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# FLOOD RISK ASSESSMENT AND DRAINAGE STRATEGY

20 Watford Rd, Radlett


**JOMAS ASSOCIATES LTD**

Unit 24 Sarum Complex, Salisbury Road, Uxbridge, UB8 2RZ

www.jomasassociates.com info@jomasassociates.com

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**Prepared by: JOMAS ASSOCIATES LTD For Roundbush Services Limited**

**Should you have any queries relating to this report, please contact**

**JOMAS ASSOCIATES LTD**

**www.jomasassociates.com**

**0333 305 9054**

**info@jomasassociates.com**

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# 1 EXECUTIVE SUMMARY

This Drainage Assessment reviews the existing drainage arrangement at the application site and proposes a Flood Risk Assessment in accordance with the National Planning Policy Framework (NPPF) and surface water drainage strategy in line with Local Authority and Lead Local Flood Authority (LLFA) guidance.

The site is located at 20 Watford Rd, Radlett. The site currently comprises an occupied residential building fronting directly onto Watford Road. The building is associated with a large driveway area, a rear patio area, a grass lawn area, tennis courts, and a pond.

The proposed development is to comprise the demolition of the existing buildings, and construction of a 3-storey building with an associated basement, parking areas, driveway, and terracing.

Flooding
The site is located within flood zone 1, so no flood risk assessment is required. An overview of flooding has been completed with the sources of flooding assessed and proposed mitigation measures listed in the table below.

| Source | Risk Category (after mitigation) | Comments |
|---|---|---|
| Fluvial (Rivers and Sea) | Very Low | Site within flood zone 1 |
| Coastal and tidal | Negligible | Not near coast or tidal waterbody |
| Groundwater | Medium | Proposed finished floor levels are 150mm above external ground levels and natural topography reduces risk. |
| Surface water | Low | Low due to natural topography and presence of surface water drainage and falls away from the site |
| Sewers | Low | Low due to natural topography and sewer location |
| Reservoirs | Very Low | Reservoir at low danger of failure |

Surface Water Drainage
Two options for the drainage are proposed.

Option 1 is to infiltrate surface water via permeable paving. Storage is provided in the subbase of the paving and an infiltration rate of 5x10-4m/s has been assumed for the sandy gravel.

Option 2 is to discharge surface water to the TW sewer in the street. Discharge will be restricted to less than 50% of the existing 1 year discharge rate for each site. Attenuation will be provided in the

paving subbase, a below ground tank and a pond. Total storage volume is designed to ensure there is no flow off site in all storms up to the 100 year +40% storm event.

Overall, the 2 options are very similar with the only difference being the requirement for tanking to the permeable paving and an additional tank and pumped outlet should attenuation be required.

Maintenance/management of all onsite drainage infrastructure has been considered within a separate maintenance plan appended to this report. This will be updated through the development process.

The proposed drainage strategy is entirely based on-site and therefore the only off-site works will be the connections to the Thames Water sewers in the street.

Overall, the proposed development has an acceptable flood risk within the terms and requirements of the NPPF. The proposals provide a high level of water treatment, runoff reduction and flooding protection for the proposed development and are in accordance with all requirements of the Lead Local Flood Authority (LLFA).

Foul Drainage

It is proposed to discharge the foul drainage from the site into the existing TW foul sewer in the street.

## 2 INTRODUCTION

2.1.1 Jomas was commissioned to undertake a Flood Risk Assessment and Drainage Assessment for the proposed development of land located at 20 Watford Rd, Radlett

2.1.2 This Drainage Assessment has been produced in support of a planning application and should be read in conjunction with the other planning documents.

2.1.3 The site currently comprises an existing building and associated external works. The proposed development comprises the demolition of the existing building and construction of a new dwelling and associated external works. Proposed development details are provided in Appendix A.

# 3 SITE DESCRIPTION

3.1.1 The total site is approximately 2663 square metres in size.

3.1.2 The site location information is as follows:

- Nearest Postcode: WD7 8LE

## 3.2 Topography

*Site Topography*

3.2.1 An onsite topographic survey has been carried out and is provided in Appendix B.

3.2.2 The site is rectangular in shape and falls gently from south to north (front to rear).

# 4 DESIGN PRINCIPLES AND POLICY REQUIREMENTS

4.1.1 Since April 2015, Lead Local Flood Authorities (LLFA's) have become a statutory consultee on surface water drainage for many planning applications. For this site, the following is considered to be the required level of detail required for planning approval:

- A Flood Risk Assessment in accordance with the National Planning Policy Framework (NPPF) and National Planning Guidance (NPG)
- SuDS: Designs, Maintenance Plans & Calculations - for SuDS proposed, the LLFA require product specifications or design drawings, <u>all supporting calculations and a maintenance plan</u>. This needs to include details of any attenuation structures and in accordance with the CIRIA C753 SuDS Manual.

## 4.2 General Principles for Flooding

4.2.1 The National Planning Policy Framework (NPPF) states that when determining planning applications, local planning authorities should ensure flood risk is not increased elsewhere and only consider development appropriate in areas at risk of flooding where informed by a site-specific FRA. This assessment is required for:

*"Proposals of 1 hectare (ha) or greater in Flood Zone 1, all new development (including minor development and change of use) in Flood Zones 2 and 3 and an area within Flood Zone 1, which has critical drainage problems as notified to the local planning authority by the Environment Agency (EA)."*

4.2.2 In accordance with the March 2014 Planning Practice Guidance (PPG), which supports the NPPF, the objectives of this FRA are to establish:

- *Whether a proposed development is likely to be affected by current or future flooding from any source;*
- *Whether it will increase flood risk elsewhere;*
- *Whether the measures proposed to deal with these effects and risks are appropriate.*

## 4.3 General Principles for Surface Water Drainage

4.3.1 The DEFRA Sustainable Drainage Systems Non-Statutory Technical Standards for Sustainable Drainage Systems (March, 2015) and LLFA Policy DM25.3 requires sustainable drainage systems in all development to reduce surface water runoff and provide water treatment on site. This includes but is not limited to addressing the following issues in order of preference:

- store rainwater for later use
- use infiltration techniques, such as porous surfaces in non-clay areas
- attenuate rainwater in ponds or open water features for gradual release
- attenuate rainwater by storing in tanks or sealed water features for gradual release
- discharge rainwater direct to a watercourse
- discharge rainwater to a surface water sewer/drain

- discharge rainwater to the combined sewer.

Consideration must be given to the direction of water flow across the site and where this may be dispersed and incorporating any features that will help reduce surface water run-off. All developments should infiltrate surface water or achieve greenfield runoff rates where possible and this needs to be demonstrated as part of the planning submission.

# 5 FLOODING INFORMATION

## 5.1 Flood Risk from Rivers (Fluvial)

5.1.1 As the site is within Flood Zone 1, there is a low risk of fluvial flooding to the site.

5.1.2 Based on the above, the risk of flooding from rivers is considered very low.

## 5.2 Coastal and Tidal Flood Risk

5.2.1 The site is located inland and is not near any tidally influenced watercourses; therefore, there is negligible risk of flooding from this source.

## 5.3 Geology and Hydrogeology

5.3.1 Groundwater flooding occurs when the water table rises to the surface and is most likely to occur in low-lying areas underlain by permeable rocks.

5.3.2 The British Geological Survey (BGS) and Aquifer Maps on the MAGIC map identifies the area as follows:

Bedrock – Lambeth Group - Clay, silt and sand. Sedimentary bedrock formed between 59.2 and 47.8 million years ago during the Palaeogene period.

Superficial Drift – Gerrards Cross Gravel - Sand and gravel. Sedimentary superficial deposit formed between 860 and 423 thousand years ago during the Quaternary period.

Source Protection – Zone III total catchment

Other – Zone II outer protection zone and drinking water safeguard zone.

5.3.3 While the existing superficial geology is generally permeable sands, the bedrock is predominantly clay and impermeable which restricts the risk of groundwater flooding.

5.3.4 As the ground is partly permeable, the site is considered to be at Medium risk of groundwater flooding. This will be mitigated by raising the floor level of the building and maintaining overland flow paths around the site.

## 5.4 Surface Water Flood Risk (Overland Flows)

5.4.1 Surface water flooding occurs when the rainwater does not drain away through the normal drainage system or infiltrate the ground, but instead lies on or flows over the ground.

5.4.2 The EA produced a Risk of Flooding from Surface Water Map in December 2013. The maps were produced using 'direct rainfall' modelling. Although they consider local drainage capacity, non-surface water influences such as rivers, seas or groundwater are not considered. The map is based on LIDAR topographic data which is not suitable for site specific assessment and therefore, where available, topographic survey data should be used to provide a more accurate understanding of potential flow paths.

5.4.3 The map shows the entire country within four different risk categories, defined below in Table 1.

***Table 1: EA Surface Water Flood Risk Categories***

| **Risk Category** | **Definition** |
|---|---|
| High | Each year, there is a chance of flooding of greater than 1 in 30 (3.3%) |
| Medium | Each year, there is a chance of flooding of between 1 in 30 (3.3%) and 1 in 100 (1%) |
| Low | Each year, there is a chance of flooding of between 1 in 100 (1%) and 1 in 1000 (0.1%) |
| Very Low | Each year, there is a chance of flooding of less than 1 in 1000 (0.1%) |

5.4.4 An extract of the map, provided below, shows that the site is generally at low risk of surface water flooding.

*Figure 1: EA Flood Risk from Surface Water Map*

5.4.5 Proposed floor levels will be raised above the existing ground to ensure the risk of flooding is minimised, and overland flow paths are maintained through the site to ensure free flow of water.

5.4.6 Based on the EA's mapping, historical data and local topography, risk of surface water flooding to the site is considered to be Low.

### 5.5 Sewer/Drainage Flood Risk

5.5.1 Sewer flooding is often caused by excess surface water entering the drainage system when there is insufficient sewer capacity to cope with this excess water, but also due to 'one off' events such as blockages.

5.5.2 Thames Water is the statutory undertaker for the local public sewer network. The nearest sewers to the site are located in the street frontage.

5.5.3 As these sewers are at a lower level than the site, the risk of flooding is low. A review of the local PFRA does not identify any flooding incidents at or near to the site.

5.5.4 On the basis there is considered to be a Low risk of sewer flooding to the site.

### 5.6 Reservoir Flood Risk

5.6.1 The EA has produced a Reservoir Flood Map that shows that the site is at low risk from reservoir flooding. This map indicates very low risk of reservoir flooding at this site.

5.6.2 It should be emphasised that the risk of flooding from reservoir breach is very small since the EA is the enforcement authority for the Reservoirs Act (1975) and all large raised reservoirs are inspected and supervised by reservoir panel engineers.

5.6.3 On the basis there is considered to be a very low risk of reservoir flooding to the site.

### 5.7 Summary of risk levels

5.7.1 Post-development, the risk of flooding is summarised below.

*Table 2: Flood Risk Categories*

| Source | Risk Category |
|---|---|
| **Fluvial (Rivers and Sea)** | Very low |
| **Coastal and tidal** | Negligible |
| **Groundwater** | Medium |

| | |
|---|---|
| **Surface water** | Low |
| **Sewers** | Low |
| **Reservoirs** | Very low |

# 6 SITE DRAINAGE INFORMATION

6.1.1 The DEFRA Sustainable Drainage Systems Non-Statutory Technical Standards for Sustainable Drainage Systems (March, 2015) states that the following options must be considered for disposal of surface water runoff in order of preference:

- Discharge to ground
- Discharge to a surface water body
- Discharge to a surface water sewer
- Discharge to a combined sewer

***Discharge to Ground***

6.1.2 The potential for surface water to discharge to ground has been assessed through a review of the likely ground conditions and possible infiltration structures.

6.1.3 The surface geology of this site is likely to be permeable, and infiltration is possible. This is to be confirmed via testing prior to construction.

6.1.4 It is noted that infiltration testing carried out by Jomas in 2016 at a neighbouring property concluded that soakaways were not suitable. Therefore, both infiltration and discharge to sewer have been considered as part of this design.

***Discharge to Surface Water Body***

6.1.5 There are no water bodies near the site.

***Discharge to Surface Water Sewer/Combined Sewer***

6.1.6 Discharge to the public sewer network should only be considered once all other options for draining surface water from the site have been exhausted. As there is assumed to be a surface water sewer in the street, this will be considered for a backup option should infiltration not be possible.

## 6.2 Sustainable Drainage Systems (SuDS)

6.2.1 To maximise the potential use of SuDS at the site, a review has been undertaken as shown in Table 3 in accordance with the SuDS Hierarchy. This review highlights the components referenced in the SuDS Hierarchy and provides recommendations on whether the components could be incorporated into the development.

***Table 3: SuDS Selection Based on the SuDS Hierarchy***

| Component | Recommendation |
|---|---|
| Green/Blue roofs | Whilst the use of green and blue roofs provides additional environmental benefits such as enhanced aesthetics and ecology, its exposure to wind and orientation must be considered. Access to undertake the construction and maintenance easily and safely is also a high priority. |

| Component | Recommendation |
|---|---|
| | If feasible, depending on the roof design, a green/blue roof will provide water quality, biodiversity and aesthetic benefits to the site. Additionally, the green/blue roof/s will offer some attenuation for run-off, reducing volumes of run-off and in higher frequency events (i.e. 1in2 year storms) will result in no run-off for the building.<br><br>There are areas of flat roof that can be considered for green roofs. |
| Basins and Ponds | Ponds and attenuation basins can provide overland storage of surface water whilst also providing additional biodiversity and aesthetic/amenity value.<br><br>There is an existing basin/pond which is to be reused. |
| Filter Strips and Swales | Swales are linear vegetated drainage features, which provide overland conveyance and storage of surface water whilst trapping sediments and hydrocarbons within run-off. They also create biodiverse areas for planting and habitat.<br><br>Swales are not suitable for this site. |
| Infiltration Devices | Infiltration devices are likely to be suitable for the main drainage system due to the permeable nature of the existing ground.<br><br>Infiltration is proposed for this site. |
| Permeable Paving | Whilst incorporating attenuation storage, permeable paving also provides treatment through filtration of silt (and attached pollutants), settlement and retention of solids, adsorption of pollutants and biodegradation of organic pollutants, including petrol and diesel.<br><br>Permeable paving is proposed for the driveway/parking area. |
| Tanked Systems | This is the least sustainable option in terms of the SuDS Hierarchy. However, the use of tanked systems would still be of benefit compared to traditional drainage systems as it does allow run-off to be slowed down to an acceptable discharge rate.<br><br>There are no tanks proposed for the site for infiltration and a single tank for attenuation. |

# 7 SURFACE WATER DRAINAGE DESIGN

## 7.1 Site Areas

7.1.1 The site currently comprises an existing building and associated external works. The proposed development comprises the demolition of the existing building and construction of a new dwelling with associated external works. The existing and proposed areas are summarised below.

*Table 4: Site Areas*

| Parameter | Existing (m2) | Existing (%) | Proposed (m2) | Proposed (%) |
|---|---|---|---|---|
| Impermeable area | 1390 | 52 | 1947 | 73 |
| Permeable area | 1273 | 47 | 716 | 23 |
| Total area | 2663 | 100 | 2663 | 100 |

7.1.2 It is assumed that the surface water runoff from the site is currently picked up in the site drainage system and discharges to the sewer or soakaway.

## 7.2 Design Considerations

7.2.1 Consideration has been given to the following when calculating the proposed impermeable areas.

- The 2013 EA 'Rainfall Run-off Management for Developments' Report (SC030219) states that urban creep, the process of gradually increasing impermeable area within an urban area (through paving soft landscaped surfaces and constructed outbuildings etc), is an acknowledged issue. To include an allowance for urban creep, the impermeable area used in the drainage calculations has been increased by 10% in accordance with the recommendation made in SC030219.

7.2.2 It is proposed to drain the site to the ground via infiltration or discharge to the sewer (2 options designed).

7.2.3 The climate change allowance used in the Drainage Strategy is in line with updated EA guidance values published in February 2016 for increased rainfall intensities by 2115.

## 7.3 Greenfield Rates

7.3.1 The existing run-off rates for a variety of return periods have been calculated using the Wallingford method.

7.3.2 The greenfield run-off rates are based on the parameters provided below in Table 5.

*Table 5: Rural Run-off Calculator Parameters*

| Parameter | Value |
|---|---|
| Area (ha) | 0.2663 |
| SAAR (mm) | 678 |
| Soil Type | 2 |

7.3.3 The calculations are presented in Appendix C and summarised below in table 6.

*Table 6: Existing Greenfield Run-off Rates*

| Parameter | Value for site (l/s) |
|---|---|
| QBAR | 0.46 |
| Q1 | 0.39 |
| Q30 | 1.06 |
| Q100 | 1.47 |

## 7.4 Existing Site Runoff Rates

7.4.1 The total site area is 2663 square metres and is 52% impermeable resulting in an impermeable area of 1390m2. Taking conservative peak 1 year, 30 year and 100 year rainfall rates of 50mm/hr, 125mm/hr and 185mm/hr respectively, the maximum existing peak discharge rates have been calculated as follows.

Contributing Area (ha) x 1 yr Rainfall (mm/hr) x 2.78

1390/10000 x 50 x 2.78 = **19.3 l/s**

Contributing Area (ha) x 30 yr Rainfall (mm/hr) x 2.78

1390/10000 x 125 x 2.78 = **48.3 l/s**

Contributing Area (ha) x 100yr Rainfall (mm/hr) x 2.78

1390/10000 x 185 x 2.78 = **71.5 l/s**

7.4.2 The greenfield, existing and proposed site calculations are summarised below in table 7. Note that the proposed discharge rates apply only in infiltration is not possible.

*Table 7: Existing and Proposed Run-off Rates*

| *Parameter* | *Greenfield Value for site (l/s)* | *Existing for site (l/s)* | *Proposed Discharge for site (l/s)* |
|---|---|---|---|
| *QBAR* | *0.46* | *NA* | *NA* |
| *Q1* | *0.39* | *19.3* | *9.6* |
| *Q30* | *1.06* | *48.3* | *9.6* |
| *Q100* | *1.47* | *71.5* | *9.6* |
| *Q100+40%* | *NA* | *NA* | *9.6* |

## 7.5 Drainage Design

7.5.1 It is proposed to discharge surface water via infiltration into the sandy ground. An infiltration rate of 5x10-4m/s has been assumed for the ground conditions. This will be confirmed via testing prior to construction.

7.5.2 Total storage volume of 50 cubic metres storage is proposed for the system within the permeable paving subbase and 12 cubic metres in the pond. This caters for the 100 year +40% storm event.

7.5.3 Should testing prove that infiltration is not possible, the permeable paving will be tanked and an attenuation tank added as well as a new connection constructed to the Thames Water sewer in the street.

**Attenuation**

7.5.4 Should attenuation be required, discharge will be restricted to less than 50% of the existing 1 year discharge rate. Total storage volume will be increased slightly by adding a 16 cubic metre attenuation tank. This caters for the 100 year +40% storm event.

7.5.5 Calculations and design drawings for both options are provided in Appendix C.

**Basement Drainage**

7.5.6 As the site extensive basement areas, these will require a dewatering system to be designed by a specialist.

7.5.7 The carpark will need a surface water pump for the access ramp and the rear basement will need a foul pump for any internal foul drainage. This foul pump will require 24 hours of storage.

7.5.8 A number of other pumps may be required depending on the final level and drainage design.

## 7.6 Exceedance Flooding and Overland Flow

7.6.1 The area is not subject to overland flow routes or surface water flooding as discussed in sections 5.3 and 5.4 above.

7.6.2 The drainage system has been designed to cater for the 1 in 100 year + 40% climate change storm. ie in this storm event all surface water will be collected on site and slowly released. Thus, the overland flow route will only be in use in the event of drainage network failure, storms in excess of the 1 in 100 year + 40% climate change storm or flows from offsite flowing through the site. See overland flow plan in Appendix C.

## 7.7 Consents, Offsite Works and Diversions

7.7.1 The proposed surface water drainage strategy is accommodated on-site, with the only requirement for consent being the confirmation of flows into the existing TW sewer should this be required.

## 7.8 Maintenance

7.8.1 A SuDS maintenance plan has been prepared to outline the management of the potential SuDS features. The maintenance plan is provided in Appendix D.

# 8 FOUL DISCHARGE

## 8.1 Discharge to Public Sewer Network

8.1.1 Thames Water are the foul sewerage suppliers for the area.

8.1.2 The identified point of connection from the site is into the foul sewer in the street.

# 9 DRAINAGE DURING CONSTRUCTION

## 9.1 Construction Run-off Management

9.1.1 Installing the surface water and foul drainage system, whilst managing temporary run-off, are key aspects of the construction works involved in any development. The information provided below is in accordance with the 'C698 Site handbook for the construction of SUDS' (CIRIA, 2007).

9.1.2 Please note that the measures recommended below are recommendations only and need to be confirmed at the construction stage by the client and the contractor.

## 9.2 Management of Construction (Including Drainage)

9.2.1 Drainage is typically an early activity in the construction stage of a development, taking form during the earthworks phase. However, final construction i.e. piped drainage system connections to the SuDS devices, should not take place until the end of site development work, unless a robust strategy for silt-removal is implemented prior to occupation of the site.

9.2.2 A plan for the management of construction (including phasing of works, details of any offsite works etc.) cannot be provided at this early stage, as construction work plans are not yet known. However, the following key points are general construction issues associated with SuDS which will be addressed when these plans are complete:

- Silt-laden waters from construction sites represent a common form of waterborne pollution;
- These silt-laden waters cannot enter SUDS drainage systems unless specifically designed to accept this as it can clog the systems and pollute receiving waters. Therefore, piped drainage systems should not be connected to the attenuation SuDS devices until the late stages of construction.
- Any gullies and piped systems should be capped off during construction and fully jetted and cleaned prior to connection to the attenuation SuDS devices.

## 9.3 Temporary Drainage During Construction

9.3.1 The three principal aspects of drainage control during construction are trapping sediment, conveying run-off, and controlling run-off.

9.3.2 Sediment traps and barriers can include basin traps and sediment fences (with any necessary boundary controls). The principal basins are to be installed after the construction site is accessed. Sediment fences and barriers will then be installed as needed during grading.

9.3.3 Conveyance of run-off can be achieved through small ditches/stream, storm drains, channels and sloped drains with sufficient inlet/outlet protection.

9.3.4 Slope stability needs to be considered when using any channels to convey run-off across the site into any basins etc.

9.3.5 Run-off control measures will need to be implemented in order not overwhelm the temporary system and cause flooding issues. Run-off rates from the site will be managed so they are no greater than pre-development or in keeping with the best practice guidance to minimise risk of blockage. Any additional conveyance measures are to be installed as needed during grading.

9.3.6 Run-off control to include provision of perimeter ditches or appropriate levels grading to direct any water from the construction site to remain on site.

9.3.7 Any necessary surface stabilisation measures are to be applied immediately on all disturbed areas where construction work is either delayed or incomplete.

9.3.8 Maintenance inspections are to be performed weekly, and maintenance repairs to be made immediately after periods of rainfall.

## 9.4 Protection of Drainage Infrastructure during Construction

9.4.1 All drainage infrastructure should be protected from damage by construction traffic and heavy machinery through the implementation of measures such as protective barriers, and storing construction materials away from the drainage infrastructure.

