

HALSNEAD FARM

Drainage Strategy

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Onward Homes

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Control Sheet

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Executive Summary

This FRA is submitted in conjunction with the Planning Application for up to 90 residential units at Halsnead Farm, Whiston. The site is currently classified as greenfield and is mostly in the catchment of the existing Fox's Bank Brook. The proposals ensure no effect on the existing watercourse through the implementation of a sustainable drainage system.

Due to the location, foul drainage is to be pumped to the nearest UU sewer. The exact location of the connection will depend on the adoption status of the adjacent residential site (under construction).

1.0 Introduction

1.1 Project Background

- 1.1.1 Curtins have been appointed from Starship Group to prepare a Drainage Strategy (DS) to accompany an application for the residential development known as Halsnead Farm. It is proposed that the site is to be developed to provide up to 90 residential units, associated highway / parking infrastructure and open space. Primary vehicular access to the site is granted from Fox Bank Lane to the east of the site. The site layout, provided by DK Architects, is included within Appendix A.
- 1.1.2 Please refer to the planning statement for a description of the site development and context.
- 1.1.3 The proposals for the outline drainage strategy are based on the requirements of Knowsley Council and their role as Lead Local Flood Authority (LLFA), United Utilities (UU) in their role as the local water company and DEFRA Non-Statutory Technical Standards for Sustainable Drainage Systems.
- 1.1.4 Proposals contained or forming part of this report represent the design intent and may be subject to alteration or adjustment in completing the detailed design of this project. Where such adjustments are undertaken as part of further design and are deemed a material deviation from the content contained in this document, prior approval shall be obtained from the relevant authority in advance of commencing such works.
- 1.1.5 This report should be read in conjunction with the Flood Risk Assessment (ref: 087052-CUR-XX-XX-T-C-0002).

1.2 National Policy

National Planning Policy Frameworks & Guidance

- 1.2.1 The Department of Communities and Local Government updated the National Planning Policy Framework (NPPF) in December 2025. The accompanying Planning Practice Guidance (PPG) on Flood Risk and Coastal Change was published in March 2014, most recently updated in December 2024, provides guidance on how flood risk should be assessed during the planning and development process.
- 1.2.2 Climate change specific guidance 'Flood Risk Assessments: Climate Change Allowances' released in December 2019 and last updated in May 2022 updates previous climate change allowances in support of the NPPF.

National Standards for Sustainable Drainage Systems

- 1.2.3 The latest National Standards for Sustainable Drainage Systems was updated in June 2025 and provides information for designers, property developers, local authorities and other interested parties, such as sewerage undertakers and the Environment Agency. They also contain links to additional supporting information relating to sustainable drainage systems (SuDS).
- 1.2.4 These standards are intended for application in the design of surface water drainage systems for new infrastructure and development, whether on greenfield or brownfield sites. They are not designed to apply to retrofit SuDS designs, which often have different objectives and face broader constraints.

1.3 Local Policy

- 1.3.1 Planning policy for Knowsley is contained within the Knowsley Local Plan Core Strategy January 2016 and the various Supplementary Plan Documents (SPDs). The below policies are applicable to this proposed development.
- CS8 – Green Infrastructure
 - CS22 – Sustainable and Low Carbon Development
 - CS24 – Managing Flood Risk

1.4 Site Description

- 1.4.1 The existing site consists of agricultural land including fields, barns and yards with a single dwelling. The site has the post code L35 3SU and the grid reference SJ 47666 89617. The site is bounded by the M62 to the North, Fox's Bank Lane to the East, and a new logistics hub to the South and agricultural land to the West. There are some existing residential properties directly to the west.
- 1.4.2 The site is within the Land South of M62, Cronton masterplan area of the Knowsley Local Plan, and part of the Halsnead Garden Village Supplementary Planning Document (SPD).
- 1.4.3 The site location is provided in Figure 3.1 below.



Figure 1.1 – Site Location Plan

1.5 Topography

- 1.5.1 The site topography appears unchanged since the construction of the M62. Fox's Bank Lane is at the lower end of the site with an elevation of approximately 34-35mAOD. From this road the land raises steeply towards the existing residential property with an elevation of around 38.8mAOD. Further west the ground levels continue to raise until the rear of the existing barn where the ground level is 42.8mAOD.
- 1.5.2 The high point is at the western pylon adjacent to the M62 with a level of 44mAOD. Further west of this pylon the ground falls gently away to approximately 42mAOD.
- 1.5.3 The topographical survey has been included in Appendix B for reference.

1.6 LLFA Comments

- 1.6.1 The LLFA were consulted in August 2025 where the below questions were submitted as an initial enquiry. Responses are given in italic below the query. Correspondence has been included in Appendix C for reference.

1. The site slopes towards the brook at the east, we propose a new connection here for surface water with QMAX limited to the greenfield equivalent. Suitable water treatment is proposed in the form of SuDS. We have instructed infiltration testing to BRE365.

Subject to provision of evidence and justification (e.g. infiltration tests and groundwater levels) so that it could demonstrate that in choosing drainage features for post development, the surface water drainage discharge hierarchy has appropriately been followed, the discharge to the brook would be acceptable. Maximum discharge to the brook should be set to the greenfield Qbar.

2. We will allow for 10% urban creep on the 1 in 100 year + climate change event. Is this suitable?

Yes, 10% urban creep during the 1 in 100 plus CC event is acceptable.

3. The proposal currently allows for permeable paving, raingardens, bioretention areas and below ground attenuation for surface water management.

A Sustainable Drainage Design (SuDS) aims to minimise the impacts from a proposed development on water quantity and quality and maximise amenity and biodiversity. In designing an appropriate set of SuDS techniques for a development site, the LLFA will be expecting surface water runoff to be managed close to source (Source control / property level control), only conveying downstream what cannot be managed at source. Therefore, the drainage design shall be required to include source control/ property level control (e.g. permeable pavements and raingardens, bioretention areas), green and open conveying systems / green corridors (e.g. green swale and ditch) and regional control (e.g. overground attenuation basin) features. The development of drainage design should therefore be planned as early as possible before the setting the property/other spaces layout in close collaboration with the landscape and biodiversity team. This becomes more important in this case where the surface water runoff is proposed to connect to a watercourse, implying that there is no much flexibility on adopted discharge rate.

Where the proposals are connecting to an existing watercourse, it is likely that the authorities responsible for maintaining that watercourse will have their own design requirements. These requirements will need to be reviewed and agreed as part of any surface water drainage scheme.

4. The proposal will prevent water shedding onto the public highway as it does now from the undrained catchment.

An explanation of existing drainage system/mechanism and flow paths on the site and that how the site is currently affected by off-site surface water runoff shall be required.

The drainage network design must be able to demonstrate that it would cope, as a minimum, the 1 in 30 plus CC rain event. The site using the SuDS elements must be able to contain the flood water

during the 1 in 100 plus CC with no water leaving the site. Exceedance scenario must be able to demonstrate the people and assets within the site and off site are safe from flooding.

5. Latest guidance requires us to consider rainwater harvesting, in this environment we do not believe it is appropriate. Not least because we only have a requirement of non-potable water of around 10m³ a day for the estate, this would require a 3rd drainage network and extensive additional plumbing with additional costs and maintenance. It's also an affordable housing scheme and we would have to put the maintenance costs onto residents moving forward, the end user will be against this and as UU cannot adopt yet we are left with an asset that can't be maintained. We will specify water butts, but I know this does not tick the box in full. There is very little environmental benefit in this location, or flood reduction benefit. We are looking to provide SuDS to meet runoff control, water quality, and amenity/biodiversity goals without RWH. Landscaping is watered from the catchment so no requirement for potable water to maintain trees etc. Is this sufficient in this circumstance?

As long as the Schedule 3 of the Flood and Water Management Act 2010 is not officially implemented, the full requirements of the new version of the SuDS Manual is not compulsory unless those are already aligned with the requirements of NPPF. For time being, rainwater harvesting is one those for which there is no force and practical guidance.

- 1.6.2 This report aims to evidence compliance with the feedback provided during initial consultation.

2.0 Existing Drainage

2.1 Foul Water

- 2.1.1 There are no identified existing foul sewers within the site boundary and very minimal effluent is generated by the current use. Based on the existing site topography, it is anticipated that the existing properties utilise septic tanks and other means of disposal.
- 2.1.2 United Utilities (UU) have confirmed that they will accept a new discharge into the existing foul sewer in Lickers Lane to the north of the site. This will require a pumped connection via a rising main to the location approximately 1,100m away.
- 2.1.3 The available UU sewer records are provided within Appendix C.

2.2 Surface Water

- 2.2.1 There are no recorded existing surface water sewers within the site boundary or shown adjacent to the site within third-party/public land. The properties on site are unlikely to be positively drained with run-off shedding onto surrounding land. There may also be existing informal soakaways.
- 2.2.2 There is evidence of drainage within Fox's Bank Lane through the presence of kerb outlet units, gullies and kerb drains however, records show no existing surface water sewers within the highway.
- 2.2.3 There is an existing watercourse to the east of the site and across Fox's Bank Lane, this is an EA maintained main river.
- 2.2.4 UU have confirmed there is no viable option for connection into their existing network.

2.3 Existing Surface Water Catchment

- 2.3.1 The overall red line boundary area of the site is 3.35ha. Within this area, a total catchment area of 2.9ha discharges surface water run-off to the existing watercourse by overland flow. This catchment is apart of the watershed of the Fox's Bank Brook. The existing catchment plan is included within Appendix D.
- 2.3.2 The additional 0.6ha catchment sheds water to the west to an unknown receptor.
- 2.3.3 In deriving the greenfield run-off for this site, the IH124 methodology was used on UK SuDS. The calculation is included within Appendix D for the main run-off to the watercourse.

- 2.3.4 The greenfield equivalent run-off rate (Q_{BAR}) for this area is 17.8 l/s. The ground conditions confirm a clayey substratum with limited possibility of infiltration which is in line with the factors used in the output. The greenfield runoff calculations have been included in Appendix D.
- 2.3.5 Table 2.1 summarises the greenfield rates for the catchment.

Greenfield Flow Rates				
Catchment Area	1 in 1 year	QBAR	1 in 30-year	1 in 100-year
Per 1.0ha	5.3 l/s	6.1 l/s	10.4 l/s	12.8 l/s
To Watercourse (2.9ha)	15.5 l/s	17.8 l/s	30.3 l/s	37.1 l/s

Table 2.1 – Greenfield Flow Rates

- 2.3.6 The discharge rate from the site post development is to be restricted to **17.8 l/s** (Q_{max}). This is in accordance with the National Standards for Sustainable Drainage Systems Paragraph 3.18 and 3.27.
- 2.3.7 On a 1 in 30-year storm, this is a circa 40% betterment on flows reaching the watercourse.

3.0 Drainage Strategy

3.1 Adoption Strategy

- 3.1.1 The drainage strategy for the site is to be split into separate foul and surface water networks. Where possible, drainage networks will be subject to adoption by UU or NAV (New Appointments & Variations); where this is not possible, assets will remain the responsibility of the landowner with a requirement for an estate management contract to be in place for the lifetime of the development. Any drainage features which have no properties connected but do have public highway purposes (e.g. the access junction) will be adopted by the local authority under S278 or S38 of the Highway Act.
- 3.1.2 It should be noted that UU and NAVs can now adopt certain sustainable drainage systems (SuDS), however, their responsibility will only extend to the hydraulic function of the asset. The water company will not be responsible for any aesthetic or form maintenance. Therefore, adopted SuDS will still require maintenance and management by the estate.

3.2 Foul Water

- 3.2.1 As outlined in Section 2.1, there are no public sewers in the vicinity of the site. The closest viable connection for foul drainage is over 1km to the north. The current proposal allows for an on site pumping station to an adoptable specification to lift effluent to the nearest public sewer. The adjacent Taylor Wimpey site is currently constructing a new drainage network to be adopted by United Utilities under S104 of the Water Industry Act. If this adoption is complete there is likely an opportunity to connect into this asset which is supported by a rising main to the Lickers Lane connection.
- 3.2.2 A pumping station is unavoidable as a septic tank or drainage field or on-site treatment would not be suitable for adoption. The number of properties requires an adopted drainage network with a suitable connection to a sewer.
- 3.2.3 The estimated flow rates shown below in Table 3.1 have been determined based on Sewerage Sector Guidance (SSG), which prescribes a design flow of 4,000 l/day/dwelling. Where required, on-site storage should amount to 150 l/dwelling which is approximately 13.5 m3 for 90 homes.

Point of Connection	Foul Flow
Pumping Station (up to 90 Homes)	4.2 l/s

Table 3.1 – Foul Flows to Each PoC

- 3.2.4 The proposed pumping station is located at the lowest point of the catchment to minimise depths of wet wells. The proposed pumping station layout shall be in accordance with DCG Figure D.3 for a Typical Type 3 Pumping Station. The pumping system shall be equipped with telemetry to ensure issues are highlighted to the adopting authority quickly and effectively. Telemetry can also inform the estate management team. The pumping station and rising main must be adopted by either the water company (UU) or NAV.

3.3 Surface Water

- 3.3.1 Any new development site drainage should be designed in accordance with the current best practice to provide adequate capacity not to flood up to the 1 in 30-year storm event, flooding may occur in the 1 in 100-year event however adequate overland routing is required to direct flow to locations which do not affect buildings or access to the site. Surface water must be disposed of through the most sustainable method as set out in the drainage hierarchy.

- 3.3.2 Surface water run-off shall be captured by a mixture of traditional drainage components and SuDS features which will convey flows to the associated attenuation tanks on site; surface water runoff shall be attenuated by the tanks while discharging at greenfield rates before discharging into the proposed outfall at the edge of the existing Fox's Bank Brook. This new discharge is subject to Ordinary Watercourse Consent (OWC).

- 3.3.3 As above, the maximum discharge rate is to be 17.8 l/s.

3.3.4 Discharge Location

Re-Use

National Standards for Sustainable Drainage Systems (Paragraph 1.11) states that Rainwater Harvesting shall be considered in all circumstances, subject to certain criteria. This development does not have a requirement for a notable non-portable water or landscape irrigation. The site is not within an area identified as water stressed. Therefore, this approach to discharge is discounted.

Infiltration

Infiltration testing has been carried out as part of the site investigation. 3 No. machine excavated trial pits were excavated for soakaways. Topsoil was encountered to a thickness of up to 1m below ground level with approximately 1m thick Glacial Till below. The cohesive till comprised of firm – stiff, reddish brown/brown/brown mottled grey, sandy, slightly gravelly clay, with gravel comprising of subrounded sandstone.

The Infiltration Rate for SA02 undertaken in the east of the site was determined as 1.08×10^{-4} . The material in which this soakaway was undertaken was described as reddish brown, clayey, slightly gravelly sand.

The Infiltration Rate for SA03 undertaken in the south-east of the site was determined as N/A. The material in which this soakaway was undertaken was described as reddish brown, very clayey, slightly gravelly sand.

Therefore, it is possible that soakaways in certain locations may be possible depending on the material. If the soil has a higher clay content (i.e. very clayey versus clayey), soakaways may not be suitable.

The variable ground conditions mean that infiltration cannot be relied upon, but nor should it be prevented. The proposed attenuation tanks and permeable paving shall not be prevented from infiltrating to ground; internal pipework shall be set 100mm above the base to ensure infiltration takes place where possible.

Watercourse

The catchment analysis (Appendix D and Section 2.3) shows that run-off from the site is towards the existing Fox's Bank Brook. Therefore, a new single point of connection to this watercourse is possible as long as it mimics the existing characteristics. The strategy proposed suitable restricts the flow (and therefore the velocity) into the brook as to not increase flooding or volume of water within the watercourse. The on site treatment train ensures contaminants are removed from the run-off prior to discharge.

3.4 Discharge Rate

- 3.4.1 The discharge rate shall not be permitted to exceed the greenfield equivalent in accordance with local and national policy. As outlined in section 2.3, the Q_{MAX} rate from the area within the redline boundary shall be taken as 17.8 l/s.
- 3.4.2 The simulations contained within Appendix F are based on an impermeable area of 1.4ha. This represents approximately 40% impermeable area across the site which is reflective of the landscaping provision to be provided. The model includes an allowance for a 10% urban creep.

3.5 Attenuation

- 3.5.1 The topography of the site does not lend itself to large scale surface level attenuation features. The only suitable (flat) area is at the west of the site which is also at the highest point meaning attenuation volumes could not be utilised. The majority of the storage requirement is provided below ground in tank

structures. Where possible these should be adopted by either the water company or NAV. If the drainage is not adopted the appropriate maintenance (and/or replacement) plan must be in place.

- 3.5.2 Further small-scale attenuation is provided in the sub-base material of the extensive permeable paving and the proposed bioretention areas. This is not included within the calculations as they can be removed by landowners or property owners.
- 3.5.3 The calculations show a storage requirement of approximately 1,150m³ is utilised across all modelled features (including pipes, manholes and tanks). The tanks provide around 90% of this volume at various levels. To ensure efficiency in the design the scheme requires multiple flow controls to manage the topographical changes.

3.6 Climate Change

- 3.6.1 Climate change must be applied to rainfall profiles for the correct epoch and location. In May 2022 the EA released guidance on the correct allowances for rainfall. The site is located within the North West River Basin District and the Lower Mersey Management Catchment.
- 3.6.2 The development should be assessed against its most vulnerable uses, this is a residential scheme and therefore the upper end allowance for the 2070s shall be incorporated into the design. Drainage calculations showing the inclusion of climate change are included within Appendix F.

3.3% Annual Rainfall Probability			1.0% Annual Rainfall Probability		
Epoch	Central Allowance	Upper End	Epoch	Central Allowance	Upper End
2050's	20%	35%	2050's	25%	40%
2070's	30%	40%	2070's	30%	45%

Table 3.2 – Rainfall Climate Change

- 3.6.3 Climate change is included within the simulation output.

3.7 Exceedance

- 3.7.1 Any exceedance in storms beyond the 1 in 30-year event needs to be routed away from buildings and access routes. The site attenuation volumes have been determined to ensure that no flooding occurs up to the 1:10-year event plus a 45% allowance for climate change. The hydraulic calculations do not take into account all the additional drainage features which will provide additional storage such as SuDS.
- 3.7.2 Negligible exceedance during the 1 in 100 year + climate change + 10% area event occurs from node 1 (at the western boundary), node 21 in the centre of the site and node 29 at the proposed junction.

Flooding which occurs at node 27 is not negligible at approximately 40m³, this exceedance will become overland flow and disperse within the highway entering the adjacent raingarden, once this is at capacity some water may flow downwards towards the access junction and cause temporary ponding at this location. A low point has been considered within the site design to ensure Fox's Bank Lane (as it is now) remains unaffected.

3.8 Land Drainage

3.8.1 The drainage is intended for adoption and land drainage which is associated with draining permeable areas is not permitted to discharge into the adopted network. The landscaping area to the north of the site adjacent to the M62 is drained independently of the adopted network via a series of filter drains and shallow wetlands. The infiltration rate is sufficient for the very low quantities of water expected to be generated by the proposed layout. Run-off from these areas will not continue to shed towards Fox's Bank Brook.

3.9 Residual Risk Parameters

3.9.1 The drainage calculations include for a failure model. This is to understand the residual risk in the event of a network operation failure. To simulate this the flow controls devices have their capacities reduced by 75%, meaning only 25% of the flow can pass. This is achieved by including orifices within the hydraulic model with 25% of the diameter.

- 1 in 2 year event – no exceedance
- 1 in 30 year event with 40% climate change – 30m³ exceedance from node 1.
- 1 in 100 year with 45% climate change – 85m³ exceedance from node 1, 165m³ from node 27 and 2m³ from node 29.

3.9.2 It is worth noting that the first flood for the 1 in 30-year event is the 720 minute event (12 hours), and the 1 in 100-year event first flood is the 120 minute event (2 hours).

3.9.3 The exceedance locations in the event of a failure of the network pose no risk to any properties or operation of the required routes to and from the site.

4.0 Sustainable Drainage Systems (SuDS)

- 4.1.1 SuDS are integral to surface water management, particularly when providing source control to manage water quality and quantity. They are also used to improve amenity and biodiversity.
- 4.1.2 SuDS can take many forms, both above and below ground. Some types of SuDS include planting, others include proprietary/manufactured products. In general terms, SuDS that are designed to manage and use rainwater close to where it falls, on the surface and incorporating vegetation, tend to provide the greatest benefits. Most SuDS schemes use a combination of SuDS components to achieve the overall design objectives for the site. All design shall be in accordance with the CIRIA SuDS Manual (C753).
- 4.1.3 As highlighted in section 3.5, attenuation is mostly provided in tanks to meet the water quantity requirement of SuDS. Some additional volume will be contained within further surface level features; however, this is not included within the hydraulic calculations as these features may not provide attenuation should a consecutive storm happen, and/or may be removed by others in the future. In low level rainfall events, it is possible to achieve a scheme with no discharge.
- 4.1.4 Table 4.1 summarises the SuDS components which are included within this scheme.

Component	Comments	Benefits		
		Water Quantity	Water Quality	Amenity & Biodiversity
Permeable Paving	Pervious surfaces, together with their associated substructures, are an efficient means of managing surface water runoff close to its source – intercepting runoff, reducing the volume and frequency of runoff, and providing a treatment medium. Pervious pavements provide a pavement suitable for pedestrian and/or vehicular traffic, while allowing rainwater to infiltrate through the surface and into the underlying structural layers. The water is temporarily stored beneath the overlying surface before controlled discharge downstream. Permeable paving should be considered in all parking bays, including adjacent to highway (adopted & private). Areas not adopted as public highway (private drives etc) are also suitable for permeable paving.	✓	✓	
Raingarden / Bioretention	Bioretention systems (including rain gardens) are shallow landscaped depressions that can reduce runoff rates and volumes and treat pollution through the use of engineered soils and vegetation. Raingardens and bioretention areas are provided in various locations; they are designed to create a suitable wetland environment to boost ecology. Raingardens are proposed adjacent to the highway (adopted and private) to treat run-off. They are designed to hold an amount of water to sustain anaerobic conditions for the planting above.	✓	✓	✓

Component	Comments	Benefits		
		Water Quantity	Water Quality	Amenity & Biodiversity
Filter Drains	Filter drains are shallow trenches filled with stone/gravel that create temporary subsurface storage for the attenuation, conveyance, and filtration of surface water runoff. Filter drains should ideally receive lateral inflow from an adjacent impermeable surface that is pre-treated using a vegetated filter strip or equivalent. Filter drains can help reduce pollutant levels in runoff by filtering out fine sediments, metals, hydrocarbons & other pollutants.	✓	✓	
Wetlands <i>(in landscaping areas to the north only)</i>	Wetlands are landscaped depressions that are normally wet. Wetlands provide treatment and will absorb some run off, as well as removing sediments and buoyant materials from the flow. Levels of nutrients, heavy metals, toxic materials and oxygen demanding materials may also be significantly reduced. Wetlands should be incorporated into the landscape design to ensure suitable planting. Well managed wetlands perform well where infiltration is the method of discharge.	✓	✓	✓

Table 4.1 – Summary of Potential SuDS Components

4.2 Water Quantity

4.2.1 With reference to the specific drainage layouts provided in Appendix E, and the attenuation requirements outlined within section 3.4, the water quality requirements are met through the implementation of the surface water drainage strategy. This is only presented as a workable solution and alternative layouts for the attenuation may be used this when considering the additional SuDS options presented in table 4.1.

4.3 Water Quality

4.3.1 The design for the development will ensure that the quality of any receiving water body is not adversely affected and preferably enhanced in accordance with CIRIA SuDS Manual C753, Chapter 4.

4.3.2 Land use is limited to Low and Very low pollution hazard levels based on the current proposed layout (residential roofs and carparking/driveways). The Simple Index Approach (SIA) has been used to determine the pollution hazard level and relevant indices for the site in accordance with table 26.2 of CIRIA C753. Mitigations shall be assessed against table 26.3 of CIRIA C753 to confirm whether or not proprietary interception (fuel/oil interceptor etc) is required.

CIRIA C753 Pollution Hazard Indices				
Land Use	Pollution Hazard Level	TSS	Metals	Hydrocarbons
Residential Roofs	Very Low	0.2	0.2	0.05
Individual property driveways, residential car parks, low traffic roads	Low	0.5	0.4	0.4

Table 4.2 – CIRIA C753 Pollution Hazard Indices

- 4.3.3 Roof drainage areas are to be discharged into the proposed permeable/porous pavement where possible. Where not possible a filter drain will be utilised to provide the mitigations.
- 4.3.4 Driveways and other areas of none adoptable highway are to be finished in a permeable/porous paving. The proposed system will be designed in accordance with C753 and include a layer of high-void ratio stone (such as Type 3 or 4/20 graded aggregate). Infiltration will not be prevented and a System B approach adopted.
- 4.3.5 The main carriageways to be adopted will be drained via a series of bioretention areas. These are to be planted features and designed to hold water within the base for anaerobic conditions.
- 4.3.6 The landscaped buffer between the development and the M62 will be managed by designated wetland areas. The hazard level for this area is very low.

