Land west of the B6003, Toton West, Broxtowe, Nottinghamshire

Flood Risk Assessment and Drainage Strategy Addendum

December 2025

Woods Hardwick

Architecture | Engineering | Planning | Surveying

Contents

Appendices

Report Reference

19678/FRA and DS Addendum

Revision History

Rev	Amendments	Prepared By	Checked By	Date
First Issue	N/A	YT	GBR	19/12/2025

Introduction

Introduction

The following paragraphs state the purpose of this document, a summary of existing and future site details is also provided.

1.1 This Flood Risk Assessment (FRA) and Drainage Strategy has been prepared by Woods Hardwick Ltd (WH) on behalf of Bloor Homes in support of an Outline Planning Application for a proposed residential development on a site known as 'Land west of the B6003, Toton West, Broxtowe, Nottinghamshire'. A copy of the Site Location Plan is provided in **Appendix A**.

1.2 The report supersedes the previous FRA and Surface Water Drainage Strategy document (Ref: P23-2379) prepared by Pegasus Group.

1.3 The application site boundary covers an area of approximately 19ha and is currently undeveloped.

1.4 Development proposals are for the following:

Outline Planning Application for the construction of a residential development of up to 420 residential dwellings and associated open space and infrastructure (With some matters reserved).

1.5 In terms of flood risk, the application site is wholly situated in Flood Zone 1, land which has less than a 1 in 1,000 annual probability of river or sea flooding. Although the site is not shown as being at risk of flooding on the Environment Agency (EA) mapping, this report has been prepared on the basis that the total site area exceeds 1ha.

1.6 This document has been written in accordance with the guidance contained within the Flood Risk and Coastal Change section of the Government's Planning Practice Guidance (FRCC, PPG).

1.7 This FRA concludes that the proposed development will not lead to the impedance of flood flows and will not increase the risk of flooding on the site itself, adjacent properties or to third parties situated either upstream or downstream of the site.

1.8 This document includes a Surface Water Drainage Strategy that identifies a suitable sustainable strategy for the disposal of surface water from the proposed development site that conforms with the guidance contained within the following document:

- CIRIA C753 SuDS Manual (2015)

1.9 The proposed Drainage Strategy is based on a maximum allowance of 40% climate change in accordance with current guidance.

1.10 A suitable foul water outfall by way of a gravity connection to Severn Trent Water (STW) assets in Stapleford Lane (B6003) has also been identified for the proposed development.

1.11 **From the findings of this report, the development proposals are considered appropriate for the site location; therefore, should be fully supported through the Planning process in terms of Flood Risk, Foul and Surface Water Drainage.**

Existing Site and Proposed Development

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Existing Site and Proposed Development

The following paragraphs provide detail on the existing and proposed future residential development site; in relation to location, land uses and topography.

2.1 The application site is situated in Toton in Broxtowe Borough Council, Nottinghamshire.

2.2 The site currently comprises 19 hectares (ha) of agricultural land and is bounded by the B6003 Stapleford Lane to the east, agricultural land to the north, existing residential area to the south and the Toton Freight Yard to the west.

2.3 The Topographical Survey of the site was carried out by TAG Surveys in October 2021. During the survey, information was recorded on the location and type of land features observed, including type of surface finishes, land boundaries, vegetation, and the geometric constraints of open channel ditches. All surveyed elevations were recorded at heights in metres above Ordnance Datum (mAOD). Ground levels and spot levels are also indicated on the drawing where they were recorded onsite. A copy of the Topographical Survey is provided in **Appendix B**.

2.4 In terms of existing drainage utilities, there are no existing sewers within the application site. STW sewer records identify existing combined sewer, surface water sewer and highway drain in Stapleford Lane to the east of the site.

2.5 STW plans also show an existing surface water sewer running in a southerly direction alongside the railway line to the west of the site. The sewer subsequently connects to a culverted watercourse which crosses the railway line towards the west. The topographical survey confirms that the existing ditch running alongside the northern site boundary before entering and crossing the site also discharges into this culverted watercourse.

2.6 The development proposals are for the following:

Outline Planning Application for the construction of a residential development of up to 420 residential dwellings and associated open space and infrastructure (With some matters reserved).

2.7 A copy of the Illustrative Masterplan is provided in **Appendix C**.

Flood Risk

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Flood Risk

The following paragraphs will identify whether or not there are any flood risks associated with the future development which may affect the proposals impact on the surrounding environment.

3.1 This FRA has been prepared in accordance with the National Planning Policy Framework (NPPF) which was published in March 2012 (last updated February 2025) and accompanying Planning Practice Guidance (PPG) Flood Risk and Coastal Change published in March 2014 (last updated September 2025).

3.2 Table 1 of the Flood Risk and Costal Change (FRCC), PPG seeks to define Flood Risk Zones. An extract of this table is shown in Figure 3.1 which follows.

3.3 Annex 3 of the FRCC, PPG defines 'Flood Risk Vulnerability Classification'. Whilst Table 2 of the same document compares the suitability of a development within a particular Flood Zone based on its corresponding Flood Risk Vulnerability Classification.

3.4 As previously mentioned, the development proposals are for the following:

Outline Planning Application for the construction of a residential development of up to 420 residential dwellings and associated open space and infrastructure (With some matters reserved).

3.5 The EA Flood Map demonstrates that the site lies within Flood Zone 1 and is therefore classified as having less than a 1 in 1,000 annual probability of flooding from rivers or seas. A copy of the EA Flood Map covering the immediate surrounding area for the proposed development is shown in **Appendix D**.

3.6 According to Annex 3, residential dwellings are classified under the 'More Vulnerable' category, which is considered to be appropriate for development within Flood Zone 1 (Table 2). Therefore, there is no need to carry out an Exception Test.

3.7 With regard to a Sequential Test, the PPG states that in applying paragraph 175 of the NPPF a proportionate approach should be taken. Where a site specific FRA demonstrates clearly that the proposed layout design, and mitigation measures would ensure that occupiers and users of the site would remain safe from current and future surface water flood risk for the lifetime of the development, without increasing flood risk elsewhere, then the sequential test need not be applied.

3.8 Based on the information provided in paragraphs 3.9 – 3.34, it is therefore concluded that a Sequential Test is not required on the basis that the risk of flooding to the development is considered to be low and the development will not increase flood risk elsewhere.

Flood Zone	Definition
Zone 1 Low Probability	Land having a less than 0.1% annual probability of river or sea flooding. (Shown as 'clear' on the Flood Map for Planning – all land outside Zones 2, 3a and 3b)
Zone 2 Medium Probability	Land having between a 1% and 0.1% annual probability of river flooding; or land having between a 0.5% and 0.1% annual probability of sea flooding. (Land shown in light blue on the Flood Map)
Zone 3a High Probability	Land having a 1% or greater annual probability of river flooding; or Land having a 0.5% or greater annual probability of sea. (Land shown in dark blue on the Flood Map)
Zone 3b The Functional Floodplain	This zone comprises land where water from rivers or the sea has to flow or be stored in times of flood. The identification of functional floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. Functional floodplain will normally comprise: • land having a 3.3% or greater annual probability of flooding, with any existing flood risk management infrastructure operating effectively; or • land that is designed to flood (such as a flood attenuation scheme), even if it would only flood in more extreme events (such as 0.1% annual probability of flooding). Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. (Not separately distinguished from Zone 3a on the Flood Map)

Figure 3.1: Flood Zone Definitions – Planning Practice Guidance Extract

Risk of Flooding to the Development from Known Sources

3.9 Notwithstanding the above, presented below is a summary and analysis of the potential for the site to flood from known sources.

Flooding from Rivers and/ or Watercourses

3.10 The topographical survey identifies an existing ditch which runs alongside the northern site boundary before entering and crossing the site, and subsequently discharges into the STW culverted watercourse to the west.

3.11 The nearest EA designated main river is the River Erewash which is located approximately 500m to the west of the site.

3.12 As previously mentioned, the EA flood mapping show that the application site is wholly situated in Flood Zone 1, land which has less than a 1 in 1,000 annual probability of river or sea flooding. On this basis, it is therefore concluded that the site is not at risk of flooding from this source.

Flooding from the Sea

3.13 The nearest sea to the site is the Irish Sea, which is located approximately 92km to the east. Given this distance and the fact that the site lies above 37m AOD; the proposed residential scheme is not considered to be at risk of flooding from this source.

Flooding from Land

3.14 The potential for overland flows needs to be considered to ensure that neither the development nor adjacent land and/ or property, including that which may be under the responsibility of a third party, is placed at an unacceptable risk of flooding.

3.15 The EA Surface Water Flood Map for the site, which is enclosed in **Appendix E**, indicates that the majority of the development site is not considered to be at risk of surface water flooding. However, areas within the extents and immediately adjacent to the existing ditch are shown to be at low to high risk of surface water flooding.

3.16 Small areas of surface water flooding are also shown to the south of the existing ditch and near the proposed site access. However, these appear to originate within the site rather than from off-site sources. Any associated surface water flood flows will be intercepted and managed by the proposed surface water drainage network.

3.17 All proposed residential dwellings are located outside areas identified as being at risk of surface water flooding from off-site flows. Surface water generated within the site will be managed within the proposed drainage network.

3.18 At the detailed design stage, final external levels will be designed to ensure that surface water flows are routed away from any vulnerable areas and directed towards the proposed drainage network. The proposed layout, drainage strategy and mitigation measures will ensure that occupiers and users remain safe from the current and future surface water flood risk, without increasing flood risk elsewhere.

3.19 Based on the information above and in line with the recent changes to the PPG in respect of the sequential test, it is considered that development in these locations of localised flooding would be acceptable on the basis that the risk will be mitigated by the proposed drainage strategy, and a sequential test is therefore not required.

Flooding from Groundwater

3.20 A Combined Phase I Desk Study and Preliminary Phase II Exploratory Investigation was undertaken by GeoDyne Limited in March 2024. Relevant extracts from the report are included in **Appendix F**.

3.21 From the report it is noted that the underlying ground conditions comprise topsoil to depths of between 0.20m and 0.40m beg. Made Ground was encountered, in close proximity to the western site boundary, to depths of between 0.6m and 2.40m begl. The natural strata initially comprises stiff or very stiff sandy silty clay, Underlying these clay soils, an extremely weak siltstone was encountered, recovered as fine to medium angular platey gravel. Beneath the siltstone, stiff slightly sandy clay was encountered within one of the boreholes at a depth of 4.50m, extending to the base of the borehole at 5m below ground level (begl). In some places, the siltstone was underlain by moderately strong mudstone to the base of the pit at 2.20m begl.

3.22 No groundwater was encountered within any of the exploratory holes at the site. On this basis, it is therefore concluded that the site is not at risk of flooding from this source.

Flooding from Sewers

3.23 A copy of the STW Wastewater Plan illustrating the site extents and the immediate surrounding areas on Ordnance Survey (OS) mapping; together with approximate locations of STW assets is enclosed in **Appendix G**. From the plan, it can be seen that there are no STW assets located within the site boundary.

3.24 The nearest STW public sewers are the existing combined sewer, surface water sewer and highway drain in Stapleford Lane to the east of the site.

3.25 STW plans also show an existing surface water sewer running in a southerly direction alongside the railway line to the west of the site. The sewer subsequently connects to a culverted watercourse which crosses the railway line towards the west.

3.26 Given that there are no existing sewers within the site boundary or immediate adjacent land, it is considered that the site is not at risk of flooding from this source.

Flooding from Reservoirs, Canals and Other Artificial Sources

3.27 The EA Reservoir Flood Map shows that the application site is not at risk of flooding from reservoirs. A copy of this mapping is enclosed in **Appendix H.**

3.28 It should be noted that an occurrence of flooding from reservoirs is considered by the EA to be extremely rare. There has been no loss of life in the UK from reservoir flooding since 1925.

Risk of Flooding from the Proposed Development

3.29 Presented below is a summary and analysis of the potential for the site to exacerbate the risk of flooding to third parties both upstream and downstream.

Encroachment onto Floodplain

3.30 As outlined above, the site does not lie within the floodplain, there is therefore no risk of encroachment upon the floodplain.

Impedance of Flood Flows

3.31 The EA Surface Water Flood map shows that the majority of the development site is not considered to be at risk of surface water flooding. However, areas within the extents and immediately adjacent to the existing ditch are shown to be at low to high risk of surface water flooding.

3.32 Small areas of surface water flooding are also shown to the south of the existing ditch and near the proposed site access. However, these appear to originate within the site rather than from off-site sources. Any associated surface water flood flows will be intercepted and managed by the proposed surface water drainage network.

3.33 All proposed residential dwellings are located outside areas identified as being at risk of surface water flooding from off-site flows.

3.34 Following the development of the site any surface water flows which emanates from the site will be intercepted and managed by the proposed surface water drainage network. Therefore, it is concluded that there is no risk of the proposed development impeding flood flows.

Contribution of Flood Flows by Development Drainage

3.35 As previously mentioned, the application site covers an area of approximately 19ha.

3.36 The development proposals comprise up to 420 residential dwellings and associated infrastructure, which will contribute to the development's surface water discharge.

3.37 If considered appropriate at the detailed design stage, flood routing measures will be incorporated to ensure that flood waters in excess of those for which the site has been designed to accommodate, will be routed away from the more vulnerable areas of the site.

3.38 The surface and foul water disposal strategies for the site are described in greater detail in the following 'Chapter 4 – Proposed Development Drainage Strategy'.

Climate Change

3.39 The EA's guidance document 'Flood risk assessment: climate change allowances' (FRA:CC) sets out the requirements for accounting for climate change within flood risk assessments and drainage strategies.

3.40 The FRA:CC provides allowances for peak river flow and peak rainfall intensity as percentage uplifts that vary by management catchment. These allowances must be applied when assessing fluvial flood risk and in the design of site-wide drainage.

3.41 The peak rainfall allowances for the application site have been taken from the EA's published data for the 'Lower Trent and Erewash Management Catchment' and are as follows;

Epoch	**Central allowance**	**Upper end allowance**
3.3% annual exceedance rainfall event		
2050s	20%	35%
2070s	25%	35%
1% annual exceedance rainfall event		
2050s	20%	40%
2070s	25%	40%

Table 3.3: Lower Trent and Erewash Management Catchment peak rainfall allowances

3.42 It is advised to use '2050s' for development with a lifetime up 2060 and the 2070s epoch for development with a lifetime between 2061 and 2125.

3.43 Considering the above, the climate change allowance that the proposed development's drainage strategy will be based on is set at a value of +40% (Upper end allowance, representing the total potential change anticipated for 2061 – 2125).

Proposed Development
Drainage Strategy

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Proposed Development Drainage Strategy

The following paragraphs will provide detail on the proposed site generated foul and surface water disposal methods, design criteria and maintenance regimes.

4.1 In addition to ensuring that the development is not at risk of flooding from external sources, it is also important to ensure that the scheme itself does not exacerbate flood risk for others. It is therefore essential that the arrangements for storm and foul water disposal are fully assessed to guarantee that the effects are mitigated and that there will be no impact on the existing land drainage regime.

Surface Water Drainage Strategy

4.2 All of the recent guidance on the arrangements for storm water disposal from new developments has encouraged the application of a hierarchy for surface water disposal. This hierarchy is set out in the Building Regulations Part H and is consistent with the relevant LLFA guidance.

4.3 Rainwater harvesting will be utilised on site through the provision of water butts; however, these are not accounted for within the calculations. In terms of the formal drainage strategy the first choice for surface water disposal which should be pursued is via infiltration. Only where it has been determined that the ground conditions are not suitable should the second choice of disposal to a ditch and/ or watercourse be considered. If there is no alternative the third and last choice of disposal to the public sewer can be considered.

Method of Surface Water Discharge

Infiltration

The preliminary ground investigations confirm that the geology encountered during the intrusive works indicates that soakaways are unlikely to be suitable at the site.

Ditch and/or Watercourse

4.4 In light of the above and in accordance with the hierarchy for surface water disposal, the next option to be considered is discharge to ditch/watercourse.

4.5 As previously mentioned, the topographical survey identifies an existing ditch which runs alongside the northern site boundary before entering and crossing through the site, and ultimately into the STW culverted watercourse to the west.

4.6 It is therefore proposed to discharge surface water runoff from the site into the aforementioned ditch via two separate outfalls in the western extent of the site. The total site runoff will be restricted to 21.7l/s which is equivalent to the Qbar greenfield runoff rate of 1.93l/s/ha.

Discharge Strategy

Rainfall Data

4.7 The Flood Estimation Handbook (FEH) methodology has been used in order to determine the requirements of the drainage network.

Runoff Rate

4.8 The proposed discharge rate at each outfall has been calculated by applying the Qbar greenfield runoff rate of 1.93l/s/ha to the total contributing catchment area.

4.9 The area to the north of the existing ditch will discharge via Surface Water Outfall 1 at a maximum rate of 2.0l/s. Whilst the remainder of the site, the area to the south of the existing ditch, will discharge via Surface Water Outfall 2 at a restricted rate of 19.7l/s.

4.10 The site is currently greenfield and does not contain any formal drainage infrastructure. The proposed development will therefore represent a significant betterment compared to the existing situation by implementing a controlled drainage strategy. Surface water runoff to the existing ditch will be restricted to the calculated Qbar greenfield runoff rate of 1.93l/s/ha and onsite attenuation will be provided to manage storm events up to and including the 100 year event plus 40% climate change allowance. This will ensure that peak flows to the receiving ditch network are significantly reduced when compared to the existing uncontrolled drainage regime particularly during extreme storm events.

Attenuation Volume Requirement

4.11 The application site is currently undeveloped; therefore, the proposed development will generate an increase in impermeable area. Based on the current layout drawing, the proposed development will generate a total impermeable area of approximately 6.784ha.

4.12 It is therefore necessary to ensure that sufficient attenuation is provided to accommodate the runoff from the impermeable surfacing during the 1 in 100 (+40% climate change) storm event, with an allowance for 10% urban creep.

4.13 On-site surface water attenuation will be provided within the proposed attenuation basins situated in the western extents of the site.

4.14 A copy of the Proposed Drainage Strategy and associated drainage calculations can be found in **Appendix I and J,** respectively.

4.15 The calculations have been carried out using HR Wallingford's Surface Water Storage Volume Design Tool, which provides an estimate of the required storage volume in line with best practice and current guidance. The tool calculates greenfield runoff rates and estimates attenuation storage volumes using the FEH statistical method. The results have informed the design and sizing of the proposed attenuation basin to ensure that surface water runoff is appropriately managed effectively on-site for all storms up to and including the 1 in 100 year event plus 40% climate change and 10% urban creep.

Method of Attenuation

4.16 In accordance with current guidelines and best practice, the developer's best endeavours will be made to ensure that appropriate Sustainable urban Drainage Systems (SuDS) are used wherever practicable. There are a number of primary methods available, the appropriateness of which has been considered and summarised in Table 4.1 below;

Table 4.1: SuDS Feasibility Consideration

SuDS System	Feasibility	Comments
Green Roofs	X	Will not be incorporated within the proposed drainage strategy as the cost is likely to adversely affect the scheme's viability.
Permeable Paving	✓	To be considered further at detailed design stage.
Soakaways	✓	To be considered at reserved matters stage.
Rainwater Harvesting	✓	Water butts will be installed as standard as a form of rainwater harvesting. However, this is not accounted for within the currently proposed drainage strategy or attenuation calculations.
Swales	✓	To be considered further at reserved matters stage.
Rain Gardens	X	Not currently included within the proposed drainage strategy as they are unlikely to be adopted.
Attenuation Basin	✓	Attenuation basins are included within the currently proposed drainage strategy to provide surface water storage and treatment on the site..
Geo-cellular Storage Crates	X	Will not be incorporated within the currently proposed Drainage Strategy as the other SuDS offer a more sustainable solution.

4.17 Based on the above assessment, which takes into account the underlying ground conditions, it is proposed to provide the site's surface water storage within the proposed attenuation basins which will be placed in the western extents of the site as shown on the Proposed Drainage Strategy in **Appendix I**.

4.18 Basin 1 will be constructed to an approximate depth of 1m with 1 in 3 side slopes and will provide approximately 935m^3 of storage. Basin 2 will be constructed to an approximate depth of 1.8m with 1 in 4 side slopes and will provide approximately 6,615m^3 of storage. Both have been designed to incorporate pre-treatment forebays and low flow channels.

4.19 In addition to the above, permeable paving and swales will be considered at the detailed design stage, where practicable.

4.20 Water butts will be installed as standard as a form of rainwater harvesting. However, this is not accounted for within currently proposed drainage Strategy or attenuation calculations.

4.21 Bloor Homes' standard specification is to install water efficient fittings that reduce flows to 110 litres/person/dwelling/day.

Surface Water Conveyance

4.22 Surface water runoff from the proposed roofs and roads will generally be routed towards the proposed attenuation basins via gravity pipes which run underneath the roads. The basins will provide storage for the 100 year event with an additional 40% climate change allowance and 10% urban creep.

4.23 From the basins surface water flows will be conveyed, via gravity pipes, to the existing ditch. A flow control device will be installed within the site, downstream of the basin, to restrict flows from the associated catchment to 1.93l/s/ha during all storms up to and including the 100 year event plus 40% climate change and 10% urban creep.

4.24 The proposed drainage strategy and associated calculations can be found in **Appendix I** and **J**, respectively.

Sustainability and Water Quality

4.25 The CIRIA SuDS Manual (C753) states that surface water runoff should be adequately treated to protect the receiving water body. However, the treatment processes provided by different SuDS components will have varying capabilities to remove different types of contaminants. The extent of treatment required will depend on the land use, level of pollution prevention in the catchment and for groundwater; the natural protection afforded by underlying soil layers.

4.26 The hazard and treatment indices for the proposed development have been reviewed from the CIRIA SuDS Manual C753. As the development proposals are for residential dwellings plus associated roads and car parking the land use in terms of pollution hazard indices consists of:

- Residential roofs
- Individual property driveways/residential car parks
- Low traffic roads

4.27 Table 26.2 of the SuDS Manual gives pollution hazard indices for different land use classifications. An extract of the table is provided below showing only the pollution hazard indices associated with the proposed land uses:

Land Use	**Pollution Hazard Level**	**Total Suspended Solids (TSS)**	**Metals**	**Hydrocarbons**
Residential Roofs	Very Low	0.2	0.2	0.05
Individual property driveways, residential car parks, low traffic roads and non-residential car parking with infrequent changes (e.g. schools, offices) i.e. < 300 traffic movements/day	Low	0.5	0.4	0.4

Table 1.1 Pollution hazard indices for different land use classifications

4.28 Table 26.3 of The SuDS Manual provides different water quality management requirements for discharges to surface water. The selected SuDS for the proposed drainage network will comprise an attenuation basin along each of the proposed surface water networks. The mitigation index provided by the SuDS Manual for the proposed SuDS are shown in the table below.

	Mitigation Indices		
Type of SuDS Component	**Total Suspended Solids (TSS)**	**Metals**	**Hydrocarbons**
Detention basin	0.5	0.5	0.6

Table 1.2 Indicative SuDS mitigation indices for discharges to surface water

4.29 To deliver adequate treatment, the proposed SuDS components should have a total mitigation index (for each contaminant type) that equals or is greater than the pollution hazard index (for each contaminant type). Where a single SuDS component is insufficient, additional components in a series would be required, where:

$$\textbf{Total SuDS mitigation index} = \textbf{mitigation index}_1 + 0.5\ (\textbf{mitigation index}_n)$$

4.30 A factor of 0.5 is used to account for the reduced performance of secondary or tertiary components associated with already reduced inflow concentration.

4.31 Table 1.4 below provides a summary of the different impermeable surfacing across the site and the associated pollution hazard indices along with the SuDS mitigation indices for the proposed attenuation basin.

Indices	Total suspended solids	Metals	Hydro-carbons
Residential roofs			
Pollution hazard indices	0.2	0.2	0.05
SuDS mitigation index – attenuation basin	0.5	0.5	0.6
Appropriate treatment	✓	✓	✓
Roads and other hardstanding (including adoptable roads, private roads and drives, car parking areas)			
Pollution hazard indices	0.5	0.4	0.4
SuDS mitigation index – Attenuation basin	0.5	0.5	0.6
Appropriate treatment	✓	✓	✓

Table 1.4 Pollution hazard indices and SuDS mitigation indices for the proposed development

4.32 As previously mentioned, the proposed strategy to discharge surface water runoff from the site into the existing ditch via the proposed attenuation basins in the western extent of the site. All surface water runoff from the site's impermeable areas will pass through one of the proposed basins before reaching the outfall ditch. From Table 1.4 above, it is evident that the mitigation indices for an attenuation basin are equal or greater than the pollution hazard generated by all land uses across the development site and therefore would offer sufficient treatment for surface water runoff from site.

Surface Water Drainage Maintenance

4.33 The arrangements for further maintenance of the surface water drainage system needs to be fully considered and, in that respect, it is anticipated that the onsite surface water drainage network, including the proposed attenuation basins would be maintained by a public or private water authority.

4.34 A summary of the likely maintenance requirements for the proposed attenuation basins is provided in Table 4.2 below.

Table 4.2: Recommended Maintenance for Attenuation Basins

Attenuation Basin	
Monitoring	**Frequency**
To be visually inspected after heavy rainfall to ensure they are free of debris and litter.	As required
Regular Maintenance	
Litter and debris removal from the site	Monthly
Amenity grass cutting at 35 – 50mm	As required
Inspect and clear inlets, control structures and overflows	Monthly
Occasional Maintenance	
Remove leaf accumulation	As required
Remove sediments from inlets and structures	As required
Remedial Work	
Inspect and repair damage to inlets, outlets, banks and overflows	As required

4.35 It should be noted that the maintenance schedule described above should be considered indicative only. The frequency and type of maintenance tasks to be carried out should be reviewed as necessary to ensure that the schedule remains relevant to the nature and location of the proposed residential development.

Foul Water Drainage Strategy

4.36 As previously mentioned, STW sewer records identify an existing combined sewer in Stapleford Lane to the east of the site. The proposed foul drainage strategy is therefore to discharge foul flows from the development site into this sewer via manhole 6502.

4.37 The eastern part of the site will convey foul flows, via a gravity foul sewer network, which will discharge directly into the STW sewer in Stapleford Lane.

