Flood Risk Assessment

Proposed Residential Development
Frolic Farm
Lode
Cambridgeshire
CB25 9HF

Revision 0: April 2022
Report Reference: 529-FRA-02-0

Martin Andrews Consulting Limited | Regents Pavilion, 4 Summerhouse Road, Northampton, NN3 6BJ
T: 01604 340544 | E: info@mac-ltd.co.uk | W: preplanningengineering.co.uk

Report Originator(s)
Martin Andrews MEng (Hons) CEng MICE MCIHT
Director
martin.andrews@mac-ltd.co.uk

Revision Record

Revision	Date	Description	Written	Approved
0	22/04/22	Planning issue	MJA	MJA

Contents

Appendices

1.0 Introduction

1.1 Instructions

1.1.1 This Flood Risk Assessment has been prepared from instructions received from Carter Jonas for Dean and Dean.

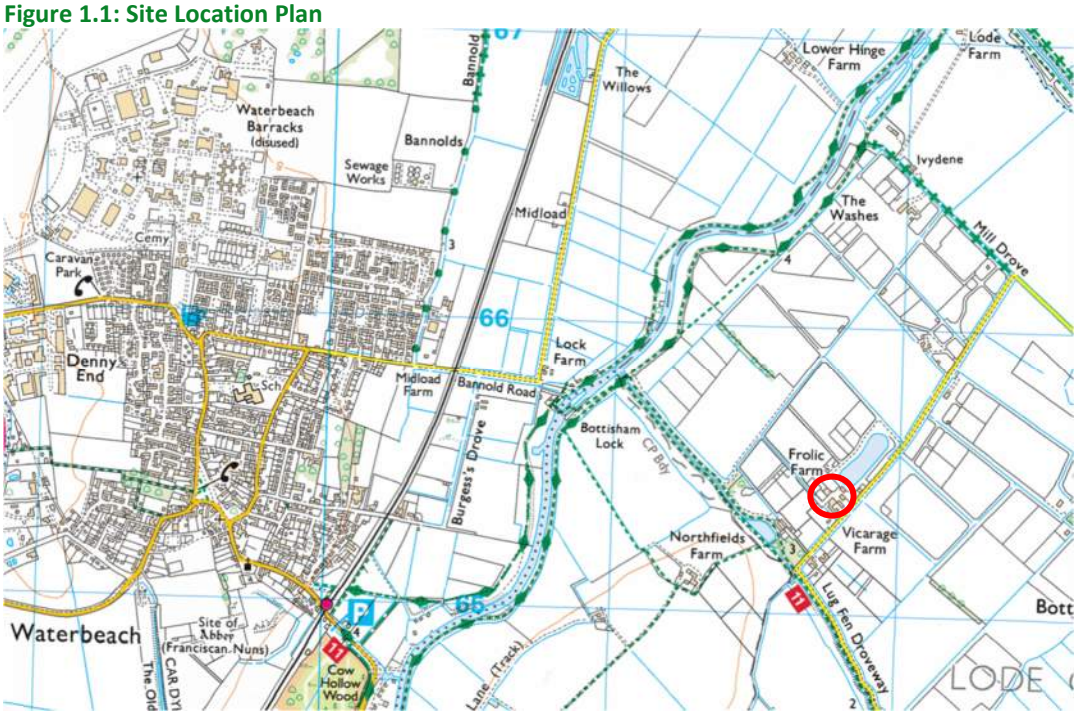
1.1.2 The report has been prepared to support the submission of a full planning application.

1.1.3 The benefit of this report is to our instructing Client.

1.2 Site Location

1.2.1 The proposed residential development is located at Frolic Farm, Lode, Cambridgeshire, as shown in Figure 1.1 below and enclosed in Appendix A. The approximate National Grid Reference for the site is E551818 N265423.

Figure 1.1: Site Location Plan



1.3 Current Use and Description

1.3.1 The site currently comprises agricultural barns and associated external areas.

1.4 Proposed Development

1.4.1 The proposed development will comprise the demolition of two barns and associated areas and their replacement with five dwellings. The proposed development layout is shown on the plan enclosed in Appendix B.

1.4.2 In line with paragraph 26 of the Planning Practice Guidance for 'Flood risk and climate change' the lifetime of a residential development is considered to be at least 100 years.

1.4.3 The 'Flood Risk Vulnerability Classification' of various development types is defined within Table 2 of the Planning Practice Guidance for Flood Risk and Coastal Change (PPG). A residential development is classified as a More Vulnerable development. The relevant extract from Table 2 of the PPG is set out below.

More vulnerable

- Hospitals.
- Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels.
- Buildings used for **dwelling houses**, student halls of residence, drinking establishments, nightclubs and hotels.
- Non–residential uses for health services, nurseries and educational establishments.
- Landfill* and sites used for waste management facilities for hazardous waste.
- Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan.