SuDS Mitigation Indices			
Type	TSS	Metals	Hydrocarbons
Filter Drain	0.4	0.4	0.4
Permeable Pavement	0.7	0.6	0.7
Bioretention System	0.8	0.8	0.8
Wetlands	0.8	0.8	0.8

Table 4.3 – CIRIA C753 Pollution Hazard Indices

- 4.3.7 The proposed treatment train within the SuDS can provide sufficient mitigation to ensure no onward pollution / contamination of protected waters.

4.4 Amenity & Biodiversity

- 4.4.1 Wherever possible the landscaping strategy should take into account the drainage requirements so that the two complement each other. The site incorporates public open space, some of which is dedicated to SuDS purposes based on the current layout. Drainage systems that are on the surface and visible with vegetated components, comprising part of the local green infrastructure and ecosystem structure, are usually the greatest way to obtain biodiversity advantages.

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- 4.4.2 The implementation of planted SuDS features within this scheme will encourage biodiversity and provide an amenity space for site users.

5.0 Summary and Conclusions

- 5.1.1 Curtins have been appointed from Starship Group to prepare a Drainage Strategy (DS) to accompany an application for the residential development known as Halsnead Farm. It is proposed that the site is to be developed to provide up to 90 residential units, associated highway / parking infrastructure and open space.
- 5.1.2 This drainage strategy presents a workable solution for the management of surface water run-off and generated foul effluent. The attenuation layout proposed is spatially compatible with the development, however some changes are possible based on further design considerations and further hydraulic analysis. The final strategy shall comply with the parameters of this document and associated drawings.
- 5.1.3 The final drainage strategy will also need to be agreed with the adopting body.
- 5.1.4 This strategy has been undertaken in accordance with the standing advice and requirements of the NPPF, the PPG and the National Standards for Sustainable Drainage Systems.
- The site shall be drained at a maximum of **17.8 l/s** to the Fox's Bank Brook at the east. This restriction shall apply to all storm events up to and including the 1 in 100 year + climate change event.
 - Attenuation is predominantly provided in below ground structures due to the topography of the site.
 - There is no increase in risk of contamination to controlled waters, based on the water quality improvements offered by the proposed SuDS features.
 - Additional foul flows are generated by the scheme and a pumped solution is required to discharge to available public sewers for treatment.

Appendices

Appendix A – Site Layout

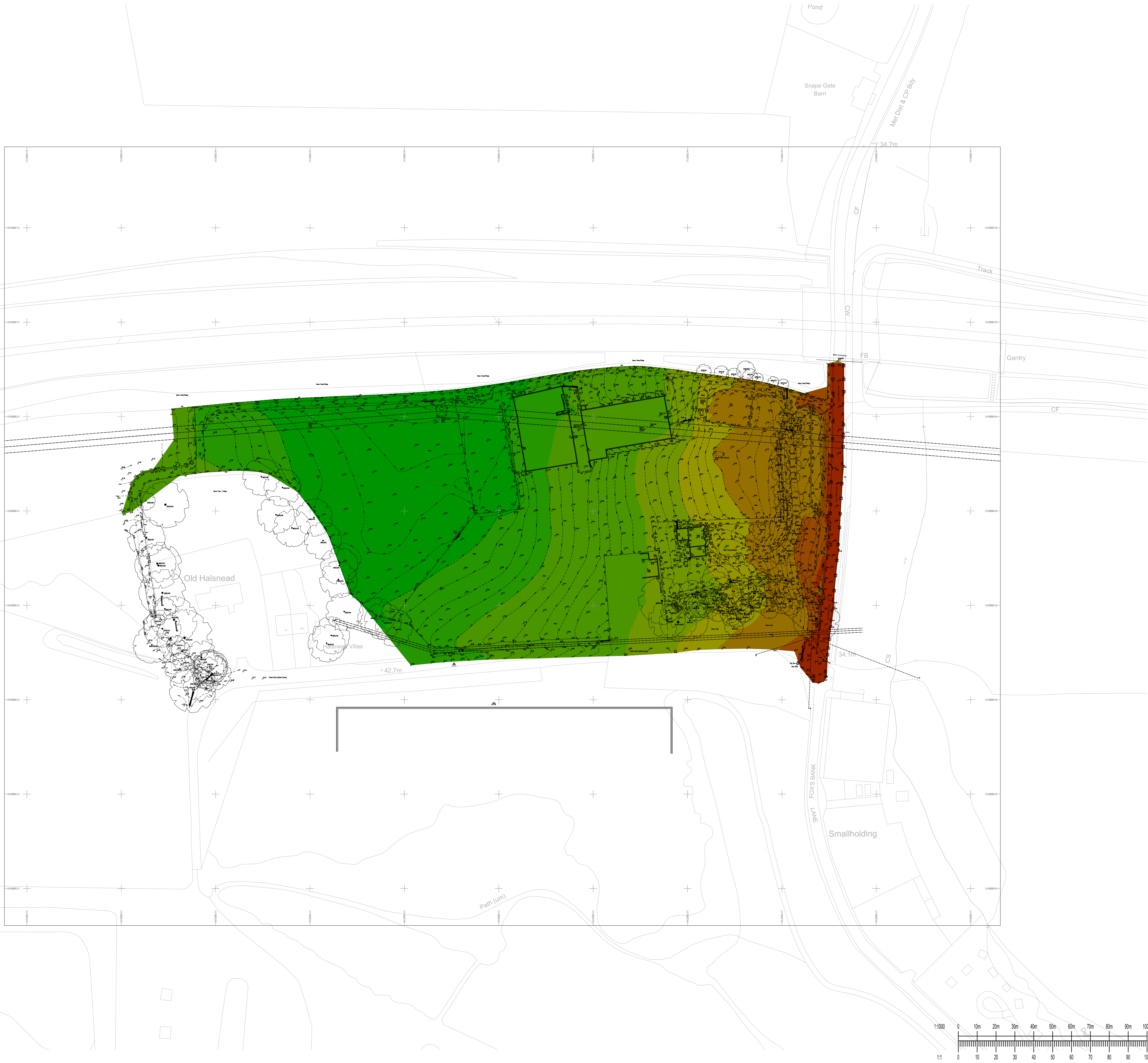
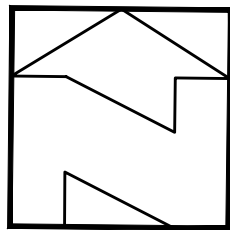


Drawing Title: Proposed Site Plan
Date: 28/09/2025
Drawing no: 1367 - 1001
Scale: 1:1250 @ A1
Drawn: HB

revision: B
revision notes: A 03/11/2025 Updated to reflect house type updates
B 07/11/2025 Red line upated

DK-Architects
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Liverpool
L1 6ER
0151 231 1209 T
mail@dk-architects.com E
www.dk-architects.com W

Appendix B – Topographical Survey



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- ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE.
- FOR GENERAL NOTES REFER TO DRAWING.

SURFACE LEVEL DATA

NUMBER	MINIMUM LEVEL	MAXIMUM LEVEL	COLOUR
1	33.000	34.000	
2	34.000	35.000	
3	35.000	36.000	
4	36.000	37.000	
5	37.000	38.000	
6	38.000	39.000	
7	39.000	40.000	
8	40.000	41.000	
9	41.000	42.000	
10	42.000	43.000	
11	43.000	44.000	
12	44.000	45.000	

P01	PLANNING (S2)	17/10/25	RT	JDB
Rev:	Description:	Date:	By:	Chkd:

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Status: **SUITABLE FOR INFORMATION** **S2**

Project: **HALSNEAD FARM**

Dwg Title: **SURVEY
EXISTING TOPOGRAPHY**

Drawn By RT	Designed By RT	Checked By JDB
Date 16/10/2025	Scales @ A1 1:1,000	Revision

Project No - Originator - Function - Spatial - Form - Discipline - Number	Revision
087052 - CUR - XX - XX - D - C - 02001	P01

Appendix C – United Utilities / Lead Local Flood Authority

United Utilities Grasmere House, 2nd Floor
Lingley Mere Business Park
Great Sankey
Warrington
WA5 3LP

09.01.25

Dear Jake

Pre-Development Enquiry for Halsnead Farm, Fox's Bank Lane

UU Reference Number: 06845283

We have assessed your application based on the information provided. This pre-development advice on your drainage strategy will be valid for 12 months. Your strategy will need review by other authorities as part of the planning process. We advise conducting necessary site investigations to confirm viability of your proposals.

Asset Protection

- We have reviewed our records and can confirm that there does not appear to be any charted public sewers located within the boundary of the proposed development.

Foul Water

Foul flow from this site will be allowed to drain into the public foul water sewer system.

Our preferred point of discharge would be to 600mm Foul Sewer on Lickers Lane to the North of your proposed development at an unrestricted rate.

Manhole reference SD 7507

[Please see the images on page 3 for clarification](#)

Surface Water

Follow the National Planning Policy Guidance drainage hierarchy and Provide evidence for discounting higher options before considering public sewer discharge. Consult the Lead Local Flood Authority regarding surface water concerns.

[Please see comment 4 within the guidance sheet](#)

Infiltration

[Please see comment 4 within the guidance sheet](#)

Waterbody

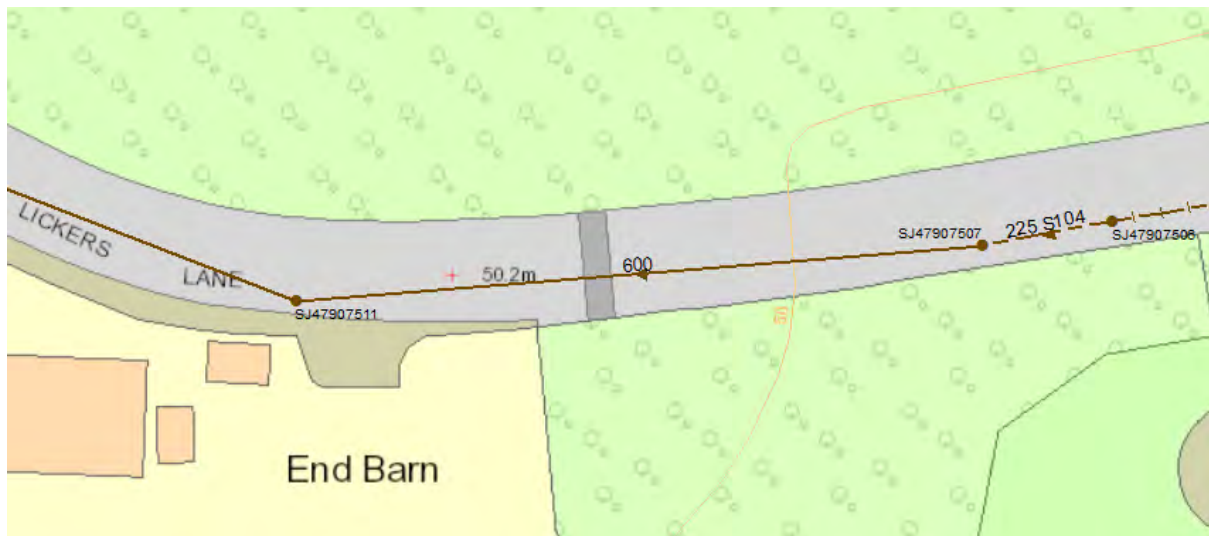
If an evidence based assessment has been carried out and confirms that infiltration is not feasible, we recommend that you contact the Lead Local Flood Authority and/or Environment Agency to discuss a point of discharge to the waterbody located to the east of the proposed site.

We would encourage you to engage with any third-party landowner and riparian owner to agree access and discharge rights to the water body if this is not in your ownership.

Public Sewer

No connection to the public sewer will be permitted as this time. This is because there is a watercourse in close

Site Images



Fw: 25/00026/PREAPP Halsnead Farm

From Alice Fearn <Alice.Fearn@curtins.com>

Date Thu 30/10/2025 13:50

To Alice Fearn <Alice.Fearn@curtins.com>

From: Tayefi, Vahid <Vahid.Tayefi@knowsley.gov.uk>

Sent: 06 August 2025 13:10

To: Jake Busby <Jake.Busby@curtins.com>

Cc: Rhys Thomas <Rhys.Thomas@curtins.com>; Sheridan, Jo (Planning & Regeneration) <Jo.Sheridan@knowsley.gov.uk>; Fortune, Louise <Louise.Fortune@Knowsley.gov.uk>

Subject: RE: 25/00026/PREAPP Halsnead Farm

Hi Jake,

In response to your enquiry please see below our comments:

- The site slopes towards the brook at the east, we propose a new connection here for surface water with QMAX limited to the greenfield equivalent. Suitable water treatment is proposed in the form of SuDS. We have instructed infiltration testing to BRE365.

Subject to provision of evidence and justification (e.g. infiltration tests and groundwater levels) so that it could demonstrate that in choosing drainage features for post development, the surface water drainage discharge hierarchy has appropriately been followed, the discharge to the o would be acceptable. Maximum discharge to the brook should be set to the greenfield Qbar.

- We will allow for 10% urban creep on the 1 in 100 year + climate change event. Is this suitable?

Yes, 10% urban creep during the 1 in 100 plus CC event is acceptable.

- The proposal currently allows for permeable paving, raingardens, bioretention areas and below ground attenuation for surface water management.

A Sustainable Drainage Design (SuDS) aims to minimise the impacts from a proposed development on water quantity and quality and maximise amenity and biodiversity. In designing an appropriate set of SuDS techniques for a development site, the LLFA will be expecting surface water runoff to be managed close to source (Source control / property level control), only conveying downstream what cannot be managed at source. Therefore, the drainage design shall be required to include source control/ property level control (e.g. permeable pavements and raingardens, bioretention areas), green and open conveying systems / green corridors (e.g. green swale and ditch) and regional control (e.g. overground attenuation basin) features. The development of drainage design should therefore be planned as early as possible before the setting the property/other spaces layout in close collaboration with the landscape and biodiversity team. This becomes more important in this case where the surface water runoff is proposed to connect to a watercourse, implying that there is no much flexibility on adopted discharge rate.

Where the proposals are connecting to an existing watercourse, it is likely that the authorities responsible for maintaining that watercourse will have their own design

requirements. These requirements will need to be reviewed and agreed as part of any surface water drainage scheme.

- The proposal will prevent water shedding onto the public highway as it does now from the undrained catchment.

An explanation of existing drainage system/mechanism and flow paths on the site and that how the site is currently affected by off-site surface water runoff shall be required.

The drainage network design must be able to demonstrate that it would cope, as a minimum, the 1 in 30 plus CC rain event. The site using the SuDS elements must be able to contain the flood water during the 1 in 100 plus CC with no water leaving the site. Exceedance scenario must be able to demonstrate the people and assets within the site and off site are safe from flooding.

- Latest guidance requires us to consider rainwater harvesting, in this environment we do not believe it is appropriate. Not least because we only have a requirement of non-potable water of around 10m³ a day for the estate, this would require a 3rd drainage network and extensive additional plumbing with additional costs and maintenance. It's also an affordable housing scheme and we would have to put the maintenance costs onto residents moving forward, the end user will be against this and as UU cannot adopt yet we are left with an asset that can't be maintained. We will specify water butts, but I know this does not tick the box in full. There is very little environmental benefit in this location, or flood reduction benefit. We are looking to provide SuDS to meet runoff control, water quality, and amenity/biodiversity goals without RWH. Landscaping is watered from the catchment so no requirement for potable water to maintain trees etc. Is this sufficient in this circumstance?

As long as the Schedule 3 of the Flood and Water Management Act 2010 is not officially implemented, the full requirements of the new version of the SuDS Manual is not compulsory unless those are already aligned with the requirements of NPPF. For time being, rainwater harvesting is one those for which there is no force and practical guidance.

Any question, please let me know.

Vahid Tayefi
Principal Drainage Engineer
Highways and Capital Delivery

Mobile: [07766 500208](tel:07766500208)

Knowsley Council, Huyton Library, Knowsley,



From: Jake Busby <Jake.Busby@curtins.com>

Sent: 01 August 2025 09:49

To: Tayefi, Vahid <Vahid.Tayefi@knowsley.gov.uk>

Cc: Rhys Thomas <Rhys.Thomas@curtins.com>

Subject: Halsnead Farm

Hi Vahid,

Your colleague in planning has passed me your contact details to discuss a site we are looking at the planning application for. It is known as Halsnead Farm, located on Fox Banks Lane (<https://maps.app.goo.gl/t4yChxGzeznJwiZy5>).

The site is designated for residential within the masterplan area (under SPD). We have been considering the drainage proposal for the development and have a few quick queries if you don't mind:

- The site slopes towards the brook at the east, we propose a new connection here for surface water with QMAX limited to the greenfield equivalent. Suitable water treatment is proposed in the form of SuDS. We have instructed infiltration testing to BRE365.
- We will allow for 10% urban creep on the 1 in 100 year + climate change event. Is this suitable?
- The proposal currently allows for permeable paving, raingardens, bioretention areas and below ground attenuation for surface water management.
- The proposal will prevent water shedding onto the public highway as it does now from the undrained catchment.
- Latest guidance requires us to consider rainwater harvesting, in this environment we do not believe it is appropriate. Not least because we only have a requirement of non-potable water of around 10m³ a day for the estate, this would require a 3rd drainage network and extensive additional plumbing with additional costs and maintenance. It's also an affordable housing scheme and we would have to put the maintenance costs onto residents moving forward, the end user will be against this and as UU cannot adopt yet we are left with an asset that can't be maintained. We will specify water butts, but I know this does not tick the box in full. There is very little environmental benefit in this location, or flood reduction benefit. We are looking to provide SuDS to meet runoff control, water quality, and amenity/biodiversity goals without RWH. Landscaping is watered from the catchment so no requirement for potable water to maintain trees etc. Is this sufficient in this circumstance?

Would a 30-minute teams call be beneficial?

Kind Regards,

Jake Busby (He/him)

Principal Civil Engineer

Tel: 0151 726 2000
Mob: 07894 615 289
jake.busby@curtins.com

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Liverpool, L2 2SB
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Date: 06/11/2024

Extract from Map of Public Sewers

Printed By:

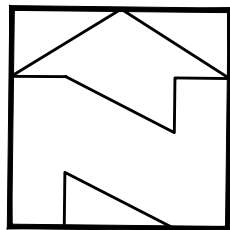
Property Search: Halsnead Farm and the adjoining land, Foxs Bank Lane, Whiston, Presc



The position of underground apparatus shown on this plan is approximate only and is given in accordance with the best information currently available. The actual positions may be different from those shown on the plan and private pipes, sewers or drains may not be recorded. United Utilities Water PLC will not accept any liability for any damage caused by the actual positions being different from those shown.

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Appendix D – Existing Catchment & Greenfield Rate



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P01	PLANNING (S2)	17/10/25	RT	JDB
Rev:	Description:	Date:	By:	Chkd:

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Status:	SUITABLE FOR INFORMATION	S2
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Project:	HALSNEAD FARM
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Orig Title:	SURVEY EXISTING CATCHMENTS
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Drawn By RT	Designed By RT	Checked By JDB
Date 16/10/2025	Scale @ A1	1:1,000

Project No - Originator - Function - Spatial - Form - Discipline - Number	Revision
087052 - CUR - XX - XX - D - C - 02101	P01

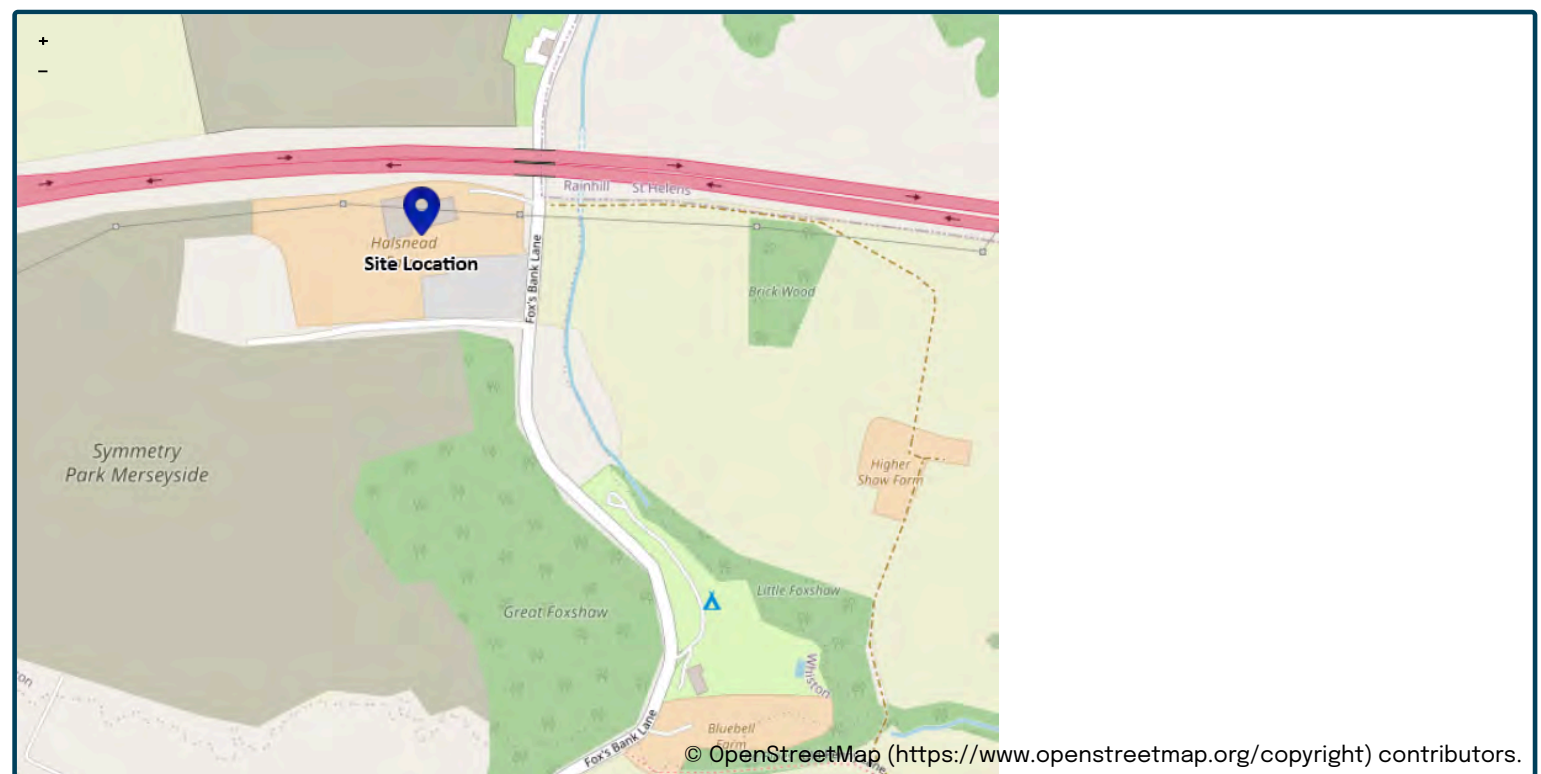
This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance “Rainfall runoff management for developments”, SC030219 (2013), the SuDS Manual C753 (CIRIA, 2015) and the non-statutory standards for SuDS (Defra, 2015).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

Project details

Date	16/10/2025
Calculated by	JDB
Reference	Halsnead Farm
Model version	2.2.1

Location

Site name	Halsnead Farm
Site location	Whiston



Site easting (British National Grid)	347657
Site northing (British National Grid)	389598

Site details

Total site area (ha)	2.9	ha
----------------------	-----	----

Greenfield runoff

Method

Method	IH124	
IH124		
	My value	Map value
SAAR (mm)	860mm	860
How should SPR be derived?	WRAP soil type	
WRAP soil type	4	4
SPR	0.47	
QBar (IH124) (l/s)	17.8l/s	

Growth curve factors

	My value	Map value
Hydrological region	10	10
1 year growth factor	0.87	
2 year growth factor	0.93	
10 year growth factor	1.38	
30 year growth factor	1.7	
100 year growth factor	2.08	
200 year growth factor	2.37	

Results

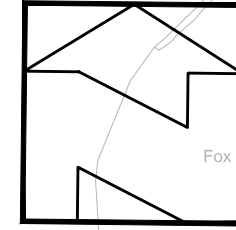
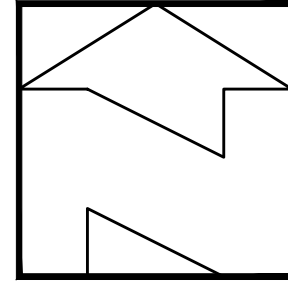
Method	IH124
Flow rate 1 year (l/s)	15.5l/s
Flow rate 2 year (l/s)	16.6l/s
Flow rate 10 years (l/s)	24.6l/s
Flow rate 30 years (l/s)	30.3l/s
Flow rate 100 years (l/s)	37.1l/s
Flow rate 200 years (l/s)	42.2l/s

Please note runoff estimation is subject to significant uncertainty. Results are therefore normally reported to only 1 decimal place. Where 2 decimal places are provided, this does not indicate accuracy to this level, it has been adopted to prevent ‘zero’ figures from being reported. Outputs less than 0.01 l/s are reported as 0.01 l/s.

