Preliminary Drainage Strategy

Project: Wixams End, Bedford

Client: Wates Developments

Reference: C86343-JNP-XX-XX-RP-C-1004

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FOR AND ON BEHALF OF JNP GROUP

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1 INTRODUCTION

1.1 Terms of Reference

1.1.1 JNP Group has been commissioned by Wates Developments to prepare a preliminary drainage strategy for the proposed Wixams End development in the Borough of Bedford.

1.1.2 This preliminary drainage strategy has been prepared in compliance with current policies (national and local) and best practices, namely Bedford Borough Council's (BBC) *Supplementary Planning Document for Sustainable Drainage Systems* (February 2018).

1.2 Sources of Information

1.2.1 This preliminary drainage strategy has been based on the following sources of information:

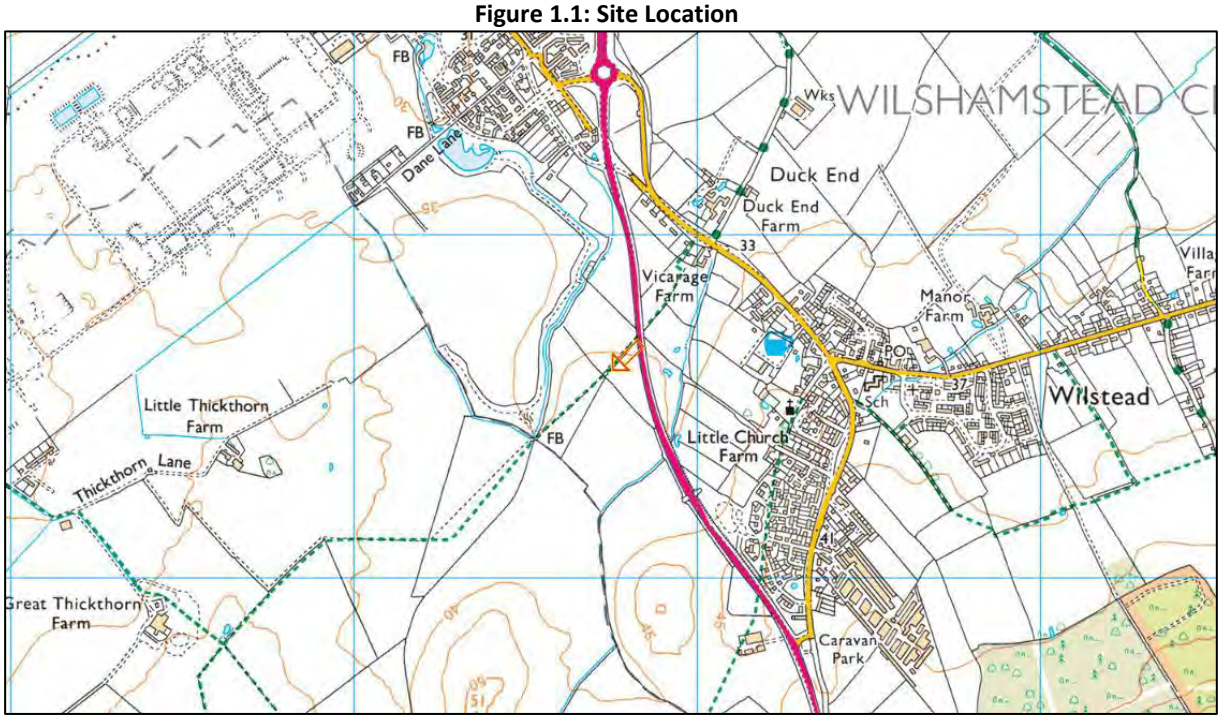
- DEFRA/EA's LiDAR topographic data (1 m resolution).
  (https://environment.data.gov.uk/DefraDataDownload/?Mode=survey)
- British Geological Survey's *GeoIndex Tool*.
  (http://mapapps2.bgs.ac.uk/geoindex/home.html)
- Cranfield University's soils data.
  (http://www.landis.org.uk/soilscapes/)
- FEH's rainfall data.
  (https://fehweb.ceh.ac.uk/)

1.3 Development Site

1.3.1 The development site is located off the A6, to the south of Wixams, Bedford (Figure 1.1).

1.3.2 The greenfield site is bounded by the A6 to the east and ordinary watercourses to the south/east and west/north.

Figure 1.1: Site Location



1.3.3 The available topographic information indicates that ground levels within the development site range between 36.2 m AOD and 32.6 m AOD, falling towards the ordinary watercourses to the south/east and west/north.

1.3.4 In accordance with Cranfield University's *Soilscapes* and BGS' *GeoIndex*, the development site lies on superficial deposits of lime-rich loamy and clayey soils with impeded drainage underlain by mudstone bedrock (Peterborough Member).

2 PROPOSED DEVELOPMENT

2.1.1 The wider development site comprises 55.44 ha or agricultural land adjacent to the southern built-up edge of Wixams (Figure 2.1 and Appendix A). Residential development is restricted to the northern half of the wider site, to a (total) area of approximately 12 ha.

2.1.2 A total impermeable area of approximately 7 ha has been assumed for the residential development with densities ranging between 25 and 50 dph (dwellings per hectare).

Figure 2.1: Proposed Development

3 SURFACE WATER DRAINAGE STRATEGY

3.1 Existing Drainage Regime

3.1.1 The undeveloped (greenfield) development site does not benefit from a formal surface water drainage system. Runoff generated within the site is expected to infiltrate into the ground or flow overland towards the ordinary watercourses to the south/east and west/north.

3.1.2 Greenfield runoff rates for the undeveloped site (Table 3.1) have been established using the *IH124* methodology with *ICP SuDS* correction for small catchments (Appendix B).

Table 3.1: Greenfield Runoff Rates

Return Period (AEP)	Runoff Rate (l/s per hectare)
1 in 1 year (100.0% AEP)	2.9
QBAR	*3.4s*
1 in 30 year (3.3% AEP)	8.1
1 in 100 year (1.0% AEP)	12.0

3.1.3 A greenfield runoff volume of 311.8 m^3 per hectare has been estimated for the 1.0% AEP and 6 hour duration event (Appendix B).

3.2 General Drainage Principles

3.2.1 Based on the available geologic information – namely soil/bedrock lithology/permeability – infiltration drainage is unlikely to be feasible at the development site.

3.2.2 Given the likely unfeasibility of infiltration drainage, the volume of runoff leaving the proposed development cannot be reduced to greenfield values and the excess volume must be discharge at a low rate that will not pose a flood risk downstream of the site. As recommended in BBC's *Supplementary Planning Document for Sustainable Drainage Systems*, runoff volumes exceeding the greenfield value must be managed in long term storage (LTS) features and discharged at a restricted rate of 2.0 l/s per hectare, while runoff volumes up to the greenfield value must be managed at attenuation storage (AS) features and discharged at rates matching greenfield values (100.0% to 1.0% AEP).

3.2.3 Given the likely unfeasibility of infiltration drainage, the proposed drainage strategy must collect, convey, and attenuate runoff from all areas to be made impermeable (~7 ha) before discharge to the adjacent watercourses.

3.3 Sustainable Drainage Systems (SuDS)

3.3.1 In accordance with the *NPPF*, (major) developments must incorporate sustainable drainage systems (SuDS) unless there is clear evidence that this would be inappropriate. In addition to water quantity control, SuDS should consider opportunities to provide water quality and amenity/biodiversity benefits (i.e., multifunctional approach).

3.3.2 Table 3.2 shortlists SuDS deemed compatible with the site's characteristics and which inclusion in the proposed development must be continuously assessed as the design progresses.

3.3.3 It is important to note the need to remove silt from runoff prior to discharge into SUDS features or off-site receptors. SuDS such as filter drains, swales, bioretention systems and pervious pavements are sustainable alternatives to proprietary treatment systems otherwise required to manage silt.

Table 3.2: Sustainable Drainage Systems (SuDS)

SuDS Component	Description and Opportunities
Filter Drains/Strips	Filter drains are trenches filled with stone/gravel that create temporary subsurface storage for the filtration, attenuation, and conveyance of surface water runoff. Ideally, filter drains receive lateral inflow from adjacent impermeable surfaces pre-treated over a filter strip. Filter drains can help manage peak flows by naturally limiting rates of conveyance through the filter medium and by providing attenuation storage when the rate of flow at the outlet is controlled. Filter drains can be effectively incorporated into the landscape and public open spaces and can have minimal land-take requirements. The use of filter drains is typically restricted to flat sites (unless placed parallel to contours). Filter drains are best located adjacent to (small) impermeable surfaces such as car parks and roads/highways.
Swales	Swales are shallow, flat bottomed, vegetated open channels designed to treat, convey, and often attenuate surface water runoff. Swales can also provide aesthetic and biodiversity benefits. Swales can help reduce flow rates by facilitating infiltration and/or providing attenuation storage when flow at the outlet is controlled. Coarse to medium sediments and associated pollutants can be removed by filtration through surface vegetation and ground cover. Swales are well suited for managing runoff from linear features such as main roads/highways. Swales are generally difficult to incorporate into dense urban developments, where space is limited.
Bioretention Systems	Bioretention systems (including rain gardens) are shallow landscaped depressions that can reduce runoff rates and volumes and treat pollution. They also provide attractive landscape features and biodiversity. Bioretention systems can help reduce flow rates from a site by promoting infiltration/evapotranspiration and providing some attenuation storage. Bioretention systems can also provide very effective treatment functionality. Bioretention systems are a very flexible surface water management component that can be integrated into a wide variety of developments/densities using different shapes, materials, planting, and dimensions.
Pervious Pavements	Pervious pavements provide a pavement suitable for pedestrian and/or vehicular traffic, while allowing rainwater to infiltrate through the surface and into the underlying structural layers. The water is temporarily stored beneath the overlying surface before use, infiltration to the ground or controlled discharge downstream. Pervious pavements help reduce flow rates from a site by providing attenuation storage. A flow control structure is required to constrain the rate of water discharged from the sub-base via an outlet pipe. Pervious pavement drainage has been shown to have decreased concentrations of a range of surface water pollutants, including heavy metals, oil and grease, sediment, and some nutrients. Pervious pavements are typically built as an alternative to impermeable surfaces and therefore require no extra development space for their construction.
Detention Basins	Detention basins are landscaped depressions that are normally dry expect during and immediately following storm events. They can be on-line components where surface runoff from regular events is routed through the basin or off-line components into which runoff is diverted once flows reach a specific threshold. Detention basins can be vegetated depressions (providing treatment in on-line components) or hard landscaped storage areas. Off-line basins will normally have an alternative principal use (e.g., amenity or recreational facility or urban (hard) landscaping).

SuDS Component	Description and Opportunities
Attenuation Storage Tanks	Attenuation storage tanks are used to create a below-ground void space for the temporary storage of surface water before use, infiltration, or controlled release. Attenuation storage tanks can help reduce flow rates from a site by providing significant attenuation storage. Storage tanks do not provide any form of treatment of surface water runoff and therefore need to be combined in a "management train" with other methods that do provide suitable treatment of all relevant pollutants (coarse sediment must always be removed upstream of a storage tank). The inherent flexibility in size and shape of the typical attenuation storage tank systems means that they can be tailored to suit the specific characteristics and requirements of any site. However, the lack of amenity and biodiversity benefits means that storage tanks should be a last resource in any surface water drainage strategy for a major development.

3.4 Proposed Surface Water Drainage Strategy

3.4.1 The preliminary surface water drainage strategy has been designed in accordance *Sewers for Adoption* and/or *Building Regulations Part H* and in compliance with the *NPPF*, local requirements and current best practices[†], to collect, convey and attenuate runoff from all impermeable areas (~7 ha) before discharge into the adjacent watercourses.

3.4.2 The preliminary drainage strategy (Appendix B) has been designed so that flooding does not occur on any part of the site for all events up to 1.0% AEP (1 in 100 year) + 40% climate change allowance.

3.4.3 The performance of the proposed surface water drainage strategy has been tested for storm events with durations of 15 to 10080 minutes and AEPs of 50.0%, 1.0% and 1.0% + 40% climate change.

3.4.4 The results of the simulations are included in Appendix B and demonstrate how the proposed surface water drainage strategy can manage runoff generated within the development site without increasing flood risk elsewhere for storm events up to the 1.0% AEP + 40% climate change allowance.

3.5 Water Quality Management

3.5.1 The suitability of the proposed drainage strategy to manage the development's pollution risk has been assessed using the simple index approach in *The SuDS Manual* (2015), as summarized in Table 3.3.

Table 3.3: Surface Water Quality Management (Simple Index Approach)

Runoff Route/Treatment Train				
Land Use/SuDS	**Hazard Level**	**TSS**	**Metals**	**Hydro-Carbons**
Pollution Hazard Indices				
Residential Roofs	Very Low	0.20	0.20	0.05
Driveways, residential car parks and low traffic roads	Low	0.50	0.40	0.40
SuDS Mitigation Indices				
Detention Basin	-	0.50	0.50	0.60
Total SuDS Mitigation Index ≥ Pollution Hazard Index (for each contaminant type)				

[†] e.g., *Non-Statutory Technical Standards for Sustainable Drainage Systems* (March 2015) and *The SuDS Manual* (2015).

APPENDIX A: **PROPOSED DEVELOPMENT**

H08(4) - Central Bedfordshire Local Plan

HAS27 - Central Bedfordshire Local Plan

MA3 - Central Bedfordshire Local Plan

Additional O&H Land - CBC confirmed logical extension to MA3

H0U15 - Bedford Plan 2040 (DRAFT)

5S - Bedford Borough Council Settlement Policy Area

RE-FO R MAT

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date created: Jan 2020
checked by: MS
scale at A3: 1:10000

project title: Land west of A6, Wixams
document title: Wider Masterplan

project	originator	volume	level	type	role	number
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status: S2
suitability description: Suitable for Information
revision: 01

rev.	date	changes description	status	issued by
01	13/07/2022	—	S2	

N

APPENDIX B: PRELIMINARY DRAINAGE STRATEGY

ICP SUDS Mean Annual Flood

Input

Return Period (years) 1000 SAAR (mm) 560 Urban 0.000
Area (ha) 1.000 Soil 0.450 Region Number Region 5

Results l/s

QBAR Rural 3.4
QBAR Urban 3.4

Q1000 years 19.5

Q1 year 2.9
Q30 years 8.1
Q100 years 12.0

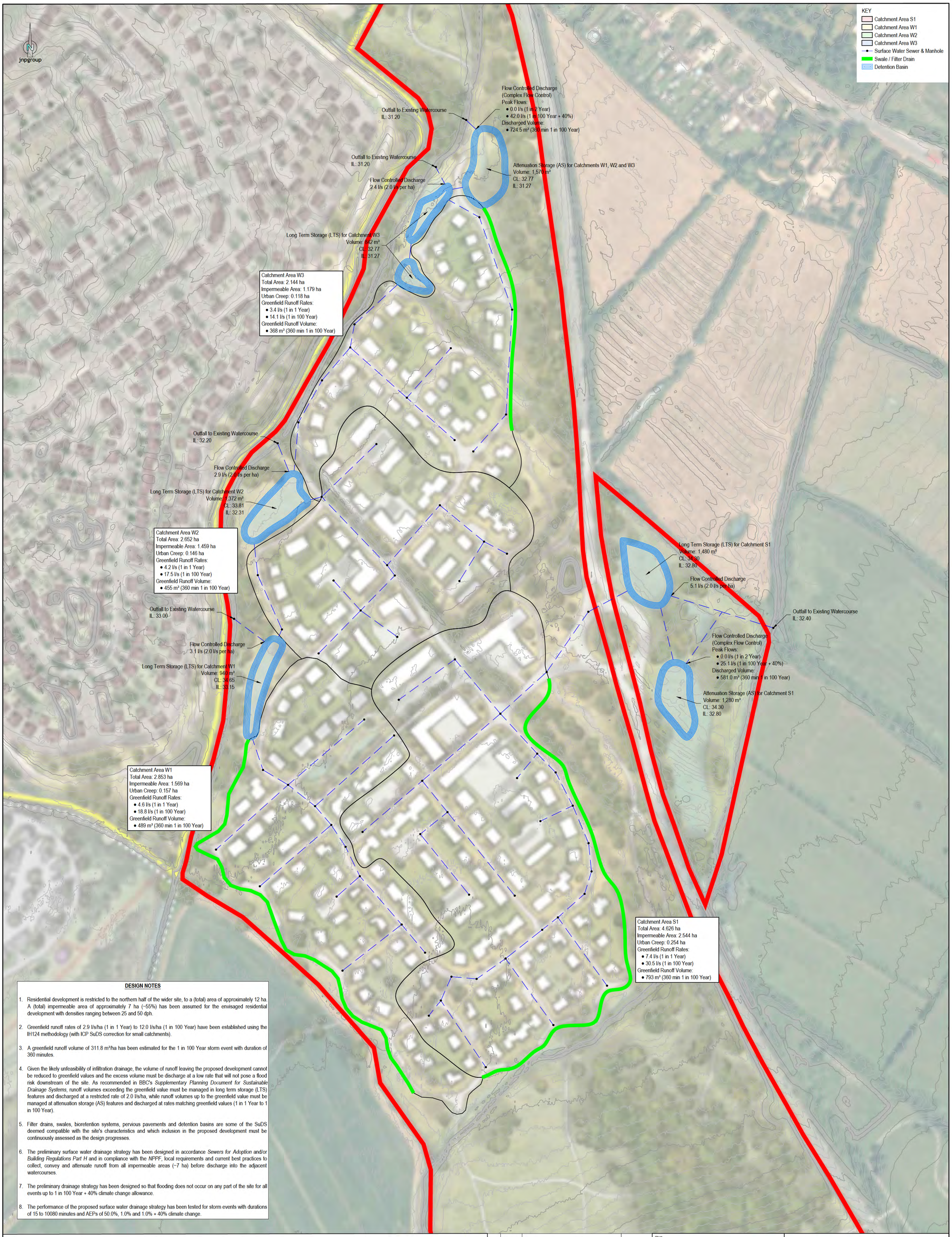
Greenfield Runoff Volume

FEH Data

Return Period (years)	100
Storm Duration (mins)	360
FEH Rainfall Version	2013
Site Location	GB 505745 243600 TL 05745 43600
Data Type	Point
Areal Reduction Factor	1.00
Area (ha)	1.000
SAAR (mm)	560
CWI	78.200
SPR Host	52.981
URBEXT (1990)	0.0000

Results

Percentage Runoff (%)	45.91
Greenfield Runoff Volume (m^3)	311.757



DESIGN NOTES

1. Residential development is restricted to the northern half of the wider site, to a (total) area of approximately 12 ha. A (total) impermeable area of approximately 7 ha (~55%) has been assumed for the envisaged residential development with densities ranging between 25 and 50 dph.
2. Greenfield runoff rates of 2.9 l/s/ha (1 in 1 Year) to 12.0 l/s/ha (1 in 100 Year) have been established using the IH124 methodology (with ICP SuDS correction for small catchments).
3. A greenfield runoff volume of 311.8 m³/ha has been estimated for the 1 in 100 Year storm event with duration of 360 minutes.
4. Given the likely unfeasibility of infiltration drainage, the volume of runoff leaving the proposed development cannot be reduced to greenfield values and the excess volume must be discharge at a low rate that will not pose a flood risk downstream of the site. As recommended in BBC's *Supplementary Planning Document for Sustainable Drainage Systems*, runoff volumes exceeding the greenfield value must be managed in long term storage (LTS) features and discharged at a restricted rate of 2.0 l/s/ha, while runoff volumes up to the greenfield value must be managed at attenuation storage (AS) features and discharged at rates matching greenfield values (1 in 1 Year to 1 in 100 Year).
5. Filter drains, swales, bioretention systems, pervious pavements and detention basins are some of the SuDS deemed compatible with the site's characteristics and which inclusion in the proposed development must be continuously assessed as the design progresses.
6. The preliminary surface water drainage strategy has been designed in accordance *Sewers for Adoption* and/or *Building Regulations Part H* and in compliance with the *NPPF*, local requirements and current best practices to collect, convey and attenuate runoff from all impermeable areas (~7 ha) before discharge into the adjacent watercourses.
7. The preliminary drainage strategy has been designed so that flooding does not occur on any part of the site for all events up to 1 in 100 Year + 40% climate change allowance.
8. The performance of the proposed surface water drainage strategy has been tested for storm events with durations of 15 to 10080 minutes and AEPs of 50.0%, 1.0% and 1.0% + 40% climate change.