1.5 Planning History

1.5.1 A change of use planning application (21/00753/ARN) was approved by East Cambridgeshire Council on 10th August 2021 for the conversion of two barns into five dwellings. Should this application be successful the barns will be replaced with purpose built dwellings.

2.0 Site Specific Flood Risk

2.1 Risk of Fluvial / Tidal Flooding

2.1.1 The likelihood of fluvial and tidal flooding is defined on the Environment Agency's map 'Flood Map for Planning'. This flood map is published on the gov.uk website.

2.1.2 An extract of this flood map is provided below in Figure 2.1. The site location is shown in red.

Figure 2.1: Fluvial / Tidal Flood Risk - gov.uk -22/04/22

2.1.3 The Environment Agency's flood map shows that the proposed development site is located within Flood Zone 2 (Medium Probability) and as such, the development is at a medium (1 in 100 years to 1 in 1000 years) from rivers or the sea.

2.2 Risk of Surface Water Flooding

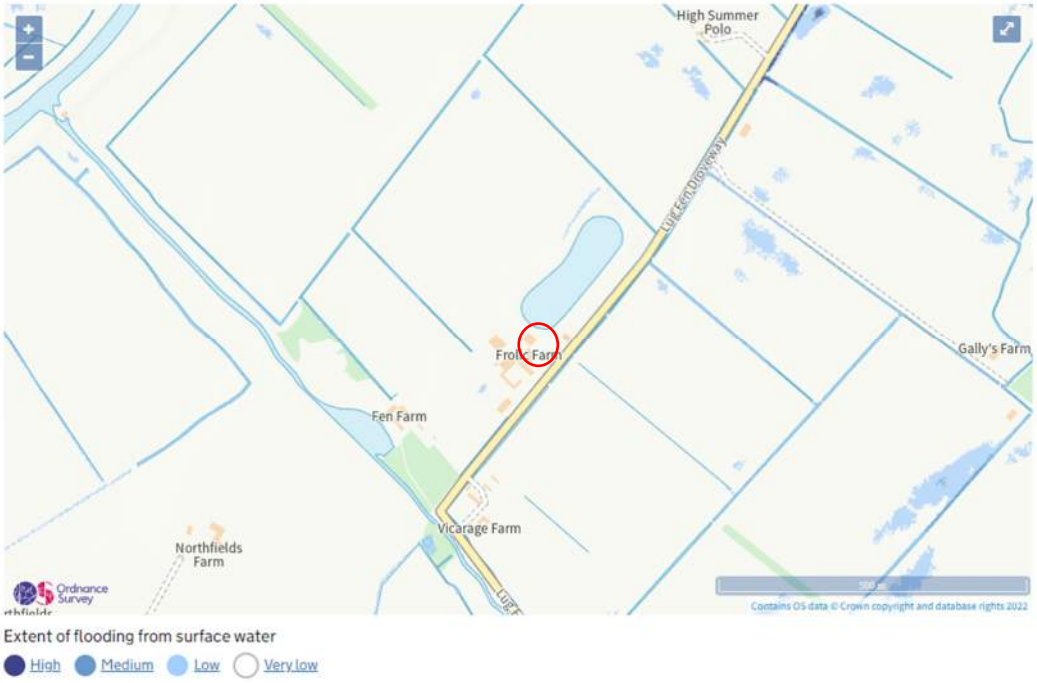
2.2.1 The likelihood of surface water flooding is defined on the Environment Agency's map 'Flood risk from surface water'. This flood map is published on the gov.uk website.

2.2.2 An extract of this flood map is provided below in Figure 2.2. The approximate site boundary is shown in red.

2.2.3 Regarding the accuracy of this map the EA state that:

"Flooding from surface water is difficult to predict as rainfall location and volume are difficult to forecast. In addition, local features can greatly affect the chance and severity of flooding. Because of this, we report the highest risk within 20m of a specific location, such as an individual property. This means reports for neighbouring properties may show different levels of risk."