Disclaimer

This report was produced using the Greenfield runoff rate estimation tool (2.2.1) developed by HR Wallingford and available at uksuds.com (<https://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 uksuds.com/terms-conditions (<https://www.uksuds.com/terms-conditions>). The outputs from this tool have been used to estimate 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, Centre for Ecology and Hydrology, Wallingford Hydrosolutions or any other organisation for the use of these data in the design or operational characteristics of any drainage scheme.

Appendix E – Drawings

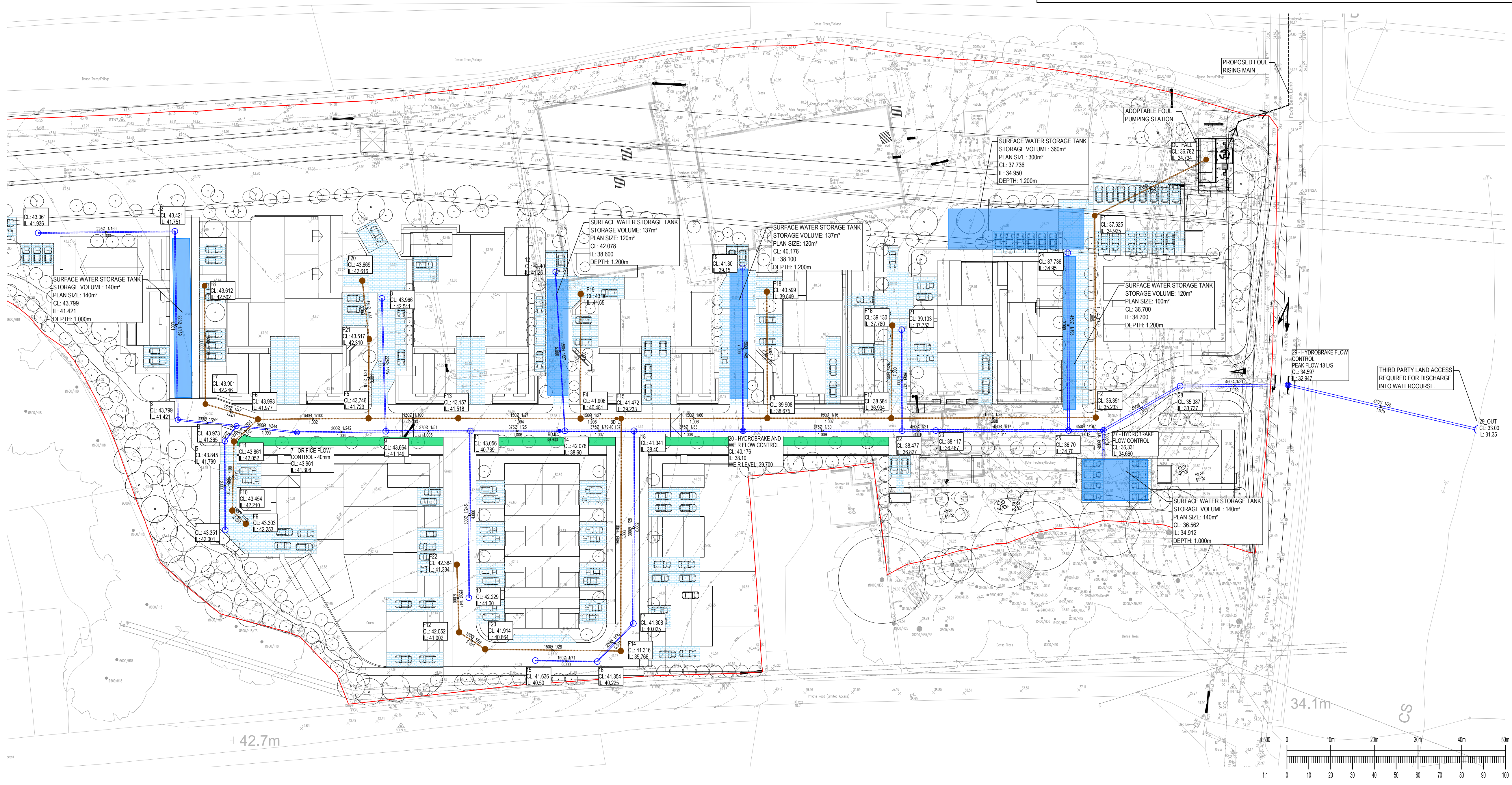


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KEY

- PROPOSED SURFACE WATER SEWER
- PROPOSED SURFACE WATER BACKDROP
- PROPOSED SURFACE WATER FLOW CONTROL
- PROPOSED FOUL WATER SEWER
- PROPOSED FOUL WATER BACKDROP
- PROPOSED FOUL WATER RISING MAIN
- SITE BOUNDARY
- PROPOSED SURFACE WATER RAIN GARDEN
- PROPOSED SURFACE WATER STORAGE TANK
- PROPOSED PERMEABLE / POROUS PAVING



P05	RED LINE BOUNDARY UPDATED	11/11/25	RT	JB
P04	PLANNING	17/10/25	RT	JB
P03	UPDATED TO SUIT REVISED LAYOUT	13/10/25	RT	JB
P02	ISSUED FOR INFORMATION	01/08/25	RT	JB
P01	ISSUED FOR INFORMATION	17/01/25	RT	JB

Rev:	Description:	Date:	By:	Chkd:
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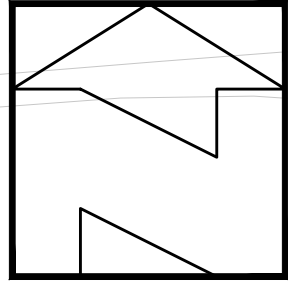
Status: **SUITABLE FOR INFORMATION** **S2**

Project: **HALSNEAD FARM**

Dwg Title: **PROPOSED DRAINAGE**

Drawn By	Designed By	Checked By
RT	RT	JB
Date	17/01/2025	Scales @ A1
1:500		

Project No - Originator - Function - Spatial - Form - Discipline - Number	Revision
087052 - CUR - XX - XX - D - C - 92001	P05



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Name	Area (ha)
1	0.05
2	0.063
3	0.013
4	0.054
5	
6	
7	0.04
8	0.101
9	0.017
10	0.128
11	0.014
12	0.072
14	0.018
15	0.019
16	0.02
17	0.143
18	0.043
19	0.063
20	0.035
21	0.069
22	0.058
23	0.056
24	0.185
25	
26	
27	0.067
28	0.033
29	
29_OUT	

P02	UPDATED REDLINE BOUNDARY	11/11/25	RIT	JDB
P01	PLANNING	17/10/25	RIT	JDB
Rev:	Description:	Date:	By:	Chkd:

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Status:

SUITABLE FOR INFORMATION

S2

Project:

HALSNEAD FARM

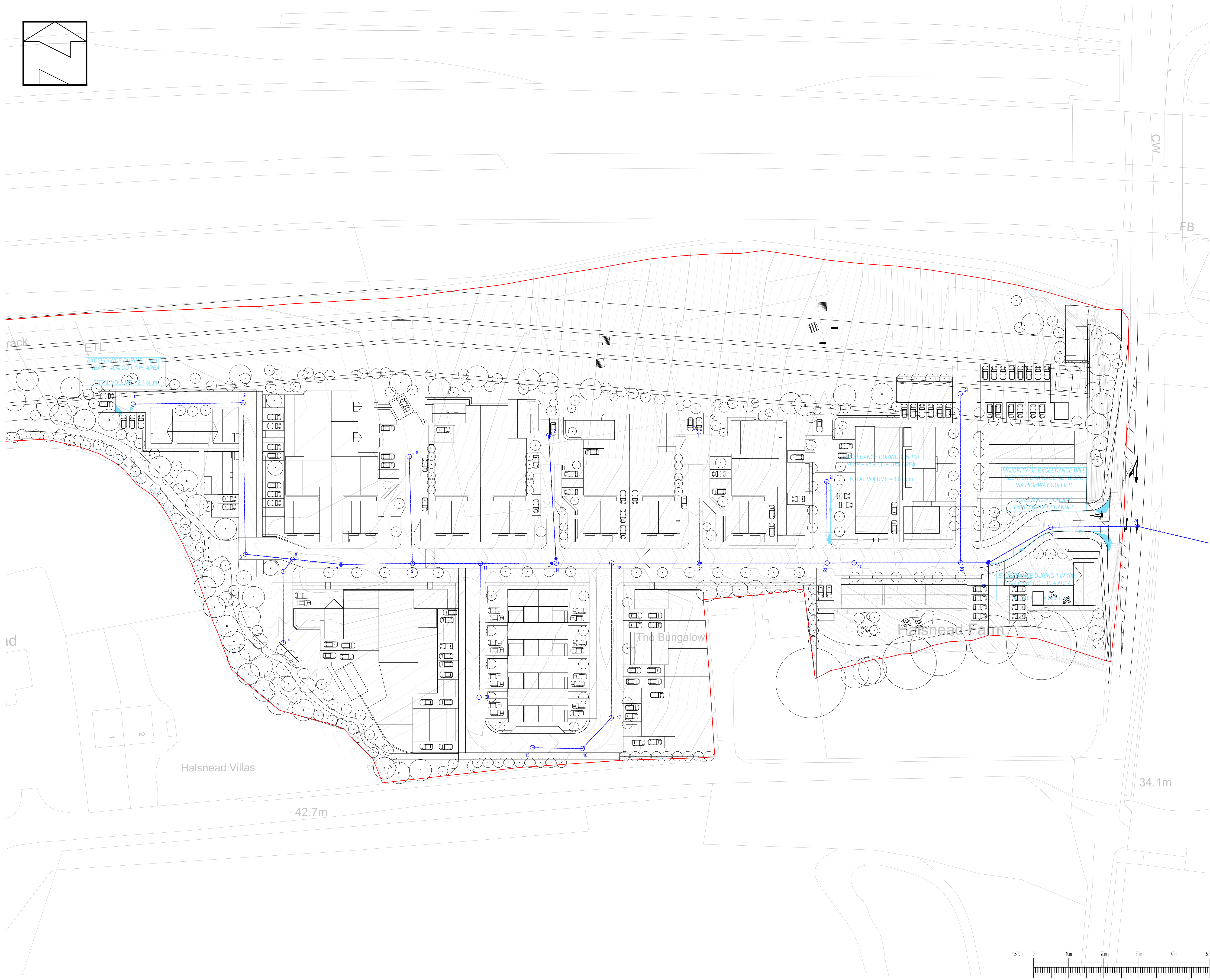
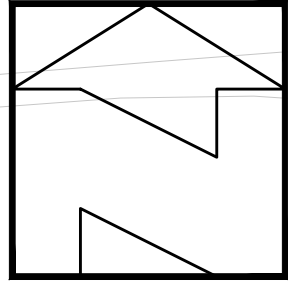
Orig Title:

PROPOSED CATCHMENT AREAS

Drawn By	Designed By	Checked By
RIT	RIT	JDB
Date	17/10/2025	Scales @ A1
		1:500

Project No - Originator - Function - Spatial - Form - Discipline - Number	Revision
087052 - CUR - XX - XX - D - C - 92102	P02

\\LFS-1\Projects\087052-Halsnead_Farm\QA-Production\A4-Models Drawings\CAD\02



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FLOODING ONLY OCCURS WITHIN THE HYDRAULIC SIMULATION DURING THE 1 IN 100 YEAR + CLIMATE CHANGE + 10% AREA.

THE AREAS AND ROUTES SHOWN ARE BASED ON THIS SIMULATION EVENT.

P02	UPDATED REDLINE BOUNDARY	11/11/25	RIT	JDB
P01	PLANNING	17/10/25	RIT	JDB
Rev:	Description:	Date:	By:	Chkd:

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Project: **HALSNEAD FARM**

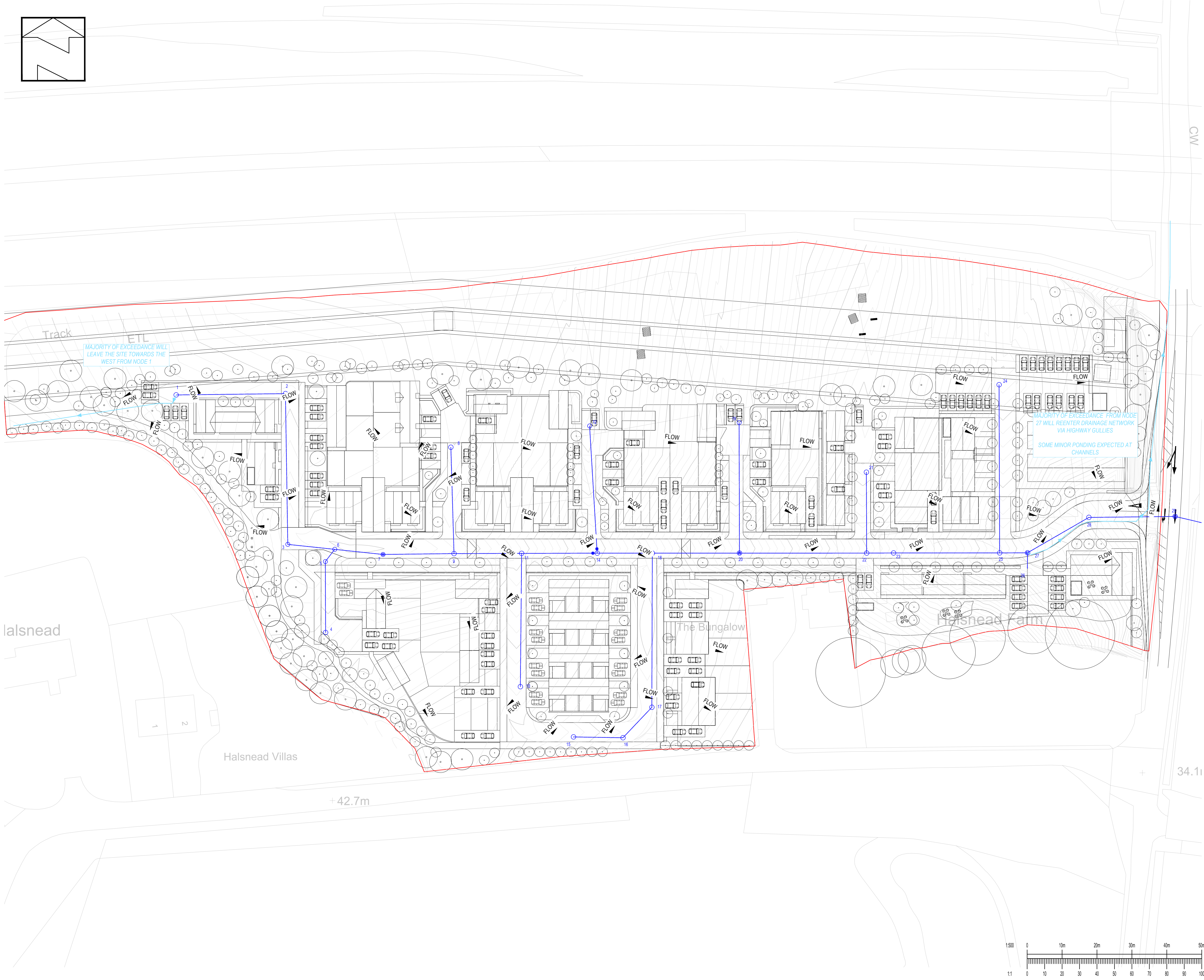
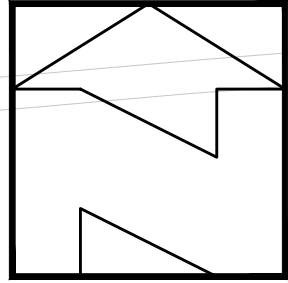
Orig Title: **FLOOD EXCEEDANCE**

Drawn By RIT	Designed By RIT	Checked By JDB
Date 17/10/2025	Scales @ A1 1:500	Revision

Project No - Originator - Function - Spatial - Form - Discipline - Number
087052 - CUR - XX - XX - D - C - 92201

P02

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THE HYDRAULIC SIMULATION PRESENTED ASSUMES A 75% LOSS IN THE DIAMETER OF THE FLOW CONTROL DURING THE 1 IN 100 YEAR + CLIMATE CHANGE.

THE OVERLAND FLOW ROUTE SHOWN ARE BASED ON THIS SIMULATION EVENT.

THE FLOW ARROWS ARE REPRESENTATIVE OF THE GENERAL GRADIENT OF THE PROPOSED AND EXISTING TOPOGRAPHY.

P02	UPDATED REDLINE BOUNDARY	11/11/25	RIT	JDB
P01	PLANNING	17/10/25	RIT	JDB
Rev:	Description:	Date:	By:	Chkd:

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Status: **SUITABLE FOR INFORMATION** **S2**

