



Project Name : Land West of B2132 Bilsham Road, Yapton
Job No : 14-111
Note Title : Flood Risk Assessment & Drainage Strategy – Addendum No.2
Author : NA
Checked : GG
Approved : GG
Date : June 2018

1.0 INTRODUCTION AND BACKGROUND

1.1 Odyssey was commissioned by Gleeson Strategic Land to undertake a Flood Risk Assessment (FRA) and Drainage Strategy in support of a planning application for a proposed residential development in Yapton (report no. 14-111-17B).

1.2 A planning application was submitted to Arun District Council (ADC) in December 2017 (application ref. Y/91/17/OUT) along with the FRA and Drainage Strategy. An addendum to the FRA and Drainage Strategy was submitted to ADC in January 2018 to address the initial comments made by ADC's Drainage Engineer (report no. 14-111-23). ADC's Drainage Engineer has since submitted further comments relating to surface water drainage.

1.3 This addendum, which should be read in conjunction with the aforementioned reports, addresses the additional comments raised by ADC regarding surface water drainage at the site. The additional correspondence from the ADC Drainage Engineer is shown in **Appendix A** and states:

- *We note that groundwater monitoring was conducted in late October. For a development of this size, we require monitoring to be completed from October through to March, i.e. the current monitoring results are insufficient.*
- *Discharge rates of $\times 10^{-6}$ are not poor enough to justify ruling out infiltration in the surface water drainage strategy. Infiltration is achievable at such a rate. Therefore, the overall strategy would need to be revised.*



- A plan showing the locations of percolation test pits would also be required.
- We do not require 1m clearance between the base of any proposed infiltration structure and maximum recorded groundwater levels. Therefore, a maximum recorded groundwater level of 1.69m bgl is not too high to rule out the use of infiltration. Shallow infiltration structures can be used with maximum groundwater levels of 1m bgl.

2.0 GROUNDWATER MONITORING

2.1 At the time of submission, groundwater monitoring had been undertaken as part of the intrusive ground investigations in October 2017. The first recorded groundwater levels ranged from 1.69m to 3.58m below ground level (bgl), and the second recorded levels ranged from 1.70m to 3.63m bgl.

2.2 Further groundwater monitoring from January 2018 to March 2018 has since been undertaken across the site, in accordance with the ADC 'Supplementary Requirements for Surface Water Drainage Proposals', which states that residential developments in excess of five properties will require groundwater monitoring to be undertaken between October and March inclusive.

2.3 **Table 1.1** below sets out the groundwater levels encountered across the site between October 2017 and March 2018. A location plan of the test pits is shown in **Figure 1** below and the full results of the groundwater monitoring are shown in **Appendix B**.

Table 1.1: Groundwater Levels

Borehole Name	Groundwater Level Below Ground Surface (m)				
	25/10/2017	31/10/2017	24/01/2018	22/02/2018	22/03/2018
WS02	2.42	2.52	0.44	0.48	0.56
WS03	2.94	3.03	1.09	1.54	1.54
WS04	3.58	3.63	1.29	1.82	1.84
WS07	1.69	1.70	0.87	1.00	1.12
WS08	1.83	1.88	0.89	1.26	1.27
WS09	1.80	1.84	1.14	1.23	1.24
WS10	2.03	2.08	n/a	1.57	1.57

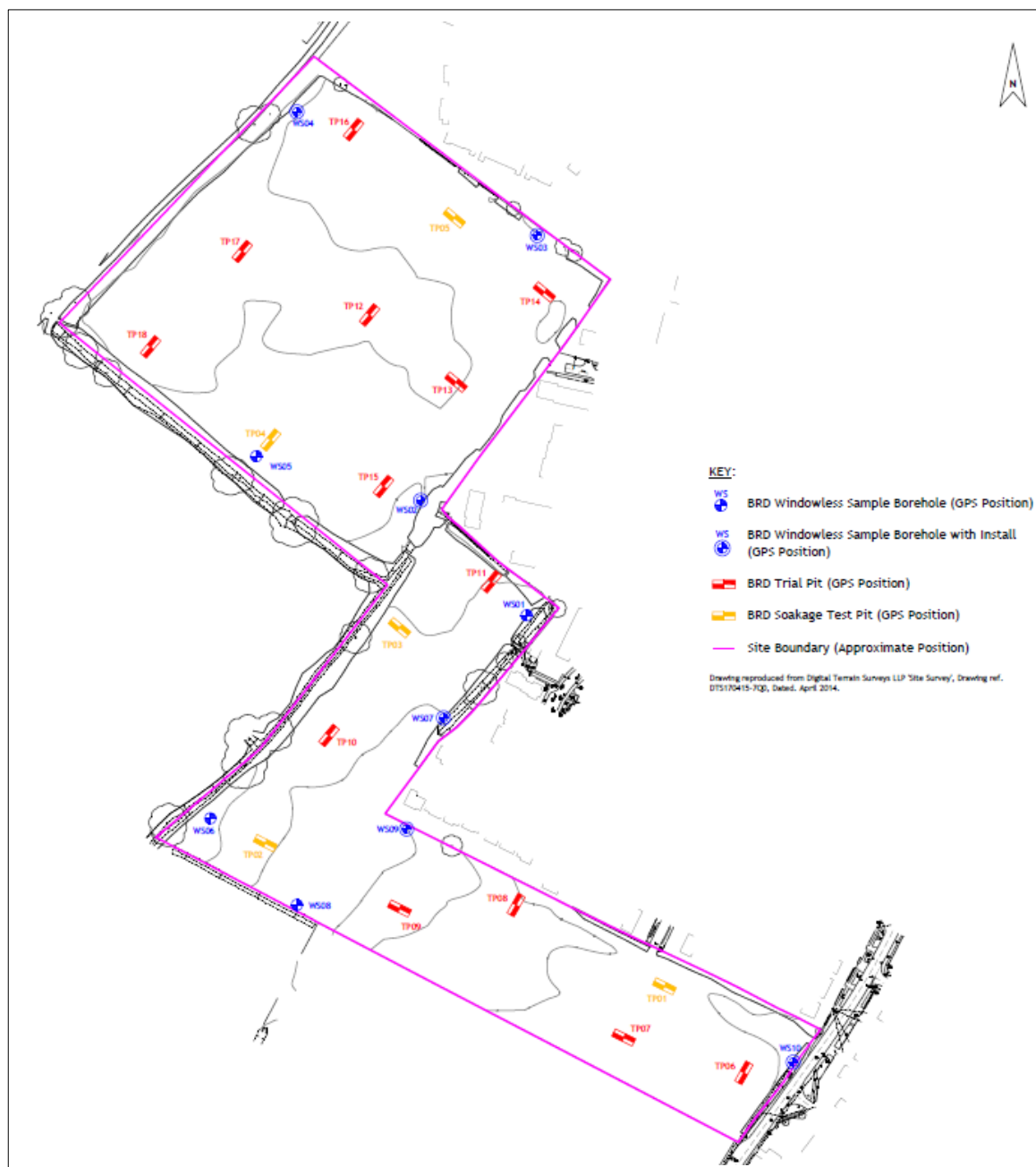


Figure 1: Location of Groundwater Monitoring Test Pits

3.0 PROPOSED SURFACE WATER DRAINAGE STRATEGY

3.1 The submitted drainage strategy was based on the October groundwater monitoring results, and it has since been revised in accordance with the results of the additional groundwater monitoring.



3.2 The ADC Drainage Engineer notes that infiltration is achievable at the rates encountered at the site, and that shallow infiltration structures can be used with maximum groundwater levels of 1m bgl. However, groundwater levels were found to be higher between January and March than in October, and the maximum recorded groundwater levels were higher than 1m bgl within the trial pits located in close proximity to the proposed basins. As such, infiltration will not be practicable at the site and surface water runoff will be discharged to the watercourses on site.

3.3 The groundwater levels at Attenuation Basin 1 (borehole WS02) were found to be particularly shallow between January and March. In order to mitigate the impact of groundwater in this location, the depth of Attenuation Basin 1 has been reduced and will be lined. To account for the loss of attenuation volume within the basin, it is proposed to implement a lined cellular storage tank within the public open space to the west of the development parcel. The tank will discharge flows to Basin 1 at a restricted rate.

3.4 Attenuations Basins 2 and 3 have also been reduced in depth and will be lined to mitigate any impacts of shallow groundwater. All basins will have infill material on top of the proposed liner to counter any buoyancy effects.

3.5 The basins and cellular storage tank shown on the proposed drainage strategy have been sized to attenuate flows for all rainfall events up to the 1 in 100 year event plus 40% to account for climate change, whilst restricting total discharge rates to less than the Q_{BAR} value for the site.

3.6 The proposed surface water drainage strategy is outlined in Drawing 14-111/103A in **Appendix C**, along with the associated Micro Drainage calculations.

4.0 SUMMARY AND CONCLUSIONS

4.1 Odyssey has been commissioned by Gleeson Strategic Land to complete an FRA addendum, incorporating an updated surface water drainage strategy informed by further groundwater monitoring, for the proposed development in Yapton.

4.2 Groundwater levels were found to be higher between January and March than those recorded in October. As such, infiltration will not be practicable at the site.

4.3 The depths of Attenuation Basins 1, 2 and 3 have been reduced in order to mitigate the impact of groundwater. It is proposed to incorporate a lined cellular storage tank to account for the loss of attenuation capacity within Attenuation Basin 1.



4.4 This addendum addresses the additional comments raised by ADC relating to surface water drainage at the site, and demonstrates that the proposed development can be drained in a sustainable manner.

APPENDIX A

Arun District Council Additional Comments on Surface Water Drainage

Sandra Edwards

From: Amanda Scholes on behalf of Planning.Responses
Sent: 24 May 2018 09:27
To: Planning Scanning
Subject: FW: Y/91/17/OUT

From: David Easton
Sent: 23 May 2018 10:58
To: Planning.Responses
Subject: FW: Y/91/17/OUT

Could the attached please be uploaded as an additional consultation response from Engineers (Drainage).

Many thanks,
David

From: Laura Gibbons
Sent: 17 May 2018 13:55
To: David Easton
Cc: Paul Cann
Subject: RE: Y/91/17/OUT

Hi David,

Additional comments relating to surface water drainage:

- We note that groundwater monitoring was conducted in late October. For a development of this size, we require monitoring to be completed from October through to March, i.e. the current monitoring results are insufficient.
- Discharge rates of $\times 10^{-6}$ are not poor enough to justify ruling out infiltration in the surface water drainage strategy. Infiltration is achievable at such a rate. Therefore, the overall strategy would need to be revised.
- A plan showing the locations of percolation test pits would also be required.
- We do not require 1m clearance between the base of any proposed infiltration structure and maximum recorded groundwater levels. Therefore, a maximum recorded groundwater level of 1.69m bgl is not too high to rule out the use of infiltration. Shallow infiltration structures can be used with maximum groundwater levels of 1m bgl.