4.38 The remainder of the site will convey foul flows via a gravity network to a proposed pumping station located in the western extent of the site. From the pumping station, foul flows will be pumped via a rising main to the gravity foul system within the eastern part of the site, where they will ultimately discharge into the STW network via manhole 6502 in Stapleford Lane. A copy of the Proposed Drainage Strategy is provided in **Appendix I**.

4.39 The STW Pre-Development Response, which is provided in **Appendix K**, confirms that a pumped connection can be made to the 225mm diameter combined sewer in Stapleford Lane to the east of the site, via manhole 6502. However, there is currently insufficient capacity within the STW network and further modelling will be required which may show that improvements are required to the STW network and receiving pump station. The site will therefore be added to the STW modelling tracker and reviewed regularly until the site can be progressed for sewer modelling.

4.40 A suitable foul sewer network to discharge the residential development, will be designed in accordance with STW adoptable standards, providing a direct point of connection between the development site and STW foul sewer. Further details of this design will be provided at the detailed design stage.

4.41 Notwithstanding the above, in accordance with relevant drainage policy, STW are obliged to accept foul water flows from a proposed development, subject to the site receiving planning consent. In anticipation that such a consent will be granted for the proposed residential scheme, it is expected that STW will make the necessary arrangements to ensure that the required provision within their public combined/foul sewer network and treatment works will be available at the time that the Applicant wishes to connect the site's foul sewers to the public combined network.

Foul Water Drainage Maintenance

4.42 In anticipation that the proposed residential development will be connected to the STW public combined sewer network; STW will act in their full capacity as the wastewater provider for the local area, to ensure that maintenance of their public sewers will be carried out as required from the point at which the private sewer outfalls connect to the public sewer network.

Summary and Conclusion

Summary and Conclusions

The following paragraphs summarise the findings of this Flood Risk Assessment and Drainage Strategy. Details of foul and surface water outfalls and SuDS features are also provided.

5.1 This Flood Risk Assessment (FRA) and Drainage Strategy has been prepared by Woods Hardwick Ltd (WH) on behalf of Bloor Homes in support of an Outline Planning Application for a proposed residential development on a site known as 'Land west of the B6003, Toton West, Broxtowe, Nottinghamshire'.

5.2 The proposals are for the following:

Outline Planning Application for the construction of a residential development of up to 420 residential dwellings and associated open space and infrastructure (With some matters reserved).

5.3 The application site comprises an area of approximately 19ha and is shown on the EA's Flood map for planning as lying within Flood Zone 1; therefore, having an annual probability of river and/ or sea flooding of less than 1 in 1,000.

5.4 The EA Surface Water Flood Map indicates that the majority of the development site is not considered to be at risk of surface water flooding. However, areas within the site extents immediately adjacent to the existing ditch are shown to be at low to high risk of surface water flooding. In addition, small isolated areas of surface water flooding are also shown to the south of the existing ditch and near the proposed site access. The flooding in these areas appears to originate from surface water generated within the site rather than from off-site sources. Any associated surface water flood flows will be intercepted and managed by the proposed surface water drainage network.

5.5 All proposed residential dwellings are located outside areas identified as being at risk of surface water flooding from off-site flows. Surface water generated within the site will be managed within the proposed drainage network.

5.6 Based on the above and in line with the recent changes to the PPG in respect of the sequential test, it is considered that development in these locations of localised flooding would be acceptable on the basis that the risk will be mitigated by the proposed drainage strategy, and a sequential test is therefore not required.

5.7 All other potential sources of flooding to the proposed development have been considered and it has been demonstrated that the site will not be at any significant risk of flooding.

5.8 It has been demonstrated that the proposed development will not exacerbate the risk of flooding to third parties either upstream or downstream from the site.

5.9 The Surface Water Drainage Strategy has been developed in accordance with the hierarchy for sustainable surface water disposal.

5.10 The Combined Phase I Desk Study and Preliminary Phase II Exploratory Investigation confirms that the geology encountered during the intrusive works indicates that soakaways are unlikely to be suitable at the site. Therefore, the proposed surface water drainage strategy is to discharge runoff from the site into the existing ditch which crosses the site via two separate outfalls in the western extent of the site. The total site runoff will be restricted to 21.7l/s which is equivalent to the Qbar greenfield runoff rate of 1.93l/s/ha.

5.11 Surface water storage will be provided within the proposed attenuation basins situated in the western extent of the site. The basins will be sized approximately to accommodate surface water runoff from the 100 year event plus allowances for 40% climate change and 10% urban creep.

5.12 It has been demonstrated that the proposed attenuation basin would offer sufficient treatment for surface water runoff from site. In addition, permeable paving and swales will be considered at the detailed design stage, where practicable.

5.13 The proposed foul drainage strategy is to discharge foul flows from the development site into the existing STW combined sewer in Stapleford Lane via manhole 6502.

5.14 The eastern part of the site will discharge directly into the STW sewer, via a gravity network. Whilst, the remainder of the site will convey foul flows to a proposed pumping station located in the western extent of the site. From the pumping station, foul flows will be pumped via a rising main to the gravity foul system within the eastern part of the site, before ultimately discharging into the STW network in Stapleford Lane.

5.15 In accordance with relevant drainage policy, STW are obliged to accept foul water flows from a proposed development, subject to the site receiving planning consent. In anticipation that such a consent will be granted for the proposed residential scheme, it is expected that STW will make the necessary arrangements to ensure that the required provision within their public combined/foul sewer network and treatment works will be available at the time that the applicant wishes to connect the site's foul sewers to the public combined network.

5.16 From the information provided within this report, it is concluded that there is no reason in terms of drainage or flood risk why the residential development proposed on 'Land west of the B6003, Toton West, Broxtowe, Nottinghamshire', should not be fully supported through the planning process.

Appendix A

Site Location Plan

Planning | Design | Environment | Economics | Heritage
East Midlands
www.pegasusgroup.co.uk

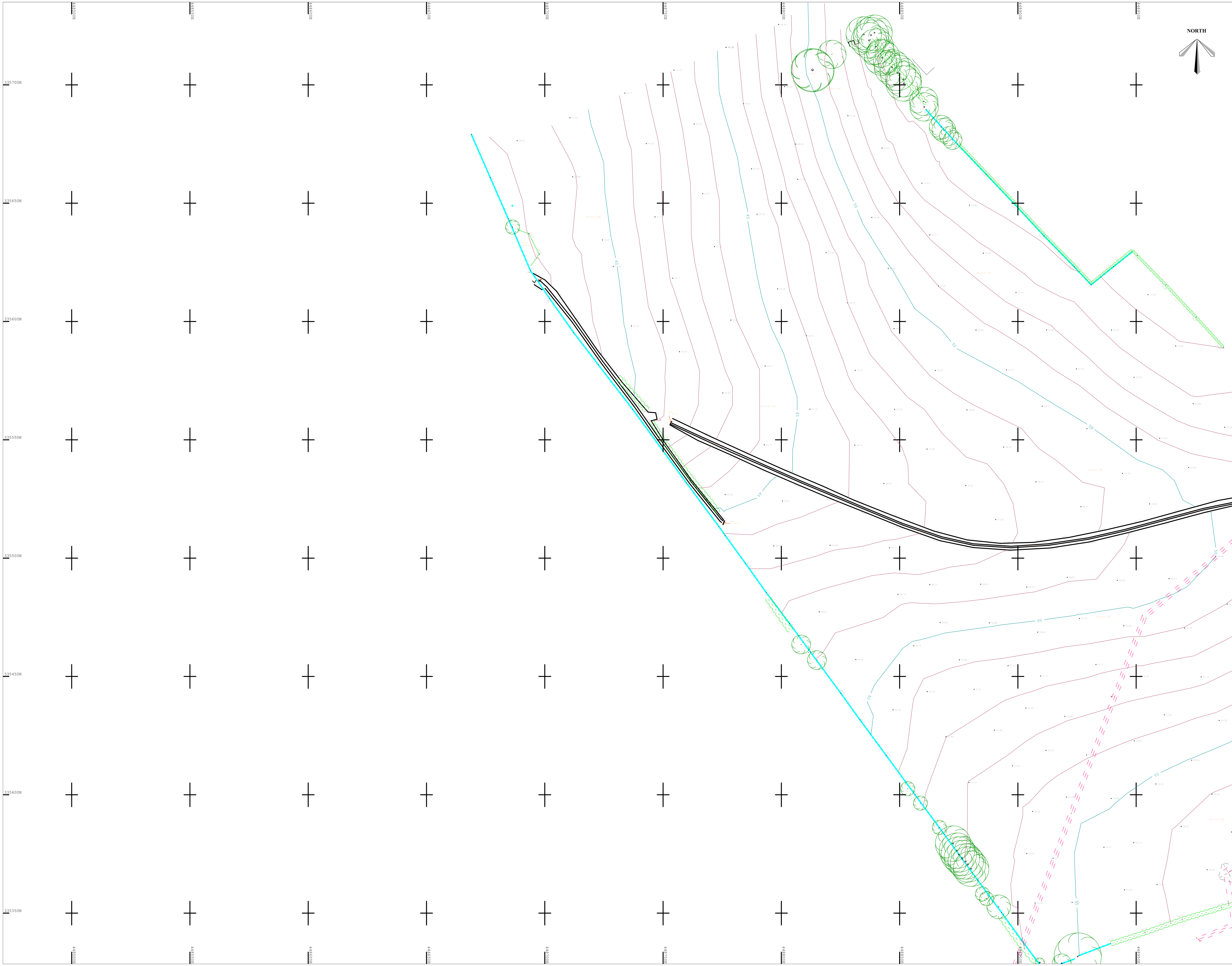
Land South of the A52, Toton West, Broxtowe, Nottinghamshire - **Site Location Plan**

| Drawn by: ALW | Approved by: - | Date: 10/11/25 | Scale: 1:2,500 @ A1 | DRG: P23-2379_DE_009 Sheet No: 01 Rev: C | Client: Bloor Homes |

PEGASUS GROUP

Appendix B

Topographic Survey



NOTES

GENERAL NOTES :–

ALL LEVELS ARE IN METRES DERIVED FROM GPS TRANSFORMATION.

GRID COORDINATES ARE ORDNANCE SURVEY NATIONAL GRID DERIVED FROM GPS TRANSFORMATION. GPS COORDINATES AND LEVELS SET AT ST02

THIS DRAWING HAS BEEN PRODUCED WITH A PLOT SCALE ACCURACY OF 1:500

SERVICE COVERS INDICATED WHERE VISIBLE. PIPE INVERTS / DETAILS SURVEYED FROM SURFACE INSPECTION ONLY. GENERALLY DAMAGED COVERS AND COVERS WITHIN HIGHWAYS WILL NOT BE LIFTED

TREE SPECIES SHOULD BE CONFIRMED BY TREE SPECIALIST IF CRITICAL.

OVERHEAD CABLES ARE INDICATED USING REMOTE SURVEY METHODS AND ARE SUBJECT TO SEASONAL VARIATION, AND SHOULD BE TREATED AS APPROXIMATE.

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ST10	448929.623	335391.076	55.163
ST11	448830.965	335665.222	51.108

SHEET LAYOUT :–

UTILITY SURVEY KEY :–

HATCHED AREA
BOREHOLE
CPT
TRIAL PIT
HAND PIT
WINDOW SAMPLE

ELECTRIC CABLE
WATER PIPE
FOUL SEWER
STORM SEWER
COMBINED SEWER
DUCTS
CABLE TELEVISION
DATA CABLE
TELECOM CABLE
GAS PIPE
UNIDENTIFIED SERVICE
OTHER
CCTV
TRAFFIC LIGHT
OFFSET FILL
VENT
FUEL PIPE
GAUGE LINES
PIPE
ASSUMED ROUTE
TAKEN FROM RECORDS

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UTILITY NOTES

0 5 10 20 30 40 50

[redacted]

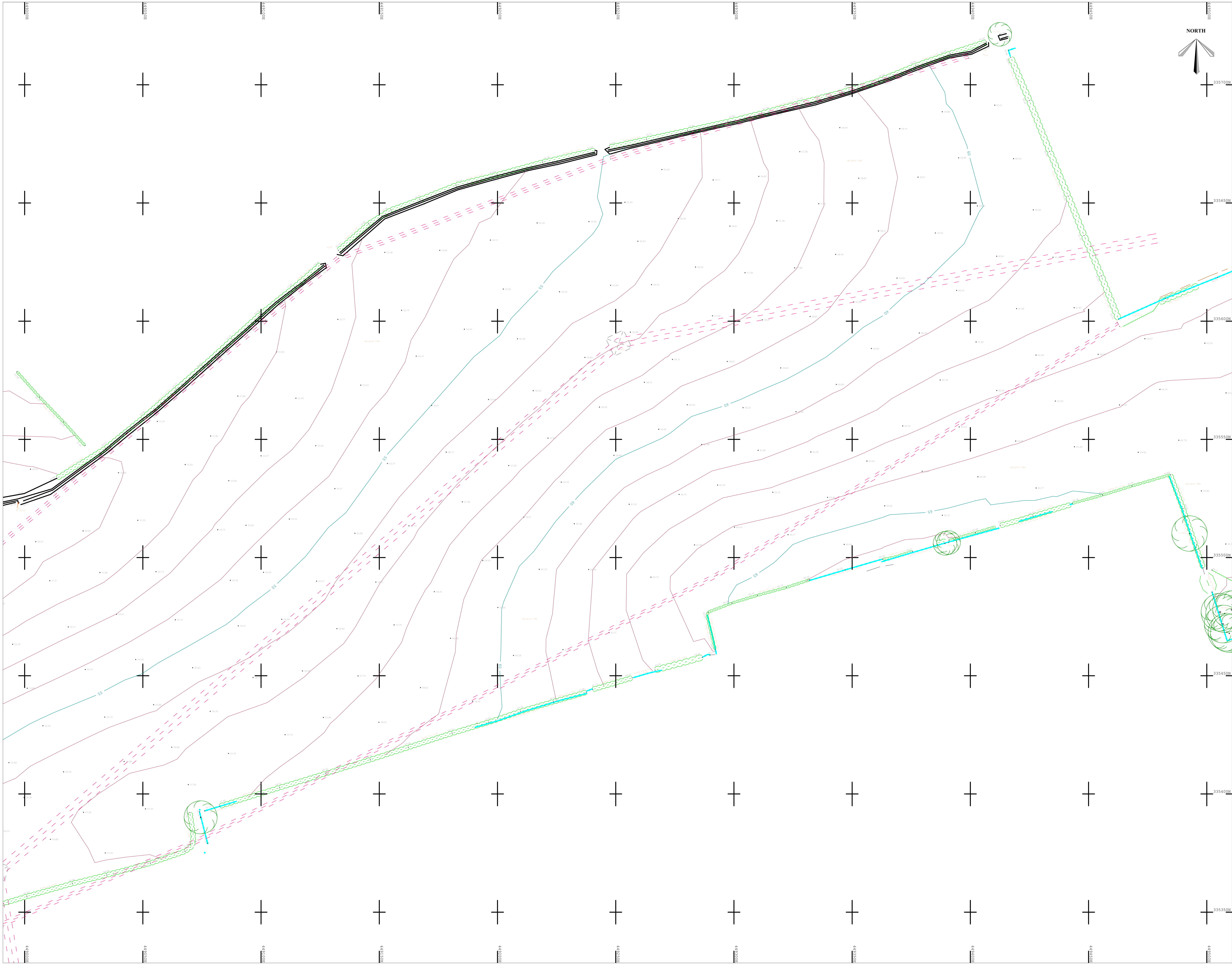
INFO@TAGSURVEYS.CO.UK WWW.TAGSURVEYS.CO.UK

Client	BLOOR HOMES (EAST MIDLANDS)
Project	LAND OFF STAPLEFORD LANE, TOTON, NG9 7JB
Title	TOPOGRAPHICAL SURVEY
Date	OCTOBER 2021
Scale	1:500@A0
Dwg No	T0109–(3D)–1
Surveyor	SMc
Checked	SB

Revisions

TOPOGRAPHICAL (LAND) SURVEYORS / UTILITY SURVEYORS
BUILDING MEASUREMENT SURVEYORS / 3D LASER SCANNING

CONTRACTORS HEALTH & SAFETY ASSESSMENT SCHEME
Accredited Contractor
www.chas.gov.uk



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Dwg No	T0109–(3D)–2
Surveyor	SMc
Checked	SB

Revisions

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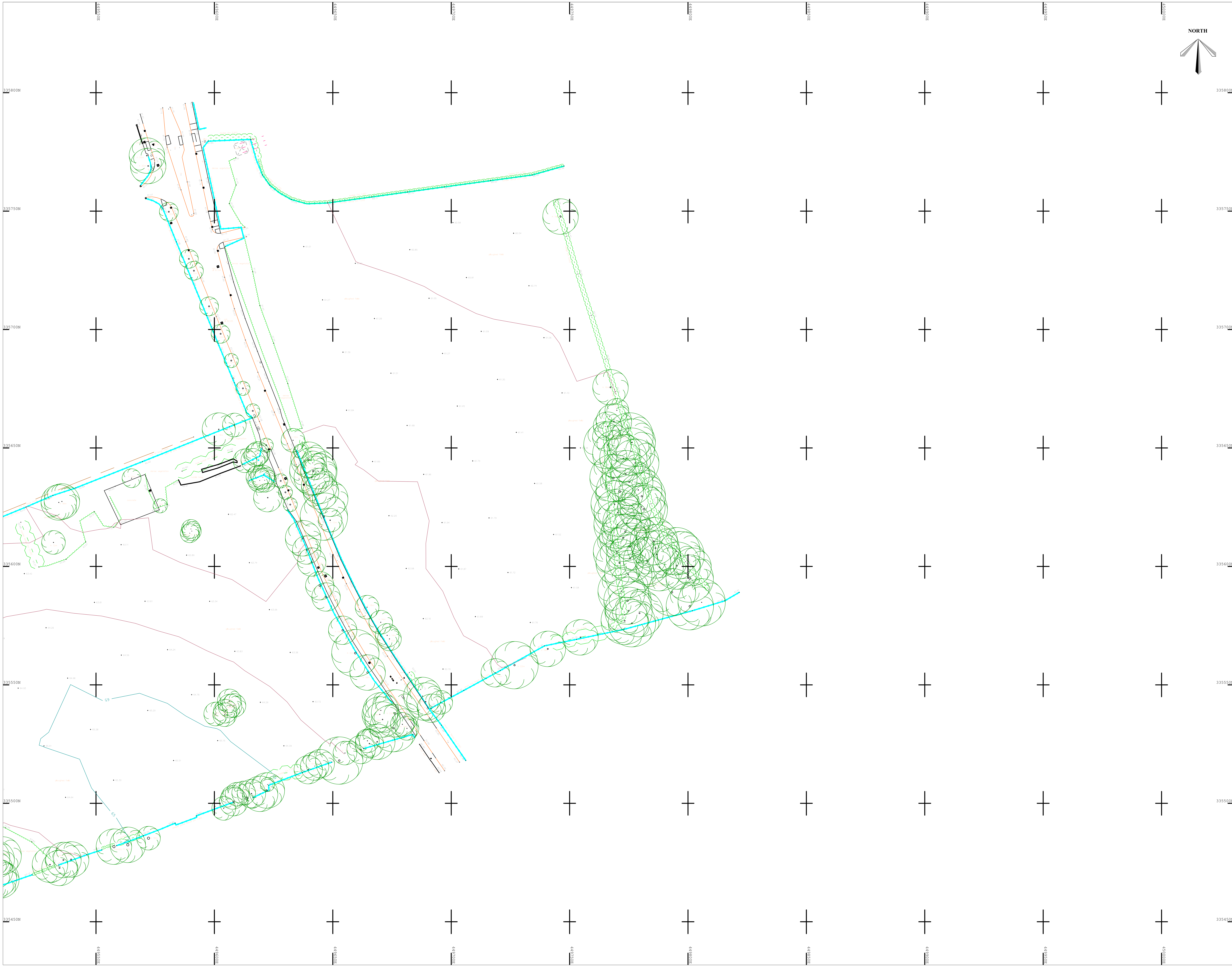
BUILDING MEASUREMENT SURVEYORS / 3D LASER SCANNING



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Surveyor	SMc
Checked	SB

Revisions

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CONTRACTORS HEALTH & SAFETY ASSESSMENT SCHEME
Accredited Contractor
www.chas.gov.uk

Appendix C

Illustrative Masterplan

Woods Hardwick

Architecture | Engineering | Planning | Surveying

A52 Brian Clough Way

Stapleford Treatment Plant

Adult Sports Provision

Formal & Informal Sports & Recreation

Community Plot

George Spencer Academy

B6003 Stapleford Lane

TOTON LANE TRAM STATION & PARK & RIDE

Spinney Rise

B6003 Stapleford Lane

KEY

- **Site Boundary** 19.62Ha
- **Development** Residential 11.7Ha @36dph = 420 dwellings
- **Public Open Space**
- **Vehicular Site Access** B6003
- **Primary Street** Indicative Alignment
- **Streets & Lanes** Illustrative street network
- **Existing Trees & Hedgerows** Retained
- **Drainage Basins**
- **Public Rights of Way** Retained Footpaths & Bridleways
- **Pedestrian & Cycle Links**
- **Pedestrian Links**
- **Pedestrian & Cycle Links** Connections dependent on land ownership
- **Pedestrian & Cycle Priority Crossings**
- **Play Space** LEAP
- **Proposed Landscaping** Buffer planting
- **Allocated Sites**
- **Illustrative Terminal Tower Location** 20m offset

DRAFT

0 50 100 m

Land west of the B6003, Toton West, Broxtowe, Nottinghamshire - **Illustrative Masterplan - Outline**

| Drawn by: AW | Approved by: - | Date: 24/11/25 | Scale: 1:2500 @ A2 | DRG: P23_2379_DE_014 Sheet No: 01 Rev: D | Client: Bloor Homes |

PEGASUS GROUP

Appendix D

Environment Agency – Flood Map for Planning

Flood map for planning

Your reference	Location (easting/northing)	Created
19678	**449131/335660**	**12 December 2025 10:05**

Your selected location is in flood zone 3, an area with a high probability of flooding.

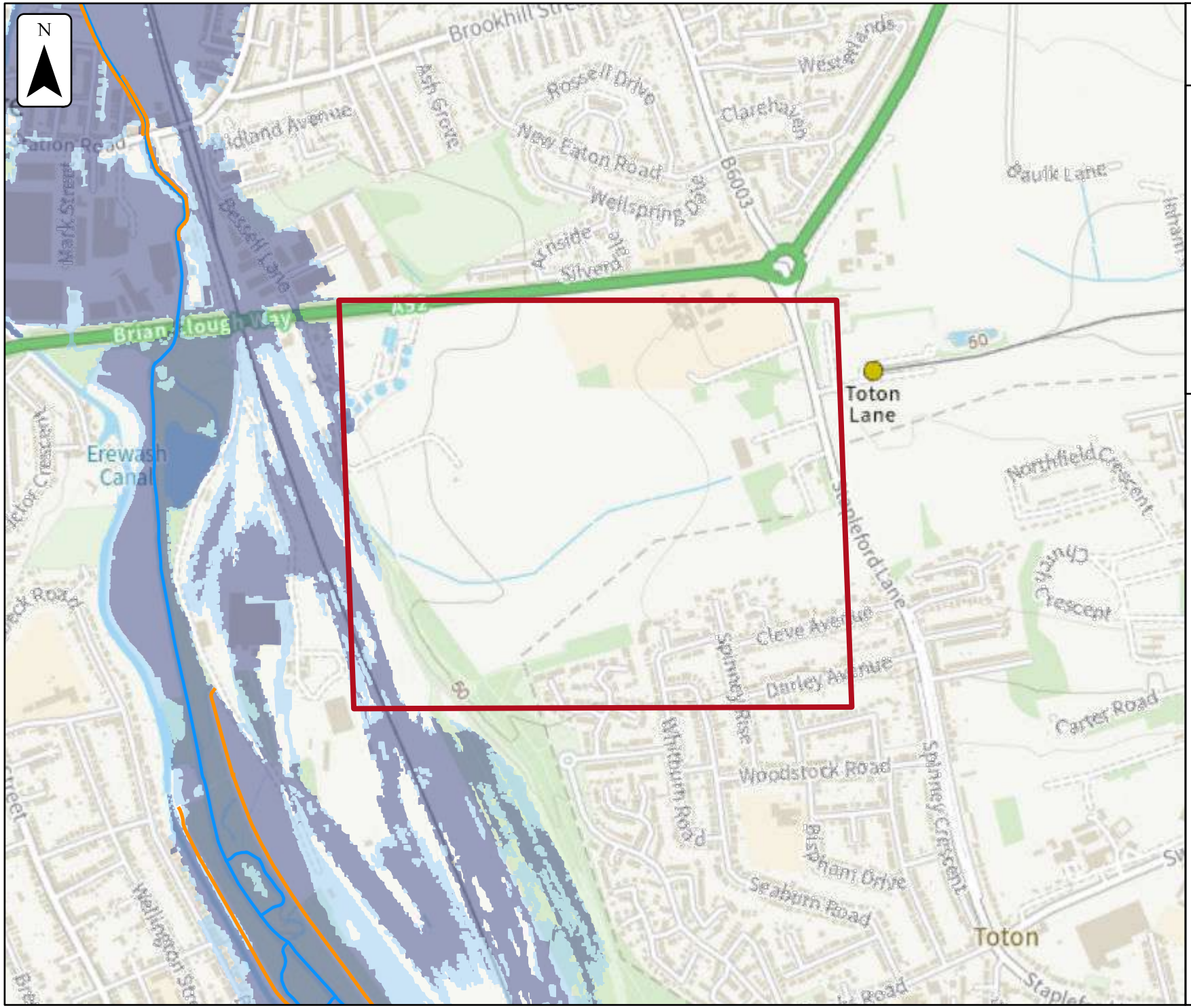
This means:

- you must complete a flood risk assessment for development in this area
- you should follow the Environment Agency's standing advice for carrying out a flood risk assessment (see https://www.gov.uk/guidance/flood-risk-assessment-standing-advice)

Notes

The flood map for planning shows river and sea flooding data only. It doesn't include other sources of flooding. It is for use in development planning and flood risk assessments.

This information relates to the selected location and is not specific to any property within it. The map is updated regularly and is correct at the time of printing.