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Project - Originator - Volume/System - Level/Location - Type - Discipline - Number: C86343 - JNP-XX-XX- SK -C- 7001

Document/Drawing Number

Revision: -

JNP Group Internal Project Number: C86343

Cascade Summary of Results for C86343-JNP-XX-XX-CA-C-0002a S1 (LTS).srcx

Upstream Structures	Outflow To	Overflow To
(None)	(None)	C86343-JNP-XX-XX-CA-C-0002b S (AS).srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Σ Max Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	33.040	0.240	4.9	0.0	4.9	235.9	O K
30 min Summer	33.096	0.296	5.1	0.0	5.1	294.6	O K
60 min Summer	33.151	0.351	5.1	0.0	5.1	352.9	O K
120 min Summer	33.274	0.474	5.1	0.0	5.1	488.2	O K
180 min Summer	33.341	0.541	5.1	0.0	5.1	564.4	O K
240 min Summer	33.384	0.584	5.1	0.0	5.1	613.1	O K
360 min Summer	33.430	0.630	5.1	0.0	5.1	667.5	O K
480 min Summer	33.453	0.653	5.1	0.0	5.1	694.4	O K
600 min Summer	33.464	0.664	5.1	0.0	5.1	707.6	O K
720 min Summer	33.468	0.668	5.1	0.0	5.1	712.7	O K
960 min Summer	33.464	0.664	5.1	0.0	5.1	708.2	O K
1440 min Summer	33.440	0.640	5.1	0.0	5.1	679.5	O K
2160 min Summer	33.409	0.609	5.1	0.0	5.1	642.9	O K
2880 min Summer	33.383	0.583	5.1	0.0	5.1	612.5	O K
4320 min Summer	33.343	0.543	5.1	0.0	5.1	565.7	O K
5760 min Summer	33.311	0.511	5.1	0.0	5.1	529.2	O K
7200 min Summer	33.286	0.486	5.1	0.0	5.1	501.6	O K
8640 min Summer	33.266	0.466	5.1	0.0	5.1	479.1	O K
10080 min Summer	33.249	0.449	5.1	0.0	5.1	460.4	O K
15 min Winter	33.040	0.240	4.9	0.0	4.9	236.0	O K
30 min Winter	33.096	0.296	5.1	0.0	5.1	294.7	O K
60 min Winter	33.151	0.351	5.1	0.0	5.1	353.0	O K
120 min Winter	33.274	0.474	5.1	0.0	5.1	488.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Summer	34.456	0.0	215.6	0.0	29
30 min Summer	21.626	0.0	271.1	0.0	44
60 min Summer	13.109	0.0	353.9	0.0	72
120 min Summer	9.207	0.0	498.1	0.0	132
180 min Summer	7.206	0.0	583.4	0.0	190
240 min Summer	5.959	0.0	640.8	0.0	250
360 min Summer	4.456	0.0	711.4	0.0	368
480 min Summer	3.581	0.0	751.7	0.0	488
600 min Summer	3.007	0.0	774.3	0.0	606
720 min Summer	2.600	0.0	783.9	0.0	724
960 min Summer	2.059	0.0	779.8	0.0	962
1440 min Summer	1.477	0.0	750.8	0.0	1220
2160 min Summer	1.065	0.0	1059.8	0.0	1568
2880 min Summer	0.850	0.0	1126.0	0.0	1968
4320 min Summer	0.631	0.0	1237.8	0.0	2776
5760 min Summer	0.518	0.0	1387.3	0.0	3592
7200 min Summer	0.450	0.0	1505.8	0.0	4400
8640 min Summer	0.404	0.0	1621.8	0.0	5192
10080 min Summer	0.372	0.0	1734.2	0.0	5960
15 min Winter	34.456	0.0	215.6	0.0	29
30 min Winter	21.626	0.0	271.1	0.0	43
60 min Winter	13.109	0.0	353.9	0.0	72
120 min Winter	9.207	0.0	498.1	0.0	130

Cascade Summary of Results for C86343-JNP-XX-XX-CA-C-0002a S1 (LTS).srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
180 min Winter	33.342	0.542	5.1	0.0	5.1	564.7	O K
240 min Winter	33.384	0.584	5.1	0.0	5.1	613.5	O K
360 min Winter	33.431	0.631	5.1	0.0	5.1	668.1	O K
480 min Winter	33.453	0.653	5.1	0.0	5.1	695.2	O K
600 min Winter	33.465	0.665	5.1	0.0	5.1	708.6	O K
720 min Winter	33.469	0.669	5.1	0.0	5.1	714.0	O K
960 min Winter	33.466	0.666	5.1	0.0	5.1	710.2	O K
1440 min Winter	33.438	0.638	5.1	0.0	5.1	677.5	O K
2160 min Winter	33.398	0.598	5.1	0.0	5.1	630.0	O K
2880 min Winter	33.361	0.561	5.1	0.0	5.1	586.5	O K
4320 min Winter	33.294	0.494	5.1	0.0	5.1	510.6	O K
5760 min Winter	33.237	0.437	5.1	0.0	5.1	447.3	O K
7200 min Winter	33.191	0.391	5.1	0.0	5.1	396.4	O K
8640 min Winter	33.152	0.352	5.1	0.0	5.1	354.6	O K
10080 min Winter	33.120	0.320	5.1	0.0	5.1	320.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
180 min Winter	7.206	0.0	583.4	0.0	188
240 min Winter	5.959	0.0	640.8	0.0	246
360 min Winter	4.456	0.0	711.5	0.0	362
480 min Winter	3.581	0.0	752.0	0.0	478
600 min Winter	3.007	0.0	775.0	0.0	592
720 min Winter	2.600	0.0	785.3	0.0	706
960 min Winter	2.059	0.0	782.6	0.0	930
1440 min Winter	1.477	0.0	756.4	0.0	1340
2160 min Winter	1.065	0.0	1060.0	0.0	1648
2880 min Winter	0.850	0.0	1126.5	0.0	2104
4320 min Winter	0.631	0.0	1241.1	0.0	2984
5760 min Winter	0.518	0.0	1387.4	0.0	3808
7200 min Winter	0.450	0.0	1506.0	0.0	4616
8640 min Winter	0.404	0.0	1622.2	0.0	5368
10080 min Winter	0.372	0.0	1735.2	0.0	6152

Cascade Rainfall Details for C86343-JNP-XX-XX-CA-C-0002a S1 (LTS).srcx

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	2	Cv (Summer)	1.000
FEH Rainfall Version	2013	Cv (Winter)	1.000
Site Location	GB 505745 243600 TL 05745 43600	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 2.798

Time From: (mins)	To:	Area (ha)	Time From: (mins)	To:	Area (ha)	Time From: (mins)	To:	Area (ha)
0	5	0.933	5	10	0.933	10	15	0.933

Cascade Model Details for C86343-JNP-XX-XX-CA-C-0002a S1 (LTS).srcx

Storage is Online Cover Level (m) 34.300

Tank or Pond Structure

Invert Level (m) 32.800

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	941.0	0.500	1130.5	1.000	1335.3	1.500	1554.6
0.250	1033.8	0.750	1231.0	1.250	1443.2		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0103-5100-1250-5100
Design Head (m)	1.250
Design Flow (l/s)	5.1
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	103
Invert Level (m)	32.800
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.250	5.1	Kick-Flo®	0.772	4.1
Flush-Flo™	0.368	5.1	Mean Flow over Head Range	-	4.5

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)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.4	0.800	4.1	2.000	6.3	4.000	8.8	7.000	11.5
0.200	4.8	1.000	4.6	2.200	6.6	4.500	9.3	7.500	11.9
0.300	5.1	1.200	5.0	2.400	6.9	5.000	9.8	8.000	12.2
0.400	5.1	1.400	5.4	2.600	7.2	5.500	10.2	8.500	12.6
0.500	5.0	1.600	5.7	3.000	7.7	6.000	10.7	9.000	12.9
0.600	4.8	1.800	6.0	3.500	8.3	6.500	11.1	9.500	13.3

Weir Overflow Control

Discharge Coef 0.544 Width (m) 1.500 Invert Level (m) 33.800

Cascade Summary of Results for C86343-JNP-XX-XX-CA-C-0002b S (AS).srcx

Upstream Structures	Outflow To	Overflow To
C86343-JNP-XX-XX-CA-C-0002a S1 (LTS).srcx	(None)	(None)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	32.800	0.000	0.0	0.0	O K
30 min Summer	32.800	0.000	0.0	0.0	O K
60 min Summer	32.800	0.000	0.0	0.0	O K
120 min Summer	32.800	0.000	0.0	0.0	O K
180 min Summer	32.800	0.000	0.0	0.0	O K
240 min Summer	32.800	0.000	0.0	0.0	O K
360 min Summer	32.800	0.000	0.0	0.0	O K
480 min Summer	32.800	0.000	0.0	0.0	O K
600 min Summer	32.800	0.000	0.0	0.0	O K
720 min Summer	32.800	0.000	0.0	0.0	O K
960 min Summer	32.800	0.000	0.0	0.0	O K
1440 min Summer	32.800	0.000	0.0	0.0	O K
2160 min Summer	32.800	0.000	0.0	0.0	O K
2880 min Summer	32.800	0.000	0.0	0.0	O K
4320 min Summer	32.800	0.000	0.0	0.0	O K
5760 min Summer	32.800	0.000	0.0	0.0	O K
7200 min Summer	32.800	0.000	0.0	0.0	O K
8640 min Summer	32.800	0.000	0.0	0.0	O K
10080 min Summer	32.800	0.000	0.0	0.0	O K
15 min Winter	32.800	0.000	0.0	0.0	O K
30 min Winter	32.800	0.000	0.0	0.0	O K
60 min Winter	32.800	0.000	0.0	0.0	O K
120 min Winter	32.800	0.000	0.0	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	34.456	0.0	0.0	0
30 min Summer	21.626	0.0	0.0	0
60 min Summer	13.109	0.0	0.0	0
120 min Summer	9.207	0.0	0.0	0
180 min Summer	7.206	0.0	0.0	0
240 min Summer	5.959	0.0	0.0	0
360 min Summer	4.456	0.0	0.0	0
480 min Summer	3.581	0.0	0.0	0
600 min Summer	3.007	0.0	0.0	0
720 min Summer	2.600	0.0	0.0	0
960 min Summer	2.059	0.0	0.0	0
1440 min Summer	1.477	0.0	0.0	0
2160 min Summer	1.065	0.0	0.0	0
2880 min Summer	0.850	0.0	0.0	0
4320 min Summer	0.631	0.0	0.0	0
5760 min Summer	0.518	0.0	0.0	0
7200 min Summer	0.450	0.0	0.0	0
8640 min Summer	0.404	0.0	0.0	0
10080 min Summer	0.372	0.0	0.0	0
15 min Winter	34.456	0.0	0.0	0
30 min Winter	21.626	0.0	0.0	0
60 min Winter	13.109	0.0	0.0	0
120 min Winter	9.207	0.0	0.0	0

Cascade Summary of Results for C86343-JNP-XX-XX-CA-C-0002b S (AS).srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
180 min Winter	32.800	0.000	0.0	0.0	O K
240 min Winter	32.800	0.000	0.0	0.0	O K
360 min Winter	32.800	0.000	0.0	0.0	O K
480 min Winter	32.800	0.000	0.0	0.0	O K
600 min Winter	32.800	0.000	0.0	0.0	O K
720 min Winter	32.800	0.000	0.0	0.0	O K
960 min Winter	32.800	0.000	0.0	0.0	O K
1440 min Winter	32.800	0.000	0.0	0.0	O K
2160 min Winter	32.800	0.000	0.0	0.0	O K
2880 min Winter	32.800	0.000	0.0	0.0	O K
4320 min Winter	32.800	0.000	0.0	0.0	O K
5760 min Winter	32.800	0.000	0.0	0.0	O K
7200 min Winter	32.800	0.000	0.0	0.0	O K
8640 min Winter	32.800	0.000	0.0	0.0	O K
10080 min Winter	32.800	0.000	0.0	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
180 min Winter	7.206	0.0	0.0	0
240 min Winter	5.959	0.0	0.0	0
360 min Winter	4.456	0.0	0.0	0
480 min Winter	3.581	0.0	0.0	0
600 min Winter	3.007	0.0	0.0	0
720 min Winter	2.600	0.0	0.0	0
960 min Winter	2.059	0.0	0.0	0
1440 min Winter	1.477	0.0	0.0	0
2160 min Winter	1.065	0.0	0.0	0
2880 min Winter	0.850	0.0	0.0	0
4320 min Winter	0.631	0.0	0.0	0
5760 min Winter	0.518	0.0	0.0	0
7200 min Winter	0.450	0.0	0.0	0
8640 min Winter	0.404	0.0	0.0	0
10080 min Winter	0.372	0.0	0.0	0

Cascade Rainfall Details for C86343-JNP-XX-XX-CA-C-0002b S (AS).srcx

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	2	Cv (Summer)	1.000
FEH Rainfall Version	2013	Cv (Winter)	1.000
Site Location	GB 505745 243600 TL 05745 43600	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.000

Time (mins) From:	To:	Area (ha)
0	5	0.000

Cascade Model Details for C86343-JNP-XX-XX-CA-C-0002b S (AS).srcx

Storage is Online Cover Level (m) 34.300

Tank or Pond Structure

Invert Level (m) 32.800

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	782.1	0.500	971.7	1.000	1175.6	1.500	1393.6
0.250	875.1	0.750	1071.9	1.250	1282.9		

Complex Outflow Control

Hydro-Brake® Optimum

Unit Reference	MD-SHE-0076-2300-0750-2300
Design Head (m)	0.750
Design Flow (l/s)	2.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	76
Invert Level (m)	32.800
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.750	2.3	Kick-Flo®	0.481	1.9
Flush-Flo™	0.223	2.3	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)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.1	0.800	2.4	2.000	3.6	4.000	5.0	7.000	6.5
0.200	2.3	1.000	2.6	2.200	3.8	4.500	5.3	7.500	6.7
0.300	2.3	1.200	2.8	2.400	3.9	5.000	5.5	8.000	6.9
0.400	2.2	1.400	3.1	2.600	4.1	5.500	5.8	8.500	7.1
0.500	1.9	1.600	3.3	3.000	4.4	6.000	6.0	9.000	7.3
0.600	2.1	1.800	3.4	3.500	4.7	6.500	6.3	9.500	7.5

Hydro-Brake® Optimum

Unit Reference	MD-SHE-0215-2250-0500-2250
Design Head (m)	0.500
Design Flow (l/s)	22.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	215
Invert Level (m)	33.550
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1200

Hydro-Brake® Optimum

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.500	22.5	Kick-Flo®	0.435	21.1
Flush-Flo™	0.295	22.5	Mean Flow over Head Range	-	16.6

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)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	7.3	0.800	28.2	2.000	43.8	4.000	61.2	7.000	80.2
0.200	21.0	1.000	31.3	2.200	45.8	4.500	64.8	7.500	83.0
0.300	22.5	1.200	34.2	2.400	47.8	5.000	68.3	8.000	85.8
0.400	21.7	1.400	36.8	2.600	49.7	5.500	70.9	8.500	88.5
0.500	22.5	1.600	39.3	3.000	53.2	6.000	74.1	9.000	91.0
0.600	24.5	1.800	41.6	3.500	57.4	6.500	77.2	9.500	93.6

Cascade Summary of Results for C86343-JNP-XX-XX-CA-C-0003a W1 (LTS).srcx

Upstream Structures	Outflow To	Overflow To
(None)	(None)	C86343-JNP-XX-XX-CA-C-0003b W2 (LTS).srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Σ Max Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	33.431	0.281	3.0	0.0	3.0	145.3	O K
30 min Summer	33.492	0.342	3.0	0.0	3.0	181.6	O K
60 min Summer	33.549	0.399	3.0	0.0	3.0	217.4	O K
120 min Summer	33.674	0.524	3.0	0.0	3.0	300.9	O K
180 min Summer	33.740	0.590	3.0	0.0	3.0	348.0	O K
240 min Summer	33.781	0.631	3.0	0.0	3.0	378.2	O K
360 min Summer	33.825	0.675	3.0	0.0	3.0	412.4	O K
480 min Summer	33.848	0.698	3.0	0.0	3.0	429.8	O K
600 min Summer	33.859	0.709	3.0	0.0	3.0	438.9	O K
720 min Summer	33.864	0.714	3.0	0.0	3.0	442.9	O K
960 min Summer	33.863	0.713	3.0	0.0	3.0	441.7	O K
1440 min Summer	33.838	0.688	3.0	0.0	3.0	422.4	O K
2160 min Summer	33.803	0.653	3.0	0.0	3.0	395.3	O K
2880 min Summer	33.776	0.626	3.0	0.0	3.0	375.1	O K
4320 min Summer	33.737	0.587	3.0	0.0	3.0	346.0	O K
5760 min Summer	33.707	0.557	3.0	0.0	3.0	324.5	O K
7200 min Summer	33.684	0.534	3.0	0.0	3.0	308.2	O K
8640 min Summer	33.666	0.516	3.0	0.0	3.0	295.2	O K
10080 min Summer	33.650	0.500	3.0	0.0	3.0	284.5	O K
15 min Winter	33.431	0.281	3.0	0.0	3.0	145.4	O K
30 min Winter	33.492	0.342	3.0	0.0	3.0	181.6	O K
60 min Winter	33.549	0.399	3.0	0.0	3.0	217.5	O K
120 min Winter	33.674	0.524	3.0	0.0	3.0	301.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Summer	34.456	0.0	140.1	0.0	29
30 min Summer	21.626	0.0	175.2	0.0	44
60 min Summer	13.109	0.0	222.4	0.0	72
120 min Summer	9.207	0.0	312.3	0.0	132
180 min Summer	7.206	0.0	365.6	0.0	192
240 min Summer	5.959	0.0	401.4	0.0	250
360 min Summer	4.456	0.0	443.6	0.0	370
480 min Summer	3.581	0.0	461.6	0.0	488
600 min Summer	3.007	0.0	463.1	0.0	608
720 min Summer	2.600	0.0	459.7	0.0	726
960 min Summer	2.059	0.0	450.8	0.0	964
1440 min Summer	1.477	0.0	433.5	0.0	1350
2160 min Summer	1.065	0.0	657.5	0.0	1652
2880 min Summer	0.850	0.0	699.1	0.0	2024
4320 min Summer	0.631	0.0	769.0	0.0	2820
5760 min Summer	0.518	0.0	857.2	0.0	3640
7200 min Summer	0.450	0.0	930.7	0.0	4464
8640 min Summer	0.404	0.0	1002.9	0.0	5272
10080 min Summer	0.372	0.0	1073.9	0.0	6056
15 min Winter	34.456	0.0	140.1	0.0	29
30 min Winter	21.626	0.0	175.2	0.0	43
60 min Winter	13.109	0.0	222.4	0.0	72
120 min Winter	9.207	0.0	312.3	0.0	130

