18.4	97.6	O K
2160 min Summer	29.967	0.117	0.0	14.7	14.7	77.5	O K
2880 min Summer	29.948	0.098	0.0	12.2	12.2	65.4	O K
4320 min Summer	29.926	0.076	0.0	9.2	9.2	50.6	O K
5760 min Summer	29.913	0.063	0.0	7.4	7.4	41.7	O K
7200 min Summer	29.903	0.053	0.0	6.3	6.3	35.5	O K
8640 min Summer	29.896	0.046	0.0	5.4	5.4	30.8	O K
10080 min Summer	29.891	0.041	0.0	4.8	4.8	27.1	O K
15 min Winter	30.099	0.249	0.0	21.8	21.8	165.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	139.635	0.0	160.1	18
30 min Summer	91.435	0.0	209.8	32
60 min Summer	57.005	0.0	261.8	60
120 min Summer	34.324	0.0	315.2	94
180 min Summer	25.168	0.0	346.7	128
240 min Summer	20.074	0.0	368.8	160
360 min Summer	14.562	0.0	401.4	228
480 min Summer	11.594	0.0	426.0	294
600 min Summer	9.707	0.0	446.0	356
720 min Summer	8.393	0.0	462.6	418
960 min Summer	6.666	0.0	489.9	536
1440 min Summer	4.811	0.0	530.6	768
2160 min Summer	3.466	0.0	573.4	1128
2880 min Summer	2.744	0.0	605.2	1500
4320 min Summer	1.972	0.0	652.4	2208
5760 min Summer	1.558	0.0	687.4	2944
7200 min Summer	1.297	0.0	715.4	3672
8640 min Summer	1.117	0.0	738.9	4408
10080 min Summer	0.983	0.0	759.2	5144
15 min Winter	139.635	0.0	179.4	18

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Hydrock Consultants Ltd		Page 2					
. . .		Former Nestle Site Network 1 - GC1					
Date 24.01.17 File Network 1_canal_GC1_out...		Designed by JH Checked by					
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Summary of Results for 100 year Return Period (+40%)							
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	30.164	0.314	0.0	22.0	22.0	208.9	O K
60 min Winter	30.213	0.363	0.0	22.0	22.0	241.1	O K
120 min Winter	30.226	0.376	0.0	22.0	22.0	250.0	O K
180 min Winter	30.218	0.368	0.0	22.0	22.0	244.6	O K
240 min Winter	30.201	0.351	0.0	22.0	22.0	233.1	O K
360 min Winter	30.160	0.310	0.0	22.0	22.0	206.0	O K
480 min Winter	30.120	0.270	0.0	21.9	21.9	179.4	O K
600 min Winter	30.084	0.234	0.0	21.8	21.8	155.5	O K
720 min Winter	30.054	0.204	0.0	21.5	21.5	135.3	O K
960 min Winter	30.014	0.164	0.0	20.2	20.2	109.0	O K
1440 min Winter	29.976	0.126	0.0	15.9	15.9	83.6	O K
2160 min Winter	29.947	0.097	0.0	12.0	12.0	64.2	O K
2880 min Winter	29.930	0.080	0.0	9.6	9.6	52.9	O K
4320 min Winter	29.909	0.059	0.0	7.0	7.0	39.5	O K
5760 min Winter	29.897	0.047	0.0	5.5	5.5	31.5	O K
7200 min Winter	29.889	0.039	0.0	4.7	4.7	26.0	O K
8640 min Winter	29.883	0.033	0.0	4.0	4.0	22.0	O K
10080 min Winter	29.878	0.028	0.0	3.5	3.5	18.7	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)			
30 min Winter	91.435	0.0	235.0	32			
60 min Winter	57.005	0.0	293.2	60			
120 min Winter	34.324	0.0	353.1	104			
180 min Winter	25.168	0.0	388.4	138			
240 min Winter	20.074	0.0	413.1	176			
360 min Winter	14.562	0.0	449.6	248			
480 min Winter	11.594	0.0	477.2	314			
600 min Winter	9.707	0.0	499.5	378			
720 min Winter	8.393	0.0	518.3	436			
960 min Winter	6.666	0.0	548.9	548			
1440 min Winter	4.811	0.0	594.1	792			
2160 min Winter	3.466	0.0	642.1	1148			
2880 min Winter	2.744	0.0	678.0	1512			
4320 min Winter	1.972	0.0	730.7	2248			
5760 min Winter	1.558	0.0	769.9	2992			
7200 min Winter	1.297	0.0	801.3	3680			
8640 min Winter	1.117	0.0	827.6	4440			
10080 min Winter	0.983	0.0	850.3	5144			
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Hydrock Consultants Ltd		Page 3																																	
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Hydrock Consultants Ltd		Page 4																																																																																																									
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Page 2

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Network 2 - PP3

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Source Control 2014.1.1

Micro Drainage

Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	30.598	0.098	0.0	13.7	13.7	29.3	O K
60 min Winter	30.596	0.096	0.0	13.7	13.7	28.1	O K
120 min Winter	30.576	0.076	0.0	13.4	13.4	19.8	O K
180 min Winter	30.556	0.056	0.0	13.0	13.0	11.8	O K
240 min Winter	30.538	0.038	0.0	12.8	12.8	5.5	O K
360 min Winter	30.500	0.000	0.0	11.8	11.8	0.0	O K
480 min Winter	30.500	0.000	0.0	9.4	9.4	0.0	O K
600 min Winter	30.500	0.000	0.0	7.9	7.9	0.0	O K
720 min Winter	30.500	0.000	0.0	6.9	6.9	0.0	O K
960 min Winter	30.500	0.000	0.0	5.5	5.5	0.0	O K
1440 min Winter	30.500	0.000	0.0	4.0	4.0	0.0	O K
2160 min Winter	30.500	0.000	0.0	2.9	2.9	0.0	O K
2880 min Winter	30.500	0.000	0.0	2.3	2.3	0.0	O K
4320 min Winter	30.500	0.000	0.0	1.6	1.6	0.0	O K
5760 min Winter	30.500	0.000	0.0	1.3	1.3	0.0	O K
7200 min Winter	30.500	0.000	0.0	1.1	1.1	0.0	O K
8640 min Winter	30.500	0.000	0.0	0.9	0.9	0.0	O K
10080 min Winter	30.500	0.000	0.0	0.8	0.8	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	49.865	0.0	46.2	27
60 min Winter	30.968	0.0	58.5	46
120 min Winter	18.666	0.0	71.7	82
180 min Winter	13.735	0.0	80.1	114
240 min Winter	11.001	0.0	85.2	142
360 min Winter	8.029	0.0	93.7	0
480 min Winter	6.419	0.0	100.1	0
600 min Winter	5.392	0.0	105.2	0
720 min Winter	4.675	0.0	109.4	0
960 min Winter	3.730	0.0	116.3	0
1440 min Winter	2.711	0.0	126.3	0
2160 min Winter	1.968	0.0	136.5	0
2880 min Winter	1.566	0.0	143.7	0
4320 min Winter	1.135	0.0	153.6	0
5760 min Winter	0.902	0.0	160.2	0
7200 min Winter	0.755	0.0	164.7	0
8640 min Winter	0.653	0.0	168.0	0
10080 min Winter	0.577	0.0	170.4	0

