

**Yatton Keynell
Cotswold Homes**



**Flood Risk Assessment
&
Drainage Strategy**

March 2025



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Executive Summary

The proposed site for the development of 55 new dwellings at Yatton Keynell is located entirely within Flood Zone 1 with a low flood risk (less than 1:1,000 or 0.1% annual probability of flooding from rivers).

The proposed development is classified as 'More Vulnerable' and is in Flood Zone 1; the proposed development is suitable in this zone and the NPPF Sequential and Exception Tests are not required.

Flood risk from pluvial, sewers, surface water, groundwater and artificial sources has been assessed and it has been demonstrated that the proposed development will not be at risk from flooding from these sources.

Surface water from the proposed development will discharge into the existing drainage network at one location with flow limited to Qbar for events up to and including the 100 year with a 45% allowance for climate change and 10% allowance for urban creep.

Attenuation will be provided by a pond and swale system with sewers discharging directly into both via precast concrete headwalls. The pond will have a permanent water level to provide treatment to the surface water run-off from the development with side slopes of 1:3 to allow safe access / egress, in accordance with Ciria report C753 the SuDS manual.

Flood routes will be provided for exceedance events, or for local failure of the drainage system, and will ensure that flood flows are directed safely through the development to the downstream drainage system.

Sewers, headwalls and the flow control will be adopted by Wessex Water with the pond being adopted by either Wessex water or a suitably experienced management company.

A pre-development enquiry has been submitted to Wessex Water and foul flows from the site will drain by gravity to a pumping station prior to connecting into the Wessex Water sewer network in Biddestone Lane via a rising main. The foul sewers will be adopted by Wessex Water.

The Flood Risk Assessment and Drainage Strategy demonstrate that the proposed development meets with all the national and regional policy requirements and satisfies all the Planning Authority, Lead Local Flood Authority and criteria of the Environment Agency.

1. Introduction

This Flood Risk Assessment (FRA) has been prepared by Phoenix Design Partnership Limited on behalf of Cotswold Homes and their successors in title to support a Full Planning Application for the proposed residential development at Yatton Keynell. See paragraph 3.1 for Site location Plan.

The proposed development will involve the construction of 55 dwellings and associated infrastructure. Primary vehicle access to the site will be via a new junction from Biddestone Lane. See the Indicative Masterplan enclosed within Appendix A for details.

This site specific Flood Risk Assessment (FRA) has been produced in accordance with the National Planning Policy Framework document, Section 14 'Meeting the challenge of climate change, flooding and coastal change' and Planning Practice Guidance document 'Flood Risk and Coastal Change' together with Environment Agency FRA Guidance Notes.

The FRA demonstrates that the site is suitable for development without flood risk and without causing an increase in flood risk to others, including allowances for climate change. It also demonstrates how SuDS will be used to manage surface water from the development, and to ensure that water quality is not adversely affected.

2. Policy & Guidance

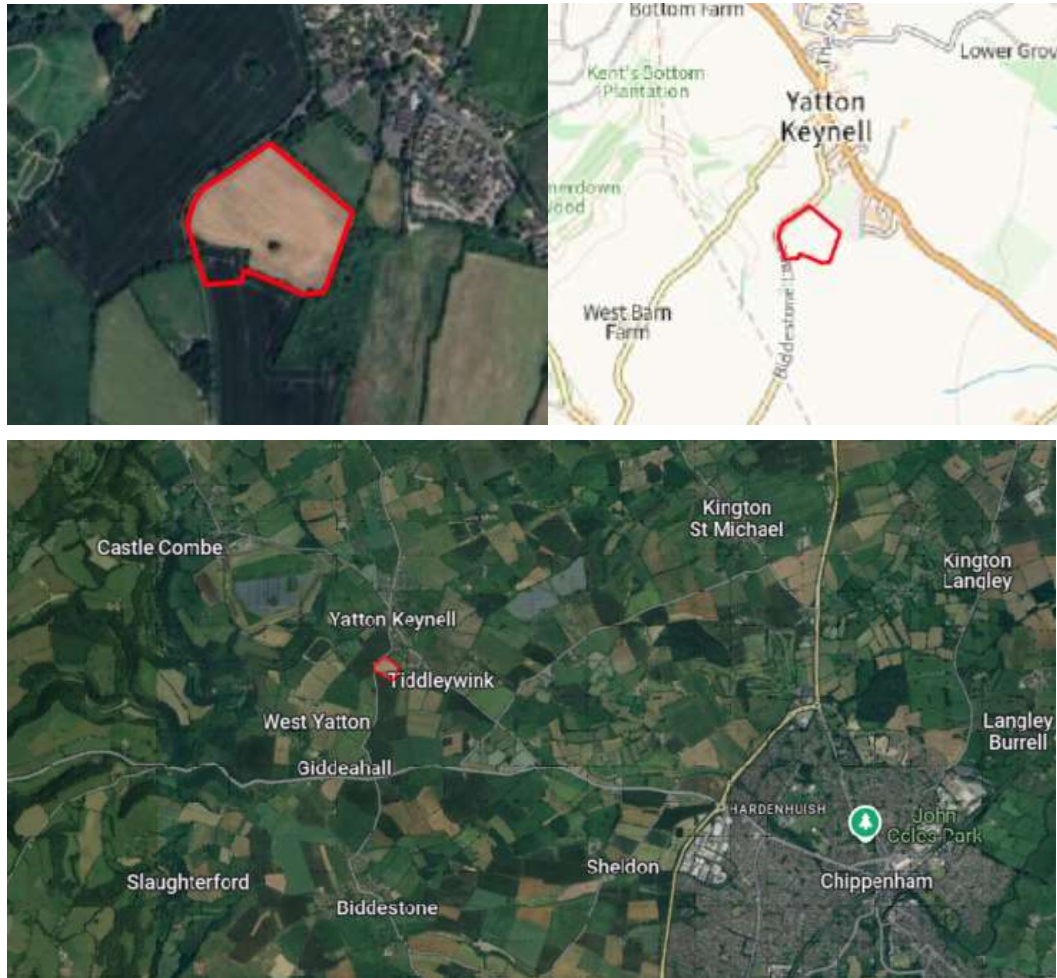
The following is a list of policy and guidance which has been referred and adhered to

- 2.1. National Planning Policy Framework (NPPF): December 2024 – Section 14 ‘Meeting the challenge of climate change flooding and coastal change’.
- 2.2. Planning Practice Guidance: September 2025 – ‘Flood risk and coastal change’
- 2.3. Flood & Water Management Act 2010 (FWMA)
- 2.4. Wiltshire Core Strategy 2015
- 2.5. Wiltshire Council Level 1 Strategic Flood Risk Assessment 2024 (SFRA 1)
- 2.6. Wiltshire Council Level 2 Strategic Flood Risk Assessment 2024 (SFRA 2)
- 2.7. Ciria C753 ‘The SuDS Manual’
- 2.8. Ciria C635 ‘Designing for Exceedance’
- 2.9. SSG Appendix C - Design and Construction guidance: Version 2.3 November 2023
- 2.10. EA, Defra & DCLG Guidance
- 2.11. Building Regulations Part H 2015 ‘Drainage & Waste Disposal’.
- 2.12. BS 8582:2013 Code of practice for surface water management for development sites
- 2.13. Non Statutory Technical Standards For Sustainable Drainage Systems 2015
- 2.14. EA ‘Flood risk assessments: climate change allowances’ 2016 (2022)

3. Existing Site Details

3.1. Site Location and Description

The site is located off Biddestone Lane to the south of Yatton Keynell in Wiltshire. The location is indicated on the images below and the site centred OS Grid Co-ordinates are E386593, N175891.



The site is currently agricultural and the total area is approximately 4.2ha.

The adjacent land is predominantly agricultural with residential areas nearby to the north and northeast.

3.2. Topographical Survey

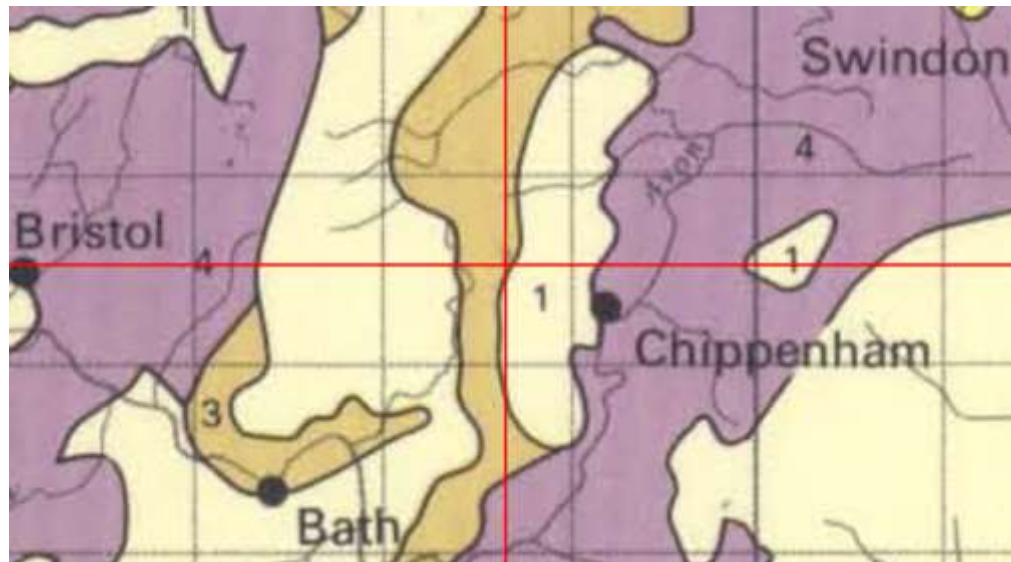
A Topographic Survey was undertaken by Dando Surveying Ltd dated June 2023 and is shown on drawing 617-P-002 Site survey and Hydrological features included in Appendix B.

The survey shows that the site is quite flat with an average gradient of approximately 1:50. Levels fall from a high point in the centre of the site at approximately 124mAOD to the edges at approximately 122.5mAOD reaching the lowest levels around 121.0mAOD in the southwest. LIDAR data obtained from DEFRA supports the findings of the survey.

There are existing ditches surrounding the site to the south and as well as two existing ponds within the site boundary in the south of the site with another immediately adjacent to the southeast. There are hedges and trees around the edge of the site with only one localised area within the site boundary.

3.3. The 'Winter Rain Acceptance Potential' (WRAP) Map

As shown below the WRAP map shows that the site is in soil class 3, though it lies on the border with an area of soil class 1.



Soil class 3 has the following general descriptions:

- (i) *Relatively impermeable soils in boulder and sedimentary clays, and in alluvium, especially in eastern England.*
- (ii) *Permeable soils with shallow ground-water in low lying areas*
- (iii) *Mixed areas of permeable and impermeable soils in approximately equal proportions*

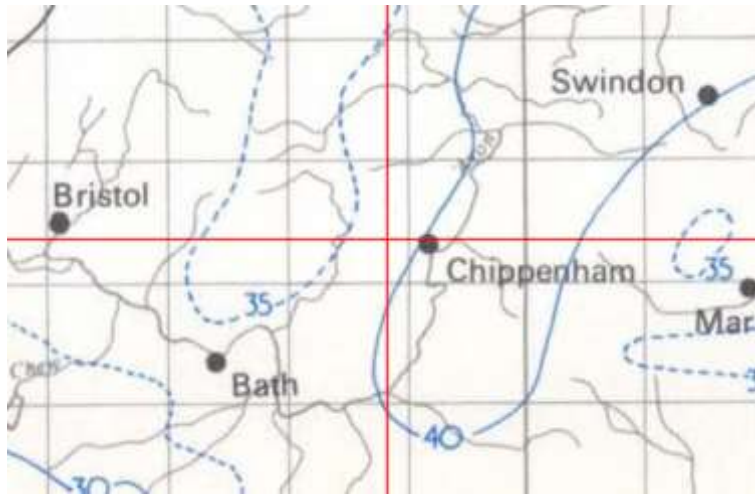
This indicates that ground conditions are unlikely to support the widespread use of infiltration.

Soil class 1 is more supportive of infiltration and can be classified as the following:

- (i) Well drained permeable sandy or loamy soils and shallower analogues over highly permeable limestone, chalk, sandstone or related drifts.
- (ii) Earthy peat soils drained by dikes and pumps.
Less permeable loamy over clayey soils on plateaux adjacent to very permeable soils in valleys.

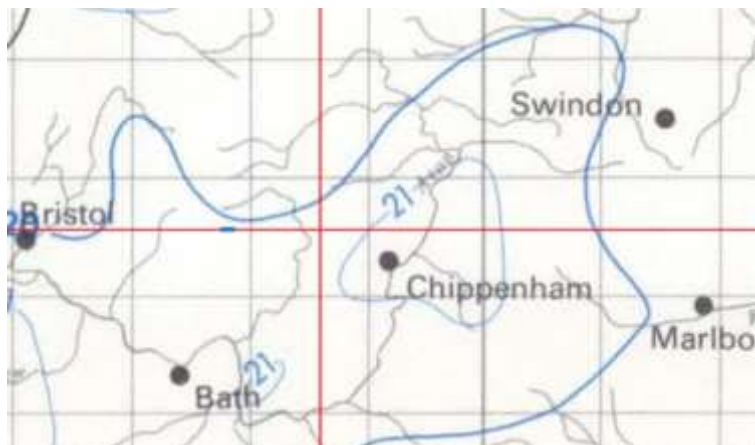
3.4. M5 60 Ratio R Map

As shown below the M5 60 Ratio R estimated to be 0.36



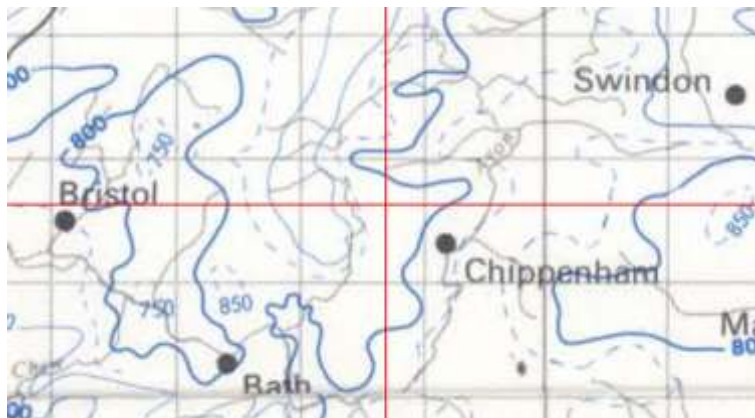
3.5. M5 60 Rainfall

The m5 60 Rainfall is estimated to be 20



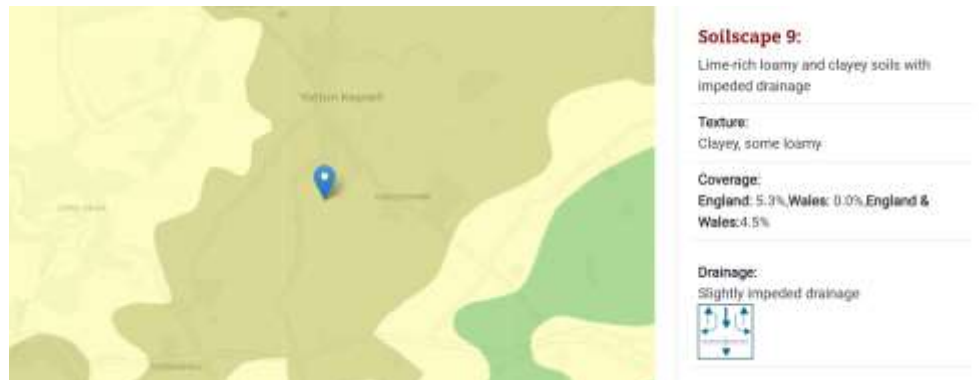
3.6. SAAR (Standard Average Annual Rainfall)

As shown below the SAAR map indicates a rainfall of 825mm



3.7. Soilscape – Soil Classification

The Soilscape Soil Classification map shows the site to be in an area of lime-rich loamy and clayey soils with impeded drainage.



3.8. The British Geological Survey (BGS) - Bedrock

Geological Survey of Great Britain mapping indicates that the site lies within the Forest Marble Formation which is predominantly a mudstone formation though limestone can be present.



3.9. The British Geological Survey (BGS) – Superficial Deposits



No Superficial Deposits are recorded as present on the site.

3.10. Ground investigation

A ground investigation was undertaken by Core Geotechnics Limited in November 2024 (report No 25013).

Infiltration testing was undertaken at 5 locations and insufficient fall was observed to be able to determine infiltration rates. It was therefore determined that infiltration is not suitable for the site. Copies of the trial pit location drawing and test results are included in Appendix C

Groundwater infiltration was observed at all trial pits.

3.11. Environment Agency Hydrogeology Information

Groundwater Source Protection Zone Map

Groundwater provides a third of our drinking water in England, and it also maintains the flow in many of our rivers. In some areas of Southern England, groundwater supplies up to 80% of the drinking water. The site is located within a Zone II, Outer Protection Source Protection Zones (SPZ) but isn't within designated Drinking Water Safeguard Zones.

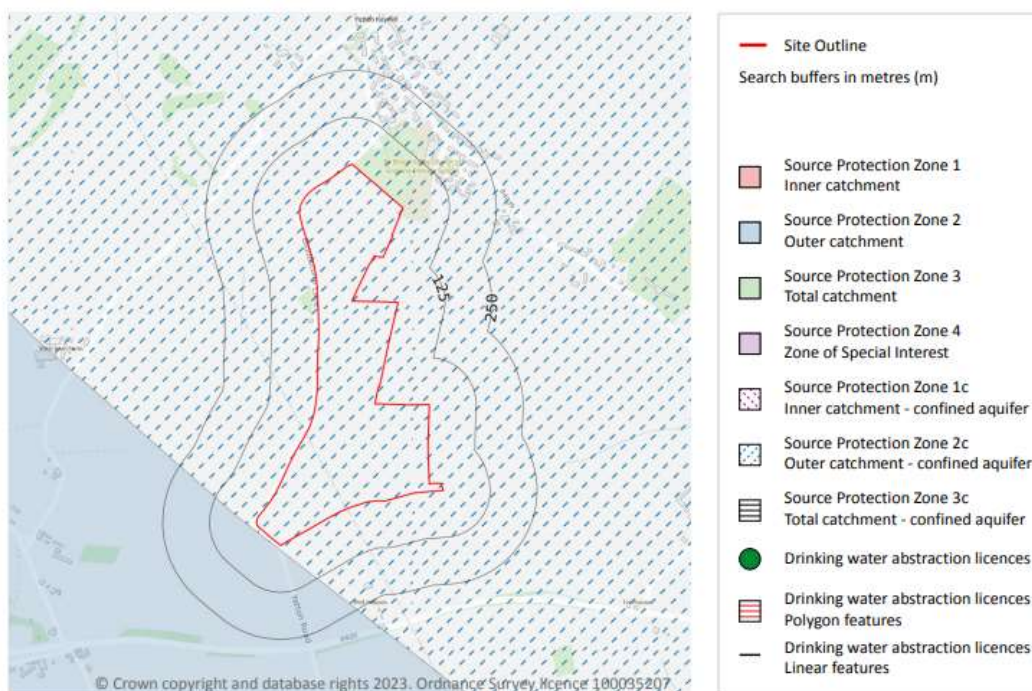
A groundwater SPZ2 is the area within 250-500m around an abstraction point for domestic supply or for food production purposes.



From the Groundsure report also undertaken on the site, it makes a further designation of Zone 2c. This is defined as the following:

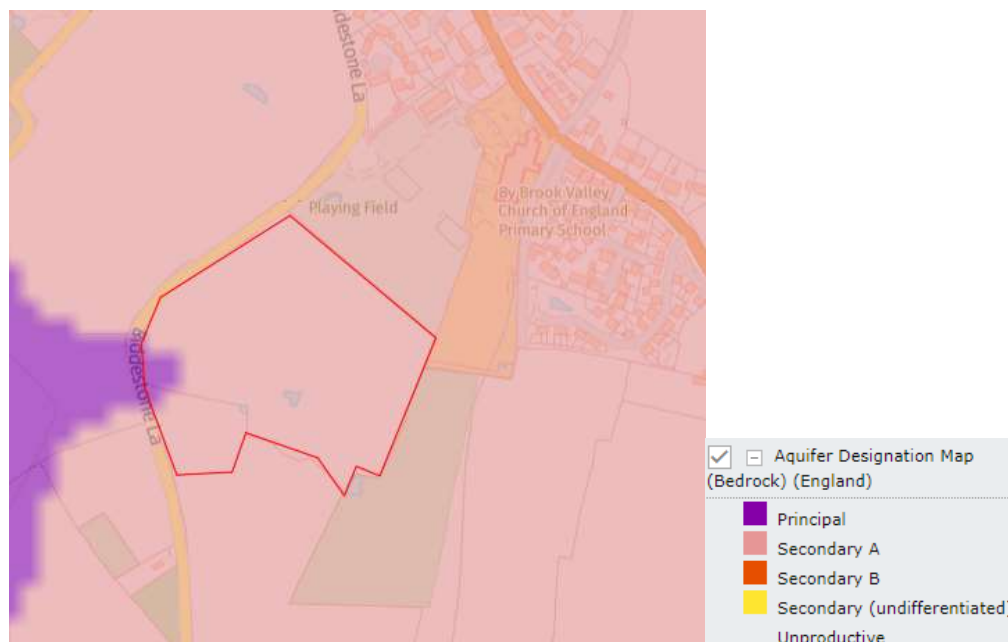
Confined aquifers are those that are protected from surface activities by a protective layer of low permeability rock (e.g. clay or glacial till). The increased interest in subsurface activities such as onshore oil and gas exploration, ground source heating and cooling now requires protection zones for confined sources to be marked on SPZ maps where this has not already been done.

Source Protection Zones and drinking water abstractions



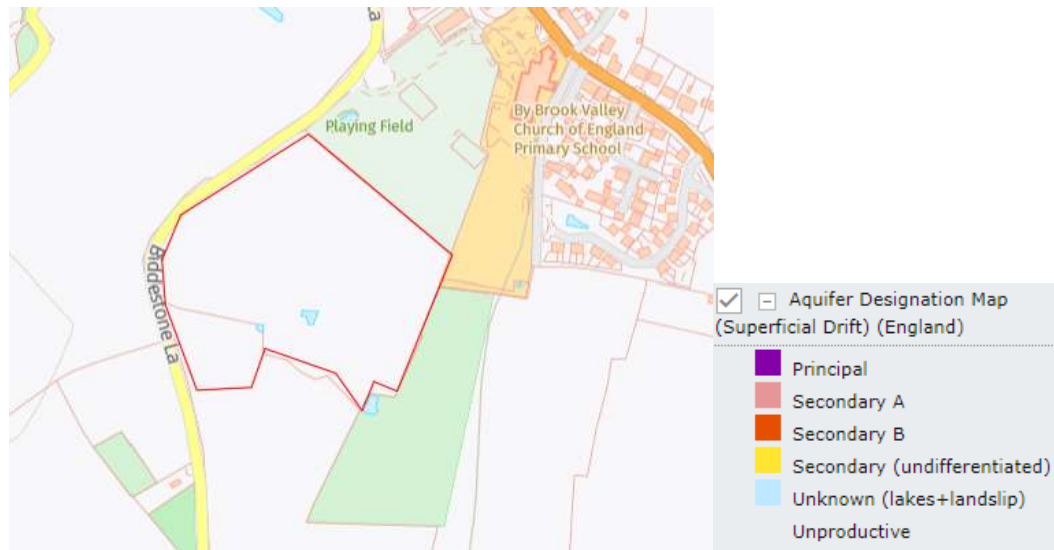
However, as no substantial subsurface activity is expected, the confining layers of clay on the surface should protect the aquifer below.

Aquifer Designation Map Bedrock



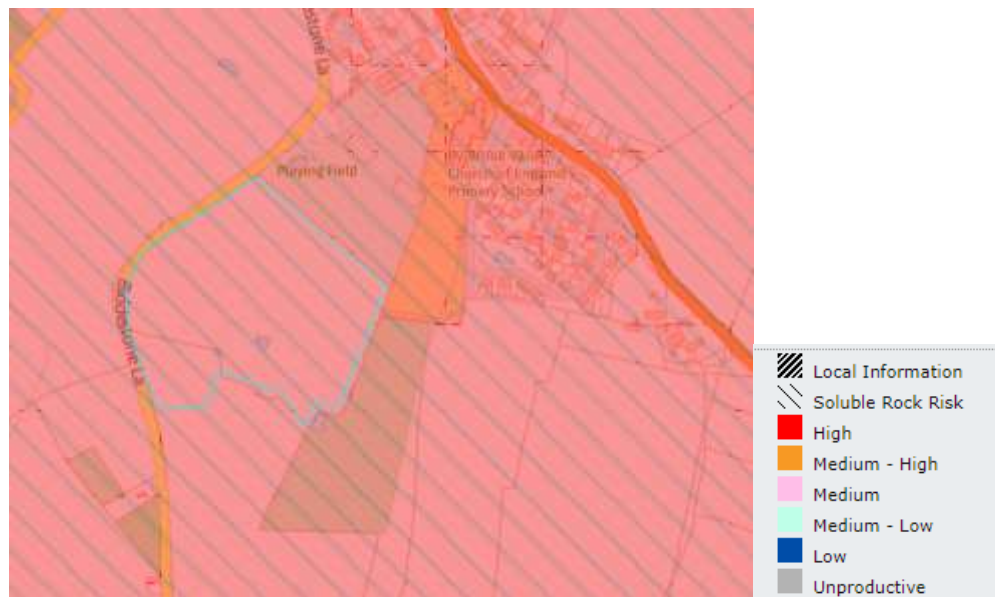
Secondary A aquifers comprise permeable layers that can support local water supplies though there is a principle aquifer, which provides groundwater at a strategic scale, bordering the site immediately to the west.

Aquifer Designation Map Superficial Drift



No superficial drift aquifers are shown across the site.

Groundwater Vulnerability Map



Groundwater vulnerability maps show the vulnerability to pollutants discharged at ground level depending on the hydrology, geology and soil properties within a square kilometre. The potential impact is a factor of the scale and importance of the groundwater for potable water supplies and baseflow in the surrounding area.

The groundwater vulnerability for the site is high with soluble rock risk present across the site meaning there is easy transmission of pollutants to groundwater due to the presence of high leaching soils and the absence of low permeability superficial deposits.

