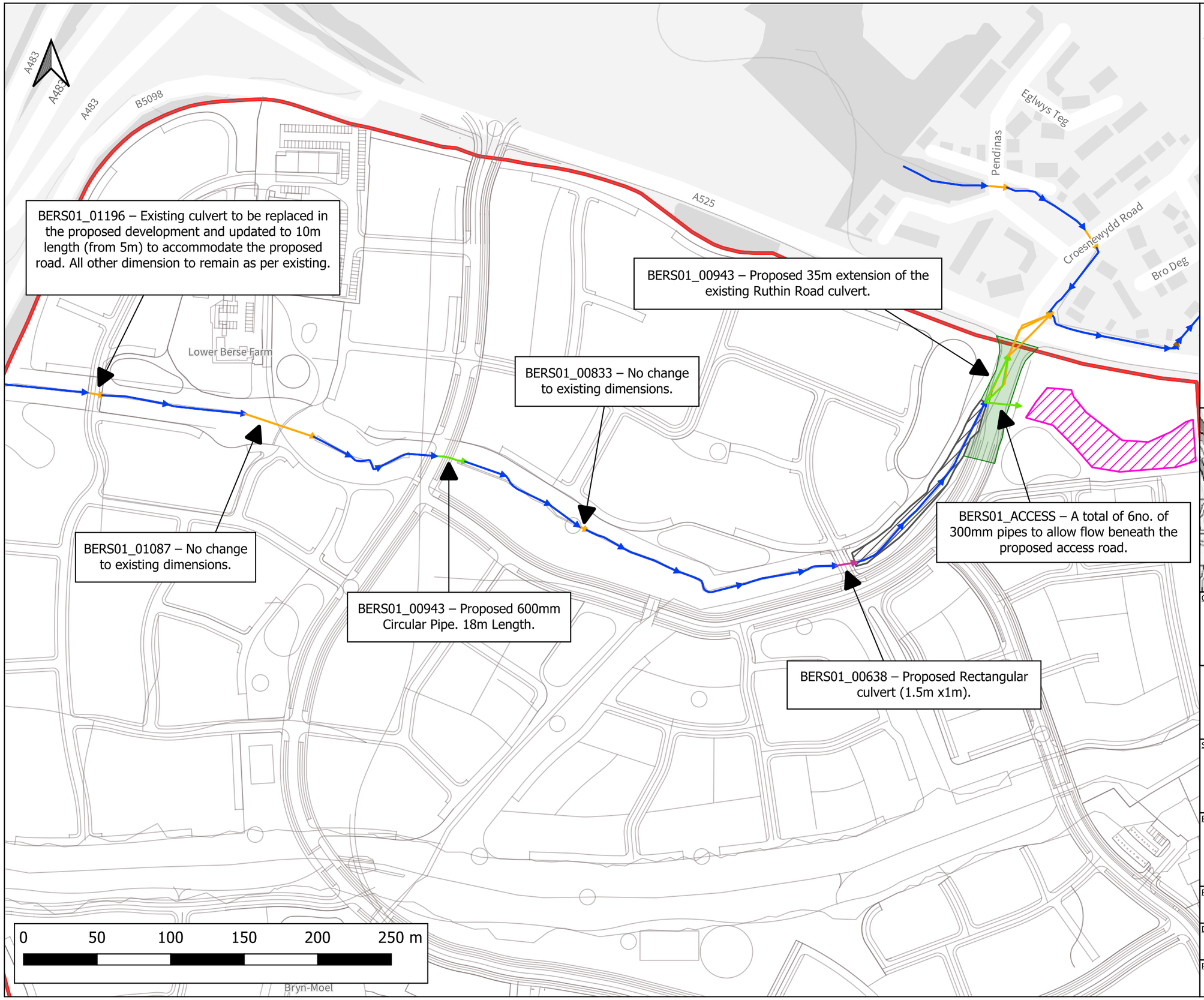
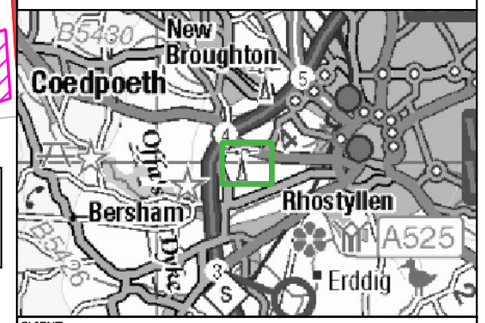
Appendix H Flood Mitigation Proposals Plan



Notes:
1) All dimensions are in metres and all levels in metres above Ordnance Datum unless stated otherwise

LEGEND

- Site Boundary
- Proposed Development
- Proposed Access Road
- Proposed Channel Widening
- Proposed Flood Storage Area
- Channel
- Bridge
- Proposed Circular Culvert
- Existing Circular Culvert
- Proposed Rectangular Culvert



CLIENT: REDROW

waterco
www.waterco.co.uk

SCHEME: Ruthin Road, Wrexham

PLOT TITLE: Proposed Layout Plan

PLOT STATUS:	DATE:
FINAL	01-11-2023

DRAWN:	CHECKED:	APPROVED:	PLOT SCALE AT A3:
IH	AR	LS	1:2500

PLOT NAME:	REVISION:
13840_Proposed_Layout_Plan	-

CONTAINS OS DATA © CROWN COPYRIGHT (2023)

Appendix I ReFH2 Greenfield Runoff Rates

DOCUMENT VERIFICATION RECORD	
Project:	13840 – Ruthin Road (Development Parcel A)
Client:	Redrow Homes Ltd
Report Title:	13840-FCA & Drainage Strategy-01
Date:	24/11/2022

DOCUMENT REVIEW & APPROVAL	
Author:	Paige Blundell BSc (Hons) PGCE
Checker:	Aled Williams BSc (Hons) MCIWEM C.WEM
Approver:	Mike Wellington BEng (Hons) MSc CEng CEnv FICE FCIWEM C.WEM IMaPS MAPM

ReFH2 RUNOFF RATES*	
Return Period (Years)	**As-rural Peak Flow (l/s)**
1	4.691655
2	5.455742
5	8.216777
10	10.52715
30	15.1625
50	17.82962
75	20.18681
100	21.98384
200	26.67986
1000	39.39378

*Runoff Rates printed from the ReFH Flood Modelling software package

DOCUMENT VERIFICATION RECORD	
Project:	13840 – Ruthin Road (Development Parcel B)
Client:	Redrow Homes Ltd
Report Title:	13840-FCA & Drainage Strategy-01
Date:	24/11/2022

DOCUMENT REVIEW & APPROVAL	
Author:	Paige Blundell BSc (Hons) PGCE
Checker:	Aled Williams BSc (Hons) MCIWEM C.WEM
Approver:	Mike Wellington BEng (Hons) MSc CEng CEnv FICE FCIWEM C.WEM IMaPS MAPM

ReFH2 RUNOFF RATES*	
Return Period (Years)	**As-rural Peak Flow (l/s)**
1	1.4279
2	1.660538
5	2.501262
10	3.204851
30	4.616686
50	5.429143
75	6.14724
100	6.694721
200	8.125514
1000	11.99984

*Runoff Rates printed from the ReFH Flood Modelling software package

DOCUMENT VERIFICATION RECORD	
Project:	13840 – Ruthin Road (Development Parcel C)
Client:	Redrow Homes Ltd
Report Title:	13840-FCA & Drainage Strategy-01
Date:	24/11/2022

DOCUMENT REVIEW & APPROVAL	
Author:	Paige Blundell BSc (Hons) PGCE
Checker:	Aled Williams BSc (Hons) MCIWEM C.WEM
Approver:	Mike Wellington BEng (Hons) MSc CEng CEnv FICE FCIWEM C.WEM IMaPS MAPM

ReFH2 RUNOFF RATES*	
Return Period (Years)	**As-rural Peak Flow (l/s)**
1	5.692432
2	6.619434
5	9.969091
10	12.77193
30	18.39517
50	21.63062
75	24.49005
100	26.66996
200	32.3664
1000	47.78833

*Runoff Rates printed from the ReFH Flood Modelling software package

DOCUMENT VERIFICATION RECORD	
Project:	13840 – Ruthin Road (Development Parcel D)
Client:	Redrow Homes Ltd
Report Title:	13840-FCA & Drainage Strategy-01
Date:	24/11/2022

DOCUMENT REVIEW & APPROVAL	
Author:	Paige Blundell BSc (Hons) PGCE
Checker:	Aled Williams BSc (Hons) MCIWEM C.WEM
Approver:	Mike Wellington BEng (Hons) MSc CEng CEnv FICE FCIWEM C.WEM IMaPS MAPM

ReFH2 RUNOFF RATES*	
Return Period (Years)	**As-rural Peak Flow (l/s)**
1	10.83163
2	12.59501
5	18.96632
10	24.29699
30	34.99047
50	41.14258
75	46.57938
100	50.72396
200	61.55378
1000	90.86942

*Runoff Rates printed from the ReFH Flood Modelling software package

DOCUMENT VERIFICATION RECORD	
Project:	13840 – Ruthin Road (Development Parcel E)
Client:	Redrow Homes Ltd
Report Title:	13840-FCA & Drainage Strategy-01
Date:	24/11/2022

DOCUMENT REVIEW & APPROVAL	
Author:	Paige Blundell BSc (Hons) PGCE
Checker:	Aled Williams BSc (Hons) MCIWEM C.WEM
Approver:	Mike Wellington BEng (Hons) MSc CEng CEnv FICE FCIWEM C.WEM IMaPS MAPM

ReFH2 RUNOFF RATES*	
Return Period (Years)	**As-rural Peak Flow (l/s)**
1	2.322591
2	2.700943
5	4.068209
10	5.212401
30	7.508236
50	8.829339
75	9.996978
100	10.88717
200	13.21356
1000	19.51262

*Runoff Rates printed from the ReFH Flood Modelling software package

DOCUMENT VERIFICATION RECORD	
Project:	13840 – Ruthin Road (Development Parcel F)
Client:	Redrow Homes Ltd
Report Title:	13840-FCA & Drainage Strategy-01
Date:	24/11/2022

DOCUMENT REVIEW & APPROVAL	
Author:	Paige Blundell BSc (Hons) PGCE
Checker:	Aled Williams BSc (Hons) MCIWEM C.WEM
Approver:	Mike Wellington BEng (Hons) MSc CEng CEnv FICE FCIWEM C.WEM IMaPS MAPM

ReFH2 RUNOFF RATES*	
Return Period (Years)	**As-rural Peak Flow (l/s)**
1	6.401623
2	7.444063
5	11.2108
10	14.36257
30	20.68574
50	24.32386
75	27.53913
100	29.99028
200	36.39549
1000	53.73588

*Runoff Rates printed from the ReFH Flood Modelling software package

DOCUMENT VERIFICATION RECORD	
Project:	13840 – Ruthin Road (Development Parcel G)
Client:	Redrow Homes Ltd
Report Title:	13840-FCA & Drainage Strategy-01
Date:	24/11/2022

DOCUMENT REVIEW & APPROVAL	
Author:	Paige Blundell BSc (Hons) PGCE
Checker:	Aled Williams BSc (Hons) MCIWEM C.WEM
Approver:	Mike Wellington BEng (Hons) MSc CEng CEnv FICE FCIWEM C.WEM IMaPS MAPM

ReFH2 RUNOFF RATES*	
Return Period (Years)	**As-rural Peak Flow (l/s)**
1	1.610591
2	1.872985
5	2.821236
10	3.614805
30	5.207176
50	6.123513
75	6.933422
100	7.550898
200	9.164605
1000	13.53418

*Runoff Rates printed from the ReFH Flood Modelling software package

DOCUMENT VERIFICATION RECORD	
Project:	13840 – Ruthin Road (Development Parcel H)
Client:	Redrow Homes Ltd
Report Title:	13840-FCA & Drainage Strategy-01
Date:	24/11/2022

DOCUMENT REVIEW & APPROVAL	
Author:	Paige Blundell BSc (Hons) PGCE
Checker:	Aled Williams BSc (Hons) MCIWEM C.WEM
Approver:	Mike Wellington BEng (Hons) MSc CEng CEnv FICE FCIWEM C.WEM IMaPS MAPM

ReFH2 RUNOFF RATES*	
Return Period (Years)	**As-rural Peak Flow (l/s)**
1	2.778643
2	3.23126
5	4.866879
10	6.235613
30	8.981936
50	10.56224
75	11.95895
100	13.02378
200	15.80651
1000	23.34101

*Runoff Rates printed from the ReFH Flood Modelling software package

DOCUMENT VERIFICATION RECORD	
Project:	13840 – Ruthin Road (Development Parcel I)
Client:	Redrow Homes Ltd
Report Title:	13840-FCA & Drainage Strategy-01
Date:	24/11/2022

DOCUMENT REVIEW & APPROVAL	
Author:	Paige Blundell BSc (Hons) PGCE
Checker:	Aled Williams BSc (Hons) MCIWEM C.WEM
Approver:	Mike Wellington BEng (Hons) MSc CEng CEnv FICE FCIWEM C.WEM IMaPS MAPM

ReFH2 RUNOFF RATES*	
Return Period (Years)	**As-rural Peak Flow (l/s)**
1	3.36204
2	3.909652
5	5.888519
10	7.544457
30	10.86697
50	12.77878
75	14.46846
100	15.75664
200	19.123
1000	3.36204

*Runoff Rates printed from the ReFH Flood Modelling software package

DOCUMENT VERIFICATION RECORD	
Project:	13840 – Ruthin Road (Development Parcel J)
Client:	Redrow Homes Ltd
Report Title:	13840-FCA & Drainage Strategy-01
Date:	24/11/2022

DOCUMENT REVIEW & APPROVAL	
Author:	Paige Blundell BSc (Hons) PGCE
Checker:	Aled Williams BSc (Hons) MCIWEM C.WEM
Approver:	Mike Wellington BEng (Hons) MSc CEng CEnv FICE FCIWEM C.WEM IMaPS MAPM

ReFH2 RUNOFF RATES*	
Return Period (Years)	**As-rural Peak Flow (l/s)**
1	6.437982
2	7.486341
5	11.27446
10	14.44412
30	20.80317
50	24.46193
75	27.69544
100	30.1605
200	36.60205
1000	54.04077

*Runoff Rates printed from the ReFH Flood Modelling software package

DOCUMENT VERIFICATION RECORD	
Project:	13840 – Ruthin Road (Development Parcel K)
Client:	Redrow Homes Ltd
Report Title:	13840-FCA & Drainage Strategy-01
Date:	31/05/2023

DOCUMENT REVIEW & APPROVAL	
Author:	Paige Blundell BSc (Hons) PGCE
Checker:	Aled Williams BSc (Hons) MCIWEM C.WEM
Approver:	Mike Wellington BEng (Hons) MSc CEng CEnv FICE FCIWEM C.WEM IMaPS MAPM

ReFH2 RUNOFF RATES*	
Return Period (Years)	**As-rural Peak Flow (l/s)**
1	6.861555
2	7.979384
5	12.01901
10	15.39964
30	22.1831
50	26.08662
75	29.53675
100	32.16712
200	39.04126
1000	57.65466

*Runoff Rates printed from the ReFH Flood Modelling software package

DOCUMENT VERIFICATION RECORD	
Project:	13840 – Ruthin Road (Development Parcel L)
Client:	Redrow Homes Ltd
Report Title:	13840-FCA & Drainage Strategy-01
Date:	31/05/2023

DOCUMENT REVIEW & APPROVAL	
Author:	Paige Blundell BSc (Hons) PGCE
Checker:	Aled Williams BSc (Hons) MCIWEM C.WEM
Approver:	Mike Wellington BEng (Hons) MSc CEng CEnv FICE FCIWEM C.WEM IMaPS MAPM

ReFH2 RUNOFF RATES*	
Return Period (Years)	**As-rural Peak Flow (l/s)**
1	3.933958
2	4.574847
5	6.890901
10	8.829128
30	12.71831
50	14.95633
75	16.9344
100	18.44248
200	22.38365
1000	33.05534

*Runoff Rates printed from the ReFH Flood Modelling software package

DOCUMENT VERIFICATION RECORD	
Project:	13840 – Ruthin Road (Development Parcel M)
Client:	Redrow Homes Ltd
Report Title:	13840-FCA & Drainage Strategy-01
Date:	24/11/2022

DOCUMENT REVIEW & APPROVAL	
Author:	Paige Blundell BSc (Hons) PGCE
Checker:	Aled Williams BSc (Hons) MCIWEM C.WEM
Approver:	Mike Wellington BEng (Hons) MSc CEng CEnv FICE FCIWEM C.WEM IMaPS MAPM

ReFH2 RUNOFF RATES*	
Return Period (Years)	**As-rural Peak Flow (l/s)**
1	5.36499
2	6.23869
5	9.395766
10	12.03748
30	17.33752
50	20.38704
75	23.08216
100	25.1368
200	30.50596
1000	45.04196

*Runoff Rates printed from the ReFH Flood Modelling software package

DOCUMENT VERIFICATION RECORD	
Project:	13840 – Ruthin Road (Development Parcel N)
Client:	Redrow Homes Ltd
Report Title:	13840-FCA & Drainage Strategy-01
Date:	24/11/2022

DOCUMENT REVIEW & APPROVAL	
Author:	Paige Blundell BSc (Hons) PGCE
Checker:	Aled Williams BSc (Hons) MCIWEM C.WEM
Approver:	Mike Wellington BEng (Hons) MSc CEng CEnv FICE FCIWEM C.WEM IMaPS MAPM

ReFH2 RUNOFF RATES*	
Return Period (Years)	**As-rural Peak Flow (l/s)**
1	3.453163
2	4.015612
5	6.048089
10	7.748883
30	11.16138
50	13.12496
75	14.8604
100	16.18346
200	19.64097
1000	29.00222

*Runoff Rates printed from the ReFH Flood Modelling software package

DOCUMENT VERIFICATION RECORD	
Project:	13840 – Ruthin Road (Development Parcel O)
Client:	Redrow Homes Ltd
Report Title:	13840-Drainage Strategy-01
Date:	01/07/2024

DOCUMENT REVIEW & APPROVAL	
Author:	Megan Williams BSc (Hons) MSc MCIWEM
Checker:	Aled Williams BSc (Hons) MCIWEM C.WEM
Approver:	Mike Wellington BEng (Hons) MSc CEng CEnv FICE FCIWEM C.WEM IMaPS MAPM

ReFH2 RUNOFF RATES*	
Return Period (Years)	**As-rural Peak Flow (l/s)**
1	4.37
2	50.8
5	7.66
10	9.81
30	14.13
50	16.62
75	18.82
100	20.50
200	24.88
1000	36.74

*Runoff Rates printed from the ReFH Flood Modelling software package

DOCUMENT VERIFICATION RECORD	
Project:	13840 – Ruthin Road (School)
Client:	Redrow Homes Ltd
Report Title:	13840-FCA & Drainage Strategy-01
Date:	24/11/2022

DOCUMENT REVIEW & APPROVAL	
Author:	Paige Blundell BSc (Hons) PGCE
Checker:	Aled Williams BSc (Hons) MCIWEM C.WEM
Approver:	Mike Wellington BEng (Hons) MSc CEng CEnv FICE FCIWEM C.WEM IMaPS MAPM

ReFH2 RUNOFF RATES*	
Return Period (Years)	**As-rural Peak Flow (l/s)**
1	2.960995
2	3.443305
5	5.186217
10	6.644726
30	9.571158
50	11.25509
75	12.74338
100	13.87803
200	16.84319
1000	24.87161

*Runoff Rates printed from the ReFH Flood Modelling software package

DOCUMENT VERIFICATION RECORD	
Project:	13840 – Ruthin Road (Local Centre Re-development)
Client:	Redrow Homes Ltd
Report Title:	13840-FCA & Drainage Strategy-01
Date:	24/11/2022

DOCUMENT REVIEW & APPROVAL	
Author:	Paige Blundell BSc (Hons) PGCE
Checker:	Aled Williams BSc (Hons) MCIWEM C.WEM
Approver:	Mike Wellington BEng (Hons) MSc CEng CEnv FICE FCIWEM C.WEM IMaPS MAPM

ReFH2 RUNOFF RATES*	
Return Period (Years)	**As-rural Peak Flow (l/s)**
1	2.669214
2	3.104011
5	4.675241
10	5.990099
30	8.628335
50	10.14644
75	11.48819
100	12.51112
200	15.18436
1000	22.42245

*Runoff Rates printed from the ReFH Flood Modelling software package

Appendix J MicroDrainage Storage Estimates

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	9.330	0.330	4.7	396.5	O K
30 min Summer	9.451	0.451	4.7	541.3	O K
60 min Summer	9.590	0.590	4.7	707.4	O K
120 min Summer	9.699	0.699	4.7	839.2	O K
180 min Summer	9.760	0.760	4.7	911.9	Flood Risk
240 min Summer	9.800	0.800	4.7	960.6	Flood Risk
360 min Summer	9.853	0.853	4.7	1023.8	Flood Risk
480 min Summer	9.886	0.886	4.7	1062.7	Flood Risk
600 min Summer	9.906	0.906	4.7	1087.7	Flood Risk
720 min Summer	9.920	0.920	4.7	1103.7	Flood Risk
960 min Summer	9.932	0.932	4.7	1118.6	Flood Risk
1440 min Summer	9.923	0.923	4.7	1108.1	Flood Risk
2160 min Summer	9.878	0.878	4.7	1053.5	Flood Risk
2880 min Summer	9.836	0.836	4.7	1002.9	Flood Risk
4320 min Summer	9.759	0.759	4.7	910.6	Flood Risk
5760 min Summer	9.698	0.698	4.7	837.9	O K
7200 min Summer	9.661	0.661	4.7	792.8	O K
8640 min Summer	9.636	0.636	4.7	762.9	O K
10080 min Summer	9.623	0.623	4.7	748.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	155.452	0.0	338.3	17
30 min Summer	106.486	0.0	395.0	32
60 min Summer	69.995	0.0	675.3	62
120 min Summer	41.971	0.0	748.7	122
180 min Summer	30.743	0.0	744.9	182
240 min Summer	24.555	0.0	737.0	242
360 min Summer	17.821	0.0	724.1	362
480 min Summer	14.163	0.0	714.7	482
600 min Summer	11.834	0.0	707.4	602
720 min Summer	10.209	0.0	701.1	722
960 min Summer	8.073	0.0	690.7	960
1440 min Summer	5.765	0.0	674.6	1440
2160 min Summer	4.088	0.0	1401.5	1884
2880 min Summer	3.199	0.0	1359.6	2276
4320 min Summer	2.258	0.0	1233.7	3028
5760 min Summer	1.778	0.0	1750.1	3872
7200 min Summer	1.508	0.0	1852.8	4752
8640 min Summer	1.337	0.0	1967.2	5536
10080 min Summer	1.225	0.0	2091.5	6360

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Winter	9.330	0.330	4.7	396.4	O K
30 min Winter	9.451	0.451	4.7	541.2	O K
60 min Winter	9.589	0.589	4.7	707.3	O K
120 min Winter	9.699	0.699	4.7	838.8	O K
180 min Winter	9.760	0.760	4.7	911.7	Flood Risk
240 min Winter	9.800	0.800	4.7	960.6	Flood Risk
360 min Winter	9.853	0.853	4.7	1024.1	Flood Risk
480 min Winter	9.886	0.886	4.7	1063.5	Flood Risk
600 min Winter	9.908	0.908	4.7	1089.0	Flood Risk
720 min Winter	9.921	0.921	4.7	1105.6	Flood Risk
960 min Winter	9.935	0.935	4.7	1121.8	Flood Risk
1440 min Winter	9.929	0.929	4.7	1114.3	Flood Risk
2160 min Winter	9.884	0.884	4.7	1060.4	Flood Risk
2880 min Winter	9.831	0.831	4.7	997.7	Flood Risk
4320 min Winter	9.737	0.737	4.7	884.5	Flood Risk
5760 min Winter	9.650	0.650	4.7	779.7	O K
7200 min Winter	9.576	0.576	4.7	691.8	O K
8640 min Winter	9.525	0.525	4.7	630.3	O K
10080 min Winter	9.491	0.491	4.7	589.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Winter	155.452	0.0	338.3	17
30 min Winter	106.486	0.0	395.1	32
60 min Winter	69.995	0.0	675.3	62
120 min Winter	41.971	0.0	749.0	122
180 min Winter	30.743	0.0	745.3	180
240 min Winter	24.555	0.0	737.4	240
360 min Winter	17.821	0.0	724.4	358
480 min Winter	14.163	0.0	715.0	474
600 min Winter	11.834	0.0	707.6	590
720 min Winter	10.209	0.0	701.3	708
960 min Winter	8.073	0.0	690.8	940
1440 min Winter	5.765	0.0	675.0	1386
2160 min Winter	4.088	0.0	1403.1	2032
2880 min Winter	3.199	0.0	1365.2	2308
4320 min Winter	2.258	0.0	1252.6	3240
5760 min Winter	1.778	0.0	1750.5	4160
7200 min Winter	1.508	0.0	1854.2	4976
8640 min Winter	1.337	0.0	1969.9	5792
10080 min Winter	1.225	0.0	2098.1	6648

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 331208 350156 SJ 31208 50156
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	1.000
Cv (Winter)	1.000
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.028

Time (mins) From:	To:	Area (ha)
0	2	1.028

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Model Details

Storage is Online Cover Level (m) 10.000

Tank or Pond Structure

Invert Level (m) 9.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1200.0	1.000	1200.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0102-4700-1000-4700
Design Head (m)	1.000
Design Flow (l/s)	4.7
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	102
Invert Level (m)	8.995
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

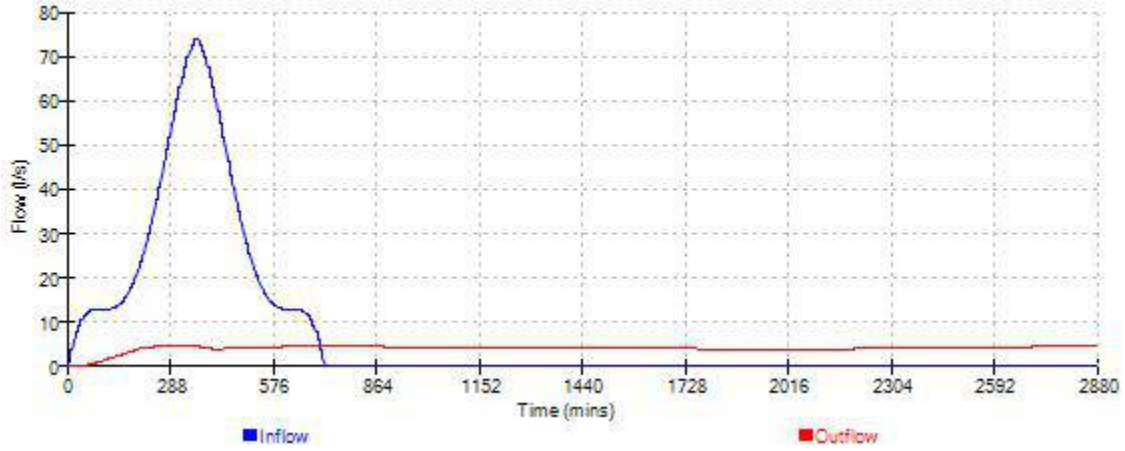
Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	4.7
Flush-Flo™	0.299	4.7
Kick-Flo®	0.640	3.8
Mean Flow over Head Range	-	4.1

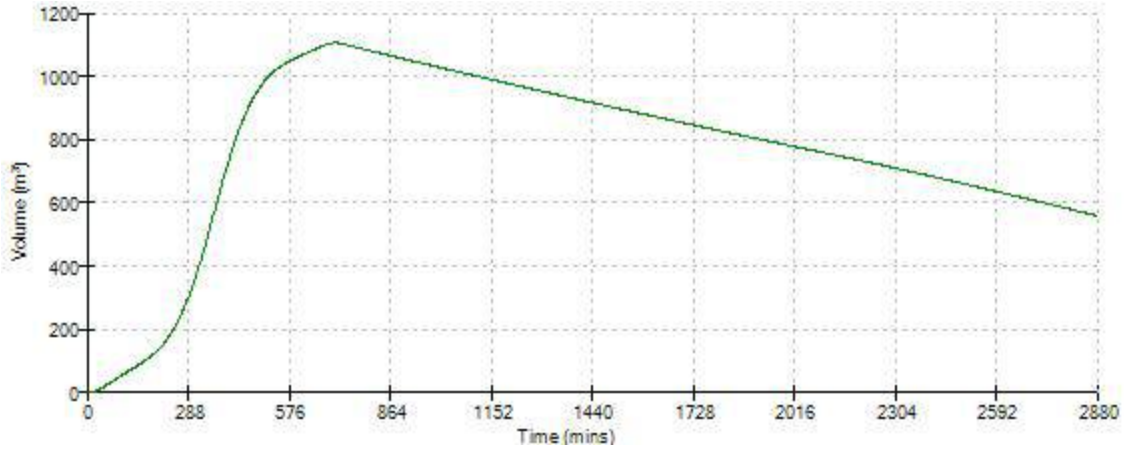
The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

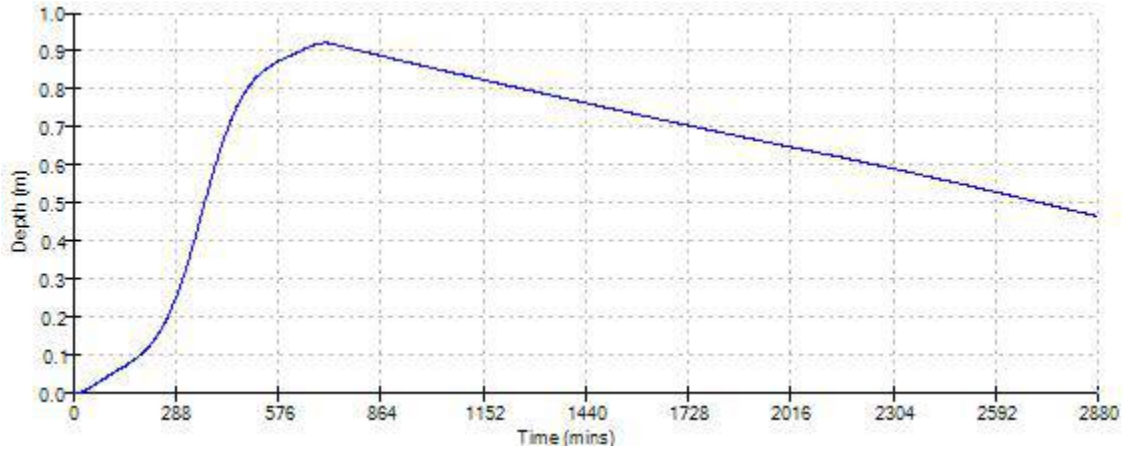
Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.4	1.600	5.8	5.000	10.0
0.200	4.6	1.800	6.2	5.500	10.5
0.300	4.7	2.000	6.5	6.000	10.9
0.400	4.6	2.200	6.8	6.500	11.3
0.500	4.5	2.400	7.1	7.000	11.7
0.600	4.1	2.600	7.3	7.500	12.1
0.800	4.2	3.000	7.9	8.000	12.5
1.000	4.7	3.500	8.4	8.500	12.9
1.200	5.1	4.000	9.0	9.000	13.2
1.400	5.5	4.500	9.5	9.500	13.6

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Event: 720 min Winter

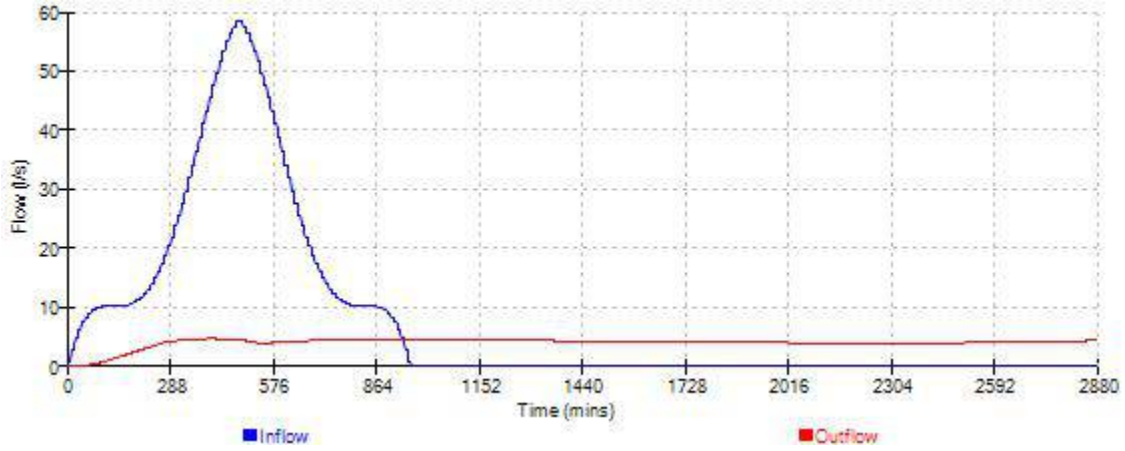


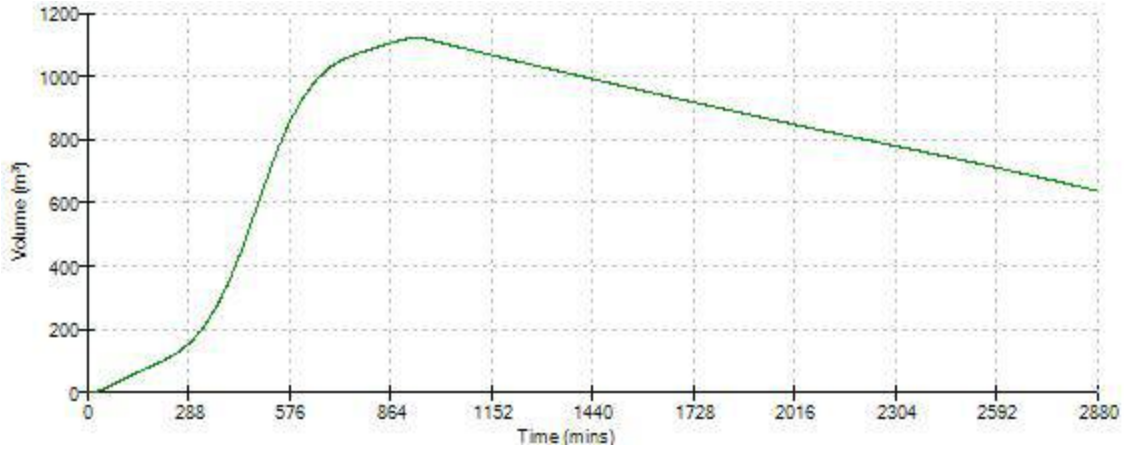


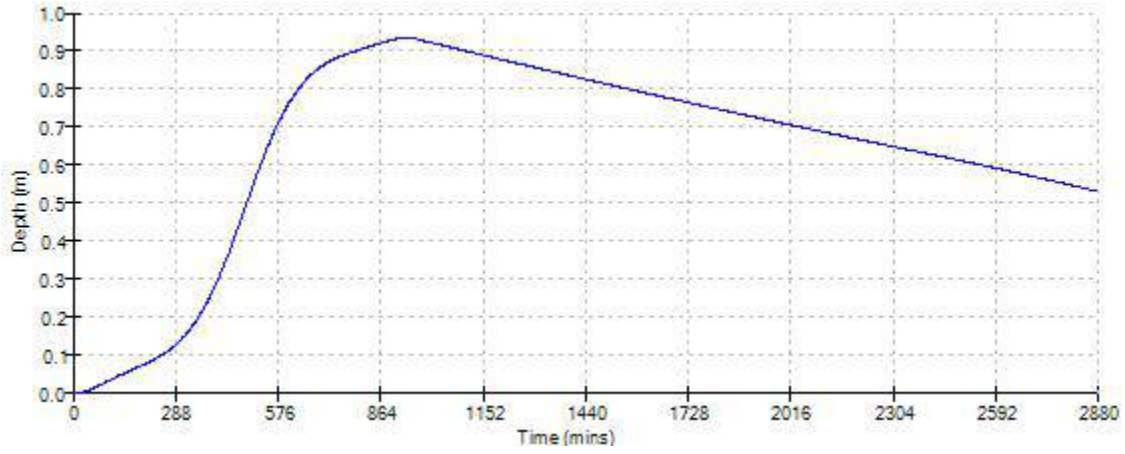


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Event: 960 min Winter

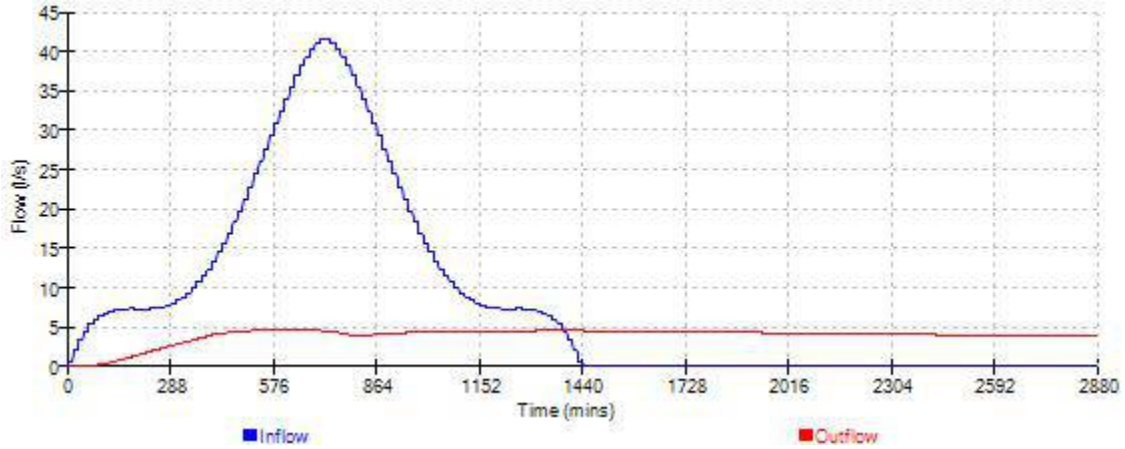


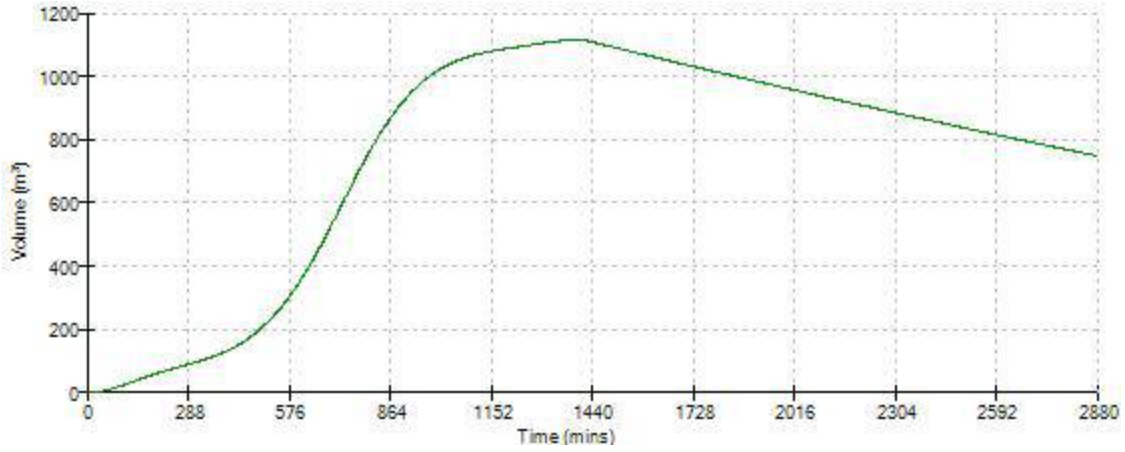


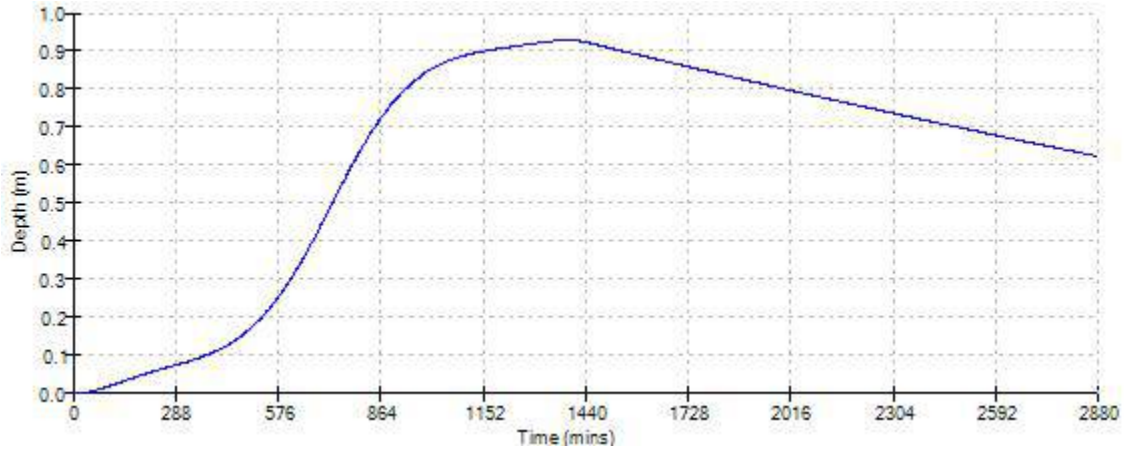


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Event: 1440 min Winter







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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	9.344	0.344	1.3	120.4	O K
30 min Summer	9.470	0.470	1.3	164.4	O K
60 min Summer	9.614	0.614	1.3	215.0	O K
120 min Summer	9.728	0.728	1.3	254.7	Flood Risk
180 min Summer	9.791	0.791	1.3	276.7	Flood Risk
240 min Summer	9.833	0.833	1.3	291.4	Flood Risk
360 min Summer	9.887	0.887	1.3	310.5	Flood Risk
480 min Summer	9.921	0.921	1.4	322.3	Flood Risk
600 min Summer	9.943	0.943	1.4	329.9	Flood Risk
720 min Summer	9.956	0.956	1.4	334.7	Flood Risk
960 min Summer	9.969	0.969	1.4	339.3	Flood Risk
1440 min Summer	9.960	0.960	1.4	336.1	Flood Risk
2160 min Summer	9.913	0.913	1.3	319.5	Flood Risk
2880 min Summer	9.870	0.870	1.3	304.4	Flood Risk
4320 min Summer	9.793	0.793	1.3	277.6	Flood Risk
5760 min Summer	9.737	0.737	1.3	258.0	Flood Risk
7200 min Summer	9.707	0.707	1.3	247.4	Flood Risk
8640 min Summer	9.691	0.691	1.3	241.8	O K
10080 min Summer	9.687	0.687	1.3	240.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	155.452	0.0	102.0	16
30 min Summer	106.486	0.0	104.0	31
60 min Summer	69.995	0.0	198.3	62
120 min Summer	41.971	0.0	199.8	122
180 min Summer	30.743	0.0	199.1	182
240 min Summer	24.555	0.0	198.9	242
360 min Summer	17.821	0.0	199.5	362
480 min Summer	14.163	0.0	200.6	482
600 min Summer	11.834	0.0	202.3	602
720 min Summer	10.209	0.0	204.1	722
960 min Summer	8.073	0.0	206.1	960
1440 min Summer	5.765	0.0	205.1	1440
2160 min Summer	4.088	0.0	398.4	1884
2880 min Summer	3.199	0.0	386.1	2276
4320 min Summer	2.258	0.0	356.3	3028
5760 min Summer	1.778	0.0	532.4	3864
7200 min Summer	1.508	0.0	564.1	4688
8640 min Summer	1.337	0.0	598.6	5536
10080 min Summer	1.225	0.0	629.9	6360

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Winter	9.344	0.344	1.3	120.4	O K
30 min Winter	9.470	0.470	1.3	164.4	O K
60 min Winter	9.614	0.614	1.3	214.9	O K
120 min Winter	9.728	0.728	1.3	254.7	Flood Risk
180 min Winter	9.791	0.791	1.3	276.8	Flood Risk
240 min Winter	9.833	0.833	1.3	291.6	Flood Risk
360 min Winter	9.888	0.888	1.3	311.0	Flood Risk
480 min Winter	9.923	0.923	1.4	323.0	Flood Risk
600 min Winter	9.945	0.945	1.4	330.8	Flood Risk
720 min Winter	9.960	0.960	1.4	335.9	Flood Risk
960 min Winter	9.974	0.974	1.4	341.0	Flood Risk
1440 min Winter	9.969	0.969	1.4	339.0	Flood Risk
2160 min Winter	9.924	0.924	1.4	323.3	Flood Risk
2880 min Winter	9.872	0.872	1.3	305.1	Flood Risk
4320 min Winter	9.782	0.782	1.3	273.8	Flood Risk
5760 min Winter	9.707	0.707	1.3	247.6	Flood Risk
7200 min Winter	9.658	0.658	1.3	230.2	O K
8640 min Winter	9.623	0.623	1.3	218.1	O K
10080 min Winter	9.602	0.602	1.3	210.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Winter	155.452	0.0	102.0	16
30 min Winter	106.486	0.0	104.0	31
60 min Winter	69.995	0.0	198.3	62
120 min Winter	41.971	0.0	199.8	122
180 min Winter	30.743	0.0	199.0	180
240 min Winter	24.555	0.0	198.8	240
360 min Winter	17.821	0.0	199.3	358
480 min Winter	14.163	0.0	200.4	474
600 min Winter	11.834	0.0	201.9	590
720 min Winter	10.209	0.0	203.7	708
960 min Winter	8.073	0.0	205.5	940
1440 min Winter	5.765	0.0	204.3	1384
2160 min Winter	4.088	0.0	397.5	2032
2880 min Winter	3.199	0.0	385.5	2308
4320 min Winter	2.258	0.0	357.5	3240
5760 min Winter	1.778	0.0	532.4	4152
7200 min Winter	1.508	0.0	564.2	5048
8640 min Winter	1.337	0.0	598.9	5968
10080 min Winter	1.225	0.0	633.6	6864

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 331208 350156 SJ 31208 50156
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	1.000
Cv (Winter)	1.000
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.312

Time (mins) From:	To:	Area (ha)
0	1	0.312

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Model Details

Storage is Online Cover Level (m) 10.000

Tank or Pond Structure

Invert Level (m) 9.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	350.0	1.000	350.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0056-1400-1000-1400
Design Head (m)	1.000
Design Flow (l/s)	1.4
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	56
Invert Level (m)	8.995
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

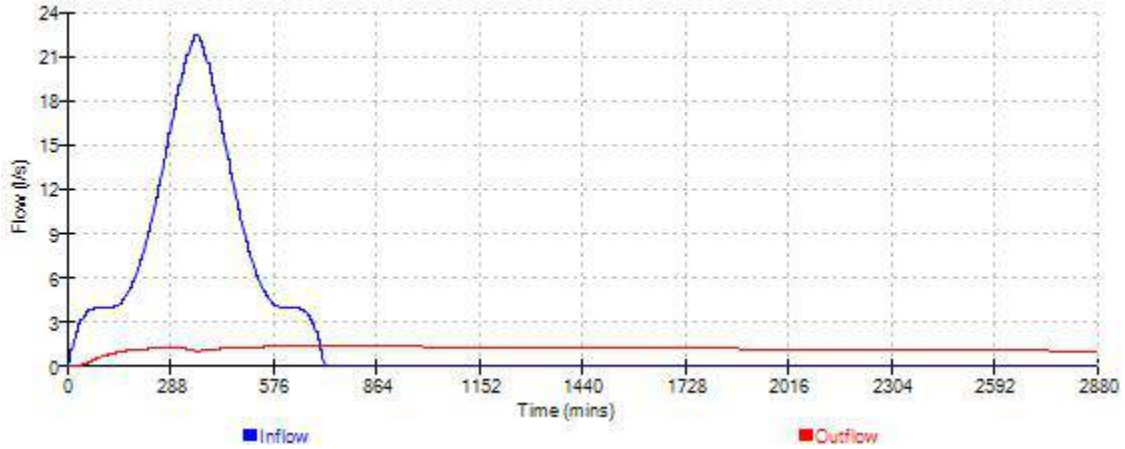
Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	1.4
Flush-Flo™	0.245	1.3
Kick-Flo®	0.497	1.0
Mean Flow over Head Range	-	1.2

