ONE HORTON HEATH

Upper Acre

Flood Risk and Drainage Strategy

December 2025

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ARCH ASSOCIATES

DRAINAGE AND FLOOD RISK TECHNICAL NOTE

UPPER ACRE,
ONE HORTON HEATH

ARCH ASSOCIATES

DRAINAGE AND FLOOD RISK TECHNICAL NOTE

for

UPPER ACRE
ONE HORTION HEATH

Client:
Eastleigh Borough Council (One Horton Heath Team)
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1.0 Executive Summary

Arch Associates Limited has been appointed by Eastleigh Borough Council (One Horton Heath Team) to prepare a Technical Note to discharge the relevant drainage conditions from the Outline Planning Permission (OPP) and to demonstrate alignment with the drainage principles established in the OPP for the Upper Acre parcel within the wider One Horton Heath development. The surface water drainage system will utilise SuDS treatment trains to manage water quality and quantity as detailed in Section 2.4, which includes using Prevention Measures and Source Control Techniques. The RMA SuDS drainage design has been prepared in accordance with the strategy developed for the OPP, the National Planning Policy Framework (NPPF), Planning Practice Guidance (PPG) and the and the LLFA requirements. The relevant conditions to discharge are listed below:

Condition 58 Flood Risk

Condition 59 Foul Drainage

Condition 61 SUDS

2.0 Introduction

The Upper Acre parcel forms a significant phase within the wider One Horton Heath development, a major mixed-use scheme proposed to the west of Burnetts Lane, Eastleigh. Refer to Figure 1 for proposed scheme location. The overall project, led by Eastleigh Borough Council's One Horton Heath Team, was granted outline planning permission in October 2025 for up to 2,500 homes, a local centre, a primary school, and commercial floorspace (LPA Ref: O/20/89498). The Reserved Matters Application (RMA) for Upper Acre, covering approximately 10.34 hectares, is now being submitted in accordance with the outline consent and associated conditions.

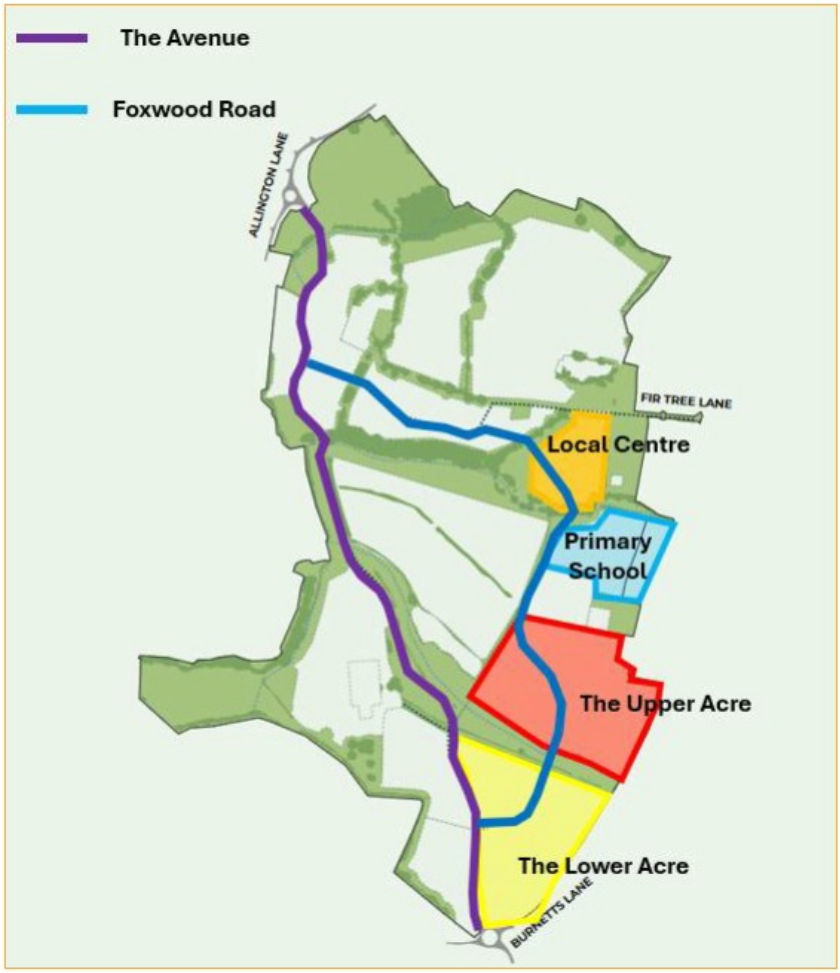

Figure 1 Location of Upper Acre within wider development

Upper Acre is strategically positioned at the eastern boundary of the outline planning site, acting as a transition between the proposed Local Centre and the southern residential neighbourhoods at Lower Acre, which are currently under construction. The site itself is predominantly open agricultural land, bounded by established hedgerows, with existing residential properties and Burnetts Lane to the east, and the ongoing Lower Acre construction to the south. To the west lies an existing solar farm.

The proposed development at Upper Acre comprises 424 dwellings, including a mix of houses and apartments, with a range of one to five-bedroom homes. The scheme is designed to provide accessible homes, with at least 80% of dwellings meeting M4(2) standards for access, parking, and internal arrangements. Car parking provision includes

635 spaces for residents and 127 for visitors, while cycle storage is integrated for all homes, either within garden stores, garages, or dedicated cycle stores for apartments.

3.0 Technical Submission

3.1 Condition 58 – Flood Risk

Condition 58 of LPA Ref: O/20/89498, regarding flood risk, states the following:

Each reserved matters application shall include details of a scheme to address the flood risk issues raised below and no development shall commence until such time as this scheme has been submitted to, and approved in writing by, the local planning authority:

- *Ensure the development is flood resilient by ensuring all finished floor levels are built 600mm above the 1 in 100yr design flood level with the latest climate change allowances.*
- *Ensure no development is built within flood zones 2 and 3*
- *Ensure development is directed away from any watercourse*
- *Ensure any watercourse crossings are detailed and do not increase the risk of flooding either on or off-site. The scheme shall be fully implemented and subsequently maintained, in accordance with the scheme's timing/phasing arrangements, or within any other period as may subsequently be agreed, in writing, by the local planning authority.*

Reason: *To reduce the risk of flooding to the proposed development and its future users and for compliance with Policy DM5 of the Eastleigh Borough Local Plan.*

RESPONSE:

Environment Agency (EA) Flood Map for Planning

Upper Acre lies wholly within EA Flood Zone 1, as can be seen in the Figures 2 and 3 below, which include both the present day flood maps and the 2070 to 2125 future range.

Figure 2 Overlay of present day flood map for planning and site location plan (Map – Flood map for planning – GOV.UK)

Figure 3 Overlay of 2070 to 2125 flood map for planning and site location plan (Map – Flood map for planning – GOV.UK)

Flooding from Rivers and Streams (Fluvial)

The risk of fluvial flooding in this case is considered to be low given the extent of the modelled flood zones from the EA and local Strategic Flood Risk Assessment (SFRA) information, specifically Flood Zones Sheet 2 of 5, Figure 1B prepared for Eastleigh Borough Council (BC). The SRFA was commissioned on behalf of 10 planning authorities in South Hampshire (the 'Partnership for South Hampshire (PfSH)) to prepare a flood risk assessment. Part 8 of the SRFA provides recommendations to Eastleigh BC to consider when developing policies and establishing requirements for development management.

Flooding from Land (Pluvial)

The EA maps indicate little to no surface water flood risk across the site, and waters are limited to the existing ordinary watercourse. Refer to Figures 4 and 5.

Figure 4 Overlay of EA Surface water flood mapping and site location plan (Map – Flood map for planning – GOV.UK)

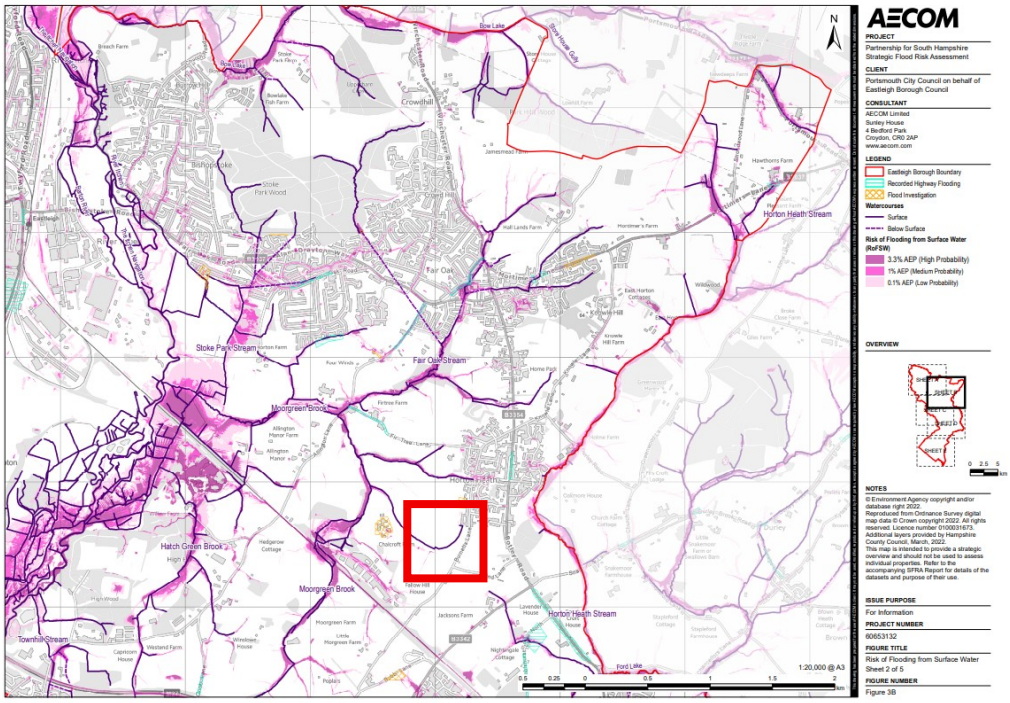

Figure 5 Extract from Eastleigh BC SFRA Surface Water Flood Risk Maps, Sheet 2 (pfsh_eastleigh_figure3_riskoffloodingfromsurfacewater.pdf)

Groundwater Flood Risk

According to the SFRA, the site lies within an area of low groundwater flood risk (<25% probability). Refer to Figure 6.

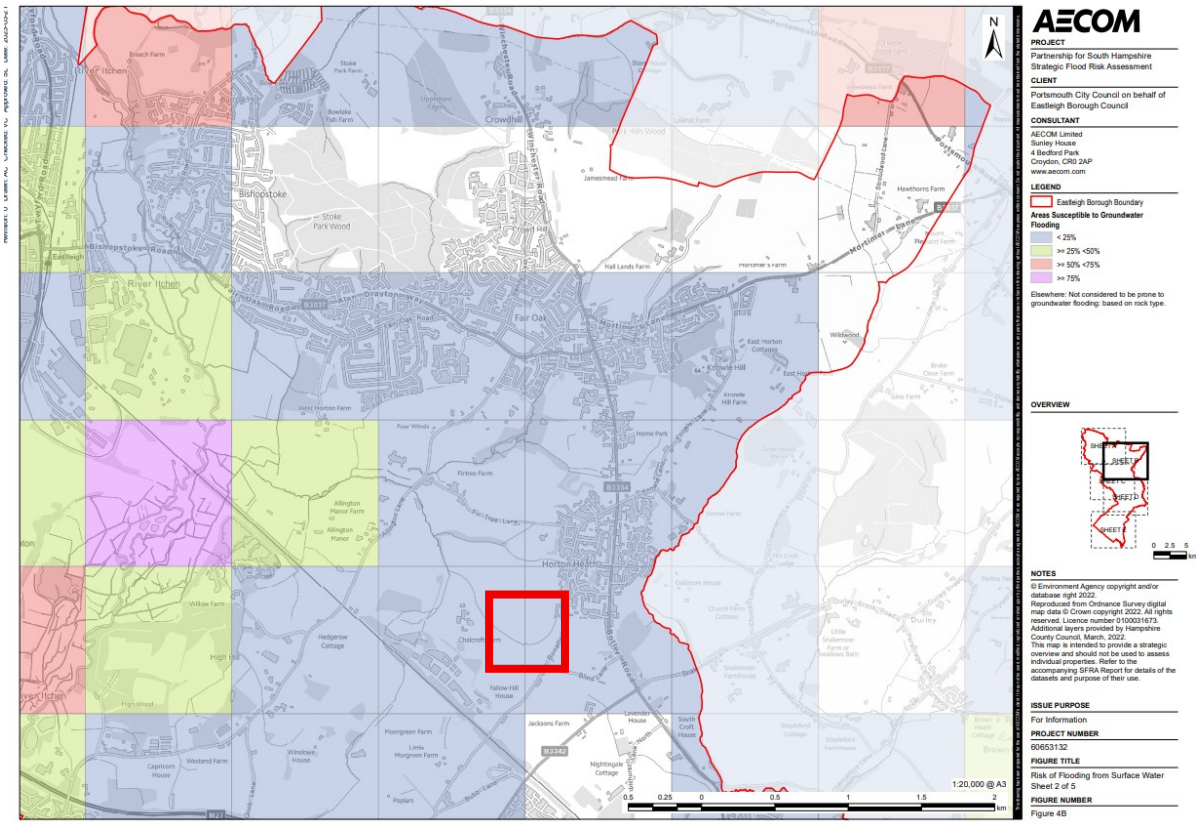

Figure 6 Extract from Eastleigh BC SFRA Groundwater Flood Risk Maps, Sheet 2 (pfsh_eastleigh_figure4_areasusceptibletogroundwaterflooding.pdf)

The majority of the site is at low risk of groundwater flooding based on available information. The only exceptions are the areas along the natural watercourses in the south and south-eastern parts of the site. Here, groundwater will naturally be shallower, especially near the watercourses, increasing the risk of localised groundwater flooding. However, development has been kept away from the watercourses leaving a reasonable buffer. In addition, the watercourses can convey any potential groundwater surge away from the development. No borehole information is available within the vicinity of the site through British Geological Survey (BGS) mapping to provide additional clarity on the groundwater conditions. A preliminary site investigation carried out by Stantec (ref. STA-10-XX-RP-G-0002) states initial groundwater findings consistent with the above, which

implies that drainage via infiltration is not suitable, though continuous groundwater monitoring remains in effect.

Historic Flooding

According to the SFRA, there have been no reported flood incidents within the development boundary. Refer to Figure 7. A Southern Water reported incident is noted within the existing housing development to the northeast of the site, however the topography local to this incident is such that exceedance flow paths are toward Burnetts Lane, which has been accounted for within the hydraulic calculations. Refer to Appendix 4 – Surface Water Draiange Calculations.

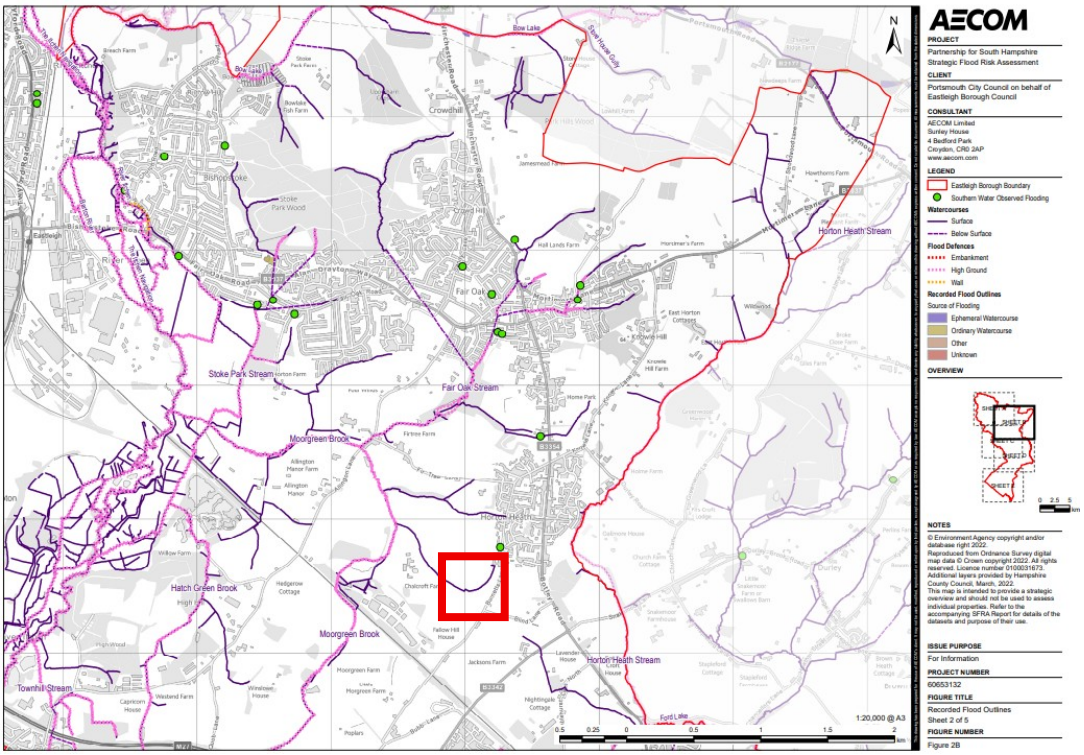

Figure 7 Extract from Eastleigh BC SFRA Report Flood Incidents Map, Sheet 2 (pfsh_eastleigh_figure2_recordedfloodoutlines.pdf)

Risk of Flooding from Reservoirs

According to the SFRA, there is a very low risk of flooding from reservoirs. Refer to Figure 8.

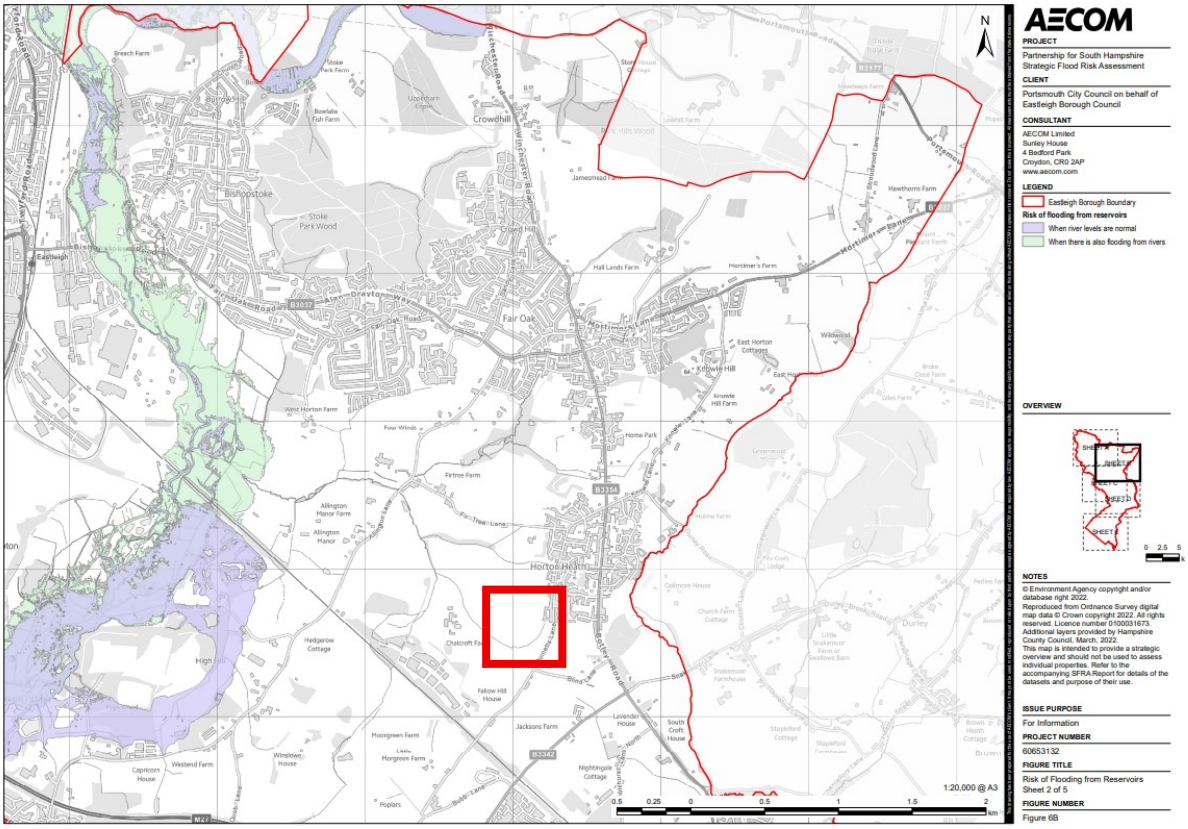

Figure 8 Extract from Eastleigh BC SFRA Report Risk of Reservoir Flooding Map, Sheet 2 (pfsh_eastleigh_figure6_riskoffloodingfromreservoirs.pdf)

The proposed development will be safe from surface water flooding and the development will not increase flood risk elsewhere.

The proposed levels and drainage strategy are such that the development is at a low risk of flooding from the various sources identified above. FFLs across the site are set above flood levels, and the EA and SRFA mapping confirm that the development resides largely within Flood Zone 1 in accordance with Policy 5 of the Eastleigh Borough Local Plan.

Continuous groundwater monitoring remains in effect, however early indications by Stantec imply that drainage via infiltration is not suitable.

3.2 Condition 59 – Foul Drainage

Condition 59 of LPA Ref: O/20/89498, regarding foul drainage, states the following:

Construction of the development of each reserved matters phase (excluding site clearance) shall not commence until full details of any proposed means of foul sewerage have been submitted to, and approved in writing by, the Local Planning Authority in consultation with Southern Water. These shall be in accordance with the submitted Utilities and Foul Water Statement 26114-RP-IE-002 Issue 02, May 2022. The approved details shall be fully implemented prior to the first occupation of development within each reserved matters phase.

***Reason**: to provide satisfactory foul drainage and to prevent flooding.*

RESPONSE:

The proposed foul drainage for Upper Acre has been largely set out in the previous submitted applications ((LPA Ref: O/20/89498) and is essentially drained via gravity to a manhole at the southern boundary between Upper and Lower Acre.

The spine road information submitted by Ridge & Partners for the SID spine road includes the proposed foul main run down into Lower Acre. In addition, the construction drawings for Lower Acre, also by Ridge, show the northernmost foul spur into Upper Acre onto which the foul drainage in to connect.

The drawings contained in Appendix 3 – Technical Drawing Pack demonstrate the foul network arrangement.

3.3 Condition 61 - SuDS

Condition 61 of LPA Ref: O/20/89498, regarding SuDS, states the following:

No development of each reserved matters phase shall begin until a detailed final surface water drainage scheme, based on the submitted PFA Flood Risk Assessment G277-FN14-FRA Addendum dated June 22 & submitted 13 Sept 2022 has been submitted and approved in writing by the Local Planning Authority. The submitted details shall include:

a) *at least three forms of naturalised filtration (as proposed) and supported by hydrological studies to demonstrate that the drainage system will not adversely affect the integrity of the River Itchen Special Area of Conservation (SAC) and will contribute towards achieving the conservation objectives of the SAC by improving water quality and reducing fine particle sediment inputs;*

b) *details of how the scheme will contribute to reductions in nitrogen and phosphorous in receiving waters including the River Itchen SAC;*

c) *A technical summary highlighting any changes to the design from that within the approved Flood Risk Assessment and addendums.*

d) *Updated drainage plans and calculations as appropriate to include type, layout and dimensions of drainage features including references to link to the drainage calculations. Cross and long sections of proposed basins to include exceedance flow paths in the event of flow control blockage between basins I & J.*

f) *Details of protection measures to minimise blockage risk to flow control devices.*

g) *Evidence that urban creep has been included within the calculations.*

h) *Updated exceedance plans demonstrating the extent of flooding expected at the 1:100 + climate change event. These must also detail how flows are likely to behave at the apparent low spots where no onward flow path is identified.*

i) *Details of land drainage provision to allow suitable drainage of green areas where overland flow routes are disrupted as a result of the development.*

j) *Confirmation that the SuDS infrastructure is in place or will be in place prior to the development of the related plot.*

k) *Confirmation that sufficient water quality measures have been included to satisfy the methodology in the Ciria SuDS Manual C753.*

l) *Sustainable drainage elements with attenuation, storage and treatment capacities incorporated as set out in the CRIA SuDS Manual C697 CIRIA SuDS Manual C753, or equivalent and updated local or national design guidance where available. If SuDS are proposed as part of the open space provision on a site, gradients should generally not exceed 1:4;*

m) *Details for the long term maintenance, management, adoption and monitoring arrangements for the surface water drainage system. The submitted details shall include:*

i) *Maintenance schedules for each drainage feature type*

ii) *A plan detailing ownership of each drainage feature*

Confirmation that adoption of features is accepted by Southern Water /Highways Authority/other public body

iv) Details of protection measures

v) Specify the responsibilities of each party for the implementation of the SuDS scheme.

vi) Specify a timetable for implementation.

The sustainable drainage system shall be implemented and thereafter managed and maintained in accordance with the approved details.

Reason: *to prevent risk of flooding and ensure satisfactory drainage for the development in accordance with Policies DM3, DM5, DM6 and DM11 of the Local Plan.*

ARCH ASSOCIATES

RESPONSE:

The basis of the surface water strategy that was put forward by PFA at planning stage (Appendix 1 – PFA Outline Planning Flood Risk Assessment and Drainage Strategy) has been carried though into our detailed design. The site development area in this reserved matters planning application considers the parcels either side of the SID spine road for the Upper Acre, which has its own SuDS Strategy and FRA (Appendix 2 – Ridge & Partners Spine Road SuDS Strategy). As such, Basin H as it is generally referred to, which is the basin to the west of the site into which most of the Upper Acre drains, has been designed and detailed by Ridge and Partners. In addition, the basins to the south of the development site, i.e. in the north of Lower Acre and referred to generally as Basins I, J, and K, are already constructed. The portion of the Upper Acre to the east of the watercourse ditch drains entirely to Basin J as allowed for in its original design and the in the PFA master drainage strategy. Consequently, we have ensured within our modelling that the capacities of these basins, considering the contribution of Lower Acre when considering Basin J, have not been exceeded.

The existing drainage strategy for Upper Acre comprises the existing watercourse only, which flows south and then to the west along the boundary between Upper Acre and Lower Acre. The topography of the site directs runoff toward the existing watercourse, which ultimately discharges into the River Itchen.

The proposed surface water strategy consists of a gravity sewer system, a SuDS management train in the forms of permeable paving, flow control units, downstream defenders and attenuation basins. The surface water run-off from the development will be attenuated via cellular attenuation crate systems before discharging into either Basins H or Basin J. The proposed discharge rate for Basin H and Basin J are 70.8l/s and 29.6l/s respectively, which has been established by PFA based on greenfield runoff rates

(Appendix 1 – PFA Outline Planning Flood Risk Assessment and Drainage Strategy) and contributing catchment areas.

Treatment Train/Water Quality

The SuDS treatment train generally includes a combination of permeable paving, specialist treatment manholes and attenuation basins. Water quality can therefore be assessed using the CIRIA SuDS Manual simple index approach as defined in Table 1.

Element	Pollution Hazard Indices			
	Pollution Hazard Level	Total Suspended Solids	Metals	Hydrocarbons
Roads (excluding low traffic roads, etc.)	Medium	0.7	0.6	0.7
	Pollution Mitigation Indices			
Downstream Defender (Advanced)		0.5	0.4	0.5
Detention Basin		0.7	0.7	0.5
Total		0.85	0.75	0.75
Sufficiency		**Sufficient**	**Sufficient**	**Sufficient**

Table 1 CIRIA Suds Simple Index Approach

*Given the varied land use across the runoff area, the land use type with the highest pollution index is selected for the assessment. Permeable paving has been excluded

from the above assessment as the spine road discharges into the treatment manhole before out-falling to the basin, therefore no permeable paving is present in this worst case condition.

Nitrate and Phosphorous Removal

Retention Ponds

- Retention ponds provide both flood attenuation and water quality treatment, as well as biodiversity and amenity benefits.

Phosphorous Removal Mechanisms

- Sediment Forebay:

  An upstream device captures coarse sediments and gross pollutants before water enters the main pond, preventing silt build-up and protecting water quality.
- Fine Sediment Deposition:

  The pond is designed so that fine sediments settle at the bottom and are not disturbed or washed out during high flows.
- Biological Uptake:

  Aquatic plants and flora within the pond absorb phosphorous, reducing its concentration in the water.

Nitrate Removal Mechanisms

- Sediment Forebay:

  Removes coarse sediments, which often bind with nutrients.
- Permanent Pool:

  Allows further settlement of fine sediments and removal of nutrients through physical and biological processes.
- Nitrogen-Reducing Vegetation:

  Marginal and aquatic species (including evergreens) are selected for their ability to uptake and reduce nitrogen compounds.
- Multi-Zone Basin Design:

The pond is divided into distinct cells/zones, increasing water residence time and pollutant removal pathways. This enhances nutrient removal, simplifies maintenance, and supports varied ecology.

- Micro Pools and Aquatic Benches:

  Micro pools and surrounding wetland planting act as biological filters, further removing nutrients and providing habitat and safety benefits.

- Marshy Grassland Areas:

  Shallow, wet grassland around the micro pools provides additional filtration.

Refer to Appendix 2 – Ridge & Partners Spine Road SuDS Strategy for details for both Basin H and Basin J, which incorporate the various features mentioned above.

SuDS Maintenance

The maintenance regime of the surface water drainage system and its components is outlined within the accompanying Arch Associates Limited SuDS Maintenance Manual (ref. AAL390 DRAINAGE MAINTENANCE MANUAL – A). Maintenance of the adopted portions of drainage will be the responsibility of the adopting authority. Maintenance of all remaining private drainage will be the responsibility of the management company.

Protection of the watercourse during construction

The site phasing plan will ultimately be provided by the contractor. As the site topography naturally falls towards the watercourse in the south, surface water run-off during construction will naturally be allowed to flow overland before entering the watercourse.

Prior to construction, a specialist silt fence should be installed along any boundary between development and a watercourse. This is to be in the form of a Terrastop Premium solution by Hy-Tex, or similar approved, and installed in accordance with the

manufacture's recommendations. Refer to Figure 9 for specialist silt fence in practice. The protection measures are to be inspected daily by the site management and any defects repaired immediately.

Figure 9 Example of Terrastop Premium on a working site

The drawings contained in Appendix 3 – Technical Drawing Pack demonstrate the surface water network arrangement.

The proposed surface water drainage strategy remains in accordance with the PFA strategy and principles outlined at OPP. The technical drawing pack and surface water hydraulic calculations within Appendices 3 (Technical Drawing Pack) and 4 (Surface Water Drainage Calculations) respectively demonstrate the alignment with the aforementioned documents/principles. The Maintenance Manual (ref. AAL390 DRAINAGE MAINTENANCE MANUAL – A) details the maintenance of each drainage asset, inclusive of responsible parties and frequency of maintenance activities.

ARCH ASSOCIATES

APPENDIX 1

PFA OUTLINE PLANNING FLOOD RISK ASSESSMENT AND DRAINAGE STRATEGY

ONE HORTON HEATH, EASTLEIGH

FLOOD RISK ASSESSMENT

EASTLEIGH BOROUGH COUNCIL

DECEMBER 2020

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engineering the future

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1. INTRODUCTION

1.1. This Flood Risk Assessment has been prepared on behalf of Eastleigh Borough Council in connection with proposals for a mixed-use development on land at Horton Heath in Hampshire.

1.2. The overall site comprises around 124 hectares, and is located to the west of Horton Heath, which lies in Eastleigh Borough in Hampshire. The post code at the centre of the site is SO50 7DF, and the approximate grid reference for the site is 448500, 117500. The location of the site is shown edged red on **Figure 1** below and the Red Line Plan, Thrive Architects' Drawing Number EAST200403-RLP.01-P2, is reproduced in **Appendix 1**.

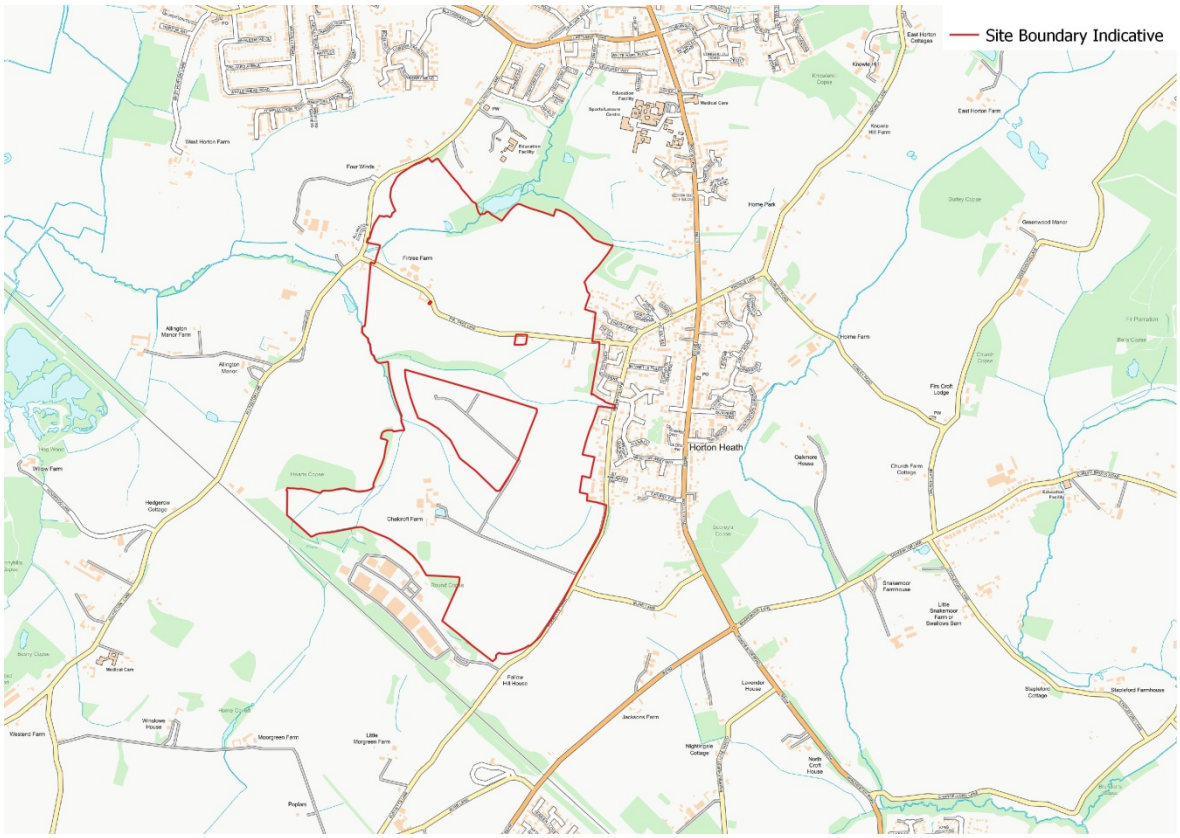

Figure 1: Site Location Plan

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1.3. The main purpose of this site-specific Flood Risk Assessment is to provide sufficient flood risk information to support a planning application for the development proposals in order to demonstrate that the development would be appropriately safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, would reduce flood risk overall.

2. SCOPE OF THE ASSESSMENT

2.1. The National Planning Policy Framework (NPPF) sets out the Government's planning policies for England and how these should be applied. It was published in February 2019 and replaces the first Framework published in March 2012, and includes minor clarifications to the revised version published in July 2018.

2.2. Policy on planning and flood risk in the NPPF is dealt with at paragraphs 155-165 in chapter 14 'Meeting the challenge of climate change, flooding and coastal change'.

2.3. The national planning practice guidance to the NPPF was launched as a web-based resource in March 2014. The category dealing with flooding is contained in Flood Risk and Coastal Change (Reference ID: 7 Updated: 16 11 2016).

2.4. Paragraph 155 of the NPPF states that inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk, but where development is necessary, making it safe without increasing flood risk elsewhere.

2.5. Paragraph 156 states that strategic policies should be informed by a strategic flood risk assessment (SFRA), and should manage flood risk from all sources.

2.6. An SFRA was prepared by Atkins on behalf of Partnership for Urban South Hampshire (PUSH), in December 2007. The SFRA was subsequently reviewed in 2016 to provide an overview of flood risk from all sources including from rivers and the sea, directly from rainfall on the ground surface and rising groundwater, overwhelmed sewers and drainage systems, and from reservoirs, canals and lakes and other artificial sources.

2.7. As set out in paragraph 157 of the NPPF, all plans should apply a sequential, risk-based approach to the location of development - taking into account the current and future impacts of climate change – so as to avoid, where possible, flood risk to people and property.

2.8. Paragraph 158 states that the aim of the sequential test is to steer new development to areas with the lowest probability of flooding, and the strategic flood risk assessment will provide the basis for applying the test.

2.9. A copy of the Environment Agency's Flood Map for Planning, obtained from the GOV.UK website, which shows the Flood Zones in the vicinity of the site, is reproduced as **Figure 2** below.

2.10. The Environment Agency's Flood Zones refer to the probability of river and sea flooding, ignoring the presence of defences, and show the extent of the natural floodplain and the additional extent of an extreme flood. The Environment Agency's Flood Map for Planning shows the area that could be affected by flooding, either from rivers or the sea, coloured dark blue corresponding to Flood Zone 3. The light blue area is Flood Zone 2 and shows the additional extent of an extreme flood from rivers or the sea. These two colours show the extent of the natural floodplain if there were no flood defences or certain other manmade structures and channel improvements. Where there is no blue shading, this shows the area where flooding from rivers and the sea is very unlikely corresponding to Flood Zone 1.

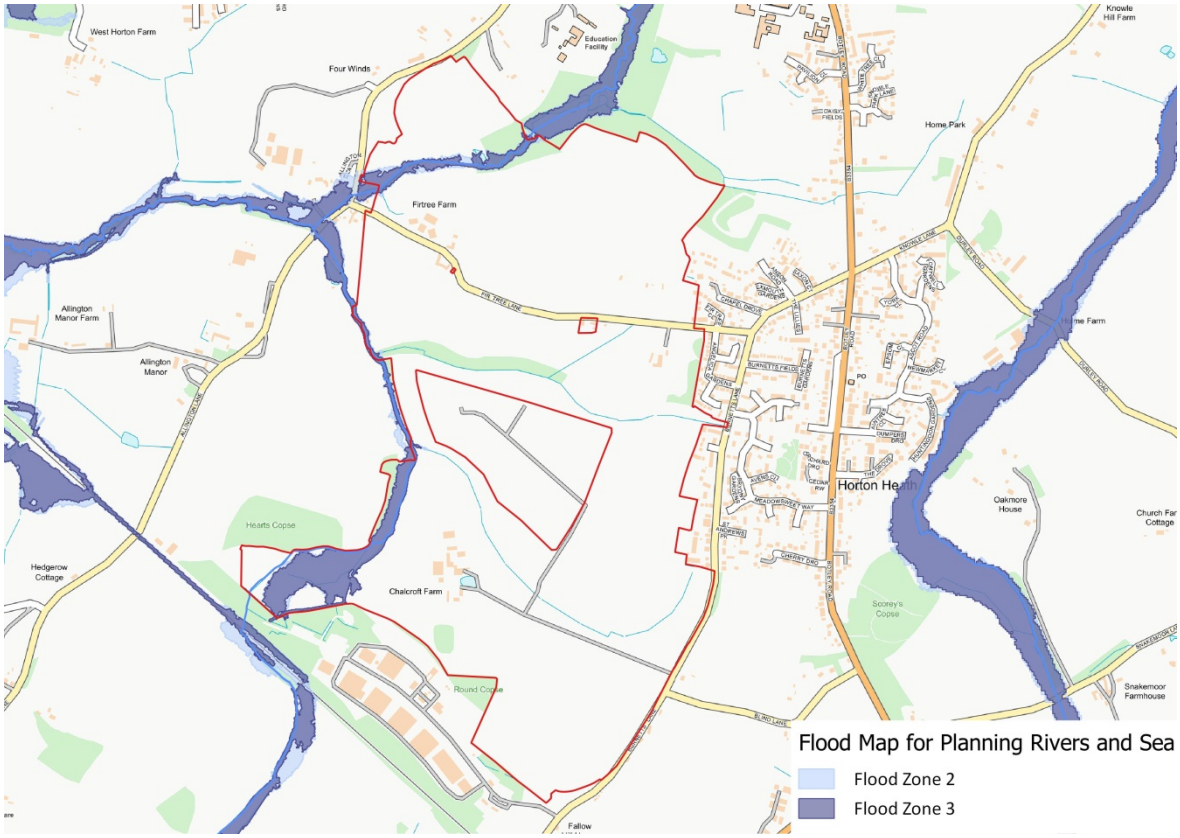

Figure 2: Environment Agency's Flood Map for Planning

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2.11. The site's red line boundary and the Environment Agency's Flood Map for Planning dataset has been used to produce Figure 2. From an inspection of the Flood Map it can be seen that the majority of the site falls within Flood Zone 1. Small areas of the site's western boundary and north-western corner are shown as falling within Flood Zone 2 and Flood Zone 3.

2.12. As set out in paragraph 163 of the NPPF, when determining any planning applications, local planning authorities should ensure that flood risk is not increased elsewhere. Where appropriate, applications should be supported by a site-specific flood risk assessment.

2.13. Footnote 50 in the NPPF states that a site-specific flood risk assessment should be provided for all development in Flood Zones 2 and 3. In Flood Zone 1, an assessment should accompany all proposals involving: sites of 1 hectare or more; land which has been identified by the Environment Agency as having critical drainage problems; land identified in a strategic flood risk assessment as being at increased flood risk in future; or land that may be subject to other sources of flooding, where its development would introduce a more vulnerable use.

Flood Risk Assessment Guidance

2.14. Paragraph 30 in the Flood Risk and Coastal Change Planning Practice Guidance (Reference ID: 7-030-20140306) advises that a site-specific flood risk assessment is carried out to assess the flood risk to and from a development site. The assessment should demonstrate how flood risk will be managed now and over the development's lifetime, taking climate change into account, and with regard to the vulnerability of its users.

2.15. For the purposes of applying the NPPF, paragraph 2 in the Flood Risk and Coastal Change Planning Practice Guidance (Reference ID: 7-002-20140306) advises that "flood risk" is a combination of the probability and the potential consequences of flooding from all sources - including from rivers and the sea, directly from rainfall on the ground surface and rising groundwater, overwhelmed sewers and drainage systems, and from reservoirs, canals and lakes and other artificial sources.

2.16. Paragraph 31 in the Flood Risk and Coastal Change Planning Practice Guidance (Reference ID: 7-031-20140306) advises that the information provided in the flood risk assessment should be credible and fit for purpose. Site-specific flood risk assessments should always be proportionate to the degree of flood risk and make optimum use of information already available, including information in a SFRA for the area, and the interactive flood risk maps. A flood risk assessment should also be appropriate to the scale, nature and location of development.

2.17. Paragraph 68 of the Flood Risk and Coastal Change Planning Practice Guidance (Reference ID: 7-068-20161116) provides a model checklist for a site specific flood risk assessment.

2.18. With regard to what further advice is available on the preparation of a site-specific flood risk assessment, paragraph 32 of the Flood Risk and Coastal Change Planning Practice Guidance (Reference ID: 7-032-20150415) refers to the Environment Agency Standing Advice on flood risk.

2.19. Guidance from the Department for Environment, Food & Rural Affairs (DEFRA) and Environment Agency (EA), published on the Government's GOV.UK website, includes guidance on how to carry out a flood risk assessment entitled: 'Flood risk assessment in flood zones 2 and 3', 'Flood risk assessment in flood zone 1 and critical drainage areas', and 'Preparing a flood risk assessment: standing advice'. This guidance provides information on the range of factors that need to be considered when assessing flood risk.

2.20. Reference has also been made to: BS 8533:2017 'Assessing and managing flood risk in development - Code of practice'; BS 8582:2013 'Code of practice for surface water management for development sites'; and the Local Authority SuDS Officer Organisation (LASOO) document entitled 'Non-Statutory Technical Standards for Sustainable Drainage :Practice Guidance'.

2.21. The DEFRA/EA guidance 'Review individual flood risk assessments: standing advice for local planning authorities' sets out when local planning authorities must consult the Environment Agency, their lead local flood authority or both, on any proposed developments at a higher risk from flooding before making a decision.

2.22. For 'major development' with surface water drainage local planning authorities need to consult their lead local flood authority (LLFA). In Flood Zone 1 they need to consult the EA if the development is in an area with critical drainage problems, other than minor development. In Flood Zone 2 they need to consult the EA if the development's flood risk vulnerability is:

- 'essential infrastructure'
- 'highly vulnerable'
- 'more vulnerable' and it's a landfill or waste facility site, caravan or camping site
- 'less vulnerable' and it's a waste treatment site, mineral processing site, water treatment plant, or a sewage treatment plant.

2.23. In Flood Zone 3 the local planning authority needs to consult the EA for all developments other than minor development. They also need to consult the EA for developments involving a change of use and the flood risk vulnerability will:

- be either 'more vulnerable' or 'highly vulnerable'
- change from 'water compatible' to 'less vulnerable'.

2.24. Local planning authorities also need to consult the Environment Agency if the development is within 20m of a main river in Flood Zones 1, 2 or 3.

2.25. The proposed development is classed as 'major development'. Main Rivers are located within the red line area of the site and the site contains areas of Flood Zones 1, 2 and 3. The local planning authority therefore needs to consult the lead local flood authority and the Environment Agency.

Local Plan Policies

2.26. The Eastleigh Borough Council Local Plan review (2001 – 2011) contains saved policies relevant to this assessment:

- Policy 41.ES – Development affecting water courses.
- Policy 42.ES – Development in a catchment of a water course.
- Policy 43.ES – Areas at risk of flooding.
- Policy 45.ES – Sustainable Drainage.

2.27. The Eastleigh Borough Local Plan 2016 – 2036 was submitted in October 2018 for public examination. The following policies in the submitted Local Plan are relevant to this assessment:

- Policy DM3 – Adaptation to climate change.
- Policy DM5 – Managing flood risk.
- Policy DM6 – Sustainable surface water management and watercourse management.
- Policy DM10 – Water and Waste Water.
- Policy DM11 – Nature conservation.

Summary of Scope

2.28. The scope of this Flood Risk Assessment is to provide sufficient information to satisfy the requirements of the NPPF, the planning practice guidance checklist, Local Plan Policies, guidance published by DEFRA/Environment Agency, the Government's 'Non-statutory technical standards for sustainable drainage systems' and Hampshire's Local standards.

3. FLOOD RISK ASSESSMENT

Development Site and Location

3.1. The site is located to the west of Horton Heath in Hampshire. The site is currently in agricultural use, mainly arable with some grassland.

3.2. The Site Location Plan and the Environment Agency's Flood Map for Planning are based on the Ordnance Survey map of the area, and show geographical features and identify watercourses and other bodies of water in the vicinity of the site.

3.3. A number of drainage features and watercourses are present within the site. The watercourses within the site are tributaries of the River Itchen which is located approximately 1.5km to the west of the site's boundary.

3.4. The watercourse on the western boundary is classified as a 'Main River' and flows from south to north under Allington Lane and into the River Itchen to the south of Chickenhall Lane Wastewater Treatment Works (WwTW). All other onsite watercourses discharge into this unnamed 'Main River'.

3.5. An ordinary watercourse is present on the site's southern boundary to the north of Chalcroft Business Park and drains from the southeast to the north. A second ordinary watercourse bisects the southern area of the site and flows from south-east (adjacent to Burnetts Lane) to west (running north of Charlcroft Farm, and south of the Solar Farm). A third ordinary watercourse bisects the central area of the site and flows from east (in the vicinity of Horton Heath) to west (to the north of the Solar Farm). A number of smaller ditches located within hedgerows drain into the onsite watercourses and are adjacent to the existing highways.

3.6. A second 'Main River' bisects the north-western area of the site and flows from the north-east to the west to the north of Firtree Farm. This watercourse is known locally as the Fair Oak Stream.

3.7. A number of ponds are also present within the site and in its immediate vicinity. A pond is present within the Chalcroft Farm site and another is present adjacent to the Fair Oak Stream in an area of woodland to the north of Firtree Farm. Quobleigh Pond is located to the north of the site on the Fair Oak Stream and an unnamed pond is present to the west of the site to the west of the unnamed 'Main River' south of Allington Lane. These waterbodies are supplemented by a number of ephemeral pools associated with the small watercourses on the site.

3.8. The natural catchments of the onsite watercourses are defined by the site's topography.

3.9. The existing surface water management arrangements at the site are indicated on Drawing Number G277/20 Rev A, a copy of which is contained in **Appendix 2**.

Development Proposals

3.10. The development proposals comprise a maximum of:

- Circa 2,500 dwellings comprising a mix of market and affordable housing.
- A Mixed Use Centre of 3.1 Ha comprising residential, retail, leisure, community, employment facilities.
- 3.3 Ha of employment land.
- A three form entry primary school and early years education facilities.
- Formal and informal publicly accessible open space, formal areas of play, youth provision and associated facilities, formal sports facilities, allotments and amenity space, including landscaping, green infrastructure and sustainable drainage systems.
- The utilisation of existing and provision of new and/ or amended highway access points along Allington Lane, Fir Tree Lane, Burnetts Lane and Bubb Lane.
- Any wider land outside the site boundary needed for development specific infrastructure.

3.11. A copy of the Illustrative Masterplan, Thrive Architects' Drawing Number EAST200403-CMP01-P13, showing the development proposals, is reproduced in **Appendix 3**.

Site Levels

3.12. A Topographical Survey was undertaken by Mayer Brown in 2014 and 2015. The survey is shown on Mayer Brown's Drawing Numbers IR.SAV.1.21.1 Rev E to IR.SAV.1.21.12 Rev E, copies of which are reproduced in **Appendix 4.**

3.13. The Topographical Survey indicates that high points are located in the vicinity of the northern, eastern and southern boundaries of the site. Areas of the site generally fall towards the onsite watercourses and ditches with the site overall having a gentle fall towards the main river on the western boundary.

Flood Risk Vulnerability and Flood Zone 'Compatibility'

3.14. Paragraphs 65-67 of the Flood Risk and Coastal Change Planning Practice Guidance (Reference ID: 7-065-20140306) refer to three Flood Zone and Flood Risk Tables.

3.15. Table 1: Flood Zones provides a definition of each Flood Zone. Table 2: Flood Risk Vulnerability Classification categorises different types of development according to their vulnerability to flood risk. Table 3: Flood risk vulnerability and flood zone 'compatibility' maps these vulnerability classes against the flood zones to indicate where development is appropriate and where development should not be permitted.

3.16. The Environment Agency's Flood Map for Planning indicates that the majority of the site falls within Flood Zone 1 with areas of Flood Zones 2 and 3 present along the site's western boundary and crossing an area in the north-west of the site.

3.17. With reference to Table 2 of the Flood Risk and Coastal Change Planning Practice Guidance, the proposed residential development falls into the 'More Vulnerable' flood risk vulnerability classification, which includes buildings used for dwelling houses. The proposed employment development falls into the 'Less Vulnerable' flood risk vulnerability classification, which includes buildings used for shops, restaurants, offices, general industry, etc. The proposed primary school and early years education facilities are classified as 'More Vulnerable'. The highway access points are classified as 'Essential Infrastructure'.

3.18. With reference to Table 3, all uses of land are appropriate in Flood Zone 1. Flood Zone 2 is appropriate for most development but the highly vulnerable uses are only appropriate in this zone if the Exception Test is passed. In Flood Zone 3a the more vulnerable, which includes dwelling houses, and essential infrastructure, uses should only be permitted in this zone if the Exception Test is passed. In Flood Zone 3b new development should not be permitted but essential infrastructure is appropriate in this zone if the Exception Test is passed.

Probability

3.19. A definition of each Flood Zone and probability of river or sea flooding is provided in Table 1 at paragraph 65 of the Flood Risk and Coastal Change Planning Practice Guidance (Reference ID: 7-065-20140306). Flood Zone 1 Low Probability is defined as land having a less than a 1 in 1000 (0.1%) annual probability of river or sea flooding.

3.20. Flood Zone 2 Medium Probability is defined as land having between a 1 in 100 (1%) and 1 in 1000 (0.1%) annual probability of river flooding; or between a 1 in 200 (0.5%) and 1 in 1000 (0.1%) annual probability of sea flooding. Flood Zone 3 High Probability is defined as having a 1 in 100 (1%) or greater annual probability of river flooding; or a 1 in 200 (0.5%) or greater annual probability of sea flooding.

3.21. Table 1 divides Flood Zone 3 into Zone 3a High Probability and Zone 3b The Functional Floodplain. Flood Zone 3a is defined as a 'high probability' zone assessed as having a 1 in 100 (1%) or greater annual probability of river flooding; or land having a 1 in 200 (0.5%) or greater annual probability of sea flooding. Zone 3b The Functional Floodplain is defined as comprising land where water has to flow or be stored in times of flood.

3.22. In relation to the identification of the functional floodplain, paragraph 15 in the Flood Risk and Coastal Change Planning Practice Guidance (Reference ID: 7-015-20140306) advises that land which would naturally flood with an annual probability of 1 in 20 (5%) or greater in any year, or is designed to flood (such as a flood attenuation scheme) in an extreme (0.1% annual probability) flood, should provide a starting point for consideration and discussions to identify the functional floodplain.

The Sequential Test and Exception Test

3.23. Paragraph 157 of the NPPF states:

> **'All plans should apply a sequential, risk-based approach to the location of development - taking into account the current and future impacts of climate change – so as to avoid, where possible, flood risk to people and property.'**

3.24. Paragraph 158 of the NPPF goes onto state:

> **'The aim of the sequential test is to steer new development to areas with the lowest probability of flooding. Development should not be allocated or permitted if there are reasonably available sites appropriate for the proposed development in areas with a lower risk of flooding. The strategic flood risk assessment will provide the basis for applying the test. The sequential approach should be used in areas known to be at risk now or in the future from any form of flooding.'**

3.25. Paragraph 160 of the NPPF states:

> **'The application of the exception test should be informed by a strategic or site-specific flood risk assessment, depending on whether it is being applied during plan production or at the application stage. For the exception test to be passed it should be demonstrated that:**
>
> **a) the development would provide wider sustainability benefits to the community that outweigh the flood risk; and**
>
> **b) the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.'**

3.26. Paragraph 161 of the NPPF goes onto state:

> **'Both elements of the exception test should be satisfied for development to be allocated or permitted.'**

3.27. Paragraph 163 of the NPPF states:

> **'When determining any planning applications, local planning authorities should ensure flood risk is not increased elsewhere. Where appropriate, applications should be supported by a site-specific flood risk assessment. Development should only be allowed in areas at risk of flooding where, in the light of this assessment (and the sequential and exception tests, as applicable) it can be demonstrated that:**
>
> **a) within the site, the most vulnerable development is located in areas of lowest flood risk, unless there are overriding reasons to prefer a different location;**
>
> **b) the development is appropriately flood resistant and resilient,**
>
> **c) it incorporates sustainable drainage systems, unless there is clear evidence that this would be inappropriate;**
>
> **d) any residual risk can be safely managed; and**
>
> **e) safe access and escape routes are included where appropriate, as part of an agreed emergency plan.'**

3.28. The Notes to Table 3 in the Flood Risk and Coastal Change Planning Practice Guidance (Reference ID: 7-067-20140306) indicate that the application of the sequential test should be applied first to guide development to Flood Zone 1, then Zone 2, and then Zone 3.

3.29. The majority of the site falls within Flood Zone 1 with areas of Flood Zones 2 and 3 present along the site's western boundary and crossing an area in the north-west of the site. In accordance with Paragraphs 158 and 163 of the NPPF, a sequential approach has been used such that no built development would be located in Flood Zones 2 or 3. On this basis the sequential test is passed.

Climate Change

3.30. The NPPF requires development to take account of the impacts of climate change. The allowances to be made for climate change effects when assessing flood risk are related to the lifetime of the development.

3.31. Guidance on the lifetime of development is provided at paragraph 26 in the Flood Risk and Coastal Change Planning Practice Guidance (Reference ID: 7-026-20140306). Residential development should be considered for a minimum of 100 years, unless there is specific justification for considering a shorter period. The lifetime of a non-residential development depends on the characteristics of that development. Developers would be expected to justify why they have adopted a given lifetime for the development.

3.32. Under heading 4 in the Site-Specific Flood Risk Assessment Checklist in the Flood Risk and Coastal Change Planning Practice Guidance (Reference ID: 7-068-20161116), it asks how flood risk at the site is likely to be affected by climate change and states that further advice on how to take account of climate change in flood risk assessments is available from the Environment Agency. Guidance published by the Environment Agency on 19 February 2016, and last updated on 22 July 2020, entitled 'Flood risk assessments: climate change allowances', sets out the climate change allowances to be used for peak river flow by river basin district, peak rainfall intensity, sea level rise, offshore wind speed and extreme wave height.

3.33. Table 1 of 'Flood risk assessments: climate change allowances' gives the peak river flow allowances by river basin district for 3 categories: central, higher central and upper end, and 3 time frames. The appropriate allowance to use depends on the flood zone and the flood risk vulnerability classification of the development.

3.34. The site lies in the South East river basin district, and the proposed development falls into the 'More Vulnerable' flood risk vulnerability classification. Based on the flood zone and flood risk vulnerability classification of the development, the higher central and upper end allowances need to be used to assess the range of impact. The total potential change anticipated for 2070 to 2115 is given as 45% for the higher central category and 105% for the upper end category.

3.35. The peak rainfall intensity allowances to be used when designing urban drainage systems are given in Table 2 of 'Flood risk assessments: climate change allowances'. Both the central and upper end allowances need to be assessed to understand the range of impact. The total potential change anticipated for 2070 to 2115 is 20% for the central category, and 40% for the upper end category.

Standard of Protection

3.36. In terms of providing an acceptable standard of protection against flooding for new development, paragraph 54 in the Flood Risk and Coastal Change Planning Practice Guidance (Reference ID: 7-054-20150415) advises how development can be made safe from flood risk. Reference is made to the ability of residents and users to safely access and exit a building during a design flood. Paragraph 55 in the Flood Risk and Coastal Change Planning Practice Guidance (Reference ID: 7-055-20140306) defines a "design flood" as follows:

'This is a flood event of a given annual probability, which is generally taken as:

- **fluvial (river) flooding likely to occur with a 1% annual probability (a 1 in 100 chance each year) or ;**
- **tidal flooding with a 0.5 per cent annual probability (1 in 200 chance each year),**

against which the suitability of a proposed development is assessed and mitigation measures, if any, are designed.'

3.37. Therefore, in terms of providing an acceptable standard of protection against flooding for new development, no flooding of property should occur as a result of the 'design flood' corresponding to a 1 in 100 year fluvial flood event, or a 1 in 200 year tidal flood event, taking account of climate change.

3.38. The Government published its 'Non-statutory technical standards for sustainable drainage systems' in March 2015. They should be used in conjunction with the NPPF and planning practice guidance. Standard S7 states that the drainage system must be designed so that flooding does not occur on any part of the site for a 1 in 30 year rainfall event. Standard S8 goes on to state that the drainage system must be designed so that flooding does not occur during a 1 in 100 year rainfall event in any part of a building (including a basement); or in any utility plant susceptible to water within the development.

Site Specific Flood Risk

3.39. In addition to flooding from rivers and the sea it is also necessary to consider the potential consequences of flooding from all other sources, which include directly from rainfall on the ground surface and rising groundwater, overwhelmed sewers and drainage systems, and from reservoirs, canals and lakes and other artificial sources.

3.40. The Government's GOV.UK website contains 'Long Term Flood Risk Information' which includes interactive maps showing 'Flood risk from rivers or the sea' and 'Flood risk from surface water'. These maps show the chance of flooding in one of four risk categories: High risk means that each year this area has a chance of flooding of greater than 3.3% (1 in 30); Medium risk between 1% and 3.3% (1 in 100 and 1 in 30); Low risk between 0.1% and 1% (1 in 1000 and 1 in 100); and Very low risk less than 0.1% (1 in 1000).

3.41. The 'Flood risk from surface water' map indicates the extent, depth and velocity of water for High, Medium and Low risk scenarios. The Long Term Flood Risk Information also includes a 'Flood risk from reservoirs' map, which includes flood depth and flood speed.

3.42. The GOV.UK website advises that this information is not suitable for use in land-use planning, and if planning a development the Environment Agency's Flood Map for Planning must be used for this purpose.

3.43. Enquiries have been made to the Environment Agency to obtain: the detailed Flood Map of the area; the latest available modelled flood levels for the watercourses in the vicinity of the site; the modelled flood extents; flood defence locations; details of historic flood events; and local flood history data from all sources of flooding. A copy of the Environment Agency's response, including copies of the detailed Flood Map, Model Nodes Maps and Modelled River Levels table, are reproduced in **Appendix 5**.

Flooding from Watercourses

3.44. A number of drainage features and watercourses are present within the site. The watercourses act as tributaries of the River Itchen which is located approximately 1.5km to the west of the site's boundary.

3.45. The watercourse on the western boundary of the site is classified as a 'Main River' and flows from south to north under Allington Lane and into the River Itchen to the south of Chickenhall Lane Wastewater Treatment Works (WwTW). All other onsite watercourses discharge into this unnamed 'Main River'.

3.46. An ordinary watercourse is present on the southern boundary to the north of Chalcroft Business Park and drains from the south-east to the north. A second ordinary watercourse bisects the southern area and flows from the south-east (adjacent to Burnetts Lane) to the west (running north of Charlcroft Farm, and south of the Solar Farm). A third ordinary watercourse bisects the central area of the site and flows from the east (in the vicinity of Horton Heath) to the west (to the north of the Solar Farm). A number of smaller ditches located within hedgerows drain into the onsite watercourses and are adjacent to the existing highways on the site.

3.47. A second 'Main River' bisects the north-western area of the site and flows from the north-east to the west to the north of Firtree Farm. This watercourse is known locally as the Fair Oak Stream.

3.48. A number of ponds are also present on the site and in its immediate vicinity. A pond is present within the Chalcroft Farm site and another is present adjacent to the Fair Oak Stream in an area of woodland to the north of Firtree Farm. Quobleigh Pond is located to the north of the site on the Fair Oak Stream and an unnamed pond is present to the west of the site to the west of the unnamed 'Main River' and south of Allington Lane. These waterbodies are supplemented by a number of ephemeral pools associated with the small watercourses on the site.

3.49. The Environment Agency's Flood Map for Planning shows the extent of the natural floodplain and the additional extent of an extreme flood. The Environment Agency's Flood Map for Planning indicates that the large majority of the site is unaffected by any floodplain and falls within Flood Zone 1 where flooding from rivers and the sea is very unlikely. In Flood Zone 1 there is a less than a 0.1 per cent (1 in 1000) chance of flooding occurring each year.

3.50. Modelled flood levels for the unnamed watercourses designated as 'main rivers' have been obtained from the Environment Agency, with relevant extracts shown in Appendix 5.

3.51. With reference to Table 1 of 'Flood risk assessments: climate change allowances' the appropriate allowances to use for the South East river basin district are the higher central and upper end allowances. The total potential change anticipated for 2070 to 2115 is given as 45% for the higher central category and 105% for the upper end category.

3.52. The Water Depths and Levels tables contained in Appendix 5 show the 1 in 100 year modelled flood levels taking into account a range of climate change allowances including the 45% and 105% increases.

3.53. On the basis of the available modelled flood levels provided by the Environment Agency, the areas of the site where built development is proposed are unaffected by the floodplain associated with the watercourses.

3.54. In terms of historic flooding, the Environment Agency has confirmed that it does not have any record of flooding in this location. However anecdotal evidence suggests that areas along the western boundary of the site and in the vicinity of the junction of Fir Tree Lane with Allington Lane have been affected by flooding. The Moon River development at the confluence of the unnamed Main River and the Fair Oak Stream has also suffered historic flooding. This is in line with the modelled flood extents shown on the Flood Map for Planning.

Flooding from Surface Water

3.55. The GOV.UK's Flood risk from surface water map indicates where surface water may be expected to flood or pond. Surface water flooding happens when rainwater does not drain away through the normal drainage systems or soak into the ground, but lies on or flows over the ground instead. The GOV.UK website advises that flooding from surface water is difficult to predict as rainfall location and volumes are difficult to forecast. In addition, local features can greatly affect the chance and severity of flooding. The information shown is a general indicator of an area's flood risk. A copy of the GOV.UK Flood risk from surface water map is reproduced in **Figure 3** below.

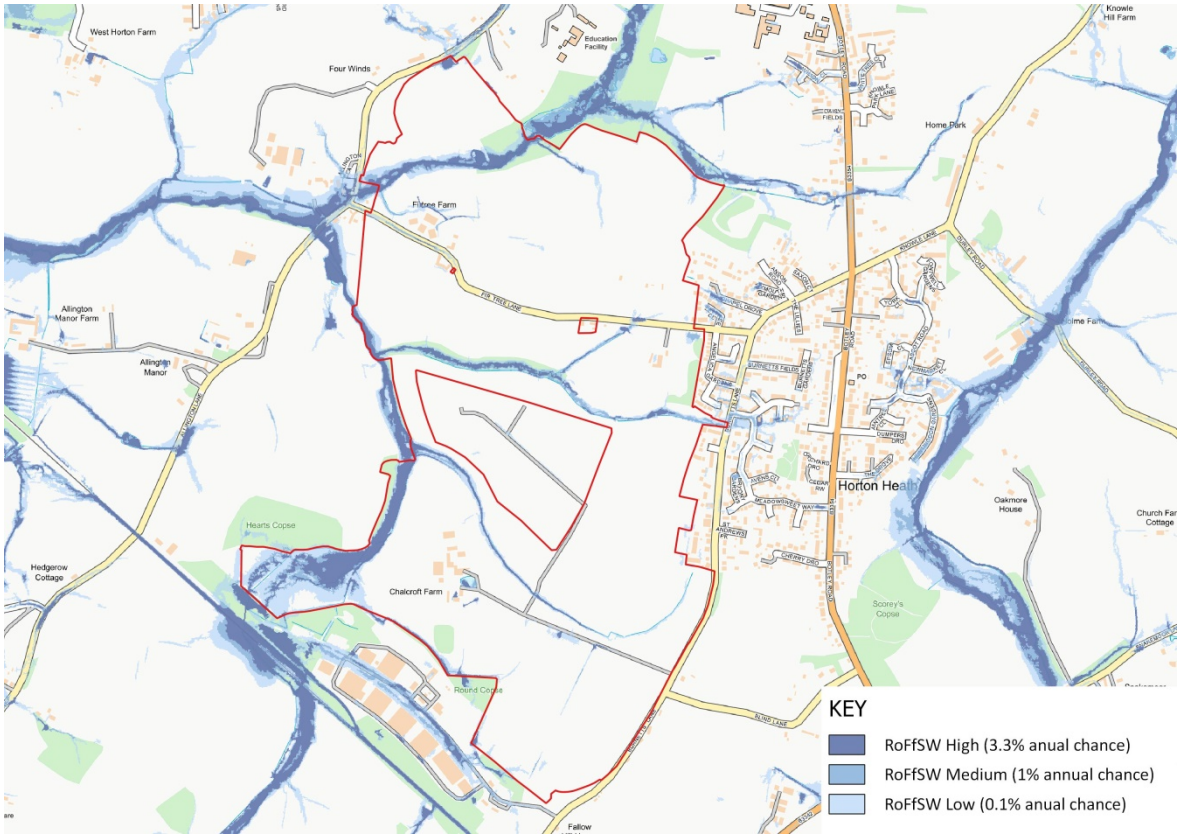


Figure 3: Flood risk from surface water map

3.56. The GOV.UK Flood risk from surface water map shows the majority of the site lies in an area with a Very Low: less than 1 in 1000 (0.1%) chance of surface water flooding.

3.57. The required standard of protection against flooding for the development is that no flooding of property should occur as a result of a 1 in 100 year flood event, which corresponds to the Medium risk scenario on the GOV.UK 'Long Term Flood Risk Information' maps.

3.58. Localised areas with a higher risk correspond to the routes of the onsite ordinary watercourses and ditches and localised low spots.

Flooding from Groundwater

3.59. Groundwater flooding is most likely to occur in low-lying areas underlain by water-bearing permeable rocks such as sands, gravels, limestone and chalk. Groundwater flooding occurs as a result of water rising from the underlying rocks or from water flowing from abnormal springs. This tends to occur after long periods of sustained high rainfall. Higher rainfall means more water will infiltrate into the ground and cause the water table to rise above normal levels. In low-lying areas the water table is usually at shallower depths, so during very wet periods, all the additional groundwater flowing towards these areas can cause the water table to rise to the surface causing groundwater flooding.

3.60. An intrusive Ground Investigation undertaken on the site anticipates shallow groundwater in the vicinity of the watercourses within the site. As part of the investigatory work Boreholes were drilled across the site and groundwater levels recorded in the winter months. Groundwater levels varied between 0.9m below ground level (m bgl) and 3.04m bgl. It is considered that groundwater could be shallow on the site and shallowest in proximity to the onsite watercourses.

3.61. If groundwater were to emerge it would follow a similar route to surface water flows shown in Figure 3 above and collect at low lying areas adjacent to watercourses.

3.62. The majority of the site is at Low risk of flooding from groundwater with areas of elevated risk associated with the low lying areas in proximity to onsite watercourses.

Flooding from Overwhelmed Sewers and Drainage Systems

3.63. No public sewers are identified on the site and there are no known instances of flooding from overwhelmed sewers affecting the site. The risk of flooding from overwhelmed sewers is therefore assessed as Low.

Flooding from Artificial Sources

3.64. The GOV.UK Flood risk from reservoirs map indicates the site is unaffected by flooding from any reservoirs.

3.65. No significant upstream waterbodies that would pose a risk to the site have been identified.

3.66. The risk of artificial flood hazards affecting the site is therefore considered to be Very Low.

Summary of Flood Risk

3.67. A summary of the potential flood risk risk from all sources of flooding associated with existing conditions pre-development is shown in Table A below.

Table A: Pre-development Potential Flood Risk from All Sources of Flooding

Flood Source	Potential Risk				Description
	Very Low	Low	Medium	High	
Watercourses		X			The majority of the site, and all proposed built development, is located in Flood Zone 1.
Surface Water		X			The topography of the land indicates that any overland flow would be directed into the ditch network away from the site.
Groundwater		X			If groundwater were to emerge it would follow a similar route to surface water flows
Overwhelmed Sewers		X			No public sewers are identified on the site and there are no known instances of flooding from overwhelmed sewers affecting the site
Artificial Sources	X				The site is not affected

3.68. The pre-development potential flood risk to the site from all sources of flooding is considered to be low.

4. WATER MANAGEMENT STRATEGY

Sustainable Drainage Systems

4.1. Government policy set out in paragraph 163 of the NPPF states that development should only be allowed in areas at risk of flooding where it can be demonstrated that it incorporates sustainable drainage systems, unless there is clear evidence that this would be inappropriate.

4.2. Paragraph 165 of the NPPF states:

> **'Major developments should incorporate sustainable drainage systems unless there is clear evidence that this would be inappropriate. The systems used should:**
>
> **a) take account of advice from the lead local flood authority;**
>
> **b) have appropriate proposed minimum operational standards;**
>
> **c) have maintenance arrangements in place to ensure an acceptable standard of operation for the lifetime of the development; and**
>
> **d) where possible, provide multifunctional benefits.'**

4.3. Paragraph 51 in the Flood Risk and Coastal Change Planning Practice Guidance (Reference ID: 7-051-20150323) advises that sustainable drainage systems are designed to control surface water runoff close to where it falls and mimic natural drainage as closely as possible. Sustainable drainage systems provide opportunities to:

- reduce the causes and impacts of flooding;
- remove pollutants from urban runoff at source;
- combine water management with green space with benefits for amenity, recreation and wildlife.

4.4. In terms of what sort of sustainable drainage system should be considered, paragraph 80 in the Flood Risk and Coastal Change Planning Practice Guidance (Reference ID: 7-080-20150323) advises that, generally, the aim should be to discharge surface water runoff as high up the following hierarchy of drainage options as reasonably practicable:

- Into the ground (infiltration);
- to a surface water body;
- to a surface water sewer, highway drain, or another drainage system;
- to a combined sewer.

4.5. The Government's 'Non-statutory technical standards for sustainable drainage systems' relate to the design, construction, operation and maintenance of sustainable drainage systems and have been published as guidance. The Government expects these standards to apply to all developments of 10 homes or more and to major commercial development.

4.6. Paragraph 81 in the Flood Risk and Coastal Change Planning Practice Guidance (Reference ID: 7-081-20150323) states that in considering a development that includes a sustainable drainage system the local planning authority will want to be satisfied that the proposed minimum standards of operation are appropriate. Paragraph 82 (Reference ID: 7-082-20150323) advises that the decision on whether a sustainable drainage system would be inappropriate is a matter of judgement for the local planning authority, taking advice from the relevant flood risk management bodies, including on what sort of sustainable drainage system they would consider to be 'reasonably practicable'. Paragraph 82 states that the judgement of what is reasonably practicable should be by reference to the technical standards and take into account design and construction costs.

4.7. Paragraph 85 in the Flood Risk and Coastal Change Planning Practice Guidance (Reference ID: 7-085-20150323) advises that any sustainable drainage system should be designed so that the capacity takes account of the likely impacts of climate change.

4.8. The Government's 'Non-statutory technical standards for sustainable drainage systems' set out peak flow control standards (S2 and S3) and volume control technical standards (S4, S5 and S6). For greenfield developments, the peak runoff rate from the development to any highway drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event should never exceed the peak greenfield runoff rate for the same event. For developments which were previously developed, the corresponding runoff rate for these events must be as close as reasonably practicable to the greenfield runoff rate from the development, but should never exceed the rate of discharge from the development prior to redevelopment for that event.

4.9. In terms of volume control, where reasonably practicable, for greenfield development, the runoff volume in the 1 in 100 year, 6 hour rainfall event should never exceed the greenfield runoff volume for the same event. Where reasonably practicable, for developments which have been previously developed this runoff volume must be constrained to a value as close as is reasonably practicable to the greenfield runoff volume, but should never exceed the runoff volume prior to redevelopment for that event. Where it is not reasonably practicable to constrain the volume of runoff as described it must be discharged at a rate that does not adversely affect flood risk.

4.10. Guidance on the design and construction of SuDS is provided in the 'Interim Code of Practice for Sustainable Drainage Systems', published by the National SUDS Working Group in July 2004, in other CIRIA documents including The SuDS Manual 2015 (CIRIA C753), in the Environment Agency's document entitled 'Sustainable Drainage Systems (SUDS) An introduction', as well as in the Design and Construction Guidance (DCG) published by Water UK.

4.11. There are a number of potential SuDS techniques that might be used on any particular site. These include pervious pavements, infiltration devices such as soakaways and infiltration trenches, bioretention systems, as well as flow balancing methods including swales, ponds/detention basins, constructed wetlands and underground storage facilities.

4.12. The use of soakaways, pervious pavements and infiltration devices to discharge surface water runoff to ground depends upon the underlying strata having a suitable permeability. In addition, the Environment Agency will seek to control discharges into underground strata from areas subject to contamination or where groundwater is judged to be at risk from pollution caused by possible contamination.

4.13. The SuDS Manual 2015, and CIRIA C687 'Planning for SuDs - making it happen', promote the use of a SuDS 'management train', which seeks to address the quality and quantity of runoff at all stages of a drainage system. It uses a hierarchy of techniques, namely: i) prevention, ii) source control, iii) site control and iv) regional control. The drainage strategy for the proposed development seeks to follow the concept of a SuDS management train.

Ground Conditions

4.14. The British Geological Survey (BGS) geological mapping of the area shows the majority of the site is underlain by the Wittering Formation, consisting of sand, silt and clay.

4.15. A Soil Site Report was obtained from the National Soil Resources Institute. Hydrology of Soil Type (HOST) data for the site characterises the underlying soils for the majority of the site as falling into HOST Class 25, which is defined as *"Slowly permeable, seasonally waterlogged soils over impermeable clay substrates with no storage capacity"*.

4.16. A site investigation was undertaken by Hydrock in April 2019. The ground conditions encountered on the site are described in the Ground Investigation Report as follows:-

> **"The ground conditions as proven by the investigation undertaken at the site comprise:**
>
> - **Topsoil – to between 0.40m and 0.50m bgl, comprising a light brown to brown sandy gravelly silt with rootlets.**
> - **Head Deposits – to between 0.95 and 1.60 in thickness, comprising a light brown to orange brown sandy gravelly silt.**
> - **River Terrace Deposits – found at BH09, in the north west of the site, to be 1.60m thick, comprising orange brown sandy, gravelly and cobbly clay/silt.**
> - **Wittering Formation – found in all locations, thickness not proven, comprising soft to firm orange and orange brown mottled grey often lenticular or laminated silt, sand and clay where weathered and soft to stiff grey, often laminated silt, sand and clay at depth.**
> - **Earnley Sand Formation – found in the south of the site in BH02, between 0.40 and 2.30m bgl, comprising light brownish grey slightly and slightly gravelly sand."**

4.17. With regards to the use of soakaways / infiltration drainage on the site, the Ground Investigation Report concluded the following:-

> **"Soakaway drainage is considered unsuitable for this site, subject to further BRE365 compliant testing."**

4.18. With regards to groundwater the Ground Investigation Report states the following:-

> **"Groundwater was not encountered during the investigation.**
>
> **"Water levels recorded post-fieldwork range from 0.93m bgl to 2.77m bgl (15.86m OD to 29.66m OD)."**

4.19. It is recommended that groundwater monitoring is undertaken in the locations of the proposed Strategic SuDS features to establish the highest annual groundwater levels to inform the detailed design of these features.

4.20. Based on the foregoing it is considered that the use of soakaways would not provide a suitable means of draining surface water runoff from development on the majority of the site. However, in line with the recommendations of the Ground Investigation Report, it is recommended that localised infiltration testing is undertaken within the individual development parcels to identify any localised areas of the site where infiltration drainage may be feasible.

Groundwater Source Protection

4.21. From an inspection of the Environment Agency's Aquifer Designation Map dataset held on Natural England's MAGIC website, the site is underlain by a Secondary A Aquifer. A copy of the Aquifer Designation Map dataset information is reproduced in **Figure 4** below.

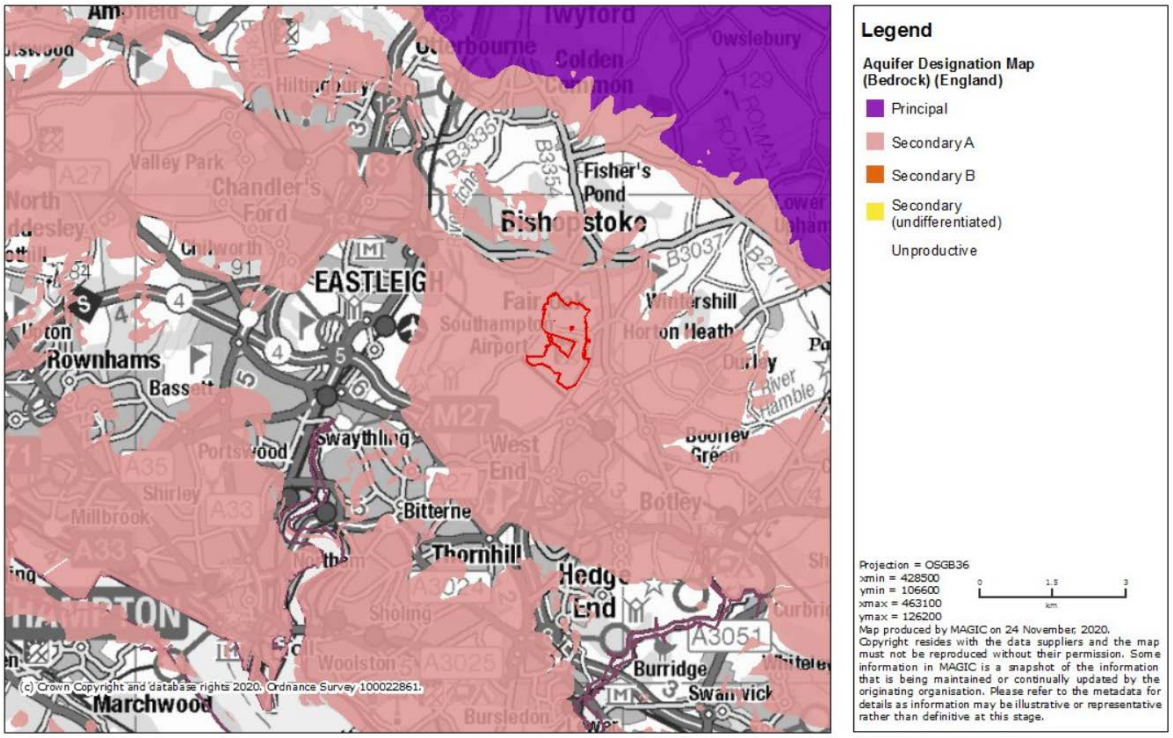


Figure 4: Aquifer Designation Map

4.22. From an inspection of the Environment Agency's Source Protection Zones dataset the site does not fall into a Groundwater Source Protection Zone. A copy of the Source Protection Zone Map dataset information is reproduced in **Figure 5** below.

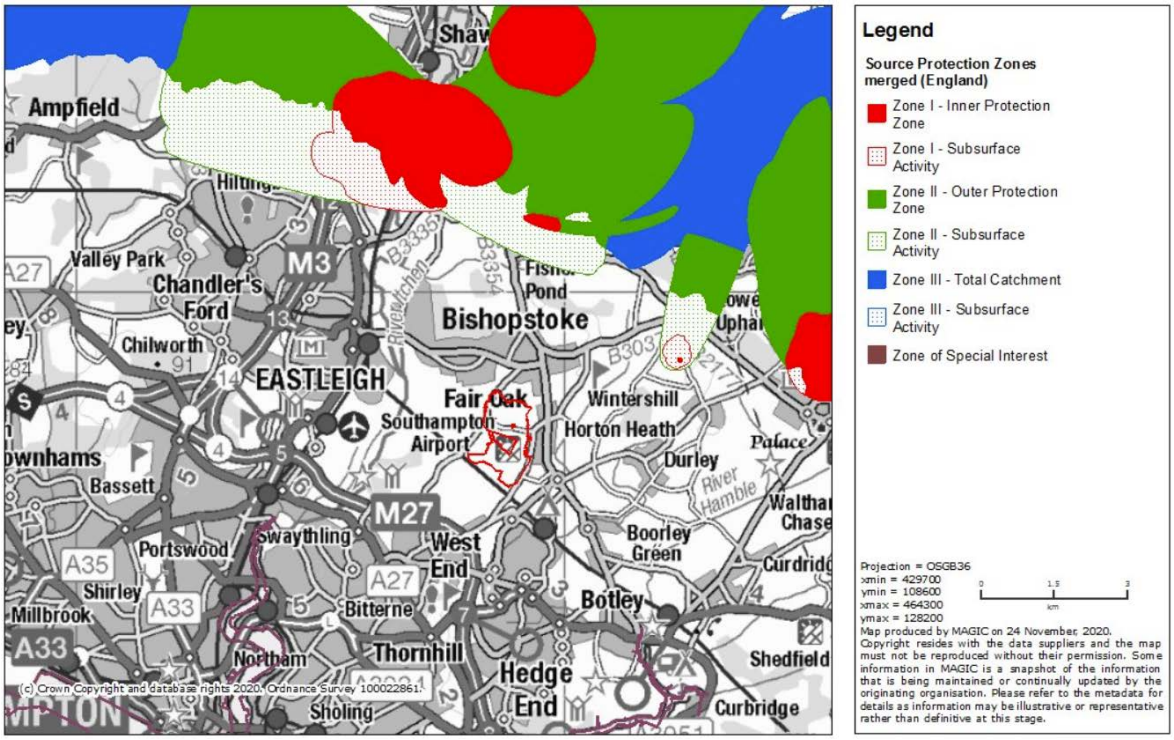


Figure 5: Source Protection Zones

4.23. With reference to the 'Environment Agency's approach to groundwater protection', the discharge of clean roof water to ground is acceptable both inside and outside SPZ1('inner zone') provided that all roof water down-pipes are sealed against pollutants entering the system from surface run-off, effluent disposal or other forms of discharge. If infiltration SuDS are to be used on any part of the site for surface run-off from roads, car parking and public or amenity areas, they would be suitably designed to ensure that the system does not pose an unacceptable risk to the source of supply.

Surface Water Management

4.24. A sustainable drainage strategy, involving the implementation of SuDS, is proposed for managing surface water on the site.

4.25. A full range of SuDS techniques have been considered for use on the site. Through early discussions with the Lead Local Flood Authority and other stakeholders it was agreed that the Strategic SuDS Features on the site should comprise above ground storage features within the green corridors that follow the onsite watercourses.

4.26. Additional source control measures should be utilised within the upstream development parcels. This approach provides flexibility for the detailed design of individual development parcels whilst maximising the water quality, water quantity, amenity and biodiversity benefits of the overall SuDS strategy.

4.27. A preliminary surface water management strategy is shown on the Preliminary Surface Water Management Strategy Plan, Drawing Numbers G277/21 Rev A and 22 Rev A, copies of which are contained in **Appendix 6**.

4.28. The proposed surface water management strategy would ensure that surface water arising from the developed site would be managed in a sustainable manner to mimic the surface water flows arising from the site prior to the proposed development, while reducing the flood risk to the site itself and elsewhere, taking climate change into account.

4.29. A SuDS Management Train approach is proposed to be implemented on the site. Guidance on the SuDS Features that should make up the SuDS Management Train is shown on drawing number G277/24, a copy of which is contained in **Appendix 7**.

4.30. In terms of the SuDS 'management train', the surface water management strategy for the proposed development seeks to address the quality and quantity of runoff as follows:-

i) Prevention

4.31. Prevention is the use of good site design and housekeeping measures to prevent pollution. Good site design and housekeeping measures that should be considered include:

- Minimising the impermeable areas created on the site by providing soft landscaping and planting wherever possible.
- Good site wide housekeeping and maintenance to minimise blockages and prevent pollution arising.
- Provision of water butts for rear gardens.
- The use of green roofs for public / commercial buildings where appropriate.
- The use of rainwater harvesting / reuse systems for public / commercial buildings and irrigation where appropriate.
- Installation of separators and other proprietary pollution control systems where land use requires or specific risks necessitate their use.
- Silt traps and trapped gullies to retain sediment.
- Planting within landscaped areas to encourage nutrient / pollutant uptake and evapotranspiration.
- The implementation of a SuDS Maintenance Strategy. Advice on what should be included within a maintenance strategy for the Strategic SuDS Features is included with this report. The SuDS Maintenance Strategy should become a living document that is continuously reviewed.

ii) Source Control

4.32. Source control is defined in the The SuDS Manual 2015 (CIRIA C753) as the control of runoff at or near its source, so that it does not enter the drainage system or is delayed and attenuated before it enters the drainage system. Source Control techniques that should be used within development parcels include the following:

- **Pervious Paving:** Pervious paving intercepts rainfall that lands on its surface before it can run overland into the downstream drainage system. This provides a degree of interception, particularly in the most polluted first-flush events, as well as filtration through the various layers of construction and through the stone sub-base. Pervious paving would typically be used for parking areas such as driveways, parking courts and car parks. Through the inclusion of a suitable flow control device, the stone sub-base in the pervious paving structure can be utilised to provide additional attenuation storage.
- **Bioretention Areas / Rain Gardens:** Bioretention areas utilise planting and constructed soils to intercept rainfall from their contributing catchment areas and contribute to interception storage, evapotranspiration and pollution removal. They can be placed around downpipes to intercept roof runoff, particularly from larger commercial buildings

where they can form part of the landscape design. They can also be incorporated into traffic calming infrastructure such as build outs and into roadside planting and tree pits. Bioretetion Swales can be installed adjacent to larger areas of highway to provide water quality treatment and attenuation storage along their length.

- **Other filtration techniques:** Filter Trenches and French Drains can be used to intercept runoff from larger parking areas and highway areas. These will provide interception storage and filtration through the stone fill within the trenches.

iii) Site Control

4.33. Site control is the management of water from several sub-catchments within a development parcel. Through close consultation with the layout designers flow conveyance measures such as swales and filter trenches should be incorporated into the development parcels to provide additional attenuation, treatment, amenity and opportunities for habitat creation.

iv) Regional Control

4.34. Regional control is the strategic management of runoff across the wider site. The Strategic SuDS Features will provide the attenuation volume and flow control required to reduce post-development flow rates to below greenfield runoff rates.

4.35. Strategic SuDS Features will incorporate erosion control and sediment forebays, designed in accordance with the guidance given in The SuDS Manual, to enhance water quality. The creation of wetland areas and the use of wetland planting within the Strategic SuDS Features will further contribute to the sediment and nutrient removal capacity of the site wide sustainable drainage systems.

4.36. A typical layout of one of the Strategic SuDS Features is shown on drawing number G277/23, a copy of which is contained in **Appendix 8**. This typical layout should be used to inform the detailed design of the Strategic SuDS Features.

Greenfield Runoff

4.37. Defra published the 'Non-statutory technical standards for sustainable drainage systems' (the technical standards) in March 2015 as guidance to designers of SuDS schemes.

4.38. The standards relevant to greenfield runoff calculations at Horton Heath are as follows:-

4.39. Standard S2 states:-

> **"S2 For greenfield developments, the peak runoff rate from the development to any highway drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event should never exceed the peak greenfield runoff rate for the same event."**

4.40. Standard S4 states:-

> **'S4 Where reasonably practicable, for greenfield development, the runoff volume from the development to any highway drain, sewer or surface water body in the 1 in 100 year, 6 hour rainfall event should never exceed the greenfield runoff volume for the same event.'**

4.41. Due to the impermeable nature of the underlying soils and water stress in the downstream catchment it is not possible to reduce the volume of runoff from the proposed development in this way and so Standard S6 applies:-

> **"S6 Where it is not reasonably practicable to constrain the volume of runoff to any drain, sewer or surface water body in accordance with S4 or S5 above, the runoff volume must be discharged at a rate that does not adversely affect flood risk."**

4.42. As the additional runoff generated cannot be disposed of by infiltration it is proposed that the outflow from the drainage system is constrained to Q_{BAR}, which approximates to a return period of 2.3 years, and hence a reduced rate of runoff for higher return periods.

4.43. In terms of what guidance is available on methods for calculating greenfield runoff rates, the 'Interim Code of Practice for Sustainable Drainage Systems' states that further information on the calculation of greenfield runoff can be found in DEFRA/Environment Agency R&D Technical Report W5-074/A 'Preliminary rainfall runoff management for developments'.

4.44. Table 1 in the 'Rainfall Runoff Management for Developments – Interim National Procedure Principles' set out in Report – SC030219 states that one of two approaches can be used:

> **'1. The Institute of Hydrology (IH) Report 124 Flood Estimation for Small Catchments (1994) method can be used to estimate the greenfield site flow rate, QBAR (the Mean Annual Flood).**
>
> **2. The Index Flood, QMED (the median of the set of annual maximum flood peaks) regression equation that forms part of the FEH statistical method can also be used where the appropriate parameters are known or can be derived/estimated.**
>
> **Where developments are smaller than 50 ha, the analysis for determining the greenfield index flood flow rate should use 50 ha in the formula and linearly interpolate the flow rate value based on the ratio of the development area.'**

4.45. Hydrology of Soil Type (HOST) data for Horton Heath has been obtained from the National Soil Resources Institute to allow derivation of the parameters required for the FEH methodology. The validity of this data has been confirmed by the findings of the Ground Investigation undertaken on the site. It is therefore considered that the FEH methodology should be followed to calculate the greenfield runoff rate for the site. The FEH methodology is one of the methods recommended by CIRIA C753 – The SuDS Manual.

4.46. Section 6.2.1 in Report – SC030219 sets out the revised FEH statistical method correlation formula equation for Q_{MED}, which requires the user to input Area, SAAR, FARL and BFIHOST. It is suggested that the HOST soil categories in IH126, 'Hydrology of Soil Types: a hydrologically based classification of soils of the United Kingdom' (1995) is used to obtain the site value for BFIHOST.

4.47. A Soils Site Report, including the 1:250,000 scale National Soil Map and HOST classes for the site, has been obtained from the National Soil Resources Institute at Cranfield University. An extract from the Soils Site Report is reproduced in **Appendix 9**. The vast majority of the site falls into HOST class 25.

4.48. From Table 3.4 in IH126, HOST Class 25 has a BFI coefficient of 0.178. Inserting this into the revised FEH statistical method correlation formula gives the following:

Q_{MED} = $8.3062AREA^{0.8510}$ x $0.1536^{(1000/SAAR)}$ x $FARL^{3.4451}$ x $0.0460^{BFIHOST\wedge 2}$ x 1000/50

= $8.3062 \times 0.5^{0.8510} \times 0.1536^{(1000/800)} \times 1 \times 0.0460^{0.178\wedge 2} \times 1000/50$

= 8.03 l/s/ha

4.49. To confirm these results the Greenfield Runoff Tool developed by HR Wallingford and available at www.uksuds.com, was used. Copies of the HR Wallingford Greenfield Runoff Tool outputs for the site are included in **Appendix 10**. A summary of the greenfield runoff rates for the various return period events is shown in **Table B**.

Table B: Greenfield Runoff Rates

Return Period (Years)	1	2 (Q_{MED})	2.33 (Q_{BAR})	30	100
Greenfield Runoff Rates (l/s/ha)	7.8	8.1	9.2	21.2	29.4

4.50. As the additional runoff generated cannot be disposed of by infiltration it is proposed that the outflow from the drainage system is constrained to Q_{MED}, which is equivalent to a return period of 2 years, and hence a reduced rate of runoff for higher return periods.

4.51. By limiting the developed rate of runoff to the median annual peak rate of runoff, Q_{MED}, for all rainfall events up to the 100 year return period event, including an allowance for climate change, the proposed development would reduce flood risk overall when compared to existing greenfield rates.

4.52. It is therefore proposed to limit the runoff rate for this site to 7.8 l/s/ha for the 1 in 1 year return period and to 8.0 l/s/ha (Q_{MED}) for all other return periods up to and including the 1 in 100 year return period including an allowance for climate change.

Surface Water Flow Balancing

4.53. It is proposed to use a SuDS Management Train in order to attenuate surface water runoff to greenfield runoff rates with discharge to the local watercourse and ditch system.

4.54. Preliminary storage calculations have been undertaken to establish the required storage for the development catchment areas on the site using the Source Control module in the MicroDrainage design software for return periods up to the 1 in 100 year event plus a 40% increase in peak rainfall intensity to take account of climate change. The outflow from the drainage system has been constrained to Q_{MED}, a return period of 2 years, and hence a reduced rate of runoff for higher return periods. Copies of the MicroDrainage outputs are reproduced in **Appendix 11**.

4.55. For the preliminary storage calculations it has been assumed that the developed areas would give rise to net impermeable areas of 100% for primary roads within the site, 65% of the respective development catchment area for residential development, 85% for employment, and 50% for the school. **Table C** below shows the development catchment areas, the required storage volume for the 1 in 1 year and 1 in 100 year event, including a 40% allowance for climate change, and the resulting discharge rates.

Table C: Runoff Rates and Storage Volumes

Dev Catchment Area	Area (ha)	Assumed % Imperm-ability	Catchment Q_{MED} (l/s)	1 in 1 yr Storage Volume (m^3)	Resulting Discharge (l/s)	1 in 100 yr + 40% CC Storage Vol. (m^3)	Resulting Discharge (l/s)
A	2.037	65	18.39	165	17.8	802.0	18.3
	0.260	100					
B	3.750	65	30.04	260	28.1	1224.1	29.9
C	6.808	65	54.53	405	50.1	2171.9	54.4
D	3.381	65	27.08	244.3	23.7	1111.5	27
E	3.650	65	32.30	337	24.8	1706.4	32.3
	0.382	100					
F	3.360	65	26.92	241	23.9	1103.4	26.9
G	2.762	65	41.47	267	34.7	1449.7	40.3
	2.415	50					
H	1.603	30	70.83	683	44.1	2694.1	70.8
	0.409	100					
	6.831	65					
I	1.556	65	29.60	314	26.7	1338.5	28.7
J	2.139	65					
K	1.696	65	13.58	127	11.0	560.3	13.5
L	3.894	65	39.57	433	32.5	1859.9	39.5
	1.046	100					
M	2.213	65	17.73	156	16.2	727.6	17.7
N	5.759	65	46.13	477	31.1	1924.3	46.0
EM	2.029	85	16.25	150	15.5	877.9	16.3

4.56. The Strategic SuDS Features shown on the Preliminary Surface Water Management Strategy Plan, in Appendix 6, indicate the location and sizes of the required storage facilities to serve the various development areas and are subject to detailed design and more detailed modelling as the details of the individual development parcels come to light.

4.57. From an inspection of Table C it can be seen that the peak runoff rate from the development for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event never exceed the peak greenfield runoff rate for the same event. The proposed surface water drainage measures therefore ensure the proposed development satisfies the peak flow control standards in the Government's 'Non-statutory technical standards for sustainable drainage systems'.

Water Quality

4.58. The proposed SuDS scheme provides treatment of surface water runoff which in turn delivers water quality benefits.

4.59. Until very recently, surface water drainage systems that were being offered for adoption by sewerage undertakers were required to be designed in accordance with Sewers for Adoption (SfA). SfA required the system being offered for adoption to comprise a continuous pipe system from inlet to outfall. This led to SuDS features being moved 'offline' such that the treatment processes associated with them were bypassed in the most polluting events. This was often implemented by removing the hydraulic link from SuDS features back in to the system being offered for adoption. The effect of this was that attenuation storage for rainfall events up to the 1 in 30 year return period was often located within the underground system being offered for adoption.

4.60. The issue was exacerbated by SfA's requirement for surface water pipe systems to be 'self-cleansing'. These requirements forced designers to produce surface water drainage systems that transported sediment, and other contaminants, through the drainage system to the outfall to avoid the siltation of underground assets.

4.61. With OFWAT's approval of the Code for Adoption in October 2019, and its implementation in April 2020, designers now have much more flexibility to utilise the treatment processes within SuDS features.

4.62. The proper implementation of a SuDS management / treatment train using a combination of upstream Source Control and Strategic SuDS Features will create greater resilience and allow the system to collect silt at various points which can then be removed as part of periodic maintenance. Creating a diverse SuDS scheme that encourages sedimentation, filtration and biological uptake throughout the site overcomes the issues previously faced.

4.63. Ensuring that the principles of the Water Management Strategy are taken forward into the future detailed design of the individual development parcels and ensuring that effective maintenance and management procedures are followed will be the key to ensuring the overall effectiveness of the SuDS scheme.

4.64. With reference to Chapter 26 of the CIRIA SuDS Manual 2015, and using the simple index approach, to deliver adequate treatment the SuDS components should have a total pollution mitigation index (for each contaminant type) that equals or exceeds the pollution hazard index (for each contaminant type):

Total SuDS mitigation index > pollution hazard index

4.65. From Table 26.2 in the CIRIA SuDS Manual 2015 the pollution hazard indices for each contaminant type for the proposed land use are shown in **Table D** below.

Table D: Pollution hazard indices

Land Use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydrocarbons
Residential roofs	Very Low	0.2	0.2	0.05
Other roofs (commercial)	Low	0.3	0.2 (up to 0.8 where there is potential for metals to leach)	0.05
Property driveways, residential car parks, low traffic roads and non-residential car parking with infrequent change (eg school, offices)	Low	0.5	0.4	0.4
Commercial yard and delivery areas, non-residential car parking with frequent change, all roads except low traffic roads and trunk roads/motorways.	Medium	0.7	0.6	0.7
Sites with heavy pollution, sites where chemicals and fuels are to be delivered, handled, stored, used or manufactured, industrial sites, trunk roads and motorways.	High	0.8	0.8	0.9

4.66. From Table 26.3 in the CIRIA SuDS Manual 2015 the indicative SuDS mitigation indices for discharges to surface waters for the SuDS components proposed on the site are shown in **Table E** below.

Table E: Indicative SuDS mitigation indices for discharges to surface waters

Type of SuDS component	TSS	Metals	Hydrocarbons
Filter Strip	0.4	0.4	0.5
Filter Drain	0.4	0.4	0.4
Swale	0.5	0.6	0.6
Bioretention system	0.8	0.8	0.8
Permeable pavement	0.7	0.6	0.7
Detention Basin	0.5	0.5	0.6
Pond	0.7	0.7	0.5
Wetland	0.8	0.8	0.8
Proprietary treatment systems	These must demonstrate that they can address each of the contaminant types to acceptable levels for frequent events up to approximately the 1 in 1 year return period event, for inflow concentrations relevant to the contributing drainage area.		

4.67. It is proposed that surface water runoff from all development areas on the site will be treated by a SuDS Management Train consisting of Source Control techniques and Strategic SuDS Features. The Source Control techniques designed for the individual development parcels should take account of the Pollution Hazard Indices and the Mitigation Indices shown in Tables D and E above.

4.68. In addition to the upstream Source Control measures, runoff from all development areas on the site will pass through at least one Strategic SuDS Feature. The Strategic SuDS Features will incorporate the following treatment processes as a minimum:-

- Sediment forebays at inlets.
- Extensive wetland areas.
- Wetland Planting.
- Secondary sedimentation areas prior to outlets.

4.69. An example of a typical layout for the Strategic SuDS Features is shown on the 'Typical Layout of Strategic SuDS Features Plan' in Appendix 8. It is intended that this drawing should be used to inform the detailed design of the Strategic SuDS Features to ensure that the treatment processes outlined above are fully incorporated.

4.70. With reference to Tables D and E above it can be seen that the total pollution mitigation associated with the wetland areas equals or exceeds the pollution hazard index (for each contaminant type), for the land uses proposed on the site with the possible exception of B2 and B8 land uses.

4.71. Where individual land uses present a 'High' pollution hazard level then bespoke solutions will need to be designed for these locations. For example, bioretention systems and proprietary treatment systems should be considered and their design should be targeted at the specific contaminant types associated with the proposed land use.

4.72. An ongoing monitoring and management plan is proposed to monitor the effectiveness of the SuDS system at removing fine sediment and nutrients from surface water runoff.

4.73. An Outline Monitoring and Management Plan produced by Johns Associates is contained in Appendix 11.5 of Volume 2 of the Environmental Statement.

Flood Risk Management Measures

Minimum Ground Floor Levels

4.74. All inhabitable development proposed on the site is located within Flood Zone 1. Some development areas on the western and north-western edges of the site are located approximately 20 metres from the extent of Flood Zones 2 and 3. From an inspection of the topographical survey, the existing ground levels in these locations are significantly higher than the associated flood levels.

4.75. Notwithstanding the above, based on the Environment Agency's standing advice for new development ground floor levels should be set at least 600mm above the 1 in 100 year annual probability river flood level in any year, including an allowance for climate change.

4.76. The Flood Map for Planning and associated modelling is periodically updated. As Reserved Matters Planning Applications come forward for the individual development parcels, the latest flood modelling data should be obtained from the Environment Agency's Customers and Engagement Team to inform their design.

Safe Access and Egress

4.77. Safe access and egress to and from the development is a route that is safe for use without the intervention of the emergency services or others.

4.78. Paragraph 39 in the Flood Risk and Coastal Change Planning Practice Guidance (Reference ID: 7-039-20140306) advises that access routes should allow occupants to safely access and exit their dwellings in design flood conditions. Wherever possible, safe access routes should be provided that are located above design flood levels and avoiding flow paths.

4.79. The proposed access arrangements for the site are shown on the Access Parameter Plan, Thrive Architects Drawing Number EAST200403-PP01 P22, a copy of which is reproduced in **Appendix 12**. From an inspection of the Access Parameter Plan it can be seen that the proposed link road and internal distributor roads cross the onsite watercourses in a number locations. The locations of watercourse crossings are highlighted on the Preliminary Water Management Strategy Plan in Appendix 6.

4.80. The detailed design of the link road and internal distributor roads should ensure that watercourse crossings are clear span of watercourse channels so as to create zero afflux. Bridge soffit levels should be set a minimum of 600mm above the relevant 1 in 100 year annual probability river flood level in any year, including an allowance for climate change.

4.81. Any loss of floodplain storage associated with watercourses should be compensated for on a direct level-for-level basis.

4.82. Where clear span structures are not feasible and/or there is a risk of bridge structures inhibiting flows within a watercourse, the detailed design of the watercourse crossing will need to be supported by hydraulic modelling in order to demonstrate that the proposed mitigation measures would be effective in protecting the bridge structure without negatively impacting on flows and water levels outside of the site.

4.83. The proposed built development is located entirely in Flood Zone 1 and so safe access and egress routes would be available for vehicles and pedestrians via the access roads to the development.

Overland Flood Flow Paths

4.84. Standard S9 in the Government's 'Non-statutory technical standards for sustainable drainage systems' states that the design of the site must ensure that, so far as is reasonably practicable, flows resulting from rainfall in excess of 1 in 100 year rainfall event are managed in exceedance routes that minimise the risk to people or property.

4.85. Overland flood flow paths would follow the natural topography of the land towards the onsite network of watercourses and ditches. The design of the internal road network would convey flows towards Strategic SuDS Features and away from properties.

4.86. The detailed design of ground levels on the site should ensure that localised low points are not created where ponding could affect properties or create a hazard.

4.87. Indicative overland flow paths for an extreme event are shown on the Preliminary Water Management Strategy Plan in Appendix 6.

Off Site Impacts

4.88. By reducing the rate of runoff and intercepting uncontrolled overland flows the proposed development would reduce flood risk overall.

Residual Risk

4.89. Paragraph 41 in the Flood Risk and Coastal Change Planning Practice Guidance (Reference ID: 7-041-20140306) advises that residual risks are those remaining after applying the sequential approach to the location of development and taking mitigating actions.

4.90. The majority of the site falls within Flood Zone 1. In accordance with the NPPF a sequential approach has been applied so that all built inhabitable development on the site would be located within Flood Zone 1.

4.91. The proposed water management measures would ensure that there is little or no residual risk of property flooding occurring during events well in excess of the minimum acceptable standard of protection for new property, which requires that no flooding of property should occur as a result of a one in 100 year storm event including an appropriate allowance for climate change.

4.92. For extreme events it is considered that the proposed development would intercept any uncontrolled overland flow and direct it into the proposed water management system. The proposed SuDS measures would ensure the proposed development would have adequate flood protection for extreme events over the lifetime of the development.

Summary of Flood Risk with Management Measures

4.93. A summary of the potential risk from all sources of flooding post-development with the various development mitigation measures incorporated is shown in **Table F** below.

Table F: Post-development Potential Flood Risk from All Sources of Flooding

Flood Source	Potential Risk				Description
	Very Low	Low	Medium	High	
Watercourses		X			Minimum ground floor levels would be set 600mm above the design flood level. Road crossings of watercourses would be clear span structures and soffit levels would be 600mm clear of the design flood level.
Surface Water		X			Overland surface water flows would be intercepted by the onsite SuDS measures.
Groundwater		X			The majority of the site is at Low risk of flooding from groundwater with areas of elevated risk associated with the low lying areas in proximity to onsite watercourses where inhabitable development is not proposed.
Overwhelmed Sewers		X			No public sewers are identified on the site. There are no known instances of flooding from overwhelmed sewers affecting the Site.
Artificial Sources	X				The site is not affected
Off-site Impacts	X				By reducing the rate of runoff and intercepting overland flows the proposed development would reduce flood risk overall.

4.94. Through the incorporation of water and flood management measures the proposed development would further reduce any risk from river, surface water, and groundwater flooding. By reducing the rate of runoff and intercepting overland flows the proposed development would reduce flood risk overall.

Non-statutory technical standards for sustainable drainage systems

4.95. The Government published its 'Non-statutory technical standards for sustainable drainage systems' in March 2015. The technical standards relate to the design, construction, operation and maintenance of sustainable drainage systems and have been published as guidance. The Government expect these standards to apply to all developments of 10 homes or more and to major commercial development.

The 'Non-statutory technical standards for sustainable drainage systems' set out peak flow control standards (S2 and S3) and volume control technical standards (S4, S5 and S6).

4.96. Standard S2 states:

'S2 For greenfield developments, the peak runoff rate from the development to any highway drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event should never exceed the peak greenfield runoff rate for the same event.'

4.97. Standard S3 states:

'S3 For developments which were previously developed, the peak runoff rate from the development to any highway drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event must be as close as reasonably practicable to the greenfield runoff rate from the development for the same rainfall event, but should never exceed the rate of discharge from the development prior to redevelopment for that event.'

4.98. In terms of volume control, standard S4 states:

'S4 Where reasonably practicable, for greenfield development, the runoff volume from the development to any highway drain, sewer or surface water body in the 1 in 100 year, 6 hour rainfall event should never exceed the greenfield runoff volume for the same event.'

4.99. Standard S5 states:

'S5 Where reasonably practicable, for developments which have been previously developed, the runoff volume from the development to any highway drain, sewer or surface water body in the 1 in 100 year, 6 hour rainfall event must be constrained to a value as close as is reasonably practicable to the greenfield runoff volume for the same event, but should never exceed the runoff volume from the development site prior to redevelopment for that event.'

4.100. Standard S6 states:

'S6 Where it is not reasonably practicable to constrain the volume of runoff to any drain, sewer or surface water body in accordance with S4 or S5 above, the runoff volume must be discharged at a rate that does not adversely affect flood risk.'

4.101. In accordance with Points 8 and 10 of the 'Rainfall Runoff Management for Developments – Interim National Procedure Principles' in the Environment Agency's Report – SC030219, the limiting discharge rate that does not adversely affect flood risk, for any return period up to the 100 year event, is the mean annual peak rate of runoff for the greenfield site referred to as Q_{BAR} or 2 l/s/ha, whichever is greater.

4.102. In terms of flood risk within the development, the Government's 'Non-statutory technical standards for sustainable drainage systems' include standards S7, S8 and S9.

4.103. Standard S7 states:

'S7 The drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur on any part of the site for a 1 in 30 year rainfall event.'

4.104. Standard S8 states:

'S8 The drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur during a 1 in 100 year rainfall event in any part of: a building (including a basement); or in any utility plant susceptible to water (eg pumping station or electricity substation) within the development.'

4.105. Standard S9 states:

'S9 The design of the site must ensure that, so far as is reasonably practicable, flows resulting from rainfall in excess of 1 in 100 year rainfall event are managed in exceedance routes that minimise the risk to people or property.'

4.106. **Table G** demonstrates how the proposed development complies with the relevant standards of the Government's 'Non-statutory technical standards for sustainable drainage systems'

Table G: Compliance with Non-statutory technical standards for sustainable drainage systems

Standard	Justification for compliance
Flood risk outside the development	
S1	N/A
Peak flow control	
S2	The peak runoff rate from the development to any highway drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event never exceed the peak greenfield runoff rate for the same event.
S3	N/A. Greenfield development so S2 applies.
Volume control	
S4	Not reasonably practicable due to low infiltration rates so S6 applies.
S5	N/A S6 applies.
S6	Runoff volume to any drain, sewer or surface water body is discharged at a rate that does not adversely affect flood risk, corresponding to less than Q_{BAR} (Q_{MED}).
Flood Risk within the development	
S7	The surface water management system would be designed so that, unless an area is designated to hold and/or convey water, flooding does not occur on any part of the site for a 1 in 30 year rainfall event.
S8	The surface water management system would be designed so that, unless an area is designated to hold and/or convey water, flooding does not occur during a 1 in 100 year rainfall event in any part of a building within the development.
S9	The design of the site ensures that, so far as is reasonably practicable, flows resulting from rainfall in excess of a 1 in 100 year rainfall event are able to be managed in exceedance routes that minimise the risks to people and property.
Structural integrity	
S10	Components would be designed to ensure structural integrity of the drainage system under anticipated loading conditions over the design life of the development.
S11	The materials specified by the designer at the detailed design stage would be of a suitable nature and quality for their intended use.
Designing for maintenance considerations	
S12	N/A. Pumping is not proposed.
Construction	
S13	No connection to existing surface water sewers is proposed. As the development is built out in phases, connections to the surface water management system of previously constructed phases may be required. The mode of construction of these connections would comply with the appropriate standards and be inspected by the relevant authority so would not be prejudicial to the structural integrity and functionally of the drainage system.
S14	Any damage to the drainage system would be rectified before the drainage system is completed to the satisfaction of the relevant authority.

Local Standards

4.107. The emerging drainage strategy was presented to the Flood and Water Management team at Hampshire County Council's offices on 14th January 2020 as part of a pre-application meeting. At the pre-application meeting there was broad agreement of the emerging surface water drainage strategy that was presented. Summary minutes of the meeting are included in **Appendix 13**, along with Hampshire County Council's Engineer's agreement to the minutes.

4.108. At the pre-application meeting Hampshire County Council provided a copy of the 'Surface Water Checklist' and associated guidance that sets out the information that is required by the Lead Local Flood Authority (LLFA) for new development proposals in Hampshire. A completed copy of the checklist is included as **Appendix 14**.

Foul Water Drainage

4.109. There are no existing foul water sewers present within the site. It is therefore assumed that all foul sewage generated by existing dwellings and farmsteads is currently treated on-site by septic tanks and drainage fields, discharging leachate ultimately to local watercourses or groundwaters.

4.110. Due to site topography foul water flows arising from the Proposed Development will be collected in foul sewers and directed to onsite foul water pumping stations. The proposed locations of the Strategic Foul Water Pumping Stations are shown on the Preliminary Water Management Strategy Plan in Appendix 6.

4.111. The pumping stations would pump foul water to the public sewer network via a rising main. The preferred point of connection is to the public sewerage system to the south-east of the development which drains to the Peel Common Wastewater Treatment Works (WwTW) which is operated by Southern Water and discharges into the Solent.

4.112. Southern Water has a statutory duty to provide sewerage conveyance and treatment infrastructure for new development and to provide additional capacity as and when required.

4.113. The details of the connection to the Peel Common WwTW would be agreed with Southern Water as part of a detailed S106 / S98 application. Any offsite works delivered by Southern Water will be designed to current standards and would mitigate the effect of additional foul water flows on sewer flood risk.

Maintenance Strategy

4.114. Paragraph 81 in the Flood Risk and Coastal Change Planning Practice Guidance (Reference ID: 7-085-20150323) advises that in considering a development that includes a sustainable drainage system the local planning authority will want to be satisfied that there are clear arrangements in place for ongoing maintenance. Paragraph 85 goes onto advise that when planning a sustainable drainage system, developers need to ensure their design takes account of maintenance requirements of both surface and subsurface components so that it continues to provide effective drainage for properties.

4.115. The foul water drainage systems would be offered for adoption by Southern Water, in its role as sewerage undertaker, under a Section 104 Agreement of the Water Industry Act 1991. Southern Water would therefore be responsible for the future maintenance of the adopted drainage systems.

4.116. A summary of maintenance responsibilities for the various stages of the SuDS Management Train is shown on the SuDS Management Train drawing in Appendix 7. It is proposed that the Site and Regional Control elements of the Management Train are offered for adoption by Southern Water under the Code for Adoption Agreement, or would be maintained by a Management Company.

4.117. Roads and footways, including highway drainage and gullies, to be adopted under Section 38 of the Highways Act 1980, would be maintained by Hampshire County Council in its role as local highway authority.

4.118. The maintenance of Source Control measures would be the responsibility of the property owners or management companies in the case of shared SuDS Features.

4.119. Guidance on the operation and maintenance requirements of sustainable drainage systems is contained in The SuDS Manual 2015 (CIRIA C753). There are three categories of maintenance: regular, occasional and remedial. The sewerage undertaker/Management Company would be responsible for putting in place a suitable maintenance plan.

4.120. Regular maintenance consists of basic tasks including litter and debris removal, grass cutting, and vegetation management, and includes inspections and monitoring to identify potential system failures such as blockages, silt and sediment build-up, eroded or damaged areas, and condition of inlets and outlets.

4.121. Occasional Maintenance comprises tasks that are likely to be required periodically for example sediment removal and vegetation replacement.

4.122. Remedial Maintenance comprises intermittent tasks to rectify faults and would comprise inlet/outlet repairs, erosion repairs, and dealing with a spillage event.

4.123. Surface water quality monitoring of the on-site watercourses is necessary pre development (to establish a baseline) and during construction and operation of the development to give certainty to the effectiveness of the proposed Water Management Strategy at capturing fine sediment and reducing nutrient levels.

4.124. Water quality from the SuDS Features on the site will be subject to an ongoing monitoring and management programme. An Outline Monitoring and Management Plan produced by Johns Associates is contained in Appendix 11.5 of Volume 2 of the Environmental Statement.

4.125. A monitoring programme will be established whereby regular sampling of discharge from the Strategic SuDS Features is undertaken to ensure that there is no adverse impact on the quality of any surface water discharging into on-site watercourses.

4.126. It is proposed to sample surface water quality in catchpit ‘monitoring‘ inspection chambers downstream of the Strategic SuDS Features’ final flow controls. This targeted monitoring is advocated to minimise the risk of confounding variables (several variables interacting causing a spurious association) resulting from wider catchment activity outside of the site.

4.127. Water samples from the ‘monitoring‘ chambers will be sent for laboratory analysis of suspended solids, turbidity, nitrites, nitrates, ammonia/ammonium, and total nitrogen.

4.128. It is proposed that dissolved oxygen concentrations of the runoff will be measured to monitor the chemistry of the runoff draining into on-site watercourses. This can be monitored using a handheld meter.

4.129. Visual evidence of sediment deposition or silty runoff should also be captured in the monitoring scheme.

4.130. A point downstream of the Moon River should be monitored pre development to establish a baseline and to capture wider catchment trends. This monitoring point can be used to support the monitoring scheme for the Wider OPA.

4.131. The intensity and duration of the monitoring will vary depending on the phase of the development. The monitoring effort will be more frequent at first and lessen as the Strategic SuDS Features become more established. Monitoring should occur at the same time each year to allow for the assessment of long term trends in the data and should be conducted in both spring and autumn to capture seasonal variations.

4.132. The maintaining body will produce an annual maintenance report summarising the maintenance activities completed by the maintenance contractor and the results of the surface water quality monitoring. The annual report will also set out the recommendations for the inspection and maintenance for the following year.

4.133. It is recommended that the maintaining body review the maintenance and monitoring regime with Natural England after 5 years to ensure the surface water discharging to the designated sites is of sufficient quality and assess whether any remedial measures are required.

4.134. If, or when, the SuDS scheme has been fully adopted by the Southern Water which has a statutory responsibly for the maintenance and monitoring of adopted drainage systems the scheme may need to be revised.

4.135. The monitoring and management plan allows for adaptive management to ensure that if an issue is identified targeted adaptive mitigation measures can be put in place. Adaptive mitigation measures include:

- Enhanced management including increased sediment / vegetation removal frequencies;
- Enhanced planting of Strategic SuDS features to increase sediment entrapment or nutrient uptake;
- Retrofit Source Control in problem areas;
- Retrofit hydrodynamic vortex separators in problem areas; and
- Education / enforcement if pollution is as a result of unconsented activities on the Site.

4.136. The CEMP will include monitoring of on-site watercourses to establish sediment loadings being discharged downstream. A management plan will be put in place to adapt construction site management to ensure that silt management techniques are working effectively.

4.137. The monitoring and management plan and CEMP can be secured by way of a planning condition.

4.138. The delivery of the First Residential Parcel will test the effectiveness of construction management mitigation measures and through implementation of a monitor-manage feedback loop these measures can be refined in future phases of the site.

5. CONCLUSIONS

5.1. This Flood Risk Assessment has been prepared in connection with proposals for a mixed-use development on land at Horton Heath in Hampshire.

5.2. The overall site comprises around 124 hectares, and is located to the west of Horton Heath, which lies in Eastleigh Borough in Hampshire

5.3. The development proposals comprise a maximum of:

- Circa 2,500 dwellings comprising a mix of market and affordable housing.
- A Mixed Use Centre of 3.1 Ha comprising residential, retail, leisure, community, employment facilities.
- 3.3 Ha of employment land.
- A three form entry primary school and early years education facilities.
- Formal and informal publicly accessible open space, formal areas of play, youth provision and associated facilities, formal sports facilities, allotments and amenity space, including landscaping, green infrastructure and sustainable drainage systems.
- The utilisation of existing and provision of new and/ or amended highway access points along Allington Lane, Fir Tree Lane, Burnetts Lane and Bubb Lane.
- Any wider land outside the site boundary needed for development specific infrastructure.

5.4. With reference to the Environment Agency's Flood Map for Planning, the majority of the site falls within Flood Zone 1. Small areas of the site's western boundary and north-western corner are shown as falling within Flood Zone 2 and Flood Zone 3.

5.5. In accordance with the NPPF, a sequential approach has been used such that no built development would be located in Flood Zones 2 or 3. On this basis the sequential test is passed.

5.6. In addition to flooding from rivers and the sea, this Flood Risk Assessment has considered the potential consequences of flooding from all other sources, which include directly from rainfall on the ground surface and rising groundwater, overwhelmed sewers and drainage systems, and from reservoirs, canals and lakes and other artificial sources.

5.7. The available flood risk information includes: The Environment Agency's Flood Map for Planning; modelled flood levels for the watercourse in the vicinity of the site; flood defence locations; details of historic flood events; local flood history data from all sources of flooding; the GOV.UK 'Long Term Flood Risk Information' interactive maps; and flooding information in the SFRA.

5.8. The pre-development potential flood risk to the site from all sources of flooding is considered to be low.

5.9. In terms of providing an acceptable standard of protection against flooding for new development, no flooding of property should occur as a result of the 'design flood' corresponding to a 1 in 100 year fluvial flood even taking account of climate change.

5.10. The British Geological Survey (BGS) geological mapping of the area shows the majority of the site is underlain by the Wittering Formation, consisting of sand, silt and clay.

5.11. A site investigation was undertaken by Hydrock in April 2019. Based on the site investigation it is considered that the use of soakaways would not provide a suitable means of draining surface water runoff from development on the majority of the site.

5.12. A sustainable water management strategy, involving the implementation of SuDS, is proposed for managing the disposal of surface water runoff from the proposed development on the site.

5.13. A full range of SuDS techniques have been considered for use on the site. Through early discussions with the Lead Local Flood Authority and other stakeholders it was agreed that the Strategic SuDS Features on the site should comprise above ground storage features within the green corridors that follow the onsite watercourses.

5.14. Additional source control measures should be utilised within the upstream development parcels. This approach provides flexibility for the detailed design of individual development parcels whilst maximising the water quality, water quantity, amenity and biodiversity benefits of the overall SuDS strategy.

5.15. The proposed water management strategy would ensure that surface water arising from the developed site would be managed in a sustainable manner to mimic the surface water flows arising from the site prior to the proposed development, while reducing the flood risk to the site itself and elsewhere, taking climate change into account.

5.16. Greenfield runoff peak flow rates have been derived using the guidance in the Environment Agency's 'Rainfall runoff management for developments' Report – SC030219 published in October 2013. In accordance with this guidance the limiting discharge for any return period up to the 100 year event, including an allowance for climate change, would not be greater than the median annual peak rate of runoff for the greenfield site, referred to as $Q_{MED,}$ which approximates to a return period of 2 years, and hence a reduced rate of runoff for higher return periods.

5.17. By limiting the development rate of runoff to the mean annual peak rate of runoff, Q_{MED}, for all rainfall events up to the 1 in 100 year return period event, including an allowance for climate change, the proposed development would reduce flood risk overall when compared to existing greenfield rates.

5.18. Minimum ground floor levels for all built development on the site would be set at least 600mm above the 1 in 100 year annual probability flood level in any year, including an allowance for climate change, in accordance with guidance for new development. In addition, all built development would be set well away from any watercourse.

5.19. The detailed design of the link road and internal distributor roads should ensure that watercourse crossings are clear span of watercourse channels so as to create zero afflux. Bridge soffit levels should be set a minimum of 600mm above the relevant 1 in 100 year annual probability river flood level in any year, including an allowance for climate change.

5.20. Any loss of floodplain storage associated with watercourses should be compensated for on a direct level-for-level basis.

5.21. The proposed drainage measures would ensure that there is little or no residual risk of property flooding occurring during events well in excess of the minimum acceptable standard of protection for new property, which requires that no flooding of property should occur as a result of a one in 100 year storm event taking account of climate change.

5.22. For extreme events it is considered that the proposed development would intercept any uncontrolled overland flow and direct it into the proposed drainage system. The proposed drainage measures would therefore ensure the proposed development would have adequate flood protection for extreme events over the lifetime of the development.

5.23. The MicroDrainage calculations contained in this Flood Risk Assessment demonstrate that a suitable means of drainage can be provided to drain the developed site in terms of surface water runoff in accordance with the guidance and standards laid down.

5.24. The proposed development complies with the relevant standards of the Government's 'Non-statutory technical standards for sustainable drainage systems'.

5.25. The proposed surface water drainage measures would ensure the proposed development satisfies the peak flow control standards and volume control technical standards in the Government's 'Non-statutory technical standards for sustainable drainage systems'.

5.26. In terms of foul water drainage, it has been demonstrated that a suitable means of drainage can be provided to serve the proposed development.

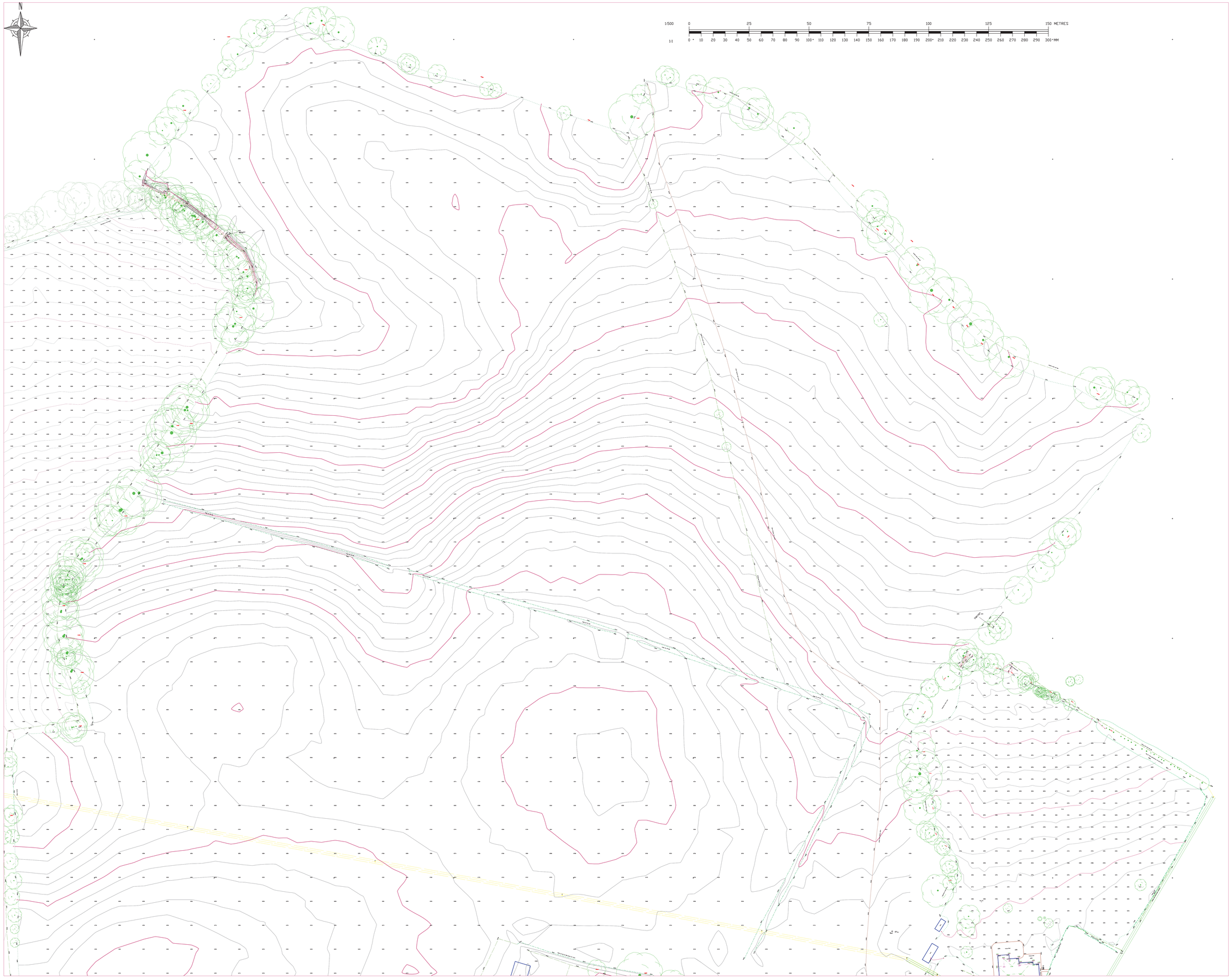
5.27. The proposed foul and surface water drainage arrangements can be covered by a suitably worded condition requiring the submission of details to be submitted to and approved by the Local Planning Authority.

5.28. A maintenance strategy for the proposed foul and surface water drainage measures to serve the development has been set out in this document.

5.29. This Flood Risk Assessment has demonstrated that the proposed development complies with the relevant requirements of the NPPF, the planning practice guidance checklist, Local Plan Policies, guidance published by DEFRA/Environment Agency, the Government's 'Non-statutory technical standards for sustainable drainage systems' and Hampshire's Local standards.

5.30. The overall conclusions drawn from this Flood Risk Assessment are that the development would be appropriately safe for its lifetime taking account of the vulnerability of its users, the development would not increase flood risk elsewhere, and would reduce flood risk overall.

Appendix 4



Notes

1. The survey was carried out during March/April 2014, using Leica TPS and Viva 5 second instruments and Viva GPS.
2. North relates to OS Grid North.
3. All co-ordinates relate to OS GB36 Datum at Stn M1. The rest of the site is orientated to OS Grid North but has been surveyed on a flat grid with no scale Factor (1:1). All heights relate to OSGB 36 datum and have been computed using the OSTN02 Geoid model.

