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# **FLOOD RISK ASSESSMENT**

**ON**

**LAND OFF KERESFORTH ROAD,  
BARNSELY**

**FOR**

**KEEPMOAT HOMES**

**E21/7774/FR01A**

**Rev A – July 2025**

**DECEMBER 2021**

**M.Huddleston MEng.**

## **1.0 INTRODUCTION**

1.1 This report is commissioned to investigate and report on the Flood Risk for this site in accordance Planning Practise Guidance- Flood Risk and Coastal Change April 2022 and the proposals for drainage of this site when redeveloped as residential land. The report is based on information supplied by the client and from relevant authorities in both written and verbal format. Some of this information is in verbal form only. No liability can be accepted for information supplied by third parties which is subsequently found to be inaccurate or incorrect.

## **2.0 THE SITE**

2.1 The site is located on land to the north of Keresforth Road, Dodworth and lies around OS Grid Reference 432390 405010. The proposed development is irregular in shape and occupies an area of approximately 7.73ha. A site location plan is attached in Appendix A at the rear of the report.

2.2 The main body of the site consists of two agricultural fields used primarily for grazing of livestock. The two fields slope to form a wooded valley which bisects the centre of the site. A small stream runs through this valley area flowing from east to west where it adjoins a larger watercourse along the western boundary of the southern portion of the site. A number of tracks and paths are evident through the centre of each field.

2.3 The immediate field boundaries are defined by mature trees and hedges. The M1 Motorway, including a slip road to junction 37 is situated parallel to the eastern boundary within a small cutting. Residential properties are situated along the southern and western site boundaries. The properties to the west are separated from the site via a strip of woodland approximately 20m in width. To the north there is a small open grassed recreation park.

2.4 The topographic survey indicates that the northern site area slopes from 130m AOD at the northern boundary to the central watercourse at around 101.0m AOD. The southern field area generally falls from east to west a high point of 115.0m AOD to 95.0m AOD. Although there are undulations within this land area. In addition to the above the site also falls at a slope of 1 in 3 to the residential properties along the southern site boundary.

### **3.0 PROPOSED DEVELOPMENT AND DRAINAGE CONSTRAINTS**

- 3.1 It is understood that the proposed development is for a series of detached, semi-detached, and terraced town houses (totalling approximately 126 units) with associated car parking and access roads. The access to the development is proposed off Keresforth Road to the south of the site.
- 3.2 The site investigation report confirms the ground consists of topsoils / clays, re-engineered clays overlying a weathered mudstone and sandstone strata. Occasional thin bands of immature coal were also noted to outcrop across the site. Coal has previously been extracted from a large portion of the central northern field area in the form of open cast mining to a depth of up to 9m below current site. The backfill strata consists primarily of a re-engineered sandy clay gravel. Infiltration testing has been undertaken on site outside of the opencast area which has proved the soakaways would not be a suitable method of surface water drainage for the development.
- 3.3 There are no existing public foul and surface water sewers crossing the main body of the development land. However a 225mm surface water sewer crosses the site close to the southern boundary, this serves the small number of properties on Wood End Court and outfalls into the watercourse. There are both adopted foul and surface water sewers located in the residential development to the east and a foul sewer in Keresforth Road to the south. A copy of the Yorkshire Water records for the site are in the appendices at the rear of the report.
- 3.4 The OS plans indicate a watercourse crossing the central portion of the site and running parallel with the western site boundary. The watercourse is culverted below Keresforth Road.
- 3.5 Yorkshire Water have confirmed that there is no capacity within adjacent adopted surface water systems to service the site. They have recommended that surface water is discharged to the adjacent watercourse on the western boundary of the site. This will require a right of discharge in perpetuity to the existing watercourse which will need to be agreed with the current landowner. Due to the site being open field a greenfield discharge will need to be agreed with the LLFA. The development site is greenfield and therefore a maximum discharge  $Q_{bar}$  rate of 23.7l/s based upon the IH124 greenfield discharge rate calculation.

3.6 Due to the slope of the land it's likely that a gravity connection for the surface water should be feasible. However due to the topography of the site some deep drainage is expected.

#### **4.0 FLOOD RISK**

4.1 On reviewing the Environment Agency websites flood risk maps (Fig 1), the majority of the site currently falls within flood zone 1: which is designated as low probability of flooding from sea or rivers less than 0.1% (ie 1 in 1000 year) probability of flooding. Only the watercourse showing bisecting the site and running down the south western boundary is shown as being in Flood Zone 3: High Probability.

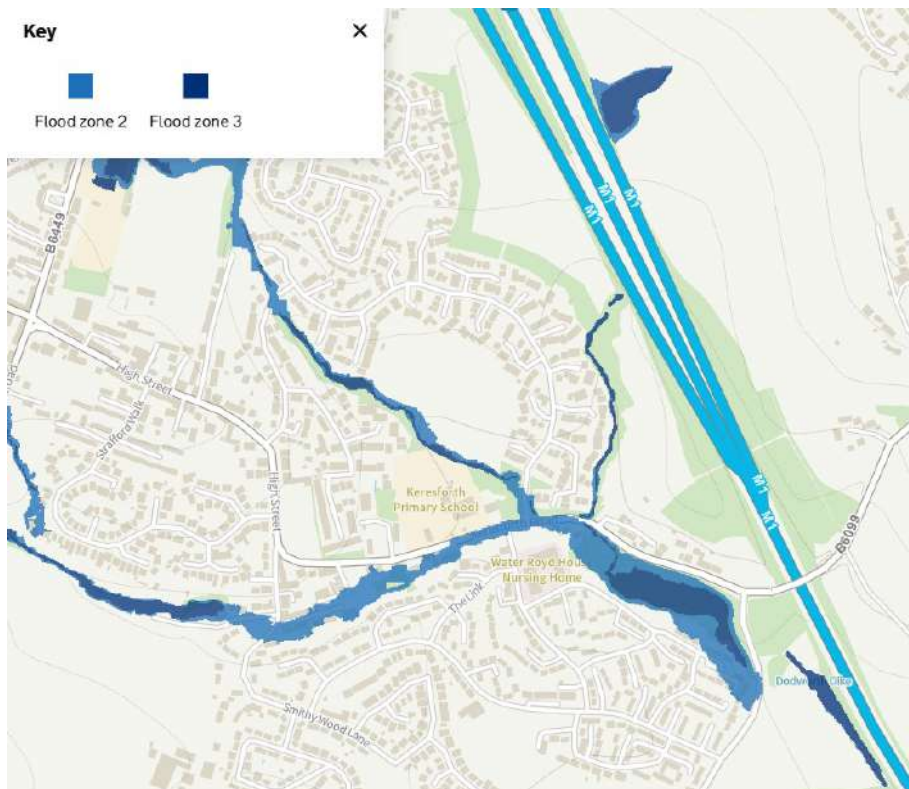
The hierarchy of flood zones are described as:

**Flood Zone 1:** Low Probability. Land assessed as having a less than 1 in 1000 chance of river and sea flooding in any year (<0.1%).

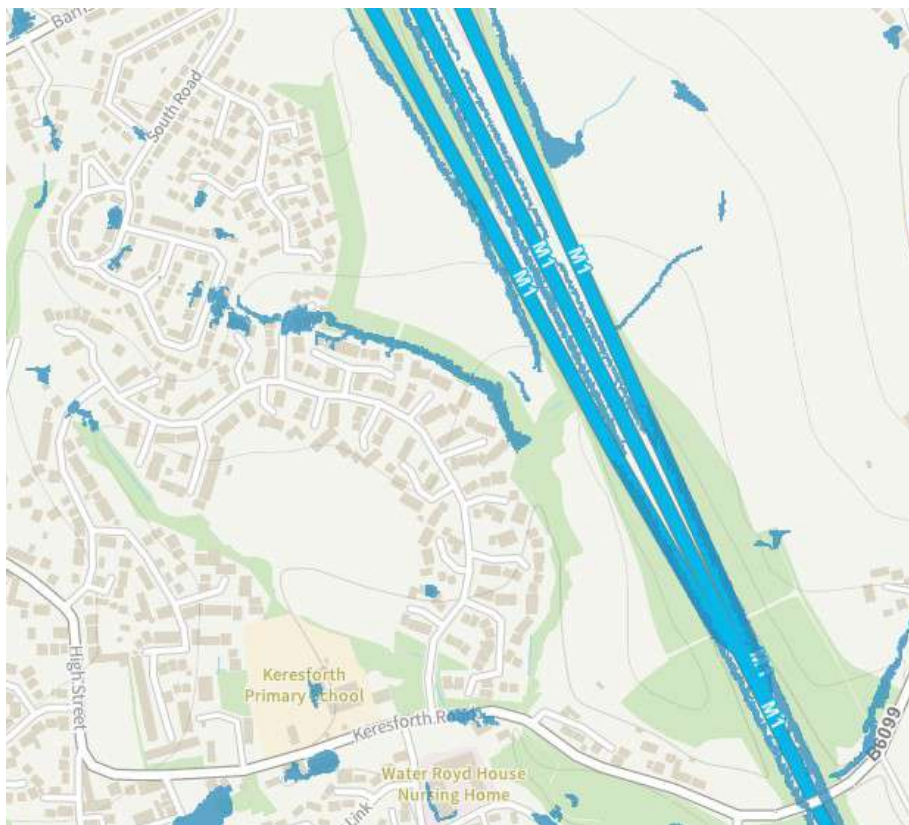
**Flood Zone 2:** Medium Probability. Land assessed as having between a 1 in 100 and 1 in 1000 chance of river flooding (1% 0.1%) and between a 1 in 200 and 1 in 1000 chance of sea flooding (0.5% 0.1%) in any year.

**Flood Zone 3:** High Probability. Land assessed as having a 1 in 100 or greater chance of river flooding (>1%) and 1 in 200 or greater chance of sea flooding (>0.5%) in any year.

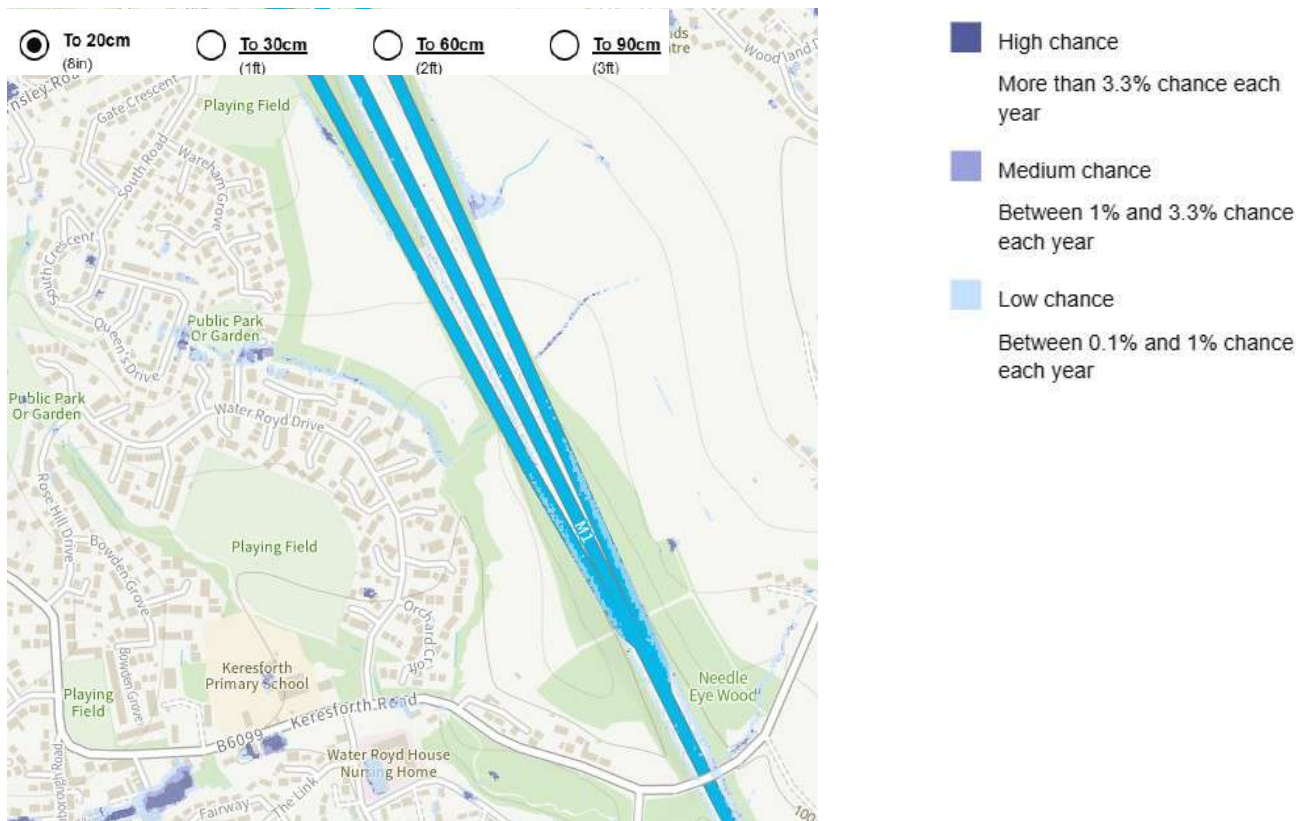
The area of the site to be developed is therefore considered not to be at risk from fluvial flooding from rivers or sea for the 1 in 100 or 1 in 1000 year flood event. The proposed use of the site would be classified as More Vulnerable in Table 2: Flood Risk Vulnerability Classification in the Planning Practise Guidance- Flood Risk and Coastal Change April 2015. In accordance with that table the proposed development would be considered to be appropriate for the site.



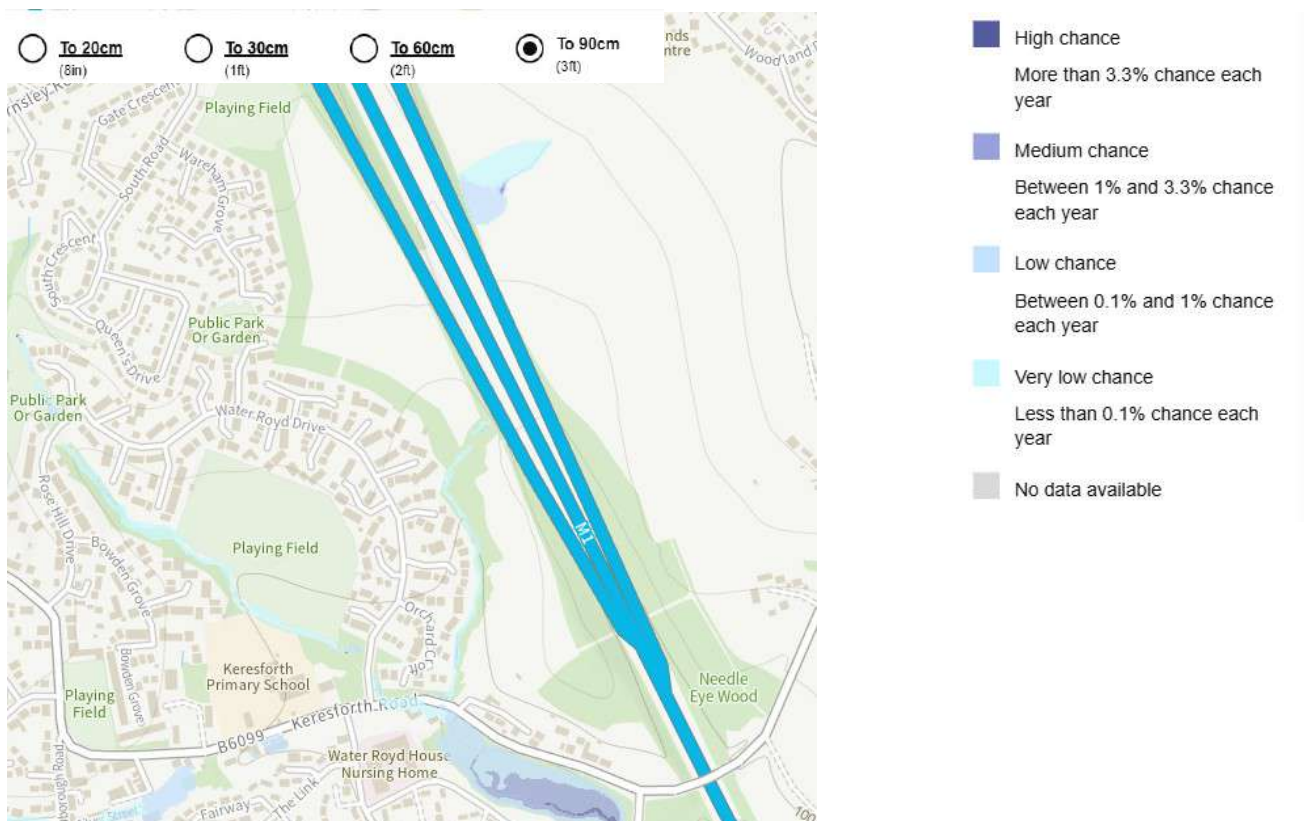
**Fig 1 A copy of the Environment Agency Flood Risk Maps for Planning**



**Fig 2 A copy of the Environment Agency overland Surface Water Plan (1 in 100 year)**



**Fig 3 A copy of the Environment Agency overland Surface Water Plan – High Risk Depth**



**Fig 4 A copy of the Environment Agency Rivers and Sea Plan –Depth**

- 4.2 The site does fall partially within an area subject to surface water flooding according to the EA maps see Fig 2 and 3 above. However this is shown to only be up to a depth of 20cm in the north east of the site.
- 4.2.1 High risk means that each year this area has a chance of flooding of greater than 3.3%. Flooding from surface water is difficult to predict as rainfall location and volume are difficult to forecast. In addition, local features can greatly affect the chance and severity of flooding.
- 4.2.2 Medium risk means that each year this area has a chance of flooding of between 1% and 3.3%. Flooding from surface water is difficult to predict as rainfall location and volume are difficult to forecast. In addition, local features can greatly affect the chance and severity of flooding.
- 4.2.3 Low risk means that each year this area has a chance of flooding of between 0.1% and 1%. Flooding from surface water is difficult to predict as rainfall location and volume are difficult to forecast. In addition, local features can greatly affect the chance and severity of flooding.
- 4.2.4 Very low risk means that each year this area has a chance of flooding of less than 0.1%. Flooding from surface water is difficult to predict as rainfall location and volume are difficult to forecast. In addition, local features can greatly affect the chance and severity of flooding.
- 4.2.5 The surface water flooding maps show some ingress into the site along the eastern boundary and through the central valley from the land to the north of the site. These indicate that the largest ingress will be from low risk and medium risk events. The line of the fluvial flooding is aligned with the proposed road pattern and therefore a flood route should be provided through the site. Floor levels adjacent the access road will need to be raised slightly to facilitate a flood route through the site. There will be a low spot on the access road to enable any overland flows to enter the watercourse.
- 4.2.6 The Environment Agency Rivers and Sea Plan (Fig 4) shows the watercourse to be at a very low risk of flooding up to 90cm. The topographical survey shows the watercourse to be 3-4m deep where it crosses the site, and floodwaters of this depth will be contained within the boundaries of the watercourse. Due to the topography of the site and the allowable highway

gradients, it is proposed to raise ground levels further adjacent the adoptable highway and extend the existing 1200mm diameter culvert to accommodate this. Due to the culvert diameter exceeding the 90cm flood depth indicated on the Environment Agency Rivers and Sea Plan, it is anticipated that this will have a negligible impact on the Flood Zone 3 indicated on the watercourse.

