MA10147-FRA-R01

Proposed Residential Development Small Drove, Weston PE12 6HU

Larkfleet Homes Ltd

Flood Risk Assessment

September 2015

millward

- Civil & Structural Engineering
- Environmental & Geotechnical
- Flood Risk & Drainage
- Highways & Infrastructure
- Structural Inspections
- Transportation

INTEGRATED ENGINEERING CONSULTANTS

REVISION

Reference	Revision	Author	Date
MA10147-FRA-R01	Initial Issue for Planning	JMcK	18 Sept 2015

CONTENTS

1. INTRODUCTION 4
2 THE SITE 5
3 CONSULTATIONS 7
4 SEQUENTIAL AND EXCEPTION TESTS 10
5 PROPOSED DEVELOPMENT 13
6 FLOOD RISK 17
7 MITIGATION MEASURES 22
8 CONCLUSIONS 24

APPENDICIES

Appendix A – Drawings

- Site Location Plan: MA10147/SK01
- Proposed Drainage Strategy: MA10147/200
- Existing Site Levels: MA10147/600
- Proposed Site Layout Plan

Appendix B – Consultations

- Anglian Water Pre Development Enquiry Response
- South Holland IDB

Appendix C – WinDES Calculation Results

- ICP SUDS Greenfield Run Off Calculation
- Preliminary Surface Water Drainage Calculations

1. INTRODUCTION

1.1 Millward have been appointed to undertake a Flood Risk Assessment (FRA) for a proposed residential development of 45 units on land adjacent to Small Drove, Weston, Spalding, PE12 6HU.

1.2 This FRA is undertaken in accordance with the National Planning Policy Framework and associated Technical Guidance Document March 2012 (NPPF).

1.3 This FRA discusses and provides both a qualitative assessment and quantitative assessment for the residential development in terms of flood risk, future flood risk over the anticipated lifetime of the development and reference to the sequential and exception test using a precautionary and risk based approach.

2 THE SITE

2.1 This proposed residential development is located to the south side of Small Drove on Greenfield Land. This land is to the rear of the existing properties fronting onto Broadgate. The site area totals 1.79 Hectares (17,900m^2) in area. The site is located adjacent to the urban extents of Weston approximately 3 miles north east of the centre of Spalding. The site location is shown on drawing MA10147/SK01 contained within Appendix A.

2.2 Vehicular access to the development will be via Small Drove with one access from this road as per the architects drawing contained within Appendix A.

2.3 As the site is not currently developed nor has been previously developed, the site is classed as Greenfield. The land is currently grassed.

2.4 There is no evidence that the site is or has been formally drained previously. According to the Anglian Water (AW) sewer maps there are no currently adopted surface or foul sewers serving the development site. AW have confirmed in their pre-development response that there are foul sewers within Broadgate which are suitable for connection of this development. There are no surface water sewers in the vicinity of the site.

2.5 There is however an existing rising main located within the site boundary which is an Anglian Water adopted asset which has been traced on site and is reflected on the proposed site layout.

2.6 Site levels within the development area vary from 3.33m AOD to the western corner of the site to 2.24m AOD to the southern corner as confirmed by the topographical ground model contours shown on drawing MA10147/600 contained within Appendix A.

2.7 The site is currently 100% permeable and therefore the site surface water run-off has been calculated by the ICP SUDS method, which confirms a Greenfield run-off rate of 2.5 l/s for the 1 in 1 year event (QBAR). The WinDES results are contained within Appendix C.

2.8 The ICP SUDS method also confirms a Q30 year run off of 6.1 l/s and Q100 year run off of 9.0 l/s for this site.

3 CONSULTATIONS

3.1 Environment Agency (EA)

3.1.1 The EA national flood risk maps available on their web site have been interrogated firstly to define in terms of planning what flood zone the site is contained within.

3.1.2 The development site is contained wholly within Flood Zone 3a which in accordance with Table 1 of the NPPF Technical Guidance document, is defined as High Probability having greater than a 1 in 100 chance (>1%) of flooding from rivers or 1 in 200 chance (>0.5%)the sea in any one year. This ignores the presence of any flood defences.

3.1.3 The Environment Agency have been consulted to establish if they hold further flood data such as flood levels and hazard mapping for this site and they have confirmed that only the basic flood map is available for this site and to refer to the South Holland SFRA for further information including hazard maps for this site.

3.1.4 Further information on the risk of flooding including actual risk taking into account the presence of the flood defences will be reviewed from the South Holland SFRA Updated 2010 and discussed in Section 6.

3.2 South Holland IDB

3.2.1 Consultation with the IDB has been held, providing out initial findings with regard to the current Greenfield run off rates and locations of adopted drains.

3.2.2 The closest IDB maintained drain is the Delgate Drain North which is owned and maintained by the South Holland IDB. This drain is approximately 280m east of the site and any drainage from the site will flow through a riparian owned watercourse before outfall into the IDB adopted drain.

3.2.3 Land in this area generally drains steadily, so any additional surface water that is draining into these watercourses may cause concern if increased above Greenfield rates.

3.2.4 Suggestion was put forward to providing an access strip adjacent to each watercourse on the development to allow sufficient room for maintenance.

3.2.5 The IDB will consider increased flows over and above the Greenfield run off rate subject to a survey and design being carried out on the existing riparian watercourse and consent being obtained by the landowners.

3.3 Anglian Water (AW)

3.3.1 As part of this assessment a pre development enquiry has been lodged with AW which the result of this enquiry is contained within Appendix B.

3.3.2 The pre development enquiry confirms that there are no surface water sewers in the vicinity of the site

3.3.3 AW have confirmed that the Moulton Water recycling centre currently has capacity to treat foul flows from this proposed development. They have also assessed the impact of a pumped solution from the development site for 45 dwellings. This solution is acceptable as the foul system at present has the capacity to accept flows from this development subject to a specific outfall location.

3.3.4 The connection point for the foul flows from this site are at manhole 8602 in Broadgate which is located to the south west of the development site. This would mean a rising main would need to be installed as part of any foul drainage scheme from the on-site pumping station, through the site to the site entrance onto Small Drove and then west to the junction of Small Drove and Broadgate (circa 80m length). The rising main would then need to be installed in a south western direction along Broadgate for approximately 110m. There will be a requirement for an intermediate manhole a minimum of 5m away from this existing manhole to allow flows to gravitate. There is a restriction on the foul flows of 3.8 l/s.

3.3.5 The proposed pump station for the development site would be confirmed as part of a S104 Water Industry Act submission to Anglian Water based upon a final site layout. Location of the pump station is within the site, adjacent to the electricity sub-station and pond area to the southern corner but at least 15m from any habitable building.

4 SEQUENTIAL AND EXCEPTION TESTS

4.1 Sequential Test

4.1.1 The site has been assessed in line with the NPPF and technical guidance document. The technical guidance document confirms that the SFRA documents refine the flood zones and provide the basis for applying the sequential test for development.

4.1.2 The site is confirmed by the EA to be wholly within in Flood Zone 3a (High probability) as defined in Table 1 (Flood zones) of the technical guidance document for the NPPF.

4.1.3 Table 2, (Flood risk vulnerability classification) of the same document confirms that residential development (buildings used for dwelling houses) is classified as 'More Vulnerable' development.

4.1.4 Table 3, (Flood risk vulnerability and flood zone 'compatibility') confirms that development classified as 'More vulnerable' development in Flood Zone 3 is only considered appropriate if the Exception Test is applied and passed.

4.1.5 In terms of the Sequential Test for this site, the extents of flood zone 3 shown on the Environment Agency mapping encompasses a large area.

4.1.6 To refine the parameters of the Sequential Test, the South Holland SFRA has been interrogated to refine the flood zone in line with the NPPF.

4.1.7 From the data within the South Holland SFRA, the site is not within an area at risk of flooding taking the flood defences into account. The actual flood limits, current day, year 2055 and 2115 for the 1 in 100 year event are outside the boundary of this development site. The closest are of flooding identified on the plans is 135m away from the Northern boundary of the site in the 2115 flood extents scenario for the 1% fluvial and 0.5% tidal events.

4.1.8 Therefore, for the purpose of this assessment, the site is within Flood Zone 1 as the effect of the long standing and very effective flood defences, (even when breached and / or overtopped) prevent flood waters from tidal and fluvial sources from reaching the development site.

4.1.9 In terms of housing supply, the South Holland Council Core Strategy 2006 confirms that with the exception of Spalding, there is a limited range of unconstrained / modestly constrained brownfield sites available. The findings reveal that some Greenfield land within the urban areas or urban extensions would also need to be identified to enable the Council to adequately meet the RSS and Structure Plan requirement 2021. Development of previously developed land is not enough on its own to fulfil the Councils need to achieve appropriate levels of housing completions and have adequate land supply.

4.1.10 Therefore there is a requirement for additional sites to come forward for development other than the sites allocated in the local plan to which this site is one.

4.1.11 The development is for up to 45 dwellings which would constitute a contribution towards the reduction of the shortfall for South Holland Council. Weston is designated as a minor service centre under the Local Plan 2006

4.1.12 The development is adjacent to the urban extents of Weston, served off an existing adopted highway (Small Drove) to which existing residential properties are positioned. To the east of the site there are playing fields. It is considered that the site is not remote from the urban extents of the village.

4.1.13 The development site is not located on agricultural land as the land is essentially a grassed area.

4.1.14 With the above evidence taken into account, it is considered that this site passes the Sequential Test as there is a defined need for additional housing site to come forward in the Borough and also the presence of the extensive flood risk defences which protects the whole of the South Holland District means that the site is within Flood Zone 1, not affected by any breach in the existing flood defences.

4.1.15 The site is in a location where there are no other sites in a position of lower flood risk when the flood defences are taken into account; therefore we consider the Sequential Test passed.

4.2 Exception Test

4.2.1 As we consider that the site passes the sequential Test the Exception Test need not apply in this case. However there are mitigation measures proposed in Section 7 which will ensure the proposed development will not be at adverse risk of flooding from other sources.

5 PROPOSED DEVELOPMENT

5.1 Summary of proposals

5.1.1 The proposed development proposals consist of 45 no dwellings in total with associated driveways and garages (off road) and garden areas with and area set aside for an attenuation pond. The proposed block plan layout of the development is shown on the architects sketch contained within in Appendix A.

5.1.2 The impermeable areas of the proposed site are circa 55%, 9,660 m^2 (0.966Ha) as shown on drawing MA10147/200 contained in Appendix A (based upon the masterplan) which is an increase in impermeable area on the site, which therefore will require mitigation measures in terms of surface water drainage to ensure Greenfield Run Off rates are maintained (as discussed and calculated in Section 2).

5.1.3 The proposals will also look into the provision of permeable paving solutions to the site access road, driveways and private shared drives. Desk top investigations suggest that the site is underlain by cohesive soils which do not lend themselves to infiltration SUDS. It is assumed from the initial investigations that infiltration SUDS will not be viable and do not form the preliminary strategy on drawing MA10147/200.

5.1.4 Foul drainage would connect into the agreed Anglian Water manhole 8602 in Broadgate via a pumping station on the site. Foul flows for the 45 units are expected to be 0.405 l/s calculated in accordance with AW developer services update April 2015, with a pump rate of 0.764 l/s, which is well below the 3.8 l/s limit stipulated by Anglian Water.

5.1.5 As the site is located and protected by the significant flood defences, an assessment has been made with regard to the proposed finished floor levels of the dwellings which are discussed further in section 7. The finished floor levels are proposed to be lifted to ensure the dwellings are safe for the lifetime of the development.

5.2 Proposed Drainage Strategy

5.2.1 The site is extremely flat with levels generally between 3.2m AOD and 2.3m AOD. Whilst the site is not deemed at risk of flooding from fluvial and tidal sources, taking the precautionary approach to design and flood risk, the proposals for the site implement a minimum floor level on the site of 3.150m AOD to protect against any potential flooding from adjacent land and highways and also ensure the proposed dwelling are above the adjacent road. The minimum level only applies to the dwellings themselves not the garages.

5.2.2 The proposed pond structure is to be designed to be offline or online with a maximum depth of 1.1m (to accommodate the 1 in 100 year event scenario including climate change) and will be maintained privately by a management company. The invert of the pond is proposed to be 1.6m AOD (set at this because the receiving ditch has an invert level of 1.50m AOD at the proposed point of outfall). Therefore the site levels around the pond will be a minimum of 3.100m AOD (top water level plus 300mm freeboard allowance). Therefore a minimum finished floor level on the site of 3.150m AOD will ensure all proposed dwellings are above the maximum pond water level for this development site.

5.2.3 In line with CIRIA C697 Table 3.3 roof drainage requires 1 treatment stage (The roof drainage outfalls into the permeable paving areas which constitutes one treatment stage).

5.2.4 The private driveways and shared driveways would be proposed to be of permeable construction which provides the first treatment stage of the two stages required for driveway run off. The main site road is also proposed to be of permeable construction to provide the whole surface water run-off from hard-standing areas with the first of the two required treatment stages in line with CIRIA C697.

5.2.5 In line with CIRIA C697, the second treatment stage for the surface water is the pond feature to the southern corner of the site. This provides further attenuation before ultimate outfall to the riparian owned ditch which currently drains the existing site area at Greenfield rates.

5.2.6 The drainage for this site is attenuated to Greenfield rates up to and including the 1 in 100 year event including climate change allowance of 30% in line with NPPF.

5.2.7 The outfall from the pond is controlled by a two stage control which ensures that the run off from the development site is no greater than the corresponding Greenfield run off for the equivalent storm event. Therefore, 1 year event 2.5l/s maximum flow (QBAR equivalent for 1 year), 30 year event 6.1 l/s maximum flow (QBAR equivalent for 30 year), 100 year event 9.0 l/s maximum flow (QBAR equivalent for 100 year).

5.2.8 This means that the site does not increase the discharge rates from the site above the corresponding Greenfield run off rate calculated for each corresponding storm event.

5.2.9 Drawing MA10164/200 shows (based upon the preliminary master plan) the potential routes of drainage and outfall position for the surface water and also the foul network for the site.

5.2.10 Attenuation is provided within the permeable paving areas (these areas would be laid with a 1 in 100 gradient at formation of the stone layer). The extent of these areas as shown on drawing MA10147/200 may well alter as detailed design progresses and discussions with the adopting authority relating to permeable paving constraints and requirements but there is still expected to be permeable paving within the site in any case.

5.2.11 As part of the suds design, the site will be split into sub catchments across the site to allow the attenuation to be dispersed evenly across the site to maximise the available attenuation within the system both in the permeable paving and also the pond area.

5.2.12 Preliminary cascade calculations have been undertaken based upon the surface water drainage strategy shown on drawing MA10147/200 and the results are contained within Appendix C.

6 FLOOD RISK

6.1 Flooding From Watercourses

6.1.1 As previously discussed in this report, taking the flood defences into account the site is not considered to be a significant risk of flooding from this source, even if the defences are breached or overtopped as confirmed on the Actual peak depth plan for year 2115 (1% fluvial / 0.5% tidal probability).

6.1.2 The riparian watercourses adjacent to the site are deep and well defined and interrogation of the environment agency maps online for surface water flooding there is a very small area of risk to the northern boundary about mid-way along this boundary which is low risk on the site side.

6.1.3 Therefore the risk of flooding from watercourses is **LOW** taking into account the defences up to and including the 1 in 100 year event scenario inclusive of climate change allowance at year 2115. There is of course a residual risk of flooding from overtopping or a breach of the defences which is considered separately in this assessment.

6.2 Flooding From Land / Adjacent Development

6.2.1 The main risk of flooding to this site is from the impermeable surfaces within the adjacent residential area surrounding the site which due to failure of the existing drainage systems or intense rainfall saturating the soil resulting in run off over land instead of infiltration or interception by drainage infrastructure.

6.2.2 Any overland flow from adjacent development is likely to be shallow. Any run off from Small Drove to the north will be intercepted by the existing drainage ditch to the boundary. The only potential area where flow could enter the site is from the western boundary. The catchment for any flow is very small (just the existing properties to the western boundary).

6.2.3 Overall the risk of flooding from this source is considered to be **LOW**.

6.3 Flooding From Infrastructure Failure

6.3.1 The site is just within the maximum extent of flooding area from reservoirs (according to the data on the EA website).

6.3.2 The reservoir which is the source of the flood risk to this site is the Crowlands Cowbit Washes, which is owned and maintained by the Environment Agency.

6.3.3 Reservoir flooding is extremely unlikely to happen. There has been no loss of life in the UK from reservoir flooding since 1925. All large reservoirs must be inspected and supervised by reservoir panel engineers. Under the Reservoirs Act 1975 in England this reservoir is inspected regularly and essential safety work is carried out.

6.3.4 Depths of flooding potentially expected in the extremely unlikely event of reservoir flooding is below 0.3 metres with velocities less than 0.5m per second. These depths and velocities would not be considered a significant danger to life.

6.3.5 Taking the above data into account, the residual risk of flooding to the site considered **LOW**.

6.4 Flooding From Groundwater

6.4.1 There are no confirmed records of groundwater flooding in the vicinity of the site in the South Holland SFRA. Section 8.3 SFRA confirms that there are no reports of groundwater flooding in the District. This source of flooding is therefore taken as having no strategic significance in relation to flood risk.

6.4.2 The area is underlain by cohesive soils which are not permeable. Therefore the chances of rising groundwater in this area is deemed low.

6.4.3 Overall the risk of flooding from this source is considered to be **LOW**.

6.5 Flooding From Sewers

6.5.1 There are no recorded existing surface water sewers in the vicinity of the site that would pose a risk to the site in terms of flooding.

6.5.2 In terms of foul sewers, there is a rising main crossing the site which outfall into the existing ditch to the north adjacent to Small Drove. There are further foul sewers in Small Drove and Broadgate.

6.5.3 If any of these sewers / drains were to flood, the water flow routes would be along the existing highways within the existing development and would be considered to be shallow in depth. As there are no recorded sewers in the vicinity of the site any flood flows and volumes would be expected to be minimal from this source. The mitigation measures proposed in section 7 will deal with the residual risk form this source of flooding.