LEGEND

- Survey Station
- IC - Inspection Cover
- CA - Cable TV Cover
- FH - Fire Hydrant
- SV - Stop Valve
- GV - Gas Valve
- PB - Post Box
- TCB - Call box
- TC - TCSU Cover
- PT - Parking Ticket Machine
- ER - Earthing Rod
- TB - Traffic Bollard
- Litter Bin
- Gully
- MH - Manhole Triangular
- MHC - Manhole Circular
- PB - Post Box
- GP Gate Post
- TP Telephone Pole
- EP Electricity Pole
- RS Road Sign (See Schedule)
- TL Traffic Light
- B Bollard
- FP Flag Pole
- LP Lamp Post
- C Camera
- Gate
- Tree (Coniferous - girth and spread to scale)
- Tree (Deciduous - girth and spread to scale)
- Tree (Dead/diseased - girth and spread to scale)
- Spot Level
- Tree Height
- Top of Wall Height
- Apex Height
- Eave Height

- Kerb
- Drop Kerb
- Road Edge (no kerb)
- Track Edge
- Change of Surface
- Road Centre Line
- Double Yellow Lines
- Wall
- Fence
- Edge of Hedge
- Vegitation Edge
- Iron Railings
- Building
- Apex Line
- Eave Line
- Parking Bay
- Overhead Power Cable
- Open Channel
- Top of Bank
- Bottom of Bank
- Major Contour Interval - 1.0m
- Minor Contour Interval - 0.2m

CO-ORDINATE TABLE

Reference	East	North	Elevation
F1	448871.230	117304.158	26.807
F3	448990.481	117297.533	26.890
F4	449155.209	117287.176	27.932
F6	449283.210	117268.823	30.369
F7	449364.794	117268.195	31.359
M1	448785.911	116520.575	21.324
M2	448947.196	116455.987	21.211
M3	449091.235	116401.087	23.227
Stn C1	448867.574	116001.014	24.983
Stn C2	448812.042	116023.730	24.516

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X1	448799.731	117314.913	26.216
X2	448618.784	117382.827	22.764
X3	448572.703	117470.551	19.863
X4	448543.136	117488.768	19.230
X5	448430.708	117529.540	17.845
X6	448379.636	117576.546	16.815
X7	448314.210	117597.301	15.142

rev.	amendment	date
E	Additional tree information at Roe Lodge and Chatcroft Business Park	25 May 15
D	Sub surface pipe line added (Bubb Lane)	10 Feb 15
C	Fir Tree Farm added	07 Jan 15
B	Additional survey area added	31 Oct 14
A	Window and door cuts added	27 Aug 14

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client: SAVILLS LIMITED

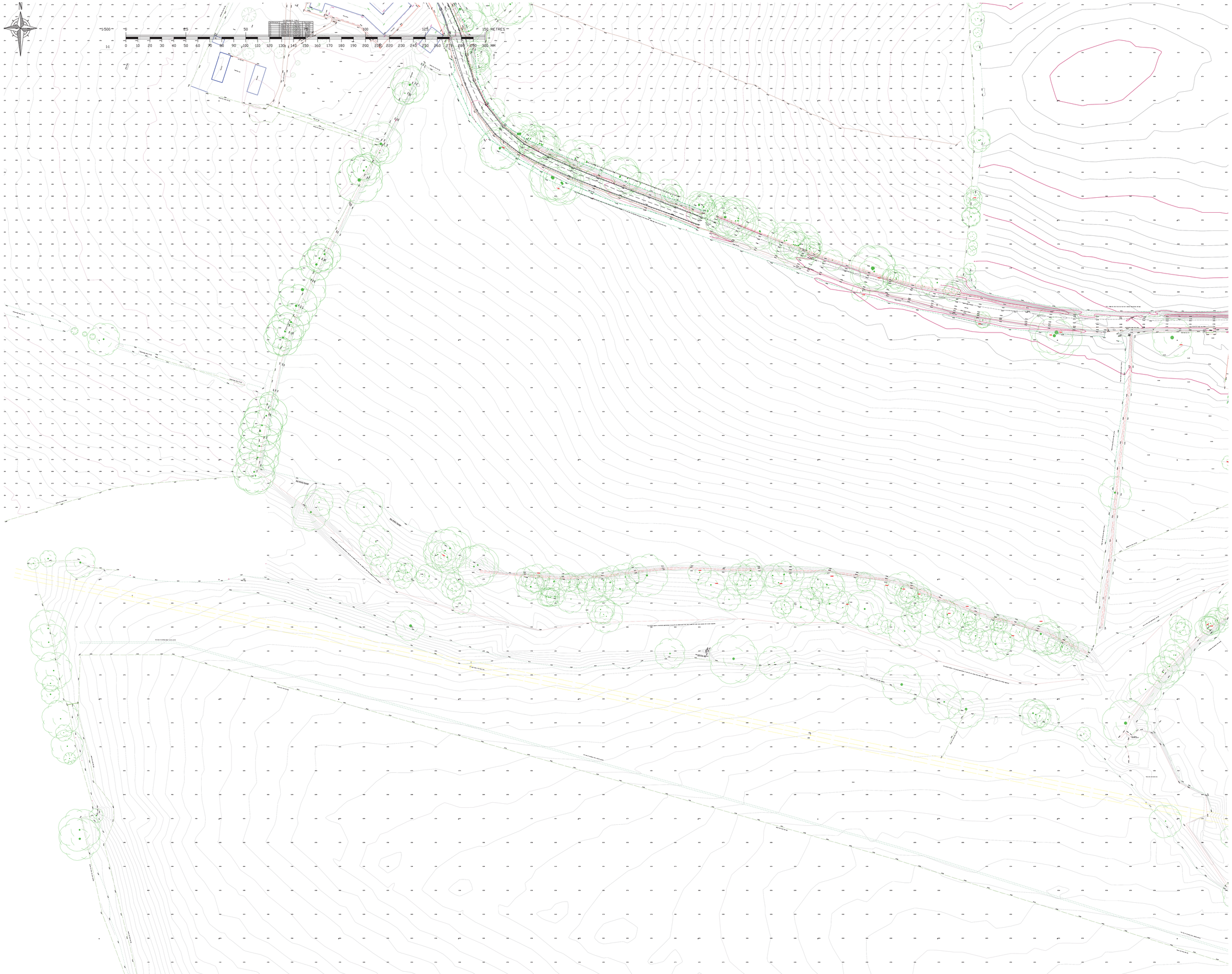
project: HORTON HEATH
HAMPSHIRE

scale: 1:500@A0 | drawn by: ML / RPW | checked by: RPW

date: 05 MAY 2014 | cad file: IR.SAV.1.21.DWG

title: DETAILED TOPOGRAPHICAL SURVEY

drawing number: IR.SAV.1.21.1 | rev.: E



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X5	448450.708	117529.540	17.845
X6	448379.636	117574.546	16.815
X7	448314.210	117597.393	15.142

rev.	amendment	date
E	Additional tree information at Roe Lodge and Chalcroft Business Park	25 May 15
D	Sub surface pipe line added (Bubb Lane)	10 Feb 15
C	Fir Tree Farm added	07 Jan 15
B	Additional survey area added	31 Oct 14
A	Window and door cuts added	27 Aug 14

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client
SAVILLS LIMITED

project
HORTON HEATH
HAMPSHIRE

scale	drawn by	checked by
1:500@A0	ML / RPW	RPW

date	cad file
05 MAY 2014	IR.SAV.1.21.DWG

title
DETAILED TOPOGRAPHICAL SURVEY

drawing number	rev.
IR.SAV.1.21.3	E

Notes

1. The survey was carried out during March/April 2014, using Leica TPS and Viva 3 second instruments and Viva GPS.
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LEGEND

- Survey Station
- IC - Inspection Cover
- CA - Cable TV Cover
- FH - Fire Hydrant
- SV - Stop Valve
- GV - Gas Valve
- PB - Post Box
- TCB - Call box
- TC - TCSU Cover
- PT - Parking Ticket Machine
- ER - Earthing Rod
- TB - Traffic Bollard
- Litter Bin
- Gully
- MH - Manhole Triangular
- MHC - Manhole Circular
- PB - Post Box
- GP Gate Post
- TP Telephone Pole
- EP Electricity Pole
- RS Road Sign (See Schedule)
- TL Traffic Light
- B Bollard
- FP Flag Pole
- LP Lamp Post
- C Camera
- Gate
- Tree (Coniferous - girth and spread to scale)
- Tree (Deciduous - girth and spread to scale)
- Tree (Dead/diseased - girth and spread to scale)
- Spot Level
- Tree Height
- Top of Wall Height
- Apex Height
- Eave Height
- Kerb
- Drop Kerb
- Road Edge (no kerb)
- Track Edge
- Change of Surface
- Road Centre Line
- Double Yellow Lines
- Wall
- Fence
- Edge of Hedge
- Vegitation Edge
- Iron Railings
- Building
- Apex Line
- Eave Line
- Parking Bay
- Overhead Power Cable
- Open Channel
- Top of Bank
- Bottom of Bank
- Major Contour Interval - 1.0m
- Minor Contour Interval - 0.2m

CO-ORDINATE TABLE

Reference	East	North	Elevation
F1	448871.230	117304.158	26.807
F3	448990.480	117297.523	26.890
F4	449155.220	117287.176	27.932
F6	449283.210	117268.823	30.369
F7	449364.794	117268.179	31.359
M1	448785.911	116520.575	21.324
M2	448947.196	116455.987	21.211
M3	449091.235	116401.087	23.227
Stn C1	448867.574	116001.014	24.983
Stn C2	448812.042	116083.730	24.516

CO-ORDINATE TABLE

Reference	East	North	Elevation
X1	448799.731	117314.913	26.216
X2	448618.784	117382.827	22.764
X3	448572.703	117470.551	19.863
X4	448543.136	117488.768	19.230
X5	448450.708	117529.540	17.845
X6	448379.636	117576.546	16.815
X7	448314.210	117597.301	15.142

rev.	amendment	date
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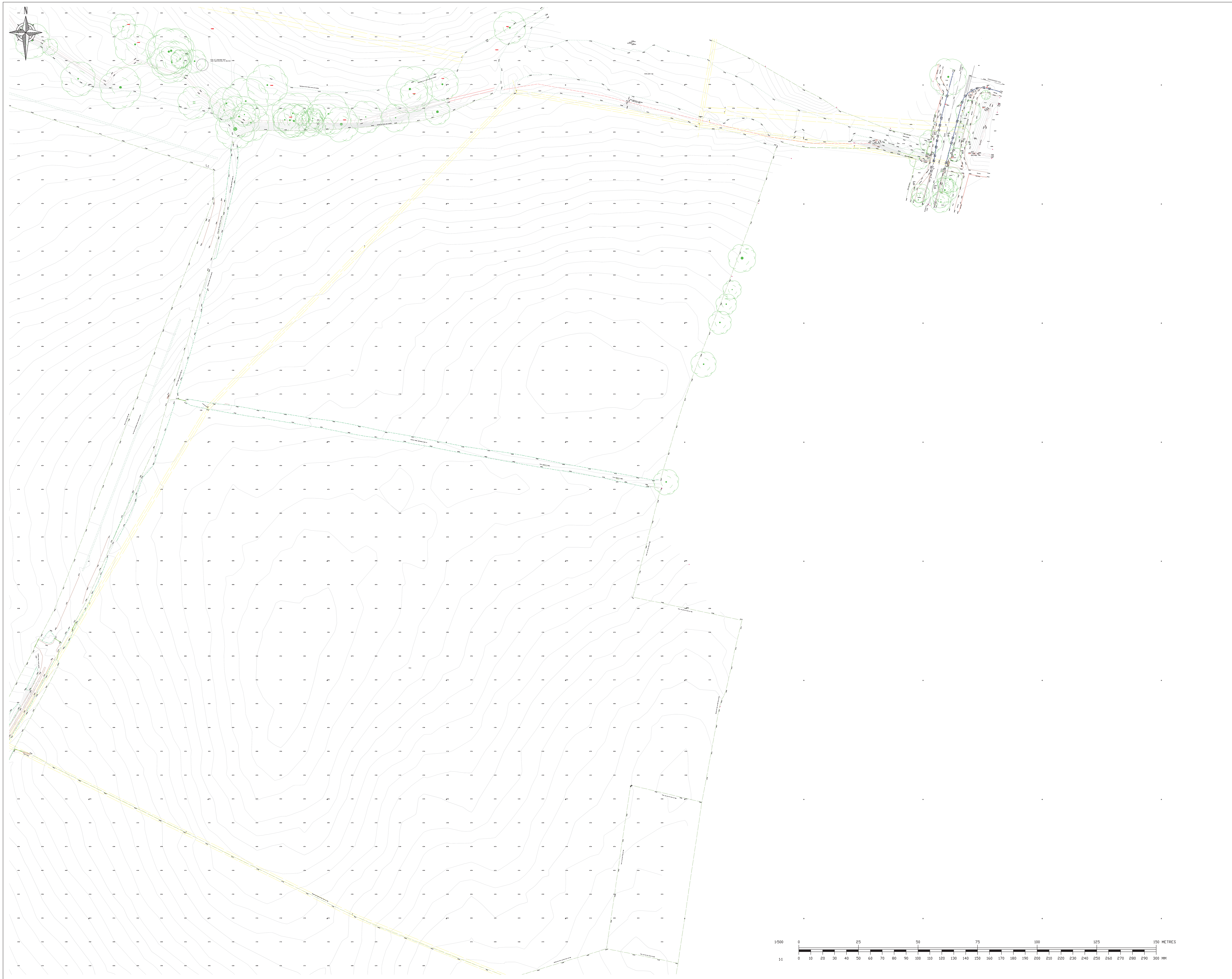
05 MAY 2014	IR.SAV.1.21.DWG

title
DETAILED TOPOGRAPHICAL SURVEY

drawing number	rev.
IR.SAV.1.21.4	E



Notes

1. The survey was carried out during March/April 2014, using Leica TPS and Viva 5 second instruments and Viva GPS.
2. North relates to OS Grid North.
3. All co-ordinates relate to OS GB36 Datum at Stn M1. The rest of the site is orientated to OS Grid North but has been surveyed on a flat grid with no scale factor (1:1). All heights relate to OSGB 36 datum and have been computed using the OSTN(02) Geoid model.

LEGEND

- Survey Station
- IC - Inspection Cover
- CA - Cable TV Cover
- FH - Fire Hydrant
- SV - Stop Valve
- GV - Gas Valve
- PB - Post Box
- TCB - Call box
- TC - TCSU Cover
- PT - Parking Ticket Machine
- ER - Earthing Rod
- TB - Traffic Bollard
- Litter Bin
- Gully
- MH - Manhole Triangular
- MHC - Manhole Circular
- PB - Post Box
- P Gate Post
- TP Telephone Pole
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- RS Road Sign (See Schedule)
- TL Traffic Light
- B Bollard
- FP Flag Pole
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- Gate
- Tree (Coniferous - girth and spread to scale)
- Tree (Deciduous - girth and spread to scale)
- Tree (Dead/diseased - girth and spread to scale)
- Spot Level
- Tree height
- Top of Wall Height
- Apex Height
- Eave Height

- Kerb
- Drop Kerb
- Road Edge (no kerb)
- Track Edge
- Change of Surface
- Road Centre Line
- Double Yellow Lines

- Wall
- Fence
- Edge of Hedge
- Vegitation Edge
- Iron Railings

- Building
- Apex Line
- Eave Line
- Parking Bay

- Overhead Power Cable
- Open Channel
- Top of Bank
- Bottom of Bank
- Major Contour Interval - 1.0m
- Minor Contour Interval - 0.2m

CO-ORDINATE TABLE

Reference	East	North	Elevation
F1	448871.230	117304.158	26.807
F3	448991.481	117297.533	26.890
F4	449155.220	117287.176	27.932
F6	449283.210	117268.823	30.369
F7	449364.794	117268.195	31.359
M1	448785.911	116520.575	21.324
M2	448947.196	116455.987	21.211
M3	449091.235	116401.087	23.227
Stn C1	448867.574	116001.014	26.983
Stn C2	448812.042	116023.730	24.516

CO-ORDINATE TABLE

Reference	East	North	Elevation
X1	448799.731	117314.913	26.216
X2	448618.784	117382.827	22.764
X3	448572.703	117470.551	19.863
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X6	448379.636	117576.546	16.815
X7	448314.210	117597.301	15.142

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project
HORTON HEATH
HAMPSHIRE

scale 1:500@A0 | drawn by ML / RPW | checked by RPW

date 05 MAY 2014 | cad file IR.SAV.1.21.DWG

title
DETAILED TOPOGRAPHICAL SURVEY

drawing number IR.SAV.1.21.5 | rev. E

Notes

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LEGEND

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- Overhead Power Cable
- Open Channel
- Top of Bank
- Bottom of Bank
- Major Contour Interval - 1.0m
- Minor Contour Interval - 0.2m

CO-ORDINATE TABLE

Reference	East	North	Elevation
F1	448871.230	117304.158	26.807
F3	448991.481	117297.533	26.890
F4	449155.220	117287.176	27.930
F6	449283.210	117268.823	30.369
F7	449364.794	117268.195	31.359
M1	448785.911	116520.575	21.324
M2	448947.196	116435.987	21.211
M3	449091.235	116401.087	23.227
Stn C1	448867.574	116001.514	26.983
Stn C2	448812.042	116023.730	24.516

CO-ORDINATE TABLE

Reference	East	North	Elevation
X1	448799.731	117314.913	26.216
X2	448618.784	117382.827	20.764
X3	448572.703	117470.551	19.863
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X5	448450.708	117529.540	17.845
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project
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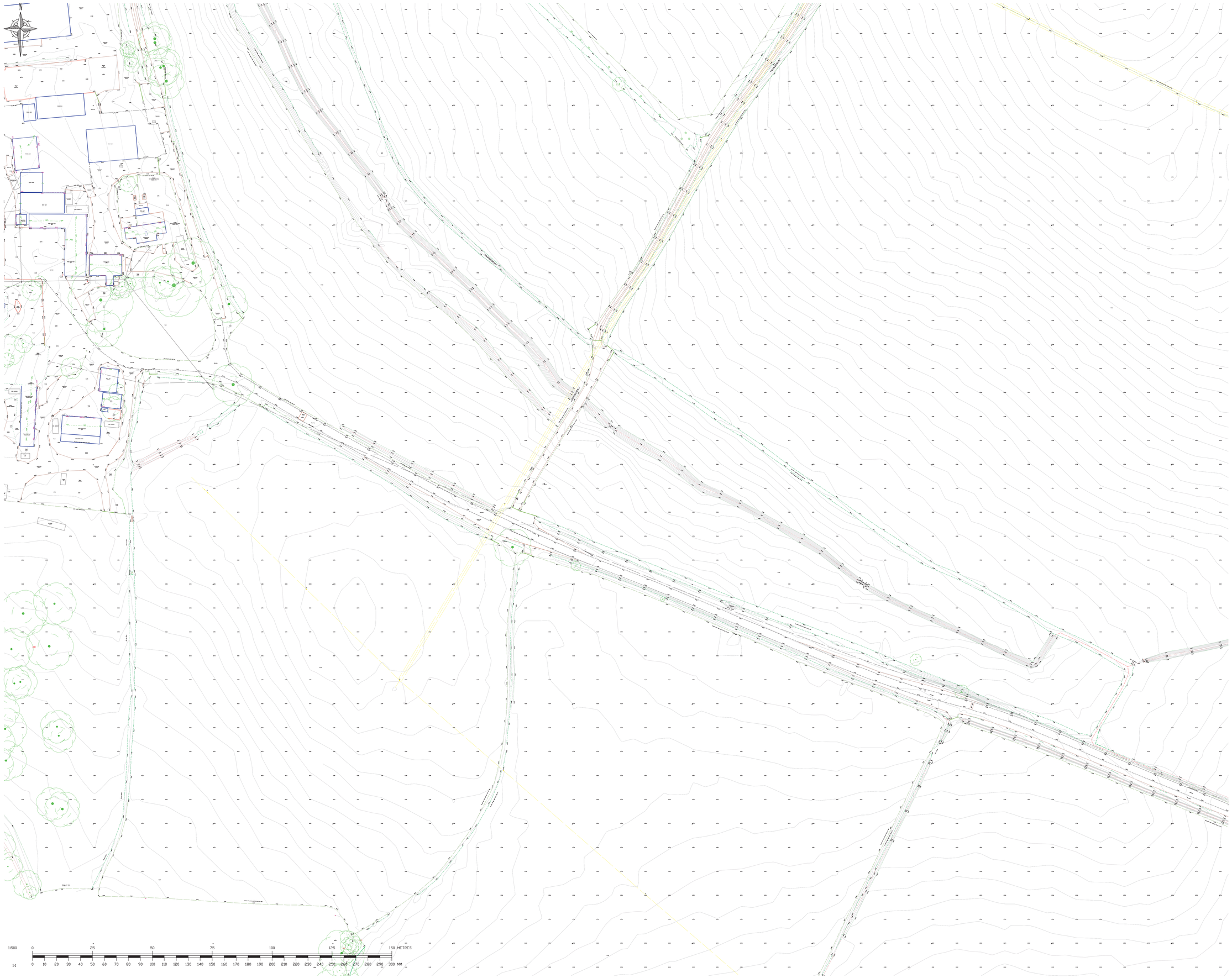
05 MAY 2014	IR.SAV.1.21.DWG

title
DETAILED TOPOGRAPHICAL
SURVEY

drawing number	rev.
IR.SAV.1.21.6	E



Notes

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- Building
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- Overhead Power Cable
- Open Channel
- Top of Bank
- Bottom of Bank
- Major Contour Interval - 1.0m
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CO-ORDINATE TABLE

Reference	East	North	Elevation
F1	448871.230	117304.158	26.807
F3	448791.481	117297.533	26.890
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M1	448785.911	116520.575	21.324
M2	448947.196	116455.987	21.211
M3	449091.235	116401.087	23.227
Stn C1	448867.574	116081.014	24.983
Stn C2	448812.542	116023.730	24.516

CO-ORDINATE TABLE

Reference	East	North	Elevation
X1	448799.731	117314.913	26.216
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X5	448450.708	117529.540	17.845
X6	448379.636	117576.546	16.815
X7	448314.210	117597.301	15.142

rev.	amendment	date
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project
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HAMPSHIRE

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date	cad file
05 MAY 2014	IR.SAV.1.21.DWG

title
DETAILED TOPOGRAPHICAL SURVEY

drawing number	rev.
IR.SAV.1.21.7	E

Notes

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LEGEND

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CO-ORDINATE TABLE

Reference	East	North	Elevation
F1	448871.230	117304.158	26.807
F3	448991.481	117297.533	26.890
F4	449155.220	117287.176	27.930
F6	449283.210	117268.823	30.369
F7	449364.794	117268.195	31.359
M1	448785.911	116510.575	21.324
M2	448947.196	116455.987	21.211
M3	449091.235	116401.087	23.227
Stn C1	448867.574	116601.014	24.983
Stn C2	448812.042	116023.730	24.516

CO-ORDINATE TABLE

Reference	East	North	Elevation
X1	448799.731	117314.913	26.216
X2	448618.784	117382.807	22.764
X3	448572.703	117470.551	19.863
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X5	448450.708	117529.540	17.845
X6	448279.636	117576.546	16.815
X7	448314.210	117597.301	15.148

rev.	amendment	date
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scale 1:500@A0 | drawn by ML / RPW | checked by RPW

date 05 MAY 2014 | cad file IR.SAV.1.21.DWG

title
DETAILED TOPOGRAPHICAL SURVEY

drawing number IR.SAV.1.21.8 | rev. E

N

Notes

1. The survey was carried out during March/April 2014, using Leica TPS and Viva 3 second instruments and Viva GPS.
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LEGEND

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- Litter Bin
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- Tree (Dead/diseased - girth and spread to scale)
- Spot Level
- Tree height
- Top of Wall Height
- Apex Height
- Eave Height

- Kerb
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- Apex Line
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- Parking Bay
- Overhead Power Cable
- Open Channel
- Top of Bank
- Bottom of Bank
- Major Contour Interval - 1.0m
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CO-ORDINATE TABLE

Reference	East	North	Elevation
F1	448871.230	117304.158	26.807
F3	448991.480	117297.533	26.690
F4	449155.220	117287.176	27.932
F6	449283.210	117268.823	30.369
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Stn C2	448812.042	116093.730	24.516

CO-ORDINATE TABLE

Reference	East	North	Elevation
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X6	448379.636	117576.546	16.815
X7	448314.210	117597.301	15.142

CO-ORDINATE TABLE

Reference	East	North	Elevation
A	448814.000	117304.000	26.000
B	448814.000	117304.000	26.000
C	448814.000	117304.000	26.000
D	448814.000	117304.000	26.000
E	448814.000	117304.000	26.000
F	448814.000	117304.000	26.000
G	448814.000	117304.000	26.000
H	448814.000	117304.000	26.000

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rev.	amendment	date
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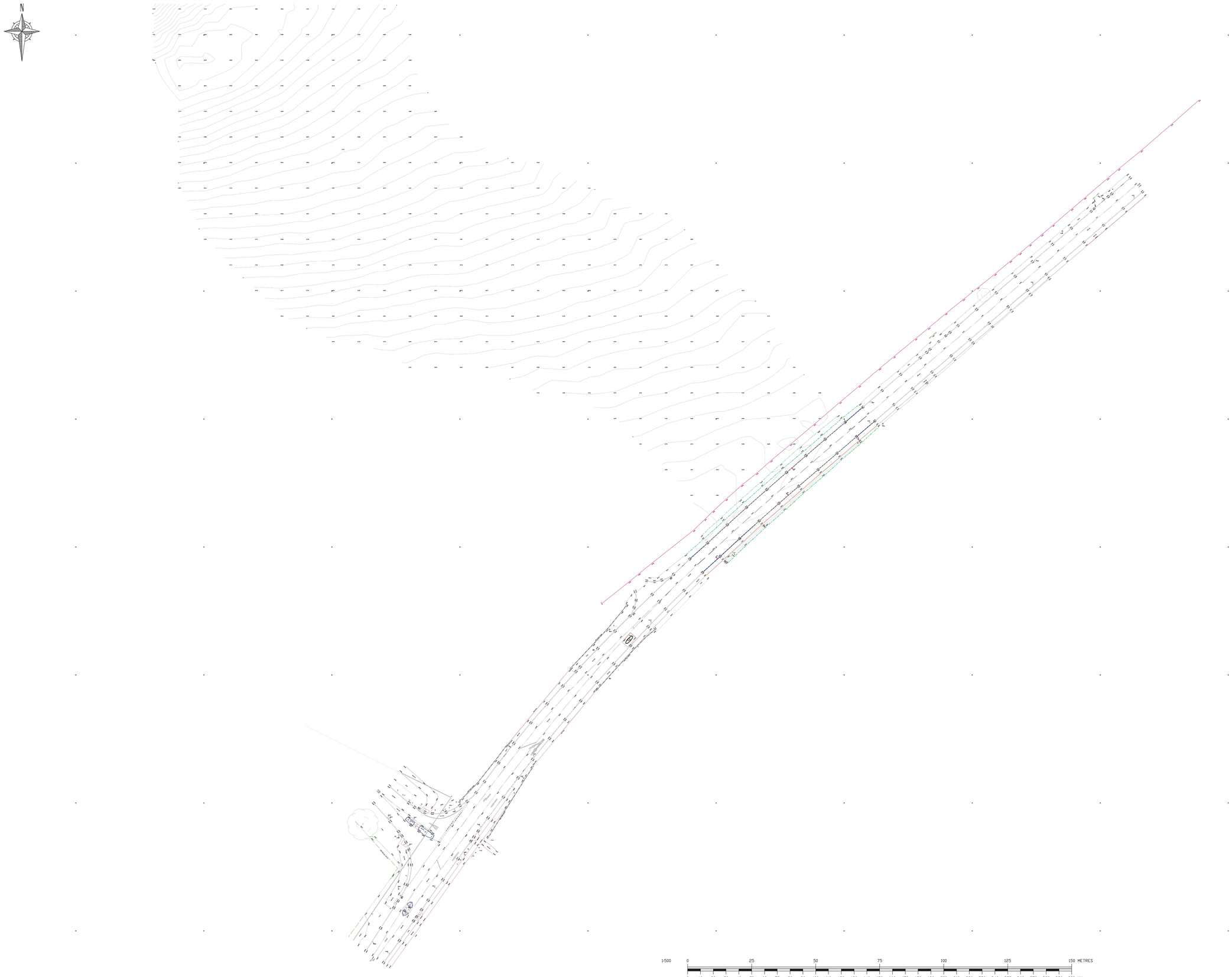
title
DETAILED TOPOGRAPHICAL SURVEY

drawing number	rev.
IR.SAV.1.21.9	E



Notes

1. The survey was carried out during March/April 2014, using Leica TPS and Viva 3 second instruments and Viva GPS.
2. North relates to OS Grid North.
3. All co-ordinates relate to OS GB36 Datum at Stn M1. The rest of the site is orientated to OS Grid North but has been surveyed on a flat grid with no scale Factor (1.0). All heights relate to OSGB 36 datum and have been computed using the OSTN02 Geoid model.

LEGEND

- Survey Station
- IC - Inspection Cover
- CA - Cable TV Cover
- FH - Fire Hydrant
- SV - Stop Valve
- GV - Gas Valve
- PB - Post Box
- TCB - Call box
- TC - TCSU Cover
- PT - Parking Ticket Machine
- ER - Earthing Rod
- TB - Traffic Bollard
- Litter Bin
- Gully
- MH - Manhole Triangular
- MHC - Manhole Circular
- PB - Post Box
- GP Gate Post
- TP Telephone Pole
- EP Electricity Pole
- RS Road Sign (See Schedule)
- TL Traffic Light
- B Bollard
- FP Flag Pole
- LP Lamp Post
- C Camera
- Gate
- Tree (Coniferous - girth and spread to scale)
- Tree (Deciduous - girth and spread to scale)
- Tree (Dead/diseased - girth and spread to scale)
- Spot Level
- Tree height
- Top of Wall Height
- Apex Height
- Eave Height
- Kerb
- Drop Kerb
- Road Edge (no kerb)
- Track Edge
- Change of Surface
- Road Centre Line
- Double Yellow Lines
- Wall
- Fence
- Edge of Hedge
- Vegitation Edge
- Iron Railings
- Building
- Apex Line
- Eave Line
- Parking Bay
- Overhead Power Cable
- Open Channel
- Top of Bank
- Bottom of Bank
- Major Contour Interval - 1.0m
- Minor Contour Interval - 0.2m

CO-ORDINATE TABLE

Reference	East	North	Elevation
F1	448871.230	117304.158	26.807
F3	448991.481	117297.533	26.890
F4	449155.220	117287.176	27.932
F6	449282.210	117268.823	30.369
F7	449364.794	117268.195	31.359
M1	448785.911	116510.575	21.324
M2	448947.196	116455.987	21.211
M3	449091.235	116401.087	23.227
Stn C1	448867.574	116001.014	26.983
Stn C2	448812.042	116023.730	24.516

CO-ORDINATE TABLE

Reference	East	North	Elevation
X1	448799.731	117314.913	26.216
X2	448618.784	117382.827	20.764
X3	448572.703	117470.551	19.863
X4	448543.136	117488.768	19.230
X5	448450.708	117529.540	17.845
X6	448379.636	117576.546	16.815
X7	448314.210	117597.301	15.142

rev.	amendment	date
E	Additional tree information at Roe Lodge and Chalcroft Business Park	25 May 15
D	Sub surface pipe line added (Bubb Lane)	10 Feb 15
C	Fir Tree Farm added	07 Jan 15
B	Additional survey area added	31 Oct 14
A	Window and door cuts added	27 Aug 14

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iowoffice@mayerbrown.co.uk www.mayerbrown.co.uk

client
SAVILLS LIMITED

project
HORTON HEATH
HAMPSHIRE

scale	drawn by	checked by
1:500@A0	ML / RPW	RPW

date	cad file
05 MAY 2014	IR.SAV.1.21.DWG

title
DETAILED TOPOGRAPHICAL SURVEY

drawing number	rev.
IR.SAV.1.21.10	E

Notes

1. The survey was carried out during March/April 2014, using Leica TPS and Viva 3 second instruments and Viva GPS.
2. North relates to OS Grid North.
3. All co-ordinates relate to OS GB36 Datum at Stn M1. The rest of the site is orientated to OS Grid North but has been surveyed on a flat grid with no scale factor (1). All heights relate to OSGB 36 datum and have been computed using the OSTN02 Geoid model.

LEGEND

- Survey Station
- IC - Inspection Cover
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- Major Contour Interval - 1.0m
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CO-ORDINATE TABLE

Reference	East	North	Elevation
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F6	449283.210	117268.823	30.369
F7	449364.794	117268.195	31.359
M1	448785.901	116509.579	21.324
M2	448947.196	116455.987	21.211
M3	449091.235	116401.087	23.227
Stn C1	448867.574	116001.014	26.983
Stn C2	448812.642	116023.730	24.516

CO-ORDINATE TABLE

Reference	East	North	Elevation
X1	448799.731	117314.913	26.216
X2	448618.784	117388.827	22.764
X3	448572.703	117470.551	19.863
X4	448543.136	117488.768	19.230
X5	448450.708	117529.540	17.845
X6	448379.636	117576.546	16.815
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rev.	amendment	date
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iowoffice@mayerbrown.co.uk www.mayerbrown.co.uk

client: SAVILLS LIMITED

project: HORTON HEATH
HAMPSHIRE

scale	drawn by	checked by
1:500@A0	ML / RPW	RPW

date	cad file
05 MAY 2014	IR.SAV.1.21.DWG

title: DETAILED TOPOGRAPHICAL SURVEY

drawing number	rev.
IR.SAV.1.21.11	E

1:500 0 25 50 75 100 125 150 METRES

1:1 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240 250 260 270 280 290 300 MM

Notes

1. The survey was carried out during March/April 2014, using Leica TPS and Viva 3 second instruments and Viva GPS.
2. North relates to OS Grid North.
3. All co-ordinates relate to OS GB36 Datum at Stn M1. The rest of the site is orientated to OS Grid North but has been surveyed on a flat grid with no scale Factor (1:1). All heights relate to OSGB 36 datum and have been computed using the OSTN02 Geoid model.

LEGEND

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M2	448947.196	116455.987	21.211
M3	449091.235	116401.087	23.227
Stn C1	448867.574	116001.014	24.983
Stn C2	448812.042	116093.739	24.516

CO-ORDINATE TABLE

Reference	East	North	Elevation
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X3	448572.703	117470.551	19.863
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X6	448379.636	117576.546	16.815
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rev.	amendment	date
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client
SAVILLS LIMITED

project
HORTON HEATH
HAMPSHIRE

scale	drawn by	checked by
1:500@A0	ML / RPW	RPW

date	cad file
05 MAY 2014	IR.SAV.1.21.DWG

title
DETAILED TOPOGRAPHICAL SURVEY

drawing number	rev.
IR.SAV.1.21.12	E

Appendix 5

From:	Partnership and Strategic Overview team, HIOW
To:	dbuciak@pfaplc.com
Cc:	SSD Enquiries
Subject:	Flood Risk Information (Product 4) for Site at Horton Heath - Ref: SSD/172634
Date:	25 June 2020 15:53:44
Attachments:	Defences Map.pdf Flood Map for Planning (Rivers and Sea).pdf Levels Map.pdf Risk of Flooding from Surface Water.pdf Open Government Licence.pdf Use of EA Information for FRAs.pdf

Dear Daniel,

Enquiry regarding Product 4 for site at Horton Heath – Grid Ref: SU 48484 16962 and SU 48376 17205.

Thank you for your enquiry which was received on 21 May 2020.

We respond to requests under the Freedom of Information Act 2000 and Environmental Information Regulations 2004. The information is attached.

The site may be affected by an extreme flood. According to our published flood map, which provides a general estimate of the likelihood of flooding across England & Wales, the site is shown to be within Flood Zone 3 - an area which may have a 1% chance of flooding annually (1 in 100), **ignoring** the presence and effect of any flood defences.

The Environment Agency has no record of flooding to this area, please note our records are not comprehensive and may not include all events. I recommend contacting the Lead Local Flooding Authority, Hampshire County Council or the Local Authority, Eastleigh Borough Council for a more comprehensive flood history check.

Defences – See attached map.

Flood Levels – Please see the attached map showing the TUFLOW flood levels for your site. These levels have been taken from the Itchen Tributaries Modelling that was carried out in 2019 by JBA Consulting.

The flood risk data provided is based on existing EA hydraulic models for existing 0.5% annual probability events with an allowance for climate change. Please note the climate change allowances provided are not up to date. These were updated on 17 December 2019. You should refer to 'Flood risk assessments: climate change allowances' for the most up to date allowances. You will need to undertake further assessment of future flood risk using different allowances to ensure your assessment of future flood risk is based on best available evidence.

FRA advisory text

Name	Product 4
Description	Basic / Detailed Flood Risk Assessment Map for site at Horton Heath – Grid Ref: SU 48484 16962 and SU 48376 17205.

Licence	Open Government Licence
Information Warnings	The majority of our models will not have the new climate change allowances. +20% is not suitable for the majority of planning purposes and the new allowances to use should be checked here: https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances
Information Warning - OS background mapping	*The mapping of features provided as a background in this product is © Ordnance Survey. It is provided to give context to this product. The Open Government Licence does not apply to this background mapping. You are granted a non-exclusive, royalty free, revocable licence solely to view the Licensed Data for non-commercial purposes for the period during which the Environment Agency makes it available. You are not permitted to copy, sub-license, distribute, sell or otherwise make available the Licensed Data to third parties in any form. Third party rights to enforce the terms of this licence shall be reserved to OS.*
Attribution	Contains Environment Agency information © Environment Agency and/or database rights. Contains Ordnance Survey data © Crown copyright 2017 Ordnance Survey 100024198.

Data Available Online

Many of our flood datasets are available online:

- Flood Map For Planning (Flood Zone 2, Flood Zone 3 ,Flood Storage Areas, Flood Defences, Areas Benefiting from Defences)
- Risk of Flooding from Rivers and Sea
- Historic Flood Map
- Current Flood Warnings

Does Your Proposal Have Environmental Issues or Opportunities? Speak To Us Early!

If you are planning a new project or development, we want to work with you to make the process as smooth as possible. Early engagement can improve subsequent planning applications to you and your clients' benefit and deliver environmental outcomes. For a cost recovery fee of £100 per hour plus VAT we will provide you with a project manager who will coordinate all meetings and reviews in order to give you detailed specialist advice with guaranteed delivery dates. More information can be found on our website here.

Please get in touch if you have any further queries or contact us within two months if you'd like us to review the information we have sent.

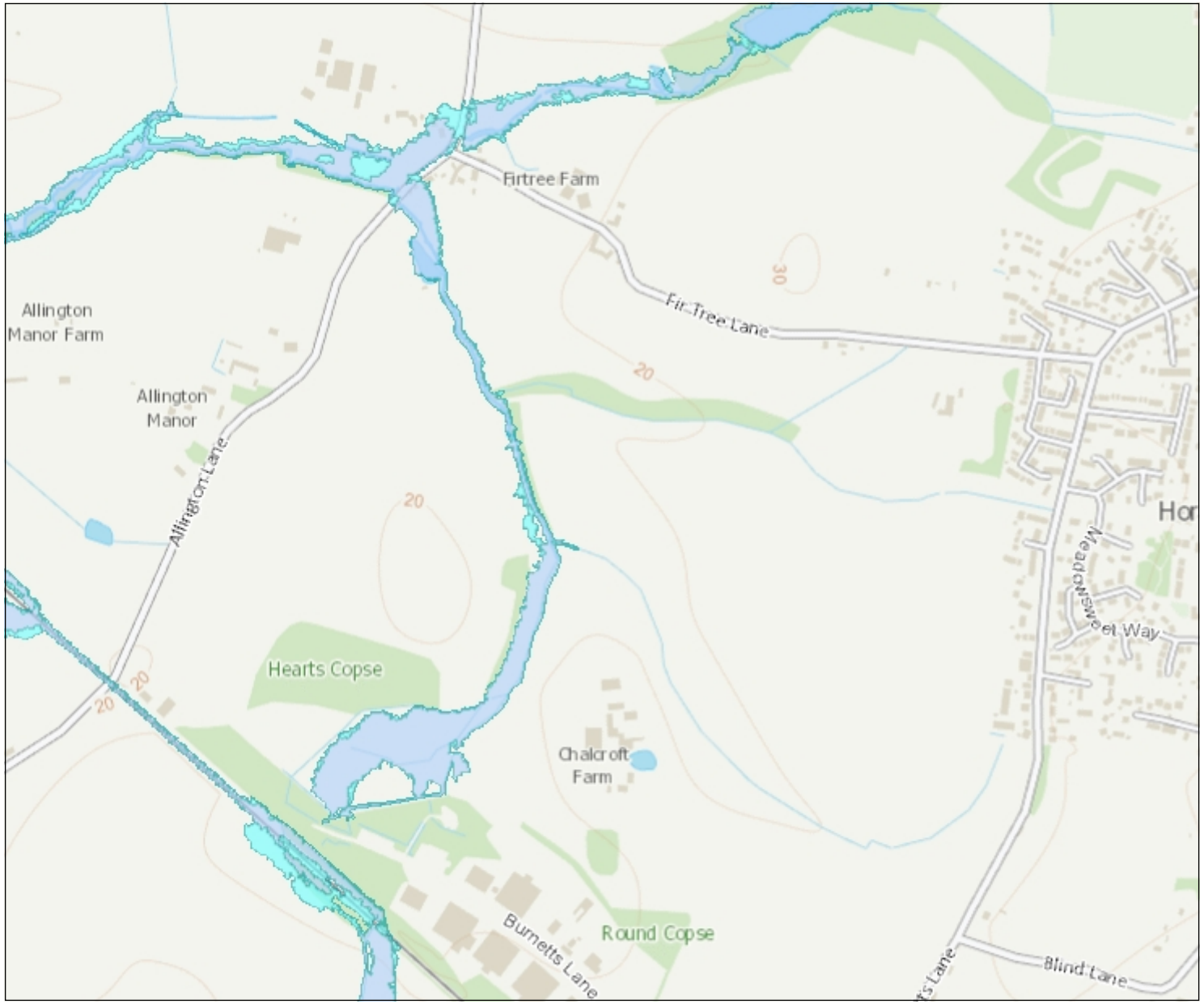
Yours sincerely,

Aimee Etheridge
Partnership and Strategic Overview team, Hampshire and Isle of Wight Environment Agency

Direct dial 020 8474 5815
Email psohiow@environment-agency.gov.uk

Information in this message may be confidential and may be legally privileged. If you have received this message by mistake, please notify the sender immediately, delete it and do not copy it to anyone else. We have checked this email and its attachments for viruses. But you should still check any attachment before opening it. We may have to make this message and any reply to it public if asked to under the Freedom of Information Act, Data Protection Act or for litigation. Email messages and attachments sent to or from any Environment Agency address may also be accessed by someone other than the sender or recipient, for business purposes.

Flood Map for Planning (Rivers and Sea) Centred on Grid Ref: SU 48484 16962 - Created 25 June 2020



Environment Agency

1: 10,000

0 Metres 250

N W E S

Flood Map for Planning (Rivers & Sea)

- Defences
- Flood Storage Areas
- Areas benefiting from flood defences
- Flood Zone 3
- Flood Zone 2

Flood Map Areas (assuming no defences)

Flood Zone 3 shows the area that could be affected by flooding:

- from the sea with a 1 in 200 or greater chance of happening each year
- or from a river with a 1 in 100 or greater chance of happening each year.

Flood Zone 2 shows the extent of an extreme flood from rivers or the sea with up to a 1 in 1000 chance of occuring each year.

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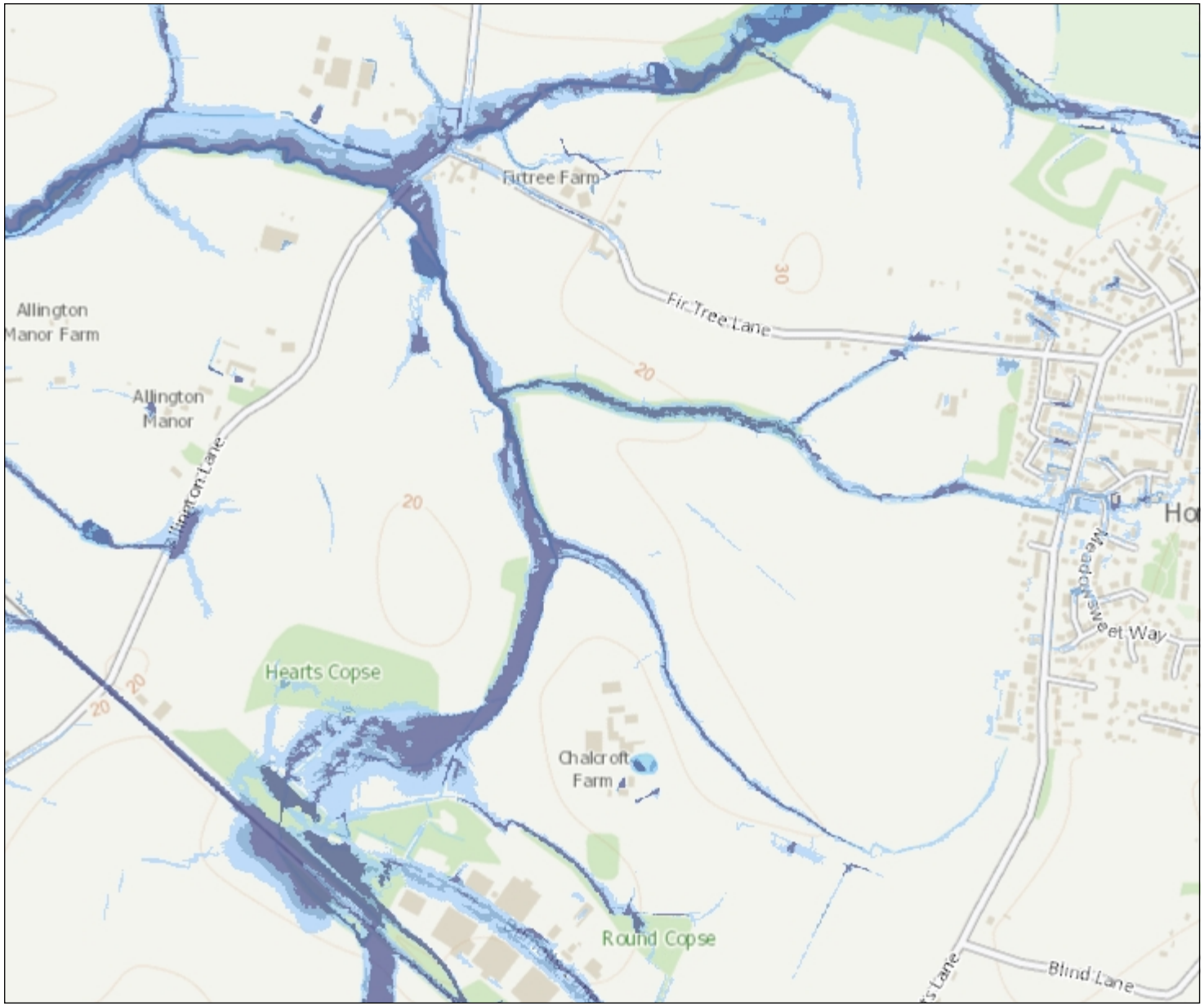
Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 03708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

Risk of flooding from Surface Water Centred on Grid Ref: SU 48484 16962 - Created 25 June 2020



Environment Agency

1: 10,000

0 Metres 250

N W E S

Likelihood of flooding from Surface Water

- High (>=3.3%)
- Medium (3.3% - 1%)
- Low (1% - 01%)
- Very Low

Likelihood of flooding from Surface Water

High:	Greater than or equal to 3.3% (1 in 30) chance in any given year
Medium:	Less than 3.3% (1 in 30) but greater than or equal to 1% (1 in 100) chance in any given year
Low:	Less than 1% (1 in 100) but greater than or equal to 0.1% (1 in 1,000) chance in any given year
Very Low:	Less than 0.1% (1 in 1,000) chance in any given year

This information is shown on the Risk of Flooding from Surface Water map on GOV.UK.

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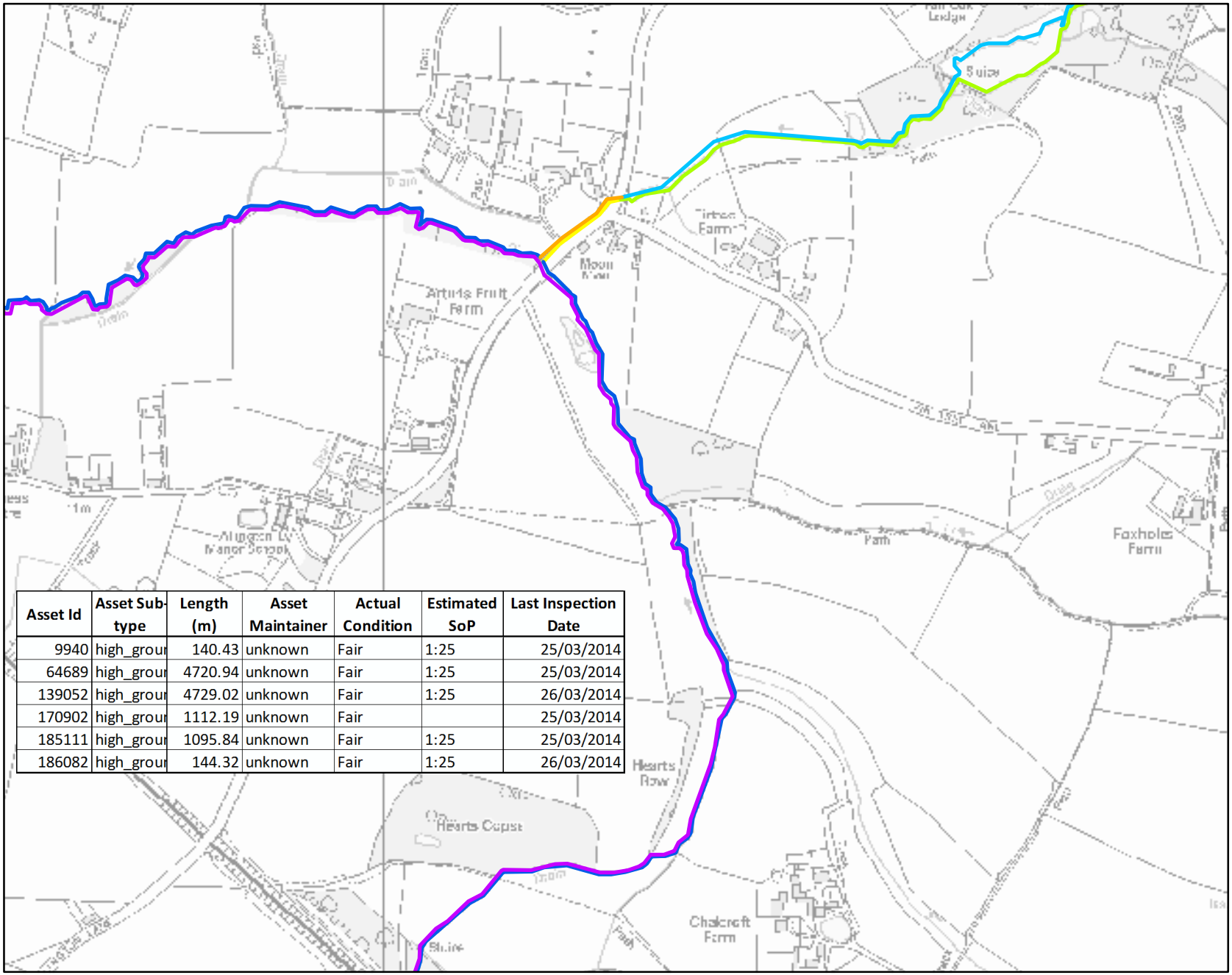
Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 03708 506 506 (Mon-Fri 8-6). E-mail: enquires@environment-agency.gov.uk

Defences Centred on Grid Ref: SU 48484 16962 - Created 24 June 2020



Asset Id	Asset Sub-type	Length (m)	Asset Maintainer	Actual Condition	Estimated SoP	Last Inspection Date
9940	high_grou	140.43	unknown	Fair	1:25	25/03/2014
64689	high_grou	4720.94	unknown	Fair	1:25	25/03/2014
139052	high_grou	4729.02	unknown	Fair	1:25	26/03/2014
170902	high_grou	1112.19	unknown	Fair		25/03/2014
185111	high_grou	1095.84	unknown	Fair	1:25	25/03/2014
186082	high_grou	144.32	unknown	Fair	1:25	26/03/2014

Environment Agency

Legend

ASSET_ID

- 9940
- 64689
- 139052
- 170902
- 185111
- 186082

1:7,721 *

*when printed at A4.

N

0 150 300

Metres

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Contact Us: National Customer Contact Centre, PO BOX 544, Rotherham, S60 1BY. Tel: 08708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

Modelled Levels Centred on Grid Ref: SU 48484 16962 - Created 24 June 2020

Environment Agency

Legend

- Location Points
- Flood Zone 3
- Flood Zone 2

Flood Map Areas (assuming no defences)

Flood Zone 3
Shows the area that could be affected by flooding:
- from the sea with an 1 in 200 or greater chance of happening each year.
- or from a river with a 1 in 100 or greater chance of happenening each year.

Flood Zone 2
Shows the extent of an extreme flood from rivers of the sea with up to a 1 in 1000 chance of occuring each year.

1:3,000 *

*when printed at A4.

N

0 50 100

Metres

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Contact Us: National Customer Contact Centre, PO BOX 544, Rotherham, S60 1BY. Tel: 08708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

Water Depths & Levels for Site at Horton Heath

	Water Surface Level (mAOD*)					
Point	5% Annual Probability/1 in 20 Year	1% Annual Probability/1 in 100 Year (Flood Zone 3)	1% Annual Probability/1 in 100 Year + 35% Climate Change	1% Annual Probability/1 in 100 Year + 45% Climate Change	1% Annual Probability/1 in 100 Year + 105% Climate Change	0.1% Annual Probability/1 in 1000 Year (Flood Zone 2)
1	14.12	14.30	14.38	14.39	14.48	14.48
2	14.23	14.38	14.45	14.47	14.55	14.56
3	14.33	14.45	14.52	14.53	14.61	14.62
4	14.45	14.55	14.62	14.63	14.71	14.72
5	15.05	15.15	15.20	15.22	15.29	15.29
6	15.15	15.24	15.28	15.29	15.35	15.35
7	No data	15.32	15.30	15.37	15.42	15.42
8	15.38	15.44	15.47	15.48	15.51	15.51
9	No data	15.50	15.51	15.51	15.53	15.53
10	15.52	15.57	15.58	15.59	15.61	15.61
11	15.61	15.64	15.65	15.65	15.67	15.67
12	15.62	15.65	15.67	15.67	15.68	15.68

* Levels in metres above Ordnance Datum Newlyn

From:	Partnership and Strategic Overview team, HIOW
To:	dbuciak@pfaplc.com
Cc:	SSD Enquiries
Subject:	Flood Risk Information (Product 4) for Horton Heath - Ref: SSD/178449
Date:	24 July 2020 08:58:54
Attachments:	Flood Map for Planning (Rivers and Sea).pdf Levels Map.pdf Risk of Flooding from Surface Water.pdf Defences Map.pdf Open Government Licence.pdf Use of EA Information for FRAs.pdf

Dear Daniel,

Enquiry regarding Product 4 for site at Horton Heath – Grid Ref: SU 448499, 117709

Thank you for your enquiry which was received on 8 July 2020.

We respond to requests under the Freedom of Information Act 2000 and Environmental Information Regulations 2004. The information is attached.

The site may be affected by an extreme flood. According to our published flood map, which provides a general estimate of the likelihood of flooding across England & Wales, the site is shown to be within Flood Zone 3 - an area which may have a 1% chance of flooding annually (1 in 100), **ignoring** the presence and effect of any flood defences.

The Environment Agency has no record of flooding to this area, please note our records are not comprehensive and may not include all events. I recommend contacting the Lead Local Flooding Authority, Hampshire County Council or the Local Authority, Eastleigh Borough Council for a more comprehensive flood history check.

Defences – See attached map.

Flood Levels – Please see the attached map showing the TUFLOW flood levels for your site. These levels have been taken from the Itchen Tributaries Modelling that was carried out in 2019 by JBA Consulting.

The flood risk data provided is based on existing EA hydraulic models for existing 0.5% annual probability events with an allowance for climate change. Please note the climate change allowances provided are not up to date. These were updated on 17 December 2019. You should refer to 'Flood risk assessments: climate change allowances' for the most up to date allowances. You will need to undertake further assessment of future flood risk using different allowances to ensure your assessment of future flood risk is based on best available evidence.

FRA advisory text

Name	Product 4
Description	Basic / Detailed Flood Risk Assessment Map for site at Horton Heath – Grid Ref: 448499, 117709

Licence	Open Government Licence
Information Warnings	The majority of our models will not have the new climate change allowances. +20% is not suitable for the majority of planning purposes and the new allowances to use should be checked here: https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances
Information Warning - OS background mapping	*The mapping of features provided as a background in this product is © Ordnance Survey. It is provided to give context to this product. The Open Government Licence does not apply to this background mapping. You are granted a non-exclusive, royalty free, revocable licence solely to view the Licensed Data for non-commercial purposes for the period during which the Environment Agency makes it available. You are not permitted to copy, sub-license, distribute, sell or otherwise make available the Licensed Data to third parties in any form. Third party rights to enforce the terms of this licence shall be reserved to OS.*
Attribution	Contains Environment Agency information © Environment Agency and/or database rights. Contains Ordnance Survey data © Crown copyright 2017 Ordnance Survey 100024198.

Data Available Online

Many of our flood datasets are available online:

- Flood Map For Planning (Flood Zone 2, Flood Zone 3 ,Flood Storage Areas, Flood Defences, Areas Benefiting from Defences)
- Risk of Flooding from Rivers and Sea
- Historic Flood Map
- Current Flood Warnings

Does Your Proposal Have Environmental Issues or Opportunities? Speak To Us Early!

If you are planning a new project or development, we want to work with you to make the process as smooth as possible. Early engagement can improve subsequent planning applications to you and your clients' benefit and deliver environmental outcomes. For a cost recovery fee of £100 per hour plus VAT we will provide you with a project manager who will coordinate all meetings and reviews in order to give you detailed specialist advice with guaranteed delivery dates. More information can be found on our website here.

Please get in touch if you have any further queries or contact us within two months if you'd like us to review the information we have sent.

Yours sincerely,

Aimee Etheridge
Partnership and Strategic Overview team, Hampshire and Isle of Wight Environment Agency

Direct dial 020 8474 5815
Email psohiow@environment-agency.gov.uk

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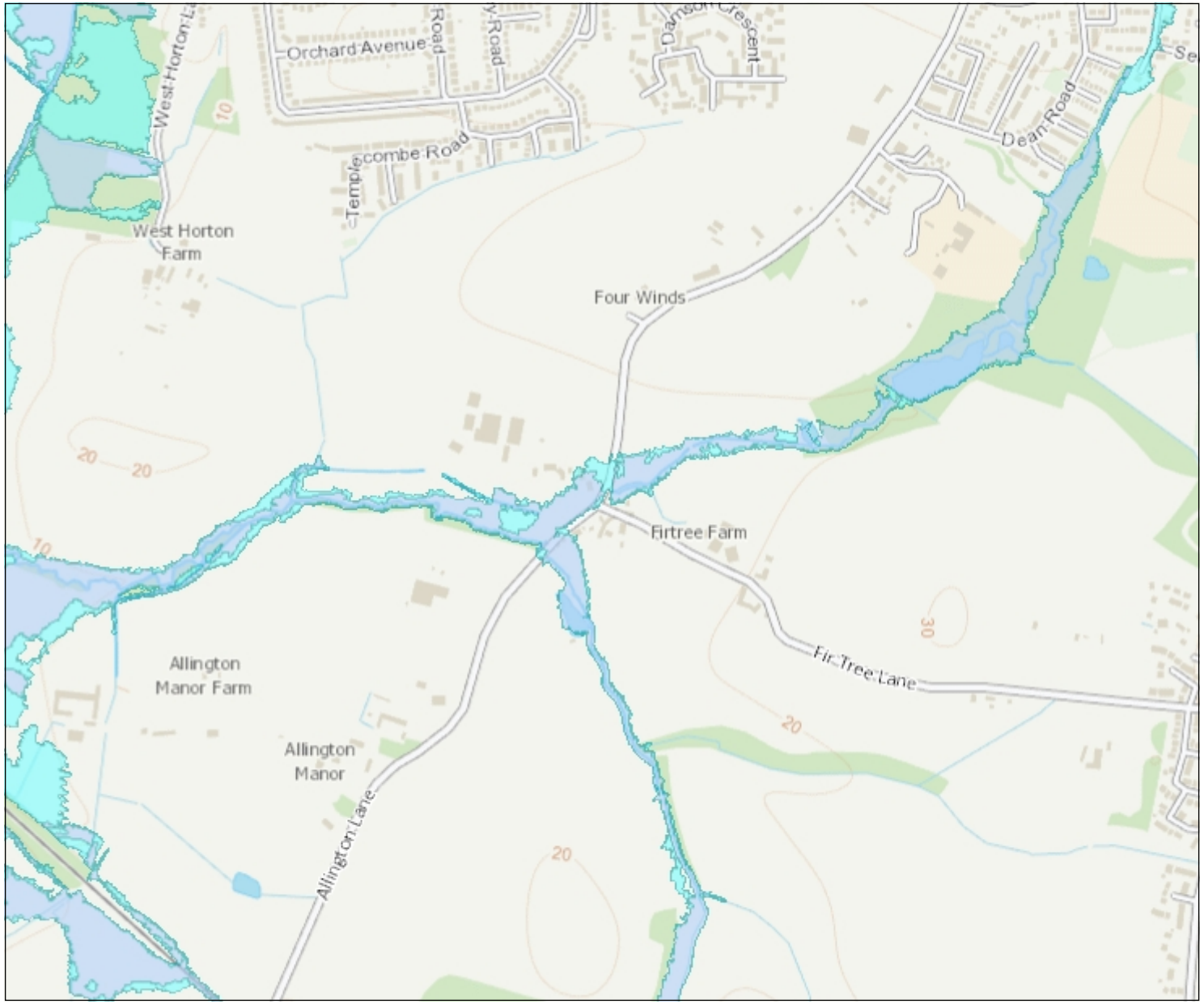
Flood Map for Planning (Rivers and Sea) Centred on Grid Ref: 448499, 117709
Created 23 July 2020



Environment Agency

1: 10,000

0 Metres 250

N W E S

Flood Map for Planning (Rivers & Sea)

- Defences
- Flood Storage Areas
- Areas benefiting from flood defences
- Flood Zone 3
- Flood Zone 2

Flood Map Areas (assuming no defences)

Flood Zone 3 shows the area that could be affected by flooding:

- from the sea with a 1 in 200 or greater chance of happening each year
- or from a river with a 1 in 100 or greater chance of happening each year.

Flood Zone 2 shows the extent of an extreme flood from rivers or the sea with up to a 1 in 1000 chance of occuring each year.

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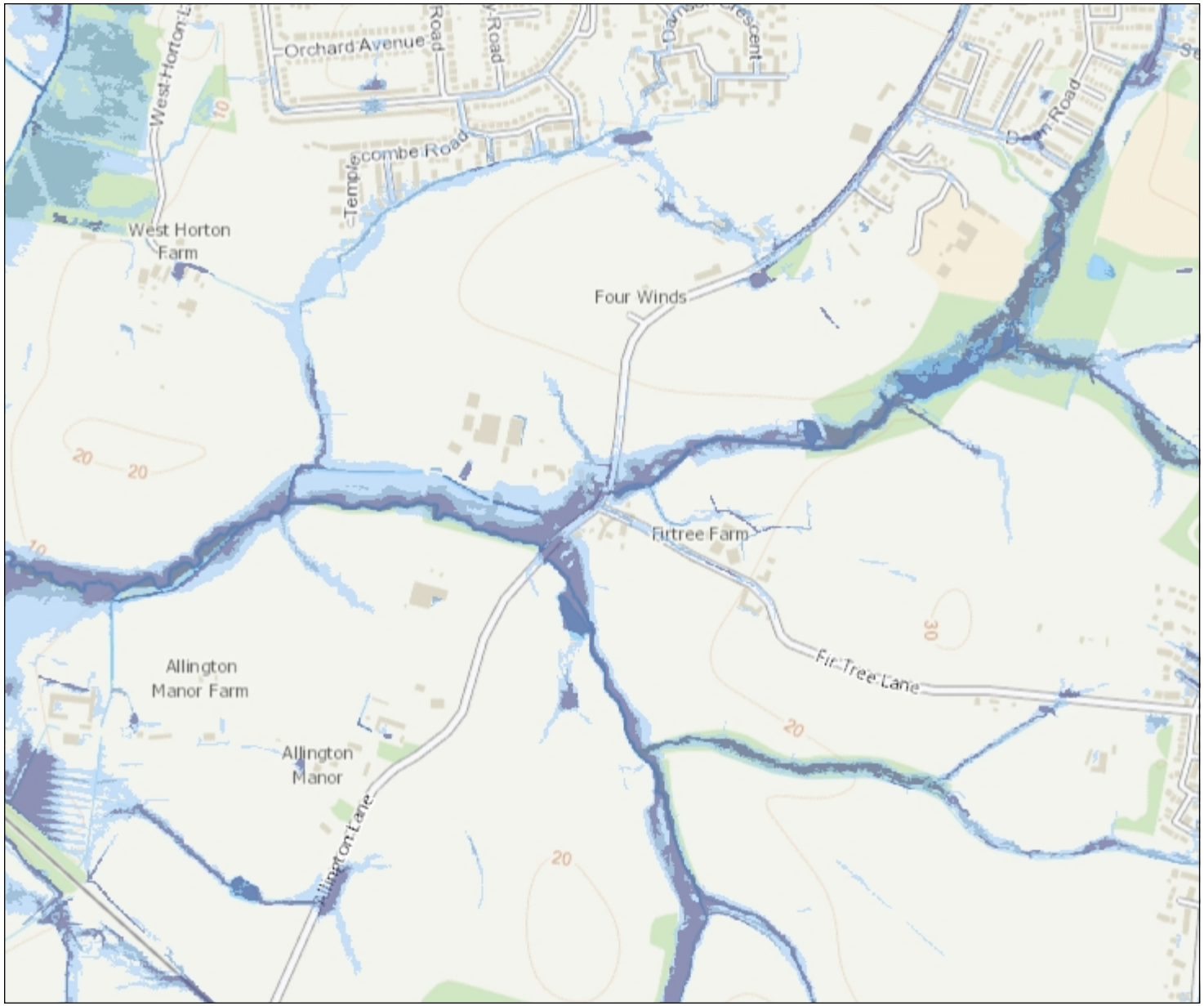
Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 03708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

Risk of flooding from Surface Water Centred on Grid Ref: 448499, 117709
Created 23 July **2020**



Environment Agency

1: 10,000

0 Metres 250

N W E S

Likelihood of flooding from Surface Water

- High (>=3.3%)
- Medium (3.3% - 1%)
- Low (1% - 01%)
- Very Low

Likelihood of flooding from Surface Water

High:	Greater than or equal to 3.3% (1 in 30) chance in any given year
Medium:	Less than 3.3% (1 in 30) but greater than or equal to 1% (1 in 100) chance in any given year
Low:	Less than 1% (1 in 100) but greater than or equal to 0.1% (1 in 1,000) chance in any given year
Very Low:	Less than 0.1% (1 in 1,000) chance in any given year

This information is shown on the Risk of Flooding from Surface Water map on GOV.UK.

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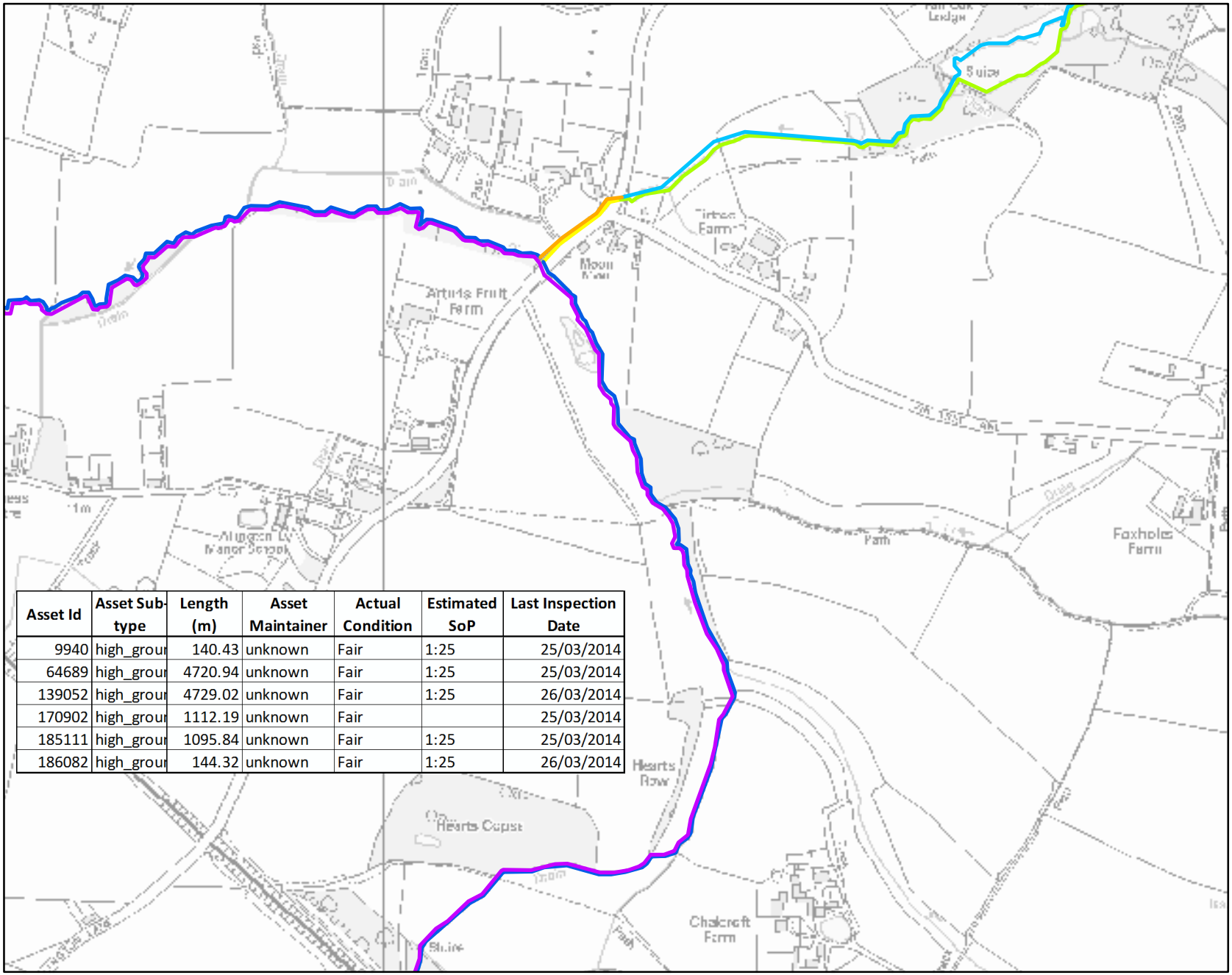
Defences Centred on Grid Ref: SU 448499, 117709 - Created 24 July 2020



Asset Id	Asset Sub-type	Length (m)	Asset Maintainer	Actual Condition	Estimated SoP	Last Inspection Date
9940	high_grour	140.43	unknown	Fair	1:25	25/03/2014
64689	high_grour	4720.94	unknown	Fair	1:25	25/03/2014
139052	high_grour	4729.02	unknown	Fair	1:25	26/03/2014
170902	high_grour	1112.19	unknown	Fair		25/03/2014
185111	high_grour	1095.84	unknown	Fair	1:25	25/03/2014
186082	high_grour	144.32	unknown	Fair	1:25	26/03/2014

Environment Agency

Legend

ASSET_ID

- 9940
- 64689
- 139052
- 170902
- 185111
- 186082

1:7,721 *

*when printed at A4.

N

0 150 300

Metres

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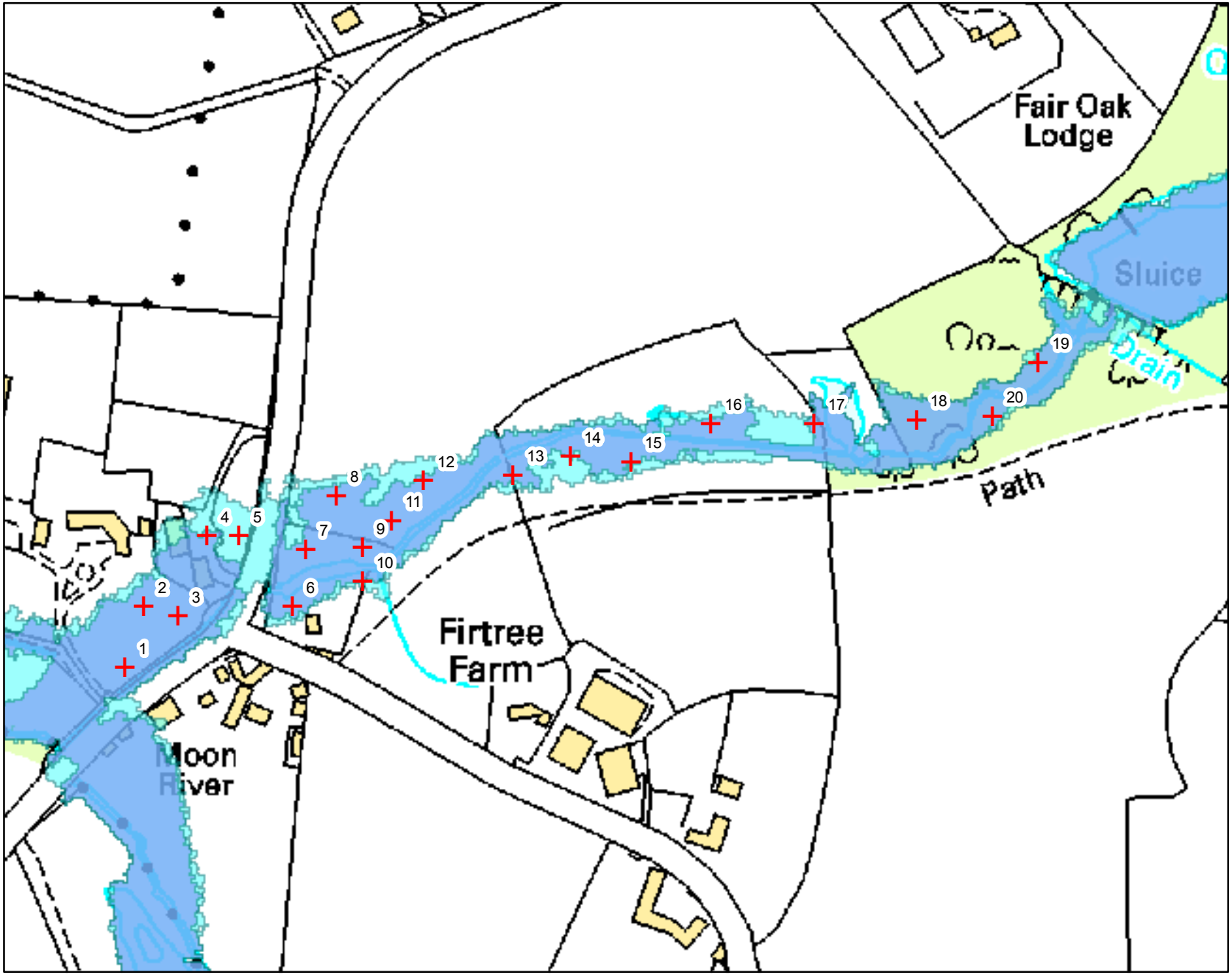
Modelled Flood Levels Centred on Grid Ref 448499 117709 - Created 22 July 2020



Environment Agency

Legend

- Location Points
- Flood Zone 3
- Flood Zone 2

Flood Map Areas (assuming no defences)

Flood Zone 3
Shows the area that could be affected by flooding:
- from the sea with an 1 in 200 or greater chance of happening each year.
- or from a river with a 1 in 100 or greater chance of happenening each year.

Flood Zone 2
Shows the extent of an extreme flood from rivers of the sea with up to a 1 in 1000 chance of occuring each year.

1:3,094 *

*when printed at A4.

N

0 60 120

Metres

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Water Depths & Levels for Site at Horton Heath

	Water Surface Level (mAOD*)					
Point	5% Annual Probability/1 in 20 Year	1% Annual Probability/1 in 100 Year (Flood Zone 3)	1% Annual Probability/1 in 100 Year + 35% Climate Change	1% Annual Probability/1 in 100 Year + 45% Climate Change	1% Annual Probability/1 in 100 Year + 105% Climate Change	0.1% Annual Probability/1 in 1000 Year (Flood Zone 2)
1	14.24	14.32	14.36	14.36	14.41	14.39
2	14.32	14.42	14.46	14.48	14.54	14.52
3	14.33	14.42	14.48	14.49	14.56	14.53
4	No Data	14.67	14.72	14.75	14.85	14.81
5	No Data	No Data	14.89	14.92	15.02	14.99
6	15.01	15.13	15.25	15.27	15.37	15.33
7	15.04	15.16	15.27	15.29	15.37	15.34
8	15.04	15.17	15.28	15.30	15.39	15.35
9	15.04	15.17	15.28	15.29	15.39	15.35
10	15.04	15.17	15.28	15.29	15.38	15.35
11	No Data	15.17	15.28	15.30	15.40	15.36
12	No Data	15.22	15.33	15.35	15.45	15.41
13	No Data	15.42	15.49	15.50	15.60	15.56
14	No Data	15.52	15.59	15.61	15.72	15.67
15	No Data	15.70	15.76	15.78	15.89	15.84
16	No Data	15.88	15.95	15.97	16.10	16.04
17	16.01	16.01	16.36	16.39	16.54	16.48
18	17.13	17.13	17.23	17.24	17.30	17.28
19	17.23	17.23	17.40	17.41	17.52	17.48
20	17.15	17.15	17.28	17.29	17.37	17.34

* Levels in metres above Ordnance Datum Newlyn

Use of Environment Agency Information for Flood Risk Assessments

Important

The Environment Agency are keen to work with partners to enable development which is resilient to flooding for its lifetime and provides wider benefits to communities. If you have requested this information to help inform a development proposal, then we recommend engaging with us as early as possible by using the pre-application form available from our website:

https://www.gov.uk/government/publications/pre-planning-application-enquiry-form-preliminary-opinion

We recognise the value of early engagement in development planning decisions. This allows complex issues to be discussed, innovative solutions to be developed that both enables new development and protects existing communities. Such engagement can often avoid delays in the planning process following planning application submission, by reaching agreements up-front. We offer a charged pre-application advice service for applicants who wish to discuss a development proposal.

We can also provide a preliminary opinion for free which will identify environmental constraints related to our responsibilities including flooding, waste, land contamination, water quality, biodiversity, navigation, pollution, water resources, foul drainage or Environmental Impact Assessment.

In preparing your planning application submission, you should refer to the Environment Agency's Flood Risk Standing Advice and the Planning Practice Guidance for information about what flood risk assessment is needed for new development in the different Flood Zones. This information can be accessed via:

https://www.gov.uk/flood-risk-assessment-standing-advice
http://planningguidance.planningportal.gov.uk/

You should also consult the Strategic Flood Risk Assessment or other relevant materials produced by your local planning authority.

You should note that:

1. Information supplied by the Environment Agency may be used to assist in producing a Flood Risk Assessment (FRA) where one is required, but does not constitute such an assessment on its own.

2. This information covers flood risk from main rivers and the sea, and you will need to consider other potential sources of flooding, such as groundwater or surface water runoff. Information produced by the local planning authority referred to above may assist here.

3. Where a planning application requires an FRA and this is not submitted or is deficient, the Environment Agency may raise an objection.

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Go to the version 1 of the licence.
Go to the version 2 of the licence.
Go to the Welsh version of the licence.

Appendix 6

N

SuDS features serving Northern Access.Part of infrastructure works to be implemented under Planning Permission X/19/86303 : (O/14/79354)

Strategic SuDS Features for N.Roundabout and draining of Northern link Road subject to detailed design. Refer to Note 7.

Watercourse Crossing

Watercourse Crossing

Crossing requires a clear span of channel with soffit set to a minimum of 600mm above the 1 in 100 year flood level with an appropriate allowance for climate change.
Detailed design to include Level for Level Flood Plain Compensatory Storage.

Strategic SuDS Feature A

Strategic SuDS Feature B

Strategic SuDS Feature C

Strategic SuDS Feature D

Strategic SuDS Feature E

Strategic SuDS Feature F

Strategic SuDS Feature G

SuDS feature serving as Conveyance feature with minimal attenuation capacity.

A

B

C

D

E

F

G

FIR TREE LANE

Watercourse Crossing

Watercourse Crossing

Bioretention Swale
Link road highway drainage design to incorporate bioretention swale. Refer to Note 7.

0m 50m 100m
Scale 1:1250

Strategic SuDS Features Schedule

Strategic SuDS Feature	Contributing Catchment (ha)	% of Impermeability	Q_{BAR} for Catchment (l/s)	1 in 1 Year Storage Volume (m^3)	1 in 1 Year Resulting Discharge (l/s)	1 in 100+40%CC Storage Volume(m^3)	1 in 100+40%CC Resulting Discharge(l/s)
A	2.037	65	18.4	165	17.8	802	18.3
	0.260	100					
B	3.750	65	30.0	260	28.1	1224	29.9
C	6.808	65	54.5	405	50.1	2172	54.4
D	3.381	65	27.1	244	23.7	1112	27
E	3.650	65	32.3	337	24.8	1706	32.3
	0.382	100					
F	3.360	65	26.9	241	23.9	1103	26.9
G	2.762	65	41.5	267	34.7	1450	40.3
	2.415	50					
H	1.603	30	70.8	683	44.1	2694	70.8
	0.409	100					
	6.831	65					
I	1.556	65	29.6	314	26.7	1339	28.7
J	2.139	65					
K	1.696	65	13.6	127	11.0	560	13.5
L	3.884	65	39.6	433	32.5	1860	39.5
	1.046	100					
M	2.213	65	17.7	156	16.2	728	17.7
N	5.759	65	46.1	477	31.1	1924	46.0
EM(Employment)	2.029	85	16.3	150	15.5	878	16.3

PFA consulting

Stratton Park House, Wanborough Road
Swindon, SN3 4HG

Telephone
01793 828000

Website
www.pfaplc.com

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This drawing is produced for the purposes of supporting a planning application and should not be relied upon for tender, pricing, or construction purposes.

NOTES

1. This drawing should be read in conjunction with PFA Consulting's Flood Risk Assessment (Doc ref G277-DOC01 FRA – Issue 1) dated Dec 2020.
2. This drawing is based on the Topographical Survey undertaken by Mayer Brown Limited, Drawing No:IR:SAV.1.21.1, Rev E, dated 05 May 2014.
3. This site layout is based on Thrive's Concept Masterplan, Drawing number EAST200403 CMP 01 Rev P13, dated 04.12.20
4. Main River designation based on Flood Map for Planning.
5. All SuDS features shown on this drawing are subject to detailed design.
6. Typical Layout of Strategic SuDS Features to inform Detailed Design shown on drawing number G277/23.
7. Detailed design of highway drainage features to provide attenuation and restrict flows to the downstream watercourse system. Sufficient attenuation should be provided to ensure discharge rates are restricted for all return periods up to the 100 year design event, including an appropriate allowance for climate change. Refer to PFA's Flood Risk Assessment (dated Dec 2020) document for guidance on flow rate restrictions.

Key

- Risk of Flooding from Surface Water Outline
- Basin Catchment Allocation
- Flood Zone 2
- Flood Zone 3
- Indicative Location of Foul Water Sewage Pumping Station with 15m odour offset
- 5m offset from Watercourse
- 8m offset from Main Rivers
- Opportunity for swale conveyance feature
- Direction of Exceedance Flows
- Outlet from SuDS Feature to be conveyance swale where feasible
- Indicative Proposed Foul Rising Main
- Indicative Proposed Strategic Foul Sewer

Sheet Key

Rev	Date	Description	Drawn	Check
P	27/11/20	First Issue.	DAB	SAM
A	11/12/20	Revised to latest Masterplan & link road design	DAB	SAM

Status
FOR PLANNING

Client
Eastleigh Borough Council

Project
One Horton Heath
Hampshire

Drawing Title
Preliminary Water Management Strategy Plan (Sheet 1 of 2)

Drawing No. G277/21 Rev A

Date: November 2020 Scale: 1:1250 @ A0

E-Mail: DBuciak@pfaplc.com

Strategic SuDS Features Schedule

Strategic SuDS Feature	Contributing Catchment (ha)	% of impermeability	Q_{MED} for Catchment (l/s)	1 in 1 Year Storage Volume (m^3)	1 in 1 Year Resulting Discharge (l/s)	1 in 100+40%CC Storage Volume (m^3)	1 in 100+40%CC Resulting Discharge (l/s)
A	2.037	65	18.4	165	17.8	802	18.3
	0.260	100					
B	3.750	65	30.0	260	28.1	1224	29.9
C	6.808	65	54.5	405	50.1	2172	54.4
D	3.381	65	27.1	244	23.7	1112	27
E	3.650	65	32.3	337	24.8	1706	32.3
	0.382	100					
F	3.360	65	26.9	241	23.9	1103	26.9
G	2.762	65	41.5	267	34.7	1450	40.3
	2.415	50					
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	0.409	100					
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I	1.556	65	29.6	314	26.7	1339	28.7
J	2.139	65					
K	1.696	65	13.6	127	11.0	560	13.5
L	3.894	65	39.6	433	32.5	1860	39.5
	1.046	100					
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4. Main River designation based on Flood Map for Planning.
5. All SuDS features shown on this drawing are subject to detailed design.
6. Typical Layout of Strategic SuDS Features to Inform Detailed Design shown on drawing number G277/23.
7. Detailed design of highway drainage features to provide attenuation and restrict flows to the downstream watercourse system. Sufficient attenuation should be provided to ensure discharge rates are restricted for all return periods up to the 100 year design event, including an appropriate allowance for climate change. Refer to PFA's Flood Risk Assessment (dated Dec 2020) document for guidance on flow rate restrictions.

Key

- Risk of Flooding from Surface Water Outline
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- Opportunity for swale conveyance feature
- Direction of Exceedance Flows
- Outlet from SuDS Feature to be conveyance swale where feasible
- Indicative Proposed Foul Rising Main
- Indicative Proposed Strategic Foul Sewer
- Indicative Foul flow direction

Sheet Key

Rev	Date	Description	Drawn	Check
#	27/11/20	First Issue.	DAB	MWS
A	11/12/20	Revised to latest Masterplan & link road design	DAB	SAM

Status
FOR PLANNING

Client
Eastleigh Borough Council

Project
One Horton Heath
Hampshire

Drawing Title
Preliminary Water Management Strategy Plan (Sheet 2 of 2)

Drawing No. G277/22 Rev A

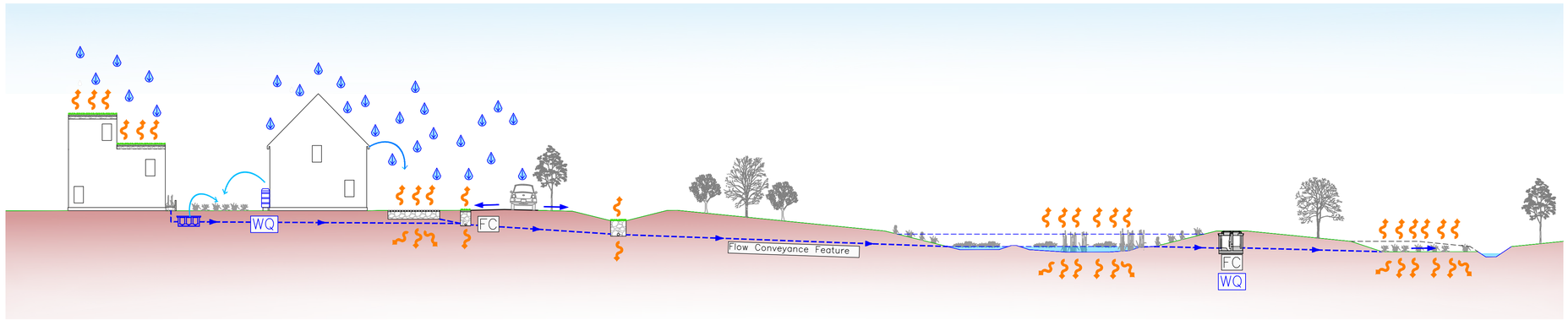
Date: November 2020 Scale: 1:1250 @ A0

E-Mail: DBuciak@pfaplc.com

Appendix 7

KEY

- Rainfall
- Interception Losses (Evapotranspiration / Infiltration)
- Water Reuse
- WQ — Water Quality Device (Oil Separator / Vortex Separator)
- FC — Flow Control Device (Orifice / Vortex Flow Control)
- Overland Flow
- Surface Water Sewer (connecting SuDS Features)



DEVELOPMENT TYPE	Commercial / Public	Residential	Private / Shared Parking	Public Highway	Conveyance Features		Green Infrastructure / Public Open Space	Watercourse Corridor
MANAGEMENT TRAIN	PREVENTION →							
	SOURCE CONTROL →							
	SITE / REGIONAL CONTROL →							
SuDS FEATURE	Rainwater Harvesting (Reuse for irrigation e.g Rainwater Butts) Green Roofs Bioretention Areas / Rain Gardens Rills	Rainwater Harvesting (Reuse for irrigation e.g Rainwater Butts) Porous Paving Tanks Flow Control Devices		Swales Bioretention Areas Filter Strips Filter Drains			Strategic SuDS incorporating sediment forbays, wetland areas, micropools at the outlet Flow Control Devices Water Quality Devices	Outfall Swale
MAINTENANCE RESPONSIBILITY	Commercial or Public Tenants	Homeowners	Homeowners / Management Company	Highway Authority	Southern Water / Management Company		Southern Water / Management Company	Southern Water / Management Company

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NOTES

1. Drawing to be read in conjunction with Flood Risk Assessment and Water Management Strategy produced by PFA Consulting (Document Ref: G277–DOC01 Dated November 2020) and Preliminary Water Management Strategy Plan (Drawing No. G277/21 & 22).
2. Future design of upstream Source Control & Site Control to take account of the principles established in in the Water Management Strategy and this drawing.

Rev	Date	Description	Drawn	Check
#	26.11.20	First Issue.	BF	MWS

Status
FOR PLANNING

Client
Eastleigh Borough Council

Project
One Horton Heath
Hampshire

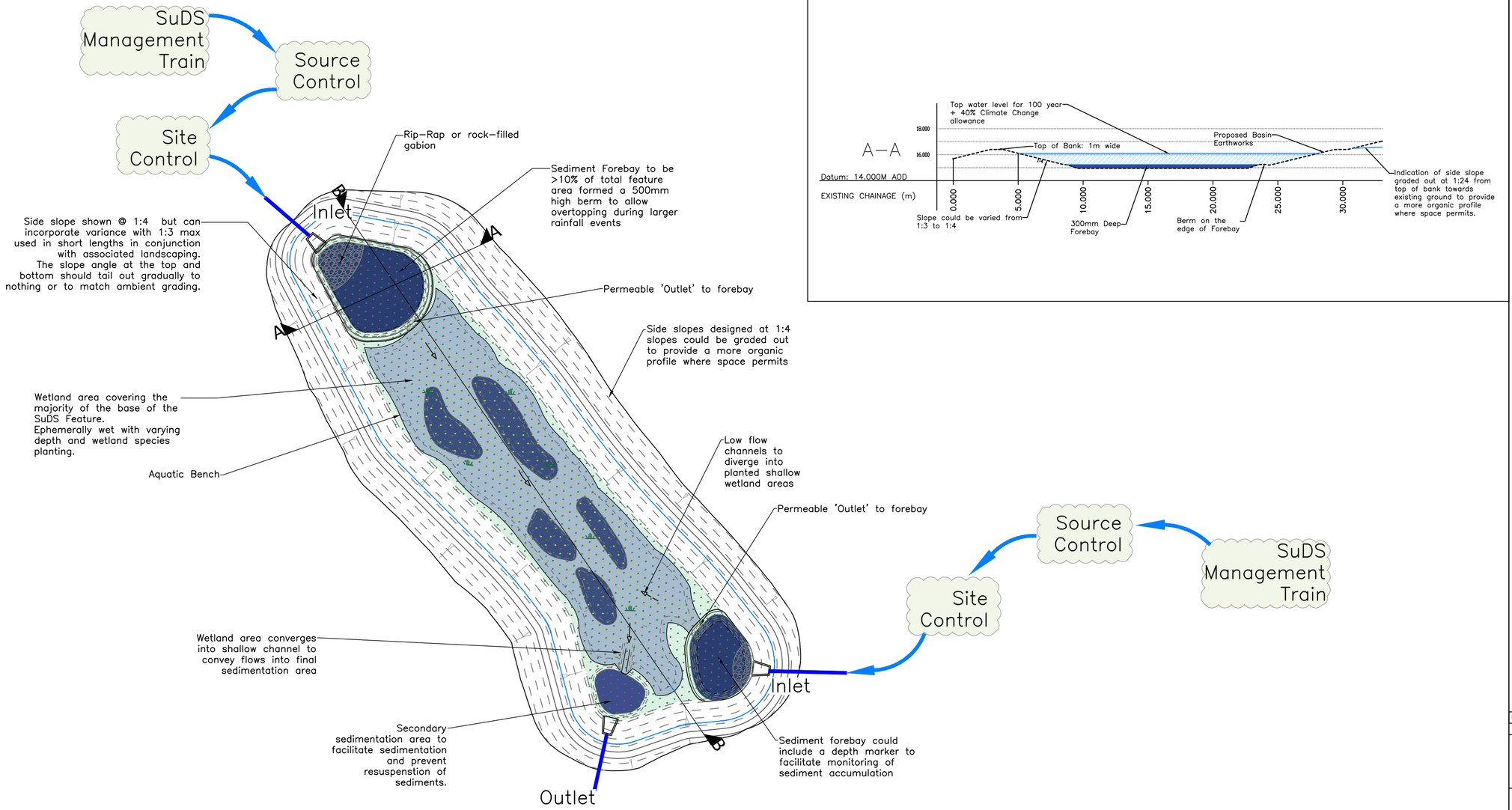
Drawing Title
SuDS Management Train

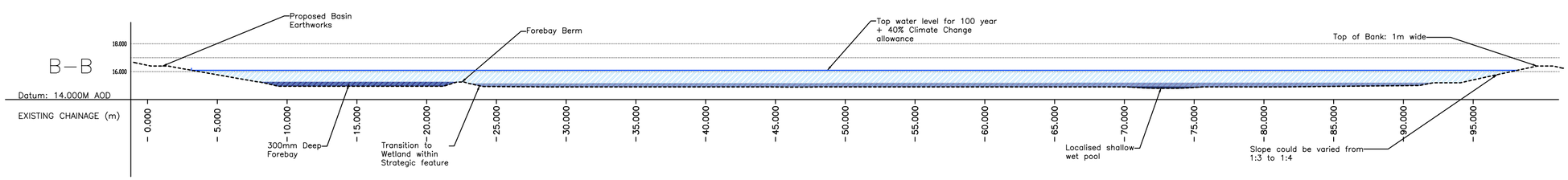
Drawing No.
G277/24

Date: November 2020 | Scale: NTS @ A1

E-Mail: bfox@pfaplc.com

Appendix 8





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NOTES

1. This drawing shows the typical SuDS feature arrangements for the SuDS features shown on the Preliminary Water Management Strategy Plan, Drawing number G277/21 & G277/22.
2. Upstream SuDS management train principles are outlined in the PFA's Water Management Strategy and depicted on drawing G277/24 dated November 2020.

Rev	Date	Description	Drawn	Check
#	26/11/20	First Issue.	DAB	SAM

Status
FOR PLANNING

Client
Eastleigh Borough Council

Project
One Horton Heath Hampshire

Drawing Title
Typical Layout of Strategic SuDS Features to Inform Detailed Design

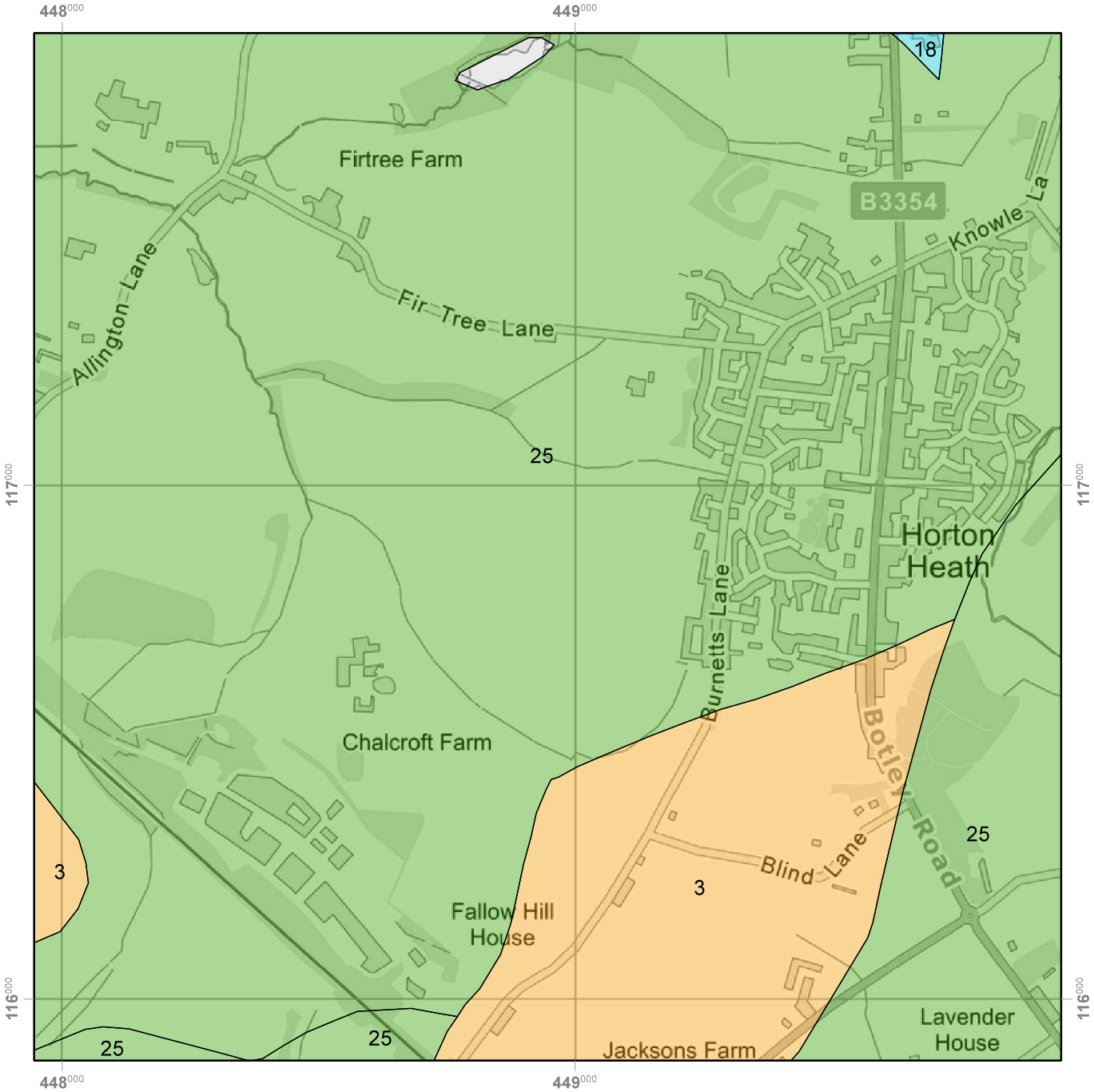
Drawing No.
G277/23

Date: November 2020 | Scale: As shown

E-Mail: DBuciak@pfaplc.com

Appendix 9

1b Hydrology of Soil Type (HOST)



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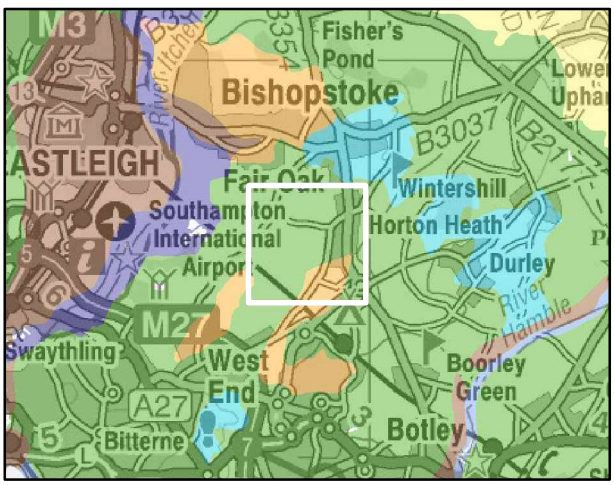

Hydrology of Soil Type (HOST) Key

3 Free draining permeable soils on soft sandstone substrates with relatively high permeability and high storage capacity

18 Slowly permeable soils with slight seasonal waterlogging and moderate storage capacity over slowly permeable substrates with negligible storage

25 Slowly permeable, seasonally waterlogged soils over impermeable clay substrates with no storage capacity

HOST CLASS DESCRIPTION

The Hydrology of Soil Types (HOST) classification describes the dominant pathways of water movement through the soil and, where appropriate, the underlying substrate. Eleven drainage models are defined according to the permeability of the soil and its substrate and the depth to a groundwater table, where one is present (Boorman et al,1995). These are further subdivided into 29 HOST classes to which all soil series have been assigned. These classes identify the way soil water flows are partitioned, with water passing over, laterally through, or vertically down the soil column. Analysis of the river hydrograph and the extent of soil series for several hundred gauged catchments allowed mean values for catchment hydrological variables to be identified for each HOST class, The HOST classification is widely used to predict river flows and the frequency and severity of flood events and also to model the behaviour of diffuse pollutants (Hollis et al, 1995).

Appendix 10

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Philipp Schilbach
Site name:	Land at Horton Heath
Site location:	Eastleigh, Hampshire

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013) , the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:	50.95332° N
Longitude:	1.30842° W
Reference:	1237022321
Date:	Oct 22 2019 14:24

Runoff estimation approach

FEH Statistical

Site characteristics

Total site area (ha):	1

Methodology

Q_{MED} estimation method:	Calculate from BFI and SAAR
BFI and SPR method:	Calculate from dominant HOST
HOST class:	25
BFI / BFIHOST:	0.17
Q_{MED} (l/s):	8.1
Q_{BAR} / Q_{MED} factor:	1.14

Hydrological characteristics

	Default	Edited
SAAR (mm):	800	800
Hydrological region:	7	7
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Growth curve factor 200 years:	3.74	3.74

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Q_{BAR} (l/s):	9.2	9.2
1 in 1 year (l/s):	7.82	7.82
1 in 30 years (l/s):	21.17	21.17
1 in 100 year (l/s):	29.36	29.36
1 in 200 years (l/s):	34.42	34.42

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement , which can both be found at www.uksuds.com/terms-and-conditions.htm. The outputs from this tool are estimates of greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of this data in the design or operational characteristics of any drainage scheme.

Appendix 11

Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	15.612	0.112	8.1	82.5	O K
30 min Summer	15.641	0.141	11.7	104.9	O K
60 min Summer	15.667	0.167	14.7	125.1	O K
120 min Summer	15.687	0.187	16.6	140.7	O K
180 min Summer	15.696	0.196	17.5	148.3	O K
240 min Summer	15.701	0.201	17.6	152.1	O K
360 min Summer	15.701	0.201	17.6	152.2	O K
480 min Summer	15.697	0.197	17.5	149.1	O K
600 min Summer	15.692	0.192	17.1	145.1	O K
720 min Summer	15.687	0.187	16.6	140.7	O K
960 min Summer	15.676	0.176	15.6	132.4	O K
1440 min Summer	15.659	0.159	13.8	118.8	O K
2160 min Summer	15.641	0.141	11.7	104.7	O K
2880 min Summer	15.629	0.129	10.2	95.1	O K
4320 min Summer	15.613	0.113	8.2	82.6	O K
5760 min Summer	15.602	0.102	6.9	74.6	O K
7200 min Summer	15.594	0.094	6.0	68.9	O K
8640 min Summer	15.588	0.088	5.4	64.4	O K
10080 min Summer	15.584	0.084	4.9	60.8	O K
15 min Winter	15.625	0.125	9.7	92.1	O K
30 min Winter	15.657	0.157	13.6	117.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	29.494	0.0	80.6	25
30 min Summer	19.618	0.0	109.3	37
60 min Summer	12.728	0.0	147.5	60
120 min Summer	8.110	0.0	188.9	92
180 min Summer	6.206	0.0	217.3	126
240 min Summer	5.126	0.0	239.7	160
360 min Summer	3.877	0.0	272.3	228
480 min Summer	3.179	0.0	297.9	292
600 min Summer	2.725	0.0	319.4	356
720 min Summer	2.403	0.0	338.1	420
960 min Summer	1.972	0.0	369.8	544
1440 min Summer	1.492	0.0	419.4	786
2160 min Summer	1.128	0.0	479.6	1152
2880 min Summer	0.925	0.0	524.1	1508
4320 min Summer	0.700	0.0	593.1	2248
5760 min Summer	0.575	0.0	654.0	2952
7200 min Summer	0.492	0.0	699.9	3680
8640 min Summer	0.433	0.0	738.2	4416
10080 min Summer	0.389	0.0	771.0	5144
15 min Winter	29.494	0.0	91.0	24
30 min Winter	19.618	0.0	123.2	36

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Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	15.686	0.186	16.5	140.2	O K
120 min Winter	15.707	0.207	17.7	156.6	O K
180 min Winter	15.715	0.215	17.8	163.2	O K
240 min Winter	15.717	0.217	17.8	164.8	O K
360 min Winter	15.710	0.210	17.7	159.6	O K
480 min Winter	15.700	0.200	17.6	151.6	O K
600 min Winter	15.691	0.191	17.0	144.1	O K
720 min Winter	15.682	0.182	16.2	137.1	O K
960 min Winter	15.667	0.167	14.7	125.2	O K
1440 min Winter	15.646	0.146	12.3	108.4	O K
2160 min Winter	15.626	0.126	9.8	92.9	O K
2880 min Winter	15.613	0.113	8.3	83.1	O K
4320 min Winter	15.597	0.097	6.4	71.0	O K
5760 min Winter	15.587	0.087	5.3	63.7	O K
7200 min Winter	15.580	0.080	4.5	58.4	O K
8640 min Winter	15.575	0.075	4.0	54.4	O K
10080 min Winter	15.571	0.071	3.6	51.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	12.728	0.0	165.7	60
120 min Winter	8.110	0.0	212.0	98
180 min Winter	6.206	0.0	243.8	136
240 min Winter	5.126	0.0	268.9	174
360 min Winter	3.877	0.0	305.4	244
480 min Winter	3.179	0.0	334.1	310
600 min Winter	2.725	0.0	358.2	374
720 min Winter	2.403	0.0	379.2	438
960 min Winter	1.972	0.0	414.8	564
1440 min Winter	1.492	0.0	470.4	808
2160 min Winter	1.128	0.0	537.5	1172
2880 min Winter	0.925	0.0	587.4	1532
4320 min Winter	0.700	0.0	665.0	2256
5760 min Winter	0.575	0.0	732.7	3000
7200 min Winter	0.492	0.0	784.2	3744
8640 min Winter	0.433	0.0	827.2	4408
10080 min Winter	0.389	0.0	864.4	5152

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Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	1	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.900	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 1.584

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.500	4	8	0.500	8	12	0.584

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Model Details

Storage is Online Cover Level (m) 16.700

Tank or Pond Structure

Invert Level (m) 15.500

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	706.6	0.401	912.5	0.801	1134.6	1.200	1372.1
0.101	756.5	0.501	966.6	0.901	1192.6		
0.201	807.5	0.601	1021.6	1.001	1251.7		
0.301	859.5	0.701	1077.6	1.101	1311.7		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0192-1830-0900-1830
Design Head (m)	0.900
Design Flow (l/s)	18.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	192
Invert Level (m)	15.500
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.900	18.3
Flush-Flo™	0.319	18.3
Kick-Flo®	0.658	15.8
Mean Flow over Head Range	-	15.3

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.7	1.200	21.0	3.000	32.5	7.000	49.0
0.200	17.6	1.400	22.6	3.500	35.0	7.500	50.7
0.300	18.2	1.600	24.1	4.000	37.4	8.000	52.3
0.400	18.1	1.800	25.5	4.500	39.6	8.500	53.9
0.500	17.7	2.000	26.8	5.000	41.6	9.000	55.4
0.600	16.8	2.200	28.0	5.500	43.6	9.500	56.6
0.800	17.3	2.400	29.2	6.000	45.5		
1.000	19.2	2.600	30.4	6.500	47.3		

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	15.963	0.463	18.3	381.4	O K
30 min Summer	16.092	0.592	18.3	507.7	O K
60 min Summer	16.216	0.716	18.3	638.5	O K
120 min Summer	16.261	0.761	18.3	687.5	O K
180 min Summer	16.274	0.774	18.3	702.4	O K
240 min Summer	16.274	0.774	18.3	702.6	O K
360 min Summer	16.258	0.758	18.3	684.7	O K
480 min Summer	16.241	0.741	18.3	666.3	O K
600 min Summer	16.225	0.725	18.3	647.9	O K
720 min Summer	16.208	0.708	18.3	629.7	O K
960 min Summer	16.173	0.673	18.3	592.6	O K
1440 min Summer	16.100	0.600	18.3	516.6	O K
2160 min Summer	16.002	0.502	18.3	419.2	O K
2880 min Summer	15.919	0.419	18.3	340.7	O K
4320 min Summer	15.800	0.300	18.2	234.3	O K
5760 min Summer	15.730	0.230	17.9	175.8	O K
7200 min Summer	15.696	0.196	17.5	148.2	O K
8640 min Summer	15.681	0.181	16.1	136.2	O K
10080 min Summer	15.670	0.170	15.0	127.6	O K
15 min Winter	16.012	0.512	18.3	429.0	O K
30 min Winter	16.154	0.654	18.3	572.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	134.447	0.0	390.5	26
30 min Summer	90.183	0.0	525.8	40
60 min Summer	57.866	0.0	683.0	70
120 min Summer	32.885	0.0	776.7	126
180 min Summer	23.621	0.0	837.0	184
240 min Summer	18.682	0.0	882.8	242
360 min Summer	13.435	0.0	952.4	322
480 min Summer	10.653	0.0	1007.0	384
600 min Summer	8.910	0.0	1052.8	446
720 min Summer	7.706	0.0	1092.6	514
960 min Summer	6.140	0.0	1160.6	654
1440 min Summer	4.483	0.0	1270.5	916
2160 min Summer	3.294	0.0	1405.8	1300
2880 min Summer	2.663	0.0	1515.4	1672
4320 min Summer	2.002	0.0	1706.1	2344
5760 min Summer	1.655	0.0	1885.5	3016
7200 min Summer	1.442	0.0	2053.3	3680
8640 min Summer	1.297	0.0	2216.4	4416
10080 min Summer	1.193	0.0	2376.1	5144
15 min Winter	134.447	0.0	438.1	26
30 min Winter	90.183	0.0	589.4	40

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	16.289	0.789	18.3	719.4	O K
120 min Winter	16.340	0.840	18.3	778.0	O K
180 min Winter	16.358	0.858	18.3	798.4	O K
240 min Winter	16.361	0.861	18.3	802.5	O K
360 min Winter	16.349	0.849	18.3	787.6	O K
480 min Winter	16.325	0.825	18.3	760.5	O K
600 min Winter	16.305	0.805	18.3	737.7	O K
720 min Winter	16.284	0.784	18.3	713.6	O K
960 min Winter	16.238	0.738	18.3	662.1	O K
1440 min Winter	16.133	0.633	18.3	550.4	O K
2160 min Winter	15.976	0.476	18.3	393.6	O K
2880 min Winter	15.849	0.349	18.3	277.1	O K
4320 min Winter	15.705	0.205	17.7	155.3	O K
5760 min Winter	15.672	0.172	15.2	128.9	O K
7200 min Winter	15.655	0.155	13.3	115.4	O K
8640 min Winter	15.644	0.144	12.1	107.0	O K
10080 min Winter	15.637	0.137	11.1	101.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	57.866	0.0	765.3	68
120 min Winter	32.885	0.0	870.2	124
180 min Winter	23.621	0.0	937.8	182
240 min Winter	18.682	0.0	989.1	238
360 min Winter	13.435	0.0	1067.1	346
480 min Winter	10.653	0.0	1128.2	410
600 min Winter	8.910	0.0	1179.5	474
720 min Winter	7.706	0.0	1224.1	550
960 min Winter	6.140	0.0	1300.2	706
1440 min Winter	4.483	0.0	1423.3	1002
2160 min Winter	3.294	0.0	1574.9	1384
2880 min Winter	2.663	0.0	1697.7	1732
4320 min Winter	2.002	0.0	1911.8	2332
5760 min Winter	1.655	0.0	2111.9	3000
7200 min Winter	1.442	0.0	2300.0	3688
8640 min Winter	1.297	0.0	2482.9	4416
10080 min Winter	1.193	0.0	2662.4	5136

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Rainfall Details

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
FEH Rainfall Version	2013	Cv (Winter)	0.840
Site Location	GB 448927 117350	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.584

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.500	4	8	0.500	8	12	0.584

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Model Details

Storage is Online Cover Level (m) 16.700

Tank or Pond Structure

Invert Level (m) 15.500

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	706.6	0.401	912.5	0.801	1134.6	1.200	1372.1
0.101	756.5	0.501	966.6	0.901	1192.6		
0.201	807.5	0.601	1021.6	1.001	1251.7		
0.301	859.5	0.701	1077.6	1.101	1311.7		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0192-1830-0900-1830
Design Head (m)	0.900
Design Flow (l/s)	18.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	192
Invert Level (m)	15.500
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.900	18.3
Flush-Flo™	0.319	18.3
Kick-Flo®	0.658	15.8
Mean Flow over Head Range	-	15.3

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.7	1.200	21.0	3.000	32.5	7.000	49.0
0.200	17.6	1.400	22.6	3.500	35.0	7.500	50.7
0.300	18.2	1.600	24.1	4.000	37.4	8.000	52.3
0.400	18.1	1.800	25.5	4.500	39.6	8.500	53.9
0.500	17.7	2.000	26.8	5.000	41.6	9.000	55.4
0.600	16.8	2.200	28.0	5.500	43.6	9.500	56.6
0.800	17.3	2.400	29.2	6.000	45.5		
1.000	19.2	2.600	30.4	6.500	47.3		

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Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	21.018	0.118	10.6	127.2	O K
30 min Summer	21.049	0.149	15.6	162.7	O K
60 min Summer	21.077	0.177	20.4	196.1	O K
120 min Summer	21.098	0.198	23.8	221.1	O K
180 min Summer	21.108	0.208	25.3	233.7	O K
240 min Summer	21.114	0.214	26.0	240.4	O K
360 min Summer	21.115	0.215	26.2	242.5	O K
480 min Summer	21.113	0.213	26.0	239.5	O K
600 min Summer	21.109	0.209	25.4	234.5	O K
720 min Summer	21.104	0.204	24.7	228.8	O K
960 min Summer	21.095	0.195	23.2	217.2	O K
1440 min Summer	21.079	0.179	20.6	197.5	O K
2160 min Summer	21.060	0.160	17.5	175.6	O K
2880 min Summer	21.047	0.147	15.3	160.2	O K
4320 min Summer	21.030	0.130	12.4	139.9	O K
5760 min Summer	21.018	0.118	10.5	126.4	O K
7200 min Summer	21.009	0.109	9.2	116.9	O K
8640 min Summer	21.003	0.103	8.2	109.3	O K
10080 min Summer	20.997	0.097	7.4	103.3	O K
15 min Winter	21.031	0.131	12.6	142.0	O K
30 min Winter	21.065	0.165	18.3	181.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	29.494	0.0	121.9	28
30 min Summer	19.618	0.0	165.9	39
60 min Summer	12.728	0.0	225.9	62
120 min Summer	8.110	0.0	289.5	96
180 min Summer	6.206	0.0	333.2	130
240 min Summer	5.126	0.0	367.6	164
360 min Summer	3.877	0.0	417.6	230
480 min Summer	3.179	0.0	457.0	296
600 min Summer	2.725	0.0	490.1	360
720 min Summer	2.403	0.0	518.8	424
960 min Summer	1.972	0.0	567.4	548
1440 min Summer	1.492	0.0	643.3	794
2160 min Summer	1.128	0.0	737.1	1156
2880 min Summer	0.925	0.0	805.4	1528
4320 min Summer	0.700	0.0	910.9	2252
5760 min Summer	0.575	0.0	1005.7	2960
7200 min Summer	0.492	0.0	1076.2	3680
8640 min Summer	0.433	0.0	1134.8	4416
10080 min Summer	0.389	0.0	1184.9	5144
15 min Winter	29.494	0.0	137.9	28
30 min Winter	19.618	0.0	187.3	39

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Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	21.096	0.196	23.5	219.2	O K
120 min Winter	21.118	0.218	26.6	245.6	O K
180 min Winter	21.127	0.227	27.8	256.3	O K
240 min Winter	21.129	0.229	28.1	259.6	O K
360 min Winter	21.125	0.225	27.6	254.5	O K
480 min Winter	21.118	0.218	26.6	245.2	O K
600 min Winter	21.110	0.210	25.5	235.2	O K
720 min Winter	21.102	0.202	24.3	225.4	O K
960 min Winter	21.088	0.188	22.1	208.2	O K
1440 min Winter	21.066	0.166	18.5	182.6	O K
2160 min Winter	21.045	0.145	14.9	157.5	O K
2880 min Winter	21.031	0.131	12.5	141.3	O K
4320 min Winter	21.013	0.113	9.7	121.0	O K
5760 min Winter	21.002	0.102	8.1	108.4	O K
7200 min Winter	20.994	0.094	7.0	99.4	O K
8640 min Winter	20.988	0.088	6.2	92.6	O K
10080 min Winter	20.983	0.083	5.5	87.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	12.728	0.0	253.7	62
120 min Winter	8.110	0.0	325.0	102
180 min Winter	6.206	0.0	374.0	138
240 min Winter	5.126	0.0	412.5	174
360 min Winter	3.877	0.0	468.6	246
480 min Winter	3.179	0.0	512.8	314
600 min Winter	2.725	0.0	549.8	380
720 min Winter	2.403	0.0	582.0	444
960 min Winter	1.972	0.0	636.5	570
1440 min Winter	1.492	0.0	721.8	818
2160 min Winter	1.128	0.0	826.1	1188
2880 min Winter	0.925	0.0	902.7	1556
4320 min Winter	0.700	0.0	1021.6	2292
5760 min Winter	0.575	0.0	1126.7	3000
7200 min Winter	0.492	0.0	1205.8	3744
8640 min Winter	0.433	0.0	1271.8	4416
10080 min Winter	0.389	0.0	1328.7	5152

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Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	1	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.900	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 2.437

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.609	4	8	0.609	8	12	0.609	12	16	0.610

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Model Details

Storage is Online Cover Level (m) 22.100

Tank or Pond Structure

Invert Level (m) 20.900

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1011.9	0.401	1443.0	0.801	1890.0	1.200	2351.9
0.101	1118.2	0.501	1553.3	0.901	2004.3		
0.201	1225.4	0.601	1664.5	1.001	2119.5		
0.301	1333.7	0.701	1776.8	1.101	2235.8		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0238-3000-0900-3000
Design Head (m)	0.900
Design Flow (l/s)	30.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	238
Invert Level (m)	20.900
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.900	30.0
Flush-Flo™	0.372	29.9
Kick-Flo®	0.690	26.4
Mean Flow over Head Range	-	24.4

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	7.8	1.200	34.4	3.000	53.5	7.000	80.8
0.200	24.0	1.400	37.0	3.500	57.7	7.500	83.5
0.300	29.7	1.600	39.5	4.000	61.5	8.000	86.2
0.400	29.9	1.800	41.8	4.500	65.1	8.500	88.8
0.500	29.4	2.000	44.0	5.000	68.6	9.000	91.3
0.600	28.4	2.200	46.1	5.500	71.8	9.500	93.2
0.800	28.3	2.400	48.0	6.000	74.9		
1.000	31.5	2.600	49.9	6.500	77.9		

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	21.362	0.462	29.9	581.0	O K
30 min Summer	21.484	0.584	29.9	774.6	O K
60 min Summer	21.602	0.702	29.9	975.7	O K
120 min Summer	21.644	0.744	29.9	1051.0	O K
180 min Summer	21.656	0.756	29.9	1072.8	O K
240 min Summer	21.655	0.755	29.9	1072.0	O K
360 min Summer	21.640	0.740	29.9	1044.0	O K
480 min Summer	21.624	0.724	29.9	1015.4	O K
600 min Summer	21.608	0.708	29.9	986.5	O K
720 min Summer	21.591	0.691	29.9	956.2	O K
960 min Summer	21.554	0.654	29.9	892.2	O K
1440 min Summer	21.485	0.585	29.9	774.8	O K
2160 min Summer	21.390	0.490	29.9	624.5	O K
2880 min Summer	21.312	0.412	29.9	507.0	O K
4320 min Summer	21.203	0.303	29.7	355.6	O K
5760 min Summer	21.144	0.244	29.0	278.4	O K
7200 min Summer	21.119	0.219	26.8	247.4	O K
8640 min Summer	21.104	0.204	24.7	228.9	O K
10080 min Summer	21.094	0.194	23.1	215.5	O K
15 min Winter	21.409	0.509	29.9	654.1	O K
30 min Winter	21.543	0.643	29.9	873.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	134.447	0.0	598.3	29
30 min Summer	90.183	0.0	806.3	43
60 min Summer	57.866	0.0	1049.5	72
120 min Summer	32.885	0.0	1193.6	128
180 min Summer	23.621	0.0	1286.4	186
240 min Summer	18.682	0.0	1356.8	242
360 min Summer	13.435	0.0	1463.9	316
480 min Summer	10.653	0.0	1547.8	378
600 min Summer	8.910	0.0	1618.2	442
720 min Summer	7.706	0.0	1679.5	510
960 min Summer	6.140	0.0	1784.0	640
1440 min Summer	4.483	0.0	1952.8	906
2160 min Summer	3.294	0.0	2162.1	1284
2880 min Summer	2.663	0.0	2330.5	1648
4320 min Summer	2.002	0.0	2623.0	2336
5760 min Summer	1.655	0.0	2900.3	3000
7200 min Summer	1.442	0.0	3158.3	3688
8640 min Summer	1.297	0.0	3409.0	4416
10080 min Summer	1.193	0.0	3654.0	5144
15 min Winter	134.447	0.0	671.4	29
30 min Winter	90.183	0.0	904.1	43

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	21.670	0.770	29.9	1100.2	O K
120 min Winter	21.718	0.818	29.9	1189.6	O K
180 min Winter	21.734	0.834	29.9	1219.5	O K
240 min Winter	21.736	0.836	29.9	1224.1	O K
360 min Winter	21.722	0.822	29.9	1197.4	O K
480 min Winter	21.700	0.800	29.9	1155.6	O K
600 min Winter	21.681	0.781	29.9	1118.9	O K
720 min Winter	21.659	0.759	29.9	1079.1	O K
960 min Winter	21.612	0.712	29.9	993.2	O K
1440 min Winter	21.503	0.603	29.9	806.1	O K
2160 min Winter	21.355	0.455	29.9	570.7	O K
2880 min Winter	21.239	0.339	29.9	403.6	O K
4320 min Winter	21.126	0.226	27.7	255.7	O K
5760 min Winter	21.095	0.195	23.3	217.7	O K
7200 min Winter	21.078	0.178	20.5	196.7	O K
8640 min Winter	21.066	0.166	18.5	182.7	O K
10080 min Winter	21.058	0.158	17.1	172.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	57.866	0.0	1176.2	72
120 min Winter	32.885	0.0	1337.5	126
180 min Winter	23.621	0.0	1441.5	182
240 min Winter	18.682	0.0	1520.4	238
360 min Winter	13.435	0.0	1640.2	346
480 min Winter	10.653	0.0	1734.3	396
600 min Winter	8.910	0.0	1813.1	470
720 min Winter	7.706	0.0	1881.8	548
960 min Winter	6.140	0.0	1998.7	702
1440 min Winter	4.483	0.0	2188.0	980
2160 min Winter	3.294	0.0	2422.1	1356
2880 min Winter	2.663	0.0	2610.9	1696
4320 min Winter	2.002	0.0	2939.5	2292
5760 min Winter	1.655	0.0	3248.7	3000
7200 min Winter	1.442	0.0	3537.9	3688
8640 min Winter	1.297	0.0	3819.0	4416
10080 min Winter	1.193	0.0	4094.6	5144

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Rainfall Details

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
FEH Rainfall Version	2013	Cv (Winter)	0.840
Site Location	GB 448927 117350	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 2.437

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.609	4	8	0.609	8	12	0.609	12	16	0.610

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Model Details

Storage is Online Cover Level (m) 22.100

Tank or Pond Structure

Invert Level (m) 20.900

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1011.9	0.401	1443.0	0.801	1890.0	1.200	2351.9
0.101	1118.2	0.501	1553.3	0.901	2004.3		
0.201	1225.4	0.601	1664.5	1.001	2119.5		
0.301	1333.7	0.701	1776.8	1.101	2235.8		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0238-3000-0900-3000
Design Head (m)	0.900
Design Flow (l/s)	30.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	238
Invert Level (m)	20.900
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.900	30.0
Flush-Flo™	0.372	29.9
Kick-Flo®	0.690	26.4
Mean Flow over Head Range	-	24.4

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	7.8	1.200	34.4	3.000	53.5	7.000	80.8
0.200	24.0	1.400	37.0	3.500	57.7	7.500	83.5
0.300	29.7	1.600	39.5	4.000	61.5	8.000	86.2
0.400	29.9	1.800	41.8	4.500	65.1	8.500	88.8
0.500	29.4	2.000	44.0	5.000	68.6	9.000	91.3
0.600	28.4	2.200	46.1	5.500	71.8	9.500	93.2
0.800	28.3	2.400	48.0	6.000	74.9		
1.000	31.5	2.600	49.9	6.500	77.9		

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Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	22.204	0.104	31.9	211.5	O K
30 min Summer	22.232	0.132	38.7	269.9	O K
60 min Summer	22.256	0.156	43.9	319.6	O K
120 min Summer	22.270	0.170	46.9	351.3	O K
180 min Summer	22.275	0.175	47.9	362.0	O K
240 min Summer	22.276	0.176	48.0	363.8	O K
360 min Summer	22.271	0.171	47.0	352.3	O K
480 min Summer	22.263	0.163	45.5	336.6	O K
600 min Summer	22.256	0.156	44.0	320.8	O K
720 min Summer	22.249	0.149	42.5	306.3	O K
960 min Summer	22.237	0.137	39.9	280.6	O K
1440 min Summer	22.218	0.118	35.3	240.6	O K
2160 min Summer	22.197	0.097	30.2	196.9	O K
2880 min Summer	22.182	0.082	26.6	165.7	O K
4320 min Summer	22.161	0.061	21.7	123.3	O K
5760 min Summer	22.147	0.047	18.5	95.1	O K
7200 min Summer	22.137	0.037	16.2	73.4	O K
8640 min Summer	22.129	0.029	14.6	57.2	O K
10080 min Summer	22.122	0.022	13.3	44.2	O K
15 min Winter	22.217	0.117	35.1	238.4	O K
30 min Winter	22.249	0.149	42.4	304.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	29.494	0.0	243.7	27
30 min Summer	19.618	0.0	324.3	38
60 min Summer	12.728	0.0	421.1	62
120 min Summer	8.110	0.0	537.4	94
180 min Summer	6.206	0.0	617.3	128
240 min Summer	5.126	0.0	679.4	164
360 min Summer	3.877	0.0	770.5	230
480 min Summer	3.179	0.0	842.4	298
600 min Summer	2.725	0.0	903.0	364
720 min Summer	2.403	0.0	955.7	428
960 min Summer	1.972	0.0	1046.2	554
1440 min Summer	1.492	0.0	1187.7	804
2160 min Summer	1.128	0.0	1345.8	1172
2880 min Summer	0.925	0.0	1471.5	1536
4320 min Summer	0.700	0.0	1671.2	2260
5760 min Summer	0.575	0.0	1830.2	3000
7200 min Summer	0.492	0.0	1960.1	3744
8640 min Summer	0.433	0.0	2069.4	4416
10080 min Summer	0.389	0.0	2166.9	5152
15 min Winter	29.494	0.0	272.9	27
30 min Winter	19.618	0.0	363.7	38

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Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	22.276	0.176	47.9	363.3	O K
120 min Winter	22.292	0.192	50.0	397.1	O K
180 min Winter	22.295	0.195	50.1	405.0	O K
240 min Winter	22.294	0.194	50.1	401.4	O K
360 min Winter	22.282	0.182	49.2	377.3	O K
480 min Winter	22.270	0.170	46.9	351.3	O K
600 min Winter	22.259	0.159	44.6	326.8	O K
720 min Winter	22.249	0.149	42.4	304.7	O K
960 min Winter	22.231	0.131	38.5	268.0	O K
1440 min Winter	22.206	0.106	32.4	215.4	O K
2160 min Winter	22.181	0.081	26.2	163.3	O K
2880 min Winter	22.164	0.064	22.4	128.8	O K
4320 min Winter	22.142	0.042	17.4	84.7	O K
5760 min Winter	22.128	0.028	14.5	56.9	O K
7200 min Winter	22.119	0.019	12.6	36.9	O K
8640 min Winter	22.111	0.011	11.1	21.6	O K
10080 min Winter	22.105	0.005	10.0	9.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	12.728	0.0	472.1	62
120 min Winter	8.110	0.0	601.3	100
180 min Winter	6.206	0.0	691.4	138
240 min Winter	5.126	0.0	760.9	176
360 min Winter	3.877	0.0	863.2	246
480 min Winter	3.179	0.0	943.9	316
600 min Winter	2.725	0.0	1011.8	382
720 min Winter	2.403	0.0	1070.9	448
960 min Winter	1.972	0.0	1171.0	578
1440 min Winter	1.492	0.0	1330.5	830
2160 min Winter	1.128	0.0	1507.8	1200
2880 min Winter	0.925	0.0	1648.6	1564
4320 min Winter	0.700	0.0	1872.2	2300
5760 min Winter	0.575	0.0	2050.0	3056
7200 min Winter	0.492	0.0	2195.4	3752
8640 min Winter	0.433	0.0	2317.8	4496
10080 min Winter	0.389	0.0	2427.1	5240

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Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	1	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.900	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 4.425

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	1.109	4	8	1.109	8	12	1.109	12	16	1.098

Time Area Diagram

Total Area (ha) 0.000

Time From:	(mins) To:	Area (ha)
0	4	0.000

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Model Details

Storage is Online Cover Level (m) 23.300

Tank or Pond Structure

Invert Level (m) 22.100

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1981.6	0.401	2369.6	0.801	2773.7	1.200	3192.8
0.101	2077.1	0.501	2469.2	0.901	2877.3		
0.201	2173.6	0.601	2569.7	1.001	2981.8		
0.301	2271.1	0.701	2671.2	1.101	3087.3		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SFF-0300-5450-1000-5210
Design Head (m)	1.000
Design Flow (l/s)	54.5
Flush-Flo™	User Defined
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	300
Invert Level (m)	22.000
Minimum Outlet Pipe Diameter (mm)	375
Suggested Manhole Diameter (mm)	1800

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	54.5
Flush-Flo™	0.443	51.9
Kick-Flo®	0.735	47.0
Mean Flow over Head Range	-	42.1

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	9.2	1.200	59.5	3.000	92.8	7.000	140.3
0.200	30.9	1.400	64.1	3.500	100.0	7.500	145.2
0.300	50.3	1.600	68.4	4.000	106.8	8.000	149.8
0.400	51.8	1.800	72.4	4.500	113.1	8.500	154.3
0.500	51.8	2.000	76.2	5.000	119.1	9.000	158.7
0.600	50.6	2.200	79.8	5.500	124.7	9.500	163.0
0.800	48.9	2.400	83.3	6.000	130.1		
1.000	54.5	2.600	86.6	6.500	135.3		

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	22.574	0.474	51.9	1048.1	O K
30 min Summer	22.714	0.614	51.9	1398.1	O K
60 min Summer	22.848	0.748	51.9	1753.2	O K
120 min Summer	22.892	0.792	51.9	1873.7	O K
180 min Summer	22.901	0.801	51.9	1900.4	O K
240 min Summer	22.897	0.797	51.9	1888.2	O K
360 min Summer	22.874	0.774	51.9	1824.8	O K
480 min Summer	22.852	0.752	51.9	1766.0	O K
600 min Summer	22.832	0.732	51.9	1710.1	O K
720 min Summer	22.812	0.712	51.9	1655.7	O K
960 min Summer	22.772	0.672	51.9	1549.4	O K
1440 min Summer	22.692	0.592	51.9	1342.1	O K
2160 min Summer	22.584	0.484	51.9	1072.6	O K
2880 min Summer	22.497	0.397	51.9	861.8	O K
4320 min Summer	22.376	0.276	51.6	582.9	O K
5760 min Summer	22.306	0.206	50.4	429.0	O K
7200 min Summer	22.274	0.174	47.7	359.3	O K
8640 min Summer	22.256	0.156	44.0	321.6	O K
10080 min Summer	22.243	0.143	41.2	294.0	O K
15 min Winter	22.628	0.528	51.9	1181.4	O K
30 min Winter	22.782	0.682	51.9	1577.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	134.447	0.0	1114.5	29
30 min Summer	90.183	0.0	1495.2	43
60 min Summer	57.866	0.0	1919.5	72
120 min Summer	32.885	0.0	2181.8	128
180 min Summer	23.621	0.0	2350.4	184
240 min Summer	18.682	0.0	2479.6	242
360 min Summer	13.435	0.0	2673.8	312
480 min Summer	10.653	0.0	2827.3	374
600 min Summer	8.910	0.0	2955.6	438
720 min Summer	7.706	0.0	3068.0	506
960 min Summer	6.140	0.0	3259.0	646
1440 min Summer	4.483	0.0	3569.2	914
2160 min Summer	3.294	0.0	3935.0	1300
2880 min Summer	2.663	0.0	4241.8	1656
4320 min Summer	2.002	0.0	4782.5	2344
5760 min Summer	1.655	0.0	5270.8	3016
7200 min Summer	1.442	0.0	5741.1	3688
8640 min Summer	1.297	0.0	6199.7	4416
10080 min Summer	1.193	0.0	6653.3	5152
15 min Winter	134.447	0.0	1248.4	29
30 min Winter	90.183	0.0	1675.2	43

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	22.930	0.830	52.6	1979.3	O K
120 min Winter	22.982	0.882	54.0	2128.6	O K
180 min Winter	22.997	0.897	54.4	2171.9	O K
240 min Winter	22.997	0.897	54.4	2170.7	O K
360 min Winter	22.975	0.875	53.8	2107.6	O K
480 min Winter	22.946	0.846	53.1	2027.0	O K
600 min Winter	22.921	0.821	52.4	1956.2	O K
720 min Winter	22.895	0.795	51.9	1882.5	O K
960 min Winter	22.840	0.740	51.9	1732.2	O K
1440 min Winter	22.726	0.626	51.9	1430.5	O K
2160 min Winter	22.555	0.455	51.9	1000.9	O K
2880 min Winter	22.425	0.325	51.9	693.6	O K
4320 min Winter	22.285	0.185	49.7	381.9	O K
5760 min Winter	22.247	0.147	42.0	301.4	O K
7200 min Winter	22.225	0.125	37.0	255.7	O K
8640 min Winter	22.211	0.111	33.5	224.9	O K
10080 min Winter	22.200	0.100	31.0	202.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	57.866	0.0	2149.6	70
120 min Winter	32.885	0.0	2443.4	126
180 min Winter	23.621	0.0	2632.4	182
240 min Winter	18.682	0.0	2776.9	238
360 min Winter	13.435	0.0	2994.9	344
480 min Winter	10.653	0.0	3167.2	392
600 min Winter	8.910	0.0	3310.7	466
720 min Winter	7.706	0.0	3436.8	544
960 min Winter	6.140	0.0	3650.6	698
1440 min Winter	4.483	0.0	3997.3	996
2160 min Winter	3.294	0.0	4406.4	1372
2880 min Winter	2.663	0.0	4751.5	1712
4320 min Winter	2.002	0.0	5356.3	2300
5760 min Winter	1.655	0.0	5903.7	3008
7200 min Winter	1.442	0.0	6430.5	3744
8640 min Winter	1.297	0.0	6943.7	4424
10080 min Winter	1.193	0.0	7451.9	5152

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Rainfall Details

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
FEH Rainfall Version	2013	Cv (Winter)	0.840
Site Location	GB 448927 117350	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 4.425

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	1.109	4	8	1.109	8	12	1.109	12	16	1.098

Time Area Diagram

Total Area (ha) 0.000

Time From:	(mins) To:	Area (ha)
0	4	0.000

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Model Details

Storage is Online Cover Level (m) 23.300

Tank or Pond Structure

Invert Level (m) 22.100

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1981.6	0.401	2369.6	0.801	2773.7	1.200	3192.8
0.101	2077.1	0.501	2469.2	0.901	2877.3		
0.201	2173.6	0.601	2569.7	1.001	2981.8		
0.301	2271.1	0.701	2671.2	1.101	3087.3		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SFF-0300-5450-1000-5210
Design Head (m)	1.000
Design Flow (l/s)	54.5
Flush-Flo™	User Defined
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	300
Invert Level (m)	22.000
Minimum Outlet Pipe Diameter (mm)	375
Suggested Manhole Diameter (mm)	1800

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	54.5
Flush-Flo™	0.443	51.9
Kick-Flo®	0.735	47.0
Mean Flow over Head Range	-	42.1

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	9.2	1.200	59.5	3.000	92.8	7.000	140.3
0.200	30.9	1.400	64.1	3.500	100.0	7.500	145.2
0.300	50.3	1.600	68.4	4.000	106.8	8.000	149.8
0.400	51.8	1.800	72.4	4.500	113.1	8.500	154.3
0.500	51.8	2.000	76.2	5.000	119.1	9.000	158.7
0.600	50.6	2.200	79.8	5.500	124.7	9.500	163.0
0.800	48.9	2.400	83.3	6.000	130.1		
1.000	54.5	2.600	86.6	6.500	135.3		

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Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	26.001	0.101	7.8	116.0	O K
30 min Summer	26.029	0.129	11.9	149.1	O K
60 min Summer	26.056	0.156	16.0	181.1	O K
120 min Summer	26.076	0.176	19.2	205.1	O K
180 min Summer	26.086	0.186	20.7	217.7	O K
240 min Summer	26.092	0.192	21.6	225.0	O K
360 min Summer	26.095	0.195	22.1	229.1	O K
480 min Summer	26.094	0.194	21.9	228.2	O K
600 min Summer	26.092	0.192	21.6	225.0	O K
720 min Summer	26.089	0.189	21.2	220.8	O K
960 min Summer	26.081	0.181	20.1	211.8	O K
1440 min Summer	26.067	0.167	17.9	195.1	O K
2160 min Summer	26.051	0.151	15.3	175.5	O K
2880 min Summer	26.039	0.139	13.4	161.3	O K
4320 min Summer	26.023	0.123	10.9	141.9	O K
5760 min Summer	26.012	0.112	9.3	129.0	O K
7200 min Summer	26.004	0.104	8.2	119.5	O K
8640 min Summer	25.998	0.098	7.3	112.1	O K
10080 min Summer	25.993	0.093	6.6	106.2	O K
15 min Winter	26.013	0.113	9.4	129.5	O K
30 min Winter	26.044	0.144	14.1	166.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	29.494	0.0	106.4	28
30 min Summer	19.618	0.0	145.8	40
60 min Summer	12.728	0.0	201.6	64
120 min Summer	8.110	0.0	258.9	100
180 min Summer	6.206	0.0	298.2	132
240 min Summer	5.126	0.0	329.2	166
360 min Summer	3.877	0.0	374.3	232
480 min Summer	3.179	0.0	409.7	300
600 min Summer	2.725	0.0	439.4	364
720 min Summer	2.403	0.0	465.2	428
960 min Summer	1.972	0.0	508.9	552
1440 min Summer	1.492	0.0	576.8	800
2160 min Summer	1.128	0.0	663.2	1168
2880 min Summer	0.925	0.0	724.6	1532
4320 min Summer	0.700	0.0	818.7	2256
5760 min Summer	0.575	0.0	906.1	2992
7200 min Summer	0.492	0.0	969.4	3688
8640 min Summer	0.433	0.0	1021.9	4416
10080 min Summer	0.389	0.0	1066.2	5152
15 min Winter	29.494	0.0	120.7	28
30 min Winter	19.618	0.0	165.0	40