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Hydrock Consultants Ltd		Page 3																																	
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Hydrock Consultants Ltd		Page 4																								
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<u>Rainfall Details</u> <table> <tr> <td>Rainfall Model</td> <td>FSR</td> <td>Winter Storms</td> <td>Yes</td> </tr> <tr> <td>Return Period (years)</td> <td>100</td> <td>Cv (Summer)</td> <td>0.750</td> </tr> <tr> <td>Region</td> <td>England and Wales</td> <td>Cv (Winter)</td> <td>0.840</td> </tr> <tr> <td>M5-60 (mm)</td> <td>20.000</td> <td>Shortest Storm (mins)</td> <td>15</td> </tr> <tr> <td>Ratio R</td> <td>0.404</td> <td>Longest Storm (mins)</td> <td>10080</td> </tr> <tr> <td>Summer Storms</td> <td>Yes</td> <td>Climate Change %</td> <td>+40</td> </tr> </table> <u>Time Area Diagram</u> Total Area (ha) 0.221 <table> <tr> <th>Time (mins)</th> <th>Area</th> </tr> <tr> <th>From:</th> <th>To: (ha)</th> </tr> <tr> <td>0</td> <td>4 0.221</td> </tr> </table>			Rainfall Model	FSR	Winter Storms	Yes	Return Period (years)	100	Cv (Summer)	0.750	Region	England and Wales	Cv (Winter)	0.840	M5-60 (mm)	20.000	Shortest Storm (mins)	15	Ratio R	0.404	Longest Storm (mins)	10080	Summer Storms	Yes	Climate Change %	+40	Time (mins)	Area	From:	To: (ha)	0	4 0.221
Rainfall Model	FSR	Winter Storms	Yes																													
Return Period (years)	100	Cv (Summer)	0.750																													
Region	England and Wales	Cv (Winter)	0.840																													
M5-60 (mm)	20.000	Shortest Storm (mins)	15																													
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0	4 0.221																															
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Hydrock Consultants Ltd		Page 4																								
. . .	Former Nestle Site Network 3 - PP1+PP2																									
Date 24.01.17	Designed by JH																									
File Network 3_canal_outfall...	Checked by																									
XP Solutions		Source Control 2014.1.1																								
<u>Model Details</u> Storage is Online Cover Level (m) 31.960 <u>Porous Car Park Structure</u> <table> <tr> <td>Infiltration Coefficient Base (m/hr)</td> <td>0.00000</td> <td>Width (m)</td> <td>80.8</td> </tr> <tr> <td>Membrane Percolation (mm/hr)</td> <td>1000</td> <td>Length (m)</td> <td>18.0</td> </tr> <tr> <td>Max Percolation (l/s)</td> <td>404.0</td> <td>Slope (1:X)</td> <td>10000.0</td> </tr> <tr> <td>Safety Factor</td> <td>2.0</td> <td>Depression Storage (mm)</td> <td>5</td> </tr> <tr> <td>Porosity</td> <td>0.32</td> <td>Evaporation (mm/day)</td> <td>3</td> </tr> <tr> <td>Invert Level (m)</td> <td>31.100</td> <td>Cap Volume Depth (m)</td> <td>0.250</td> </tr> </table> <u>Orifice Outflow Control</u> Diameter (m) 0.111 Discharge Coefficient 0.600 Invert Level (m) 31.080			Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	80.8	Membrane Percolation (mm/hr)	1000	Length (m)	18.0	Max Percolation (l/s)	404.0	Slope (1:X)	10000.0	Safety Factor	2.0	Depression Storage (mm)	5	Porosity	0.32	Evaporation (mm/day)	3	Invert Level (m)	31.100	Cap Volume Depth (m)	0.250
Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	80.8																							
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Hydrock Consultants Ltd		Page 1	
. . .		Former Nestle Site Network 3A-PodiumB	
Date 24.01.17 File Network 3A_canal_outfal...		Designed by JH Checked by	
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Summary of Results for 30 year Return Period

Half Drain Time : 171 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	38.558	0.058	0.0	1.5	1.5	27.4	O K
30 min Summer	38.573	0.073	0.0	2.1	2.1	34.7	O K
60 min Summer	38.586	0.086	0.0	2.7	2.7	40.7	O K
120 min Summer	38.593	0.093	0.0	3.1	3.1	44.1	O K
180 min Summer	38.595	0.095	0.0	3.2	3.2	45.3	O K
240 min Summer	38.597	0.097	0.0	3.3	3.3	45.9	O K
360 min Summer	38.597	0.097	0.0	3.3	3.3	46.1	O K
480 min Summer	38.596	0.096	0.0	3.3	3.3	45.6	O K
600 min Summer	38.594	0.094	0.0	3.2	3.2	44.9	O K
720 min Summer	38.593	0.093	0.0	3.1	3.1	44.0	O K
960 min Summer	38.589	0.089	0.0	2.9	2.9	42.1	O K
1440 min Summer	38.582	0.082	0.0	2.5	2.5	38.8	O K
2160 min Summer	38.573	0.073	0.0	2.1	2.1	34.9	O K
2880 min Summer	38.567	0.067	0.0	1.8	1.8	31.7	O K
4320 min Summer	38.558	0.058	0.0	1.5	1.5	27.4	O K
5760 min Summer	38.552	0.052	0.0	1.3	1.3	24.9	O K
7200 min Summer	38.549	0.049	0.0	1.1	1.1	23.1	O K
8640 min Summer	38.546	0.046	0.0	1.0	1.0	21.9	O K
10080 min Summer	38.544	0.044	0.0	0.8	0.8	20.8	O K
15 min Winter	38.565	0.065	0.0	1.7	1.7	30.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	76.822	0.0	23.5	18
30 min Summer	49.886	0.0	31.6	33
60 min Summer	30.968	0.0	42.8	62
120 min Summer	18.658	0.0	52.0	104
180 min Summer	13.726	0.0	57.6	132
240 min Summer	10.992	0.0	61.6	166
360 min Summer	8.021	0.0	67.6	234
480 min Summer	6.411	0.0	72.2	302
600 min Summer	5.385	0.0	75.8	368
720 min Summer	4.668	0.0	78.9	434
960 min Summer	3.724	0.0	83.9	562
1440 min Summer	2.706	0.0	90.9	812
2160 min Summer	1.964	0.0	101.6	1192
2880 min Summer	1.563	0.0	107.6	1556
4320 min Summer	1.132	0.0	116.0	2288
5760 min Summer	0.900	0.0	125.3	3000
7200 min Summer	0.753	0.0	130.8	3744
8640 min Summer	0.651	0.0	135.3	4448
10080 min Summer	0.575	0.0	138.6	5240
15 min Winter	76.822	0.0	26.7	18

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. . .	Former Nestle Site Network 3A-PodiumB																																		
Date 24.01.17	Designed by JH																																		
File Network 3A_canal_outfal...	Checked by																																		
XP Solutions		Source Control 2014.1.1																																	
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Hydrock Consultants Ltd		Page 4
. . .	Former Nestle Site Network 3A-PodiumB	
Date 24.01.17	Designed by JH	
File Network 3A_canal_outfal...	Checked by	
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Model Details

Storage is Online Cover Level (m) 40.000

Cellular Storage Structure

Invert Level (m) 38.500 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	500.0	0.0	0.201	0.0	0.0
0.200	500.0	0.0			