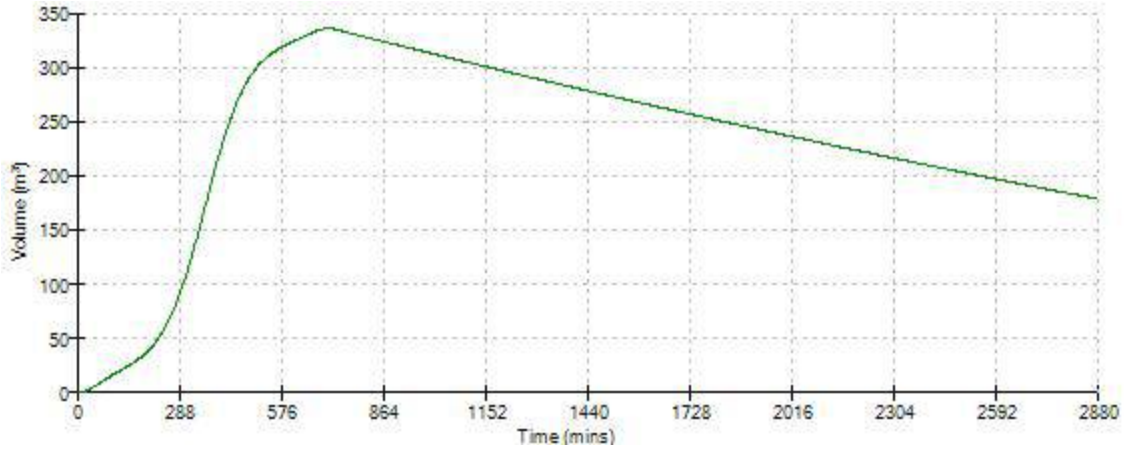
The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

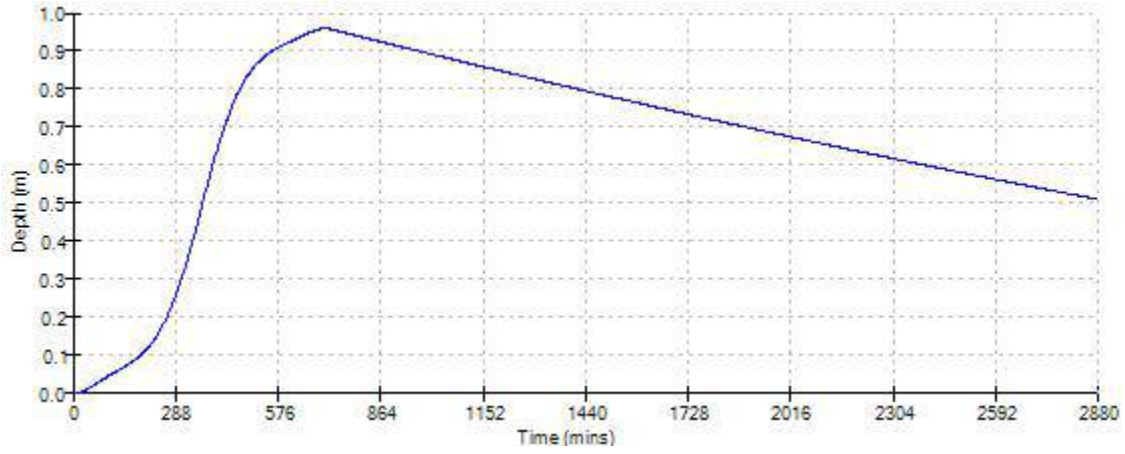
Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.1	1.600	1.7	5.000	2.9
0.200	1.2	1.800	1.8	5.500	3.1
0.300	1.2	2.000	1.9	6.000	3.2
0.400	1.2	2.200	2.0	6.500	3.3
0.500	1.0	2.400	2.1	7.000	3.4
0.600	1.1	2.600	2.2	7.500	3.5
0.800	1.3	3.000	2.3	8.000	3.6
1.000	1.4	3.500	2.5	8.500	3.7
1.200	1.5	4.000	2.6	9.000	3.8
1.400	1.6	4.500	2.8	9.500	3.9

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Event: 720 min Winter

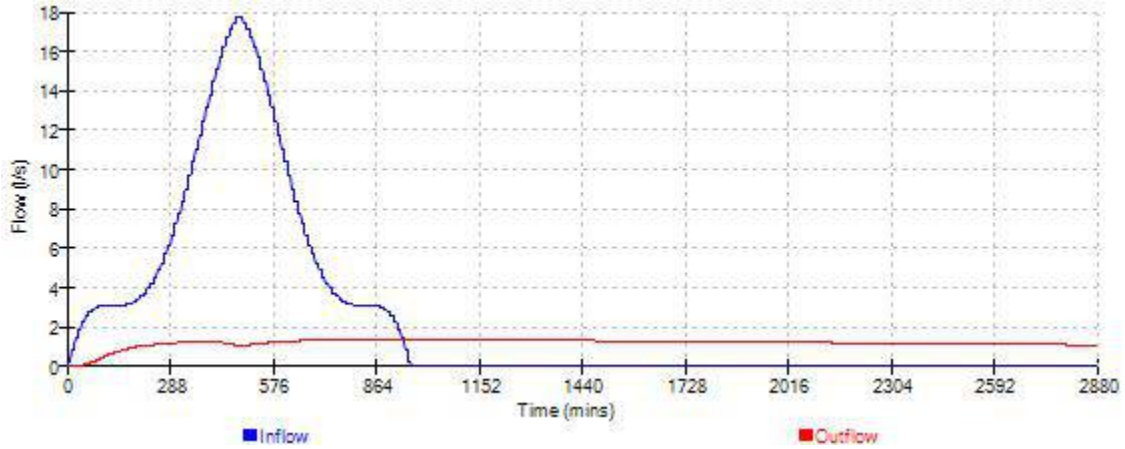


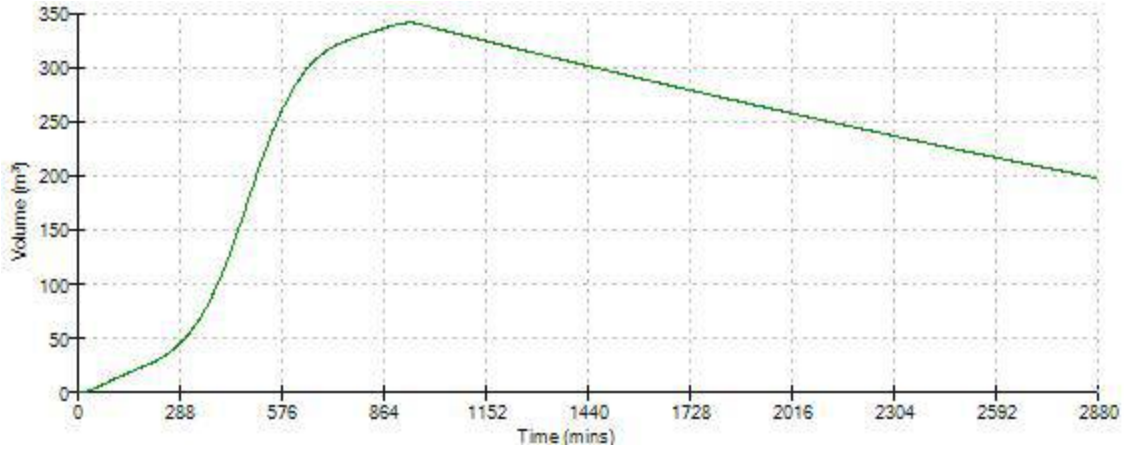


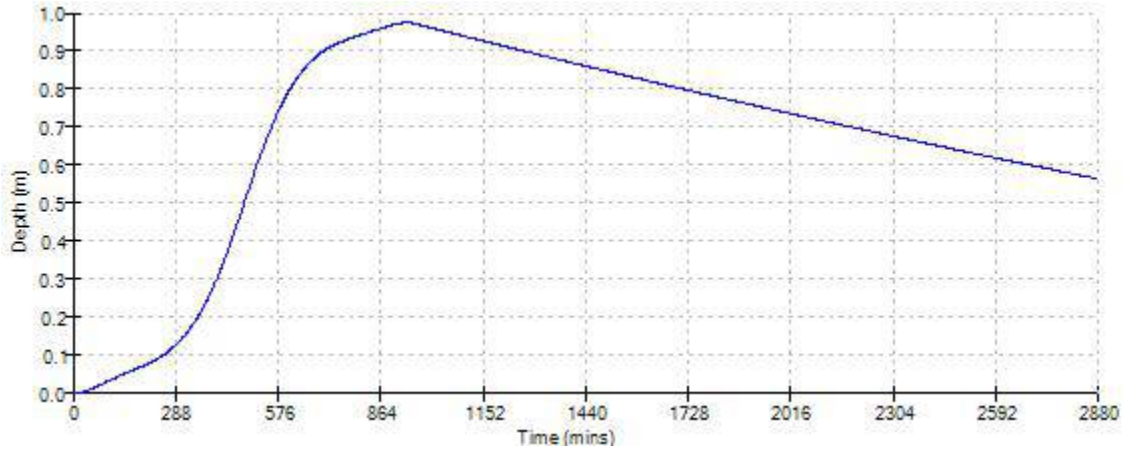


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Event: 960 min Winter

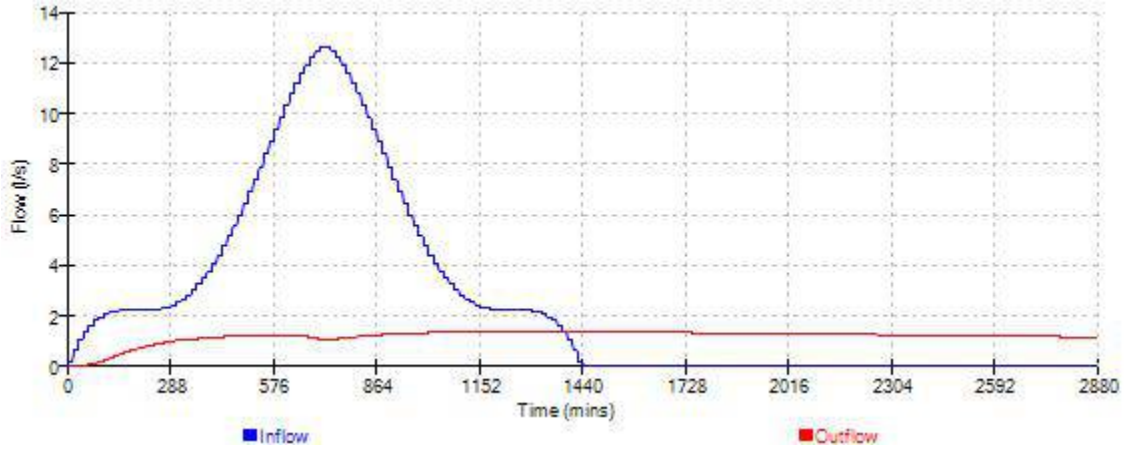


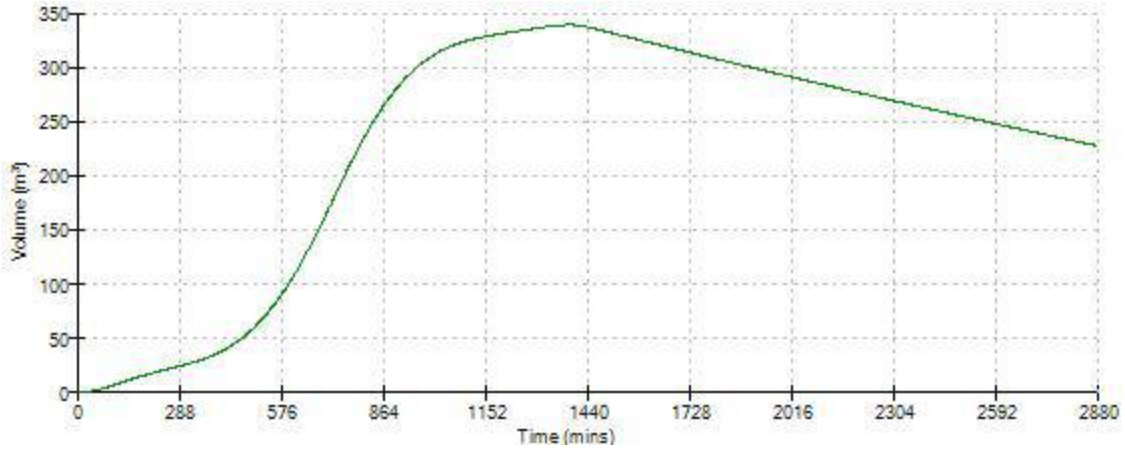


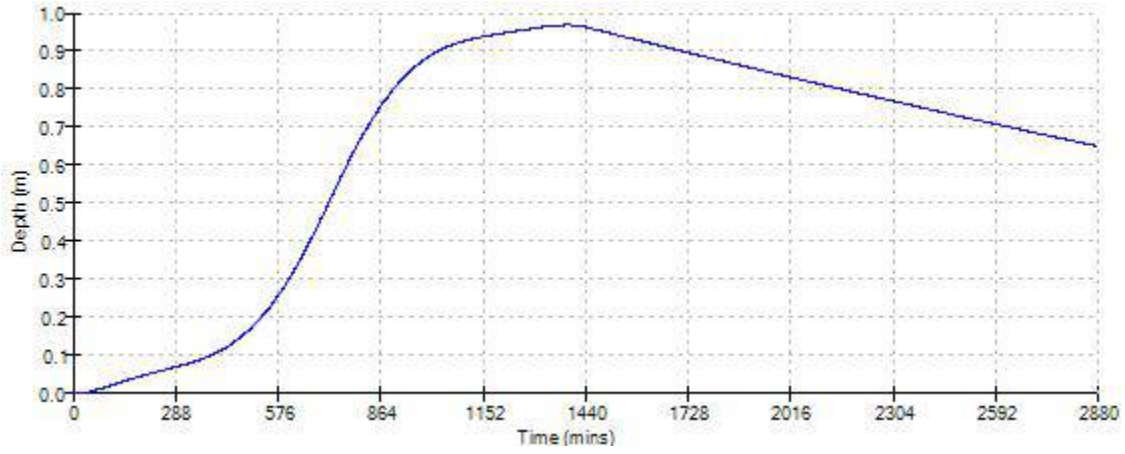


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Event: 1440 min Winter







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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	9.332	0.332	5.7	481.4	O K
30 min Summer	9.453	0.453	5.7	657.3	O K
60 min Summer	9.592	0.592	5.7	859.1	O K
120 min Summer	9.703	0.703	5.7	1019.2	Flood Risk
180 min Summer	9.764	0.764	5.7	1107.7	Flood Risk
240 min Summer	9.805	0.805	5.7	1167.0	Flood Risk
360 min Summer	9.858	0.858	5.7	1244.0	Flood Risk
480 min Summer	9.891	0.891	5.7	1291.6	Flood Risk
600 min Summer	9.912	0.912	5.7	1322.3	Flood Risk
720 min Summer	9.926	0.926	5.7	1342.0	Flood Risk
960 min Summer	9.938	0.938	5.7	1360.7	Flood Risk
1440 min Summer	9.930	0.930	5.7	1348.8	Flood Risk
2160 min Summer	9.885	0.885	5.7	1283.9	Flood Risk
2880 min Summer	9.844	0.844	5.7	1223.6	Flood Risk
4320 min Summer	9.768	0.768	5.7	1113.0	Flood Risk
5760 min Summer	9.707	0.707	5.7	1025.8	Flood Risk
7200 min Summer	9.670	0.670	5.7	972.1	O K
8640 min Summer	9.647	0.647	5.7	937.6	O K
10080 min Summer	9.635	0.635	5.7	920.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	155.452	0.0	405.8	17
30 min Summer	106.486	0.0	477.1	32
60 min Summer	69.995	0.0	814.4	62
120 min Summer	41.971	0.0	904.0	122
180 min Summer	30.743	0.0	899.9	182
240 min Summer	24.555	0.0	890.3	242
360 min Summer	17.821	0.0	874.9	362
480 min Summer	14.163	0.0	863.9	482
600 min Summer	11.834	0.0	855.2	602
720 min Summer	10.209	0.0	847.8	722
960 min Summer	8.073	0.0	835.3	960
1440 min Summer	5.765	0.0	815.7	1440
2160 min Summer	4.088	0.0	1693.2	1884
2880 min Summer	3.199	0.0	1640.9	2276
4320 min Summer	2.258	0.0	1487.8	3028
5760 min Summer	1.778	0.0	2122.7	3872
7200 min Summer	1.508	0.0	2246.9	4752
8640 min Summer	1.337	0.0	2384.8	5536
10080 min Summer	1.225	0.0	2533.3	6360

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Winter	9.332	0.332	5.7	481.3	O K
30 min Winter	9.453	0.453	5.7	657.1	O K
60 min Winter	9.592	0.592	5.7	858.9	O K
120 min Winter	9.703	0.703	5.7	1018.8	Flood Risk
180 min Winter	9.764	0.764	5.7	1107.4	Flood Risk
240 min Winter	9.805	0.805	5.7	1166.9	Flood Risk
360 min Winter	9.858	0.858	5.7	1244.4	Flood Risk
480 min Winter	9.891	0.891	5.7	1292.5	Flood Risk
600 min Winter	9.913	0.913	5.7	1323.8	Flood Risk
720 min Winter	9.927	0.927	5.7	1344.2	Flood Risk
960 min Winter	9.941	0.941	5.7	1364.4	Flood Risk
1440 min Winter	9.935	0.935	5.7	1356.3	Flood Risk
2160 min Winter	9.891	0.891	5.7	1292.1	Flood Risk
2880 min Winter	9.840	0.840	5.7	1217.3	Flood Risk
4320 min Winter	9.746	0.746	5.7	1081.7	Flood Risk
5760 min Winter	9.660	0.660	5.7	956.9	O K
7200 min Winter	9.588	0.588	5.7	852.0	O K
8640 min Winter	9.536	0.536	5.7	777.5	O K
10080 min Winter	9.502	0.502	5.7	728.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Winter	155.452	0.0	405.8	17
30 min Winter	106.486	0.0	477.2	32
60 min Winter	69.995	0.0	814.5	62
120 min Winter	41.971	0.0	904.4	122
180 min Winter	30.743	0.0	900.5	180
240 min Winter	24.555	0.0	890.9	240
360 min Winter	17.821	0.0	875.5	358
480 min Winter	14.163	0.0	864.4	474
600 min Winter	11.834	0.0	855.6	590
720 min Winter	10.209	0.0	848.1	708
960 min Winter	8.073	0.0	835.5	940
1440 min Winter	5.765	0.0	816.3	1384
2160 min Winter	4.088	0.0	1695.2	2032
2880 min Winter	3.199	0.0	1647.7	2308
4320 min Winter	2.258	0.0	1510.0	3240
5760 min Winter	1.778	0.0	2123.3	4160
7200 min Winter	1.508	0.0	2248.7	4976
8640 min Winter	1.337	0.0	2388.6	5800
10080 min Winter	1.225	0.0	2543.1	6656

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 331208 350156 SJ 31208 50156
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	1.000
Cv (Winter)	1.000
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.248

Time (mins) From:	To:	Area (ha)
0	2	1.248

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Model Details

Storage is Online Cover Level (m) 10.000

Tank or Pond Structure

Invert Level (m) 9.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1450.0	1.000	1450.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0112-5700-1000-5700
Design Head (m)	1.000
Design Flow (l/s)	5.7
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	112
Invert Level (m)	8.995
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

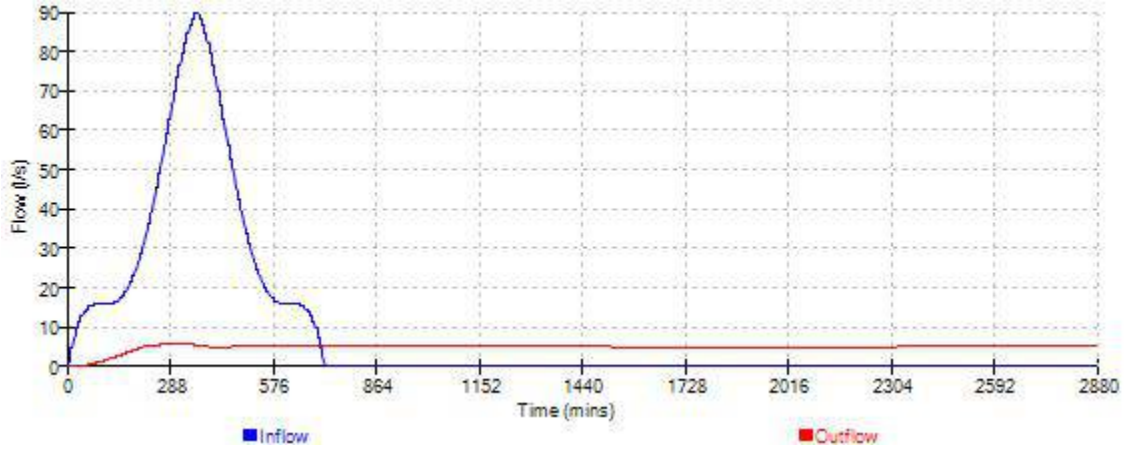
Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	5.7
Flush-Flo™	0.296	5.7
Kick-Flo®	0.642	4.6
Mean Flow over Head Range	-	4.9

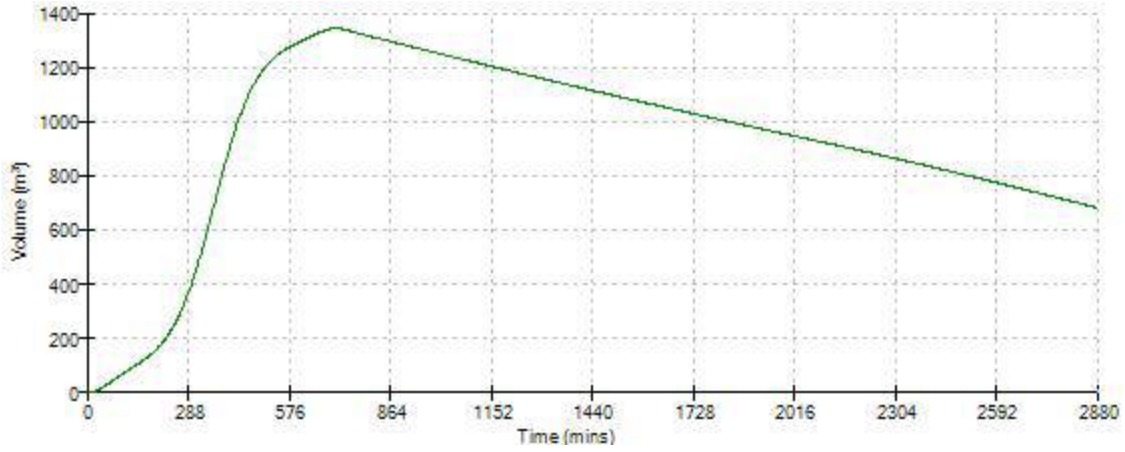
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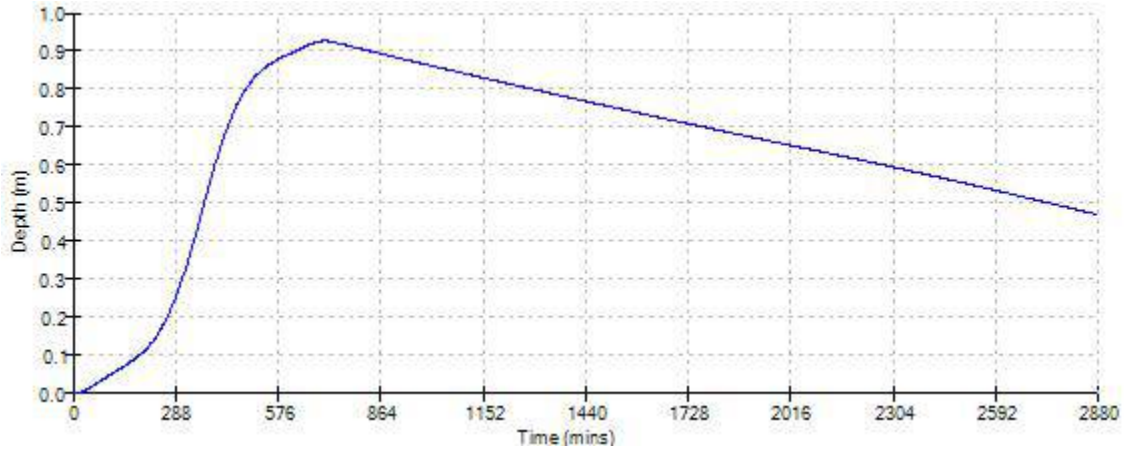
Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.9	1.600	7.1	5.000	12.2
0.200	5.5	1.800	7.5	5.500	12.7
0.300	5.7	2.000	7.9	6.000	13.3
0.400	5.6	2.200	8.2	6.500	13.8
0.500	5.4	2.400	8.6	7.000	14.3
0.600	5.0	2.600	8.9	7.500	14.7
0.800	5.1	3.000	9.5	8.000	15.2
1.000	5.7	3.500	10.3	8.500	15.7
1.200	6.2	4.000	10.9	9.000	16.1
1.400	6.7	4.500	11.6	9.500	16.5

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Event: 720 min Winter

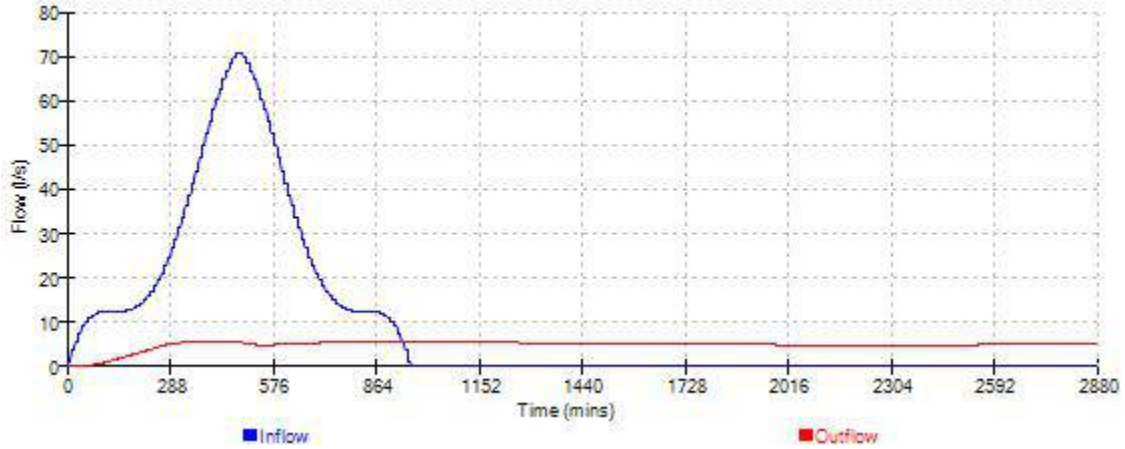


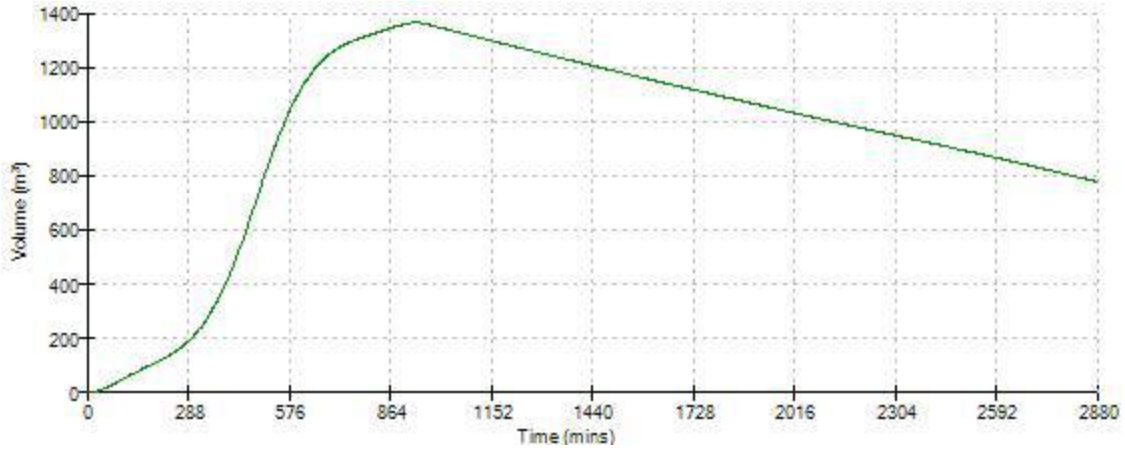


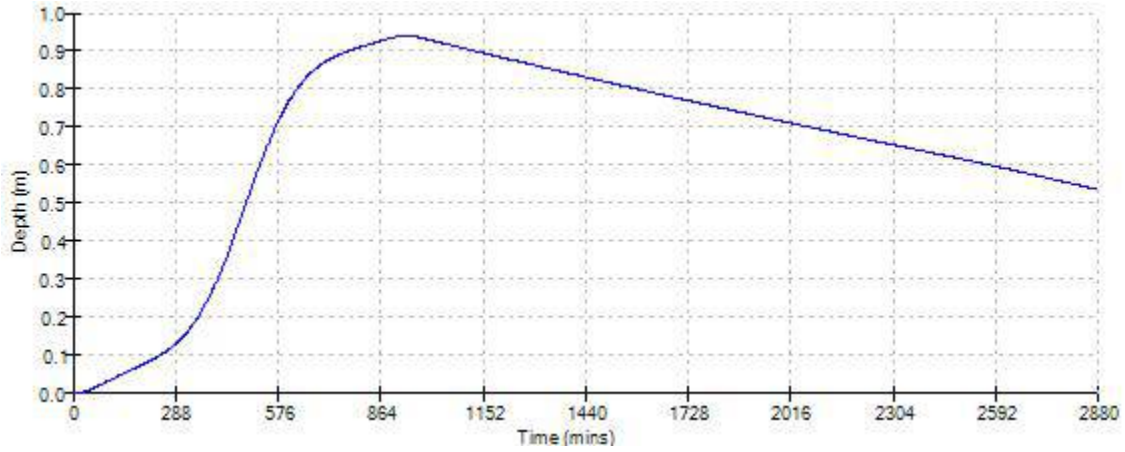


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Event: 960 min Winter

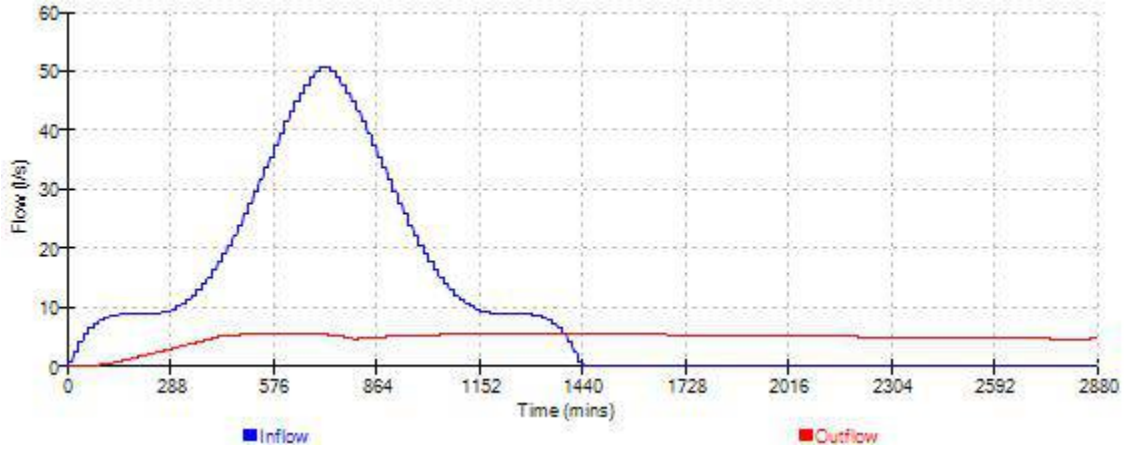


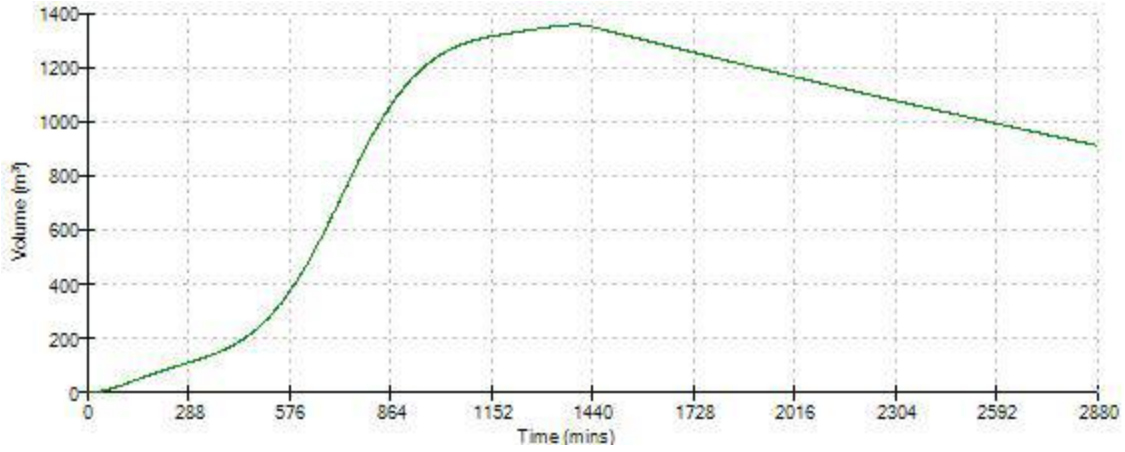


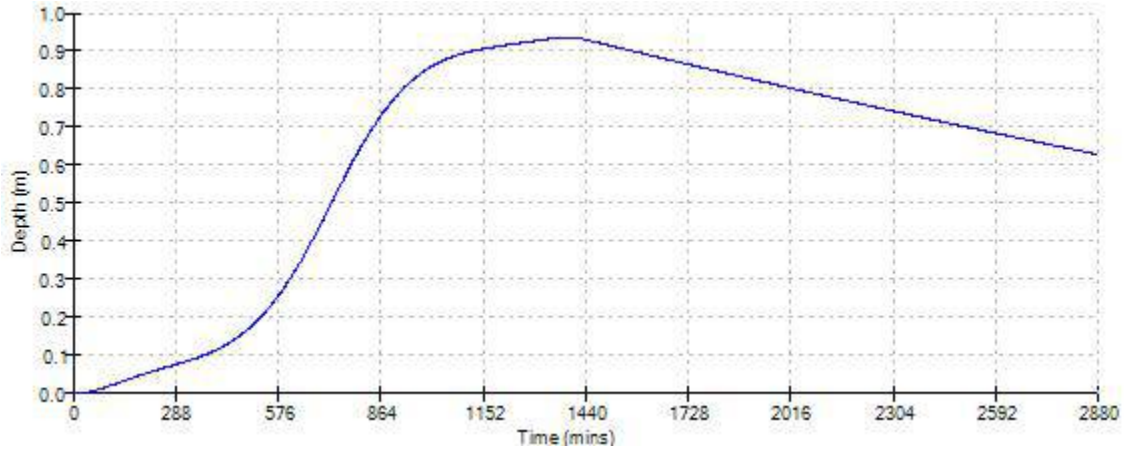


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Event: 1440 min Winter







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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	9.079	0.479	12.4	1053.3	O K
30 min Summer	9.254	0.654	12.4	1438.4	O K
60 min Summer	9.455	0.855	12.4	1880.0	O K
120 min Summer	9.614	1.014	12.4	2230.2	O K
180 min Summer	9.701	1.101	12.4	2423.3	Flood Risk
240 min Summer	9.760	1.160	12.4	2553.0	Flood Risk
360 min Summer	9.837	1.237	12.4	2721.3	Flood Risk
480 min Summer	9.884	1.284	12.4	2825.0	Flood Risk
600 min Summer	9.914	1.314	12.4	2891.6	Flood Risk
720 min Summer	9.934	1.334	12.4	2934.1	Flood Risk
960 min Summer	9.952	1.352	12.4	2973.7	Flood Risk
1440 min Summer	9.939	1.339	12.4	2945.6	Flood Risk
2160 min Summer	9.874	1.274	12.4	2801.8	Flood Risk
2880 min Summer	9.813	1.213	12.4	2668.9	Flood Risk
4320 min Summer	9.703	1.103	12.4	2427.2	Flood Risk
5760 min Summer	9.618	1.018	12.4	2238.6	O K
7200 min Summer	9.566	0.966	12.4	2124.2	O K
8640 min Summer	9.533	0.933	12.4	2053.4	O K
10080 min Summer	9.519	0.919	12.4	2022.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	155.452	0.0	895.4	18
30 min Summer	106.486	0.0	1042.5	33
60 min Summer	69.995	0.0	1786.3	64
120 min Summer	41.971	0.0	1968.2	124
180 min Summer	30.743	0.0	1953.0	184
240 min Summer	24.555	0.0	1932.2	242
360 min Summer	17.821	0.0	1900.5	362
480 min Summer	14.163	0.0	1878.6	482
600 min Summer	11.834	0.0	1861.9	602
720 min Summer	10.209	0.0	1848.0	722
960 min Summer	8.073	0.0	1825.7	962
1440 min Summer	5.765	0.0	1795.5	1440
2160 min Summer	4.088	0.0	3706.8	1884
2880 min Summer	3.199	0.0	3587.7	2272
4320 min Summer	2.258	0.0	3252.0	3028
5760 min Summer	1.778	0.0	4645.2	3864
7200 min Summer	1.508	0.0	4917.5	4688
8640 min Summer	1.337	0.0	5219.9	5536
10080 min Summer	1.225	0.0	5544.7	6448

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Winter	9.079	0.479	12.4	1053.2	O K
30 min Winter	9.254	0.654	12.4	1438.0	O K
60 min Winter	9.454	0.854	12.4	1879.6	O K
120 min Winter	9.614	1.014	12.4	2230.1	O K
180 min Winter	9.702	1.102	12.4	2423.5	Flood Risk
240 min Winter	9.761	1.161	12.4	2553.7	Flood Risk
360 min Winter	9.838	1.238	12.4	2722.8	Flood Risk
480 min Winter	9.885	1.285	12.4	2827.6	Flood Risk
600 min Winter	9.916	1.316	12.4	2895.6	Flood Risk
720 min Winter	9.936	1.336	12.4	2939.9	Flood Risk
960 min Winter	9.956	1.356	12.4	2983.1	Flood Risk
1440 min Winter	9.947	1.347	12.4	2963.7	Flood Risk
2160 min Winter	9.882	1.282	12.4	2821.5	Flood Risk
2880 min Winter	9.808	1.208	12.4	2657.8	Flood Risk
4320 min Winter	9.674	1.074	12.4	2362.1	O K
5760 min Winter	9.552	0.952	12.4	2094.8	O K
7200 min Winter	9.451	0.851	12.4	1872.9	O K
8640 min Winter	9.373	0.773	12.4	1700.8	O K
10080 min Winter	9.323	0.723	12.4	1589.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Winter	155.452	0.0	895.5	18
30 min Winter	106.486	0.0	1042.8	33
60 min Winter	69.995	0.0	1786.4	64
120 min Winter	41.971	0.0	1969.0	122
180 min Winter	30.743	0.0	1954.0	180
240 min Winter	24.555	0.0	1933.2	240
360 min Winter	17.821	0.0	1901.3	358
480 min Winter	14.163	0.0	1879.1	476
600 min Winter	11.834	0.0	1862.0	592
720 min Winter	10.209	0.0	1847.9	708
960 min Winter	8.073	0.0	1825.3	940
1440 min Winter	5.765	0.0	1795.4	1386
2160 min Winter	4.088	0.0	3709.8	2032
2880 min Winter	3.199	0.0	3599.8	2308
4320 min Winter	2.258	0.0	3296.1	3240
5760 min Winter	1.778	0.0	4646.1	4152
7200 min Winter	1.508	0.0	4921.0	5040
8640 min Winter	1.337	0.0	5228.5	5872
10080 min Winter	1.225	0.0	5568.6	6656

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 331208 350156 SJ 31208 50156
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	1.000
Cv (Winter)	1.000
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 2.732

Time (mins) From:	To:	Area (ha)
0	3	2.732

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Model Details

Storage is Online Cover Level (m) 10.000

Tank or Pond Structure

Invert Level (m) 8.600

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	2200.0	1.400	2200.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0155-1240-1400-1240
Design Head (m)	1.400
Design Flow (l/s)	12.4
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	155
Invert Level (m)	8.595
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

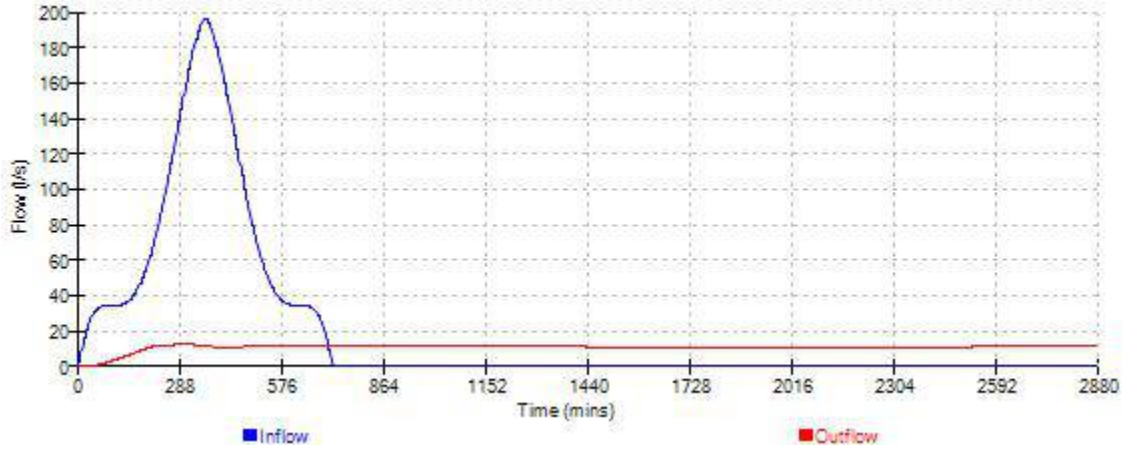
Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.400	12.4
Flush-Flo™	0.410	12.4
Kick-Flo®	0.891	10.0
Mean Flow over Head Range	-	10.8

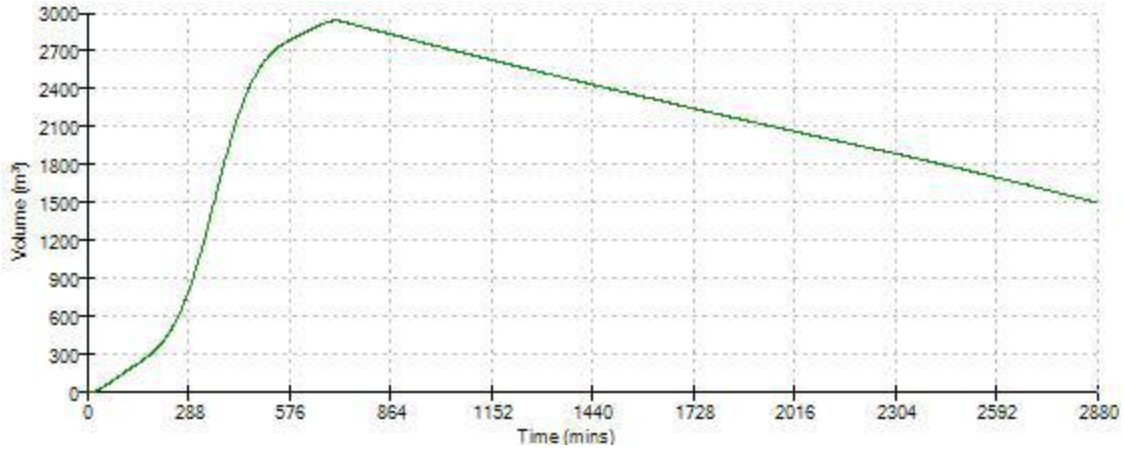
The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

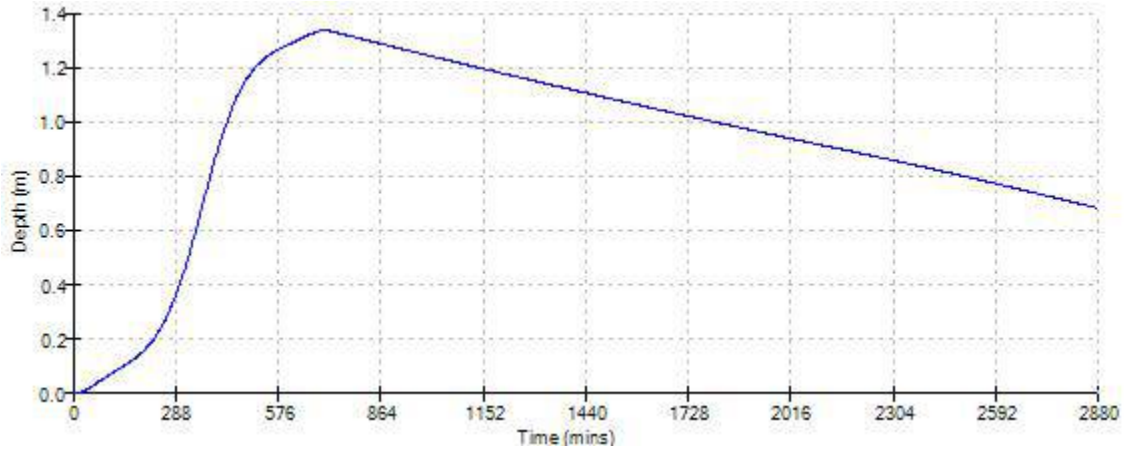
Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	5.6	1.600	13.2	5.000	22.7
0.200	11.4	1.800	14.0	5.500	23.8
0.300	12.2	2.000	14.7	6.000	24.8
0.400	12.4	2.200	15.4	6.500	25.8
0.500	12.3	2.400	16.0	7.000	26.7
0.600	12.1	2.600	16.6	7.500	27.6
0.800	11.1	3.000	17.8	8.000	28.5
1.000	10.6	3.500	19.2	8.500	29.3
1.200	11.5	4.000	20.4	9.000	30.2
1.400	12.4	4.500	21.6	9.500	31.0