Environment Agency

Flood map for planning

Your reference
19678

Location (easting/northing)
449131/335660

Scale
1:10,000

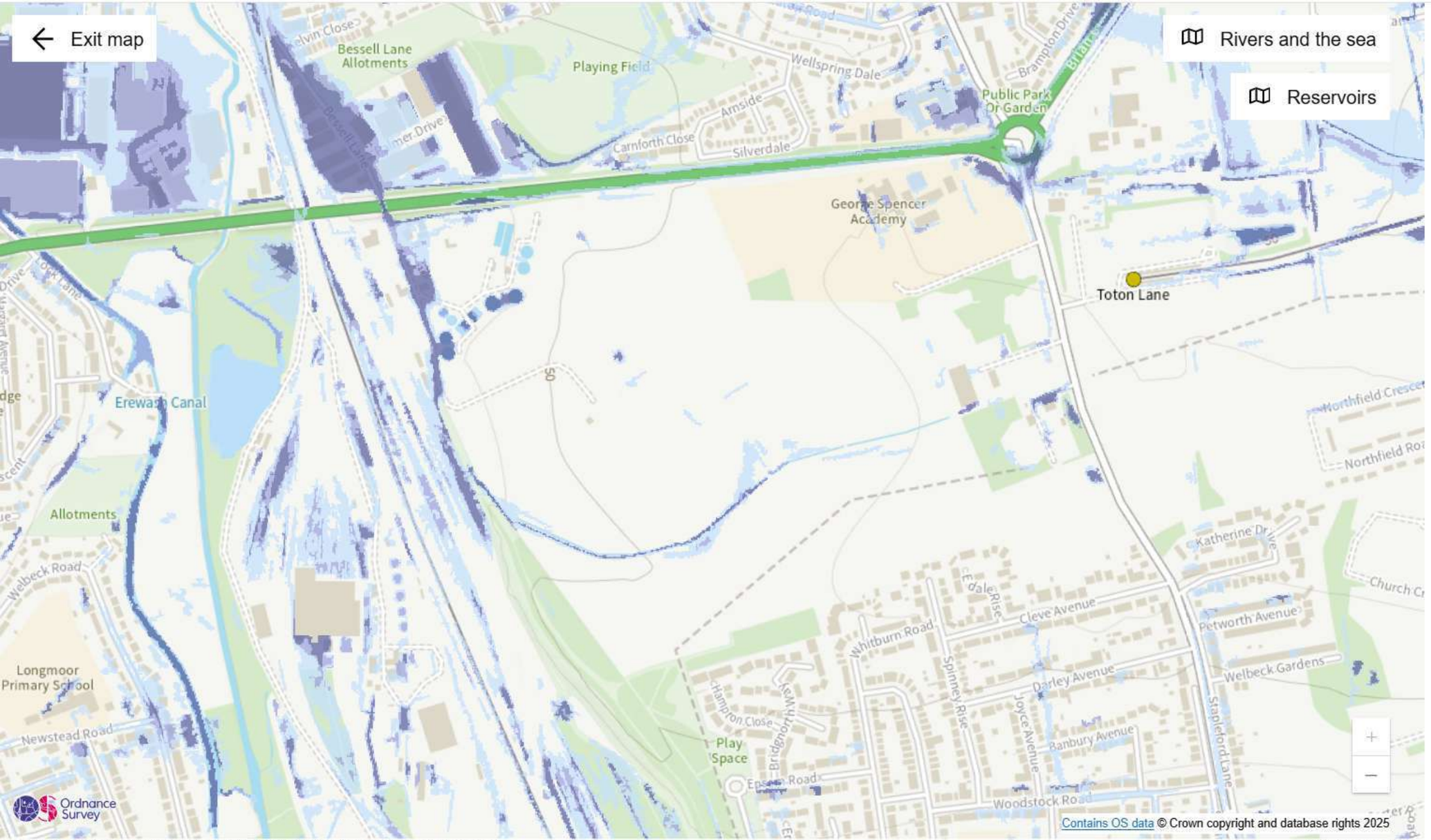
Created
12 Dec 2025 10:05

- Selected area
- Flood zone 3
- Flood zone 2
- Flood zone 1
- Flood defence
- Main river
- Water storage area

0 100 200 300m

Appendix E

Environment Agency – Surface Water Flood Map



Surface water map

Yearly chance of flooding

- ○ Extent
- ○ Depth

Yearly chance of flooding between 2040 and 2060

- ◉ Extent
  - High chance
    More than 3.3% chance each year
  - Medium chance
    Between 1% and 3.3% chance each year
  - Low chance
    Between 0.1% and 1% chance each year
- ○ Depth

Map details

- ☑ Show flooding

Appendix F

GeoDyne Limited Report Extracts

Appendix G

Severn Trent Water Sewer Records

Date: 02/10/24

Scale: 1:1250

Map Centre: 449057,335764

Data updated: 14/09/24

Our Ref: 1584604 - 3

Wastewater Plan A0
Powered by digdat

Public Foul Gravity/Lateral Drain	Highway Drain	Manhole Foul
Public Combined Gravity/Lateral Drain	Overflow Pipe	Manhole Surface
Public Surface Water Gravity/Lateral Drain	Disposal Pipe	Abandoned Pipe
Pressure Foul	Culverted Water Course	Chamber
Pressure Combined	Pumping Station	Section 104 sewers are shown in green
Pressure Surface Water	Fitting	Private sewers are shown in magenta

cambridgeinfrastructureteam@pegasusgroup.co.uk

Toton West

SEVERN TRENT

GENERAL CONDITIONS AND PRECAUTIONS TO BE TAKEN WHEN CARRYING OUT WORK ADJACENT TO SEVERN TRENT WATER'S APPARATUS

Please ensure that a copy of these conditions is passed to your representative and/or your contractor on site. If any damage is caused to Severn Trent Water Limited (STW) apparatus (defined below), the person, contractor or subcontractor responsible must inform STW immediately on:
0800 783 4444 (24 hours)

a) These general conditions and precautions apply to the public sewerage, water distribution and cables in ducts including (but not limited to) sewers which are the subject of an Agreement under Section 104 of the Water Industry Act 1991(a legal agreement between a developer and STW, where a developer agrees to build sewers to an agreed standard, which STW will then adopt); mains installed in accordance with an agreement for the self-construction of water mains entered into with STW and the assets described at condition b) of these general conditions and precautions. Such apparatus is referred to as "STW Apparatus" in these general conditions and precautions.

b) Please be aware that due to The Private Sewers Transfer Regulations June 2011, the number of public sewers has increased, but many of these are not shown on the public sewer record. However, some idea of their positions may be obtained from the position of inspection covers and their existence must be anticipated.

c) On request, STW will issue a copy of the plan showing the approximate locations of STW Apparatus although in certain instances a charge will be made. The position of private drains, private sewers and water service pipes to properties are not normally shown but their presence must be anticipated. This plan and the information supplied with it is furnished as a general guide only and STW does not guarantee its accuracy.

d) STW does not update these plans on a regular basis. Therefore the position and depth of STW Apparatus may change and this plan is issued subject to any such change. Before any works are carried out, you should confirm whether any changes to the plan have been made since it was issued.

e) The plan must not be relied upon in the event of excavations or other works in the vicinity of STW Apparatus. It is your responsibility to ascertain the precise location of any STW Apparatus prior to undertaking any development or other works (including but not limited to excavations).

f) No person or company shall be relieved from liability for loss and/or damage caused to STW Apparatus by reason of the actual position and/or depths of STW Apparatus being different from those shown on the plan.

In order to achieve safe working conditions adjacent to any STW Apparatus the following should be observed:

1. All STW Apparatus should be located by hand digging prior to the use of mechanical excavators.

2. All information set out in any plans received from us, or given by our staff at the site of the works, about the position and depth of the mains, is approximate. Every possible precaution should be taken to avoid damage to STW Apparatus. You or your contractor must ensure the safety of STW Apparatus and will be responsible for the cost of repairing any loss and/or damage caused (including without limitation replacement parts).

3. Water mains are normally laid at a depth of 900mm. No records are kept of customer service pipes which are normally laid at a depth of 750mm; but some idea of their positions may be obtained from the position of stop tap covers and their existence must be anticipated.

4. During construction work, where heavy plant will cross the line of STW Apparatus, specific crossing points must be agreed with STW and suitably reinforced where required. These crossing points should be clearly marked and crossing of the line of STW Apparatus at other locations must be prevented.

5. Where it is proposed to carry out piling or boring within 20 metres of any STW Apparatus, STW should be consulted to enable any affected STW Apparatus to be surveyed prior to the works commencing.

6. Where excavation of trenches adjacent to any STW Apparatus affects its support, the STW Apparatus must be supported to the satisfaction of STW. Water mains and some sewers are pressurised and can fail if excavation removes support to thrust blocks to bends and other fittings.

7. Where a trench is excavated crossing or parallel to the line of any STW Apparatus, the backfill should be adequately compacted to prevent any settlement which could subsequently cause damage to the STW Apparatus. In special cases, it may be necessary to provide permanent support to STW Apparatus which has been exposed over a length of the excavation before backfilling and reinstatement is carried out. There should be no concrete backfill in contact with the STW Apparatus.

8. No other apparatus should be laid along the line of STW Apparatus irrespective of clearance. Above ground apparatus must not be located within a minimum of 3 metres either side of the centre line of STW Apparatus for smaller sized pipes and 6 metres either side for larger sized pipes without prior approval. No manhole or chamber shall be built over or around any STW Apparatus.

9. A minimum radial clearance of 300 millimetres should be allowed between any plant or equipment being installed and existing STW Apparatus. We reserve the right to increase this distance where strategic assets are affected.

10. Where any STW Apparatus coated with a special wrapping is damaged, even to a minor extent, STW must be notified and the trench left open until the damage has been inspected and the necessary repairs have been carried out. In the case of any material damage to any STW Apparatus causing leakage, weakening of the mechanical strength of the pipe or corrosion-protection damage, the necessary remedial work will be recharged to you.

11. It may be necessary to adjust the finished level of any surface boxes which may fall within your proposed construction. Please ensure that these are not damaged, buried or otherwise rendered inaccessible as a result of the works and that all stop taps, valves, hydrants, etc. remain accessible and operable. Minor reduction in existing levels may result in conflict with STW Apparatus such as valve spindles or tops of hydrants housed under the surface boxes. Checks should be made during site investigations to ascertain the level of such STW Apparatus in order to determine any necessary alterations in advance of the works.

12. With regard to any proposed resurfacing works, you are required to contact STW on the number given above to arrange a site inspection to establish the condition of any STW Apparatus in the nature of surface boxes or manhole covers and frames affected by the works. STW will then advise on any measures to be taken, in the event of this a proportionate charge will be made.

13. You are advised that STW will not agree to either the erection of posts, directly over or within 1.0 metre of valves and hydrants,

14. No explosives are to be used in the vicinity of any STW Apparatus without prior consultation with STW.

TREE PLANTING RESTRICTIONS

There are many problems with the location of trees adjacent to sewers, water mains and other STW Apparatus and these can lead to the loss of trees and hence amenity to the area which many people may have become used to. It is best if the problem is not created in the first place. Set out below are the recommendations for tree planting in close proximity to public sewers, water mains and other STW Apparatus.

15. Please ensure that, in relation to STW Apparatus, the mature root systems and canopies of any tree planted do not and will not encroach within the recommended distances specified in the notes below.

16. Both Poplar and Willow trees have extensive root systems and should not be planted within 12 metres of a sewer, water main or other STW Apparatus.

17. The following trees and those of similar size, be they deciduous or evergreen, should not be planted within 6 metres of a sewer, water main or other STW Apparatus. E.g. Ash, Beech, Birch, most Conifers, Elm, Horse Chestnut, Lime, Oak, Sycamore, Apple and Pear. Asset Protection Statements Updated May 2014

18. STW personnel require a clear path to conduct surveys etc. No shrubs or bushes should be planted within 2 metre of the centre line of a sewer, water main or other STW Apparatus.

19. In certain circumstances, both STW and landowners may wish to plant shrubs/bushes in close proximity to a sewer, water main of other STW Apparatus for screening purposes. The following are shallow rooting and are suitable for this purpose: Blackthorn, Broom, Cotoneaster, Elder, Hazel, Laurel, Privet, Quickthorn, Snowberry, and most ornamental flowering shrubs.

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert
	C		0	0
	C		0	0
	C		0	0
	C		0	0
	C		0	0
0106	C	53.71	52.24	1.47
0201	C	57.91	55.5	2.41
1107	C		0	0
1204	C		0	0
1236	C	59.29	56.19	3.1
1237	C	59.3	56.31	2.99
2201	C	59.13	56.78	2.35
2241	C	58.69	56.82	1.87
2242	C	58.94	56.69	2.25
3203	C	58.9	57.09	1.81
3238	C	58.51	56.97	1.54
3301	C	57.96	56.3	1.66
3304	C	56.62	55.01	1.61
3401	C	64.88	63.39	1.49
3403	C	66.12	64.22	1.9
4101	C	35.2	31.98	3.23
4102	C	35.28	32.84	2.45
4107	C	35.18	33.03	2.15
4201	C	48.29	46.83	1.46
4201	C	35.4	31.77	3.63
4202	C	35.46	31.88	3.58
4204	C	35.41	33.31	2.1
4205	C	48.52	46.58	1.94
4301	C	48.14	45.87	2.27
4406	C	58.97	56.68	2.29
5002	C	35.53	32.53	3
5004	C	35.33	31.36	3.97
5005	C	35.37	32.74	2.63
5103	C	35.41	31.47	3.94
5104	C	35.31	32.76	2.55
5304	C		0	0
5402	C	59.11	56.94	2.17
5403	C	63.55	62.26	1.29
5404	C		0	0
5405	C		0	0
5702	C	61.55	60.14	1.41
5901	C	35.75	32.45	3.3
5902	C	35.95	31.11	4.84
5903	C	35.74	31.26	4.48
5904	C	35.85	31.17	4.68
5910	C	36	31.05	4.95
6001	C	37.82	36.27	1.55
6004	C	37.8	35.8	2
6302	C		0	0
6303	C		0	0
6304	C	50.48	48.06	2.42
6402	C	62.72	60.92	1.8
6502	C	63.49	59.09	4.4
6602	C	62.99	59.23	3.76
6604	C	62.14	59.54	2.6
7002	C	38.36	36.73	1.63
7003	C	41.8	39.98	1.82
7203	C	44.7	43.02	1.68
7301	C	54.08	51.88	2.2
7304	C	47.21	45.64	1.57
7401	C	60.53	58.38	2.15
7402	C	59.69	57.45	2.24
7407	C	57.16	55.47	1.69
7415	C	61.66	58.63	3.03
8001	C	43.5	41.29	2.21
8201	C	45.35	43.81	1.54
8202	C	45.36	43.46	1.9
9101	C	44.98	42.61	2.37
9106	C	45.13	43.27	1.86
9107	C	46.59	45.07	1.52
9201	C	49.61	48.24	1.37
	F		0	0
	F		0	0
	F		0	0
	F		0	0
	F		0	0
	F		0	0
	F		0	0
	F		0	0
	F		0	0
	F		0	0
	F		0	0
	F		0	0
	F		0	0
	F		0	0
	F		0	0
	F		0	0
	F		0	0
0103	F	52.42	50.99	1.43
0104	F	54.56	52.86	1.7
0105	F	57.72	53.56	4.16
1101	F	59.11	53.81	5.3
1104	F	59.36	54.45	4.91
1105	F	59.47	54.66	4.81
1108	F	58.69	53.6	5.09
1202	F	59.1	57.12	1.98
1207	F	52.18	50.37	1.81
1217	F		0	0
1226	F		0	0
1228	F		0	0
1229	F		0	0
1301	F	54.28	52.15	2.13
1303	F	55.36	52.9	2.46
2101	F		0	0
2102	F		0	0
2103	F		0	0
2110	F		0	0
2202	F	51.92	50.22	1.7
2215	F		0	0
2216	F		0	0
2217	F		0	0
2227	F		0	0
2228	F		0	0
2229	F		0	0
2230	F		0	0
2237	F		0	0
2238	F		0	0
2239	F		0	0
2240	F		0	0
2302	F	56.07	54.37	1.7
2304	F	55.01	53.78	1.23
2306	F	56.92	55.37	1.55
2402	F	59.45	57.56	1.89
2404	F	59.68	58.52	1.16
2406	F	59.03	57.96	1.07
3224	F		0	0
3230	F		0	0
3231	F		0	0
3232	F		0	0
3233	F		0	0
3234	F		0	0
3235	F		0	0
3300	F		0	0
3307	F		0	0
4200	F		0	0
4401	F	64.63	63.31	1.32
4402	F	63.74	62.63	1.11
5107	F	35.47	33.32	2.15
5108	F	36.37	34.32	2.05
5202	F	57.74	55.88	1.86
5700	F		61.04	0
5704	F		0	0
5804	F		0	0
6101	F	37.66	35.85	1.81
7404	F	59.89	58.66	1.23
8101	F	43.41	41.49	1.92
9103	F	45.79	44.04	1.75
9105	F	49.83	47.3	2.53
0101	S	53.28	51.23	2.05
0102	S	57.27	55.41	1.86

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert
0107	S	57.63	55.25	2.38
0215	S		0	0
1102	S	59.19	57.57	1.62
1103	S	59.26	57.8	1.46
1106	S	59.23	57.16	2.07
1109	S	58.5	55.93	2.57
1201	S	59.1	56.88	2.22
1212	S		0	0
1213	S		0	0
1214	S		0	0
1215	S		0	0
1216	S		0	0
1302	S	52.03	49.95	2.08
1304	S	54.39	52.14	2.25
1305	S	55.4	52.96	2.44
1306	S	55.64	53.78	1.86
2104	S		0	0
2105	S		0	0
2106	S		0	0
2107	S		0	0
2108	S		0	0
2109	S		0	0
2213	S		0	0
2214	S		0	0
2221	S		0	0
2222	S		0	0
2223	S		0	0
2225	S		0	0
2226	S		0	0
2231	S		0	0
2232	S		0	0
2233	S		0	0
2234	S		0	0
2235	S		0	0
2236	S		0	0
2301	S	56.92	55.83	1.09
2303	S	56.07	54.44	1.63
2305	S	51.85	50.75	1.1
2401	S	58.97	58.11	0.86
2403	S	59.43	57.91	1.52
2405	S	59.62	58.61	1.01
3210	S		0	0
3211	S		0	0
3212	S		0	0
3213	S		0	0
3214	S		0	0
3215	S		0	0
3229	S		0	0
3302	S	57.98	56.32	1.66
3303	S	57.18	55.8	1.38
3305	S	57.54	56.63	0.91
3306	S	58.19	56.66	1.53
3402	S	63.23	61.77	1.46
4100	S	56.81	55.21	1.6
4103	S	35.32	34.52	0.8
4104	S	35.13	34.5	0.63
4105	S	35.23	34.41	0.82
4106	S		0	0
4202	S	48.24	46.53	1.71
4203	S	57.57	56.73	0.84
4203	S	35.48	34.86	0.62
4204	S	48.24	47.14	1.1
4403	S	63.7	62.62	1.08
4404	S	62.38	60.74	1.64
4405	S	58.99	57.54	1.45
4407	S	64.94	63.42	1.52
5001	S	35.54	33.45	2.09
5002	S	56.79	54.95	1.84
5003	S	56.54	54.86	1.68
5003	S	35.33	33.93	1.4
5006	S	35.33	34.23	1.1
5008	S	35	34.1	0.9
5102	S	35.31	34.51	0.8
5201	S	57.74	55.55	2.19
5205	S	47.59	45.89	1.7
5305	S	48.97	47.66	1.31
5306	S	48.12	46.17	1.95
5401	S	59.25	57.9	1.35
5406	S	64.42	62.17	2.25
5501	S		0	0
5503	S		0	0
5903	S		0	0
5904	S		0	0
5905	S	35.25	33.31	1.94
5906	S	35.63	33.17	2.46
5907	S	35.25	33.54	1.71
5908	S	35.28	32.8	2.48
5909	S	35.2	32.29	2.91
5913	S	35.76	33.93	1.83
6000	S		0	0
6102	S	38.64	35.88	2.76
6301	S	51.12	49.35	1.77
6401	S	63.29	62.22	1.07
6601	S		0	0
6601	S	62.96	0	0
6602	S		0	0
6701	S	35.78	32.5	3.28
6702	S		0	0
6800	S		0	0
6801	S	35.83	32.58	3.25
6801	S		0	0
6802	S	35.09	32.95	2.14
6802	S		0	0
6803	S	35.7	33.23	2.47
6804	S	36.2	33.8	2.4
6900	S		0	0
6901	S		0	0
6902	S		0	0
6903	S		0	0
6904	S		0	0
6905	S		0	0
7000	S		0	0
7001	S	38.32	36.82	1.5
7202	S	44.64	43.62	1.02
7302	S	54.02	52.18	1.84
7303	S	53.74	52.49	1.25
7306	S	47.04	45.54	1.5
7403	S	59.67	58.21	1.46
7405	S	59.92	58.53	1.39
7406	S	60.79	59.59	1.2
7408	S	55.48	53.73	1.75
7700	S		0	0
7800	S		0	0
7802	S		0	0
7900	S		0	0
7901	S		0	0
7902	S		0	0
7904	S		0	0
7905	S		0	0
7906	S		0	0
8002	S	41.28	38.92	2.36
8102	S	42.72	41.29	1.43
8103	S	43.36	41.69	1.67
9102	S	45.67	43.24	2.43
9104	S	49.78	46.66	3.12
9108	S	45.42	43.76	1.66
9202	S	49.92	48.33	1.59

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert

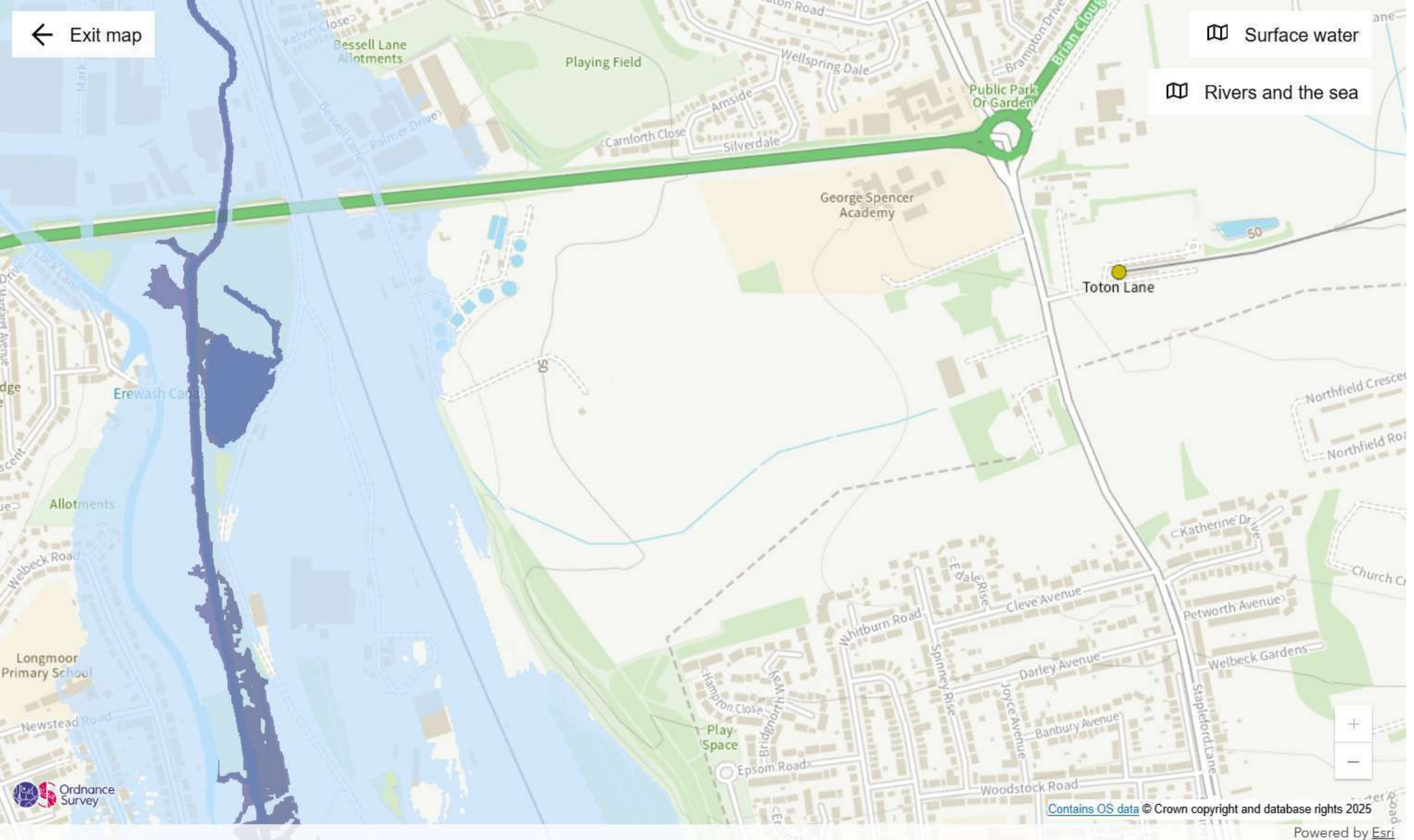
Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert

Appendix H

Environment Agency – Reservoir Flood Map



Reservoirs map

Extent

When river levels are normal

When there is also flooding from rivers

Map details

Show flooding

Appendix I

Proposed Drainage Strategy

Severn Trent surface water manhole (6602) for culverted watercourse

Attenuation basin 1
Min. basin invert level = 46.000mAOD
Min. top of bank level = 47.000mAOD
1.0m deep / 1:3 slopes
Max. storage volume = 935m³
Min. 300mm freeboard

Flow Control Chamber 1
Vortex control restricted to 2.0l/s

Surface Water Outfall 1
New headwall to be constructed within bank of existing watercourse (max. discharge rate of 2.0l/s) at ditch IL 44.500. Existing watercourse to be locally dredged of silt & debris (including jetting of existing immediate downstream culverts)

Foul water pumping station
Adoptable foul water pumping station
(Type 3 with 15-meter offset between wet well and habitable buildings).
Number of dwellings served, pump rate & storage requirements TBC

Low-flow channel
0.375m deep
0.375m bed
1:2 slopes

Pre-treatment forebays

Surface Water Outfall 2
New headwall to be constructed within bank of existing watercourse (max. discharge rate of 19.7l/s) at ditch IL 43.900. Existing watercourse to be locally dredged of silt & debris (including jetting of existing immediate downstream culverts)

Flow Control Chamber 2
Vortex control restricted to 19.7l/s

Low-flow channel
(0.9m deep, 0.900m bed, 1:2 slopes)

Attenuation basin 2
Min. basin invert level = 45.000mAOD
Min. top of bank level = 46.800mAOD
1.8m deep / 1:3 slopes
Max. storage volume = 6,615m³
Min. 300mm freeboard

Pre-treatment forebays

Foul water rising main outfall
Adoptable foul water rising main to outfall into proposed gravity network draining to existing Severn Trent manhole (6502) in Stapleford Lane

Foul water rising main outfall
Adoptable foul water rising main to outfall into proposed gravity network draining to existing Severn Trent manhole (6502) in Stapleford Lane

Foul water outfall
Connection into existing Severn Trent manhole (6502) in Stapleford Lane at CL 63.490 and IL 59.165 (Ø150). Max. pumped flow of 3.8l/s (from F.R.A.)