Orifice Outflow Control

Diameter (m) 0.092 Discharge Coefficient 0.600 Invert Level (m) 38.500

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Page 1

Former Nestle Site
Network 3A-PodiumB

Micro
Drainage

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Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 164 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	38.604	0.104	0.0	3.7	3.7	49.3	O K
30 min Summer	38.631	0.131	0.0	5.2	5.2	62.3	O K
60 min Summer	38.653	0.153	0.0	5.8	5.8	72.8	O K
120 min Summer	38.665	0.165	0.0	6.1	6.1	78.5	O K
180 min Summer	38.669	0.169	0.0	6.2	6.2	80.3	O K
240 min Summer	38.670	0.170	0.0	6.2	6.2	80.5	O K
360 min Summer	38.667	0.167	0.0	6.2	6.2	79.3	O K
480 min Summer	38.663	0.163	0.0	6.0	6.0	77.2	O K
600 min Summer	38.657	0.157	0.0	5.9	5.9	74.7	O K
720 min Summer	38.652	0.152	0.0	5.7	5.7	72.1	O K
960 min Summer	38.641	0.141	0.0	5.5	5.5	67.2	O K
1440 min Summer	38.626	0.126	0.0	4.9	4.9	59.6	O K
2160 min Summer	38.610	0.110	0.0	4.0	4.0	52.1	O K
2880 min Summer	38.599	0.099	0.0	3.4	3.4	46.9	O K
4320 min Summer	38.584	0.084	0.0	2.6	2.6	39.9	O K
5760 min Summer	38.575	0.075	0.0	2.1	2.1	35.5	O K
7200 min Summer	38.567	0.067	0.0	1.8	1.8	31.9	O K
8640 min Summer	38.561	0.061	0.0	1.6	1.6	29.2	O K
10080 min Summer	38.557	0.057	0.0	1.5	1.5	27.2	O K
15 min Winter	38.616	0.116	0.0	4.3	4.3	55.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	139.635	0.0	45.9	18
30 min Summer	91.435	0.0	61.5	32
60 min Summer	57.005	0.0	80.8	62
120 min Summer	34.324	0.0	97.7	100
180 min Summer	25.168	0.0	107.7	130
240 min Summer	20.074	0.0	114.7	164
360 min Summer	14.562	0.0	124.9	232
480 min Summer	11.594	0.0	132.7	300
600 min Summer	9.707	0.0	138.9	366
720 min Summer	8.393	0.0	144.1	432
960 min Summer	6.666	0.0	152.5	558
1440 min Summer	4.811	0.0	164.5	806
2160 min Summer	3.466	0.0	180.6	1168
2880 min Summer	2.744	0.0	190.4	1532
4320 min Summer	1.972	0.0	204.0	2252
5760 min Summer	1.558	0.0	217.6	3000
7200 min Summer	1.297	0.0	226.3	3744
8640 min Summer	1.117	0.0	233.2	4488
10080 min Summer	0.983	0.0	238.5	5152
15 min Winter	139.635	0.0	51.9	18

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Hydrock Consultants Ltd		Page 3
. . .	Former Nestle Site Network 3A-PodiumB	
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Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.100	Shortest Storm (mins)	15
Ratio R	0.406	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.195

Time (mins)	Area
From:	To: (ha)
0	4 0.195

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Hydrock Consultants Ltd		Page 4
. . .	Former Nestle Site Network 3A-PodiumB	
Date 24.01.17	Designed by JH	
File Network 3A_canal_outfal...	Checked by	
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Model Details

Storage is Online Cover Level (m) 40.000

Cellular Storage Structure

Invert Level (m) 38.500 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	500.0	0.0	0.201	0.0	0.0
0.200	500.0	0.0			

Orifice Outflow Control

Diameter (m) 0.092 Discharge Coefficient 0.600 Invert Level (m) 38.500

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Hydrock Consultants Ltd						Page 2	
. . .			Former Nestle Site Network 4 - PP4 + PP5				
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File Network 4_TW_PP4+PP5_ou...			Checked by				
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<u>Summary of Results for 30 year Return Period</u>							
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	30.484	0.074	0.0	72.0	72.0	40.4	O K
60 min Winter	30.453	0.043	0.0	70.3	70.3	22.2	O K
120 min Winter	30.410	0.000	0.0	67.2	67.2	0.0	O K
180 min Winter	30.410	0.000	0.0	49.7	49.7	0.0	O K
240 min Winter	30.410	0.000	0.0	39.8	39.8	0.0	O K
360 min Winter	30.410	0.000	0.0	29.1	29.1	0.0	O K
480 min Winter	30.410	0.000	0.0	23.2	23.2	0.0	O K
600 min Winter	30.410	0.000	0.0	19.5	19.5	0.0	O K
720 min Winter	30.410	0.000	0.0	16.9	16.9	0.0	O K
960 min Winter	30.410	0.000	0.0	13.5	13.5	0.0	O K
1440 min Winter	30.410	0.000	0.0	9.8	9.8	0.0	O K
2160 min Winter	30.410	0.000	0.0	7.1	7.1	0.0	O K
2880 min Winter	30.410	0.000	0.0	5.6	5.6	0.0	O K
4320 min Winter	30.410	0.000	0.0	4.1	4.1	0.0	O K
5760 min Winter	30.410	0.000	0.0	3.2	3.2	0.0	O K
7200 min Winter	30.410	0.000	0.0	2.7	2.7	0.0	O K
8640 min Winter	30.410	0.000	0.0	2.3	2.3	0.0	O K
10080 min Winter	30.410	0.000	0.0	2.0	2.0	0.0	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)			
30 min Winter	49.584	0.0	117.3	23			
60 min Winter	30.811	0.0	149.3	40			
120 min Winter	18.584	0.0	183.0	0			
180 min Winter	13.680	0.0	202.9	0			
240 min Winter	10.960	0.0	217.2	0			
360 min Winter	8.001	0.0	238.3	0			
480 min Winter	6.397	0.0	254.3	0			
600 min Winter	5.375	0.0	267.2	0			
720 min Winter	4.661	0.0	278.0	0			
960 min Winter	3.719	0.0	295.7	0			
1440 min Winter	2.704	0.0	321.7	0			
2160 min Winter	1.963	0.0	348.9	0			
2880 min Winter	1.563	0.0	368.8	0			
4320 min Winter	1.133	0.0	397.2	0			
5760 min Winter	0.901	0.0	417.3	0			
7200 min Winter	0.754	0.0	432.7	0			
8640 min Winter	0.652	0.0	444.8	0			
10080 min Winter	0.576	0.0	454.6	0			
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. . .	Former Nestle Site Network 4 - PP4 + PP5	
Date 24.01.17 File Network 4_TW_PP4+PP5_ou...	Designed by JH Checked by	
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Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	30	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.404	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.617