# Appendix A: Proposed Development Details


Architecture
Urban design
Interior design

7 Lovers Walk London N3 1JH
T: 020 8343 0156
F: 020 8346 0160
E: mail@ddwharchitects.com

ddwh
ARCHITECTS

# Appendix B: Topographic Survey


Architecture
Urban design
Interior design

7 Lovers Walk London N3 1JH
T: 020 8343 0156
F: 020 8346 0160
E: mail@ddwharchitects.com

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# Appendix C: Drainage Drawings and Calculations

# Asset location search

Thames Water Property Searches

andrew wallace
22Park Rise
HARPENDEN
AL5 3AL

| | |
|---|---|
| **Search address supplied** | 20<br>Watford Road<br>Radlett<br>WD7 8LE |
| **Your reference** | Radlett |
| **Our reference** | ALS/ALS Standard/2023_4830543 |
| **Search date** | 22 May 2023 |

**Notification of Price Changes**

From 1st April 2023 Thames water Property Searches will be increasing the prices of its CON29DW, CommercialDW Drainage & Water Enquiries and Asset Location Searches. Historically costs would rise in line with RPI but as this currently sits at 14.2%, we are capping it at 10%.

Customers will be emailed with the new prices by January 1st 2023.

Any orders received with a higher payment prior to the 1st April 2023 will be non-refundable. For further details on the price increase please visit our website at www.thameswater-propertysearches.co.uk


Thames Water Utilities Ltd
Property Searches, PO Box 3189, Slough SL1 4WW

searches@thameswater.co.uk
www.thameswater-propertysearches.co.uk

0800 009 4540

Asset location search

Thames Water Property Searches

**Search address supplied:** 20, Watford Road, Radlett, WD7 8LE

Dear Sir / Madam

**An Asset Location Search is recommended when undertaking a site development.** It is essential to obtain information on the size and location of clean water and sewerage assets to safeguard against expensive damage and allow cost-effective service design.

The following records were searched in compiling this report: - the map of public sewers & the map of waterworks. Thames Water Utilities Ltd (TWUL) holds all of these.

This searchprovides maps showing the position, size of Thames Water assets close to the proposed development and also manhole cover and invert levels, where available.

Please note that none of the charges made for this report relate to the provision of Ordnance Survey mapping information. The replies contained in this letter are given following inspection of the public service records available to this company. No responsibility can be accepted for any error or omission in the replies.

You should be aware that the information contained on these plans is current only on the day that the plans are issued. The plans should only be used for the duration of the work that is being carried out at the present time. Under no circumstances should this data be copied or transmitted to parties other than those for whom the current work is being carried out.

Thames Water do update these service plans on a regular basis and failure to observe the above conditions could lead to damage arising to new or diverted services at a later date.

**Contact Us**

If you have any further queries regarding this enquiry please feel free to contact a member of the team on 0800 009 4540, or use the address below:

Thames Water Utilities Ltd
Property Searches
PO Box 3189
Slough
SL1 4WW

Email: searches@thameswater.co.uk
Web: www.thameswater-propertysearches.co.uk

## Waste Water Services

**Please provide a copy extract from the public sewer map.**

Enclosed is a map showing the approximate lines of our sewers. Our plans do not show sewer connections from individual properties or any sewers not owned by Thames Water unless specifically annotated otherwise. Records such as "private" pipework are in some cases available from the Building Control Department of the relevant Local Authority.

Where the Local Authority does not hold such plans it might be advisable to consult the property deeds for the site or contact neighbouring landowners.

This report relates only to sewerage apparatus of Thames Water Utilities Ltd, it does not disclose details of cables and or communications equipment that may be running through or around such apparatus.

The sewer level information contained in this response represents all of the level data available in our existing records. Should you require any further Information, please refer to the relevant section within the 'Further Contacts' page found later in this document.

For your guidance:

- The Company is not generally responsible for rivers, watercourses, ponds, culverts or highway drains. If any of these are shown on the copy extract they are shown for information only.
- Any private sewers or lateral drains which are indicated on the extract of the public sewer map as being subject to an agreement under Section 104 of the Water Industry Act 1991 are not an ‘as constructed’ record. It is recommended these details be checked with the developer.

## Clean Water Services

**Please provide a copy extract from the public water main map.**

With regard to the fresh water supply, this site falls within the boundary of another water company. For more information, please redirect your enquiry to the following address:

Affinity Water Ltd
Tamblin Way
Hatfield
AL10 9EZ
Tel: 0345 3572401

For your guidance:

- Assets other than vested water mains may be shown on the plan, for information only.
- If an extract of the public water main record is enclosed, this will show known public water mains in the vicinity of the property. It should be possible to estimate the likely length and route of any private water supply pipe connecting the property to the public water network.

**Payment for this Search**

A charge will be added to your suppliers account.

## Further contacts:

### Waste Water queries

Should you require verification of the invert levels of public sewers, by site measurement, you will need to approach the relevant Thames Water Area Network Office for permission to lift the appropriate covers. This permission will usually involve you completing a TWOSA form. For further information please contact our Customer Centre on Tel: 0845 920 0800. Alternatively, a survey can be arranged, for a fee, through our Customer Centre on the above number.

If you have any questions regarding sewer connections, budget estimates, diversions, building over issues or any other questions regarding operational issues please direct them to our service desk. Which can be contacted by writing to:

Developer Services (Waste Water)
Thames Water
Clearwater Court
Vastern Road
Reading
RG1 8DB

Tel: 0800 009 3921
Email: developer.services@thameswater.co.uk

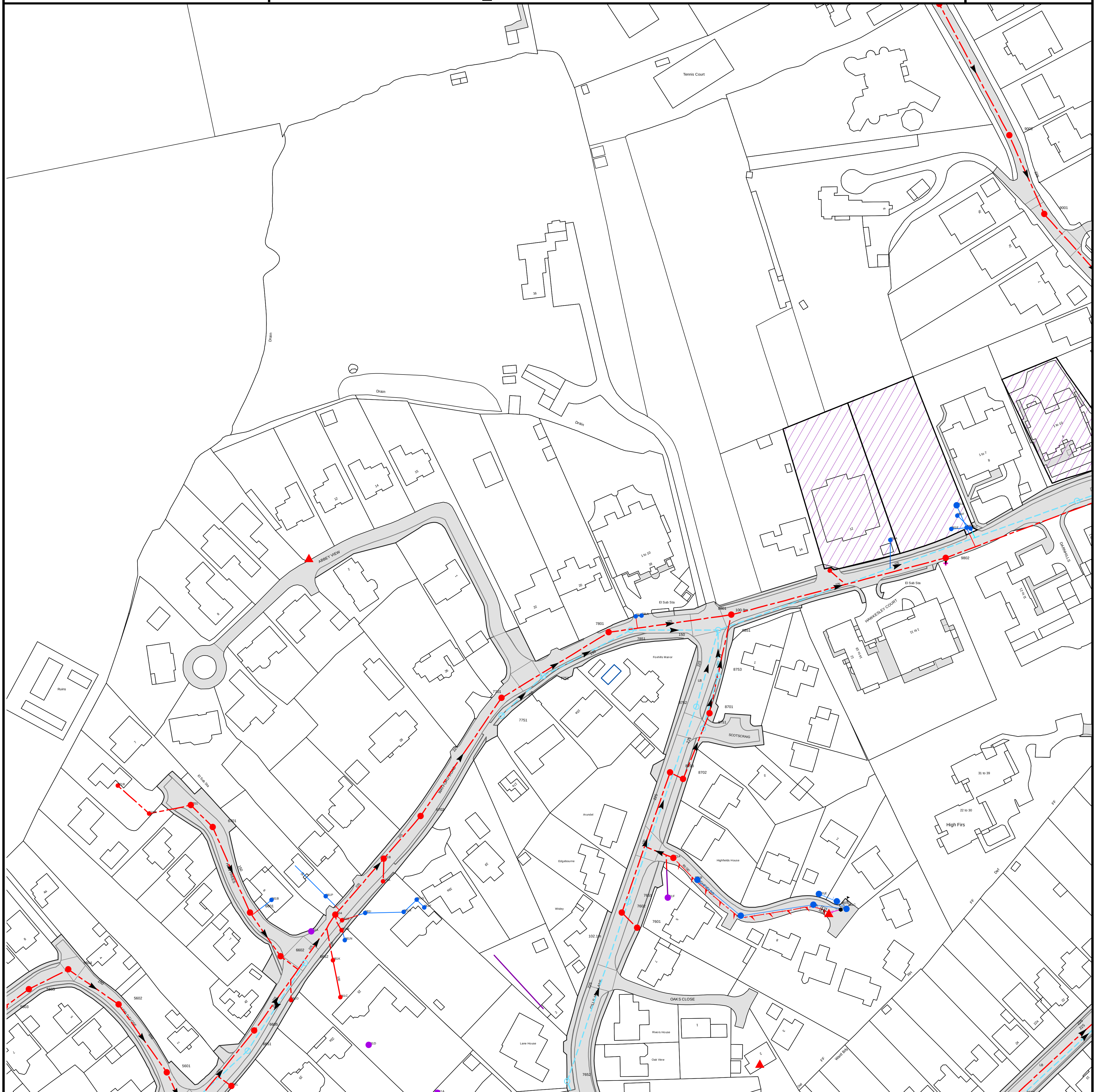
### Clean Water queries

Should you require any advice concerning clean water operational issues or clean water connections, please contact:

Developer Services (Clean Water)
Thames Water
Clearwater Court
Vastern Road
Reading
RG1 8DB

Tel: 0800 009 3921
Email: developer.services@thameswater.co.uk

# Asset Location Search Sewer Map - ALS/ALS Standard/2023_4830543




The width of the displayed area is 500 m and the centre of the map is located at OS coordinates 515758,199853

**The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.**

NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

| Manhole Reference | Manhole Cover Level | Manhole Invert Level |
|---|---|---|
| 981A | n/a | n/a |
| 981E | 95.1 | 93.8 |
| 981D | 95.75 | 92.75 |
| 981F | 95.7 | 93.3 |
| 981B | 94.89 | 92.64 |
| 981C | 94.9 | 93.24 |
| 661P | n/a | n/a |
| 8801 | 101.04 | 94.31 |
| 881A | n/a | n/a |
| 9802 | 95.09 | 92.87 |
| 9002 | 92.11 | 89.23 |
| 9101 | 92 | n/a |
| 9851 | 91.47 | 90.24 |
| 9001 | n/a | n/a |
| 861B | n/a | n/a |
| 7651 | 102.38 | 101.01 |
| 861D | n/a | n/a |
| 661G | n/a | n/a |
| 861F | n/a | n/a |
| 861E | n/a | n/a |
| 671A | n/a | n/a |
| 871B | n/a | n/a |
| 671B | n/a | n/a |
| 871A | 102.325 | 100.7 |
| 6702 | 103.36 | 96.23 |
| 8702 | 102.52 | 97.48 |
| 8703 | 103 | 99.52 |
| 8751 | 102.51 | 101.25 |
| 7751 | 103.18 | 101.92 |
| 8701 | 102.05 | 95.89 |
| 8752 | 102.43 | 100.47 |
| 7701 | n/a | n/a |
| 8753 | 101.83 | 100.99 |
| 7752 | 102.99 | 101.61 |
| 7801 | 102.53 | 95.48 |
| 8851 | 101.41 | 100.23 |
| 7851 | 102.37 | 101.18 |
| 781B | n/a | n/a |
| 781A | 102.35 | 99.03 |
| 661L | n/a | n/a |
| 5601 | 102.45 | 97.66 |
| 6651 | 103.65 | 102.48 |
| 6605 | 103.73 | 96.92 |
| 5603 | 100.15 | 98.9 |
| 5602 | 101.47 | 98.34 |
| 661O | n/a | n/a |
| 661C | n/a | n/a |
| 5605 | 100.25 | 98.77 |
| 5604 | 100.67 | 98.51 |
| 6652 | 103.9 | 102.84 |
| 661K | n/a | n/a |
| 6602 | 103.69 | 97.29 |
| 661N | n/a | n/a |
| 661A | n/a | n/a |
| 661M | n/a | n/a |
| 661E | n/a | n/a |
| 6604 | 103.77 | 96.52 |
| 6601 | 103 | 97.48 |
| 661B | n/a | n/a |
| 6701 | 101.57 | 98.04 |
| 571A | n/a | n/a |
| 5701 | 100.76 | 98.22 |
| 571B | n/a | n/a |
| 761A | n/a | n/a |
| 7652 | 105.08 | 103.1 |
| 661D | n/a | n/a |
| 7601 | 102.04 | 100.93 |
| 861A | n/a | n/a |
| 661I | n/a | n/a |
| 7602 | 102.38 | 100.53 |
| 661H | n/a | n/a |
| 861C | n/a | n/a |
| 661F | n/a | n/a |

**The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.**

# Asset Location Search - Sewer Key

## Public Sewer Types (Operated and maintained by Thames Water)

**Foul Sewer:** A sewer designed to convey waste water from domestic and industrial sources to a treatment works.

**Surface Water Sewer:** A sewer designed to convey surface water (e.g. rain water from roofs, yards and car parks) to rivers or watercourses.

**Combined Sewer:** A sewer designed to convey both waste water and surface water from domestic and industrial sources to a treatment works.

Storm Sewer

Sludge Sewer

Foul Trunk Sewer

Surface Trunk Sewer

Combined Trunk Sewer

Foul Rising Main

Surface Water Rising Main

Combined Rising Main

Vacuum

Thames Water Proposed

Vent Pipe

Gallery

## Other Sewer Types (Not operated and maintained by Thames Water)

Sewer

Culverted Watercourse

Proposed

Decommissioned Sewer

Content of this drainage network is currently unknown

Ownership of this drainage network is currently unknown

## Sewer Fittings

A feature in a sewer that does not affect the flow in the pipe. Example: a vent is a fitting as the function of a vent is to release excess gas.

Air Valve

Meter

Dam Chase

Vent

Fitting

## Operational Controls

A feature in a sewer that changes or diverts the flow in the sewer. Example: A hydrobrake limits the flow passing downstream.

Ancillary

Drop Pipe

Control Valve

Weir

## End Items

End symbols appear at the start or end of a sewer pipe. Examples: an Undefined End at the start of a sewer indicates that Thames Water has no knowledge of the position of the sewer upstream of that symbol. Outfall on a surface water sewer indicates that the pipe discharges into a stream or river.

Inlet

Outfall

Undefined End

## Other Symbols

Symbols used on maps which do not fall under other general categories.

Change of Characteristic Indicator

Public / Private Pumping Station

Invert Level

Summit

## Areas

Lines denoting areas of underground surveys, etc.

Agreement

Chamber

Operational Site

## Ducts or Crossings

Casement

Ducts may contain high voltage cables. Please check with Thames Water.

Conduit Bridge

Subway

Tunnel

**Notes:**

1) All levels associated with the plans are to Ordnance Datum Newlyn.
2) All measurements on the plan are metric.
3) Arrows (on gravity fed sewers) or flecks (on rising mains) indicate the direction of flow.
4) Most private pipes are not shown on our plans, as in the past, this information has not been recorded.
5) 'na' or '0' on a manhole indicates that data is unavailable.
6) The text appearing alongside a sewer line indicates the internal diameter of the pipe in millimeters. Text next to a manhole indicates the manhole reference number and should not be taken as a measurement. If you are unsure about any text or symbology, please contact Property Searches on 0800 009 4540.

## Payment Terms and Conditions

All sales are made in accordance with Thames Water Utilities Limited (TWUL) standard terms and conditions unless previously agreed in writing.

1. All goods remain in the property of Thames Water Utilities Ltd until full payment is received.
2. Provision of service will be in accordance with all legal requirements and published TWUL policies.
3. All invoices are strictly due for payment within 14 days of the date of the invoice. Any other terms must be accepted/agreed in writing prior to provision of goods or service or will be held to be invalid.
4. Penalty interest may be invoked by TWUL in the event of unjustifiable payment delay. Interest charges will be in line with UK Statute Law 'The Late Payment of Commercial Debts (Interest) Act 1998'.
5. Interest will be charged in line with current Court Interest Charges, if legal action is taken.
6. A charge may be made at the discretion of the company for increased administration costs.

A copy of Thames Water's standard terms and conditions are available from the Commercial Billing Team (cashoperations@thameswater.co.uk).

We publish several Codes of Practice including a guaranteed standards scheme. You can obtain copies of these leaflets by calling us on 0800 316 9800.

If you are unhappy with our service, you can speak to your original goods or customer service provider. If you are still not satisfied with the outcome provided, we will refer the matter to a Senior Manager for resolution who will provide you with a response.

If you are still dissatisfied with our final response, and in certain circumstances such as you are buying a residential property or commercial property within certain parameters, The Property Ombudsman will investigate your case and give an independent view. The Ombudsman can award compensation of up to £25,000 to you if he finds that you have suffered actual financial loss and/or aggravation, distress, or inconvenience because of your search not keeping to the Code. Further information can be obtained by visiting www.tpos.co.uk or by sending an email to admin@tpos.co.uk.

If the Goods or Services covered by this invoice falls under the regulation of the 1991 Water Industry Act, and you remain dissatisfied you can refer your complaint to Consumer Council for Water on 0300 034 2222 or write to them at Consumer Council for Water, 1st Floor, Victoria Square House, Victoria Square, Birmingham, B2 4AJ.

**Ways to pay your bill**

| **Credit Card** | **BACS Payment** | **Telephone Banking** |
|---|---|---|
| Please Call **0800 009 4540** quoting your invoice number starting CBA or ADS | Account number **90478703**<br>Sort code **60-00-01**<br>A remittance advice must be sent to: **Thames Water Utilities Ltd., PO Box 3189, Slough SL1 4WW.**<br>or email<br>**ps.billing@thameswater.co.uk** | By calling your bank and quoting:<br>Account number **90478703**<br>Sort code **60-00-01**<br>and your invoice number |

Thames Water Utilities Ltd Registered in England & Wales No. 2366661 Registered Office Clearwater Court, Vastern Rd, Reading, Berks, RG1 8DB.

# Greenfield runoff r
# estimation for s

www.uksuds.com | Greenfield runo

| | |
|---|---|
| **Calculated by:** | andrew wallace |
| **Site name:** | Watford Rd |
| **Site location:** | Radlett |

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

## Site Details

| | |
|---|---|
| **Latitude:** | 51.68546 |
| **Longitude:** | 0.32526° |
| **Reference:** | 14741630 |
| **Date:** | May 23 2023 11: |

## Runoff estimation approach

IH124

## Site characteristics

| | |
|---|---|
| **Total site area (ha):** | .2633 |

## Methodology

| | |
|---|---|
| **$Q_{BAR}$ estimation method:** | Calculate from SPR and SAAR |
| **SPR estimation method:** | Calculate from SOIL type |

## Soil characteristics

| | Default | Edited |
|---|---|---|
| **SOIL type:** | 2 | 2 |
| **HOST class:** | N/A | N/A |
| **SPR/SPRHOST:** | 0.3 | 0.3 |

## Hydrological characteristics

| | Default | Edited |
|---|---|---|
| **SAAR (mm):** | 678 | 678 |
| **Hydrological region:** | 6 | 6 |
| **Growth curve factor 1 year:** | 0.85 | 0.85 |
| **Growth curve factor 30 years:** | 2.3 | 2.3 |
| **Growth curve factor 100 years:** | 3.19 | 3.19 |
| **Growth curve factor 200 years:** | 3.74 | 3.74 |

## Notes

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

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

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

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

### (3) Is SPR/SPRHOST ≤ 0.3?

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

## Greenfield runoff rates

| | Default | Edited |
|---|---|---|
| $Q_{BAR}$ (l/s): | 0.46 | 0.46 |
| **1 in 1 year (l/s):** | 0.39 | 0.39 |
| **1 in 30 years (l/s):** | 1.06 | 1.06 |
| **1 in 100 year (l/s):** | 1.47 | 1.47 |
| **1 in 200 years (l/s):** | 1.73 | 1.73 |

ALL DIMENSIONS TO BE CHECKED BY CONTRACTOR
NOTE: CONTRACTOR TO NOTE THE LIKELY PRESENCE OF MULTIPLE EXISTING SERVICES.
ALL SERVICES TO BE CONFIRMED PRIOR TO CONSTRUCTION AND DIVERTED AS NECESSARY


## DRAINAGE CONCEPT LEGEND

| | |
|---|---|
| **18.30+** | Proposed Level |
| **FFL 80.90** | Finished floor level |
| | Permeable Paving |
| Ø80> | Rising Main |
| Ø100@1:100> | Perforated Pipe - Diameter and fall |
| Ø100@1:100> | Stormwater Pipe - Diameter and fall |
| SMH<br>Ø1200<br>CL 80.90<br>IL 80.00 | Manhole type - SMH Surface Water<br>Diameter<br>Cover Level<br>Invert Level |
| SWIC<br>Ø450 | Polypropylene Inspection Chamber (PPIC) |
| RWP | Rain Water Pipe |
| Ø150@1:100> | Foul Pipe - Diameter and fall |
| 80> | Foul Rising Main |
| FMH<br>Ø1200<br>CL 80.90<br>IL 80.00 | Manhole type - FMH Foul Water<br>Diameter<br>Cover Level<br>Invert Level |
| FWIC<br>Ø450 | Polypropylene Inspection Chamber (PPIC) |
| FO | Sewer Vent Pipe/Sub Stack/Outlet |

Job. No. **P4735J2775** Rev.

DRAINAGE NOTES

1. THIS DRAWING IS FOR PLANNING ONLY AND IS NOT FOR CONSTRUCTION. IT IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT SERIES DESIGN DRAWINGS, SPECIFICATIONS AND DOCUMENTATION.
2. CONSTRUCTION TO BE IN ACCORDANCE WITH ALL BRITISH AND EUROPEAN STANDARDS AND BUILDING REGULATIONS.
3. ALL DIMENSIONS ARE IN MILLIMETRES AND LEVELS IN METRES ABOVE LOCAL DATUM.
4. ANY DISCREPANCIES IN THE DETAILS SHOWN ARE TO BE REPORTED TO THE EMPLOYER'S REPRESENTATIVE/ENGINEER PRIOR TO CONSTRUCTION.
5. ALL EXISTING SERVICES ARE TO BE LOCATED PRIOR TO THE COMMENCEMENT OF ANY WORKS. THE CONTRACTOR MUST NOTIFY THE ENGINEER IMMEDIATELY OF ANY CONFLICT WITH THE PROPOSED WORKS.
6. THE GENERAL SPECIFICATION OF MATERIALS AND WORKMANSHIPS FOR THE CONSTRUCTION OF THE ACCESS ROAD, FOOTPATHS AND OTHER AREAS OF HARDSTANDING SHALL BE THE MANUAL OF CONTRACT DOCUMENTS FOR HIGHWAY WORKS, VOLUME 1. SPECIFICATION OF HIGHWAY WORKS (SHW) PUBLISHED BY THE STATIONARY OFFICE.
7. NODE NUMBERS REFER TO CALCULATIONS WITHIN DRAINAGE REPORT
8. ALL DRAINAGE INCLUDING RWP AND FO SHOWN ARE INDICATIVE ONLY AND SUBJECT TO DETAILED DESIGN AND COUNCIL APPROVAL.
9. NOTE THE PRESENCE OF NUMEROUS TREES. DRAINAGE DESIGN TO BE REVISED AS NECESSARY TO ACCOMMODATE TREE PROTECTION AND HAND DIGGING MAY BE REQUIRED FOR DRAINAGE INSTALLATION.
10. UNLESS NOTED OTHERWISE, PIPES TO BE:
    FOUL PIPES UNDER BUILDING ø100@1:40,
    FOUL PIPES EXTERNAL ø100@1:80,
    SURFACE WATER PIPES ø150@1:100

Notes.



Key dimensions to be checked by engineer before major structural works commence on site.