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Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	26.073	0.173	18.8	202.2	O K
120 min Winter	26.094	0.194	21.9	228.2	O K
180 min Winter	26.104	0.204	23.2	239.6	O K
240 min Winter	26.108	0.208	23.7	244.3	O K
360 min Winter	26.106	0.206	23.5	242.3	O K
480 min Winter	26.101	0.201	22.8	235.8	O K
600 min Winter	26.094	0.194	21.9	228.0	O K
720 min Winter	26.088	0.188	21.0	220.2	O K
960 min Winter	26.076	0.176	19.3	205.7	O K
1440 min Winter	26.057	0.157	16.3	182.9	O K
2160 min Winter	26.038	0.138	13.2	159.5	O K
2880 min Winter	26.025	0.125	11.2	143.9	O K
4320 min Winter	26.008	0.108	8.7	124.0	O K
5760 min Winter	25.998	0.098	7.3	111.6	O K
7200 min Winter	25.990	0.090	6.2	102.7	O K
8640 min Winter	25.984	0.084	5.6	95.8	O K
10080 min Winter	25.979	0.079	5.0	90.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	12.728	0.0	226.7	64
120 min Winter	8.110	0.0	290.9	104
180 min Winter	6.206	0.0	335.0	140
240 min Winter	5.126	0.0	369.7	176
360 min Winter	3.877	0.0	420.2	248
480 min Winter	3.179	0.0	460.0	318
600 min Winter	2.725	0.0	493.3	384
720 min Winter	2.403	0.0	522.2	448
960 min Winter	1.972	0.0	571.2	576
1440 min Winter	1.492	0.0	647.6	826
2160 min Winter	1.128	0.0	743.5	1196
2880 min Winter	0.925	0.0	812.4	1564
4320 min Winter	0.700	0.0	918.6	2292
5760 min Winter	0.575	0.0	1015.2	3000
7200 min Winter	0.492	0.0	1086.4	3752
8640 min Winter	0.433	0.0	1145.5	4480
10080 min Winter	0.389	0.0	1196.0	5240

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Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	1	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.900	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 2.198

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.548	4	8	0.550	8	12	0.550	12	16	0.550

Time Area Diagram

Total Area (ha) 0.000

Time From:	(mins) To:	Area (ha)
0	4	0.000

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Model Details

Storage is Online Cover Level (m) 27.100

Tank or Pond Structure

Invert Level (m) 25.900

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1115.9	0.401	1359.2	0.801	1618.6	1.200	1893.3
0.101	1175.2	0.501	1422.5	0.901	1685.9		
0.201	1235.5	0.601	1486.9	1.001	1754.3		
0.301	1296.8	0.701	1552.2	1.101	1823.6		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0228-2710-0900-2710
Design Head (m)	0.900
Design Flow (l/s)	27.1
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	228
Invert Level (m)	25.900
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.900	27.1
Flush-Flo™	0.358	27.0
Kick-Flo®	0.679	23.7
Mean Flow over Head Range	-	22.1

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	7.6	1.200	31.1	3.000	48.3	7.000	72.9
0.200	22.7	1.400	33.5	3.500	52.1	7.500	75.4
0.300	26.8	1.600	35.7	4.000	55.6	8.000	77.8
0.400	26.9	1.800	37.8	4.500	58.8	8.500	80.2
0.500	26.4	2.000	39.8	5.000	61.9	9.000	82.4
0.600	25.4	2.200	41.6	5.500	64.9	9.500	84.2
0.800	25.6	2.400	43.4	6.000	67.7		
1.000	28.5	2.600	45.1	6.500	70.4		

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	26.323	0.423	27.0	525.0	O K
30 min Summer	26.446	0.546	27.0	699.5	O K
60 min Summer	26.568	0.668	27.0	881.3	O K
120 min Summer	26.614	0.714	27.0	952.0	O K
180 min Summer	26.628	0.728	27.0	973.9	O K
240 min Summer	26.629	0.729	27.0	975.2	O K
360 min Summer	26.614	0.714	27.0	952.6	O K
480 min Summer	26.599	0.699	27.0	928.7	O K
600 min Summer	26.583	0.683	27.0	903.6	O K
720 min Summer	26.565	0.665	27.0	876.4	O K
960 min Summer	26.528	0.628	27.0	821.2	O K
1440 min Summer	26.459	0.559	27.0	718.2	O K
2160 min Summer	26.366	0.466	27.0	584.7	O K
2880 min Summer	26.290	0.390	27.0	480.0	O K
4320 min Summer	26.187	0.287	26.7	345.0	O K
5760 min Summer	26.133	0.233	26.1	275.7	O K
7200 min Summer	26.110	0.210	24.0	247.2	O K
8640 min Summer	26.096	0.196	22.1	229.7	O K
10080 min Summer	26.085	0.185	20.7	217.1	O K
15 min Winter	26.370	0.470	27.0	590.8	O K
30 min Winter	26.507	0.607	27.0	788.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	134.447	0.0	534.9	29
30 min Summer	90.183	0.0	722.1	43
60 min Summer	57.866	0.0	944.0	72
120 min Summer	32.885	0.0	1073.9	128
180 min Summer	23.621	0.0	1157.5	186
240 min Summer	18.682	0.0	1220.9	242
360 min Summer	13.435	0.0	1317.3	318
480 min Summer	10.653	0.0	1392.9	380
600 min Summer	8.910	0.0	1456.3	444
720 min Summer	7.706	0.0	1511.5	508
960 min Summer	6.140	0.0	1605.5	640
1440 min Summer	4.483	0.0	1757.2	904
2160 min Summer	3.294	0.0	1948.4	1284
2880 min Summer	2.663	0.0	2099.9	1648
4320 min Summer	2.002	0.0	2362.4	2336
5760 min Summer	1.655	0.0	2614.8	3000
7200 min Summer	1.442	0.0	2847.2	3688
8640 min Summer	1.297	0.0	3072.8	4416
10080 min Summer	1.193	0.0	3292.6	5144
15 min Winter	134.447	0.0	600.8	29
30 min Winter	90.183	0.0	810.1	43

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	26.641	0.741	27.0	994.3	O K
120 min Winter	26.693	0.793	27.0	1076.9	O K
180 min Winter	26.710	0.810	27.0	1105.7	O K
240 min Winter	26.714	0.814	27.0	1111.5	O K
360 min Winter	26.701	0.801	27.0	1090.5	O K
480 min Winter	26.679	0.779	27.0	1054.6	O K
600 min Winter	26.659	0.759	27.0	1023.3	O K
720 min Winter	26.637	0.737	27.0	988.9	O K
960 min Winter	26.589	0.689	27.0	912.9	O K
1440 min Winter	26.478	0.578	27.0	746.7	O K
2160 min Winter	26.332	0.432	27.0	537.8	O K
2880 min Winter	26.221	0.321	26.9	388.9	O K
4320 min Winter	26.117	0.217	24.8	255.9	O K
5760 min Winter	26.088	0.188	21.0	219.7	O K
7200 min Winter	26.071	0.171	18.4	199.2	O K
8640 min Winter	26.060	0.160	16.7	185.6	O K
10080 min Winter	26.052	0.152	15.4	175.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	57.866	0.0	1058.2	72
120 min Winter	32.885	0.0	1203.6	126
180 min Winter	23.621	0.0	1297.2	182
240 min Winter	18.682	0.0	1368.3	238
360 min Winter	13.435	0.0	1476.3	346
480 min Winter	10.653	0.0	1560.9	398
600 min Winter	8.910	0.0	1631.9	472
720 min Winter	7.706	0.0	1693.7	548
960 min Winter	6.140	0.0	1798.9	704
1440 min Winter	4.483	0.0	1969.1	980
2160 min Winter	3.294	0.0	2182.9	1356
2880 min Winter	2.663	0.0	2352.9	1700
4320 min Winter	2.002	0.0	2647.9	2296
5760 min Winter	1.655	0.0	2929.1	3000
7200 min Winter	1.442	0.0	3189.6	3744
8640 min Winter	1.297	0.0	3442.7	4416
10080 min Winter	1.193	0.0	3690.1	5144

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Rainfall Details

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
FEH Rainfall Version	2013	Cv (Winter)	0.840
Site Location	GB 448927 117350	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 2.198

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.548	4	8	0.550	8	12	0.550	12	16	0.550

Time Area Diagram

Total Area (ha) 0.000

Time From:	(mins) To:	Area (ha)
0	4	0.000

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Model Details

Storage is Online Cover Level (m) 27.100

Tank or Pond Structure

Invert Level (m) 25.900

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1115.9	0.401	1359.2	0.801	1618.6	1.200	1893.3
0.101	1175.2	0.501	1422.5	0.901	1685.9		
0.201	1235.5	0.601	1486.9	1.001	1754.3		
0.301	1296.8	0.701	1552.2	1.101	1823.6		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0228-2710-0900-2710
Design Head (m)	0.900
Design Flow (l/s)	27.1
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	228
Invert Level (m)	25.900
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.900	27.1
Flush-Flo™	0.358	27.0
Kick-Flo®	0.679	23.7
Mean Flow over Head Range	-	22.1

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	7.6	1.200	31.1	3.000	48.3	7.000	72.9
0.200	22.7	1.400	33.5	3.500	52.1	7.500	75.4
0.300	26.8	1.600	35.7	4.000	55.6	8.000	77.8
0.400	26.9	1.800	37.8	4.500	58.8	8.500	80.2
0.500	26.4	2.000	39.8	5.000	61.9	9.000	82.4
0.600	25.4	2.200	41.6	5.500	64.9	9.500	84.2
0.800	25.6	2.400	43.4	6.000	67.7		
1.000	28.5	2.600	45.1	6.500	70.4		

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Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	15.289	0.089	6.5	147.6	O K
30 min Summer	15.315	0.115	10.3	191.4	O K
60 min Summer	15.341	0.141	14.7	236.3	O K
120 min Summer	15.362	0.162	18.3	272.4	O K
180 min Summer	15.372	0.172	20.2	290.4	O K
240 min Summer	15.379	0.179	21.4	302.4	O K
360 min Summer	15.385	0.185	22.5	313.1	O K
480 min Summer	15.387	0.187	22.8	316.6	O K
600 min Summer	15.387	0.187	22.8	316.4	O K
720 min Summer	15.386	0.186	22.6	314.1	O K
960 min Summer	15.382	0.182	21.9	306.8	O K
1440 min Summer	15.372	0.172	20.1	289.2	O K
2160 min Summer	15.358	0.158	17.7	265.4	O K
2880 min Summer	15.347	0.147	15.7	246.6	O K
4320 min Summer	15.332	0.132	13.0	219.6	O K
5760 min Summer	15.321	0.121	11.2	201.1	O K
7200 min Summer	15.313	0.113	9.9	186.9	O K
8640 min Summer	15.306	0.106	8.9	175.4	O K
10080 min Summer	15.301	0.101	8.1	166.5	O K
15 min Winter	15.300	0.100	8.0	164.9	O K
30 min Winter	15.328	0.128	12.5	213.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	29.494	0.0	123.9	29
30 min Summer	19.618	0.0	172.4	42
60 min Summer	12.728	0.0	246.7	68
120 min Summer	8.110	0.0	318.3	112
180 min Summer	6.206	0.0	367.4	140
240 min Summer	5.126	0.0	406.1	172
360 min Summer	3.877	0.0	462.4	240
480 min Summer	3.179	0.0	506.5	308
600 min Summer	2.725	0.0	543.5	374
720 min Summer	2.403	0.0	575.6	440
960 min Summer	1.972	0.0	629.7	568
1440 min Summer	1.492	0.0	713.4	818
2160 min Summer	1.128	0.0	827.0	1188
2880 min Summer	0.925	0.0	903.2	1556
4320 min Summer	0.700	0.0	1018.6	2292
5760 min Summer	0.575	0.0	1133.0	3008
7200 min Summer	0.492	0.0	1211.8	3744
8640 min Summer	0.433	0.0	1276.5	4488
10080 min Summer	0.389	0.0	1330.1	5152
15 min Winter	29.494	0.0	141.5	29
30 min Winter	19.618	0.0	196.1	41

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Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	15.357	0.157	17.5	263.9	O K
120 min Winter	15.380	0.180	21.6	304.1	O K
180 min Winter	15.390	0.190	23.4	322.0	O K
240 min Winter	15.396	0.196	24.3	332.4	O K
360 min Winter	15.399	0.199	24.8	337.0	O K
480 min Winter	15.397	0.197	24.6	334.3	O K
600 min Winter	15.394	0.194	24.0	328.4	O K
720 min Winter	15.390	0.190	23.3	321.2	O K
960 min Winter	15.381	0.181	21.8	306.1	O K
1440 min Winter	15.366	0.166	19.0	278.7	O K
2160 min Winter	15.348	0.148	15.8	247.4	O K
2880 min Winter	15.335	0.135	13.6	225.1	O K
4320 min Winter	15.318	0.118	10.7	195.5	O K
5760 min Winter	15.306	0.106	8.9	176.5	O K
7200 min Winter	15.298	0.098	7.8	162.5	O K
8640 min Winter	15.292	0.092	6.8	151.9	O K
10080 min Winter	15.287	0.087	6.2	143.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	12.728	0.0	278.1	66
120 min Winter	8.110	0.0	358.4	116
180 min Winter	6.206	0.0	413.4	146
240 min Winter	5.126	0.0	456.8	184
360 min Winter	3.877	0.0	519.9	256
480 min Winter	3.179	0.0	569.4	328
600 min Winter	2.725	0.0	610.9	396
720 min Winter	2.403	0.0	646.9	464
960 min Winter	1.972	0.0	707.7	596
1440 min Winter	1.492	0.0	801.9	850
2160 min Winter	1.128	0.0	927.6	1220
2880 min Winter	0.925	0.0	1013.2	1592
4320 min Winter	0.700	0.0	1143.7	2332
5760 min Winter	0.575	0.0	1269.9	3064
7200 min Winter	0.492	0.0	1358.4	3760
8640 min Winter	0.433	0.0	1431.5	4504
10080 min Winter	0.389	0.0	1492.8	5248

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Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	1	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.900	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 2.755

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.688	4	8	0.688	8	12	0.688	12	16	0.691

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Model Details

Storage is Online Cover Level (m) 16.400

Tank or Pond Structure

Invert Level (m) 15.200

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1613.4	0.401	1959.3	0.801	2321.2	1.200	2698.2
0.101	1698.4	0.501	2048.2	0.901	2414.2		
0.201	1784.3	0.601	2138.2	1.001	2508.2		
0.301	1871.3	0.701	2229.2	1.101	2603.2		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0245-3230-0900-3230
Design Head (m)	0.900
Design Flow (l/s)	32.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	245
Invert Level (m)	15.200
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.900	32.3
Flush-Flo™	0.380	32.3
Kick-Flo®	0.696	28.6
Mean Flow over Head Range	-	26.2

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	8.0	1.200	37.1	3.000	57.7	7.000	87.1
0.200	25.0	1.400	39.9	3.500	62.2	7.500	90.1
0.300	31.9	1.600	42.6	4.000	66.3	8.000	93.0
0.400	32.3	1.800	45.1	4.500	70.2	8.500	95.7
0.500	31.8	2.000	47.4	5.000	73.9	9.000	98.5
0.600	30.7	2.200	49.6	5.500	77.4	9.500	100.5
0.800	30.5	2.400	51.8	6.000	80.8		
1.000	34.0	2.600	53.8	6.500	84.0		

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	15.573	0.373	32.3	661.8	O K
30 min Summer	15.684	0.484	32.3	880.7	O K
60 min Summer	15.794	0.594	32.3	1109.5	O K
120 min Summer	15.837	0.637	32.3	1202.6	O K
180 min Summer	15.852	0.652	32.3	1235.9	O K
240 min Summer	15.855	0.655	32.3	1243.0	O K
360 min Summer	15.846	0.646	32.3	1222.0	O K
480 min Summer	15.835	0.635	32.3	1197.9	O K
600 min Summer	15.823	0.623	32.3	1172.5	O K
720 min Summer	15.811	0.611	32.3	1145.8	O K
960 min Summer	15.784	0.584	32.3	1088.7	O K
1440 min Summer	15.730	0.530	32.3	975.2	O K
2160 min Summer	15.654	0.454	32.3	820.3	O K
2880 min Summer	15.590	0.390	32.3	695.0	O K
4320 min Summer	15.502	0.302	32.0	526.0	O K
5760 min Summer	15.451	0.251	31.3	431.4	O K
7200 min Summer	15.428	0.228	29.2	389.0	O K
8640 min Summer	15.413	0.213	27.0	362.0	O K
10080 min Summer	15.402	0.202	25.4	343.3	O K
15 min Winter	15.615	0.415	32.3	744.0	O K
30 min Winter	15.738	0.538	32.3	991.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	134.447	0.0	656.9	29
30 min Summer	90.183	0.0	890.0	43
60 min Summer	57.866	0.0	1176.0	72
120 min Summer	32.885	0.0	1338.3	128
180 min Summer	23.621	0.0	1442.9	186
240 min Summer	18.682	0.0	1522.2	242
360 min Summer	13.435	0.0	1642.6	322
480 min Summer	10.653	0.0	1736.9	380
600 min Summer	8.910	0.0	1816.0	440
720 min Summer	7.706	0.0	1884.7	506
960 min Summer	6.140	0.0	2001.6	640
1440 min Summer	4.483	0.0	2189.7	908
2160 min Summer	3.294	0.0	2437.4	1296
2880 min Summer	2.663	0.0	2626.5	1656
4320 min Summer	2.002	0.0	2951.8	2348
5760 min Summer	1.655	0.0	3274.6	3016
7200 min Summer	1.442	0.0	3565.1	3744
8640 min Summer	1.297	0.0	3846.4	4424
10080 min Summer	1.193	0.0	4118.7	5152
15 min Winter	134.447	0.0	739.0	29
30 min Winter	90.183	0.0	999.6	43

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	15.860	0.660	32.3	1252.2	O K
120 min Winter	15.910	0.710	32.3	1364.5	O K
180 min Winter	15.930	0.730	32.3	1409.1	O K
240 min Winter	15.937	0.737	32.3	1424.1	O K
360 min Winter	15.931	0.731	32.3	1411.5	O K
480 min Winter	15.914	0.714	32.3	1373.5	O K
600 min Winter	15.897	0.697	32.3	1334.8	O K
720 min Winter	15.879	0.679	32.3	1294.1	O K
960 min Winter	15.838	0.638	32.3	1204.8	O K
1440 min Winter	15.753	0.553	32.3	1023.0	O K
2160 min Winter	15.634	0.434	32.3	779.9	O K
2880 min Winter	15.539	0.339	32.2	596.6	O K
4320 min Winter	15.437	0.237	30.5	406.7	O K
5760 min Winter	15.406	0.206	25.9	350.2	O K
7200 min Winter	15.388	0.188	22.9	317.9	O K
8640 min Winter	15.376	0.176	20.8	296.2	O K
10080 min Winter	15.367	0.167	19.2	280.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	57.866	0.0	1318.8	72
120 min Winter	32.885	0.0	1500.6	128
180 min Winter	23.621	0.0	1617.6	184
240 min Winter	18.682	0.0	1706.4	240
360 min Winter	13.435	0.0	1841.2	350
480 min Winter	10.653	0.0	1946.8	448
600 min Winter	8.910	0.0	2035.3	482
720 min Winter	7.706	0.0	2112.4	556
960 min Winter	6.140	0.0	2243.4	702
1440 min Winter	4.483	0.0	2454.4	984
2160 min Winter	3.294	0.0	2731.4	1372
2880 min Winter	2.663	0.0	2943.6	1716
4320 min Winter	2.002	0.0	3309.7	2336
5760 min Winter	1.655	0.0	3668.5	3056
7200 min Winter	1.442	0.0	3994.3	3752
8640 min Winter	1.297	0.0	4310.2	4488
10080 min Winter	1.193	0.0	4617.4	5152

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Rainfall Details

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
FEH Rainfall Version	2013	Cv (Winter)	0.840
Site Location	GB 448927 117350	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 2.755

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.688	4	8	0.688	8	12	0.688	12	16	0.691

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Model Details

Storage is Online Cover Level (m) 16.400

Tank or Pond Structure

Invert Level (m) 15.200

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1613.4	0.401	1959.3	0.801	2321.2	1.200	2698.2
0.101	1698.4	0.501	2048.2	0.901	2414.2		
0.201	1784.3	0.601	2138.2	1.001	2508.2		
0.301	1871.3	0.701	2229.2	1.101	2603.2		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0245-3230-0900-3230
Design Head (m)	0.900
Design Flow (l/s)	32.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	245
Invert Level (m)	15.200
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.900	32.3
Flush-Flo™	0.380	32.3
Kick-Flo®	0.696	28.6
Mean Flow over Head Range	-	26.2

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	8.0	1.200	37.1	3.000	57.7	7.000	87.1
0.200	25.0	1.400	39.9	3.500	62.2	7.500	90.1
0.300	31.9	1.600	42.6	4.000	66.3	8.000	93.0
0.400	32.3	1.800	45.1	4.500	70.2	8.500	95.7
0.500	31.8	2.000	47.4	5.000	73.9	9.000	98.5
0.600	30.7	2.200	49.6	5.500	77.4	9.500	100.5
0.800	30.5	2.400	51.8	6.000	80.8		
1.000	34.0	2.600	53.8	6.500	84.0		

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Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	19.822	0.122	15.1	77.0	O K
30 min Summer	19.855	0.155	15.3	99.3	O K
60 min Summer	19.883	0.183	15.4	118.3	O K
120 min Summer	19.897	0.197	15.5	128.1	O K
180 min Summer	19.899	0.199	15.5	129.7	O K
240 min Summer	19.897	0.197	15.5	128.2	O K
360 min Summer	19.886	0.186	15.4	120.6	O K
480 min Summer	19.874	0.174	15.4	112.3	O K
600 min Summer	19.862	0.162	15.4	104.0	O K
720 min Summer	19.850	0.150	15.3	95.8	O K
960 min Summer	19.828	0.128	15.2	80.8	O K
1440 min Summer	19.793	0.093	14.8	58.1	O K
2160 min Summer	19.765	0.065	12.9	40.1	O K
2880 min Summer	19.747	0.047	11.3	29.0	O K
4320 min Summer	19.726	0.026	9.1	15.9	O K
5760 min Summer	19.714	0.014	7.7	8.2	O K
7200 min Summer	19.705	0.005	6.8	3.0	O K
8640 min Summer	19.700	0.000	6.1	0.0	O K
10080 min Summer	19.700	0.000	5.5	0.0	O K
15 min Winter	19.838	0.138	15.2	87.9	O K
30 min Winter	19.876	0.176	15.4	113.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	29.494	0.0	95.1	26
30 min Summer	19.618	0.0	126.8	38
60 min Summer	12.728	0.0	164.4	62
120 min Summer	8.110	0.0	209.3	100
180 min Summer	6.206	0.0	240.7	134
240 min Summer	5.126	0.0	264.9	168
360 min Summer	3.877	0.0	300.2	236
480 min Summer	3.179	0.0	328.4	304
600 min Summer	2.725	0.0	352.0	370
720 min Summer	2.403	0.0	373.0	434
960 min Summer	1.972	0.0	407.8	558
1440 min Summer	1.492	0.0	463.1	792
2160 min Summer	1.128	0.0	525.1	1148
2880 min Summer	0.925	0.0	573.9	1508
4320 min Summer	0.700	0.0	651.7	2216
5760 min Summer	0.575	0.0	713.9	2944
7200 min Summer	0.492	0.0	764.2	3680
8640 min Summer	0.433	0.0	807.1	0
10080 min Summer	0.389	0.0	845.1	0
15 min Winter	29.494	0.0	106.5	27
30 min Winter	19.618	0.0	142.0	39

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Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	19.910	0.210	15.5	137.0	O K
120 min Winter	19.926	0.226	15.5	149.0	O K
180 min Winter	19.928	0.228	15.5	150.0	O K
240 min Winter	19.923	0.223	15.5	146.7	O K
360 min Winter	19.904	0.204	15.5	133.0	O K
480 min Winter	19.883	0.183	15.4	118.2	O K
600 min Winter	19.862	0.162	15.4	104.2	O K
720 min Winter	19.843	0.143	15.3	91.0	O K
960 min Winter	19.809	0.109	15.0	68.7	O K
1440 min Winter	19.771	0.071	13.4	43.8	O K
2160 min Winter	19.742	0.042	10.8	25.7	O K
2880 min Winter	19.726	0.026	9.1	15.8	O K
4320 min Winter	19.707	0.007	7.0	4.2	O K
5760 min Winter	19.700	0.000	5.9	0.0	O K
7200 min Winter	19.700	0.000	5.0	0.0	O K
8640 min Winter	19.700	0.000	4.4	0.0	O K
10080 min Winter	19.700	0.000	4.0	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	12.728	0.0	184.1	64
120 min Winter	8.110	0.0	234.9	108
180 min Winter	6.206	0.0	269.3	144
240 min Winter	5.126	0.0	296.7	182
360 min Winter	3.877	0.0	336.6	256
480 min Winter	3.179	0.0	368.2	328
600 min Winter	2.725	0.0	394.8	394
720 min Winter	2.403	0.0	417.4	458
960 min Winter	1.972	0.0	456.9	578
1440 min Winter	1.492	0.0	518.7	808
2160 min Winter	1.128	0.0	588.0	1164
2880 min Winter	0.925	0.0	642.7	1532
4320 min Winter	0.700	0.0	729.9	2252
5760 min Winter	0.575	0.0	799.6	0
7200 min Winter	0.492	0.0	856.2	0
8640 min Winter	0.433	0.0	904.0	0
10080 min Winter	0.389	0.0	946.6	0

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Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	1	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.900	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 1.725

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.424	4	8	0.424	8	12	0.424	12	16	0.453

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Model Details

Storage is Online Cover Level (m) 21.074

Tank or Pond Structure

Invert Level (m) 19.700

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	601.7	0.401	806.9	0.801	1027.7	1.201	1264.4
0.101	651.5	0.501	860.6	0.901	1085.4	1.301	1326.0
0.201	702.3	0.601	915.3	1.001	1144.1	1.374	1371.5
0.301	754.1	0.701	971.0	1.101	1203.7		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SFF-0177-1620-1100-1550
Design Head (m)	1.100
Design Flow (l/s)	16.2
Flush-Flo™	User Defined
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	177
Invert Level (m)	19.600
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.100	16.2
Flush-Flo™	0.323	15.5
Kick-Flo®	0.705	13.1
Mean Flow over Head Range	-	13.4

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.3	1.200	16.9	3.000	26.1	7.000	39.3
0.200	14.9	1.400	18.2	3.500	28.2	7.500	40.7
0.300	15.5	1.600	19.4	4.000	30.0	8.000	42.0
0.400	15.4	1.800	20.5	4.500	31.8	8.500	43.2
0.500	15.1	2.000	21.5	5.000	33.4	9.000	44.4
0.600	14.5	2.200	22.5	5.500	35.0	9.500	45.6
0.800	13.9	2.400	23.5	6.000	36.5		
1.000	15.5	2.600	24.4	6.500	37.9		

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	20.254	0.554	15.5	411.6	O K
30 min Summer	20.403	0.703	15.5	549.7	O K
60 min Summer	20.541	0.841	15.5	690.2	O K
120 min Summer	20.591	0.891	15.5	743.4	O K
180 min Summer	20.607	0.907	15.5	760.0	O K
240 min Summer	20.608	0.908	15.5	761.5	O K
360 min Summer	20.591	0.891	15.5	743.0	O K
480 min Summer	20.567	0.867	15.5	717.3	O K
600 min Summer	20.546	0.846	15.5	695.1	O K
720 min Summer	20.527	0.827	15.5	675.2	O K
960 min Summer	20.493	0.793	15.5	640.4	O K
1440 min Summer	20.435	0.735	15.5	581.1	O K
2160 min Summer	20.352	0.652	15.5	501.1	O K
2880 min Summer	20.262	0.562	15.5	418.5	O K
4320 min Summer	20.108	0.408	15.5	287.3	O K
5760 min Summer	19.993	0.293	15.5	197.7	O K
7200 min Summer	19.911	0.211	15.5	138.1	O K
8640 min Summer	19.856	0.156	15.3	99.9	O K
10080 min Summer	19.820	0.120	15.1	75.9	O K
15 min Winter	20.312	0.612	15.5	464.2	O K
30 min Winter	20.473	0.773	15.5	619.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	134.447	0.0	434.5	30
30 min Summer	90.183	0.0	583.0	44
60 min Summer	57.866	0.0	748.0	72
120 min Summer	32.885	0.0	850.9	130
180 min Summer	23.621	0.0	916.5	188
240 min Summer	18.682	0.0	966.4	244
360 min Summer	13.435	0.0	1042.5	360
480 min Summer	10.653	0.0	1102.0	420
600 min Summer	8.910	0.0	1152.5	482
720 min Summer	7.706	0.0	1196.2	544
960 min Summer	6.140	0.0	1270.7	678
1440 min Summer	4.483	0.0	1391.5	956
2160 min Summer	3.294	0.0	1533.5	1372
2880 min Summer	2.663	0.0	1653.4	1764
4320 min Summer	2.002	0.0	1864.3	2480
5760 min Summer	1.655	0.0	2054.8	3176
7200 min Summer	1.442	0.0	2238.0	3888
8640 min Summer	1.297	0.0	2416.8	4512
10080 min Summer	1.193	0.0	2593.8	5248
15 min Winter	134.447	0.0	486.5	30
30 min Winter	90.183	0.0	653.2	44

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	20.625	0.925	15.7	780.2	O K
120 min Winter	20.684	0.984	16.1	845.9	O K
180 min Winter	20.706	1.006	16.2	870.7	O K
240 min Winter	20.712	1.012	16.3	877.9	O K
360 min Winter	20.703	1.003	16.2	867.3	O K
480 min Winter	20.681	0.981	16.1	842.2	O K
600 min Winter	20.654	0.954	15.9	811.9	O K
720 min Winter	20.632	0.932	15.7	787.6	O K
960 min Winter	20.589	0.889	15.5	740.9	O K
1440 min Winter	20.506	0.806	15.5	653.3	O K
2160 min Winter	20.381	0.681	15.5	529.1	O K
2880 min Winter	20.235	0.535	15.5	394.7	O K
4320 min Winter	19.991	0.291	15.5	196.5	O K
5760 min Winter	19.843	0.143	15.3	91.0	O K
7200 min Winter	19.784	0.084	14.5	52.0	O K
8640 min Winter	19.767	0.067	13.1	41.2	O K
10080 min Winter	19.755	0.055	12.1	34.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	57.866	0.0	838.5	72
120 min Winter	32.885	0.0	952.8	128
180 min Winter	23.621	0.0	1026.1	184
240 min Winter	18.682	0.0	1082.5	240
360 min Winter	13.435	0.0	1167.5	352
480 min Winter	10.653	0.0	1234.8	460
600 min Winter	8.910	0.0	1290.7	546
720 min Winter	7.706	0.0	1339.5	574
960 min Winter	6.140	0.0	1422.9	730
1440 min Winter	4.483	0.0	1558.6	1036
2160 min Winter	3.294	0.0	1717.3	1484
2880 min Winter	2.663	0.0	1852.0	1884
4320 min Winter	2.002	0.0	2088.3	2560
5760 min Winter	1.655	0.0	2301.5	3176
7200 min Winter	1.442	0.0	2506.8	3712
8640 min Winter	1.297	0.0	2706.9	4416
10080 min Winter	1.193	0.0	2905.1	5144

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Rainfall Details

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
FEH Rainfall Version	2013	Cv (Winter)	0.840
Site Location	GB 448927 117350	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.725

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.424	4	8	0.424	8	12	0.424	12	16	0.453

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Model Details

Storage is Online Cover Level (m) 21.074

Tank or Pond Structure

Invert Level (m) 19.700

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	601.7	0.401	806.9	0.801	1027.7	1.201	1264.4
0.101	651.5	0.501	860.6	0.901	1085.4	1.301	1326.0
0.201	702.3	0.601	915.3	1.001	1144.1	1.374	1371.5
0.301	754.1	0.701	971.0	1.101	1203.7		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SFF-0177-1620-1100-1550
Design Head (m)	1.100
Design Flow (l/s)	16.2
Flush-Flo™	User Defined
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	177
Invert Level (m)	19.600
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.100	16.2
Flush-Flo™	0.323	15.5
Kick-Flo®	0.705	13.1
Mean Flow over Head Range	-	13.4

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.3	1.200	16.9	3.000	26.1	7.000	39.3
0.200	14.9	1.400	18.2	3.500	28.2	7.500	40.7
0.300	15.5	1.600	19.4	4.000	30.0	8.000	42.0
0.400	15.4	1.800	20.5	4.500	31.8	8.500	43.2
0.500	15.1	2.000	21.5	5.000	33.4	9.000	44.4
0.600	14.5	2.200	22.5	5.500	35.0	9.500	45.6
0.800	13.9	2.400	23.5	6.000	36.5		
1.000	15.5	2.600	24.4	6.500	37.9		

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Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	18.353	0.103	8.0	115.0	O K
30 min Summer	18.382	0.132	12.2	147.7	O K
60 min Summer	18.408	0.158	16.4	179.1	O K
120 min Summer	18.428	0.178	19.6	202.7	O K
180 min Summer	18.438	0.188	21.0	215.0	O K
240 min Summer	18.444	0.194	21.9	221.9	O K
360 min Summer	18.447	0.197	22.3	225.6	O K
480 min Summer	18.446	0.196	22.1	224.3	O K
600 min Summer	18.443	0.193	21.7	220.9	O K
720 min Summer	18.440	0.190	21.2	216.5	O K
960 min Summer	18.432	0.182	20.1	207.2	O K
1440 min Summer	18.418	0.168	17.9	190.4	O K
2160 min Summer	18.401	0.151	15.3	170.8	O K
2880 min Summer	18.389	0.139	13.4	156.8	O K
4320 min Summer	18.373	0.123	10.9	137.8	O K
5760 min Summer	18.362	0.112	9.3	125.0	O K
7200 min Summer	18.354	0.104	8.2	115.8	O K
8640 min Summer	18.348	0.098	7.3	108.7	O K
10080 min Summer	18.343	0.093	6.6	102.8	O K
15 min Winter	18.365	0.115	9.7	128.4	O K
30 min Winter	18.396	0.146	14.5	164.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	29.494	0.0	106.5	28
30 min Summer	19.618	0.0	145.7	40
60 min Summer	12.728	0.0	200.7	64
120 min Summer	8.110	0.0	257.7	100
180 min Summer	6.206	0.0	296.8	132
240 min Summer	5.126	0.0	327.6	166
360 min Summer	3.877	0.0	372.4	232
480 min Summer	3.179	0.0	407.7	298
600 min Summer	2.725	0.0	437.2	364
720 min Summer	2.403	0.0	462.9	426
960 min Summer	1.972	0.0	506.3	552
1440 min Summer	1.492	0.0	573.9	798
2160 min Summer	1.128	0.0	659.3	1168
2880 min Summer	0.925	0.0	720.3	1532
4320 min Summer	0.700	0.0	814.2	2256
5760 min Summer	0.575	0.0	900.5	2992
7200 min Summer	0.492	0.0	963.5	3688
8640 min Summer	0.433	0.0	1015.8	4416
10080 min Summer	0.389	0.0	1060.0	5152
15 min Winter	29.494	0.0	120.7	28
30 min Winter	19.618	0.0	164.8	40

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Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	18.426	0.176	19.2	200.0	O K
120 min Winter	18.447	0.197	22.2	225.4	O K
180 min Winter	18.456	0.206	23.4	236.4	O K
240 min Winter	18.460	0.210	23.9	240.7	O K
360 min Winter	18.457	0.207	23.6	238.2	O K
480 min Winter	18.452	0.202	22.9	231.4	O K
600 min Winter	18.445	0.195	22.0	223.4	O K
720 min Winter	18.439	0.189	21.1	215.4	O K
960 min Winter	18.427	0.177	19.3	200.7	O K
1440 min Winter	18.407	0.157	16.2	178.0	O K
2160 min Winter	18.388	0.138	13.2	154.9	O K
2880 min Winter	18.375	0.125	11.2	139.5	O K
4320 min Winter	18.358	0.108	8.7	120.2	O K
5760 min Winter	18.347	0.097	7.2	108.0	O K
7200 min Winter	18.340	0.090	6.2	99.2	O K
8640 min Winter	18.334	0.084	5.5	92.6	O K
10080 min Winter	18.329	0.079	5.0	87.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	12.728	0.0	225.7	64
120 min Winter	8.110	0.0	289.6	102
180 min Winter	6.206	0.0	333.4	140
240 min Winter	5.126	0.0	367.9	176
360 min Winter	3.877	0.0	418.1	248
480 min Winter	3.179	0.0	457.6	316
600 min Winter	2.725	0.0	490.7	382
720 min Winter	2.403	0.0	519.5	448
960 min Winter	1.972	0.0	568.2	574
1440 min Winter	1.492	0.0	644.2	824
2160 min Winter	1.128	0.0	739.1	1192
2880 min Winter	0.925	0.0	807.6	1560
4320 min Winter	0.700	0.0	913.3	2296
5760 min Winter	0.575	0.0	1009.0	3008
7200 min Winter	0.492	0.0	1079.7	3744
8640 min Winter	0.433	0.0	1138.6	4496
10080 min Winter	0.389	0.0	1188.9	5152

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Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	1	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.900	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 2.184

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.546	4	8	0.546	8	12	0.546	12	16	0.546

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Model Details

Storage is Online Cover Level (m) 19.450

Tank or Pond Structure

Invert Level (m) 18.250

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1076.4	0.401	1361.2	0.801	1662.1	1.200	1978.3
0.101	1146.1	0.501	1434.9	0.901	1739.9		
0.201	1216.8	0.601	1509.7	1.001	1818.6		
0.301	1288.5	0.701	1585.4	1.101	1898.4		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0227-2690-0900-2690
Design Head (m)	0.900
Design Flow (l/s)	26.9
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	227
Invert Level (m)	18.250
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.900	26.9
Flush-Flo™	0.357	26.9
Kick-Flo®	0.682	23.6
Mean Flow over Head Range	-	22.0

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	7.6	1.200	30.9	3.000	48.0	7.000	72.4
0.200	22.6	1.400	33.2	3.500	51.7	7.500	74.9
0.300	26.7	1.600	35.4	4.000	55.2	8.000	77.3
0.400	26.8	1.800	37.5	4.500	58.4	8.500	79.6
0.500	26.3	2.000	39.5	5.000	61.5	9.000	81.8
0.600	25.3	2.200	41.3	5.500	64.4	9.500	83.6
0.800	25.4	2.400	43.1	6.000	67.2		
1.000	28.3	2.600	44.8	6.500	69.8		

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	18.675	0.425	26.9	521.4	O K
30 min Summer	18.797	0.547	26.9	694.7	O K
60 min Summer	18.916	0.666	26.9	875.1	O K
120 min Summer	18.961	0.711	26.9	945.0	O K
180 min Summer	18.974	0.724	26.9	966.5	O K
240 min Summer	18.975	0.725	26.9	967.5	O K
360 min Summer	18.960	0.710	26.9	944.4	O K
480 min Summer	18.945	0.695	26.9	919.8	O K
600 min Summer	18.928	0.678	26.9	893.6	O K
720 min Summer	18.910	0.660	26.9	866.2	O K
960 min Summer	18.875	0.625	26.9	811.0	O K
1440 min Summer	18.806	0.556	26.9	708.3	O K
2160 min Summer	18.714	0.464	26.9	575.3	O K
2880 min Summer	18.639	0.389	26.9	471.1	O K
4320 min Summer	18.537	0.287	26.6	337.0	O K
5760 min Summer	18.482	0.232	26.0	268.6	O K
7200 min Summer	18.460	0.210	23.9	240.8	O K
8640 min Summer	18.445	0.195	22.0	223.5	O K
10080 min Summer	18.435	0.185	20.6	211.1	O K
15 min Winter	18.722	0.472	26.9	586.8	O K
30 min Winter	18.856	0.606	26.9	783.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	134.447	0.0	532.6	29
30 min Summer	90.183	0.0	718.6	43
60 min Summer	57.866	0.0	938.6	72
120 min Summer	32.885	0.0	1067.6	128
180 min Summer	23.621	0.0	1150.7	186
240 min Summer	18.682	0.0	1213.8	242
360 min Summer	13.435	0.0	1309.6	318
480 min Summer	10.653	0.0	1384.8	380
600 min Summer	8.910	0.0	1447.8	442
720 min Summer	7.706	0.0	1502.6	506
960 min Summer	6.140	0.0	1596.1	638
1440 min Summer	4.483	0.0	1746.9	904
2160 min Summer	3.294	0.0	1936.3	1284
2880 min Summer	2.663	0.0	2087.0	1648
4320 min Summer	2.002	0.0	2348.1	2336
5760 min Summer	1.655	0.0	2598.4	3000
7200 min Summer	1.442	0.0	2829.4	3688
8640 min Summer	1.297	0.0	3053.6	4416
10080 min Summer	1.193	0.0	3272.3	5144
15 min Winter	134.447	0.0	598.0	29
30 min Winter	90.183	0.0	806.2	43

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	18.987	0.737	26.9	987.6	O K
120 min Winter	19.037	0.787	26.9	1069.4	O K
180 min Winter	19.054	0.804	26.9	1097.8	O K
240 min Winter	19.058	0.808	26.9	1103.4	O K
360 min Winter	19.045	0.795	26.9	1082.1	O K
480 min Winter	19.023	0.773	26.9	1045.7	O K
600 min Winter	19.003	0.753	26.9	1013.9	O K
720 min Winter	18.982	0.732	26.9	979.1	O K
960 min Winter	18.933	0.683	26.9	901.6	O K
1440 min Winter	18.825	0.575	26.9	735.7	O K
2160 min Winter	18.680	0.430	26.9	527.9	O K
2880 min Winter	18.570	0.320	26.8	380.1	O K
4320 min Winter	18.466	0.216	24.7	249.2	O K
5760 min Winter	18.437	0.187	20.9	213.5	O K
7200 min Winter	18.421	0.171	18.4	193.6	O K
8640 min Winter	18.409	0.159	16.6	180.1	O K
10080 min Winter	18.401	0.151	15.3	170.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	57.866	0.0	1052.0	72
120 min Winter	32.885	0.0	1196.5	126
180 min Winter	23.621	0.0	1289.6	182
240 min Winter	18.682	0.0	1360.3	238
360 min Winter	13.435	0.0	1467.6	346
480 min Winter	10.653	0.0	1551.7	400
600 min Winter	8.910	0.0	1622.3	472
720 min Winter	7.706	0.0	1683.7	550
960 min Winter	6.140	0.0	1788.3	704
1440 min Winter	4.483	0.0	1957.5	978
2160 min Winter	3.294	0.0	2169.4	1352
2880 min Winter	2.663	0.0	2338.4	1688
4320 min Winter	2.002	0.0	2631.7	2296
5760 min Winter	1.655	0.0	2910.7	3000
7200 min Winter	1.442	0.0	3169.6	3736
8640 min Winter	1.297	0.0	3421.1	4416
10080 min Winter	1.193	0.0	3667.2	5144

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Rainfall Details

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
FEH Rainfall Version	2013	Cv (Winter)	0.840
Site Location	GB 448927 117350	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 2.184

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.546	4	8	0.546	8	12	0.546	12	16	0.546

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Model Details

Storage is Online Cover Level (m) 19.450

Tank or Pond Structure

Invert Level (m) 18.250

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1076.4	0.401	1361.2	0.801	1662.1	1.200	1978.3
0.101	1146.1	0.501	1434.9	0.901	1739.9		
0.201	1216.8	0.601	1509.7	1.001	1818.6		
0.301	1288.5	0.701	1585.4	1.101	1898.4		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0227-2690-0900-2690
Design Head (m)	0.900
Design Flow (l/s)	26.9
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	227
Invert Level (m)	18.250
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.900	26.9
Flush-Flo™	0.357	26.9
Kick-Flo®	0.682	23.6
Mean Flow over Head Range	-	22.0

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	7.6	1.200	30.9	3.000	48.0	7.000	72.4
0.200	22.6	1.400	33.2	3.500	51.7	7.500	74.9
0.300	26.7	1.600	35.4	4.000	55.2	8.000	77.3
0.400	26.8	1.800	37.5	4.500	58.4	8.500	79.6
0.500	26.3	2.000	39.5	5.000	61.5	9.000	81.8
0.600	25.3	2.200	41.3	5.500	64.4	9.500	83.6
0.800	25.4	2.400	43.1	6.000	67.2		
1.000	28.3	2.600	44.8	6.500	69.8		

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Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	21.473	0.073	22.1	141.0	O K
30 min Summer	21.493	0.093	26.2	180.1	O K
60 min Summer	21.509	0.109	29.6	212.7	O K
120 min Summer	21.519	0.119	31.6	232.2	O K
180 min Summer	21.522	0.122	32.0	237.8	O K
240 min Summer	21.522	0.122	32.0	237.7	O K
360 min Summer	21.517	0.117	31.1	228.0	O K
480 min Summer	21.512	0.112	30.1	217.2	O K
600 min Summer	21.506	0.106	29.0	207.0	O K
720 min Summer	21.502	0.102	28.1	197.3	O K
960 min Summer	21.493	0.093	26.2	179.8	O K
1440 min Summer	21.478	0.078	23.3	151.6	O K
2160 min Summer	21.462	0.062	20.0	120.0	O K
2880 min Summer	21.451	0.051	17.7	97.2	O K
4320 min Summer	21.434	0.034	14.5	65.4	O K
5760 min Summer	21.423	0.023	12.5	44.3	O K
7200 min Summer	21.415	0.015	11.0	28.3	O K
8640 min Summer	21.409	0.009	10.0	16.6	O K
10080 min Summer	21.404	0.004	9.1	7.6	O K
15 min Winter	21.482	0.082	24.1	159.4	O K
30 min Winter	21.505	0.105	28.7	204.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	29.494	0.0	164.9	27
30 min Summer	19.618	0.0	219.7	38
60 min Summer	12.728	0.0	285.5	62
120 min Summer	8.110	0.0	363.9	94
180 min Summer	6.206	0.0	417.4	130
240 min Summer	5.126	0.0	460.6	164
360 min Summer	3.877	0.0	521.6	232
480 min Summer	3.179	0.0	570.7	298
600 min Summer	2.725	0.0	612.3	364
720 min Summer	2.403	0.0	647.8	430
960 min Summer	1.972	0.0	708.3	558
1440 min Summer	1.492	0.0	804.2	808
2160 min Summer	1.128	0.0	912.0	1176
2880 min Summer	0.925	0.0	997.4	1540
4320 min Summer	0.700	0.0	1132.1	2260
5760 min Summer	0.575	0.0	1239.6	3000
7200 min Summer	0.492	0.0	1328.1	3744
8640 min Summer	0.433	0.0	1401.9	4416
10080 min Summer	0.389	0.0	1467.9	5152
15 min Winter	29.494	0.0	184.7	27
30 min Winter	19.618	0.0	246.0	38

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Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	21.524	0.124	32.5	242.5	O K
120 min Winter	21.535	0.135	34.4	263.5	O K
180 min Winter	21.537	0.137	34.7	267.2	O K
240 min Winter	21.535	0.135	34.4	263.9	O K
360 min Winter	21.526	0.126	32.8	246.7	O K
480 min Winter	21.517	0.117	31.2	228.4	O K
600 min Winter	21.509	0.109	29.5	211.5	O K
720 min Winter	21.501	0.101	28.0	197.0	O K
960 min Winter	21.489	0.089	25.4	172.0	O K
1440 min Winter	21.470	0.070	21.5	134.4	O K
2160 min Winter	21.450	0.050	17.5	96.2	O K
2880 min Winter	21.437	0.037	15.0	70.2	O K
4320 min Winter	21.419	0.019	11.8	36.6	O K
5760 min Winter	21.408	0.008	9.9	15.3	O K
7200 min Winter	21.401	0.001	8.7	1.0	O K
8640 min Winter	21.400	0.000	7.7	0.0	O K
10080 min Winter	21.400	0.000	6.9	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	12.728	0.0	319.0	62
120 min Winter	8.110	0.0	407.1	100
180 min Winter	6.206	0.0	467.7	138
240 min Winter	5.126	0.0	515.7	174
360 min Winter	3.877	0.0	585.0	248
480 min Winter	3.179	0.0	639.8	316
600 min Winter	2.725	0.0	685.3	386
720 min Winter	2.403	0.0	724.9	452
960 min Winter	1.972	0.0	793.8	582
1440 min Winter	1.492	0.0	901.2	836
2160 min Winter	1.128	0.0	1021.0	1216
2880 min Winter	0.925	0.0	1116.7	1584
4320 min Winter	0.700	0.0	1268.0	2304
5760 min Winter	0.575	0.0	1388.6	3008
7200 min Winter	0.492	0.0	1488.1	3680
8640 min Winter	0.433	0.0	1571.1	0
10080 min Winter	0.389	0.0	1645.1	0

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Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	1	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.900	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 2.998

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.750	4	8	0.750	8	12	0.750	12	16	0.748

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Model Details

Storage is Online Cover Level (m) 22.400

Tank or Pond Structure

Invert Level (m) 21.400

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1904.7	0.301	2137.6	0.601	2379.6	0.901	2630.6
0.101	1981.3	0.401	2217.3	0.701	2462.3	1.000	2715.5
0.201	2058.9	0.501	2297.9	0.801	2546.0		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SFF-0269-4140-1000-4040
Design Head (m)	1.000
Design Flow (l/s)	41.4
Flush-Flo™	User Defined
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	269
Invert Level (m)	21.300
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1800

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	41.4
Flush-Flo™	0.411	40.3
Kick-Flo®	0.737	35.8
Mean Flow over Head Range	-	33.0

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	8.5	1.200	45.2	3.000	70.4	7.000	106.3
0.200	27.7	1.400	48.7	3.500	75.9	7.500	110.0
0.300	39.6	1.600	51.9	4.000	80.9	8.000	113.5
0.400	40.3	1.800	55.0	4.500	85.7	8.500	116.9
0.500	40.0	2.000	57.8	5.000	90.2	9.000	120.2
0.600	39.0	2.200	60.6	5.500	94.5	9.500	123.5
0.800	37.2	2.400	63.2	6.000	98.6		
1.000	41.4	2.600	65.7	6.500	102.6		

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	21.746	0.346	40.3	704.2	O K
30 min Summer	21.851	0.451	40.3	936.7	O K
60 min Summer	21.953	0.553	40.3	1171.9	O K
120 min Summer	21.984	0.584	40.3	1246.2	O K
180 min Summer	21.989	0.589	40.3	1256.5	O K
240 min Summer	21.982	0.582	40.3	1239.5	O K
360 min Summer	21.959	0.559	40.3	1186.4	O K
480 min Summer	21.939	0.539	40.3	1138.3	O K
600 min Summer	21.919	0.519	40.3	1092.6	O K
720 min Summer	21.899	0.499	40.3	1048.0	O K
960 min Summer	21.862	0.462	40.3	963.2	O K
1440 min Summer	21.796	0.396	40.3	814.8	O K
2160 min Summer	21.714	0.314	40.3	636.0	O K
2880 min Summer	21.652	0.252	40.1	504.6	O K
4320 min Summer	21.575	0.175	39.1	345.6	O K
5760 min Summer	21.542	0.142	35.6	278.9	O K
7200 min Summer	21.523	0.123	32.2	239.1	O K
8640 min Summer	21.510	0.110	29.7	213.6	O K
10080 min Summer	21.500	0.100	27.8	194.9	O K
15 min Winter	21.787	0.387	40.3	793.9	O K
30 min Winter	21.904	0.504	40.3	1058.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	134.447	0.0	754.8	29
30 min Summer	90.183	0.0	1012.6	43
60 min Summer	57.866	0.0	1299.4	72
120 min Summer	32.885	0.0	1478.1	128
180 min Summer	23.621	0.0	1592.1	184
240 min Summer	18.682	0.0	1679.7	240
360 min Summer	13.435	0.0	1811.8	298
480 min Summer	10.653	0.0	1914.9	358
600 min Summer	8.910	0.0	2002.8	422
720 min Summer	7.706	0.0	2077.9	490
960 min Summer	6.140	0.0	2207.3	624
1440 min Summer	4.483	0.0	2418.2	888
2160 min Summer	3.294	0.0	2665.1	1264
2880 min Summer	2.663	0.0	2873.5	1620
4320 min Summer	2.002	0.0	3240.0	2300
5760 min Summer	1.655	0.0	3570.4	3000
7200 min Summer	1.442	0.0	3889.9	3744
8640 min Summer	1.297	0.0	4199.9	4416
10080 min Summer	1.193	0.0	4507.2	5152
15 min Winter	134.447	0.0	845.3	29
30 min Winter	90.183	0.0	1134.7	43

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	22.019	0.619	40.3	1329.2	O K
120 min Winter	22.059	0.659	40.3	1425.6	O K
180 min Winter	22.069	0.669	40.3	1449.7	O K
240 min Winter	22.067	0.667	40.3	1443.5	O K
360 min Winter	22.044	0.644	40.3	1388.9	O K
480 min Winter	22.014	0.614	40.3	1317.4	O K
600 min Winter	21.988	0.588	40.3	1254.1	O K
720 min Winter	21.960	0.560	40.3	1189.3	O K
960 min Winter	21.905	0.505	40.3	1060.8	O K
1440 min Winter	21.803	0.403	40.3	829.5	O K
2160 min Winter	21.678	0.278	40.3	559.8	O K
2880 min Winter	21.594	0.194	39.5	384.8	O K
4320 min Winter	21.531	0.131	33.7	255.0	O K
5760 min Winter	21.503	0.103	28.4	200.9	O K
7200 min Winter	21.487	0.087	25.0	168.0	O K
8640 min Winter	21.475	0.075	22.6	145.0	O K
10080 min Winter	21.467	0.067	20.9	128.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	57.866	0.0	1456.1	70
120 min Winter	32.885	0.0	1655.3	126
180 min Winter	23.621	0.0	1783.4	182
240 min Winter	18.682	0.0	1880.5	238
360 min Winter	13.435	0.0	2028.8	344
480 min Winter	10.653	0.0	2145.7	390
600 min Winter	8.910	0.0	2242.3	462
720 min Winter	7.706	0.0	2328.1	536
960 min Winter	6.140	0.0	2473.0	682
1440 min Winter	4.483	0.0	2707.8	954
2160 min Winter	3.294	0.0	2986.2	1324
2880 min Winter	2.663	0.0	3218.5	1648
4320 min Winter	2.002	0.0	3628.7	2304
5760 min Winter	1.655	0.0	3999.1	3008
7200 min Winter	1.442	0.0	4356.1	3752
8640 min Winter	1.297	0.0	4704.0	4424
10080 min Winter	1.193	0.0	5048.1	5152

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Rainfall Details

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
FEH Rainfall Version	2013	Cv (Winter)	0.840
Site Location	GB 448927 117350	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 2.998

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.750	4	8	0.750	8	12	0.750	12	16	0.748

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Model Details

Storage is Online Cover Level (m) 22.400

Tank or Pond Structure

Invert Level (m) 21.400

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1904.7	0.301	2137.6	0.601	2379.6	0.901	2630.6
0.101	1981.3	0.401	2217.3	0.701	2462.3	1.000	2715.5
0.201	2058.9	0.501	2297.9	0.801	2546.0		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SFF-0269-4140-1000-4040
Design Head (m)	1.000
Design Flow (l/s)	41.4
Flush-Flo™	User Defined
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	269
Invert Level (m)	21.300
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1800

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	41.4
Flush-Flo™	0.411	40.3
Kick-Flo®	0.737	35.8
Mean Flow over Head Range	-	33.0

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	8.5	1.200	45.2	3.000	70.4	7.000	106.3
0.200	27.7	1.400	48.7	3.500	75.9	7.500	110.0
0.300	39.6	1.600	51.9	4.000	80.9	8.000	113.5
0.400	40.3	1.800	55.0	4.500	85.7	8.500	116.9
0.500	40.0	2.000	57.8	5.000	90.2	9.000	120.2
0.600	39.0	2.200	60.6	5.500	94.5	9.500	123.5
0.800	37.2	2.400	63.2	6.000	98.6		
1.000	41.4	2.600	65.7	6.500	102.6		

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Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	18.800	0.100	10.0	287.4	O K
30 min Summer	18.830	0.130	16.2	374.4	O K
60 min Summer	18.860	0.160	23.7	465.6	O K
120 min Summer	18.886	0.186	30.7	543.4	O K
180 min Summer	18.898	0.198	34.1	579.3	O K
240 min Summer	18.906	0.206	36.6	604.7	O K
360 min Summer	18.914	0.214	38.9	630.2	O K
480 min Summer	18.918	0.218	40.1	641.5	O K
600 min Summer	18.919	0.219	40.4	644.9	O K
720 min Summer	18.919	0.219	40.2	643.7	O K
960 min Summer	18.916	0.216	39.3	634.4	O K
1440 min Summer	18.907	0.207	36.7	606.4	O K
2160 min Summer	18.893	0.193	32.7	563.7	O K
2880 min Summer	18.881	0.181	29.3	528.0	O K
4320 min Summer	18.863	0.163	24.5	474.7	O K
5760 min Summer	18.850	0.150	21.2	436.5	O K
7200 min Summer	18.841	0.141	18.8	407.7	O K
8640 min Summer	18.833	0.133	16.9	383.9	O K
10080 min Summer	18.826	0.126	15.4	364.2	O K
15 min Winter	18.812	0.112	12.3	321.3	O K
30 min Winter	18.844	0.144	19.7	418.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	29.494	0.0	226.2	30
30 min Summer	19.618	0.0	318.3	43
60 min Summer	12.728	0.0	467.9	68
120 min Summer	8.110	0.0	606.0	120
180 min Summer	6.206	0.0	700.7	148
240 min Summer	5.126	0.0	775.3	178
360 min Summer	3.877	0.0	883.7	244
480 min Summer	3.179	0.0	968.8	312
600 min Summer	2.725	0.0	1039.9	378
720 min Summer	2.403	0.0	1101.5	444
960 min Summer	1.972	0.0	1205.4	574
1440 min Summer	1.492	0.0	1364.9	826
2160 min Summer	1.128	0.0	1593.0	1196
2880 min Summer	0.925	0.0	1739.3	1564
4320 min Summer	0.700	0.0	1958.9	2296
5760 min Summer	0.575	0.0	2187.8	3008
7200 min Summer	0.492	0.0	2339.1	3752
8640 min Summer	0.433	0.0	2462.9	4496
10080 min Summer	0.389	0.0	2563.7	5240
15 min Winter	29.494	0.0	259.5	29
30 min Winter	19.618	0.0	363.5	42

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Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	18.878	0.178	28.6	519.8	O K
120 min Winter	18.907	0.207	36.7	606.5	O K
180 min Winter	18.919	0.219	40.2	643.3	O K
240 min Winter	18.926	0.226	42.4	667.2	O K
360 min Winter	18.932	0.232	44.1	683.1	O K
480 min Winter	18.932	0.232	44.1	683.1	O K
600 min Winter	18.929	0.229	43.3	675.9	O K
720 min Winter	18.926	0.226	42.3	665.4	O K
960 min Winter	18.918	0.218	39.9	640.8	O K
1440 min Winter	18.902	0.202	35.4	592.3	O K
2160 min Winter	18.882	0.182	29.7	532.9	O K
2880 min Winter	18.868	0.168	25.7	488.4	O K
4320 min Winter	18.847	0.147	20.4	427.7	O K
5760 min Winter	18.834	0.134	17.1	387.4	O K
7200 min Winter	18.824	0.124	14.9	357.9	O K
8640 min Winter	18.816	0.116	13.2	334.7	O K
10080 min Winter	18.810	0.110	11.9	316.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	12.728	0.0	528.5	68
120 min Winter	8.110	0.0	683.3	118
180 min Winter	6.206	0.0	789.6	150
240 min Winter	5.126	0.0	873.3	186
360 min Winter	3.877	0.0	994.8	260
480 min Winter	3.179	0.0	1090.3	332
600 min Winter	2.725	0.0	1170.1	402
720 min Winter	2.403	0.0	1239.3	470
960 min Winter	1.972	0.0	1356.1	604
1440 min Winter	1.492	0.0	1535.8	860
2160 min Winter	1.128	0.0	1787.5	1240
2880 min Winter	0.925	0.0	1952.0	1612
4320 min Winter	0.700	0.0	2200.6	2344
5760 min Winter	0.575	0.0	2452.5	3064
7200 min Winter	0.492	0.0	2622.8	3824
8640 min Winter	0.433	0.0	2762.6	4504
10080 min Winter	0.389	0.0	2878.5	5256

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Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	1	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.900	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 5.330

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	1.332	4	8	1.332	8	12	1.332	12	16	1.334

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Model Details

Storage is Online Cover Level (m) 19.900

Tank or Pond Structure

Invert Level (m) 18.700

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	2816.2	0.401	3284.4	0.801	3768.6	1.200	4267.6
0.101	2931.7	0.501	3404.0	0.901	3892.2		
0.201	3048.3	0.601	3524.5	1.001	4016.7		
0.301	3165.8	0.701	3646.1	1.101	4142.3		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0342-7080-0900-7080
Design Head (m)	0.900
Design Flow (l/s)	70.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	342
Invert Level (m)	18.700
Minimum Outlet Pipe Diameter (mm)	375
Suggested Manhole Diameter (mm)	2100

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.900	70.8
Flush-Flo™	0.486	70.8
Kick-Flo®	0.758	65.1
Mean Flow over Head Range	-	54.2

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	10.0	1.200	81.4	3.000	127.0	7.000	192.3
0.200	34.7	1.400	87.7	3.500	137.0	7.500	198.9
0.300	63.2	1.600	93.6	4.000	146.2	8.000	205.3
0.400	70.1	1.800	99.1	4.500	154.9	8.500	211.5
0.500	70.8	2.000	104.3	5.000	163.1	9.000	217.6
0.600	69.8	2.200	109.2	5.500	170.9	9.500	221.5
0.800	66.9	2.400	114.0	6.000	178.3		
1.000	74.5	2.600	118.5	6.500	185.4		

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	19.118	0.418	70.4	1278.3	O K
30 min Summer	19.242	0.542	70.8	1696.6	O K
60 min Summer	19.365	0.665	70.8	2131.6	O K
120 min Summer	19.412	0.712	70.8	2300.4	O K
180 min Summer	19.426	0.726	70.8	2353.0	O K
240 min Summer	19.426	0.726	70.8	2354.3	O K
360 min Summer	19.415	0.715	70.8	2313.0	O K
480 min Summer	19.403	0.703	70.8	2269.3	O K
600 min Summer	19.390	0.690	70.8	2220.9	O K
720 min Summer	19.375	0.675	70.8	2167.4	O K
960 min Summer	19.343	0.643	70.8	2052.5	O K
1440 min Summer	19.279	0.579	70.8	1824.3	O K
2160 min Summer	19.191	0.491	70.8	1524.0	O K
2880 min Summer	19.123	0.423	70.4	1295.4	O K
4320 min Summer	19.036	0.336	68.5	1013.0	O K
5760 min Summer	18.998	0.298	62.8	890.9	O K
7200 min Summer	18.975	0.275	56.8	819.1	O K
8640 min Summer	18.960	0.260	52.3	770.4	O K
10080 min Summer	18.949	0.249	49.1	735.4	O K
15 min Winter	19.165	0.465	70.8	1436.2	O K
30 min Winter	19.303	0.603	70.8	1910.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	134.447	0.0	1251.5	29
30 min Summer	90.183	0.0	1702.1	43
60 min Summer	57.866	0.0	2264.5	72
120 min Summer	32.885	0.0	2578.4	128
180 min Summer	23.621	0.0	2780.5	184
240 min Summer	18.682	0.0	2933.7	240
360 min Summer	13.435	0.0	3166.4	298
480 min Summer	10.653	0.0	3348.7	360
600 min Summer	8.910	0.0	3501.3	424
720 min Summer	7.706	0.0	3634.1	492
960 min Summer	6.140	0.0	3859.6	626
1440 min Summer	4.483	0.0	4221.1	890
2160 min Summer	3.294	0.0	4708.1	1264
2880 min Summer	2.663	0.0	5072.6	1620
4320 min Summer	2.002	0.0	5696.3	2300
5760 min Summer	1.655	0.0	6330.6	3000
7200 min Summer	1.442	0.0	6891.4	3744
8640 min Summer	1.297	0.0	7433.5	4424
10080 min Summer	1.193	0.0	7955.7	5152
15 min Winter	134.447	0.0	1410.2	29
30 min Winter	90.183	0.0	1914.1	43

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	19.441	0.741	70.8	2407.6	O K
120 min Winter	19.495	0.795	70.8	2610.0	O K
180 min Winter	19.514	0.814	70.8	2680.4	O K
240 min Winter	19.517	0.817	70.8	2694.1	O K
360 min Winter	19.504	0.804	70.8	2642.4	O K
480 min Winter	19.484	0.784	70.8	2569.9	O K
600 min Winter	19.465	0.765	70.8	2497.7	O K
720 min Winter	19.442	0.742	70.8	2412.0	O K
960 min Winter	19.391	0.691	70.8	2224.7	O K
1440 min Winter	19.288	0.588	70.8	1856.4	O K
2160 min Winter	19.154	0.454	70.7	1398.8	O K
2880 min Winter	19.061	0.361	69.3	1090.5	O K
4320 min Winter	18.985	0.285	59.4	849.7	O K
5760 min Winter	18.953	0.253	50.2	749.0	O K
7200 min Winter	18.933	0.233	44.4	686.1	O K
8640 min Winter	18.918	0.218	40.1	642.4	O K
10080 min Winter	18.908	0.208	37.0	610.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	57.866	0.0	2540.8	70
120 min Winter	32.885	0.0	2892.3	126
180 min Winter	23.621	0.0	3118.6	182
240 min Winter	18.682	0.0	3290.2	238
360 min Winter	13.435	0.0	3550.8	342
480 min Winter	10.653	0.0	3754.9	388
600 min Winter	8.910	0.0	3925.9	464
720 min Winter	7.706	0.0	4074.7	540
960 min Winter	6.140	0.0	4327.7	684
1440 min Winter	4.483	0.0	4734.5	956
2160 min Winter	3.294	0.0	5276.8	1328
2880 min Winter	2.663	0.0	5685.9	1652
4320 min Winter	2.002	0.0	6388.7	2332
5760 min Winter	1.655	0.0	7092.8	3056
7200 min Winter	1.442	0.0	7721.8	3752
8640 min Winter	1.297	0.0	8330.8	4496
10080 min Winter	1.193	0.0	8920.9	5240

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Rainfall Details

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
FEH Rainfall Version	2013	Cv (Winter)	0.840
Site Location	GB 448927 117350	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 5.330

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	1.332	4	8	1.332	8	12	1.332	12	16	1.334

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Model Details

Storage is Online Cover Level (m) 19.900

Tank or Pond Structure

Invert Level (m) 18.700

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	2816.2	0.401	3284.4	0.801	3768.6	1.200	4267.6
0.101	2931.7	0.501	3404.0	0.901	3892.2		
0.201	3048.3	0.601	3524.5	1.001	4016.7		
0.301	3165.8	0.701	3646.1	1.101	4142.3		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0342-7080-0900-7080
Design Head (m)	0.900
Design Flow (l/s)	70.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	342
Invert Level (m)	18.700
Minimum Outlet Pipe Diameter (mm)	375
Suggested Manhole Diameter (mm)	2100

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.900	70.8
Flush-Flo™	0.486	70.8
Kick-Flo®	0.758	65.1
Mean Flow over Head Range	-	54.2

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	10.0	1.200	81.4	3.000	127.0	7.000	192.3
0.200	34.7	1.400	87.7	3.500	137.0	7.500	198.9
0.300	63.2	1.600	93.6	4.000	146.2	8.000	205.3
0.400	70.1	1.800	99.1	4.500	154.9	8.500	211.5
0.500	70.8	2.000	104.3	5.000	163.1	9.000	217.6
0.600	69.8	2.200	109.2	5.500	170.9	9.500	221.5
0.800	66.9	2.400	114.0	6.000	178.3		
1.000	74.5	2.600	118.5	6.500	185.4		

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Cascade Summary of Results for Basin I.srcx

	Upstream Structures	Outflow To	Overflow To
Basin J.srcx		(None)	(None)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	20.593	0.093	6.8	87.6	O K
30 min Summer	20.620	0.120	10.7	114.7	O K
60 min Summer	20.650	0.150	15.6	144.8	O K
120 min Summer	20.682	0.182	20.8	176.8	O K
180 min Summer	20.694	0.194	22.7	189.5	O K
240 min Summer	20.702	0.202	23.8	197.2	O K
360 min Summer	20.709	0.209	24.8	204.4	O K
480 min Summer	20.710	0.210	24.9	205.5	O K
600 min Summer	20.708	0.208	24.6	203.5	O K
720 min Summer	20.704	0.204	24.2	199.9	O K
960 min Summer	20.696	0.196	22.9	191.1	O K
1440 min Summer	20.680	0.180	20.5	174.5	O K
2160 min Summer	20.661	0.161	17.4	155.6	O K
2880 min Summer	20.648	0.148	15.2	142.1	O K
4320 min Summer	20.630	0.130	12.2	124.1	O K
5760 min Summer	20.618	0.118	10.3	112.4	O K
7200 min Summer	20.609	0.109	9.1	103.7	O K
8640 min Summer	20.602	0.102	8.1	97.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	29.494	0.0	119.8	69
30 min Summer	19.618	0.0	163.3	72
60 min Summer	12.728	0.0	222.5	90
120 min Summer	8.110	0.0	285.3	126
180 min Summer	6.206	0.0	328.3	164
240 min Summer	5.126	0.0	362.2	192
360 min Summer	3.877	0.0	411.5	252
480 min Summer	3.179	0.0	450.3	314
600 min Summer	2.725	0.0	482.8	376
720 min Summer	2.403	0.0	511.1	440
960 min Summer	1.972	0.0	558.9	564
1440 min Summer	1.492	0.0	633.5	808
2160 min Summer	1.128	0.0	726.1	1172
2880 min Summer	0.925	0.0	793.3	1532
4320 min Summer	0.700	0.0	896.9	2256
5760 min Summer	0.575	0.0	990.8	2992
7200 min Summer	0.492	0.0	1060.2	3712
8640 min Summer	0.433	0.0	1117.8	4424

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Cascade Summary of Results for Basin I.srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
10080 min Summer	20.597	0.097	7.4	91.8	O K
15 min Winter	20.603	0.103	8.1	97.6	O K
30 min Winter	20.633	0.133	12.7	127.0	O K
60 min Winter	20.664	0.164	17.9	158.9	O K
120 min Winter	20.698	0.198	23.3	193.8	O K
180 min Winter	20.714	0.214	25.5	210.1	O K
240 min Winter	20.721	0.221	26.4	217.4	O K
360 min Winter	20.723	0.223	26.7	219.9	O K
480 min Winter	20.719	0.219	26.1	214.9	O K
600 min Winter	20.711	0.211	25.1	207.3	O K
720 min Winter	20.704	0.204	24.1	199.3	O K
960 min Winter	20.689	0.189	22.0	184.5	O K
1440 min Winter	20.667	0.167	18.4	161.9	O K
2160 min Winter	20.645	0.145	14.7	139.7	O K
2880 min Winter	20.631	0.131	12.5	125.4	O K
4320 min Winter	20.613	0.113	9.6	107.5	O K
5760 min Winter	20.602	0.102	8.0	96.3	O K
7200 min Winter	20.594	0.094	6.9	88.5	O K
8640 min Winter	20.587	0.087	6.0	82.5	O K
10080 min Winter	20.583	0.083	5.5	77.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Summer	0.389	0.0	1166.7	5152
15 min Winter	29.494	0.0	135.7	67
30 min Winter	19.618	0.0	184.4	73
60 min Winter	12.728	0.0	250.0	92
120 min Winter	8.110	0.0	320.3	128
180 min Winter	6.206	0.0	368.5	170
240 min Winter	5.126	0.0	406.5	196
360 min Winter	3.877	0.0	461.8	262
480 min Winter	3.179	0.0	505.3	328
600 min Winter	2.725	0.0	541.7	392
720 min Winter	2.403	0.0	573.4	456
960 min Winter	1.972	0.0	627.1	582
1440 min Winter	1.492	0.0	710.9	828
2160 min Winter	1.128	0.0	813.8	1192
2880 min Winter	0.925	0.0	889.3	1560
4320 min Winter	0.700	0.0	1006.0	2296
5760 min Winter	0.575	0.0	1110.0	3000
7200 min Winter	0.492	0.0	1187.9	3712
8640 min Winter	0.433	0.0	1252.8	4488
10080 min Winter	0.389	0.0	1308.5	5144

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Cascade Rainfall Details for Basin I.srcx

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	1	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.900	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 1.011

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.501	4	8	0.510

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Cascade Model Details for Basin I.srcx

Storage is Online Cover Level (m) 21.700

Tank or Pond Structure

Invert Level (m) 20.500

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	918.6	0.401	1160.9	0.801	1419.2	1.200	1692.9
0.101	977.6	0.501	1224.0	0.901	1486.3		
0.201	1037.7	0.601	1288.1	1.001	1554.4		
0.301	1098.8	0.701	1353.1	1.101	1623.5		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SFF-0234-2960-0900-2870
Design Head (m)	0.900
Design Flow (l/s)	29.6
Flush-Flo™	User Defined
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	234
Invert Level (m)	20.500
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.900	29.6
Flush-Flo™	0.360	28.7
Kick-Flo®	0.653	25.4
Mean Flow over Head Range	-	23.6

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	7.7	1.200	34.0	3.000	52.8	7.000	79.7
0.200	23.6	1.400	36.6	3.500	56.9	7.500	82.5
0.300	28.5	1.600	39.0	4.000	60.7	8.000	85.1
0.400	28.6	1.800	41.3	4.500	64.3	8.500	87.7
0.500	28.0	2.000	43.4	5.000	67.7	9.000	90.1
0.600	26.7	2.200	45.5	5.500	70.9	9.500	92.1
0.800	28.0	2.400	47.4	6.000	74.0		
1.000	31.1	2.600	49.3	6.500	76.9		

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Cascade Summary of Results for Basin I.srcx

	Upstream Structures	Outflow To	Overflow To
Basin J.srcx		(None)	(None)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	20.792	0.292	28.4	293.8	O K
30 min Summer	20.959	0.459	28.7	484.2	O K
60 min Summer	21.137	0.637	28.7	707.3	O K
120 min Summer	21.204	0.704	28.7	797.1	O K
180 min Summer	21.227	0.727	28.7	827.9	O K
240 min Summer	21.236	0.736	28.7	841.4	O K
360 min Summer	21.245	0.745	28.7	853.6	O K
480 min Summer	21.247	0.747	28.7	855.8	O K
600 min Summer	21.243	0.743	28.7	850.9	O K
720 min Summer	21.224	0.724	28.7	824.0	O K
960 min Summer	21.177	0.677	28.7	760.9	O K
1440 min Summer	21.139	0.639	28.7	710.7	O K
2160 min Summer	21.057	0.557	28.7	605.1	O K
2880 min Summer	20.963	0.463	28.7	489.4	O K
4320 min Summer	20.828	0.328	28.6	333.1	O K
5760 min Summer	20.754	0.254	28.0	251.9	O K
7200 min Summer	20.722	0.222	26.5	218.1	O K
8640 min Summer	20.706	0.206	24.4	201.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	134.447	0.0	589.9	152
30 min Summer	90.183	0.0	795.3	168
60 min Summer	57.866	0.0	1034.4	196
120 min Summer	32.885	0.0	1176.4	250
180 min Summer	23.621	0.0	1267.8	302
240 min Summer	18.682	0.0	1337.2	354
360 min Summer	13.435	0.0	1442.7	444
480 min Summer	10.653	0.0	1525.5	526
600 min Summer	8.910	0.0	1594.8	608
720 min Summer	7.706	0.0	1655.2	686
960 min Summer	6.140	0.0	1758.0	818
1440 min Summer	4.483	0.0	1924.1	1008
2160 min Summer	3.294	0.0	2130.1	1324
2880 min Summer	2.663	0.0	2296.0	1676
4320 min Summer	2.002	0.0	2583.9	2360
5760 min Summer	1.655	0.0	2857.4	3024
7200 min Summer	1.442	0.0	3111.6	3704
8640 min Summer	1.297	0.0	3358.5	4416

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Cascade Summary of Results for Basin I.srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
10080 min Summer	20.695	0.195	22.8	189.8	O K
15 min Winter	20.851	0.351	28.6	358.8	O K
30 min Winter	21.040	0.540	28.7	584.0	O K
60 min Winter	21.225	0.725	28.7	826.3	O K
120 min Winter	21.292	0.792	28.7	919.5	O K
180 min Winter	21.318	0.818	28.7	955.9	O K
240 min Winter	21.327	0.827	28.7	968.6	O K
360 min Winter	21.330	0.830	28.7	972.7	O K
480 min Winter	21.326	0.826	28.7	966.9	O K
600 min Winter	21.317	0.817	28.7	954.1	O K
720 min Winter	21.304	0.804	28.7	936.3	O K
960 min Winter	21.255	0.755	28.7	866.8	O K
1440 min Winter	21.202	0.702	28.7	795.0	O K
2160 min Winter	21.023	0.523	28.7	563.1	O K
2880 min Winter	20.877	0.377	28.7	388.3	O K
4320 min Winter	20.729	0.229	27.4	225.6	O K
5760 min Winter	20.696	0.196	23.0	191.7	O K
7200 min Winter	20.678	0.178	20.2	173.1	O K
8640 min Winter	20.666	0.166	18.2	161.0	O K
10080 min Winter	20.658	0.158	16.8	152.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Summer	1.193	0.0	3599.6	5144
15 min Winter	134.447	0.0	662.2	154
30 min Winter	90.183	0.0	891.9	170
60 min Winter	57.866	0.0	1159.2	196
120 min Winter	32.885	0.0	1318.3	246
180 min Winter	23.621	0.0	1420.7	300
240 min Winter	18.682	0.0	1498.4	354
360 min Winter	13.435	0.0	1616.6	452
480 min Winter	10.653	0.0	1709.3	542
600 min Winter	8.910	0.0	1786.9	630
720 min Winter	7.706	0.0	1854.6	716
960 min Winter	6.140	0.0	1969.8	870
1440 min Winter	4.483	0.0	2155.8	1028
2160 min Winter	3.294	0.0	2386.4	1392
2880 min Winter	2.663	0.0	2572.3	1728
4320 min Winter	2.002	0.0	2895.7	2292
5760 min Winter	1.655	0.0	3200.7	3000
7200 min Winter	1.442	0.0	3485.6	3720
8640 min Winter	1.297	0.0	3762.4	4440
10080 min Winter	1.193	0.0	4033.6	5152

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Cascade Rainfall Details for Basin I.srcx

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
FEH Rainfall Version	2013	Cv (Winter)	0.840
Site Location	GB 448927 117350	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.011

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.501	4	8	0.510

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Cascade Model Details for Basin I.srcx

Storage is Online Cover Level (m) 21.700

Tank or Pond Structure

Invert Level (m) 20.500

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	918.6	0.401	1160.9	0.801	1419.2	1.200	1692.9
0.101	977.6	0.501	1224.0	0.901	1486.3		
0.201	1037.7	0.601	1288.1	1.001	1554.4		
0.301	1098.8	0.701	1353.1	1.101	1623.5		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SFF-0234-2960-0900-2870
Design Head (m)	0.900
Design Flow (l/s)	29.6
Flush-Flo™	User Defined
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	234
Invert Level (m)	20.500
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.900	29.6
Flush-Flo™	0.360	28.7
Kick-Flo®	0.653	25.4
Mean Flow over Head Range	-	23.6

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	7.7	1.200	34.0	3.000	52.8	7.000	79.7
0.200	23.6	1.400	36.6	3.500	56.9	7.500	82.5
0.300	28.5	1.600	39.0	4.000	60.7	8.000	85.1
0.400	28.6	1.800	41.3	4.500	64.3	8.500	87.7
0.500	28.0	2.000	43.4	5.000	67.7	9.000	90.1
0.600	26.7	2.200	45.5	5.500	70.9	9.500	92.1
0.800	28.0	2.400	47.4	6.000	74.0		
1.000	31.1	2.600	49.3	6.500	76.9		

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Cascade Summary of Results for Basin J.srcx

	Upstream Structures	Outflow To	Overflow To
	(None)	Basin I.srcx	Basin I.srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	21.699	0.199	23.9	0.0	23.9	61.1	O K
30 min Summer	21.740	0.240	28.9	0.0	28.9	74.8	O K
60 min Summer	21.768	0.268	29.3	0.0	29.3	84.5	O K
120 min Summer	21.779	0.279	29.5	0.0	29.5	88.7	O K
180 min Summer	21.773	0.273	29.4	0.0	29.4	86.3	O K
240 min Summer	21.760	0.260	29.2	0.0	29.2	82.0	O K
360 min Summer	21.733	0.233	28.6	0.0	28.6	72.7	O K
480 min Summer	21.715	0.215	26.2	0.0	26.2	66.3	O K
600 min Summer	21.700	0.200	24.1	0.0	24.1	61.4	O K
720 min Summer	21.688	0.188	22.2	0.0	22.2	57.5	O K
960 min Summer	21.671	0.171	19.4	0.0	19.4	51.8	O K
1440 min Summer	21.648	0.148	15.5	0.0	15.5	44.5	O K
2160 min Summer	21.628	0.128	12.1	0.0	12.1	38.1	O K
2880 min Summer	21.616	0.116	10.2	0.0	10.2	34.2	O K
4320 min Summer	21.600	0.100	7.8	0.0	7.8	29.3	O K
5760 min Summer	21.590	0.090	6.5	0.0	6.5	26.3	O K
7200 min Summer	21.583	0.083	5.6	0.0	5.6	24.1	O K
8640 min Summer	21.578	0.078	4.9	0.0	4.9	22.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Summer	29.494	0.0	75.8	0.0	25
30 min Summer	19.618	0.0	101.2	0.0	33
60 min Summer	12.728	0.0	132.2	0.0	50
120 min Summer	8.110	0.0	168.6	0.0	84
180 min Summer	6.206	0.0	193.5	0.0	116
240 min Summer	5.126	0.0	213.2	0.0	148
360 min Summer	3.877	0.0	241.9	0.0	208
480 min Summer	3.179	0.0	264.5	0.0	268
600 min Summer	2.725	0.0	283.5	0.0	328
720 min Summer	2.403	0.0	300.0	0.0	388
960 min Summer	1.972	0.0	328.1	0.0	510
1440 min Summer	1.492	0.0	372.5	0.0	750
2160 min Summer	1.128	0.0	422.8	0.0	1112
2880 min Summer	0.925	0.0	462.2	0.0	1476
4320 min Summer	0.700	0.0	524.4	0.0	2208
5760 min Summer	0.575	0.0	575.1	0.0	2936
7200 min Summer	0.492	0.0	615.7	0.0	3672
8640 min Summer	0.433	0.0	649.9	0.0	4400

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Cascade Summary of Results for Basin J.srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
10080 min Summer	21.573	0.073	4.4	0.0	4.4	21.1	O K
15 min Winter	21.719	0.219	26.8	0.0	26.8	67.8	O K
30 min Winter	21.765	0.265	29.3	0.0	29.3	83.6	O K
60 min Winter	21.794	0.294	29.6	0.0	29.6	94.1	O K
120 min Winter	21.795	0.295	29.6	0.0	29.6	94.3	O K
180 min Winter	21.775	0.275	29.4	0.0	29.4	87.3	O K
240 min Winter	21.752	0.252	29.1	0.0	29.1	79.1	O K
360 min Winter	21.717	0.217	26.5	0.0	26.5	67.1	O K
480 min Winter	21.694	0.194	23.2	0.0	23.2	59.5	O K
600 min Winter	21.678	0.178	20.5	0.0	20.5	54.2	O K
720 min Winter	21.666	0.166	18.5	0.0	18.5	50.2	O K
960 min Winter	21.649	0.149	15.5	0.0	15.5	44.5	O K
1440 min Winter	21.627	0.127	12.0	0.0	12.0	37.7	O K
2160 min Winter	21.609	0.109	9.2	0.0	9.2	32.1	O K
2880 min Winter	21.598	0.098	7.5	0.0	7.5	28.6	O K
4320 min Winter	21.584	0.084	5.7	0.0	5.7	24.5	O K
5760 min Winter	21.576	0.076	4.7	0.0	4.7	22.0	O K
7200 min Winter	21.570	0.070	4.0	0.0	4.0	20.2	O K
8640 min Winter	21.565	0.065	3.6	0.0	3.6	18.8	O K
10080 min Winter	21.562	0.062	3.2	0.0	3.2	17.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
10080 min Summer	0.389	0.0	680.2	0.0	5080
15 min Winter	29.494	0.0	85.1	0.0	25
30 min Winter	19.618	0.0	113.5	0.0	35
60 min Winter	12.728	0.0	148.1	0.0	54
120 min Winter	8.110	0.0	188.9	0.0	90
180 min Winter	6.206	0.0	216.8	0.0	122
240 min Winter	5.126	0.0	238.9	0.0	154
360 min Winter	3.877	0.0	271.0	0.0	214
480 min Winter	3.179	0.0	296.3	0.0	274
600 min Winter	2.725	0.0	317.6	0.0	334
720 min Winter	2.403	0.0	336.1	0.0	394
960 min Winter	1.972	0.0	367.6	0.0	514
1440 min Winter	1.492	0.0	417.3	0.0	756
2160 min Winter	1.128	0.0	473.6	0.0	1124
2880 min Winter	0.925	0.0	517.8	0.0	1480
4320 min Winter	0.700	0.0	587.5	0.0	2204
5760 min Winter	0.575	0.0	644.1	0.0	2944
7200 min Winter	0.492	0.0	689.7	0.0	3672
8640 min Winter	0.433	0.0	728.0	0.0	4400
10080 min Winter	0.389	0.0	761.9	0.0	5096

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Cascade Rainfall Details for Basin J.srcx

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	1	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.900	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 1.390

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.348	4	8	0.348	8	12	0.347	12	16	0.347

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Cascade Model Details for Basin J.srcx

Storage is Online Cover Level (m) 22.743

Tank or Pond Structure

Invert Level (m) 21.500

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	280.0	0.401	392.7	0.801	521.5	1.201	666.4
0.101	306.7	0.501	423.4	0.901	556.3	1.243	682.5
0.201	334.4	0.601	455.1	1.001	592.0		
0.301	363.1	0.701	487.8	1.101	628.7		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0238-3000-0900-3000
Design Head (m)	0.900
Design Flow (l/s)	30.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	238
Invert Level (m)	21.500
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.900	30.0
Flush-Flo™	0.372	29.9
Kick-Flo®	0.690	26.4
Mean Flow over Head Range	-	24.4

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	7.8	1.200	34.4	3.000	53.5	7.000	80.8
0.200	24.0	1.400	37.0	3.500	57.7	7.500	83.5
0.300	29.7	1.600	39.5	4.000	61.5	8.000	86.2
0.400	29.9	1.800	41.8	4.500	65.1	8.500	88.8
0.500	29.4	2.000	44.0	5.000	68.6	9.000	91.3
0.600	28.4	2.200	46.1	5.500	71.8	9.500	93.2
0.800	28.3	2.400	48.0	6.000	74.9		
1.000	31.5	2.600	49.9	6.500	77.9		

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Weir Overflow Control

Discharge Coef 0.544 Width (m) 1.800 Invert Level (m) 22.200

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Cascade Summary of Results for Basin J.srcx

	Upstream Structures	Outflow To	Overflow To
	(None)	Basin I.srcx	Basin I.srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	22.273	0.773	29.9	60.2	88.0	302.1	O K
30 min Summer	22.352	0.852	29.9	181.3	210.5	343.5	O K
60 min Summer	22.375	0.875	29.9	225.0	254.6	356.2	O K
120 min Summer	22.348	0.848	29.9	175.1	204.2	341.7	O K
180 min Summer	22.326	0.826	29.9	137.6	166.3	330.1	O K
240 min Summer	22.309	0.809	29.9	110.7	139.2	321.0	O K
360 min Summer	22.284	0.784	29.9	75.0	103.1	308.1	O K
480 min Summer	22.267	0.767	29.9	52.9	80.7	299.1	O K
600 min Summer	22.254	0.754	29.9	38.2	65.8	292.2	O K
720 min Summer	22.242	0.742	29.9	26.2	53.5	286.5	O K
960 min Summer	22.219	0.719	29.9	7.9	34.8	274.9	O K
1440 min Summer	22.031	0.531	29.9	0.0	29.9	187.9	O K
2160 min Summer	21.826	0.326	29.8	0.0	29.8	105.7	O K
2880 min Summer	21.736	0.236	28.8	0.0	28.8	73.5	O K
4320 min Summer	21.690	0.190	22.5	0.0	22.5	58.0	O K
5760 min Summer	21.667	0.167	18.7	0.0	18.7	50.6	O K
7200 min Summer	21.654	0.154	16.4	0.0	16.4	46.1	O K
8640 min Summer	21.644	0.144	14.7	0.0	14.7	43.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Summer	134.447	0.0	349.3	31.0	25
30 min Summer	90.183	0.0	468.9	132.1	32
60 min Summer	57.866	0.0	602.7	231.6	46
120 min Summer	32.885	0.0	685.1	244.2	78
180 min Summer	23.621	0.0	738.2	228.2	108
240 min Summer	18.682	0.0	778.5	206.9	140
360 min Summer	13.435	0.0	839.8	168.2	206
480 min Summer	10.653	0.0	887.8	133.9	272
600 min Summer	8.910	0.0	928.2	102.4	340
720 min Summer	7.706	0.0	963.4	72.7	412
960 min Summer	6.140	0.0	1023.3	17.9	566
1440 min Summer	4.483	0.0	1120.6	0.0	824
2160 min Summer	3.294	0.0	1235.7	0.0	1152
2880 min Summer	2.663	0.0	1332.3	0.0	1476
4320 min Summer	2.002	0.0	1501.6	0.0	2204
5760 min Summer	1.655	0.0	1655.8	0.0	2936
7200 min Summer	1.442	0.0	1803.4	0.0	3672
8640 min Summer	1.297	0.0	1947.3	0.0	4400

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Cascade Summary of Results for Basin J.srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
10080 min Summer	21.637	0.137	13.5	0.0	13.5	40.8	O K
15 min Winter	22.315	0.815	29.9	120.0	148.6	324.0	O K
30 min Winter	22.381	0.881	29.9	236.7	266.3	359.5	O K
60 min Winter	22.392	0.892	29.9	258.5	288.4	365.8	O K
120 min Winter	22.352	0.852	29.9	182.2	211.4	343.9	O K
180 min Winter	22.325	0.825	29.9	135.9	164.7	329.2	O K
240 min Winter	22.306	0.806	29.9	105.5	133.9	319.2	O K
360 min Winter	22.280	0.780	29.9	69.7	97.7	305.9	O K
480 min Winter	22.263	0.763	29.9	48.8	76.5	297.1	O K
600 min Winter	22.250	0.750	29.9	34.5	62.0	290.5	O K
720 min Winter	22.239	0.739	29.9	23.4	50.7	284.7	O K
960 min Winter	22.206	0.706	29.9	1.3	29.9	268.4	O K
1440 min Winter	21.886	0.386	29.9	0.0	29.9	128.4	O K
2160 min Winter	21.718	0.218	26.6	0.0	26.6	67.4	O K
2880 min Winter	21.685	0.185	21.7	0.0	21.7	56.4	O K
4320 min Winter	21.654	0.154	16.4	0.0	16.4	46.2	O K
5760 min Winter	21.637	0.137	13.6	0.0	13.6	40.8	O K
7200 min Winter	21.626	0.126	11.8	0.0	11.8	37.4	O K
8640 min Winter	21.619	0.119	10.6	0.0	10.6	35.2	O K
10080 min Winter	21.613	0.113	9.8	0.0	9.8	33.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
10080 min Summer	1.193	0.0	2089.3	0.0	5136
15 min Winter	134.447	0.0	391.3	68.0	24
30 min Winter	90.183	0.0	525.3	185.3	31
60 min Winter	57.866	0.0	675.1	300.7	46
120 min Winter	32.885	0.0	767.4	321.9	78
180 min Winter	23.621	0.0	826.8	309.1	110
240 min Winter	18.682	0.0	872.0	284.2	142
360 min Winter	13.435	0.0	940.6	231.9	208
480 min Winter	10.653	0.0	994.5	182.5	276
600 min Winter	8.910	0.0	1039.7	134.7	348
720 min Winter	7.706	0.0	1079.1	88.6	426
960 min Winter	6.140	0.0	1146.2	1.9	626
1440 min Winter	4.483	0.0	1255.1	0.0	838
2160 min Winter	3.294	0.0	1384.0	0.0	1120
2880 min Winter	2.663	0.0	1492.2	0.0	1476
4320 min Winter	2.002	0.0	1682.0	0.0	2204
5760 min Winter	1.655	0.0	1854.5	0.0	2936
7200 min Winter	1.442	0.0	2019.9	0.0	3672
8640 min Winter	1.297	0.0	2181.1	0.0	4408
10080 min Winter	1.193	0.0	2340.2	0.0	5136

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Cascade Rainfall Details for Basin J.srcx

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
FEH Rainfall Version	2013	Cv (Winter)	0.840
Site Location	GB 448927 117350	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.390

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.348	4	8	0.348	8	12	0.347	12	16	0.347

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Cascade Model Details for Basin J.srcx

Storage is Online Cover Level (m) 22.743

Tank or Pond Structure

Invert Level (m) 21.500

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	280.0	0.401	392.7	0.801	521.5	1.201	666.4
0.101	306.7	0.501	423.4	0.901	556.3	1.243	682.5
0.201	334.4	0.601	455.1	1.001	592.0		
0.301	363.1	0.701	487.8	1.101	628.7		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0238-3000-0900-3000
Design Head (m)	0.900
Design Flow (l/s)	30.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	238
Invert Level (m)	21.500
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.900	30.0
Flush-Flo™	0.372	29.9
Kick-Flo®	0.690	26.4
Mean Flow over Head Range	-	24.4

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	7.8	1.200	34.4	3.000	53.5	7.000	80.8
0.200	24.0	1.400	37.0	3.500	57.7	7.500	83.5
0.300	29.7	1.600	39.5	4.000	61.5	8.000	86.2
0.400	29.9	1.800	41.8	4.500	65.1	8.500	88.8
0.500	29.4	2.000	44.0	5.000	68.6	9.000	91.3
0.600	28.4	2.200	46.1	5.500	71.8	9.500	93.2
0.800	28.3	2.400	48.0	6.000	74.9		
1.000	31.5	2.600	49.9	6.500	77.9		

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Weir Overflow Control

Discharge Coef 0.544 Width (m) 1.800 Invert Level (m) 22.200

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Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	19.371	0.071	3.4	59.1	O K
30 min Summer	19.391	0.091	5.2	76.3	O K
60 min Summer	19.410	0.110	7.1	92.9	O K
120 min Summer	19.424	0.124	8.5	105.5	O K
180 min Summer	19.432	0.132	9.4	112.3	O K
240 min Summer	19.436	0.136	9.8	116.5	O K
360 min Summer	19.440	0.140	10.2	119.6	O K
480 min Summer	19.440	0.140	10.2	119.9	O K
600 min Summer	19.439	0.139	10.1	118.9	O K
720 min Summer	19.437	0.137	9.9	117.3	O K
960 min Summer	19.433	0.133	9.5	113.3	O K
1440 min Summer	19.424	0.124	8.5	105.4	O K
2160 min Summer	19.413	0.113	7.4	95.6	O K
2880 min Summer	19.404	0.104	6.5	88.2	O K
4320 min Summer	19.393	0.093	5.4	77.9	O K
5760 min Summer	19.385	0.085	4.6	71.0	O K
7200 min Summer	19.379	0.079	4.0	65.8	O K
8640 min Summer	19.374	0.074	3.6	61.7	O K
10080 min Summer	19.370	0.070	3.3	58.5	O K
15 min Winter	19.379	0.079	4.1	66.0	O K
30 min Winter	19.401	0.101	6.2	85.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	29.494	0.0	52.0	22
30 min Summer	19.618	0.0	71.6	36
60 min Summer	12.728	0.0	100.2	62
120 min Summer	8.110	0.0	128.9	100
180 min Summer	6.206	0.0	148.6	130
240 min Summer	5.126	0.0	164.1	164
360 min Summer	3.877	0.0	186.7	232
480 min Summer	3.179	0.0	204.5	298
600 min Summer	2.725	0.0	219.3	364
720 min Summer	2.403	0.0	232.2	430
960 min Summer	1.972	0.0	254.0	556
1440 min Summer	1.492	0.0	287.9	806
2160 min Summer	1.128	0.0	331.9	1172
2880 min Summer	0.925	0.0	362.6	1532
4320 min Summer	0.700	0.0	409.4	2252
5760 min Summer	0.575	0.0	453.9	3000
7200 min Summer	0.492	0.0	485.6	3744
8640 min Summer	0.433	0.0	511.7	4416
10080 min Summer	0.389	0.0	533.7	5152
15 min Winter	29.494	0.0	59.1	22
30 min Winter	19.618	0.0	81.2	35

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Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	19.422	0.122	8.4	103.9	O K
120 min Winter	19.437	0.137	9.9	117.5	O K
180 min Winter	19.445	0.145	10.6	124.1	O K
240 min Winter	19.448	0.148	10.9	127.3	O K
360 min Winter	19.448	0.148	11.0	127.4	O K
480 min Winter	19.446	0.146	10.7	125.1	O K
600 min Winter	19.442	0.142	10.4	121.8	O K
720 min Winter	19.438	0.138	10.0	118.2	O K
960 min Winter	19.431	0.131	9.3	111.4	O K
1440 min Winter	19.418	0.118	7.9	100.0	O K
2160 min Winter	19.404	0.104	6.5	87.8	O K
2880 min Winter	19.394	0.094	5.5	79.4	O K
4320 min Winter	19.382	0.082	4.4	68.6	O K
5760 min Winter	19.374	0.074	3.6	61.7	O K
7200 min Winter	19.368	0.068	3.1	56.8	O K
8640 min Winter	19.364	0.064	2.8	53.0	O K
10080 min Winter	19.360	0.060	2.5	50.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	12.728	0.0	112.8	62
120 min Winter	8.110	0.0	145.0	102
180 min Winter	6.206	0.0	167.1	138
240 min Winter	5.126	0.0	184.4	176
360 min Winter	3.877	0.0	209.7	248
480 min Winter	3.179	0.0	229.6	318
600 min Winter	2.725	0.0	246.3	386
720 min Winter	2.403	0.0	260.8	452
960 min Winter	1.972	0.0	285.2	580
1440 min Winter	1.492	0.0	323.3	834
2160 min Winter	1.128	0.0	372.2	1208
2880 min Winter	0.925	0.0	406.6	1564
4320 min Winter	0.700	0.0	459.5	2292
5760 min Winter	0.575	0.0	508.6	3000
7200 min Winter	0.492	0.0	544.2	3752
8640 min Winter	0.433	0.0	573.7	4496
10080 min Winter	0.389	0.0	598.7	5240

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Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	1	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.900	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 1.102

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.500	4	8	0.602

Time Area Diagram

Total Area (ha) 0.000

Time From:	(mins) To:	Area (ha)
0	4	0.000

Time Area Diagram

Total Area (ha) 0.000

Time From:	(mins) To:	Area (ha)
0	4	0.000

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Model Details

Storage is Online Cover Level (m) 20.200

Tank or Pond Structure

Invert Level (m) 19.300

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	806.9	0.201	954.3	0.501	1182.8	0.801	1420.4
0.001	806.9	0.301	1029.5	0.601	1261.0	0.900	1500.8
0.101	880.1	0.401	1105.6	0.701	1340.2		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0172-1350-0600-1350
Design Head (m)	0.600
Design Flow (l/s)	13.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	172
Invert Level (m)	19.300
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.600	13.5
Flush-Flo™	0.260	13.5
Kick-Flo®	0.469	12.0
Mean Flow over Head Range	-	10.8

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.1	1.200	18.7	3.000	29.1	7.000	43.6
0.200	13.3	1.400	20.2	3.500	31.3	7.500	45.2
0.300	13.4	1.600	21.5	4.000	33.4	8.000	46.7
0.400	12.9	1.800	22.8	4.500	35.4	8.500	48.1
0.500	12.4	2.000	23.9	5.000	37.2	9.000	49.6
0.600	13.5	2.200	25.1	5.500	39.0	9.500	50.9
0.800	15.5	2.400	26.1	6.000	40.7		
1.000	17.2	2.600	27.1	6.500	42.0		

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	19.593	0.293	13.5	267.5	O K
30 min Summer	19.676	0.376	13.5	354.8	O K
60 min Summer	19.757	0.457	13.5	445.4	O K
120 min Summer	19.787	0.487	13.5	480.4	O K
180 min Summer	19.796	0.496	13.5	491.4	O K
240 min Summer	19.797	0.497	13.5	491.9	O K
360 min Summer	19.788	0.488	13.5	481.4	O K
480 min Summer	19.778	0.478	13.5	470.4	O K
600 min Summer	19.768	0.468	13.5	458.7	O K
720 min Summer	19.757	0.457	13.5	446.0	O K
960 min Summer	19.734	0.434	13.5	419.8	O K
1440 min Summer	19.689	0.389	13.5	369.9	O K
2160 min Summer	19.628	0.328	13.5	304.4	O K
2880 min Summer	19.578	0.278	13.5	252.8	O K
4320 min Summer	19.511	0.211	13.4	186.0	O K
5760 min Summer	19.475	0.175	13.1	152.1	O K
7200 min Summer	19.459	0.159	11.8	137.2	O K
8640 min Summer	19.448	0.148	11.0	127.7	O K
10080 min Summer	19.441	0.141	10.3	120.8	O K
15 min Winter	19.625	0.325	13.5	300.6	O K
30 min Winter	19.716	0.416	13.5	399.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	134.447	0.0	266.3	22
30 min Summer	90.183	0.0	359.9	37
60 min Summer	57.866	0.0	472.3	66
120 min Summer	32.885	0.0	537.4	124
180 min Summer	23.621	0.0	579.2	182
240 min Summer	18.682	0.0	611.0	242
360 min Summer	13.435	0.0	659.3	314
480 min Summer	10.653	0.0	697.1	376
600 min Summer	8.910	0.0	728.9	438
720 min Summer	7.706	0.0	756.5	502
960 min Summer	6.140	0.0	803.5	636
1440 min Summer	4.483	0.0	879.3	898
2160 min Summer	3.294	0.0	976.2	1280
2880 min Summer	2.663	0.0	1052.1	1644
4320 min Summer	2.002	0.0	1183.1	2336
5760 min Summer	1.655	0.0	1310.6	3000
7200 min Summer	1.442	0.0	1427.0	3744
8640 min Summer	1.297	0.0	1539.9	4416
10080 min Summer	1.193	0.0	1649.6	5144
15 min Winter	134.447	0.0	299.2	22
30 min Winter	90.183	0.0	404.0	36

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	19.805	0.505	13.5	501.9	O K
120 min Winter	19.839	0.539	13.5	543.1	O K
180 min Winter	19.851	0.551	13.5	557.4	O K
240 min Winter	19.854	0.554	13.5	560.3	O K
360 min Winter	19.845	0.545	13.5	550.3	O K
480 min Winter	19.831	0.531	13.5	533.2	O K
600 min Winter	19.819	0.519	13.5	518.4	O K
720 min Winter	19.805	0.505	13.5	502.0	O K
960 min Winter	19.774	0.474	13.5	465.2	O K
1440 min Winter	19.703	0.403	13.5	384.8	O K
2160 min Winter	19.607	0.307	13.5	282.2	O K
2880 min Winter	19.534	0.234	13.5	208.6	O K
4320 min Winter	19.465	0.165	12.3	142.9	O K
5760 min Winter	19.443	0.143	10.5	122.6	O K
7200 min Winter	19.430	0.130	9.2	111.1	O K
8640 min Winter	19.422	0.122	8.3	103.4	O K
10080 min Winter	19.416	0.116	7.7	98.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	57.866	0.0	529.5	66
120 min Winter	32.885	0.0	602.4	122
180 min Winter	23.621	0.0	649.3	180
240 min Winter	18.682	0.0	684.9	236
360 min Winter	13.435	0.0	738.9	342
480 min Winter	10.653	0.0	781.3	394
600 min Winter	8.910	0.0	816.8	466
720 min Winter	7.706	0.0	847.8	544
960 min Winter	6.140	0.0	900.4	698
1440 min Winter	4.483	0.0	985.4	974
2160 min Winter	3.294	0.0	1093.8	1348
2880 min Winter	2.663	0.0	1178.9	1700
4320 min Winter	2.002	0.0	1326.3	2296
5760 min Winter	1.655	0.0	1468.2	3000
7200 min Winter	1.442	0.0	1598.7	3744
8640 min Winter	1.297	0.0	1725.3	4416
10080 min Winter	1.193	0.0	1849.0	5144

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Rainfall Details

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
FEH Rainfall Version	2013	Cv (Winter)	0.840
Site Location	GB 448927 117350	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.102

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.500	4	8	0.602

Time Area Diagram

Total Area (ha) 0.000

Time From:	(mins) To:	Area (ha)
0	4	0.000

Time Area Diagram

Total Area (ha) 0.000

Time From:	(mins) To:	Area (ha)
0	4	0.000

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Model Details

Storage is Online Cover Level (m) 20.200

Tank or Pond Structure

Invert Level (m) 19.300

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	806.9	0.201	954.3	0.501	1182.8	0.801	1420.4
0.001	806.9	0.301	1029.5	0.601	1261.0	0.900	1500.8
0.101	880.1	0.401	1105.6	0.701	1340.2		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0172-1350-0600-1350
Design Head (m)	0.600
Design Flow (l/s)	13.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	172
Invert Level (m)	19.300
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.600	13.5
Flush-Flo™	0.260	13.5
Kick-Flo®	0.469	12.0
Mean Flow over Head Range	-	10.8

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.1	1.200	18.7	3.000	29.1	7.000	43.6
0.200	13.3	1.400	20.2	3.500	31.3	7.500	45.2
0.300	13.4	1.600	21.5	4.000	33.4	8.000	46.7
0.400	12.9	1.800	22.8	4.500	35.4	8.500	48.1
0.500	12.4	2.000	23.9	5.000	37.2	9.000	49.6
0.600	13.5	2.200	25.1	5.500	39.0	9.500	50.9
0.800	15.5	2.400	26.1	6.000	40.7		
1.000	17.2	2.600	27.1	6.500	42.0		

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Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	19.104	0.104	9.1	191.2	O K
30 min Summer	19.133	0.133	14.1	247.6	O K
60 min Summer	19.162	0.162	19.9	305.1	O K
120 min Summer	19.185	0.185	24.5	350.9	O K
180 min Summer	19.197	0.197	26.9	374.1	O K
240 min Summer	19.205	0.205	28.5	389.3	O K
360 min Summer	19.211	0.211	29.8	402.4	O K
480 min Summer	19.213	0.213	30.0	406.2	O K
600 min Summer	19.212	0.212	29.9	405.3	O K
720 min Summer	19.211	0.211	29.7	401.8	O K
960 min Summer	19.206	0.206	28.7	391.3	O K
1440 min Summer	19.194	0.194	26.2	367.7	O K
2160 min Summer	19.178	0.178	23.0	336.0	O K
2880 min Summer	19.166	0.166	20.6	311.3	O K
4320 min Summer	19.148	0.148	17.0	276.3	O K
5760 min Summer	19.136	0.136	14.7	252.5	O K
7200 min Summer	19.126	0.126	12.9	234.4	O K
8640 min Summer	19.119	0.119	11.6	219.7	O K
10080 min Summer	19.113	0.113	10.6	208.4	O K
15 min Winter	19.115	0.115	11.0	213.6	O K
30 min Winter	19.148	0.148	17.0	276.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	29.494	0.0	163.5	29
30 min Summer	19.618	0.0	226.7	42
60 min Summer	12.728	0.0	322.0	66
120 min Summer	8.110	0.0	415.0	110
180 min Summer	6.206	0.0	478.8	140
240 min Summer	5.126	0.0	529.1	172
360 min Summer	3.877	0.0	602.2	240
480 min Summer	3.179	0.0	659.6	306
600 min Summer	2.725	0.0	707.6	374
720 min Summer	2.403	0.0	749.3	438
960 min Summer	1.972	0.0	819.8	566
1440 min Summer	1.492	0.0	928.7	816
2160 min Summer	1.128	0.0	1074.8	1188
2880 min Summer	0.925	0.0	1173.8	1556
4320 min Summer	0.700	0.0	1324.5	2292
5760 min Summer	0.575	0.0	1471.5	3000
7200 min Summer	0.492	0.0	1573.9	3744
8640 min Summer	0.433	0.0	1658.3	4424
10080 min Summer	0.389	0.0	1728.3	5152
15 min Winter	29.494	0.0	186.4	29
30 min Winter	19.618	0.0	257.5	41

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Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	19.180	0.180	23.5	340.8	O K
120 min Winter	19.206	0.206	28.7	391.8	O K
180 min Winter	19.217	0.217	30.9	414.8	O K
240 min Winter	19.224	0.224	32.1	427.7	O K
360 min Winter	19.226	0.226	32.5	432.9	O K
480 min Winter	19.224	0.224	32.1	428.4	O K
600 min Winter	19.220	0.220	31.4	420.0	O K
720 min Winter	19.215	0.215	30.4	410.1	O K
960 min Winter	19.205	0.205	28.5	389.6	O K
1440 min Winter	19.187	0.187	24.8	353.1	O K
2160 min Winter	19.166	0.166	20.6	312.0	O K
2880 min Winter	19.151	0.151	17.7	283.1	O K
4320 min Winter	19.132	0.132	13.9	245.1	O K
5760 min Winter	19.119	0.119	11.7	220.8	O K
7200 min Winter	19.110	0.110	10.1	203.2	O K
8640 min Winter	19.103	0.103	8.9	189.6	O K
10080 min Winter	19.097	0.097	8.1	178.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	12.728	0.0	362.8	66
120 min Winter	8.110	0.0	467.0	114
180 min Winter	6.206	0.0	538.6	146
240 min Winter	5.126	0.0	594.9	182
360 min Winter	3.877	0.0	676.8	256
480 min Winter	3.179	0.0	741.2	326
600 min Winter	2.725	0.0	795.1	396
720 min Winter	2.403	0.0	841.9	462
960 min Winter	1.972	0.0	921.1	594
1440 min Winter	1.492	0.0	1043.7	848
2160 min Winter	1.128	0.0	1205.3	1220
2880 min Winter	0.925	0.0	1316.6	1588
4320 min Winter	0.700	0.0	1486.8	2332
5760 min Winter	0.575	0.0	1649.1	3056
7200 min Winter	0.492	0.0	1764.2	3760
8640 min Winter	0.433	0.0	1859.4	4504
10080 min Winter	0.389	0.0	1939.6	5240

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Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	1	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.900	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 3.576

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.894	4	8	0.894	8	12	0.894	12	16	0.894

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Model Details

Storage is Online Cover Level (m) 20.200

Tank or Pond Structure

Invert Level (m) 19.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1787.7	0.401	2247.7	0.801	2723.7	1.200	3214.5
0.101	1901.2	0.501	2365.2	0.901	2845.2		
0.201	2015.7	0.601	2483.7	1.001	2967.7		
0.301	2131.2	0.701	2603.2	1.101	3091.3		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0267-3950-0900-3950
Design Head (m)	0.900
Design Flow (l/s)	39.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	267
Invert Level (m)	19.000
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1800

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.900	39.5
Flush-Flo™	0.401	39.5
Kick-Flo®	0.706	35.2
Mean Flow over Head Range	-	31.6

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	8.5	1.200	45.4	3.000	70.6	7.000	106.7
0.200	27.5	1.400	48.9	3.500	76.1	7.500	110.4
0.300	38.8	1.600	52.1	4.000	81.3	8.000	113.9
0.400	39.5	1.800	55.2	4.500	86.0	8.500	117.4
0.500	39.0	2.000	58.0	5.000	90.6	9.000	120.7
0.600	37.8	2.200	60.8	5.500	94.9	9.500	123.1
0.800	37.3	2.400	63.4	6.000	99.0		
1.000	41.6	2.600	65.9	6.500	102.9		

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	19.424	0.424	39.5	860.4	O K
30 min Summer	19.546	0.546	39.5	1146.2	O K
60 min Summer	19.666	0.666	39.5	1446.5	O K
120 min Summer	19.715	0.715	39.5	1573.4	O K
180 min Summer	19.734	0.734	39.5	1621.8	O K
240 min Summer	19.739	0.739	39.5	1635.8	O K
360 min Summer	19.731	0.731	39.5	1615.1	O K
480 min Summer	19.720	0.720	39.5	1584.8	O K
600 min Summer	19.708	0.708	39.5	1552.9	O K
720 min Summer	19.694	0.694	39.5	1518.3	O K
960 min Summer	19.666	0.666	39.5	1445.6	O K
1440 min Summer	19.609	0.609	39.5	1301.1	O K
2160 min Summer	19.527	0.527	39.5	1102.0	O K
2880 min Summer	19.458	0.458	39.5	937.6	O K
4320 min Summer	19.355	0.355	39.3	707.3	O K
5760 min Summer	19.292	0.292	38.6	570.9	O K
7200 min Summer	19.258	0.258	37.7	498.3	O K
8640 min Summer	19.240	0.240	34.9	461.7	O K
10080 min Summer	19.228	0.228	32.8	436.9	O K
15 min Winter	19.470	0.470	39.5	967.3	O K
30 min Winter	19.605	0.605	39.5	1290.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	134.447	0.0	856.0	29
30 min Summer	90.183	0.0	1158.4	43
60 min Summer	57.866	0.0	1528.3	72
120 min Summer	32.885	0.0	1739.0	130
180 min Summer	23.621	0.0	1874.6	186
240 min Summer	18.682	0.0	1977.6	244
360 min Summer	13.435	0.0	2133.8	342
480 min Summer	10.653	0.0	2256.3	396
600 min Summer	8.910	0.0	2358.8	458
720 min Summer	7.706	0.0	2448.1	520
960 min Summer	6.140	0.0	2599.9	654
1440 min Summer	4.483	0.0	2844.1	920
2160 min Summer	3.294	0.0	3165.1	1308
2880 min Summer	2.663	0.0	3410.9	1680
4320 min Summer	2.002	0.0	3834.2	2384
5760 min Summer	1.655	0.0	4251.3	3064
7200 min Summer	1.442	0.0	4628.7	3744
8640 min Summer	1.297	0.0	4994.2	4424
10080 min Summer	1.193	0.0	5348.6	5152
15 min Winter	134.447	0.0	962.5	29
30 min Winter	90.183	0.0	1300.6	43

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	19.738	0.738	39.5	1631.9	O K
120 min Winter	19.792	0.792	39.5	1778.8	O K
180 min Winter	19.814	0.814	39.5	1838.2	O K
240 min Winter	19.822	0.822	39.5	1859.9	O K
360 min Winter	19.818	0.818	39.5	1848.0	O K
480 min Winter	19.802	0.802	39.5	1803.7	O K
600 min Winter	19.785	0.785	39.5	1759.4	O K
720 min Winter	19.769	0.769	39.5	1715.8	O K
960 min Winter	19.732	0.732	39.5	1616.9	O K
1440 min Winter	19.643	0.643	39.5	1387.9	O K
2160 min Winter	19.514	0.514	39.5	1069.9	O K
2880 min Winter	19.407	0.407	39.5	821.6	O K
4320 min Winter	19.274	0.274	38.3	532.0	O K
5760 min Winter	19.233	0.233	33.7	446.5	O K
7200 min Winter	19.211	0.211	29.8	402.9	O K
8640 min Winter	19.197	0.197	26.9	374.6	O K
10080 min Winter	19.187	0.187	24.9	354.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	57.866	0.0	1713.6	72
120 min Winter	32.885	0.0	1949.6	128
180 min Winter	23.621	0.0	2101.5	184
240 min Winter	18.682	0.0	2216.8	240
360 min Winter	13.435	0.0	2391.8	350
480 min Winter	10.653	0.0	2528.9	450
600 min Winter	8.910	0.0	2643.7	482
720 min Winter	7.706	0.0	2743.6	558
960 min Winter	6.140	0.0	2913.3	714
1440 min Winter	4.483	0.0	3187.1	1002
2160 min Winter	3.294	0.0	3546.6	1392
2880 min Winter	2.663	0.0	3822.5	1756
4320 min Winter	2.002	0.0	4298.6	2380
5760 min Winter	1.655	0.0	4762.7	3056
7200 min Winter	1.442	0.0	5185.7	3752
8640 min Winter	1.297	0.0	5596.1	4496
10080 min Winter	1.193	0.0	5995.8	5152

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Rainfall Details

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
FEH Rainfall Version	2013	Cv (Winter)	0.840
Site Location	GB 448927 117350	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 3.576

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.894	4	8	0.894	8	12	0.894	12	16	0.894

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Model Details

Storage is Online Cover Level (m) 20.200

Tank or Pond Structure

Invert Level (m) 19.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1787.7	0.401	2247.7	0.801	2723.7	1.200	3214.5
0.101	1901.2	0.501	2365.2	0.901	2845.2		
0.201	2015.7	0.601	2483.7	1.001	2967.7		
0.301	2131.2	0.701	2603.2	1.101	3091.3		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0267-3950-0900-3950
Design Head (m)	0.900
Design Flow (l/s)	39.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	267
Invert Level (m)	19.000
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1800

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.900	39.5
Flush-Flo™	0.401	39.5
Kick-Flo®	0.706	35.2
Mean Flow over Head Range	-	31.6

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	8.5	1.200	45.4	3.000	70.6	7.000	106.7
0.200	27.5	1.400	48.9	3.500	76.1	7.500	110.4
0.300	38.8	1.600	52.1	4.000	81.3	8.000	113.9
0.400	39.5	1.800	55.2	4.500	86.0	8.500	117.4
0.500	39.0	2.000	58.0	5.000	90.6	9.000	120.7
0.600	37.8	2.200	60.8	5.500	94.9	9.500	123.1
0.800	37.3	2.400	63.4	6.000	99.0		
1.000	41.6	2.600	65.9	6.500	102.9		

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Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	18.392	0.092	5.7	75.4	O K
30 min Summer	18.417	0.117	8.6	96.6	O K
60 min Summer	18.441	0.141	11.5	116.8	O K
120 min Summer	18.458	0.158	13.5	131.9	O K
180 min Summer	18.467	0.167	14.4	139.7	O K
240 min Summer	18.472	0.172	14.9	143.9	O K
360 min Summer	18.474	0.174	15.1	145.8	O K
480 min Summer	18.473	0.173	14.9	144.5	O K
600 min Summer	18.470	0.170	14.7	141.9	O K
720 min Summer	18.466	0.166	14.3	138.7	O K
960 min Summer	18.459	0.159	13.5	132.2	O K
1440 min Summer	18.446	0.146	12.1	120.7	O K
2160 min Summer	18.431	0.131	10.3	107.9	O K
2880 min Summer	18.420	0.120	8.9	98.8	O K
4320 min Summer	18.406	0.106	7.3	86.6	O K
5760 min Summer	18.396	0.096	6.2	78.5	O K
7200 min Summer	18.389	0.089	5.4	72.7	O K
8640 min Summer	18.384	0.084	4.8	68.2	O K
10080 min Summer	18.379	0.079	4.4	64.5	O K
15 min Winter	18.403	0.103	6.9	84.2	O K
30 min Winter	18.431	0.131	10.3	107.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	29.494	0.0	70.9	28
30 min Summer	19.618	0.0	96.8	40
60 min Summer	12.728	0.0	132.6	64
120 min Summer	8.110	0.0	170.2	98
180 min Summer	6.206	0.0	195.9	130
240 min Summer	5.126	0.0	216.2	164
360 min Summer	3.877	0.0	245.7	232
480 min Summer	3.179	0.0	268.9	298
600 min Summer	2.725	0.0	288.4	362
720 min Summer	2.403	0.0	305.3	426
960 min Summer	1.972	0.0	334.0	550
1440 min Summer	1.492	0.0	378.6	794
2160 min Summer	1.128	0.0	434.4	1160
2880 min Summer	0.925	0.0	474.7	1528
4320 min Summer	0.700	0.0	536.7	2252
5760 min Summer	0.575	0.0	593.1	2992
7200 min Summer	0.492	0.0	634.6	3680
8640 min Summer	0.433	0.0	669.1	4416
10080 min Summer	0.389	0.0	698.4	5152
15 min Winter	29.494	0.0	80.3	28
30 min Winter	19.618	0.0	109.3	40

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Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	18.457	0.157	13.3	130.4	O K
120 min Winter	18.475	0.175	15.2	146.6	O K
180 min Winter	18.483	0.183	15.9	153.4	O K
240 min Winter	18.486	0.186	16.2	155.8	O K
360 min Winter	18.483	0.183	15.9	153.4	O K
480 min Winter	18.477	0.177	15.4	148.4	O K
600 min Winter	18.471	0.171	14.8	142.8	O K
720 min Winter	18.465	0.165	14.2	137.2	O K
960 min Winter	18.453	0.153	12.9	127.3	O K
1440 min Winter	18.436	0.136	10.9	112.2	O K
2160 min Winter	18.418	0.118	8.7	97.3	O K
2880 min Winter	18.407	0.107	7.4	87.6	O K
4320 min Winter	18.392	0.092	5.7	75.3	O K
5760 min Winter	18.383	0.083	4.8	67.7	O K
7200 min Winter	18.377	0.077	4.1	62.2	O K
8640 min Winter	18.371	0.071	3.6	58.1	O K
10080 min Winter	18.368	0.068	3.3	54.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	12.728	0.0	149.1	64
120 min Winter	8.110	0.0	191.1	102
180 min Winter	6.206	0.0	220.0	138
240 min Winter	5.126	0.0	242.7	176
360 min Winter	3.877	0.0	275.8	246
480 min Winter	3.179	0.0	301.8	314
600 min Winter	2.725	0.0	323.6	380
720 min Winter	2.403	0.0	342.6	446
960 min Winter	1.972	0.0	374.8	572
1440 min Winter	1.492	0.0	424.9	820
2160 min Winter	1.128	0.0	487.0	1188
2880 min Winter	0.925	0.0	532.1	1556
4320 min Winter	0.700	0.0	602.0	2288
5760 min Winter	0.575	0.0	664.6	3000
7200 min Winter	0.492	0.0	711.2	3744
8640 min Winter	0.433	0.0	750.0	4496
10080 min Winter	0.389	0.0	783.3	5224

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Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	1	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.900	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 1.438

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.360	4	8	0.360	8	12	0.360	12	16	0.358

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Model Details

Storage is Online Cover Level (m) 19.500

Tank or Pond Structure

Invert Level (m) 18.300

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	795.9	0.401	989.2	0.801	1198.5	1.200	1423.4
0.101	842.7	0.501	1040.0	0.901	1253.4		
0.201	890.5	0.601	1091.8	1.001	1309.2		
0.301	939.4	0.701	1144.7	1.101	1366.1		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0189-1770-0900-1770
Design Head (m)	0.900
Design Flow (l/s)	17.7
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	189
Invert Level (m)	18.300
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.900	17.7
Flush-Flo™	0.318	17.7
Kick-Flo®	0.660	15.3
Mean Flow over Head Range	-	14.8

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.6	1.200	20.3	3.000	31.4	7.000	47.3
0.200	17.0	1.400	21.8	3.500	33.9	7.500	48.9
0.300	17.7	1.600	23.2	4.000	36.1	8.000	50.5
0.400	17.5	1.800	24.6	4.500	38.2	8.500	52.0
0.500	17.1	2.000	25.9	5.000	40.2	9.000	53.5
0.600	16.3	2.200	27.1	5.500	42.1	9.500	54.7
0.800	16.7	2.400	28.2	6.000	43.9		
1.000	18.6	2.600	29.3	6.500	45.7		

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	18.687	0.387	17.7	343.1	O K
30 min Summer	18.799	0.499	17.7	457.1	O K
60 min Summer	18.910	0.610	17.7	575.3	O K
120 min Summer	18.951	0.651	17.7	620.9	O K
180 min Summer	18.964	0.664	17.7	635.5	O K
240 min Summer	18.965	0.665	17.7	636.3	O K
360 min Summer	18.950	0.650	17.7	619.1	O K
480 min Summer	18.933	0.633	17.7	600.6	O K
600 min Summer	18.917	0.617	17.7	582.6	O K
720 min Summer	18.900	0.600	17.7	564.5	O K
960 min Summer	18.867	0.567	17.7	528.2	O K
1440 min Summer	18.803	0.503	17.7	460.8	O K
2160 min Summer	18.717	0.417	17.7	373.3	O K
2880 min Summer	18.647	0.347	17.7	304.6	O K
4320 min Summer	18.552	0.252	17.5	215.9	O K
5760 min Summer	18.502	0.202	17.1	170.5	O K
7200 min Summer	18.481	0.181	15.7	151.9	O K
8640 min Summer	18.468	0.168	14.5	140.7	O K
10080 min Summer	18.459	0.159	13.6	132.6	O K
15 min Winter	18.730	0.430	17.7	386.1	O K
30 min Winter	18.855	0.555	17.7	515.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	134.447	0.0	351.7	29
30 min Summer	90.183	0.0	474.3	43
60 min Summer	57.866	0.0	618.6	72
120 min Summer	32.885	0.0	703.5	128
180 min Summer	23.621	0.0	758.3	186
240 min Summer	18.682	0.0	799.8	242
360 min Summer	13.435	0.0	862.9	322
480 min Summer	10.653	0.0	912.4	380
600 min Summer	8.910	0.0	954.0	438
720 min Summer	7.706	0.0	990.1	504
960 min Summer	6.140	0.0	1051.7	638
1440 min Summer	4.483	0.0	1151.1	904
2160 min Summer	3.294	0.0	1275.3	1284
2880 min Summer	2.663	0.0	1374.5	1648
4320 min Summer	2.002	0.0	1546.7	2336
5760 min Summer	1.655	0.0	1711.0	3000
7200 min Summer	1.442	0.0	1863.2	3688
8640 min Summer	1.297	0.0	2011.0	4416
10080 min Summer	1.193	0.0	2155.2	5144
15 min Winter	134.447	0.0	394.8	29
30 min Winter	90.183	0.0	532.0	43

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	18.977	0.677	17.7	650.2	O K
120 min Winter	19.025	0.725	17.7	704.5	O K
180 min Winter	19.041	0.741	17.7	723.6	O K
240 min Winter	19.045	0.745	17.7	727.6	O K
360 min Winter	19.033	0.733	17.7	714.1	O K
480 min Winter	19.011	0.711	17.7	688.8	O K
600 min Winter	18.992	0.692	17.7	666.4	O K
720 min Winter	18.970	0.670	17.7	642.0	O K
960 min Winter	18.920	0.620	17.7	585.9	O K
1440 min Winter	18.820	0.520	17.7	478.4	O K
2160 min Winter	18.686	0.386	17.7	342.0	O K
2880 min Winter	18.583	0.283	17.6	244.4	O K
4320 min Winter	18.487	0.187	16.3	157.2	O K
5760 min Winter	18.461	0.161	13.7	134.1	O K
7200 min Winter	18.446	0.146	12.1	121.1	O K
8640 min Winter	18.436	0.136	10.9	112.7	O K
10080 min Winter	18.429	0.129	10.1	106.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	57.866	0.0	693.2	72
120 min Winter	32.885	0.0	788.4	126
180 min Winter	23.621	0.0	849.7	184
240 min Winter	18.682	0.0	896.2	240
360 min Winter	13.435	0.0	966.9	348
480 min Winter	10.653	0.0	1022.4	438
600 min Winter	8.910	0.0	1068.8	476
720 min Winter	7.706	0.0	1109.3	554
960 min Winter	6.140	0.0	1178.3	700
1440 min Winter	4.483	0.0	1289.9	978
2160 min Winter	3.294	0.0	1428.7	1356
2880 min Winter	2.663	0.0	1540.0	1696
4320 min Winter	2.002	0.0	1733.5	2296
5760 min Winter	1.655	0.0	1916.7	3000
7200 min Winter	1.442	0.0	2087.2	3744
8640 min Winter	1.297	0.0	2252.9	4416
10080 min Winter	1.193	0.0	2415.2	5144

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Rainfall Details

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
FEH Rainfall Version	2013	Cv (Winter)	0.840
Site Location	GB 448927 117350	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.438

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.360	4	8	0.360	8	12	0.360	12	16	0.358

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Model Details

Storage is Online Cover Level (m) 19.500

Tank or Pond Structure

Invert Level (m) 18.300

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	795.9	0.401	989.2	0.801	1198.5	1.200	1423.4
0.101	842.7	0.501	1040.0	0.901	1253.4		
0.201	890.5	0.601	1091.8	1.001	1309.2		
0.301	939.4	0.701	1144.7	1.101	1366.1		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0189-1770-0900-1770
Design Head (m)	0.900
Design Flow (l/s)	17.7
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	189
Invert Level (m)	18.300
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.900	17.7
Flush-Flo™	0.318	17.7
Kick-Flo®	0.660	15.3
Mean Flow over Head Range	-	14.8

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.6	1.200	20.3	3.000	31.4	7.000	47.3
0.200	17.0	1.400	21.8	3.500	33.9	7.500	48.9
0.300	17.7	1.600	23.2	4.000	36.1	8.000	50.5
0.400	17.5	1.800	24.6	4.500	38.2	8.500	52.0
0.500	17.1	2.000	25.9	5.000	40.2	9.000	53.5
0.600	16.3	2.200	27.1	5.500	42.1	9.500	54.7
0.800	16.7	2.400	28.2	6.000	43.9		
1.000	18.6	2.600	29.3	6.500	45.7		

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Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	17.190	0.090	7.3	201.6	O K
30 min Summer	17.217	0.117	11.8	262.5	O K
60 min Summer	17.244	0.144	17.1	326.1	O K
120 min Summer	17.267	0.167	22.0	379.9	O K
180 min Summer	17.278	0.178	24.4	405.0	O K
240 min Summer	17.285	0.185	26.1	422.6	O K
360 min Summer	17.292	0.192	27.7	440.2	O K
480 min Summer	17.296	0.196	28.4	447.7	O K
600 min Summer	17.296	0.196	28.6	449.7	O K
720 min Summer	17.296	0.196	28.4	448.6	O K
960 min Summer	17.293	0.193	27.8	441.4	O K
1440 min Summer	17.284	0.184	25.9	421.1	O K
2160 min Summer	17.271	0.171	23.0	390.4	O K
2880 min Summer	17.261	0.161	20.7	365.1	O K
4320 min Summer	17.245	0.145	17.3	327.7	O K
5760 min Summer	17.233	0.133	14.9	301.0	O K
7200 min Summer	17.224	0.124	13.2	280.8	O K
8640 min Summer	17.217	0.117	11.9	264.3	O K
10080 min Summer	17.212	0.112	10.9	250.8	O K
15 min Winter	17.200	0.100	8.9	225.4	O K
30 min Winter	17.230	0.130	14.3	293.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	29.494	0.0	160.5	30
30 min Summer	19.618	0.0	225.5	42
60 min Summer	12.728	0.0	329.8	68
120 min Summer	8.110	0.0	426.8	120
180 min Summer	6.206	0.0	493.4	146
240 min Summer	5.126	0.0	545.8	178
360 min Summer	3.877	0.0	622.0	244
480 min Summer	3.179	0.0	681.8	312
600 min Summer	2.725	0.0	731.8	378
720 min Summer	2.403	0.0	775.1	444
960 min Summer	1.972	0.0	848.2	574
1440 min Summer	1.492	0.0	960.5	826
2160 min Summer	1.128	0.0	1119.6	1196
2880 min Summer	0.925	0.0	1222.5	1564
4320 min Summer	0.700	0.0	1377.2	2296
5760 min Summer	0.575	0.0	1536.9	3008
7200 min Summer	0.492	0.0	1643.4	3752
8640 min Summer	0.433	0.0	1730.5	4496
10080 min Summer	0.389	0.0	1801.6	5240
15 min Winter	29.494	0.0	184.1	29
30 min Winter	19.618	0.0	257.3	42

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Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	17.260	0.160	20.6	364.0	O K
120 min Winter	17.286	0.186	26.2	424.2	O K
180 min Winter	17.296	0.196	28.6	449.8	O K
240 min Winter	17.303	0.203	30.1	466.3	O K
360 min Winter	17.308	0.208	31.1	476.9	O K
480 min Winter	17.308	0.208	31.1	476.4	O K
600 min Winter	17.305	0.205	30.6	470.9	O K
720 min Winter	17.302	0.202	29.9	463.2	O K
960 min Winter	17.295	0.195	28.2	445.3	O K
1440 min Winter	17.280	0.180	24.9	410.5	O K
2160 min Winter	17.262	0.162	21.0	368.3	O K
2880 min Winter	17.249	0.149	18.1	337.0	O K
4320 min Winter	17.230	0.130	14.4	294.6	O K
5760 min Winter	17.218	0.118	12.1	266.6	O K
7200 min Winter	17.209	0.109	10.4	246.0	O K
8640 min Winter	17.202	0.102	9.3	230.1	O K
10080 min Winter	17.197	0.097	8.4	217.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	12.728	0.0	372.4	68
120 min Winter	8.110	0.0	481.2	118
180 min Winter	6.206	0.0	555.8	150
240 min Winter	5.126	0.0	614.6	186
360 min Winter	3.877	0.0	700.1	260
480 min Winter	3.179	0.0	767.1	332
600 min Winter	2.725	0.0	823.2	402
720 min Winter	2.403	0.0	871.9	470
960 min Winter	1.972	0.0	954.0	602
1440 min Winter	1.492	0.0	1080.6	860
2160 min Winter	1.128	0.0	1256.2	1236
2880 min Winter	0.925	0.0	1371.9	1600
4320 min Winter	0.700	0.0	1546.9	2344
5760 min Winter	0.575	0.0	1722.9	3064
7200 min Winter	0.492	0.0	1842.5	3824
8640 min Winter	0.433	0.0	1940.9	4576
10080 min Winter	0.389	0.0	2022.7	5256

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Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	1	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.900	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 3.743

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.935	4	8	0.935	8	12	0.935	12	16	0.938

Time Area Diagram

Total Area (ha) 0.000

Time From:	(mins) To:	Area (ha)
0	4	0.000

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Model Details

Storage is Online Cover Level (m) 18.300

Tank or Pond Structure

Invert Level (m) 17.100

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	2197.7	0.401	2579.3	0.801	2976.7	1.200	3388.8
0.101	2291.7	0.501	2677.2	0.901	3078.5		
0.201	2386.6	0.601	2776.0	1.001	3181.3		
0.301	2482.5	0.701	2875.8	1.101	3285.0		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0285-4610-0900-4610
Design Head (m)	0.900
Design Flow (l/s)	46.1
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	285
Invert Level (m)	17.100
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1800

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.900	46.1
Flush-Flo™	0.426	46.0
Kick-Flo®	0.721	41.4
Mean Flow over Head Range	-	36.5

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	8.9	1.200	52.9	3.000	82.5	7.000	124.7
0.200	29.4	1.400	57.0	3.500	88.9	7.500	128.9
0.300	44.8	1.600	60.8	4.000	94.9	8.000	133.1
0.400	46.0	1.800	64.4	4.500	100.5	8.500	137.1
0.500	45.7	2.000	67.7	5.000	105.8	9.000	141.0
0.600	44.6	2.200	70.9	5.500	110.8	9.500	143.8
0.800	43.5	2.400	74.0	6.000	115.6		
1.000	48.5	2.600	76.9	6.500	120.2		

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	17.479	0.379	45.9	899.6	O K
30 min Summer	17.592	0.492	46.0	1195.6	O K
60 min Summer	17.705	0.605	46.0	1504.6	O K
120 min Summer	17.750	0.650	46.0	1628.8	O K
180 min Summer	17.765	0.665	46.0	1671.6	O K
240 min Summer	17.767	0.667	46.0	1678.8	O K
360 min Summer	17.758	0.658	46.0	1651.6	O K
480 min Summer	17.747	0.647	46.0	1622.1	O K
600 min Summer	17.736	0.636	46.0	1590.1	O K
720 min Summer	17.723	0.623	46.0	1555.2	O K
960 min Summer	17.696	0.596	46.0	1479.4	O K
1440 min Summer	17.641	0.541	46.0	1326.5	O K
2160 min Summer	17.563	0.463	46.0	1118.7	O K
2880 min Summer	17.500	0.400	46.0	953.8	O K
4320 min Summer	17.414	0.314	45.1	737.4	O K
5760 min Summer	17.370	0.270	43.5	626.7	O K
7200 min Summer	17.348	0.248	39.5	573.4	O K
8640 min Summer	17.333	0.233	36.6	536.6	O K
10080 min Summer	17.322	0.222	34.4	511.0	O K
15 min Winter	17.522	0.422	46.0	1010.9	O K
30 min Winter	17.648	0.548	46.0	1346.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	134.447	0.0	881.1	29
30 min Summer	90.183	0.0	1197.1	43
60 min Summer	57.866	0.0	1591.4	72
120 min Summer	32.885	0.0	1811.8	128
180 min Summer	23.621	0.0	1953.6	184
240 min Summer	18.682	0.0	2061.2	242
360 min Summer	13.435	0.0	2224.5	310
480 min Summer	10.653	0.0	2352.5	370
600 min Summer	8.910	0.0	2459.6	434
720 min Summer	7.706	0.0	2552.8	500
960 min Summer	6.140	0.0	2711.1	634
1440 min Summer	4.483	0.0	2965.2	900
2160 min Summer	3.294	0.0	3307.2	1284
2880 min Summer	2.663	0.0	3563.4	1648
4320 min Summer	2.002	0.0	4002.1	2340
5760 min Summer	1.655	0.0	4446.3	3008
7200 min Summer	1.442	0.0	4840.3	3744
8640 min Summer	1.297	0.0	5221.3	4424
10080 min Summer	1.193	0.0	5588.5	5152
15 min Winter	134.447	0.0	992.4	29
30 min Winter	90.183	0.0	1345.8	43

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	17.774	0.674	46.0	1698.0	O K
120 min Winter	17.826	0.726	46.0	1848.0	O K
180 min Winter	17.846	0.746	46.0	1906.2	O K
240 min Winter	17.852	0.752	46.0	1924.3	O K
360 min Winter	17.845	0.745	46.0	1902.4	O K
480 min Winter	17.826	0.726	46.0	1847.9	O K
600 min Winter	17.809	0.709	46.0	1798.7	O K
720 min Winter	17.790	0.690	46.0	1743.6	O K
960 min Winter	17.747	0.647	46.0	1622.1	O K
1440 min Winter	17.658	0.558	46.0	1375.5	O K
2160 min Winter	17.538	0.438	46.0	1052.1	O K
2880 min Winter	17.446	0.346	45.6	816.9	O K
4320 min Winter	17.358	0.258	41.4	598.1	O K
5760 min Winter	17.326	0.226	35.2	521.4	O K
7200 min Winter	17.308	0.208	31.1	476.2	O K
8640 min Winter	17.294	0.194	28.1	445.0	O K
10080 min Winter	17.285	0.185	26.0	422.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	57.866	0.0	1785.3	72
120 min Winter	32.885	0.0	2032.1	128
180 min Winter	23.621	0.0	2190.9	184
240 min Winter	18.682	0.0	2311.4	240
360 min Winter	13.435	0.0	2494.2	348
480 min Winter	10.653	0.0	2637.5	412
600 min Winter	8.910	0.0	2757.5	472
720 min Winter	7.706	0.0	2862.0	548
960 min Winter	6.140	0.0	3039.5	694
1440 min Winter	4.483	0.0	3324.8	974
2160 min Winter	3.294	0.0	3706.6	1352
2880 min Winter	2.663	0.0	3994.1	1700
4320 min Winter	2.002	0.0	4488.3	2336
5760 min Winter	1.655	0.0	4981.5	3056
7200 min Winter	1.442	0.0	5423.4	3752
8640 min Winter	1.297	0.0	5851.4	4496
10080 min Winter	1.193	0.0	6266.3	5240

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Rainfall Details

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
FEH Rainfall Version	2013	Cv (Winter)	0.840
Site Location	GB 448927 117350	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 3.743

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.935	4	8	0.935	8	12	0.935	12	16	0.938

Time Area Diagram

Total Area (ha) 0.000

Time From:	(mins) To:	Area (ha)
0	4	0.000

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Model Details

Storage is Online Cover Level (m) 18.300

Tank or Pond Structure

Invert Level (m) 17.100

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	2197.7	0.401	2579.3	0.801	2976.7	1.200	3388.8
0.101	2291.7	0.501	2677.2	0.901	3078.5		
0.201	2386.6	0.601	2776.0	1.001	3181.3		
0.301	2482.5	0.701	2875.8	1.101	3285.0		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0285-4610-0900-4610
Design Head (m)	0.900
Design Flow (l/s)	46.1
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	285
Invert Level (m)	17.100
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1800

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.900	46.1
Flush-Flo™	0.426	46.0
Kick-Flo®	0.721	41.4
Mean Flow over Head Range	-	36.5

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	8.9	1.200	52.9	3.000	82.5	7.000	124.7
0.200	29.4	1.400	57.0	3.500	88.9	7.500	128.9
0.300	44.8	1.600	60.8	4.000	94.9	8.000	133.1
0.400	46.0	1.800	64.4	4.500	100.5	8.500	137.1
0.500	45.7	2.000	67.7	5.000	105.8	9.000	141.0
0.600	44.6	2.200	70.9	5.500	110.8	9.500	143.8
0.800	43.5	2.400	74.0	6.000	115.6		
1.000	48.5	2.600	76.9	6.500	120.2		

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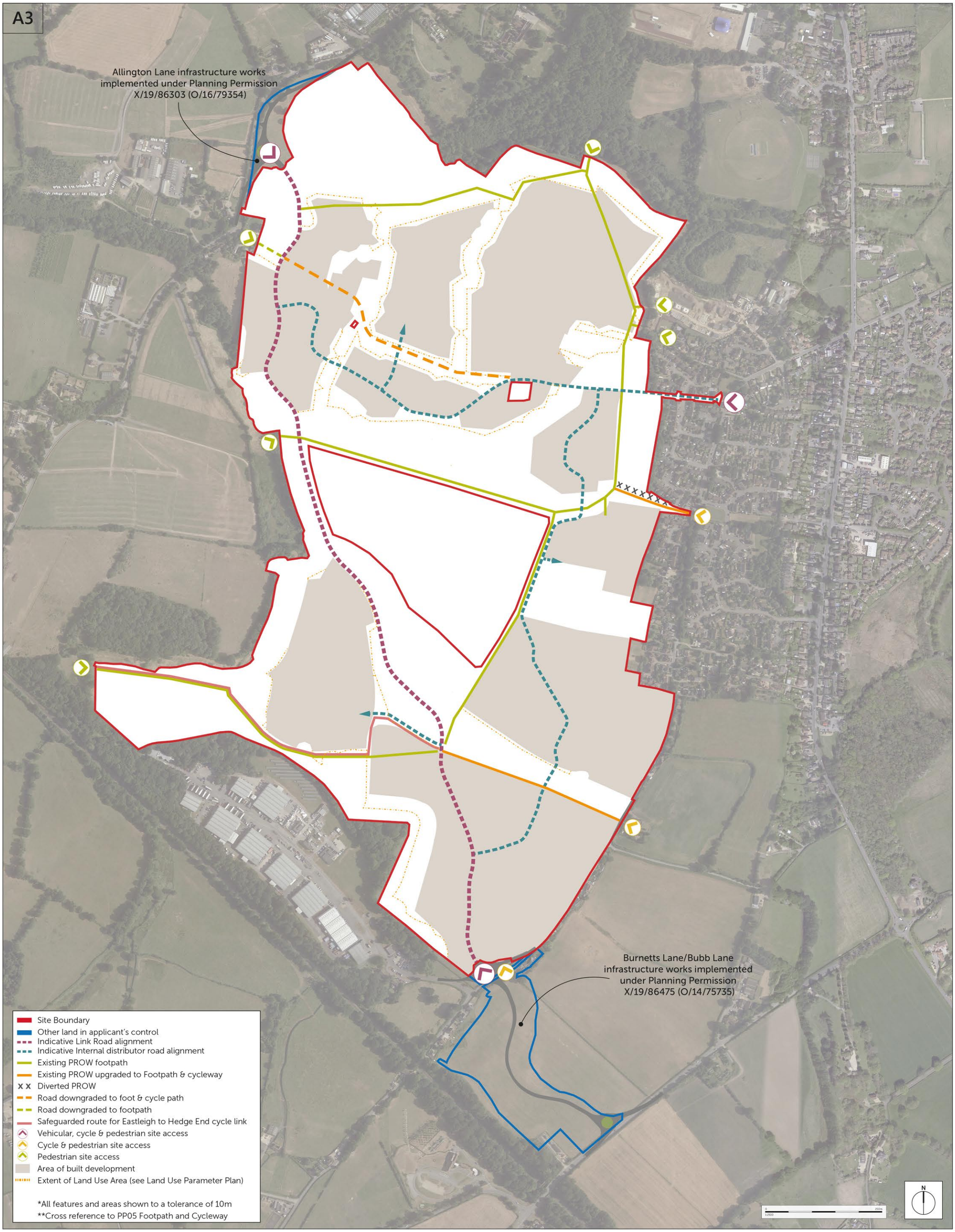
Appendix 12

A3



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www.thrivearchitects.co.uk

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Rev	Description	Date	Au	Ch
P10	Solar farm relocation land moved	14.09.20	GR/kn	GR
P11	Minor graphic changes, realignment of internal distributor road	16.09.20	GR/kn	GR
P12	Minor amendment to Fir Tree Farm developable land	17.09.20	GR/kn	GR
P13	Layout amendments	25.09.20	GR/kn	GR
P14	Minor layout amendments, key updated	02.10.20	GR/kn	GR
P15	All PROW grouped	07.10.20	GR/kn	GR
P16	Routes revised	14.10.20	GR/kn	GR
P17	Minor Updates	19.10.20	GR/SWD	GR
P18	Minor layout and redline adjustment	29.10.20	GR/kn	GR
P19	Pedestrian & cycle access points revised, key updated	13.11.20	GR/kn	GR
P20	Allington Lane/Fir Tree Lane access route amended	16.11.20	GR/kn	GR
P21	Redline amended	26.11.20	GR/kn	GR
P22	Nett & Gross developable areas updated	03.12.20	GR/kn	GR

Project	ONE HORTON HEATH				
Drawing	Parameter Plan Access				
Client	Eastleigh Borough Council				
Job no.	EAST200403			Date	09.06.20
Dwg no.	PP01			Rev.	P22
Author	KS/kn	Checked	GR/KS	Scale	NTS@A3
Status	PRELIMINARY			Office	Romsey
Client ref.	-				

thrive. architects

Appendix 13

From:	FWM Statutory SWM Consultee mailbox
To:	Mark Skivington
Cc:	FWM Statutory SWM Consultee mailbox
Subject:	RE: G277 - One Horton Heath - 14/01/2020 Meeting with LLFA
Date:	02 March 2020 12:26:50

Dear Mr Skivington,

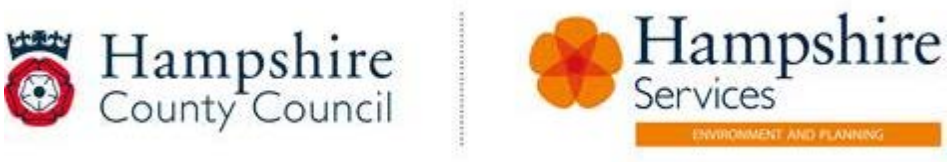
Thank you for your email.