Regards,

Laura Gibbons, MEng, GMICE
Engineer (Drainage & Coastal)

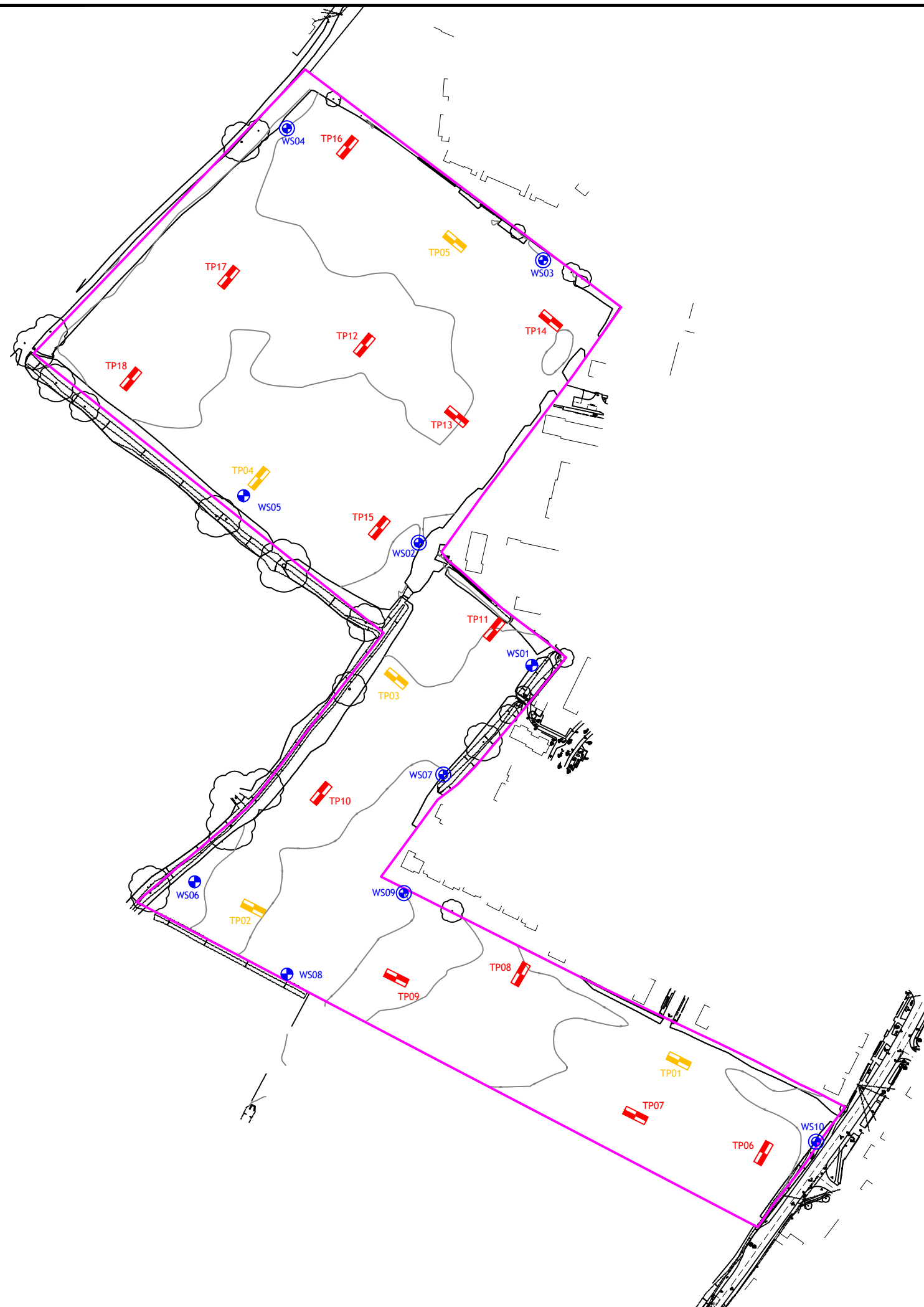
[Laura Gibbons](#) | Engineer (Drainage & Coastal), Engineering Services, [Arun District Council](#) | Location: First Floor, Arun Civic Centre, Maltravers Road, Littlehampton, BN17 5LF
Internal: 37818 | External: +44 (0) 1903 737818 | Fax: +44 (0) 1903 716018 | E-mail: laura.gibbons@arun.gov.uk
Arun is Working in Partnership with Chichester District Council
Visit Arun's web site at <http://www.arun.gov.uk/> and www.chichester.gov.uk



Save the environment - think before you print.

APPENDIX B

Groundwater Monitoring Records



KEY:

- BRD Windowless Sample Borehole (GPS Position)
- BRD Windowless Sample Borehole with Install (GPS Position)
- BRD Trial Pit (GPS Position)
- BRD Soakage Test Pit (GPS Position)
- Site Boundary (Approximate Position)

Drawing reproduced from Digital Terrain Surveys LLP 'Site Survey', Drawing ref. DTS170415-7Q0, Dated. April 2014.

Revision	Date	Description	Drawn	Approved
Drawing title				
EXPLORATORY POINT PLAN				
Project title				
LAND AT BILSHAM ROAD, YAPTON				
Client				
GLEESON DEVELOPMENTS				
Scale	Original drg. size/colour		Date	
1:2500	A3 / C		03/11/2017	
Drawn	Checked		Approved	
HKA	AP		BD	
Drawing Number				Rev
BRD2693-OD1				A



BRD Environmental Ltd

01295 272244
info@brduk.com
www.brduk.com



Groundwater Monitoring Record

Project: Land at Bilsham Road, Yapton
Client: Gleeson Developments
Project No: BRD2693

Borehole name	Date	Monitored by (initials)	Borehole depth (m)	Qty free product detected (mm)	Groundwater level below ground surface (m)	Groundwater level below top of standpipe (m)	Amount purged (l)	Post purge groundwater level below top of standpipe (m)	Comments
WS04	25/10/2017	AN	3.98	0.00	3.58	3.44	n/a	n/a	No odour noted on retrieval of interface meter.
WS03	25/10/2017	AN	4.01	0.00	2.94	2.79	n/a	n/a	No odour noted on retrieval of interface meter.
WS02	25/10/2017	AN	3.96	0.00	2.42	2.30	n/a	n/a	No odour noted on retrieval of interface meter.
WS07	25/10/2017	AN	3.89	0.00	1.69	1.54	n/a	n/a	No odour noted on retrieval of interface meter.
WS08	25/10/2017	AN	3.89	0.00	1.83	1.71	n/a	n/a	No odour noted on retrieval of interface meter. Borehole located immediately next to a dry ditch.
WS09	25/10/2017	AN	3.99	0.00	1.80	1.66	n/a	n/a	No odour noted on retrieval of interface meter.
WS10	25/10/2017	AN	3.00	0.00	2.03	1.88	n/a	n/a	No odour noted on retrieval of interface meter.



Groundwater Monitoring Record

Project: Land at Bilsham Road, Yapton
Client: Gleeson Developments
Project No: BRD2693

Borehole name	Date	Monitored by (initials)	Borehole depth (m)	Qty free product detected (mm)	Groundwater level below ground surface (m)	Groundwater level below top of standpipe (m)	Amount purged (l)	Post purge groundwater level below top of standpipe (m)	Comments
WS04	31/10/2017	AN	3.97	0.00	3.63	3.51	n/a	n/a	No odour noted on retrieval of interface meter.
WS03	31/10/2017	AN	4.00	0.00	3.03	2.87	n/a	n/a	No odour noted on retrieval of interface meter.
WS02	31/10/2017	AN	3.95	0.00	2.52	2.40	n/a	n/a	No odour noted on retrieval of interface meter.
WS07	31/10/2017	AN	3.85	0.00	1.70	1.56	n/a	n/a	No odour noted on retrieval of interface meter.
WS08	31/10/2017	AN	3.89	0.00	1.88	1.75	n/a	n/a	No odour noted on retrieval of interface meter. Borehole located immediately next to a dry ditch.
WS09	31/10/2017	AN	3.99	0.00	1.84	1.71	n/a	n/a	No odour noted on retrieval of interface meter.
WS10	31/10/2017	AN	3.97	0.00	2.08	1.93	n/a	n/a	No odour noted on retrieval of interface meter.



Groundwater Monitoring Record

Project: Land at Bilsham Road, Yapton
Client: Gleeson Developments
Project No: BRD2693

Borehole name	Date	Monitored by (initials)	Borehole depth (m)	Qty free product detected (mm)	Groundwater level below ground surface (m)	Groundwater level below top of standpipe (m)	Amount purged (l)	Post purge groundwater level below top of standpipe (m)	Comments
WS02	24/01/2018	NK	3.95	n/a	0.44	0.33	n/a	n/a	No odour noted on retrieval of interface meter.
WS03	24/01/2018	NK	4.01	n/a	1.09	0.93	n/a	n/a	No odour noted on retrieval of interface meter.
WS04	24/01/2018	NK	3.97	n/a	1.29	1.17	n/a	n/a	No odour noted on retrieval of interface meter.
WS07	24/01/2018	NK	3.83	n/a	0.87	0.74	n/a	n/a	No odour noted on retrieval of interface meter.
WS08	24/01/2018	NK	3.83	n/a	0.89	0.77	n/a	n/a	No odour noted on retrieval of interface meter.
WS09	24/01/2018	NK	3.98	n/a	1.14	1.00	n/a	n/a	No odour noted on retrieval of interface meter.
WS10	24/01/2018	NK	n/a	n/a	n/a	n/a	n/a	n/a	Under a large puddle so was unable to get measurements.



Groundwater Monitoring Record

Project: Land at Bilsham Road, Yapton
Client: Gleeson Developments
Project No: BRD2693

Borehole name	Date	Monitored by (initials)	Borehole depth (m)	Qty free product detected (mm)	Groundwater level below ground surface (m)	Groundwater level below top of standpipe (m)	Amount purged (l)	Post purge groundwater level below top of standpipe (m)	Comments
WS02	22/02/2018	NK	3.96	n/a	0.48	0.37	n/a	n/a	No odour noted on retrieval of interface meter.
WS03	22/02/2018	NK	4.02	n/a	1.54	1.38	n/a	n/a	No odour noted on retrieval of interface meter.
WS04	22/02/2018	NK	3.97	n/a	1.82	1.69	n/a	n/a	No odour noted on retrieval of interface meter.
WS07	22/02/2018	NK	3.83	n/a	1.00	0.87	n/a	n/a	No odour noted on retrieval of interface meter.
WS08	22/02/2018	NK	3.83	n/a	1.26	1.14	n/a	n/a	No odour noted on retrieval of interface meter.
WS09	22/02/2018	NK	3.98	n/a	1.23	1.09	n/a	n/a	No odour noted on retrieval of interface meter.
WS10	22/02/2018	NK	3.87	n/a	1.57	1.41	n/a	n/a	No odour noted on retrieval of interface meter.