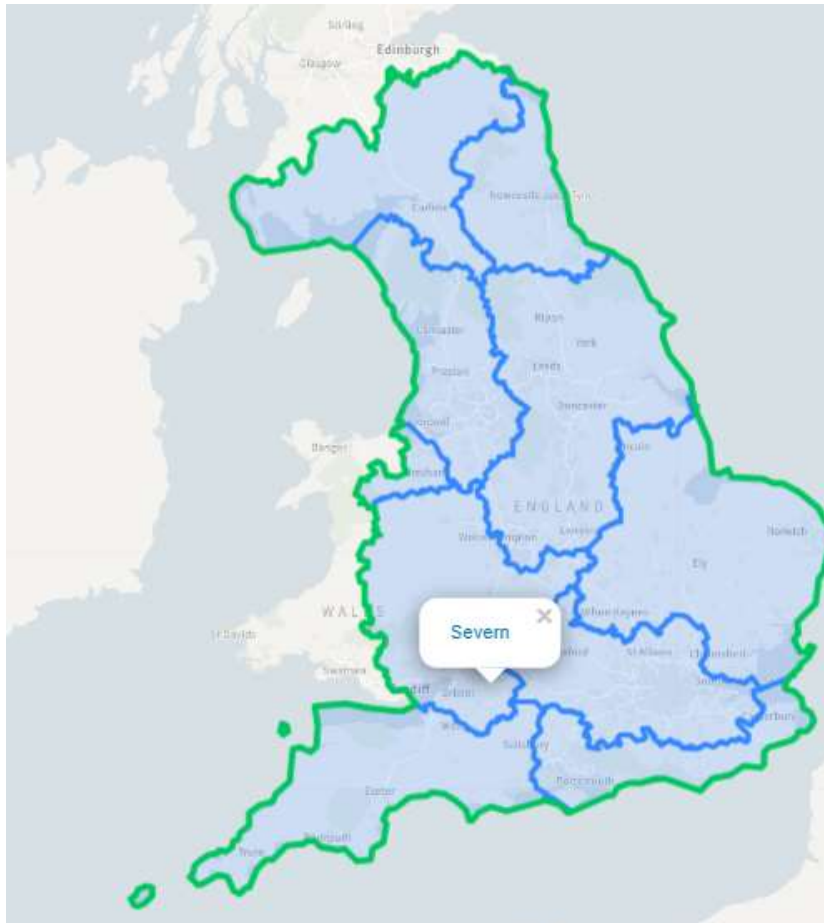
There are no records of licensed water abstractions within 1000m of the site.

3.12. Water Framework Directive River Basin Management Plans (WFD)

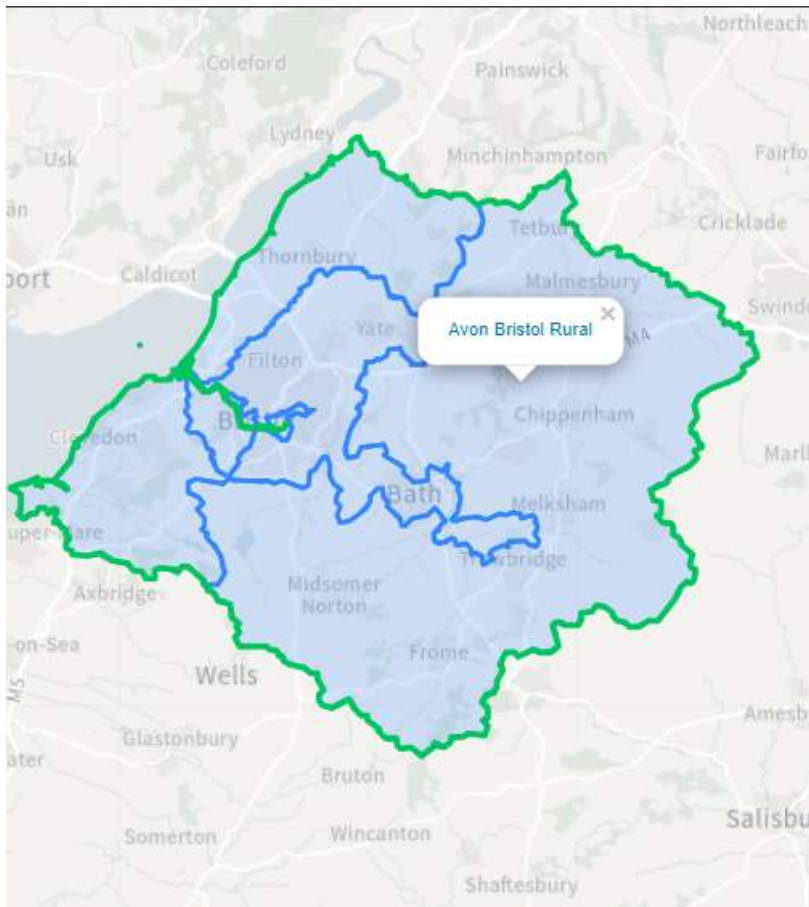
There are 10 river basin districts in England. Each river basin district has a river basin management plan. These plans set out the environmental objectives and a summary programmes of measures to achieve those objectives.

The aim / goal of the Water Framework Directive objective is for all watercourses to achieve good status by 2027.

The application site is located in Severn River Basin District shown below:-

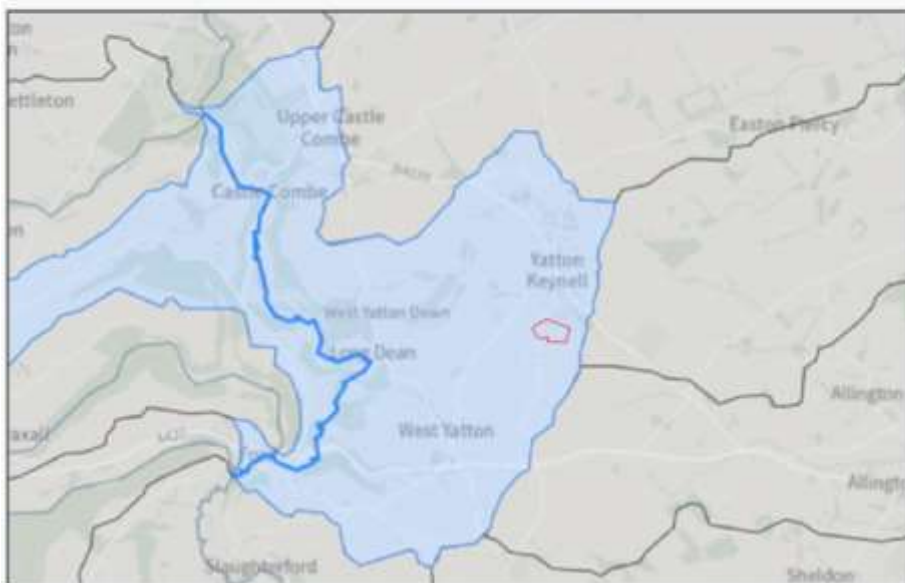


This is further subdivided into 11 management catchments of which Yatton Keynell is in the Avon Bristol and Somerset North Stream area which has a further 4 operational catchments:



This operational catchment contains 73 water bodies. The site is on the boundary of three of these catchments, but lies wholly within the Broadmead Brook to Doncombe Brook catchment.

By Brook (Broadmead Bk to Doncombe Bk) Water Body



The EA has deemed Broadmead Brook to Doncombe Brook as having moderate ecological status.

Classifications

Classification Item	2019
Ecological	Moderate
Biological quality elements	Moderate
Invertebrates	High
Macrophytes and Phytobenthos Combined	Moderate
Macrophytes Sub Element	Moderate
Physico-chemical quality elements	Good
Ammonia (Phys-Chem)	High
Dissolved oxygen	High
Phosphate	Good
Temperature	High
pH	High
Hydromorphological Supporting Elements	Supports good
Hydrological Regime	Supports good
Morphology	Supports good
Chemical	Fail
Priority hazardous substances	Fail
Benzo(a)pyrene	Good
Dioxins and dioxin-like compounds	Good
Heptachlor and cis-Heptachlor epoxide	Good
Hexabromocyclododecane (HBCDD)	Good
Hexachlorobenzene	Good
Hexachlorobutadiene	Good
Mercury and Its Compounds	Fail
Perfluorooctane sulphonate (PFOS)	Good
Polybrominated diphenyl ethers (PBDE)	Fail
Priority substances	Good
Cypermethrin (Priority)	Good
Fluoranthene	Good
Other Pollutants	Does not require assessment

Reasons for not achieving good (RNAG) and reasons for deterioration (RFD)

All reasons (RFDs and RNAGs) attributed to the classification elements in this water body.

Reason Type	SWMI	Activity	Category	Classification Element	More information
RNAG	Diffuse source	Poor Livestock Management	Agriculture and rural land management	Macrophytes and Phytobenthos Combined	Details
RNAG	Point source	Sewage discharge (continuous)	Water Industry	Macrophytes and Phytobenthos Combined	Details
RNAG	measures delivered to address reason, awaiting recovery	Not applicable	No sector responsible	Polybrominated diphenyl ethers (PBDE)	Details
RNAG	measures delivered to address reason, awaiting recovery	Not applicable	No sector responsible	Mercury and Its Compounds	Details

Objectives

Classification Item	Status	Year	Reasons
Ecological	Good	2027 - Low confidence	Disproportionately expensive: Disproportionate burdens
Biological quality elements	Good	2027 - Low confidence	Disproportionately expensive: Disproportionate burdens
Invertebrates	Good	2015	
Macrophytes and Phytobenthos Combined	Good	2027 - Low confidence	Disproportionately expensive: Disproportionate burdens
Physico-chemical quality elements	Good	2015	
Ammonia (Phys-Chem)	Good	2015	
Dissolved oxygen	Good	2015	
Phosphate	Good	2015	
Temperature	Good	2015	
pH	Good	2015	
Hydromorphological Supporting Elements	Supports good	2015	
Hydrological Regime	Supports good	2015	
Supporting elements (Surface Water)	Not assessed	2015	
Specific pollutants	Not assessed	2015	
Chemical	Good	2063	Natural conditions: Chemical status recovery time
Priority hazardous substances	Good	2063	Natural conditions: Chemical status recovery time
Benzo(a)pyrene	Good	2015	
Dioxins and dioxin-like compounds	Good	2015	
Heptachlor and cis-Heptachlor epoxide	Good	2015	
Hexabromocyclododecane (HBCDD)	Good	2015	
Hexachlorobenzene	Good	2015	
Hexachlorobutadiene	Good	2015	
Mercury and its Compounds	Good	2040	Natural conditions: Chemical status recovery time
Perfluorooctane sulphonate (PFOS)	Good	2015	
Polybrominated diphenyl ethers (PBDE)	Good	2063	Natural conditions: Chemical status recovery time
Priority substances	Good	2015	
Cypermethrin (Priority)	Good	2015	
Fluoranthene	Good	2015	
Other Pollutants	Does not require assessment	2015	

The proposed SuDS will provide treatment to the surface water run-off from the development and will follow the guidance provided in Ciria C753, 'The SuDS Manual' to ensure that the WFD objectives are not adversely affected.

3.13. Existing Catchments

The site has two distinct catchments with the northern catchment flowing northwards and the southern catchment draining to the existing ditch on the boundary

3.14. Existing Green-field Run-off Rates

The green-field run-off rate for the development catchment area has been calculated for 1 hectare using Causeway Flow see below for the results. As per LLFA requirements, a 30% betterment will be applied to the 1 year event.

Site Makeup	Greenfield
Greenfield Method	IH124
Positively Drained Area (ha)	1.000
SAAR (mm)	825
Soil Index	3
SPR	0.40
Region	8
Betterment (%)	30
Calc	
QBar (l/s)	4.1

Return Period (years)	Growth Factor	Q (l/s)
1	0.78	2.3

Values are obtained from the FEH Web Service provided by the UK Centre for Ecology and Hydrology.

Since the original design was undertaken, SAAR₆₁₉₀ has been replaced by SAAR₉₁₂₀ which suggests a value of 879mm. However, the original design has been kept to provide a betterment over the new run-off rates.

3.15. Existing Green-field Run-off Volume.

Ciria C753 & the EA/DEFRA guide 'Preliminary Rainfall Runoff Management for Developments' recommend that the basis for considering the run-off volume is the difference pre- and post-development for the 100-year 6 hour event.

Ciria C753 (Section 24.10)

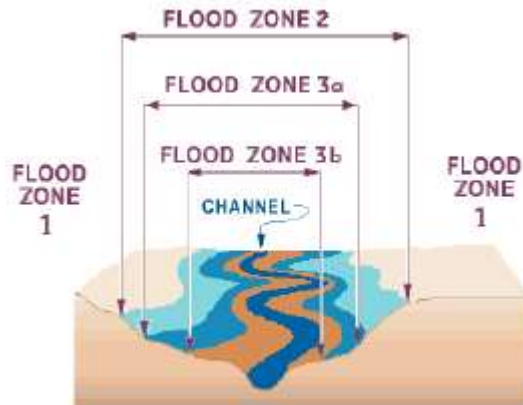
Green-field Run-off Volume = $10 \times RD \times A \times (SPR \text{ or } PR)$

Existing 100 Year Green-field Run-off Volume: **1115m³**(Refer to Section 5.2 and Appendix D for the calculation)

4. Flood Risk Assessment

4.1. Flood Zones

Table 1 of the NPPF Technical Guidance defines different flood zones according to the probability of river and sea flooding, ignoring the presence of any defences (although areas benefiting from formal defences are identified).



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 in any year (<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 (1% - 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 between a 1 in 100 or greater annual probability of river flooding (>1%) or 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 (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, including conveyance routes).

It should be noted that flooding from surface water, groundwater, sewers and impounded water bodies can occur in any flood zone, even in Flood Zone 1.

Flood risk from all potential sources (sea, fluvial, pluvial, sewers, groundwater, and artificial) has been assessed and discussed in detail within Section 4.2.

4.2. Environment Agency Flood Zone Mapping

The site benefits from various flood maps as shown below.

EA Flood Map for Planning



Flood mapping shows that the site is entirely within flood zone 1.

EA Map Risk of Flooding from Rivers and Sea

The EA mapping above shows that the site is within areas of Very Low risk of flooding from rivers or the sea. The EA Maps state that:

- **Very low risk** means that each year this area has a chance of flooding of less than 0.1%. This takes into account the effect of any flood defences in the area. These defences reduce but do not completely stop the chance of flooding as they can be overtopped or fail.

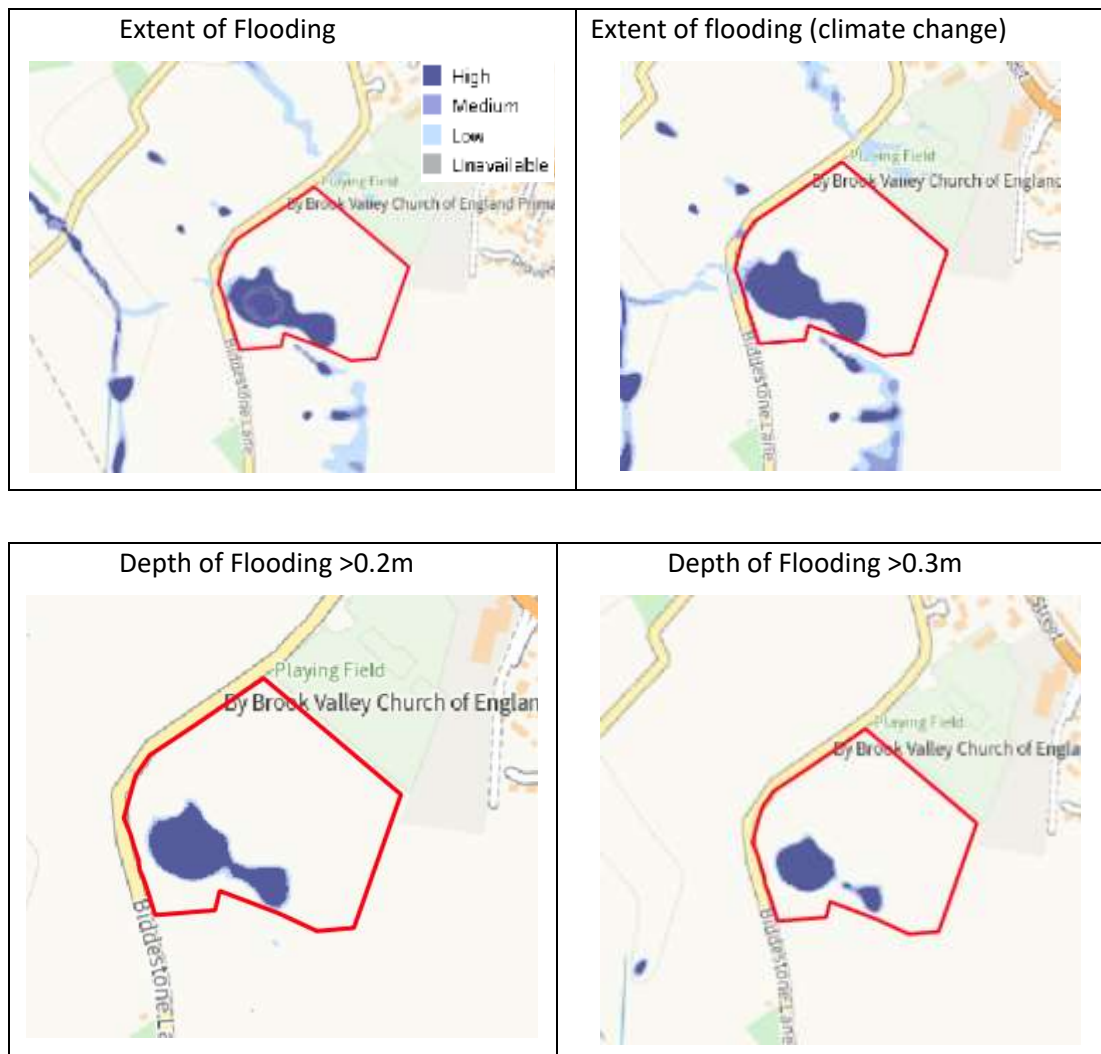


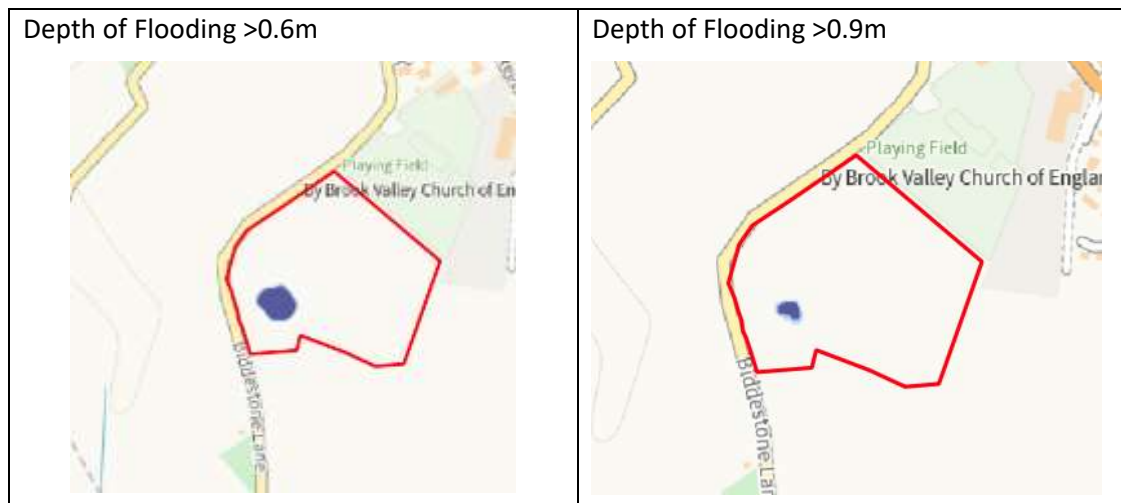
EA Map Risk of Flooding from Surface Water

Intense periods of rainfall over a short duration can often lead to overland flow as rainwater is unable to infiltrate into the ground or enter drainage systems. It is made worse when soils are saturated so that they cannot accept any more water. Surface water run-off is currently collected by on site ditches and watercourses.

The EA surface water flood map below has been generated by simulating rainfall events over the site to determine where surface flows and collects based on Lidar survey information. The rainfall events chosen for modelling were the 1 in 30, 1 in 100 and 1 in 1000 year storm return periods. These events were modelled for the 1 hour, 3 hour and 6 hour storm durations.

Maps showing surface water flooding have recently been updated with the latest modelling techniques and rainfall data. The maps have also been changed to show the likelihood of certain flood depths occurring, replacing the depths of flooding at each likelihood of rainfall event.





The maps show that the southern area of the site is at risk of flooding from surface water. The EA define these as follows:

- **Very Low risk** means that each year this area has a chance of flooding of less than 0.1%.
- **Low risk** means that each year this area has a chance of flooding of between 0.1% and 1%.
- **Medium risk** means that each year this area has a chance of flooding of between 1% and 3.3%.
- **High risk** means that each year this area has a chance of flooding of greater than 3.3%.

However, the EA states that: *'Flooding from surface water is difficult to predict as rainfall location and volume are difficult to forecast. In addition, local features can greatly affect the chance and severity of flooding.'*

These areas subject to increased flood risk appear to be located at the low points of the site and are likely to be the result of overland runoff. The drainage proposals for the site will reduce the risk by managing the runoff from the development.

It is also to be noted that most of this surface water flooding is shown in the location of the existing ditches which are present to the south of the site.

EA Map Risk of Flooding from Reservoirs



The Map does not identify a risk of flooding from a reservoir.

4.3. Strategic Flood Risk Assessment (SFRA) Scott Wilson June 2009

A SFRA was undertaken by Scott Wilson with the final report data June 2009

4.4. Strategic Flood Risk Assessment (SFRA) URS July 2013

The June 2008 SFRA was updated to reflect the amalgamation of the former districts into the single unitary authority of Wiltshire Council and to reflect current guidance / policy.

4.5. Strategic Flood Risk Assessment (SFRA) JBA May 2019

The 2019 SFRA was updated to review the Wiltshire Core Strategy and to help form the Wiltshire Local Plan.

4.6. Strategic Flood Risk Assessment (SFRA) JBA November 2024

The 2024 SFRA was updated to bring it in line with the Local Plan as well as NPPF changes and climate change allowances.

The table below lists how the site is affected by relevant appendices.

SFRA Appendices	What Extract Shows
<i>Appendix C Flood map for Planning</i>	Site not within Flood Zone 2 or 3
<i>Appendix D Flood Zone 3b</i>	Site not within Flood Zone 3b
<i>Appendix E Risk of Flooding from Surface Water</i>	Low, Medium and High Risk areas of flooding from surface water shown in vicinity of site
<i>Appendix F Impact of Climate Change on Risk of Flooding</i>	Shows Flood Risk in vicinity of the site
<i>Appendix G Groundwater Emergence</i>	Site is in an area deemed as having a negligible risk of groundwater flooding
<i>Appendix H Risk of Flooding from Reservoirs</i>	Site is not within an area at risk of reservoir flooding
<i>Appendix I Risk of Flooding from Sewers</i>	No previously recorded sewer flooding has occurred in the vicinity of the site
<i>Appendix J Recorded Flood History</i>	No LLFA recorded flood incidents have occurred on the site
<i>Appendix K Flood Alert and Warning Areas</i>	Site not within a flood alert area
<i>Appendix L1 Type of Flood Defences</i>	No Flood Defences are in the vicinity of the site
<i>Appendix L2 Flood Defences Standard of Protection</i>	No Flood defence protection affecting the site
<i>Appendix M Risk of Flooding from Canals and Recorded Incidents</i>	Site not at risk from canal flooding
<i>Appendix N Summary of Flood Risk in Wiltshire</i>	Suggests that flood risk in the area is generally localised away from the site

<i>Appendix O Cumulative Impact Assessment</i>	The site straddles an area between Medium and Low
<i>Appendix P Fluvial and Central Climate Change</i>	The site is not within an affected area
<i>Appendix Q Fluvial and Higher Climate Change</i>	The site is not within an affected area
<i>Appendix R Methodology for Sequential Testing</i>	Site not within Groundwater Sequential Testing area

The drawings which constitute the appendices can be found at:

<https://www.wiltshire.gov.uk/article/10094/Submission-and-document-library>

4.7. Flood Risk from Sewers.

There is a single surface water sewer within 100m of the site coming from the Farrells Field and Drovers Green developments. It outfalls into a pond at the southeastern boundary of the site which is assumed to outfall to the existing onsite ditch on the southern boundary of the site.

The pond is at a lower level than that of the site and therefore the risk of flooding because of a failure of this sewer can be considered as low.

4.8. Flood Risk from Existing Ditches

There are existing ditches that border the site to the south and east which flow towards the southwest of the site towards its border with Biddestone Lane. There is also a short section along the road in the northwest which is predominantly dry.

The upstream flow enters the site from an adjacent field before flowing around the field to the south. See below with the route of the ditch shown in red below.



Flows have been observed discharging to the ground at the western end of the ditch. See below for image.



Where the water resurfaces once it discharges to the ground is currently undetermined, but the wider catchment drains to the west away from the site. Anecdotal evidence suggests that the outfall becomes overwhelmed in extreme events causing water to build up and pond in the southwestern corner of the site. Based on the levels shown on the survey the water will rise until it gets to an approximate level 121.95m AOD when it will overtop the low point of Biddestone Lane and flow overland to the west.

Refer to Appendix B for drawing '617-P-002 Site Survey and Hydrological Features' and Appendix E for drawing '617-P-060 Flood Route and Cross Section.'

Also refer to Appendix D for drainage modelling under surcharged outfall conditions.

4.9. Ponds

There are three ponds affecting the site, two within the boundary in the south and one immediately adjacent to the southeast. The one outside the boundary acts as storage for flow from the neighbouring development though it is unclear where this pond currently drains to.

The southernmost of the two ponds within the site boundary lies online with the ditch network and therefore would flood the site in line with the water levels in the ditches though these are below the level of the site and the risk appears small. The other pond more central to the site seems disconnected from the ditch network and will only collect rainfall.

4.10. Catchments

Using the FEH web service, the surrounding catchments overlying the site can be viewed as well as the point to which they drain towards. It can be seen in the images below that the surrounding areas drain away from the site and therefore flooding from overland flow routes is shown to be unlikely.



Lidar data also produces a catchment for the outlet in the southwestern edge of the ditch.



4.11. Sequential Test.

Paragraph 174 of the NPPF states that:

‘Within this context the aim of the sequential test is to steer new development to areas with the lowest risk of flooding from any source. Development should not be allocated or permitted if there are reasonably available sites appropriate for the proposed development in areas with a lower risk of flooding. The strategic flood risk assessment will provide the basis for applying this test.’

