



IAN FENNY

INGLENOOK FARM

BARWELL

LE9 8BD

FLOOD RISK ASSESSMENT

SEPTEMBER 2023

FW2376_FRA_001 V2

REVISION HISTORY

Revision	Reason for Issue	Author	Checker	Approved	Date
v1	First Issue.	EC	JD	DM	19.09.2023
v2	Paragraphs 5.6.2, 7.1.1, 8.1.2, 8.1.3 & 8.2.1 amended to suit Planner's comments received 20.09.2023.	EC	JD	DM	20.09.2023

EXECUTIVE SUMMARY

1. The site is at **NO** quantifiable risk of flooding from tidal events.
2. The property is identified within the Environment Agency Flood Risk mapping as being at **very low** risk of flooding from Rivers and Seas.
3. The site is identified by the Environment Agency as having a **Low** risk of flooding from overland Surface Water with the existing pond partially identified as Medium – High risk.
4. The site is considered to be at a **Low** quantifiable risk of flooding from groundwater sources.
5. The site is identified by the Environment Agency as being at **NO** quantifiable risk of flooding from manmade lakes within the topographical catchment of the site.
6. The site is at a negligible risk of flooding from the existing sewerage network in the vicinity of the site.
7. The site is at a negligible risk of flooding from its own private drainage connections however this can be mitigated by regular maintenance to ensure the ongoing performance of the system.
8. We therefore conclude that the proposed units are above the modelled flood level of the local watercourses and sits within Flood Zone 1 as defined in the National Planning Policy Framework July 2021 Table 1.

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1.0 INTRODUCTION

1.1.1 Farrow Walsh has been engaged by the applicant, Ian Fenny, to produce a Flood Risk Assessment to accompany the planning application for a proposed development to be situated at Inglenook Farm, Barwell.

1.1.2 The development proposals include the construction of 20 accommodation pods, 10 holiday lodges and a management building, with associated access parking and landscaping. The proposed development has a site footprint of 15,578 m². A site location plan is included within Appendix A and the development proposals can be found within Appendix B.

1.1.3 This report considers the flood risk associated with a development proposal of this type and considers mitigation measures to ensure user safety.

1.1.4 The Flood Risk Assessment (FRA) report has been informed by the guidance contained within The National Planning Framework (July 2021, Department for Communities and Local Government) (NPPF).

1.1.5 Reference has been made to basic flood maps contained within the Environment Agency websites and the Environment Agency Standing Advice for Local Planning Authorities.

1.1.6 In consulting the Environment Agency website this report examines the following:

- Assessment of Flood risk and the likely sources of flooding
- Managing Residual Flood Risk
- Managing surface water
- Remedial Measures

1.1.7 This FRA examines the flood implications of the proposed development based on the following objectives, set out within the NPPF.

- Appraising risk
- Managing risk
- Reducing risk
- A partnership approach.

1.1.8 This report has been prepared using the following policy and guidance documentation:

- National Planning Policy Guidance (NPPG)
- Ciria C753 – The SUDs Manual
- Flood and Coastal Risk Projects, Schemes and Strategies: Climate Change Allowances (July 2020)
- Hinckley and Bosworth Level 1 Strategic Flood Risk Assessment (JBA Consulting Ltd – July 2019)
- Hinckley and Bosworth Borough Council Local Plan 2020-2039 (June 2021)
- Non-Statutory Technical Standards 2015
- Written Ministerial Statement regarding Sustainable Drainage (HCWS161) 2014
- The Water Framework Directive (2000)
- Building Regulations Part H 2015

1.1.9 In consulting with key stakeholders and policies this report aims to assess the risk of flooding both to the site and the impact of any development on the downstream network.

1.1.10 The flood management strategy, including consideration of safe access / egress to and from the site and flood resilience measures, is based on relevant British Standards (BS8533), the standing advice provided by the Environment Agency and on best engineering judgement. The approach for the FRA is based on the requirements of the Environment Agency and Hinckley and Bosworth Borough Council.

1.1.11 Any comments and opinions expressed in this report, including any conclusions are based on the information available to Farrow Walsh Ltd at the time of writing. The conclusions therefore could differ if the information is found to be inaccurate, incomplete or misleading. Farrow Walsh Ltd. accepts no liability should this be proven to be the case, or, if additional information is made available with respect to this site.

2.0 SITE DETAILS

2.1 SITE LOCATION

- 2.1.1 The proposed development site is located at Inglenook Farm off Leicester Road, Barwell.
- 2.1.2 The site location is bounded by the adopted highway Leicester Road to the east, Inglenook Farm to the south and west and greenfield land to the north.
- 2.1.3 A site location plan can be found within Appendix A.

2.2 SITE DESCRIPTION

- 2.2.1 The application site is triangular in shape and covers a total area of 15,578m² or 1.558 hectares.
- 2.2.2 The site is currently classified as greenfield land with agricultural land and a hardstanding track providing access to the farm to the south.
- 2.2.3 The site has an existing access point already in place via Leicester Road.

2.3 TOPOGRAPHY

- 2.3.1 The ground levels on the site are recorded to OS datum as between 100.07 to 107.11mAOD and the site generally slopes in a north to south direction.
- 2.3.2 A copy of the topographical survey can be located within Appendix C.

2.4 HYDROLOGICAL CONTEXT

- 2.4.1 Online OS mapping indicates that there is an unnamed watercourse located within the boundaries of the site as well as two existing ponds.
- 2.4.2 The nearest main river, as classified by the EA, to the site is the Ashby de la Zouch Canal located 4.6km north east of the development site.
- 2.4.3 The site lies within the Soar management catchment of the Humber River Basin District.

2.5 GEOLOGICAL CONTEXT

- 2.5.1 The British Geological Society (BGS) online mapping indicates that the site bedrock geology comprises of Mercia Mudstone Group – a sedimentary mudstone bedrock. The site is said to be overlain with Bosworth Clay Member superficial deposits – Clay and silt.
- 2.5.2 No intrusive ground investigation has taken place on the site at present.

2.5.3 The nearest available borehole data is located 1.25km south and south east of the site. These borehole records align with the BGS online mapping in that the site is underlain by clays. Historic Borehole records can be found within Appendix D.

2.6 GROUNDWATER VULNERABILITY

2.6.1 The bedrock stratum below the site is classified by the Environment Agency as being secondary B in terms of aquifer designation.

2.6.2 In terms of vulnerability, the ground is classified as medium - low by the Environment Agency.

2.6.3 The site does not lie within a Source Protection Zone.

2.7 EXISTING DRAINAGE

2.7.1 Severn Trent Water are responsible for maintaining the public sewers within the area of Leicester Road, Barwell and the sewer records have been obtained and can be found within Appendix E.

2.7.2 The sewer records indicate that there are no surface water or foul sewers within the vicinity of the site, with the nearest being shown within the common, 500m to the west of the site and across third party land.

2.7.3 However, there is a combined rising main to the east of the site, running from south to north, within Leicester Road, shown within the records.

2.7.4 The existing topographical survey identifies an inspection chamber located at the site entrance but no underground drainage within the site. The survey does highlight two ponds to the north of the site and a ditch to the south.

2.7.5 The topographical survey can be found contained within Appendix C.

2.8 ARTIFICIAL WATER BODIES

2.8.1 The nearest artificial body of water to the site is Stoney Cove located 4.5km to the south east of the site.

2.8.2 There is an unnamed body of water within the Mallory Park 3.35km to the west of the site.

3.0 ASSESSMENT OF FLOOD RISK

3.1 FLUVIAL

3.1.1 The site lies in the Humber River basin catchment and falls under the administrative jurisdiction of the Environment Agency.

3.1.2 The Environment Agency have derived flood maps of England from which it is possible to initially identify whether a site is located within an area that is at risk of fluvial flooding. The maps, which are available on the Environment Agency's website, categorise land as being within Flood Zone 1, Flood Zone 2 or Flood Zone 3, with Flood Zone 1 being all land falling outside of the flood plain and Flood Zones 2 and 3 being all land within the floodplain. Flood Zone 3 is split into two further categories, namely Flood Zone 3a and Flood Zone 3b with Flood Zone 3b considered to be the functional floodplain.

3.1.3 The definitions of the Flood Zones extracted from the National Planning Policy Framework (NPPF) are described below:

- Flood Zone 1 – low probability. This zone comprises land assessed as having a less than 1 in 1000 annual probability of river or sea flooding (<0.1%).
- Flood Zone 2 – medium probability. This zone comprises land assessed as having between a 1 in 100 and 1 in 1000 annual probability of river flooding (15 – 0.1%) or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5% - 0.1%) in any year.
- Flood Zone 3a – high probability. This zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%), or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.
- Flood Zone 3b – the functional floodplain. This zone comprises land where water has to flow or be stored in times of flood. Typically, land which would flood with an annual probability of 1 in 20 (5%) or greater in any year or is designed to flood in an extreme (0.1%) flood.

3.1.4 The extent of flooding on main rivers is indicated on the Environment Agency web site and an extract from the indicative flood maps can be seen in Figure 1. The areas of dark blue identify flooding probability of 1 percent (1 in 100 year) and the light blue areas are areas of extreme flood between the 1 percent and 0.1 percent (1 in 1000 year) probability.



Figure 1 - Extract from EA Flood Map for Planning (September 2023)

- 3.1.5 It is identified on the EA indicative planning flood mapping the site lies within Flood Zone 1.
- 3.1.6 Based on Table 1 of the NPPF the site has a low probability of flooding due to main rivers within the extents outlined within Figure 1.
- 3.1.7 The SFRA indicates that no historic fluvial flood events have been recorded within the vicinity of the site.
- 3.2 TIDAL OR COASTAL**
- 3.2.1 The site has an elevational range of 100.07 to 107.11 metres above sea level as shown within the topographical survey within Appendix C.
- 3.2.2 The site is geographically remote from any coastline. The site lies within the Humber River basin and the catchment of the Soar River.
- 3.2.3 The site is indicated by mapping as being remote from the areas at risk of tidal flooding with the existing coastal defences intact or removed.
- 3.2.4 The site is therefore considered comprehensively free from risk from tidal or coastal flooding effects, being horizontally and vertically remote from such influences at present, and after consideration of climate change effects.

3.3 GROUNDWATER FLOODING

3.3.1 Groundwater flooding occurs as a result of rising water from underlying aquifers or from water flowing from abnormal springs. This tends to occur after long periods of sustained high rainfall, and the areas at most risk are often low-lying where the water table is more likely to be at a shallow depth. Groundwater flooding is known to occur in areas underlain by major aquifers, although it is increasingly being associated with localised floodplain sand and gravels.

3.3.2 The SFRA classifies the site as having less than 25% risk of groundwater flooding as shown in Appendix F.

3.4 ARTIFICIAL WATER BODIES FLOODING

3.4.1 There are no reservoirs or manmade lakes within the vicinity of the site, However there are two large ponds on the site.

3.4.2 The EA online mapping indicates that there are no areas within the vicinity of the site at risk of flooding from reservoirs.

3.4.3 The failure of the water mains running in the vicinity of the development site is considered statistically remote.

3.4.4 We conclude that the risk of failure of the water main is remote. It must however be noted that for a failure adjacent to the site the nature of the escape and probable pressurized column of water could itself cause some local flood damage, but this is beyond practical mitigation.

3.4.5 The SFRA indicates there have been no recorded historic incidents of flooding due to artificial sources.

Maximum extent of flooding from reservoirs:

● when river levels are normal ● when there is also flooding from rivers ● Location you selected

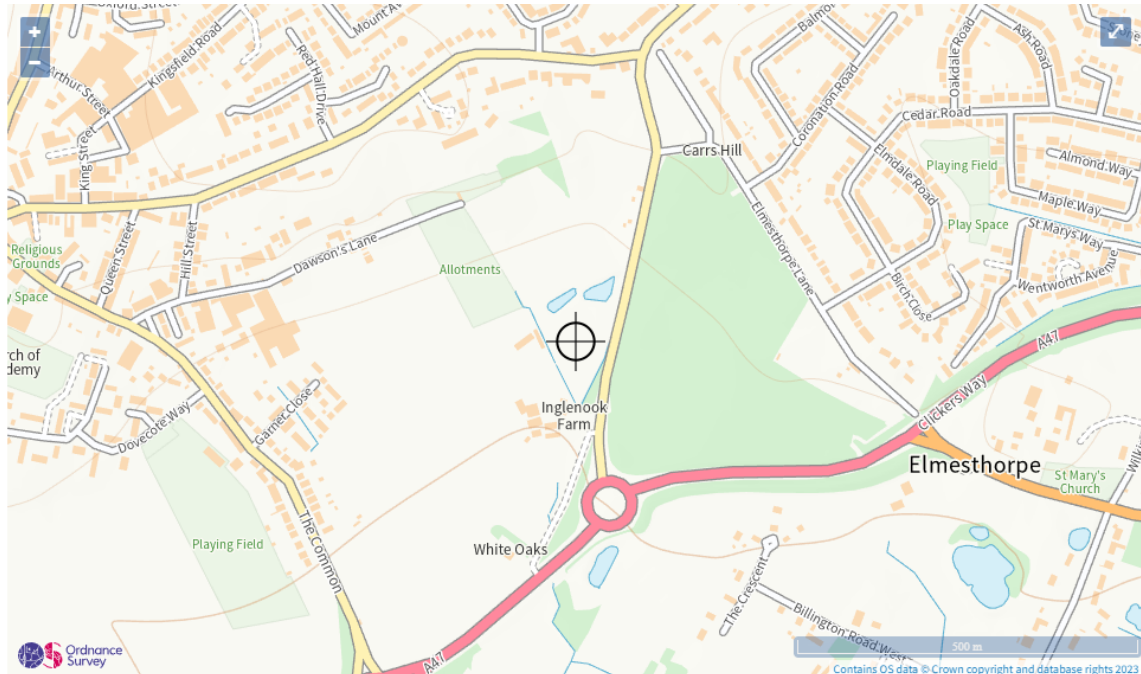


Figure 2 - Extract from EA Mapping Risk of Flooding from Reservoirs (September 2023)

3.5 SURFACE WATER FLOODING

- 3.5.1 Surface water flooding occurs when natural and engineered systems drainage network capacity is exceeded and thus cannot accommodate the volume of rainfall / runoff. Surface water flooding occurs often in urban areas during extreme, high intensity, low duration rainfall events which overwhelm the local surface water drainage systems. In rural areas this type of flooding can occur during medium intensity, long duration events where saturated ground conditions prevent natural infiltration into the subsoils below the surface. Flood water arising from such events is then conveyed above ground following the topography of the surrounding land.
- 3.5.2 The Environment Agency have modelled locations along critical flow paths and area situated in topographic depressions, which could flood following an extreme rainfall event when drainage capacity has been exceeded. Figure 3 indicates the predicted surface water flood risk map taken from the Environment Agency's website.
- 3.5.3 The majority of the site is considered to be at very low risk from overland flows by the EA, however the mapping indicates a low risk of surface water flooding emanating from the north and running around the northern and western boundaries of the site. The surface water is shown to cross into the site on the northern boundary before running north to south through the site. The point of entry into the site is more

likely attributed to lack of maintenance to the existing ditch network. The existing pond is identified as medium to high risk of flooding.

- 3.5.4 The SFRA mapping indicates that the western boundary and the majority of the northern boundary of the site are considered to be at low risk from the 1 in 1000-year and 1 in 100-year storm events with only a small section of the northern boundary at a medium risk of surface water flooding for the 1 in 30-year storm event. The flows through the site mirror that of the Environment Agency mapping. The SFRA mapping can be found within Appendix F.



Figure 3 - Extract from EA Mapping Risk of Surface Water Flooding (September 2023)

3.6 EXISTING SEWER FLOODING

- 3.6.1 The sewer network surrounding the development is owned and maintained by Severn Trent Water. A copy of the sewer records for the area can be found within Appendix E.
- 3.6.2 These records indicate that no sewers run in the vicinity of the site, however, there is a combined rising main within Leicester Road to the east of the site.
- 3.6.3 Generally, due to the site levels and those of the surrounding areas it is considered that any breach of the sewers within the highway would follow the natural topography of the highway within Leicester Road. In the event the sewers breached and exceeded the kerb, flows that enter the site will fall towards the southern edge of the site and into the existing ditch network.
- 3.6.4 The site is also not recorded as a critical drainage area by the SFRA.

3.6.5 No historic flooding within the vicinity of the site was recorded in the SFRA. It should be noted that the sewerage systems are designed to accommodate the 1 in 30 year storm events and thus events above this probability, flooding from sewers will occur.

4.0 PROPOSED DEVELOPMENT

4.1 DEVELOPMENT PROPOSALS

- 4.1.1 The development proposal includes the construction of 20 accommodation pods, 10 holiday lodges and a management building with associated access, parking and landscaping. A site location plan is included within Appendix A and the development proposals can be found within Appendix B.
- 4.1.2 All access points for the units shall be a minimum 150mm above the final ground levels to ensure that overland flows do not enter the property.
- 4.1.3 The current use of the application site is classed as greenfield, with no positive drainage or impermeable hardstand areas currently within the site.
- 4.1.4 In accordance with Flood risk vulnerability classification, found within Annex 3 of NPPG (2019), a building used for residential has a flood vulnerability classification of 'more vulnerable'.
- 4.1.5 In accordance with Table 3 of NPPG (2019), the more vulnerable development within Flood Zone 1 is appropriate.