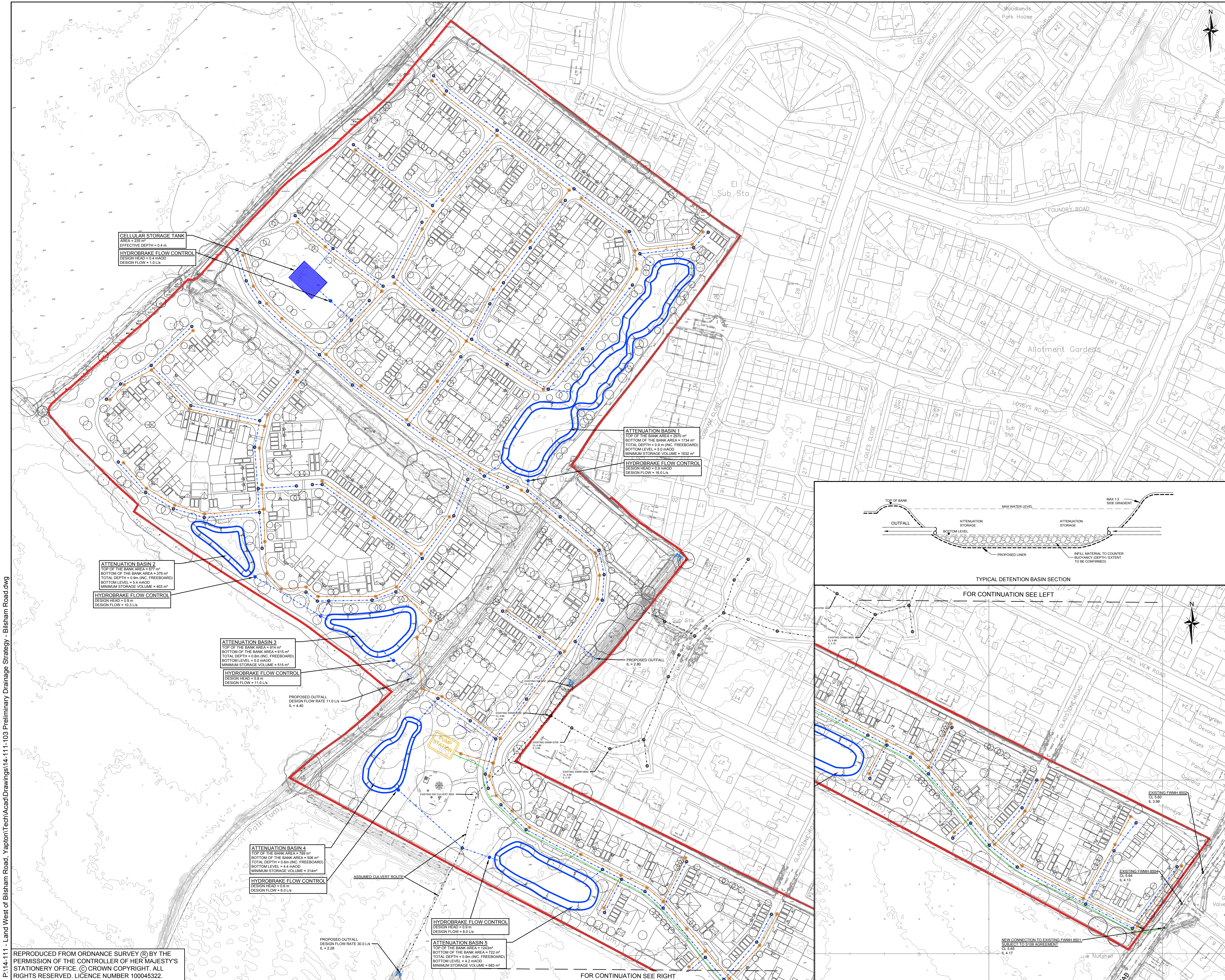
Groundwater Monitoring Record

Project: Land at Bilsham Road, Yapton
Client: Gleeson Developments
Project No: BRD2693

Borehole name	Date	Monitored by (initials)	Borehole depth (m)	Qty free product detected (mm)	Groundwater level below ground surface (m)	Groundwater level below top of standpipe (m)	Amount purged (l)	Post purge groundwater level below top of standpipe (m)	Comments
WS02	22/03/2018	NK	3.95	n/a	0.56	0.45	n/a	n/a	
WS03	22/03/2018	NK	4.02	n/a	1.54	1.38	n/a	n/a	
WS04	22/03/2018	NK	3.97	n/a	1.84	1.71	n/a	n/a	
WS07	22/03/2018	NK	3.82	n/a	1.12	0.98	n/a	n/a	
WS08	22/03/2018	NK	3.83	n/a	1.27	1.15	n/a	n/a	
WS09	22/03/2018	NK	3.98	n/a	1.24	1.11	n/a	n/a	
WS10	22/03/2018	NK	3.87	n/a	1.57	1.41	n/a	n/a	

APPENDIX C

Proposed Drainage Strategy and Micro Drainage Calculations



NOTES

- DO NOT SCALE FROM THIS DRAWING. WORK FROM FIGURED DIMENSIONS ONLY.
- ALL DIMENSIONS SHOWN IN METRES UNLESS NOTED OTHERWISE.
- PROPOSED SITE LAYOUT HAS BEEN PROVIDED BY RICHARD URBAN DESIGN (DRAWING NUMBER: 1244G.05 - DATED 13.10.2017).
- SURROUNDING TOPOGRAPHICAL IS EXTRACTED FROM THE TOPOGRAPHICAL SURVEY THAT WAS UNDERTAKEN BY DIGITAL TERRAIN SURVEYS LLP FROM APRIL 2014 - DRAWING REF. DTS240417-Q0B.
- ALL PROPOSED DRAINAGE LEVELS ARE INDICATIVE ONLY.

LEGEND

- SITE BOUNDARY
- PROPOSED SURFACE WATER SEWER & MANHOLE
- EXISTING SURFACE WATER SEWER
- PROPOSED DIFFUSER UNIT
- PROPOSED HYDROBRAKE FLOW CONTROL CHAMBER
- PROPOSED SURFACE WATER CATCHPIT WITH 300mm MIN SUMP
- PROPOSED BASIN WITH 1:3 SIDE GRADIENT
- PROPOSED FOUL SEWER & MANHOLE
- EXISTING FOUL SEWER & MANHOLE
- PROPOSED FOUL WATER RISING MAIN
- LIDAR DTM 250m CONTOUR
- PROPOSED LINED CELLULAR STORAGE TANK

TYPICAL DETENTION BASIN SECTION

FOR CONTINUATION SEE LEFT

A	PONDS UPDATED	LP	NA	GG	15.06.18
Rev	Amendments	Dm	Chk	App	Date

ODYSSEY

Tuscany House
White Hart Lane
Basingstoke
Hampshire RG21 4AF

Telephone: 01256 331144
Fax: 01256 331134
E: info@odysseyconsult.co.uk
W: www.odysseyconsult.co.uk

Job Title

**BILSHAM ROAD
YAPTON, WEST SUSSEX**

Drawing Title

**PRELIMINARY
DRAINAGE STRATEGY**

Client

GLEESON

Scale	Date	Designed
1:1000 @A1	NOV 17	
Drawn	Checked	Approved
CF	JH	GG
Job No	Drawing No	Rev
14-111	14-111/103	A

Odyssey Markides LLP		Page 1
Tuscany House White Hart Lane Basingstoke RG21 4AF	Land at Bilsham Road Yapton Greenfield Runoff	
Date 22/11/2017 16:09 File	Designed by NA Checked by GG	
Micro Drainage Source Control 2017.1.2		
<u>ICP SUDS Mean Annual Flood</u> Input Return Period (years) 100 Soil 0.400 Area (ha) 11.700 Urban 0.000 SAAR (mm) 747 Region Number Region 7 Results l/s QBAR Rural 43.0 QBAR Urban 43.0 Q100 years 137.0 Q1 year 36.5 Q30 years 97.3 Q100 years 137.0		
©1982-2017 XP Solutions		