Time (mins)	Area
From:	To: (ha)
0	4 0.617

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. . .	Former Nestle Site Network 4 - PP4 + PP5																									
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File Network 4_TW_PP4+PP5_ou...	Checked by																									
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<u>Model Details</u> Storage is Online Cover Level (m) 31.100 <u>Porous Car Park Structure</u> <table> <tr> <td>Infiltration Coefficient Base (m/hr)</td> <td>0.00000</td> <td>Width (m)</td> <td>18.0</td> </tr> <tr> <td>Membrane Percolation (mm/hr)</td> <td>1000</td> <td>Length (m)</td> <td>101.4</td> </tr> <tr> <td>Max Percolation (l/s)</td> <td>507.0</td> <td>Slope (1:X)</td> <td>10000.0</td> </tr> <tr> <td>Safety Factor</td> <td>2.0</td> <td>Depression Storage (mm)</td> <td>5</td> </tr> <tr> <td>Porosity</td> <td>0.32</td> <td>Evaporation (mm/day)</td> <td>3</td> </tr> <tr> <td>Invert Level (m)</td> <td>30.410</td> <td>Cap Volume Depth (m)</td> <td>0.300</td> </tr> </table> <u>Orifice Outflow Control</u> Diameter (m) 0.206 Discharge Coefficient 0.600 Invert Level (m) 29.720			Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	18.0	Membrane Percolation (mm/hr)	1000	Length (m)	101.4	Max Percolation (l/s)	507.0	Slope (1:X)	10000.0	Safety Factor	2.0	Depression Storage (mm)	5	Porosity	0.32	Evaporation (mm/day)	3	Invert Level (m)	30.410	Cap Volume Depth (m)	0.300
Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	18.0																							
Membrane Percolation (mm/hr)	1000	Length (m)	101.4																							
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Hydrock Consultants Ltd		Page 3																														
. . .	Former Nestle Site Network 4 - PP4 + PP5																															
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<u>Rainfall Details</u> <table> <tr> <td>Rainfall Model</td> <td>FSR</td> <td>Winter Storms</td> <td>Yes</td> </tr> <tr> <td>Return Period (years)</td> <td>100</td> <td>Cv (Summer)</td> <td>0.750</td> </tr> <tr> <td>Region</td> <td>England and Wales</td> <td>Cv (Winter)</td> <td>0.840</td> </tr> <tr> <td>M5-60 (mm)</td> <td>20.000</td> <td>Shortest Storm (mins)</td> <td>15</td> </tr> <tr> <td>Ratio R</td> <td>0.404</td> <td>Longest Storm (mins)</td> <td>10080</td> </tr> <tr> <td>Summer Storms</td> <td>Yes</td> <td>Climate Change %</td> <td>+40</td> </tr> </table> <u>Time Area Diagram</u> Total Area (ha) 0.617 <table> <tr> <th>Time (mins)</th> <th>Area</th> </tr> <tr> <th>From:</th> <th>To: (ha)</th> </tr> <tr> <td>0</td> <td>4 0.617</td> </tr> </table>			Rainfall Model	FSR	Winter Storms	Yes	Return Period (years)	100	Cv (Summer)	0.750	Region	England and Wales	Cv (Winter)	0.840	M5-60 (mm)	20.000	Shortest Storm (mins)	15	Ratio R	0.404	Longest Storm (mins)	10080	Summer Storms	Yes	Climate Change %	+40	Time (mins)	Area	From:	To: (ha)	0	4 0.617
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Summer</td><td>29.515</td><td>0.155</td><td>0.0</td><td>31.0</td><td>31.0</td><td>18.9</td><td>O K</td></tr><tr><td>360 min Summer</td><td>29.489</td><td>0.129</td><td>0.0</td><td>25.0</td><td>25.0</td><td>13.0</td><td>O K</td></tr><tr><td>480 min Summer</td><td>29.468</td><td>0.108</td><td>0.0</td><td>21.4</td><td>21.4</td><td>9.1</td><td>O K</td></tr><tr><td>600 min Summer</td><td>29.452</td><td>0.092</td><td>0.0</td><td>18.8</td><td>18.8</td><td>6.6</td><td>O K</td></tr><tr><td>720 min Summer</td><td>29.440</td><td>0.080</td><td>0.0</td><td>16.8</td><td>16.8</td><td>5.0</td><td>O K</td></tr><tr><td>960 min Summer</td><td>29.426</td><td>0.066</td><td>0.0</td><td>13.9</td><td>13.9</td><td>3.4</td><td>O K</td></tr><tr><td>1440 min Summer</td><td>29.409</td><td>0.049</td><td>0.0</td><td>10.1</td><td>10.1</td><td>1.9</td><td>O K</td></tr><tr><td>2160 min Summer</td><td>29.390</td><td>0.030</td><td>0.0</td><td>7.4</td><td>7.4</td><td>0.7</td><td>O K</td></tr><tr><td>2880 min Summer</td><td>29.379</td><td>0.019</td><td>0.0</td><td>5.9</td><td>5.9</td><td>0.3</td><td>O K</td></tr><tr><td>4320 min Summer</td><td>29.366</td><td>0.006</td><td>0.0</td><td>4.3</td><td>4.3</td><td>0.0</td><td>O K</td></tr><tr><td>5760 min Summer</td><td>29.360</td><td>0.000</td><td>0.0</td><td>3.4</td><td>3.4</td><td>0.0</td><td>O K</td></tr><tr><td>7200 min Summer</td><td>29.360</td><td>0.000</td><td>0.0</td><td>2.8</td><td>2.8</td><td>0.0</td><td>O K</td></tr><tr><td>8640 min Summer</td><td>29.360</td><td>0.000</td><td>0.0</td><td>2.4</td><td>2.4</td><td>0.0</td><td>O K</td></tr><tr><td>10080 min Summer</td><td>29.360</td><td>0.000</td><td>0.0</td><td>2.1</td><td>2.1</td><td>0.0</td><td>O K</td></tr><tr><td>15 min Winter</td><td>29.601</td><td>0.241</td><td>0.0</td><td>51.2</td><td>51.2</td><td>44.1</td><td>O K</td></tr></table> <table><tr><th>Storm Event</th><th>Rain (mm/hr)</th><th>Flooded Volume (m³)</th><th>Discharge Volume (m³)</th><th>Time-Peak (mins)</th></tr><tr><td>15 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Summer</td><td>2.704</td><td>0.0</td><td>217.0</td><td>734</td></tr><tr><td>2160 min Summer</td><td>1.963</td><td>0.0</td><td>235.5</td><td>1100</td></tr><tr><td>2880 min Summer</td><td>1.563</td><td>0.0</td><td>249.2</td><td>1436</td></tr><tr><td>4320 min Summer</td><td>1.133</td><td>0.0</td><td>268.9</td><td>2200</td></tr><tr><td>5760 min Summer</td><td>0.901</td><td>0.0</td><td>283.0</td><td>0</td></tr><tr><td>7200 min Summer</td><td>0.754</td><td>0.0</td><td>293.9</td><td>0</td></tr><tr><td>8640 min Summer</td><td>0.652</td><td>0.0</td><td>302.7</td><td>0</td></tr><tr><td>10080 min Summer</td><td>0.576</td><td>0.0</td><td>309.9</td><td>0</td></tr><tr><td>15 min Winter</td><td>76.290</td><td>0.0</td><td>69.1</td><td>14</td></tr></table>				Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status	15 min Summer	29.584	0.224	0.0	47.2	47.2	38.9	O K	30 min Summer	29.594	0.234	0.0	49.6	49.6	42.1	O K	60 min Summer	29.584	0.224	0.0	47.2	47.2	38.9	O K	120 min Summer	29.556	0.196	0.0	40.6	40.6	30.1	O K	180 min Summer	29.533	0.173	0.0	35.2	35.2	23.6	O K	240 min Summer	29.515	0.155	0.0	31.0	31.0	18.9	O K	360 min Summer	29.489	0.129	0.0	25.0	25.0	13.0	O K	480 min Summer	29.468	0.108	0.0	21.4	21.4	9.1	O K	600 min Summer	29.452	0.092	0.0	18.8	18.8	6.6	O K	720 min Summer	29.440	0.080	0.0	16.8	16.8	5.0	O K	960 min Summer	29.426	0.066	0.0	13.9	13.9	3.4	O K	1440 min Summer	29.409	0.049	0.0	10.1	10.1	1.9	O K	2160 min Summer	29.390	0.030	0.0	7.4	7.4	0.7	O K	2880 min Summer	29.379	0.019	0.0	5.9	5.9	0.3	O K	4320 min Summer	29.366	0.006	0.0	4.3	4.3	0.0	O K	5760 min Summer	29.360	0.000	0.0	3.4	3.4	0.0	O K	7200 min Summer	29.360	0.000	0.0	2.8	2.8	0.0	O K	8640 min Summer	29.360	0.000	0.0	2.4	2.4	0.0	O K	10080 min Summer	29.360	0.000	0.0	2.1	2.1	0.0	O K	15 min Winter	29.601	0.241	0.0	51.2	51.2	44.1	O K	Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	15 min Summer	76.290	0.0	61.2	13	30 min Summer	49.584	0.0	80.9	22	60 min Summer	30.811	0.0	101.4	38	120 min Summer	18.584	0.0	123.4	70	180 min Summer	13.680	0.0	136.8	100	240 min Summer	10.960	0.0	146.5	132	360 min Summer	8.001	0.0	160.7	192	480 min Summer	6.397	0.0	171.5	250	600 min Summer	5.375	0.0	180.1	310	720 min Summer	4.661	0.0	187.4	370	960 min Summer	3.719	0.0	199.4	490	1440 min Summer	2.704	0.0	217.0	734	2160 min Summer	1.963	0.0	235.5	1100	2880 min Summer	1.563	0.0	249.2	1436	4320 min Summer	1.133	0.0	268.9	2200	5760 min Summer	0.901	0.0	283.0	0	7200 min Summer	0.754	0.0	293.9	0	8640 min Summer	0.652	0.0	302.7	0	10080 min Summer	0.576	0.0	309.9	0	15 min Winter	76.290	0.0	69.1	14
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<u>Rainfall Details</u> <table> <tr> <td>Rainfall Model</td> <td>FSR</td> <td>Winter Storms</td> <td>Yes</td> </tr> <tr> <td>Return Period (years)</td> <td>30</td> <td>Cv (Summer)</td> <td>0.750</td> </tr> <tr> <td>Region</td> <td>England and Wales</td> <td>Cv (Winter)</td> <td>0.840</td> </tr> <tr> <td>M5-60 (mm)</td> <td>20.000</td> <td>Shortest Storm (mins)</td> <td>15</td> </tr> <tr> <td>Ratio R</td> <td>0.404</td> <td>Longest Storm (mins)</td> <td>10080</td> </tr> <tr> <td>Summer Storms</td> <td>Yes</td> <td>Climate Change %</td> <td>+0</td> </tr> </table> <u>Time Area Diagram</u> Total Area (ha) 0.462 <table> <tr> <th colspan="2">Time (mins)</th> <th>Area</th> </tr> <tr> <th>From:</th> <th>To:</th> <th>(ha)</th> </tr> <tr> <td>0</td> <td>4</td> <td>0.462</td> </tr> </table>			Rainfall Model	FSR	Winter Storms	Yes	Return Period (years)	30	Cv (Summer)	0.750	Region	England and Wales	Cv (Winter)	0.840	M5-60 (mm)	20.000	Shortest Storm (mins)	15	Ratio R	0.404	Longest Storm (mins)	10080	Summer Storms	Yes	Climate Change %	+0	Time (mins)		Area	From:	To:	(ha)	0	4	0.462