1. This survey has been computed and drawn about O S National Grid.
2. All levels are in metres and relate to O S National Datum by GPS instruments.
3. This survey was measured for a scale of 1:100, any subsequent enlargements should be verified on site.

## Amendments

| Rev | Date | | By | Chkd |
|---|---|---|---|---|
| | | | | |

JOMAS
ENGINEERING
ENVIRONMENTAL
Jomas Associates Ltd.
Unit 24 Sarum Complex,
Salisbury Road,
Uxbridge, UB8 2RZ

Project
20 WATFORD RD, RADLETT

Drawing
Proposed Drainage Plan
ATTENUATION

| Dwg no | Checked | Surveyor |
|---|---|---|
| C01 | AW | - |

Date 23.05.23 | Scale 1:200 @ A1

Job No. **P4735J2775** Rev. -

Grid | Contours | Level Datum

## Design Settings

| | | | |
|---|---|---|---|
| Rainfall Methodology | FEH-13 | Minimum Velocity (m/s) | 1.00 |
| Return Period (years) | 10 | Connection Type | Level Soffits |
| Additional Flow (%) | 0 | Minimum Backdrop Height (m) | 0.200 |
| CV | 0.750 | Preferred Cover Depth (m) | 0.600 |
| Time of Entry (mins) | 2.00 | Include Intermediate Ground | x |
| Maximum Time of Concentration (mins) | 30.00 | Enforce best practice design rules | x |
| 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 |

## Circular Link Type

| | | | |
|---|---|---|---|
| Shape | Circular | Auto Increment (mm) | 75 |
| Barrels | 1 | Follow Ground | x |

**Available Diameters (mm)**

| | |
|---|---|
| 100 | 150 |

## Nodes

| Name | Area (ha) | T of E (mins) | Cover Level (m) | Diameter (mm) | Easting (m) | Northing (m) | Depth (m) |
|---|---|---|---|---|---|---|---|
| 1 | | | 102.700 | 1200 | 100.000 | 100.000 | 2.200 |
| 2 | | | 102.700 | 450 | 98.000 | 105.000 | 2.100 |
| 3 | 0.040 | 2.00 | 102.600 | 1200 | 97.000 | 108.000 | 1.900 |
| 4 | 0.040 | 2.00 | 102.000 | 450 | 80.000 | 113.000 | 1.100 |
| 5 | 0.020 | 2.00 | 102.000 | 450 | 75.000 | 125.000 | 0.750 |
| 6 | 0.050 | 2.00 | 98.533 | 1200 | 75.000 | 140.000 | 1.533 |
| 7 | 0.030 | 2.00 | 102.000 | 450 | 99.000 | 110.000 | 1.200 |
| 8 | 0.030 | 2.00 | 102.000 | 450 | 102.000 | 125.000 | 1.000 |

## 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) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.004 | 2 | 1 | 5.385 | 0.600 | 100.600 | 100.500 | 0.100 | 53.9 | 100 | 2.67 | 50.0 |
| 1.003 | 3 | 2 | 3.162 | 0.600 | 100.700 | 100.600 | 0.100 | 31.6 | 225 | 2.59 | 50.0 |
| 1.002 | 4 | 3 | 17.720 | 0.600 | 100.900 | 100.700 | 0.200 | 88.6 | 225 | 2.56 | 50.0 |
| 1.001 | 5 | 4 | 13.000 | 0.600 | 101.250 | 100.900 | 0.350 | 37.1 | 225 | 2.35 | 50.0 |
| 1.000 | 6 | 5 | 15.000 | 0.600 | 97.000 | 101.450 | -4.450 | -3.4 | 150 | 2.25 | 50.0 |
| 2.001 | 7 | 3 | 2.828 | 0.600 | 100.800 | 100.700 | 0.100 | 28.3 | 150 | 2.25 | 50.0 |
| 2.000 | 8 | 7 | 15.297 | 0.600 | 101.000 | 100.800 | 0.200 | 76.5 | 150 | 2.22 | 50.0 |

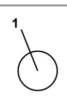
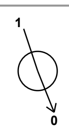
| Name | Vel (m/s) | Cap (l/s) | Flow (l/s) | US Depth (m) | DS Depth (m) | Σ Area (ha) | Σ Add Inflow (l/s) | Pro Depth (mm) | Pro Velocity (m/s) |
|---|---|---|---|---|---|---|---|---|---|
| 1.004 | 1.052 | 8.3 | 28.5 | 2.000 | 2.100 | 0.210 | 0.0 | 100 | 1.080 |
| 1.003 | 2.334 | 92.8 | 28.5 | 1.675 | 1.875 | 0.210 | 0.0 | 86 | 2.064 |
| 1.002 | 1.389 | 55.2 | 14.9 | 0.875 | 1.675 | 0.110 | 0.0 | 80 | 1.183 |
| 1.001 | 2.153 | 85.6 | 9.5 | 0.525 | 0.875 | 0.070 | 0.0 | 51 | 1.433 |
| 1.000 | 1.000 | 17.7 | 6.8 | 1.383 | 0.400 | 0.050 | 0.0 | 150 | 0.000 |
| 2.001 | 1.900 | 33.6 | 8.1 | 1.050 | 1.750 | 0.060 | 0.0 | 50 | 1.568 |
| 2.000 | 1.150 | 20.3 | 4.1 | 0.850 | 1.050 | 0.030 | 0.0 | 45 | 0.900 |

## Pipeline Schedule

| Link | Length (m) | Slope (1:X) | Dia (mm) | Link Type | US CL (m) | US IL (m) | US Depth (m) | DS CL (m) | DS IL (m) | DS Depth (m) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1.004 | 5.385 | 53.9 | 100 | Circular | 102.700 | 100.600 | 2.000 | 102.700 | 100.500 | 2.100 |
| 1.003 | 3.162 | 31.6 | 225 | Circular | 102.600 | 100.700 | 1.675 | 102.700 | 100.600 | 1.875 |
| 1.002 | 17.720 | 88.6 | 225 | Circular | 102.000 | 100.900 | 0.875 | 102.600 | 100.700 | 1.675 |
| 1.001 | 13.000 | 37.1 | 225 | Circular | 102.000 | 101.250 | 0.525 | 102.000 | 100.900 | 0.875 |
| 1.000 | 15.000 | -3.4 | 150 | Circular | 98.533 | 97.000 | 1.383 | 102.000 | 101.450 | 0.400 |
| 2.001 | 2.828 | 28.3 | 150 | Circular | 102.000 | 100.800 | 1.050 | 102.600 | 100.700 | 1.750 |
| 2.000 | 15.297 | 76.5 | 150 | Circular | 102.000 | 101.000 | 0.850 | 102.000 | 100.800 | 1.050 |

| Link | US Node | Dia (mm) | Node Type | MH Type | DS Node | Dia (mm) | Node Type | MH Type |
|---|---|---|---|---|---|---|---|---|
| 1.004 | 2 | 450 | Manhole | Adoptable | 1 | 1200 | Manhole | Adoptable |
| 1.003 | 3 | 1200 | Manhole | Adoptable | 2 | 450 | Manhole | Adoptable |
| 1.002 | 4 | 450 | Manhole | Adoptable | 3 | 1200 | Manhole | Adoptable |
| 1.001 | 5 | 450 | Manhole | Adoptable | 4 | 450 | Manhole | Adoptable |
| 1.000 | 6 | 1200 | Manhole | Adoptable | 5 | 450 | Manhole | Adoptable |
| 2.001 | 7 | 450 | Manhole | Adoptable | 3 | 1200 | Manhole | Adoptable |
| 2.000 | 8 | 450 | Manhole | Adoptable | 7 | 450 | Manhole | Adoptable |

## Manhole Schedule

| Node | Easting (m) | Northing (m) | CL (m) | Depth (m) | Dia (mm) | Connections | | Link | IL (m) | Dia (mm) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 100.000 | 100.000 | 102.700 | 2.200 | 1200 |  | 1 | 1.004 | 100.500 | 100 |
| 2 | 98.000 | 105.000 | 102.700 | 2.100 | 450 |  | 1 | 1.003 | 100.600 | 225 |
| | | | | | | | 0 | 1.004 | 100.600 | 100 |

## Manhole Schedule

| Node | Easting (m) | Northing (m) | CL (m) | Depth (m) | Dia (mm) | Connections | Link | IL (m) | Dia (mm) |
|---|---|---|---|---|---|---|---|---|---|
| 3 | 97.000 | 108.000 | 102.600 | 1.900 | 1200 | 1 | 2.001 | 100.700 | 150 |
| | | | | | | 2 | 1.002 | 100.700 | 225 |
| | | | | | | 0 | 1.003 | 100.700 | 225 |
| 4 | 80.000 | 113.000 | 102.000 | 1.100 | 450 | 1 | 1.001 | 100.900 | 225 |
| | | | | | | 0 | 1.002 | 100.900 | 225 |
| 5 | 75.000 | 125.000 | 102.000 | 0.750 | 450 | 1 | 1.000 | 101.450 | 150 |
| | | | | | | 0 | 1.001 | 101.250 | 225 |
| 6 | 75.000 | 140.000 | 98.533 | 1.533 | 1200 | 0 | 1.000 | 97.000 | 150 |
| 7 | 99.000 | 110.000 | 102.000 | 1.200 | 450 | 1 | 2.000 | 100.800 | 150 |
| | | | | | | 0 | 2.001 | 100.800 | 150 |
| 8 | 102.000 | 125.000 | 102.000 | 1.000 | 450 | 0 | 2.000 | 101.000 | 150 |

## Simulation Settings

| | | | |
|---|---|---|---|
| Rainfall Methodology | FSR | Analysis Speed | Normal |
| FSR Region | England and Wales | Skip Steady State | x |
| M5-60 (mm) | 19.000 | Drain Down Time (mins) | 240 |
| Ratio-R | 0.400 | Additional Storage (m³/ha) | 0.0 |
| Summer CV | 0.750 | Check Discharge Rate(s) | x |
| Winter CV | 0.840 | Check Discharge Volume | x |

**Storm Durations**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 15 | 60 | 180 | 360 | 600 | 960 | 2160 | 4320 | 7200 | 10080 |
| 30 | 120 | 240 | 480 | 720 | 1440 | 2880 | 5760 | 8640 | |

| Return Period (years) | Climate Change (CC %) | Additional Area (A %) | Additional Flow (Q %) |
|---|---|---|---|
| 1 | 0 | 0 | 0 |
| 10 | 0 | 0 | 0 |
| 30 | 0 | 0 | 0 |
| 100 | 0 | 0 | 0 |
| 100 | 40 | 0 | 0 |

## Node 3 Online Depth/Flow Control

| | | | | | |
|---|---|---|---|---|---|
| Flap Valve | x | Replaces Downstream Link | ✓ | Invert Level (m) | 100.700 |

| Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) |
|---|---|---|---|
| 0.010 | 9.600 | 2.000 | 9.600 |

**Node 6 Online Depth/Flow Control**

| | | | | | |
|---|---|---|---|---|---|
| Flap Valve | x | Replaces Downstream Link | ✓ | Invert Level (m) | 97.000 |

| Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) |
|---|---|---|---|
| 0.001 | 50.000 | 5.000 | 50.000 |

**Node 3 Depth/Area Storage Structure**

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Safety Factor | 1.5 | Invert Level (m) | 100.800 |
| Side Inf Coefficient (m/hr) | 0.00000 | Porosity | 0.30 | Time to half empty (mins) | 37 |

| Depth (m) | Area (m²) | Inf Area (m²) | Depth (m) | Area (m²) | Inf Area (m²) | Depth (m) | Area (m²) | Inf Area (m²) |
|---|---|---|---|---|---|---|---|---|
| 0.000 | 130.0 | 0.0 | 1.300 | 130.0 | 0.0 | 1.301 | 1.0 | 0.0 |

**Node 3 Depth/Area Storage Structure**

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Safety Factor | 1.5 | Invert Level (m) | 100.800 |
| Side Inf Coefficient (m/hr) | 0.00000 | Porosity | 0.95 | Time to half empty (mins) | 65 |

| Depth (m) | Area (m²) | Inf Area (m²) | Depth (m) | Area (m²) | Inf Area (m²) | Depth (m) | Area (m²) | Inf Area (m²) |
|---|---|---|---|---|---|---|---|---|
| 0.000 | 20.0 | 0.0 | 0.800 | 20.0 | 0.0 | 0.801 | 0.1 | 0.0 |

**Other (defaults)**

| | | | | | |
|---|---|---|---|---|---|
| Entry Loss (manhole) | 0.250 | Entry Loss (junction) | 0.000 | Apply Recommended Losses | x |
| Exit Loss (manhole) | 0.250 | Exit Loss (junction) | 0.000 | Flood Risk (m) | 0.300 |

**Rainfall**

| Event | Peak Intensity (mm/hr) | Average Intensity (mm/hr) |
|---|---|---|
| 1 year 15 minute summer | 103.832 | 29.381 |
| 1 year 15 minute winter | 72.865 | 29.381 |
| 1 year 30 minute summer | 67.515 | 19.105 |
| 1 year 30 minute winter | 47.379 | 19.105 |
| 1 year 60 minute summer | 45.726 | 12.084 |
| 1 year 60 minute winter | 30.379 | 12.084 |
| 1 year 120 minute summer | 28.340 | 7.489 |
| 1 year 120 minute winter | 18.828 | 7.489 |
| 1 year 180 minute summer | 21.894 | 5.634 |
| 1 year 180 minute winter | 14.231 | 5.634 |
| 1 year 240 minute summer | 17.401 | 4.599 |
| 1 year 240 minute winter | 11.561 | 4.599 |
| 1 year 360 minute summer | 13.397 | 3.448 |
| 1 year 360 minute winter | 8.709 | 3.448 |
| 1 year 480 minute summer | 10.573 | 2.794 |
| 1 year 480 minute winter | 7.024 | 2.794 |
| 1 year 600 minute summer | 8.677 | 2.373 |

**Rainfall**

| Event | Peak Intensity (mm/hr) | Average Intensity (mm/hr) |
|---|---|---|
| 1 year 600 minute winter | 5.929 | 2.373 |
| 1 year 720 minute summer | 7.750 | 2.077 |
| 1 year 720 minute winter | 5.209 | 2.077 |
| 1 year 960 minute summer | 6.393 | 1.683 |
| 1 year 960 minute winter | 4.235 | 1.683 |
| 1 year 1440 minute summer | 4.671 | 1.252 |
| 1 year 1440 minute winter | 3.140 | 1.252 |
| 1 year 2160 minute summer | 3.372 | 0.932 |
| 1 year 2160 minute winter | 2.323 | 0.932 |
| 1 year 2880 minute summer | 2.820 | 0.756 |
| 1 year 2880 minute winter | 1.895 | 0.756 |
| 1 year 4320 minute summer | 2.149 | 0.562 |
| 1 year 4320 minute winter | 1.415 | 0.562 |
| 1 year 5760 minute summer | 1.779 | 0.455 |
| 1 year 5760 minute winter | 1.151 | 0.455 |
| 1 year 7200 minute summer | 1.517 | 0.387 |
| 1 year 7200 minute winter | 0.979 | 0.387 |
| 1 year 8640 minute summer | 1.329 | 0.339 |
| 1 year 8640 minute winter | 0.858 | 0.339 |
| 1 year 10080 minute summer | 1.188 | 0.303 |
| 1 year 10080 minute winter | 0.767 | 0.303 |
| 10 year 15 minute summer | 200.971 | 56.868 |
| 10 year 15 minute winter | 141.032 | 56.868 |
| 10 year 30 minute summer | 129.855 | 36.744 |
| 10 year 30 minute winter | 91.126 | 36.744 |
| 10 year 60 minute summer | 86.243 | 22.792 |
| 10 year 60 minute winter | 57.298 | 22.792 |
| 10 year 120 minute summer | 52.179 | 13.789 |
| 10 year 120 minute winter | 34.667 | 13.789 |
| 10 year 180 minute summer | 39.634 | 10.199 |
| 10 year 180 minute winter | 25.763 | 10.199 |
| 10 year 240 minute summer | 31.075 | 8.212 |
| 10 year 240 minute winter | 20.646 | 8.212 |
| 10 year 360 minute summer | 23.443 | 6.033 |
| 10 year 360 minute winter | 15.239 | 6.033 |
| 10 year 480 minute summer | 18.333 | 4.845 |
| 10 year 480 minute winter | 12.180 | 4.845 |
| 10 year 600 minute summer | 14.935 | 4.085 |
| 10 year 600 minute winter | 10.205 | 4.085 |
| 10 year 720 minute summer | 13.257 | 3.553 |
| 10 year 720 minute winter | 8.909 | 3.553 |
| 10 year 960 minute summer | 10.821 | 2.849 |
| 10 year 960 minute winter | 7.168 | 2.849 |
| 10 year 1440 minute summer | 7.784 | 2.086 |
| 10 year 1440 minute winter | 5.231 | 2.086 |
| 10 year 2160 minute summer | 5.523 | 1.526 |
| 10 year 2160 minute winter | 3.806 | 1.526 |
| 10 year 2880 minute summer | 4.561 | 1.223 |
| 10 year 2880 minute winter | 3.066 | 1.223 |
| 10 year 4320 minute summer | 3.418 | 0.894 |
| 10 year 4320 minute winter | 2.251 | 0.894 |
| 10 year 5760 minute summer | 2.794 | 0.715 |

**Rainfall**

| Event | Peak Intensity (mm/hr) | Average Intensity (mm/hr) |
|---|---|---|
| 10 year 5760 minute winter | 1.808 | 0.715 |
| 10 year 7200 minute summer | 2.359 | 0.602 |
| 10 year 7200 minute winter | 1.522 | 0.602 |
| 10 year 8640 minute summer | 2.048 | 0.522 |
| 10 year 8640 minute winter | 1.322 | 0.522 |
| 10 year 10080 minute summer | 1.817 | 0.463 |
| 10 year 10080 minute winter | 1.173 | 0.463 |
| 30 year 15 minute summer | 254.498 | 72.014 |
| 30 year 15 minute winter | 178.595 | 72.014 |
| 30 year 30 minute summer | 165.775 | 46.909 |
| 30 year 30 minute winter | 116.334 | 46.909 |
| 30 year 60 minute summer | 110.635 | 29.238 |
| 30 year 60 minute winter | 73.503 | 29.238 |
| 30 year 120 minute summer | 66.994 | 17.704 |
| 30 year 120 minute winter | 44.509 | 17.704 |
| 30 year 180 minute summer | 50.789 | 13.070 |
| 30 year 180 minute winter | 33.014 | 13.070 |
| 30 year 240 minute summer | 39.713 | 10.495 |
| 30 year 240 minute winter | 26.384 | 10.495 |
| 30 year 360 minute summer | 29.789 | 7.666 |
| 30 year 360 minute winter | 19.364 | 7.666 |
| 30 year 480 minute summer | 23.214 | 6.135 |
| 30 year 480 minute winter | 15.423 | 6.135 |
| 30 year 600 minute summer | 18.859 | 5.158 |
| 30 year 600 minute winter | 12.885 | 5.158 |
| 30 year 720 minute summer | 16.698 | 4.475 |
| 30 year 720 minute winter | 11.222 | 4.475 |
| 30 year 960 minute summer | 13.576 | 3.575 |
| 30 year 960 minute winter | 8.993 | 3.575 |
| 30 year 1440 minute summer | 9.708 | 2.602 |
| 30 year 1440 minute winter | 6.524 | 2.602 |
| 30 year 2160 minute summer | 6.844 | 1.892 |
| 30 year 2160 minute winter | 4.716 | 1.892 |
| 30 year 2880 minute summer | 5.625 | 1.508 |
| 30 year 2880 minute winter | 3.780 | 1.508 |
| 30 year 4320 minute summer | 4.184 | 1.094 |
| 30 year 4320 minute winter | 2.755 | 1.094 |
| 30 year 5760 minute summer | 3.402 | 0.871 |
| 30 year 5760 minute winter | 2.202 | 0.871 |
| 30 year 7200 minute summer | 2.859 | 0.729 |
| 30 year 7200 minute winter | 1.845 | 0.729 |
| 30 year 8640 minute summer | 2.473 | 0.631 |
| 30 year 8640 minute winter | 1.596 | 0.631 |
| 30 year 10080 minute summer | 2.187 | 0.558 |
| 30 year 10080 minute winter | 1.411 | 0.558 |
| 100 year 15 minute summer | 329.664 | 93.284 |
| 100 year 15 minute winter | 231.343 | 93.284 |
| 100 year 30 minute summer | 216.648 | 61.304 |
| 100 year 30 minute winter | 152.034 | 61.304 |
| 100 year 60 minute summer | 145.356 | 38.413 |
| 100 year 60 minute winter | 96.571 | 38.413 |
| 100 year 120 minute summer | 88.100 | 23.282 |

**Rainfall**

| Event | Peak Intensity (mm/hr) | Average Intensity (mm/hr) |
|---|---|---|
| 100 year 120 minute winter | 58.532 | 23.282 |
| 100 year 180 minute summer | 66.650 | 17.151 |
| 100 year 180 minute winter | 43.325 | 17.151 |
| 100 year 240 minute summer | 51.959 | 13.731 |
| 100 year 240 minute winter | 34.521 | 13.731 |
| 100 year 360 minute summer | 38.732 | 9.967 |
| 100 year 360 minute winter | 25.177 | 9.967 |
| 100 year 480 minute summer | 30.068 | 7.946 |
| 100 year 480 minute winter | 19.977 | 7.946 |
| 100 year 600 minute summer | 24.351 | 6.660 |
| 100 year 600 minute winter | 16.638 | 6.660 |
| 100 year 720 minute summer | 21.505 | 5.763 |
| 100 year 720 minute winter | 14.452 | 5.763 |
| 100 year 960 minute summer | 17.408 | 4.584 |
| 100 year 960 minute winter | 11.531 | 4.584 |
| 100 year 1440 minute summer | 12.367 | 3.314 |
| 100 year 1440 minute winter | 8.311 | 3.314 |
| 100 year 2160 minute summer | 8.657 | 2.393 |
| 100 year 2160 minute winter | 5.965 | 2.393 |
| 100 year 2880 minute summer | 7.077 | 1.897 |
| 100 year 2880 minute winter | 4.756 | 1.897 |
| 100 year 4320 minute summer | 5.223 | 1.365 |
| 100 year 4320 minute winter | 3.439 | 1.365 |
| 100 year 5760 minute summer | 4.221 | 1.080 |
| 100 year 5760 minute winter | 2.732 | 1.080 |
| 100 year 7200 minute summer | 3.530 | 0.900 |
| 100 year 7200 minute winter | 2.278 | 0.900 |
| 100 year 8640 minute summer | 3.041 | 0.776 |
| 100 year 8640 minute winter | 1.962 | 0.776 |
| 100 year 10080 minute summer | 2.680 | 0.684 |
| 100 year 10080 minute winter | 1.729 | 0.684 |
| 100 year +40% CC 15 minute summer | 461.530 | 130.597 |
| 100 year +40% CC 15 minute winter | 323.881 | 130.597 |
| 100 year +40% CC 30 minute summer | 303.307 | 85.825 |
| 100 year +40% CC 30 minute winter | 212.847 | 85.825 |
| 100 year +40% CC 60 minute summer | 203.498 | 53.779 |
| 100 year +40% CC 60 minute winter | 135.199 | 53.779 |
| 100 year +40% CC 120 minute summer | 123.340 | 32.595 |
| 100 year +40% CC 120 minute winter | 81.944 | 32.595 |
| 100 year +40% CC 180 minute summer | 93.311 | 24.012 |
| 100 year +40% CC 180 minute winter | 60.654 | 24.012 |
| 100 year +40% CC 240 minute summer | 72.743 | 19.224 |
| 100 year +40% CC 240 minute winter | 48.329 | 19.224 |
| 100 year +40% CC 360 minute summer | 54.225 | 13.954 |
| 100 year +40% CC 360 minute winter | 35.248 | 13.954 |
| 100 year +40% CC 480 minute summer | 42.096 | 11.125 |
| 100 year +40% CC 480 minute winter | 27.967 | 11.125 |
| 100 year +40% CC 600 minute summer | 34.091 | 9.325 |
| 100 year +40% CC 600 minute winter | 23.293 | 9.325 |
| 100 year +40% CC 720 minute summer | 30.106 | 8.069 |
| 100 year +40% CC 720 minute winter | 20.233 | 8.069 |
| 100 year +40% CC 960 minute summer | 24.371 | 6.417 |