Odyssey Markides							Page 1																																																																																																																																																																																																																																										
Tuscany House White Hart Lane Basingstoke RG21 4AF			Land west of Bilsham Road Yapton Tank 1																																																																																																																																																																																																																																														
Date 13/06/2018 12:42 File Tank & Basin 1 Cascade....			Designed by NA Checked by GG																																																																																																																																																																																																																																														
XP Solutions			Source Control 2018.1																																																																																																																																																																																																																																														
<u>Cascade Summary of Results for Tank 1.srcx</u> Upstream Outflow To Overflow To Structures (None) Basin 1.srcx (None) Half Drain Time : 737 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 E Outflow (l/s)</th><th>Max Volume (m³)</th><th>Status</th></tr><tr><td>15 min Summer</td><td>5.756</td><td>0.156</td><td>0.0</td><td>1.0</td><td>1.0</td><td>34.8</td><td>O K</td></tr><tr><td>30 min Summer</td><td>5.787</td><td>0.187</td><td>0.0</td><td>1.0</td><td>1.0</td><td>41.8</td><td>O K</td></tr><tr><td>60 min Summer</td><td>5.823</td><td>0.223</td><td>0.0</td><td>1.0</td><td>1.0</td><td>49.9</td><td>O K</td></tr><tr><td>120 min Summer</td><td>5.863</td><td>0.263</td><td>0.0</td><td>1.0</td><td>1.0</td><td>58.7</td><td>O K</td></tr><tr><td>180 min Summer</td><td>5.887</td><td>0.287</td><td>0.0</td><td>1.0</td><td>1.0</td><td>64.0</td><td>O K</td></tr><tr><td>240 min Summer</td><td>5.902</td><td>0.302</td><td>0.0</td><td>1.0</td><td>1.0</td><td>67.5</td><td>O K</td></tr><tr><td>360 min Summer</td><td>5.921</td><td>0.321</td><td>0.0</td><td>1.0</td><td>1.0</td><td>71.7</td><td>O K</td></tr><tr><td>480 min Summer</td><td>5.930</td><td>0.330</td><td>0.0</td><td>1.0</td><td>1.0</td><td>73.7</td><td>O K</td></tr><tr><td>600 min Summer</td><td>5.934</td><td>0.334</td><td>0.0</td><td>1.0</td><td>1.0</td><td>74.5</td><td>O K</td></tr><tr><td>720 min Summer</td><td>5.935</td><td>0.335</td><td>0.0</td><td>1.0</td><td>1.0</td><td>74.9</td><td>O K</td></tr><tr><td>960 min Summer</td><td>5.919</td><td>0.319</td><td>0.0</td><td>1.0</td><td>1.0</td><td>71.2</td><td>O K</td></tr><tr><td>1440 min Summer</td><td>5.889</td><td>0.289</td><td>0.0</td><td>1.0</td><td>1.0</td><td>64.6</td><td>O K</td></tr><tr><td>2160 min Summer</td><td>5.846</td><td>0.246</td><td>0.0</td><td>1.0</td><td>1.0</td><td>55.0</td><td>O K</td></tr><tr><td>2880 min Summer</td><td>5.810</td><td>0.210</td><td>0.0</td><td>1.0</td><td>1.0</td><td>47.0</td><td>O K</td></tr><tr><td>4320 min Summer</td><td>5.772</td><td>0.172</td><td>0.0</td><td>1.0</td><td>1.0</td><td>38.4</td><td>O K</td></tr><tr><td>5760 min Summer</td><td>5.739</td><td>0.139</td><td>0.0</td><td>1.0</td><td>1.0</td><td>31.0</td><td>O K</td></tr><tr><td>7200 min Summer</td><td>5.713</td><td>0.113</td><td>0.0</td><td>1.0</td><td>1.0</td><td>25.3</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 min Summer</td><td>163.213</td><td>0.0</td><td>33.7</td><td>19</td></tr><tr><td>30 min Summer</td><td>99.086</td><td>0.0</td><td>41.0</td><td>34</td></tr><tr><td>60 min Summer</td><td>60.155</td><td>0.0</td><td>51.4</td><td>64</td></tr><tr><td>120 min Summer</td><td>36.520</td><td>0.0</td><td>62.5</td><td>122</td></tr><tr><td>180 min Summer</td><td>27.273</td><td>0.0</td><td>70.1</td><td>182</td></tr><tr><td>240 min Summer</td><td>22.171</td><td>0.0</td><td>76.0</td><td>242</td></tr><tr><td>360 min Summer</td><td>16.558</td><td>0.0</td><td>85.1</td><td>362</td></tr><tr><td>480 min Summer</td><td>13.460</td><td>0.0</td><td>92.2</td><td>480</td></tr><tr><td>600 min Summer</td><td>11.462</td><td>0.0</td><td>98.1</td><td>584</td></tr><tr><td>720 min Summer</td><td>10.052</td><td>0.0</td><td>103.1</td><td>630</td></tr><tr><td>960 min Summer</td><td>7.824</td><td>0.0</td><td>106.9</td><td>758</td></tr><tr><td>1440 min Summer</td><td>5.496</td><td>0.0</td><td>112.0</td><td>1010</td></tr><tr><td>2160 min Summer</td><td>3.861</td><td>0.0</td><td>120.3</td><td>1404</td></tr><tr><td>2880 min Summer</td><td>3.005</td><td>0.0</td><td>124.8</td><td>1788</td></tr><tr><td>4320 min Summer</td><td>2.244</td><td>0.0</td><td>139.5</td><td>2552</td></tr><tr><td>5760 min Summer</td><td>1.824</td><td>0.0</td><td>152.1</td><td>3280</td></tr><tr><td>7200 min Summer</td><td>1.554</td><td>0.0</td><td>161.8</td><td>3960</td></tr></table>								Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max E Outflow (l/s)	Max Volume (m³)	Status	15 min Summer	5.756	0.156	0.0	1.0	1.0	34.8	O K	30 min Summer	5.787	0.187	0.0	1.0	1.0	41.8	O K	60 min Summer	5.823	0.223	0.0	1.0	1.0	49.9	O K	120 min Summer	5.863	0.263	0.0	1.0	1.0	58.7	O K	180 min Summer	5.887	0.287	0.0	1.0	1.0	64.0	O K	240 min Summer	5.902	0.302	0.0	1.0	1.0	67.5	O K	360 min Summer	5.921	0.321	0.0	1.0	1.0	71.7	O K	480 min Summer	5.930	0.330	0.0	1.0	1.0	73.7	O K	600 min Summer	5.934	0.334	0.0	1.0	1.0	74.5	O K	720 min Summer	5.935	0.335	0.0	1.0	1.0	74.9	O K	960 min Summer	5.919	0.319	0.0	1.0	1.0	71.2	O K	1440 min Summer	5.889	0.289	0.0	1.0	1.0	64.6	O K	2160 min Summer	5.846	0.246	0.0	1.0	1.0	55.0	O K	2880 min Summer	5.810	0.210	0.0	1.0	1.0	47.0	O K	4320 min Summer	5.772	0.172	0.0	1.0	1.0	38.4	O K	5760 min Summer	5.739	0.139	0.0	1.0	1.0	31.0	O K	7200 min Summer	5.713	0.113	0.0	1.0	1.0	25.3	O K	Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	15 min Summer	163.213	0.0	33.7	19	30 min Summer	99.086	0.0	41.0	34	60 min Summer	60.155	0.0	51.4	64	120 min Summer	36.520	0.0	62.5	122	180 min Summer	27.273	0.0	70.1	182	240 min Summer	22.171	0.0	76.0	242	360 min Summer	16.558	0.0	85.1	362	480 min Summer	13.460	0.0	92.2	480	600 min Summer	11.462	0.0	98.1	584	720 min Summer	10.052	0.0	103.1	630	960 min Summer	7.824	0.0	106.9	758	1440 min Summer	5.496	0.0	112.0	1010	2160 min Summer	3.861	0.0	120.3	1404	2880 min Summer	3.005	0.0	124.8	1788	4320 min Summer	2.244	0.0	139.5	2552	5760 min Summer	1.824	0.0	152.1	3280	7200 min Summer	1.554	0.0	161.8	3960
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Odyssey Markides							Page 2
Tuscany House White Hart Lane Basingstoke RG21 4AF			Land west of Bilsham Road Yapton Tank 1				
Date 13/06/2018 12:42 File Tank & Basin 1 Cascade....			Designed by NA Checked by GG				
XP Solutions			Source Control 2018.1				
<u>Cascade Summary of Results for Tank 1.srcx</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
8640 min Summer	5.694	0.094	0.0	1.0	1.0	21.0	O K
10080 min Summer	5.681	0.081	0.0	1.0	1.0	18.0	O K
15 min Winter	5.775	0.175	0.0	1.0	1.0	39.1	O K
30 min Winter	5.811	0.211	0.0	1.0	1.0	47.0	O K
60 min Winter	5.851	0.251	0.0	1.0	1.0	56.1	O K
120 min Winter	5.897	0.297	0.0	1.0	1.0	66.3	O K
180 min Winter	5.924	0.324	0.0	1.0	1.0	72.3	O K
240 min Winter	5.942	0.342	0.0	1.0	1.0	76.4	O K
360 min Winter	5.965	0.365	0.0	1.0	1.0	81.4	O K
480 min Winter	5.977	0.377	0.0	1.0	1.0	84.1	O K
600 min Winter	5.983	0.383	0.0	1.0	1.0	85.5	O K
720 min Winter	5.986	0.386	0.0	1.0	1.0	86.1	O K
960 min Winter	5.964	0.364	0.0	1.0	1.0	81.2	O K
1440 min Winter	5.928	0.328	0.0	1.0	1.0	73.1	O K
2160 min Winter	5.872	0.272	0.0	1.0	1.0	60.7	O K
2880 min Winter	5.816	0.216	0.0	1.0	1.0	48.3	O K
4320 min Winter	5.754	0.154	0.0	1.0	1.0	34.4	O K
5760 min Winter	5.708	0.108	0.0	1.0	1.0	24.0	O K
7200 min Winter	5.680	0.080	0.0	1.0	1.0	17.7	O K
8640 min Winter	5.668	0.068	0.0	0.9	0.9	15.2	O K
10080 min Winter	5.661	0.061	0.0	0.8	0.8	13.6	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)			
8640 min Summer	1.362	0.0	170.1	4592			
10080 min Summer	1.219	0.0	177.2	5248			
15 min Winter	163.213	0.0	37.8	19			
30 min Winter	99.086	0.0	46.0	33			
60 min Winter	60.155	0.0	57.7	62			
120 min Winter	36.520	0.0	70.1	120			
180 min Winter	27.273	0.0	78.5	180			
240 min Winter	22.171	0.0	85.1	238			
360 min Winter	16.558	0.0	95.3	352			
480 min Winter	13.460	0.0	103.2	466			
600 min Winter	11.462	0.0	109.8	576			
720 min Winter	10.052	0.0	115.4	684			
960 min Winter	7.824	0.0	119.5	792			
1440 min Winter	5.496	0.0	124.9	1082			
2160 min Winter	3.861	0.0	134.8	1540			
2880 min Winter	3.005	0.0	139.8	1932			
4320 min Winter	2.244	0.0	156.3	2680			
5760 min Winter	1.824	0.0	170.3	3344			
7200 min Winter	1.554	0.0	181.2	3960			
8640 min Winter	1.362	0.0	190.6	4584			
10080 min Winter	1.219	0.0	198.7	5248			
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Tuscany House White Hart Lane Basingstoke RG21 4AF	Land west of Bilsham Road Yapton Tank 1																																									
Date 13/06/2018 12:42 File Tank & Basin 1 Cascade....	Designed by NA Checked by GG																																									
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<u>Cascade Rainfall Details for Tank 1.srcx</u> <table> <tr> <td>Rainfall Model</td> <td>FEH</td> </tr> <tr> <td>Return Period (years)</td> <td>100</td> </tr> <tr> <td>FEH Rainfall Version</td> <td>1999</td> </tr> <tr> <td>Site Location</td> <td>GB 497050 103400 SU 97050 03400</td> </tr> <tr> <td>C (1km)</td> <td>-0.025</td> </tr> <tr> <td>D1 (1km)</td> <td>0.395</td> </tr> <tr> <td>D2 (1km)</td> <td>0.244</td> </tr> <tr> <td>D3 (1km)</td> <td>0.395</td> </tr> <tr> <td>E (1km)</td> <td>0.309</td> </tr> <tr> <td>F (1km)</td> <td>2.339</td> </tr> <tr> <td>Summer Storms</td> <td>Yes</td> </tr> <tr> <td>Winter Storms</td> <td>Yes</td> </tr> <tr> <td>Cv (Summer)</td> <td>0.750</td> </tr> <tr> <td>Cv (Winter)</td> <td>0.840</td> </tr> <tr> <td>Shortest Storm (mins)</td> <td>15</td> </tr> <tr> <td>Longest Storm (mins)</td> <td>10080</td> </tr> <tr> <td>Climate Change %</td> <td>+40</td> </tr> </table> <u>Time Area Diagram</u> Total Area (ha) 0.116 <table> <tr> <td>Time (mins)</td> <td>Area</td> </tr> <tr> <td>From: To:</td> <td>(ha)</td> </tr> <tr> <td>0</td> <td>4 0.116</td> </tr> </table>			Rainfall Model	FEH	Return Period (years)	100	FEH Rainfall Version	1999	Site Location	GB 497050 103400 SU 97050 03400	C (1km)	-0.025	D1 (1km)	0.395	D2 (1km)	0.244	D3 (1km)	0.395	E (1km)	0.309	F (1km)	2.339	Summer Storms	Yes	Winter Storms	Yes	Cv (Summer)	0.750	Cv (Winter)	0.840	Shortest Storm (mins)	15	Longest Storm (mins)	10080	Climate Change %	+40	Time (mins)	Area	From: To:	(ha)	0	4 0.116
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Date 13/06/2018 12:42 File Tank & Basin 1 Cascade....	Designed by NA Checked by GG	
XP Solutions Source Control 2018.1		

Cascade Model Details for Tank 1.srcx

Storage is Online Cover Level (m) 6.600

Cellular Storage Structure

Invert Level (m) 5.600 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	235.0	235.0	0.401	0.0	259.6
0.400	235.0	259.5			

Hydro-Brake® Optimum Outflow Control

Unit Reference MD-SHE-0055-1000-0400-1000
Design Head (m) 0.400
Design Flow (l/s) 1.0
Flush-Flo™ Calculated
Objective Minimise upstream storage
Application Surface
Sump Available Yes
Diameter (mm) 55
Invert Level (m) 5.600
Minimum Outlet Pipe Diameter (mm) 75
Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.400	1.0
Flush-Flo™	0.117	1.0
Kick-Flo®	0.273	0.8
Mean Flow over Head Range	-	0.9

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	1.0	1.200	1.6	3.000	2.5	7.000	3.8
0.200	1.0	1.400	1.8	3.500	2.7	7.500	3.9
0.300	0.9	1.600	1.9	4.000	2.8	8.000	4.0
0.400	1.0	1.800	2.0	4.500	3.0	8.500	4.1
0.500	1.1	2.000	2.1	5.000	3.2	9.000	4.3
0.600	1.2	2.200	2.2	5.500	3.3	9.500	4.4
0.800	1.4	2.400	2.2	6.000	3.5		
1.000	1.5	2.600	2.3	6.500	3.6		