SCALE 1:1000

NOTES

1. Contractors must check all dimensions on site. Only figured dimensions are to be worked from. Discrepancies must be reported to the Architect or Engineer before proceeding.
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3. Direct scaling off the drawing is permissible for planning purposes only.
4. Layout taken from Pegasus 'Illustrative Masterplan Plan - P23_2379_DE_014 - Rev D'
5. The exact location and level of all existing sewers, drains and services are to be confirmed on site prior to the commencement of any works.
6. Drainage to be designed in accordance with the Sewerage Sector Guidance, Design and Construction Guidance ("the Code") Approved Version 2.3, 11 November 2023.

DRAINAGE STRATEGY DESIGN PRINCIPLES

- Infiltration testing by Soilscapes and BGS concluded surface water discharge via infiltration to be unviable, therefore the proposed method of discharge is to the existing open watercourse.
- Proposed system designed to accommodate events up to the 100-year + 40% climate change + 10% urban creep

HR WALLINGFORD GREENFIELD RUNOFF ESTIMATION

- Total site area = 18.95ha
- Total development area = 11.28ha
- QBar (1:2.3-years) = 1.93l/s/ha
- Greenfield run-off rate (Qbar) calculated using the FEH statistical method (2025).

KEY

- Site Boundary
- Existing foul water sewer (Severn Trent Water)
- Proposed adoptable foul water sewer
- Proposed adoptable foul water rising main
- Proposed adoptable foul water pumping station Indicative Location (Type 3)
- 15-meter FWPS offset between wet well and habitable buildings
- Proposed adoptable surface water sewer
- Proposed adoptable surface water headwall
- Proposed sewer easement
- Proposed watercourse culvert
- Existing watercourse
- Existing watercourse culvert
- Pre-treatment forebay with check dam
- Low-flow channel

REV	DESCRIPTION	DRN	CHD	DATE
	PRELIMINARY ☐ INFORMATION ☐ TENDER			
	CONSTRUCTION ☐ AS BUILT			

DRAFT V1

SCALE	1:1000 @ A0
DATE	NOVEMBER 2025
DRAWN	RD
CHK	EML
DRAWING NO.	19678-TOTO-5-1000
REV	-
TITLE	TOTON WEST, NOTTINGHAM OUTLINE PLANNING APPLICATION
DETAILS	SURFACE & FOUL WATER DRAINAGE STRATEGY

Woods Hardwick
Architecture | Engineering | Planning | Surveying

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Appendix J

Drainage Calculations

Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	2	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.200
CV	0.750	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	✓
Maximum Rainfall (mm/hr)	50.0		

Adoptable Manhole Type

Max Width (mm)	Diameter (mm)	Max Width (mm)	Diameter (mm)
374	1200	749	1500
499	1350	900	1800

>900 Link+900 mm

Max Depth (m)	Diameter (mm)	Max Depth (m)	Diameter (mm)
1.500	1050	99.999	1200

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)	Invert Level (m)
100	0.116	5.00	53.686	1200	448976.197	335581.200	1.436	52.250
101	0.147	5.00	51.502	1200	448944.474	335551.122	1.427	50.075
102	0.105	5.00	50.773	1200	448938.554	335536.191	1.448	49.325
103	0.047	5.00	51.237	1350	448941.462	335546.512	2.137	49.100
104	0.178	5.00	49.801	1350	448891.764	335571.067	1.576	48.225
105	0.000		49.426	1350	448868.568	335580.202	1.576	47.850
106	0.000		48.000	1350	448851.401	335549.999	1.375	46.625
107	0.000		47.000	1350	448817.707	335546.855	1.375	45.625
108	0.000		47.000	1350	448816.950	335545.522	1.400	45.600
109			45.000	1200	448809.643	335532.072	0.500	44.500

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	100	101	43.715	0.600	52.250	50.075	2.175	20.1	225	5.25	50.0
1.001	101	103	5.507	0.600	50.075	49.250	0.825	6.7	225	5.27	50.0
2.000	102	103	10.723	0.600	49.325	49.250	0.075	143.0	225	5.16	50.0
1.002	103	104	55.433	0.600	49.100	48.225	0.875	63.4	375	5.67	50.0
1.003	104	105	24.930	0.600	48.225	47.850	0.375	66.5	375	5.86	50.0
1.004	105	106	34.741	0.600	47.850	46.625	1.225	28.4	375	6.03	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	2.931	116.6	15.7	1.211	1.202	0.116	0.0	56	2.067
1.001	5.097	202.6	35.6	1.202	1.762	0.263	0.0	64	3.868
2.000	1.091	43.4	14.2	1.223	1.762	0.105	0.0	88	0.978
1.002	2.279	251.7	56.2	1.762	1.201	0.415	0.0	120	1.849
1.003	2.225	245.7	80.4	1.201	1.201	0.593	0.0	147	1.997
1.004	3.413	377.0	80.4	1.201	1.000	0.593	0.0	117	2.734

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)
1.005	106	107	33.840	0.600	46.625	45.625	1.000	33.8	375	6.21	50.0
1.006	107	108	1.533	0.600	45.625	45.600	0.025	61.3	375	6.22	50.0
1.007	108	109	15.307	0.600	45.600	44.500	1.100	13.9	225	6.29	0.0

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)
1.005	3.123	345.0	80.4	1.000	1.000	0.593	0.0	123	2.566
1.006	2.317	255.9	80.4	1.000	1.025	0.593	0.0	144	2.060
1.007	3.526	140.2	0.0	1.175	0.275	0.593	0.0	0	0.000

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Normal	Starting Level (m)	
Rainfall Events	Singular	Skip Steady State	✓	Check Discharge Rate(s)	✓
Summer CV	0.750	Drain Down Time (mins)	240	Check Discharge Volume	✓
Winter CV	0.840	Additional Storage (m³/ha)	20.0	100 year 360 minute (m³)	

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	0	0
30	0	0	0
100	0	0	0
100	40	10	0

Pre-development Discharge Rate

Site Makeup	Greenfield	Growth Factor 30 year	1.95
Greenfield Method	IH124	Growth Factor 100 year	2.48
Positively Drained Area (ha)		Betterment (%)	0
SAAR (mm)		QBar	
Soil Index	1	Q 1 year (l/s)	
SPR	0.10	Q 30 year (l/s)	
Region	1	Q 100 year (l/s)	
Growth Factor 1 year	0.85		

Pre-development Discharge Volume

Site Makeup	Greenfield	Return Period (years)	100
Greenfield Method	FSR/FEH	Climate Change (%)	0
Positively Drained Area (ha)		Storm Duration (mins)	360
Soil Index	1	Betterment (%)	0
SPR	0.10	PR	
CWI		Runoff Volume (m³)	

Node 108 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	45.600	Product Number	CTL-SHE-0062-2000-1400-2000
Design Depth (m)	1.400	Min Outlet Diameter (m)	0.075
Design Flow (l/s)	2.0	Min Node Diameter (mm)	1200

Node 107 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	46.000
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	728.0	0.0	1.000	1143.1	0.0

Results for 2 year Critical Storm Duration. Lowest mass balance: 99.40%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	100	10	52.307	0.057	16.7	0.1566	0.0000	OK
15 minute winter	101	10	50.150	0.075	37.7	0.2384	0.0000	OK
15 minute winter	102	10	49.423	0.098	15.2	0.2518	0.0000	OK
15 minute winter	103	10	49.221	0.121	59.0	0.2265	0.0000	OK
15 minute winter	104	11	48.388	0.163	83.9	0.6033	0.0000	OK
15 minute winter	105	11	47.974	0.124	83.5	0.1769	0.0000	OK
15 minute winter	106	11	46.749	0.124	83.9	0.1781	0.0000	OK
360 minute winter	107	360	46.121	0.496	14.7	91.9892	0.0000	SURCHARGED
360 minute winter	108	376	46.125	0.525	12.9	0.7518	0.0000	SURCHARGED
15 minute summer	109	1	44.500	0.000	1.6	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	100	1.000	101	16.5	1.708	0.142	0.4239	
15 minute winter	101	1.001	103	37.3	3.559	0.184	0.0578	
15 minute winter	102	2.000	103	14.9	0.951	0.344	0.1680	
15 minute winter	103	1.002	104	58.2	1.525	0.231	2.1274	
15 minute winter	104	1.003	105	83.5	2.154	0.340	0.9689	
15 minute winter	105	1.004	106	83.9	2.643	0.223	1.1036	
15 minute winter	106	1.005	107	84.0	1.281	0.243	2.4063	
360 minute winter	107	1.006	108	12.3	0.466	0.048	0.1691	
360 minute winter	108	Hydro-Brake®	109	1.6				51.3

Results for 30 year Critical Storm Duration. Lowest mass balance: 98.88%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	100	10	52.344	0.094	43.3	0.2581	0.0000	OK
15 minute winter	101	10	50.214	0.139	97.6	0.4439	0.0000	OK
15 minute winter	102	10	49.510	0.185	39.2	0.4785	0.0000	OK
15 minute winter	103	10	49.310	0.210	152.5	0.3922	0.0000	OK
15 minute winter	104	11	48.536	0.311	217.3	1.1466	0.0000	OK
15 minute winter	105	11	48.066	0.216	216.2	0.3094	0.0000	OK
15 minute winter	106	11	46.849	0.224	217.4	0.3212	0.0000	OK
480 minute winter	107	480	46.293	0.668	24.2	232.3116	0.0000	SURCHARGED
480 minute winter	108	496	46.297	0.697	9.9	0.9969	0.0000	SURCHARGED
15 minute summer	109	1	44.500	0.000	1.6	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	100	1.000	101	42.9	2.067	0.368	0.9061	
15 minute winter	101	1.001	103	96.7	4.318	0.477	0.1232	
15 minute winter	102	2.000	103	38.3	1.169	0.884	0.3518	
15 minute winter	103	1.002	104	151.0	1.859	0.600	4.4452	
15 minute winter	104	1.003	105	216.2	2.614	0.880	2.0371	
15 minute winter	105	1.004	106	217.4	3.230	0.577	2.3380	
15 minute winter	106	1.005	107	217.5	2.179	0.631	3.0307	
480 minute winter	107	1.006	108	8.4	0.354	0.033	0.1691	
480 minute winter	108	Hydro-Brake®	109	1.6				61.7

Results for 100 year Critical Storm Duration. Lowest mass balance: 98.84%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	100	10	52.359	0.109	56.4	0.2999	0.0000	OK
15 minute winter	101	10	50.248	0.173	127.3	0.5522	0.0000	OK
15 minute winter	102	10	49.583	0.258	51.0	0.6662	0.0000	SURCHARGED
15 minute winter	103	11	49.372	0.272	198.7	0.5091	0.0000	OK
15 minute winter	104	11	48.813	0.588	278.6	2.1688	0.0000	SURCHARGED
15 minute winter	105	11	48.106	0.255	276.2	0.3656	0.0000	OK
15 minute winter	106	11	46.906	0.281	276.0	0.4018	0.0000	OK
600 minute winter	107	600	46.387	0.762	25.7	314.3445	0.0000	SURCHARGED
480 minute winter	108	504	46.388	0.788	13.0	1.1282	0.0000	SURCHARGED
15 minute summer	109	1	44.500	0.000	1.6	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	100	1.000	101	55.9	2.133	0.480	1.1336	
15 minute winter	101	1.001	103	125.9	4.473	0.621	0.1540	
15 minute winter	102	2.000	103	49.9	1.270	1.150	0.4013	
15 minute winter	103	1.002	104	194.8	1.875	0.774	5.4313	
15 minute winter	104	1.003	105	276.2	2.685	1.124	2.3718	
15 minute winter	105	1.004	106	276.0	3.289	0.732	2.9271	
15 minute winter	106	1.005	107	273.7	2.570	0.793	3.3642	
600 minute winter	107	1.006	108	2.0	0.107	0.008	0.1691	
480 minute winter	108	Hydro-Brake®	109	1.6				63.9

Results for 100 year +40% CC +10% A Critical Storm Duration. Lowest mass balance: 98.97%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	100	11	52.438	0.188	86.6	0.5464	0.0000	OK
15 minute winter	101	12	51.502	1.427	192.3	4.8475	0.4670	FLOOD
15 minute winter	102	12	50.773	1.448	78.3	3.9472	1.6315	FLOOD
15 minute winter	103	12	50.618	1.518	248.1	2.9067	0.0000	SURCHARGED
15 minute winter	104	12	49.724	1.499	367.7	5.8704	0.0000	FLOOD RISK
15 minute winter	105	12	48.722	0.872	347.8	1.2478	0.0000	SURCHARGED
15 minute winter	106	12	47.416	0.791	345.4	1.1318	0.0000	SURCHARGED
960 minute winter	107	960	46.603	0.978	26.6	516.0836	0.0000	SURCHARGED
960 minute winter	108	945	46.603	1.003	4.7	1.4351	0.0000	SURCHARGED
15 minute summer	109	1	44.500	0.000	1.6	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	100	1.000	101	82.6	2.197	0.709	1.6435	
15 minute winter	101	1.001	103	156.4	4.469	0.772	0.2190	
15 minute winter	102	2.000	103	60.1	1.512	1.386	0.4265	
15 minute winter	103	1.002	104	239.5	2.171	0.951	6.1141	
15 minute winter	104	1.003	105	347.8	3.154	1.415	2.7497	
15 minute winter	105	1.004	106	345.4	3.286	0.916	3.8318	
15 minute winter	106	1.005	107	345.3	3.131	1.001	3.7325	
960 minute winter	107	1.006	108	4.7	0.141	0.018	0.1691	
960 minute winter	108	Hydro-Brake®	109	1.7				113.1

Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	2	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.200
CV	0.750	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	✓
Maximum Rainfall (mm/hr)	50.0		

Adoptable Manhole Type

Max Width (mm)	Diameter (mm)	Max Width (mm)	Diameter (mm)
374	1200	749	1500
499	1350	900	1800

>900 Link+900 mm

Max Depth (m)	Diameter (mm)	Max Depth (m)	Diameter (mm)
1.500	1050	99.999	1200

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)	Invert Level (m)
1	0.108	5.00	64.163	1200	449601.690	335560.658	1.438	62.725
2	0.140	5.00	63.002	1200	449639.470	335576.947	1.502	61.500
3	0.134	5.00	62.528	1500	449613.365	335637.578	3.238	59.290
4	0.170	5.00	63.279	1350	449558.919	335614.580	4.264	59.015
5	0.177	5.00	65.458	1200	449568.603	335500.099	2.158	63.300
6	0.066	5.00	65.832	1200	449552.296	335540.948	2.807	63.025
7	0.152	5.00	64.350	1350	449535.025	335584.054	2.600	61.750
8	0.044	5.00	63.563	1500	449535.567	335610.440	4.773	58.790
9	0.048	5.00	63.377	1500	449516.728	335610.790	4.712	58.665
10	0.220	5.00	62.557	1500	449478.216	335597.156	3.992	58.565
11	0.051	5.00	62.243	1500	449461.541	335592.086	3.728	58.515
12	0.098	5.00	62.459	1500	449430.972	335595.583	4.019	58.440
13	0.091	5.00	65.033	1200	449394.907	335524.536	1.433	63.600
14	0.107	5.00	64.934	1200	449382.992	335526.724	1.934	63.000
15	0.201	5.00	62.763	1500	449368.010	335577.241	4.448	58.315
16	0.192	5.00	60.172	1500	449243.981	335541.472	2.357	57.815
17	0.208	5.00	62.147	1200	449240.830	335462.015	1.522	60.625
18	0.100	5.00	60.026	1350	449222.619	335521.587	1.576	58.450
19	0.020	5.00	59.310	1500	449227.183	335541.208	1.885	57.425
20	0.020	5.00	58.367	1500	449211.177	335550.464	1.892	56.475
21	0.171	5.00	61.252	1200	449421.711	335626.378	1.427	59.825
22	0.067	5.00	60.782	1200	449410.552	335653.310	1.507	59.275
23	0.105	5.00	60.049	1350	449376.489	335639.384	1.599	58.450
24	0.303	5.00	57.831	1500	449281.477	335612.056	1.881	55.950
25	0.224	5.00	56.758	1800	449230.129	335596.583	2.033	54.725
26	0.144	5.00	57.072	1800	449195.831	335571.205	2.497	54.575
27	0.046	5.00	56.082	1800	449184.056	335587.118	2.857	53.225
28	0.099	5.00	54.864	1800	449167.984	335610.245	2.189	52.675
29	0.154	5.00	60.058	1200	449397.863	335686.240	1.433	58.625
30	0.000		60.020	1200	449390.796	335702.153	1.545	58.475
31	0.081	5.00	57.475	1200	449316.970	335678.684	1.500	55.975

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)	Invert Level (m)
32	0.080	5.00	55.846	1200	449268.622	335657.475	1.446	54.400
33	0.061	5.00	55.679	1350	449266.516	335666.468	1.579	54.100
34	0.058	5.00	55.350	1350	449230.510	335657.743	1.650	53.700
35	0.000		54.900	1350	449196.698	335648.176	1.650	53.250
36	0.060	5.00	54.398	1800	449154.480	335627.178	2.198	52.200
37	0.000		52.675	1800	449097.352	335583.677	2.400	50.275
38	0.075	5.00	51.850	1350	449065.107	335548.521	2.175	49.675
39	0.000		51.497	1800	449060.458	335553.846	2.672	48.825
40	0.000		51.500	1800	449040.028	335535.913	3.250	48.250
41	0.156	5.00	52.767	1200	449031.282	335503.208	1.867	50.900
42	0.000		51.700	1800	449018.344	335520.712	3.675	48.025
43	0.000		51.750	1800	449000.627	335512.191	3.975	47.775
44	0.023	5.00	51.156	1200	448966.605	335490.439	2.556	48.600
45	0.093	5.00	50.971	1800	448957.860	335502.273	4.321	46.650
46	0.085	5.00	49.700	1800	448937.936	335495.780	3.300	46.400
47	0.000		48.400	1800	448867.901	335484.322	2.700	45.700
48	0.109	5.00	59.477	1200	449185.401	335442.802	1.777	57.700
49	0.108	5.00	57.329	1200	449171.799	335487.518	1.829	55.500
50	0.036	5.00	55.936	1200	449163.652	335514.334	1.911	54.025
51	0.064	5.00	55.617	1350	449160.700	335519.979	1.992	53.625
52	0.022	5.00	54.601	1200	449152.841	335561.677	1.426	53.175
53	0.143	5.00	54.182	1500	449136.128	335548.147	1.957	52.225
54	0.125	5.00	53.920	1500	449104.541	335520.592	1.995	51.925
55	0.020	5.00	54.488	1500	449100.470	335505.356	2.738	51.750
56	0.048	5.00	55.186	1500	449106.987	335489.703	3.611	51.575
57	0.172	5.00	58.316	1200	449129.843	335425.523	1.441	56.875
58	0.052	5.00	56.342	1200	449117.826	335464.822	2.717	53.625
59	0.047	5.00	55.677	1500	449104.115	335475.933	4.252	51.425
60	0.016	5.00	55.695	1500	449095.136	335469.028	4.370	51.325
61	0.110	5.00	55.190	1500	449056.819	335457.306	4.165	51.025
62	0.078	5.00	54.612	1500	449022.536	335446.819	3.812	50.800
63	0.166	5.00	57.233	1200	449033.869	335382.972	1.433	55.800
64	0.067	5.00	55.786	1200	449025.375	335410.908	1.536	54.250
65	0.075	5.00	54.233	1500	449007.208	335435.492	3.483	50.750
66	0.148	5.00	52.219	1500	448983.263	335467.896	2.469	49.750
67	0.103	5.00	53.400	1500	448936.014	335432.973	3.775	49.625
68	0.050	5.00	51.875	1500	448912.089	335465.342	3.450	48.425
69	0.000		48.400	1500	448878.840	335465.161	3.050	45.350
70	0.000		46.800	1800	448796.990	335517.801	2.700	44.100
71	0.000		46.800	1800	448795.933	335527.099	2.725	44.075
72			44.660	1200	448796.139	335536.941	0.760	43.900

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	41.142	0.600	62.725	61.575	1.150	35.8	225	5.31	50.0
1.001	2	3	66.012	0.600	61.500	59.365	2.135	30.9	300	5.70	50.0
1.002	3	4	59.104	0.600	59.290	59.090	0.200	295.5	375	6.64	49.5
1.003	4	8	23.716	0.600	59.015	58.940	0.075	316.2	450	6.99	48.3
2.000	5	6	43.984	0.600	63.300	63.025	0.275	159.9	300	5.59	50.0
2.001	6	7	46.437	0.600	63.025	61.825	1.200	38.7	300	5.90	50.0
2.002	7	8	26.392	0.600	61.750	59.015	2.735	9.6	375	5.97	50.0
1.004	8	9	18.842	0.600	58.790	58.740	0.050	376.8	600	7.24	47.5
1.005	9	10	40.854	0.600	58.665	58.565	0.100	408.5	675	7.77	45.8
1.006	10	11	17.429	0.600	58.565	58.515	0.050	348.6	675	7.97	45.2
1.007	11	12	30.768	0.600	58.515	58.440	0.075	410.2	675	8.37	44.1
1.008	12	15	65.579	0.600	58.440	58.315	0.125	524.6	675	9.33	41.6
3.000	13	14	12.114	0.600	63.600	63.150	0.450	26.9	150	5.10	50.0
3.001	14	15	52.692	0.600	63.000	58.690	4.310	12.2	300	5.30	50.0
1.009	15	16	129.084	0.600	58.315	57.815	0.500	258.2	675	10.66	38.7
1.010	16	19	16.800	0.600	57.815	57.425	0.390	43.1	675	10.73	38.6
4.000	17	18	62.293	0.600	60.625	58.525	2.100	29.7	300	5.36	50.0
4.001	18	19	20.145	0.600	58.450	57.725	0.725	27.8	375	5.46	50.0
1.011	19	20	18.490	0.600	57.425	56.475	0.950	19.5	675	10.78	38.4
1.012	20	26	25.801	0.600	56.475	54.725	1.750	14.7	675	10.84	38.3
5.000	21	22	29.152	0.600	59.825	59.350	0.475	61.4	225	5.29	50.0
5.001	22	23	36.800	0.600	59.275	58.525	0.750	49.1	300	5.56	50.0
5.002	23	24	98.864	0.600	58.450	56.100	2.350	42.1	375	6.15	50.0
5.003	24	25	53.629	0.600	55.950	55.025	0.925	58.0	525	6.46	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	2.194	87.2	14.6	1.213	1.202	0.108	0.0	62	1.638
1.001	2.837	200.6	33.6	1.202	2.863	0.248	0.0	82	2.121
1.002	1.049	115.8	51.3	2.863	3.814	0.382	0.0	175	1.018
1.003	1.138	180.9	72.2	3.814	4.173	0.552	0.0	197	1.076
2.000	1.240	87.7	24.0	1.858	2.507	0.177	0.0	107	1.062
2.001	2.535	179.2	32.9	2.507	2.225	0.243	0.0	86	1.945
2.002	5.861	647.3	53.5	2.225	4.173	0.395	0.0	72	3.601
1.004	1.248	352.9	127.5	4.173	4.037	0.991	0.0	249	1.151
1.005	1.290	461.7	129.0	4.037	3.317	1.039	0.0	243	1.113
1.006	1.398	500.2	154.1	3.317	3.053	1.259	0.0	256	1.238
1.007	1.287	460.7	156.5	3.053	3.344	1.310	0.0	271	1.170
1.008	1.137	406.9	158.8	3.344	3.773	1.408	0.0	292	1.070
3.000	1.948	34.4	12.3	1.283	1.634	0.091	0.0	62	1.787
3.001	4.520	319.5	26.8	1.634	3.773	0.198	0.0	58	2.783
1.009	1.626	581.9	189.5	3.773	1.682	1.807	0.0	264	1.461
1.010	4.000	1431.3	208.9	1.682	1.210	1.999	0.0	172	2.896
4.000	2.897	204.8	28.2	1.222	1.201	0.208	0.0	75	2.053
4.001	3.448	380.9	41.7	1.201	1.210	0.308	0.0	83	2.296
1.011	5.957	2131.6	242.5	1.210	1.217	2.327	0.0	152	4.028
1.012	6.846	2449.8	243.7	1.217	1.672	2.347	0.0	142	4.460
5.000	1.672	66.5	23.2	1.202	1.207	0.171	0.0	92	1.528
5.001	2.250	159.0	32.3	1.207	1.224	0.238	0.0	91	1.775
5.002	2.800	309.2	46.5	1.224	1.356	0.343	0.0	98	2.039
5.003	2.945	637.6	87.5	1.356	1.208	0.646	0.0	130	2.092