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Summer</td><td>29.608</td><td>0.248</td><td>0.0</td><td>52.9</td><td>52.9</td><td>46.3</td><td>O K</td></tr><tr><td>360 min Summer</td><td>29.568</td><td>0.208</td><td>0.0</td><td>43.3</td><td>43.3</td><td>33.7</td><td>O K</td></tr><tr><td>480 min Summer</td><td>29.542</td><td>0.182</td><td>0.0</td><td>37.2</td><td>37.2</td><td>25.8</td><td>O K</td></tr><tr><td>600 min Summer</td><td>29.522</td><td>0.162</td><td>0.0</td><td>32.5</td><td>32.5</td><td>20.5</td><td>O K</td></tr><tr><td>720 min Summer</td><td>29.506</td><td>0.146</td><td>0.0</td><td>28.9</td><td>28.9</td><td>16.6</td><td>O K</td></tr><tr><td>960 min Summer</td><td>29.481</td><td>0.121</td><td>0.0</td><td>23.7</td><td>23.7</td><td>11.5</td><td>O K</td></tr><tr><td>1440 min Summer</td><td>29.446</td><td>0.086</td><td>0.0</td><td>17.8</td><td>17.8</td><td>5.8</td><td>O K</td></tr><tr><td>2160 min Summer</td><td>29.422</td><td>0.062</td><td>0.0</td><td>13.1</td><td>13.1</td><td>3.0</td><td>O K</td></tr><tr><td>2880 min Summer</td><td>29.410</td><td>0.050</td><td>0.0</td><td>10.3</td><td>10.3</td><td>1.9</td><td>O K</td></tr><tr><td>4320 min Summer</td><td>29.391</td><td>0.031</td><td>0.0</td><td>7.4</td><td>7.4</td><td>0.7</td><td>O K</td></tr><tr><td>5760 min Summer</td><td>29.379</td><td>0.019</td><td>0.0</td><td>5.9</td><td>5.9</td><td>0.3</td><td>O K</td></tr><tr><td>7200 min Summer</td><td>29.371</td><td>0.011</td><td>0.0</td><td>4.9</td><td>4.9</td><td>0.1</td><td>O K</td></tr><tr><td>8640 min Summer</td><td>29.366</td><td>0.006</td><td>0.0</td><td>4.2</td><td>4.2</td><td>0.0</td><td>O K</td></tr><tr><td>10080 min Summer</td><td>29.360</td><td>0.000</td><td>0.0</td><td>3.7</td><td>3.7</td><td>0.0</td><td>O K</td></tr><tr><td>15 min Winter</td><td>29.746</td><td>0.386</td><td>0.0</td><td>74.0</td><td>74.0</td><td>89.7</td><td>O K</td></tr></table> <table><tr><th>Storm Event</th><th>Rain (mm/hr)</th><th>Flooded Volume (m³)</th><th>Discharge Volume (m³)</th><th>Time-Peak (mins)</th></tr><tr><td>15 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Summer</td><td>4.807</td><td>0.0</td><td>391.9</td><td>734</td></tr><tr><td>2160 min Summer</td><td>3.465</td><td>0.0</td><td>422.9</td><td>1096</td></tr><tr><td>2880 min Summer</td><td>2.744</td><td>0.0</td><td>445.6</td><td>1464</td></tr><tr><td>4320 min Summer</td><td>1.973</td><td>0.0</td><td>478.4</td><td>2188</td></tr><tr><td>5760 min Summer</td><td>1.559</td><td>0.0</td><td>501.8</td><td>2840</td></tr><tr><td>7200 min Summer</td><td>1.298</td><td>0.0</td><td>520.2</td><td>3544</td></tr><tr><td>8640 min Summer</td><td>1.118</td><td>0.0</td><td>535.1</td><td>4312</td></tr><tr><td>10080 min Summer</td><td>0.985</td><td>0.0</td><td>547.7</td><td>4976</td></tr><tr><td>15 min Winter</td><td>138.634</td><td>0.0</td><td>129.5</td><td>15</td></tr></table>				Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status	15 min Summer	29.711	0.351	0.0	70.0	70.0	78.7	O K	30 min Summer	29.740	0.380	0.0	73.3	73.3	87.6	O K	60 min Summer	29.728	0.368	0.0	72.0	72.0	84.1	O K	120 min Summer	29.678	0.318	0.0	65.9	65.9	68.2	O K	180 min Summer	29.637	0.277	0.0	59.8	59.8	55.4	O K	240 min Summer	29.608	0.248	0.0	52.9	52.9	46.3	O K	360 min Summer	29.568	0.208	0.0	43.3	43.3	33.7	O K	480 min Summer	29.542	0.182	0.0	37.2	37.2	25.8	O K	600 min Summer	29.522	0.162	0.0	32.5	32.5	20.5	O K	720 min Summer	29.506	0.146	0.0	28.9	28.9	16.6	O K	960 min Summer	29.481	0.121	0.0	23.7	23.7	11.5	O K	1440 min Summer	29.446	0.086	0.0	17.8	17.8	5.8	O K	2160 min Summer	29.422	0.062	0.0	13.1	13.1	3.0	O K	2880 min Summer	29.410	0.050	0.0	10.3	10.3	1.9	O K	4320 min Summer	29.391	0.031	0.0	7.4	7.4	0.7	O K	5760 min Summer	29.379	0.019	0.0	5.9	5.9	0.3	O K	7200 min Summer	29.371	0.011	0.0	4.9	4.9	0.1	O K	8640 min Summer	29.366	0.006	0.0	4.2	4.2	0.0	O K	10080 min Summer	29.360	0.000	0.0	3.7	3.7	0.0	O K	15 min Winter	29.746	0.386	0.0	74.0	74.0	89.7	O K	Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	15 min Summer	138.634	0.0	115.3	14	30 min Summer	90.866	0.0	152.4	22	60 min Summer	56.713	0.0	191.5	40	120 min Summer	34.190	0.0	231.7	72	180 min Summer	25.088	0.0	255.6	102	240 min Summer	20.020	0.0	272.0	132	360 min Summer	14.528	0.0	296.4	194	480 min Summer	11.570	0.0	314.8	254	600 min Summer	9.690	0.0	329.6	314	720 min Summer	8.380	0.0	342.1	372	960 min Summer	6.658	0.0	362.2	492	1440 min Summer	4.807	0.0	391.9	734	2160 min Summer	3.465	0.0	422.9	1096	2880 min Summer	2.744	0.0	445.6	1464	4320 min Summer	1.973	0.0	478.4	2188	5760 min Summer	1.559	0.0	501.8	2840	7200 min Summer	1.298	0.0	520.2	3544	8640 min Summer	1.118	0.0	535.1	4312	10080 min Summer	0.985	0.0	547.7	4976	15 min Winter	138.634	0.0	129.5	15
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<u>Rainfall Details</u> <table> <tr> <td>Rainfall Model</td> <td>FSR</td> <td>Winter Storms</td> <td>Yes</td> </tr> <tr> <td>Return Period (years)</td> <td>100</td> <td>Cv (Summer)</td> <td>0.750</td> </tr> <tr> <td>Region</td> <td>England and Wales</td> <td>Cv (Winter)</td> <td>0.840</td> </tr> <tr> <td>M5-60 (mm)</td> <td>20.000</td> <td>Shortest Storm (mins)</td> <td>15</td> </tr> <tr> <td>Ratio R</td> <td>0.404</td> <td>Longest Storm (mins)</td> <td>10080</td> </tr> <tr> <td>Summer Storms</td> <td>Yes</td> <td>Climate Change %</td> <td>+40</td> </tr> </table> <u>Time Area Diagram</u> Total Area (ha) 0.462 <table> <thead> <tr> <th colspan="2">Time (mins)</th> <th>Area</th> </tr> <tr> <th>From:</th> <th>To:</th> <th>(ha)</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>4</td> <td>0.462</td> </tr> </tbody> </table>			Rainfall Model	FSR	Winter Storms	Yes	Return Period (years)	100	Cv (Summer)	0.750	Region	England and Wales	Cv (Winter)	0.840	M5-60 (mm)	20.000	Shortest Storm (mins)	15	Ratio R	0.404	Longest Storm (mins)	10080	Summer Storms	Yes	Climate Change %	+40	Time (mins)		Area	From:	To:	(ha)	0	4	0.462
Rainfall Model	FSR	Winter Storms	Yes																																
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. . .	Former Nestle Site Network 5 - PP6_Rev_B																									
Date 27.01.17	Designed by JH																									
File Network 5_TW_PP6_outfal...	Checked by																									
XP Solutions		Source Control 2015.1																								
<u>Model Details</u> Storage is Online Cover Level (m) 31.320 <u>Porous Car Park Structure</u> <table> <tr> <td>Infiltration Coefficient Base (m/hr)</td> <td>0.00000</td> <td>Width (m)</td> <td>54.4</td> </tr> <tr> <td>Membrane Percolation (mm/hr)</td> <td>1000</td> <td>Length (m)</td> <td>18.0</td> </tr> <tr> <td>Max Percolation (l/s)</td> <td>272.0</td> <td>Slope (1:X)</td> <td>90.0</td> </tr> <tr> <td>Safety Factor</td> <td>2.0</td> <td>Depression Storage (mm)</td> <td>5</td> </tr> <tr> <td>Porosity</td> <td>0.32</td> <td>Evaporation (mm/day)</td> <td>3</td> </tr> <tr> <td>Invert Level (m)</td> <td>29.360</td> <td>Cap Volume Depth (m)</td> <td>0.470</td> </tr> </table> <u>Orifice Outflow Control</u> Diameter (m) 0.248 Discharge Coefficient 0.600 Invert Level (m) 29.290			Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	54.4	Membrane Percolation (mm/hr)	1000	Length (m)	18.0	Max Percolation (l/s)	272.0	Slope (1:X)	90.0	Safety Factor	2.0	Depression Storage (mm)	5	Porosity	0.32	Evaporation (mm/day)	3	Invert Level (m)	29.360	Cap Volume Depth (m)	0.470
Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	54.4																							
Membrane Percolation (mm/hr)	1000	Length (m)	18.0																							
Max Percolation (l/s)	272.0	Slope (1:X)	90.0																							
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Porosity	0.32	Evaporation (mm/day)	3																							
Invert Level (m)	29.360	Cap Volume Depth (m)	0.470																							
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Page 1