6.5.4 Overall the risk of flooding from this source is considered to be **LOW**.

6.6 Flooding From Climate Change

6.6.1 The NPPF Technical Guidance Document confirms in Table 5 that peak rainfall intensity is estimated to increase up to 30% over the lifetime of this development (100 years) and peak river flows by 20%. Tidal aspects extreme wave heights could increase between 5% and 10%. Sea level rises in this area over the lifetime of the development would be anticipated to be circa 1.2m (to year 2115).

6.6.2 The South Holland SFRA assesses the risk of flooding from Tidal and Fluvial events at year 2115. The plans show that the anticipated flood depths in the 1 in 100 year event scenario including climate change would not affect the proposed site.

6.6.3 The proposed site drainage will however be designed not to flood with an allowance of 30% for climate change in line with the NPPF technical guidance document and restricted to Greenfield run off rate (9.0 l/s QBAR max rate at the 100 year event).

6.6.4 Overall the risk of flooding from the effects of climate change is considered to be **LOW** as the site is not affected by flooding when climate change is applied at year 2115.

7 MITIGATION MEASURES

7.1 Essential Mitigation Measures

7.1.1 The assessment of flood risk in Section 6 of this assessment confirms a **LOW** risk of flooding from all sources of flooding and therefore there are no essential mitigation measures required in terms of finished floor levels.

7.1.2 Surface water drainage for the site should be designed to accommodate the 1 in 100 year event storm scenarios including a 30% allowance for climate change and restricted to Greenfield run off rates in general accordance with the drainage strategy described in chapter 5 and shown on drawing MA10147/200 contained within Appendix A.

7.2 Recommended Mitigation Measures

7.2.1 All dwellings should have concrete ground floors with damp proof membranes as they are regarded as the most flood resilient floor types with effective connections between the dpc and dpm. The dpm should be between the surface screed and the concrete slab as this enables the concrete floor to dry out quickly and would also protect against any rising groundwater (unlikely) should flood risk from this source increase over the lifetime of the development.

7.2.2 Permeable paving to private driveways and parking areas should be utilised even if infiltration SUDS are not viable as permeable paving can be designed into a sealed system before outfall into either the sewer or drainage ditch. This would form part of a SUDS treatment train in line with CIRIA C697.

7.2.3 The outfall for surface water drainage from this development should be into the Drain adjacent to the southern corner of the site at equivalent Greenfield run off rates for each storm event (1 year 30 and 100 year) or other rate agreed with the IDB.

7.2.4 Where external gradients are flat or towards the dwelling entrances, provision of linear drainage should be provided to all access points just in case permeable paving fails.

7.2.5 All dwellings should be fitted with one way valves on drainage pipework entries into the units to prevent sewage backing up into the dwellings during flood events.

8 CONCLUSIONS

8.1 This Flood Risk Assessment serves to review, assess and quantify (where applicable) the sources, or any potential flooding, the pathways of this flooding and potential receptors within the vicinity of the site.

8.2 The assessment of flood risk undertaken for this development confirms that the risk of flooding is **LOW** from all sources of flooding.

8.3 As the site is outside the limits of flooding at the 1 in 100 year event including climate change safe, dry access egress to the dwellings at the 1 in 100 year event is achievable along Small Drove

8.4 The recommended mitigation measures will provide further protection to the development and reduce any residual risk (however low) as far as practicable. It is recommended that compliance with the recommendations of this FRA are conditioned as part of any planning permission.

8.5 This assessment concludes that the site is suitable for development for residential use without unacceptable risk of flooding from all sources to the site itself and elsewhere.

Appendix A – Drawings

Site Location Plan: MA10147/SK01

Proposed Drainage Strategy: MA10147/200

Existing Site Levels: MA10147/600

Proposed Site Layout Plan



©THIS DRAWING IS THE PROPERTY OF `THE MILLWARD PARTNERSHIP' AND MUST NOT BE REPRODUCED, WHOLLY OR IN PART, NOR THE INFORMATION THEREIN DISCLOSED TO A THIRD PARTY, WITHOUT THE WRITTEN PERMISSION OF THE OWNERS

A3

ASSOCIATED DRAWINGS

No.	TITLE

NOTES

REV	DATE	BY	DETAILS	CHK'D

AMENDMENTS

CLIENT

LarkfleetHomes

PROJECT

PROPOSED RESIDENTIAL DEVELOPMENT SMALL DROVE, WESTON

TITLE

SITE LOCATION PLAN

DRAWING No:	DRAWING STATUS
MA10147 / 001	Strategy

SCALE	DRAWN	ENGINEER
1:2500 APPROX @ A3	JH	JMcK
DATE	CHECKED	APPROVED BY
September 2015	JMcK	JMcK

millward
t: 0115 941 4560
no.1 malin hill, nottingham ng1 1jq
e: info@millward.co.uk w: www.millward.co.uk



STATION	EASTINGS	NORTHINGS	LEVEL	DESCRIPTION
PS1	528910.923	324655.947	2.994	Pipe Nail
PS4	529081.544	324530.013	2.720	Hilti Nail
PS5	528980.836	324599.593	2.769	Philips Screw
PS6	528873.175	324724.419	2.997	Philips Screw
PS7	528824.560	324647.742	3.046	Philips Screw

ASSOCIATED DRAWINGS

No.	TITLE

NOTES

Key

- Permeable Paving Area
- Catchpit and connection between permeable pav
- Foul sewer and manhole
- Foul sewer rising main

REV	DATE	BY	DETAILS	CHK'D

AMENDMENTS

CLIENT

LarkfleetHomes

PROJECT

PROPOSED RESIDENTIAL DEVELOPMENT SMALL DROVE WESTON

TITLE

Proposed Drainage Strategy

DRAWING No:	DRAWING STATUS
MA10147-200	PLANNING

SCALE	DRAWN	ENGINEER
1:500	D.W	JMcK
DATE	CHECKED	APPROVED BY
18 Sept 15	JMcK	JMcK

millward
t: 0115 941 4560
no.1 malin hill, nottingham ng1 1jq
e: info@millward.co.uk w: www.millward.co.uk

©THIS DRAWING IS THE PROPERTY OF THE MILLWARD PARTNERSHIP AND MUST NOT BE REPRODUCED, WHOLLY OR IN PART, NOR THE INFORMATION THEREIN DISCLOSED TO A THIRD PARTY, WITHOUT THE WRITTEN PERMISSION OF THE OWNERS

A1



STATION	EASTINGS	NORTHINGS	LEVEL	DESCRIPTION
PS1	528910.923	324655.947	2.994	Pipe Nail
PS4	529081.544	324530.013	2.720	Hilti Nail
PS5	528980.836	324599.593	2.769	Philips Screw
PS6	528873.175	324724.419	2.997	Philips Screw
PS7	528824.560	324647.742	3.046	Philips Screw

ASSOCIATED DRAWINGS

No.	TITLE

NOTES

REV	DATE	BY	DETAILS	CHK'D

AMENDMENTS

CLIENT

LarkfleetHomes

PROJECT

PROPOSED RESIDENTIAL DEVELOPMENT
SMALL DROVE WESTON

TITLE

Existing
Site
Levels

DRAWING No:	DRAWING STATUS
MA10147-600	PLANNING

SCALE	DRAWN	ENGINEER
1:500	D.W	JMcK
DATE	CHECKED	APPROVED BY
18 Sept 15	JMcK	JMcK

millward
t: 0115 941 4560
no.1 malin hill, nottingham ng1 1jq
e: info@millward.co.uk w: www.millward.co.uk

©THIS DRAWING IS THE PROPERTY OF 'THE MILLWARD PARTNERSHIP' AND MUST NOT BE REPRODUCED, WHOLLY OR IN PART, NOR THE INFORMATION THEREIN DISCLOSED TO A THIRD PARTY, WITHOUT THE WRITTEN PERMISSION OF THE OWNERS

A1



Market

House type	ft²	storeys	beds	no of	
2224	655	2	2	1	655
2306	880	2	3	2	1760
2308	926	2	3	4	3704
2324	984	2	3	1	984
2404	1581	2	4	3	4743
2410	1314	2	4	1	1314
2426	1228	2	4	3	3684
2427	1259	2	4	3	3777
2428	1287	2	4	6	7722
2502	2048	2	5	2	4096
2508	1553	2	5	2	3106
2509	1317	2	5	2	2634
				30	38179

Affordable

House type	ft²	storeys	beds	no of	
2110	563	2	1	4	2252
2224	655	2	2	6	3930
2306	880	2	3	2	1760
2323	801	2	3	2	1602
2324	984	2	3	1	984
				15	8276

Site Area = 4.351 acres gross
4.032 acres nett

Density = 11.2 units/acre nett
= 11521 ft²/acre nett

Plot	Type
1	2428
2	2502
3	2404
4	2428
5	2410
6	2428
7	2404
8	2502
9	2426
10	2306
11	2428
12	2426
13	2509
14	2426
15	2308
16	2308
17	2508
18	2404
19	2306
20	2428
21	2509
22	2427
23	2508
24	2428
25	2427
26	2308
27	2308
28	2224
29	2224
30	2306
31	2306
32	2110
33	2110
34	2110
35	2110
36	2224
37	2224
38	2224
39	2224
40	2224
41	2323
42	2323
43	2324
44	2324
45	2427

LEGEND

	Existing Trees & Hedges to be retained
	Proposed Indicative Trees & Hedges
	Existing Trees & Hedges to be removed
	1.8m Close Boarded Timber Fence
	1.8m Timber Panelled Fence
	1.2m Post & Wire Fence
	1.2m Vertical Metal Fence
	1.2m Metal Estate Fence
	Brick Wall (1.8m high unless stated)

rev	date			
		Copyright reserved	Do not scale	All dimensions to be checked on site

Project
Weston, Land off Small Drove

ALLISON Homes

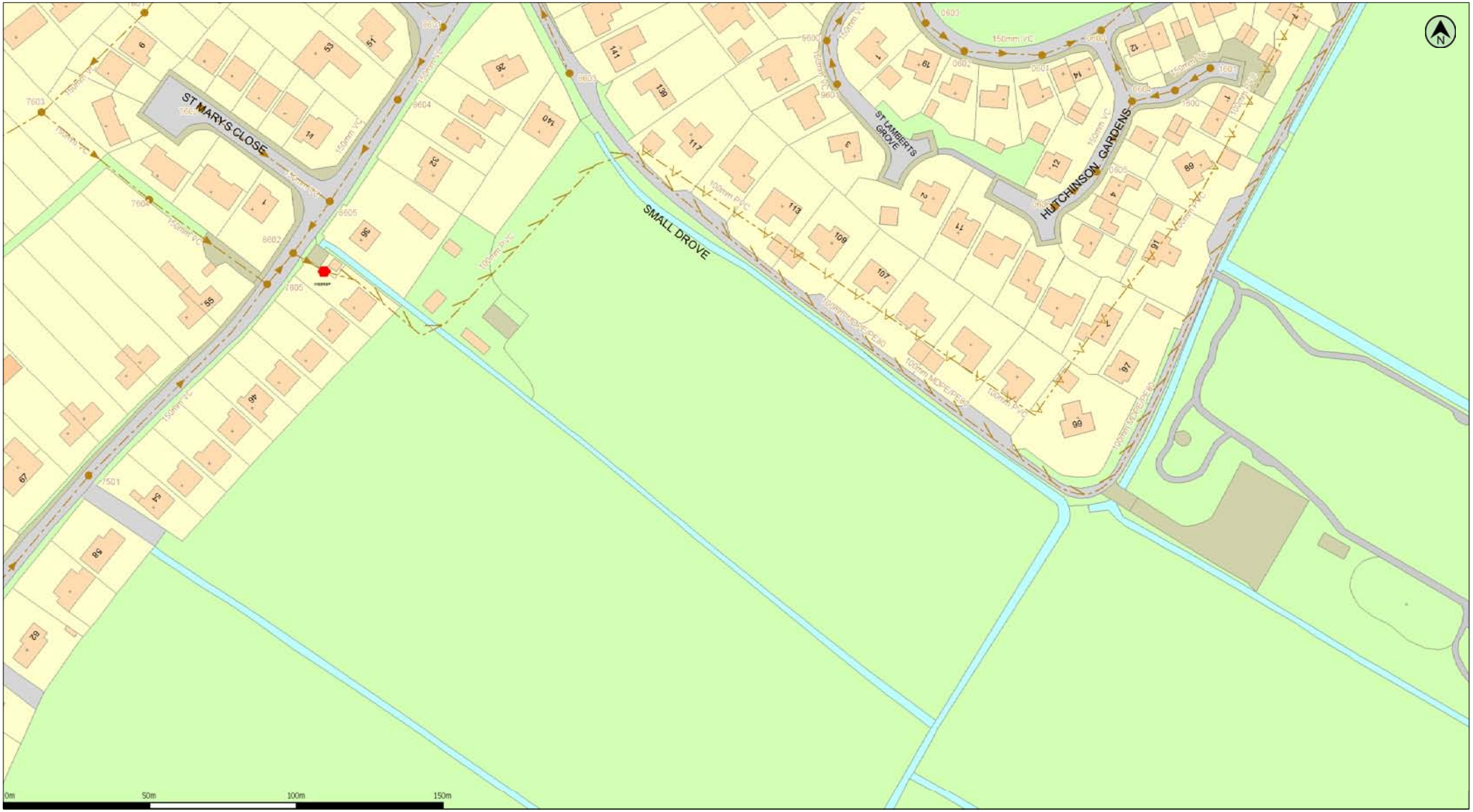
Drawing
Proposed Layout

Date	Scale	By	Drn No.	Rev
27/08/15	1:500 @ A1	MC	PL-01	

Appendix B – Consultations

Anglian Water Pre Development Enquiry Response

South Holland IDB



(c) Crown Copyright and database rights 2014 Ordnance Survey 100022432 Date: 05/06/15 Scale: 1:1250 Map Centre: 528955,324562 Data updated: 01/05/15 Our Ref: 143913 - 2 Wastewater Plan A3

This plan is provided by Anglian Water pursuant its obligations under the Water Industry Act 1991 sections 198 or 199. It must be used in conjunction with any search results attached. The information on this plan is based on data currently recorded but position must be regarded as approximate. Service pipes, private sewers and drains are generally not shown. Users of this map are strongly advised to commission their own survey of the area shown on the plan before carrying out any works. The actual position of all apparatus MUST be established by trial holes. No liability whatsoever, including liability for negligence, is accepted by Anglian Water for any error or inaccuracy or omission, including the failure to accurately record, or record at all, the location of any water main, discharge pipe, sewer or disposal main or any item of apparatus. This information is valid for the date printed. The plan is produced by Anglian Water Services Limited from Ordnance Survey © Crown Copyright, 100022432. This map is to be used for the purposes of viewing the location of Anglian Water plant only. Any other uses of the map data or further copies is not permitted. This notice is not intended to exclude or restrict liability for death or personal injury resulting from negligence.

Foul Sewer
Surface Sewer
Combined Sewer
Final Effluent
Rising Main (Colour denotes effluent type)
Private Sewer (Colour denotes effluent type)
Decommissioned Sewer (Colour denotes effluent type)
Outfall (Colour denotes effluent type)
Inlet (Colour denotes effluent type)
Manhole (Colour denotes effluent type)
Sewage Treatment Works
Pumping Station

ssmith@epstrategies.co.uk

UK15.1906

love every drop anglianwater

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert
0600	F	3.1	-0.398	3.498
0601	F	3.184	-0.199	3.383
0602	F	2.95	-0.048	2.998
0603	F	3.037	0.087	2.95
0604	F	3.06	0.276	2.784
0605	F	3.06	0.555	2.505
0606	F	2.98	0.804	2.176
1600	F	3.02	0.723	2.297
1601	F	3.14	1.21	1.93
7501	F	2.996	-0.027	3.023
7601	F	3.106	1.646	1.46
7602	F	3.23	1.92	1.31
7603	F	3.213	1.423	1.79
7604	F	3.493	1.167	2.326
7605	F	2.914	-0.485	3.399
8601	F	3.008	1.058	1.95
8602	F	-	-	-
8603	F	2.883	1.582	1.301
8604	F	3.085	0.954	2.131
8605	F	3.002	-0.65	3.652
9600	F	3.093	0.527	2.566
9601	F	3.182	0.816	2.366

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert

GROWTH PLANNING
AND EQUIVALENCE

Pre-Planning Assessment Report

Small Drove, Weston

Section 1: Proposed Development

Thank you for submitting a pre-planning enquiry. This has been produced for Millward. Your reference number is **00007392**. If you have any questions upon receipt of this report, please contact Lauren McMahon on 01733 414690 or email planningliaison@anglianwater.co.uk.

The response within this report has been based on the following information which was submitted as part of your application:

List of Planned Developments	
Type of Development	No. Of Units
C3 Dwellings	48

The anticipated residential build rate is:

Year	2015
Build Rate	48

- The grid reference for the site is TF2894124574.
- The site currently does not have planning permission and is located on a greenfield site.



Figure 1: Location of proposed development

The comments contained within this report relate to the public water mains and sewers indicated on our records. Your attention is drawn to the disclaimer in the useful information section of this report.

Section 2: Assets Affected

Our records indicate that we have the following types of assets within or overlapping the boundary of your development site as listed in the table below.

Additionally, it is highly recommended that you carry out a thorough investigation of your proposed working area to establish whether any unmapped public or private sewers and lateral drains are in existence. We are unable to permit development either over or within the easement strip without our prior consent. The extent of the easement is provided in the table below. Please be aware that the existing water mains/public sewers should be located in highway or open space and not in private gardens. This is to ensure available access for any future maintenance and repair and this should be taken into consideration when planning your site layout.

Water and Used Water Easement Information		
Asset Type	Pipe Size (mm)	Total Easement Required (m)
Public Foul Sewer	100	3m either side of the centre line

If it is not possible to avoid our assets then the water main/sewer may need to be diverted in accordance with Section 185 of the Water Industry Act (1991). We have a duty to divert our sewerage infrastructure if requested to do so although this would be at your expense. You will need to make a formal application if you would like a diversion to be considered. A copy of the section 185 diversion application form can be found at www.anglianwater.co.uk/developers

Due to the private sewer transfer in October 2011 many newly adopted public used water assets and their history are not indicated on our records. You also need to be aware that your development site may contain private water mains, drains or other assets not shown on our records. These are private assets and not the responsibility of Anglian Water but that of the landowner.