Figure 2.2: Surface Water Flooding - gov.uk – 22/04/22



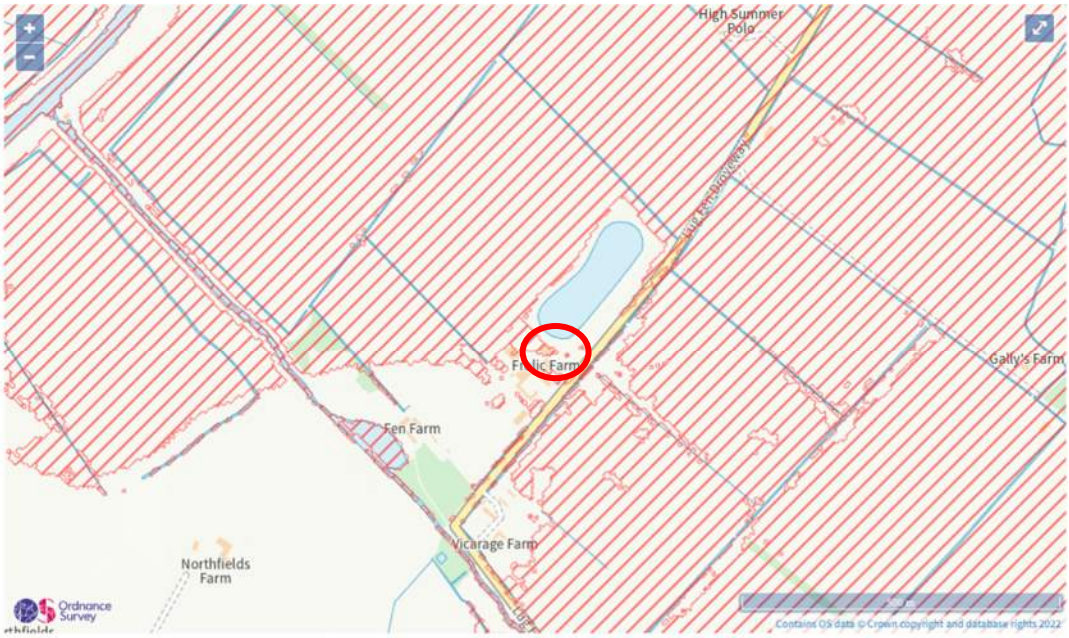
2.2.4 The site is in an area of very low surface water flood risk.

2.3 Risk of Reservoirs, Canals and Other Artificial Sources Flooding

2.3.1 The likelihood of reservoir water flooding is defined on the Environment Agency's map 'Flood Risk from Reservoirs'. This flood map is published on the gov.uk website.

2.3.2 An extract of this flood map is provided below in Figure 2.3. The approximate site boundary is shown in red.

Figure 2.3: Reservoir Flooding - gov.uk - 16/05/21



2.3.3 The site is not at risk of reservoir flooding when river levels are normal but is at risk of flooding when there also flooding from rivers. The Environment Agency states that:

The outline reservoir flood maps do not give any information about the likelihood of reservoir failure, the depth and speed of the flood waters, or the length of time it would take for the flood waters to reach any location. Even in a worst case scenario many areas shown as possibly being at risk of reservoir flooding would be expected to receive no more than a few centimetres of flood water.

In England and Wales, the Environment Agency has a regulatory role for reservoir safety, under the Reservoirs Act 1975. It ensures that reservoirs are regularly inspected and essential safety works are carried out. The Environment Agency has the power to prosecute reservoir owners for failure to carry out essential safety works, and where emergency works are required, it has the power to carry out these works itself.

2.3.4 We therefore consider the risk of reservoir flooding to be very low. We are not aware of any canals or other artificial sources which may cause flooding on the site.

2.4 Risk of Ground Water Flooding

2.4.1 We do not have any records of ground water flooding within the vicinity of the site. We therefore consider the risk of ground water sewer flooding to be low.

2.5 Risk of Sewer Flooding

2.5.1 We do not have any records of sewer flooding within the vicinity of the site. We therefore consider the risk of sewer flooding to be low.

2.6 Previous Flood Events

2.6.1 The Environment Agency's Historic Flood Map does not show any flooding within the boundary of the site. The Environment Agency's "Historic Flood Map is a GIS layer showing the maximum extent of all individual Recorded Flood Outlines from river, the sea and groundwater springs that meet a set criteria. It shows areas of land that have previously been subject to flooding in England. Records began in 1946 when predecessor bodies to the Environment Agency started collecting detailed information about flooding incidents".

2.7 Summary of Flood Risk

2.7.1 The proposed development site is located within Flood Zone 2 and is at a low risk of flooding from all other sources.

2.8 Flood Risk Vulnerability and Flood Zone 'Compatibility'

2.8.1 The suitability of different development types to be built and occupied within a particular Flood Zone is defined within Table 3 of the Planning Practice Guidance for 'Flood Risk and Coastal Change' to the National Planning Policy Framework. Table 3 is replicated below in Table 2.1below. This table maps vulnerability classes against the flood zones to indicate where development is 'appropriate' and where it should not be permitted.

2.8.2 The proposed residential conversion of two existing agricultural buildings is located within Flood Zone 2 and is classified as a More Vulnerable development. Based on this categorisation of the development it is considered 'appropriate'.

Table 2.1: Flood risk vulnerability and flood zone 'compatibility'

Flood Zone	Flood Risk Vulnerability Classification				
	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test required	✓	✓	✓
Zone 3a †	Exception Test required †	×	Exception Test required	✓	
Zone 3b *	Exception Test required *	×	×	×	×

✓ Development is appropriate
✗ Development should not be permitted.
† In Flood Zone 3a essential infrastructure should be designed and constructed to remain operational and safe in times of flood.
" * " In Flood Zone 3b (functional floodplain) essential infrastructure that has to be there and has passed the Exception Test, and water-compatible uses, should be designed and constructed to:

- remain operational and safe for users in times of flood;
- result in no net loss of floodplain storage;
- not impede water flows and not increase flood risk elsewhere.