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Cascade Summary of Results for Basin 1.srcx Upstream Structures Outflow To (None) Overflow To (None) <table><thead><tr><th>Storm Event</th><th>Max Level (m)</th><th>Max Depth (m)</th><th>Max Control (l/s)</th><th>Max Volume (m³)</th><th>Status</th></tr></thead><tbody><tr><td>15 min Summer</td><td>5.320</td><td>0.320</td><td>16.0</td><td>617.3</td><td>O K</td></tr><tr><td>30 min Summer</td><td>5.377</td><td>0.377</td><td>16.0</td><td>743.2</td><td>O K</td></tr><tr><td>60 min Summer</td><td>5.442</td><td>0.442</td><td>16.0</td><td>888.9</td><td>O K</td></tr><tr><td>120 min Summer</td><td>5.511</td><td>0.511</td><td>16.0</td><td>1051.2</td><td>O K</td></tr><tr><td>180 min Summer</td><td>5.552</td><td>0.552</td><td>16.0</td><td>1150.0</td><td>O K</td></tr><tr><td>240 min Summer</td><td>5.580</td><td>0.580</td><td>16.0</td><td>1219.1</td><td>O K</td></tr><tr><td>360 min Summer</td><td>5.616</td><td>0.616</td><td>16.0</td><td>1310.5</td><td>Flood Risk</td></tr><tr><td>480 min Summer</td><td>5.638</td><td>0.638</td><td>16.0</td><td>1367.0</td><td>Flood Risk</td></tr><tr><td>600 min Summer</td><td>5.652</td><td>0.652</td><td>16.0</td><td>1402.8</td><td>Flood Risk</td></tr><tr><td>720 min Summer</td><td>5.660</td><td>0.660</td><td>16.0</td><td>1423.4</td><td>Flood Risk</td></tr><tr><td>960 min Summer</td><td>5.634</td><td>0.634</td><td>16.0</td><td>1355.7</td><td>Flood Risk</td></tr><tr><td>1440 min Summer</td><td>5.590</td><td>0.590</td><td>16.0</td><td>1245.0</td><td>O K</td></tr><tr><td>2160 min Summer</td><td>5.533</td><td>0.533</td><td>16.0</td><td>1104.2</td><td>O K</td></tr><tr><td>2880 min Summer</td><td>5.481</td><td>0.481</td><td>16.0</td><td>978.7</td><td>O K</td></tr><tr><td>4320 min Summer</td><td>5.424</td><td>0.424</td><td>16.0</td><td>848.2</td><td>O K</td></tr><tr><td>5760 min Summer</td><td>5.370</td><td>0.370</td><td>16.0</td><td>725.9</td><td>O K</td></tr><tr><td>7200 min Summer</td><td>5.321</td><td>0.321</td><td>16.0</td><td>619.9</td><td>O K</td></tr><tr><td>8640 min Summer</td><td>5.280</td><td>0.280</td><td>16.0</td><td>533.1</td><td>O K</td></tr></tbody></table> <table><thead><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></thead><tbody><tr><td>15 min Summer</td><td>163.213</td><td>0.0</td><td>600.5</td><td>19</td></tr><tr><td>30 min Summer</td><td>99.086</td><td>0.0</td><td>733.2</td><td>34</td></tr><tr><td>60 min Summer</td><td>60.155</td><td>0.0</td><td>945.2</td><td>64</td></tr><tr><td>120 min Summer</td><td>36.520</td><td>0.0</td><td>1150.5</td><td>122</td></tr><tr><td>180 min Summer</td><td>27.273</td><td>0.0</td><td>1289.7</td><td>182</td></tr><tr><td>240 min Summer</td><td>22.171</td><td>0.0</td><td>1397.9</td><td>242</td></tr><tr><td>360 min Summer</td><td>16.558</td><td>0.0</td><td>1564.5</td><td>362</td></tr><tr><td>480 min Summer</td><td>13.460</td><td>0.0</td><td>1692.8</td><td>482</td></tr><tr><td>600 min Summer</td><td>11.462</td><td>0.0</td><td>1797.5</td><td>600</td></tr><tr><td>720 min Summer</td><td>10.052</td><td>0.0</td><td>1885.9</td><td>720</td></tr><tr><td>960 min Summer</td><td>7.824</td><td>0.0</td><td>1948.4</td><td>828</td></tr><tr><td>1440 min Summer</td><td>5.496</td><td>0.0</td><td>2027.5</td><td>1040</td></tr><tr><td>2160 min Summer</td><td>3.861</td><td>0.0</td><td>2234.6</td><td>1428</td></tr><tr><td>2880 min Summer</td><td>3.005</td><td>0.0</td><td>2317.3</td><td>1820</td></tr><tr><td>4320 min Summer</td><td>2.244</td><td>0.0</td><td>2585.2</td><td>2596</td></tr><tr><td>5760 min Summer</td><td>1.824</td><td>0.0</td><td>2832.8</td><td>3352</td></tr><tr><td>7200 min Summer</td><td>1.554</td><td>0.0</td><td>3013.1</td><td>4104</td></tr><tr><td>8640 min Summer</td><td>1.362</td><td>0.0</td><td>3166.0</td><td>4760</td></tr></tbody></table>						Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status	15 min Summer	5.320	0.320	16.0	617.3	O K	30 min Summer	5.377	0.377	16.0	743.2	O K	60 min Summer	5.442	0.442	16.0	888.9	O K	120 min Summer	5.511	0.511	16.0	1051.2	O K	180 min Summer	5.552	0.552	16.0	1150.0	O K	240 min Summer	5.580	0.580	16.0	1219.1	O K	360 min Summer	5.616	0.616	16.0	1310.5	Flood Risk	480 min Summer	5.638	0.638	16.0	1367.0	Flood Risk	600 min Summer	5.652	0.652	16.0	1402.8	Flood Risk	720 min Summer	5.660	0.660	16.0	1423.4	Flood Risk	960 min Summer	5.634	0.634	16.0	1355.7	Flood Risk	1440 min Summer	5.590	0.590	16.0	1245.0	O K	2160 min Summer	5.533	0.533	16.0	1104.2	O K	2880 min Summer	5.481	0.481	16.0	978.7	O K	4320 min Summer	5.424	0.424	16.0	848.2	O K	5760 min Summer	5.370	0.370	16.0	725.9	O K	7200 min Summer	5.321	0.321	16.0	619.9	O K	8640 min Summer	5.280	0.280	16.0	533.1	O K	Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	15 min Summer	163.213	0.0	600.5	19	30 min Summer	99.086	0.0	733.2	34	60 min Summer	60.155	0.0	945.2	64	120 min Summer	36.520	0.0	1150.5	122	180 min Summer	27.273	0.0	1289.7	182	240 min Summer	22.171	0.0	1397.9	242	360 min Summer	16.558	0.0	1564.5	362	480 min Summer	13.460	0.0	1692.8	482	600 min Summer	11.462	0.0	1797.5	600	720 min Summer	10.052	0.0	1885.9	720	960 min Summer	7.824	0.0	1948.4	828	1440 min Summer	5.496	0.0	2027.5	1040	2160 min Summer	3.861	0.0	2234.6	1428	2880 min Summer	3.005	0.0	2317.3	1820	4320 min Summer	2.244	0.0	2585.2	2596	5760 min Summer	1.824	0.0	2832.8	3352	7200 min Summer	1.554	0.0	3013.1	4104	8640 min Summer	1.362	0.0	3166.0	4760
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Odyssey Markides					Page 2
Tuscany House White Hart Lane Basingstoke RG21 4AF			Land west of Bilsham Road Yapton Basin 1		
Date 13/06/2018 12:42 File Tank & Basin 1 Cascade....			Designed by NA Checked by GG		
XP Solutions			Source Control 2018.1		
<u>Cascade Summary of Results for Basin 1.srcx</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
10080 min Summer	5.246	0.246	15.9	463.4	O K
15 min Winter	5.354	0.354	16.0	692.2	O K
30 min Winter	5.418	0.418	16.0	834.2	O K
60 min Winter	5.489	0.489	16.0	998.7	O K
120 min Winter	5.566	0.566	16.0	1184.1	O K
180 min Winter	5.612	0.612	16.0	1299.1	Flood Risk
240 min Winter	5.644	0.644	16.0	1381.4	Flood Risk
360 min Winter	5.686	0.686	16.0	1492.6	Flood Risk
480 min Winter	5.712	0.712	16.0	1561.0	Flood Risk
600 min Winter	5.728	0.728	16.0	1604.7	Flood Risk
720 min Winter	5.738	0.738	16.0	1632.1	Flood Risk
960 min Winter	5.715	0.715	16.0	1569.0	Flood Risk
1440 min Winter	5.662	0.662	16.0	1429.3	Flood Risk
2160 min Winter	5.584	0.584	16.0	1228.6	O K
2880 min Winter	5.508	0.508	16.0	1044.6	O K
4320 min Winter	5.416	0.416	16.0	829.5	O K
5760 min Winter	5.330	0.330	16.0	639.6	O K
7200 min Winter	5.260	0.260	15.9	491.9	O K
8640 min Winter	5.209	0.209	15.6	388.8	O K
10080 min Winter	5.183	0.183	14.9	337.2	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
10080 min Summer	1.219	0.0	3293.6	5448	
15 min Winter	163.213	0.0	675.4	19	
30 min Winter	99.086	0.0	822.2	33	
60 min Winter	60.155	0.0	1060.5	62	
120 min Winter	36.520	0.0	1289.9	122	
180 min Winter	27.273	0.0	1445.0	180	
240 min Winter	22.171	0.0	1565.3	238	
360 min Winter	16.558	0.0	1749.5	354	
480 min Winter	13.460	0.0	1890.4	470	
600 min Winter	11.462	0.0	2004.2	584	
720 min Winter	10.052	0.0	2098.2	694	
960 min Winter	7.824	0.0	2158.9	912	
1440 min Winter	5.496	0.0	2212.6	1142	
2160 min Winter	3.861	0.0	2503.6	1560	
2880 min Winter	3.005	0.0	2596.5	1988	
4320 min Winter	2.244	0.0	2899.2	2808	
5760 min Winter	1.824	0.0	3174.2	3520	
7200 min Winter	1.554	0.0	3376.5	4184	
8640 min Winter	1.362	0.0	3548.8	4760	
10080 min Winter	1.219	0.0	3694.3	5344	
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Odyssey Markides		Page 3
Tuscany House White Hart Lane Basingstoke RG21 4AF	Land west of Bilsham Road Yapton Basin 1	
Date 13/06/2018 12:42 File Tank & Basin 1 Cascade....	Designed by NA Checked by GG	
XP Solutions Source Control 2018.1		

Cascade Rainfall Details for Basin 1.srcx

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 497050 103400 SU 97050 03400
C (1km)	-0.025
D1 (1km)	0.395
D2 (1km)	0.244
D3 (1km)	0.395
E (1km)	0.309
F (1km)	2.339
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 2.049

Time (mins)	Area
From:	To: (ha)
0	4 2.049

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Odyssey Markides		Page 4
Tuscany House White Hart Lane Basingstoke RG21 4AF	Land west of Bilsham Road Yapton Basin 1	
Date 13/06/2018 12:42 File Tank & Basin 1 Cascade....	Designed by NA Checked by GG	
XP Solutions Source Control 2018.1		

Cascade Model Details for Basin 1.srcx

Storage is Online Cover Level (m) 5.900

Tank or Pond Structure

Invert Level (m) 5.000

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	1734.9	0.900	2970.8	0.901	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference MD-SHE-0181-1600-0900-1600

Design Head (m) 0.900

Design Flow (l/s) 16.0

Flush-Flo™ Calculated

Objective Minimise upstream storage

Application Surface

Sump Available Yes

Diameter (mm) 181

Invert Level (m) 5.000

Minimum Outlet Pipe Diameter (mm) 225

Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.900	16.0
Flush-Flo™	0.307	16.0
Kick-Flo®	0.651	13.7
Mean Flow over Head Range	-	13.4

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	6.4	1.200	18.3	3.000	28.4	7.000	42.8
0.200	15.5	1.400	19.7	3.500	30.6	7.500	44.2
0.300	16.0	1.600	21.0	4.000	32.6	8.000	45.7
0.400	15.8	1.800	22.3	4.500	34.6	8.500	47.0
0.500	15.4	2.000	23.4	5.000	36.4	9.000	48.3
0.600	14.6	2.200	24.5	5.500	38.1	9.500	49.4
0.800	15.1	2.400	25.5	6.000	39.7		
1.000	16.8	2.600	26.5	6.500	41.3		