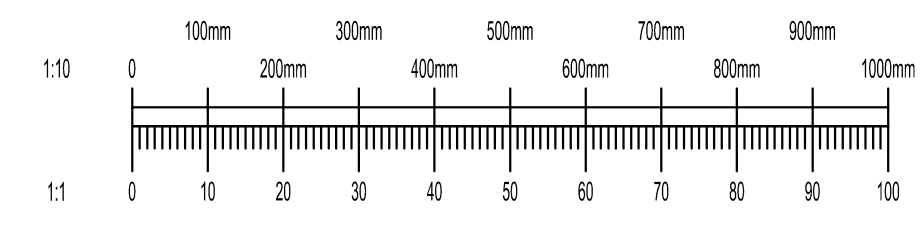
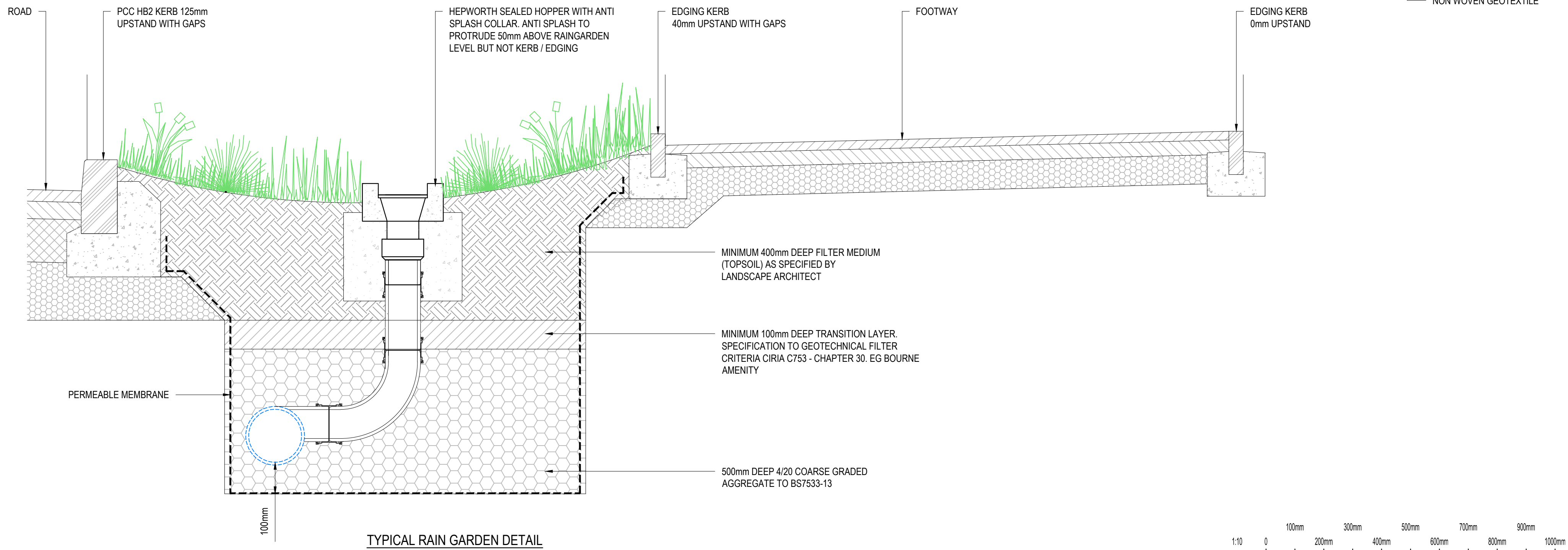
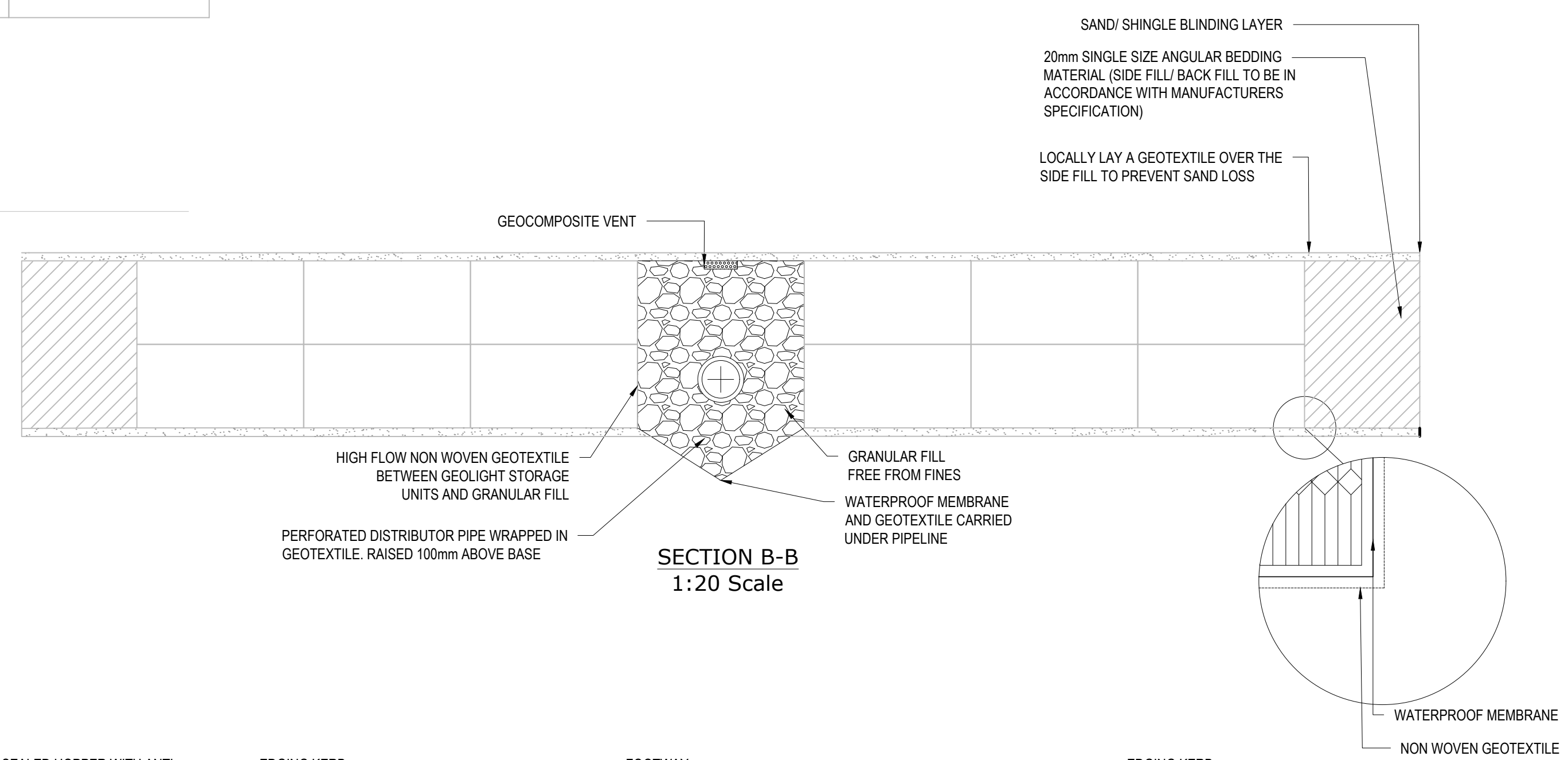
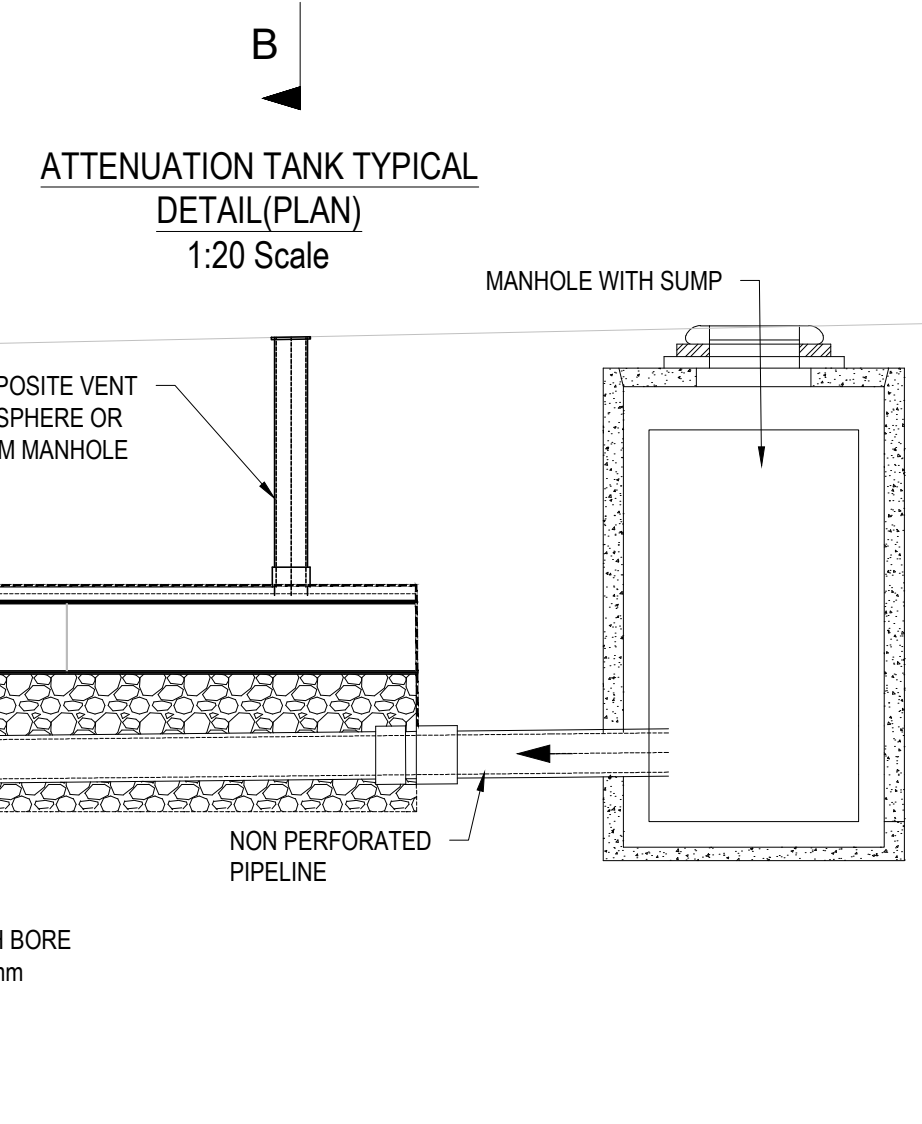
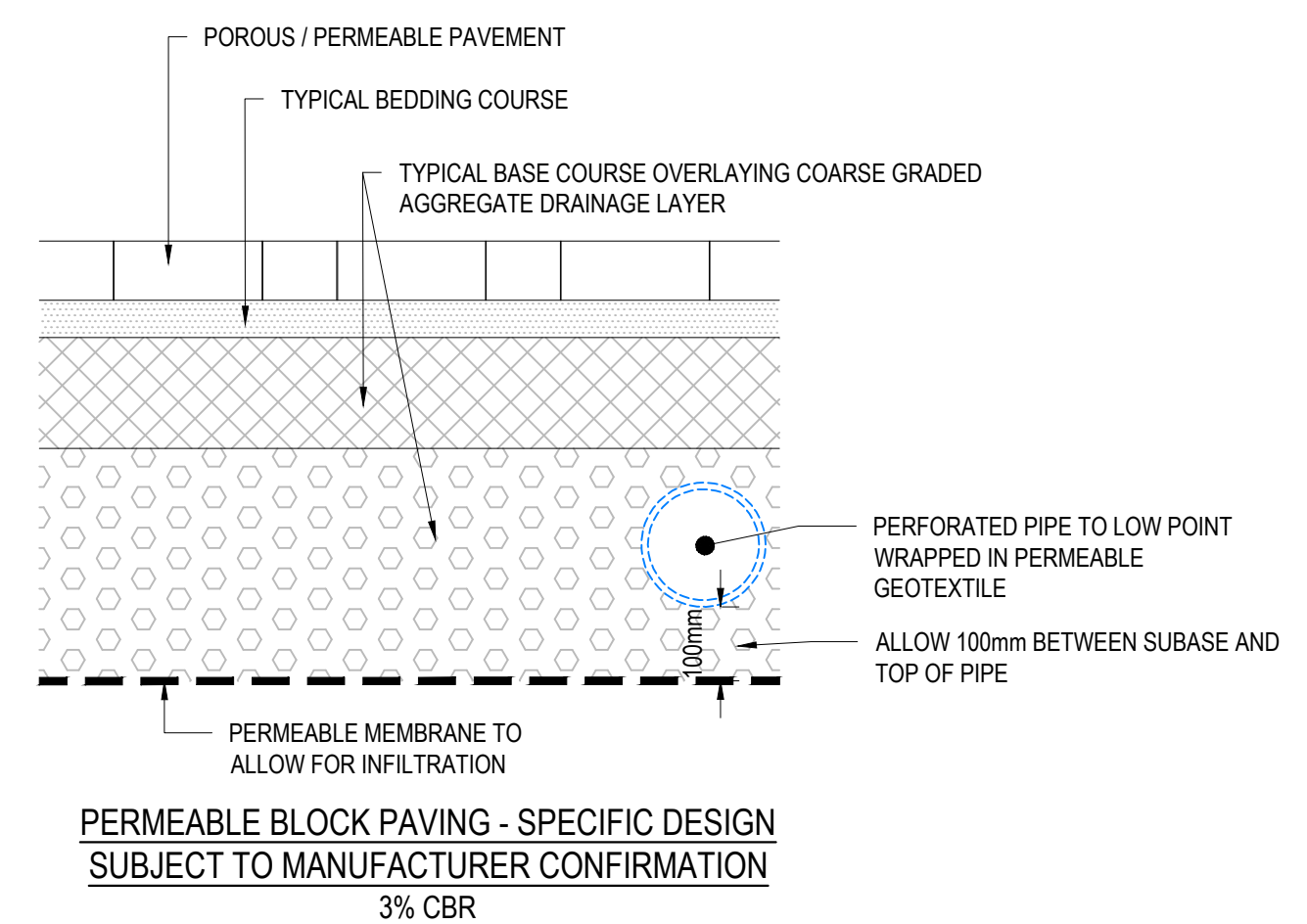
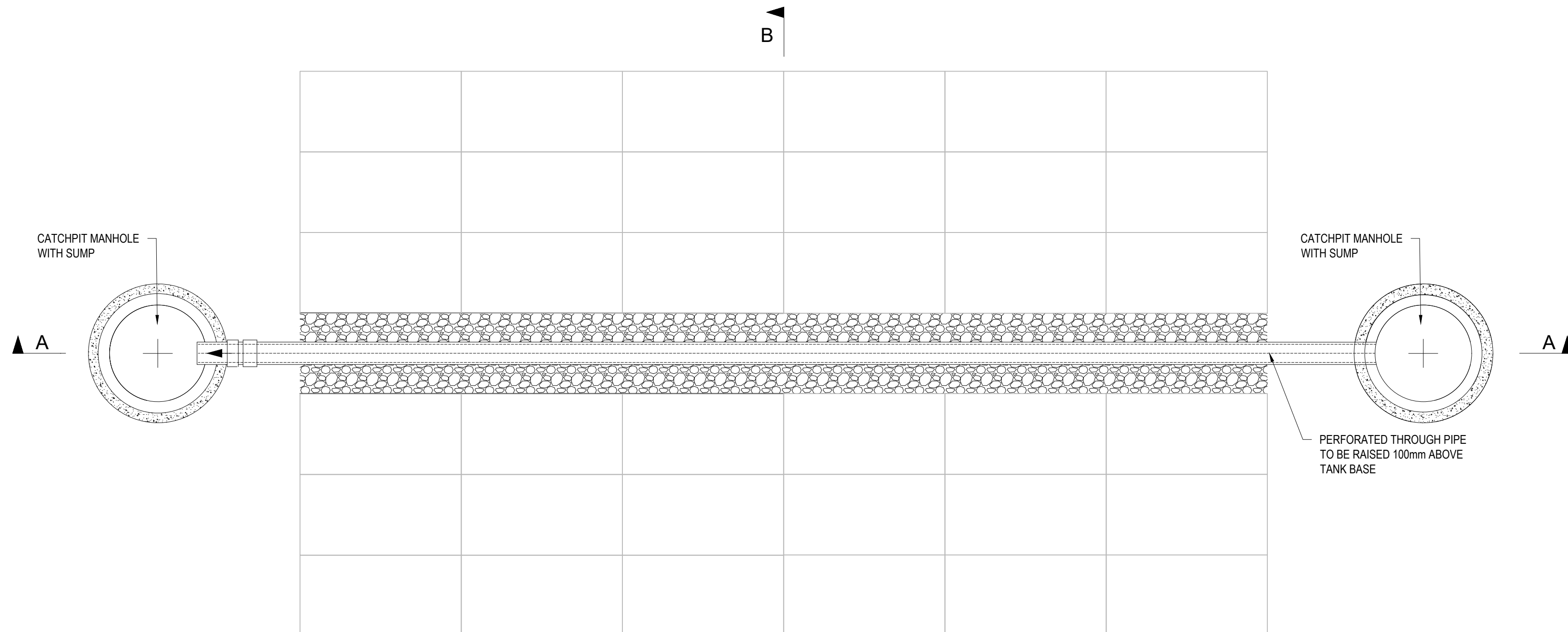
Project: **HALSNEAD FARM**

Orig Title: **CATASTROPHIC FAILURE
FLOOD EXCEEDANCE**

Drawn By RIT	Designed By RIT	Checked By JDB
Date 17/10/2025	Scales @ A1 1:500	Revision

Project No - Originator - Function - Spatial - Form - Discipline - Number
087052 - CUR - XX - XX - D - C - 92202

P02



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P01	PLANNING	17/10/25	VOM	JB
Rev:	Description:	Date:	By:	Chkd:

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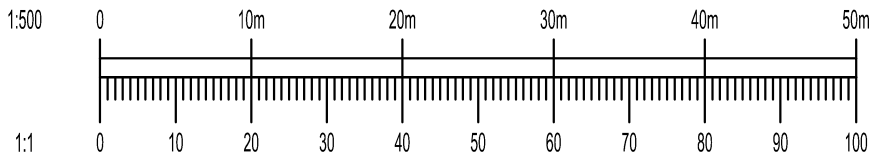
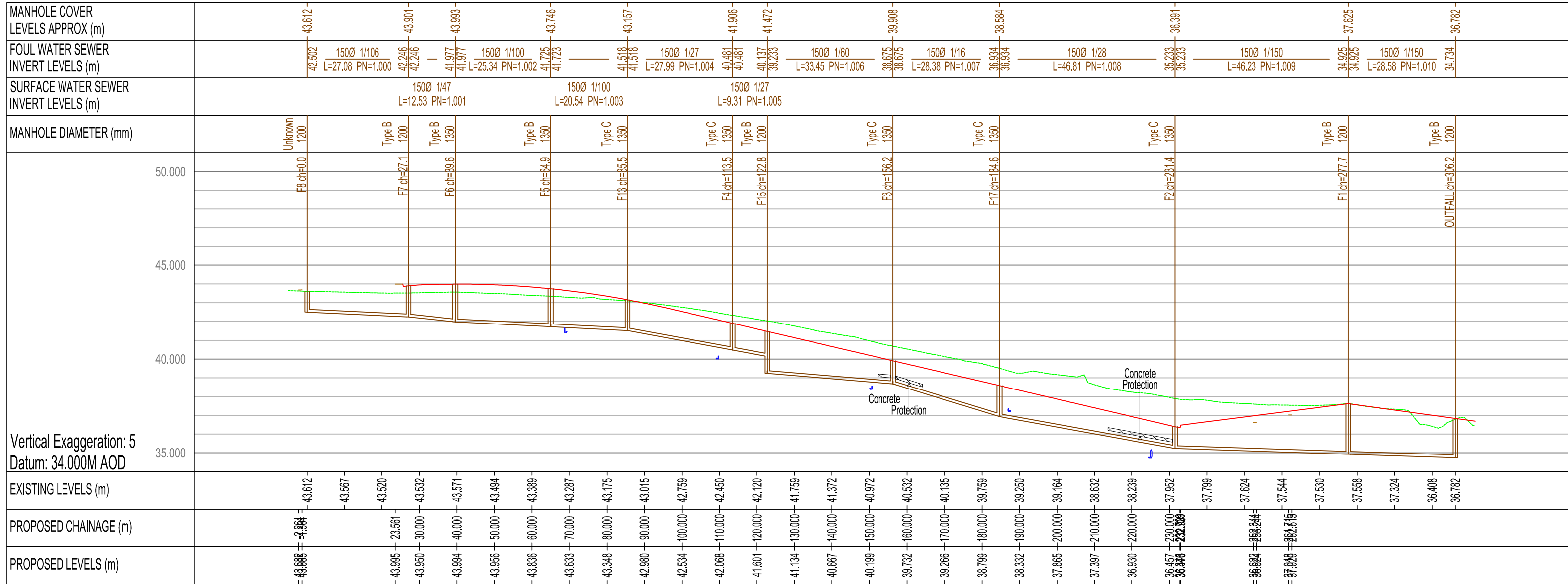
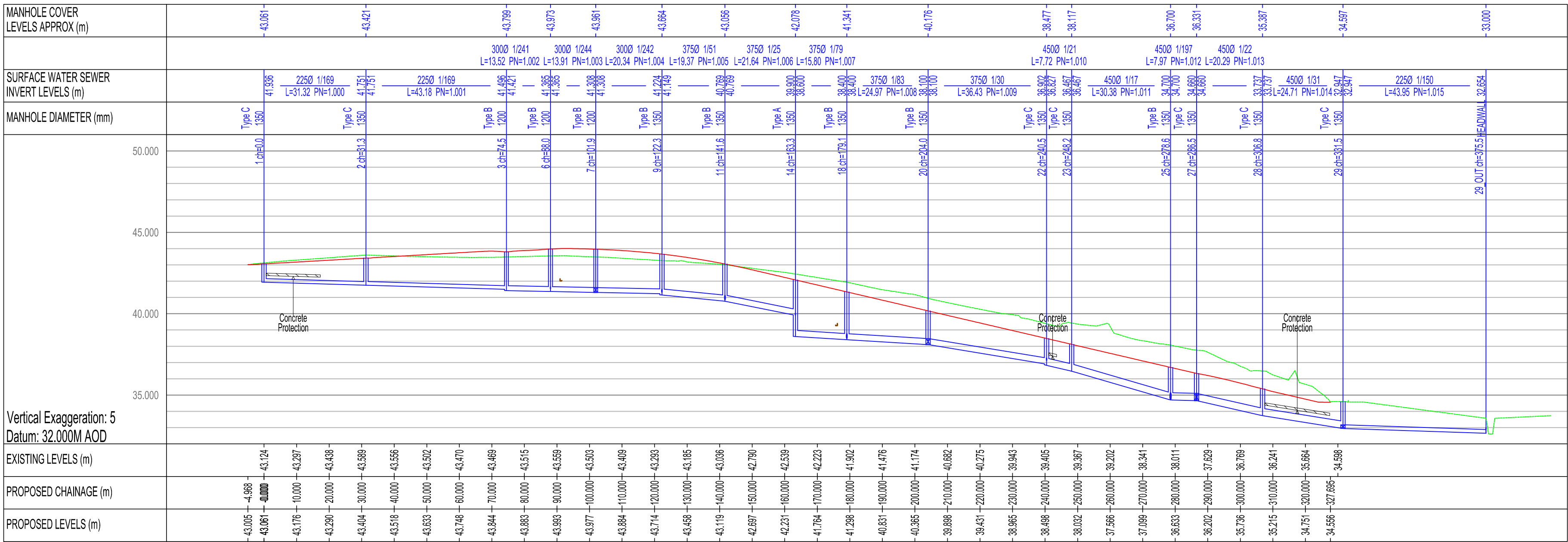
Status: **SUITABLE FOR INFORMATION** **S2**

Project: **HALSNEAD FARM**

Orig Title: **DRAINAGE DETAILS**

Drawn By VOM	Designed By VOM	Checked By JB
Date 17/10/2025	Scales @ A1 1:10	Revision

Project No - Originator - Function - Spatial - Form - Discipline - Number
087052 - CUR - XX - XX - D - C - 92801 **P01**



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P01	PLANNING	17/10/25	RT	JB
Rev:	Description:	Date:	By:	Chkd:

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Status:

SUITABLE FOR INFORMATION

S2

Project:

HALSNEAD FARM

Orig Title:

PROPOSED DRAINAGE

Drawn By	Designed By	Checked By
RT	RT	JB
Date	17/01/2025	Scales @ A1
1:500		
Revision		

Project No - Originator - Function - Spatial - Form - Discipline - Number

087052 - CUR - XX - XX - D - C - 92901

P01

Appendix F – Calculations

Design Settings

Frequency of use (kDU)	1.00	Minimum Velocity (m/s)	1.00
Flow per dwelling per day (l/day)	4000	Connection Type	Level Soffits
Domestic Flow (l/s/ha)	0.6	Minimum Backdrop Height (m)	0.200
Industrial Flow (l/s/ha)	0.5	Preferred Cover Depth (m)	1.200
Additional Flow (%)	0	Include Intermediate Ground	✓

Nodes

Name	Dwellings	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
F8	8	43.612	1200	347531.325	389619.734	1.110
F7	2	43.901	1200	347531.522	389592.658	1.655
F9	3	43.303	1350	347540.770	389565.239	1.050
F10		43.454	1350	347537.680	389568.276	1.244
F11		43.861	1350	347538.077	389584.067	1.809
F6		43.993	1350	347543.553	389589.158	2.016
F20	3	43.669	1350	347567.439	389620.929	1.053
F21		43.517	1350	347568.978	389607.515	1.207
F5	4	43.746	1350	347568.889	389589.394	2.023
F13	2	43.157	1350	347589.426	389589.402	1.639
F19	2	43.000	1350	347617.450	389617.879	1.350
F4	2	41.906	1350	347617.421	389589.335	1.426
F22	6	42.384	1350	347589.080	389555.870	1.050
F12	3	42.052	1350	347589.605	389540.376	1.051
F23		41.914	1350	347595.566	389536.490	1.050
F14	9	41.316	1350	347626.628	389536.083	1.550
F15	3	41.472	1200	347626.727	389589.328	2.239
F18	4	40.599	1350	347660.060	389618.402	1.050
F3		39.908	1350	347660.178	389589.435	1.234
F16	5	39.130	1350	347688.762	389610.658	1.350
F17	3	38.584	1350	347688.553	389589.419	1.651
F2	8	36.391	1350	347735.365	389589.579	1.160
F1	23	37.625	1200	347735.122	389635.811	2.702
OUTFALL		36.782	1200	347760.646	389648.674	2.050

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)
1.000	F8	F7	27.076	1.500	42.502	42.246	0.256	105.8	150
1.001	F7	F6	12.529	1.500	42.246	41.977	0.269	46.6	150
2.000	F9	F10	4.333	1.500	42.253	42.210	0.043	100.8	150
2.001	F10	F11	15.796	1.500	42.210	42.052	0.158	100.0	150
2.002	F11	F6	7.476	1.500	42.052	41.977	0.075	99.7	150

Name	Pro Vel @ 1/3 Q (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Dwellings (ha)	Σ Units (ha)	Σ Add Inflow (ha)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	0.249	0.851	15.0	0.4	0.960	1.505	0.000	8	0.0	0.0	17	0.352
1.001	0.346	1.285	22.7	0.5	1.505	1.866	0.000	10	0.0	0.0	15	0.493
2.000	0.174	0.872	15.4	0.1	0.900	1.094	0.000	3	0.0	0.0	10	0.255
2.001	0.175	0.876	15.5	0.1	1.094	1.659	0.000	3	0.0	0.0	10	0.256
2.002	0.175	0.877	15.5	0.1	1.659	1.866	0.000	3	0.0	0.0	10	0.257

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)
1.002	F6	F5	25.338	1.500	41.977	41.725	0.252	100.5	150
3.000	F20	F21	13.502	1.500	42.616	42.310	0.306	44.1	150
3.001	F21	F5	18.122	1.500	42.310	41.724	0.586	30.9	150
1.003	F5	F13	20.536	1.500	41.723	41.518	0.205	100.2	150
1.004	F13	F4	27.995	1.500	41.518	40.481	1.037	27.0	150
4.000	F19	F4	28.544	1.500	41.650	40.480	1.170	24.4	150
1.005	F4	F15	9.306	1.500	40.480	40.135	0.345	27.0	150
5.000	F22	F12	15.502	1.500	41.334	41.001	0.333	46.6	150
5.001	F12	F23	7.117	1.500	41.001	40.864	0.137	51.9	150
5.002	F23	F14	31.064	1.500	40.864	39.766	1.098	28.3	150
5.003	F14	F15	53.245	1.500	39.766	39.233	0.533	99.9	150
1.006	F15	F3	33.452	1.500	39.233	38.675	0.558	59.9	150
6.000	F18	F3	28.968	1.500	39.549	38.674	0.875	33.1	150
1.007	F3	F17	28.375	1.500	38.674	36.933	1.741	16.3	150
7.000	F16	F17	21.239	1.500	37.780	36.934	0.846	25.1	150
1.008	F17	F2	46.812	1.500	36.933	35.231	1.702	27.5	150
1.009	F2	F1	46.233	1.500	35.231	34.923	0.308	150.1	150
1.010	F1	OUTFALL	28.582	1.500	34.923	34.732	0.191	149.6	150

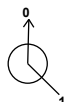
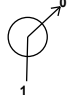
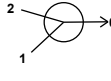
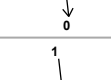
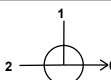
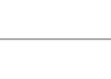
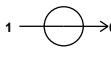
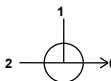
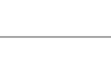
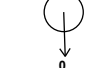
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1.002	0.296	0.874	15.4	0.6	1.866	1.871	0.000	13	0.0	0.0	20	0.411
3.000	0.245	1.321	23.3	0.1	0.903	1.057	0.000	3	0.0	0.0	8	0.339
3.001	0.270	1.580	27.9	0.1	1.057	1.872	0.000	3	0.0	0.0	8	0.384
1.003	0.335	0.875	15.5	0.9	1.873	1.489	0.000	20	0.0	0.0	25	0.471
1.004	0.538	1.690	29.9	1.0	1.489	1.275	0.000	22	0.0	0.0	19	0.766
4.000	0.245	1.778	31.4	0.1	1.200	1.276	0.000	2	0.0	0.0	6	0.358
1.005	0.577	1.690	29.9	1.2	1.276	1.187	0.000	26	0.0	0.0	21	0.812
5.000	0.295	1.285	22.7	0.3	0.900	0.901	0.000	6	0.0	0.0	12	0.423
5.001	0.327	1.218	21.5	0.4	0.901	0.900	0.000	9	0.0	0.0	15	0.467
5.002	0.402	1.651	29.2	0.4	0.900	1.400	0.000	9	0.0	0.0	13	0.563
5.003	0.326	0.876	15.5	0.8	1.400	2.089	0.000	18	0.0	0.0	24	0.458
1.006	0.523	1.133	20.0	2.2	2.089	1.083	0.000	47	0.0	0.0	34	0.739
6.000	0.284	1.526	27.0	0.2	0.900	1.084	0.000	4	0.0	0.0	9	0.411
1.007	0.838	2.177	38.5	2.4	1.084	1.501	0.000	51	0.0	0.0	25	1.194
7.000	0.327	1.753	31.0	0.2	1.200	1.500	0.000	5	0.0	0.0	10	0.495
1.008	0.743	1.675	29.6	2.7	1.501	1.010	0.000	59	0.0	0.0	31	1.034
1.009	0.424	0.714	12.6	3.1	1.010	2.552	0.000	67	0.0	0.0	51	0.589
1.010	0.466	0.715	12.6	4.2	2.552	1.900	0.000	90	0.0	0.0	59	0.641

Pipeline Schedule

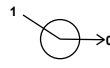
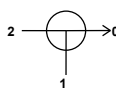
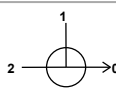
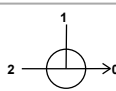
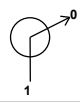
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1.000	27.076	105.8	150	Circular	43.612	42.502	0.960	43.901	42.246	1.505
1.001	12.529	46.6	150	Circular	43.901	42.246	1.505	43.993	41.977	1.866
2.000	4.333	100.8	150	Circular	43.303	42.253	0.900	43.454	42.210	1.094
2.001	15.796	100.0	150	Circular	43.454	42.210	1.094	43.861	42.052	1.659
2.002	7.476	99.7	150	Circular	43.861	42.052	1.659	43.993	41.977	1.866
1.002	25.338	100.5	150	Circular	43.993	41.977	1.866	43.746	41.725	1.871
3.000	13.502	44.1	150	Circular	43.669	42.616	0.903	43.517	42.310	1.057
3.001	18.122	30.9	150	Circular	43.517	42.310	1.057	43.746	41.724	1.872
1.003	20.536	100.2	150	Circular	43.746	41.723	1.873	43.157	41.518	1.489
1.004	27.995	27.0	150	Circular	43.157	41.518	1.489	41.906	40.481	1.275
4.000	28.544	24.4	150	Circular	43.000	41.650	1.200	41.906	40.480	1.276
1.005	9.306	27.0	150	Circular	41.906	40.480	1.276	41.472	40.135	1.187
5.000	15.502	46.6	150	Circular	42.384	41.334	0.900	42.052	41.001	0.901
5.001	7.117	51.9	150	Circular	42.052	41.001	0.901	41.914	40.864	0.900
5.002	31.064	28.3	150	Circular	41.914	40.864	0.900	41.316	39.766	1.400
5.003	53.245	99.9	150	Circular	41.316	39.766	1.400	41.472	39.233	2.089
1.006	33.452	59.9	150	Circular	41.472	39.233	2.089	39.908	38.675	1.083
6.000	28.968	33.1	150	Circular	40.599	39.549	0.900	39.908	38.674	1.084
1.007	28.375	16.3	150	Circular	39.908	38.674	1.084	38.584	36.933	1.501
7.000	21.239	25.1	150	Circular	39.130	37.780	1.200	38.584	36.934	1.500
1.008	46.812	27.5	150	Circular	38.584	36.933	1.501	36.391	35.231	1.010
1.009	46.233	150.1	150	Circular	36.391	35.231	1.010	37.625	34.923	2.552
1.010	28.582	149.6	150	Circular	37.625	34.923	2.552	36.782	34.732	1.900