Section 3: Water Recycling Services

In examining the used water system we assess the ability for your site to connect to the public sewerage network without causing a detriment to the operation of the system. We also assess the receiving water recycling centre and determine whether the water recycling centre can cope with the increased flow and influent quality arising from your development.

Water Recycling Centre

The foul drainage from the proposed development is in the catchment of Moulton Water Recycling Centre, which currently has capacity to treat the flows from your development site. Anglian Water cannot reserve capacity and the available capacity at the water recycling centre can be reduced at any time due to growth and due to environmental and regulation driven changes.

Used Water Network

As per your request we have assessed the impact of a pumped solution to your preferred connection point. Unfortunately, there is insufficient capacity in this sewer to accommodate your site. We have therefore looked at alternative connection points and can confirm that there is capacity for a pumped solution to manhole 8602 into Broadgate at National Grid Reference (NGR) TF28802461 at a discharge rate of 3.80 l/s. Your preferred connection point at Small Drove is a rising main and connection to a rising main is not permitted. As per the current version of Sewers for Adoption, Anglian Water would wish to see an intermediate manhole constructed no closer than 5 metres from manhole 8602 for pumped connections to allow flows to gravitate.

Surface Water Disposal

There are no public surface water sewers within the vicinity of the proposed development. Therefore Anglian Water will be unable to provide the site with a feasible solution of surface water disposal within the current assets. Alternative methods of surface water disposal will need to be investigated such as infiltration techniques or a discharge to a watercourse in accordance with the surface water management hierarchy as outlined in Building Regulations Part H.A new surface water sewer can be used as a mechanism to discharge surface water to a watercourse or as part of a SuDs scheme where appropriate. Subject to the sewer being designed in accordance with the current version of Sewers For Adoption, the sewer can be put forward for adoption by Anglian Water under Section 104 of the Water Industry Act 1991. If the outfall is to a watercourse, the applicant will be required to obtain consent to discharge via the appropriate body.

As you may be aware, Anglian Water will consider the adoption of SuDs provided that they meet the criteria outline in our SuDs adoption manual. This can be found on our website at www.anglianwater.co.uk/developers/sewer-connection/suds.aspx. We will adopt features located in public open space that are designed and constructed, in conjunction

with the future SuDs Approving Body, to the criteria within our SuDs adoption manual. Specifically, developers must be able to demonstrate:

1. Effective upstream source control,
2. Effective exceedance design, and
3. Effective maintenance schedule demonstrating than the assets can be maintained both now and in the future with adequate access.

Our preference is that the Local Authority is requested to adopt in the first instance as duty will pass to them in future legislation. Consequently as part of your submission, evidence will need to be provided to show that you have approached the local authority. If you wish to look at the adoption of any SuDs then an expression of interest form can be found on our website at:
http://www.anglianwater.co.uk/_assets/media/SuDS_Adoption_Form_2012.pdf

The proposed method of surface water disposal is not relevant to Anglian Water; we suggest that you contact the future SuDS Approving Body for the area, the Environment Agency, the Internal Drainage Board.

Trade Effluent

We note that you do not have any trade effluent requirements. Should this be required in the future you will need our written formal consent. This is in accordance with Section 118 of the Water Industry Act (1991).

Used Water Budget Costs

It has been assumed that the onsite used water network will be provided under a section 104 Water Industry Act application. It is recommended that you also budget for both infrastructure charges and connection costs. The 2015/16 charges are:

Infrastructure Charge	£433.00 per connection

Please note that we offer alternative types of connections depending on your needs and these costs are available in our annual charges booklet, which can be downloaded from www.anglianwater.co.uk/developers/charges.

Section 4: Map of Proposed Connection Points

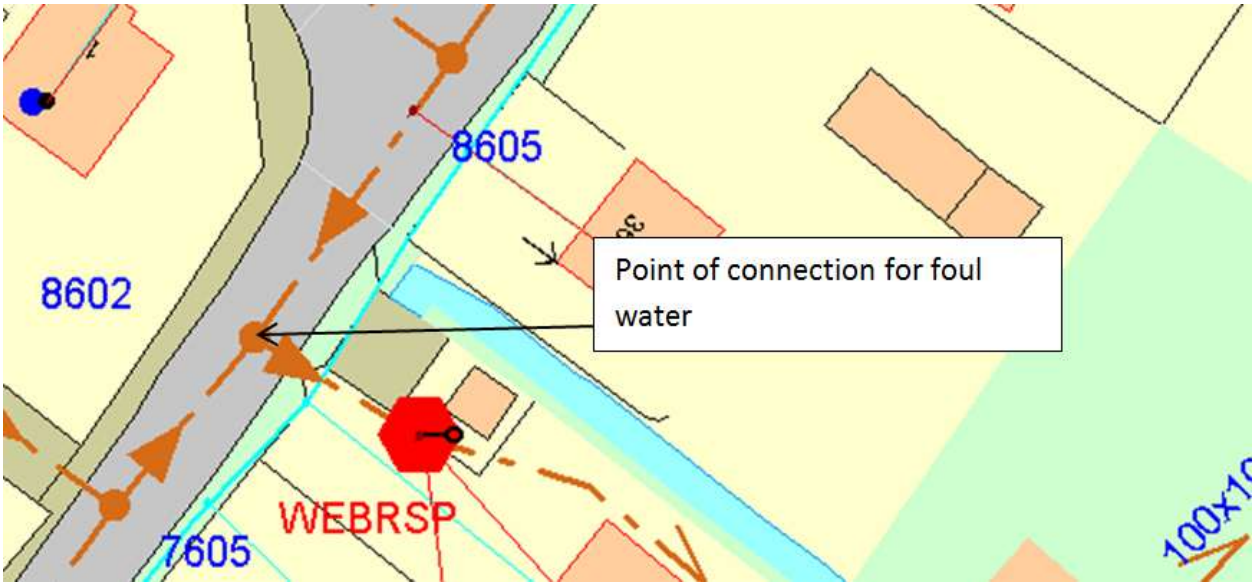


Figure 1: Showing your used water point of connection at manhole 8602

Water

Water Industry Act – Key Water Sections:

- Section 41: This provides you with the right to requisition a new water main for domestic purposes to connect your site to the public water network.
- Section 45: This provides you with the right to have a connection for domestic purposes from a building or part of a building to the public water main.
- Section 51A: This provides you with the right to provide the water main or service connection yourself and for us to vest them into our company.
- Section 55: This applies where you request a supply of water for non domestic premises.
- Section 185: This provides you with the right to make a reasonable request to have a public water main, sewer or public lateral drain removed or altered, at your expense. Details on how to make an application and the s185 form is available on our website at http://www.anglianwater.co.uk20/developers or via our Developer Services team on 08457 60 66 087.

Details on how you can make a formal application for a new water main, new connection or diversion are available on from our Developer Services team on 08457 60 66 087 or via our website at www.anglianwater.co.uk/developers

If you have any other queries on the rights to requisition or connect your housing to the public water and sewerage infrastructure then please contact our developer services team at: Developer Services, Anglian Water, PO Box 495, Huntingdon, PE29 6YY or Telephone: 0845 60 66 087 or Email: developerservices@anglianwater.co.uk

Water pressure and flow rate: The water pressure and consistency that we must meet for your site is laid out in the Water Industry Act (1991). This states that we must supply a flow rate of 9 litres per minute at a pressure of 10 metres of head to the external stop tap. If your water pressure requirements exceed this then you will need to provide and maintain any booster requirements to the development site.

Self Lay of Water Mains: A list of accredited Self Lay Organisations can be found at www.lloydsregister.co.uk/schemes/WIRS/providers-list.aspx.

Used Water

Water Industry Act – Key Used Water Sections:

- Section 98: This provides you with the right to requisition a new public sewer. The new public sewer can be constructed by Anglian Water on your behalf. Alternatively, you can construct the sewer yourself under section 30 of the Anglian Water Authority Act 1977.

- Section 102: This provides you with the right to have an existing sewerage asset vested by us. It is your responsibility to bring the infrastructure to an adoptable condition ahead of the asset being vested.
- Section 104: This provides you with the right to have a design technically vetted and an agreement reached that will see us adopt your assets following their satisfactory construction and connection to the public sewer.
- Section 106: This provides you with the right to have your constructed sewer connected to the public sewer.
- Section 185: This provides you with the right to have a public sewerage asset diverted.

Details on how to make a formal application for a new sewer, new connection or diversion are available on our website at www.anglianwater.co.uk/developers or via our Developer Services team on 08457 60 66 087.

Sustainable Drainage Systems:
Many existing urban drainage systems can cause problems of flooding, pollution or damage to the environment and are not resilient to climate change in the long term. Therefore our preferred method of surface water disposal is through the use of Sustainable Drainage Systems (SuDS). SuDS are a range of techniques that aim to mimic the way surface water drains in natural systems within urban areas. For more information on SuDS, please visit our website at http://anglianwater.co.uk/developers/sewer-connection/suds.aspx. We also recommend that you contact the future SuDS Approving Body (SAB) for the area to discuss your application.

Private Sewer Transfers: Sewers and lateral drains connected to the public sewer on the 1 July 2011 transferred into Water Company ownership on the 1 October 2011. This follows the implementation of the Floods and Water Management Act (FWMA). This included sewers and lateral drains that were subject to an existing Section 104 Adoption Agreement and those that were not. There were exemptions and the main non-transferable assets were as follows:

- Surface water sewers and lateral drains that did not discharge to the public sewer, e.g. those that discharged to a watercourse.
- Foul sewers and lateral drains that discharged to a privately owned sewage treatment/collection facility.
- Pumping stations and rising mains will transfer between 1 October 2011 and 1 October 2016.

The implementation of Section 42 of the FWMA will ensure that future private sewers will not be created. It is anticipated that all new sewer applications will need to have an approved section 104 application ahead of a section 106 connection.

Encroachment: Anglian Water operates a risk based approach to development encroaching close to our used water infrastructure. We assess the issue of encroachment if you are

planning to build within 400 metres of a water recycling centre or, within 15 metres to 100 metres of a pumping station. We have more information available on our website at http://anglianwater.co.uk/developers/encroachment.aspx

Locating our assets: Maps detailing the location of our water and used water infrastructure including both underground assets and above ground assets such as pumping stations and recycling centres are available from www.digdat.co.uk. All requests from members of the public or non-statutory bodies for maps showing the location of our assets will be subject to an appropriate administrative charge. We have more information on our website at: www.anglianwater.co.uk/developers/our-assets/

Summary of charges: A summary of this year's water and used water connection and infrastructure charges can be found at
http://www.anglianwater.co.uk/developers/charges/

Disclaimer: The information provided within this report is based on the best data currently recorded, recorded within the last 12 months or provided by a third party. The position must be regarded as approximate. If there is further development in the area or for other reasons the position may change.

The accuracy of this report is therefore not guaranteed and does not obviate the need to make additional appropriate searches, inspections and enquiries. You are advised therefore to renew your enquiry should there be a delay in submitting your application for water supply/sewer connection to re-confirm the situation.

Any cost calculations provided within the report are estimated only and may be subject to change.

The responses made in this report are based on the presumption that your proposed development obtains planning permission. Whilst this report has been prepared to help assess the viability of your proposal, it must not be considered in isolation. Anglian Water supports the plan led approach to sustainable development that is set out in the National Planning Policy Framework (NPPF). As a spatial planning statutory consultee, we assist planning authorities in the preparation of a sustainable local plan on the basis of capacity within our water and water recycling (formerly referred to as wastewater) infrastructure. Consequently, any infrastructure needs identified in this report must only be considered in the context of up to date, adopted or emerging local plans. Where local plans are absent, silent or out of date these needs should be considered against the definition of sustainability set out in the NPPF as a whole.

No liability whatsoever including liability for negligence is accepted by Anglian Water Services Limited for any error or inaccuracy or omission including the failure to accurately record or record at all, the location of any water main, discharge pipe, sewer, or drain or disposal main or any item of apparatus.

Jason McKellar

From: Dominic Morris <Dominic@wlma.org.uk>
Sent: 21 July 2015 16:49
To: Jason McKellar
Subject: FW: Small Drove Weston - PE12 6HU - Proposed Residential Development 48 units
Attachments: Weston - site location.jpg; Weston Development.pdf

Importance: High

Follow Up Flag: Follow up
Flag Status: Completed

Jason

Please see plan attached showing the Board's Delgate Drain North watercourse the nearest to the site. As you can see the surface water will have to flow through the Riparian watercourses before it gets to the Board's watercourse. These watercourses may require improving and you will require consent from the adjacent landowners to increase the flow through these watercourses. From experience the land around the proposed development and generally the Weston area drains steadily so any additional surface water that is a draining into these watercourse may cause a concern if increased above greenfield rates. However, the Board would consider accepting the 5l/s/ha subject to a survey and design being carried out on the existing Riparian watercourse and consent being obtained by the landowners.

LCC are the Local Lead Flood Authority and they will have to approve any drainage design for the propose development and they will consult the Board on the design and if the Board are acceptable for additional flows to enter their drainage system.

The Board would charge a Surface Water Development Contribution which is currently £7.40 a square metre for the impermeable surface created from the development draining into the Boards catchment. This payment will be reduced down to 20% of the fee payable due to the flow rate being restricted.

I would also suggest that an access strip is left adjacent to each watercourses on the development to allow sufficient room for maintenance.

Please let me know if you require further assistance with this matter.

Regards

Dom

From: Jason McKellar [mailto:jason@millward.co.uk]
Sent: 21 July 2015 10:16
To: Karl Vines <Karl@wlma.org.uk>
Subject: Small Drove Weston - PE12 6HU - Proposed Residential Development 48 units
Importance: High

Dear Sir,

We are looking at a proposed development in Weston (Postcode PE12 6HU) as per the attached location plan. We understand this site is within the South Holland IDB area but are enquiring on the limits of IDB adopted watercourses / ditches in this area. I have looked on line but can't seem to locate a plan showing this.

In terms of the development if the site is adjacent to adopted ditches then we enquire what the maintenance access width would be bearing in mind there would be free access from the adjacent land to these ditches (if they are IDB maintained).

We have calculated the Greenfield run off rate using ICP SUDS QBAR which confirms for the site area (1.77ha) the run off rate is 2.5l/s (equivalent to 1.4 l/s/ha). However, in terms of outfall, rates we would be looking at 5 l/s maximum discharge rate for the site up to and including the 1 in 100 plus 30% climate change event. This is the minimum rate we can readily achieve with a hydrobrake (as the site drainage will be adopted by Anglian Water and we need to meet adoption requirements for the hydrobrake 80mm orifice). The ICP SUDS return period flood at the 1 in 30 year event for this site is 5.9 l/s and 1 in 100 is 8.8 l/s.

Our proposed discharge rate is lower than the 1 in 30 and 1 in 100 greenfield rates and therefore we would be looking at providing betterment in the higher storm events when the watercourses are at great risk of flooding.

Infiltration is not viable as the ground is superficial deposits of silts and clays with bedrock of mudstone and siltstone, hence watercourse outfall is the next option we are looking at.

I look forward to hearing from you. If there is anyhting at all that you wish to discuss then please do not hesitate in contacting me.

Jason McKellar AMIHE
Associate

t 0115 941 4560 w www.millward.co.uk
a no.1 malin hill, nottingham, ng1 1jq



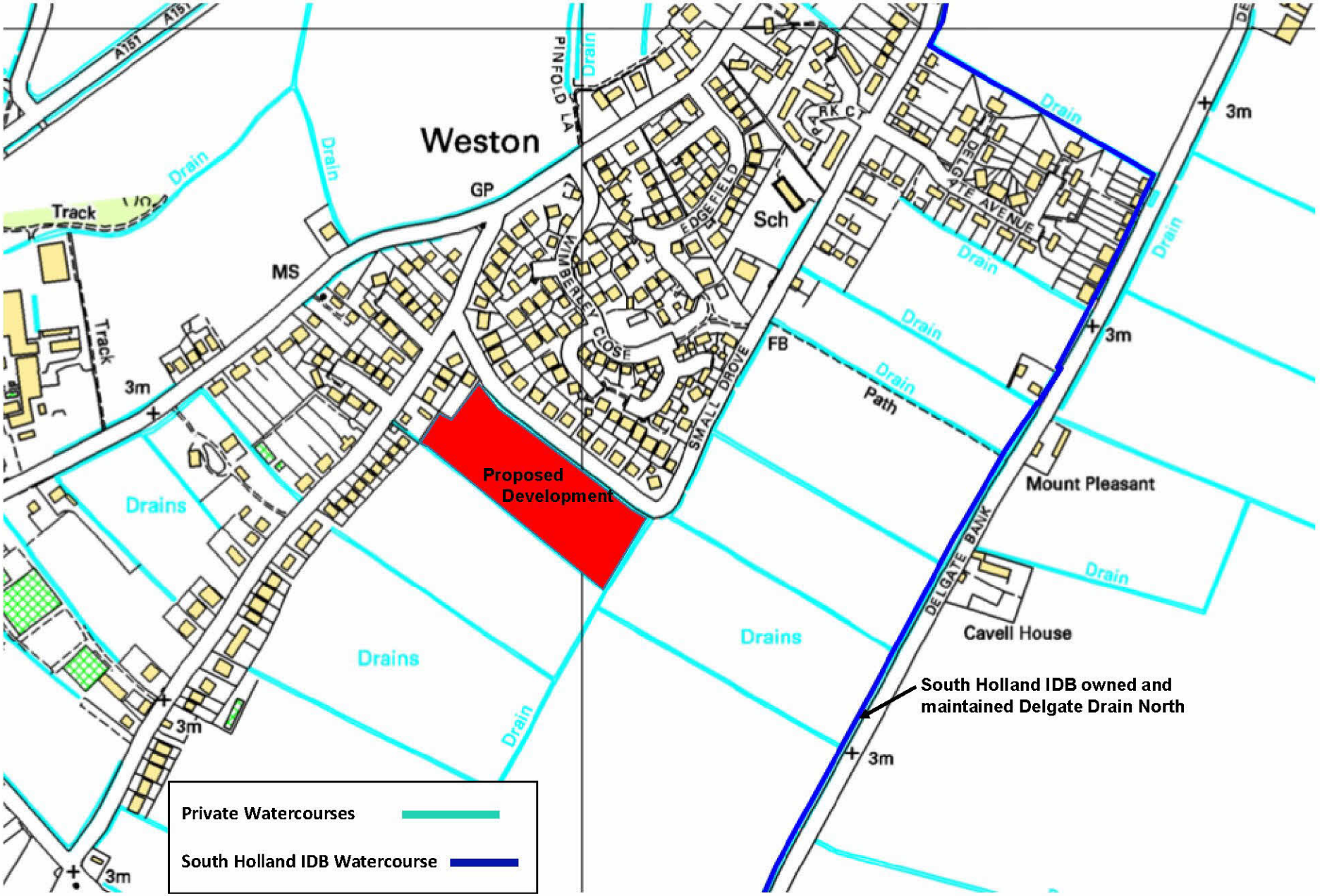
The Millward Partnership Registered in England No: 4079805 no. 1 Malin Hill, Nottingham, NG1 1JQ

This email and any files transmitted with it are confidential and intended solely for the use of the individual to whom they are addressed. If an addressing or transmission error has misdirected this e-mail, please notify the author by replying to this e-mail. If you are not the intended recipient you must not use, disclose, copy, print or rely on this e-mail.