Cascade Summary of Results for C86343-JNP-XX-XX-CA-C-0003a W1 (LTS).srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
180 min Winter	33.740	0.590	3.0	0.0	3.0	348.3	O K
240 min Winter	33.781	0.631	3.0	0.0	3.0	378.6	O K
360 min Winter	33.826	0.676	3.0	0.0	3.0	413.0	O K
480 min Winter	33.849	0.699	3.0	0.0	3.0	430.5	O K
600 min Winter	33.860	0.710	3.0	0.0	3.0	439.7	O K
720 min Winter	33.865	0.715	3.0	0.0	3.0	443.7	O K
960 min Winter	33.864	0.714	3.0	0.0	3.0	442.8	O K
1440 min Winter	33.840	0.690	3.0	0.0	3.0	424.0	O K
2160 min Winter	33.795	0.645	3.0	0.0	3.0	389.4	O K
2880 min Winter	33.758	0.608	3.0	0.0	3.0	361.7	O K
4320 min Winter	33.694	0.544	3.0	0.0	3.0	314.7	O K
5760 min Winter	33.638	0.488	3.0	0.0	3.0	276.0	O K
7200 min Winter	33.591	0.441	3.0	0.0	3.0	244.6	O K
8640 min Winter	33.551	0.401	3.0	0.0	3.0	218.5	O K
10080 min Winter	33.516	0.366	3.0	0.0	3.0	196.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
180 min Winter	7.206	0.0	365.7	0.0	188
240 min Winter	5.959	0.0	401.4	0.0	246
360 min Winter	4.456	0.0	443.7	0.0	362
480 min Winter	3.581	0.0	461.8	0.0	480
600 min Winter	3.007	0.0	463.7	0.0	596
720 min Winter	2.600	0.0	460.5	0.0	710
960 min Winter	2.059	0.0	452.2	0.0	938
1440 min Winter	1.477	0.0	436.5	0.0	1372
2160 min Winter	1.065	0.0	657.6	0.0	1696
2880 min Winter	0.850	0.0	699.3	0.0	2140
4320 min Winter	0.631	0.0	771.7	0.0	3028
5760 min Winter	0.518	0.0	857.3	0.0	3864
7200 min Winter	0.450	0.0	930.7	0.0	4680
8640 min Winter	0.404	0.0	1003.0	0.0	5448
10080 min Winter	0.372	0.0	1074.2	0.0	6248

Cascade Rainfall Details for C86343-JNP-XX-XX-CA-C-0003a W1 (LTS).srcx

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	2	Cv (Summer)	1.000
FEH Rainfall Version	2013	Cv (Winter)	1.000
Site Location	GB 505745 243600 TL 05745 43600	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 1.726

Time From: (mins)	To:	Area (ha)	Time From: (mins)	To:	Area (ha)	Time From: (mins)	To:	Area (ha)
0	5	0.575	5	10	0.575	10	15	0.576

Cascade Model Details for C86343-JNP-XX-XX-CA-C-0003a W1 (LTS).srcx

Storage is Online Cover Level (m) 34.650

Tank or Pond Structure

Invert Level (m) 33.150

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	452.4	0.500	688.3	1.000	938.4	1.500	1202.5
0.250	568.6	0.750	811.6	1.250	1068.7		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0080-3100-1250-3100
Design Head (m)	1.250
Design Flow (l/s)	3.1
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	80
Invert Level (m)	33.150
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.250	3.1	Kick-Flo®	0.712	2.4
Flush-Flo™	0.348	3.0	Mean Flow over Head Range	-	2.7

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)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.3	0.800	2.5	2.000	3.8	4.000	5.3	7.000	6.9
0.200	2.8	1.000	2.8	2.200	4.0	4.500	5.6	7.500	7.1
0.300	3.0	1.200	3.0	2.400	4.2	5.000	5.9	8.000	7.4
0.400	3.0	1.400	3.3	2.600	4.3	5.500	6.2	8.500	7.6
0.500	2.9	1.600	3.5	3.000	4.6	6.000	6.4	9.000	7.8
0.600	2.8	1.800	3.7	3.500	5.0	6.500	6.7	9.500	8.0

Weir Overflow Control

Discharge Coef 0.544 Width (m) 1.000 Invert Level (m) 34.150

Cascade Summary of Results for C86343-JNP-XX-XX-CA-C-0003b W2 (LTS).srcx

Upstream Structures	Outflow To	Overflow To
C86343-JNP-XX-XX-CA-C-0003a W1 (LTS).srcx	(None)	C86343-JNP-XX-XX-CA-C-0003c W3 (LTS).srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Σ Max Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	32.467	0.157	2.5	0.0	2.5	135.8	O K
30 min Summer	32.505	0.195	2.6	0.0	2.6	169.6	O K
60 min Summer	32.541	0.231	2.7	0.0	2.7	203.4	O K
120 min Summer	32.624	0.314	2.7	0.0	2.7	281.7	O K
180 min Summer	32.670	0.360	2.7	0.0	2.7	326.0	O K
240 min Summer	32.699	0.389	2.7	0.0	2.7	354.5	O K
360 min Summer	32.731	0.421	2.7	0.0	2.7	386.8	O K
480 min Summer	32.747	0.437	2.7	0.0	2.7	403.1	O K
600 min Summer	32.756	0.446	2.7	0.0	2.7	411.6	O K
720 min Summer	32.760	0.450	2.7	0.0	2.7	415.5	O K
960 min Summer	32.759	0.449	2.7	0.0	2.7	414.8	O K
1440 min Summer	32.747	0.437	2.7	0.0	2.7	402.4	O K
2160 min Summer	32.731	0.421	2.7	0.0	2.7	386.2	O K
2880 min Summer	32.717	0.407	2.7	0.0	2.7	372.4	O K
4320 min Summer	32.695	0.385	2.7	0.0	2.7	350.5	O K
5760 min Summer	32.677	0.367	2.7	0.0	2.7	333.4	O K
7200 min Summer	32.664	0.354	2.7	0.0	2.7	320.4	O K
8640 min Summer	32.654	0.344	2.7	0.0	2.7	310.1	O K
10080 min Summer	32.645	0.335	2.7	0.0	2.7	302.0	O K
15 min Winter	32.467	0.157	2.5	0.0	2.5	135.8	O K
30 min Winter	32.505	0.195	2.6	0.0	2.6	169.7	O K
60 min Winter	32.541	0.231	2.7	0.0	2.7	203.5	O K
120 min Winter	32.624	0.314	2.7	0.0	2.7	281.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Summer	34.456	0.0	116.2	0.0	29
30 min Summer	21.626	0.0	146.0	0.0	44
60 min Summer	13.109	0.0	198.5	0.0	72
120 min Summer	9.207	0.0	279.4	0.0	132
180 min Summer	7.206	0.0	326.5	0.0	192
240 min Summer	5.959	0.0	357.5	0.0	250
360 min Summer	4.456	0.0	393.8	0.0	368
480 min Summer	3.581	0.0	412.3	0.0	488
600 min Summer	3.007	0.0	420.8	0.0	606
720 min Summer	2.600	0.0	423.4	0.0	724
960 min Summer	2.059	0.0	420.0	0.0	962
1440 min Summer	1.477	0.0	404.3	0.0	1222
2160 min Summer	1.065	0.0	602.3	0.0	1584
2880 min Summer	0.850	0.0	638.3	0.0	1984
4320 min Summer	0.631	0.0	689.6	0.0	2812
5760 min Summer	0.518	0.0	793.9	0.0	3632
7200 min Summer	0.450	0.0	861.5	0.0	4408
8640 min Summer	0.404	0.0	927.5	0.0	5200
10080 min Summer	0.372	0.0	990.7	0.0	6048
15 min Winter	34.456	0.0	116.2	0.0	29
30 min Winter	21.626	0.0	146.0	0.0	43
60 min Winter	13.109	0.0	198.5	0.0	72
120 min Winter	9.207	0.0	279.5	0.0	130

Cascade Summary of Results for C86343-JNP-XX-XX-CA-C-0003b W2 (LTS).srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
180 min Winter	32.670	0.360	2.7	0.0	2.7	326.2	O K
240 min Winter	32.699	0.389	2.7	0.0	2.7	354.7	O K
360 min Winter	32.731	0.421	2.7	0.0	2.7	387.1	O K
480 min Winter	32.748	0.438	2.7	0.0	2.7	403.5	O K
600 min Winter	32.756	0.446	2.7	0.0	2.7	412.2	O K
720 min Winter	32.760	0.450	2.7	0.0	2.7	416.2	O K
960 min Winter	32.760	0.450	2.7	0.0	2.7	416.0	O K
1440 min Winter	32.746	0.436	2.7	0.0	2.7	401.7	O K
2160 min Winter	32.725	0.415	2.7	0.0	2.7	380.1	O K
2880 min Winter	32.704	0.394	2.7	0.0	2.7	360.0	O K
4320 min Winter	32.668	0.358	2.7	0.0	2.7	324.1	O K
5760 min Winter	32.636	0.326	2.7	0.0	2.7	293.3	O K
7200 min Winter	32.610	0.300	2.7	0.0	2.7	268.3	O K
8640 min Winter	32.588	0.278	2.7	0.0	2.7	247.5	O K
10080 min Winter	32.570	0.260	2.7	0.0	2.7	230.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
180 min Winter	7.206	0.0	326.6	0.0	188
240 min Winter	5.959	0.0	357.6	0.0	246
360 min Winter	4.456	0.0	394.0	0.0	362
480 min Winter	3.581	0.0	412.7	0.0	478
600 min Winter	3.007	0.0	421.4	0.0	592
720 min Winter	2.600	0.0	424.3	0.0	706
960 min Winter	2.059	0.0	421.4	0.0	930
1440 min Winter	1.477	0.0	406.9	0.0	1340
2160 min Winter	1.065	0.0	602.5	0.0	1656
2880 min Winter	0.850	0.0	638.7	0.0	2112
4320 min Winter	0.631	0.0	693.1	0.0	2992
5760 min Winter	0.518	0.0	794.0	0.0	3856
7200 min Winter	0.450	0.0	861.7	0.0	4680
8640 min Winter	0.404	0.0	927.8	0.0	5456
10080 min Winter	0.372	0.0	991.5	0.0	6256

Cascade Rainfall Details for C86343-JNP-XX-XX-CA-C-0003b W2 (LTS).srcx

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	2	Cv (Summer)	1.000
FEH Rainfall Version	2013	Cv (Winter)	1.000
Site Location	GB 505745 243600 TL 05745 43600	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 1.605

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	5	0.535	5	10	0.535	10	15	0.535

Cascade Model Details for C86343-JNP-XX-XX-CA-C-0003b W2 (LTS).srcx

Storage is Online Cover Level (m) 33.810

Tank or Pond Structure

Invert Level (m) 32.310

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	832.2	0.500	1040.3	1.000	1262.7	1.500	1499.3
0.250	934.5	0.750	1149.7	1.250	1379.2		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0077-2900-1250-2900
Design Head (m)	1.250
Design Flow (l/s)	2.9
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	77
Invert Level (m)	32.310
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.250	2.9	Kick-Flo®	0.690	2.2
Flush-Flo™	0.339	2.7	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)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.2	0.800	2.4	2.000	3.6	4.000	5.0	7.000	6.5
0.200	2.6	1.000	2.6	2.200	3.8	4.500	5.3	7.500	6.7
0.300	2.7	1.200	2.8	2.400	3.9	5.000	5.5	8.000	6.9
0.400	2.7	1.400	3.1	2.600	4.1	5.500	5.8	8.500	7.1
0.500	2.7	1.600	3.2	3.000	4.3	6.000	6.0	9.000	7.3
0.600	2.5	1.800	3.4	3.500	4.7	6.500	6.2	9.500	7.5

Weir Overflow Control

Discharge Coef 0.544 Width (m) 1.000 Invert Level (m) 33.310

Cascade Summary of Results for C86343-JNP-XX-XX-CA-C-0003c W3 (LTS).srcx

Upstream Structures	Outflow To	Overflow To
C86343-JNP-XX-XX-CA-C-0003b W2 (LTS).srcx C86343-JNP-XX-XX-CA-C-0003a W1 (LTS).srcx	(None)	C86343-JNP-XX-XX-CA-C-0003d W (AS).srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	31.530	0.260	2.1	0.0	2.1	109.3	O K
30 min Summer	31.586	0.316	2.2	0.0	2.2	136.5	O K
60 min Summer	31.637	0.367	2.2	0.0	2.2	163.5	O K
120 min Summer	31.749	0.479	2.2	0.0	2.2	226.4	O K
180 min Summer	31.808	0.538	2.2	0.0	2.2	262.1	O K
240 min Summer	31.844	0.574	2.2	0.0	2.2	285.0	O K
360 min Summer	31.885	0.615	2.2	0.0	2.2	311.3	O K
480 min Summer	31.905	0.635	2.2	0.0	2.2	324.8	O K
600 min Summer	31.916	0.646	2.2	0.0	2.2	331.9	O K
720 min Summer	31.921	0.651	2.2	0.0	2.2	335.2	O K
960 min Summer	31.920	0.650	2.2	0.0	2.2	335.0	O K
1440 min Summer	31.902	0.632	2.2	0.0	2.2	322.9	O K
2160 min Summer	31.871	0.601	2.2	0.0	2.2	302.1	O K
2880 min Summer	31.847	0.577	2.2	0.0	2.2	286.7	O K
4320 min Summer	31.813	0.543	2.2	0.0	2.2	265.4	O K
5760 min Summer	31.788	0.518	2.2	0.0	2.2	249.9	O K
7200 min Summer	31.769	0.499	2.2	0.0	2.2	238.4	O K
8640 min Summer	31.754	0.484	2.2	0.0	2.2	229.3	O K
10080 min Summer	31.741	0.471	2.2	0.0	2.2	221.8	O K
15 min Winter	31.531	0.261	2.1	0.0	2.1	109.3	O K
30 min Winter	31.586	0.316	2.2	0.0	2.2	136.6	O K
60 min Winter	31.638	0.368	2.2	0.0	2.2	163.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Summer	34.456	0.0	105.6	0.0	29
30 min Summer	21.626	0.0	131.8	0.0	44
60 min Summer	13.109	0.0	167.3	0.0	72
120 min Summer	9.207	0.0	234.8	0.0	132
180 min Summer	7.206	0.0	274.7	0.0	192
240 min Summer	5.959	0.0	301.2	0.0	250
360 min Summer	4.456	0.0	330.1	0.0	370
480 min Summer	3.581	0.0	336.9	0.0	488
600 min Summer	3.007	0.0	334.6	0.0	608
720 min Summer	2.600	0.0	331.2	0.0	726
960 min Summer	2.059	0.0	323.7	0.0	964
1440 min Summer	1.477	0.0	309.3	0.0	1412
2160 min Summer	1.065	0.0	494.0	0.0	1708
2880 min Summer	0.850	0.0	525.1	0.0	2056
4320 min Summer	0.631	0.0	574.0	0.0	2860
5760 min Summer	0.518	0.0	644.2	0.0	3688
7200 min Summer	0.450	0.0	699.4	0.0	4472
8640 min Summer	0.404	0.0	753.8	0.0	5280
10080 min Summer	0.372	0.0	807.2	0.0	6064
15 min Winter	34.456	0.0	105.6	0.0	29
30 min Winter	21.626	0.0	131.8	0.0	43
60 min Winter	13.109	0.0	167.3	0.0	72

Cascade Summary of Results for C86343-JNP-XX-XX-CA-C-0003c W3 (LTS).srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
120 min Winter	31.750	0.480	2.2	0.0	2.2	226.6	O K
180 min Winter	31.808	0.538	2.2	0.0	2.2	262.3	O K
240 min Winter	31.845	0.575	2.2	0.0	2.2	285.3	O K
360 min Winter	31.886	0.616	2.2	0.0	2.2	311.7	O K
480 min Winter	31.906	0.636	2.2	0.0	2.2	325.3	O K
600 min Winter	31.917	0.647	2.2	0.0	2.2	332.5	O K
720 min Winter	31.921	0.651	2.2	0.0	2.2	335.8	O K
960 min Winter	31.921	0.651	2.2	0.0	2.2	335.8	O K
1440 min Winter	31.904	0.634	2.2	0.0	2.2	324.2	O K
2160 min Winter	31.865	0.595	2.2	0.0	2.2	298.0	O K
2880 min Winter	31.833	0.563	2.2	0.0	2.2	277.7	O K
4320 min Winter	31.778	0.508	2.2	0.0	2.2	243.4	O K
5760 min Winter	31.730	0.460	2.2	0.0	2.2	215.0	O K
7200 min Winter	31.689	0.419	2.2	0.0	2.2	192.0	O K
8640 min Winter	31.654	0.384	2.2	0.0	2.2	172.6	O K
10080 min Winter	31.624	0.354	2.2	0.0	2.2	156.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
120 min Winter	9.207	0.0	234.9	0.0	130
180 min Winter	7.206	0.0	274.7	0.0	188
240 min Winter	5.959	0.0	301.2	0.0	246
360 min Winter	4.456	0.0	330.2	0.0	364
480 min Winter	3.581	0.0	337.1	0.0	480
600 min Winter	3.007	0.0	335.1	0.0	596
720 min Winter	2.600	0.0	331.8	0.0	710
960 min Winter	2.059	0.0	324.7	0.0	938
1440 min Winter	1.477	0.0	311.5	0.0	1380
2160 min Winter	1.065	0.0	494.1	0.0	1732
2880 min Winter	0.850	0.0	525.3	0.0	2168
4320 min Winter	0.631	0.0	577.6	0.0	3036
5760 min Winter	0.518	0.0	644.3	0.0	3880
7200 min Winter	0.450	0.0	699.5	0.0	4696
8640 min Winter	0.404	0.0	753.9	0.0	5528
10080 min Winter	0.372	0.0	807.4	0.0	6264

Cascade Rainfall Details for C86343-JNP-XX-XX-CA-C-0003c W3 (LTS).srcx

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	2	Cv (Summer)	1.000
FEH Rainfall Version	2013	Cv (Winter)	1.000
Site Location	GB 505745 243600 TL 05745 43600	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 1.297

Time From: (mins)	To:	Area (ha)	Time From: (mins)	To:	Area (ha)	Time From: (mins)	To:	Area (ha)
0	5	0.432	5	10	0.432	10	15	0.433

Cascade Model Details for C86343-JNP-XX-XX-CA-C-0003c W3 (LTS).srcx

Storage is Online Cover Level (m) 32.770

Tank or Pond Structure

Invert Level (m) 31.270

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	359.8	0.500	601.7	1.000	872.7	1.500	1172.0
0.250	477.0	0.750	733.6	1.250	1018.8		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0070-2400-1250-2400
Design Head (m)	1.250
Design Flow (l/s)	2.4
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	70
Invert Level (m)	31.270
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.250	2.4	Kick-Flo®	0.623	1.7
Flush-Flo™	0.307	2.2	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)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.8	0.800	2.0	2.000	3.0	4.000	4.1	7.000	5.3
0.200	2.1	1.000	2.2	2.200	3.1	4.500	4.3	7.500	5.5
0.300	2.2	1.200	2.4	2.400	3.2	5.000	4.6	8.000	5.7
0.400	2.1	1.400	2.5	2.600	3.4	5.500	4.8	8.500	5.8
0.500	2.0	1.600	2.7	3.000	3.6	6.000	5.0	9.000	6.0
0.600	1.8	1.800	2.8	3.500	3.9	6.500	5.1	9.500	6.2