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Event: 720 min Winter

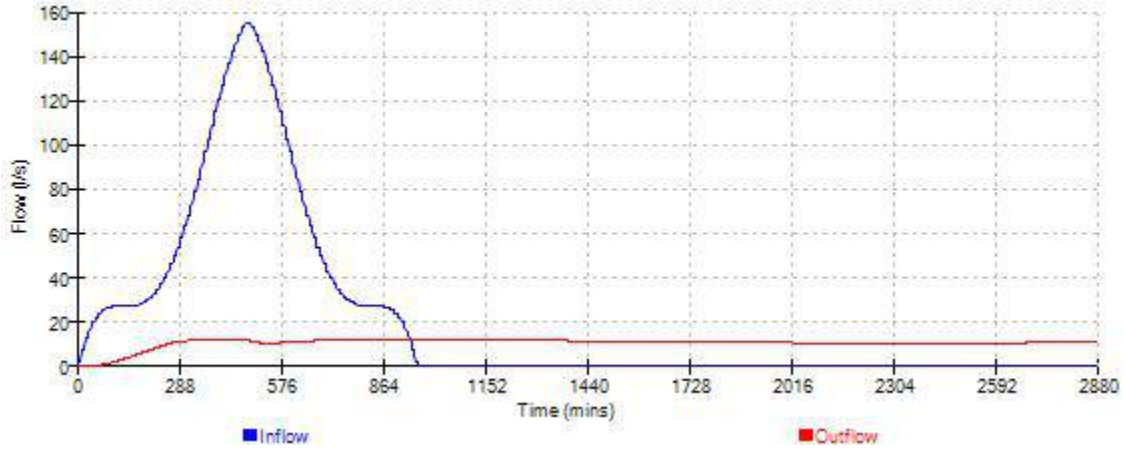


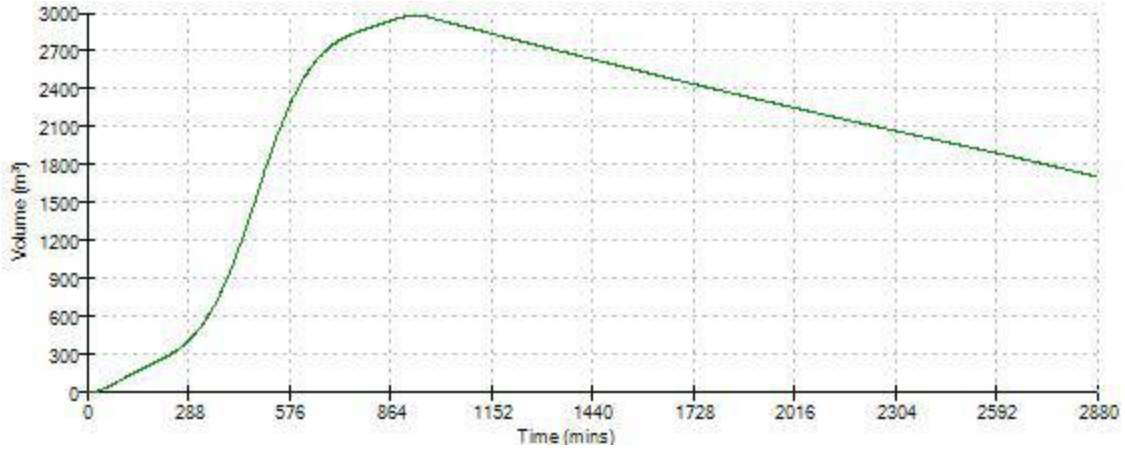


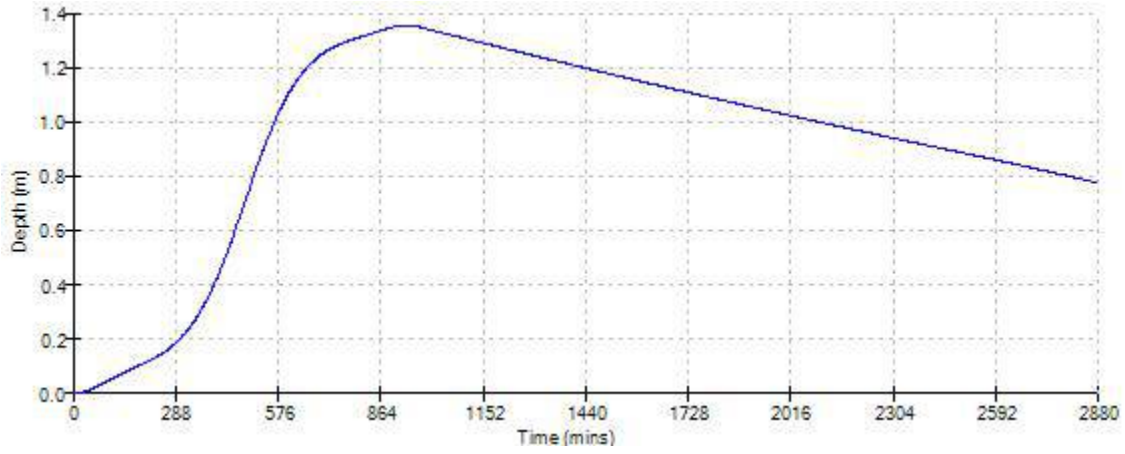


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Event: 960 min Winter

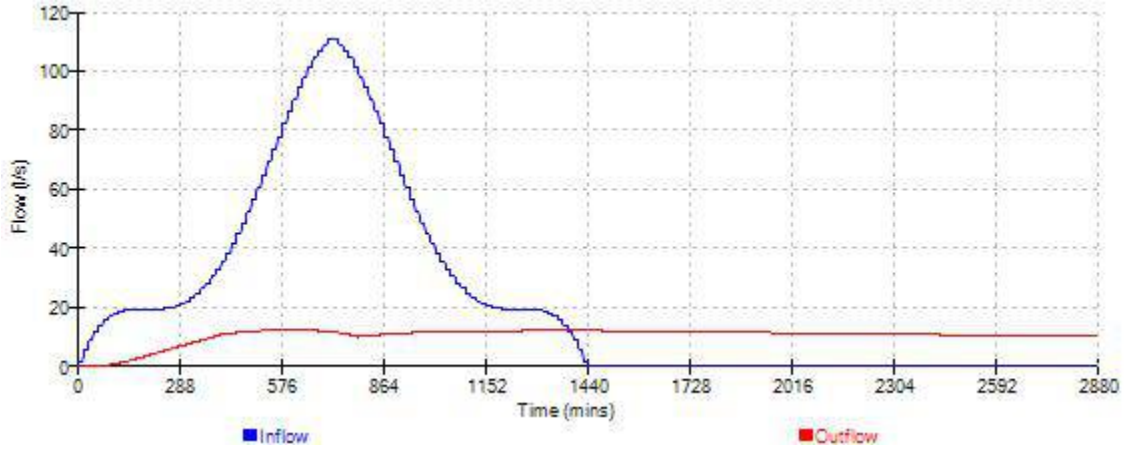


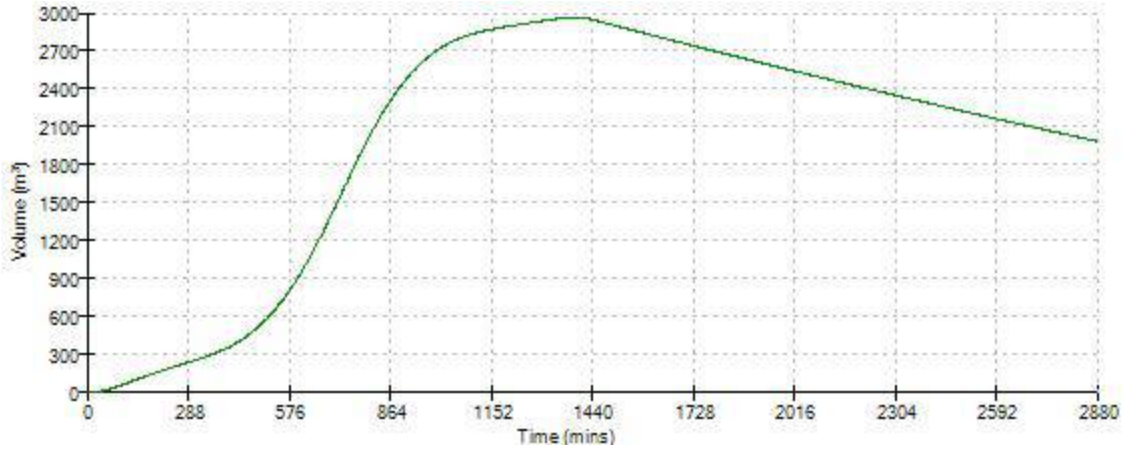


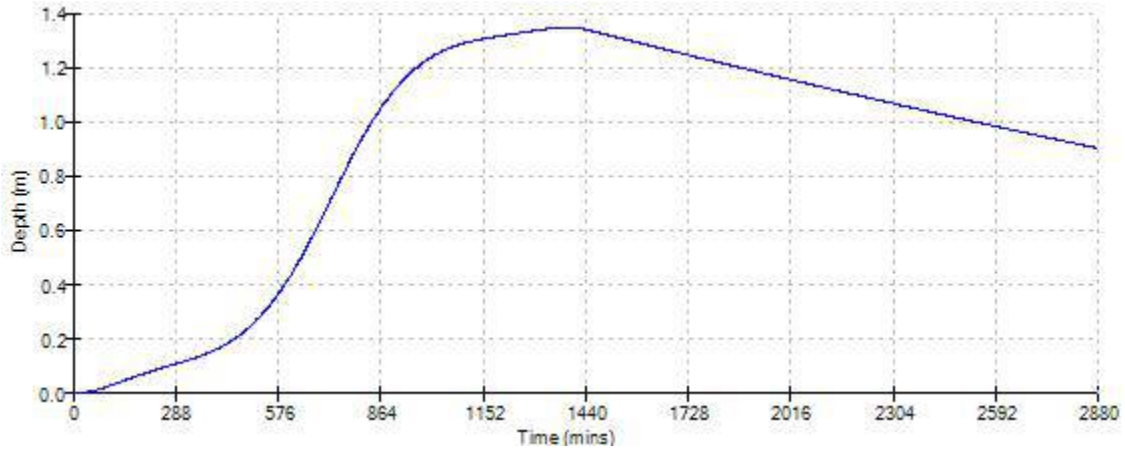


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Event: 1440 min Winter







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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	9.327	0.327	2.3	196.0	O K
30 min Summer	9.446	0.446	2.3	267.5	O K
60 min Summer	9.582	0.582	2.3	349.4	O K
120 min Summer	9.691	0.691	2.3	414.4	O K
180 min Summer	9.750	0.750	2.3	450.2	Flood Risk
240 min Summer	9.790	0.790	2.3	474.2	Flood Risk
360 min Summer	9.842	0.842	2.3	505.2	Flood Risk
480 min Summer	9.874	0.874	2.3	524.3	Flood Risk
600 min Summer	9.894	0.894	2.3	536.5	Flood Risk
720 min Summer	9.907	0.907	2.3	544.3	Flood Risk
960 min Summer	9.919	0.919	2.3	551.5	Flood Risk
1440 min Summer	9.910	0.910	2.3	546.0	Flood Risk
2160 min Summer	9.864	0.864	2.3	518.2	Flood Risk
2880 min Summer	9.821	0.821	2.3	492.3	Flood Risk
4320 min Summer	9.743	0.743	2.3	445.9	Flood Risk
5760 min Summer	9.683	0.683	2.3	410.0	O K
7200 min Summer	9.647	0.647	2.3	388.1	O K
8640 min Summer	9.623	0.623	2.3	373.9	O K
10080 min Summer	9.612	0.612	2.3	367.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	155.452	0.0	171.2	16
30 min Summer	106.486	0.0	193.0	31
60 min Summer	69.995	0.0	338.2	62
120 min Summer	41.971	0.0	366.1	122
180 min Summer	30.743	0.0	363.3	182
240 min Summer	24.555	0.0	359.5	242
360 min Summer	17.821	0.0	353.5	362
480 min Summer	14.163	0.0	349.2	482
600 min Summer	11.834	0.0	345.8	602
720 min Summer	10.209	0.0	343.0	722
960 min Summer	8.073	0.0	338.6	960
1440 min Summer	5.765	0.0	332.5	1440
2160 min Summer	4.088	0.0	689.0	1924
2880 min Summer	3.199	0.0	668.4	2280
4320 min Summer	2.258	0.0	608.5	3068
5760 min Summer	1.778	0.0	866.7	3912
7200 min Summer	1.508	0.0	917.9	4752
8640 min Summer	1.337	0.0	975.1	5616
10080 min Summer	1.225	0.0	1037.5	6448

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Winter	9.327	0.327	2.3	195.9	O K
30 min Winter	9.446	0.446	2.3	267.4	O K
60 min Winter	9.582	0.582	2.3	349.4	O K
120 min Winter	9.690	0.690	2.3	414.3	O K
180 min Winter	9.750	0.750	2.3	450.2	Flood Risk
240 min Winter	9.790	0.790	2.3	474.2	Flood Risk
360 min Winter	9.843	0.843	2.3	505.5	Flood Risk
480 min Winter	9.875	0.875	2.3	524.8	Flood Risk
600 min Winter	9.896	0.896	2.3	537.3	Flood Risk
720 min Winter	9.909	0.909	2.3	545.5	Flood Risk
960 min Winter	9.922	0.922	2.3	553.3	Flood Risk
1440 min Winter	9.915	0.915	2.3	549.3	Flood Risk
2160 min Winter	9.870	0.870	2.3	522.3	Flood Risk
2880 min Winter	9.817	0.817	2.3	490.4	Flood Risk
4320 min Winter	9.723	0.723	2.3	434.0	Flood Risk
5760 min Winter	9.637	0.637	2.3	382.5	O K
7200 min Winter	9.566	0.566	2.3	339.5	O K
8640 min Winter	9.516	0.516	2.3	309.5	O K
10080 min Winter	9.483	0.483	2.3	290.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Winter	155.452	0.0	171.2	16
30 min Winter	106.486	0.0	193.0	31
60 min Winter	69.995	0.0	338.3	62
120 min Winter	41.971	0.0	366.2	122
180 min Winter	30.743	0.0	363.4	180
240 min Winter	24.555	0.0	359.7	240
360 min Winter	17.821	0.0	353.6	358
480 min Winter	14.163	0.0	349.1	476
600 min Winter	11.834	0.0	345.7	590
720 min Winter	10.209	0.0	342.9	708
960 min Winter	8.073	0.0	338.4	940
1440 min Winter	5.765	0.0	332.4	1386
2160 min Winter	4.088	0.0	689.6	2032
2880 min Winter	3.199	0.0	670.7	2336
4320 min Winter	2.258	0.0	617.3	3244
5760 min Winter	1.778	0.0	866.8	4200
7200 min Winter	1.508	0.0	918.4	4976
8640 min Winter	1.337	0.0	976.1	5800
10080 min Winter	1.225	0.0	1040.4	6656

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 331208 350156 SJ 31208 50156
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	1.000
Cv (Winter)	1.000
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.508

Time (mins) From:	To:	Area (ha)
0	1	0.508

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Model Details

Storage is Online Cover Level (m) 10.000

Tank or Pond Structure

Invert Level (m) 9.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	600.0	1.000	600.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0072-2300-1000-2300
Design Head (m)	1.000
Design Flow (l/s)	2.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	72
Invert Level (m)	8.995
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

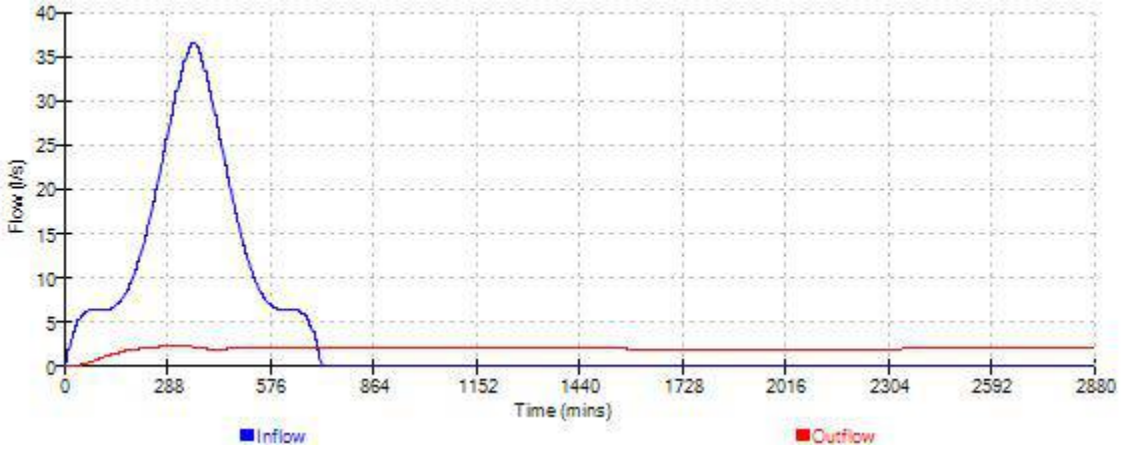
Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	2.3
Flush-Flo™	0.307	2.3
Kick-Flo®	0.625	1.9
Mean Flow over Head Range	-	2.0

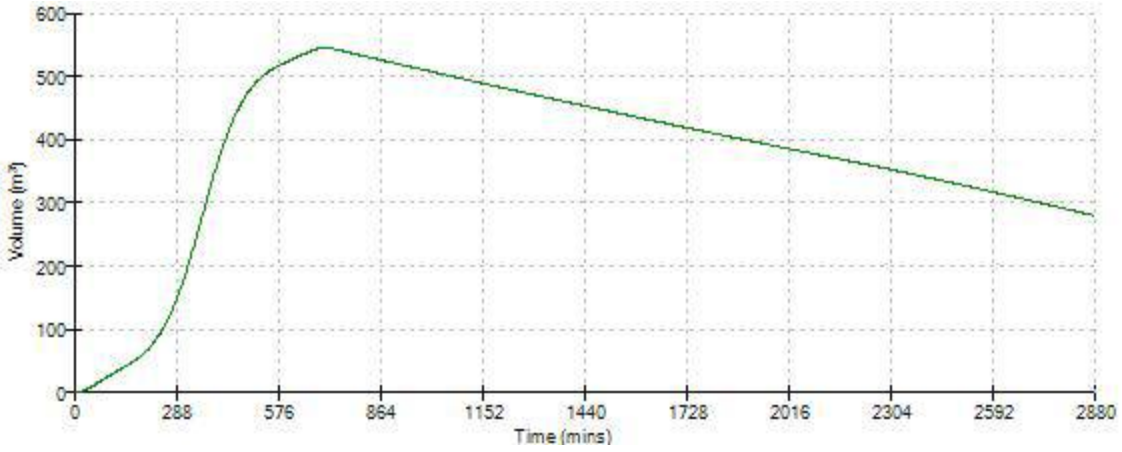
The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

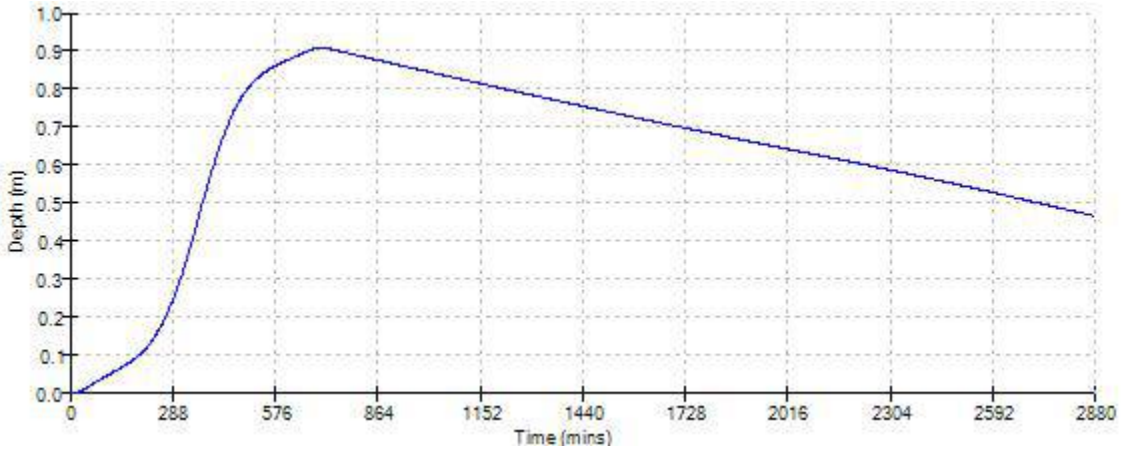
Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.9	1.600	2.9	5.000	4.8
0.200	2.2	1.800	3.0	5.500	5.1
0.300	2.3	2.000	3.2	6.000	5.3
0.400	2.3	2.200	3.3	6.500	5.5
0.500	2.2	2.400	3.4	7.000	5.7
0.600	2.0	2.600	3.6	7.500	5.9
0.800	2.1	3.000	3.8	8.000	6.0
1.000	2.3	3.500	4.1	8.500	6.2
1.200	2.5	4.000	4.4	9.000	6.4
1.400	2.7	4.500	4.6	9.500	6.6

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Event: 720 min Winter

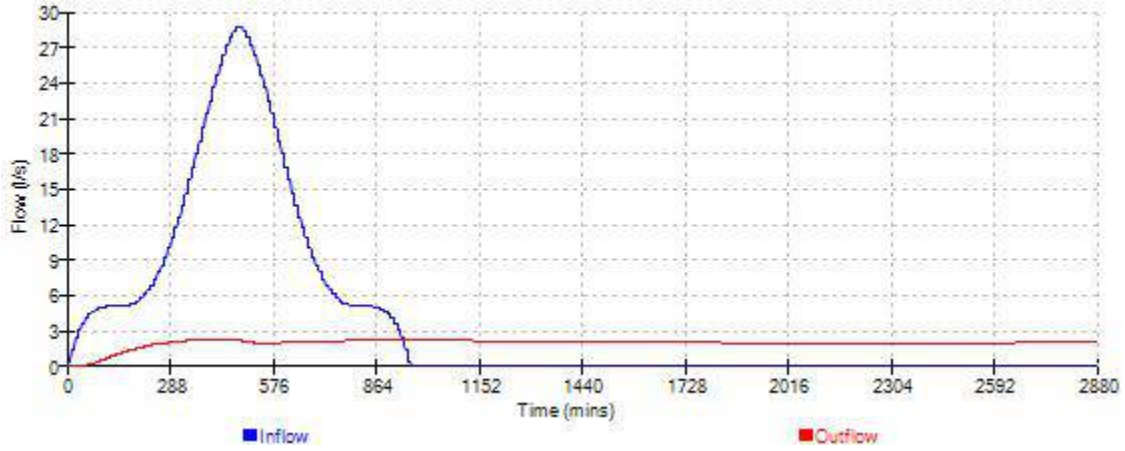


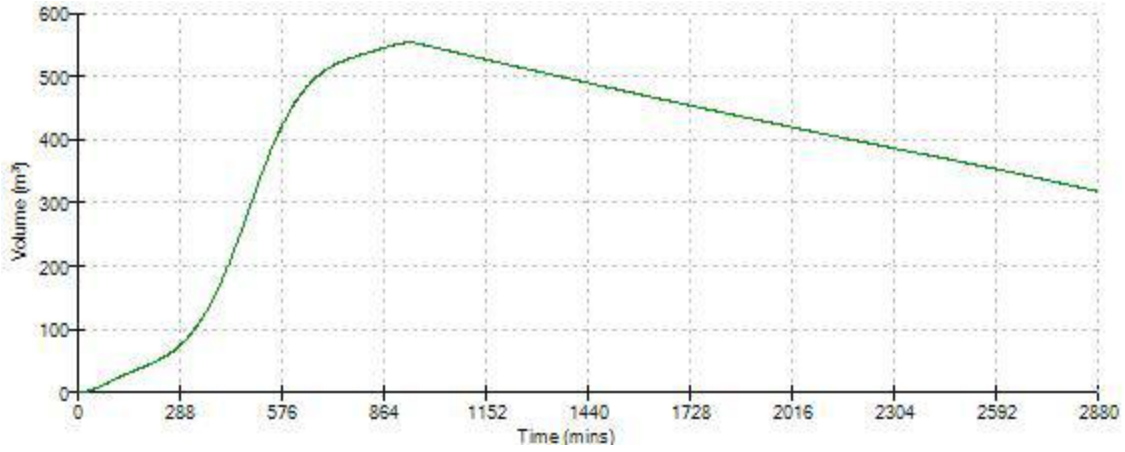


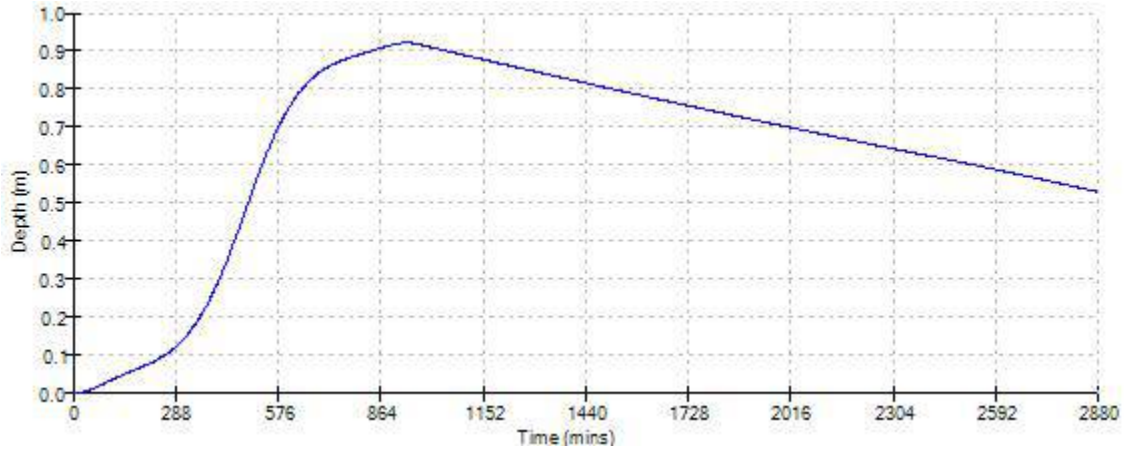


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Event: 960 min Winter

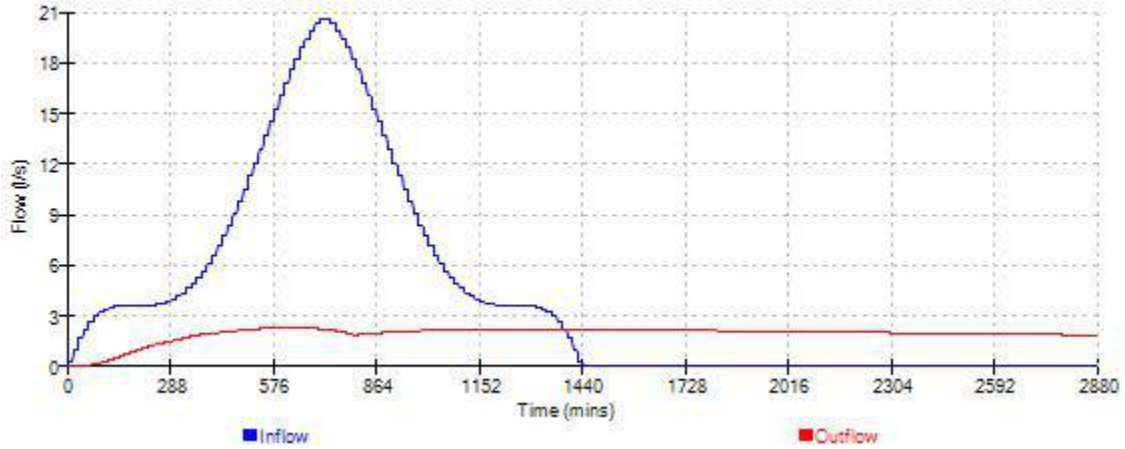


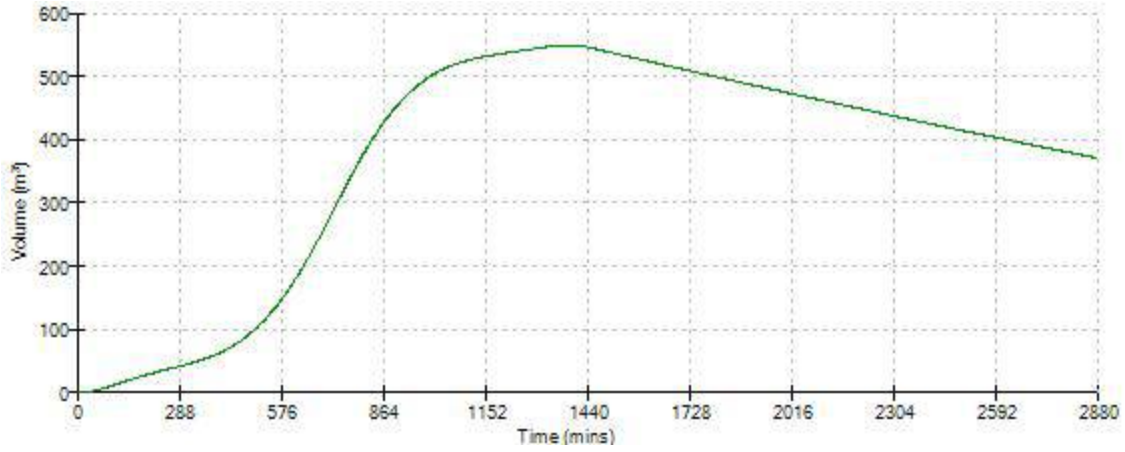


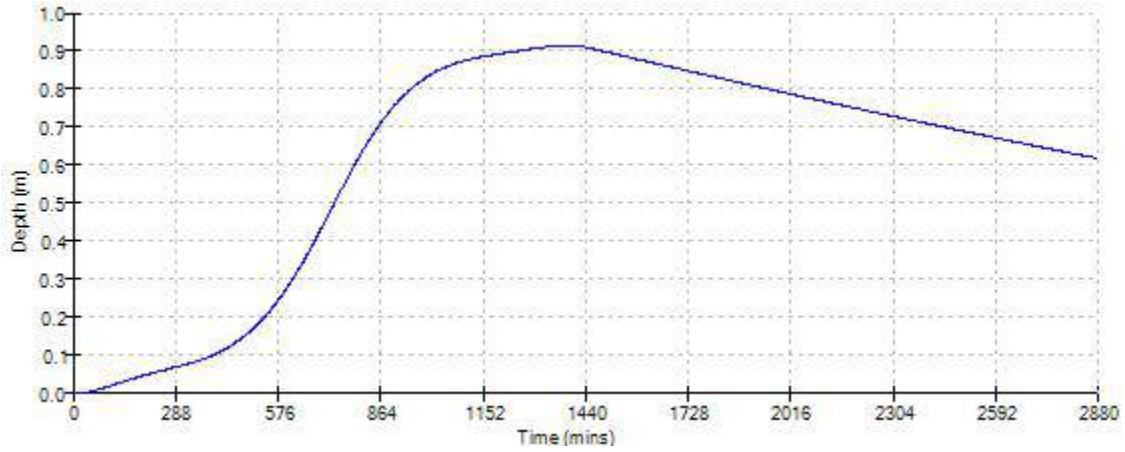


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Event: 1440 min Winter







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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	9.217	0.417	6.4	541.5	O K
30 min Summer	9.369	0.569	6.4	739.2	O K
60 min Summer	9.543	0.743	6.4	966.4	O K
120 min Summer	9.681	0.881	6.4	1145.8	O K
180 min Summer	9.757	0.957	6.4	1244.6	Flood Risk
240 min Summer	9.808	1.008	6.4	1310.7	Flood Risk
360 min Summer	9.874	1.074	6.4	1396.2	Flood Risk
480 min Summer	9.914	1.114	6.4	1448.7	Flood Risk
600 min Summer	9.940	1.140	6.4	1482.1	Flood Risk
720 min Summer	9.956	1.156	6.4	1503.3	Flood Risk
960 min Summer	9.971	1.171	6.4	1522.4	Flood Risk
1440 min Summer	9.958	1.158	6.4	1505.5	Flood Risk
2160 min Summer	9.900	1.100	6.4	1429.4	Flood Risk
2880 min Summer	9.846	1.046	6.4	1359.8	Flood Risk
4320 min Summer	9.750	0.950	6.4	1234.6	Flood Risk
5760 min Summer	9.675	0.875	6.4	1137.9	O K
7200 min Summer	9.631	0.831	6.4	1080.0	O K
8640 min Summer	9.604	0.804	6.4	1044.6	O K
10080 min Summer	9.592	0.792	6.4	1029.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	155.452	0.0	468.3	17
30 min Summer	106.486	0.0	535.3	32
60 min Summer	69.995	0.0	925.6	62
120 min Summer	41.971	0.0	1010.2	122
180 min Summer	30.743	0.0	1002.8	182
240 min Summer	24.555	0.0	993.4	242
360 min Summer	17.821	0.0	979.3	362
480 min Summer	14.163	0.0	969.6	482
600 min Summer	11.834	0.0	962.3	602
720 min Summer	10.209	0.0	956.4	722
960 min Summer	8.073	0.0	947.2	960
1440 min Summer	5.765	0.0	935.6	1440
2160 min Summer	4.088	0.0	1915.9	1880
2880 min Summer	3.199	0.0	1856.6	2252
4320 min Summer	2.258	0.0	1685.6	3028
5760 min Summer	1.778	0.0	2391.0	3864
7200 min Summer	1.508	0.0	2531.7	4688
8640 min Summer	1.337	0.0	2688.2	5536
10080 min Summer	1.225	0.0	2857.3	6360

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Winter	9.216	0.416	6.4	541.4	O K
30 min Winter	9.369	0.569	6.4	739.1	O K
60 min Winter	9.543	0.743	6.4	966.2	O K
120 min Winter	9.681	0.881	6.4	1145.4	O K
180 min Winter	9.757	0.957	6.4	1244.6	Flood Risk
240 min Winter	9.808	1.008	6.4	1311.0	Flood Risk
360 min Winter	9.875	1.075	6.4	1397.1	Flood Risk
480 min Winter	9.916	1.116	6.4	1450.3	Flood Risk
600 min Winter	9.942	1.142	6.4	1484.6	Flood Risk
720 min Winter	9.959	1.159	6.4	1506.8	Flood Risk
960 min Winter	9.975	1.175	6.4	1527.8	Flood Risk
1440 min Winter	9.966	1.166	6.4	1515.7	Flood Risk
2160 min Winter	9.908	1.108	6.4	1440.1	Flood Risk
2880 min Winter	9.842	1.042	6.4	1355.2	Flood Risk
4320 min Winter	9.725	0.925	6.4	1202.2	Flood Risk
5760 min Winter	9.620	0.820	6.4	1066.0	O K
7200 min Winter	9.536	0.736	6.4	957.0	O K
8640 min Winter	9.466	0.666	6.4	866.0	O K
10080 min Winter	9.422	0.622	6.4	808.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Winter	155.452	0.0	468.3	17
30 min Winter	106.486	0.0	535.4	32
60 min Winter	69.995	0.0	925.6	62
120 min Winter	41.971	0.0	1010.5	122
180 min Winter	30.743	0.0	1003.1	180
240 min Winter	24.555	0.0	993.7	240
360 min Winter	17.821	0.0	979.4	358
480 min Winter	14.163	0.0	969.5	474
600 min Winter	11.834	0.0	962.0	590
720 min Winter	10.209	0.0	955.8	708
960 min Winter	8.073	0.0	946.5	940
1440 min Winter	5.765	0.0	934.9	1384
2160 min Winter	4.088	0.0	1916.6	2028
2880 min Winter	3.199	0.0	1861.5	2304
4320 min Winter	2.258	0.0	1706.4	3240
5760 min Winter	1.778	0.0	2391.4	4152
7200 min Winter	1.508	0.0	2533.0	5048
8640 min Winter	1.337	0.0	2691.8	5872
10080 min Winter	1.225	0.0	2868.2	6656

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 331208 350156 SJ 31208 50156
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	1.000
Cv (Winter)	1.000
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.404

Time (mins) From:	To:	Area (ha)
0	2	1.404

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Model Details

Storage is Online Cover Level (m) 10.000

Tank or Pond Structure

Invert Level (m) 8.800

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1300.0	1.200	1300.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0116-6400-1200-6400
Design Head (m)	1.200
Design Flow (l/s)	6.4
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	116
Invert Level (m)	8.795
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

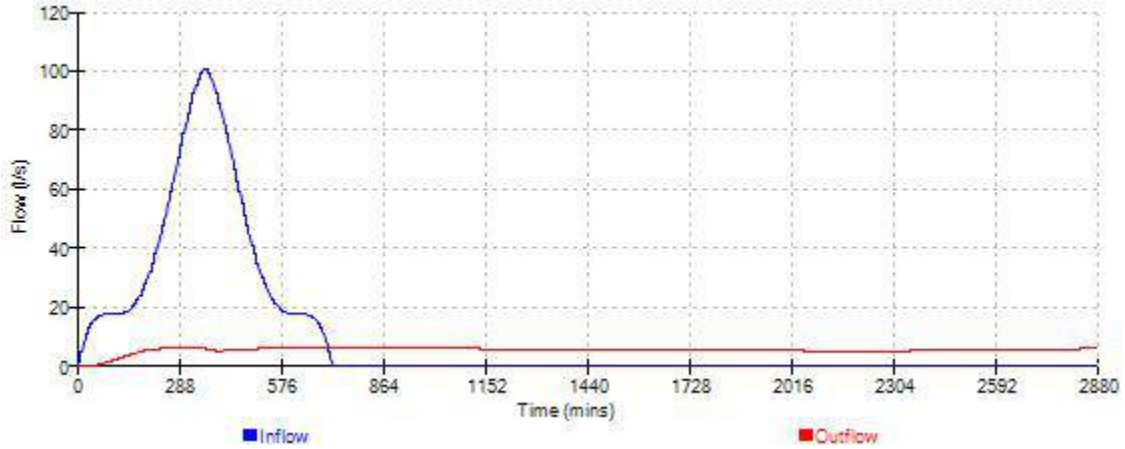
Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	6.4
Flush-Flo™	0.354	6.4
Kick-Flo®	0.751	5.1
Mean Flow over Head Range	-	5.6

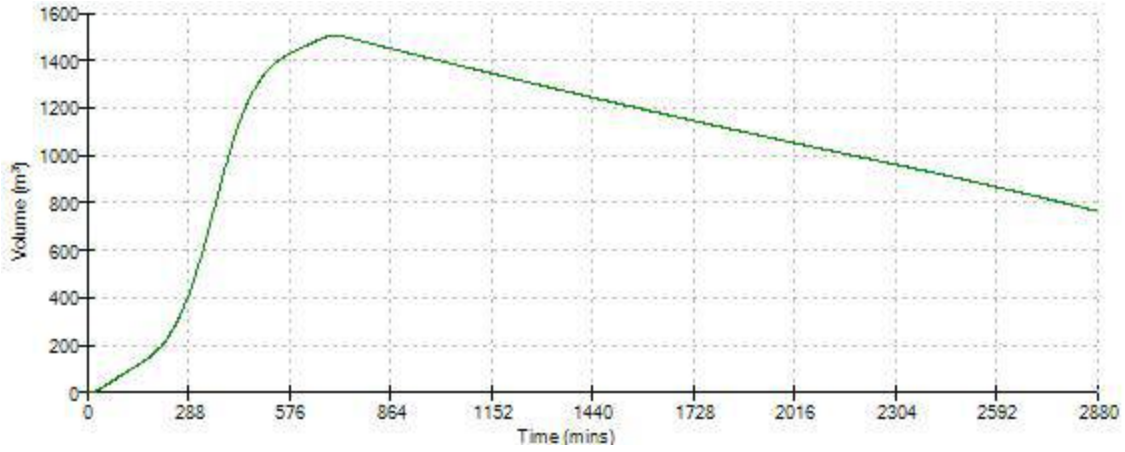
The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

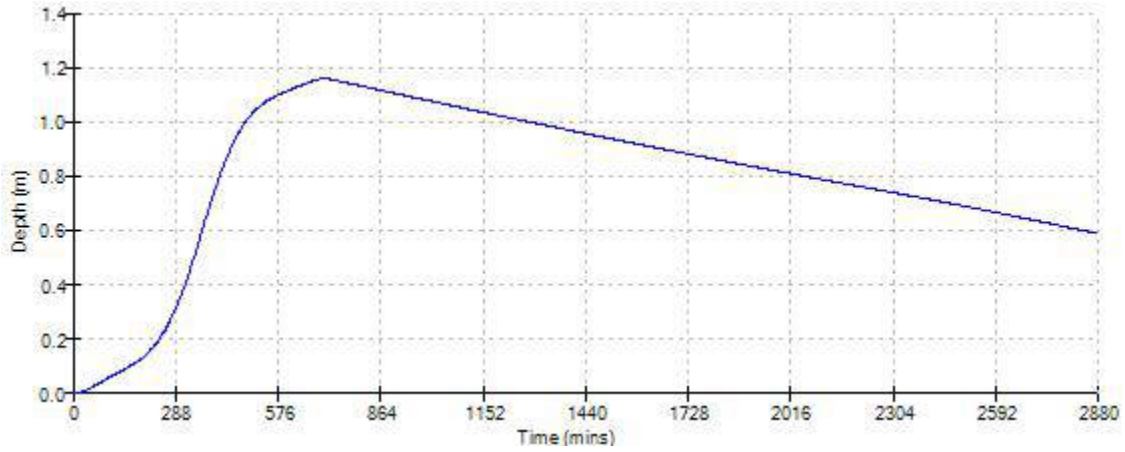
Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	4.1	1.600	7.3	5.000	12.5
0.200	6.0	1.800	7.7	5.500	13.1
0.300	6.3	2.000	8.1	6.000	13.7
0.400	6.3	2.200	8.5	6.500	14.2
0.500	6.2	2.400	8.9	7.000	14.7
0.600	6.0	2.600	9.2	7.500	15.2
0.800	5.3	3.000	9.8	8.000	15.7
1.000	5.9	3.500	10.6	8.500	16.2
1.200	6.4	4.000	11.3	9.000	16.6
1.400	6.9	4.500	11.9	9.500	17.0

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Event: 720 min Winter

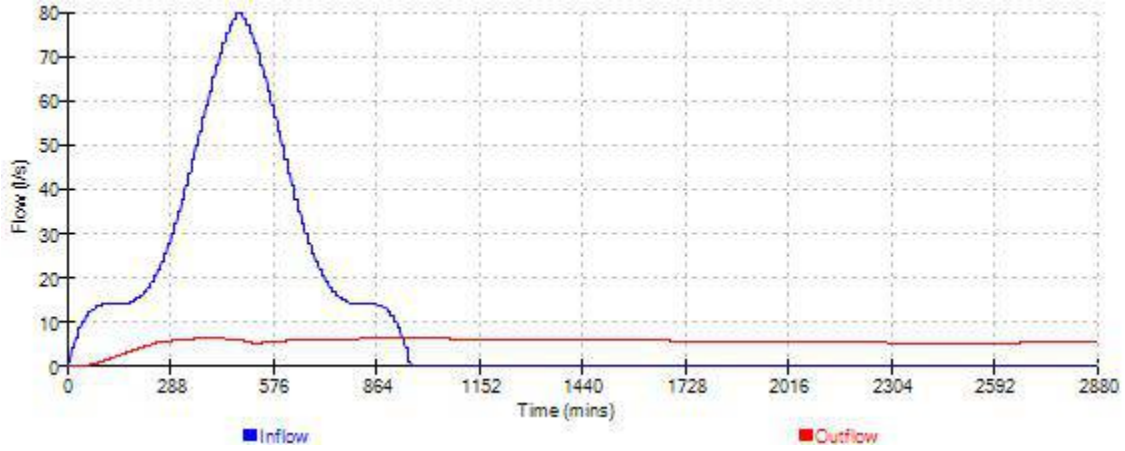


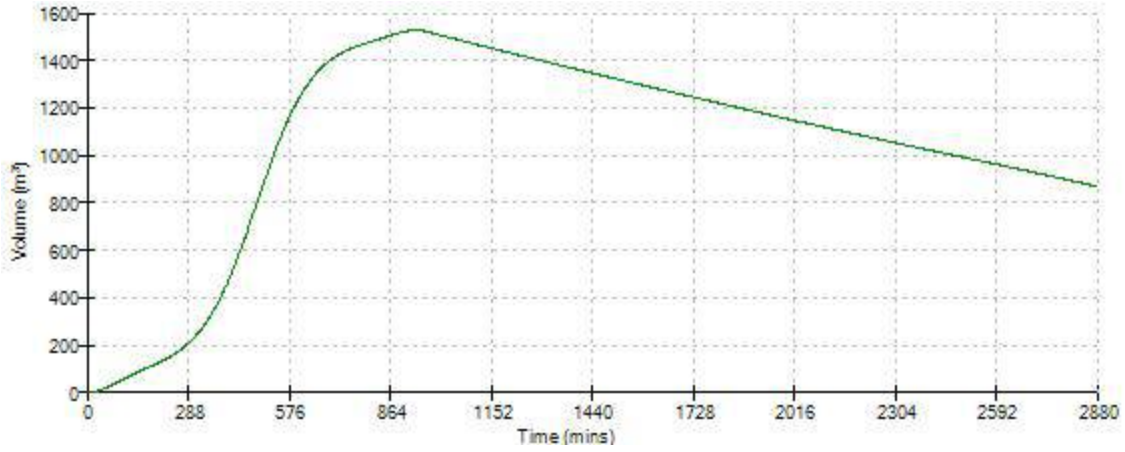


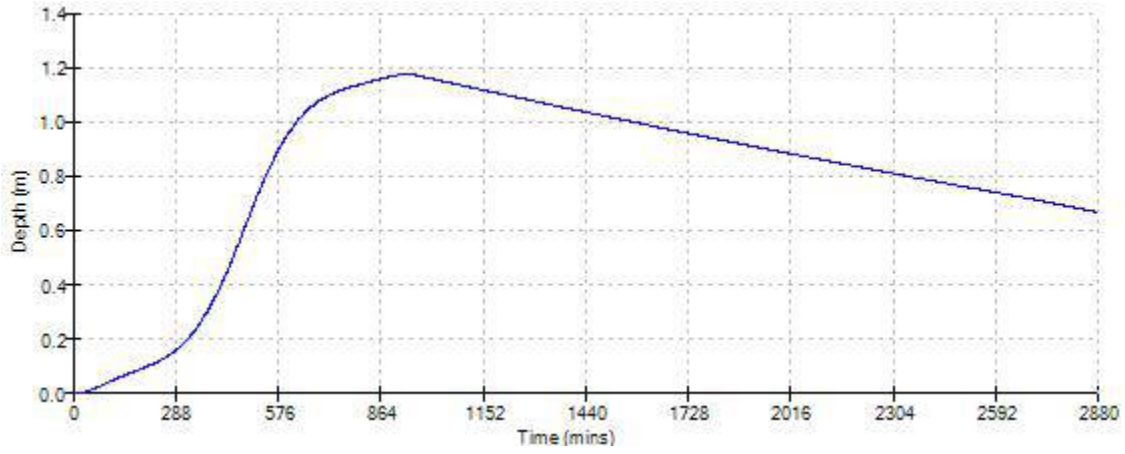


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Event: 960 min Winter

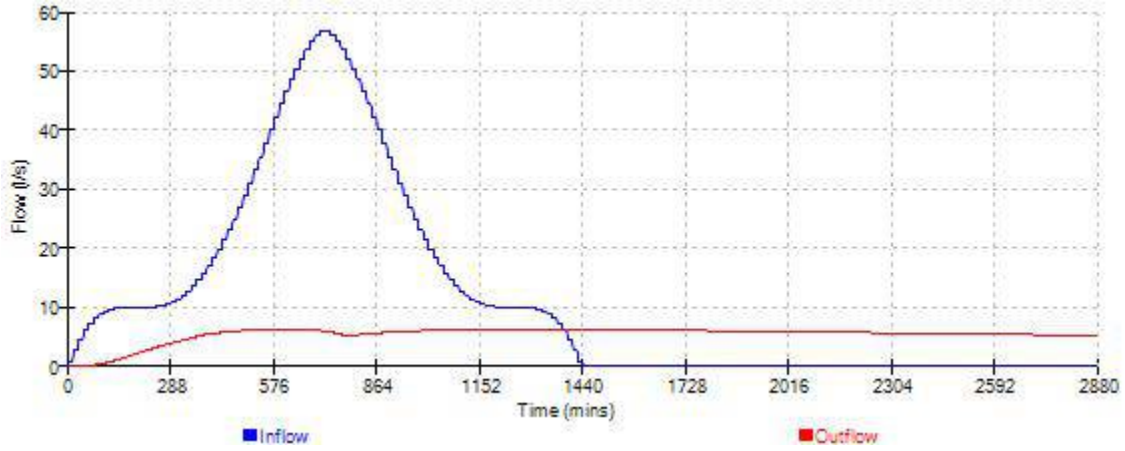


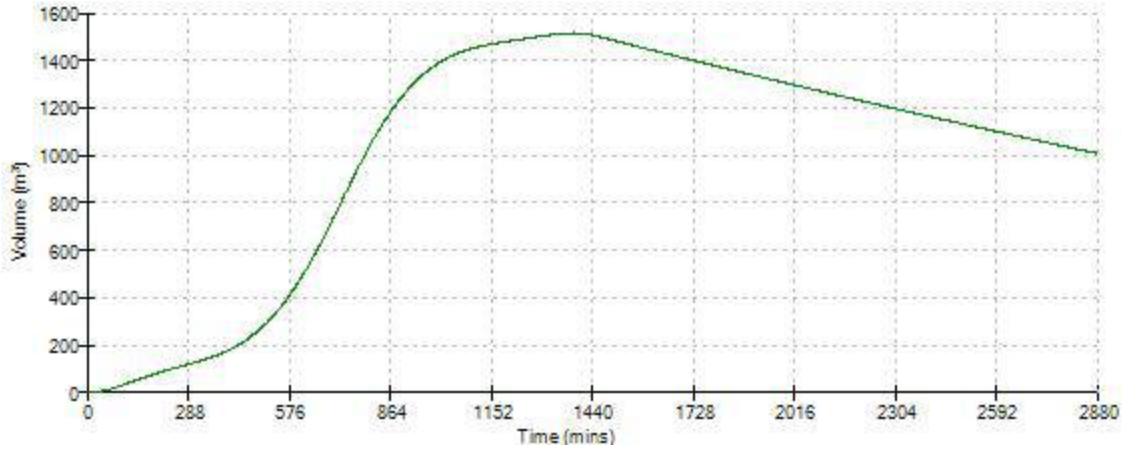


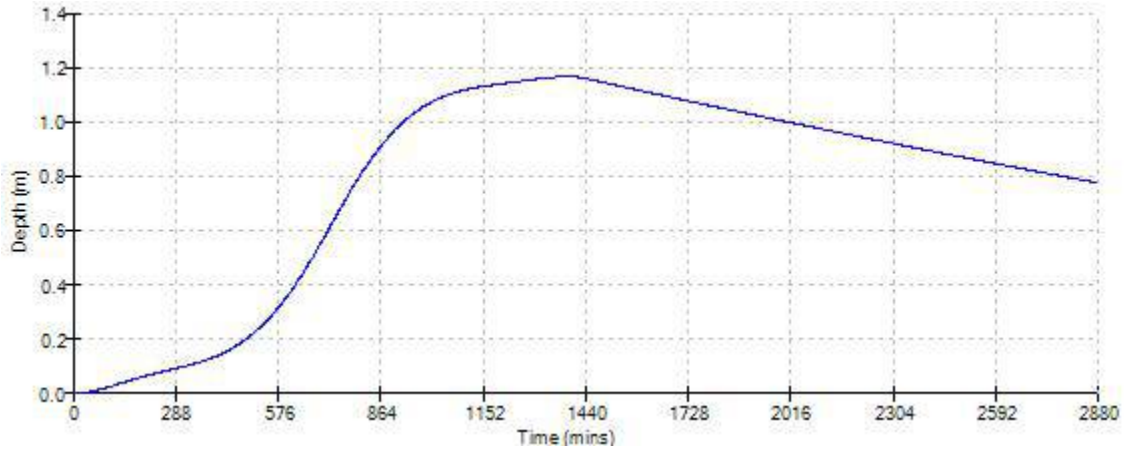


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Event: 1440 min Winter







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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	9.335	0.335	2.8	234.5	O K
30 min Summer	9.457	0.457	2.8	320.1	O K
60 min Summer	9.597	0.597	2.8	418.2	O K
120 min Summer	9.708	0.708	2.8	495.8	Flood Risk
180 min Summer	9.769	0.769	2.8	538.5	Flood Risk
240 min Summer	9.810	0.810	2.8	567.0	Flood Risk
360 min Summer	9.863	0.863	2.8	603.8	Flood Risk
480 min Summer	9.895	0.895	2.8	626.4	Flood Risk
600 min Summer	9.915	0.915	2.8	640.7	Flood Risk
720 min Summer	9.928	0.928	2.8	649.7	Flood Risk
960 min Summer	9.940	0.940	2.8	657.7	Flood Risk
1440 min Summer	9.928	0.928	2.8	649.8	Flood Risk
2160 min Summer	9.880	0.880	2.8	616.0	Flood Risk
2880 min Summer	9.836	0.836	2.8	585.0	Flood Risk
4320 min Summer	9.757	0.757	2.8	529.6	Flood Risk
5760 min Summer	9.695	0.695	2.8	486.5	O K
7200 min Summer	9.657	0.657	2.8	460.2	O K
8640 min Summer	9.633	0.633	2.8	443.4	O K
10080 min Summer	9.622	0.622	2.8	435.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	155.452	0.0	206.0	16
30 min Summer	106.486	0.0	235.0	31
60 min Summer	69.995	0.0	405.2	62
120 min Summer	41.971	0.0	443.9	122
180 min Summer	30.743	0.0	441.3	182
240 min Summer	24.555	0.0	437.1	242
360 min Summer	17.821	0.0	430.2	362
480 min Summer	14.163	0.0	425.3	482
600 min Summer	11.834	0.0	421.5	602
720 min Summer	10.209	0.0	418.3	722
960 min Summer	8.073	0.0	413.2	960
1440 min Summer	5.765	0.0	406.4	1440
2160 min Summer	4.088	0.0	837.4	1884
2880 min Summer	3.199	0.0	813.8	2272
4320 min Summer	2.258	0.0	739.7	3028
5760 min Summer	1.778	0.0	1037.1	3864
7200 min Summer	1.508	0.0	1098.3	4688
8640 min Summer	1.337	0.0	1166.7	5536
10080 min Summer	1.225	0.0	1241.7	6448