I confirm that I agree with the submitted minutes.

Kind regards,
Santi

Santiago Manzanero
Flood and Water Management Engineer
01962 846777
Santi.Manzanero@hants.gov.uk

Economy Transport and Environment
EII Court West
The Castle
Winchester
Hampshire
SO23 8UD



Hampshire Services offers a range of professional consultancy services to partner organisations.
www.hants.gov.uk/sharedexpertise

The HCC Flood and Water Management team offer a Flood and Water Management information service for Local Authorities and developers offering both historic site information and a full Pre-Application assessment of a proposed development's Surface Water Drainage features. For specific information please visit the 'Reducing flood risk in planning' webpage or for general information see HCC Flood & Water Management

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From: Mark Skivington <mskivington@pfaplc.com>
Sent: 25 February 2020 15:58
To: FWM Statutory SWM Consultee mailbox <SWM.Consultee@hants.gov.uk>
Cc: 'Cranmer, David' <David.Cranmer@eastleigh.gov.uk>; smillard@pfaplc.com
Subject: G277 - One Horton Heath - 14/01/2020 Meeting with LLFA

Dear Santiago,

Thank you for taking the time to meet with us at your offices last month. I believe that the

following provides a summary of the discussions in relation to the outline planning application.

Broad agreement of the surface water drainage strategy as shown on drawing G277/9 Rev A (attached). HCC confirmed that, for an Outline Application of this scale, Micro Drainage Source Control modelling outputs would be suitable to demonstrate that the proposed strategic SuDS features provide the required attenuation.

Strategic SuDS features to incorporate a series of treatment processes, i.e. sediment forebays, micropools, low flow channels, wetland planting areas and swales for outfalls where possible. Upstream Source Control and green infrastructure measures to be covered by text within drainage strategy / Flood Risk Assessment reports to inform later detailed designs.

Agreement that BGS borehole logs and other evidence is suitable to demonstrate that infiltration drainage is not feasible. If information on groundwater levels is not available SuDS features may need to be clay lined to prevent ingress.

Due to the lack of potential for infiltration drainage it will not be feasible to reduce post-development runoff volumes to the greenfield volume. HCC confirmed that they would accept flow rates for events up to the 1 in 100year + 40% being restricted to Qbar/Qmed as an alternative. The SuDS features shown on G277/9 Rev A have been sized on this basis.

Catchments draining to strategic SuDS features should replicate natural catchments as closely as possible.

HCC to provide guidance on offsets from Ordinary Watercourses. It was mentioned in the meeting that the appropriate offsets are thought to be 8 metres for Main Rivers (EA) and 5 metres for Ordinary Watercourses. HCC to confirm.

PFA to provide Greenfield Runoff calculations for approval by HCC. A Technical Note setting out the Greenfield Runoff calculations is attached.

Please could you confirm that you agree that the above is a fair reflection of our discussions and please let me know if you have any further comments.

Kind regards,

Mark Skivington
Associate Designate

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Wanborough Road
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SN3 4HG

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PFA Consulting Ltd
Company Registered in England 03871018. Registered address as above.

Appendix 14

This document should be read in conjunction with the Surface Water Checklist Guidance document located on our website

SURFACE WATER SUBMITTED INFORMATION

Some applications have a considerable number of documents associated with them. To make sure we are reviewing the correct documentation, please ensure the following table is completed.

Document / Drawing Title	Document / Drawing Reference (and revision)
PFA Consulting's: One Horton Heath, Eastleigh – Flood Risk Assessment	G277-DOC01 Issue 1 & Appendices

PRE-APPLICATION / PREVIOUS PLANNING APPLICATIONS

If this site was subject to a previous planning application i.e. an outline application in relation to a wider strategic site, pre-application enquiry or if you are reliant on information previously submitted, please provide the relevant reference numbers below.

Planning / Pre-app Titles	Reference Number
Pre-application meeting and follow up emails.	Meeting date: 14/01/2020 with Santiago Manzanero

ORDINARY WATERCOURSE CONSENTING – to be completed and signed by the applicant

I confirm that I have reviewed the site and there are watercourses / ditches / flow routes that will be affected or amended by the works. I understand that these works require Ordinary Watercourse Consent under the Land Drainage Act 1991 and confirm that applications will be made for these works prior to works starting on site.

Name:…… **Job Title:……**

Signature:……

SURFACE WATER CHECKLIST

Site Name		Planning ref			
Ref	**SURFACE WATER REQUIREMENTS**	**PLANNING STAGE**		**SUBMISSSION CHECKLIST**	
		OUTLINE PLANNING	DETAILED PLANNING	Included Yes/Not	DOCUMENT Ref
	EXISTING INFORMATION	X	X		
1	Topographical Survey.	X	X	Yes	Mayer Brown IR SAV 1.21 Rev E
2	Existing Drainage	X	X	Yes	PFA dwg G277/20
3	Discharge Rates and Volumes	X	X	Yes	FRA
4	Existing Overland Flow Paths	X	X	Yes	PFA dwg G277/20
5	Site Investigations	X	X	Yes	Hydrock Doc ref: HHD-HYD-XX-XX-RP-GE-0002
	OUTLINE DRAINAGE STRATEGY				
6	Confirmation of a discharge location	X	X	Yes	PFA dwg G277/21&22
7	Outline Surface Water Calculations	X		Yes	FRA
8	Flood Risk Assessment / Drainage Strategy	X	X	Yes	FRA
9	Potential Flood Risk	X	X	Yes	FRA
10	Outline Drainage Layout Plan	X		Yes	PFA dwg G277/21,22&23
	DETAILED DRAINAGE STRATEGY		X		
11	Detailed Drainage Assessment		X		
12	Detailed Drainage Layout Drawings		X		
13	Detailed Hydraulic Calculations		X		
14	Water Treatment		X		
15	Exceedance Flows		X		
16	Urban Creep		X		
17	Maintenance		X		

ONE HORTON HEATH

FLOOD RISK ASSESSMENT ADDENDUM (O/20/89498)

1. Introduction

1.1. A Flood Risk Assessment (FRA) was prepared by PFA Consulting (reference G277-DOC01 FRA - Issue 2) to support the Outline Planning Application (OPA) for the proposed One Horton Heath development, under planning application reference number (0/20/89498).

1.2. This Flood Risk Assessment Addendum technical note has been prepared by PFA Consulting on behalf of Eastleigh Borough Council to summarise the emergent ecological mitigation measures proposed for the OPA.

1.3. This technical note captures the changes incorporated into the proposed water management strategy, relating to water quality, that have evolved through the application process for the One Horton Heath development.

2. Surface Water Management Strategy

2.1. This section summaries the proposed water quality measures incorporated within the OPA surface water management strategy.

2.2. A sustainable drainage strategy, involving the implementation of SuDS, is proposed for managing surface water on the site.

2.3. A full range of SuDS techniques has been considered for use on the site. Through early discussions with the Lead Local Flood Authority (LLFA) and other stakeholders, it was agreed that the Strategic SuDS Features on the site should comprise above ground storage features within the green corridors that follow the existing onsite watercourses. An overview of the proposed SuDS features and their associated outfall locations is shown on drawing numbers G277/38 and G277/39 in **Appendix A.**

2.4. Additional source control measures should be utilised within the upstream development parcels. This approach provides flexibility for the detailed design of individual development parcels whilst maximising the water quality, water quantity, amenity and biodiversity benefits of the overall SuDS strategy.

2.5. A SuDS 'management train' approach is proposed to be implemented on the site. Guidance on the SuDS Features that should make up the SuDS management train is shown on drawing number G277/24 Rev A, a copy of which is contained in **Appendix B**.

2.6. In terms of the SuDS 'management train', the surface water management strategy for the proposed development seeks to address the quality and quantity of runoff as follows:-

i) Prevention

2.7. Prevention is the use of good site design and housekeeping measures to prevent pollution. Good site design and housekeeping measures that should be considered include:

- Minimising the impermeable areas created on the site by providing soft landscaping and planting wherever possible.

- Good site wide housekeeping and maintenance to minimise blockages and prevent pollution arising.
- Provision of water butts for rear gardens.
- The use of green roofs for public / commercial buildings where appropriate.
- The use of rainwater harvesting / reuse systems for public / commercial buildings and irrigation where appropriate.
- Installation of separators and other proprietary pollution control systems where land use requires or specific risks necessitate their use.
- Silt traps and trapped gullies to retain sediment.
- Planting within landscaped areas to encourage nutrient / pollutant uptake and evapotranspiration.
- The implementation of a SuDS Maintenance Strategy. Advice on what should be included within a maintenance strategy for the Strategic SuDS Features is included with this report. The SuDS Maintenance Strategy should become a living document that is continuously reviewed.

ii) Source Control

2.8. Source control is defined in The SuDS Manual 2015 (CIRIA C753) as the control of runoff at or near its source, so that it does not enter the drainage system or is delayed and attenuated before it enters the drainage system. Source Control techniques that should be used within development parcels include the following:

- **Pervious Paving:** Pervious paving intercepts rainfall that lands on its surface before it can run overland into the downstream drainage system. This provides a degree of interception, particularly in the most polluted first-flush events, as well as filtration through the various layers of construction and through the stone sub-base. Pervious paving would typically be used for parking areas such as driveways, parking courts and car parks. Through the inclusion of a suitable flow control device, the stone sub-base in the pervious paving structure can be utilised to provide additional attenuation storage.
- **Bioretention Areas / Rain Gardens:** Bioretention areas utilise planting and constructed soils to intercept rainfall from their contributing catchment areas and contribute to interception storage, evapotranspiration and pollution removal. They can be placed around downpipes to intercept roof runoff, particularly from larger commercial buildings where they can form part of the landscape design. They can also be incorporated into traffic calming infrastructure such as build outs and into roadside planting and tree pits. Bioretention Swales can be installed adjacent to larger areas of highway to provide water quality treatment and attenuation storage along their length.
- **Other filtration techniques:** Filter Trenches and French Drains can be used to intercept runoff from larger parking areas and highway areas. These will provide interception storage and filtration through the stone fill within the trenches.

iii) Site Control

2.9. Site control is the management of water from several sub-catchments within a development parcel. Through close consultation with the layout designers flow conveyance measures such as swales and filter trenches should be incorporated into the development parcels to provide additional attenuation, treatment, amenity and opportunities for habitat creation.

iv) Regional Control

2.10. Regional control is the strategic management of runoff across the wider site. The Strategic SuDS Features will provide the attenuation volume and flow control required to reduce post-development flow rates to below greenfield runoff rates.

2.11. The proper implementation of a SuDS management / treatment train using a combination of upstream source control and strategic SuDS features will create greater resilience and allow the system to collect silt at various points which can then be removed as part of periodic maintenance.

2.12. Detailed design of the individual development parcels should, where possible, create a diverse SuDS scheme that encourages sedimentation, filtration and biological uptake throughout the site; ensuring that effective maintenance and management procedures are followed will be the key to ensuring the overall effectiveness of the SuDS scheme.

Water Quality

2.13. With reference to Chapter 26 of the CIRIA SuDS Manual 2015, and using the simple index approach, to deliver adequate treatment the SuDS components should have a total pollution mitigation index (for each contaminant type) that equals or exceeds the pollution hazard index (for each contaminant type):

Total SuDS mitigation index > pollution hazard index

2.14. From Table 26.2 in the CIRIA SuDS Manual 2015 the pollution hazard indices for each contaminant type for the proposed land use are shown in **Table A** below.

Table A: Pollution hazard indices

Land Use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydrocarbons
Residential roofs	Very Low	0.2	0.2	0.05
Other roofs (commercial)	Low	0.3	0.2 (up to 0.8 where there is potential for metals to leach)	0.05
Property driveways, residential car parks, low traffic roads and non-residential car parking with infrequent change (eg school, offices)	Low	0.5	0.4	0.4
Commercial yard and delivery areas, non-residential car parking with frequent change, all roads except low traffic roads and trunk roads/motorways.	Medium	0.7	0.6	0.7
Sites with heavy pollution, sites where chemicals and fuels are to be delivered, handled, stored, used or manufactured, industrial sites, trunk roads and motorways.	High	0.8	0.8	0.9

2.15. From Table 26.3 in the CIRIA SuDS Manual 2015 the indicative SuDS mitigation indices for discharges to surface waters for the SuDS components proposed on the site are shown in **Table B** below.

Table B: Indicative SuDS mitigation indices for discharges to surface waters

Type of SuDS component	TSS	Metals	Hydrocarbons
Filter Strip	0.4	0.4	0.5
Filter Drain	0.4	0.4	0.4
Swale	0.5	0.6	0.6
Bioretention system	0.8	0.8	0.8
Permeable pavement	0.7	0.6	0.7
Detention Basin	0.5	0.5	0.6
Pond	0.7	0.7	0.5
Wetland	0.8	0.8	0.8
Hydrodynamic vortex separator *	0.8	0.8	0.8

* Proprietary treatment systems must demonstrate that they can address each of the contaminant types to acceptable levels for frequent events up to approximately the 1 in 1 year return period event, for inflow concentrations relevant to the contributing drainage area.

2.16. It is proposed that surface water runoff from all development areas on the site will be treated by a SuDS Management Train consisting of source control techniques, strategic SuDS features and mechanical separators. The source control techniques designed for the individual development parcels should take account of the Pollution Hazard Indices and the Mitigation Indices shown in Tables A and B above.

2.17. In addition to the upstream source control measures, runoff from all development areas on the site will pass through at least one Strategic SuDS Feature. The Strategic SuDS Features are enhanced features that promote sedimentation and filtration through multiple forms incorporated into the feature's design.

2.18. The Strategic SuDS Features will incorporate the following treatment processes as a minimum: -

- Sediment forebays at inlets.
- Extensive wetland areas incorporating micro pools.
- Wetland planting.
- Secondary sedimentation areas prior to outlets.

2.19. The incorporation of the above measures forming distinct zones within the Strategic SuDS Features will promote water quality through increased retention times, filtration and sedimentation. Filtration, chemical precipitation, microbial degradation and vegetation uptake are key features/processes associated with these enhanced SuDS features.

2.20. As an additional measure, mechanical separation in the form of Downstream Defenders, or similar approved apparatus, will be incorporated downstream of Strategic SuDS Features. This approach has already been implemented for the Southern Access and should be replicated elsewhere on the site. Details of the proposed Downstream Defenders are contained in **Appendix C**.

2.21. An example of a typical layout for the Strategic SuDS Features is shown on the 'Typical Layout of Strategic SuDS Features Plan' in **Appendix D.** It is intended that this drawing should be used to inform the detailed design of the Strategic SuDS Features to ensure that the treatment processes outlined above are fully incorporated.

2.22. With reference to Tables A and B above it can be seen that the total pollution mitigation associated with the wetland areas equals or exceeds the pollution hazard index (for each contaminant type), for the land uses proposed on the site with the possible exception of B2 and B8 land uses.

2.23. Where individual land uses present a 'High' pollution hazard level then bespoke solutions will need to be designed for these locations. For example, bioretention systems and proprietary treatment systems should be considered and their design should be targeted at the specific contaminant types associated with the proposed land use.

2.24. Provided that good practice is followed and that suitable housekeeping and maintenance of the SuDS features and wider site is undertaken, based on the Pollution and Mitigation Indices, it is not envisaged that increased sediment loads would occur post construction. On the basis that the post-construction sediment shed would be lower than the existing baseline, there is no requirement for water monitoring or any additional post construction mitigation measures.

3. Summary

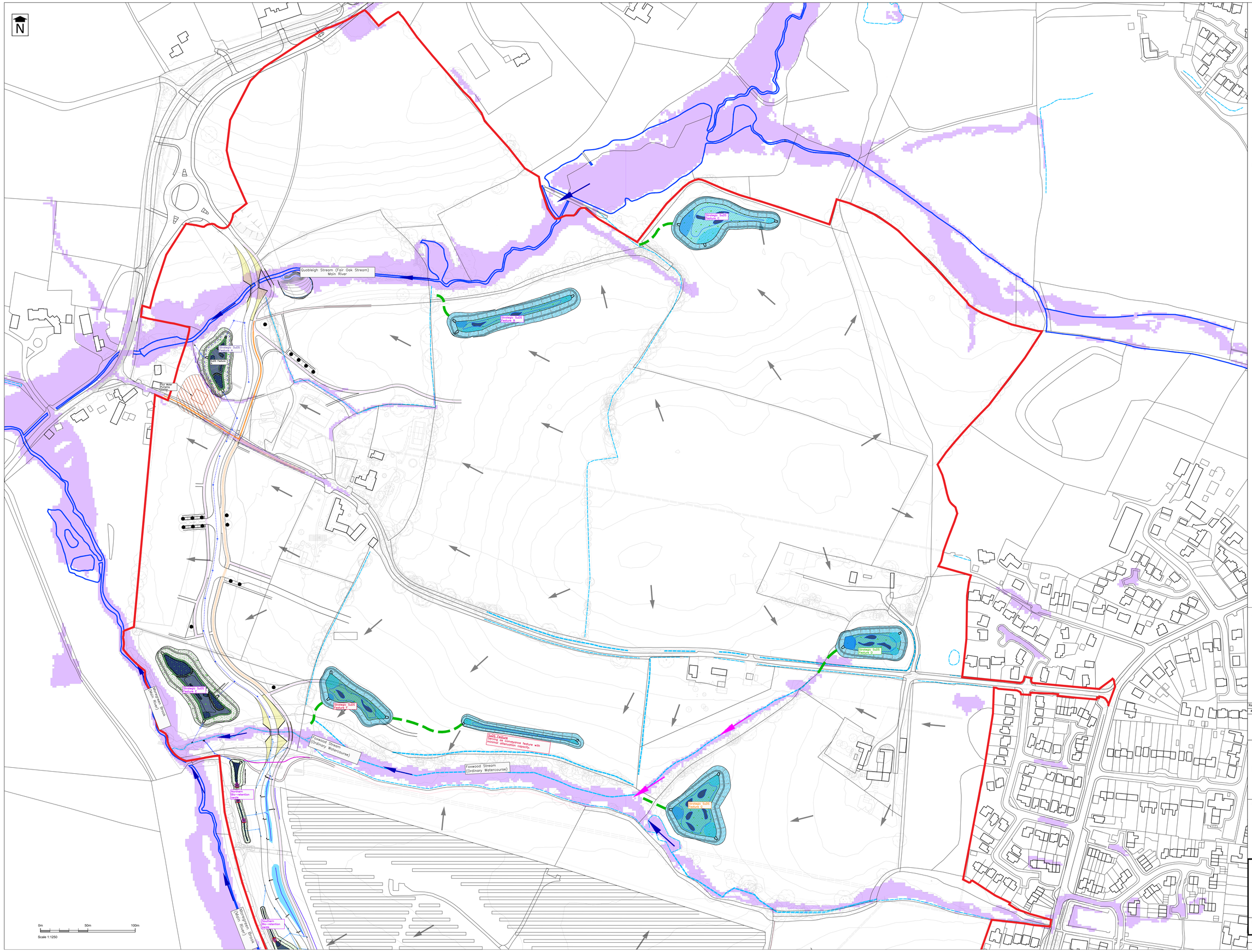
3.1. The Strategic SuDS Features proposed should incorporate the distinct treatment processes described above which, together with effective housekeeping and maintenance procedures, would ensure their effectiveness over the lifetime of the development.

3.2. Mechanical separation in the form of Downstream Defenders, or similar approved apparatus, will be incorporated downstream of the proposed Strategic SuDS Features.

3.3. Detailed design of the individual development parcels should, where possible, create a diverse SuDS scheme that incorporates the principles of the SuDS 'management train' set out in this technical note.

Appendices

Appendix A



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For Planning
This drawing is produced for the purposes of supporting a planning application and should not be relied upon for tender, pricing, or construction purposes.

NOTES

1. This drawing is based on the Topographical Survey undertaken by Mayer Brown Limited, Drawing No.IR.SAV.1.21.1, Rev E, dated 05 May 2014 and Encompass Surveys' drawing number ENC/ONE-HH-DCC20.
2. This drawing is based on Clague Architects' Proposed Illustrative Plan drawing Extracts 1 – 7, drawing number 22100A/20 – 27.
3. Details of surface water drainage network associated with the carriageway and shared paths/footway of Segment 2 of the Link Road is shown on Rueby & Stagg's Drawings 10413-SEG 3-350 – 362, (as revised)
4. Typical SuDS drainage details, including typical headwall inlets and outlets is shown on drawing G277/30.

KEY

- OPA Site Boundary Red Line
- Ordinary Watercourse/Ditch
- Main River
- Proposed Surface Water Sewer
- Rueby & Stagg's Proposed Surface Water Sewer
- Rueby & Stagg's Proposed Land Drain
- Medium Risk of Flooding from Surface Water (1 in 100 year)
- Overland Flow Route
- Overland Flow Route Catchment upstream of proposed Link Road
- Indicative Surface Water Outfall Route

Sheet Key

Rev	Date	Description	Drawn	Check
#	25.02.22	First Issue.	DAB	MWS

Status
FOR PLANNING

Client
Eastleigh Borough Council

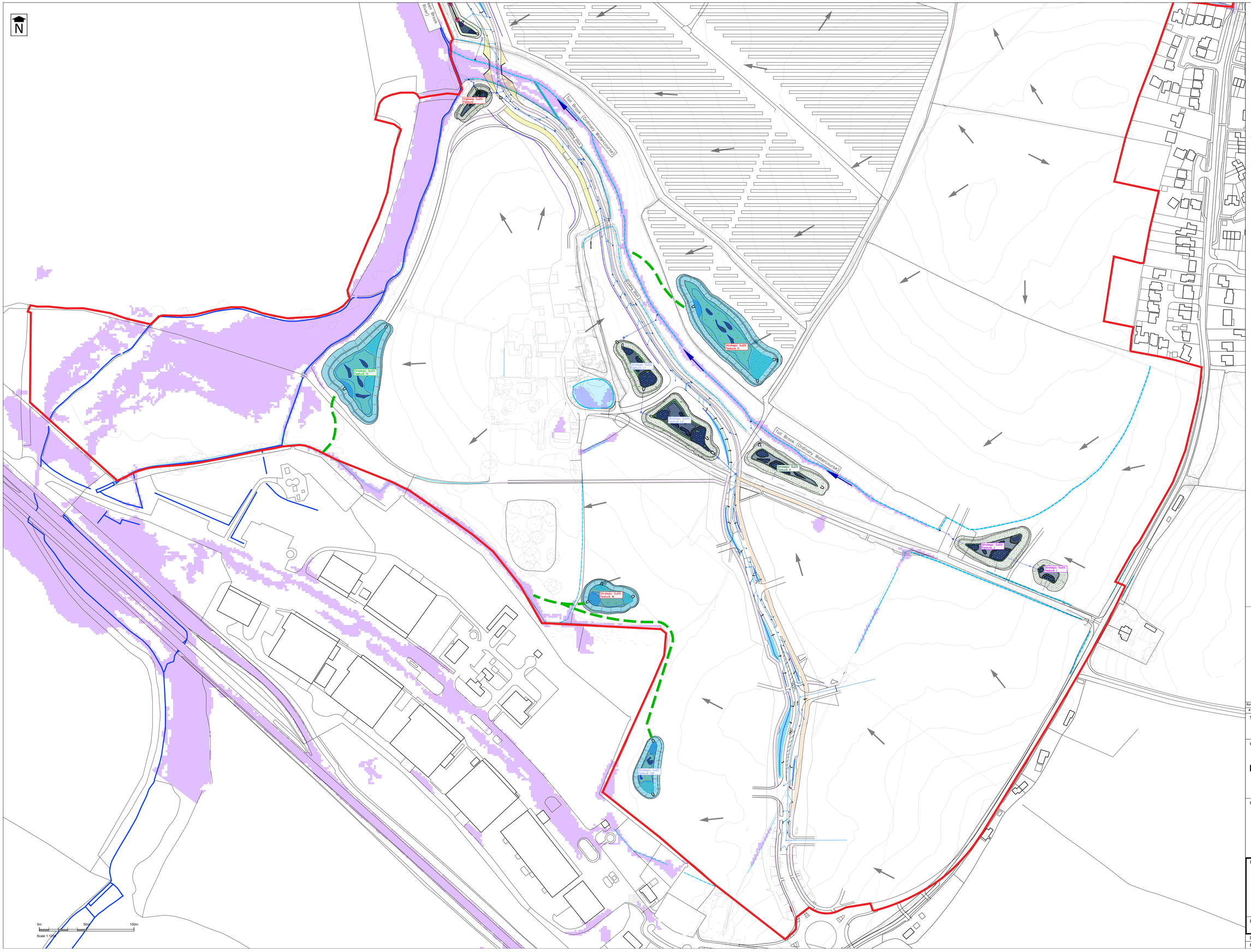
Project
One Horton Heath

Drawing Title
OPA Indicative Outfall Location Plan (Sheet 1 of 2)

Drawing No.
G277/38

Date: February 2022 | Scale: 1:1250 @ A0

E-Mail: DBuciak@pfaplc.com



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NOTES

1. This drawing is based on the Topographical Survey undertaken by Mayer Brown Limited, Drawing No:IR.SAV.1.21.1, Rev E, dated 05 May 2014 and Encompass Surveys' drawing number ENC/ONE-HH-DEC20.
2. This drawing is based on Clague Architects' Proposed Illustrative Plan drawing Extracts 1 – 7, drawing number 22100A/20 – 27.
3. Details of surface water drainage network associated with the carriageway and shared paths/footway of Segment 3 of the Link Road is shown on Rueby & Stagg's Drawings 10413-SEG 3-350 – 362, (as revised)
4. Typical SuDS drainage details, including typical headwall inlets and outlets is shown on drawing G277/30.

KEY

- OPA Site Boundary Red Line
- Ordinary Watercourse/Ditch
- Main River
- Proposed Surface Water Sewer
- Reuby & Stagg's Proposed Surface Water Sewer
- Reuby & Stagg's Proposed Land Drain
- Medium Risk of Flooding from Surface Water (1 in 100 year)
- Overland Flow Route
- Overland Flow Route Catchment upstream of proposed Link Road
- Indicative Surface Water Outfall Route

Sheet Key

Rev	Date	Description	Drawn	Check
#	25.02.22	First Issue.	DAB	MWS

Status
FOR PLANNING

Client
Eastleigh Borough Council

Project
One Horton Heath

Drawing Title
OPA Indicative Outfall Location Plan (Sheet 2 of 2)

Drawing No. **G277/39**

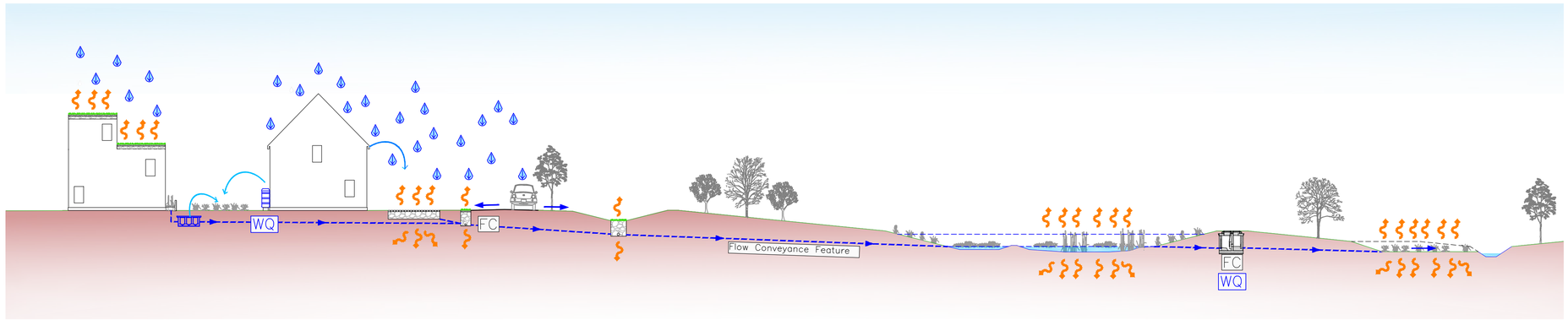
Date: February 2022 | Scale: 1:1250 @ A0

E-Mail: DBuciak@pfaplc.com

Appendix B

KEY

- Rainfall
- Interception Losses (Evapotranspiration / Infiltration)
- Water Reuse
- WQ — Water Quality Device (Oil Separator / Vortex Separator)
- FC — Flow Control Device (Orifice / Vortex Flow Control)
- Overland Flow
- Surface Water Sewer (connecting SuDS Features)



DEVELOPMENT TYPE	Commercial / Public	Residential	Private / Shared Parking	Public Highway	Conveyance Features		Green Infrastructure / Public Open Space	Watercourse Corridor
MANAGEMENT TRAIN	PREVENTION → SOURCE CONTROL → SITE / REGIONAL CONTROL							
SuDS FEATURE	Rainwater Harvesting (Reuse for irrigation e.g Rainwater Butts) Green Roofs Bioretention Areas / Rain Gardens Rills	Rainwater Harvesting (Reuse for irrigation e.g Rainwater Butts) Porous Paving Tanks Flow Control Devices		Swales Bioretention Areas Filter Strips Filter Drains			Strategic SuDS incorporating sediment forbays, wetland areas, micropools at the outlet Flow Control Devices Water Quality Devices	Outfall Swale
MAINTENANCE RESPONSIBILITY	Commercial or Public Tenants	Homeowners	Homeowners / Management Company	Highway Authority	Southern Water / Management Company		Southern Water / Management Company	Southern Water / Management Company

PFA consulting

Stratton Park House, Wanborough Road
Swindon, SN3 4HG

Telephone
01793 828000

Website
www.pfaplc.com

For Planning
This drawing is produced for the purposes of supporting a planning application and should not be relied upon for tender, pricing, or construction purposes.

NOTES

1. Drawing to be read in conjunction with Flood Risk Assessment and Water Management Strategy produced by PFA Consulting (Document Ref: G277–DOC01 Issue 2, Dated May 2021) and Preliminary Water Management Strategy Plan (Drawing No. G277/21 Rev C & G277/22 Rev C).
2. Future design of upstream Source Control & Site Control to take account of the principles established in in the Water Management Strategy and this drawing.

Rev	Date	Description	Drawn	Check
#	26.11.20	First Issue.	BF	MWS
A	21.05.21	Cross references updated	DAB	MWS

Status
FOR PLANNING

Client
Eastleigh Borough Council

Project
One Horton Heath
Hampshire

Drawing Title
SuDS Management Train

Drawing No. G277/24 Rev A

Date: November 2020 | Scale: NTS @ A1

E-Mail: bfox@pfaplc.com

Appendix C

DOWNSTREAM DEFENDER® DESIGN SUMMARY

PROJECT INFORMATION

Reference	SuDS Feature L
Site	One Horton Heath
Designer	Daniel Buciak
Date	16/02/2022 14:12

DESIGN INPUTS

Sediment Type	TFR-FINE
Design Flow Rate (l/s)	11.6
Peak Flow Rate (l/s)	32.5

DESIGN OUTPUTS

Product	HYDRO INTERNATIONAL DOWNSTREAM DEFENDER®
Unit Reference	DD3_1.2M_300DN

UNIT WEIGHTS AND DIMENSIONS

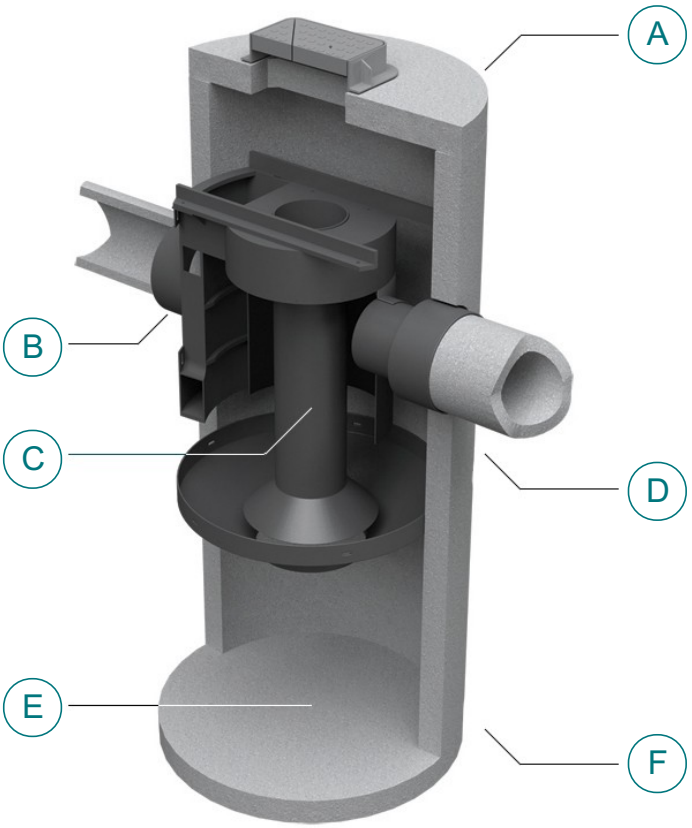
(A) Unit Size (m)	1.20
(B) Inlet Pipe Size (mm)	300
(D) Outlet Pipe Size (mm)	300
(F) Unit Depth (m)	2.83
Inlet Invert Height (m)	1.91
Max. Component Weight (t)	2.2

PERFORMANCE AND HYDRAULICS

Max. Treatment Flow-Rate (l/s)	38
Hydraulic Capacity Flow-Rate (l/s)	120
Typical Operating Headloss (mm)	150
Maximum Headloss (mm)	500

STORAGE

(C) Min. Oil Storage Capacity (l)	292.5
(E) Min.Sediment Storage Capacity (m^3)	0.39



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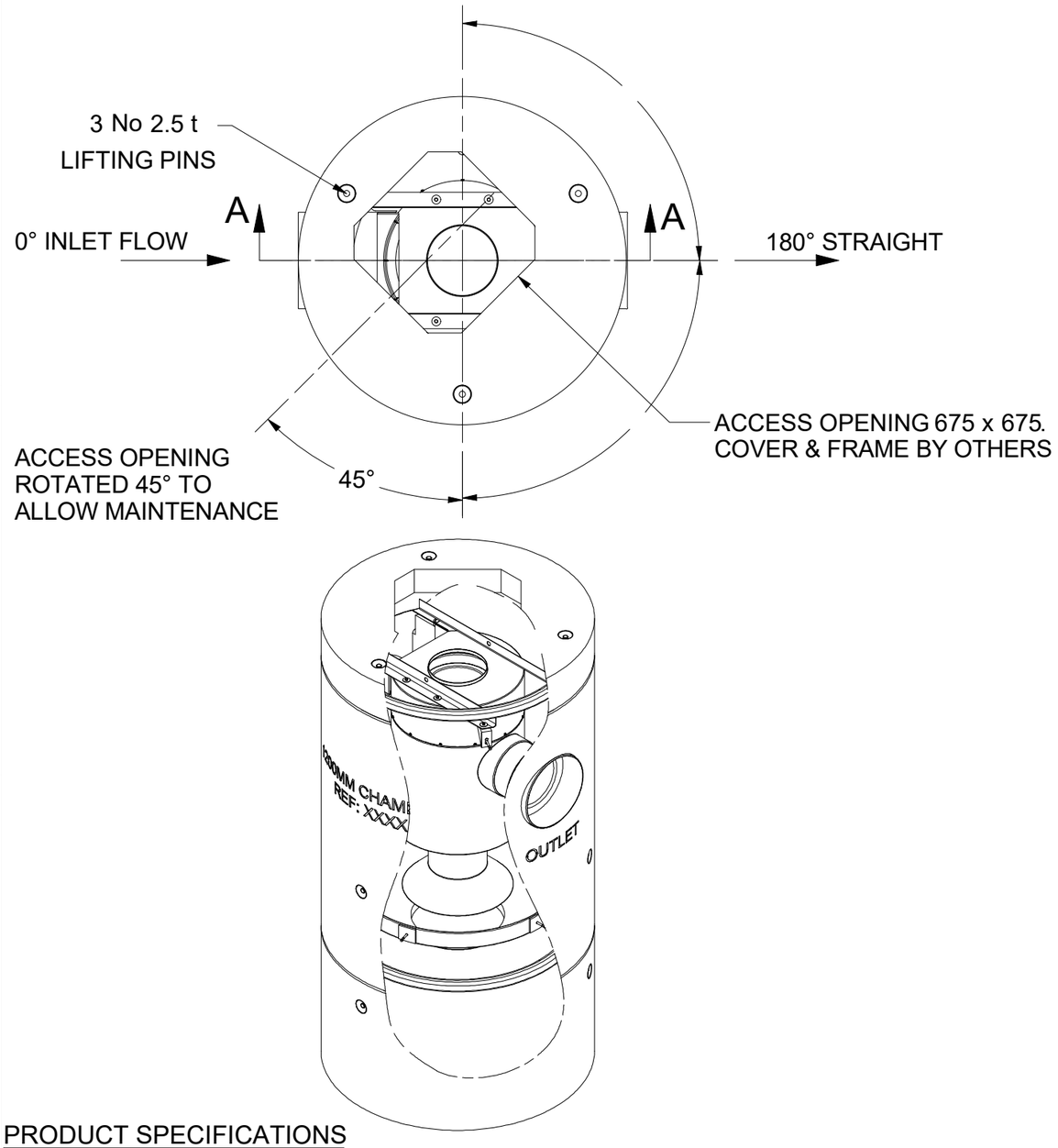

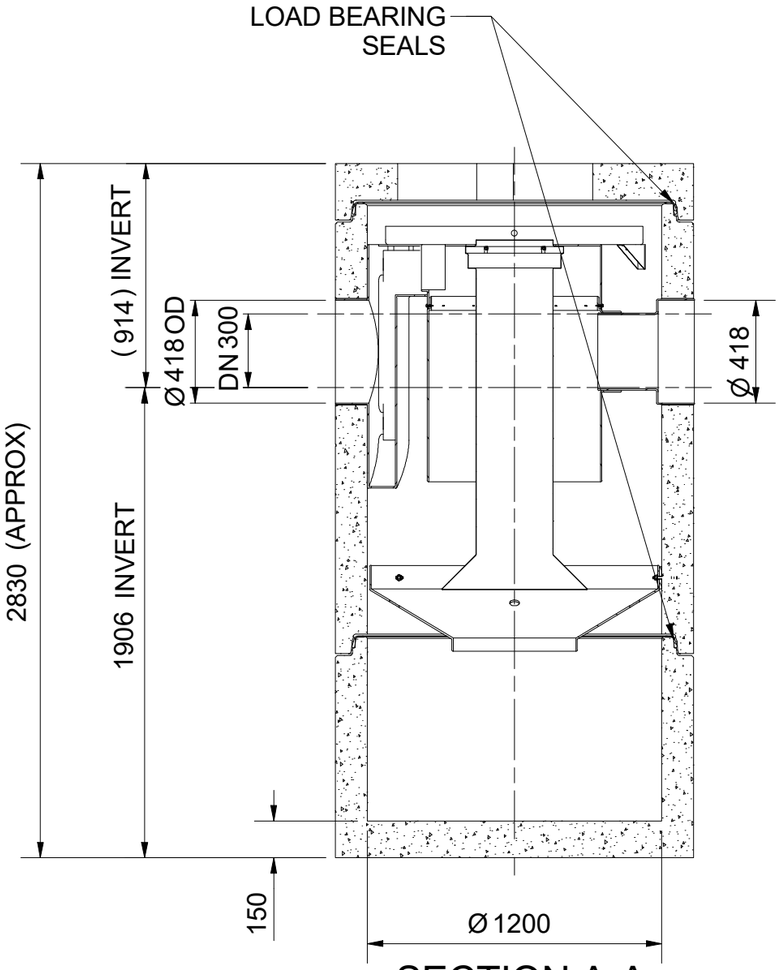

SECTION A-A

PRODUCT SPECIFICATIONS

TREATMENT FLOW - COARSE	38 l/s
TREATMENT FLOW - FINE	30 l/s
HYDRAULIC CAPACITY	120 l/s
OIL STORAGE CAPACITY	292.5 l
MIN. SEDIMENT STORAGE CAPACITY	0.39 m³

MAXIMUM HEADLOSS AT TREATMENT
FLOW RATE - COARSE (mm) 150

PROJECT			
-	INVERT	MATERIAL	DIAMETER
COVER			
OUTLET			
INLET			

PARTS LIST	
COMPONENT	MASS
1200 PCC Cover slab	0.5 t
1200 PCC Lower Chamber	1.5 t
1200 PCC Upper Section Assembly	2.2 t
DN300 Inlet / Outlet Pipe (By Others)	N/A
Pre Installed Internal Components	N/A

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PROJECTION

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2. ALL COMPONENTS SHALL BE MANUFACTURED IN ACCORDANCE WITH THE PRODUCTION SPECIFICATION HRD-FM9/15

REVISION HISTORY			
REV	BY	DESCRIPTION	DATE
A	CRA	FIRST ISSUE	04 FEB 19

DATE: 16/10/2018
SCALE: VARIES
DRAWN BY: DGE
CHECKED BY: CJN
APPROVED BY: WCJ

Title
HYDRO INTERNATIONAL
DOWNSTREAM
DEFENDER®

1200 PERFECT MANHOLE
CONCRETE CHAMBER

DESIGN DATA

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BS21 7RD
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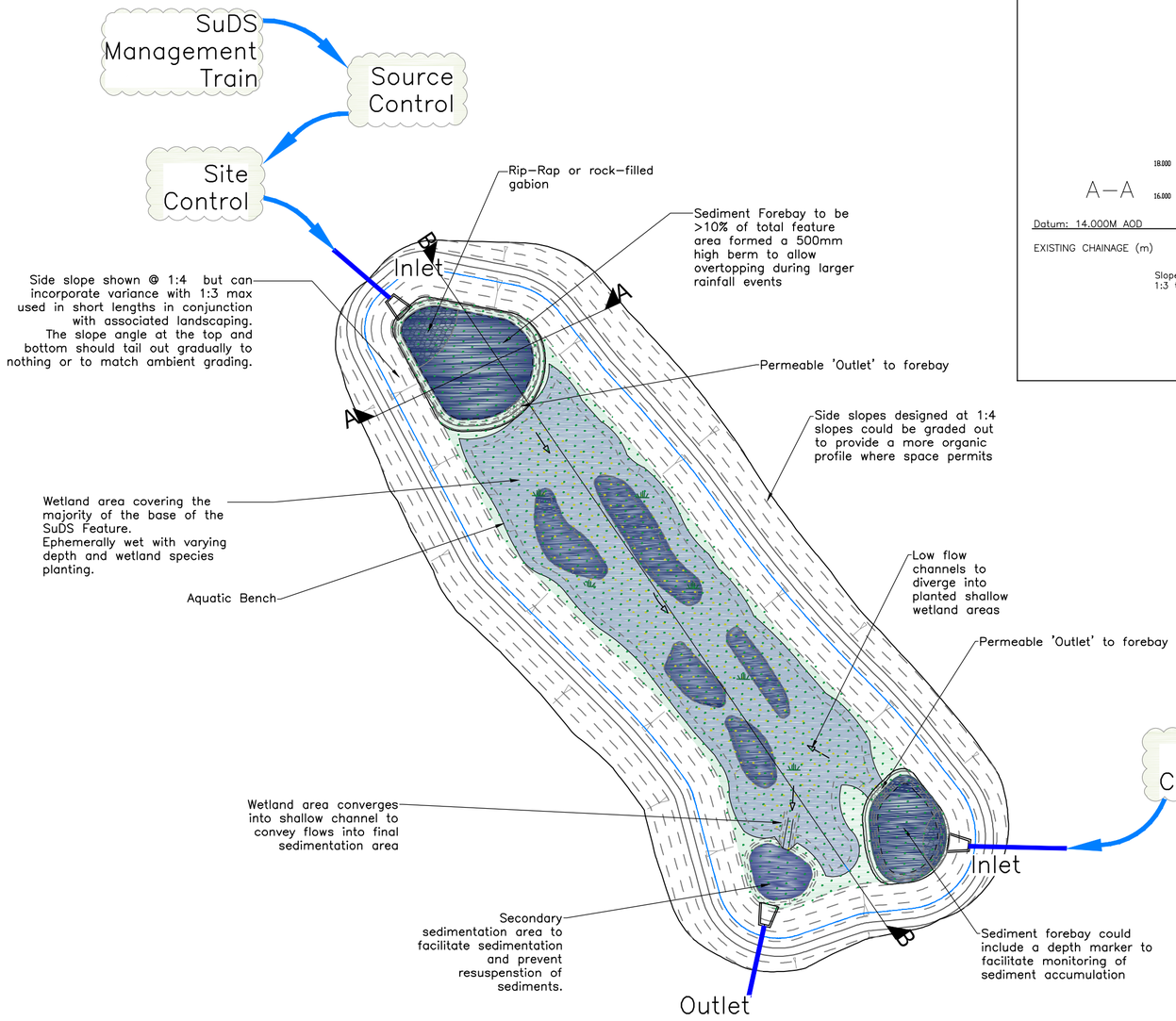
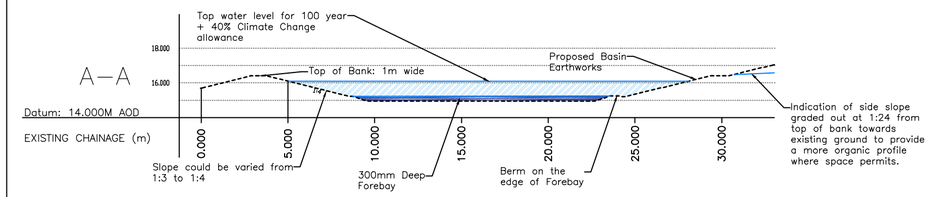
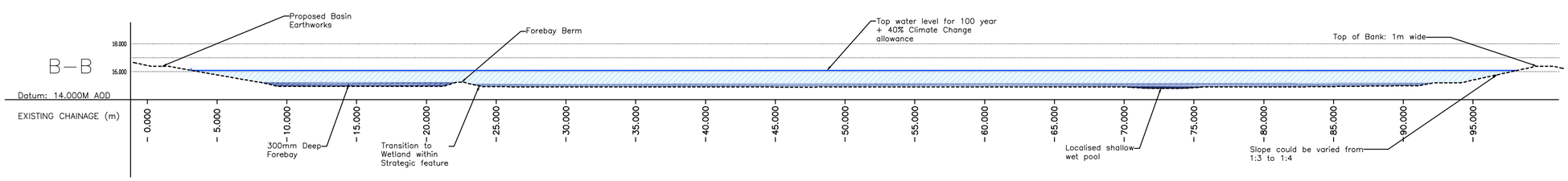
Fax: +44 (0)1275 874979
hydro-int.com

APPROX WEIGHT: 4.28 t
MATERIAL:
REFERENCE: SuDS Feature L
DRAWING NO.: C 1320-1000-01000
SHEET SIZE: A3
SHEET: 1 OF 1
Rev: A

Appendix D







PFA consulting

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Telephone
01793 828000

Website
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For Planning
This drawing is produced for the purposes of supporting a planning application and should not be relied upon for tender, pricing, or construction purposes.

NOTES

1. This drawing shows the typical SuDS feature arrangements for the SuDS features shown on the Preliminary Water Management Strategy Plan, Drawing number G277/21 Rev C & G277/22 Rev C.
2. Upstream SuDS management train principles are outlined in the PFA's Water Management Strategy and depicted on drawing G277/24 dated May 2021.

Rev	Date	Description	Drawn	Check
#	26/11/20	First Issue.	DAB	SAM
A	21/05/21	Cross references updated	DAB	MWS

Status
FOR PLANNING

Client
Eastleigh Borough Council

Project
One Horton Heath
Hampshire

Drawing Title
Typical Layout of Strategic SuDS Features to Inform Detailed Design

Drawing No. G277/23 Rev A

Date: November 2020 | Scale: As shown

E-Mail: DBuciak@pfaplc.com

ARCH ASSOCIATES

APPENDIX 2

RIDGE & PARTNERS SPINE ROAD SUDS STRATEGY

RIDGE

FLOOD RISK ASSESSMENT
ONE HORTON HEATH

EASTLEIGH BOROUGH COUNCIL

December 2023

FLOOD RISK ASSESSMENT
ONE HORTON HEATH

December 2023

Prepared for

Eastleigh Borough Council

Prepared by

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VERSION CONTROL

PROJECT NAME:	One Horton Heath – Eastleigh Borough Council – FRA - INTERNAL DISTRIBUTOR ROADS
PROJECT NUMBER:	5018551
DOCUMENT REFERENCE:	5018551 - RDG-XX-XX-DOC-C-9950
DOCUMENT STATUS:	S2 – Suitable for Information

REV	DATE	DESCRIPTION	AUTHOR	CSE	ICSE
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1	31.07.23	Revised	Gary Beamish Eng.C, C.Eng, C.Env, CWEM, MICE, MCIWEM, FQSI, FCInstCES	Chris Levitt BEng (Hons) EngTech MICE	Tom Clark MEng GMICE
2	31.07.23	Revised	Gary Beamish Eng.C, C.Eng, C.Env, CWEM, MICE, MCIWEM, FQSI, FCInstCES	Chris Levitt BEng (Hons) EngTech MICE	Tom Clark MEng GMICE
3	01.12.23	Updated to client's comment	Binam Tiwari MSc GMICE	Tom Clark GMICE MEng	Chris Levitt BEng (Hons) EngTech MICE

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SECTION 01
INTRODUCTION

1. INTRODUCTION

1.1. Appointment and Brief

Ridge & Partners prepared this Flood Risk Assessment on behalf of Eastleigh Borough Council. The proposed development has been designed in full accordance with the Development Plan and Outline Planning Application (OPA) O/20/89498, which has a resolution to grant consent subject to S106 negotiations relating to education. This application is for full planning consent due to the time for these negotiations to complete. Submitting details of the Secondary Infrastructure Road (SIR) as a full planning application will deliver the SIR in accordance with, and as part of the OPA, but enable commencement more quickly than waiting for the resolution of the OPA S106 and the determination of an application for Reserved Matters Approval of details of the SIR. The site is located at One Horton Heath at approximately SO50 7BZ, Grid reference SU 48905 16935 (hereby referred to as the 'Application Site- reserved matters planning application.

This assessment has been prepared for the benefit of the Hampshire County Council Lead Local Flood Authority and seeks to demonstrate that the proposed Internal Distributor Road is not at risk of flooding.

The purpose of this document is:

- To determine and outline potential sources of flooding along the Internal Distributor Road route, and;
- Establish how flood risk will be managed throughout the lifetime of the proposed Internal Distributor Road, taking into account the potential for climate change.
- Discuss the proposed outline surface water strategy for incorporation with the Internal Distributor Roads at the application site including SuDS for surface water quantity, surface water quality, amenity and biodiversity.

1.2. Aims and Objectives

It is intended to follow the procedures and guidance outlined within NPPF (2021), BS 8533 (2017), BS 8582 (2013), CIRIA C624 (2004) and SuDS Manual (C753) (2015) in the preparation of this document.

The governments flood mapping service shows that the site is largely within flood zone 1. It is therefore recommended that the proposal is split into steps. Step 1 and 2, outlined below, are required initially and will determine the risk of flooding. Subject to the findings, steps 3 and 4 may be required and even step 5 should the site be in the highest risk category.

Step 1 - Consultation with Lead Local Flood Authority (LLFA)

- Obtain and review the most up-to-date local flood risk information including the any previous Preliminary Flood Risk Assessments (PFRA), Strategic Flood Risk Assessments (SFRA) or Surface Water Management Plans (SWMP) undertaken for the area of interest;
- Review Environment Agency's online flood risk maps.
- Review Planning Policy applicable to the site.
- Liaise with Thames Water to obtain flooding history information etc.
- Consult with the Local Flood Authority.
- Advise you on our findings (email or tech note format).

Step 2 - Outline Flood Risk Assessment:

- Undertake a desktop assessment of pre- and post-development flood risk at the Site from all possible sources (fluvial, tidal, groundwater, sewers, overland and artificial sources);

- Outline the Sequential and Exception Test requirements.
- Advise on matters to be addressed with the Environment Agency.
- Produce an outline Flood Risk Assessment and circulate to the Client for comment.
- Incorporate comments from the Client and issue the final version.

If stages 1 and 2 determine that the site is either wholly or partly within are area of flood zone 2 or 3 then stages 3 and 4 are required.

Step 3 - Sequential Test:

- The process identifies the flood risks and development vulnerability in order to assess the suitability of each development location and where possible, steers more vulnerable developments to areas of lowest flood risk, matching vulnerability of land use to flood risk.

Step 4 - Exception Test:

- The Exception Test allows consideration of the wider sustainability benefits of a development to be considered to justify development in a higher risk flood zone.
- To ensure that the proposed development meets the requirements of the Exception test (NPPF):
  - It must be demonstrated that the development provides wider sustainability benefits for the community that outweigh flood risk, informed by a Strategic Flood Risk Assessment where one has been prepared.
  - The site-specific Flood Risk Assessment must demonstrate that the development will be safe for its lifetime taking into account the vulnerability of its users, without decreasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

Should completed steps 1-4 still show that the development is at a high risk of flooding, hydraulic modelling would be required, as follow:

Step 5 - Hydraulic Modelling

- Obtain Environment Agency flood model for the development area.
- Review flood model variables to ensure data and variables are current.
- Update model to take account of findings of review and to include proposal.
- Validate model to assess updated risk of flood to the development area.
- All the above is to be undertaken in conjunction with Environment Agency to ensure their acceptance.

1.3. Limitations

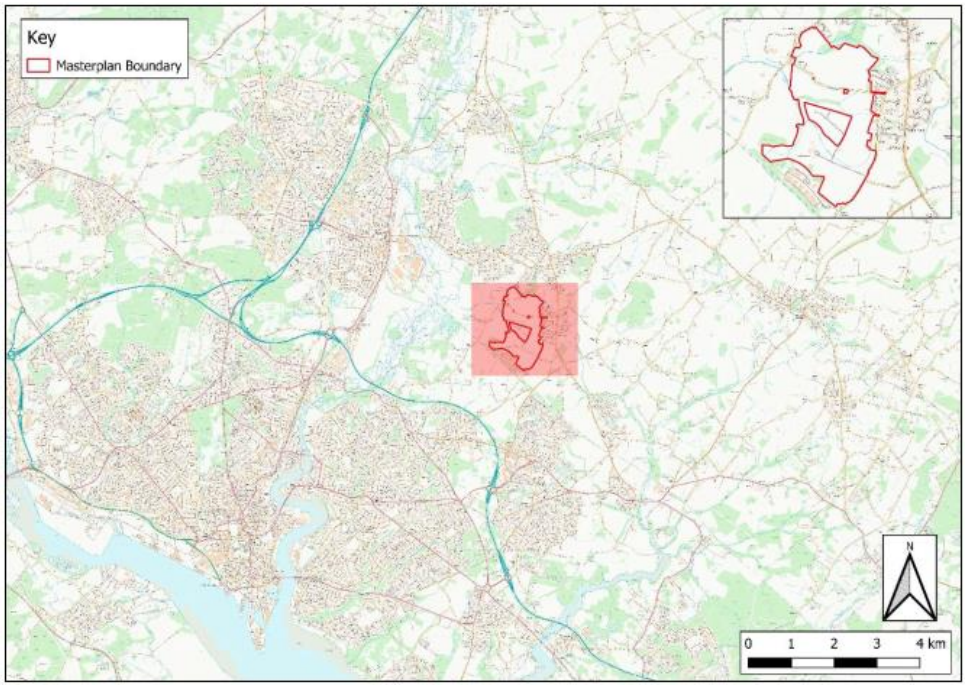
The purpose of this report as outlined in Section 1.2, together with those related matters specifically referred to therein and it is not intended to be used for any other purposes. The report is for the sole benefit and may only be relied upon by the addressee, to whom we will owe a duty of care. The report and any part of it is confidential to the addressee and should not be disclosed to any third party for any purpose, without the prior written consent of Ridge and Partners LLP as to the form and context of such disclosure. The granting of such consent shall not entitle the third party to place reliance on the report, nor shall it confer any third-party rights pursuant to the Contracts (Rights of Third Parties) Act. The report may not be assigned to any third party.

SECTION 02
PROJECT BACKGROUND

2. PROJECT BACKGROUND

2.1. Site Location and Existing Land Use

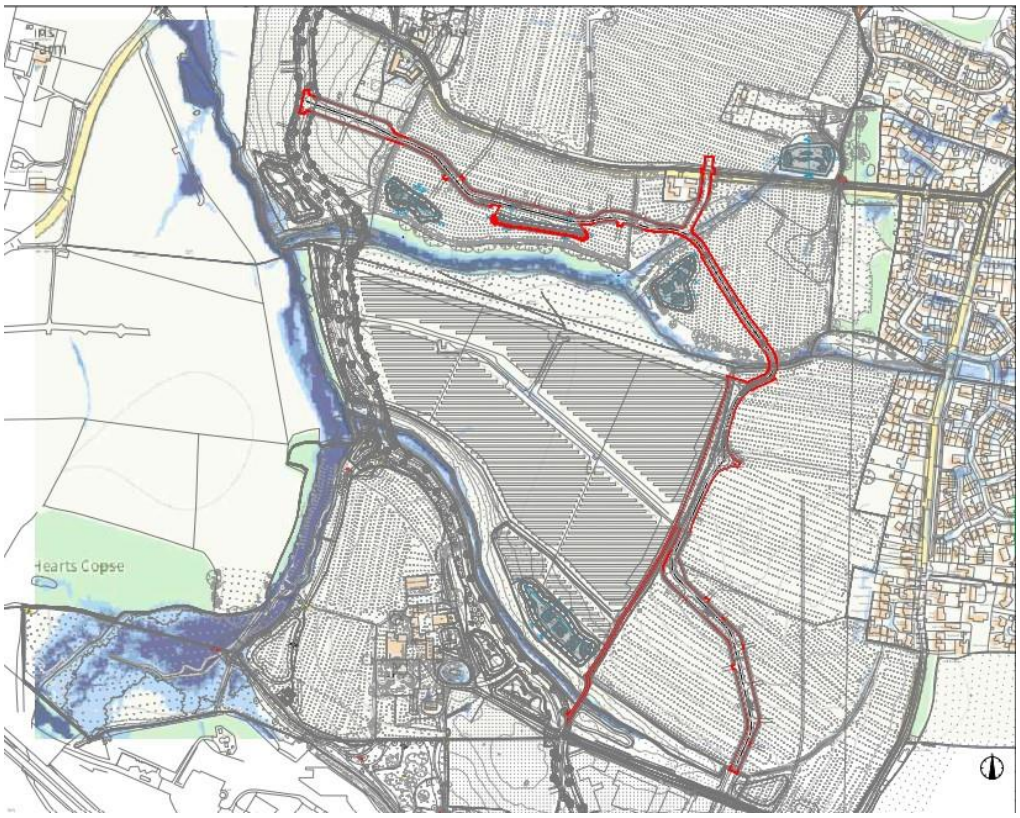
The site is located within the central two-thirds of One Horton Heath, Grid Reference SU 48931 17787, X (Easting) 448855 and Y (Northing) 117787. Latitude and Longitude (decimal), 50.949902 , -1.3059010, Latitude and Longitude (degs, mins, secs), 50°57′00″N , 001°18′21″W. Postcode (nearest) is SO50 7BZ. The site is currently in agricultural use, mainly arable with some grassland. The overall road lengths for this assessment are captured within the central two-thirds of the One Horton Heath, red outline, as shown below:



Site Location Area Plan (Google Earth Maps)

Area Of Flood Risk Assessment and Site Extents Area Plan (Google Earth Maps)

The Internal Distributor Road route focused upon by this Flood Risk Assessment is indicated below overlaid upon the Environment Agency (EA) surface water flood map:



EA Surface Water Flood Map With Internal Distributor Road Route Indicated In Red

2.2. Geology

The British Geological information is indicated below:

Bedrock geology: Wittering Formation - Bracklesham Group (BRB) are secondary or minor aquifers capable of supporting water supplies at a local rather than strategic level - Sand, silt and clay. Sedimentary bedrock formed between 56 and 41.2 million years ago during the Palaeogene period. Greyish brown laminated clay; wavy-to lenticular-bedded sand interbedded with clay in equal proportions; and fine-to medium-grained sparsely glauconitic sand. Bedrock Tertiary clays and sands which overlay Cretaceous Chalk at depth.

Definition of Lower Boundary: Rests on London Clay, a dark grey bioturbated clay below with marked lithological change to interbedded glauconitic fine-grained sand and very silty clay above.

Definition of Upper Boundary: Overlain by Earnley Sand Formation, well-marked by the transgressive basal surface of glauconitic silty sands with pebbles. Thickness: 40-53m.

Superficial deposits: Alluvium - Clay, silt, sand and gravel. Sedimentary superficial deposit formed between 11.8 thousand years ago and the present during the Quaternary period. Alluvium is a general term for clay, silt, sand and gravel. It is the unconsolidated detrital material deposited by a river, stream or other body of running water as a sorted or semi-sorted sediment in the bed of the stream or on its floodplain or delta, or as a cone or fan at the base of a mountain slope. Synonym: alluvial deposits. Normally soft to firm consolidated, compressible silty clay, but can contain layers of silt, sand, peat and basal gravel. A stronger, desiccated surface zone may be present. A number of drainage features and watercourses are present within the site. The watercourses within the site are tributaries of the River Itchen which is located approximately 1.5km to

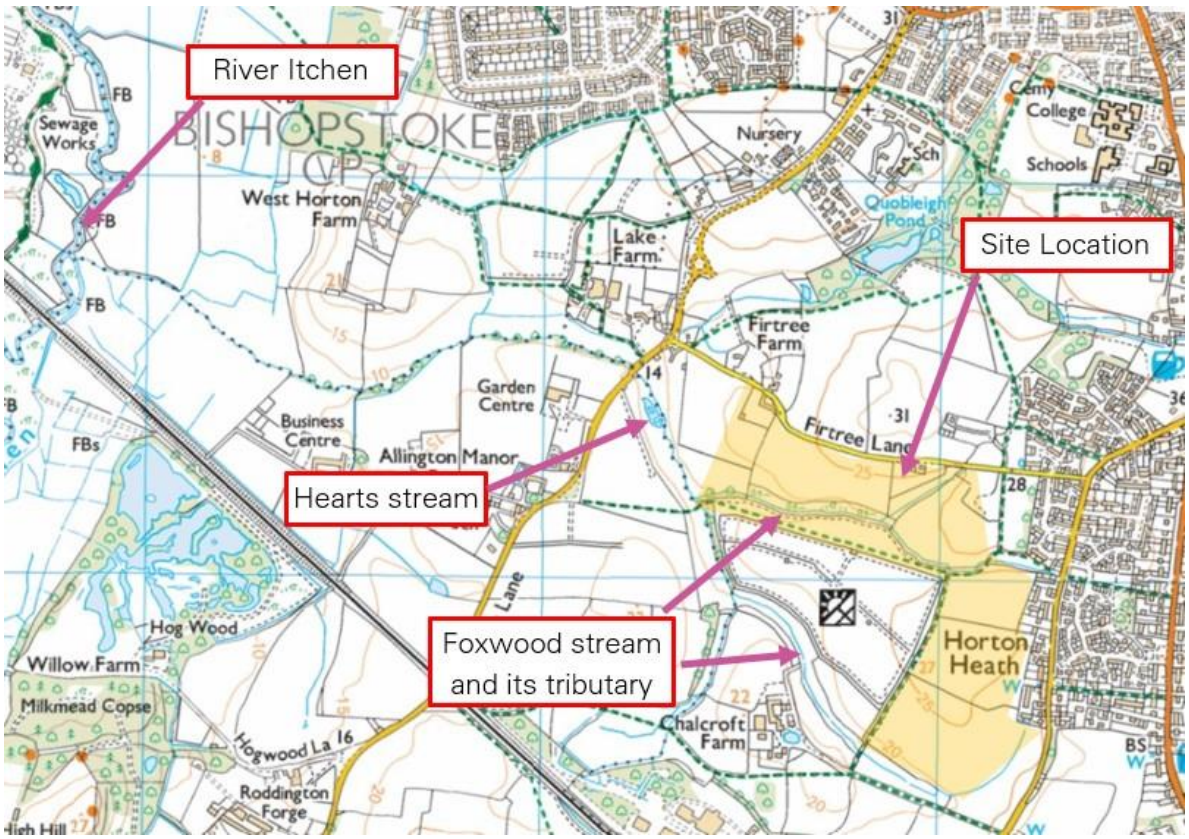
the west of the site's boundary. The watercourse on the western boundary is classified as a 'Main River' and flows from south to north under Allington Lane and into the River Itchen to the south of Chickenhall Lane Wastewater Treatment Works (WwTW). All other onsite watercourses discharge into this unnamed 'Main River'. A number of ponds are also present within the site and in its immediate vicinity.

British Geological information map

The above British Geological information map indicates the Aquifer Classification is Secondary A. From an inspection of the Environment Agency's Source Protection Zones dataset the site does not fall into a Groundwater Source Protection Zone. With reference to the 'Environment Agency's approach to groundwater protection', the discharge of clean roof water to ground is acceptable both inside and outside SPZ1('inner zone') provided that all roof water down-pipes are sealed against pollutants entering the system from surface run-off, effluent disposal or other forms of discharge. If infiltration SuDS are to be used on any part of the site for surface run-off from roads, car parking and public or amenity areas, they would be suitably designed to ensure that the system does not pose an unacceptable risk to the source of supply.

In addition to the above information, Ridge has provided a report based on a visual site inspection and study of readily accessible referenced historical records, information supplied by those parties noted in the report and preliminary discussions with local and Statutory Authorities; reference Ridge *Geotechnical Investigation Report* (Ref: 5019962-RDG-XX-ST-DOC-C-00GIR01) dated 3 February 2023.

As part of the Geotechnical Investigation eleven boreholes were installed with 50mm diameter standpipes to circa 2.50mbgl to allow monitoring of groundwater levels across the site between 3 November 2022 and 30 March 2023. Following the completion of winter groundwater monitoring at land near Horton Heath, Hampshire, broadly centred on 448877 E 117310 N, the report provided commentary on groundwater gauging rounds conducted although it was unclear whether groundwater levels have peaked across the site, and therefore it recommends additional rounds to capture peak levels, and subsequent fall in groundwater level. Reference *One Horton Heath – Winter Groundwater Monitoring*, Letter Reference: 5019962-WGM/MS/T-815 dated 3 April 2023.



Location of River Itchen from the proposed site

The majority of the site geology is falling into HOST Class 25, which is defined as "Slowly permeable, seasonally waterlogged soils over impermeable clay substrates with no storage capacity".

On the basis of the available modelled flood levels provided by the Environment Agency, the areas of the site where built-development and the Internal Distributor Road are proposed are unaffected by the floodplain associated with the watercourses except for the watercourse crossing points where culverts have been designed to ensure the watercourse flows are maintained with no flooding of the roads.

2.3. Proposed Development

The proposed development is a part of One Horton Heath Site Wide Infrastructure Delivery which includes the construction of the Internal Distributor Road, residential homes, local centres and primary schools. However, this report primarily focuses on the Internal Distributor Road which runs between the Fir Tree Lane and the Foxwood stream connecting west to east and crosses the Foxwood Stream and runs adjacent to the solar farm before connecting to the north of the proposed lower acre site.

SECTION 03
FLOOD RISK STATEMENT

3. FLOOD RISK STATEMENT

3.1. Sources of Information

Information relating to the flood risk at the site at the time of writing has been obtained from, but not limited to:

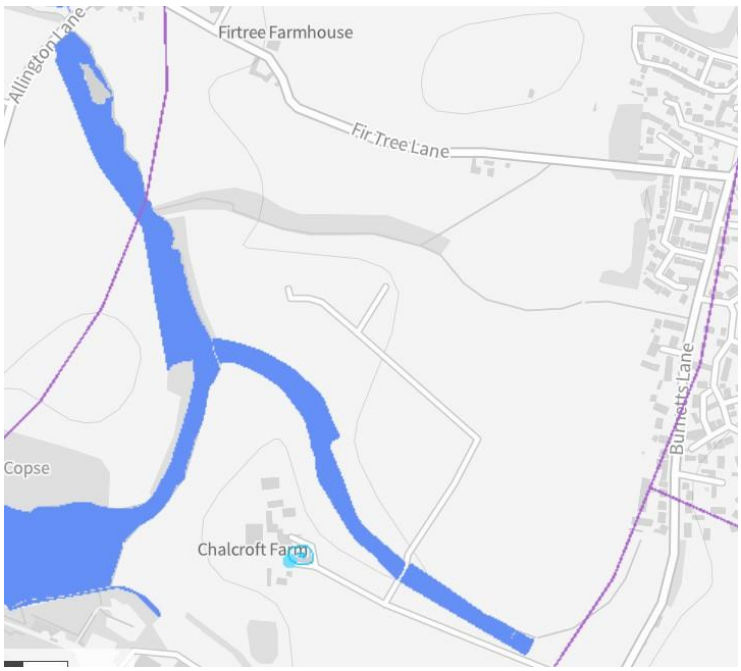
- The Environment Agency (EA) website;
- Water Environment (Water Framework Directive (WFD) England and Wales) Regulations 2017
- Flood and Water Management Act 2010
- Flood Risk Regulations 2009
- Flood Risk Assessments: Climate Change Allowances (2021)
- Eastleigh Borough Local Plan (2016-2036) April 2022
- Hampshire County Council Surface Water Management Plan – Eastleigh
- Eastleigh Flood Risk Assessment Guidance Document 2016
- CIRIA C753 SuDS Manual November 2015
- Internet research.

3.2. Hydrology / Hydrological Features

Hydrology is the study of the distribution and movement of water both on and below the Earth's surface, as well as the impact of human activity on water availability and conditions.

Hydrogeology is the study of groundwater – it is sometimes referred to as geohydrology or groundwater hydrology. Hydrogeology deals with how water gets into the ground (recharge), how it flows in the subsurface (through aquifers) and how groundwater interacts with the surrounding soil and rock (the geology).

The vadose zone is the variably saturated zone between the ground surface and the permanent water table of the groundwater. It is an important part of the water cycle and stores at least 8.5 times more water than is held by rivers. The vadose zone is the Earth's terrestrial subsurface that extends from the surface to the regional groundwater table. The vadose zone may be very shallow (less than 1 m) or very deep (extending hundreds of meters or more), depending on the depth to the water table. This zone is one of the underground soil stratums that are of considerable interest in terms of pollution and becomes the focus for SUDS via infiltrating surface water and rainwater below ground to alleviate surface flooding.



Defra Magic Portal and the BGS GeoIndex

The above base map by Defra Magic Portal and the BGS GeoIndex (https://www.bgs.ac.uk/datasets/aquifer-designation-data/), states the aquifer designation dataset has been created by the Environment Agency (EA), Natural Resources Wales (NRW) and the BGS, and identifies the different aquifers of England and Wales. Groundwater protection policy in England and Wales uses aquifer designations that are consistent with the Water Framework Directive. The above blue shading (watercourses) relates to *"Priority Habitat Inventory - Coastal and Floodplain Grazing Marsh (England)". Groundwater Vulnerability Map (England) – Medium.*

The map indicates the following:

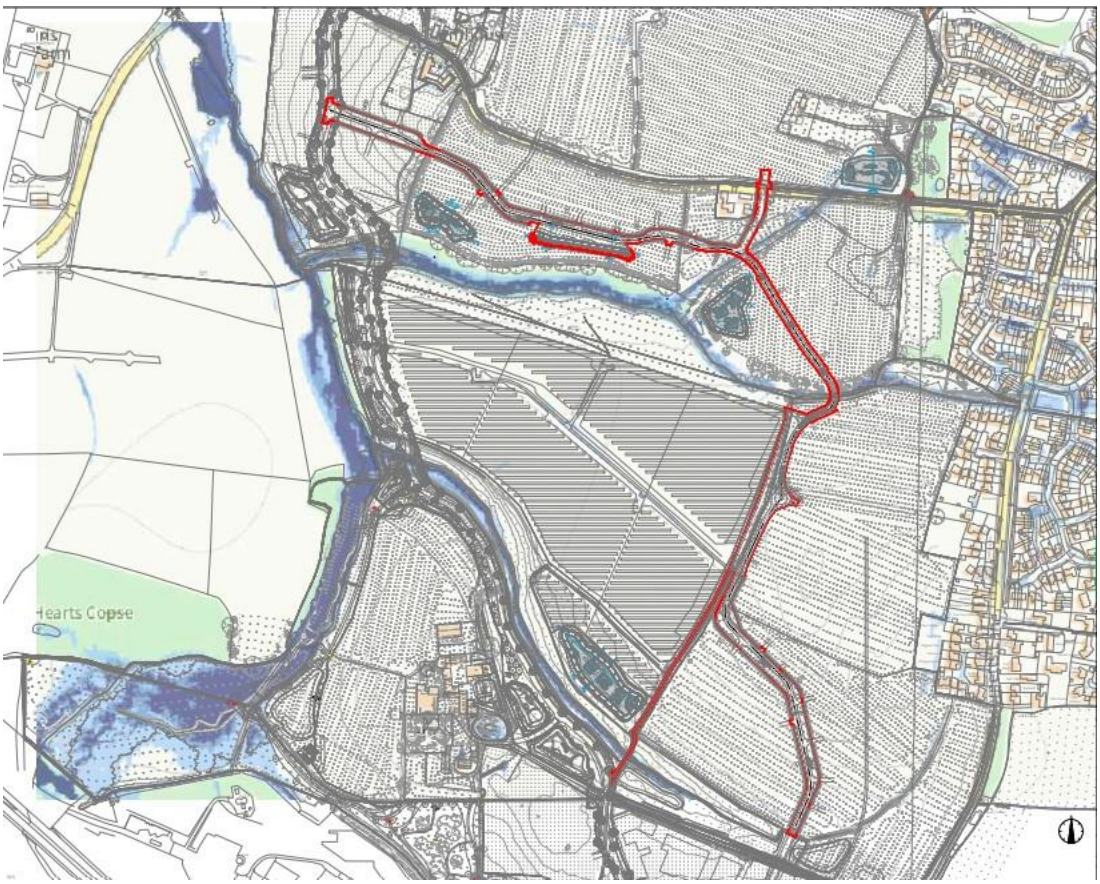
The borough of Eastleigh is dominated by two main river catchments; the River Itchen catchment covers the majority of the borough with the River Hamble catchment to the East.

- Geology and Soils: Groundwater Vulnerability Classification is Medium
- [Blue areas] Grassland: Priority Habitat Inventory - Coastal and Floodplain Grazing Marsh (England)
- [Green areas] Woodland: Ancient and Semi-Natural Woodland
- [Green areas] Woodland: Priority Habitat Inventory - Deciduous Woodland (England)

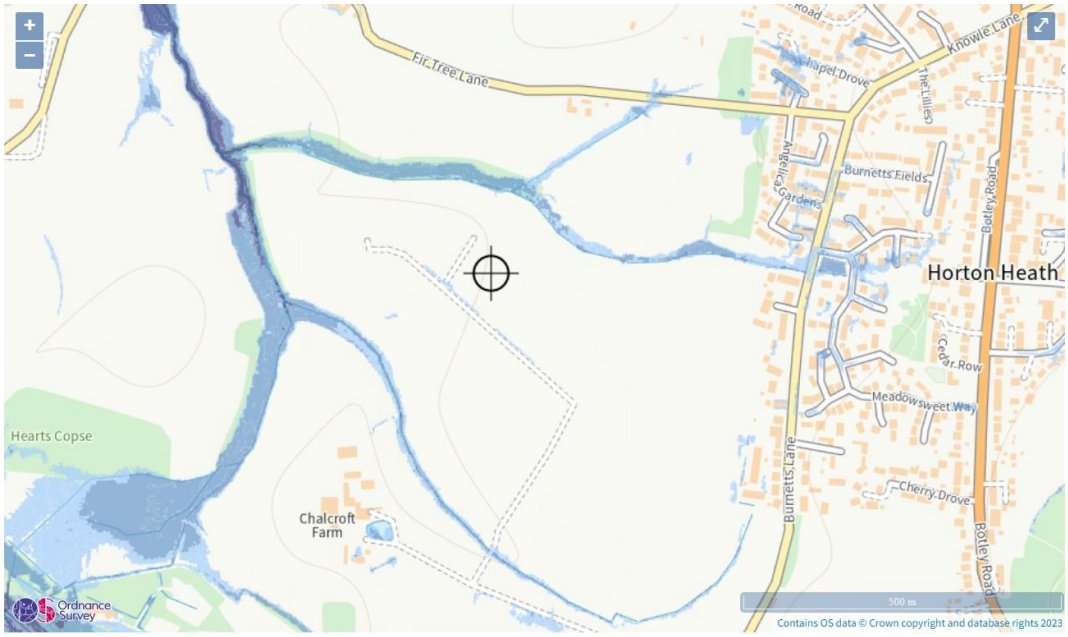
3.3. Historic Flooding

According to the Strategic Flood Risk Assessment produced by the Eastern Solent Coastal Partnership for the Partnership for Urban South Hampshire, and the Environment Agency Flood Maps for Planning, the site has a natural main river running through its western flank. The watercourse has tributaries running into it from the east and lower also from the east. Apart from the watercourse causing local bank-full and local overland flooding the remaining site area is in Flood Zone 1. However, apart from the watercourses there is no recorded flooding from any other sources, neither historical flooding nor specific event records, apart from the main river (outside the roads boundaries) and the watercourses.

The Environment Agency flood zoning map does shows surface water flooding from watercourse tributaries.



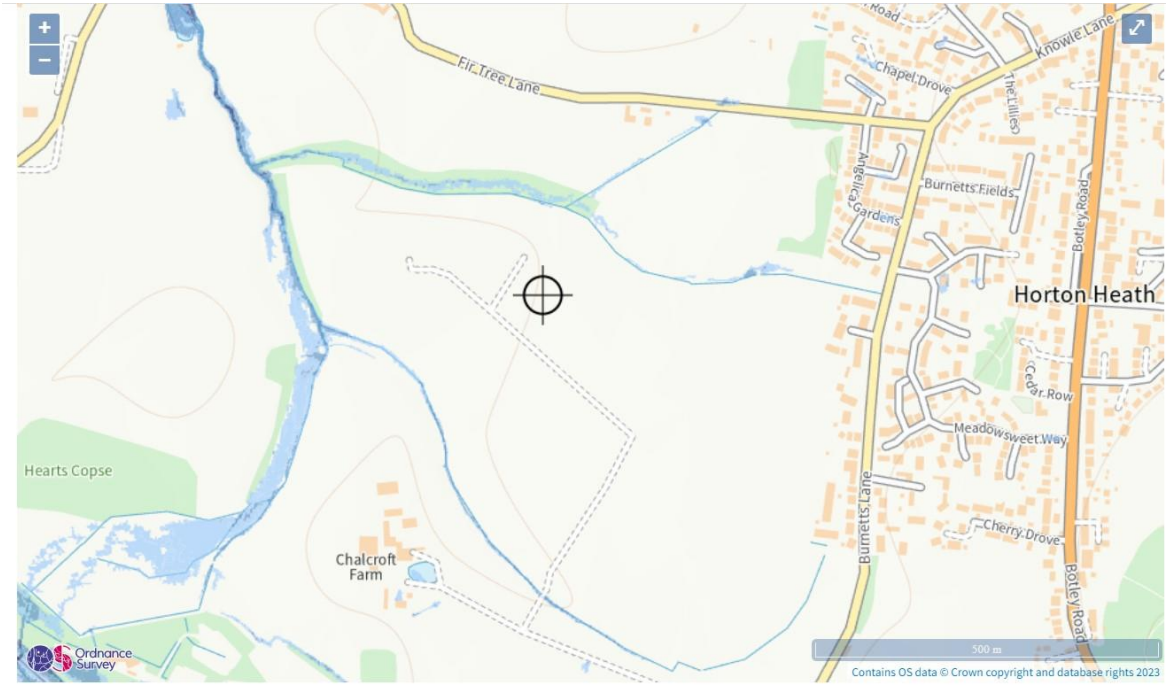
Environment Agency Extent of Flooding from surface water with proximity of the new roads in red



Surface water flood risk: water depth in a low risk scenario
Flood depth (millimetres)

Over 900mm | 300 to 900mm | Below 300mm | Location you selected

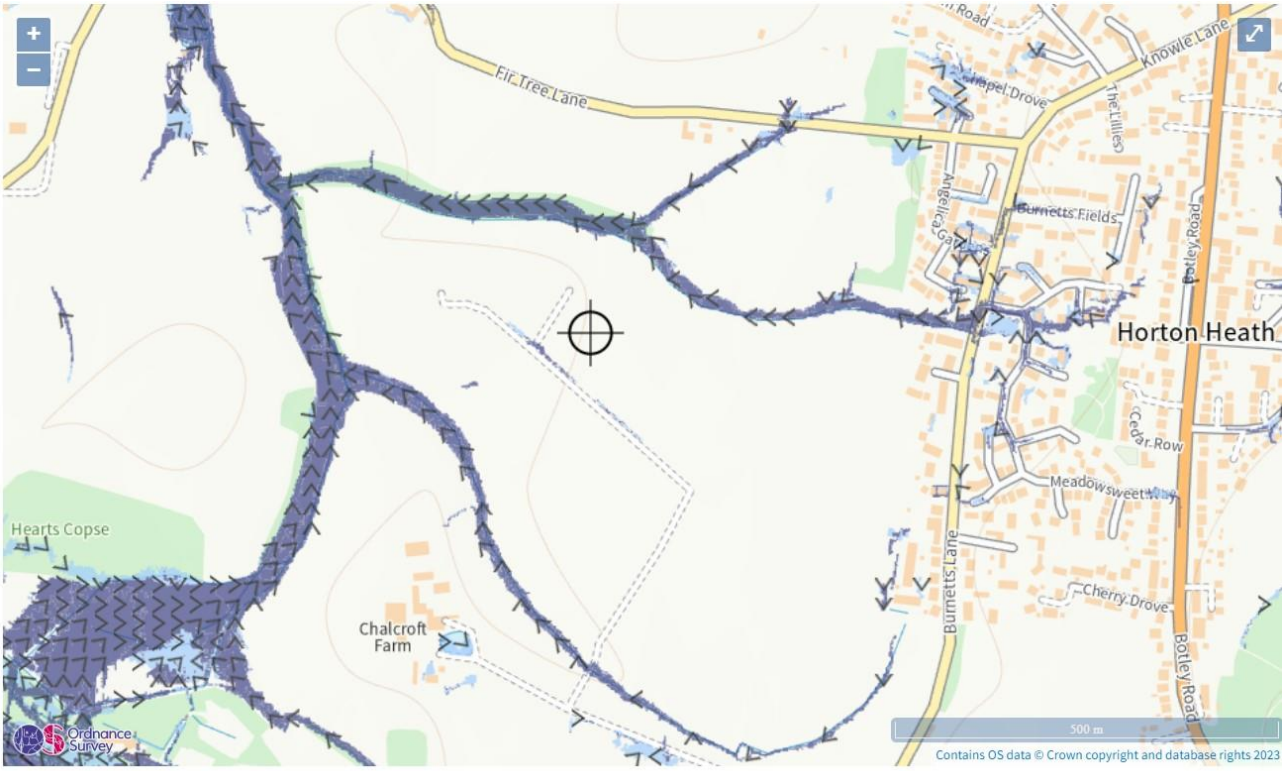
Environment Agency Surface Water Depth Low Risk Scenario



Surface water flood risk: water depth in a high risk scenario
Flood depth (millimetres)

Over 900mm | 300 to 900mm | Below 300mm | Location you selected

Environment Agency Surface Water Depth High Risk Scenario



Surface water flood risk: water velocity in a low risk scenario
Flood velocity (metres/second)

Over 0.25 m/s | Less than 0.25 m/s | Direction of water flow | Location you selected

Environment Agency Surface Water Velocity Low Risk Scenario

Environment Agency Surface Water Velocity High Risk Scenario

The definition of EA flood zones is provided within the National Planning Policy Framework (NPPF) and its associated Planning Practice Guidance (PPG) Table 1 (Flood Zones) and summarised below:

- **Flood Zone 1 (Low Probability)**
  Land which could be at risk of flooding from fluvial or tidal flood events with less than 0.1 % (1:1000 year) annual probability of occurrence and therefore considered to be at 'low probability' of flooding.

- **Flood Zone 2 (Medium Probability)**
  Land which could be at risk of flooding with an annual probability of occurrence between 1% (1:100 year) and 0.1% (1:1000 year) from fluvial sources and between 0.5% (1:200 year) and 0.1% (1:1000 year) from tidal sources and therefore considered to be at 'medium probability' of flooding.

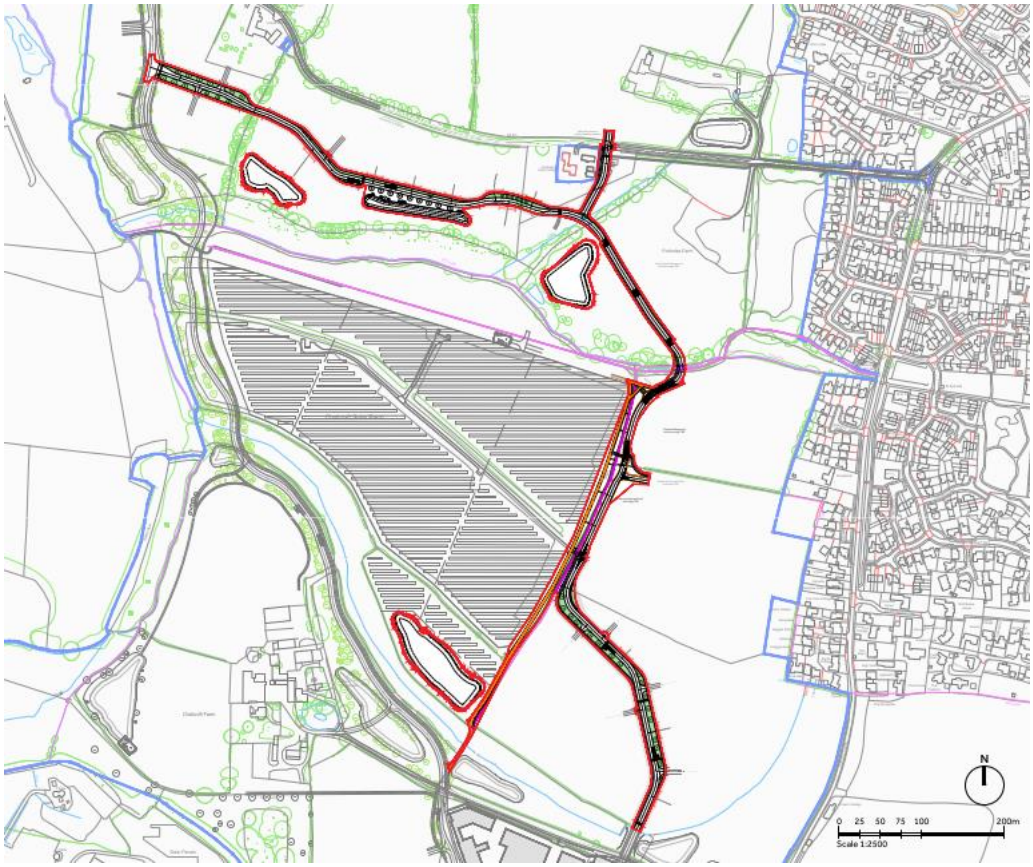
- **Flood Zone 3A (High Probability)**
  Land which could be at risk of flooding with an annual probability of occurrence greater than 1% (1:100 year) from fluvial sources and greater than 0.5% (1:200 year) from tidal sources and therefore considered to be at 'high probability' of flooding.

- **Flood Zone 3B (Functional Floodplain)**
  Land where water has to flow or be stored in times of flood. Local Planning Authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain in agreement with the Environment Agency. However, in general it is defined as land that would flood with an annual probability of 5 % (1:20 year) or greater.

Footnote 50 in the NPPF states that a site-specific flood risk assessment should be provided for all development in Flood Zones 2 and 3. In Flood Zone 1, an assessment should accompany all proposals involving: sites of 1 hectare or more; land which has been identified by the Environment Agency as having

critical drainage problems; land identified in a strategic flood risk assessment as being at increased flood risk in future; or land that may be subject to other sources of flooding, where its development would introduce a more vulnerable use. Furthermore, in assessing the flood zoning, the protection afforded by any flood defence structures or strategic flood management measures is not taken into account by the EA.

Paragraph 30 in the Flood Risk and Coastal Change Planning Practice Guidance (Reference ID: 7-030-20140306) advises that a site-specific flood risk assessment is carried out to assess the flood risk to and from a development site. The assessment should demonstrate how flood risk will be managed now and over the development's lifetime, taking climate change into account, and with regard to the vulnerability of its users.



Internal Distributor Road routes and watercourses crossings

With the foregoing in consideration, the northern section of the Internal Distributor Road runs parallel with the surface water flooding from the watercourse, before crossing the watercourse twice at its eastern extent and then running south to a further crossing point. The remaining site areas and Internal Distributor Road route are not shown to be at risk of flooding, as indicated by EA flood maps.

The majority of the developable site, and all proposed built development including the Internal Distributor Road, is to be located in Flood Zone 1 with the exception of the watercourse crossings that are design not to flood and not to exacerbate flooding elsewhere.

Failure (Breaching) of Flood Defences and Management Measures

Based upon EA mapping, the site does not benefit from, nor rely upon, the presence of formal raised flood defences and therefore corresponding flood risk to the site due to defence failure (breach) is negligible. With the foregoing in consideration, the site is deemed to be at **low risk of flooding due to failure of flood defences and management measures.**

Reservoirs

Based upon EA mapping, the site does not lie within an area denoted as being at risk of flooding in the event of a significant breach (failure) of raised reservoir embankments. With the foregoing in consideration, the site is deemed to be at **low risk of flooding from Reservoirs.**

Canals and Artificial Water Bodies

There are no canals and other artificial water body in the site area apart from natural watercourses running across the site area and therefore this source poses no flood risk to the wider development area unaffected by flooding. With the foregoing in consideration, the site is deemed to be at **low risk of flooding from Canals and Artificial Water Bodies.**

Groundwater Flooding

Groundwater flooding is defined as flooding caused by the emergence of water originating from subsurface strata, with the most common forms being:

- A rise in groundwater from unconfined permeable soils (such as chalk), or shallow perched water tables after periods of heavy rainfall; or
-
- A rise in groundwater in unconsolidated permeable superficial deposits, which are in hydraulic continuity with local river levels and where the hydraulic gradient of the water table is low.

Based on the SFRA, the entire site is deemed to be at low risk of groundwater flooding except for the natural watercourses running along the western-south area, southern leg and north eastern area. It is considered that groundwater could be shallow on the site and shallowest in proximity to the onsite watercourses. With the foregoing in consideration, the site with the exception of the overland western-south area, southern leg and north eastern area watercourses flooding locally, the remaining site area is deemed to be at **low risk of groundwater flooding**, unless further intrusive site investigation identifies evidence to the contrary, such as perched water or similar.

Sewers and Artificial Drainage Systems

No public sewers are identified on the site and there are no known instances of flooding from overwhelmed sewers affecting the site. The risk of flooding from overwhelmed sewers is therefore assessed as Low. The SFRA does not find or mention any flooding in the area surrounding the application site. With the foregoing in consideration, the site is deemed to be at **low risk of sewers flooding.**

Failure of Utilities Infrastructure

It should be noted that burst water mains and failure of sewerage infrastructure could inherently pose a residual risk to any site. Assuming an adequate provision of buffer zones to allow overland flow paths along proposed infrastructure routes to be safeguarded, and accommodation of any sewer and utility easements within the future development layout, then utility and sewerage infrastructure are not deemed to pose a significant flood risk to the site. With the foregoing in consideration, the site is deemed to be at **low risk of flooding due to failure of utilities infrastructure.**

Tidal Flooding

Due to its inland location, the risk of tidal flooding to the site is considered negligible. With the foregoing in consideration, the site is deemed to be at **low risk of tidal flooding.**

Surface Water Flooding

The SFRA does not find or mention any surface water flooding at the application site with the exception of the watercourses flooding locally. With the foregoing in consideration, the remaining areas of the site are deemed to be at **low risk of surface water flooding**.

Overland Flow

Based upon the topography of the site and surrounding area, there is limited potential for surface water from **off-site** areas to progress overland toward the road or built development proposals, which is reinforced by interrogation of EA mapping. With the foregoing in consideration, the site, with the exception of the watercourses flooding locally, the remaining area of the site is deemed to be at **low risk of flooding** due to overland surface water flows**.**

Summary

FLOODING SOURCE	RISK
Fluvial Flooding (excluding existing natural watercourse)	Low
Failure (Breaching) of Flood Defences and Management Measures	Low
Reservoirs	Low
Canals and Artificial Water Bodies	Low
Groundwater Flooding	Low
Sewers and Artificial Drainage Systems	Low
Failure of Utility Infrastructure	Low
Tidal Flooding	Low
Surface Water Flooding (except for watercourse)	Low
Overland Flow from off-site areas (except for watercourse)	Low

Eastleigh Borough Council has a number of permissive powers under the Land Drainage Act 1991 for the prevention and mitigation of flood damage from ordinary watercourses and also responsibility for managing flood risk encompassed in planning legislation. Eastleigh falls within the Environment Agency's South East region. The Environment Agency has a supervisory role over all aspects relating to flood defence with a more specific role to the maintenance of main rivers. The borough is served by Southern Water supplying foul and surface water sewerage systems. Southern Water is also responsible for the maintenance of these networks.

SECTION 04
CLIMATE CHANGE

4. CLIMATE CHANGE

4.1. Anticipated Development Lifecycle

The NPPF requires development to take account of the impacts of climate change. The allowances to be made for climate change effects when assessing flood risk are related to the lifetime of the development. In accordance with the PPG, NPPF and best practice, a 100-year development lifecycle has been assumed for the proposed development of the site for predominantly residential end-use.

4.2. Climate Change Allowances

EA guidance "*Flood Risk Assessments: Climate Change Allowances*" (2022) outlines the required climate change allowances to be adopted when interrogating existing flood data and for use in the design of future surface water drainage systems.

Table 1 of 'Flood risk assessments: climate change allowances' gives the peak river flow allowances by river basin district for 3 categories: central, higher central and upper end, and 3-time frames. The appropriate allowance to use depends on the flood zone and the flood risk vulnerability classification of the development.

With reference to Table 1 of 'Flood risk assessments: climate change allowances' the appropriate allowances to use for the South East **river** basin district are the higher central and upper end allowances. The total potential change anticipated for 2070 to 2115 is given as 45% for the higher central category and 105% for the upper end category.

Table 2 of the same document also outlines that an extra 40% climate change allowance should be adopted for all peak **rainfall** intensities for the purposes of new surface water drainage design. This again assumes the 'upper end' value and a 100-year development lifecycle.

Department for Environment Food & Rural Affairs data services platform for the River Test and Itchen Management Catchment peak rainfall allowances, 3.3% annual exceedance rainfall event provides Central allowance 2050s epoch of 20% and 2070s epoch of 25%, Upper end allowances are given as 35% and 40% respectively. It also provides for a 1% annual exceedance rainfall event at the Central allowance for 2050s epoch of 20% and 2070s epoch of 25%, Upper end allowances are given as 40% and 45% respectively.

In addition, a building development creep allowance of 10% should be adopted in the calculations for new surface water drainage design within new housing conurbations.

4.3. Impacts on Flood Risk

Therefore, in terms of providing an acceptable standard of protection against flooding for new Internal Distributor Road and associated development, no flooding of the road or property should occur as a result of the 'design flood' corresponding to a 1 in 100-year fluvial flood event, or a 1 in 200-year tidal flood event, taking account of climate change and development creep. However, as this report primarily focuses on the construction of the road it is anticipated that this construction would not be considered appropriate to include 10% allowance for creep within separate modelling calculations.

SFRA and EA mapping confirms, apart from the existing natural watercourses, the site remains unaffected by fluvial or surface water flooding up to and including the 1% (1:100 year) AEP event, including an allowance for climate change and creep. Detailed EA mapping has also been interrogated with regard to the area of the site subject to Flood Zone 1 conditions, considering an appropriate climate change allowance.

The impact of climate change over the lifetime of the development must be taken into account within the assessment of post-development surface water runoff and subsequent design of surface water drainage systems for the proposed site.

4.4. Impacts on Proposed Surface Water Drainage Design

The impact of climate change over the lifetime of the development must be taken into account within the assessment of post-development surface water runoff and subsequent design of surface water drainage systems for the proposed site. SUDS systems will necessarily respect the Simple Index Approach for ensuring water quality is not impacted.

4.5. SuDS Management Train & Proposed SuDS Features

In accordance with the discharge hierarchy, the proposed development will discharge surface water to an existing ditch, Foxwood Stream and its tributary. The surface water discharged from the Internal Distributor Road and the nearby catchments will flow towards the SUDS feature which will be located within each catchment area.

SECTION 05

POLICY CONSTRAINTS AND IMPLICATIONS TO THE DEVELOPMENT

5. POLICY CONSTRAINTS AND IMPLICATIONS TO THE DEVELOPMENT

5.1. Sequential Test

The Sequential Test as outlined within the NPPF gives preference to locating new development in areas at lowest risk of flooding (i.e. Flood Zone 1) and requires developers to:

> "*… demonstrate that there are no reasonably available sites in areas with a lower probability of flooding that would be appropriate to the type of development or land use proposed*"

Paragraph 157 of the NPPF states:
'All plans should apply a sequential, risk-based approach to the location of development - taking into account the current and future impacts of climate change – so as to avoid, where possible, flood risk to people and property.'

Paragraph 158 of the NPPF goes onto state:
'The aim of the sequential test is to steer new development to areas with the lowest probability of flooding. Development should not be allocated or permitted if there are reasonably available sites appropriate for the proposed development in areas with a lower risk of flooding. The strategic flood risk assessment will provide the basis for applying the test. The sequential approach should be used in areas known to be at risk now or in the future from any form of flooding.'

Paragraph 160 of the NPPF states:
'The application of the exception test should be informed by a strategic or site-specific flood risk assessment, depending on whether it is being applied during plan production or at the application stage. For the exception test to be passed it should be demonstrated that:

a) the development would provide wider sustainability benefits to the community that outweigh the flood risk; and
b) the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.'

Paragraph 161 of the NPPF goes onto state:
'Both elements of the exception test should be satisfied for development to be allocated or permitted.'

Whilst it is ultimately the responsibility of the Local Planning Authority to undertake this test, the principle of siting residential development on this site has already been firmly established.

Similarly, redevelopment of a site which is wholly situated within Flood Zone 1 and where all future proposed built development can be sited within Flood Zone 1, will easily satisfy the requirements of the Sequential Test as no reasonably available alternative sites, at a lower risk of flooding, are expected to be identified.

With the foregoing in consideration, it is **likely** that the requirements of the sequential test would be satisfied.

5.2. Flood Risk Vulnerability

PPG Table 2: Flood Risk Vulnerability Classification (summarised below), identifies that transport infrastructure (including mass evacuation routes) which has to cross the area at risk are considered as a **'Essential Infrastructure'** use.

CLASSIFICATION	EXAMPLES OF USE
Essential Infrastructure	▪ Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk. ▪ Essential utility infrastructure which has to be located within a flood risk area for operational reasons, including electricity generating power stations and grid and primary substations; and water treatment works that need to remain operation in times of flood. ▪ Wind turbines.
Highly Vulnerable	▪ Police and ambulance stations; fire stations and command centres; telecommunications installations required to be operational during flooding. ▪ Emergency dispersal points. ▪ Basement dwellings. ▪ Caravans, mobile homes and park homes intended for permanent residential use. ▪ Installations requiring hazardous substances consent.
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.
Less Vulnerable	▪ Police, ambulance and fire stations which are not required to be operational during flooding. ▪ Buildings used for shops, financial, professional and other services, restaurants, cafes and hot food takeaways, offices, general industry, storage and distribution, non-residential institutions not included in the 'more vulnerable' class and assembly and leisure. ▪ Land and buildings used for agriculture and forestry. ▪ Waste treatment (excl. landfill and hazardous waste facilities). ▪ Minerals working and processing (except for sand and gravel working). ▪ Water treatment works which do not need to remain operation during times of flood. ▪ Sewage treatment works, if adequate measures to control pollution and manage sewage during flooding events are in place.
Water-Compatible Development	▪ Flood control infrastructure. ▪ Water transmission infrastructure and pumping stations. ▪ Sewage transmission infrastructure and pumping stations. ▪ Sand and gravel working. ▪ Docks, marinas and wharves.

- Navigation facilities.
- Ministry of Defence installations.
- Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location.
- Water-based recreation (excluding sleeping accommodation).
- Lifeguard and coastguard stations.
- Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms.
- Essential ancillary sleeping or residential accommodation for staff required by uses in this category, subject to a specific warning and evacuation plan.

5.3. Flood Zone Compatibility

PPG Table 3: Flood Risk Vulnerability and Flood Zone Compatibility (summarised below), confirms that the site is appropriate for 'Essential Infrastructure' and 'More Vulnerable' uses in Flood Zone 1 and Flood Zone 2 without the need for application of the Exception Test. In Flood Zone 3a the more vulnerable, which includes dwelling houses, and essential infrastructure, uses should only be permitted in this zone if the Exception Test is passed. In Flood Zone 3b new residential development should not be permitted but essential infrastructure is appropriate in this zone if the Exception Test is passed.

FLOOD ZONE	ESSENTIAL INFRASTRUCTURE	HIGHLY VULNERABLE	MORE VULNERABLE	LESS VULNERABLE	WATER COMPATIBLE
Zone 1	Permitted	Permitted	Permitted	Permitted	Permitted
Zone 2	Permitted	Exception Test Required	Permitted	Permitted	Permitted
Zone 3A	Exception Test Required	Not Permitted	Exception Test Required	Permitted	Permitted
Zone 3B	Exception Test Required	Not Permitted	Not Permitted	Not Permitted	Permitted

5.4. Functional Floodplain

The existing natural watercourses impose flood zones 2 and 3 to the immediate areas to the sides of the watercourse runs. However, the majority of the site and locations of the proposed Internal Distributor Road is not located within an area designated as functional floodplain Zone 2, 3A, 3B and therefore no constraints apply to the proposed development other than at watercourse crossing points where the design will cater for the flood risk and the watercourse.

5.5. Off-site Impact

If the site is redeveloped, roads or residential, there is the potential to exacerbate flood risk elsewhere (off-site).

This said, adequate site area is available within the application boundary to mitigate any loss of flood conveyance capacity that may result from the proposed development. SUDS and pond features are being designed to ensure adequate provisions.

Furthermore, provided that surface water run-off generated from the proposed development and Internal Distributor Road will be managed on-site in a sustainable manner, then no detrimental off-site impact is anticipated.

5.6. Safe Access and Egress

Safe (dry) access and egress via the proposed Internal Distributor Road is maintained at the site for well beyond the 1% (1:100 year) fluvial event + climate change + creep allowances, and therefore the associated requirements of the NPPF and PPG are satisfied.

5.7. Local Plan Requirements

In addition to the requirements set out within the NPPF (2021) and the PPGs, the Eastleigh Borough Council Local Plan review (2001 – 2011) contains saved policies relevant to this assessment:

- Policy 41.ES – Development affecting water courses.
  Limits development as required by PPSs 25 and 9 and PPG20
- Policy 42.ES – Development in a catchment of a water course.
  Limits development in areas at risk of flooding as required by PPS25
- Policy 43.ES – Areas at risk of flooding.
  Limits development in areas at risk of flooding as required by PPS25
- Policy 44.ES – Development in areas at risk of flooding
  Limits development in areas at risk of flooding as required by PPS25
- Policy 45.ES – Sustainable Drainage.
  Controls development giving rise to risk of flooding as required by PPS25

The Eastleigh Borough Local Plan 2016 – 2036 was Adopted in April 2022. The following policies in the Adopted Local Plan are relevant to this assessment:

Eastleigh Borough Local Plan 2016-2036, Chapter 5: Development Management Policies, provides:

- Policy DM3 – Adaptation to climate change.
- Policy DM5 – Managing flood risk.
- Policy DM6 – Sustainable surface water management and watercourse management.
- Policy DM10 – Water and Waste Water.
- Policy DM11 – Nature conservation.

5.8. Compliance Summary

In order to comply with Eastleigh Borough Local Plan, the following steps will be taken:

- As the proposed new Internal Distributor Road routes are located within Flood Zone 1 except for crossing points within the overall red line area, roads and properties within flood zone 2 or 3 will not be proposed or built except for the crossing points and therefore a Sequential Test is not required.
- Incorporating thorough SuDS features as a method of alleviating and storing surface water run off
- Installing swales and ponds for surface water storage, if required

- Complying with Building Regulations and all relevant legislation
- Incorporating water butts for new residential developments, as required
- Maintaining the water quality through the use of swales, ponds, catchpits, sumps and gullies to intercept any contaminants before they reach infiltration systems or discharge into the watercourse.
- Ensuring the future proofing of the design by allowing for climate change and creep when calculating required storage volumes

SECTION 06

PROPOSED FLOOD MITIGATION AND MANAGEMENT MEASURES

6. PROPOSED FLOOD MITIGATION AND MANAGEMENT MEASURES

6.1. Siting of the Built Development

As the proposed roads are to be located within Flood Zone 1 only, except for the watercourse crossing points, hence there is no need to consider alternative locations or designate areas for flood compensation.

6.2. Elevation of the Development Platform

In accordance with Highway and Building Regulations, it is recommended that the Internal Distributor Road will be 300mm above any predicted flood levels and finished ground floor levels be set a minimum of 150 mm above immediately adjacent ground levels for all proposed buildings, with the exception of level thresholds at access points.

6.3. External Ground Levels

It is considered that no significant criteria need be adopted for the setting of external ground levels, assuming these will not be significantly reduced or increased from existing, as above.

It is recommended that external levels are maintained below the proposed Internal Distributor Road levels and that residential property thresholds are not lower than the road levels without adequate flood resilience.

6.4. Fluvial Flood Storage Compensation

As the proposed site is categorised as being at low risk of Fluvial Flooding, there is no need to provide any compensation or mitigation for Fluvial Flooding

6.5. Overland Flow Routes

Pluvial Flooding (or surface runoff flooding) is caused by rainfall and is that flooding which occurs due to water ponding on or flowing over the surface before it reaches a drain or watercourse or SuDS system.

Any surface water run-off, including exceedance flows, can be appropriately conveyed to a new surface water SUDS drainage system whilst avoiding the road and proposed built development and key infrastructure (i.e., substations).

All proposed highways and associated drainage will be designed in accordance with current Highways Act and Building Regulations criteria, and SuDS adopting overland flow routes for the conveyance of excess floodwater toward areas of low vulnerability and water compatible end use (such as open space and soft landscaping), where water may be temporarily detained, if required.

SECTION 07
SURFACE WATER DRAINAGE

7. SURFACE WATER DRAINAGE

7.1. Context

Without mitigation and consideration, the proposed redevelopment of the site and the new Internal Distributor Road could lead to an unacceptable increase in the rate and volume of surface water generated from the site.

To comply with current guidance and best practice, sustainable drainage systems (SuDS) will be required, to be implemented in order to manage the volume, rate and quality of surface water discharged off-site.

In terms of volume control, where reasonably practicable, for greenfield development, the runoff volume in the 1 in 100-year, 6-hour rainfall event should never exceed the greenfield runoff volume for the same event. Where reasonably practicable, for developments which have been previously developed this runoff volume must be constrained to a value as close as is reasonably practicable to the greenfield runoff volume but should never exceed the runoff volume prior to redevelopment for that event. Where it is not reasonably practicable to constrain the volume of runoff as described it must be discharged at a rate that does not adversely affect flood risk. A separate modelling study demonstrates through evidenced based facts that the design will not be affected by flooding and flooding will not be exacerbated elsewhere.

Guidance on the design and construction of SuDS is provided in the 'Interim Code of Practice for Sustainable Drainage Systems', published by the National SUDS Working Group in July 2004 and in other CIRIA documents including The SuDS Manual 2015 (CIRIA C753), in the Environment Agency's document entitled 'Sustainable Drainage Systems (SUDS) An introduction', as well as in the Design and Construction Guidance (DCG) published by Water UK.

A sustainable drainage strategy, involving the implementation of SuDS, is proposed for managing surface water on the site wherever feasible. A full range of SuDS techniques has been considered for use on the site. Through early discussions with the Lead Local Flood Authority and other stakeholders it was agreed that the Strategic SuDS features on the site should include above ground storage features, ponds and swales, within the green corridors that follow the onsite watercourses.

Additional source control measures should be utilised within the upstream development parcels. This approach provides flexibility for the detailed design of individual development parcels whilst maximising the water quality, water quantity, amenity and biodiversity benefits of the overall SuDS strategy.

The SuDS Manual 2015, and CIRIA C687 'Planning for SuDs - making it happen', promote the use of a SuDS 'management train', which seeks to address the quality and quantity of runoff at all stages of a drainage system. It uses a hierarchy of techniques, namely: i) prevention, ii) source control, iii) site control and iv) regional control. The drainage strategy for the proposed Internal Distributor Road and associated development seeks to follow the concept of a SuDS management train.

A SuDS 'management train' approach is proposed to be implemented on the site. In terms of the SuDS 'management train', the surface water management strategy for the proposed Internal Distributor Road and development seeks to address the quality and quantity of runoff as follows:-

i) Prevention

Prevention is the use of good site design and housekeeping measures to prevent pollution. Good site design and housekeeping measures that should be considered include:

▪ Minimising the impermeable areas created on the site by providing permeable road surfaces and soft landscaping and planting wherever possible.
▪ Good site wide housekeeping and maintenance to minimise blockages and prevent pollution arising.
▪ Provision of water butts for rear gardens.
▪ The use of green roofs for public / commercial buildings where appropriate.
▪ The use of rainwater harvesting / reuse systems for public / commercial buildings and irrigation where appropriate.
▪ Installation of separators and other proprietary pollution control systems where land use requires or specific risks necessitate their use.
▪ Silt traps and trapped gullies to retain sediment.
▪ Planting within landscaped areas to encourage nutrient / pollutant uptake and evapotranspiration.
▪ The implementation of a SuDS Maintenance Strategy. Advice on what should be included within a maintenance strategy for the Strategic SuDS Features is included with this report. The SuDS Maintenance Strategy should become a living document that is continuously reviewed.

ii) Source Control

Source control is defined in The SuDS Manual 2015 (CIRIA C753) as the control of runoff at or near its source, so that it does not enter the drainage system or is delayed and attenuated before it enters the drainage system. Source Control techniques that should be used within road and development parcels include the following:

▪ Pervious Paving: Pervious paving intercepts rainfall that lands on its surface before it can run overland into the downstream drainage system. This provides a degree of interception, particularly in the most polluted first-flush events, as well as filtration through the various layers of construction and through the stone sub-base. Pervious paving will be used for the road design and would typically be used for parking areas such as driveways, parking courts and car parks. Through the inclusion of a suitable flow control device, the stone sub-base in the pervious paving structure can be utilised to provide additional attenuation storage.

▪ Bioretention Areas / Rain Gardens / Swales / Ponds: Bioretention areas utilise planting and constructed soils to intercept rainfall from their contributing catchment areas and contribute to interception storage, evapotranspiration and pollution removal. They can also be incorporated into traffic calming infrastructure such as build outs and into roadside planting and tree pits. Bioretention Swales can be installed adjacent to larger areas of highway to provide water quality treatment and attenuation storage along their length. Ponds serve as attenuation and storage and provide a wide range of biodiversity benefits.

▪ Other filtration techniques: Filter Trenches and French Drains can be used to intercept runoff from larger parking areas and highway areas, if required. These will provide interception storage and filtration through the stone fill within the trenches.

iii) Site Control

Site control is the management of water from roads and sub-catchments within a development parcels. Through close consultation with the layout designers flow conveyance measures such as swales, ponds and filter trenches can be incorporated into the development parcels to provide additional attenuation, treatment, amenity and opportunities for habitat creation.

iv) Regional Control

Regional control is the strategic management of runoff across the wider site. The Strategic SuDS Features will provide the attenuation volume and flow control required to reduce post-development flow rates to below greenfield runoff rates.

The proper implementation of a SuDS management / treatment train using a combination of upstream source control and strategic SuDS features will create greater resilience and allow the system to collect silt at various points which can then be removed as part of periodic maintenance.

Detailed design of the road and individual development parcels should, where possible, create a diverse SuDS scheme that encourages sedimentation, filtration and biological uptake throughout the site; ensuring that effective maintenance and management procedures are followed and will be the key to ensuring the overall effectiveness of the SuDS scheme.

Detailed design of the road and individual development parcels should, where possible, create a diverse SuDS scheme that incorporates the principles of the SuDS 'management train'.

7.2. SuDS Constraints

Geology

A site investigation is reported to have been undertaken by Hydrock in April 2019. With regards to the use of soakaways / infiltration drainage on the site, the Ground Investigation Report concluded the following: -

> *"Soakaway drainage is considered unsuitable for this site, subject to further BRE365 compliant testing."*

With regards to groundwater the Ground Investigation Report states the following: -

> *"Groundwater was not encountered during the investigation."*

> *"Water levels recorded post-fieldwork range from 0.93m bgl to 2.77m bgl (15.86m OD to 29.66m OD)."*

Based on the foregoing it is considered that the use of soakaways would not provide a suitable means of draining surface water runoff from the roads or the development on the majority of the site. However, in line with the recommendations of the Ground Investigation Report, it is recommended that localised infiltration testing is undertaken within the individual development parcels to identify any localised areas of the site where infiltration drainage may be feasible.

Groundwater monitoring is on-going in the locations of the proposed Strategic SuDS features to establish the highest annual groundwater levels to inform the detailed design of these features; it is noted that the winter Groundwater monitoring report is available.

Topography

The site predominantly slopes from East to West from an elevation of 28.14m to 20.59m with an approximately gradient of 1 in 12. However, the site falls from North to South from an elevation of 26.00m to 20.784m with an approximate gradient of 1 in 92m. The application site falls towards Foxwood Stream and its tributaries.

Trees

The siting and location of proposed SuDS features may be constrained by any proposal to retain established trees and to plant new trees, although requiring new drainage and SuDS features to be positioned outside of any root protection zones.

Public Safety and Maintenance

It is intended to fully utilise SUDS train management systems and the existing watercourses, it is unlikely that below ground geocellular drainage units for surface water will be required. It is intended to work with nature and enhance biodiversity opportunities.

Consideration must also be given to the access and future maintenance of these features, which lend themselves to significant landscaped areas remaining under private ownership.

Additional biodiversity and SuDS benefits could be achieved via the incorporation of 'above ground' systems such as swales, ponds, rainwater harvesting and water butts, within the development proposals.

7.3. Required Maintenance Schedule

To ensure the long-term performance of the proposed DS, the onsite drainage system will be owned and maintained by the site operator or a maintenance company (MC) in accordance with the indicative schedule below, in the alternative the local authority may wish to adopt such features. However, at the detailed drainage design stage a full management and maintenance plan detailing best practice system maintenance regimes and proprietary manufacturer requirements and lifecycle management, in accordance with the CIRIA SuDS Manual will need to be produced. In the absence of local authority adoptions, maintenance of the overall drainage network will be the responsibility of an appointed management company.

ELEMENT / DRAINAGE COMPONENT	OWNERSHIP / ADOPTION	MAINTENANCE REQUIREMENTS
Geocellular Attenuation Tank (if required)	Site Operator / MC	To be monitored for silt build-up and cleaned as required using suction methods, ensuring no solid material passes through outlet. Monitored for general condition of the tank and system generally, to suit manufacturer's guidance, check for leaks and displacement of 'cells'. **Inspection annually and before / after extreme storm events**.
Permeable Paving	Site Operator / MC	Non-aggressive brushing of the whole surface (avoiding disruption of the jointing material, with suction rates adjusted, based on a trial), either manually or mechanically carried out annually. Top up of the gritstone may be required after cleaning. Weed control – excessive weed growth can be managed by localised spot-treatment with weed killers, in accordance with suppliers' recommendations. **Inspection annually.**
Flow Restriction Device & Chamber	Site Operator / MC	To be monitored for silt build-up and cleaned as required using suction methods. Check function of flow restriction componentry to suit manufacturer's guidance. **Inspection annually and before / after extreme storm events**.
Catchpit Manholes	Site Operator / MC	To be monitored for silt build-up and cleaned as required using suction methods. **Inspection annually and before / after extreme storm events**.
Rain Water Pipes	Site Operator / MC	Clearance of leaves / debris from guttering and hopper inlets. Rodding points provided to clear blockages via conventional rodding methods. **Inspection annually and before / after extreme storm events.**

Soil Vent Piles / "Stub Stacks"	Site Operator / MC	Rodding points to be provided to clear blockages via conventional rodding methods. **Inspection annually**.
Gullies (Internal & External)	Site Operator / MC	To be monitored for silt build-up and cleaned as required. Where provided, ensure air traps are primed and sealed to prevent smells. **Inspection quarterly.**
Swales	Site Operator / MC	To be monitored for litter and debris. Strimming to remove overgrown vegetation twice yearly. Removal of self-seeded saplings to prevent new tree growth. Monitor for silt build up and remove and spread locally outside design profile as required. **Inspection quarterly and before / after extreme storm events.**
Ponds	Site Operator / MC	To be monitored for litter and debris. Careful strimming to remove overgrown vegetation twice yearly. Removal of self-seeded saplings to prevent new tree growth. Monitor for silt build up and remove and spread locally outside design profile as required. **Inspection quarterly and before / after extreme storm events.**

SECTION 08
FOUL WATER DRAINAGE

8. FOUL WATER DRAINAGE

The existing development site area is not crossed by any public foul sewers. Where appropriate it should be proposed to connect to an existing Public Foul Sewer network operated by Southern Water supplying foul and surface water sewerage systems.

The Foul sewers built as part of any new development must be constructed in accordance with Building Regulations Part H and where offered for adoption, to the local water company, in accordance with the latest technical guidance for the Design And Construction Guidance (DCG) April 2020.

SECTION 09
CONCLUSION

9. CONCLUSION

- Ridge & Partners prepared this Flood Risk Assessment on behalf of Eastleigh Borough Council. The proposed development has been designed in full accordance with the Development Plan and Outline Planning Application (OPA) O/20/89498, which has a resolution to grant consent subject to S106 negotiations relating to education. This application is for full planning consent due to the time for these negotiations to complete. Submitting details of the Secondary Infrastructure Road (SIR) as a full planning application will deliver the SIR in accordance with, and as part of the OPA, but enable commencement more quickly than waiting for the resolution of the OPA S106 and the determination of an application for Reserved Matters Approval of details of the SIR.

- Flood risk has been assessed in line with NPPF (2021), BS 8533 (2017), BS BS 8582 (2013), CIRIA C624 (2004) and SuDS Manual (C753) (2015), taking into account national and local planning policy and guidance to consider all potential sources of flooding to the site.

- Apart from the watercourse causing local bank-full and local overland flooding the remaining site area is in Flood Zone 1, although there are two additional tributary watercourses that will need to be crossed. However, apart from the watercourses there is no recorded flooding from any other sources, neither historical flooding nor specific event records, apart from the watercourses.

- Flood risk to the site from other potential sources such as surface water, ground water, sewers and infrastructure are also all considered low, with no significant flood risks identified. Soil Investigations and winter period borehole monitoring have been completed as referenced in Section 2.2.

- Based upon current information provided by the EA, the carefully selected site areas for the Internal Distributor Road and residential development within the site area are demonstrated to be at low probability of flooding (Flood Zone 1) from fluvial sources.

- Based upon our initial appraisal of flood risk, mitigation measures should be utilised to manage residual flood risks to the site. However, it is felt that the recommended measures are readily deliverable and would not unduly hinder or prevent the Internal Distributor Road construction or the redevelopment of the site.

- Development of the Internal Distributor Road and site within Floor Zone 1 areas only, with appropriate mitigation measures as outlined within this document, should readily satisfy the requirements of the Sequential Test as no reasonably available alternative sites, at a lower risk of flooding are expected to be identified. There is no requirement for the proposed development to be subject to the Exception Test. Adequately modelled and designed Internal Distributor Road crossing points over watercourses have been demonstrated.

- Surface water generated from the proposed Internal Distributor Road and development could be managed in a sustainable manner and at source by employing a wide variety of SuDS as far as possible with the support of enhanced biodiversity.

- Foul sewage from all new development should be connected to an existing public foul sewer system, subject to permission to connect or alternatively to new sewerage provisions with appropriate management and maintenance.

- The technical assessment of flood risk presented within this document demonstrates that the immediate and residual flood risks over the lifetime of the Internal Distributor Road and development are readily manageable and the redevelopment proposals are deemed acceptable in terms of flood risk throughout their lifetime, without increasing flood risk elsewhere.