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Odyssey Markides				Page 1																																																																																																																																																																																																																		
Tuscany House White Hart Lane Basingstoke RG21 4AF		Land west of Bilsham Road Yapton Basin 2																																																																																																																																																																																																																				
Date 13/06/2018 12:44 File Basin 2 & 3 Cascade.casx		Designed by NA Checked by GG																																																																																																																																																																																																																				
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<u>Cascade Summary of Results for Basin 2.srcx</u> Upstream Outflow To Overflow To Structures (None) Basin 3.srcx (None) <table><tr><th>Storm Event</th><th>Max Level (m)</th><th>Max Depth (m)</th><th>Max Control (l/s)</th><th>Max Volume (m³)</th><th>Status</th></tr><tr><td>15 min Summer</td><td>5.847</td><td>0.447</td><td>10.3</td><td>199.8</td><td>O K</td></tr><tr><td>30 min Summer</td><td>5.920</td><td>0.520</td><td>10.3</td><td>238.1</td><td>O K</td></tr><tr><td>60 min Summer</td><td>5.994</td><td>0.594</td><td>10.3</td><td>279.4</td><td>O K</td></tr><tr><td>120 min Summer</td><td>6.064</td><td>0.664</td><td>10.3</td><td>319.8</td><td>Flood Risk</td></tr><tr><td>180 min Summer</td><td>6.094</td><td>0.694</td><td>10.3</td><td>337.8</td><td>Flood Risk</td></tr><tr><td>240 min Summer</td><td>6.108</td><td>0.708</td><td>10.3</td><td>345.9</td><td>Flood Risk</td></tr><tr><td>360 min Summer</td><td>6.113</td><td>0.713</td><td>10.3</td><td>349.2</td><td>Flood Risk</td></tr><tr><td>480 min Summer</td><td>6.111</td><td>0.711</td><td>10.3</td><td>348.1</td><td>Flood Risk</td></tr><tr><td>600 min Summer</td><td>6.106</td><td>0.706</td><td>10.3</td><td>344.8</td><td>Flood Risk</td></tr><tr><td>720 min Summer</td><td>6.098</td><td>0.698</td><td>10.3</td><td>340.0</td><td>Flood Risk</td></tr><tr><td>960 min Summer</td><td>6.044</td><td>0.644</td><td>10.3</td><td>307.9</td><td>Flood Risk</td></tr><tr><td>1440 min Summer</td><td>5.935</td><td>0.535</td><td>10.3</td><td>246.3</td><td>O K</td></tr><tr><td>2160 min Summer</td><td>5.801</td><td>0.401</td><td>10.3</td><td>176.3</td><td>O K</td></tr><tr><td>2880 min Summer</td><td>5.698</td><td>0.298</td><td>10.3</td><td>126.1</td><td>O K</td></tr><tr><td>4320 min Summer</td><td>5.600</td><td>0.200</td><td>10.1</td><td>81.6</td><td>O K</td></tr><tr><td>5760 min Summer</td><td>5.556</td><td>0.156</td><td>9.5</td><td>62.7</td><td>O K</td></tr><tr><td>7200 min Summer</td><td>5.537</td><td>0.137</td><td>8.3</td><td>54.9</td><td>O K</td></tr><tr><td>8640 min Summer</td><td>5.525</td><td>0.125</td><td>7.4</td><td>49.6</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 min Summer</td><td>163.213</td><td>0.0</td><td>204.3</td><td>18</td></tr><tr><td>30 min Summer</td><td>99.086</td><td>0.0</td><td>248.5</td><td>33</td></tr><tr><td>60 min Summer</td><td>60.155</td><td>0.0</td><td>304.0</td><td>62</td></tr><tr><td>120 min Summer</td><td>36.520</td><td>0.0</td><td>369.4</td><td>122</td></tr><tr><td>180 min Summer</td><td>27.273</td><td>0.0</td><td>413.9</td><td>182</td></tr><tr><td>240 min Summer</td><td>22.171</td><td>0.0</td><td>448.7</td><td>240</td></tr><tr><td>360 min Summer</td><td>16.558</td><td>0.0</td><td>502.7</td><td>312</td></tr><tr><td>480 min Summer</td><td>13.460</td><td>0.0</td><td>545.0</td><td>376</td></tr><tr><td>600 min Summer</td><td>11.462</td><td>0.0</td><td>580.1</td><td>440</td></tr><tr><td>720 min Summer</td><td>10.052</td><td>0.0</td><td>610.5</td><td>508</td></tr><tr><td>960 min Summer</td><td>7.824</td><td>0.0</td><td>633.5</td><td>646</td></tr><tr><td>1440 min Summer</td><td>5.496</td><td>0.0</td><td>667.4</td><td>898</td></tr><tr><td>2160 min Summer</td><td>3.861</td><td>0.0</td><td>704.8</td><td>1272</td></tr><tr><td>2880 min Summer</td><td>3.005</td><td>0.0</td><td>731.3</td><td>1612</td></tr><tr><td>4320 min Summer</td><td>2.244</td><td>0.0</td><td>818.4</td><td>2292</td></tr><tr><td>5760 min Summer</td><td>1.824</td><td>0.0</td><td>888.7</td><td>2944</td></tr><tr><td>7200 min Summer</td><td>1.554</td><td>0.0</td><td>945.9</td><td>3672</td></tr><tr><td>8640 min Summer</td><td>1.362</td><td>0.0</td><td>995.1</td><td>4408</td></tr></table>						Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status	15 min Summer	5.847	0.447	10.3	199.8	O K	30 min Summer	5.920	0.520	10.3	238.1	O K	60 min Summer	5.994	0.594	10.3	279.4	O K	120 min Summer	6.064	0.664	10.3	319.8	Flood Risk	180 min Summer	6.094	0.694	10.3	337.8	Flood Risk	240 min Summer	6.108	0.708	10.3	345.9	Flood Risk	360 min Summer	6.113	0.713	10.3	349.2	Flood Risk	480 min Summer	6.111	0.711	10.3	348.1	Flood Risk	600 min Summer	6.106	0.706	10.3	344.8	Flood Risk	720 min Summer	6.098	0.698	10.3	340.0	Flood Risk	960 min Summer	6.044	0.644	10.3	307.9	Flood Risk	1440 min Summer	5.935	0.535	10.3	246.3	O K	2160 min Summer	5.801	0.401	10.3	176.3	O K	2880 min Summer	5.698	0.298	10.3	126.1	O K	4320 min Summer	5.600	0.200	10.1	81.6	O K	5760 min Summer	5.556	0.156	9.5	62.7	O K	7200 min Summer	5.537	0.137	8.3	54.9	O K	8640 min Summer	5.525	0.125	7.4	49.6	O K	Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	15 min Summer	163.213	0.0	204.3	18	30 min Summer	99.086	0.0	248.5	33	60 min Summer	60.155	0.0	304.0	62	120 min Summer	36.520	0.0	369.4	122	180 min 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Odyssey Markides				Page 2	
Tuscany House White Hart Lane Basingstoke RG21 4AF		Land west of Bilsham Road Yapton Basin 2			
Date 13/06/2018 12:44 File Basin 2 & 3 Cascade.casx		Designed by NA Checked by GG			
XP Solutions		Source Control 2018.1			
<u>Cascade Summary of Results for Basin 2.srcx</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
10080 min Summer	5.515	0.115	6.6	45.8	O K
15 min Winter	5.894	0.494	10.3	224.5	O K
30 min Winter	5.974	0.574	10.3	268.1	O K
60 min Winter	6.058	0.658	10.3	316.1	Flood Risk
120 min Winter	6.135	0.735	10.3	362.7	Flood Risk
180 min Winter	6.171	0.771	10.3	385.1	Flood Risk
240 min Winter	6.189	0.789	10.3	396.6	Flood Risk
360 min Winter	6.199	0.799	10.3	402.9	Flood Risk
480 min Winter	6.193	0.793	10.3	399.0	Flood Risk
600 min Winter	6.186	0.786	10.3	394.3	Flood Risk
720 min Winter	6.174	0.774	10.3	387.1	Flood Risk
960 min Winter	6.105	0.705	10.3	344.5	Flood Risk
1440 min Winter	5.953	0.553	10.3	256.5	O K
2160 min Winter	5.755	0.355	10.3	153.3	O K
2880 min Winter	5.620	0.220	10.2	90.4	O K
4320 min Winter	5.545	0.145	8.8	58.0	O K
5760 min Winter	5.522	0.122	7.2	48.6	O K
7200 min Winter	5.510	0.110	6.2	43.3	O K
8640 min Winter	5.501	0.101	5.4	39.6	O K
10080 min Winter	5.494	0.094	4.8	36.9	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
10080 min Summer	1.219	0.0	1038.2	5136	
15 min Winter	163.213	0.0	229.0	18	
30 min Winter	99.086	0.0	278.5	33	
60 min Winter	60.155	0.0	340.7	62	
120 min Winter	36.520	0.0	413.8	120	
180 min Winter	27.273	0.0	463.7	178	
240 min Winter	22.171	0.0	502.7	234	
360 min Winter	16.558	0.0	563.2	342	
480 min Winter	13.460	0.0	610.5	396	
600 min Winter	11.462	0.0	649.9	468	
720 min Winter	10.052	0.0	683.9	546	
960 min Winter	7.824	0.0	709.7	702	
1440 min Winter	5.496	0.0	747.6	980	
2160 min Winter	3.861	0.0	789.5	1336	
2880 min Winter	3.005	0.0	819.2	1640	
4320 min Winter	2.244	0.0	916.9	2248	
5760 min Winter	1.824	0.0	995.4	2944	
7200 min Winter	1.554	0.0	1059.5	3672	
8640 min Winter	1.362	0.0	1114.7	4408	
10080 min Winter	1.219	0.0	1163.1	5144	
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Odyssey Markides		Page 3
Tuscany House White Hart Lane Basingstoke RG21 4AF	Land west of Bilsham Road Yapton Basin 2	
Date 13/06/2018 12:44 File Basin 2 & 3 Cascade.casx	Designed by NA Checked by GG	
XP Solutions Source Control 2018.1		

Cascade Rainfall Details for Basin 2.srcx

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 497050 103400 SU 97050 03400
C (1km)	-0.025
D1 (1km)	0.395
D2 (1km)	0.244
D3 (1km)	0.395
E (1km)	0.309
F (1km)	2.339
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.677

Time (mins)	Area
From:	To: (ha)
0	4 0.677

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Odyssey Markides		Page 4
Tuscany House White Hart Lane Basingstoke RG21 4AF	Land west of Bilsham Road Yapton Basin 2	
Date 13/06/2018 12:44 File Basin 2 & 3 Cascade.casx	Designed by NA Checked by GG	
XP Solutions Source Control 2018.1		

Cascade Model Details for Basin 2.srcx

Storage is Online Cover Level (m) 6.300

Tank or Pond Structure

Invert Level (m) 5.400

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	379.7	0.900	677.6	0.901	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference MD-SHE-0149-1030-0900-1030

Design Head (m) 0.900

Design Flow (l/s) 10.3

Flush-Flo™ Calculated

Objective Minimise upstream storage

Application Surface

Sump Available Yes

Diameter (mm) 149

Invert Level (m) 5.400

Minimum Outlet Pipe Diameter (mm) 225

Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.900	10.3
Flush-Flo™	0.281	10.3
Kick-Flo®	0.624	8.7
Mean Flow over Head Range	-	8.8

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	5.4	1.200	11.8	3.000	18.2	7.000	27.4
0.200	10.1	1.400	12.7	3.500	19.6	7.500	28.3
0.300	10.3	1.600	13.5	4.000	20.9	8.000	29.2
0.400	10.1	1.800	14.3	4.500	22.1	8.500	30.1
0.500	9.8	2.000	15.0	5.000	23.3	9.000	30.9
0.600	9.0	2.200	15.7	5.500	24.4	9.500	31.6
0.800	9.7	2.400	16.4	6.000	25.4		
1.000	10.8	2.600	17.0	6.500	26.4		