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Winter	9.335	0.335	2.8	234.5	O K
30 min Winter	9.457	0.457	2.8	320.0	O K
60 min Winter	9.597	0.597	2.8	418.1	O K
120 min Winter	9.708	0.708	2.8	495.7	Flood Risk
180 min Winter	9.769	0.769	2.8	538.5	Flood Risk
240 min Winter	9.810	0.810	2.8	567.1	Flood Risk
360 min Winter	9.863	0.863	2.8	604.2	Flood Risk
480 min Winter	9.896	0.896	2.8	627.1	Flood Risk
600 min Winter	9.917	0.917	2.8	641.7	Flood Risk
720 min Winter	9.930	0.930	2.8	651.1	Flood Risk
960 min Winter	9.943	0.943	2.8	659.9	Flood Risk
1440 min Winter	9.934	0.934	2.8	654.1	Flood Risk
2160 min Winter	9.886	0.886	2.8	620.5	Flood Risk
2880 min Winter	9.832	0.832	2.8	582.6	Flood Risk
4320 min Winter	9.735	0.735	2.8	514.5	Flood Risk
5760 min Winter	9.647	0.647	2.8	452.9	O K
7200 min Winter	9.572	0.572	2.8	400.7	O K
8640 min Winter	9.519	0.519	2.8	363.2	O K
10080 min Winter	9.484	0.484	2.8	338.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Winter	155.452	0.0	206.0	16
30 min Winter	106.486	0.0	235.1	31
60 min Winter	69.995	0.0	405.2	62
120 min Winter	41.971	0.0	444.0	122
180 min Winter	30.743	0.0	441.4	180
240 min Winter	24.555	0.0	437.2	240
360 min Winter	17.821	0.0	430.3	358
480 min Winter	14.163	0.0	425.2	474
600 min Winter	11.834	0.0	421.3	590
720 min Winter	10.209	0.0	418.1	708
960 min Winter	8.073	0.0	413.0	940
1440 min Winter	5.765	0.0	406.2	1384
2160 min Winter	4.088	0.0	837.9	2032
2880 min Winter	3.199	0.0	816.4	2308
4320 min Winter	2.258	0.0	750.2	3240
5760 min Winter	1.778	0.0	1037.2	4152
7200 min Winter	1.508	0.0	1098.9	4976
8640 min Winter	1.337	0.0	1168.0	5792
10080 min Winter	1.225	0.0	1245.1	6648

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 331208 350156 SJ 31208 50156
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	1.000
Cv (Winter)	1.000
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.608

Time (mins) From:	To:	Area (ha)
0	1	0.608

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Model Details

Storage is Online Cover Level (m) 10.000

Tank or Pond Structure

Invert Level (m) 9.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	700.0	1.000	700.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0080-2800-1000-2800
Design Head (m)	1.000
Design Flow (l/s)	2.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	80
Invert Level (m)	8.995
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

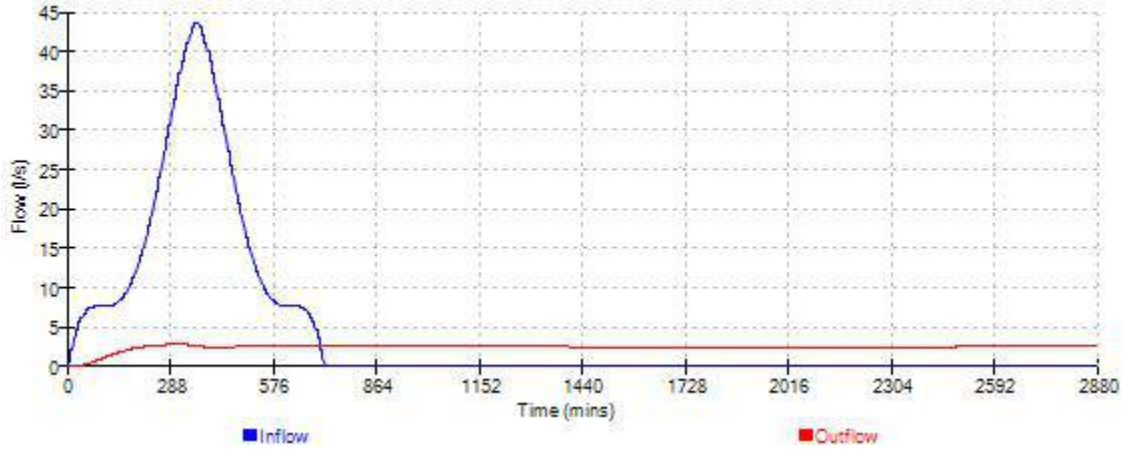
Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	2.8
Flush-Flo™	0.299	2.8
Kick-Flo®	0.623	2.3
Mean Flow over Head Range	-	2.5

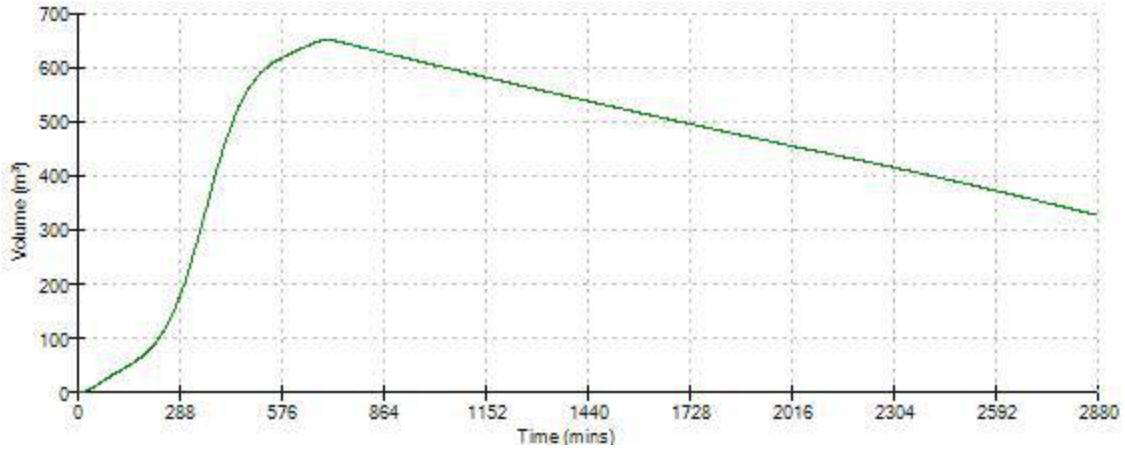
The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

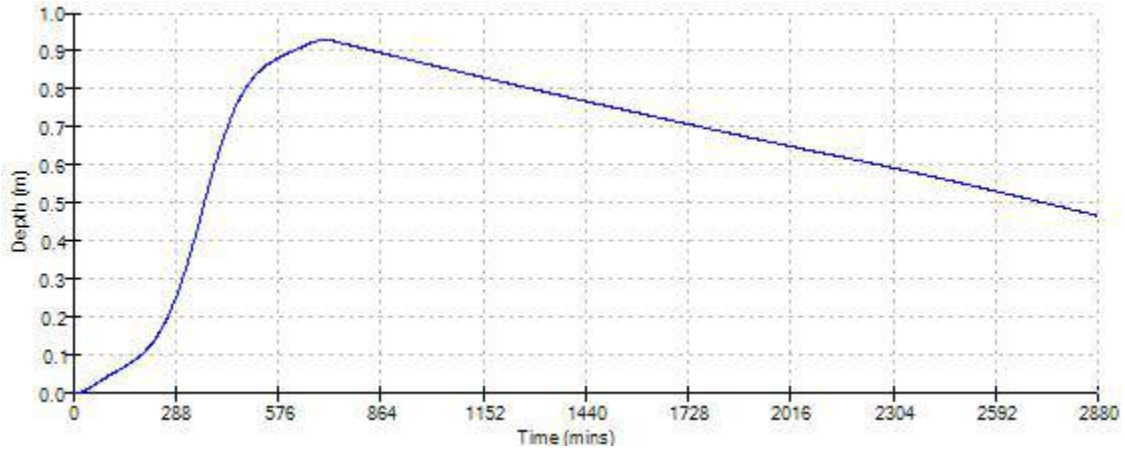
Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.3	1.600	3.5	5.000	5.9
0.200	2.7	1.800	3.7	5.500	6.2
0.300	2.8	2.000	3.9	6.000	6.4
0.400	2.8	2.200	4.0	6.500	6.7
0.500	2.6	2.400	4.2	7.000	6.9
0.600	2.4	2.600	4.4	7.500	7.2
0.800	2.5	3.000	4.7	8.000	7.4
1.000	2.8	3.500	5.0	8.500	7.6
1.200	3.0	4.000	5.3	9.000	7.8
1.400	3.3	4.500	5.6	9.500	8.0

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Event: 720 min Winter

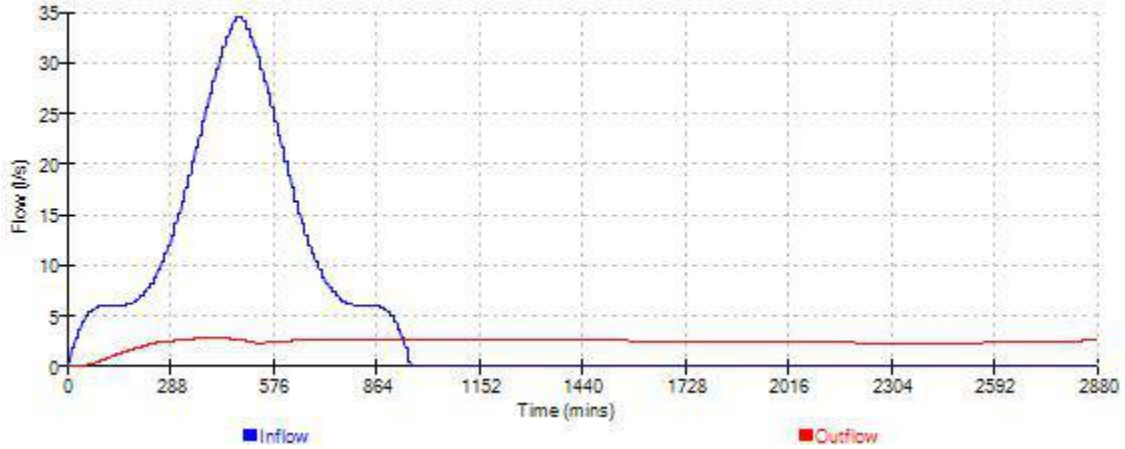


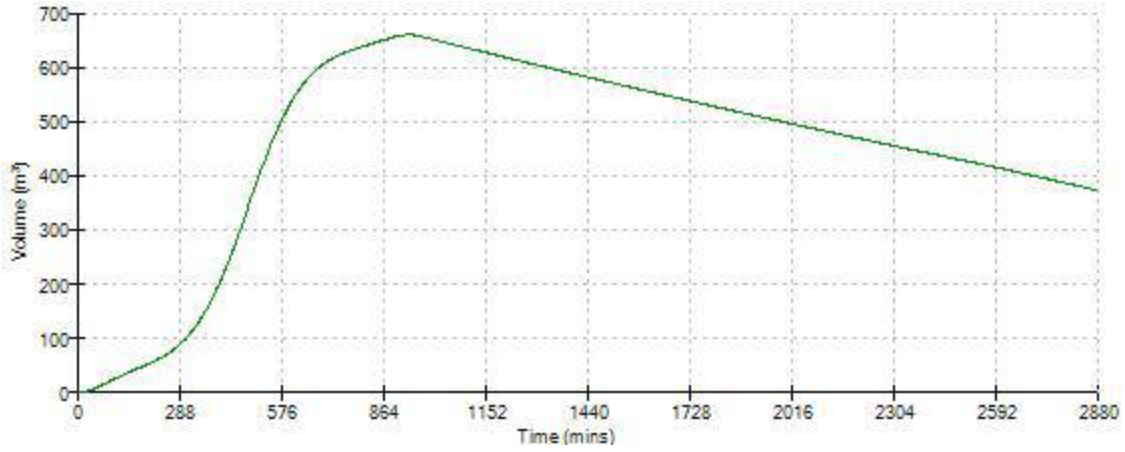


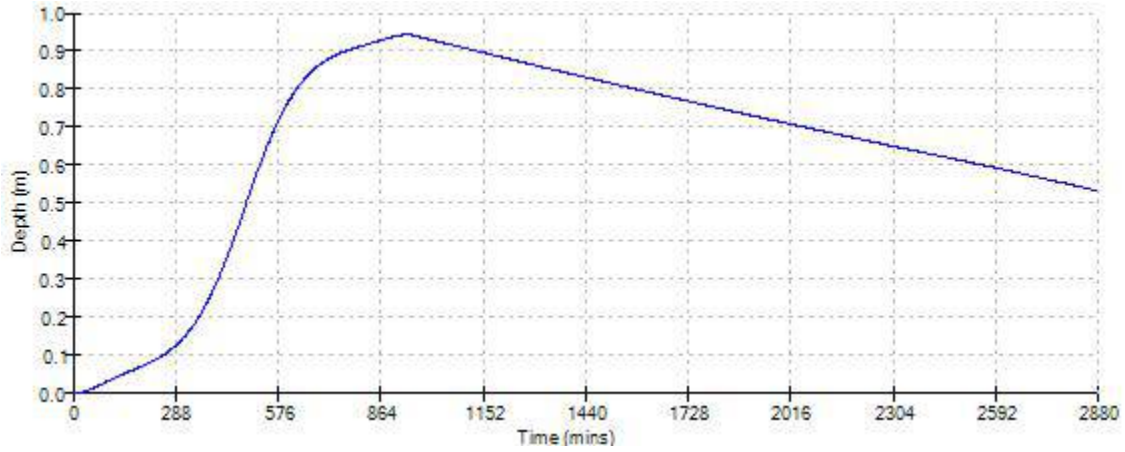


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Event: 960 min Winter

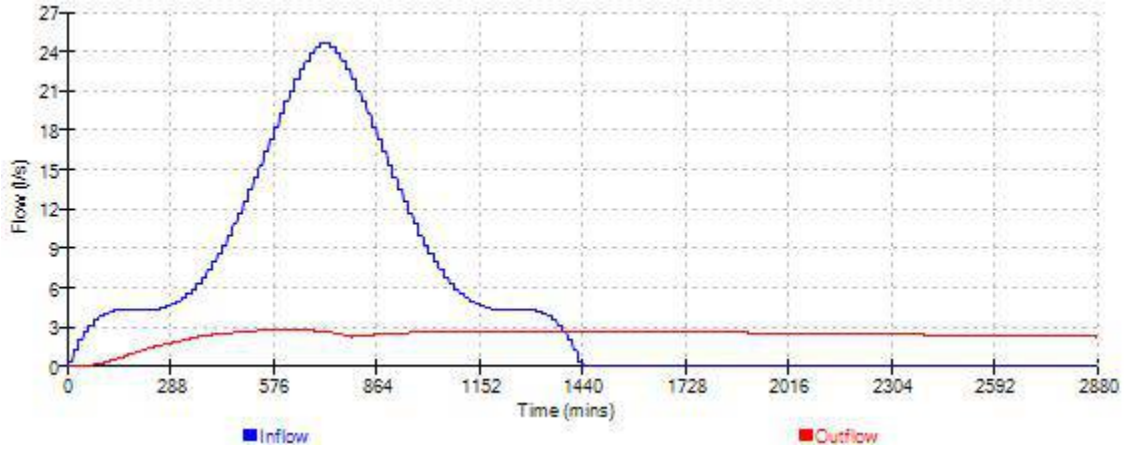


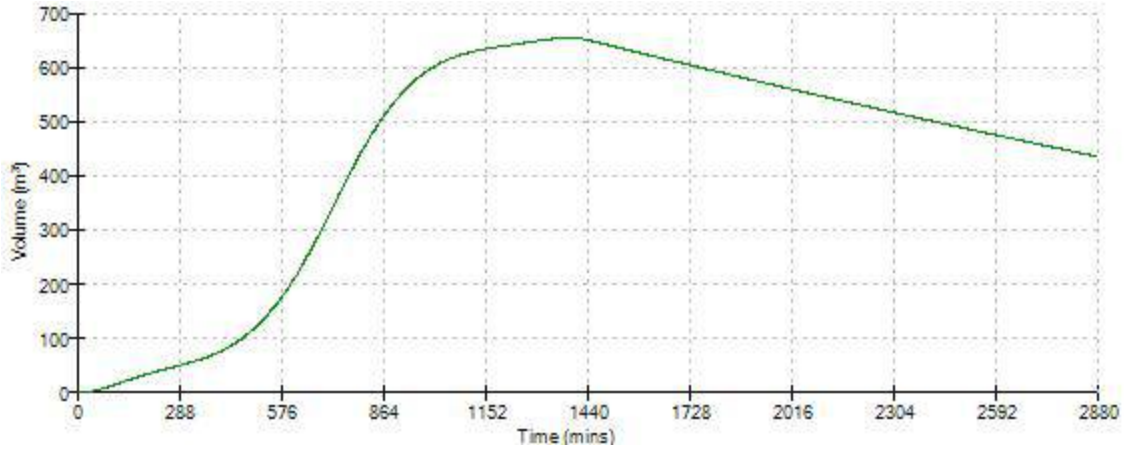


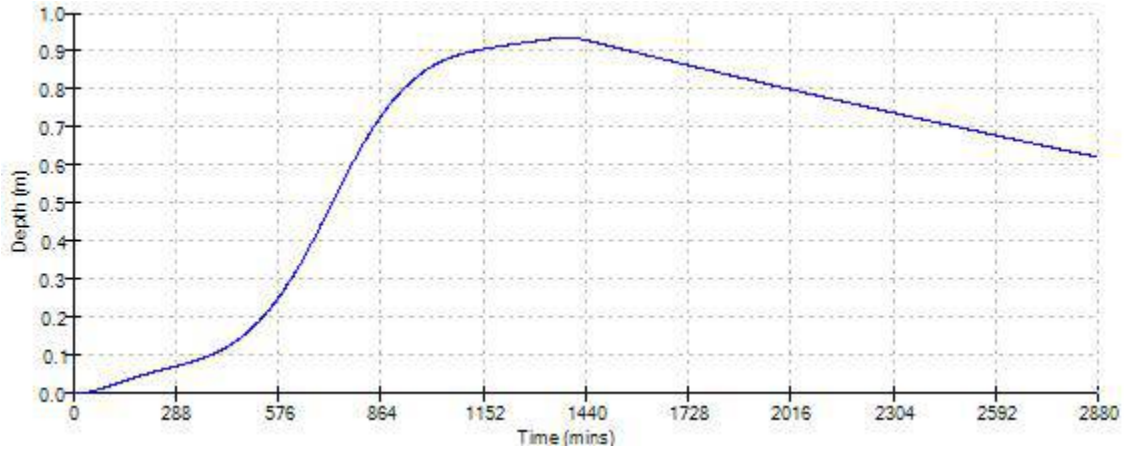


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Event: 1440 min Winter







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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	9.355	0.355	3.4	283.9	O K
30 min Summer	9.484	0.484	3.4	387.5	O K
60 min Summer	9.633	0.633	3.4	506.4	O K
120 min Summer	9.750	0.750	3.4	600.1	Flood Risk
180 min Summer	9.814	0.814	3.4	651.5	Flood Risk
240 min Summer	9.857	0.857	3.4	685.9	Flood Risk
360 min Summer	9.913	0.913	3.4	730.2	Flood Risk
480 min Summer	9.946	0.946	3.4	757.1	Flood Risk
600 min Summer	9.968	0.968	3.4	774.1	Flood Risk
720 min Summer	9.981	0.981	3.4	784.7	Flood Risk
960 min Summer	9.992	0.992	3.4	793.7	Flood Risk
1440 min Summer	9.979	0.979	3.4	783.0	Flood Risk
2160 min Summer	9.927	0.927	3.4	741.8	Flood Risk
2880 min Summer	9.881	0.881	3.4	704.6	Flood Risk
4320 min Summer	9.798	0.798	3.4	638.2	Flood Risk
5760 min Summer	9.734	0.734	3.4	587.1	Flood Risk
7200 min Summer	9.696	0.696	3.4	556.5	O K
8640 min Summer	9.672	0.672	3.4	537.5	O K
10080 min Summer	9.661	0.661	3.4	529.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	155.452	0.0	249.6	16
30 min Summer	106.486	0.0	284.3	31
60 min Summer	69.995	0.0	489.4	62
120 min Summer	41.971	0.0	536.3	122
180 min Summer	30.743	0.0	533.8	182
240 min Summer	24.555	0.0	529.6	242
360 min Summer	17.821	0.0	523.0	362
480 min Summer	14.163	0.0	518.4	482
600 min Summer	11.834	0.0	514.9	602
720 min Summer	10.209	0.0	512.0	720
960 min Summer	8.073	0.0	507.5	960
1440 min Summer	5.765	0.0	501.8	1440
2160 min Summer	4.088	0.0	1019.7	1860
2880 min Summer	3.199	0.0	992.2	2224
4320 min Summer	2.258	0.0	901.4	3024
5760 min Summer	1.778	0.0	1255.1	3864
7200 min Summer	1.508	0.0	1329.2	4688
8640 min Summer	1.337	0.0	1411.8	5536
10080 min Summer	1.225	0.0	1502.2	6360

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Winter	9.355	0.355	3.4	283.9	O K
30 min Winter	9.484	0.484	3.4	387.4	O K
60 min Winter	9.633	0.633	3.4	506.3	O K
120 min Winter	9.750	0.750	3.4	599.9	Flood Risk
180 min Winter	9.815	0.815	3.4	651.6	Flood Risk
240 min Winter	9.858	0.858	3.4	686.1	Flood Risk
360 min Winter	9.913	0.913	3.4	730.8	Flood Risk
480 min Winter	9.948	0.948	3.4	758.2	Flood Risk
600 min Winter	9.970	0.970	3.4	775.6	Flood Risk
720 min Winter	9.983	0.983	3.4	786.7	Flood Risk
960 min Winter	9.996	0.996	3.4	796.8	Flood Risk
1440 min Winter	9.986	0.986	3.4	788.8	Flood Risk
2160 min Winter	9.934	0.934	3.4	747.1	Flood Risk
2880 min Winter	9.878	0.878	3.4	702.2	Flood Risk
4320 min Winter	9.776	0.776	3.4	620.7	Flood Risk
5760 min Winter	9.686	0.686	3.4	548.5	O K
7200 min Winter	9.614	0.614	3.4	491.0	O K
8640 min Winter	9.553	0.553	3.4	442.1	O K
10080 min Winter	9.514	0.514	3.4	411.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Winter	155.452	0.0	249.7	16
30 min Winter	106.486	0.0	284.4	31
60 min Winter	69.995	0.0	489.4	62
120 min Winter	41.971	0.0	536.4	122
180 min Winter	30.743	0.0	534.0	180
240 min Winter	24.555	0.0	529.7	240
360 min Winter	17.821	0.0	522.9	358
480 min Winter	14.163	0.0	518.2	474
600 min Winter	11.834	0.0	514.5	590
720 min Winter	10.209	0.0	511.5	706
960 min Winter	8.073	0.0	506.9	940
1440 min Winter	5.765	0.0	501.2	1384
2160 min Winter	4.088	0.0	1019.8	2012
2880 min Winter	3.199	0.0	994.5	2280
4320 min Winter	2.258	0.0	912.3	3200
5760 min Winter	1.778	0.0	1255.2	4152
7200 min Winter	1.508	0.0	1329.7	5048
8640 min Winter	1.337	0.0	1413.4	5800
10080 min Winter	1.225	0.0	1506.7	6656

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 331208 350156 SJ 31208 50156
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	1.000
Cv (Winter)	1.000
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.736

Time (mins) From:	To:	Area (ha)
0	1	0.736

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Model Details

Storage is Online Cover Level (m) 10.000

Tank or Pond Structure

Invert Level (m) 9.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	800.0	1.000	800.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0088-3400-1000-3400
Design Head (m)	1.000
Design Flow (l/s)	3.4
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	88
Invert Level (m)	8.995
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

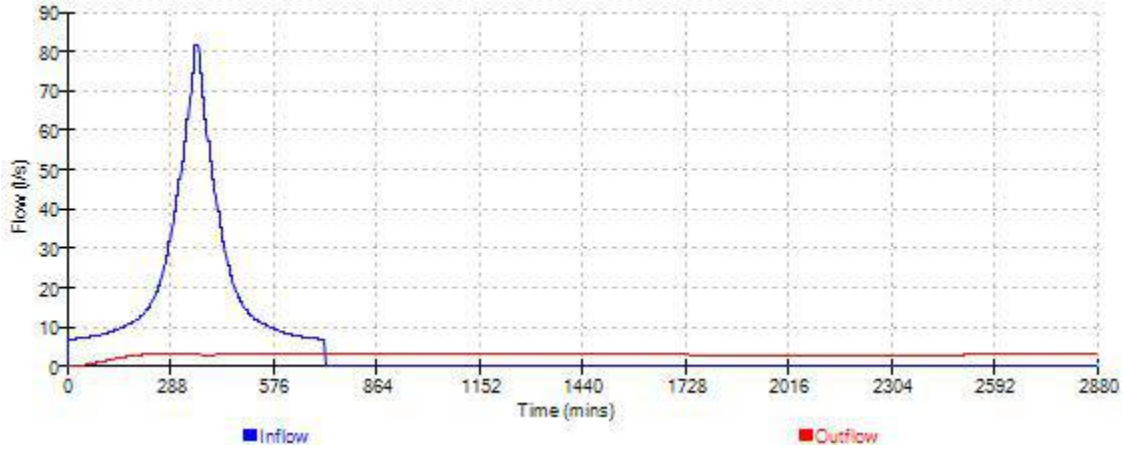
Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	3.4
Flush-Flo™	0.297	3.4
Kick-Flo®	0.624	2.7
Mean Flow over Head Range	-	3.0

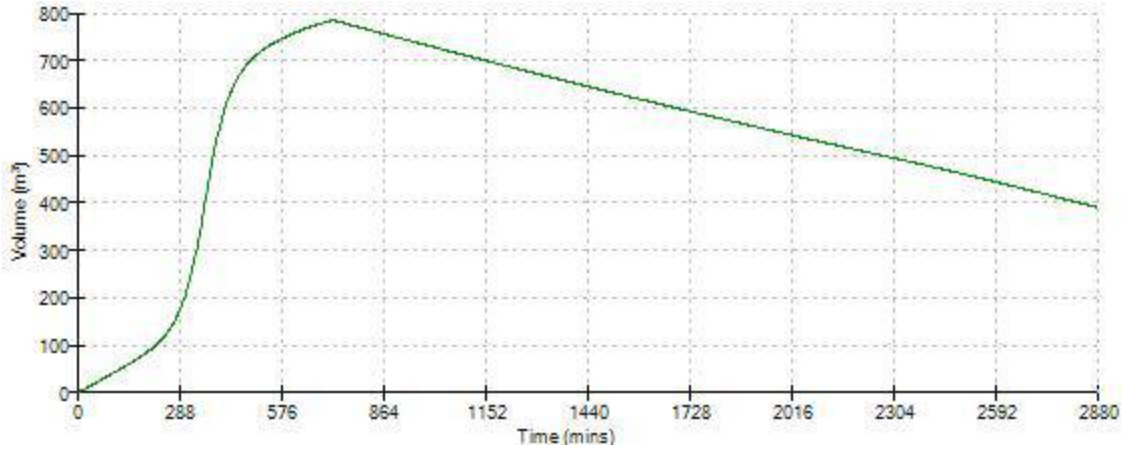
The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

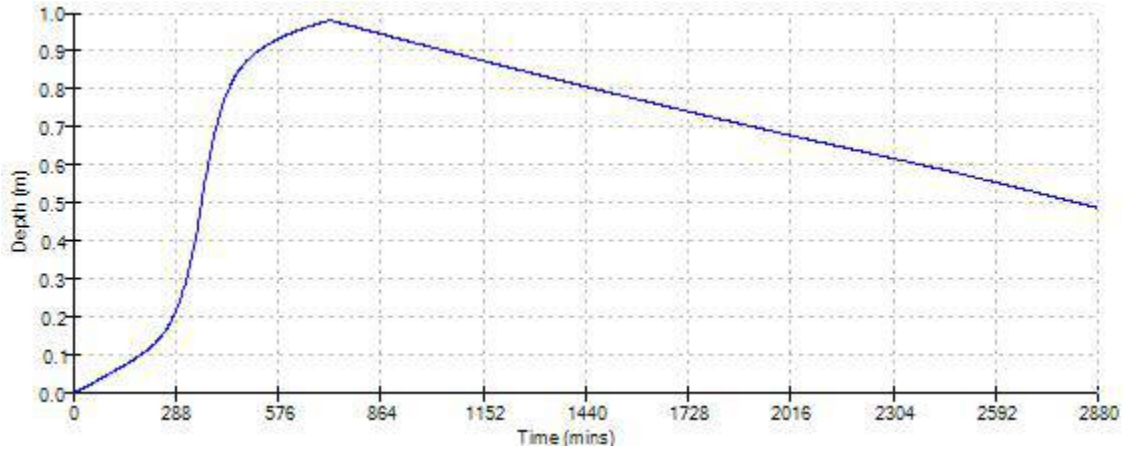
Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.7	1.600	4.2	5.000	7.2
0.200	3.3	1.800	4.5	5.500	7.5
0.300	3.4	2.000	4.7	6.000	7.8
0.400	3.3	2.200	4.9	6.500	8.2
0.500	3.2	2.400	5.1	7.000	8.4
0.600	2.9	2.600	5.3	7.500	8.7
0.800	3.1	3.000	5.7	8.000	9.0
1.000	3.4	3.500	6.1	8.500	9.3
1.200	3.7	4.000	6.5	9.000	9.5
1.400	4.0	4.500	6.9	9.500	9.8

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Event: 720 min Summer

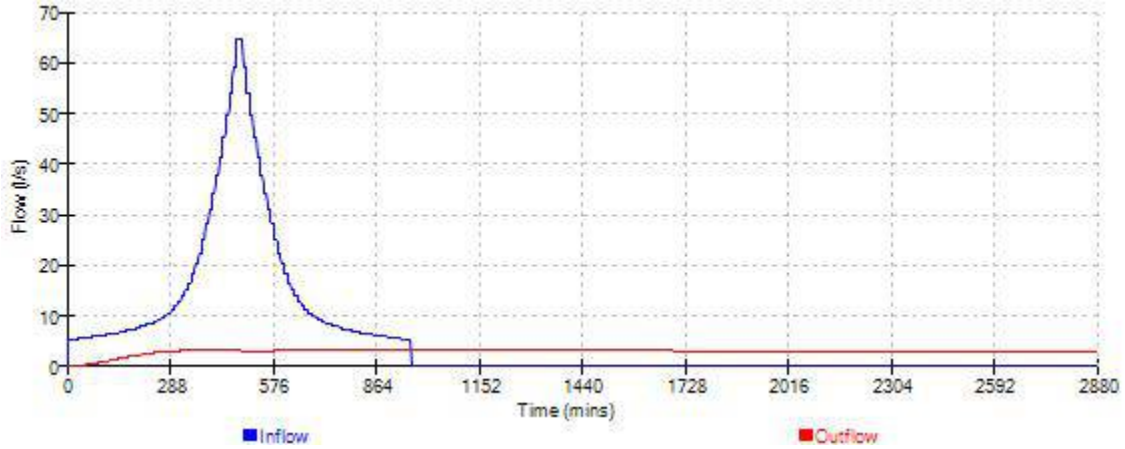


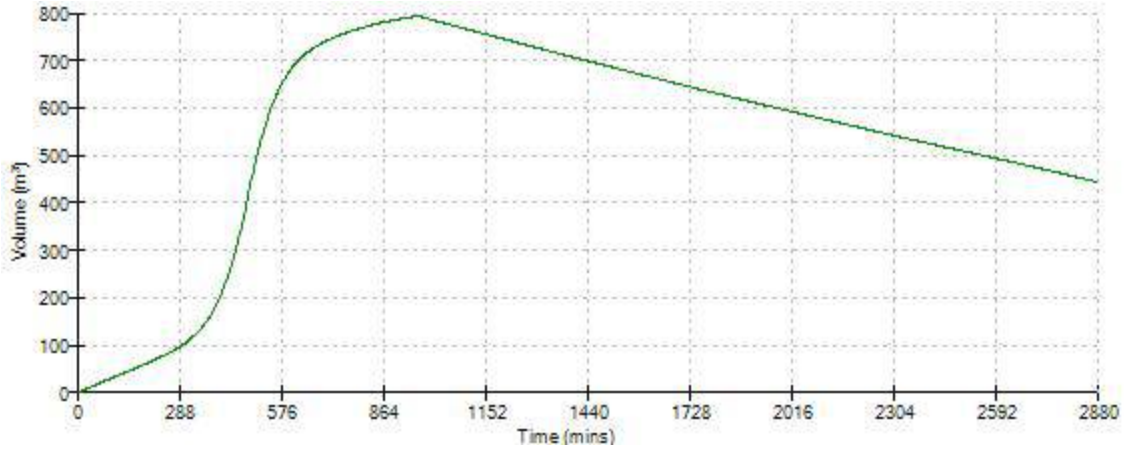


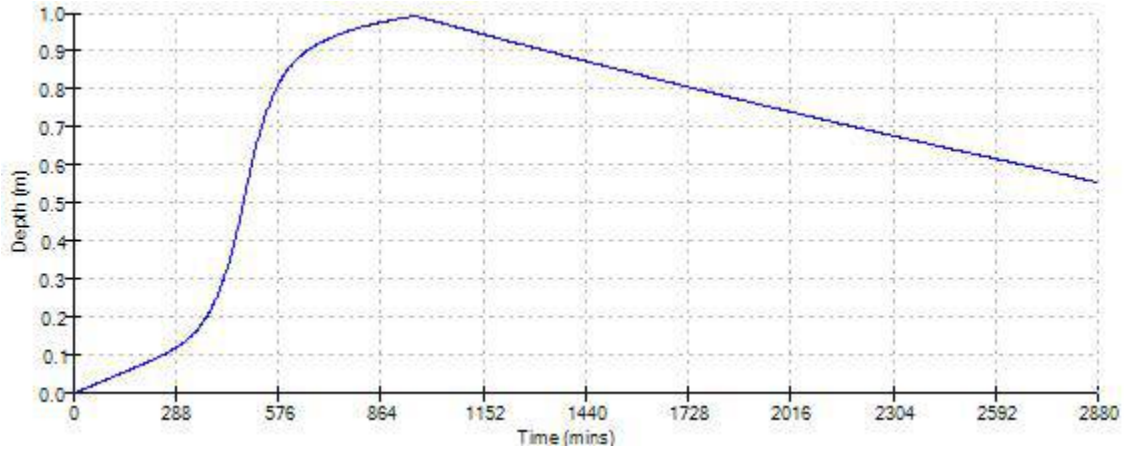


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Event: 960 min Summer

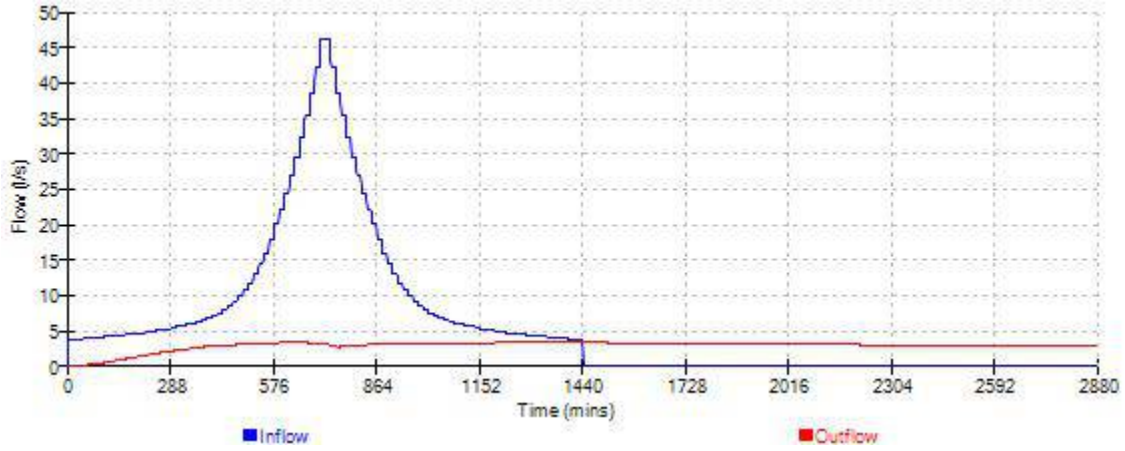


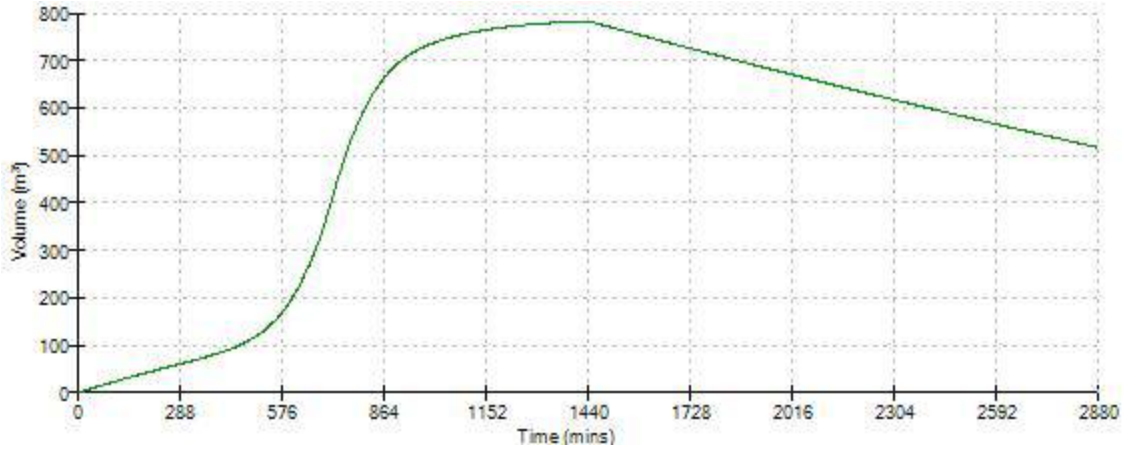


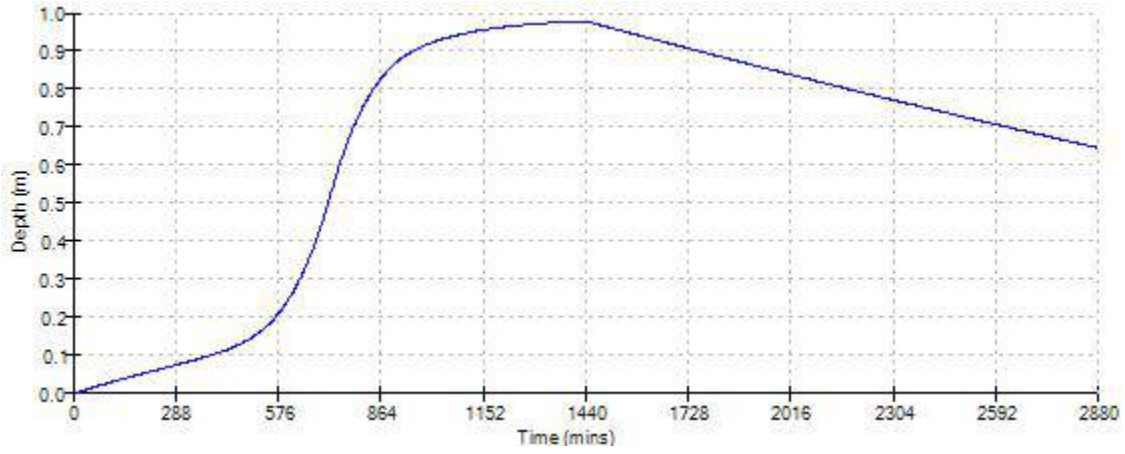


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Event: 1440 min Summer







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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	9.219	0.419	6.4	544.6	O K
30 min Summer	9.372	0.572	6.4	743.5	O K
60 min Summer	9.548	0.748	6.4	972.0	O K
120 min Summer	9.686	0.886	6.4	1152.4	O K
180 min Summer	9.763	0.963	6.4	1251.8	Flood Risk
240 min Summer	9.814	1.014	6.4	1318.4	Flood Risk
360 min Summer	9.880	1.080	6.4	1404.6	Flood Risk
480 min Summer	9.921	1.121	6.4	1457.4	Flood Risk
600 min Summer	9.947	1.147	6.4	1491.2	Flood Risk
720 min Summer	9.963	1.163	6.4	1512.5	Flood Risk
960 min Summer	9.978	1.178	6.4	1532.0	Flood Risk
1440 min Summer	9.966	1.166	6.4	1515.4	Flood Risk
2160 min Summer	9.907	1.107	6.4	1439.2	Flood Risk
2880 min Summer	9.853	1.053	6.4	1369.4	Flood Risk
4320 min Summer	9.757	0.957	6.4	1243.9	Flood Risk
5760 min Summer	9.682	0.882	6.4	1147.2	O K
7200 min Summer	9.638	0.838	6.4	1089.6	O K
8640 min Summer	9.611	0.811	6.4	1054.7	O K
10080 min Summer	9.600	0.800	6.4	1040.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	155.452	0.0	470.4	17
30 min Summer	106.486	0.0	535.5	32
60 min Summer	69.995	0.0	929.8	62
120 min Summer	41.971	0.0	1010.3	122
180 min Summer	30.743	0.0	1002.4	182
240 min Summer	24.555	0.0	993.1	242
360 min Summer	17.821	0.0	979.2	362
480 min Summer	14.163	0.0	969.9	482
600 min Summer	11.834	0.0	962.9	602
720 min Summer	10.209	0.0	957.3	722
960 min Summer	8.073	0.0	948.9	960
1440 min Summer	5.765	0.0	938.4	1440
2160 min Summer	4.088	0.0	1919.4	1880
2880 min Summer	3.199	0.0	1858.6	2252
4320 min Summer	2.258	0.0	1687.8	3028
5760 min Summer	1.778	0.0	2404.5	3864
7200 min Summer	1.508	0.0	2545.9	4688
8640 min Summer	1.337	0.0	2703.1	5536
10080 min Summer	1.225	0.0	2872.4	6360

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Winter	9.219	0.419	6.4	544.5	O K
30 min Winter	9.372	0.572	6.4	743.3	O K
60 min Winter	9.548	0.748	6.4	971.9	O K
120 min Winter	9.686	0.886	6.4	1152.1	O K
180 min Winter	9.763	0.963	6.4	1251.9	Flood Risk
240 min Winter	9.814	1.014	6.4	1318.7	Flood Risk
360 min Winter	9.881	1.081	6.4	1405.5	Flood Risk
480 min Winter	9.922	1.122	6.4	1459.1	Flood Risk
600 min Winter	9.949	1.149	6.4	1493.7	Flood Risk
720 min Winter	9.966	1.166	6.4	1516.1	Flood Risk
960 min Winter	9.983	1.183	6.4	1537.5	Flood Risk
1440 min Winter	9.974	1.174	6.4	1525.8	Flood Risk
2160 min Winter	9.916	1.116	6.4	1450.3	Flood Risk
2880 min Winter	9.850	1.050	6.4	1365.1	Flood Risk
4320 min Winter	9.732	0.932	6.4	1212.1	Flood Risk
5760 min Winter	9.628	0.828	6.4	1076.4	O K
7200 min Winter	9.547	0.747	6.4	970.7	O K
8640 min Winter	9.476	0.676	6.4	878.3	O K
10080 min Winter	9.431	0.631	6.4	819.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Winter	155.452	0.0	470.4	17
30 min Winter	106.486	0.0	535.6	32
60 min Winter	69.995	0.0	929.8	62
120 min Winter	41.971	0.0	1010.6	122
180 min Winter	30.743	0.0	1002.8	180
240 min Winter	24.555	0.0	993.3	240
360 min Winter	17.821	0.0	979.3	358
480 min Winter	14.163	0.0	969.7	474
600 min Winter	11.834	0.0	962.5	590
720 min Winter	10.209	0.0	956.7	708
960 min Winter	8.073	0.0	948.1	940
1440 min Winter	5.765	0.0	937.6	1384
2160 min Winter	4.088	0.0	1920.0	2032
2880 min Winter	3.199	0.0	1863.2	2304
4320 min Winter	2.258	0.0	1708.0	3240
5760 min Winter	1.778	0.0	2404.9	4152
7200 min Winter	1.508	0.0	2547.2	5112
8640 min Winter	1.337	0.0	2706.9	5880
10080 min Winter	1.225	0.0	2884.1	6664