Paragraph 175 of the NPPF states that:

‘The sequential test should be used in areas known to be at risk now or in the future from any form of flooding, except in situations where a site-specific flood risk assessment demonstrates that no built development within the site boundary, including access or escape routes, land raising or other potentially vulnerable elements, would be located on an area that would be at risk of flooding from any source, now and in the future (having regard to potential changes in flood risk)’

The application site is located entirely in Flood Zone 1 and the development will be located outside of the surface water flow paths, therefore the proposals are in accordance with the NPPF sequential approach to locate development in areas of lowest flood risk.

4.12. Flood Risk Vulnerability Classification

The proposed development, classified in accordance with Annex 3 of the Planning Practice Guidance ‘Flood Risk Vulnerability Classification’, is ‘More Vulnerable’ (residential).

Table 2: Flood risk vulnerability and flood zone ‘incompatibility’

Flood Zones	Flood Risk Vulnerability Classification				
	Essential infrastructure	Highly vulnerable	More vulnerable	Less vulnerable	Water compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test required	✓	✓	✓
Zone 3a †	Exception Test required †	X	Exception Test required	✓	✓
Zone 3b *	Exception Test required *	X	X	X	✓ *

Key:

✓ Exception test is not required

X Development should not be permitted

4.13. Exception Test.

Paragraph 177 of the NPPF states that:

‘Having applied the sequential test, if it is not possible for development to be located in areas with a lower risk of flooding (taking into account wider sustainable development objectives), the exception test may have to be applied. The need for the exception test will depend on the potential vulnerability of the site and of the development proposed, in line with the Flood Risk Vulnerability Classification set out in Annex 3.’

Paragraph 178 of the NPPF states that:

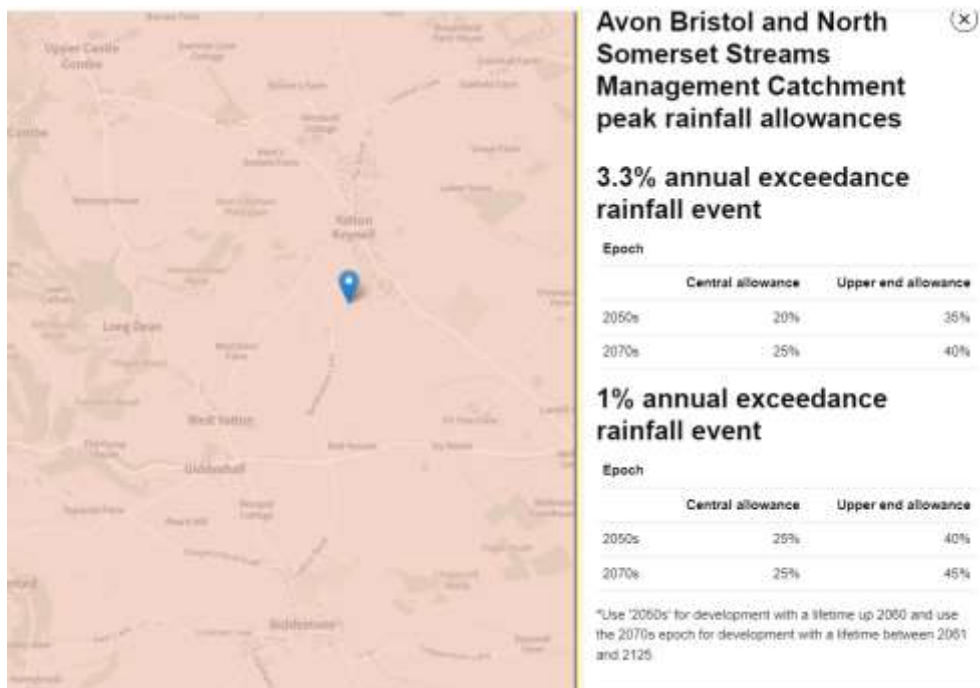
‘The application of the exception test should be informed by a strategic or site-specific flood risk assessment, depending on whether it is being applied during plan production or at the application stage. For the exception test to be passed it should be demonstrated that:-

- *the development provides wider sustainability benefits to the community that outweigh flood risk, and*
- *the development will be safe for its lifetime taking in to account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall’.*

The Flood Risk Vulnerability and Flood Zone ‘incompatibility’ Table 2 within PPG Annex 3 shows that the proposed development is appropriate and compatible and therefore an exception test is not required.

4.14. Climate Change.

In accordance with the February 2022 EA guidance ‘Flood risk assessments: climate change allowances’ the SuDS design will include a 45% (upper end) allowance for the predicted increase in rainfall intensity over the lifetime of the residential development (100 year design life to 2070 to 2125).



4.15. Exceedance.

To manage any residual flood risk the Proposed Development will include flood exceedance routes to direct any flows from extreme events or localised failures away from existing or proposed properties safely to the downstream surface water drainage system. Any existing routes will either be maintained, managed or diverted.

4.16. Probability of Flood Risk.

The risk of flooding from all sources has been assessed and the FRA demonstrates how flood risk and surface water run-off will be managed to ensure that the development will be safe from flood risk and that it will not increase flood risk elsewhere, including allowance for climate change. Whilst the surface water flood maps show a greater area of the site being subject to the risk of surface water flooding, based on the levels shown on the survey, the flood extents will only reach 121.95m AoD. Refer to Appendix B for drawing 617-P-002 Site Survey and Hydrological Features

It is therefore concluded that the site is at low risk from flooding.

5. Surface Water Run-off

5.1. SuDS

SuDS will be used to manage surface water run-off from the proposed development. The SuDS will be designed to ensure that the existing run-off regime is maintained as closely as possible and that there is no increase in flood risk as a result of the development of the site.

5.2. Run-off Volumes

Guidance recommends that the run-off volume for the 100 year 6 hour event is used to compare existing and proposed volumes. Existing run-off from the development area has been calculated at 1115m³. The developed run-off has been calculated using formulae from Ciria C753 as shown below.

Developed Run-off Volume:

$$10.RD.A[((PIMP/100)\alpha 0.8) + ((1-(PIMP/100))\beta SPR)] \text{ (From Paragraph 24.4)}$$

RD = Rainfall Depth (mm)

A = Catchment Area

SPR = Standard Percentage Run-off (0.40 for SOIL Type 3)

α = Proportion of impermeable draining to system at 80% (0.8) run-off (roofs, parking, roads, etc). Can be increased to 100 % for more conservative assessment (will depend on materials, drainage...).

β = Proportion of pervious areas draining to system, 0-1.0 (gardens, open space, etc).

A: Site Area (Ha) = 4.28 ha

PIMP: 32% (

SPR: Soil Type Standard Percentage Run-off (Soil Type 3 from WRAP Map) = 0.40

Existing 100 Year 6 Hour Volume = 1115m³

Developed 100 Year + 45% 6 Hour Volume = 2951 m³

The calculations show that there is an 1835m³ increase in the volume of runoff from the development. As the underlying clay soils are impermeable and are not suitable for infiltration it will be necessary to follow alternative guidance to mitigate for the increase in run-off volume resulting from the development.

To mitigate for the additional run-off volume EA/Defra and Ciria guidance together with BS8582 recommend that Extended Attenuation Storage is provided and that run-off is restricted to the Mean Annual Flood Flow (Qbar) green-field rate for all events above the 1:1 year and up to the 1:100 year with an allowance for climate change.

6. Surface Water Drainage Strategy

6.1. Surface Water Parameters

A surface water drainage strategy has been developed that incorporates a Sustainable Drainage System. The SuDS will ensure that flood risk resulting from pluvial events (rainfall) will be managed on-site and that flood risk will not be increased elsewhere as a result of the development.

The surface water drainage and SuDS will be designed in accordance with the following:

- Building Regulations Part H: Drainage & Waste Disposal
- Sewers for Adoption / Design and Construction Guidance
- The requirements of Wessex Water
- Ciria C753: The SuDS Manual.
- Lead Local Flood Authority requirements

The hierarchy for the disposal of surface water (Part H of Building regulations) is that rainwater shall discharge to one of the following, listed in order of priority:

- a) an adequate soakaway, or some other adequate infiltration system; or, where that is not reasonably practicable,
- b) a watercourse; or, where that is not reasonably practicable,
- c) a sewer.

6.2. Flood Compensation

It is proposed that the attenuation pond is located adjacent to the onsite ditch network. It is located within the area that is affected by any rise in water levels caused by the water backing up at the outlet as mentioned above in Section 4.8. The construction of the attenuation pond will result in a reduction in storage of 660m³.

It is proposed to mitigate this by the excavation of a flood compensation area to the south of the existing ditch. This compensation area will have an approximate volume of 4270m³ which allows for the required 660m³ from the attenuation pond, plus an extra 3610m³ of flood storage. This results in an increase of approximately 160% in the total storage volume across the site up to 121.95mAOD which is being provided to aid in the further reduction of surface water encroaching upon Biddestone Lane. Alleviation of existing flooding is not a requirement of the scheme and the compensation is being offered to benefit the wider community.

Refer to drawing 617-P-050 'Drainage Strategy Rev B' included in Appendix E.

6.3. Proposed Strategy

It is proposed that surface water connects to the existing ditch system at the southwest of the site.

Discharge will be limited to Q_{bar} calculated at 6.5l/s based on a rate of 4.1l/s/ha as shown above in 3.14 for events above the 1 in 1 year storm event up to the 1 in 100-year storm event with a 45% allowance for climate change. In line with the requirements of the Lead local Flood Authority, flows for the 1 year event will be subject to betterment of 30% resulting in a rate of 3.6 l/s. Flows will be restricted via a Vortex Control.

Attenuation will be provided by a pond, see Section 7 for details. Surface water will discharge into the north of the pond via a precast concrete headwall which will be to adoptable standards, and via a swale to the east of the pond.

It is proposed that the surface water sewers be adopted by Wessex Water.

The Drainage Strategy for the development is shown on drawing 617-P-050 'Drainage Strategy Rev A' included in Appendix E.

The estimated volume of total attenuation required in the pond for events up to the 1 in 100-year with a 45% allowance for climate change is 943m³. Values used for the calculations are shown in Appendix D. In line with the requirements of the Lead local Flood Authority an allowance for urban creep of 10% has been applied.

7. SuDS Details

7.1. Attenuation Pond Design

The ponds have been designed to provide storage of and treatment to the surface water run-off from the proposed residential development.

To provide treatment to the surface water run-off from the development and remove pollutants prior to discharge to the downstream receiving waters, the ponds will have a permanent 1m depth of water.

The ponds will be designed as a feature to store surface water and allow it to discharge into the existing surface water network. The ponds will provide 1m for surface water attenuation for events up to and including the 1 in 100 year event with a climate change allowance. The maximum depth of water in the pond is therefore likely to be 1.65m (comprising 0.65m of permanent water depth and 1m of attenuation).

The ponds have been designed with slopes of 1 in 3 for safety purposes in accordance with the SUDS Manual. The ponds will have a shallow zone (aquatic bench) along the edge of the permanent pool to support wetland planting which will act as a biological filter and safety margin. The ponds will provide ecology, amenity and biodiversity benefits and will add to the aesthetics of the open space.

7.2. Swale Design

These are shallow, flat bottomed, vegetated open channels designed to convey, treat and often attenuate surface water run-off.

The swale will be designed to enhance the natural landscape and provide aesthetic and biodiversity benefits as an alternative to conventional pipework as a means of conveying run-off.

It has been designed with a 1m wide base and 1 in 4 sides with a minimum depth of 0.7m as per the SuDS manual.

7.3. Landscaping

The landscaping and aquatic planting for the pond will be designed by the Landscape Architect to provide a diversity of plant species to enhance visual interest and provide a variety of wildlife habitats. Details of the planting will be agreed with the Local Planning Authority and adopting body at the detailed engineering stage.

7.4. Pond Access

Access to the pond will be via the new development roads. A grassed maintenance strip will be provided to allow routine maintenance activities and inspections to be carried out.

7.5. Water Butts

Water butts could be used for individual dwellings to collect water for reuse externally for irrigation. The provision of water butts will help reduce potable water consumption but will not provide significant attenuation, reduction in flows or treatment. Further guidance on water butts is provided in Part D of Ciria C753 'The SuDS Manual'.

7.6. Filter Drains

Filter Drains are used primarily for filtration rather than attenuation and shall be used to remove sediments from surface runoff.

They are comprised of a geotextile containing a filter aggregate and contain one or more perforated outlet pipes to convey the water out of the drain. They can be placed in grassy areas to aid in silt removal but if grass filter strips aren't available (such as adjacent to roads), sacrificial stone layers can be placed above the filter drain to achieve this process.

7.7. Health and Safety

Fencing would isolate the ponds and reduce its amenity benefit. Barrier planting and landscaping will therefore be used to discourage public access to the open areas of water.

Safety signage and information boards can be provided around the perimeter to improve awareness, discourage unauthorised access and inform the public of the potential danger. Details can be agreed pursuant to discharge of conditions / reserved matters.

Fencing or guarding will be provided around any structures such as headwalls where there is a vertical drop of 600mm or more.

Full safety details will be considered prior to construction and will be agreed with the Local Planning Authority and adopting body at the detailed engineering stage.

8. Water Quality

The proposed development will include roads, hard standings, roofs and landscaped areas. Run-off from roofs is unlikely to contain significant pollution. Run-off from roads and hard standings will pick up fuel, oil, heavy metals, rubbish and other pollutants. Run-off from landscaped areas could include pesticides and fertilisers.

The main techniques used to remove pollutants are filtration and detention. Improvements to stormwater quality can be achieved by filtering the run-off (particularly for small frequent events) using a variety of media such as gravels (permeable paving and filter trenches), grass/vegetation (swales, basins and ponds). Storing run-off with controlled discharges allows sedimentation to take place which also contributes to water quality improvements

Higher concentration of pollutants occur in the early stages of a storm event known as the 'first flush' and is due to higher initial rainfall intensities, greater erosion potential and to greater solids and pollutants that have built up on urban surfaces during preceding dry weather. To remove pollutants and improve water quality Ciria C753 'The SuDS Manual' recommends that a Treatment Volume is provided in suitable SuDS features such as ponds, filter trenches, permeable paving, etc. The treatment volume is calculated using the fixed rainfall depth method. Ciria C753 recommends that the first flush is retained for treatment (5-10mm for at source filtration, >10mm if treatment is in a pond).

Assuming a 5mm fixed rainfall depth over the impermeable area of 1.46ha, the minimum treatment volume required would be approximately 73m³. For 10mm the treatment volume would be 146m³.

The treatment volume will be provided within the attenuation pond in the form of permanent water level. It is estimated that there is a treatment volume available in the ponds approximately of 242m³.

Improvements to water quality will also be achieved with the use of the swale and filter drains. Trapped gullies in access roads, drives and parking areas will also help to remove sediments.

During construction there is also an increased risk of pollution particularly from silt and sediment. Temporary pre-treatment might be needed in line with current guidance and good practice prior to discharge to the main drainage system. Areas of permeable or porous construction will also need to be protected from silt during construction.

Ciria C753, Chapter 26 provides guidance on Water Quality Management: Design Methods. The SuDS pollution mitigation index should equal or exceed the pollution hazard index. Tables 26.2 and 26.3 below provide details of the indices.

TABLE 26.2 Pollution hazard indices for different land use classifications

Land use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydrocarbons
Residential roofs	Very low	0.2	0.2	0.05
Other roofs (typically commercial/ industrial roofs)	Low	0.3	0.2 (up to 0.8 where there is potential for metals to leach from the roof)	0.05
Individual property driveways, residential car parks, low traffic roads (eg cul de sacs, homezones and general access roads) and non-residential car parking with infrequent change (eg schools, offices) ie < 300 traffic movements/day	Low	0.5	0.4	0.4
Commercial yard and delivery areas, non-residential car parking with frequent change (eg hospitals, retail), all roads except low traffic roads and trunk roads/motorways ¹	Medium	0.7	0.6	0.7
Sites with heavy pollution (eg haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured; industrial sites; trunk roads and motorways ¹	High	0.8 ²	0.8 ²	0.8 ²

TABLE 26.3 Indicative SuDS mitigation indices for discharges to surface waters

Type of SuDS component	Mitigation indices ¹		
	TSS	Metals	Hydrocarbons
Filter strip	0.4	0.4	0.5
Filter drain	0.4 ²	0.4	0.4
Swale	0.5	0.6	0.6
Bioretention system	0.8	0.8	0.8
Permeable pavement	0.7	0.6	0.7
Detention basin	0.5	0.5	0.6
Pond ⁴	0.7 ³	0.7	0.5
Wetland	0.8 ³	0.8	0.8
Proprietary treatment systems ^{5,6}	These must demonstrate that they can address each of the contaminant types to acceptable levels for frequent events up to approximately the 1 in 1 year return period event, for inflow concentrations relevant to the contributing drainage area.		

The table below summarizes the Indices for the proposed development. The mitigation index can be seen to exceed the pollution index for all hazards.

Pollution Index

	Total Suspended Solids	Metals	Hydrocarbons
Residential Roofs	0.2	0.2	0.05
Residential Roads and Driveways	0.5	0.4	0.4
Local Centre parking	0.7	0.6	0.7

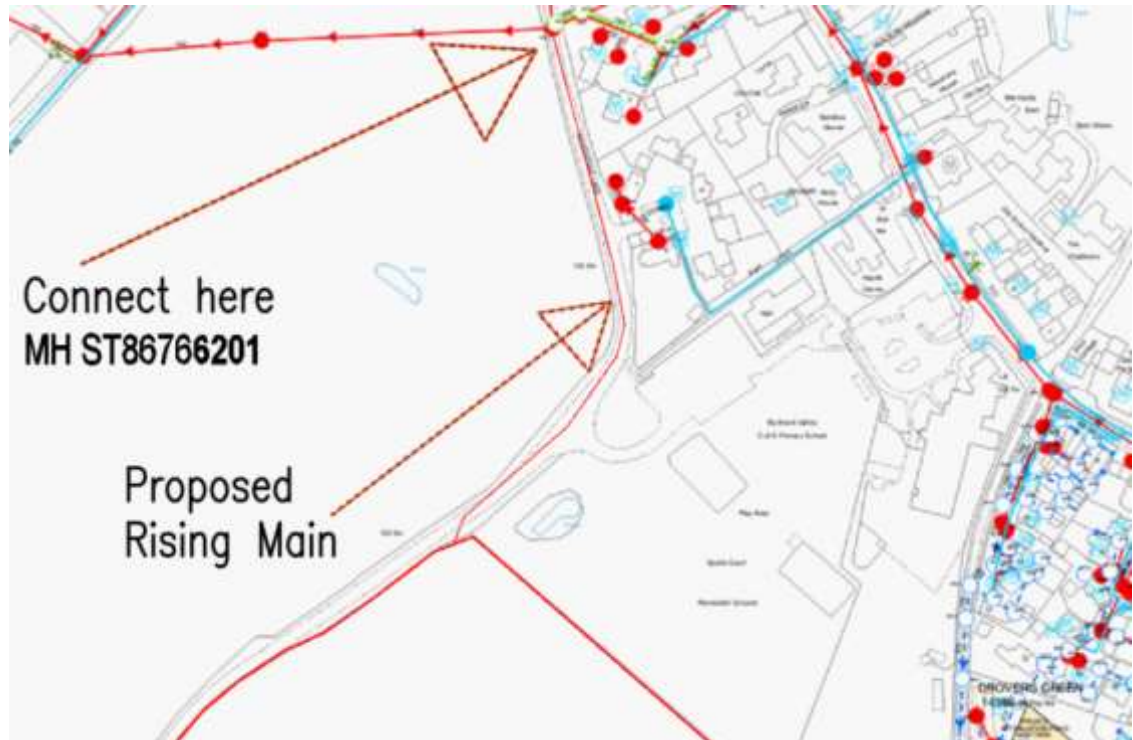
Mitigation Index

	Total Suspended Solids	Metals	Hydrocarbons
Attenuation Pond	0.7	0.7	0.5
Swale	0.7	0.4	0.6
Filter Drains	0.9	0.7	0.8

Trapped gullies will also be used (Access Roads, Drives and Parking Areas) which will help remove sediments.

9. Foul Drainage Strategy

A pre-development enquiry has been submitted to Wessex Water who have advised that there is an existing Wessex Water Sewer approximately 250m north of the site along Biddestone Lane and that there is a viable point of discharge at MH ST86766201 (see screen shot below).



See Appendix F for Wessex Water correspondence.

Based on a connection into MH ST86766201 and proposed site levels a pumping station within the proposed development with a connection to the existing foul network via a rising main is required.

It is proposed that foul flows from the development connect to the foul pumping station by gravity, see drawing 617-P-050 for details in Appendix E.

It is proposed that foul sewers be adopted by Wessex Water and that private foul drainage will be in accordance with Part H of the Building regulations approved documents.

10. Management & Maintenance

10.1. General

The table below lists the proposed drainage and anticipated Maintenance / Management responsibilities.

Drainage Feature	Management and Maintenance Responsibility
Sewers (Foul & Surface Water)	Wessex Water
Precast Concrete Headwalls	Wessex Water
Ponds, Swales and Filter Drains	Wessex Water or a Private Management Company with appropriate experience
Flow Controls	Wessex Water or a Private Management Company with appropriate experience
Highway Gullies	Wiltshire Council
Drainage for buildings, drives, parking spaces, landscaping, etc. in private ownership	The owners where in sole ownership

The exact maintenance regime will be confirmed although it is likely it will be similar to that recommended by the SUDS manual.

TABLE 32.1 Typical key SuDS components operation and maintenance activities (for full specifications, see Chapters 11–23)

Operation and maintenance activity	SuDS component										
	Pond	Wetland	Detention basin	Infiltration basin	Soakaway	Infiltration trench	Filter drain	Modular storage	Pervious pavement	Swale/bioretention/trees	Filter strip
Regular maintenance											
Inspection	■	■	■	■	■	■	■	■	■	■	■
Litter and debris removal	■	■	■	■	□	■	■	□	■	■	□
Grass cutting	■	■	■	■	□	■	■	□	■	■	■
Weed and invasive plant control	□	□	□	□	□	□	□	□	□	□	■
Shrub management (including pruning)	□	□	□	□	□	□	□	□	□	□	□
Shoreline vegetation management	■	■	□	□	□	□	□	□	□	□	□
Aquatic vegetation management	■	■	□	□	□	□	□	□	□	□	□
Occasional maintenance											
Sediment management ¹	■	■	■	■	■	■	■	■	■	■	■
Vegetation replacement	□	□	□	□	□	□	□	□	□	□	■
Vacuum sweeping and brushing	□	□	□	□	□	□	□	■	□	□	□
Remedial maintenance											
Structure rehabilitation /repair	□	□	□	□	□	□	□	□	□	□	□
Infiltration surface reconditioning	□	□	□	□	□	□	□	□	□	□	□

Key

■ will be required

□ may be required

Notes

¹ Sediment should be collected and managed in pre-treatment systems, upstream of the main device.

10.2. Swales

TABLE 17.1 Operation and maintenance requirements for swales

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Remove litter and debris	Monthly, or as required
	Cut grass – to retain grass height within specified design range	Monthly (during growing season), or as required
	Manage other vegetation and remove nuisance plants	Monthly at start, then as required
	Inspect inlets, outlets and overflows for blockages, and clear if required	Monthly
	Inspect infiltration surfaces for ponding, compaction, silt accumulation, record areas where water is ponding for > 48 hours	Monthly, or when required
	Inspect vegetation coverage	Monthly for 6 months, quarterly for 2 years, then half yearly
	Inspect inlets and facility surface for silt accumulation, establish appropriate silt removal frequencies	Half yearly
Occasional maintenance	Reseed areas of poor vegetation growth, alter plant types to better suit conditions, if required	As required or if bare soil is exposed over 10% or more of the swale treatment area
Remedial actions	Repair erosion or other damage by re-turfing or reseeded	As required
	Relevel uneven surfaces and reinstate design levels	As required
	Scarify and spike topsoil layer to improve infiltration performance, break up silt deposits and prevent compaction of the soil surface	As required
	Remove build-up of sediment on upstream gravel trench, flow spreader or at top of filter strip	As required
	Remove and dispose of oils or petrol residues using safe standard practices	As required

10.3. Ponds

TABLE 23.1 Operation and maintenance requirements for ponds and wetlands

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Remove litter and debris	Monthly (or as required)
	Cut the grass – public areas	Monthly (during growing season)
	Cut the meadow grass	Half yearly (spring, before nesting season, and autumn)
	Inspect marginal and bankside vegetation and remove nuisance plants (for first 3 years)	Monthly (at start, then as required)
	Inspect inlets, outlets, banksides, structures, pipework etc for evidence of blockage and/or physical damage	Monthly
	Inspect water body for signs of poor water quality	Monthly (May – October)
	Inspect silt accumulation rates in any forebay and in main body of the pond and establish appropriate removal frequencies; undertake contamination testing once some build-up has occurred, to inform management and disposal options	Half yearly
	Check any mechanical devices, eg penstocks	Half yearly
	Hand cut submerged and emergent aquatic plants (at minimum of 0.1 m above pond base; include max 25% of pond surface)	Annually
	Remove 25% of bank vegetation from water's edge to a minimum of 1 m above water level	Annually
	Tidy all dead growth (scrub clearance) before start of growing season (Note: tree maintenance is usually part of overall landscape management contract)	Annually
	Remove sediment from any forebay.	Every 1–5 years, or as required
	Remove sediment and planting from one quadrant of the main body of ponds without sediment forebays.	Every 5 years, or as required
Occasional maintenance	Remove sediment from the main body of big ponds when pool volume is reduced by 20%	With effective pre-treatment, this will only be required rarely, eg every 25–50 years
Remedial actions	Repair erosion or other damage	As required
	Replant, where necessary	As required
	Aerate pond when signs of eutrophication are detected	As required
	Realign rip-rap or repair other damage	As required
	Repair / rehabilitate inlets, outlets and overflows.	As required

10.4. Filter Drains

TABLE 16.1 Operation and maintenance requirements for filter drains		
Maintenance schedule	Required action	Typical frequency
Regular maintenance	Remove litter (including leaf litter) and debris from filter drain surface, access chambers and pre-treatment devices	Monthly (or as required)
	Inspect filter drain surface, inlet/outlet pipework and control systems for blockages, clogging, standing water and structural damage	Monthly
	Inspect pre-treatment systems, inlets and perforated pipework for silt accumulation, and establish appropriate silt removal frequencies	Six monthly
	Remove sediment from pre-treatment devices	Six monthly, or as required
Occasional maintenance	Remove or control tree roots where they are encroaching the sides of the filter drain, using recommended methods (eg NJUG, 2007 or BS 3998:2010)	As required
	At locations with high pollution loads, remove surface geotextile and replace, and wash or replace overlying filter medium	Five yearly, or as required
	Clear perforated pipework of blockages	As required

11. Conclusions

11.1. Flood Risk

The site-specific FRA has been produced in accordance with the requirements of the NPPF, Planning Practice Guidance as well as EA advice notes and demonstrates that the proposed development will be safe from flood risk and that it will not increase flood risk elsewhere.