Weir Overflow Control

Discharge Coef 0.544 Width (m) 1.500 Invert Level (m) 32.270

Cascade Summary of Results for C86343-JNP-XX-XX-CA-C-0003d W (AS).srcx

Upstream Structures	Outflow To	Overflow To
C86343-JNP-XX-XX-CA-C-0003c W3 (LTS).srcx C86343-JNP-XX-XX-CA-C-0003b W2 (LTS).srcx C86343-JNP-XX-XX-CA-C-0003a W1 (LTS).srcx	(None)	(None)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	31.270	0.000	0.0	0.0	O K
30 min Summer	31.270	0.000	0.0	0.0	O K
60 min Summer	31.270	0.000	0.0	0.0	O K
120 min Summer	31.270	0.000	0.0	0.0	O K
180 min Summer	31.270	0.000	0.0	0.0	O K
240 min Summer	31.270	0.000	0.0	0.0	O K
360 min Summer	31.270	0.000	0.0	0.0	O K
480 min Summer	31.270	0.000	0.0	0.0	O K
600 min Summer	31.270	0.000	0.0	0.0	O K
720 min Summer	31.270	0.000	0.0	0.0	O K
960 min Summer	31.270	0.000	0.0	0.0	O K
1440 min Summer	31.270	0.000	0.0	0.0	O K
2160 min Summer	31.270	0.000	0.0	0.0	O K
2880 min Summer	31.270	0.000	0.0	0.0	O K
4320 min Summer	31.270	0.000	0.0	0.0	O K
5760 min Summer	31.270	0.000	0.0	0.0	O K
7200 min Summer	31.270	0.000	0.0	0.0	O K
8640 min Summer	31.270	0.000	0.0	0.0	O K
10080 min Summer	31.270	0.000	0.0	0.0	O K
15 min Winter	31.270	0.000	0.0	0.0	O K
30 min Winter	31.270	0.000	0.0	0.0	O K
60 min Winter	31.270	0.000	0.0	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	34.456	0.0	0.0	0
30 min Summer	21.626	0.0	0.0	0
60 min Summer	13.109	0.0	0.0	0
120 min Summer	9.207	0.0	0.0	0
180 min Summer	7.206	0.0	0.0	0
240 min Summer	5.959	0.0	0.0	0
360 min Summer	4.456	0.0	0.0	0
480 min Summer	3.581	0.0	0.0	0
600 min Summer	3.007	0.0	0.0	0
720 min Summer	2.600	0.0	0.0	0
960 min Summer	2.059	0.0	0.0	0
1440 min Summer	1.477	0.0	0.0	0
2160 min Summer	1.065	0.0	0.0	0
2880 min Summer	0.850	0.0	0.0	0
4320 min Summer	0.631	0.0	0.0	0
5760 min Summer	0.518	0.0	0.0	0
7200 min Summer	0.450	0.0	0.0	0
8640 min Summer	0.404	0.0	0.0	0
10080 min Summer	0.372	0.0	0.0	0
15 min Winter	34.456	0.0	0.0	0
30 min Winter	21.626	0.0	0.0	0
60 min Winter	13.109	0.0	0.0	0

Cascade Summary of Results for C86343-JNP-XX-XX-CA-C-0003d W (AS).srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m^3)	Status
120 min Winter	31.270	0.000	0.0	0.0	O K
180 min Winter	31.270	0.000	0.0	0.0	O K
240 min Winter	31.270	0.000	0.0	0.0	O K
360 min Winter	31.270	0.000	0.0	0.0	O K
480 min Winter	31.270	0.000	0.0	0.0	O K
600 min Winter	31.270	0.000	0.0	0.0	O K
720 min Winter	31.270	0.000	0.0	0.0	O K
960 min Winter	31.270	0.000	0.0	0.0	O K
1440 min Winter	31.270	0.000	0.0	0.0	O K
2160 min Winter	31.270	0.000	0.0	0.0	O K
2880 min Winter	31.270	0.000	0.0	0.0	O K
4320 min Winter	31.270	0.000	0.0	0.0	O K
5760 min Winter	31.270	0.000	0.0	0.0	O K
7200 min Winter	31.270	0.000	0.0	0.0	O K
8640 min Winter	31.270	0.000	0.0	0.0	O K
10080 min Winter	31.270	0.000	0.0	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m^3)	Discharge Volume (m^3)	Time-Peak (mins)
120 min Winter	9.207	0.0	0.0	0
180 min Winter	7.206	0.0	0.0	0
240 min Winter	5.959	0.0	0.0	0
360 min Winter	4.456	0.0	0.0	0
480 min Winter	3.581	0.0	0.0	0
600 min Winter	3.007	0.0	0.0	0
720 min Winter	2.600	0.0	0.0	0
960 min Winter	2.059	0.0	0.0	0
1440 min Winter	1.477	0.0	0.0	0
2160 min Winter	1.065	0.0	0.0	0
2880 min Winter	0.850	0.0	0.0	0
4320 min Winter	0.631	0.0	0.0	0
5760 min Winter	0.518	0.0	0.0	0
7200 min Winter	0.450	0.0	0.0	0
8640 min Winter	0.404	0.0	0.0	0
10080 min Winter	0.372	0.0	0.0	0

Cascade Rainfall Details for C86343-JNP-XX-XX-CA-C-0003d W (AS).srcx

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	2	Cv (Summer)	1.000
FEH Rainfall Version	2013	Cv (Winter)	1.000
Site Location	GB 505745 243600 TL 05745 43600	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.000

Time (mins) From:	To:	Area (ha)
0	5	0.000

Cascade Model Details for C86343-JNP-XX-XX-CA-C-0003d W (AS).srcx

Storage is Online Cover Level (m) 32.770

Tank or Pond Structure

Invert Level (m) 31.270

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	996.6	0.500	1199.8	1.000	1417.2	1.500	1648.7
0.250	1096.4	0.750	1306.7	1.250	1531.2		

Complex Outflow Control

Hydro-Brake® Optimum

Unit Reference	MD-SHE-0096-3800-0750-3800
Design Head (m)	0.750
Design Flow (l/s)	3.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	96
Invert Level (m)	31.270
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.750	3.8	Kick-Flo®	0.497	3.1
Flush-Flo™	0.224	3.8	Mean Flow over Head Range	-	3.3

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.1	0.800	3.9	2.000	6.0	4.000	8.3	7.000	10.8
0.200	3.8	1.000	4.3	2.200	6.3	4.500	8.8	7.500	11.2
0.300	3.7	1.200	4.7	2.400	6.5	5.000	9.2	8.000	11.5
0.400	3.6	1.400	5.1	2.600	6.8	5.500	9.7	8.500	11.9
0.500	3.2	1.600	5.4	3.000	7.2	6.000	10.1	9.000	12.2
0.600	3.4	1.800	5.7	3.500	7.8	6.500	10.5	9.500	12.6

Hydro-Brake® Optimum

Unit Reference	MD-SHE-0267-3720-0500-3720
Design Head (m)	0.500
Design Flow (l/s)	37.2
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	267
Invert Level (m)	32.020
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1500

Hydro-Brake® Optimum

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.500	37.2	Kick-Flo®	0.463	35.9
Flush-Flo™	0.348	37.2	Mean Flow over Head Range	-	25.7

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)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	8.5	0.800	46.6	2.000	72.6	4.000	101.8	7.000	133.1
0.200	27.4	1.000	51.9	2.200	76.1	4.500	107.8	7.500	137.8
0.300	36.9	1.200	56.7	2.400	79.4	5.000	113.5	8.000	142.4
0.400	36.9	1.400	61.1	2.600	82.5	5.500	117.7	8.500	146.9
0.500	37.2	1.600	65.2	3.000	88.5	6.000	123.0	9.000	151.2
0.600	40.6	1.800	69.0	3.500	95.4	6.500	128.2	9.500	155.4

Cascade Summary of Results for C86343-JNP-XX-XX-CA-C-0002a S1 (LTS).srcx

Upstream Structures	Outflow To	Overflow To
(None)	(None)	C86343-JNP-XX-XX-CA-C-0002b S (AS).srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	33.458	0.658	5.1	0.0	5.1	700.5	O K
30 min Summer	33.622	0.822	5.1	0.0	5.1	901.5	O K
60 min Summer	33.774	0.974	5.1	0.0	5.1	1098.0	O K
120 min Summer	33.889	1.089	5.1	68.1	72.9	1253.5	O K
180 min Summer	33.911	1.111	5.1	94.2	99.0	1283.7	O K
240 min Summer	33.925	1.125	5.1	112.6	117.5	1302.6	O K
360 min Summer	33.931	1.131	5.1	121.5	126.4	1311.6	O K
480 min Summer	33.927	1.127	5.1	116.0	120.9	1306.1	O K
600 min Summer	33.921	1.121	5.1	107.2	112.1	1297.0	O K
720 min Summer	33.914	1.114	5.1	98.1	102.9	1287.7	O K
960 min Summer	33.901	1.101	5.1	82.3	87.1	1270.6	O K
1440 min Summer	33.883	1.083	5.1	60.8	65.6	1245.1	O K
2160 min Summer	33.865	1.065	5.1	42.6	47.3	1220.8	O K
2880 min Summer	33.854	1.054	5.1	31.8	36.6	1205.5	O K
4320 min Summer	33.840	1.040	5.1	20.6	25.3	1186.9	O K
5760 min Summer	33.833	1.033	5.1	15.1	19.8	1177.0	O K
7200 min Summer	33.829	1.029	5.1	12.5	17.1	1171.2	O K
8640 min Summer	33.826	1.026	5.1	10.6	15.2	1167.2	O K
10080 min Summer	33.824	1.024	5.1	9.7	14.3	1165.4	O K
15 min Winter	33.458	0.658	5.1	0.0	5.1	700.5	O K
30 min Winter	33.622	0.822	5.1	0.0	5.1	901.5	O K
60 min Winter	33.774	0.974	5.1	0.0	5.1	1098.2	O K
120 min Winter	33.894	1.094	5.1	74.0	78.7	1260.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Summer	101.039	0.0	428.0	0.0	30
30 min Summer	65.072	0.0	391.5	0.0	45
60 min Summer	39.810	0.0	796.2	0.0	74
120 min Summer	25.352	0.0	1010.6	224.2	116
180 min Summer	19.126	0.0	1180.2	396.4	134
240 min Summer	15.497	0.0	1292.6	511.4	164
360 min Summer	11.318	0.0	1424.7	648.7	228
480 min Summer	8.951	0.0	1494.1	723.4	292
600 min Summer	7.418	0.0	1532.0	766.5	356
720 min Summer	6.343	0.0	1552.0	791.5	422
960 min Summer	4.927	0.0	1560.7	809.5	550
1440 min Summer	3.426	0.0	1526.8	788.7	808
2160 min Summer	2.379	0.0	2262.4	712.7	1200
2880 min Summer	1.844	0.0	2138.4	625.2	1596
4320 min Summer	1.307	0.0	1909.7	488.2	2420
5760 min Summer	1.038	0.0	2777.1	406.3	3224
7200 min Summer	0.882	0.0	2944.4	368.5	4032
8640 min Summer	0.781	0.0	3086.2	352.6	4800
10080 min Summer	0.711	0.0	2998.8	351.9	5552
15 min Winter	101.039	0.0	428.0	0.0	30
30 min Winter	65.072	0.0	391.6	0.0	44
60 min Winter	39.810	0.0	796.2	0.0	74
120 min Winter	25.352	0.0	1010.8	224.5	116

Cascade Summary of Results for C86343-JNP-XX-XX-CA-C-0002a S1 (LTS).srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
180 min Winter	33.918	1.118	5.1	103.9	108.8	1293.7	O K
240 min Winter	33.928	1.128	5.1	117.4	122.2	1307.6	O K
360 min Winter	33.927	1.127	5.1	116.0	120.9	1306.5	O K
480 min Winter	33.919	1.119	5.1	105.2	110.1	1295.6	O K
600 min Winter	33.911	1.111	5.1	94.8	99.7	1284.0	O K
720 min Winter	33.903	1.103	5.1	84.8	89.6	1273.2	O K
960 min Winter	33.890	1.090	5.1	69.3	74.1	1255.2	O K
1440 min Winter	33.872	1.072	5.1	49.6	54.4	1230.3	O K
2160 min Winter	33.856	1.056	5.1	33.6	38.4	1208.2	O K
2880 min Winter	33.846	1.046	5.1	25.0	29.7	1194.4	O K
4320 min Winter	33.834	1.034	5.1	15.8	20.5	1178.4	O K
5760 min Winter	33.827	1.027	5.1	11.2	15.8	1168.7	O K
7200 min Winter	33.822	1.022	5.1	8.5	13.1	1162.9	O K
8640 min Winter	33.819	1.019	5.1	6.8	11.5	1158.7	O K
10080 min Winter	33.817	1.017	5.1	5.8	10.4	1155.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
180 min Winter	19.126	0.0	1180.6	397.2	140
240 min Winter	15.497	0.0	1293.1	512.5	172
360 min Winter	11.318	0.0	1425.9	651.0	240
480 min Winter	8.951	0.0	1496.0	726.7	308
600 min Winter	7.418	0.0	1534.7	771.0	374
720 min Winter	6.343	0.0	1555.3	797.0	440
960 min Winter	4.927	0.0	1565.1	816.8	572
1440 min Winter	3.426	0.0	1533.1	799.4	840
2160 min Winter	2.379	0.0	2271.9	727.7	1248
2880 min Winter	1.844	0.0	2153.8	643.2	1660
4320 min Winter	1.307	0.0	1912.1	488.6	2512
5760 min Winter	1.038	0.0	2777.0	387.8	3400
7200 min Winter	0.882	0.0	2943.7	325.7	4256
8640 min Winter	0.781	0.0	3073.7	283.6	5112
10080 min Winter	0.711	0.0	2954.8	256.4	5968

Cascade Rainfall Details for C86343-JNP-XX-XX-CA-C-0002a S1 (LTS).srcx

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	1.000
FEH Rainfall Version	2013	Cv (Winter)	1.000
Site Location	GB 505745 243600 TL 05745 43600	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 2.798

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	5	0.933	5	10	0.933	10	15	0.933

Cascade Model Details for C86343-JNP-XX-XX-CA-C-0002a S1 (LTS).srcx

Storage is Online Cover Level (m) 34.300

Tank or Pond Structure

Invert Level (m) 32.800

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	941.0	0.500	1130.5	1.000	1335.3	1.500	1554.6
0.250	1033.8	0.750	1231.0	1.250	1443.2		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0103-5100-1250-5100
Design Head (m)	1.250
Design Flow (l/s)	5.1
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	103
Invert Level (m)	32.800
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.250	5.1	Kick-Flo®	0.772	4.1
Flush-Flo™	0.368	5.1	Mean Flow over Head Range	-	4.5

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)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.4	0.800	4.1	2.000	6.3	4.000	8.8	7.000	11.5
0.200	4.8	1.000	4.6	2.200	6.6	4.500	9.3	7.500	11.9
0.300	5.1	1.200	5.0	2.400	6.9	5.000	9.8	8.000	12.2
0.400	5.1	1.400	5.4	2.600	7.2	5.500	10.2	8.500	12.6
0.500	5.0	1.600	5.7	3.000	7.7	6.000	10.7	9.000	12.9
0.600	4.8	1.800	6.0	3.500	8.3	6.500	11.1	9.500	13.3

Weir Overflow Control

Discharge Coef 0.544 Width (m) 1.500 Invert Level (m) 33.800

Cascade Summary of Results for C86343-JNP-XX-XX-CA-C-0002b S (AS).srcx

Upstream Structures	Outflow To	Overflow To
C86343-JNP-XX-XX-CA-C-0002a S1 (LTS).srcx	(None)	(None)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	32.800	0.000	0.0	0.0	O K
30 min Summer	32.800	0.000	0.0	0.0	O K
60 min Summer	32.800	0.000	0.0	0.0	O K
120 min Summer	33.052	0.252	2.3	208.5	O K
180 min Summer	33.237	0.437	2.3	376.9	O K
240 min Summer	33.352	0.552	2.3	489.2	O K
360 min Summer	33.481	0.681	2.3	619.7	O K
480 min Summer	33.545	0.745	2.3	687.2	O K
600 min Summer	33.577	0.777	2.9	721.9	O K
720 min Summer	33.591	0.791	3.7	737.1	O K
960 min Summer	33.593	0.793	3.8	739.3	O K
1440 min Summer	33.554	0.754	2.3	697.4	O K
2160 min Summer	33.449	0.649	2.3	587.4	O K
2880 min Summer	33.360	0.560	2.3	497.1	O K
4320 min Summer	33.228	0.428	2.3	368.8	O K
5760 min Summer	33.141	0.341	2.3	288.4	O K
7200 min Summer	33.096	0.296	2.3	247.5	O K
8640 min Summer	33.071	0.271	2.3	225.7	O K
10080 min Summer	33.061	0.261	2.3	216.4	O K
15 min Winter	32.800	0.000	0.0	0.0	O K
30 min Winter	32.800	0.000	0.0	0.0	O K
60 min Winter	32.800	0.000	0.0	0.0	O K
120 min Winter	33.052	0.252	2.3	209.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	101.039	0.0	0.0	0
30 min Summer	65.072	0.0	0.0	0
60 min Summer	39.810	0.0	0.0	0
120 min Summer	25.352	0.0	211.6	206
180 min Summer	19.126	0.0	352.8	264
240 min Summer	15.497	0.0	346.9	320
360 min Summer	11.318	0.0	329.1	428
480 min Summer	8.951	0.0	326.3	540
600 min Summer	7.418	0.0	329.8	648
720 min Summer	6.343	0.0	333.0	758
960 min Summer	4.927	0.0	322.6	986
1440 min Summer	3.426	0.0	274.7	1462
2160 min Summer	2.379	0.0	584.9	2028
2880 min Summer	1.844	0.0	532.5	2364
4320 min Summer	1.307	0.0	439.4	3104
5760 min Summer	1.038	0.0	402.7	3896
7200 min Summer	0.882	0.0	364.6	4712
8640 min Summer	0.781	0.0	348.2	5520
10080 min Summer	0.711	0.0	346.6	6352
15 min Winter	101.039	0.0	0.0	0
30 min Winter	65.072	0.0	0.0	0
60 min Winter	39.810	0.0	0.0	0
120 min Winter	25.352	0.0	212.0	204

Cascade Summary of Results for C86343-JNP-XX-XX-CA-C-0002b S (AS).srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
180 min Winter	33.238	0.438	2.3	378.4	O K
240 min Winter	33.355	0.555	2.3	491.4	O K
360 min Winter	33.484	0.684	2.3	623.4	O K
480 min Winter	33.549	0.749	2.3	692.4	O K
600 min Winter	33.582	0.782	3.2	727.9	O K
720 min Winter	33.597	0.797	4.1	743.9	O K
960 min Winter	33.600	0.800	4.4	747.8	O K
1440 min Winter	33.568	0.768	2.6	712.7	O K
2160 min Winter	33.471	0.671	2.3	610.0	O K
2880 min Winter	33.370	0.570	2.3	507.1	O K
4320 min Winter	33.222	0.422	2.3	363.5	O K
5760 min Winter	33.109	0.309	2.3	259.2	O K
7200 min Winter	33.037	0.237	2.3	195.3	O K
8640 min Winter	32.988	0.188	2.3	153.9	O K
10080 min Winter	32.957	0.157	2.2	127.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
180 min Winter	19.126	0.0	352.8	262
240 min Winter	15.497	0.0	345.9	316
360 min Winter	11.318	0.0	328.3	424
480 min Winter	8.951	0.0	326.0	534
600 min Winter	7.418	0.0	331.7	638
720 min Winter	6.343	0.0	336.6	744
960 min Winter	4.927	0.0	327.9	968
1440 min Winter	3.426	0.0	275.7	1432
2160 min Winter	2.379	0.0	581.0	2084
2880 min Winter	1.844	0.0	525.9	2432
4320 min Winter	1.307	0.0	431.9	3268
5760 min Winter	1.038	0.0	384.3	4160
7200 min Winter	0.882	0.0	321.9	5008
8640 min Winter	0.781	0.0	279.3	5864
10080 min Winter	0.711	0.0	251.3	6736

Cascade Rainfall Details for C86343-JNP-XX-XX-CA-C-0002b S (AS).srcx

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	1.000
FEH Rainfall Version	2013	Cv (Winter)	1.000
Site Location	GB 505745 243600 TL 05745 43600	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.000

Time (mins) From:	To:	Area (ha)
0	5	0.000

Cascade Model Details for C86343-JNP-XX-XX-CA-C-0002b S (AS).srcx

Storage is Online Cover Level (m) 34.300

Tank or Pond Structure

Invert Level (m) 32.800

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	782.1	0.500	971.7	1.000	1175.6	1.500	1393.6
0.250	875.1	0.750	1071.9	1.250	1282.9		