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 331208 350156 SJ 31208 50156
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	1.000
Cv (Winter)	1.000
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.412

Time (mins) From:	To:	Area (ha)
0	2	1.412

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Model Details

Storage is Online Cover Level (m) 10.000

Tank or Pond Structure

Invert Level (m) 8.800

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1300.0	1.200	1300.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0116-6400-1200-6400
Design Head (m)	1.200
Design Flow (l/s)	6.4
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	116
Invert Level (m)	8.795
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

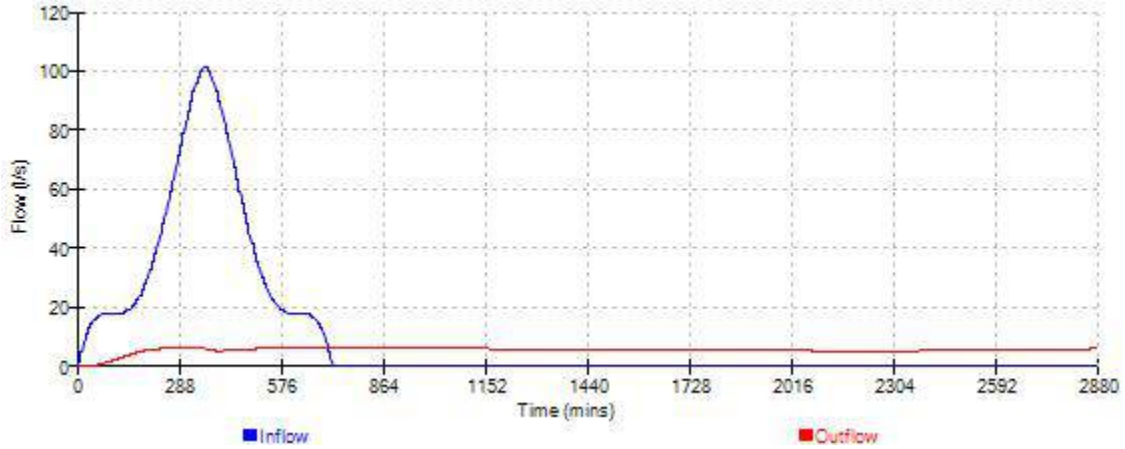
Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	6.4
Flush-Flo™	0.354	6.4
Kick-Flo®	0.751	5.1
Mean Flow over Head Range	-	5.6

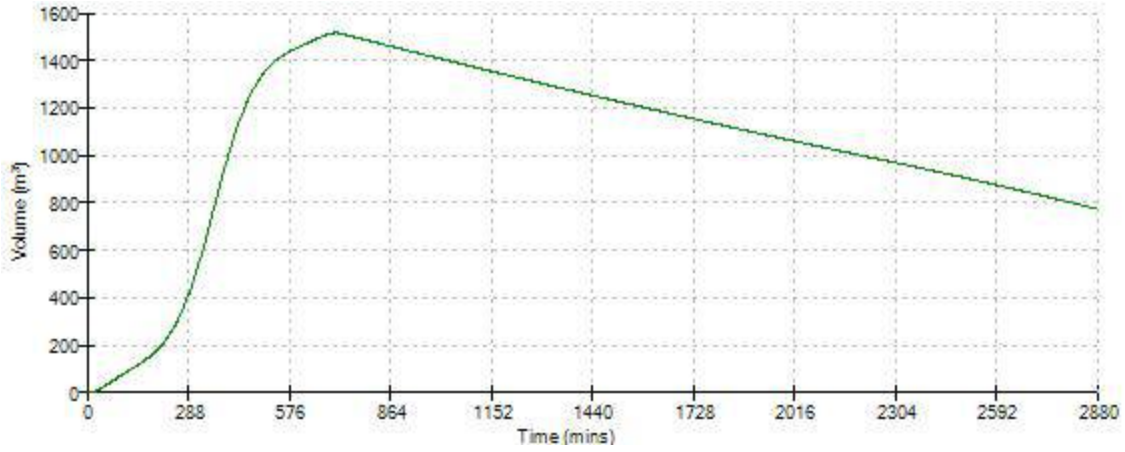
The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

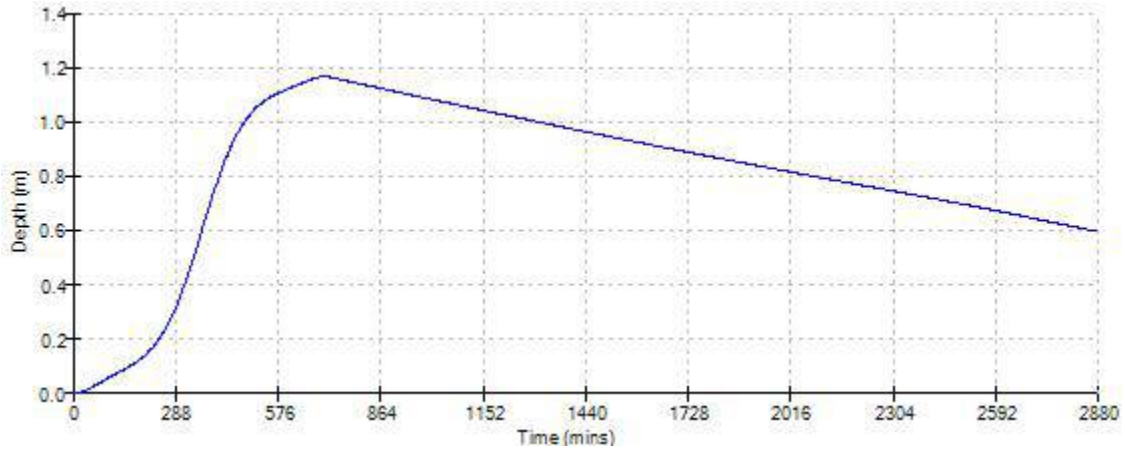
Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	4.1	1.600	7.3	5.000	12.5
0.200	6.0	1.800	7.7	5.500	13.1
0.300	6.3	2.000	8.1	6.000	13.7
0.400	6.3	2.200	8.5	6.500	14.2
0.500	6.2	2.400	8.9	7.000	14.7
0.600	6.0	2.600	9.2	7.500	15.2
0.800	5.3	3.000	9.8	8.000	15.7
1.000	5.9	3.500	10.6	8.500	16.2
1.200	6.4	4.000	11.3	9.000	16.6
1.400	6.9	4.500	11.9	9.500	17.0

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Event: 720 min Winter

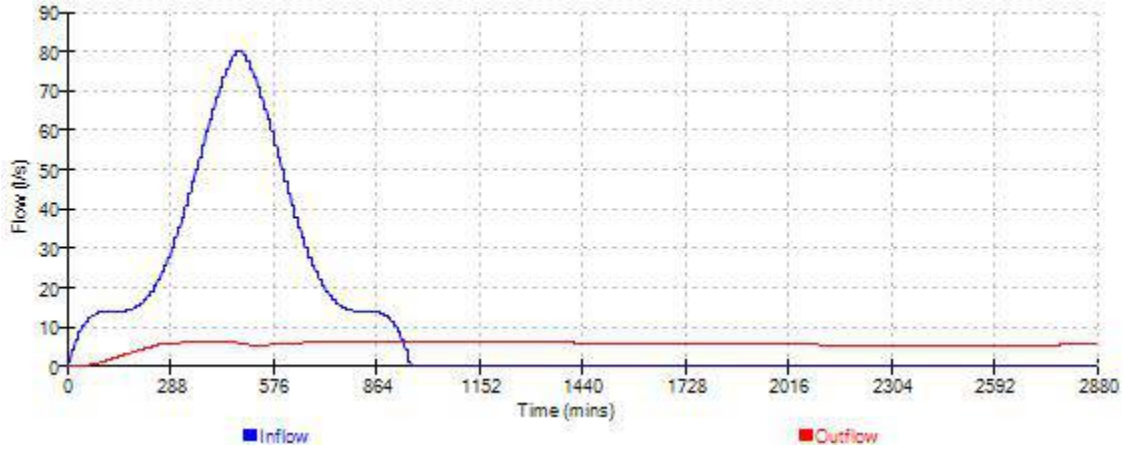


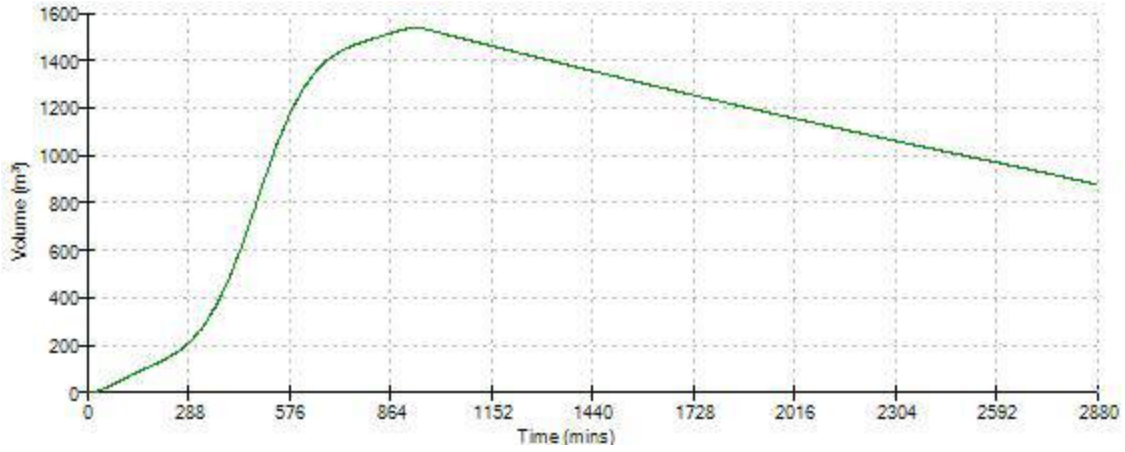


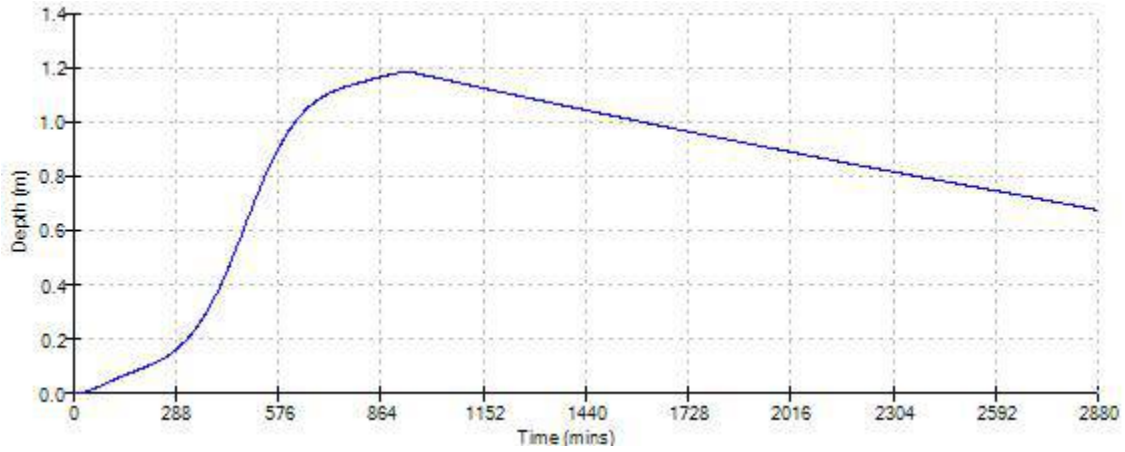


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Event: 960 min Winter

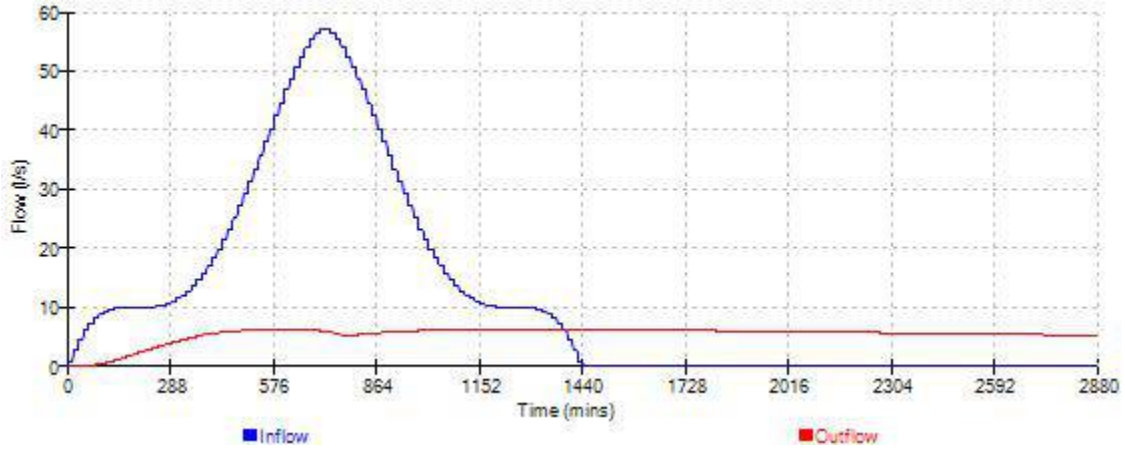


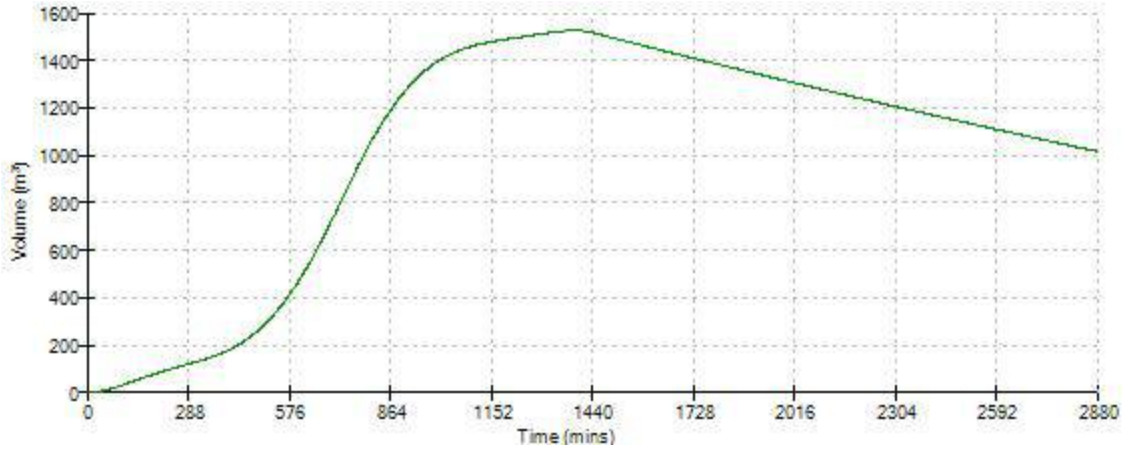


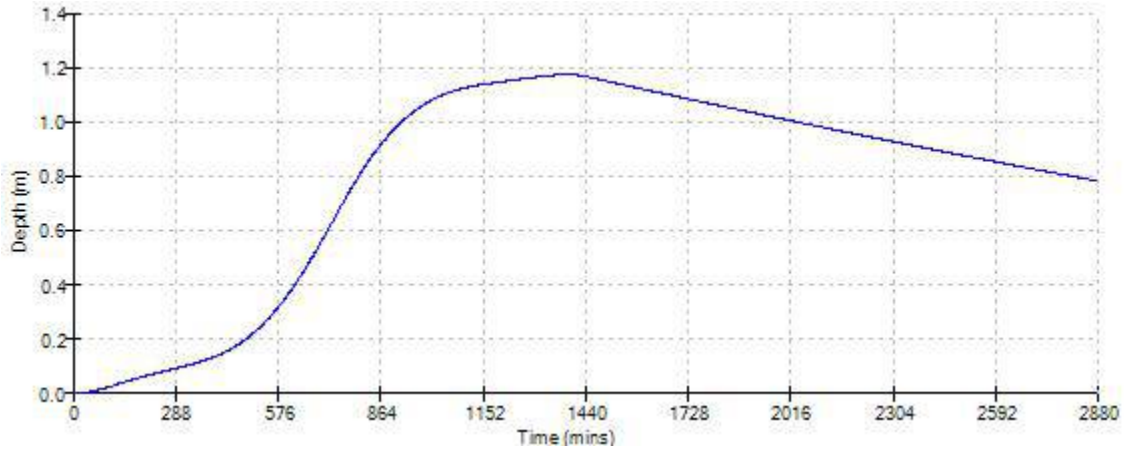


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Event: 1440 min Winter







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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	9.213	0.413	6.9	578.2	O K
30 min Summer	9.364	0.564	6.9	789.5	O K
60 min Summer	9.537	0.737	6.9	1031.8	O K
120 min Summer	9.674	0.874	6.9	1223.4	O K
180 min Summer	9.749	0.949	6.9	1328.9	Flood Risk
240 min Summer	9.800	1.000	6.9	1399.6	Flood Risk
360 min Summer	9.865	1.065	6.9	1491.1	Flood Risk
480 min Summer	9.905	1.105	6.9	1547.0	Flood Risk
600 min Summer	9.930	1.130	6.9	1582.6	Flood Risk
720 min Summer	9.947	1.147	6.9	1605.1	Flood Risk
960 min Summer	9.961	1.161	6.9	1625.1	Flood Risk
1440 min Summer	9.948	1.148	6.9	1606.5	Flood Risk
2160 min Summer	9.889	1.089	6.9	1524.9	Flood Risk
2880 min Summer	9.836	1.036	6.9	1450.3	Flood Risk
4320 min Summer	9.740	0.940	6.9	1315.6	Flood Risk
5760 min Summer	9.665	0.865	6.9	1210.7	O K
7200 min Summer	9.619	0.819	6.9	1146.8	O K
8640 min Summer	9.590	0.790	6.9	1106.5	O K
10080 min Summer	9.577	0.777	6.9	1088.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	155.452	0.0	500.1	18
30 min Summer	106.486	0.0	579.5	33
60 min Summer	69.995	0.0	989.9	64
120 min Summer	41.971	0.0	1093.6	124
180 min Summer	30.743	0.0	1087.5	184
240 min Summer	24.555	0.0	1077.2	242
360 min Summer	17.821	0.0	1060.6	362
480 min Summer	14.163	0.0	1048.9	482
600 min Summer	11.834	0.0	1039.9	602
720 min Summer	10.209	0.0	1032.3	722
960 min Summer	8.073	0.0	1020.1	962
1440 min Summer	5.765	0.0	1003.4	1440
2160 min Summer	4.088	0.0	2062.6	1880
2880 min Summer	3.199	0.0	2003.7	2248
4320 min Summer	2.258	0.0	1817.7	3028
5760 min Summer	1.778	0.0	2554.0	3864
7200 min Summer	1.508	0.0	2704.4	4688
8640 min Summer	1.337	0.0	2871.8	5536
10080 min Summer	1.225	0.0	3054.1	6360

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Winter	9.213	0.413	6.9	578.1	O K
30 min Winter	9.364	0.564	6.9	789.3	O K
60 min Winter	9.537	0.737	6.9	1031.5	O K
120 min Winter	9.674	0.874	6.9	1223.5	O K
180 min Winter	9.749	0.949	6.9	1329.2	Flood Risk
240 min Winter	9.800	1.000	6.9	1400.2	Flood Risk
360 min Winter	9.866	1.066	6.9	1492.1	Flood Risk
480 min Winter	9.906	1.106	6.9	1548.7	Flood Risk
600 min Winter	9.932	1.132	6.9	1585.2	Flood Risk
720 min Winter	9.949	1.149	6.9	1608.6	Flood Risk
960 min Winter	9.965	1.165	6.9	1630.7	Flood Risk
1440 min Winter	9.955	1.155	6.9	1617.1	Flood Risk
2160 min Winter	9.897	1.097	6.9	1535.3	Flood Risk
2880 min Winter	9.832	1.032	6.9	1444.1	Flood Risk
4320 min Winter	9.713	0.913	6.9	1278.5	Flood Risk
5760 min Winter	9.606	0.806	6.9	1129.1	O K
7200 min Winter	9.517	0.717	6.9	1003.3	O K
8640 min Winter	9.449	0.649	6.9	908.4	O K
10080 min Winter	9.405	0.605	6.9	846.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Winter	155.452	0.0	500.2	18
30 min Winter	106.486	0.0	579.6	33
60 min Winter	69.995	0.0	990.0	64
120 min Winter	41.971	0.0	1093.9	122
180 min Winter	30.743	0.0	1088.0	180
240 min Winter	24.555	0.0	1077.6	240
360 min Winter	17.821	0.0	1060.9	358
480 min Winter	14.163	0.0	1048.9	476
600 min Winter	11.834	0.0	1039.7	592
720 min Winter	10.209	0.0	1032.0	708
960 min Winter	8.073	0.0	1019.6	940
1440 min Winter	5.765	0.0	1003.1	1386
2160 min Winter	4.088	0.0	2063.8	2028
2880 min Winter	3.199	0.0	2010.1	2304
4320 min Winter	2.258	0.0	1842.6	3240
5760 min Winter	1.778	0.0	2554.5	4152
7200 min Winter	1.508	0.0	2706.0	5040
8640 min Winter	1.337	0.0	2875.7	5800
10080 min Winter	1.225	0.0	3064.3	6648

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 331208 350156 SJ 31208 50156
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	1.000
Cv (Winter)	1.000
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.500

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	1	0.500	1	2	0.500	2	3	0.500

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Model Details

Storage is Online Cover Level (m) 10.000

Tank or Pond Structure

Invert Level (m) 8.800

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1400.0	1.200	1400.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0120-6900-1200-6900
Design Head (m)	1.200
Design Flow (l/s)	6.9
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	120
Invert Level (m)	8.795
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

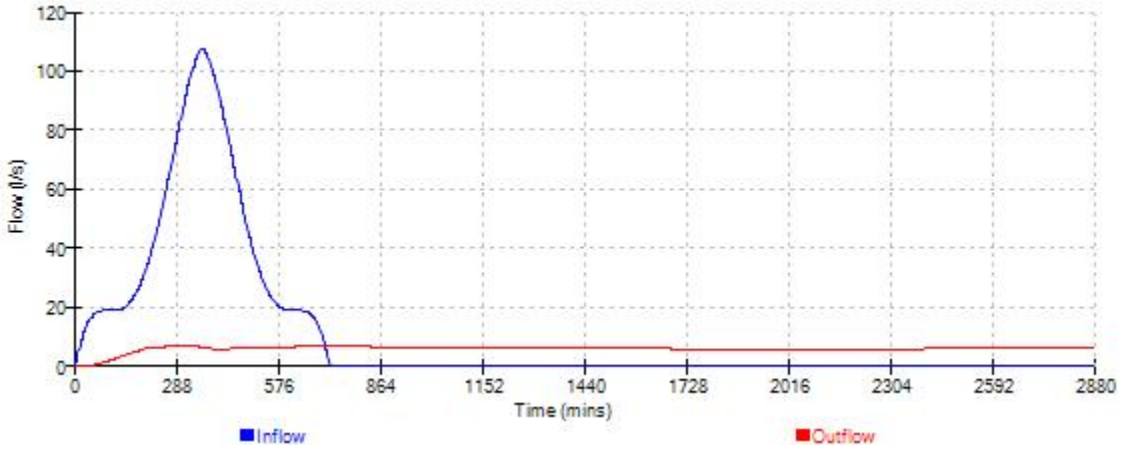
Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	6.9
Flush-Flo™	0.356	6.9
Kick-Flo®	0.760	5.6
Mean Flow over Head Range	-	6.0

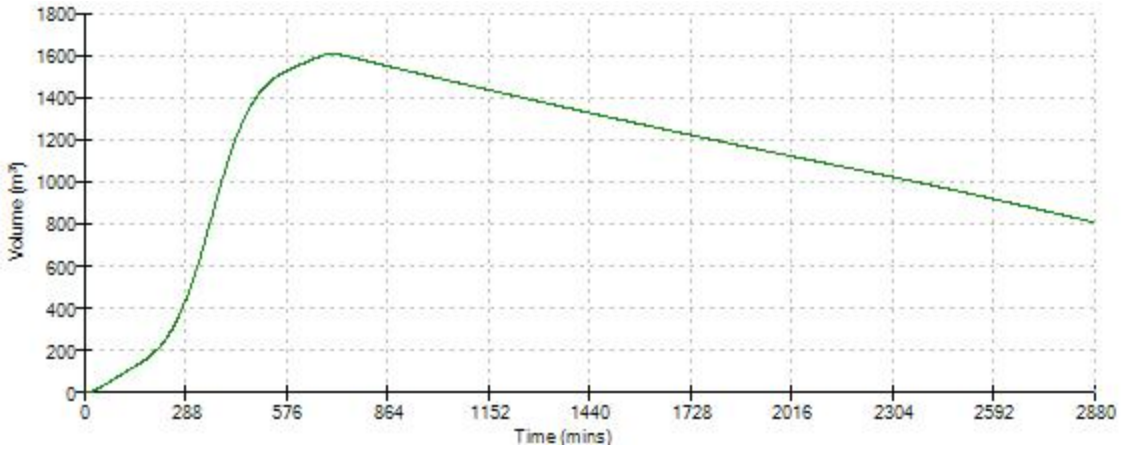
The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

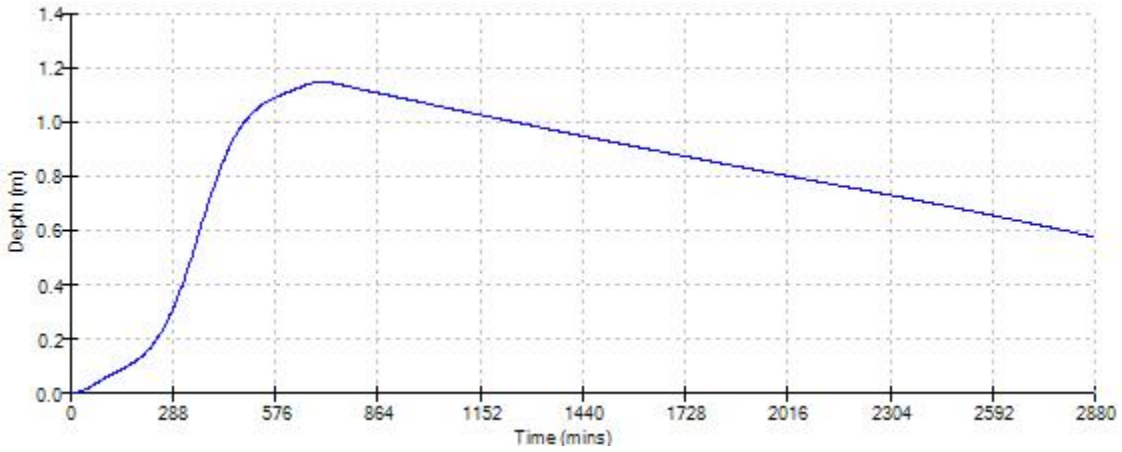
Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	4.2	1.600	7.9	5.000	13.5
0.200	6.5	1.800	8.3	5.500	14.2
0.300	6.9	2.000	8.8	6.000	14.8
0.400	6.9	2.200	9.2	6.500	15.3
0.500	6.8	2.400	9.5	7.000	15.9
0.600	6.5	2.600	9.9	7.500	16.4
0.800	5.7	3.000	10.6	8.000	16.9
1.000	6.3	3.500	11.4	8.500	17.4
1.200	6.9	4.000	12.2	9.000	17.9
1.400	7.4	4.500	12.9	9.500	18.4

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Event: 720 min Winter

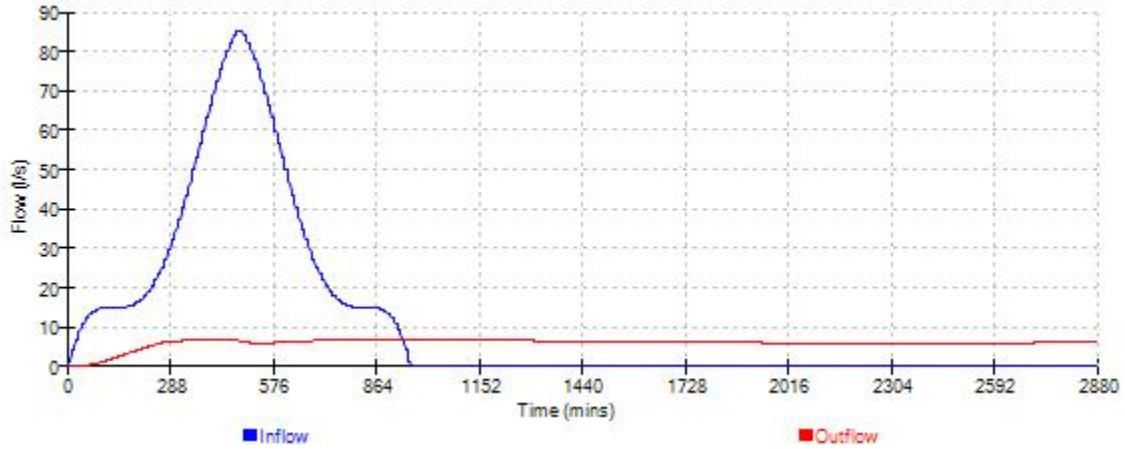


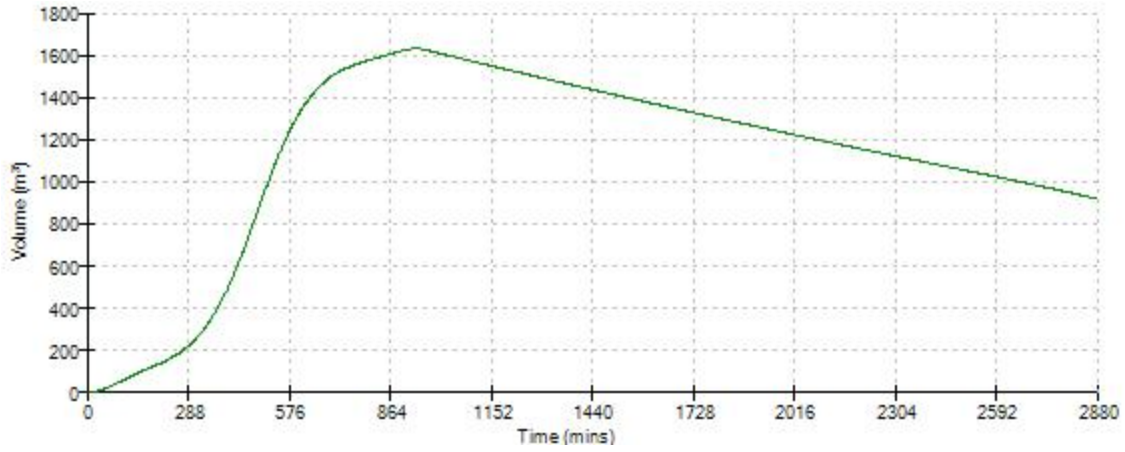


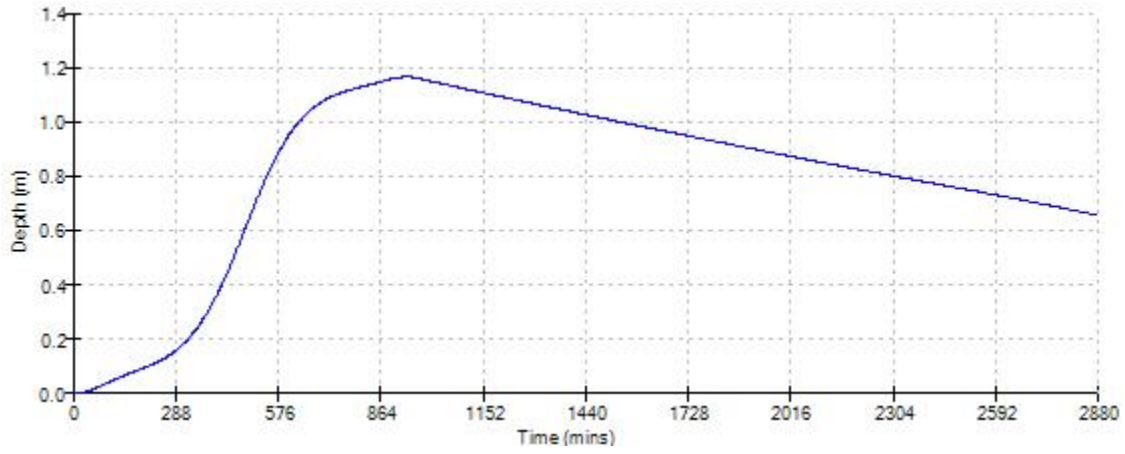


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Event: 960 min Winter

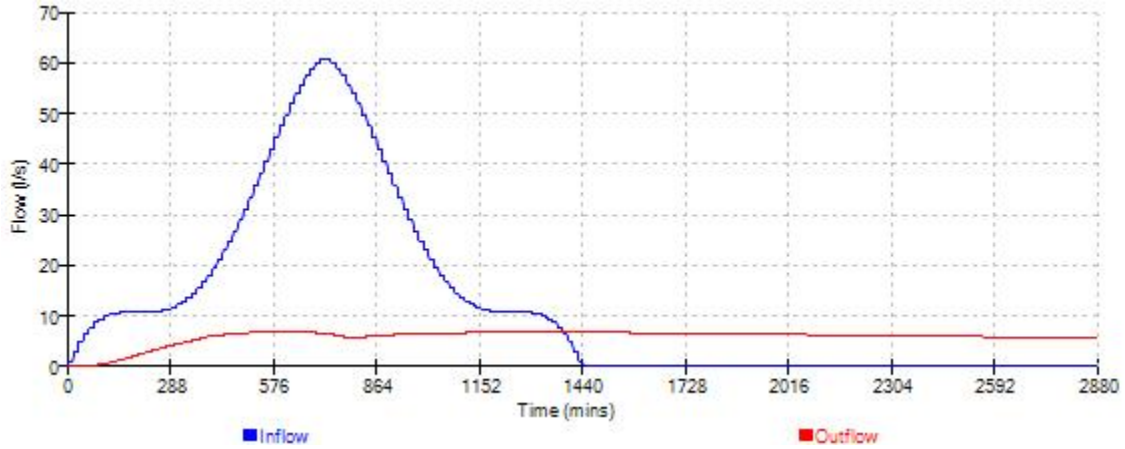


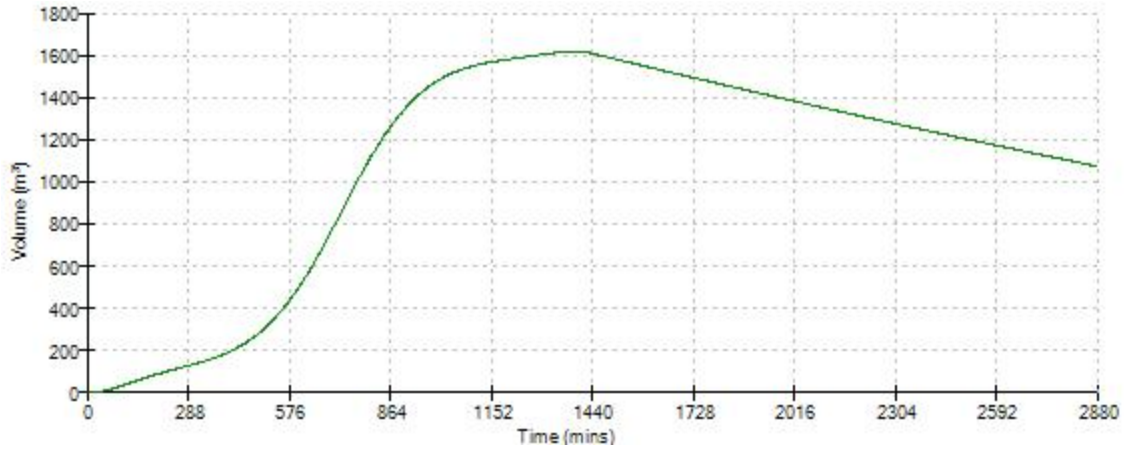


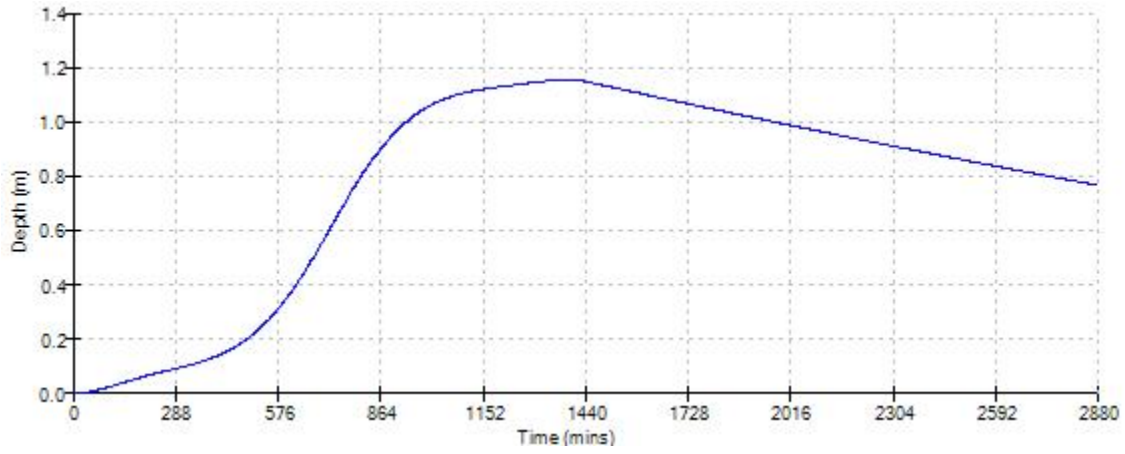


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Event: 1440 min Winter







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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	9.324	0.324	5.7	486.1	O K
30 min Summer	9.442	0.442	5.7	663.7	O K
60 min Summer	9.578	0.578	5.7	867.5	O K
120 min Summer	9.686	0.686	5.7	1029.4	O K
180 min Summer	9.746	0.746	5.7	1119.0	Flood Risk
240 min Summer	9.786	0.786	5.7	1179.3	Flood Risk
360 min Summer	9.838	0.838	5.7	1257.7	Flood Risk
480 min Summer	9.871	0.871	5.7	1306.3	Flood Risk
600 min Summer	9.892	0.892	5.7	1337.9	Flood Risk
720 min Summer	9.906	0.906	5.7	1358.4	Flood Risk
960 min Summer	9.919	0.919	5.7	1378.4	Flood Risk
1440 min Summer	9.912	0.912	5.7	1368.6	Flood Risk
2160 min Summer	9.870	0.870	5.7	1304.4	Flood Risk
2880 min Summer	9.829	0.829	5.7	1243.9	Flood Risk
4320 min Summer	9.755	0.755	5.7	1132.6	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	155.452	0.0	406.2	17
30 min Summer	106.486	0.0	477.2	32
60 min Summer	69.995	0.0	818.9	62
120 min Summer	41.971	0.0	907.0	122
180 min Summer	30.743	0.0	901.0	182
240 min Summer	24.555	0.0	890.4	242
360 min Summer	17.821	0.0	873.7	362
480 min Summer	14.163	0.0	861.8	482
600 min Summer	11.834	0.0	852.4	602
720 min Summer	10.209	0.0	844.4	722
960 min Summer	8.073	0.0	831.0	960
1440 min Summer	5.765	0.0	809.9	1440
2160 min Summer	4.088	0.0	1691.9	1924
2880 min Summer	3.199	0.0	1635.8	2280
4320 min Summer	2.258	0.0	1483.4	3068

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
5760 min Summer	9.696	0.696	5.7	1044.6	O K
7200 min Summer	9.660	0.660	5.7	990.4	O K
8640 min Summer	9.636	0.636	5.7	954.2	O K
10080 min Summer	9.625	0.625	5.7	937.4	O K
15 min Winter	9.324	0.324	5.7	486.0	O K
30 min Winter	9.442	0.442	5.7	663.5	O K
60 min Winter	9.578	0.578	5.7	867.3	O K
120 min Winter	9.686	0.686	5.7	1028.9	O K
180 min Winter	9.746	0.746	5.7	1118.8	Flood Risk
240 min Winter	9.786	0.786	5.7	1179.1	Flood Risk
360 min Winter	9.839	0.839	5.7	1257.9	Flood Risk
480 min Winter	9.871	0.871	5.7	1307.0	Flood Risk
600 min Winter	9.893	0.893	5.7	1339.1	Flood Risk
720 min Winter	9.907	0.907	5.7	1360.3	Flood Risk
960 min Winter	9.921	0.921	5.7	1381.8	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
5760 min Summer	1.778	0.0	2142.2	3912
7200 min Summer	1.508	0.0	2267.3	4752
8640 min Summer	1.337	0.0	2406.0	5544
10080 min Summer	1.225	0.0	2554.7	6360
15 min Winter	155.452	0.0	406.2	17
30 min Winter	106.486	0.0	477.3	32
60 min Winter	69.995	0.0	819.0	62
120 min Winter	41.971	0.0	907.3	122
180 min Winter	30.743	0.0	901.6	180
240 min Winter	24.555	0.0	891.1	240
360 min Winter	17.821	0.0	874.4	358
480 min Winter	14.163	0.0	862.4	476
600 min Winter	11.834	0.0	853.0	590
720 min Winter	10.209	0.0	845.0	708
960 min Winter	8.073	0.0	831.5	940

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
1440 min Winter	9.917	0.917	5.7	1375.4	Flood Risk
2160 min Winter	9.875	0.875	5.7	1312.9	Flood Risk
2880 min Winter	9.825	0.825	5.7	1237.3	Flood Risk
4320 min Winter	9.734	0.734	5.7	1101.4	Flood Risk
5760 min Winter	9.650	0.650	5.7	975.0	O K
7200 min Winter	9.580	0.580	5.7	869.9	O K
8640 min Winter	9.531	0.531	5.7	796.5	O K
10080 min Winter	9.499	0.499	5.7	748.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
1440 min Winter	5.765	0.0	810.8	1386
2160 min Winter	4.088	0.0	1694.4	2032
2880 min Winter	3.199	0.0	1643.2	2336
4320 min Winter	2.258	0.0	1506.5	3244
5760 min Winter	1.778	0.0	2142.9	4200
7200 min Winter	1.508	0.0	2269.3	4976
8640 min Winter	1.337	0.0	2410.1	5800
10080 min Winter	1.225	0.0	2565.0	6656

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 331208 350156 SJ 31208 50156
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	1.000
Cv (Winter)	1.000
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.260

Time (mins) From:	To:	Area (ha)
0	2	1.260

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Model Details

Storage is Online Cover Level (m) 10.000

Tank or Pond Structure

Invert Level (m) 9.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1500.0	1.000	1500.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0112-5700-1000-5700
Design Head (m)	1.000
Design Flow (l/s)	5.7
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	112
Invert Level (m)	8.995
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	5.7
Flush-Flo™	0.296	5.7
Kick-Flo®	0.642	4.6
Mean Flow over Head Range	-	4.9

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	3.9	0.400	5.6	0.800	5.1	1.400	6.7
0.200	5.5	0.500	5.4	1.000	5.7	1.600	7.1
0.300	5.7	0.600	5.0	1.200	6.2	1.800	7.5

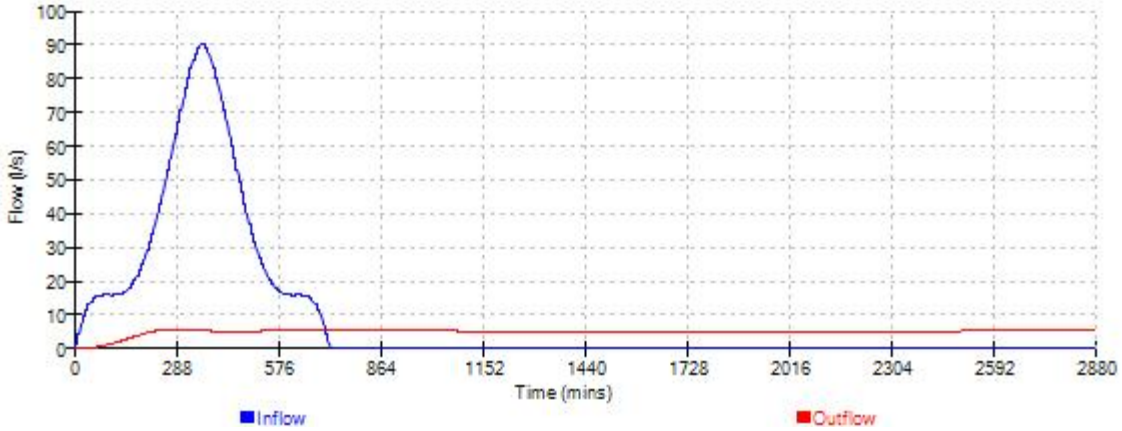
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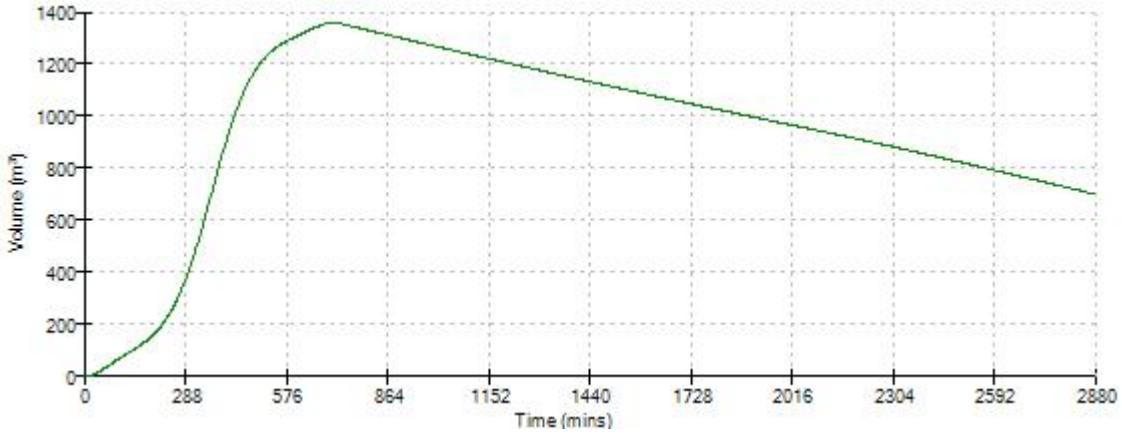
Hydro-Brake® Optimum Outflow Control

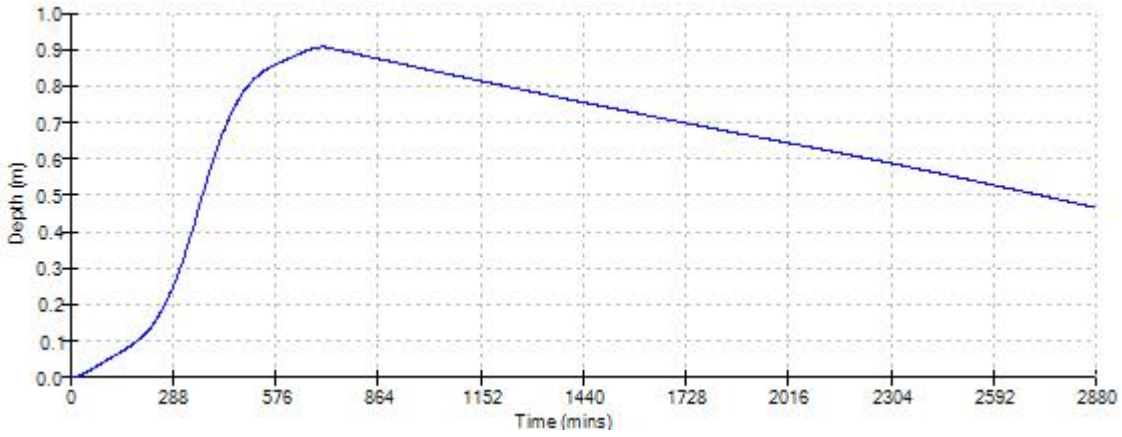
Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
2.000	7.9	3.500	10.3	6.000	13.3	8.500	15.7
2.200	8.2	4.000	10.9	6.500	13.8	9.000	16.1
2.400	8.6	4.500	11.6	7.000	14.3	9.500	16.5
2.600	8.9	5.000	12.2	7.500	14.7		
3.000	9.5	5.500	12.7	8.000	15.2		