- 4.3 The site does not appear to fall within an area subject to flooding from reservoirs according to the EA maps. We consider the risk of such a source of flooding would be low. The site does not fall within a flood warning zone.
- 4.4 Due to the size of the development being in excess of 1Ha, it would be necessary to prepare a site specific Flood Risk Assessment for the site.
- 4.5 There are a number of potential flooding mechanisms that the Planning Practise Guidance- Flood Risk and Coastal Change April 2022 now requires to be evaluated for each proposed development site. Each method of flooding requires an assessment to be made on its probability relative to the site development. The normal requirement of the document is for no flooding of properties for storms up to a 1% probability or a once in a 100 years storm. The risk assessment also includes for flooding both on site and off site, and the effects of the development on the downstream catchment or the flow regime of the watercourse. NPPG also requires that the effects of severe storms above the normal 1% probability are reviewed together with the effects of climatic change relating to the design life of the development.
- 4.6 It also requires that the effects of climate change are taken into account together with the impacts of extreme events and flood defence failures. Prior to this the Sequential Test, and where necessary, the Exception test as outlined in Planning Practise Guidance- Flood Risk and Coastal Change April 2022, must also be applied to each development site. These aspects are not covered in this report but the area to be developed being in Flood Zone 1, would mean these requirements are already met and do not apply.
- 4.7 The Planning Practise Guidance- Flood Risk and Coastal Change April 2022 requires that each flooding mechanism is addressed and levels of risk evaluated. We consider there are three main risks of flooding to the site. The alternative mechanisms are not applicable to this site.

- Inundation from floodwaters leaving watercourses or rivers entering the site. This can include the effects on culverted watercourses and where the risk of blockage can occur and from breach scenarios.
- Rainwater falling on the site and not being able to leave the site at sufficient rate to prevent flooding on the site.
- Overland flows from adjacent land sites due to surcharging of sewerage systems or other watercourses.
- The impact of the developed site on the existing drainage systems and off-site surface water systems must also be assessed as part of this flood risk assessment.

## **5.0 DISCUSSION OF FLOOD RISKS**

### **5.1 Flood Risk from Watercourses, River & Tidal**

5.1.1 The proposed residential development area does not fall within the 0.1% or the 1% probability Flood Risk Maps (Zone 2 and 3) as published by the Environment Agency, however the watercourse bisecting the site and passing beneath the proposed link highway is classified as Flood Zone 3. The residential areas of the site are therefore considered not to be at risk from fluvial flooding for the once in 100 year flood event. We therefore consider the risk of flooding of the site from River and Sea is acceptable for this type of development on this site.

5.1.2 Due to the topography of the site and the allowable highway gradients, it is proposed to raise ground levels further adjacent the adoptable highway and extend the existing 1200mm diameter culvert to accommodate this. Due to the culvert diameter exceeding the 90cm flood depth indicated on the Environment Agency Rivers and Sea Plan, it is anticipated that this will have a negligible impact on the Flood Zone 3 indicated on the watercourse.

5.1.3 Although the flood risk maps show the flooding to be contained within the watercourse under ordinary circumstances, we should consider a scenario where the culvert below the adoptable highway becomes blocked or partially obstructed. This would result in a build up of water within the watercourse and a potential impact on the development. The watercourse is located at a proposed low spot in the highway within a small valley, with the lowest property

to the south approximately 4m above the low-point in the highway. Therefore, should the culvert become blocked the surface water from the watercourse would cross the low point of the highway and re-join the watercourse to the south west of the highway and continue to flow to the south west along the western boundary of the site, maintaining the status quo. This is indicated on the Flood Routing Plan in Appendix D.

## 5.2 **Risk of Flooding from overland flows from adjacent land.**

5.2.1 The site lies on an area of sloping land, with residential development to the western and southern boundaries these are typically at a lower level to the development site. To the eastern boundary is the M1 this is situated in a slightly cutting and therefore will not represent a problem in relation to overland flows to the development site. A small area of open grassed recreational land is located directly to the north of the proposed site at a slightly elevated level. A fluvial overland flood route is indicated to run along the eastern boundary of the northern field prior to joining the watercourse running centrally through the site. The overland flood levels are indicated as medium to low risk in terms of depth. The proposed planning layout indicates the new highway to run along the eastern boundary with adjoining plots being raised at least 300mm above footpath levels, these properties will also be served by a proposed public drainage systems.

5.2.2 The existing watercourse running centrally across the site and along the western boundary is shown not to affect the development on the flood risk maps for planning published by the Environment Agency. There is no hydrological modelling available for this watercourse to accurately quantify the level of flood risk, further to a site visit the watercourse is situated within a relatively deep channel with steep banks to the development site. Based upon the level difference between the watercourse and development site it is extremely unlikely that floodwaters would inundate the development site and flooding from this source is classed as extremely low risk. In addition to the above no new properties are indicated within the central lower lying valley area and the proposed road network will be considerably elevated as it crosses the central region of the site, to enable appropriate culverting of the watercourse to be achieved. This should provide sufficient level of protection to the new proposed construction on site.

5.2.3 Flooding from sewers – the existing drainage system to the west and south of the site is not considered a risk to the proposed development due to the current topography. The proposed site will be served by a system of new adopted sewers, and blockages and exceedance storm events should be considered as part of the design proposals for the new site.

5.2.4 We would recommend that an overland flood routes is provided through the site to cater for extreme events and in addition to any blockage failure of new drainage systems on site. As is normal under the sewers for adoption criteria and floor levels are to be based a minimum of 300mm above existing ground levels.

### 5.3 **Risk of Flooding from Rainwater Falling on Site**

5.3.1 The risk of flooding from water falling on site and not being able to leave the site is relatively high. The impermeable area of the site will increase significantly due to the development and this would increase the run off from the site. This would increase the flood risk to downstream properties unless attenuation measures and restriction of flows took place.

5.3.2 The normal hierarchy for surface water discharge in accordance with current planning and SUDS policies is as follows:

1. The use of infiltration systems such as Soakaways.
2. Discharge to nearby rivers or watercourses with the use of attenuation.
3. Discharge to existing public sewer network with the use of attenuation.

5.3.3 Infiltration testing has previously been undertaken on site which has proved unsuccessful. In addition to this a large proportion of the site consists of re-engineered clays due to former open cast coal mining. The soakaway testing confirmed that soakaways will not be a viable method of dealing with surface water discharge from the site.

5.3.4 Therefore the development should drain to the identified watercourse located to the western boundary of the site. Due to the topography of the site, two separate outfalls are proposed to the watercourse from both the northern and southern parcels of land. Storm water attenuation systems should be utilised to ensure the flows from the site are reduced to agricultural run-off rates or as otherwise agreed with the Barnsley Land Drainage Authority.

5.3.5 There are no significant existing buildings or paved areas on site. In conjunction with infiltration systems not being suitable and based upon the developable site area of 4.95ha greenfield discharge  $Q_{bar}$  rate of 23.7l/s has been proposed for the overall development into the existing culverted watercourse. This has been calculated using the IH124 greenfield runoff estimation provided by HR Wallingford. Therefore, this has been considered as the design option for the treatment of the discharge of surface water and storage volumes calculated based upon this discharge rate should be split between the two parcels of land and the proposed separate outfalls. Negotiations would be required with the authorities and current landowners to secure permission to discharge in perpetuity together with easements etc. for the construction of a new sewers and connecting headwalls onto the watercourse. Any run off from the site post development would have to be limited to 23.7lit/s overall for the development.

5.3.6 With attenuation of flows there would have to be a storm-water storage facility. The use of above storage systems such as swales, detention basins or ponds, would provide the most sustainable urban drainage system and possibly the most economic but this would entail significant land up take and potentially large, commuted sums. With the recent implementation of the Codes for Adoption by Yorkshire Water there is greater scope for a regulatory body to adopt and maintain the above ground storage facilities than previously. However there is detailed criteria to be met to able this to take place. Based on this criteria, the estimated volumes of storage required are shown in the attached calculation sheets.

i. **North Site**

Based upon a discharge rate of 15.6l/s approximate surface water attenuation for 1 in 100yr return period and 40% climate change in the range of 910m<sup>3</sup>.

ii. **South Site**

Based upon a discharge rate of 8.1l/s approximate surface water attenuation for 1 in 100yr return period and 40% climate change in the range of 430m<sup>3</sup>

5.3.7 The use of below ground storage facilities on their own, may not provide a suitable level of treatment of the run off from the site and biological systems, at source, may be needed to ensure contaminants are dealt with prior to discharge of site. The use of open swales and ponds would allow the use of reed beds and other organic systems to be employed so should

still be considered in the final designs. However due to the steep topography of the site, this would entail significant land up take and potentially large commuted sums. Primary treatment for the roads would be the use of trapped gullies for all hard standings. The use of filter drains adjacent to private drives or permeable paving on private drives would also provide a first stage treatment of run off from drives and allow a discharge into the top soils on site. Rainwater butts may also be provided to enable some recycling of run off from the roofs and paved areas. The use of green roofs is not considered appropriate in this development. We understand that open space to the south of the site has been designated as a possible area to locate surface water attenuation. Please note Yorkshire Water will require an easement and access for future maintenance.

5.3.8 The size of the storm water storage facilities would need to be determined accurately in the final detailed designs. The volumes of storage can include flooding to roads and designated areas such as carpark areas or public open space for the 100 year storm with 40% allowance for climate change and a restricted overall discharge rate of 23.7 l/s, but must ensure that no buildings are flooded.

5.3.9 The proposed discharge point and discharge rates from the site needs to be formally agreed with Yorkshire Water, the Environment Agency and the Local Land Drainage Authority prior to detailed design being undertaken.

#### 5.4 **Impact on existing drainage systems.**

5.4.1 If the site is developed with attenuation systems and an agreed discharge rate of 23.7l/s reduced to agricultural rates of discharge, there should be no increase in the flood risk to properties off site or in the drainage networks downstream of the site. In real terms there would be slight reduction in flood risk to adjacent land due to the attenuation provided on site for the 1 in 100 year storms with the discharge rate cut to below the current estimated 1 in 1 year storm agricultural discharge rate.

5.4.2 The existing site topography slopes steeply towards the existing houses off Wood End Court and therefore surface water management will need to be considered carefully during and within the final designs to avoid any overland surface water flows affecting these properties.

5.4.3 The maintenance of the onsite proposed SUDS basin would be carried out by Yorkshire Water as part of the Section 104 Agreement and they would adopt the underground oversized pipework and manholes. The maintenance of any on or off site above ground storage systems will need to be resolved satisfactorily in perpetuity either with Yorkshire Water, a management company or Barnsley MBC. This may mean commuted sums being paid for such an agreement.

5.4.4 The developer will be responsible to maintain the drainage systems on site until final adoption by Yorkshire Water ensuring that they are working effectively in the intervening period between construction and adoption.

## 6.0 **FUTURE MAINTENANCE**

- 6.1 It is proposed for the surface water system serving the development to be adopted by Yorkshire Water or similar approved body under a Section 104 Agreement, this will include the attenuation tanks, flow controls, and outfall sewers.
- 6.2 The maintenance of the attenuation tank should be in line with the SUDS manual (CIRIA C753, 2015) as detailed in table 21.3 below.

<b>Operation and Maintenance Requirements for Attenuation Storage Tanks</b>		
<b>Maintenance schedule</b>	<b>Required action</b>	<b>Typical frequency</b>
Regular maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action	Monthly for 3 months, then annually
	Remove debris from the catchment surface (where it may cause risks to performance)	Monthly
	For systems where rainfall infiltrates into the tank from above, check surface of filter for blockage by sediment, algae or other matter; remove and replace surface infiltration medium as necessary.	Annually
	Remove sediment from pre-treatment structures and/or internal forebays	Annually, or as required
Remedial actions	Repair/rehabilitate inlets, outlet, overflows and vents	As required
Monitoring	Inspect/check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed	Annually
	Survey inside of tank for sediment build-up and remove if necessary	Every 5 years or as required

- 6.3 The developer will be responsible to maintain the drainage systems on site until final adoption by the relevant authority ensuring that they are working effectively in the intervening period between construction and adoption.

## 7.0 CONCLUSIONS

- 7.1 The majority of the site currently falls within Flood Zone 1 as defined by the EA Flood maps, with only the existing watercourse bisecting the site and running down the south western boundary classified as Flood Zone 3. The area of the site to be developed is not at risk of flooding from river or tidal water up to a 1% return period. The flood risk is considered to be acceptable for residential development.
- 7.2 Due to the topography of the site and the allowable highway gradients, it is proposed to raise ground levels further adjacent the adoptable highway and extend the existing 1200mm diameter culvert to accommodate this, extending in the area designated as Flood Zone 3 on the watercourse. Due to the culvert diameter of 1200mm exceeding the 900mm flood depth indicated on the Environment Agency Rivers and Sea Plan, it is anticipated that this will have a negligible impact on the Flood Zone 3 indicated on the watercourse.
- 7.3 The development of the site utilising infiltration techniques is not considered suitable. A surface water attenuation system should be designed to reduce the run-off from the site to an agricultural discharge rate of 23.7l/s for the overall development site with attenuation provided for the 1 in 100 year + 40% climate change events, to ensure there is no increase in flood risk to the downstream catchment. Due to the steep topography of the site, the use of underground surface water attenuation is proposed. The location of the final outfalls to the watercourse will require further investigation on site.
- 7.4 The risk of overland flows entering the site is considered to be low due to the topography of the area around the site. The risk can be further minimised by providing a flood water route through the site to ensure flood water flows are directed away from the existing and proposed housing. We would recommend that the floor levels of the proposed houses should be a minimum of 300mm above the existing ground/road levels.



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# APPENDIX A

## LOCATION PLAN



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Civil Structural Engineering Consultants

t 01924 574074

e martin@haighhuddleston.co.uk

Unit 4  
Midgley Business Park  
Bar Lane  
Midgely  
WF4 4JJ

Client : Keepmoat  
Job Title: Keresforth Road, Barnsley  
Job Number : E20/7774

## LOCATION PLAN

OS Grid Reference : SE 323049  
Easting : 432383  
Northing : 404902

Topographical Survey carried out using  
GPS.



# APPENDIX B

## EA FLOOD MAP





### Flood map for planning

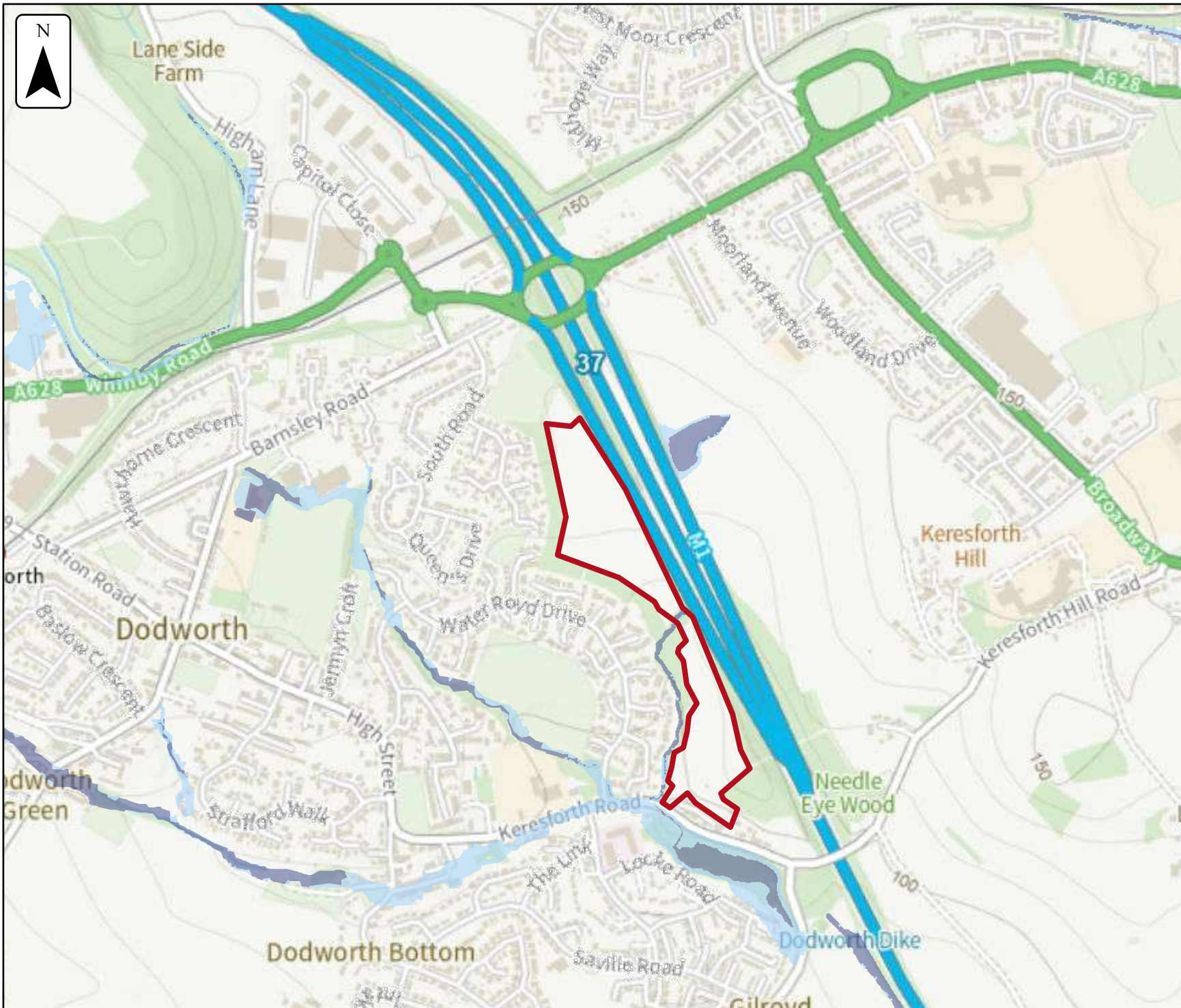
Your reference  
**7774 - KERESFORTH ROAD**

Location (easting/northing)  
**432270/405473**

Scale  
**1:10,000**

Created  
**24 Jul 2025 14:20**

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



# APPENDIX C

## YORKSHIRE WATER RECORDS



YorkshireWater

**Mr C MacDonald**  
**Haigh Huddleston & Associates**  
**Firth Buildings**  
**99-101 Leeds Road**  
**Dewsbury**  
**WF12 7BU**  
**c.macdonald@haighhuddleston.c**  
**o.uk**

**Yorkshire Water Services**  
**Developer Services**  
**Pre-Development Team**  
**PO BOX 52**  
**Bradford**  
**BD3 7AY**

**Tel: 0345 120 8482**

**Fax:**

**Email:**

**technical.sewerage@yorkshirewa**  
**ter.co.uk**

**Your Ref:**  
**Our Ref: W015769**

**For telephone enquiries ring:**  
**Chris Roberts on 0345 120 8482**

**25th November 2020**

Dear Mr MacDonald,

**Keresforth Road, Barnsley, S75 3QY - Pre-Planning Sewerage Enquiry**  
**U040647**

Thank you for your recent enquiry and remittance. Our official VAT receipt has been sent to you under separate cover. Please find enclosed a complimentary extract from the Statutory Sewer Map which indicates the recorded position of the public sewers. Please note that as of October 2011 and the private to public sewer transfer, there are many uncharted Yorkshire Water assets currently not shown on our records.