RIDGE

www.ridge.co.uk

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EXTERNAL REFERENCES:

THIS INFORMATION & RIDGE & PARTNERS LLP CIVILS 3D MODEL & ASSOCIATED 3D OUTPUTS ARE BASED UPON THE FOLLOWING INFORMATION FROM THE DESIGN TEAM

ARCHITECT REFERENCE:
- **ARCH DWG No.** 30454A / XX (DATED DEC 22)

SURVEY REFERENCE:
- **SURVEY DWG No.ENC/ONE-HH-FEB21** (DATED FEB 21)

IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY THIS INFORMATION IS CURRENT PRIOR TO CONSTRUCTION

KEY PLAN

LEGEND

- PROPOSED PRIVATE S.W. DRAIN
- PROPOSED 1200mmØ MANHOLE
- PROPOSED HEADWALL
- PROPOSED OIL INTERCEPTOR
- PROPOSED PIPE/MAINMAL
- CATCHMENT AREA F
- CATCHMENT ROAD AREA F
- CATCHMENT AREA G
- CATCHMENT ROAD AREA G
- CATCHMENT AREA H
- CATCHMENT ROAD AREA H
- CATCHMENT ROAD AREA E

REV	DESCRIPTION	DATE	DRAWN
P02	UPDATED DRAINAGE LAYOUT	01/12/2023	BT
P01	UPDATED DRAINAGE LAYOUT	27/07/2023	PO
-	INITIAL ISSUE	16/06/2023	JM

ORIGINATOR:

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CLIENT:

EASTLEIGH BOROUGH COUNCIL

IN ASSOCIATION WITH:

PROJECT:

ONE HORTON HEATH
SITE WIDE
INFRASTRUCTURE DELIVERY

TITLE:

DRAINAGE STRATEGY
SHEET 4

TECH:	CSE:	ICSE:	SCALE: 1:500 @ A1
PO			INITIAL ISSUE: 16/06/2023

STATUS:

PRELIMINARY

DRAWING No:

PROJECT:	ORG:	ZONE:	LEVEL:	TYPE:	ROLE:	NUMBER:	REV:
5018551	RDG	XX	ST	DR	C	0504	P02

SCALE 1:500 (5 0 5 10 15 20 25 m)

APPENDIX D
SURFACE WATER CALCULATIONS

5018551 : Main Road SW Infodrainage Calcs P02	Date: 01/12/2023			RIDGE
	Designed by: BT	Checked by:	Approved By:	
Report Details: Type: Inflow Summary Storm Phase: Phase	Ridge:			

Inflow Label	Connected To	Flow (L/s)	Runoff Method	Area (ha)	Percentage Impervious (%)	Urban Creep (%)	Adjusted Percentage Impervious (%)	Area Analysed (ha)
CATCHMENT_F1	MH_CF14		Time of Concentration	0.338	65	0	65	0.220
CATCHMENT_F2	MH_CF16		Time of Concentration	0.289	65	0	65	0.188
CATCHMENT_F3	MH_CF12		Time of Concentration	0.454	65	0	65	0.295
CATCHMENT_F4	MH_CF11		Time of Concentration	0.417	65	0	65	0.271
CATCHMENT_F5	MH_CF10		Time of Concentration	0.317	65	0	65	0.206
CATCHMENT_F6	MH_CF8		Time of Concentration	0.270	65	0	65	0.176
CATCHMENT_F7	MH_CF7		Time of Concentration	0.265	65	0	65	0.172
CATCHMENT_F8	MH_CF3		Time of Concentration	0.330	65	0	65	0.215
CATCHMENT_F9	GG_F8		Time of Concentration	0.168	65	0	65	0.109
CATCHMENT_F10	MH_CF18		Time of Concentration	0.481	65	0	65	0.313
CATCHMENT_F11	MH_CF7		Time of Concentration	0.216	65	0	65	0.140
CATCHMENT_G1	MH_CG34		Time of Concentration	1.525	65	0	65	0.991
CATCHMENT_G2	GG_G5 (1)		Time of Concentration	1.236	65	0	65	0.803
CATCHMENT_G3	MH_CG32		Time of Concentration	0.698	65	0	65	0.454
CATCHMENT_G4	GG_G5		Time of Concentration	1.923	50	0	50	0.961
CATCHMENT_G5	GG_G6		Time of Concentration	1.090	50	0	50	0.545
CATCHMENT_H1	MH_CG36		Time of Concentration	1.540	30	0	30	0.462
CATCHMENT_H2	GG_H2		Time of Concentration	2.416	65	0	65	1.570
CATCHMENT_H3	MH_CH40		Time of Concentration	1.463	65	0	65	0.951
CATCHMENT_H4	GG_H4		Time of Concentration	1.024	65	0	65	0.666
CATCHMENT_H5	GG_H5		Time of Concentration	1.739	65	0	65	1.130
CATCHMENT_H6	MH_CH48		Time of Concentration	1.191	65	0	65	0.774
F_ROAD_1	MH_CF17		Time of Concentration	0.234	100	0	100	0.234
F_ROAD_2	MH_CF11		Time of Concentration	0.342	100	0	100	0.342
F_ROAD_3	MH_CF4		Time of Concentration	0.161	100	0	100	0.161
F_ROAD_4	MH_CF2		Time of Concentration	0.096	100	0	100	0.096
G_ROAD_1	MH_CG22		Time of Concentration	0.260	100	0	100	0.260
G_ROAD_2	MH_CG34		Time of Concentration	0.237	100	0	100	0.237
H_ROAD_1	MH_CG36		Time of Concentration	0.352	100	0	100	0.352
H_ROAD_2	MH_CH37		Time of Concentration	0.284	100	0	100	0.284
H_ROAD_3	MH_CH42		Time of Concentration	0.306	100	0	100	0.306
TOTAL		**0.0**		**21.662**				**13.885**

Flow Options

Peak Flow Calculation	(UK) Modified Rational Method
Min. Time of Entry (mins)	5
Max. Travel Time (mins)	30

FSR

Type: FSR

Return Period (years)	100.0
Region	England And Wales
M5-60 (mm)	19.9
Ratio R	0.350

Lock Slope Options	None
Design Level	Level Soffits
Min. Cover Depth (m)	1.200
Min. Slope (1:X)	500.00
Max. Slope (1:X)	40.00
Min. Velocity (m/s)	1.0
Max. Velocity (m/s)	3.0
Use Flow Restriction	☐
Reduce Channel Depths	☐

Pipe Size Library

Default

Add. Increment (mm)	75

Diameter (mm)	Min. Slope (1:X)	Max. Slope (1:X)
100	0.00	0.00
150	0.00	0.00

Manhole Size Library

Default

Diameter / Width

Connection (mm)	Diameter / Length (m)	Width (m)
0	1.200	0.000
375	1.350	0.000
500	1.500	0.000
750	1.800	0.000

Additional Sizing

Connection (mm)	900
Diameter / Length (m)	0.900
Width (m)	0.000

Depth

Depth (m)	Diameter / Length (m)	Width (m)
0.000	1.050	0.000
1.500	1.200	0.000

Access

Depth (m)	Ladder Protrusion (mm)
0.000	130
3.000	230

Benching Requirements

Landing Width (mm)	500
Benching Width (mm)	225

5018551 : Main Road SW Infodrainage Calcs P02	Date: 01/12/2023			RIDGE
	Designed by: BT	Checked by:	Approved By:	
Report Details: Type: Outfall Details Storm Phase: Phase	Ridge:			

Outfalls

Outfall	Outfall Type	Fixed Surcharged Level (m)	Level Curve
OUTFALL_H	Free Discharge		
OUTFALL_F	Free Discharge		
OUTFALL_G	Free Discharge		

Runoff Type	Dynamic
Output Interval (mins)	5
Time Step	Default
Urban Creep	Apply Global Value
Urban Creep Global Value (%)	0
Junction Flood Risk Margin (mm)	300
Perform No Discharge Analysis	☐

Rainfall

FSR

Type: FSR

Region	England And Wales
M5-60 (mm)	19.9
Ratio R	0.350
Summer	☑
Winter	☑

Return Period

Return Period (years)	Increase Rainfall (%)
1.0	0.000
30.0	0.000
100.0	0.000
100.0	45.000

Storm Durations

Duration (mins)	Run Time (mins)
15	30
30	60
60	120
120	240
240	480
360	720
480	960
960	1920
1440	2880

5018551 : Main Road SW Infodrainage Calcs P02	Date: 01/12/2023			RIDGE
	Designed by: BT	Checked by:	Approved By:	
Report Details: Type: Inflows Summary Storm Phase: Phase	Ridge:			

FSR: 1 years: Increase Rainfall (%): +0: Critical Storm Per Item: Rank By: Max. Inflow

Inflow	Storm Event	Inflow Area (ha)	Max. Inflow (L/s)	Total Inflow Volume (m^3)
F_ROAD_1	FSR: 1 years: +0 %: 15 mins: Winter	0.23	31.2	14.478
F_ROAD_2	FSR: 1 years: +0 %: 15 mins: Winter	0.34	45.5	21.103
F_ROAD_3	FSR: 1 years: +0 %: 15 mins: Winter	0.16	21.4	9.935
F_ROAD_4	FSR: 1 years: +0 %: 15 mins: Winter	0.10	12.9	5.964
G_ROAD_2	FSR: 1 years: +0 %: 15 mins: Winter	0.24	31.5	14.622
G_ROAD_1	FSR: 1 years: +0 %: 15 mins: Winter	0.26	34.6	16.064
H_ROAD_2	FSR: 1 years: +0 %: 15 mins: Winter	0.28	37.8	17.545
CATCHMENT_H4	FSR: 1 years: +0 %: 15 mins: Winter	1.02	88.7	41.138
CATCHMENT_H3	FSR: 1 years: +0 %: 15 mins: Winter	1.46	126.6	58.755
CATCHMENT_H2	FSR: 1 years: +0 %: 15 mins: Winter	2.42	209.1	97.027
CATCHMENT_H5	FSR: 1 years: +0 %: 15 mins: Winter	1.74	150.5	69.834
CATCHMENT_H6	FSR: 1 years: +0 %: 15 mins: Winter	1.19	103.1	47.812
CATCHMENT_H1	FSR: 1 years: +0 %: 15 mins: Winter	1.54	61.5	28.546
CATCHMENT_G5	FSR: 1 years: +0 %: 15 mins: Winter	1.09	72.6	33.672
CATCHMENT_G4	FSR: 1 years: +0 %: 15 mins: Winter	1.92	128.0	59.393
CATCHMENT_G2	FSR: 1 years: +0 %: 15 mins: Winter	1.24	107.0	49.622
CATCHMENT_G1	FSR: 1 years: +0 %: 15 mins: Winter	1.52	132.0	61.236
CATCHMENT_G3	FSR: 1 years: +0 %: 15 mins: Winter	0.70	60.4	28.034
CATCHMENT_F9	FSR: 1 years: +0 %: 15 mins: Winter	0.17	14.5	6.736
CATCHMENT_F8	FSR: 1 years: +0 %: 15 mins: Winter	0.33	28.6	13.266

CATCHMENT_F6	FSR: 1 years: +0 %: 15 mins: Winter	0.27	23.4	10.854
CATCHMENT_F3	FSR: 1 years: +0 %: 15 mins: Winter	0.45	39.3	18.245
CATCHMENT_F1	FSR: 1 years: +0 %: 15 mins: Winter	0.34	29.3	13.577
CATCHMENT_F10	FSR: 1 years: +0 %: 15 mins: Winter	0.48	41.6	19.323
CATCHMENT_F11	FSR: 1 years: +0 %: 15 mins: Winter	0.22	18.7	8.654
CATCHMENT_F2	FSR: 1 years: +0 %: 15 mins: Winter	0.29	25.0	11.596
CATCHMENT_F4	FSR: 1 years: +0 %: 15 mins: Winter	0.42	36.1	16.761
CATCHMENT_F5	FSR: 1 years: +0 %: 15 mins: Winter	0.32	27.4	12.727
CATCHMENT_F7	FSR: 1 years: +0 %: 15 mins: Winter	0.27	22.9	10.641
H_ROAD_1	FSR: 1 years: +0 %: 15 mins: Winter	0.35	46.9	21.774
H_ROAD_3	FSR: 1 years: +0 %: 15 mins: Winter	0.31	40.7	18.892

5018551 : Main Road SW Infodrainage Calcs P02	Date: 01/12/2023			RIDGE
	Designed by: BT	Checked by:	Approved By:	
Report Details: Type: Inflows Summary Storm Phase: Phase	Ridge:			

FSR: 30 years: Increase Rainfall (%): +0: Critical Storm Per Item: Rank By: Max. Inflow

Inflow	Storm Event	Inflow Area (ha)	Max. Inflow (L/s)	Total Inflow Volume (m³)
F_ROAD_1	FSR: 30 years: +0 %: 15 mins: Winter	0.23	76.6	35.521
F_ROAD_2	FSR: 30 years: +0 %: 15 mins: Winter	0.34	111.7	51.781
F_ROAD_3	FSR: 30 years: +0 %: 15 mins: Winter	0.16	52.6	24.381
F_ROAD_4	FSR: 30 years: +0 %: 15 mins: Winter	0.10	31.5	14.624
G_ROAD_2	FSR: 30 years: +0 %: 15 mins: Winter	0.24	77.4	35.877
G_ROAD_1	FSR: 30 years: +0 %: 15 mins: Winter	0.26	85.0	39.421
H_ROAD_2	FSR: 30 years: +0 %: 15 mins: Winter	0.28	92.9	43.049
CATCHMENT_H4	FSR: 30 years: +0 %: 15 mins: Winter	1.02	217.7	100.940
CATCHMENT_H3	FSR: 30 years: +0 %: 15 mins: Winter	1.46	311.0	144.166
CATCHMENT_H2	FSR: 30 years: +0 %: 15 mins: Winter	2.42	513.5	238.073
CATCHMENT_H5	FSR: 30 years: +0 %: 15 mins: Winter	1.74	369.6	171.350
CATCHMENT_H6	FSR: 30 years: +0 %: 15 mins: Winter	1.19	253.0	117.311
CATCHMENT_H1	FSR: 30 years: +0 %: 15 mins: Winter	1.54	151.1	70.048
CATCHMENT_G5	FSR: 30 years: +0 %: 15 mins: Winter	1.09	178.2	82.626
CATCHMENT_G4	FSR: 30 years: +0 %: 15 mins: Winter	1.92	314.3	145.730

CATCHMENT_G2	FSR: 30 years: +0 %: 15 mins: Winter	1.24	262.6	121.756
CATCHMENT_G1	FSR: 30 years: +0 %: 15 mins: Winter	1.52	324.1	150.259
CATCHMENT_G3	FSR: 30 years: +0 %: 15 mins: Winter	0.70	148.4	68.792
CATCHMENT_F9	FSR: 30 years: +0 %: 15 mins: Winter	0.17	35.6	16.523
CATCHMENT_F8	FSR: 30 years: +0 %: 15 mins: Winter	0.33	70.2	32.552
CATCHMENT_F6	FSR: 30 years: +0 %: 15 mins: Winter	0.27	57.4	26.630
CATCHMENT_F3	FSR: 30 years: +0 %: 15 mins: Winter	0.45	96.6	44.765
CATCHMENT_F1	FSR: 30 years: +0 %: 15 mins: Winter	0.34	71.9	33.313
CATCHMENT_F10	FSR: 30 years: +0 %: 15 mins: Winter	0.48	102.3	47.416
CATCHMENT_F11	FSR: 30 years: +0 %: 15 mins: Winter	0.22	45.8	21.241
CATCHMENT_F2	FSR: 30 years: +0 %: 15 mins: Winter	0.29	61.4	28.455
CATCHMENT_F4	FSR: 30 years: +0 %: 15 mins: Winter	0.42	88.7	41.135
CATCHMENT_F5	FSR: 30 years: +0 %: 15 mins: Winter	0.32	67.4	31.228
CATCHMENT_F7	FSR: 30 years: +0 %: 15 mins: Winter	0.27	56.3	26.118
H_ROAD_1	FSR: 30 years: +0 %: 15 mins: Winter	0.35	115.2	53.428
H_ROAD_3	FSR: 30 years: +0 %: 15 mins: Winter	0.31	100.0	46.353

FSR: 100 years: Increase Rainfall (%): +0: Critical Storm Per Item: Rank By: Max. Inflow

Inflow	Storm Event	Inflow Area (ha)	Max. Inflow (L/s)	Total Inflow Volume (m³)
F_ROAD_1	FSR: 100 years: +0 %: 15 mins: Winter	0.23	99.3	46.027
F_ROAD_2	FSR: 100 years: +0 %: 15 mins: Winter	0.34	144.8	67.098
F_ROAD_3	FSR: 100 years: +0 %: 15 mins: Winter	0.16	68.2	31.591
F_ROAD_4	FSR: 100 years: +0 %: 15 mins: Winter	0.10	40.9	18.954
G_ROAD_2	FSR: 100 years: +0 %: 15 mins: Winter	0.24	100.3	46.485
G_ROAD_1	FSR: 100 years: +0 %: 15 mins: Winter	0.26	110.2	51.078
H_ROAD_2	FSR: 100 years: +0 %: 15 mins: Winter	0.28	120.3	55.782
CATCHMENT_H4	FSR: 100 years: +0 %: 15 mins: Winter	1.02	282.2	130.793
CATCHMENT_H3	FSR: 100 years: +0 %: 15 mins: Winter	1.46	403.0	186.809
CATCHMENT_H2	FSR: 100 years: +0 %: 15 mins: Winter	2.42	665.5	308.493
CATCHMENT_H5	FSR: 100 years: +0 %: 15 mins: Winter	1.74	479.0	222.031
CATCHMENT_H6	FSR: 100 years: +0 %: 15 mins: Winter	1.19	328.0	152.015
CATCHMENT_H1	FSR: 100 years: +0 %: 15 mins: Winter	1.54	195.8	90.765
CATCHMENT_G5	FSR: 100 years: +0 %: 15 mins: Winter	1.09	231.0	107.064
CATCHMENT_G4	FSR: 100 years: +0 %: 15 mins: Winter	1.92	407.4	188.834

CATCHMENT_G2	FSR: 100 years: +0 %: 15 mins: Winter	1.24	340.4	157.773
CATCHMENT_G1	FSR: 100 years: +0 %: 15 mins: Winter	1.52	420.1	194.703
CATCHMENT_G3	FSR: 100 years: +0 %: 15 mins: Winter	0.70	192.3	89.135
CATCHMENT_F9	FSR: 100 years: +0 %: 15 mins: Winter	0.17	46.2	21.413
CATCHMENT_F8	FSR: 100 years: +0 %: 15 mins: Winter	0.33	91.0	42.173
CATCHMENT_F6	FSR: 100 years: +0 %: 15 mins: Winter	0.27	74.4	34.500
CATCHMENT_F3	FSR: 100 years: +0 %: 15 mins: Winter	0.45	125.1	58.005
CATCHMENT_F1	FSR: 100 years: +0 %: 15 mins: Winter	0.34	93.1	43.165
CATCHMENT_F10	FSR: 100 years: +0 %: 15 mins: Winter	0.48	132.6	61.445
CATCHMENT_F11	FSR: 100 years: +0 %: 15 mins: Winter	0.22	59.4	27.525
CATCHMENT_F2	FSR: 100 years: +0 %: 15 mins: Winter	0.29	79.6	36.876
CATCHMENT_F4	FSR: 100 years: +0 %: 15 mins: Winter	0.42	115.0	53.301
CATCHMENT_F5	FSR: 100 years: +0 %: 15 mins: Winter	0.32	87.3	40.469
CATCHMENT_F7	FSR: 100 years: +0 %: 15 mins: Winter	0.27	73.0	33.844
H_ROAD_1	FSR: 100 years: +0 %: 15 mins: Winter	0.35	149.4	69.235
H_ROAD_3	FSR: 100 years: +0 %: 15 mins: Winter	0.31	129.6	60.060

5018551 : Main Road SW Infodrainage Calcs P02	Date: 01/12/2023			RIDGE
	Designed by: BT	Checked by:	Approved By:	
Report Details: Type: Inflows Summary Storm Phase: Phase	Ridge:			

FSR: 100 years: Increase Rainfall (%): +45: Critical Storm Per Item: Rank By: Max. Inflow

Inflow	Storm Event	Inflow Area (ha)	Max. Inflow (L/s)	Total Inflow Volume (m^3)
F_ROAD_1	FSR: 100 years: +45 %: 15 mins: Winter	0.23	144.6	66.735
F_ROAD_2	FSR: 100 years: +45 %: 15 mins: Winter	0.34	210.8	97.282
F_ROAD_3	FSR: 100 years: +45 %: 15 mins: Winter	0.16	99.2	45.812
F_ROAD_4	FSR: 100 years: +45 %: 15 mins: Winter	0.10	59.5	27.479
G_ROAD_2	FSR: 100 years: +45 %: 15 mins: Winter	0.24	146.0	67.404
G_ROAD_1	FSR: 100 years: +45 %: 15 mins: Winter	0.26	160.4	74.061
H_ROAD_2	FSR: 100 years: +45 %: 15 mins: Winter	0.28	175.2	80.879
CATCHMENT_H4	FSR: 100 years: +45 %: 15 mins: Winter	1.02	410.8	189.643
CATCHMENT_H3	FSR: 100 years: +45 %: 15 mins: Winter	1.46	586.8	270.858
CATCHMENT_H2	FSR: 100 years: +45 %: 15 mins: Winter	2.42	969.0	447.297
CATCHMENT_H5	FSR: 100 years: +45 %: 15 mins: Winter	1.74	697.4	321.930
CATCHMENT_H6	FSR: 100 years: +45 %: 15 mins: Winter	1.19	477.5	220.405
CATCHMENT_H1	FSR: 100 years: +45 %: 15 mins: Winter	1.54	285.1	131.604
CATCHMENT_G5	FSR: 100 years: +45 %: 15 mins: Winter	1.09	336.3	155.234
CATCHMENT_G4	FSR: 100 years: +45 %: 15 mins: Winter	1.92	593.1	273.803

CATCHMENT_G2	FSR: 100 years: +45 %: 15 mins: Winter	1.24	495.6	228.758
CATCHMENT_G1	FSR: 100 years: +45 %: 15 mins: Winter	1.52	611.6	282.308
CATCHMENT_G3	FSR: 100 years: +45 %: 15 mins: Winter	0.70	280.0	129.244
CATCHMENT_F9	FSR: 100 years: +45 %: 15 mins: Winter	0.17	67.3	31.044
CATCHMENT_F8	FSR: 100 years: +45 %: 15 mins: Winter	0.33	132.5	61.154
CATCHMENT_F6	FSR: 100 years: +45 %: 15 mins: Winter	0.27	108.4	50.027
CATCHMENT_F3	FSR: 100 years: +45 %: 15 mins: Winter	0.45	182.2	84.106
CATCHMENT_F1	FSR: 100 years: +45 %: 15 mins: Winter	0.34	135.6	62.592
CATCHMENT_F10	FSR: 100 years: +45 %: 15 mins: Winter	0.48	193.0	89.082
CATCHMENT_F11	FSR: 100 years: +45 %: 15 mins: Winter	0.22	86.5	39.909
CATCHMENT_F2	FSR: 100 years: +45 %: 15 mins: Winter	0.29	115.8	53.466
CATCHMENT_F4	FSR: 100 years: +45 %: 15 mins: Winter	0.42	167.4	77.281
CATCHMENT_F5	FSR: 100 years: +45 %: 15 mins: Winter	0.32	127.1	58.673
CATCHMENT_F7	FSR: 100 years: +45 %: 15 mins: Winter	0.27	106.3	49.068
H_ROAD_1	FSR: 100 years: +45 %: 15 mins: Winter	0.35	217.5	100.380
H_ROAD_3	FSR: 100 years: +45 %: 15 mins: Winter	0.31	188.7	87.087

5018551 : Main Road SW Infodrainage Calcs P02	Date: 01/12/2023			RIDGE
	Designed by: BT	Checked by:	Approved By:	
Report Details: Type: Junctions Summary Storm Phase: Phase	Ridge:			

FSR: 1 years: Increase Rainfall (%): +0: Critical Storm Per Item: Rank By: Max. Depth

Junction	Storm Event	Cover Level (m)	Invert Level (m)	Max. Level (m)	Max. Depth (m)	Max. Inflow (L/s)	Max. Resident Volume (m³)	Max. Flooded Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Status
MH_CF14	FSR: 1 years: +0 %: 15 mins: Winter	22.810	20.096	20.202	0.106	29.3	0.119	0.000	27.9	13.613	OK
MH_CF16	FSR: 1 years: +0 %: 15 mins: Winter	21.570	19.557	19.673	0.116	77.8	0.131	0.000	76.4	39.553	OK
MH_CF18	FSR: 1 years: +0 %: 15 mins: Winter	20.810	18.707	18.863	0.156	118.0	0.176	0.000	115.2	58.910	OK
MH_CF17	FSR: 1 years: +0 %: 15 mins: Winter	21.930	20.000	20.101	0.101	31.2	0.114	0.000	29.3	14.472	OK
MH_CF15	FSR: 1 years: +0 %: 15 mins: Winter	21.720	19.756	19.876	0.120	27.9	0.136	0.000	23.4	13.505	OK
MH_CF12	FSR: 1 years: +0 %: 15 mins: Winter	22.440	19.979	20.235	0.256	134.8	0.888	0.000	129.4	68.668	OK
MH_CF11	FSR: 1 years: +0 %: 15 mins: Winter	22.920	20.349	20.571	0.222	107.6	0.251	0.000	95.4	50.489	OK
MH_CF9	FSR: 1 years: +0 %: 15 mins: Winter	23.510	20.118	20.268	0.150	107.4	0.169	0.000	102.4	59.421	OK
MH_CF8	FSR: 1 years: +0 %: 15 mins: Winter	23.930	20.401	20.590	0.189	113.6	0.213	0.000	107.4	59.529	OK
MH_CF4	FSR: 1 years: +0 %: 15 mins: Winter	24.630	21.257	21.425	0.168	60.1	0.190	0.000	58.5	29.686	OK
MH_CF3	FSR: 1 years: +0 %: 15 mins: Winter	25.120	22.567	22.655	0.088	41.6	0.099	0.000	38.7	19.778	OK
MH_CF7	FSR: 1 years: +0 %: 15 mins: Winter	24.210	20.702	20.856	0.154	94.3	0.175	0.000	90.2	48.751	OK
MH_CF10	FSR: 1 years: +0 %: 15 mins: Winter	23.360	20.557	20.659	0.102	27.4	0.181	0.000	26.0	12.737	OK
MH_CG22	FSR: 1 years: +0 %: 15 mins: Winter	27.290	24.035	24.112	0.077	34.8	0.197	0.000	33.9	27.705	OK
MH_CG24	FSR: 1 years: +0 %: 30 mins: Winter	26.870	23.372	23.492	0.120	31.9	0.136	0.000	31.4	49.129	OK
MH_CG28	FSR: 1 years: +0 %: 30 mins: Winter	26.050	22.472	22.602	0.130	55.1	0.147	0.000	54.8	105.354	OK
MH_CG34	FSR: 1 years: +0 %: 15 mins: Winter	25.470	21.313	21.597	0.284	236.6	0.321	0.000	220.3	156.318	OK
MH_CG35	FSR: 1 years: +0 %: 15 mins: Winter	24.930	20.956	21.206	0.250	220.3	0.283	0.000	210.5	154.918	OK
MH_CG36	FSR: 1 years: +0 %: 15 mins: Winter	27.460	24.560	24.759	0.199	108.5	0.506	0.000	103.2	50.386	OK
MH_CG37	FSR: 1 years: +0 %: 15 mins: Winter	27.180	24.000	24.157	0.157	103.2	0.177	0.000	95.8	50.251	OK
MH_CG39	FSR: 1 years: +0 %: 15 mins: Winter	26.400	23.000	23.200	0.200	88.1	0.226	0.000	85.1	50.100	OK
MH_CG41	FSR: 1 years: +0 %: 15 mins: Winter	25.920	22.781	22.909	0.128	81.9	0.145	0.000	78.0	50.020	OK
MH_CH38	FSR: 1 years: +0 %: 15 mins: Winter	25.300	23.196	23.270	0.074	36.2	0.083	0.000	33.7	31.149	OK
MH_CH42	FSR: 1 years: +0 %: 15 mins: Winter	22.770	19.971	20.079	0.108	40.7	0.122	0.000	38.5	20.952	OK
MH_CH43	FSR: 1 years: +0 %: 15 mins: Summer	21.770	20.148	20.148	0.000	0.0	0.000	0.000	0.0	0.000	OK
MH_CH40	FSR: 1 years: +0 %: 15 mins: Winter	24.580	19.433	19.666	0.233	194.7	0.593	0.000	183.6	109.270	OK
MH_CH47	FSR: 1 years: +0 %: 15 mins: Winter	22.990	18.921	19.123	0.202	176.6	0.229	0.000	162.8	116.184	OK
OUTFALL_H	FSR: 1 years: +0 %: 960 mins: Winter	17.862	16.662	16.873	0.211	37.7	0.239	0.000	37.7	1494.465	OK
OUTFALL_F	FSR: 1 years: +0 %: 960 mins: Winter	17.770	16.570	16.688	0.118	10.0	0.133	0.000	10.0	567.986	OK
OUTFALL_G	FSR: 1 years: +0 %: 960 mins: Winter	20.563	19.363	19.563	0.201	27.9	0.227	0.000	27.9	1024.745	OK

MH_CH50	FSR: 1 years: +0 %: 30 mins: Winter	20.830	18.036	18.287	0.251	290.7	0.283	0.000	290.4	318.143	OK
MH_CH36	FSR: 1 years: +0 %: 240 mins: Winter	25.710	23.750	24.213	0.463	19.5	0.524	0.000	16.0	243.442	OK
MH_CH37	FSR: 1 years: +0 %: 15 mins: Winter	25.770	23.681	23.779	0.098	38.2	0.249	0.000	36.2	31.829	OK
MH_CH41	FSR: 1 years: +0 %: 240 mins: Winter	22.610	20.188	20.417	0.229	7.1	0.259	0.000	6.6	90.232	OK
MH_CH31	FSR: 1 years: +0 %: 240 mins: Winter	22.430	19.470	19.727	0.257	9.2	0.290	0.000	9.1	176.067	OK
MH_CG19	FSR: 1 years: +0 %: 60 mins: Winter	27.580	25.054	25.465	0.411	17.0	0.465	0.000	11.8	49.982	OK
MH_CG20	FSR: 1 years: +0 %: 60 mins: Winter	27.430	24.600	24.660	0.060	11.8	0.068	0.000	11.8	49.778	OK
MH_CG29	FSR: 1 years: +0 %: 60 mins: Winter	25.619	23.119	24.438	1.319	23.7	1.491	0.000	25.3	90.723	Surcharged
MH_CF2	FSR: 1 years: +0 %: 15 mins: Winter	26.210	23.453	23.496	0.043	13.2	0.049	0.000	13.0	6.591	OK
MH_CF1	FSR: 1 years: +0 %: 360 mins: Winter	26.150	23.545	24.141	0.596	1.3	0.674	0.000	0.6	20.216	Surcharged
MH_CG32	FSR: 1 years: +0 %: 30 mins: Winter	25.970	21.530	21.710	0.180	94.4	0.886	0.000	92.1	153.197	OK
MH_CF13	FSR: 1 years: +0 %: 1440 mins: Winter	21.720	19.536	19.910	0.374	4.3	0.423	0.000	4.3	621.306	OK
MH_CH45	FSR: 1 years: +0 %: 15 mins: Winter	23.770	19.702	19.801	0.099	38.5	0.175	0.000	35.6	20.641	OK
MH_CG30	FSR: 1 years: +0 %: 30 mins: Winter	25.990	22.289	22.439	0.150	54.8	0.382	0.000	53.4	104.412	OK
MH_CG27	FSR: 1 years: +0 %: 30 mins: Winter	26.160	22.860	22.942	0.082	30.4	0.093	0.000	29.8	48.299	OK
MH_CG26	FSR: 1 years: +0 %: 30 mins: Winter	26.440	23.113	23.213	0.100	31.0	0.113	0.000	30.4	48.583	OK
MH_CH49	FSR: 1 years: +0 %: 15 mins: Winter	21.512	18.227	18.530	0.303	305.4	0.343	0.000	287.8	211.133	OK
MH_CH46	FSR: 1 years: +0 %: 15 mins: Winter	23.070	19.105	19.334	0.229	183.6	0.259	0.000	173.1	108.354	OK
MH_CH48	FSR: 1 years: +0 %: 15 mins: Winter	22.650	18.478	18.797	0.319	335.3	1.106	0.000	305.4	212.234	OK
MH_CG42	FSR: 1 years: +0 %: 30 mins: Winter	24.230	21.624	21.741	0.117	72.7	0.132	0.000	72.7	66.864	OK
MH_CG31	FSR: 1 years: +0 %: 15 mins: Winter	26.080	22.163	22.311	0.148	50.7	0.168	0.000	53.0	50.129	OK
MH_CG33	FSR: 1 years: +0 %: 240 mins: Winter	25.840	24.218	24.472	0.254	6.2	0.287	0.000	6.2	117.922	OK
MH_CF6	FSR: 1 years: +0 %: 15 mins: Winter	24.310	21.089	21.194	0.105	55.3	0.119	0.000	52.7	29.491	OK
MH_CF5	FSR: 1 years: +0 %: 15 mins: Winter	24.480	21.189	21.343	0.154	58.5	0.174	0.000	55.3	29.596	OK
MH_CG25	FSR: 1 years: +0 %: 30 mins: Winter	26.640	23.298	23.393	0.095	31.4	0.107	0.000	31.0	48.898	OK
MH_CG23	FSR: 1 years: +0 %: 15 mins: Winter	27.110	23.499	23.617	0.118	33.9	0.134	0.000	32.2	27.293	OK
MH_CG21	FSR: 1 years: +0 %: 60 mins: Winter	27.390	24.424	24.474	0.050	11.8	0.056	0.000	11.8	49.696	OK
MH_CG40	FSR: 1 years: +0 %: 15 mins: Winter	26.260	22.900	23.090	0.190	85.1	0.215	0.000	81.9	50.049	OK
MH_CG38	FSR: 1 years: +0 %: 15 mins: Winter	26.510	23.110	23.313	0.203	95.8	0.230	0.000	88.1	50.139	OK
MH_CH39	FSR: 1 years: +0 %: 15 mins: Winter	24.970	21.285	21.358	0.073	33.7	0.082	0.000	32.5	30.827	OK
MH_CH44	FSR: 1 years: +0 %: 15 mins: Summer	22.240	20.115	20.115	0.000	0.0	0.000	0.000	0.0	0.000	OK

5018551 : Main Road SW Infodrainage Calcs P02	Date: 01/12/2023			RIDGE
	Designed by: BT	Checked by:	Approved By:	
Report Details: Type: Junctions Summary Storm Phase: Phase	Ridge:			

FSR: 30 years: Increase Rainfall (%): +0: Critical Storm Per Item: Rank By: Max. Depth

Junction	Storm Event	Cover Level (m)	Invert Level (m)	Max. Level (m)	Max. Depth (m)	Max. Inflow (L/s)	Max. Resident Volume (m³)	Max. Flooded Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Status
MH_CF14	FSR: 30 years: +0 %: 15 mins: Winter	22.810	20.096	20.274	0.178	71.9	0.201	0.000	69.1	33.360	OK
MH_CF16	FSR: 30 years: +0 %: 15 mins: Winter	21.570	19.557	19.757	0.200	194.6	0.226	0.000	191.8	97.157	OK
MH_CF18	FSR: 30 years: +0 %: 15 mins: Winter	20.810	18.707	18.970	0.263	294.0	0.297	0.000	288.2	144.648	OK
MH_CF17	FSR: 30 years: +0 %: 15 mins: Winter	21.930	20.000	20.167	0.167	76.6	0.189	0.000	72.9	35.509	OK
MH_CF15	FSR: 30 years: +0 %: 15 mins: Winter	21.720	19.756	19.961	0.205	69.1	0.232	0.000	60.3	33.217	OK
MH_CF12	FSR: 30 years: +0 %: 15 mins: Winter	22.440	19.979	20.413	0.434	324.7	1.502	0.000	316.2	168.669	OK
MH_CF11	FSR: 30 years: +0 %: 15 mins: Winter	22.920	20.349	20.776	0.427	255.1	0.483	0.000	228.2	123.989	OK
MH_CF9	FSR: 30 years: +0 %: 15 mins: Winter	23.510	20.118	20.376	0.258	272.8	0.291	0.000	262.9	145.644	OK
MH_CF8	FSR: 30 years: +0 %: 15 mins: Winter	23.930	20.401	20.722	0.320	285.0	0.362	0.000	272.8	145.792	OK
MH_CF4	FSR: 30 years: +0 %: 15 mins: Winter	24.630	21.257	21.535	0.278	148.9	0.315	0.000	145.9	72.183	OK
MH_CF3	FSR: 30 years: +0 %: 15 mins: Winter	25.120	22.567	22.709	0.142	101.8	0.161	0.000	96.3	47.832	OK
MH_CF7	FSR: 30 years: +0 %: 15 mins: Winter	24.210	20.702	20.974	0.272	236.4	0.308	0.000	227.5	119.252	OK
MH_CF10	FSR: 30 years: +0 %: 15 mins: Winter	23.360	20.557	20.802	0.245	67.4	0.433	0.000	54.7	31.237	OK
MH_CG22	FSR: 30 years: +0 %: 15 mins: Winter	27.290	24.035	24.168	0.133	93.0	0.340	0.000	90.3	54.018	OK
MH_CG24	FSR: 30 years: +0 %: 15 mins: Winter	26.870	23.372	23.574	0.202	85.4	0.228	0.000	81.0	53.140	OK
MH_CG28	FSR: 30 years: +0 %: 15 mins: Winter	26.050	22.472	22.648	0.176	94.9	0.199	0.000	91.3	82.378	OK
MH_CG34	FSR: 30 years: +0 %: 15 mins: Winter	25.470	21.313	21.866	0.553	599.7	0.625	0.000	561.7	337.923	OK
MH_CG35	FSR: 30 years: +0 %: 15 mins: Winter	24.930	20.956	21.378	0.422	561.7	0.477	0.000	545.6	336.683	OK
MH_CG36	FSR: 30 years: +0 %: 15 mins: Winter	27.460	24.560	24.921	0.361	266.3	0.919	0.000	253.8	123.542	OK
MH_CG37	FSR: 30 years: +0 %: 15 mins: Winter	27.180	24.000	24.278	0.278	253.8	0.315	0.000	236.9	123.266	OK
MH_CG39	FSR: 30 years: +0 %: 15 mins: Winter	26.400	23.000	23.372	0.372	219.9	0.420	0.000	213.9	123.177	OK
MH_CG41	FSR: 30 years: +0 %: 15 mins: Winter	25.920	22.781	22.999	0.217	208.2	0.246	0.000	201.0	123.090	OK
MH_CH38	FSR: 30 years: +0 %: 15 mins: Winter	25.300	23.196	23.318	0.122	96.4	0.138	0.000	89.8	61.409	OK
MH_CH42	FSR: 30 years: +0 %: 15 mins: Winter	22.770	19.971	20.145	0.174	100.6	0.196	0.000	94.1	53.539	OK
MH_CH43	FSR: 30 years: +0 %: 15 mins: Winter	21.770	20.148	20.148	0.000	0.0	0.001	0.000	0.0	0.000	OK
MH_CH40	FSR: 30 years: +0 %: 15 mins: Winter	24.580	19.433	19.833	0.400	476.5	1.017	0.000	453.7	256.894	OK
MH_CH47	FSR: 30 years: +0 %: 15 mins: Winter	22.990	18.921	19.270	0.349	444.1	0.395	0.000	419.7	266.312	OK
OUTFALL_H	FSR: 30 years: +0 %: 960 mins: Winter	17.862	16.662	16.984	0.322	67.1	0.364	0.000	67.1	3246.703	OK
OUTFALL_F	FSR: 30 years: +0 %: 480 mins: Winter	17.770	16.570	16.759	0.189	20.7	0.214	0.000	20.7	532.707	OK
OUTFALL_G	FSR: 30 years: +0 %: 480 mins: Winter	20.563	19.363	19.779	0.416	41.5	0.471	0.000	41.4	1573.297	OK

MH_CH50	FSR: 30 years: +0 %: 15 mins: Winter	20.830	18.036	18.462	0.426	769.9	0.481	0.000	752.5	502.774	OK
MH_CH36	FSR: 30 years: +0 %: 240 mins: Winter	25.710	23.750	24.419	0.669	19.7	0.756	0.000	16.9	413.175	Surcharged
MH_CH37	FSR: 30 years: +0 %: 15 mins: Winter	25.770	23.681	23.843	0.162	101.7	0.411	0.000	96.4	62.217	OK
MH_CH41	FSR: 30 years: +0 %: 240 mins: Winter	22.610	20.188	20.524	0.336	7.9	0.380	0.000	7.3	169.003	OK
MH_CH31	FSR: 30 years: +0 %: 240 mins: Winter	22.430	19.470	19.944	0.474	10.5	0.536	0.000	10.5	257.193	Surcharged
MH_CG19	FSR: 30 years: +0 %: 120 mins: Winter	27.580	25.054	25.702	0.648	18.0	0.732	0.000	12.4	151.135	Surcharged
MH_CG20	FSR: 30 years: +0 %: 120 mins: Winter	27.430	24.600	24.661	0.061	12.4	0.069	0.000	12.4	150.450	OK
MH_CG29	FSR: 30 years: +0 %: 120 mins: Winter	25.619	23.119	24.666	1.547	31.6	1.750	0.000	25.3	277.762	Surcharged
MH_CF2	FSR: 30 years: +0 %: 15 mins: Winter	26.210	23.453	23.519	0.066	32.0	0.075	0.000	31.6	15.376	OK
MH_CF1	FSR: 30 years: +0 %: 360 mins: Winter	26.150	23.545	24.364	0.819	1.1	0.926	0.000	0.6	24.280	Surcharged
MH_CG32	FSR: 30 years: +0 %: 15 mins: Winter	25.970	21.530	21.911	0.381	227.0	1.870	0.000	198.2	153.630	OK
MH_CF13	FSR: 30 years: +0 %: 1440 mins: Winter	21.720	19.536	20.234	0.698	31.6	0.790	0.000	4.3	693.583	Surcharged
MH_CH45	FSR: 30 years: +0 %: 15 mins: Winter	23.770	19.702	19.873	0.171	94.1	0.302	0.000	78.8	52.778	OK
MH_CG30	FSR: 30 years: +0 %: 30 mins: Winter	25.990	22.289	22.490	0.201	91.4	0.511	0.000	91.4	147.292	OK
MH_CG27	FSR: 30 years: +0 %: 15 mins: Winter	26.160	22.860	22.993	0.132	74.4	0.150	0.000	71.1	52.181	OK
MH_CG26	FSR: 30 years: +0 %: 15 mins: Winter	26.440	23.113	23.275	0.162	78.1	0.184	0.000	74.4	52.515	OK
MH_CH49	FSR: 30 years: +0 %: 15 mins: Winter	21.512	18.227	18.775	0.549	798.6	0.621	0.000	769.9	503.307	OK
MH_CH46	FSR: 30 years: +0 %: 15 mins: Winter	23.070	19.105	19.498	0.393	453.7	0.444	0.000	435.6	255.754	OK
MH_CH48	FSR: 30 years: +0 %: 15 mins: Winter	22.650	18.478	19.088	0.610	858.7	2.115	0.000	798.6	504.616	OK
MH_CG42	FSR: 30 years: +0 %: 15 mins: Winter	24.230	21.624	21.824	0.200	201.0	0.227	0.000	186.0	122.870	OK
MH_CG31	FSR: 30 years: +0 %: 30 mins: Winter	26.080	22.163	22.363	0.200	91.4	0.226	0.000	91.5	144.859	OK
MH_CG33	FSR: 30 years: +0 %: 240 mins: Winter	25.840	24.218	24.660	0.442	7.0	0.500	0.000	7.0	170.061	Surcharged
MH_CF6	FSR: 30 years: +0 %: 15 mins: Winter	24.310	21.089	21.271	0.182	140.0	0.206	0.000	134.2	71.932	OK
MH_CF5	FSR: 30 years: +0 %: 15 mins: Winter	24.480	21.189	21.438	0.249	145.9	0.282	0.000	140.0	72.069	OK
MH_CG25	FSR: 30 years: +0 %: 15 mins: Winter	26.640	23.298	23.459	0.161	81.0	0.182	0.000	78.1	52.873	OK
MH_CG23	FSR: 30 years: +0 %: 15 mins: Winter	27.110	23.499	23.706	0.207	90.3	0.235	0.000	85.4	53.585	OK
MH_CG21	FSR: 30 years: +0 %: 60 mins: Winter	27.390	24.424	24.475	0.051	12.4	0.058	0.000	12.4	73.197	OK
MH_CG40	FSR: 30 years: +0 %: 15 mins: Winter	26.260	22.900	23.228	0.328	213.9	0.371	0.000	208.2	123.098	OK
MH_CG38	FSR: 30 years: +0 %: 15 mins: Winter	26.510	23.110	23.505	0.395	236.9	0.446	0.000	219.9	123.216	OK
MH_CH39	FSR: 30 years: +0 %: 15 mins: Winter	24.970	21.285	21.406	0.121	89.8	0.137	0.000	86.7	61.071	OK
MH_CH44	FSR: 30 years: +0 %: 15 mins: Winter	22.240	20.115	20.145	0.029	1.4	0.033	0.000	0.0	0.161	OK

5018551 : Main Road SW Infodrainage Calcs P02	Date: 01/12/2023			RIDGE
	Designed by: BT	Checked by:	Approved By:	
Report Details: Type: Junctions Summary Storm Phase: Phase	Ridge:			

FSR: 100 years: Increase Rainfall (%): +0: Critical Storm Per Item: Rank By: Max. Depth

Junction	Storm Event	Cover Level (m)	Invert Level (m)	Max. Level (m)	Max. Depth (m)	Max. Inflow (L/s)	Max. Resident Volume (m³)	Max. Flooded Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Status
MH_CF14	FSR: 100 years: +0 %: 15 mins: Winter	22.810	20.096	20.305	0.209	93.1	0.237	0.000	89.9	43.213	OK
MH_CF16	FSR: 100 years: +0 %: 15 mins: Winter	21.570	19.557	19.795	0.238	253.3	0.269	0.000	249.7	125.926	OK
MH_CF18	FSR: 100 years: +0 %: 15 mins: Winter	20.810	18.707	19.019	0.312	382.3	0.353	0.000	374.6	187.469	OK
MH_CF17	FSR: 100 years: +0 %: 15 mins: Winter	21.930	20.000	20.196	0.196	99.3	0.222	0.000	94.6	46.014	OK
MH_CF15	FSR: 100 years: +0 %: 15 mins: Winter	21.720	19.756	19.999	0.243	89.9	0.275	0.000	79.1	43.062	OK
MH_CF12	FSR: 100 years: +0 %: 15 mins: Winter	22.440	19.979	20.502	0.523	435.0	1.811	0.000	413.4	218.642	OK
MH_CF11	FSR: 100 years: +0 %: 15 mins: Winter	22.920	20.349	21.111	0.762	333.4	0.862	0.000	309.9	160.702	Surcharged
MH_CF9	FSR: 100 years: +0 %: 15 mins: Winter	23.510	20.118	20.421	0.303	354.2	0.343	0.000	343.0	188.602	OK
MH_CF8	FSR: 100 years: +0 %: 15 mins: Winter	23.930	20.401	20.779	0.378	368.3	0.427	0.000	354.2	188.790	OK
MH_CF4	FSR: 100 years: +0 %: 15 mins: Winter	24.630	21.257	21.580	0.323	196.9	0.366	0.000	187.9	93.328	OK
MH_CF3	FSR: 100 years: +0 %: 15 mins: Winter	25.120	22.567	22.732	0.165	131.9	0.186	0.000	128.7	61.751	OK
MH_CF7	FSR: 100 years: +0 %: 15 mins: Winter	24.210	20.702	21.027	0.325	305.0	0.367	0.000	293.8	154.385	OK
MH_CF10	FSR: 100 years: +0 %: 15 mins: Winter	23.360	20.557	21.167	0.610	87.3	1.077	0.000	73.7	40.533	Surcharged
MH_CG22	FSR: 100 years: +0 %: 15 mins: Winter	27.290	24.035	24.192	0.157	121.0	0.400	0.000	118.1	66.360	OK
MH_CG24	FSR: 100 years: +0 %: 15 mins: Winter	26.870	23.372	23.611	0.239	113.1	0.270	0.000	108.5	65.467	OK
MH_CG28	FSR: 100 years: +0 %: 15 mins: Winter	26.050	22.472	22.674	0.202	119.0	0.229	0.000	115.7	94.475	OK
MH_CG34	FSR: 100 years: +0 %: 15 mins: Winter	25.470	21.313	22.245	0.932	718.3	1.054	0.000	706.5	426.288	Surcharged
MH_CG35	FSR: 100 years: +0 %: 15 mins: Winter	24.930	20.956	21.453	0.497	706.5	0.562	0.000	689.9	425.155	OK
MH_CG36	FSR: 100 years: +0 %: 15 mins: Winter	27.460	24.560	25.120	0.560	345.2	1.426	0.000	317.1	159.683	Surcharged
MH_CG37	FSR: 100 years: +0 %: 15 mins: Winter	27.180	24.000	24.316	0.316	317.1	0.357	0.000	299.5	159.651	OK
MH_CG39	FSR: 100 years: +0 %: 15 mins: Winter	26.400	23.000	23.538	0.538	291.5	0.608	0.000	288.4	159.763	Surcharged
MH_CG41	FSR: 100 years: +0 %: 15 mins: Winter	25.920	22.781	23.044	0.263	281.6	0.297	0.000	267.0	159.689	OK
MH_CH38	FSR: 100 years: +0 %: 15 mins: Winter	25.300	23.196	23.339	0.143	128.7	0.162	0.000	121.1	75.088	OK
MH_CH42	FSR: 100 years: +0 %: 15 mins: Winter	22.770	19.971	20.175	0.204	131.1	0.230	0.000	121.2	68.184	OK
MH_CH43	FSR: 100 years: +0 %: 15 mins: Winter	21.770	20.148	20.158	0.010	0.9	0.012	0.000	0.0	0.087	OK
MH_CH40	FSR: 100 years: +0 %: 15 mins: Winter	24.580	19.433	19.912	0.478	617.9	1.218	0.000	586.4	327.477	OK
MH_CH47	FSR: 100 years: +0 %: 15 mins: Winter	22.990	18.921	19.349	0.428	562.1	0.484	0.000	467.5	337.980	OK
OUTFALL_H	FSR: 100 years: +0 %: 960 mins: Winter	17.862	16.662	17.052	0.390	69.7	0.442	0.000	69.7	4136.302	OK
OUTFALL_F	FSR: 100 years: +0 %: 360 mins: Winter	17.770	16.570	16.816	0.246	25.9	0.279	0.000	25.9	543.126	OK
OUTFALL_G	FSR: 100 years: +0 %: 240 mins: Winter	20.563	19.363	19.791	0.429	41.5	0.485	0.000	41.5	933.730	OK

MH_CH50	FSR: 100 years: +0 %: 15 mins: Winter	20.830	18.036	18.528	0.492	981.4	0.557	0.000	964.0	645.416	OK
MH_CH36	FSR: 100 years: +0 %: 240 mins: Winter	25.710	23.750	24.545	0.795	19.1	0.899	0.000	17.0	428.622	Surcharged
MH_CH37	FSR: 100 years: +0 %: 15 mins: Winter	25.770	23.681	23.869	0.188	133.7	0.478	0.000	128.7	75.946	OK
MH_CH41	FSR: 100 years: +0 %: 240 mins: Winter	22.610	20.188	20.588	0.400	7.7	0.453	0.000	7.6	179.145	OK
MH_CH31	FSR: 100 years: +0 %: 360 mins: Winter	22.430	19.470	20.075	0.605	10.7	0.684	0.000	10.7	404.361	Surcharged
MH_CG19	FSR: 100 years: +0 %: 120 mins: Winter	27.580	25.054	25.855	0.801	17.7	0.905	0.000	12.4	156.914	Surcharged
MH_CG20	FSR: 100 years: +0 %: 360 mins: Winter	27.430	24.600	24.661	0.061	12.5	0.069	0.000	12.5	297.895	OK
MH_CG29	FSR: 100 years: +0 %: 120 mins: Winter	25.619	23.119	24.811	1.692	31.1	1.914	0.000	25.3	271.520	Surcharged
MH_CF2	FSR: 100 years: +0 %: 15 mins: Winter	26.210	23.453	23.528	0.075	41.4	0.085	0.000	40.9	19.750	OK
MH_CF1	FSR: 100 years: +0 %: 480 mins: Winter	26.150	23.545	24.495	0.950	1.0	1.074	0.000	0.7	34.417	Surcharged
MH_CG32	FSR: 100 years: +0 %: 15 mins: Winter	25.970	21.530	22.319	0.789	304.1	3.875	0.000	198.0	187.052	Surcharged
MH_CF13	FSR: 100 years: +0 %: 1440 mins: Winter	21.720	19.536	20.415	0.879	33.9	0.994	0.000	4.3	619.935	Surcharged
MH_CH45	FSR: 100 years: +0 %: 15 mins: Winter	23.770	19.702	19.950	0.248	121.2	0.438	0.000	97.6	67.098	OK
MH_CG30	FSR: 100 years: +0 %: 15 mins: Winter	25.990	22.289	22.512	0.222	115.7	0.566	0.000	107.2	93.120	OK
MH_CG27	FSR: 100 years: +0 %: 15 mins: Winter	26.160	22.860	23.018	0.158	100.7	0.178	0.000	96.3	64.494	OK
MH_CG26	FSR: 100 years: +0 %: 15 mins: Winter	26.440	23.113	23.305	0.193	105.1	0.218	0.000	100.7	64.834	OK
MH_CH49	FSR: 100 years: +0 %: 15 mins: Winter	21.512	18.227	18.883	0.656	1002.8	0.742	0.000	981.4	645.888	OK
MH_CH46	FSR: 100 years: +0 %: 15 mins: Winter	23.070	19.105	19.571	0.466	586.4	0.527	0.000	553.2	326.316	OK
MH_CH48	FSR: 100 years: +0 %: 15 mins: Winter	22.650	18.478	19.282	0.804	1038.3	2.783	0.000	1002.8	647.183	Surcharged
MH_CG42	FSR: 100 years: +0 %: 15 mins: Winter	24.230	21.624	21.861	0.237	267.0	0.268	0.000	242.9	159.452	OK
MH_CG31	FSR: 100 years: +0 %: 30 mins: Winter	26.080	22.163	22.383	0.220	108.4	0.249	0.000	108.5	160.352	OK
MH_CG33	FSR: 100 years: +0 %: 360 mins: Winter	25.840	24.218	24.776	0.558	7.1	0.631	0.000	7.1	267.641	Surcharged
MH_CF6	FSR: 100 years: +0 %: 15 mins: Winter	24.310	21.089	21.303	0.214	179.5	0.242	0.000	172.6	93.054	OK
MH_CF5	FSR: 100 years: +0 %: 15 mins: Winter	24.480	21.189	21.476	0.287	187.9	0.325	0.000	179.5	93.204	OK
MH_CG25	FSR: 100 years: +0 %: 15 mins: Winter	26.640	23.298	23.491	0.193	108.5	0.218	0.000	105.1	65.194	OK
MH_CG23	FSR: 100 years: +0 %: 15 mins: Winter	27.110	23.499	23.746	0.247	118.1	0.279	0.000	113.1	65.920	OK
MH_CG21	FSR: 100 years: +0 %: 30 mins: Winter	27.390	24.424	24.475	0.051	12.5	0.058	0.000	12.5	35.287	OK
MH_CG40	FSR: 100 years: +0 %: 15 mins: Winter	26.260	22.900	23.318	0.418	288.4	0.472	0.000	281.6	159.692	OK
MH_CG38	FSR: 100 years: +0 %: 15 mins: Winter	26.510	23.110	23.743	0.633	299.5	0.716	0.000	291.5	159.795	Surcharged
MH_CH39	FSR: 100 years: +0 %: 15 mins: Winter	24.970	21.285	21.428	0.143	121.1	0.161	0.000	117.3	74.745	OK
MH_CH44	FSR: 100 years: +0 %: 15 mins: Winter	22.240	20.115	20.173	0.058	3.3	0.065	0.000	0.3	0.521	OK

5018551 : Main Road SW Infodrainage Calcs P02	Date: 01/12/2023			RIDGE
	Designed by: BT	Checked by:	Approved By:	
Report Details: Type: Junctions Summary Storm Phase: Phase	Ridge:			

FSR: 100 years: Increase Rainfall (%): +45: Critical Storm Per Item: Rank By: Max. Depth

Junction	Storm Event	Cover Level (m)	Invert Level (m)	Max. Level (m)	Max. Depth (m)	Max. Inflow (L/s)	Max. Resident Volume (m³)	Max. Flooded Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Status
MH_CF14	FSR: 100 years: +45 %: 15 mins: Winter	22.810	20.096	20.368	0.272	135.6	0.307	0.000	130.6	62.616	OK
MH_CF16	FSR: 100 years: +45 %: 15 mins: Winter	21.570	19.557	19.876	0.319	372.4	0.361	0.000	361.9	182.461	OK
MH_CF18	FSR: 100 years: +45 %: 15 mins: Winter	20.810	18.707	19.151	0.444	554.9	0.502	0.000	530.4	271.683	OK
MH_CF17	FSR: 100 years: +45 %: 15 mins: Winter	21.930	20.000	20.257	0.257	144.6	0.291	0.000	140.6	66.486	OK
MH_CF15	FSR: 100 years: +45 %: 15 mins: Winter	21.720	19.756	20.078	0.322	130.6	0.364	0.000	116.0	62.469	OK
MH_CF12	FSR: 100 years: +45 %: 1440 mins: Winter	22.440	19.979	20.784	0.805	36.0	2.788	0.000	35.4	1209.897	Surcharged
MH_CF11	FSR: 100 years: +45 %: 15 mins: Winter	22.920	20.349	22.017	1.668	490.5	1.887	0.000	479.6	233.036	Surcharged
MH_CF9	FSR: 100 years: +45 %: 1440 mins: Winter	23.510	20.118	20.784	0.666	31.6	0.753	0.000	31.2	1151.145	Surcharged
MH_CF8	FSR: 100 years: +45 %: 15 mins: Winter	23.930	20.401	20.906	0.504	543.7	0.570	0.000	521.3	273.550	OK
MH_CF4	FSR: 100 years: +45 %: 15 mins: Winter	24.630	21.257	21.671	0.414	285.7	0.468	0.000	277.2	135.033	OK
MH_CF3	FSR: 100 years: +45 %: 15 mins: Winter	25.120	22.567	22.767	0.200	191.7	0.226	0.000	186.5	89.278	OK
MH_CF7	FSR: 100 years: +45 %: 15 mins: Winter	24.210	20.702	21.133	0.431	451.7	0.488	0.000	435.3	223.651	OK
MH_CF10	FSR: 100 years: +45 %: 15 mins: Winter	23.360	20.557	22.092	1.535	127.1	2.712	0.000	112.4	58.758	Surcharged
MH_CG22	FSR: 100 years: +45 %: 15 mins: Winter	27.290	24.035	24.234	0.199	172.6	0.508	0.000	168.5	90.100	OK
MH_CG24	FSR: 100 years: +45 %: 15 mins: Winter	26.870	23.372	23.674	0.301	162.5	0.341	0.000	157.6	89.183	OK
MH_CG28	FSR: 100 years: +45 %: 15 mins: Winter	26.050	22.472	22.772	0.300	166.6	0.339	0.000	114.4	119.628	OK
MH_CG34	FSR: 100 years: +45 %: 15 mins: Winter	25.470	21.313	22.857	1.544	922.7	1.747	0.000	918.2	600.674	Surcharged
MH_CG35	FSR: 100 years: +45 %: 960 mins: Winter	24.930	20.956	21.657	0.701	127.3	0.793	0.000	126.5	4185.894	Surcharged
MH_CG36	FSR: 100 years: +45 %: 15 mins: Winter	27.460	24.560	27.195	2.635	502.6	6.707	0.000	440.0	230.918	Flood Risk
MH_CG37	FSR: 100 years: +45 %: 15 mins: Winter	27.180	24.000	25.777	1.777	440.0	2.010	0.000	418.0	231.533	Surcharged

MH_CG39	FSR: 100 years: +45 %: 15 mins: Winter	26.400	23.000	24.104	1.104	407.1	1.248	0.000	400.1	231.816	Surcharged
MH_CG41	FSR: 100 years: +45 %: 15 mins: Winter	25.920	22.781	23.122	0.341	395.4	0.386	0.000	376.6	231.737	OK
MH_CH38	FSR: 100 years: +45 %: 15 mins: Winter	25.300	23.196	23.372	0.176	184.3	0.199	0.000	176.7	101.388	OK
MH_CH42	FSR: 100 years: +45 %: 30 mins: Winter	22.770	19.971	20.295	0.324	132.2	0.366	0.000	122.3	139.831	OK
MH_CH43	FSR: 100 years: +45 %: 30 mins: Winter	21.770	20.148	20.311	0.163	2.4	0.184	0.000	0.2	0.844	OK
MH_CH40	FSR: 100 years: +45 %: 15 mins: Winter	24.580	19.433	20.470	1.037	759.7	2.639	0.000	598.9	472.519	Surcharged
MH_CH47	FSR: 100 years: +45 %: 15 mins: Winter	22.990	18.921	20.274	1.353	638.6	1.530	0.000	657.7	475.033	Surcharged
OUTFALL_H	FSR: 100 years: +45 %: 960 mins: Summer	17.862	16.662	17.145	0.483	70.7	0.546	0.000	70.7	5273.240	OK
OUTFALL_F	FSR: 100 years: +45 %: 360 mins: Winter	17.770	16.570	16.940	0.370	26.9	0.419	0.000	26.9	745.967	OK
OUTFALL_G	FSR: 100 years: +45 %: 120 mins: Summer	20.563	19.363	19.781	0.418	41.5	0.473	0.000	41.4	456.265	OK
MH_CH50	FSR: 100 years: +45 %: 15 mins: Winter	20.830	18.036	18.648	0.612	1336.3	0.692	0.000	1308.1	918.780	OK
MH_CH36	FSR: 100 years: +45 %: 360 mins: Winter	25.710	23.750	24.814	1.063	18.3	1.203	0.000	17.0	664.048	Surcharged
MH_CH37	FSR: 100 years: +45 %: 15 mins: Winter	25.770	23.681	23.909	0.228	190.3	0.580	0.000	184.3	102.325	OK
MH_CH41	FSR: 100 years: +45 %: 360 mins: Winter	22.610	20.188	20.725	0.537	8.0	0.607	0.000	7.7	287.582	Surcharged
MH_CH31	FSR: 100 years: +45 %: 480 mins: Winter	22.430	19.470	20.364	0.894	10.8	1.012	0.000	10.7	555.312	Surcharged
MH_CG19	FSR: 100 years: +45 %: 120 mins: Winter	27.580	25.054	27.208	2.153	15.2	2.436	0.000	12.4	156.813	Surcharged
MH_CG20	FSR: 100 years: +45 %: 30 mins: Winter	27.430	24.600	24.662	0.062	12.5	0.070	0.000	12.4	36.395	OK
MH_CG29	FSR: 100 years: +45 %: 120 mins: Winter	25.619	23.119	25.087	1.968	27.4	2.226	0.000	24.2	289.382	Surcharged
MH_CF2	FSR: 100 years: +45 %: 15 mins: Winter	26.210	23.453	23.543	0.090	60.1	0.102	0.000	59.3	28.342	OK
MH_CF1	FSR: 100 years: +45 %: 480 mins: Winter	26.150	23.545	24.766	1.221	1.2	1.380	0.000	0.8	38.329	Surcharged
MH_CG32	FSR: 100 years: +45 %: 15 mins: Winter	25.970	21.530	22.884	1.354	326.7	6.648	0.000	426.6	257.735	Surcharged
MH_CF13	FSR: 100 years: +45 %: 1440 mins: Winter	21.720	19.536	20.784	1.248	5.9	1.411	0.000	4.3	659.407	Surcharged
MH_CH45	FSR: 100 years: +45 %: 15 mins: Winter	23.770	19.702	20.395	0.692	357.7	1.224	0.000	265.7	108.273	Surcharged

MH_CG30	FSR: 100 years: +45 %: 15 mins: Winter	25.990	22.289	22.920	0.630	120.6	1.604	0.000	163.1	119.606	Surcharged
MH_CG27	FSR: 100 years: +45 %: 15 mins: Winter	26.160	22.860	23.061	0.200	149.2	0.227	0.000	144.4	88.421	OK
MH_CG26	FSR: 100 years: +45 %: 15 mins: Winter	26.440	23.113	23.356	0.243	153.9	0.275	0.000	149.2	88.716	OK
MH_CH49	FSR: 100 years: +45 %: 15 mins: Winter	21.512	18.227	19.343	1.117	1342.1	1.263	0.000	1336.3	919.133	Surcharged
MH_CH46	FSR: 100 years: +45 %: 15 mins: Winter	23.070	19.105	20.400	1.296	598.9	1.465	0.000	625.4	463.899	Surcharged
MH_CH48	FSR: 100 years: +45 %: 15 mins: Winter	22.650	18.478	20.052	1.574	1371.3	5.451	0.000	1342.1	920.385	Surcharged
MH_CG42	FSR: 100 years: +45 %: 15 mins: Winter	24.230	21.624	21.922	0.298	376.6	0.338	0.000	339.9	231.490	OK
MH_CG31	FSR: 100 years: +45 %: 15 mins: Winter	26.080	22.163	22.948	0.785	163.1	0.887	0.000	242.8	124.248	Surcharged
MH_CG33	FSR: 100 years: +45 %: 480 mins: Winter	25.840	24.218	25.027	0.809	7.2	0.914	0.000	7.1	366.707	Surcharged
MH_CF6	FSR: 100 years: +45 %: 15 mins: Winter	24.310	21.089	21.359	0.270	267.6	0.306	0.000	258.9	134.725	OK
MH_CF5	FSR: 100 years: +45 %: 15 mins: Winter	24.480	21.189	21.550	0.361	277.2	0.408	0.000	267.6	134.888	OK
MH_CG25	FSR: 100 years: +45 %: 15 mins: Winter	26.640	23.298	23.544	0.246	157.6	0.278	0.000	153.9	88.916	OK
MH_CG23	FSR: 100 years: +45 %: 15 mins: Winter	27.110	23.499	23.815	0.316	168.5	0.358	0.000	162.5	89.641	OK
MH_CG21	FSR: 100 years: +45 %: 240 mins: Summer	27.390	24.424	24.475	0.051	12.5	0.058	0.000	12.5	318.311	OK
MH_CG40	FSR: 100 years: +45 %: 15 mins: Winter	26.260	22.900	23.713	0.813	400.1	0.919	0.000	395.4	231.754	Surcharged
MH_CG38	FSR: 100 years: +45 %: 15 mins: Winter	26.510	23.110	24.507	1.397	418.0	1.580	0.000	407.1	231.842	Surcharged
MH_CH39	FSR: 100 years: +45 %: 15 mins: Winter	24.970	21.285	21.461	0.176	176.7	0.200	0.000	172.9	100.849	OK
MH_CH44	FSR: 100 years: +45 %: 30 mins: Winter	22.240	20.115	20.302	0.187	20.2	0.211	0.000	0.5	3.557	OK

5018551 : Main Road SW Infodrainage Calcs P02	Date: 01/12/2023			RIDGE
	Designed by: BT	Checked by:	Approved By:	
Report Details: Type: Stormwater Controls Summary Storm Phase: Phase	Ridge:			

FSR: 1 years: Increase Rainfall (%): +0: Critical Storm Per Item: Rank By: Max. Avg. Depth

Stormwater Control	Storm Event	Max. US Level (m)	Max. DS Level (m)	Max. US Depth (m)	Max. DS Depth (m)	Max. Inflow (L/s)	Max. Resident Volume (m³)	Max. Flooded Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Half Drain Down Time (mins)	Percentage Available (%)	Status
Pond_F	FSR: 1 years: +0 %: 960 mins: Winter	17.973	17.973	0.160	0.160	15.2	183.362	0.000	10.0	568.308	244	81.627	OK
Swale	FSR: 1 years: +0 %: 1440 mins: Winter	19.910	19.910	0.081	0.349	18.8	390.252	0.000	4.3	621.526	791	84.655	OK
POND_G	FSR: 1 years: +0 %: 960 mins: Winter	20.991	20.991	0.259	0.259	45.4	501.062	0.000	27.9	1024.926	234	78.602	OK
POND H	FSR: 1 years: +0 %: 960 mins: Winter	17.936	17.936	0.280	0.280	65.5	831.431	0.000	37.7	1494.769	295	80.130	OK
GG_H2	FSR: 1 years: +0 %: 240 mins: Winter	24.216	24.216	0.116	0.116	47.1	154.028	0.000	19.5	243.856	82	85.574	OK
GG_H4	FSR: 1 years: +0 %: 240 mins: Winter	20.422	20.422	0.067	0.067	20.0	73.774	0.000	7.1	90.551	137	83.239	OK
GG_H5	FSR: 1 years: +0 %: 240 mins: Winter	19.728	19.728	0.128	0.128	33.9	120.407	0.000	9.2	176.209	124	84.015	OK
GG_G6	FSR: 1 years: +0 %: 60 mins: Winter	25.468	25.468	0.108	0.108	37.5	34.003	0.000	17.0	50.481	32	86.522	OK
GG_G5	FSR: 1 years: +0 %: 60 mins: Winter	24.457	24.457	0.097	0.097	66.1	58.303	0.000	23.7	90.930	36	87.890	OK
GG_F8	FSR: 1 years: +0 %: 360 mins: Winter	24.141	24.141	0.121	0.121	2.5	12.080	0.000	1.3	20.281	114	85.013	OK
GG_G5 (1)	FSR: 1 years: +0 %: 240 mins: Winter	24.474	24.474	0.114	0.114	24.1	89.712	0.000	6.2	118.173	130	85.722	OK

5018551 : Main Road SW Infodrainage Calcs P02	Date: 01/12/2023			RIDGE
	Designed by: BT	Checked by:	Approved By:	
Report Details: Type: Stormwater Controls Summary Storm Phase: Phase	Ridge:			

FSR: 30 years: Increase Rainfall (%): +0: Critical Storm Per Item: Rank By: Max. Avg. Depth

Stormwater Control	Storm Event	Max. US Level (m)	Max. DS Level (m)	Max. US Depth (m)	Max. DS Depth (m)	Max. Inflow (L/s)	Max. Resident Volume (m³)	Max. Flooded Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Half Drain Down Time (mins)	Percentage Available (%)	Status
Pond_F	FSR: 30 years: +0 %: 480 mins: Winter	18.060	18.060	0.247	0.247	42.7	293.666	0.000	20.7	533.082	187	70.574	OK
Swale	FSR: 30 years: +0 %: 1440 mins: Winter	20.234	20.234	0.405	0.673	37.1	979.110	0.000	31.6	694.165	455	61.500	OK
POND_G	FSR: 30 years: +0 %: 480 mins: Winter	21.227	21.227	0.494	0.494	120.1	1019.288	0.000	41.5	1574.298	244	56.471	OK
POND H	FSR: 30 years: +0 %: 960 mins: Winter	18.073	18.073	0.417	0.417	107.7	1268.509	0.000	67.1	3247.145	240	69.684	OK
GG_H2	FSR: 30 years: +0 %: 240 mins: Winter	24.419	24.419	0.319	0.319	105.0	425.231	0.000	19.7	418.482	204	60.173	OK
GG_H4	FSR: 30 years: +0 %: 240 mins: Winter	20.525	20.525	0.170	0.170	44.5	186.683	0.000	7.9	171.059	208	57.588	OK
GG_H5	FSR: 30 years: +0 %: 240 mins: Winter	19.944	19.944	0.344	0.344	75.5	323.361	0.000	10.5	258.028	287	57.073	OK
GG_G6	FSR: 30 years: +0 %: 120 mins: Winter	25.703	25.703	0.343	0.343	59.2	107.379	0.000	18.0	154.380	71	57.439	OK
GG_G5	FSR: 30 years: +0 %: 120 mins: Winter	24.676	24.676	0.316	0.316	104.5	189.638	0.000	31.6	278.654	59	60.611	OK
GG_F8	FSR: 30 years: +0 %: 360 mins: Winter	24.364	24.364	0.344	0.344	5.4	34.331	0.000	1.1	25.373	334	57.408	OK
GG_G5 (1)	FSR: 30 years: +0 %: 240 mins: Winter	24.661	24.661	0.301	0.301	53.7	236.192	0.000	7.0	171.320	309	62.409	OK

5018551 : Main Road SW Infodrainage Calcs P02	Date: 01/12/2023			RIDGE
	Designed by: BT	Checked by:	Approved By:	
Report Details: Type: Stormwater Controls Summary Storm Phase: Phase	Ridge:			

FSR: 100 years: Increase Rainfall (%): +0: Critical Storm Per Item: Rank By: Max. Avg. Depth

Stormwater Control	Storm Event	Max. US Level (m)	Max. DS Level (m)	Max. US Depth (m)	Max. DS Depth (m)	Max. Inflow (L/s)	Max. Resident Volume (m³)	Max. Flooded Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Half Drain Down Time (mins)	Percentage Available (%)	Status
Pond_F	FSR: 100 years: +0 %: 360 mins: Winter	18.111	18.111	0.297	0.297	65.6	361.355	0.000	25.9	543.565	179	63.791	OK
Swale	FSR: 100 years: +0 %: 1440 mins: Winter	20.415	20.415	0.586	0.854	46.6	1307.805	0.000	33.9	611.335	573	48.575	OK
POND_G	FSR: 100 years: +0 %: 960 mins: Winter	21.357	21.357	0.625	0.625	102.0	1334.288	0.000	41.5	2767.455	276	43.019	OK
POND H	FSR: 100 years: +0 %: 960 mins: Winter	18.158	18.158	0.502	0.502	129.0	1550.895	0.000	69.7	4136.890	260	62.935	OK
GG_H2	FSR: 100 years: +0 %: 240 mins: Winter	24.545	24.545	0.445	0.445	136.5	593.137	0.000	19.1	435.176	297	44.446	OK
GG_H4	FSR: 100 years: +0 %: 240 mins: Winter	20.589	20.589	0.234	0.234	57.9	256.544	0.000	7.7	181.880	297	41.716	OK
GG_H5	FSR: 100 years: +0 %: 360 mins: Winter	20.075	20.075	0.475	0.475	72.6	446.909	0.000	10.7	405.323	365	40.671	OK
GG_G6	FSR: 100 years: +0 %: 120 mins: Winter	25.855	25.855	0.495	0.495	77.8	155.327	0.000	17.7	161.331	87	38.434	OK
GG_G5	FSR: 100 years: +0 %: 120 mins: Winter	24.820	24.820	0.460	0.460	137.3	276.695	0.000	31.1	274.298	92	42.528	OK
GG_F8	FSR: 100 years: +0 %: 480 mins: Winter	24.496	24.496	0.476	0.476	5.6	47.434	0.000	1.0	35.599	508	41.152	OK
GG_G5 (1)	FSR: 100 years: +0 %: 360 mins: Winter	24.777	24.777	0.417	0.417	51.6	327.175	0.000	7.1	269.014	398	47.928	OK

5018551 : Main Road SW Infodrainage Calcs P02	Date: 01/12/2023			RIDGE
	Designed by: BT	Checked by:	Approved By:	
Report Details: Type: Stormwater Controls Summary Storm Phase: Phase	Ridge:			

FSR: 100 years: Increase Rainfall (%): +45: Critical Storm Per Item: Rank By: Max. Avg. Depth

Stormwater Control	Storm Event	Max. US Level (m)	Max. DS Level (m)	Max. US Depth (m)	Max. DS Depth (m)	Max. Inflow (L/s)	Max. Resident Volume (m³)	Max. Flooded Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Half Drain Down Time (mins)	Percentage Available (%)	Status
Pond_F	FSR: 100 years: +45 %: 360 mins: Winter	18.228	18.228	0.415	0.415	93.1	529.083	0.000	26.9	746.513	207	46.984	OK
Swale	FSR: 100 years: +45 %: 1440 mins: Winter	20.784	20.784	0.955	1.223	66.6	1977.956	0.000	5.9	660.149	3370	22.223	OK
POND_G	FSR: 100 years: +45 %: 960 mins: Winter	21.656	21.656	0.924	0.924	126.5	2127.053	0.000	41.5	3787.846	437	9.164	OK
POND H	FSR: 100 years: +45 %: 960 mins: Winter	18.364	18.364	0.709	0.709	173.0	2270.344	0.000	70.7	5799.621	293	45.741	OK
GG_H2	FSR: 100 years: +45 %: 360 mins: Winter	24.814	24.814	0.714	0.714	146.3	951.128	0.000	18.3	671.578	473	10.917	OK
GG_H4	FSR: 100 years: +45 %: 360 mins: Winter	20.726	20.726	0.371	0.371	62.0	406.538	0.000	8.0	291.156	440	7.639	OK
GG_H5	FSR: 100 years: +45 %: 480 mins: Winter	20.365	20.365	0.765	0.765	84.9	719.095	0.000	10.8	556.675	575	4.537	OK
GG_G6	FSR: 100 years: +45 %: 120 mins: Winter	27.207	27.207	1.847	1.847	112.8	251.905	0.000	15.2	162.020	161	0.155	OK
GG_G5	FSR: 100 years: +45 %: 120 mins: Winter	25.098	25.098	0.738	0.738	199.0	443.435	0.000	27.4	292.480	168	7.895	OK
GG_F8	FSR: 100 years: +45 %: 480 mins: Winter	24.766	24.766	0.746	0.746	8.2	74.430	0.000	1.2	39.798	677	7.660	OK
GG_G5 (1)	FSR: 100 years: +45 %: 480 mins: Winter	25.028	25.028	0.668	0.668	60.3	523.436	0.000	7.2	368.339	627	16.692	OK

5018551 : Main Road SW Infodrainage Calcs P02	Date: 01/12/2023			RIDGE
	Designed by: BT	Checked by:	Approved By:	
Report Details: Type: Connections Summary Storm Phase: Phase	Ridge:			

FSR: 1 years: Increase Rainfall (%): +0: Critical Storm Per Item: Rank By: Max. Flow

Connection	Storm Event	Connection Type	From	To	Upstream Cover Level (m)	Max. US Water Level (m)	Max. Flow Depth (m)	Discharge Volume (m³)	Max. Velocity (m/s)	Flow / Capacity	Max. Flow (L/s)	Status
SW3.000	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CF 14	MH_CF1 5	22.810	20.202	0.113	13.613	1.0	0.17	27.9	OK
SW3.001	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CF 15	MH_CF1 6	21.720	19.876	0.114	13.505	0.8	0.2	23.4	OK
SW3.002	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CF 16	MH_CF1 8	21.570	19.673	0.136	39.553	1.9	0.14	76.4	OK
SW4.000	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CF 17	MH_CF1 6	21.930	20.101	0.099	14.472	1.3	0.15	29.3	OK
SW3.003	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CF 18	Pond_F	20.810	18.863	0.102	58.910	4.2	0.19	115.2	OK
SW2.002	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CF 12	Swale	22.440	20.235	0.243	68.668	1.2	0.31	129.4	OK
SW1.009	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CF 9	Swale	23.510	20.268	0.141	59.421	2.0	0.11	102.4	OK
SW2.001	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CF 11	MH_CF1 2	22.920	20.571	0.214	50.489	1.3	0.43	95.4	OK
SW1.008	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CF 8	MH_CF9	23.930	20.590	0.169	59.529	1.6	0.19	107.4	OK
SW1.003	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CF 3	MH_CF4	25.120	22.655	0.087	19.778	1.8	0.08	38.7	OK
SW1.007	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CF 7	MH_CF8	24.210	20.856	0.172	48.751	1.4	0.13	90.2	OK
SW2.000	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CF 10	MH_CF1 1	23.360	20.659	0.162	12.737	0.5	0.12	26.0	OK
SW5.014	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CG 34	MH_CG 35	25.470	21.597	0.267	156.318	1.8	0.39	220.3	OK
SW5.015	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CG 35	POND_ G	24.930	21.206	0.149	154.918	3.9	0.31	210.5	OK
SW8.000	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CG 36	MH_CG 37	27.460	24.759	0.178	50.386	1.8	0.36	103.2	OK
SW 9.011	FSR: 1 years: +0 %: 960 mins: Winter	Pipe	POND H	OUTFAL L_H	19.472	17.936	0.140	1494.712	0.7	0.02	37.7	OK
SW1.012	FSR: 1 years: +0 %: 960 mins: Winter	Pipe	Pond_F	OUTFAL L_F	19.119	17.973	0.080	568.251	0.7	0.04	10.0	OK
SW5.016	FSR: 1 years: +0 %: 960 mins: Winter	Pipe	POND_ G	OUTFAL L_G	22.178	20.991	0.130	1024.894	0.7	0.03	27.9	OK
SW 9.010	FSR: 1 years: +0 %: 30 mins: Winter	Pipe	MH_CH 50	POND H	20.830	18.287	0.163	318.143	4.1	0.19	290.4	OK

SW9.002	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CH 37	MH_CH 38	25.770	23.779	0.086	31.824	1.5	0.05	36.2	OK
SW9.001	FSR: 1 years: +0 %: 240 mins: Winter	Pipe	MH_CH 36	MH_CH 37	25.710	24.213	0.076	243.413	0.9	0.03	16.0	OK
SW9.000	FSR: 1 years: +0 %: 30 mins: Winter	Pipe	GG_H2	MH_CH 36	27.826	24.183	0.256	42.674	0.4	0.04	26.4	OK
SW10.000	FSR: 1 years: +0 %: 120 mins: Winter	Pipe	GG_H4	MH_CH 41	22.618	20.417	0.143	54.853	0.2	0.04	7.8	OK
SW 12.001	FSR: 1 years: +0 %: 240 mins: Winter	Pipe	MH_CH 31	MH_CH 47	22.430	19.727	0.087	176.032	0.8	0.02	9.1	OK
SW 12.000	FSR: 1 years: +0 %: 240 mins: Winter	Pipe	GG_H5	MH_CH 31	22.085	19.728	0.192	176.209	0.3	0.02	9.2	OK
SW5.000	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	GG_G6	MH_CG 19	27.877	25.440	0.227	16.025	0.5	0.08	20.8	OK
SW5.001	FSR: 1 years: +0 %: 60 mins: Winter	Pipe	MH_CG 19	MH_CG 20	27.580	25.465	0.059	49.911	1.0	0.04	11.8	OK
SW6.000	FSR: 1 years: +0 %: 60 mins: Summer	Pipe	GG_G5	MH_CG 29	26.056	24.448	0.300	80.745	0.6	0.14	36.8	OK
SW6.001	FSR: 1 years: +0 %: 60 mins: Winter	Pipe	MH_CG 29	MH_CG 28	25.619	24.438	0.090	90.700	1.7	0.08	25.3	Surch arged
SW1.002	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CF 2	MH_CF3	26.210	23.496	0.065	6.591	0.9	0.02	13.0	OK
SW1.000	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	GG_F8	MH_CF1	26.085	24.075	0.141	1.512	0.5	0.26	3.8	OK
SW1.001	FSR: 1 years: +0 %: 360 mins: Winter	Pipe	MH_CF 1	MH_CF2	26.150	24.141	0.017	20.202	0.5	0	0.6	Surch arged
SW5.013	FSR: 1 years: +0 %: 30 mins: Winter	Pipe	MH_CG 32	MH_CG 34	25.970	21.710	0.221	153.197	1.1	0.19	92.1	OK
SW1.010	FSR: 1 years: +0 %: 15 mins: Summer	Pipe	Swale	MH_CF1 3	21.381	19.622	0.176	3.987	0.1	0.03	4.8	OK
SW1.011	FSR: 1 years: +0 %: 1440 mins: Winter	Pipe	MH_CF 13	Pond_F	21.720	19.910	0.093	621.205	0.7	0.01	4.3	OK
SW10.002	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CH 42	MH_CH 45	22.770	20.079	0.104	20.952	1.2	0.07	38.5	OK
SW5.010	FSR: 1 years: +0 %: 30 mins: Winter	Pipe	MH_CG 28	MH_CG 30	26.050	22.602	0.140	105.354	1.1	0.09	54.8	OK
SW5.009	FSR: 1 years: +0 %: 30 mins: Winter	Pipe	MH_CG 27	MH_CG 28	26.160	22.942	0.079	48.299	1.6	0.06	29.8	OK
SW5.008	FSR: 1 years: +0 %: 30 mins: Winter	Pipe	MH_CG 26	MH_CG 27	26.440	23.213	0.091	48.583	1.3	0.1	30.4	OK
SW10.003	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CH 45	MH_CH 40	23.770	19.801	0.166	20.641	0.6	0.06	35.6	OK
SW 9.009	FSR: 1 years: +0 %: 30 mins: Winter	Pipe	MH_CH 49	MH_CH 50	21.512	18.525	0.274	318.667	2.0	0.29	290.7	OK
SW9.005	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CH 40	MH_CH 46	24.580	19.666	0.231	109.270	1.6	0.18	183.6	OK

SW9.006	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CH 46	MH_CH 47	23.070	19.334	0.216	108.354	1.6	0.17	173.1	OK
SW10.001	FSR: 1 years: +0 %: 240 mins: Winter	Pipe	MH_CH 41	MH_CH 42	22.610	20.417	0.053	90.206	0.8	0.02	6.6	OK
SW 9.007	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CH 47	MH_CH 48	22.990	19.123	0.261	116.184	1.2	0.16	162.8	OK
SW 9.008	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CH 48	MH_CH 49	22.650	18.797	0.311	212.234	1.8	0.3	305.4	OK
SW8.005	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CG 41	MH_CG 42	25.920	22.909	0.122	50.020	2.2	0.16	78.0	OK
SW8.006	FSR: 1 years: +0 %: 30 mins: Winter	Pipe	MH_CG 42	MH_CH 48	24.230	21.741	0.116	66.864	2.2	0.14	72.7	OK
SW5.011	FSR: 1 years: +0 %: 60 mins: Summer	Pipe	MH_CG 30	MH_CG 31	25.990	22.439	0.149	148.502	1.0	0.12	53.4	OK
SW5.012	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CG 31	MH_CG 32	26.080	22.311	0.146	50.129	1.0	0.13	53.0	OK
SW7.000	FSR: 1 years: +0 %: 60 mins: Summer	Pipe	GG_G5 (1)	MH_CG 33	26.867	24.442	0.151	31.611	0.3	0.09	7.3	OK
SW7.001	FSR: 1 years: +0 %: 240 mins: Winter	Pipe	MH_CG 33	MH_CG 32	25.840	24.472	0.054	117.877	0.7	0.07	6.2	OK
SW1.006	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CF 6	MH_CF7	24.310	21.194	0.130	29.491	1.2	0.07	52.7	OK
SW1.004	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CF 4	MH_CF5	24.630	21.425	0.161	29.686	1.0	0.15	58.5	OK
SW1.005	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CF 5	MH_CF6	24.480	21.343	0.129	29.596	1.2	0.14	55.3	OK
SW5.006	FSR: 1 years: +0 %: 30 mins: Winter	Pipe	MH_CG 24	MH_CG 25	26.870	23.492	0.107	49.129	1.1	0.15	31.4	OK
SW5.007	FSR: 1 years: +0 %: 30 mins: Winter	Pipe	MH_CG 25	MH_CG 26	26.640	23.393	0.097	48.898	1.2	0.09	31.0	OK
SW5.004	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CG 22	MH_CG 23	27.290	24.112	0.098	27.705	1.3	0.07	33.9	OK
SW5.005	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CG 23	MH_CG 24	27.110	23.617	0.119	27.293	1.0	0.13	32.2	OK
SW5.002	FSR: 1 years: +0 %: 60 mins: Winter	Pipe	MH_CG 20	MH_CG 21	27.430	24.660	0.055	49.778	1.1	0.03	11.8	OK
SW5.003	FSR: 1 years: +0 %: 60 mins: Winter	Pipe	MH_CG 21	MH_CG 22	27.390	24.474	0.059	49.696	1.3	0.02	11.8	OK
SW8.003	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CG 39	MH_CG 40	26.400	23.200	0.195	50.100	1.3	0.32	85.1	OK
SW8.004	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CG 40	MH_CG 41	26.260	23.090	0.159	50.049	1.6	0.34	81.9	OK
SW8.001	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CG 37	MH_CG 38	27.180	24.157	0.180	50.251	1.6	0.26	95.8	OK
SW8.002	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CG 38	MH_CG 39	26.510	23.313	0.202	50.139	1.3	0.32	88.1	OK

SW9.003	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CH 38	MH_CH 39	25.300	23.270	0.073	31.149	1.7	0.03	33.7	OK
SW9.004	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CH 39	MH_CH 40	24.970	21.358	0.072	30.827	1.7	0.03	32.5	OK
SW11.000	FSR: 1 years: +0 %: 15 mins: Summer	Pipe	MH_CH 43	MH_CH 44	21.770	20.148	0.000	0.000	0.0	0	0.0	OK
SW11.001	FSR: 1 years: +0 %: 15 mins: Summer	Pipe	MH_CH 44	MH_CH 42	22.240	20.115	0.053	0.000	0.0	0	0.0	OK

FSR: 30 years: Increase Rainfall (%): +0: Critical Storm Per Item: Rank By: Max. Flow

Connection	Storm Event	Connection Type	From	To	Upstream Cover Level (m)	Max. US Water Level (m)	Max. Flow Depth (m)	Discharge Volume (m³)	Max. Velocity (m/s)	Flow / Capacity	Max. Flow (L/s)	Status
SW3.000	FSR: 30 years: +0 %: 15 mins: Winter	Pipe	MH_CF14	MH_CF15	22.810	20.274	0.191	33.360	1.2	0.41	69.1	OK
SW3.001	FSR: 30 years: +0 %: 15 mins: Winter	Pipe	MH_CF15	MH_CF16	21.720	19.961	0.191	33.217	1.1	0.52	60.3	OK
SW3.002	FSR: 30 years: +0 %: 15 mins: Winter	Pipe	MH_CF16	MH_CF18	21.570	19.757	0.231	97.157	2.3	0.36	191.8	OK
SW4.000	FSR: 30 years: +0 %: 15 mins: Winter	Pipe	MH_CF17	MH_CF16	21.930	20.167	0.162	35.509	1.6	0.37	72.9	OK
SW3.003	FSR: 30 years: +0 %: 15 mins: Winter	Pipe	MH_CF18	Pond_F	20.810	18.970	0.173	144.648	5.1	0.47	288.2	OK
SW2.002	FSR: 30 years: +0 %: 15 mins: Winter	Pipe	MH_CF12	Swale	22.440	20.413	0.400	168.669	1.6	0.77	316.2	OK
SW1.009	FSR: 30 years: +0 %: 15 mins: Winter	Pipe	MH_CF9	Swale	23.510	20.376	0.237	145.644	2.5	0.28	262.9	OK
SW2.001	FSR: 30 years: +0 %: 15 mins: Winter	Pipe	MH_CF11	MH_CF12	22.920	20.776	0.382	123.989	1.6	1.03	228.2	OK
SW1.008	FSR: 30 years: +0 %: 15 mins: Winter	Pipe	MH_CF8	MH_CF9	23.930	20.722	0.289	145.792	2.0	0.48	272.8	OK
SW1.003	FSR: 30 years: +0 %: 15 mins: Winter	Pipe	MH_CF3	MH_CF4	25.120	22.709	0.139	47.832	2.3	0.2	96.3	OK
SW1.007	FSR: 30 years: +0 %: 15 mins: Winter	Pipe	MH_CF7	MH_CF8	24.210	20.974	0.296	119.252	1.6	0.32	227.5	OK
SW2.000	FSR: 30 years: +0 %: 15 mins: Winter	Pipe	MH_CF10	MH_CF11	23.360	20.802	0.336	31.237	0.5	0.25	54.7	OK
SW5.014	FSR: 30 years: +0 %: 15 mins: Winter	Pipe	MH_CG34	MH_CG35	25.470	21.866	0.487	337.923	2.3	1	561.7	OK
SW5.015	FSR: 30 years: +0 %: 15 mins: Winter	Pipe	MH_CG35	POND_G	24.930	21.378	0.253	336.683	4.8	0.79	545.6	OK

SW8.000	FSR: 30 years: +0 %: 15 mins: Winter	Pipe	MH_CG 36	MH_CG 37	27.460	24.921	0.320	123.542	2.1	0.88	253.8	OK
SW 9.011	FSR: 30 years: +0 %: 960 mins: Winter	Pipe	POND H	OUTFAL L_H	19.472	18.073	0.205	3247.063	0.7	0.04	67.1	OK
SW1.012	FSR: 30 years: +0 %: 480 mins: Winter	Pipe	Pond_F	OUTFAL L_F	19.119	18.060	0.124	533.015	0.7	0.09	20.7	OK
SW5.016	FSR: 30 years: +0 %: 480 mins: Winter	Pipe	POND_ G	OUTFAL L_G	22.178	21.227	0.242	1574.131	0.7	0.04	41.5	OK
SW 9.010	FSR: 30 years: +0 %: 15 mins: Winter	Pipe	MH_CH 50	POND H	20.830	18.462	0.264	502.774	5.4	0.49	752.5	OK
SW9.002	FSR: 30 years: +0 %: 15 mins: Winter	Pipe	MH_CH 37	MH_CH 38	25.770	23.843	0.142	62.136	1.9	0.14	96.4	OK
SW9.001	FSR: 30 years: +0 %: 240 mins: Winter	Pipe	MH_CH 36	MH_CH 37	25.710	24.419	0.086	413.056	0.9	0.03	16.9	Surch arged
SW9.000	FSR: 30 years: +0 %: 60 mins: Summer	Pipe	GG_H2	MH_CH 36	27.826	24.336	0.410	101.009	0.3	0.06	38.7	OK
SW10.000	FSR: 30 years: +0 %: 30 mins: Winter	Pipe	GG_H4	MH_CH 41	22.618	20.468	0.196	20.337	0.4	0.07	13.9	OK
SW 12.001	FSR: 30 years: +0 %: 240 mins: Winter	Pipe	MH_CH 31	MH_CH 47	22.430	19.944	0.112	257.101	0.7	0.02	10.5	Surch arged
SW 12.000	FSR: 30 years: +0 %: 240 mins: Winter	Pipe	GG_H5	MH_CH 31	22.085	19.944	0.409	258.028	0.3	0.03	10.5	OK
SW5.000	FSR: 30 years: +0 %: 15 mins: Winter	Pipe	GG_G6	MH_CG 19	27.877	25.582	0.373	20.235	0.5	0.16	42.6	OK
SW5.001	FSR: 30 years: +0 %: 120 mins: Winter	Pipe	MH_CG 19	MH_CG 20	27.580	25.702	0.061	150.878	1.0	0.04	12.4	Surch arged
SW6.000	FSR: 30 years: +0 %: 30 mins: Summer	Pipe	GG_G5	MH_CG 29	26.056	24.593	0.300	67.330	0.7	0.17	46.6	OK
SW6.001	FSR: 30 years: +0 %: 480 mins: Winter	Pipe	MH_CG 29	MH_CG 28	25.619	24.511	0.086	438.821	1.6	0.08	25.3	Surch arged
SW1.002	FSR: 30 years: +0 %: 15 mins: Winter	Pipe	MH_CF 2	MH_CF3	26.210	23.519	0.104	15.376	1.1	0.05	31.6	OK
SW1.000	FSR: 30 years: +0 %: 15 mins: Winter	Pipe	GG_F8	MH_CF1	26.085	24.172	0.150	1.703	0.6	0.49	7.2	Surch arged

SW1.001	FSR: 30 years: +0 %: 360 mins: Winter	Pipe	MH_CF 1	MH_CF2	26.150	24.364	0.021	24.265	0.5	0	0.6	Surch arged
SW5.013	FSR: 30 years: +0 %: 15 mins: Winter	Pipe	MH_CG 32	MH_CG 34	25.970	21.911	0.467	153.630	1.1	0.41	198.2	OK
SW1.010	FSR: 30 years: +0 %: 1440 mins: Winter	Pipe	Swale	MH_CF1 3	21.381	20.100	0.450	669.171	0.2	0.17	31.6	Surch arged
SW1.011	FSR: 30 years: +0 %: 120 mins: Winter	Pipe	MH_CF 13	Pond_F	21.720	20.045	0.127	53.065	0.6	0.01	4.3	Surch arged
SW10.002	FSR: 30 years: +0 %: 15 mins: Winter	Pipe	MH_CH 42	MH_CH 45	22.770	20.145	0.172	53.372	1.4	0.16	94.1	OK
SW5.010	FSR: 30 years: +0 %: 30 mins: Winter	Pipe	MH_CG 28	MH_CG 30	26.050	22.646	0.187	148.666	1.2	0.15	91.4	OK
SW5.009	FSR: 30 years: +0 %: 15 mins: Winter	Pipe	MH_CG 27	MH_CG 28	26.160	22.993	0.125	52.181	2.0	0.15	71.1	OK
SW5.008	FSR: 30 years: +0 %: 15 mins: Winter	Pipe	MH_CG 26	MH_CG 27	26.440	23.275	0.147	52.515	1.6	0.24	74.4	OK
SW10.003	FSR: 30 years: +0 %: 15 mins: Winter	Pipe	MH_CH 45	MH_CH 40	23.770	19.873	0.285	52.778	0.7	0.14	78.8	OK
SW 9.009	FSR: 30 years: +0 %: 15 mins: Winter	Pipe	MH_CH 49	MH_CH 50	21.512	18.775	0.487	503.307	2.5	0.76	769.9	OK
SW9.005	FSR: 30 years: +0 %: 15 mins: Winter	Pipe	MH_CH 40	MH_CH 46	24.580	19.833	0.396	256.894	1.9	0.45	453.7	OK
SW9.006	FSR: 30 years: +0 %: 15 mins: Winter	Pipe	MH_CH 46	MH_CH 47	23.070	19.498	0.371	255.754	2.0	0.43	435.6	OK
SW10.001	FSR: 30 years: +0 %: 240 mins: Winter	Pipe	MH_CH 41	MH_CH 42	22.610	20.524	0.066	168.926	0.9	0.02	7.3	OK
SW 9.007	FSR: 30 years: +0 %: 15 mins: Winter	Pipe	MH_CH 47	MH_CH 48	22.990	19.270	0.480	266.312	1.4	0.42	419.7	OK
SW 9.008	FSR: 30 years: +0 %: 15 mins: Winter	Pipe	MH_CH 48	MH_CH 49	22.650	19.088	0.580	504.616	2.2	0.79	798.6	OK
SW8.005	FSR: 30 years: +0 %: 15 mins: Winter	Pipe	MH_CG 41	MH_CG 42	25.920	22.999	0.209	123.090	2.8	0.42	201.0	OK
SW8.006	FSR: 30 years: +0 %: 15 mins: Winter	Pipe	MH_CG 42	MH_CH 48	24.230	21.824	0.194	122.870	2.8	0.36	186.0	OK

SW5.011	FSR: 30 years: +0 %: 30 mins: Winter	Pipe	MH_CG 30	MH_CG 31	25.990	22.490	0.200	147.292	1.1	0.21	91.4	OK
SW5.012	FSR: 30 years: +0 %: 30 mins: Winter	Pipe	MH_CG 31	MH_CG 32	26.080	22.363	0.195	144.859	1.1	0.22	91.5	OK
SW7.000	FSR: 30 years: +0 %: 15 mins: Winter	Pipe	GG_G5 (1)	MH_CG 33	26.867	24.508	0.218	9.231	0.4	0.14	12.2	OK
SW7.001	FSR: 30 years: +0 %: 240 mins: Winter	Pipe	MH_CG 33	MH_CG 32	25.840	24.660	0.057	169.927	0.7	0.08	7.0	Surch arged
SW1.006	FSR: 30 years: +0 %: 15 mins: Winter	Pipe	MH_CF 6	MH_CF7	24.310	21.271	0.227	71.932	1.4	0.17	134.2	OK
SW1.004	FSR: 30 years: +0 %: 15 mins: Winter	Pipe	MH_CF 4	MH_CF5	24.630	21.535	0.264	72.183	1.2	0.37	145.9	OK
SW1.005	FSR: 30 years: +0 %: 15 mins: Winter	Pipe	MH_CF 5	MH_CF6	24.480	21.438	0.215	72.069	1.5	0.35	140.0	OK
SW5.006	FSR: 30 years: +0 %: 15 mins: Winter	Pipe	MH_CG 24	MH_CG 25	26.870	23.574	0.181	53.140	1.3	0.38	81.0	OK
SW5.007	FSR: 30 years: +0 %: 15 mins: Winter	Pipe	MH_CG 25	MH_CG 26	26.640	23.459	0.162	52.873	1.5	0.22	78.1	OK
SW5.004	FSR: 30 years: +0 %: 15 mins: Winter	Pipe	MH_CG 22	MH_CG 23	27.290	24.168	0.170	54.018	1.6	0.17	90.3	OK
SW5.005	FSR: 30 years: +0 %: 15 mins: Winter	Pipe	MH_CG 23	MH_CG 24	27.110	23.706	0.205	53.585	1.2	0.35	85.4	OK
SW5.002	FSR: 30 years: +0 %: 120 mins: Winter	Pipe	MH_CG 20	MH_CG 21	27.430	24.661	0.056	150.450	1.1	0.04	12.4	OK
SW5.003	FSR: 30 years: +0 %: 120 mins: Winter	Pipe	MH_CG 21	MH_CG 22	27.390	24.475	0.067	150.224	1.3	0.03	12.4	OK
SW8.003	FSR: 30 years: +0 %: 15 mins: Winter	Pipe	MH_CG 39	MH_CG 40	26.400	23.372	0.350	123.177	1.6	0.81	213.9	OK
SW8.004	FSR: 30 years: +0 %: 15 mins: Winter	Pipe	MH_CG 40	MH_CG 41	26.260	23.228	0.273	123.098	2.1	0.87	208.2	OK
SW8.001	FSR: 30 years: +0 %: 15 mins: Winter	Pipe	MH_CG 37	MH_CG 38	27.180	24.278	0.336	123.266	1.9	0.63	236.9	OK
SW8.002	FSR: 30 years: +0 %: 15 mins: Winter	Pipe	MH_CG 38	MH_CG 39	26.510	23.505	0.383	123.216	1.5	0.8	219.9	OK

SW9.003	FSR: 30 years: +0 %: 15 mins: Winter	Pipe	MH_CH 38	MH_CH 39	25.300	23.318	0.119	61.409	2.3	0.08	89.8	OK
SW9.004	FSR: 30 years: +0 %: 15 mins: Winter	Pipe	MH_CH 39	MH_CH 40	24.970	21.406	0.118	61.071	2.2	0.08	86.7	OK
SW11.000	FSR: 30 years: +0 %: 15 mins: Winter	Pipe	MH_CH 43	MH_CH 44	21.770	20.148	0.015	0.000	0.0	0	0.0	OK
SW11.001	FSR: 30 years: +0 %: 15 mins: Winter	Pipe	MH_CH 44	MH_CH 42	22.240	20.145	0.101	0.000	0.0	0	0.0	OK

FSR: 100 years: Increase Rainfall (%): +0: Critical Storm Per Item: Rank By: Max. Flow

Connection	Storm Event	Connection Type	From	To	Upstream Cover Level (m)	Max. US Water Level (m)	Max. Flow Depth (m)	Discharge Volume (m³)	Max. Velocity (m/s)	Flow / Capacity	Max. Flow (L/s)	Status
SW3.000	FSR: 100 years: +0 %: 15 mins: Winter	Pipe	MH_CF14	MH_CF15	22.810	20.305	0.226	43.213	1.3	0.53	89.9	OK
SW3.001	FSR: 100 years: +0 %: 15 mins: Winter	Pipe	MH_CF15	MH_CF16	21.720	19.999	0.224	43.062	1.1	0.68	79.1	OK
SW3.002	FSR: 100 years: +0 %: 15 mins: Winter	Pipe	MH_CF16	MH_CF18	21.570	19.795	0.275	125.926	2.5	0.47	249.7	OK
SW4.000	FSR: 100 years: +0 %: 15 mins: Winter	Pipe	MH_CF17	MH_CF16	21.930	20.196	0.189	46.014	1.7	0.47	94.6	OK
SW3.003	FSR: 100 years: +0 %: 15 mins: Winter	Pipe	MH_CF18	Pond_F	20.810	19.019	0.205	187.469	5.3	0.61	374.6	OK
SW2.002	FSR: 100 years: +0 %: 15 mins: Winter	Pipe	MH_CF12	Swale	22.440	20.502	0.472	218.642	1.7	1	413.4	OK
SW1.009	FSR: 100 years: +0 %: 15 mins: Winter	Pipe	MH_CF9	Swale	23.510	20.421	0.276	188.602	2.7	0.36	343.0	OK
SW2.001	FSR: 100 years: +0 %: 15 mins: Winter	Pipe	MH_CF11	MH_CF12	22.920	21.111	0.450	160.702	1.9	1.4	309.9	Surcharged
SW1.008	FSR: 100 years: +0 %: 15 mins: Winter	Pipe	MH_CF8	MH_CF9	23.930	20.779	0.341	188.790	2.1	0.63	354.2	OK
SW1.003	FSR: 100 years: +0 %: 15 mins: Winter	Pipe	MH_CF3	MH_CF4	25.120	22.732	0.169	61.751	2.4	0.27	128.7	OK
SW1.007	FSR: 100 years: +0 %: 15 mins: Winter	Pipe	MH_CF7	MH_CF8	24.210	21.027	0.351	154.385	1.7	0.41	293.8	OK
SW2.000	FSR: 100 years: +0 %: 15 mins: Winter	Pipe	MH_CF10	MH_CF11	23.360	21.167	0.450	40.533	0.5	0.34	73.7	Surcharged
SW5.014	FSR: 100 years: +0 %: 15 mins: Winter	Pipe	MH_CG34	MH_CG35	25.470	22.245	0.600	426.288	2.5	1.26	706.5	Surcharged
SW5.015	FSR: 100 years: +0 %: 15 mins: Winter	Pipe	MH_CG35	POND_G	24.930	21.453	0.297	425.155	4.9	1	689.9	OK

SW8.000	FSR: 100 years: +0 %: 15 mins: Winter	Pipe	MH_CG 36	MH_CG 37	27.460	25.120	0.438	159.683	2.0	1.1	317.1	Surch arged
SW 9.011	FSR: 100 years: +0 %: 960 mins: Winter	Pipe	POND H	OUTFAL L_H	19.472	18.158	0.240	4136.782	0.7	0.04	69.7	OK
SW1.012	FSR: 100 years: +0 %: 360 mins: Winter	Pipe	Pond_F	OUTFAL L_F	19.119	18.111	0.156	543.488	0.8	0.11	25.9	OK
SW5.016	FSR: 100 years: +0 %: 480 mins: Winter	Pipe	POND_ G	OUTFAL L_G	22.178	21.343	0.242	1879.839	0.7	0.04	41.5	Surch arged
SW 9.010	FSR: 100 years: +0 %: 15 mins: Winter	Pipe	MH_CH 50	POND H	20.830	18.528	0.311	645.416	5.6	0.63	964.0	OK
SW9.002	FSR: 100 years: +0 %: 15 mins: Winter	Pipe	MH_CH 37	MH_CH 38	25.770	23.869	0.166	75.834	2.0	0.19	128.7	OK
SW9.001	FSR: 100 years: +0 %: 240 mins: Winter	Pipe	MH_CH 36	MH_CH 37	25.710	24.545	0.089	428.499	0.9	0.03	17.0	Surch arged
SW9.000	FSR: 100 years: +0 %: 15 mins: Winter	Pipe	GG_H2	MH_CH 36	27.826	24.318	0.392	26.990	0.5	0.08	51.9	OK
SW10.000	FSR: 100 years: +0 %: 60 mins: Winter	Pipe	GG_H4	MH_CH 41	22.618	20.541	0.270	44.632	0.3	0.07	14.0	OK
SW 12.001	FSR: 100 years: +0 %: 360 mins: Winter	Pipe	MH_CH 31	MH_CH 47	22.430	20.075	0.112	404.268	0.7	0.02	10.7	Surch arged
SW 12.000	FSR: 100 years: +0 %: 30 mins: Winter	Pipe	GG_H5	MH_CH 31	22.085	19.900	0.365	31.335	0.4	0.03	10.8	OK
SW5.000	FSR: 100 years: +0 %: 15 mins: Summer	Pipe	GG_G6	MH_CG 19	27.877	25.622	0.414	20.730	0.5	0.18	48.9	OK
SW5.001	FSR: 100 years: +0 %: 60 mins: Winter	Pipe	MH_CG 19	MH_CG 20	27.580	25.824	0.061	76.028	1.0	0.04	12.5	Surch arged
SW6.000	FSR: 100 years: +0 %: 60 mins: Summer	Pipe	GG_G5	MH_CG 29	26.056	24.738	0.300	132.542	0.6	0.12	33.1	Surch arged
SW6.001	FSR: 100 years: +0 %: 360 mins: Summer	Pipe	MH_CG 29	MH_CG 28	25.619	24.683	0.093	469.508	1.6	0.08	25.3	Surch arged
SW1.002	FSR: 100 years: +0 %: 15 mins: Winter	Pipe	MH_CF 2	MH_CF3	26.210	23.528	0.120	19.750	1.2	0.06	40.9	OK
SW1.000	FSR: 100 years: +0 %: 15 mins: Summer	Pipe	GG_F8	MH_CF1	26.085	24.197	0.150	1.747	0.5	0.61	8.9	Surch arged

SW1.001	FSR: 100 years: +0 %: 480 mins: Winter	Pipe	MH_CF 1	MH_CF2	26.150	24.495	0.021	34.400	0.5	0	0.7	Surch arged
SW5.013	FSR: 100 years: +0 %: 30 mins: Winter	Pipe	MH_CG 32	MH_CG 34	25.970	22.000	0.550	298.038	1.1	0.51	242.1	OK
SW1.010	FSR: 100 years: +0 %: 1440 mins: Winter	Pipe	Swale	MH_CF1 3	21.381	20.281	0.450	606.563	0.2	0.18	33.9	Surch arged
SW1.011	FSR: 100 years: +0 %: 60 mins: Winter	Pipe	MH_CF 13	Pond_F	21.720	20.073	0.138	25.503	0.5	0.01	4.3	Surch arged
SW10.002	FSR: 100 years: +0 %: 15 mins: Winter	Pipe	MH_CH 42	MH_CH 45	22.770	20.175	0.226	67.750	1.2	0.21	121.2	OK
SW5.010	FSR: 100 years: +0 %: 15 mins: Winter	Pipe	MH_CG 28	MH_CG 30	26.050	22.674	0.212	94.475	1.3	0.19	115.7	OK
SW5.009	FSR: 100 years: +0 %: 15 mins: Winter	Pipe	MH_CG 27	MH_CG 28	26.160	23.018	0.148	64.494	2.1	0.2	96.3	OK
SW5.008	FSR: 100 years: +0 %: 15 mins: Winter	Pipe	MH_CG 26	MH_CG 27	26.440	23.305	0.175	64.834	1.8	0.33	100.7	OK
SW10.003	FSR: 100 years: +0 %: 15 mins: Winter	Pipe	MH_CH 45	MH_CH 40	23.770	19.950	0.363	67.098	0.7	0.17	97.6	OK
SW 9.009	FSR: 100 years: +0 %: 15 mins: Winter	Pipe	MH_CH 49	MH_CH 50	21.512	18.883	0.574	645.888	2.7	0.97	981.4	OK
SW9.005	FSR: 100 years: +0 %: 15 mins: Winter	Pipe	MH_CH 40	MH_CH 46	24.580	19.912	0.472	327.477	2.0	0.58	586.4	OK
SW9.006	FSR: 100 years: +0 %: 15 mins: Winter	Pipe	MH_CH 46	MH_CH 47	23.070	19.571	0.447	326.316	2.0	0.55	553.2	OK
SW10.001	FSR: 100 years: +0 %: 240 mins: Winter	Pipe	MH_CH 41	MH_CH 42	22.610	20.588	0.071	179.064	0.9	0.02	7.6	OK
SW 9.007	FSR: 100 years: +0 %: 15 mins: Summer	Pipe	MH_CH 47	MH_CH 48	22.990	19.315	0.566	304.125	1.4	0.49	491.8	OK
SW 9.008	FSR: 100 years: +0 %: 15 mins: Winter	Pipe	MH_CH 48	MH_CH 49	22.650	19.282	0.730	647.183	2.3	0.99	1002. 8	Surch arged
SW8.005	FSR: 100 years: +0 %: 15 mins: Winter	Pipe	MH_CG 41	MH_CG 42	25.920	23.044	0.250	159.689	2.9	0.55	267.0	OK
SW8.006	FSR: 100 years: +0 %: 15 mins: Winter	Pipe	MH_CG 42	MH_CH 48	24.230	21.861	0.227	159.452	3.0	0.47	242.9	OK

SW5.011	FSR: 100 years: +0 %: 30 mins: Winter	Pipe	MH_CG 30	MH_CG 31	25.990	22.511	0.221	162.711	1.1	0.25	108.4	OK
SW5.012	FSR: 100 years: +0 %: 30 mins: Winter	Pipe	MH_CG 31	MH_CG 32	26.080	22.383	0.214	160.352	1.2	0.26	108.5	OK
SW7.000	FSR: 100 years: +0 %: 15 mins: Summer	Pipe	GG_G5 (1)	MH_CG 33	26.867	24.532	0.243	9.588	0.4	0.15	12.9	OK
SW7.001	FSR: 100 years: +0 %: 240 mins: Winter	Pipe	MH_CG 33	MH_CG 32	25.840	24.771	0.058	177.694	0.7	0.08	7.1	Surch arged
SW1.006	FSR: 100 years: +0 %: 15 mins: Winter	Pipe	MH_CF 6	MH_CF7	24.310	21.303	0.269	93.054	1.4	0.21	172.6	OK
SW1.004	FSR: 100 years: +0 %: 15 mins: Winter	Pipe	MH_CF 4	MH_CF5	24.630	21.580	0.305	93.328	1.3	0.48	187.9	OK
SW1.005	FSR: 100 years: +0 %: 15 mins: Winter	Pipe	MH_CF 5	MH_CF6	24.480	21.476	0.250	93.204	1.6	0.45	179.5	OK
SW5.006	FSR: 100 years: +0 %: 15 mins: Winter	Pipe	MH_CG 24	MH_CG 25	26.870	23.611	0.216	65.467	1.4	0.51	108.5	OK
SW5.007	FSR: 100 years: +0 %: 15 mins: Winter	Pipe	MH_CG 25	MH_CG 26	26.640	23.491	0.193	65.194	1.6	0.29	105.1	OK
SW5.004	FSR: 100 years: +0 %: 15 mins: Winter	Pipe	MH_CG 22	MH_CG 23	27.290	24.192	0.202	66.360	1.7	0.23	118.1	OK
SW5.005	FSR: 100 years: +0 %: 15 mins: Winter	Pipe	MH_CG 23	MH_CG 24	27.110	23.746	0.243	65.920	1.3	0.47	113.1	OK
SW5.002	FSR: 100 years: +0 %: 30 mins: Winter	Pipe	MH_CG 20	MH_CG 21	27.430	24.661	0.056	35.543	1.1	0.04	12.5	OK
SW5.003	FSR: 100 years: +0 %: 60 mins: Summer	Pipe	MH_CG 21	MH_CG 22	27.390	24.475	0.084	74.253	1.3	0.03	12.5	OK
SW8.003	FSR: 100 years: +0 %: 15 mins: Winter	Pipe	MH_CG 39	MH_CG 40	26.400	23.538	0.450	159.763	1.8	1.09	288.4	Surch arged
SW8.004	FSR: 100 years: +0 %: 15 mins: Winter	Pipe	MH_CG 40	MH_CG 41	26.260	23.318	0.340	159.692	2.2	1.18	281.6	OK
SW8.001	FSR: 100 years: +0 %: 15 mins: Summer	Pipe	MH_CG 37	MH_CG 38	27.180	24.308	0.435	142.471	1.9	0.8	299.9	OK
SW8.002	FSR: 100 years: +0 %: 15 mins: Winter	Pipe	MH_CG 38	MH_CG 39	26.510	23.743	0.450	159.795	1.8	1.06	291.5	Surch arged

SW9.003	FSR: 100 years: +0 %: 15 mins: Winter	Pipe	MH_CH 38	MH_CH 39	25.300	23.339	0.139	75.088	2.4	0.11	121.1	OK
SW9.004	FSR: 100 years: +0 %: 15 mins: Winter	Pipe	MH_CH 39	MH_CH 40	24.970	21.428	0.138	74.745	2.4	0.11	117.3	OK
SW11.000	FSR: 100 years: +0 %: 15 mins: Winter	Pipe	MH_CH 43	MH_CH 44	21.770	20.158	0.034	0.000	0.1	0	0.0	OK
SW11.001	FSR: 100 years: +0 %: 15 mins: Winter	Pipe	MH_CH 44	MH_CH 42	22.240	20.173	0.131	0.000	0.0	0	0.3	OK

FSR: 100 years: Increase Rainfall (%): +45: Critical Storm Per Item: Rank By: Max. Flow

Connection	Storm Event	Connection Type	From	To	Upstream Cover Level (m)	Max. US Water Level (m)	Max. Flow Depth (m)	Discharge Volume (m³)	Max. Velocity (m/s)	Flow / Capacity	Max. Flow (L/s)	Status
SW3.000	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CF14	MH_CF15	22.810	20.368	0.297	62.616	1.4	0.77	130.6	OK
SW3.001	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CF15	MH_CF16	21.720	20.078	0.286	62.469	1.3	0.99	116.0	OK
SW3.002	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CF16	MH_CF18	21.570	19.876	0.381	182.461	2.5	0.68	361.9	OK
SW4.000	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CF17	MH_CF16	21.930	20.257	0.250	66.486	1.8	0.7	140.6	OK
SW3.003	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CF18	Pond_F	20.810	19.151	0.283	271.683	5.0	0.87	530.4	OK
SW2.002	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CF12	Swale	22.440	20.774	0.600	316.742	2.3	1.58	653.2	Surcharged
SW1.009	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CF9	Swale	23.510	20.509	0.351	273.116	2.9	0.53	505.7	OK
SW2.001	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CF11	MH_CF12	22.920	22.017	0.450	233.036	3.0	2.17	479.6	Surcharged
SW1.008	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CF8	MH_CF9	23.930	20.906	0.448	273.550	2.3	0.92	521.3	OK
SW1.003	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CF3	MH_CF4	25.120	22.767	0.232	89.278	2.3	0.39	186.5	OK
SW1.007	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CF7	MH_CF8	24.210	21.133	0.468	223.651	1.8	0.61	435.3	OK
SW2.000	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CF10	MH_CF11	23.360	22.092	0.450	58.758	0.7	0.52	112.4	Surcharged
SW5.014	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CG34	MH_CG35	25.470	22.857	0.600	600.674	3.2	1.63	918.2	Surcharged
SW5.015	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CG35	POND_G	24.930	21.649	0.405	599.658	4.5	1.32	912.4	Surcharged

SW8.000	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CG 36	MH_CG 37	27.460	27.195	0.450	230.918	2.8	1.53	440.0	Flood Risk
SW 9.011	FSR: 100 years: +45 %: 360 mins: Winter	Pipe	POND H	OUTFAL L_H	19.472	18.339	0.285	2429.918	0.7	0.04	70.7	Surch arged
SW1.012	FSR: 100 years: +45 %: 360 mins: Winter	Pipe	Pond_F	OUTFAL L_F	19.119	18.228	0.218	746.418	0.8	0.12	26.9	Surch arged
SW5.016	FSR: 100 years: +45 %: 240 mins: Summer	Pipe	POND_ G	OUTFAL L_G	22.178	21.368	0.226	947.235	0.7	0.04	41.5	Surch arged
SW 9.010	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CH 50	POND H	20.830	18.648	0.391	918.780	5.8	0.86	1308. 1	OK
SW9.002	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CH 37	MH_CH 38	25.770	23.909	0.202	102.162	2.2	0.27	184.3	OK
SW9.001	FSR: 100 years: +45 %: 60 mins: Winter	Pipe	MH_CH 36	MH_CH 37	25.710	24.636	0.137	104.456	0.9	0.03	17.3	Surch arged
SW9.000	FSR: 100 years: +45 %: 15 mins: Summer	Pipe	GG_H2	MH_CH 36	27.826	24.386	0.458	28.223	0.5	0.07	42.7	OK
SW10.000	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	GG_H4	MH_CH 41	22.618	20.523	0.250	9.094	0.5	0.08	15.7	OK
SW 12.001	FSR: 100 years: +45 %: 15 mins: Summer	Pipe	MH_CH 31	MH_CH 47	22.430	19.901	0.450	8.983	0.7	0.04	21.5	OK
SW 12.000	FSR: 100 years: +45 %: 60 mins: Winter	Pipe	GG_H5	MH_CH 31	22.085	20.154	0.450	68.351	0.3	0.03	11.2	Surch arged
SW5.000	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	GG_G6	MH_CG 19	27.877	25.807	0.450	22.375	0.6	0.16	44.3	OK
SW5.001	FSR: 100 years: +45 %: 30 mins: Winter	Pipe	MH_CG 19	MH_CG 20	27.580	25.948	0.061	36.852	1.0	0.04	12.5	Surch arged
SW6.000	FSR: 100 years: +45 %: 60 mins: Summer	Pipe	GG_G5	MH_CG 29	26.056	24.943	0.300	140.813	0.7	0.12	33.6	Surch arged
SW6.001	FSR: 100 years: +45 %: 960 mins: Summer	Pipe	MH_CG 29	MH_CG 28	25.619	24.756	0.088	860.722	1.6	0.08	25.3	Surch arged
SW1.002	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CF 2	MH_CF3	26.210	23.543	0.145	28.342	1.3	0.09	59.3	OK
SW1.000	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	GG_F8	MH_CF1	26.085	24.315	0.150	1.965	0.4	0.24	3.5	Surch arged

SW1.001	FSR: 100 years: +45 %: 480 mins: Winter	Pipe	MH_CF 1	MH_CF2	26.150	24.766	0.024	38.312	0.6	0	0.8	Surch arged
SW5.013	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CG 32	MH_CG 34	25.970	22.884	0.600	253.130	1.5	0.89	426.6	Surch arged
SW1.010	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	Swale	MH_CF1 3	21.381	19.883	0.450	6.529	0.1	0.04	7.5	OK
SW1.011	FSR: 100 years: +45 %: 60 mins: Summer	Pipe	MH_CF 13	Pond_F	21.720	20.186	0.169	25.464	0.5	0.01	4.3	Surch arged
SW10.002	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CH 42	MH_CH 45	22.770	20.209	0.465	94.343	1.3	0.34	199.5	OK
SW5.010	FSR: 100 years: +45 %: 15 mins: Summer	Pipe	MH_CG 28	MH_CG 30	26.050	22.706	0.301	109.316	1.1	0.26	160.0	OK
SW5.009	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CG 27	MH_CG 28	26.160	23.061	0.185	88.421	2.3	0.31	144.4	OK
SW5.008	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CG 26	MH_CG 27	26.440	23.356	0.222	88.716	1.9	0.48	149.2	OK
SW10.003	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CH 45	MH_CH 40	23.770	20.395	0.600	93.899	1.0	0.47	265.7	Surch arged
SW 9.009	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CH 49	MH_CH 50	21.512	19.343	0.750	919.133	3.0	1.33	1336. 3	Surch arged
SW9.005	FSR: 100 years: +45 %: 15 mins: Summer	Pipe	MH_CH 40	MH_CH 46	24.580	20.115	0.750	416.692	1.6	0.61	616.0	OK
SW9.006	FSR: 100 years: +45 %: 15 mins: Summer	Pipe	MH_CH 46	MH_CH 47	23.070	20.115	0.750	416.175	1.6	0.63	635.9	Surch arged
SW10.001	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CH 41	MH_CH 42	22.610	20.520	0.139	6.115	0.9	0.02	8.9	OK
SW 9.007	FSR: 100 years: +45 %: 15 mins: Summer	Pipe	MH_CH 47	MH_CH 48	22.990	20.040	0.750	423.785	1.5	0.67	675.3	Surch arged
SW 9.008	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CH 48	MH_CH 49	22.650	20.052	0.750	920.385	3.0	1.33	1342. 1	Surch arged
SW8.005	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CG 41	MH_CG 42	25.920	23.122	0.320	231.737	3.1	0.78	376.6	OK
SW8.006	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CG 42	MH_CH 48	24.230	21.922	0.283	231.490	3.2	0.66	339.9	OK

SW5.011	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CG 30	MH_CG 31	25.990	22.920	0.600	117.919	1.1	0.38	163.1	Surcharged
SW5.012	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CG 31	MH_CG 32	26.080	22.948	0.600	118.295	1.4	0.58	242.8	Surcharged
SW7.000	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	GG_G5 (1)	MH_CG 33	26.867	24.643	0.300	10.849	0.5	0.13	10.9	OK
SW7.001	FSR: 100 years: +45 %: 120 mins: Summer	Pipe	MH_CG 33	MH_CG 32	25.840	24.860	0.058	88.970	0.7	0.08	7.1	Surcharged
SW1.006	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CF 6	MH_CF7	24.310	21.359	0.351	134.725	1.5	0.32	258.9	OK
SW1.004	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CF 4	MH_CF5	24.630	21.671	0.387	135.033	1.4	0.7	277.2	OK
SW1.005	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CF 5	MH_CF6	24.480	21.550	0.315	134.888	1.8	0.67	267.6	OK
SW5.006	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CG 24	MH_CG 25	26.870	23.674	0.274	89.183	1.6	0.74	157.6	OK
SW5.007	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CG 25	MH_CG 26	26.640	23.544	0.244	88.916	1.7	0.43	153.9	OK
SW5.004	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CG 22	MH_CG 23	27.290	24.234	0.258	90.100	1.8	0.33	168.5	OK
SW5.005	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CG 23	MH_CG 24	27.110	23.815	0.309	89.641	1.4	0.67	162.5	OK
SW5.002	FSR: 100 years: +45 %: 120 mins: Winter	Pipe	MH_CG 20	MH_CG 21	27.430	24.661	0.056	156.090	1.1	0.04	12.5	OK
SW5.003	FSR: 100 years: +45 %: 120 mins: Winter	Pipe	MH_CG 21	MH_CG 22	27.390	24.475	0.080	155.849	1.3	0.03	12.5	OK
SW8.003	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CG 39	MH_CG 40	26.400	24.104	0.450	231.816	2.5	1.51	400.1	Surcharged
SW8.004	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CG 40	MH_CG 41	26.260	23.713	0.450	231.754	2.5	1.66	395.4	Surcharged
SW8.001	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CG 37	MH_CG 38	27.180	25.777	0.450	231.533	2.6	1.12	418.0	Surcharged
SW8.002	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CG 38	MH_CG 39	26.510	24.507	0.450	231.842	2.6	1.48	407.1	Surcharged

SW9.003	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CH 38	MH_CH 39	25.300	23.372	0.170	101.388	2.7	0.16	176.7	OK
SW9.004	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CH 39	MH_CH 40	24.970	21.461	0.169	100.849	2.6	0.16	172.9	OK
SW11.000	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CH 43	MH_CH 44	21.770	20.224	0.090	0.078	0.4	0.03	11.1	OK
SW11.001	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CH 44	MH_CH 42	22.240	20.219	0.168	0.520	0.6	0.06	36.7	OK

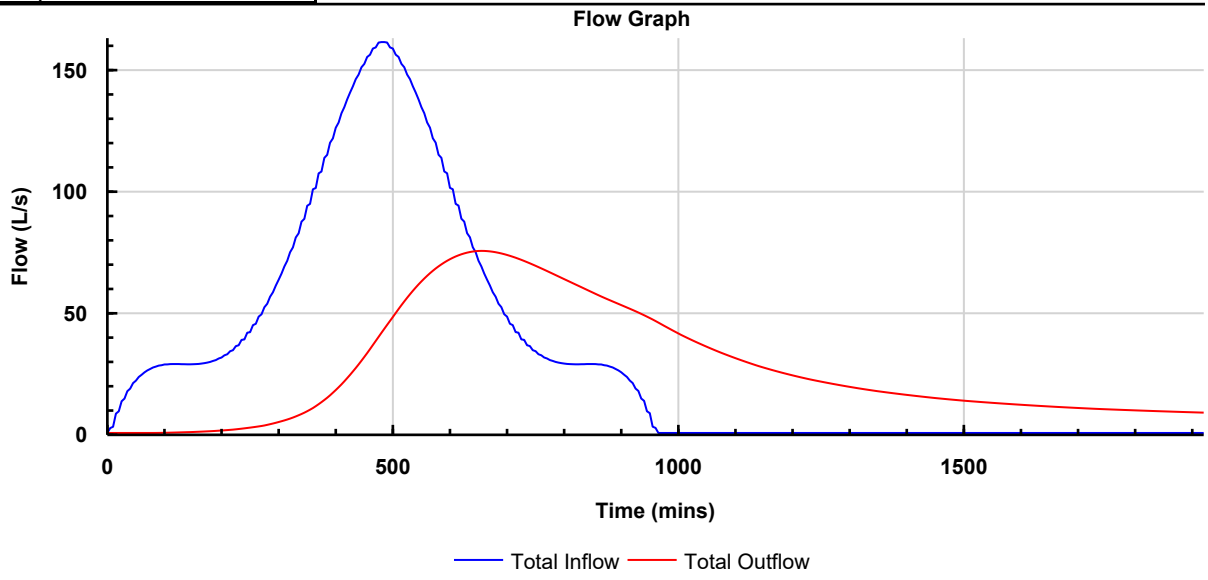
5018551 : Main Road SW Infodrainage Calcs P02	Date: 01/12/2023			RIDGE
	Designed by: BT	Checked by:	Approved By:	
Report Details: Type: Phase Management Storm Phase: Phase	Ridge:			

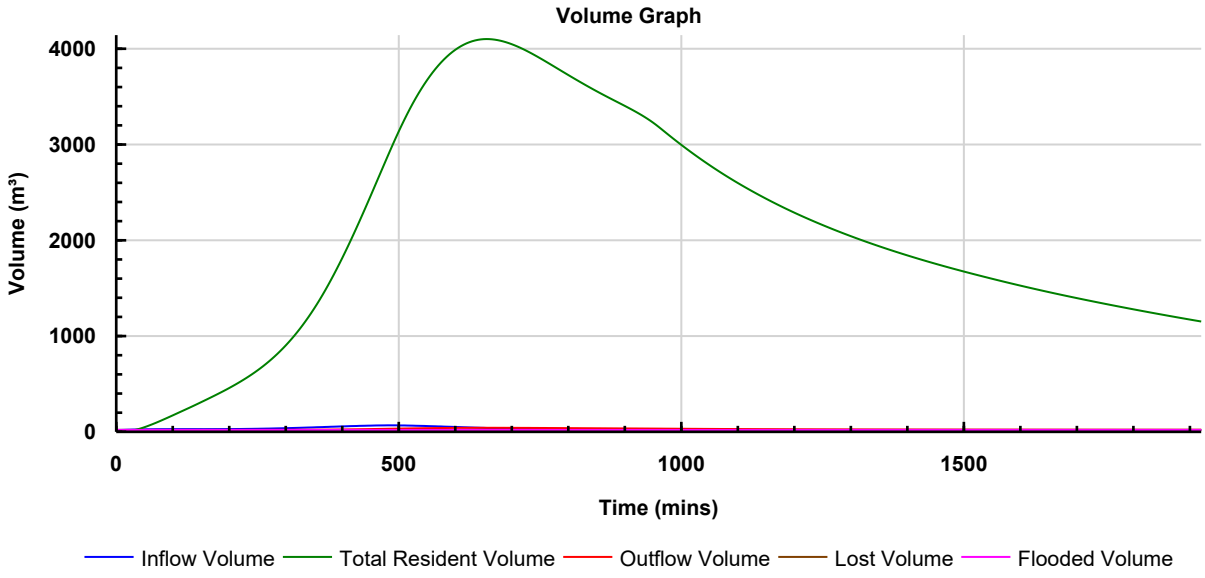
Phase
FSR: 1 years: Increase Rainfall (%): +0: 960 mins: Winter

Tables

Name	Max. Inflow (L/s)	Total Inflow Volume (m³)	Max. Outflow (L/s)	Total Outflow Volume (m³)
OUTFALL_H			37.7	1494.465
OUTFALL_F			10.0	567.986
OUTFALL_G			27.9	1024.745
TOTAL	161.5	3678.825	75.2	3087.196

Graphs





5018551 : Main Road SW Infodrainage Calcs P02	Date: 01/12/2023			RIDGE
	Designed by: BT	Checked by:	Approved By:	
Report Details: Type: Phase Management Storm Phase: Phase	Ridge:			

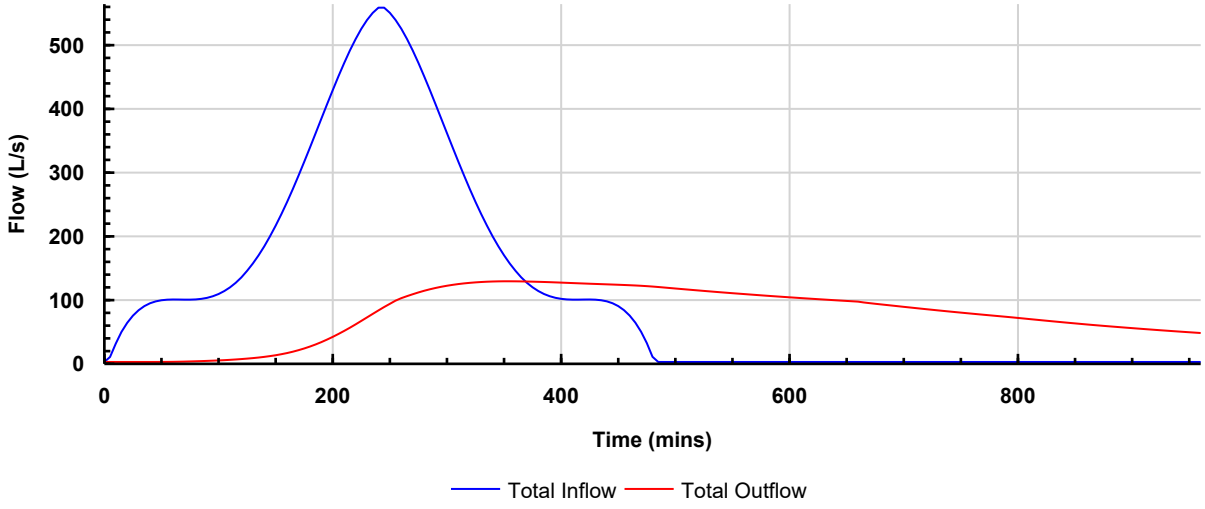
Phase
FSR: 30 years: Increase Rainfall (%): +0: 480 mins: Winter

Tables

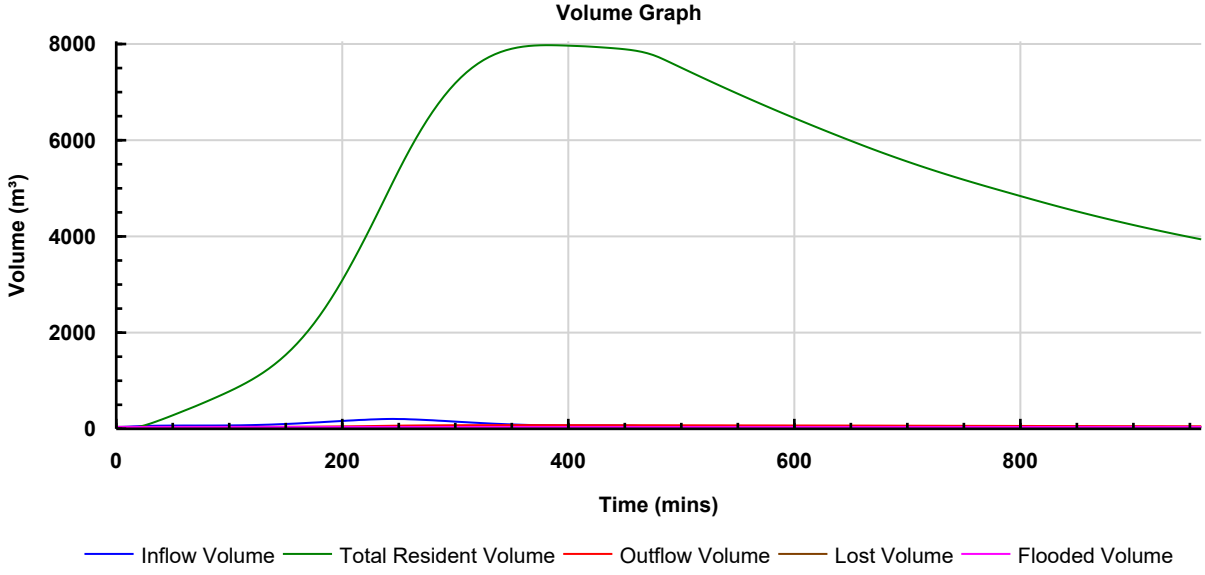
Name	Max. Inflow (L/s)	Total Inflow Volume (m³)	Max. Outflow (L/s)	Total Outflow Volume (m³)
OUTFALL_H			65.7	2221.736
OUTFALL_F			20.7	532.707
OUTFALL_G			41.4	1573.297
TOTAL	558.8	6366.310	127.3	4327.740