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	F8	1200	Manhole	Adoptable	F7	1200	Manhole	Adoptable
1.001	F7	1200	Manhole	Adoptable	F6	1350	Manhole	Adoptable
2.000	F9	1350	Manhole	Adoptable	F10	1350	Manhole	Adoptable
2.001	F10	1350	Manhole	Adoptable	F11	1350	Manhole	Adoptable
2.002	F11	1350	Manhole	Adoptable	F6	1350	Manhole	Adoptable
1.002	F6	1350	Manhole	Adoptable	F5	1350	Manhole	Adoptable
3.000	F20	1350	Manhole	Adoptable	F21	1350	Manhole	Adoptable
3.001	F21	1350	Manhole	Adoptable	F5	1350	Manhole	Adoptable
1.003	F5	1350	Manhole	Adoptable	F13	1350	Manhole	Adoptable
1.004	F13	1350	Manhole	Adoptable	F4	1350	Manhole	Adoptable
4.000	F19	1350	Manhole	Adoptable	F4	1350	Manhole	Adoptable
1.005	F4	1350	Manhole	Adoptable	F15	1200	Manhole	Adoptable
5.000	F22	1350	Manhole	Adoptable	F12	1350	Manhole	Adoptable
5.001	F12	1350	Manhole	Adoptable	F23	1350	Manhole	Adoptable
5.002	F23	1350	Manhole	Adoptable	F14	1350	Manhole	Adoptable
5.003	F14	1350	Manhole	Adoptable	F15	1200	Manhole	Adoptable
1.006	F15	1200	Manhole	Adoptable	F3	1350	Manhole	Adoptable
6.000	F18	1350	Manhole	Adoptable	F3	1350	Manhole	Adoptable
1.007	F3	1350	Manhole	Adoptable	F17	1350	Manhole	Adoptable
7.000	F16	1350	Manhole	Adoptable	F17	1350	Manhole	Adoptable
1.008	F17	1350	Manhole	Adoptable	F2	1350	Manhole	Adoptable
1.009	F2	1350	Manhole	Adoptable	F1	1200	Manhole	Adoptable
1.010	F1	1200	Manhole	Adoptable	OUTFALL	1200	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
F8	347531.325	389619.734	43.612	1.110	1200		0	1.000	42.502	150
F7	347531.522	389592.658	43.901	1.655	1200		1	1.000	42.246	150
							0	1.001	42.246	150
F9	347540.770	389565.239	43.303	1.050	1350		0	2.000	42.253	150
F10	347537.680	389568.276	43.454	1.244	1350		1	2.000	42.210	150
							0	2.001	42.210	150
F11	347538.077	389584.067	43.861	1.809	1350		1	2.001	42.052	150
							0	2.002	42.052	150
F6	347543.553	389589.158	43.993	2.016	1350		1	2.002	41.977	150
							2	1.001	41.977	150
							0	1.002	41.977	150
F20	347567.439	389620.929	43.669	1.053	1350		0	3.000	42.616	150
F21	347568.978	389607.515	43.517	1.207	1350		1	3.000	42.310	150
							0	3.001	42.310	150
F5	347568.889	389589.394	43.746	2.023	1350		1	3.001	41.724	150
							2	1.002	41.725	150
							0	1.003	41.723	150
F13	347589.426	389589.402	43.157	1.639	1350		1	1.003	41.518	150
							0	1.004	41.518	150
F19	347617.450	389617.879	43.000	1.350	1350		0	4.000	41.650	150
F4	347617.421	389589.335	41.906	1.426	1350		1	4.000	40.480	150
							2	1.004	40.481	150
							0	1.005	40.480	150
F22	347589.080	389555.870	42.384	1.050	1350		0	5.000	41.334	150

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
F12	347589.605	389540.376	42.052	1.051	1350		1	5.000	41.001	150
							0	5.001	41.001	150
F23	347595.566	389536.490	41.914	1.050	1350		1	5.001	40.864	150
							0	5.002	40.864	150
F14	347626.628	389536.083	41.316	1.550	1350		1	5.002	39.766	150
							0	5.003	39.766	150
F15	347626.727	389589.328	41.472	2.239	1200		1	5.003	39.233	150
							2	1.005	40.135	150
							0	1.006	39.233	150
F18	347660.060	389618.402	40.599	1.050	1350		0	6.000	39.549	150
F3	347660.178	389589.435	39.908	1.234	1350		1	6.000	38.674	150
							2	1.006	38.675	150
							0	1.007	38.674	150
F16	347688.762	389610.658	39.130	1.350	1350		0	7.000	37.780	150
F17	347688.553	389589.419	38.584	1.651	1350		1	7.000	36.934	150
							2	1.007	36.933	150
							0	1.008	36.933	150
F2	347735.365	389589.579	36.391	1.160	1350		1	1.008	35.231	150
							0	1.009	35.231	150
F1	347735.122	389635.811	37.625	2.702	1200		1	1.009	34.923	150
							0	1.010	34.923	150
OUTFALL	347760.646	389648.674	36.782	2.050	1200		1	1.010	34.732	150

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	2	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	1.500
Ratio-R	0.400	Preferred Cover Depth (m)	1.200
CV	1.000	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	x

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
1	0.050	5.00	43.061	1350	347493.221	389631.849	1.125
2	0.063	5.00	43.421	1200	347524.534	389632.223	1.670
3	0.013	5.00	43.799	1200	347525.207	389589.048	2.378
4	0.054	5.00	43.351	1350	347536.042	389563.801	1.350
5			43.845	1350	347535.962	389584.126	2.046
6			43.973	1200	347538.650	389587.626	2.608
7	0.040	5.00	43.961	1200	347552.483	389586.162	2.653
8	0.101	5.00	43.966	1350	347571.919	389616.872	1.425
9	0.017	5.00	43.664	1200	347572.820	389586.409	2.515
10	0.128	5.00	42.229	1350	347591.828	389548.290	1.229
11	0.014	5.00	43.056	1200	347592.191	389586.467	2.287
12	0.072	5.00	43.400	1350	347611.570	389622.954	2.150
14	0.018	5.00	42.078	1350	347613.829	389586.532	3.478
15	0.019	5.00	41.636	1350	347607.033	389533.897	1.136
16	0.020	5.00	41.354	1350	347621.214	389533.665	1.129
17	0.143	5.00	41.308	1350	347629.488	389542.389	1.283
18	0.043	5.00	41.341	1200	347629.625	389586.537	2.941
19	0.063	5.00	41.300	1350	347654.485	389623.927	2.150
20	0.035	5.00	40.176	1800	347654.592	389586.544	2.076
21	0.069	5.00	39.103	1350	347690.945	389609.702	1.350
22	0.058	5.00	38.477	1350	347691.019	389586.554	1.650
23	0.056	5.00	38.117	1350	347698.737	389586.582	1.650
24	0.185	5.00	37.736	1350	347728.946	389634.777	2.786
25			36.700	1350	347729.120	389586.607	2.000
26		5.00	36.562	100	347737.070	389582.246	1.650
27	0.067	5.00	36.331	1800	347737.093	389586.635	1.672
28	0.033	5.00	35.387	1350	347754.673	389596.771	1.650
29			34.597	1800	347779.384	389597.047	1.650
29_OUT			33.000	100	347822.170	389586.998	1.650

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)
1.000	1	2	31.315	0.600	41.936	41.751	0.185	169.3	225	5.52	50.0
1.001	2	3	43.180	0.600	41.751	41.496	0.255	169.3	225	6.24	50.0
1.002	3	6	13.518	0.600	41.421	41.365	0.056	241.4	300	6.46	50.0
2.000	4	5	20.325	0.600	42.001	41.799	0.202	100.6	150	5.34	50.0
2.001	5	6	4.413	0.600	41.799	41.515	0.284	15.5	150	5.37	50.0
1.003	6	7	13.910	0.600	41.365	41.308	0.057	244.0	300	6.69	50.0
1.004	7	9	20.338	0.600	41.308	41.224	0.084	242.1	300	7.03	50.0
3.000	8	9	30.476	0.600	42.541	41.299	1.242	24.5	225	5.19	50.0
1.005	9	11	19.371	0.600	41.149	40.769	0.380	51.0	375	7.16	50.0
4.000	10	11	38.179	0.600	41.000	40.844	0.156	244.7	300	5.64	50.0
1.006	11	14	21.638	0.600	40.769	39.900	0.869	24.9	375	7.26	50.0
5.000	12	14	36.492	0.600	41.250	39.900	1.350	27.0	150	5.31	50.0
1.007	14	18	15.796	0.600	38.600	38.400	0.200	79.0	375	7.39	50.0
6.000	15	16	14.183	0.600	40.500	40.300	0.200	70.9	150	5.20	50.0
6.001	16	17	12.024	0.600	40.225	40.100	0.125	96.2	225	5.35	50.0
6.002	17	18	44.148	0.600	40.025	38.475	1.550	28.5	300	5.60	50.0
1.008	18	20	24.967	0.600	38.400	38.100	0.300	83.2	375	7.60	50.0
7.000	19	20	37.383	0.600	39.150	38.325	0.825	45.3	150	5.42	50.0
1.009	20	22	36.427	0.600	38.100	36.902	1.198	30.4	375	7.78	50.0
8.000	21	22	23.148	0.600	37.753	37.127	0.626	37.0	150	5.23	50.0
1.010	22	23	7.718	0.600	36.827	36.467	0.360	21.4	450	7.81	50.0
1.011	23	25	30.383	0.600	36.467	34.700	1.767	17.2	450	7.91	50.0
9.000	24	25	48.170	0.600	34.950	34.700	0.250	192.7	450	5.55	50.0

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)
1.000	1.002	39.8	9.0	0.900	1.445	0.050	0.0	73	0.813
1.001	1.002	39.8	20.4	1.445	2.078	0.113	0.0	114	1.006
1.002	1.007	71.2	22.8	2.078	2.308	0.126	0.0	116	0.899
2.000	1.001	17.7	9.8	1.200	1.896	0.054	0.0	79	1.025
2.001	2.568	45.4	9.8	1.896	2.308	0.054	0.0	47	2.054
1.003	1.002	70.8	32.5	2.308	2.353	0.180	0.0	143	0.981
1.004	1.006	71.1	39.8	2.353	2.140	0.220	0.0	160	1.032
3.000	2.652	105.4	18.3	1.200	2.140	0.101	0.0	63	1.996
1.005	2.542	280.8	61.1	2.140	1.912	0.338	0.0	118	2.049
4.000	1.000	70.7	23.1	0.929	1.912	0.128	0.0	118	0.899
1.006	3.643	402.4	86.7	1.912	1.803	0.480	0.0	118	2.928
5.000	1.944	34.4	13.0	2.000	2.028	0.072	0.0	64	1.814
1.007	2.040	225.3	103.0	3.103	2.566	0.570	0.0	178	1.995
6.000	1.195	21.1	3.4	0.986	0.904	0.019	0.0	41	0.880
6.001	1.333	53.0	7.0	0.904	0.983	0.039	0.0	55	0.929
6.002	2.957	209.0	32.9	0.983	2.566	0.182	0.0	80	2.176
1.008	1.987	219.5	143.7	2.566	1.701	0.795	0.0	222	2.113
7.000	1.498	26.5	11.4	2.000	1.701	0.063	0.0	69	1.444
1.009	3.296	364.0	161.4	1.701	1.200	0.893	0.0	175	3.200
8.000	1.660	29.3	12.5	1.200	1.200	0.069	0.0	68	1.594
1.010	4.405	700.6	184.3	1.200	1.200	1.020	0.0	157	3.741
1.011	4.920	782.6	194.4	1.200	1.550	1.076	0.0	152	4.108
9.000	1.461	232.3	33.4	2.336	1.550	0.185	0.0	115	1.051

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)
1.012	25	27	7.973	0.600	34.700	34.660	0.040	196.9	450	8.00	50.0
10.000	26	27	4.389	0.600	34.912	34.660	0.252	17.4	450	5.01	50.0
1.013	27	28	20.293	0.600	34.660	33.737	0.923	22.0	450	8.08	50.0
1.014	28	29	24.713	0.600	33.737	32.947	0.790	31.3	450	8.20	50.0
1.015	29	29_OUT	43.950	0.600	32.947	31.350	1.597	27.5	450	8.38	50.0

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)
1.012	1.445	229.8	227.9	1.550	1.222	1.261	0.0	369	1.635
10.000	4.894	778.3	0.0	1.200	1.222	0.000	0.0	0	0.000
1.013	4.349	691.6	240.0	1.222	1.200	1.328	0.0	182	3.970
1.014	3.645	579.7	245.9	1.200	1.200	1.361	0.0	204	3.501
1.015	3.887	618.1	245.9	1.200	1.200	1.361	0.0	197	3.677

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)
1.000	31.315	169.3	225	Circular	43.061	41.936	0.900	43.421	41.751	1.445
1.001	43.180	169.3	225	Circular	43.421	41.751	1.445	43.799	41.496	2.078
1.002	13.518	241.4	300	Circular	43.799	41.421	2.078	43.973	41.365	2.308
2.000	20.325	100.6	150	Circular	43.351	42.001	1.200	43.845	41.799	1.896
2.001	4.413	15.5	150	Circular	43.845	41.799	1.896	43.973	41.515	2.308
1.003	13.910	244.0	300	Circular	43.973	41.365	2.308	43.961	41.308	2.353
1.004	20.338	242.1	300	Circular	43.961	41.308	2.353	43.664	41.224	2.140
3.000	30.476	24.5	225	Circular	43.966	42.541	1.200	43.664	41.299	2.140
1.005	19.371	51.0	375	Circular	43.664	41.149	2.140	43.056	40.769	1.912
4.000	38.179	244.7	300	Circular	42.229	41.000	0.929	43.056	40.844	1.912
1.006	21.638	24.9	375	Circular	43.056	40.769	1.912	42.078	39.900	1.803
5.000	36.492	27.0	150	Circular	43.400	41.250	2.000	42.078	39.900	2.028
1.007	15.796	79.0	375	Circular	42.078	38.600	3.103	41.341	38.400	2.566
6.000	14.183	70.9	150	Circular	41.636	40.500	0.986	41.354	40.300	0.904

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	1	1350	Manhole	Adoptable	2	1200	Manhole	Adoptable
1.001	2	1200	Manhole	Adoptable	3	1200	Manhole	Adoptable
1.002	3	1200	Manhole	Adoptable	6	1200	Manhole	Adoptable
2.000	4	1350	Manhole	Adoptable	5	1350	Manhole	Adoptable
2.001	5	1350	Manhole	Adoptable	6	1200	Manhole	Adoptable
1.003	6	1200	Manhole	Adoptable	7	1200	Manhole	Adoptable
1.004	7	1200	Manhole	Adoptable	9	1200	Manhole	Adoptable
3.000	8	1350	Manhole	Adoptable	9	1200	Manhole	Adoptable
1.005	9	1200	Manhole	Adoptable	11	1200	Manhole	Adoptable
4.000	10	1350	Manhole	Adoptable	11	1200	Manhole	Adoptable
1.006	11	1200	Manhole	Adoptable	14	1350	Manhole	Adoptable
5.000	12	1350	Manhole	Adoptable	14	1350	Manhole	Adoptable
1.007	14	1350	Manhole	Adoptable	18	1200	Manhole	Adoptable
6.000	15	1350	Manhole	Adoptable	16	1350	Manhole	Adoptable

Pipeline Schedule

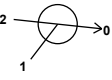
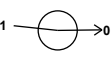
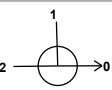
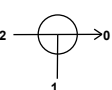
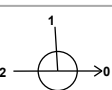
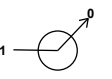
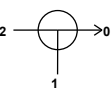
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
6.001	12.024	96.2	225	Circular	41.354	40.225	0.904	41.308	40.100	0.983
6.002	44.148	28.5	300	Circular	41.308	40.025	0.983	41.341	38.475	2.566
1.008	24.967	83.2	375	Circular	41.341	38.400	2.566	40.176	38.100	1.701
7.000	37.383	45.3	150	Circular	41.300	39.150	2.000	40.176	38.325	1.701
1.009	36.427	30.4	375	Circular	40.176	38.100	1.701	38.477	36.902	1.200
8.000	23.148	37.0	150	Circular	39.103	37.753	1.200	38.477	37.127	1.200
1.010	7.718	21.4	450	Circular	38.477	36.827	1.200	38.117	36.467	1.200
1.011	30.383	17.2	450	Circular	38.117	36.467	1.200	36.700	34.700	1.550
9.000	48.170	192.7	450	Circular	37.736	34.950	2.336	36.700	34.700	1.550
1.012	7.973	196.9	450	Circular	36.700	34.700	1.550	36.331	34.660	1.222
10.000	4.389	17.4	450	Circular	36.562	34.912	1.200	36.331	34.660	1.222
1.013	20.293	22.0	450	Circular	36.331	34.660	1.222	35.387	33.737	1.200
1.014	24.713	31.3	450	Circular	35.387	33.737	1.200	34.597	32.947	1.200
1.015	43.950	27.5	450	Circular	34.597	32.947	1.200	33.000	31.350	1.200

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
6.001	16	1350	Manhole	Adoptable	17	1350	Manhole	Adoptable
6.002	17	1350	Manhole	Adoptable	18	1200	Manhole	Adoptable
1.008	18	1200	Manhole	Adoptable	20	1800	Manhole	Adoptable
7.000	19	1350	Manhole	Adoptable	20	1800	Manhole	Adoptable
1.009	20	1800	Manhole	Adoptable	22	1350	Manhole	Adoptable
8.000	21	1350	Manhole	Adoptable	22	1350	Manhole	Adoptable
1.010	22	1350	Manhole	Adoptable	23	1350	Manhole	Adoptable
1.011	23	1350	Manhole	Adoptable	25	1350	Manhole	Adoptable
9.000	24	1350	Manhole	Adoptable	25	1350	Manhole	Adoptable
1.012	25	1350	Manhole	Adoptable	27	1800	Manhole	Adoptable
10.000	26	100	Manhole	Adoptable	27	1800	Manhole	Adoptable
1.013	27	1800	Manhole	Adoptable	28	1350	Manhole	Adoptable
1.014	28	1350	Manhole	Adoptable	29	1800	Manhole	Adoptable
1.015	29	1800	Manhole	Adoptable	29_OUT	100	Manhole	Adoptable

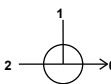
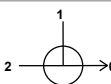
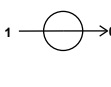
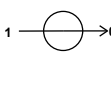
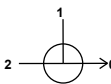
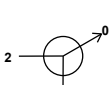
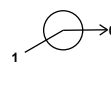
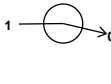
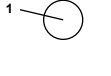
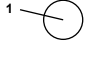
Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
1	347493.221	389631.849	43.061	1.125	1350				
						0	1.000	41.936	225
2	347524.534	389632.223	43.421	1.670	1200				
						0	1.001	41.751	225
3	347525.207	389589.048	43.799	2.378	1200				
						0	1.002	41.421	300
4	347536.042	389563.801	43.351	1.350	1350				
						0	2.000	42.001	150

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
5	347535.962	389584.126	43.845	2.046	1350		1 2.000	41.799	150
							0 2.001	41.799	150
6	347538.650	389587.626	43.973	2.608	1200		1 2.001	41.515	150
							2 1.002	41.365	300
							0 1.003	41.365	300
7	347552.483	389586.162	43.961	2.653	1200		1 1.003	41.308	300
							0 1.004	41.308	300
8	347571.919	389616.872	43.966	1.425	1350		0 3.000	42.541	225
9	347572.820	389586.409	43.664	2.515	1200		1 3.000	41.299	225
							2 1.004	41.224	300
							0 1.005	41.149	375
10	347591.828	389548.290	42.229	1.229	1350		0 4.000	41.000	300
11	347592.191	389586.467	43.056	2.287	1200		1 4.000	40.844	300
							2 1.005	40.769	375
							0 1.006	40.769	375
12	347611.570	389622.954	43.400	2.150	1350		0 5.000	41.250	150
14	347613.829	389586.532	42.078	3.478	1350		1 5.000	39.900	150
							2 1.006	39.900	375
							0 1.007	38.600	375
15	347607.033	389533.897	41.636	1.136	1350		0 6.000	40.500	150
16	347621.214	389533.665	41.354	1.129	1350		1 6.000	40.300	150
							0 6.001	40.225	225
17	347629.488	389542.389	41.308	1.283	1350		1 6.001	40.100	225
							0 6.002	40.025	300
18	347629.625	389586.537	41.341	2.941	1200		1 6.002	38.475	300
							2 1.007	38.400	375
							0 1.008	38.400	375

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
19	347654.485	389623.927	41.300	2.150	1350		0	7.000	39.150	150
20	347654.592	389586.544	40.176	2.076	1800		1 2	7.000 1.008	38.325 38.100	150 375
21	347690.945	389609.702	39.103	1.350	1350		0	1.009	38.100	375
22	347691.019	389586.554	38.477	1.650	1350		1 2	8.000 1.009	37.127 36.902	150 375
23	347698.737	389586.582	38.117	1.650	1350		1	1.010	36.827	450
24	347728.946	389634.777	37.736	2.786	1350		0	1.011	36.467	450
25	347729.120	389586.607	36.700	2.000	1350		1 2	9.000 1.011	34.950 34.700	450 450
26	347737.070	389582.246	36.562	1.650	100		0	1.012	34.700	450
27	347737.093	389586.635	36.331	1.672	1800		1 2	10.000 1.012	34.912 34.660	450 450
28	347754.673	389596.771	35.387	1.650	1350		1	1.013	34.660	450
29	347779.384	389597.047	34.597	1.650	1800		1	1.014	33.737	450
29_OUT	347822.170	389586.998	33.000	1.650	100		0	1.015	32.947	450
							1	1.015	31.350	450

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Detailed
Rainfall Events	Singular	Skip Steady State	x
FSR Region	England and Wales	Drain Down Time (mins)	240
M5-60 (mm)	20.000	Additional Storage (m ³ /ha)	20.0
Ratio-R	0.400	Starting Level (m)	
Summer CV	1.000	Check Discharge Rate(s)	x
Winter CV	1.000	Check Discharge Volume	x

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440
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Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	0	0
30	40	0	0
30	40	10	0
100	45	0	0
100	45	10	0

Node 20 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	38.100	Product Number	CTL-SHE-0184-2000-2000-2000
Design Depth (m)	2.000	Min Outlet Diameter (m)	0.225
Design Flow (l/s)	20.0	Min Node Diameter (mm)	1800

Node 7 Online Orifice Control

Flap Valve	x	Invert Level (m)	41.308	Discharge Coefficient	0.600
Replaces Downstream Link	x	Diameter (m)	0.040		

Node 20 Online Weir Control

Flap Valve	x	Invert Level (m)	39.700	Discharge Coefficient	0.590
Replaces Downstream Link	x	Width (m)	2.000		

Node 29 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	32.947	Product Number	CTL-SHE-0178-1780-1700-1780
Design Depth (m)	1.700	Min Outlet Diameter (m)	0.225
Design Flow (l/s)	17.8	Min Node Diameter (mm)	1800

Node 27 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	34.660	Product Number	CTL-SHE-0168-1500-1500-1500
Design Depth (m)	1.500	Min Outlet Diameter (m)	0.225
Design Flow (l/s)	15.0	Min Node Diameter (mm)	1500

Node 20 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	38.100
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	150

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	120.0	120.0	1.200	120.0	166.6	1.201	0.0	166.6

Node 14 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	38.600
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	111

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	120.0	120.0	1.200	120.0	166.6	1.201	0.0	166.6

Node 3 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	41.421
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	140.0	140.0	1.000	140.0	181.9	1.001	0.0	181.9

Node 24 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	34.950
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	300.0	300.0	1.200	300.0	373.7	1.201	0.0	373.7

Node 26 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	34.912
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	140.0	140.0	1.000	140.0	181.9	1.001	0.0	181.9

Node 25 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	34.700
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	100.0	100.0	1.200	100.0	142.5	1.201	0.0	142.5