5.0 SURFACE WATER MANAGEMENT

5.1 FLOOD RISK FROM THE DEVELOPMENT

- 5.1.1 In accordance with NPPG site specific flood risk assessments should consider and assess how runoff from the development will be managed and whether it will increase flood risk elsewhere.
- 5.1.2 The primary flood risk generated by the new development is likely to be the risk posed by overland surface water flooding due to exceedance of the existing drainage network.

5.2 EXISTING SURFACE WATER DISCHARGE

- 5.2.1 There is currently no positive on site drainage network within the site, there are however ponds to the north and ditches running along the eastern and southern boundaries of the site, which can be seen mapped out within the topographical survey contained within Appendix C. Severn Trent Water Mapping which can be seen in Appendix E, shows that there is a combined rising main running to the east of the site but no other sewers within the vicinity.
- 5.2.2 The site is thought to naturally drain towards the ditches to the east and west and then follow the topography of the site to the south, where the ditches diverge and the resultant ditch gets culverted. The culverted watercourse then reemerges into a ditch 130m to the south.
- 5.2.3 The existing site is classified as greenfield.
- 5.2.4 Existing greenfield runoff rates have been calculated for the development area of 1.558ha, resulting in the below discharges:

Greenfield Runoff Rates	
Storm Event	Site 1.558 ha (l/s)
$Q_{BAR,GR}$	6.7
$Q_{1,GR}$	5.6
$Q_{30,GR}$	13.4
$Q_{100,GR}$	17.25

Table 1 - Greenfield Runoff Rates

- 5.2.5 The full greenfield calculations can be found in Appendix G.

5.3 CLIMATE CHANGE

- 5.3.1 National Planning Policy Guidance requires that climate change be incorporated within the surface water drainage design in accordance with the Environment Agency's 'Flood and coastal risk projects, schemes and strategies: Climate change allowances' (July 2020) when assessing flood risk for a development.
- 5.3.2 The design life of the development is beyond 2070, therefore in accordance with the Environment Agency guidance the development should make allowances for an increase in extreme rainfall intensity of an additional 40% when compared to the 1961-1990 baseline.

5.4 PROPOSED SURFACE WATER DRAINAGE STRATEGY

- 5.4.1 Surface Water runoff from the proposed development should mimic, as far as possible, the surface flows from an undeveloped greenfield site.
- 5.4.2 Building Regulations 2010 Part H guidance for disposal of surface water is as follows:
- A soakaway or infiltration system, or where not reasonably practical;
 - A surface water ditch or watercourse, or where not reasonably practical;
 - A below ground sewer
- 5.4.3 While no current ground investigation has been made available, BGS data suggests the site to be underlain by Bosworth Clay Member, which does not support infiltration, therefore it can be concluded that infiltration would not be suitable for disposal of surface water on the site.
- 5.4.4 There is an unnamed watercourse that flows through the site making a direct connection to the watercourse a feasible and preferred option.
- 5.4.5 The Severn Trent Water mapping indicates that the nearest appropriate sewer is the Ø450mm surface water sewer located 0.5km to the west of the site through third party land within The Common.
- 5.4.6 Therefore, surface water disposal by the means of treatment and detention prior to controlled release into the Watercourse is deemed the most appropriate solution, subject to Ordinary Watercourse consent.
- 5.4.7 The development area of the site is 1.558 hectares, and it is proposed that 11% (0.176ha) of the development will be impermeable and require collecting and attenuating prior to discharge. The above areas are based on the current site layout available contained within Appendix B.
- 5.4.8 It is currently proposed that the drains within the site will remain under private ownership.
- 5.4.9 It is proposed that the surface water will be attenuated using a pond and swales before its controlled discharge using a flow control prior to discharge into the existing watercourse within the site.

5.4.10 A copy of the Drainage Strategy can be found within Appendix H.

5.5 PROPOSED SURFACE WATER DISCHARGE

5.5.1 Surface water drainage will be provided in the form of swales running parallel to the main access road. Where the swales cross parking bays or tributary roads where precast headwalls will be placed with a linear drain running through the hardstanding to keep the flow at just below ground level. Attenuation is to be provided in the form of the swales and central pond. The proposed surface water runoff rates for the site will be limited to the Greenfield Q_{BAR} rate of 6.6l/s for all storm events up to the 1 in 100year + 40% climate change storm event subject to agreement with the LLFA.

Proposed Runoff Rates	
Storm Event	Site – 1.558ha (l/s)
$Q_{1,PR}$	2.4
$Q_{30,PR}$	5.1
$Q_{100,PR}$	5.9
$Q_{100+40\%CC,PR}$	6.6

Table 2 – Proposed Runoff Rates

5.5.2 This rate is subject to approval from the LLFA.

5.5.3 By controlling the discharge rate from the site for a 1in100 year + 40% storm event the site is offering a significant betterment to the downstream network by utilising on site flood storage at an earlier stage in the overall river catchment potentially reducing flooding downstream.

5.5.4 When compared to the greenfield runoff rates calculated within Appendix G, the proposed 6.7l/s for the 1 in 100 year storm event provides a 60% betterment.

5.5.5 All sewers and drainage are to be constructed in accordance with all relevant industry standards, including but not limited to:

- Building Regulations Approved Document Part H 2010
- Sewer Sector Design Guidance

5.5.6 The drawings & schedules of the as-built site drainage system are to be made available to site operator to enable drainage maintenance and future works to be undertaken.

5.6 CONSIDERATION OF SUDS

- 5.6.1 With reference to CIRIA 753 and the surface water treatment process, the provision of a blue roof to provide source control and temporary attenuation, with a green roof finish to provide surface water treatment, allowing for the removal of silts from the drainage system and also providing ecological benefits for the site.
- 5.6.2 Both the Environment Agency and the Hinckley & Bosworth Borough Council require Sustainable Drainage (SuDS) techniques to be incorporated within new developments where possible, as highlighted in policy 5.13 on Sustainable drainage within their Integrated Water Management Strategy (June 2018).
- 5.6.3 Consideration should therefore be given to the use of the Sustainable Urban Drainage Systems. Table 2 below gives commentary in relation to the suitability of SuDS techniques for the proposed development.

SUDS Technique	Commentary	Suitability
Green Roof	There is limited potential for green roofs to be utilised due to the pitched nature of the roofs.	No
Infiltration by Soakaway	No current ground investigation has been made available, it is however anticipated that the ground is made up of clay and therefore, soakaways are not suitable for this site.	No
Water Butt	Storage of roof runoff via the use of water butts has the potential to be utilised, however it is unlikely with the commercial nature of the site.	Potential
Filter Strip	There is limited potential, due to the nature of the site area.	No
Infiltration Trench/Filter Trench	No current ground investigation has been made available, it is however anticipated that the ground is made up of clay and therefore, infiltration trenches are not suitable for this site.	No
Swale	There is the potential for a swale to be utilised throughout the site.	Yes
Bio-retention	There is potential for Bio-retention for the site to be utilised in the form of rain gardens.	Potential
Permeable Paving	Permeable surfaces can be utilised for the tracks throughout the site.	Yes
Geocellular/modular system	A geocellular system could be utilised for storage within the site.	Yes
Infiltration Basin	No current ground investigation has been made available, it is however anticipated that the ground is made up of clay and therefore, an infiltration basin would not be suitable for this site.	No
Detention Basin	There is limited potential to accommodate a further detention basin within the site, with three ponds already proposed.	No
Pond	There are two ponds on site and the proposal includes a further pond, which has the potential to be utilised within the drainage strategy.	Yes
Stormwater Wetland	It is not viable or practical to accommodate a stormwater wetland with the site being used for holiday homes.	No

Table 3 - SuDS Consideration Table

- 5.6.4 The table above identifies that due to site constraints, the most feasible method for providing SuDS is to utilise swales to treat and convey surface water throughout the site and ponds and rain gardens to provide further treatment and storage.
- 5.6.5 It is proposed that the road/track that is running through the site is to be granular and permeable in nature and mimic the existing greenfield behaviour.
- 5.6.6 Rain gardens, a pond and swales will provide treatment to the surface water that runs off the roofs of the pods and lodges at surface level before discharging into the watercourse.
- 5.6.7 The rain gardens are to be utilised where the lodges are set back from the main access road to treat and convey the surface water towards the swales.
- 5.6.8 The swales are to be utilised for attenuation in large storm events with the use of orifice plate flow controls to reduce flow and aid in the distribution of the surface water throughout the length of the swale. Where

the Swale crosses hardstanding, a headwall will be joined into a linear drain to allow the water to continue to flow at surface level before opening back out into a swale.

5.6.9 The Pond in the central area of the site is to be utilised for attenuation with the outfall is to be raised off the base of the pond to ensure that a permanent pool remains throughout the year, less any evaporation and vegetation absorption during extended periods of dry weather. This not only provides attenuation for the surface water but also improves biodiversity and amenities within the site.

5.6.10 It is proposed that just over 11% of the site is to be impermeable, compared to the previous 100% permeable state. As such attenuation will be provided within the swales and central pond.

5.7 ATTENUATION PROPOSALS

5.7.1 In accordance with current design guidelines the attenuation volume for a site should be calculated based on a 1 in 100 year + climate change allowance.

5.7.2 It is proposed that surface water from roof areas will be conveyed to the swales and pond to be treated and attenuated before being discharged at a controlled rate into the watercourse that runs through the site via a flow control chamber.

5.7.3 Hydraulic modelling of the drainage network has been undertaken using industry recognised software to confirm the drainage design suitability and these calculations can be found within Appendix I. The FEH runoff estimation method was used for the calculation for storm events 30 minutes or longer, however, for those of shorter durations FSR rainfall statistics would need to be used as stated in Ciria C753 SuDS Manual 2015, Part E, Chapter 24.

5.8 MAINTENANCE

5.8.1 At this stage it has been assumed that the development owners will maintain the drainage elements as outlined within this report. Future maintenance schedules for the SuDS features have been provided within Appendix J.

5.8.2 The drawings and schedules of the as built drainage are to be made available to the development owner to enable drainage maintenance and future works to be undertaken.

5.8.3 At this stage, the maintenance company has not yet been appointed and as such the applicant will be responsible until such time as they are appointed. Once appointed, the contact details will be provided to the LLFA for records.

5.9 EXCEEDANCE FLOWS

- 5.9.1 Exceedance flows are to be directed to the south of the site in line with the existing topography of the site, towards the ditch and site outfall. The intention is to direct flows away from any access points for the units, with the accesses being a minimum of 150mm above the external surrounding levels.

5.10 CONSTRUCTION SEQUENCING

5.10.1 Temporary drainage is to be constructed at the start of the programme to ensure that runoff is controlled from the site throughout the duration of the works. This will minimise the impact of the developed at the start of the project potentially lessening the effects of flooding on downstream properties.

5.10.2 Protection is to be provided to the watercourse through the lifetime of the works and the drainage outfalls are to have mesh grillage installed during the construction phase to prevent the entry of construction debris entering the watercourse network.

5.11 DRAINAGE SUMMARY

5.11.1 The proposed surface water drainage system can be summarised as follows:

- Surface water runoff from the site will be treated and conveyed around the site via rain gardens and swales. The swales will be used for attenuation in high storm events with orifice flow controls utilised within headwalls to control the distribution of surface water.
- A pond will be utilised for storage and treatment within the central area of the site.
- Use of Flow control to control discharge rate to 6.7l/s for all storm events up to 1 in 100year +40% climate change into the watercourse.

6.0 FOUL WATER DRAINAGE STRATEGY

6.1 FOUL WATER DRAINAGE DESIGN

- 6.1.1 It is proposed that foul water drainage will be conveyed from the north to the south of the site by private below ground gravity drains prior to connection into a foul water treatment tank before discharging into the watercourse to the south of the site subject to EA and LLFA approvals.

7.0 FLOOD MITIGATION STRATEGY

7.1 PRINCIPLES FOR MITIGATION STRATEGY

7.1.1 In accordance with Table 3 of NPPG (2019), a building used for Holiday Accommodation has a flood vulnerability classification of 'less vulnerable'.

Flood Risk Vulnerability Classification					
Flood Zones	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test Required	✓	✓	✓
Zone 3a	Exception Test Required	✗	Exception Test Required	✓	✓
Zone 3b	Exception Test Required	✗	✗	✗	✓

Table 4 - Extract from NPPG 2019 (Table 3)

- ✓ Denotes Development is appropriate
- ✗ Development should not be permitted

7.1.2 The findings of the FRA indicate that the site is located within FZ1 and thus deemed appropriate for development in accordance with NPPG.

7.1.3 The findings of the FRA indicate that the site may be susceptible to surface water flooding when considering the impacts of climate change. As such, the following mitigation measures should be introduced to protect the parcel for its lifetime.

- Any air vents to the property are to be set a minimum 0.60m above FFL to prevent flood water ingress, with new telescoping underfloor vents provided where required.
- It is also proposed that all access points to the building comprise of sealed uPVC or composite doors with sealed gaskets to the perimeter.
- Raised electrical sockets and meters set a minimum of 600mm above the proposed FFL should be implemented along with the use of plastic or stainless-steel fixtures for longevity.

7.1.4 The drainage design should account for any residual risk of flooding from surface water as a result of exceedance events.

7.2 SEQUENTIAL APPROACH

7.2.1 The site is located within Flood Zone 1 with the proposed units being positioned where possible outside of the proposed surface water flood extents to ensure a sequential approach is taken by trying to position buildings as far away from the source of flooding as practical.

7.3 FINISHED FLOOR LEVELS

7.3.1 Floor levels should be set such that they are a minimum of 150mm above the final surrounding ground levels. The Proposed pods and lodges are to have stepped access and as a result will be raised above ground level.

7.4 SAFE ACCESS

7.4.1 In accordance with current guidance and DEFRA FD2320 safe access is to be provided for users in the event of flooding. Where safe access cannot be provided measures are to be implemented to ensure the users' safety until the emergency services have been able to reach them.

7.4.2 The EA online mapping indicates that the site access lies within FZ1 and therefore has a low probability of flooding. The access points lie outside the mapped extents of flooding caused by rivers and seas but Leicester Road is identified as having a very low risk of flooding due to surface water overland flows. The mapping indicates that the access will encounter a flood depth of below 300mm with flows over 0.25m/s.

7.4.3 In accordance with DEFRA FD2320 Table 13.1 shown in Figure 4 a flood depth of below 300mm with a velocity more than 0.25m/s as on Leicester Road would represent a danger to some. When velocities exceed 1.00m/s meaning that some users would be required to maintain a stay put approach, namely the elderly and the infirm.

Table 13.1 Danger to people for different combinations of depth and velocity

Velocity (m/s)	Depth of flooding (m)											
	0.05	0.10	0.20	0.30	0.40	0.50	0.60	0.80	1.00	1.50	2.00	2.50
0.00												
0.10												
0.25												
0.50												
1.00												
1.50												
2.00												
2.50												
3.00												
3.50												
4.00												
4.50												
5.00												

Key:
 Danger for some
 Danger for most
 Danger for all

Figure 4 - Extract from DEFRA FD2320 showing Table 13.1

7.4.4 In extreme flood events above the 1 in 1000-year (0.1%) storm event the development would operate a 'stay put' approach in extreme flooding events for users. They would be advised to stay within the development and await assistance from emergency services.

7.5 FLOOD WARNING & EVACUATION

7.5.1 Whilst the site is considered to have a low probability of flooding from all sources, and a stay put approach can be adopted, access and egress from the site in storm events above the 1 in 100 year probability will impact on the ability of some users to be able to access / egress the site. Therefore it is important that all users of the development are made aware of the flood warning procedures

7.5.2 By utilising the flood warning systems available it is anticipated that the users will be able to egress from the site in a safe manner in advance of an extreme (1.0 – 0.1 percent probability) storm event occurring.

7.5.3 Flood warnings are published by the Met Office can be found here:

<https://flood-warning-information.service.gov.uk/warnings>

7.5.4 The Met Office Flood Forecasting Centre in conjunction with the Environment Agency publishes Flood Guidance Statements containing:

- General overview of the flood risk
- Assessment of the flood risk
- Weather warnings and flood warnings
- Specific area of concern map

7.5.5 The Met Office uses a Flood Risk Matrix (see Figure 4) to assess the likelihood against the potential impact and assigns a risk colour and level.