The following comments reflect our view, with regard to the public sewer network only, based on a 'desk top' study of the site and are valid for a maximum period of twelve months:

Development of the site should take place with separate systems for foul and surface water drainage. The separate systems should extend to the



points of discharge to be agreed.

### **Existing Infrastructure**

There is a 225 mm diameter public surface sewer recorded on the site. In this instance, building-over may take place under the control of Part H4 Building Regulations 2000. No trees planted within 5 (five) metres of this public sewer. It may not be acceptable to raise or lower ground levels over the sewer, nor to restrict access to the manholes on the sewer. If you wish to have this sewer diverted under Section 185 of the Water Industry Act 1991 an application should be made in writing. To discuss this matter, please telephone 0345 120 84 82.

There is a wastewater outfall to watercourse, under the control of Yorkshire Water, located near to/within the site. Vehicular access, including with large tankers, could be required at any time.

### **Foul Water**

The closest practicable point of discharge for foul will be the 150 mm foul public sewer in Keresforth Road, but at present there is no spare capacity available to accept the foul discharge from all the proposed development. Further investigation in the form of modelling, at the developers cost, will be required to understand the impact on the public sewer network along with a build programme of the development. Please contact us on the above number to discuss this further.

### **Surface Water**

The developer's attention is drawn to Requirement H3 of the Building Regulations 2000. This establishes a preferred hierarchy for surface water disposal. Consideration should firstly be given to discharge to soakaway, infiltration system and watercourse in that priority order.

Sustainable Drainage Systems (SuDS), for example the use of soakaways and/or permeable hardstanding etc, may be a suitable solution for surface water disposal appropriate in this situation. You are advised to seek comments on the suitability of SuDS in this instance from the appropriate authorities.

As the proposed site is currently undeveloped no surface water is known to have previously discharged to the public sewer network

As such, the local public sewer network does not have capacity to accept any surface water from the proposed site. If SuDS are not viable, the developer is advised to contact the Environment Agency/local Land Drainage Authority/Internal Drainage Board with a view to establishing a suitable watercourse for discharge.

It is understood that a watercourse is located through the site. This appears to be the obvious place for surface water disposal (if SuDS are not viable). Please note Yorkshire Water cannot provide plans of culverted watercourses or highway drains. To obtain plans please contact the Lead Local Flood Authority for more details.

### **Other Observations**

Any new connection to an existing public sewer will require the prior approval of Yorkshire Water. You may apply on line or obtain an application form from our website ([www.yorkshirewater.com](http://www.yorkshirewater.com)) or by telephoning 0345 120 84 82.

An off-site foul and surface water drain sewer may be required which may be provided by the developer and considered for adoption under Section 104 of the Water Industry Act 1991. Please telephone 0345 120 84 82 for advice on sewer adoptions. Alternatively, the developer may in certain circumstances be able to requisition off-site sewers under Section 98 of the Water Industry Act 1991 for which an application must be made in writing. For further information, please telephone 0345 120 84 82.



YorkshireWater

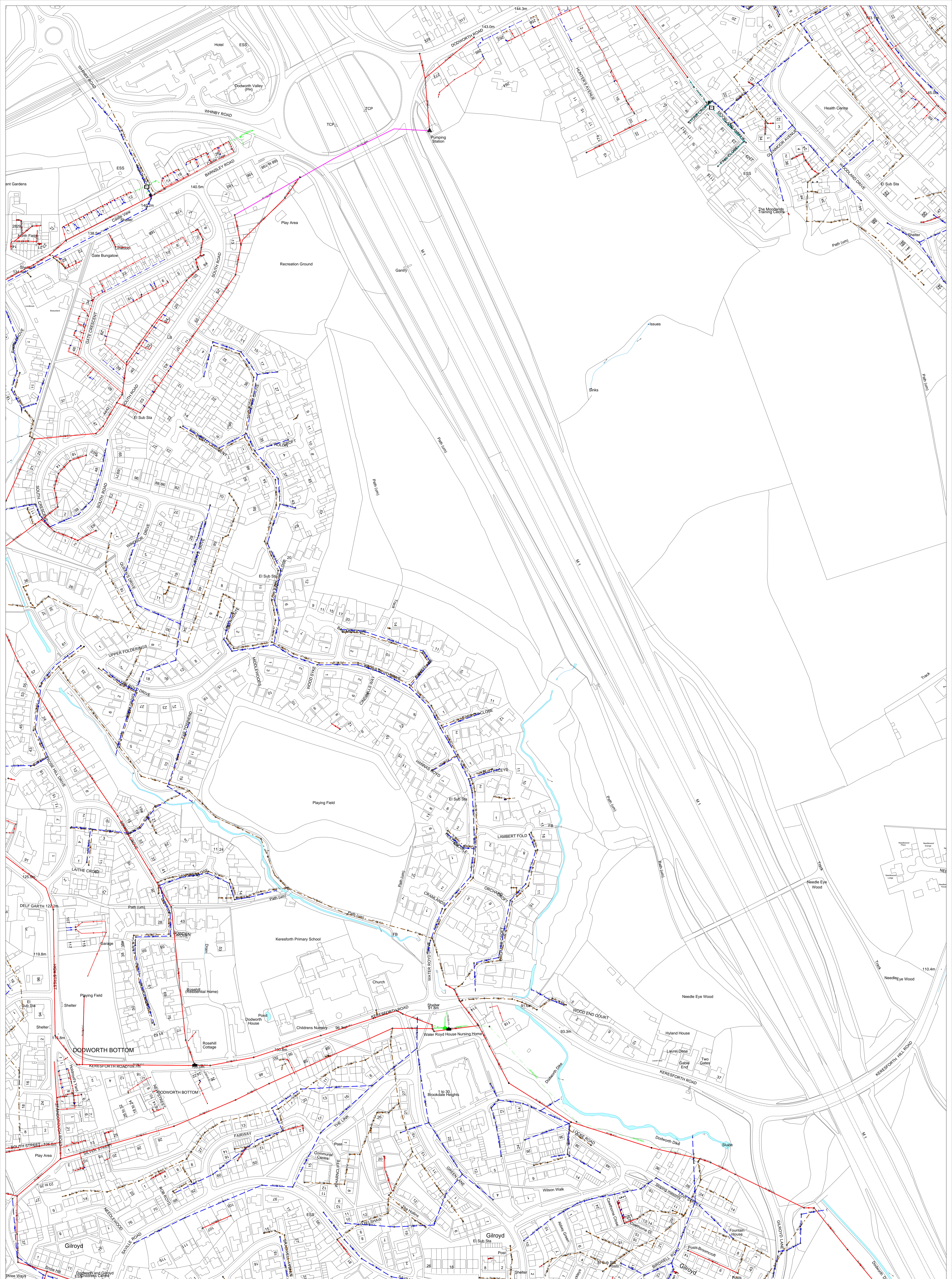
Prospectively adoptable sewers and pumping stations must be designed and constructed in accordance with the WRc publication "Sewers for Adoption - a design and construction guide for developers" 6th Edition as supplemented by Yorkshire Water's requirements, pursuant to an agreement under Section 104 of the Water Industry Act 1991.

An application to enter into a Section 104 agreement must be made in writing prior to any works commencing on site. Please contact our Developer Services Team (telephone 0345 120 84 82) for further information.

All the above comments are based upon the information and records available at the present time and is subject to formal planning approval agreement. The information contained in this letter together with that shown on any extract from the Statutory Sewer Map that may be enclosed is believed to be correct and is supplied in good faith. Please note that capacity in the public sewer network is not reserved for specific future development. It is used up on a 'first come, first served' basis. You should visit the site and establish the line and level of any public sewers affecting your proposals before the commencement of any design work.

yours sincerely

**Chris Roberts**  
**Development Services Technician**

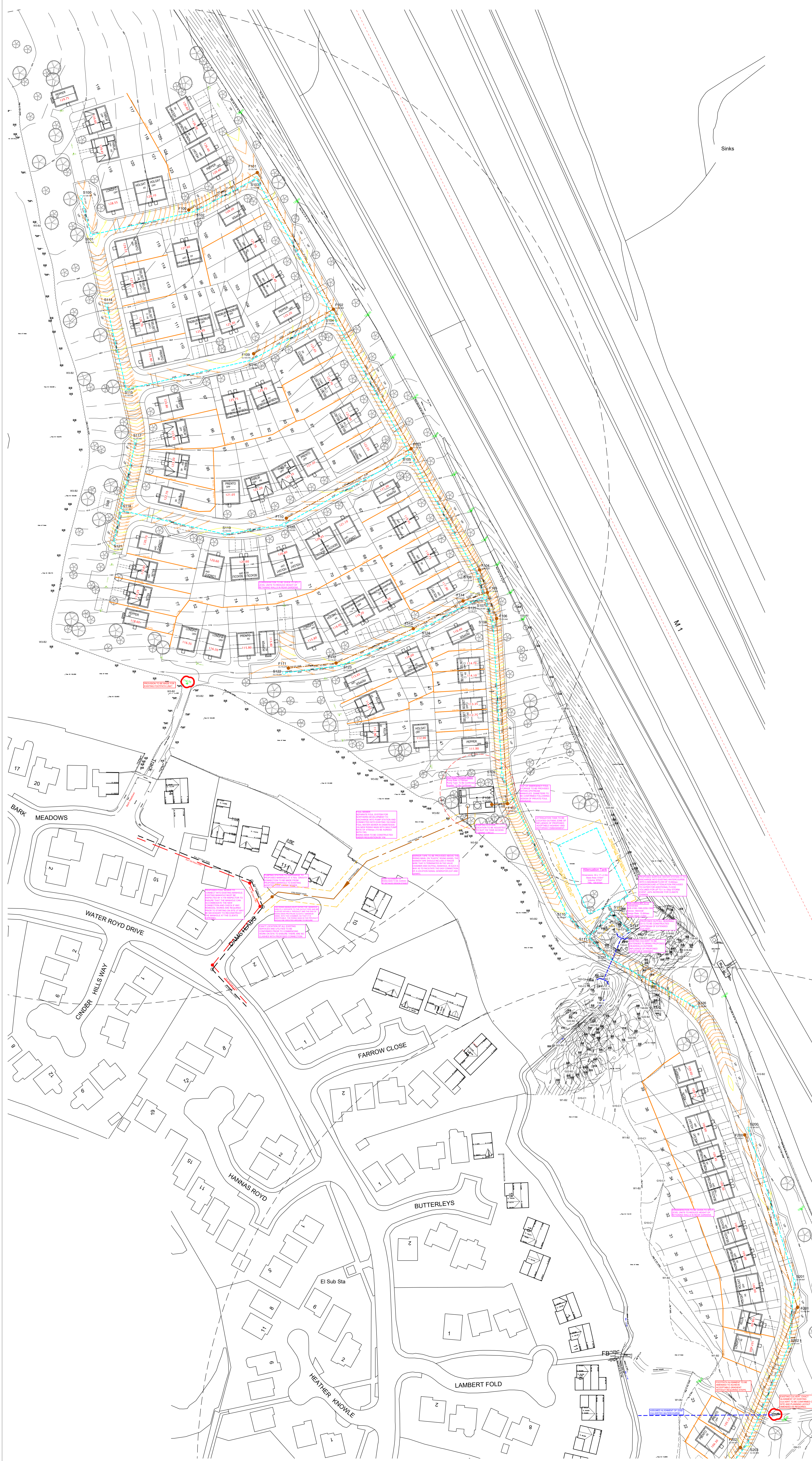
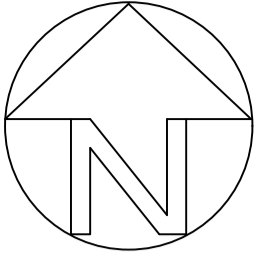


	432265 - 405201 Map Name: SE3104NE Title:
	Notes: Yorkshire Water, PO Box 500, Halifax Road, Bradford BD6 3JZ Contact Name: Yorkshire Water Contact Tel : 87 2582
Partial Key: Field Sewer - 1 Combined Sewer - 2 Surface Water Sewer - 3 Road Sewer - 10 Public Sewer - 11	This plan is furnished as a general guide only and does not constitute an offer of any service. It is intended to be used in conjunction with the relevant technical specifications and standards. The user should verify the accuracy of the information shown on this plan and is responsible for any errors or omissions.
Date Issued : 24/11/2020, 19:33:30 Scale : Sewer Network Enquiry	Date Gen : 24/11/2020, 19:34:04

# APPENDIX D

## ENGINEERING FEASIBILITY PLANS

### FLOOD ROUTING PLAN



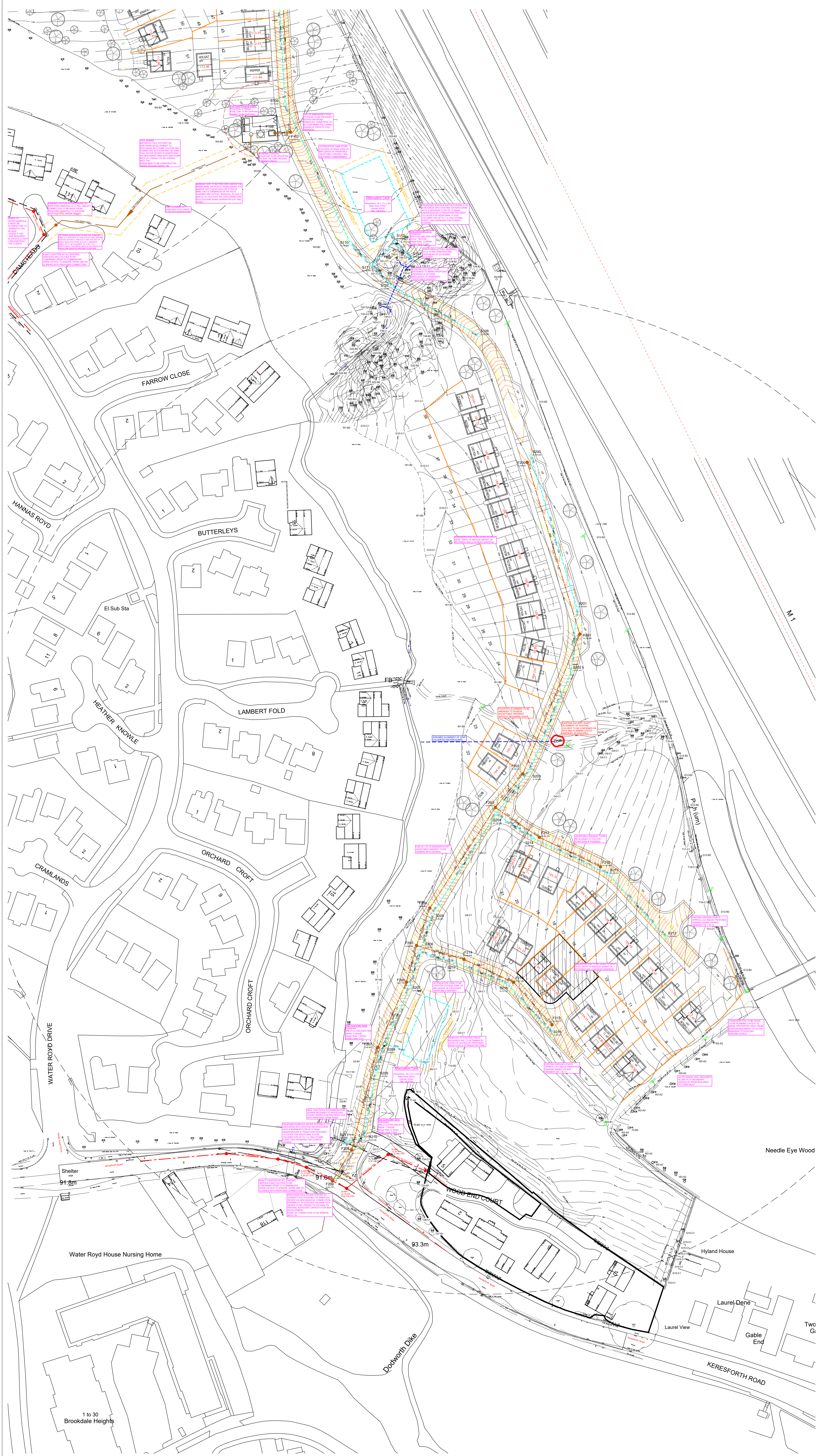
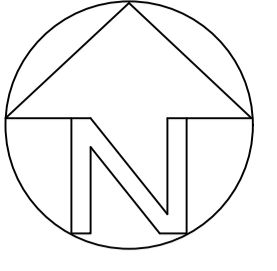
Rev C Remainder of plot levels added  
 Rev B Road & sewer design amended to suit latest planning layout  
 Rev A Road & sewer design amended to suit latest planning layout

16.07.25 MD  
 10.07.25 MD  
 03.03.21 HH

**Haigh Huddleston & Associates**  
 Civil Structural Engineering Consultants

Unit 4, Midgley Business Park, Bar Lane, Midgley, WF4 4JJ | 01924 574074  
 e martin@haighhuddleston.co.uk

Client <b>KEEPMOAT</b>				
Project <b>KERESFORTH ROAD, DODWORTH</b>				
Detail <b>PRELIMINARY FEASIBILITY PLAN - NORTH</b>				
Drawn HH	Checked HH	Date OCT-20	Scale 1:500@A0	Dwg No. E207774/001-01C



Rev C Remainder of plot levels added  
 Rev B Road & sewer design amended to suit latest planning layout  
 Rev A Road & sewer design amended to suit latest planning layout

16.07.25 MD  
 10.07.25 MD  
 03.03.21 HH

**Haigh Huddleston & Associates**  
 Civil Structural Engineering Consultants

Unit 4, Midgley Business Park, Bar Lane, Midgley, WF4 4JJ 1 01924 574074  
 e martin@haighhuddleston.co.uk

Client  
**KEEPMOAT**

Project  
**KERESFORTH ROAD, DODWORTH**

Detail  
**PRELIMINARY FEASIBILITY PLAN - SOUTH**

Drawn  
 HH

Checked  
 HH

Date  
 OCT-20

Scale  
 1:500@A0

Dwg No.  
 E207774/001-02C

Two G.