**Rainfall**

| Event | Peak Intensity (mm/hr) | Average Intensity (mm/hr) |
|---|---|---|
| 100 year +40% CC 960 minute winter | 16.144 | 6.417 |
| 100 year +40% CC 1440 minute summer | 17.314 | 4.640 |
| 100 year +40% CC 1440 minute winter | 11.636 | 4.640 |
| 100 year +40% CC 2160 minute summer | 12.120 | 3.350 |
| 100 year +40% CC 2160 minute winter | 8.351 | 3.350 |
| 100 year +40% CC 2880 minute summer | 9.908 | 2.656 |
| 100 year +40% CC 2880 minute winter | 6.659 | 2.656 |
| 100 year +40% CC 4320 minute summer | 7.312 | 1.912 |
| 100 year +40% CC 4320 minute winter | 4.815 | 1.912 |
| 100 year +40% CC 5760 minute summer | 5.909 | 1.513 |
| 100 year +40% CC 5760 minute winter | 3.824 | 1.513 |
| 100 year +40% CC 7200 minute summer | 4.942 | 1.261 |
| 100 year +40% CC 7200 minute winter | 3.189 | 1.261 |
| 100 year +40% CC 8640 minute summer | 4.257 | 1.086 |
| 100 year +40% CC 8640 minute winter | 2.747 | 1.086 |
| 100 year +40% CC 10080 minute summer | 3.751 | 0.957 |
| 100 year +40% CC 10080 minute winter | 2.421 | 0.957 |

**Results for 1 year Critical Storm Duration. Lowest mass balance: 98.49%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 15 minute summer | 1 | 15 | 100.594 | 0.094 | 9.6 | 0.0000 | 0.0000 | OK |
| 15 minute summer | 2 | 16 | 100.774 | 0.174 | 9.6 | 0.0277 | 0.0000 | SURCHARGED |
| 15 minute winter | 3 | 13 | 100.890 | 0.190 | 33.3 | 5.4403 | 0.0000 | OK |
| 15 minute summer | 4 | 9 | 100.996 | 0.096 | 19.6 | 0.0153 | 0.0000 | OK |
| 15 minute summer | 5 | 9 | 101.308 | 0.058 | 13.3 | 0.0092 | 0.0000 | OK |
| 60 minute summer | 6 | 35 | 97.005 | 0.005 | 4.8 | 0.0058 | 0.0000 | OK |
| 30 minute winter | 7 | 21 | 100.891 | 0.091 | 6.6 | 0.0145 | 0.0000 | OK |
| 15 minute summer | 8 | 9 | 101.052 | 0.052 | 5.3 | 0.0083 | 0.0000 | OK |

| Link Event (Upstream Depth) | US Node | Link | DS Node | Outflow (l/s) | Velocity (m/s) | Flow/Cap | Link Vol (m³) | Discharge Vol (m³) |
|---|---|---|---|---|---|---|---|---|
| 15 minute summer | 2 | 1.004 | 1 | 9.6 | 1.227 | 1.162 | 0.0416 | 11.4 |
| 15 minute winter | 3 | Depth/Flow | 2 | 9.6 | | | | |
| 15 minute summer | 4 | 1.002 | 3 | 20.0 | 1.346 | 0.361 | 0.3823 | |
| 15 minute summer | 5 | 1.001 | 4 | 12.5 | 1.049 | 0.146 | 0.1580 | |
| 60 minute summer | 6 | Depth/Flow | 5 | 6.1 | | | | |
| 30 minute winter | 7 | 2.001 | 3 | 8.3 | 1.492 | 0.247 | 0.0408 | |
| 15 minute summer | 8 | 2.000 | 7 | 5.3 | 0.786 | 0.261 | 0.1033 | |

**Results for 10 year Critical Storm Duration. Lowest mass balance: 98.49%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 15 minute summer | 1 | 12 | 100.594 | 0.094 | 9.6 | 0.0000 | 0.0000 | OK |
| 15 minute summer | 2 | 13 | 100.774 | 0.174 | 9.6 | 0.0277 | 0.0000 | SURCHARGED |
| 30 minute winter | 3 | 25 | 101.065 | 0.365 | 43.2 | 15.8175 | 0.0000 | SURCHARGED |
| 30 minute winter | 4 | 24 | 101.066 | 0.166 | 23.4 | 0.0264 | 0.0000 | OK |
| 15 minute summer | 5 | 9 | 101.334 | 0.084 | 24.5 | 0.0134 | 0.0000 | OK |
| 15 minute winter | 6 | 10 | 97.030 | 0.030 | 15.3 | 0.0341 | 0.0000 | OK |
| 30 minute winter | 7 | 24 | 101.066 | 0.266 | 12.7 | 0.0423 | 0.0000 | SURCHARGED |
| 15 minute summer | 8 | 9 | 101.075 | 0.075 | 10.3 | 0.0120 | 0.0000 | OK |

| Link Event (Upstream Depth) | US Node | Link | DS Node | Outflow (l/s) | Velocity (m/s) | Flow/Cap | Link Vol (m³) | Discharge Vol (m³) |
|---|---|---|---|---|---|---|---|---|
| 15 minute summer | 2 | 1.004 | 1 | 9.6 | 1.227 | 1.162 | 0.0416 | 22.2 |
| 30 minute winter | 3 | Depth/Flow | 2 | 9.6 | | | | |
| 30 minute winter | 4 | 1.002 | 3 | 23.1 | 1.358 | 0.419 | 0.6309 | |
| 15 minute summer | 5 | 1.001 | 4 | 24.1 | 1.189 | 0.281 | 0.2633 | |
| 15 minute winter | 6 | Depth/Flow | 5 | 16.2 | | | | |
| 30 minute winter | 7 | 2.001 | 3 | 11.5 | 1.513 | 0.343 | 0.0498 | |
| 15 minute summer | 8 | 2.000 | 7 | 10.3 | 0.836 | 0.506 | 0.2024 | |

**Results for 30 year Critical Storm Duration. Lowest mass balance: 98.49%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 15 minute summer | 1 | 11 | 100.594 | 0.094 | 9.6 | 0.0000 | 0.0000 | OK |
| 15 minute summer | 2 | 12 | 100.774 | 0.174 | 9.6 | 0.0277 | 0.0000 | SURCHARGED |
| 30 minute winter | 3 | 28 | 101.188 | 0.488 | 53.8 | 23.1069 | 0.0000 | SURCHARGED |
| 30 minute winter | 4 | 28 | 101.191 | 0.291 | 30.3 | 0.0462 | 0.0000 | SURCHARGED |
| 15 minute summer | 5 | 8 | 101.352 | 0.102 | 33.3 | 0.0162 | 0.0000 | OK |
| 30 minute winter | 6 | 16 | 97.024 | 0.024 | 13.6 | 0.0269 | 0.0000 | OK |
| 30 minute winter | 7 | 28 | 101.190 | 0.390 | 16.1 | 0.0620 | 0.0000 | SURCHARGED |
| 30 minute winter | 8 | 28 | 101.191 | 0.191 | 8.1 | 0.0303 | 0.0000 | SURCHARGED |

| Link Event (Upstream Depth) | US Node | Link | DS Node | Outflow (l/s) | Velocity (m/s) | Flow/Cap | Link Vol (m³) | Discharge Vol (m³) |
|---|---|---|---|---|---|---|---|---|
| 15 minute summer | 2 | 1.004 | 1 | 9.6 | 1.227 | 1.162 | 0.0416 | 28.5 |
| 30 minute winter | 3 | Depth/Flow | 2 | 9.6 | | | | |
| 30 minute winter | 4 | 1.002 | 3 | 28.0 | 1.354 | 0.508 | 0.7047 | |
| 15 minute summer | 5 | 1.001 | 4 | 31.1 | 1.196 | 0.364 | 0.3502 | |
| 30 minute winter | 6 | Depth/Flow | 5 | 16.4 | | | | |
| 30 minute winter | 7 | 2.001 | 3 | 15.0 | 1.505 | 0.446 | 0.0498 | |
| 30 minute winter | 8 | 2.000 | 7 | 8.1 | 0.817 | 0.396 | 0.2693 | |

**Results for 100 year Critical Storm Duration. Lowest mass balance: 98.49%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 15 minute summer | 1 | 11 | 100.594 | 0.094 | 9.6 | 0.0000 | 0.0000 | OK |
| 15 minute summer | 2 | 12 | 100.774 | 0.174 | 9.6 | 0.0277 | 0.0000 | SURCHARGED |
| 30 minute winter | 3 | 29 | 101.381 | 0.681 | 70.3 | 34.4975 | 0.0000 | SURCHARGED |
| 30 minute winter | 4 | 29 | 101.383 | 0.483 | 36.9 | 0.0768 | 0.0000 | SURCHARGED |
| 15 minute summer | 5 | 9 | 101.392 | 0.142 | 45.2 | 0.0225 | 0.0000 | OK |
| 15 minute summer | 6 | 8 | 97.047 | 0.047 | 28.2 | 0.0531 | 0.0000 | OK |
| 30 minute winter | 7 | 29 | 101.383 | 0.583 | 19.8 | 0.0926 | 0.0000 | SURCHARGED |
| 30 minute winter | 8 | 29 | 101.384 | 0.384 | 10.6 | 0.0610 | 0.0000 | SURCHARGED |

| Link Event (Upstream Depth) | US Node | Link | DS Node | Outflow (l/s) | Velocity (m/s) | Flow/Cap | Link Vol (m³) | Discharge Vol (m³) |
|---|---|---|---|---|---|---|---|---|
| 15 minute summer | 2 | 1.004 | 1 | 9.6 | 1.227 | 1.162 | 0.0416 | 36.8 |
| 30 minute winter | 3 | Depth/Flow | 2 | 9.6 | | | | |
| 30 minute winter | 4 | 1.002 | 3 | 37.7 | 1.338 | 0.682 | 0.7047 | |
| 15 minute summer | 5 | 1.001 | 4 | 37.7 | 1.187 | 0.441 | 0.4324 | |
| 15 minute summer | 6 | Depth/Flow | 5 | 33.9 | | | | |
| 30 minute winter | 7 | 2.001 | 3 | 18.6 | 1.492 | 0.555 | 0.0498 | |
| 30 minute winter | 8 | 2.000 | 7 | 9.3 | 0.813 | 0.460 | 0.2693 | |

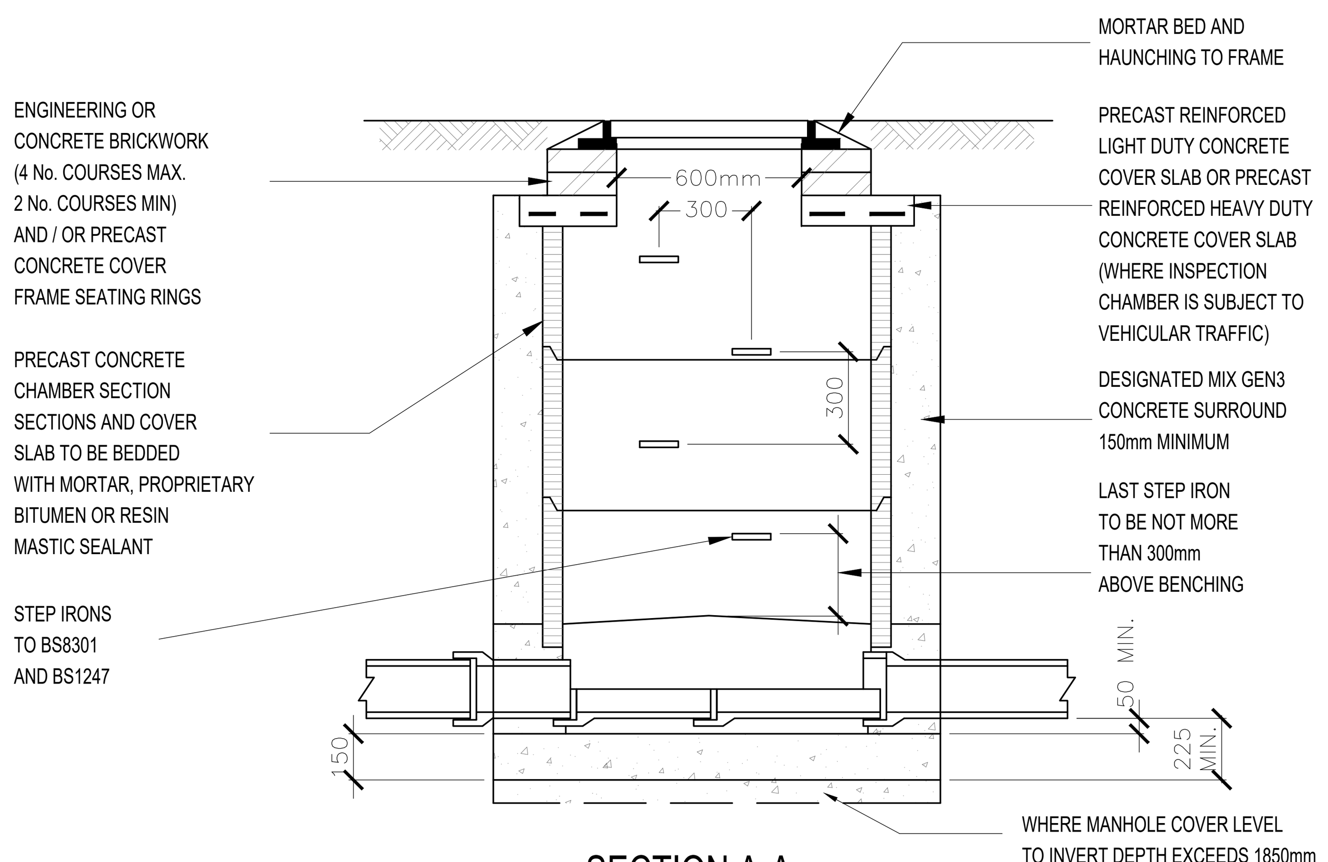
**Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 98.49%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 15 minute summer | 1 | 11 | 100.594 | 0.094 | 9.6 | 0.0000 | 0.0000 | OK |
| 15 minute summer | 2 | 12 | 100.774 | 0.174 | 9.6 | 0.0277 | 0.0000 | SURCHARGED |
| 60 minute winter | 3 | 58 | 101.841 | 1.141 | 61.6 | 57.1519 | 0.0000 | SURCHARGED |
| 60 minute winter | 4 | 57 | 101.843 | 0.943 | 34.0 | 0.1499 | 0.0000 | FLOOD RISK |
| 15 minute summer | 5 | 9 | 101.911 | 0.661 | 56.0 | 0.1051 | 0.0000 | FLOOD RISK |
| 60 minute summer | 6 | 27 | 97.029 | 0.029 | 21.2 | 0.0333 | 0.0000 | OK |
| 60 minute winter | 7 | 57 | 101.842 | 1.042 | 18.1 | 0.1657 | 0.0000 | FLOOD RISK |
| 60 minute winter | 8 | 57 | 101.844 | 0.843 | 9.5 | 0.1341 | 0.0000 | FLOOD RISK |

| Link Event (Upstream Depth) | US Node | Link | DS Node | Outflow (l/s) | Velocity (m/s) | Flow/Cap | Link Vol (m³) | Discharge Vol (m³) |
|---|---|---|---|---|---|---|---|---|
| 15 minute summer | 2 | 1.004 | 1 | 9.6 | 1.227 | 1.162 | 0.0416 | 51.3 |
| 60 minute winter | 3 | Depth/Flow | 2 | 9.6 | | | | |
| 60 minute winter | 4 | 1.002 | 3 | 32.5 | 1.360 | 0.587 | 0.7047 | |
| 15 minute summer | 5 | 1.001 | 4 | 52.6 | 1.323 | 0.614 | 0.5170 | |
| 60 minute summer | 6 | Depth/Flow | 5 | 21.5 | | | | |
| 60 minute winter | 7 | 2.001 | 3 | 17.1 | 1.511 | 0.511 | 0.0498 | |
| 60 minute winter | 8 | 2.000 | 7 | 8.6 | 0.774 | 0.421 | 0.2693 | |

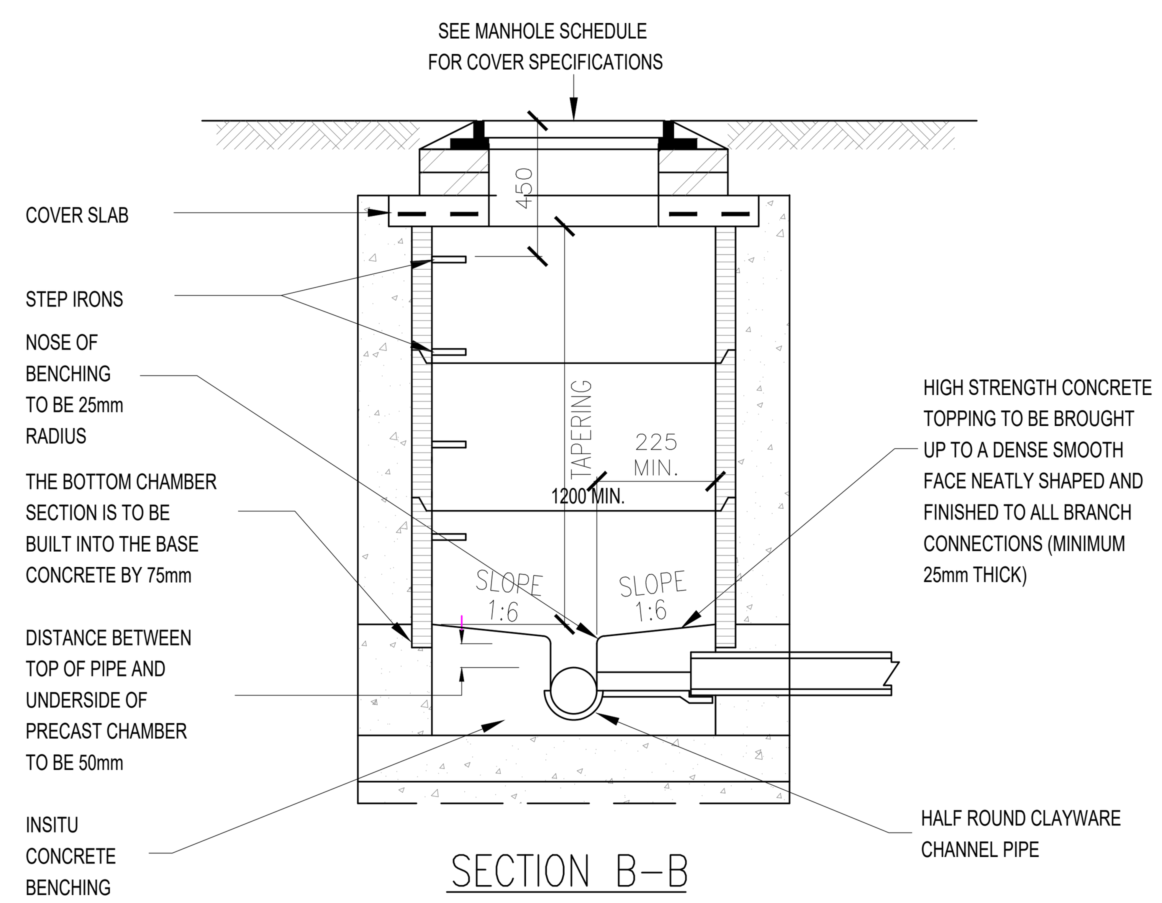
ALL DIMENSIONS TO BE CHECKED BY CONTRACTOR

NOTE: Details for private drainage only.