2.9 Sequential Test

2.9.1 The development has approval for residential dwellings this planning approval changes the type of dwelling. Therefore, the proposed development is considered to have passed the sequential test.

3.0 Surface Water Management

3.1 Existing Drainage

3.1.1 The site is a brownfield site and comprises two barns with an unconfirmed drainage outfall. For the purposes of this assessment the site will be treated as greenfield.

3.2 Existing Discharge Rate

3.2.1 The existing discharge rate for the site has been calculated using the IH124 method. Full calculations are enclosed in **Appendix E** whilst the input parameters and results are summarised in **Table 3.1** below.

Table 3.1: Existing Run-off Rate Calculation Parameters and Results

Parameter	Value
Proposed Drained Area (ha)	0.095, see **Appendix D**
SAAR (mm)	538
Soil Index / SPR	3/0.4
Region	5
Results	Value
Q_{Bar} (l/s)	0.2
Q1 (l/s)	0.2
Q30 (l/s)	0.6
Q100 (l/s)	0.8

3.2.2 The allowable discharge rate for the site is the Q_{Bar} rate of 0.2 l/s. A discharge rate of 0.2 l/s will result in an increased risk of blockage caused by a small aperture at the outfall. In line with local guidance and as permeable paving will be utilised to reduce the risk of blockage a minimum aperture of 50mm is required. Based on the current design proposals this will result in a discharge rate of 1.0l/s.

3.3 Proposed Method of Discharge

3.3.1 Paragraph 80 of the Planning Practice Guidance for 'Flood Risk and Coastal Change' defines the hierarchy of drainage options. Where reasonably practicable the aim should be to discharge surface water run-off as high up the following hierarchy of drainage options as reasonably practicable:

1. into the ground (infiltration)
2. to a surface water body
3. to a surface water sewer, highway drain, or another drainage system
4. to a combined sewer

3.3.2 Each of these is considered separately below:

Into the ground

3.3.3 Inspection of the British Geological Survey's maps show that the site is likely to be underlain by River Terrace Deposits - Sand and Gravel overlying Gault Formation – Mudstone.

3.3.4 Based on the above geology description we would anticipate that infiltration techniques could be viable in the River Terrace Deposits but the low-lying nature of the site might mean that ground water is relatively high meaning that infiltration techniques are not viable. At detailed design stage infiltration testing will be undertaken to confirm whether infiltration is viable. Should infiltration be found to be viable the drainage strategy proposed for the development will be altered to take this into account.

To a surface water body

3.3.5 There is a watercourse located adjacent to the site's southern boundary. This will be used as the outfall for the site.

3.3.6 As a surface water body is viable the use of alternative drainage methods will not be considered further in this report.

3.4 Proposed Drainage Strategy

3.4.1 Surface water discharge from the proposed development outfall to the watercourse located adjacent to the site's southern boundary. The surface water discharge rate from the site will be restricted to minimum viable discharge rates.

3.4.2 The proposed drainage strategy will comprise a:

- A piped network
- Hydrobrake flow control
- Permeable paving tanked with sub-base and sub-base replacement storage

3.4.3 The proposed surface water drainage strategy is shown on the drawing enclosed in **Appendix C**.

Design Parameters

3.4.4 Surface water drainage will be designed using the rainfall parameters from the Flood Estimation Handbook (FEH).

3.4.5 Climate change allowances are defined by the Environment Agency in their document 'Flood risk assessments: climate change allowances' first published in February 2016. Table 2 of this document shows anticipated changes in extreme rainfall intensity in small and urban catchments. The Environment Agency advise that flood risk assessments and strategic flood risk assessments, assess both the central and upper end allowances to understand the range of impact. Table 2 of the Environment Agency's guidance is replicated below in **Table 3.2**.

Table 3.2: Table 2 Peak rainfall intensity allowance in small and urban catchments

Applies across all of England	Total potential change anticipated for the '2020s' (2015 to 2039)	Total potential change anticipated for the '2050s' (2040 to 2069)	Total potential change anticipated for the '2080s' (2070 to 2115)
Upper end	10%	20%	40%
Central	5%	10%	20%

3.4.6 To ensure a worst-case assessment is undertaken a 40% climate change allowance will be used throughout.

3.5 Drainage Design

3.5.1 Surface water attenuation is required to store excess water during an extreme event whilst maintaining a minimum viable discharge rate of 1.0 l/s. Surface water will be attenuated within subbase and subbase replacement storage driveways and the road. Full calculations are enclosed in **Appendix E** whilst design parameters are set out below.