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)
5.004	25	26	42.666	0.600	54.725	54.575	0.150	284.4	825	6.86	48.7
1.013	26	27	19.796	0.600	54.575	53.225	1.350	14.7	825	10.88	38.2
1.014	27	28	28.163	0.600	53.225	52.750	0.475	59.3	825	11.01	38.0
1.015	28	36	21.658	0.600	52.675	52.200	0.475	45.6	900	11.08	37.8
6.000	29	30	17.412	0.600	58.625	58.550	0.075	232.2	225	5.34	50.0
6.001	30	31	77.467	0.600	58.475	55.975	2.500	31.0	300	5.80	50.0
6.002	31	33	51.912	0.600	55.975	54.175	1.800	28.8	300	6.09	50.0
7.000	32	33	9.236	0.600	54.400	54.250	0.150	61.6	225	5.09	50.0
6.003	33	34	37.048	0.600	54.100	53.775	0.325	114.0	375	6.45	50.0
6.004	34	35	35.139	0.600	53.700	53.250	0.450	78.1	450	6.71	49.3
6.005	35	36	47.152	0.600	53.250	52.650	0.600	78.6	450	7.05	48.1
1.016	36	37	71.805	0.600	52.200	50.275	1.925	37.3	900	11.32	37.4
1.017	37	39	47.445	0.600	50.275	48.825	1.450	32.7	900	11.46	37.1
8.000	38	39	7.069	0.600	49.675	49.275	0.400	17.7	450	5.02	50.0
1.018	39	40	27.184	0.600	48.825	48.250	0.575	47.3	900	11.56	37.0
1.019	40	42	26.481	0.600	48.250	48.025	0.225	117.7	900	11.71	36.7
9.000	41	42	21.767	0.600	50.900	48.700	2.200	9.9	225	5.09	50.0
1.020	42	43	19.660	0.600	48.025	47.775	0.250	78.6	900	11.81	36.5
1.021	43	45	43.902	0.600	47.775	46.675	1.100	39.9	900	11.95	36.3
10.000	44	45	14.715	0.600	48.600	47.325	1.275	11.5	225	5.06	50.0
1.022	45	46	20.955	0.600	46.650	46.400	0.250	83.8	900	12.05	36.1
1.023	46	47	70.966	0.600	46.400	45.700	0.700	101.4	900	12.43	35.5
1.024	47	70	78.417	0.600	45.700	44.100	1.600	49.0	900	12.73	35.0
11.000	48	49	46.739	0.600	57.700	55.500	2.200	21.2	225	5.27	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)
5.004	1.755	938.2	114.9	1.208	1.672	0.870	0.0	193	1.212
1.013	7.774	4155.5	348.3	1.672	2.032	3.361	0.0	159	4.833
1.014	3.859	2063.0	350.7	2.032	1.289	3.407	0.0	228	2.916
1.015	4.646	2955.7	359.6	1.289	1.298	3.506	0.0	209	3.201
6.000	0.854	33.9	20.9	1.208	1.245	0.154	0.0	128	0.897
6.001	2.834	200.3	20.9	1.245	1.200	0.154	0.0	65	1.852
6.002	2.938	207.7	31.8	1.200	1.204	0.235	0.0	79	2.145
7.000	1.669	66.4	10.8	1.221	1.204	0.080	0.0	61	1.236
6.003	1.696	187.3	51.0	1.204	1.200	0.376	0.0	133	1.450
6.004	2.302	366.1	58.0	1.200	1.200	0.434	0.0	120	1.699
6.005	2.295	365.0	56.5	1.200	1.298	0.434	0.0	119	1.687
1.016	5.138	3268.8	405.6	1.298	1.500	4.000	0.0	211	3.565
1.017	5.487	3490.6	402.8	1.500	1.772	4.000	0.0	203	3.729
8.000	4.853	771.9	10.2	1.725	1.772	0.075	0.0	36	1.739
1.018	4.563	2902.6	408.3	1.772	2.350	4.075	0.0	225	3.278
1.019	2.887	1836.6	405.2	2.350	2.775	4.075	0.0	285	2.344
9.000	4.184	166.4	21.1	1.642	2.775	0.156	0.0	54	2.898
1.020	3.535	2248.7	418.8	2.775	3.075	4.231	0.0	261	2.741
1.021	4.967	3159.8	415.7	3.075	3.396	4.231	0.0	218	3.500
10.000	3.873	154.0	3.1	2.331	3.421	0.023	0.0	22	1.571
1.022	3.423	2177.8	425.1	3.421	2.400	4.347	0.0	267	2.686
1.023	3.112	1979.5	425.9	2.400	1.800	4.432	0.0	281	2.507
1.024	4.481	2850.6	420.2	1.800	1.800	4.432	0.0	231	3.259
11.000	2.851	113.4	14.8	1.552	1.604	0.109	0.0	55	1.992

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)
11.001	49	50	28.026	0.600	55.500	54.100	1.400	20.0	225	5.43	50.0
11.002	50	51	6.370	0.600	54.025	53.700	0.325	19.6	300	5.46	50.0
11.003	51	53	37.379	0.600	53.625	52.375	1.250	29.9	375	5.65	50.0
12.000	52	53	21.503	0.600	53.175	52.525	0.650	33.1	225	5.16	50.0
11.004	53	54	41.917	0.600	52.225	51.925	0.300	139.7	525	6.02	50.0
11.005	54	55	15.771	0.600	51.925	51.825	0.100	157.7	525	6.17	50.0
11.006	55	56	16.955	0.600	51.750	51.650	0.100	169.6	600	6.32	50.0
11.007	56	59	14.066	0.600	51.575	51.425	0.150	93.8	675	6.40	50.0
13.000	57	58	41.095	0.600	56.875	53.625	3.250	12.6	225	5.19	50.0
13.001	58	59	17.648	0.600	53.625	51.875	1.750	10.1	225	5.26	50.0
11.008	59	60	11.327	0.600	51.425	51.325	0.100	113.3	675	6.48	50.0
11.009	60	61	40.070	0.600	51.325	51.025	0.300	133.6	675	6.78	49.0
11.010	61	62	35.851	0.600	51.025	50.800	0.225	159.3	675	7.06	48.0
11.011	62	65	19.059	0.600	50.800	50.750	0.050	381.2	675	7.30	47.3
14.000	63	64	29.199	0.600	55.800	54.250	1.550	18.8	225	5.16	50.0
14.001	64	65	30.568	0.600	54.250	51.200	3.050	10.0	225	5.28	50.0
11.012	65	66	40.291	0.600	50.750	49.750	1.000	40.3	675	7.46	46.8
11.013	66	67	58.754	0.600	49.750	49.625	0.125	470.0	675	8.28	44.3
11.014	67	68	40.251	0.600	49.625	48.425	1.200	33.5	675	8.43	43.9
11.015	68	69	33.249	0.600	48.425	45.350	3.075	10.8	675	8.50	43.7
11.016	69	70	97.316	0.600	45.350	44.325	1.025	94.9	675	9.10	42.2
1.025	70	71	9.358	0.600	44.100	44.075	0.025	374.3	900	12.82	34.8
1.026	71	72	9.844	0.600	44.075	43.900	0.175	56.3	225	12.92	0.0

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)
11.001	2.937	116.8	29.4	1.604	1.611	0.217	0.0	77	2.461
11.002	3.567	252.1	34.3	1.611	1.617	0.253	0.0	74	2.518
11.003	3.323	367.1	43.0	1.617	1.432	0.317	0.0	86	2.256
12.000	2.282	90.7	3.0	1.201	1.432	0.022	0.0	28	1.056
11.004	1.893	409.7	65.3	1.432	1.470	0.482	0.0	141	1.402
11.005	1.781	385.5	82.3	1.470	2.138	0.607	0.0	164	1.429
11.006	1.867	527.9	85.0	2.138	2.936	0.627	0.0	161	1.387
11.007	2.707	968.6	91.5	2.936	3.577	0.675	0.0	138	1.733
13.000	3.699	147.1	23.3	1.216	2.492	0.172	0.0	60	2.721
13.001	4.144	164.8	30.4	2.492	3.577	0.224	0.0	65	3.191
11.008	2.462	880.9	128.2	3.577	3.695	0.946	0.0	172	1.781
11.009	2.266	810.8	127.9	3.695	3.490	0.962	0.0	180	1.676
11.010	2.073	742.0	139.5	3.490	3.137	1.072	0.0	197	1.609
11.011	1.336	478.1	147.3	3.137	2.808	1.150	0.0	256	1.183
14.000	3.028	120.4	22.5	1.208	1.311	0.166	0.0	65	2.331
14.001	4.157	165.3	31.6	1.311	2.808	0.233	0.0	66	3.224
11.012	4.136	1480.1	184.8	2.808	1.794	1.458	0.0	159	2.868
11.013	1.202	430.1	193.0	1.794	3.100	1.606	0.0	317	1.171
11.014	4.534	1622.6	203.5	3.100	2.775	1.709	0.0	160	3.152
11.015	7.996	2861.5	208.6	2.775	2.375	1.759	0.0	122	4.771
11.016	2.690	962.6	201.0	2.375	1.800	1.759	0.0	208	2.149
1.025	1.613	1026.3	584.3	1.800	1.825	6.191	0.0	487	1.663
1.026	1.747	69.5	0.0	2.500	0.535	6.191	0.0	0	0.000

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Normal	Starting Level (m)	
Rainfall Events	Singular	Skip Steady State	✓	Check Discharge Rate(s)	✓
Summer CV	0.750	Drain Down Time (mins)	240	Check Discharge Volume	✓
Winter CV	0.840	Additional Storage (m³/ha)	20.0	100 year 360 minute (m³)	

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	0	0
30	0	0	0
100	0	0	0
100	40	10	0

Pre-development Discharge Rate

Site Makeup	Greenfield	Growth Factor 30 year	1.95
Greenfield Method	IH124	Growth Factor 100 year	2.48
Positively Drained Area (ha)		Betterment (%)	0
SAAR (mm)		QBar	
Soil Index	1	Q 1 year (l/s)	
SPR	0.10	Q 30 year (l/s)	
Region	1	Q 100 year (l/s)	
Growth Factor 1 year	0.85		

Pre-development Discharge Volume

Site Makeup	Greenfield	Return Period (years)	100
Greenfield Method	FSR/FEH	Climate Change (%)	0
Positively Drained Area (ha)		Storm Duration (mins)	360
Soil Index	1	Betterment (%)	0
SPR	0.10	PR	
CWI		Runoff Volume (m³)	

Node 71 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	44.075	Product Number	CTL-SHE-0172-1970-2725-1970
Design Depth (m)	2.725	Min Outlet Diameter (m)	0.225
Design Flow (l/s)	19.7	Min Node Diameter (mm)	1800

Node 70 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	45.000
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	3001.3	0.0	1.800	4385.8	0.0

Results for 2 year Critical Storm Duration. Lowest mass balance: 98.66%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	62.790	0.065	15.6	0.1700	0.0000	OK
15 minute winter	2	10	61.584	0.084	35.3	0.2516	0.0000	OK
15 minute winter	3	11	59.471	0.181	54.1	0.4686	0.0000	OK
15 minute winter	4	11	59.226	0.211	74.8	0.4711	0.0000	OK
15 minute winter	5	10	63.415	0.115	25.6	0.3173	0.0000	OK
15 minute winter	6	11	63.115	0.090	34.5	0.1447	0.0000	OK
15 minute winter	7	11	61.826	0.076	55.0	0.1977	0.0000	OK
15 minute winter	8	11	59.060	0.270	135.5	0.5277	0.0000	OK
15 minute winter	9	11	58.945	0.280	141.6	0.5510	0.0000	OK
15 minute winter	10	12	58.883	0.318	169.3	0.9135	0.0000	OK
15 minute winter	11	12	58.835	0.320	172.0	0.6532	0.0000	OK
15 minute winter	12	12	58.767	0.327	183.7	0.7374	0.0000	OK
15 minute winter	13	10	63.668	0.068	13.1	0.1625	0.0000	OK
15 minute winter	14	10	63.060	0.060	28.3	0.1352	0.0000	OK
15 minute winter	15	12	58.613	0.298	228.6	0.7952	0.0000	OK
15 minute winter	16	13	58.029	0.214	242.2	0.7263	0.0000	OK
15 minute winter	17	10	60.702	0.077	30.0	0.2983	0.0000	OK
15 minute winter	18	10	58.539	0.089	43.4	0.2404	0.0000	OK
15 minute winter	19	13	57.607	0.182	275.3	0.3595	0.0000	OK
15 minute winter	20	13	56.640	0.165	277.7	0.3257	0.0000	OK
15 minute winter	21	10	59.922	0.097	24.7	0.3427	0.0000	OK
15 minute winter	22	11	59.371	0.096	33.7	0.1930	0.0000	OK
15 minute winter	23	11	58.550	0.100	48.1	0.2742	0.0000	OK
15 minute winter	24	11	56.085	0.135	89.0	0.6742	0.0000	OK
15 minute winter	25	11	54.927	0.202	119.7	0.9601	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 winter	1	1.000	2	15.2	1.640	0.174	0.3809	
15 minute winter	2	1.001	3	34.8	2.016	0.174	1.2582	
15 minute winter	3	1.002	4	51.7	1.051	0.447	2.9278	
15 minute winter	4	1.003	8	74.2	1.095	0.410	1.6112	
15 minute winter	5	2.000	6	25.1	1.190	0.286	0.9288	
15 minute winter	6	2.001	7	34.3	1.952	0.191	0.8156	
15 minute winter	7	2.002	8	55.2	3.558	0.085	0.4099	
15 minute winter	8	1.004	9	135.1	1.196	0.383	2.1283	
15 minute winter	9	1.005	10	139.4	0.924	0.302	6.2146	
15 minute winter	10	1.006	11	166.2	1.012	0.332	2.8939	
15 minute winter	11	1.007	12	172.5	1.021	0.374	5.1978	
15 minute winter	12	1.008	15	181.6	1.132	0.446	10.5880	
15 minute winter	13	3.000	14	12.9	1.744	0.376	0.0898	
15 minute winter	14	3.001	15	27.9	2.788	0.087	0.5265	
15 minute winter	15	1.009	16	226.1	1.829	0.389	16.0144	
15 minute winter	16	1.010	19	243.2	2.804	0.170	1.4632	
15 minute winter	17	4.000	18	29.0	2.060	0.142	0.8805	
15 minute winter	18	4.001	19	43.0	2.244	0.113	0.3866	
15 minute winter	19	1.011	20	276.0	3.825	0.129	1.3349	
15 minute winter	20	1.012	26	278.6	4.416	0.114	1.6280	
15 minute winter	21	5.000	22	24.1	1.513	0.362	0.4644	
15 minute winter	22	5.001	23	33.4	1.772	0.210	0.6946	
15 minute winter	23	5.002	24	47.7	2.053	0.154	2.2996	
15 minute winter	24	5.003	25	89.2	2.085	0.140	2.2948	
15 minute winter	25	5.004	26	120.0	1.369	0.128	3.8180	

Results for 2 year Critical Storm Duration. Lowest mass balance: 98.66%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	26	12	54.751	0.176	398.5	0.6496	0.0000	OK
15 minute winter	27	12	53.498	0.273	402.8	0.7823	0.0000	OK
15 minute winter	28	12	52.930	0.255	411.2	0.8782	0.0000	OK
15 minute winter	29	10	58.762	0.137	22.2	0.4507	0.0000	OK
15 minute winter	30	11	58.541	0.066	21.5	0.0748	0.0000	OK
15 minute winter	31	11	56.056	0.081	32.7	0.1800	0.0000	OK
15 minute winter	32	10	54.468	0.068	11.6	0.1512	0.0000	OK
15 minute winter	33	11	54.240	0.140	52.0	0.3079	0.0000	OK
15 minute winter	34	11	53.827	0.127	59.8	0.2705	0.0000	OK
15 minute winter	35	12	53.375	0.125	59.8	0.1784	0.0000	OK
15 minute winter	36	12	52.438	0.238	476.0	0.7357	0.0000	OK
15 minute winter	37	13	50.502	0.227	473.3	0.5780	0.0000	OK
15 minute winter	38	10	49.714	0.039	10.8	0.0825	0.0000	OK
15 minute winter	39	13	49.097	0.272	484.1	0.6930	0.0000	OK
15 minute winter	40	13	48.607	0.357	486.9	0.9093	0.0000	OK
15 minute winter	41	10	50.957	0.057	22.5	0.1603	0.0000	OK
15 minute winter	42	13	48.358	0.333	501.9	0.8465	0.0000	OK
15 minute winter	43	13	48.022	0.247	502.0	0.6287	0.0000	OK
15 minute winter	44	10	48.623	0.023	3.3	0.0302	0.0000	OK
15 minute winter	45	13	46.997	0.347	511.4	1.0313	0.0000	OK
15 minute winter	46	13	46.734	0.334	517.3	1.0208	0.0000	OK
15 minute winter	47	14	45.952	0.252	515.1	0.6411	0.0000	OK
15 minute winter	48	10	57.756	0.056	15.7	0.1321	0.0000	OK
15 minute winter	49	10	55.581	0.081	31.1	0.1872	0.0000	OK
15 minute winter	50	10	54.111	0.086	35.6	0.1304	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 winter	26	1.013	27	397.6	3.399	0.096	2.3405	
15 minute winter	27	1.014	28	400.0	2.858	0.194	3.9668	
15 minute winter	28	1.015	36	410.0	2.944	0.139	3.0436	
15 minute winter	29	6.000	30	21.5	0.914	0.633	0.4117	
15 minute winter	30	6.001	31	21.7	1.617	0.108	1.0429	
15 minute winter	31	6.002	33	32.6	2.142	0.157	0.7893	
15 minute winter	32	7.000	33	11.4	1.199	0.172	0.0880	
15 minute winter	33	6.003	34	51.9	1.436	0.277	1.3398	
15 minute winter	34	6.004	35	59.8	1.658	0.163	1.2679	
15 minute winter	35	6.005	36	59.1	1.692	0.162	1.6461	
15 minute winter	36	1.016	37	473.3	3.672	0.145	9.2765	
15 minute winter	37	1.017	39	477.6	3.334	0.137	6.8075	
15 minute winter	38	8.000	39	10.7	1.690	0.014	0.0448	
15 minute winter	39	1.018	40	486.9	2.466	0.168	5.3815	
15 minute winter	40	1.019	42	488.0	2.184	0.266	5.9197	
15 minute winter	41	9.000	42	22.3	2.872	0.134	0.1687	
15 minute winter	42	1.020	43	502.0	2.849	0.223	3.4787	
15 minute winter	43	1.021	45	501.6	2.933	0.159	7.5607	
15 minute winter	44	10.000	45	3.3	1.552	0.021	0.0309	
15 minute winter	45	1.022	46	510.2	2.334	0.234	4.5958	
15 minute winter	46	1.023	47	515.1	2.908	0.260	12.6195	
15 minute winter	47	1.024	70	518.0	1.164	0.182	30.5352	
15 minute winter	48	11.000	49	15.5	1.518	0.137	0.4800	
15 minute winter	49	11.001	50	30.4	2.431	0.260	0.3510	
15 minute winter	50	11.002	51	35.4	2.318	0.141	0.0976	

Results for 2 year Critical Storm Duration. Lowest mass balance: 98.66%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	51	11	53.715	0.090	44.6	0.1864	0.0000	OK
15 minute winter	52	10	53.204	0.029	3.2	0.0417	0.0000	OK
15 minute winter	53	11	52.371	0.146	67.5	0.4725	0.0000	OK
15 minute winter	54	11	52.107	0.182	84.9	0.5500	0.0000	OK
15 minute winter	55	11	51.929	0.179	88.1	0.3418	0.0000	OK
15 minute winter	56	11	51.739	0.164	94.5	0.3339	0.0000	OK
15 minute winter	57	10	56.937	0.062	24.8	0.2180	0.0000	OK
15 minute winter	58	10	53.695	0.070	32.0	0.1058	0.0000	OK
15 minute winter	59	11	51.629	0.204	132.0	0.4048	0.0000	OK
15 minute winter	60	11	51.518	0.193	134.1	0.3557	0.0000	OK
15 minute winter	61	11	51.244	0.219	148.7	0.5028	0.0000	OK
15 minute winter	62	12	51.049	0.249	156.8	0.5426	0.0000	OK
15 minute winter	63	10	55.869	0.069	24.0	0.2380	0.0000	OK
15 minute winter	64	10	54.320	0.070	33.4	0.1402	0.0000	OK
15 minute winter	65	12	50.912	0.162	196.3	0.3568	0.0000	OK
15 minute winter	66	12	50.068	0.318	214.5	0.9434	0.0000	OK
15 minute winter	67	12	49.813	0.188	229.0	0.4340	0.0000	OK
15 minute winter	68	12	48.553	0.128	234.8	0.2629	0.0000	OK
15 minute winter	69	12	45.569	0.219	234.5	0.3871	0.0000	OK
360 minute winter	70	360	45.281	1.181	152.5	879.4137	0.0000	SURCHARGED
360 minute winter	71	368	45.282	1.207	22.5	3.0725	0.0000	SURCHARGED
15 minute summer	72	1	43.900	0.000	19.1	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	51	11.003	53	44.5	2.245	0.121	0.7408	
15 minute winter	52	12.000	53	3.1	1.062	0.034	0.0632	
15 minute winter	53	11.004	54	67.9	1.178	0.166	2.4219	
15 minute winter	54	11.005	55	85.4	1.375	0.221	0.9796	
15 minute winter	55	11.006	56	88.0	1.339	0.167	1.1154	
15 minute winter	56	11.007	59	94.5	1.218	0.098	1.1081	
15 minute winter	57	13.000	58	24.5	2.537	0.167	0.3978	
15 minute winter	58	13.001	59	31.7	3.122	0.192	0.1791	
15 minute winter	59	11.008	60	131.9	1.509	0.150	0.9900	
15 minute winter	60	11.009	61	133.7	1.454	0.165	3.6963	
15 minute winter	61	11.010	62	147.4	1.350	0.199	3.9292	
15 minute winter	62	11.011	65	158.3	1.722	0.331	1.7681	
15 minute winter	63	14.000	64	23.7	2.281	0.197	0.3039	
15 minute winter	64	14.001	65	33.0	3.207	0.200	0.3145	
15 minute winter	65	11.012	66	196.5	1.730	0.133	4.6564	
15 minute winter	66	11.013	67	217.3	1.782	0.505	7.2294	
15 minute winter	67	11.014	68	229.2	3.624	0.141	2.5695	
15 minute winter	68	11.015	69	234.5	3.242	0.082	2.4454	
15 minute winter	69	11.016	70	229.9	1.583	0.239	22.2477	
360 minute winter	70	1.025	71	22.5	0.239	0.022	5.9309	
360 minute winter	71	Hydro-Brake®	72	19.1				625.8

Results for 30 year Critical Storm Duration. Lowest mass balance: 98.07%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	62.835	0.110	40.3	0.2884	0.0000	OK
15 minute winter	2	10	61.640	0.140	91.6	0.4195	0.0000	OK
15 minute winter	3	11	59.739	0.449	140.5	1.1647	0.0000	SURCHARGED
15 minute winter	4	11	59.451	0.436	190.5	0.9729	0.0000	OK
15 minute winter	5	10	63.501	0.201	65.9	0.5572	0.0000	OK
15 minute winter	6	11	63.179	0.154	89.4	0.2469	0.0000	OK
15 minute winter	7	10	61.868	0.118	143.5	0.3078	0.0000	OK
15 minute winter	8	12	59.349	0.559	344.0	1.0915	0.0000	OK
15 minute winter	9	12	59.276	0.611	355.7	1.2043	0.0000	OK
15 minute winter	10	12	59.213	0.648	423.7	1.8604	0.0000	OK
15 minute winter	11	12	59.152	0.637	432.1	1.2993	0.0000	OK
15 minute winter	12	12	59.061	0.621	458.4	1.3998	0.0000	OK
15 minute winter	13	11	63.769	0.169	33.9	0.4065	0.0000	SURCHARGED
15 minute winter	14	10	63.099	0.099	72.5	0.2207	0.0000	OK
15 minute winter	15	12	58.862	0.547	581.4	1.4613	0.0000	OK
15 minute winter	16	12	58.202	0.387	637.5	1.3150	0.0000	OK
15 minute winter	17	10	60.754	0.129	77.5	0.4999	0.0000	OK
15 minute winter	18	10	58.602	0.152	113.0	0.4101	0.0000	OK
15 minute winter	19	12	57.753	0.328	733.8	0.6500	0.0000	OK
15 minute winter	20	12	56.766	0.291	739.3	0.5767	0.0000	OK
15 minute winter	21	10	60.013	0.188	63.7	0.6626	0.0000	OK
15 minute winter	22	10	59.440	0.165	86.9	0.3341	0.0000	OK
15 minute winter	23	11	58.617	0.167	124.5	0.4594	0.0000	OK
15 minute winter	24	11	56.179	0.229	231.3	1.1422	0.0000	OK
15 minute winter	25	11	55.068	0.343	311.5	1.6301	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 winter	1	1.000	2	39.4	2.109	0.452	0.7698	
15 minute winter	2	1.001	3	90.5	2.139	0.451	3.3728	
15 minute winter	3	1.002	4	130.3	1.224	1.125	6.4808	
15 minute winter	4	1.003	8	186.3	1.311	1.030	3.6518	
15 minute winter	5	2.000	6	64.8	1.495	0.739	1.9019	
15 minute winter	6	2.001	7	88.5	2.496	0.494	1.6468	
15 minute winter	7	2.002	8	143.0	3.766	0.221	1.7499	
15 minute winter	8	1.004	9	338.8	1.387	0.960	5.0791	
15 minute winter	9	1.005	10	346.4	1.042	0.750	14.1374	
15 minute winter	10	1.006	11	414.2	1.208	0.828	6.1107	
15 minute winter	11	1.007	12	428.6	1.247	0.930	10.6524	
15 minute winter	12	1.008	15	458.3	1.397	1.126	21.4244	
15 minute winter	13	3.000	14	32.7	2.078	0.950	0.1939	
15 minute winter	14	3.001	15	71.8	3.631	0.225	1.5723	
15 minute winter	15	1.009	16	581.3	2.234	0.999	33.6663	
15 minute winter	16	1.010	19	630.9	3.336	0.441	3.2255	
15 minute winter	17	4.000	18	75.8	2.664	0.370	1.7720	
15 minute winter	18	4.001	19	112.1	2.862	0.294	0.7899	
15 minute winter	19	1.011	20	733.5	4.590	0.344	2.9554	
15 minute winter	20	1.012	26	738.2	5.555	0.301	3.4318	
15 minute winter	21	5.000	22	61.9	1.841	0.931	0.9846	
15 minute winter	22	5.001	23	86.3	2.249	0.543	1.4122	
15 minute winter	23	5.002	24	124.4	2.660	0.402	4.6224	
15 minute winter	24	5.003	25	232.7	2.684	0.365	4.6517	
15 minute winter	25	5.004	26	312.3	1.616	0.333	8.5161	