Graphs

Flow Graph



Volume Graph



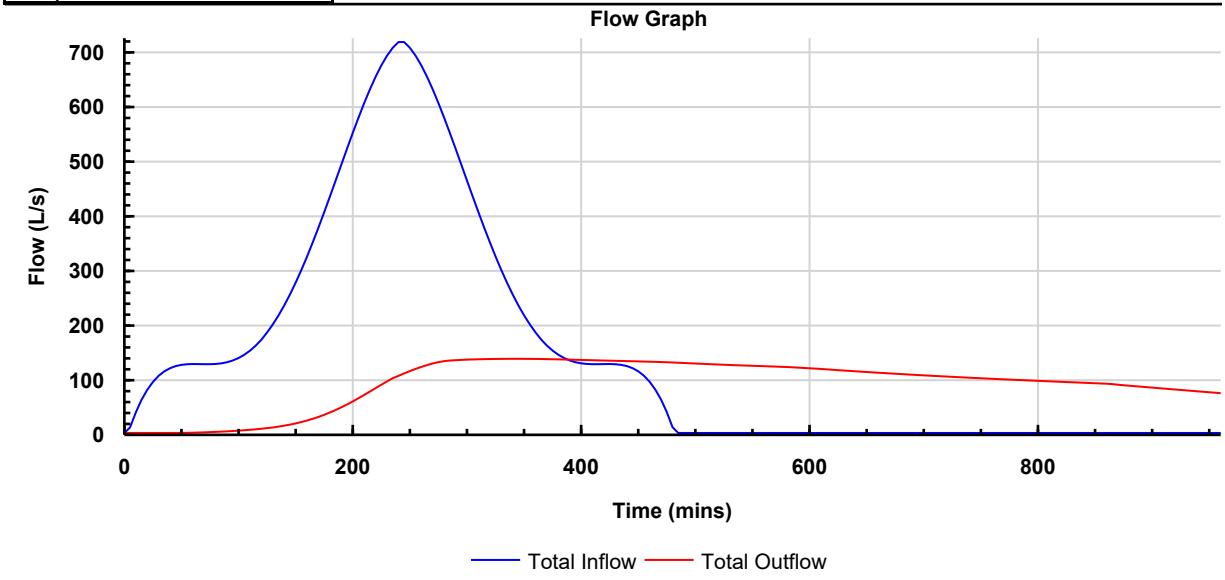
5018551 : Main Road SW Infodrainage Calcs P02	Date: 01/12/2023			RIDGE
	Designed by: BT	Checked by:	Approved By:	
Report Details: Type: Phase Management Storm Phase: Phase	Ridge:			

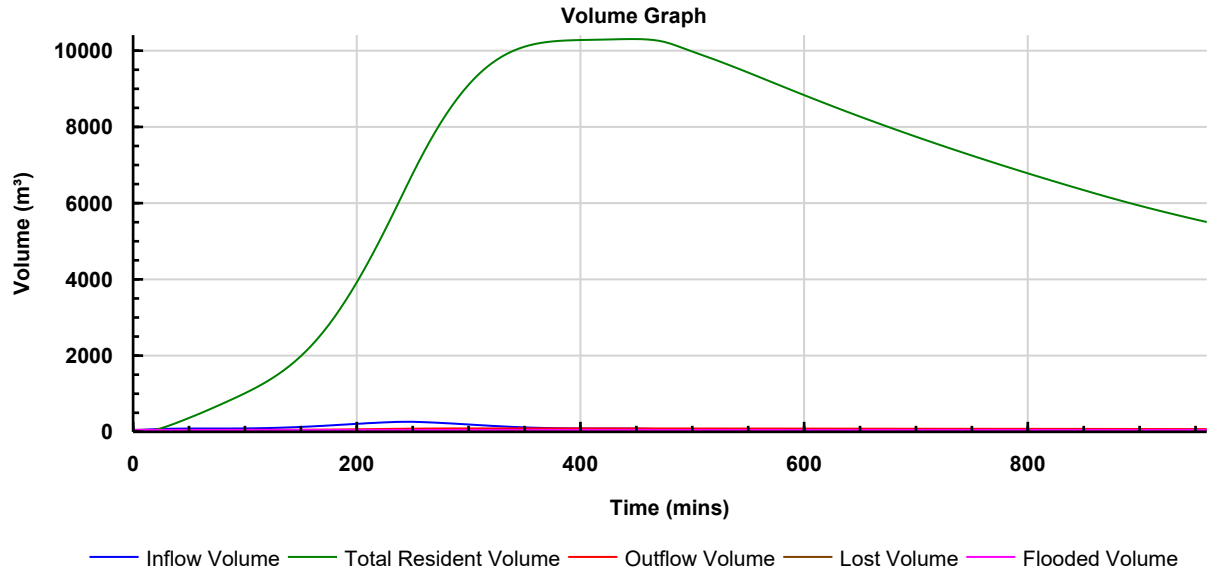
Phase
FSR: 100 years: Increase Rainfall (%): +0: 480 mins: Winter

Tables

Name	Max. Inflow (L/s)	Total Inflow Volume (m³)	Max. Outflow (L/s)	Total Outflow Volume (m³)
OUTFALL_H			69.6	2706.451
OUTFALL_F			25.7	648.932
OUTFALL_G			41.4	1878.391
TOTAL	718.9	8189.674	136.4	5233.774

Graphs





5018551 : Main Road SW Infodrainage Calcs P02	Date: 01/12/2023			RIDGE
	Designed by: BT	Checked by:	Approved By:	
Report Details: Type: Phase Management Storm Phase: Phase	Ridge:			

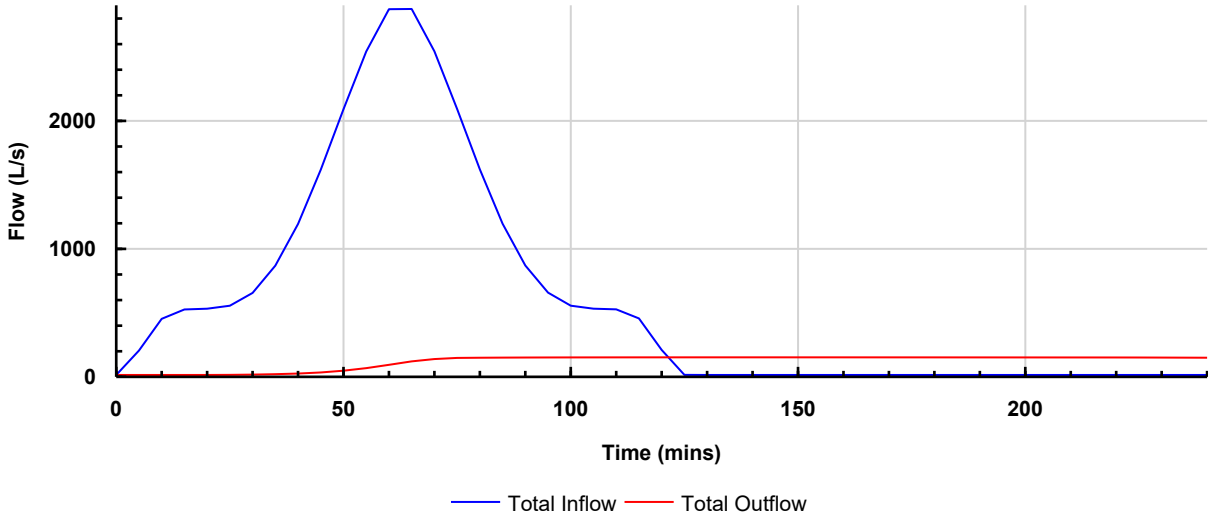
Phase
FSR: 100 years: Increase Rainfall (%): +45: 120 mins: Winter

Tables

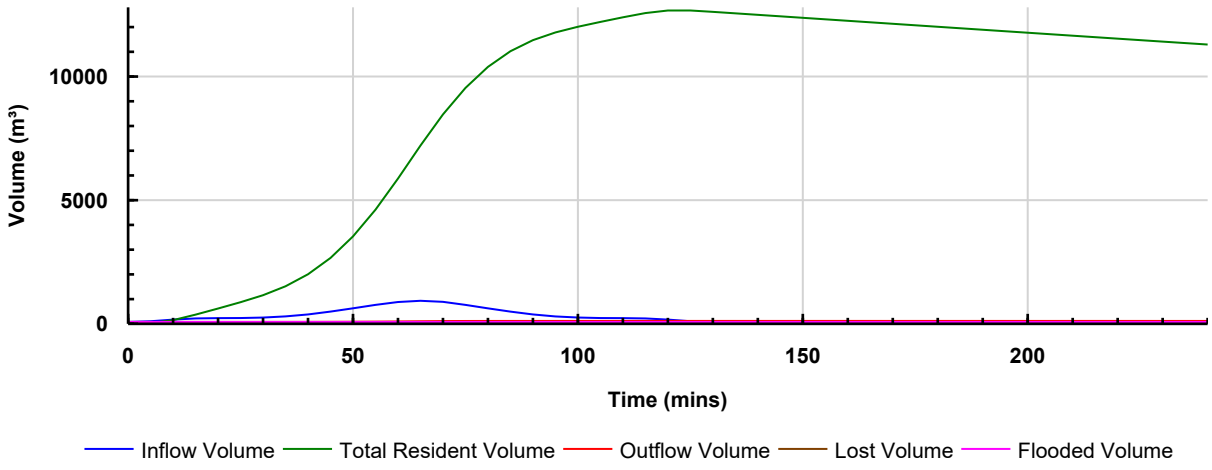
Name	Max. Inflow (L/s)	Total Inflow Volume (m³)	Max. Outflow (L/s)	Total Outflow Volume (m³)
OUTFALL_H			70.4	759.921
OUTFALL_F			26.8	291.410
OUTFALL_G			41.3	463.683
TOTAL	2874.4	8415.893	138.5	1515.014

Graphs

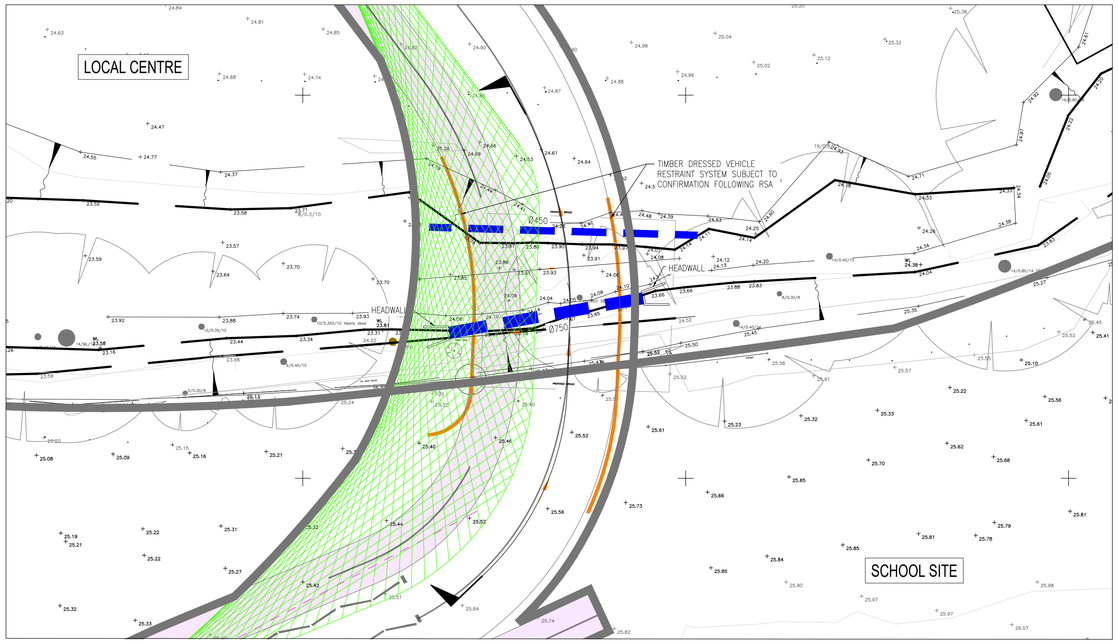
Flow Graph



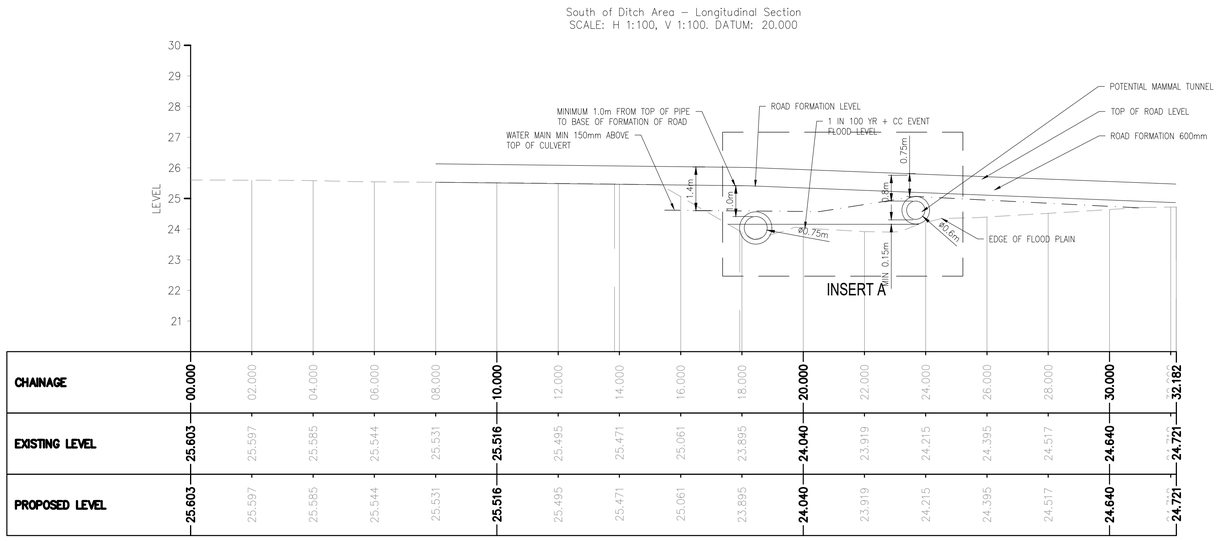
Volume Graph



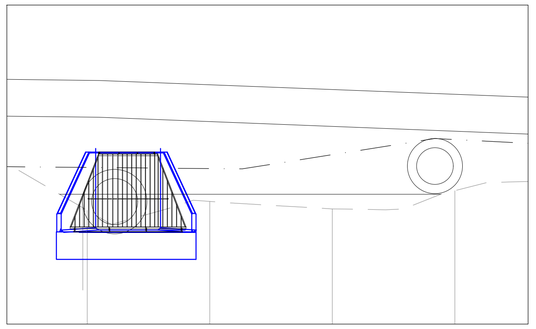
APPENDIX E
CROSSING POINT DRAWINGS



OVERALL PLAN
SCALE 1:200



CHAINAGE	**00.000**	02.000	04.000	06.000	08.000	**10.000**	12.000	14.000	16.000	18.000	**20.000**	22.000	24.000	26.000	28.000	**30.000**	**32.182**
EXISTING LEVEL	**25.603**	25.597	25.585	25.544	25.531	**25.516**	25.495	25.471	25.061	23.895	**24.040**	23.919	24.215	24.395	24.517	**24.640**	**24.721**
PROPOSED LEVEL	**25.603**	25.597	25.585	25.544	25.531	**25.516**	25.495	25.471	25.061	23.895	**24.040**	23.919	24.215	24.395	24.517	**24.640**	**24.721**



INSERT A
SCALE 1:50

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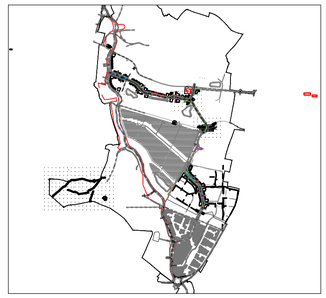

SITE PLAN
SCALE : 1:5000

REV	DESCRIPTION	DATE	DRAWN
P04	LEVELS ADJUST FOR MAMMAL TUNNELS AND TW REQURIEMENTS	01/12/23	PO
P03	UPDATED LENGTH PIPE AND MAMMAL	27/07/2023	PO
P02	MAMMAL TUNNEL REPOSITIONED	12/07/2023	JM
P01	UPDATE DRAWING WITH COMMENTS	05/07/2023	PO
-	INITIAL ISSUE	18/05/2023	RML

ORIGINATOR:

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WINCHESTER,
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TEL: 01962 834400
WWW.RIDGE.CO.UK

CLIENT:

EASTLEIGH BOROUGH COUNCIL

IN ASSOCIATION WITH:

PROJECT:
ONE HORTON HEATH
SITE WIDE
INFRASTRUCTURE DELIVERY

TITLE:
PROPOSED ROAD RC05
CROSSING ROUTES
SECTIONS & PLAN

TECH:	CSE:	ICSE:	SCALE: AS SHOWN @ A1
RML			INITIAL ISSUE: 18/05/2023

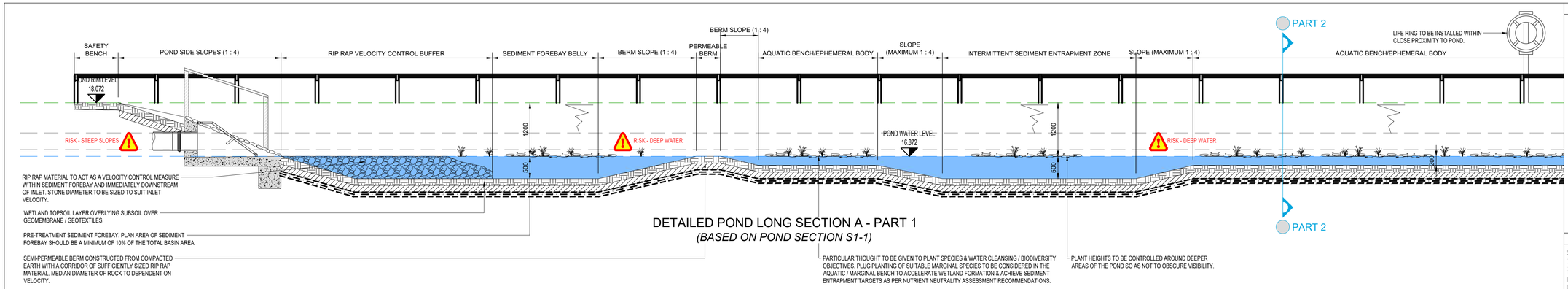
STATUS:
PRELIMINARY

DRAWING No:

PROJECT:	ORG:	ZONE:	LEVEL:	TYPE:	ROLE:	NUMBER:	REV:
5018551	RDG	XX	ST	DR	C	0595	P04

APPENDIX F

SUDS PLAN DRAWINGS



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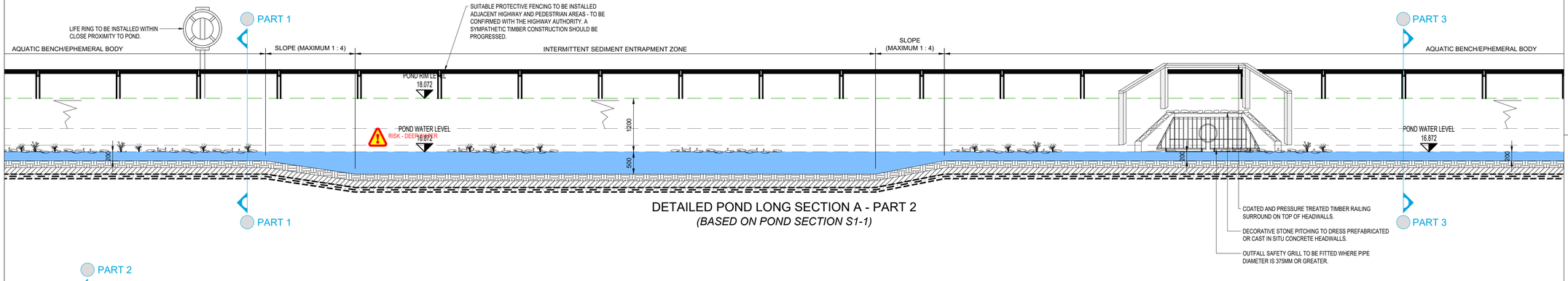

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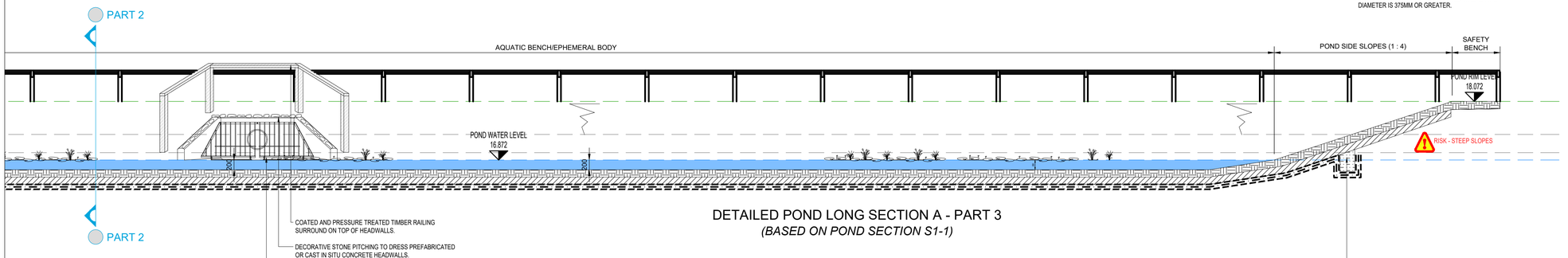

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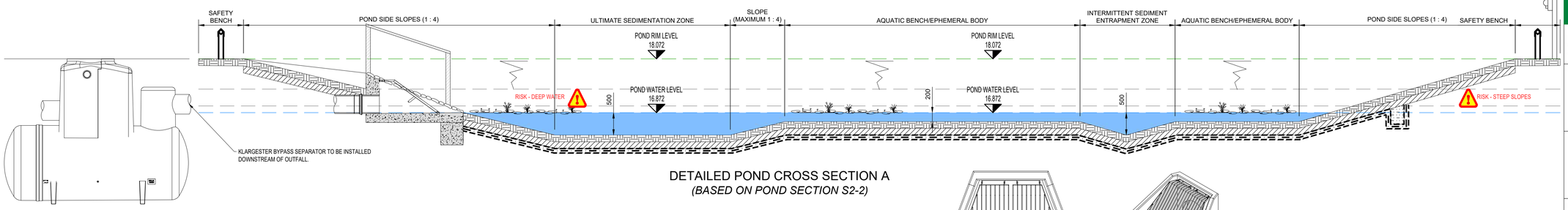

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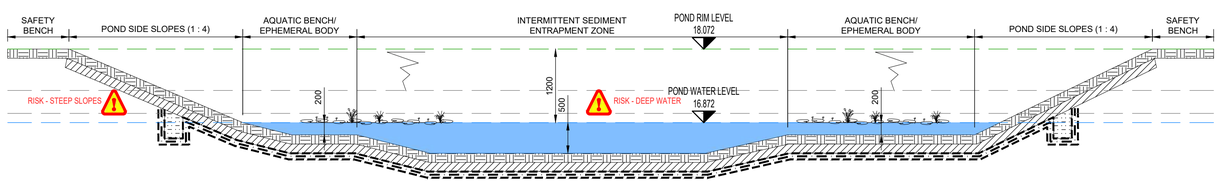

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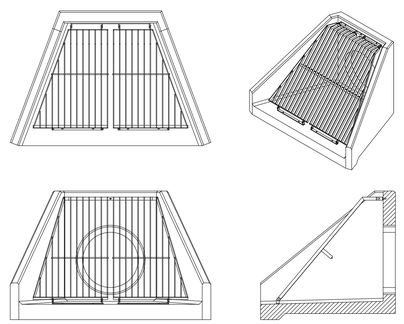

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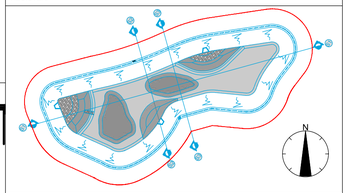

WESTERN POND EXTRACT

REV	DESCRIPTION	DATE	DRAWN
P01	AMENDMENTS MADE IN SEDIMENTATION AREAS	17/02/2023	RML
-	INITIAL ISSUE	10/02/2023	ZS

ORIGINATOR:

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TEL: 01962 834400
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CLIENT:

EASTLEIGH BOROUGH COUNCIL

IN ASSOCIATION WITH:

PROJECT:
ONE HORTON HEATH
SITE WIDE
INFRASTRUCTURE DELIVERY

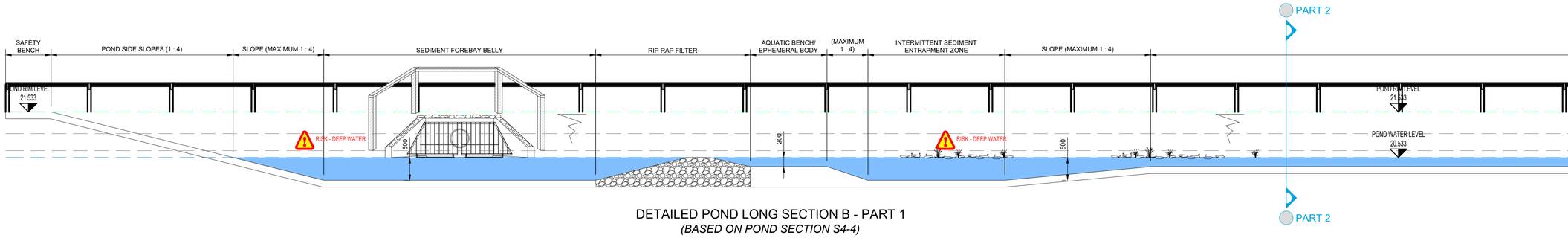
TITLE:
DETAILED SuDS SECTIONS
WESTERN POND

TECH:	CSE:	ICSE:	SCALE: 1:50 @ A1
RML	ZS	TC	INITIAL ISSUE: 10/02/2023

STATUS:
PRELIMINARY

DRAWING No:

PROJECT:	ORG:	ZONE:	LEVEL:	TYPE:	ROLE:	NUMBER:	REV:
5018551	RDG	XX	ST	DR	C	0570	P01



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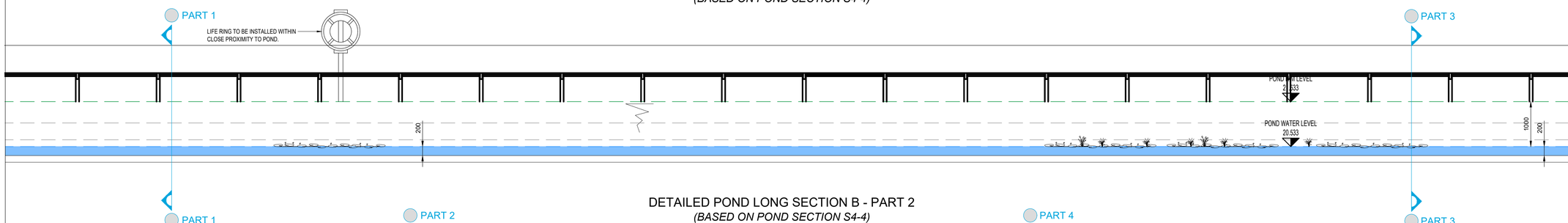

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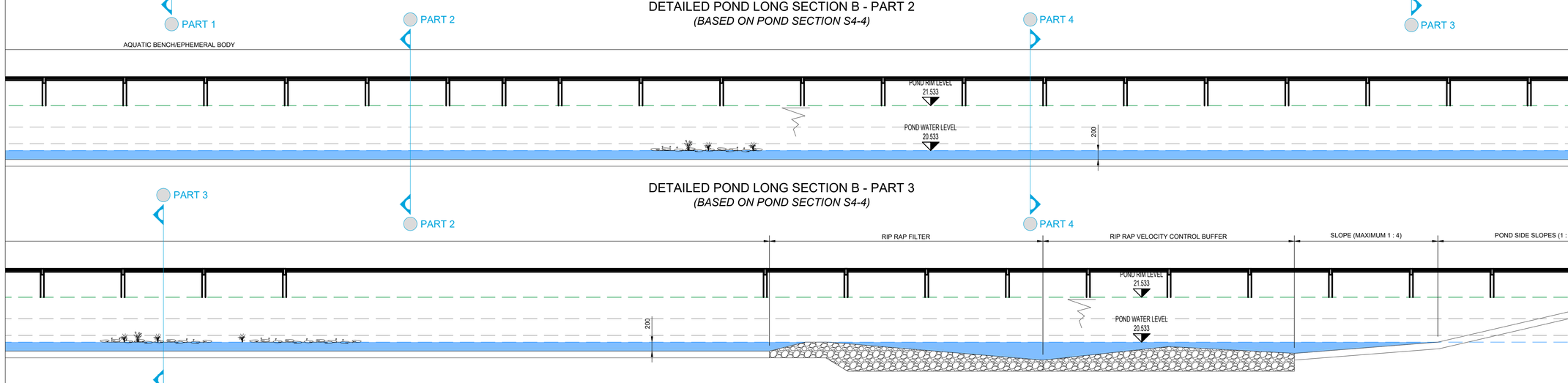

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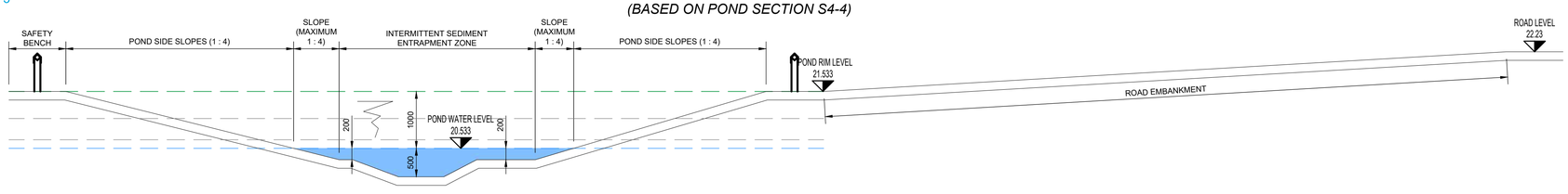

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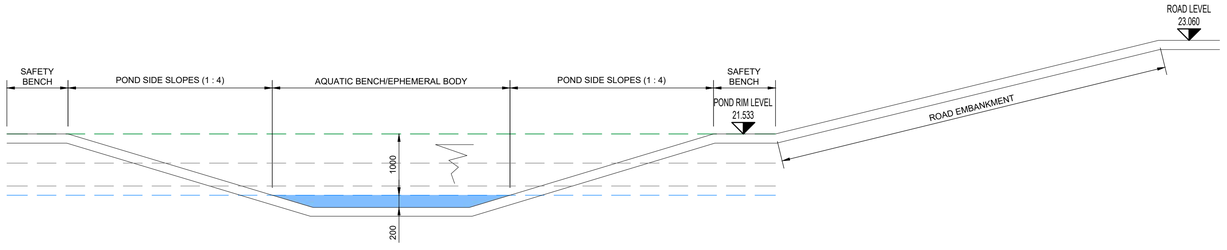

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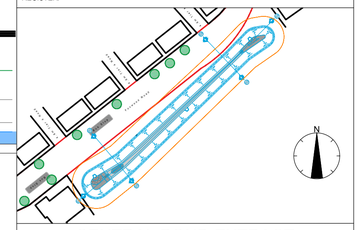

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REV	DESCRIPTION	DATE	DRAWN
-	INITIAL ISSUE	17/02/2023	RML

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1 Royal Court,
Kings Worthy,
Winchester,
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TEL: 01962 834400
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CLIENT:

EASTLEIGH BOROUGH COUNCIL

IN ASSOCIATION WITH:

PROJECT:
ONE HORTON HEATH
SITE WIDE
INFRASTRUCTURE DELIVERY

TITLE:
DETAILED SuDS SECTIONS
CENTRAL POND

TECH:	CSE:	ICSE:	SCALE: 1:50 @ A1
RML	ZS	TC	INITIAL ISSUE: 17/02/2023

STATUS:
PRELIMINARY

DRAWING No:

PROJECT:	ORG:	ZONE:	LEVEL:	TYPE:	ROLE:	NUMBER:	REV:
5018551	RDG	XX	ST	DR	C	0571	-

RIDGE

SPINE ROAD
SUDS STRATEGY

ONE HORTON HEATH
EASTLEIGH BOROUGH COUNCIL

December 2023

SPINE ROAD SUDS STRATEGY
ONE HORTON HEATH

Prepared for

Eastleigh Borough Council
Eastleigh House,
Upper Market Street,
Eastleigh,
SO50 9YN

Prepared by

Ridge and Partners LLP
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Winchester
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Contact

Tom Clark
Senior Civil Engineer
tomclark@ridge.co.uk
07392 283451

RIDGE

PROJECT NAME: Spine Road SuDS Strategy
PROJECT NUMBER: 5018551
DOCUMENT REFERENCE: 5018551-RDG-XX-XX-DOC-C-9951
DOCUMENT STATUS: S2 – Suitable for Information

REV	DATE	DESCRIPTION	AUTHOR	CSE	ICSE
-	16.06.23	Initial Issue	Binam Tiwari MSc GMICE	Chris Levitt BEng (Hons) EngTech MICE	Gary Beamish Eng.C, C.Eng, C.Env, CWEM, MICE, MCIWEM, FQSI, FCInstCES
P01	26.07.23	Updated to Client's comment	Binam Tiwari MSc GMICE	Chris Levitt BEng (Hons) EngTech MICE	Gary Beamish Eng.C, C.Eng, C.Env, CWEM, MICE, MCIWEM, FQSI, FCInstCES
P02	01.12.23	Updated to Client's comment	Binam Tiwari MSc GMICE	Tom Clark GMICE MEng	Chris Levitt BEng (Hons) EngTech MICE
P03	04.12.23	Updated to Client's comment	Binam Tiwari MSc GMICE	Tom Clark GMICE MEng	Chris Levitt BEng (Hons) EngTech MICE
P04	08.12.23	Updated Appendix C	Binam Tiwari MSc GMICE	Tom Clark GMICE MEng	Chris Levitt BEng (Hons) EngTech MICE
P05	22.02.24	Updated to LLFA's comment	Binam Tiwari MSc GMICE	Tom Clark GMICE MEng	Chris Levitt BEng (Hons) EngTech MICE
P06	10.09.24	Updated to LLFA Comments	Sami Sultan BSc Eng	Tom Clark GMICE MEng	Chris Levitt BEng (Hons) EngTech MICE

RIDGE

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SECTION 1
INTRODUCTION

1. PROJECT BACKGROUND

1.1. Overview

Ridge & Partners prepared this SuDS Strategy on behalf of Eastleigh Borough Council. The proposed development has been designed in full accordance with the Development Plan and Outline Planning Application (OPA) O/20/89498, which has a resolution to grant consent subject to S106 negotiations relating to education. This application is for full planning consent due to the time for these negotiations to complete. Submitting details of the Secondary Infrastructure Road (SIR) as a full planning application will deliver the SIR in accordance with, and as part of the OPA, but enable commencement more quickly than waiting for the resolution of the OPA S106 and the determination of an application for Reserved Matters Approval of details of the SIR. The site is located at One Horton Heath at approximately SO50 7BZ, Grid reference SU 48905 16935 (hereby referred to as the 'Application Site- reserved matters planning application.

1.2. Site Location

The application site is situated south of the Fir Tree Lane and north of the proposed Lower Acre development, adjacent to an existing solar farm. The existing site is currently an empty greenfield area.

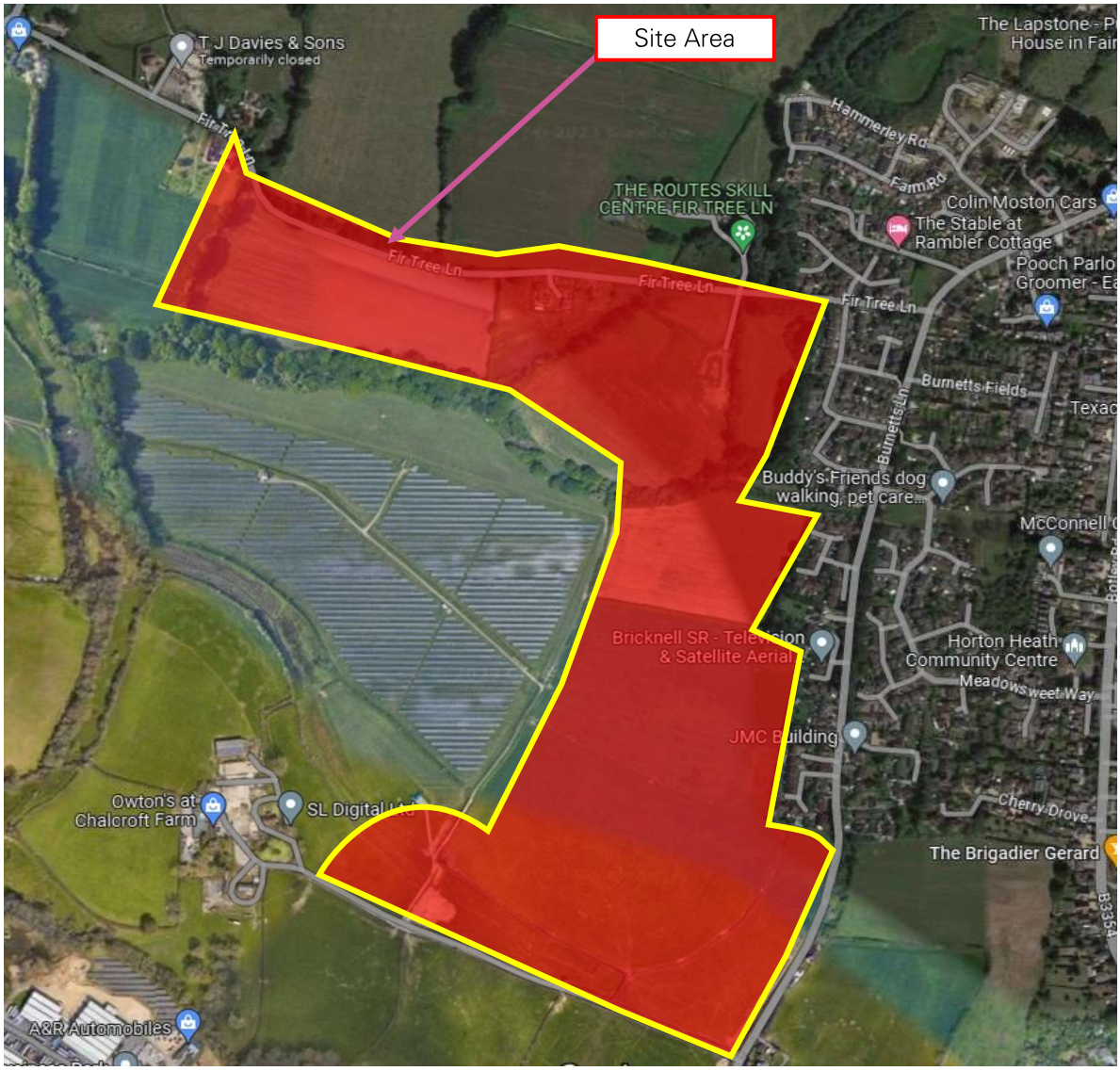


Figure 1: Site Location Plan

The Ordnance Survey grid reference for the application site is SU 48807 17233, approximately 448807N, 117233E and the nearest postcode is SO50 7BZ. The total area of the proposed application site is 21.56ha.

1.3. Hydrological Settings

The nearest river is the River Itchen which is located 1.67km away from the proposed development. The tributary of Foxwood Stream runs between the solar farm and the Fir Tree Lane and north of the proposed one Horton heath Lower Acre site as shown in figure 3.

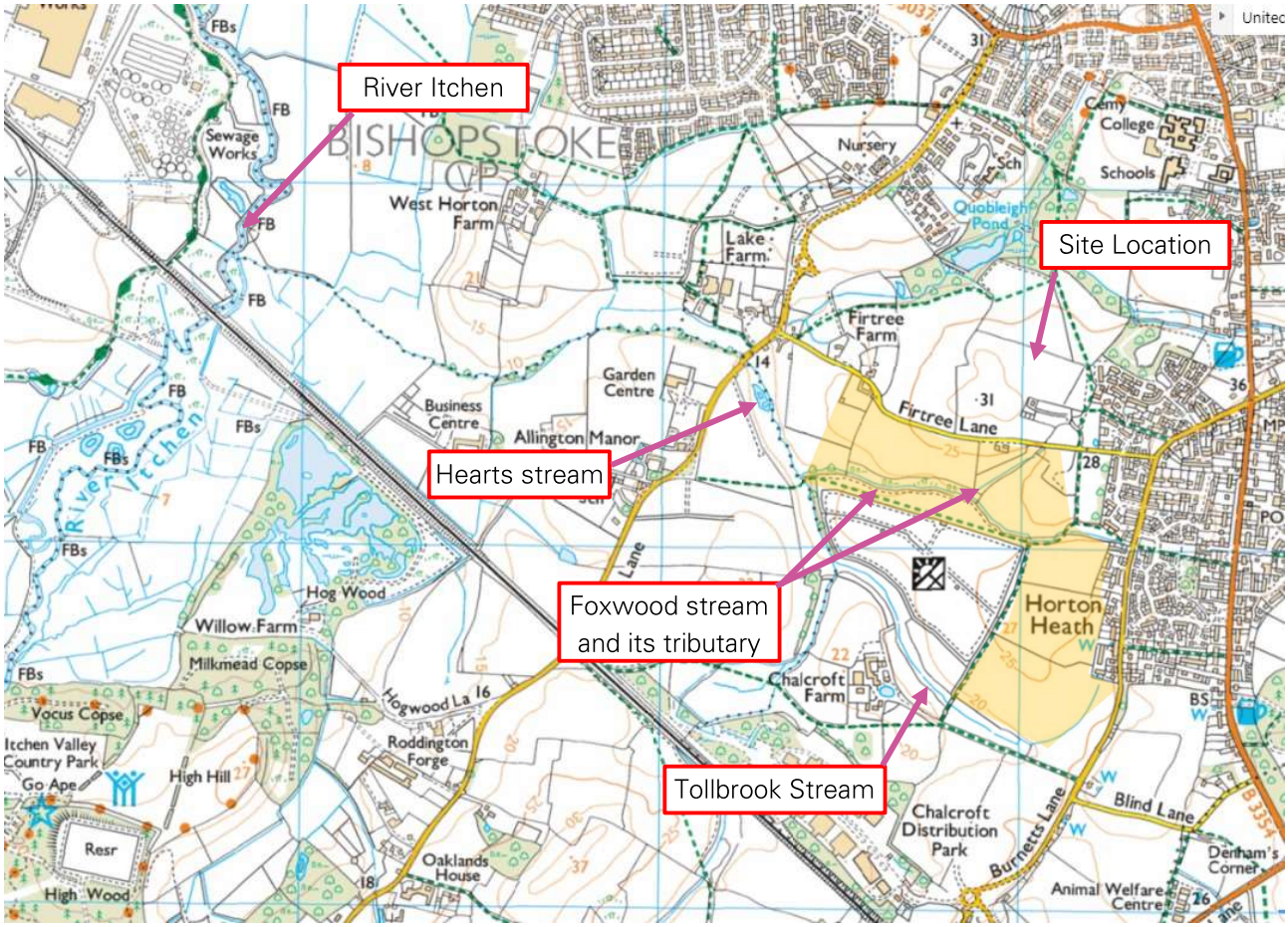


Figure 2: Location of River Itchen from the proposed site

1.4. Proposed Development

The proposed development is a part of the One Horton Heath Site Wide Infrastructure Delivery, which includes the construction of the roads, residential homes, local centres, school and its playground. However, this report primarily focuses on the spine road that spans between Fir Tree Lane and Foxwood stream, connecting the west and east portion of the development. This spine road crosses the Foxwood Stream and runs alongside the solar farm before linking to the northern section of the proposed Lower Acre site.

SECTION 2
WATER QUALITY

2. WATER QUALITY

2.1. Introduction

The proposed development utilises flow paths through swales and pond before making its final destination to the nearest watercourse, Foxwood Stream and its tributaries in addition to some catchments out falling into TollBrook stream. Water is collected from the road into the pond, treated in the pond then into a Downstream defender before making its way to the watercourse.

Refer to Appendix A for overall drainage layout.

2.2. Simple Index Tool

The Simple Index Approach has been utilised to assess the water quality management set out in the SuDS Manual, with appropriate cross referencing to the relevant 'Design Conditions'.

The results of these assessments are in the following tables for each catchment area and confirm that the proposed spine roads and access roads are suitable designed into maintain water quality.

Catchment F

Access Road to Pond F

SUMMARY TABLE	
Land Use Type	Low traffic roads (e.g. residential roads and general access roads, < 300 traffic movements/day)
Pollution Hazard Level	Low
Pollution Hazard Indices	
TSS	0.5
Metals	0.4
Hydrocarbons	0.4
SuDS components proposed	
Component 1	Detention Basin
SuDS Pollution Mitigation Indices	
TSS	0.5
Metals	0.5
Hydrocarbons	0.6
SuDS components proposed	

Component 2	Proprietary treatment system (Downstream defender)
SuDS Pollution Mitigation Indices	
TSS	0.5
Metals	0.4
Hydrocarbons	0.8
Combined Pollution Mitigation Indices	
TSS	0.75
Metals	0.7
Hydrocarbons	>0.95
Acceptability of Pollution Mitigation	
TSS	Sufficient
Metals	Sufficient
Hydrocarbons	Sufficient

Spine road to pond F

SUMMARY TABLE	
Land Use Type	Roads (excluding low traffic roads, highly frequented lorry approaches to industrial estates, trunk roads/motorways)
Pollution Hazard Level	Medium
Pollution Hazard Indices	
TSS	0.7
Metals	0.6
Hydrocarbons	0.7
SuDS components proposed	
Component 1	Detention Basin

SuDS Pollution Mitigation Indices	
TSS	0.5
Metals	0.5
Hydrocarbons	0.6
SuDS components proposed	
Component 2	Proprietary treatment system (Downstream Defender)
SuDS Pollution Mitigation Indices	
TSS	0.5
Metals	0.4
Hydrocarbons	0.8
Combined Pollution Mitigation Indices	
TSS	0.75
Metals	0.7
Hydrocarbons	>0.95
Acceptability of Pollution Mitigation	
TSS	Sufficient
Metals	Sufficient
Hydrocarbons	Sufficient

Spine road to Pond F via swale

SUMMARY TABLE	
Land Use Type	Roads (excluding low traffic roads, highly frequented lorry approaches to industrial estates, trunk roads/motorways)
Pollution Hazard Level	Medium
Pollution Hazard Indices	
TSS	0.7
Metals	0.6
Hydrocarbons	0.7
SuDS components proposed	
Component 1	Detention Basin
SuDS Pollution Mitigation Indices	
TSS	0.5
Metals	0.5
Hydrocarbons	0.6
SuDS components proposed	
Component 2	Proprietary treatment system (Downstream Defender)
SuDS Pollution Mitigation Indices	
TSS	0.5
Metals	0.4
Hydrocarbons	0.8
SuDS components proposed	
Component 3	Swale

SuDS Pollution Mitigation Indices	
SuDS Pollution Mitigation Indices	
TSS	0.5
Metals	0.6
Hydrocarbons	0.6
Combined Pollution Mitigation Indices	
TSS	>0.95
Metals	>0.95
Hydrocarbons	>0.95
Acceptability of Pollution Mitigation	
TSS	Sufficient
Metals	Sufficient
Hydrocarbons	Sufficient

Access road to Pond F via swale

SUMMARY TABLE	
Land Use Type	Low traffic roads (e.g. residential roads and general access roads, < 300 traffic movements/day)
Pollution Hazard Level	Low
Pollution Hazard Indices	
TSS	0.5
Metals	0.4
Hydrocarbons	0.4
SuDS components proposed	
Component 1	Pond
SuDS Pollution Mitigation Indices	
TSS	0.5
Metals	0.5
Hydrocarbons	0.6
SuDS components proposed	
Component 2	Proprietary treatment system (Downstream Defender)
SuDS Pollution Mitigation Indices	
TSS	0.5
Metals	0.4
Hydrocarbons	0.8
SuDS components proposed	
Component 3	Swale

SuDS Pollution Mitigation Indices	
SuDS Pollution Mitigation Indices	
TSS	0.5
Metals	0.6
Hydrocarbons	0.6
Combined Pollution Mitigation Indices	
TSS	>0.95
Metals	>0.95
Hydrocarbons	>0.95
Acceptability of Pollution Mitigation	
TSS	Sufficient
Metals	Sufficient
Hydrocarbons	Sufficient

Catchment G

Access Road to Pond G

SUMMARY TABLE	
Land Use Type	Low traffic roads (e.g. residential roads and general access roads, < 300 traffic movements/day)
Pollution Hazard Level	Low
Pollution Hazard Indices	
TSS	0.5
Metals	0.4
Hydrocarbons	0.4
SuDS components proposed	

Component 1	Detention Basin
SuDS Pollution Mitigation Indices	
TSS	0.5
Metals	0.5
Hydrocarbons	0.6
SuDS components proposed	
Component 2	Proprietary treatment system (Downstream Defender)
SuDS Pollution Mitigation Indices	
TSS	0.5
Metals	0.4
Hydrocarbons	0.8
Combined Pollution Mitigation Indices	
TSS	0.75
Metals	0.7
Hydrocarbons	>0.95
Acceptability of Pollution Mitigation	
TSS	Sufficient
Metals	Sufficient
Hydrocarbons	Sufficient

Spine road to pond G

SUMMARY TABLE	
Land Use Type	Roads (excluding low traffic roads, highly frequented lorry approaches to industrial estates, trunk roads/motorways)
Pollution Hazard Level	Medium
Pollution Hazard Indices	
TSS	0.7
Metals	0.6
Hydrocarbons	0.7
SuDS components proposed	
Component 1	Detention Basin
SuDS Pollution Mitigation Indices	
TSS	0.5
Metals	0.5
Hydrocarbons	0.6
SuDS components proposed	
Component 2	Proprietary treatment system (Downstream Defender)
SuDS Pollution Mitigation Indices	
TSS	0.7
Metals	0.7
Hydrocarbons	0.7
Combined Pollution Mitigation Indices	
TSS	0.75
Metals	0.7

Hydrocarbons	>0.95
Acceptability of Pollution Mitigation	
TSS	Sufficient
Metals	Sufficient
Hydrocarbons	Sufficient

Catchment H

Access Road to Pond H

SUMMARY TABLE	
Land Use Type	Low traffic roads (e.g. residential roads and general access roads, < 300 traffic movements/day)
Pollution Hazard Level	Low
Pollution Hazard Indices	
TSS	0.5
Metals	0.4
Hydrocarbons	0.4
SuDS components proposed	
Component 1	Detention Basin
SuDS Pollution Mitigation Indices	
TSS	0.5
Metals	0.5
Hydrocarbons	0.6
SuDS components proposed	
Component 2	Proprietary treatment system (Downstream defender)
SuDS Pollution Mitigation Indices	
TSS	0.7

Metals	0.4
Hydrocarbons	0.8
Combined Pollution Mitigation Indices	
TSS	0.75
Metals	0.7
Hydrocarbons	>0.95
Acceptability of Pollution Mitigation	
TSS	Sufficient
Metals	Sufficient
Hydrocarbons	Sufficient

Spine road to pond G

SUMMARY TABLE	
Land Use Type	Roads (excluding low traffic roads, highly frequented lorry approaches to industrial estates, trunk roads/motorways)
Pollution Hazard Level	Medium
Pollution Hazard Indices	
TSS	0.7
Metals	0.6
Hydrocarbons	0.7
SuDS components proposed	
Component 1	Detention Basin
SuDS Pollution Mitigation Indices	
TSS	0.5
Metals	0.5

Hydrocarbons	0.6
SuDS components proposed	
Component 2	Proprietary treatment system (Downstream Defender)
SuDS Pollution Mitigation Indices	
TSS	0.5
Metals	0.4
Hydrocarbons	0.8
Combined Pollution Mitigation Indices	
TSS	0.75
Metals	0.7
Hydrocarbons	>0.95
Acceptability of Pollution Mitigation	
TSS	Sufficient
Metals	Sufficient
Hydrocarbons	Sufficient

2.3. Removal of Nutrient (Nitrates and Phosphorous)

Ponds

Retention ponds are structures that provide both retention and treatment of contaminated storm water runoff. Retention ponds include a permanent pool of water into which storm water runoff is directed and outflows are controlled to reduced flow rate. A well-designed pond provides a community asset and opportunities for new habitats. The pond's physical, biological and chemical processes work to remove storm water pollutants. Sedimentation processes remove particulates, organic matter, and metals, while dissolved metals and nutrients are removed through biological uptake. In general, a higher-level storm water quantity control can be achieved as well as providing amenity benefits.

Landscaped depressions containing permanent pools of water, retention ponds are similar in many respects to detention basins, in that they can collect and temporarily store / attenuate surface water runoff and release it more slowly to the discharge point. However, they can provide an enhanced level of water quality treatment and also provide biodiversity and amenity benefits by supporting emergent and submerged vegetation along the waterline and within shallow marshy areas. Retention ponds need to be designed with suitable upstream

pre-treatment systems to prevent open water areas becoming blocked with silt, odorous due to pollution or stagnant.

The phosphorous within the pond will be alleviated using the following mechanism:

- Sediment removal device has been included upstream to prevent gross pollution and the volume of the pond being compromised by the build of up of sediments.
- The pond has been designed so that the deposited fine sediment on the bottom is not washed out in high flows.
- Uptake by plants and aquatic flora to reduce the phosphorous within the pond.

The nitrate within the pond will be alleviated using the following mechanism:

- Removal of course sediments within the sediment forebay.
- The permanent pool of water provides further settlement of fine sediments and removal of nutrients
- Nitrogen reducing native marginal and aquatic species (including evergreen plants).
- The incorporation of distinct zones in the large basin providing the water quality and quantity volume storage in a number of independent cells. These features create increased attenuation, longer pollutant removal pathways (and therefore enhanced pollution removal) an easier maintenance regime and more varied ecology.
- Basin include a sediment forebay, permanent micro pools, attenuation storage volume above permanent pool water level and aquatic benches surrounding the permanent micro pools, which support wetland planting, acting as a biological filter and providing ecology amenity and safety benefits. Around the micro pools shallow wet/marshy grassland areas provide further filtration.

Swale

Swales are a linear SuDS device often used along roads or paths. Dry swale is a good pollutant removal which provides significantly better performance for metals and nitrate. Dry swales typically remove 65 percent of total phosphorus (TP), 50 percent of total nitrogen (TN), and between 80 and 90 percent of metals.

The phosphorous within the swale will be alleviated using the following mechanism:

- By use of hydbrobrake, the flow entering the swale can be slowed down which help to reduce the phosphorous count within the swale.
- Uptake by plants and aquatic flora to reduce the phosphorous within the swale.
- Sediment bound phosphorous is removed through sedimentation.

SECTION 03

SUDS MAINTENANCE PLAN

3. SUDS MAINTENANCE PLAN

3.1. Introduction

This section sets out the principles for the long-term management and maintenance of the proposed surface water Sustainable Drainage Systems (SuDS) to be constructed to discharge surface water discharged from the spine road and the access road nearby within the area of One Horton Heath (See Appendix B for proposed site plan). The purpose of this section is to set out the basis of the SuDS Maintenance Plan for the development and to ensure that the management company is entrusted with a robust inspection and maintenance programme. It ensures that the optimum operation of the drainage network is continually maintained for the lifetime of the development and to prevent the increased risk of flooding both on and off site in accordance with the National Planning P9olicy Framework (NPPF).

All those responsible for maintenance should follow relevant Health and Safety legislation (Health and Safety at Work Regulations, 1999) for all activities listed within this section including lone working, if relevant) and risk assessments should always be undertaken. Any contractor employed by the Site Operator/Management Company shall carry out periodic maintenance of all such SuDS in accordance with the schedules listed in this section. Inspection checks shall be carried out by a qualified and competent person, at the minimum intervals listed within the schedules and the appropriate work carried out.

3.2. SuDs Layout

The storm water drainage strategy for the proposed development is to utilise a range of SuDS features to discharge the surface water to the nearest water course, Foxwood Stream via ponds. The layout for the proposed residential development is not confirmed yet. However, this application is for the infrastructural roads that serve the residential development.

The proposed storm water system contains the following SuDS Components:

- Ponds
- Swales
- Hydro brake Flow Controls
- Downstream Defenders

There are three categories of maintenance activities referred to in this Section:

– Regular maintenance (including inspections and monitoring).

Consists of basic tasks done on a frequent and predictable schedule, including vegetation management, litter and debris removal, and inspections.

– Occasional maintenance

Comprises tasks that are likely to be required periodically, but on a much less frequent and predictable basis than the routine tasks (sediment removal is an example).

– Remedial maintenance

Comprises intermittent tasks that may be required to rectify faults associated with the system, although the likelihood of faults can be minimised by good design. Where remedial work is found to be necessary, it is likely to be due to site-specific characteristics or unforeseen events, and as such timings are difficult to predict.

Ponds

There are 3 ponds present within the vicinity of the spine road which will be utilised to discharge the surface water from the spine road and the nearby catchments. The depth of the pond are as follows:

POND	DEPTH
Pond_F	1.0m
Pond_G	1.2m
Pond_H	1.5m

To ensure that the people who are in the vicinity of the pond are aware of the potential danger and also to minimize the risk of drowning, a lifesaving ring should be provided within the area of the pond.

Ponds will require regular maintenance to ensure continuing operation to design performance standards, and all designers should provide detailed specifications and frequencies for the required maintenance activities, along with likely machinery requirements and typical annual costs- within the Maintenance Plan. The treatment performance of ponds is dependent on maintenance, and robust management plans will be required to ensure maintenance is carried out in the long term. Different designs will have different operation and maintenance requirements, but this section gives some generic guidance.

Maintenance of ponds is relatively straightforward for landscape contractors, and typically there should only be a small amount of extra work required for a SuDS Pond is necessary for standard public open space.

Regular inspection and maintenance are important for the effective operation of ponds as designed. Maintenance responsibility for a pond and its surrounding area should always be placed with a responsible organisation. Litter and debris removal should be undertaken as part of general landscape maintenance for the site and before any other SuDS management task. All litter should be removed from site.

Any invasive maintenance work such as silt or vegetation removal is only required intermittently, but it should be planned to be sympathetic to the requirements of wildlife in a pond. Care should be taken to avoid disturbance to nesting birds during the breeding season and habitats of target species (e.g., great crested newt and water voles) at critical times. The window for carrying out maintenance to achieve this is usually towards the end of the growing season (typically September/October), although this will vary with species).

Invasive silt and vegetation removal should only be carried out to limited areas at any one time 25-30% of the pond area on one occasion each year to minimise the impact on biodiversity. Plant management, to achieve particular desired habitat effects, should be clearly specified in a maintenance schedule.

Site vegetation should be trimmed as necessary to keep the pond free of leaves and to maintain the aesthetic appearance of the site. Slope areas that have become bare should be re-vegetated and any eroded areas should be regraded before replanting.

Maintenance access (or "easement") should be provided to the pond from a public or private road. An assessment should be made at the planning stage regarding the maintenance and associated access requirements. Ideally, access should be at least 3.5 m wide, have a maximum cross fall of 1 in 7, and be sufficiently robust to withstand maintenance equipment and vehicles. However, temporary access routes for infrequent operations could be considered where permanent routes are not appropriate. The access should extend to any forebay, safety and aquatic benches, inlet and outlet infrastructure. Consideration should be given as to whether maintenance vehicles will need to turn around. Wherever possible.

SuDS ponds and wetlands should be designed so that special machinery is not required to undertake maintenance. The list of actions is not exhaustive, and some actions may not always be required.
Consideration should be given to the need to control risks to biosecurity during maintenance operations.

Sediments excavated from ponds or forebays that receive runoff from residential or standard road and roof areas should be safely disposed of in accordance with current waste management legislation.
However, consultation should take place with the environmental regulator to confirm appropriate protocols. Chemical testing of the sediment may be required, before sediment excavation, to determine its classification and appropriate disposal methods. For industrial site runoff, sediment testing will be essential. In the majority of cases on low-risk sites with source control and a Management Train, it will be acceptable to distribute the sediment on site, if there is an appropriate safe and acceptable location to do so. If ponds are to be drawn down, care should be taken to prevent downstream discharge of sediments and anoxic water. The environmental regulator should be notified before such activities.

New ponds may become rapidly dominated by invasive native plants, particularly common bulrush (Typha latifolia). As it is not desirable for all new ponds to be bulrush dominated, it should be ensured that in the first five years, while vegetation is establishing, certain plant growth is controlled. After this time, ponds can usually be allowed to develop naturally recognising that, unless the margins are occasionally managed, they are likely to become dominated by trees and shrubs.

Eutrophication of SuDS ponds can occur during the summer months. This is best alleviated by controlling the nutrient source or providing a continuous baseflow to the pond. Unless eutrophication is severe, aeration can be used as a stop-gap measure to save aquatic animal species and reduce risks to receiving waters. However, the addition of barley straw bales, dredging or rendering the nutrients inactive by chemical means can also be successful.

Maintenance Plans and schedules should be developed during the design phase. Specific maintenance needs of the pond should be monitored, and maintenance schedules adjusted to suit requirements.

CDM 2015 requires designers to ensure that all maintenance risks have been identified, eliminated, reduced and/or controlled where appropriate.
This information will be required as part of the health and safety file.

Regular Maintenance

Monthly

Remove any debris and litter. Cut grass and manage other vegetation, inspect outlet and inlet and for blockage.

Yearly

Hand cut submerged and emergent aquatic plants. Remove 25% of bank vegetation from water's edge to a minimum of 1m above water level. Tidy all dead growth before the start of growing season.

Occasional Maintenance

Remove sediment from the main body of big ponds when pool volume is reduced by 20%.

Remedial Actions

Repair erosion or other damages, replant, aerate pond when signs of eutrophication are detected, realign riprap or repair other damage, repair/rehabilitate inlets, outlets and overflows.

Swale

There is only one swale within the proposed development. The depth of the swale is 1.4m. To ensure that the people who are in the vicinity of the swale are aware of the potential danger and also to minimize the risk of drowning, a lifesaving ring should be provided within the area of the swale.

Swales will require regular maintenance to ensure continuing operation to design performance standards, and all designers should provide detailed specifications and frequencies for the required maintenance activities along with likely machinery requirements and typical annual costs - within the Maintenance Plan. The treatment performance of swales is dependent on maintenance, and robust management plans will be required to ensure maintenance is carried out in the long term. Different designs will have different operation and maintenance requirements, but this section gives some generic guidance.

Maintenance of swales is relatively straightforward for landscape contractors, and typically there should only be a small amount of extra work (if any) required for a swale over and above what is necessary for standard public open space. Provided that landscape management is already required at site, swale maintenance should have marginal cost implications. However, regular inspection and maintenance are important for the effective operation of swales as designed. Maintenance responsibility for a swale should always be placed with an appropriate organisation. If swales are implemented within private property, owners should be educated on their routine maintenance needs, and should understand the long-term Maintenance Plan and any legally binding maintenance agreement.

Adequate access should be provided to all swale areas for inspection and maintenance, including for appropriate equipment and vehicles. Litter and debris removal should be undertaken as part of general landscape maintenance for the site and before any other SuDS management task. All litter should be removed from site.

The major maintenance requirement for dry swales is mowing. Mowing should ideally retain grass lengths of 75-150 mm across the main "treatment" surface, to assist in filtering pollutants and retaining sediments and to reduce the risk of flattening during runoff events. However, longer vegetation lengths, where appropriate, are not considered to pose a significant risk to functionality.

Grass clippings should be disposed of either off site or outside the area of the swale, to remove nutrients and pollutants. For wet swales, mowing of wetland vegetation is not required. However, harvesting of very dense vegetation may be desirable in the autumn after plant die-back, to prevent the discharge of excess organic material into receiving waters. All vegetation management activities should take account of the need to maximise biosecurity and prevent the spread of invasive species.

Occasionally sediment will need to be removed (e.g., once deposits exceed 25 mm in depth), although this can be minimised by ensuring that upstream areas are stabilised and by incorporating effective pre-treatment devices. Available evidence from monitoring studies indicates that small, distributed infiltration practices such as swales do not contaminate underlying soils, even after more than 10 years of operation (TRCA, 2008). Sediments excavated from a swale that receives runoff from residential or standard road and roof areas are generally not toxic or hazardous material and can therefore be safely disposed of by either land application or landfilling. However, consultation should take place with the environmental regulator to confirm appropriate protocols. Sediment testing may be required before sediment excavation to determine its classification and appropriate disposal methods. For runoff from busy streets with high vehicle traffic, sediment testing will be essential. Any damage due to sediment removal or erosion should be repaired and immediately reseeded or planted.

Maintenance Plans and schedules should be developed during the design phase. Specific maintenance needs of the swales should be monitored, and maintenance schedules adjusted to suit requirements.

CDM 2015 requires designers to ensure that all maintenance risks have been identified, eliminated, reduced and/or controlled where appropriate. This information will be required as part of the health and safety file.

Regular Maintenance

Monthly

Remove any debris from the catchment surface (If it poses any risk on its operation work). Cut grass and manage other vegetation, inspect outlet and inlet and overflows for blockage.

Half yearly

Inspect inlet and facility surface for silt accumulation, establish silt removal frequencies.

Occasional Maintenance

Reseed areas of poor vegetation growth, alter plant types to better suit conditions, if required.

Remedial Actions

Remove erosion or other damage by re-turfing or re-seeding. Relevel uneven surface and reinstate design level. Remove build-up of sediment. Remove and dispose of oil or petrol residues using safe standard practices.

Downstream Defenders

The primary regular tasks to be undertaken is cleaning the channel drain, removing any sediment that has accumulated in the storage. Dirt, grime, debris and standing or. It is advised to be cleaned every 3 to 6 months.

Quarterly Maintenance

-Check the integrity of the inceptor and its mechanical parts and service all the electrical system.
-Inspect the filters and repair or replace as necessary
- Remove all silt and contaminants removed and disposed in accordance with regulation.

Hydro brake Flow Control

There are 11 hydro brakes placed within the manholes of surface water network. They tend to have an S-shaped discharge curve. These should be maintained in accordance with maintenance plan. The manhole with hydro brake should be checked for silt before and after each storm. It is also required to check the functionality of flow restriction as per manufacturer's specification.

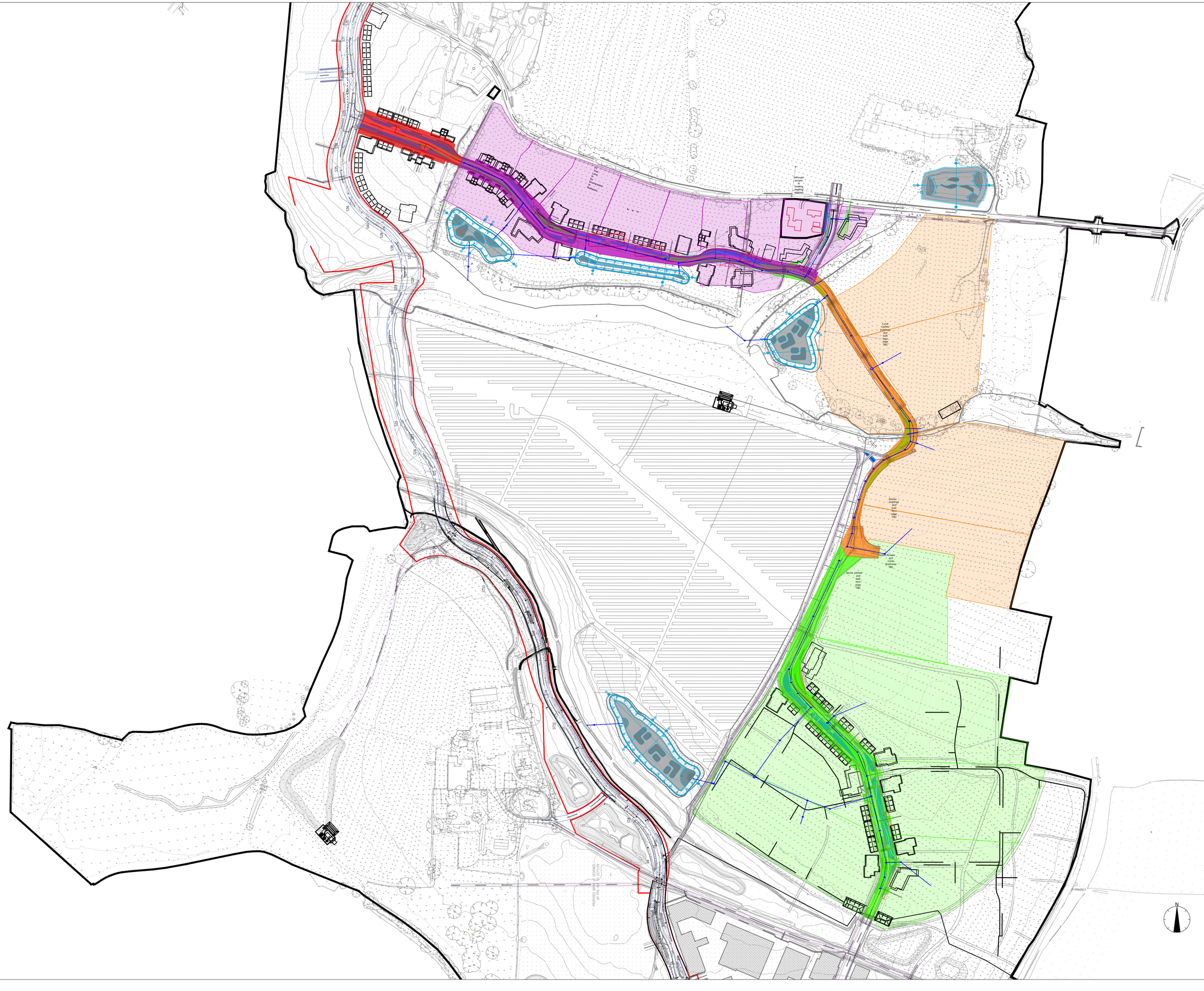
3.3. Required Maintenance Schedule

To ensure the long-term performance of the proposed DS, the onsite drainage system will be owned and maintained by the site operator or a maintenance company (MC) in accordance with the indicative schedule below, in the alternative the local authority may wish to adopt such features. However, at the detailed drainage design stage a full management and maintenance plan detailing best practice system maintenance regimes and proprietary manufacturer requirements and lifecycle management, in accordance with the CIRIA SuDS Manual will need to be produced. In the absence of local authority adoptions, maintenance of the overall drainage network will be the responsibility of an appointed management company.

ELEMENT / DRAINAGE COMPONENT	OWNERSHIP / ADOPTION	MAINTENANCE REQUIREMENTS
Flow Restriction Device & Chamber	Southern Water	To be monitored for silt build-up and cleaned as required using suction methods. Check function of flow restriction componentry to suit manufacturer's guidance. **Inspection annually and before / after extreme storm events.**
Catchpit Manholes	Homeowners/Southern Water	To be monitored for silt build-up and cleaned as required using suction methods. **Inspection annually and before / after extreme storm events.**
Rainwater Pipes	Homeowners	Clearance of leaves / debris from guttering and hopper inlets. Rodding points provided to clear blockages via conventional rodding methods. **Inspection annually and before / after extreme storm events.**
Soil Vent Piles / "Stub Stacks"	Homeowners	Rodding points to be provided to clear blockages via conventional rodding methods. **Inspection annually.**
Gullies (Internal & External)	HCC Highways	To be monitored for silt build-up and cleaned as required. Where provided, ensure air traps are primed and sealed to prevent smells. **Inspection quarterly.**
Swales	Site Operator / MC	To be monitored for litter and debris. Strimming to remove overgrown vegetation twice yearly. Removal of self-seeded saplings to prevent new tree growth. Monitor for silt build up and remove and spread locally outside design profile as required. **Inspection quarterly and before / after extreme storm events.**

Ponds	Eastleigh council management company	To be monitored for litter and debris. Careful strimming to remove overgrown vegetation twice yearly. Removal of self-seeded saplings to prevent new tree growth. Monitor for silt build up and remove and spread locally outside design profile as required. **Inspection quarterly and before / after extreme storm events.**

APPENDIX A
OVERALL DRAINAGE LAYOUT



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DRAWING NOTES:

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EXTERNAL REFERENCES:

THIS INFORMATION & RIDGE & PARTNERS LLP CIVILS 3D MODEL & ASSOCIATED 3D OUTPUTS ARE BASED UPON THE FOLLOWING INFORMATION FROM THE DESIGN TEAM

ARCHITECT REFERENCE:
- **ARCH DWG No.** 30454A / XX (DATED DEC 22)

SURVEY REFERENCE:
- **SURVEY DWG No.ENC/ONE-HH-FEB21** (DATED FEB 21)

IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY THIS INFORMATION IS CURRENT PRIOR TO CONSTRUCTION

LEGEND

- PROPOSED PRIVATE S.W. DRAIN
- PROPOSED 1200mmØ MANHOLE
- PROPOSED HEADWALL
- PROPOSED OIL INTERCEPTOR
- PROPOSED PIPE/MANMAL
- CATCHMENT AREA F
- CATCHMENT ROAD AREA F
- CATCHMENT AREA G
- CATCHMENT ROAD AREA G
- CATCHMENT AREA H
- CATCHMENT ROAD AREA H
- CATCHMENT ROAD AREA E

REV	DESCRIPTION	DATE	DRAWN
P02	UPDATED DRAINAGE LAYOUT	01/12/2023	BT
P01	UPDATED DRAINAGE LAYOUT	27/07/2023	PO
-	INITIAL ISSUE	16/06/2023	JM

ORIGINATOR:

RIDGE

1 ROYAL COURT
KINGS WORTHY
WINCHESTER
SO23 7TW
TEL: 01962 834400
WWW.RIDGE.CO.UK

CLIENT:

EASTLEIGH BOROUGH COUNCIL

IN ASSOCIATION WITH:

PROJECT:
ONE HORTON HEATH
SITE WIDE
INFRASTRUCTURE DELIVERY

TITLE:
OVERALL DRAINAGE LAYOUT

TECH:	CSE:	ICSE:	SCALE: 1:2000 @ A1
JM			INITIAL ISSUE: 16/06/2023

STATUS:
PRELIMINARY

DRAWING No:

PROJECT:	ORG:	ZONE:	LEVEL:	TYPE:	ROLE:	NUMBER:	REV:
5018551	RDG	XX	ST	DR	C	0500	P02

APPENDIX B
PROPOSED SITE PLAN

KEY

Application Site Boundary.

Denotes limits of built form (including boundary treatments of garden etc.) adjacent to road.

Fence.

Footway.

Shared footway & cycleway.

N

0 25 50 75 100 200m

Scale 1:2500

Project Title

Eastleigh Borough Council
One Horton Heath
Phase 3 Road
Burnetts Lane to Allington Lane

Drawing Description

Internal Distribution Road Layout Plan

Scale	Drawn by
1:2500 @ A1	HP
Date	Checked by
July 2023	TWM

CLAGUE ARCHITECTS

62 Burgate, Canterbury
Kent CT1 2BH 01227 762060

2 Kinsbourne Court, Luton Road,
Harpenden, Hertfordshire AL5 3BL 01582 765102

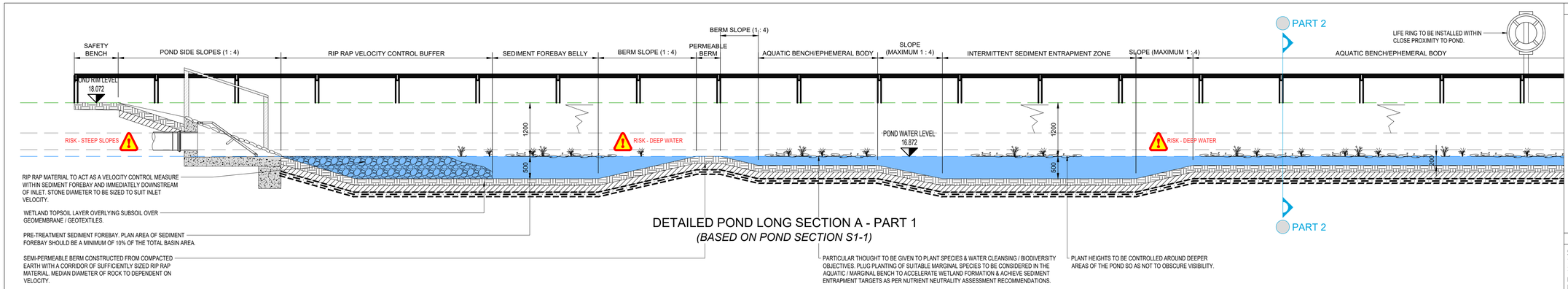
8, Disney Street
London SE1 1JF 0203 597 6112

CANTERBURY LONDON HARPENDEN

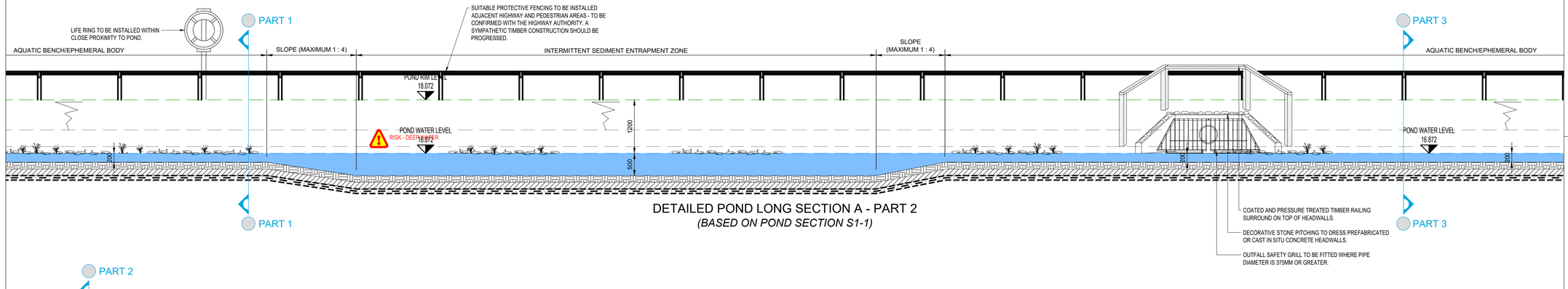
Drawing Number	Revision
30454A / 3875	A

APPENDIX C

SUDS PLAN DRAWINGS



DETAILED POND LONG SECTION A - PART 1
(BASED ON POND SECTION S1-1)



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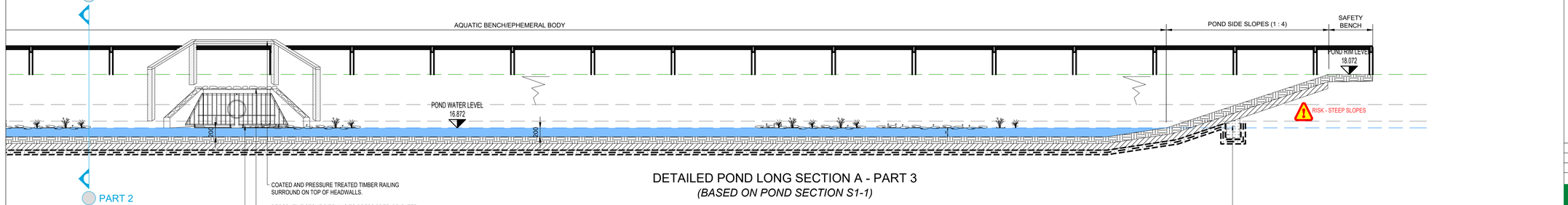

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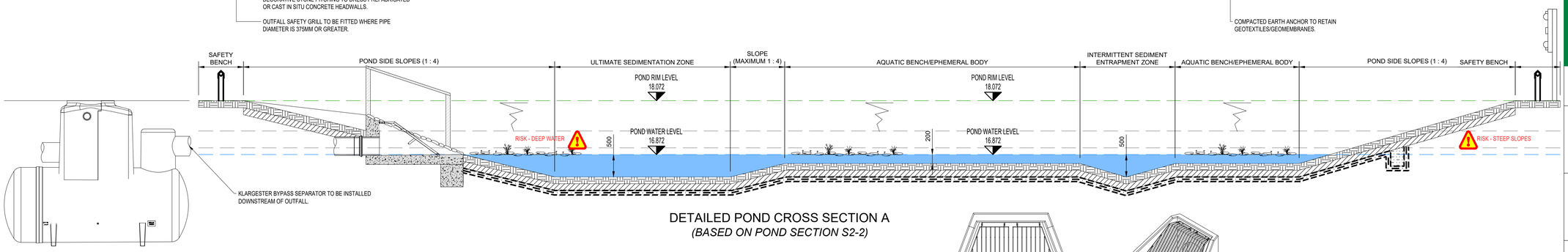

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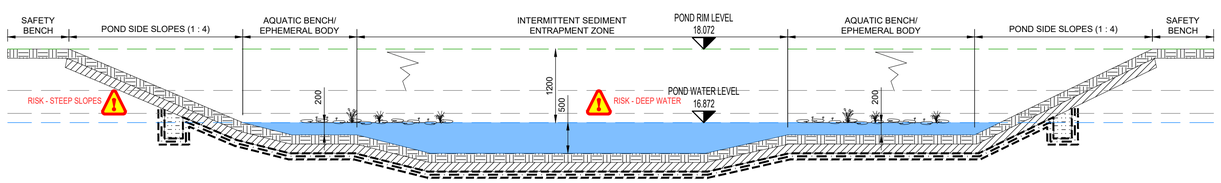
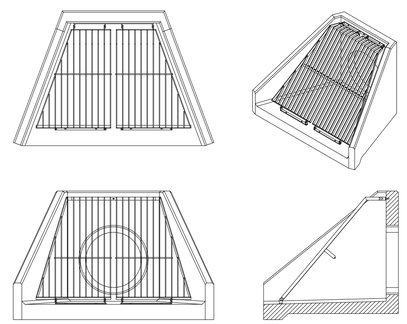


DETAILED POND CROSS SECTION B
(BASED ON POND SECTION S3-3)



HEADWALL DETAILS

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DRAWING NOTES:

CDM REGULATIONS 2015
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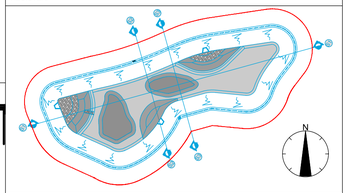


WESTERN POND EXTRACT

REV	DESCRIPTION	DATE	DRAWN
P01	AMENDMENTS MADE IN SEDIMENTATION AREAS	17/02/2023	RML
-	INITIAL ISSUE	10/02/2023	ZS

ORIGINATOR:

RIDGE

1 Royal Court,
Kings Worthy,
Winchester,
SO23 7TW
TEL: 01962 834400
WWW.RIDGE.CO.UK

CLIENT:

EASTLEIGH BOROUGH COUNCIL

IN ASSOCIATION WITH:

PROJECT:
ONE HORTON HEATH
SITE WIDE
INFRASTRUCTURE DELIVERY

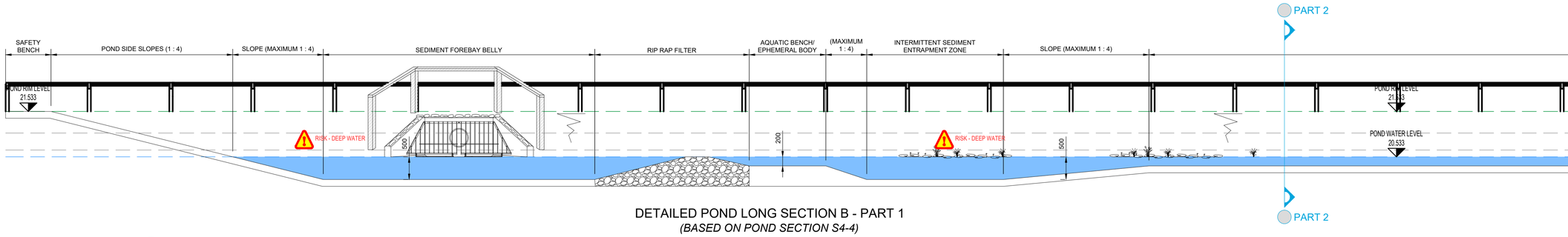
TITLE:
DETAILED SuDS SECTIONS
WESTERN POND

TECH:	CSE:	ICSE:	SCALE: 1:50 @ A1
RML	ZS	TC	INITIAL ISSUE: 10/02/2023

STATUS:
PRELIMINARY

DRAWING No:

PROJECT:	ORG:	ZONE:	LEVEL:	TYPE:	ROLE:	NUMBER:	REV:
5018551	RDG	XX	ST	DR	C	0570	P01



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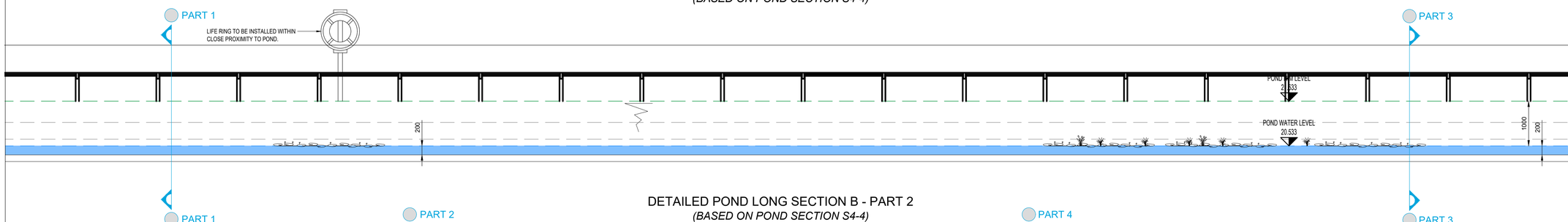

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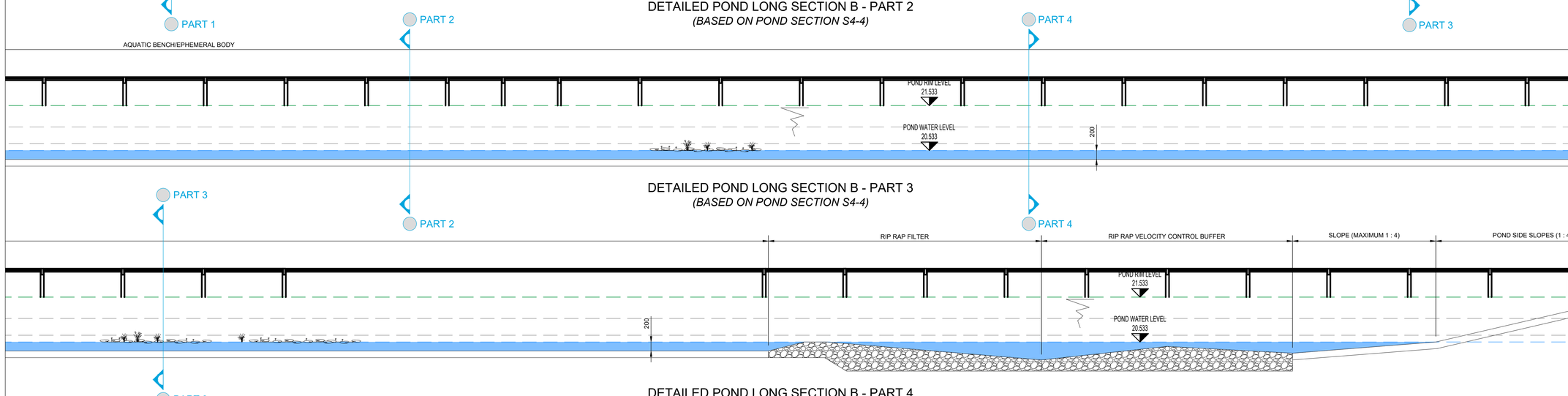

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(BASED ON POND SECTION S4-4)

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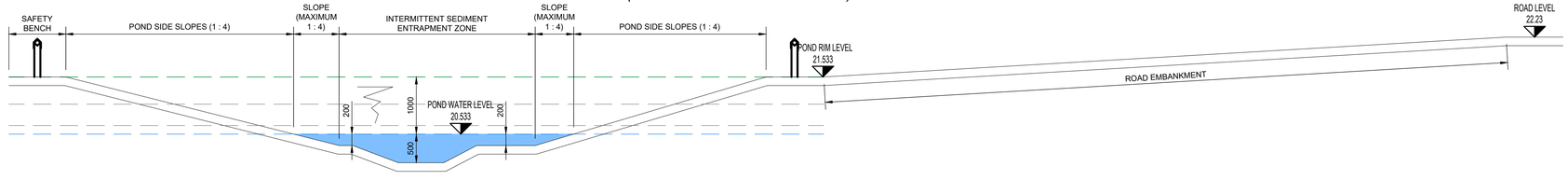
(BASED ON POND SECTION S4-4)



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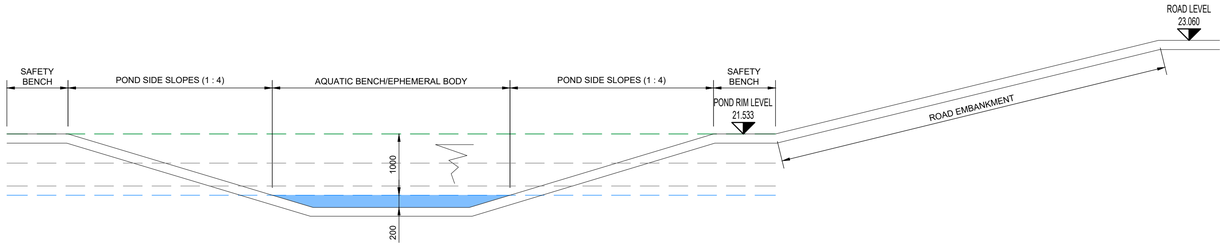

DETAILED POND CROSS SECTION B
(BASED ON POND SECTION S6-6)

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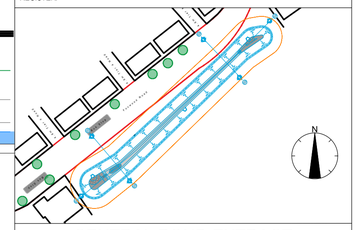


CENTRAL POND EXTRACT

REV	DESCRIPTION	DATE	DRAWN
-	INITIAL ISSUE	17/02/2023	RML

ORIGINATOR:

RIDGE

1 Royal Court,
Kings Worthy,
Winchester,
SO23 7TW
TEL: 01962 834400
WWW.RIDGE.CO.UK

CLIENT:

EASTLEIGH BOROUGH COUNCIL

IN ASSOCIATION WITH:

PROJECT:
ONE HORTON HEATH
SITE WIDE
INFRASTRUCTURE DELIVERY

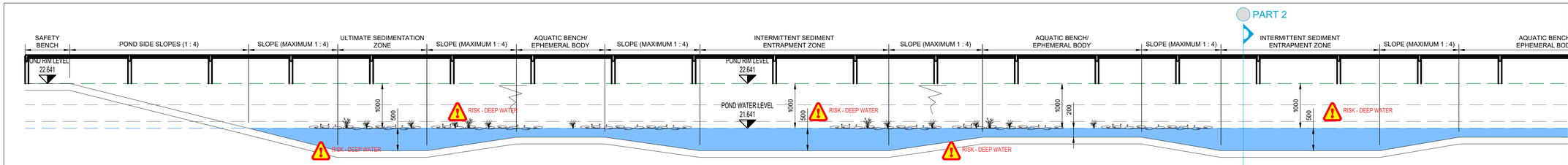
TITLE:
DETAILED SuDS SECTIONS
CENTRAL POND

TECH:	CSE:	ICSE:	SCALE: 1:50 @ A1
RML	ZS	TC	INITIAL ISSUE: 17/02/2023

STATUS:
PRELIMINARY

DRAWING No:

PROJECT:	ORG:	ZONE:	LEVEL:	TYPE:	ROLE:	NUMBER:	REV:
5018551	RDG	XX	ST	DR	C	0571	-



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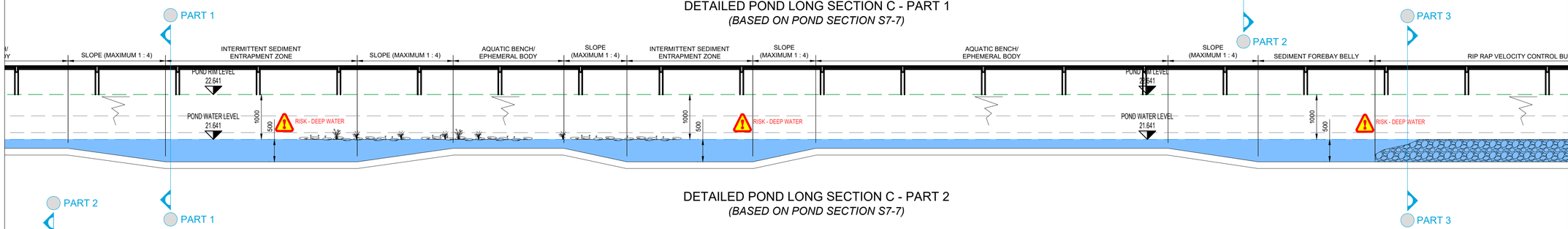

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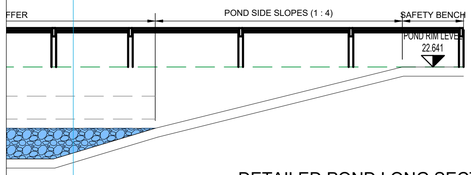

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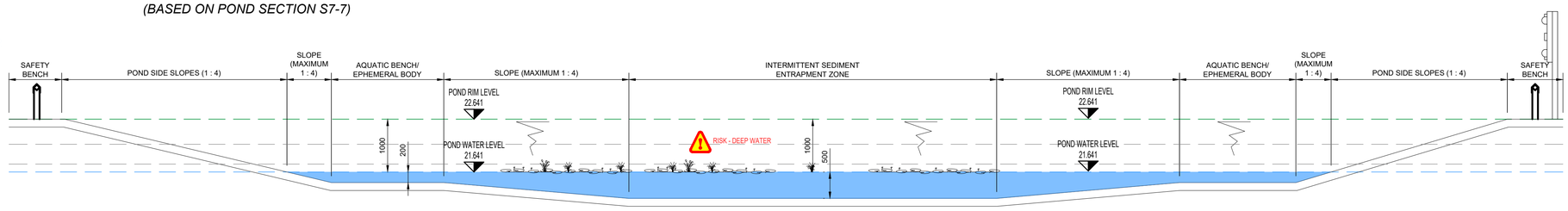

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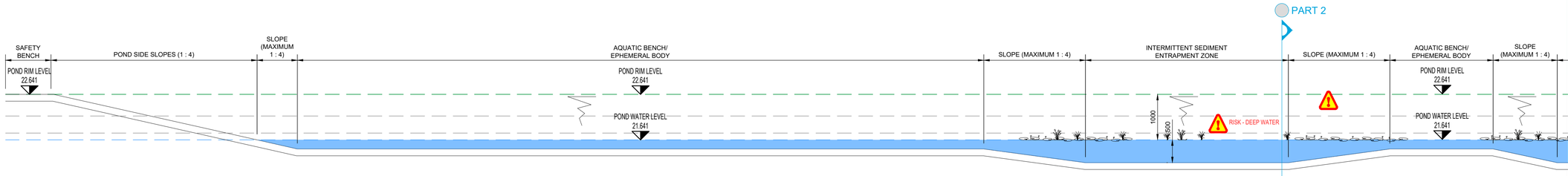

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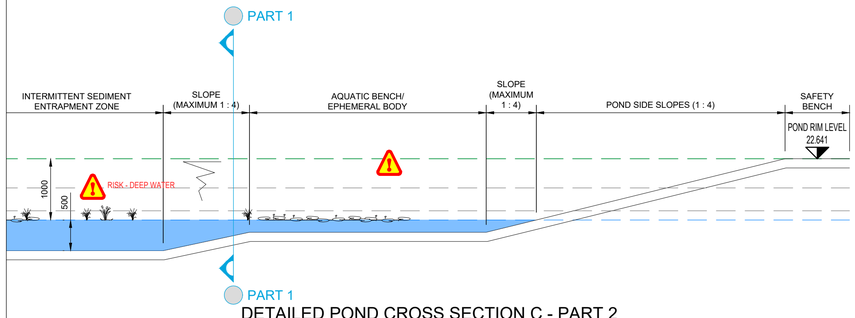

DETAILED POND CROSS SECTION C - PART 2
(BASED ON POND SECTION S9-9)

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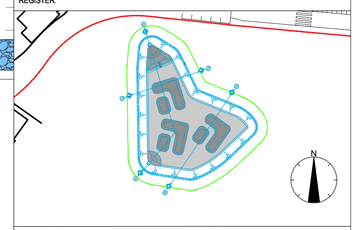


EASTERN POND EXTRACT

REV	DESCRIPTION	DATE	DRAWN
-	INITIAL ISSUE	17/02/2023	RML

ORIGINATOR:

RIDGE
1 Royal Court,
Kings Worthy,
Winchester,
SO23 7TW
TEL: 01962 834400
WWW.RIDGE.CO.UK

CLIENT:

EASTLEIGH BOROUGH COUNCIL

IN ASSOCIATION WITH:

PROJECT:
ONE HORTON HEATH
SITE WIDE
INFRASTRUCTURE DELIVERY

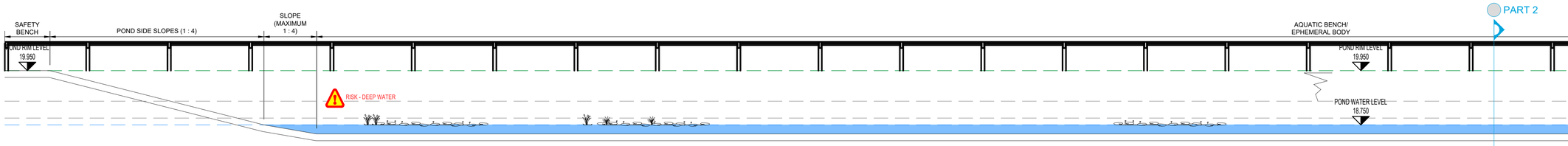
TITLE:
DETAILED SuDS SECTIONS
EASTERN POND

TECH:	CSE:	ICSE:	SCALE: 1:50 @ A1
RML	ZS	TC	INITIAL ISSUE: 17/02/2023

STATUS:
PRELIMINARY

DRAWING No:

PROJECT:	ORG:	ZONE:	LEVEL:	TYPE:	ROLE:	NUMBER:	REV:
5018551	RDG	XX	ST	DR	C	0572	-



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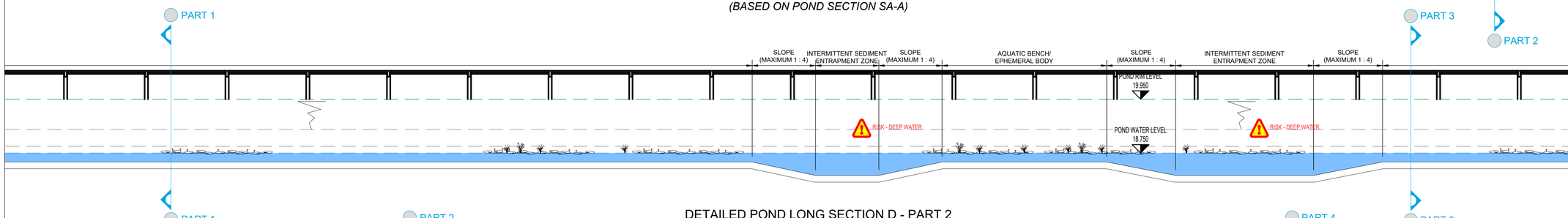
(BASED ON POND SECTION SA-A)



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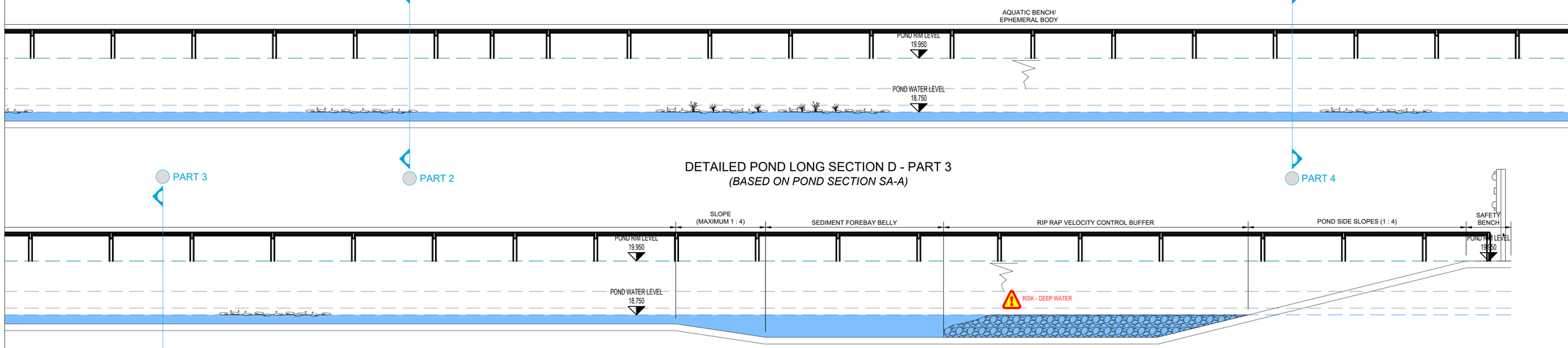
(BASED ON POND SECTION SA-A)



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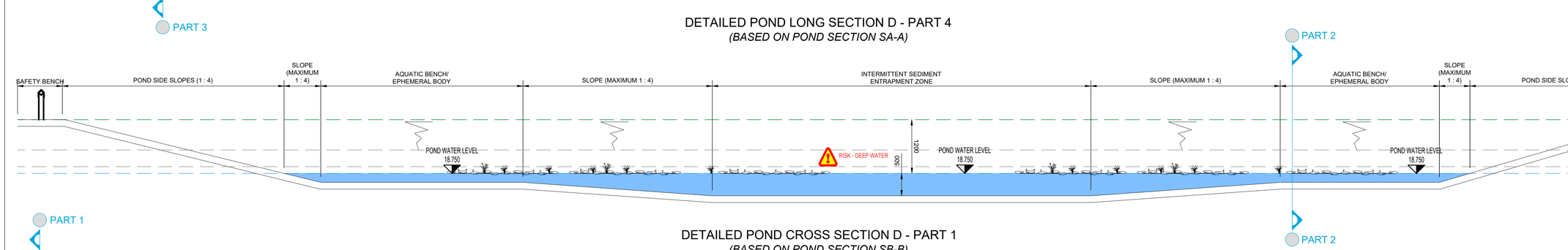
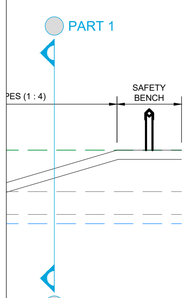


DETAILED POND LONG SECTION D - PART 4
(BASED ON POND SECTION SA-A)

DETAILED POND CROSS SECTION D - PART 1
(BASED ON POND SECTION SB-B)



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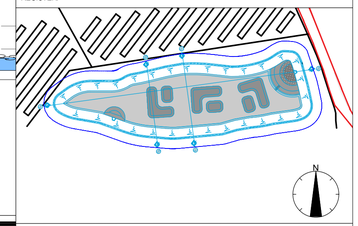


SOUTHERN POND EXTRACT

REV	DESCRIPTION	DATE	DRAWN
-	INITIAL ISSUE	17/02/2023	RML

ORIGINATOR:

RIDGE

1 Royal Court,
Kings Worthy,
Winchester,
SO23 7TW

TEL: 01962 834400

WWW.RIDGE.CO.UK

CLIENT:

EASTLEIGH BOROUGH COUNCIL

IN ASSOCIATION WITH:

PROJECT:
ONE HORTON HEATH
SITE WIDE
INFRASTRUCTURE DELIVERY

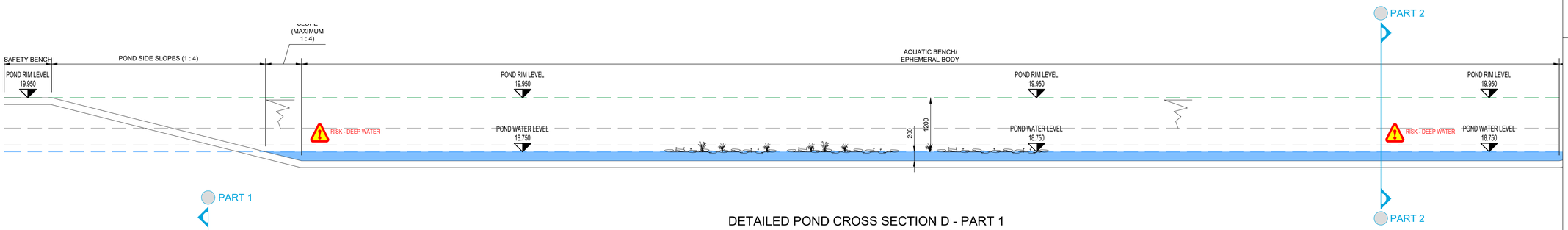
TITLE:
DETAILED SuDS SECTIONS
SOUTHERN POND

TECH:	CSE:	ICSE:	SCALE: 1:50 @ A1
RML	ZS	TC	INITIAL ISSUE: 17/02/2023

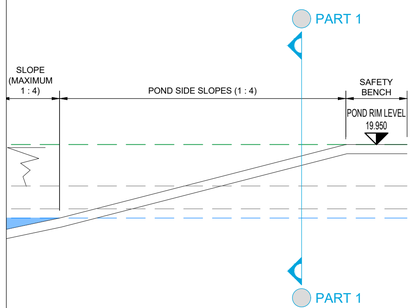
STATUS:
PRELIMINARY

DRAWING No:

PROJECT:	ORG:	ZONE:	LEVEL:	TYPE:	ROLE:	NUMBER:	REV:
5018551	RDG	XX	ST	DR	C	0573	-



DETAILED POND CROSS SECTION D - PART 1
(BASED ON POND SECTION SC-C)



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(BASED ON POND SECTION SC-C)

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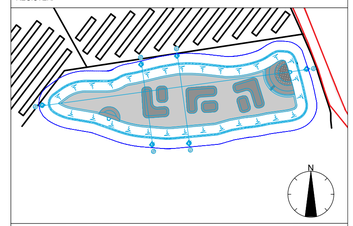

SOUTHERN POND EXTRACT

REV	DESCRIPTION	DATE	DRAWN
-	INITIAL ISSUE	17/02/2023	RML

ORIGINATOR:

RIDGE

1 Royal Court,
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CLIENT:

EASTLEIGH BOROUGH COUNCIL

IN ASSOCIATION WITH:

PROJECT:
ONE HORTON HEATH
SITE WIDE
INFRASTRUCTURE DELIVERY

TITLE:
DETAILED SuDS SECTIONS
SOUTHERN POND

TECH:	CSE:	ICSE:	SCALE: 1:50 @ A1
ZS	CL	TC	INITIAL ISSUE: 17/02/2023

STATUS:
PRELIMINARY

DRAWING No:

PROJECT:	ORG:	ZONE:	LEVEL:	TYPE:	ROLE:	NUMBER:	REV:
5018551	RDG	XX	ST	DR	C	0574	-

RIDGE

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TECHNICAL NOTE / FILE NOTE

RIDGE

PROJECT	DATE	BY	REFERENCE
5018551 OHH SID	10/09/2024	SS	5018551-TN-004

TITLE	REVISION
Response to LLFA Comment	P01

1. INTRODUCTION

Ridge & Partners prepared Flood Risk Assessment, Drainage Strategy and SuDS Strategy on behalf of Eastleigh Borough Council. The proposed development has been designed in full accordance with the Development Plan and Outline Planning Application (OPA) O/20/89498, which has a resolution to grant consent subject to S106 negotiations relating to education. This application is for full planning consent due to the time for these negotiations to complete.

This document involves a review of the Lead Local Flood Authorities (LLFA) in regard to the following documents:

- Response to LLFA Comments & Southern Water Technical Note ref: 5018551 – TN – 003
- Flood Risk Assessment Report Rev 4 (Appendix A)
- Drainage Strategy Report Rev P05 (Appendix B)
- Pre & Post Development Exceedance Flow Plans (Appendix G)
- Hydrobrake Data Sheet (Appendix H)
- SuDS Strategy Report Rev P05 (Appendix C)

2. RESPONSE TO QUERIES RAISED BY LLFA

1. **The water quality assessment refers to elements which are part of future development parcels (permeable paving) and needs to be revised to reflect the elements which will be included as part of this phase of work or are already in place. Some additional information has been provided in relation to future connections within the drainage network for this phase, but we do require allowable discharge rates not just impermeable areas and a statement that says unrestricted discharge.**

    - Water will be collected from the road into the ponds, then will be treated in the ponds, then flow into a downstream defender, finally ending into the watercourse. The SuDS Strategy report has been updated to the relevant information Rev P06. Reference to the plans are drawing No. 0556 and 0555. They have been attached in Appendix A.

2. **A clear plan is required showing what flow rate is catered for in relation to the future developments, so it is clear what their discharge rate is. While we have accepted high level calculations based on impermeable area, without the flow rates we will not be able to review future parcels to ensure the downstream network is suitable. This is exacerbated as none of the plans will open due to their size / complexity. The tables in section 3.8 state 'no restriction' in a number of areas. While flows may not need to be restricted, these should list an allowable discharge rate for clarity for future plots.**

    - Reference to the plans are drawing No. 0556 and 0555. They have been attached in Appendix A.

3. **Level information has been provided and given the minimal volume of flooding identified, we believe there is sufficient level difference between the point of flooding and properties to keep impacts at a minimal level within the road.**

    - This has been noted.

4. **Exceedance flow plans have been provided however, they are not clear, and the information needs to be re-processed to allow it to be read on screen at a sensible scale and reflect the proposed works.**

    - Drawing have been updated refer to Drawing No. 0540 and 0541 Rev P01.

5. **Given that the drainage plans have not been reviewed due to technical issues, these should be resubmitted / reprocessed to allow them to be viewed.**

    - This query has been Noted.

APPENDIX A

FLOW RATE PLAN 0555 AND 0556

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ARCHITECT REFERENCE:
- **CLAGUE ARCHITECTS DWG No.** 30454A/3875 (DATED JULY 2023)

TOPO SURVEY REFERENCE:
- **ENCOMPASS SURVEYS DWG No.** ENC/ONE-HH-FEB21 (DATED FEBUARY 2021)

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SCALE 1:1250 m

REV	DESCRIPTION	DATE	DRAWN
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EASTLEIGH BOROUGH COUNCIL

IN ASSOCIATION WITH:

PROJECT:
ONE HORTON HEATH
SITE WIDE
INFRASTRUCTURE DELIVERY

TITLE:
MAXIMUM INFLOW RATES
FROM PARCELS CATCHMENTS 1

TECH:	CSE:	ICSE:	SCALE: 1:1250 @ A1
PO			INITIAL ISSUE: 09/09/2024

STATUS:
INFORMATION

DRAWING No:

PROJECT:	ORG:	ZONE:	LEVEL:	TYPE:	ROLE:	NUMBER:	REV:
5018551	RDG	XX	ST	DR	C	0555P01	

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SCALE 1:1250 m

REV	DESCRIPTION	DATE	DRAWN
-	INITIAL ISSUE	09/09/2024	SS

ORIGINATOR:

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WINCHESTER
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CLIENT:

EASTLEIGH BOROUGH COUNCIL

IN ASSOCIATION WITH:

PROJECT:
ONE HORTON HEATH
SITE WIDE
INFRASTRUCTURE DELIVERY

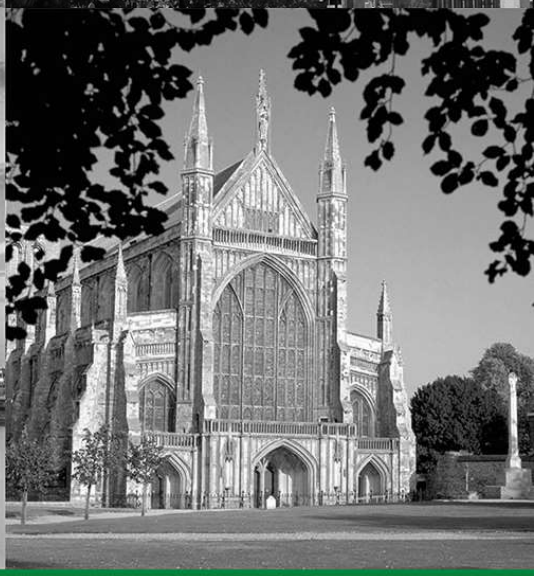
TITLE:
MAXIMUM INFLOW RATES
FROM PARCELS CATCHMENTS 2

TECH:	CSE:	ICSE:	SCALE: 1:1250 @ A1
PO			INITIAL ISSUE: 09/09/2024

STATUS:
INFORMATION

DRAWING No:

PROJECT:	ORG:	ZONE:	LEVEL:	TYPE:	ROLE:	NUMBER:	REV:
5018551	RDG	XX	ST	DR	C	0556P01	



RIDGE

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ARCH ASSOCIATES

APPENDIX 3

TECHNICAL DRAWING PACK

Scale 1:1
0mm 50 100

DRAINAGE LEGEND

	EXISTING SURFACE WATER SEWER / MANHOLE
	EXISTING FOUL WATER SEWER / MANHOLE
	EXISTING SURFACE / FOUL WATER SEWER TO BE ABANDONED
	ADOPTABLE SURFACE WATER MANHOLE / INSPECTION CHAMBER / ACCESS CHAMBER
	PRIVATE SURFACE WATER MANHOLE / INSPECTION CHAMBER / ACCESS CHAMBER
	DIVERTED SURFACE WATER MANHOLE / INSPECTION CHAMBER / ACCESS CHAMBER
	SURFACE WATER CATCHPIT MANHOLE
	FLOW CONTROL MANHOLE
	ADOPTABLE SURFACE WATER DRAIN / ADOPTABLE FILTER DRAIN / PRIVATE SURFACE WATER DRAIN 100mm Dia. U.N.O.
	RODDING EYE.
	PATIO LAND DRAIN
	YARD GULLY
	PERMAVOID DIFFUSER UNIT
	ROAD GULLY
	ATTENUATION TANK OUT OF PROPRIETARY CRATE SYSTEM
	SURFACE WATER HEADWALL
	ADOPTABLE FOUL WATER MANHOLE / INSPECTION CHAMBER / ACCESS CHAMBER
	ADOPTABLE FOUL WATER DRAIN 100mm Dia. U.N.O.
	EXTERNAL BACKDROP
	LINED (TYPE C) PERMEABLE CONSTRUCTION WITH 30% VOID MATERIAL SUBBASE. MINIMUM 300mm DEPTH OF PERMEABLE SUBBASE.

NOTES

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5. THE CONTRACTOR IS TO ENSURE THE STABILITY AND STRUCTURAL INTEGRITY OF THE EXISTING PROPERTY AT ALL TIMES DURING WORKS AND IS TO BE RESPONSIBLE FOR ALL PROPPING AND SHORING AS REQUIRED.
6. MAIN CONTRACTOR TO PROVIDE AND FIX SUITABLE BRACING AND PROPPING FOR ALL ELEMENTS IN THE TEMPORARY CONDITION DURING CONSTRUCTION STAGE, SUCH AS TO ENSURE STRUCTURE STABILITY AT ALL TIMES.
7. IT IS THE CONTRACTORS SOLE RESPONSIBILITY FOR ASCERTAINING SAFE DISPOSAL OF ANY OFF-SITE EXCAVATED SPOIL. NO CLAIM RESULTING FROM ABNORMAL TIP REQUIREMENTS WILL BE ENTERTAINED.
8. LEVELS SHOWN ARE IN mAOD.

DRAINAGE NOTES

1. REFER TO DRAWING AAL390-ED-XX-LS-C-5199 FOR COMPREHENSIVE DRAINAGE NOTES.

EXTERNAL REFERENCES

1. SITE LAYOUT: UAOHH-BSL-ZZ-XX-DR-A-2001-P1 (04/11/2025)
2. TOPO SURVEY: ENC/130524/7LL1B (05/2024)

COLOURED DRAWING
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Rev.	Date	Description	By
P03	21.11.2025	RESERVED MATTERS SUBMISSION	TA
P02	17.11.2025	INTERIM DRAINAGE SUBMISSION	TA
P01	11.11.2025	PRELIMINARY ISSUE FOR COMMENT	TA

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Client
EASTLEIGH BOROUGH COUNCIL

Architect
BOYLE & SUMMERS

Project title
ONE HORTON HEATH, UPPER ACRE, EASTLEIGH.

Drawing title
DRAINAGE, GENERAL ARRANGEMENT.

Scale	Paper size	Date	Drawn by	Checked by	Status
1:1000	A1	NOV 2025	TA	CH	S3

Name
Project code | Originator | Functional breakdown | Spatial breakdown | Form | Discipline | Number | Revision

AAL390-AAL-ED-XX-DP-C-5100-P03

DRAINAGE LEGEND

- EXISTING SURFACE WATER SEWER / MANHOLE
- EXISTING FOUL WATER SEWER / MANHOLE
- EXISTING SURFACE / FOUL WATER SEWER TO BE ABANDONED
- ADOPTABLE SURFACE WATER MANHOLE / INSPECTION CHAMBER / ACCESS CHAMBER
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- EXTERNAL BACKDROP
- LINED (TYPE C) PERMEABLE CONSTRUCTION WITH 30% VOID MATERIAL SUBBASE. MINIMUM 300mm DEPTH OF PERMEABLE SUBBASE.

FLOW CONTROL
DISCHARGE RESTRICTED TO 10l/s

VENTED ATTENUATION TANK 8
AREA 20.000m²
DEPTH 0.840m
BASE CRATE LEVEL 25.140m
TOP CRATE LEVEL 25.980m
POLYSTORM XTRA CRATES OR SIMILAR APPROVED

VENTED ATTENUATION TANK 7
AREA 132.000m²
DEPTH 1.260m
BASE CRATE LEVEL 25.070m
TOP CRATE LEVEL 26.330m
POLYSTORM XTRA CRATES OR SIMILAR APPROVED

FLOW CONTROL
DISCHARGE RESTRICTED TO 18.2l/s

Block 1
1 - 30

Block 2
245-274

Refuse Store

Cycle Store

Reuse Store

FSID13 CL 27.240 IL 22.830 TYPE A 1200 DIA. DEPTH 4.410m

FSID12 CL 26.900 IL 22.640 TYPE A 1200 DIA. DEPTH 4.260m

SSID12 CL 28.825 IL 23.110 TYPE A 1350 DIA. DEPTH 3.715m

SSID11 CL 26.700 IL 23.000 TYPE A 1350 DIA. DEPTH 3.700m

FSID11 CL 26.700 IL 22.540 TYPE A 1200 DIA. DEPTH 4.160m

SSID10 CL 26.575 IL 22.900 TYPE A 1200 DIA. DEPTH 3.675m

FSID10 CL 25.300 IL 22.120 TYPE A 1200 DIA. DEPTH 3.180m

SSID9 CL 26.490 IL 22.780 TYPE A 1200 DIA. DEPTH 3.710m

FSID9 CL 26.100 IL 22.120 TYPE A 1200 DIA. DEPTH 3.980m

SSID4 CL 26.085 IL 23.680 TYPE B 1500 DIA. DEPTH 2.405m

S1 CL 27.500 IL 25.850 TYPE B 1200 DIA. DEPTH 1.650m

S2 CL 27.150 IL 25.225 TYPE B 1200 DIA. DEPTH 1.925m

S3 CL 27.250 IL 25.701 TYPE C 1200 DIA. DEPTH 1.549m

S4 CL 27.025 IL 25.051 TYPE B 1200 DIA. DEPTH 1.974m

S5 CL 27.200 IL 25.600 TYPE B 1200 DIA. DEPTH 1.650m

S6 CL 26.800 IL 24.982 TYPE B 1200 DIA. DEPTH 1.818m

S7 CL 26.950 IL 24.935 TYPE B 1200 DIA. DEPTH 2.015m

F82 CL 28.350 IL 26.750 TYPE B 1200 DIA. DEPTH 1.600m

F76 CL 28.450 IL 26.800 TYPE B 1200 DIA. DEPTH 1.650m

F78 CL 28.350 IL 26.362 TYPE B 1200 DIA. DEPTH 1.988m

F83 CL 26.900 IL 24.933 TYPE B 1200 DIA. DEPTH 1.967m

F84 CL 26.650 IL 25.000 TYPE B1 1200 DIA. DEPTH 1.650m

F86 CL 27.450 IL 25.800 TYPE B 1200 DIA. DEPTH 1.650m

F77 CL 26.450 IL 23.882 TYPE B 1200 DIA. DEPTH 2.988m

S69 CL 26.275 IL 24.063 FLOW CONTROL MANHOLE 1350 DIA. DEPTH 2.212m

S23 CL 24.650 IL 22.925 TYPE B 1200 DIA. DEPTH 1.725m

S20 CL 23.915 IL 22.190 TYPE B 1200 DIA. DEPTH 1.725m

S19 CL 23.175 IL 21.450 TYPE B 1200 DIA. DEPTH 1.725m

S4 CL 22.858 IL 18.305 TYPE A 1200 DIA. DEPTH 4.545m

S3 CL 22.200 IL 18.088 TYPE A 1200 DIA. DEPTH 4.112m

F50 CL 24.715 IL 23.065 TYPE B 1200 DIA. DEPTH 1.650m

F49 CL 25.100 IL 22.720 TYPE B 1200 DIA. DEPTH 2.380m

S21 CL 25.250 IL 23.680 TYPE B 1500 DIA. DEPTH 3.400m

S22 CL 24.600 IL 23.075 TYPE B 1200 DIA. DEPTH 1.725m

S85 CL 27.300 IL 25.102 TYPE B 1350 DIA. DEPTH 2.273m

FSID8 CL 25.600 IL 21.810 TYPE A 1200 DIA. DEPTH 3.790m

Scale 1:250
0m 10.0 20.0

NOTES

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8. LEVELS SHOWN ARE IN mAOD.

DRAINAGE NOTES

1. REFER TO DRAWING AAL390-ED-XX-LS-C-5199 FOR COMPREHENSIVE DRAINAGE NOTES.

EXTERNAL REFERENCES

1. SITE LAYOUT: UAOHH-BSL-ZZ-XX-DR-A-2001-P1 (04/11/2025)
2. TOPO SURVEY: ENC/130524/7LL1B (05/2024)

COLOURED DRAWING
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Rev.	Date	Description	By
P03	21.11.2025	RESERVED MATTERS SUBMISSION	TA
P02	17.11.2025	INTERIM DRAINAGE SUBMISSION	TA
P01	11.11.2025	PRELIMINARY ISSUE FOR COMMENT	TA

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Client
EASTLEIGH BOROUGH COUNCIL

Architect
BOYLE & SUMMERS

Project title
ONE HORTON HEATH,
UPPER ACRE,
EASTLEIGH.

Drawing title
DRAINAGE,
SHEET 1.

Scale	Paper size	Date	Drawn by	Checked by	Status
1:250	A1	NOV 2025	TA	CH	S3

Name
Project code: Originator | Functional breakdown | Spatial breakdown | Form | Discipline | Number | Revision
AAL390-AAL-ED-XX-DP-C-5101-P03

COLOURED DRAWING
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DRAINAGE NOTES
1. REFER TO DRAWING AAL390-ED-XX-LS-C-5199 FOR COMPREHENSIVE DRAINAGE NOTES.

EXTERNAL REFERENCES
1. SITE LAYOUT: UAOHH-BSL-ZZ-XX-DR-A-2001-P1 (04/11/2025)
2. TOPO SURVEY: ENC/130524/7LL1B (05/2024)

VENTED ATTENUATION TANK 7
AREA 132.000m²
DEPTH 1.260m
BASE CRATE LEVEL 25.070m
TOP CRATE LEVEL 26.330m
POLYSTORM XTRA CRATES OR SIMILAR APPROVED

NOTES

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8. LEVELS SHOWN ARE IN mAOD.

DRAINAGE LEGEND
- EXISTING SURFACE WATER SEWER / MANHOLE
- EXISTING FOUL WATER SEWER / MANHOLE
- EXISTING SURFACE / FOUL WATER SEWER TO BE ABANDONED
- ADOPTABLE SURFACE WATER MANHOLE / INSPECTION CHAMBER / ACCESS CHAMBER
- PRIVATE SURFACE WATER MANHOLE / INSPECTION CHAMBER / ACCESS CHAMBER
- DIVERTED SURFACE WATER MANHOLE / INSPECTION CHAMBER / ACCESS CHAMBER
- SURFACE WATER CATCHPIT MANHOLE
- FLOW CONTROL MANHOLE
- ADOPTABLE SURFACE WATER DRAIN / ADOPTABLE FILTER DRAIN / PRIVATE SURFACE WATER DRAIN 100mm Dia. U.N.O.
- RODDING EYE.
- PATIO LAND DRAIN
- YARD GULLY
- PERMAVOID DIFFUSER UNIT
- ROAD GULLY
- ATTENUATION TANK OUT OF PROPRIETARY CRATE SYSTEM
- SURFACE WATER HEADWALL
- ADOPTABLE FOUL WATER MANHOLE / INSPECTION CHAMBER / ACCESS CHAMBER
- ADOPTABLE FOUL WATER DRAIN 100mm Dia. U.N.O.
- EXTERNAL BACKDROP
- LINED (TYPE C) PERMEABLE CONSTRUCTION WITH 30% VOID MATERIAL SUBBASE. MINIMUM 300mm DEPTH OF PERMEABLE SUBBASE.

Rev.	Date	Description	By
P03	21.11.2025	RESERVED MATTERS SUBMISSION	TA
P02	17.11.2025	INTERIM DRAINAGE SUBMISSION	TA
P01	11.11.2025	PRELIMINARY ISSUE FOR COMMENT	TA

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Client
EASTLEIGH BOROUGH COUNCIL

Architect
BOYLE & SUMMERS

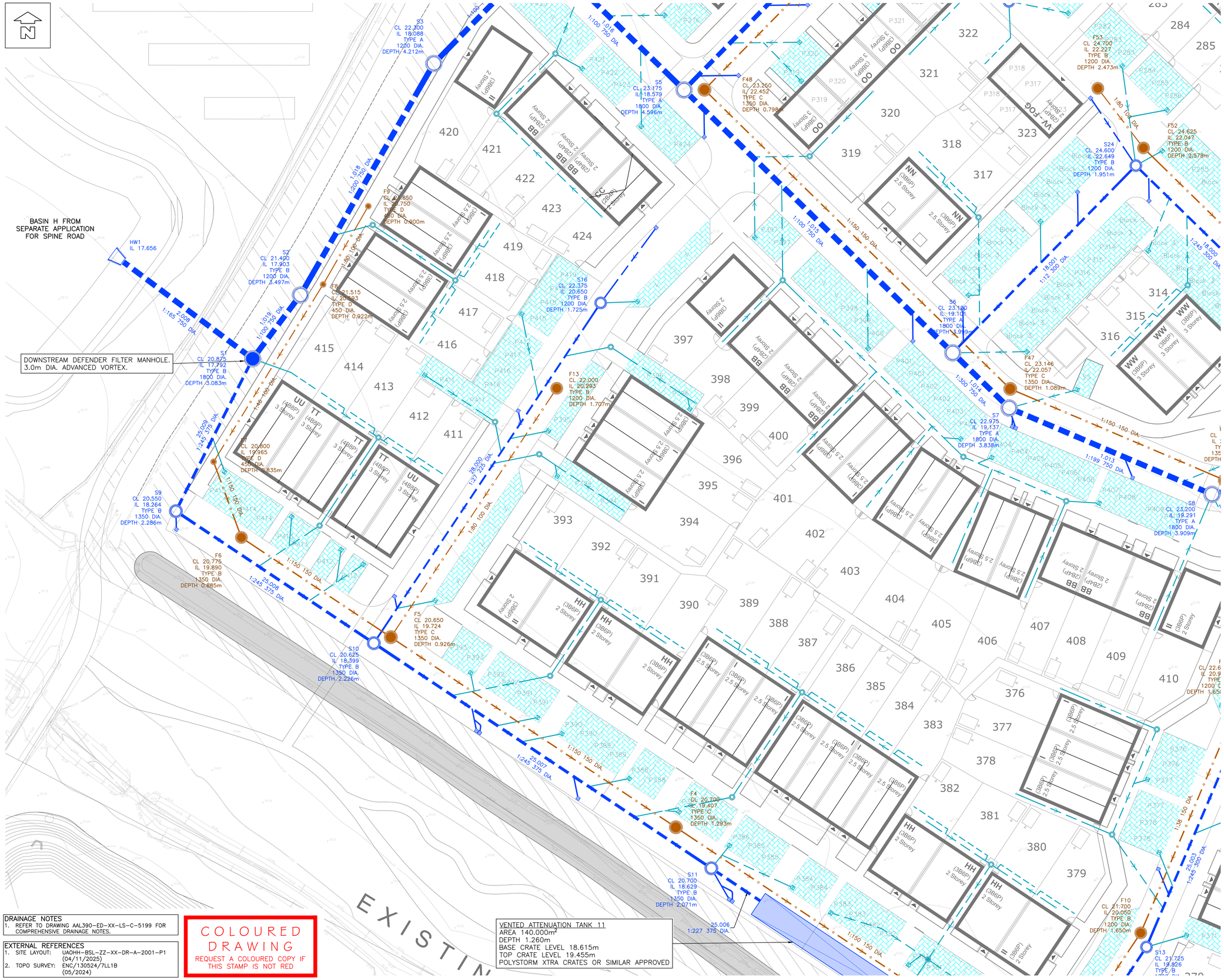
Project title
ONE HORTON HEATH,
UPPER ACRE,
EASTLEIGH.

Drawing title
DRAINAGE,
SHEET 2.

Scale	Paper size	Date	Drawn by	Checked by	Status
1:250	A1	NOV 2025	TA	CH	S3

Name
Project code | Originator | Functional breakdown | Spatial breakdown | Form | Discipline | Number | Revision
AAL390-AAL-ED-XX-DP-C-5102-P03

Scale 1:250
0m 10.0 20.0



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8. LEVELS SHOWN ARE IN mAOD.

DRAINAGE LEGEND

- EXISTING SURFACE WATER SEWER / MANHOLE
- EXISTING FOUL WATER SEWER / MANHOLE
- EXISTING SURFACE / FOUL WATER SEWER TO BE ABANDONED
- ADOPTABLE SURFACE WATER MANHOLE / INSPECTION CHAMBER / ACCESS CHAMBER
- PRIVATE SURFACE WATER MANHOLE / INSPECTION CHAMBER / ACCESS CHAMBER
- DIVERTED SURFACE WATER MANHOLE / INSPECTION CHAMBER / ACCESS CHAMBER
- SURFACE WATER CATCHPIT MANHOLE
- FLOW CONTROL MANHOLE
- ADOPTABLE SURFACE WATER DRAIN / ADOPTABLE FILTER DRAIN / PRIVATE SURFACE WATER DRAIN 100mm Dia. U.N.O.
- RODDING EYE.
- PATIO LAND DRAIN
- YARD GULLY
- PERMAVOID DIFFUSER UNIT
- ROAD GULLY
- ATTENUATION TANK OUT OF PROPRIETARY CRATE SYSTEM
- SURFACE WATER HEADWALL
- ADOPTABLE FOUL WATER MANHOLE / INSPECTION CHAMBER / ACCESS CHAMBER
- ADOPTABLE FOUL WATER DRAIN 100mm Dia. U.N.O.
- EXTERNAL BACKDROP
- LINED (TYPE C) PERMEABLE CONSTRUCTION WITH 30% VOID MATERIAL SUBBASE. MINIMUM 300mm DEPTH OF PERMEABLE SUBBASE.

Rev.	Date	Description	By
P03	21.11.2025	RESERVED MATTERS SUBMISSION	TA
P02	17.11.2025	INTERIM DRAINAGE SUBMISSION	TA
P01	11.11.2025	PRELIMINARY ISSUE FOR COMMENT	TA

DRAINAGE NOTES
1. REFER TO DRAWING AAL390-ED-XX-LS-C-5199 FOR COMPREHENSIVE DRAINAGE NOTES.