Table 3.3: Attenuation Calculation Parameters and Results

Parameter	Value
Return Period (years)	100 + 40% Climate Change
Rainfall Parameters	FEH13
Drained Area (ha)	0.105, see **Appendix E** includes 10% urban creep
Discharge Rate (l/s)	1.0l/s

3.6 Maintenance Requirements

3.6.1 The drainage will be designed in line with Building Regulations, Design and Construction Guidance for foul and surface water sewers offered for adoption under the Code for adoption agreements for water and sewerage companies operating wholly or mainly in England ("the Code"); as well as local SUDS guidance to ensure compliance with best practice guidance, thus minimising the maintenance requirements.

3.6.2 The person / authority responsible for maintenance of the drainage will depend on ownership which will vary across the site; as detailed design and adoption progresses the exact body responsible for adoption of the various surface water aspects will become clear. Typical responsibilities are set out below in **Table 3.4**.

Table 3.4: Surface Water Maintenance

Drainage	Maintainer
Drains	Home owner
Private Sewers	Home owner / management company
Household SUDS	Home owner
Communal SUDS - private	Management company / home owner.

3.6.3 A detailed drainage maintenance plan will be prepared by the body responsible for maintenance once detailed design has been undertaken. This will follow the principles set out in the SUDS Manual, which are set out below:

Permeable Paving – taken from the SUDS Manual

Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface)	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturers' recommendations – pay particular attention to areas where water runs onto pervious pavement from adjacent impermeable areas as this area is most likely to collect the most sediment.
Occasional Maintenance	Stabilise and mow contribution and adjacent areas	As required
	Removal of weeds or management using glyphosate applied directly to the weeds by an applicator rather than spraying	As required – once per year on less frequently used pavements.
Remedial Actions	Remedial any landscaping which through vegetation maintenance or soil slip has been raised to within 50mm of the level of the paving	As required
	Remedial work to any depressions, rutting and cracked of broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing material	As required
	Rehabilitate of surface and upper structure by remedial sweeping	Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging)
Monitoring	Initial inspection	Monthly for three months after installation
	Inspect for evidence of poor operation and/or weed growth – if required, take remedial action	Three-monthly. 48h after large storms in first 6 months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually

Pipes

Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Open any inspection chambers and remove and debris.	Annually
Remedial Actions	Remediate any damaged pipe works.	As required
Monitoring	Monitor inspection chambers	Annually

Hydrobrake

3.6.4 All maintenance should follow manufacturer's current guidance. As hydrobrakes include no moving parts maintenance is limited.

Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Open any inspection chambers and remove any debris.	Annually
Remedial Actions	Remediate any damaged elements.	As required
Monitoring	Monitor inspection chambers	Annually

4.0 Conclusions

4.1 Site location and proposed development

4.1.1 The proposed residential development is located at Frolic Farm, Lode, Cambridgeshire.

4.1.2 The proposed development will comprise conversion of two agricultural buildings into five dwellings.

4.2 Flood Risk

4.2.1 The proposed development site is located within Flood Zone 2 and is at a low risk of flooding from all other sources.

4.2.2 The proposed development's vulnerability classification is compatible with the Flood Zone therefore the development is appropriate.