Results for 30 year Critical Storm Duration. Lowest mass balance: 98.07%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	26	12	54.898	0.323	1069.9	1.1927	0.0000	OK
15 minute winter	27	12	53.731	0.506	1086.4	1.4510	0.0000	OK
15 minute winter	28	12	53.146	0.471	1119.5	1.6260	0.0000	OK
15 minute winter	29	11	58.986	0.361	57.3	1.1830	0.0000	SURCHARGED
15 minute winter	30	11	58.582	0.107	55.5	0.1213	0.0000	OK
15 minute winter	31	11	56.107	0.132	84.2	0.2918	0.0000	OK
15 minute winter	32	10	54.517	0.117	29.8	0.2627	0.0000	OK
15 minute winter	33	11	54.352	0.252	134.4	0.5554	0.0000	OK
15 minute winter	34	11	53.918	0.218	155.6	0.4650	0.0000	OK
15 minute winter	35	11	53.465	0.215	155.9	0.3070	0.0000	OK
15 minute winter	36	12	52.618	0.418	1291.2	1.2907	0.0000	OK
15 minute winter	37	12	50.679	0.404	1294.3	1.0293	0.0000	OK
15 minute winter	38	10	49.738	0.063	28.0	0.1346	0.0000	OK
15 minute winter	39	12	49.373	0.548	1316.4	1.3943	0.0000	OK
15 minute winter	40	12	48.938	0.688	1311.1	1.7511	0.0000	OK
15 minute winter	41	10	50.996	0.096	58.1	0.2701	0.0000	OK
15 minute winter	42	12	48.640	0.615	1351.0	1.5654	0.0000	OK
15 minute winter	43	12	48.231	0.456	1348.1	1.1615	0.0000	OK
15 minute winter	44	10	48.637	0.037	8.6	0.0483	0.0000	OK
15 minute winter	45	13	47.323	0.673	1381.6	2.0021	0.0000	OK
15 minute winter	46	13	47.013	0.613	1405.4	1.8758	0.0000	OK
15 minute winter	47	13	46.151	0.451	1418.1	1.1481	0.0000	OK
15 minute winter	48	10	57.792	0.092	40.7	0.2174	0.0000	OK
15 minute winter	49	10	55.645	0.145	80.5	0.3354	0.0000	OK
15 minute winter	50	10	54.181	0.156	92.4	0.2349	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 winter	26	1.013	27	1072.9	4.005	0.258	5.3030	
15 minute winter	27	1.014	28	1090.6	3.581	0.529	8.5723	
15 minute winter	28	1.015	36	1120.9	3.594	0.379	6.7575	
15 minute winter	29	6.000	30	55.5	1.402	1.634	0.6636	
15 minute winter	30	6.001	31	55.7	2.128	0.278	2.0314	
15 minute winter	31	6.002	33	84.5	2.359	0.407	1.8970	
15 minute winter	32	7.000	33	29.5	1.514	0.444	0.1798	
15 minute winter	33	6.003	34	135.2	1.801	0.722	2.7808	
15 minute winter	34	6.004	35	155.9	2.071	0.426	2.6452	
15 minute winter	35	6.005	36	153.9	2.169	0.422	3.3629	
15 minute winter	36	1.016	37	1294.3	4.591	0.396	20.2471	
15 minute winter	37	1.017	39	1294.1	3.809	0.371	16.1350	
15 minute winter	38	8.000	39	27.8	2.191	0.036	0.1254	
15 minute winter	39	1.018	40	1311.1	2.836	0.452	12.5622	
15 minute winter	40	1.019	42	1304.2	2.680	0.710	13.0013	
15 minute winter	41	9.000	42	57.7	3.694	0.347	0.3401	
15 minute winter	42	1.020	43	1348.1	3.444	0.600	7.7110	
15 minute winter	43	1.021	45	1356.4	3.339	0.429	17.7966	
15 minute winter	44	10.000	45	8.5	2.057	0.055	0.0610	
15 minute winter	45	1.022	46	1387.0	2.862	0.637	10.1488	
15 minute winter	46	1.023	47	1418.1	3.651	0.716	27.6050	
15 minute winter	47	1.024	70	1407.2	2.586	0.494	37.3157	
15 minute winter	48	11.000	49	40.3	1.898	0.355	0.9899	
15 minute winter	49	11.001	50	79.0	3.051	0.677	0.7267	
15 minute winter	50	11.002	51	92.1	2.857	0.365	0.2055	

Results for 30 year Critical Storm Duration. Lowest mass balance: 98.07%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	51	10	53.776	0.151	115.9	0.3125	0.0000	OK
15 minute winter	52	10	53.221	0.046	8.2	0.0667	0.0000	OK
15 minute winter	53	10	52.483	0.258	175.7	0.8340	0.0000	OK
15 minute winter	54	11	52.245	0.320	220.1	0.9649	0.0000	OK
15 minute winter	55	11	52.057	0.307	228.6	0.5880	0.0000	OK
15 minute winter	56	11	51.877	0.302	246.3	0.6144	0.0000	OK
15 minute winter	57	10	56.978	0.103	64.1	0.3622	0.0000	OK
15 minute winter	58	10	53.747	0.122	83.0	0.1850	0.0000	OK
15 minute winter	59	11	51.794	0.369	343.2	0.7340	0.0000	OK
15 minute winter	60	11	51.674	0.349	349.5	0.6418	0.0000	OK
15 minute winter	61	11	51.423	0.398	388.9	0.9137	0.0000	OK
15 minute winter	62	11	51.223	0.423	414.5	0.9205	0.0000	OK
15 minute winter	63	10	55.918	0.118	61.8	0.4071	0.0000	OK
15 minute winter	64	10	54.371	0.121	86.3	0.2415	0.0000	OK
15 minute winter	65	11	51.038	0.288	521.3	0.6330	0.0000	OK
15 minute winter	66	11	50.313	0.563	571.4	1.6697	0.0000	OK
15 minute winter	67	12	49.952	0.327	598.7	0.7560	0.0000	OK
15 minute winter	68	12	48.633	0.208	618.8	0.4284	0.0000	OK
15 minute winter	69	12	45.732	0.382	620.1	0.6748	0.0000	OK
480 minute winter	70	488	45.710	1.610	252.9	2330.0220	0.0000	SURCHARGED
480 minute winter	71	488	45.709	1.634	21.0	4.1585	0.0000	SURCHARGED
15 minute summer	72	1	43.900	0.000	19.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	51	11.003	53	114.8	2.892	0.313	1.4867	
15 minute winter	52	12.000	53	8.1	1.398	0.089	0.1239	
15 minute winter	53	11.004	54	175.3	1.446	0.428	5.0756	
15 minute winter	54	11.005	55	221.6	1.746	0.575	2.0010	
15 minute winter	55	11.006	56	229.4	1.713	0.435	2.2708	
15 minute winter	56	11.007	59	246.6	1.401	0.255	2.4920	
15 minute winter	57	13.000	58	63.7	3.207	0.433	0.8159	
15 minute winter	58	13.001	59	82.2	3.947	0.499	0.3677	
15 minute winter	59	11.008	60	343.9	1.783	0.390	2.1843	
15 minute winter	60	11.009	61	350.2	1.731	0.432	8.1134	
15 minute winter	61	11.010	62	387.1	1.714	0.522	8.1438	
15 minute winter	62	11.011	65	411.7	2.205	0.861	3.6259	
15 minute winter	63	14.000	64	61.3	2.871	0.509	0.6240	
15 minute winter	64	14.001	65	85.4	4.084	0.517	0.6392	
15 minute winter	65	11.012	66	519.3	2.193	0.351	9.3320	
15 minute winter	66	11.013	67	568.6	2.298	1.322	14.3290	
15 minute winter	67	11.014	68	604.1	4.592	0.372	5.3253	
15 minute winter	68	11.015	69	620.1	4.180	0.217	5.0138	
15 minute winter	69	11.016	70	620.3	1.952	0.644	27.4986	
480 minute winter	70	1.025	71	21.0	0.238	0.020	5.9309	
480 minute winter	71	Hydro-Brake®	72	19.1				685.4

Results for 100 year Critical Storm Duration. Lowest mass balance: 99.17%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	62.854	0.129	52.4	0.3402	0.0000	OK
15 minute winter	2	11	61.675	0.175	119.5	0.5242	0.0000	OK
15 minute winter	3	12	60.590	1.300	183.1	3.3744	0.0000	SURCHARGED
15 minute winter	4	12	60.167	1.152	227.6	2.5686	0.0000	SURCHARGED
15 minute winter	5	10	63.547	0.247	86.0	0.6840	0.0000	OK
15 minute winter	6	11	63.208	0.183	116.3	0.2932	0.0000	OK
15 minute winter	7	10	61.886	0.136	187.0	0.3537	0.0000	OK
15 minute winter	8	12	60.001	1.211	426.0	2.3646	0.0000	SURCHARGED
15 minute winter	9	12	59.883	1.218	432.4	2.4015	0.0000	SURCHARGED
15 minute winter	10	12	59.764	1.199	526.4	3.4404	0.0000	SURCHARGED
15 minute winter	11	12	59.661	1.146	539.2	2.3384	0.0000	SURCHARGED
15 minute winter	12	12	59.506	1.066	576.2	2.4041	0.0000	SURCHARGED
15 minute winter	13	11	64.087	0.487	44.2	1.1688	0.0000	SURCHARGED
15 minute winter	14	10	63.108	0.108	90.7	0.2417	0.0000	OK
15 minute winter	15	12	59.202	0.887	750.0	2.3696	0.0000	SURCHARGED
15 minute winter	16	12	58.275	0.460	807.7	1.5630	0.0000	OK
15 minute winter	17	10	60.776	0.151	101.0	0.5849	0.0000	OK
15 minute winter	18	10	58.629	0.179	147.4	0.4822	0.0000	OK
15 minute winter	19	12	57.813	0.388	938.1	0.7683	0.0000	OK
15 minute winter	20	12	56.817	0.342	946.2	0.6770	0.0000	OK
15 minute winter	21	11	60.322	0.497	83.0	1.7526	0.0000	SURCHARGED
15 minute winter	22	11	59.469	0.194	109.0	0.3927	0.0000	OK
15 minute winter	23	11	58.642	0.192	157.3	0.5280	0.0000	OK
15 minute winter	24	11	56.216	0.266	295.7	1.3251	0.0000	OK
15 minute winter	25	11	55.129	0.404	399.8	1.9198	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 winter	1	1.000	2	51.4	2.243	0.590	0.9436	
15 minute winter	2	1.001	3	118.1	2.142	0.589	3.7323	
15 minute winter	3	1.002	4	160.2	1.453	1.384	6.5190	
15 minute winter	4	1.003	8	222.8	1.406	1.231	3.7576	
15 minute winter	5	2.000	6	84.3	1.566	0.961	2.3486	
15 minute winter	6	2.001	7	115.4	2.647	0.644	2.0243	
15 minute winter	7	2.002	8	186.4	3.830	0.288	1.9311	
15 minute winter	8	1.004	9	410.4	1.457	1.163	5.3074	
15 minute winter	9	1.005	10	427.9	1.199	0.927	14.5840	
15 minute winter	10	1.006	11	515.9	1.445	1.031	6.2218	
15 minute winter	11	1.007	12	535.4	1.500	1.162	10.9835	
15 minute winter	12	1.008	15	574.0	1.608	1.411	23.4103	
15 minute winter	13	3.000	14	40.8	2.317	1.185	0.2133	
15 minute winter	14	3.001	15	90.1	3.730	0.282	2.4567	
15 minute winter	15	1.009	16	734.5	2.295	1.262	39.7717	
15 minute winter	16	1.010	19	804.3	3.453	0.562	3.9618	
15 minute winter	17	4.000	18	98.9	2.846	0.483	2.1650	
15 minute winter	18	4.001	19	146.3	3.045	0.384	0.9689	
15 minute winter	19	1.011	20	938.5	4.765	0.440	3.6413	
15 minute winter	20	1.012	26	946.1	5.851	0.386	4.1743	
15 minute winter	21	5.000	22	78.3	1.968	1.177	1.1477	
15 minute winter	22	5.001	23	109.2	2.359	0.686	1.7030	
15 minute winter	23	5.002	24	156.9	2.814	0.507	5.5120	
15 minute winter	24	5.003	25	297.2	2.844	0.466	5.6054	
15 minute winter	25	5.004	26	398.9	1.678	0.425	10.7049	

Results for 100 year Critical Storm Duration. Lowest mass balance: 99.17%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	26	12	54.960	0.385	1374.8	1.4249	0.0000	OK
15 minute winter	27	12	53.832	0.607	1397.5	1.7414	0.0000	OK
15 minute winter	28	12	53.237	0.562	1440.8	1.9369	0.0000	OK
15 minute winter	29	11	59.182	0.557	74.8	1.8267	0.0000	SURCHARGED
15 minute winter	30	11	58.599	0.124	72.2	0.1398	0.0000	OK
15 minute winter	31	11	56.129	0.154	109.6	0.3396	0.0000	OK
15 minute winter	32	10	54.543	0.143	38.9	0.3192	0.0000	OK
15 minute winter	33	11	54.414	0.314	174.7	0.6917	0.0000	OK
15 minute winter	34	11	53.957	0.257	202.0	0.5494	0.0000	OK
15 minute winter	35	11	53.503	0.253	202.3	0.3616	0.0000	OK
15 minute winter	36	12	52.689	0.489	1666.1	1.5126	0.0000	OK
15 minute winter	37	12	50.757	0.482	1671.3	1.2265	0.0000	OK
15 minute summer	38	10	49.746	0.071	34.7	0.1511	0.0000	OK
15 minute winter	39	12	49.525	0.700	1705.5	1.7812	0.0000	OK
15 minute winter	40	12	49.181	0.931	1698.7	2.3701	0.0000	SURCHARGED
15 minute winter	41	10	51.013	0.113	75.7	0.3167	0.0000	OK
15 minute winter	42	12	48.778	0.753	1757.7	1.9175	0.0000	OK
15 minute winter	43	12	48.340	0.565	1748.9	1.4371	0.0000	OK
15 minute winter	44	10	48.642	0.042	11.2	0.0552	0.0000	OK
15 minute winter	45	13	47.531	0.881	1776.8	2.6198	0.0000	OK
15 minute winter	46	13	47.152	0.752	1812.8	2.3005	0.0000	OK
15 minute winter	47	13	46.283	0.583	1820.1	1.4849	0.0000	OK
15 minute winter	48	10	57.807	0.107	52.9	0.2523	0.0000	OK
15 minute winter	49	10	55.680	0.180	104.9	0.4163	0.0000	OK
15 minute winter	50	10	54.212	0.187	120.1	0.2820	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 winter	26	1.013	27	1379.9	4.120	0.332	6.5796	
15 minute winter	27	1.014	28	1403.0	3.740	0.680	10.5296	
15 minute winter	28	1.015	36	1444.9	3.760	0.489	8.3191	
15 minute winter	29	6.000	30	72.2	1.815	2.127	0.6827	
15 minute winter	30	6.001	31	72.4	2.277	0.361	2.4650	
15 minute winter	31	6.002	33	109.9	2.358	0.529	2.5028	
15 minute winter	32	7.000	33	38.3	1.567	0.578	0.2635	
15 minute winter	33	6.003	34	175.5	1.878	0.937	3.4635	
15 minute winter	34	6.004	35	202.3	2.183	0.553	3.2567	
15 minute winter	35	6.005	36	200.0	2.305	0.548	4.1132	
15 minute winter	36	1.016	37	1671.3	4.791	0.511	25.0519	
15 minute winter	37	1.017	39	1676.6	3.810	0.480	20.7495	
15 minute summer	38	8.000	39	34.6	2.291	0.045	0.3117	
15 minute winter	39	1.018	40	1698.7	2.874	0.585	15.8058	
15 minute winter	40	1.019	42	1696.7	2.792	0.924	15.8982	
15 minute winter	41	9.000	42	75.2	3.937	0.452	0.4159	
15 minute winter	42	1.020	43	1748.9	3.529	0.778	9.6892	
15 minute winter	43	1.021	45	1742.7	3.400	0.552	22.8399	
15 minute winter	44	10.000	45	11.1	2.217	0.072	0.3052	
15 minute winter	45	1.022	46	1788.9	2.981	0.821	12.5333	
15 minute winter	46	1.023	47	1820.1	3.630	0.920	35.5113	
15 minute winter	47	1.024	70	1806.4	3.073	0.634	41.9018	
15 minute winter	48	11.000	49	52.5	1.977	0.463	1.2309	
15 minute winter	49	11.001	50	102.6	3.178	0.879	0.9068	
15 minute winter	50	11.002	51	119.6	3.006	0.475	0.2536	

Results for 100 year Critical Storm Duration. Lowest mass balance: 99.17%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	51	10	53.801	0.176	150.7	0.3650	0.0000	OK
15 minute winter	52	10	53.228	0.053	10.7	0.0765	0.0000	OK
15 minute winter	53	10	52.532	0.307	228.8	0.9899	0.0000	OK
15 minute winter	54	11	52.307	0.382	286.8	1.1528	0.0000	OK
15 minute winter	55	11	52.112	0.362	297.6	0.6919	0.0000	OK
15 minute winter	56	11	51.941	0.366	320.6	0.7449	0.0000	OK
15 minute winter	57	10	56.995	0.120	83.5	0.4229	0.0000	OK
15 minute winter	58	10	53.772	0.147	108.2	0.2222	0.0000	OK
15 minute winter	59	11	51.870	0.445	446.8	0.8844	0.0000	OK
15 minute winter	60	11	51.743	0.418	455.1	0.7688	0.0000	OK
15 minute winter	61	11	51.508	0.483	506.4	1.1081	0.0000	OK
15 minute winter	62	11	51.298	0.498	541.1	1.0847	0.0000	OK
15 minute winter	63	10	55.940	0.140	80.6	0.4842	0.0000	OK
15 minute winter	64	10	54.394	0.144	112.5	0.2885	0.0000	OK
15 minute winter	65	11	51.097	0.347	679.6	0.7631	0.0000	OK
15 minute winter	66	11	50.586	0.836	739.8	2.4801	0.0000	SURCHARGED
15 minute winter	67	12	50.011	0.386	778.0	0.8938	0.0000	OK
15 minute winter	68	12	48.664	0.239	803.0	0.4909	0.0000	OK
600 minute winter	69	600	45.936	0.586	76.6	1.0360	0.0000	OK
600 minute winter	70	600	45.936	1.836	267.4	3154.0050	0.0000	SURCHARGED
600 minute winter	71	615	45.937	1.862	21.0	4.7386	0.0000	SURCHARGED
15 minute summer	72	1	43.900	0.000	19.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	51	11.003	53	149.6	3.086	0.408	1.8134	
15 minute winter	52	12.000	53	10.5	1.508	0.116	0.1504	
15 minute winter	53	11.004	54	228.1	1.527	0.557	6.2442	
15 minute winter	54	11.005	55	288.4	1.854	0.748	2.4495	
15 minute winter	55	11.006	56	298.5	1.827	0.566	2.7702	
15 minute winter	56	11.007	59	321.0	1.447	0.331	3.1456	
15 minute winter	57	13.000	58	82.9	3.382	0.564	1.0065	
15 minute winter	58	13.001	59	107.1	4.163	0.650	0.4540	
15 minute winter	59	11.008	60	447.8	1.860	0.508	2.7264	
15 minute winter	60	11.009	61	456.1	1.803	0.562	10.1201	
15 minute winter	61	11.010	62	505.4	1.819	0.681	9.9616	
15 minute winter	62	11.011	65	536.6	2.405	1.122	4.4544	
15 minute winter	63	14.000	64	80.0	3.025	0.664	0.7721	
15 minute winter	64	14.001	65	111.4	4.321	0.674	0.7878	
15 minute winter	65	11.012	66	672.1	2.216	0.454	10.9160	
15 minute winter	66	11.013	67	738.7	2.349	1.717	16.6909	
15 minute winter	67	11.014	68	783.9	4.853	0.483	6.5190	
15 minute winter	68	11.015	69	804.9	4.347	0.281	6.5564	
600 minute winter	69	11.016	70	75.7	0.669	0.079	33.3896	
600 minute winter	70	1.025	71	21.0	0.245	0.020	5.9309	
600 minute winter	71	Hydro-Brake®	72	18.9				819.2

Results for 100 year +40% CC +10% A Critical Storm Duration. Lowest mass balance: 99.32%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	12	63.772	1.047	80.8	2.9125	0.0000	SURCHARGED
15 minute winter	2	11	63.002	1.502	172.9	4.7794	8.4391	FLOOD
15 minute winter	3	12	62.528	3.238	230.6	8.6714	0.1170	FLOOD
15 minute winter	4	12	62.050	3.035	298.0	7.0057	0.0000	SURCHARGED
15 minute winter	5	11	63.916	0.616	132.4	1.8072	0.0000	SURCHARGED
15 minute winter	6	12	63.355	0.330	174.7	0.5446	0.0000	SURCHARGED
15 minute winter	7	12	62.345	0.595	281.3	1.6163	0.0000	SURCHARGED
15 minute winter	8	12	61.813	3.023	568.5	5.9548	0.0000	SURCHARGED
15 minute winter	9	12	61.602	2.937	583.8	5.8481	0.0000	SURCHARGED
15 minute winter	10	12	61.386	2.821	725.6	8.4077	0.0000	SURCHARGED
15 minute winter	11	12	61.189	2.674	743.1	5.5302	0.0000	SURCHARGED
15 minute winter	12	12	60.890	2.450	800.0	5.6451	0.0000	SURCHARGED
15 minute winter	13	11	64.946	1.346	68.0	3.4031	0.0000	FLOOD RISK
15 minute winter	14	11	63.135	0.135	134.8	0.3159	0.0000	OK
15 minute winter	15	12	60.289	1.974	1060.5	5.4494	0.0000	SURCHARGED
15 minute winter	16	12	58.507	0.692	1169.5	2.4616	0.0000	SURCHARGED
15 minute winter	17	10	60.826	0.201	155.5	0.8335	0.0000	OK
15 minute winter	18	10	58.688	0.238	227.1	0.6739	0.0000	OK
15 minute winter	19	11	57.953	0.528	1383.3	1.0571	0.0000	OK
15 minute winter	20	11	56.908	0.433	1391.6	0.8659	0.0000	OK
15 minute winter	21	11	61.227	1.402	127.9	5.2814	0.0000	FLOOD RISK
15 minute winter	22	12	59.633	0.358	160.3	0.7558	0.0000	SURCHARGED
15 minute winter	23	11	58.697	0.247	231.4	0.7116	0.0000	OK
15 minute winter	24	11	56.300	0.350	447.0	1.8605	0.0000	OK
15 minute winter	25	11	55.292	0.567	607.6	2.8177	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 winter	1	1.000	2	74.5	2.277	0.854	1.6363	
15 minute winter	2	1.001	3	136.5	2.156	0.681	4.6485	
15 minute winter	3	1.002	4	198.3	1.798	1.712	6.5190	
15 minute winter	4	1.003	8	287.1	1.812	1.587	3.7576	
15 minute winter	5	2.000	6	127.9	1.821	1.459	3.0973	
15 minute winter	6	2.001	7	174.0	2.776	0.971	3.2701	
15 minute winter	7	2.002	8	268.9	3.788	0.415	2.9110	
15 minute winter	8	1.004	9	553.4	1.965	1.568	5.3074	
15 minute winter	9	1.005	10	588.4	1.649	1.275	14.5840	
15 minute winter	10	1.006	11	708.7	1.985	1.417	6.2218	
15 minute winter	11	1.007	12	742.5	2.080	1.612	10.9835	
15 minute winter	12	1.008	15	804.5	2.254	1.977	23.4103	
15 minute winter	13	3.000	14	58.8	3.341	1.708	0.2132	
15 minute winter	14	3.001	15	134.5	3.658	0.421	2.6615	
15 minute winter	15	1.009	16	1056.8	2.961	1.816	46.0802	
15 minute winter	16	1.010	19	1172.3	3.618	0.819	5.5065	
15 minute winter	17	4.000	18	152.3	3.131	0.744	3.0360	
15 minute winter	18	4.001	19	225.3	3.330	0.592	1.4232	
15 minute winter	19	1.011	20	1379.6	5.127	0.647	5.0060	
15 minute winter	20	1.012	26	1395.3	5.976	0.570	6.5767	
15 minute winter	21	5.000	22	113.0	2.842	1.700	1.1594	
15 minute winter	22	5.001	23	155.1	2.438	0.976	2.3721	
15 minute winter	23	5.002	24	231.5	3.072	0.749	7.4530	
15 minute winter	24	5.003	25	449.6	3.107	0.705	7.7575	
15 minute winter	25	5.004	26	595.2	1.738	0.634	17.7478	