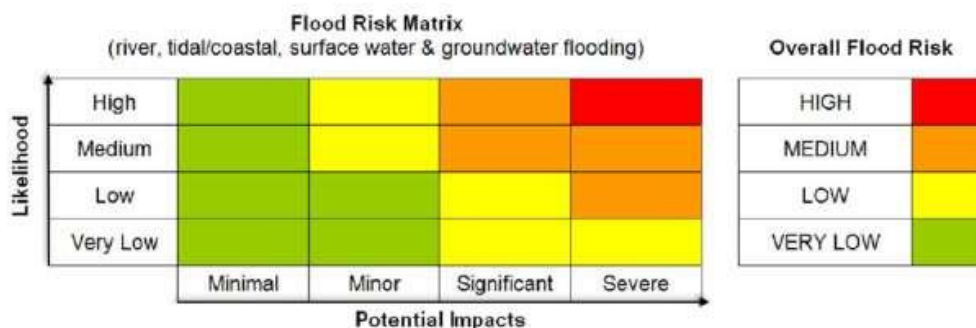


Figure 5 - Flood Risk Matrix

7.5.6 Typical examples of impacts from flooding aligned with the flood risk matrix are shown in Table 4.

Flood Impacts Table			
Minimal Impacts	Minor Impacts	Significant Impacts	Severe Impacts
Generally, no impact, however there may still be	Localised flooding of land and roads – risk of aquaplaning	Flooding affecting properties and parts of communities	Widespread flooding affecting significant numbers of properties and whole communities
Isolated and minor flooding of low-lying land and roads	Localised flooding could affect individual properties	Damage to buildings/structures is possible	Collapse of buildings/structures is possible
Isolated instances of spray/wave overtopping on coastal promenades	Individual properties in coastal location affected by spray and/or wave overtopping	Possible danger to life due to fast flowing/deep water/wave overtopping/wave inundation	Danger to life due to fast flowing/deep water/wave overtopping/wave inundation
Little or no disruption to travel although wet road surfaces could lead to difficult driving conditions	Localised disruption to key sites identified in flood plans (e.g. Railways, utilities)	Disruption to key sites identified in flood plains (e.g. railways, utilities, hospitals)	Widespread disruption or loss of infrastructure identified in flood plans (e.g. railways, utilities, hospitals)
	Local disruption to travel – longer journey times	Disruption to travel is expected. A number of roads are likely to be closed	Large scale evacuation of properties may be required
			Severe disruption to travel. Risk of motorists becoming stranded.

Table 5 - Flood Impact Table

7.5.7 The Environment Agency constantly monitors rainfall, river levels and sea conditions to forecast the possibility of flooding. If necessary, the Environment Agency can be contacted:

Incident hotline 0800 80 70 60 (24hrs)

Floodline 0345 988 1188

7.5.8 The Environment Agency Flood Warning Levels:

Warning type		Meaning	When it is used
	Flood Alert	Flooding is possible. Be prepared.	Two hours to two days in advance of flooding
	Flood Warning	Flooding is expected. Immediate action required	Half an hour to one day in advance of flooding
	Severe Flood Warning	Severe Flooding. Danger to life.	When flooding poses a significant threat to life.

Table 6 - Environment Agency Flood Warning Levels

8.0 SEQUENTIAL AND EXCEPTION TESTS

8.1 SEQUENTIAL TEST

- 8.1.1 For clarity the aim of the sequential test is to steer new development to areas with the lowest probability of flooding. Furthermore, approval of the Sequential Test lies with the Local Planning Authority.
- 8.1.2 The NPPF indicates that for a more vulnerable land use within Flood Zone 1, development is appropriate. Environment Agency mapping and the Strategic Flood Risk Assessment both indicate that the entirety of the site lies within Flood Zone 1.
- 8.1.3 In view of the facts as identified the applicant does not own other sites considered to be more suitable for use for holiday accommodation in the immediate vicinity.
- 8.1.4 The above clearly demonstrates that the sequential test would be satisfied provided it can be demonstrated that flood water will not pose excessive risk to the development, safe ingress and egress can be created and the development will not increase risk of flooding elsewhere.
- 8.1.5 The NPPF defines what type of development is appropriate in an individual location and seeks to guide development generally away from areas of flood risk. It nevertheless accepts implicitly that some development in areas of higher potential risk may be appropriate or indeed essential, and seeks to classify zones of risk, types of development and development suitability.

8.2 EXCEPTION TEST

- 8.2.1 Table 3 within the NPPF indicates that the site is appropriate for use as a more vulnerable land use due to the site being within Flood Zone 1.
- 8.2.2 Wider sustainable benefits to the community include:
- Potential for reduced risk of flooding elsewhere by increasing flood storage volume within the site.
 - Reduction in surface water runoff when compared to the existing situation delaying discharge into the watercourse and potentially providing a betterment downstream.

8.2.3 The FRA demonstrates safety and flooding sustainability by:

- Maintaining floor level proud of surrounding ground level to reduce opportunity for surface water flows to run towards building.
- Controlling runoff on site to delay the discharge into the sewer network.
- Safe ingress and egress routes for pedestrians being available from the properties to the surrounding highways.

8.2.4 There will be a significant reduction in the level of surface water runoff rate over the current land use.

8.2.5 In view of the above the exception test is deemed to have passed.

9.0 CONCLUSIONS

9.1 CONCLUSIONS

- 9.1.1 The site proposed for development is free of potential risk of flooding from tidal events.
- 9.1.2 The site is outside the extents of the mapped flood plain of main river systems while being classified as a very low risk area.
- 9.1.3 The site is at low risk of flooding from overland flow routing from surface water, the existing pond area is partially identified as a Medium – High risk area. However, this can be mitigated against by units being set way from this area and raising any vent bricks and electrical sockets. The FFL for each of the units is to be a minimum of 300mm above the surrounding ground level, with stepped access to all units, further mitigating the flood risk.
- 9.1.4 The site is at a low quantifiable risk of flooding from groundwater sources.
- 9.1.5 The site is identified by the Environment Agency as being at no quantifiable risk of flooding from manmade lakes within the topographical catchment of the site.
- 9.1.6 The escape flow route from the strategic water mains has also been considered. In the unlikely event of failure of the mains, there is a negligible risk that flows would not reach the properties.
- 9.1.7 The site is at a negligible risk of flooding from existing sewerage systems for the same reason as the water mains issue.
- 9.1.8 The proposed surface water discharge rate looks to mimic the existing greenfield Q_{bar} runoff rates for all storm events with the use of SUDS to treat and delay runoff entering the watercourse network.
- 9.1.9 The site is at a negligible risk of flooding from its own private drainage systems; however, this can be mitigated against by regular maintenance in accordance with the maintenance strategy provided within this report and channelling of flows within the development away from the properties.
- 9.1.10 We therefore conclude the application site lies above the modelled flood level of the local watercourses and within Flood Zone 1 as defined in the National Planning Policy Framework (July 2021) Table 1 and since the exception test for this has been passed, less vulnerable development uses should be permitted.

APPENDICES

APPENDIX A – SITE LOCATION PLAN

SITE LOCATION PLAN

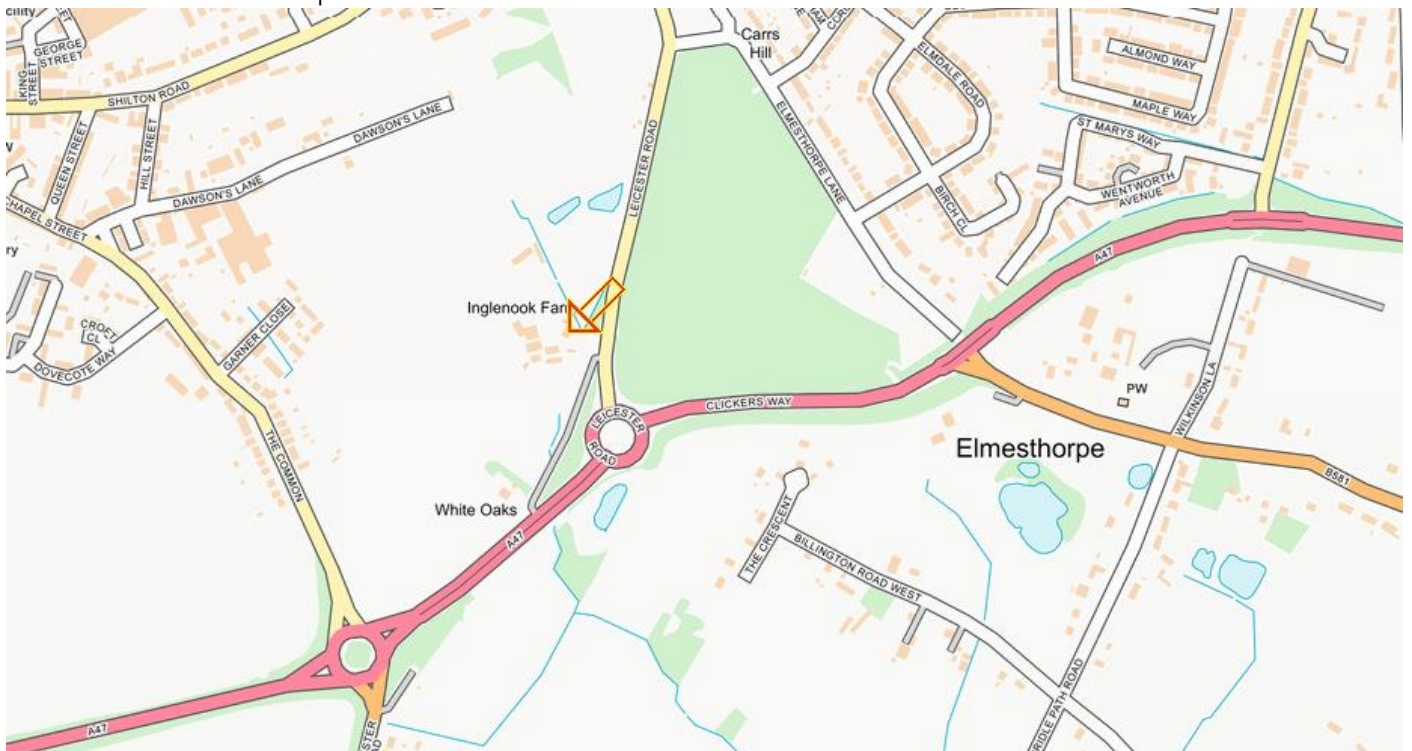
FW2376 Inglebrook Farm, Barwell, LE9 8BD

X 445253, Y 296572

Site Location – Aerial Photograph

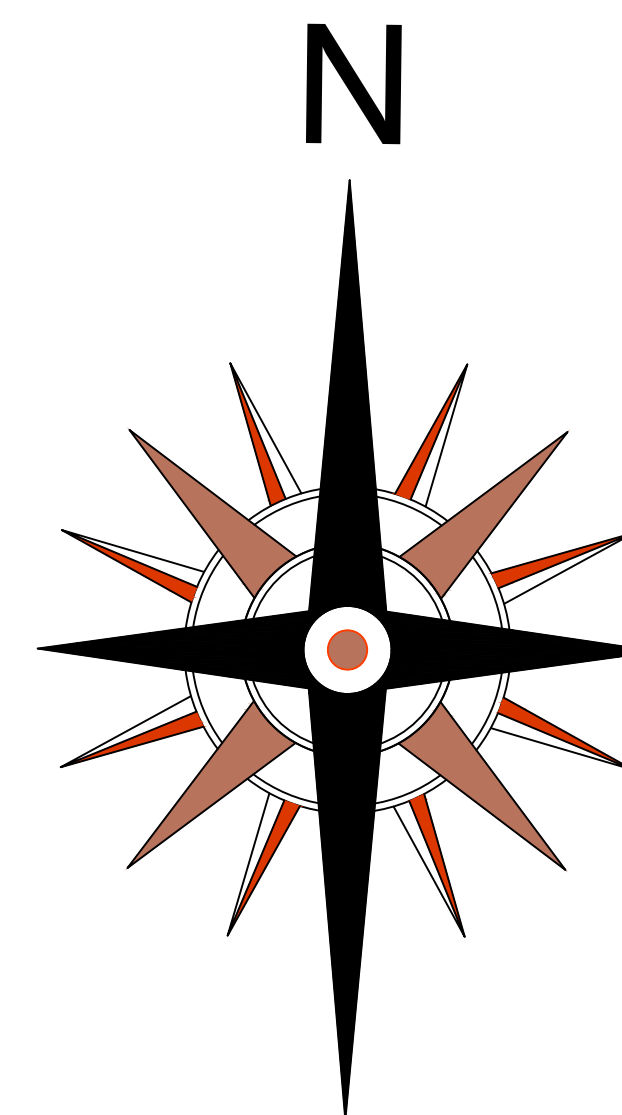


Site Location – Road Map



APPENDIX B – DEVELOPMENT PROPOSALS

This drawing is protected under the copyright designers & patents act 1988. Do not scale, plotted dimensions only are to be taken as current information. All dimensions coordinates and levels are to be checked and confirmed on site prior to any works being undertaken.



Rev E Application boundary revised 24/05/23
Rev D Revised to reflect tree survey. 2/05/23
Rev C Redraw based on survey and revised main access point. 15/03/23

Inglenook Farm Barwell

Site as proposed

Scale: 1:500, @ A1 Date: Jan 2023

Dwg No. 1003 Revision: E

Brook House Consulting

BHC 72 Boston Road
Leicester
LE4 1HB

Tel:- 0116 2169415 E mail:- mail@brookhouseconsulting.com

All landscaping indicative only

APPENDIX C – TOPOGRAPHICAL SURVEY

APPENDIX D – NEARBY BOREHOLE DATA



SP49NW51
SP49NW55
SP49NW49

White House or
ite House Cottage

ck
In
m

Leicester
Road Sports
Ground

Church View
Fields Farm

Houston Lodge

Basset
Cottage

Burbage Common

White
Oaks

Ingleno
Farm

Bridge Farm

SP49NE125

The Weeping
Willows

Woodhouse Farm

Billington Rd West

Bridle Path Rd

Billington Rd East

Elmesthorpe

St Mary's
Church

Cars Hill

Cedar Rd

Elmdale Rd

Maple Way

Station Rd

Ash Rd

Heycroft Rd

Balm

Kingsfield Rd

Arthur St

Shilton Rd

Dawson's La

The Common

Breach
Lane Farm

Breach La

SP49NE69SP4

Hult Farm

SP49NE44SP49NE58
SP49NE46SP49NE49

Station Rd

SP49NE16

SP49NE17

SP49NE1

SP49NE13

SP49NE15

SP49NE2

The
White House

The Hom

M60
SP49NE12

SP49NE11

SP49NE62

SP49SE16

SP49NE21SP

SP49NE19

SP49NE18

WD-2011-37

SP49/19

Daily Borehole Log

Site	Bridge Farm	Drill Method	RA	Rig No.	PSM16	Crew	D.Bellamy
Client	D W Hebblethwaite	Hole Dia.	220mm	Log No.	1 Of 1	Names	J.Hall
							D.Hufton
Day		Date	05/-2/11	Start	08:00 AM	Stop	06:00 PM
Boreholes							sp456952

[illegible]

Remarks:

Signature on behalf of client:

Drilling & Servicing Contractors Ltd

<http://www.dsc-online.co.uk>

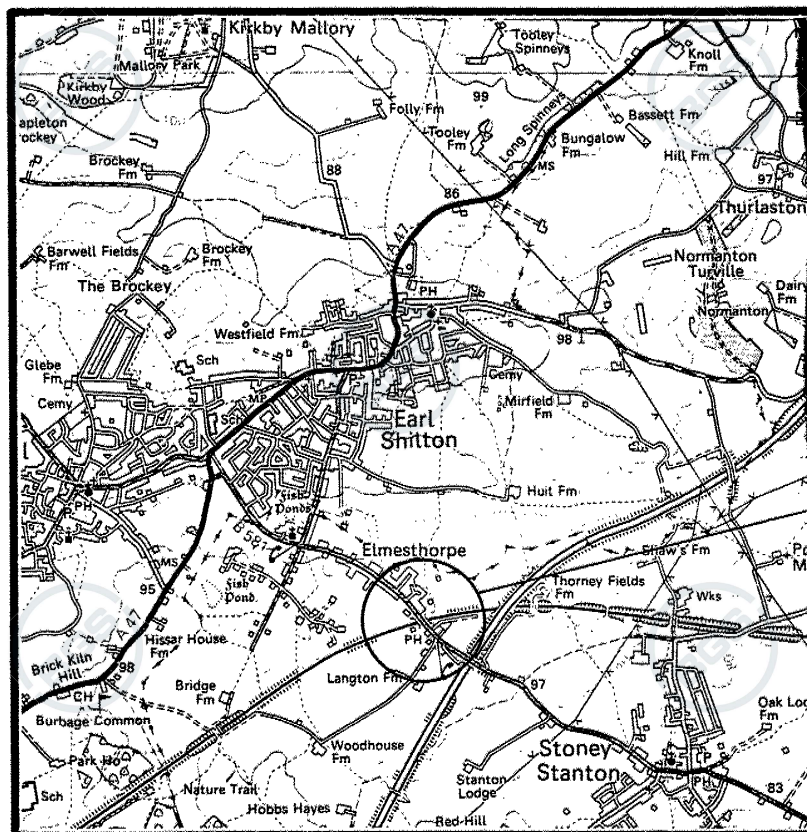
11 Bennetts Hill, Dunton Bassett, Lutterworth, LE17 5JJ.
Tel: 01455 209314 Fax: 01455 560011 Mobile: 07836 665418/7

Proposed Housing Development
Station Road, Elvesthorpe

Drawing No. 7412/4

SP 49 NE 49-61.