The site is located entirely within Flood Zone 1 with a low flood risk (less than 1:1,000 or 0.1% annual probability of flooding from rivers).

The proposed development is classified as 'More Vulnerable' and is in Flood Zone 1; the proposed development is suitable in this zone and the NPPF Sequential and Exception Tests are not required.

Flood risk from pluvial, sewers, surface water, groundwater and artificial sources has been assessed and it has been demonstrated that the proposed development will not be at risk from flooding from these sources.

11.2. Surface Water Drainage

Surface water from the proposed development will discharge into the existing drainage network with flow limited to Qbar for events up to and including the 100 year with a 45% allowance for climate change and 10% Urban Creep.

Attenuation will be provided by one pond with sewers discharging directly into it via a precast concrete headwall. The pond will have a permanent water level to provide treatment to the surface water run-off from the development with side slopes of 1:3 to allow safe access / egress, in accordance with Ciria report C753 the SuDS manual.

Flood routes will be provided for exceedance events, or for local failure of the drainage system, and will ensure that flood flows are directed safely through the development to the downstream drainage system.

Sewers, headwalls and the flow control will be adopted by Wessex Water with the pond being adopted by either Wessex water or a management company.

11.3. Foul Drainage

It is anticipated that foul flows from the site will drain by gravity to a proposed pumping station then connect to the existing Wessex Water network in Biddestone Lane via a rising main.

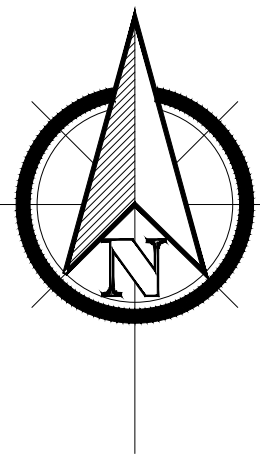
The foul sewers will be adopted by Wessex Water.

11.4. Summary

The Flood Risk Assessment and Drainage Strategy demonstrate that the proposed development meets with all the national and regional policy requirements and satisfies all the criteria of the Planning Authority, Lead Local Flood Authority, and Environment Agency.

The Flood Risk Assessment concludes that the site can be safely developed without flood risk and without increasing flood risk elsewhere through the use of an appropriately designed Sustainable Drainage System.

Appendix A Indicative Masterplan



Play Area

Sports Court

Recreation Ground

- Statutory approvals to be received prior to commencement of works.
- Building control submission to be deposited prior to any works.
- Check / trace positions of existing services / drainage prior to new works.
- Ensure no Easements / rights of way exist on site prior to construction.
- Check dimensions on site against site survey prior to any new works.
- Report and resolve any discrepancies prior to any new building works.
- Relevant Party Wall notices to be served and agreed before new works.
- CDM Co-ordinator to be appointed with Health & Safety file in place prior to any new works.

Revision:	Date:	Description:	By:
REV A	AUG 2025	Plots 1 & 52 repositioned forwards. Plots 4-6 swapped. Plots 8, 28 changed to F+ type. 3m planting strip added to the corner of plot 8. Plots 9-20 repositioned & types changed. Connecting points added to footpath around northern perimeter. Road changed to shared surface next to plot 21 onwards. Plot areas 21-31 repositioned easterly. Plot area 34, 37-46 revised. Dwarf walls to frontages indicated along principle road. Pumping station & substation repositioned. Paths & access to gardens revised accordingly. Garage 32 & 35 revised to single and double.	BT

Accommodation Schedule:

1	4b8p F+ Type	162.7m ²	30	4b7p Dv1 Type	133m ²
2	4b7p Dv1 Type	133m ²	31	4b8p P+ Type	148m ²
3	4b7p B Type	117m ²	32	4b8p F+ Type	162.7m ²
4	4b7p D Type	130m ²	33	4b8p P Type	147m ²
5	4b7p Dv1 Type	133m ²	34	4b7p B Type	117m ²
6	4b8p P Type	147m ²	35	3b6p K Type	95.8m ²
7	4b8p F Type	161m ²	36	3b6p KV1 Type	95.8m ²
8	4b8p F+ Type	162.7m ²	37	2B4P A2 House	67.2m ²
9	3B5P Ash Type	83.6m ²	38	2B4P A2 House	67.2m ²
10	3B5P Ash Type	83.6m ²	39	2B4P A2 House	67.2m ²
11	2B4P A2 House	67.2m ²	40	2B4P A2 House	67.2m ²
12	2B4P A2 House	67.2m ²	41	2B4P A2 House	67.2m ²
13	2B4P A2 House	67.2m ²	42	3B5P A3 House	79.8m ²
14	3B5P A3 House	79.8m ²	43	3B5P A3 House	79.8m ²
15	3B5P A3 House	79.8m ²	44	3B5P A3 House	79.8m ²
16	3B5P A3 House	79.8m ²	45	2B4P A2 House	67.2m ²
17	3B5P A3 House	79.8m ²	46	2B4P A2 House	67.2m ²
18	1b2p GF Maisonette	51m ²	47	2B4P A2 House	67.2m ²
19	1b2p FF Maisonette	60m ²	48	2B4P A2 House	67.2m ²
20	2b4p Bungalow	61m ²	49	3B5P M+ Type	97.6m ²
21	4b7p Dv1+ Type	134.7m ²	50	3B5P M Type	97.6m ²
22	4b7p D Type	130m ²	51	4b8p F Type	161m ²
23	4b8p P Type	147m ²	52	4b8p F+ Type	162.7m ²
24	4b8p W Type	179m ²	53	4b7p Dv1 Type	133m ²
25	4b8p W Type	179m ²	54	4b8p P Type	147m ²
26	4b8p F+ Type	162.7m ²	55	4b8p F Type	161m ²
27	4b8p P Type	147m ²			
28	4b8p W Type	179m ²			
29	4b8p W Type	179m ²			

★ Handed house type from individual floor plan drawn. (Includes semi-detached & terraced.) Where applicable.

Client:

COTSWOLD
HOMES

Drawn By:

Trower Davies
Architectural Consultants

Site Address:

LAND OFF BIDDESTONE LANE
YATTON KEYNELL

Drawing Title:

SITE LAYOUT

Scale:

1:500

Date drawn:

MARCH 2025

Drawn by:

BT

Project Number:

948

Drawing Number:

100

Revision:

A

Status:

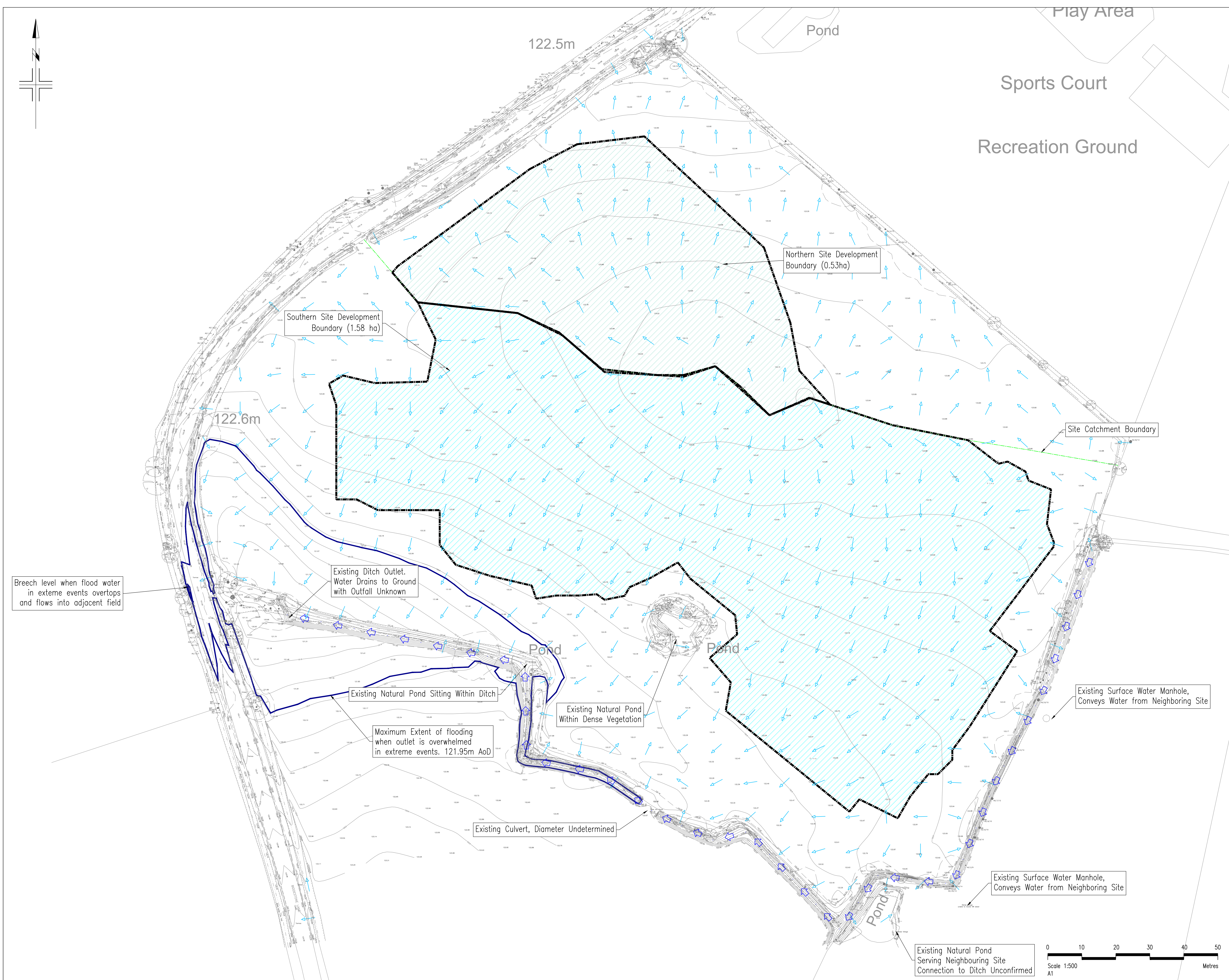
PLANNING

A1

0 10m 50m

Appendix B

617-P-002 Site Survey and Hydrological Features



Key

- Existing Ditches
- Existing Overland Flow Direction

Revision

Project:	Yatton Keynell
Client:	
Drawing:	Site Survey and Hydrological Features
Scale:	1:500 @ A1
Date:	March 2025
Drawn by:	JP
Drawing No:	617-P-002
Rev:	-

PHOENIX DESIGN
Partnership Ltd.

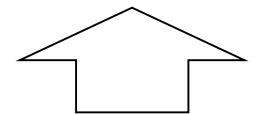
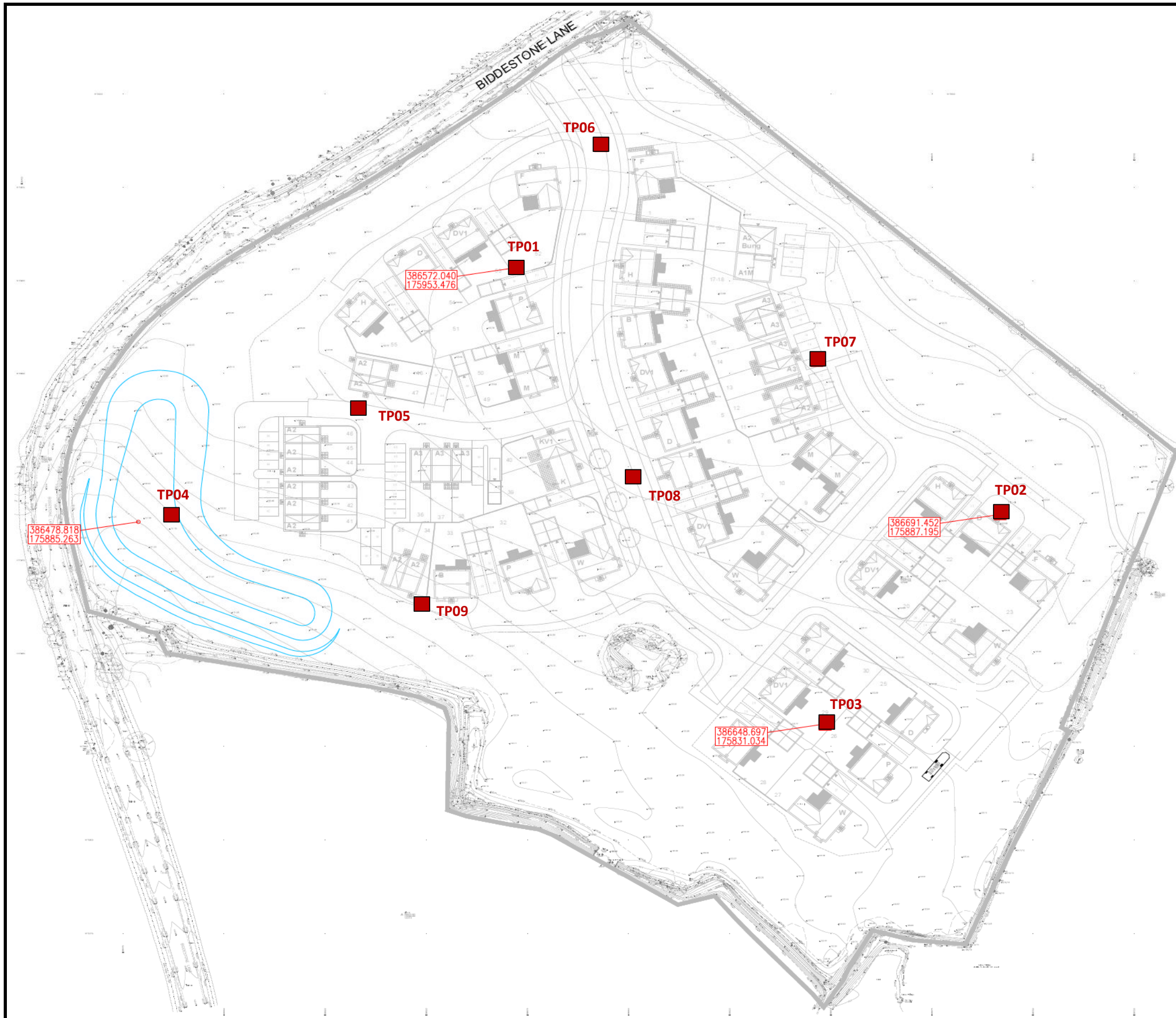
Unit 9, Westway Garage,
Markbury, Bath, BA2 9HN
tel: 01761 479950
email: enquiries@phoenixdp.co.uk

Suite 7, Unit Three, Mele Corrug
Business Parc, Upper Boat, Pontypriid,
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Drg Status: **PLANNING**

Appendix C Soakaway Testing



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SITE PLAN



CLIENT COTSWOLD HOMES LTD

SITE BIDDESTONE LANE, YATTON KEYNELL

SCALE UNKNOWN

CONTRACT
25013

FIGURE
1

APPENDIX A

EXPLORATORY HOLE DATA AND IN SITU TESTING



KEY TO EXPLORATORY HOLE LOGS

Sample Type & Symbols

D	Small disturbed sample	B	Bulk sample
G	Gas sample	W	Ground water sample
U	Undisturbed (open drive) sample	DS	Dynamic sample
C	Core run	P	Piston sample
ES	Contamination sample (soil)	EW	Contamination sample (water)
		CS	Core sub sample



Undisturbed sample



Core sample

*% Total core recovery expressed as percentage of total core run

*% Solid core recovery expressed as percentage of total core run

*% Rock quality designation expressed as a percentage of total core run

Test Type

SPT ↓ Standard Penetration Test

S Standard Penetration Test – split spoon

C Standard Penetration Test – solid cone

H Hand Vane (kPa)

tv Torvane (kPa)

PP Pocket Penetrometer (unconfined compressive strength (kg/cm²))

G Headspace vapour readings, uncorrected peak values in ppm, using a PID.

Installation



Concrete



Bentonite seal

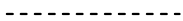


Granular response zone

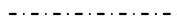


Slotted standpipe/
piezometer

Strata boundaries



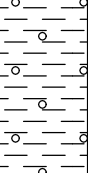
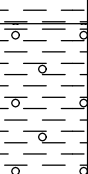
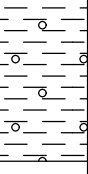
Estimated boundary



Gradational boundary



Project Name: Proposed Development	Project No. 25013	Co-ords: Level: mAD	Date 27/11/2024
Location: Biddestone Lane, Yatton Keynell		Dimensions: 2.50m Depth 2.00m 	Scale 1 : 25
Client: Cotswold Homes Limited			Logged By RS

Water Levels	Samples & In Situ Testing			Depth (m)	Level (mAD)	Legend	Stratum Description	
	Depth (m)	No/Type	Results					
	0.10 - 0.20	ES		0.25			Brown slightly gravelly sandy silty very clayey TOPSOIL. Gravel is fine to coarse angular to sub angular limestone	0
	0.50	D	H 88				Stiff light brown mottled light grey slightly sandy slightly gravelly silty CLAY with occasional very thin limestone laminae and fossil shell fragments. Gravel is fine to coarse angular to sub angular limestone	
	0.90	D	H >140	0.95			Stiff light grey mottled light brown very closely fissured slightly sandy CLAY with occasional very thin limestone laminae and fossil shell fragments.	1
	1.60	D		2.00			1.80 becomes shaly with many very thin limestone laminae	2
							Trial Pit completed at 2.00m.	
				{4.00}				3
								4

Remarks:
EQUIPMENT: 7 tonne excavator equipped with 0.60m wide toothless bucket
METHOD: machine dug. Effective refusal to excavation at 2.00m on intact limestone
GROUNDWATER: None encountered.
Trial pit terminated at 2.00m for full scale soakaway test
BACKFILL: On completion trial pit backfilled with arisings.

CORE GEOTECHNICS LIMITED

SOAKAWAY TEST



CLIENT COTSWOLD HOMES LIMITED
 SITE BIDDESTONE LANE, YATTON KEYNELL
 DATE 27/11/2024

TRIAL PIT TP01

TEST 1 LENGTH2.50 m BREADTH0.70 m DEPTH2.00 m WATER LEVELdry m FILL LEVEL0.62 m 75% Eff Depth0.97 m 25% Eff Depth1.66 m V_{p75-25}1.2075 m³ a_{p50}6.1660 m² t_{p75-25}** secs soil infiltration rate, <i>f</i>** ms⁻¹ **INSUFFICIENT FALL TO DETERMINE RATE	Time (minutes) 0255075100125150175200 0.50 0.70 0.90 1.10 1.30 1.50 1.70 1.90 Depth to water (m) 75% full 25% full	
TEST 2 LENGTHm BREADTHm DEPTHm WATER LEVELm FILL LEVELm 75% Eff Depthm 25% Eff Depthm V_{p75-25}m³ a_{p50}m² t_{p75-25}secs soil infiltration rate, <i>f</i>ms⁻¹	Time (minutes) 010203040506070 0.25 0.45 0.65 0.85 1.05 Depth to water (m) 75% full 25% full	
TEST 3 LENGTHm BREADTHm DEPTHm WATER LEVELm FILL LEVELm 75% Eff Depthm 25% Eff Depthm V_{p75-25}m³ a_{p50}m² t_{p75-25}secs soil infiltration rate, <i>f</i>ms⁻¹	Time (minutes) 01020304050607080 0.25 0.45 0.65 0.85 1.05 Depth to water (m) 75% full 25% full	
Remarks Test carried out in accordance with BRE DG 365 (2016).	CONTRACT 25013	CHECKED RS



Project Name:	Proposed Development	Project No.	25013	Co-ords:	Level: mAD	Date	27/11/2024
Location:	Biddestone Lane, Yatton Keynell			Dimensions:	2.40m	Scale	1 : 25
Client:	Cotswold Homes Limited			Depth	1.10m	0.70m	Logged By RS

Water Levels	Samples & In Situ Testing			Depth (m)	Level (mAD)	Legend	Stratum Description	
	Depth (m)	No/Type	Results					
	0.10 - 0.20	ES		0.25			Brown slightly gravelly sandy silty very clayey TOPSOIL. Gravel is fine to coarse angular to sub angular limestone	0
	0.50	D	H 85	0.85			Stiff light brown and orange brown silty sandy slightly gravelly CLAY. Gravel is fine to coarse angular to sub angular limestone	
				1.10			Weak to medium strong thinly sub horizontally laminated becoming thinly bedded shelly crystalline LIMESTONE with very close to closely spaced discontinuities	1
							Trial Pit completed at 1.10m.	
								2
								3
								4

Remarks:

EQUIPMENT: 7 tonne excavator equipped with 0.60m wide toothless bucket
METHOD: machine dug. Effective refusal to excavation at 1.10m on intact limestone
GROUNDWATER: Continuous slight seepages below 0.50m. Water standing at 1.00m on completion
Trial pit terminated at 1.10m for full scale soakaway test
BACKFILL: On completion trial pit backfilled with arisings.

CORE GEOTECHNICS LIMITED

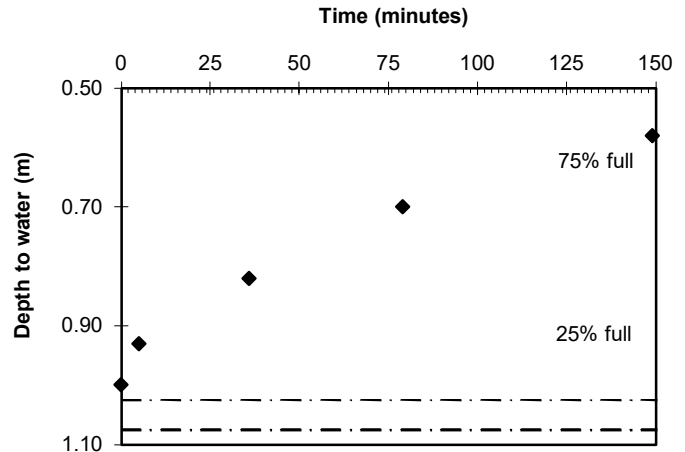
SOAKAWAY TEST



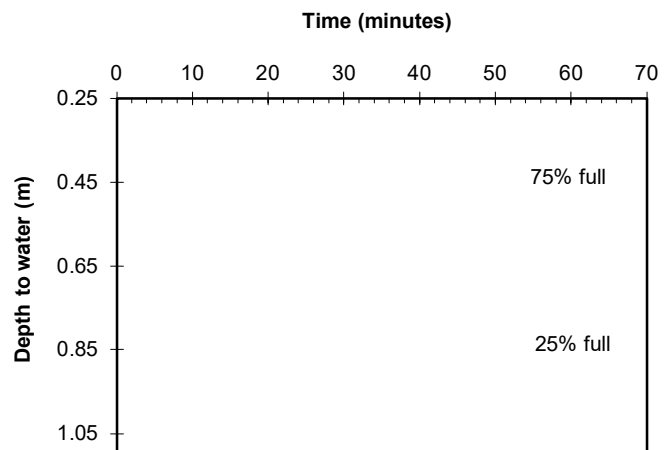
CLIENT COTSWOLD HOMES LIMITED
 SITE BIDDESTONE LANE, YATTON KEYNELL
 DATE 27/11/2024

TRIAL PIT TP02

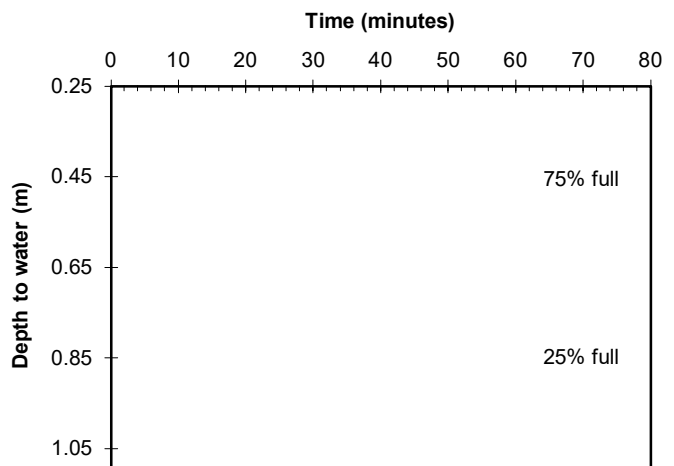
TEST 1	
LENGTH	2.40 m
BREADTH	0.70 m
DEPTH	1.10 m
WATER LEVEL	0.50 m
FILL LEVEL	1.00 m
75% Eff Depth	1.03 m
25% Eff Depth	1.08 m
V_{p75-25}	0.0840 m ³
a_{p50}	1.9900 m ²
t_{p75-25}	** secs
soil infiltration rate, f ** ms ⁻¹	
**INSUFFICIENT FALL TO DETERMINE RATE	



TEST 2	
LENGTH	m
BREADTH	m
DEPTH	m
WATER LEVEL	m
FILL LEVEL	m
75% Eff Depth	m
25% Eff Depth	m
V_{p75-25}	m ³
a_{p50}	m ²
t_{p75-25}	secs
soil infiltration rate, f ms ⁻¹	



TEST 3	
LENGTH	m
BREADTH	m
DEPTH	m
WATER LEVEL	m
FILL LEVEL	m
75% Eff Depth	m
25% Eff Depth	m
V_{p75-25}	m ³
a_{p50}	m ²
t_{p75-25}	secs
soil infiltration rate, f ms ⁻¹	



Remarks Test carried out in accordance with BRE DG 365 (2016).