Results for 100 year +40% CC +10% A Critical Storm Duration. Lowest mass balance: 99.32%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	26	13	55.223	0.648	2086.8	2.4693	0.0000	OK
15 minute winter	27	13	54.608	1.383	2084.9	4.0107	0.0000	SURCHARGED
15 minute winter	28	13	53.903	1.228	2137.3	4.3457	0.0000	SURCHARGED
15 minute winter	29	11	59.736	1.111	115.2	3.8847	0.0000	SURCHARGED
15 minute winter	30	11	58.632	0.157	109.6	0.1772	0.0000	OK
15 minute winter	31	11	56.196	0.221	166.7	0.5126	0.0000	OK
15 minute winter	32	11	55.029	0.629	59.8	1.4762	0.0000	SURCHARGED
15 minute winter	33	11	54.875	0.775	261.2	1.7675	0.0000	SURCHARGED
15 minute winter	34	11	54.045	0.345	298.6	0.7615	0.0000	OK
15 minute winter	35	13	53.853	0.603	297.3	0.8625	0.0000	SURCHARGED
15 minute winter	36	13	53.464	1.264	2459.7	3.9754	0.0000	SURCHARGED
15 minute winter	37	13	52.277	2.002	2431.0	5.0957	0.0000	SURCHARGED
15 minute winter	38	13	51.387	1.712	77.0	3.7486	0.0000	SURCHARGED
15 minute winter	39	13	51.385	2.560	2273.8	6.5162	0.0000	FLOOD RISK
15 minute winter	40	13	50.719	2.469	2274.3	6.2824	0.0000	SURCHARGED
15 minute winter	41	10	51.048	0.148	116.7	0.4382	0.0000	OK
15 minute winter	42	13	50.059	2.034	2344.8	5.1768	0.0000	SURCHARGED
15 minute winter	43	14	49.455	1.680	2345.9	4.2762	0.0000	SURCHARGED
15 minute winter	44	9	48.651	0.051	17.2	0.0672	0.0000	OK
15 minute winter	45	14	48.591	1.941	2397.3	5.8580	0.0000	SURCHARGED
15 minute winter	46	14	47.980	1.580	2435.6	4.9154	0.0000	SURCHARGED
15 minute winter	47	15	46.707	1.007	2437.3	2.5633	0.0000	SURCHARGED
15 minute winter	48	11	57.863	0.163	81.5	0.4036	0.0000	OK
15 minute winter	49	12	56.706	1.206	159.3	2.9297	0.0000	SURCHARGED
15 minute winter	50	11	54.268	0.243	166.4	0.3751	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 winter	26	1.013	27	2052.4	4.154	0.494	9.7205	
15 minute winter	27	1.014	28	2067.5	3.907	1.002	15.0146	
15 minute winter	28	1.015	36	2127.0	3.968	0.720	13.7263	
15 minute winter	29	6.000	30	109.6	2.757	3.230	0.6855	
15 minute winter	30	6.001	31	109.6	2.413	0.547	3.5967	
15 minute winter	31	6.002	33	163.9	2.419	0.789	3.2723	
15 minute winter	32	7.000	33	54.3	1.531	0.819	0.3673	
15 minute winter	33	6.003	34	257.6	2.336	1.375	4.0276	
15 minute winter	34	6.004	35	297.3	2.327	0.812	4.9805	
15 minute winter	35	6.005	36	290.4	2.463	0.796	7.4709	
15 minute winter	36	1.016	37	2431.0	4.827	0.744	45.5081	
15 minute winter	37	1.017	39	2240.1	3.788	0.642	30.0694	
15 minute winter	38	8.000	39	57.5	2.434	0.075	1.1200	
15 minute winter	39	1.018	40	2274.3	3.589	0.784	17.2285	
15 minute winter	40	1.019	42	2274.6	3.589	1.238	16.7830	
15 minute winter	41	9.000	42	118.4	4.237	0.712	0.7267	
15 minute winter	42	1.020	43	2345.9	3.702	1.043	12.4600	
15 minute winter	43	1.021	45	2346.9	3.703	0.743	27.8239	
15 minute winter	44	10.000	45	17.1	2.311	0.111	0.3415	
15 minute winter	45	1.022	46	2398.9	3.786	1.102	13.2807	
15 minute winter	46	1.023	47	2437.3	3.851	1.231	44.9764	
15 minute winter	47	1.024	70	2412.2	3.811	0.846	49.6986	
15 minute winter	48	11.000	49	78.4	2.109	0.692	1.6481	
15 minute winter	49	11.001	50	141.6	3.560	1.212	1.1034	
15 minute winter	50	11.002	51	166.1	3.164	0.659	0.3312	

Results for 100 year +40% CC +10% A Critical Storm Duration. Lowest mass balance: 99.32%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	51	10	53.831	0.206	211.2	0.4406	0.0000	OK
15 minute winter	52	10	53.239	0.064	16.5	0.0947	0.0000	OK
15 minute winter	53	12	52.932	0.707	329.2	2.3864	0.0000	SURCHARGED
15 minute winter	54	12	52.721	0.796	408.1	2.5043	0.0000	SURCHARGED
15 minute winter	55	12	52.549	0.799	406.8	1.5400	0.0000	SURCHARGED
15 minute winter	56	12	52.445	0.870	437.1	1.7924	0.0000	SURCHARGED
15 minute winter	57	10	57.036	0.161	128.7	0.6041	0.0000	OK
15 minute winter	58	11	54.236	0.611	166.6	0.9476	0.0000	SURCHARGED
15 minute winter	59	12	52.383	0.958	616.3	1.9255	0.0000	SURCHARGED
15 minute winter	60	12	52.269	0.944	613.5	1.7448	0.0000	SURCHARGED
15 minute winter	61	12	52.033	1.008	664.2	2.3675	0.0000	SURCHARGED
15 minute winter	62	12	51.766	0.966	711.2	2.1425	0.0000	SURCHARGED
15 minute winter	63	11	56.200	0.400	124.2	1.4731	0.0000	SURCHARGED
15 minute winter	64	12	54.655	0.405	165.1	0.8477	0.0000	SURCHARGED
15 minute winter	65	12	51.555	0.805	908.1	1.8039	0.0000	SURCHARGED
15 minute winter	66	12	51.014	1.264	997.1	3.8995	0.0000	SURCHARGED
15 minute winter	67	12	50.097	0.472	1058.3	1.1183	0.0000	OK
15 minute winter	68	12	48.738	0.313	1094.4	0.6520	0.0000	OK
15 minute winter	69	12	46.739	1.389	1095.7	2.4545	0.0000	SURCHARGED
720 minute winter	70	720	46.461	2.361	353.0	5214.2600	0.0000	SURCHARGED
720 minute winter	71	720	46.462	2.387	21.8	6.0748	0.0000	SURCHARGED
15 minute summer	72	1	43.900	0.000	19.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	51	11.003	53	212.7	3.072	0.579	3.2052	
15 minute winter	52	12.000	53	16.4	1.626	0.180	0.5143	
15 minute winter	53	11.004	54	314.6	1.563	0.768	9.0554	
15 minute winter	54	11.005	55	391.9	1.947	1.017	3.4071	
15 minute winter	55	11.006	56	401.2	1.869	0.760	4.7758	
15 minute winter	56	11.007	59	432.8	1.469	0.447	5.0213	
15 minute winter	57	13.000	58	127.7	3.537	0.868	1.4410	
15 minute winter	58	13.001	59	150.9	4.280	0.916	0.7019	
15 minute winter	59	11.008	60	601.5	1.904	0.683	4.0435	
15 minute winter	60	11.009	61	599.8	1.829	0.740	14.3041	
15 minute winter	61	11.010	62	665.5	1.874	0.897	12.7980	
15 minute winter	62	11.011	65	712.3	2.387	1.490	6.8036	
15 minute winter	63	14.000	64	115.0	3.143	0.955	1.1613	
15 minute winter	64	14.001	65	153.7	4.485	0.930	1.2157	
15 minute winter	65	11.012	66	909.2	2.547	0.614	14.3830	
15 minute winter	66	11.013	67	997.8	2.948	2.320	18.3256	
15 minute winter	67	11.014	68	1065.1	5.010	0.656	8.6220	
15 minute winter	68	11.015	69	1095.7	4.308	0.383	8.6208	
15 minute winter	69	11.016	70	1088.9	3.051	1.131	34.7397	
720 minute winter	70	1.025	71	21.8	0.241	0.021	5.9309	
720 minute winter	71	Hydro-Brake®	72	19.1				1001.1

Appendix K

Severn Trent Water Pre-Development Response

Woods Hardwick

Architecture | Engineering | Planning | Surveying

WONDERFUL ON TAP

8th October 2024

Thomas Brewer
Pegasus Group
4 Pioneer House
Histon
Cambridge
CB24 9NL

Severn Trent Water Ltd
Oxley Moor Road
Wolverhampton
WV9 5HN

www.stwater.co.uk

Email:
Network.Solutions@SevernTrent.co.uk

Our ref: 1129020

Dear Thomas

Proposed Development: B6003 Selby Close Beeston

I refer to your 'Development Enquiry Request' of 400 houses, , in respect of the above named site. Please find enclosed the sewer records that are included in the fee together with the Supplementary Guidance Notes (SGN) which refer to surface water disposal from development sites.

Protective Strip

Due to a change in legislation on 1 October 2011, there may be former private sewers on the site which have transferred to the responsibility of Severn Trent Water Ltd, which are not shown on the statutory sewer records, but are in your client's land. These sewers would also have protective strips that we will not allow to be built over. If such sewers are identified to be present on the site, please contact us for further guidance.

Foul Water Drainage

Foul flows for a development with proposed split flows, m/h 6502 on the 225mm combined sewer to the east, as this may require a pumped solution, pumped flows max 3.8l/s would apply, to the south of the site m/h 0201 in Hampton Close or further south m/h 0101 on the 150mm fws, the additional flows and existing flood and surcharge levels, there is insufficient capacity within the Severn Trent network at present and further modelling will be required, which may show that improvements are required to the Severn Trent network and receiving pump station.

We are undergoing a prioritisation process of all investment requirements and emerging risks from growth on our network and treatment works as we build our plan for the coming Asset Management Plan period (2025-2030) and beyond.

We will pass details of your site over for consideration and feedback if anything arises which is of concern. We will let you know as soon as possible if anything will affect your connection points and timescales, should we need to make representation to the Planning Authority to apply conditions relating to phasing or occupation of the site. it's more to allow us to understand whether what system improvements will be required because of your proposed development drainage scheme.

In the meantime, the site will be added to our modelling tracker and reviewed regularly until the site can be progressed for sewer modelling. I would therefore be grateful if you would forward as soon as possible the following details:

- Confirmation whether a pumped solution is required (please provide pump rate and frequency, if available), all adoptable pump stations must pump min of 3.8l/s minimal
- Anticipated flow rate from the site
- Proposed planned start and completion date
- Any phasing details of the proposed development
- Confirm how many properties will discharge into each of the connections to the public sewer.
- Planned occupation date

.
All connections are subject to the required S106 sewer connection applications.

Surface Water Drainage

Under the terms of Section H of the Building Regulations 2000, the disposal of surface water by means of soakaways should be considered as the primary method. If these are found to be unsuitable, satisfactory evidence will need to be submitted. The evidence should be either percolation test results or by the submission of a statement from the SI consultant (extract or a supplementary letter).

Subject to above Severn Trent Water expects all surface water from the development to be drained in a sustainable way to the nearest watercourse etc. subject to the developer discussing all aspects of the developments surface water drainage, Connection to the culverted watercourse to the west m/h6602 at greenfield rates 5l/s/ha would be acceptable with agreement with the Local Lead

Flood Authority (LLFA). Any discharge rate to a watercourse or drainage ditch will be determined by the LLFA / EA.

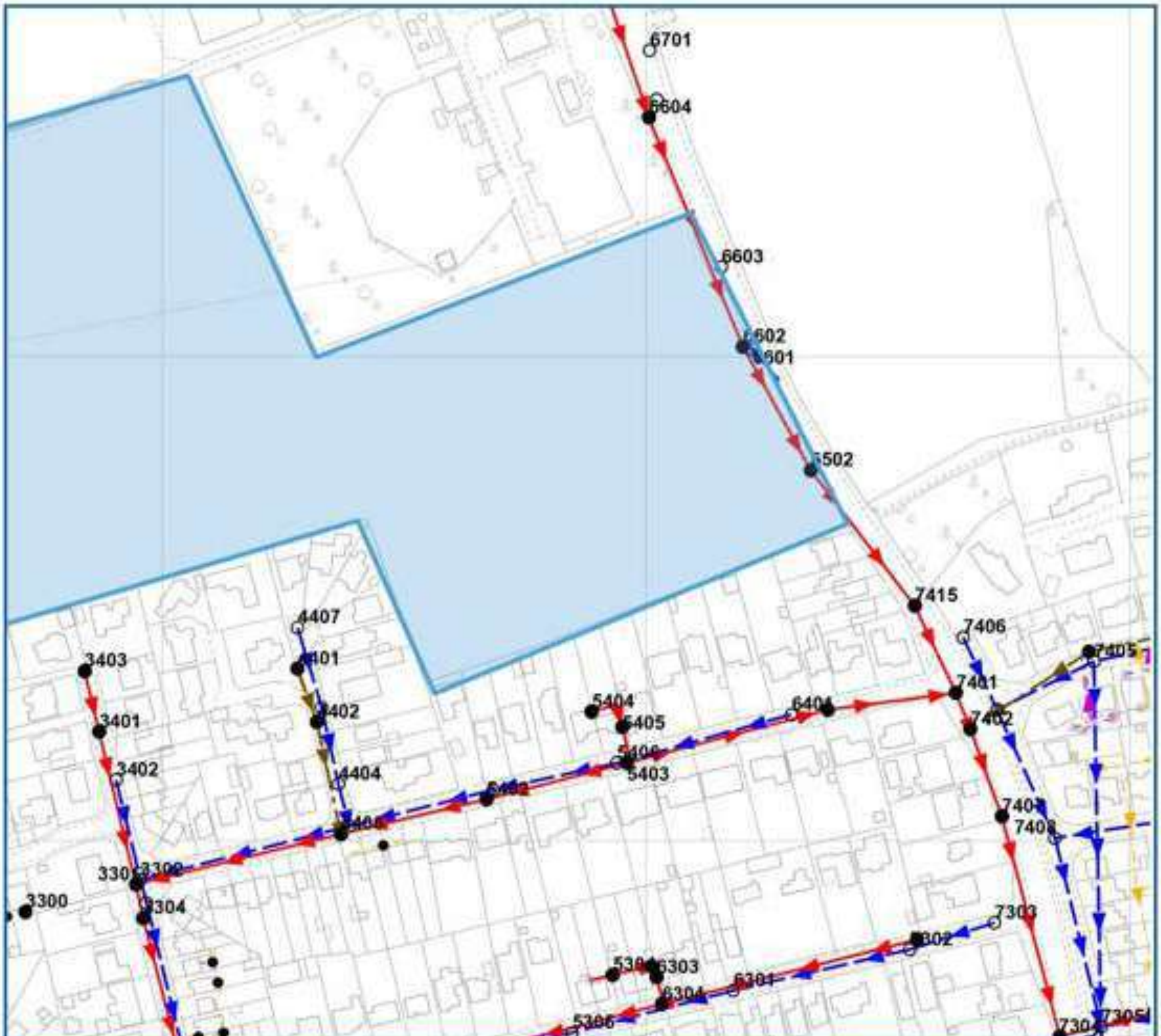
New Connections

For any new connections (including the re-use of existing connections) to the public sewerage system, the developer will need to submit a Section 106 application form. Our Developer Services department are responsible for handling all new connections enquiries and applications. To contact them for an application form and associated guidance notes please call 0800 707 6600 or download from

Please quote the reference 1129020 in any future correspondence (including e-mails) with STW Limited. Please note that Developer Enquiry responses are only valid for 6 months from the date of this letter.

Yours sincerely,

Michael Taylor
Network Solutions
Developer Services



Severn Trent Water Limited

SEVERN TRENT

Asset Data Management
PO Box 5344
Coventry
CV3 9FT
Telephone: 0345 601 6616

SEWER RECORD

O/S Map Scale: 1:2,500

This map is centred upon:

Date of Issue: 08-10-24

X: 449572.13 **Y:** 335531.05

Disclaimer Statement:

1 **Do not scale off this Map.**

2 This plan and any information supplied with it is furnished as a general guide, is only valid at the date of issue and no warranty as to its correctness is given or implied. In particular this plan and any information shown on it must not be relied upon in the event of any development or works (including but not limited to excavations) in the vicinity of SEVERN TRENT WATER assets or for the purposes of determining the suitability of a point of connection to the sewerage or distribution systems.

3 On 1 October 2011 most private sewers and private lateral drains in Severn Trent Water's sewerage area, which were connected to a public sewer as at 1 July 2011, transferred to the ownership of Severn Trent Water and became public sewers and public lateral drains. A further transfer takes place on 1 October 2012. Private pumping stations, which form part of these sewers or lateral drains, will transfer to ownership of Severn Trent Water on or before 1 October 2016. Severn Trent Water does not possess complete records of these assets. These assets may not be displayed on the map.

5 Ordnance Survey licence number: **100031673**

Sewer Node Sewer Pipe Data

Reference	Cover Level	Invert Level Upstream	Invert Level Downstream	Purpose	Material	Pipe Shape	Max Size	Min Size	Gradient	Year Laid
SK49357307	46.2	44.83	40.82	S	VC	C	<UNK>	<UNK>	12.72	31/12/1899 00:00:00
SK49357800	<UNK>	<UNK>	<UNK>	S	PP	C	375	<UNK>	<UNK>	01/07/2016 00:00:00
SK49357302	54.02	52.18	49.35	S	VC	C	150	<UNK>	26.48	31/12/1899 00:00:00
SK49353401	64.8799	63.39	56.398	C	VC	C	150	<UNK>	9.28	31/12/1899 00:00:00
SK49357204	42.18	40.96	38.67	S	VC	C	150	<UNK>	21.41	31/12/1899 00:00:00
SK49356302	<UNK>	<UNK>	<UNK>	C	<UNK>	<UNK>	<UNK>	<UNK>	0	31/12/1899 00:00:00
SK49353303	57.1829	55.803	46.54	S	VC	C	225	<UNK>	10.03	31/12/1899 00:00:00
SK49357306	47.04	45.54	39.6	S	VC	C	<UNK>	<UNK>	14.7	31/12/1899 00:00:00
SK49355206	43.24	41.56	39	C	VC	C	150	<UNK>	22.08	31/12/1899 00:00:00
SK49353403	66.12	64.22	63.39	C	VC	C	150	<UNK>	30.98	31/12/1899 00:00:00
SK49355305	48.971	47.661	46.193	S	CO	C	300	<UNK>	47.71	31/12/1899 00:00:00
SK49353300	<UNK>	<UNK>	<UNK>	F	U	U	<UNK>	<UNK>	<UNK>	24/11/2015 00:00:00
SK49354203	43.27	41.2	39.86	S	VC	C	225	<UNK>	25.54	31/12/1899 00:00:00
SK49355201	43.38	41.8	40.16	S	VC	C	225	<UNK>	16.42	31/12/1899 00:00:00
SK49356801	<UNK>	<UNK>	<UNK>	S	PP	C	375	<UNK>	<UNK>	01/07/2016 00:00:00
SK49357207	40.31	38.89	37.26	C	VC	C	150	<UNK>	30.46	31/12/1899 00:00:00
SK49356203	42.0499	40	38.18	S	VC	C	225	<UNK>	25.65	31/12/1899 00:00:00
SK49353306	58.1879	56.658	56.417	S	VC	C	225	<UNK>	11.13	31/12/1899 00:00:00
SK49355403	63.5499	62.26	57.028	C	VC	C	150	<UNK>	11.46	31/12/1899 00:00:00
SK49355403	63.5499	62.26	60.93	C	VC	C	150	<UNK>	64.56	31/12/1899 00:00:00
SK49355406	64.4199	62.17	57.897	S	VC	C	150	<UNK>	12.25	31/12/1899 00:00:00
SK49355401	59.247	57.897	57.538	S	CO	C	300	<UNK>	170.39	31/12/1899 00:00:00
SK49355205	47.588	45.888	41.8	S	VC	C	225	<UNK>	13.13	31/12/1899 00:00:00
SK49355704	<UNK>	<UNK>	<UNK>	F	U	U	<UNK>	<UNK>	<UNK>	01/07/2016 00:00:00
SK49356206	39.9099	38.18	36.47	S	VC	C	225	<UNK>	29.39	31/12/1899 00:00:00
SK49357408	55.4799	53.73	45.95	S	VC	C	225	<UNK>	10.32	31/12/1899 00:00:00
SK49356702	<UNK>	<UNK>	<UNK>	S	PP	C	150	<UNK>	<UNK>	01/07/2016 00:00:00
SK49355202	42	40.15	38.06	S	VC	C	225	<UNK>	16.25	31/12/1899 00:00:00
SK49357305	48.0299	45.94	44.83	S	VC	C	<UNK>	<UNK>	18.04	31/12/1899 00:00:00
SK49357305	48.0299	45.94	45.55	S	VC	C	<UNK>	<UNK>	20.03	31/12/1899 00:00:00
SK49357303	53.74	52.49	52.18	S	VC	C	150	<UNK>	118.35	31/12/1899 00:00:00
SK49354401	64.6299	63.31	62.64	F	VC	C	150	<UNK>	34.94	31/12/1899 00:00:00
SK49356402	62.72	60.92	58.39	C	VC	C	150	<UNK>	21.13	31/12/1899 00:00:00
SK49356604	62.1399	59.54	59.24	C	VC	C	225	<UNK>	341.57	31/12/1899 00:00:00
SK49355306	48.123	46.173	45.888	S	CO	C	300	<UNK>	36.55	31/12/1899 00:00:00
SK49357301	54.08	51.88	48.06	C	VC	C	150	<UNK>	28.49	31/12/1899 00:00:00
SK49357205	42.8199	40.82	38.66	S	VC	C	150	<UNK>	21.16	31/12/1899 00:00:00
SK49355203	41.9199	41	40.15	S	VC	C	150	<UNK>	41.09	31/12/1899 00:00:00
SK49354202	48.24	46.53	41.2	S	VC	C	225	<UNK>	14.44	31/12/1899 00:00:00
SK49357403	59.6699	58.21	53.73	S	VC	C	225	<UNK>	12.99	31/12/1899 00:00:00
SK49357304	47.2099	45.64	43.02	C	VC	C	<UNK>	<UNK>	9.73	31/12/1899 00:00:00

Sewer Node Sewer Pipe Data

Reference	Cover Level	Invert Level Upstream	Invert Level Downstream	Purpose	Material	Pipe Shape	Max Size	Min Size	Gradient	Year Laid
SK49358303	48.9199	46.67	45.64	C	VC	C	150	<UNK>	39.09	31/12/1899 00:00:00
SK49353301	57.958	56.298	55.023	C	PP	C	225	<UNK>	11.11	31/12/1899 00:00:00
SK49357404	59.8899	58.66	57.45	F	VC	C	150	<UNK>	48.36	31/12/1899 00:00:00
SK49358402	56.59	54.87	53.73	S	VC	C	225	<UNK>	50.62	31/12/1899 00:00:00
SK49357203	44.7	43.02	37.21	C	VC	C	225	<UNK>	22.11	31/12/1899 00:00:00
SK49354301	48.1399	45.87	41.57	C	VC	C	150	<UNK>	15.58	31/12/1899 00:00:00
SK49357401	60.5299	58.38	57.45	C	VC	C	<UNK>	<UNK>	17.38	31/12/1899 00:00:00
SK49357415	61.6599	58.63	58.39	C	VC	C	225	<UNK>	165.88	31/12/1899 00:00:00
SK49356502	63.49	59.09	58.64	C	VC	C	225	<UNK>	156.89	31/12/1899 00:00:00
SK49356800	<UNK>	<UNK>	<UNK>	S	PP	C	375	<UNK>	<UNK>	01/07/2016 00:00:00
SK49353302	57.977	56.317	55.803	S	CO	C	300	<UNK>	19.45	31/12/1899 00:00:00
SK49357406	60.79	59.59	58.22	S	VC	C	<UNK>	<UNK>	24.17	31/12/1899 00:00:00
SK49354405	58.985	57.538	56.347	S	CO	C	300	<UNK>	74.88	31/12/1899 00:00:00
SK49354404	62.38	60.74	57.705	S	VC	C	150	<UNK>	5.88	31/12/1899 00:00:00
SK49356401	63.29	62.22	62.18	S	VC	C	150	<UNK>	1868.25	31/12/1899 00:00:00
SK49353201	44.9199	43.37	38.07	S	DI	C	225	<UNK>	16.13	31/12/1899 00:00:00
SK49357405	59.9199	58.53	58.21	S	VC	C	225	<UNK>	139.75	31/12/1899 00:00:00
SK49357405	59.9199	58.53	45.95	S	VC	C	150	<UNK>	12.01	31/12/1899 00:00:00
SK49353307	<UNK>	<UNK>	<UNK>	F	U	U	<UNK>	<UNK>	<UNK>	24/11/2015 00:00:00
SK49355402	59.108	56.938	56.68	C	PP	C	225	<UNK>	237.62	31/12/1899 00:00:00
SK49354403	63.7	62.62	60.74	S	VC	C	150	<UNK>	17.26	31/12/1899 00:00:00
SK49358201	40.2099	38.66	36.96	S	VC	C	150	<UNK>	22.73	31/12/1899 00:00:00
SK49355702	61.5499	60.14	59.55	C	<UNK>	C	225	<UNK>	147.8	31/12/1899 00:00:00
SK49356303	<UNK>	<UNK>	<UNK>	C	<UNK>	<UNK>	<UNK>	<UNK>	0	31/12/1899 00:00:00
SK49355304	<UNK>	<UNK>	<UNK>	C	<UNK>	<UNK>	<UNK>	<UNK>	0	31/12/1899 00:00:00
SK49356301	51.1199	49.35	47.661	S	VC	C	225	<UNK>	40.73	31/12/1899 00:00:00
SK49357407	57.1599	55.47	45.65	C	VC	C	225	<UNK>	9.58	31/12/1899 00:00:00
SK49355204	41.99	40.94	40.55	S	VC	C	225	<UNK>	128.23	31/12/1899 00:00:00
SK49354204	48.24	47.14	46.623	S	VC	C	150	<UNK>	93.33	31/12/1899 00:00:00
SK49354407	64.94	63.42	62.62	S	VC	C	150	<UNK>	43.1	31/12/1899 00:00:00
SK49356201	42.0299	40.55	40	S	VC	C	225	<UNK>	83.11	31/12/1899 00:00:00
SK49358400	<UNK>	<UNK>	<UNK>	F	VC	C	<UNK>	<UNK>	<UNK>	31/12/1899 00:00:00
SK49357402	59.6899	57.45	55.47	C	VC	C	<UNK>	<UNK>	19.33	31/12/1899 00:00:00
SK49353402	63.2299	61.77	56.658	S	VC	C	225	<UNK>	7.78	31/12/1899 00:00:00
SK49357700	<UNK>	<UNK>	<UNK>	S	PP	C	150	<UNK>	<UNK>	01/07/2016 00:00:00
SK49356602	62.99	59.23	59.1	C	VC	C	225	<UNK>	447.54	31/12/1899 00:00:00
SK49355405	<UNK>	<UNK>	<UNK>	C	<UNK>	<UNK>	<UNK>	<UNK>	0	31/12/1899 00:00:00
SK49357201	42.5099	40.78	40.01	S	VC	C	150	<UNK>	35.32	31/12/1899 00:00:00
SK49357208	39.8499	38.67	37.58	S	VC	C	150	<UNK>	40.13	31/12/1899 00:00:00
SK49356207	42.08	40.39	39.93	C	VC	C	150	<UNK>	98.59	31/12/1899 00:00:00
SK49353203	45.31	43.84	38.58	C	VC	C	150	<UNK>	16.6	31/12/1899 00:00:00
SK49356202	42.1699	39.93	38.44	C	VC	C	150	<UNK>	34.22	31/12/1899 00:00:00