The Millward Partnership aims to prevent the propagation of viruses, but cannot guarantee that this email is virus free. You are advised to scan all attachments and open them at your own risk.

Scanned by **MailMarshal** - Marshal's comprehensive email content security solution. Download a free evaluation of MailMarshal at www.marshal.com

---


A151
Weston
PINFOLD LA
Drain
RK C
GP
Sch
EDGEFIELD
DELGATE AVENUE
Track
MS
WIMBERLEY CLOSE
SMALL DROVE
FB
Path
3m
Proposed Development
Drains
Mount Pleasant
DELGATE BANK
Cavell House
South Holland IDB owned and maintained Delgate Drain North
Private Watercourses
South Holland IDB Watercourse

Appendix C – WinDES Calculation Results

ICP SUDS Greenfield Run Off Calculation

Preliminary Surface Water Drainage Calculations

ICP SUDS Mean Annual Flood

Input

Return Period (years)	1	Soil	0.300
Area (ha)	1.810	Urban	0.000
SAAR (mm)	557	Region Number	Region 5

Results l/s

QBAR Rural	2.5
QBAR Urban	2.5
Q1 year	2.2
Q1 year	2.2
Q30 years	6.1
Q100 years	9.0

©1982-2010 Micro Drainage Ltd

Cascade Summary of Results for MA10147 PP01 1 year.srcx

Upstream Structures	Outflow To	Overflow To
(None)	MA10147 PP05 Optimum 1 year.srcx	(None)

Half Drain Time : 3 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	2.522	0.022	0.0	1.7	1.7	0.3	O K
30 min Summer	2.528	0.028	0.0	1.8	1.8	0.4	O K
60 min Summer	2.528	0.028	0.0	1.8	1.8	0.4	O K
120 min Summer	2.521	0.021	0.0	1.7	1.7	0.2	O K
180 min Summer	2.514	0.014	0.0	1.5	1.5	0.1	O K
240 min Summer	2.508	0.008	0.0	1.3	1.3	0.0	O K
360 min Summer	2.500	0.000	0.0	1.0	1.0	0.0	O K
480 min Summer	2.500	0.000	0.0	0.8	0.8	0.0	O K
600 min Summer	2.500	0.000	0.0	0.7	0.7	0.0	O K
720 min Summer	2.500	0.000	0.0	0.6	0.6	0.0	O K
960 min Summer	2.500	0.000	0.0	0.5	0.5	0.0	O K
1440 min Summer	2.500	0.000	0.0	0.4	0.4	0.0	O K
2160 min Summer	2.500	0.000	0.0	0.3	0.3	0.0	O K
2880 min Summer	2.500	0.000	0.0	0.2	0.2	0.0	O K
4320 min Summer	2.500	0.000	0.0	0.2	0.2	0.0	O K
5760 min Summer	2.500	0.000	0.0	0.1	0.1	0.0	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
15 min Summer	29.381	19
30 min Summer	19.105	27
60 min Summer	12.084	42
120 min Summer	7.489	72
180 min Summer	5.634	100
240 min Summer	4.599	130
360 min Summer	3.448	0
480 min Summer	2.794	0
600 min Summer	2.373	0
720 min Summer	2.077	0
960 min Summer	1.683	0
1440 min Summer	1.252	0
2160 min Summer	0.932	0
2880 min Summer	0.756	0
4320 min Summer	0.562	0
5760 min Summer	0.455	0

©1982-2010 Micro Drainage Ltd

Cascade Summary of Results for MA10147 PP01 1 year.srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
7200 min Summer	2.500	0.000	0.0	0.1	0.1	0.0	O K
8640 min Summer	2.500	0.000	0.0	0.1	0.1	0.0	O K
10080 min Summer	2.500	0.000	0.0	0.1	0.1	0.0	O K
15 min Winter	2.527	0.027	0.0	1.8	1.8	0.4	O K
30 min Winter	2.532	0.032	0.0	1.9	1.9	0.5	O K
60 min Winter	2.528	0.028	0.0	1.8	1.8	0.4	O K
120 min Winter	2.516	0.016	0.0	1.5	1.5	0.1	O K
180 min Winter	2.505	0.005	0.0	1.2	1.2	0.0	O K
240 min Winter	2.500	0.000	0.0	1.0	1.0	0.0	O K
360 min Winter	2.500	0.000	0.0	0.8	0.8	0.0	O K
480 min Winter	2.500	0.000	0.0	0.6	0.6	0.0	O K
600 min Winter	2.500	0.000	0.0	0.5	0.5	0.0	O K
720 min Winter	2.500	0.000	0.0	0.5	0.5	0.0	O K
960 min Winter	2.500	0.000	0.0	0.4	0.4	0.0	O K
1440 min Winter	2.500	0.000	0.0	0.3	0.3	0.0	O K
2160 min Winter	2.500	0.000	0.0	0.2	0.2	0.0	O K
2880 min Winter	2.500	0.000	0.0	0.2	0.2	0.0	O K
4320 min Winter	2.500	0.000	0.0	0.1	0.1	0.0	O K
5760 min Winter	2.500	0.000	0.0	0.1	0.1	0.0	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
7200 min Summer	0.387	0
8640 min Summer	0.339	0
10080 min Summer	0.303	0
15 min Winter	29.381	19
30 min Winter	19.105	27
60 min Winter	12.084	42
120 min Winter	7.489	72
180 min Winter	5.634	98
240 min Winter	4.599	0
360 min Winter	3.448	0
480 min Winter	2.794	0
600 min Winter	2.373	0
720 min Winter	2.077	0
960 min Winter	1.683	0
1440 min Winter	1.252	0
2160 min Winter	0.932	0
2880 min Winter	0.756	0
4320 min Winter	0.562	0
5760 min Winter	0.455	0

©1982-2010 Micro Drainage Ltd

Cascade Summary of Results for MA10147 PP01 1 year.srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
7200 min Winter	2.500	0.000	0.0	0.1	0.1	0.0	O K
8640 min Winter	2.500	0.000	0.0	0.1	0.1	0.0	O K
10080 min Winter	2.500	0.000	0.0	0.1	0.1	0.0	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
7200 min Winter	0.387	0
8640 min Winter	0.339	0
10080 min Winter	0.303	0

©1982-2010 Micro Drainage Ltd

Cascade Summary of Results for MA10147 PP02 1 year.srcx

Upstream Structures	Outflow To	Overflow To
(None)	MA10147 PP05 Optimum 1 year.srcx	(None)

Half Drain Time : 55 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	2.153	0.053	0.0	1.6	1.6	5.0	O K
30 min Summer	2.165	0.065	0.0	1.6	1.6	7.0	O K
60 min Summer	2.174	0.074	0.0	1.6	1.6	8.4	O K
120 min Summer	2.177	0.077	0.0	1.6	1.6	9.0	O K
180 min Summer	2.176	0.076	0.0	1.6	1.6	8.8	O K
240 min Summer	2.173	0.073	0.0	1.6	1.6	8.3	O K
360 min Summer	2.166	0.066	0.0	1.6	1.6	7.2	O K
480 min Summer	2.159	0.059	0.0	1.6	1.6	6.0	O K
600 min Summer	2.153	0.053	0.0	1.6	1.6	4.9	O K
720 min Summer	2.147	0.047	0.0	1.6	1.6	3.9	O K
960 min Summer	2.136	0.036	0.0	1.5	1.5	2.3	O K
1440 min Summer	2.116	0.016	0.0	1.5	1.5	0.4	O K
2160 min Summer	2.100	0.000	0.0	1.2	1.2	0.0	O K
2880 min Summer	2.100	0.000	0.0	1.0	1.0	0.0	O K
4320 min Summer	2.100	0.000	0.0	0.7	0.7	0.0	O K
5760 min Summer	2.100	0.000	0.0	0.6	0.6	0.0	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
15 min Summer	29.381	23
30 min Summer	19.105	35
60 min Summer	12.084	58
120 min Summer	7.489	92
180 min Summer	5.634	126
240 min Summer	4.599	160
360 min Summer	3.448	228
480 min Summer	2.794	292
600 min Summer	2.373	356
720 min Summer	2.077	416
960 min Summer	1.683	532
1440 min Summer	1.252	752
2160 min Summer	0.932	0
2880 min Summer	0.756	0
4320 min Summer	0.562	0
5760 min Summer	0.455	0

©1982-2010 Micro Drainage Ltd

Cascade Summary of Results for MA10147 PP02 1 year.srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
7200 min Summer	2.100	0.000	0.0	0.5	0.5	0.0	O K
8640 min Summer	2.100	0.000	0.0	0.4	0.4	0.0	O K
10080 min Summer	2.100	0.000	0.0	0.4	0.4	0.0	O K
15 min Winter	2.159	0.059	0.0	1.6	1.6	6.0	O K
30 min Winter	2.173	0.073	0.0	1.6	1.6	8.3	O K
60 min Winter	2.183	0.083	0.0	1.6	1.6	10.0	O K
120 min Winter	2.186	0.086	0.0	1.6	1.6	10.5	O K
180 min Winter	2.183	0.083	0.0	1.6	1.6	10.1	O K
240 min Winter	2.179	0.079	0.0	1.6	1.6	9.3	O K
360 min Winter	2.168	0.068	0.0	1.6	1.6	7.4	O K
480 min Winter	2.156	0.056	0.0	1.6	1.6	5.5	O K
600 min Winter	2.147	0.047	0.0	1.6	1.6	3.8	O K
720 min Winter	2.137	0.037	0.0	1.5	1.5	2.5	O K
960 min Winter	2.117	0.017	0.0	1.5	1.5	0.5	O K
1440 min Winter	2.100	0.000	0.0	1.2	1.2	0.0	O K
2160 min Winter	2.100	0.000	0.0	0.9	0.9	0.0	O K
2880 min Winter	2.100	0.000	0.0	0.7	0.7	0.0	O K
4320 min Winter	2.100	0.000	0.0	0.5	0.5	0.0	O K
5760 min Winter	2.100	0.000	0.0	0.4	0.4	0.0	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
7200 min Summer	0.387	0
8640 min Summer	0.339	0
10080 min Summer	0.303	0
15 min Winter	29.381	23
30 min Winter	19.105	35
60 min Winter	12.084	60
120 min Winter	7.489	98
180 min Winter	5.634	136
240 min Winter	4.599	174
360 min Winter	3.448	244
480 min Winter	2.794	310
600 min Winter	2.373	372
720 min Winter	2.077	430
960 min Winter	1.683	530
1440 min Winter	1.252	0
2160 min Winter	0.932	0
2880 min Winter	0.756	0
4320 min Winter	0.562	0
5760 min Winter	0.455	0

©1982-2010 Micro Drainage Ltd

Cascade Summary of Results for MA10147 PP02 1 year.srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
7200 min Winter	2.100	0.000	0.0	0.4	0.4	0.0	O K
8640 min Winter	2.100	0.000	0.0	0.3	0.3	0.0	O K
10080 min Winter	2.100	0.000	0.0	0.3	0.3	0.0	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
7200 min Winter	0.387	0
8640 min Winter	0.339	0
10080 min Winter	0.303	0

©1982-2010 Micro Drainage Ltd

Cascade Summary of Results for MA10147 PP03 1 year.srcx

Upstream Structures	Outflow To	Overflow To
(None)	MA10147 PP05 Optimum 1 year.srcx	(None)

Half Drain Time : 1 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	2.141	0.041	0.0	10.3	10.3	0.6	O K
30 min Summer	2.149	0.049	0.0	10.4	10.4	0.9	O K
60 min Summer	2.137	0.037	0.0	10.2	10.2	0.5	O K
120 min Summer	2.100	0.000	0.0	8.9	8.9	0.0	O K
180 min Summer	2.100	0.000	0.0	7.1	7.1	0.0	O K
240 min Summer	2.100	0.000	0.0	6.0	6.0	0.0	O K
360 min Summer	2.100	0.000	0.0	4.7	4.7	0.0	O K
480 min Summer	2.100	0.000	0.0	3.8	3.8	0.0	O K
600 min Summer	2.100	0.000	0.0	3.3	3.3	0.0	O K
720 min Summer	2.100	0.000	0.0	2.9	2.9	0.0	O K
960 min Summer	2.100	0.000	0.0	2.3	2.3	0.0	O K
1440 min Summer	2.100	0.000	0.0	1.7	1.7	0.0	O K
2160 min Summer	2.100	0.000	0.0	1.3	1.3	0.0	O K
2880 min Summer	2.100	0.000	0.0	1.0	1.0	0.0	O K
4320 min Summer	2.100	0.000	0.0	0.8	0.8	0.0	O K
5760 min Summer	2.100	0.000	0.0	0.6	0.6	0.0	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
15 min Summer	29.381	18
30 min Summer	19.105	25
60 min Summer	12.084	40
120 min Summer	7.489	0
180 min Summer	5.634	0
240 min Summer	4.599	0
360 min Summer	3.448	0
480 min Summer	2.794	0
600 min Summer	2.373	0
720 min Summer	2.077	0
960 min Summer	1.683	0
1440 min Summer	1.252	0
2160 min Summer	0.932	0
2880 min Summer	0.756	0
4320 min Summer	0.562	0
5760 min Summer	0.455	0

©1982-2010 Micro Drainage Ltd

Cascade Summary of Results for MA10147 PP03 1 year.srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
7200 min Summer	2.100	0.000	0.0	0.5	0.5	0.0	O K
8640 min Summer	2.100	0.000	0.0	0.5	0.5	0.0	O K
10080 min Summer	2.100	0.000	0.0	0.4	0.4	0.0	O K
15 min Winter	2.155	0.055	0.0	10.5	10.5	1.1	O K
30 min Winter	2.159	0.059	0.0	10.6	10.6	1.3	O K
60 min Winter	2.128	0.028	0.0	10.0	10.0	0.3	O K
120 min Winter	2.100	0.000	0.0	7.3	7.3	0.0	O K
180 min Winter	2.100	0.000	0.0	5.6	5.6	0.0	O K
240 min Winter	2.100	0.000	0.0	4.6	4.6	0.0	O K
360 min Winter	2.100	0.000	0.0	3.5	3.5	0.0	O K
480 min Winter	2.100	0.000	0.0	2.8	2.8	0.0	O K
600 min Winter	2.100	0.000	0.0	2.4	2.4	0.0	O K
720 min Winter	2.100	0.000	0.0	2.1	2.1	0.0	O K
960 min Winter	2.100	0.000	0.0	1.7	1.7	0.0	O K
1440 min Winter	2.100	0.000	0.0	1.2	1.2	0.0	O K
2160 min Winter	2.100	0.000	0.0	0.9	0.9	0.0	O K
2880 min Winter	2.100	0.000	0.0	0.7	0.7	0.0	O K
4320 min Winter	2.100	0.000	0.0	0.5	0.5	0.0	O K
5760 min Winter	2.100	0.000	0.0	0.4	0.4	0.0	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
7200 min Summer	0.387	0
8640 min Summer	0.339	0
10080 min Summer	0.303	0
15 min Winter	29.381	18
30 min Winter	19.105	26
60 min Winter	12.084	40
120 min Winter	7.489	0
180 min Winter	5.634	0
240 min Winter	4.599	0
360 min Winter	3.448	0
480 min Winter	2.794	0
600 min Winter	2.373	0
720 min Winter	2.077	0
960 min Winter	1.683	0
1440 min Winter	1.252	0
2160 min Winter	0.932	0
2880 min Winter	0.756	0
4320 min Winter	0.562	0
5760 min Winter	0.455	0

©1982-2010 Micro Drainage Ltd

Cascade Summary of Results for MA10147 PP03 1 year.srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
7200 min Winter	2.100	0.000	0.0	0.4	0.4	0.0	O K
8640 min Winter	2.100	0.000	0.0	0.3	0.3	0.0	O K
10080 min Winter	2.100	0.000	0.0	0.3	0.3	0.0	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
7200 min Winter	0.387	0
8640 min Winter	0.339	0
10080 min Winter	0.303	0

©1982-2010 Micro Drainage Ltd

Cascade Summary of Results for MA10147 PP04 1 year.srcx

Upstream Structures	Outflow To	Overflow To
(None)	MA10147 PP05 Optimum 1 year.srcx	(None)