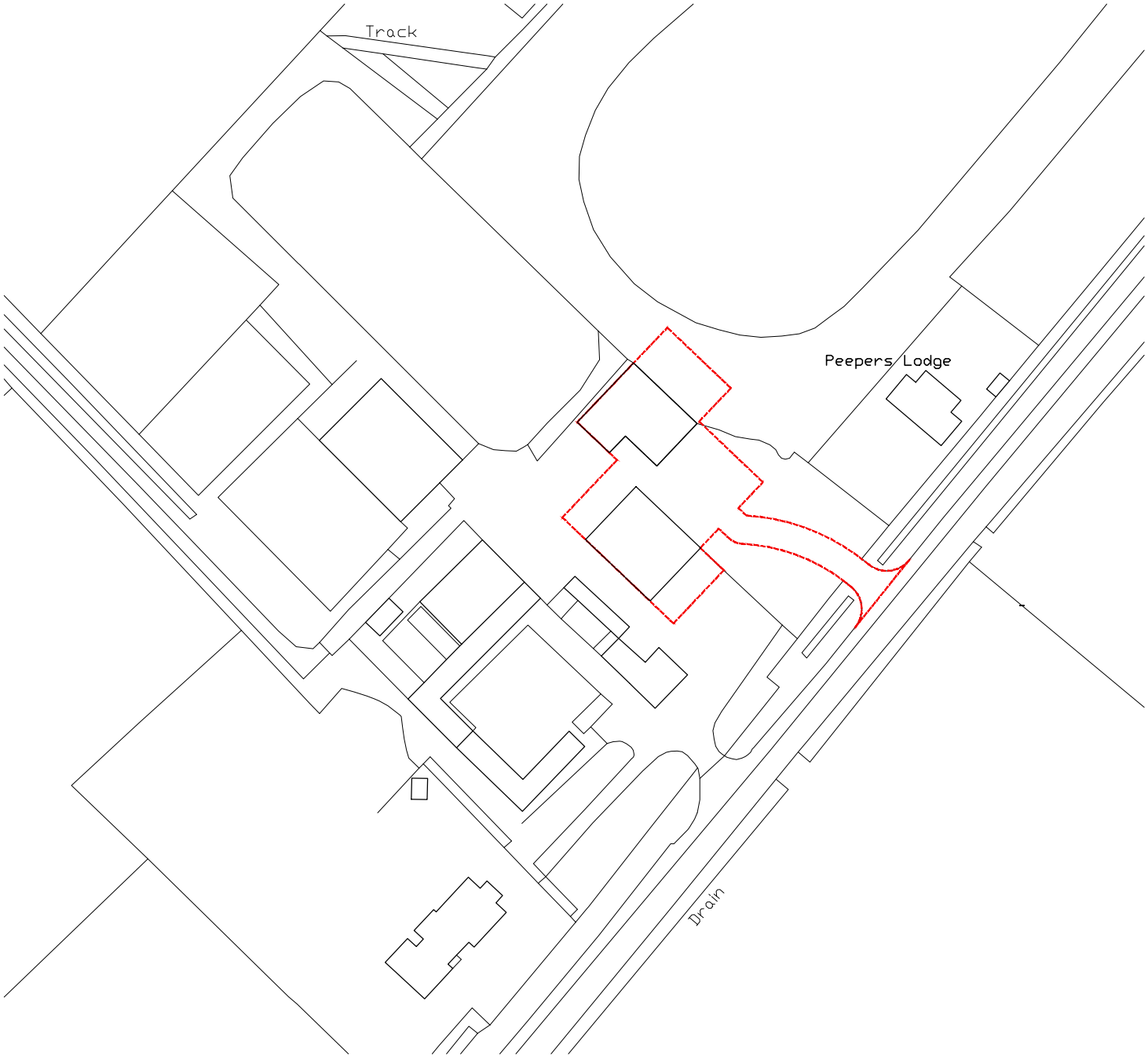
4.3 Surface Water Management

4.3.1 The key proposed surface water parameters are:

- Discharge rate: 1.0 l/s
- Outfall: watercourse
- SUDS features:
  - Hydrobrake flow control
  - Permeable paving tanked with sub-base storage

Appendix A

Location Plan
Twenty Nine Architecture



drawing title LOCATION PLAN

scale 1:1250 original A4

address 25 Cromwell Road
Cambridge
Cambridgeshire
CB1 3EB

telephone +44 (0)1223 212253
email info@29architecture.co.uk
website www.29architecture.co.uk

TWENTY NINE. ARCHITECTURE + PLANNING

Appendix B

Proposed Site Plan
Twenty Nine Architecture drawing no.PL(21)01

general notes

The drawing is to be read in conjunction with all other relevant drawings and specifications.

All dimensions to be checked on site prior to commencement of works and any discrepancies to be checked immediately.

Do not scale from this drawing.

Unless otherwise stated, all dimensions are in mm.

LEGEND

- SITE BOUNDARY
- EXISTING TREES TO BE REMOVED
- PROPOSED TREE LOCATIONS
- SOFT LANDSCAPING- REFER TO
- FLAG PAVING TO PATIOS AND PATHS
- PERMEABLE BLOCK PAVING TO DRIVEWAYS- HERRINGBONE BOND
- PERMEABLE BLOCK PAVING TO PARKING BAYS- STRETCHER BOND

rev	-	date	April '22
drawn	DSR		

client

project: Frolic Farm, Lodge
Cambridgeshire CB25 9HF

drawing title: Proposed Site Plan

drawing no	PL(21)01	checked	DSR
scale	1:200	original	A2
status	PLANNING		

address: 25 Cromwell Road
Cambridge
Cambridgeshire
CB1 3EB

telephone: +44 (0)1223 212253
email: info@29architecture.co.uk
website: www.29architecture.co.uk

TWENTY NINE. ARCHITECTURE + PLANNING

Appendix C

Proposed Drainage Strategy
MAC drawing no. 529-FRA03

NORTH

Notes:

1. Based on Proposed SIte Plan which includes topo and OS data by Twenty Nine Architecture, drawing number PL(21)01 dated April '22.