ALL MANHOLE BASE SLABS TO HAVE ONE LAYER A393 MESH CENTRALLY PLACED

SECTION A-A




SECTION B–B

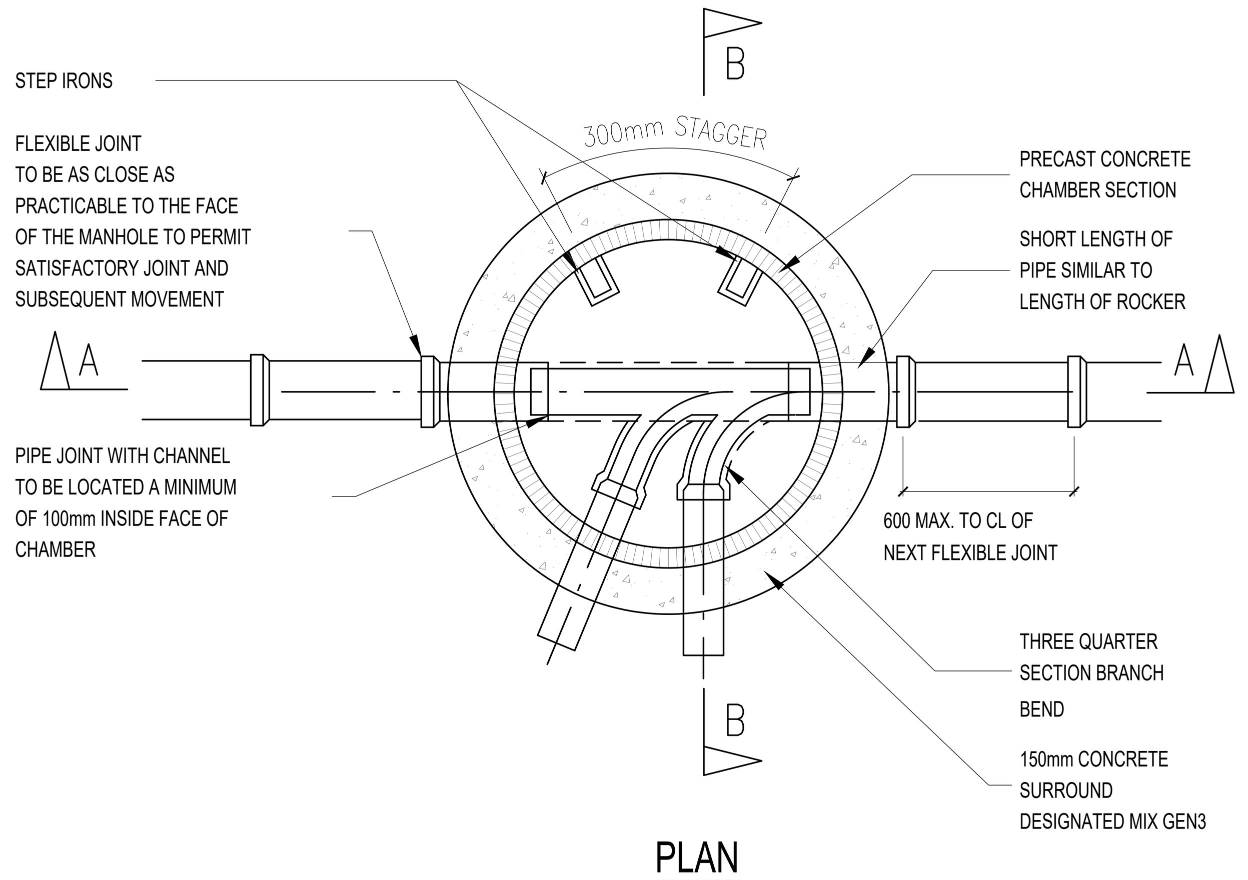
PRECAST CONCRETE MANHOLE TYPE B (PCC) IN EXTERNAL AREAS DETAIL

SCALE 1:20

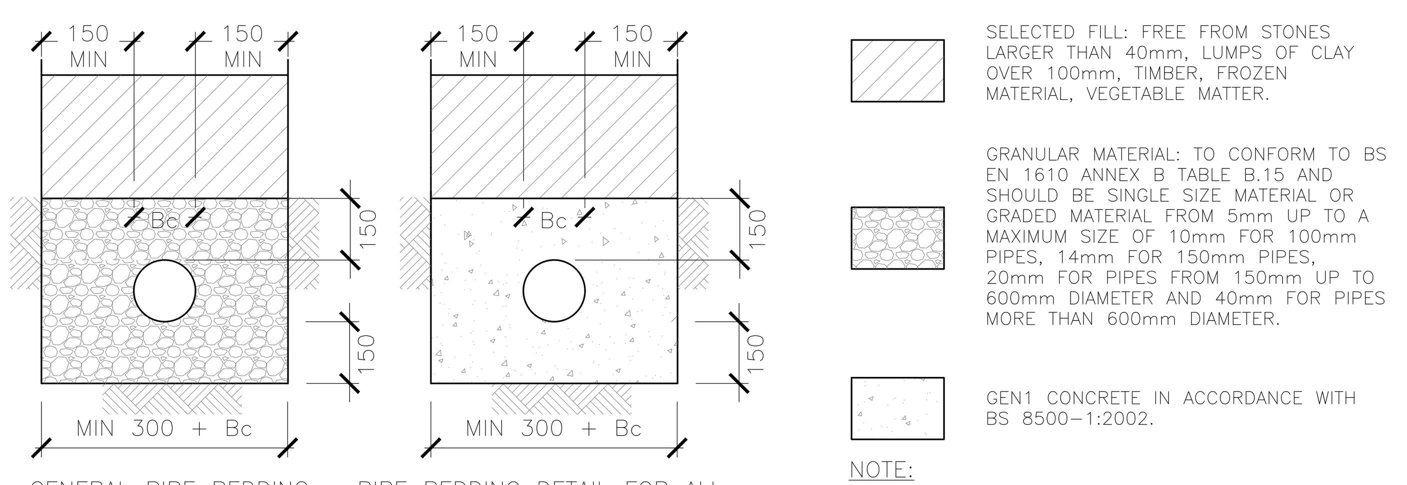
NOTES:
CHAMBERS WITH OUTGOING PIPES GREATER THAN 500mm DIAMETER SHALL BE FITTED WITH GUARD BARS, SAFETY CHAINS OR OTHER SAFETY DEVICES. TOE HOLES TO BE PROVIDED IN BENCHING OF SEWERS GREATER THAN 450mm DIAMETER FOR ACCESS TO INVERT. WHERE INTERNAL HEIGHT EXCEEDS 1800mm MANHOLE MAY BE PROVIDED WITH REDUCING COVER AND SHAFT. SHAFT DIAMETER TO BE 600mm DIAMETER OR 900mm DIAMETER IF LONGER THAN 900mm.

| PIPE DIAMETER | ROCKER PIPE * LENGTH |
|---|---|
| 150mm-450mm | 500mm-750mm |
| 475mm-750mm | 750mm-1000mm |
| OVER 750mm | 1200mm |

* OR LINTEL AND COMPRESSIBLE SEALANT IN ACCORDANCE WITH CLAUSE 689 OF THE SPECIFICATION.



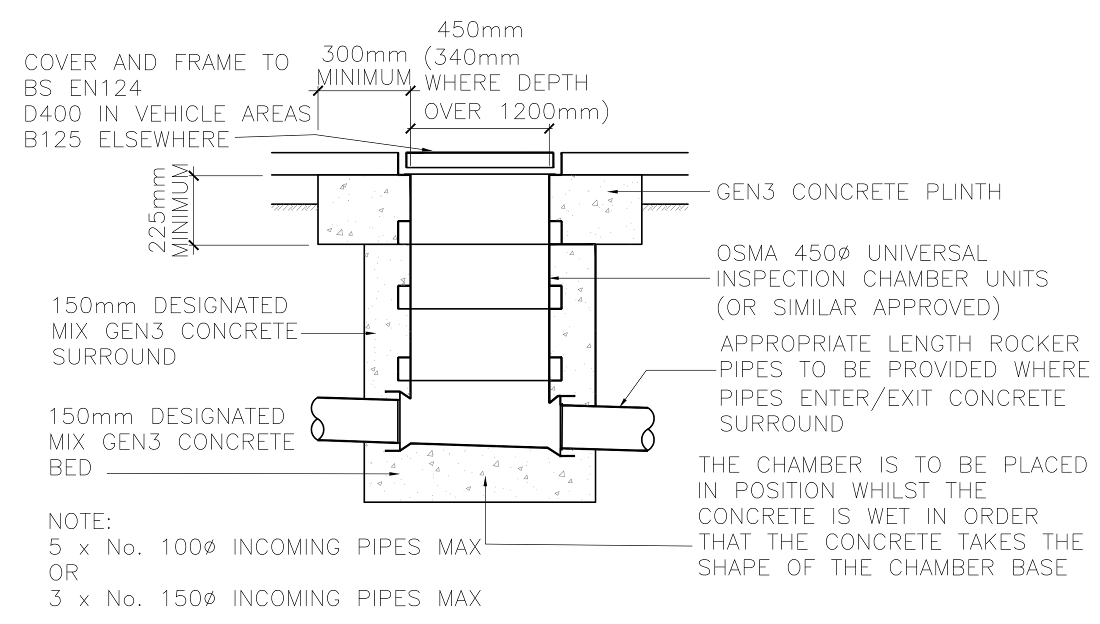

PLAN




NOTE:
PIPES LESS THAN 1200mm BELOW ROADS AND LESS THAN 600mm BELOW OTHER EXTERNAL AREAS SHALL HAVE A 150mm GEN1 CONCRETE SURROUND. OTHER THAN PIPES CAST WITHIN PILECAPS ALL PIPES BELOW SUSPENDED SLAB SHALL HAVE GRANULAR SURROUND AS SHOWN.

PIPE BEDDING DETAIL

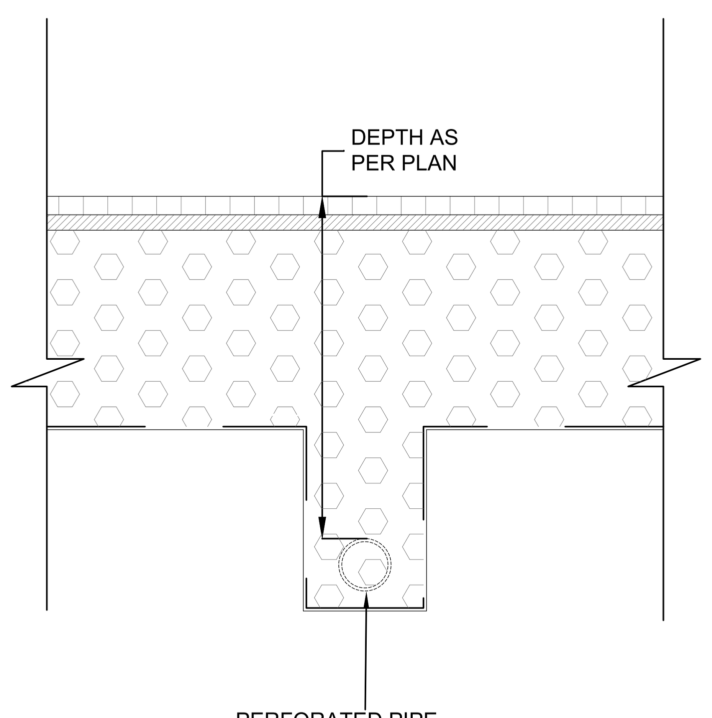
SCALE 1:10



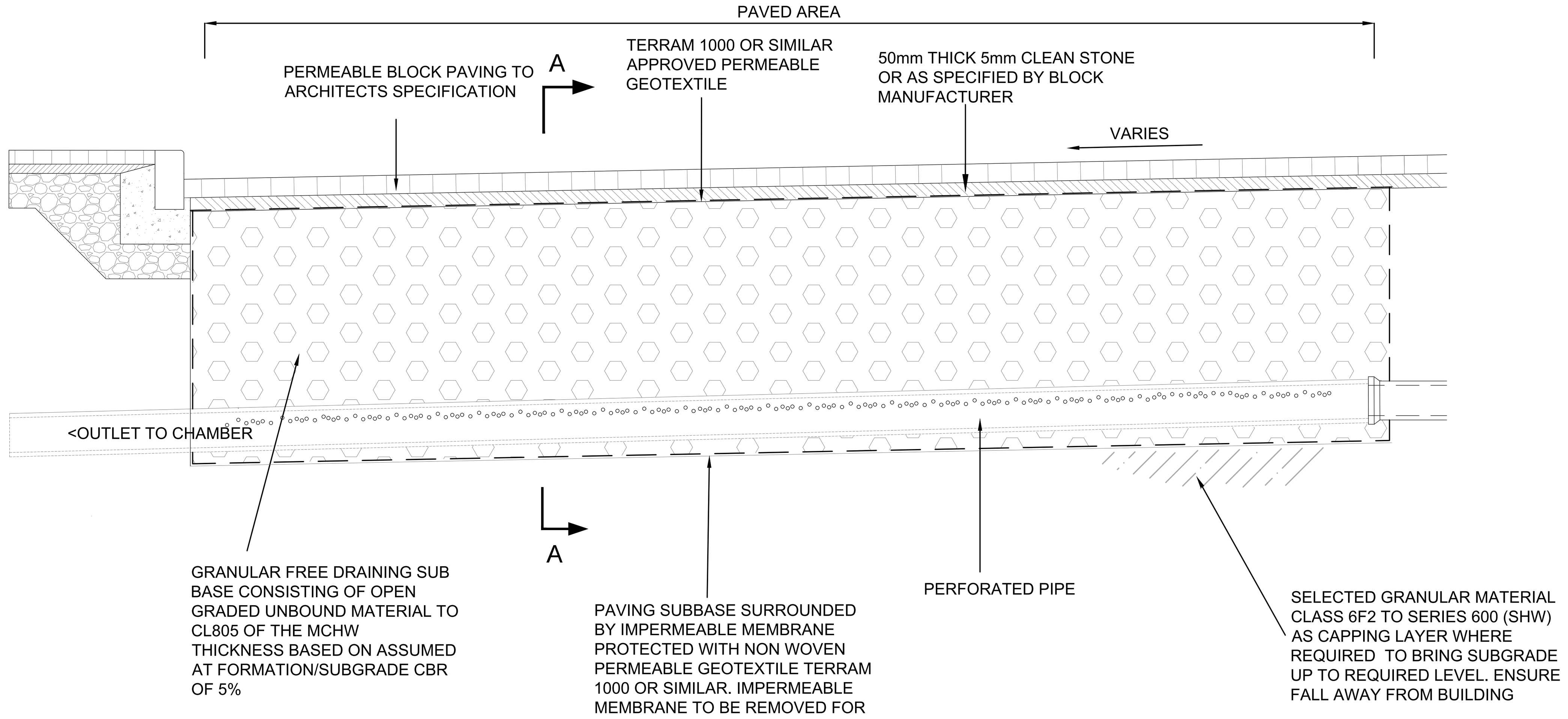

EXTERNAL POLYPROPYLENE INSPECTION CHAMBER (PPIC)

MAXIMUM DEPTH TO INVERT OF CHAMBER TO BE 1200mm (3000mm FOR REDUCED ACCESS)
CUT TO INTERMEDIATE SIZES

SCALE 1:20




SECTION A-A




TANKED PERMEABLE PAVING DETAIL

SCALE 1:20

Job. No. P4735J2775 | Rev.

NOTES

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6. CHAMBER WALLS 225 THICK TO BE CONSTRUCTED IN CLASS B ENGINEERING BRICKS TO SHW SERIES 2400 IN DESIGNATION (i) MORTAR OR IN–SITU STRENGTH CLASS C16/20 CONCRETE TO CLAUSE 2602
7. CHAMBER WALLS AND COVER SLAB TO BE CONSTRUCTED IN PRECAST CONCRETE TO BS EN 1917 AND BS 5911–3.
8. CONCRETE MIXES INDICATED ON THIS DRAWING ARE DESIGNATED MIXES IN ACCORDANCE WITH BS8500–1:2006. ALL CONCRETE TO BE SULPHATE RESISTANT
9. BACKFILL TO ALL TRENCHES UNDER CARRIAGEWAYS TO BE TYPE 1 SUB–BASE MATERIAL, ELSEWHERE BACKFILL TO BE IN ACCORDANCE WITH THE SPECIFICATION, FREE DRAINING READILY COMPACTIBLE MATERIAL, FREE FROM RUBBISH AND ORGANIC MATTER, FROZEN SOIL CLAY LUMPS AND LARGE STONES. TO BE COMPACTED IN LAYERS NOT EXCEEDING 150mm THICK.
10. A FLEXIBLE JOINT SHALL BE PROVIDED AS CLOSE AS IS FEASIBLE TO OUTSIDE FACE OF ANY STRUCTURE INTO WHICH A PIPE IS BUILT, IN ACCORDANCE WITH THE DETAIL.
11. THE GENERAL SPECIFICATION OF MATERIALS AND WORKMANSHIPS FOR THE CONSTRUCTION OF THE ACCESS ROAD, FOOTPATHS AND OTHER AREAS OF HARDSTANDING SHALL BE THE MANUAL OF CONTRACT DOCUMENTS FOR HIGHWAY WORKS, VOLUME 1. SPECIFICATION OF HIGHWAY WORKS (SHW) PUBLISHED BY THE STATIONARY OFFICE.
12. ALL PIPES TO BE LAID SOFFIT TO SOFFIT UNLESS NOTED OTHERWISE.
13. MANHOLE COVERS AND FRAMES SHALL COMPLY WITH BS EN124 AND SHALL BE OF A NON–ROCKING DESIGN WHICH DOES NOT RELY ON THE USE OF CUSHION INSERTS. CLASS D COVERS SHALL BE USED IN CARRIAGEWAYS, HARD SHOULDERS AND PARKING AREAS USED BY ALL TYPE OF ROAD VEHICLES. CLASS C SHALL BE USED IN FOOTWAYS, PEDESTRIAN AREAS AND ALL COMPARABLE LOCATIONS.

Notes.



Key dimensions to be checked by engineer before major structural works commence on site.

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3. This survey was measured for a scale of 1:100, any subsequent enlargements should be verified on site.

Amendments

| Rev | Date | | By | Chkd |
|---|---|---|---|---|
| | | | | |

JOMAS ENGINEERING ENVIRONMENTAL

Jomas Associates Ltd.
Unit 24 Sarum Complex,
Salisbury Road,
Uxbridge, UB8 2RZ

Project
20 WATFORD RD, RADLETT

Drawing
Proposed Drainage Details

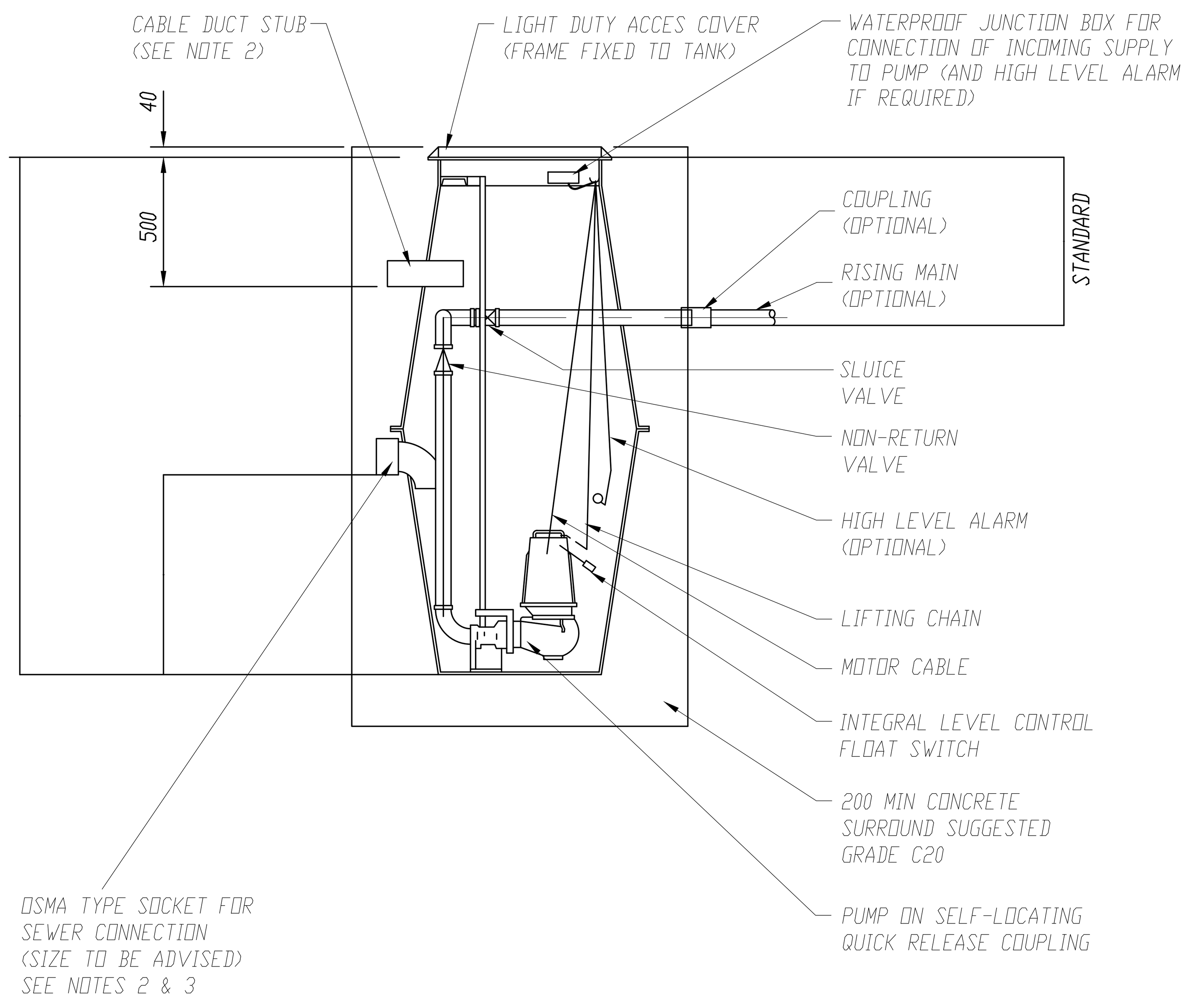
| Dwg no | Checked | Surveyor | |
|---|---|---|---|
| C02 | AW | - | |
| Date | 23.05.23 | Scale | AS SHOWN |

Job No. P4735J2775 | Rev. -

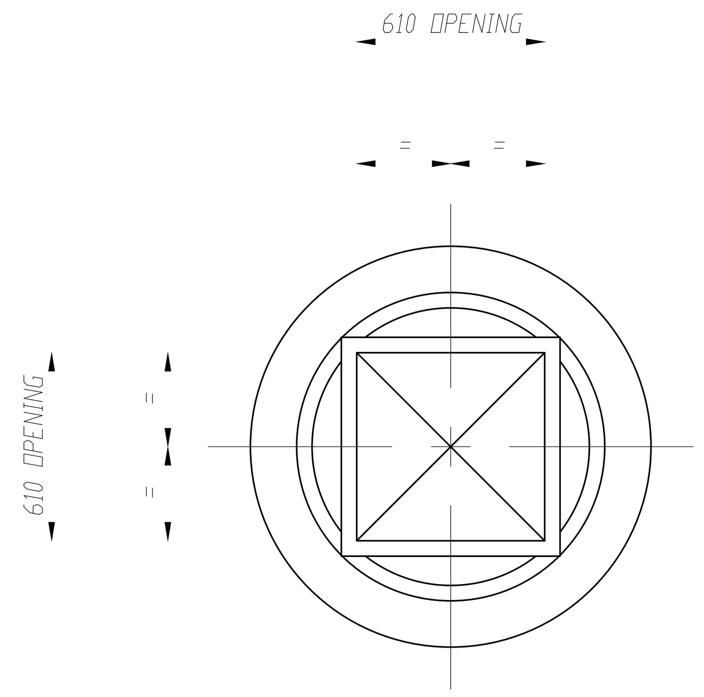
Grid | Contours | Level Datum

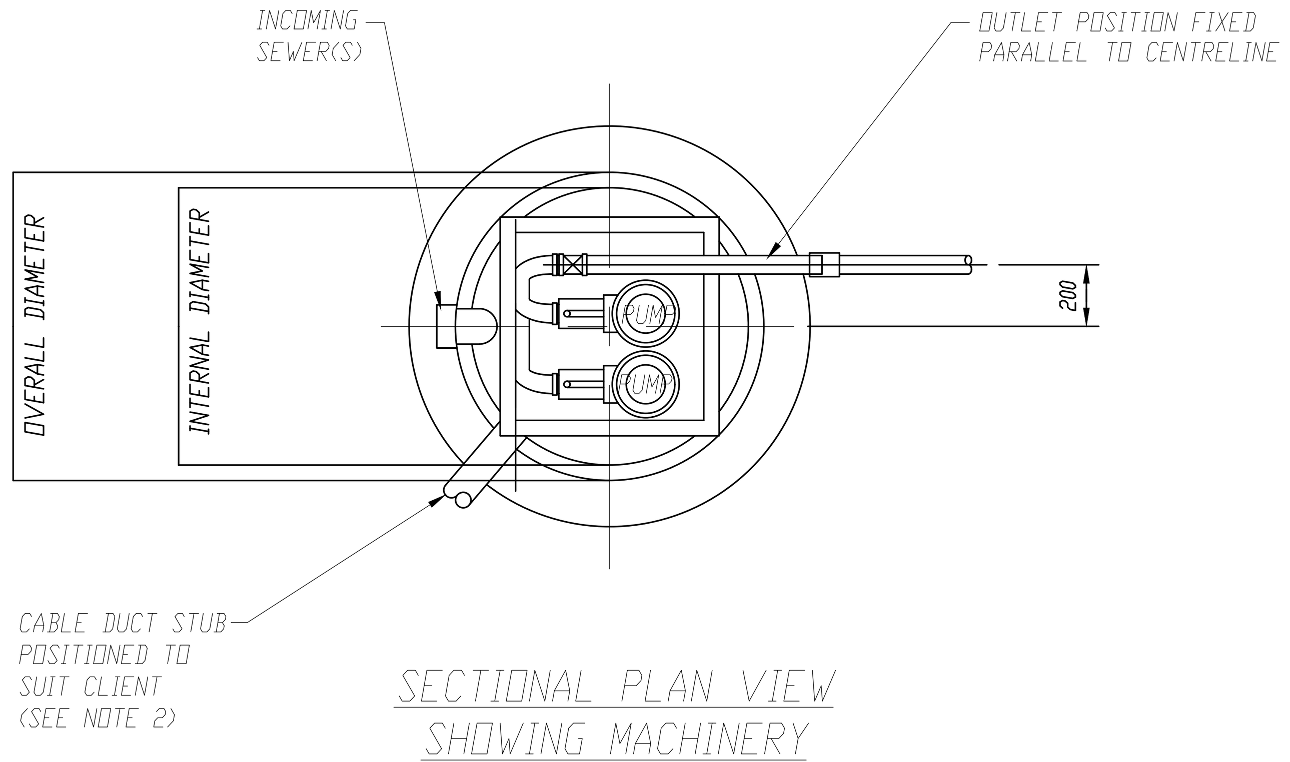
ALL DIMENSIONS TO BE CHECKED BY CONTRACTOR

NOTE: Details for private drainage only.