Half Drain Time : 0 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	2.100	0.000	0.0	10.4	10.4	0.0	O K
30 min Summer	2.108	0.008	0.0	10.6	10.6	0.0	O K
60 min Summer	2.100	0.000	0.0	9.8	9.8	0.0	O K
120 min Summer	2.100	0.000	0.0	7.5	7.5	0.0	O K
180 min Summer	2.100	0.000	0.0	6.0	6.0	0.0	O K
240 min Summer	2.100	0.000	0.0	5.1	5.1	0.0	O K
360 min Summer	2.100	0.000	0.0	3.9	3.9	0.0	O K
480 min Summer	2.100	0.000	0.0	3.2	3.2	0.0	O K
600 min Summer	2.100	0.000	0.0	2.8	2.8	0.0	O K
720 min Summer	2.100	0.000	0.0	2.4	2.4	0.0	O K
960 min Summer	2.100	0.000	0.0	2.0	2.0	0.0	O K
1440 min Summer	2.100	0.000	0.0	1.5	1.5	0.0	O K
2160 min Summer	2.100	0.000	0.0	1.1	1.1	0.0	O K
2880 min Summer	2.100	0.000	0.0	0.9	0.9	0.0	O K
4320 min Summer	2.100	0.000	0.0	0.7	0.7	0.0	O K
5760 min Summer	2.100	0.000	0.0	0.5	0.5	0.0	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
15 min Summer	29.381	0
30 min Summer	19.105	22
60 min Summer	12.084	0
120 min Summer	7.489	0
180 min Summer	5.634	0
240 min Summer	4.599	0
360 min Summer	3.448	0
480 min Summer	2.794	0
600 min Summer	2.373	0
720 min Summer	2.077	0
960 min Summer	1.683	0
1440 min Summer	1.252	0
2160 min Summer	0.932	0
2880 min Summer	0.756	0
4320 min Summer	0.562	0
5760 min Summer	0.455	0

©1982-2010 Micro Drainage Ltd

Cascade Summary of Results for MA10147 PP04 1 year.srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
7200 min Summer	2.100	0.000	0.0	0.4	0.4	0.0	O K
8640 min Summer	2.100	0.000	0.0	0.4	0.4	0.0	O K
10080 min Summer	2.100	0.000	0.0	0.3	0.3	0.0	O K
15 min Winter	2.124	0.024	0.0	10.9	10.9	0.2	O K
30 min Winter	2.122	0.022	0.0	10.9	10.9	0.2	O K
60 min Winter	2.100	0.000	0.0	9.2	9.2	0.0	O K
120 min Winter	2.100	0.000	0.0	6.2	6.2	0.0	O K
180 min Winter	2.100	0.000	0.0	4.7	4.7	0.0	O K
240 min Winter	2.100	0.000	0.0	3.9	3.9	0.0	O K
360 min Winter	2.100	0.000	0.0	2.9	2.9	0.0	O K
480 min Winter	2.100	0.000	0.0	2.4	2.4	0.0	O K
600 min Winter	2.100	0.000	0.0	2.0	2.0	0.0	O K
720 min Winter	2.100	0.000	0.0	1.8	1.8	0.0	O K
960 min Winter	2.100	0.000	0.0	1.4	1.4	0.0	O K
1440 min Winter	2.100	0.000	0.0	1.1	1.1	0.0	O K
2160 min Winter	2.100	0.000	0.0	0.8	0.8	0.0	O K
2880 min Winter	2.100	0.000	0.0	0.6	0.6	0.0	O K
4320 min Winter	2.100	0.000	0.0	0.5	0.5	0.0	O K
5760 min Winter	2.100	0.000	0.0	0.4	0.4	0.0	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
7200 min Summer	0.387	0
8640 min Summer	0.339	0
10080 min Summer	0.303	0
15 min Winter	29.381	16
30 min Winter	19.105	23
60 min Winter	12.084	0
120 min Winter	7.489	0
180 min Winter	5.634	0
240 min Winter	4.599	0
360 min Winter	3.448	0
480 min Winter	2.794	0
600 min Winter	2.373	0
720 min Winter	2.077	0
960 min Winter	1.683	0
1440 min Winter	1.252	0
2160 min Winter	0.932	0
2880 min Winter	0.756	0
4320 min Winter	0.562	0
5760 min Winter	0.455	0

©1982-2010 Micro Drainage Ltd

Cascade Summary of Results for MA10147 PP04 1 year.srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
7200 min Winter	2.100	0.000	0.0	0.3	0.3	0.0	O K
8640 min Winter	2.100	0.000	0.0	0.3	0.3	0.0	O K
10080 min Winter	2.100	0.000	0.0	0.2	0.2	0.0	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
7200 min Winter	0.387	0
8640 min Winter	0.339	0
10080 min Winter	0.303	0

©1982-2010 Micro Drainage Ltd

Cascade Summary of Results for MA10147 PP05 Optimum 1 year.srcx

Upstream Structures	Outflow To	Overflow To
MA10147 PP01 1 year.srcx MA10147 PP02 1 year.srcx MA10147 PP03 1 year.srcx MA10147 PP04 1 year.srcx	MA10147 Pond 1 year alternative HB test.srcx	(None)

Half Drain Time : 67 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	2.272	0.172	0.0	3.6	3.6	30.9	O K
30 min Summer	2.303	0.203	0.0	6.8	6.8	43.3	O K
60 min Summer	2.326	0.226	0.0	9.5	9.5	53.8	O K
120 min Summer	2.341	0.241	0.0	11.1	11.1	60.9	O K
180 min Summer	2.348	0.248	0.0	11.9	11.9	64.7	O K
240 min Summer	2.352	0.252	0.0	12.3	12.3	66.5	O K
360 min Summer	2.353	0.253	0.0	12.4	12.4	67.2	O K
480 min Summer	2.350	0.250	0.0	12.1	12.1	65.7	O K
600 min Summer	2.347	0.247	0.0	11.7	11.7	63.8	O K
720 min Summer	2.343	0.243	0.0	11.3	11.3	61.8	O K
960 min Summer	2.335	0.235	0.0	10.4	10.4	57.9	O K
1440 min Summer	2.322	0.222	0.0	9.0	9.0	51.7	O K
2160 min Summer	2.307	0.207	0.0	7.3	7.3	45.0	O K
2880 min Summer	2.297	0.197	0.0	6.1	6.1	40.5	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
15 min Summer	29.381	26
30 min Summer	19.105	37
60 min Summer	12.084	62
120 min Summer	7.489	90
180 min Summer	5.634	124
240 min Summer	4.599	156
360 min Summer	3.448	222
480 min Summer	2.794	286
600 min Summer	2.373	346
720 min Summer	2.077	408
960 min Summer	1.683	530
1440 min Summer	1.252	770
2160 min Summer	0.932	1128
2880 min Summer	0.756	1484

©1982-2010 Micro Drainage Ltd

Cascade Summary of Results for MA10147 PP05 Optimum 1 year.srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
4320 min Summer	2.283	0.183	0.0	4.7	4.7	35.3	O K
5760 min Summer	2.274	0.174	0.0	3.8	3.8	31.8	O K
7200 min Summer	2.268	0.168	0.0	3.3	3.3	29.6	O K
8640 min Summer	2.263	0.163	0.0	2.9	2.9	27.9	O K
10080 min Summer	2.259	0.159	0.0	2.5	2.5	26.6	O K
15 min Winter	2.287	0.187	0.0	5.0	5.0	36.6	O K
30 min Winter	2.318	0.218	0.0	8.6	8.6	50.1	O K
60 min Winter	2.343	0.243	0.0	11.3	11.3	61.7	O K
120 min Winter	2.356	0.256	0.0	12.7	12.7	69.0	O K
180 min Winter	2.361	0.261	0.0	13.2	13.2	71.4	O K
240 min Winter	2.361	0.261	0.0	13.3	13.3	71.6	O K
360 min Winter	2.357	0.257	0.0	12.8	12.8	69.3	O K
480 min Winter	2.350	0.250	0.0	12.1	12.1	65.6	O K
600 min Winter	2.343	0.243	0.0	11.4	11.4	62.1	O K
720 min Winter	2.337	0.237	0.0	10.6	10.6	58.9	O K
960 min Winter	2.326	0.226	0.0	9.5	9.5	53.7	O K
1440 min Winter	2.309	0.209	0.0	7.5	7.5	45.9	O K
2160 min Winter	2.293	0.193	0.0	5.7	5.7	39.1	O K
2880 min Winter	2.283	0.183	0.0	4.7	4.7	35.2	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
4320 min Summer	0.562	2208
5760 min Summer	0.455	2944
7200 min Summer	0.387	3672
8640 min Summer	0.339	4408
10080 min Summer	0.303	5136
15 min Winter	29.381	25
30 min Winter	19.105	37
60 min Winter	12.084	60
120 min Winter	7.489	96
180 min Winter	5.634	132
240 min Winter	4.599	166
360 min Winter	3.448	234
480 min Winter	2.794	298
600 min Winter	2.373	360
720 min Winter	2.077	422
960 min Winter	1.683	542
1440 min Winter	1.252	778
2160 min Winter	0.932	1132
2880 min Winter	0.756	1504

©1982-2010 Micro Drainage Ltd

Cascade Summary of Results for MA10147 PP05 Optimum 1 year.srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
4320 min Winter	2.270	0.170	0.0	3.4	3.4	30.3	O K
5760 min Winter	2.262	0.162	0.0	2.8	2.8	27.7	O K
7200 min Winter	2.257	0.157	0.0	2.4	2.4	25.7	O K
8640 min Winter	2.252	0.152	0.0	2.0	2.0	24.3	O K
10080 min Winter	2.249	0.149	0.0	1.8	1.8	23.3	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
4320 min Winter	0.562	2248
5760 min Winter	0.455	2944
7200 min Winter	0.387	3672
8640 min Winter	0.339	4400
10080 min Winter	0.303	5136

©1982-2010 Micro Drainage Ltd

Cascade Summary of Results for MA10147 Pond 1 year alternative HB test.srcx

Upstream Structures	Outflow To	Overflow To
MA10147 PP05 Optimum 1 year.srcx MA10147 PP01 1 year.srcx MA10147 PP02 1 year.srcx MA10147 PP03 1 year.srcx MA10147 PP04 1 year.srcx	(None)	(None)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m^3)	Status
15 min Summer	1.751	0.051	1.0	13.0	O K
30 min Summer	1.788	0.088	1.8	22.9	O K
60 min Summer	1.837	0.137	2.2	36.5	O K
120 min Summer	1.899	0.199	2.2	54.4	O K
180 min Summer	1.942	0.242	2.2	67.1	O K
240 min Summer	1.973	0.273	2.2	76.6	O K
360 min Summer	2.015	0.315	2.2	89.9	O K
480 min Summer	2.037	0.337	2.3	97.3	O K
600 min Summer	2.049	0.349	2.3	101.1	O K
720 min Summer	2.055	0.355	2.3	103.2	O K
960 min Summer	2.063	0.363	2.3	106.0	O K
1440 min Summer	2.067	0.367	2.3	107.3	O K
2160 min Summer	2.057	0.357	2.3	103.7	O K
2880 min Summer	2.037	0.337	2.3	97.1	O K
4320 min Summer	1.985	0.285	2.2	80.7	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
15 min Summer	29.381	156
30 min Summer	19.105	158
60 min Summer	12.084	192
120 min Summer	7.489	250
180 min Summer	5.634	298
240 min Summer	4.599	340
360 min Summer	3.448	424
480 min Summer	2.794	512
600 min Summer	2.373	608
720 min Summer	2.077	670
960 min Summer	1.683	792
1440 min Summer	1.252	1052
2160 min Summer	0.932	1448
2880 min Summer	0.756	1852
4320 min Summer	0.562	2624

©1982-2010 Micro Drainage Ltd

Cascade Summary of Results for MA10147 Pond 1 year alternative HB test.srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
5760 min Summer	1.933	0.233	2.2	64.4	O K
7200 min Summer	1.886	0.186	2.2	50.5	O K
8640 min Summer	1.852	0.152	2.2	40.6	O K
10080 min Summer	1.828	0.128	2.1	34.0	O K
15 min Winter	1.766	0.066	1.3	17.0	O K
30 min Winter	1.809	0.109	2.0	28.6	O K
60 min Winter	1.868	0.168	2.2	45.3	O K
120 min Winter	1.941	0.241	2.2	66.8	O K
180 min Winter	1.987	0.287	2.2	81.3	O K
240 min Winter	2.021	0.321	2.3	92.0	O K
360 min Winter	2.066	0.366	2.3	106.9	O K
480 min Winter	2.092	0.392	2.4	115.5	O K
600 min Winter	2.105	0.405	2.4	120.2	O K
720 min Winter	2.112	0.412	2.4	122.3	O K
960 min Winter	2.115	0.415	2.5	123.3	O K
1440 min Winter	2.110	0.410	2.4	121.6	O K
2160 min Winter	2.083	0.383	2.4	112.4	O K
2880 min Winter	2.046	0.346	2.3	100.2	O K
4320 min Winter	1.961	0.261	2.2	73.0	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
5760 min Summer	0.455	3360
7200 min Summer	0.387	4040
8640 min Summer	0.339	4696
10080 min Summer	0.303	5376
15 min Winter	29.381	147
30 min Winter	19.105	164
60 min Winter	12.084	204
120 min Winter	7.489	266
180 min Winter	5.634	312
240 min Winter	4.599	352
360 min Winter	3.448	432
480 min Winter	2.794	516
600 min Winter	2.373	610
720 min Winter	2.077	704
960 min Winter	1.683	832
1440 min Winter	1.252	1116
2160 min Winter	0.932	1556
2880 min Winter	0.756	1976
4320 min Winter	0.562	2768

©1982-2010 Micro Drainage Ltd

Cascade Summary of Results for MA10147 PP01 30 year.srcx

Upstream Structures	Outflow To	Overflow To
(None)	MA10147 PP05 Optimum 30 year.srcx	(None)

Half Drain Time : 15 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	2.568	0.068	0.0	2.4	2.4	2.4	O K
30 min Summer	2.578	0.078	0.0	2.5	2.5	3.0	O K
60 min Summer	2.578	0.078	0.0	2.5	2.5	3.0	O K
120 min Summer	2.568	0.068	0.0	2.4	2.4	2.4	O K
180 min Summer	2.558	0.058	0.0	2.2	2.2	1.8	O K
240 min Summer	2.549	0.049	0.0	2.1	2.1	1.3	O K
360 min Summer	2.534	0.034	0.0	1.9	1.9	0.6	O K
480 min Summer	2.523	0.023	0.0	1.7	1.7	0.3	O K
600 min Summer	2.516	0.016	0.0	1.5	1.5	0.1	O K
720 min Summer	2.510	0.010	0.0	1.4	1.4	0.1	O K
960 min Summer	2.501	0.001	0.0	1.1	1.1	0.0	O K
1440 min Summer	2.500	0.000	0.0	0.8	0.8	0.0	O K
2160 min Summer	2.500	0.000	0.0	0.6	0.6	0.0	O K
2880 min Summer	2.500	0.000	0.0	0.5	0.5	0.0	O K
4320 min Summer	2.500	0.000	0.0	0.3	0.3	0.0	O K
5760 min Summer	2.500	0.000	0.0	0.3	0.3	0.0	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
15 min Summer	72.014	20
30 min Summer	46.909	29
60 min Summer	29.238	46
120 min Summer	17.704	78
180 min Summer	13.070	108
240 min Summer	10.495	138
360 min Summer	7.666	196
480 min Summer	6.135	254
600 min Summer	5.158	312
720 min Summer	4.475	370
960 min Summer	3.575	488
1440 min Summer	2.602	0
2160 min Summer	1.892	0
2880 min Summer	1.508	0
4320 min Summer	1.094	0
5760 min Summer	0.871	0

©1982-2010 Micro Drainage Ltd

Cascade Summary of Results for MA10147 PP01 30 year.srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
7200 min Summer	2.500	0.000	0.0	0.2	0.2	0.0	O K
8640 min Summer	2.500	0.000	0.0	0.2	0.2	0.0	O K
10080 min Summer	2.500	0.000	0.0	0.2	0.2	0.0	O K
15 min Winter	2.575	0.075	0.0	2.4	2.4	2.9	O K
30 min Winter	2.586	0.086	0.0	2.6	2.6	3.5	O K
60 min Winter	2.584	0.084	0.0	2.5	2.5	3.4	O K
120 min Winter	2.568	0.068	0.0	2.4	2.4	2.4	O K
180 min Winter	2.553	0.053	0.0	2.2	2.2	1.5	O K
240 min Winter	2.539	0.039	0.0	2.0	2.0	0.8	O K
360 min Winter	2.521	0.021	0.0	1.7	1.7	0.2	O K
480 min Winter	2.510	0.010	0.0	1.4	1.4	0.1	O K
600 min Winter	2.503	0.003	0.0	1.2	1.2	0.0	O K
720 min Winter	2.500	0.000	0.0	1.0	1.0	0.0	O K
960 min Winter	2.500	0.000	0.0	0.8	0.8	0.0	O K
1440 min Winter	2.500	0.000	0.0	0.6	0.6	0.0	O K
2160 min Winter	2.500	0.000	0.0	0.4	0.4	0.0	O K
2880 min Winter	2.500	0.000	0.0	0.3	0.3	0.0	O K
4320 min Winter	2.500	0.000	0.0	0.2	0.2	0.0	O K
5760 min Winter	2.500	0.000	0.0	0.2	0.2	0.0	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
7200 min Summer	0.729	0
8640 min Summer	0.631	0
10080 min Summer	0.558	0
15 min Winter	72.014	21
30 min Winter	46.909	31
60 min Winter	29.238	48
120 min Winter	17.704	82
180 min Winter	13.070	114
240 min Winter	10.495	142
360 min Winter	7.666	194
480 min Winter	6.135	250
600 min Winter	5.158	304
720 min Winter	4.475	0
960 min Winter	3.575	0
1440 min Winter	2.602	0
2160 min Winter	1.892	0
2880 min Winter	1.508	0
4320 min Winter	1.094	0
5760 min Winter	0.871	0

©1982-2010 Micro Drainage Ltd

Cascade Summary of Results for MA10147 PP01 30 year.srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
7200 min Winter	2.500	0.000	0.0	0.2	0.2	0.0	O K
8640 min Winter	2.500	0.000	0.0	0.1	0.1	0.0	O K
10080 min Winter	2.500	0.000	0.0	0.1	0.1	0.0	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
7200 min Winter	0.729	0
8640 min Winter	0.631	0
10080 min Winter	0.558	0

©1982-2010 Micro Drainage Ltd

Cascade Summary of Results for MA10147 PP02 30 year.srcx

Upstream Structures	Outflow To	Overflow To
(None)	MA10147 PP05 Optimum 30 year.srcx	(None)