Former Nestle Site
Network 5A_Podium C

Date 24.01.17
File Network 5A_TW_AB2_outfa...

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Micro Drainage

Summary of Results for 30 year Return Period

Half Drain Time : 57 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	38.578	0.078	0.0	3.4	3.4	16.3	O K
30 min Summer	38.593	0.093	0.0	4.4	4.4	19.3	O K
60 min Summer	38.602	0.102	0.0	5.0	5.0	21.2	O K
120 min Summer	38.606	0.106	0.0	5.2	5.2	22.1	O K
180 min Summer	38.604	0.104	0.0	5.1	5.1	21.7	O K
240 min Summer	38.601	0.101	0.0	4.9	4.9	21.1	O K
360 min Summer	38.594	0.094	0.0	4.5	4.5	19.7	O K
480 min Summer	38.588	0.088	0.0	4.1	4.1	18.4	O K
600 min Summer	38.583	0.083	0.0	3.7	3.7	17.4	O K
720 min Summer	38.579	0.079	0.0	3.5	3.5	16.6	O K
960 min Summer	38.573	0.073	0.0	3.0	3.0	15.3	O K
1440 min Summer	38.565	0.065	0.0	2.3	2.3	13.7	O K
2160 min Summer	38.557	0.057	0.0	1.7	1.7	11.9	O K
2880 min Summer	38.551	0.051	0.0	1.4	1.4	10.7	O K
4320 min Summer	38.544	0.044	0.0	1.1	1.1	9.3	O K
5760 min Summer	38.540	0.040	0.0	0.9	0.9	8.3	O K
7200 min Summer	38.536	0.036	0.0	0.7	0.7	7.6	O K
8640 min Summer	38.534	0.034	0.0	0.6	0.6	7.1	O K
10080 min Summer	38.532	0.032	0.0	0.6	0.6	6.7	O K
15 min Winter	38.587	0.087	0.0	4.0	4.0	18.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	76.354	0.0	17.0	17
30 min Summer	49.606	0.0	22.3	30
60 min Summer	30.811	0.0	28.3	44
120 min Summer	18.576	0.0	34.2	78
180 min Summer	13.671	0.0	37.8	112
240 min Summer	10.952	0.0	40.4	144
360 min Summer	7.993	0.0	44.2	208
480 min Summer	6.390	0.0	47.2	268
600 min Summer	5.368	0.0	49.5	330
720 min Summer	4.654	0.0	51.5	390
960 min Summer	3.714	0.0	54.7	512
1440 min Summer	2.699	0.0	59.6	762
2160 min Summer	1.959	0.0	65.4	1124
2880 min Summer	1.560	0.0	69.4	1496
4320 min Summer	1.130	0.0	75.1	2208
5760 min Summer	0.899	0.0	80.1	2944
7200 min Summer	0.752	0.0	83.8	3672
8640 min Summer	0.650	0.0	86.8	4408
10080 min Summer	0.575	0.0	89.2	5144
15 min Winter	76.354	0.0	19.1	17