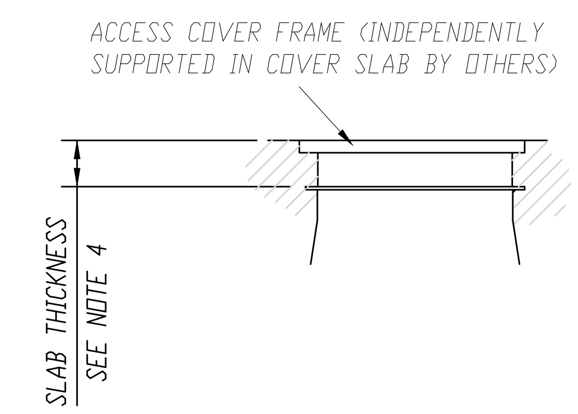

ACCESS COVER DETAIL




SECTIONAL PLAN VIEW SHOWING MACHINERY

PART SECTION SHOWING SEPARATE ACCESS COVER
-OPTIONAL IF LIGHT DUTY
-ESSENTIAL IF HEAVY DUTY OR NON-STANDARD




# PACKAGED PUMP STATION DETAIL

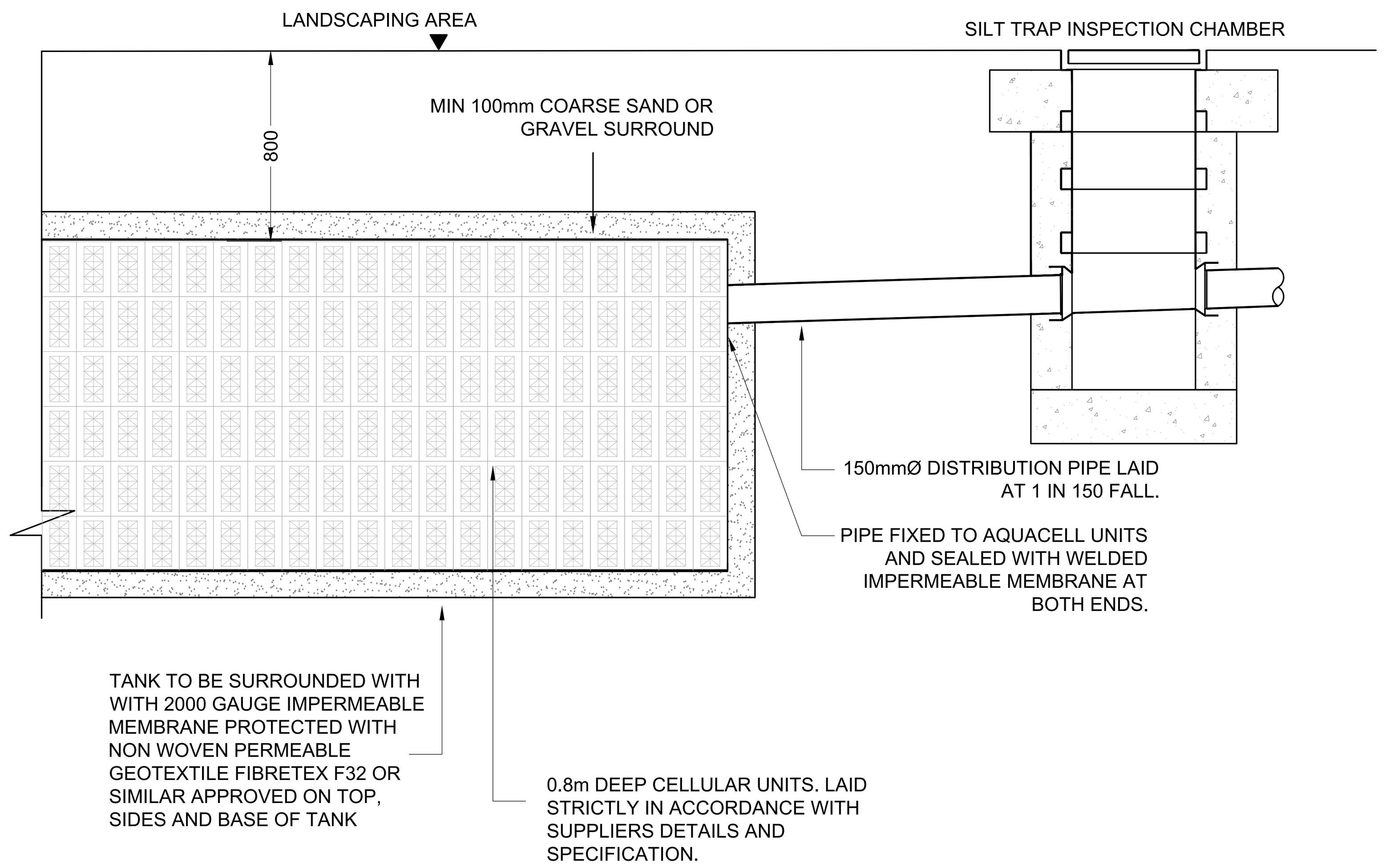
SCALE 1:20

NOTE:
PUMP DETAILS SHOWN INDICATIVELY ONLY AND SUBJECT TO SPECIALIST DESIGN BY DUTY POINT OR SIMILAR

FOUL PUMP TO INCLUDE A MACERATOR OR SIMILAR AND BE DESIGNED TO HOLD 24 HOURS OF FLOW IN CASE OF BREAKDOWN

## PUMP NOTES

1. ALL DIMENSIONS IN MILLIMETRES, UNLESS OTHERWISE STATED.
2. CABLE DUCT AND INLET SEWER(S) MAY BE POSITIONED AROUND PERIPHERY TO SUIT CLIENTS REASONABLE REQUIREMENTS. WHERE APIPE POSITION COINCIDES WITH A STRUCTURAL JOINT IT WILL BE PLACEDIN THE NEAREST POSSIBLE LOWER AND/OR ADJACENT LOCATION.
3. ADDITIONAL/DIFFERENT MATERIAL INLETS AVAILABLE.
4. SLAB THICKNESS TO BE ADDED TO OVERALL HEIGHT.
5. THE PUMPS SHALL BE PROGRAMMED TO WORK ALTERNATIVELY SO AS TO ALLOW BOTH PUMPS TOHAVE AN EQUAL OPERATION LOAD AND PUMP LIFE.
6. A HIGH WATER LEVEL FLOAT SHALL BE PROVIDED AT A HIGH LEVEL WHICH IS APPROXIMATELY 300mm BELOW THE ROOF LEVELOF THE BELOW GROUND TANK. THIS FLOAT SHOULD START THE OTHER PUMP THAT IS NOT OPERATING
7. AN ALARM SYSTEM SHALL BE PROVIDED WITH A FLASHING STROBE LIGHT AND A PUMP FAILURE WARNING SIGN WHICH ARE TO BE LOCATED WITHIN THE AREA OF THE STORE ROOM. THE ALARM SYSTEM SHALL BE PROVIDED WITH A BATTERY BACK-UP IN CASE OF POWER FAILURE. CONTACT DETAILS FOR THE ORGANISATION RESPONSIBLE FOR MAINTAINING THE PUMP ARE TO BE PROVIDED NEARBY TO THE ALARM SYSTEM




TYPICAL SECTION THROUGH ATTENUATION TANK
SCALE 1:20

Job. No. **P4735J2775** Rev.

NOTES

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Notes.



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3. This survey was measured for a scale of 1:100, any subsequent enlargements should be verified on site.

Amendments

| Rev | Date | | By | Chkd |
|---|---|---|---|---|
| | | | | |

JOMAS
ENGINEERING
ENVIRONMENTAL

Jomas Associates Ltd.
Unit 24 Sarum Complex,
Salisbury Road,
Uxbridge, UB8 2RZ

Project
20 WATFORD RD, RADLETT

Drawing
Proposed Drainage Details 2

| Dwg no | Checked | | Surveyor |
|---|---|---|---|
| C03 | AW | | - |
| Date 23.05.23 | | Scale | AS SHOWN |

Job No. **P4735J2775** Rev. -

| Grid | Contours | Level Datum |
|---|---|---|

ALL DIMENSIONS TO BE CHECKED BY CONTRACTOR
NOTE: CONTRACTOR TO NOTE THE LIKELY PRESENCE OF MULTIPLE EXISTING SERVICES.
ALL SERVICES TO BE CONFIRMED PRIOR TO CONSTRUCTION AND DIVERTED AS NECESSARY


| Job. No. | P4735J2775 | Rev. |
|---|---|---|

DRAINAGE NOTES

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7. ALL RWP AND FO SHOWN ARE INDICATIVE ONLY AND SUBJECT TO APPROVAL AND SETTING OUT BY THE ARCHITECT.
8. UNLESS NOTED OTHERWISE, PIPES TO BE:
   FOUL PIPES UNDER BUILDING ø100@1:40,
   FOUL PIPES EXTERNAL ø100@1:80,
   SURFACE WATER PIPES ø150@1:100

**STORMWATER CONCEPT LEGEND**

| | |
|---|---|
| **18.30x** | Proposed Level |
| **FFL 80.90** | Finished floor level |
| (arrow) | Overland flow |

Notes.



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Amendments

| Rev | Date | | By | Chkd |
|---|---|---|---|---|

JOMAS
ENGINEERING
ENVIRONMENTAL

Jomas Associates Ltd.
Unit 24 Sarum Complex,
Salisbury Road,
Uxbridge, UB8 2RZ

Project
20 WATFORD RD, RADLETT

Drawing
Proposed Overland Flow

| Dwg no | Checked | Surveyor |
|---|---|---|
| C04 | AW | - |
| Date 23.05.23 | Scale 1:100 | |
| Job No. P4735J2775 | | Rev. - |
| Grid | Contours | Level Datum |

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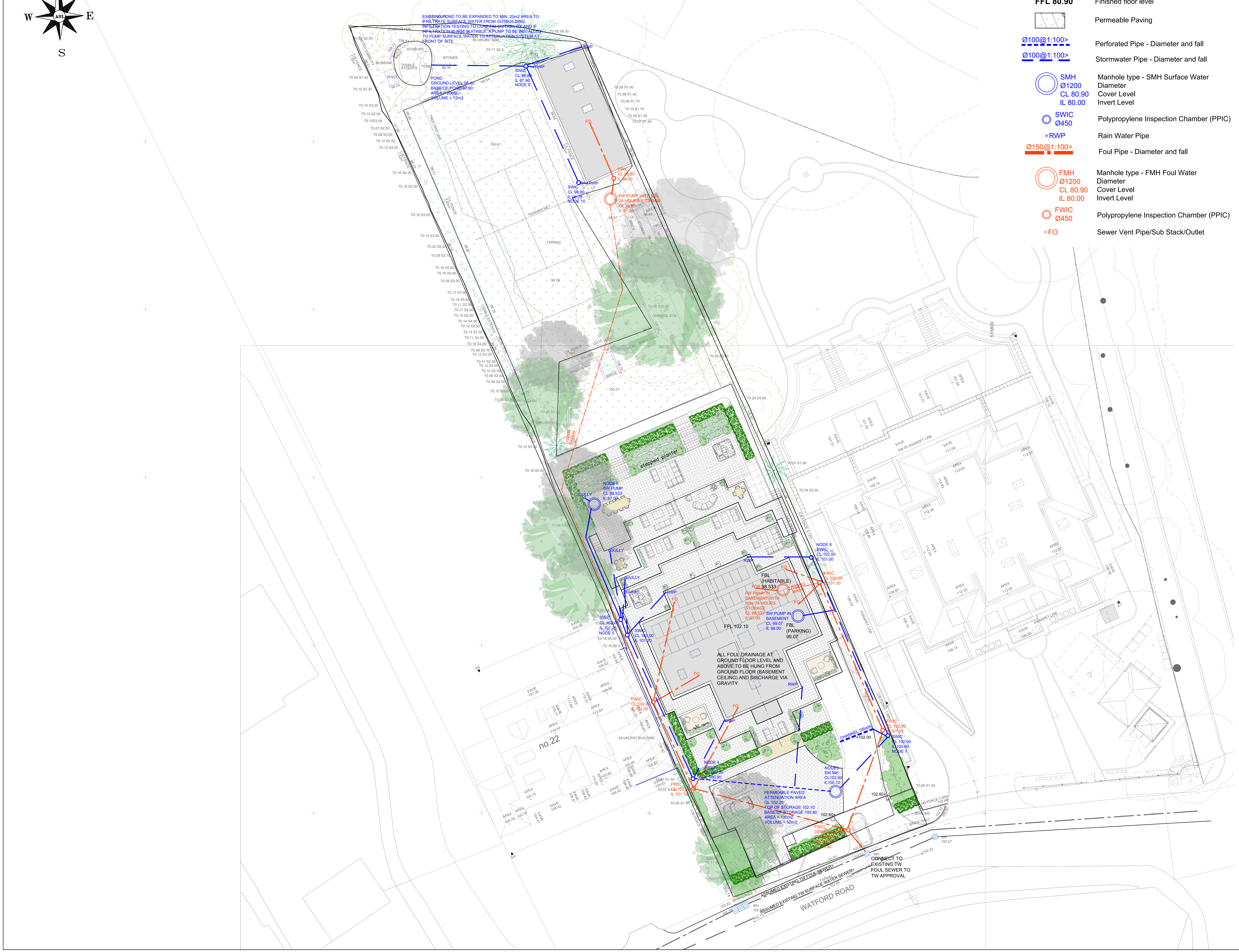


## DRAINAGE CONCEPT LEGEND

| | |
|---|---|
| 18.30+ | Proposed Level |
| FFL 80.90 | Finished floor level |
| | Permeable Paving |
| Ø100@1:100> | Perforated Pipe - Diameter and fall |
| Ø100@1:100> | Stormwater Pipe - Diameter and fall |
| SMH Ø1200 CL 80.90 IL 80.00 | Manhole type - SMH Surface Water Diameter Cover Level Invert Level |
| SWIC Ø450 | Polypropylene Inspection Chamber (PPIC) |
| RWP | Rain Water Pipe |
| Ø150@1:100> | Foul Pipe - Diameter and fall |
| FMH Ø1200 CL 80.90 IL 80.00 | Manhole type - FMH Foul Water Diameter Cover Level Invert Level |
| FWIC Ø450 | Polypropylene Inspection Chamber (PPIC) |
| FO | Sewer Vent Pipe/Sub Stack/Outlet |

Job. No. **P4735J2775** Rev.

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7. NODE NUMBERS REFER TO CALCULATIONS WITHIN DRAINAGE REPORT
8. ALL DRAINAGE INCLUDING RWP AND FO SHOWN ARE INDICATIVE ONLY AND SUBJECT TO DETAILED DESIGN AND COUNCIL APPROVAL.
9. NOTE THE PRESENCE OF NUMEROUS TREES. DRAINAGE DESIGN TO BE REVISED AS NECESSARY TO ACCOMMODATE TREE PROTECTION AND HAND DIGGING MAY BE REQUIRED FOR DRAINAGE INSTALLATION.
10. UNLESS NOTED OTHERWISE, PIPES TO BE:
    FOUL PIPES UNDER BUILDING ø100@1:40,
    FOUL PIPES EXTERNAL ø100@1:80,
    SURFACE WATER PIPES ø150@1:100

Notes.



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|---|---|---|---|---|

JOMAS ENGINEERING ENVIRONMENTAL
Jomas Associates Ltd.
Unit 24 Sarum Complex,
Salisbury Road,
Uxbridge, UB8 2RZ

Project
20 WATFORD RD, RADLETT

Drawing
Proposed Drainage Plan
INFILTRATION

| Dwg no | Checked | Surveyor |
|---|---|---|
| C05 | AW | - |
| Date 23.05.23 | Scale 1:100 @ A1 | |
| Job No. P4735J2775 | | Rev. - |
| Grid | Contours | Level Datum |

## Design Settings

| | | | |
|---|---|---|---|
| Rainfall Methodology | FEH-13 | Minimum Velocity (m/s) | 1.00 |
| Return Period (years) | 10 | Connection Type | Level Soffits |
| Additional Flow (%) | 0 | Minimum Backdrop Height (m) | 0.200 |
| CV | 0.750 | Preferred Cover Depth (m) | 0.600 |
| Time of Entry (mins) | 2.00 | Include Intermediate Ground | x |
| Maximum Time of Concentration (mins) | 30.00 | Enforce best practice design rules | x |
| 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 |

## Circular Link Type

| | | | |
|---|---|---|---|
| Shape | Circular | Auto Increment (mm) | 75 |
| Barrels | 1 | Follow Ground | x |

**Available Diameters (mm)**

| | |
|---|---|
| 100 | 150 |

## Nodes

| Name | Area (ha) | T of E (mins) | Cover Level (m) | Diameter (mm) | Easting (m) | Northing (m) | Depth (m) |
|---|---|---|---|---|---|---|---|
| 1 | | | 102.700 | 1200 | 100.000 | 100.000 | 0.300 |
| 2 | | | 102.700 | 450 | 98.000 | 105.000 | 0.300 |
| 3 | 0.040 | 2.00 | 102.600 | 1200 | 97.000 | 108.000 | 1.900 |
| 4 | 0.040 | 2.00 | 102.000 | 450 | 80.000 | 113.000 | 1.100 |
| 5 | 0.020 | 2.00 | 102.000 | 450 | 75.000 | 125.000 | 0.750 |
| 6 | 0.010 | 2.00 | 98.533 | 1200 | 75.000 | 140.000 | 1.533 |
| 7 | 0.030 | 2.00 | 102.000 | 450 | 99.000 | 110.000 | 1.200 |
| 8 | 0.030 | 2.00 | 102.000 | 450 | 102.000 | 125.000 | 1.000 |
| 9 | 0.000 | | 98.800 | 450 | 95.000 | 160.000 | 0.850 |
| 10 | 0.050 | 2.00 | 98.800 | 450 | 95.000 | 150.000 | 0.750 |

## 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) |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1.004 | 2 | 1 | 5.385 | 0.600 | 102.500 | 102.400 | 0.100 | 53.9 | 100 | 2.70 | 50.0 |
| 1.003 | 3 | 2 | 3.162 | 0.600 | 100.700 | 102.400 | -1.700 | -1.9 | 225 | 2.62 | 50.0 |
| 1.002 | 4 | 3 | 17.720 | 0.600 | 100.900 | 100.700 | 0.200 | 88.6 | 225 | 2.56 | 50.0 |
| 1.001 | 5 | 4 | 13.000 | 0.600 | 101.250 | 100.900 | 0.350 | 37.1 | 225 | 2.35 | 50.0 |
| 1.000 | 6 | 5 | 15.000 | 0.600 | 97.000 | 101.450 | -4.450 | -3.4 | 150 | 2.25 | 50.0 |
| 2.001 | 7 | 3 | 2.828 | 0.600 | 100.800 | 100.700 | 0.100 | 28.3 | 150 | 2.25 | 50.0 |
| 2.000 | 8 | 7 | 15.297 | 0.600 | 101.000 | 100.800 | 0.200 | 76.5 | 150 | 2.22 | 50.0 |
| 3.000 | 10 | 9 | 10.000 | 0.600 | 98.050 | 97.950 | 0.100 | 100.0 | 150 | 2.17 | 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) |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1.004 | 1.052 | 8.3 | 23.0 | 0.100 | 0.200 | 0.170 | 0.0 | 100 | 1.080 |
| 1.003 | 1.000 | 39.8 | 23.0 | 1.675 | 0.075 | 0.170 | 0.0 | 225 | 0.000 |
| 1.002 | 1.389 | 55.2 | 9.5 | 0.875 | 1.675 | 0.070 | 0.0 | 63 | 1.044 |
| 1.001 | 2.153 | 85.6 | 4.1 | 0.525 | 0.875 | 0.030 | 0.0 | 33 | 1.110 |
| 1.000 | 1.000 | 17.7 | 1.4 | 1.383 | 0.400 | 0.010 | 0.0 | 150 | 0.000 |
| 2.001 | 1.900 | 33.6 | 8.1 | 1.050 | 1.750 | 0.060 | 0.0 | 50 | 1.568 |
| 2.000 | 1.150 | 20.3 | 4.1 | 0.850 | 1.050 | 0.030 | 0.0 | 45 | 0.900 |
| 3.000 | 1.005 | 17.8 | 6.8 | 0.600 | 0.700 | 0.050 | 0.0 | 64 | 0.937 |

## Pipeline Schedule

| Link | Length (m) | Slope (1:X) | Dia (mm) | Link Type | US CL (m) | US IL (m) | US Depth (m) | DS CL (m) | DS IL (m) | DS Depth (m) |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1.004 | 5.385 | 53.9 | 100 | Circular | 102.700 | 102.500 | 0.100 | 102.700 | 102.400 | 0.200 |
| 1.003 | 3.162 | -1.9 | 225 | Circular | 102.600 | 100.700 | 1.675 | 102.700 | 102.400 | 0.075 |
| 1.002 | 17.720 | 88.6 | 225 | Circular | 102.000 | 100.900 | 0.875 | 102.600 | 100.700 | 1.675 |
| 1.001 | 13.000 | 37.1 | 225 | Circular | 102.000 | 101.250 | 0.525 | 102.000 | 100.900 | 0.875 |
| 1.000 | 15.000 | -3.4 | 150 | Circular | 98.533 | 97.000 | 1.383 | 102.000 | 101.450 | 0.400 |
| 2.001 | 2.828 | 28.3 | 150 | Circular | 102.000 | 100.800 | 1.050 | 102.600 | 100.700 | 1.750 |
| 2.000 | 15.297 | 76.5 | 150 | Circular | 102.000 | 101.000 | 0.850 | 102.000 | 100.800 | 1.050 |
| 3.000 | 10.000 | 100.0 | 150 | Circular | 98.800 | 98.050 | 0.600 | 98.800 | 97.950 | 0.700 |

| Link | US Node | Dia (mm) | Node Type | MH Type | DS Node | Dia (mm) | Node Type | MH Type |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1.004 | 2 | 450 | Manhole | Adoptable | 1 | 1200 | Manhole | Adoptable |
| 1.003 | 3 | 1200 | Manhole | Adoptable | 2 | 450 | Manhole | Adoptable |
| 1.002 | 4 | 450 | Manhole | Adoptable | 3 | 1200 | Manhole | Adoptable |
| 1.001 | 5 | 450 | Manhole | Adoptable | 4 | 450 | Manhole | Adoptable |
| 1.000 | 6 | 1200 | Manhole | Adoptable | 5 | 450 | Manhole | Adoptable |
| 2.001 | 7 | 450 | Manhole | Adoptable | 3 | 1200 | Manhole | Adoptable |
| 2.000 | 8 | 450 | Manhole | Adoptable | 7 | 450 | Manhole | Adoptable |
| 3.000 | 10 | 450 | Manhole | Adoptable | 9 | 450 | Manhole | Adoptable |