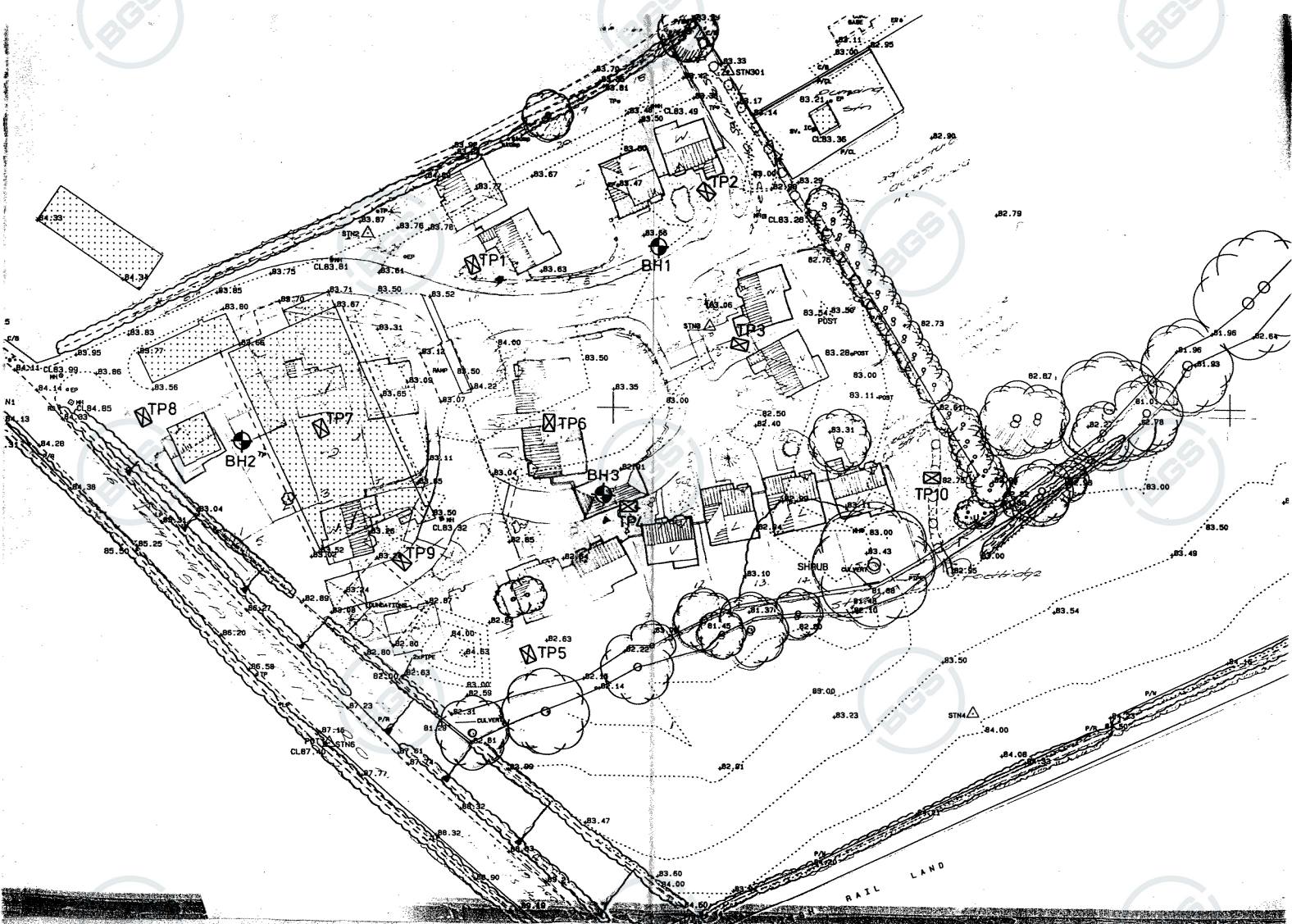
SITE LOCATION PLAN



The Site

This Plan is based upon the
Ordnance Survey Map with the
sanction of the Controller of
H.M. Stationery Office.
Crown Copyright Reserved.

Scale: 1:50,000





BOREHOLE RECORD

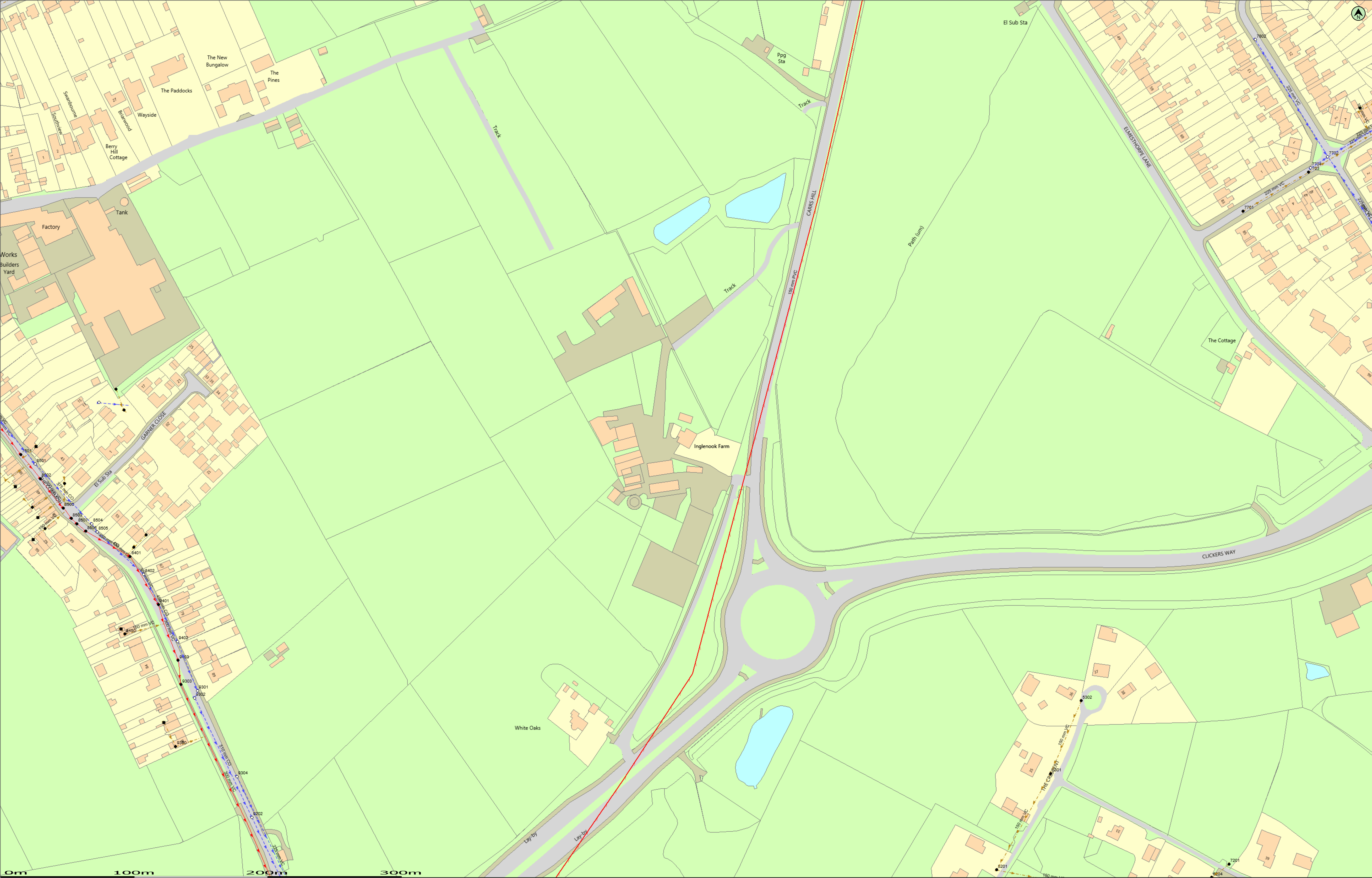
SP49NE 69 470-960

Project		Proposed Housing Development				Client		Bryant Homes		Borehole		1	
										Sheet1		of 1	
Location		Station Road, Elmhursthorpe				Contractor		T. & L. Explorations Ltd		Project No.		7412	
Sampling		Properties				Strata							
Depth	Sample Type	Depth of Casing	Depth to Water	Strength kN/m ²	W %	S. P. T. N	Description	Depth	Legend	Level O.D.			
GL-1.15	B						MADE GROUND: Firm intact greyish brown mottled orange brown silty clay with occasional fine quartzite gravel and brick fragments	GL		83.7			
1.15-1.60	SPT, J					8		1.15		82.55			
1.25	W						Soft to firm intact blue-grey occasionally mottled greenish grey silty CLAY						
1.60-2.05	U												
2.05-2.50	SPT, J		1.85			10	Firm intact greenish grey sandy CLAY with scattered fine to medium quartz and quartzite gravel (Alluvium)	2.05		81.65			
2.50-3.25	J						Firm intact dark reddish brown silty CLAY with occasional fine gravel sized mudstone fragments and traces of organic matter (Weathered Keuper Marl)	2.30		81.4			
3.25-3.70	U												
3.70-4.15	SPT, J					14	Stiff friable dark reddish brown very silty CLAY with occasional platy coarse sand to fine gravel sized mudstone fragments (Weathered Keuper Marl)	3.50		80.2			
4.15-4.80	J												
4.80-5.25	U							5.0		78.7			
5.25-5.70	SPT, J					54	Very stiff, becoming hard, closely fissured, friable dark reddish brown occasionally mottled greenish grey very silty CLAY with occasional platy coarse sand and fine gravel mudstone fragments (Weathered Keuper Marl)						
5.70-6.85	J												
6.85-7.0	SPT, J					48+ 75mm							
7.0-8.45	J												
8.45-8.60	SPT, J					54+ 75mm							
8.60-9.35	J												
9.35-9.50	SPT, J					69+ 75mm		9.50		74.2			
							Borehole Completed						

Ground Water

Date	am pm	Depth of Hole	Depth of Casing	Depth to Water	Depth Struck	Flow Rate	Depth Sealed	Remarks	Plant Crew
30.3.89	9.00	—	—	—	—	—	Nil	*Symbols and abbreviations are explained on the accompanying key. All linear dimensions are in metres. + Blows for 75mm penetration Groundwater standing at 5.35m on 30.3.89 Rose to 1.25m overnight Penetrated to 7.0m on 30.3.89	Type and Diameter
30.3.89	pm	7.00	—	5.35	1.25	—	Nil		Depth
31.4.89	9.00	7.00	—	1.25	—	—	Nil		L.C.P. 150mm
31.4.89	pm	9.5	—	—	—	—	Nil		9.50m
Start Date 30.3.89									Finish Date 31.3.89

APPENDIX E – SEVERN TRENT WATER SEWER RECORDS



(c) Crown copyright and database rights 2023 Ordnance Survey 100031673

Date: 11/08/23

Scale: 1:1250

Map Centre: 445296.296578

Data updated: 14/07/23

Our Ref: 1247805 - 1

Wastewater Plan A1

Do not scale off this map. The plan and any information supplied with it is furnished as a general guide, is only valid at the date of issue and no warranty as to its correctness is given or implied. In particular this plan and any information shown on it must not be relied upon in the event of any development or works (including but not limited to excavations) in the vicinity of SEVERN TRENT WATER assets or for the purposes of determining the suitability of a point of connection to the sewerage or distribution systems. Reproduction by permission of Ordnance Survey on behalf of HMSO. ©Crown Copyright and database rights 2023. All rights reserved. Ordnance Survey licence number 100031673. Document users other than SEVERN TRENT WATER business users are advised that this document is provided for reference purpose only and is subject to copyright, therefore, no further copies should be made from it.

- | | | | |
|--|---------------------|---------------------------------------|------------------------------------|
| Public Four Gravity/Lateral Drain | Highway Drain | Manhole Foul | Manhole Surface |
| Public Combined Gravity/Lateral Drain | Overflow Pipe | Abandoned Pipe | Chamber |
| Public Surface Water Gravity/Lateral Drain | Disposal Pipe | Section 151 sewers are shown in green | Private sewers are shown in orange |
| Pressure Foul | Covert Water Course | | |
| Pressure Combined | Pumping Station | | |
| Pressure Surface Water | Filling | | |

civils@farrowwalsh.co.uk

FW2376 Inglenook



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

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

- a) These general conditions and precautions apply to the public sewerage, water distribution and cables in ducts including (but not limited to) sewers which are the subject of an Agreement under Section 104 of the Water Industry Act 1991(a legal agreement between a developer and STW, where a developer agrees to build sewers to an agreed standard, which STW will then adopt); mains installed in accordance with an agreement for the self-construction of water mains entered into with STW and the assets described at condition b) of these general conditions and precautions. Such apparatus is referred to as "STW Apparatus" in these general conditions and precautions.
- b) Please be aware that due to The Private Sewers Transfer Regulations June 2011, the number of public sewers has increased, but many of these are not shown on the public sewer record. However, some idea of their positions may be obtained from the position of inspection covers and their existence must be anticipated.
- c) On request, STW will issue a copy of the plan showing the approximate locations of STW Apparatus although in certain instances a charge will be made. The position of private drains, private sewers and water service pipes to properties are not normally shown but their presence must be anticipated. This plan and the information supplied with it is furnished as a general guide only and STW does not guarantee its accuracy.
- d) STW does not update these plans on a regular basis. Therefore the position and depth of STW Apparatus may change and this plan is issued subject to any such change. Before any works are carried out, you should confirm whether any changes to the plan have been made since it was issued.
- e) The plan must not be relied upon in the event of excavations or other works in the vicinity of STW Apparatus. It is your responsibility to ascertain the precise location of any STW Apparatus prior to undertaking any development or other works (including but not limited to excavations).
- f) No person or company shall be relieved from liability for loss and/or damage caused to STW Apparatus by reason of the actual position and/or depths of STW Apparatus being different from those shown on the plan.