EXTERNAL REFERENCES
1. SITE LAYOUT: UAOHH-BSL-ZZ-XX-DR-A-2001-P1 (04/11/2025)
2. TOPO SURVEY: ENC/130524/7LL1B (05/2024)

COLOURED DRAWING
REQUEST A COLOURED COPY IF THIS STAMP IS NOT RED

VENTED ATTENUATION TANK 11
AREA 140.000m²
DEPTH 1.260m
BASE CRATE LEVEL 18.615m
TOP CRATE LEVEL 19.455m
POLYSTORM XTRA CRATES OR SIMILAR APPROVED

Scale 1:250 0m 10.0 20.0

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Client
EASTLEIGH BOROUGH COUNCIL

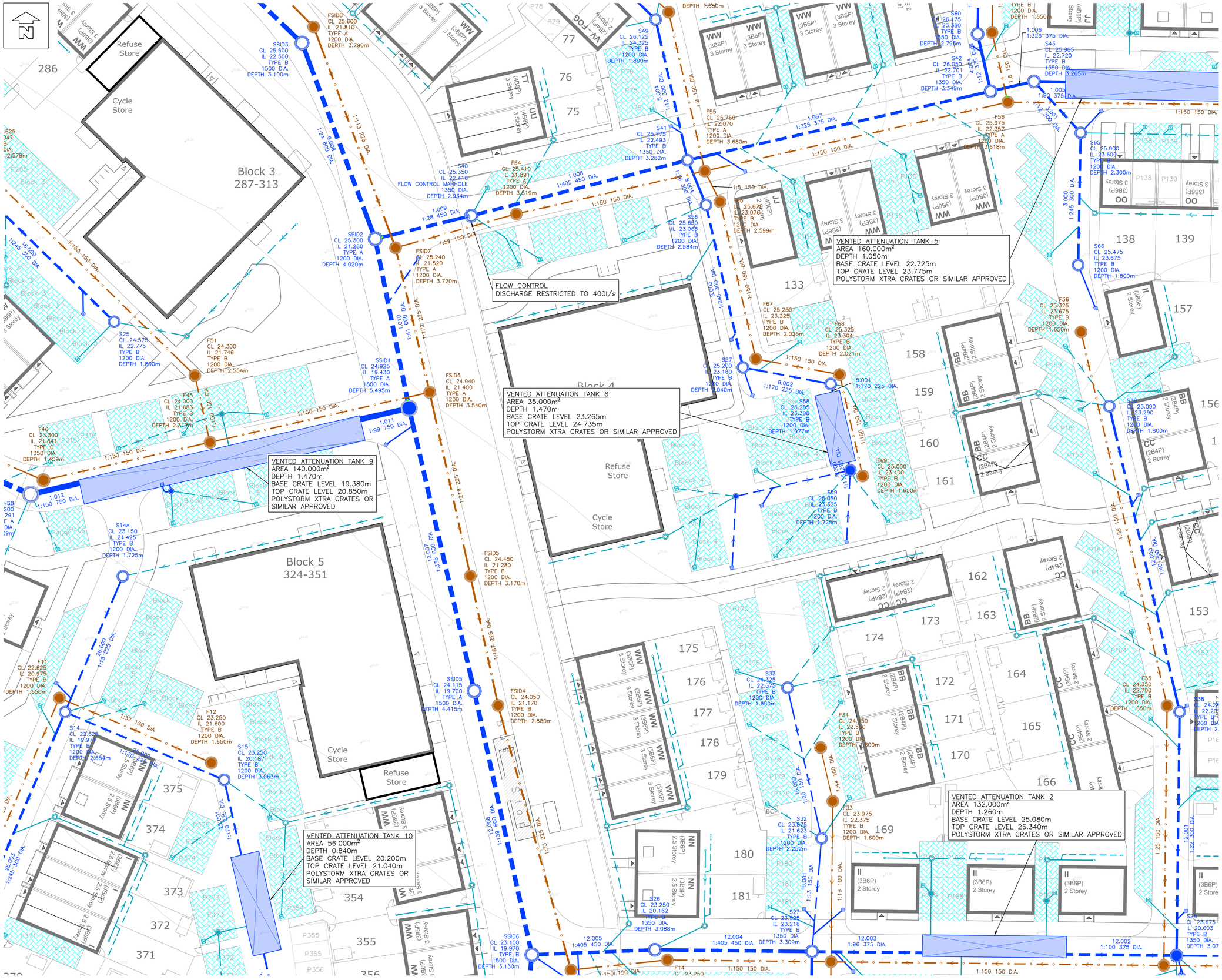
Architect
BOYLE & SUMMERS

Project title
ONE HORTON HEATH, UPPER ACRE, EASTLEIGH.

Drawing title
DRAINAGE, SHEET 3.

Scale	Paper size	Date	Drawn by	Checked by	Status
1:250	A1	NOV 2025	TA	CH	S3

Name
Project code | Originator | Functional breakdown | Spatial breakdown | Form | Discipline | Number | Revision
AAL390 - AAL - ED - XX - DP - C - 5103 - P03



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8. LEVELS SHOWN ARE IN mAOD.

DRAINAGE NOTES

1. REFER TO DRAWING AAL390-ED-XX-LS-C-5199 FOR COMPREHENSIVE DRAINAGE NOTES.

EXTERNAL REFERENCES

1. SITE LAYOUT: UAOHH-BSL-ZZ-XX-DR-A-2001-P1 (04/11/2025)
2. TOPO SURVEY: ENC/130524/7LL1B (05/2024)

DRAINAGE LEGEND

- EXISTING SURFACE WATER SEWER / MANHOLE
- EXISTING FOUL WATER SEWER / MANHOLE
- EXISTING SURFACE / FOUL WATER SEWER TO BE ABANDONED
- ADOPTABLE SURFACE WATER MANHOLE / INSPECTION CHAMBER / ACCESS CHAMBER
- PRIVATE SURFACE WATER MANHOLE / INSPECTION CHAMBER / ACCESS CHAMBER
- DIVERTED SURFACE WATER MANHOLE / INSPECTION CHAMBER / ACCESS CHAMBER
- SURFACE WATER CATCHPIT MANHOLE
- FLOW CONTROL MANHOLE
- ADOPTABLE SURFACE WATER DRAIN / ADOPTABLE FILTER DRAIN / PRIVATE SURFACE WATER DRAIN 100mm Dia. U.N.O.
- RODDING EYE.
- PATIO LAND DRAIN
- YARD GULLY
- PERMAVOID DIFFUSER UNIT
- ROAD GULLY
- ATTENUATION TANK OUT OF PROPRIETARY CRATE SYSTEM
- SURFACE WATER HEADWALL
- ADOPTABLE FOUL WATER MANHOLE / INSPECTION CHAMBER / ACCESS CHAMBER
- ADOPTABLE FOUL WATER DRAIN 100mm Dia. U.N.O.
- EXTERNAL BACKDROP
- LINED (TYPE C) PERMEABLE CONSTRUCTION WITH 30% VOID MATERIAL SUBBASE. MINIMUM 300mm DEPTH OF PERMEABLE SUBBASE.

Rev.	Date	Description	By
P03	21.11.2025	RESERVED MATTERS SUBMISSION	TA

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Client
EASTLEIGH BOROUGH COUNCIL

Architect
BOYLE & SUMMERS

Project title
ONE HORTON HEATH,
UPPER ACRE,
EASTLEIGH.

Drawing title
DRAINAGE,
SHEET 4.

Scale	Paper size	Date	Drawn by	Checked by	Status
1:250	A1	NOV 2025	TA	CH	S3

Name

Project code	Originator	Functional breakdown	Spatial breakdown	Form	Discipline	Number	Revision
AAL390	AAL	ED	XX	DP	C	5104	P03

VENTED ATTENUATION TANK 5
AREA 160.000m²
DEPTH 1.050m
BASE CRATE LEVEL 22.725m
TOP CRATE LEVEL 23.775m
POLYSTORM XTRA CRATES OR SIMILAR APPROVED

VENTED ATTENUATION TANK 4
AREA 75.000m²
DEPTH 1.260m
BASE CRATE LEVEL 23.000m
TOP CRATE LEVEL 24.260m
POLYSTORM XTRA CRATES OR SIMILAR APPROVED

VENTED ATTENUATION TANK 1
AREA 100.000m²
DEPTH 0.630m
BASE CRATE LEVEL 22.665m
TOP CRATE LEVEL 23.295m
POLYSTORM XTRA CRATES OR SIMILAR APPROVED

2.4m x 1.8m CULVERTED WATERCOURSE, SUBJECT TO LAND DRAINAGE CONSENT. CULVERT DESIGNED TO ACCOMMODATE THE 1:1000YR EVENT WITH 300mm FREEBOARD TO ALLOW THE FREE FLOR OF FLOOD WATER UNDER THE PROPOSED ROAD CROSSING.

EXISTING WATERCOURSE CHANNEL AND TOP OF BANK TO BE LOCALLY REPROFILED.

ENHANCE SWALE TO CONVEY ROAD RUN-OFF TO EXISTING WATERCOURSE

REFER TO INSET A FOR CONTINUATION

INSET A

COLOURED DRAWING
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DRAINAGE NOTES
1. REFER TO DRAWING AAL390-ED-XX-LS-C-5199 FOR COMPREHENSIVE DRAINAGE NOTES.

EXTERNAL REFERENCES
1. SITE LAYOUT: UAOHH-BSL-ZZ-XX-DR-A-2001-P1 (04/11/2025)
2. TOPO SURVEY: ENC/130524/7LL1B (05/2024)

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- PATIO LAND DRAIN
- YARD GULLY
- PERMAVOID DIFFUSER UNIT
- ROAD GULLY
- ATTENUATION TANK OUT OF PROPRIETARY CRATE SYSTEM
- SURFACE WATER HEADWALL
- ADOPTABLE FOUL WATER MANHOLE / INSPECTION CHAMBER / ACCESS CHAMBER
- ADOPTABLE FOUL WATER DRAIN 100mm Dia. U.N.O.
- EXTERNAL BACKDROP
- LINED (TYPE C) PERMEABLE CONSTRUCTION WITH 30% VOID MATERIAL SUBBASE. MINIMUM 300mm DEPTH OF PERMEABLE SUBBASE.

P03	21.11.2025	RESERVED MATTERS SUBMISSION	TA
P02	17.11.2025	INTERIM DRAINAGE SUBMISSION	TA
P01	11.11.2025	PRELIMINARY ISSUE FOR COMMENT	TA
Rev.	Date	Description	By

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Client
EASTLEIGH BOROUGH COUNCIL

Architect
BOYLE & SUMMERS

Project title
ONE HORTON HEATH,
UPPER ACRE,
EASTLEIGH.

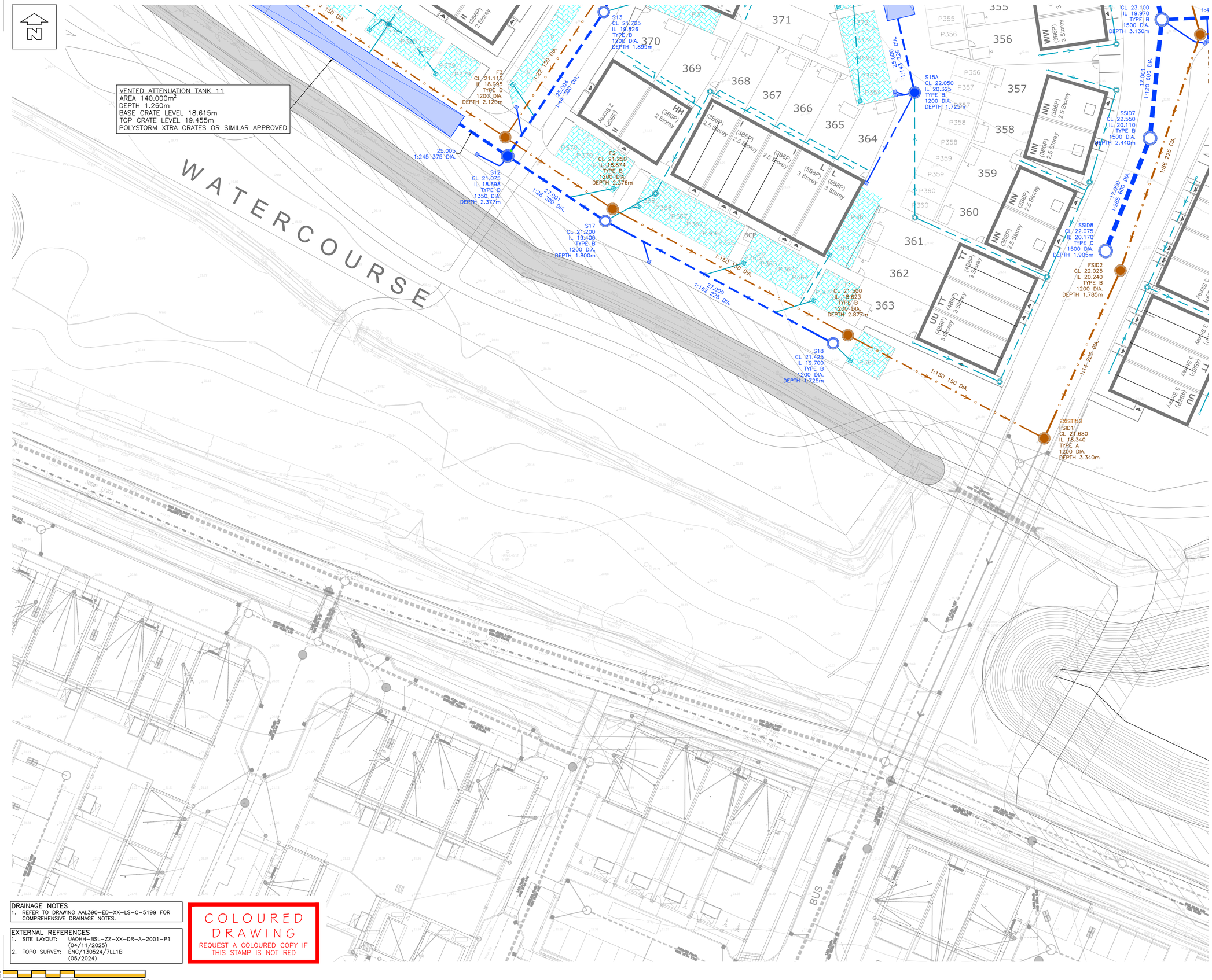
Drawing title
DRAINAGE,
SHEET 5.

Scale	Paper size	Date	Drawn by	Checked by	Status
1:250	A1	NOV 2025	TA	CH	S3

Name

Project code	Originator	Functional breakdown	Spatial breakdown	Form	Discipline	Number	Revision
AAL390-	AAL -	ED -	XX -	DP -	C -	5105-	P03

Scale 1:250
0m 10.0 20.0



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DRAINAGE NOTES

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EXTERNAL REFERENCES

1. SITE LAYOUT: UAOHH-BSL-ZZ-XX-DR-A-2001-P1 (04/11/2025)
2. TOPO SURVEY: ENG/130524/7LL1B (05/2024)

COLOURED DRAWING
REQUEST A COLOURED COPY IF THIS STAMP IS NOT RED

Scale 1:250
0m 10.0 20.0

Rev.	Date	Description	By
P03	21.11.2025	RESERVED MATTERS SUBMISSION	TA
P02	17.11.2025	INTERIM DRAINAGE SUBMISSION	TA
P01	11.11.2025	PRELIMINARY ISSUE FOR COMMENT	TA

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Client
EASTLEIGH BOROUGH COUNCIL

Architect
BOYLE & SUMMERS

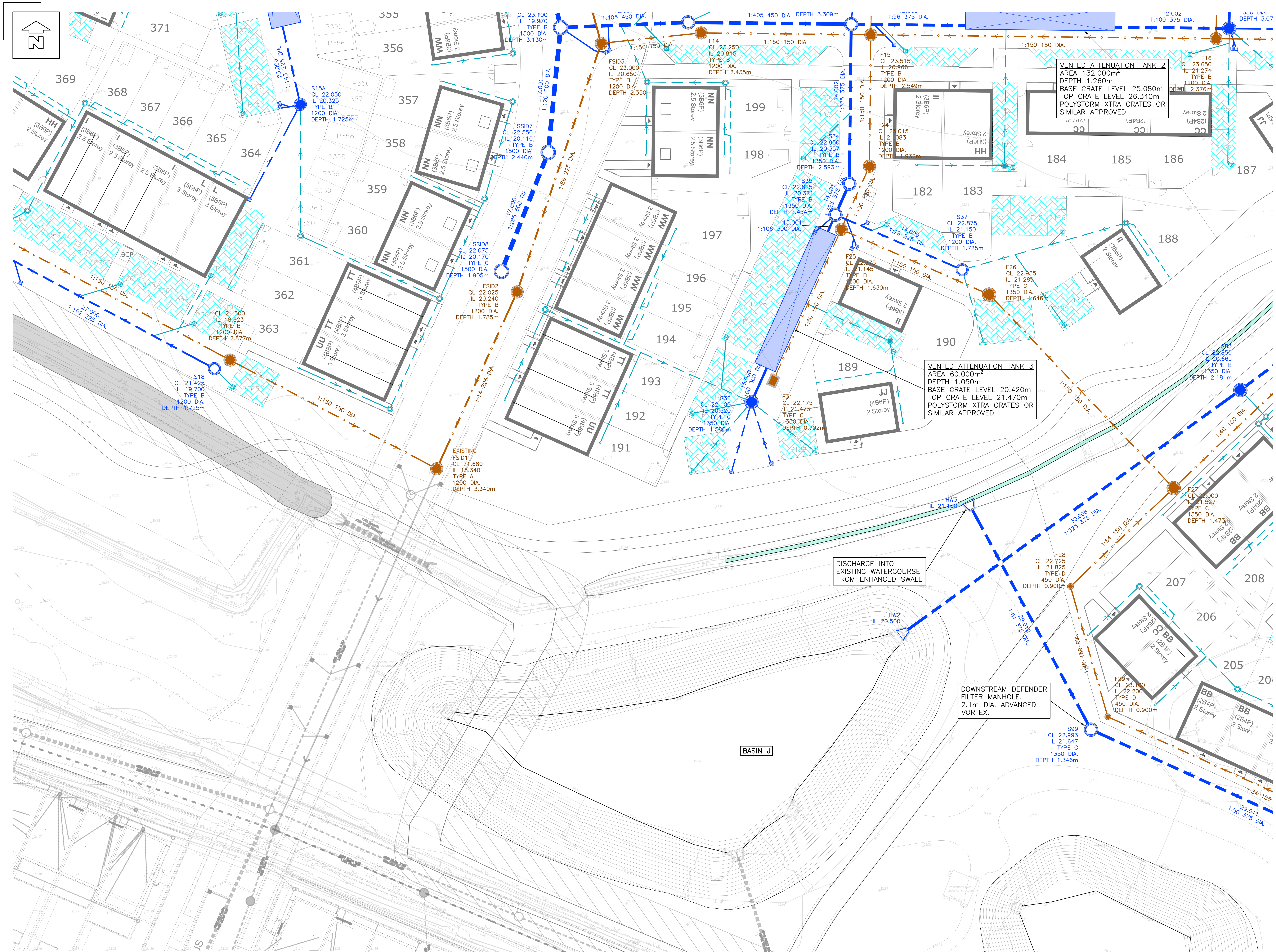
Project title
ONE HORTON HEATH,
UPPER ACRE,
EASTLEIGH.

Drawing title
DRAINAGE,
SHEET 6.

Scale	Paper size	Date	Drawn by	Checked by	Status
1:250	A1	NOV 2025	TA	CH	S3

Name

Project code	Originator	Functional breakdown	Spatial breakdown	Form	Discipline	Number	Revision
AAL390-	AAL -	ED -	XX -	DP -	C -	5106-	P03



DRAINAGE NOTES
1. REFER TO DRAWING AAL390-ED-XX-LS-C-5199 FOR COMPREHENSIVE DRAINAGE NOTES.

EXTERNAL REFERENCES
1. SITE LAYOUT: UAOHH-BSL-ZZ-XX-DR-A-2001-P1 (04/11/2025)
2. TOPO SURVEY: ENC/130524/7LL1B (05/2024)

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Scale 1:250 0m 10.0 20.0

NOTES

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7. IT IS THE CONTRACTORS SOLE RESPONSIBILITY FOR ASCERTAINING SAFE DISPOSAL OF ANY OFF-SITE EXCAVATED SPOIL. NO CLAIM RESULTING FROM ABNORMAL TIP REQUIREMENTS WILL BE ENTERTAINED.
8. LEVELS SHOWN ARE IN mAOD.

DRAINAGE LEGEND

- EXISTING SURFACE WATER SEWER / MANHOLE
- EXISTING FOUL WATER SEWER / MANHOLE
- EXISTING SURFACE / FOUL WATER SEWER TO BE ABANDONED
- ADOPTABLE SURFACE WATER MANHOLE / INSPECTION CHAMBER / ACCESS CHAMBER
- PRIVATE SURFACE WATER MANHOLE / INSPECTION CHAMBER / ACCESS CHAMBER
- DIVERTED SURFACE WATER MANHOLE / INSPECTION CHAMBER / ACCESS CHAMBER
- SURFACE WATER CATCHPIT MANHOLE
- FLOW CONTROL MANHOLE
- ADOPTABLE SURFACE WATER DRAIN / ADOPTABLE FILTER DRAIN / PRIVATE SURFACE WATER DRAIN 100mm Dia. U.N.O.
- RODDING EYE.
- PATIO LAND DRAIN
- YARD GULLY
- PERMAVOID DIFFUSER UNIT
- ROAD GULLY
- ATTENUATION TANK OUT OF PROPRIETARY CRATE SYSTEM
- SURFACE WATER HEADWALL
- ADOPTABLE FOUL WATER MANHOLE / INSPECTION CHAMBER / ACCESS CHAMBER
- ADOPTABLE FOUL WATER DRAIN 100mm Dia. U.N.O.
- EXTERNAL BACKDROP
- LINED (TYPE C) PERMEABLE CONSTRUCTION WITH 30% VOID MATERIAL SUBBASE. MINIMUM 300mm DEPTH OF PERMEABLE SUBBASE.

Rev.	Date	Description	By
P03	21.11.2025	RESERVED MATTERS SUBMISSION	TA
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P01	11.11.2025	PRELIMINARY ISSUE FOR COMMENT	TA

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BOYLE & SUMMERS

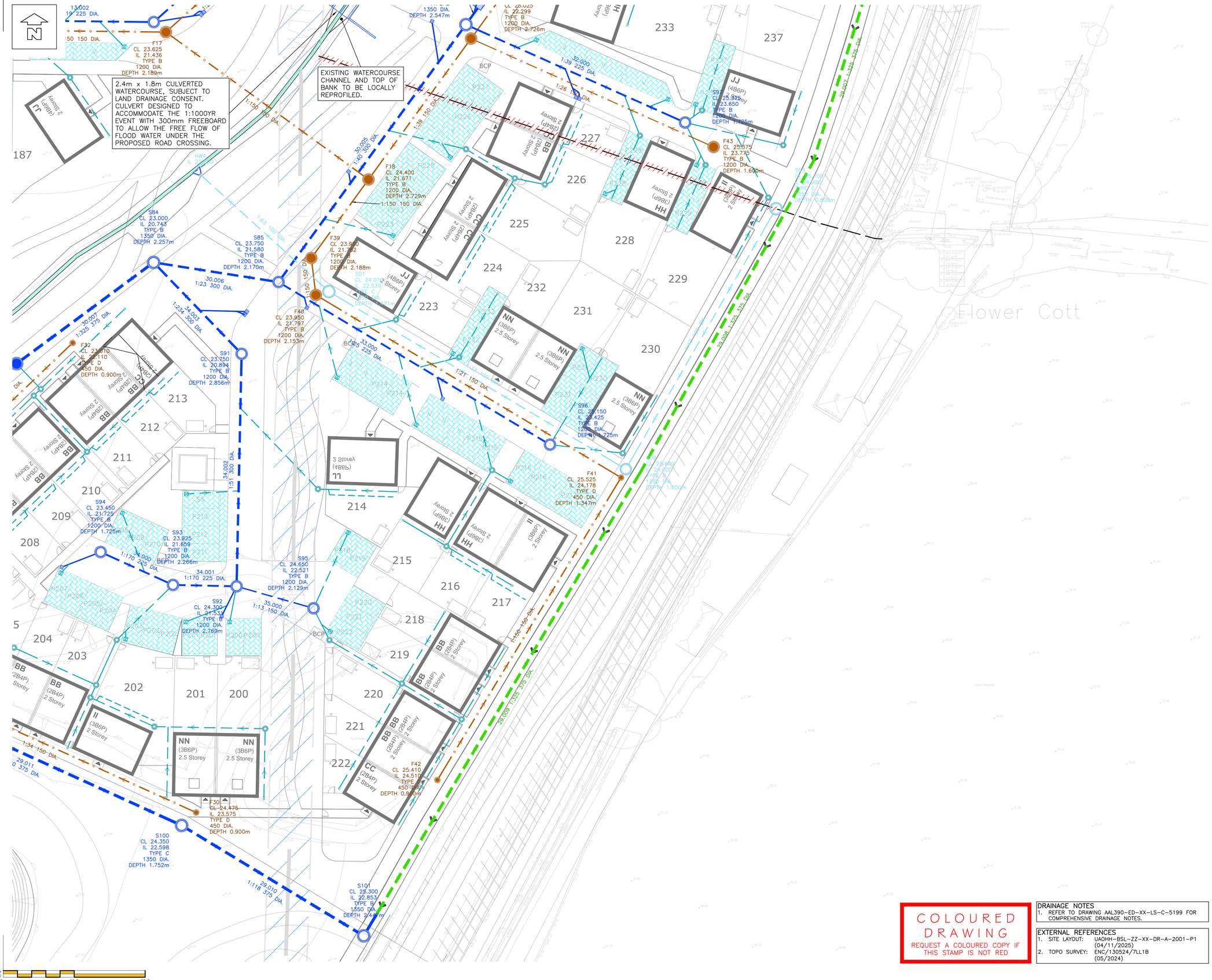
Project title
ONE HORTON HEATH, UPPER ACRE, EASTLEIGH.

Drawing title
DRAINAGE, SHEET 7.

Scale	Paper size	Date	Drawn by	Checked by	Status
1:250	A1	NOV 2025	TA	CH	S3

Name
Project code | Originator | Functional breakdown | Spatial breakdown | Form | Discipline | Number | Revision

AAL390-AAL-ED-XX-DP-C-5107-P03



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- EXISTING FOUL WATER SEWER / MANHOLE
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- ADOPTABLE SURFACE WATER MANHOLE / INSPECTION CHAMBER / ACCESS CHAMBER
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- SURFACE WATER CATCHPIT MANHOLE
- FLOW CONTROL MANHOLE
- ADOPTABLE SURFACE WATER DRAIN / ADOPTABLE FILTER DRAIN / PRIVATE SURFACE WATER DRAIN 100mm Dia. U.N.O.
- RODDING EYE.
- PATIO LAND DRAIN
- YARD GULLY
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- ROAD GULLY
- ATTENUATION TANK OUT OF PROPRIETARY CRATE SYSTEM
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EXTERNAL REFERENCES
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Client
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Project title
ONE HORTON HEATH, UPPER ACRE, EASTLEIGH.

Drawing title
DRAINAGE, SHEET 8.

Scale	Paper size	Date	Drawn by	Checked by	Status
1:250	A1	NOV 2025	TA	CH	S3

Name
Project code: Originator | Functional breakdown | Spatial breakdown | Form | Discipline | Number | Revision
AAL390-AAL-ED-XX-DP-C-5108-P03

DRAINAGE NOTES

1. ANY PIPES TO BE ADOPTED, OR CONNECTING TO ADOPTED SEWERS, AND/OR SITUATED UNDER THE HIGHWAY, TO BE VITRIFIED CLAY TO BS EN 295 & BS65 (SWS ONLY), OR CONCRETE PIPES TO BS EN 1916 & BS5811:PART 1, OR PLASTIC IN ACCORDANCE WITH THE FOLLOWING STANDARDS:
   - SOLID WALL PVC-U TO BS EN 1401
   - SPIRAL WOUND WELDED HDPE TO BS EN 13476 PARTS 1 & 2
   - STRUCTURE-WALL THERMOPLASTIC TO BS EN 13476 PARTS 1, 2 & 3
   - POLYPROPYLENE TO BS EN 1852
2. FOR CONSTRUCTION DETAILS REFER TO THE RELEVANT ARCH ASSOCIATES DRAWING NUMBERS LISTED ON THE DRAWING ISSUE SHEET.
3. ADOPTABLE HIGHWAY WORKS ARE TO BE IN ACCORDANCE WITH LOCAL AUTHORITY DESIGN GUIDANCE.
4. ANY WORKS ASSOCIATED WITH THE HIGHWAY/EXTERNAL WORKS INCLUDING HIGHWAY DRAINAGE, SHALL BE IN ACCORDANCE WITH THE HIGHWAYS AGENCY 'MANUAL OF CONTRACT DOCUMENTS FOR HIGHWAY WORKS, VOL 1' (MCHW), UNLESS OTHERWISE SPECIFIED.
5. ALL ADOPTABLE DRAINAGE WORKS TO BE CONSTRUCTED AS DETAILED IN "THE CODE" FOR ADOPTION DESIGN AND CONSTRUCTION GUIDANCE AND THE LOCAL WATER AUTHORITY'S LOCAL PRACTICE NOTE.
6. ALL ADOPTABLE SEWERS WITH LESS THAN 1.20m OF COVER WHEN LAID BENEATH THE ROADS, OR 0.90m OF COVER IN OTHER AREAS, SHALL HAVE CONCRETE PROTECTION IN ACCORDANCE WITH EITHER OF THE DETAILS SHOWN ON THE STANDARD DRAWING PROVIDED.
7. ALL DRAINAGE WORKS SHOULD COMMENCE AT THE PROPOSED DOWNSTREAM CONNECTION POINT, THE WORKS CONTINUING UPSTREAM FOLLOWING CONFIRMATION OF THE TIE-IN INVERT LEVELS TO THE ENGINEER. CONNECTIONS TO MANHOLES OR LARGER SIZED PIPES ETC. SHOULD BE SOFFIT TO SOFFIT UNLESS OTHERWISE INSTRUCTED BY THE ENGINEER, IF THIS IS NOT POSSIBLE INFORM THE ENGINEER IMMEDIATELY.
8. COVER LEVELS SHOWN ARE APPROXIMATE. COVERS AND FRAMES SHALL BE SET TO FINISHED GROUND LEVELS AND FALLS.
9. ROAD GULLY PIPES ARE TO BE 150mm DIA. WITH CONCRETE SURROUND AND FLEXIBLE JOINTS, ALL OTHER UN-REFERENCED PIPES ARE ASSUMED TO BE 100mm DIA.
   - FW MIN GRADIENT – 1 IN 40 (100 DIA) NO WC'S CONNECTED
   - FW MIN GRADIENT – 1 IN 80 (100 DIA) MIN 1 WC CONNECTED
   - FW MIN GRADIENT – 1 IN 150 (150 DIA) MIN 5 WC'S CONNECTED
   - SW MIN GRADIENT – 1 IN 100 (100 DIA)
   - SW MIN GRADIENT – 1 IN 150 (150 DIA)

   ALL GULLIES SHALL BE FITTED WITH GRADE D400 GRATINGS AND FRAMES TO BS EN124, UNLESS OTHERWISE STATED.
14. IN ORDER TO MAINTAIN THE SATISFACTORY FUNCTIONING OF SURFACE WATER SEWERS, ALL ROAD AND YARD GULLIES ARE TO BE "TRAPPED".
15. ALL NON ADOPTABLE LATERALS BENEATH THE HIGHWAY SHALL BE BACK FILLED WITH A TYPE 1 GRANULAR MATERIAL AS CL.803 (MCHW) APPROVED BY THE ENGINEER.
16. ALL PRIVATE DRAINAGE TO BE IN ACCORDANCE WITH THE BUILDING REGULATIONS APPROVED DOCUMENT PART-H, AND TO THE SATISFACTION OF THE BUILDING CONTROL INSPECTOR.
17. WHERE DRAINS PASS THROUGH FOUNDATIONS OR CONNECT TO MANHOLES, A FLEXIBLE PIPE JOINT SHOULD BE PROVIDED TO FORM A ROCKER PIPE IN ACCORDANCE WITH THE STANDARD DETAIL PROVIDED.
18. SHALLOW PRIVATE DRAINS MAY REQUIRE PROTECTION USING CLASS 'Z' CONCRETE SURROUND OR PAVING SLABS BRIDGING THE TRENCH SUBJECT TO THE NHBC INSPECTOR'S REQUIREMENTS.
19. WHERE DRAINAGE RUNS PASS CLOSE TO BUILDINGS OR THEIR INVERT LEVELS ARE BELOW FOUNDATION LEVEL, THEN THE TRENCHES ARE TO BE BACK FILLED IN ACCORDANCE WITH THE STANDARD DETAIL PROVIDED.
20. REFERENCE SHOULD BE MADE TO THE STRUCTURAL ENGINEERS DETAILS FOR ALL ASPECTS OF FOUNDATION DESIGN AND CONSTRUCTION.
21. THE CONTRACTOR IS TO KEEP A RECORD OF ANY VARIATIONS MADE ON SITE, INCLUDING THE RELOCATION OF SEWERS OR DRAINS, SO THAT AN AS CONSTRUCTED DRAWING CAN BE PREPARED UPON COMPLETION OF THE PROJECT.
22. THE CONTRACTOR SHOULD CHECK ALL DIMENSIONS ON SITE. NO DIMENSIONS ARE TO BE SCALED FROM THESE DRAWINGS.
23. IT IS THE CONTRACTORS/SUBCONTRACTORS RESPONSIBILITY TO ENSURE COMPLIANCE WITH THE CURRENT BUILDING REGULATIONS AND CODES OF PRACTICE.
24. STUB CONNECTIONS TO ADOPTABLE MANHOLES SHALL BE MADE FROM VITRIFIED CLAY AND CONSIST OF TWO ROCKER PIPES LAID AT THE SAME GRADIENT AS THE UP OR DOWNSTREAM PIPE.
25. ALL DOWNPIPES ARE TO BE SEALED, IE CONNECTED DIRECTLY TO THE STORMWATER DRAIN. ACCESS POINTS TO BE PROVIDED 1m ABOVE GROUND LEVEL FOR EXTERNAL RWP'S AND 1m ABOVE FFL FOR INTERNAL RWP'S.
26. UNLESS OTHERWISE NOTED OR SIMILAR APPROVED CHANNEL DRAINS TO BE ACO MULTI DRAIN WITH A15 GRATING IN PEDESTRIAN AREAS, C250 IN CAR PARKS AND D400 IN CARRIAGEWAYS. SLOTTED CHANNEL TO BE USED FOR AREAS WITH FALLS <1:15 MESH GRATING TO BE USED WHERE FALLS >1:15.
27. GULLY AND CHANNEL DRAIN POSITIONS ARE LIABLE TO AMENDMENT WHEN THE DESIGN LEVELS HAVE BEEN DETERMINED.
28. MODULAR GEOCELLULAR STORAGE/SOAKAWAY SYSTEM TO CONFORM TO CIRIA C793 THE SUDS MANUAL, C680 STRUCTURAL DESIGN OF MODULAR GEOCELLULAR DRAINAGE TANKS & C698 SITE HANDBOOK FOR THE CONSTRUCTION OF SUDS. THE MANUFACTURER SHOULD PROVIDE A COMPLETE SET OF INDEPENDENT TEST RESULTS FOR A PROPOSED SYSTEM INCLUDING, AS A MINIMUM, STRESS/STRAIN CURVES FOR VERTICAL AND LATERAL COMPRESSION, AND CREEP TESTS UNDER SUSTAINED LONG-TERM LOADS. A BBA CERTIFICATE IS NOT INDEPENDENT TEST DATA.
29. ALL REDUNDANT DRAINAGE TO BE ABANDONED ONCE THE CONTRACTOR HAS SATISFIED HIMSELF THAT NO CONNECTIONS REMAIN LIVE. REDUNDANT DRAINAGE TO BE GRUBBED OUT.
30. ALL BELOW GROUND CONCRETE TO ACCORD WITH BS5328:1997;SULPHATE CLASS TBA.
31. IF ANY SUB SOIL DRAINAGE SYSTEMS ARE UNCOVERED DURING THE WORKS CONTACT THE ENGINEER FOR INSTRUCTIONS. GENERALLY SUB SOIL DRAINS AFFECTED ARE TO BE DIVERTED AROUND NEW WORKS AND CONNECTED INTO THE SURFACE WATER DRAINAGE SYSTEM. PIPE DIAMETERS AND GRADIENTS ARE TO BE MAINTAINED.
32. BEFORE COMMENCING CONSTRUCTION THE CONTRACTOR MUST CHECK THE INVERT LEVELS OF EXISTING SEWERS TO WHICH CONNECTIONS ARE MADE. IN ADDITION THE CONTRACTOR MUST LOCATE AND DETERMINE INVERT LEVELS OF THE EXISTING SPURS TO WHICH CONNECTIONS ARE PROPOSED. ADDITIONAL SPUR/MANHOLE CONNECTIONS ARE TO BE AGREED WITH THE RELEVANT ADOPTING AUTHORITY. ANY DISCREPANCIES ARE TO BE NOTIFIED TO THE ENGINEER IMMEDIATELY, PRIOR TO CONSTRUCTION.
33. ROAD REINSTATEMENTS ARE TO BE TO THE HIGHWAY AUTHORITY APPROVAL.
34. NO PRIVATE AREAS ARE TO DRAIN ONTO ADOPTABLE AREAS AND VICE VERSA.

Scale 1:1
0mm 50 100

NOTES

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P02	21.11.2025	RESERVED MATTERS SUBMISSION	TA
P01	17.11.2025	PRELIMINARY ISSUE FOR COMMENT	TA

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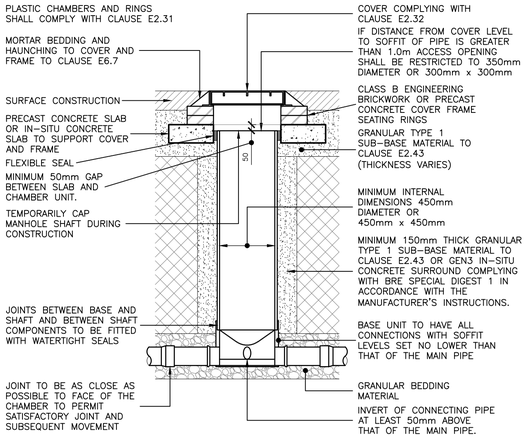
Drawing title
DRAINAGE NOTES.

Scale	Paper size	Date	Drawn by	Checked by	Status
NTS	A1	NOV 2025	TA	CH	S3

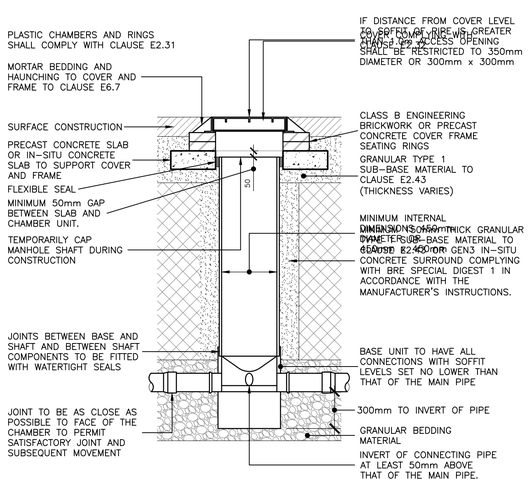
Name
Project code: Originator | Functional breakdown | Spatial breakdown | Form | Discipline | Number | Revision
AAL390-AAL-ED-XX-LS-C-5199-P02



NOTE: WHERE THE ACCESS CHAMBER IS IN THE HIGHWAY (INCLUDING ANY FOOTWAY) THE HIGHWAY AUTHORITY MAY HAVE SPECIFIC REQUIREMENTS

TYPICAL INSPECTION CHAMBER DETAIL – TYPE D

DEPTH FROM COVER LEVEL TO SOFFIT OF PIPE UP TO 3m
FLEXIBLE MATERIAL CONSTRUCTION FOR USE IN AREAS SUBJECT TO VEHICLE LOADING
(SCALE 1:25@A1)

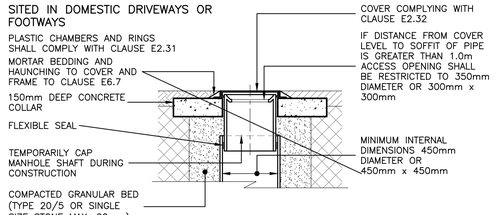


NOTE: WHERE THE ACCESS CHAMBER IS IN THE HIGHWAY (INCLUDING ANY FOOTWAY) THE HIGHWAY AUTHORITY MAY HAVE SPECIFIC REQUIREMENTS

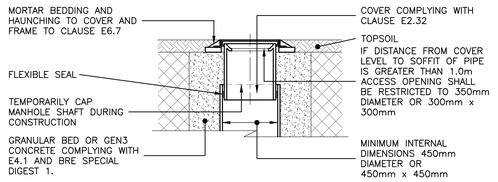
TYPICAL INSPECTION CHAMBER CATCHPIT DETAIL – TYPE D

DEPTH FROM COVER LEVEL TO SOFFIT OF PIPE UP TO 3m
FLEXIBLE MATERIAL CONSTRUCTION FOR USE IN AREAS SUBJECT TO VEHICLE LOADING
(SCALE 1:25@A1)

SITED IN DOMESTIC DRIVEWAYS OR FOOTWAYS

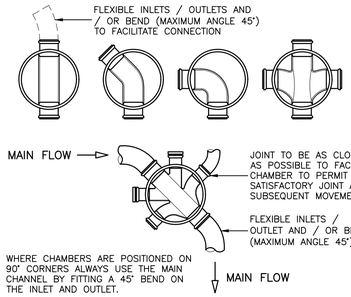


SITED IN DOMESTIC GARDENS



TYPICAL INSPECTION CHAMBER DETAIL – TYPE D

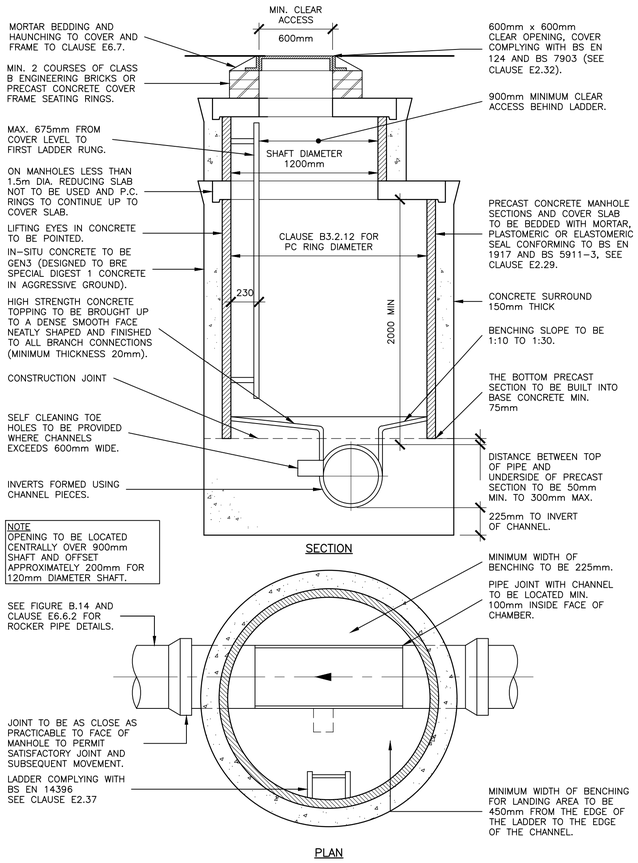
FLEXIBLE MATERIAL CONSTRUCTION ALTERNATIVE TOP DETAILS FOR USE IN AREAS OF LIGHT VEHICLE LOADING AND LANDSCAPED AREAS
(SCALE 1:25@A1)



NOTE: WHERE A BEND IS USED IMMEDIATELY OUTSIDE THE MANHOLE, THIS MAY BE USED AS A ROCKER PIPE.

TYPICAL BASE LAYOUTS FOR TYPE D CHAMBERS

(SCALE 1:25@A1)



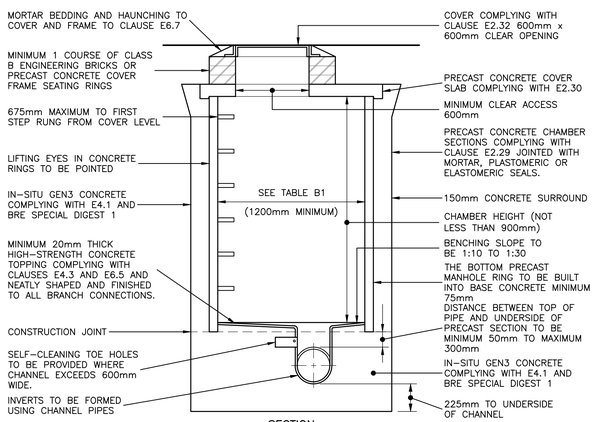
NOTE
OPENING TO BE LOCATED CENTRALLY OVER 900mm SHAFT AND OFFSET APPROXIMATELY 200mm FOR 120mm DIAMETER SHAFT.

SECTION

PLAN

TYPICAL MANHOLE DETAIL – TYPE A

DEPTH FROM COVER LEVEL TO SOFFIT OF PIPE 3.0m TO 6.0m
(SCALE 1:25@A1)



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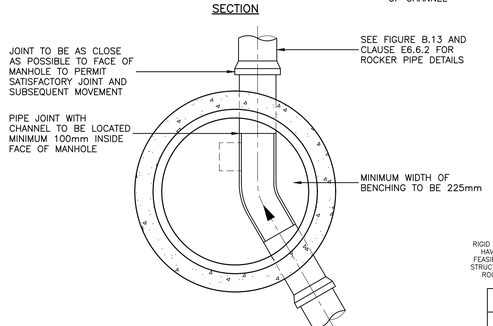


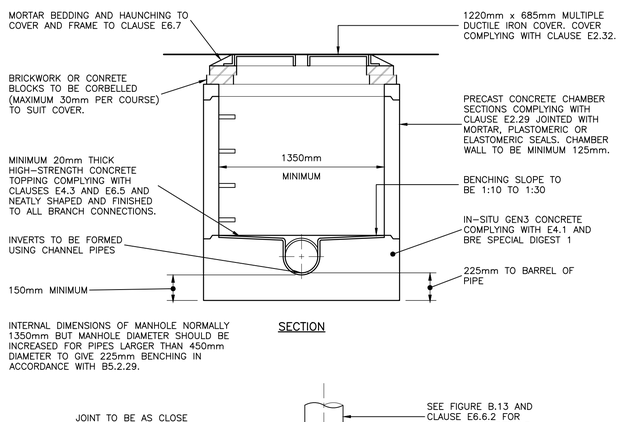
PLAN

RIGID PIPES BUILT INTO MANHOLE SHOULD HAVE A FLEXIBLE JOINT AS CLOSE AS FEASIBLE TO THE EXTERNAL FACE OF THE STRUCTURE AND THE LENGTH OF THE NEXT ROCKER PIPE SHOULD BE AS SHOWN

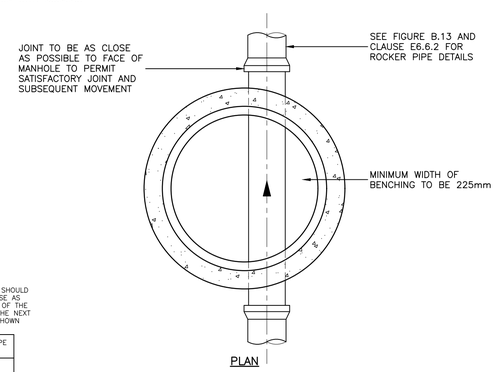
NOMINAL DIAMETER.	ROCKER PIPE LENGTH
150–600	0.6
601–750	1.0
OVER 750	1.25

TYPICAL MANHOLE DETAIL – TYPE B

DEPTH FROM COVER LEVEL TO SOFFIT OF PIPE 1.5m–3.0m
(RIGID MATERIAL CONSTRUCTION WITH CONCRETE SURROUND)
(SCALE 1:25@A1)



SECTION



PLAN

TYPICAL MANHOLE DETAIL – TYPE C

DEPTH FROM COVER LEVEL TO SOFFIT OF PIPE LESS THAN 1.5m
(RIGID MATERIAL CONSTRUCTION)
(SCALE 1:25@A1)

Scale 1:1
0mm 50 100

NOTES

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Client
EASTLEIGH BOROUGH COUNCIL

Architect
BOYLE & SUMMERS

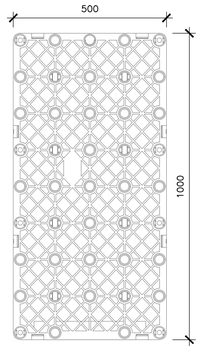
Project title
ONE HORTON HEATH,
UPPER ACRE,
EASTLEIGH.

Drawing title
DRAINAGE DETAILS,
SHEET 1.

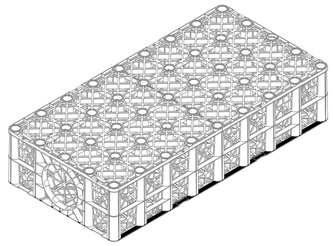
Scale	Paper size	Date	Drawn by	Checked by	Status
AS SHOWN	A1	OCT 2025	TA	CH	

Name

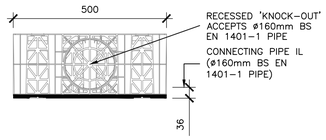
Project code: Originator | Functional breakdown | Spatial breakdown | Form | Discipline | Number | Revision
AAL390 - AAL - ED - XX - DD - C - 5551 - P02



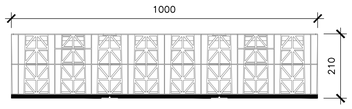
POLYSTORM XTRA – PLAN VIEW
(SCALE 1:10@A1)



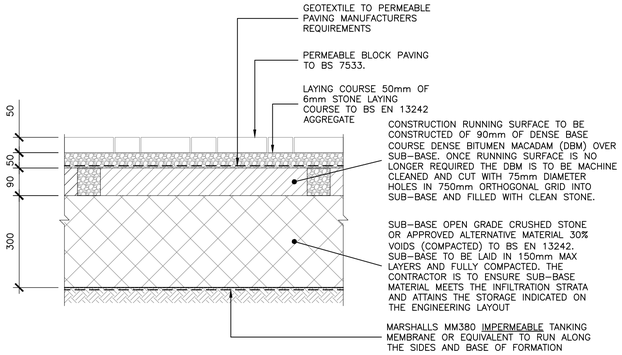
POLYSTORM XTRA – ISOMETRIC VIEW
(SCALE 1:10@A1)



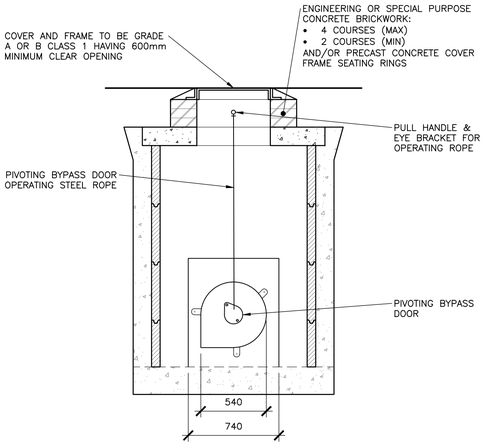
POLYSTORM XTRA – END ELEVATION
(SCALE 1:10@A1)



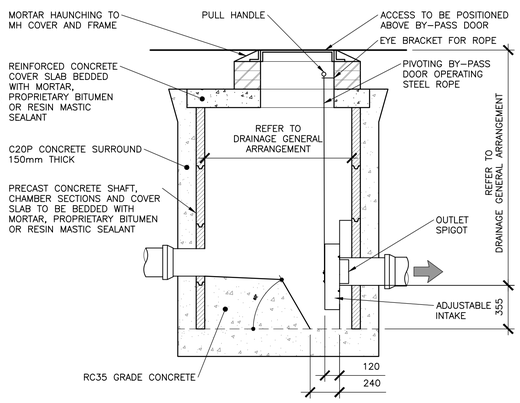
POLYSTORM XTRA – SIDE ELEVATION
(SCALE 1:10@A1)



LINED PERMEABLE BLOCK PAVED PRIVATE DRIVES AND PARKING AREAS
(SCALE 1:10@A1)



SECTION 1–1



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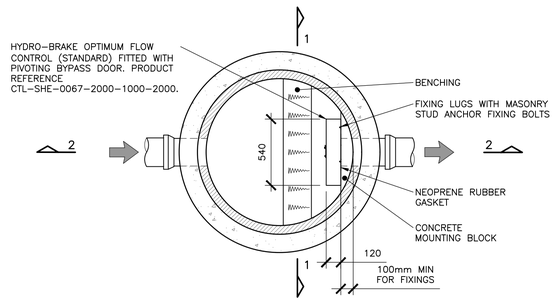
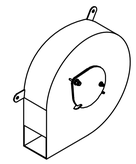
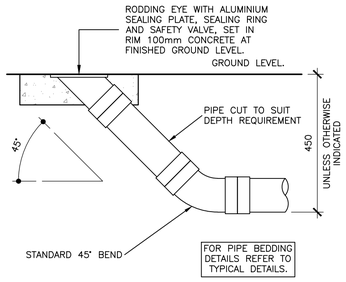


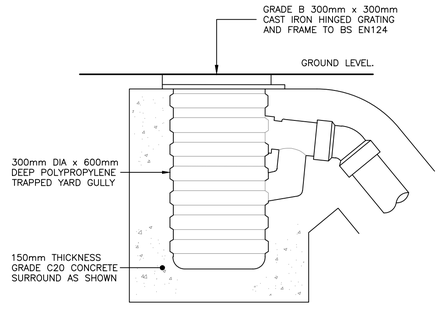
STANDARD FLOW CONTROL MANHOLE DETAIL
(1:25)



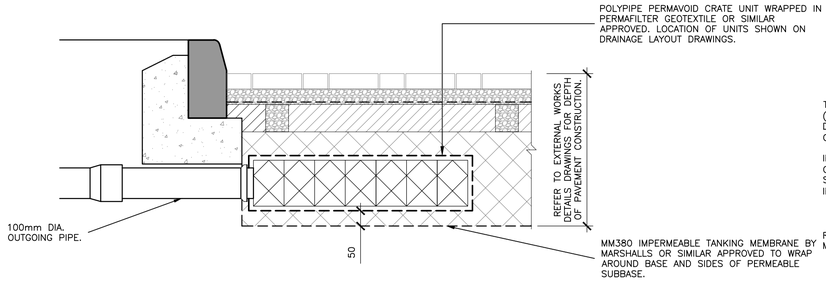
ISOMETRIC VIEW



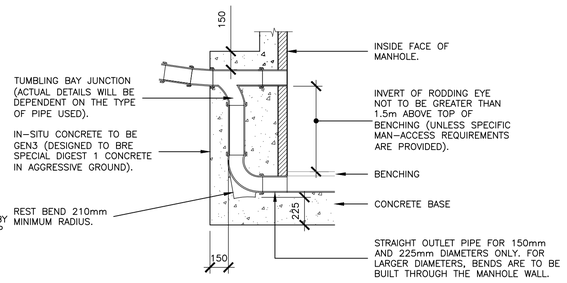
RODDING EYE DETAIL
(SCALE 1:10@A1)
TO BE USED IN PEDESTRAIN AND LANDSCAPED AREAS NOT SUBJECT TO VEHICULAR LOADING. MAXIMUM DEPTH TO INVERT 600mm.



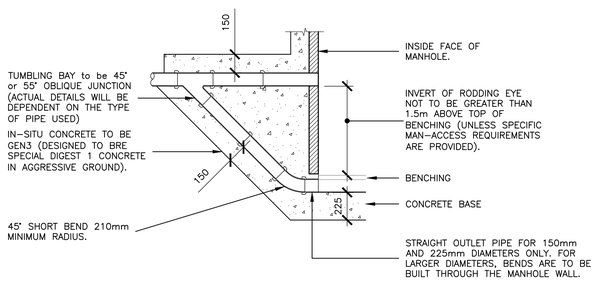
YARD GULLY DETAIL
(SCALE 1:10@A1)



PERMAVOID DISTRIBUTION TANK DETAIL
(SCALE 1:10@A1)



EXTERNAL VERTICAL BACKDROP DETAIL
(SCALE 1:25@A1)



EXTERNAL RAMPED BACKDROP DETAIL
(SCALE 1:25@A1)

Scale 1:1
0mm 50 100

NOTES

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Rev.	Date	Description	By
P02	21.11.2025	RESERVED MATTERS SUBMISSION	TA
P01	17.11.2025	PRELIMINARY ISSUES FOR COMMENT	TA

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Client
EASTLEIGH BOROUGH COUNCIL

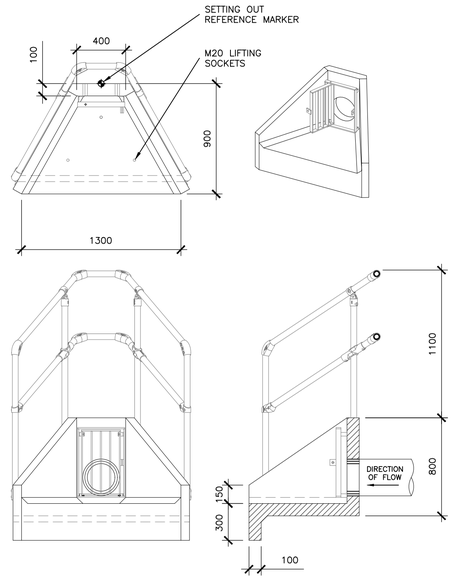
Architect
BOYLE & SUMMERS

Project title
ONE HORTON HEATH,
UPPER ACRE,
EASTLEIGH.

Drawing title
DRAINAGE DETAILS,
SHEET 2.

Scale	Paper size	Date	Drawn by	Checked by	Status
AS SHOWN	A1	OCT 2025	TA	CH	

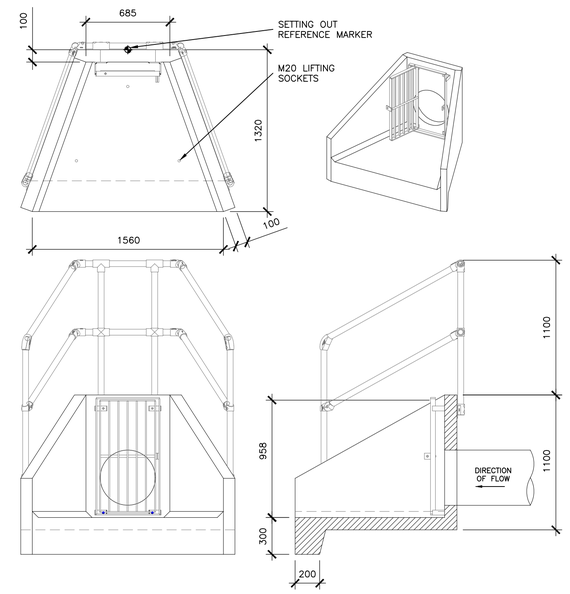
Name
Project code | Originator | Functional breakdown | Spatial breakdown | Form | Discipline | Number | Revision
AAL390-AAL-ED-XX-DD-C-5552-P02



H3C HEADWALL AND HINGED CLOSE COUPLED GRATING AND 3 SIDED KEE KLAMP

[OUTLET FOR PIPES UP TO 300mm DIA.]

(SCALE 1:25@A1)



H6CA HEADWALL AND HINGED CLOSE COUPLED GRATING AND 3 SIDED KEE KLAMP

[OUTLET FOR PIPES UP TO 600mm DIA.]

(SCALE 1:25@A1)

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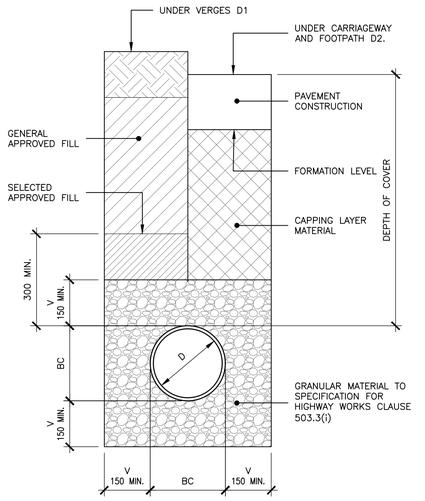
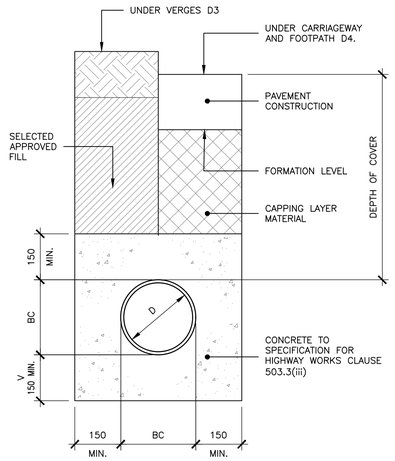


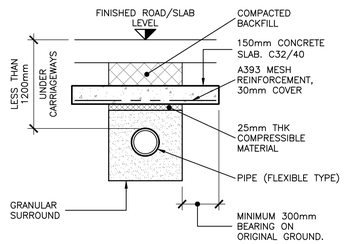
IN UNIFORM SOILS
V = 1/6 BC (150mm MIN., UNDER BARREL AND COLLAR)
IN MIXED SOILS CONTAINING IRREGULAR HARD SPOTS
V = 1/4 BC (200mm. MIN)
DESIGN D1 (UNDER VERGES – >900 COVER)
DESIGN D2 (UNDER CARRIAGEWAYS – >1200 COVER)

BEDDING DETAIL – CLASS 'S'



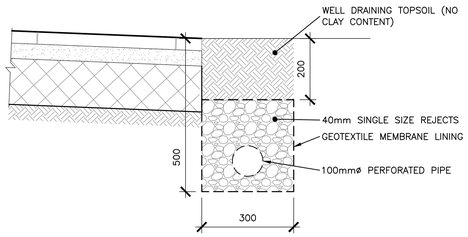
V = 1/4 D (150mm MIN., UNDER BARREL AND COLLAR)
DESIGN D3 (UNDER VERGES – <900 COVER)
DESIGN D4 (UNDER CARRIAGEWAYS – <1200 COVER)

BEDDING DETAIL – CLASS 'Z'



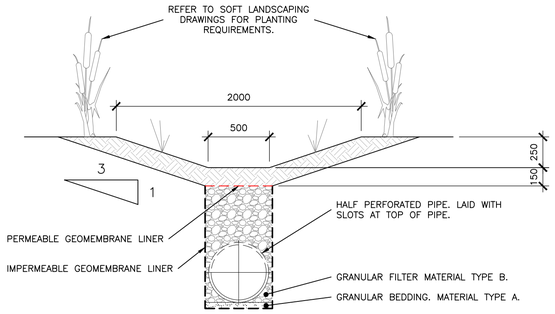
ALTERNATIVE PROTECTION OF A SHALLOW PIPELINE USING A SLAB

UNDER VERGES LESS THAN 900 COVER
UNDER CARRIAGEWAYS LESS THAN 1200 COVER
(SCALE 1:25@A1)



LAND DRAIN DETAIL

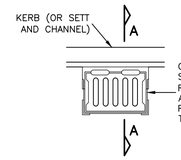
(1:10)



CONEYANCE SWALE DETAIL

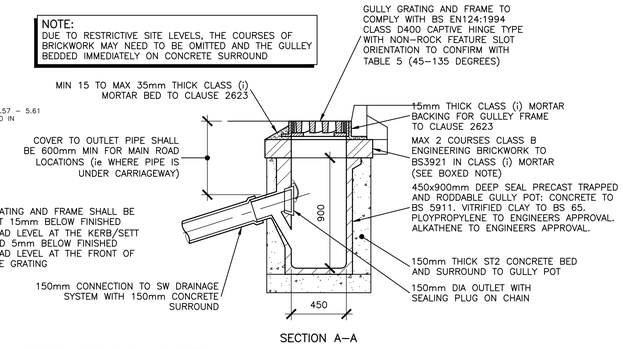
(SCALE 1:25@A1)

NOTES
1. ALL DIMENSIONS IN MILLIMETRES
2. ALL DETAILS IN ACCORDANCE WITH SECTIONS 5.57 – 5.61
3. UNTRAPPED GULLY CHAMBER MAY BE EMPLOYED IN CONNECTED TO SURFACE WATER ONLY



PLAN

NOTE:
DUE TO RESTRICTIVE SITE LEVELS, THE COURSES OF BRICKWORK MAY NEED TO BE OMITTED AND THE GULLEY BEDDED IMMEDIATELY ON CONCRETE SURROUND



SECTION A–A

TYPICAL ROAD GULLY DETAIL

(1:25)

Scale 1:1
0mm 50 100

Rev.	Date	Description	By
P02	21.11.2025	RESERVED MATTERS SUBMISSION	TA
P01	17.11.2025	PRELIMINARY ISSUES FOR COMMENT	TA

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Client
EASTLEIGH BOROUGH COUNCIL

Architect
BOYLE & SUMMERS

Project title
ONE HORTON HEATH,
UPPER ACRE,
EASTLEIGH.

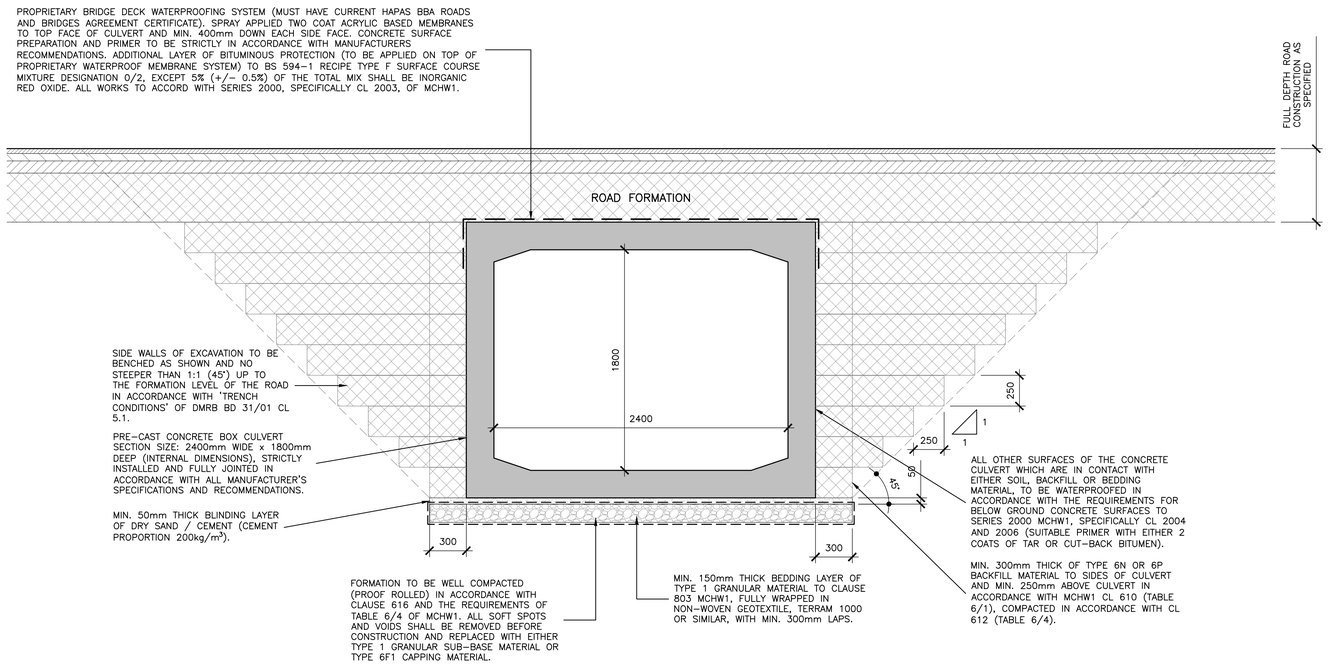
Drawing title
DRAINAGE DETAILS,
SHEET 3.

Scale	Paper size	Date	Drawn by	Checked by	Status
AS SHOWN	A1	OCT 2025	TA	CH	

Name

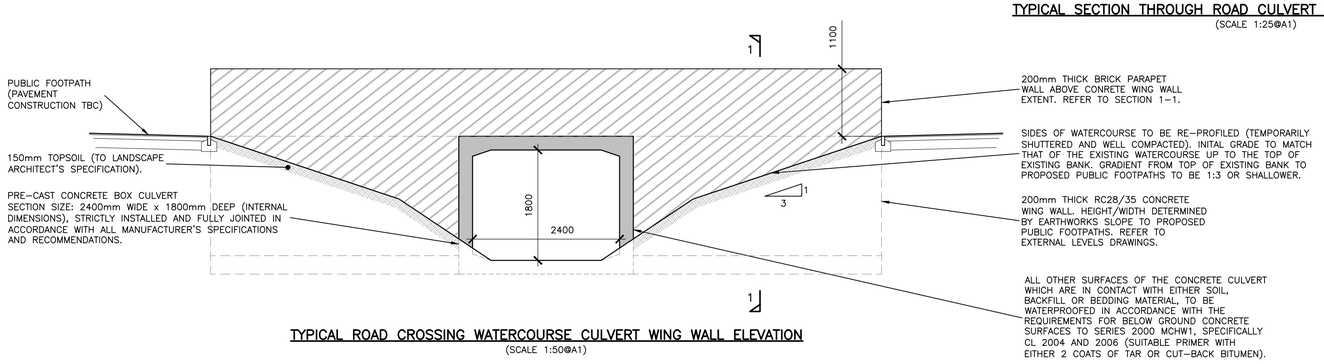
Project code | Originator | Functional breakdown | Spatial breakdown | Form | Discipline | Number | Revision

AAL390-AAL-ED-XX-DR-C-5553-P02



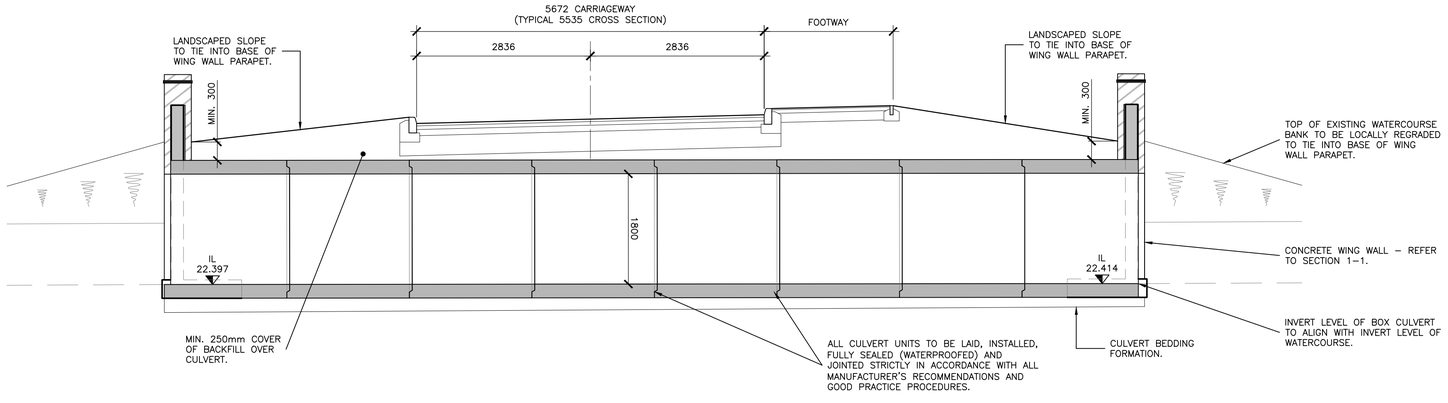
TYPICAL SECTION THROUGH ROAD CULVERT WATERCOURSE CROSSING

(SCALE 1:25@A1)



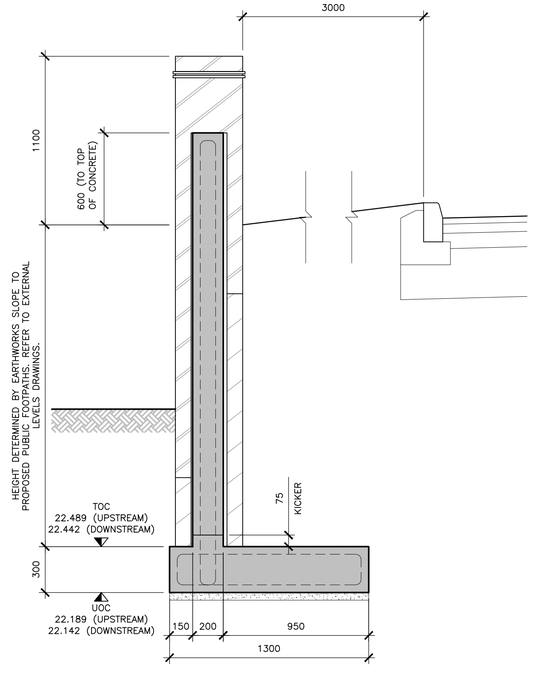
TYPICAL ROAD CROSSING WATERCOURSE CULVERT WING WALL ELEVATION

(SCALE 1:50@A1)



LONGITUDINAL SECTION THROUGH WATERCOURSE CROSSING CULVERT

(SCALE 1:50@A1)



SECTION 1-1

(SCALE 1:20@A1)

Scale 1:1
0mm 50 100

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Architect
BOYLE & SUMMERS

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ONE HORTON HEATH,
UPPER ACRE,
EASTLEIGH.

Drawing title
DRAINAGE DETAILS,
SHEET 4.

Scale	Paper size	Date	Drawn by	Checked by	Status
AS SHOWN	A1	NOV 2025	TA	CH	

Name

Project code	Originator	Functional breakdown	Spatial breakdown	Form	Discipline	Number	Revision
AAL390	AAL	ED	XX	DD	C	5554	P02

CATCHMENT PLAN LEGEND

- CATCHMENT DRAINING TO BASIN H
- CATCHMENT DRAINING TO BASIN J
- CATCHMENT DRAINING TO EXISTING WATERCOURSE

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8. LEVELS SHOWN ARE IN mAOD.

DRAINAGE NOTES

1. REFER TO DRAWING AAL390-ED-XX-LS-C-5199 FOR COMPREHENSIVE DRAINAGE NOTES.

EXTERNAL REFERENCES

1. SITE LAYOUT: UAOHH-BSL-ZZ-XX-DR-A-2001-P1 (04/11/2025)
2. TOPO SURVEY: ENC/130524/7LL1B (05/2024)

COLOURED DRAWING
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Rev.	Date	Description	By
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Client
EASTLEIGH BOROUGH COUNCIL

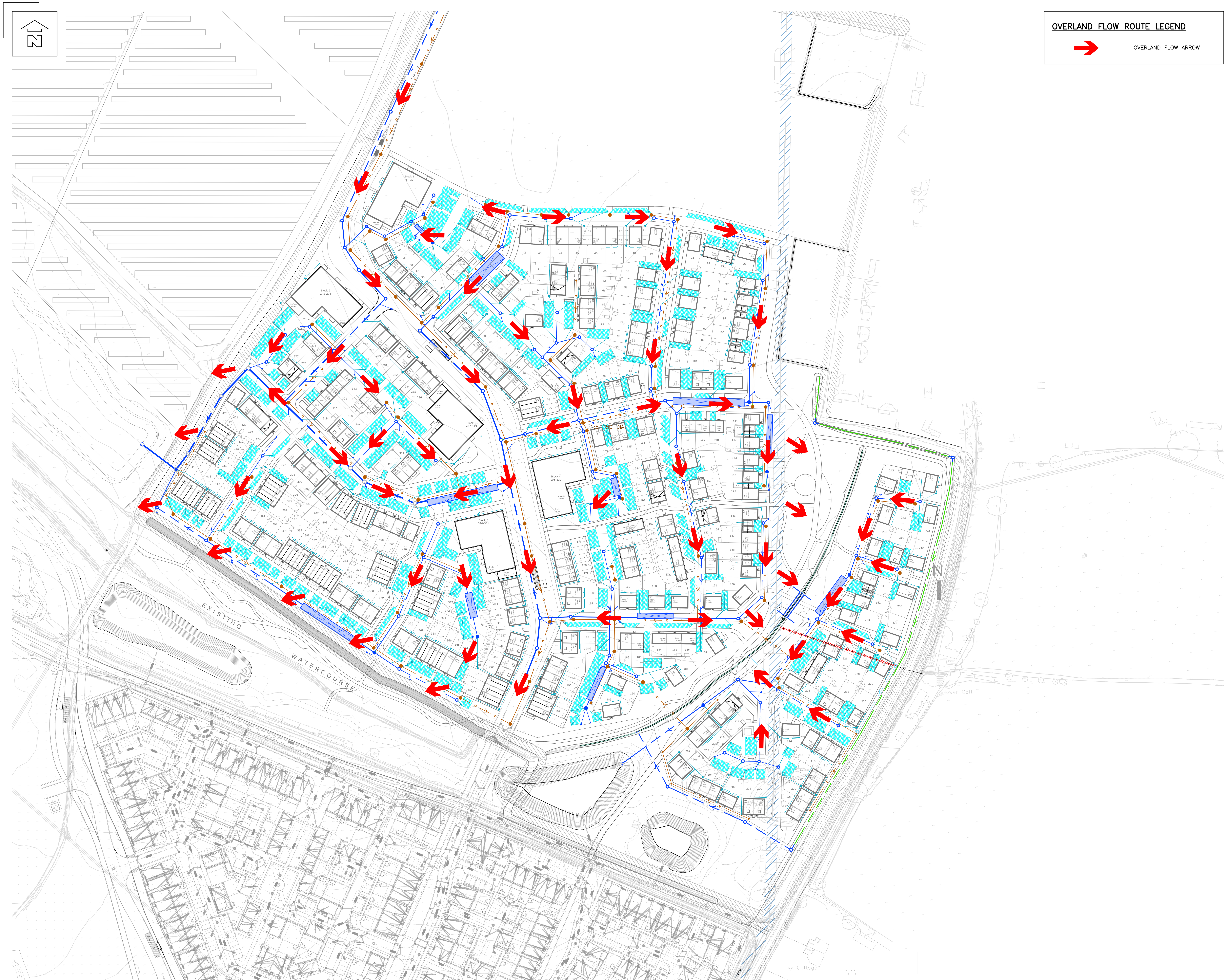
Architect
BOYLE & SUMMERS

Project title
ONE HORTON HEATH,
UPPER ACRE,
EASTLEIGH.

Drawing title
DRAINAGE,
CATCHMENT PLAN.

Scale	Paper size	Date	Drawn by	Checked by	Status
1:1000	A1	NOV 2025	TA	CH	S3

Name
Project code: AAL390-AAL-ED-XX-DP-C-5109-P02
(Originator | Functional breakdown | Spatial breakdown | Form | Discipline | Number | Revision)



OVERLAND FLOW ROUTE LEGEND

OVERLAND FLOW ARROW

Scale 1:1
0mm 50 100

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1. REFER TO DRAWING AAL390–ED–XX–LS–C–5199 FOR COMPREHENSIVE DRAINAGE NOTES.

EXTERNAL REFERENCES

1. SITE LAYOUT: UAOHH–BSL–ZZ–XX–DR–A–2001–P1 (04/11/2025)
2. TOPO SURVEY: ENC/130524/7LL1B (05/2024)

COLOURED DRAWING
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Rev.	Date	Description	By
P02	21.11.2025	RESERVED MATTERS SUBMISSION	TA
P01	17.11.2025	PRELIMINARY ISSUE FOR COMMENT	TA

ARCH ASSOCIATES
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www.archassociates.co.uk

Client
EASTLEIGH BOROUGH COUNCIL

Architect
BOYLE & SUMMERS

Project title
ONE HORTON HEATH, UPPER ACRE, EASTLEIGH.

Drawing title
DRAINAGE, OVERLAND FLOW ROUTE PLAN.

Scale	Paper size	Date	Drawn by	Checked by	Status
1:1000	A1	NOV 2025	TA	CH	S3

Name
Project code | Originator | Functional breakdown | Spatial breakdown | Form | Discipline | Number | Revision

AAL390-AAL-ED-XX-DP-C-5110-P02

EXTERNAL REFERENCES
1. SITE LAYOUT: UAOHH-BSL-ZZ-XX-DR-A-2001-P1 (04/11/2025)
2. TOPO SURVEY: ENC/130524/7LL1B (05/2024)

EXTERNAL WORKS LEGEND

FFL 65.475	PROPOSED FINISHED FLOOR LEVEL
1 in 17	GENERAL CROSS FALL
2.400	PROPOSED MINOR CONTOUR (100mm)
2.500	PROPOSED MAJOR CONTOUR (500mm)
RTW350	RETAINING WALL (HEIGHT mm)
GB300	GRAVEL BOARD (HEIGHT mm)
	RAISED DPC
	EXPOSED BRICKWORK / UNDERBUILD
	TANKED BRICKWORK / OVERBUILD
L S R	BUILDING ACCESS UP (LEVEL, STEPS, RAMP)
L S R	BUILDING ACCESS DOWN (LEVEL, STEPS, RAMP)
56.34	EXISTING LEVEL

ALL LEVELS IN mAOD

Block 1
1 - 30
FFL 27.225
FFL 27.075
Cycle Store
Refuse Store
Block 2
245-274
FFL 25.075
FFL 24.700
Cycle Store
FFL 26.700
FFL 26.575
FFL 26.475
FFL 26.375
FFL 26.600
FFL 27.575
FFL 27.450
FFL 28.575
FFL 28.800
FFL 26.750
FFL 26.150
FFL 25.950
FFL 25.825
FFL 26.400
FFL 26.225
FFL 26.050
FFL 25.000
FFL 23.500
FFL 24.100
FFL 24.850
FFL 24.550

Scale 1:250
0m 10.0 20.0

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7. IT IS THE CONTRACTORS SOLE RESPONSIBILITY FOR ASCERTAINING SAFE DISPOSAL OF ANY OFF-SITE EXCAVATED SPOIL. NO CLAIM RESULTING FROM ABNORMAL TIP REQUIREMENTS WILL BE ENTERTAINED.

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Rev.	Date	Description	By
P02	21.11.2025	RESERVED MATTERS SUBMISSION	JH
P01	11.11.2025	PRELIMINARY ISSUE FOR COMMENT	JH

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Client
EASTLEIGH BOROUGH COUNCIL

Architect
BOYLE & SUMMERS

Project title
ONE HORTON HEATH,
UPPER ACRE,
EASTLEIGH.

Drawing title
LEVELS OVERVIEW
SHEET 1.

Scale	Paper size	Date	Drawn by	Checked by	Status
1:250	A1	NOV 2025	JH	CH	S3

Name
Project code | Originator | Functional breakdown | Spatial breakdown | Form | Discipline | Number | Revision
AAL390 - AAL - ED - XX - DP - C - 5001 - P02

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EXTERNAL REFERENCES

1. SITE LAYOUT: UAOHH-BSL-ZZ-XX-DR-A-2001-P1 (04/11/2025)
2. TOPO SURVEY: ENC/130524/7LL1B (05/2024)

EXTERNAL WORKS LEGEND

- FFL 65.475 — PROPOSED FINISHED FLOOR LEVEL
- 1 in 17 — GENERAL CROSS FALL
- 2.400 — PROPOSED MINOR CONTOUR (100mm)
- 2.500 — PROPOSED MAJOR CONTOUR (500mm)
- RTW350 — RETAINING WALL (HEIGHT mm)
- GB300 — GRAVEL BOARD (HEIGHT mm)
- RAISED DPC
- EXPOSED BRICKWORK / UNDERBUILD
- TANKED BRICKWORK / OVERBUILD
- LSR — BUILDING ACCESS UP (LEVEL, STEPS, RAMP)
- LSR — BUILDING ACCESS DOWN (LEVEL, STEPS, RAMP)
- EXISTING LEVEL

ALL LEVELS IN mAOD

Rev.	Date	Description	By
P02	21.11.2025	RESERVED MATTERS SUBMISSION	JH
P01	11.11.2025	PRELIMINARY ISSUE FOR COMMENT	JH

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Client
EASTLEIGH BOROUGH COUNCIL

Architect
BOYLE & SUMMERS

Project title
ONE HORTON HEATH,
UPPER ACRE,
EASTLEIGH.

Drawing title
LEVELS OVERVIEW
SHEET 2.

Scale	Paper size	Date	Drawn by	Checked by	Status
1:250	A1	NOV 2025	JH	CH	S3

Name
Project code | Originator | Functional breakdown | Spatial breakdown | Form | Discipline | Number | Revision
AAL390 - AAL - ED - XX - DP - C - 5002 - P02

Scale 1:250
0m 10.0 20.0

BASIN H FROM SEPARATE APPLICATION FOR SPINE ROAD

EXISTING

TOLL BROOK ORDINARY WATERCOURSE

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Scale 1:250
0m 10.0 20.0

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EXTERNAL REFERENCES

1. SITE LAYOUT: UAOHH-BSL-ZZ-XX-DR-A-2001-P1 (04/11/2025)
2. TOPO SURVEY: ENC/130524/7LL1B (05/2024)

EXTERNAL WORKS LEGEND

- FFL 65.475 — PROPOSED FINISHED FLOOR LEVEL
- 1 in 17 — GENERAL CROSS FALL
- 2.400 — PROPOSED MINOR CONTOUR (100mm)
- 2.500 — PROPOSED MAJOR CONTOUR (500mm)
- RTW350 — RETAINING WALL (HEIGHT mm)
- GB300 — GRAVEL BOARD (HEIGHT mm)
- RAISED DPC
- EXPOSED BRICKWORK / UNDERBUILD
- TANKED BRICKWORK / OVERBUILD
- LSR — BUILDING ACCESS UP (LEVEL, STEPS, RAMP)
- LSR — BUILDING ACCESS DOWN (LEVEL, STEPS, RAMP)
- 24.884 — EXISTING LEVEL

ALL LEVELS IN mAOD

P02	21.11.2025	RESERVED MATTERS SUBMISSION	JH
P01	11.11.2025	PRELIMINARY ISSUE FOR COMMENT	JH
Rev.	Date	Description	By

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Client
EASTLEIGH BOROUGH COUNCIL

Architect
BOYLE & SUMMERS

Project title
ONE HORTON HEATH,
UPPER ACRE,
EASTLEIGH.

Drawing title
LEVELS OVERVIEW
SHEET 3.

Scale	Paper size	Date	Drawn by	Checked by	Status
1:250	A1	NOV 2025	JH	CH	S3

Name

Project code	Originator	Functional breakdown	Spatial breakdown	Form	Discipline	Number	Revision
AAL390	AAL	ED	XX	DP	C	5003	P02

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EXTERNAL REFERENCES

1. SITE LAYOUT: UAOHH-BSL-ZZ-XX-DR-A-2001-P1 (04/11/2025)
2. TOPO SURVEY: ENC/130524/7LL1B (05/2024)

EXTERNAL WORKS LEGEND

- FFL 65.475 — PROPOSED FINISHED FLOOR LEVEL
- 1 in 17 — GENERAL CROSS FALL
- 2.400 — PROPOSED MINOR CONTOUR (100mm)
- 2.500 — PROPOSED MAJOR CONTOUR (500mm)
- RTW350 — RETAINING WALL (HEIGHT mm)
- GB300 — GRAVEL BOARD (HEIGHT mm)
- RAISED DPC
- EXPOSED BRICKWORK / UNDERBUILD
- TANKED BRICKWORK / OVERBUILD
- LSR — BUILDING ACCESS UP (LEVEL, STEPS, RAMP)
- LSR — BUILDING ACCESS DOWN (LEVEL, STEPS, RAMP)
- 50.84 — EXISTING LEVEL

ALL LEVELS IN mAOD

Rev.	Date	Description	By
P02	21.11.2025	RESERVED MATTERS SUBMISSION	JH
P01	11.11.2025	PRELIMINARY ISSUE FOR COMMENT	JH

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Client
EASTLEIGH BOROUGH COUNCIL

Architect
BOYLE & SUMMERS

Project title
ONE HORTON HEATH,
UPPER ACRE,
EASTLEIGH.

Drawing title
LEVELS OVERVIEW
SHEET 4.

Scale	Paper size	Date	Drawn by	Checked by	Status
1:250	A1	NOV 2025	JH	CH	S3

Name

Project code: AAL390-AAL-ED-XX-DP-C-5004-P02 (Originator | Functional breakdown | Spatial breakdown | Form | Discipline | Number | Revision)

Scale 1:250
0m 10.0 20.0

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EXTERNAL REFERENCES

1. SITE LAYOUT: UAOHH-BSL-ZZ-XX-DR-A-2001-P1 (04/11/2025)
2. TOPO SURVEY: ENC/130524/7LL1B (05/2024)

EXTERNAL WORKS LEGEND

- FFL 65.475 — PROPOSED FINISHED FLOOR LEVEL
- 1 in 17 — GENERAL CROSS FALL
- 2.400 — PROPOSED MINOR CONTOUR (100mm)
- 2.500 — PROPOSED MAJOR CONTOUR (500mm)
- RTW350 — RETAINING WALL (HEIGHT mm)
- GB300 — GRAVEL BOARD (HEIGHT mm)
- RAISED DPC
- EXPOSED BRICKWORK / UNDERBUILD
- TANKED BRICKWORK / OVERBUILD
- BUILDING ACCESS UP (LEVEL, STEPS, RAMP)
- BUILDING ACCESS DOWN (LEVEL, STEPS, RAMP)
- 24.654 — EXISTING LEVEL

ALL LEVELS IN mAOD

PROPOSED CULVERTED DITCH WORKS

Scale 1:250 — 0m — 10.0 — 20.0

Rev.	Date	Description	By
P02	21.11.2025	RESERVED MATTERS SUBMISSION	JH
P01	11.11.2025	PRELIMINARY ISSUE FOR COMMENT	JH

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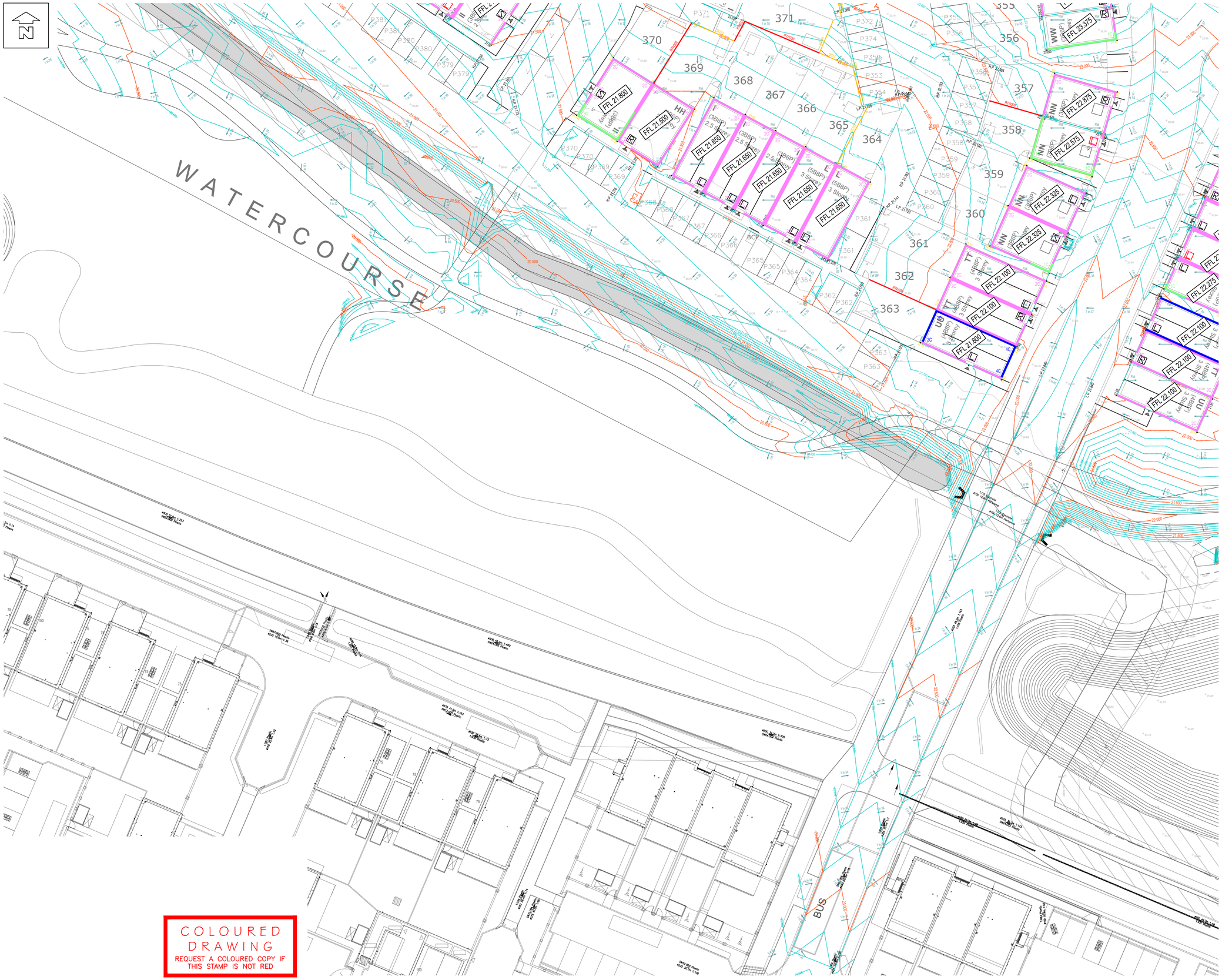
Client: EASTLEIGH BOROUGH COUNCIL
Architect: BOYLE & SUMMERS
Project title: ONE HORTON HEATH, UPPER ACRE, EASTLEIGH.
Drawing title: LEVELS OVERVIEW SHEET 5.

Scale	Paper size	Date	Drawn by	Checked by	Status
1:250	A1	NOV 2025	JH	CH	S3

Name
Project code: AAL390-AAL-ED-XX-DP-C-5005-P02
(Originator | Functional breakdown | Spatial breakdown | Form | Discipline | Number | Revision)



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EXTERNAL REFERENCES

1. SITE LAYOUT:	UAOHH-BSL-ZZ-XX-DR-A-2001-P1	(04/11/2025)
2. TOPO SURVEY:	ENG/130524/7LL1B	(05/2024)

EXTERNAL WORKS LEGEND

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- BUILDING ACCESS UP (LEVEL, STEPS, RAMP)
- BUILDING ACCESS DOWN (LEVEL, STEPS, RAMP)
- EXISTING LEVEL

ALL LEVELS IN mAOD

Rev.	Date	Description	By
P02	21.11.2025	RESERVED MATTERS SUBMISSION	JH
P01	11.11.2025	PRELIMINARY ISSUE FOR COMMENT	JH

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www.archassociates.co.uk

Client
EASTLEIGH BOROUGH COUNCIL

Architect
BOYLE & SUMMERS

Project title
ONE HORTON HEATH,
UPPER ACRE,
EASTLEIGH.

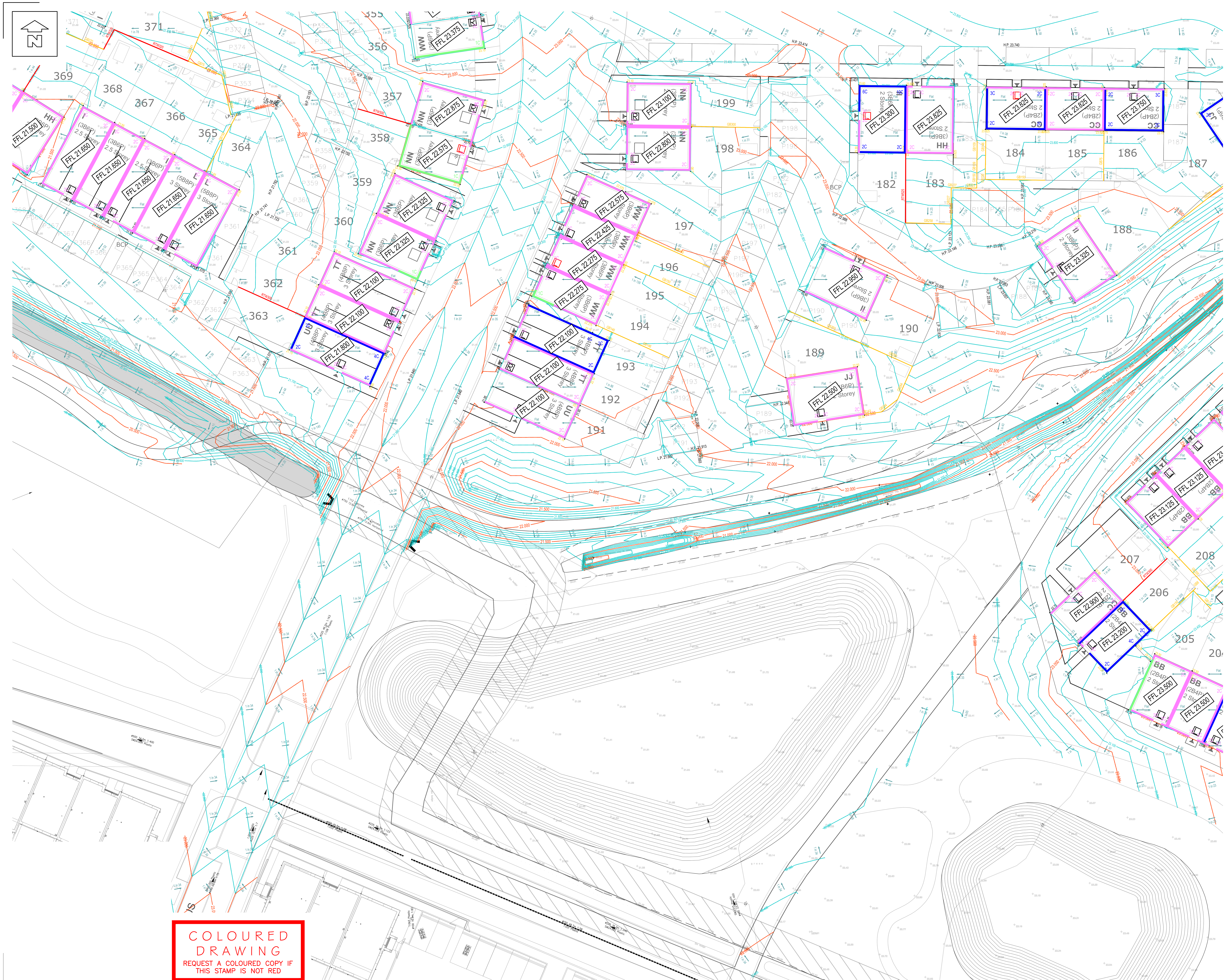
Drawing title
LEVELS OVERVIEW
SHEET 6.

Scale	Paper size	Date	Drawn by	Checked by	Status
1:250	A1	NOV 2025	JH	CH	S3

Name

Project code: Originator | Functional breakdown | Spatial breakdown | Form | Discipline | Number | Revision

AAL390-AAL-ED-XX-DP-C-5006-P02



Scale 1:250
0m 10.0 20.0

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EXTERNAL REFERENCES
1. SITE LAYOUT: UAOHH-BSL-ZZ-XX-DR-A-2001-P1 (04/11/2025)
2. TOPO SURVEY: ENC/130524/7LL1B (05/2024)

EXTERNAL WORKS LEGEND

FFL 65.475	PROPOSED FINISHED FLOOR LEVEL
1 in 17	GENERAL CROSS FALL
2.400	PROPOSED MINOR CONTOUR (100mm)
2.500	PROPOSED MAJOR CONTOUR (500mm)
RTW350	RETAINING WALL (HEIGHT mm)
GB300	GRAVEL BOARD (HEIGHT mm)
	RAISED DPC
	EXPOSED BRICKWORK / UNDERBUILD
	TANKED BRICKWORK / OVERBUILD
L S R	BUILDING ACCESS UP (LEVEL, STEPS, RAMP)
L S R	BUILDING ACCESS DOWN (LEVEL, STEPS, RAMP)
56.84	EXISTING LEVEL

ALL LEVELS IN mAOD

Rev.	Date	Description	By
P02	21.11.2025	RESERVED MATTERS SUBMISSION	JH
P01	11.11.2025	PRELIMINARY ISSUE FOR COMMENT	JH

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www.archassociates.co.uk

Client
EASTLEIGH BOROUGH COUNCIL

Architect
BOYLE & SUMMERS

Project title
ONE HORTON HEATH, UPPER ACRE, EASTLEIGH.

Drawing title
LEVELS OVERVIEW SHEET 7.

Scale	Paper size	Date	Drawn by	Checked by	Status
1:250	A1	NOV 2025	JH	CH	S3

Name
Project code | Originator | Functional breakdown | Spatial breakdown | Form | Discipline | Number | Revision

AAL390-AAL-ED-XX-DP-C-5007-P02

PROPOSED CULVERTED DITCH WORKS

Flower Cott

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EXTERNAL REFERENCES

1.	SITE LAYOUT:	UAOHH-BSL-ZZ-XX-DR-A-2001-P1 (04/11/2025)
2.	TOPO SURVEY:	ENC/130524/7LL1B (05/2024)

EXTERNAL WORKS LEGEND

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- 1 in 17 — GENERAL CROSS FALL
- 2.400 — PROPOSED MINOR CONTOUR (100mm)
- 2.500 — PROPOSED MAJOR CONTOUR (500mm)
- RTW350 — RETAINING WALL (HEIGHT mm)
- GB300 — GRAVEL BOARD (HEIGHT mm)
- RAISED DPC
- EXPOSED BRICKWORK / UNDERBUILD
- TANKED BRICKWORK / OVERBUILD
- LSR — BUILDING ACCESS UP (LEVEL, STEPS, RAMP)
- LSR — BUILDING ACCESS DOWN (LEVEL, STEPS, RAMP)
- EXISTING LEVEL

ALL LEVELS IN mAOD

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Scale 1:250
0m 10.0 20.0

Rev.	Date	Description	By
P02	21.11.2025	RESERVED MATTERS SUBMISSION	JH
P01	11.11.2025	PRELIMINARY ISSUE FOR COMMENT	JH

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Client
EASTLEIGH BOROUGH COUNCIL

Architect
BOYLE & SUMMERS

Project title
ONE HORTON HEATH,
UPPER ACRE,
EASTLEIGH.

Drawing title
LEVELS OVERVIEW
SHEET 8.

Scale	Paper size	Date	Drawn by	Checked by	Status
1:250	A1	NOV 2025	JH	CH	S3

Name

Project code	Originator	Functional breakdown	Spatial breakdown	Form	Discipline	Number	Revision
AAL390-	AAL-	ED -	XX -	DP -	C -	5008-	P02

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APPENDIX 4

SURFACE WATER DRAINAGE CALCULATIONS

Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	1	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.200
CV	1.000	Preferred Cover Depth (m)	1.500
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	✓
Maximum Rainfall (mm/hr)	100.0		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
102	0.026	5.00	26.150	1350	449265.762	116633.048	2.559
FD Junction 5	0.067	5.00	25.800		449263.920	116615.550	2.263
FD Junction 4			25.480		449259.599	116595.413	2.006
FD Junction 3			25.720		449247.535	116550.824	2.388
FD Junction 2	0.121	5.00	25.600		449239.040	116523.540	2.356
FD Junction 1	0.006	5.00	25.600		449214.800	116479.952	2.509
101			25.300	1350	449175.649	116414.322	2.444
100			24.350	1350	449149.968	116429.898	1.752
99			22.975	1350	449106.700	116449.571	1.328
HW3			21.700		449090.820	116478.961	0.600
15A	0.076	5.00	22.050	1200	449000.831	116533.276	1.725
15	0.038	5.00	23.250	1200	448992.961	116567.829	3.063
14A	0.122	5.00	23.150	1200	448978.892	116596.095	1.725
14	0.088	5.00	22.625	1200	448970.868	116577.235	2.654
13			21.725	1200	448956.997	116544.633	1.899
18	0.033	5.00	21.425	1200	448989.330	116497.894	1.725
17	0.088	5.00	21.200	1200	448957.202	116515.144	1.800
12	0.098	5.00	21.075	1350	448943.444	116524.318	2.377
16	0.119	5.00	22.375	1200	448881.227	116634.035	1.725
10	0.105	5.00	20.625	1350	448849.734	116586.806	2.226
9	0.008	5.00	20.550	1350	448822.257	116605.129	2.286
SSID1	0.028	5.00	24.925	1800	449018.638	116619.420	5.495
8	0.096	5.00	23.200	1800	448966.096	116607.468	3.909
7	0.054	5.00	22.975	1800	448937.936	116619.449	3.838
25	0.125	5.00	24.575	1200	448977.685	116631.421	1.800
24	0.103	5.00	24.600	1200	448955.520	116653.093	1.951
6	0.075	5.00	23.100	1800	448930.107	116627.108	3.999
SSID9	0.048	5.00	26.080	1350	448949.619	116721.594	3.300
22	0.086	5.00	24.800	1200	448937.899	116675.890	1.725
23	0.088	5.00	24.650	1200	448907.308	116705.896	1.725
21	0.080	5.00	25.050	1500	448921.020	116692.397	4.977
5	0.066	5.00	23.175	1800	448892.807	116663.594	4.596
20	0.049	5.00	23.915	1200	448893.803	116701.436	1.725
19	0.027	5.00	23.175	1200	448883.238	116686.260	1.725
4	0.007	5.00	22.850	1800	448873.217	116682.756	4.545
3	0.006	5.00	22.300	1800	448858.070	116667.272	4.212
2	0.046	5.00	21.400	1800	448839.548	116635.132	3.497
1	0.018	5.00	20.875	1800	448832.920	116626.282	3.083
HW1			19.156		448814.965	116639.730	1.500
90	0.077	5.00	25.325	1200	449247.418	116608.535	1.725
89	0.013	5.00	24.775	1200	449222.994	116610.404	1.725
Att. Tank 1			25.200		449199.079	116555.259	2.485

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Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
98	0.052	5.00	25.215	1200	449234.596	116570.790	1.725
88	0.029	5.00	25.125	1200	449211.877	116578.492	2.349
87	0.021	5.00	25.415	1200	449208.105	116567.666	2.686
97	0.065	5.00	25.375	1200	449220.957	116529.037	1.725
86	0.057	5.00	25.250	1200	449190.053	116542.853	2.547
96	0.098	5.00	25.150	1200	449201.910	116483.607	1.725
85	0.060	5.00	23.750	1200	449163.631	116506.539	2.170
94	0.038	5.00	23.450	1200	449138.548	116468.459	1.725
93	0.020	5.00	23.925	1200	449148.752	116463.819	2.266
95	0.047	5.00	24.650	1200	449168.568	116460.527	2.129
92	0.031	5.00	24.300	1200	449157.722	116463.621	2.769
91	0.023	5.00	23.750	1200	449158.428	116496.412	2.856
84			23.025	1350	449146.020	116509.307	2.282
83	0.029	5.00	22.850	1350	449126.696	116495.027	2.181
HW2			21.700		449082.179	116462.958	1.200
48	0.029	5.00	27.215	1200	449143.385	116756.853	1.725
47	0.044	5.00	26.815	1200	449160.640	116752.334	1.725
46	0.050	5.00	26.515	1200	449159.859	116731.733	1.800
45	0.056	5.00	25.860	1350	449152.570	116684.682	1.875
68	0.057	5.00	24.815	1200	449162.173	116625.157	1.725
67	0.003	5.00	25.400	1200	449162.924	116663.653	2.390
44	0.015	5.00	25.515	1350	449152.192	116663.861	2.718
66	0.019	5.00	25.475	1200	449111.539	116639.294	1.800
65	0.075	5.00	25.900	1200	449111.891	116657.646	2.300
43	0.026	5.00	25.985	1350	449105.399	116664.775	3.265
64	0.045	5.00	28.025	1200	449087.756	116766.482	1.725
63	0.009	5.00	27.850	1200	449099.236	116766.482	1.725
62	0.052	5.00	27.700	1200	449110.302	116764.565	1.800
61	0.086	5.00	26.350	1200	449097.819	116684.000	1.800
60	0.079	5.00	26.175	1350	449097.576	116671.178	2.870
42	0.017	5.00	26.050	1350	449099.377	116663.406	3.349
53	0.022	5.00	26.850	1200	449064.717	116693.294	1.725
52	0.031	5.00	26.925	1200	449057.660	116700.200	2.047
55	0.072	5.00	27.200	1200	449045.250	116713.889	1.725
51	0.010	5.00	26.675	1200	449044.773	116696.947	1.950
54	0.034	5.00	26.550	1200	449032.634	116693.150	1.650
50	0.007	5.00	26.450	1200	449036.941	116688.938	1.800
49	0.052	5.00	26.125	1200	449052.862	116673.369	1.800
Att. Tank 2			23.700		449099.894	116543.723	3.210
59	0.060	5.00	25.050	1200	449079.899	116610.801	1.725
58	0.019	5.00	25.285	1200	449077.173	116622.789	1.977
57	0.095	5.00	25.200	1200	449064.998	116625.069	2.040
56	0.037	5.00	25.650	1200	449059.866	116647.637	2.584
41	0.052	5.00	25.775	1350	449057.302	116653.666	3.282
40	0.026	5.00	25.350	1350	449027.250	116646.126	2.934
81	0.022	5.00	27.500	1200	448976.451	116779.293	1.650
80	0.024	5.00	27.250	1200	448970.756	116768.449	1.650
79	0.074	5.00	27.025	1200	448963.849	116764.624	1.974
76	0.001	5.00	28.450	1200	449006.402	116772.007	1.650
74	0.056	5.00	28.600	1200	449052.813	116766.232	1.725
73	0.031	5.00	28.825	1200	449038.956	116766.232	2.031
72	0.023	5.00	28.850	1200	449018.882	116768.206	2.330

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Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
71	0.028	5.00	28.415	1200	449014.565	116750.590	2.399
75	0.074	5.00	27.050	1200	449013.561	116713.483	1.725
70	0.076	5.00	27.375	1200	448995.525	116731.121	2.273
SSID4	0.018	5.00	26.085	1500	448968.822	116703.815	2.405
39	0.091	5.00	25.090	1200	449115.854	116619.706	1.800
38	0.076	5.00	24.285	1200	449125.623	116577.270	2.084
31	0.055	5.00	24.515	1200	449160.114	116596.529	1.725
30	0.022	5.00	24.800	1200	449159.305	116555.224	2.503
29	0.049	5.00	24.100	1200	449146.041	116543.209	2.250
28	0.077	5.00	23.675	1350	449125.202	116543.441	3.137
36	0.074	5.00	22.100	1200	449061.237	116493.427	1.580
Att. Tank 3			22.200		449067.371	116507.109	1.730
37	0.048	5.00	22.875	1200	449089.443	116511.124	1.725
35	0.013	5.00	22.825	1350	449072.481	116518.507	2.454
34	0.032	5.00	22.950	1350	449074.346	116522.667	2.593
33	0.008	5.00	24.325	1200	449071.186	116580.625	1.650
32			23.875	1200	449075.905	116559.712	2.252
Att. Tank 4			24.925		449162.549	116644.405	1.875
27	0.124	5.00	23.525	1350	449074.586	116544.005	3.448
26	0.055	5.00	23.250	1350	449052.769	116544.248	3.227
11	0.112	5.00	20.700	1350	448896.589	116555.562	2.071
69	0.025	5.00	26.275	1800	448976.299	116711.461	2.212
SSID2	0.020	5.00	25.300	1500	449013.936	116642.927	4.020
SSID6	0.034	5.00	23.100	1500	449035.683	116543.560	3.269
Basin J			21.700		449044.510	116465.091	1.200
LA S12	0.550	5.00	22.610	1350	449064.886	116425.631	1.909
Basin I	0.007	5.00	22.750	1200	449095.972	116436.196	1.250
Basin I Inlet			21.700		449083.708	116445.060	1.200
LA Inlet			21.700		449062.093	116437.167	1.200
SSID10	0.014	5.00	26.575	1350	448934.783	116737.557	3.675
SSID8	0.014	5.00	22.075	1500	449027.763	116510.915	1.905
SSID7	0.014	5.00	22.550	1500	449034.018	116526.838	2.440
SSID5	0.036	5.00	24.115	1500	449027.676	116580.174	4.554
SSID3	0.036	5.00	25.600	1500	449003.766	116670.105	3.100
Basin H		5.00	19.156		448733.321	116703.121	1.500
Basin H FC			19.300	2400	448723.067	116702.612	1.747
Basin H Outfall			17.400		448693.613	116701.064	1.005
Att. Tank 5			25.475		449128.796	116664.318	2.700
Att. Tank 6			25.025		449078.536	116616.795	1.710
82	0.076	5.00	27.150	1200	448975.925	116752.815	1.925
Att. Tank 7			27.425		449004.346	116740.140	2.305
78			26.800	1200	448949.124	116756.470	1.818
SSID12	0.564	5.00	26.825	1350	448925.440	116765.131	3.715
SSID11	0.014	5.00	26.700	1350	448926.963	116750.097	3.700
77			26.950	1200	448939.123	116761.783	2.015
Att. Tank 8			27.000		448969.887	116758.720	1.810
Att. Tank 9			23.300		448992.367	116613.444	3.940
Att. Tank 10			22.415		448996.896	116550.552	2.165
Att. Tank 11			20.700		448920.017	116539.940	2.035
FD Junction 8	0.003	5.00	25.215		449191.667	116678.164	1.300
103	0.009	5.00	24.950	1350	449188.878	116652.396	1.115
FD Junction 7			24.625		449207.440	116647.404	0.849

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Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
FD Junction 6			24.750		449233.594	116641.743	1.056

Links

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)
29.004	102	FD Junction 5	17.595	15.000	23.591	23.537	0.054	325.0	375	8.46	31.6
29.005	FD Junction 5	FD Junction 4	20.595	15.000	23.537	23.474	0.063	325.0	375	9.04	30.5
29.006	FD Junction 4	FD Junction 3	46.192	15.000	23.474	23.332	0.142	325.0	375	10.35	28.5
29.007	FD Junction 3	FD Junction 2	28.576	15.000	23.332	23.244	0.088	325.0	375	11.15	27.3
29.008	FD Junction 2	FD Junction 1	49.875	15.000	23.244	23.091	0.153	325.0	375	12.56	25.6
29.009	FD Junction 1	101	76.421	15.000	23.091	22.856	0.235	325.0	375	14.71	23.5
29.010	101	100	30.035	0.600	22.856	22.598	0.258	116.4	375	15.01	23.2
29.011	100	99	47.530	0.600	22.598	21.647	0.951	50.0	375	15.32	22.9
29.012	99	HW3	33.406	0.600	21.647	21.100	0.547	61.1	375	15.56	22.7
25.000	15A	Att. Tank 10	10.719	0.600	20.325	20.250	0.075	142.9	225	5.16	40.2
25.002	15	14	24.012	0.600	20.187	20.046	0.141	170.3	225	5.74	38.3
26.000	14A	14	20.496	0.600	21.425	20.046	1.379	14.9	225	5.10	40.5
25.003	14	13	35.430	0.600	19.971	19.826	0.145	244.3	300	6.33	36.5
25.004	13	12	24.421	0.600	19.826	19.273	0.553	44.2	300	6.50	36.0
27.000	18	17	36.466	0.600	19.700	19.475	0.225	162.1	225	5.59	38.8
27.001	17	12	16.536	0.600	19.400	18.773	0.627	26.4	300	5.68	38.5
25.005	12	Att. Tank 11	8.158	0.600	18.698	18.665	0.033	247.2	375	6.62	35.7
25.007	11	10	56.317	0.600	18.629	18.399	0.230	244.9	375	7.55	33.5
28.000	16	10	56.766	0.600	20.650	18.549	2.101	27.0	225	5.37	39.5
25.008	10	9	33.026	0.600	18.399	18.264	0.135	244.6	375	8.03	32.4
25.009	9	1	23.689	0.600	18.264	18.167	0.097	244.2	375	8.37	31.8

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
29.004	0.591	65.3	4.3	2.184	1.888	0.038	0.0	67	0.318
29.005	0.591	65.3	11.5	1.888	1.631	0.104	0.0	108	0.437
29.006	0.591	65.3	10.7	1.631	2.013	0.104	0.0	104	0.427
29.007	0.591	65.3	10.3	2.013	1.981	0.104	0.0	102	0.422
29.008	0.591	65.3	20.9	1.981	2.134	0.226	0.0	147	0.522
29.009	0.591	65.3	19.6	2.134	2.069	0.231	0.0	142	0.512
29.010	1.678	185.3	19.4	2.069	1.377	0.231	0.0	81	1.098
29.011	2.567	283.5	19.2	1.377	0.953	0.231	0.0	66	1.489
29.012	2.322	256.4	19.0	0.953	0.225	0.231	0.0	68	1.381
25.000	1.091	43.4	11.1	1.500	1.940	0.076	0.0	78	0.918
25.002	0.999	39.7	15.8	2.838	2.354	0.114	0.0	98	0.941
26.000	3.411	135.6	17.9	1.500	2.354	0.122	0.0	55	2.384
25.003	1.001	70.8	42.7	2.354	1.599	0.324	0.0	168	1.047
25.004	2.372	167.7	42.2	1.599	1.502	0.324	0.0	102	1.987
27.000	1.024	40.7	4.7	1.500	1.500	0.033	0.0	51	0.687
27.001	3.073	217.2	16.9	1.500	2.002	0.121	0.0	56	1.846
25.005	1.148	126.7	70.1	2.002	1.660	0.543	0.0	200	1.176
25.007	1.153	127.4	79.2	1.696	1.851	0.654	0.0	214	1.213
28.000	2.527	100.5	17.1	1.500	1.851	0.119	0.0	63	1.902
25.008	1.154	127.4	103.1	1.851	1.911	0.879	0.0	257	1.279
25.009	1.155	127.5	101.9	1.911	2.333	0.887	0.0	255	1.277

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Links

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)
1.009	SSID1	Att. Tank 9	6.942	0.600	19.430	19.360	0.070	99.2	750	7.58	33.4
1.011	8	7	30.603	0.600	19.291	19.137	0.154	198.7	750	7.88	32.8
1.012	7	6	10.952	0.600	19.137	19.101	0.036	304.2	750	8.00	32.5
18.000	25	24	30.999	0.600	22.775	22.649	0.126	246.0	300	5.52	39.0
18.001	24	6	36.346	0.600	22.649	19.551	3.098	11.7	300	5.65	38.6
1.013	6	5	52.178	0.600	19.101	18.579	0.522	100.0	750	8.31	31.9
19.007	SSID9	21	40.870	0.600	22.780	20.223	2.557	16.0	450	6.24	36.8
22.000	22	21	23.609	0.600	23.075	20.448	2.627	9.0	225	5.09	40.5
23.000	23	21	19.242	0.600	22.925	20.448	2.477	7.8	225	5.07	40.6
19.008	21	5	40.319	0.600	20.073	18.729	1.344	30.0	600	6.39	36.3
1.014	5	4	27.403	0.600	18.579	18.305	0.274	100.0	750	8.47	31.6
24.000	20	19	18.491	0.600	22.190	21.450	0.740	25.0	225	5.12	40.4
24.001	19	4	10.616	0.600	21.450	18.830	2.620	4.1	225	5.14	40.3
1.015	4	3	21.661	0.600	18.305	18.088	0.217	100.0	750	8.60	31.4
1.016	3	2	37.095	0.600	18.088	17.903	0.185	200.0	750	8.91	30.8
1.017	2	1	11.057	0.600	17.903	17.792	0.111	100.0	750	8.98	30.6
2.008	1	HW1	22.433	0.600	17.792	17.656	0.136	164.9	750	9.15	29.9
30.000	90	89	24.495	0.600	23.600	23.050	0.550	44.5	225	5.21	40.1
30.001	89	88	33.793	0.600	23.050	22.851	0.199	170.0	225	5.77	38.2
16.001	32	27	15.762	0.600	21.623	20.441	1.182	13.3	150	5.25	39.9
31.000	98	88	23.989	0.600	23.490	22.851	0.639	37.5	225	5.19	40.2
30.002	88	87	11.464	0.600	22.776	22.729	0.047	243.9	300	5.96	37.5
30.003	87	Att. Tank 1	2.842	0.600	22.729	22.715	0.014	203.0	300	6.00	37.4
32.000	97	86	33.852	0.600	23.650	22.778	0.872	38.8	225	5.27	39.9

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.009	2.810	1241.4	291.8	4.745	3.190	2.416	0.0	246	2.318
1.011	1.981	875.3	297.3	3.159	3.088	2.511	0.0	300	1.799
1.012	1.599	706.3	301.4	3.088	3.249	2.566	0.0	342	1.539
18.000	0.998	70.5	17.6	1.500	1.651	0.125	0.0	102	0.832
18.001	4.614	326.2	31.8	1.651	3.249	0.228	0.0	63	2.971
1.013	2.798	1236.2	330.9	3.249	3.846	2.869	0.0	263	2.389
19.007	5.104	811.8	111.1	2.850	4.377	0.837	0.0	111	3.619
22.000	4.390	174.6	12.5	1.500	4.377	0.086	0.0	41	2.586
23.000	4.723	187.8	12.9	1.500	4.377	0.088	0.0	40	2.746
19.008	4.456	1260.0	143.2	4.377	3.846	1.090	0.0	135	3.009
1.014	2.798	1236.2	459.8	3.846	3.795	4.025	0.0	316	2.603
24.000	2.628	104.5	7.2	1.500	1.500	0.049	0.0	40	1.526
24.001	6.545	260.2	11.1	1.500	3.795	0.076	0.0	31	3.275
1.015	2.798	1236.2	465.6	3.795	3.462	4.108	0.0	318	2.611
1.016	1.975	872.5	457.6	3.462	2.747	4.114	0.0	386	1.997
1.017	2.798	1236.2	460.8	2.747	2.333	4.160	0.0	316	2.603
2.008	2.176	961.3	547.4	2.333	0.750	5.066	0.0	406	2.243
30.000	1.965	78.1	11.1	1.500	1.500	0.077	0.0	57	1.396
30.001	1.000	39.7	12.4	1.500	2.049	0.090	0.0	87	0.888
16.001	2.773	49.0	1.1	2.102	2.934	0.008	0.0	16	1.163
31.000	2.141	85.1	7.5	1.500	2.049	0.052	0.0	44	1.322
30.002	1.002	70.8	23.2	2.049	2.386	0.171	0.0	118	0.900
30.003	1.100	77.7	26.0	2.386	2.185	0.192	0.0	119	0.993
32.000	2.106	83.7	9.3	1.500	2.247	0.065	0.0	51	1.402

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Links

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)
30.005	86	85	44.909	0.600	22.703	21.580	1.123	40.0	300	6.35	36.5
33.000	96	85	44.622	0.600	23.425	21.655	1.770	25.2	225	5.28	39.8
30.006	85	84	17.827	0.600	21.580	20.818	0.762	23.4	300	6.44	36.2
34.000	94	93	11.209	0.600	21.725	21.659	0.066	170.0	225	5.19	40.2
34.001	93	92	8.972	0.600	21.659	21.606	0.053	169.3	225	5.34	39.7
35.000	95	92	11.279	0.600	22.521	21.681	0.840	13.4	150	5.07	40.6
34.002	92	91	32.799	0.600	21.531	20.894	0.637	51.5	300	5.59	38.8
34.003	91	84	17.895	0.600	20.894	20.818	0.076	235.5	300	5.88	37.8
30.007	84	83	24.028	0.600	20.743	20.669	0.074	324.7	375	6.84	35.1
30.008	83	HW2	54.865	0.600	20.669	20.500	0.169	324.6	375	7.76	33.0
2.000	48	47	17.837	0.600	25.490	25.090	0.400	44.6	225	5.15	40.3
2.001	47	46	20.616	0.600	25.090	24.790	0.300	68.7	225	5.37	39.5
2.002	46	45	47.612	0.600	24.715	24.060	0.655	72.7	300	5.80	38.1
2.003	45	44	20.824	0.600	23.985	22.797	1.188	17.5	375	5.88	37.8
3.000	68	Att. Tank 4	6.751	0.600	23.090	23.050	0.040	168.8	225	5.11	40.4
3.002	67	44	10.734	0.600	23.010	22.947	0.063	170.4	225	5.40	39.4
2.004	44	Att. Tank 5	2.401	0.600	22.797	22.775	0.022	109.1	375	5.90	37.7
4.000	66	65	18.355	0.600	23.675	23.600	0.075	244.7	300	5.31	39.8
4.001	65	43	9.642	0.600	23.600	22.795	0.805	12.0	300	5.34	39.6
2.006	43	42	6.176	0.600	22.720	22.701	0.019	325.0	375	6.04	37.3
1.000	64	63	11.480	0.600	26.300	26.125	0.175	65.6	225	5.12	40.4
1.001	63	62	11.231	0.600	26.125	25.975	0.150	74.9	225	5.24	40.0
1.002	62	61	81.526	0.600	25.900	24.550	1.350	60.4	300	5.91	37.7
1.003	61	60	12.824	0.600	24.550	23.380	1.170	11.0	300	5.96	37.6

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
30.005	2.493	176.2	41.4	2.247	1.870	0.314	0.0	99	2.052
33.000	2.616	104.0	14.1	1.500	1.870	0.098	0.0	56	1.844
30.006	3.264	230.7	61.7	1.870	1.907	0.471	0.0	106	2.782
34.000	1.000	39.7	5.5	1.500	2.041	0.038	0.0	56	0.702
34.001	1.002	39.8	8.2	2.041	2.469	0.057	0.0	69	0.791
35.000	2.764	48.8	6.9	1.979	2.469	0.047	0.0	38	1.956
34.002	2.196	155.2	19.0	2.469	2.556	0.136	0.0	71	1.507
34.003	1.020	72.1	21.7	2.556	1.907	0.158	0.0	112	0.894
30.007	1.000	110.4	80.0	1.907	1.806	0.630	0.0	237	1.086
30.008	1.000	110.4	78.6	1.806	0.825	0.659	0.0	235	1.083
2.000	1.964	78.1	4.2	1.500	1.500	0.029	0.0	36	1.061
2.001	1.579	62.8	10.4	1.500	1.500	0.072	0.0	62	1.179
2.002	1.846	130.5	16.9	1.500	1.500	0.122	0.0	72	1.284
2.003	4.345	479.9	24.4	1.500	2.343	0.178	0.0	57	2.316
3.000	1.003	39.9	8.3	1.500	1.650	0.057	0.0	69	0.793
3.002	0.999	39.7	8.5	2.165	2.343	0.060	0.0	71	0.800
2.004	1.734	191.5	34.5	2.343	2.325	0.253	0.0	107	1.327
4.000	1.000	70.7	2.7	1.500	2.000	0.019	0.0	40	0.488
4.001	4.567	322.8	13.5	2.000	2.890	0.094	0.0	41	2.288
2.006	0.999	110.4	50.3	2.890	2.974	0.373	0.0	178	0.977
1.000	1.617	64.3	6.6	1.500	1.500	0.045	0.0	49	1.054
1.001	1.513	60.1	7.8	1.500	1.500	0.054	0.0	55	1.055
1.002	2.026	143.2	14.5	1.500	1.500	0.106	0.0	64	1.316
1.003	4.774	337.5	26.1	1.500	2.495	0.192	0.0	56	2.870

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Links

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1.004	60	42	7.978	0.600	23.305	22.701	0.604	13.2	375	5.98	37.5
1.005	42	41	43.188	0.600	22.701	22.568	0.133	324.7	375	6.76	35.4
5.000	53	52	9.874	0.600	25.125	24.878	0.247	40.0	225	5.08	40.5
5.001	52	51	13.291	0.600	24.878	24.800	0.078	170.4	225	5.30	39.8
6.000	55	51	16.949	0.600	25.475	24.800	0.675	25.1	225	5.11	40.4
5.002	51	50	11.202	0.600	24.725	24.650	0.075	149.4	300	5.45	39.3
7.000	54	50	6.024	0.600	24.900	24.800	0.100	60.2	150	5.08	40.5
5.003	50	49	22.268	0.600	24.650	24.325	0.325	68.5	300	5.64	38.6
5.004	49	41	20.197	0.600	24.325	22.643	1.682	12.0	300	5.72	38.4
30.004	Att. Tank 1	86	2.842	0.600	22.715	22.703	0.012	236.8	300	6.05	37.3
8.000	59	Att. Tank 6	1.147	0.600	23.325	23.315	0.010	114.7	225	5.02	40.7
8.002	58	57	12.387	0.600	23.308	23.235	0.073	169.7	225	5.24	40.0
8.003	57	56	23.144	0.600	23.160	23.066	0.094	246.2	300	5.63	38.7
8.004	56	41	6.552	0.600	23.066	22.643	0.423	15.5	300	5.65	38.6
1.006	41	40	30.983	0.600	22.493	22.416	0.077	402.4	450	7.27	34.1
19.000	81	80	12.248	0.600	25.850	25.600	0.250	49.0	150	5.14	40.3
19.001	80	79	7.895	0.600	25.600	25.201	0.399	19.8	150	5.20	40.1
20.000	82	Att. Tank 8	3.445	0.600	25.225	25.190	0.035	98.4	225	5.04	40.7
10.000	76	72	13.046	0.600	26.800	26.670	0.130	100.0	150	5.22	40.1
9.000	74	73	13.857	0.600	26.875	26.794	0.081	171.1	225	5.23	40.0
9.001	73	72	20.171	0.600	26.794	26.595	0.199	101.4	225	5.49	39.1
9.002	72	71	18.137	0.600	26.520	26.016	0.504	36.0	300	5.61	38.7
9.003	71	Att. Tank 7	3.616	0.600	26.016	25.980	0.036	100.4	300	5.64	38.6
11.000	75	70	25.227	0.600	25.325	25.177	0.148	170.0	225	5.42	39.4

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1.004	5.007	553.0	36.7	2.495	2.974	0.271	0.0	65	2.889
1.005	1.000	110.4	84.6	2.974	2.832	0.662	0.0	246	1.097
5.000	2.075	82.5	3.3	1.500	1.822	0.022	0.0	30	1.016
5.001	0.998	39.7	7.7	1.822	1.650	0.054	0.0	67	0.778
6.000	2.621	104.2	10.6	1.500	1.650	0.072	0.0	48	1.693
5.002	1.284	90.8	19.3	1.650	1.500	0.136	0.0	93	1.026
7.000	1.298	22.9	5.0	1.500	1.500	0.034	0.0	47	1.037
5.003	1.902	134.4	24.6	1.500	1.500	0.176	0.0	86	1.458
5.004	4.561	322.4	31.6	1.500	2.832	0.228	0.0	63	2.937
30.004	1.017	71.9	25.9	2.185	2.247	0.192	0.0	125	0.937
8.000	1.220	48.5	8.8	1.500	1.485	0.060	0.0	65	0.930
8.002	1.001	39.8	11.4	1.752	1.740	0.079	0.0	82	0.866
8.003	0.997	70.5	24.2	1.740	2.284	0.173	0.0	121	0.907
8.004	4.014	283.7	29.3	2.284	2.832	0.210	0.0	65	2.626
1.006	1.007	160.2	141.9	2.832	2.484	1.151	0.0	331	1.131
19.000	1.441	25.5	3.2	1.500	1.500	0.022	0.0	36	0.990
19.001	2.274	40.2	6.7	1.500	1.674	0.046	0.0	41	1.691
20.000	1.318	52.4	11.1	1.700	1.585	0.076	0.0	70	1.049
10.000	1.005	17.8	0.1	1.500	2.030	0.001	0.0	7	0.241
9.000	0.996	39.6	8.0	1.500	1.806	0.056	0.0	69	0.787
9.001	1.298	51.6	12.3	1.806	2.030	0.087	0.0	74	1.067
9.002	2.629	185.8	15.4	2.030	2.099	0.110	0.0	58	1.607
9.003	1.568	110.9	19.3	2.099	1.145	0.139	0.0	84	1.185
11.000	1.000	39.7	10.5	1.500	1.973	0.074	0.0	79	0.846

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9.005	70	69	27.498	0.600	25.102	24.138	0.964	28.5	300	5.82	38.0
13.000	39	38	43.546	0.600	23.290	22.201	1.089	40.0	300	5.29	39.8
13.001	38	28	33.832	0.600	22.201	20.613	1.588	21.3	300	5.46	39.3
12.000	31	30	41.313	0.600	22.790	22.297	0.493	83.8	225	5.48	39.2
12.001	30	29	17.897	0.600	22.297	21.850	0.447	40.0	225	5.63	38.7
12.002	29	28	20.840	0.600	21.850	20.688	1.162	17.9	225	5.74	38.3
12.003	28	Att. Tank 2	15.310	0.600	20.538	20.490	0.048	319.0	375	5.99	37.4
15.000	36	Att. Tank 3	4.993	0.600	20.520	20.470	0.050	99.9	300	5.05	40.6
12.004	Att. Tank 2	27	15.310	0.600	20.490	20.152	0.338	45.3	375	6.09	37.2
14.000	37	35	18.499	0.600	21.150	20.521	0.629	29.4	225	5.13	40.4
14.001	35	34	4.559	0.600	20.371	20.357	0.014	325.6	375	5.43	39.3
14.002	34	27	21.339	0.600	20.357	20.291	0.066	323.3	375	5.79	38.1
16.000	33	32	21.439	0.600	22.675	21.623	1.052	20.4	150	5.16	40.3
15.001	Att. Tank 3	35	12.491	0.600	20.470	20.446	0.024	520.5	300	5.36	39.6
3.001	Att. Tank 4	67	6.751	0.600	23.050	23.010	0.040	168.8	225	5.22	40.0
12.005	27	26	21.818	0.600	20.077	20.023	0.054	404.0	450	6.45	36.2
1.007	40	SSID2	13.693	0.600	22.416	21.930	0.486	28.2	450	7.33	34.0
12.006	26	SSID6	17.100	0.600	20.023	19.981	0.042	407.1	450	6.73	35.4
37.000	Basin I	Basin I Inlet	15.132	0.600	21.500	20.500	1.000	15.1	300	5.06	40.6
38.000	LA S12	LA Inlet	11.869	0.600	20.701	20.500	0.201	59.1	450	5.07	40.5
19.006	SSID10	SSID9	21.793	0.600	22.900	22.780	0.120	181.6	450	6.11	37.1
17.000	SSID8	SSID7	17.108	0.600	20.170	20.110	0.060	285.1	600	5.20	40.1
17.001	SSID7	SSID6	16.805	0.600	20.110	19.970	0.140	120.0	600	5.32	39.7

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9.005	2.954	208.8	39.7	1.973	1.837	0.289	0.0	88	2.292
13.000	2.493	176.2	13.2	1.500	1.784	0.091	0.0	55	1.478
13.001	3.421	241.8	23.7	1.784	2.762	0.167	0.0	63	2.202
12.000	1.429	56.8	7.8	1.500	2.278	0.055	0.0	56	1.006
12.001	2.074	82.5	10.8	2.278	2.025	0.077	0.0	55	1.448
12.002	3.104	123.4	17.6	2.025	2.762	0.127	0.0	57	2.208
12.003	1.009	111.4	50.1	2.762	2.835	0.371	0.0	176	0.983
15.000	1.573	111.2	10.9	1.280	1.430	0.074	0.0	63	1.010
12.004	2.698	298.0	49.8	2.835	2.998	0.371	0.0	103	2.020
14.000	2.421	96.3	7.0	1.500	2.079	0.048	0.0	41	1.424
14.001	0.998	110.3	19.3	2.079	2.218	0.135	0.0	106	0.757
14.002	1.002	110.7	23.1	2.218	2.859	0.168	0.0	116	0.798
16.000	2.241	39.6	1.2	1.500	2.102	0.008	0.0	18	1.003
15.001	0.682	48.2	10.6	1.430	2.079	0.074	0.0	95	0.549
3.001	1.003	39.9	8.2	1.650	2.165	0.057	0.0	69	0.793
12.005	1.005	159.8	87.6	2.998	2.777	0.670	0.0	238	1.027
1.007	3.841	610.9	144.6	2.484	2.920	1.178	0.0	148	3.169
12.006	1.001	159.2	92.8	2.777	2.669	0.725	0.0	247	1.038
37.000	4.061	287.1	1.0	0.950	0.900	0.007	0.0	13	0.970
38.000	2.649	421.3	80.6	1.459	0.750	0.550	0.0	132	2.061
19.006	1.505	239.4	105.8	3.225	2.850	0.789	0.0	210	1.462
17.000	1.437	406.2	2.1	1.305	1.840	0.014	0.0	31	0.388
17.001	2.221	628.1	4.1	1.840	2.530	0.028	0.0	34	0.641