Needle Eye Wood

Hyland House

Laurel Dene

Gable End

Laurel View

KERESFORTH ROAD

Dodworth Pike

Water Royd House Nursing Home

Shelter

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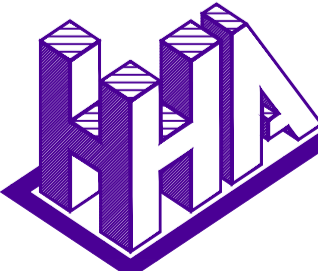
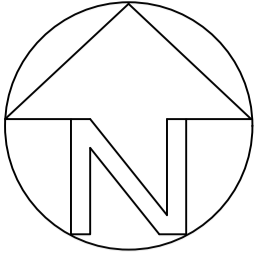
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Haigh Huddleston & Associates

Civil Structural Engineering Consultants

Unit 4, Midgley Business Park, Bar Lane, Midgley, WF4 4JJ 1 01924 574074  
e martin@haighhuddleston.co.uk

Client  
**KEEPMOAT**

Project  
**KERESFORTH ROAD, DODWORTH**

Detail  
**FLOOD ROUTING PLAN**

Dwn	Chkd	Date	Scale	Dwg No.
AH		Jul/25	1:1000@A1	E207774/019

# APPENDIX E

## GREENFIELD RUN-OFF CALCULATIONS

## PRELIMINARY DRAINAGE CALCULATIONS

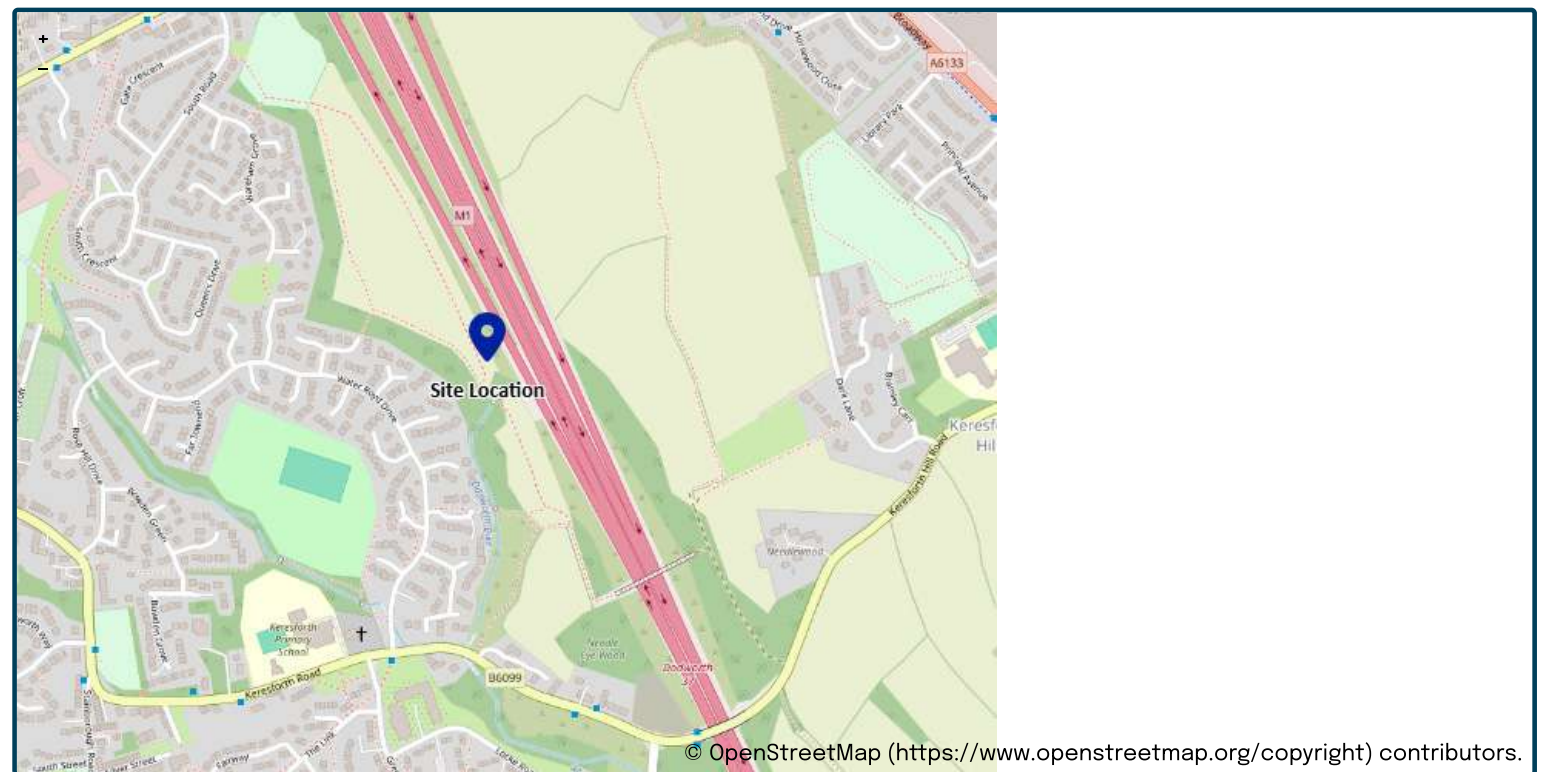
This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance “Rainfall runoff management for developments”, SC030219 (2013), the SuDS Manual C753 (CIRIA, 2015) and the non-statutory standards for SuDS (Defra, 2015).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

## Project details

Date	<input type="text" value="18/06/2025"/>
Calculated by	<input type="text" value="M DEAN"/>
Reference	<input type="text" value="7774"/>
Model version	<input type="text" value="2.0.1"/>

## Location

Site name	<input type="text" value="DODWORTH"/>
Site location	<input type="text" value="KERESFORTH ROAD"/>



Site easting	<input type="text" value="432413"/>
Site northing	<input type="text" value="405267"/>

## Site details

Total site area (ha)	<input type="text" value="4.95"/>	ha
----------------------	-----------------------------------	----

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MORE INFO

# Greenfield runoff

## Method

Method

## IH124

SAAR (mm)	<input type="text" value="696"/> mm	<input type="radio"/>	<input type="text" value="696"/>
How should SPR be derived?	<input type="text" value="WRAP soil type"/>		
WRAP soil type	<input type="text" value="4"/>	<input type="radio"/>	<input type="text" value="4"/>
SPR	<input type="text" value="0.47"/>		
QBar (IH124) (l/s)	<input type="text" value="23.7"/> l/s		

## Growth curve factors

Hydrological region	<input type="text" value="3"/>	<input type="radio"/>	<input type="text" value="3"/>
1 year growth factor	<input type="text" value="0.86"/>		
2 year growth factor	<input type="text" value="0.94"/>		
10 year growth factor	<input type="text" value="1.45"/>		
30 year growth factor	<input type="text" value="1.75"/>		
100 year growth factor	<input type="text" value="2.08"/>		
200 year growth factor	<input type="text" value="2.37"/>		

## Results

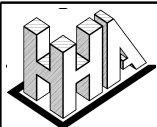
Method	<input type="text" value="IH124"/>	
Flow rate 1 year (l/s)	<input type="text" value="20.4"/> l/s	
Flow rate 2 year (l/s)	<input type="text" value="22.3"/> l/s	
Flow rate 10 years (l/s)	<input type="text" value="34.4"/> l/s	
Flow rate 30 years (l/s)	<input type="text" value="41.5"/> l/s	
Flow rate 100 years (l/s)	<input type="text" value="49.4"/> l/s	
Flow rate 200 years (l/s)	<input type="text" value="56.3"/> l/s	

### Disclaimer

This report was produced using the Greenfield runoff rate estimation tool (2.0.1) developed by HR Wallingford and available at [uksuds.com](https://www.uksuds.com/) (<https://www.uksuds.com/>). The use of this tool is subject to the UK SuDS terms and conditions and licence agreement, which can both be found at [uksuds.com/terms-conditions](https://www.uksuds.com/terms-conditions) (<https://www.uksuds.com/terms-conditions>). The outputs from this tool have been used to estimate Greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, Centre for Ecology and Hydrology, Wallingford Hydrosolutions or any other organisation for the use of these data in the design or operational characteristics of any drainage scheme.

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Haigh Huddleston & Associates  
Unit 4 Midgley Business Park  
Bar Lane, Midgley  
WF4 4JJ

File: 7774 NETWORK 1 NORTH 03.07  
Network: Storm Network 1  
M Dean  
10/07/2025

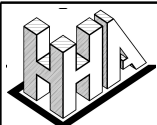
Page 1  
Keepmoat Homes  
Keresforth Road  
North

### Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	2	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	19.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.373	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	4.00	Enforce best practice design rules	x

### Nodes

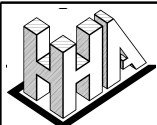
Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
100	0.069	4.00	128.729	1200	432209.830	405557.630	1.479
101	0.084	4.00	128.544	1200	432213.763	405542.426	1.490
102	0.026	4.00	126.907	1200	432255.553	405551.931	1.567
103	0.167	4.00	125.698	1500	432279.614	405565.057	1.878
114	0.096	4.00	127.242	1200	432219.989	405514.321	1.542
115	0.050	4.00	125.026	1200	432227.807	405480.885	1.690
116	0.087	4.00	125.399	1200	432277.581	405492.461	2.404
104	0.104	4.00	124.592	1500	432310.004	405510.532	1.919
117	0.081	4.00	123.442	1200	432231.457	405460.171	2.142
121	0.067	4.00	120.159	1500	432222.764	405419.563	1.584
118	0.036	4.00	121.153	1500	432225.735	405432.575	2.820
119	0.019	4.00	120.434	1500	432267.172	405423.112	2.384
120	0.161	4.00	120.655	1500	432290.762	405426.937	2.764
105	0.098	4.00	121.100	1500	432341.009	405454.942	3.592
106	0.008	4.00	117.209	1500	432368.075	405406.380	3.460
122	0.095	4.00	115.224	1200	432290.753	405367.734	1.599
123	0.094	4.00	115.472	1200	432313.640	405370.762	2.136
124	0.019	4.00	115.994	1200	432345.174	405384.962	2.889
125	0.006	4.00	116.370	1200	432364.388	405395.671	3.412
107	0.009	4.00	116.400	1500	432370.847	405397.701	3.637
108	0.053	4.00	115.449	1500	432374.142	405387.387	2.758
109	0.167	4.00	110.401	1500	432377.675	405326.941	1.747
110	0.000		105.959	1500	432403.804	405271.095	2.443
126	0.059	4.00	107.850	1200	432455.100	405234.390	1.500
127	0.000		105.695	1200	432420.477	405254.066	1.688
111	0.022	4.00	105.792	1500	432412.213	405262.506	2.336
112	0.000		105.069	1800	432416.929	405266.334	2.263
113	0.000		103.000	1200	432423.721	405261.531	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)
1.000	100	101	15.704	0.600	127.250	127.054	0.196	80.0	225	4.18	50.0
1.001	101	102	42.857	0.600	127.054	125.340	1.714	25.0	225	4.45	50.0
1.002	102	103	27.408	0.600	125.340	123.970	1.370	20.0	225	4.61	50.0
1.003	103	104	62.422	0.600	123.820	122.673	1.147	54.4	375	5.03	50.0
2.000	114	115	34.338	0.600	125.700	123.411	2.289	15.0	225	4.17	50.0
2.001	115	116	51.102	0.600	123.336	122.995	0.341	150.0	300	4.83	50.0
2.002	116	104	37.119	0.600	122.995	122.748	0.247	150.0	300	5.32	50.0
1.004	104	105	63.652	0.600	122.673	117.508	5.165	12.3	375	5.52	50.0
3.000	117	118	28.183	0.600	121.300	118.483	2.817	10.0	225	4.11	50.0
4.000	121	118	13.347	0.600	118.575	118.408	0.167	80.0	375	4.11	50.0
3.001	118	119	42.504	0.600	118.333	118.050	0.283	150.0	375	4.59	50.0
3.002	119	120	23.898	0.600	118.050	117.891	0.159	150.0	375	4.86	50.0
3.003	120	105	57.524	0.600	117.891	117.508	0.383	150.0	375	5.51	50.0
1.005	105	106	55.595	0.600	117.508	113.749	3.759	14.8	375	5.72	50.0
1.006	106	107	9.111	0.600	113.749	112.838	0.911	10.0	375	5.74	50.0
5.000	122	123	23.086	0.600	113.625	113.336	0.289	80.0	300	4.22	50.0
5.001	123	124	34.584	0.600	113.336	113.105	0.231	150.0	300	4.67	50.0
5.002	124	125	21.997	0.600	113.105	112.958	0.147	150.0	300	4.95	50.0
5.003	125	107	6.770	0.600	112.958	112.913	0.045	150.0	300	5.04	50.0
1.007	107	108	10.828	0.600	112.763	112.691	0.072	150.0	450	5.85	50.0
1.008	108	109	60.549	0.600	112.691	108.654	4.037	15.0	450	6.04	50.0
1.009	109	110	61.656	0.600	108.654	103.516	5.138	12.0	450	6.22	50.0
1.010	110	111	12.020	0.600	103.516	103.456	0.060	200.0	450	6.36	50.0
6.000	126	127	39.823	0.600	106.350	104.007	2.343	17.0	225	4.21	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	1.463	58.2	9.4	1.254	1.265	0.069	0.0	61	1.083
1.001	2.627	104.5	20.7	1.265	1.342	0.153	0.0	68	2.065
1.002	2.939	116.8	24.3	1.342	1.503	0.179	0.0	69	2.327
1.003	2.460	271.7	46.9	1.503	1.544	0.346	0.0	104	1.856
2.000	3.395	135.0	13.0	1.317	1.390	0.096	0.0	47	2.171
2.001	1.281	90.6	19.8	1.390	2.104	0.146	0.0	95	1.030
2.002	1.281	90.6	31.6	2.104	1.544	0.233	0.0	122	1.170
1.004	5.184	572.6	92.6	1.544	3.217	0.683	0.0	101	3.855
3.000	4.160	165.4	11.0	1.917	2.445	0.081	0.0	39	2.387
4.000	2.027	223.9	9.1	1.209	2.370	0.067	0.0	51	1.008
3.001	1.477	163.1	24.9	2.445	2.009	0.184	0.0	99	1.079
3.002	1.477	163.1	27.5	2.009	2.389	0.203	0.0	104	1.109
3.003	1.477	163.1	49.3	2.389	3.217	0.364	0.0	141	1.299
1.005	4.731	522.6	155.2	3.217	3.085	1.145	0.0	140	4.146
1.006	5.757	635.8	156.3	3.085	3.187	1.153	0.0	126	4.802
5.000	1.759	124.3	12.9	1.299	1.836	0.095	0.0	65	1.148
5.001	1.281	90.6	25.6	1.836	2.589	0.189	0.0	109	1.106
5.002	1.281	90.6	28.2	2.589	3.112	0.208	0.0	115	1.135
5.003	1.281	90.6	29.0	3.112	3.187	0.214	0.0	116	1.143
1.007	1.657	263.6	186.5	3.187	2.308	1.376	0.0	280	1.790
1.008	5.269	838.0	193.7	2.308	1.297	1.429	0.0	146	4.321
1.009	5.893	937.2	216.3	1.297	1.993	1.596	0.0	146	4.833
1.010	1.434	228.0	216.3	1.993	1.886	1.596	0.0	352	1.620
6.000	3.189	126.8	8.0	1.275	1.463	0.059	0.0	38	1.803



**Links**

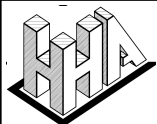
Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
6.001	127	111	11.812	0.600	104.007	103.681	0.326	36.2	225	4.30	50.0
1.011	111	112	6.074	0.600	103.456	102.856	0.600	10.1	450	6.37	50.0
1.012	112	113	8.319	0.600	102.806	102.000	0.806	10.3	225	6.41	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)
6.001	2.180	86.7	8.0	1.463	1.886	0.059	0.0	46	1.377
1.011	6.417	1020.5	227.3	1.886	1.763	1.677	0.0	144	5.214
1.012	4.096	162.9	227.3	2.038	0.775	1.677	0.0	225	4.171

**Pipeline Schedule**

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	15.704	80.0	225	Circular_Default Sewer Type	128.729	127.250	1.254	128.544	127.054	1.265
1.001	42.857	25.0	225	Circular_Default Sewer Type	128.544	127.054	1.265	126.907	125.340	1.342
1.002	27.408	20.0	225	Circular_Default Sewer Type	126.907	125.340	1.342	125.698	123.970	1.503
1.003	62.422	54.4	375	Circular_Default Sewer Type	125.698	123.820	1.503	124.592	122.673	1.544
2.000	34.338	15.0	225	Circular_Default Sewer Type	127.242	125.700	1.317	125.026	123.411	1.390
2.001	51.102	150.0	300	Circular_Default Sewer Type	125.026	123.336	1.390	125.399	122.995	2.104
2.002	37.119	150.0	300	Circular_Default Sewer Type	125.399	122.995	2.104	124.592	122.748	1.544
1.004	63.652	12.3	375	Circular_Default Sewer Type	124.592	122.673	1.544	121.100	117.508	3.217
3.000	28.183	10.0	225	Circular_Default Sewer Type	123.442	121.300	1.917	121.153	118.483	2.445
4.000	13.347	80.0	375	Circular_Default Sewer Type	120.159	118.575	1.209	121.153	118.408	2.370
3.001	42.504	150.0	375	Circular_Default Sewer Type	121.153	118.333	2.445	120.434	118.050	2.009
3.002	23.898	150.0	375	Circular_Default Sewer Type	120.434	118.050	2.009	120.655	117.891	2.389
3.003	57.524	150.0	375	Circular_Default Sewer Type	120.655	117.891	2.389	121.100	117.508	3.217
1.005	55.595	14.8	375	Circular_Default Sewer Type	121.100	117.508	3.217	117.209	113.749	3.085
1.006	9.111	10.0	375	Circular_Default Sewer Type	117.209	113.749	3.085	116.400	112.838	3.187
5.000	23.086	80.0	300	Circular_Default Sewer Type	115.224	113.625	1.299	115.472	113.336	1.836
5.001	34.584	150.0	300	Circular_Default Sewer Type	115.472	113.336	1.836	115.994	113.105	2.589