CONTRACT
25013

CHECKED
RS



Project Name:	Proposed Development	Project No.	25013	Co-ords:	Level:	mAD	Date	27/11/2024
Location:	Biddestone Lane, Yatton Keynell			Dimensions:	2.40m		Scale	1 : 25
Client:	Cotswold Homes Limited			Depth	1.70m	0.65m	Logged By	RS

Water Levels	Samples & In Situ Testing			Depth (m)	Level (mAD)	Legend	Stratum Description	
	Depth (m)	No/Type	Results					
	0.10 - 0.20	ES		0.25			Brown slightly gravelly sandy silty very clayey TOPSOIL. Gravel is fine to coarse angular to sub angular limestone	0
	0.50	D	H 96				Stiff light brown mottled light grey and orange brown slightly sandy slightly gravelly silty CLAY with occasional very thin limestone laminae and fossil shell fragments. Gravel is fine to coarse angular to sub angular limestone	
	1.00	D	H 110	0.95			Stiff light grey mottled light brown very closely fissured slightly sandy CLAY with occasional very thin limestone laminae and fossil shell fragments.	1
	1.50	D		1.70			1.50 with some increasing to many limestone laminae	
							Trial Pit completed at 1.70m.	2
								3
								4
				{4.00}				

Remarks:
EQUIPMENT: 7 tonne excavator equipped with 0.60m wide toothless bucket
METHOD: machine dug. Effective refusal to excavation at 1.70m on intact limestone
GROUNDWATER: Slight continuous seepage below 1.00m
Trial pit terminated at 1.70m for full scale soakaway test
BACKFILL: On completion trial pit backfilled with arisings.

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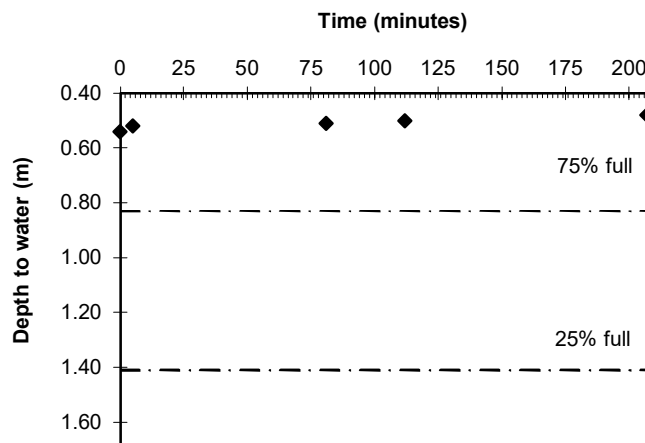
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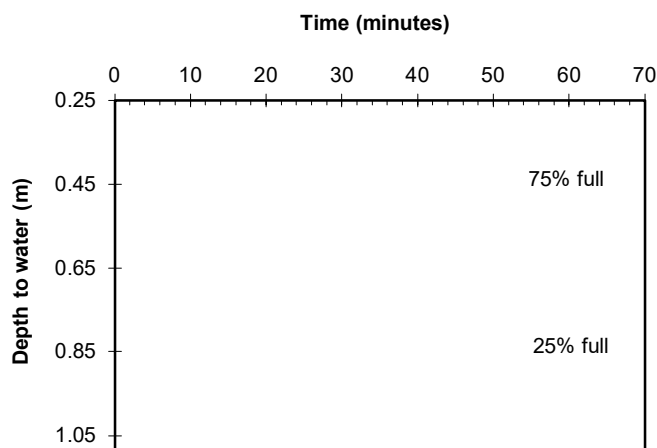
CLIENT COTSWOLD HOMES LIMITED
 SITE BIDDESTONE LANE, YATTON KEYNELL
 DATE 27/11/2024

TRIAL PIT TP03

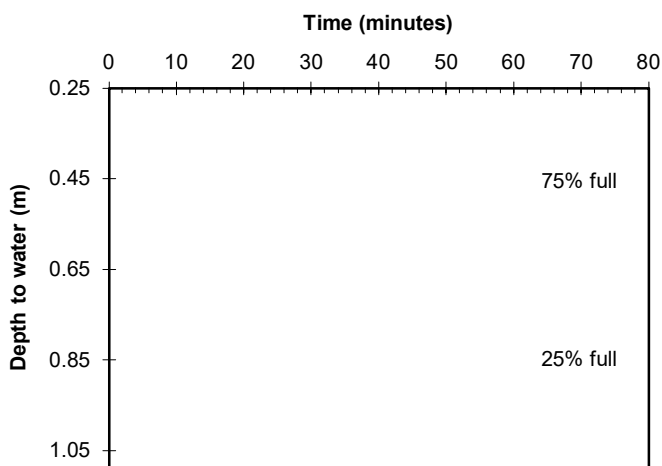
TEST 1	
LENGTH	2.40 m
BREADTH	0.65 m
DEPTH	1.70 m
WATER LEVEL	dry m
FILL LEVEL	0.54 m
75% Eff Depth	0.83 m
25% Eff Depth	1.41 m
V_{p75-25}	0.9048 m ³
a_{p50}	5.0980 m ²
t_{p75-25}	** secs
soil infiltration rate, f ** ms ⁻¹	
**INSUFFICIENT FALL TO DETERMINE RATE	



TEST 2	
LENGTH	m
BREADTH	m
DEPTH	m
WATER LEVEL	m
FILL LEVEL	m
75% Eff Depth	m
25% Eff Depth	m
V_{p75-25}	m ³
a_{p50}	m ²
t_{p75-25}	secs
soil infiltration rate, f ms ⁻¹	



TEST 3	
LENGTH	m
BREADTH	m
DEPTH	m
WATER LEVEL	m
FILL LEVEL	m
75% Eff Depth	m
25% Eff Depth	m
V_{p75-25}	m ³
a_{p50}	m ²
t_{p75-25}	secs
soil infiltration rate, f ms ⁻¹	



Remarks Test carried out in accordance with BRE DG 365 (2016).

CONTRACT
25013

CHECKED
RS



Project Name:	Proposed Development	Project No.	25013	Co-ords:	Level: mAD	Date	27/11/2024
Location:	Biddestone Lane, Yatton Keynell			Dimensions:	2.00m	Scale	1 : 25
Client:	Cotswold Homes Limited			Depth	1.90m	0.60m	Logged By RS

Water Levels	Samples & In Situ Testing			Depth (m)	Level (mAD)	Legend	Stratum Description	
	Depth (m)	No/Type	Results					
	0.50	D ES					MADE GROUND: Firm light grey occasionally mottled brown and orange brown very closely fissured CLAY	0
	0.80 - 1.00	ES		0.75			MADE GROUND: Dark brown sandy very silty CLAY (Relict Topsoil)	1
	1.50	D		1.10			Firm brown slightly sandy silty gravelly CLAY. Gravel is fine to coarse angular to sub angular limestone with some tabular cobbles	
				1.90			Trial Pit completed at 1.90m.	2
								3
								4
				{4.00}				

Remarks:
EQUIPMENT: 7 tonne excavator equipped with 0.60m wide toothless bucket
METHOD: machine dug. Effective refusal to excavation at 1.90m on intact limestone
GROUNDWATER: Slight continuous seepage below 1.05m, strong ingress below 1.50m
Trial pit terminated at 1.90m for full scale soakaway test
BACKFILL: On completion trial pit backfilled with arisings.

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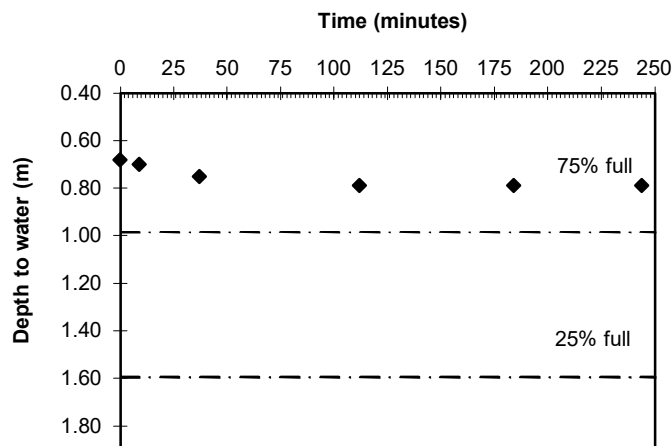
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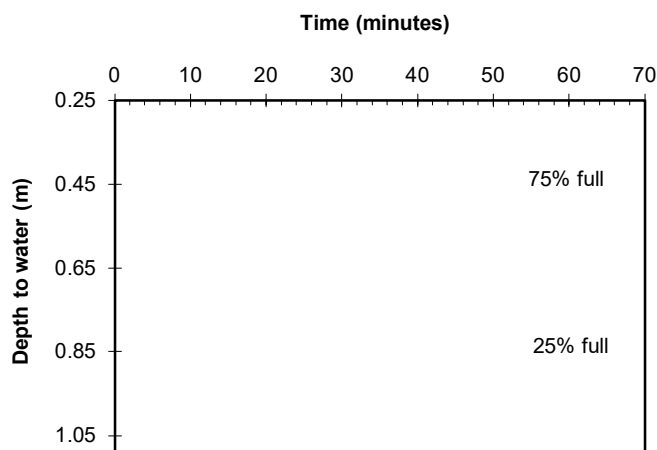
CLIENT COTSWOLD HOMES LIMITED
 SITE BIDDESTONE LANE, YATTON KEYNELL
 DATE 27/11/2024

TRIAL PIT TP04

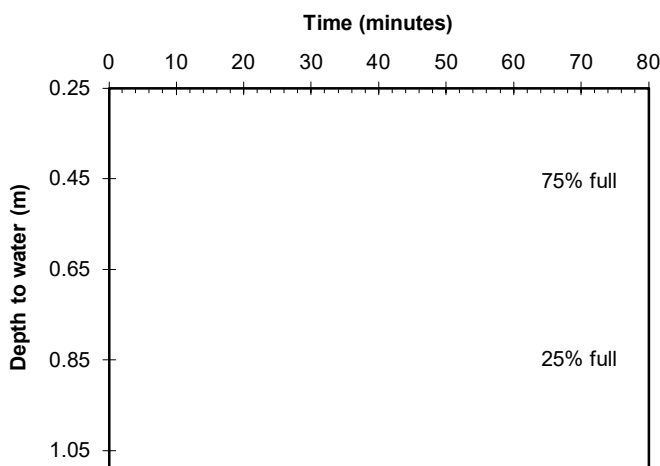
TEST 1	
LENGTH	2.00 m
BREADTH	0.60 m
DEPTH	1.90 m
WATER LEVEL	dry m
FILL LEVEL	0.68 m
75% Eff Depth	0.99 m
25% Eff Depth	1.60 m
V_{p75-25}	0.7320 m ³
a_{p50}	4.3720 m ²
t_{p75-25}	** secs
soil infiltration rate, f ** ms ⁻¹	
**INSUFFICIENT FALL TO DETERMINE RATE	



TEST 2	
LENGTH	m
BREADTH	m
DEPTH	m
WATER LEVEL	m
FILL LEVEL	m
75% Eff Depth	m
25% Eff Depth	m
V_{p75-25}	m ³
a_{p50}	m ²
t_{p75-25}	secs
soil infiltration rate, f ms ⁻¹	



TEST 3	
LENGTH	m
BREADTH	m
DEPTH	m
WATER LEVEL	m
FILL LEVEL	m
75% Eff Depth	m
25% Eff Depth	m
V_{p75-25}	m ³
a_{p50}	m ²
t_{p75-25}	secs
soil infiltration rate, f ms ⁻¹	



Remarks Test carried out in accordance with BRE DG 365 (2016).

CONTRACT
25013

CHECKED
RS



Core Geotechnics Ltd
Website: www.coregeotechnics.co.uk
Offices in Ledbury & Cheltenham
email: mail@coregeotechnics.co.uk

Trial Pit No
TP05
Sheet 1 of 1

Project Name:	Proposed Development	Project No.	25013	Co-ords:	Level: mAD	Date	27/11/2024
Location:	Biddestone Lane, Yatton Keynell			Dimensions:	2.40m	Scale	1 : 25
Client:	Cotswold Homes Limited			Depth	2.10m	Logged By	RS

Water Levels	Samples & In Situ Testing			Depth (m)	Level (mAD)	Legend	Stratum Description	
	Depth (m)	No/Type	Results					
				0.25			Brown slightly gravelly sandy silty very clayey TOPSOIL. Gravel is fine to coarse angular to sub angular limestone	0
	0.60		H 115	0.55			Firm orange brown slightly gravelly silty sandy CLAY. Gravel is fine to coarse angular to sub angular limestone	
	1.00		H 100				Stiff light grey occasionally mottled brown and orange brown slightly sandy silty CLAY with some very thin limestone laminae and fossil shell fragments.	1
				2.10			1.70 with some to many limestone laminae	2
				{4.00}			Trial Pit completed at 2.10m.	3
								4

Remarks:
EQUIPMENT: 7 tonne excavator equipped with 0.60m wide toothless bucket
METHOD: machine dug. Effective refusal to excavation at 2.10m on intact limestone
GROUNDWATER: Slight continuous seepage below 0.50m
BACKFILL: On completion trial pit backfilled with arisings.



Core Geotechnics Ltd
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Offices in Ledbury & Cheltenham
email: mail@coregeotechnics.co.uk

Trial Pit No
TP06
Sheet 1 of 1

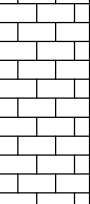
Project Name:	Proposed Development	Project No.	25013	Co-ords:	Level: mAD	Date	27/11/2024
Location:	Biddestone Lane, Yatton Keynell			Dimensions:	2.40m	Scale	1 : 25
Client:	Cotswold Homes Limited			Depth	1.70m	0.70m	Logged By RS

Water Levels	Samples & In Situ Testing			Depth (m)	Level (mAD)	Legend	Stratum Description	
	Depth (m)	No/Type	Results					
	0.50		H 90	0.25			Brown slightly gravelly sandy silty very clayey TOPSOIL. Gravel is fine to coarse angular to sub angular limestone	0
							Stiff light brown slightly sandy silty CLAY with occasional very thin limestone laminae and fossil shell fragments.	1
				1.70			1.40 with some to many very thin limestone laminae	2
				{4.00}			Trial Pit completed at 1.70m.	3
								4

Remarks:
EQUIPMENT: 7 tonne excavator equipped with 0.60m wide toothless bucket
METHOD: machine dug. Effective refusal to excavation at 1.70m on intact limestone
GROUNDWATER: None encountered
BACKFILL: On completion trial pit backfilled with arisings.



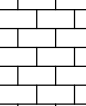
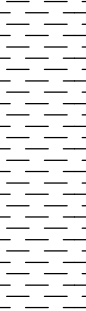
Project Name:	Proposed Development	Project No.	25013	Co-ords:	Level: mAD	Date	27/11/2024
Location:	Biddestone Lane, Yatton Keynell	Dimensions:	2.40m	Depth	1.20m	Scale	1 : 25
Client:	Cotswold Homes Limited					Logged By	RS

Water Levels	Samples & In Situ Testing			Depth (m)	Level (mAD)	Legend	Stratum Description	
	Depth (m)	No/Type	Results					
				0.25			Brown slightly gravelly sandy silty very clayey TOPSOIL. Gravel is fine to coarse angular to sub angular limestone	0
				1.00			Weak to medium strong grey discoloured yellow brown very thinly sub horizontally bedded shelly crystalline LIMESTONE with very close to closely spaced random discontinuities open 10-30mm infilled with clay	
				1.20			Stiff light grey mottled occasionally mottled light brown and orange brown very closely fissured slightly sandy silty CLAY	1
				{4.00}			Trial Pit completed at 1.20m.	2 3 4

Remarks:
EQUIPMENT: 7 tonne excavator equipped with 0.60m wide toothless bucket
METHOD: machine dug. Effective refusal to excavation at 1.20m on intact limestone
GROUNDWATER: Continuous slight seepages below 1.10m.
BACKFILL: On completion trial pit backfilled with arisings.



Project Name:	Proposed Development	Project No.	25013	Co-ords:	Level: mAD	Date	27/11/2024
Location:	Biddestone Lane, Yatton Keynell	Dimensions:	2.00m	Depth	1.70m	Scale	1 : 25
Client:	Cotswold Homes Limited					Logged By	RS

Water Levels	Samples & In Situ Testing			Depth (m)	Level (mAD)	Legend	Stratum Description	
	Depth (m)	No/Type	Results					
	0.10 - 0.20	ES		0.25			Brown slightly gravelly sandy silty very clayey TOPSOIL. Gravel is fine to coarse angular to sub angular limestone	0
				0.65			Medium strong orange brown very thinly sub horizontally bedded LIMESTONE with very close to closely spaced random discontinuities	
	0.80	D	H >140				Very stiff light grey mottled occasionally mottled light brown and orange brown very closely fissured slightly sandy silty CLAY	1
	1.50	D		1.70				
							Trial Pit completed at 1.70m.	2
								3
								4

Remarks:

EQUIPMENT: 7 tonne excavator equipped with 0.60m wide toothless bucket
METHOD: machine dug.
GROUNDWATER: Slight continuous seepage below 0.65m
Trial pit terminated at 1.70m for full scale soakaway test
BACKFILL: On completion trial pit backfilled with arisings.

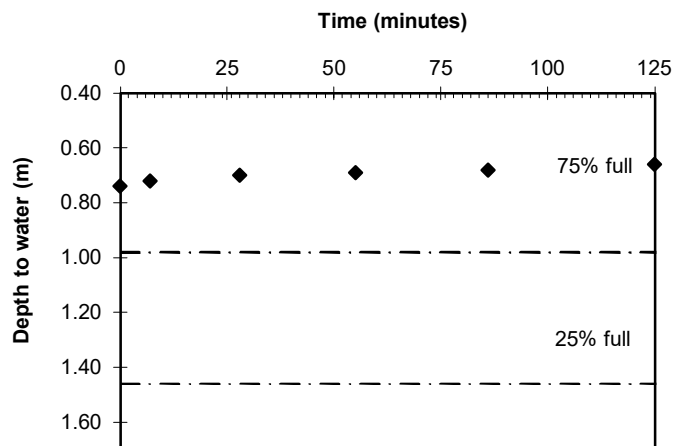
CORE GEOTECHNICS LIMITED
SOAKAWAY TEST



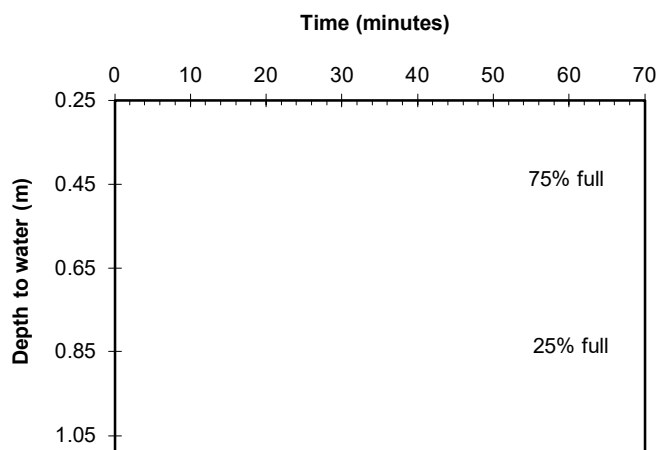
CLIENT COTSWOLD HOMES LIMITED
SITE BIDDESTONE LANE, YATTON KEYNELL
DATE 27/11/2024

TRIAL PIT **TP08**

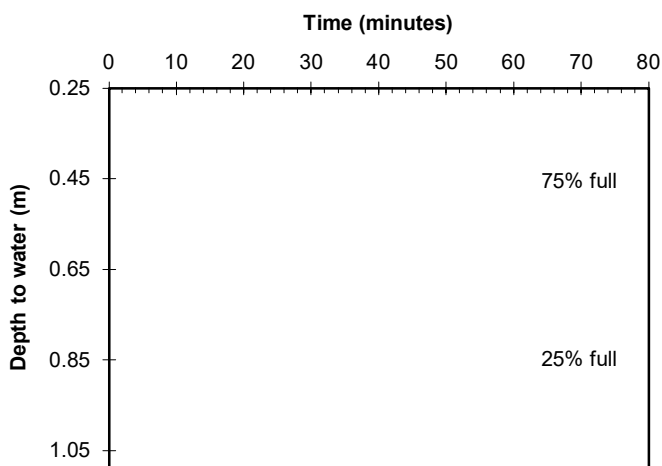
TEST 1
LENGTH 2.60 m
BREADTH 0.65 m
DEPTH 1.70 m
WATER LEVEL dry m
FILL LEVEL 0.74 m
75% Eff Depth 0.98 m
25% Eff Depth 1.46 m
 V_{p75-25} 0.8112 m³
 a_{p50} 4.8100 m²
 t_{p75-25} ** secs
soil infiltration rate, f ** ms⁻¹
**INSUFFICIENT FALL TO DETERMINE RATE



TEST 2
LENGTH m
BREADTH m
DEPTH m
WATER LEVEL m
FILL LEVEL m
75% Eff Depth m
25% Eff Depth m
 V_{p75-25} m³
 a_{p50} m²
 t_{p75-25} secs
soil infiltration rate, f ms⁻¹



TEST 3
LENGTH m
BREADTH m
DEPTH m
WATER LEVEL m
FILL LEVEL m
75% Eff Depth m
25% Eff Depth m
 V_{p75-25} m³
 a_{p50} m²
 t_{p75-25} secs
soil infiltration rate, f ms⁻¹



Remarks Test carried out in accordance with BRE DG 365 (2016).

CONTRACT
25013

CHECKED
RS

Appendix D Drainage Calculations

Drainage Calculations (Surcharged Outfall)

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
S9	0.044	5.00	123.652	1350	386697.060	175830.232	1.415
S10	0.076	5.00	122.786	1350	386666.393	175789.758	0.847
HW2			122.720	1	386654.399	175783.803	0.860
SW1			122.450	1900	386620.228	175803.228	0.767
S1	0.145	5.00	123.972	1350	386660.572	175916.199	1.578
S2	0.122	5.00	123.904	1350	386671.682	175903.249	1.671
S3	0.064	5.00	123.815	1350	386664.977	175850.701	1.449
S4	0.069	5.00	123.625	1350	386645.950	175865.525	1.620
S5	0.074	5.00	123.779	1350	386607.882	175872.900	1.681
S6	0.035	5.00	123.608	1350	386615.427	175862.076	1.651
S7	0.042	5.00	123.326	1350	386631.417	175849.017	1.547
S8	0.064	5.00	122.597	1350	386615.179	175829.203	0.946
HW1			122.330	1	386603.669	175819.902	0.753
SW2			122.325	1900	386585.739	175839.424	0.867
SW3	0.074	5.00	122.235	1900	386573.099	175846.863	0.843
SW4			122.250	1900	386526.186	175862.009	1.080
S11	0.054	5.00	123.319	1350	386593.222	175983.580	1.298
S12	0.038	5.00	123.030	1350	386586.751	175993.494	1.068
S13	0.089	5.00	123.629	1200	386536.391	175962.599	1.963
S14	0.011	5.00	123.208	1350	386520.101	175940.196	1.680
S15	0.128	5.00	124.035	1350	386588.915	175945.066	1.500
S16	0.078	5.00	124.197	1350	386597.203	175902.781	1.425
S17	0.044	5.00	124.291	1200	386592.347	175916.585	2.526
S18	0.102	5.00	123.906	1350	386563.575	175907.863	2.366
S19	0.088	5.00	123.000	1350	386512.236	175907.480	1.792
HW3			122.250	1	386491.078	175902.721	1.150
HW4			122.250	1	386496.593	175868.892	1.300
S20			122.250	2400	386493.815	175864.082	1.333
HW5			122.000	1	386490.546	175858.375	1.158

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	S9	S10	50.779	0.600	122.237	121.939	0.298	170.4	225	5.85	50.0
1.001	S10	HW2	13.392	0.600	121.939	121.860	0.079	169.5	225	6.07	50.0
1.002	HW2	SW1	39.306	0.600	121.860	121.683	0.177	222.1	750	6.42	50.0
1.003	SW1	HW1	23.499	0.600	121.683	121.577	0.106	221.7	750	6.63	50.0
2.000	S1	S2	17.063	0.600	122.394	122.308	0.086	198.4	300	5.26	50.0
2.001	S2	S4	45.664	0.600	122.233	122.005	0.228	200.3	375	5.85	50.0
3.000	S3	S4	24.120	0.600	122.366	122.220	0.146	165.2	225	5.40	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	0.998	39.7	6.0	1.190	0.622	0.044	0.0	59	0.726
1.001	1.001	39.8	16.3	0.622	0.635	0.120	0.0	100	0.950
1.002	1.873	827.7	16.3	0.110	0.017	0.120	0.0	71	0.760
1.003	1.875	828.4	16.3	0.017	0.003	0.120	0.0	71	0.761
2.000	1.112	78.6	19.6	1.278	1.296	0.145	0.0	102	0.928
2.001	1.276	141.0	36.1	1.296	1.245	0.266	0.0	129	1.073
3.000	1.014	40.3	8.6	1.224	1.180	0.064	0.0	71	0.812