Key

- Site Boundary = AREAm^2
- Proposed Surface Water Drainage
- Attenuation - sub-base storage
- Attenuation - sub-base replacement storage
- Depths of storage vary, refer to calculations

Peepers Lodge

MH1
CL 2.000
IL 1.500

1.001:300Ø@500

MH2
CL 2.150
IL 1.458

1.002:300Ø@500

MH3
CL 2.150
IL 1.424

1.003:300Ø@500

MH4
CL 2.150
IL 1.378

1.004300Ø@500

Outfall
IL 1.366

ENHANCED PLANTING THROUGHOUT SITE

EXISTING AGRICULTURAL BARNS TO BE DEMOLISHED TO MAKE WAY FOR NEW PROPOSAL

NEW 5M WIDE VEHICULAR ACCESS WITH 2X2m VISIBILITY SPLAY AND CROSSOVER TO HIGHWAY AUTHORITIES STANDARDS

PLOT 1 · PLOT 2 · PLOT 3 · PLOT 4 · PLOT 5

PRIVATE GARDEN AREA 180m² · PRIVATE GARDEN AREA 173m² · PRIVATE GARDEN AREA 160m² · PRIVATE GARDEN AREA 90m² · PRIVATE GARDEN AREA 93m²

POND · GRASS · PATIO AREA · TOP ARENA WALL 4.42 · OIL TANK · STEP · GY · LP · SILVER BIRCH G 0.3 HT 9m · SILVER BIRCH G 0.4 HT 10m · G 0.1 HT 4m · G 0.2 HT 5m · G 0.5 HT 11m

MAC
T: 01604 340544 Northampton Office
E: info@mac-ltd.co.uk W: mac-ltd.co.uk
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- Transport Assessments
- Flood Risk Assessments
- Highway Advice
- Access Design
- Drainage Strategies
- Vehicle tracking

Client:

Project: Frolic Farm, Lode Cambridgeshire CB25 9HF

Title: Proposed Drainage Strategy

Date: 22/04/22
Drw: MJA
Chk: MJA

Drawing No: 529-FRA03

Revision: -

Scale: 1:250
Size: A3

Appendix D

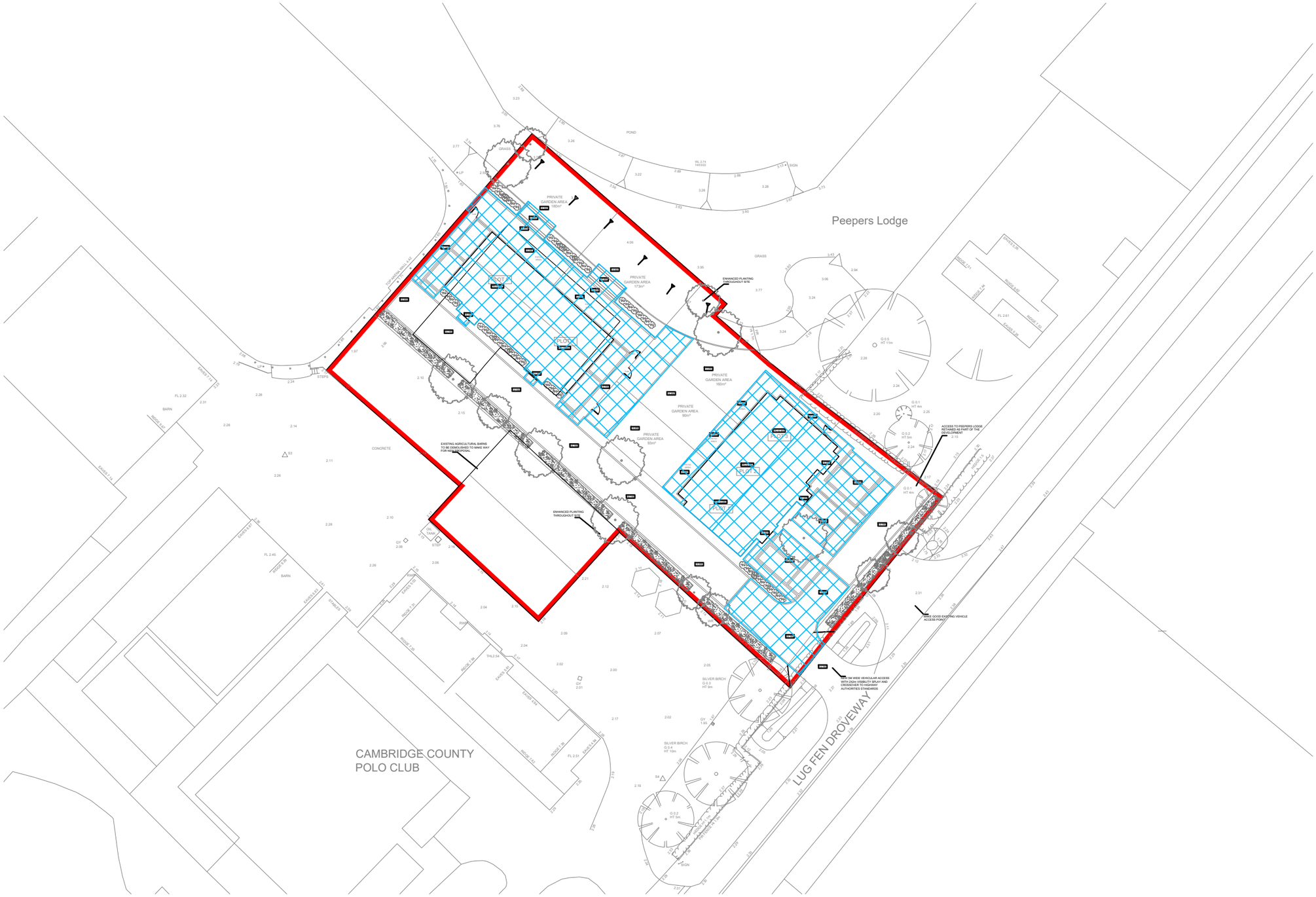
Proposed Impermeable Area
MAC drawing no. 529-FRA02