## Manhole Schedule

| Node | Easting (m) | Northing (m) | CL (m) | Depth (m) | Dia (mm) | Connections | Link | IL (m) | Dia (mm) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 100.000 | 100.000 | 102.700 | 0.300 | 1200 | 1 | 1.004 | 102.400 | 100 |
| 2 | 98.000 | 105.000 | 102.700 | 0.300 | 450 | 1 | 1.003 | 102.400 | 225 |
| | | | | | | 0 | 1.004 | 102.500 | 100 |
| 3 | 97.000 | 108.000 | 102.600 | 1.900 | 1200 | 1 | 2.001 | 100.700 | 150 |
| | | | | | | 2 | 1.002 | 100.700 | 225 |
| | | | | | | 0 | 1.003 | 100.700 | 225 |
| 4 | 80.000 | 113.000 | 102.000 | 1.100 | 450 | 1 | 1.001 | 100.900 | 225 |
| | | | | | | 0 | 1.002 | 100.900 | 225 |
| 5 | 75.000 | 125.000 | 102.000 | 0.750 | 450 | 1 | 1.000 | 101.450 | 150 |
| | | | | | | 0 | 1.001 | 101.250 | 225 |
| 6 | 75.000 | 140.000 | 98.533 | 1.533 | 1200 | 0 | 1.000 | 97.000 | 150 |
| 7 | 99.000 | 110.000 | 102.000 | 1.200 | 450 | 1 | 2.000 | 100.800 | 150 |
| | | | | | | 0 | 2.001 | 100.800 | 150 |
| 8 | 102.000 | 125.000 | 102.000 | 1.000 | 450 | 0 | 2.000 | 101.000 | 150 |
| 9 | 95.000 | 160.000 | 98.800 | 0.850 | 450 | 1 | 3.000 | 97.950 | 150 |
| 10 | 95.000 | 150.000 | 98.800 | 0.750 | 450 | 0 | 3.000 | 98.050 | 150 |

## Simulation Settings

| | | | |
|---|---|---|---|
| Rainfall Methodology | FSR | Analysis Speed | Normal |
| FSR Region | England and Wales | Skip Steady State | x |
| M5-60 (mm) | 19.000 | Drain Down Time (mins) | 240 |
| Ratio-R | 0.400 | Additional Storage (m³/ha) | 0.0 |
| Summer CV | 0.750 | Check Discharge Rate(s) | x |
| Winter CV | 0.840 | Check Discharge Volume | x |

**Storm Durations**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 15 | 60 | 180 | 360 | 600 | 960 | 2160 | 4320 | 7200 | 10080 |
| 30 | 120 | 240 | 480 | 720 | 1440 | 2880 | 5760 | 8640 | |

| Return Period (years) | Climate Change (CC %) | Additional Area (A %) | Additional Flow (Q %) |
|---|---|---|---|
| 1 | 0 | 0 | 0 |
| 10 | 0 | 0 | 0 |
| 30 | 0 | 0 | 0 |
| 100 | 0 | 0 | 0 |
| 100 | 40 | 0 | 0 |

**Node 6 Online Depth/Flow Control**

| | | | | | |
|---|---|---|---|---|---|
| Flap Valve | x | Replaces Downstream Link | ✓ | Invert Level (m) | 97.000 |

| Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) |
|---|---|---|---|
| 0.001 | 50.000 | 5.000 | 50.000 |

**Node 3 Depth/Area Storage Structure**

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 1.80000 | Safety Factor | 1.5 | Invert Level (m) | 100.800 |
| Side Inf Coefficient (m/hr) | 1.80000 | Porosity | 0.30 | Time to half empty (mins) | 0 |

| Depth (m) | Area (m²) | Inf Area (m²) | Depth (m) | Area (m²) | Inf Area (m²) | Depth (m) | Area (m²) | Inf Area (m²) |
|---|---|---|---|---|---|---|---|---|
| 0.000 | 130.0 | 130.0 | 1.300 | 130.0 | 130.0 | 1.301 | 1.0 | 130.0 |

**Node 9 Depth/Area Storage Structure**

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 1.80000 | Safety Factor | 2.0 | Invert Level (m) | 97.800 |
| Side Inf Coefficient (m/hr) | 1.80000 | Porosity | 1.00 | Time to half empty (mins) | 23 |

| Depth (m) | Area (m²) | Inf Area (m²) | Depth (m) | Area (m²) | Inf Area (m²) | Depth (m) | Area (m²) | Inf Area (m²) |
|---|---|---|---|---|---|---|---|---|
| 0.000 | 20.0 | 20.0 | 0.600 | 20.0 | 20.0 | 0.601 | 1.0 | 20.0 |

**Other (defaults)**

| | | | | | |
|---|---|---|---|---|---|
| Entry Loss (manhole) | 0.250 | Entry Loss (junction) | 0.000 | Apply Recommended Losses | x |
| Exit Loss (manhole) | 0.250 | Exit Loss (junction) | 0.000 | Flood Risk (m) | 0.300 |

**Rainfall**

| Event | Peak Intensity (mm/hr) | Average Intensity (mm/hr) |
|---|---|---|
| 1 year 15 minute summer | 103.832 | 29.381 |
| 1 year 15 minute winter | 72.865 | 29.381 |
| 1 year 30 minute summer | 67.515 | 19.105 |
| 1 year 30 minute winter | 47.379 | 19.105 |
| 1 year 60 minute summer | 45.726 | 12.084 |
| 1 year 60 minute winter | 30.379 | 12.084 |
| 1 year 120 minute summer | 28.340 | 7.489 |
| 1 year 120 minute winter | 18.828 | 7.489 |
| 1 year 180 minute summer | 21.894 | 5.634 |
| 1 year 180 minute winter | 14.231 | 5.634 |
| 1 year 240 minute summer | 17.401 | 4.599 |
| 1 year 240 minute winter | 11.561 | 4.599 |
| 1 year 360 minute summer | 13.397 | 3.448 |

**Rainfall**

| Event | Peak Intensity (mm/hr) | Average Intensity (mm/hr) |
|---|---|---|
| 1 year 360 minute winter | 8.709 | 3.448 |
| 1 year 480 minute summer | 10.573 | 2.794 |
| 1 year 480 minute winter | 7.024 | 2.794 |
| 1 year 600 minute summer | 8.677 | 2.373 |
| 1 year 600 minute winter | 5.929 | 2.373 |
| 1 year 720 minute summer | 7.750 | 2.077 |
| 1 year 720 minute winter | 5.209 | 2.077 |
| 1 year 960 minute summer | 6.393 | 1.683 |
| 1 year 960 minute winter | 4.235 | 1.683 |
| 1 year 1440 minute summer | 4.671 | 1.252 |
| 1 year 1440 minute winter | 3.140 | 1.252 |
| 1 year 2160 minute summer | 3.372 | 0.932 |
| 1 year 2160 minute winter | 2.323 | 0.932 |
| 1 year 2880 minute summer | 2.820 | 0.756 |
| 1 year 2880 minute winter | 1.895 | 0.756 |
| 1 year 4320 minute summer | 2.149 | 0.562 |
| 1 year 4320 minute winter | 1.415 | 0.562 |
| 1 year 5760 minute summer | 1.779 | 0.455 |
| 1 year 5760 minute winter | 1.151 | 0.455 |
| 1 year 7200 minute summer | 1.517 | 0.387 |
| 1 year 7200 minute winter | 0.979 | 0.387 |
| 1 year 8640 minute summer | 1.329 | 0.339 |
| 1 year 8640 minute winter | 0.858 | 0.339 |
| 1 year 10080 minute summer | 1.188 | 0.303 |
| 1 year 10080 minute winter | 0.767 | 0.303 |
| 10 year 15 minute summer | 200.971 | 56.868 |
| 10 year 15 minute winter | 141.032 | 56.868 |
| 10 year 30 minute summer | 129.855 | 36.744 |
| 10 year 30 minute winter | 91.126 | 36.744 |
| 10 year 60 minute summer | 86.243 | 22.792 |
| 10 year 60 minute winter | 57.298 | 22.792 |
| 10 year 120 minute summer | 52.179 | 13.789 |
| 10 year 120 minute winter | 34.667 | 13.789 |
| 10 year 180 minute summer | 39.634 | 10.199 |
| 10 year 180 minute winter | 25.763 | 10.199 |
| 10 year 240 minute summer | 31.075 | 8.212 |
| 10 year 240 minute winter | 20.646 | 8.212 |
| 10 year 360 minute summer | 23.443 | 6.033 |
| 10 year 360 minute winter | 15.239 | 6.033 |
| 10 year 480 minute summer | 18.333 | 4.845 |
| 10 year 480 minute winter | 12.180 | 4.845 |
| 10 year 600 minute summer | 14.935 | 4.085 |
| 10 year 600 minute winter | 10.205 | 4.085 |
| 10 year 720 minute summer | 13.257 | 3.553 |
| 10 year 720 minute winter | 8.909 | 3.553 |
| 10 year 960 minute summer | 10.821 | 2.849 |
| 10 year 960 minute winter | 7.168 | 2.849 |
| 10 year 1440 minute summer | 7.784 | 2.086 |
| 10 year 1440 minute winter | 5.231 | 2.086 |
| 10 year 2160 minute summer | 5.523 | 1.526 |
| 10 year 2160 minute winter | 3.806 | 1.526 |
| 10 year 2880 minute summer | 4.561 | 1.223 |

**Rainfall**

| Event | Peak Intensity (mm/hr) | Average Intensity (mm/hr) |
|---|---|---|
| 10 year 2880 minute winter | 3.066 | 1.223 |
| 10 year 4320 minute summer | 3.418 | 0.894 |
| 10 year 4320 minute winter | 2.251 | 0.894 |
| 10 year 5760 minute summer | 2.794 | 0.715 |
| 10 year 5760 minute winter | 1.808 | 0.715 |
| 10 year 7200 minute summer | 2.359 | 0.602 |
| 10 year 7200 minute winter | 1.522 | 0.602 |
| 10 year 8640 minute summer | 2.048 | 0.522 |
| 10 year 8640 minute winter | 1.322 | 0.522 |
| 10 year 10080 minute summer | 1.817 | 0.463 |
| 10 year 10080 minute winter | 1.173 | 0.463 |
| 30 year 15 minute summer | 254.498 | 72.014 |
| 30 year 15 minute winter | 178.595 | 72.014 |
| 30 year 30 minute summer | 165.775 | 46.909 |
| 30 year 30 minute winter | 116.334 | 46.909 |
| 30 year 60 minute summer | 110.635 | 29.238 |
| 30 year 60 minute winter | 73.503 | 29.238 |
| 30 year 120 minute summer | 66.994 | 17.704 |
| 30 year 120 minute winter | 44.509 | 17.704 |
| 30 year 180 minute summer | 50.789 | 13.070 |
| 30 year 180 minute winter | 33.014 | 13.070 |
| 30 year 240 minute summer | 39.713 | 10.495 |
| 30 year 240 minute winter | 26.384 | 10.495 |
| 30 year 360 minute summer | 29.789 | 7.666 |
| 30 year 360 minute winter | 19.364 | 7.666 |
| 30 year 480 minute summer | 23.214 | 6.135 |
| 30 year 480 minute winter | 15.423 | 6.135 |
| 30 year 600 minute summer | 18.859 | 5.158 |
| 30 year 600 minute winter | 12.885 | 5.158 |
| 30 year 720 minute summer | 16.698 | 4.475 |
| 30 year 720 minute winter | 11.222 | 4.475 |
| 30 year 960 minute summer | 13.576 | 3.575 |
| 30 year 960 minute winter | 8.993 | 3.575 |
| 30 year 1440 minute summer | 9.708 | 2.602 |
| 30 year 1440 minute winter | 6.524 | 2.602 |
| 30 year 2160 minute summer | 6.844 | 1.892 |
| 30 year 2160 minute winter | 4.716 | 1.892 |
| 30 year 2880 minute summer | 5.625 | 1.508 |
| 30 year 2880 minute winter | 3.780 | 1.508 |
| 30 year 4320 minute summer | 4.184 | 1.094 |
| 30 year 4320 minute winter | 2.755 | 1.094 |
| 30 year 5760 minute summer | 3.402 | 0.871 |
| 30 year 5760 minute winter | 2.202 | 0.871 |
| 30 year 7200 minute summer | 2.859 | 0.729 |
| 30 year 7200 minute winter | 1.845 | 0.729 |
| 30 year 8640 minute summer | 2.473 | 0.631 |
| 30 year 8640 minute winter | 1.596 | 0.631 |
| 30 year 10080 minute summer | 2.187 | 0.558 |
| 30 year 10080 minute winter | 1.411 | 0.558 |
| 100 year 15 minute summer | 329.664 | 93.284 |
| 100 year 15 minute winter | 231.343 | 93.284 |
| 100 year 30 minute summer | 216.648 | 61.304 |

**Rainfall**

| Event | Peak Intensity (mm/hr) | Average Intensity (mm/hr) |
|---|---|---|
| 100 year 30 minute winter | 152.034 | 61.304 |
| 100 year 60 minute summer | 145.356 | 38.413 |
| 100 year 60 minute winter | 96.571 | 38.413 |
| 100 year 120 minute summer | 88.100 | 23.282 |
| 100 year 120 minute winter | 58.532 | 23.282 |
| 100 year 180 minute summer | 66.650 | 17.151 |
| 100 year 180 minute winter | 43.325 | 17.151 |
| 100 year 240 minute summer | 51.959 | 13.731 |
| 100 year 240 minute winter | 34.521 | 13.731 |
| 100 year 360 minute summer | 38.732 | 9.967 |
| 100 year 360 minute winter | 25.177 | 9.967 |
| 100 year 480 minute summer | 30.068 | 7.946 |
| 100 year 480 minute winter | 19.977 | 7.946 |
| 100 year 600 minute summer | 24.351 | 6.660 |
| 100 year 600 minute winter | 16.638 | 6.660 |
| 100 year 720 minute summer | 21.505 | 5.763 |
| 100 year 720 minute winter | 14.452 | 5.763 |
| 100 year 960 minute summer | 17.408 | 4.584 |
| 100 year 960 minute winter | 11.531 | 4.584 |
| 100 year 1440 minute summer | 12.367 | 3.314 |
| 100 year 1440 minute winter | 8.311 | 3.314 |
| 100 year 2160 minute summer | 8.657 | 2.393 |
| 100 year 2160 minute winter | 5.965 | 2.393 |
| 100 year 2880 minute summer | 7.077 | 1.897 |
| 100 year 2880 minute winter | 4.756 | 1.897 |
| 100 year 4320 minute summer | 5.223 | 1.365 |
| 100 year 4320 minute winter | 3.439 | 1.365 |
| 100 year 5760 minute summer | 4.221 | 1.080 |
| 100 year 5760 minute winter | 2.732 | 1.080 |
| 100 year 7200 minute summer | 3.530 | 0.900 |
| 100 year 7200 minute winter | 2.278 | 0.900 |
| 100 year 8640 minute summer | 3.041 | 0.776 |
| 100 year 8640 minute winter | 1.962 | 0.776 |
| 100 year 10080 minute summer | 2.680 | 0.684 |
| 100 year 10080 minute winter | 1.729 | 0.684 |
| 100 year +40% CC 15 minute summer | 461.530 | 130.597 |
| 100 year +40% CC 15 minute winter | 323.881 | 130.597 |
| 100 year +40% CC 30 minute summer | 303.307 | 85.825 |
| 100 year +40% CC 30 minute winter | 212.847 | 85.825 |
| 100 year +40% CC 60 minute summer | 203.498 | 53.779 |
| 100 year +40% CC 60 minute winter | 135.199 | 53.779 |
| 100 year +40% CC 120 minute summer | 123.340 | 32.595 |
| 100 year +40% CC 120 minute winter | 81.944 | 32.595 |
| 100 year +40% CC 180 minute summer | 93.311 | 24.012 |
| 100 year +40% CC 180 minute winter | 60.654 | 24.012 |
| 100 year +40% CC 240 minute summer | 72.743 | 19.224 |
| 100 year +40% CC 240 minute winter | 48.329 | 19.224 |
| 100 year +40% CC 360 minute summer | 54.225 | 13.954 |
| 100 year +40% CC 360 minute winter | 35.248 | 13.954 |
| 100 year +40% CC 480 minute summer | 42.096 | 11.125 |
| 100 year +40% CC 480 minute winter | 27.967 | 11.125 |
| 100 year +40% CC 600 minute summer | 34.091 | 9.325 |

**Rainfall**

| Event | Peak Intensity (mm/hr) | Average Intensity (mm/hr) |
|---|---|---|
| 100 year +40% CC 600 minute winter | 23.293 | 9.325 |
| 100 year +40% CC 720 minute summer | 30.106 | 8.069 |
| 100 year +40% CC 720 minute winter | 20.233 | 8.069 |
| 100 year +40% CC 960 minute summer | 24.371 | 6.417 |
| 100 year +40% CC 960 minute winter | 16.144 | 6.417 |
| 100 year +40% CC 1440 minute summer | 17.314 | 4.640 |
| 100 year +40% CC 1440 minute winter | 11.636 | 4.640 |
| 100 year +40% CC 2160 minute summer | 12.120 | 3.350 |
| 100 year +40% CC 2160 minute winter | 8.351 | 3.350 |
| 100 year +40% CC 2880 minute summer | 9.908 | 2.656 |
| 100 year +40% CC 2880 minute winter | 6.659 | 2.656 |
| 100 year +40% CC 4320 minute summer | 7.312 | 1.912 |
| 100 year +40% CC 4320 minute winter | 4.815 | 1.912 |
| 100 year +40% CC 5760 minute summer | 5.909 | 1.513 |
| 100 year +40% CC 5760 minute winter | 3.824 | 1.513 |
| 100 year +40% CC 7200 minute summer | 4.942 | 1.261 |
| 100 year +40% CC 7200 minute winter | 3.189 | 1.261 |
| 100 year +40% CC 8640 minute summer | 4.257 | 1.086 |
| 100 year +40% CC 8640 minute winter | 2.747 | 1.086 |
| 100 year +40% CC 10080 minute summer | 3.751 | 0.957 |
| 100 year +40% CC 10080 minute winter | 2.421 | 0.957 |

**Results for 1 year Critical Storm Duration. Lowest mass balance: 99.65%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 15 minute summer | 1 | 1 | 102.400 | 0.000 | 0.0 | 0.0000 | 0.0000 | OK |
| 15 minute summer | 2 | 1 | 102.400 | 0.000 | 0.0 | 0.0000 | 0.0000 | OK |
| 15 minute summer | 3 | 9 | 100.831 | 0.131 | 30.3 | 1.3658 | 0.0000 | OK |
| 15 minute summer | 4 | 9 | 100.973 | 0.072 | 12.5 | 0.0115 | 0.0000 | OK |
| 15 minute summer | 5 | 9 | 101.288 | 0.038 | 6.0 | 0.0061 | 0.0000 | OK |
| 15 minute summer | 6 | 9 | 97.001 | 0.001 | 1.8 | 0.0011 | 0.0000 | OK |
| 15 minute summer | 7 | 9 | 100.872 | 0.072 | 10.6 | 0.0114 | 0.0000 | OK |
| 15 minute summer | 8 | 9 | 101.052 | 0.052 | 5.3 | 0.0083 | 0.0000 | OK |
| 15 minute winter | 9 | 11 | 97.856 | -0.094 | 7.9 | 1.1105 | 0.0000 | OK |
| 15 minute summer | 10 | 9 | 98.130 | 0.080 | 8.9 | 0.0128 | 0.0000 | OK |

| Link Event (Upstream Depth) | US Node | Link | DS Node | Outflow (l/s) | Velocity (m/s) | Flow/Cap | Link Vol (m³) | Discharge Vol (m³) |
|---|---|---|---|---|---|---|---|---|
| 15 minute summer | 2 | 1.004 | 1 | 0.0 | 0.000 | 0.000 | 0.0000 | 0.0 |
| 15 minute summer | 3 | 1.003 | 2 | 0.0 | 0.000 | 0.000 | 0.0378 | |
| 15 minute summer | 3 | Infiltration | | 26.6 | | | | |
| 15 minute summer | 4 | 1.002 | 3 | 12.5 | 0.722 | 0.227 | 0.3096 | |
| 15 minute summer | 5 | 1.001 | 4 | 5.4 | 0.728 | 0.063 | 0.1006 | |
| 15 minute summer | 6 | Depth/Flow | 5 | 2.4 | | | | |
| 15 minute summer | 7 | 2.001 | 3 | 10.6 | 0.841 | 0.317 | 0.0348 | |
| 15 minute summer | 8 | 2.000 | 7 | 5.3 | 0.787 | 0.261 | 0.1054 | |
| 15 minute winter | 9 | Infiltration | | 5.0 | | | | |
| 15 minute summer | 10 | 3.000 | 9 | 8.9 | 0.968 | 0.501 | 0.0919 | |

**Results for 10 year Critical Storm Duration. Lowest mass balance: 99.65%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 15 minute summer | 1 | 1 | 102.400 | 0.000 | 0.0 | 0.0000 | 0.0000 | OK |
| 15 minute summer | 2 | 1 | 102.400 | 0.000 | 0.0 | 0.0000 | 0.0000 | OK |
| 15 minute summer | 3 | 10 | 100.875 | 0.175 | 58.8 | 3.1279 | 0.0000 | OK |
| 15 minute summer | 4 | 9 | 101.009 | 0.109 | 24.2 | 0.0173 | 0.0000 | OK |
| 15 minute summer | 5 | 9 | 101.303 | 0.053 | 11.4 | 0.0084 | 0.0000 | OK |
| 15 minute winter | 6 | 9 | 97.001 | 0.001 | 3.1 | 0.0014 | 0.0000 | OK |
| 15 minute summer | 7 | 9 | 100.924 | 0.124 | 20.6 | 0.0197 | 0.0000 | OK |
| 15 minute summer | 8 | 9 | 101.075 | 0.075 | 10.3 | 0.0120 | 0.0000 | OK |
| 15 minute winter | 9 | 12 | 97.954 | 0.004 | 15.3 | 3.0710 | 0.0000 | OK |
| 15 minute summer | 10 | 9 | 98.185 | 0.135 | 17.2 | 0.0215 | 0.0000 | OK |

| Link Event (Upstream Depth) | US Node | Link | DS Node | Outflow (l/s) | Velocity (m/s) | Flow/Cap | Link Vol (m³) | Discharge Vol (m³) |
|---|---|---|---|---|---|---|---|---|
| 15 minute summer | 2 | 1.004 | 1 | 0.0 | 0.000 | 0.000 | 0.0000 | 0.0 |
| 15 minute summer | 3 | 1.003 | 2 | 0.0 | 0.000 | 0.000 | 0.0523 | |
| 15 minute summer | 3 | Infiltration | | 43.3 | | | | |
| 15 minute summer | 4 | 1.002 | 3 | 24.6 | 0.976 | 0.446 | 0.4440 | |
| 15 minute summer | 5 | 1.001 | 4 | 10.4 | 0.819 | 0.121 | 0.1689 | |
| 15 minute winter | 6 | Depth/Flow | 5 | 3.9 | | | | |
| 15 minute summer | 7 | 2.001 | 3 | 20.4 | 1.173 | 0.608 | 0.0469 | |
| 15 minute summer | 8 | 2.000 | 7 | 10.3 | 0.837 | 0.507 | 0.1869 | |
| 15 minute winter | 9 | Infiltration | | 5.0 | | | | |
| 15 minute summer | 10 | 3.000 | 9 | 17.1 | 1.073 | 0.965 | 0.1591 | |