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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)
12.007	SSID6	SSID5	37.479	0.600	19.831	19.561	0.270	138.8	600	7.03	34.6
12.008	SSID5	SSID1	40.273	0.600	19.561	19.441	0.120	335.6	600	7.54	33.5
1.008	SSID2	SSID1	23.973	0.600	21.280	20.700	0.580	41.3	600	7.44	33.7
9.007	SSID4	SSID3	48.554	0.600	23.680	22.500	1.180	41.1	600	6.11	37.1
9.008	SSID3	SSID2	29.018	0.600	22.500	21.280	1.220	23.8	600	6.21	36.9
36.000	Basin H	Basin H FC	10.267	0.600	17.656	17.553	0.103	100.0	675	5.07	40.6
36.001	Basin H FC	Basin H Outfall	29.495	0.600	17.553	16.395	1.158	25.5	675	5.16	40.3
2.005	Att. Tank 5	43	4.401	0.600	22.775	22.720	0.055	80.0	375	5.94	37.6
8.001	Att. Tank 6	58	1.147	0.600	23.315	23.308	0.007	163.9	225	5.03	40.7
19.002	79	78	16.832	0.600	25.051	24.982	0.069	243.9	300	5.48	39.2
21.000	SSID12	SSID11	15.111	0.600	23.110	23.000	0.110	137.4	450	5.15	40.3
19.005	SSID11	SSID10	14.778	0.600	23.000	22.900	0.100	147.8	450	5.87	37.9
19.003	78	77	11.325	0.600	24.982	24.935	0.047	241.0	300	5.67	38.5
19.004	77	SSID11	16.865	0.600	24.935	23.150	1.785	9.4	300	5.72	38.4
9.004	Att. Tank 7	70	1.616	0.600	25.120	25.102	0.018	89.8	300	5.66	38.6
20.001	Att. Tank 8	79	3.445	0.600	25.190	25.170	0.020	172.3	225	5.10	40.5
1.010	Att. Tank 9	8	6.942	0.600	19.360	19.291	0.069	100.6	750	7.62	33.3
25.001	Att. Tank 10	15	10.719	0.600	20.250	20.187	0.063	170.1	225	5.34	39.6
25.006	Att. Tank 11	11	8.158	0.600	18.665	18.629	0.036	226.6	375	6.74	35.4
9.006	69	SSID4	10.694	0.600	24.063	23.905	0.158	67.7	375	5.90	37.8
29.000	FD Junction 8	103	25.918	15.000	23.915	23.835	0.080	325.0	375	5.73	38.3
29.001	103	FD Junction 7	19.222	15.000	23.835	23.776	0.059	325.0	375	6.27	36.7
29.002	FD Junction 7	FD Junction 6	26.760	15.000	23.776	23.694	0.082	325.0	375	7.03	34.7

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
12.007	2.065	583.8	98.5	2.669	3.954	0.787	0.0	166	1.555
12.008	1.323	374.2	99.7	3.954	4.884	0.823	0.0	211	1.128
1.008	3.795	1072.9	190.8	3.420	3.625	1.565	0.0	170	2.898
9.007	3.803	1075.3	44.4	1.805	2.500	0.331	0.0	82	1.919
9.008	5.006	1415.5	48.9	2.500	3.420	0.367	0.0	75	2.395
36.000	2.621	937.8	0.0	0.825	1.072	0.000	0.0	0	0.000
36.001	5.205	1862.8	0.0	1.072	0.330	0.000	0.0	0	0.000
2.005	2.027	223.8	34.4	2.325	2.890	0.253	0.0	99	1.481
8.001	1.018	40.5	8.8	1.485	1.752	0.060	0.0	71	0.816
19.002	1.002	70.8	27.7	1.674	1.518	0.196	0.0	130	0.943
21.000	1.732	275.5	82.2	3.265	3.250	0.564	0.0	167	1.518
19.005	1.670	265.6	105.9	3.250	3.225	0.774	0.0	197	1.579
19.003	1.008	71.3	27.3	1.518	1.715	0.196	0.0	129	0.943
19.004	5.143	363.6	27.2	1.715	3.250	0.196	0.0	55	3.054
9.004	1.660	117.3	19.3	2.005	1.973	0.139	0.0	82	1.235
20.001	0.993	39.5	11.0	1.585	1.630	0.076	0.0	81	0.855
1.010	2.790	1232.4	291.0	3.190	3.159	2.416	0.0	246	2.305
25.001	0.999	39.7	10.9	1.940	2.838	0.076	0.0	80	0.855
25.006	1.199	132.4	69.5	1.660	1.696	0.543	0.0	193	1.213
9.006	2.205	243.5	42.8	1.837	1.805	0.314	0.0	106	1.676
29.000	0.591	65.3	0.4	0.925	0.740	0.003	0.0	22	0.136
29.001	0.591	65.3	1.5	0.740	0.474	0.011	0.0	41	0.224
29.002	0.591	65.3	1.4	0.474	0.681	0.011	0.0	41	0.221

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Links

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)
29.003	FD Junction 6	102	33.322	15.000	23.694	23.591	0.103	325.0	375	7.97	32.6

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
29.003	0.591	65.3	1.3	0.681	2.184	0.011	0.0	39	0.215

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
29.004	17.595	325.0	375	Circular	26.150	23.591	2.184	25.800	23.537	1.888
29.005	20.595	325.0	375	Circular	25.800	23.537	1.888	25.480	23.474	1.631
29.006	46.192	325.0	375	Circular	25.480	23.474	1.631	25.720	23.332	2.013
29.007	28.576	325.0	375	Circular	25.720	23.332	2.013	25.600	23.244	1.981
29.008	49.875	325.0	375	Circular	25.600	23.244	1.981	25.600	23.091	2.134
29.009	76.421	325.0	375	Circular	25.600	23.091	2.134	25.300	22.856	2.069
29.010	30.035	116.4	375	Circular	25.300	22.856	2.069	24.350	22.598	1.377
29.011	47.530	50.0	375	Circular	24.350	22.598	1.377	22.975	21.647	0.953
29.012	33.406	61.1	375	Circular	22.975	21.647	0.953	21.700	21.100	0.225
25.000	10.719	142.9	225	Circular	22.050	20.325	1.500	22.415	20.250	1.940
25.002	24.012	170.3	225	Circular	23.250	20.187	2.838	22.625	20.046	2.354
26.000	20.496	14.9	225	Circular	23.150	21.425	1.500	22.625	20.046	2.354
25.003	35.430	244.3	300	Circular	22.625	19.971	2.354	21.725	19.826	1.599
25.004	24.421	44.2	300	Circular	21.725	19.826	1.599	21.075	19.273	1.502
27.000	36.466	162.1	225	Circular	21.425	19.700	1.500	21.200	19.475	1.500
27.001	16.536	26.4	300	Circular	21.200	19.400	1.500	21.075	18.773	2.002
25.005	8.158	247.2	375	Circular	21.075	18.698	2.002	20.700	18.665	1.660
25.007	56.317	244.9	375	Circular	20.700	18.629	1.696	20.625	18.399	1.851
28.000	56.766	27.0	225	Circular	22.375	20.650	1.500	20.625	18.549	1.851

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
29.004	102	1350	Manhole	Adoptable	FD Junction 5		Junction	
29.005	FD Junction 5		Junction		FD Junction 4		Junction	
29.006	FD Junction 4		Junction		FD Junction 3		Junction	
29.007	FD Junction 3		Junction		FD Junction 2		Junction	
29.008	FD Junction 2		Junction		FD Junction 1		Junction	
29.009	FD Junction 1		Junction		101	1350	Manhole	Adoptable
29.010	101	1350	Manhole	Adoptable	100	1350	Manhole	Adoptable
29.011	100	1350	Manhole	Adoptable	99	1350	Manhole	Adoptable
29.012	99	1350	Manhole	Adoptable	HW3		Junction	
25.000	15A	1200	Manhole	Adoptable	Att. Tank 10		Junction	
25.002	15	1200	Manhole	Adoptable	14	1200	Manhole	Adoptable
26.000	14A	1200	Manhole	Adoptable	14	1200	Manhole	Adoptable
25.003	14	1200	Manhole	Adoptable	13	1200	Manhole	Adoptable
25.004	13	1200	Manhole	Adoptable	12	1350	Manhole	Adoptable
27.000	18	1200	Manhole	Adoptable	17	1200	Manhole	Adoptable
27.001	17	1200	Manhole	Adoptable	12	1350	Manhole	Adoptable
25.005	12	1350	Manhole	Adoptable	Att. Tank 11		Junction	
25.007	11	1350	Manhole	Adoptable	10	1350	Manhole	Adoptable
28.000	16	1200	Manhole	Adoptable	10	1350	Manhole	Adoptable

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Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
25.008	33.026	244.6	375	Circular	20.625	18.399	1.851	20.550	18.264	1.911
25.009	23.689	244.2	375	Circular	20.550	18.264	1.911	20.875	18.167	2.333
1.009	6.942	99.2	750	Circular	24.925	19.430	4.745	23.300	19.360	3.190
1.011	30.603	198.7	750	Circular	23.200	19.291	3.159	22.975	19.137	3.088
1.012	10.952	304.2	750	Circular	22.975	19.137	3.088	23.100	19.101	3.249
18.000	30.999	246.0	300	Circular	24.575	22.775	1.500	24.600	22.649	1.651
18.001	36.346	11.7	300	Circular	24.600	22.649	1.651	23.100	19.551	3.249
1.013	52.178	100.0	750	Circular	23.100	19.101	3.249	23.175	18.579	3.846
19.007	40.870	16.0	450	Circular	26.080	22.780	2.850	25.050	20.223	4.377
22.000	23.609	9.0	225	Circular	24.800	23.075	1.500	25.050	20.448	4.377
23.000	19.242	7.8	225	Circular	24.650	22.925	1.500	25.050	20.448	4.377
19.008	40.319	30.0	600	Circular	25.050	20.073	4.377	23.175	18.729	3.846
1.014	27.403	100.0	750	Circular	23.175	18.579	3.846	22.850	18.305	3.795
24.000	18.491	25.0	225	Circular	23.915	22.190	1.500	23.175	21.450	1.500
24.001	10.616	4.1	225	Circular	23.175	21.450	1.500	22.850	18.830	3.795
1.015	21.661	100.0	750	Circular	22.850	18.305	3.795	22.300	18.088	3.462
1.016	37.095	200.0	750	Circular	22.300	18.088	3.462	21.400	17.903	2.747
1.017	11.057	100.0	750	Circular	21.400	17.903	2.747	20.875	17.792	2.333
2.008	22.433	164.9	750	Circular	20.875	17.792	2.333	19.156	17.656	0.750
30.000	24.495	44.5	225	Circular	25.325	23.600	1.500	24.775	23.050	1.500
30.001	33.793	170.0	225	Circular	24.775	23.050	1.500	25.125	22.851	2.049
16.001	15.762	13.3	150	Circular	23.875	21.623	2.102	23.525	20.441	2.934
31.000	23.989	37.5	225	Circular	25.215	23.490	1.500	25.125	22.851	2.049
30.002	11.464	243.9	300	Circular	25.125	22.776	2.049	25.415	22.729	2.386
30.003	2.842	203.0	300	Circular	25.415	22.729	2.386	25.200	22.715	2.185

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
25.008	10	1350	Manhole	Adoptable	9	1350	Manhole	Adoptable
25.009	9	1350	Manhole	Adoptable	1	1800	Manhole	Adoptable
1.009	SSID1	1800	Manhole	Adoptable	Att. Tank 9		Junction	
1.011	8	1800	Manhole	Adoptable	7	1800	Manhole	Adoptable
1.012	7	1800	Manhole	Adoptable	6	1800	Manhole	Adoptable
18.000	25	1200	Manhole	Adoptable	24	1200	Manhole	Adoptable
18.001	24	1200	Manhole	Adoptable	6	1800	Manhole	Adoptable
1.013	6	1800	Manhole	Adoptable	5	1800	Manhole	Adoptable
19.007	SSID9	1350	Manhole	Adoptable	21	1500	Manhole	Adoptable
22.000	22	1200	Manhole	Adoptable	21	1500	Manhole	Adoptable
23.000	23	1200	Manhole	Adoptable	21	1500	Manhole	Adoptable
19.008	21	1500	Manhole	Adoptable	5	1800	Manhole	Adoptable
1.014	5	1800	Manhole	Adoptable	4	1800	Manhole	Adoptable
24.000	20	1200	Manhole	Adoptable	19	1200	Manhole	Adoptable
24.001	19	1200	Manhole	Adoptable	4	1800	Manhole	Adoptable
1.015	4	1800	Manhole	Adoptable	3	1800	Manhole	Adoptable
1.016	3	1800	Manhole	Adoptable	2	1800	Manhole	Adoptable
1.017	2	1800	Manhole	Adoptable	1	1800	Manhole	Adoptable
2.008	1	1800	Manhole	Adoptable	HW1		Junction	
30.000	90	1200	Manhole	Adoptable	89	1200	Manhole	Adoptable
30.001	89	1200	Manhole	Adoptable	88	1200	Manhole	Adoptable
16.001	32	1200	Manhole	Adoptable	27	1350	Manhole	Adoptable
31.000	98	1200	Manhole	Adoptable	88	1200	Manhole	Adoptable
30.002	88	1200	Manhole	Adoptable	87	1200	Manhole	Adoptable
30.003	87	1200	Manhole	Adoptable	Att. Tank 1		Junction	

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Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
32.000	33.852	38.8	225	Circular	25.375	23.650	1.500	25.250	22.778	2.247
30.005	44.909	40.0	300	Circular	25.250	22.703	2.247	23.750	21.580	1.870
33.000	44.622	25.2	225	Circular	25.150	23.425	1.500	23.750	21.655	1.870
30.006	17.827	23.4	300	Circular	23.750	21.580	1.870	23.025	20.818	1.907
34.000	11.209	170.0	225	Circular	23.450	21.725	1.500	23.925	21.659	2.041
34.001	8.972	169.3	225	Circular	23.925	21.659	2.041	24.300	21.606	2.469
35.000	11.279	13.4	150	Circular	24.650	22.521	1.979	24.300	21.681	2.469
34.002	32.799	51.5	300	Circular	24.300	21.531	2.469	23.750	20.894	2.556
34.003	17.895	235.5	300	Circular	23.750	20.894	2.556	23.025	20.818	1.907
30.007	24.028	324.7	375	Circular	23.025	20.743	1.907	22.850	20.669	1.806
30.008	54.865	324.6	375	Circular	22.850	20.669	1.806	21.700	20.500	0.825
2.000	17.837	44.6	225	Circular	27.215	25.490	1.500	26.815	25.090	1.500
2.001	20.616	68.7	225	Circular	26.815	25.090	1.500	26.515	24.790	1.500
2.002	47.612	72.7	300	Circular	26.515	24.715	1.500	25.860	24.060	1.500
2.003	20.824	17.5	375	Circular	25.860	23.985	1.500	25.515	22.797	2.343
3.000	6.751	168.8	225	Circular	24.815	23.090	1.500	24.925	23.050	1.650
3.002	10.734	170.4	225	Circular	25.400	23.010	2.165	25.515	22.947	2.343
2.004	2.401	109.1	375	Circular	25.515	22.797	2.343	25.475	22.775	2.325
4.000	18.355	244.7	300	Circular	25.475	23.675	1.500	25.900	23.600	2.000
4.001	9.642	12.0	300	Circular	25.900	23.600	2.000	25.985	22.795	2.890
2.006	6.176	325.0	375	Circular	25.985	22.720	2.890	26.050	22.701	2.974
1.000	11.480	65.6	225	Circular	28.025	26.300	1.500	27.850	26.125	1.500
1.001	11.231	74.9	225	Circular	27.850	26.125	1.500	27.700	25.975	1.500
1.002	81.526	60.4	300	Circular	27.700	25.900	1.500	26.350	24.550	1.500
1.003	12.824	11.0	300	Circular	26.350	24.550	1.500	26.175	23.380	2.495

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
32.000	97	1200	Manhole	Adoptable	86	1200	Manhole	Adoptable
30.005	86	1200	Manhole	Adoptable	85	1200	Manhole	Adoptable
33.000	96	1200	Manhole	Adoptable	85	1200	Manhole	Adoptable
30.006	85	1200	Manhole	Adoptable	84	1350	Manhole	Adoptable
34.000	94	1200	Manhole	Adoptable	93	1200	Manhole	Adoptable
34.001	93	1200	Manhole	Adoptable	92	1200	Manhole	Adoptable
35.000	95	1200	Manhole	Adoptable	92	1200	Manhole	Adoptable
34.002	92	1200	Manhole	Adoptable	91	1200	Manhole	Adoptable
34.003	91	1200	Manhole	Adoptable	84	1350	Manhole	Adoptable
30.007	84	1350	Manhole	Adoptable	83	1350	Manhole	Adoptable
30.008	83	1350	Manhole	Adoptable	HW2		Junction	
2.000	48	1200	Manhole	Adoptable	47	1200	Manhole	Adoptable
2.001	47	1200	Manhole	Adoptable	46	1200	Manhole	Adoptable
2.002	46	1200	Manhole	Adoptable	45	1350	Manhole	Adoptable
2.003	45	1350	Manhole	Adoptable	44	1350	Manhole	Adoptable
3.000	68	1200	Manhole	Adoptable	Att. Tank 4		Junction	
3.002	67	1200	Manhole	Adoptable	44	1350	Manhole	Adoptable
2.004	44	1350	Manhole	Adoptable	Att. Tank 5		Junction	
4.000	66	1200	Manhole	Adoptable	65	1200	Manhole	Adoptable
4.001	65	1200	Manhole	Adoptable	43	1350	Manhole	Adoptable
2.006	43	1350	Manhole	Adoptable	42	1350	Manhole	Adoptable
1.000	64	1200	Manhole	Adoptable	63	1200	Manhole	Adoptable
1.001	63	1200	Manhole	Adoptable	62	1200	Manhole	Adoptable
1.002	62	1200	Manhole	Adoptable	61	1200	Manhole	Adoptable
1.003	61	1200	Manhole	Adoptable	60	1350	Manhole	Adoptable

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Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.004	7.978	13.2	375	Circular	26.175	23.305	2.495	26.050	22.701	2.974
1.005	43.188	324.7	375	Circular	26.050	22.701	2.974	25.775	22.568	2.832
5.000	9.874	40.0	225	Circular	26.850	25.125	1.500	26.925	24.878	1.822
5.001	13.291	170.4	225	Circular	26.925	24.878	1.822	26.675	24.800	1.650
6.000	16.949	25.1	225	Circular	27.200	25.475	1.500	26.675	24.800	1.650
5.002	11.202	149.4	300	Circular	26.675	24.725	1.650	26.450	24.650	1.500
7.000	6.024	60.2	150	Circular	26.550	24.900	1.500	26.450	24.800	1.500
5.003	22.268	68.5	300	Circular	26.450	24.650	1.500	26.125	24.325	1.500
5.004	20.197	12.0	300	Circular	26.125	24.325	1.500	25.775	22.643	2.832
30.004	2.842	236.8	300	Circular	25.200	22.715	2.185	25.250	22.703	2.247
8.000	1.147	114.7	225	Circular	25.050	23.325	1.500	25.025	23.315	1.485
8.002	12.387	169.7	225	Circular	25.285	23.308	1.752	25.200	23.235	1.740
8.003	23.144	246.2	300	Circular	25.200	23.160	1.740	25.650	23.066	2.284
8.004	6.552	15.5	300	Circular	25.650	23.066	2.284	25.775	22.643	2.832
1.006	30.983	402.4	450	Circular	25.775	22.493	2.832	25.350	22.416	2.484
19.000	12.248	49.0	150	Circular	27.500	25.850	1.500	27.250	25.600	1.500
19.001	7.895	19.8	150	Circular	27.250	25.600	1.500	27.025	25.201	1.674
20.000	3.445	98.4	225	Circular	27.150	25.225	1.700	27.000	25.190	1.585
10.000	13.046	100.0	150	Circular	28.450	26.800	1.500	28.850	26.670	2.030
9.000	13.857	171.1	225	Circular	28.600	26.875	1.500	28.825	26.794	1.806
9.001	20.171	101.4	225	Circular	28.825	26.794	1.806	28.850	26.595	2.030
9.002	18.137	36.0	300	Circular	28.850	26.520	2.030	28.415	26.016	2.099
9.003	3.616	100.4	300	Circular	28.415	26.016	2.099	27.425	25.980	1.145
11.000	25.227	170.0	225	Circular	27.050	25.325	1.500	27.375	25.177	1.973
9.005	27.498	28.5	300	Circular	27.375	25.102	1.973	26.275	24.138	1.837

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.004	60	1350	Manhole	Adoptable	42	1350	Manhole	Adoptable
1.005	42	1350	Manhole	Adoptable	41	1350	Manhole	Adoptable
5.000	53	1200	Manhole	Adoptable	52	1200	Manhole	Adoptable
5.001	52	1200	Manhole	Adoptable	51	1200	Manhole	Adoptable
6.000	55	1200	Manhole	Adoptable	51	1200	Manhole	Adoptable
5.002	51	1200	Manhole	Adoptable	50	1200	Manhole	Adoptable
7.000	54	1200	Manhole	Adoptable	50	1200	Manhole	Adoptable
5.003	50	1200	Manhole	Adoptable	49	1200	Manhole	Adoptable
5.004	49	1200	Manhole	Adoptable	41	1350	Manhole	Adoptable
30.004	Att. Tank 1		Junction		86	1200	Manhole	Adoptable
8.000	59	1200	Manhole	Adoptable	Att. Tank 6		Junction	
8.002	58	1200	Manhole	Adoptable	57	1200	Manhole	Adoptable
8.003	57	1200	Manhole	Adoptable	56	1200	Manhole	Adoptable
8.004	56	1200	Manhole	Adoptable	41	1350	Manhole	Adoptable
1.006	41	1350	Manhole	Adoptable	40	1350	Manhole	Adoptable
19.000	81	1200	Manhole	Adoptable	80	1200	Manhole	Adoptable
19.001	80	1200	Manhole	Adoptable	79	1200	Manhole	Adoptable
20.000	82	1200	Manhole	Adoptable	Att. Tank 8		Junction	
10.000	76	1200	Manhole	Adoptable	72	1200	Manhole	Adoptable
9.000	74	1200	Manhole	Adoptable	73	1200	Manhole	Adoptable
9.001	73	1200	Manhole	Adoptable	72	1200	Manhole	Adoptable
9.002	72	1200	Manhole	Adoptable	71	1200	Manhole	Adoptable
9.003	71	1200	Manhole	Adoptable	Att. Tank 7		Junction	
11.000	75	1200	Manhole	Adoptable	70	1200	Manhole	Adoptable
9.005	70	1200	Manhole	Adoptable	69	1800	Manhole	Adoptable

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Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
13.000	43.546	40.0	300	Circular	25.090	23.290	1.500	24.285	22.201	1.784
13.001	33.832	21.3	300	Circular	24.285	22.201	1.784	23.675	20.613	2.762
12.000	41.313	83.8	225	Circular	24.515	22.790	1.500	24.800	22.297	2.278
12.001	17.897	40.0	225	Circular	24.800	22.297	2.278	24.100	21.850	2.025
12.002	20.840	17.9	225	Circular	24.100	21.850	2.025	23.675	20.688	2.762
12.003	15.310	319.0	375	Circular	23.675	20.538	2.762	23.700	20.490	2.835
15.000	4.993	99.9	300	Circular	22.100	20.520	1.280	22.200	20.470	1.430
12.004	15.310	45.3	375	Circular	23.700	20.490	2.835	23.525	20.152	2.998
14.000	18.499	29.4	225	Circular	22.875	21.150	1.500	22.825	20.521	2.079
14.001	4.559	325.6	375	Circular	22.825	20.371	2.079	22.950	20.357	2.218
14.002	21.339	323.3	375	Circular	22.950	20.357	2.218	23.525	20.291	2.859
16.000	21.439	20.4	150	Circular	24.325	22.675	1.500	23.875	21.623	2.102
15.001	12.491	520.5	300	Circular	22.200	20.470	1.430	22.825	20.446	2.079
3.001	6.751	168.8	225	Circular	24.925	23.050	1.650	25.400	23.010	2.165
12.005	21.818	404.0	450	Circular	23.525	20.077	2.998	23.250	20.023	2.777
1.007	13.693	28.2	450	Circular	25.350	22.416	2.484	25.300	21.930	2.920
12.006	17.100	407.1	450	Circular	23.250	20.023	2.777	23.100	19.981	2.669
37.000	15.132	15.1	300	Circular	22.750	21.500	0.950	21.700	20.500	0.900
38.000	11.869	59.1	450	Circular	22.610	20.701	1.459	21.700	20.500	0.750
19.006	21.793	181.6	450	Circular	26.575	22.900	3.225	26.080	22.780	2.850
17.000	17.108	285.1	600	Circular	22.075	20.170	1.305	22.550	20.110	1.840
17.001	16.805	120.0	600	Circular	22.550	20.110	1.840	23.100	19.970	2.530
12.007	37.479	138.8	600	Circular	23.100	19.831	2.669	24.115	19.561	3.954
12.008	40.273	335.6	600	Circular	24.115	19.561	3.954	24.925	19.441	4.884

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
13.000	39	1200	Manhole	Adoptable	38	1200	Manhole	Adoptable
13.001	38	1200	Manhole	Adoptable	28	1350	Manhole	Adoptable
12.000	31	1200	Manhole	Adoptable	30	1200	Manhole	Adoptable
12.001	30	1200	Manhole	Adoptable	29	1200	Manhole	Adoptable
12.002	29	1200	Manhole	Adoptable	28	1350	Manhole	Adoptable
12.003	28	1350	Manhole	Adoptable	Att. Tank 2		Junction	
15.000	36	1200	Manhole	Adoptable	Att. Tank 3		Junction	
12.004	Att. Tank 2		Junction		27	1350	Manhole	Adoptable
14.000	37	1200	Manhole	Adoptable	35	1350	Manhole	Adoptable
14.001	35	1350	Manhole	Adoptable	34	1350	Manhole	Adoptable
14.002	34	1350	Manhole	Adoptable	27	1350	Manhole	Adoptable
16.000	33	1200	Manhole	Adoptable	32	1200	Manhole	Adoptable
15.001	Att. Tank 3		Junction		35	1350	Manhole	Adoptable
3.001	Att. Tank 4		Junction		67	1200	Manhole	Adoptable
12.005	27	1350	Manhole	Adoptable	26	1350	Manhole	Adoptable
1.007	40	1350	Manhole	Adoptable	SSID2	1500	Manhole	Adoptable
12.006	26	1350	Manhole	Adoptable	SSID6	1500	Manhole	Adoptable
37.000	Basin I	1200	Manhole	Adoptable	Basin I Inlet		Junction	
38.000	LA S12	1350	Manhole	Adoptable	LA Inlet		Junction	
19.006	SSID10	1350	Manhole	Adoptable	SSID9	1350	Manhole	Adoptable
17.000	SSID8	1500	Manhole	Adoptable	SSID7	1500	Manhole	Adoptable
17.001	SSID7	1500	Manhole	Adoptable	SSID6	1500	Manhole	Adoptable
12.007	SSID6	1500	Manhole	Adoptable	SSID5	1500	Manhole	Adoptable
12.008	SSID5	1500	Manhole	Adoptable	SSID1	1800	Manhole	Adoptable

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Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.008	23.973	41.3	600	Circular	25.300	21.280	3.420	24.925	20.700	3.625
9.007	48.554	41.1	600	Circular	26.085	23.680	1.805	25.600	22.500	2.500
9.008	29.018	23.8	600	Circular	25.600	22.500	2.500	25.300	21.280	3.420
36.000	10.267	100.0	675	Circular	19.156	17.656	0.825	19.300	17.553	1.072
36.001	29.495	25.5	675	Circular	19.300	17.553	1.072	17.400	16.395	0.330
2.005	4.401	80.0	375	Circular	25.475	22.775	2.325	25.985	22.720	2.890
8.001	1.147	163.9	225	Circular	25.025	23.315	1.485	25.285	23.308	1.752
19.002	16.832	243.9	300	Circular	27.025	25.051	1.674	26.800	24.982	1.518
21.000	15.111	137.4	450	Circular	26.825	23.110	3.265	26.700	23.000	3.250
19.005	14.778	147.8	450	Circular	26.700	23.000	3.250	26.575	22.900	3.225
19.003	11.325	241.0	300	Circular	26.800	24.982	1.518	26.950	24.935	1.715
19.004	16.865	9.4	300	Circular	26.950	24.935	1.715	26.700	23.150	3.250
9.004	1.616	89.8	300	Circular	27.425	25.120	2.005	27.375	25.102	1.973
20.001	3.445	172.3	225	Circular	27.000	25.190	1.585	27.025	25.170	1.630
1.010	6.942	100.6	750	Circular	23.300	19.360	3.190	23.200	19.291	3.159
25.001	10.719	170.1	225	Circular	22.415	20.250	1.940	23.250	20.187	2.838
25.006	8.158	226.6	375	Circular	20.700	18.665	1.660	20.700	18.629	1.696
9.006	10.694	67.7	375	Circular	26.275	24.063	1.837	26.085	23.905	1.805
29.000	25.918	325.0	375	Circular	25.215	23.915	0.925	24.950	23.835	0.740
29.001	19.222	325.0	375	Circular	24.950	23.835	0.740	24.625	23.776	0.474
29.002	26.760	325.0	375	Circular	24.625	23.776	0.474	24.750	23.694	0.681
29.003	33.322	325.0	375	Circular	24.750	23.694	0.681	26.150	23.591	2.184

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.008	SSID2	1500	Manhole	Adoptable	SSID1	1800	Manhole	Adoptable
9.007	SSID4	1500	Manhole	Adoptable	SSID3	1500	Manhole	Adoptable
9.008	SSID3	1500	Manhole	Adoptable	SSID2	1500	Manhole	Adoptable
36.000	Basin H		Junction		Basin H FC	2400	Manhole	Adoptable
36.001	Basin H FC	2400	Manhole	Adoptable	Basin H Outfall		Junction	
2.005	Att. Tank 5		Junction		43	1350	Manhole	Adoptable
8.001	Att. Tank 6		Junction		58	1200	Manhole	Adoptable
19.002	79	1200	Manhole	Adoptable	78	1200	Manhole	Adoptable
21.000	SSID12	1350	Manhole	Adoptable	SSID11	1350	Manhole	Adoptable
19.005	SSID11	1350	Manhole	Adoptable	SSID10	1350	Manhole	Adoptable
19.003	78	1200	Manhole	Adoptable	77	1200	Manhole	Adoptable
19.004	77	1200	Manhole	Adoptable	SSID11	1350	Manhole	Adoptable
9.004	Att. Tank 7		Junction		70	1200	Manhole	Adoptable
20.001	Att. Tank 8		Junction		79	1200	Manhole	Adoptable
1.010	Att. Tank 9		Junction		8	1800	Manhole	Adoptable
25.001	Att. Tank 10		Junction		15	1200	Manhole	Adoptable
25.006	Att. Tank 11		Junction		11	1350	Manhole	Adoptable
9.006	69	1800	Manhole	Adoptable	SSID4	1500	Manhole	Adoptable
29.000	FD Junction 8		Junction		103	1350	Manhole	Adoptable
29.001	103	1350	Manhole	Adoptable	FD Junction 7		Junction	
29.002	FD Junction 7		Junction		FD Junction 6		Junction	
29.003	FD Junction 6		Junction		102	1350	Manhole	Adoptable

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Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
102	449265.762	116633.048	26.150	2.559	1350	1	29.003	23.591	375
						0	29.004	23.591	375
FD Junction 5	449263.920	116615.550	25.800	2.263		1	29.004	23.537	375
						0	29.005	23.537	375
FD Junction 4	449259.599	116595.413	25.480	2.006		1	29.005	23.474	375
						0	29.006	23.474	375
FD Junction 3	449247.535	116550.824	25.720	2.388		1	29.006	23.332	375
						0	29.007	23.332	375
FD Junction 2	449239.040	116523.540	25.600	2.356		1	29.007	23.244	375
						0	29.008	23.244	375
FD Junction 1	449214.800	116479.952	25.600	2.509		1	29.008	23.091	375
						0	29.009	23.091	375
101	449175.649	116414.322	25.300	2.444	1350	1	29.009	22.856	375
						0	29.010	22.856	375
100	449149.968	116429.898	24.350	1.752	1350	1	29.010	22.598	375
						0	29.011	22.598	375
99	449106.700	116449.571	22.975	1.328	1350	1	29.011	21.647	375
						0	29.012	21.647	375
HW3	449090.820	116478.961	21.700	0.600		1	29.012	21.100	375
15A	449000.831	116533.276	22.050	1.725	1200	0	25.000	20.325	225
15	448992.961	116567.829	23.250	3.063	1200	1	25.001	20.187	225
						0	25.002	20.187	225
14A	448978.892	116596.095	23.150	1.725	1200	0	26.000	21.425	225

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Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
14	448970.868	116577.235	22.625	2.654	1200	1	26.000	20.046	225
						2	25.002	20.046	225
						0	25.003	19.971	300
13	448956.997	116544.633	21.725	1.899	1200	1	25.003	19.826	300
						0	25.004	19.826	300
18	448989.330	116497.894	21.425	1.725	1200	0	27.000	19.700	225
17	448957.202	116515.144	21.200	1.800	1200	1	27.000	19.475	225
						0	27.001	19.400	300
12	448943.444	116524.318	21.075	2.377	1350	1	27.001	18.773	300
						2	25.004	19.273	300
						0	25.005	18.698	375
16	448881.227	116634.035	22.375	1.725	1200	0	28.000	20.650	225
10	448849.734	116586.806	20.625	2.226	1350	1	28.000	18.549	225
						2	25.007	18.399	375
						0	25.008	18.399	375
9	448822.257	116605.129	20.550	2.286	1350	1	25.008	18.264	375
						0	25.009	18.264	375
SSID1	449018.638	116619.420	24.925	5.495	1800	1	12.008	19.441	600
						2	1.008	20.700	600
						0	1.009	19.430	750
8	448966.096	116607.468	23.200	3.909	1800	1	1.010	19.291	750
						0	1.011	19.291	750
7	448937.936	116619.449	22.975	3.838	1800	1	1.011	19.137	750
						0	1.012	19.137	750
25	448977.685	116631.421	24.575	1.800	1200	0	18.000	22.775	300
24	448955.520	116653.093	24.600	1.951	1200	1	18.000	22.649	300
						0	18.001	22.649	300

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Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
6	448930.107	116627.108	23.100	3.999	1800	1	18.001	19.551	300
						2	1.012	19.101	750
						0	1.013	19.101	750
SSID9	448949.619	116721.594	26.080	3.300	1350	1	19.006	22.780	450
						0	19.007	22.780	450
22	448937.899	116675.890	24.800	1.725	1200	0	22.000	23.075	225
23	448907.308	116705.896	24.650	1.725	1200	0	23.000	22.925	225
21	448921.020	116692.397	25.050	4.977	1500	1	23.000	20.448	225
						2	22.000	20.448	225
						3	19.007	20.223	450
						0	19.008	20.073	600
5	448892.807	116663.594	23.175	4.596	1800	1	19.008	18.729	600
						2	1.013	18.579	750
						0	1.014	18.579	750
20	448893.803	116701.436	23.915	1.725	1200	0	24.000	22.190	225
19	448883.238	116686.260	23.175	1.725	1200	1	24.000	21.450	225
						0	24.001	21.450	225
4	448873.217	116682.756	22.850	4.545	1800	1	24.001	18.830	225
						2	1.014	18.305	750
						0	1.015	18.305	750
3	448858.070	116667.272	22.300	4.212	1800	1	1.015	18.088	750
						0	1.016	18.088	750
2	448839.548	116635.132	21.400	3.497	1800	1	1.016	17.903	750
						0	1.017	17.903	750
1	448832.920	116626.282	20.875	3.083	1800	1	25.009	18.167	375
						2	1.017	17.792	750
						0	2.008	17.792	750
HW1	448814.965	116639.730	19.156	1.500		1	2.008	17.656	750

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Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
90	449247.418	116608.535	25.325	1.725	1200				
						0	30.000	23.600	225
89	449222.994	116610.404	24.775	1.725	1200	1	30.000	23.050	225
						0	30.001	23.050	225
Att. Tank 1	449199.079	116555.259	25.200	2.485		1	30.003	22.715	300
						0	30.004	22.715	300
98	449234.596	116570.790	25.215	1.725	1200				
						0	31.000	23.490	225
88	449211.877	116578.492	25.125	2.349	1200	1	31.000	22.851	225
						2	30.001	22.851	225
						0	30.002	22.776	300
87	449208.105	116567.666	25.415	2.686	1200	1	30.002	22.729	300
						0	30.003	22.729	300
97	449220.957	116529.037	25.375	1.725	1200				
						0	32.000	23.650	225
86	449190.053	116542.853	25.250	2.547	1200	1	32.000	22.778	225
						2	30.004	22.703	300
						0	30.005	22.703	300
96	449201.910	116483.607	25.150	1.725	1200				
						0	33.000	23.425	225
85	449163.631	116506.539	23.750	2.170	1200	1	33.000	21.655	225
						2	30.005	21.580	300
						0	30.006	21.580	300
94	449138.548	116468.459	23.450	1.725	1200				
						0	34.000	21.725	225
93	449148.752	116463.819	23.925	2.266	1200	1	34.000	21.659	225
						0	34.001	21.659	225
95	449168.568	116460.527	24.650	2.129	1200				
						0	35.000	22.521	150

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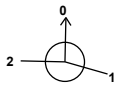
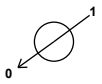
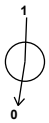
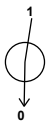
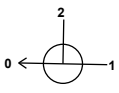
Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
92	449157.722	116463.621	24.300	2.769	1200		1 2 0	35.000 34.001 34.002	21.681 21.606 21.531	150 225 300
91	449158.428	116496.412	23.750	2.856	1200		1 0	34.002 34.003	20.894 20.894	300 300
84	449146.020	116509.307	23.025	2.282	1350		1 2 0	34.003 30.006 30.007	20.818 20.818 20.743	300 300 375
83	449126.696	116495.027	22.850	2.181	1350		1 0	30.007 30.008	20.669 20.669	375 375
HW2	449082.179	116462.958	21.700	1.200			1	30.008	20.500	375
48	449143.385	116756.853	27.215	1.725	1200		0	2.000	25.490	225
47	449160.640	116752.334	26.815	1.725	1200		1 0	2.000 2.001	25.090 25.090	225 225
46	449159.859	116731.733	26.515	1.800	1200		1 0	2.001 2.002	24.790 24.715	225 300
45	449152.570	116684.682	25.860	1.875	1350		1 0	2.002 2.003	24.060 23.985	300 375
68	449162.173	116625.157	24.815	1.725	1200		0	3.000	23.090	225
67	449162.924	116663.653	25.400	2.390	1200		1 0	3.001 3.002	23.010 23.010	225 225
44	449152.192	116663.861	25.515	2.718	1350		1 2 0	3.002 2.003 2.004	22.947 22.797 22.797	225 375 375
66	449111.539	116639.294	25.475	1.800	1200		0	4.000	23.675	300

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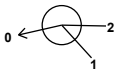
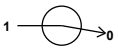
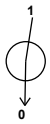
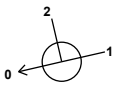
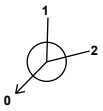
Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
65	449111.891	116657.646	25.900	2.300	1200		1	4.000	23.600	300
							0	4.001	23.600	300
43	449105.399	116664.775	25.985	3.265	1350		1	4.001	22.795	300
							2	2.005	22.720	375
							0	2.006	22.720	375
64	449087.756	116766.482	28.025	1.725	1200		0	1.000	26.300	225
63	449099.236	116766.482	27.850	1.725	1200		1	1.000	26.125	225
							0	1.001	26.125	225
62	449110.302	116764.565	27.700	1.800	1200		1	1.001	25.975	225
							0	1.002	25.900	300
61	449097.819	116684.000	26.350	1.800	1200		1	1.002	24.550	300
							0	1.003	24.550	300
60	449097.576	116671.178	26.175	2.870	1350		1	1.003	23.380	300
							0	1.004	23.305	375
42	449099.377	116663.406	26.050	3.349	1350		1	2.006	22.701	375
							2	1.004	22.701	375
							0	1.005	22.701	375
53	449064.717	116693.294	26.850	1.725	1200		0	5.000	25.125	225
52	449057.660	116700.200	26.925	2.047	1200		1	5.000	24.878	225
							0	5.001	24.878	225
55	449045.250	116713.889	27.200	1.725	1200		0	6.000	25.475	225
51	449044.773	116696.947	26.675	1.950	1200		1	6.000	24.800	225
							2	5.001	24.800	225
							0	5.002	24.725	300
54	449032.634	116693.150	26.550	1.650	1200		0	7.000	24.900	150

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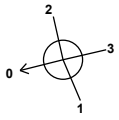
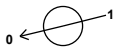
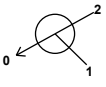
Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
50	449036.941	116688.938	26.450	1.800	1200		1 7.000	24.800	150
							2 5.002	24.650	300
							0 5.003	24.650	300
49	449052.862	116673.369	26.125	1.800	1200		1 5.003	24.325	300
							0 5.004	24.325	300
Att. Tank 2	449099.894	116543.723	23.700	3.210			1 12.003	20.490	375
							0 12.004	20.490	375
59	449079.899	116610.801	25.050	1.725	1200		0 8.000	23.325	225
58	449077.173	116622.789	25.285	1.977	1200		1 8.001	23.308	225
							0 8.002	23.308	225
57	449064.998	116625.069	25.200	2.040	1200		1 8.002	23.235	225
							0 8.003	23.160	300
56	449059.866	116647.637	25.650	2.584	1200		1 8.003	23.066	300
							0 8.004	23.066	300
41	449057.302	116653.666	25.775	3.282	1350		1 8.004	22.643	300
							2 5.004	22.643	300
							3 1.005	22.568	375
							0 1.006	22.493	450
40	449027.250	116646.126	25.350	2.934	1350		1 1.006	22.416	450
							0 1.007	22.416	450
81	448976.451	116779.293	27.500	1.650	1200		0 19.000	25.850	150
80	448970.756	116768.449	27.250	1.650	1200		1 19.000	25.600	150
							0 19.001	25.600	150
79	448963.849	116764.624	27.025	1.974	1200		1 20.001	25.170	225
							2 19.001	25.201	150
							0 19.002	25.051	300
76	449006.402	116772.007	28.450	1.650	1200		0 10.000	26.800	150

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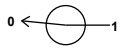
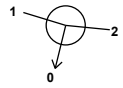
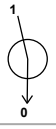
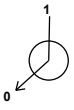
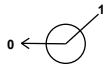
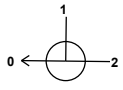
Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
74	449052.813	116766.232	28.600	1.725	1200				
						0	9.000	26.875	225
73	449038.956	116766.232	28.825	2.031	1200		1	9.000	26.794	225
									
						0	9.001	26.794	225
72	449018.882	116768.206	28.850	2.330	1200		1	10.000	26.670	150
							2	9.001	26.595	225
							0	9.002	26.520	300
71	449014.565	116750.590	28.415	2.399	1200		1	9.002	26.016	300
							0	9.003	26.016	300
75	449013.561	116713.483	27.050	1.725	1200					
							0	11.000	25.325	225
70	448995.525	116731.121	27.375	2.273	1200		1	11.000	25.177	225
							2	9.004	25.102	300
							0	9.005	25.102	300
SSID4	448968.822	116703.815	26.085	2.405	1500		1	9.006	23.905	375
							0	9.007	23.680	600
39	449115.854	116619.706	25.090	1.800	1200					
							0	13.000	23.290	300
38	449125.623	116577.270	24.285	2.084	1200		1	13.000	22.201	300
							0	13.001	22.201	300
31	449160.114	116596.529	24.515	1.725	1200					
							0	12.000	22.790	225
30	449159.305	116555.224	24.800	2.503	1200		1	12.000	22.297	225
							0	12.001	22.297	225
29	449146.041	116543.209	24.100	2.250	1200		1	12.001	21.850	225
							0	12.002	21.850	225
28	449125.202	116543.441	23.675	3.137	1350		1	13.001	20.613	300
							2	12.002	20.688	225
							0	12.003	20.538	375

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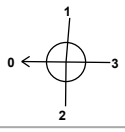
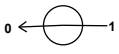
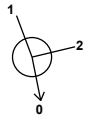
Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
36	449061.237	116493.427	22.100	1.580	1200				
						0	15.000	20.520	300
Att. Tank 3	449067.371	116507.109	22.200	1.730			1	15.000	20.470	300
						0	15.001	20.470	300
37	449089.443	116511.124	22.875	1.725	1200				
						0	14.000	21.150	225
35	449072.481	116518.507	22.825	2.454	1350		1	15.001	20.446	300
							2	14.000	20.521	225
						0	14.001	20.371	375
34	449074.346	116522.667	22.950	2.593	1350		1	14.001	20.357	375
						0	14.002	20.357	375
33	449071.186	116580.625	24.325	1.650	1200				
						0	16.000	22.675	150
32	449075.905	116559.712	23.875	2.252	1200		1	16.000	21.623	150
						0	16.001	21.623	150
Att. Tank 4	449162.549	116644.405	24.925	1.875			1	3.000	23.050	225
						0	3.001	23.050	225
27	449074.586	116544.005	23.525	3.448	1350		1	16.001	20.441	150
							2	14.002	20.291	375
							3	12.004	20.152	375
						0	12.005	20.077	450
26	449052.769	116544.248	23.250	3.227	1350		1	12.005	20.023	450
						0	12.006	20.023	450
11	448896.589	116555.562	20.700	2.071	1350		1	25.006	18.629	375
						0	25.007	18.629	375
69	448976.299	116711.461	26.275	2.212	1800		1	9.005	24.138	300
						0	9.006	24.063	375
SSID2	449013.936	116642.927	25.300	4.020	1500		1	9.008	21.280	600
							2	1.007	21.930	450
						0	1.008	21.280	600

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Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
SSID6	449035.683	116543.560	23.100	3.269	1500	1	17.001	19.970	600
						2	12.006	19.981	450
						0	12.007	19.831	600
Basin J	449044.510	116465.091	21.700	1.200					
LA S12	449064.886	116425.631	22.610	1.909	1350	0	38.000	20.701	450
Basin I	449095.972	116436.196	22.750	1.250	1200	0	37.000	21.500	300
Basin I Inlet	449083.708	116445.060	21.700	1.200		1	37.000	20.500	300
LA Inlet	449062.093	116437.167	21.700	1.200		1	38.000	20.500	450
SSID10	448934.783	116737.557	26.575	3.675	1350	1	19.005	22.900	450
						0	19.006	22.900	450
SSID8	449027.763	116510.915	22.075	1.905	1500	0	17.000	20.170	600
SSID7	449034.018	116526.838	22.550	2.440	1500	1	17.000	20.110	600
						0	17.001	20.110	600
SSID5	449027.676	116580.174	24.115	4.554	1500	1	12.007	19.561	600
						0	12.008	19.561	600
SSID3	449003.766	116670.105	25.600	3.100	1500	1	9.007	22.500	600
						0	9.008	22.500	600
Basin H	448733.321	116703.121	19.156	1.500		0	36.000	17.656	675
Basin H FC	448723.067	116702.612	19.300	1.747	2400	1	36.000	17.553	675
						0	36.001	17.553	675

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Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
Basin H Outfall	448693.613	116701.064	17.400	1.005		1	36.001	16.395	675
Att. Tank 5	449128.796	116664.318	25.475	2.700		1	2.004	22.775	375
						0	2.005	22.775	375
Att. Tank 6	449078.536	116616.795	25.025	1.710		1	8.000	23.315	225
						0	8.001	23.315	225
82	448975.925	116752.815	27.150	1.925	1200	0	20.000	25.225	225
Att. Tank 7	449004.346	116740.140	27.425	2.305		1	9.003	25.980	300
						0	9.004	25.120	300
78	448949.124	116756.470	26.800	1.818	1200	1	19.002	24.982	300
						0	19.003	24.982	300
SSID12	448925.440	116765.131	26.825	3.715	1350	0	21.000	23.110	450
SSID11	448926.963	116750.097	26.700	3.700	1350	1	21.000	23.000	450
						2	19.004	23.150	300
						0	19.005	23.000	450
77	448939.123	116761.783	26.950	2.015	1200	1	19.003	24.935	300
						0	19.004	24.935	300
Att. Tank 8	448969.887	116758.720	27.000	1.810		1	20.000	25.190	225
						0	20.001	25.190	225
Att. Tank 9	448992.367	116613.444	23.300	3.940		1	1.009	19.360	750
						0	1.010	19.360	750
Att. Tank 10	448996.896	116550.552	22.415	2.165		1	25.000	20.250	225
						0	25.001	20.250	225
Att. Tank 11	448920.017	116539.940	20.700	2.035		1	25.005	18.665	375
						0	25.006	18.665	375

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Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
FD Junction 8	449191.667	116678.164	25.215	1.300		0	29.000	23.915	375
103	449188.878	116652.396	24.950	1.115	1350	1	29.000	23.835	375
						0	29.001	23.835	375
FD Junction 7	449207.440	116647.404	24.625	0.849		1	29.001	23.776	375
						0	29.002	23.776	375
FD Junction 6	449233.594	116641.743	24.750	1.056		1	29.002	23.694	375
						0	29.003	23.694	375

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Normal	Starting Level (m)	
Rainfall Events	Singular	Skip Steady State	x	Check Discharge Rate(s)	x
Summer CV	1.000	Drain Down Time (mins)	240	Check Discharge Volume	x
Winter CV	1.000	Additional Storage (m³/ha)	0.0		

Storm Durations

15	30	60	120	240	480	720	1440	2880

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
30	40	0	0
100	45	10	0

Node 69 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	24.063	Product Number	CTL-SHE-0177-1820-1942-1820
Design Depth (m)	1.942	Min Outlet Diameter (m)	0.225
Design Flow (l/s)	18.2	Min Node Diameter (mm)	1800

Node 77 Online Orifice Control

Flap Valve	x	Design Depth (m)	0.650	Discharge Coefficient	0.600
Replaces Downstream Link	x	Design Flow (l/s)	100.0		
Invert Level (m)	24.935	Diameter (m)	0.257		

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Node Basin I Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	21.500	Product Number	CTL-SHE-0047-1000-1000-1000
Design Depth (m)	1.000	Min Outlet Diameter (m)	0.075
Design Flow (l/s)	1.0	Min Node Diameter (mm)	1200

Node Basin J Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	20.500	Product Number	CTL-SHE-0235-2960-1000-2960
Design Depth (m)	1.000	Min Outlet Diameter (m)	0.300
Design Flow (l/s)	29.6	Min Node Diameter (mm)	1800

Node 40 Online Orifice Control

Flap Valve	x	Design Depth (m)	2.500	Discharge Coefficient	0.600
Replaces Downstream Link	x	Design Flow (l/s)	400.0		
Invert Level (m)	22.416	Diameter (m)	0.354		

Node Basin H FC Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	17.553	Product Number	CTL-SHE-0340-7080-1081-7080
Design Depth (m)	1.081	Min Outlet Diameter (m)	0.375
Design Flow (l/s)	70.8	Min Node Diameter (mm)	2400

Node Att. Tank 8 Soakaway Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	25.190	Depth (m)	0.840
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	5	Inf Depth (m)	
Safety Factor	2.0	Pit Width (m)	2.000	Number Required	1
Porosity	0.94	Pit Length (m)	10.000		

Node Att. Tank 9 Soakaway Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	19.360	Depth (m)	1.470
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	9	Inf Depth (m)	
Safety Factor	2.0	Pit Width (m)	3.500	Number Required	1
Porosity	0.94	Pit Length (m)	40.000		

Node Basin J Pond Storage Structure

Invert Level (m)	20.500	Time to half empty (mins)	0	Analyse flow through structure	x

Inlets

HW2

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	918.0	1.200	1693.0

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Node Att. Tank 2 Soakaway Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	20.490	Depth (m)	0.840
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	7	Inf Depth (m)	
Safety Factor	2.0	Pit Width (m)	3.000	Number Required	1
Porosity	0.94	Pit Length (m)	20.000		

Node Att. Tank 5 Soakaway Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	22.775	Depth (m)	1.050
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	17	Inf Depth (m)	
Safety Factor	2.0	Pit Width (m)	4.000	Number Required	1
Porosity	0.94	Pit Length (m)	40.000		

Node Att. Tank 6 Soakaway Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	23.315	Depth (m)	1.470
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	7	Inf Depth (m)	
Safety Factor	2.0	Pit Width (m)	3.500	Number Required	1
Porosity	0.94	Pit Length (m)	10.000		

Node Att. Tank 7 Soakaway Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	25.120	Depth (m)	1.260
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	63	Inf Depth (m)	
Safety Factor	2.0	Pit Width (m)	6.000	Number Required	1
Porosity	0.94	Pit Length (m)	22.000		

Node Basin H Pond Storage Structure

Invert Level (m)	17.656	Time to half empty (mins)		Analyse flow through structure	x

Inlets

HW1

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	2820.0	1.500	4587.0

Node Att. Tank 10 Soakaway Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	20.250	Depth (m)	0.840
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	9	Inf Depth (m)	
Safety Factor	2.0	Pit Width (m)	4.000	Number Required	1
Porosity	0.94	Pit Length (m)	14.000		

Node Att. Tank 4 Soakaway Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	23.050	Depth (m)	1.260
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	18	Inf Depth (m)	
Safety Factor	2.0	Pit Width (m)	3.000	Number Required	1
Porosity	0.94	Pit Length (m)	25.000		

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Node Att. Tank 3 Soakaway Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	20.470	Depth (m)	1.050
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	8	Inf Depth (m)	
Safety Factor	2.0	Pit Width (m)	3.000	Number Required	1
Porosity	0.94	Pit Length (m)	20.000		

Node Att. Tank 1 Soakaway Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	22.715	Depth (m)	0.630
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	7	Inf Depth (m)	
Safety Factor	2.0	Pit Width (m)	4.000	Number Required	1
Porosity	0.94	Pit Length (m)	25.000		

Node Att. Tank 11 Soakaway Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	18.665	Depth (m)	1.260
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	17	Inf Depth (m)	
Safety Factor	2.0	Pit Width (m)	3.500	Number Required	1
Porosity	0.94	Pit Length (m)	40.000		

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Results for 1 year Critical Storm Duration. Lowest mass balance: 99.73%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	102	11	23.652	0.061	3.5	0.0876	0.0000	OK
15 minute summer	FD Junction 5	11	23.643	0.106	11.7	0.0000	0.0000	OK
15 minute summer	FD Junction 4	11	23.587	0.113	11.6	0.0000	0.0000	OK
15 minute summer	FD Junction 3	13	23.435	0.103	11.9	0.0000	0.0000	OK
15 minute summer	FD Junction 2	12	23.395	0.151	23.1	0.0000	0.0000	OK
30 minute summer	FD Junction 1	21	23.260	0.169	22.0	0.0000	0.0000	OK
30 minute summer	101	22	22.944	0.088	20.6	0.1256	0.0000	OK
30 minute summer	100	22	22.666	0.068	20.4	0.0972	0.0000	OK
30 minute summer	99	23	21.718	0.071	20.4	0.1022	0.0000	OK
30 minute summer	HW3	23	21.171	0.071	20.3	0.0000	0.0000	OK
15 minute summer	15A	10	20.400	0.075	10.2	0.0853	0.0000	OK
30 minute summer	15	20	20.260	0.073	8.7	0.0821	0.0000	OK
15 minute summer	14A	10	21.478	0.053	16.4	0.0594	0.0000	OK
15 minute summer	14	11	20.122	0.151	34.7	0.1713	0.0000	OK
15 minute summer	13	11	19.922	0.096	34.7	0.1089	0.0000	OK
15 minute summer	18	11	19.750	0.050	4.5	0.0566	0.0000	OK
15 minute summer	17	10	19.455	0.055	16.0	0.0618	0.0000	OK
15 minute summer	12	11	18.881	0.183	62.7	0.2618	0.0000	OK
15 minute summer	16	10	20.711	0.061	16.0	0.0686	0.0000	OK
30 minute summer	10	20	18.589	0.190	59.5	0.2713	0.0000	OK
30 minute summer	9	20	18.455	0.191	60.1	0.2734	0.0000	OK
30 minute summer	SSID1	21	19.667	0.237	205.0	0.6022	0.0000	OK
30 minute summer	8	22	19.550	0.259	188.9	0.6597	0.0000	OK
30 minute summer	7	22	19.406	0.269	192.4	0.6848	0.0000	OK
15 minute summer	25	10	22.878	0.103	16.7	0.1159	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)
15 minute summer	102	29.004	FD Junction 5	3.4	0.201	0.051	0.3276	
15 minute summer	FD Junction 5	29.005	FD Junction 4	11.6	0.439	0.178	0.5499	
15 minute summer	FD Junction 4	29.006	FD Junction 3	11.9	0.478	0.182	1.1625	
15 minute summer	FD Junction 3	29.007	FD Junction 2	10.9	0.351	0.168	0.9202	
15 minute summer	FD Junction 2	29.008	FD Junction 1	22.8	0.546	0.349	2.1775	
30 minute summer	FD Junction 1	29.009	101	20.6	0.621	0.316	2.5821	
30 minute summer	101	29.010	100	20.4	1.238	0.110	0.4977	
30 minute summer	100	29.011	99	20.4	1.452	0.072	0.6684	
30 minute summer	99	29.012	HW3	20.3	1.403	0.079	0.4827	17.6
15 minute summer	15A	25.000	Att. Tank 10	10.2	1.466	0.234	0.0891	
30 minute summer	15	25.002	14	8.6	0.792	0.216	0.2601	
15 minute summer	14A	26.000	14	16.3	2.067	0.120	0.1916	
15 minute summer	14	25.003	13	34.7	1.263	0.490	0.9770	
15 minute summer	13	25.004	12	34.6	1.834	0.206	0.4606	
15 minute summer	18	27.000	17	4.4	0.671	0.107	0.2366	
15 minute summer	17	27.001	12	15.9	1.364	0.073	0.2598	
15 minute summer	12	25.005	Att. Tank 11	62.7	1.998	0.495	0.3226	
15 minute summer	16	28.000	10	15.6	1.836	0.156	0.4839	
30 minute summer	10	25.008	9	59.4	1.058	0.466	1.8536	
30 minute summer	9	25.009	1	59.5	1.111	0.467	1.2717	
30 minute summer	SSID1	1.009	Att. Tank 9	203.2	2.053	0.164	0.8368	
30 minute summer	8	1.011	7	189.8	1.372	0.217	4.2358	
30 minute summer	7	1.012	6	193.0	1.590	0.273	1.3360	
15 minute summer	25	18.000	24	16.5	1.051	0.234	0.4935	

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Results for 1 year Critical Storm Duration. Lowest mass balance: 99.73%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	24	10	22.711	0.062	30.3	0.0706	0.0000	OK
30 minute summer	6	22	19.313	0.212	209.4	0.5393	0.0000	OK
15 minute summer	SSID9	11	22.893	0.113	105.8	0.1612	0.0000	OK
15 minute summer	22	10	23.115	0.040	11.5	0.0449	0.0000	OK
15 minute summer	23	10	22.964	0.039	11.8	0.0441	0.0000	OK
15 minute summer	21	11	20.212	0.139	138.6	0.2449	0.0000	OK
30 minute summer	5	20	18.866	0.287	312.9	0.7307	0.0000	OK
15 minute summer	20	10	22.231	0.041	6.6	0.0458	0.0000	OK
15 minute summer	19	10	21.481	0.031	10.2	0.0353	0.0000	OK
30 minute summer	4	20	18.611	0.306	318.3	0.7785	0.0000	OK
30 minute summer	3	21	18.429	0.341	317.5	0.8671	0.0000	OK
30 minute summer	2	21	18.233	0.330	322.8	0.8399	0.0000	OK
30 minute summer	1	21	18.112	0.320	384.1	0.8135	0.0000	OK
480 minute summer	HW1	312	17.874	0.218	144.9	0.0000	0.0000	OK
15 minute summer	90	10	23.655	0.055	10.3	0.0619	0.0000	OK
15 minute summer	89	11	23.135	0.085	12.0	0.0965	0.0000	OK
30 minute summer	Att. Tank 1	22	22.801	0.086	22.8	8.0819	0.0000	OK
15 minute summer	98	10	23.533	0.043	6.9	0.0490	0.0000	OK
15 minute summer	88	11	22.900	0.124	22.2	0.1403	0.0000	OK
15 minute summer	87	11	22.845	0.116	25.0	0.1307	0.0000	OK
15 minute summer	97	10	23.699	0.049	8.6	0.0554	0.0000	OK
30 minute summer	86	20	22.776	0.073	23.0	0.0821	0.0000	OK
15 minute summer	96	10	23.479	0.054	13.1	0.0612	0.0000	OK
30 minute summer	85	19	21.663	0.083	39.5	0.0943	0.0000	OK
15 minute summer	94	10	21.780	0.055	5.1	0.0623	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)
15 minute summer	24	18.001	6	30.0	2.877	0.092	0.3789	
30 minute summer	6	1.013	5	210.4	1.746	0.170	6.6438	
15 minute summer	SSID9	19.007	21	106.1	3.518	0.131	1.2322	
15 minute summer	22	22.000	21	11.4	2.464	0.065	0.1093	
15 minute summer	23	23.000	21	11.7	2.610	0.063	0.0866	
15 minute summer	21	19.008	5	138.7	2.924	0.110	1.9129	
30 minute summer	5	1.014	4	310.7	1.926	0.251	4.4346	
15 minute summer	20	24.000	19	6.6	1.615	0.063	0.0755	
15 minute summer	19	24.001	4	10.1	3.132	0.039	0.0343	
30 minute summer	4	1.015	3	317.1	1.751	0.257	3.9247	
30 minute summer	3	1.016	2	319.9	1.679	0.367	7.0670	
30 minute summer	2	1.017	1	323.4	1.770	0.262	2.0201	
30 minute summer	1	2.008	HW1	384.1	4.676	0.400	2.1494	
15 minute summer	90	30.000	89	10.2	1.016	0.131	0.2579	
15 minute summer	89	30.001	88	11.7	0.867	0.295	0.4573	
30 minute summer	Att. Tank 1	30.004	86	13.2	0.935	0.183	0.0416	
15 minute summer	98	31.000	88	6.9	1.240	0.081	0.1385	
15 minute summer	88	30.002	87	22.3	0.848	0.314	0.3009	
15 minute summer	87	30.003	Att. Tank 1	25.0	1.752	0.322	0.0517	
15 minute summer	97	32.000	86	8.5	1.349	0.101	0.2127	
30 minute summer	86	30.005	85	23.0	1.627	0.130	0.6433	
15 minute summer	96	33.000	85	12.9	1.777	0.124	0.3232	
30 minute summer	85	30.006	84	39.5	2.002	0.171	0.4127	
15 minute summer	94	34.000	93	5.0	0.561	0.127	0.1009	

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Results for 1 year Critical Storm Duration. Lowest mass balance: 99.73%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	93	10	21.729	0.070	7.6	0.0791	0.0000	OK
15 minute summer	95	10	22.559	0.038	6.3	0.0425	0.0000	OK
15 minute summer	92	10	21.599	0.068	18.0	0.0770	0.0000	OK
15 minute summer	91	11	21.011	0.117	20.9	0.1323	0.0000	OK
15 minute summer	84	12	20.953	0.210	59.2	0.3001	0.0000	OK
15 minute summer	83	12	20.874	0.205	62.2	0.2931	0.0000	OK
720 minute summer	HW2	435	20.596	0.096	14.6	0.0000	0.0000	OK
15 minute summer	48	10	25.524	0.034	3.9	0.0384	0.0000	OK
15 minute summer	47	10	25.151	0.061	9.7	0.0688	0.0000	OK
15 minute summer	46	11	24.787	0.072	16.2	0.0811	0.0000	OK
15 minute summer	45	11	24.041	0.056	23.1	0.0795	0.0000	OK
15 minute summer	68	10	23.156	0.066	7.6	0.0745	0.0000	OK
120 minute summer	67	68	23.052	0.042	2.8	0.0472	0.0000	OK
15 minute summer	44	11	22.890	0.093	26.4	0.1329	0.0000	OK
15 minute summer	66	10	23.714	0.039	2.6	0.0442	0.0000	OK
15 minute summer	65	10	23.640	0.040	12.6	0.0456	0.0000	OK
30 minute summer	43	22	22.871	0.151	22.4	0.2165	0.0000	OK
15 minute summer	64	10	26.348	0.047	6.1	0.0537	0.0000	OK
15 minute summer	63	10	26.180	0.055	7.3	0.0619	0.0000	OK
15 minute summer	62	11	25.964	0.064	14.1	0.0727	0.0000	OK
15 minute summer	61	11	24.608	0.058	25.2	0.0655	0.0000	OK
15 minute summer	60	11	23.369	0.064	35.3	0.0910	0.0000	OK
30 minute summer	42	22	22.860	0.159	40.1	0.2279	0.0000	OK
15 minute summer	53	10	25.154	0.029	3.0	0.0331	0.0000	OK
15 minute summer	52	10	24.945	0.067	7.2	0.0756	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)
15 minute summer	93	34.001	92	7.5	0.748	0.188	0.0902	
15 minute summer	95	35.000	92	6.3	1.859	0.128	0.0380	
15 minute summer	92	34.002	91	17.8	0.986	0.114	0.6122	
15 minute summer	91	34.003	84	20.8	0.773	0.289	0.4977	
15 minute summer	84	30.007	83	59.2	0.947	0.536	1.5007	
15 minute summer	83	30.008	HW2	62.8	2.293	0.568	1.7406	
15 minute summer	48	2.000	47	3.9	0.637	0.049	0.1105	
15 minute summer	47	2.001	46	9.5	1.126	0.151	0.1739	
15 minute summer	46	2.002	45	16.0	1.259	0.123	0.6063	
15 minute summer	45	2.003	44	23.2	1.516	0.048	0.3264	
15 minute summer	68	3.000	Att. Tank 4	7.6	1.528	0.190	0.0407	
120 minute summer	67	3.002	44	2.8	0.571	0.071	0.0530	
15 minute summer	44	2.004	Att. Tank 5	26.4	2.271	0.138	0.0432	
15 minute summer	66	4.000	65	2.5	0.461	0.035	0.1007	
15 minute summer	65	4.001	43	12.6	1.960	0.039	0.0729	
30 minute summer	43	2.006	42	22.8	0.580	0.207	0.2660	
15 minute summer	64	1.000	63	6.1	0.896	0.094	0.0777	
15 minute summer	63	1.001	62	7.1	0.992	0.119	0.0808	
15 minute summer	62	1.002	61	14.0	1.360	0.097	0.8381	
15 minute summer	61	1.003	60	25.1	2.739	0.074	0.1177	
15 minute summer	60	1.004	42	35.3	1.413	0.064	0.2139	
30 minute summer	42	1.005	41	40.4	0.893	0.365	2.4037	
15 minute summer	53	5.000	52	3.0	0.486	0.036	0.0635	
15 minute summer	52	5.001	51	7.0	0.741	0.177	0.1267	

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Results for 1 year Critical Storm Duration. Lowest mass balance: 99.73%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	55	10	25.522	0.047	9.7	0.0537	0.0000	OK
15 minute summer	51	10	24.822	0.097	18.0	0.1092	0.0000	OK
15 minute summer	54	10	24.949	0.049	4.6	0.0549	0.0000	OK
15 minute summer	50	10	24.741	0.091	23.3	0.1030	0.0000	OK
15 minute summer	49	11	24.386	0.061	29.9	0.0693	0.0000	OK
15 minute summer	Att. Tank 2	12	20.587	0.097	50.6	5.4590	0.0000	OK
30 minute summer	59	19	23.388	0.063	7.2	0.0718	0.0000	OK
30 minute summer	58	20	23.372	0.064	6.5	0.0725	0.0000	OK
15 minute summer	57	11	23.265	0.105	17.6	0.1188	0.0000	OK
15 minute summer	56	11	23.122	0.056	22.2	0.0637	0.0000	OK
15 minute summer	41	12	22.801	0.308	95.6	0.4404	0.0000	OK
15 minute summer	40	12	22.763	0.347	96.3	0.4960	0.0000	OK
15 minute summer	81	10	25.884	0.034	2.9	0.0386	0.0000	OK
15 minute summer	80	10	25.642	0.042	6.2	0.0472	0.0000	OK
15 minute summer	79	11	25.180	0.129	23.7	0.1457	0.0000	OK
15 minute winter	76	12	26.808	0.008	0.1	0.0090	0.0000	OK
15 minute summer	74	10	26.944	0.069	7.5	0.0778	0.0000	OK
15 minute summer	73	10	26.868	0.074	11.6	0.0840	0.0000	OK
15 minute summer	72	11	26.576	0.056	14.4	0.0636	0.0000	OK
15 minute summer	71	11	26.104	0.088	18.1	0.0992	0.0000	OK
15 minute summer	75	10	25.403	0.078	9.9	0.0880	0.0000	OK
30 minute summer	70	19	25.166	0.064	21.0	0.0722	0.0000	OK
30 minute summer	SSID4	21	23.736	0.056	19.1	0.0990	0.0000	OK
15 minute summer	39	10	23.343	0.053	12.2	0.0599	0.0000	OK
15 minute summer	38	10	22.262	0.061	22.2	0.0686	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)
15 minute summer	55	6.000	51	9.6	1.616	0.092	0.1008	
15 minute summer	51	5.002	50	17.8	0.950	0.196	0.2107	
15 minute summer	54	7.000	50	4.5	0.967	0.198	0.0283	
15 minute summer	50	5.003	49	23.1	1.648	0.172	0.3152	
15 minute summer	49	5.004	41	29.8	2.411	0.093	0.4752	
15 minute summer	Att. Tank 2	12.004	27	44.5	1.505	0.149	0.5103	
30 minute summer	59	8.000	Att. Tank 6	7.1	1.075	0.147	0.0103	
30 minute summer	58	8.002	57	6.5	0.725	0.164	0.1116	
15 minute summer	57	8.003	56	17.5	1.146	0.248	0.3600	
15 minute summer	56	8.004	41	22.1	1.948	0.078	0.1514	
15 minute summer	41	1.006	40	93.5	0.763	0.584	3.8199	
15 minute summer	40	1.007	SSID2	95.9	2.641	0.157	0.4976	
15 minute summer	81	19.000	80	2.9	0.826	0.113	0.0428	
15 minute summer	80	19.001	79	6.1	1.589	0.152	0.0304	
15 minute summer	79	19.002	78	23.7	0.787	0.334	0.5123	
15 minute winter	76	10.000	72	0.1	0.263	0.005	0.0046	
15 minute summer	74	9.000	73	7.4	0.684	0.187	0.1502	
15 minute summer	73	9.001	72	11.4	1.028	0.221	0.2237	
15 minute summer	72	9.002	71	14.4	1.115	0.078	0.2379	
15 minute summer	71	9.003	Att. Tank 7	18.2	1.116	0.164	0.0588	
15 minute summer	75	11.000	70	9.7	0.819	0.244	0.2994	
30 minute summer	70	9.005	69	21.0	1.059	0.101	1.1112	
30 minute summer	SSID4	9.007	SSID3	19.0	1.550	0.018	0.6026	
15 minute summer	39	13.000	38	12.1	1.307	0.069	0.4030	
15 minute summer	38	13.001	28	21.9	1.831	0.091	0.4652	

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Results for 1 year Critical Storm Duration. Lowest mass balance: 99.73%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	31	10	22.845	0.055	7.4	0.0624	0.0000	OK
15 minute summer	30	10	22.351	0.054	10.3	0.0613	0.0000	OK
15 minute summer	29	11	21.907	0.057	16.7	0.0647	0.0000	OK
15 minute summer	28	11	20.702	0.164	48.6	0.2341	0.0000	OK
15 minute summer	36	10	20.581	0.061	9.9	0.0694	0.0000	OK
30 minute summer	Att. Tank 3	22	20.529	0.059	9.0	3.3036	0.0000	OK
15 minute summer	37	10	21.190	0.040	6.4	0.0452	0.0000	OK
30 minute summer	35	19	20.460	0.089	10.0	0.1279	0.0000	OK
15 minute summer	34	11	20.448	0.091	13.8	0.1308	0.0000	OK
15 minute summer	33	10	22.693	0.018	1.1	0.0199	0.0000	OK
15 minute summer	32	11	21.638	0.015	1.1	0.0175	0.0000	OK
120 minute summer	Att. Tank 4	70	23.090	0.040	3.8	2.8498	0.0000	OK
15 minute summer	27	12	20.310	0.233	72.8	0.3338	0.0000	OK
15 minute summer	26	12	20.252	0.229	78.6	0.3282	0.0000	OK
30 minute summer	11	21	18.771	0.142	40.6	0.2038	0.0000	OK
30 minute summer	69	22	24.533	0.470	23.7	1.1970	0.0000	SURCHARGED
15 minute summer	SSID2	12	21.424	0.144	120.4	0.2544	0.0000	OK
15 minute summer	SSID6	12	19.992	0.161	86.0	0.2852	0.0000	OK
720 minute summer	Basin J	450	20.592	0.092	9.2	88.7636	0.0000	OK
15 minute summer	LA S12	10	20.835	0.134	73.6	0.1911	0.0000	OK
15 minute summer	Basin I	12	21.595	0.095	0.9	0.1071	0.0000	OK
15 minute summer	Basin I Inlet	12	20.511	0.011	0.7	0.0000	0.0000	OK
15 minute summer	LA Inlet	10	20.625	0.125	73.4	0.0000	0.0000	OK
15 minute summer	SSID10	11	23.111	0.211	99.3	0.3013	0.0000	OK
15 minute summer	SSID8	10	20.199	0.029	1.9	0.0513	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)
15 minute summer	31	12.000	30	7.3	0.984	0.129	0.3071	
15 minute summer	30	12.001	29	10.1	1.330	0.123	0.1365	
15 minute summer	29	12.002	28	16.6	2.134	0.134	0.1618	
15 minute summer	28	12.003	Att. Tank 2	50.6	1.570	0.454	0.5195	
15 minute summer	36	15.000	Att. Tank 3	9.9	1.589	0.089	0.0409	
30 minute summer	Att. Tank 3	15.001	35	4.1	0.487	0.084	0.1045	
15 minute summer	37	14.000	35	6.3	1.358	0.066	0.0863	
30 minute summer	35	14.001	34	10.0	0.491	0.090	0.0927	
15 minute summer	34	14.002	27	13.6	0.704	0.123	0.4132	
15 minute summer	33	16.000	32	1.1	1.035	0.027	0.0224	
15 minute summer	32	16.001	27	1.1	1.116	0.022	0.0149	
120 minute summer	Att. Tank 4	3.001	67	2.7	0.545	0.067	0.0333	
15 minute summer	27	12.005	26	72.8	0.887	0.455	1.7906	
15 minute summer	26	12.006	SSID6	79.2	1.079	0.497	1.2557	
30 minute summer	11	25.007	10	40.3	0.906	0.316	2.6144	
30 minute summer	69	9.006	SSID4	17.8	1.248	0.073	0.1525	
15 minute summer	SSID2	1.008	SSID1	119.9	2.446	0.112	1.1757	
15 minute summer	SSID6	12.007	SSID5	86.4	1.171	0.148	2.7743	
720 minute summer	Basin J	Hydro-Brake®		6.6				137.9
15 minute summer	LA S12	38.000	LA Inlet	73.4	1.951	0.174	0.4467	31.8
15 minute summer	Basin I	37.000	Basin I Inlet	0.7	0.876	0.003	0.0126	0.4
15 minute summer	SSID10	19.006	SSID9	99.7	1.949	0.417	1.1302	
15 minute summer	SSID8	17.000	SSID7	1.8	0.343	0.005	0.0933	

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Results for 1 year Critical Storm Duration. Lowest mass balance: 99.73%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	SSID7	11	20.143	0.033	3.6	0.0584	0.0000	OK
15 minute summer	SSID5	12	19.770	0.209	90.2	0.3688	0.0000	OK
15 minute summer	SSID3	11	22.552	0.052	22.7	0.0921	0.0000	OK
480 minute summer	Basin H	320	17.863	0.207	93.3	624.7992	0.0000	OK
720 minute summer	Basin H FC	435	17.918	0.365	86.2	1.6519	0.0000	OK
480 minute summer	Basin H Outfall	336	16.477	0.082	60.5	0.0000	0.0000	OK
30 minute summer	Att. Tank 5	22	22.861	0.086	33.1	12.9499	0.0000	OK
30 minute summer	Att. Tank 6	20	23.379	0.064	7.1	2.0943	0.0000	OK
15 minute summer	82	11	25.297	0.072	10.1	0.0815	0.0000	OK
30 minute summer	Att. Tank 7	22	25.178	0.058	16.9	7.1728	0.0000	OK
15 minute summer	78	11	25.121	0.139	23.7	0.1574	0.0000	OK
15 minute summer	SSID12	10	23.296	0.186	75.5	0.2663	0.0000	OK
15 minute summer	SSID11	11	23.214	0.214	97.1	0.3068	0.0000	OK
15 minute summer	77	12	25.098	0.163	23.3	0.1841	0.0000	OK
15 minute summer	Att. Tank 8	12	25.265	0.075	10.0	1.4117	0.0000	OK
30 minute summer	Att. Tank 9	22	19.602	0.242	203.2	31.8711	0.0000	OK
30 minute summer	Att. Tank 10	21	20.305	0.055	9.2	2.9101	0.0000	OK
30 minute summer	Att. Tank 11	22	18.807	0.142	58.1	18.6481	0.0000	OK
15 minute summer	FD Junction 8	11	23.934	0.019	0.4	0.0000	0.0000	OK
15 minute summer	103	11	23.876	0.041	1.5	0.0585	0.0000	OK
15 minute summer	FD Junction 7	13	23.822	0.046	1.5	0.0000	0.0000	OK
30 minute summer	FD Junction 6	23	23.728	0.034	1.3	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)
15 minute summer	SSID7	17.001	SSID6	3.6	0.611	0.006	0.0996	
15 minute summer	SSID5	12.008	SSID1	88.4	0.998	0.236	3.6353	
15 minute summer	SSID3	9.008	SSID2	22.5	0.827	0.016	0.9228	
480 minute summer	Basin H	36.000	Basin H FC	93.6	0.752	0.100	1.4571	
720 minute summer	Basin H FC	36.001	Basin H Outfall	57.7	2.368	0.031	0.7285	1218.0
30 minute summer	Att. Tank 5	2.005	43	18.0	0.679	0.080	0.1335	
30 minute summer	Att. Tank 6	8.001	58	5.0	0.551	0.122	0.0106	
15 minute summer	82	20.000	Att. Tank 8	10.0	1.163	0.191	0.0385	
30 minute summer	Att. Tank 7	9.004	70	7.9	0.934	0.067	0.0152	
15 minute summer	78	19.003	77	23.3	0.659	0.327	0.4009	
15 minute summer	SSID12	21.000	SSID11	75.0	1.118	0.272	1.0248	
15 minute summer	SSID11	19.005	SSID10	97.5	1.325	0.367	1.0877	
15 minute summer	77	19.004	SSID11	23.0	2.840	0.063	0.1596	
15 minute summer	Att. Tank 8	20.001	79	8.6	0.775	0.219	0.0384	
30 minute summer	Att. Tank 9	1.010	8	184.4	1.432	0.150	0.8946	
30 minute summer	Att. Tank 10	25.001	15	5.3	0.592	0.132	0.0988	
30 minute summer	Att. Tank 11	25.006	11	34.6	0.910	0.261	0.3119	
15 minute summer	FD Junction 8	29.000	103	0.3	0.080	0.005	0.1095	
15 minute summer	103	29.001	FD Junction 7	1.5	0.251	0.023	0.1270	
15 minute summer	FD Junction 7	29.002	FD Junction 6	1.4	0.292	0.021	0.1447	
30 minute summer	FD Junction 6	29.003	102	1.1	0.171	0.017	0.2354	

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Results for 30 year +40% CC Critical Storm Duration. Lowest mass balance: 99.73%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	102	12	23.888	0.297	24.3	0.4255	0.0000	OK
15 minute summer	FD Junction 5	12	23.895	0.358	53.1	0.0000	0.0000	OK
15 minute summer	FD Junction 4	12	23.878	0.404	50.1	0.0000	0.0000	SURCHARGED
15 minute summer	FD Junction 3	12	23.857	0.525	50.8	0.0000	0.0000	SURCHARGED
15 minute summer	FD Junction 2	12	23.841	0.597	91.7	0.0000	0.0000	SURCHARGED
15 minute summer	FD Junction 1	12	23.549	0.458	90.1	0.0000	0.0000	SURCHARGED
15 minute summer	101	12	23.051	0.195	89.6	0.2796	0.0000	OK
15 minute summer	100	13	22.745	0.147	88.9	0.2101	0.0000	OK
15 minute summer	99	13	21.803	0.156	89.4	0.2228	0.0000	OK
15 minute summer	HW3	13	21.251	0.151	89.5	0.0000	0.0000	OK
15 minute summer	15A	12	20.692	0.367	48.1	0.4152	0.0000	SURCHARGED
30 minute summer	15	20	20.627	0.440	47.7	0.4974	0.0000	SURCHARGED
15 minute summer	14A	10	21.550	0.125	76.8	0.1415	0.0000	OK
15 minute summer	14	11	20.578	0.607	131.5	0.6869	0.0000	SURCHARGED
15 minute summer	13	12	20.033	0.207	120.2	0.2345	0.0000	OK
15 minute summer	18	10	19.816	0.116	21.0	0.1314	0.0000	OK
30 minute summer	17	19	19.531	0.131	69.5	0.1479	0.0000	OK
30 minute summer	12	22	19.530	0.832	239.6	1.1904	0.0000	SURCHARGED
15 minute summer	16	10	20.793	0.143	75.1	0.1621	0.0000	OK
30 minute summer	10	20	19.186	0.787	191.9	1.1262	0.0000	SURCHARGED
30 minute summer	9	19	18.805	0.541	195.1	0.7748	0.0000	SURCHARGED
30 minute summer	SSID1	22	20.288	0.858	594.2	2.1848	0.0000	SURCHARGED
30 minute summer	8	21	20.219	0.928	699.4	2.3619	0.0000	SURCHARGED
30 minute summer	7	21	20.126	0.989	708.1	2.5161	0.0000	SURCHARGED
15 minute summer	25	10	23.029	0.254	78.7	0.2874	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)
15 minute summer	102	29.004	FD Junction 5	29.3	0.372	0.449	1.7788	
15 minute summer	FD Junction 5	29.005	FD Junction 4	50.1	0.705	0.767	2.2526	
15 minute summer	FD Junction 4	29.006	FD Junction 3	50.8	0.548	0.779	5.0948	
15 minute summer	FD Junction 3	29.007	FD Junction 2	54.6	0.515	0.836	3.1518	
15 minute summer	FD Junction 2	29.008	FD Junction 1	87.0	0.789	1.333	5.5011	
15 minute summer	FD Junction 1	29.009	101	89.6	0.936	1.372	6.4313	
15 minute summer	101	29.010	100	88.9	1.823	0.480	1.4678	
15 minute summer	100	29.011	99	89.4	2.150	0.315	1.9774	
15 minute summer	99	29.012	HW3	89.5	2.116	0.349	1.4139	62.8
15 minute summer	15A	25.000	Att. Tank 10	45.1	1.776	1.040	0.4263	
30 minute summer	15	25.002	14	49.1	1.239	1.238	0.9550	
15 minute summer	14A	26.000	14	76.4	2.170	0.563	0.6398	
15 minute summer	14	25.003	13	120.2	1.808	1.699	2.1679	
15 minute summer	13	25.004	12	120.3	2.459	0.718	1.1940	
15 minute summer	18	27.000	17	20.5	1.019	0.503	0.7338	
30 minute summer	17	27.001	12	68.5	1.373	0.315	0.8259	
30 minute summer	12	25.005	Att. Tank 11	234.6	2.127	1.851	0.8998	
15 minute summer	16	28.000	10	74.6	2.204	0.743	1.8864	
30 minute summer	10	25.008	9	191.8	1.739	1.505	3.6427	
30 minute summer	9	25.009	1	196.3	1.781	1.539	2.5387	
30 minute summer	SSID1	1.009	Att. Tank 9	572.4	2.869	0.461	3.0553	
30 minute summer	8	1.011	7	702.0	1.796	0.802	13.4690	
30 minute summer	7	1.012	6	713.8	2.114	1.011	4.8202	
15 minute summer	25	18.000	24	77.9	1.609	1.104	1.5103	

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Results for 30 year +40% CC Critical Storm Duration. Lowest mass balance: 99.73%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	24	10	22.794	0.145	142.8	0.1644	0.0000	OK
30 minute summer	6	20	20.077	0.976	746.3	2.4832	0.0000	SURCHARGED
15 minute summer	SSID9	11	23.047	0.267	471.0	0.3819	0.0000	OK
15 minute summer	22	10	23.165	0.089	53.9	0.1012	0.0000	OK
15 minute summer	23	10	23.013	0.088	55.5	0.0998	0.0000	OK
15 minute summer	21	11	20.467	0.394	624.5	0.6964	0.0000	OK
30 minute summer	5	20	19.926	1.347	1078.7	3.4275	0.0000	SURCHARGED
15 minute summer	20	10	22.283	0.093	31.0	0.1047	0.0000	OK
15 minute summer	19	10	21.515	0.065	47.9	0.0731	0.0000	OK
15 minute summer	4	12	19.570	1.265	1111.7	3.2194	0.0000	SURCHARGED
30 minute summer	3	20	19.233	1.145	1118.7	2.9135	0.0000	SURCHARGED
15 minute winter	2	11	18.785	0.882	1131.7	2.2448	0.0000	SURCHARGED
15 minute winter	1	11	18.510	0.718	1312.6	1.8269	0.0000	OK
240 minute winter	HW1	240	18.387	0.731	508.1	0.0000	0.0000	OK
15 minute summer	90	11	23.777	0.177	48.2	0.2005	0.0000	OK
15 minute summer	89	11	23.595	0.545	54.5	0.6169	0.0000	SURCHARGED
30 minute summer	Att. Tank 1	21	23.072	0.357	104.3	33.5584	0.0000	SURCHARGED
15 minute summer	98	10	23.585	0.095	32.4	0.1080	0.0000	OK
15 minute summer	88	12	23.195	0.419	102.3	0.4735	0.0000	SURCHARGED
30 minute summer	87	21	23.094	0.365	106.6	0.4123	0.0000	SURCHARGED
15 minute summer	97	10	23.764	0.114	40.7	0.1289	0.0000	OK
30 minute summer	86	21	23.053	0.350	128.7	0.3963	0.0000	SURCHARGED
15 minute summer	96	11	23.569	0.144	61.5	0.1632	0.0000	OK
15 minute summer	85	12	22.781	1.201	199.4	1.3579	0.0000	SURCHARGED
15 minute summer	94	12	22.626	0.901	23.8	1.0188	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	24	18.001	6	141.9	4.275	0.435	1.8382	
30 minute summer	6	1.013	5	776.0	2.014	0.628	22.9646	
15 minute summer	SSID9	19.007	21	471.9	5.081	0.581	3.7951	
15 minute summer	22	22.000	21	53.7	3.772	0.307	0.3358	
15 minute summer	23	23.000	21	55.3	3.987	0.294	0.2669	
15 minute summer	21	19.008	5	641.1	3.287	0.509	9.6344	
30 minute summer	5	1.014	4	1079.2	2.452	0.873	12.0606	
15 minute summer	20	24.000	19	30.9	2.504	0.296	0.2291	
15 minute summer	19	24.001	4	47.8	4.423	0.184	0.2610	
15 minute summer	4	1.015	3	1107.3	2.516	0.896	9.5335	
30 minute summer	3	1.016	2	1121.1	2.547	1.285	16.3263	
15 minute winter	2	1.017	1	1127.7	2.563	0.912	4.8305	
15 minute winter	1	2.008	HW1	1432.1	5.801	1.490	6.1513	
15 minute summer	90	30.000	89	46.0	1.350	0.589	0.8982	
15 minute summer	89	30.001	88	53.6	1.347	1.348	1.3440	
30 minute summer	Att. Tank 1	30.004	86	112.0	1.751	1.558	0.2001	
15 minute summer	98	31.000	88	32.3	1.257	0.379	0.6692	
15 minute summer	88	30.002	87	102.3	1.453	1.444	0.8073	
30 minute summer	87	30.003	Att. Tank 1	104.3	1.835	1.342	0.2001	
15 minute summer	97	32.000	86	41.0	1.996	0.489	0.9500	
30 minute summer	86	30.005	85	130.5	2.246	0.741	3.1625	
15 minute summer	96	33.000	85	59.3	2.444	0.570	1.4872	
15 minute summer	85	30.006	84	166.5	2.365	0.722	1.2554	
15 minute summer	94	34.000	93	21.8	0.743	0.549	0.4458	

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Results for 30 year +40% CC Critical Storm Duration. Lowest mass balance: 99.73%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	93	12	22.606	0.947	33.5	1.0707	0.0000	SURCHARGED
15 minute summer	95	12	22.821	0.300	29.7	0.3391	0.0000	SURCHARGED
15 minute summer	92	12	22.566	1.035	78.3	1.1701	0.0000	SURCHARGED
15 minute summer	91	12	22.420	1.526	77.7	1.7261	0.0000	SURCHARGED
15 minute summer	84	12	22.298	1.555	238.8	2.2251	0.0000	SURCHARGED
15 minute summer	83	12	21.855	1.186	251.0	1.6974	0.0000	SURCHARGED
120 minute summer	HW2	94	20.756	0.256	164.5	0.0000	0.0000	OK
15 minute summer	48	10	25.563	0.073	18.1	0.0827	0.0000	OK
15 minute summer	47	10	25.242	0.152	45.5	0.1722	0.0000	OK
15 minute summer	46	10	24.885	0.170	76.4	0.1923	0.0000	OK
15 minute summer	45	10	24.105	0.120	109.9	0.1724	0.0000	OK
60 minute summer	68	42	23.576	0.486	24.7	0.5491	0.0000	SURCHARGED
60 minute summer	67	42	23.569	0.559	42.5	0.6326	0.0000	SURCHARGED
30 minute summer	44	23	23.621	0.824	111.1	1.1793	0.0000	SURCHARGED
15 minute summer	66	10	23.762	0.087	12.0	0.0979	0.0000	OK
15 minute summer	65	10	23.686	0.086	59.2	0.0975	0.0000	OK
30 minute summer	43	23	23.618	0.898	244.1	1.2854	0.0000	SURCHARGED
15 minute summer	64	10	26.415	0.115	28.5	0.1305	0.0000	OK
15 minute summer	63	10	26.258	0.133	33.9	0.1508	0.0000	OK
15 minute summer	62	11	26.047	0.147	66.3	0.1666	0.0000	OK
15 minute summer	61	9	24.680	0.130	119.0	0.1466	0.0000	OK
30 minute summer	60	19	23.692	0.387	158.0	0.5544	0.0000	SURCHARGED
30 minute summer	42	20	23.622	0.921	179.9	1.3175	0.0000	SURCHARGED
15 minute summer	53	10	25.188	0.063	14.1	0.0707	0.0000	OK
15 minute summer	52	10	25.062	0.184	33.6	0.2086	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)
15 minute summer	93	34.001	92	31.8	1.050	0.797	0.3568	
15 minute summer	95	35.000	92	29.1	2.699	0.595	0.1986	
15 minute summer	92	34.002	91	66.4	1.186	0.428	2.3097	
15 minute summer	91	34.003	84	77.5	1.100	1.074	1.2602	
15 minute summer	84	30.007	83	233.6	2.118	2.115	2.6502	
15 minute summer	83	30.008	HW2	244.1	3.213	2.210	4.1739	
15 minute summer	48	2.000	47	18.0	0.910	0.231	0.3547	
15 minute summer	47	2.001	46	44.9	1.651	0.714	0.5608	
15 minute summer	46	2.002	45	75.4	1.891	0.578	1.8992	
15 minute summer	45	2.003	44	109.6	2.098	0.228	1.4661	
60 minute summer	68	3.000	Att. Tank 4	24.1	1.246	0.604	0.2685	
60 minute summer	67	3.002	44	-41.4	-1.042	-1.043	0.4269	
30 minute summer	44	2.004	Att. Tank 5	93.6	2.258	0.489	0.2648	
15 minute summer	66	4.000	65	11.9	0.712	0.168	0.3076	
15 minute summer	65	4.001	43	59.0	1.935	0.183	0.4201	
30 minute summer	43	2.006	42	-175.5	-1.591	-1.590	0.6812	
15 minute summer	64	1.000	63	28.4	1.261	0.441	0.2582	
15 minute summer	63	1.001	62	33.5	1.464	0.558	0.2572	
15 minute summer	62	1.002	61	64.9	2.127	0.453	2.5733	
15 minute summer	61	1.003	60	120.7	3.928	0.358	0.6198	
30 minute summer	60	1.004	42	152.2	1.487	0.275	0.8800	
30 minute summer	42	1.005	41	136.0	1.233	1.231	4.7635	
15 minute summer	53	5.000	52	14.0	0.658	0.170	0.2164	
15 minute summer	52	5.001	51	33.0	0.989	0.832	0.4715	

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Results for 30 year +40% CC Critical Storm Duration. Lowest mass balance: 99.73%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	55	10	25.578	0.103	45.5	0.1168	0.0000	OK
15 minute summer	51	10	24.992	0.267	84.6	0.3020	0.0000	OK
15 minute summer	54	10	25.037	0.137	21.4	0.1548	0.0000	OK
15 minute summer	50	10	24.880	0.230	108.8	0.2603	0.0000	OK
15 minute summer	49	11	24.482	0.157	140.5	0.1772	0.0000	OK
15 minute summer	Att. Tank 2	13	20.930	0.440	221.9	24.8194	0.0000	SURCHARGED
30 minute summer	59	21	23.765	0.440	34.2	0.4975	0.0000	SURCHARGED
30 minute summer	58	21	23.754	0.446	38.2	0.5048	0.0000	SURCHARGED
30 minute summer	57	20	23.726	0.566	73.0	0.6404	0.0000	SURCHARGED
30 minute summer	56	20	23.653	0.587	85.3	0.6640	0.0000	SURCHARGED
30 minute summer	41	20	23.603	1.110	220.4	1.5880	0.0000	SURCHARGED
30 minute summer	40	20	23.411	0.995	229.6	1.4244	0.0000	SURCHARGED
15 minute summer	81	12	25.957	0.107	13.8	0.1208	0.0000	OK
15 minute summer	80	12	25.912	0.312	29.2	0.3533	0.0000	SURCHARGED
15 minute summer	79	12	25.717	0.666	87.6	0.7527	0.0000	SURCHARGED
15 minute summer	76	12	26.814	0.014	0.3	0.0155	0.0000	OK
15 minute summer	74	11	27.103	0.228	35.0	0.2574	0.0000	SURCHARGED
15 minute summer	73	11	27.028	0.234	53.7	0.2648	0.0000	SURCHARGED
15 minute summer	72	10	26.647	0.127	66.3	0.1431	0.0000	OK
15 minute summer	71	10	26.230	0.214	83.9	0.2426	0.0000	OK
60 minute winter	75	57	25.799	0.474	23.3	0.5355	0.0000	SURCHARGED
60 minute winter	70	57	25.797	0.695	46.1	0.7858	0.0000	SURCHARGED
15 minute summer	SSID4	8	23.744	0.064	26.6	0.1130	0.0000	OK
15 minute summer	39	10	23.408	0.118	57.5	0.1330	0.0000	OK
15 minute summer	38	10	22.337	0.136	104.7	0.1541	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)
15 minute summer	55	6.000	51	45.4	1.959	0.435	0.4565	
15 minute summer	51	5.002	50	83.4	1.343	0.919	0.6959	
15 minute summer	54	7.000	50	21.2	1.352	0.922	0.0938	
15 minute summer	50	5.003	49	108.5	2.302	0.807	1.0563	
15 minute summer	49	5.004	41	139.5	2.414	0.433	1.0870	
15 minute summer	Att. Tank 2	12.004	27	165.0	1.496	0.554	1.6886	
30 minute summer	59	8.000	Att. Tank 6	32.8	1.453	0.675	0.0456	
30 minute summer	58	8.002	57	39.1	1.050	0.984	0.4926	
30 minute summer	57	8.003	56	66.1	1.484	0.938	1.6298	
30 minute summer	56	8.004	41	69.9	1.887	0.247	0.4614	
30 minute summer	41	1.006	40	218.0	1.376	1.361	4.9091	
30 minute summer	40	1.007	SSID2	229.7	3.226	0.376	0.9754	
15 minute summer	81	19.000	80	13.8	1.144	0.544	0.1900	
15 minute summer	80	19.001	79	26.0	1.913	0.646	0.1390	
15 minute summer	79	19.002	78	87.2	1.239	1.232	1.1853	
15 minute summer	76	10.000	72	0.3	0.378	0.017	0.0103	
15 minute summer	74	9.000	73	34.0	0.920	0.858	0.5511	
15 minute summer	73	9.001	72	52.3	1.425	1.014	0.7615	
15 minute summer	72	9.002	71	66.2	1.610	0.356	0.7446	
15 minute summer	71	9.003	Att. Tank 7	83.4	1.645	0.752	0.1832	
60 minute winter	75	11.000	70	22.6	0.949	0.569	1.0033	
60 minute winter	70	9.005	69	35.9	1.145	0.172	1.9364	
15 minute summer	SSID4	9.007	SSID3	26.2	1.575	0.024	0.8692	
15 minute summer	39	13.000	38	57.1	2.015	0.324	1.2348	
15 minute summer	38	13.001	28	104.0	1.827	0.430	1.7174	

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Results for 30 year +40% CC Critical Storm Duration. Lowest mass balance: 99.73%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	31	10	22.920	0.130	34.8	0.1470	0.0000	OK
15 minute summer	30	10	22.430	0.133	48.3	0.1501	0.0000	OK
15 minute summer	29	11	21.984	0.134	79.0	0.1517	0.0000	OK
15 minute summer	28	12	21.100	0.562	230.2	0.8041	0.0000	SURCHARGED
15 minute summer	36	13	20.849	0.329	46.8	0.3725	0.0000	SURCHARGED
15 minute summer	Att. Tank 3	13	20.847	0.377	90.8	21.2885	0.0000	SURCHARGED
15 minute summer	37	10	21.236	0.086	30.2	0.0972	0.0000	OK
15 minute summer	35	13	20.830	0.459	59.8	0.6574	0.0000	SURCHARGED
15 minute summer	34	13	20.822	0.465	66.9	0.6650	0.0000	SURCHARGED
15 minute summer	33	10	22.712	0.037	5.0	0.0423	0.0000	OK
15 minute summer	32	10	21.655	0.032	5.0	0.0364	0.0000	OK
60 minute summer	Att. Tank 4	42	23.574	0.524	62.1	36.9644	0.0000	SURCHARGED
30 minute summer	27	21	20.805	0.728	259.2	1.0420	0.0000	SURCHARGED
30 minute summer	26	21	20.633	0.610	282.1	0.8724	0.0000	SURCHARGED
30 minute summer	11	23	19.426	0.797	147.2	1.1406	0.0000	SURCHARGED
60 minute winter	69	57	25.790	1.727	40.4	4.3948	0.0000	SURCHARGED
15 minute summer	SSID2	11	21.514	0.234	284.8	0.4139	0.0000	OK
30 minute summer	SSID6	22	20.460	0.629	308.9	1.1112	0.0000	SURCHARGED
120 minute summer	Basin J	96	20.745	0.245	88.0	250.0545	0.0000	OK
15 minute summer	LA S12	10	21.047	0.346	346.1	0.4957	0.0000	OK
30 minute summer	Basin I	23	22.664	1.164	4.0	1.3163	0.0000	FLOOD RISK
30 minute summer	Basin I Inlet	24	20.513	0.013	1.1	0.0000	0.0000	OK
15 minute summer	LA Inlet	10	20.803	0.303	345.3	0.0000	0.0000	OK
15 minute summer	SSID10	11	23.764	0.864	441.3	1.2371	0.0000	SURCHARGED
30 minute summer	SSID8	22	20.462	0.292	29.8	0.5159	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)
15 minute summer	31	12.000	30	34.4	1.432	0.606	0.9939	
15 minute summer	30	12.001	29	47.9	1.971	0.581	0.4353	
15 minute summer	29	12.002	28	78.1	2.396	0.632	0.6714	
15 minute summer	28	12.003	Att. Tank 2	221.9	2.189	1.991	1.6886	
15 minute summer	36	15.000	Att. Tank 3	45.5	1.853	0.410	0.3516	
15 minute summer	Att. Tank 3	15.001	35	53.5	1.016	1.110	0.8796	
15 minute summer	37	14.000	35	30.1	1.902	0.313	0.4929	
15 minute summer	35	14.001	34	63.7	0.816	0.577	0.5028	
15 minute summer	34	14.002	27	71.0	1.100	0.641	2.3536	
15 minute summer	33	16.000	32	5.0	1.607	0.125	0.0664	
15 minute summer	32	16.001	27	4.9	1.326	0.101	0.1605	
60 minute summer	Att. Tank 4	3.001	67	-41.5	-1.044	-1.040	0.2685	
30 minute summer	27	12.005	26	259.1	1.635	1.621	3.4569	
30 minute summer	26	12.006	SSID6	282.2	1.802	1.772	2.7094	
30 minute summer	11	25.007	10	147.7	1.339	1.160	6.2116	
60 minute winter	69	9.006	SSID4	18.2	1.255	0.075	0.1548	
15 minute summer	SSID2	1.008	SSID1	283.5	3.034	0.264	2.2456	
30 minute summer	SSID6	12.007	SSID5	299.6	1.460	0.513	10.5570	
120 minute summer	Basin J	Hydro-Brake®		28.7				282.0
15 minute summer	LA S12	38.000	LA Inlet	345.3	2.821	0.820	1.4500	149.5
30 minute summer	Basin I	37.000	Basin I Inlet	1.1	0.975	0.004	0.0165	2.5
15 minute summer	SSID10	19.006	SSID9	442.3	3.091	1.848	2.7934	
30 minute summer	SSID8	17.000	SSID7	-23.7	0.535	-0.058	2.5980	

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Results for 30 year +40% CC Critical Storm Duration. Lowest mass balance: 99.73%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute summer	SSID7	22	20.455	0.345	37.6	0.6096	0.0000	OK
30 minute summer	SSID5	21	20.391	0.830	320.4	1.4666	0.0000	SURCHARGED
15 minute summer	SSID3	10	22.575	0.075	48.3	0.1317	0.0000	OK
240 minute winter	Basin H	244	18.369	0.713	407.1	2341.7890	0.0000	SURCHARGED
240 minute winter	Basin H FC	244	18.368	0.815	268.5	3.6867	0.0000	SURCHARGED
2880 minute summer	Basin H Outfall	1440	16.484	0.089	72.5	0.0000	0.0000	OK
30 minute summer	Att. Tank 5	23	23.621	0.846	332.8	127.2696	0.0000	SURCHARGED
30 minute summer	Att. Tank 6	21	23.761	0.446	53.2	14.6722	0.0000	SURCHARGED
15 minute summer	82	12	25.762	0.537	47.6	0.6076	0.0000	SURCHARGED
60 minute winter	Att. Tank 7	57	25.797	0.677	78.6	83.9990	0.0000	SURCHARGED
15 minute summer	78	12	25.569	0.587	87.2	0.6638	0.0000	SURCHARGED
15 minute summer	SSID12	11	24.507	1.397	354.9	1.9993	0.0000	SURCHARGED
15 minute summer	SSID11	11	24.222	1.222	434.1	1.7492	0.0000	SURCHARGED
15 minute summer	77	12	25.458	0.523	86.9	0.5910	0.0000	SURCHARGED
15 minute summer	Att. Tank 8	12	25.734	0.544	45.4	10.2297	0.0000	SURCHARGED
30 minute summer	Att. Tank 9	22	20.256	0.896	572.4	117.9327	0.0000	SURCHARGED
30 minute summer	Att. Tank 10	21	20.651	0.401	66.9	21.1205	0.0000	SURCHARGED
30 minute summer	Att. Tank 11	23	19.473	0.808	250.1	106.3971	0.0000	SURCHARGED
15 minute summer	FD Junction 8	11	23.955	0.040	1.7	0.0000	0.0000	OK
15 minute summer	103	14	23.920	0.084	6.9	0.1209	0.0000	OK
15 minute summer	FD Junction 7	13	23.931	0.155	7.1	0.0000	0.0000	OK
30 minute summer	FD Junction 6	21	23.899	0.205	21.5	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)
30 minute summer	SSID7	17.001	SSID6	-31.8	0.623	-0.051	3.4786	
30 minute summer	SSID5	12.008	SSID1	301.9	1.308	0.807	11.3440	
15 minute summer	SSID3	9.008	SSID2	48.2	1.544	0.034	1.7653	
240 minute winter	Basin H	36.000	Basin H FC	268.5	0.988	0.286	3.6651	
240 minute winter	Basin H FC	36.001	Basin H Outfall	72.2	2.567	0.039	0.8301	1630.6
30 minute summer	Att. Tank 5	2.005	43	-239.2	-2.169	-1.069	0.4854	
30 minute summer	Att. Tank 6	8.001	58	36.1	0.907	0.890	0.0456	
15 minute summer	82	20.000	Att. Tank 8	45.4	1.518	0.866	0.1370	
60 minute winter	Att. Tank 7	9.004	70	-35.4	1.252	-0.302	0.1138	
15 minute summer	78	19.003	77	86.9	1.234	1.219	0.7975	
15 minute summer	SSID12	21.000	SSID11	350.7	2.214	1.273	2.3942	
15 minute summer	SSID11	19.005	SSID10	432.7	2.731	1.629	2.3415	
15 minute summer	77	19.004	SSID11	86.5	3.605	0.238	0.7726	
15 minute summer	Att. Tank 8	20.001	79	48.7	1.225	1.234	0.1370	
30 minute summer	Att. Tank 9	1.010	8	688.6	1.730	0.559	3.0553	
30 minute summer	Att. Tank 10	25.001	15	42.7	1.074	1.075	0.4263	
30 minute summer	Att. Tank 11	25.006	11	136.6	1.239	1.032	0.8998	
15 minute summer	FD Junction 8	29.000	103	1.6	0.136	0.025	0.3149	
15 minute summer	103	29.001	FD Junction 7	7.1	0.394	0.108	0.5700	
15 minute summer	FD Junction 7	29.002	FD Junction 6	8.5	0.467	0.129	1.3954	
30 minute summer	FD Junction 6	29.003	102	-15.5	0.267	-0.237	2.5413	

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Results for 100 year +45% CC +10% A Critical Storm Duration. Lowest mass balance: 99.73%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute summer	102	21	24.432	0.841	66.2	1.2030	0.0000	SURCHARGED
30 minute summer	FD Junction 5	21	24.422	0.885	59.5	0.0000	0.0000	SURCHARGED
30 minute summer	FD Junction 4	21	24.378	0.904	56.6	0.0000	0.0000	SURCHARGED
30 minute summer	FD Junction 3	21	24.283	0.951	57.2	0.0000	0.0000	SURCHARGED
30 minute summer	FD Junction 2	21	24.225	0.981	113.1	0.0000	0.0000	SURCHARGED
30 minute summer	FD Junction 1	21	23.796	0.705	113.2	0.0000	0.0000	SURCHARGED
30 minute summer	101	21	23.081	0.225	112.4	0.3214	0.0000	OK
30 minute summer	100	22	22.765	0.167	111.4	0.2387	0.0000	OK
30 minute summer	99	22	21.824	0.177	111.7	0.2535	0.0000	OK
30 minute summer	HW3	22	21.271	0.171	112.0	0.0000	0.0000	OK
30 minute summer	15A	21	21.072	0.747	62.7	0.8443	0.0000	SURCHARGED
30 minute summer	15	21	21.005	0.818	57.4	0.9250	0.0000	SURCHARGED
15 minute summer	14A	11	22.014	0.589	109.0	0.6662	0.0000	SURCHARGED
15 minute summer	14	11	21.016	1.045	181.8	1.1822	0.0000	SURCHARGED
30 minute summer	13	20	20.380	0.554	142.4	0.6263	0.0000	SURCHARGED
30 minute summer	18	19	20.106	0.406	27.3	0.4593	0.0000	SURCHARGED
30 minute summer	17	20	20.035	0.635	99.6	0.7184	0.0000	SURCHARGED
30 minute summer	12	22	19.981	1.283	302.4	1.8360	0.0000	SURCHARGED
15 minute summer	16	11	21.731	1.081	106.5	1.2221	0.0000	SURCHARGED
30 minute summer	10	21	19.567	1.168	233.8	1.6709	0.0000	SURCHARGED
30 minute summer	9	21	19.045	0.781	237.4	1.1171	0.0000	SURCHARGED
30 minute summer	SSID1	21	21.404	1.974	699.9	5.0232	0.0000	SURCHARGED
30 minute summer	8	21	21.341	2.050	791.8	5.2161	0.0000	SURCHARGED
30 minute summer	7	21	21.225	2.088	803.7	5.3128	0.0000	SURCHARGED
15 minute summer	25	10	23.260	0.485	111.6	0.5488	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute summer	102	29.004	FD Junction 5	-44.6	0.414	-0.683	1.9407	
30 minute summer	FD Junction 5	29.005	FD Junction 4	56.6	0.710	0.867	2.2716	
30 minute summer	FD Junction 4	29.006	FD Junction 3	57.2	0.554	0.876	5.0948	
30 minute summer	FD Junction 3	29.007	FD Junction 2	58.0	0.526	0.888	3.1518	
30 minute summer	FD Junction 2	29.008	FD Junction 1	109.0	0.988	1.669	5.5011	
30 minute summer	FD Junction 1	29.009	101	112.4	1.125	1.722	6.8457	
30 minute summer	101	29.010	100	111.4	1.918	0.601	1.7433	
30 minute summer	100	29.011	99	111.7	2.267	0.394	2.3417	
30 minute summer	99	29.012	HW3	112.0	2.240	0.437	1.6706	119.2
30 minute summer	15A	25.000	Att. Tank 10	60.4	1.519	1.392	0.4263	
30 minute summer	15	25.002	14	58.3	1.465	1.467	0.9550	
15 minute summer	14A	26.000	14	103.6	2.606	0.764	0.8151	
15 minute summer	14	25.003	13	150.6	2.159	2.128	2.4950	
30 minute summer	13	25.004	12	139.2	2.440	0.830	1.7197	
30 minute summer	18	27.000	17	27.4	1.023	0.673	1.4503	
30 minute summer	17	27.001	12	88.3	1.386	0.406	1.1645	
30 minute summer	12	25.005	Att. Tank 11	299.7	2.717	2.364	0.8998	
15 minute summer	16	28.000	10	99.6	2.505	0.991	2.2576	
30 minute summer	10	25.008	9	232.6	2.109	1.826	3.6427	
30 minute summer	9	25.009	1	235.7	2.137	1.848	2.6128	
30 minute summer	SSID1	1.009	Att. Tank 9	690.3	3.138	0.556	3.0553	
30 minute summer	8	1.011	7	796.0	1.870	0.909	13.4690	
30 minute summer	7	1.012	6	808.0	2.173	1.144	4.8202	
15 minute summer	25	18.000	24	109.6	1.752	1.555	1.7257	

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Results for 100 year +45% CC +10% A Critical Storm Duration. Lowest mass balance: 99.73%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	24	9	22.818	0.169	201.6	0.1913	0.0000	OK
30 minute summer	6	21	21.148	2.047	857.3	5.2102	0.0000	SURCHARGED
15 minute summer	SSID9	11	23.119	0.339	639.2	0.4854	0.0000	OK
15 minute summer	22	9	23.181	0.106	76.4	0.1202	0.0000	OK
15 minute summer	23	9	23.030	0.105	78.7	0.1187	0.0000	OK
30 minute summer	21	21	21.241	1.168	811.2	2.0645	0.0000	SURCHARGED
30 minute summer	5	21	20.864	2.285	1372.2	5.8158	0.0000	SURCHARGED
15 minute summer	20	10	22.304	0.114	43.9	0.1287	0.0000	OK
15 minute summer	19	10	21.527	0.077	67.8	0.0876	0.0000	OK
30 minute summer	4	21	20.287	1.982	1405.9	5.0432	0.0000	SURCHARGED
30 minute summer	3	21	19.755	1.667	1403.0	4.2421	0.0000	SURCHARGED
30 minute summer	2	21	19.028	1.125	1419.8	2.8622	0.0000	SURCHARGED
240 minute winter	1	240	18.680	0.888	691.3	2.2602	0.0000	SURCHARGED
240 minute winter	HW1	240	18.679	1.023	689.9	0.0000	0.0000	OK
15 minute summer	90	11	24.752	1.152	68.3	1.3032	0.0000	SURCHARGED
30 minute summer	89	21	24.486	1.436	70.1	1.6241	0.0000	FLOOD RISK
30 minute summer	Att. Tank 1	21	24.235	1.520	198.9	59.2670	0.0000	SURCHARGED
30 minute summer	98	21	24.352	0.862	42.3	0.9745	0.0000	SURCHARGED
30 minute summer	88	21	24.316	1.540	130.8	1.7417	0.0000	SURCHARGED
30 minute summer	87	21	24.259	1.530	143.8	1.7307	0.0000	SURCHARGED
30 minute summer	97	21	24.310	0.660	53.0	0.7464	0.0000	SURCHARGED
30 minute summer	86	21	24.210	1.507	138.2	1.7049	0.0000	SURCHARGED
15 minute summer	96	11	24.435	1.010	87.3	1.1422	0.0000	SURCHARGED
30 minute summer	85	21	23.587	2.007	214.1	2.2695	0.0000	FLOOD RISK
15 minute summer	94	12	23.450	1.725	33.7	1.9510	0.1160	FLOOD

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	24	18.001	6	200.8	4.315	0.616	2.0200	
30 minute summer	6	1.013	5	864.6	2.202	0.699	22.9646	
15 minute summer	SSID9	19.007	21	634.5	5.076	0.782	5.8574	
15 minute summer	22	22.000	21	76.2	4.042	0.437	0.6795	
15 minute summer	23	23.000	21	78.6	4.273	0.418	0.5484	
30 minute summer	21	19.008	5	784.0	2.923	0.622	11.3569	
30 minute summer	5	1.014	4	1368.3	3.109	1.107	12.0606	
15 minute summer	20	24.000	19	43.7	2.723	0.419	0.2979	
15 minute summer	19	24.001	4	67.7	4.272	0.260	0.2753	
30 minute summer	4	1.015	3	1400.2	3.182	1.133	9.5335	
30 minute summer	3	1.016	2	1399.8	3.181	1.604	16.3263	
30 minute summer	2	1.017	1	1419.1	3.225	1.148	4.8664	
240 minute winter	1	2.008	HW1	689.9	3.113	0.718	9.8732	
15 minute summer	90	30.000	89	62.9	1.582	0.805	0.9742	
30 minute summer	89	30.001	88	67.1	1.687	1.688	1.3440	
30 minute summer	Att. Tank 1	30.004	86	124.6	1.925	1.733	0.2001	
30 minute summer	98	31.000	88	40.7	1.228	0.478	0.9541	
30 minute summer	88	30.002	87	126.2	1.793	1.782	0.8073	
30 minute summer	87	30.003	Att. Tank 1	141.4	2.008	1.819	0.2001	
30 minute summer	97	32.000	86	52.5	1.976	0.627	1.3463	
30 minute summer	86	30.005	85	143.9	2.313	0.816	3.1625	
15 minute summer	96	33.000	85	81.5	2.363	0.783	1.7747	
30 minute summer	85	30.006	84	191.5	2.720	0.830	1.2554	
15 minute summer	94	34.000	93	26.9	0.764	0.677	0.4458	

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Results for 100 year +45% CC +10% A Critical Storm Duration. Lowest mass balance: 99.73%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	93	12	23.412	1.753	43.5	1.9823	0.0000	SURCHARGED
15 minute summer	95	12	23.900	1.379	42.1	1.5599	0.0000	SURCHARGED
15 minute summer	92	12	23.336	1.805	98.9	2.0410	0.0000	SURCHARGED
15 minute summer	91	12	23.038	2.144	113.6	2.4245	0.0000	SURCHARGED
30 minute summer	84	21	22.844	2.101	277.1	3.0059	0.0000	FLOOD RISK
15 minute summer	83	12	22.222	1.553	284.1	2.2227	0.0000	SURCHARGED
120 minute summer	HW2	104	20.863	0.363	221.8	0.0000	0.0000	OK
15 minute summer	48	10	25.578	0.088	25.7	0.0997	0.0000	OK
15 minute summer	47	11	25.333	0.243	64.5	0.2751	0.0000	SURCHARGED
15 minute summer	46	10	24.931	0.216	106.3	0.2438	0.0000	OK
30 minute summer	45	21	24.813	0.828	146.0	1.1843	0.0000	SURCHARGED
60 minute summer	68	43	24.109	1.019	35.6	1.1524	0.0000	SURCHARGED
60 minute summer	67	39	24.137	1.127	99.5	1.2752	0.0000	SURCHARGED
30 minute summer	44	21	24.778	1.981	157.6	2.8346	0.0000	SURCHARGED
30 minute summer	66	21	24.762	1.087	15.7	1.2296	0.0000	SURCHARGED
30 minute summer	65	21	24.780	1.180	77.5	1.3342	0.0000	SURCHARGED
30 minute summer	43	21	24.778	2.058	325.0	2.9446	0.0000	SURCHARGED
15 minute summer	64	10	26.449	0.149	40.5	0.1688	0.0000	OK
15 minute summer	63	10	26.297	0.172	48.1	0.1947	0.0000	OK
15 minute summer	62	10	26.080	0.180	94.1	0.2038	0.0000	OK
30 minute summer	61	21	24.929	0.379	158.8	0.4281	0.0000	SURCHARGED
30 minute summer	60	21	24.830	1.525	217.9	2.1824	0.0000	SURCHARGED
30 minute summer	42	21	24.778	2.077	244.0	2.9721	0.0000	SURCHARGED
15 minute summer	53	12	25.508	0.383	20.0	0.4327	0.0000	SURCHARGED
15 minute summer	52	12	25.490	0.612	43.8	0.6922	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	93	34.001	92	38.5	1.064	0.965	0.3568	
15 minute summer	95	35.000	92	34.8	2.759	0.713	0.1986	
15 minute summer	92	34.002	91	95.6	1.358	0.616	2.3097	
15 minute summer	91	34.003	84	112.0	1.590	1.553	1.2602	
30 minute summer	84	30.007	83	277.9	2.520	2.517	2.6502	
15 minute summer	83	30.008	HW2	283.2	3.554	2.564	4.8530	
15 minute summer	48	2.000	47	25.6	0.948	0.328	0.4799	
15 minute summer	47	2.001	46	62.2	1.738	0.990	0.7977	
15 minute summer	46	2.002	45	105.3	2.017	0.807	2.4858	
30 minute summer	45	2.003	44	145.0	1.618	0.302	2.2968	
60 minute summer	68	3.000	Att. Tank 4	34.2	1.332	0.858	0.2685	
60 minute summer	67	3.002	44	-98.2	-2.469	-2.473	0.4269	
30 minute summer	44	2.004	Att. Tank 5	-103.3	2.366	-0.539	0.2648	
30 minute summer	66	4.000	65	15.8	0.716	0.223	1.2925	
30 minute summer	65	4.001	43	72.3	1.989	0.224	0.6790	
30 minute summer	43	2.006	42	-240.6	-2.182	-2.180	0.6812	
15 minute summer	64	1.000	63	40.3	1.328	0.627	0.3475	
15 minute summer	63	1.001	62	47.6	1.569	0.791	0.3403	
15 minute summer	62	1.002	61	94.3	2.165	0.658	3.9147	
30 minute summer	61	1.003	60	153.0	3.879	0.453	0.9031	
30 minute summer	60	1.004	42	212.7	1.929	0.385	0.8800	
30 minute summer	42	1.005	41	150.3	1.363	1.361	4.7635	
15 minute summer	53	5.000	52	22.2	0.670	0.269	0.3927	
15 minute summer	52	5.001	51	44.9	1.130	1.132	0.5286	

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Results for 100 year +45% CC +10% A Critical Storm Duration. Lowest mass balance: 99.73%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	55	11	25.645	0.170	64.5	0.1921	0.0000	OK
15 minute summer	51	12	25.372	0.647	112.7	0.7319	0.0000	SURCHARGED
15 minute summer	54	12	25.408	0.508	30.4	0.5748	0.0000	SURCHARGED
15 minute summer	50	12	25.214	0.564	143.2	0.6380	0.0000	SURCHARGED
30 minute summer	49	21	24.818	0.493	179.3	0.5575	0.0000	SURCHARGED
30 minute summer	Att. Tank 2	21	21.780	1.290	283.1	47.4042	0.0000	SURCHARGED
30 minute summer	59	23	24.515	1.190	48.9	1.3464	0.0000	SURCHARGED
30 minute summer	58	23	24.509	1.201	62.7	1.3584	0.0000	SURCHARGED
30 minute summer	57	21	24.502	1.342	77.7	1.5181	0.0000	SURCHARGED
30 minute summer	56	21	24.501	1.435	83.4	1.6228	0.0000	SURCHARGED
30 minute summer	41	21	24.500	2.007	303.2	2.8716	0.0000	SURCHARGED
30 minute summer	40	21	24.132	1.716	313.7	2.4560	0.0000	SURCHARGED
15 minute summer	81	12	26.768	0.918	19.6	1.0383	0.0000	SURCHARGED
15 minute summer	80	12	26.704	1.104	36.3	1.2481	0.0000	SURCHARGED
15 minute summer	79	12	26.489	1.438	124.5	1.6260	0.0000	SURCHARGED
15 minute summer	76	11	26.816	0.016	0.5	0.0186	0.0000	OK
15 minute summer	74	11	27.484	0.609	49.7	0.6893	0.0000	SURCHARGED
15 minute summer	73	11	27.323	0.529	75.8	0.5984	0.0000	SURCHARGED
15 minute summer	72	10	26.686	0.166	95.1	0.1872	0.0000	OK
15 minute summer	71	11	26.332	0.316	120.2	0.3573	0.0000	SURCHARGED
60 minute winter	75	59	26.238	0.913	33.6	1.0329	0.0000	SURCHARGED
60 minute winter	70	59	26.236	1.134	67.1	1.2829	0.0000	SURCHARGED
15 minute summer	SSID4	11	23.749	0.069	31.1	0.1217	0.0000	OK
15 minute summer	39	10	23.432	0.142	81.6	0.1603	0.0000	OK
15 minute summer	38	11	22.400	0.199	148.9	0.2254	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)
15 minute summer	55	6.000	51	63.4	1.929	0.608	0.6095	
15 minute summer	51	5.002	50	109.0	1.549	1.201	0.7888	
15 minute summer	54	7.000	50	28.3	1.607	1.234	0.1061	
15 minute summer	50	5.003	49	140.8	2.268	1.047	1.5681	
30 minute summer	49	5.004	41	174.7	2.520	0.542	1.4223	
30 minute summer	Att. Tank 2	12.004	27	184.3	1.671	0.618	1.6886	
30 minute summer	59	8.000	Att. Tank 6	45.4	1.570	0.937	0.0456	
30 minute summer	58	8.002	57	64.4	1.619	1.618	0.4926	
30 minute summer	57	8.003	56	78.2	1.471	1.109	1.6298	
30 minute summer	56	8.004	41	86.6	1.852	0.305	0.4614	
30 minute summer	41	1.006	40	302.2	1.907	1.887	4.9091	
30 minute summer	40	1.007	SSID2	313.4	3.431	0.513	1.2498	
15 minute summer	81	19.000	80	15.1	1.132	0.595	0.2156	
15 minute summer	80	19.001	79	32.4	1.872	0.806	0.1390	
15 minute summer	79	19.002	78	122.4	1.738	1.728	1.1853	
15 minute summer	76	10.000	72	0.4	0.424	0.025	0.0135	
15 minute summer	74	9.000	73	48.2	1.212	1.216	0.5511	
15 minute summer	73	9.001	72	75.4	1.896	1.460	0.7927	
15 minute summer	72	9.002	71	95.2	1.640	0.512	1.0000	
15 minute summer	71	9.003	Att. Tank 7	119.9	1.719	1.081	0.2462	
60 minute winter	75	11.000	70	32.5	0.960	0.818	1.0033	
60 minute winter	70	9.005	69	32.3	1.111	0.155	1.9364	
15 minute summer	SSID4	9.007	SSID3	30.9	1.574	0.029	1.0136	
15 minute summer	39	13.000	38	81.3	2.134	0.461	1.7749	
15 minute summer	38	13.001	28	144.0	2.223	0.595	2.0319	

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Results for 100 year +45% CC +10% A Critical Storm Duration. Lowest mass balance: 99.73%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	31	12	23.078	0.288	49.4	0.3254	0.0000	SURCHARGED
15 minute summer	30	12	22.782	0.485	69.7	0.5485	0.0000	SURCHARGED
15 minute summer	29	12	22.490	0.640	103.3	0.7242	0.0000	SURCHARGED
30 minute summer	28	21	21.943	1.405	290.4	2.0111	0.0000	SURCHARGED
30 minute summer	36	23	21.652	1.132	61.0	1.2802	0.0000	SURCHARGED
30 minute summer	Att. Tank 3	23	21.682	1.212	153.9	59.2482	0.0000	SURCHARGED
30 minute summer	37	23	21.804	0.654	39.4	0.7400	0.0000	SURCHARGED
30 minute summer	35	23	21.678	1.307	127.5	1.8709	0.0000	SURCHARGED
30 minute summer	34	23	21.653	1.296	108.2	1.8550	0.0000	SURCHARGED
15 minute summer	33	10	22.720	0.045	7.1	0.0508	0.0000	OK
15 minute summer	32	10	21.661	0.038	7.1	0.0434	0.0000	OK
60 minute summer	Att. Tank 4	43	24.107	1.057	121.4	74.4995	0.0000	SURCHARGED
30 minute summer	27	21	21.633	1.556	272.8	2.2267	0.0000	SURCHARGED
30 minute summer	26	21	21.594	1.571	313.9	2.2475	0.0000	SURCHARGED
30 minute summer	11	23	19.846	1.217	174.8	1.7416	0.0000	SURCHARGED
60 minute winter	69	59	26.228	2.165	36.3	5.5093	0.0000	FLOOD RISK
15 minute summer	SSID2	11	21.548	0.268	355.0	0.4731	0.0000	OK
30 minute summer	SSID6	21	21.531	1.700	345.3	3.0040	0.0000	SURCHARGED
120 minute summer	Basin J	108	20.850	0.350	121.5	368.4675	0.0000	OK
15 minute summer	LA S12	10	21.330	0.629	490.6	0.9003	0.0000	SURCHARGED
60 minute summer	Basin I	34	22.750	1.250	4.4	1.4138	0.7436	FLOOD
15 minute summer	Basin I Inlet	14	20.514	0.014	1.1	0.0000	0.0000	OK
30 minute summer	LA Inlet	17	20.948	0.448	451.7	0.0000	0.0000	OK
15 minute summer	SSID10	11	24.309	1.409	597.3	2.0166	0.0000	SURCHARGED
30 minute summer	SSID8	21	21.553	1.383	98.2	2.4433	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	31	12.000	30	50.0	1.503	0.881	1.6431	
15 minute summer	30	12.001	29	61.3	1.924	0.743	0.7118	
15 minute summer	29	12.002	28	97.9	2.487	0.793	0.8288	
30 minute summer	28	12.003	Att. Tank 2	283.1	2.567	2.541	1.6886	
30 minute summer	36	15.000	Att. Tank 3	59.0	1.612	0.531	0.3516	
30 minute summer	Att. Tank 3	15.001	35	-124.4	-1.767	-2.581	0.8796	
30 minute summer	37	14.000	35	39.1	1.859	0.407	0.7357	
30 minute summer	35	14.001	34	-105.3	-0.955	-0.955	0.5028	
30 minute summer	34	14.002	27	101.3	1.207	0.915	2.3536	
15 minute summer	33	16.000	32	7.1	1.772	0.178	0.0855	
15 minute summer	32	16.001	27	7.0	1.310	0.143	0.1667	
60 minute summer	Att. Tank 4	3.001	67	-97.2	-2.444	-2.436	0.2685	
30 minute summer	27	12.005	26	268.8	1.697	1.682	3.4569	
30 minute summer	26	12.006	SSID6	310.7	1.961	1.952	2.7094	
30 minute summer	11	25.007	10	175.3	1.589	1.376	6.2116	
60 minute winter	69	9.006	SSID4	18.8	1.268	0.077	0.1590	
15 minute summer	SSID2	1.008	SSID1	352.9	3.190	0.329	3.1635	
30 minute summer	SSID6	12.007	SSID5	312.9	1.462	0.536	10.5570	
120 minute summer	Basin J	Hydro-Brake®		29.6				403.5
15 minute summer	LA S12	38.000	LA Inlet	489.8	3.092	1.163	1.8631	212.2
60 minute summer	Basin I	37.000	Basin I Inlet	1.1	0.984	0.004	0.0169	3.9
15 minute summer	SSID10	19.006	SSID9	598.5	3.904	2.500	3.1233	
30 minute summer	SSID8	17.000	SSID7	-86.3	0.566	-0.212	4.8189	

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Results for 100 year +45% CC +10% A Critical Storm Duration. Lowest mass balance: 99.73%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute summer	SSID7	21	21.533	1.423	131.4	2.5153	0.0000	SURCHARGED
30 minute summer	SSID5	21	21.471	1.910	342.7	3.3752	0.0000	SURCHARGED
15 minute summer	SSID3	10	22.584	0.084	62.7	0.1487	0.0000	OK
240 minute winter	Basin H	248	18.659	1.003	446.4	3460.8290	0.0000	SURCHARGED
240 minute winter	Basin H FC	248	18.658	1.105	263.9	5.0005	0.0000	SURCHARGED
480 minute summer	Basin H Outfall	216	16.484	0.089	72.5	0.0000	0.0000	OK
30 minute summer	Att. Tank 5	21	24.778	2.003	415.3	157.9952	0.0000	SURCHARGED
30 minute summer	Att. Tank 6	23	24.513	1.198	101.1	39.4165	0.0000	SURCHARGED
15 minute summer	82	12	26.594	1.369	67.4	1.5484	0.0000	SURCHARGED
60 minute winter	Att. Tank 7	59	26.237	1.117	121.1	138.5450	0.0000	SURCHARGED
15 minute summer	78	12	26.196	1.214	122.4	1.3728	0.0000	SURCHARGED
15 minute summer	SSID12	11	25.722	2.612	503.1	3.7378	0.0000	SURCHARGED
15 minute summer	SSID11	11	25.148	2.148	585.3	3.0731	0.0000	SURCHARGED
15 minute summer	77	12	25.977	1.042	120.7	1.1787	0.0000	SURCHARGED
15 minute summer	Att. Tank 8	12	26.540	1.350	64.8	15.8014	0.0000	SURCHARGED
30 minute summer	Att. Tank 9	21	21.372	2.012	690.3	193.5178	0.0000	SURCHARGED
30 minute summer	Att. Tank 10	22	21.031	0.781	109.4	41.1085	0.0000	SURCHARGED
30 minute summer	Att. Tank 11	24	19.907	1.242	350.9	163.3944	0.0000	SURCHARGED
30 minute summer	FD Junction 8	21	24.466	0.551	30.9	0.0000	0.0000	SURCHARGED
30 minute summer	103	21	24.459	0.624	46.8	0.8934	0.0000	SURCHARGED
30 minute summer	FD Junction 7	21	24.468	0.692	43.4	0.0000	0.0000	FLOOD RISK
30 minute summer	FD Junction 6	21	24.451	0.757	56.9	0.0000	0.0000	FLOOD RISK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute summer	SSID7	17.001	SSID6	-120.1	0.631	-0.191	4.7336	
30 minute summer	SSID5	12.008	SSID1	327.3	1.310	0.875	11.3440	
15 minute summer	SSID3	9.008	SSID2	62.1	1.568	0.044	2.1105	
240 minute winter	Basin H	36.000	Basin H FC	263.9	0.867	0.281	3.6651	
240 minute winter	Basin H FC	36.001	Basin H Outfall	71.4	2.577	0.038	0.8254	1626.1
30 minute summer	Att. Tank 5	2.005	43	-318.2	-2.886	-1.422	0.4854	
30 minute summer	Att. Tank 6	8.001	58	60.2	1.515	1.487	0.0456	
15 minute summer	82	20.000	Att. Tank 8	63.4	1.650	1.210	0.1370	
60 minute winter	Att. Tank 7	9.004	70	-58.5	1.220	-0.499	0.1138	
15 minute summer	78	19.003	77	120.7	1.715	1.694	0.7975	
15 minute summer	SSID12	21.000	SSID11	496.3	3.133	1.801	2.3942	
15 minute summer	SSID11	19.005	SSID10	585.1	3.693	2.203	2.3415	
15 minute summer	77	19.004	SSID11	127.7	3.814	0.351	1.1876	
15 minute summer	Att. Tank 8	20.001	79	58.2	1.464	1.475	0.1370	
30 minute summer	Att. Tank 9	1.010	8	778.2	1.794	0.631	3.0553	
30 minute summer	Att. Tank 10	25.001	15	52.9	1.330	1.331	0.4263	
30 minute summer	Att. Tank 11	25.006	11	169.7	1.539	1.281	0.8998	
30 minute summer	FD Junction 8	29.000	103	-28.9	-0.368	-0.443	2.8587	
30 minute summer	103	29.001	FD Junction 7	-40.4	0.423	-0.619	2.1201	
30 minute summer	FD Junction 7	29.002	FD Junction 6	-43.4	-0.435	-0.665	2.9515	
30 minute summer	FD Junction 6	29.003	102	-56.9	-0.516	-0.872	3.6753	

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BOX CULVERT CALCULATION

UPPER ACRE
ONE HORTON HEATH

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BOX CULVERT CALCULATION

for

UPPER ACRE
ONE HORTON HEATH

ISSUE		A	B	C
Issued By	C Hendry			
Date	18.11.2025			
Purpose	Information			
Approved By	CH			

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CONTENTS

1.0 Box Culvert Calculation

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1.0 Box Culvert Calculation

The surface water flows through the existing watercourse are estimated using the Manning Resistance Equation. The surface water flows have been estimated based on the 1 in 1000 year data provided by the Environment Agency, which shows a maximum water level of 23.800mAOD.

The existing flows through the watercourse for the 1:1000YR storm event is estimated as follows:

Gradient of Ditch = 1:97

S = 0.0103

Manning's Equation: $Q = 1/n \times R^{2/3} \times S^{1/2} \times A$

A (Cross-sectional Area) = 3.95m^2

P (Wetted Perimeter of Flow) = 14.66m

R (Hydraulic Radius of Flow) = A/P = 3.95 / 14.66 = 0.264m

n (Roughness Coefficient) = 0.04

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$Q_{Flood\ 1000y} = 1/0.04 \times 0.2694^{2/3} \times 0.0103^{1/2} \times 3.95 = 4.18m^3/s$

$D_{Flood\ 1000y} = 1.383m$

Assume 2.4m wide x 1.8m high box culvert to incorporate 300mm freeboard:

Box Culvert Sizing at Design Depth 1.383m:

A (Cross-sectional Area) = $2.4 \times 1.383 = 3.319m^2$

P (Wetted Perimeter of Flow) = $2.4 + (2 \times 1.383) = 5.166m^2$

R (Hydraulic Radius of Flow) = A/P = 3.319 / 5.166 = 0.642m

S = 0.0103

n = 0.011

$Q = 1/0.011 \times 0.642^{2/3} \times 0.0103^{1/2} \times 3.319 = 4.21m^3/s$

$4.21m^3/s > 4.18m^3/s \therefore$ Culvert Size is sufficient to accommodate the 1:1000YR storm event.