Half Drain Time : 169 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	2.228	0.128	0.0	1.7	1.7	17.6	O K
30 min Summer	2.262	0.162	0.0	1.8	1.8	23.4	O K
60 min Summer	2.289	0.189	0.0	1.9	1.9	27.9	O K
120 min Summer	2.304	0.204	0.0	1.9	1.9	30.5	Flood Risk
180 min Summer	2.303	0.203	0.0	1.9	1.9	30.3	Flood Risk
240 min Summer	2.299	0.199	0.0	1.9	1.9	29.5	O K
360 min Summer	2.288	0.188	0.0	1.9	1.9	27.6	O K
480 min Summer	2.278	0.178	0.0	1.8	1.8	25.9	O K
600 min Summer	2.268	0.168	0.0	1.8	1.8	24.3	O K
720 min Summer	2.258	0.158	0.0	1.8	1.8	22.6	O K
960 min Summer	2.240	0.140	0.0	1.8	1.8	19.5	O K
1440 min Summer	2.207	0.107	0.0	1.7	1.7	14.0	O K
2160 min Summer	2.170	0.070	0.0	1.6	1.6	7.7	O K
2880 min Summer	2.145	0.045	0.0	1.5	1.5	3.5	O K
4320 min Summer	2.105	0.005	0.0	1.4	1.4	0.0	O K
5760 min Summer	2.100	0.000	0.0	1.2	1.2	0.0	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
15 min Summer	72.014	25
30 min Summer	46.909	38
60 min Summer	29.238	66
120 min Summer	17.704	122
180 min Summer	13.070	156
240 min Summer	10.495	188
360 min Summer	7.666	254
480 min Summer	6.135	322
600 min Summer	5.158	390
720 min Summer	4.475	458
960 min Summer	3.575	592
1440 min Summer	2.602	846
2160 min Summer	1.892	1208
2880 min Summer	1.508	1540
4320 min Summer	1.094	2204
5760 min Summer	0.871	0

©1982-2010 Micro Drainage Ltd

Cascade Summary of Results for MA10147 PP02 30 year.srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
7200 min Summer	2.100	0.000	0.0	1.0	1.0	0.0	O K
8640 min Summer	2.100	0.000	0.0	0.8	0.8	0.0	O K
10080 min Summer	2.100	0.000	0.0	0.7	0.7	0.0	O K
15 min Winter	2.244	0.144	0.0	1.8	1.8	20.3	O K
30 min Winter	2.282	0.182	0.0	1.8	1.8	26.7	O K
60 min Winter	2.315	0.215	0.0	1.9	1.9	32.3	Flood Risk
120 min Winter	2.335	0.235	0.0	1.9	1.9	35.5	Flood Risk
180 min Winter	2.335	0.235	0.0	1.9	1.9	35.6	Flood Risk
240 min Winter	2.329	0.229	0.0	1.9	1.9	34.6	Flood Risk
360 min Winter	2.315	0.215	0.0	1.9	1.9	32.2	Flood Risk
480 min Winter	2.300	0.200	0.0	1.9	1.9	29.7	O K
600 min Winter	2.285	0.185	0.0	1.8	1.8	27.1	O K
720 min Winter	2.270	0.170	0.0	1.8	1.8	24.6	O K
960 min Winter	2.242	0.142	0.0	1.8	1.8	19.9	O K
1440 min Winter	2.194	0.094	0.0	1.7	1.7	11.9	O K
2160 min Winter	2.145	0.045	0.0	1.5	1.5	3.5	O K
2880 min Winter	2.103	0.003	0.0	1.4	1.4	0.0	O K
4320 min Winter	2.100	0.000	0.0	1.0	1.0	0.0	O K
5760 min Winter	2.100	0.000	0.0	0.8	0.8	0.0	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
7200 min Summer	0.729	0
8640 min Summer	0.631	0
10080 min Summer	0.558	0
15 min Winter	72.014	25
30 min Winter	46.909	38
60 min Winter	29.238	66
120 min Winter	17.704	120
180 min Winter	13.070	174
240 min Winter	10.495	198
360 min Winter	7.666	274
480 min Winter	6.135	350
600 min Winter	5.158	424
720 min Winter	4.475	496
960 min Winter	3.575	634
1440 min Winter	2.602	892
2160 min Winter	1.892	1232
2880 min Winter	1.508	1472
4320 min Winter	1.094	0
5760 min Winter	0.871	0

©1982-2010 Micro Drainage Ltd

Cascade Summary of Results for MA10147 PP02 30 year.srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
7200 min Winter	2.100	0.000	0.0	0.7	0.7	0.0	O K
8640 min Winter	2.100	0.000	0.0	0.6	0.6	0.0	O K
10080 min Winter	2.100	0.000	0.0	0.5	0.5	0.0	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
7200 min Winter	0.729	0
8640 min Winter	0.631	0
10080 min Winter	0.558	0

©1982-2010 Micro Drainage Ltd

Cascade Summary of Results for MA10147 PP03 30 year.srcx

Upstream Structures	Outflow To	Overflow To
(None)	MA10147 PP05 Optimum 30 year.srcx	(None)

Half Drain Time : 11 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	2.267	0.167	0.0	12.4	12.4	10.4	O K
30 min Summer	2.283	0.183	0.0	12.7	12.7	12.5	O K
60 min Summer	2.273	0.173	0.0	12.5	12.5	11.3	O K
120 min Summer	2.244	0.144	0.0	12.1	12.1	7.8	O K
180 min Summer	2.212	0.112	0.0	11.5	11.5	4.7	O K
240 min Summer	2.181	0.081	0.0	11.0	11.0	2.5	O K
360 min Summer	2.125	0.025	0.0	10.0	10.0	0.2	O K
480 min Summer	2.100	0.000	0.0	8.4	8.4	0.0	O K
600 min Summer	2.100	0.000	0.0	7.2	7.2	0.0	O K
720 min Summer	2.100	0.000	0.0	6.3	6.3	0.0	O K
960 min Summer	2.100	0.000	0.0	5.0	5.0	0.0	O K
1440 min Summer	2.100	0.000	0.0	3.6	3.6	0.0	O K
2160 min Summer	2.100	0.000	0.0	2.6	2.6	0.0	O K
2880 min Summer	2.100	0.000	0.0	2.1	2.1	0.0	O K
4320 min Summer	2.100	0.000	0.0	1.5	1.5	0.0	O K
5760 min Summer	2.100	0.000	0.0	1.2	1.2	0.0	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
15 min Summer	72.014	20
30 min Summer	46.909	29
60 min Summer	29.238	44
120 min Summer	17.704	76
180 min Summer	13.070	106
240 min Summer	10.495	136
360 min Summer	7.666	190
480 min Summer	6.135	0
600 min Summer	5.158	0
720 min Summer	4.475	0
960 min Summer	3.575	0
1440 min Summer	2.602	0
2160 min Summer	1.892	0
2880 min Summer	1.508	0
4320 min Summer	1.094	0
5760 min Summer	0.871	0

©1982-2010 Micro Drainage Ltd

Cascade Summary of Results for MA10147 PP03 30 year.srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
7200 min Summer	2.100	0.000	0.0	1.0	1.0	0.0	O K
8640 min Summer	2.100	0.000	0.0	0.9	0.9	0.0	O K
10080 min Summer	2.100	0.000	0.0	0.8	0.8	0.0	O K
15 min Winter	2.281	0.181	0.0	12.6	12.6	12.3	O K
30 min Winter	2.298	0.198	0.0	12.9	12.9	14.8	O K
60 min Winter	2.283	0.183	0.0	12.7	12.7	12.6	O K
120 min Winter	2.235	0.135	0.0	11.9	11.9	6.9	O K
180 min Winter	2.184	0.084	0.0	11.1	11.1	2.6	O K
240 min Winter	2.132	0.032	0.0	10.1	10.1	0.4	O K
360 min Winter	2.100	0.000	0.0	7.7	7.7	0.0	O K
480 min Winter	2.100	0.000	0.0	6.2	6.2	0.0	O K
600 min Winter	2.100	0.000	0.0	5.2	5.2	0.0	O K
720 min Winter	2.100	0.000	0.0	4.5	4.5	0.0	O K
960 min Winter	2.100	0.000	0.0	3.6	3.6	0.0	O K
1440 min Winter	2.100	0.000	0.0	2.6	2.6	0.0	O K
2160 min Winter	2.100	0.000	0.0	1.9	1.9	0.0	O K
2880 min Winter	2.100	0.000	0.0	1.5	1.5	0.0	O K
4320 min Winter	2.100	0.000	0.0	1.1	1.1	0.0	O K
5760 min Winter	2.100	0.000	0.0	0.9	0.9	0.0	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
7200 min Summer	0.729	0
8640 min Summer	0.631	0
10080 min Summer	0.558	0
15 min Winter	72.014	20
30 min Winter	46.909	30
60 min Winter	29.238	48
120 min Winter	17.704	80
180 min Winter	13.070	108
240 min Winter	10.495	134
360 min Winter	7.666	0
480 min Winter	6.135	0
600 min Winter	5.158	0
720 min Winter	4.475	0
960 min Winter	3.575	0
1440 min Winter	2.602	0
2160 min Winter	1.892	0
2880 min Winter	1.508	0
4320 min Winter	1.094	0
5760 min Winter	0.871	0

©1982-2010 Micro Drainage Ltd

Cascade Summary of Results for MA10147 PP03 30 year.srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Σ Max Outflow (l/s)	Max Volume (m³)	Status
7200 min Winter	2.100	0.000	0.0	0.7	0.7	0.0	O K
8640 min Winter	2.100	0.000	0.0	0.6	0.6	0.0	O K
10080 min Winter	2.100	0.000	0.0	0.5	0.5	0.0	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
7200 min Winter	0.729	0
8640 min Winter	0.631	0
10080 min Winter	0.558	0

©1982-2010 Micro Drainage Ltd

Cascade Summary of Results for MA10147 PP04 30 year.srcx

Upstream Structures	Outflow To	Overflow To
(None)	MA10147 PP05 Optimum 30 year.srcx	(None)

Half Drain Time : 7 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	2.238	0.138	0.0	13.0	13.0	7.1	O K
30 min Summer	2.249	0.149	0.0	13.2	13.2	8.4	O K
60 min Summer	2.237	0.137	0.0	13.0	13.0	7.0	O K
120 min Summer	2.202	0.102	0.0	12.4	12.4	3.9	O K
180 min Summer	2.164	0.064	0.0	11.7	11.7	1.5	O K
240 min Summer	2.128	0.028	0.0	11.0	11.0	0.3	O K
360 min Summer	2.100	0.000	0.0	8.8	8.8	0.0	O K
480 min Summer	2.100	0.000	0.0	7.1	7.1	0.0	O K
600 min Summer	2.100	0.000	0.0	6.1	6.1	0.0	O K
720 min Summer	2.100	0.000	0.0	5.3	5.3	0.0	O K
960 min Summer	2.100	0.000	0.0	4.2	4.2	0.0	O K
1440 min Summer	2.100	0.000	0.0	3.1	3.1	0.0	O K
2160 min Summer	2.100	0.000	0.0	2.2	2.2	0.0	O K
2880 min Summer	2.100	0.000	0.0	1.8	1.8	0.0	O K
4320 min Summer	2.100	0.000	0.0	1.3	1.3	0.0	O K
5760 min Summer	2.100	0.000	0.0	1.0	1.0	0.0	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
15 min Summer	72.014	20
30 min Summer	46.909	28
60 min Summer	29.238	44
120 min Summer	17.704	74
180 min Summer	13.070	102
240 min Summer	10.495	130
360 min Summer	7.666	0
480 min Summer	6.135	0
600 min Summer	5.158	0
720 min Summer	4.475	0
960 min Summer	3.575	0
1440 min Summer	2.602	0
2160 min Summer	1.892	0
2880 min Summer	1.508	0
4320 min Summer	1.094	0
5760 min Summer	0.871	0

©1982-2010 Micro Drainage Ltd

Cascade Summary of Results for MA10147 PP04 30 year.srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
7200 min Summer	2.100	0.000	0.0	0.9	0.9	0.0	O K
8640 min Summer	2.100	0.000	0.0	0.7	0.7	0.0	O K
10080 min Summer	2.100	0.000	0.0	0.6	0.6	0.0	O K
15 min Winter	2.253	0.153	0.0	13.2	13.2	8.8	O K
30 min Winter	2.263	0.163	0.0	13.4	13.4	9.9	O K
60 min Winter	2.241	0.141	0.0	13.1	13.1	7.5	O K
120 min Winter	2.181	0.081	0.0	12.0	12.0	2.5	O K
180 min Winter	2.116	0.016	0.0	10.8	10.8	0.1	O K
240 min Winter	2.100	0.000	0.0	8.9	8.9	0.0	O K
360 min Winter	2.100	0.000	0.0	6.5	6.5	0.0	O K
480 min Winter	2.100	0.000	0.0	5.2	5.2	0.0	O K
600 min Winter	2.100	0.000	0.0	4.4	4.4	0.0	O K
720 min Winter	2.100	0.000	0.0	3.8	3.8	0.0	O K
960 min Winter	2.100	0.000	0.0	3.0	3.0	0.0	O K
1440 min Winter	2.100	0.000	0.0	2.2	2.2	0.0	O K
2160 min Winter	2.100	0.000	0.0	1.6	1.6	0.0	O K
2880 min Winter	2.100	0.000	0.0	1.3	1.3	0.0	O K
4320 min Winter	2.100	0.000	0.0	0.9	0.9	0.0	O K
5760 min Winter	2.100	0.000	0.0	0.7	0.7	0.0	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
7200 min Summer	0.729	0
8640 min Summer	0.631	0
10080 min Summer	0.558	0
15 min Winter	72.014	20
30 min Winter	46.909	29
60 min Winter	29.238	46
120 min Winter	17.704	76
180 min Winter	13.070	100
240 min Winter	10.495	0
360 min Winter	7.666	0
480 min Winter	6.135	0
600 min Winter	5.158	0
720 min Winter	4.475	0
960 min Winter	3.575	0
1440 min Winter	2.602	0
2160 min Winter	1.892	0
2880 min Winter	1.508	0
4320 min Winter	1.094	0
5760 min Winter	0.871	0

©1982-2010 Micro Drainage Ltd

Cascade Summary of Results for MA10147 PP04 30 year.srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Σ Max Outflow (l/s)	Max Volume (m³)	Status
7200 min Winter	2.100	0.000	0.0	0.6	0.6	0.0	O K
8640 min Winter	2.100	0.000	0.0	0.5	0.5	0.0	O K
10080 min Winter	2.100	0.000	0.0	0.5	0.5	0.0	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
7200 min Winter	0.729	0
8640 min Winter	0.631	0
10080 min Winter	0.558	0

©1982-2010 Micro Drainage Ltd

Cascade Summary of Results for MA10147 PP05 Optimum 30 year.srcx

Upstream Structures	Outflow To	Overflow To
MA10147 PP01 30 year.srcx MA10147 PP02 30 year.srcx MA10147 PP03 30 year.srcx MA10147 PP04 30 year.srcx	MA10147 Pond 30 year alternative HB test.srcx	(None)

Half Drain Time : 106 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	2.392	0.292	0.0	15.6	15.6	89.3	O K
30 min Summer	2.437	0.337	0.0	16.5	16.5	119.1	O K
60 min Summer	2.480	0.380	0.0	16.7	16.7	151.9	O K
120 min Summer	2.504	0.404	0.0	16.8	16.8	171.3	O K
180 min Summer	2.510	0.410	0.0	16.8	16.8	176.0	O K
240 min Summer	2.510	0.410	0.0	16.8	16.8	176.1	O K
360 min Summer	2.502	0.402	0.0	16.8	16.8	169.9	O K
480 min Summer	2.491	0.391	0.0	16.7	16.7	160.6	O K
600 min Summer	2.478	0.378	0.0	16.7	16.7	150.1	O K
720 min Summer	2.465	0.365	0.0	16.7	16.7	139.6	O K
960 min Summer	2.439	0.339	0.0	16.5	16.5	120.4	O K
1440 min Summer	2.398	0.298	0.0	15.9	15.9	93.5	O K
2160 min Summer	2.366	0.266	0.0	13.7	13.7	74.2	O K
2880 min Summer	2.347	0.247	0.0	11.7	11.7	64.1	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
15 min Summer	72.014	32
30 min Summer	46.909	44
60 min Summer	29.238	70
120 min Summer	17.704	110
180 min Summer	13.070	140
240 min Summer	10.495	170
360 min Summer	7.666	238
480 min Summer	6.135	306
600 min Summer	5.158	370
720 min Summer	4.475	434
960 min Summer	3.575	556
1440 min Summer	2.602	786
2160 min Summer	1.892	1136
2880 min Summer	1.508	1500

©1982-2010 Micro Drainage Ltd

Cascade Summary of Results for MA10147 PP05 Optimum 30 year.srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
4320 min Summer	2.324	0.224	0.0	9.2	9.2	52.8	O K
5760 min Summer	2.309	0.209	0.0	7.5	7.5	45.9	O K
7200 min Summer	2.299	0.199	0.0	6.3	6.3	41.5	O K
8640 min Summer	2.291	0.191	0.0	5.5	5.5	38.3	O K
10080 min Summer	2.285	0.185	0.0	4.9	4.9	35.9	O K
15 min Winter	2.409	0.309	0.0	16.2	16.2	100.3	O K
30 min Winter	2.458	0.358	0.0	16.6	16.6	134.8	O K
60 min Winter	2.505	0.405	0.0	16.8	16.8	172.2	O K
120 min Winter	2.534	0.434	0.0	16.8	16.8	196.6	O K
180 min Winter	2.537	0.437	0.0	16.8	16.8	199.0	O K
240 min Winter	2.534	0.434	0.0	16.8	16.8	196.9	O K
360 min Winter	2.519	0.419	0.0	16.8	16.8	184.3	O K
480 min Winter	2.500	0.400	0.0	16.8	16.8	168.2	O K
600 min Winter	2.480	0.380	0.0	16.7	16.7	151.3	O K
720 min Winter	2.459	0.359	0.0	16.6	16.6	135.2	O K
960 min Winter	2.421	0.321	0.0	16.4	16.4	107.9	O K
1440 min Winter	2.375	0.275	0.0	14.5	14.5	79.4	O K
2160 min Winter	2.344	0.244	0.0	11.4	11.4	62.4	O K
2880 min Winter	2.326	0.226	0.0	9.5	9.5	53.6	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
4320 min Summer	1.094	2212
5760 min Summer	0.871	2936
7200 min Summer	0.729	3672
8640 min Summer	0.631	4408
10080 min Summer	0.558	5136
15 min Winter	72.014	34
30 min Winter	46.909	47
60 min Winter	29.238	70
120 min Winter	17.704	118
180 min Winter	13.070	148
240 min Winter	10.495	186
360 min Winter	7.666	260
480 min Winter	6.135	330
600 min Winter	5.158	396
720 min Winter	4.475	460
960 min Winter	3.575	576
1440 min Winter	2.602	798
2160 min Winter	1.892	1152
2880 min Winter	1.508	1504