Sewer Node Sewer Pipe Data

Reference	Cover Level	Invert Level Upstream	Invert Level Downstream	Purpose	Material	Pipe Shape	Max Size	Min Size	Gradient	Year Laid
SK49353304	56.623	55.013	46.59	C	VC	C	150	<UNK>	10.19	31/12/1899 00:00:00
SK49354402	63.74	62.63	57.47	F	VC	C	150	<UNK>	9.18	31/12/1899 00:00:00
SK49354205	48.52	46.58	40.22	C	VC	C	150	<UNK>	17.46	31/12/1899 00:00:00
SK49356204	39.99	38.44	<UNK>	C	VC	C	150	<UNK>	0	31/12/1899 00:00:00
SK49354406	58.97	56.68	56.328	C	PP	C	225	<UNK>	249.2	31/12/1899 00:00:00
SK49355404	<UNK>	<UNK>	<UNK>	C	<UNK>	<UNK>	<UNK>	<UNK>	0	31/12/1899 00:00:00
SK49353202	49.33	47.96	43.38	S	VC	C	150	<UNK>	13.98	31/12/1899 00:00:00
SK49356304	50.4799	48.06	45.87	C	VC	C	150	<UNK>	50.68	31/12/1899 00:00:00
SK49355700	<UNK>	61.04	60.32	F	VC	<UNK>	100	<UNK>	13.481	31/12/1899 00:00:00
SK49356205	42.61	40.66	39.93	C	VC	C	150	<UNK>	37.89	31/12/1899 00:00:00
SK49357206	41.3199	39.6	36.73	S	VC	C	300	<UNK>	27.1	31/12/1899 00:00:00
SK49354201	48.29	46.83	45.87	C	VC	C	150	<UNK>	62.14	31/12/1899 00:00:00
SK49357202	44.6399	43.62	40.96	S	VC	C	150	<UNK>	13.79	31/12/1899 00:00:00
SK49357801	<UNK>	<UNK>	<UNK>	S	PP	C	450	<UNK>	<UNK>	01/07/2016 00:00:00
<UNK>	<UNK>	<UNK>	<UNK>	F	VC	<UNK>	<UNK>	<UNK>	<UNK>	23/01/2023 00:00:00
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<UNK>	<UNK>	<UNK>	<UNK>	F	VC	<UNK>	<UNK>	<UNK>	<UNK>	24/11/2015 00:00:00
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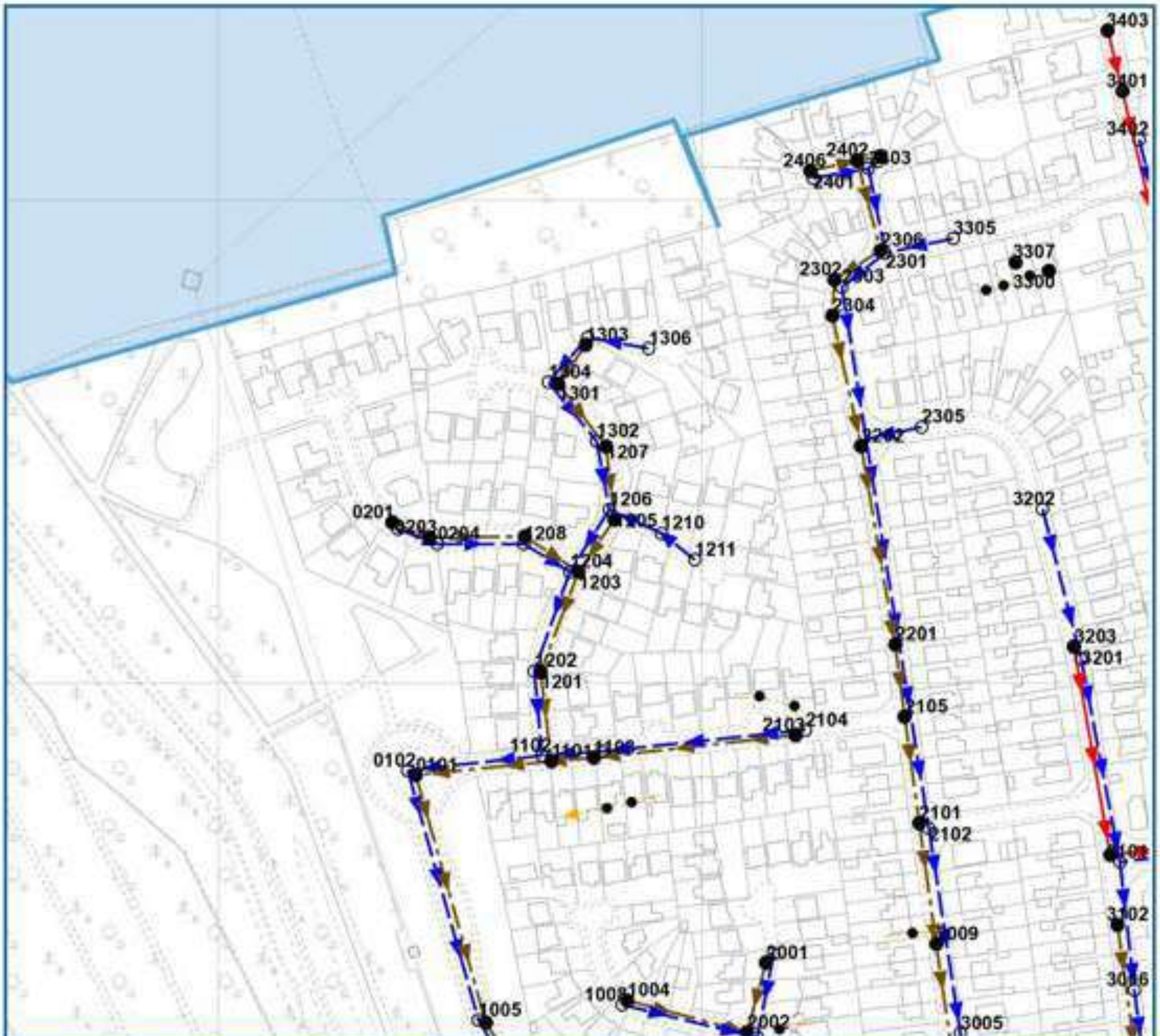

Severn Trent Water Limited

SEVERN TRENT

Asset Data Management
PO Box 5344
Coventry
CV3 9FT
Telephone: 0345 601 6616

SEWER RECORD

O/S Map Scale: 1:2,500

This map is centred upon:

Date of Issue: 08-10-24

X: 449148.80 **Y:** 335266.47

Disclaimer Statement:

1 **Do not scale off this Map.**

2 This plan and any information supplied with it is furnished as a general guide, is only valid at the date of issue and no warranty as to its correctness is given or implied. In particular this plan and any information shown on it must not be relied upon in the event of any development or works (including but not limited to excavations) in the vicinity of SEVERN TRENT WATER assets or for the purposes of determining the suitability of a point of connection to the sewerage or distribution systems.

3 On 1 October 2011 most private sewers and private lateral drains in Severn Trent Water's sewerage area, which were connected to a public sewer as at 1 July 2011, transferred to the ownership of Severn Trent Water and became public sewers and public lateral drains. A further transfer takes place on 1 October 2016. Private pumping stations, which form part of these sewers or lateral drains, will transfer to ownership of Severn Trent Water on or before 1 October 2016. Severn Trent Water does not possess complete records of these assets. These assets may not be displayed on the map.

5 Ordnance Survey licence number: **100031673**

Sewer Node Sewer Pipe Data

Reference	Cover Level	Invert Level Upstream	Invert Level Downstream	Purpose	Material	Pipe Shape	Max Size	Min Size	Gradient	Year Laid
SK49350201	51.9059	49.97	3.12	F	<UNK>	C	150	<UNK>	0.36	31/12/1899 00:00:00
SK49352102	41.38	39.76	37.13	S	DI	C	375	<UNK>	32.7	31/12/1899 00:00:00
SK49351209	49.2309	47.41	46.42	F	<UNK>	C	150	<UNK>	26.92	31/12/1899 00:00:00
SK49352305	51.8499	50.75	<UNK>	S	VC	C	150	<UNK>	0	31/12/1899 00:00:00
SK49351104	43.0919	41.06	40.67	S	<UNK>	C	375	<UNK>	63.23	31/12/1899 00:00:00
SK49351301	54.275	52.15	50.38	F	<UNK>	C	150	<UNK>	18.54	31/12/1899 00:00:00
SK49351203	47.9959	46.35	43.34	F	<UNK>	C	150	<UNK>	14.74	31/12/1899 00:00:00
SK49350102	43.6199	39.9	35.62	S	CO	C	375	<UNK>	25.11	31/12/1899 00:00:00
SK49342901	35.61	34.21	33.805	S	VC	C	225	<UNK>	52.27	31/12/1899 00:00:00
SK49353401	64.8799	63.39	56.398	C	VC	C	150	<UNK>	9.28	31/12/1899 00:00:00
SK49351003	36.45	34.95	34.55	F	VC	C	225	<UNK>	143.15	31/12/1899 00:00:00
SK49353303	57.1829	55.803	46.54	S	VC	C	225	<UNK>	10.03	31/12/1899 00:00:00
SK49343902	35.61	34.39	33.99	S	VC	C	150	<UNK>	129.05	31/12/1899 00:00:00
SK49352005	38.886	36.99	36	S	CO	C	150	<UNK>	35.72	31/12/1899 00:00:00
SK49352406	59.0299	57.96	57.57	F	VC	C	150	<UNK>	50.69	31/12/1899 00:00:00
SK49353403	66.12	64.22	63.39	C	VC	C	150	<UNK>	30.98	31/12/1899 00:00:00
SK49353007	36.97	35.32	34.92	F	VC	C	150	<UNK>	97.63	31/12/1899 00:00:00
SK49351008	38.0299	36.53	35.9	S	VC	C	225	<UNK>	91.16	31/12/1899 00:00:00
SK49353300	<UNK>	<UNK>	<UNK>	F	U	U	<UNK>	<UNK>	<UNK>	24/11/2015 00:00:00
SK49353103	40.08	38.57	38.302	C	VC	C	225	<UNK>	276.56	31/12/1899 00:00:00
SK49351205	49.9239	48.15	46.4	F	<UNK>	C	150	<UNK>	14.96	31/12/1899 00:00:00
SK49350101	43.36	39.86	36.75	F	VC	C	150	<UNK>	34.22	31/12/1899 00:00:00
SK49353004	37.2599	35.75	35.33	F	VC	C	150	<UNK>	122	31/12/1899 00:00:00
SK49342907	35.846	34.196	34.12	S	CO	C	525	<UNK>	210.75	31/12/1899 00:00:00
SK49353306	58.1879	56.658	56.417	S	VC	C	225	<UNK>	11.13	31/12/1899 00:00:00
SK49352103	43.74	42.05	40.92	F	<UNK>	C	150	<UNK>	74.35	31/12/1899 00:00:00
SK49351206	49.826	47.74	48.04	S	<UNK>	C	225	<UNK>	<UNK>	31/12/1899 00:00:00
SK49352001	38.8569	36.28	35.26	F	VC	C	150	<UNK>	29.34	31/12/1899 00:00:00
SK49353305	57.54	56.63	55.83	S	VC	C	150	<UNK>	35.8	31/12/1899 00:00:00
SK49353101	39.8899	38.07	36.12	S	DI	C	375	<UNK>	27.35	31/12/1899 00:00:00
SK49353005	38.0999	37.12	36.46	S	DI	C	450	<UNK>	54.88	31/12/1899 00:00:00
SK49343903	35.5	34.34	34.21	S	VC	C	225	<UNK>	198.62	31/12/1899 00:00:00
SK49352101	41.49	39.46	37.77	F	VC	C	150	<UNK>	29.88	31/12/1899 00:00:00
SK49342908	35.9799	34.49	34.46	F	VC	C	225	<UNK>	577.33	31/12/1899 00:00:00
SK49352008	37.151	35.1	34.49	S	CO	C	375	<UNK>	67.61	31/12/1899 00:00:00
SK49352401	58.97	58.11	57.91	S	VC	C	150	<UNK>	116.75	31/12/1899 00:00:00
SK49350202	51.804	49.46	48.52	S	<UNK>	C	150	<UNK>	18.51	31/12/1899 00:00:00
SK49352304	55.0099	53.78	50.23	F	VC	C	150	<UNK>	15.58	31/12/1899 00:00:00
SK49352004	37.159	34.84	34.5	F	VC	C	150	<UNK>	110.94	31/12/1899 00:00:00
SK49351211	49.492	48	48.06	S	<UNK>	C	150	<UNK>	<UNK>	31/12/1899 00:00:00
SK49352404	59.68	58.52	57.56	F	VC	C	150	<UNK>	10.26	31/12/1899 00:00:00

Sewer Node Sewer Pipe Data

Reference	Cover Level	Invert Level Upstream	Invert Level Downstream	Purpose	Material	Pipe Shape	Max Size	Min Size	Gradient	Year Laid
SK49353302	57.977	56.317	55.803	S	CO	C	300	<UNK>	19.45	31/12/1899 00:00:00
SK49351204	49.9659	47.92	43.18	S	<UNK>	C	300	<UNK>	9.21	31/12/1899 00:00:00
SK49352402	59.45	57.56	55.38	F	VC	C	150	<UNK>	17.68	31/12/1899 00:00:00
SK49351102	42.936	40.66	39.96	S	<UNK>	C	375	<UNK>	79.9	31/12/1899 00:00:00
SK49351201	44.868	43.27	40.66	F	<UNK>	C	150	<UNK>	14.24	31/12/1899 00:00:00
SK49352006	37.6599	35.8	35.46	S	CO	C	300	<UNK>	66.21	31/12/1899 00:00:00
SK49352302	56.0699	54.37	53.79	F	VC	C	150	<UNK>	25.91	31/12/1899 00:00:00
SK49351005	38.5849	35.59	35.67	S	CO	C	450	<UNK>	<UNK>	31/12/1899 00:00:00
SK49352201	45.84	44.39	42.55	F	VC	C	150	<UNK>	16.45	31/12/1899 00:00:00
SK49353201	44.9199	43.37	38.07	S	DI	C	225	<UNK>	16.13	31/12/1899 00:00:00
SK49353307	<UNK>	<UNK>	<UNK>	F	U	U	<UNK>	<UNK>	<UNK>	24/11/2015 00:00:00
SK49351208	49.198	46.67	48.05	S	<UNK>	C	225	<UNK>	<UNK>	31/12/1899 00:00:00
SK49353301	57.958	56.298	55.023	C	PP	C	225	<UNK>	11.11	31/12/1899 00:00:00
SK49352405	59.6199	58.61	57.92	S	VC	C	150	<UNK>	7.25	31/12/1899 00:00:00
SK49353006	37.9099	36.11	35.43	S	DI	C	450	<UNK>	83	31/12/1899 00:00:00
SK49351001	38.4	36.74	35.4	F	VC	C	150	<UNK>	29.35	31/12/1899 00:00:00
SK49350203	5.0789	3.09	47.43	F	<UNK>	C	150	<UNK>	<UNK>	31/12/1899 00:00:00
SK49352301	56.9199	55.83	54.44	S	VC	C	150	<UNK>	16.4	31/12/1899 00:00:00
SK49351304	54.386	52.14	49.96	S	<UNK>	C	225	<UNK>	14.41	31/12/1899 00:00:00
SK49351006	37.52	35.65	34.93	S	CO	C	525	<UNK>	60.44	31/12/1899 00:00:00
SK49351103	43.012	40.88	40.66	F	VC	C	150	<UNK>	79.82	31/12/1899 00:00:00
SK49353003	37.33	36.3	35.44	S	DI	C	450	<UNK>	71.27	31/12/1899 00:00:00
SK49343904	36.3899	34.92	34.14	F	VC	C	150	<UNK>	84.96	31/12/1899 00:00:00
SK49351302	52.033	49.95	47.77	S	<UNK>	C	225	<UNK>	13.25	31/12/1899 00:00:00
SK49351002	36.9519	35.39	34.95	F	VC	C	225	<UNK>	108.3	31/12/1899 00:00:00
SK49353402	63.2299	61.77	56.658	S	VC	C	225	<UNK>	7.78	31/12/1899 00:00:00
SK49353102	38.79	36.99	35.32	F	VC	C	150	<UNK>	52.59	31/12/1899 00:00:00
SK49351305	55.395	52.96	52.22	S	<UNK>	C	150	<UNK>	33.32	31/12/1899 00:00:00
SK49351303	55.36	52.9	52.28	F	<UNK>	C	150	<UNK>	31.92	31/12/1899 00:00:00
SK49353203	45.31	43.84	38.58	C	VC	C	150	<UNK>	16.6	31/12/1899 00:00:00
SK49351306	55.6409	53.78	53.03	S	<UNK>	C	150	<UNK>	34.13	31/12/1899 00:00:00
SK49351101	42.9099	40.64	39.88	F	VC	C	150	<UNK>	74.2	31/12/1899 00:00:00
SK49342905	35.9659	34.08	33.805	S	CO	C	525	<UNK>	179.5	31/12/1899 00:00:00
SK49352105	43.8499	42.55	39.47	F	VC	C	150	<UNK>	14.42	31/12/1899 00:00:00
SK49351007	36.58	34.91	34.22	S	CO	C	525	<UNK>	96.41	31/12/1899 00:00:00
SK49353008	36.93	35.43	34.99	S	DI	C	450	<UNK>	88.91	31/12/1899 00:00:00
SK49353002	37.45	36.46	36.3	S	DI	C	450	<UNK>	100.75	31/12/1899 00:00:00
SK49352104	43.805	42.21	41.09	S	<UNK>	C	225	<UNK>	75.6	31/12/1899 00:00:00
SK49352303	56.0699	54.44	<UNK>	S	VC	C	150	<UNK>	0	31/12/1899 00:00:00
SK49352202	51.9199	50.22	44.39	F	VC	C	150	<UNK>	14.27	31/12/1899 00:00:00
SK49351207	52.1819	50.37	48.18	F	<UNK>	C	150	<UNK>	13.83	31/12/1899 00:00:00
SK49351210	49.993	48.05	47.78	S	<UNK>	C	150	<UNK>	87.85	31/12/1899 00:00:00

Sewer Node Sewer Pipe Data

Reference	Cover Level	Invert Level Upstream	Invert Level Downstream	Purpose	Material	Pipe Shape	Max Size	Min Size	Gradient	Year Laid
SK49351004	38	35.53	35.27	F	VC	C	150	<UNK>	197.5	31/12/1899 00:00:00
SK49351202	44.8919	43.1	40.8	S	<UNK>	C	300	<UNK>	15.28	31/12/1899 00:00:00
SK49352007	37.463	35.42	35.15	S	CO	C	300	<UNK>	95.15	31/12/1899 00:00:00
SK49352403	59.43	57.91	55.86	S	VC	C	150	<UNK>	17.41	31/12/1899 00:00:00
SK49352002	37.6889	35.24	35.03	F	VC	C	150	<UNK>	131.33	31/12/1899 00:00:00
SK49353202	49.33	47.96	43.38	S	VC	C	150	<UNK>	13.98	31/12/1899 00:00:00
SK49352009	39.1199	37.77	36.06	F	VC	C	150	<UNK>	40.19	31/12/1899 00:00:00
SK49342906	36.136	34.44	33.909	F	VC	C	<UNK>	<UNK>	105.13	31/12/1899 00:00:00
SK49343901	36.3699	34.99	33.96	S	DI	C	450	<UNK>	64.19	31/12/1899 00:00:00
SK49352003	37.478	35.01	34.85	F	VC	C	150	<UNK>	147.81	31/12/1899 00:00:00
SK49350204	50.7369	48.38	46.67	S	<UNK>	C	225	<UNK>	20.94	31/12/1899 00:00:00
SK49352306	56.9199	55.37	54.37	F	VC	C	150	<UNK>	22.47	31/12/1899 00:00:00
SK49353001	37.49	36.06	35.75	F	VC	C	150	<UNK>	98.48	31/12/1899 00:00:00
SK49353304	56.623	55.013	46.59	C	VC	C	150	<UNK>	10.19	31/12/1899 00:00:00
<UNK>	<UNK>	<UNK>	<UNK>	F	VC	<UNK>	<UNK>	<UNK>	<UNK>	24/11/2015 00:00:00
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<UNK>	<UNK>	<UNK>	<UNK>	F	VC	<UNK>	<UNK>	<UNK>	<UNK>	31/12/1899 00:00:00
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<UNK>	<UNK>	<UNK>	<UNK>	F	VC	<UNK>	<UNK>	<UNK>	<UNK>	20/01/2023 00:00:00
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<UNK>	<UNK>	<UNK>	<UNK>	F	VC	<UNK>	<UNK>	<UNK>	<UNK>	31/12/1899 00:00:00
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SUPPLEMENTARY GUIDANCE NOTES RELATING TO DISPOSAL OF SURFACE WATER

Introduction

The purpose of this guidance note is to provide advice to applicants when completing the surface water drainage design for a new development, both for Greenfield and Brownfield sites. This does not affect foul drainage disposal which should be discussed with Severn Trent as early as possible to ensure additional flows can be accommodated without undue delay to the development.

Lead Local Flood Authority (LLFA) Consultation

Since April 2015, the LLFA have assumed the role of being a statutory consultee in the planning process for developments of 10 dwellings or more; or equivalent non-residential and/or mixed development. The LLFAs role is vital to ensure that surface water disposal on new development is adequately assessed so that the local planning authority can satisfy themselves that drainage proposals are satisfactory and to make sure, through the use of planning conditions or planning obligations, that there are clear arrangements in place for future maintenance of sustainable drainage systems (SuDS) over the lifetime of the development. This will also ensure surface water disposal aligns with local planning policies, flood risk strategies and national policies, such as the National Planning Policy Framework (NPPF).

It is strongly recommend that the LLFA are involved in early pre-application discussions when the development of a site is initially being considered. Pre-application discussions will help to ensure that SuDS are appropriately considered ahead of or as part of preliminary development layouts, and that they are fully integrated into the final development layout. Whilst Severn Trent are willing to advise on sewerage availability this does to negate the planning requirement relating to adequacy of SuDS on new development.

SuDS Hierarchy

Severn Trent is fully supportive of the fundamental SuDS principle that priority should be given to managing surface water as close to source as possible. In accordance with national standards and guidance a sequential series of checks should be undertaken to ensure the relevant SuDS features are being proposed whereby (in order of priority) rainwater re-use, infiltration to ground and controlled discharge to a water body are properly considered ahead of any controlled connection to a culverted watercourse/other drainage system or public surface water sewer.

A controlled connection to a public combined/foul sewer would only be considered under rare exceptional circumstances where all other options have been completely exhausted. Acceptance of surface water into a combined sewer is not only unsustainable because of the need to convey/treat rainwater but is also takes away existing capacity which could constraint the connection of foul flows on future development. It is also possible that connection of additional surface water flows will require capacity upgrades to the existing sewerage system which may delay development.

Connection to a Public Sewer

Whilst Severn Trent will be able to provide advice on potential public surface water sewer connection options, it is essential that a developer contacts the LLFA as early as possible to discuss surface water disposal as they will be able to provide guidance on surface water flood risk policy which may influence SuDS requirements. It is strongly recommended that LLFA discussions take place before contacting Severn Trent. Where the outcome of LLFA discussions concludes that a controlled discharge to the public sewerage system is the only viable option then Severn Trent would be pleased to discuss sewer connection options, satisfied that the LLFA have been consulted in line with their surface water management role and in their capacity as statutory consultee.

Evidence must be provided to demonstrate why the sequential SuDS checks have concluded that a connection to the public sewer is required. This must include a Site Investigation Report including percolation test data/graphs/calculations/results together with relevant correspondence with the LLFA.

Design Standards

Surface water disposal design should consider the interactions between the adoptable sewer design criteria based on a 30 year design storm (outlined in 'Sewers For Adoption') and the "Non-statutory technical standards for SuDS" requirement to restrict discharge from a site up to and including the 1 in 100 year critical storm event plus an allowance for climate change as required by the LLFA.

For Greenfield development, the peak runoff rate should never exceed the peak pre-development run-off rates/volumes for the same rainfall event irrespective of the design storm duration consistent with the national non-statutory technical standards. For developments which were previously developed (Brownfield), the peak runoff rate must be as close as reasonably practicable to the greenfield runoff rate from the development for the same rainfall event, but should never exceed the rate of discharge from the development prior to redevelopment again for the same rainfall event. This requirement to remove pre-development surface water discharges to the sewerage system will help remove capacity constraints and aid future development.

To establish the pre-development run-off rates a detailed existing drainage survey will be required indicating pipe locations including sizes and levels, impermeable area connectivity to each pipe and topographical information to support existing drainage assumptions. Photographs of the existing buildings and surface features should be provided and where necessary a CCTV sewer survey should be provided to support the drainage survey to demonstrate connectivity.

In line with 'Sewers for Adoption', the drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur on any part of the site for a 1 in 30 year rainfall event. For higher storm return periods the drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur during a 1 in 100 year rainfall event in any part of: a building (including a basement); or in any utility plant susceptible to water (e.g. pumping station, electricity substation, water booster station) within the development.

Small Developments

Whilst developments of fewer than 10 dwellings (or their equivalent) are excluded from the post April 2015 planning requirements the underlying principles regarding sustainable surface water management are still valid. The collective impacts of surface water discharges from smaller developments can have an adverse impact on flood risk, especially in smaller rural catchments where smaller sewerage systems are more susceptible to increases in surface water inflow. On small developments infiltration to ground and peak flow attenuation must be considered to mitigate flood risk in the community but where a sewer connection is envisaged then the developer is recommended to discuss surface water disposal options with Severn Trent as early as possible.

Contact

For further assistance please contact our Network Solutions team via:
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