Complex Outflow Control

Hydro-Brake® Optimum

Unit Reference	MD-SHE-0076-2300-0750-2300
Design Head (m)	0.750
Design Flow (l/s)	2.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	76
Invert Level (m)	32.800
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.750	2.3	Kick-Flo®	0.481	1.9
Flush-Flo™	0.223	2.3	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)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.1	0.800	2.4	2.000	3.6	4.000	5.0	7.000	6.5
0.200	2.3	1.000	2.6	2.200	3.8	4.500	5.3	7.500	6.7
0.300	2.3	1.200	2.8	2.400	3.9	5.000	5.5	8.000	6.9
0.400	2.2	1.400	3.1	2.600	4.1	5.500	5.8	8.500	7.1
0.500	1.9	1.600	3.3	3.000	4.4	6.000	6.0	9.000	7.3
0.600	2.1	1.800	3.4	3.500	4.7	6.500	6.3	9.500	7.5

Hydro-Brake® Optimum

Unit Reference	MD-SHE-0215-2250-0500-2250
Design Head (m)	0.500
Design Flow (l/s)	22.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	215
Invert Level (m)	33.550
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1200

Hydro-Brake® Optimum

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.500	22.5	Kick-Flo®	0.435	21.1
Flush-Flo™	0.295	22.5	Mean Flow over Head Range	-	16.6

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)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	7.3	0.800	28.2	2.000	43.8	4.000	61.2	7.000	80.2
0.200	21.0	1.000	31.3	2.200	45.8	4.500	64.8	7.500	83.0
0.300	22.5	1.200	34.2	2.400	47.8	5.000	68.3	8.000	85.8
0.400	21.7	1.400	36.8	2.600	49.7	5.500	70.9	8.500	88.5
0.500	22.5	1.600	39.3	3.000	53.2	6.000	74.1	9.000	91.0
0.600	24.5	1.800	41.6	3.500	57.4	6.500	77.2	9.500	93.6

Cascade Summary of Results for C86343-JNP-XX-XX-CA-C-0003a W1 (LTS).srcx

Upstream Structures	Outflow To	Overflow To
(None)	(None)	C86343-JNP-XX-XX-CA-C-0003b W2 (LTS).srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	33.851	0.701	3.0	0.0	3.0	432.3	O K
30 min Summer	34.001	0.851	3.0	0.0	3.0	556.0	O K
60 min Summer	34.136	0.986	3.0	0.0	3.0	677.1	O K
120 min Summer	34.234	1.084	3.0	41.7	44.6	771.1	O K
180 min Summer	34.254	1.104	3.0	57.4	60.3	790.7	O K
240 min Summer	34.267	1.117	3.0	68.0	70.9	802.9	O K
360 min Summer	34.272	1.122	3.0	72.8	75.8	808.8	O K
480 min Summer	34.269	1.119	3.0	70.2	73.1	805.4	O K
600 min Summer	34.263	1.113	3.0	64.9	67.9	799.4	O K
720 min Summer	34.257	1.107	3.0	59.8	62.8	793.4	O K
960 min Summer	34.246	1.096	3.0	50.5	53.4	782.0	O K
1440 min Summer	34.228	1.078	3.0	37.3	40.2	765.0	O K
2160 min Summer	34.212	1.062	3.0	26.1	29.0	748.8	O K
2880 min Summer	34.201	1.051	3.0	19.5	22.3	738.5	O K
4320 min Summer	34.188	1.038	3.0	12.7	15.6	726.2	O K
5760 min Summer	34.181	1.031	3.0	9.4	12.2	719.5	O K
7200 min Summer	34.177	1.027	3.0	7.7	10.5	715.7	O K
8640 min Summer	34.175	1.025	3.0	6.6	9.5	713.2	O K
10080 min Summer	34.173	1.023	3.0	6.0	8.9	712.2	O K
15 min Winter	33.851	0.701	3.0	0.0	3.0	432.2	O K
30 min Winter	34.001	0.851	3.0	0.0	3.0	556.1	O K
60 min Winter	34.136	0.986	3.0	0.0	3.0	677.3	O K
120 min Winter	34.239	1.089	3.0	45.4	48.3	776.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Summer	101.039	0.0	240.9	0.0	30
30 min Summer	65.072	0.0	219.2	0.0	45
60 min Summer	39.810	0.0	459.2	0.0	74
120 min Summer	25.352	0.0	601.9	145.3	116
180 min Summer	19.126	0.0	707.3	251.5	134
240 min Summer	15.497	0.0	777.4	322.5	164
360 min Summer	11.318	0.0	860.6	407.4	228
480 min Summer	8.951	0.0	905.3	453.6	294
600 min Summer	7.418	0.0	930.8	480.3	358
720 min Summer	6.343	0.0	945.3	495.9	422
960 min Summer	4.927	0.0	955.7	507.1	550
1440 min Summer	3.426	0.0	946.2	494.4	810
2160 min Summer	2.379	0.0	1370.4	447.7	1200
2880 min Summer	1.844	0.0	1296.2	393.7	1596
4320 min Summer	1.307	0.0	1177.5	308.0	2420
5760 min Summer	1.038	0.0	1716.0	257.5	3224
7200 min Summer	0.882	0.0	1820.8	235.4	4032
8640 min Summer	0.781	0.0	1891.8	227.2	4832
10080 min Summer	0.711	0.0	1822.6	228.5	5552
15 min Winter	101.039	0.0	240.9	0.0	30
30 min Winter	65.072	0.0	219.2	0.0	44
60 min Winter	39.810	0.0	459.2	0.0	74
120 min Winter	25.352	0.0	602.0	145.6	116

Cascade Summary of Results for C86343-JNP-XX-XX-CA-C-0003a W1 (LTS).srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
180 min Winter	34.261	1.111	3.0	62.8	65.7	797.2	O K
240 min Winter	34.270	1.120	3.0	70.6	73.5	806.3	O K
360 min Winter	34.269	1.119	3.0	70.2	73.1	805.8	O K
480 min Winter	34.262	1.112	3.0	64.1	67.0	798.6	O K
600 min Winter	34.255	1.105	3.0	57.8	60.7	791.0	O K
720 min Winter	34.247	1.097	3.0	51.7	54.6	783.9	O K
960 min Winter	34.235	1.085	3.0	42.4	45.3	771.9	O K
1440 min Winter	34.218	1.068	3.0	30.4	33.3	755.3	O K
2160 min Winter	34.203	1.053	3.0	20.6	23.5	740.5	O K
2880 min Winter	34.194	1.044	3.0	15.6	18.4	731.4	O K
4320 min Winter	34.182	1.032	3.0	9.9	12.7	720.5	O K
5760 min Winter	34.176	1.026	3.0	7.0	9.9	714.2	O K
7200 min Winter	34.172	1.022	3.0	5.5	8.3	710.4	O K
8640 min Winter	34.169	1.019	3.0	4.4	7.2	707.9	O K
10080 min Winter	34.167	1.017	3.0	3.9	6.7	706.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
180 min Winter	19.126	0.0	707.4	252.1	140
240 min Winter	15.497	0.0	777.6	323.3	174
360 min Winter	11.318	0.0	861.3	409.1	242
480 min Winter	8.951	0.0	906.4	456.0	308
600 min Winter	7.418	0.0	932.2	483.4	374
720 min Winter	6.343	0.0	947.1	499.6	442
960 min Winter	4.927	0.0	958.0	512.2	576
1440 min Winter	3.426	0.0	949.6	502.0	842
2160 min Winter	2.379	0.0	1376.6	458.4	1252
2880 min Winter	1.844	0.0	1305.0	406.8	1664
4320 min Winter	1.307	0.0	1179.3	311.5	2512
5760 min Winter	1.038	0.0	1716.0	249.9	3400
7200 min Winter	0.882	0.0	1820.5	214.2	4248
8640 min Winter	0.781	0.0	1877.9	191.0	5104
10080 min Winter	0.711	0.0	1799.4	177.1	5952

Cascade Rainfall Details for C86343-JNP-XX-XX-CA-C-0003a W1 (LTS).srcx

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	1.000
FEH Rainfall Version	2013	Cv (Winter)	1.000
Site Location	GB 505745 243600 TL 05745 43600	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 1.726

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	5	0.575	5	10	0.575	10	15	0.576

Cascade Model Details for C86343-JNP-XX-XX-CA-C-0003a W1 (LTS).srcx

Storage is Online Cover Level (m) 34.650

Tank or Pond Structure

Invert Level (m) 33.150

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	452.4	0.500	688.3	1.000	938.4	1.500	1202.5
0.250	568.6	0.750	811.6	1.250	1068.7		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0080-3100-1250-3100
Design Head (m)	1.250
Design Flow (l/s)	3.1
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	80
Invert Level (m)	33.150
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.250	3.1	Kick-Flo®	0.712	2.4
Flush-Flo™	0.348	3.0	Mean Flow over Head Range	-	2.7

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)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.3	0.800	2.5	2.000	3.8	4.000	5.3	7.000	6.9
0.200	2.8	1.000	2.8	2.200	4.0	4.500	5.6	7.500	7.1
0.300	3.0	1.200	3.0	2.400	4.2	5.000	5.9	8.000	7.4
0.400	3.0	1.400	3.3	2.600	4.3	5.500	6.2	8.500	7.6
0.500	2.9	1.600	3.5	3.000	4.6	6.000	6.4	9.000	7.8
0.600	2.8	1.800	3.7	3.500	5.0	6.500	6.7	9.500	8.0

Weir Overflow Control

Discharge Coef 0.544 Width (m) 1.000 Invert Level (m) 34.150

Cascade Summary of Results for C86343-JNP-XX-XX-CA-C-0003b W2 (LTS).srcx

Upstream Structures	Outflow To	Overflow To
C86343-JNP-XX-XX-CA-C-0003a W1 (LTS).srcx	(None)	C86343-JNP-XX-XX-CA-C-0003c W3 (LTS).srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Σ Max Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	32.746	0.436	2.7	0.0	2.7	402.0	O K
30 min Summer	32.857	0.547	2.7	0.0	2.7	517.2	O K
60 min Summer	32.962	0.652	2.7	0.0	2.7	630.4	O K
120 min Summer	33.220	0.910	2.7	0.0	2.7	930.8	O K
180 min Summer	33.355	1.045	2.7	16.4	19.1	1100.1	O K
240 min Summer	33.395	1.085	2.7	42.4	45.1	1151.7	O K
360 min Summer	33.403	1.093	2.7	48.5	51.2	1162.3	O K
480 min Summer	33.406	1.096	2.7	50.9	53.6	1166.2	O K
600 min Summer	33.407	1.097	2.7	51.3	54.0	1166.6	O K
720 min Summer	33.405	1.095	2.7	50.1	52.8	1164.8	O K
960 min Summer	33.399	1.089	2.7	45.4	48.2	1157.1	O K
1440 min Summer	33.386	1.076	2.7	35.5	38.2	1139.6	O K
2160 min Summer	33.369	1.059	2.7	24.6	27.3	1118.1	O K
2880 min Summer	33.357	1.047	2.7	17.5	20.2	1102.9	O K
4320 min Summer	33.342	1.032	2.7	9.9	12.5	1083.2	O K
5760 min Summer	33.332	1.022	2.7	5.7	8.3	1070.9	O K
7200 min Summer	33.328	1.018	2.7	4.0	6.7	1064.7	O K
8640 min Summer	33.326	1.016	2.7	3.4	6.0	1062.2	O K
10080 min Summer	33.325	1.015	2.7	3.2	5.8	1061.9	O K
15 min Winter	32.746	0.436	2.7	0.0	2.7	402.0	O K
30 min Winter	32.857	0.547	2.7	0.0	2.7	517.2	O K
60 min Winter	32.962	0.652	2.7	0.0	2.7	630.5	O K
120 min Winter	33.220	0.910	2.7	0.0	2.7	931.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Summer	101.039	0.0	233.2	0.0	30
30 min Summer	65.072	0.0	231.0	0.0	45
60 min Summer	39.810	0.0	454.0	0.0	74
120 min Summer	25.352	0.0	407.4	0.0	200
180 min Summer	19.126	0.0	493.0	76.1	202
240 min Summer	15.497	0.0	628.9	211.2	244
360 min Summer	11.318	0.0	794.1	375.9	300
480 min Summer	8.951	0.0	884.9	466.5	358
600 min Summer	7.418	0.0	938.0	519.6	424
720 min Summer	6.343	0.0	969.2	551.0	492
960 min Summer	4.927	0.0	992.9	575.6	630
1440 min Summer	3.426	0.0	970.5	557.2	916
2160 min Summer	2.379	0.0	1290.6	476.0	1352
2880 min Summer	1.844	0.0	1181.7	380.7	1800
4320 min Summer	1.307	0.0	1008.1	225.8	2724
5760 min Summer	1.038	0.0	1745.3	132.9	3664
7200 min Summer	0.882	0.0	1647.6	92.1	4568
8640 min Summer	0.781	0.0	1566.7	77.1	5448
10080 min Summer	0.711	0.0	1513.8	80.2	6264
15 min Winter	101.039	0.0	233.2	0.0	30
30 min Winter	65.072	0.0	231.0	0.0	44
60 min Winter	39.810	0.0	454.0	0.0	74
120 min Winter	25.352	0.0	407.4	0.0	200

Cascade Summary of Results for C86343-JNP-XX-XX-CA-C-0003b W2 (LTS).srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
180 min Winter	33.355	1.045	2.7	16.4	19.1	1100.1	O K
240 min Winter	33.399	1.089	2.7	45.4	48.2	1156.7	O K
360 min Winter	33.409	1.099	2.7	52.9	55.6	1169.5	O K
480 min Winter	33.414	1.104	2.7	56.9	59.7	1176.1	O K
600 min Winter	33.414	1.104	2.7	56.9	59.7	1175.7	O K
720 min Winter	33.411	1.101	2.7	54.5	57.2	1171.8	O K
960 min Winter	33.402	1.092	2.7	47.7	50.5	1160.9	O K
1440 min Winter	33.386	1.076	2.7	35.9	38.6	1140.0	O K
2160 min Winter	33.369	1.059	2.7	24.3	26.9	1117.4	O K
2880 min Winter	33.357	1.047	2.7	17.2	19.9	1102.0	O K
4320 min Winter	33.341	1.031	2.7	9.4	12.1	1081.9	O K
5760 min Winter	33.330	1.020	2.7	4.9	7.5	1067.9	O K
7200 min Winter	33.322	1.012	2.7	2.3	4.9	1058.2	O K
8640 min Winter	33.315	1.005	2.7	0.6	3.2	1048.6	O K
10080 min Winter	33.300	0.990	2.7	0.0	2.7	1029.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
180 min Winter	19.126	0.0	493.7	76.8	200
240 min Winter	15.497	0.0	629.9	212.4	240
360 min Winter	11.318	0.0	796.2	378.4	302
480 min Winter	8.951	0.0	887.9	470.1	368
600 min Winter	7.418	0.0	941.9	524.4	440
720 min Winter	6.343	0.0	974.2	557.0	514
960 min Winter	4.927	0.0	999.8	583.8	662
1440 min Winter	3.426	0.0	981.1	569.5	962
2160 min Winter	2.379	0.0	1306.3	493.3	1424
2880 min Winter	1.844	0.0	1200.7	401.4	1904
4320 min Winter	1.307	0.0	1013.7	230.3	2900
5760 min Winter	1.038	0.0	1734.5	116.1	3944
7200 min Winter	0.882	0.0	1616.4	50.3	5048
8640 min Winter	0.781	0.0	1514.6	8.6	6224
10080 min Winter	0.711	0.0	1455.6	0.0	7264

Cascade Rainfall Details for C86343-JNP-XX-XX-CA-C-0003b W2 (LTS).srcx

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	1.000
FEH Rainfall Version	2013	Cv (Winter)	1.000
Site Location	GB 505745 243600 TL 05745 43600	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 1.605

Time From: (mins)	To:	Area (ha)	Time From: (mins)	To:	Area (ha)	Time From: (mins)	To:	Area (ha)
0	5	0.535	5	10	0.535	10	15	0.535

Cascade Model Details for C86343-JNP-XX-XX-CA-C-0003b W2 (LTS).srcx

Storage is Online Cover Level (m) 33.810

Tank or Pond Structure

Invert Level (m) 32.310

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	832.2	0.500	1040.3	1.000	1262.7	1.500	1499.3
0.250	934.5	0.750	1149.7	1.250	1379.2		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0077-2900-1250-2900
Design Head (m)	1.250
Design Flow (l/s)	2.9
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	77
Invert Level (m)	32.310
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.250	2.9	Kick-Flo®	0.690	2.2
Flush-Flo™	0.339	2.7	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)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.2	0.800	2.4	2.000	3.6	4.000	5.0	7.000	6.5
0.200	2.6	1.000	2.6	2.200	3.8	4.500	5.3	7.500	6.7
0.300	2.7	1.200	2.8	2.400	3.9	5.000	5.5	8.000	6.9
0.400	2.7	1.400	3.1	2.600	4.1	5.500	5.8	8.500	7.1
0.500	2.7	1.600	3.2	3.000	4.3	6.000	6.0	9.000	7.3
0.600	2.5	1.800	3.4	3.500	4.7	6.500	6.2	9.500	7.5

Weir Overflow Control

Discharge Coef 0.544 Width (m) 1.000 Invert Level (m) 33.310

Cascade Summary of Results for C86343-JNP-XX-XX-CA-C-0003c W3 (LTS).srcx

Upstream Structures	Outflow To	Overflow To
C86343-JNP-XX-XX-CA-C-0003b W2 (LTS).srcx C86343-JNP-XX-XX-CA-C-0003a W1 (LTS).srcx	(None)	C86343-JNP-XX-XX-CA-C-0003d W (AS).srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	31.905	0.635	2.2	0.0	2.2	324.9	O K
30 min Summer	32.037	0.767	2.2	0.0	2.2	417.9	O K
60 min Summer	32.154	0.884	2.2	0.0	2.2	508.9	O K
120 min Summer	32.299	1.029	2.2	12.8	15.0	631.9	O K
180 min Summer	32.317	1.047	2.2	26.2	28.5	647.8	O K
240 min Summer	32.346	1.076	2.2	53.3	55.5	673.6	O K
360 min Summer	32.354	1.084	2.2	62.5	64.7	681.5	O K
480 min Summer	32.356	1.086	2.2	64.7	67.0	683.6	O K
600 min Summer	32.357	1.087	2.2	65.3	67.5	683.8	O K
720 min Summer	32.356	1.086	2.2	64.2	66.4	682.8	O K
960 min Summer	32.351	1.081	2.2	58.6	60.9	678.4	O K
1440 min Summer	32.339	1.069	2.2	46.6	48.8	667.7	O K
2160 min Summer	32.325	1.055	2.2	32.7	35.0	654.4	O K
2880 min Summer	32.314	1.044	2.2	23.4	25.6	644.5	O K
4320 min Summer	32.300	1.030	2.2	13.1	15.3	632.0	O K
5760 min Summer	32.291	1.021	2.2	7.6	9.8	624.0	O K
7200 min Summer	32.286	1.016	2.2	5.3	7.5	620.0	O K
8640 min Summer	32.284	1.014	2.2	4.3	6.5	618.4	O K
10080 min Summer	32.284	1.014	2.2	4.1	6.3	618.2	O K
15 min Winter	31.905	0.635	2.2	0.0	2.2	324.9	O K
30 min Winter	32.037	0.767	2.2	0.0	2.2	417.9	O K
60 min Winter	32.155	0.885	2.2	0.0	2.2	509.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Summer	101.039	0.0	171.7	0.0	30
30 min Summer	65.072	0.0	158.9	0.0	45
60 min Summer	39.810	0.0	333.2	0.0	74
120 min Summer	25.352	0.0	364.3	26.9	128
180 min Summer	19.126	0.0	509.3	169.1	160
240 min Summer	15.497	0.0	696.8	355.3	244
360 min Summer	11.318	0.0	926.7	583.7	310
480 min Summer	8.951	0.0	1053.5	709.3	368
600 min Summer	7.418	0.0	1128.2	782.9	432
720 min Summer	6.343	0.0	1172.6	826.4	498
960 min Summer	4.927	0.0	1207.6	860.1	638
1440 min Summer	3.426	0.0	1181.6	833.6	924
2160 min Summer	2.379	0.0	1397.8	719.3	1364
2880 min Summer	1.844	0.0	1256.1	585.5	1816
4320 min Summer	1.307	0.0	1031.9	368.0	2728
5760 min Summer	1.038	0.0	1421.3	238.1	3680
7200 min Summer	0.882	0.0	1450.5	181.3	4592
8640 min Summer	0.781	0.0	1403.4	160.8	5456
10080 min Summer	0.711	0.0	1359.9	165.2	6296
15 min Winter	101.039	0.0	171.7	0.0	30
30 min Winter	65.072	0.0	158.9	0.0	44
60 min Winter	39.810	0.0	333.2	0.0	74