**Results for 30 year Critical Storm Duration. Lowest mass balance: 99.65%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 15 minute summer | 1 | 1 | 102.400 | 0.000 | 0.0 | 0.0000 | 0.0000 | OK |
| 15 minute summer | 2 | 1 | 102.400 | 0.000 | 0.0 | 0.0000 | 0.0000 | OK |
| 15 minute summer | 3 | 10 | 100.925 | 0.225 | 73.5 | 5.1327 | 0.0000 | OK |
| 15 minute summer | 4 | 9 | 101.025 | 0.125 | 30.5 | 0.0199 | 0.0000 | OK |
| 15 minute summer | 5 | 9 | 101.309 | 0.059 | 13.3 | 0.0094 | 0.0000 | OK |
| 15 minute winter | 6 | 7 | 97.001 | 0.001 | 3.9 | 0.0014 | 0.0000 | OK |
| 15 minute summer | 7 | 9 | 101.007 | 0.207 | 25.8 | 0.0329 | 0.0000 | SURCHARGED |
| 15 minute summer | 8 | 9 | 101.090 | 0.090 | 13.1 | 0.0143 | 0.0000 | OK |
| 15 minute winter | 9 | 13 | 98.016 | 0.066 | 19.3 | 4.3361 | 0.0000 | OK |
| 15 minute summer | 10 | 9 | 98.271 | 0.221 | 21.8 | 0.0351 | 0.0000 | SURCHARGED |

| Link Event (Upstream Depth) | US Node | Link | DS Node | Outflow (l/s) | Velocity (m/s) | Flow/Cap | Link Vol (m³) | Discharge Vol (m³) |
|---|---|---|---|---|---|---|---|---|
| 15 minute summer | 2 | 1.004 | 1 | 0.0 | 0.000 | 0.000 | 0.0000 | 0.0 |
| 15 minute summer | 3 | 1.003 | 2 | 0.0 | 0.000 | 0.000 | 0.0628 | |
| 15 minute summer | 3 | Infiltration | | 43.3 | | | | |
| 15 minute summer | 4 | 1.002 | 3 | 31.3 | 1.055 | 0.566 | 0.5268 | |
| 15 minute summer | 5 | 1.001 | 4 | 13.1 | 0.856 | 0.153 | 0.2021 | |
| 15 minute winter | 6 | Depth/Flow | 5 | 4.1 | | | | |
| 15 minute summer | 7 | 2.001 | 3 | 24.9 | 1.417 | 0.743 | 0.0498 | |
| 15 minute summer | 8 | 2.000 | 7 | 12.7 | 0.880 | 0.625 | 0.2190 | |
| 15 minute winter | 9 | Infiltration | | 5.0 | | | | |
| 15 minute summer | 10 | 3.000 | 9 | 21.7 | 1.232 | 1.220 | 0.1706 | |

**Results for 100 year Critical Storm Duration. Lowest mass balance: 99.65%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 15 minute summer | 1 | 1 | 102.400 | 0.000 | 0.0 | 0.0000 | 0.0000 | OK |
| 15 minute summer | 2 | 1 | 102.400 | 0.000 | 0.0 | 0.0000 | 0.0000 | OK |
| 15 minute winter | 3 | 11 | 101.022 | 0.322 | 82.5 | 9.0333 | 0.0000 | SURCHARGED |
| 15 minute summer | 4 | 9 | 101.052 | 0.152 | 39.5 | 0.0241 | 0.0000 | OK |
| 15 minute summer | 5 | 9 | 101.318 | 0.068 | 17.4 | 0.0108 | 0.0000 | OK |
| 15 minute winter | 6 | 11 | 97.004 | 0.004 | 5.0 | 0.0041 | 0.0000 | OK |
| 15 minute summer | 7 | 9 | 101.114 | 0.314 | 31.9 | 0.0499 | 0.0000 | SURCHARGED |
| 15 minute summer | 8 | 9 | 101.254 | 0.254 | 16.9 | 0.0403 | 0.0000 | SURCHARGED |
| 30 minute winter | 9 | 23 | 98.118 | 0.168 | 17.3 | 6.3878 | 0.0000 | OK |
| 15 minute summer | 10 | 9 | 98.414 | 0.364 | 28.2 | 0.0578 | 0.0000 | SURCHARGED |

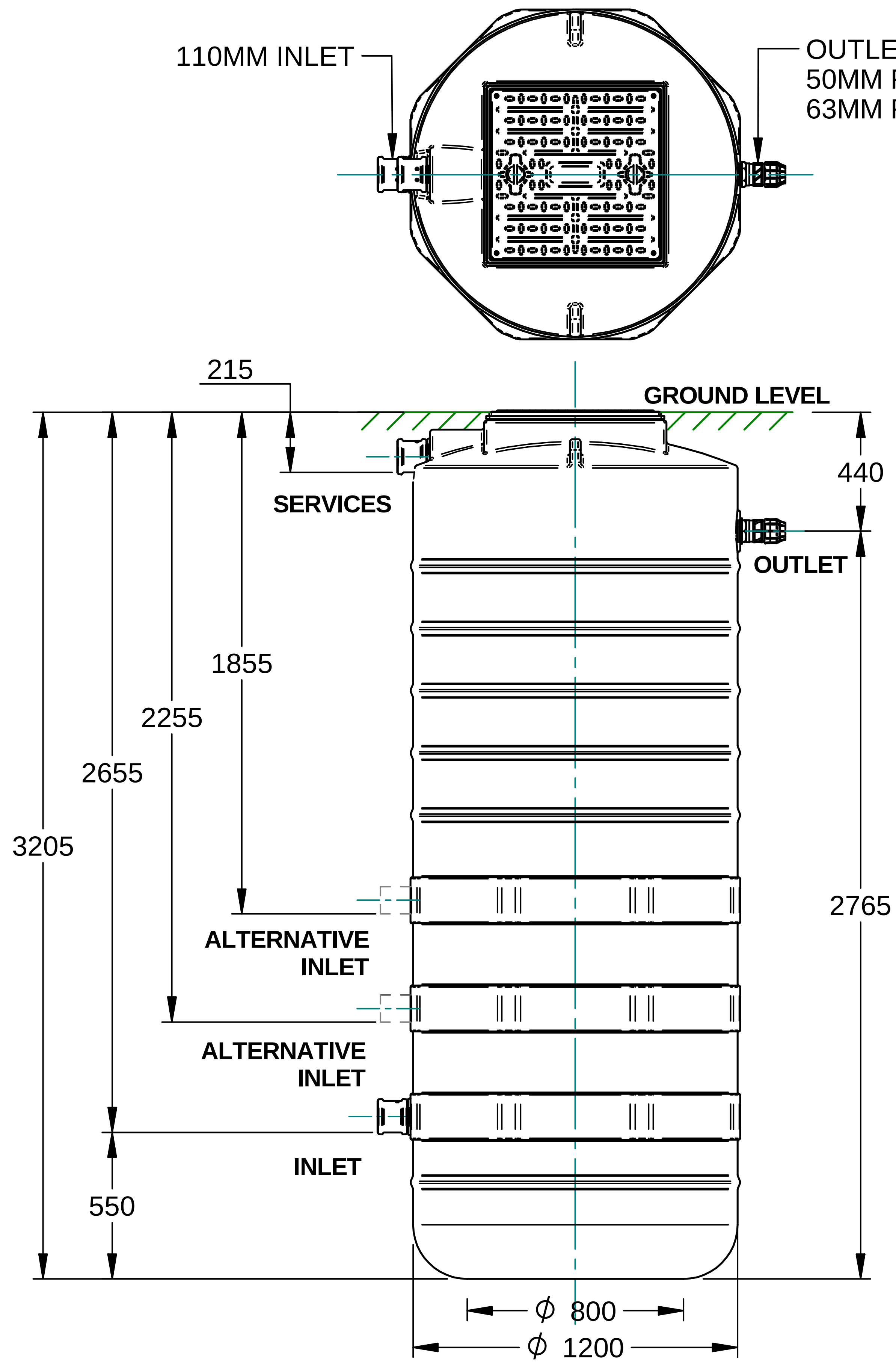
| Link Event (Upstream Depth) | US Node | Link | DS Node | Outflow (l/s) | Velocity (m/s) | Flow/Cap | Link Vol (m³) | Discharge Vol (m³) |
|---|---|---|---|---|---|---|---|---|
| 15 minute summer | 2 | 1.004 | 1 | 0.0 | 0.000 | 0.000 | 0.0000 | 0.0 |
| 15 minute winter | 3 | 1.003 | 2 | 0.0 | 0.000 | 0.000 | 0.0629 | |
| 15 minute winter | 3 | Infiltration | | 43.3 | | | | |
| 15 minute summer | 4 | 1.002 | 3 | 40.0 | 1.157 | 0.724 | 0.6053 | |
| 15 minute summer | 5 | 1.001 | 4 | 17.1 | 0.886 | 0.199 | 0.2508 | |
| 15 minute winter | 6 | Depth/Flow | 5 | 6.4 | | | | |
| 15 minute summer | 7 | 2.001 | 3 | 30.5 | 1.732 | 0.908 | 0.0498 | |
| 15 minute summer | 8 | 2.000 | 7 | 15.1 | 0.859 | 0.744 | 0.2693 | |
| 30 minute winter | 9 | Infiltration | | 5.0 | | | | |
| 15 minute summer | 10 | 3.000 | 9 | 28.0 | 1.591 | 1.577 | 0.1742 | |

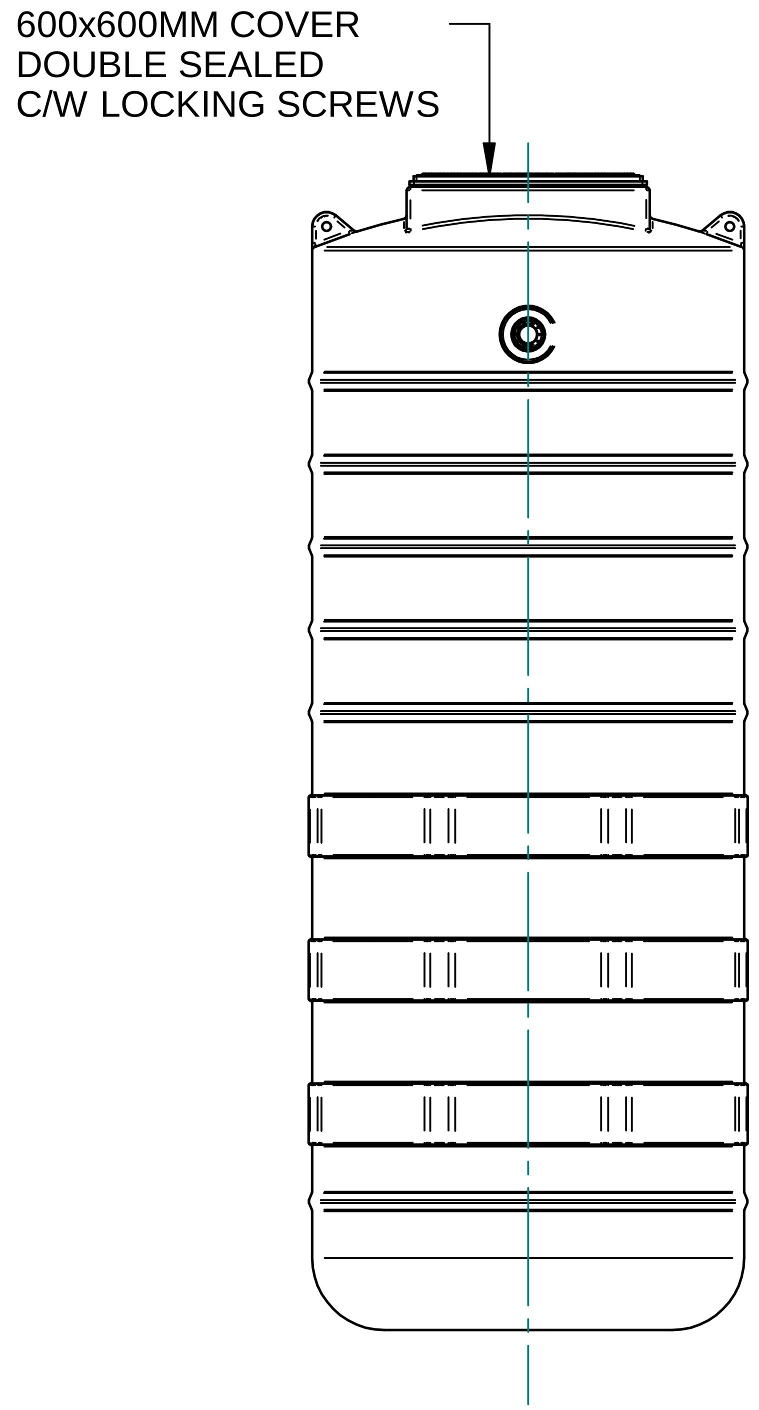
**Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.65%**

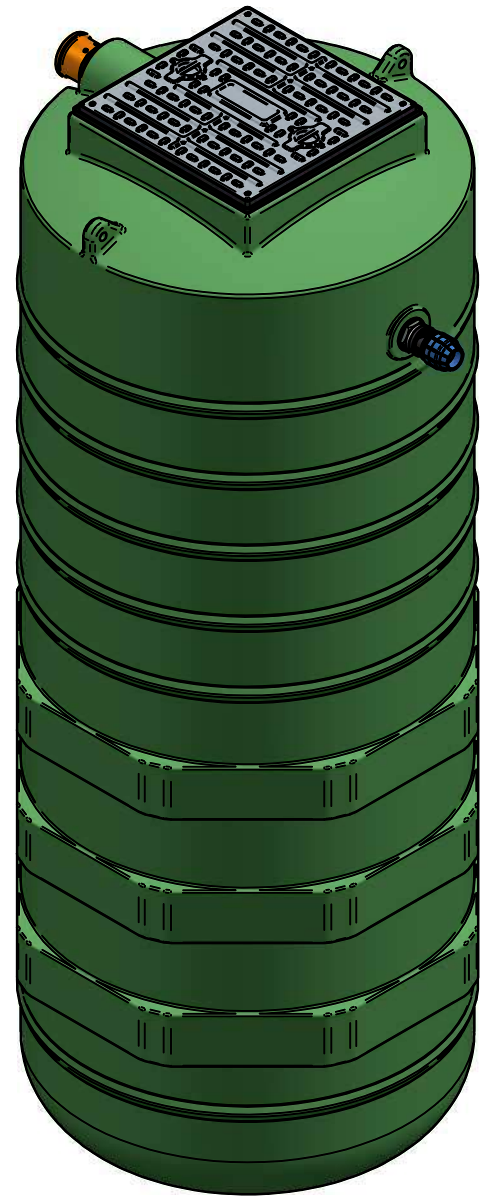
| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 15 minute summer | 1 | 1 | 102.400 | 0.000 | 0.0 | 0.0000 | 0.0000 | OK |
| 15 minute summer | 2 | 1 | 102.400 | 0.000 | 0.0 | 0.0000 | 0.0000 | OK |
| 15 minute winter | 3 | 12 | 101.232 | 0.532 | 112.7 | 17.4811 | 0.0000 | SURCHARGED |
| 15 minute winter | 4 | 10 | 101.277 | 0.376 | 50.5 | 0.0599 | 0.0000 | SURCHARGED |
| 15 minute summer | 5 | 9 | 101.331 | 0.081 | 24.1 | 0.0129 | 0.0000 | OK |
| 30 minute winter | 6 | 25 | 97.003 | 0.003 | 5.0 | 0.0030 | 0.0000 | OK |
| 15 minute winter | 7 | 10 | 101.367 | 0.566 | 39.9 | 0.0901 | 0.0000 | SURCHARGED |
| 15 minute summer | 8 | 9 | 101.612 | 0.612 | 23.6 | 0.0973 | 0.0000 | SURCHARGED |
| 30 minute winter | 9 | 25 | 98.315 | 0.365 | 24.4 | 10.3660 | 0.0000 | OK |
| 15 minute summer | 10 | 9 | 98.710 | 0.660 | 39.3 | 0.1050 | 0.0000 | FLOOD RISK |

| Link Event (Upstream Depth) | US Node | Link | DS Node | Outflow (l/s) | Velocity (m/s) | Flow/Cap | Link Vol (m³) | Discharge Vol (m³) |
|---|---|---|---|---|---|---|---|---|
| 15 minute summer | 2 | 1.004 | 1 | 0.0 | 0.000 | 0.000 | 0.0000 | 0.0 |
| 15 minute winter | 3 | 1.003 | 2 | 0.0 | 0.000 | 0.000 | 0.0629 | |
| 15 minute winter | 3 | Infiltration | | 43.3 | | | | |
| 15 minute winter | 4 | 1.002 | 3 | 46.6 | 1.173 | 0.844 | 0.7047 | |
| 15 minute summer | 5 | 1.001 | 4 | 23.9 | 0.892 | 0.280 | 0.3422 | |
| 30 minute winter | 6 | Depth/Flow | 5 | 8.1 | | | | |
| 15 minute winter | 7 | 2.001 | 3 | 38.0 | 2.159 | 1.132 | 0.0498 | |
| 15 minute summer | 8 | 2.000 | 7 | 20.5 | 1.166 | 1.010 | 0.2693 | |
| 30 minute winter | 9 | Infiltration | | 5.0 | | | | |
| 15 minute summer | 10 | 3.000 | 9 | 38.8 | 2.204 | 2.185 | 0.1760 | |

# Appendix D: SuDS Maintenance Report



**Available in single or twin pump configurations for rain water, effluent or sewage**

| Revision | Issue Date | ECN Reference |
|---|---|---|



UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MM
LINEAR TOLERANCE ± 0.25mm, ANGLES ±0.5°

DO NOT SCALE DRAWING - Use Figure Dimensions Only

IF IN DOUBT, ASK

TITLE: **3200LT Pump Station**

NOTES:

| | |
|---|---|
| DWG NO: 17-005-001 | ISSUE DATE: 01/09/2020 |
| REVISION: 00 | DRAWN BY: RC |
| SHEET: 1 of 1 | |
| FILE NAME: 3200LT Pump Station.dft | |

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# DRAINAGE MAINTENANCE PLAN

## 20 WATFORD ROAD, RADLETT

**JOMAS ASSOCIATES LTD**
Unit 24 Sarum Complex, Salisbury Road, Uxbridge, UB8 2RZ
www.jomasassociates.com info@jomasassociates.com

**Report Title:** DRAINAGE AND SUDS MAINTENANCE PLAN

**Report Status:** Final v1.0

**Job No:** P4735J2775

**Date:** 23 May 2023

**Control: Previous Release**

| Version | Date | Issued By |
|---|---|---|
| V1.0 | 23.05.23 | A Wallace |
| | | |
| | | |

**Prepared by: JOMAS ASSOCIATES LTD For Roundbush Services Limited**

**Should you have any queries relating to this report, please contact**

**JOMAS ASSOCIATES LTD**

**www.jomasassociates.com**

**info@jomasassociates.com**

# 1.0 GENERAL

**1.1** Sustainable Drainage Systems (SuDS) are an environmentally friendly approach to managing rainfall. SuDS techniques use landscape features to deal with surface water with the aim to:

1.1.1 Control the flow, volume and frequency of water leaving a development.

1.1.2 Prevent pollution by intercepting silt and cleaning runoff from hard surfaces.

1.1.3 Provide attractive surroundings for the community.

**1.2** The surface water drainage strategy for this development utilises permeable paving as the main SUDS feature along with a tank and a pond. The following sections provides a brief description of these features and outlines the maintenance programme that should be adopted.

# 2.0 CLEANING OF THE DRAINAGE SYSTEM

**2.1** Drainage systems should be inspected at regular intervals and where necessary, thoroughly cleaned out at the same time. Any defects discovered should be made good.

**2.2** The following operations should be carried out during the periodic cleaning of a drainage system:-

| Product Type | Period | Responsibility | Maintenance Methods |
|---|---|---|---|
| ***Silt Trap*** | As necessary and before wet season | Owner/ Maintenance Company | • Sediment and debris that accumulated during summer needs to be removed before the wet season.<br>• Inspect and clean out routinely prior to inlet pipework to minimise debris reaching the tank.<br>• Conduct inspections more frequently during the wet season for the area where sediment or trash accumulates more often. Clean and repair as needed. |
| ***Standard Manholes/ Inspection Chambers*** | As necessary | Owner/ Maintenance Company | • Remove and clean any soil and vegetation that covers the manhole cover to prevent blockage of the drainage system at the manhole. |

| Product Type | Period | Responsibility | Maintenance Methods |
|---|---|---|---|
| | | | • Renew/replace any damaged/missing bolts and damaged/missing manhole covers. |
| ***Drainage Pipes*** | Six monthly interval | Owner/ Maintenance Company | • Inspect underground drainage pipes to ensure that the distribution pipework arrangement is operational and free from blockages. If required, take remedial action. |
| ***Permeable Paving*** | As required | Owner/ Maintenance Company | • Inspect the paving after any precipitation to ensure no displacement of any organic matter onto the surface of the pavement. |
| | Six monthly (Ideally, this activity to be carried out in spring and autumn seasons) | Owner/ Maintenance Company | • Agitate (e.g. brush, vacuum, etc.) the block paving to ensure no vegetation of any sort is allowed to grow and develop in the joints (where may affect performance). |
| | Winter season | Owner/ Maintenance Company | • De-icing may be used without causing significant detrimental effects towards the permeable pavement's performance. When used carefully, the use of these chlorides will not result in an increase in the chloride levels in the local ground. |
| | Annually and after large storms | Owner/ Maintenance Company | • Inspection/check of all inlets to ensure that they are in good condition and operating as designed. |
| ***Pump*** | Monthly for 3 months | Owner/ Maintenance Company | • Inspect and identify any areas that are not operating correctly. If required, take remedial action. |
| | Monthly | Owner/ Maintenance Company | • Debris removal from catchment surface (where may cause risks to performance). |
| | Annually | Owner/ Maintenance Company | • Remove sediment from pre-treatment structures. |

| Product Type | Period | Responsibility | Maintenance Methods |
|---|---|---|---|
| | Annually and after large storms | Owner/ Maintenance Company | • Inspection/check all inlets and outlets to ensure that they are in good condition and operating as designed. |
| ***Pond*** | Monthly for 3 months | Owner/ Maintenance Company | • Inspect and identify any areas that are not operating correctly. If required, take remedial action. |
| | Monthly | Owner/ Maintenance Company | • Debris removal from catchment surface (where may cause risks to performance). |
| | Annually | Owner/ Maintenance Company | • Remove sediment from pre-treatment structures. |
| ***Attenuation Tank*** | Monthly for 3 months | Owner/ Maintenance Company | • Inspect and identify any areas that are not operating correctly. If required, take remedial action. |
| | Monthly | Owner/ Maintenance Company | • Debris removal from catchment surface (where may cause risks to performance). |
| | Annually | Owner/ Maintenance Company | • Remove sediment from pre-treatment structures. |

## 3.0 SKETCHES AND PLANS

**3.1** The locations of the above features can be found by examining Drawing P4735J2775-C01

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**JOMAS ASSOCIATES LTD**

**Unit 24 Sarum Complex**

**Salisbury Rd**

**Uxbridge**

**UB8 2RZ**

**CONTACT US**

**Website:** www.jomasassociates.com

**Tel:** 0333 305 9054

**Email:** info@jomasassociates.com