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
2 year 15 minute summer	141.566	40.058
2 year 15 minute winter	99.345	40.058
2 year 30 minute summer	91.753	25.963
2 year 30 minute winter	64.388	25.963
2 year 60 minute summer	61.301	16.200
2 year 60 minute winter	40.727	16.200
2 year 120 minute summer	37.449	9.897
2 year 120 minute winter	24.880	9.897
2 year 180 minute summer	28.672	7.378
2 year 180 minute winter	18.637	7.378
2 year 240 minute summer	22.636	5.982
2 year 240 minute winter	15.039	5.982
2 year 360 minute summer	17.235	4.435
2 year 360 minute winter	11.203	4.435
2 year 480 minute summer	13.550	3.581
2 year 480 minute winter	9.003	3.581
2 year 600 minute summer	11.088	3.033
2 year 600 minute winter	7.576	3.033
2 year 720 minute summer	9.878	2.647
2 year 720 minute winter	6.639	2.647
2 year 960 minute summer	8.113	2.136
2 year 960 minute winter	5.374	2.136
2 year 1440 minute summer	5.891	1.579
2 year 1440 minute winter	3.959	1.579
30 year +40% CC 15 minute summer	376.189	106.449
30 year +40% CC 15 minute winter	263.992	106.449
30 year +40% CC 30 minute summer	244.900	69.298
30 year +40% CC 30 minute winter	171.860	69.298
30 year +40% CC 60 minute summer	163.225	43.136
30 year +40% CC 60 minute winter	108.443	43.136
30 year +40% CC 120 minute summer	98.613	26.061
30 year +40% CC 120 minute winter	65.516	26.061
30 year +40% CC 180 minute summer	74.617	19.202
30 year +40% CC 180 minute winter	48.503	19.202
30 year +40% CC 240 minute summer	58.245	15.393
30 year +40% CC 240 minute winter	38.697	15.393
30 year +40% CC 360 minute summer	43.710	11.248
30 year +40% CC 360 minute winter	28.413	11.248
30 year +40% CC 480 minute summer	34.053	8.999
30 year +40% CC 480 minute winter	22.624	8.999
30 year +40% CC 600 minute summer	27.658	7.565
30 year +40% CC 600 minute winter	18.898	7.565
30 year +40% CC 720 minute summer	24.485	6.562
30 year +40% CC 720 minute winter	16.456	6.562
30 year +40% CC 960 minute summer	19.901	5.240
30 year +40% CC 960 minute winter	13.183	5.240
30 year +40% CC 1440 minute summer	14.225	3.812
30 year +40% CC 1440 minute winter	9.560	3.812
30 year +40% CC +10% A 15 minute summer	376.189	106.449
30 year +40% CC +10% A 15 minute winter	263.992	106.449
30 year +40% CC +10% A 30 minute summer	244.900	69.298
30 year +40% CC +10% A 30 minute winter	171.860	69.298

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
30 year +40% CC +10% A 60 minute summer	163.225	43.136
30 year +40% CC +10% A 60 minute winter	108.443	43.136
30 year +40% CC +10% A 120 minute summer	98.613	26.061
30 year +40% CC +10% A 120 minute winter	65.516	26.061
30 year +40% CC +10% A 180 minute summer	74.617	19.202
30 year +40% CC +10% A 180 minute winter	48.503	19.202
30 year +40% CC +10% A 240 minute summer	58.245	15.393
30 year +40% CC +10% A 240 minute winter	38.697	15.393
30 year +40% CC +10% A 360 minute summer	43.710	11.248
30 year +40% CC +10% A 360 minute winter	28.413	11.248
30 year +40% CC +10% A 480 minute summer	34.053	8.999
30 year +40% CC +10% A 480 minute winter	22.624	8.999
30 year +40% CC +10% A 600 minute summer	27.658	7.565
30 year +40% CC +10% A 600 minute winter	18.898	7.565
30 year +40% CC +10% A 720 minute summer	24.485	6.562
30 year +40% CC +10% A 720 minute winter	16.456	6.562
30 year +40% CC +10% A 960 minute summer	19.901	5.240
30 year +40% CC +10% A 960 minute winter	13.183	5.240
30 year +40% CC +10% A 1440 minute summer	14.225	3.812
30 year +40% CC +10% A 1440 minute winter	9.560	3.812
100 year +45% CC 15 minute summer	505.670	143.087
100 year +45% CC 15 minute winter	354.856	143.087
100 year +45% CC 30 minute summer	332.000	93.944
100 year +45% CC 30 minute winter	232.982	93.944
100 year +45% CC 60 minute summer	222.268	58.739
100 year +45% CC 60 minute winter	147.669	58.739
100 year +45% CC 120 minute summer	134.215	35.469
100 year +45% CC 120 minute winter	89.169	35.469
100 year +45% CC 180 minute summer	101.219	26.047
100 year +45% CC 180 minute winter	65.795	26.047
100 year +45% CC 240 minute summer	78.690	20.795
100 year +45% CC 240 minute winter	52.280	20.795
100 year +45% CC 360 minute summer	58.701	15.106
100 year +45% CC 360 minute winter	38.157	15.106
100 year +45% CC 480 minute summer	45.550	12.038
100 year +45% CC 480 minute winter	30.262	12.038
100 year +45% CC 600 minute summer	36.875	10.086
100 year +45% CC 600 minute winter	25.195	10.086
100 year +45% CC 720 minute summer	32.556	8.725
100 year +45% CC 720 minute winter	21.879	8.725
100 year +45% CC 960 minute summer	26.340	6.936
100 year +45% CC 960 minute winter	17.448	6.936
100 year +45% CC 1440 minute summer	18.700	5.012
100 year +45% CC 1440 minute winter	12.567	5.012
100 year +45% CC +10% A 15 minute summer	505.670	143.087
100 year +45% CC +10% A 15 minute winter	354.856	143.087
100 year +45% CC +10% A 30 minute summer	332.000	93.944
100 year +45% CC +10% A 30 minute winter	232.982	93.944
100 year +45% CC +10% A 60 minute summer	222.268	58.739
100 year +45% CC +10% A 60 minute winter	147.669	58.739
100 year +45% CC +10% A 120 minute summer	134.215	35.469
100 year +45% CC +10% A 120 minute winter	89.169	35.469

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
100 year +45% CC +10% A 180 minute summer	101.219	26.047
100 year +45% CC +10% A 180 minute winter	65.795	26.047
100 year +45% CC +10% A 240 minute summer	78.690	20.795
100 year +45% CC +10% A 240 minute winter	52.280	20.795
100 year +45% CC +10% A 360 minute summer	58.701	15.106
100 year +45% CC +10% A 360 minute winter	38.157	15.106
100 year +45% CC +10% A 480 minute summer	45.550	12.038
100 year +45% CC +10% A 480 minute winter	30.262	12.038
100 year +45% CC +10% A 600 minute summer	36.875	10.086
100 year +45% CC +10% A 600 minute winter	25.195	10.086
100 year +45% CC +10% A 720 minute summer	32.556	8.725
100 year +45% CC +10% A 720 minute winter	21.879	8.725
100 year +45% CC +10% A 960 minute summer	26.340	6.936
100 year +45% CC +10% A 960 minute winter	17.448	6.936
100 year +45% CC +10% A 1440 minute summer	18.700	5.012
100 year +45% CC +10% A 1440 minute winter	12.567	5.012

Results for 2 year Critical Storm Duration. Lowest mass balance: 99.87%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	1	10	42.017	0.081	11.6	0.1889	0.0000	OK
15 minute summer	2	11	41.884	0.133	25.9	0.2512	0.0000	OK
240 minute summer	3	188	41.642	0.221	11.4	31.1685	0.0000	OK
15 minute summer	4	10	42.101	0.100	12.5	0.2233	0.0000	OK
15 minute summer	5	11	41.859	0.060	12.3	0.0856	0.0000	OK
240 minute summer	6	188	41.642	0.277	4.1	0.3129	0.0000	OK
240 minute summer	7	188	41.642	0.334	2.5	0.4781	0.0000	SURCHARGED
15 minute summer	8	10	42.614	0.073	23.4	0.2092	0.0000	OK
15 minute summer	9	10	41.230	0.081	28.6	0.1026	0.0000	OK
15 minute summer	10	11	41.137	0.137	29.6	0.4815	0.0000	OK
15 minute summer	11	11	40.872	0.103	60.1	0.1291	0.0000	OK
15 minute summer	12	10	41.325	0.075	16.6	0.1570	0.0000	OK
30 minute summer	14	20	38.741	0.141	73.1	16.2366	0.0000	OK
15 minute summer	15	10	40.548	0.048	4.4	0.0840	0.0000	OK
15 minute summer	16	10	40.290	0.065	8.9	0.1161	0.0000	OK
15 minute summer	17	10	40.117	0.092	41.8	0.3363	0.0000	OK
120 minute summer	18	84	38.659	0.259	54.0	0.3686	0.0000	OK
15 minute summer	19	10	39.230	0.080	14.6	0.1622	0.0000	OK
120 minute summer	20	84	38.658	0.558	63.3	65.1912	0.0000	SURCHARGED
15 minute summer	21	10	37.835	0.082	16.0	0.2001	0.0000	OK
30 minute summer	22	19	36.907	0.080	40.1	0.1705	0.0000	OK
30 minute summer	23	19	36.544	0.077	50.6	0.1616	0.0000	OK
240 minute summer	24	224	35.102	0.152	14.7	45.9818	0.0000	OK
240 minute summer	25	224	35.102	0.402	36.5	40.7425	0.0000	OK
240 minute summer	26	224	35.101	0.189	19.1	26.5135	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	1	1.000	2	11.3	0.632	0.284	0.5841	
15 minute summer	2	1.001	3	25.2	1.052	0.632	1.0332	
240 minute summer	3	1.002	6	-3.7	0.137	-0.052	0.8345	
15 minute summer	4	2.000	5	12.3	1.293	0.694	0.1925	
15 minute summer	5	2.001	6	12.2	2.001	0.269	0.0282	
240 minute summer	6	1.003	7	1.8	0.114	0.025	0.9621	
240 minute summer	7	1.004	9	1.8	0.448	0.026	0.0832	
15 minute summer	8	3.000	9	23.1	2.098	0.219	0.3353	
15 minute summer	9	1.005	11	28.4	1.368	0.101	0.4042	
15 minute summer	10	4.000	11	28.9	0.953	0.409	1.1576	
15 minute summer	11	1.006	14	60.4	2.564	0.150	0.5099	
15 minute summer	12	5.000	14	16.3	1.894	0.475	0.3145	
30 minute summer	14	1.007	18	57.0	1.399	0.253	0.7084	
15 minute summer	15	6.000	16	4.3	0.922	0.204	0.0664	
15 minute summer	16	6.001	17	8.8	0.963	0.166	0.1099	
15 minute summer	17	6.002	18	41.8	2.215	0.200	0.8740	
120 minute summer	18	1.008	20	54.1	1.054	0.247	2.3907	
15 minute summer	19	7.000	20	14.2	1.509	0.537	0.3689	
120 minute summer	20	1.009	22	19.9	1.775	0.055	0.4089	
15 minute summer	21	8.000	22	15.7	1.651	0.536	0.2204	
30 minute summer	22	1.010	23	40.1	2.180	0.057	0.1420	
30 minute summer	23	1.011	25	50.6	2.251	0.065	1.8763	
240 minute summer	24	9.000	25	7.2	0.129	0.031	4.7291	
240 minute summer	25	1.012	27	30.0	0.256	0.130	1.2241	
240 minute summer	26	10.000	27	-19.1	-0.303	-0.025	0.4850	

Results for 2 year Critical Storm Duration. Lowest mass balance: 99.87%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
240 minute summer	27	224	35.101	0.441	33.9	1.4768	0.0000	OK
60 minute summer	28	34	33.791	0.054	18.2	0.0991	0.0000	OK
120 minute summer	29	72	33.257	0.310	17.4	0.7894	0.0000	OK
120 minute summer	29_OUT	72	31.400	0.050	16.6	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m ³)	Discharge Vol (m ³)
240 minute summer	27	1.013	28	14.9	1.681	0.022	0.1836	
60 minute summer	28	1.014	29	18.2	0.629	0.031	1.5337	
120 minute summer	29	1.015	29_OUT	16.6	1.703	0.027	0.4277	236.9

Results for 30 year +40% CC Critical Storm Duration. Lowest mass balance: 99.60%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	1	12	42.390	0.454	30.7	1.0528	0.0000	SURCHARGED
15 minute summer	2	11	42.291	0.540	63.5	1.0188	0.0000	SURCHARGED
240 minute winter	3	232	42.108	0.687	21.0	97.0130	0.0000	SURCHARGED
15 minute summer	4	11	42.613	0.612	33.2	1.3659	0.0000	SURCHARGED
240 minute winter	5	232	42.108	0.309	5.8	0.4421	0.0000	SURCHARGED
240 minute winter	6	232	42.108	0.743	7.6	0.8401	0.0000	SURCHARGED
240 minute winter	7	232	42.108	0.800	4.3	1.1460	0.0000	SURCHARGED
15 minute summer	8	10	42.671	0.130	62.1	0.3703	0.0000	OK
15 minute summer	9	10	41.286	0.137	73.7	0.1739	0.0000	OK
15 minute summer	10	11	41.281	0.281	78.5	0.9858	0.0000	OK
15 minute summer	11	11	40.948	0.179	156.7	0.2240	0.0000	OK
15 minute summer	12	12	41.861	0.611	44.2	1.2840	0.0000	SURCHARGED
120 minute winter	14	118	39.564	0.964	65.2	111.4293	0.0000	SURCHARGED
15 minute summer	15	10	40.584	0.084	11.7	0.1481	0.0000	OK
15 minute summer	16	10	40.339	0.114	23.8	0.2036	0.0000	OK
15 minute summer	17	10	40.179	0.154	111.4	0.5627	0.0000	OK
120 minute winter	18	118	39.564	1.164	82.7	1.6559	0.0000	SURCHARGED
15 minute summer	19	12	39.982	0.832	38.7	1.6779	0.0000	SURCHARGED
120 minute winter	20	118	39.562	1.462	87.5	141.0696	0.0000	SURCHARGED
15 minute summer	21	11	38.404	0.651	42.4	1.5980	0.0000	SURCHARGED
15 minute summer	22	11	36.953	0.126	90.4	0.2687	0.0000	OK
15 minute summer	23	11	36.586	0.119	123.2	0.2512	0.0000	OK
720 minute winter	24	705	35.690	0.740	13.9	224.0565	0.0000	SURCHARGED
720 minute winter	25	705	35.690	0.990	28.5	100.4176	0.0000	SURCHARGED
720 minute winter	26	705	35.690	0.778	6.3	108.8942	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	1	1.000	2	26.9	0.758	0.676	1.2454	
15 minute summer	2	1.001	3	60.2	1.515	1.511	1.7173	
240 minute winter	3	1.002	6	-7.4	-0.106	-0.105	0.9519	
15 minute summer	4	2.000	5	29.3	1.745	1.655	0.3197	
240 minute winter	5	2.001	6	5.8	1.353	0.128	0.0777	
240 minute winter	6	1.003	7	2.9	0.122	0.040	0.9795	
240 minute winter	7	1.004	9	2.9	0.504	0.041	0.1175	
15 minute summer	8	3.000	9	61.4	2.679	0.582	0.6985	
15 minute summer	9	1.005	11	73.2	1.668	0.261	0.8521	
15 minute summer	10	4.000	11	76.2	1.223	1.077	2.3417	
15 minute summer	11	1.006	14	157.4	3.250	0.391	1.0481	
15 minute summer	12	5.000	14	38.1	2.163	1.108	0.6421	
120 minute winter	14	1.007	18	49.4	1.145	0.219	1.7423	
15 minute summer	15	6.000	16	11.5	1.181	0.545	0.1382	
15 minute summer	16	6.001	17	23.5	1.235	0.444	0.2293	
15 minute summer	17	6.002	18	110.6	2.354	0.529	2.3562	
120 minute winter	18	1.008	20	73.0	1.332	0.333	2.7538	
15 minute summer	19	7.000	20	31.2	1.771	1.177	0.6581	
120 minute winter	20	1.009	22	20.0	1.777	0.055	0.4101	
15 minute summer	21	8.000	22	36.9	2.098	1.259	0.4073	
15 minute summer	22	1.010	23	90.4	2.593	0.129	0.2691	
15 minute summer	23	1.011	25	123.3	3.019	0.158	2.7745	
720 minute winter	24	9.000	25	6.6	0.086	0.028	7.6322	
720 minute winter	25	1.012	27	19.0	0.189	0.083	1.2633	
720 minute winter	26	10.000	27	-6.3	-0.111	-0.008	0.6954	

Results for 30 year +40% CC Critical Storm Duration. Lowest mass balance: 99.60%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
720 minute winter	27	705	35.689	1.030	21.3	3.4456	0.0000	SURCHARGED
120 minute summer	28	120	34.256	0.519	23.5	0.9506	0.0000	SURCHARGED
120 minute summer	29	120	34.255	1.308	23.5	3.3297	0.0000	SURCHARGED
360 minute summer	29_OUT	208	31.402	0.052	17.8	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m ³)	Discharge Vol (m ³)
720 minute winter	27	1.013	28	14.9	1.662	0.022	0.1857	
120 minute summer	28	1.014	29	23.5	0.703	0.041	3.9156	
120 minute summer	29	1.015	29_OUT	17.8	1.739	0.029	0.4499	296.2

Results for 30 year +40% CC +10% A Critical Storm Duration. Lowest mass balance: 99.67%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	1	12	42.548	0.612	33.8	1.4742	0.0000	SURCHARGED
15 minute summer	2	12	42.429	0.678	68.5	1.3291	0.0000	SURCHARGED
360 minute winter	3	336	42.188	0.767	16.0	108.3816	0.0000	SURCHARGED
15 minute summer	4	11	42.725	0.724	36.5	1.6723	0.0000	SURCHARGED
360 minute winter	5	336	42.188	0.389	4.7	0.5572	0.0000	SURCHARGED
360 minute winter	6	336	42.188	0.823	6.1	0.9311	0.0000	SURCHARGED
360 minute winter	7	336	42.188	0.880	3.5	1.2877	0.0000	SURCHARGED
15 minute summer	8	10	42.680	0.139	68.2	0.4145	0.0000	OK
15 minute summer	9	10	41.294	0.145	80.9	0.1862	0.0000	OK
15 minute summer	10	11	41.325	0.325	86.4	1.2109	0.0000	SURCHARGED
15 minute summer	11	11	40.959	0.190	172.1	0.2403	0.0000	OK
15 minute summer	12	12	42.132	0.882	48.7	1.9129	0.0000	SURCHARGED
120 minute winter	14	100	39.727	1.127	88.2	130.2456	0.0000	SURCHARGED
15 minute summer	15	10	40.589	0.089	12.8	0.1601	0.0000	OK
15 minute summer	16	10	40.346	0.121	26.1	0.2200	0.0000	OK
15 minute summer	17	10	40.188	0.163	122.4	0.6318	0.0000	OK
120 minute winter	18	100	39.726	1.326	83.4	1.9260	0.0000	SURCHARGED
15 minute summer	19	12	40.232	1.082	42.6	2.2458	0.0000	SURCHARGED
120 minute winter	20	100	39.720	1.620	88.5	141.5818	0.0000	SURCHARGED
15 minute summer	21	12	38.589	0.836	46.6	2.1376	0.0000	SURCHARGED
15 minute summer	22	11	36.958	0.131	96.7	0.2887	0.0000	OK
15 minute summer	23	11	36.591	0.124	132.8	0.2693	0.0000	OK
720 minute winter	24	735	35.811	0.861	14.9	260.6767	0.0000	SURCHARGED
720 minute winter	25	735	35.811	1.111	29.2	112.6424	0.0000	SURCHARGED
720 minute winter	26	735	35.810	0.898	6.7	125.7601	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	1	1.000	2	29.4	0.766	0.738	1.2454	
15 minute summer	2	1.001	3	65.4	1.645	1.642	1.7173	
360 minute winter	3	1.002	6	-6.0	-0.086	-0.085	0.9519	
15 minute summer	4	2.000	5	31.9	1.843	1.805	0.3400	
360 minute winter	5	2.001	6	5.1	1.190	0.113	0.0777	
360 minute winter	6	1.003	7	3.0	0.111	0.042	0.9795	
360 minute winter	7	1.004	9	3.1	0.511	0.043	0.1216	
15 minute summer	8	3.000	9	67.5	2.733	0.640	0.7529	
15 minute summer	9	1.005	11	80.4	1.701	0.286	0.9169	
15 minute summer	10	4.000	11	83.8	1.237	1.185	2.4312	
15 minute summer	11	1.006	14	173.1	3.321	0.430	1.1281	
15 minute summer	12	5.000	14	40.8	2.318	1.188	0.6424	
120 minute winter	14	1.007	18	49.7	1.136	0.221	1.7423	
15 minute summer	15	6.000	16	12.6	1.205	0.597	0.1484	
15 minute summer	16	6.001	17	25.8	1.263	0.487	0.2462	
15 minute summer	17	6.002	18	121.6	2.380	0.582	2.4156	
120 minute winter	18	1.008	20	73.7	1.357	0.336	2.7538	
15 minute summer	19	7.000	20	33.3	1.892	1.258	0.6581	
120 minute winter	20	1.009	22	28.4	1.964	0.078	0.5264	
15 minute summer	21	8.000	22	39.9	2.267	1.361	0.4073	
15 minute summer	22	1.010	23	96.7	2.628	0.138	0.2840	
15 minute summer	23	1.011	25	132.8	3.075	0.170	2.8673	
720 minute winter	24	9.000	25	5.8	0.084	0.025	7.6322	
720 minute winter	25	1.012	27	18.4	0.191	0.080	1.2633	
720 minute winter	26	10.000	27	-6.7	-0.118	-0.009	0.6954	

Results for 30 year +40% CC +10% A Critical Storm Duration. Lowest mass balance: 99.67%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
720 minute winter	27	735	35.810	1.150	21.8	3.9418	0.0000	SURCHARGED
60 minute summer	28	61	34.341	0.604	29.7	1.1292	0.0000	SURCHARGED
60 minute summer	29	61	34.340	1.393	29.5	3.5446	0.0000	FLOOD RISK
120 minute winter	29_OUT	58	31.402	0.052	17.8	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m ³)	Discharge Vol (m ³)
720 minute winter	27	1.013	28	14.9	1.640	0.022	0.1863	
60 minute summer	28	1.014	29	29.5	0.817	0.051	3.9156	
60 minute summer	29	1.015	29_OUT	17.8	1.738	0.029	0.4494	254.7

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 99.69%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	1	12	42.993	1.057	41.3	2.4517	0.0000	FLOOD RISK
15 minute summer	2	12	42.817	1.066	82.9	2.0101	0.0000	SURCHARGED
360 minute winter	3	344	42.392	0.971	19.5	137.2028	0.0000	SURCHARGED
15 minute summer	4	12	43.125	1.124	44.6	2.5076	0.0000	FLOOD RISK
360 minute winter	5	344	42.392	0.593	5.7	0.8493	0.0000	SURCHARGED
360 minute winter	6	344	42.392	1.027	6.8	1.1619	0.0000	SURCHARGED
360 minute winter	7	344	42.392	1.084	4.2	1.5537	0.0000	SURCHARGED
15 minute summer	8	10	42.702	0.161	83.4	0.4577	0.0000	OK
15 minute summer	9	10	41.314	0.165	98.5	0.2083	0.0000	OK
15 minute summer	10	11	41.455	0.455	105.6	1.5983	0.0000	SURCHARGED
15 minute summer	11	11	40.986	0.217	210.4	0.2715	0.0000	OK
15 minute summer	12	12	42.888	1.638	59.5	3.4421	0.0000	SURCHARGED
60 minute summer	14	42	39.946	1.346	213.8	138.9233	0.0000	SURCHARGED
15 minute summer	15	10	40.603	0.103	15.7	0.1815	0.0000	OK
15 minute summer	16	10	40.363	0.138	32.0	0.2463	0.0000	OK
15 minute summer	17	11	40.214	0.189	149.7	0.6919	0.0000	OK
120 minute summer	18	74	39.894	1.494	104.0	2.1266	0.0000	SURCHARGED
15 minute summer	19	12	40.922	1.772	52.0	3.5748	0.0000	SURCHARGED
120 minute summer	20	74	39.796	1.696	128.0	141.7459	0.0000	SURCHARGED
15 minute summer	21	12	39.097	1.344	57.0	3.2979	0.0000	FLOOD RISK
60 minute winter	22	44	37.004	0.177	153.6	0.3769	0.0000	OK
120 minute summer	23	74	36.606	0.139	165.0	0.2938	0.0000	OK
960 minute winter	24	960	36.144	1.194	14.5	361.5328	0.0000	SURCHARGED
960 minute winter	25	960	36.144	1.444	28.8	122.1164	0.0000	SURCHARGED
960 minute winter	26	960	36.144	1.232	6.6	140.0798	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	1	1.000	2	35.8	0.900	0.898	1.2454	
15 minute summer	2	1.001	3	78.9	1.983	1.980	1.7173	
360 minute winter	3	1.002	6	-6.6	-0.094	-0.093	0.9519	
15 minute summer	4	2.000	5	36.9	2.096	2.085	0.3578	
360 minute winter	5	2.001	6	5.4	1.192	0.119	0.0777	
360 minute winter	6	1.003	7	3.3	0.116	0.047	0.9795	
360 minute winter	7	1.004	9	3.4	0.528	0.048	0.1311	
15 minute summer	8	3.000	9	82.4	2.835	0.782	0.8858	
15 minute summer	9	1.005	11	97.9	1.750	0.348	1.0828	
15 minute summer	10	4.000	11	102.7	1.475	1.452	2.5338	
15 minute summer	11	1.006	14	211.4	3.464	0.525	1.3204	
15 minute summer	12	5.000	14	47.6	2.703	1.385	0.6424	
60 minute summer	14	1.007	18	76.0	1.189	0.337	1.7423	
15 minute summer	15	6.000	16	15.5	1.256	0.732	0.1747	
15 minute summer	16	6.001	17	31.7	1.322	0.597	0.2882	
15 minute summer	17	6.002	18	147.9	2.377	0.708	2.5863	
120 minute summer	18	1.008	20	110.5	1.435	0.503	2.7538	
15 minute summer	19	7.000	20	39.4	2.237	1.487	0.6581	
120 minute summer	20	1.009	22	131.3	2.985	0.361	1.6025	
15 minute summer	21	8.000	22	46.9	2.666	1.600	0.4075	
60 minute winter	22	1.010	23	155.2	3.141	0.221	0.3821	
120 minute summer	23	1.011	25	167.7	2.349	0.214	3.0400	
960 minute winter	24	9.000	25	10.4	0.081	0.045	7.6322	
960 minute winter	25	1.012	27	18.3	0.189	0.079	1.2633	
960 minute winter	26	10.000	27	-6.6	-0.083	-0.008	0.6954	