Cascade Summary of Results for C86343-JNP-XX-XX-CA-C-0003c W3 (LTS).srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Outflow Σ (l/s)	Max Volume (m³)	Status
120 min Winter	32.300	1.030	2.2	13.4	15.6	632.7	O K
180 min Winter	32.320	1.050	2.2	28.4	30.6	650.1	O K
240 min Winter	32.348	1.078	2.2	55.9	58.2	675.9	O K
360 min Winter	32.359	1.089	2.2	67.6	69.8	685.6	O K
480 min Winter	32.363	1.093	2.3	72.2	74.4	689.6	O K
600 min Winter	32.363	1.093	2.3	72.8	75.0	690.0	O K
720 min Winter	32.361	1.091	2.3	70.4	72.7	688.2	O K
960 min Winter	32.355	1.085	2.2	63.1	65.3	681.8	O K
1440 min Winter	32.340	1.070	2.2	47.6	49.8	668.8	O K
2160 min Winter	32.325	1.055	2.2	32.7	35.0	654.5	O K
2880 min Winter	32.314	1.044	2.2	23.4	25.6	644.5	O K
4320 min Winter	32.299	1.029	2.2	12.5	14.7	631.3	O K
5760 min Winter	32.289	1.019	2.2	6.6	8.7	622.2	O K
7200 min Winter	32.281	1.011	2.2	3.0	5.2	615.7	O K
8640 min Winter	32.279	1.009	2.2	2.1	4.3	613.4	O K
10080 min Winter	32.278	1.008	2.2	1.7	3.9	612.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
120 min Winter	25.352	0.0	364.5	27.4	126
180 min Winter	19.126	0.0	510.1	170.3	164
240 min Winter	15.497	0.0	698.1	357.2	240
360 min Winter	11.318	0.0	929.4	587.3	316
480 min Winter	8.951	0.0	1057.7	714.6	376
600 min Winter	7.418	0.0	1133.7	789.8	448
720 min Winter	6.343	0.0	1179.5	835.0	522
960 min Winter	4.927	0.0	1217.3	872.0	668
1440 min Winter	3.426	0.0	1196.3	851.5	972
2160 min Winter	2.379	0.0	1419.3	744.7	1432
2880 min Winter	1.844	0.0	1281.6	615.6	1908
4320 min Winter	1.307	0.0	1037.3	376.0	2900
5760 min Winter	1.038	0.0	1404.5	216.8	3968
7200 min Winter	0.882	0.0	1406.1	125.3	5048
8640 min Winter	0.781	0.0	1321.7	67.9	5536
10080 min Winter	0.711	0.0	1265.0	52.0	6440

Cascade Rainfall Details for C86343-JNP-XX-XX-CA-C-0003c W3 (LTS).srcx

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	1.000
FEH Rainfall Version	2013	Cv (Winter)	1.000
Site Location	GB 505745 243600 TL 05745 43600	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 1.297

Time From: (mins)	To:	Area (ha)	Time From: (mins)	To:	Area (ha)	Time From: (mins)	To:	Area (ha)
0	5	0.432	5	10	0.432	10	15	0.433

Cascade Model Details for C86343-JNP-XX-XX-CA-C-0003c W3 (LTS).srcx

Storage is Online Cover Level (m) 32.770

Tank or Pond Structure

Invert Level (m) 31.270

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	359.8	0.500	601.7	1.000	872.7	1.500	1172.0
0.250	477.0	0.750	733.6	1.250	1018.8		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0070-2400-1250-2400
Design Head (m)	1.250
Design Flow (l/s)	2.4
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	70
Invert Level (m)	31.270
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.250	2.4	Kick-Flo®	0.623	1.7
Flush-Flo™	0.307	2.2	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)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.8	0.800	2.0	2.000	3.0	4.000	4.1	7.000	5.3
0.200	2.1	1.000	2.2	2.200	3.1	4.500	4.3	7.500	5.5
0.300	2.2	1.200	2.4	2.400	3.2	5.000	4.6	8.000	5.7
0.400	2.1	1.400	2.5	2.600	3.4	5.500	4.8	8.500	5.8
0.500	2.0	1.600	2.7	3.000	3.6	6.000	5.0	9.000	6.0
0.600	1.8	1.800	2.8	3.500	3.9	6.500	5.1	9.500	6.2

Weir Overflow Control

Discharge Coef 0.544 Width (m) 1.500 Invert Level (m) 32.270

Cascade Summary of Results for C86343-JNP-XX-XX-CA-C-0003d W (AS).srcx

Upstream Structures	Outflow To	Overflow To
C86343-JNP-XX-XX-CA-C-0003c W3 (LTS).srcx C86343-JNP-XX-XX-CA-C-0003b W2 (LTS).srcx C86343-JNP-XX-XX-CA-C-0003a W1 (LTS).srcx	(None)	(None)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	31.270	0.000	0.0	0.0	O K
30 min Summer	31.270	0.000	0.0	0.0	O K
60 min Summer	31.270	0.000	0.0	0.0	O K
120 min Summer	31.296	0.026	0.3	25.7	O K
180 min Summer	31.404	0.134	3.6	137.2	O K
240 min Summer	31.564	0.294	3.8	310.3	O K
360 min Summer	31.754	0.484	3.8	528.9	O K
480 min Summer	31.850	0.580	3.8	645.6	O K
600 min Summer	31.901	0.631	3.8	709.4	O K
720 min Summer	31.928	0.658	3.8	743.4	O K
960 min Summer	31.940	0.670	3.8	758.7	O K
1440 min Summer	31.892	0.622	3.8	697.6	O K
2160 min Summer	31.755	0.485	3.8	530.4	O K
2880 min Summer	31.627	0.357	3.8	381.0	O K
4320 min Summer	31.472	0.202	3.8	209.4	O K
5760 min Summer	31.390	0.120	3.6	122.1	O K
7200 min Summer	31.362	0.092	2.9	92.9	O K
8640 min Summer	31.351	0.081	2.5	82.2	O K
10080 min Summer	31.352	0.082	2.5	82.6	O K
15 min Winter	31.270	0.000	0.0	0.0	O K
30 min Winter	31.270	0.000	0.0	0.0	O K
60 min Winter	31.270	0.000	0.0	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	101.039	0.0	0.0	0
30 min Summer	65.072	0.0	0.0	0
60 min Summer	39.810	0.0	0.0	0
120 min Summer	25.352	0.0	19.1	196
180 min Summer	19.126	0.0	156.9	302
240 min Summer	15.497	0.0	337.0	374
360 min Summer	11.318	0.0	532.6	488
480 min Summer	8.951	0.0	544.6	594
600 min Summer	7.418	0.0	523.7	704
720 min Summer	6.343	0.0	506.2	812
960 min Summer	4.927	0.0	474.8	1034
1440 min Summer	3.426	0.0	412.8	1484
2160 min Summer	2.379	0.0	701.5	2144
2880 min Summer	1.844	0.0	570.0	2392
4320 min Summer	1.307	0.0	353.0	3124
5760 min Summer	1.038	0.0	234.1	3952
7200 min Summer	0.882	0.0	176.8	4824
8640 min Summer	0.781	0.0	155.7	5688
10080 min Summer	0.711	0.0	159.2	6512
15 min Winter	101.039	0.0	0.0	0
30 min Winter	65.072	0.0	0.0	0
60 min Winter	39.810	0.0	0.0	0

Cascade Summary of Results for C86343-JNP-XX-XX-CA-C-0003d W (AS).srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
120 min Winter	31.296	0.026	0.4	26.1	O K
180 min Winter	31.405	0.135	3.6	138.4	O K
240 min Winter	31.566	0.296	3.8	312.9	O K
360 min Winter	31.759	0.489	3.8	535.0	O K
480 min Winter	31.857	0.587	3.8	654.3	O K
600 min Winter	31.910	0.640	3.8	720.7	O K
720 min Winter	31.939	0.669	3.8	757.4	O K
960 min Winter	31.955	0.685	3.8	777.8	O K
1440 min Winter	31.915	0.645	3.8	726.4	O K
2160 min Winter	31.794	0.524	3.8	576.8	O K
2880 min Winter	31.652	0.382	3.8	409.9	O K
4320 min Winter	31.481	0.211	3.8	219.0	O K
5760 min Winter	31.379	0.109	3.4	111.2	O K
7200 min Winter	31.336	0.066	1.9	66.7	O K
8640 min Winter	31.309	0.039	0.7	38.9	O K
10080 min Winter	31.304	0.034	0.6	34.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
120 min Winter	25.352	0.0	19.4	196
180 min Winter	19.126	0.0	158.0	300
240 min Winter	15.497	0.0	338.7	372
360 min Winter	11.318	0.0	534.0	486
480 min Winter	8.951	0.0	541.3	590
600 min Winter	7.418	0.0	519.9	698
720 min Winter	6.343	0.0	502.3	804
960 min Winter	4.927	0.0	470.2	1022
1440 min Winter	3.426	0.0	405.7	1464
2160 min Winter	2.379	0.0	724.5	2120
2880 min Winter	1.844	0.0	598.2	2472
4320 min Winter	1.307	0.0	359.4	3308
5760 min Winter	1.038	0.0	212.6	4216
7200 min Winter	0.882	0.0	120.7	5256
8640 min Winter	0.781	0.0	62.9	5976
10080 min Winter	0.711	0.0	46.3	6944

Cascade Rainfall Details for C86343-JNP-XX-XX-CA-C-0003d W (AS).srcx

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	1.000
FEH Rainfall Version	2013	Cv (Winter)	1.000
Site Location	GB 505745 243600 TL 05745 43600	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.000

Time (mins) From:	To:	Area (ha)
0	5	0.000

Cascade Model Details for C86343-JNP-XX-XX-CA-C-0003d W (AS).srcx

Storage is Online Cover Level (m) 32.770

Tank or Pond Structure

Invert Level (m) 31.270

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	996.6	0.500	1199.8	1.000	1417.2	1.500	1648.7
0.250	1096.4	0.750	1306.7	1.250	1531.2		

Complex Outflow Control

Hydro-Brake® Optimum

Unit Reference	MD-SHE-0096-3800-0750-3800
Design Head (m)	0.750
Design Flow (l/s)	3.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	96
Invert Level (m)	31.270
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.750	3.8	Kick-Flo®	0.497	3.1
Flush-Flo™	0.224	3.8	Mean Flow over Head Range	-	3.3

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.1	0.800	3.9	2.000	6.0	4.000	8.3	7.000	10.8
0.200	3.8	1.000	4.3	2.200	6.3	4.500	8.8	7.500	11.2
0.300	3.7	1.200	4.7	2.400	6.5	5.000	9.2	8.000	11.5
0.400	3.6	1.400	5.1	2.600	6.8	5.500	9.7	8.500	11.9
0.500	3.2	1.600	5.4	3.000	7.2	6.000	10.1	9.000	12.2
0.600	3.4	1.800	5.7	3.500	7.8	6.500	10.5	9.500	12.6

Hydro-Brake® Optimum

Unit Reference	MD-SHE-0267-3720-0500-3720
Design Head (m)	0.500
Design Flow (l/s)	37.2
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	267
Invert Level (m)	32.020
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1500

Hydro-Brake® Optimum

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.500	37.2	Kick-Flo®	0.463	35.9
Flush-Flo™	0.348	37.2	Mean Flow over Head Range	-	25.7

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)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	8.5	0.800	46.6	2.000	72.6	4.000	101.8	7.000	133.1
0.200	27.4	1.000	51.9	2.200	76.1	4.500	107.8	7.500	137.8
0.300	36.9	1.200	56.7	2.400	79.4	5.000	113.5	8.000	142.4
0.400	36.9	1.400	61.1	2.600	82.5	5.500	117.7	8.500	146.9
0.500	37.2	1.600	65.2	3.000	88.5	6.000	123.0	9.000	151.2
0.600	40.6	1.800	69.0	3.500	95.4	6.500	128.2	9.500	155.4

Cascade Summary of Results for C86343-JNP-XX-XX-CA-C-0002a S1 (LTS).srcx

Upstream Structures	Outflow To	Overflow To
(None)	(None)	C86343-JNP-XX-XX-CA-C-0002b S (AS).srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Outflow Σ (l/s)	Max Volume (m³)	Status
15 min Summer	33.686	0.886	5.1	0.0	5.1	983.3	O K
30 min Summer	33.877	1.077	5.1	54.9	59.6	1237.3	O K
60 min Summer	33.964	1.164	5.1	169.4	174.3	1357.1	O K
120 min Summer	34.032	1.232	5.1	286.1	291.1	1454.5	Flood Risk
180 min Summer	34.052	1.252	5.1	323.8	328.9	1483.7	Flood Risk
240 min Summer	34.053	1.253	5.1	325.7	330.8	1485.1	Flood Risk
360 min Summer	34.039	1.239	5.1	299.1	304.2	1464.6	Flood Risk
480 min Summer	34.021	1.221	5.1	266.0	271.0	1439.2	Flood Risk
600 min Summer	34.005	1.205	5.1	237.7	242.7	1415.7	Flood Risk
720 min Summer	33.991	1.191	5.1	212.9	217.9	1395.8	O K
960 min Summer	33.968	1.168	5.1	175.6	180.5	1363.1	O K
1440 min Summer	33.936	1.136	5.1	128.5	133.4	1319.2	O K
2160 min Summer	33.909	1.109	5.1	91.7	96.5	1280.8	O K
2880 min Summer	33.892	1.092	5.1	71.6	76.4	1257.7	O K
4320 min Summer	33.873	1.073	5.1	50.2	54.9	1231.0	O K
5760 min Summer	33.861	1.061	5.1	38.7	43.5	1215.8	O K
7200 min Summer	33.855	1.055	5.1	32.7	37.5	1206.5	O K
8640 min Summer	33.850	1.050	5.1	28.4	33.1	1200.3	O K
10080 min Summer	33.847	1.047	5.1	25.8	30.5	1195.6	O K
15 min Winter	33.686	0.886	5.1	0.0	5.1	983.3	O K
30 min Winter	33.878	1.078	5.1	55.9	60.7	1238.9	O K
60 min Winter	33.971	1.171	5.1	180.3	185.3	1366.9	O K
120 min Winter	34.032	1.232	5.1	285.1	290.2	1453.6	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Summer	141.455	0.0	380.2	0.0	30
30 min Summer	91.101	0.0	475.2	101.2	41
60 min Summer	55.734	0.0	1165.1	374.6	60
120 min Summer	35.493	0.0	1575.1	786.7	86
180 min Summer	26.776	0.0	1820.3	1033.8	116
240 min Summer	21.695	0.0	1984.2	1199.8	148
360 min Summer	15.846	0.0	2182.3	1402.2	208
480 min Summer	12.531	0.0	2292.9	1517.0	268
600 min Summer	10.385	0.0	2359.4	1587.6	328
720 min Summer	8.880	0.0	2400.9	1632.9	388
960 min Summer	6.898	0.0	2439.6	1678.5	510
1440 min Summer	4.797	0.0	2443.4	1690.0	750
2160 min Summer	3.331	0.0	3216.2	1642.0	1112
2880 min Summer	2.582	0.0	3121.4	1573.5	1476
4320 min Summer	1.829	0.0	2923.8	1437.4	2204
5760 min Summer	1.453	0.0	3890.5	1334.3	2936
7200 min Summer	1.235	0.0	4121.9	1299.8	3672
8640 min Summer	1.094	0.0	4230.2	1301.7	4408
10080 min Summer	0.996	0.0	4146.9	1329.5	5136
15 min Winter	141.455	0.0	380.3	0.0	30
30 min Winter	91.101	0.0	475.2	101.2	41
60 min Winter	55.734	0.0	1165.0	374.6	60
120 min Winter	35.493	0.0	1575.1	787.1	90

Cascade Summary of Results for C86343-JNP-XX-XX-CA-C-0002a S1 (LTS).srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow Σ (l/s)	Max Outflow (l/s)	Max Volume (m³)	Status
180 min Winter	34.039	1.239	5.1	299.1	304.2	1464.6	Flood Risk
240 min Winter	34.032	1.232	5.1	285.1	290.2	1454.0	Flood Risk
360 min Winter	34.009	1.209	5.1	243.8	248.8	1420.9	Flood Risk
480 min Winter	33.987	1.187	5.1	207.1	212.1	1390.2	O K
600 min Winter	33.969	1.169	5.1	178.0	182.9	1365.3	O K
720 min Winter	33.955	1.155	5.1	155.6	160.5	1344.9	O K
960 min Winter	33.933	1.133	5.1	123.6	128.5	1314.1	O K
1440 min Winter	33.905	1.105	5.1	87.3	92.1	1275.5	O K
2160 min Winter	33.882	1.082	5.1	59.7	64.5	1243.6	O K
2880 min Winter	33.868	1.068	5.1	45.6	50.3	1225.1	O K
4320 min Winter	33.853	1.053	5.1	31.0	35.7	1204.2	O K
5760 min Winter	33.844	1.044	5.1	23.8	28.5	1192.3	O K
7200 min Winter	33.839	1.039	5.1	19.5	24.2	1185.0	O K
8640 min Winter	33.835	1.035	5.1	16.9	21.6	1180.1	O K
10080 min Winter	33.832	1.032	5.1	14.8	19.5	1176.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
180 min Winter	26.776	0.0	1820.7	1034.9	122
240 min Winter	21.695	0.0	1984.9	1201.4	154
360 min Winter	15.846	0.0	2183.8	1405.1	216
480 min Winter	12.531	0.0	2294.9	1520.9	278
600 min Winter	10.385	0.0	2362.2	1592.8	338
720 min Winter	8.880	0.0	2404.2	1639.3	400
960 min Winter	6.898	0.0	2444.2	1687.2	520
1440 min Winter	4.797	0.0	2449.8	1702.9	760
2160 min Winter	3.331	0.0	3225.7	1660.9	1124
2880 min Winter	2.582	0.0	3136.5	1597.7	1480
4320 min Winter	1.829	0.0	2945.4	1470.4	2212
5760 min Winter	1.453	0.0	3890.8	1355.6	2936
7200 min Winter	1.235	0.0	4122.1	1298.3	3680
8640 min Winter	1.094	0.0	4227.2	1284.6	4400
10080 min Winter	0.996	0.0	4136.8	1293.7	5144

Cascade Rainfall Details for C86343-JNP-XX-XX-CA-C-0002a S1 (LTS).srcx

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	1.000
FEH Rainfall Version	2013	Cv (Winter)	1.000
Site Location	GB 505745 243600 TL 05745 43600	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 2.798

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	5	0.933	5	10	0.933	10	15	0.933