©1982-2010 Micro Drainage Ltd

Cascade Summary of Results for MA10147 PP05 Optimum 30 year.srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
4320 min Winter	2.304	0.204	0.0	6.9	6.9	43.7	O K
5760 min Winter	2.291	0.191	0.0	5.5	5.5	38.3	O K
7200 min Winter	2.283	0.183	0.0	4.6	4.6	35.0	O K
8640 min Winter	2.275	0.175	0.0	3.9	3.9	32.3	O K
10080 min Winter	2.270	0.170	0.0	3.5	3.5	30.4	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
4320 min Winter	1.094	2216
5760 min Winter	0.871	2944
7200 min Winter	0.729	3664
8640 min Winter	0.631	4408
10080 min Winter	0.558	5088

©1982-2010 Micro Drainage Ltd

Cascade Summary of Results for MA10147 Pond 30 year alternative HB test.srcx

Upstream Structures	Outflow To	Overflow To
MA10147 PP05 Optimum 30 year.srcx MA10147 PP01 30 year.srcx MA10147 PP02 30 year.srcx MA10147 PP03 30 year.srcx MA10147 PP04 30 year.srcx	(None)	(None)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m^3)	Status
15 min Summer	1.969	0.269	2.2	75.5	O K
30 min Summer	2.081	0.381	2.4	111.8	O K
60 min Summer	2.187	0.487	2.6	149.0	O K
120 min Summer	2.293	0.593	2.9	188.8	O K
180 min Summer	2.354	0.654	3.0	213.2	O K
240 min Summer	2.397	0.697	3.1	230.6	O K
360 min Summer	2.455	0.755	3.3	255.3	O K
480 min Summer	2.496	0.796	3.4	273.1	O K
600 min Summer	2.525	0.825	3.4	285.7	Flood Risk
720 min Summer	2.543	0.843	3.4	294.0	Flood Risk
960 min Summer	2.557	0.857	3.5	300.6	Flood Risk
1440 min Summer	2.550	0.850	3.5	297.1	Flood Risk
2160 min Summer	2.526	0.826	3.4	286.4	Flood Risk
2880 min Summer	2.493	0.793	3.3	271.5	O K
4320 min Summer	2.421	0.721	3.2	240.7	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
15 min Summer	72.014	228
30 min Summer	46.909	282
60 min Summer	29.238	330
120 min Summer	17.704	388
180 min Summer	13.070	436
240 min Summer	10.495	476
360 min Summer	7.666	548
480 min Summer	6.135	616
600 min Summer	5.158	690
720 min Summer	4.475	778
960 min Summer	3.575	968
1440 min Summer	2.602	1184
2160 min Summer	1.892	1544
2880 min Summer	1.508	1940
4320 min Summer	1.094	2744

©1982-2010 Micro Drainage Ltd

Cascade Summary of Results for MA10147 Pond 30 year alternative HB test.srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
5760 min Summer	2.353	0.653	3.0	212.7	O K
7200 min Summer	2.290	0.590	2.9	187.9	O K
8640 min Summer	2.233	0.533	2.8	166.0	O K
10080 min Summer	2.181	0.481	2.6	146.6	O K
15 min Winter	2.014	0.314	2.2	89.7	O K
30 min Winter	2.133	0.433	2.5	129.7	O K
60 min Winter	2.248	0.548	2.8	171.8	O K
120 min Winter	2.359	0.659	3.0	215.0	O K
180 min Winter	2.425	0.725	3.2	242.3	O K
240 min Winter	2.470	0.770	3.3	261.9	O K
360 min Winter	2.533	0.833	3.4	289.4	Flood Risk
480 min Winter	2.577	0.877	3.5	309.5	Flood Risk
600 min Winter	2.609	0.909	3.6	324.6	Flood Risk
720 min Winter	2.632	0.932	3.6	335.2	Flood Risk
960 min Winter	2.653	0.953	3.7	345.4	Flood Risk
1440 min Winter	2.644	0.944	3.6	341.1	Flood Risk
2160 min Winter	2.609	0.909	3.6	324.2	Flood Risk
2880 min Winter	2.560	0.860	3.5	301.8	Flood Risk
4320 min Winter	2.458	0.758	3.3	256.4	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
5760 min Summer	0.871	3536
7200 min Summer	0.729	4320
8640 min Summer	0.631	5072
10080 min Summer	0.558	5840
15 min Winter	72.014	248
30 min Winter	46.909	302
60 min Winter	29.238	348
120 min Winter	17.704	410
180 min Winter	13.070	460
240 min Winter	10.495	500
360 min Winter	7.666	572
480 min Winter	6.135	638
600 min Winter	5.158	704
720 min Winter	4.475	782
960 min Winter	3.575	974
1440 min Winter	2.602	1236
2160 min Winter	1.892	1644
2880 min Winter	1.508	2084
4320 min Winter	1.094	2940

©1982-2010 Micro Drainage Ltd

Cascade Summary of Results for MA10147 Pond 30 year alternative HB test.srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m^3)	Status
5760 min Winter	2.361	0.661	3.1	215.9	O K
7200 min Winter	2.274	0.574	2.8	181.4	O K
8640 min Winter	2.194	0.494	2.7	151.6	O K
10080 min Winter	2.122	0.422	2.5	125.8	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
5760 min Winter	0.871	3760
7200 min Winter	0.729	4560
8640 min Winter	0.631	5352
10080 min Winter	0.558	6136

©1982-2010 Micro Drainage Ltd

Cascade Summary of Results for MA10147 PP01 100yr.srcx

Upstream Structures	Outflow To	Overflow To
(None)	MA10147 PP05 Optimum 100yr.srcx	(None)

Half Drain Time : 25 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	2.613	0.113	0.0	2.9	2.9	5.3	O K
30 min Summer	2.635	0.135	0.0	3.1	3.1	6.7	O K
60 min Summer	2.639	0.139	0.0	3.1	3.1	6.9	O K
120 min Summer	2.627	0.127	0.0	3.0	3.0	6.2	O K
180 min Summer	2.613	0.113	0.0	2.8	2.8	5.3	O K
240 min Summer	2.599	0.099	0.0	2.7	2.7	4.4	O K
360 min Summer	2.577	0.077	0.0	2.5	2.5	3.0	O K
480 min Summer	2.562	0.062	0.0	2.3	2.3	2.0	O K
600 min Summer	2.550	0.050	0.0	2.1	2.1	1.3	O K
720 min Summer	2.540	0.040	0.0	2.0	2.0	0.8	O K
960 min Summer	2.524	0.024	0.0	1.8	1.8	0.3	O K
1440 min Summer	2.509	0.009	0.0	1.3	1.3	0.0	O K
2160 min Summer	2.500	0.000	0.0	1.0	1.0	0.0	O K
2880 min Summer	2.500	0.000	0.0	0.8	0.8	0.0	O K
4320 min Summer	2.500	0.000	0.0	0.5	0.5	0.0	O K
5760 min Summer	2.500	0.000	0.0	0.4	0.4	0.0	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
15 min Summer	121.269	21
30 min Summer	79.695	31
60 min Summer	49.937	48
120 min Summer	30.267	82
180 min Summer	22.297	114
240 min Summer	17.851	146
360 min Summer	12.957	208
480 min Summer	10.330	266
600 min Summer	8.659	324
720 min Summer	7.492	382
960 min Summer	5.959	496
1440 min Summer	4.309	730
2160 min Summer	3.110	0
2880 min Summer	2.466	0
4320 min Summer	1.775	0
5760 min Summer	1.405	0

©1982-2010 Micro Drainage Ltd

Cascade Summary of Results for MA10147 PP01 100yr.srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
7200 min Summer	2.500	0.000	0.0	0.4	0.4	0.0	O K
8640 min Summer	2.500	0.000	0.0	0.3	0.3	0.0	O K
10080 min Summer	2.500	0.000	0.0	0.3	0.3	0.0	O K
15 min Winter	2.627	0.127	0.0	3.0	3.0	6.2	O K
30 min Winter	2.651	0.151	0.0	3.2	3.2	7.7	O K
60 min Winter	2.654	0.154	0.0	3.2	3.2	7.9	O K
120 min Winter	2.635	0.135	0.0	3.1	3.1	6.7	O K
180 min Winter	2.613	0.113	0.0	2.9	2.9	5.3	O K
240 min Winter	2.594	0.094	0.0	2.7	2.7	4.1	O K
360 min Winter	2.565	0.065	0.0	2.3	2.3	2.2	O K
480 min Winter	2.545	0.045	0.0	2.1	2.1	1.1	O K
600 min Winter	2.530	0.030	0.0	1.9	1.9	0.5	O K
720 min Winter	2.521	0.021	0.0	1.7	1.7	0.2	O K
960 min Winter	2.509	0.009	0.0	1.3	1.3	0.0	O K
1440 min Winter	2.500	0.000	0.0	1.0	1.0	0.0	O K
2160 min Winter	2.500	0.000	0.0	0.7	0.7	0.0	O K
2880 min Winter	2.500	0.000	0.0	0.5	0.5	0.0	O K
4320 min Winter	2.500	0.000	0.0	0.4	0.4	0.0	O K
5760 min Winter	2.500	0.000	0.0	0.3	0.3	0.0	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
7200 min Summer	1.171	0
8640 min Summer	1.008	0
10080 min Summer	0.889	0
15 min Winter	121.269	22
30 min Winter	79.695	32
60 min Winter	49.937	50
120 min Winter	30.267	86
180 min Winter	22.297	122
240 min Winter	17.851	154
360 min Winter	12.957	214
480 min Winter	10.330	270
600 min Winter	8.659	324
720 min Winter	7.492	376
960 min Winter	5.959	490
1440 min Winter	4.309	0
2160 min Winter	3.110	0
2880 min Winter	2.466	0
4320 min Winter	1.775	0
5760 min Winter	1.405	0

©1982-2010 Micro Drainage Ltd

Cascade Summary of Results for MA10147 PP01 100yr.srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Σ Max Outflow (l/s)	Max Volume (m³)	Status
7200 min Winter	2.500	0.000	0.0	0.3	0.3	0.0	O K
8640 min Winter	2.500	0.000	0.0	0.2	0.2	0.0	O K
10080 min Winter	2.500	0.000	0.0	0.2	0.2	0.0	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
7200 min Winter	1.171	0
8640 min Winter	1.008	0
10080 min Winter	0.889	0

©1982-2010 Micro Drainage Ltd

Cascade Summary of Results for MA10147 PP02 100yr.srcx

Upstream Structures	Outflow To	Overflow To
(None)	MA10147 PP05 Optimum 100yr.srcx	(None)

Half Drain Time : 281 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	2.317	0.217	0.0	1.9	1.9	32.6	Flood Risk
30 min Summer	2.379	0.279	0.0	2.0	2.0	43.0	Flood Risk
60 min Summer	2.435	0.335	0.0	2.1	2.1	52.5	Flood Risk
120 min Summer	2.477	0.377	0.0	2.2	2.2	59.5	Flood Risk
180 min Summer	2.486	0.386	0.0	2.2	2.2	61.0	Flood Risk
240 min Summer	2.483	0.383	0.0	2.2	2.2	60.5	Flood Risk
360 min Summer	2.468	0.368	0.0	2.2	2.2	58.1	Flood Risk
480 min Summer	2.453	0.353	0.0	2.2	2.2	55.6	Flood Risk
600 min Summer	2.440	0.340	0.0	2.1	2.1	53.3	Flood Risk
720 min Summer	2.427	0.327	0.0	2.1	2.1	51.1	Flood Risk
960 min Summer	2.403	0.303	0.0	2.1	2.1	47.1	Flood Risk
1440 min Summer	2.360	0.260	0.0	2.0	2.0	39.8	Flood Risk
2160 min Summer	2.303	0.203	0.0	1.9	1.9	30.2	Flood Risk
2880 min Summer	2.257	0.157	0.0	1.8	1.8	22.4	O K
4320 min Summer	2.189	0.089	0.0	1.6	1.6	11.1	O K
5760 min Summer	2.148	0.048	0.0	1.6	1.6	4.1	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
15 min Summer	121.269	25
30 min Summer	79.695	39
60 min Summer	49.937	68
120 min Summer	30.267	124
180 min Summer	22.297	182
240 min Summer	17.851	226
360 min Summer	12.957	284
480 min Summer	10.330	348
600 min Summer	8.659	418
720 min Summer	7.492	486
960 min Summer	5.959	624
1440 min Summer	4.309	892
2160 min Summer	3.110	1280
2880 min Summer	2.466	1652
4320 min Summer	1.775	2376
5760 min Summer	1.405	3048

©1982-2010 Micro Drainage Ltd

Cascade Summary of Results for MA10147 PP02 100yr.srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
7200 min Summer	2.120	0.020	0.0	1.5	1.5	0.7	O K
8640 min Summer	2.100	0.000	0.0	1.3	1.3	0.0	O K
10080 min Summer	2.100	0.000	0.0	1.2	1.2	0.0	O K
15 min Winter	2.344	0.244	0.0	2.0	2.0	37.1	Flood Risk
30 min Winter	2.414	0.314	0.0	2.1	2.1	48.9	Flood Risk
60 min Winter	2.479	0.379	0.0	2.2	2.2	59.9	Flood Risk
120 min Winter	2.529	0.429	0.0	2.3	2.3	68.4	Flood Risk
180 min Winter	2.544	0.444	0.0	2.3	2.3	70.8	Flood Risk
240 min Winter	2.544	0.444	0.0	2.3	2.3	70.9	Flood Risk
360 min Winter	2.527	0.427	0.0	2.3	2.3	68.0	Flood Risk
480 min Winter	2.510	0.410	0.0	2.3	2.3	65.1	Flood Risk
600 min Winter	2.490	0.390	0.0	2.2	2.2	61.8	Flood Risk
720 min Winter	2.472	0.372	0.0	2.2	2.2	58.8	Flood Risk
960 min Winter	2.437	0.337	0.0	2.1	2.1	52.9	Flood Risk
1440 min Winter	2.372	0.272	0.0	2.0	2.0	41.9	Flood Risk
2160 min Winter	2.291	0.191	0.0	1.9	1.9	28.2	O K
2880 min Winter	2.227	0.127	0.0	1.7	1.7	17.4	O K
4320 min Winter	2.144	0.044	0.0	1.5	1.5	3.5	O K
5760 min Winter	2.100	0.000	0.0	1.3	1.3	0.0	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
7200 min Summer	1.171	3680
8640 min Summer	1.008	0
10080 min Summer	0.889	0
15 min Winter	121.269	25
30 min Winter	79.695	39
60 min Winter	49.937	66
120 min Winter	30.267	122
180 min Winter	22.297	178
240 min Winter	17.851	234
360 min Winter	12.957	300
480 min Winter	10.330	372
600 min Winter	8.659	450
720 min Winter	7.492	526
960 min Winter	5.959	676
1440 min Winter	4.309	960
2160 min Winter	3.110	1360
2880 min Winter	2.466	1732
4320 min Winter	1.775	2380
5760 min Winter	1.405	0

©1982-2010 Micro Drainage Ltd

Cascade Summary of Results for MA10147 PP02 100yr.srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
7200 min Winter	2.100	0.000	0.0	1.1	1.1	0.0	O K
8640 min Winter	2.100	0.000	0.0	1.0	1.0	0.0	O K
10080 min Winter	2.100	0.000	0.0	0.8	0.8	0.0	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
7200 min Winter	1.171	0
8640 min Winter	1.008	0
10080 min Winter	0.889	0

©1982-2010 Micro Drainage Ltd

Cascade Summary of Results for MA10147 PP03 100yr.srcx

Upstream Structures	Outflow To	Overflow To
(None)	MA10147 PP05 Optimum 100yr.srcx	(None)

Half Drain Time : 23 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	2.353	0.253	0.0	13.7	13.7	23.9	Flood Risk
30 min Summer	2.381	0.281	0.0	14.1	14.1	29.2	Flood Risk
60 min Summer	2.379	0.279	0.0	14.1	14.1	29.0	Flood Risk
120 min Summer	2.357	0.257	0.0	13.8	13.8	24.7	Flood Risk
180 min Summer	2.330	0.230	0.0	13.4	13.4	19.9	Flood Risk
240 min Summer	2.303	0.203	0.0	13.0	13.0	15.5	Flood Risk
360 min Summer	2.251	0.151	0.0	12.2	12.2	8.6	O K
480 min Summer	2.206	0.106	0.0	11.5	11.5	4.2	O K
600 min Summer	2.167	0.067	0.0	10.8	10.8	1.7	O K
720 min Summer	2.131	0.031	0.0	10.1	10.1	0.4	O K
960 min Summer	2.100	0.000	0.0	8.3	8.3	0.0	O K
1440 min Summer	2.100	0.000	0.0	6.0	6.0	0.0	O K
2160 min Summer	2.100	0.000	0.0	4.3	4.3	0.0	O K
2880 min Summer	2.100	0.000	0.0	3.4	3.4	0.0	O K
4320 min Summer	2.100	0.000	0.0	2.5	2.5	0.0	O K
5760 min Summer	2.100	0.000	0.0	2.0	2.0	0.0	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
15 min Summer	121.269	21
30 min Summer	79.695	31
60 min Summer	49.937	48
120 min Summer	30.267	82
180 min Summer	22.297	114
240 min Summer	17.851	144
360 min Summer	12.957	204
480 min Summer	10.330	262
600 min Summer	8.659	318
720 min Summer	7.492	372
960 min Summer	5.959	0
1440 min Summer	4.309	0
2160 min Summer	3.110	0
2880 min Summer	2.466	0
4320 min Summer	1.775	0
5760 min Summer	1.405	0