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Event: 720 min Winter

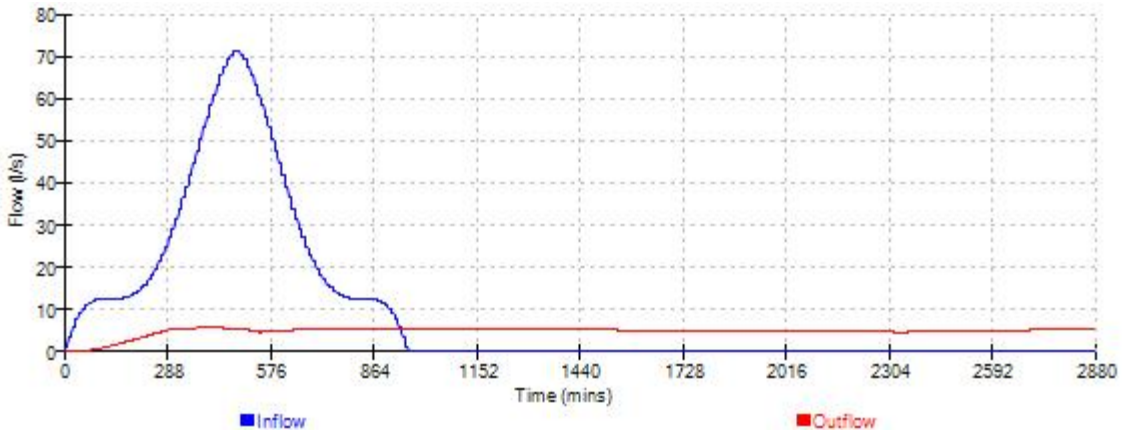


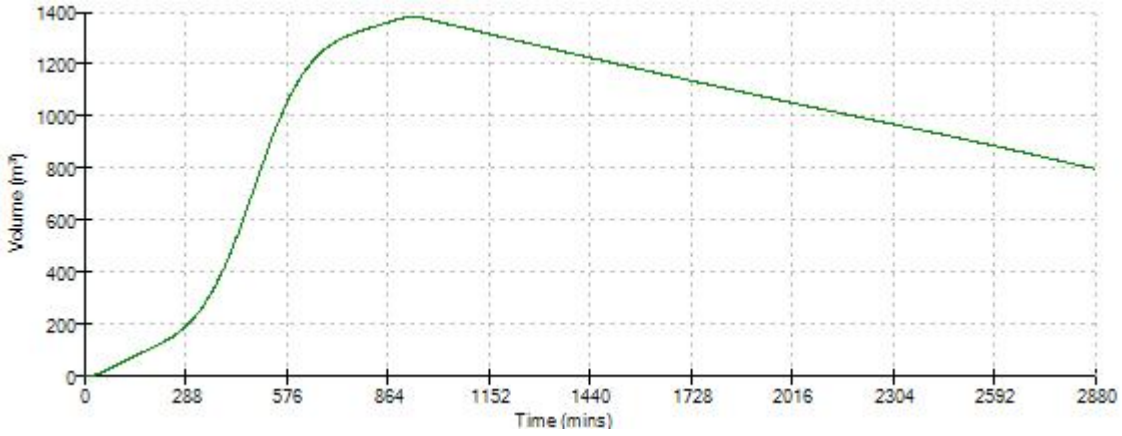


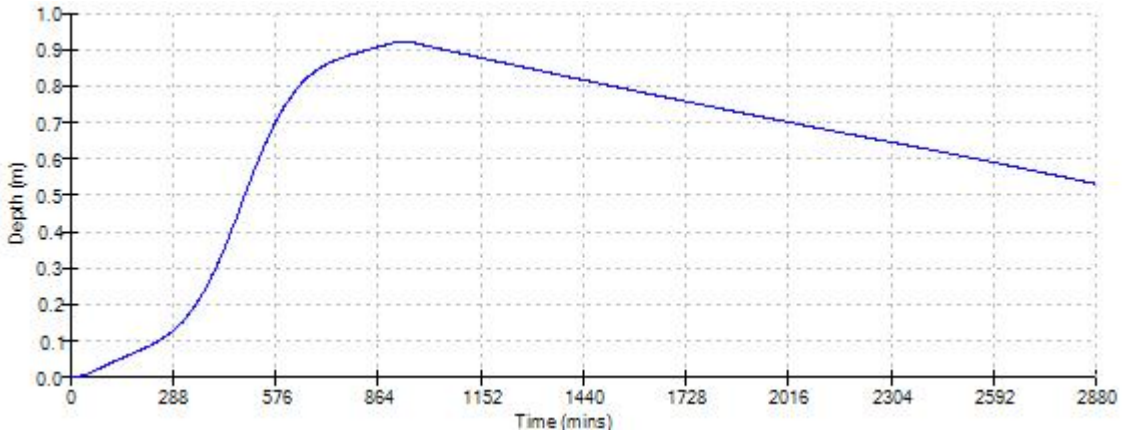


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Event: 960 min Winter

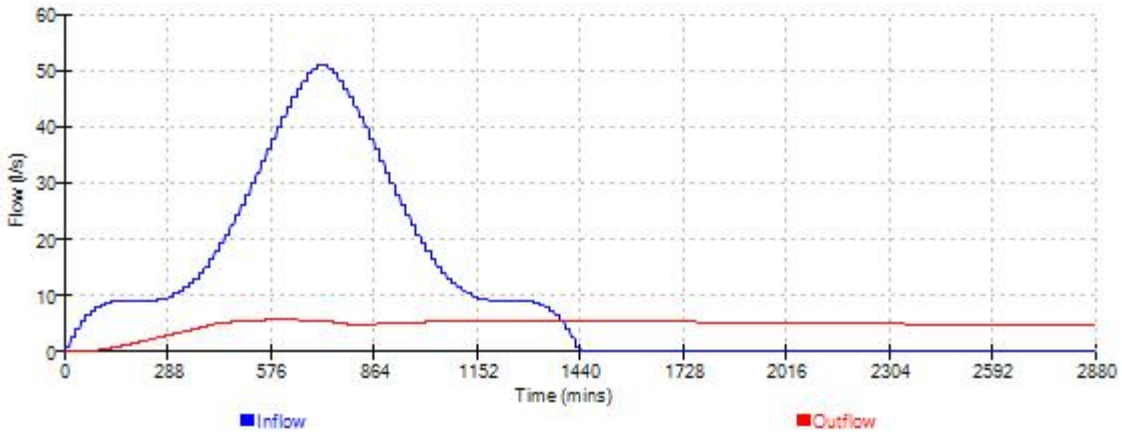


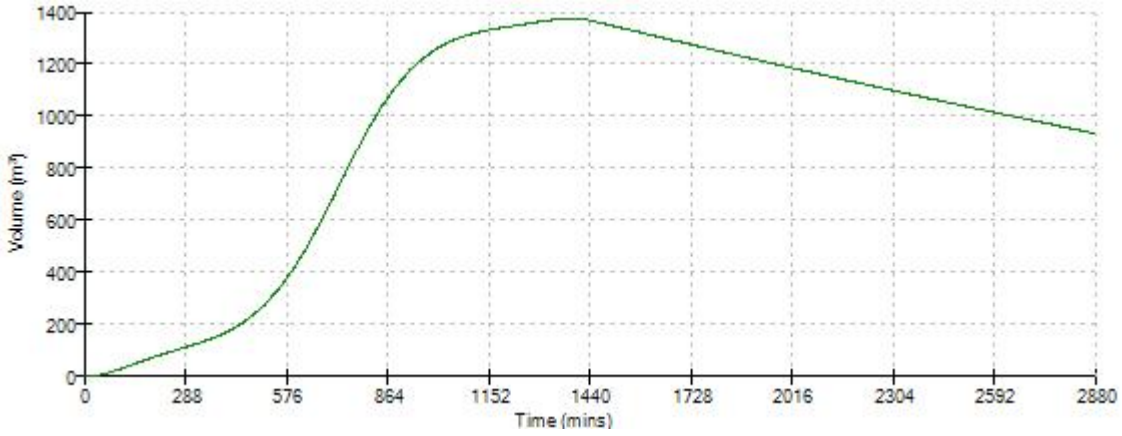


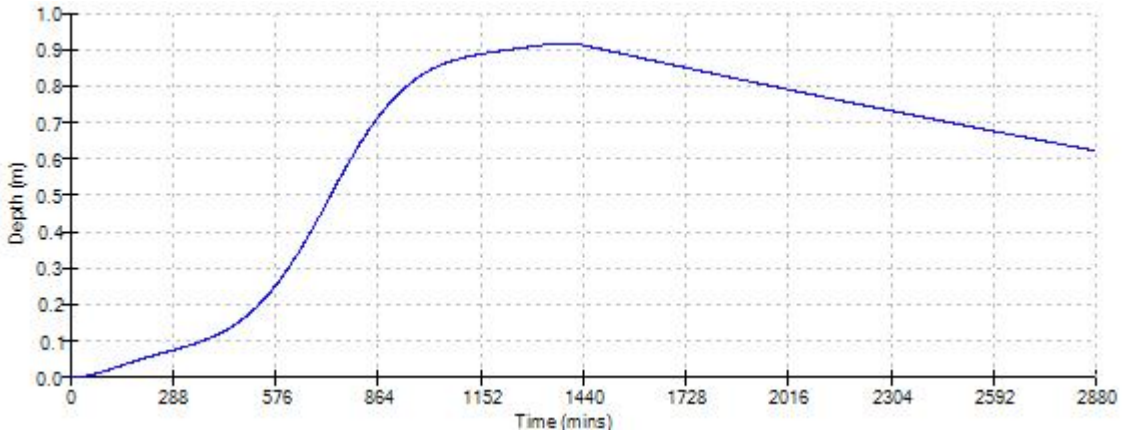


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Event: 1440 min Winter







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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	9.349	0.349	3.9	331.5	O K
30 min Summer	9.476	0.476	3.9	452.6	O K
60 min Summer	9.623	0.623	3.9	591.6	O K
120 min Summer	9.738	0.738	3.9	701.5	Flood Risk
180 min Summer	9.802	0.802	3.9	761.9	Flood Risk
240 min Summer	9.845	0.845	3.9	802.5	Flood Risk
360 min Summer	9.900	0.900	3.9	854.9	Flood Risk
480 min Summer	9.934	0.934	3.9	887.1	Flood Risk
600 min Summer	9.955	0.955	3.9	907.6	Flood Risk
720 min Summer	9.969	0.969	3.9	920.5	Flood Risk
960 min Summer	9.981	0.981	3.9	932.1	Flood Risk
1440 min Summer	9.970	0.970	3.9	921.7	Flood Risk
2160 min Summer	9.921	0.921	3.9	875.0	Flood Risk
2880 min Summer	9.876	0.876	3.9	832.2	Flood Risk
4320 min Summer	9.795	0.795	3.9	755.3	Flood Risk
5760 min Summer	9.733	0.733	3.9	695.9	Flood Risk
7200 min Summer	9.695	0.695	3.9	660.3	O K
8640 min Summer	9.672	0.672	3.9	638.5	O K
10080 min Summer	9.662	0.662	3.9	629.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	155.452	0.0	287.6	18
30 min Summer	106.486	0.0	328.1	33
60 min Summer	69.995	0.0	568.0	64
120 min Summer	41.971	0.0	619.5	124
180 min Summer	30.743	0.0	615.0	184
240 min Summer	24.555	0.0	609.3	242
360 min Summer	17.821	0.0	600.5	362
480 min Summer	14.163	0.0	594.6	482
600 min Summer	11.834	0.0	590.0	602
720 min Summer	10.209	0.0	586.3	722
960 min Summer	8.073	0.0	580.6	962
1440 min Summer	5.765	0.0	573.2	1440
2160 min Summer	4.088	0.0	1174.6	1880
2880 min Summer	3.199	0.0	1138.6	2252
4320 min Summer	2.258	0.0	1034.1	3028
5760 min Summer	1.778	0.0	1465.5	3864
7200 min Summer	1.508	0.0	1551.7	4688
8640 min Summer	1.337	0.0	1647.7	5536
10080 min Summer	1.225	0.0	1751.5	6360

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Winter	9.349	0.349	3.9	331.5	O K
30 min Winter	9.476	0.476	3.9	452.6	O K
60 min Winter	9.623	0.623	3.9	591.5	O K
120 min Winter	9.738	0.738	3.9	701.5	Flood Risk
180 min Winter	9.802	0.802	3.9	762.1	Flood Risk
240 min Winter	9.845	0.845	3.9	802.8	Flood Risk
360 min Winter	9.901	0.901	3.9	855.6	Flood Risk
480 min Winter	9.935	0.935	3.9	888.1	Flood Risk
600 min Winter	9.957	0.957	3.9	909.1	Flood Risk
720 min Winter	9.971	0.971	3.9	922.6	Flood Risk
960 min Winter	9.985	0.985	3.9	935.5	Flood Risk
1440 min Winter	9.977	0.977	3.9	928.0	Flood Risk
2160 min Winter	9.928	0.928	3.9	881.5	Flood Risk
2880 min Winter	9.873	0.873	3.9	829.3	Flood Risk
4320 min Winter	9.774	0.774	3.9	735.3	Flood Risk
5760 min Winter	9.686	0.686	3.9	651.6	O K
7200 min Winter	9.615	0.615	3.9	584.1	O K
8640 min Winter	9.557	0.557	3.9	528.7	O K
10080 min Winter	9.519	0.519	3.9	493.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Winter	155.452	0.0	287.6	18
30 min Winter	106.486	0.0	328.2	33
60 min Winter	69.995	0.0	568.0	64
120 min Winter	41.971	0.0	619.7	122
180 min Winter	30.743	0.0	615.2	180
240 min Winter	24.555	0.0	609.4	240
360 min Winter	17.821	0.0	600.6	358
480 min Winter	14.163	0.0	594.5	476
600 min Winter	11.834	0.0	589.8	592
720 min Winter	10.209	0.0	586.0	708
960 min Winter	8.073	0.0	580.1	940
1440 min Winter	5.765	0.0	572.8	1386
2160 min Winter	4.088	0.0	1175.1	2028
2880 min Winter	3.199	0.0	1141.7	2304
4320 min Winter	2.258	0.0	1047.0	3240
5760 min Winter	1.778	0.0	1465.7	4152
7200 min Winter	1.508	0.0	1552.5	5048
8640 min Winter	1.337	0.0	1649.9	5872
10080 min Winter	1.225	0.0	1758.0	6656

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 331208 350156 SJ 31208 50156
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	1.000
Cv (Winter)	1.000
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.860

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	1	0.287	1	2	0.287	2	3	0.287

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Model Details

Storage is Online Cover Level (m) 10.000

Tank or Pond Structure

Invert Level (m) 9.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	950.0	1.000	950.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0094-3900-1000-3900
Design Head (m)	1.000
Design Flow (l/s)	3.9
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	94
Invert Level (m)	8.995
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

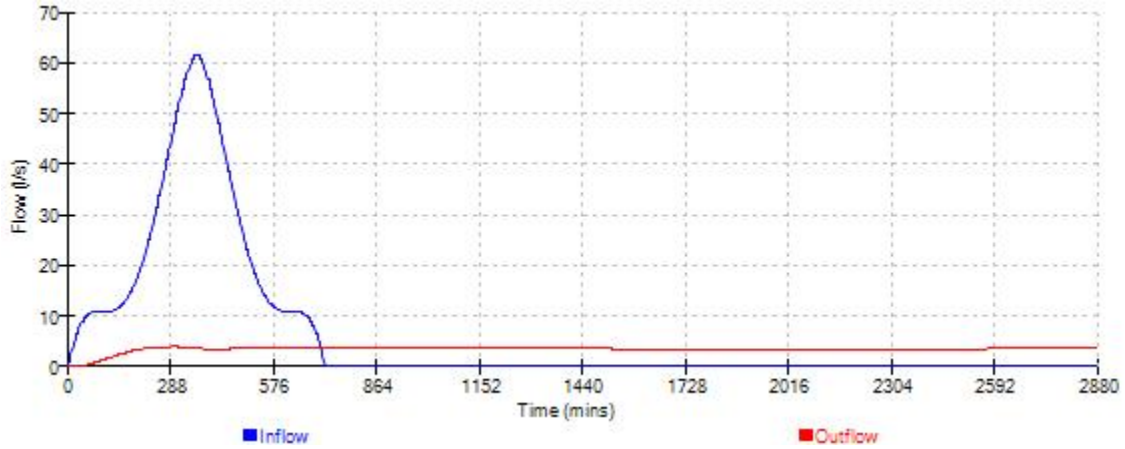
Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	3.9
Flush-Flo™	0.297	3.9
Kick-Flo®	0.632	3.2
Mean Flow over Head Range	-	3.4

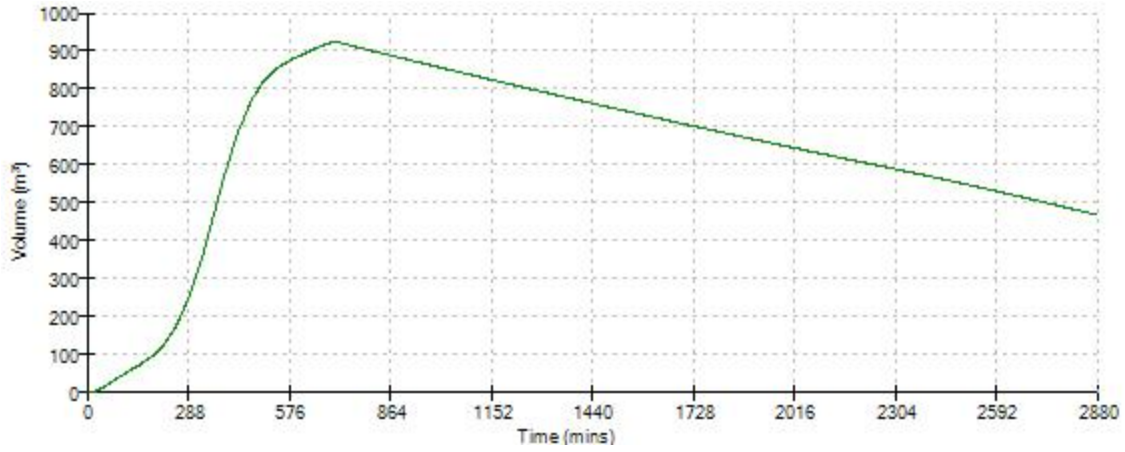
The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

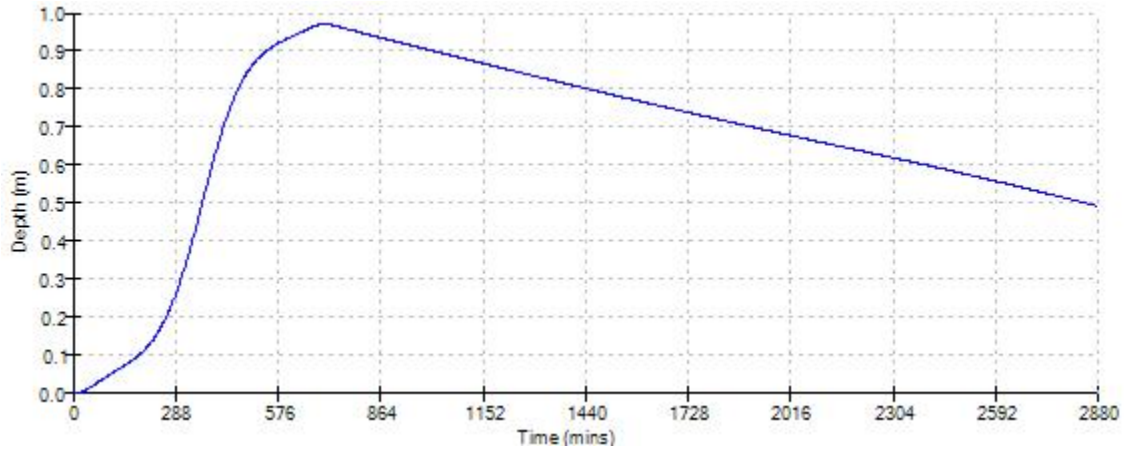
Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.0	1.600	4.8	5.000	8.3
0.200	3.8	1.800	5.1	5.500	8.7
0.300	3.9	2.000	5.4	6.000	9.0
0.400	3.8	2.200	5.6	6.500	9.4
0.500	3.7	2.400	5.9	7.000	9.7
0.600	3.4	2.600	6.1	7.500	10.0
0.800	3.5	3.000	6.5	8.000	10.4
1.000	3.9	3.500	7.0	8.500	10.7
1.200	4.2	4.000	7.4	9.000	10.9
1.400	4.6	4.500	7.9	9.500	11.2

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Event: 720 min Winter

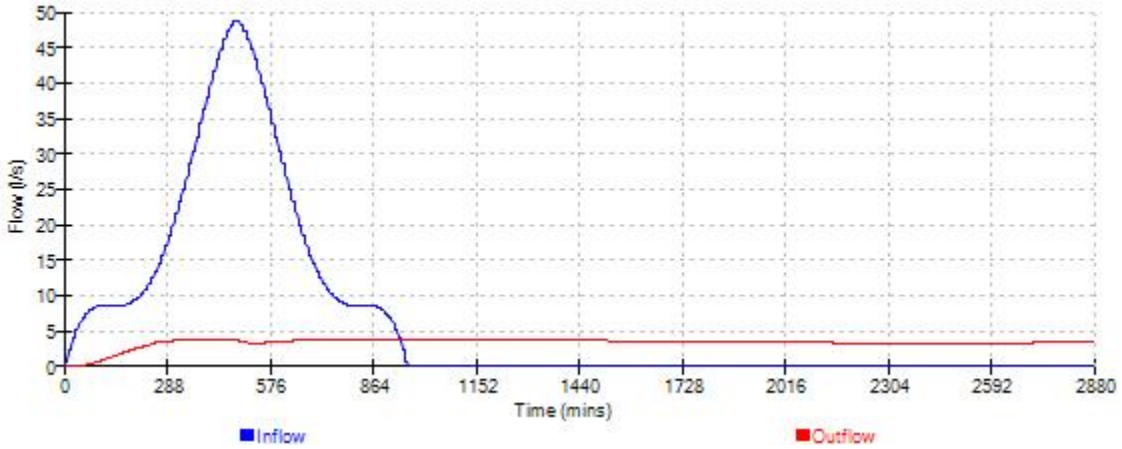


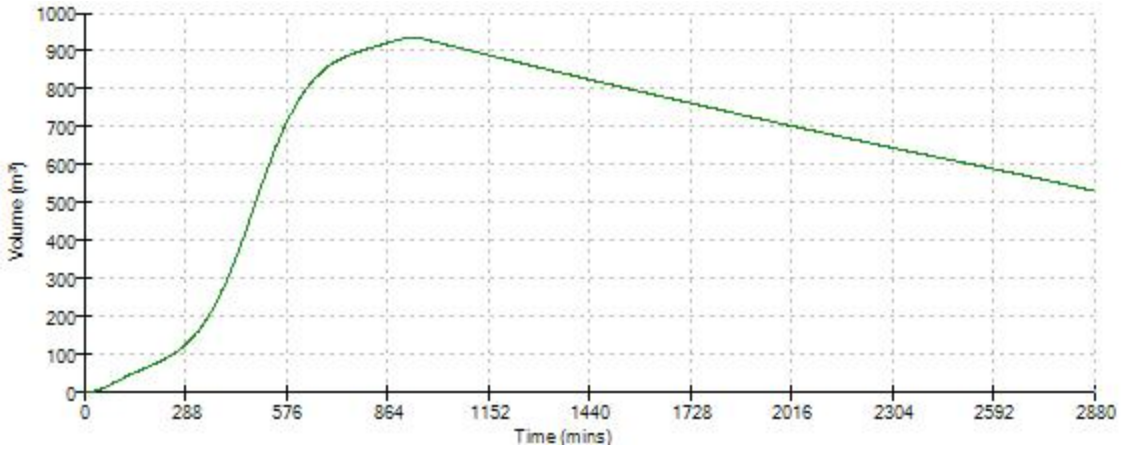


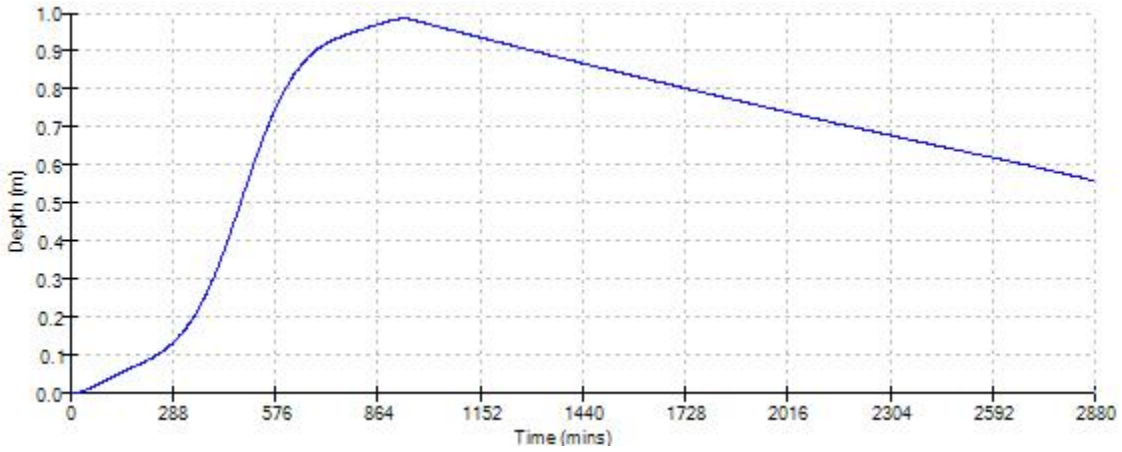


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Event: 960 min Winter

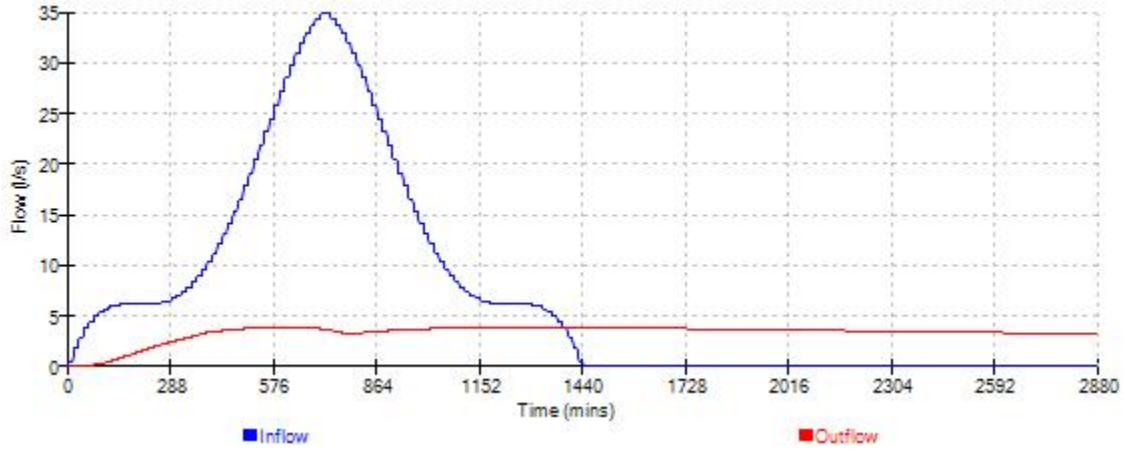


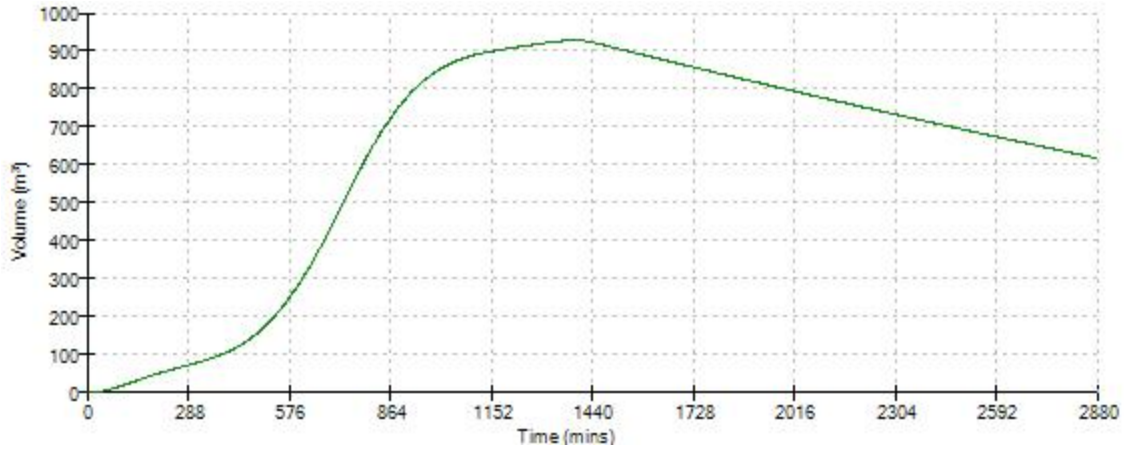


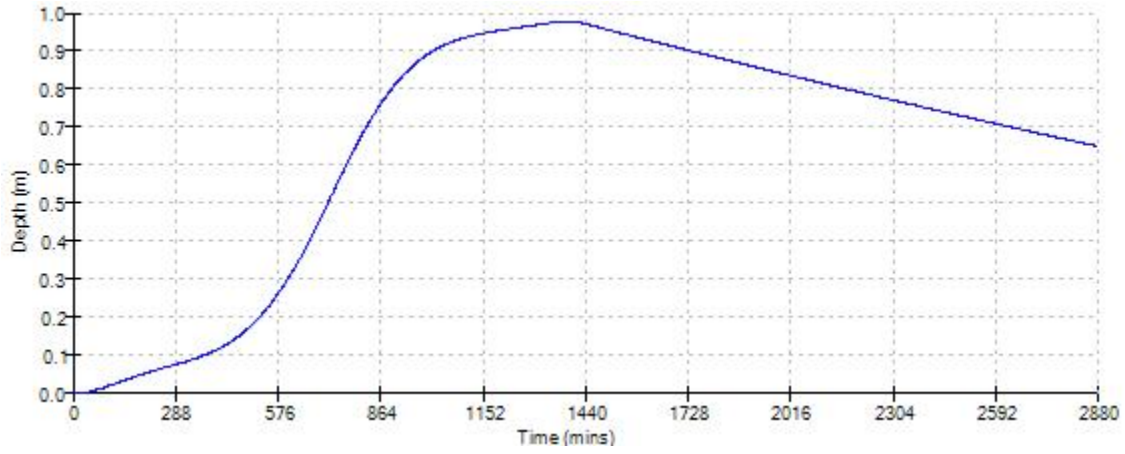


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Event: 1440 min Winter







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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	9.153	0.453	5.4	453.4	O K
30 min Summer	9.319	0.619	5.4	618.9	O K
60 min Summer	9.509	0.809	5.4	809.1	O K
120 min Summer	9.659	0.959	5.4	958.9	O K
180 min Summer	9.741	1.041	5.4	1041.2	Flood Risk
240 min Summer	9.796	1.096	5.4	1096.2	Flood Risk
360 min Summer	9.867	1.167	5.4	1167.1	Flood Risk
480 min Summer	9.910	1.210	5.4	1210.3	Flood Risk
600 min Summer	9.938	1.238	5.4	1237.6	Flood Risk
720 min Summer	9.955	1.255	5.4	1254.7	Flood Risk
960 min Summer	9.969	1.269	5.4	1269.4	Flood Risk
1440 min Summer	9.953	1.253	5.4	1252.9	Flood Risk
2160 min Summer	9.887	1.187	5.4	1186.9	Flood Risk
2880 min Summer	9.827	1.127	5.4	1127.0	Flood Risk
4320 min Summer	9.720	1.020	5.4	1020.4	Flood Risk
5760 min Summer	9.639	0.939	5.4	938.6	O K
7200 min Summer	9.590	0.890	5.4	889.5	O K
8640 min Summer	9.559	0.859	5.4	859.3	O K
10080 min Summer	9.546	0.846	5.4	846.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	155.452	0.0	400.4	17
30 min Summer	106.486	0.0	453.4	32
60 min Summer	69.995	0.0	783.5	62
120 min Summer	41.971	0.0	852.6	122
180 min Summer	30.743	0.0	847.3	182
240 min Summer	24.555	0.0	839.7	242
360 min Summer	17.821	0.0	827.9	362
480 min Summer	14.163	0.0	819.9	482
600 min Summer	11.834	0.0	813.8	602
720 min Summer	10.209	0.0	809.1	722
960 min Summer	8.073	0.0	802.2	960
1440 min Summer	5.765	0.0	794.2	1440
2160 min Summer	4.088	0.0	1621.7	1880
2880 min Summer	3.199	0.0	1575.1	2248
4320 min Summer	2.258	0.0	1430.8	3028
5760 min Summer	1.778	0.0	2004.8	3864
7200 min Summer	1.508	0.0	2123.4	4688
8640 min Summer	1.337	0.0	2255.8	5536
10080 min Summer	1.225	0.0	2400.7	6360

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Winter	9.153	0.453	5.4	453.3	O K
30 min Winter	9.319	0.619	5.4	618.8	O K
60 min Winter	9.509	0.809	5.4	809.0	O K
120 min Winter	9.659	0.959	5.4	958.6	O K
180 min Winter	9.741	1.041	5.4	1041.3	Flood Risk
240 min Winter	9.797	1.097	5.4	1096.6	Flood Risk
360 min Winter	9.868	1.168	5.4	1168.0	Flood Risk
480 min Winter	9.912	1.212	5.4	1211.9	Flood Risk
600 min Winter	9.940	1.240	5.4	1240.0	Flood Risk
720 min Winter	9.958	1.258	5.4	1257.9	Flood Risk
960 min Winter	9.974	1.274	5.4	1274.3	Flood Risk
1440 min Winter	9.962	1.262	5.4	1262.1	Flood Risk
2160 min Winter	9.896	1.196	5.4	1196.0	Flood Risk
2880 min Winter	9.823	1.123	5.4	1123.4	Flood Risk
4320 min Winter	9.693	0.993	5.4	992.8	O K
5760 min Winter	9.577	0.877	5.4	877.1	O K
7200 min Winter	9.483	0.783	5.4	783.2	O K
8640 min Winter	9.405	0.705	5.4	705.4	O K
10080 min Winter	9.356	0.656	5.4	655.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Winter	155.452	0.0	400.5	17
30 min Winter	106.486	0.0	453.5	32
60 min Winter	69.995	0.0	783.5	62
120 min Winter	41.971	0.0	852.8	122
180 min Winter	30.743	0.0	847.5	180
240 min Winter	24.555	0.0	839.8	240
360 min Winter	17.821	0.0	827.8	358
480 min Winter	14.163	0.0	819.5	474
600 min Winter	11.834	0.0	813.3	590
720 min Winter	10.209	0.0	808.4	708
960 min Winter	8.073	0.0	801.3	940
1440 min Winter	5.765	0.0	793.3	1384
2160 min Winter	4.088	0.0	1622.0	2028
2880 min Winter	3.199	0.0	1578.9	2304
4320 min Winter	2.258	0.0	1448.7	3240
5760 min Winter	1.778	0.0	2005.1	4152
7200 min Winter	1.508	0.0	2124.2	5048
8640 min Winter	1.337	0.0	2258.2	5872
10080 min Winter	1.225	0.0	2407.8	6656

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 331208 350156 SJ 31208 50156
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	1.000
Cv (Winter)	1.000
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.176

Time (mins) From:	To:	Area (ha)
0	2	1.176

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Model Details

Storage is Online Cover Level (m) 10.000

Tank or Pond Structure

Invert Level (m) 8.700

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1000.0	1.300	1000.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0105-5400-1300-5400
Design Head (m)	1.300
Design Flow (l/s)	5.4
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	105
Invert Level (m)	8.695
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

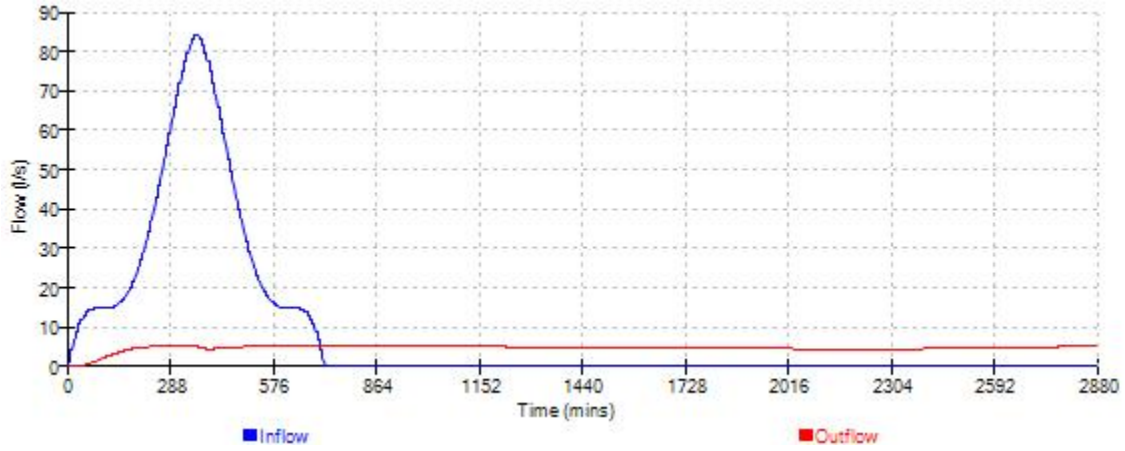
Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.300	5.4
Flush-Flo™	0.385	5.4
Kick-Flo®	0.803	4.3
Mean Flow over Head Range	-	4.7

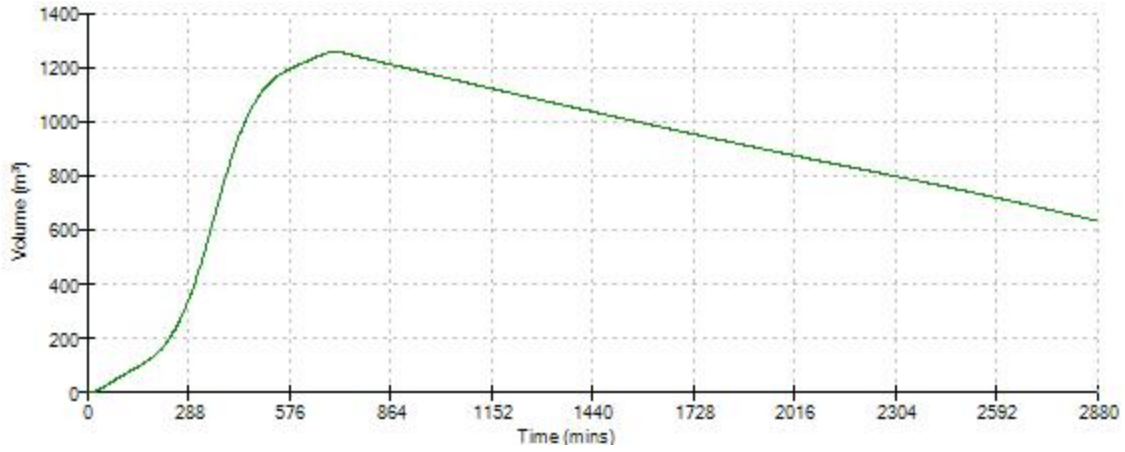
The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

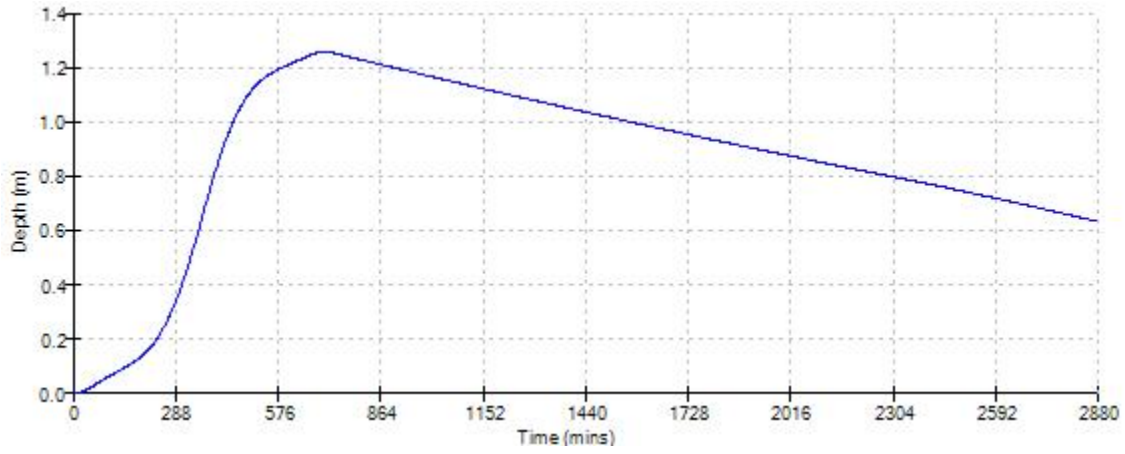
Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.5	1.600	5.9	5.000	10.2
0.200	5.0	1.800	6.3	5.500	10.6
0.300	5.3	2.000	6.6	6.000	11.1
0.400	5.4	2.200	6.9	6.500	11.5
0.500	5.3	2.400	7.2	7.000	11.9
0.600	5.2	2.600	7.5	7.500	12.3
0.800	4.4	3.000	8.0	8.000	12.7
1.000	4.8	3.500	8.6	8.500	13.1
1.200	5.2	4.000	9.1	9.000	13.5
1.400	5.6	4.500	9.7	9.500	13.8