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
2.002	S4	S7	21.993	0.600	122.005	121.895	0.110	199.9	375	6.14	50.0
4.000	S5	S6	13.194	0.600	122.098	122.032	0.066	199.9	300	5.20	50.0
4.001	S6	S7	20.645	0.600	121.957	121.854	0.103	200.4	375	5.47	50.0
2.003	S7	S8	25.618	0.600	121.779	121.651	0.128	200.1	450	6.44	50.0
2.004	S8	HW1	14.798	0.600	121.651	121.577	0.074	200.0	450	6.61	50.0
1.004	HW1	SW2	26.506	0.030	121.577	121.458	0.119	222.7	750	6.98	50.0
1.005	SW2	SW3	14.667	0.030	121.458	121.392	0.066	222.2	750	7.18	50.0
1.006	SW3	SW4	49.297	0.030	121.392	121.170	0.222	222.1	750	7.84	50.0
1.007	SW4	HW4	30.383	0.030	121.170	121.033	0.137	221.8	750	8.24	50.0
5.000	S11	S12	11.840	0.600	122.021	121.962	0.059	200.7	300	5.18	50.0
5.001	S12	S13	59.082	0.600	121.962	121.666	0.296	199.6	300	6.07	50.0
5.002	S13	S14	27.699	0.600	121.666	121.528	0.138	200.7	300	6.48	50.0
5.003	S14	S19	33.648	0.600	121.528	121.359	0.169	199.1	300	6.99	50.0
6.000	S15	S17	28.687	0.600	122.535	121.766	0.769	37.3	300	5.19	50.0
7.000	S16	S17	14.633	0.600	122.772	121.841	0.931	15.7	225	5.07	50.0
6.001	S17	S18	30.065	0.600	121.765	121.615	0.150	200.4	300	5.64	50.0
6.002	S18	S19	51.340	0.600	121.540	121.283	0.257	199.8	375	6.31	50.0
5.004	S19	HW3	21.687	0.600	121.208	121.100	0.108	200.8	450	7.24	50.0
5.005	HW3	HW4	34.275	0.600	121.100	120.950	0.150	228.5	750	7.55	50.0
1.008	HW4	S20	5.555	0.030	120.950	120.917	0.033	168.3	750	8.35	50.0
1.009	S20	HW5	6.577	0.030	120.917	120.842	0.075	87.7	750	8.45	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
2.002	1.277	141.1	54.1	1.245	1.056	0.399	0.0	161	1.196
4.000	1.108	78.3	10.0	1.381	1.276	0.074	0.0	72	0.769
4.001	1.276	140.9	14.7	1.276	1.097	0.109	0.0	81	0.834
2.003	1.433	227.9	74.5	1.097	0.496	0.549	0.0	176	1.287
2.004	1.434	228.0	83.1	0.496	0.303	0.613	0.0	188	1.326
1.004	1.248	3743.2	99.4	0.003	0.117	0.733	0.0	135	0.476
1.005	1.249	3747.5	99.4	0.117	0.093	0.733	0.0	135	0.477
1.006	1.250	3749.0	109.5	0.093	0.330	0.808	0.0	142	0.491
1.007	1.250	3751.4	109.5	0.330	0.467	0.808	0.0	142	0.491
5.000	1.106	78.2	7.3	0.998	0.768	0.054	0.0	61	0.697
5.001	1.109	78.4	12.4	0.768	1.663	0.091	0.0	80	0.814
5.002	1.106	78.2	24.5	1.663	1.380	0.181	0.0	115	0.982
5.003	1.110	78.5	26.0	1.380	1.341	0.192	0.0	119	1.000
6.000	2.582	182.5	17.3	1.200	2.225	0.128	0.0	62	1.643
7.000	3.317	131.9	10.6	1.200	2.225	0.078	0.0	43	2.002
6.001	1.107	78.2	33.9	2.226	1.991	0.250	0.0	138	1.068
6.002	1.278	141.2	47.8	1.991	1.342	0.352	0.0	150	1.158
5.004	1.431	227.5	85.6	1.342	0.700	0.632	0.0	191	1.334
5.005	1.847	815.9	85.6	0.400	0.550	0.632	0.0	162	1.220
1.008	0.842	371.8	195.1	0.550	0.583	1.439	0.0	386	0.852
1.009	1.166	515.2	195.1	0.583	0.408	1.439	0.0	320	1.085

Simulation Settings

Rainfall Methodology	FSR	Skip Steady State	x
FSR Region	England and Wales	Drain Down Time (mins)	120
M5-60 (mm)	20.000	Additional Storage (m³/ha)	0.0
Ratio-R	0.360	Check Discharge Rate(s)	✓
Summer CV	0.750	1 year (l/s)	3.6
Winter CV	0.840	Check Discharge Volume	x
Analysis Speed	Detailed		

Storm Durations

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

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
30	0	0	0
100	45	0	0

Pre-development Discharge Rate

Site Makeup	Greenfield	Region	8
Greenfield Method	IH124	Growth Factor 1 year	0.78
Positively Drained Area (ha)	1.580	Betterment (%)	30
SAAR (mm)	825	QBar	6.5
Soil Index	3	Q 1 year (l/s)	3.6
SPR	0.40		

Node S20 Online Head/Flow Control

Flap Valve	x	Invert Level (m)	120.917	Design Flow (l/s)	3.6
Replaces Downstream Link	x	Design Depth (m)	0.500		

Head (m)	Flow (l/s)	Head (m)	Flow (l/s)	Head (m)	Flow (l/s)	Head (m)	Flow (l/s)	Head (m)	Flow (l/s)	Head (m)	Flow (l/s)	Head (m)	Flow (l/s)
0.020	0.128	0.184	2.884	0.347	3.036	0.510	3.634	0.673	4.140	0.837	4.585	1.000	4.988
0.041	0.479	0.204	2.859	0.367	3.118	0.531	3.702	0.694	4.198	0.857	4.637	1.100	5.217
0.061	0.998	0.224	2.817	0.388	3.198	0.551	3.768	0.714	4.256	0.878	4.689	1.200	5.437
0.082	1.611	0.245	2.756	0.408	3.275	0.571	3.832	0.735	4.312	0.898	4.740		
0.102	2.224	0.265	2.682	0.429	3.350	0.592	3.896	0.755	4.369	0.918	4.791		
0.122	2.728	0.286	2.775	0.449	3.424	0.612	3.959	0.776	4.423	0.939	4.840		
0.143	2.869	0.306	2.865	0.469	3.496	0.633	4.020	0.796	4.478	0.959	4.890		
0.163	2.888	0.327	2.952	0.490	3.566	0.653	4.080	0.816	4.532	0.980	4.939		

Node S20 Online Orifice Control

Flap Valve	x	Design Depth (m)	0.500	Discharge Coefficient	0.600
Replaces Downstream Link	x	Design Flow (l/s)			
Invert Level (m)	121.550	Diameter (m)	0.038		

Node S20 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	120.917
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	



Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	707.6	0.0	0.400	892.4	0.0	0.800	1087.1	0.0	1.200	1290.9	0.0
0.100	752.3	0.0	0.500	940.2	0.0	0.900	1137.2	0.0	1.300	1343.3	0.0
0.200	798.4	0.0	0.600	988.6	0.0	1.000	1187.9	0.0			
0.300	845.1	0.0	0.700	1037.6	0.0	1.100	1239.1	0.0			

Results for 1 year Critical Storm Duration. Lowest mass balance: 99.73%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S9	11	122.295	0.058	6.0	0.0825	0.0000	OK
15 minute winter	S10	11	122.041	0.102	16.0	0.1460	0.0000	OK
15 minute winter	HW2	11	121.932	0.072	15.8	0.0000	0.0000	OK
15 minute winter	SW1	12	121.753	0.070	15.8	0.1974	0.0000	OK
15 minute winter	S1	10	122.501	0.107	19.7	0.1524	0.0000	OK
15 minute winter	S2	10	122.360	0.127	35.9	0.1811	0.0000	OK
15 minute winter	S3	10	122.437	0.071	8.6	0.1020	0.0000	OK
15 minute winter	S4	11	122.173	0.168	53.2	0.2406	0.0000	OK
15 minute winter	S5	10	122.173	0.075	10.1	0.1077	0.0000	OK
15 minute winter	S6	10	122.038	0.081	14.6	0.1161	0.0000	OK
15 minute winter	S7	11	121.967	0.188	72.7	0.2689	0.0000	OK
15 minute winter	S8	11	121.842	0.191	81.2	0.2734	0.0000	OK
15 minute winter	HW1	11	121.712	0.135	96.1	0.0000	0.0000	OK
15 minute winter	SW2	12	121.593	0.134	96.1	0.3812	0.0000	OK
15 minute winter	SW3	11	121.529	0.137	102.1	0.3875	0.0000	OK
15 minute winter	SW4	14	121.407	0.237	101.0	0.6721	0.0000	OK
15 minute winter	S11	10	122.085	0.064	7.3	0.0910	0.0000	OK
15 minute winter	S12	11	122.040	0.078	12.3	0.1122	0.0000	OK
15 minute winter	S13	11	121.783	0.117	23.7	0.1321	0.0000	OK
15 minute winter	S14	12	121.646	0.118	24.9	0.1682	0.0000	OK
15 minute winter	S15	10	122.597	0.062	17.4	0.0885	0.0000	OK
15 minute winter	S16	10	122.815	0.043	10.7	0.0617	0.0000	OK
15 minute winter	S17	11	121.906	0.141	33.9	0.1597	0.0000	OK
15 minute winter	S18	11	121.691	0.151	46.3	0.2164	0.0000	OK
15 minute winter	S19	15	121.410	0.202	81.5	0.2895	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	S9	1.000	S10	5.8	0.460	0.146	0.6478	
15 minute winter	S10	1.001	HW2	15.7	1.110	0.396	0.1906	
15 minute winter	HW2	1.002	SW1	15.8	0.763	0.019	0.8160	
15 minute winter	SW1	1.003	HW1	15.4	0.432	0.019	0.8668	
15 minute winter	S1	2.000	S2	19.3	0.900	0.246	0.3667	
15 minute winter	S2	2.001	S4	35.5	0.897	0.252	1.8291	
15 minute winter	S3	3.000	S4	8.3	0.795	0.206	0.2539	
15 minute winter	S4	2.002	S7	53.0	1.160	0.375	1.0047	
15 minute winter	S5	4.000	S6	9.9	0.745	0.127	0.1756	
15 minute winter	S6	4.001	S7	14.6	0.713	0.104	0.4634	
15 minute winter	S7	2.003	S8	73.0	1.152	0.320	1.6234	
15 minute winter	S8	2.004	HW1	81.1	1.565	0.355	0.7699	
15 minute winter	HW1	1.004	SW2	96.1	0.469	0.026	5.4808	
15 minute winter	SW2	1.005	SW3	94.2	0.451	0.025	3.0622	
15 minute winter	SW3	1.006	SW4	101.0	0.469	0.027	16.3255	
15 minute winter	SW4	1.007	HW4	133.5	0.313	0.036	20.9349	
15 minute winter	S11	5.000	S12	7.2	0.574	0.092	0.1493	
15 minute winter	S12	5.001	S13	12.0	0.603	0.153	1.1814	
15 minute winter	S13	5.002	S14	23.5	0.925	0.300	0.7050	
15 minute winter	S14	5.003	S19	24.4	0.976	0.310	0.8401	
15 minute winter	S15	6.000	S17	17.2	0.845	0.095	0.6092	
15 minute winter	S16	7.000	S17	10.6	1.800	0.081	0.1071	
15 minute winter	S17	6.001	S18	33.2	1.050	0.424	0.9498	
15 minute winter	S18	6.002	S19	46.3	1.143	0.328	2.0795	
15 minute winter	S19	5.004	HW3	80.9	1.400	0.356	1.9456	

Results for 1 year Critical Storm Duration. Lowest mass balance: 99.73%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	HW3	14	121.401	0.301	80.9	0.0000	0.0000	OK
15 minute winter	HW4	14	121.403	0.453	186.6	0.0000	0.0000	OK
2160 minute winter	S20	1620	121.252	0.335	9.0	264.4353	0.0000	OK
8640 minute summer	HW5	4620	120.874	0.031	2.9	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	HW3	5.005	HW4	73.7	0.677	0.090	7.5881	
15 minute winter	HW4	1.008	S20	243.3	2.279	0.654	0.7767	
8640 minute summer	S20	1.009	HW5	2.9	0.347	0.006	0.0557	495.9

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.73%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S9	10	122.330	0.093	14.8	0.1329	0.0000	OK
15 minute winter	S10	10	122.115	0.176	39.6	0.2519	0.0000	OK
15 minute winter	HW2	11	121.972	0.112	38.7	0.0000	0.0000	OK
15 minute winter	SW1	12	121.793	0.110	39.2	0.3115	0.0000	OK
15 minute winter	S1	10	122.576	0.182	48.3	0.2605	0.0000	OK
15 minute winter	S2	10	122.450	0.217	88.2	0.3107	0.0000	OK
15 minute winter	S3	10	122.486	0.120	21.2	0.1712	0.0000	OK
15 minute winter	S4	11	122.315	0.310	130.9	0.4440	0.0000	OK
15 minute winter	S5	10	122.221	0.123	24.7	0.1754	0.0000	OK
15 minute winter	S6	11	122.125	0.168	35.8	0.2401	0.0000	OK
15 minute winter	S7	11	122.118	0.339	178.1	0.4852	0.0000	OK
15 minute winter	S8	11	121.971	0.320	198.7	0.4573	0.0000	OK
15 minute winter	HW1	11	121.791	0.214	236.0	0.0000	0.0000	OK
15 minute winter	SW2	12	121.674	0.216	233.0	0.6126	0.0000	OK
15 minute winter	SW3	13	121.621	0.229	252.5	0.6481	0.0000	OK
15 minute winter	SW4	13	121.595	0.425	242.4	1.2048	0.0000	OK
15 minute winter	S11	10	122.128	0.107	18.0	0.1532	0.0000	OK
15 minute winter	S12	11	122.088	0.126	30.4	0.1802	0.0000	OK
15 minute winter	S13	11	121.874	0.208	59.0	0.2352	0.0000	OK
15 minute winter	S14	11	121.740	0.212	61.4	0.3027	0.0000	OK
15 minute winter	S15	10	122.633	0.098	42.7	0.1397	0.0000	OK
15 minute winter	S16	10	122.840	0.067	26.1	0.0966	0.0000	OK
15 minute winter	S17	11	122.037	0.272	83.2	0.3080	0.0000	OK
15 minute winter	S18	11	121.805	0.265	112.7	0.3798	0.0000	OK
15 minute winter	S19	13	121.662	0.454	202.7	0.6503	0.0000	SURCHARGED

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	S9	1.000	S10	14.4	0.582	0.363	1.2386	
15 minute winter	S10	1.001	HW2	38.7	1.443	0.972	0.3552	
15 minute winter	HW2	1.002	SW1	39.2	0.981	0.047	1.5837	
15 minute winter	SW1	1.003	HW1	38.1	0.550	0.046	1.6781	
15 minute winter	S1	2.000	S2	47.5	1.123	0.604	0.7224	
15 minute winter	S2	2.001	S4	87.1	1.067	0.618	3.6979	
15 minute winter	S3	3.000	S4	20.7	1.004	0.514	0.4995	
15 minute winter	S4	2.002	S7	130.5	1.434	0.925	1.9940	
15 minute winter	S5	4.000	S6	24.3	0.947	0.311	0.3392	
15 minute winter	S6	4.001	S7	34.5	0.719	0.245	1.3486	
15 minute winter	S7	2.003	S8	178.6	1.437	0.784	3.1834	
15 minute winter	S8	2.004	HW1	198.5	2.030	0.870	1.4394	
15 minute winter	HW1	1.004	SW2	233.0	0.592	0.062	10.5552	
15 minute winter	SW2	1.005	SW3	233.1	0.585	0.062	6.0657	
15 minute winter	SW3	1.006	SW4	242.4	0.522	0.065	39.0729	
15 minute winter	SW4	1.007	HW4	353.6	0.379	0.094	44.5600	
15 minute winter	S11	5.000	S12	17.8	0.706	0.227	0.2985	
15 minute winter	S12	5.001	S13	29.5	0.743	0.376	2.3676	
15 minute winter	S13	5.002	S14	58.0	1.116	0.742	1.4571	
15 minute winter	S14	5.003	S19	61.0	1.151	0.777	2.0459	
15 minute winter	S15	6.000	S17	42.4	0.993	0.232	1.2367	
15 minute winter	S16	7.000	S17	26.0	1.784	0.197	0.3395	
15 minute winter	S17	6.001	S18	80.7	1.300	1.032	1.8500	
15 minute winter	S18	6.002	S19	114.1	1.339	0.809	4.7689	
15 minute winter	S19	5.004	HW3	189.2	1.587	0.831	3.4359	

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.73%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	HW3	13	121.586	0.486	189.2	0.0000	0.0000	OK
15 minute winter	HW4	13	121.588	0.638	504.7	0.0000	0.0000	OK
1440 minute winter	S20	1350	121.549	0.632	21.2	542.3317	0.0000	OK
1440 minute winter	HW5	1350	120.878	0.036	3.9	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute summer	HW3	5.005	HW4	176.7	0.823	0.217	7.3597	
15 minute winter	HW4	1.008	S20	575.3	2.964	1.547	1.1373	
1440 minute winter	S20	1.009	HW5	3.9	0.378	0.007	0.0677	245.5

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 99.73%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S9	11	122.526	0.289	27.9	0.4129	0.0000	SURCHARGED
15 minute winter	S10	11	122.378	0.439	70.7	0.6282	0.0000	SURCHARGED
15 minute winter	HW2	11	122.009	0.149	69.9	0.0000	0.0000	OK
1440 minute winter	SW1	1380	121.890	0.207	3.8	0.5860	0.0000	OK
15 minute winter	S1	11	123.508	1.114	90.7	1.5942	0.0000	SURCHARGED
15 minute winter	S2	11	123.366	1.133	157.8	1.6207	0.0000	SURCHARGED
15 minute winter	S3	11	123.177	0.811	39.9	1.1607	0.0000	SURCHARGED
15 minute winter	S4	11	123.025	1.020	235.2	1.4598	0.0000	SURCHARGED
15 minute winter	S5	11	122.660	0.562	46.4	0.8039	0.0000	SURCHARGED
15 minute winter	S6	11	122.629	0.672	64.0	0.9618	0.0000	SURCHARGED
15 minute winter	S7	11	122.599	0.820	323.4	1.1731	0.0000	SURCHARGED
15 minute winter	S8	11	122.231	0.580	360.9	0.8304	0.0000	SURCHARGED
1440 minute winter	HW1	1380	121.890	0.313	23.0	0.0000	0.0000	OK
1440 minute winter	SW2	1380	121.890	0.432	23.0	1.2239	0.0000	OK
1440 minute winter	SW3	1380	121.890	0.498	24.2	1.4110	0.0000	OK
1440 minute winter	SW4	1380	121.890	0.720	21.9	2.0403	0.0000	OK
15 minute winter	S11	12	122.821	0.800	33.7	1.1446	0.0000	SURCHARGED
15 minute winter	S12	12	122.809	0.847	53.1	1.2125	0.0000	FLOOD RISK
15 minute winter	S13	12	122.675	1.009	100.0	1.1409	0.0000	SURCHARGED
15 minute winter	S14	12	122.427	0.899	99.0	1.2868	0.0000	SURCHARGED
15 minute winter	S15	11	123.370	0.835	80.3	1.1942	0.0000	SURCHARGED
15 minute winter	S16	11	123.346	0.574	49.1	0.8210	0.0000	SURCHARGED
15 minute winter	S17	11	123.219	1.454	139.1	1.6441	0.0000	SURCHARGED
15 minute winter	S18	11	122.652	1.112	195.9	1.5909	0.0000	SURCHARGED
15 minute winter	S19	12	122.096	0.888	338.3	1.2711	0.0000	SURCHARGED

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	S9	1.000	S10	26.1	0.717	0.657	2.0195	
15 minute winter	S10	1.001	HW2	69.9	1.884	1.755	0.4528	
15 minute winter	HW2	1.002	SW1	69.2	1.040	0.084	2.8591	
15 minute winter	SW1	1.003	HW1	73.4	0.621	0.089	2.8038	
15 minute winter	S1	2.000	S2	85.5	1.214	1.087	1.2016	
15 minute winter	S2	2.001	S4	157.4	1.427	1.117	5.0366	
15 minute winter	S3	3.000	S4	37.4	0.981	0.926	0.9593	
15 minute winter	S4	2.002	S7	235.0	2.130	1.665	2.4258	
15 minute winter	S5	4.000	S6	43.5	1.018	0.556	0.9291	
15 minute winter	S6	4.001	S7	63.7	0.724	0.452	2.2771	
15 minute winter	S7	2.003	S8	323.2	2.040	1.418	4.0590	
15 minute winter	S8	2.004	HW1	360.7	2.468	1.582	1.9598	
15 minute winter	HW1	1.004	SW2	421.2	0.684	0.113	17.9295	
15 minute winter	SW2	1.005	SW3	391.4	0.657	0.104	12.1721	
15 minute winter	SW3	1.006	SW4	441.1	0.549	0.118	67.9545	
15 minute winter	SW4	1.007	HW4	600.8	0.350	0.160	68.3013	
15 minute winter	S11	5.000	S12	30.8	0.797	0.394	0.8338	
15 minute winter	S12	5.001	S13	48.6	0.793	0.620	4.1605	
15 minute winter	S13	5.002	S14	93.7	1.331	1.199	1.9505	
15 minute winter	S14	5.003	S19	99.8	1.418	1.272	2.3695	
15 minute winter	S15	6.000	S17	72.2	1.105	0.396	2.0201	
15 minute summer	S16	7.000	S17	44.3	1.749	0.336	0.5820	
15 minute winter	S17	6.001	S18	136.8	1.942	1.748	2.1172	
15 minute winter	S18	6.002	S19	192.8	1.748	1.366	5.6627	
15 minute winter	S19	5.004	HW3	335.7	2.119	1.475	3.4362	

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 99.73%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
1440 minute winter	HW3	1380	121.890	0.790	19.3	0.0000	0.0000	SURCHARGED
1440 minute winter	HW4	1380	121.890	0.940	35.9	0.0000	0.0000	SURCHARGED
1440 minute winter	S20	1380	121.890	0.973	33.4	914.8165	0.0000	SURCHARGED
1440 minute winter	HW5	1380	120.887	0.045	6.5	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	HW3	5.005	HW4	324.8	0.941	0.398	14.5640	
15 minute winter	HW4	1.008	S20	892.2	3.055	2.400	1.5949	
1440 minute winter	S20	1.009	HW5	6.5	0.453	0.013	0.0948	392.7

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
S9	0.044	5.00	123.652	1350	386697.060	175830.232	1.415
S10	0.076	5.00	122.786	1350	386666.393	175789.758	0.847
HW2			122.720	1	386654.399	175783.803	0.860
SW1			122.450	1900	386620.228	175803.228	0.767
S1	0.145	5.00	123.972	1350	386660.572	175916.199	1.578
S2	0.122	5.00	123.904	1350	386671.682	175903.249	1.671
S3	0.064	5.00	123.815	1350	386664.977	175850.701	1.449
S4	0.069	5.00	123.625	1350	386645.950	175865.525	1.620
S5	0.074	5.00	123.779	1350	386607.882	175872.900	1.681
S6	0.035	5.00	123.608	1350	386615.427	175862.076	1.651
S7	0.042	5.00	123.326	1350	386631.417	175849.017	1.547
S8	0.064	5.00	122.597	1350	386615.179	175829.203	0.946
HW1			122.330	1	386603.669	175819.902	0.753
SW2			122.325	1900	386585.739	175839.424	0.867
SW3	0.074	5.00	122.235	1900	386573.099	175846.863	0.843
SW4			122.250	1900	386526.186	175862.009	1.080
S11	0.054	5.00	123.319	1350	386593.222	175983.580	1.298
S12	0.038	5.00	123.030	1350	386586.751	175993.494	1.068
S13	0.089	5.00	123.629	1200	386536.391	175962.599	1.963
S14	0.011	5.00	123.208	1350	386520.101	175940.196	1.680
S15	0.128	5.00	124.035	1350	386588.915	175945.066	1.500
S16	0.078	5.00	124.197	1350	386597.203	175902.781	1.425
S17	0.044	5.00	124.291	1200	386592.347	175916.585	2.526
S18	0.102	5.00	123.906	1350	386563.575	175907.863	2.366
S19	0.088	5.00	123.000	1350	386512.236	175907.480	1.792
HW3			122.250	1	386491.078	175902.721	1.150
HW4			122.250	1	386496.593	175868.892	1.300
S20			122.250	2400	386493.815	175864.082	1.333
HW5			122.000	1	386490.546	175858.375	1.158

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	S9	S10	50.779	0.600	122.237	121.939	0.298	170.4	225	5.85	50.0
1.001	S10	HW2	13.392	0.600	121.939	121.860	0.079	169.5	225	6.07	50.0
1.002	HW2	SW1	39.306	0.600	121.860	121.683	0.177	222.1	750	6.42	50.0
1.003	SW1	HW1	23.499	0.600	121.683	121.577	0.106	221.7	750	6.63	50.0
2.000	S1	S2	17.063	0.600	122.394	122.308	0.086	198.4	300	5.26	50.0
2.001	S2	S4	45.664	0.600	122.233	122.005	0.228	200.3	375	5.85	50.0
3.000	S3	S4	24.120	0.600	122.366	122.220	0.146	165.2	225	5.40	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	0.998	39.7	6.0	1.190	0.622	0.044	0.0	59	0.726
1.001	1.001	39.8	16.3	0.622	0.635	0.120	0.0	100	0.950
1.002	1.873	827.7	16.3	0.110	0.017	0.120	0.0	71	0.760
1.003	1.875	828.4	16.3	0.017	0.003	0.120	0.0	71	0.761
2.000	1.112	78.6	19.6	1.278	1.296	0.145	0.0	102	0.928
2.001	1.276	141.0	36.1	1.296	1.245	0.266	0.0	129	1.073
3.000	1.014	40.3	8.6	1.224	1.180	0.064	0.0	71	0.812

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
2.002	S4	S7	21.993	0.600	122.005	121.895	0.110	199.9	375	6.14	50.0
4.000	S5	S6	13.194	0.600	122.098	122.032	0.066	199.9	300	5.20	50.0
4.001	S6	S7	20.645	0.600	121.957	121.854	0.103	200.4	375	5.47	50.0
2.003	S7	S8	25.618	0.600	121.779	121.651	0.128	200.1	450	6.44	50.0
2.004	S8	HW1	14.798	0.600	121.651	121.577	0.074	200.0	450	6.61	50.0
1.004	HW1	SW2	26.506	0.030	121.577	121.458	0.119	222.7	750	6.98	50.0
1.005	SW2	SW3	14.667	0.030	121.458	121.392	0.066	222.2	750	7.18	50.0
1.006	SW3	SW4	49.297	0.030	121.392	121.170	0.222	222.1	750	7.84	50.0
1.007	SW4	HW4	30.383	0.030	121.170	121.033	0.137	221.8	750	8.24	50.0
5.000	S11	S12	11.840	0.600	122.021	121.962	0.059	200.7	300	5.18	50.0
5.001	S12	S13	59.082	0.600	121.962	121.666	0.296	199.6	300	6.07	50.0
5.002	S13	S14	27.699	0.600	121.666	121.528	0.138	200.7	300	6.48	50.0
5.003	S14	S19	33.648	0.600	121.528	121.359	0.169	199.1	300	6.99	50.0
6.000	S15	S17	28.687	0.600	122.535	121.766	0.769	37.3	300	5.19	50.0
7.000	S16	S17	14.633	0.600	122.772	121.841	0.931	15.7	225	5.07	50.0
6.001	S17	S18	30.065	0.600	121.765	121.615	0.150	200.4	300	5.64	50.0
6.002	S18	S19	51.340	0.600	121.540	121.283	0.257	199.8	375	6.31	50.0
5.004	S19	HW3	21.687	0.600	121.208	121.100	0.108	200.8	450	7.24	50.0
5.005	HW3	HW4	34.275	0.600	121.100	120.950	0.150	228.5	750	7.55	50.0
1.008	HW4	S20	5.555	0.030	120.950	120.917	0.033	168.3	750	8.35	50.0
1.009	S20	HW5	6.577	0.030	120.917	120.842	0.075	87.7	750	8.45	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
2.002	1.277	141.1	54.1	1.245	1.056	0.399	0.0	161	1.196
4.000	1.108	78.3	10.0	1.381	1.276	0.074	0.0	72	0.769
4.001	1.276	140.9	14.7	1.276	1.097	0.109	0.0	81	0.834
2.003	1.433	227.9	74.5	1.097	0.496	0.549	0.0	176	1.287
2.004	1.434	228.0	83.1	0.496	0.303	0.613	0.0	188	1.326
1.004	1.248	3743.2	99.4	0.003	0.117	0.733	0.0	135	0.476
1.005	1.249	3747.5	99.4	0.117	0.093	0.733	0.0	135	0.477
1.006	1.250	3749.0	109.5	0.093	0.330	0.808	0.0	142	0.491
1.007	1.250	3751.4	109.5	0.330	0.467	0.808	0.0	142	0.491
5.000	1.106	78.2	7.3	0.998	0.768	0.054	0.0	61	0.697
5.001	1.109	78.4	12.4	0.768	1.663	0.091	0.0	80	0.814
5.002	1.106	78.2	24.5	1.663	1.380	0.181	0.0	115	0.982
5.003	1.110	78.5	26.0	1.380	1.341	0.192	0.0	119	1.000
6.000	2.582	182.5	17.3	1.200	2.225	0.128	0.0	62	1.643
7.000	3.317	131.9	10.6	1.200	2.225	0.078	0.0	43	2.002
6.001	1.107	78.2	33.9	2.226	1.991	0.250	0.0	138	1.068
6.002	1.278	141.2	47.8	1.991	1.342	0.352	0.0	150	1.158
5.004	1.431	227.5	85.6	1.342	0.700	0.632	0.0	191	1.334
5.005	1.847	815.9	85.6	0.400	0.550	0.632	0.0	162	1.220
1.008	0.842	371.8	195.1	0.550	0.583	1.439	0.0	386	0.852
1.009	1.166	515.2	195.1	0.583	0.408	1.439	0.0	320	1.085