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. . .		Former Nestle Site Network 5A_Podium C					
Date 24.01.17 File Network 5A_TW_AB2_outfa...		Designed by JH Checked by					
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Summary of Results for 30 year Return Period							
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	38.604	0.104	0.0	5.1	5.1	21.6	O K
60 min Winter	38.612	0.112	0.0	5.8	5.8	23.5	O K
120 min Winter	38.613	0.113	0.0	5.9	5.9	23.5	O K
180 min Winter	38.608	0.108	0.0	5.4	5.4	22.6	O K
240 min Winter	38.602	0.102	0.0	5.0	5.0	21.4	O K
360 min Winter	38.592	0.092	0.0	4.3	4.3	19.2	O K
480 min Winter	38.584	0.084	0.0	3.8	3.8	17.6	O K
600 min Winter	38.578	0.078	0.0	3.4	3.4	16.4	O K
720 min Winter	38.574	0.074	0.0	3.1	3.1	15.5	O K
960 min Winter	38.568	0.068	0.0	2.5	2.5	14.2	O K
1440 min Winter	38.559	0.059	0.0	1.8	1.8	12.4	O K
2160 min Winter	38.550	0.050	0.0	1.4	1.4	10.5	O K
2880 min Winter	38.545	0.045	0.0	1.1	1.1	9.4	O K
4320 min Winter	38.539	0.039	0.0	0.8	0.8	8.0	O K
5760 min Winter	38.534	0.034	0.0	0.7	0.7	7.1	O K
7200 min Winter	38.531	0.031	0.0	0.5	0.5	6.5	O K
8640 min Winter	38.529	0.029	0.0	0.5	0.5	6.1	O K
10080 min Winter	38.527	0.027	0.0	0.4	0.4	5.7	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)			
30 min Winter	49.606	0.0	25.0	30			
60 min Winter	30.811	0.0	31.8	46			
120 min Winter	18.576	0.0	38.4	84			
180 min Winter	13.671	0.0	42.4	118			
240 min Winter	10.952	0.0	45.3	152			
360 min Winter	7.993	0.0	49.6	216			
480 min Winter	6.390	0.0	52.9	278			
600 min Winter	5.368	0.0	55.5	338			
720 min Winter	4.654	0.0	57.7	398			
960 min Winter	3.714	0.0	61.4	524			
1440 min Winter	2.699	0.0	66.8	780			
2160 min Winter	1.959	0.0	73.3	1144			
2880 min Winter	1.560	0.0	77.7	1496			
4320 min Winter	1.130	0.0	84.2	2252			
5760 min Winter	0.899	0.0	89.7	2976			
7200 min Winter	0.752	0.0	93.9	3672			
8640 min Winter	0.650	0.0	97.3	4408			
10080 min Winter	0.575	0.0	100.0	5240			
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Hydrock Consultants Ltd		Page 3
. . .	Former Nestle Site Network 5A_Podium C	
Date 24.01.17	Designed by JH	
File Network 5A_TW_AB2_outfa...	Checked by	
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Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	30	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.405	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.124

Time (mins)	Area
From:	To: (ha)
0	4 0.124

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Hydrock Consultants Ltd		Page 4
. . .	Former Nestle Site Network 5A_Podium C	
Date 24.01.17	Designed by JH	
File Network 5A_TW_AB2_outfa...	Checked by	
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Model Details

Storage is Online Cover Level (m) 40.000

Cellular Storage Structure

Invert Level (m) 38.500 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	220.0	0.0	0.201	0.0	0.0
0.200	220.0	0.0			

Orifice Outflow Control

Diameter (m) 0.134 Discharge Coefficient 0.600 Invert Level (m) 38.500

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Page 1

Former Nestle Site

Network 5A_Podium C

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Micro Drainage

Date 24.01.17

File Network 5A_TW_AB2_outfa...

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Source Control 2014.1.1

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 40 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	38.637	0.137	0.0	8.0	8.0	28.6	O K
30 min Summer	38.661	0.161	0.0	10.3	10.3	33.6	O K
60 min Summer	38.675	0.175	0.0	11.7	11.7	36.7	O K
120 min Summer	38.677	0.177	0.0	11.9	11.9	37.0	O K
180 min Summer	38.670	0.170	0.0	11.2	11.2	35.5	O K
240 min Summer	38.662	0.162	0.0	10.4	10.4	33.8	O K
360 min Summer	38.647	0.147	0.0	9.0	9.0	30.7	O K
480 min Summer	38.635	0.135	0.0	7.9	7.9	28.3	O K
600 min Summer	38.626	0.126	0.0	7.1	7.1	26.4	O K
720 min Summer	38.619	0.119	0.0	6.4	6.4	24.8	O K
960 min Summer	38.607	0.107	0.0	5.4	5.4	22.4	O K
1440 min Summer	38.590	0.090	0.0	4.2	4.2	18.8	O K
2160 min Summer	38.577	0.077	0.0	3.3	3.3	16.0	O K
2880 min Summer	38.570	0.070	0.0	2.7	2.7	14.5	O K
4320 min Summer	38.560	0.060	0.0	1.9	1.9	12.6	O K
5760 min Summer	38.553	0.053	0.0	1.5	1.5	11.1	O K
7200 min Summer	38.549	0.049	0.0	1.3	1.3	10.1	O K
8640 min Summer	38.545	0.045	0.0	1.1	1.1	9.4	O K
10080 min Summer	38.543	0.043	0.0	1.0	1.0	8.9	O K
15 min Winter	38.653	0.153	0.0	9.6	9.6	31.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	138.754	0.0	31.4	17
30 min Summer	90.906	0.0	41.4	27
60 min Summer	56.713	0.0	52.4	42
120 min Summer	34.176	0.0	63.2	76
180 min Summer	25.072	0.0	69.6	108
240 min Summer	20.006	0.0	74.1	140
360 min Summer	14.514	0.0	80.6	204
480 min Summer	11.557	0.0	85.6	266
600 min Summer	9.678	0.0	89.6	326
720 min Summer	8.369	0.0	92.9	390
960 min Summer	6.648	0.0	98.4	512
1440 min Summer	4.799	0.0	106.4	752
2160 min Summer	3.459	0.0	115.6	1104
2880 min Summer	2.739	0.0	122.0	1472
4320 min Summer	1.968	0.0	131.2	2204
5760 min Summer	1.556	0.0	138.8	2936
7200 min Summer	1.295	0.0	144.5	3672
8640 min Summer	1.115	0.0	149.1	4400
10080 min Summer	0.982	0.0	152.9	5104
15 min Winter	138.754	0.0	35.3	16

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Hydrock Consultants Ltd		Page 3
. . .	Former Nestle Site Network 5A_Podium C	
Date 24.01.17	Designed by JH	
File Network 5A_TW_AB2_outfa...	Checked by	
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Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.405	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.124

Time (mins)	Area
From:	To: (ha)
0	4 0.124

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Hydrock Consultants Ltd		Page 4
. . .	Former Nestle Site Network 5A_Podium C	
Date 24.01.17	Designed by JH	
File Network 5A_TW_AB2_outfa...	Checked by	
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Model Details

Storage is Online Cover Level (m) 40.000

Cellular Storage Structure

Invert Level (m) 38.500 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	220.0	0.0	0.201	0.0	0.0
0.200	220.0	0.0			

Orifice Outflow Control

Diameter (m) 0.134 Discharge Coefficient 0.600 Invert Level (m) 38.500

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Hydrock Consultants Ltd		Page 1	
. . .		Former Nestle Site Network 6 - GC2_Rev_B	
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Summary of Results for 30 year Return Period

Half Drain Time : 23 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	29.191	0.191	0.0	34.2	34.2	60.0	O K
30 min Summer	29.217	0.217	0.0	38.8	38.8	68.0	O K
60 min Summer	29.225	0.225	0.0	40.2	40.2	70.4	O K
120 min Summer	29.208	0.208	0.0	37.4	37.4	65.2	O K
180 min Summer	29.189	0.189	0.0	33.8	33.8	59.1	O K
240 min Summer	29.172	0.172	0.0	30.4	30.4	54.0	O K
360 min Summer	29.149	0.149	0.0	25.2	25.2	46.7	O K
480 min Summer	29.133	0.133	0.0	21.7	21.7	41.6	O K
600 min Summer	29.120	0.120	0.0	19.0	19.0	37.7	O K
720 min Summer	29.111	0.111	0.0	17.0	17.0	34.7	O K
960 min Summer	29.097	0.097	0.0	14.2	14.2	30.3	O K
1440 min Summer	29.078	0.078	0.0	10.7	10.7	24.6	O K
2160 min Summer	29.063	0.063	0.0	8.1	8.1	19.6	O K
2880 min Summer	29.053	0.053	0.0	6.5	6.5	16.5	O K
4320 min Summer	29.040	0.040	0.0	4.8	4.8	12.6	O K
5760 min Summer	29.033	0.033	0.0	3.9	3.9	10.2	O K
7200 min Summer	29.027	0.027	0.0	3.2	3.2	8.5	O K
8640 min Summer	29.023	0.023	0.0	2.8	2.8	7.2	O K
10080 min Summer	29.020	0.020	0.0	2.5	2.5	6.2	O K
15 min Winter	29.215	0.215	0.0	38.5	38.5	67.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	76.354	0.0	75.9	15
30 min Summer	49.606	0.0	98.6	23
60 min Summer	30.811	0.0	122.5	40
120 min Summer	18.576	0.0	147.8	72
180 min Summer	13.671	0.0	163.2	104
240 min Summer	10.952	0.0	174.3	136
360 min Summer	7.993	0.0	190.8	196
480 min Summer	6.390	0.0	203.4	258
600 min Summer	5.368	0.0	213.6	320
720 min Summer	4.654	0.0	222.3	378
960 min Summer	3.714	0.0	236.4	500
1440 min Summer	2.699	0.0	257.8	740
2160 min Summer	1.959	0.0	280.7	1104
2880 min Summer	1.560	0.0	298.0	1468
4320 min Summer	1.130	0.0	323.9	2204
5760 min Summer	0.899	0.0	343.4	2936
7200 min Summer	0.752	0.0	359.2	3672
8640 min Summer	0.650	0.0	372.6	4400
10080 min Summer	0.575	0.0	384.3	5136
15 min Winter	76.354	0.0	85.0	15