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Event: 720 min Winter

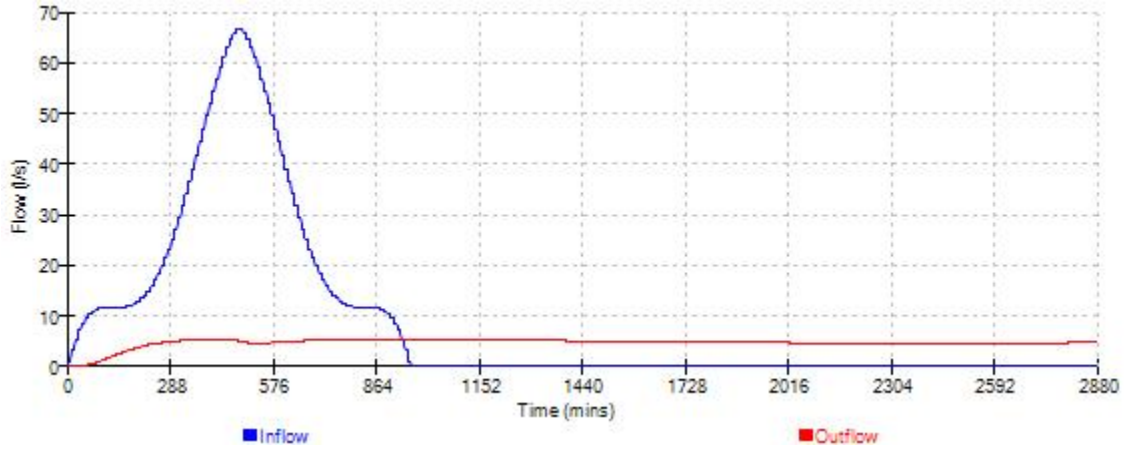


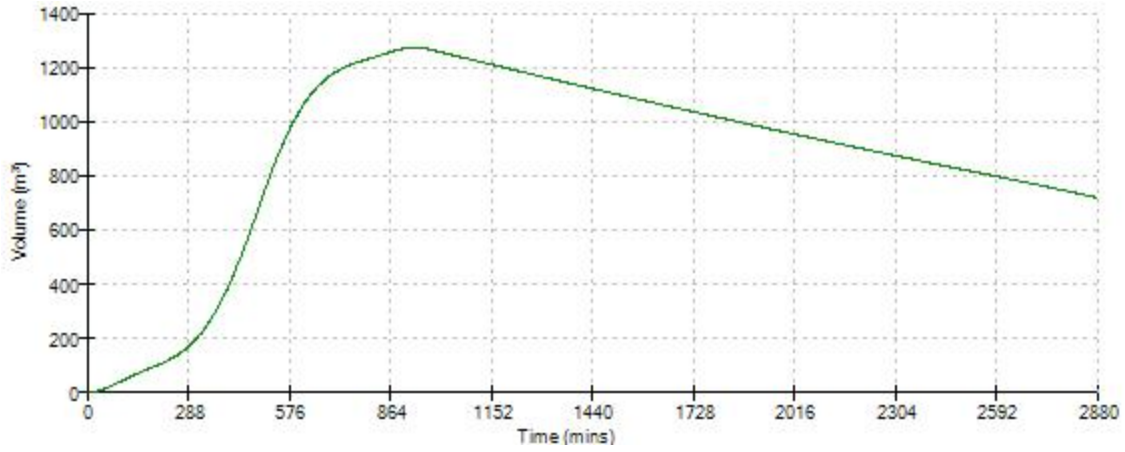


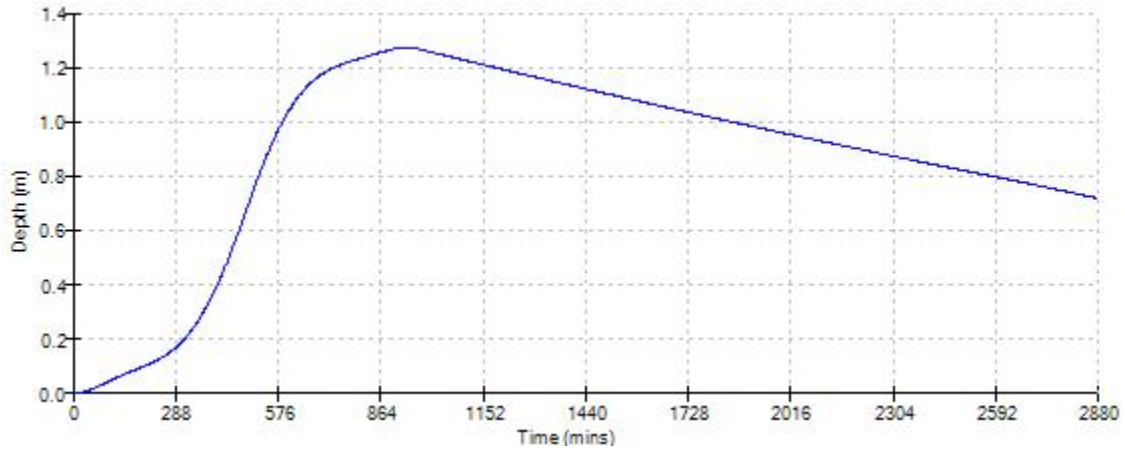


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Event: 960 min Winter

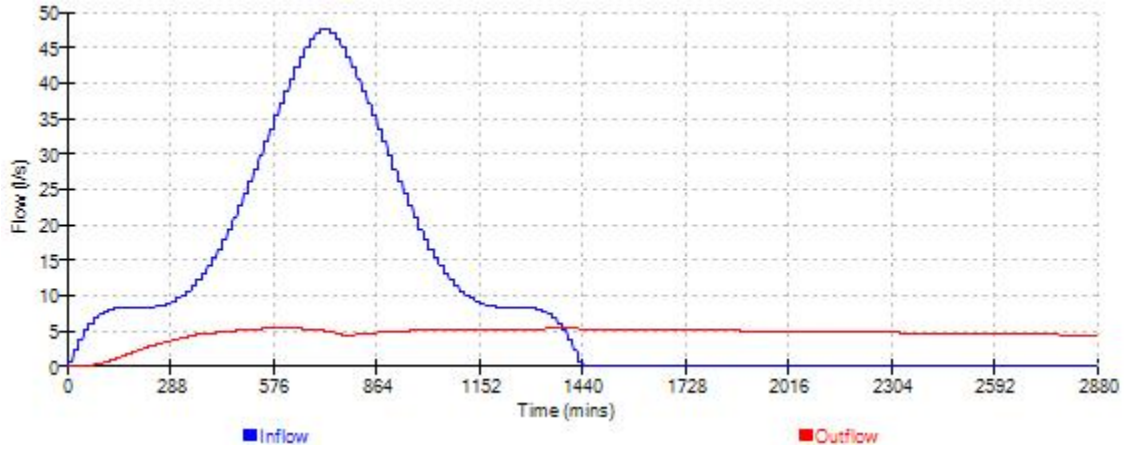


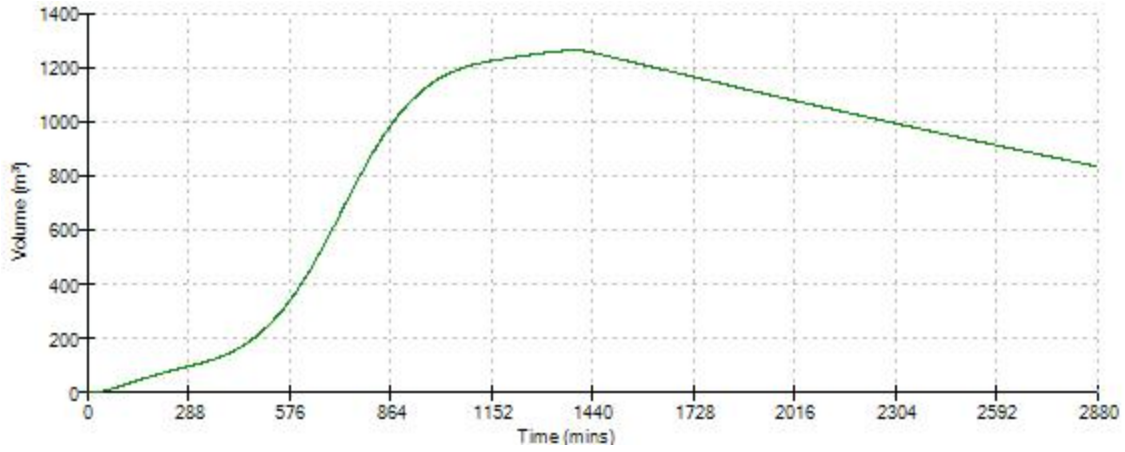


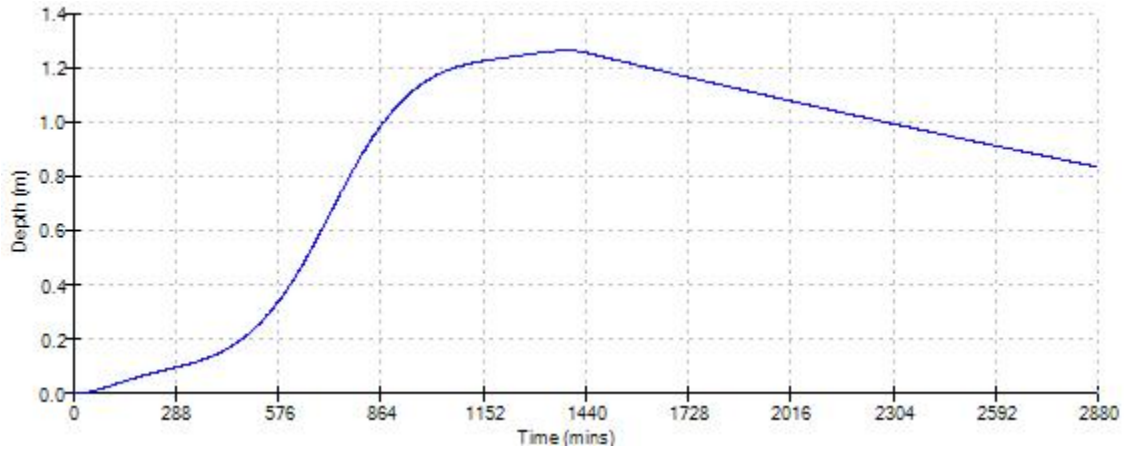


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Event: 1440 min Winter







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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	9.353	0.353	3.5	291.6	O K
30 min Summer	9.482	0.482	3.5	398.0	O K
60 min Summer	9.630	0.630	3.5	520.1	O K
120 min Summer	9.747	0.747	3.5	616.4	Flood Risk
180 min Summer	9.811	0.811	3.5	669.3	Flood Risk
240 min Summer	9.854	0.854	3.5	704.6	Flood Risk
360 min Summer	9.909	0.909	3.5	750.1	Flood Risk
480 min Summer	9.943	0.943	3.5	777.8	Flood Risk
600 min Summer	9.964	0.964	3.5	795.3	Flood Risk
720 min Summer	9.977	0.977	3.5	806.1	Flood Risk
960 min Summer	9.988	0.988	3.5	815.5	Flood Risk
1440 min Summer	9.975	0.975	3.5	804.5	Flood Risk
2160 min Summer	9.924	0.924	3.5	762.3	Flood Risk
2880 min Summer	9.878	0.878	3.5	724.0	Flood Risk
4320 min Summer	9.795	0.795	3.5	655.6	Flood Risk
5760 min Summer	9.731	0.731	3.5	602.7	Flood Risk
7200 min Summer	9.692	0.692	3.5	570.7	O K
8640 min Summer	9.668	0.668	3.5	550.7	O K
10080 min Summer	9.657	0.657	3.5	541.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	155.452	0.0	256.2	16
30 min Summer	106.486	0.0	293.4	31
60 min Summer	69.995	0.0	503.0	62
120 min Summer	41.971	0.0	553.5	122
180 min Summer	30.743	0.0	551.1	182
240 min Summer	24.555	0.0	546.7	242
360 min Summer	17.821	0.0	539.4	362
480 min Summer	14.163	0.0	534.2	482
600 min Summer	11.834	0.0	530.2	602
720 min Summer	10.209	0.0	526.9	720
960 min Summer	8.073	0.0	521.6	960
1440 min Summer	5.765	0.0	514.6	1440
2160 min Summer	4.088	0.0	1048.8	1860
2880 min Summer	3.199	0.0	1021.4	2224
4320 min Summer	2.258	0.0	927.8	3024
5760 min Summer	1.778	0.0	1289.1	3864
7200 min Summer	1.508	0.0	1365.2	4688
8640 min Summer	1.337	0.0	1450.1	5536
10080 min Summer	1.225	0.0	1543.2	6360

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Winter	9.353	0.353	3.5	291.6	O K
30 min Winter	9.482	0.482	3.5	397.9	O K
60 min Winter	9.630	0.630	3.5	520.0	O K
120 min Winter	9.747	0.747	3.5	616.2	Flood Risk
180 min Winter	9.811	0.811	3.5	669.4	Flood Risk
240 min Winter	9.854	0.854	3.5	704.8	Flood Risk
360 min Winter	9.910	0.910	3.5	750.7	Flood Risk
480 min Winter	9.944	0.944	3.5	778.8	Flood Risk
600 min Winter	9.966	0.966	3.5	796.8	Flood Risk
720 min Winter	9.980	0.980	3.5	808.2	Flood Risk
960 min Winter	9.992	0.992	3.5	818.6	Flood Risk
1440 min Winter	9.982	0.982	3.5	810.4	Flood Risk
2160 min Winter	9.930	0.930	3.5	767.5	Flood Risk
2880 min Winter	9.874	0.874	3.5	721.2	Flood Risk
4320 min Winter	9.772	0.772	3.5	637.0	Flood Risk
5760 min Winter	9.681	0.681	3.5	562.0	O K
7200 min Winter	9.606	0.606	3.5	499.9	O K
8640 min Winter	9.547	0.547	3.5	451.0	O K
10080 min Winter	9.508	0.508	3.5	419.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Winter	155.452	0.0	256.3	16
30 min Winter	106.486	0.0	293.4	31
60 min Winter	69.995	0.0	503.0	62
120 min Winter	41.971	0.0	553.6	122
180 min Winter	30.743	0.0	551.3	180
240 min Winter	24.555	0.0	546.8	240
360 min Winter	17.821	0.0	539.4	358
480 min Winter	14.163	0.0	534.1	474
600 min Winter	11.834	0.0	529.9	590
720 min Winter	10.209	0.0	526.5	706
960 min Winter	8.073	0.0	521.1	940
1440 min Winter	5.765	0.0	514.1	1384
2160 min Winter	4.088	0.0	1049.1	2016
2880 min Winter	3.199	0.0	1024.1	2280
4320 min Winter	2.258	0.0	939.7	3200
5760 min Winter	1.778	0.0	1289.3	4152
7200 min Winter	1.508	0.0	1365.8	5040
8640 min Winter	1.337	0.0	1451.7	5800
10080 min Winter	1.225	0.0	1547.6	6648

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 331208 350156 SJ 31208 50156
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	1.000
Cv (Winter)	1.000
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.756

Time (mins) From:	To:	Area (ha)
0	1	0.756

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Model Details

Storage is Online Cover Level (m) 10.000

Tank or Pond Structure

Invert Level (m) 9.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	825.0	1.000	825.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0089-3500-1000-3500
Design Head (m)	1.000
Design Flow (l/s)	3.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	89
Invert Level (m)	8.995
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

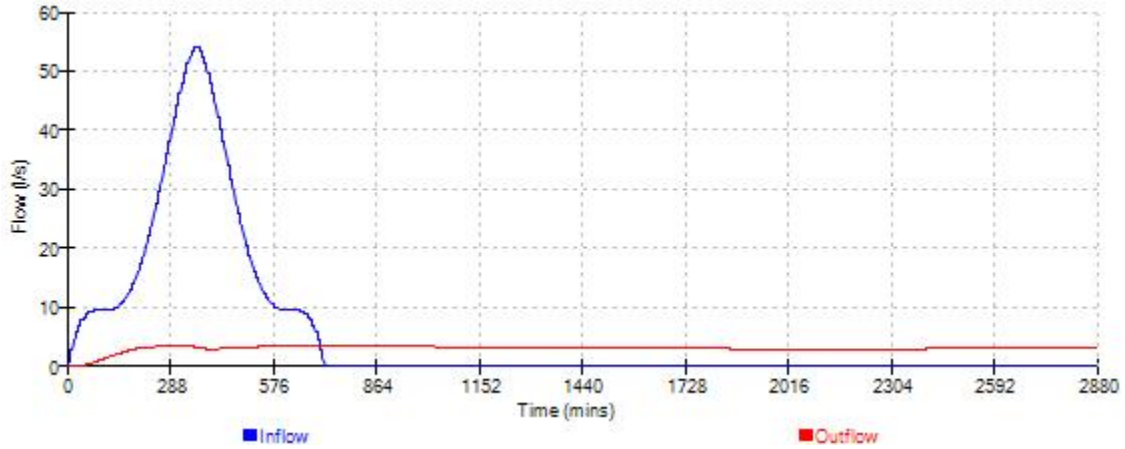
Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	3.5
Flush-Flo™	0.300	3.5
Kick-Flo®	0.632	2.8
Mean Flow over Head Range	-	3.1

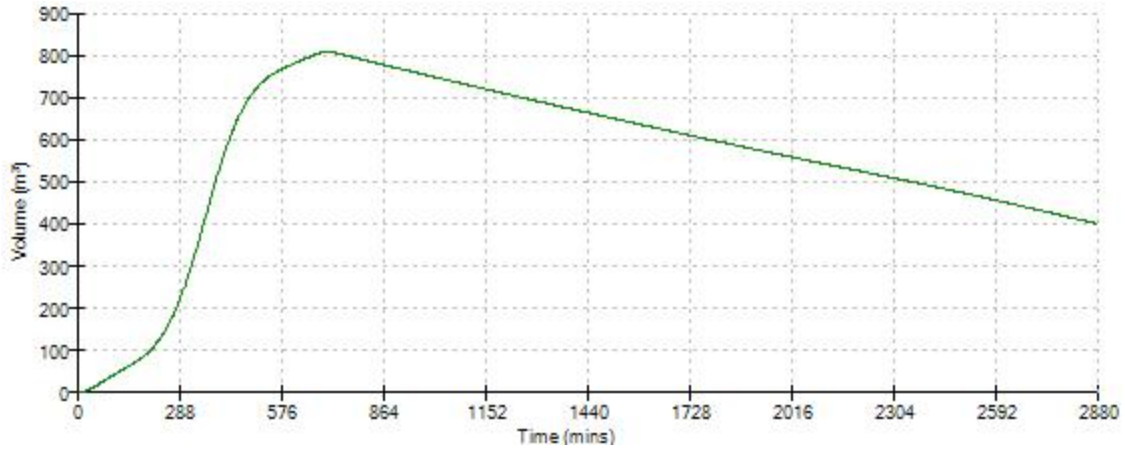
The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

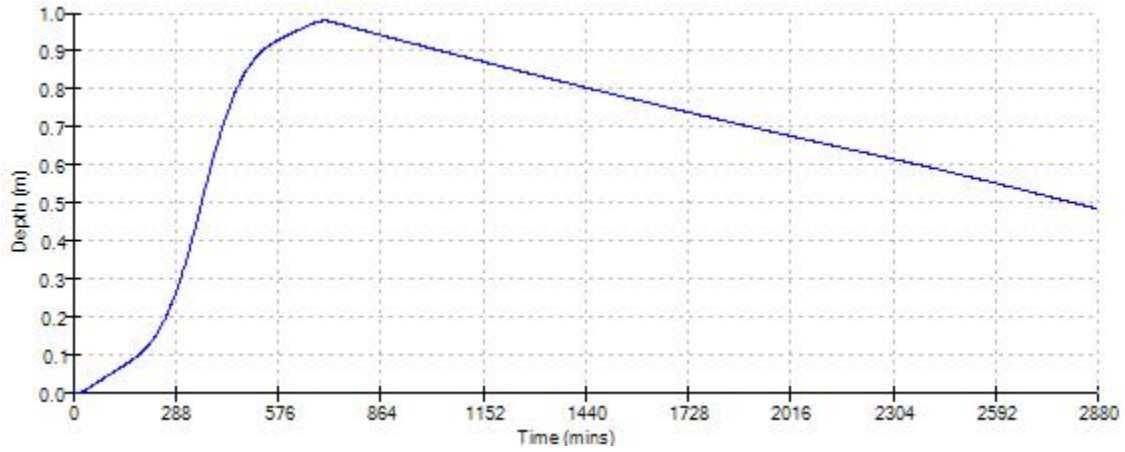
Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.7	1.600	4.3	5.000	7.4
0.200	3.4	1.800	4.6	5.500	7.7
0.300	3.5	2.000	4.8	6.000	8.1
0.400	3.4	2.200	5.0	6.500	8.4
0.500	3.3	2.400	5.2	7.000	8.7
0.600	3.0	2.600	5.4	7.500	9.0
0.800	3.1	3.000	5.8	8.000	9.2
1.000	3.5	3.500	6.2	8.500	9.5
1.200	3.8	4.000	6.7	9.000	9.8
1.400	4.1	4.500	7.0	9.500	10.0

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Event: 720 min Winter

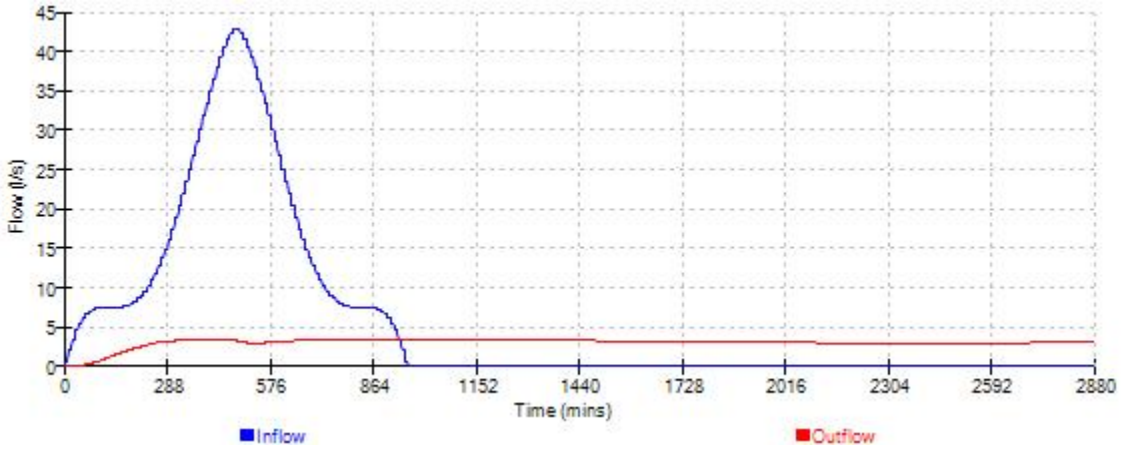


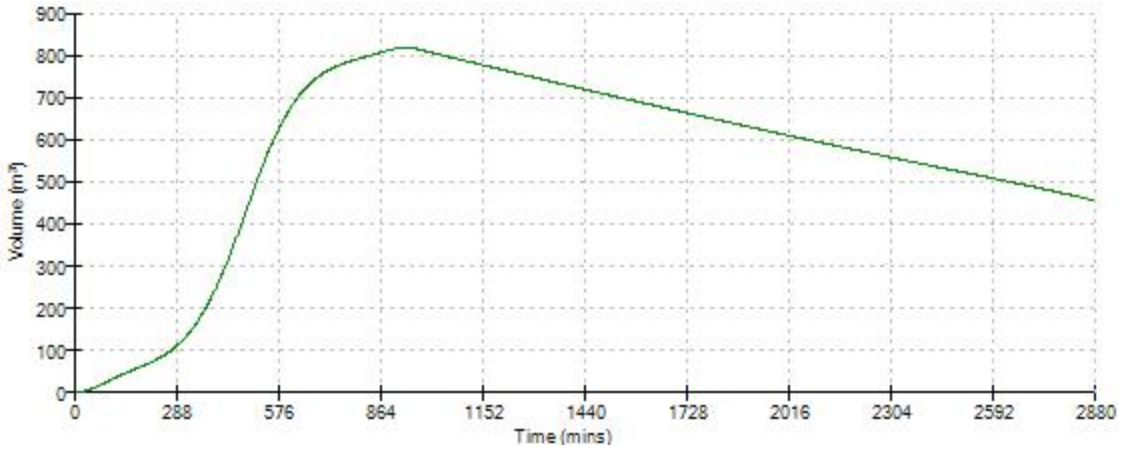


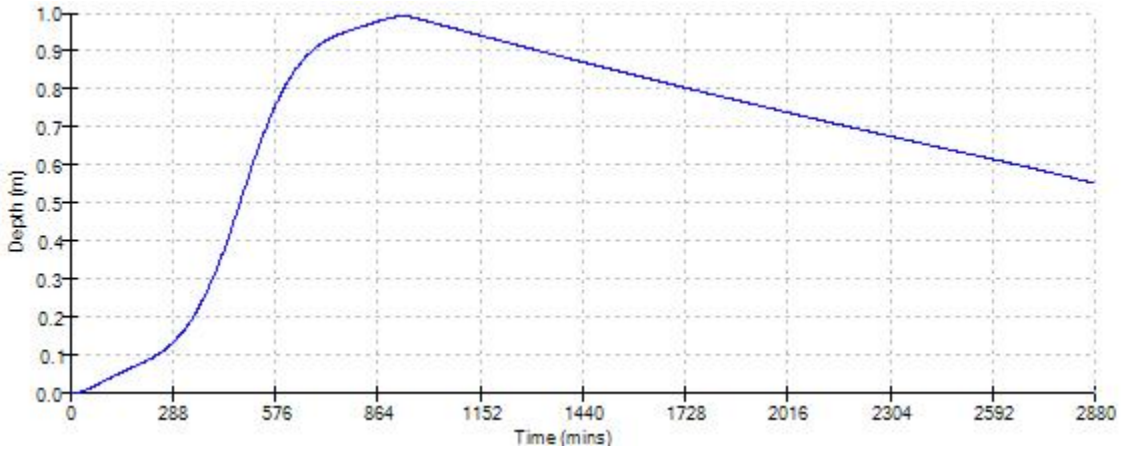


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Event: 960 min Winter

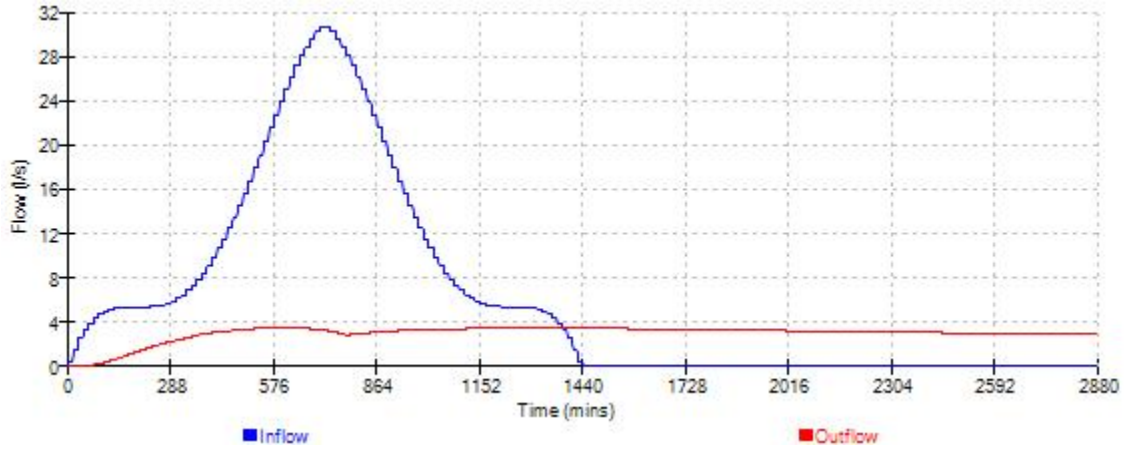


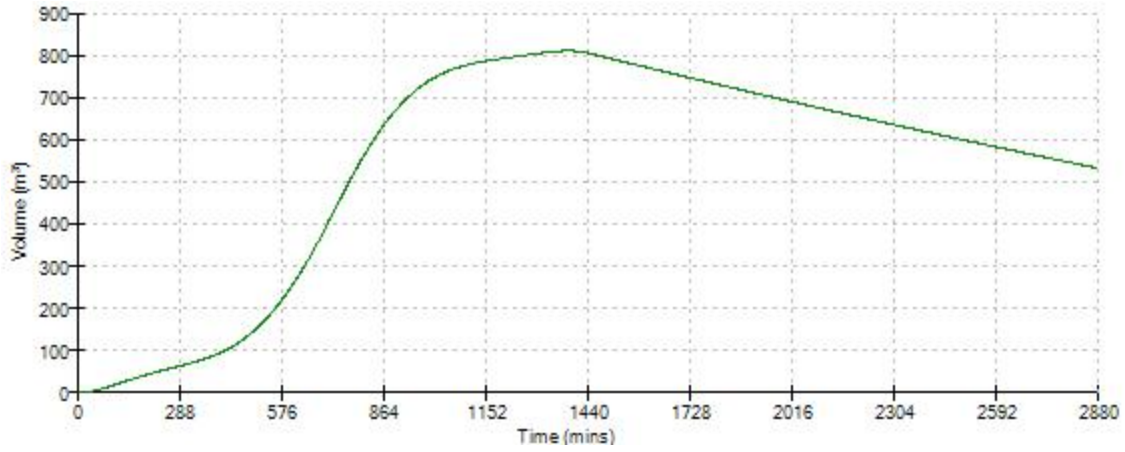


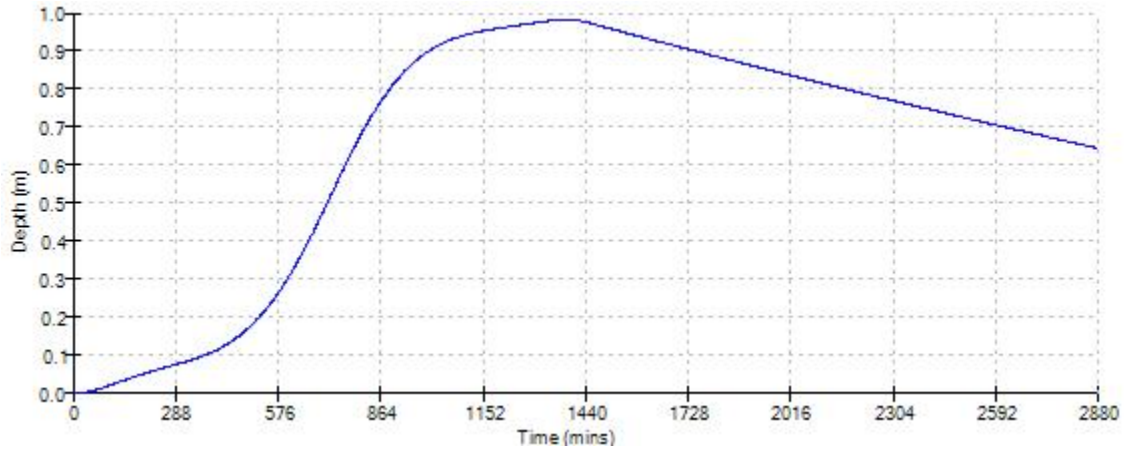


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Event: 1440 min Winter







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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	9.355	0.355	4.4	368.5	O K
30 min Summer	9.485	0.485	4.4	503.1	O K
60 min Summer	9.634	0.634	4.4	657.6	O K
120 min Summer	9.752	0.752	4.4	779.5	Flood Risk
180 min Summer	9.816	0.816	4.4	846.5	Flood Risk
240 min Summer	9.860	0.860	4.4	891.4	Flood Risk
360 min Summer	9.915	0.915	4.4	949.3	Flood Risk
480 min Summer	9.949	0.949	4.4	984.6	Flood Risk
600 min Summer	9.971	0.971	4.4	1006.9	Flood Risk
720 min Summer	9.984	0.984	4.4	1020.9	Flood Risk
960 min Summer	9.996	0.996	4.4	1033.0	Flood Risk
1440 min Summer	9.984	0.984	4.4	1019.9	Flood Risk
2160 min Summer	9.933	0.933	4.4	967.4	Flood Risk
2880 min Summer	9.887	0.887	4.4	919.7	Flood Risk
4320 min Summer	9.804	0.804	4.4	834.0	Flood Risk
5760 min Summer	9.740	0.740	4.4	767.5	Flood Risk
7200 min Summer	9.701	0.701	4.4	727.3	Flood Risk
8640 min Summer	9.677	0.677	4.4	702.3	O K
10080 min Summer	9.667	0.667	4.4	691.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	155.452	0.0	320.6	18
30 min Summer	106.486	0.0	369.8	33
60 min Summer	69.995	0.0	632.3	64
120 min Summer	41.971	0.0	697.8	124
180 min Summer	30.743	0.0	694.8	184
240 min Summer	24.555	0.0	689.0	242
360 min Summer	17.821	0.0	679.7	362
480 min Summer	14.163	0.0	673.3	482
600 min Summer	11.834	0.0	668.3	602
720 min Summer	10.209	0.0	664.1	722
960 min Summer	8.073	0.0	657.4	962
1440 min Summer	5.765	0.0	648.3	1440
2160 min Summer	4.088	0.0	1321.6	1860
2880 min Summer	3.199	0.0	1286.1	2224
4320 min Summer	2.258	0.0	1167.2	3024
5760 min Summer	1.778	0.0	1628.9	3864
7200 min Summer	1.508	0.0	1724.8	4688
8640 min Summer	1.337	0.0	1831.7	5536
10080 min Summer	1.225	0.0	1948.1	6360

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Winter	9.355	0.355	4.4	368.4	O K
30 min Winter	9.485	0.485	4.4	503.0	O K
60 min Winter	9.634	0.634	4.4	657.5	O K
120 min Winter	9.752	0.752	4.4	779.5	Flood Risk
180 min Winter	9.816	0.816	4.4	846.7	Flood Risk
240 min Winter	9.860	0.860	4.4	891.8	Flood Risk
360 min Winter	9.916	0.916	4.4	950.0	Flood Risk
480 min Winter	9.951	0.951	4.4	985.8	Flood Risk
600 min Winter	9.973	0.973	4.4	1008.7	Flood Risk
720 min Winter	9.987	0.987	4.4	1023.4	Flood Risk
960 min Winter	10.000	1.000	4.4	1036.8	Flood Risk
1440 min Winter	9.991	0.991	4.4	1027.2	Flood Risk
2160 min Winter	9.939	0.939	4.4	973.8	Flood Risk
2880 min Winter	9.883	0.883	4.4	916.1	Flood Risk
4320 min Winter	9.782	0.782	4.4	810.6	Flood Risk
5760 min Winter	9.691	0.691	4.4	716.5	O K
7200 min Winter	9.617	0.617	4.4	639.8	O K
8640 min Winter	9.557	0.557	4.4	577.4	O K
10080 min Winter	9.518	0.518	4.4	537.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Winter	155.452	0.0	320.6	18
30 min Winter	106.486	0.0	369.9	33
60 min Winter	69.995	0.0	632.3	64
120 min Winter	41.971	0.0	698.1	122
180 min Winter	30.743	0.0	695.1	180
240 min Winter	24.555	0.0	689.2	240
360 min Winter	17.821	0.0	679.8	358
480 min Winter	14.163	0.0	673.2	476
600 min Winter	11.834	0.0	668.0	592
720 min Winter	10.209	0.0	663.7	708
960 min Winter	8.073	0.0	656.9	940
1440 min Winter	5.765	0.0	647.8	1384
2160 min Winter	4.088	0.0	1322.0	2016
2880 min Winter	3.199	0.0	1289.6	2280
4320 min Winter	2.258	0.0	1181.9	3200
5760 min Winter	1.778	0.0	1629.2	4152
7200 min Winter	1.508	0.0	1725.7	5040
8640 min Winter	1.337	0.0	1834.0	5800
10080 min Winter	1.225	0.0	1954.5	6656

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 331208 350156 SJ 31208 50156
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	1.000
Cv (Winter)	1.000
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.956

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	1	0.319	1	2	0.319	2	3	0.319

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Model Details

Storage is Online Cover Level (m) 10.000

Tank or Pond Structure

Invert Level (m) 9.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1037.0	1.000	1037.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0099-4400-1000-4400
Design Head (m)	1.000
Design Flow (l/s)	4.4
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	99
Invert Level (m)	8.995
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

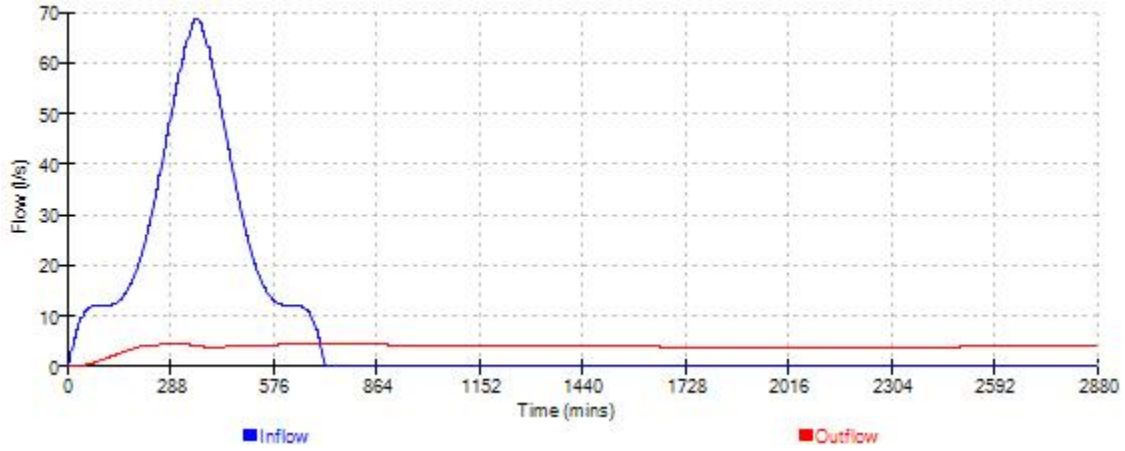
Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	4.4
Flush-Flo™	0.297	4.4
Kick-Flo®	0.636	3.6
Mean Flow over Head Range	-	3.8

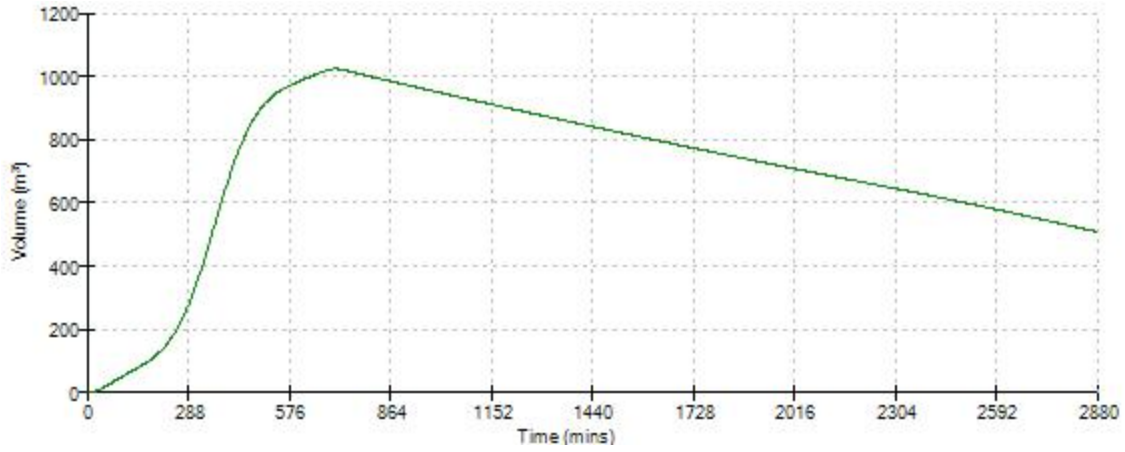
The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

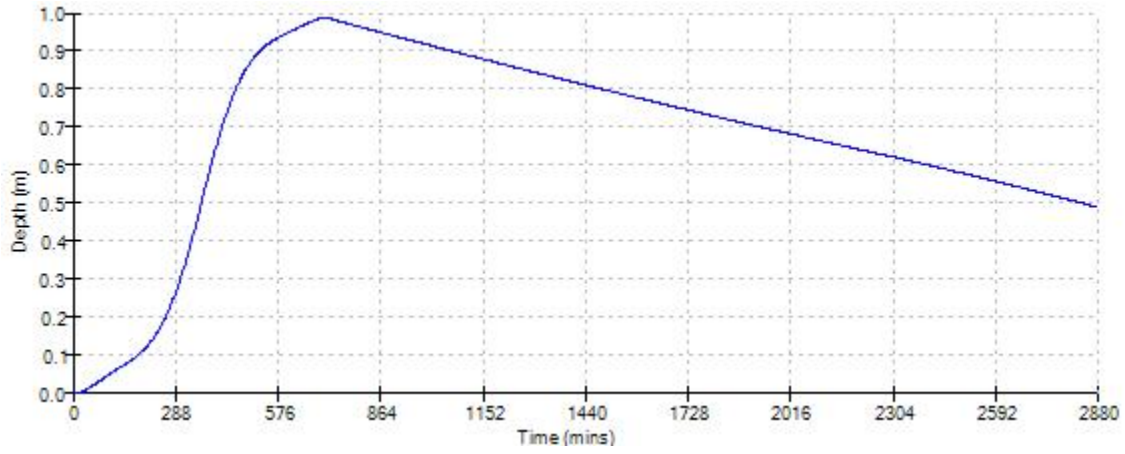
Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.3	1.600	5.5	5.000	9.4
0.200	4.3	1.800	5.8	5.500	9.8
0.300	4.4	2.000	6.1	6.000	10.2
0.400	4.3	2.200	6.4	6.500	10.6
0.500	4.2	2.400	6.6	7.000	11.0
0.600	3.8	2.600	6.9	7.500	11.3
0.800	4.0	3.000	7.3	8.000	11.7
1.000	4.4	3.500	7.9	8.500	12.0
1.200	4.8	4.000	8.4	9.000	12.4
1.400	5.1	4.500	8.9	9.500	12.7

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Event: 720 min Winter

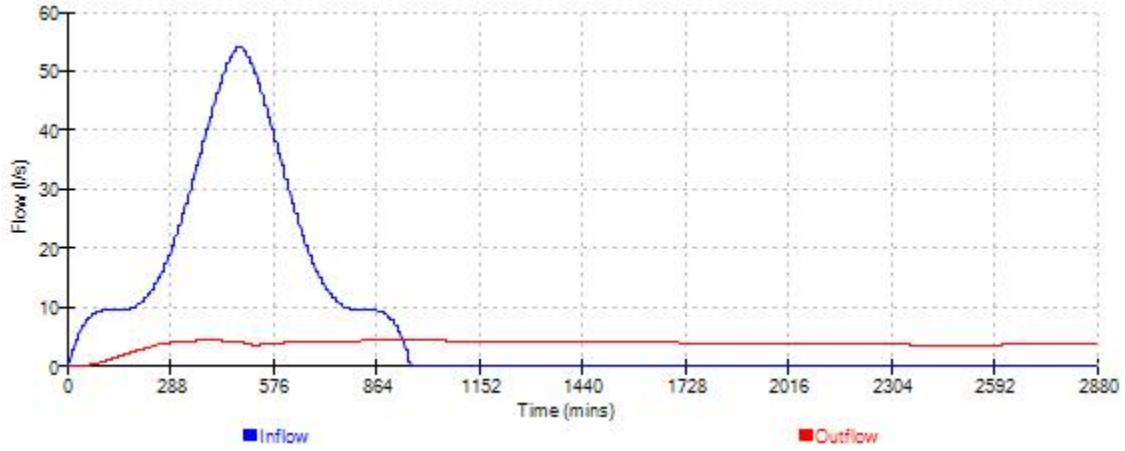


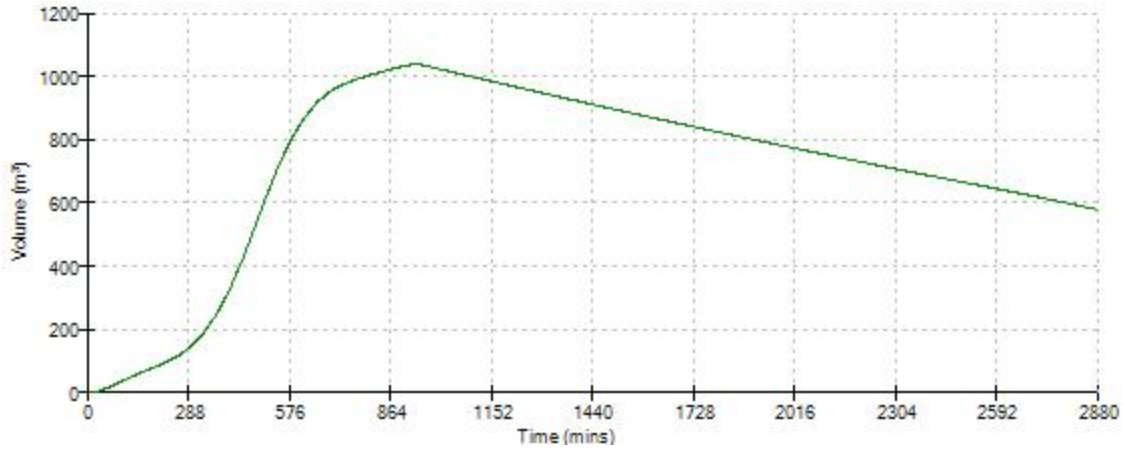


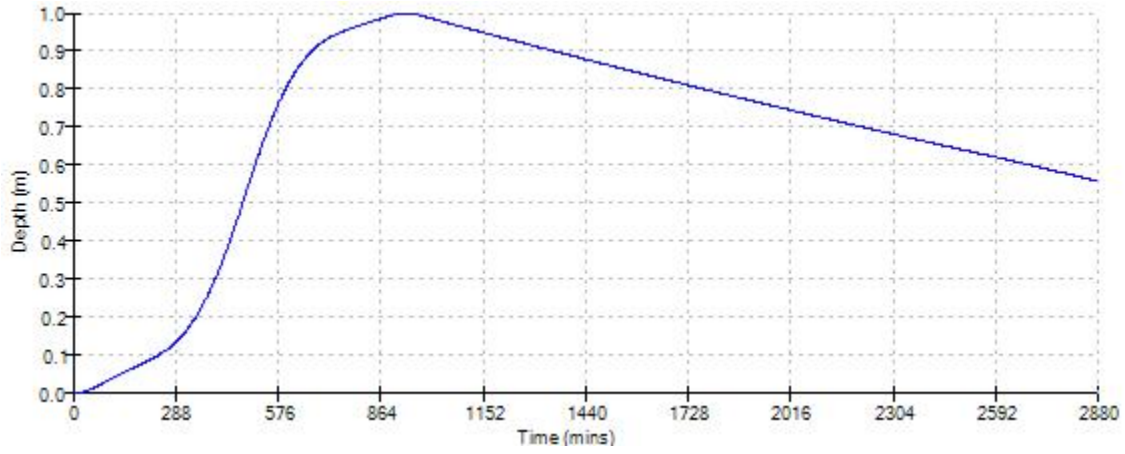


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Event: 960 min Winter

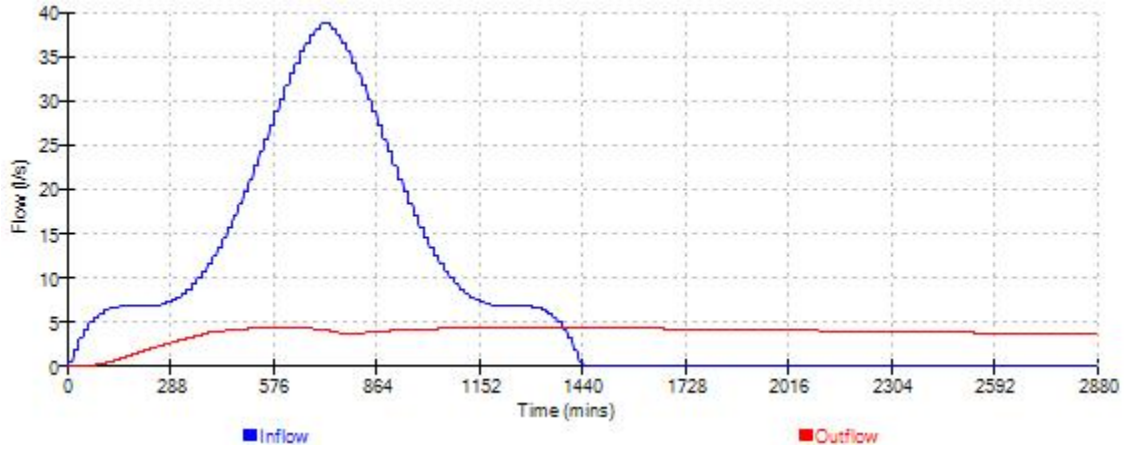


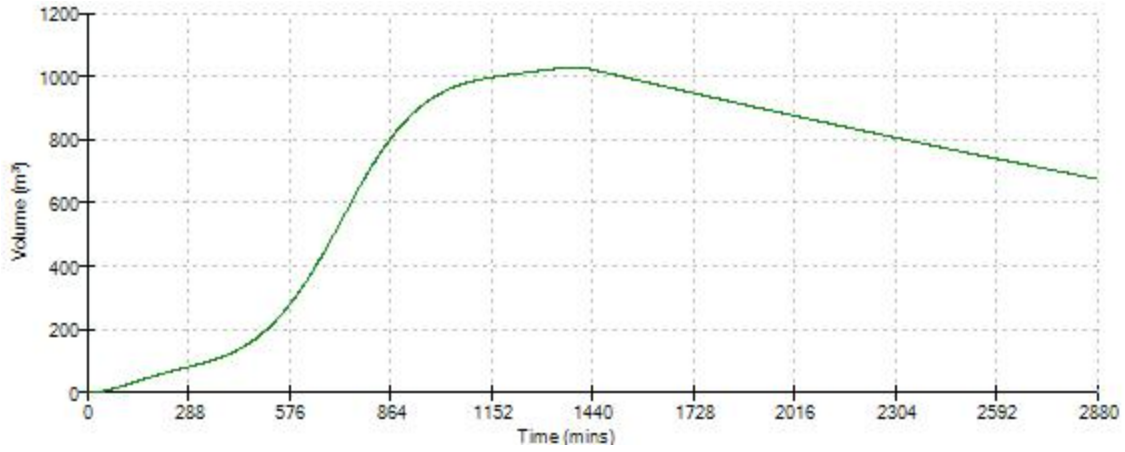


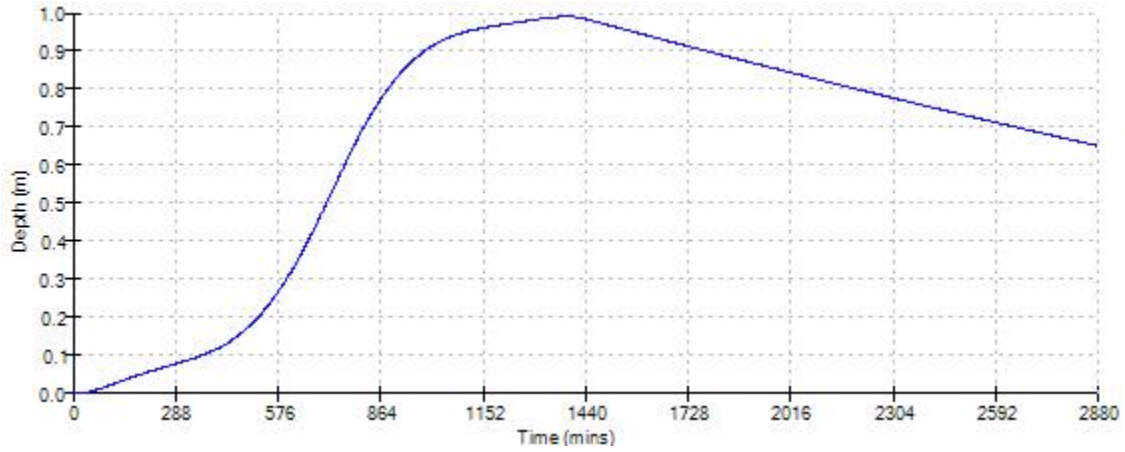


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Event: 1440 min Winter







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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	9.338	0.338	3.0	312.9	O K
30 min Summer	9.462	0.462	3.0	427.4	O K
60 min Summer	9.604	0.604	3.0	559.1	O K
120 min Summer	9.718	0.718	3.0	664.3	Flood Risk
180 min Summer	9.782	0.782	3.0	723.2	Flood Risk
240 min Summer	9.825	0.825	3.0	763.2	Flood Risk
360 min Summer	9.883	0.883	3.0	816.3	Flood Risk
480 min Summer	9.919	0.919	3.0	850.4	Flood Risk
600 min Summer	9.944	0.944	3.0	873.5	Flood Risk
720 min Summer	9.962	0.962	3.0	889.4	Flood Risk
960 min Summer	9.981	0.981	3.0	907.8	Flood Risk
1440 min Summer	9.986	0.986	3.0	911.9	Flood Risk
2160 min Summer	9.953	0.953	3.0	881.4	Flood Risk
2880 min Summer	9.912	0.912	3.0	843.8	Flood Risk
4320 min Summer	9.840	0.840	3.0	777.4	Flood Risk
5760 min Summer	9.788	0.788	3.0	728.6	Flood Risk
7200 min Summer	9.760	0.760	3.0	703.5	Flood Risk
8640 min Summer	9.748	0.748	3.0	691.8	Flood Risk
10080 min Summer	9.748	0.748	3.0	692.2	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	155.452	0.0	243.0	16
30 min Summer	106.486	0.0	254.2	31
60 min Summer	69.995	0.0	487.3	62
120 min Summer	41.971	0.0	474.7	122
180 min Summer	30.743	0.0	464.5	182
240 min Summer	24.555	0.0	458.5	242
360 min Summer	17.821	0.0	452.0	362
480 min Summer	14.163	0.0	449.1	482
600 min Summer	11.834	0.0	448.3	602
720 min Summer	10.209	0.0	448.8	722
960 min Summer	8.073	0.0	451.9	960
1440 min Summer	5.765	0.0	450.0	1440
2160 min Summer	4.088	0.0	903.1	2160
2880 min Summer	3.199	0.0	872.9	2452
4320 min Summer	2.258	0.0	807.6	3200
5760 min Summer	1.778	0.0	1376.1	4032
7200 min Summer	1.508	0.0	1452.8	4832
8640 min Summer	1.337	0.0	1524.0	5704
10080 min Summer	1.225	0.0	1501.5	6552