Cascade Model Details for C86343-JNP-XX-XX-CA-C-0002a S1 (LTS).srcx

Storage is Online Cover Level (m) 34.300

Tank or Pond Structure

Invert Level (m) 32.800

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	941.0	0.500	1130.5	1.000	1335.3	1.500	1554.6
0.250	1033.8	0.750	1231.0	1.250	1443.2		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0103-5100-1250-5100
Design Head (m)	1.250
Design Flow (l/s)	5.1
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	103
Invert Level (m)	32.800
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.250	5.1	Kick-Flo®	0.772	4.1
Flush-Flo™	0.368	5.1	Mean Flow over Head Range	-	4.5

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)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.4	0.800	4.1	2.000	6.3	4.000	8.8	7.000	11.5
0.200	4.8	1.000	4.6	2.200	6.6	4.500	9.3	7.500	11.9
0.300	5.1	1.200	5.0	2.400	6.9	5.000	9.8	8.000	12.2
0.400	5.1	1.400	5.4	2.600	7.2	5.500	10.2	8.500	12.6
0.500	5.0	1.600	5.7	3.000	7.7	6.000	10.7	9.000	12.9
0.600	4.8	1.800	6.0	3.500	8.3	6.500	11.1	9.500	13.3

Weir Overflow Control

Discharge Coef 0.544 Width (m) 1.500 Invert Level (m) 33.800

Cascade Summary of Results for C86343-JNP-XX-XX-CA-C-0002b S (AS).srcx

Upstream Structures	Outflow To	Overflow To
C86343-JNP-XX-XX-CA-C-0002a S1 (LTS).srcx	(None)	(None)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	32.800	0.000	0.0	0.0	O K
30 min Summer	32.913	0.113	2.1	90.8	O K
60 min Summer	33.217	0.417	2.3	358.5	O K
120 min Summer	33.610	0.810	5.2	758.1	O K
180 min Summer	33.764	0.964	24.5	931.8	O K
240 min Summer	33.861	1.061	25.1	1046.0	O K
360 min Summer	33.958	1.158	25.1	1165.4	O K
480 min Summer	33.991	1.191	25.1	1205.9	O K
600 min Summer	33.989	1.189	25.1	1203.8	O K
720 min Summer	33.976	1.176	25.1	1187.9	O K
960 min Summer	33.945	1.145	25.1	1149.1	O K
1440 min Summer	33.881	1.081	25.1	1070.7	O K
2160 min Summer	33.802	1.002	24.9	976.0	O K
2880 min Summer	33.752	0.952	23.8	917.7	O K
4320 min Summer	33.705	0.905	17.6	864.5	O K
5760 min Summer	33.678	0.878	13.6	834.2	O K
7200 min Summer	33.665	0.865	11.7	818.7	O K
8640 min Summer	33.657	0.857	10.7	810.7	O K
10080 min Summer	33.654	0.854	10.3	806.9	O K
15 min Winter	32.800	0.000	0.0	0.0	O K
30 min Winter	32.913	0.113	2.1	90.8	O K
60 min Winter	33.217	0.417	2.3	358.7	O K
120 min Winter	33.610	0.810	5.3	758.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	141.455	0.0	0.0	0
30 min Summer	91.101	0.0	83.9	119
60 min Summer	55.734	0.0	343.6	162
120 min Summer	35.493	0.0	383.2	198
180 min Summer	26.776	0.0	601.2	212
240 min Summer	21.695	0.0	752.3	266
360 min Summer	15.846	0.0	932.2	378
480 min Summer	12.531	0.0	1030.0	492
600 min Summer	10.385	0.0	1087.1	596
720 min Summer	8.880	0.0	1120.9	640
960 min Summer	6.898	0.0	1147.4	752
1440 min Summer	4.797	0.0	1120.4	1004
2160 min Summer	3.331	0.0	1354.6	1400
2880 min Summer	2.582	0.0	1210.3	1796
4320 min Summer	1.829	0.0	967.0	2644
5760 min Summer	1.453	0.0	1323.7	3488
7200 min Summer	1.235	0.0	1282.6	4328
8640 min Summer	1.094	0.0	1260.1	5136
10080 min Summer	0.996	0.0	1192.4	5904
15 min Winter	141.455	0.0	0.0	0
30 min Winter	91.101	0.0	83.8	119
60 min Winter	55.734	0.0	343.6	162
120 min Winter	35.493	0.0	383.5	198

Cascade Summary of Results for C86343-JNP-XX-XX-CA-C-0002b S (AS).srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
180 min Winter	33.766	0.966	24.5	934.6	O K
240 min Winter	33.868	1.068	25.1	1055.4	O K
360 min Winter	33.976	1.176	25.1	1186.9	O K
480 min Winter	34.014	1.214	25.1	1235.2	Flood Risk
600 min Winter	34.018	1.218	25.1	1240.0	Flood Risk
720 min Winter	34.004	1.204	25.1	1223.2	Flood Risk
960 min Winter	33.968	1.168	25.1	1177.7	O K
1440 min Winter	33.892	1.092	25.1	1083.6	O K
2160 min Winter	33.795	0.995	24.9	967.7	O K
2880 min Winter	33.742	0.942	22.6	906.5	O K
4320 min Winter	33.694	0.894	15.9	851.4	O K
5760 min Winter	33.665	0.865	11.8	819.3	O K
7200 min Winter	33.648	0.848	9.5	800.4	O K
8640 min Winter	33.637	0.837	8.1	788.1	O K
10080 min Winter	33.631	0.831	7.4	780.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
180 min Winter	26.776	0.0	602.1	210
240 min Winter	21.695	0.0	753.4	264
360 min Winter	15.846	0.0	933.8	374
480 min Winter	12.531	0.0	1032.4	484
600 min Winter	10.385	0.0	1090.5	590
720 min Winter	8.880	0.0	1124.8	688
960 min Winter	6.898	0.0	1152.5	782
1440 min Winter	4.797	0.0	1131.8	1068
2160 min Winter	3.331	0.0	1374.7	1484
2880 min Winter	2.582	0.0	1234.4	1900
4320 min Winter	1.829	0.0	981.1	2796
5760 min Winter	1.453	0.0	1343.6	3712
7200 min Winter	1.235	0.0	1276.9	4632
8640 min Winter	1.094	0.0	1211.5	5528
10080 min Winter	0.996	0.0	1097.0	6384

Cascade Rainfall Details for C86343-JNP-XX-XX-CA-C-0002b S (AS).srcx

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	1.000
FEH Rainfall Version	2013	Cv (Winter)	1.000
Site Location	GB 505745 243600 TL 05745 43600	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.000

Time (mins) From:	To:	Area (ha)
0	5	0.000

Cascade Model Details for C86343-JNP-XX-XX-CA-C-0002b S (AS).srcx

Storage is Online Cover Level (m) 34.300

Tank or Pond Structure

Invert Level (m) 32.800

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	782.1	0.500	971.7	1.000	1175.6	1.500	1393.6
0.250	875.1	0.750	1071.9	1.250	1282.9		

Complex Outflow Control

Hydro-Brake® Optimum

Unit Reference	MD-SHE-0076-2300-0750-2300
Design Head (m)	0.750
Design Flow (l/s)	2.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	76
Invert Level (m)	32.800
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.750	2.3	Kick-Flo®	0.481	1.9
Flush-Flo™	0.223	2.3	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)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.1	0.800	2.4	2.000	3.6	4.000	5.0	7.000	6.5
0.200	2.3	1.000	2.6	2.200	3.8	4.500	5.3	7.500	6.7
0.300	2.3	1.200	2.8	2.400	3.9	5.000	5.5	8.000	6.9
0.400	2.2	1.400	3.1	2.600	4.1	5.500	5.8	8.500	7.1
0.500	1.9	1.600	3.3	3.000	4.4	6.000	6.0	9.000	7.3
0.600	2.1	1.800	3.4	3.500	4.7	6.500	6.3	9.500	7.5

Hydro-Brake® Optimum

Unit Reference	MD-SHE-0215-2250-0500-2250
Design Head (m)	0.500
Design Flow (l/s)	22.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	215
Invert Level (m)	33.550
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1200

Hydro-Brake® Optimum

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.500	22.5	Kick-Flo®	0.435	21.1
Flush-Flo™	0.295	22.5	Mean Flow over Head Range	-	16.6

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)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	7.3	0.800	28.2	2.000	43.8	4.000	61.2	7.000	80.2
0.200	21.0	1.000	31.3	2.200	45.8	4.500	64.8	7.500	83.0
0.300	22.5	1.200	34.2	2.400	47.8	5.000	68.3	8.000	85.8
0.400	21.7	1.400	36.8	2.600	49.7	5.500	70.9	8.500	88.5
0.500	22.5	1.600	39.3	3.000	53.2	6.000	74.1	9.000	91.0
0.600	24.5	1.800	41.6	3.500	57.4	6.500	77.2	9.500	93.6

Cascade Summary of Results for C86343-JNP-XX-XX-CA-C-0003a W1 (LTS).srcx

Upstream Structures	Outflow To	Overflow To
(None)	(None)	C86343-JNP-XX-XX-CA-C-0003b W2 (LTS).srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	34.059	0.909	3.0	0.0	3.0	606.5	O K
30 min Summer	34.225	1.075	3.0	34.8	37.7	761.8	O K
60 min Summer	34.302	1.152	3.0	101.2	104.2	838.6	O K
120 min Summer	34.363	1.213	3.1	167.8	170.8	902.1	Flood Risk
180 min Summer	34.382	1.232	3.1	190.7	193.8	921.8	Flood Risk
240 min Summer	34.384	1.234	3.1	193.2	196.3	923.9	Flood Risk
360 min Summer	34.372	1.222	3.1	177.9	181.0	911.0	Flood Risk
480 min Summer	34.356	1.206	3.0	159.6	162.6	894.5	Flood Risk
600 min Summer	34.342	1.192	3.0	143.1	146.1	879.2	O K
720 min Summer	34.329	1.179	3.0	128.8	131.8	865.9	O K
960 min Summer	34.308	1.158	3.0	106.8	109.7	844.2	O K
1440 min Summer	34.278	1.128	3.0	78.3	81.2	814.8	O K
2160 min Summer	34.253	1.103	3.0	56.1	59.0	789.1	O K
2880 min Summer	34.237	1.087	3.0	43.9	46.8	773.6	O K
4320 min Summer	34.219	1.069	3.0	30.7	33.6	755.7	O K
5760 min Summer	34.208	1.058	3.0	24.0	26.8	745.6	O K
7200 min Summer	34.202	1.052	3.0	20.1	22.9	739.4	O K
8640 min Summer	34.198	1.048	3.0	17.8	20.6	735.2	O K
10080 min Summer	34.194	1.044	3.0	15.9	18.7	731.9	O K
15 min Winter	34.059	0.909	3.0	0.0	3.0	606.5	O K
30 min Winter	34.226	1.076	3.0	35.9	38.8	762.9	O K
60 min Winter	34.308	1.158	3.0	107.3	110.3	844.9	O K
120 min Winter	34.363	1.213	3.1	167.8	170.8	901.9	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Summer	141.455	0.0	218.3	0.0	30
30 min Summer	91.101	0.0	298.0	69.5	41
60 min Summer	55.734	0.0	696.3	238.0	60
120 min Summer	35.493	0.0	949.9	492.2	86
180 min Summer	26.776	0.0	1102.0	644.9	118
240 min Summer	21.695	0.0	1204.0	747.5	148
360 min Summer	15.846	0.0	1328.0	872.6	210
480 min Summer	12.531	0.0	1398.0	943.7	270
600 min Summer	10.385	0.0	1441.2	987.6	330
720 min Summer	8.880	0.0	1469.0	1015.8	390
960 min Summer	6.898	0.0	1498.0	1044.5	510
1440 min Summer	4.797	0.0	1511.6	1052.4	752
2160 min Summer	3.331	0.0	1958.4	1023.9	1112
2880 min Summer	2.582	0.0	1902.6	982.4	1476
4320 min Summer	1.829	0.0	1807.4	899.8	2208
5760 min Summer	1.453	0.0	2403.2	835.8	2936
7200 min Summer	1.235	0.0	2547.6	814.8	3672
8640 min Summer	1.094	0.0	2580.4	816.8	4400
10080 min Summer	0.996	0.0	2540.9	835.3	5136
15 min Winter	141.455	0.0	218.3	0.0	30
30 min Winter	91.101	0.0	298.0	69.6	41
60 min Winter	55.734	0.0	696.3	238.1	60
120 min Winter	35.493	0.0	949.9	492.5	90

Cascade Summary of Results for C86343-JNP-XX-XX-CA-C-0003a W1 (LTS).srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
180 min Winter	34.371	1.221	3.1	177.3	180.4	910.5	Flood Risk
240 min Winter	34.366	1.216	3.1	170.7	173.8	904.3	Flood Risk
360 min Winter	34.345	1.195	3.0	147.0	150.0	882.9	O K
480 min Winter	34.326	1.176	3.0	125.5	128.5	862.8	O K
600 min Winter	34.309	1.159	3.0	108.3	111.3	846.2	O K
720 min Winter	34.296	1.146	3.0	95.3	98.3	832.5	O K
960 min Winter	34.276	1.126	3.0	76.0	78.9	811.9	O K
1440 min Winter	34.249	1.099	3.0	53.3	56.2	785.9	O K
2160 min Winter	34.228	1.078	3.0	36.9	39.8	764.4	O K
2880 min Winter	34.215	1.065	3.0	28.1	30.9	751.8	O K
4320 min Winter	34.200	1.050	3.0	19.2	22.0	737.7	O K
5760 min Winter	34.192	1.042	3.0	14.8	17.6	730.0	O K
7200 min Winter	34.187	1.037	3.0	12.0	14.8	725.1	O K
8640 min Winter	34.183	1.033	3.0	10.3	13.2	721.7	O K
10080 min Winter	34.181	1.031	3.0	9.2	12.0	719.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
180 min Winter	26.776	0.0	1102.1	645.5	124
240 min Winter	21.695	0.0	1204.3	748.5	156
360 min Winter	15.846	0.0	1328.7	874.4	218
480 min Winter	12.531	0.0	1399.1	946.2	280
600 min Winter	10.385	0.0	1442.6	990.9	342
720 min Winter	8.880	0.0	1470.8	1019.8	400
960 min Winter	6.898	0.0	1500.4	1050.0	522
1440 min Winter	4.797	0.0	1515.1	1060.7	764
2160 min Winter	3.331	0.0	1964.6	1036.1	1120
2880 min Winter	2.582	0.0	1911.3	998.4	1480
4320 min Winter	1.829	0.0	1818.9	922.0	2208
5760 min Winter	1.453	0.0	2403.3	852.7	2936
7200 min Winter	1.235	0.0	2547.7	816.8	3680
8640 min Winter	1.094	0.0	2578.8	809.5	4416
10080 min Winter	0.996	0.0	2535.5	817.4	5144

Cascade Rainfall Details for C86343-JNP-XX-XX-CA-C-0003a W1 (LTS).srcx

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	1.000
FEH Rainfall Version	2013	Cv (Winter)	1.000
Site Location	GB 505745 243600 TL 05745 43600	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.726

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	5	0.575	5	10	0.575	10	15	0.576

Cascade Model Details for C86343-JNP-XX-XX-CA-C-0003a W1 (LTS).srcx

Storage is Online Cover Level (m) 34.650

Tank or Pond Structure

Invert Level (m) 33.150

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	452.4	0.500	688.3	1.000	938.4	1.500	1202.5
0.250	568.6	0.750	811.6	1.250	1068.7		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0080-3100-1250-3100
Design Head (m)	1.250
Design Flow (l/s)	3.1
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	80
Invert Level (m)	33.150
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.250	3.1	Kick-Flo®	0.712	2.4
Flush-Flo™	0.348	3.0	Mean Flow over Head Range	-	2.7

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)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.3	0.800	2.5	2.000	3.8	4.000	5.3	7.000	6.9
0.200	2.8	1.000	2.8	2.200	4.0	4.500	5.6	7.500	7.1
0.300	3.0	1.200	3.0	2.400	4.2	5.000	5.9	8.000	7.4
0.400	3.0	1.400	3.3	2.600	4.3	5.500	6.2	8.500	7.6
0.500	2.9	1.600	3.5	3.000	4.6	6.000	6.4	9.000	7.8
0.600	2.8	1.800	3.7	3.500	5.0	6.500	6.7	9.500	8.0

Weir Overflow Control

Discharge Coef 0.544 Width (m) 1.000 Invert Level (m) 34.150

Cascade Summary of Results for C86343-JNP-XX-XX-CA-C-0003b W2 (LTS).srcx

Upstream Structures	Outflow To	Overflow To
C86343-JNP-XX-XX-CA-C-0003a W1 (LTS).srcx	(None)	C86343-JNP-XX-XX-CA-C-0003c W3 (LTS).srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	32.901	0.591	2.7	0.0	2.7	564.1	O K
30 min Summer	33.097	0.787	2.7	0.0	2.7	783.6	O K
60 min Summer	33.343	1.033	2.7	10.1	12.8	1084.3	O K
120 min Summer	33.493	1.183	2.8	133.1	135.9	1281.1	O K
180 min Summer	33.525	1.215	2.9	169.6	172.4	1324.3	Flood Risk
240 min Summer	33.545	1.235	2.9	193.8	196.7	1351.7	Flood Risk
360 min Summer	33.557	1.247	2.9	208.8	211.7	1368.1	Flood Risk
480 min Summer	33.552	1.242	2.9	202.5	205.4	1361.5	Flood Risk
600 min Summer	33.542	1.232	2.9	190.1	193.0	1347.6	Flood Risk
720 min Summer	33.531	1.221	2.9	176.7	179.6	1332.3	Flood Risk
960 min Summer	33.510	1.200	2.8	152.1	155.0	1303.8	O K
1440 min Summer	33.477	1.167	2.8	116.5	119.3	1260.0	O K
2160 min Summer	33.446	1.136	2.8	85.2	88.0	1218.1	O K
2880 min Summer	33.425	1.115	2.7	66.7	69.4	1191.4	O K
4320 min Summer	33.401	1.091	2.7	47.0	49.7	1159.4	O K
5760 min Summer	33.387	1.077	2.7	36.6	39.3	1141.3	O K
7200 min Summer	33.379	1.069	2.7	31.1	33.7	1131.0	O K
8640 min Summer	33.374	1.064	2.7	27.4	30.1	1124.2	O K
10080 min Summer	33.370	1.060	2.7	25.2	27.9	1119.2	O K
15 min Winter	32.901	0.591	2.7	0.0	2.7	564.1	O K
30 min Winter	33.097	0.787	2.7	0.0	2.7	783.5	O K
60 min Winter	33.343	1.033	2.7	10.1	12.8	1084.3	O K
120 min Winter	33.500	1.190	2.8	141.4	144.2	1290.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Summer	141.455	0.0	228.7	0.0	30
30 min Summer	91.101	0.0	197.6	0.0	113
60 min Summer	55.734	0.0	467.6	49.8	112
120 min Summer	35.493	0.0	955.2	535.5	120
180 min Summer	26.776	0.0	1250.9	830.4	144
240 min Summer	21.695	0.0	1449.9	1028.9	172
360 min Summer	15.846	0.0	1693.8	1271.6	234
480 min Summer	12.531	0.0	1832.9	1409.8	298
600 min Summer	10.385	0.0	1919.5	1495.6	362
720 min Summer	8.880	0.0	1975.6	1551.1	424
960 min Summer	6.898	0.0	2033.7	1608.5	550
1440 min Summer	4.797	0.0	2052.8	1628.0	802
2160 min Summer	3.331	0.0	2411.2	1579.6	1176
2880 min Summer	2.582	0.0	2331.7	1506.4	1560
4320 min Summer	1.829	0.0	2183.2	1360.1	2312
5760 min Summer	1.453	0.0	2916.1	1244.4	3072
7200 min Summer	1.235	0.0	2834.3	1207.2	3824
8640 min Summer	1.094	0.0	2793.9	1212.3	4584
10080 min Summer	0.996	0.0	2802.8	1248.0	5288
15 min Winter	141.455	0.0	228.7	0.0	30
30 min Winter	91.101	0.0	197.6	0.0	113
60 min Winter	55.734	0.0	467.6	49.9	112
120 min Winter	35.493	0.0	955.5	536.0	120