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	100	1200	Manhole	Adoptable	101	1200	Manhole	Adoptable
1.001	101	1200	Manhole	Adoptable	102	1200	Manhole	Adoptable
1.002	102	1200	Manhole	Adoptable	103	1500	Manhole	Adoptable
1.003	103	1500	Manhole	Adoptable	104	1500	Manhole	Adoptable
2.000	114	1200	Manhole	Adoptable	115	1200	Manhole	Adoptable
2.001	115	1200	Manhole	Adoptable	116	1200	Manhole	Adoptable
2.002	116	1200	Manhole	Adoptable	104	1500	Manhole	Adoptable
1.004	104	1500	Manhole	Adoptable	105	1500	Manhole	Adoptable
3.000	117	1200	Manhole	Adoptable	118	1500	Manhole	Adoptable
4.000	121	1500	Manhole	Adoptable	118	1500	Manhole	Adoptable
3.001	118	1500	Manhole	Adoptable	119	1500	Manhole	Adoptable
3.002	119	1500	Manhole	Adoptable	120	1500	Manhole	Adoptable
3.003	120	1500	Manhole	Adoptable	105	1500	Manhole	Adoptable
1.005	105	1500	Manhole	Adoptable	106	1500	Manhole	Adoptable
1.006	106	1500	Manhole	Adoptable	107	1500	Manhole	Adoptable
5.000	122	1200	Manhole	Adoptable	123	1200	Manhole	Adoptable
5.001	123	1200	Manhole	Adoptable	124	1200	Manhole	Adoptable



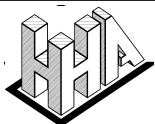
**Pipeline Schedule**

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
5.002	21.997	150.0	300	Circular_Default Sewer Type	115.994	113.105	2.589	116.370	112.958	3.112
5.003	6.770	150.0	300	Circular_Default Sewer Type	116.370	112.958	3.112	116.400	112.913	3.187
1.007	10.828	150.0	450	Circular_Default Sewer Type	116.400	112.763	3.187	115.449	112.691	2.308
1.008	60.549	15.0	450	Circular_Default Sewer Type	115.449	112.691	2.308	110.401	108.654	1.297
1.009	61.656	12.0	450	Circular_Default Sewer Type	110.401	108.654	1.297	105.959	103.516	1.993
1.010	12.020	200.0	450	Circular_Default Sewer Type	105.959	103.516	1.993	105.792	103.456	1.886
6.000	39.823	17.0	225	Circular_Default Sewer Type	107.850	106.350	1.275	105.695	104.007	1.463
6.001	11.812	36.2	225	Circular_Default Sewer Type	105.695	104.007	1.463	105.792	103.681	1.886
1.011	6.074	10.1	450	Circular_Default Sewer Type	105.792	103.456	1.886	105.069	102.856	1.763
1.012	8.319	10.3	225	Circular_Default Sewer Type	105.069	102.806	2.038	103.000	102.000	0.775

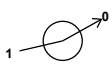
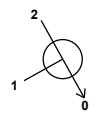


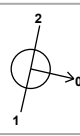

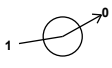
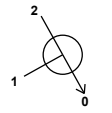



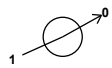
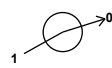
Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
5.002	124	1200	Manhole	Adoptable	125	1200	Manhole	Adoptable
5.003	125	1200	Manhole	Adoptable	107	1500	Manhole	Adoptable
1.007	107	1500	Manhole	Adoptable	108	1500	Manhole	Adoptable
1.008	108	1500	Manhole	Adoptable	109	1500	Manhole	Adoptable
1.009	109	1500	Manhole	Adoptable	110	1500	Manhole	Adoptable
1.010	110	1500	Manhole	Adoptable	111	1500	Manhole	Adoptable
6.000	126	1200	Manhole	Adoptable	127	1200	Manhole	Adoptable
6.001	127	1200	Manhole	Adoptable	111	1500	Manhole	Adoptable
1.011	111	1500	Manhole	Adoptable	112	1800	Manhole	Adoptable
1.012	112	1800	Manhole	Adoptable	113	1200	Manhole	Adoptable

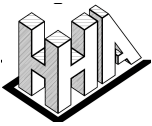
**Manhole Schedule**

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
100	432209.830	405557.630	128.729	1.479	1200				
						0	1.000	127.250	225
101	432213.763	405542.426	128.544	1.490	1200				
						0	1.001	127.054	225
						1	1.001	125.340	225
102	432255.553	405551.931	126.907	1.567	1200				
						0	1.002	125.340	225
						1	1.002	123.970	225
103	432279.614	405565.057	125.698	1.878	1500				
						0	1.003	123.820	375
114	432219.989	405514.321	127.242	1.542	1200				
						0	2.000	125.700	225
115	432227.807	405480.885	125.026	1.690	1200				
						1	2.000	123.411	225
						0	2.001	123.336	300



**Manhole Schedule**

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
116	432277.581	405492.461	125.399	2.404	1200		1	2.001	122.995	300
							0	2.002	122.995	300
104	432310.004	405510.532	124.592	1.919	1500		1	2.002	122.748	300
							2	1.003	122.673	375
							0	1.004	122.673	375
117	432231.457	405460.171	123.442	2.142	1200		0	3.000	121.300	225
121	432222.764	405419.563	120.159	1.584	1500		0	4.000	118.575	375
118	432225.735	405432.575	121.153	2.820	1500		1	4.000	118.408	375
							2	3.000	118.483	225
							0	3.001	118.333	375
119	432267.172	405423.112	120.434	2.384	1500		1	3.001	118.050	375
							0	3.002	118.050	375
120	432290.762	405426.937	120.655	2.764	1500		1	3.002	117.891	375
							0	3.003	117.891	375
105	432341.009	405454.942	121.100	3.592	1500		1	3.003	117.508	375
							2	1.004	117.508	375
							0	1.005	117.508	375
106	432368.075	405406.380	117.209	3.460	1500		1	1.005	113.749	375
							0	1.006	113.749	375
122	432290.753	405367.734	115.224	1.599	1200		0	5.000	113.625	300
123	432313.640	405370.762	115.472	2.136	1200		1	5.000	113.336	300
							0	5.001	113.336	300
124	432345.174	405384.962	115.994	2.889	1200		1	5.001	113.105	300
							0	5.002	113.105	300
125	432364.388	405395.671	116.370	3.412	1200		1	5.002	112.958	300
							0	5.003	112.958	300



**Manhole Schedule**

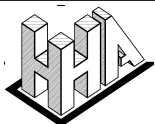
Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
107	432370.847	405397.701	116.400	3.637	1500		1	5.003	112.913	300
						2	1.006	112.838	375	
						0	1.007	112.763	450	
108	432374.142	405387.387	115.449	2.758	1500		1	1.007	112.691	450
						0	1.008	112.691	450	
109	432377.675	405326.941	110.401	1.747	1500		1	1.008	108.654	450
						0	1.009	108.654	450	
110	432403.804	405271.095	105.959	2.443	1500		1	1.009	103.516	450
						0	1.010	103.516	450	
126	432455.100	405234.390	107.850	1.500	1200		0	6.000	106.350	225
						1	6.000	104.007	225	
127	432420.477	405254.066	105.695	1.688	1200		0	6.001	104.007	225
						1	6.001	103.681	225	
111	432412.213	405262.506	105.792	2.336	1500		2	1.010	103.456	450
						0	1.011	103.456	450	
112	432416.929	405266.334	105.069	2.263	1800		1	1.011	102.856	450
						0	1.012	102.806	225	
113	432423.721	405261.531	103.000	1.000	1200		1	1.012	102.000	225

**Simulation Settings**

Rainfall Methodology	FSR	Analysis Speed	Normal
Rainfall Events	Singular	Skip Steady State	✓
FSR Region	England and Wales	Drain Down Time (mins)	240
M5-60 (mm)	19.000	Additional Storage (m <sup>3</sup> /ha)	20.0
Ratio-R	0.373	Starting Level (m)	
Summer CV	0.750	Check Discharge Rate(s)	✓
Winter CV	0.840	Check Discharge Volume	x

**Storm Durations**

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



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

**Pre-development Discharge Rate**

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

**Node 112 Online Hydro-Brake® Control**

Flap Valve	x	Objective (HE)	Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	102.806	Product Number	CTL-SHE-0160-1560-2250-1560
Design Depth (m)	2.250	Min Outlet Diameter (m)	0.225
Design Flow (l/s)	15.6	Min Node Diameter (mm)	1800

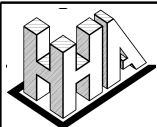
**Node 112 Depth/Area Storage Structure**

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	1.0	Invert Level (m)	102.950
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m <sup>2</sup> )	Inf Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf Area (m <sup>2</sup> )
0.000	510.0	510.0	2.000	510.0	670.1	2.001	0.0	670.1

**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



**Results for 2 year Critical Storm Duration. Lowest mass balance: 99.42%**

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m <sup>3</sup> )	Flood (m <sup>3</sup> )	Status
15 minute winter	100	10	127.323	0.073	12.3	0.1497	0.0000	OK
15 minute summer	101	10	127.133	0.079	27.3	0.1785	0.0000	OK
15 minute winter	102	10	125.423	0.083	31.9	0.1214	0.0000	OK
15 minute summer	103	10	123.945	0.125	61.6	0.4416	0.0000	OK
15 minute winter	114	10	125.755	0.055	17.2	0.1310	0.0000	OK
15 minute summer	115	10	123.445	0.109	26.1	0.1880	0.0000	OK
15 minute winter	116	10	123.140	0.145	41.5	0.2688	0.0000	OK
15 minute winter	104	10	122.787	0.114	119.8	0.3260	0.0000	OK
15 minute winter	117	10	121.346	0.046	14.5	0.0863	0.0000	OK
15 minute summer	121	10	118.636	0.061	12.0	0.1599	0.0000	OK
15 minute summer	118	10	118.449	0.116	32.9	0.2346	0.0000	OK
15 minute winter	119	10	118.173	0.123	36.4	0.2375	0.0000	OK
15 minute winter	120	10	118.057	0.166	64.5	0.4875	0.0000	OK
15 minute winter	105	11	117.672	0.164	198.7	0.3789	0.0000	OK
15 minute winter	106	11	113.909	0.160	198.1	0.2895	0.0000	OK
15 minute winter	122	10	113.699	0.074	17.0	0.1723	0.0000	OK
15 minute summer	123	10	113.467	0.131	33.8	0.2632	0.0000	OK
15 minute summer	124	10	113.248	0.143	37.2	0.1801	0.0000	OK
15 minute winter	125	11	113.132	0.174	37.9	0.2029	0.0000	OK
15 minute winter	107	11	113.101	0.338	238.4	0.6140	0.0000	OK
15 minute winter	108	11	112.864	0.173	247.5	0.3720	0.0000	OK
15 minute winter	109	11	108.818	0.164	273.9	0.6039	0.0000	OK
15 minute winter	110	11	103.902	0.386	274.5	0.6825	0.0000	OK
15 minute winter	126	10	106.394	0.044	10.5	0.0837	0.0000	OK
15 minute winter	127	10	104.062	0.055	10.5	0.0625	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m <sup>3</sup> )	Discharge Vol (m <sup>3</sup> )
15 minute winter	100	1.000	101	12.3	1.048	0.211	0.1843	
15 minute summer	101	1.001	102	27.3	2.127	0.262	0.5510	
15 minute winter	102	1.002	103	31.9	2.461	0.273	0.3549	
15 minute summer	103	1.003	104	61.6	2.047	0.227	1.8780	
15 minute winter	114	2.000	115	17.2	2.319	0.127	0.2547	
15 minute summer	115	2.001	116	26.1	0.929	0.289	1.4463	
15 minute winter	116	2.002	104	39.9	1.232	0.440	1.2082	
15 minute winter	104	1.004	105	118.3	3.187	0.207	2.3741	
15 minute winter	117	3.000	118	14.5	2.549	0.088	0.1603	
15 minute summer	121	4.000	118	12.0	1.065	0.054	0.1505	
15 minute summer	118	3.001	119	33.1	1.094	0.203	1.2849	
15 minute winter	119	3.002	120	35.7	0.919	0.219	0.9396	
15 minute winter	120	3.003	105	62.9	1.358	0.385	2.6850	
15 minute winter	105	1.005	106	196.9	4.333	0.377	2.5273	
15 minute winter	106	1.006	107	199.5	3.119	0.314	0.5797	
15 minute winter	122	5.000	123	17.0	0.803	0.137	0.4971	
15 minute summer	123	5.001	124	33.8	1.082	0.373	1.0808	
15 minute winter	124	5.002	125	36.8	1.008	0.407	0.8141	
15 minute winter	125	5.003	107	37.6	0.988	0.415	0.3006	
15 minute winter	107	1.007	108	239.4	2.579	0.908	0.9950	
15 minute winter	108	1.008	109	248.4	4.587	0.296	3.2802	
15 minute winter	109	1.009	110	274.5	2.717	0.293	6.0755	
15 minute winter	110	1.010	111	273.7	2.454	1.200	1.3218	
15 minute winter	126	6.000	127	10.5	1.647	0.083	0.2576	
15 minute winter	127	6.001	111	10.5	1.436	0.121	0.0861	

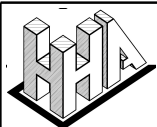


**Results for 2 year Critical Storm Duration. Lowest mass balance: 99.42%**

<b>Node Event</b>	<b>US Node</b>	<b>Peak (mins)</b>	<b>Level (m)</b>	<b>Depth (m)</b>	<b>Inflow (l/s)</b>	<b>Node Vol (m<sup>3</sup>)</b>	<b>Flood (m<sup>3</sup>)</b>	<b>Status</b>
15 minute summer	111	11	103.672	0.216	283.6	0.4233	0.0000	OK
120 minute winter	112	118	103.320	0.514	92.7	180.9028	0.0000	SURCHARGED
120 minute winter	113	118	102.046	0.046	15.2	0.0000	0.0000	OK

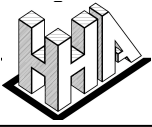
<b>Link Event (Outflow)</b>	<b>US Node</b>	<b>Link</b>	<b>DS Node</b>	<b>Outflow (l/s)</b>	<b>Velocity (m/s)</b>	<b>Flow/Cap</b>	<b>Link Vol (m<sup>3</sup>)</b>	<b>Discharge Vol (m<sup>3</sup>)</b>
15 minute winter	111	1.011	112	287.0	4.257	0.281	0.4560	
120 minute winter	112	1.012	113	15.2	2.480	0.094	0.0512	265.8



**Results for 30 year Critical Storm Duration. Lowest mass balance: 99.42%**

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m <sup>3</sup> )	Flood (m <sup>3</sup> )	Status
15 minute winter	100	10	127.355	0.105	23.4	0.2174	0.0000	OK
15 minute summer	101	10	127.167	0.113	51.8	0.2562	0.0000	OK
15 minute summer	102	10	125.461	0.121	60.7	0.1773	0.0000	OK
15 minute summer	103	10	123.999	0.179	117.1	0.6334	0.0000	OK
15 minute winter	114	9	125.776	0.076	32.5	0.1809	0.0000	OK
15 minute summer	115	10	123.492	0.156	49.4	0.2687	0.0000	OK
15 minute winter	116	10	123.219	0.224	78.7	0.4154	0.0000	OK
15 minute winter	104	10	122.835	0.162	228.2	0.4610	0.0000	OK
15 minute summer	117	10	121.363	0.063	27.4	0.1197	0.0000	OK
15 minute winter	121	10	118.660	0.085	22.7	0.2210	0.0000	OK
15 minute summer	118	10	118.499	0.166	62.3	0.3358	0.0000	OK
15 minute winter	119	10	118.233	0.183	68.9	0.3526	0.0000	OK
15 minute winter	120	10	118.142	0.251	122.6	0.7364	0.0000	OK
15 minute summer	105	10	117.746	0.238	378.6	0.5514	0.0000	OK
15 minute winter	106	11	114.065	0.316	380.8	0.5733	0.0000	OK
15 minute winter	122	10	113.728	0.103	32.2	0.2391	0.0000	OK
15 minute winter	123	11	113.655	0.319	64.0	0.6411	0.0000	SURCHARGED
15 minute winter	124	11	113.558	0.453	66.2	0.5719	0.0000	SURCHARGED
15 minute winter	125	11	113.479	0.521	68.0	0.6075	0.0000	SURCHARGED
15 minute winter	107	11	113.442	0.679	439.9	1.2343	0.0000	SURCHARGED
15 minute winter	108	11	112.940	0.249	455.9	0.5362	0.0000	OK
15 minute winter	109	11	108.885	0.231	505.0	0.8502	0.0000	OK
15 minute winter	110	11	104.390	0.874	505.5	1.5445	0.0000	SURCHARGED
15 minute winter	126	10	106.410	0.060	20.0	0.1155	0.0000	OK
15 minute summer	127	10	104.084	0.077	20.0	0.0871	0.0000	OK

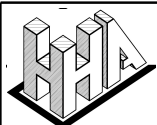
Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m <sup>3</sup> )	Discharge Vol (m <sup>3</sup> )
15 minute winter	100	1.000	101	23.4	1.223	0.402	0.3005	
15 minute summer	101	1.001	102	51.9	2.479	0.496	0.8966	
15 minute summer	102	1.002	103	60.6	2.885	0.519	0.5762	
15 minute summer	103	1.003	104	117.2	2.416	0.431	3.0296	
15 minute winter	114	2.000	115	32.5	2.698	0.241	0.4210	
15 minute summer	115	2.001	116	49.4	1.073	0.546	2.3824	
15 minute winter	116	2.002	104	75.8	1.414	0.837	2.0076	
15 minute winter	104	1.004	105	226.5	3.793	0.396	3.7955	
15 minute winter	117	3.000	118	27.4	3.048	0.166	0.2534	
15 minute winter	121	4.000	118	22.7	1.181	0.101	0.2615	
15 minute summer	118	3.001	119	62.6	1.247	0.384	2.1341	
15 minute winter	119	3.002	120	68.1	1.041	0.417	1.5750	
15 minute winter	120	3.003	105	120.2	1.614	0.737	4.3793	
15 minute winter	105	1.005	106	378.1	4.635	0.724	4.7306	
15 minute winter	106	1.006	107	380.8	3.481	0.599	0.9542	
15 minute winter	122	5.000	123	32.2	0.921	0.259	1.0373	
15 minute winter	123	5.001	124	59.8	1.205	0.660	2.4354	
15 minute winter	124	5.002	125	67.1	1.038	0.741	1.5490	
15 minute summer	125	5.003	107	74.0	1.178	0.817	0.4767	
15 minute winter	107	1.007	108	440.6	3.143	1.671	1.3457	
15 minute winter	108	1.008	109	456.7	5.308	0.545	5.2097	
15 minute winter	109	1.009	110	505.5	3.690	0.539	7.4114	
15 minute winter	110	1.010	111	502.8	3.272	2.205	1.7303	
15 minute winter	126	6.000	127	20.0	1.970	0.158	0.4056	
15 minute summer	127	6.001	111	20.5	1.658	0.237	0.1836	



**Results for 30 year Critical Storm Duration. Lowest mass balance: 99.42%**

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m <sup>3</sup> )	Flood (m <sup>3</sup> )	Status
180 minute winter	111	132	103.814	0.358	129.9	0.6996	0.0000	OK
180 minute winter	112	180	103.801	0.995	129.9	415.1854	0.0000	SURCHARGED
30 minute winter	113	62	102.047	0.047	15.6	0.0000	0.0000	OK