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Winter	9.338	0.338	3.0	312.9	O K
30 min Winter	9.462	0.462	3.0	427.3	O K
60 min Winter	9.604	0.604	3.0	559.0	O K
120 min Winter	9.718	0.718	3.0	664.2	Flood Risk
180 min Winter	9.782	0.782	3.0	723.2	Flood Risk
240 min Winter	9.825	0.825	3.0	763.3	Flood Risk
360 min Winter	9.883	0.883	3.0	816.7	Flood Risk
480 min Winter	9.920	0.920	3.0	851.1	Flood Risk
600 min Winter	9.946	0.946	3.0	874.6	Flood Risk
720 min Winter	9.963	0.963	3.0	890.9	Flood Risk
960 min Winter	9.984	0.984	3.0	910.2	Flood Risk
1440 min Winter	9.991	0.991	3.0	916.4	Flood Risk
2160 min Winter	9.962	0.962	3.0	889.6	Flood Risk
2880 min Winter	9.918	0.918	3.0	849.0	Flood Risk
4320 min Winter	9.833	0.833	3.0	770.2	Flood Risk
5760 min Winter	9.764	0.764	3.0	706.7	Flood Risk
7200 min Winter	9.719	0.719	3.0	665.1	Flood Risk
8640 min Winter	9.688	0.688	3.0	636.4	O K
10080 min Winter	9.671	0.671	3.0	620.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Winter	155.452	0.0	243.0	16
30 min Winter	106.486	0.0	254.2	31
60 min Winter	69.995	0.0	487.4	62
120 min Winter	41.971	0.0	474.9	122
180 min Winter	30.743	0.0	464.7	180
240 min Winter	24.555	0.0	458.6	240
360 min Winter	17.821	0.0	452.0	358
480 min Winter	14.163	0.0	449.0	476
600 min Winter	11.834	0.0	448.1	594
720 min Winter	10.209	0.0	448.5	708
960 min Winter	8.073	0.0	451.4	942
1440 min Winter	5.765	0.0	449.3	1398
2160 min Winter	4.088	0.0	902.5	2072
2880 min Winter	3.199	0.0	873.4	2680
4320 min Winter	2.258	0.0	812.7	3332
5760 min Winter	1.778	0.0	1376.5	4272
7200 min Winter	1.508	0.0	1454.0	5192
8640 min Winter	1.337	0.0	1531.6	6136
10080 min Winter	1.225	0.0	1544.1	7064

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 331208 350156 SJ 31208 50156
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	1.000
Cv (Winter)	1.000
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.810

Time (mins) From:	To:	Area (ha)
0	1	0.810

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Model Details

Storage is Online Cover Level (m) 10.000

Tank or Pond Structure

Invert Level (m) 9.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	925.0	1.000	925.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0082-3000-1000-3000
Design Head (m)	1.000
Design Flow (l/s)	3.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	82
Invert Level (m)	8.995
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

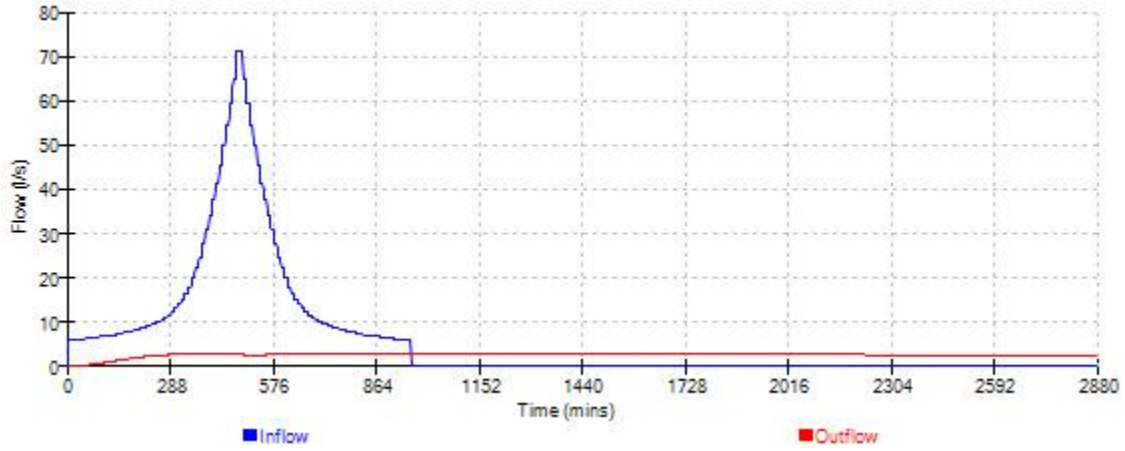
Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	3.0
Flush-Flo™	0.297	3.0
Kick-Flo®	0.623	2.4
Mean Flow over Head Range	-	2.6

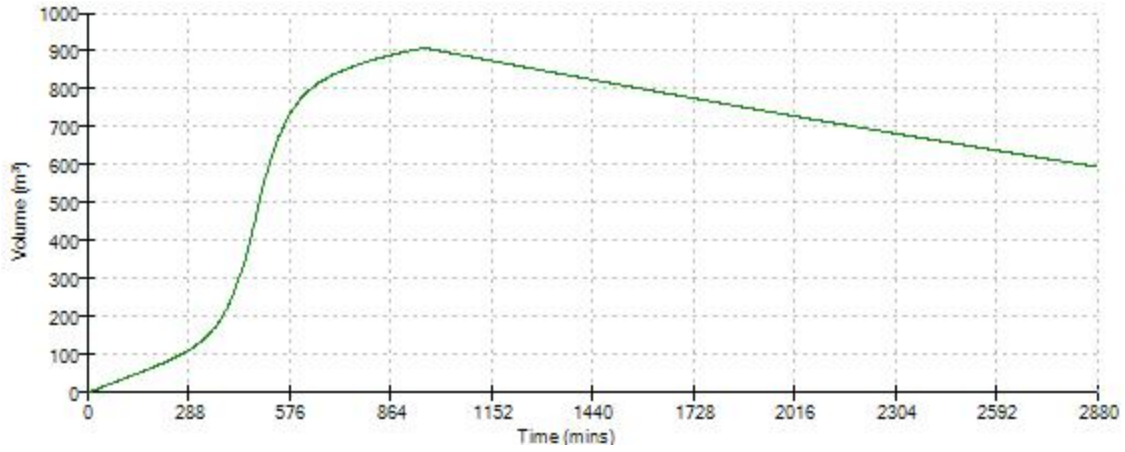
The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

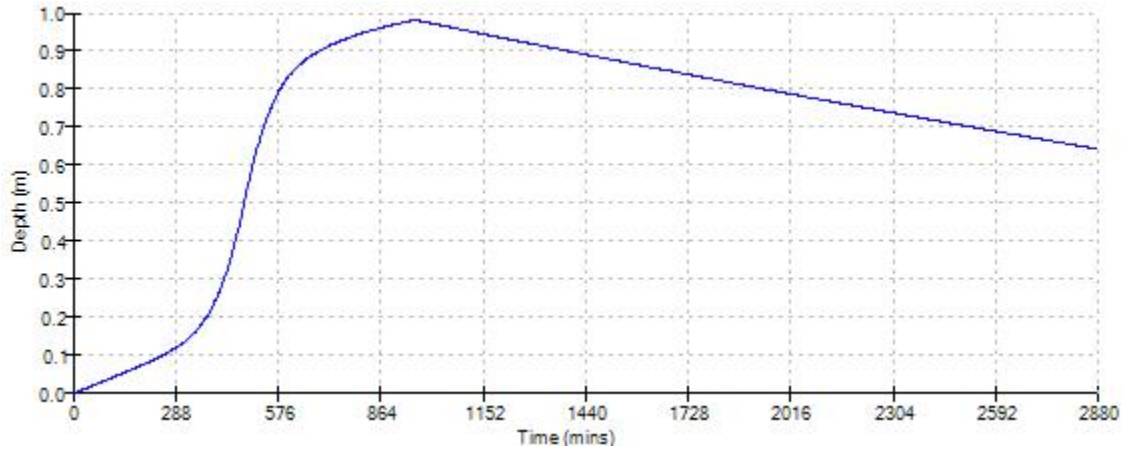
Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.4	1.600	3.7	5.000	6.3
0.200	2.9	1.800	3.9	5.500	6.6
0.300	3.0	2.000	4.1	6.000	6.9
0.400	2.9	2.200	4.3	6.500	7.2
0.500	2.8	2.400	4.5	7.000	7.4
0.600	2.5	2.600	4.7	7.500	7.7
0.800	2.7	3.000	5.0	8.000	7.9
1.000	3.0	3.500	5.4	8.500	8.2
1.200	3.3	4.000	5.7	9.000	8.4
1.400	3.5	4.500	6.0	9.500	8.6

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Event: 960 min Summer

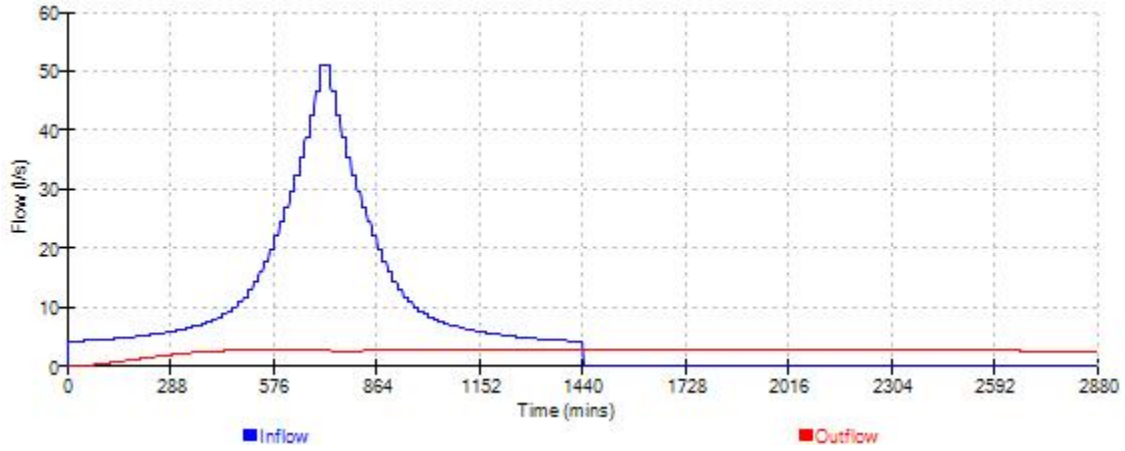


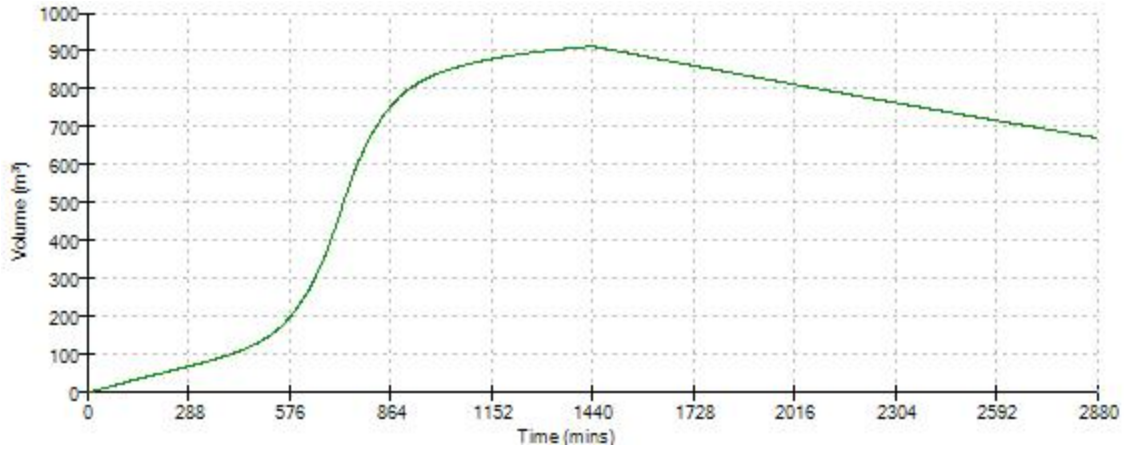


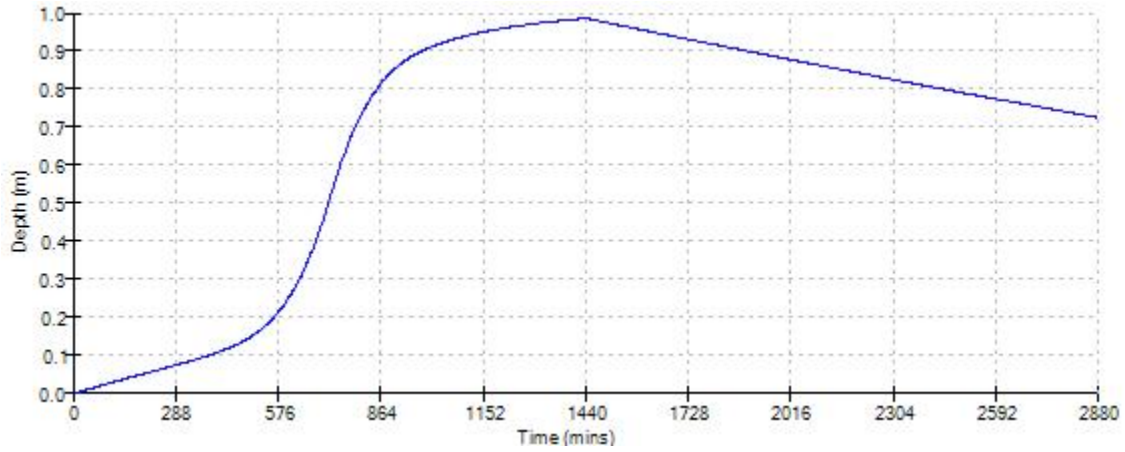


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Event: 1440 min Summer

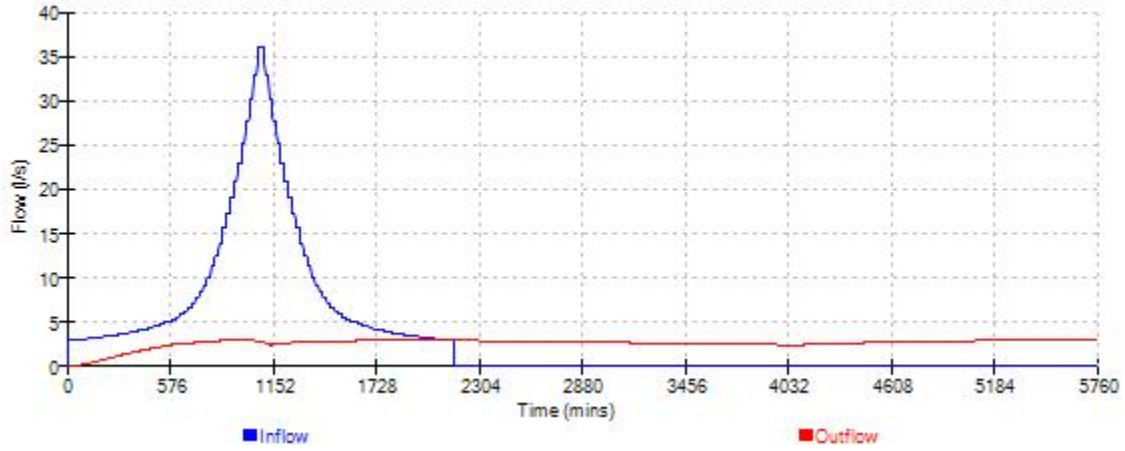


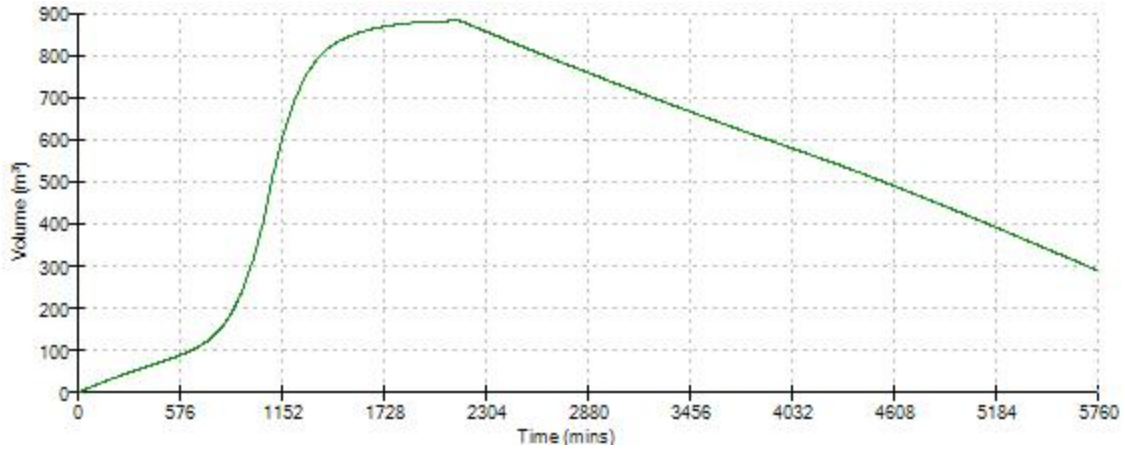


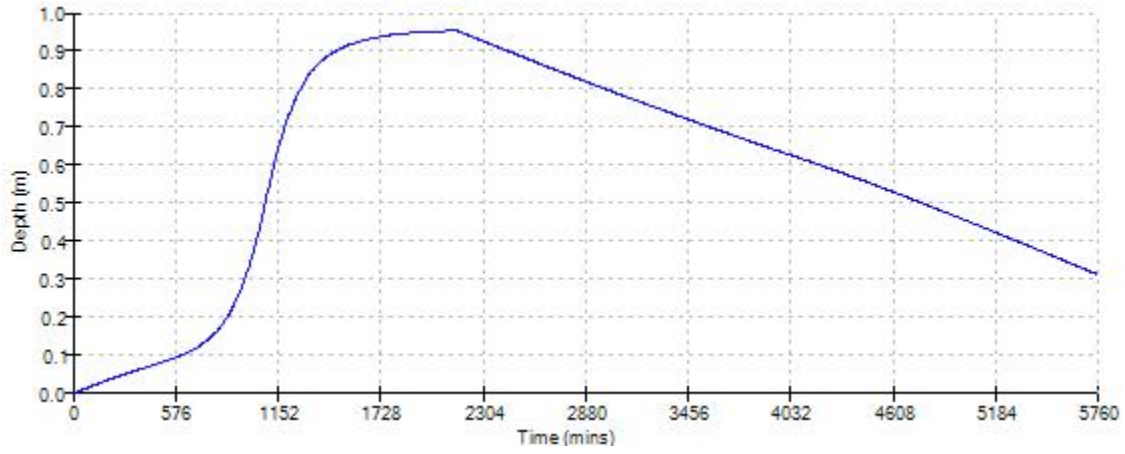


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Event: 2160 min Summer







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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	8.952	0.452	2.3	452.3	O K
30 min Summer	9.119	0.619	2.3	618.8	O K
60 min Summer	9.311	0.811	2.3	811.3	O K
120 min Summer	9.467	0.967	2.3	967.4	O K
180 min Summer	9.557	1.057	2.3	1057.1	O K
240 min Summer	9.620	1.120	2.4	1119.8	O K
360 min Summer	9.707	1.207	2.4	1206.6	Flood Risk
480 min Summer	9.766	1.266	2.5	1266.1	Flood Risk
600 min Summer	9.810	1.310	2.5	1309.7	Flood Risk
720 min Summer	9.843	1.343	2.6	1343.0	Flood Risk
960 min Summer	9.890	1.390	2.6	1389.9	Flood Risk
1440 min Summer	9.935	1.435	2.6	1435.4	Flood Risk
2160 min Summer	9.946	1.446	2.7	1446.3	Flood Risk
2880 min Summer	9.931	1.431	2.6	1430.6	Flood Risk
4320 min Summer	9.864	1.364	2.6	1363.5	Flood Risk
5760 min Summer	9.814	1.314	2.5	1313.5	Flood Risk
7200 min Summer	9.800	1.300	2.5	1300.5	Flood Risk
8640 min Summer	9.808	1.308	2.5	1308.4	Flood Risk
10080 min Summer	9.835	1.335	2.6	1335.1	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	155.452	0.0	193.4	17
30 min Summer	106.486	0.0	178.5	32
60 min Summer	69.995	0.0	341.0	62
120 min Summer	41.971	0.0	347.7	122
180 min Summer	30.743	0.0	363.1	182
240 min Summer	24.555	0.0	373.1	242
360 min Summer	17.821	0.0	386.0	362
480 min Summer	14.163	0.0	393.7	482
600 min Summer	11.834	0.0	398.6	602
720 min Summer	10.209	0.0	401.7	722
960 min Summer	8.073	0.0	404.2	962
1440 min Summer	5.765	0.0	400.8	1442
2160 min Summer	4.088	0.0	793.7	2160
2880 min Summer	3.199	0.0	786.0	2880
4320 min Summer	2.258	0.0	752.4	4020
5760 min Summer	1.778	0.0	1448.1	4680
7200 min Summer	1.508	0.0	1438.6	5472
8640 min Summer	1.337	0.0	1430.2	6232
10080 min Summer	1.225	0.0	1414.5	7064

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Winter	8.952	0.452	2.3	452.3	O K
30 min Winter	9.119	0.619	2.3	618.8	O K
60 min Winter	9.311	0.811	2.3	811.3	O K
120 min Winter	9.467	0.967	2.3	967.4	O K
180 min Winter	9.557	1.057	2.3	1057.2	O K
240 min Winter	9.620	1.120	2.4	1120.2	O K
360 min Winter	9.707	1.207	2.4	1207.3	Flood Risk
480 min Winter	9.767	1.267	2.5	1267.1	Flood Risk
600 min Winter	9.811	1.311	2.5	1311.2	Flood Risk
720 min Winter	9.845	1.345	2.6	1345.0	Flood Risk
960 min Winter	9.893	1.393	2.6	1392.7	Flood Risk
1440 min Winter	9.940	1.440	2.7	1440.1	Flood Risk
2160 min Winter	9.954	1.454	2.7	1454.4	Flood Risk
2880 min Winter	9.943	1.443	2.7	1442.5	Flood Risk
4320 min Winter	9.883	1.383	2.6	1382.5	Flood Risk
5760 min Winter	9.822	1.322	2.5	1321.7	Flood Risk
7200 min Winter	9.805	1.305	2.5	1304.8	Flood Risk
8640 min Winter	9.807	1.307	2.5	1307.0	Flood Risk
10080 min Winter	9.827	1.327	2.6	1326.5	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Winter	155.452	0.0	193.4	17
30 min Winter	106.486	0.0	178.5	32
60 min Winter	69.995	0.0	341.0	62
120 min Winter	41.971	0.0	347.6	122
180 min Winter	30.743	0.0	362.9	180
240 min Winter	24.555	0.0	372.9	240
360 min Winter	17.821	0.0	385.5	360
480 min Winter	14.163	0.0	393.1	478
600 min Winter	11.834	0.0	397.7	596
720 min Winter	10.209	0.0	400.6	714
960 min Winter	8.073	0.0	402.7	950
1440 min Winter	5.765	0.0	398.4	1414
2160 min Winter	4.088	0.0	790.6	2116
2880 min Winter	3.199	0.0	782.0	2792
4320 min Winter	2.258	0.0	747.1	4104
5760 min Winter	1.778	0.0	1443.6	5184
7200 min Winter	1.508	0.0	1435.0	5624
8640 min Winter	1.337	0.0	1427.2	6568
10080 min Winter	1.225	0.0	1412.2	7560

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 331208 350156 SJ 31208 50156
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	1.000
Cv (Winter)	1.000
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.168

Time (mins) From:	To:	Area (ha)
0	2	1.168

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Model Details

Storage is Online Cover Level (m) 10.000

Tank or Pond Structure

Invert Level (m) 8.500

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1000.0	1.500	1000.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0071-2700-1500-2700
Design Head (m)	1.500
Design Flow (l/s)	2.7
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	71
Invert Level (m)	8.495
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

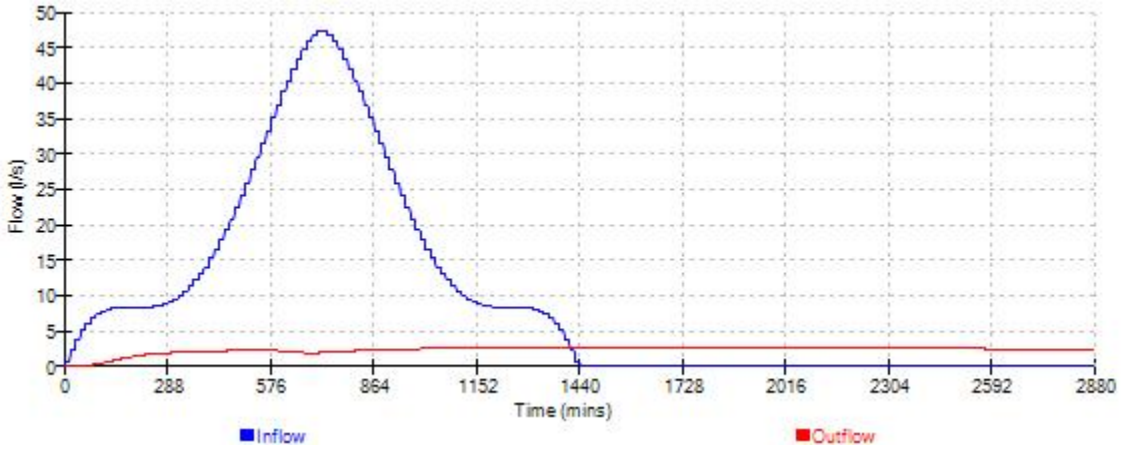
Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.500	2.7
Flush-Flo™	0.310	2.3
Kick-Flo®	0.635	1.8
Mean Flow over Head Range	-	2.2

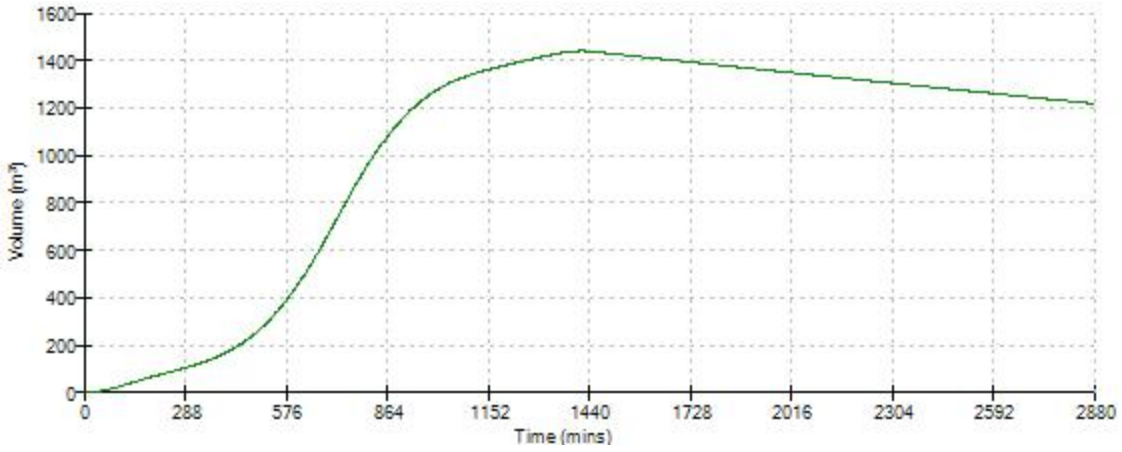
The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

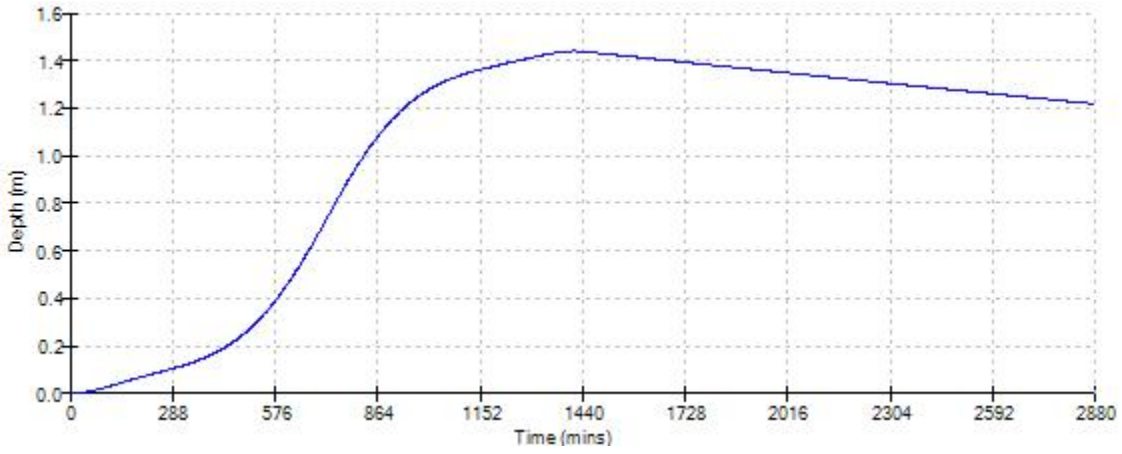
Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.9	1.600	2.8	5.000	4.7
0.200	2.2	1.800	2.9	5.500	4.9
0.300	2.3	2.000	3.1	6.000	5.1
0.400	2.2	2.200	3.2	6.500	5.3
0.500	2.2	2.400	3.3	7.000	5.5
0.600	2.0	2.600	3.5	7.500	5.7
0.800	2.0	3.000	3.7	8.000	5.9
1.000	2.2	3.500	4.0	8.500	6.1
1.200	2.4	4.000	4.2	9.000	6.2
1.400	2.6	4.500	4.5	9.500	6.4

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Event: 1440 min Winter

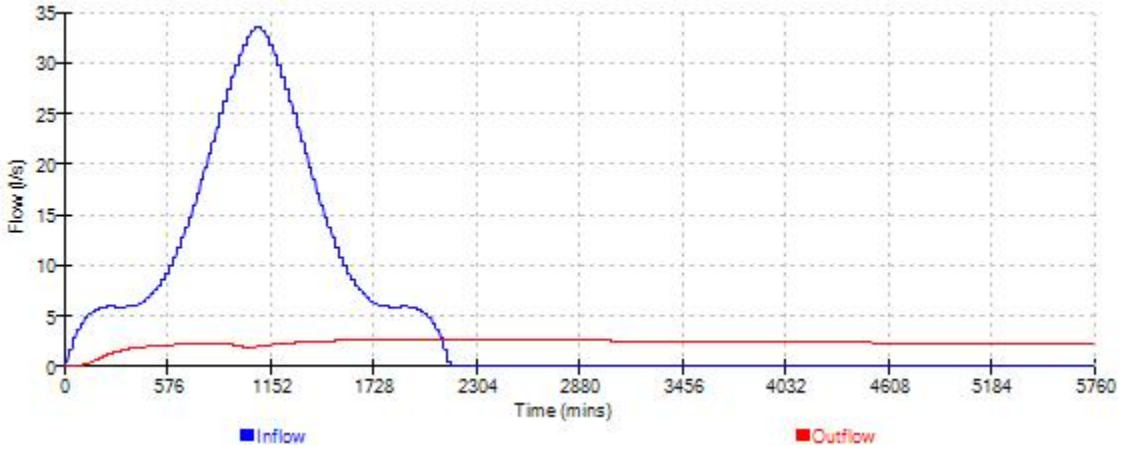


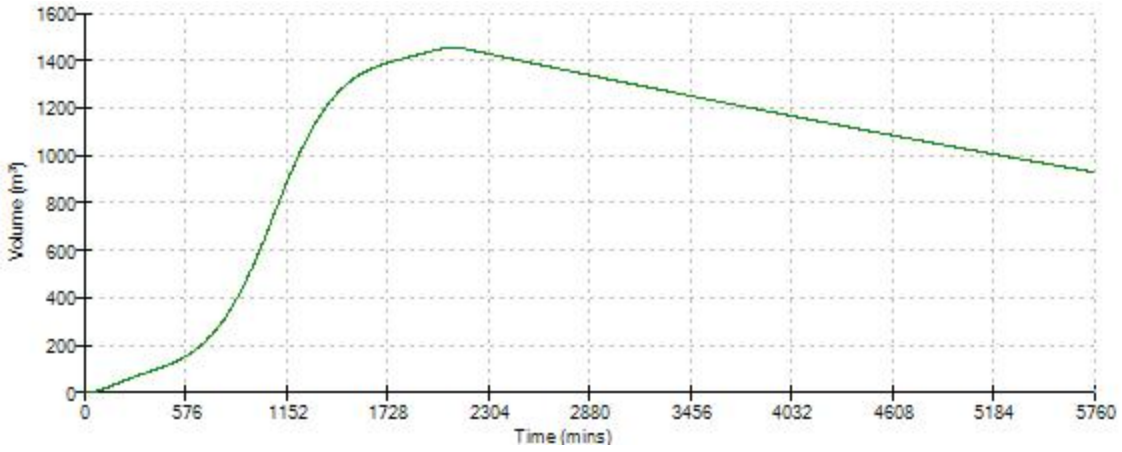


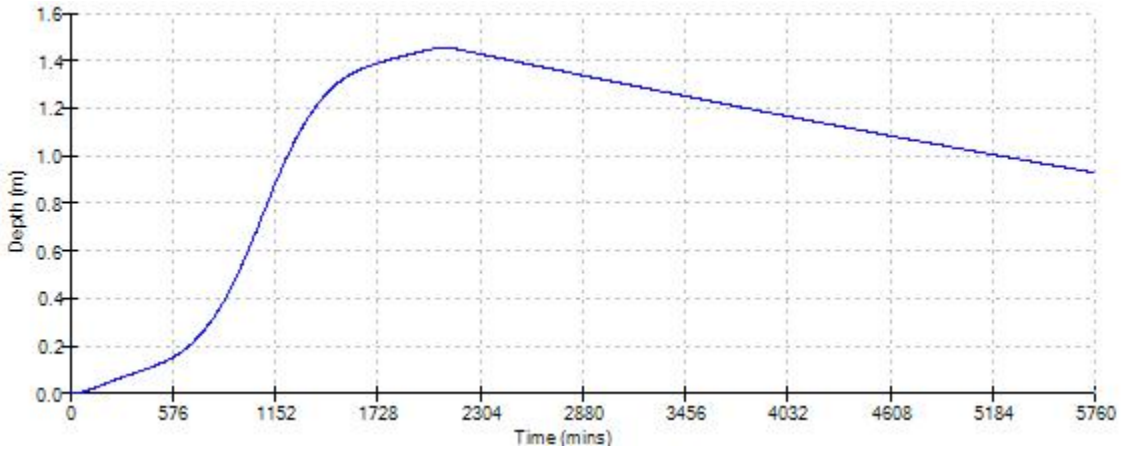


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Event: 2160 min Winter

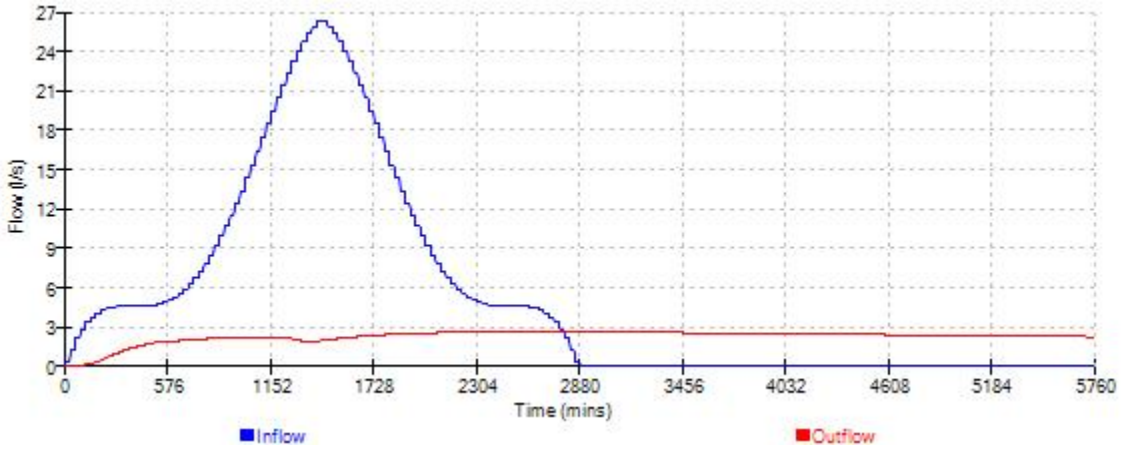


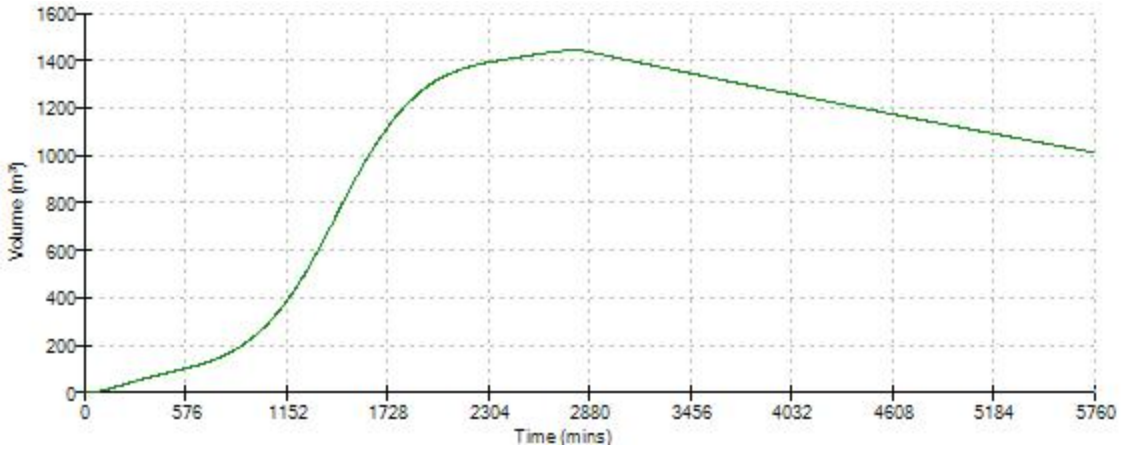


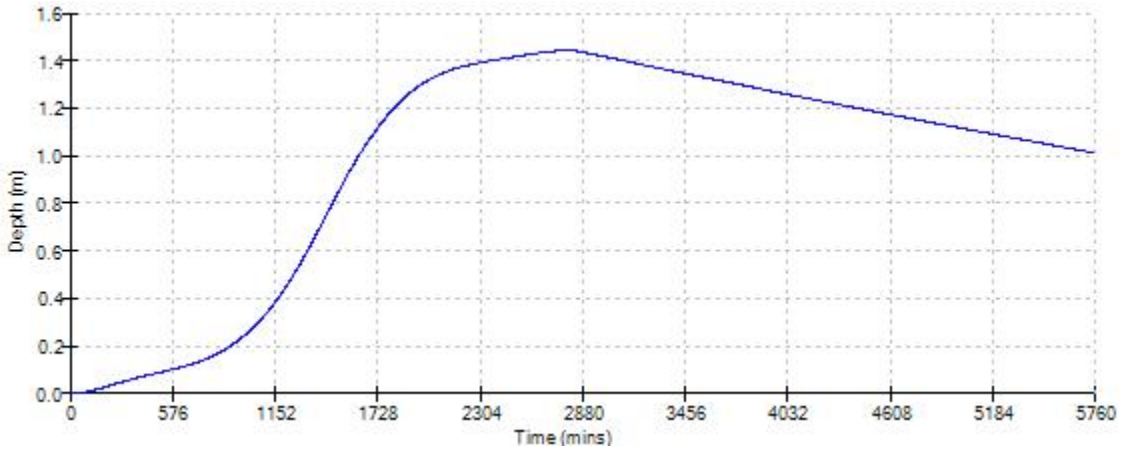


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Event: 2880 min Winter







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Appendix K Discharge Route Plan to River Clywedog

Notes:
1) All dimensions are in metres and all levels in metres above Ordnance Datum unless stated otherwise

LEGEND

- Site Boundary
- Area not included within site bounadary
- Watercourses
- Proposed route of connection to River Clywedog

0 200 400 600 800 m

CONTAINS OS DATA © CROWN COPYRIGHT (2022)

CLIENT: Redrow Homes Ltd

www.waterco.co.uk

SCHEME: Ruthin Road, Wrexham

PLOT TITLE: Connection to River Clywedog

PLOT STATUS:	DATE:
FINAL	06-12-2022

DRAWN:	CHECKED:	APPROVED:	PLOT SCALE AT A3:
PB	AW	NJ	1:10400

PLOT NAME:	REVISION:
13840_Conncetion_to_River_Clywedog	-

Appendix L Maintenance Schedules

Operation and Maintenance Requirements for Permeable Paving

Maintenance Schedule	Required Action	Typical Frequency
Regular maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface)	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturer's recommendations – pay particular attention to areas where water runs onto pervious surface from adjacent impermeable areas as this area is most likely to collect the most sediment
Occasional maintenance	Stabilise and move contributing and adjacent areas	As required
	Removal of weeds or management using glyphospate applied directly into the weeds by an applicator rather than spraying	As required – once per year on less frequently used pavements
Remedial actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50mm of the level or the paving	As required
	Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging)
Monitoring	Inspect for evidence of poor operation and / or weed growth – if required, take remedial action	Three-monthly, 48hr after large storms in first six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually

Ref. Table 20.15, CIRIA C753 'The SuDS Manual'

The maintenance requirements detailed above are to be undertaken by the site owner.

Name :

Position :

Date :

Signed on behalf of the site owner :

Operation and Maintenance Requirements for Swale

Maintenance Schedule	Required Action	Typical Frequency
Regular maintenance	Remove litter and debris	Monthly (or as required)
	Cut the grass – to retain grass height within specified design range	Monthly (during growing season), or as required
	Manage other vegetation and remove nuisance plants	Monthly at start, then as Required
	Inspect inlets, outlets and overflows for blockages, and clear if required	Monthly
	Inspect infiltration surfaces for ponding, compaction, silt accumulation, record areas where water is ponding for > 48 hours	Monthly, or when required
	Inspect vegetation coverage	Monthly for 6 months, quarterly for 2 years, then half yearly
	Inspect inlets and facility surface for silt accumulation, establish appropriate silt removal frequencies	Half yearly
Occasional maintenance	Reseed areas of poor vegetation growth, alter plant types to better suit conditions, if required	As required or if bare soil is exposed over 10% or more of the swales treatment area
Remedial actions	Repair erosion or other damage by re-turfing or reseeding	As required
	Relevel uneven surfaces and reinstate design levels	As required
	Scarify and spike topsoil layer to improve infiltration performance, break up silt deposits and prevent compaction of the soil surface	As required
	Remove build-up of sediment on upstream gravel trench, flow spreader or at top of filter strip	As required
	Remove and dispose of oil or petrol residues using safe standard practices	As required

Ref. Table 17.1 CIRIA C753 'The SuDS Manual'

The maintenance requirements detailed above are to be undertaken by the site owner.

Name :

Position :

Date :

Signed on behalf of the site owner :

Operation and Maintenance Requirements for Ponds and Wetlands

Maintenance Schedule	Required Action	Typical Frequency
Regular maintenance	Remove litter and debris	Monthly (or as required)
	Cut the grass – public areas	Monthly (during growing season), or as required
	Inspect marginal and bankside vegetation and remove nuisance plants (for first 3 years)	Monthly (at start, then as required)
	Inspect inlets, outlets, banksides, structures, pipework etc for evidence of blockage, and / or physical damage.	Monthly
	Inspect water body for signs of poor water quality	Monthly (May – October)
	Inspect silt accumulation rates in any forebay and in main body of the pond and establish appropriate removal frequencies; undertake contamination testing once some build-up has occurred, to inform management and disposal options.	Half yearly
	Check any mechanical devices e.g. penstocks	Half yearly
	Hand cut submerged and emergent aquatic plants (at minimum of 0.1m above pond base; include max 25% of pond surface)	Annually
	Remove 25% of bank vegetation from water's edge to a minimum of 1m above water level	Annually
	Remove sediment from any forebay	Every 1 – 5 years, or as required
	Remove sediment and planting from one quadrant of the main body of ponds without sediment forebays	Every 5 years, or as required
Occasional maintenance	Remove sediment from the main body of big ponds when pool volume is reduced by 20%	With effective pre-treatment, this will only be required rarely, e.g. 25-50 years
Remedial actions	Repair erosion or other damage	As required
	Replant where necessary	As required
	Aerate pond when signs of eutrophication are detected	As required
	Realign rip-rap or repair other damage	As required
	Repair/rehabilitate of Inlets, outlets and overflows	As required

Ref. Table 23.1 CIRIA C753 'The SuDS Manual'

The maintenance requirements detailed above are to be undertaken by the site owner.

Name :

Position :

Date :

Signed on behalf of the site owner :

Appendix M CDRA

CONCEPT DESIGNER'S RISK ASSESSMENT

Project:	Ruthin Road, Wrexham	**Project No:**	13840
Client:	Redrow Homes Ltd		
Report Reference:	13840-FCA & Drainage Strategy-01-V1		

Prepared by:	Paige Blundell	**Date:**	21/11/2022
Checked by:	Aled Williams	**Date:**	23/11/2022
Reviewed by:	Mike Wellington	**Date:**	23/11/2022

Requirement:

The Construction (Design and Management) Regulations 2015 (CDM 2015) place an obligation on the Designer to take all reasonable steps to provide, with the design, sufficient information about the design, construction or maintenance of the structure, to adequately assist the client, other designers and contractors to comply with their duties under CDM. The Designer has undertaken this assessment to identify any extra-ordinary risks, or those that would not be expected on this particular project by an experienced and competent Contractor. The aim is to avoid needless paperwork and bureaucracy and ensure the assessment is project specific, relevant and proportionate to the risk.

DRA Summary

Each of the following risk areas has been considered using the question below. Is a risk present which is considered to be **extra-ordinary or unexpected** in this instance?

If **YES** - A detailed risk assessment is required at design stage
If **UNKNOWN** - Insufficient information has been provided at concept design stage and the risks are unknown. Further consideration must be given at design stage(s)
If **NO** - No further action is required.

Hazard Ref.	Risk Areas	YES, UNKNOWN or NO	Comments
1	Ground Conditions	Unknown	Refer to ground investigation by E3P. Litte to no contamination
2	Hazardous Environment	No	Refer to ground investigation by E3P
3	Existing Working Environment	Yes	Lower Berse Farm in north-west and communications mast
4	Existing Services	Unknown	Full suite of utility searches not undertaken. Searches should be undertake by Principal Designer and Principal Contractor and included in construction phase plan
5	Proximity to Other Structure(s)	Unknown	Communications mast encircled by site
6	Near Waterbody / flood risk	Yes	Two unnamed watercourses crossing the site
7	Proximity to Other Activities	Unknown	To be determined at detail design stage
8	Sequence of Construction	Unknown	To be determined at detail design stage
9	Access	Unknown	To be determined at detail design stage
10	Interfaces	Unknown	To be determined at detail design stage
11	Confined Space Working	Unknown	To be determined at detail design stage
12	Maintenance Considerations	Unknown	Maintenance of SuDS required
13	Working at Height	Unknown	To be determined at detail design stage
14	Steep Slopes	No	Limited fall identified by topographical survey
15	Demolition / Refurbishment / Repair	Yes	Re-development of buildings in northern extent of site
16	Welfare	Unknown	To be determined at detail design stage
17	Occupational Health	Unknown	To be determined at detail design stage
18	Environmental Issues	Unknown	To be determined at detail design stage
19	Other Significant Hazards not Identified Above	Unknown	To be determined at detail design stage
20	Residual Risk to Future Users	Unknown	To be determined at detail design stage