Simulation Settings

Rainfall Methodology	FSR	Skip Steady State	x
FSR Region	England and Wales	Drain Down Time (mins)	120
M5-60 (mm)	20.000	Additional Storage (m³/ha)	0.0
Ratio-R	0.360	Check Discharge Rate(s)	✓
Summer CV	0.750	1 year (l/s)	3.6
Winter CV	0.840	Check Discharge Volume	x
Analysis Speed	Detailed		

Storm Durations

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

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
30	0	0	0
100	45	0	0

Pre-development Discharge Rate

Site Makeup	Greenfield	Region	8
Greenfield Method	IH124	Growth Factor 1 year	0.78
Positively Drained Area (ha)	1.580	Betterment (%)	30
SAAR (mm)	825	QBar	6.5
Soil Index	3	Q 1 year (l/s)	3.6
SPR	0.40		

Node HW5 Surcharged Outfall

Overrides Design Area	x	Depression Storage Area (m²)	0	Evapo-transpiration (mm/day)	0
Overrides Design Additional Inflow	x	Depression Storage Depth (mm)	0		

Applies to All storms

Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)
0	0.500	2000	1.000	4000	1.000	6000	1.000	8000	1.000	10000	0.500
1000	1.000	3000	1.000	5000	1.000	7000	1.000	9000	1.000		

Node S20 Online Head/Flow Control

Flap Valve	x	Invert Level (m)	120.917	Design Flow (l/s)	3.6
Replaces Downstream Link	x	Design Depth (m)	0.500		

Head (m)	Flow (l/s)	Head (m)	Flow (l/s)	Head (m)	Flow (l/s)	Head (m)	Flow (l/s)	Head (m)	Flow (l/s)	Head (m)	Flow (l/s)	Head (m)	Flow (l/s)
0.020	0.128	0.184	2.884	0.347	3.036	0.510	3.634	0.673	4.140	0.837	4.585	1.000	4.988
0.041	0.479	0.204	2.859	0.367	3.118	0.531	3.702	0.694	4.198	0.857	4.637	1.100	5.217
0.061	0.998	0.224	2.817	0.388	3.198	0.551	3.768	0.714	4.256	0.878	4.689	1.200	5.437
0.082	1.611	0.245	2.756	0.408	3.275	0.571	3.832	0.735	4.312	0.898	4.740		
0.102	2.224	0.265	2.682	0.429	3.350	0.592	3.896	0.755	4.369	0.918	4.791		
0.122	2.728	0.286	2.775	0.449	3.424	0.612	3.959	0.776	4.423	0.939	4.840		
0.143	2.869	0.306	2.865	0.469	3.496	0.633	4.020	0.796	4.478	0.959	4.890		
0.163	2.888	0.327	2.952	0.490	3.566	0.653	4.080	0.816	4.532	0.980	4.939		



Node S20 Online Orifice Control

Flap Valve	x	Design Depth (m)	0.500	Discharge Coefficient	0.600
Replaces Downstream Link	x	Design Flow (l/s)			
Invert Level (m)	121.550	Diameter (m)	0.038		

Node S20 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	120.917
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	707.6	0.0	0.400	892.4	0.0	0.800	1087.1	0.0	1.200	1290.9	0.0
0.100	752.3	0.0	0.500	940.2	0.0	0.900	1137.2	0.0	1.300	1343.3	0.0
0.200	798.4	0.0	0.600	988.6	0.0	1.000	1187.9	0.0			
0.300	845.1	0.0	0.700	1037.6	0.0	1.100	1239.1	0.0			

Results for 1 year Critical Storm Duration. Lowest mass balance: 99.02%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S9	11	122.295	0.058	6.0	0.0825	0.0000	OK
15 minute winter	S10	11	122.041	0.102	16.0	0.1460	0.0000	OK
15 minute winter	HW2	11	121.932	0.072	15.8	0.0000	0.0000	OK
15 minute winter	SW1	12	121.753	0.070	15.8	0.1974	0.0000	OK
15 minute winter	S1	10	122.501	0.107	19.7	0.1524	0.0000	OK
15 minute winter	S2	10	122.360	0.127	35.9	0.1811	0.0000	OK
15 minute winter	S3	10	122.437	0.071	8.6	0.1020	0.0000	OK
15 minute winter	S4	11	122.173	0.168	53.2	0.2406	0.0000	OK
15 minute winter	S5	10	122.173	0.075	10.1	0.1077	0.0000	OK
15 minute winter	S6	10	122.038	0.081	14.6	0.1161	0.0000	OK
15 minute winter	S7	11	121.967	0.188	72.7	0.2689	0.0000	OK
15 minute winter	S8	11	121.842	0.191	81.2	0.2734	0.0000	OK
15 minute winter	HW1	11	121.712	0.135	96.1	0.0000	0.0000	OK
15 minute winter	SW2	12	121.593	0.134	96.1	0.3812	0.0000	OK
10080 minute winter	SW3	9540	121.562	0.170	1.9	0.4815	0.0000	OK
10080 minute winter	SW4	9480	121.562	0.392	1.9	1.1109	0.0000	OK
15 minute winter	S11	10	122.085	0.064	7.3	0.0910	0.0000	OK
15 minute winter	S12	11	122.040	0.078	12.3	0.1122	0.0000	OK
15 minute winter	S13	11	121.783	0.117	23.7	0.1321	0.0000	OK
15 minute winter	S14	12	121.646	0.118	24.9	0.1682	0.0000	OK
15 minute winter	S15	10	122.597	0.062	17.4	0.0885	0.0000	OK
15 minute winter	S16	10	122.815	0.043	10.7	0.0617	0.0000	OK
15 minute winter	S17	11	121.906	0.141	33.9	0.1597	0.0000	OK
15 minute winter	S18	11	121.691	0.151	46.3	0.2164	0.0000	OK
10080 minute winter	S19	9540	121.562	0.354	1.4	0.5064	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	S9	1.000	S10	5.8	0.460	0.146	0.6478	
15 minute winter	S10	1.001	HW2	15.7	1.110	0.396	0.1906	
15 minute winter	HW2	1.002	SW1	15.8	0.763	0.019	0.8160	
15 minute winter	SW1	1.003	HW1	15.4	0.432	0.019	0.8668	
15 minute winter	S1	2.000	S2	19.3	0.900	0.246	0.3667	
15 minute winter	S2	2.001	S4	35.5	0.897	0.252	1.8291	
15 minute winter	S3	3.000	S4	8.3	0.795	0.206	0.2539	
15 minute winter	S4	2.002	S7	53.0	1.160	0.375	1.0047	
15 minute winter	S5	4.000	S6	9.9	0.745	0.127	0.1756	
15 minute winter	S6	4.001	S7	14.6	0.713	0.104	0.4634	
15 minute winter	S7	2.003	S8	73.0	1.152	0.320	1.6234	
15 minute winter	S8	2.004	HW1	81.1	1.565	0.355	0.7699	
15 minute winter	HW1	1.004	SW2	96.1	0.469	0.026	5.4808	
15 minute winter	SW2	1.005	SW3	94.2	0.451	0.025	3.0622	
15 minute winter	SW3	1.006	SW4	101.0	0.469	0.027	16.3259	
15 minute winter	SW4	1.007	HW4	133.5	0.313	0.036	20.9356	
15 minute winter	S11	5.000	S12	7.2	0.574	0.092	0.1493	
15 minute winter	S12	5.001	S13	12.0	0.603	0.153	1.1814	
15 minute winter	S13	5.002	S14	23.5	0.925	0.300	0.7050	
15 minute winter	S14	5.003	S19	24.4	0.976	0.310	0.8401	
15 minute winter	S15	6.000	S17	17.2	0.845	0.095	0.6092	
15 minute winter	S16	7.000	S17	10.6	1.800	0.081	0.1071	
15 minute winter	S17	6.001	S18	33.2	1.050	0.424	0.9498	
15 minute winter	S18	6.002	S19	46.3	1.143	0.328	2.0795	
15 minute winter	S19	5.004	HW3	80.9	1.400	0.356	1.9460	

Results for 1 year Critical Storm Duration. Lowest mass balance: 99.02%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
10080 minute winter	HW3	9540	121.562	0.462	1.4	0.0000	0.0000	OK
10080 minute winter	HW4	9540	121.562	0.612	3.0	0.0000	0.0000	OK
10080 minute winter	S20	9540	121.562	0.645	2.8	555.3986	0.0000	OK
960 minute summer	HW5	1005	121.842	1.000	0.0	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	HW3	5.005	HW4	73.7	0.677	0.090	7.5883	
15 minute winter	HW4	1.008	S20	243.3	2.279	0.654	0.7767	
10080 minute winter	S20	1.009	HW5	2.9	0.010	0.006	2.7719	84.2

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.02%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S9	10	122.330	0.093	14.8	0.1329	0.0000	OK
15 minute winter	S10	10	122.115	0.176	39.6	0.2519	0.0000	OK
15 minute winter	HW2	11	121.972	0.112	38.7	0.0000	0.0000	OK
8640 minute winter	SW1	8100	121.875	0.192	0.5	0.5439	0.0000	OK
15 minute winter	S1	10	122.576	0.182	48.3	0.2605	0.0000	OK
15 minute winter	S2	10	122.450	0.217	88.2	0.3107	0.0000	OK
15 minute winter	S3	10	122.486	0.120	21.2	0.1712	0.0000	OK
15 minute winter	S4	11	122.315	0.310	130.9	0.4440	0.0000	OK
15 minute winter	S5	10	122.221	0.123	24.7	0.1754	0.0000	OK
15 minute winter	S6	11	122.125	0.168	35.8	0.2401	0.0000	OK
15 minute winter	S7	11	122.118	0.339	178.1	0.4852	0.0000	OK
15 minute winter	S8	11	121.971	0.320	198.7	0.4573	0.0000	OK
8640 minute winter	HW1	8100	121.875	0.298	3.2	0.0000	0.0000	OK
8640 minute winter	SW2	8100	121.875	0.417	3.2	1.1818	0.0000	OK
8640 minute winter	SW3	8100	121.875	0.483	3.4	1.3689	0.0000	OK
8640 minute winter	SW4	8100	121.875	0.705	3.2	1.9983	0.0000	OK
15 minute winter	S11	10	122.128	0.107	18.0	0.1532	0.0000	OK
15 minute winter	S12	11	122.088	0.126	30.4	0.1802	0.0000	OK
8640 minute winter	S13	8100	121.875	0.209	0.8	0.2362	0.0000	OK
8640 minute winter	S14	8100	121.875	0.347	0.8	0.4964	0.0000	SURCHARGED
15 minute winter	S15	10	122.633	0.098	42.7	0.1397	0.0000	OK
15 minute winter	S16	10	122.840	0.067	26.1	0.0966	0.0000	OK
15 minute winter	S17	11	122.037	0.272	83.2	0.3080	0.0000	OK
8640 minute winter	S18	8100	121.875	0.335	1.5	0.4792	0.0000	OK
8640 minute winter	S19	8100	121.875	0.667	2.7	0.9543	0.0000	SURCHARGED

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	S9	1.000	S10	14.4	0.582	0.363	1.2386	
15 minute winter	S10	1.001	HW2	38.7	1.443	0.972	0.3552	
15 minute winter	HW2	1.002	SW1	39.2	0.981	0.047	1.5837	
15 minute winter	SW1	1.003	HW1	38.1	0.550	0.046	1.6781	
15 minute winter	S1	2.000	S2	47.5	1.123	0.604	0.7224	
15 minute winter	S2	2.001	S4	87.1	1.067	0.618	3.6979	
15 minute winter	S3	3.000	S4	20.7	1.004	0.514	0.4995	
15 minute winter	S4	2.002	S7	130.5	1.434	0.925	1.9940	
15 minute winter	S5	4.000	S6	24.3	0.947	0.311	0.3392	
15 minute winter	S6	4.001	S7	34.5	0.719	0.245	1.3486	
15 minute winter	S7	2.003	S8	178.6	1.437	0.784	3.1834	
15 minute winter	S8	2.004	HW1	198.5	2.030	0.870	1.4394	
15 minute winter	HW1	1.004	SW2	233.0	0.592	0.062	10.5552	
15 minute winter	SW2	1.005	SW3	233.1	0.585	0.062	6.0659	
15 minute winter	SW3	1.006	SW4	242.4	0.522	0.065	39.0767	
15 minute winter	SW4	1.007	HW4	353.6	0.379	0.094	44.5633	
15 minute winter	S11	5.000	S12	17.8	0.706	0.227	0.2985	
15 minute winter	S12	5.001	S13	29.5	0.743	0.376	2.3676	
15 minute winter	S13	5.002	S14	58.0	1.116	0.742	1.4571	
15 minute winter	S14	5.003	S19	61.0	1.151	0.777	2.0459	
15 minute winter	S15	6.000	S17	42.4	0.993	0.232	1.2367	
15 minute winter	S16	7.000	S17	26.0	1.784	0.197	0.3395	
15 minute winter	S17	6.001	S18	80.7	1.300	1.032	1.8500	
15 minute winter	S18	6.002	S19	114.1	1.339	0.809	4.7689	
15 minute winter	S19	5.004	HW3	189.2	1.587	0.831	3.4359	

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.02%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
8640 minute winter	HW3	8100	121.875	0.775	2.6	0.0000	0.0000	SURCHARGED
8640 minute winter	HW4	8100	121.875	0.925	4.9	0.0000	0.0000	SURCHARGED
8640 minute winter	S20	8100	121.875	0.958	4.6	897.4081	0.0000	SURCHARGED
960 minute summer	HW5	1005	121.842	1.000	0.0	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute summer	HW3	5.005	HW4	176.7	0.823	0.217	7.3609	
15 minute winter	HW4	1.008	S20	575.4	2.964	1.547	1.1373	
10080 minute winter	S20	1.009	HW5	4.7	0.016	0.009	2.8947	368.6

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 99.02%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S9	11	122.526	0.289	27.9	0.4129	0.0000	SURCHARGED
15 minute winter	S10	11	122.378	0.439	70.7	0.6282	0.0000	SURCHARGED
7200 minute winter	HW2	5100	122.059	0.199	1.1	0.0000	0.0000	OK
7200 minute winter	SW1	5100	122.059	0.376	1.1	1.0669	0.0000	OK
15 minute winter	S1	11	123.508	1.114	90.7	1.5942	0.0000	SURCHARGED
15 minute winter	S2	11	123.366	1.133	157.8	1.6207	0.0000	SURCHARGED
15 minute winter	S3	11	123.177	0.811	39.9	1.1607	0.0000	SURCHARGED
15 minute winter	S4	11	123.025	1.020	235.2	1.4598	0.0000	SURCHARGED
15 minute winter	S5	11	122.660	0.562	46.4	0.8039	0.0000	SURCHARGED
15 minute winter	S6	11	122.629	0.672	64.0	0.9618	0.0000	SURCHARGED
15 minute winter	S7	11	122.599	0.820	323.4	1.1731	0.0000	SURCHARGED
15 minute winter	S8	11	122.231	0.580	360.9	0.8304	0.0000	SURCHARGED
7200 minute winter	HW1	5100	122.059	0.482	6.5	0.0000	0.0000	OK
7200 minute winter	SW2	5100	122.059	0.601	6.1	1.7047	0.0000	OK
7200 minute winter	SW3	5100	122.059	0.667	6.3	1.8918	0.0000	OK
7200 minute winter	SW4	5100	122.059	0.889	5.2	2.5212	0.0000	FLOOD RISK
15 minute winter	S11	12	122.821	0.800	33.7	1.1447	0.0000	SURCHARGED
15 minute winter	S12	12	122.809	0.847	53.1	1.2125	0.0000	FLOOD RISK
15 minute winter	S13	12	122.675	1.009	100.0	1.1409	0.0000	SURCHARGED
15 minute winter	S14	12	122.427	0.899	99.0	1.2868	0.0000	SURCHARGED
15 minute winter	S15	11	123.370	0.835	80.3	1.1942	0.0000	SURCHARGED
15 minute winter	S16	11	123.346	0.574	49.1	0.8210	0.0000	SURCHARGED
15 minute winter	S17	11	123.219	1.454	139.1	1.6441	0.0000	SURCHARGED
15 minute winter	S18	11	122.652	1.112	195.9	1.5909	0.0000	SURCHARGED
15 minute winter	S19	12	122.096	0.888	338.3	1.2711	0.0000	SURCHARGED

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	S9	1.000	S10	26.1	0.717	0.657	2.0195	
15 minute winter	S10	1.001	HW2	69.9	1.884	1.755	0.4528	
15 minute winter	HW2	1.002	SW1	69.2	1.040	0.084	2.8591	
15 minute winter	SW1	1.003	HW1	73.4	0.621	0.089	2.8038	
15 minute winter	S1	2.000	S2	85.5	1.214	1.087	1.2016	
15 minute winter	S2	2.001	S4	157.4	1.427	1.117	5.0366	
15 minute winter	S3	3.000	S4	37.4	0.981	0.926	0.9593	
15 minute winter	S4	2.002	S7	235.0	2.130	1.665	2.4258	
15 minute winter	S5	4.000	S6	43.5	1.018	0.556	0.9291	
15 minute winter	S6	4.001	S7	63.7	0.724	0.452	2.2771	
15 minute winter	S7	2.003	S8	323.2	2.040	1.418	4.0590	
15 minute winter	S8	2.004	HW1	360.7	2.468	1.582	1.9598	
15 minute winter	HW1	1.004	SW2	421.2	0.684	0.113	17.9298	
15 minute winter	SW2	1.005	SW3	391.4	0.657	0.104	12.1731	
15 minute winter	SW3	1.006	SW4	441.1	0.549	0.118	67.9606	
15 minute winter	SW4	1.007	HW4	600.9	0.350	0.160	68.3068	
15 minute winter	S11	5.000	S12	30.8	0.797	0.394	0.8338	
15 minute winter	S12	5.001	S13	48.6	0.793	0.620	4.1605	
15 minute winter	S13	5.002	S14	93.7	1.331	1.199	1.9505	
15 minute winter	S14	5.003	S19	99.8	1.418	1.272	2.3695	
15 minute winter	S15	6.000	S17	72.2	1.105	0.396	2.0201	
15 minute summer	S16	7.000	S17	44.3	1.749	0.336	0.5820	
15 minute winter	S17	6.001	S18	136.8	1.942	1.748	2.1172	
15 minute winter	S18	6.002	S19	192.8	1.748	1.366	5.6627	
15 minute winter	S19	5.004	HW3	335.7	2.119	1.475	3.4362	

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 99.02%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
7200 minute winter	HW3	5100	122.059	0.959	5.4	0.0000	0.0000	FLOOD RISK
7200 minute winter	HW4	5100	122.059	1.109	8.8	0.0000	0.0000	FLOOD RISK
7200 minute winter	S20	5100	122.059	1.142	8.0	1122.0860	0.0000	FLOOD RISK
960 minute summer	HW5	1005	121.842	1.000	3.9	0.0000	0.0000	OK

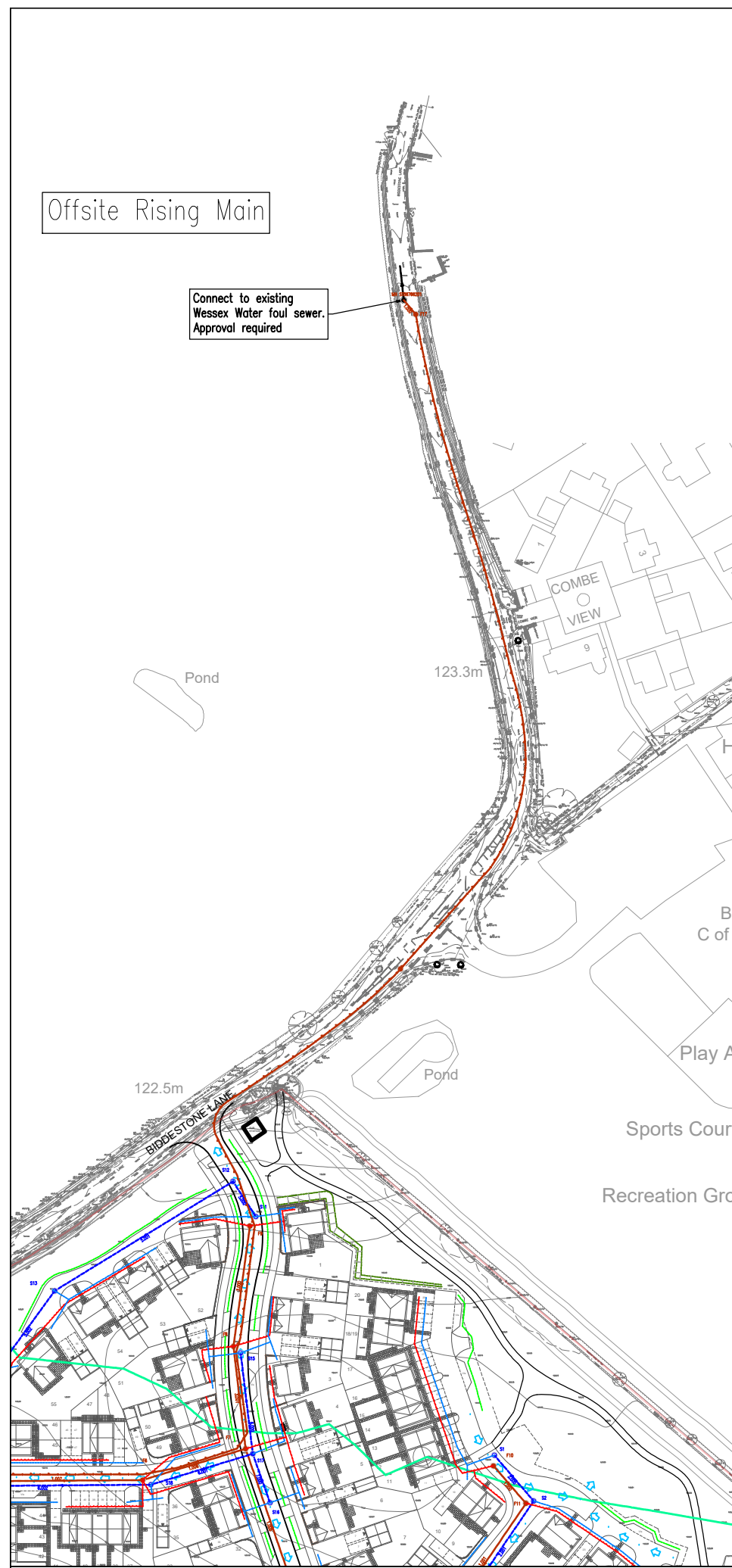
Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	HW3	5.005	HW4	324.8	0.941	0.398	14.5641	
15 minute winter	HW4	1.008	S20	892.3	3.054	2.400	1.5950	
10080 minute winter	S20	1.009	HW5	5.2	0.018	0.010	2.8947	1257.7

**Appendix E
617-P-050 Drainage Strategy Rev B**

617-P-055 Pond and Swale Rev A

617-P-060 Flow Route and Cross Section

617-P-505 Impermeable Areas



Pumping Station.
Pump rate approx 2.5/s
(based on 55 houses)
To be accessed from public highway.
No Dwellings to be located within
15m of pump chamber

Attenuation Pond 1
Greenfield Catchment 15812m²
Greenfield runoff rate QBar (@4.1l/s/ha) 6.5l/s
Greenfield runoff rate 1 year (@3.2l/s/ha) + 30% Betterment 3.6l/s
Permanent Water Level 120.95m
Minimum Bank Level 122.25m
Maximum Water Level 121.95m
Maximum Water Volume (1 in 100 YRP +45% CC) 864m³
Side Slopes 1 in 3
Cut Volume 975m³
Fill Volume 513m³
Area 2089m²

Maximum Flood Extent
at 121.95mAOD

Surface water outfall
to existing ditch

Flood compensation area
Volume 4270m³ up to flood
level of 121.95mAOD

Swale,
1m wide base,
1 in 4 side slopes,
Minimum Bank Level 122.25m
Minimum Depth 0.7m

Drainage Strategy Key

- Site Boundary
- Surface Water Catchment boundary
- Proposed Foul Sewer
- Proposed Foul Rising Main
- Proposed Surface Water Sewer
- Filter Trench
- Proposed Private Foul Drainage
- Proposed Private Surface Water Drainage
- Overland Flow Route

- Grass Maintenance Strip (minimum 3.0m wide)
- Bank Slope from 1 in 3
- 3m Aquatic Bench @ 1:15 (0-0.2m deep)
- Permanent Water (max 1.0m deep, 1:3 slopes)

Note

The proposed Drainage System shown is indicative and is subject to the development of the Masterplan for the site and also the detailed design in accordance with the appropriate standards and approval from the relevant authorities.