NORTH

Notes:

1. Based on Ordnance Survey Mapping ©Crown Copyright and database rights 2021 OS 100019980

2. Based on 'Proposed Site Plan' by Twenty Nine, drawing number PL(21)01 dated April 22.



Key:

Site Boundary = 2512m^2 (0.251ha)

Proposed Impermeable Area = 952m^2 (0.095ha)

Proposed Impermeable Area

T: 01604 340544 Northampton Office
E: info@mac-ltd.co.uk W: mac-ltd.co.uk
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- Transport Assessments
- Flood Risk Assessments
- Highway Advice
- Access Design
- Drainage Strategies
- Vehicle tracking

Client: Manor Oak Homes		Project: Frolic Farm, Lode Cambridgeshire CB25 9HF	
Title: Proposed Impermeable Area			Date: 22/04/22
			Drw: SH
			Chk: MJA
Drawing No: 529-FRA02	Revision: -		Scale: 1:500
			Size: A3

Appendix E

Drainage Calculations

Design Settings

Rainfall Methodology	FEH-13	Minimum Velocity (m/s)	1.00
Return Period (years)	2	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.200
CV	0.750	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	x
Maximum Rainfall (mm/hr)	50.0		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
1	0.005	5.00	2.000	1200	8264.520	-410.748	0.500
2	0.045	5.00	2.150	1200	8280.260	-424.768	0.692
3	0.018	5.00	2.150	1200	8292.868	-435.900	0.726
4	0.037	5.00	2.150	1200	8310.242	-450.917	0.772
5	0.000		2.100	1200	8312.103	-456.865	0.734

Links (Input)

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	1	2	21.079	0.600	1.500	1.458	0.042	500.0	300	5.50	50.0
1.001	2	3	16.819	0.600	1.458	1.424	0.034	500.0	300	5.91	50.0
1.002	3	4	22.964	0.600	1.424	1.378	0.046	500.0	300	6.46	50.0
1.003	4	5	6.232	0.600	1.378	1.366	0.012	500.0	300	6.61	50.0

Simulation Settings

Rainfall Methodology	FEH-13	Analysis Speed	Normal	Additional Storage (m³/ha)	20.0
Summer CV	0.750	Skip Steady State	x	Check Discharge Rate(s)	x
Winter CV	0.840	Drain Down Time (mins)	240	Check Discharge Volume	x

Storm Durations

15	60	180	360	600	960	2160	4320	7200
30	120	240	480	720	1440	2880	5760	8640

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
100	40	0	0

Node 4 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	1.378	Product Number	CTL-SHE-0051-1000-0700-1000
Design Depth (m)	0.700	Min Outlet Diameter (m)	0.075
Design Flow (l/s)	1.0	Min Node Diameter (mm)	1200

Node 4 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	1.400
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	35.9	0.0	0.500	35.9	0.0	0.501	0.0	0.0

Node 4 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	1.420
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	35.9	0.0	0.500	35.9	0.0	0.501	0.0	0.0

Node 4 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	1.440
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	35.9	0.0	0.500	35.9	0.0	0.501	0.0	0.0

Node 1 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	1.500
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	28.9	0.0	0.450	29.9	0.0	0.451	0.0	0.0

Node 2 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	1.458
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	24.7	0.0	0.400	24.7	0.0	0.401	0.0	0.0

Node 4 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	1.378
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	92.8	0.0	0.600	92.8	0.0	0.601	0.0	0.0

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
480 minute winter	1	472	1.978	0.478	0.7	4.6094	0.0000	FLOOD RISK
480 minute winter	2	472	1.978	0.520	4.0	4.2318	0.0000	FLOOD RISK
480 minute winter	3	472	1.978	0.554	4.6	0.9010	0.0000	FLOOD RISK
480 minute winter	4	472	1.978	0.600	7.6	69.2123	0.0000	FLOOD RISK
15 minute summer	5	1	1.366	0.000	1.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
480 minute winter	1	1.000	2	-0.3	0.063	-0.005	1.4844	
480 minute winter	2	1.001	3	3.0	0.245	0.061	1.1844	
480 minute winter	3	1.002	4	4.3	0.267	0.088	1.6171	
480 minute winter	4	Hydro-Brake®	5	1.0				35.9