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Hydrock Consultants Ltd		Page 3																																	
. . .	Former Nestle Site Network 6 - GC2_Rev_B																																		
Date 27.01.17 File Network 6_TW_GC2_outfal...	Designed by JH Checked by																																		
XP Solutions Source Control 2015.1																																			
<u>Rainfall Details</u> <table> <tr> <td>Rainfall Model</td> <td>FSR</td> <td>Winter Storms</td> <td>Yes</td> </tr> <tr> <td>Return Period (years)</td> <td>30</td> <td>Cv (Summer)</td> <td>0.750</td> </tr> <tr> <td>Region</td> <td>England and Wales</td> <td>Cv (Winter)</td> <td>0.840</td> </tr> <tr> <td>M5-60 (mm)</td> <td>20.000</td> <td>Shortest Storm (mins)</td> <td>15</td> </tr> <tr> <td>Ratio R</td> <td>0.405</td> <td>Longest Storm (mins)</td> <td>10080</td> </tr> <tr> <td>Summer Storms</td> <td>Yes</td> <td>Climate Change %</td> <td>+0</td> </tr> </table> <u>Time Area Diagram</u> Total Area (ha) 0.531 <table> <tr> <th colspan="2">Time (mins)</th> <th>Area</th> </tr> <tr> <th>From:</th> <th>To:</th> <th>(ha)</th> </tr> <tr> <td>0</td> <td>4</td> <td>0.531</td> </tr> </table>			Rainfall Model	FSR	Winter Storms	Yes	Return Period (years)	30	Cv (Summer)	0.750	Region	England and Wales	Cv (Winter)	0.840	M5-60 (mm)	20.000	Shortest Storm (mins)	15	Ratio R	0.405	Longest Storm (mins)	10080	Summer Storms	Yes	Climate Change %	+0	Time (mins)		Area	From:	To:	(ha)	0	4	0.531
Rainfall Model	FSR	Winter Storms	Yes																																
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0	4	0.531																																	
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Hydrock Consultants Ltd		Page 4
. . .	Former Nestle Site Network 6 - GC2_Rev_B	
Date 27.01.17	Designed by JH	
File Network 6_TW_GC2_outfal...	Checked by	
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Model Details

Storage is Online Cover Level (m) 30.300

Cellular Storage Structure

Invert Level (m) 29.000 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	330.0	0.0	0.501	0.0	0.0
0.500	330.0	0.0			

Hydro-Brake Optimum® Outflow Control

Unit Reference MD-SCL-0263-4820-1000-4820
 Design Head (m) 1.000
 Design Flow (l/s) 48.2
 Flush-Flo™ Calculated
 Objective Minimise blockage risk
 Diameter (mm) 263
 Invert Level (m) 28.970
 Minimum Outlet Pipe Diameter (mm) 300
 Suggested Manhole Diameter (mm) 1800

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	47.5
Flush-Flo™	0.336	47.4
Kick-Flo®	0.684	39.6
Mean Flow over Head Range	-	37.3

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 (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	9.3	1.200	51.9	3.000	80.8	7.000	122.0
0.200	29.9	1.400	55.9	3.500	87.0	7.500	126.1
0.300	47.1	1.600	59.6	4.000	92.9	8.000	130.2
0.400	47.1	1.800	63.1	4.500	98.3	8.500	134.1
0.500	45.5	2.000	66.4	5.000	103.5	9.000	137.9
0.600	43.0	2.200	69.5	5.500	108.4	9.500	141.6
0.800	42.7	2.400	72.5	6.000	113.1		
1.000	47.5	2.600	75.4	6.500	117.6		

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Page 1

Former Nestle Site

Network 6 - GC2_Rev_B

Date 27.01.17

File Network 6_TW_GC2_outfal...

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Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 34 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	29.356	0.356	0.0	47.4	47.4	111.8	O K
30 min Summer	29.419	0.419	0.0	47.4	47.4	131.4	O K
60 min Summer	29.446	0.446	0.0	47.4	47.4	139.7	O K
120 min Summer	29.415	0.415	0.0	47.4	47.4	130.0	O K
180 min Summer	29.363	0.363	0.0	47.4	47.4	113.9	O K
240 min Summer	29.315	0.315	0.0	47.4	47.4	98.8	O K
360 min Summer	29.254	0.254	0.0	44.7	44.7	79.6	O K
480 min Summer	29.219	0.219	0.0	39.2	39.2	68.7	O K
600 min Summer	29.195	0.195	0.0	34.9	34.9	61.0	O K
720 min Summer	29.177	0.177	0.0	31.4	31.4	55.5	O K
960 min Summer	29.152	0.152	0.0	26.0	26.0	47.7	O K
1440 min Summer	29.123	0.123	0.0	19.6	19.6	38.5	O K
2160 min Summer	29.098	0.098	0.0	14.5	14.5	30.8	O K
2880 min Summer	29.083	0.083	0.0	11.6	11.6	26.1	O K
4320 min Summer	29.065	0.065	0.0	8.5	8.5	20.4	O K
5760 min Summer	29.054	0.054	0.0	6.8	6.8	16.9	O K
7200 min Summer	29.046	0.046	0.0	5.6	5.6	14.5	O K
8640 min Summer	29.041	0.041	0.0	4.9	4.9	12.7	O K
10080 min Summer	29.036	0.036	0.0	4.2	4.2	11.3	O K
15 min Winter	29.406	0.406	0.0	47.4	47.4	127.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	138.754	0.0	138.0	16
30 min Summer	90.906	0.0	180.8	26
60 min Summer	56.713	0.0	225.7	44
120 min Summer	34.176	0.0	272.0	78
180 min Summer	25.072	0.0	299.4	110
240 min Summer	20.006	0.0	318.6	140
360 min Summer	14.514	0.0	346.8	198
480 min Summer	11.557	0.0	368.1	258
600 min Summer	9.678	0.0	385.2	318
720 min Summer	8.369	0.0	399.7	376
960 min Summer	6.648	0.0	423.4	500
1440 min Summer	4.799	0.0	458.5	738
2160 min Summer	3.459	0.0	495.7	1104
2880 min Summer	2.739	0.0	523.3	1468
4320 min Summer	1.968	0.0	564.2	2200
5760 min Summer	1.556	0.0	594.6	2936
7200 min Summer	1.295	0.0	618.9	3672
8640 min Summer	1.115	0.0	639.3	4400
10080 min Summer	0.982	0.0	657.0	5136
15 min Winter	138.754	0.0	154.6	16

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Hydrock Consultants Ltd		Page 3																																	
. . .	Former Nestle Site Network 6 - GC2_Rev_B																																		
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