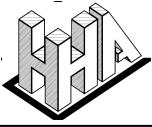
Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m <sup>3</sup> )	Discharge Vol (m <sup>3</sup> )
15 minute winter	111	1.011	112	527.3	4.671	0.517	0.8075	
30 minute winter	112	1.012	113	15.6	2.494	0.096	0.0519	237.2



**Results for 100 year Critical Storm Duration. Lowest mass balance: 99.42%**

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m <sup>3</sup> )	Flood (m <sup>3</sup> )	Status
15 minute winter	100	10	127.374	0.124	30.2	0.2559	0.0000	OK
15 minute summer	101	10	127.187	0.133	67.0	0.3010	0.0000	OK
15 minute summer	102	10	125.484	0.144	78.5	0.2108	0.0000	OK
15 minute summer	103	10	124.030	0.210	151.5	0.7430	0.0000	OK
15 minute winter	114	10	125.786	0.086	42.1	0.2040	0.0000	OK
15 minute summer	115	10	123.519	0.183	63.9	0.3153	0.0000	OK
15 minute winter	116	11	123.303	0.308	101.9	0.5719	0.0000	SURCHARGED
15 minute winter	104	10	122.859	0.186	291.8	0.5312	0.0000	OK
15 minute winter	117	10	121.373	0.073	35.5	0.1374	0.0000	OK
15 minute winter	121	10	118.673	0.098	29.4	0.2548	0.0000	OK
15 minute winter	118	10	118.528	0.195	80.7	0.3945	0.0000	OK
15 minute winter	119	10	118.272	0.222	89.2	0.4277	0.0000	OK
15 minute winter	120	10	118.202	0.311	158.3	0.9110	0.0000	OK
15 minute winter	105	11	117.822	0.314	487.3	0.7252	0.0000	OK
15 minute winter	106	11	114.704	0.955	477.6	1.7319	0.0000	SURCHARGED
15 minute winter	122	11	114.079	0.454	41.6	1.0526	0.0000	SURCHARGED
15 minute winter	123	11	114.050	0.714	81.9	1.4363	0.0000	SURCHARGED
15 minute winter	124	11	113.896	0.791	73.8	0.9992	0.0000	SURCHARGED
15 minute winter	125	11	113.768	0.810	78.3	0.9449	0.0000	SURCHARGED
15 minute winter	107	11	113.708	0.945	552.2	1.7162	0.0000	SURCHARGED
15 minute winter	108	11	112.980	0.289	570.4	0.6222	0.0000	OK
15 minute winter	109	11	108.924	0.270	631.6	0.9922	0.0000	OK
15 minute winter	110	12	104.793	1.277	628.0	2.2572	0.0000	SURCHARGED
15 minute winter	126	10	106.419	0.069	25.8	0.1315	0.0000	OK
240 minute winter	127	240	104.172	0.165	4.9	0.1863	0.0000	OK

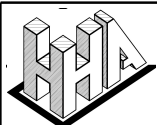
Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m <sup>3</sup> )	Discharge Vol (m <sup>3</sup> )
15 minute winter	100	1.000	101	30.2	1.288	0.519	0.3683	
15 minute summer	101	1.001	102	67.1	2.613	0.642	1.0999	
15 minute summer	102	1.002	103	78.5	3.047	0.672	0.7058	
15 minute winter	103	1.003	104	151.7	2.573	0.558	3.6800	
15 minute winter	114	2.000	115	42.1	2.713	0.312	0.5619	
15 minute summer	115	2.001	116	63.8	1.132	0.704	2.9383	
15 minute winter	116	2.002	104	95.4	1.453	1.054	2.4289	
15 minute winter	104	1.004	105	290.3	3.948	0.507	4.8206	
15 minute winter	117	3.000	118	35.5	3.269	0.215	0.3061	
15 minute winter	121	4.000	118	29.4	1.173	0.131	0.3545	
15 minute winter	118	3.001	119	80.9	1.299	0.496	2.6737	
15 minute winter	119	3.002	120	87.8	1.062	0.538	1.9781	
15 minute winter	120	3.003	105	154.1	1.613	0.945	5.5730	
15 minute winter	105	1.005	106	474.6	4.644	0.908	5.8026	
15 minute winter	106	1.006	107	474.6	4.304	0.746	1.0049	
15 minute winter	122	5.000	123	40.7	0.944	0.327	1.6257	
15 minute summer	123	5.001	124	70.0	1.208	0.773	2.4354	
15 minute winter	124	5.002	125	77.5	1.101	0.856	1.5490	
15 minute winter	125	5.003	107	82.2	1.225	0.907	0.4767	
15 minute winter	107	1.007	108	550.6	3.756	2.089	1.4407	
15 minute winter	108	1.008	109	569.1	5.528	0.679	6.2614	
15 minute winter	109	1.009	110	628.0	4.375	0.670	7.9413	
15 minute winter	110	1.010	111	620.6	3.917	2.722	1.9045	
15 minute winter	126	6.000	127	25.8	2.146	0.203	0.4796	
15 minute summer	127	6.001	111	26.0	1.683	0.300	0.2922	



**Results for 100 year Critical Storm Duration. Lowest mass balance: 99.42%**

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m <sup>3</sup> )	Flood (m <sup>3</sup> )	Status
240 minute winter	111	236	104.172	0.716	138.1	1.4001	0.0000	SURCHARGED
240 minute winter	112	240	104.172	1.366	137.5	595.6191	0.0000	SURCHARGED
15 minute winter	113	53	102.047	0.047	15.6	0.0000	0.0000	OK

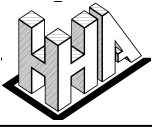
Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m <sup>3</sup> )	Discharge Vol (m <sup>3</sup> )
15 minute winter	111	1.011	112	646.8	4.792	0.634	0.9624	
15 minute winter	112	1.012	113	15.6	2.494	0.096	0.0519	226.7



**Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.42%**

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m <sup>3</sup> )	Flood (m <sup>3</sup> )	Status
15 minute summer	100	10	127.409	0.159	42.3	0.3280	0.0000	OK
15 minute summer	101	10	127.225	0.171	93.8	0.3860	0.0000	OK
15 minute winter	102	10	125.534	0.194	109.9	0.2835	0.0000	OK
15 minute summer	103	10	124.085	0.265	211.8	0.9391	0.0000	OK
15 minute summer	114	10	125.803	0.103	58.9	0.2457	0.0000	OK
15 minute winter	115	11	123.929	0.593	89.6	1.0212	0.0000	SURCHARGED
15 minute winter	116	11	123.601	0.606	133.2	1.1243	0.0000	SURCHARGED
15 minute winter	104	11	122.907	0.234	402.6	0.6670	0.0000	OK
15 minute summer	117	9	121.387	0.087	49.7	0.1643	0.0000	OK
15 minute winter	121	12	119.798	1.223	93.9	3.1966	0.0000	SURCHARGED
15 minute winter	118	12	119.781	1.448	111.5	2.9270	0.0000	SURCHARGED
15 minute winter	119	12	119.735	1.685	123.2	3.2466	0.0000	SURCHARGED
15 minute winter	120	12	119.681	1.790	167.2	5.2492	0.0000	SURCHARGED
15 minute winter	105	12	119.372	1.863	563.1	4.3102	0.0000	SURCHARGED
15 minute winter	106	12	115.088	1.339	516.0	2.4269	0.0000	SURCHARGED
15 minute winter	122	11	114.717	1.092	58.3	2.5331	0.0000	SURCHARGED
15 minute winter	123	11	114.655	1.319	105.7	2.6526	0.0000	SURCHARGED
15 minute winter	124	11	114.313	1.208	109.9	1.5263	0.0000	SURCHARGED
15 minute winter	125	11	114.030	1.072	112.7	1.2495	0.0000	SURCHARGED
15 minute winter	107	12	113.906	1.143	624.2	2.0762	0.0000	SURCHARGED
15 minute winter	108	12	112.999	0.308	648.0	0.6630	0.0000	OK
15 minute winter	109	11	108.996	0.342	734.7	1.2565	0.0000	OK
15 minute winter	110	12	105.420	1.904	731.4	3.3650	0.0000	SURCHARGED
15 minute summer	126	10	106.432	0.082	36.2	0.1571	0.0000	OK
360 minute winter	127	352	104.815	0.808	5.0	0.9138	0.0000	SURCHARGED

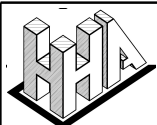
Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m <sup>3</sup> )	Discharge Vol (m <sup>3</sup> )
15 minute summer	100	1.000	101	42.3	1.357	0.727	0.4896	
15 minute summer	101	1.001	102	94.0	2.746	0.900	1.4733	
15 minute winter	102	1.002	103	109.4	3.190	0.937	0.9427	
15 minute winter	103	1.003	104	211.7	2.751	0.779	4.7986	
15 minute summer	114	2.000	115	58.9	2.688	0.436	0.9883	
15 minute winter	115	2.001	116	82.7	1.174	0.913	3.5986	
15 minute winter	116	2.002	104	130.7	1.857	1.443	2.5513	
15 minute winter	104	1.004	105	392.7	4.029	0.686	5.8108	
15 minute summer	117	3.000	118	49.7	3.510	0.301	0.7511	
15 minute winter	121	4.000	118	-52.8	1.171	-0.236	1.4721	
15 minute winter	118	3.001	119	120.8	1.336	0.741	4.6881	
15 minute winter	119	3.002	120	131.1	1.189	0.804	2.6359	
15 minute summer	120	3.003	105	187.1	2.122	1.147	6.3447	
15 minute winter	105	1.005	106	512.9	4.651	0.982	6.1320	
15 minute winter	106	1.006	107	517.0	4.688	0.813	1.0049	
15 minute winter	122	5.000	123	50.4	0.953	0.405	1.6257	
15 minute winter	123	5.001	124	100.0	1.421	1.105	2.4354	
15 minute winter	124	5.002	125	109.6	1.557	1.210	1.5490	
15 minute winter	125	5.003	107	112.0	1.591	1.237	0.4767	
15 minute winter	107	1.007	108	625.6	4.190	2.373	1.4844	
15 minute winter	108	1.008	109	647.3	5.529	0.772	7.4110	
15 minute winter	109	1.009	110	731.4	4.763	0.780	8.8640	
15 minute winter	110	1.010	111	721.6	4.554	3.165	1.9045	
15 minute summer	126	6.000	127	36.2	2.301	0.286	0.9584	
15 minute winter	127	6.001	111	37.2	1.669	0.429	0.4698	



**Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.42%**

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m <sup>3</sup> )	Flood (m <sup>3</sup> )	Status
360 minute winter	111	352	104.815	1.359	137.1	2.6581	0.0000	SURCHARGED
360 minute winter	112	352	104.815	2.008	136.1	908.6958	0.0000	FLOOD RISK
30 minute winter	113	19	102.047	0.047	15.6	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m <sup>3</sup> )	Discharge Vol (m <sup>3</sup> )
15 minute winter	111	1.011	112	751.9	4.826	0.737	0.9624	
30 minute winter	112	1.012	113	15.6	2.494	0.096	0.0519	231.2



### Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	2	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	19.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.373	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	4.00	Enforce best practice design rules	x

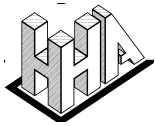
### Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
200	0.146	4.00	109.300	1200	432475.912	405186.034	1.500
201	0.024	4.00	108.667	1200	432494.334	405125.293	1.660
202	0.111	4.00	107.514	1200	432492.141	405099.755	1.532
203	0.037	4.00	104.569	1200	432475.510	405060.147	1.526
212	0.104	4.00	109.602	1200	432530.137	404993.365	1.602
213	0.072	4.00	106.751	1200	432507.057	405018.636	1.603
214	0.042	4.00	103.935	1200	432476.546	405033.335	1.609
204	0.045	4.00	103.140	1200	432461.989	405042.849	1.561
205	0.016	4.00	99.803	1500	432436.678	405002.898	2.240
215	0.086	4.00	103.411	1200	432484.256	404955.186	1.511
216	0.058	4.00	101.221	1200	432466.655	404974.700	1.511
217	0.012	4.00	99.333	1200	432445.338	404983.588	1.548
206	0.014	4.00	98.716	1500	432431.468	404987.460	1.968
207	0.027	4.00	97.652	1500	432427.454	404973.470	1.632
208	0.000	4.00	95.931	1500	432417.530	404950.659	2.449
209	0.043	4.00	95.100	1800	432413.971	404939.177	4.302
210	0.000		93.280	1800	432408.938	404913.074	2.709
211	0.000		92.500	1200	432401.153	404911.598	1.982

### Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	200	201	63.473	0.600	107.800	107.007	0.793	80.0	225	4.72	50.0
1.001	201	202	25.632	0.600	107.007	105.982	1.025	25.0	225	4.89	50.0
1.002	202	203	42.958	0.600	105.982	103.118	2.864	15.0	225	5.10	50.0
1.003	203	204	21.955	0.600	103.043	101.579	1.464	15.0	300	5.19	50.0
2.000	212	213	34.224	0.600	108.000	105.148	2.852	12.0	225	4.15	50.0
2.001	213	214	33.867	0.600	105.148	102.326	2.822	12.0	225	4.30	50.0
2.002	214	204	17.390	0.600	102.326	101.654	0.672	25.9	225	4.41	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	1.463	58.2	19.8	1.275	1.435	0.146	0.0	90	1.325
1.001	2.627	104.5	23.0	1.435	1.307	0.170	0.0	72	2.121
1.002	3.395	135.0	38.1	1.307	1.226	0.281	0.0	81	2.926
1.003	4.079	288.3	43.1	1.226	1.261	0.318	0.0	78	2.954
2.000	3.798	151.0	14.1	1.377	1.378	0.104	0.0	46	2.402
2.001	3.798	151.0	23.9	1.378	1.384	0.176	0.0	60	2.794
2.002	2.582	102.7	29.5	1.384	1.261	0.218	0.0	82	2.236



**Links**

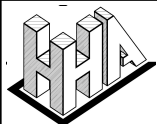
Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.004	204	205	47.294	0.600	101.579	97.638	3.941	12.0	300	5.36	50.0
1.005	205	206	16.293	0.600	97.563	96.748	0.815	20.0	375	5.43	50.0
3.000	215	216	26.279	0.600	101.900	99.710	2.190	12.0	225	4.12	50.0
3.001	216	217	23.096	0.600	99.710	97.785	1.925	12.0	225	4.22	50.0
3.002	217	206	14.400	0.600	97.785	96.898	0.887	16.2	225	4.29	50.0
1.006	206	207	14.554	0.600	96.748	96.020	0.728	20.0	375	5.49	50.0
1.007	207	208	24.876	0.600	96.020	93.532	2.488	10.0	375	5.56	50.0
1.008	208	209	12.021	0.600	93.482	92.280	1.202	10.0	225	5.61	50.0
1.009	209	210	26.584	0.600	90.798	90.621	0.177	150.0	900	5.78	50.0
1.010	210	211	7.924	0.600	90.571	90.518	0.053	150.0	225	5.90	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	4.562	322.5	78.7	1.261	1.865	0.581	0.0	100	3.790
1.005	4.067	449.2	80.9	1.865	1.593	0.597	0.0	107	3.116
3.000	3.798	151.0	11.7	1.286	1.286	0.086	0.0	42	2.264
3.001	3.798	151.0	19.5	1.286	1.323	0.144	0.0	54	2.630
3.002	3.263	129.7	21.1	1.323	1.593	0.156	0.0	61	2.419
1.006	4.067	449.2	103.9	1.593	1.257	0.767	0.0	122	3.331
1.007	5.757	635.8	107.6	1.257	2.024	0.794	0.0	104	4.331
1.008	4.161	165.5	107.6	2.224	2.595	0.794	0.0	132	4.420
1.009	2.556	1625.9	113.4	3.402	1.759	0.837	0.0	159	1.508
1.010	1.065	42.3	113.4	2.484	1.757	0.837	0.0	225	1.085

**Pipeline Schedule**

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	63.473	80.0	225	Circular_Default Sewer Type	109.300	107.800	1.275	108.667	107.007	1.435
1.001	25.632	25.0	225	Circular_Default Sewer Type	108.667	107.007	1.435	107.514	105.982	1.307
1.002	42.958	15.0	225	Circular_Default Sewer Type	107.514	105.982	1.307	104.569	103.118	1.226
1.003	21.955	15.0	300	Circular_Default Sewer Type	104.569	103.043	1.226	103.140	101.579	1.261
2.000	34.224	12.0	225	Circular_Default Sewer Type	109.602	108.000	1.377	106.751	105.148	1.378
2.001	33.867	12.0	225	Circular_Default Sewer Type	106.751	105.148	1.378	103.935	102.326	1.384
2.002	17.390	25.9	225	Circular_Default Sewer Type	103.935	102.326	1.384	103.140	101.654	1.261
1.004	47.294	12.0	300	Circular_Default Sewer Type	103.140	101.579	1.261	99.803	97.638	1.865
1.005	16.293	20.0	375	Circular_Default Sewer Type	99.803	97.563	1.865	98.716	96.748	1.593
3.000	26.279	12.0	225	Circular_Default Sewer Type	103.411	101.900	1.286	101.221	99.710	1.286

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	200	1200	Manhole	Adoptable	201	1200	Manhole	Adoptable
1.001	201	1200	Manhole	Adoptable	202	1200	Manhole	Adoptable
1.002	202	1200	Manhole	Adoptable	203	1200	Manhole	Adoptable
1.003	203	1200	Manhole	Adoptable	204	1200	Manhole	Adoptable
2.000	212	1200	Manhole	Adoptable	213	1200	Manhole	Adoptable
2.001	213	1200	Manhole	Adoptable	214	1200	Manhole	Adoptable
2.002	214	1200	Manhole	Adoptable	204	1200	Manhole	Adoptable
1.004	204	1200	Manhole	Adoptable	205	1500	Manhole	Adoptable
1.005	205	1500	Manhole	Adoptable	206	1500	Manhole	Adoptable
3.000	215	1200	Manhole	Adoptable	216	1200	Manhole	Adoptable



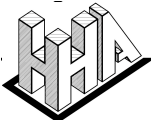
**Pipeline Schedule**

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
3.001	23.096	12.0	225	Circular_Default Sewer Type	101.221	99.710	1.286	99.333	97.785	1.323
3.002	14.400	16.2	225	Circular_Default Sewer Type	99.333	97.785	1.323	98.716	96.898	1.593
1.006	14.554	20.0	375	Circular_Default Sewer Type	98.716	96.748	1.593	97.652	96.020	1.257
1.007	24.876	10.0	375	Circular_Default Sewer Type	97.652	96.020	1.257	95.931	93.532	2.024
1.008	12.021	10.0	225	Circular_Default Sewer Type	95.931	93.482	2.224	95.100	92.280	2.595
1.009	26.584	150.0	900	Circular_Default Sewer Type	95.100	90.798	3.402	93.280	90.621	1.759
1.010	7.924	150.0	225	Circular_Default Sewer Type	93.280	90.571	2.484	92.500	90.518	1.757