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Odyssey Markides					Page 1																																																																																																																																																																																																																		
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Cascade Summary of Results for Basin 3.srcx Upstream Structures Outflow To Overflow To Basin 2.srcx (None) (None) <table><thead><tr><th>Storm Event</th><th>Max Level (m)</th><th>Max Depth (m)</th><th>Max Control (l/s)</th><th>Max Volume (m³)</th><th>Status</th></tr></thead><tbody><tr><td>15 min Summer</td><td>5.231</td><td>0.231</td><td>10.9</td><td>151.0</td><td>O K</td></tr><tr><td>30 min Summer</td><td>5.277</td><td>0.277</td><td>11.0</td><td>183.4</td><td>O K</td></tr><tr><td>60 min Summer</td><td>5.331</td><td>0.331</td><td>11.0</td><td>222.6</td><td>O K</td></tr><tr><td>120 min Summer</td><td>5.394</td><td>0.394</td><td>11.0</td><td>269.3</td><td>O K</td></tr><tr><td>180 min Summer</td><td>5.436</td><td>0.436</td><td>11.0</td><td>301.3</td><td>O K</td></tr><tr><td>240 min Summer</td><td>5.468</td><td>0.468</td><td>11.0</td><td>326.2</td><td>O K</td></tr><tr><td>360 min Summer</td><td>5.515</td><td>0.515</td><td>11.0</td><td>363.7</td><td>Flood Risk</td></tr><tr><td>480 min Summer</td><td>5.550</td><td>0.550</td><td>11.0</td><td>391.8</td><td>Flood Risk</td></tr><tr><td>600 min Summer</td><td>5.587</td><td>0.587</td><td>11.0</td><td>422.0</td><td>Flood Risk</td></tr><tr><td>720 min Summer</td><td>5.604</td><td>0.604</td><td>11.0</td><td>436.7</td><td>Flood Risk</td></tr><tr><td>960 min Summer</td><td>5.612</td><td>0.612</td><td>11.0</td><td>442.7</td><td>Flood Risk</td></tr><tr><td>1440 min Summer</td><td>5.634</td><td>0.634</td><td>11.0</td><td>461.8</td><td>Flood Risk</td></tr><tr><td>2160 min Summer</td><td>5.574</td><td>0.574</td><td>11.0</td><td>411.2</td><td>Flood Risk</td></tr><tr><td>2880 min Summer</td><td>5.512</td><td>0.512</td><td>11.0</td><td>361.0</td><td>Flood Risk</td></tr><tr><td>4320 min Summer</td><td>5.428</td><td>0.428</td><td>11.0</td><td>295.5</td><td>O K</td></tr><tr><td>5760 min Summer</td><td>5.331</td><td>0.331</td><td>11.0</td><td>222.9</td><td>O K</td></tr><tr><td>7200 min Summer</td><td>5.255</td><td>0.255</td><td>11.0</td><td>168.3</td><td>O K</td></tr><tr><td>8640 min Summer</td><td>5.204</td><td>0.204</td><td>10.9</td><td>132.3</td><td>O K</td></tr></tbody></table> <table><thead><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></thead><tbody><tr><td>15 min Summer</td><td>163.213</td><td>0.0</td><td>344.4</td><td>19</td></tr><tr><td>30 min Summer</td><td>99.086</td><td>0.0</td><td>419.7</td><td>34</td></tr><tr><td>60 min Summer</td><td>60.155</td><td>0.0</td><td>520.7</td><td>64</td></tr><tr><td>120 min Summer</td><td>36.520</td><td>0.0</td><td>633.1</td><td>124</td></tr><tr><td>180 min Summer</td><td>27.273</td><td>0.0</td><td>709.7</td><td>184</td></tr><tr><td>240 min Summer</td><td>22.171</td><td>0.0</td><td>769.4</td><td>244</td></tr><tr><td>360 min Summer</td><td>16.558</td><td>0.0</td><td>862.1</td><td>364</td></tr><tr><td>480 min Summer</td><td>13.460</td><td>0.0</td><td>934.4</td><td>484</td></tr><tr><td>600 min Summer</td><td>11.462</td><td>0.0</td><td>994.3</td><td>1042</td></tr><tr><td>720 min Summer</td><td>10.052</td><td>0.0</td><td>1046.2</td><td>1126</td></tr><tr><td>960 min Summer</td><td>7.824</td><td>0.0</td><td>1085.0</td><td>1236</td></tr><tr><td>1440 min Summer</td><td>5.496</td><td>0.0</td><td>1141.2</td><td>1440</td></tr><tr><td>2160 min Summer</td><td>3.861</td><td>0.0</td><td>1213.5</td><td>1676</td></tr><tr><td>2880 min Summer</td><td>3.005</td><td>0.0</td><td>1258.7</td><td>1932</td></tr><tr><td>4320 min Summer</td><td>2.244</td><td>0.0</td><td>1406.5</td><td>2592</td></tr><tr><td>5760 min Summer</td><td>1.824</td><td>0.0</td><td>1531.8</td><td>3272</td></tr><tr><td>7200 min Summer</td><td>1.554</td><td>0.0</td><td>1629.9</td><td>3936</td></tr><tr><td>8640 min Summer</td><td>1.362</td><td>0.0</td><td>1714.0</td><td>4584</td></tr></tbody></table>							Storm Event	Max Level (m)	Max Depth 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Summer	99.086	0.0	419.7	34	60 min Summer	60.155	0.0	520.7	64	120 min Summer	36.520	0.0	633.1	124	180 min Summer	27.273	0.0	709.7	184	240 min Summer	22.171	0.0	769.4	244	360 min Summer	16.558	0.0	862.1	364	480 min Summer	13.460	0.0	934.4	484	600 min Summer	11.462	0.0	994.3	1042	720 min Summer	10.052	0.0	1046.2	1126	960 min Summer	7.824	0.0	1085.0	1236	1440 min Summer	5.496	0.0	1141.2	1440	2160 min Summer	3.861	0.0	1213.5	1676	2880 min Summer	3.005	0.0	1258.7	1932	4320 min Summer	2.244	0.0	1406.5	2592	5760 min Summer	1.824	0.0	1531.8	3272	7200 min Summer	1.554	0.0	1629.9	3936	8640 min Summer	1.362	0.0	1714.0	4584
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Odyssey Markides					Page 2
Tuscany House White Hart Lane Basingstoke RG21 4AF			Land west of Bilsham Road Yapton Basin 3		
Date 13/06/2018 12:44 File Basin 2 & 3 Cascade.casx			Designed by NA Checked by GG		
XP Solutions			Source Control 2018.1		
<u>Cascade Summary of Results for Basin 3.srcx</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
10080 min Summer	5.171	0.171	10.6	110.2	O K
15 min Winter	5.256	0.256	11.0	168.9	O K
30 min Winter	5.307	0.307	11.0	205.0	O K
60 min Winter	5.366	0.366	11.0	248.4	O K
120 min Winter	5.437	0.437	11.0	301.9	O K
180 min Winter	5.484	0.484	11.0	338.7	O K
240 min Winter	5.520	0.520	11.0	367.7	Flood Risk
360 min Winter	5.585	0.585	11.0	420.5	Flood Risk
480 min Winter	5.618	0.618	11.0	448.2	Flood Risk
600 min Winter	5.648	0.648	11.0	473.1	Flood Risk
720 min Winter	5.669	0.669	11.0	491.5	Flood Risk
960 min Winter	5.667	0.667	11.0	490.0	Flood Risk
1440 min Winter	5.697	0.697	11.0	515.5	Flood Risk
2160 min Winter	5.653	0.653	11.0	477.4	Flood Risk
2880 min Winter	5.548	0.548	11.0	389.9	Flood Risk
4320 min Winter	5.360	0.360	11.0	243.9	O K
5760 min Winter	5.224	0.224	10.9	146.7	O K
7200 min Winter	5.163	0.163	10.4	104.5	O K
8640 min Winter	5.144	0.144	9.2	92.3	O K
10080 min Winter	5.132	0.132	8.3	84.0	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
10080 min Summer	1.219	0.0	1786.1	5240	
15 min Winter	163.213	0.0	386.7	19	
30 min Winter	99.086	0.0	470.8	34	
60 min Winter	60.155	0.0	583.7	64	
120 min Winter	36.520	0.0	709.6	122	
180 min Winter	27.273	0.0	795.3	182	
240 min Winter	22.171	0.0	862.1	242	
360 min Winter	16.558	0.0	965.6	940	
480 min Winter	13.460	0.0	1046.5	482	
600 min Winter	11.462	0.0	1113.7	598	
720 min Winter	10.052	0.0	1171.5	716	
960 min Winter	7.824	0.0	1214.7	944	
1440 min Winter	5.496	0.0	1276.9	1442	
2160 min Winter	3.861	0.0	1359.5	1724	
2880 min Winter	3.005	0.0	1410.3	1996	
4320 min Winter	2.244	0.0	1576.6	2676	
5760 min Winter	1.824	0.0	1715.9	3280	
7200 min Winter	1.554	0.0	1826.0	3800	
8640 min Winter	1.362	0.0	1920.4	4504	
10080 min Winter	1.219	0.0	2002.0	5224	
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Odyssey Markides		Page 3
Tuscany House White Hart Lane Basingstoke RG21 4AF	Land west of Bilsham Road Yapton Basin 3	
Date 13/06/2018 12:44 File Basin 2 & 3 Cascade.casx	Designed by NA Checked by GG	
XP Solutions Source Control 2018.1		

Cascade Rainfall Details for Basin 3.srcx

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 497050 103400 SU 97050 03400
C (1km)	-0.025
D1 (1km)	0.395
D2 (1km)	0.244
D3 (1km)	0.395
E (1km)	0.309
F (1km)	2.339
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.491

Time (mins)	Area
From:	To: (ha)
0	4 0.491

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Odyssey Markides		Page 4
Tuscany House White Hart Lane Basingstoke RG21 4AF	Land west of Bilsham Road Yapton Basin 3	
Date 13/06/2018 12:44 File Basin 2 & 3 Cascade.casx	Designed by NA Checked by GG	
XP Solutions Source Control 2018.1		

Cascade Model Details for Basin 3.srcx

Storage is Online Cover Level (m) 5.800

Tank or Pond Structure

Invert Level (m) 5.000

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	615.0	0.800	914.3	0.801	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference MD-SHE-0155-1100-0800-1100

Design Head (m) 0.800

Design Flow (l/s) 11.0

Flush-Flo™ Calculated

Objective Minimise upstream storage

Application Surface

Sump Available Yes

Diameter (mm) 155

Invert Level (m) 5.000

Minimum Outlet Pipe Diameter (mm) 225

Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.800	11.0
Flush-Flo™	0.267	11.0
Kick-Flo®	0.575	9.4
Mean Flow over Head Range	-	9.3

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	5.6	1.200	13.3	3.000	20.6	7.000	31.0
0.200	10.8	1.400	14.3	3.500	22.2	7.500	32.0
0.300	11.0	1.600	15.3	4.000	23.6	8.000	33.0
0.400	10.7	1.800	16.1	4.500	25.0	8.500	33.9
0.500	10.3	2.000	17.0	5.000	26.3	9.000	34.9
0.600	9.6	2.200	17.8	5.500	27.6	9.500	35.9
0.800	11.0	2.400	18.5	6.000	28.7		
1.000	12.2	2.600	19.2	6.500	29.9		