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 99.69%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
960 minute winter	27	960	36.143	1.484	21.5	4.9644	0.0000	FLOOD RISK
60 minute winter	28	51	34.571	0.834	28.1	1.5262	0.0000	SURCHARGED
60 minute winter	29	50	34.569	1.622	27.2	4.1292	0.0000	FLOOD RISK
360 minute summer	29_OUT	176	31.402	0.052	17.8	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m ³)	Discharge Vol (m ³)
960 minute winter	27	1.013	28	14.9	1.675	0.022	0.1854	
60 minute winter	28	1.014	29	27.2	0.779	0.047	3.9156	
60 minute winter	29	1.015	29_OUT	17.8	1.739	0.029	0.4499	254.5

Results for 100 year +45% CC +10% A Critical Storm Duration. Lowest mass balance: 99.59%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
240 minute winter	1	208	43.061	1.125	8.0	2.7101	2.1407	FLOOD
240 minute winter	2	208	43.063	1.312	17.8	2.5721	0.0000	SURCHARGED
240 minute winter	3	208	43.064	1.643	30.1	142.1255	0.0000	SURCHARGED
15 minute summer	4	12	43.350	1.349	49.1	3.1173	0.0000	FLOOD RISK
240 minute winter	5	208	43.065	1.266	8.6	1.8112	0.0000	SURCHARGED
240 minute winter	6	208	43.064	1.699	11.6	1.9219	0.0000	SURCHARGED
240 minute winter	7	208	43.064	1.756	6.6	2.5694	0.0000	SURCHARGED
15 minute summer	8	10	42.715	0.174	91.7	0.5214	0.0000	OK
15 minute summer	9	10	41.324	0.175	108.1	0.2239	0.0000	OK
15 minute summer	10	11	41.536	0.536	116.2	1.9956	0.0000	SURCHARGED
15 minute summer	11	11	41.000	0.231	231.2	0.2929	0.0000	OK
15 minute summer	12	12	43.284	2.034	65.4	4.4097	0.0000	FLOOD RISK
60 minute summer	14	39	40.178	1.578	306.8	139.2957	0.0000	SURCHARGED
15 minute summer	15	10	40.611	0.111	17.3	0.1993	0.0000	OK
15 minute summer	16	10	40.372	0.147	35.2	0.2682	0.0000	OK
15 minute summer	17	11	40.237	0.212	164.6	0.8240	0.0000	OK
60 minute winter	18	40	40.115	1.715	163.7	2.4918	0.0000	SURCHARGED
15 minute summer	19	12	41.284	2.134	57.2	4.4293	0.0000	FLOOD RISK
60 minute summer	20	39	39.836	1.736	203.0	141.9190	0.0000	SURCHARGED
15 minute summer	21	11	39.103	1.350	62.7	3.4506	0.9064	FLOOD
60 minute summer	22	39	37.076	0.249	256.7	0.5492	0.0000	OK
60 minute summer	23	39	36.649	0.182	275.0	0.3969	0.0000	OK
720 minute winter	24	795	36.337	1.387	21.1	364.1610	0.0000	SURCHARGED
240 minute winter	25	456	36.335	1.635	113.2	122.3890	0.0000	SURCHARGED
720 minute summer	26	750	36.333	1.421	13.7	140.0814	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)
240 minute winter	1	1.000	2	7.9	0.545	0.197	1.2454	
240 minute winter	2	1.001	3	16.9	0.708	0.426	1.7173	
240 minute winter	3	1.002	6	-11.3	-0.161	-0.159	0.9519	
15 minute summer	4	2.000	5	39.4	2.237	2.226	0.3578	
240 minute winter	5	2.001	6	8.2	1.312	0.180	0.0777	
240 minute winter	6	1.003	7	4.6	0.121	0.064	0.9795	
240 minute winter	7	1.004	9	4.4	0.564	0.061	0.1571	
15 minute summer	8	3.000	9	90.6	2.874	0.859	0.9611	
15 minute summer	9	1.005	11	107.4	1.775	0.382	1.1709	
15 minute summer	10	4.000	11	112.8	1.610	1.595	2.5747	
15 minute summer	11	1.006	14	232.3	3.529	0.577	1.4237	
15 minute summer	12	5.000	14	50.8	2.884	1.478	0.6359	
60 minute summer	14	1.007	18	-129.4	1.194	-0.574	1.7423	
15 minute summer	15	6.000	16	17.0	1.277	0.806	0.1891	
15 minute summer	16	6.001	17	34.8	1.347	0.657	0.3159	
15 minute summer	17	6.002	18	161.5	2.429	0.773	2.7306	
60 minute winter	18	1.008	20	163.4	1.709	0.745	2.7538	
15 minute summer	19	7.000	20	42.2	2.399	1.595	0.6581	
60 minute summer	20	1.009	22	213.1	3.306	0.585	2.3480	
15 minute summer	21	8.000	22	47.0	2.670	1.602	0.4062	
60 minute summer	22	1.010	23	259.8	3.462	0.371	0.5795	
60 minute summer	23	1.011	25	269.8	2.640	0.345	3.3208	
720 minute winter	24	9.000	25	-12.8	0.089	-0.055	7.6322	
240 minute winter	25	1.012	27	39.0	0.246	0.170	1.2633	
720 minute summer	26	10.000	27	-13.7	-0.086	-0.018	0.6954	

Results for 100 year +45% CC +10% A Critical Storm Duration. Lowest mass balance: 99.59%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
720 minute summer	27	750	36.332	1.672	27.3	5.7299	38.4784	FLOOD
60 minute winter	28	42	34.603	0.866	29.4	1.6200	0.0000	SURCHARGED
60 minute winter	29	42	34.597	1.650	27.7	4.1993	1.1113	FLOOD
240 minute summer	29_OUT	112	31.402	0.052	17.8	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m ³)	Discharge Vol (m ³)
720 minute summer	27	1.013	28	15.6	1.705	0.023	0.1919	
60 minute winter	28	1.014	29	27.7	0.794	0.048	3.9156	
60 minute winter	29	1.015	29_OUT	17.8	1.739	0.029	0.4499	239.0

Curtins Building a better future	Curtins Consulting Ltd 51-55 Tithebarn St Liverpool L2 2SB	File: Planning Application Model - Re Network: Surface Water Jake Busby 17/10/2025	Page 1 Halsnead Farm Network Operational Failure 25% reduction on flow controls																																																																																																																																																																																																																																																
Design Settings Rainfall Methodology Return Period (years) Additional Flow (%) FSR Region M5-60 (mm) Ratio-R CV Time of Entry (mins) FSR 2 0 England and Wales 20.000 0.400 1.000 5.00 Maximum Time of Concentration (mins) Maximum Rainfall (mm/hr) Minimum Velocity (m/s) Connection Type Minimum Backdrop Height (m) Preferred Cover Depth (m) Include Intermediate Ground Enforce best practice design rules 30.00 50.0 1.00 Level Soffits 1.500 1.200 ✓ x																																																																																																																																																																																																																																																			
Nodes <table><tr><th>Name</th><th>Area (ha)</th><th>T of E (mins)</th><th>Cover Level (m)</th><th>Diameter (mm)</th><th>Easting (m)</th><th>Northing (m)</th><th>Depth (m)</th></tr><tr><td>1</td><td>0.050</td><td>5.00</td><td>43.061</td><td>1350</td><td>347493.221</td><td>389631.849</td><td>1.125</td></tr><tr><td>2</td><td>0.063</td><td>5.00</td><td>43.421</td><td>1200</td><td>347524.534</td><td>389632.223</td><td>1.670</td></tr><tr><td>3</td><td>0.013</td><td>5.00</td><td>43.799</td><td>1200</td><td>347525.207</td><td>389589.048</td><td>2.378</td></tr><tr><td>4</td><td>0.054</td><td>5.00</td><td>43.351</td><td>1350</td><td>347536.042</td><td>389563.801</td><td>1.350</td></tr><tr><td>5</td><td></td><td></td><td>43.845</td><td>1350</td><td>347535.962</td><td>389584.126</td><td>2.046</td></tr><tr><td>6</td><td></td><td></td><td>43.973</td><td>1200</td><td>347538.650</td><td>389587.626</td><td>2.608</td></tr><tr><td>7</td><td>0.040</td><td>5.00</td><td>43.961</td><td>1200</td><td>347552.483</td><td>389586.162</td><td>2.653</td></tr><tr><td>8</td><td>0.101</td><td>5.00</td><td>43.966</td><td>1350</td><td>347571.919</td><td>389616.872</td><td>1.425</td></tr><tr><td>9</td><td>0.017</td><td>5.00</td><td>43.664</td><td>1200</td><td>347572.820</td><td>389586.409</td><td>2.515</td></tr><tr><td>10</td><td>0.128</td><td>5.00</td><td>42.229</td><td>1350</td><td>347591.828</td><td>389548.290</td><td>1.229</td></tr><tr><td>11</td><td>0.014</td><td>5.00</td><td>43.056</td><td>1200</td><td>347592.191</td><td>389586.467</td><td>2.287</td></tr><tr><td>12</td><td>0.072</td><td>5.00</td><td>43.400</td><td>1350</td><td>347611.570</td><td>389622.954</td><td>2.150</td></tr><tr><td>14</td><td>0.018</td><td>5.00</td><td>42.078</td><td>1350</td><td>347613.829</td><td>389586.532</td><td>3.478</td></tr><tr><td>15</td><td>0.019</td><td>5.00</td><td>41.636</td><td>1350</td><td>347607.033</td><td>389533.897</td><td>1.136</td></tr><tr><td>16</td><td>0.020</td><td>5.00</td><td>41.354</td><td>1350</td><td>347621.214</td><td>389533.665</td><td>1.129</td></tr><tr><td>17</td><td>0.143</td><td>5.00</td><td>41.308</td><td>1350</td><td>347629.488</td><td>389542.389</td><td>1.283</td></tr><tr><td>18</td><td>0.043</td><td>5.00</td><td>41.341</td><td>1200</td><td>347629.625</td><td>389586.537</td><td>2.941</td></tr><tr><td>19</td><td>0.063</td><td>5.00</td><td>41.300</td><td>1350</td><td>347654.485</td><td>389623.927</td><td>2.150</td></tr><tr><td>20</td><td>0.035</td><td>5.00</td><td>40.176</td><td>1800</td><td>347654.592</td><td>389586.544</td><td>2.076</td></tr><tr><td>21</td><td>0.069</td><td>5.00</td><td>39.103</td><td>1350</td><td>347690.945</td><td>389609.702</td><td>1.350</td></tr><tr><td>22</td><td>0.058</td><td>5.00</td><td>38.477</td><td>1350</td><td>347691.019</td><td>389586.554</td><td>1.650</td></tr><tr><td>23</td><td>0.056</td><td>5.00</td><td>38.117</td><td>1350</td><td>347698.737</td><td>389586.582</td><td>1.650</td></tr><tr><td>24</td><td>0.185</td><td>5.00</td><td>37.736</td><td>1350</td><td>347728.946</td><td>389634.777</td><td>2.786</td></tr><tr><td>25</td><td></td><td></td><td>36.700</td><td>1350</td><td>347729.120</td><td>389586.607</td><td>2.000</td></tr><tr><td>26</td><td></td><td>5.00</td><td>36.562</td><td>100</td><td>347737.070</td><td>389582.246</td><td>1.650</td></tr><tr><td>27</td><td>0.067</td><td>5.00</td><td>36.331</td><td>1800</td><td>347737.093</td><td>389586.635</td><td>1.672</td></tr><tr><td>28</td><td>0.033</td><td>5.00</td><td>35.387</td><td>1350</td><td>347754.673</td><td>389596.771</td><td>1.650</td></tr><tr><td>29</td><td></td><td></td><td>34.597</td><td>1800</td><td>347779.384</td><td>389597.047</td><td>1.650</td></tr><tr><td>29_OUT</td><td></td><td></td><td>33.000</td><td>100</td><td>347822.170</td><td>389586.998</td><td>1.650</td></tr></table>				Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)	1	0.050	5.00	43.061	1350	347493.221	389631.849	1.125	2	0.063	5.00	43.421	1200	347524.534	389632.223	1.670	3	0.013	5.00	43.799	1200	347525.207	389589.048	2.378	4	0.054	5.00	43.351	1350	347536.042	389563.801	1.350	5			43.845	1350	347535.962	389584.126	2.046	6			43.973	1200	347538.650	389587.626	2.608	7	0.040	5.00	43.961	1200	347552.483	389586.162	2.653	8	0.101	5.00	43.966	1350	347571.919	389616.872	1.425	9	0.017	5.00	43.664	1200	347572.820	389586.409	2.515	10	0.128	5.00	42.229	1350	347591.828	389548.290	1.229	11	0.014	5.00	43.056	1200	347592.191	389586.467	2.287	12	0.072	5.00	43.400	1350	347611.570	389622.954	2.150	14	0.018	5.00	42.078	1350	347613.829	389586.532	3.478	15	0.019	5.00	41.636	1350	347607.033	389533.897	1.136	16	0.020	5.00	41.354	1350	347621.214	389533.665	1.129	17	0.143	5.00	41.308	1350	347629.488	389542.389	1.283	18	0.043	5.00	41.341	1200	347629.625	389586.537	2.941	19	0.063	5.00	41.300	1350	347654.485	389623.927	2.150	20	0.035	5.00	40.176	1800	347654.592	389586.544	2.076	21	0.069	5.00	39.103	1350	347690.945	389609.702	1.350	22	0.058	5.00	38.477	1350	347691.019	389586.554	1.650	23	0.056	5.00	38.117	1350	347698.737	389586.582	1.650	24	0.185	5.00	37.736	1350	347728.946	389634.777	2.786	25			36.700	1350	347729.120	389586.607	2.000	26		5.00	36.562	100	347737.070	389582.246	1.650	27	0.067	5.00	36.331	1800	347737.093	389586.635	1.672	28	0.033	5.00	35.387	1350	347754.673	389596.771	1.650	29			34.597	1800	347779.384	389597.047	1.650	29_OUT			33.000	100	347822.170	389586.998	1.650
Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)																																																																																																																																																																																																																																												
1	0.050	5.00	43.061	1350	347493.221	389631.849	1.125																																																																																																																																																																																																																																												
2	0.063	5.00	43.421	1200	347524.534	389632.223	1.670																																																																																																																																																																																																																																												
3	0.013	5.00	43.799	1200	347525.207	389589.048	2.378																																																																																																																																																																																																																																												
4	0.054	5.00	43.351	1350	347536.042	389563.801	1.350																																																																																																																																																																																																																																												
5			43.845	1350	347535.962	389584.126	2.046																																																																																																																																																																																																																																												
6			43.973	1200	347538.650	389587.626	2.608																																																																																																																																																																																																																																												
7	0.040	5.00	43.961	1200	347552.483	389586.162	2.653																																																																																																																																																																																																																																												
8	0.101	5.00	43.966	1350	347571.919	389616.872	1.425																																																																																																																																																																																																																																												
9	0.017	5.00	43.664	1200	347572.820	389586.409	2.515																																																																																																																																																																																																																																												
10	0.128	5.00	42.229	1350	347591.828	389548.290	1.229																																																																																																																																																																																																																																												
11	0.014	5.00	43.056	1200	347592.191	389586.467	2.287																																																																																																																																																																																																																																												
12	0.072	5.00	43.400	1350	347611.570	389622.954	2.150																																																																																																																																																																																																																																												
14	0.018	5.00	42.078	1350	347613.829	389586.532	3.478																																																																																																																																																																																																																																												
15	0.019	5.00	41.636	1350	347607.033	389533.897	1.136																																																																																																																																																																																																																																												
16	0.020	5.00	41.354	1350	347621.214	389533.665	1.129																																																																																																																																																																																																																																												
17	0.143	5.00	41.308	1350	347629.488	389542.389	1.283																																																																																																																																																																																																																																												
18	0.043	5.00	41.341	1200	347629.625	389586.537	2.941																																																																																																																																																																																																																																												
19	0.063	5.00	41.300	1350	347654.485	389623.927	2.150																																																																																																																																																																																																																																												
20	0.035	5.00	40.176	1800	347654.592	389586.544	2.076																																																																																																																																																																																																																																												
21	0.069	5.00	39.103	1350	347690.945	389609.702	1.350																																																																																																																																																																																																																																												
22	0.058	5.00	38.477	1350	347691.019	389586.554	1.650																																																																																																																																																																																																																																												
23	0.056	5.00	38.117	1350	347698.737	389586.582	1.650																																																																																																																																																																																																																																												
24	0.185	5.00	37.736	1350	347728.946	389634.777	2.786																																																																																																																																																																																																																																												
25			36.700	1350	347729.120	389586.607	2.000																																																																																																																																																																																																																																												
26		5.00	36.562	100	347737.070	389582.246	1.650																																																																																																																																																																																																																																												
27	0.067	5.00	36.331	1800	347737.093	389586.635	1.672																																																																																																																																																																																																																																												
28	0.033	5.00	35.387	1350	347754.673	389596.771	1.650																																																																																																																																																																																																																																												
29			34.597	1800	347779.384	389597.047	1.650																																																																																																																																																																																																																																												
29_OUT			33.000	100	347822.170	389586.998	1.650																																																																																																																																																																																																																																												
Flow+ v15.0 Copyright © 1988-2025 Causeway Technologies Ltd																																																																																																																																																																																																																																																			

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)
1.000	1	2	31.315	0.600	41.936	41.751	0.185	169.3	225	5.52	50.0
1.001	2	3	43.180	0.600	41.751	41.496	0.255	169.3	225	6.24	50.0
1.002	3	6	13.518	0.600	41.421	41.365	0.056	241.4	300	6.46	50.0
2.000	4	5	20.325	0.600	42.001	41.799	0.202	100.6	150	5.34	50.0
2.001	5	6	4.413	0.600	41.799	41.515	0.284	15.5	150	5.37	50.0
1.003	6	7	13.910	0.600	41.365	41.308	0.057	244.0	300	6.69	50.0
1.004	7	9	20.338	0.600	41.308	41.224	0.084	242.1	300	7.03	50.0
3.000	8	9	30.476	0.600	42.541	41.299	1.242	24.5	225	5.19	50.0
1.005	9	11	19.371	0.600	41.149	40.769	0.380	51.0	375	7.16	50.0
4.000	10	11	38.179	0.600	41.000	40.844	0.156	244.7	300	5.64	50.0
1.006	11	14	21.638	0.600	40.769	39.900	0.869	24.9	375	7.26	50.0
5.000	12	14	36.492	0.600	41.250	39.900	1.350	27.0	150	5.31	50.0
1.007	14	18	15.796	0.600	38.600	38.400	0.200	79.0	375	7.39	50.0
6.000	15	16	14.183	0.600	40.500	40.300	0.200	70.9	150	5.20	50.0
6.001	16	17	12.024	0.600	40.225	40.100	0.125	96.2	225	5.35	50.0
6.002	17	18	44.148	0.600	40.025	38.475	1.550	28.5	300	5.60	50.0
1.008	18	20	24.967	0.600	38.400	38.100	0.300	83.2	375	7.60	50.0
7.000	19	20	37.383	0.600	39.150	38.325	0.825	45.3	150	5.42	50.0
1.009	20	22	36.427	0.600	38.100	36.902	1.198	30.4	375	7.78	50.0
8.000	21	22	23.148	0.600	37.753	37.127	0.626	37.0	150	5.23	50.0
1.010	22	23	7.718	0.600	36.827	36.467	0.360	21.4	450	7.81	50.0
1.011	23	25	30.383	0.600	36.467	34.700	1.767	17.2	450	7.91	50.0
9.000	24	25	48.170	0.600	34.950	34.700	0.250	192.7	450	5.55	50.0

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)
1.000	1.002	39.8	9.0	0.900	1.445	0.050	0.0	73	0.813
1.001	1.002	39.8	20.4	1.445	2.078	0.113	0.0	114	1.006
1.002	1.007	71.2	22.8	2.078	2.308	0.126	0.0	116	0.899
2.000	1.001	17.7	9.8	1.200	1.896	0.054	0.0	79	1.025
2.001	2.568	45.4	9.8	1.896	2.308	0.054	0.0	47	2.054
1.003	1.002	70.8	32.5	2.308	2.353	0.180	0.0	143	0.981
1.004	1.006	71.1	39.8	2.353	2.140	0.220	0.0	160	1.032
3.000	2.652	105.4	18.3	1.200	2.140	0.101	0.0	63	1.996
1.005	2.542	280.8	61.1	2.140	1.912	0.338	0.0	118	2.049
4.000	1.000	70.7	23.1	0.929	1.912	0.128	0.0	118	0.899
1.006	3.643	402.4	86.7	1.912	1.803	0.480	0.0	118	2.928
5.000	1.944	34.4	13.0	2.000	2.028	0.072	0.0	64	1.814
1.007	2.040	225.3	103.0	3.103	2.566	0.570	0.0	178	1.995
6.000	1.195	21.1	3.4	0.986	0.904	0.019	0.0	41	0.880
6.001	1.333	53.0	7.0	0.904	0.983	0.039	0.0	55	0.929
6.002	2.957	209.0	32.9	0.983	2.566	0.182	0.0	80	2.176
1.008	1.987	219.5	143.7	2.566	1.701	0.795	0.0	222	2.113
7.000	1.498	26.5	11.4	2.000	1.701	0.063	0.0	69	1.444
1.009	3.296	364.0	161.4	1.701	1.200	0.893	0.0	175	3.200
8.000	1.660	29.3	12.5	1.200	1.200	0.069	0.0	68	1.594
1.010	4.405	700.6	184.3	1.200	1.200	1.020	0.0	157	3.741
1.011	4.920	782.6	194.4	1.200	1.550	1.076	0.0	152	4.108
9.000	1.461	232.3	33.4	2.336	1.550	0.185	0.0	115	1.051

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)
1.012	25	27	7.973	0.600	34.700	34.660	0.040	196.9	450	8.00	50.0
10.000	26	27	4.389	0.600	34.912	34.660	0.252	17.4	450	5.01	50.0
1.013	27	28	20.293	0.600	34.660	33.737	0.923	22.0	450	8.08	50.0
1.014	28	29	24.713	0.600	33.737	32.947	0.790	31.3	450	8.20	50.0
1.015	29	29 OUT	43.950	0.600	32.947	31.350	1.597	27.5	450	8.38	50.0

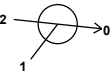
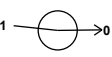
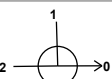
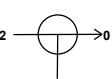
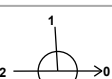
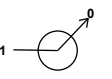
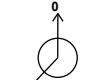
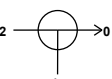
Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.012	1.445	229.8	227.9	1.550	1.222	1.261	0.0	369	1.635
10.000	4.894	778.3	0.0	1.200	1.222	0.000	0.0	0	0.000
1.013	4.349	691.6	240.0	1.222	1.200	1.328	0.0	182	3.970
1.014	3.645	579.7	245.9	1.200	1.200	1.361	0.0	204	3.501
1.015	3.887	618.1	245.9	1.200	1.200	1.361	0.0	197	3.677