©1982-2010 Micro Drainage Ltd

Cascade Summary of Results for MA10147 PP03 100yr.srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
7200 min Summer	2.100	0.000	0.0	1.6	1.6	0.0	O K
8640 min Summer	2.100	0.000	0.0	1.4	1.4	0.0	O K
10080 min Summer	2.100	0.000	0.0	1.2	1.2	0.0	O K
15 min Winter	2.372	0.272	0.0	14.0	14.0	27.5	Flood Risk
30 min Winter	2.407	0.307	0.0	14.5	14.5	34.2	Flood Risk
60 min Winter	2.404	0.304	0.0	14.4	14.4	33.6	Flood Risk
120 min Winter	2.367	0.267	0.0	13.9	13.9	26.6	Flood Risk
180 min Winter	2.326	0.226	0.0	13.3	13.3	19.2	Flood Risk
240 min Winter	2.285	0.185	0.0	12.7	12.7	12.8	O K
360 min Winter	2.206	0.106	0.0	11.5	11.5	4.2	O K
480 min Winter	2.136	0.036	0.0	10.2	10.2	0.5	O K
600 min Winter	2.100	0.000	0.0	8.8	8.8	0.0	O K
720 min Winter	2.100	0.000	0.0	7.6	7.6	0.0	O K
960 min Winter	2.100	0.000	0.0	6.0	6.0	0.0	O K
1440 min Winter	2.100	0.000	0.0	4.4	4.4	0.0	O K
2160 min Winter	2.100	0.000	0.0	3.1	3.1	0.0	O K
2880 min Winter	2.100	0.000	0.0	2.5	2.5	0.0	O K
4320 min Winter	2.100	0.000	0.0	1.8	1.8	0.0	O K
5760 min Winter	2.100	0.000	0.0	1.4	1.4	0.0	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
7200 min Summer	1.171	0
8640 min Summer	1.008	0
10080 min Summer	0.889	0
15 min Winter	121.269	21
30 min Winter	79.695	32
60 min Winter	49.937	52
120 min Winter	30.267	86
180 min Winter	22.297	120
240 min Winter	17.851	152
360 min Winter	12.957	208
480 min Winter	10.330	256
600 min Winter	8.659	0
720 min Winter	7.492	0
960 min Winter	5.959	0
1440 min Winter	4.309	0
2160 min Winter	3.110	0
2880 min Winter	2.466	0
4320 min Winter	1.775	0
5760 min Winter	1.405	0

©1982-2010 Micro Drainage Ltd

Cascade Summary of Results for MA10147 PP03 100yr.srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Σ Max Outflow (l/s)	Max Volume (m³)	Status
7200 min Winter	2.100	0.000	0.0	1.2	1.2	0.0	O K
8640 min Winter	2.100	0.000	0.0	1.0	1.0	0.0	O K
10080 min Winter	2.100	0.000	0.0	0.9	0.9	0.0	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
7200 min Winter	1.171	0
8640 min Winter	1.008	0
10080 min Winter	0.889	0

©1982-2010 Micro Drainage Ltd

Cascade Summary of Results for MA10147 PP04 100yr.srcx

Upstream Structures	Outflow To	Overflow To
(None)	MA10147 PP05 Optimum 100yr.srcx	(None)

Half Drain Time : 16 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	2.334	0.234	0.0	14.5	14.5	18.1	Flood Risk
30 min Summer	2.364	0.264	0.0	15.0	15.0	21.5	Flood Risk
60 min Summer	2.355	0.255	0.0	14.8	14.8	20.5	Flood Risk
120 min Summer	2.317	0.217	0.0	14.3	14.3	16.1	Flood Risk
180 min Summer	2.279	0.179	0.0	13.7	13.7	11.8	O K
240 min Summer	2.246	0.146	0.0	13.1	13.1	8.0	O K
360 min Summer	2.190	0.090	0.0	12.2	12.2	3.0	O K
480 min Summer	2.141	0.041	0.0	11.3	11.3	0.6	O K
600 min Summer	2.100	0.000	0.0	10.2	10.2	0.0	O K
720 min Summer	2.100	0.000	0.0	8.9	8.9	0.0	O K
960 min Summer	2.100	0.000	0.0	7.0	7.0	0.0	O K
1440 min Summer	2.100	0.000	0.0	5.1	5.1	0.0	O K
2160 min Summer	2.100	0.000	0.0	3.7	3.7	0.0	O K
2880 min Summer	2.100	0.000	0.0	2.9	2.9	0.0	O K
4320 min Summer	2.100	0.000	0.0	2.1	2.1	0.0	O K
5760 min Summer	2.100	0.000	0.0	1.6	1.6	0.0	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
15 min Summer	121.269	20
30 min Summer	79.695	30
60 min Summer	49.937	46
120 min Summer	30.267	78
180 min Summer	22.297	110
240 min Summer	17.851	140
360 min Summer	12.957	198
480 min Summer	10.330	252
600 min Summer	8.659	0
720 min Summer	7.492	0
960 min Summer	5.959	0
1440 min Summer	4.309	0
2160 min Summer	3.110	0
2880 min Summer	2.466	0
4320 min Summer	1.775	0
5760 min Summer	1.405	0

©1982-2010 Micro Drainage Ltd

Cascade Summary of Results for MA10147 PP04 100yr.srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
7200 min Summer	2.100	0.000	0.0	1.4	1.4	0.0	O K
8640 min Summer	2.100	0.000	0.0	1.2	1.2	0.0	O K
10080 min Summer	2.100	0.000	0.0	1.0	1.0	0.0	O K
15 min Winter	2.363	0.263	0.0	14.9	14.9	21.4	Flood Risk
30 min Winter	2.397	0.297	0.0	15.4	15.4	25.3	Flood Risk
60 min Winter	2.380	0.280	0.0	15.2	15.2	23.3	Flood Risk
120 min Winter	2.318	0.218	0.0	14.3	14.3	16.3	Flood Risk
180 min Winter	2.261	0.161	0.0	13.4	13.4	9.7	O K
240 min Winter	2.213	0.113	0.0	12.6	12.6	4.8	O K
360 min Winter	2.121	0.021	0.0	10.9	10.9	0.2	O K
480 min Winter	2.100	0.000	0.0	8.8	8.8	0.0	O K
600 min Winter	2.100	0.000	0.0	7.4	7.4	0.0	O K
720 min Winter	2.100	0.000	0.0	6.4	6.4	0.0	O K
960 min Winter	2.100	0.000	0.0	5.1	5.1	0.0	O K
1440 min Winter	2.100	0.000	0.0	3.7	3.7	0.0	O K
2160 min Winter	2.100	0.000	0.0	2.6	2.6	0.0	O K
2880 min Winter	2.100	0.000	0.0	2.1	2.1	0.0	O K
4320 min Winter	2.100	0.000	0.0	1.5	1.5	0.0	O K
5760 min Winter	2.100	0.000	0.0	1.2	1.2	0.0	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
7200 min Summer	1.171	0
8640 min Summer	1.008	0
10080 min Summer	0.889	0
15 min Winter	121.269	21
30 min Winter	79.695	31
60 min Winter	49.937	48
120 min Winter	30.267	84
180 min Winter	22.297	114
240 min Winter	17.851	144
360 min Winter	12.957	192
480 min Winter	10.330	0
600 min Winter	8.659	0
720 min Winter	7.492	0
960 min Winter	5.959	0
1440 min Winter	4.309	0
2160 min Winter	3.110	0
2880 min Winter	2.466	0
4320 min Winter	1.775	0
5760 min Winter	1.405	0

©1982-2010 Micro Drainage Ltd

Cascade Summary of Results for MA10147 PP04 100yr.srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
7200 min Winter	2.100	0.000	0.0	1.0	1.0	0.0	O K
8640 min Winter	2.100	0.000	0.0	0.8	0.8	0.0	O K
10080 min Winter	2.100	0.000	0.0	0.7	0.7	0.0	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
7200 min Winter	1.171	0
8640 min Winter	1.008	0
10080 min Winter	0.889	0

©1982-2010 Micro Drainage Ltd

Cascade Summary of Results for MA10147 PP05 Optimum 100yr.srcx

Upstream Structures	Outflow To	Overflow To
MA10147 PP01 100yr.srcx MA10147 PP02 100yr.srcx MA10147 PP03 100yr.srcx MA10147 PP04 100yr.srcx	MA10147 Pond Optimum 100yr.srcx	(None)

Half Drain Time : 205 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	2.485	0.385	0.0	16.7	16.7	155.9	O K
30 min Summer	2.552	0.452	0.0	16.8	16.8	211.6	O K
60 min Summer	2.624	0.524	0.0	16.8	16.8	272.1	O K
120 min Summer	2.693	0.593	0.0	16.8	16.8	330.1	O K
180 min Summer	2.714	0.614	0.0	16.8	16.8	347.8	Flood Risk
240 min Summer	2.713	0.613	0.0	16.8	16.8	347.3	Flood Risk
360 min Summer	2.702	0.602	0.0	16.8	16.8	337.7	Flood Risk
480 min Summer	2.687	0.587	0.0	16.8	16.8	325.2	O K
600 min Summer	2.670	0.570	0.0	16.8	16.8	310.7	O K
720 min Summer	2.652	0.552	0.0	16.8	16.8	295.4	O K
960 min Summer	2.615	0.515	0.0	16.8	16.8	264.5	O K
1440 min Summer	2.549	0.449	0.0	16.8	16.8	208.8	O K
2160 min Summer	2.473	0.373	0.0	16.7	16.7	146.1	O K
2880 min Summer	2.419	0.319	0.0	16.3	16.3	107.0	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
15 min Summer	121.269	46
30 min Summer	79.695	62
60 min Summer	49.937	86
120 min Summer	30.267	132
180 min Summer	22.297	180
240 min Summer	17.851	210
360 min Summer	12.957	270
480 min Summer	10.330	336
600 min Summer	8.659	404
720 min Summer	7.492	470
960 min Summer	5.959	604
1440 min Summer	4.309	858
2160 min Summer	3.110	1212
2880 min Summer	2.466	1536

©1982-2010 Micro Drainage Ltd

Cascade Summary of Results for MA10147 PP05 Optimum 100yr.srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
4320 min Summer	2.370	0.270	0.0	14.0	14.0	76.3	O K
5760 min Summer	2.347	0.247	0.0	11.7	11.7	64.1	O K
7200 min Summer	2.332	0.232	0.0	10.1	10.1	56.6	O K
8640 min Summer	2.321	0.221	0.0	8.9	8.9	51.1	O K
10080 min Summer	2.312	0.212	0.0	7.8	7.8	47.1	O K
15 min Winter	2.510	0.410	0.0	16.8	16.8	176.6	O K
30 min Winter	2.584	0.484	0.0	16.8	16.8	238.8	O K
60 min Winter	2.664	0.564	0.0	16.8	16.8	306.1	O K
120 min Winter	2.744	0.644	0.0	16.8	16.8	373.1	Flood Risk
180 min Winter	2.777	0.677	0.0	16.8	16.8	400.7	Flood Risk
240 min Winter	2.778	0.678	0.0	16.8	16.8	401.6	Flood Risk
360 min Winter	2.760	0.660	0.0	16.8	16.8	386.1	Flood Risk
480 min Winter	2.739	0.639	0.0	16.8	16.8	368.4	Flood Risk
600 min Winter	2.713	0.613	0.0	16.8	16.8	346.8	Flood Risk
720 min Winter	2.685	0.585	0.0	16.8	16.8	323.5	O K
960 min Winter	2.629	0.529	0.0	16.8	16.8	276.2	O K
1440 min Winter	2.529	0.429	0.0	16.8	16.8	192.2	O K
2160 min Winter	2.423	0.323	0.0	16.4	16.4	109.8	O K
2880 min Winter	2.376	0.276	0.0	14.6	14.6	80.2	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
4320 min Summer	1.775	2216
5760 min Summer	1.405	2944
7200 min Summer	1.171	3672
8640 min Summer	1.008	4408
10080 min Summer	0.889	5136
15 min Winter	121.269	50
30 min Winter	79.695	67
60 min Winter	49.937	94
120 min Winter	30.267	134
180 min Winter	22.297	180
240 min Winter	17.851	232
360 min Winter	12.957	292
480 min Winter	10.330	366
600 min Winter	8.659	442
720 min Winter	7.492	514
960 min Winter	5.959	654
1440 min Winter	4.309	906
2160 min Winter	3.110	1228
2880 min Winter	2.466	1532

©1982-2010 Micro Drainage Ltd

Cascade Summary of Results for MA10147 PP05 Optimum 100yr.srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
4320 min Winter	2.341	0.241	0.0	11.1	11.1	60.8	O K
5760 min Winter	2.322	0.222	0.0	9.0	9.0	51.5	O K
7200 min Winter	2.309	0.209	0.0	7.5	7.5	45.7	O K
8640 min Winter	2.299	0.199	0.0	6.4	6.4	41.8	O K
10080 min Winter	2.292	0.192	0.0	5.6	5.6	38.7	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
4320 min Winter	1.775	2244
5760 min Winter	1.405	2944
7200 min Winter	1.171	3672
8640 min Winter	1.008	4408
10080 min Winter	0.889	5136

©1982-2010 Micro Drainage Ltd

Cascade Summary of Results for MA10147 Pond Optimum 100yr.srcx

Upstream Structures	Outflow To	Overflow To
MA10147 PP05 Optimum 100yr.srcx MA10147 PP01 100yr.srcx MA10147 PP02 100yr.srcx MA10147 PP03 100yr.srcx MA10147 PP04 100yr.srcx	(None)	(None)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m^3)	Status
15 min Summer	1.995	0.295	8.9	83.6	O K
30 min Summer	2.104	0.404	8.9	119.6	O K
60 min Summer	2.215	0.515	8.9	159.3	O K
120 min Summer	2.326	0.626	8.9	202.0	O K
180 min Summer	2.395	0.695	8.9	230.0	O K
240 min Summer	2.444	0.744	8.9	250.4	O K
360 min Summer	2.503	0.803	8.9	276.3	Flood Risk
480 min Summer	2.544	0.844	8.9	294.6	Flood Risk
600 min Summer	2.573	0.873	8.9	307.8	Flood Risk
720 min Summer	2.594	0.894	8.9	317.4	Flood Risk
960 min Summer	2.619	0.919	8.9	329.1	Flood Risk
1440 min Summer	2.585	0.885	8.9	313.4	Flood Risk
2160 min Summer	2.515	0.815	8.9	281.4	Flood Risk
2880 min Summer	2.427	0.727	8.9	243.4	O K
4320 min Summer	2.203	0.503	8.9	154.7	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
15 min Summer	121.269	191
30 min Summer	79.695	272
60 min Summer	49.937	368
120 min Summer	30.267	478
180 min Summer	22.297	554
240 min Summer	17.851	612
360 min Summer	12.957	694
480 min Summer	10.330	766
600 min Summer	8.659	834
720 min Summer	7.492	896
960 min Summer	5.959	1018
1440 min Summer	4.309	1232
2160 min Summer	3.110	1540
2880 min Summer	2.466	1900
4320 min Summer	1.775	2568

©1982-2010 Micro Drainage Ltd

Cascade Summary of Results for MA10147 Pond Optimum 100yr.srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
5760 min Summer	2.037	0.337	8.9	97.1	O K
7200 min Summer	1.931	0.231	8.7	63.8	O K
8640 min Summer	1.869	0.169	8.3	45.6	O K
10080 min Summer	1.845	0.145	7.6	38.6	O K
15 min Winter	2.037	0.337	8.9	97.2	O K
30 min Winter	2.157	0.457	8.9	138.0	O K
60 min Winter	2.278	0.578	8.9	183.0	O K
120 min Winter	2.404	0.704	8.9	233.8	O K
180 min Winter	2.477	0.777	8.9	264.6	O K
240 min Winter	2.523	0.823	8.9	284.9	Flood Risk
360 min Winter	2.586	0.886	8.9	313.6	Flood Risk
480 min Winter	2.630	0.930	8.9	334.6	Flood Risk
600 min Winter	2.663	0.963	8.9	350.2	Flood Risk
720 min Winter	2.687	0.987	8.9	362.0	Flood Risk
960 min Winter	2.718	1.018	8.9	377.5	Flood Risk
1440 min Winter	2.698	0.998	8.9	367.2	Flood Risk
2160 min Winter	2.589	0.889	8.9	315.2	Flood Risk
2880 min Winter	2.434	0.734	8.9	246.3	O K
4320 min Winter	2.078	0.378	8.9	110.8	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
5760 min Summer	1.405	3224
7200 min Summer	1.171	3848
8640 min Summer	1.008	4504
10080 min Summer	0.889	5176
15 min Winter	121.269	219
30 min Winter	79.695	311
60 min Winter	49.937	416
120 min Winter	30.267	542
180 min Winter	22.297	618
240 min Winter	17.851	672
360 min Winter	12.957	760
480 min Winter	10.330	832
600 min Winter	8.659	896
720 min Winter	7.492	956
960 min Winter	5.959	1070
1440 min Winter	4.309	1282
2160 min Winter	3.110	1600
2880 min Winter	2.466	2028
4320 min Winter	1.775	2624

©1982-2010 Micro Drainage Ltd

Cascade Summary of Results for MA10147 Pond Optimum 100yr.srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m^3)	Status
5760 min Winter	1.890	0.190	8.5	51.8	O K
7200 min Winter	1.840	0.140	7.4	37.2	O K
8640 min Winter	1.821	0.121	6.4	32.1	O K
10080 min Winter	1.809	0.109	5.6	28.8	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
5760 min Winter	1.405	3152
7200 min Winter	1.171	3752
8640 min Winter	1.008	4472
10080 min Winter	0.889	5152

©1982-2010 Micro Drainage Ltd