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Odyssey Markides				Page 1	
Tuscany House White Hart Lane Basingstoke RG21 4AF		Land west of Bilsham Road Yapton Basin 4			
Date 13/06/2018 12:44 File Basin 4.srcx		Designed by NA Checked by GG			
XP Solutions		Source Control 2018.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	4.654	0.254	6.0	142.5	O K
30 min Summer	4.698	0.298	6.0	170.6	O K
60 min Summer	4.746	0.346	6.0	201.7	Flood Risk
120 min Summer	4.794	0.394	6.0	233.7	Flood Risk
180 min Summer	4.819	0.419	6.0	251.0	Flood Risk
240 min Summer	4.834	0.434	6.0	261.5	Flood Risk
360 min Summer	4.847	0.447	6.0	271.2	Flood Risk
480 min Summer	4.851	0.451	6.0	273.7	Flood Risk
600 min Summer	4.852	0.452	6.0	274.4	Flood Risk
720 min Summer	4.851	0.451	6.0	273.6	Flood Risk
960 min Summer	4.822	0.422	6.0	253.1	Flood Risk
1440 min Summer	4.768	0.368	6.0	216.5	Flood Risk
2160 min Summer	4.700	0.300	6.0	171.4	O K
2880 min Summer	4.643	0.243	6.0	135.7	O K
4320 min Summer	4.582	0.182	6.0	99.3	O K
5760 min Summer	4.543	0.143	5.9	77.0	O K
7200 min Summer	4.525	0.125	5.5	66.4	O K
8640 min Summer	4.513	0.113	4.9	60.0	O K
10080 min Summer	4.505	0.105	4.5	55.3	O K
15 min Winter	4.682	0.282	6.0	160.0	O K
30 min Winter	4.731	0.331	6.0	191.8	Flood Risk
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	163.213	0.0	140.9	19	
30 min Summer	99.086	0.0	171.8	33	
60 min Summer	60.155	0.0	213.3	62	
120 min Summer	36.520	0.0	259.4	122	
180 min Summer	27.273	0.0	290.8	182	
240 min Summer	22.171	0.0	315.3	242	
360 min Summer	16.558	0.0	353.3	360	
480 min Summer	13.460	0.0	383.0	416	
600 min Summer	11.462	0.0	407.7	480	
720 min Summer	10.052	0.0	429.1	544	
960 min Summer	7.824	0.0	445.1	666	
1440 min Summer	5.496	0.0	468.6	924	
2160 min Summer	3.861	0.0	497.5	1300	
2880 min Summer	3.005	0.0	516.0	1672	
4320 min Summer	2.244	0.0	576.6	2376	
5760 min Summer	1.824	0.0	628.1	3048	
7200 min Summer	1.554	0.0	668.3	3744	
8640 min Summer	1.362	0.0	702.8	4416	
10080 min Summer	1.219	0.0	732.4	5144	
15 min Winter	163.213	0.0	158.3	18	
30 min Winter	99.086	0.0	192.8	33	
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Odyssey Markides				Page 2	
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XP Solutions		Source Control 2018.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	4.784	0.384	6.0	227.3	Flood Risk
120 min Winter	4.839	0.439	6.0	265.0	Flood Risk
180 min Winter	4.868	0.468	6.0	285.8	Flood Risk
240 min Winter	4.885	0.485	6.0	298.3	Flood Risk
360 min Winter	4.902	0.502	6.0	310.9	Flood Risk
480 min Winter	4.907	0.507	6.0	314.4	Flood Risk
600 min Winter	4.905	0.505	6.0	313.3	Flood Risk
720 min Winter	4.903	0.503	6.0	311.5	Flood Risk
960 min Winter	4.870	0.470	6.0	287.2	Flood Risk
1440 min Winter	4.796	0.396	6.0	235.3	Flood Risk
2160 min Winter	4.694	0.294	6.0	168.1	O K
2880 min Winter	4.612	0.212	6.0	117.4	O K
4320 min Winter	4.536	0.136	5.8	73.1	O K
5760 min Winter	4.514	0.114	5.0	60.3	O K
7200 min Winter	4.500	0.100	4.3	52.9	O K
8640 min Winter	4.492	0.092	3.8	48.2	O K
10080 min Winter	4.485	0.085	3.4	44.7	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	60.155	0.0	239.1	62	
120 min Winter	36.520	0.0	290.7	120	
180 min Winter	27.273	0.0	325.9	178	
240 min Winter	22.171	0.0	353.3	236	
360 min Winter	16.558	0.0	395.9	348	
480 min Winter	13.460	0.0	429.2	454	
600 min Winter	11.462	0.0	456.8	548	
720 min Winter	10.052	0.0	480.7	572	
960 min Winter	7.824	0.0	498.6	724	
1440 min Winter	5.496	0.0	524.9	1012	
2160 min Winter	3.861	0.0	557.4	1404	
2880 min Winter	3.005	0.0	578.2	1732	
4320 min Winter	2.244	0.0	646.4	2336	
5760 min Winter	1.824	0.0	703.6	3048	
7200 min Winter	1.554	0.0	748.7	3744	
8640 min Winter	1.362	0.0	787.4	4416	
10080 min Winter	1.219	0.0	820.9	5144	
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Odyssey Markides		Page 3
Tuscany House White Hart Lane Basingstoke RG21 4AF	Land west of Bilsham Road Yapton Basin 4	
Date 13/06/2018 12:44 File Basin 4.srcx	Designed by NA Checked by GG	
XP Solutions Source Control 2018.1		

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 497050 103400 SU 97050 03400
C (1km)	-0.025
D1 (1km)	0.395
D2 (1km)	0.244
D3 (1km)	0.395
E (1km)	0.309
F (1km)	2.339
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.479

Time (mins)	Area
From:	To: (ha)
0	4 0.479

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Odyssey Markides		Page 4
Tuscany House White Hart Lane Basingstoke RG21 4AF	Land west of Bilsham Road Yapton Basin 4	
Date 13/06/2018 12:44 File Basin 4.srcx	Designed by NA Checked by GG	
XP Solutions Source Control 2018.1		

Model Details

Storage is Online Cover Level (m) 5.000

Tank or Pond Structure

Invert Level (m) 4.400

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	506.7	0.600	789.5	0.601	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0121-6000-0600-6000
Design Head (m)	0.600
Design Flow (l/s)	6.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	121
Invert Level (m)	4.400
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.600	6.0
Flush-Flo™	0.202	6.0
Kick-Flo®	0.435	5.2
Mean Flow over Head Range	-	5.0

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	4.3	1.200	8.3	3.000	12.8	7.000	19.2
0.200	6.0	1.400	8.9	3.500	13.8	7.500	19.9
0.300	5.9	1.600	9.5	4.000	14.7	8.000	20.5
0.400	5.5	1.800	10.0	4.500	15.5	8.500	21.1
0.500	5.5	2.000	10.6	5.000	16.3	9.000	21.8
0.600	6.0	2.200	11.0	5.500	17.1	9.500	22.4
0.800	6.9	2.400	11.5	6.000	17.8		
1.000	7.6	2.600	12.0	6.500	18.5		

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Odyssey Markides					Page 1
Tuscany House White Hart Lane Basingstoke RG21 4AF		Land west of Bilsham Road Yapton Basin 5			
Date 13/06/2018 12:45 File Basin 5.srcx		Designed by NA Checked by GG			
XP Solutions		Source Control 2018.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	4.540	0.340	8.0	275.6	O K
30 min Summer	4.600	0.400	8.0	331.2	O K
60 min Summer	4.666	0.466	8.0	394.4	O K
120 min Summer	4.735	0.535	8.0	463.3	O K
180 min Summer	4.775	0.575	8.0	504.0	O K
240 min Summer	4.802	0.602	8.0	531.7	Flood Risk
360 min Summer	4.834	0.634	8.0	566.0	Flood Risk
480 min Summer	4.849	0.649	8.0	583.0	Flood Risk
600 min Summer	4.856	0.656	8.0	590.1	Flood Risk
720 min Summer	4.858	0.658	8.0	592.0	Flood Risk
960 min Summer	4.828	0.628	8.0	559.5	Flood Risk
1440 min Summer	4.770	0.570	8.0	498.6	O K
2160 min Summer	4.695	0.495	8.0	423.1	O K
2880 min Summer	4.630	0.430	8.0	359.5	O K
4320 min Summer	4.556	0.356	8.0	290.8	O K
5760 min Summer	4.492	0.292	8.0	232.8	O K
7200 min Summer	4.440	0.240	8.0	188.0	O K
8640 min Summer	4.400	0.200	7.9	154.7	O K
10080 min Summer	4.371	0.171	7.7	131.0	O K
15 min Winter	4.577	0.377	8.0	309.2	O K
30 min Winter	4.643	0.443	8.0	372.0	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	163.213	0.0	268.8	19	
30 min Summer	99.086	0.0	327.3	33	
60 min Summer	60.155	0.0	408.6	64	
120 min Summer	36.520	0.0	496.8	122	
180 min Summer	27.273	0.0	556.7	182	
240 min Summer	22.171	0.0	603.5	242	
360 min Summer	16.558	0.0	675.9	362	
480 min Summer	13.460	0.0	732.3	480	
600 min Summer	11.462	0.0	779.1	600	
720 min Summer	10.052	0.0	819.3	670	
960 min Summer	7.824	0.0	849.1	772	
1440 min Summer	5.496	0.0	892.0	998	
2160 min Summer	3.861	0.0	954.0	1384	
2880 min Summer	3.005	0.0	989.8	1784	
4320 min Summer	2.244	0.0	1106.1	2548	
5760 min Summer	1.824	0.0	1205.0	3240	
7200 min Summer	1.554	0.0	1282.2	3960	
8640 min Summer	1.362	0.0	1348.3	4592	
10080 min Summer	1.219	0.0	1405.0	5256	
15 min Winter	163.213	0.0	301.7	19	
30 min Winter	99.086	0.0	366.9	33	
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Odyssey Markides				Page 2	
Tuscany House White Hart Lane Basingstoke RG21 4AF		Land west of Bilsham Road Yapton Basin 5			
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XP Solutions		Source Control 2018.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	4.716	0.516	8.0	443.8	O K
120 min Winter	4.794	0.594	8.0	523.5	O K
180 min Winter	4.839	0.639	8.0	571.8	Flood Risk
240 min Winter	4.869	0.669	8.0	604.4	Flood Risk
360 min Winter	4.906	0.706	8.0	644.9	Flood Risk
480 min Winter	4.925	0.725	8.0	667.1	Flood Risk
600 min Winter	4.936	0.736	8.0	678.8	Flood Risk
720 min Winter	4.940	0.740	8.0	683.6	Flood Risk
960 min Winter	4.904	0.704	8.0	643.4	Flood Risk
1440 min Winter	4.840	0.640	8.0	572.4	Flood Risk
2160 min Winter	4.734	0.534	8.0	462.1	O K
2880 min Winter	4.638	0.438	8.0	367.1	O K
4320 min Winter	4.520	0.320	8.0	258.0	O K
5760 min Winter	4.427	0.227	7.9	177.7	O K
7200 min Winter	4.367	0.167	7.7	128.2	O K
8640 min Winter	4.341	0.141	7.2	106.6	O K
10080 min Winter	4.327	0.127	6.5	96.1	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	60.155	0.0	458.0	62	
120 min Winter	36.520	0.0	556.7	120	
180 min Winter	27.273	0.0	623.7	180	
240 min Winter	22.171	0.0	676.0	238	
360 min Winter	16.558	0.0	756.9	354	
480 min Winter	13.460	0.0	819.8	466	
600 min Winter	11.462	0.0	871.8	578	
720 min Winter	10.052	0.0	916.4	686	
960 min Winter	7.824	0.0	949.1	884	
1440 min Winter	5.496	0.0	993.9	1098	
2160 min Winter	3.861	0.0	1068.8	1516	
2880 min Winter	3.005	0.0	1108.9	1908	
4320 min Winter	2.244	0.0	1239.9	2680	
5760 min Winter	1.824	0.0	1349.9	3344	
7200 min Winter	1.554	0.0	1436.5	3960	
8640 min Winter	1.362	0.0	1510.7	4504	
10080 min Winter	1.219	0.0	1574.9	5240	
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Tuscany House White Hart Lane Basingstoke RG21 4AF	Land west of Bilsham Road Yapton Basin 5	
Date 13/06/2018 12:45 File Basin 5.srcx	Designed by NA Checked by GG	
XP Solutions Source Control 2018.1		

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 497050 103400 SU 97050 03400
C (1km)	-0.025
D1 (1km)	0.395
D2 (1km)	0.244
D3 (1km)	0.395
E (1km)	0.309
F (1km)	2.339
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.919

Time (mins)	Area
From:	To: (ha)
0	4 0.919

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Odyssey Markides		Page 4
Tuscany House White Hart Lane Basingstoke RG21 4AF	Land west of Bilsham Road Yapton Basin 5	
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XP Solutions Source Control 2018.1		

Model Details

Storage is Online Cover Level (m) 5.100

Tank or Pond Structure

Invert Level (m) 4.200

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	722.9	0.900	1243.7	0.901	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0133-8000-0900-8000
Design Head (m)	0.900
Design Flow (l/s)	8.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	133
Invert Level (m)	4.200
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.900	8.0
Flush-Flo™	0.276	8.0
Kick-Flo®	0.613	6.7
Mean Flow over Head Range	-	6.9

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	4.8	1.200	9.2	3.000	14.1	7.000	21.2
0.200	7.9	1.400	9.8	3.500	15.2	7.500	21.9
0.300	8.0	1.600	10.5	4.000	16.2	8.000	22.6
0.400	7.8	1.800	11.1	4.500	17.1	8.500	23.3
0.500	7.6	2.000	11.7	5.000	18.0	9.000	23.9
0.600	6.9	2.200	12.2	5.500	18.9	9.500	24.5
0.800	7.6	2.400	12.7	6.000	19.7		
1.000	8.4	2.600	13.2	6.500	20.4		

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