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

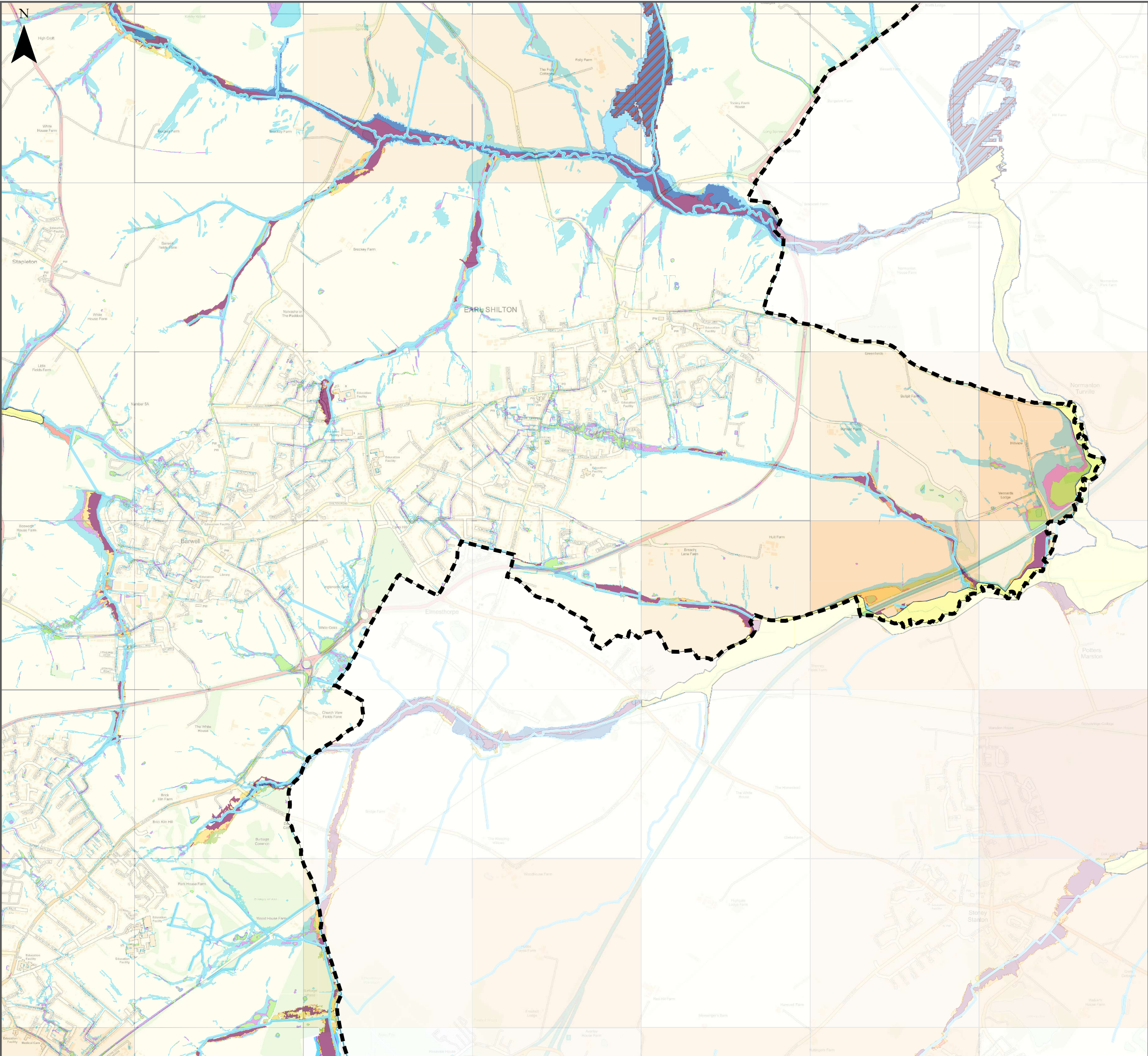
1. All STW Apparatus should be located by hand digging prior to the use of mechanical excavators.
2. All information set out in any plans received from us, or given by our staff at the site of the works, about the position and depth of the mains, is approximate. Every possible precaution should be taken to avoid damage to STW Apparatus. You or your contractor must ensure the safety of STW Apparatus and will be responsible for the cost of repairing any loss and/or damage caused (including without limitation replacement parts).
3. Water mains are normally laid at a depth of 900mm. No records are kept of customer service pipes which are normally laid at a depth of 750mm; but some idea of their positions may be obtained from the position of stop tap covers and their existence must be anticipated.
4. During construction work, where heavy plant will cross the line of STW Apparatus, specific crossing points must be agreed with STW and suitably reinforced where required. These crossing points should be clearly marked and crossing of the line of STW Apparatus at other locations must be prevented.
5. Where it is proposed to carry out piling or boring within 20 metres of any STW Apparatus, STW should be consulted to enable any affected STW Apparatus to be surveyed prior to the works commencing.
6. Where excavation of trenches adjacent to any STW Apparatus affects its support, the STW Apparatus must be supported to the satisfaction of STW. Water mains and some sewers are pressurised and can fail if excavation removes support to thrust blocks to bends and other fittings.
7. Where a trench is excavated crossing or parallel to the line of any STW Apparatus, the backfill should be adequately compacted to prevent any settlement which could subsequently cause damage to the STW Apparatus. In special cases, it may be necessary to provide permanent support to STW Apparatus which has been exposed over a length of the excavation before backfilling and reinstatement is carried out. There should be no concrete backfill in contact with the STW Apparatus.
8. No other apparatus should be laid along the line of STW Apparatus irrespective of clearance. Above ground apparatus must not be located within a minimum of 3 metres either side of the centre line of STW Apparatus for smaller sized pipes and 6 metres either side for larger sized pipes without prior approval. No manhole or chamber shall be built over or around any STW Apparatus.
9. A minimum radial clearance of 300 millimetres should be allowed between any plant or equipment being installed and existing STW Apparatus. We reserve the right to increase this distance where strategic assets are affected.
10. Where any STW Apparatus coated with a special wrapping is damaged, even to a minor extent, STW must be notified and the trench left open until the damage has been inspected and the necessary repairs have been carried out. In the case of any material damage to any STW Apparatus causing leakage, weakening of the mechanical strength of the pipe or corrosion-protection damage, the necessary remedial work will be recharged to you.
11. It may be necessary to adjust the finished level of any surface boxes which may fall within your proposed construction. Please ensure that these are not damaged, buried or otherwise rendered inaccessible as a result of the works and that all stop taps, valves, hydrants, etc. remain accessible and operable. Minor reduction in existing levels may result in conflict with STW Apparatus such as valve spindles or tops of hydrants housed under the surface boxes. Checks should be made during site investigations to ascertain the level of such STW Apparatus in order to determine any necessary alterations in advance of the works.
12. With regard to any proposed resurfacing works, you are required to contact STW on the number given above to arrange a site inspection to establish the condition of any STW Apparatus in the nature of surface boxes or manhole covers and frames affected by the works. STW will then advise on any measures to be taken, in the event of this a proportionate charge will be made.
13. You are advised that STW will not agree to either the erection of posts, directly over or within 1.0 metre of valves and hydrants,
14. No explosives are to be used in the vicinity of any STW Apparatus without prior consultation with STW.

TREE PLANTING RESTRICTIONS

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

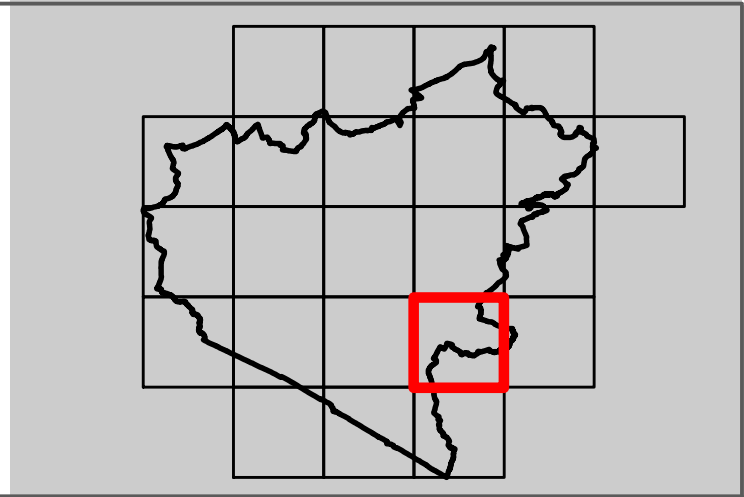
15. Please ensure that, in relation to STW Apparatus, the mature root systems and canopies of any tree planted do not and will not encroach within the recommended distances specified in the notes below.
16. Both Poplar and Willow trees have extensive root systems and should not be planted within 12 metres of a sewer, water main or other STW Apparatus.
17. The following trees and those of similar size, be they deciduous or evergreen, should not be planted within 6 metres of a sewer, water main or other STW Apparatus. E.g. Ash, Beech, Birch, most Conifers, Elm, Horse Chestnut, Lime, Oak, Sycamore, Apple and Pear. Asset Protection Statements Updated May 2014
18. STW personnel require a clear path to conduct surveys etc. No shrubs or bushes should be planted within 2 metre of the centre line of a sewer, water main or other STW Apparatus.
19. In certain circumstances, both STW and landowners may wish to plant shrubs/bushes in close proximity to a sewer, water main of other STW Apparatus for screening purposes. The following are shallow rooting and are suitable for this purpose: Blackthorn, Broom, Cotoneaster, Elder, Hazel, Laurel, Privet, Quickthorn, Snowberry, and most ornamental flowering shrubs.

APPENDIX F – SFRA MAPPING [EXTRACTED AUGUST 2023]



HINCKLEY AND BOSWORTH BOROUGH LEVEL 1 STRATEGIC FLOOD RISK ASSESSMENT

APPENDIX A: GEOPDF FLOOD RISK MAPPING INDEX GRID: D4



**Note: All layers are turned off by default.
Click the box next to the layer of interest to**

Authority Information



Council Boundary



Main Rivers



Detailed River Network

Flood Zones



Flood Zone 3b



Indicative Flood Zone 3b



Flood Zone 3a



Flood Zone 2

Surface Water



RoFfSW 3.3% AEP



RoFfSW 1% AEP



RoFfSW 0.1% AEP

Emergency Planning



Flood Warning Areas



Flood Alert Areas

Climate Change



Climate Change Central



Climate Change Higher Central



Climate Change Upper



Indicative Flood Zone 2

Areas Susceptible to Groundwater Flooding



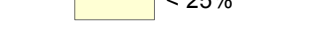
>= 75%



>= 50% <75%



>= 25% <50%



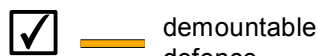
< 25%

Historical Flooding



Historic Flooding

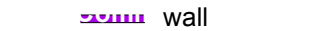
Defences



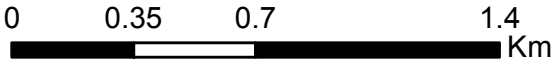
demountable defence



embankment



wall



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APPENDIX G – GREENFIELD RUNOFF RATE CALCULATIONS

Calculated by: Civils Team

Site name: FW2376

Site location: Barwell

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

Site Details

Latitude: 52.56612° N

Longitude: 1.33278° W

Reference: 2159236139

Date: Aug 14 2023 12:04

Runoff estimation approach

IH124

Site characteristics

Total site area (ha): 1.558

Methodology

Q_{BAR} estimation method: Calculate from SPR and SAAR

SPR estimation method: Calculate from SOIL type

Notes

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

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

Soil characteristics

	Default	Edited
SOIL type:	4	4
HOST class:	N/A	N/A
SPR/SPRHOST:	0.47	0.47

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

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

Hydrological
characteristics

	Default	Edited
SAAR (mm):	635	635
Hydrological region:	4	4
Growth curve factor 1 year:	0.83	0.83
Growth curve factor 30 years:	2	2
Growth curve factor 100 years:	2.57	2.57
Growth curve factor 200 years:	3.04	3.04

(3) Is SPR/SPRHOST ≤ 0.3?

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

Greenfield runoff rates

	Default	Edited
Q _{BAR} (l/s):	6.71	6.71
1 in 1 year (l/s):	5.57	5.57
1 in 30 years (l/s):	13.42	13.42
1 in 100 year (l/s):	17.25	17.25
1 in 200 years (l/s):	20.4	20.4

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at www.uksuds.com.

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

APPENDIX H – DRAINAGE STRATEGY



- ## NOTES
1. This drawing to be read in conjunction with all other relevant Engineers and Architect's details.
 2. All work is to be carried out in accordance with the current British Standards, codes of practice and building regulations.
 3. The design of any temporary works required shall be the responsibility of the Contractor.
 4. Do not scale this drawing. All dimensions are in millimetres unless noted otherwise. Any discrepancies are to be recorded and reported to the Engineers immediately.
 5. All work is to be to the satisfaction of the Engineer.
 6. The Contractor is responsible for and must take all necessary precautions to ensure the stability of the works at all times during construction.
 7. All workmanship and materials are to be current British Standards.
 8. All services are to be located and protected as necessary by the Contractor prior to the commencement of the works.
 9. Any existing details which are shown on this drawing are for guidance only and are to be checked on site by the Contractor. Any variations are to be recorded and reported to the Engineer immediately.

	Development Boundary
	Proposed Swale
	Proposed Rain Garden
	Linear Drain (ACO MD M200D or similar approved)
	Precast Concrete Headwall
	Private Surface Water Drain
	Private Foul Water Drain
	450mm Dia. Inspection Chamber (Foul)
	315mm Dia. Inspection Chamber (Foul)
	600mm dia. Catchpit with 400mm sump
	Proposed Pond Grassed flow through pond Min. Volume = 130m ³
	Orifice Flow Control Storm discharge from the site to be restricted into existing watercourse via orifice flow control. Orifice to be sized in detailed design.

farrow
walsh

62 Highcross Street, Leicester LE1 4NN
321 Bradford Street, Birmingham B5 6ET

☎ 0330 100 0363
www.farrowwalsh.com

Client: **Ian Fenny**

Title:
Drainage Strategy
Sheet 1 of 2

Drawing No.	Revision:
FW2376-C-400-01	A1

Site Details

15,578m² / 1.558 ha : Development area

0m² / 0.000 ha : Existing impermeable area

1,763m² / 0.176 ha : Proposed impermeable area including 10% urban creep

6.70l/s Q_{BAR,GR} Greenfield discharge rate to watercourse.

2.40l/s : Proposed Q1 storm discharge rate to watercourse.

5.10l/s : Proposed Q30 storm discharge rate to watercourse.

5.90l/s : Proposed Q100 storm discharge rate to watercourse.

6.60l/s : Proposed Q100+40% climate change storm discharge rate to watercourse.

Development impermeable areas to be drained into the storm drain via rain gardens, swales and a pond with minimum SUDs treatment to Cria753, via gravity sewers.

1. DO NOT SCALE.
2. This drawing is to be read in conjunction with all other relevant drawings and details.
3. Should there be any conflict between the details indicated on this drawing and those on other drawings the Engineer should be informed PRIOR to construction on site.
4. Until technical approval has been obtained from the relevant Authority, it should be understood that all drawings issued are Preliminary and NOT for construction. Should the Contractor commence site work prior to such approval being given it is entirely at their own risk.
5. Sketch proposals are for illustrative purposes only and as such are subject to detailed site investigation including ground conditions / contaminants, drainage, design and planning / density negotiations.
6. All dimensions are in millimetres unless otherwise stated.
7. The Farrow Walsh Consulting Designers Risk Assessments for this project must be reviewed PRIOR to the commencement of any works on site.

1. This drawing to be read in conjunction with all other relevant Engineers and Architect's details.
2. All work is to be carried out in accordance with the current British Standards, codes of practice and building regulations.
3. The design of any temporary works required shall be the responsibility of the Contractor.
4. Do not scale this drawing. All dimensions are in millimetres unless noted otherwise. Any discrepancies are to be recorded and reported to the Engineers immediately.
5. All work is to be to the satisfaction of the Engineer.
6. The Contractor is responsible for and must take all necessary precautions to ensure the stability of the works at all times during construction.
7. All workmanship and materials are to be to current British Standards.
8. All services are to be located and protected as necessary by the Contractor prior to the commencement of the works.
9. Any existing details which are shown on this drawing are for guidance only and are to be checked on site by the Contractor. Any variations are to be recorded and reported to the Engineer immediately.

	Development Boundary
	Proposed Swale
	Proposed Rain Garden
	Linear Drain (ACO MD M200D or similar approved)
	Precast Concrete Headwall
	Private Surface Water Drain
	Private Foul Water Drain
	450mm Dia. Inspection Chamber (Foul)
	315mm Dia. Inspection Chamber (Foul)
	600mm dia. Catchpit with 400mm sump
	Surface water Discharge Connection into existing drain. Maximum discharge 5.0l/s up to 1in100yr +40% Climate Change storm event.
	Orifice Flow Control Storm discharge from the site to be restricted into existing watercourse via orifice flow control. Orifice to sized in detailed design.
	Sewage Treatment Unit Sewage Treatment Unit subject to confirmation of final development use and detailed design.
	Proposed Pond Grassed flow through pond Min. Volume = 130m³

A1

APPENDIX I – SURFACE WATER DRAINAGE CALCULATIONS

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)	19.670	Minimum Backdrop Height (m)	0.200
Ratio-R	0.400	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)	Sump (m)	Easting (m)	Northing (m)	Depth (m)
✓	A	0.002	4.00	104.750			445348.731	296726.635	0.410
✓	HW1	0.002	4.00	104.700			445341.407	296728.307	0.410
✓	HW2			104.650			445338.908	296728.379	0.410
✓	HW3	0.002	4.00	104.550			445332.363	296727.390	0.410
✓	HW4	0.014	4.00	104.500			445327.713	296725.552	0.410
✓	HW5			104.400			445324.079	296723.687	0.410
✓	HW6			104.350			445321.442	296722.251	0.410
✓	HW7	0.012	4.00	104.150			445309.926	296715.108	0.410
✓	HW8			104.050			445307.877	296713.675	0.410
✓	HW9	0.012	4.00	103.750			445298.568	296706.382	0.410
✓	HW10			103.700			445296.715	296704.703	0.410
✓	HW11			103.550			445289.911	296697.235	0.410
✓	HW12	0.024	4.00	103.500			445288.315	296694.120	0.410
✓	HW13			103.250			445286.903	296686.505	0.410
✓	HW14	0.008	4.00	103.200			445287.627	296681.558	0.410
✓	HW15	0.004	4.00	102.450			445295.961	296666.920	0.410
✓	HW16			102.450			445299.870	296664.122	0.460
✓	Pond	0.016	4.00	103.000			445305.024	296671.488	0.360
✓	HW17	0.012	4.00	102.400			445307.347	296662.640	0.460
✓	HW18			102.200			445310.069	296652.275	0.410
✓	HW19			102.150			445311.932	296647.635	0.410
✓	B	0.019	4.00	104.450			445358.142	296701.726	0.410
✓	HW20	0.002	4.00	103.900			445348.717	296695.288	0.410
✓	HW21	0.002	4.00	103.800			445345.848	296691.192	0.410
✓	HW22			103.500			445342.011	296687.775	0.410
✓	HW23	0.016	4.00	103.400			445337.663	296685.306	0.410
✓	HW24			103.150			445325.377	296675.600	0.410
✓	HW25			103.000			445322.232	296671.708	0.410
✓	HW26			102.500			445315.095	296659.907	0.410
✓	HW27	0.012	4.00	102.350			445316.364	296655.070	0.410
✓	HW28			102.000			445320.238	296646.220	0.410
✓	HW29	0.012	4.00	101.900			445317.113	296641.307	0.410
✓	HW30	0.008	4.00	101.250			445304.008	296617.642	0.810
✓	HW31			101.200			445302.752	296616.159	0.810
✓	S1			101.150	600	0.400	445303.775	296612.051	1.300
✓	Outfall			100.400			445302.606	296608.868	0.250

Links (Input)