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
3.001	216	1200	Manhole	Adoptable	217	1200	Manhole	Adoptable
3.002	217	1200	Manhole	Adoptable	206	1500	Manhole	Adoptable
1.006	206	1500	Manhole	Adoptable	207	1500	Manhole	Adoptable
1.007	207	1500	Manhole	Adoptable	208	1500	Manhole	Adoptable
1.008	208	1500	Manhole	Adoptable	209	1800	Manhole	Adoptable
1.009	209	1800	Manhole	Adoptable	210	1800	Manhole	Adoptable
1.010	210	1800	Manhole	Adoptable	211	1200	Manhole	Adoptable

**Manhole Schedule**

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
200	432475.912	405186.034	109.300	1.500	1200					
						0	1.000	107.800	225	
201	432494.334	405125.293	108.667	1.660	1200		1	1.000	107.007	225
						0	1.001	107.007	225	
202	432492.141	405099.755	107.514	1.532	1200		1	1.001	105.982	225
						0	1.002	105.982	225	
203	432475.510	405060.147	104.569	1.526	1200		1	1.002	103.118	225
						0	1.003	103.043	300	
212	432530.137	404993.365	109.602	1.602	1200		0	2.000	108.000	225
213	432507.057	405018.636	106.751	1.603	1200		1	2.000	105.148	225
						0	2.001	105.148	225	
214	432476.546	405033.335	103.935	1.609	1200		1	2.001	102.326	225
						0	2.002	102.326	225	



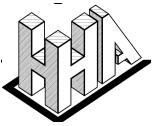
**Manhole Schedule**

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
204	432461.989	405042.849	103.140	1.561	1200		1	2.002	101.654	225
							2	1.003	101.579	300
							0	1.004	101.579	300
205	432436.678	405002.898	99.803	2.240	1500		1	1.004	97.638	300
							0	1.005	97.563	375
215	432484.256	404955.186	103.411	1.511	1200					
							0	3.000	101.900	225
216	432466.655	404974.700	101.221	1.511	1200		1	3.000	99.710	225
							0	3.001	99.710	225
217	432445.338	404983.588	99.333	1.548	1200		1	3.001	97.785	225
							0	3.002	97.785	225
206	432431.468	404987.460	98.716	1.968	1500		1	3.002	96.898	225
							2	1.005	96.748	375
							0	1.006	96.748	375
207	432427.454	404973.470	97.652	1.632	1500		1	1.006	96.020	375
							0	1.007	96.020	375
208	432417.530	404950.659	95.931	2.449	1500		1	1.007	93.532	375
							0	1.008	93.482	225
209	432413.971	404939.177	95.100	4.302	1800		1	1.008	92.280	225
							0	1.009	90.798	900
210	432408.938	404913.074	93.280	2.709	1800		1	1.009	90.621	900
							0	1.010	90.571	225
211	432401.153	404911.598	92.500	1.982	1200		1	1.010	90.518	225

**Simulation Settings**

Rainfall Methodology FSR  
 Rainfall Events Singular  
 FSR Region England and Wales  
 M5-60 (mm) 19.000  
 Ratio-R 0.373  
 Summer CV 0.750

Winter CV 0.840  
 Analysis Speed Normal  
 Skip Steady State ✓  
 Drain Down Time (mins) 240  
 Additional Storage (m³/ha) 20.0  
 Starting Level (m)



**Simulation Settings**

Check Discharge Rate(s)  | Check Discharge Volume

**Storm Durations**

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

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

**Pre-development Discharge Rate**

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

**Node 210 Online Hydro-Brake® Control**

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	<input checked="" type="checkbox"/>
Invert Level (m)	90.571	Product Number	CTL-SHE-0112-8100-2400-8100
Design Depth (m)	2.400	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	8.1	Min Node Diameter (mm)	1500

**Node 208 Online Hydro-Brake® Control**

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	<input checked="" type="checkbox"/>
Invert Level (m)	93.482	Product Number	CTL-SHE-0113-7500-2000-7500
Design Depth (m)	2.000	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	7.5	Min Node Diameter (mm)	1500

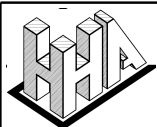
**Node 208 Depth/Area Storage Structure**

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	93.800
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m <sup>2</sup> )	Inf Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf Area (m <sup>2</sup> )
0.000	250.0	250.0	2.000	250.0	362.1	2.001	0.0	362.1

**Other (defaults)**

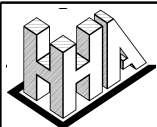
Entry Loss (manhole)	0.250	Entry Loss (junction)	0.000	Apply Recommended Losses	<input type="checkbox"/>
Exit Loss (manhole)	0.250	Exit Loss (junction)	0.000	Flood Risk (m)	0.300



**Results for 2 year Critical Storm Duration. Lowest mass balance: 99.34%**

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m <sup>3</sup> )	Flood (m <sup>3</sup> )	Status
15 minute summer	200	10	107.912	0.112	26.1	0.3432	0.0000	OK
15 minute winter	201	10	107.090	0.083	30.4	0.1183	0.0000	OK
15 minute winter	202	10	106.079	0.097	50.0	0.2499	0.0000	OK
15 minute winter	203	10	103.132	0.089	56.2	0.1438	0.0000	OK
15 minute summer	212	10	108.053	0.053	18.6	0.1291	0.0000	OK
15 minute winter	213	10	105.218	0.069	31.5	0.1409	0.0000	OK
15 minute winter	214	10	102.429	0.103	39.0	0.1695	0.0000	OK
15 minute winter	204	10	101.699	0.120	103.0	0.2041	0.0000	OK
15 minute winter	205	10	97.692	0.129	105.2	0.2456	0.0000	OK
15 minute summer	215	10	101.948	0.048	15.4	0.1097	0.0000	OK
15 minute summer	216	10	99.773	0.063	25.8	0.1190	0.0000	OK
15 minute winter	217	10	97.860	0.075	27.9	0.0963	0.0000	OK
15 minute winter	206	10	96.912	0.164	135.4	0.3124	0.0000	OK
15 minute winter	207	10	96.138	0.118	139.7	0.2473	0.0000	OK
120 minute winter	208	116	94.129	0.647	44.0	79.3009	0.0000	SURCHARGED
480 minute winter	209	496	91.248	0.450	8.9	1.2360	0.0000	OK
480 minute winter	210	520	91.250	0.679	17.1	1.7277	0.0000	SURCHARGED
240 minute winter	211	412	90.578	0.060	6.8	0.0000	0.0000	OK

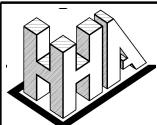
Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m <sup>3</sup> )	Discharge Vol (m <sup>3</sup> )
15 minute summer	200	1.000	201	26.1	1.587	0.449	1.0461	
15 minute winter	201	1.001	202	30.2	2.039	0.289	0.3804	
15 minute winter	202	1.002	203	49.6	3.098	0.367	0.6873	
15 minute winter	203	1.003	204	56.0	2.577	0.194	0.4790	
15 minute summer	212	2.000	213	18.6	2.128	0.123	0.3002	
15 minute winter	213	2.001	214	31.5	2.261	0.209	0.4742	
15 minute winter	214	2.002	204	39.0	2.316	0.380	0.2926	
15 minute winter	204	1.004	205	102.3	4.010	0.317	1.2065	
15 minute winter	205	1.005	206	105.0	2.648	0.234	0.6481	
15 minute summer	215	3.000	216	15.4	2.027	0.102	0.2005	
15 minute summer	216	3.001	217	25.8	2.514	0.171	0.2375	
15 minute winter	217	3.002	206	27.9	2.516	0.215	0.1597	
15 minute winter	206	1.006	207	134.9	3.574	0.300	0.5515	
15 minute winter	207	1.007	208	139.3	1.900	0.219	1.7314	
15 minute winter	208	1.008	209	6.9	2.031	0.042	0.0408	
15 minute summer	209	1.009	210	21.8	0.591	0.013	4.2401	
240 minute winter	210	1.010	211	6.8	0.757	0.160	0.0711	163.5



**Results for 30 year Critical Storm Duration. Lowest mass balance: 99.34%**

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m <sup>3</sup> )	Flood (m <sup>3</sup> )	Status
15 minute summer	200	10	107.971	0.171	49.4	0.5260	0.0000	OK
15 minute winter	201	10	107.128	0.121	57.4	0.1721	0.0000	OK
15 minute winter	202	10	106.127	0.145	94.8	0.3730	0.0000	OK
15 minute winter	203	10	103.170	0.127	106.6	0.2047	0.0000	OK
15 minute summer	212	10	108.074	0.074	35.2	0.1788	0.0000	OK
15 minute winter	213	10	105.246	0.098	59.6	0.1982	0.0000	OK
15 minute winter	214	10	102.483	0.157	73.8	0.2596	0.0000	OK
15 minute winter	204	10	101.755	0.176	195.4	0.3012	0.0000	OK
15 minute winter	205	10	97.754	0.191	199.8	0.3654	0.0000	OK
15 minute summer	215	10	101.967	0.067	29.1	0.1513	0.0000	OK
15 minute winter	216	10	99.798	0.088	48.7	0.1665	0.0000	OK
15 minute summer	217	10	97.894	0.109	52.8	0.1396	0.0000	OK
15 minute winter	206	10	97.000	0.252	257.2	0.4803	0.0000	OK
15 minute winter	207	10	96.186	0.166	265.4	0.3491	0.0000	OK
240 minute winter	208	236	94.624	1.142	49.9	197.7902	0.0000	SURCHARGED
1440 minute winter	209	1140	92.397	1.599	8.5	4.3900	0.0000	SURCHARGED
1440 minute winter	210	1140	92.397	1.826	16.1	4.6478	0.0000	SURCHARGED
1440 minute winter	211	1140	90.579	0.061	7.0	0.0000	0.0000	OK

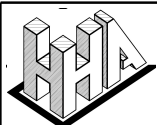
Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m <sup>3</sup> )	Discharge Vol (m <sup>3</sup> )
15 minute winter	200	1.000	201	49.3	1.809	0.848	1.7187	
15 minute winter	201	1.001	202	57.2	2.345	0.548	0.6247	
15 minute winter	202	1.002	203	94.1	3.596	0.697	1.1241	
15 minute winter	203	1.003	204	106.4	2.984	0.369	0.7830	
15 minute summer	212	2.000	213	35.2	2.541	0.233	0.4755	
15 minute winter	213	2.001	214	59.6	2.590	0.395	0.7808	
15 minute winter	214	2.002	204	73.8	2.653	0.719	0.4833	
15 minute winter	204	1.004	205	194.4	4.678	0.603	1.9660	
15 minute winter	205	1.005	206	199.5	2.960	0.444	1.1005	
15 minute summer	215	3.000	216	29.1	2.419	0.193	0.3170	
15 minute summer	216	3.001	217	48.7	2.931	0.322	0.3839	
15 minute summer	217	3.002	206	52.9	2.921	0.408	0.2609	
15 minute winter	206	1.006	207	256.3	4.062	0.571	0.9154	
15 minute winter	207	1.007	208	264.9	2.899	0.417	1.9589	
15 minute winter	208	1.008	209	6.9	2.031	0.042	0.0408	
15 minute winter	209	1.009	210	24.1	0.583	0.015	6.2614	
1440 minute winter	210	1.010	211	7.0	0.764	0.165	0.0727	456.7



**Results for 100 year Critical Storm Duration. Lowest mass balance: 99.34%**

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	200	11	108.105	0.305	64.0	0.9388	0.0000	SURCHARGED
15 minute winter	201	9	107.141	0.134	68.5	0.1906	0.0000	OK
15 minute summer	202	10	106.152	0.170	115.2	0.4379	0.0000	OK
15 minute summer	203	10	103.187	0.144	132.2	0.2322	0.0000	OK
15 minute summer	212	10	108.084	0.084	45.6	0.2049	0.0000	OK
15 minute summer	213	10	105.261	0.113	77.1	0.2298	0.0000	OK
15 minute winter	214	10	102.530	0.203	95.5	0.3363	0.0000	OK
15 minute winter	204	10	101.788	0.209	246.9	0.3574	0.0000	OK
15 minute winter	205	10	97.790	0.227	254.0	0.4338	0.0000	OK
15 minute summer	215	10	101.976	0.076	37.7	0.1731	0.0000	OK
15 minute winter	216	10	99.813	0.103	63.1	0.1954	0.0000	OK
15 minute summer	217	9	97.908	0.123	68.3	0.1578	0.0000	OK
15 minute winter	206	10	97.058	0.310	328.6	0.5916	0.0000	OK
15 minute winter	207	10	96.213	0.193	340.1	0.4050	0.0000	OK
240 minute winter	208	236	94.969	1.487	65.4	280.4785	0.0000	SURCHARGED
1440 minute winter	209	1620	92.324	1.526	9.5	4.1890	0.0000	SURCHARGED
1440 minute winter	210	1620	92.324	1.753	16.5	4.4615	0.0000	SURCHARGED
1440 minute winter	211	1620	90.579	0.061	6.9	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	200	1.000	201	58.0	1.784	0.997	2.0404	
15 minute summer	201	1.001	202	66.6	2.505	0.638	0.7234	
15 minute summer	202	1.002	203	116.0	3.728	0.859	1.3360	
15 minute summer	203	1.003	204	132.4	3.073	0.459	0.9419	
15 minute summer	212	2.000	213	45.6	2.722	0.302	0.5747	
15 minute summer	213	2.001	214	77.1	2.675	0.511	0.9785	
15 minute winter	214	2.002	204	95.1	2.730	0.926	0.6073	
15 minute winter	204	1.004	205	247.0	4.901	0.766	2.3834	
15 minute winter	205	1.005	206	254.1	3.029	0.566	1.3623	
15 minute summer	215	3.000	216	37.7	2.572	0.250	0.3878	
15 minute winter	216	3.001	217	63.1	3.197	0.418	0.4557	
15 minute summer	217	3.002	206	68.4	2.870	0.528	0.3739	
15 minute winter	206	1.006	207	328.3	4.185	0.731	1.1248	
15 minute winter	207	1.007	208	339.1	3.553	0.533	2.0827	
15 minute summer	208	1.008	209	6.9	2.031	0.042	0.0408	
15 minute winter	209	1.009	210	24.8	0.637	0.015	6.7793	
1440 minute winter	210	1.010	211	6.9	0.760	0.162	0.0717	548.6



**Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.34%**

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m <sup>3</sup> )	Flood (m <sup>3</sup> )	Status
15 minute winter	200	11	108.684	0.883	89.4	2.7193	0.0000	SURCHARGED
15 minute winter	201	12	107.272	0.265	90.8	0.3760	0.0000	SURCHARGED
15 minute winter	202	11	106.530	0.548	148.9	1.4140	0.0000	SURCHARGED
15 minute summer	203	9	103.208	0.165	160.6	0.2662	0.0000	OK
15 minute summer	212	10	108.102	0.102	63.7	0.2466	0.0000	OK
15 minute winter	213	10	105.294	0.146	108.0	0.2964	0.0000	OK
15 minute winter	214	10	103.151	0.825	132.9	1.3641	0.0000	SURCHARGED
15 minute winter	204	10	101.823	0.244	302.4	0.4173	0.0000	OK
15 minute winter	205	11	97.934	0.371	312.2	0.7082	0.0000	OK
15 minute summer	215	10	101.991	0.091	52.7	0.2071	0.0000	OK
15 minute winter	216	9	99.835	0.125	88.3	0.2380	0.0000	OK
15 minute winter	217	10	97.970	0.185	95.7	0.2374	0.0000	OK
15 minute winter	206	10	97.380	0.632	412.1	1.2066	0.0000	SURCHARGED
15 minute winter	207	11	96.264	0.244	427.8	0.5109	0.0000	OK
360 minute winter	208	352	95.578	2.096	67.0	426.0607	0.0000	SURCHARGED
360 minute winter	209	344	93.053	2.255	15.7	6.1908	0.0000	SURCHARGED
360 minute winter	210	344	93.053	2.482	21.0	6.3174	0.0000	FLOOD RISK
360 minute winter	211	344	90.584	0.066	8.1	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m <sup>3</sup> )	Discharge Vol (m <sup>3</sup> )
15 minute winter	200	1.000	201	78.2	1.969	1.345	2.5244	
15 minute winter	201	1.001	202	84.5	2.469	0.809	1.0194	
15 minute winter	202	1.002	203	138.5	3.708	1.026	1.7084	
15 minute winter	203	1.003	204	161.8	3.176	0.561	1.1048	
15 minute summer	212	2.000	213	63.8	2.952	0.422	0.7614	
15 minute winter	213	2.001	214	107.1	2.905	0.710	1.1353	
15 minute winter	214	2.002	204	126.1	3.172	1.229	0.6889	
15 minute winter	204	1.004	205	303.8	4.992	0.942	3.0726	
15 minute summer	205	1.005	206	310.6	3.143	0.691	1.7255	
15 minute summer	215	3.000	216	52.7	2.831	0.349	0.4942	
15 minute summer	216	3.001	217	88.3	3.384	0.585	0.6548	
15 minute winter	217	3.002	206	94.7	2.927	0.730	0.5375	
15 minute winter	206	1.006	207	411.2	4.132	0.916	1.3538	
15 minute winter	207	1.007	208	426.6	4.179	0.671	2.3139	
360 minute winter	208	1.008	209	7.6	2.031	0.046	0.2605	
15 minute summer	209	1.009	210	33.2	0.618	0.020	8.2088	
360 minute winter	210	1.010	211	8.1	0.794	0.192	0.0810	251.9

# APPENDIX F

## SITE INVESTIGATION INFORMATION

To reduce the effects of the potential settlement of external areas in relation to the piled plots within the backfill, extra facings, flexible service connections and generous falls on drain runs should be allowed for.

## 7.8 Excavation Problems

Significant obstructions were not encountered during the site investigation. Some boulders were encountered within the opencast backfill material.

Outside of the opencast areas, strong mudstone was encountered in three locations in the north of the site, at between 2.3 m and 2.6 m bgl. Strong sandstone was encountered in two locations in the south of the site at between 1.6 m and 2.1 m.

Loose material and side collapse was noted within the opencast material. Outside of the opencast the trial pits were found to be generally stable. During the soakaway tests, occasional minor side collapse was observed. Support will be required in accordance with current Health & Safety Regulations wherever access is required to trenches deeper than 1.2 m or less where there is risk of collapse.

## 7.9 Surface Water Drainage





Infiltration tests were carried out in seven soakaway pits, referenced SA1 to SA7. Tests were generally carried out within clay or weathered mudstone, with the exception of SA7 which encountered weathered sandstone. The locations of the pits are indicated on the Exploratory Hole Location Plan in Appendix 1. The soakaway logs are in Appendix 3 and the test results and infiltration calculations are provided in Appendix 4.

The water within SA1 to SA6 did not drain over the monitoring period of at least 1.5 hours.

The tests in SA7 drained quickly due to fractures within the sandstone, recording infiltration rates of between 1500 and  $910 \times 10^{-6}$  m/s

Based on these results, although the tests carried out in SA7 drained rapidly, this sandstone is not expected to be extensive across the site and regulators are unlikely to accept both a piped and soakaway drainage system. Soakaways are therefore not considered to be a suitable method of surface water drainage at the site.