Cascade Summary of Results for C86343-JNP-XX-XX-CA-C-0003b W2 (LTS).srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
180 min Winter	33.534	1.224	2.9	180.3	183.2	1336.3	Flood Risk
240 min Winter	33.550	1.240	2.9	200.6	203.5	1359.5	Flood Risk
360 min Winter	33.551	1.241	2.9	201.3	204.2	1359.8	Flood Risk
480 min Winter	33.538	1.228	2.9	185.2	188.1	1341.9	Flood Risk
600 min Winter	33.523	1.213	2.9	167.2	170.1	1321.5	Flood Risk
720 min Winter	33.509	1.199	2.8	151.0	153.8	1302.7	O K
960 min Winter	33.485	1.175	2.8	125.0	127.8	1270.7	O K
1440 min Winter	33.452	1.142	2.8	90.9	93.7	1226.5	O K
2160 min Winter	33.422	1.112	2.7	64.1	66.8	1187.2	O K
2880 min Winter	33.404	1.094	2.7	49.3	52.0	1163.6	O K
4320 min Winter	33.383	1.073	2.7	33.8	36.5	1136.1	O K
5760 min Winter	33.371	1.061	2.7	25.8	28.5	1120.5	O K
7200 min Winter	33.364	1.054	2.7	21.2	23.9	1110.8	O K
8640 min Winter	33.359	1.049	2.7	18.3	21.0	1104.5	O K
10080 min Winter	33.355	1.045	2.7	16.4	19.1	1100.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
180 min Winter	26.776	0.0	1251.5	831.4	148
240 min Winter	21.695	0.0	1451.2	1030.6	180
360 min Winter	15.846	0.0	1696.0	1274.6	246
480 min Winter	12.531	0.0	1836.2	1414.1	312
600 min Winter	10.385	0.0	1923.8	1501.2	376
720 min Winter	8.880	0.0	1981.0	1558.1	442
960 min Winter	6.898	0.0	2041.2	1618.0	570
1440 min Winter	4.797	0.0	2064.4	1642.6	828
2160 min Winter	3.331	0.0	2429.0	1601.2	1212
2880 min Winter	2.582	0.0	2354.6	1534.3	1596
4320 min Winter	1.829	0.0	2215.5	1397.5	2380
5760 min Winter	1.453	0.0	2941.6	1272.4	3168
7200 min Winter	1.235	0.0	2837.2	1208.8	3920
8640 min Winter	1.094	0.0	2784.1	1196.5	4680
10080 min Winter	0.996	0.0	2779.2	1212.1	5448

Cascade Rainfall Details for C86343-JNP-XX-XX-CA-C-0003b W2 (LTS).srcx

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	1.000
FEH Rainfall Version	2013	Cv (Winter)	1.000
Site Location	GB 505745 243600 TL 05745 43600	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.605

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	5	0.535	5	10	0.535	10	15	0.535

Cascade Model Details for C86343-JNP-XX-XX-CA-C-0003b W2 (LTS).srcx

Storage is Online Cover Level (m) 33.810

Tank or Pond Structure

Invert Level (m) 32.310

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	832.2	0.500	1040.3	1.000	1262.7	1.500	1499.3
0.250	934.5	0.750	1149.7	1.250	1379.2		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0077-2900-1250-2900
Design Head (m)	1.250
Design Flow (l/s)	2.9
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	77
Invert Level (m)	32.310
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.250	2.9	Kick-Flo®	0.690	2.2
Flush-Flo™	0.339	2.7	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)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.2	0.800	2.4	2.000	3.6	4.000	5.0	7.000	6.5
0.200	2.6	1.000	2.6	2.200	3.8	4.500	5.3	7.500	6.7
0.300	2.7	1.200	2.8	2.400	3.9	5.000	5.5	8.000	6.9
0.400	2.7	1.400	3.1	2.600	4.1	5.500	5.8	8.500	7.1
0.500	2.7	1.600	3.2	3.000	4.3	6.000	6.0	9.000	7.3
0.600	2.5	1.800	3.4	3.500	4.7	6.500	6.2	9.500	7.5

Weir Overflow Control

Discharge Coef 0.544 Width (m) 1.000 Invert Level (m) 33.310

Cascade Summary of Results for C86343-JNP-XX-XX-CA-C-0003c W3 (LTS).srcx

Upstream Structures	Outflow To	Overflow To
C86343-JNP-XX-XX-CA-C-0003b W2 (LTS).srcx C86343-JNP-XX-XX-CA-C-0003a W1 (LTS).srcx	(None)	C86343-JNP-XX-XX-CA-C-0003d W (AS).srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	32.087	0.817	2.2	0.0	2.2	455.9	O K
30 min Summer	32.247	0.977	2.2	0.0	2.2	586.4	O K
60 min Summer	32.342	1.072	2.2	49.6	51.9	670.5	O K
120 min Summer	32.432	1.162	2.3	166.3	168.6	754.4	O K
180 min Summer	32.460	1.190	2.3	211.3	213.6	781.8	O K
240 min Summer	32.478	1.208	2.4	242.0	244.4	799.4	Flood Risk
360 min Summer	32.491	1.221	2.4	265.1	267.4	812.7	Flood Risk
480 min Summer	32.489	1.219	2.4	261.5	263.9	810.8	Flood Risk
600 min Summer	32.481	1.211	2.4	248.2	250.5	803.3	Flood Risk
720 min Summer	32.472	1.202	2.4	232.5	234.8	794.4	Flood Risk
960 min Summer	32.454	1.184	2.3	202.1	204.5	776.6	O K
1440 min Summer	32.425	1.155	2.3	156.3	158.7	748.5	O K
2160 min Summer	32.397	1.127	2.3	115.3	117.6	721.2	O K
2880 min Summer	32.378	1.108	2.3	91.0	93.3	703.7	O K
4320 min Summer	32.356	1.086	2.2	64.2	66.4	682.7	O K
5760 min Summer	32.343	1.073	2.2	50.2	52.4	670.7	O K
7200 min Summer	32.335	1.065	2.2	42.6	44.8	663.9	O K
8640 min Summer	32.330	1.060	2.2	37.8	40.0	659.7	O K
10080 min Summer	32.327	1.057	2.2	34.6	36.8	656.4	O K
15 min Winter	32.087	0.817	2.2	0.0	2.2	455.8	O K
30 min Winter	32.247	0.977	2.2	0.0	2.2	586.4	O K
60 min Winter	32.345	1.075	2.2	52.2	54.5	672.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Summer	141.455	0.0	159.9	0.0	30
30 min Summer	91.101	0.0	174.5	0.0	45
60 min Summer	55.734	0.0	473.6	133.9	64
120 min Summer	35.493	0.0	1147.5	805.8	122
180 min Summer	26.776	0.0	1557.9	1215.3	148
240 min Summer	21.695	0.0	1834.5	1490.9	176
360 min Summer	15.846	0.0	2173.4	1828.0	238
480 min Summer	12.531	0.0	2366.9	2019.9	302
600 min Summer	10.385	0.0	2487.4	2138.9	366
720 min Summer	8.880	0.0	2565.7	2215.9	430
960 min Summer	6.898	0.0	2647.3	2295.3	556
1440 min Summer	4.797	0.0	2676.0	2321.6	808
2160 min Summer	3.331	0.0	2941.4	2253.1	1188
2880 min Summer	2.582	0.0	2835.5	2149.8	1564
4320 min Summer	1.829	0.0	2636.7	1943.4	2328
5760 min Summer	1.453	0.0	3048.6	1780.9	3080
7200 min Summer	1.235	0.0	3078.9	1728.2	3824
8640 min Summer	1.094	0.0	3053.3	1734.9	4584
10080 min Summer	0.996	0.0	3079.7	1784.3	5304
15 min Winter	141.455	0.0	159.9	0.0	30
30 min Winter	91.101	0.0	174.5	0.0	44
60 min Winter	55.734	0.0	473.7	134.0	64

Cascade Summary of Results for C86343-JNP-XX-XX-CA-C-0003c W3 (LTS).srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
120 min Winter	32.437	1.167	2.3	174.0	176.4	759.3	O K
180 min Winter	32.467	1.197	2.3	223.9	226.2	789.4	O K
240 min Winter	32.485	1.215	2.4	254.3	256.7	806.8	Flood Risk
360 min Winter	32.489	1.219	2.4	262.4	264.7	811.1	Flood Risk
480 min Winter	32.479	1.209	2.4	244.6	247.0	801.3	Flood Risk
600 min Winter	32.467	1.197	2.3	223.9	226.2	789.1	O K
720 min Winter	32.455	1.185	2.3	203.0	205.3	777.2	O K
960 min Winter	32.434	1.164	2.3	169.4	171.7	756.6	O K
1440 min Winter	32.403	1.133	2.3	124.3	126.6	727.6	O K
2160 min Winter	32.376	1.106	2.3	88.5	90.8	701.6	O K
2880 min Winter	32.359	1.089	2.2	68.1	70.4	685.9	O K
4320 min Winter	32.339	1.069	2.2	46.6	48.8	667.7	O K
5760 min Winter	32.328	1.058	2.2	35.5	37.7	657.5	O K
7200 min Winter	32.321	1.051	2.2	29.2	31.4	651.1	O K
8640 min Winter	32.316	1.046	2.2	25.4	27.6	646.8	O K
10080 min Winter	32.313	1.043	2.2	22.6	24.8	644.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
120 min Winter	35.493	0.0	1147.9	806.5	122
180 min Winter	26.776	0.0	1558.9	1216.7	152
240 min Winter	21.695	0.0	1836.3	1493.3	182
360 min Winter	15.846	0.0	2176.7	1832.2	250
480 min Winter	12.531	0.0	2371.8	2025.9	316
600 min Winter	10.385	0.0	2493.9	2146.9	382
720 min Winter	8.880	0.0	2573.8	2225.7	448
960 min Winter	6.898	0.0	2658.4	2308.7	576
1440 min Winter	4.797	0.0	2693.2	2342.1	836
2160 min Winter	3.331	0.0	2967.5	2283.6	1216
2880 min Winter	2.582	0.0	2869.0	2189.5	1608
4320 min Winter	1.829	0.0	2682.3	1996.6	2384
5760 min Winter	1.453	0.0	3076.8	1820.3	3176
7200 min Winter	1.235	0.0	3080.7	1731.5	3960
8640 min Winter	1.094	0.0	3035.1	1713.4	4688
10080 min Winter	0.996	0.0	3038.9	1734.6	5456

Cascade Rainfall Details for C86343-JNP-XX-XX-CA-C-0003c W3 (LTS).srcx

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	1.000
FEH Rainfall Version	2013	Cv (Winter)	1.000
Site Location	GB 505745 243600 TL 05745 43600	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.297

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	5	0.432	5	10	0.432	10	15	0.433

Cascade Model Details for C86343-JNP-XX-XX-CA-C-0003c W3 (LTS).srcx

Storage is Online Cover Level (m) 32.770

Tank or Pond Structure

Invert Level (m) 31.270

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	359.8	0.500	601.7	1.000	872.7	1.500	1172.0
0.250	477.0	0.750	733.6	1.250	1018.8		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0070-2400-1250-2400
Design Head (m)	1.250
Design Flow (l/s)	2.4
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	70
Invert Level (m)	31.270
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.250	2.4	Kick-Flo®	0.623	1.7
Flush-Flo™	0.307	2.2	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)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.8	0.800	2.0	2.000	3.0	4.000	4.1	7.000	5.3
0.200	2.1	1.000	2.2	2.200	3.1	4.500	4.3	7.500	5.5
0.300	2.2	1.200	2.4	2.400	3.2	5.000	4.6	8.000	5.7
0.400	2.1	1.400	2.5	2.600	3.4	5.500	4.8	8.500	5.8
0.500	2.0	1.600	2.7	3.000	3.6	6.000	5.0	9.000	6.0
0.600	1.8	1.800	2.8	3.500	3.9	6.500	5.1	9.500	6.2

Weir Overflow Control

Discharge Coef 0.544 Width (m) 1.500 Invert Level (m) 32.270

Cascade Summary of Results for C86343-JNP-XX-XX-CA-C-0003d W (AS).srcx

Upstream Structures	Outflow To	Overflow To
C86343-JNP-XX-XX-CA-C-0003c W3 (LTS).srcx C86343-JNP-XX-XX-CA-C-0003b W2 (LTS).srcx C86343-JNP-XX-XX-CA-C-0003a W1 (LTS).srcx	(None)	(None)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	31.270	0.000	0.0	0.0	O K
30 min Summer	31.270	0.000	0.0	0.0	O K
60 min Summer	31.376	0.106	3.3	107.8	O K
120 min Summer	31.941	0.671	3.8	759.2	O K
180 min Summer	32.179	0.909	23.3	1074.9	O K
240 min Summer	32.294	1.024	40.9	1235.7	O K
360 min Summer	32.431	1.161	41.7	1435.9	O K
480 min Summer	32.481	1.211	41.7	1510.9	Flood Risk
600 min Summer	32.486	1.216	41.7	1518.0	Flood Risk
720 min Summer	32.471	1.201	41.7	1495.6	Flood Risk
960 min Summer	32.435	1.165	41.7	1442.1	O K
1440 min Summer	32.364	1.094	41.7	1337.1	O K
2160 min Summer	32.282	1.012	40.7	1219.5	O K
2880 min Summer	32.239	0.969	35.5	1158.6	O K
4320 min Summer	32.190	0.920	25.6	1090.5	O K
5760 min Summer	32.161	0.891	19.7	1049.7	O K
7200 min Summer	32.146	0.876	17.0	1029.9	O K
8640 min Summer	32.139	0.869	15.7	1020.6	O K
10080 min Summer	32.137	0.867	15.4	1017.6	O K
15 min Winter	31.270	0.000	0.0	0.0	O K
30 min Winter	31.270	0.000	0.0	0.0	O K
60 min Winter	31.376	0.106	3.3	107.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	141.455	0.0	0.0	0
30 min Summer	91.101	0.0	0.0	0
60 min Summer	55.734	0.0	122.8	192
120 min Summer	35.493	0.0	588.8	284
180 min Summer	26.776	0.0	795.5	262
240 min Summer	21.695	0.0	1047.7	290
360 min Summer	15.846	0.0	1346.4	394
480 min Summer	12.531	0.0	1509.9	500
600 min Summer	10.385	0.0	1606.8	606
720 min Summer	8.880	0.0	1665.5	664
960 min Summer	6.898	0.0	1713.6	776
1440 min Summer	4.797	0.0	1669.8	1032
2160 min Summer	3.331	0.0	2083.9	1428
2880 min Summer	2.582	0.0	1846.6	1844
4320 min Summer	1.829	0.0	1435.7	2708
5760 min Summer	1.453	0.0	1771.7	3576
7200 min Summer	1.235	0.0	1716.0	4416
8640 min Summer	1.094	0.0	1716.9	5224
10080 min Summer	0.996	0.0	1749.7	6008
15 min Winter	141.455	0.0	0.0	0
30 min Winter	91.101	0.0	0.0	0
60 min Winter	55.734	0.0	123.0	192

Cascade Summary of Results for C86343-JNP-XX-XX-CA-C-0003d W (AS).srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
120 min Winter	31.941	0.671	3.8	760.3	O K
180 min Winter	32.180	0.910	23.6	1076.5	O K
240 min Winter	32.298	1.028	41.0	1241.7	O K
360 min Winter	32.447	1.177	41.7	1459.7	O K
480 min Winter	32.507	1.237	41.7	1550.7	Flood Risk
600 min Winter	32.520	1.250	42.0	1570.8	Flood Risk
720 min Winter	32.509	1.239	41.7	1553.9	Flood Risk
960 min Winter	32.468	1.198	41.7	1492.0	O K
1440 min Winter	32.385	1.115	41.7	1367.6	O K
2160 min Winter	32.284	1.014	40.7	1221.4	O K
2880 min Winter	32.235	0.965	34.7	1153.3	O K
4320 min Winter	32.183	0.913	24.1	1080.1	O K
5760 min Winter	32.150	0.880	17.7	1035.3	O K
7200 min Winter	32.131	0.861	14.3	1009.0	O K
8640 min Winter	32.119	0.849	12.3	992.7	O K
10080 min Winter	32.112	0.842	11.2	983.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
120 min Winter	35.493	0.0	588.2	284
180 min Winter	26.776	0.0	796.8	262
240 min Winter	21.695	0.0	1049.8	290
360 min Winter	15.846	0.0	1349.1	392
480 min Winter	12.531	0.0	1513.6	496
600 min Winter	10.385	0.0	1612.0	600
720 min Winter	8.880	0.0	1671.6	696
960 min Winter	6.898	0.0	1721.4	808
1440 min Winter	4.797	0.0	1690.0	1092
2160 min Winter	3.331	0.0	2116.6	1512
2880 min Winter	2.582	0.0	1886.1	1952
4320 min Winter	1.829	0.0	1460.2	2868
5760 min Winter	1.453	0.0	1810.4	3800
7200 min Winter	1.235	0.0	1718.0	4728
8640 min Winter	1.094	0.0	1690.8	5624
10080 min Winter	0.996	0.0	1674.5	6488

Cascade Rainfall Details for C86343-JNP-XX-XX-CA-C-0003d W (AS).srcx

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	1.000
FEH Rainfall Version	2013	Cv (Winter)	1.000
Site Location	GB 505745 243600 TL 05745 43600	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.000

Time (mins) From:	To:	Area (ha)
0	5	0.000

Cascade Model Details for C86343-JNP-XX-XX-CA-C-0003d W (AS).srcx

Storage is Online Cover Level (m) 32.770

Tank or Pond Structure

Invert Level (m) 31.270

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	996.6	0.500	1199.8	1.000	1417.2	1.500	1648.7
0.250	1096.4	0.750	1306.7	1.250	1531.2		

Complex Outflow Control

Hydro-Brake® Optimum

Unit Reference	MD-SHE-0096-3800-0750-3800
Design Head (m)	0.750
Design Flow (l/s)	3.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	96
Invert Level (m)	31.270
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.750	3.8	Kick-Flo®	0.497	3.1
Flush-Flo™	0.224	3.8	Mean Flow over Head Range	-	3.3

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.1	0.800	3.9	2.000	6.0	4.000	8.3	7.000	10.8
0.200	3.8	1.000	4.3	2.200	6.3	4.500	8.8	7.500	11.2
0.300	3.7	1.200	4.7	2.400	6.5	5.000	9.2	8.000	11.5
0.400	3.6	1.400	5.1	2.600	6.8	5.500	9.7	8.500	11.9
0.500	3.2	1.600	5.4	3.000	7.2	6.000	10.1	9.000	12.2
0.600	3.4	1.800	5.7	3.500	7.8	6.500	10.5	9.500	12.6

Hydro-Brake® Optimum

Unit Reference	MD-SHE-0267-3720-0500-3720
Design Head (m)	0.500
Design Flow (l/s)	37.2
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	267
Invert Level (m)	32.020
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1500

Hydro-Brake® Optimum

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.500	37.2	Kick-Flo®	0.463	35.9
Flush-Flo™	0.348	37.2	Mean Flow over Head Range	-	25.7

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)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	8.5	0.800	46.6	2.000	72.6	4.000	101.8	7.000	133.1
0.200	27.4	1.000	51.9	2.200	76.1	4.500	107.8	7.500	137.8
0.300	36.9	1.200	56.7	2.400	79.4	5.000	113.5	8.000	142.4
0.400	36.9	1.400	61.1	2.600	82.5	5.500	117.7	8.500	146.9
0.500	37.2	1.600	65.2	3.000	88.5	6.000	123.0	9.000	151.2
0.600	40.6	1.800	69.0	3.500	95.4	6.500	128.2	9.500	155.4

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