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	A	HW1	7.512	0.036	104.340	104.290	0.050	150.2	350	4.16	50.0
1.001	HW1	HW2	2.500	0.036	104.540	104.490	0.050	50.0	100	4.28	50.0
1.002	HW2	HW3	6.619	0.036	104.240	104.140	0.100	66.2	350	4.38	50.0
1.003	HW3	HW4	5.000	0.036	104.390	104.340	0.050	100.0	100	4.73	50.0
1.004	HW4	HW5	4.085	0.036	104.090	103.990	0.100	40.8	350	4.77	50.0
1.005	HW5	HW6	3.003	0.036	104.190	104.140	0.050	60.1	150	4.90	50.0
1.006	HW6	HW7	13.551	0.036	103.940	103.740	0.200	67.8	350	5.09	50.0
1.007	HW7	HW8	2.500	0.036	103.940	103.840	0.100	25.0	150	5.16	50.0
1.008	HW8	HW9	11.826	0.036	103.640	103.340	0.300	39.4	350	5.28	50.0
1.009	HW9	HW10	2.501	0.036	103.540	103.490	0.050	50.0	150	5.38	50.0
1.010	HW10	HW11	10.103	0.036	103.290	103.140	0.150	67.4	350	5.52	50.0
1.011	HW11	HW12	3.500	0.036	103.340	103.290	0.050	70.0	150	5.68	50.0
1.012	HW12	HW13	7.745	0.036	103.090	102.840	0.250	31.0	350	5.75	50.0
1.013	HW13	HW14	5.000	0.036	103.040	102.990	0.050	100.0	150	6.02	50.0
1.014	HW14	HW15	16.844	0.036	102.790	102.040	0.750	22.5	350	6.16	50.0
1.015	HW15	HW16	4.807	0.036	102.240	102.190	0.050	96.1	150	6.41	50.0
1.016	HW16	HW17	7.622	0.036	101.990	101.940	0.050	152.4	350	6.57	50.0
2.000	Pond	HW17	9.148	0.600	102.640	101.940	0.700	13.1	100	4.07	50.0
1.017	HW17	HW18	10.716	0.036	101.940	101.790	0.150	71.4	350	6.73	50.0
1.018	HW18	HW19	5.000	0.036	101.990	101.940	0.050	100.0	150	7.00	50.0
1.019	HW19	HW29	8.178	0.036	101.740	101.490	0.250	32.7	350	7.08	50.0
3.000	B	HW20	11.414	0.036	104.040	103.490	0.550	20.8	350	4.09	50.0
3.001	HW20	HW21	5.001	0.036	103.690	103.590	0.100	50.0	150	4.28	50.0
3.002	HW21	HW22	5.138	0.036	103.390	103.090	0.300	17.1	350	4.32	50.0
3.003	HW22	HW23	5.000	0.036	103.290	103.190	0.100	50.0	150	4.51	50.0
3.004	HW23	HW24	15.657	0.036	102.990	102.740	0.250	62.6	350	4.72	50.0
3.005	HW24	HW25	5.004	0.036	102.940	102.790	0.150	33.4	150	4.87	50.0
3.006	HW25	HW26	13.791	0.036	102.590	102.090	0.500	27.6	350	5.00	50.0
3.007	HW26	HW27	5.001	0.036	102.290	102.140	0.150	33.3	150	5.15	50.0
3.008	HW27	HW28	9.661	0.036	101.940	101.590	0.350	27.6	350	5.24	50.0
3.009	HW28	HW29	5.823	0.036	101.790	101.690	0.100	58.2	150	5.48	50.0
3.010	HW29	HW30	27.051	0.036	101.490	100.440	1.050	25.8	350	7.31	50.0
1.021	HW30	HW31	1.943	0.036	100.440	100.390	0.050	38.9	350	7.33	50.0
1.022	HW31	S1	4.233	0.036	100.390	100.250	0.140	30.2	300	7.41	50.0
1.023	S1	Outfall	3.391	0.036	100.250	100.150	0.100	33.9	100	7.55	50.0

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	7.512	150.2	350	104.750	104.340	0.060	104.700	104.290	0.060
1.001	2.500	50.0	100	104.700	104.540	0.060	104.650	104.490	0.060
1.002	6.619	66.2	350	104.650	104.240	0.060	104.550	104.140	0.060
1.003	5.000	100.0	100	104.550	104.390	0.060	104.500	104.340	0.060
1.004	4.085	40.8	350	104.500	104.090	0.060	104.400	103.990	0.060

Link	US Node	Dia (mm)	Sump (m)	Node Type	DS Node	Dia (mm)	Sump (m)	Node Type
1.000	A			Junction	HW1			Junction
1.001	HW1			Junction	HW2			Junction
1.002	HW2			Junction	HW3			Junction
1.003	HW3			Junction	HW4			Junction
1.004	HW4			Junction	HW5			Junction

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.005	3.003	60.1	150	104.400	104.190	0.060	104.350	104.140	0.060
1.006	13.551	67.8	350	104.350	103.940	0.060	104.150	103.740	0.060
1.007	2.500	25.0	150	104.150	103.940	0.060	104.050	103.840	0.060
1.008	11.826	39.4	350	104.050	103.640	0.060	103.750	103.340	0.060
1.009	2.501	50.0	150	103.750	103.540	0.060	103.700	103.490	0.060
1.010	10.103	67.4	350	103.700	103.290	0.060	103.550	103.140	0.060
1.011	3.500	70.0	150	103.550	103.340	0.060	103.500	103.290	0.060
1.012	7.745	31.0	350	103.500	103.090	0.060	103.250	102.840	0.060
1.013	5.000	100.0	150	103.250	103.040	0.060	103.200	102.990	0.060
1.014	16.844	22.5	350	103.200	102.790	0.060	102.450	102.040	0.060
1.015	4.807	96.1	150	102.450	102.240	0.060	102.450	102.190	0.110
1.016	7.622	152.4	350	102.450	101.990	0.110	102.400	101.940	0.110
2.000	9.148	13.1	100	103.000	102.640	0.260	102.400	101.940	0.360
1.017	10.716	71.4	350	102.400	101.940	0.110	102.200	101.790	0.060
1.018	5.000	100.0	150	102.200	101.990	0.060	102.150	101.940	0.060
1.019	8.178	32.7	350	102.150	101.740	0.060	101.900	101.490	0.060
3.000	11.414	20.8	350	104.450	104.040	0.060	103.900	103.490	0.060
3.001	5.001	50.0	150	103.900	103.690	0.060	103.800	103.590	0.060
3.002	5.138	17.1	350	103.800	103.390	0.060	103.500	103.090	0.060
3.003	5.000	50.0	150	103.500	103.290	0.060	103.400	103.190	0.060
3.004	15.657	62.6	350	103.400	102.990	0.060	103.150	102.740	0.060
3.005	5.004	33.4	150	103.150	102.940	0.060	103.000	102.790	0.060
3.006	13.791	27.6	350	103.000	102.590	0.060	102.500	102.090	0.060
3.007	5.001	33.3	150	102.500	102.290	0.060	102.350	102.140	0.060
3.008	9.661	27.6	350	102.350	101.940	0.060	102.000	101.590	0.060

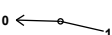
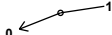
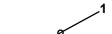
Link	US Node	Dia (mm)	Sump (m)	Node Type	DS Node	Dia (mm)	Sump (m)	Node Type
1.005	HW5			Junction	HW6			Junction
1.006	HW6			Junction	HW7			Junction
1.007	HW7			Junction	HW8			Junction
1.008	HW8			Junction	HW9			Junction
1.009	HW9			Junction	HW10			Junction
1.010	HW10			Junction	HW11			Junction
1.011	HW11			Junction	HW12			Junction
1.012	HW12			Junction	HW13			Junction
1.013	HW13			Junction	HW14			Junction
1.014	HW14			Junction	HW15			Junction
1.015	HW15			Junction	HW16			Junction
1.016	HW16			Junction	HW17			Junction
2.000	Pond			Junction	HW17			Junction
1.017	HW17			Junction	HW18			Junction
1.018	HW18			Junction	HW19			Junction
1.019	HW19			Junction	HW29			Junction
3.000	B			Junction	HW20			Junction
3.001	HW20			Junction	HW21			Junction
3.002	HW21			Junction	HW22			Junction
3.003	HW22			Junction	HW23			Junction
3.004	HW23			Junction	HW24			Junction
3.005	HW24			Junction	HW25			Junction
3.006	HW25			Junction	HW26			Junction
3.007	HW26			Junction	HW27			Junction
3.008	HW27			Junction	HW28			Junction

Pipeline Schedule

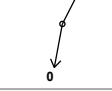
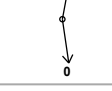
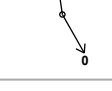
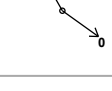
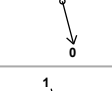
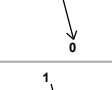
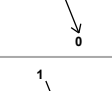
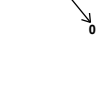
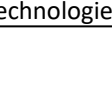
Link	Length (m)	Slope (1:X)	Dia (mm)	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
3.009	5.823	58.2	150	102.000	101.790	0.060	101.900	101.690	0.060
3.010	27.051	25.8	350	101.900	101.490	0.060	101.250	100.440	0.460
1.021	1.943	38.9	350	101.250	100.440	0.460	101.200	100.390	0.460
1.022	4.233	30.2	300	101.200	100.390	0.510	101.150	100.250	0.600
1.023	3.391	33.9	100	101.150	100.250	0.800	100.400	100.150	0.150

Link	US Node	Dia (mm)	Sump (m)	Node Type	DS Node	Dia (mm)	Sump (m)	Node Type
3.009	HW28			Junction	HW29			Junction
3.010	HW29			Junction	HW30			Junction
1.021	HW30			Junction	HW31			Junction
1.022	HW31			Junction	S1	600	0.400	Manhole
1.023	S1	600	0.400	Manhole	Outfall			Junction

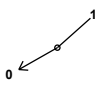
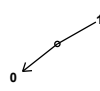
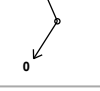
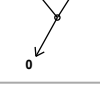
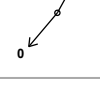
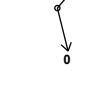
Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Node Type	Connections	Link	IL (m)	Dia (mm)	
A	445348.731	296726.635	104.750	0.410		Junction		0	1.000	104.340	350
HW1	445341.407	296728.307	104.700	0.410		Junction		1	1.000	104.290	350
							0	1.001	104.540	100	
HW2	445338.908	296728.379	104.650	0.410		Junction		1	1.001	104.490	100
							0	1.002	104.240	350	
HW3	445332.363	296727.390	104.550	0.410		Junction		1	1.002	104.140	350
							0	1.003	104.390	100	
HW4	445327.713	296725.552	104.500	0.410		Junction		1	1.003	104.340	100
							0	1.004	104.090	350	
HW5	445324.079	296723.687	104.400	0.410		Junction		1	1.004	103.990	350
							0	1.005	104.190	150	
HW6	445321.442	296722.251	104.350	0.410		Junction		1	1.005	104.140	150
							0	1.006	103.940	350	
HW7	445309.926	296715.108	104.150	0.410		Junction		1	1.006	103.740	350
							0	1.007	103.940	150	

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Node Type	Connections	Link	IL (m)	Dia (mm)
HW8	445307.877	296713.675	104.050	0.410		Junction		1 1.007	103.840	150
HW9	445298.568	296706.382	103.750	0.410		Junction		0 1.008 1 1.008	103.640 103.340	350 350
HW10	445296.715	296704.703	103.700	0.410		Junction		0 1.009 1 1.009	103.540 103.490	150 150
HW11	445289.911	296697.235	103.550	0.410		Junction		0 1.010 1 1.010	103.290 103.140	350 350
HW12	445288.315	296694.120	103.500	0.410		Junction		0 1.011 1 1.011	103.340 103.290	150 150
HW13	445286.903	296686.505	103.250	0.410		Junction		0 1.012 1 1.012	103.090 102.840	350 350
HW14	445287.627	296681.558	103.200	0.410		Junction		0 1.013 1 1.013	103.040 102.990	150 150
HW15	445295.961	296666.920	102.450	0.410		Junction		0 1.014 1 1.014	102.790 102.040	350 350
HW16	445299.870	296664.122	102.450	0.460		Junction		0 1.015 1 1.015	102.240 102.190	150 150
Pond	445305.024	296671.488	103.000	0.360		Junction		0 1.016 1 1.016	101.990 101.990	350 350
HW17	445307.347	296662.640	102.400	0.460		Junction		0 2.000 1 2.000 2 1.016	102.640 101.940 101.940	100 100 350
HW18	445310.069	296652.275	102.200	0.410		Junction		0 1.017 1 1.017	101.940 101.790	350 350
HW19	445311.932	296647.635	102.150	0.410		Junction		0 1.018 1 1.018	101.990 101.940	150 150
								0 1.019	101.740	350

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Node Type	Connections	Link	IL (m)	Dia (mm)
B	445358.142	296701.726	104.450	0.410		Junction				
HW20	445348.717	296695.288	103.900	0.410		Junction		0 3.000 104.040 350 1 3.000 103.490 350		
HW21	445345.848	296691.192	103.800	0.410		Junction		0 3.001 103.690 150 1 3.001 103.590 150		
HW22	445342.011	296687.775	103.500	0.410		Junction		0 3.002 103.390 350 1 3.002 103.090 350		
HW23	445337.663	296685.306	103.400	0.410		Junction		0 3.003 103.290 150 1 3.003 103.190 150		
HW24	445325.377	296675.600	103.150	0.410		Junction		0 3.004 102.990 350 1 3.004 102.740 350		
HW25	445322.232	296671.708	103.000	0.410		Junction		0 3.005 102.940 150 1 3.005 102.790 150		
HW26	445315.095	296659.907	102.500	0.410		Junction		0 3.006 102.590 350 1 3.006 102.090 350		
HW27	445316.364	296655.070	102.350	0.410		Junction		0 3.007 102.290 150 1 3.007 102.140 150		
HW28	445320.238	296646.220	102.000	0.410		Junction		0 3.008 101.940 350 1 3.008 101.590 350		
HW29	445317.113	296641.307	101.900	0.410		Junction		0 3.009 101.790 150 1 3.009 101.690 150 2 1.019 101.490 350		
HW30	445304.008	296617.642	101.250	0.810		Junction		0 3.010 101.490 350 1 3.010 100.440 350		
HW31	445302.752	296616.159	101.200	0.810		Junction		0 1.021 100.440 350 1 1.021 100.390 350 0 1.022 100.390 300		

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Node Type	Connections	Link	IL (m)	Dia (mm)	
S1	445303.775	296612.051	101.150	1.300	600	Manhole		1	1.022	100.250	300
								0	1.023	100.250	100
Outfall	445302.606	296608.868	100.400	0.250		Junction		1	1.023	100.150	100

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Detailed
FSR Region	England and Wales	Skip Steady State	x
M5-60 (mm)	19.670	Drain Down Time (mins)	240
Ratio-R	0.400	Additional Storage (m³/ha)	20.0
Summer CV	0.750	Check Discharge Rate(s)	x
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 %)
1	0	0	0
30	0	0	0
100	0	0	0
100	40	0	0

Node S1 Online Orifice Control

Flap Valve	x	Design Depth (m)	1.100	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Design Flow (l/s)	6.7		
Invert Level (m)	100.250	Diameter (m)	0.060		

Node HW5 Online Orifice Control

Flap Valve	x	Invert Level (m)	104.190	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Diameter (m)	0.060		

Node HW11 Online Orifice Control

Flap Valve	x	Invert Level (m)	103.340	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Diameter (m)	0.065		

Node HW7 Online Orifice Control

Flap Valve	x	Invert Level (m)	103.940	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Diameter (m)	0.065		

Node HW15 Online Orifice Control

Flap Valve	x	Invert Level (m)	102.240	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Diameter (m)	0.100		

Node Pond Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	102.200
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	0

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	80.0	0.0	0.800	250.0	0.0

Node HW30 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	100.440
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	88

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	0.0	0.0	0.399	0.0	0.0	0.400	60.0	0.0	0.800	100.0	0.0

Other (defaults)

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

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
1 year 15 minute summer	107.641	30.459	30 year 60 minute winter	76.157	30.293
1 year 15 minute winter	75.538	30.459	30 year 120 minute summer	69.308	18.316
1 year 30 minute summer	70.140	19.847	30 year 120 minute winter	46.047	18.316
1 year 30 minute winter	49.221	19.847	30 year 180 minute summer	52.477	13.504
1 year 60 minute summer	47.538	12.563	30 year 180 minute winter	34.111	13.504
1 year 60 minute winter	31.583	12.563	30 year 240 minute summer	40.987	10.832
1 year 120 minute summer	29.485	7.792	30 year 240 minute winter	27.231	10.832
1 year 120 minute winter	19.589	7.792	30 year 360 minute summer	30.750	7.913
1 year 180 minute summer	22.789	5.864	30 year 360 minute winter	19.988	7.913
1 year 180 minute winter	14.813	5.864	30 year 480 minute summer	23.959	6.332
1 year 240 minute summer	18.119	4.788	30 year 480 minute winter	15.918	6.332
1 year 240 minute winter	12.038	4.788	30 year 600 minute summer	19.460	5.323
1 year 360 minute summer	13.913	3.580	30 year 600 minute winter	13.297	5.323
1 year 360 minute winter	9.044	3.580	30 year 720 minute summer	17.229	4.618
1 year 480 minute summer	10.982	2.902	30 year 720 minute winter	11.579	4.618
1 year 480 minute winter	7.296	2.902	30 year 960 minute summer	14.005	3.688
1 year 600 minute summer	9.015	2.466	30 year 960 minute winter	9.277	3.688
1 year 600 minute winter	6.160	2.466	30 year 1440 minute summer	10.012	2.683
1 year 720 minute summer	8.053	2.158	30 year 1440 minute winter	6.729	2.683
1 year 720 minute winter	5.412	2.158	100 year 15 minute summer	342.436	96.898
1 year 960 minute summer	6.644	1.749	100 year 15 minute winter	240.306	96.898
1 year 960 minute winter	4.401	1.749	100 year 30 minute summer	224.904	63.640
1 year 1440 minute summer	4.857	1.302	100 year 30 minute winter	157.827	63.640
1 year 1440 minute winter	3.264	1.302	100 year 60 minute summer	150.681	39.821
30 year 15 minute summer	264.014	74.707	100 year 60 minute winter	100.109	39.821
30 year 15 minute winter	185.273	74.707	100 year 120 minute summer	91.104	24.076
30 year 30 minute summer	171.910	48.645	100 year 120 minute winter	60.527	24.076
30 year 30 minute winter	120.638	48.645	100 year 180 minute summer	68.780	17.699
30 year 60 minute summer	114.629	30.293	100 year 180 minute winter	44.709	17.699