To provide water quality benefits and source control the use of the following features may be considered;
Swales,
Rain Gardens,
Filter Drains,
Filter Strips,
Permeable Paving,
Water butts,
Conveyance ditches.

Flows from the development will be restricted to Qbar for all events up to and including the 100 year with a 45% allowance for climate change

All outfalls to watercourses are to be fitted with suitable controls to prevent flood waters flowing back in to the proposed drainage systems.

Maximum water level is for the 100 year + 45% climate change

Survey of existing foul sewers required to confirm location and depths.

B 02.10.2025 Revised layout, Overland Flow Routes added
A 04.04.2025 Compensation Area increased

Revision

Project: **Yatton Keynell**

Client:



Drawing: **Drainage Strategy**

Scale: 1:500 @ A1 Date: March 2025 Drawn by: JP

Drawing No: **617-P-050** Rev: B

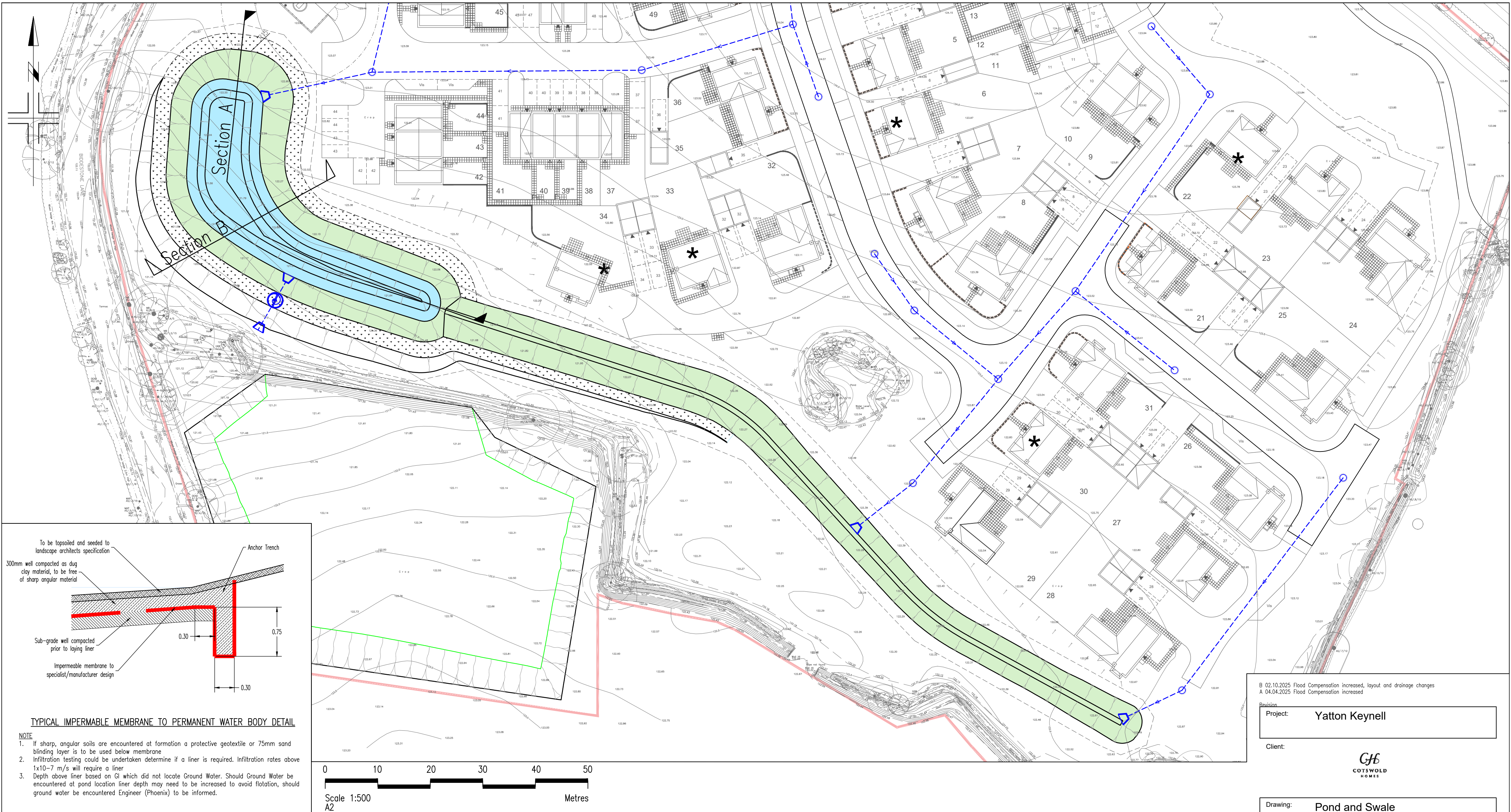
PHOENIX DESIGN
Partnership Ltd.

Unit 9, Westway Garage,
Marksbury, Bath, BA2 9HN
tel: 01761 479950
email: enquiries@phoenixdp.co.uk www.phoenixdp.co.uk

Suite 7, Unit Three, Mele Corner,
Business Park, Upper Boat, Pontypriid,
CF37 5BE, tel: 029 2049 0771

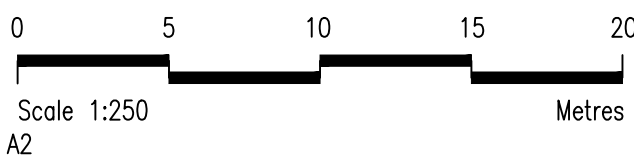
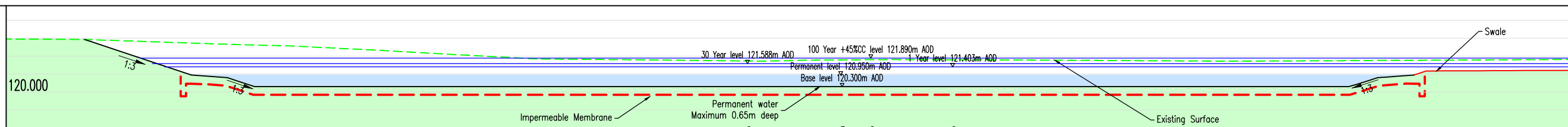
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Drg Status: **PLANNING**



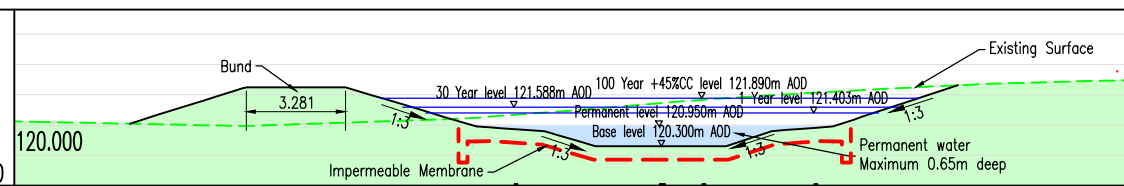
Section A

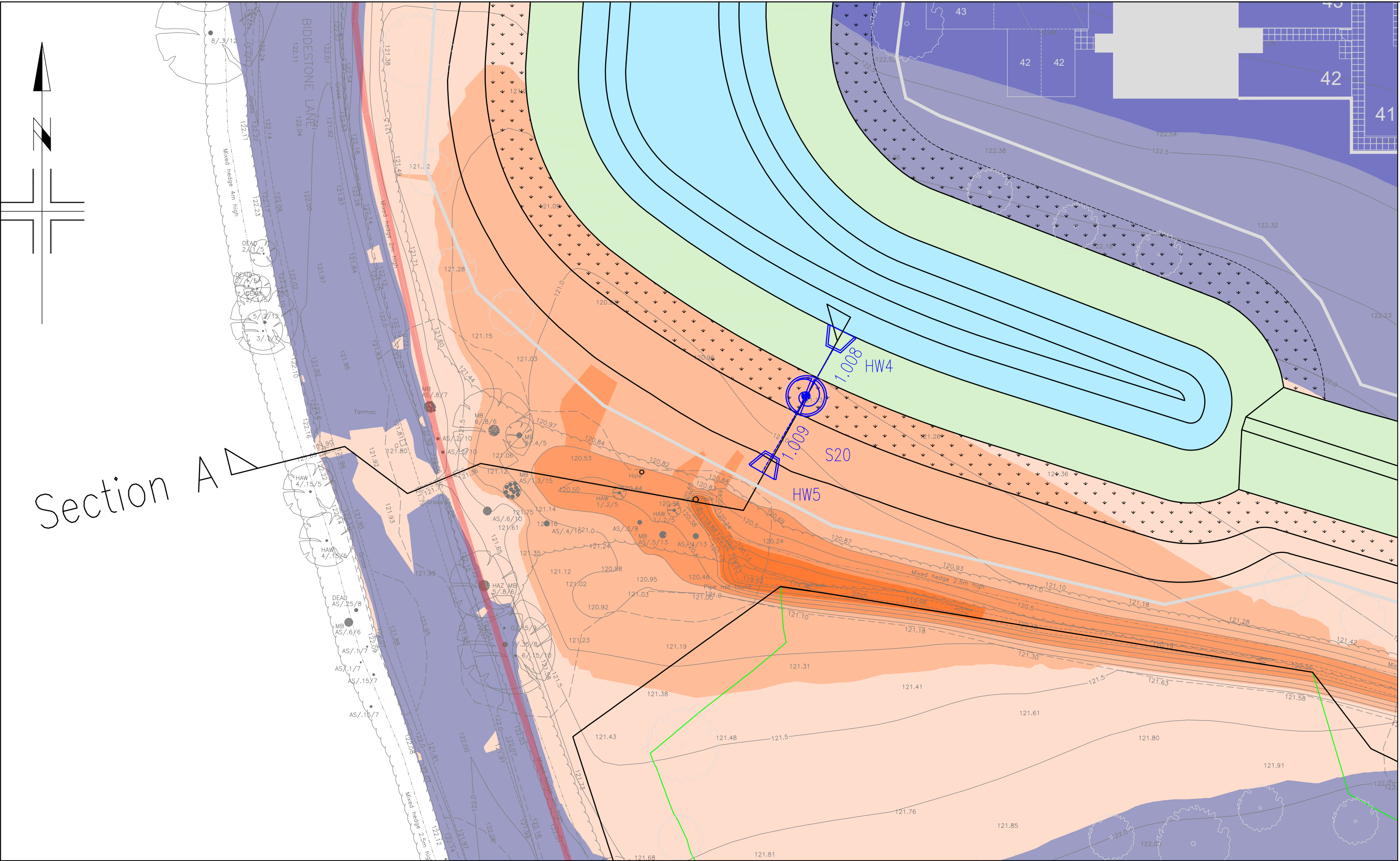
Datum 118.000M AOD



Section B

Datum 119.000M AOD





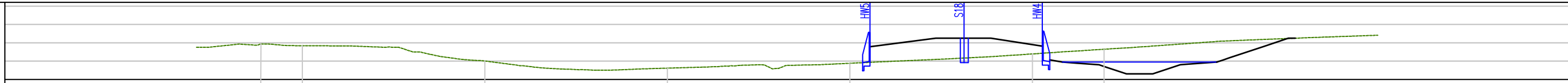
KEY

Areas Higher than 121.95m AOD

Areas Lower than 121.95m AOD (flowpath)

Section A

ANY WORKS RELATED TO SECTION 38 & 104 AGREEMENTS ARE SUBJECT TO TECHNICAL APPROVAL AND ARE UNDERTAKEN AT THE CLIENTS RISK

Flood Route	122.000															
Datum: 119.000M AOD	120.000															
EXISTING LEVELS (m)		7.727	121.938	10.000	121.841	20.000	121.005	30.000	120.615	40.000	120.882	50.000	121.392	53.923	121.647	
EXISTING CHAINAGE (m)																

Project: Yatton Keynell

Client:

Drawing: Flood Route and Cross Section

Scale: 1:250 @A2 Date: 02.10.2025 Drawn by: JP

Drawing No: 617-P-060 Rev:



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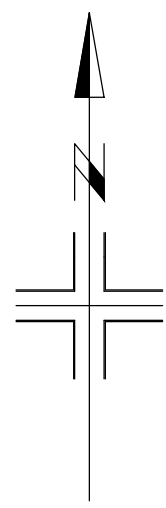
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Marksbury, Bath, BA2 9HN
tel. 01761 479950
email. enquiries@phoenixdp.co.uk

☒ Suite 7, Unit Three, Melin Corrwg
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Drg. Status: PLANNING



122.5m

BIDDESTONE LANE

Pond

Play Area

Sports Court

Recreation Ground

122.6m

Pond

Pond

Impermeable Areas Key

Impermeable Area

Associated Surface Water Sewer

Manhole No.	Pipe No.	Total IMP+UC	Total Area (ha)
S9	1.00	444.21	0.04
S10	1.00	755.52	0.08
HW2	1.00	0.00	0.00
SW1	1.00	0.00	0.00
HW1	1.00	0.00	0.00
SW2	1.01	0.00	0.00
SW3	1.01	743.86	0.07
SW4	1.01	0.00	0.00
HW4	1.01	0.00	0.00
S20	1.01	0.00	0.00
S1	2.00	1445.78	0.14
S2	2.00	1218.18	0.12
S4	2.00	691.46	0.07
S7	2.00	418.96	0.04
S8	2.00	639.02	0.06
S3	3.00	635.19	0.06
S5	4.00	739.79	0.07
S6	4.00	345.44	0.03
S11	5.00	537.84	0.05
S12	5.00	514.55	0.05
S13	5.00	891.31	0.09
S14	5.00	109.10	0.01
S19	5.00	878.69	0.09
HW3	5.01	0.00	0.00
S15	6.00	1279.00	0.13
S17	6.00	443.07	0.04
S18	6.00	1019.06	0.10
S16	7.00	782.67	0.08
Totals:		14532.48	1.45

A 03.10.2025 Revised to suit updated layout

Revision

Project: Yatton Keynell

Client:

CH
COTSWOLD
WATER

Drawing: Impermeable areas

Scale: 1:500 @ A1 Date: March 2025 Drawn by: JP

Drawing No: 617-P-505 Rev: A

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Drg Status: PLANNING

0 10 20 30 40 50
Scale 1:500
A1 Metres

Appendix F Wessex Water Correspondence

Joe Prescott

From: Joe Prescott
Sent: 17 March 2025 09:25
To: Joe Prescott
Subject: FW: WWDevRespST87NE/ 86 Land at Biddestone Lane, Yatton Keynell, Chippenham
Attachments: WWMap Land at Biddestone Lane Yatton Keynell.pdf; Yatton Keynell A3.pdf; Yatton Keynal Wessex map.pdf

From: Alison Kurobasa <Alison.Kurobasa@wessexwater.co.uk>
Sent: 21 May 2024 09:22
To: Alex McPherson <Alex.McPherson@phoenixdp.co.uk>
Subject: WWDevRespST87NE/ 86 Land at Biddestone Lane, Yatton Keynell, Chippenham

Hello Alex

Land at Biddestone Lane, Yatton Keynell, Chippenham 51 plots

Thank you for your drainage enquiry

Separate systems of drainage are required:

Foul Sewerage

Development will require a 150mm foul connection.

Point of discharge would be the 150mm foul sewer in Biddestone Lane at MH ST8676**6201**; Cover Level 124.691, Invert Level 121.881

Due to topography you may need to consider a pumped connection. Adoptable pumping stations require 15m buffer from nearest habitable dwelling and adequate provision for tanker lorry access directly off adopted highway (not through shared private drives) with provision for turning manoeuvres. We use the Sewerage Sector Guidance (SSG) April 2020 as the design standard for adoptable sewers.

Foul effluent in the Yatton Keynell and Castle Combe catchment is treated at the Long Dean WRC.

Developers fund the cost of connecting to the nearest 'size for size' sewer. Wessex Water will manage the foul sewer network to accommodate the additional foul flows from granted development.

Surface Water Drainage

Surface Water to be disposed of in accordance with SuDS Hierarchy and NPPF Guidelines and should be directed to local land drainage systems.

Surface water strategy and flood risk matters must be agreed with the Lead Local Flood Authority.

Please Note: No surface water runoff, land drainage or ground water will be accepted into the foul sewer either directly or indirectly.

Regards

Alison Kurobasa
Planning Liaison
Wessex Water
Claverton Down Bath BA2 7WW
wessexwater.co.uk



Please send/copy emails to the planning liaison email planning.liaison@wessexwater.co.uk where all enquires are automatically recorded and can be responded to.

These comments are based upon known circumstances prevailing at the time of writing. A review of the contents of this email is required where 18 months or more have elapsed since issue, or in the light of significant changes likely to impact on our response such as development numbers or phasing. Please email review requests to planning.liaison@wessexwater.co.uk

This email is confidential. If you are not the intended recipient, you must not copy, distribute, disclose or use the information contained in it. If you have received this communication in error, please tell us immediately by return email and then delete the email and any copies of it from your computer system. Thank you.

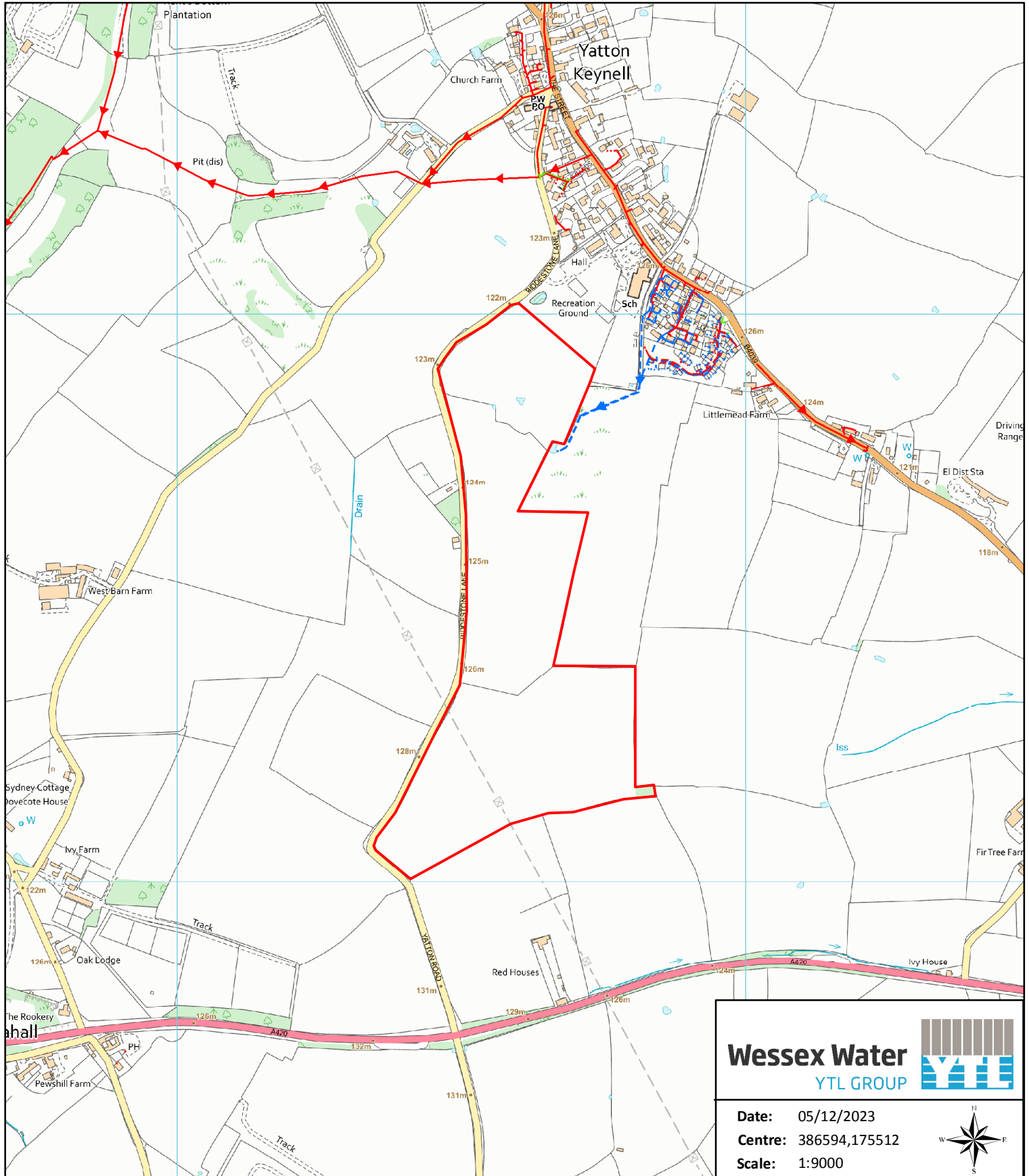
Wessex Water Services Limited, Registered in England No 2366648. Registered Office – Wessex Water Operations Centre, Claverton Down Road, Claverton Down, Bath, BA2 7WW

Search Order ID: 959963

Our Ref: 959963

Your Ref: 48191270

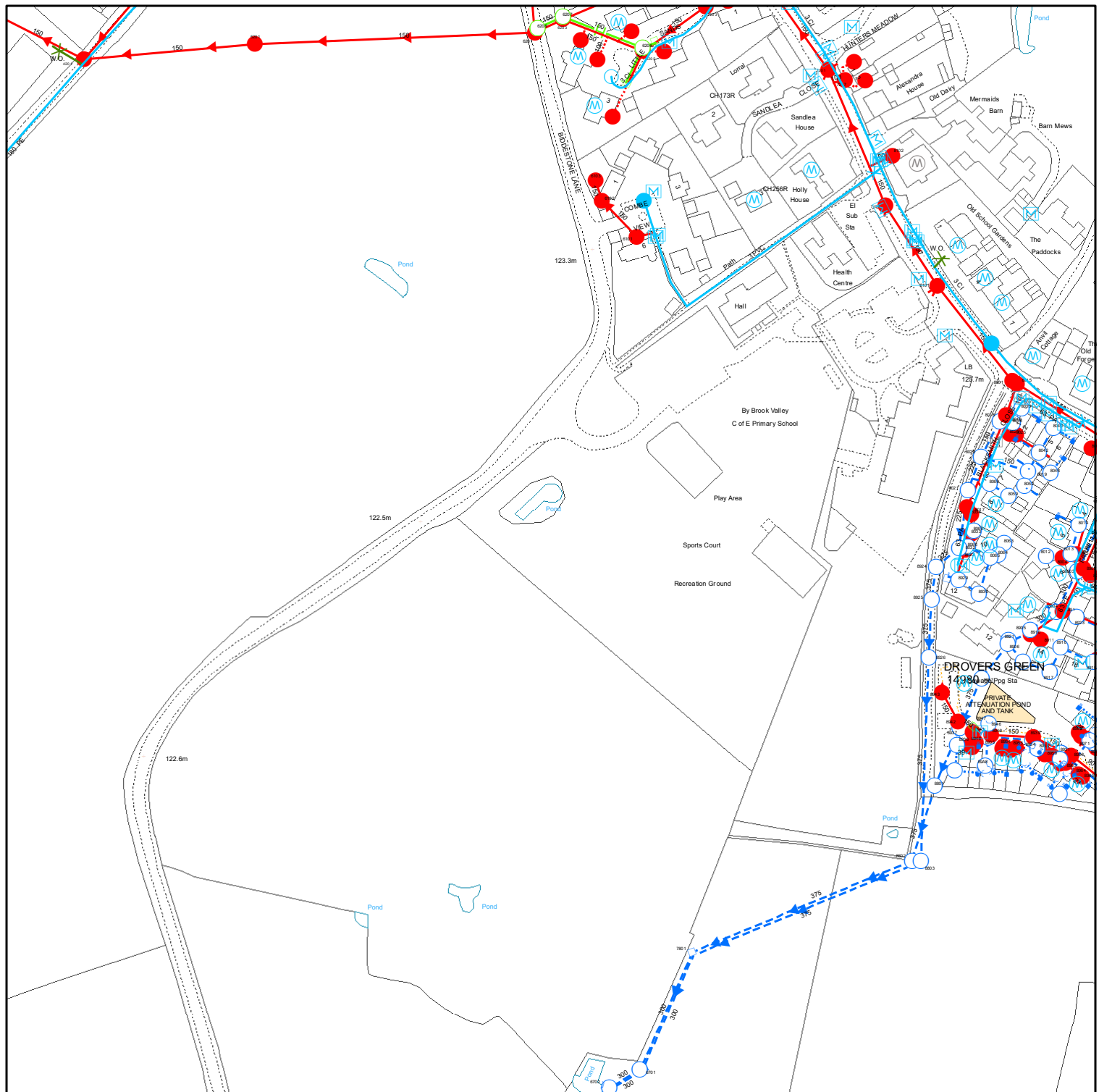
Option over Land at, Biddestone Lane, Yatton Keynell, Chippenham, SN14 7BD



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Land at Biddestone Lane, Yatton Keynell



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WATER MAINS	SEWERS	PUBLIC	PRIVATE	SECTION 104	OTHER WESSEX PIPES	NON-WESSEX / UNKNOWN
Distribution Main	Foul	Foul	Foul	Foul	Rising Mains	Private Rising Mains
Washout Main	Surface	Surface	Surface	Surface	Standby Rising Mains	Culverted Watercourse
Raw Water Main	Combined	Combined	Combined	Combined	EDM Effluent Disposal	Highway Drain
Abandoned Main	Abandoned	Abandoned	Abandoned	Abandoned	Overflow	Use Unknown
Private Main					Syphon	Status Unknown

Colours generally indicate the use of the sewer/drain (i.e Red - Foul, Dark Blue - Surface, Magenta - Combined/Dual Use, Light Green - Highway Drain, Mid Green - Overflow) styles of line are shown on the key in sample/typical colours.

SITES	STRUCTURES	OTHER STRUCTURES
Source	Manhole - Foul	Chamber
Reservoir	Manhole - Surface	Tunnel
Pump	Manhole - Combined	Interceptor
Treatment Works	Outfall	Attenuation Tank
	Inlet	Storage Tank
	Lamphole	
	Bifurcation - Foul	
	Bifurcation - Surface	
FITTINGS	Bifurcation - Combined	
Valve - Open	Combined Sewage Overflow	
Valve - Closed	Pumping Station - Surface	
Fire Hydrant	Pumping Stn - Foul/Combined	
Pressure Reducing Valve	Gully	
Meter	Vent Column	
	Rodding Eye	
	Catchpit	
	Flushing Chamber	
	Soakaway	
	Non Return Valve	
	Washout	
	Air Valve	
	Hatch Box	

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Wessex Water
YTL GROUP

Date: 21/05/2024, 09:19:22

Scale: 1:2,500

Centre: 386,644, 176,005