Project Name Land off Keresforth Road	Project No. 38633	Co-ords: - Level: 129.80 m AOD	Date 01/04/2016
Location: Dodworth		Dimensions: - Depth 2.10m	Scale 1:25
Client: Strata Homes			Logged By LED


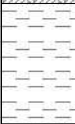



Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
0.10	D		0.30	129.50		TOPSOIL: Brown slightly sandy clay with vegetative and occasional brick and coal fragments
			0.60	129.20		Reworked firm orange mottled grey CLAY
0.80	D					Firm grey mottled orange slightly gravelly CLAY. Gravel is fine to coarse subangular of mudstone
2.00	D		2.10	127.70		Trialpit Complete at 2.10 m

Remarks:

Groundwater: None encountered.



Project Name Land off Keresforth Road	Project No. 38633	Co-ords: - Level: 125.15 m AOD	Date 01/04/2016
Location: Dodworth	Dimensions: -		Scale 1:25
Client: Strata Homes	Depth 2.00m		Logged By LED


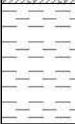


Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
0.10	D					TOPSOIL: Brown slightly sandy clay with vegetative and occasional brick and coal fragments
0.30			0.30	124.85		
0.50	D					Reworked firm orange mottled grey CLAY
0.70			0.70	124.45		
1.10	IPP 1	350				Stiff grey mottled orange slightly gravelly CLAY. Gravel is fine to coarse subangular of mudstone
1.10	IPP 2	425				
1.10	IPP 3	325				
1.10	IPP 4	450				
1.10	D					
1.70			1.70	123.45		Weathered moderately weak grey MUDSTONE recovered as clayey gravel
1.90			1.90	123.25		
2.00			2.00	123.15		COAL recovered as fine to medium angular gravel
Trialpit Complete at 2.00 m						

Remarks: IPP = Penetrometer readings given as unconfined compressive strength in kN/m2.

Groundwater: None encountered.



Project Name Land off Keresforth Road	Project No. 38633	Co-ords: - Level: 121.35 m AOD	Date 01/04/2016
Location: Dodworth		Dimensions: - Depth 1.90m	Scale 1:25
Client: Strata Homes			Logged By LED




Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
0.10	D					TOPSOIL: Brown slightly sandy clay with vegetative and occasional coal fragments
0.30			0.30	121.05		
0.50	D					Reworked firm orange mottled grey CLAY
0.70			0.70	120.65		
1.40	D					Stiff grey mottled orange slightly gravelly CLAY. Gravel is fine to coarse subangular mudstone.
1.50			1.50	119.85		
1.90			1.90	119.45		Weathered moderately weak grey MUDSTONE recovered as clayey gravel
Trialpit Complete at 1.90 m						

Remarks:

Groundwater: None encountered.



Project Name Land off Keresforth Road	Project No. 38633	Co-ords: - Level: 104.85 m AOD	Date 01/04/2016
Location: Dodworth		Dimensions: - Depth 2.00m	Scale 1:25
Client: Strata Homes			Logged By LED





Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
0.10	D		0.30	104.55		TOPSOIL: Brown slightly sandy clay with vegetative and occasional coal fragments and gravel of mudstone
						Stiff orange mottled grey CLAY
1.00	D		1.80	103.05		Weathered moderately weak grey MUDSTONE with occasional thin sandstone interbeds recovered as clayey gravel
			2.00	102.85		Trialpit Complete at 2.00 m

Remarks:

Groundwater: None encountered.



Project Name Land off Keresforth Road	Project No. 38633	Co-ords: - Level: 106.80 m AOD	Date 05/04/2016
Location: Dodworth		Dimensions: - Depth 1.20m	Scale 1:25
Client: Strata Homes			Logged By LED



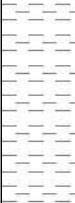


Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
0.10	D					TOPSOIL: Brown slightly gravelly clay with coal fragments. Gravel is fine to coarse of mudstone.
0.50	D		0.30	106.50		Firm red orange slightly sandy gravelly CLAY. Gravel is fine to medium angular of sandstone
			0.70	106.10		Moderately strong light orange SANDSTONE recovered as clayey sandy gravel and cobbles
			1.00	105.80		Firm grey mottled orange gravelly CLAY. Gravel is fine to medium subangular of mudstone.
			1.20	105.60		Trialpit Complete at 1.20 m

Remarks:

Groundwater: None encountered.



Project Name Land off Keresforth Road	Project No. 38633	Co-ords: - Level: 111.45 m AOD	Date 05/04/2016
Location: Dodworth		Dimensions: - Depth 1.90m	Scale 1:25
Client: Strata Homes			Logged By LED



Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
0.10	D					TOPSOIL: Brown slightly gravelly clay with coal fragments. Gravel is fine to coarse of mudstone.
			0.30	111.15		Reworked firm slightly sandy orange mottled grey CLAY
			0.50	110.95		Firm orange mottled grey CLAY
			1.20	110.25		COAL recovered as fine to medium angular gravel
			1.60	109.85		Firm grey mottled orange CLAY
1.80	D		1.90	109.55		Trialpit Complete at 1.90 m

Remarks: Depth of coal shown for east pit face. Coal in west pit face from 0.9 to 1.3 m bgl. Coal therefore dipping towards the east.

Groundwater: None encountered.



Project Name Land off Keresforth Road	Project No. 38633	Co-ords: - Level: 106.15 m AOD	Date 05/04/2016
Location: Dodworth		Dimensions: - Depth 1.55m	Scale 1:25
Client: Strata Homes			Logged By LED

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
0.10	D		0.20	105.95		TOPSOIL: Brown sandy slightly gravelly clay. Gravel is fine to medium of sandstone
			1.55	104.60		Weathered orange brown moderately strong SANDSTONE recovered as slightly clayey sandy fine to coarse angular gravel and cobbles.
Trialpit Complete at 1.55 m						

Remarks:

Groundwater: None encountered.





<b>PROJECT:</b>	Keresforth Road, Dodworth	<b>Job No.</b> 38633	<b>Date</b> 19.04.16
<b>SUBJECT:</b>	Infiltration Test Results and Calculation of Infiltration Rates	<b>Prepared</b> LED	<b>Checked</b> KE

**Test No. SA1**

**Soil Infiltration Rate in Accordance with BR365**

$$f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$$

Where:

- $V_{p75-25}$  is the effective storage volume of water in the trial pit between 75% and 25% effective depth;
- $a_{p50}$  is the internal surface area of the trial pit up to 50% effective depth and including the base area
- $t_{p75-25}$  is the time for the water level to fall from 75% to 25% effective depth

Initial parameters

Depth to water = **1550** mm      Average water depth: **445** mm  
 Start time = **0** min

Change in water depth: **10** mm

Final parameters

Depth to water = **1560** mm      Time interval: **55** min  
 End time = **55** min

Effective Storage Volume of Water in the Trial Pit = **0.4095** m<sup>3</sup>  
 75% Effective Depth = **1663** mm from ground level  
 25% Effective Depth = **1888** mm from ground level  
 Time at 75% Effective Depth = **N/A** minutes  
 Time at 25% Effective Depth = **N/A** minutes

$V_{p75-25}$  = **0.20** m<sup>3</sup>

$a_{p50}$  = **1.81** m<sup>2</sup>

$t_{p75-25}$  = **0** sec

$f$  = **#DIV/0!** m/sec

Average Soakaway Rate = **2.8E-06** m<sup>3</sup>/sec  
 Average soakaway area = **2.69** m<sup>2</sup> (sides + base)

**BR365 Soil Infiltration Rate** = **#DIV/0!** m/sec  
**Average Infiltration Rate** = **1.0E-06** m/sec



<b>PROJECT:</b>	Keresforth Road, Dodworth	<b>Job No.</b> 38633	<b>Date</b> 19.04.16
<b>SUBJECT:</b>	Infiltration Test Results and Calculation of Infiltration Rates	<b>Prepared</b> LED	<b>Checked</b> KE

**Test No. SA2**

**Soil Infiltration Rate in Accordance with BR365**

$$f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$$

Where:

- $V_{p75-25}$  is the effective storage volume of water in the trial pit between 75% and 25% effective depth;
- $a_{p50}$  is the internal surface area of the trial pit up to 50% effective depth and including the base area
- $t_{p75-25}$  is the time for the water level to fall from 75% to 25% effective depth

Initial parameters

Depth to water = **1450 mm**      Average water depth: **550 mm**  
 Start time = **0 min**

Change in water depth: **0 mm**

Final parameters

Depth to water = **1450 mm**      Time interval: **63 min**  
 End time = **63 min**

Effective Storage Volume of Water in the Trial Pit = **0.429 m<sup>3</sup>**  
 75% Effective Depth = **1588 mm** from ground level  
 25% Effective Depth = **1863 mm** from ground level  
 Time at 75% Effective Depth = **N/A** minutes  
 Time at 25% Effective Depth = **N/A** minutes

$V_{p75-25}$  = **0.21 m<sup>3</sup>**

$a_{p50}$  = **1.80 m<sup>2</sup>**

$t_{p75-25}$  = **0 sec**

$f$  = **#DIV/0! m/sec**

Average Soakaway Rate = **0.0E+00 m<sup>3</sup>/sec**  
 Average soakaway area = **2.82 m<sup>2</sup>** (sides + base)

**BR365 Soil Infiltration Rate** = **#DIV/0! m/sec**  
**Average Infiltration Rate** = **0.0E+00 m/sec**



<b>PROJECT:</b>	Keresforth Road, Dodworth	<b>Job No.</b> 38633	<b>Date</b> 19.04.16
<b>SUBJECT:</b>	Infiltration Test Results and Calculation of Infiltration Rates	<b>Prepared</b> LED	<b>Checked</b> KE

Test No. SA3

**Soil Infiltration Rate in Accordance with BR365**

$$f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$$

Where:

- $V_{p75-25}$  is the effective storage volume of water in the trial pit between 75% and 25% effective depth;
- $a_{p50}$  is the internal surface area of the trial pit up to 50% effective depth and including the base area
- $t_{p75-25}$  is the time for the water level to fall from 75% to 25% effective depth

Initial parameters

Depth to water = 1500 mm      Average water depth: 400 mm  
 Start time = 0 min

Change in water depth: 0 mm

Final parameters

Depth to water = 1500 mm      Time interval: 0 min  
 End time = 0 min

Effective Storage Volume of Water in the Trial Pit = 0.504 m<sup>3</sup>  
 75% Effective Depth = 1600 mm from ground level  
 25% Effective Depth = 1800 mm from ground level  
 Time at 75% Effective Depth = N/A minutes  
 Time at 25% Effective Depth = N/A minutes

$V_{p75-25}$  = 0.25 m<sup>3</sup>

$a_{p50}$  = 2.26 m<sup>2</sup>

$t_{p75-25}$  = 0 sec

$f$  = #DIV/0! m/sec

Average Soakaway Rate = #DIV/0! m<sup>3</sup>/sec  
 Average soakaway area = 3.26 m<sup>2</sup> (sides + base)

**BR365 Soil Infiltration Rate** = #DIV/0! m/sec  
**Average Infiltration Rate** = #DIV/0! m/sec



<b>PROJECT:</b>	Keresforth Road, Dodworth	<b>Job No.</b> 38633	<b>Date</b> 19.04.16
<b>SUBJECT:</b>	Infiltration Test Results and Calculation of Infiltration Rates	<b>Prepared</b> LED	<b>Checked</b> KE

**Test No. SA4**

**Soil Infiltration Rate in Accordance with BR365**

$$f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$$

Where:

- $V_{p75-25}$  is the effective storage volume of water in the trial pit between 75% and 25% effective depth;
- $a_{p50}$  is the internal surface area of the trial pit up to 50% effective depth and including the base area
- $t_{p75-25}$  is the time for the water level to fall from 75% to 25% effective depth

Initial parameters

Depth to water = **1350** mm      Average water depth: **615** mm  
 Start time = **0** min

Change in water depth: **70** mm

Final parameters

Depth to water = **1420** mm      Time interval: **164** min  
 End time = **164** min

Effective Storage Volume of Water in the Trial Pit = **0.637** m<sup>3</sup>  
 75% Effective Depth = **1513** mm from ground level  
 25% Effective Depth = **1838** mm from ground level  
 Time at 75% Effective Depth = **N/A** minutes  
 Time at 25% Effective Depth = **N/A** minutes

$V_{p75-25}$  = **0.32** m<sup>3</sup>

$a_{p50}$  = **2.35** m<sup>2</sup>

$t_{p75-25}$  = **0** sec

$f$  = **#DIV/0!** m/sec

Average Soakaway Rate = **7.0E-06** m<sup>3</sup>/sec  
 Average soakaway area = **3.56** m<sup>2</sup> (sides + base)

**BR365 Soil Infiltration Rate** = **#DIV/0!** m/sec  
**Average Infiltration Rate** = **2.0E-06** m/sec



<b>PROJECT:</b>	Keresforth Road, Dodworth	<b>Job No.</b> 38633	<b>Date</b> 19.04.16
<b>SUBJECT:</b>	Infiltration Test Results and Calculation of Infiltration Rates	<b>Prepared</b> LED	<b>Checked</b> KE

Test No. SA5

**Soil Infiltration Rate in Accordance with BR365**

$$f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$$

Where:

- $V_{p75-25}$  is the effective storage volume of water in the trial pit between 75% and 25% effective depth;
- $a_{p50}$  is the internal surface area of the trial pit up to 50% effective depth and including the base area
- $t_{p75-25}$  is the time for the water level to fall from 75% to 25% effective depth

Initial parameters

Depth to water = 700 mm      Average water depth: 470 mm  
Start time = 0 min

Change in water depth: 80 mm

Final parameters

Depth to water = 780 mm      Time interval: 60 min  
End time = 60 min

Effective Storage Volume of Water in the Trial Pit = 0.62475 m<sup>3</sup>  
75% Effective Depth = 828 mm from ground level  
25% Effective Depth = 1083 mm from ground level  
Time at 75% Effective Depth = N/A minutes  
Time at 25% Effective Depth = N/A minutes

$V_{p75-25}$  = 0.31 m<sup>3</sup>

$a_{p50}$  = 2.47 m<sup>2</sup>

$t_{p75-25}$  = 0 sec

$f$  = #DIV/0! m/sec

Average Soakaway Rate = 2.7E-05 m<sup>3</sup>/sec  
Average soakaway area = 3.53 m<sup>2</sup> (sides + base)

**BR365 Soil Infiltration Rate** = #DIV/0! m/sec  
**Average Infiltration Rate** = 7.7E-06 m/sec



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Test No. SA6

**Soil Infiltration Rate in Accordance with BR365**

$$f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$$

Where:

- $V_{p75-25}$  is the effective storage volume of water in the trial pit between 75% and 25% effective depth;
- $a_{p50}$  is the internal surface area of the trial pit up to 50% effective depth and including the base area
- $t_{p75-25}$  is the time for the water level to fall from 75% to 25% effective depth

Initial parameters

Depth to water = 1420 mm      Average water depth: 525 mm  
Start time = 0 min

Change in water depth: 10 mm

Final parameters

Depth to water = 1430 mm      Time interval: 95 min  
End time = 95 min

Effective Storage Volume of Water in the Trial Pit = 0.477 m<sup>3</sup>  
75% Effective Depth = 1553 mm from ground level  
25% Effective Depth = 1818 mm from ground level  
Time at 75% Effective Depth = N/A minutes  
Time at 25% Effective Depth = N/A minutes

$V_{p75-25}$  = 0.24 m<sup>3</sup>

$a_{p50}$  = 2.01 m<sup>2</sup>

$t_{p75-25}$  = 0 sec

$f$  = #DIV/0! m/sec

Average Soakaway Rate = 1.6E-06 m<sup>3</sup>/sec  
Average soakaway area = 3.11 m<sup>2</sup> (sides + base)

**BR365 Soil Infiltration Rate** = #DIV/0! m/sec  
**Average Infiltration Rate** = 5.1E-07 m/sec



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**Test No. SA7(1)**

**Soil Infiltration Rate in Accordance with BR365**

$$f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$$

Where:

- $V_{p75-25}$  is the effective storage volume of water in the trial pit between 75% and 25% effective depth;
- $a_{p50}$  is the internal surface area of the trial pit up to 50% effective depth and including the base area
- $t_{p75-25}$  is the time for the water level to fall from 75% to 25% effective depth

Initial parameters

Depth to water = **1150 mm**      Average water depth: **125 mm**  
 Start time = **0 min**

Change in water depth: **250 mm**

Final parameters

Depth to water = **1400 mm**      Time interval: **3 min**  
 End time = **3 min**

Effective Storage Volume of Water in the Trial Pit = **0.45 m<sup>3</sup>**  
 75% Effective Depth = **1213 mm** from ground level  
 25% Effective Depth = **1338 mm** from ground level  
 Time at 75% Effective Depth = **1 minutes**  
 Time at 25% Effective Depth = **2 minutes**

$V_{p75-25}$  = **0.23 m<sup>3</sup>**

$a_{p50}$  = **2.50 m<sup>2</sup>**

$t_{p75-25}$  = **60 sec**

$f$  = **1.5E-03 m/sec**

Average Soakaway Rate = **2.5E-03 m<sup>3</sup>/sec**  
 Average soakaway area = **2.50 m<sup>2</sup>** (sides + base)

**BR365 Soil Infiltration Rate = 1.5E-03 m/sec**  
**Average Infiltration Rate = 1.0E-03 m/sec**



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**Test No. SA7(2)**

**Soil Infiltration Rate in Accordance with BR365**

$$f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$$

Where:

- $V_{p75-25}$  is the effective storage volume of water in the trial pit between 75% and 25% effective depth;
- $a_{p50}$  is the internal surface area of the trial pit up to 50% effective depth and including the base area
- $t_{p75-25}$  is the time for the water level to fall from 75% to 25% effective depth

Initial parameters

Depth to water = **1240 mm**      Average water depth: **65 mm**  
 Start time = **0 min**

Change in water depth: **130 mm**

Final parameters

Depth to water = **1370 mm**      Time interval: **3 min**  
 End time = **3 min**

Effective Storage Volume of Water in the Trial Pit = **0.2574 m<sup>3</sup>**  
 75% Effective Depth = **1273 mm** from ground level  
 25% Effective Depth = **1338 mm** from ground level  
 Time at 75% Effective Depth = **1 minutes**  
 Time at 25% Effective Depth = **2 minutes**

$V_{p75-25}$  = **0.13 m<sup>3</sup>**

$a_{p50}$  = **2.36 m<sup>2</sup>**

$t_{p75-25}$  = **60 sec**

$f$  = **9.1E-04 m/sec**

Average Soakaway Rate = **1.4E-03 m<sup>3</sup>/sec**  
 Average soakaway area = **2.36 m<sup>2</sup> (sides + base)**

**BR365 Soil Infiltration Rate = 9.1E-04 m/sec**  
**Average Infiltration Rate = 6.1E-04 m/sec**