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
100 year 240 minute summer	53.522	14.144	100 year +40% CC 60 minute winter	140.153	55.749
100 year 240 minute winter	35.558	14.144	100 year +40% CC 120 minute summer	127.545	33.706
100 year 360 minute summer	39.908	10.270	100 year +40% CC 120 minute winter	84.738	33.706
100 year 360 minute winter	25.941	10.270	100 year +40% CC 180 minute summer	96.292	24.779
100 year 480 minute summer	30.972	8.185	100 year +40% CC 180 minute winter	62.592	24.779
100 year 480 minute winter	20.577	8.185	100 year +40% CC 240 minute summer	74.930	19.802
100 year 600 minute summer	25.077	6.859	100 year +40% CC 240 minute winter	49.782	19.802
100 year 600 minute winter	17.134	6.859	100 year +40% CC 360 minute summer	55.872	14.378
100 year 720 minute summer	22.141	5.934	100 year +40% CC 360 minute winter	36.318	14.378
100 year 720 minute winter	14.880	5.934	100 year +40% CC 480 minute summer	43.361	11.459
100 year 960 minute summer	17.917	4.718	100 year +40% CC 480 minute winter	28.808	11.459
100 year 960 minute winter	11.869	4.718	100 year +40% CC 600 minute summer	35.107	9.603
100 year 1440 minute summer	12.723	3.410	100 year +40% CC 600 minute winter	23.987	9.603
100 year 1440 minute winter	8.550	3.410	100 year +40% CC 720 minute summer	30.998	8.308
100 year +40% CC 15 minute summer	479.411	135.657	100 year +40% CC 720 minute winter	20.832	8.308
100 year +40% CC 15 minute winter	336.429	135.657	100 year +40% CC 960 minute summer	25.084	6.605
100 year +40% CC 30 minute summer	314.865	89.096	100 year +40% CC 960 minute winter	16.616	6.605
100 year +40% CC 30 minute winter	220.958	89.096	100 year +40% CC 1440 minute summer	17.812	4.774
100 year +40% CC 60 minute summer	210.954	55.749	100 year +40% CC 1440 minute winter	11.971	4.774

Results for 1 year Critical Storm Duration. Lowest mass balance: 94.21%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
180 minute winter	A	396	104.370	0.030	0.1	0.0029	0.0000	OK
180 minute winter	HW1	112	104.370	0.080	0.2	0.0078	0.0000	OK
15 minute summer	HW2	1	104.240	0.000	0.0	0.0000	0.0000	OK
180 minute winter	HW3	112	104.203	0.063	0.1	0.0061	0.0000	OK
180 minute summer	HW4	104	104.218	0.128	0.7	0.0872	0.0000	OK
180 minute summer	HW5	104	104.218	0.228	0.5	0.0000	0.0000	OK
360 minute winter	HW6	232	103.965	0.025	0.3	0.0000	0.0000	OK
360 minute winter	HW7	232	103.965	0.225	0.6	0.1317	0.0000	OK
360 minute winter	HW8	232	103.645	0.005	0.4	0.0000	0.0000	OK
360 minute winter	HW9	232	103.570	0.229	0.6	0.1343	0.0000	OK
1440 minute winter	HW10	930	103.361	0.071	0.3	0.0000	0.0000	OK
1440 minute winter	HW11	930	103.361	0.221	0.3	0.0000	0.0000	OK
15 minute winter	HW12	10	103.107	0.017	3.5	0.0201	0.0000	OK
60 minute winter	HW13	39	103.098	0.258	1.7	0.0000	0.0000	OK
60 minute winter	HW14	38	102.800	0.010	1.7	0.0039	0.0000	OK
180 minute winter	HW15	120	102.270	0.230	1.2	0.0448	0.0000	OK
360 minute winter	HW16	240	102.039	0.049	0.7	0.0000	0.0000	OK
180 minute winter	Pond	120	102.649	0.009	0.6	1.4229	0.0000	OK
360 minute winter	HW17	240	102.039	0.099	1.0	0.0517	0.0000	OK
360 minute winter	HW18	240	102.039	0.249	0.9	0.0000	0.0000	OK
360 minute winter	HW19	240	101.748	0.008	0.9	0.0000	0.0000	OK
15 minute winter	B	10	104.053	0.013	2.8	0.0124	0.0000	OK
120 minute winter	HW20	76	103.724	0.234	1.0	0.0229	0.0000	OK
120 minute winter	HW21	78	103.396	0.006	0.8	0.0006	0.0000	OK
180 minute winter	HW22	124	103.316	0.226	0.7	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
180 minute winter	A	1.000	HW1	0.1	0.026	0.000	0.3295	
180 minute winter	HW1	1.001	HW2	0.0	0.000	0.000	0.0000	
15 minute summer	HW2	1.002	HW3	0.0	0.000	0.000	0.0775	
180 minute winter	HW3	1.003	HW4	0.0	0.000	0.000	0.0000	
180 minute summer	HW4	1.004	HW5	0.5	0.031	0.001	0.8533	
180 minute summer	HW5	Orifice	HW6	0.4				
360 minute winter	HW6	1.006	HW7	0.3	0.004	0.000	2.0605	
360 minute winter	HW7	Orifice	HW8	0.4				
360 minute winter	HW8	1.008	HW9	0.4	0.003	0.000	1.7665	
360 minute winter	HW9	1.009	HW10	0.5	0.279	0.069	0.0048	
1440 minute winter	HW10	1.010	HW11	0.3	0.021	0.000	1.7049	
1440 minute winter	HW11	Orifice	HW12	0.3				
15 minute winter	HW12	1.012	HW13	3.5	0.146	0.003	1.2680	
60 minute winter	HW13	1.013	HW14	1.3	0.286	0.229	0.0224	
60 minute winter	HW14	1.014	HW15	1.7	0.049	0.001	2.3727	
180 minute winter	HW15	Orifice	HW16	0.8				
360 minute winter	HW16	1.016	HW17	0.6	0.025	0.001	0.4779	
180 minute winter	Pond	2.000	HW17	0.3	0.527	0.015	0.0365	
360 minute winter	HW17	1.017	HW18	0.9	0.043	0.001	2.2727	
360 minute winter	HW18	1.018	HW19	0.9	0.252	0.159	0.0176	
360 minute winter	HW19	1.019	HW29	0.9	0.174	0.001	0.0416	
15 minute winter	B	3.000	HW20	2.8	0.125	0.002	1.3210	
120 minute winter	HW20	3.001	HW21	0.7	0.294	0.087	0.0116	
120 minute winter	HW21	3.002	HW22	0.8	0.047	0.001	0.7417	
180 minute winter	HW22	3.003	HW23	0.4	0.244	0.047	0.0076	

Results for 1 year Critical Storm Duration. Lowest mass balance: 94.21%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	HW23	10	103.006	0.016	2.3	0.0128	0.0000	OK
240 minute winter	HW24	168	102.965	0.225	0.6	0.0000	0.0000	OK
240 minute winter	HW25	168	102.595	0.005	0.5	0.0000	0.0000	OK
960 minute winter	HW26	690	102.307	0.216	0.3	0.0000	0.0000	OK
15 minute summer	HW27	10	101.951	0.011	1.8	0.0065	0.0000	OK
960 minute winter	HW28	675	101.812	0.222	0.2	0.0000	0.0000	OK
15 minute winter	HW29	10	101.501	0.011	1.8	0.0062	0.0000	OK
15 minute winter	HW30	11	100.456	0.016	2.9	0.0032	0.0000	OK
15 minute winter	HW31	11	100.433	0.043	2.8	0.0000	0.0000	OK
15 minute winter	S1	12	100.382	0.132	2.8	0.0374	0.0000	SURCHARGED
15 minute summer	Outfall	1	100.150	0.000	2.3	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	HW23	3.004	HW24	2.3	0.128	0.003	0.9981	
240 minute winter	HW24	3.005	HW25	0.5	0.302	0.051	0.0080	
240 minute winter	HW25	3.006	HW26	0.5	0.097	0.000	1.7479	
960 minute winter	HW26	3.007	HW27	0.2	0.232	0.021	0.0043	
15 minute summer	HW27	3.008	HW28	1.8	0.116	0.002	0.6243	
960 minute winter	HW28	3.009	HW29	0.2	0.192	0.030	0.0067	
15 minute winter	HW29	3.010	HW30	1.7	0.203	0.002	0.2298	
15 minute winter	HW30	1.021	HW31	2.8	0.138	0.003	0.0405	
15 minute winter	HW31	1.022	S1	2.8	0.317	0.044	0.0755	
15 minute winter	S1	Orifice	Outfall	2.4				1.3

Results for 30 year Critical Storm Duration. Lowest mass balance: 94.21%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
480 minute winter	A	392	104.454	0.114	0.2	0.0112	0.0000	OK
480 minute winter	HW1	304	104.454	0.164	0.2	0.0161	0.0000	OK
480 minute winter	HW2	696	104.275	0.035	0.1	0.0000	0.0000	OK
480 minute winter	HW3	688	104.275	0.135	0.1	0.0132	0.0000	OK
30 minute winter	HW4	22	104.282	0.192	3.8	0.1309	0.0000	OK
30 minute winter	HW5	22	104.281	0.291	2.7	0.0000	0.0000	OK
60 minute winter	HW6	47	104.017	0.077	1.8	0.0000	0.0000	OK
60 minute winter	HW7	46	104.017	0.277	3.5	0.1618	0.0000	OK
60 minute winter	HW8	47	103.653	0.013	1.9	0.0000	0.0000	OK
120 minute winter	HW9	76	103.604	0.264	2.7	0.1542	0.0000	OK
120 minute winter	HW10	94	103.416	0.126	2.7	0.0000	0.0000	OK
120 minute winter	HW11	94	103.417	0.276	2.5	0.0000	0.0000	OK
15 minute winter	HW12	13	103.154	0.064	8.6	0.0748	0.0000	OK
15 minute winter	HW13	12	103.154	0.314	8.4	0.0000	0.0000	OK
15 minute winter	HW14	12	102.813	0.023	6.7	0.0089	0.0000	OK
60 minute winter	HW15	41	102.336	0.296	5.7	0.0577	0.0000	OK
120 minute winter	HW16	82	102.099	0.109	3.4	0.0000	0.0000	OK
60 minute winter	Pond	44	102.656	0.016	2.8	2.7953	0.0000	OK
120 minute winter	HW17	82	102.099	0.159	5.0	0.0828	0.0000	OK
120 minute winter	HW18	82	102.099	0.309	4.5	0.0000	0.0000	OK
120 minute winter	HW19	82	101.760	0.020	4.4	0.0000	0.0000	OK
15 minute winter	B	10	104.063	0.022	6.8	0.0208	0.0000	OK
30 minute winter	HW20	21	103.773	0.283	5.6	0.0278	0.0000	OK
30 minute winter	HW21	20	103.406	0.016	4.4	0.0016	0.0000	OK
30 minute winter	HW22	23	103.368	0.277	4.4	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
480 minute winter	A	1.000	HW1	0.1	0.019	0.000	1.0738	
480 minute winter	HW1	1.001	HW2	0.0	0.000	0.000	0.0000	
480 minute winter	HW2	1.002	HW3	-0.1	-0.002	0.000	0.5278	
480 minute winter	HW3	1.003	HW4	0.0	0.000	0.000	0.0000	
30 minute winter	HW4	1.004	HW5	2.7	0.101	0.003	1.3375	
30 minute winter	HW5	Orifice	HW6	1.9				
60 minute winter	HW6	1.006	HW7	1.8	0.012	0.003	3.1069	
60 minute winter	HW7	Orifice	HW8	1.9				
60 minute winter	HW8	1.008	HW9	1.8	0.013	0.002	2.2043	
120 minute winter	HW9	1.009	HW10	2.7	0.458	0.345	0.0147	
120 minute winter	HW10	1.010	HW11	2.5	0.130	0.004	2.6217	
120 minute winter	HW11	Orifice	HW12	1.9				
15 minute winter	HW12	1.012	HW13	8.4	0.158	0.008	2.0690	
15 minute winter	HW13	1.013	HW14	4.8	0.445	0.878	0.0536	
15 minute winter	HW14	1.014	HW15	6.7	0.121	0.006	3.3296	
60 minute winter	HW15	Orifice	HW16	4.4				
120 minute winter	HW16	1.016	HW17	3.1	0.052	0.007	1.0350	
60 minute winter	Pond	2.000	HW17	1.0	0.431	0.058	0.0396	
120 minute winter	HW17	1.017	HW18	4.5	0.071	0.007	3.4394	
120 minute winter	HW18	1.018	HW19	4.4	0.433	0.805	0.0508	
120 minute winter	HW19	1.019	HW29	4.4	0.291	0.005	0.1307	
15 minute winter	B	3.000	HW20	6.8	0.146	0.006	2.3393	
30 minute winter	HW20	3.001	HW21	4.0	0.498	0.520	0.0407	
30 minute winter	HW21	3.002	HW22	4.4	0.059	0.003	1.0462	
30 minute winter	HW22	3.003	HW23	3.6	0.480	0.458	0.0372	

Results for 30 year Critical Storm Duration. Lowest mass balance: 94.21%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	HW23	10	103.018	0.028	5.8	0.0220	0.0000	OK
60 minute winter	HW24	41	103.017	0.277	5.5	0.0000	0.0000	OK
60 minute winter	HW25	41	102.610	0.019	4.6	0.0000	0.0000	OK
60 minute winter	HW26	49	102.352	0.262	4.6	0.0000	0.0000	OK
15 minute winter	HW27	10	101.959	0.019	4.3	0.0109	0.0000	OK
120 minute winter	HW28	82	101.873	0.283	3.8	0.0000	0.0000	OK
120 minute winter	HW29	82	101.518	0.027	8.6	0.0161	0.0000	OK
180 minute winter	HW30	148	100.748	0.308	8.3	0.0610	0.0000	OK
180 minute winter	HW31	148	100.748	0.358	5.3	0.0000	0.0000	SURCHARGED
180 minute winter	S1	148	100.747	0.497	5.1	0.1407	0.0000	SURCHARGED
15 minute summer	Outfall	1	100.150	0.000	3.5	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	HW23	3.004	HW24	5.8	0.160	0.008	2.7272	
60 minute winter	HW24	3.005	HW25	4.6	0.579	0.485	0.0400	
60 minute winter	HW25	3.006	HW26	4.6	0.207	0.004	2.5690	
60 minute winter	HW26	3.007	HW27	3.1	0.519	0.326	0.0300	
15 minute winter	HW27	3.008	HW28	4.3	0.158	0.004	1.5811	
120 minute winter	HW28	3.009	HW29	3.6	0.457	0.497	0.0458	
120 minute winter	HW29	3.010	HW30	8.6	0.291	0.008	6.1215	
180 minute winter	HW30	1.021	HW31	5.3	0.156	0.006	1.0392	
180 minute winter	HW31	1.022	S1	5.1	0.225	0.081	0.2981	
180 minute winter	S1	Orifice	Outfall	5.1				40.2