Pipeline Schedule

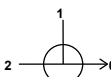
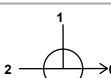
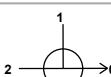
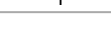
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	31.315	169.3	225	Circular	43.061	41.936	0.900	43.421	41.751	1.445
1.001	43.180	169.3	225	Circular	43.421	41.751	1.445	43.799	41.496	2.078
1.002	13.518	241.4	300	Circular	43.799	41.421	2.078	43.973	41.365	2.308
2.000	20.325	100.6	150	Circular	43.351	42.001	1.200	43.845	41.799	1.896
2.001	4.413	15.5	150	Circular	43.845	41.799	1.896	43.973	41.515	2.308
1.003	13.910	244.0	300	Circular	43.973	41.365	2.308	43.961	41.308	2.353
1.004	20.338	242.1	300	Circular	43.961	41.308	2.353	43.664	41.224	2.140
3.000	30.476	24.5	225	Circular	43.966	42.541	1.200	43.664	41.299	2.140
1.005	19.371	51.0	375	Circular	43.664	41.149	2.140	43.056	40.769	1.912
4.000	38.179	244.7	300	Circular	42.229	41.000	0.929	43.056	40.844	1.912
1.006	21.638	24.9	375	Circular	43.056	40.769	1.912	42.078	39.900	1.803
5.000	36.492	27.0	150	Circular	43.400	41.250	2.000	42.078	39.900	2.028
1.007	15.796	79.0	375	Circular	42.078	38.600	3.103	41.341	38.400	2.566
6.000	14.183	70.9	150	Circular	41.636	40.500	0.986	41.354	40.300	0.904

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	1	1350	Manhole	Adoptable	2	1200	Manhole	Adoptable
1.001	2	1200	Manhole	Adoptable	3	1200	Manhole	Adoptable
1.002	3	1200	Manhole	Adoptable	6	1200	Manhole	Adoptable
2.000	4	1350	Manhole	Adoptable	5	1350	Manhole	Adoptable
2.001	5	1350	Manhole	Adoptable	6	1200	Manhole	Adoptable
1.003	6	1200	Manhole	Adoptable	7	1200	Manhole	Adoptable
1.004	7	1200	Manhole	Adoptable	9	1200	Manhole	Adoptable
3.000	8	1350	Manhole	Adoptable	9	1200	Manhole	Adoptable
1.005	9	1200	Manhole	Adoptable	11	1200	Manhole	Adoptable
4.000	10	1350	Manhole	Adoptable	11	1200	Manhole	Adoptable
1.006	11	1200	Manhole	Adoptable	14	1350	Manhole	Adoptable
5.000	12	1350	Manhole	Adoptable	14	1350	Manhole	Adoptable
1.007	14	1350	Manhole	Adoptable	18	1200	Manhole	Adoptable
6.000	15	1350	Manhole	Adoptable	16	1350	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
5	347535.962	389584.126	43.845	2.046	1350		1 2.000	41.799	150
							0 2.001	41.799	150
6	347538.650	389587.626	43.973	2.608	1200		1 2.001	41.515	150
							2 1.002	41.365	300
							0 1.003	41.365	300
7	347552.483	389586.162	43.961	2.653	1200		1 1.003	41.308	300
							0 1.004	41.308	300
8	347571.919	389616.872	43.966	1.425	1350		0 3.000	42.541	225
9	347572.820	389586.409	43.664	2.515	1200		1 3.000	41.299	225
							2 1.004	41.224	300
							0 1.005	41.149	375
10	347591.828	389548.290	42.229	1.229	1350		0 4.000	41.000	300
11	347592.191	389586.467	43.056	2.287	1200		1 4.000	40.844	300
							2 1.005	40.769	375
							0 1.006	40.769	375
12	347611.570	389622.954	43.400	2.150	1350		0 5.000	41.250	150
14	347613.829	389586.532	42.078	3.478	1350		1 5.000	39.900	150
							2 1.006	39.900	375
							0 1.007	38.600	375
15	347607.033	389533.897	41.636	1.136	1350		0 6.000	40.500	150
16	347621.214	389533.665	41.354	1.129	1350		1 6.000	40.300	150
							0 6.001	40.225	225
17	347629.488	389542.389	41.308	1.283	1350		1 6.001	40.100	225
							0 6.002	40.025	300
18	347629.625	389586.537	41.341	2.941	1200		1 6.002	38.475	300
							2 1.007	38.400	375
							0 1.008	38.400	375

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
19	347654.485	389623.927	41.300	2.150	1350		0	7.000	39.150	150
20	347654.592	389586.544	40.176	2.076	1800		1 2 0	7.000 1.008 1.009	38.325 38.100 38.100	150 375 375
21	347690.945	389609.702	39.103	1.350	1350		0	8.000	37.753	150
22	347691.019	389586.554	38.477	1.650	1350		1 2 0	8.000 1.009 1.010	37.127 36.902 36.827	150 375 450
23	347698.737	389586.582	38.117	1.650	1350		1 0	1.010 1.011	36.467 36.467	450 450
24	347728.946	389634.777	37.736	2.786	1350		0	9.000	34.950	450
25	347729.120	389586.607	36.700	2.000	1350		1 2 0	9.000 1.011 1.012	34.700 34.700 34.700	450 450 450
26	347737.070	389582.246	36.562	1.650	100		0	10.000	34.912	450
27	347737.093	389586.635	36.331	1.672	1800		1 2 0	10.000 1.012 1.013	34.660 34.660 34.660	450 450 450
28	347754.673	389596.771	35.387	1.650	1350		1 0	1.013 1.014	33.737 33.737	450 450
29	347779.384	389597.047	34.597	1.650	1800		1 0	1.014 1.015	32.947 32.947	450 450
29_OUT	347822.170	389586.998	33.000	1.650	100		1	1.015	31.350	450

Node 14 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	38.600
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	120.0	120.0	1.200	120.0	166.6	1.201	0.0	166.6

Node 3 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	41.421
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	140.0	140.0	1.000	140.0	181.9	1.001	0.0	181.9

Node 24 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	34.950
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	300.0	300.0	1.200	300.0	373.7	1.201	0.0	373.7

Node 26 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	34.912
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	140.0	140.0	1.000	140.0	181.9	1.001	0.0	181.9

Node 25 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	34.700
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	100.0	100.0	1.200	100.0	142.5	1.201	0.0	142.5

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
2 year 15 minute summer	141.566	40.058	2 year 120 minute winter	24.880	9.897
2 year 15 minute winter	99.345	40.058	2 year 180 minute summer	28.672	7.378
2 year 30 minute summer	91.753	25.963	2 year 180 minute winter	18.637	7.378
2 year 30 minute winter	64.388	25.963	2 year 240 minute summer	22.636	5.982
2 year 60 minute summer	61.301	16.200	2 year 240 minute winter	15.039	5.982
2 year 60 minute winter	40.727	16.200	2 year 360 minute summer	17.235	4.435
2 year 120 minute summer	37.449	9.897	2 year 360 minute winter	11.203	4.435

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
2 year 480 minute summer	13.550	3.581	30 year +40% CC 720 minute winter	16.456	6.562
2 year 480 minute winter	9.003	3.581	30 year +40% CC 960 minute summer	19.901	5.240
2 year 600 minute summer	11.088	3.033	30 year +40% CC 960 minute winter	13.183	5.240
2 year 600 minute winter	7.576	3.033	30 year +40% CC 1440 minute summer	14.225	3.812
2 year 720 minute summer	9.878	2.647	30 year +40% CC 1440 minute winter	9.560	3.812
2 year 720 minute winter	6.639	2.647	100 year +45% CC 15 minute summer	505.670	143.087
2 year 960 minute summer	8.113	2.136	100 year +45% CC 15 minute winter	354.856	143.087
2 year 960 minute winter	5.374	2.136	100 year +45% CC 30 minute summer	332.000	93.944
2 year 1440 minute summer	5.891	1.579	100 year +45% CC 30 minute winter	232.982	93.944
2 year 1440 minute winter	3.959	1.579	100 year +45% CC 60 minute summer	222.268	58.739
30 year +40% CC 15 minute summer	376.189	106.449	100 year +45% CC 60 minute winter	147.669	58.739
30 year +40% CC 15 minute winter	263.992	106.449	100 year +45% CC 120 minute summer	134.215	35.469
30 year +40% CC 30 minute summer	244.900	69.298	100 year +45% CC 120 minute winter	89.169	35.469
30 year +40% CC 30 minute winter	171.860	69.298	100 year +45% CC 180 minute summer	101.219	26.047
30 year +40% CC 60 minute summer	163.225	43.136	100 year +45% CC 180 minute winter	65.795	26.047
30 year +40% CC 60 minute winter	108.443	43.136	100 year +45% CC 240 minute summer	78.690	20.795
30 year +40% CC 120 minute summer	98.613	26.061	100 year +45% CC 240 minute winter	52.280	20.795
30 year +40% CC 120 minute winter	65.516	26.061	100 year +45% CC 360 minute summer	58.701	15.106
30 year +40% CC 180 minute summer	74.617	19.202	100 year +45% CC 360 minute winter	38.157	15.106
30 year +40% CC 180 minute winter	48.503	19.202	100 year +45% CC 480 minute summer	45.550	12.038
30 year +40% CC 240 minute summer	58.245	15.393	100 year +45% CC 480 minute winter	30.262	12.038
30 year +40% CC 240 minute winter	38.697	15.393	100 year +45% CC 600 minute summer	36.875	10.086
30 year +40% CC 360 minute summer	43.710	11.248	100 year +45% CC 600 minute winter	25.195	10.086
30 year +40% CC 360 minute winter	28.413	11.248	100 year +45% CC 720 minute summer	32.556	8.725
30 year +40% CC 480 minute summer	34.053	8.999	100 year +45% CC 720 minute winter	21.879	8.725
30 year +40% CC 480 minute winter	22.624	8.999	100 year +45% CC 960 minute summer	26.340	6.936
30 year +40% CC 600 minute summer	27.658	7.565	100 year +45% CC 960 minute winter	17.448	6.936
30 year +40% CC 600 minute winter	18.898	7.565	100 year +45% CC 1440 minute summer	18.700	5.012
30 year +40% CC 720 minute summer	24.485	6.562	100 year +45% CC 1440 minute winter	12.567	5.012

Results for 2 year Critical Storm Duration. Lowest mass balance: 99.66%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	1	10	42.017	0.081	11.6	0.1889	0.0000	OK
1440 minute summer	2	1470	41.896	0.145	1.8	0.2737	0.0000	OK
1440 minute summer	3	1470	41.896	0.475	3.4	67.1204	0.0000	SURCHARGED
15 minute summer	4	10	42.101	0.100	12.5	0.2238	0.0000	OK
1440 minute summer	5	1470	41.896	0.097	0.9	0.1391	0.0000	OK
1440 minute summer	6	1470	41.896	0.531	1.4	0.6008	0.0000	SURCHARGED
1440 minute summer	7	1470	41.896	0.588	0.7	0.8429	0.0000	SURCHARGED
15 minute summer	8	10	42.614	0.073	23.4	0.2092	0.0000	OK
15 minute summer	9	10	41.228	0.079	27.1	0.0995	0.0000	OK
15 minute summer	10	11	41.137	0.137	29.6	0.4815	0.0000	OK
15 minute summer	11	11	40.871	0.102	58.6	0.1274	0.0000	OK
15 minute summer	12	10	41.325	0.075	16.6	0.1570	0.0000	OK
480 minute summer	14	360	38.873	0.273	16.7	31.5492	0.0000	OK
15 minute summer	15	10	40.548	0.048	4.4	0.0840	0.0000	OK
15 minute summer	16	10	40.290	0.065	8.9	0.1161	0.0000	OK
15 minute summer	17	10	40.117	0.092	41.8	0.3371	0.0000	OK
480 minute summer	18	360	38.873	0.473	20.5	0.6731	0.0000	SURCHARGED
15 minute summer	19	10	39.230	0.080	14.6	0.1622	0.0000	OK
480 minute summer	20	360	38.873	0.773	21.9	90.3444	0.0000	SURCHARGED
15 minute summer	21	10	37.835	0.082	16.0	0.2001	0.0000	OK
15 minute summer	22	10	36.895	0.068	30.3	0.1450	0.0000	OK
15 minute summer	23	9	36.538	0.071	43.1	0.1498	0.0000	OK
1440 minute winter	24	1500	35.240	0.290	3.1	87.9058	0.0000	OK
1440 minute winter	25	1500	35.240	0.540	5.3	54.8081	0.0000	SURCHARGED
1440 minute winter	26	1500	35.240	0.328	2.0	45.9695	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	1	1.000	2	11.3	0.632	0.284	0.5841	
1440 minute summer	2	1.001	3	1.8	0.382	0.045	1.4435	
1440 minute summer	3	1.002	6	-1.4	-0.023	-0.020	0.9519	
15 minute summer	4	2.000	5	12.3	1.302	0.694	0.1911	
1440 minute summer	5	2.001	6	0.9	0.716	0.020	0.0655	
1440 minute summer	6	1.003	7	-0.5	-0.008	-0.008	0.9795	
1440 minute summer	7	1.004	9	0.2	0.265	0.002	0.0124	
15 minute summer	8	3.000	9	23.1	2.098	0.219	0.3353	
15 minute summer	9	1.005	11	26.9	1.336	0.096	0.3925	
15 minute summer	10	4.000	11	28.9	0.953	0.409	1.1576	
15 minute summer	11	1.006	14	58.9	2.547	0.146	0.5006	
15 minute summer	12	5.000	14	16.3	1.894	0.475	0.3145	
480 minute summer	14	1.007	18	12.1	0.778	0.054	1.5502	
15 minute summer	15	6.000	16	4.3	0.922	0.204	0.0664	
15 minute summer	16	6.001	17	8.8	0.963	0.166	0.1099	
15 minute summer	17	6.002	18	41.8	2.231	0.200	0.8658	
480 minute summer	18	1.008	20	18.2	0.833	0.083	2.7538	
15 minute summer	19	7.000	20	14.2	1.509	0.537	0.3814	
480 minute summer	20	1.009	22	3.8	1.083	0.010	0.1284	
15 minute summer	21	8.000	22	15.7	1.651	0.536	0.2204	
15 minute summer	22	1.010	23	30.2	1.959	0.043	0.1190	
15 minute summer	23	1.011	25	42.8	2.854	0.055	1.5921	
1440 minute winter	24	9.000	25	1.3	0.079	0.005	6.4205	
1440 minute winter	25	1.012	27	3.4	0.110	0.015	1.2633	
1440 minute winter	26	10.000	27	-2.0	-0.037	-0.003	0.6197	

Results for 2 year Critical Storm Duration. Lowest mass balance: 99.66%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
1440 minute winter	27	1500	35.240	0.580	4.0	1.9418	0.0000	SURCHARGED
15 minute summer	28	10	33.775	0.038	8.9	0.0704	0.0000	OK
180 minute summer	29	116	33.536	0.589	4.4	1.4991	0.0000	SURCHARGED
180 minute summer	29_OUT	116	31.373	0.023	3.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m ³)	Discharge Vol (m ³)
1440 minute winter	27	1.013	28	2.8	1.011	0.004	0.0558	
15 minute summer	28	1.014	29	8.8	0.797	0.015	1.8952	
180 minute summer	29	1.015	29_OUT	3.0	1.020	0.005	0.1310	54.7

Results for 30 year +40% CC Critical Storm Duration. Lowest mass balance: 99.26%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
1440 minute winter	1	1020	43.061	1.125	1.9	2.6100	23.6324	FLOOD
720 minute winter	2	660	43.062	1.311	5.2	2.4721	0.0000	SURCHARGED
720 minute winter	3	660	43.063	1.642	9.1	142.1064	0.0000	SURCHARGED
720 minute winter	4	660	43.064	1.063	2.5	2.3718	0.0000	FLOOD RISK
720 minute winter	5	660	43.063	1.264	2.5	1.8094	0.0000	SURCHARGED
720 minute winter	6	660	43.063	1.698	3.9	1.9207	0.0000	SURCHARGED
720 minute winter	7	660	43.063	1.755	1.8	2.5152	0.0000	SURCHARGED
15 minute summer	8	10	42.671	0.130	62.1	0.3703	0.0000	OK
15 minute summer	9	10	41.284	0.135	71.9	0.1714	0.0000	OK
15 minute summer	10	11	41.281	0.281	78.5	0.9858	0.0000	OK
15 minute summer	11	11	40.947	0.178	154.9	0.2224	0.0000	OK
15 minute summer	12	12	41.861	0.611	44.2	1.2846	0.0000	SURCHARGED
240 minute summer	14	152	39.761	1.161	69.2	134.0816	0.0000	SURCHARGED
15 minute summer	15	10	40.584	0.084	11.7	0.1481	0.0000	OK
15 minute summer	16	10	40.339	0.114	23.8	0.2036	0.0000	OK
15 minute summer	17	10	40.179	0.154	111.4	0.5627	0.0000	OK
240 minute summer	18	152	39.757	1.357	41.8	1.9313	0.0000	SURCHARGED
15 minute summer	19	12	39.993	0.843	38.7	1.7010	0.0000	SURCHARGED
240 minute summer	20	152	39.746	1.646	55.1	141.6011	0.0000	SURCHARGED
15 minute summer	21	11	38.404	0.651	42.4	1.5979	0.0000	SURCHARGED
15 minute summer	22	11	36.938	0.111	73.9	0.2379	0.0000	OK
15 minute summer	23	11	36.578	0.111	106.7	0.2337	0.0000	OK
1440 minute winter	24	1680	35.900	0.950	11.5	287.5933	0.0000	SURCHARGED
1440 minute winter	25	1680	35.900	1.200	17.7	121.7078	0.0000	SURCHARGED
1440 minute winter	26	1680	35.900	0.988	4.9	138.3107	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)
1440 minute winter	1	1.000	2	-1.4	0.312	-0.035	1.2454	
720 minute winter	2	1.001	3	4.7	0.451	0.118	1.7173	
720 minute winter	3	1.002	6	-3.8	-0.086	-0.054	0.9519	
720 minute winter	4	2.000	5	2.5	0.842	0.141	0.3578	
720 minute winter	5	2.001	6	2.4	0.879	0.052	0.0777	
720 minute winter	6	1.003	7	-1.6	0.032	-0.022	0.9795	
720 minute winter	7	1.004	9	0.3	0.268	0.004	0.0212	
15 minute summer	8	3.000	9	61.4	2.679	0.582	0.6985	
15 minute summer	9	1.005	11	71.5	1.651	0.255	0.8405	
15 minute summer	10	4.000	11	76.2	1.223	1.077	2.3417	
15 minute summer	11	1.006	14	155.6	3.242	0.387	1.0388	
15 minute summer	12	5.000	14	38.1	2.163	1.108	0.6421	
240 minute summer	14	1.007	18	-28.6	0.836	-0.127	1.7423	
15 minute summer	15	6.000	16	11.5	1.181	0.545	0.1382	
15 minute summer	16	6.001	17	23.5	1.235	0.444	0.2293	
15 minute summer	17	6.002	18	110.6	2.372	0.529	2.3562	
240 minute summer	18	1.008	20	39.8	1.138	0.181	2.7538	
15 minute summer	19	7.000	20	31.0	1.763	1.172	0.6581	
240 minute summer	20	1.009	22	42.3	2.198	0.116	0.7007	
15 minute summer	21	8.000	22	36.9	2.098	1.259	0.4073	
15 minute summer	22	1.010	23	73.9	2.432	0.105	0.2345	
15 minute summer	23	1.011	25	106.8	3.011	0.136	2.7136	
1440 minute winter	24	9.000	25	-7.4	0.068	-0.032	7.6322	
1440 minute winter	25	1.012	27	7.1	0.088	0.031	1.2633	
1440 minute winter	26	10.000	27	-4.9	-0.034	-0.006	0.6954	

Results for 30 year +40% CC Critical Storm Duration. Lowest mass balance: 99.26%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
1440 minute winter	27	1680	35.899	1.240	8.4	4.1486	0.0000	SURCHARGED
120 minute summer	28	88	34.160	0.423	11.0	0.7745	0.0000	OK
120 minute summer	29	86	34.162	1.215	9.0	3.0910	0.0000	SURCHARGED
120 minute summer	29_OUT	86	31.377	0.027	4.4	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m ³)	Discharge Vol (m ³)
1440 minute winter	27	1.013	28	4.1	0.911	0.006	1.0397	
120 minute summer	28	1.014	29	9.0	0.692	0.015	3.8684	
120 minute summer	29	1.015	29_OUT	4.4	1.140	0.007	0.1698	72.3

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 99.07%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
1440 minute summer	1	810	43.061	1.125	7.6	2.6100	84.9527	FLOOD
600 minute winter	2	375	43.081	1.330	7.7	2.5070	0.0000	SURCHARGED
600 minute summer	3	360	43.096	1.675	20.8	142.1471	0.0000	SURCHARGED
15 minute summer	4	12	43.130	1.129	44.6	2.5195	0.0000	FLOOD RISK
600 minute winter	5	375	43.100	1.301	3.6	1.8612	0.0000	SURCHARGED
600 minute summer	6	360	43.096	1.731	8.7	1.9577	0.0000	SURCHARGED
600 minute winter	7	375	43.097	1.789	2.8	2.5633	0.0000	SURCHARGED
15 minute summer	8	10	42.702	0.161	83.4	0.4577	0.0000	OK
15 minute summer	9	10	41.311	0.162	96.6	0.2057	0.0000	OK
15 minute summer	10	11	41.455	0.455	105.7	1.5984	0.0000	SURCHARGED
15 minute summer	11	11	40.984	0.215	208.4	0.2698	0.0000	OK
15 minute summer	12	12	42.888	1.638	59.5	3.4422	0.0000	SURCHARGED
120 minute summer	14	70	40.066	1.466	209.1	139.1074	0.0000	SURCHARGED
15 minute summer	15	10	40.603	0.103	15.7	0.1815	0.0000	OK
15 minute summer	16	10	40.363	0.138	32.0	0.2463	0.0000	OK
15 minute summer	17	11	40.214	0.189	149.7	0.6925	0.0000	OK
60 minute winter	18	41	40.045	1.645	132.4	2.3410	0.0000	SURCHARGED
15 minute summer	19	12	40.936	1.786	52.0	3.6019	0.0000	SURCHARGED
120 minute summer	20	70	39.828	1.728	173.9	141.8363	0.0000	SURCHARGED
15 minute summer	21	12	39.097	1.344	57.0	3.2979	0.0000	FLOOD RISK
120 minute summer	22	70	37.042	0.215	209.6	0.4595	0.0000	OK
120 minute summer	23	70	36.630	0.163	224.1	0.3429	0.0000	OK
720 minute summer	24	510	36.355	1.405	51.7	364.0268	0.0000	SURCHARGED
720 minute winter	25	525	36.336	1.636	51.6	122.3915	0.0000	SURCHARGED
360 minute summer	26	352	36.334	1.422	35.8	140.0814	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)
1440 minute summer	1	1.000	2	-5.8	0.318	-0.147	1.2454	
600 minute winter	2	1.001	3	7.5	0.474	0.188	1.7173	
600 minute summer	3	1.002	6	-8.5	-0.121	-0.119	0.9519	
15 minute summer	4	2.000	5	36.9	2.093	2.082	0.3578	
600 minute winter	5	2.001	6	3.4	0.928	0.076	0.0777	
600 minute summer	6	1.003	7	-3.7	-0.053	-0.052	0.9795	
600 minute winter	7	1.004	9	0.3	0.268	0.004	0.0212	
15 minute summer	8	3.000	9	82.4	2.835	0.782	0.8858	
15 minute summer	9	1.005	11	96.0	1.736	0.342	1.0709	
15 minute summer	10	4.000	11	102.7	1.475	1.452	2.5338	
15 minute summer	11	1.006	14	209.5	3.458	0.521	1.3108	
15 minute summer	12	5.000	14	47.6	2.703	1.385	0.6424	
120 minute summer	14	1.007	18	92.6	1.009	0.411	1.7423	
15 minute summer	15	6.000	16	15.5	1.256	0.732	0.1747	
15 minute summer	16	6.001	17	31.7	1.322	0.597	0.2882	
15 minute summer	17	6.002	18	147.9	2.394	0.708	2.5874	
60 minute winter	18	1.008	20	134.1	1.675	0.611	2.7538	
15 minute summer	19	7.000	20	39.2	2.230	1.482	0.6581	
120 minute summer	20	1.009	22	178.5	3.199	0.490	2.0330	
15 minute summer	21	8.000	22	46.9	2.666	1.600	0.4075	
120 minute summer	22	1.010	23	210.6	3.336	0.301	0.4880	
120 minute summer	23	1.011	25	225.0	2.346	0.288	3.1904	
720 minute summer	24	9.000	25	-35.0	-0.221	-0.151	7.6322	
720 minute winter	25	1.012	27	23.3	0.147	0.101	1.2633	
360 minute summer	26	10.000	27	-35.8	-0.226	-0.046	0.6954	

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 99.07%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
1440 minute winter	27	960	36.332	1.672	20.4	5.5945	165.1758	FLOOD
120 minute winter	28	78	34.601	0.864	10.7	1.5823	0.0000	SURCHARGED
180 minute winter	29	116	34.597	1.650	8.4	4.1993	1.8066	FLOOD
60 minute winter	29_OUT	54	31.379	0.029	5.1	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m ³)	Discharge Vol (m ³)
1440 minute winter	27	1.013	28	4.7	0.890	0.007	1.6456	
120 minute winter	28	1.014	29	8.9	0.616	0.015	3.9156	
180 minute winter	29	1.015	29_OUT	5.1	1.196	0.008	0.1890	100.4