Results for 100 year Critical Storm Duration. Lowest mass balance: 94.21%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
600 minute winter	A	435	104.488	0.148	0.2	0.0145	0.0000	OK
600 minute winter	HW1	555	104.488	0.198	0.2	0.0194	0.0000	OK
720 minute winter	HW2	540	104.298	0.058	0.0	0.0000	0.0000	OK
600 minute winter	HW3	630	104.298	0.158	0.1	0.0155	0.0000	OK
30 minute winter	HW4	22	104.322	0.231	4.9	0.1581	0.0000	OK
30 minute winter	HW5	22	104.321	0.331	4.0	0.0000	0.0000	OK
60 minute winter	HW6	48	104.050	0.110	2.4	0.0000	0.0000	OK
60 minute winter	HW7	47	104.050	0.310	4.7	0.1816	0.0000	OK
60 minute winter	HW8	48	103.655	0.015	2.5	0.0000	0.0000	OK
60 minute winter	HW9	40	103.618	0.278	4.2	0.1624	0.0000	OK
120 minute winter	HW10	94	103.456	0.166	3.5	0.0000	0.0000	OK
120 minute winter	HW11	94	103.455	0.315	3.2	0.0000	0.0000	OK
15 minute winter	HW12	12	103.180	0.089	11.2	0.1048	0.0000	OK
15 minute winter	HW13	12	103.181	0.341	11.7	0.0000	0.0000	OK
15 minute winter	HW14	11	102.818	0.028	9.4	0.0108	0.0000	OK
30 minute winter	HW15	25	102.374	0.334	10.0	0.0651	0.0000	OK
60 minute winter	HW16	49	102.133	0.143	6.0	0.0000	0.0000	OK
60 minute winter	Pond	44	102.660	0.020	3.7	3.4728	0.0000	OK
60 minute winter	HW17	49	102.133	0.193	8.4	0.1007	0.0000	OK
60 minute winter	HW18	49	102.133	0.343	7.1	0.0000	0.0000	OK
60 minute winter	HW19	49	101.766	0.026	6.9	0.0000	0.0000	OK
15 minute winter	B	10	104.066	0.026	8.9	0.0244	0.0000	OK
30 minute winter	HW20	20	103.795	0.305	7.4	0.0299	0.0000	OK
15 minute winter	HW21	12	103.411	0.020	6.4	0.0020	0.0000	OK
30 minute winter	HW22	22	103.393	0.303	6.4	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
600 minute winter	A	1.000	HW1	0.1	0.011	0.000	1.4624	
600 minute winter	HW1	1.001	HW2	0.0	0.000	0.000	0.0000	
720 minute winter	HW2	1.002	HW3	0.0	-0.001	0.000	0.7092	
600 minute winter	HW3	1.003	HW4	0.0	0.000	0.000	0.0000	
30 minute winter	HW4	1.004	HW5	4.0	0.109	0.005	1.6914	
30 minute winter	HW5	Orifice	HW6	2.4				
60 minute winter	HW6	1.006	HW7	2.7	0.013	0.004	3.9103	
60 minute winter	HW7	Orifice	HW8	2.5				
60 minute winter	HW8	1.008	HW9	2.5	0.017	0.003	2.4056	
60 minute winter	HW9	1.009	HW10	3.9	0.514	0.505	0.0191	
120 minute winter	HW10	1.010	HW11	3.2	0.120	0.005	3.3807	
120 minute winter	HW11	Orifice	HW12	2.5				
15 minute winter	HW12	1.012	HW13	11.7	0.176	0.012	2.4444	
15 minute winter	HW13	1.013	HW14	6.7	0.496	1.226	0.0651	
15 minute winter	HW14	1.014	HW15	9.3	0.104	0.008	4.0755	
30 minute winter	HW15	Orifice	HW16	6.1				
60 minute winter	HW16	1.016	HW17	5.4	0.060	0.012	1.4270	
60 minute winter	Pond	2.000	HW17	1.5	0.443	0.088	0.0409	
60 minute winter	HW17	1.017	HW18	7.1	0.105	0.011	4.2100	
60 minute winter	HW18	1.018	HW19	6.9	0.499	1.250	0.0656	
60 minute winter	HW19	1.019	HW29	6.9	0.334	0.007	0.1754	
15 minute winter	B	3.000	HW20	8.9	0.187	0.007	2.7067	
30 minute winter	HW20	3.001	HW21	5.9	0.550	0.752	0.0530	
15 minute winter	HW21	3.002	HW22	6.4	0.083	0.005	1.1416	
30 minute winter	HW22	3.003	HW23	5.7	0.546	0.733	0.0520	

Results for 100 year Critical Storm Duration. Lowest mass balance: 94.21%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute winter	HW23	40	103.038	0.048	8.1	0.0376	0.0000	OK
60 minute winter	HW24	40	103.038	0.298	7.8	0.0000	0.0000	OK
60 minute winter	HW25	40	102.614	0.024	6.7	0.0000	0.0000	OK
60 minute winter	HW26	45	102.378	0.288	6.7	0.0000	0.0000	OK
60 minute winter	HW27	45	101.964	0.024	6.6	0.0141	0.0000	OK
60 minute winter	HW28	47	101.907	0.317	6.6	0.0000	0.0000	OK
60 minute winter	HW29	48	101.526	0.036	13.7	0.0210	0.0000	OK
180 minute winter	HW30	156	100.898	0.458	12.3	3.7790	0.0000	SURCHARGED
180 minute winter	HW31	156	100.898	0.508	6.3	0.0000	0.0000	SURCHARGED
180 minute winter	S1	156	100.897	0.647	5.9	0.1830	0.0000	FLOOD RISK
15 minute summer	Outfall	1	100.150	0.000	3.7	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
60 minute winter	HW23	3.004	HW24	7.8	0.133	0.011	3.7654	
60 minute winter	HW24	3.005	HW25	6.7	0.638	0.705	0.0525	
60 minute winter	HW25	3.006	HW26	6.7	0.228	0.006	3.0128	
60 minute winter	HW26	3.007	HW27	5.7	0.613	0.602	0.0467	
60 minute winter	HW27	3.008	HW28	6.6	0.122	0.006	2.4520	
60 minute winter	HW28	3.009	HW29	6.2	0.528	0.856	0.0672	
60 minute winter	HW29	3.010	HW30	13.6	0.249	0.012	10.6876	
180 minute winter	HW30	1.021	HW31	6.3	0.143	0.007	1.9278	
180 minute winter	HW31	1.022	S1	5.9	0.231	0.093	0.2981	
180 minute winter	S1	Orifice	Outfall	5.9				57.7

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 94.21%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
960 minute winter	A	615	104.552	0.212	0.2	0.0208	0.0000	OK
960 minute winter	HW1	615	104.552	0.262	0.2	0.0257	0.0000	OK
960 minute winter	HW2	1200	104.364	0.124	0.1	0.0000	0.0000	OK
960 minute winter	HW3	1200	104.364	0.224	0.1	0.0219	0.0000	OK
30 minute winter	HW4	23	104.388	0.297	6.9	0.2032	0.0000	OK
30 minute winter	HW5	23	104.388	0.398	4.8	0.0000	0.0000	FLOOD RISK
60 minute winter	HW6	48	104.102	0.161	3.2	0.0000	0.0000	OK
60 minute winter	HW7	50	104.102	0.362	6.2	0.2115	0.0000	FLOOD RISK
60 minute winter	HW8	50	103.657	0.017	3.2	0.0000	0.0000	OK
30 minute winter	HW9	21	103.639	0.299	7.0	0.1747	0.0000	OK
120 minute winter	HW10	98	103.522	0.232	4.8	0.0000	0.0000	OK
120 minute winter	HW11	98	103.522	0.382	4.3	0.0000	0.0000	FLOOD RISK
15 minute winter	HW12	12	103.224	0.134	15.7	0.1571	0.0000	OK
15 minute winter	HW13	12	103.227	0.387	12.5	0.0000	0.0000	FLOOD RISK
15 minute winter	HW14	11	102.824	0.034	13.4	0.0133	0.0000	OK
30 minute winter	HW15	25	102.449	0.409	14.1	0.0798	0.0000	FLOOD RISK
60 minute winter	HW16	53	102.194	0.204	8.2	0.0000	0.0000	OK
60 minute winter	Pond	42	102.666	0.026	5.2	4.4805	0.0000	OK
60 minute winter	HW17	53	102.194	0.254	12.1	0.1323	0.0000	OK
60 minute winter	HW18	53	102.194	0.404	10.2	0.0000	0.0000	FLOOD RISK
60 minute winter	HW19	54	101.772	0.032	9.7	0.0000	0.0000	OK
15 minute winter	B	10	104.072	0.032	12.4	0.0296	0.0000	OK
15 minute winter	HW20	12	103.837	0.347	13.7	0.0340	0.0000	OK
30 minute winter	HW21	22	103.428	0.038	9.3	0.0038	0.0000	OK
30 minute winter	HW22	22	103.430	0.340	10.4	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
960 minute winter	A	1.000	HW1	0.1	0.011	0.000	2.3550	
960 minute winter	HW1	1.001	HW2	0.1	0.143	0.021	0.0010	
960 minute winter	HW2	1.002	HW3	0.0	-0.001	0.000	1.3418	
960 minute winter	HW3	1.003	HW4	0.0	0.000	0.000	0.0000	
30 minute winter	HW4	1.004	HW5	4.8	0.107	0.006	2.3626	
30 minute winter	HW5	Orifice	HW6	3.1				
60 minute winter	HW6	1.006	HW7	3.7	0.013	0.005	5.3059	
60 minute winter	HW7	Orifice	HW8	3.2				
60 minute winter	HW8	1.008	HW9	3.2	0.020	0.004	2.6652	
30 minute winter	HW9	1.009	HW10	5.9	0.582	0.764	0.0255	
120 minute winter	HW10	1.010	HW11	4.3	0.147	0.006	4.8779	
120 minute winter	HW11	Orifice	HW12	3.4				
15 minute winter	HW12	1.012	HW13	12.5	0.205	0.012	3.1616	
15 minute winter	HW13	1.013	HW14	9.2	0.579	1.670	0.0710	
15 minute winter	HW14	1.014	HW15	13.4	0.124	0.011	5.5615	
30 minute winter	HW15	Orifice	HW16	8.3				
60 minute winter	HW16	1.016	HW17	7.7	0.054	0.017	2.2540	
60 minute winter	Pond	2.000	HW17	2.4	0.435	0.144	0.0431	
60 minute winter	HW17	1.017	HW18	10.2	0.111	0.015	5.7630	
60 minute winter	HW18	1.018	HW19	9.7	0.606	1.764	0.0720	
60 minute winter	HW19	1.019	HW29	9.7	0.408	0.010	0.2239	
15 minute winter	B	3.000	HW20	12.4	0.217	0.010	3.3524	
15 minute winter	HW20	3.001	HW21	8.9	0.603	1.145	0.0703	
30 minute winter	HW21	3.002	HW22	10.4	0.077	0.008	1.4868	
30 minute winter	HW22	3.003	HW23	8.5	0.598	1.090	0.0685	

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 94.21%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute winter	HW23	24	103.079	0.089	14.5	0.0691	0.0000	OK
30 minute winter	HW24	24	103.079	0.339	13.1	0.0000	0.0000	OK
30 minute winter	HW25	25	102.621	0.031	10.0	0.0000	0.0000	OK
60 minute winter	HW26	44	102.413	0.323	9.6	0.0000	0.0000	OK
60 minute winter	HW27	42	101.972	0.032	10.8	0.0187	0.0000	OK
60 minute winter	HW28	46	101.971	0.381	10.8	0.0000	0.0000	FLOOD RISK
60 minute winter	HW29	46	101.535	0.045	20.3	0.0264	0.0000	OK
180 minute winter	HW30	172	101.062	0.622	18.0	15.9337	0.0000	FLOOD RISK
180 minute winter	HW31	172	101.062	0.672	6.8	0.0000	0.0000	FLOOD RISK
180 minute winter	S1	172	101.060	0.810	6.6	0.2293	0.0000	FLOOD RISK
15 minute summer	Outfall	1	100.150	0.000	5.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute winter	HW23	3.004	HW24	13.1	0.144	0.019	4.8856	
30 minute winter	HW24	3.005	HW25	10.0	0.688	1.053	0.0711	
30 minute winter	HW25	3.006	HW26	10.0	0.270	0.009	3.5892	
60 minute winter	HW26	3.007	HW27	9.0	0.679	0.944	0.0654	
60 minute winter	HW27	3.008	HW28	10.8	0.133	0.010	3.3097	
60 minute winter	HW28	3.009	HW29	9.8	0.611	1.358	0.0840	
60 minute winter	HW29	3.010	HW30	20.3	0.248	0.018	17.0797	
180 minute winter	HW30	1.021	HW31	6.8	0.149	0.008	3.1980	
180 minute winter	HW31	1.022	S1	6.6	0.238	0.105	0.2981	
180 minute winter	S1	Orifice	Outfall	6.6				89.5

APPENDIX J – DRAINAGE MAINTENANCE SCHEDULE

Drainage Maintenance Schedule - Inglenook Farm, Barwell

Schedule	Feature	Location	Inspection Type	Inspection Frequency	Required Action	Maintenance Works	Maintenance Intervals	Comments
Regular Maintenance	Swales	Entire site along access road	Visual	As Required	Remove Litter and Debris, Cut Grass – to Retain Grass Height Within Specified Design Range, Manage Other Vegetation and Remove Nuisance Plants, Inspect Inlets, Outlets and Overflows for Blockages, and Clear if Required, Inspect Infiltration Surfaces for Ponding, Compaction, Silt Accumulation, Record Areas Where Water is Ponding for > 48 Hours, Inspect Vegetation Coverage, Inspect Inlets and Facility Surface for Silt Accumulation, Establish Appropriate Silt Removal Frequencies.	Silt / Debris removal	As required	Maintenance interval subject to Visual Inspection findings
	Rain Gardens	Wirhin landscaping	Visual	As Required	Remove Litter and Debris, Cut Grass for access and in and around basin, Manage Other Vegetation and Remove Nuisance Plants, Inspect Inlets, Outlets and Overflows for Blockages, and Clear if Required, Inspect banksides and headwalls for evidence of physical damage, Tidy any dead growth before the start of growing season, Remove sediment from inlets and outlets, Manage wetland plants, inspect silt accumulation to establish appropriate removal frequency.	Silt / Debris removal	As required	Maintenance interval subject to Visual Inspection findings
	Pond	Wirhin landscaping	Visual	As Required	Remove Litter and Debris, Cut Grass for access and in and around basin, Manage Other Vegetation and Remove Nuisance Plants, Inspect Inlets, Outlets and Overflows for Blockages, and Clear if Required, Inspect banksides and headwalls for evidence of physical damage, Tidy any dead growth before the start of growing season, Remove sediment from inlets and outlets, Manage wetland plants, inspect silt accumulation to establish appropriate removal frequency.	Silt / Debris removal	As required	Maintenance interval subject to Visual Inspection findings
	Orifice Plate Flow Control	Within Swale headwalls, HW5, HW7, HW11 & HW15	Visual	As Required	Remove Litter and Debris, Inspect Orifice for any blockages.	Silt/ Debris Removal	As Required	Maintenance interval subject to Visual Inspection findings

Occasional Maintenance	Linear Drain	Across Parking bays and roads that cross swale	Visual	As Required	Remove silt and leaf build up from linear drain.	Silt / Debris removal	As required	Maintenance interval subject to Visual Inspection findings
	Foul & Surface Water Chambers	Entire site	Visual	6 Months	Remove silt and leaf build up from gullies, chambers, gutters etc.	Silt / Debris removal	As required (debris max. 60% of capacity)	Maintenance interval subject to Visual Inspection findings
	Flow Control Chamber	Surface Water Flow Control Chamber	Visual	6 Months	Mechanical silt removal from sump	Silt / Debris removal	As required (debris max. 60% of capacity)	Maintenance interval subject to Visual Inspection findings
	Orifice Plate Flow control	Within Swale headwalls, HW5, HW7, HW11 & HW15	Visual	As Required	Manual removal of any silt/ debris that could cause blockages	Silt/ Debris Removal	6 Months (or as required)	Maintenance interval subject to Visual Inspection findings
	Foul Water Treatment Tank	Within landscaping	Visual	As necessary	Removal of sediment and floatables, removal of litter and debris, change the filter media.	Debris removal	6 months or as necessary (indicated by system inspections or immediately following significant ooverspill)	Maintenance interval subject to Visual Inspection findings

Remedial Actions	Foul & Surface Water Drainage	Entire site	Visual	12 Months	Remove and dispose of oils or fuel (diesel & petrol) residues using safe standard practices.	Safe removal or contaminant residues	As required	As required.
	Swales	Entire site	Visual	As Required	Repair Erosion or Other Damage by Re-Turfing or Reseeding, Relevel Uneven Surfaces and Reinstate Design Levels, Scarify and Spike Topsoil Layer to Improve Infiltration Performance, Break Up Silt Deposits and Prevent Compaction of the Soil Surface, Remove Build-Up of Sediment on Upstream Gravel Trench, Flow Spreader or at Top of Filter Strip, Remove and Dispose of Oils or Petrol Residues Using Safe Standard Practices.	Silt / Debris removal, repair as required	As required	Maintenance interval subject to Visual Inspection findings
	Attenuation basin	Within Landscaping	Visual	As Required	Repair Erosion or Other Damage by Re-Turfing or Reseeding, Replant where necessary, realign rip-rap, repair or rehabilitate inlets, outlets or overflows, Reinstate design levels.	Repair as required	As required	Maintenance interval subject to Visual Inspection findings
	Foul Water Treatment Tank	Within Landscaping	Visual	As Required	Replace malfunctioning parts or structures	Replace malfunctioning parts as required	As required	Maintenance interval subject to Visual Inspection findings
Monitoring	Foul & Surface Water Drainage	Entire site	Visual	12 Months	Walk over inspection for condition (breaks, lifting & missing) of chamber covers and grates.	Replace broken or cracked inspection chamber covers	As required	Maintenance interval subject to Visual Inspection findings
	Foul Water Treatment Tank	Within landscaping	Visual	12 Months	Inspect for evidence of poor operation.	Remove sediment as required	Annually or as required	Maintenance interval subject to Visual Inspection findings

* If weeds are persistent, weed killer may be used to reduce the requirement for manual weed removal.

Maintenance procedures to be undertaken in accordance with Ciria 753. This schedule should be read in conjunction with all engineering drawings